Ripshin Branch Stream & Wetland Restoration
Ashe County, NC

Ripshin Branch, Ashe County, NC

Prepared for: **NCDENR-Ecosystem Enhancement Program**
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Restoration Plan

March 9, 2007

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ECOLOGIC

Executive Summary

Michael and Virginia Tate contacted the North Carolina Ecosystem Enhancement Program (NCEEP) with an interest in protecting the streams and wetlands on their farm in Ashe County. They have previously placed portions of this farm under conservation easements and have produced a forestry plan for the farm. The result of this contact was the development of the current stream and wetland restoration project. This is a proactive landowner-initiated project, so their goals and interests have strongly influenced the project goals and scope. In addition, Larry Miller, an intervening landowner with a small triangular parcel within the lower reaches, agreed to the inclusion of his parcel in the project.

i. Project Goals

The design goals of the Ripshin Branch restoration project are as follows:

- Improve stream water quality and ecological function by excluding livestock, restoring pool and riffle sequences, and restoring tree canopy and instream large woody debris;
- Enhance aquatic and terrestrial habitat in the stream corridor and adjacent wetlands;
- Enhance and/or restore the ecological function of riparian wetlands;
- Restore the riparian corridor (forested buffer) for watershed and wildlife benefits;
- Enhance habitat for native brook trout (*Salvelinus fontinalis*) and improve fishery potential; and
- Increase the biodiversity of the stream ecology, riparian buffers and wetlands.

ii. Project Objectives

The design objectives of the Ripshin Branch restoration project are as follows:

- Improve channel geomorphology toward reference conditions by providing watershed-scaled and Rosgen-typed channel dimension, adding floodplain benches where floodplain access is not feasible, restoring sinuous pattern to straightened reaches where possible, and adjusting profile as needed to restore or maintain sediment transport equilibrium;
- Restore streamside floodprone area where appropriate (increase floodwater access to the floodplain);
- Reduce sediment and nutrient loading by reshaping and stabilizing banks, reducing bank scour, excluding livestock, and restoring riparian buffers; and
- Enhance or restore wetland hydrology and vegetation in former pastures and filled wetlands.

iii. Existing Amounts of Streams and Wetlands

The existing streams within the project areas include a straightened section of an Unnamed Tributary to Ripshin Branch that is 920 feet long, and a section of Ripshin Branch that is 2,738 feet long. There are 1.24 acres of existing wetlands adjacent to the Unnamed Tributary and 3.25 acres of wetlands adjacent to Ripshin Branch. All the wetlands have been impacted

by ditching, filling, grazing, beaver activity and hay production. On February 21, 2007, Amanda Jones of the U.S. Army Corps of Engineers visited and reconnoitered the site and confirmed the wetland identifications and boundaries established by EcoLogic.

iv. Amounts of Streams and Wetlands Designed

The proposed design interventions for Ripshin Branch include 1,485 linear feet in Reach 1 (Type B4), comprised of 1,085 linear feet of enhancement (Level II) and 400 linear feet of restoration (Priority 2), and 815 linear feet in Reach 2 (Type C4), comprised of 815 linear feet of restoration (Priority 2). An additional 518 linear feet of stream preservation is proposed in the lowest reach of Ripshin Branch. The proposed design interventions for the Unnamed Tributary (Reach 3) include 132 linear of enhancement (Level I, Type B4) and 780 linear feet of restoration (Priority 1, Type C4).

Two and seven tenths (2.7) acres of existing wetlands alongside the Ripshin Branch restoration corridor are proposed to be enhanced by removing ditches and agricultural impacts, with an additional 0.93 acre to be restored by remediating agricultural and beaver impacts. About one-half acre (0.55) of existing wetlands will be impacted (removed) by the stream restoration (new channel construction). About one and one-half (1.49) acres of existing wetlands adjacent to the Unnamed Tributary are proposed to undergo enhancement by removing agricultural impacts and restoring wetland vegetation, including 0.25 acre of new wetland created by filling the existing channel. An additional 1.63 acres of prior-converted wetlands are to be restored by removing ditches, underdrains and fill.

1.0 Project Site Location

1.1 Directions to Project Site

The project is in the northwest corner of Ashe County, about one (1) mile south of the Virginia line and three (3) miles east of the Tennessee line in the Park USGS Quadrangle.

The site is accessed from Jefferson, NC by following NC 88 west to Warrensville, then NC 194 north to Lansing, NC. From Lansing, follow Big Horse Creek Road to Ripshin Road. The site is approximately 13 miles north of Lansing at the intersection of Ripshin Road and Buddy's Run.

1.2 USGS Hydrologic Unit Codes (8 and 14 digit)

Ripshin Branch is located in USGS Hydrologic Unit 05050001, the Upper New Stream subbasin, which lies in the Kanawha Stream Basin. The 14-digit Hydrologic Unit Code is 05050001010050. NCDWQ's stream basin designation for the New Stream is 05-07 and the project site is located in subbasin 05-07-02.

1.3 Project Vicinity Map

See attached Figure 1.

2.0 Watershed Characterization

2.1 Drainage area

The drainage area measured at the upper end of the restoration reach on the main channel of Ripshin Branch is 1.6 square miles, and for the Unnamed Tributary is 0.56 square miles. See attached Figures 2A and 2B for watershed maps of the two drainages.

2.2 Surface Water Classification

The site surface waters are classified as Class C waters, High Quality Waters (HQW) and Trout Waters.

2.3 Physiography, Geology and Soils

The Michael and Virginia Tate property including Ripshin Branch lies in the northernmost portion of Ashe County, NC near the Virginia border in the Blue Ridge Physiographic Province. The surrounding area is characterized by mountains with steep forested slopes, with small inclusions of farm and pastureland in the floodplains.

The site lies within the Mount Rogers Formation of the Blue Ridge Belt. Mapped county rock types (sedimentary and metamorphic) include Metafelsite (symbol Zmf), a light-colored, porphyritic extrusive rock and Metagraywacke interlayered with metaconglomerate, laminated metasiltstone, and slate (symbol Zml), with minor inclusions of calcareous metasandstone, greenstone, and metarhyolite.

A large portion of the floodplain along Ripshin Branch contains mapped units of Colvard soils (see Figure 3). Colvard soils are well drained and are not themselves hydric soils, but frequently contain hydric soils. On the Ashe County list of hydric soils Colvard fine sandy loam (map unit symbol Co) is listed, with "Toxaway, undrained" listed as the component within the map unit that is hydric. The hydric criteria that Toxaway meets is "2B3", which means that it is in an Aquic suborder, is poorly drained, and has a seasonal high water table depth of one-foot or less. The soils observed in the proposed wetland restoration areas are typically inclusions of Iotla, which is a somewhat poorly drained soil, or Toxaway, which is a poorly drained or very poorly drained soil. Depths to a cobble layer were somewhat shallow for these series. Toxaway soils are typical of wetlands in the area. Iotla soils are not hydric, but have very good potential for wetland creation, and in some cases may be present in wetlands in this area. The extent of these soils was confirmed in the field and used as the basis of restoration strategies.

A site-specific, preliminary soils investigation relative to wetlands was conducted by Foothills Soils Consulting, LLC under subcontract to EcoLogic. The report of that investigation is attached (Appendix 5). The above discussion was also contributed by Foothills Soils Consulting.

2.4 Historical Land Use and Development Trends

The watershed that includes Ripshin Branch, its tributaries and adjacent wetlands is in a relatively remote and undeveloped portion of Ashe County. Historically, there were dairy and beef cattle and limited support agriculture in this area; however, most of the dairies are now gone. The watershed is now used mostly for cattle grazing, forestry and limited residential use.

There is virtually no development underway in the vicinity, with Lansing being the closest town and located southeast of the project site. Between 1990 and 2000, Lansing suffered a decrease in population of about 11 percent. Rural residential properties and pasturelands are scattered throughout the watershed.

The Tates have put most of the farm, including the project watershed, into conservation easements, in perpetuity, with the Blue Ridge Rural Land Trust. In a telecommunication with James Colman, Executive Director at Blue Ridge Rural Land Trust, he noted that the Clean Water Management Trust Fund (CWMTF) easements contain specific language allowing stream restoration within their bounds. The CWMTF easements also contain requirements for a 50-foot buffer on all headwater streams and for cattle to be fenced out of stream corridors. Mr. Colman stated that the CWMTF easements are for the purpose of watershed and farmland protection and do not address mitigation of any kind. The CWMTF easements do not prohibit the stream or wetland restoration outlined in this restoration plan.

2.5 Endangered and Threatened Species

The US Fish and Wildlife Service (USFWS) lists 32 species ranging from Federal Species of Concern to Endangered in Ashe County. Of the 32 listed species, four (4) species are listed as Threatened (T), three (3) are Endangered (E), and the remainder are listed as Federal Species of Concern (FSC). The threatened or endangered species are: Bog Turtle (*Glyptemys* (formerly *Clemmys*) *muhlenbergii*), Heller's Blazing Star (*Liatris helleri*), Roan Mountain Bluet (*Houstonia montana*), Spreading Avens (*Geum radiatum*), Swamp Pink (*Helonias bullata*), Virginia spiraea (*Spriaea virginiana*) and Rock Gnome Lichen (*Gymnoderma lineare*). These species are either rock outcrop or cliff-dwelling species, or occur in other habitats that are not found within the project limits; thus, detailed biological surveys are not warranted.

EcoLogic conducted a site reconnaissance on May 9-10, 2006 for the purpose of investigating and documenting the presence or absence of listed T or E species or suitable habitat for same. On the basis of that reconnaissance and the noted absence of said species and suitable habitat, we conclude that the proposed project will have no effect on the listed T or E species. The Asheville Field Office of the USFWS was notified of our findings and determination in a letter dated May 31, 2006 and asked for comment or concurrence by default. As of this writing, no response has been received. Refer to Appendix 7 for correspondence with this agency.

The North Carolina Natural Heritage Program (NCNHP) lists 145 rare species and uncommon natural communities as occurring in Ashe County. A closer examination of NCNHP listings in the Park Quadrangle where the project is located indicates one Significantly Rare stonefly (*Bolotoperla rossi*) occurrence several miles downstream in Big Horse Creek, one occurrence of the Significantly Rare Pigmy Salamander (*Desmognathus wrightii*) in the Sturgills area five (5) miles east, three (3) downstream occurrences of the Significantly Rare Kanawa darter (*Etheostoma kanawahae*) (one in Big Horse Creek and two in sections of Helton Creek), and one occurrence of the Significantly Rare American Speedwell (*Veronica americana*) about 5 miles east of the project site.

Consultation with the North Carolina Wildlife Resources Commission indicates that the Kanawha darter (*Etheostoma kanawahae*) and the Toungtied minnow (*Exoglossum laurae*), both Significantly Rare, and the Kanawha minnow (*Phenacobius teretuus*), listed as a NC Special Concern and a Federal Species of Concern, all occur in the greater watershed which includes the project site. All these species, however, are normally found in much larger streams further down the watershed. In a letter to EcoLogic dated June 14, 2006, the NCWRC Regional Coordinator of the Habitat Conservation Program stated, "Based on our review, we believe that adequate measures can be taken to minimize impacts to listed species while improving aquatic habitats in the area." Refer to Appendix 7 for correspondence with this agency.

2.6 Cultural Resources

There are no known cultural resources within the project boundaries. There are no buildings or other structures within the proposed impact area. The current farm manager, who has lived in the immediate vicinity for more than 70 years, confirms that the project area has consistently been used as pasture for grazing livestock throughout his lifetime.

A response dated July 12, 2006 was received from the NC State Historic Preservation Office (SHPO) to an inquiry letter dated June 12, 2006. In their response, SHPO expressed concern for historic structures (>50 years old), if any are present on or adjacent to the project. After conferring with EEP, it was determined that no such structures exist within the project limits (aka "area of potential effect" or APE, defined for this project as the limits of the proposed conservation easement). Refer to Appendix 7 for correspondence with these agencies.

Regarding archaeological resources, SHPO states, "There are no known recorded archaeological sites within the project boundaries. … Based on the topographic and hydrological situation, there is a high probability for the presence of prehistoric or historic archaeological sites." Further, SHPO says, "We recommend that a comprehensive survey be conducted by an experienced archaeologist to identify and evaluate the significance of archaeological remains that may be damaged or destroyed by the proposed project. Potential effects on unknown resources must be assessed prior to the initiation of construction activities." A survey report is requested for review and comment "well in advance of any construction activities". We understand that EEP has contracted for such a survey and that it is pending.

The Tribal Historic Preservation Office of the Eastern Band of Cherokee Indians was notified of the project and solicited for comments in a letter dated June 6, 2006. As of this writing, no response has been received. Refer to Appendix 7 for correspondence with this agency.

2.7 Potential Constraints

2.7.1 Property Ownership and Boundary

The Unnamed Tributary project site is entirely owned by Tate. The restoration reach along Ripshin Branch starts at the Tate property line and continues for 1,485 feet. The stream then crosses a property line (Miller) and flows off site about 100 feet before returning to the Tate property. For the next 715 feet the channel is entirely on Tate land. The last 518 feet of channel is on a boundary between Tate and Lee, with the historic centerline of the channel apparently forming the property line.

2.7.2 Site Access

The project site along the Unnamed Tributary has easy access from both sides of the channel and entirely within the Tate property. The main channel of Ripshin Branch is mostly adjacent to Ripshin Road, with some access at the upper end on Tate property and from the middle of the reach on Miller land. The lower portion of the project is in a steep, narrow valley on mostly Tate property where access will be difficult, but not impossible. Access to the lower end of the stream channel will be from one side only (Tate property) due to topographic constraints (steep hillside).

2.7.3 Utilities

The Unnamed Tributary is crossed by a power line right of way that overlaps a good portion of the existing channel. The proposed channel will be relocated to avoid this conflict. Ripshin Branch is crossed by one power line in the middle of the project reach. The power line traverses the valley from a ridge top to Ripshin Road, and is therefore about 100 feet above the ground. No other utilities are indicated on the project site.

2.7.4 FEMA and Hydrologic Trespass

The project is not in a FEMA mapped waterway and is high in the headwaters of the Upper New Stream subbasin. Topography and property boundaries preclude hydrologic trespass beyond that which presently occurs on shared boundaries during high water. According to the landowner, who has owned the property since 1967, there have been no instances of overbank flooding on the property. This anecdotal finding is consistent with the first-order character of the stream and its relatively high degree of incision, presumably from upstream migration of head-cutting following channelization. This suggests very low potential for hydrological trespass onto adjacent property or outside the immediate riparian corridor.

2.7.5 Trout Waters

The NCWRC designates this area of Ashe County, including Ripshin Branch, as home to native brook trout. The receiving waters of Big Horse Creek just downstream are also a hatchery-supported, public access fishery. There is a state-mandated moratorium on disturbance in Trout Water stream corridors from October 15 to April 15 (spawn).

3.0 Project Site Streams (Existing Conditions)

3.0.1 Ripshin Branch

The Ripshin Branch stream and wetland restoration project on the Michael and Virginia Tate and Larry Miller properties in Ashe County is composed of two separate stream segments that will be described in this document as Ripshin Branch (proper) and Unnamed Tributary (UT). These two reaches will be treated as separate restoration projects in the following discussion. Photos of the restoration sites are included in Appendix 1.

The restoration reach of Ripshin Branch begins about 1,100 feet downstream from the confluence of the Unnamed Tributary described below. At this point, the branch closely follows Ripshin Road after crossing under the road three times in a little over 1,000 feet. Upon emerging from beneath the third bridge (flowing east), the branch remains on the north side of Ripshin Road and enters a steeper, narrower section of the valley (Reach 1). The valley widens about 600 feet downstream. The stream flows against a wooded hillside on stream left (north slope), with a wet meadow on stream right (south floodplain). More than half of the creek width is well shaded by the canopy trees on stream left. Only an area where beaver dams were recently removed (Reach 2) is fully exposed to the sun.

Ripshin Branch encounters two more tributaries from the south about 1,000 feet and 1,500 feet below the start. At this point, the creek and the valley turn northeast and become less steep (Reach 2) and pass through another narrowing of the valley followed by another widening. The proposed restoration ends at a fence line about 2,300 feet from the start. An additional 518 linear feet of stream preservation is proposed in the lowest reach of Ripshin Branch.

In the first 1,500 feet (Reach 1), the creek is relatively steep and has well vegetated banks, with only a few indications of instability. Most notable in this section is a car embedded in the bank on stream right. A previous bank stabilization project occurs just below the bridge at the start of the reach, which was done by lining the outer bank (stream left) with large rocks (cribbing). There are some sections within the reach with well-formed bankfull and interberm benches and a few locations of bank instability. There are a few large colonies of Multiflora rose scattered throughout the reach, but few other occurrences of invasive plants.

Reach 2 starts at a point of confluence with a tributary at a wide area in the lower valley floodplain. Reach 2 was inhabited by beavers until the start of the design phase of this project and they had built several ponds in this area. The largest pond spanned the valley width of 100 feet. Once the beaver dams were breached, the main channel and a tributary formed sinuous meandering channels.

3.0.2 Unnamed Tributary

This restoration reach flows through a relatively flat pasture area (floodplain) bounded on the south and west sides by Ripshin Road. The north boundary of this floodplain is a steep hillside, and the eastern limit is the confluence of the tributary with Ripshin Branch.

Historically, Ripshin Branch meandered across its floodplain to merge with the tributary about 500 feet further west than currently. At that time, the existing pasture was most likely a wetland around the confluence. Remnants of the old channel, located roughly in the middle of the current pasture, can be seen in aerial photographs and detected in the topography of the existing surface. Hydric soils located below a shallow layer of fill dirt also provide evidence of the previous wetland condition and the subsequent land use changes at this location. When Ripshin Branch was relocated, likely to provide more usable agricultural bottomland, it necessitated a lengthening of the tributary, which now follows a straight line across the pasture.

The impacted reach of the tributary starts at a roadway culvert at the west end of the pasture. The existing channel follows a straight route across the pasture to a point at which Ripshin Branch passes under Ripshin Road, where the confluence occurs. This straight reach lies beneath an overhead power line. As a result, the entire reach lies within the power line easement, which is subject to periodic maintenance in the form of clear-cutting of all vegetation within the easement. This has contributed to channel instability where banks fail from lack of woody root reinforcement. Riparian woody plant removal, combined with unrestricted cattle grazing and access to the creek for watering, has resulted in a significant loss of riparian buffer and significant bank instability.

3.1 Channel Classification

Ripshin Branch is a Rosgen B4c stream type in Reach 1 and varies between F4 and C4 in Reach 2. Morphological survey indicates a stretch of B4c (about 1,500 feet long) transitioning to predominantly F4 type for most of the remainder, including the beaver damaged areas, with a few short reaches of C4 in the lowest reaches. The Unnamed Tributary exhibits Rosgen channel classifications of B4c upstream and F4 for the majority of the reach.

3.2 Discharge

3.2.1 Ripshin Branch

The bankfull cross-sectional area measured at the most stable riffle in the existing channel was near that indicated on the NC Mountain regional curve, which leads to a bankfull discharge (Q_{bkf}) estimate using velocity from RIVERMorph classification of 158 cubic feet per second (cfs), slightly higher than the regional curve prediction of 144 cfs.

3.2.2 Unnamed Tributary

The bankfull cross-sectional area measured at the most stable riffle in the existing channel was near that indicated on the NC Mountain regional curve, which leads to a bankfull discharge (Q_{bkf}) estimate using velocity from RIVERMorph classification of 83 cubic feet per second (cfs), 30% higher than the regional curve prediction of 64 cubic cfs. This could result from the location of the measured riffle being just below a road culvert.

We have not monitored the streams long enough to measure a bankfull discharge or note any discharge trends; however, it is expected that the land use in the watershed will not

change in the foreseeable future, so the current runoff response of the watershed should remain reasonably stable.

3.3 Channel Morphology

3.3.1 Ripshin Branch

The existing Ripshin Branch geometry is a typical B type in the upper reach (Reach 1) and a disturbed C type in the lower reach (Reach 2). The upper reach is mostly straight, with only a few locations of lateral instability noted, apparently from limited woody riparian vegetation. Pattern in Reach 1 reflects the valley shape and not unrestricted channel fluvial geomorphology. Reach 2 is where most of the variability in the surveyed morphological data comes from. Here, the channel is in a less steep section of valley and the bed is bedrock-controlled, so the channel has a higher propensity to migrate laterally.

As measured, belt width ranges from 7 to 80 feet, radius of curvature from 10 to 160 feet, and meander length from 30 to 240 feet, all indicating a channel with highly irregular geometry. Sinuosity is 1.2 and the meander width ratio ranges from 0.8 to 2.1.

Bankfull width measurements ranged from 17 to 24 feet, with a typical riffle average of just over 20 feet. Mean bankfull depth (d_{bkf}) was measured as 1.2 to 1.3 feet at riffles and pool depths were measured as 0.9 to 3.6 feet. The channel is slightly entrenched for most of its length, resulting in entrenchment ratios (ER) of 1.6 to 2.6.

The profile geometry indicates a valley slope and water surface slope of about 2 percent. There are a few locations of bedrock control, most notably just below the beaver impacted area.

3.3.2 Unnamed Tributary

The Unnamed Tributary essentially has no pattern. The channel has been straightened to the shortest distance across the floodplain, presumably to maximize grazing area. There are a few places where the shear stress on the unvegetated banks has caused channel widening and a localized increase in belt width. This suggests the early stages of channel evolution to a C type from the existing B/F type, but these apparent adjustments are not typical of most of the channel.

As measured, belt width ranges from 12 to 33 feet, radius of curvature from 2.5 to 25 feet, and meander length from 50 to 170 feet, again indicating a channel with highly irregular geometry. Sinuosity is calculated to be 1.2 and the meander width ratio is 1.4.

Bankfull width is reported as 18 feet. Mean bankfull depth (d_{bkf}) was measured as 0.9 feet at a riffle and pool depth was measured as 1.4 feet. The channel is entrenched for most of its length, with recent evidence of dredging and straightening, resulting in an entrenchment ratio (ER) of 1.6.

The profile indicates a valley slope and water surface slope of about 2 percent. There are a few locations of bedrock control.

3.4 Channel Stability Assessment

3.4.1 Ripshin Branch

The distribution of bed features is irregular and dominated by long riffle and run complexes. Pools are short and infrequent throughout the reach.

The Pfankuch rating is 91 for a condition rating of Poor, mostly due to the beaver impacted portion, which is about 1/3 to 1/2 the total length. The BEHI numerical rating is 39.2 indicating a high rate of bank erosion, again mostly driven by the beaver damaged portions. Sediment loss from the banks is estimated to be between 0.6 and 0.9 ton/year from a 25-foot long assessment section.

The current length of the restoration reach is about 2,450 feet, with about 650 feet of exposed and failing banks. Extrapolating through the entire reach with similar bank conditions, we estimate 15 to 23 tons of sediment contribution to the stream annually from bank losses. This does not include the beaver impacted banks, temporary ponds or cattle access.

3.4.2 Unnamed Tributary

The distribution of bed features is irregular and dominated by debris jams and bank collapses. Pools are short and infrequent throughout the reach.

The Pfankuch rating is 95 for a condition rating of Poor. The BEHI numerical rating is 41.5 indicating a very high rate of bank erosion. Sediment loss from the banks is estimated to be between 0.6 and 0.9 ton/year from a 25-foot long assessment section.

The current length of the restoration reach is about 920 feet with about 250 feet of exposed, unstable bank. Extrapolating through the entire reach with similar bank conditions, we estimate 7.5 to 10.5 tons of sediment contribution to the stream annually from bank losses. This does not include the cattle-trampled banks and crossings. Entrainment calculations indicate the bed is stable, which is a further indication of the sediment load in the system coming from failing banks.

3.5 Bankfull Verification

3.5.1 Ripshin Branch

Good bankfull indicators occur in the stable sections of Reach 1 and the non-beaver-impacted sections of Reach 2. Bankfull indicators associated with riffles are difficult to identify in some places (mostly in Reach 2) due to bank instability, beaver activity, heavy herbaceous vegetation and lack of good diagnostic riffles. Bankfull width measurements ranged from 17 to 24 feet, with a typical riffle average of just over 20 feet.

3.5.2 Unnamed Tributary

Bankfull indicators associated with riffles are difficult to identify throughout the reach due to bank instability. A bankfull width measurement of 18 feet was noted at a

relatively stable riffle at the head of the reach, with a typical riffle cross-sectional area of slightly over 16 square feet, which compares favorably to the regional curve prediction of 15.3 square feet.

3.6 Vegetation

3.6.1 Ripshin Branch

The vegetation along Ripshin Branch includes a mixture of wetland and pasture plants along stream right. The upper portion of Reach 1 is bounded by the Ripshin Road embankment on stream right and an active pasture on stream left with some isolated hawthorn and ironwood trees and a wet meadow, then the road and creek diverge. The stream crosses the floodplain, which has been used as a hay field recently and for growing corn in the days of horse-drawn agriculture. There are some large patches of multiflora rose along the creek banks.

At station 6+00, the creek encounters a hillside on stream left, thence the creek abuts this steep, forested hillside. The forest is a mixture of oaks, hickories and red maple, with occasional white pine and Canadian hemlocks. On the north and east slopes, in areas with limited or no cattle grazing, there is a thick understory of rhododendron, mountain laurel and flame azalea. Included in the understory is a typical mix of other ericaceous plants. The floodplain on stream right also contains (or contained) yellow buckeye, cherry birch and isolated red maples.

3.6.2 Unnamed Tributary

The vegetation along the entire length of the Unnamed Tributary is typical of cattle-impacted, grazed pastures with a thin strip of woody plants dominated by Silky willow, apple and tag alders. The herb layer is variable and includes typical pasture and wet meadow species along with a few interesting species like *Trillium erectum.*

4.0 Reference Streams

The proposed stream restorations will involve work on both Ripshin Branch and an Unnamed Tributary to it. The valley slope is less than 2 percent along the Unnamed Tributary and the lower section of Ripshin Branch (Reach 2), with some notably steeper areas along the upper portion (Reach 1) of Ripshin Branch. Based on the stream profiles, valley type, and the existing condition surveys, it is apparent the restorations will need to include sections of both B4 and C4 stream types (Rosgen 1994).

We have reference data from two C4 streams in the northwest mountain region, including Long Branch in Patrick County, Virginia (a tributary in the Dan River system) and Basin Creek in Wilkes County, North Carolina. Both of these reference reaches have been approved for use by EEP and NCDWQ in other stream restoration projects. We selected Long Branch to be our primary C4 reference for this project.

After an extensive search, we were unable to locate a suitable B4 type reference reach in the northwest mountains in the vicinity of Ripshin Branch. The alternative B type stream reference that was ultimately selected (and approved by EEP in e-mail correspondence) is a short section of the upper end (Reach 1) of the Ripshin Branch restoration reach. It is not as pristine and undisturbed as might be desired; however, this reference has the advantage of being in the same valley and watershed, with the same bed and bank material, and it is stable after several decades in the same location (personal communication from Tate Farm Manager Jim Farmer).

In the literature on reference reaches from Wildland Hydrology's website and papers by Richard Hay (Hey 2006), one of the themes that come through is that reference reaches should be as close to the scale of the project reach as possible and also comparable with regard to valley type, geology, sediment load, climate, etc. We consider apparent stability to be a key characteristic of an acceptable reference as well. Therefore, the proposed on-site reference reach would seem to be the best option since it is in the same valley as the restoration reach and should give a good indication of what is attainable given the constrained nature of the valley and channel. The bottom line is it also appears better than the alternatives.

Photos of the reference sites are included in Appendix 4. Additional data from the reference surveys can be found in the Morphological Data Summary Table (Table 4).

4.1 Watershed Characterization

The Long Branch watershed is just north of the Virginia-North Carolina state line in Patrick County, Virginia. The watershed is a tributary to Peters Creek in the Dan River system, located in the Roanoke Basin. The Long Branch watershed is 1.7 square miles in size and comprised of about 75% forest lands, 15% agricultural fields (cattle pastures), 5% residential, and 5% road corridors. The elevation of the center of the restoration reach is about 1,290 feet above mean sea level.

The internal reference is at the head of Ripshin Branch (Reach 1) and has a drainage area of about 1.6 square miles. The watershed land use is about 50% forest, 40% cattle pasture, 5%

residential, and 5% road corridors. The center of the reference reach is at about 3,300 feet above mean sea level.

4.2 Channel Classification

Long Branch is a C4 stream type and the internal reference reach is a B4 stream type (Rosgen 1994).

4.3 Discharge

Long Branch has good bankfull indicators and has been determined to have a bankfull discharge (Q_{bkf}) of 60.4 cfs. The Ripshin internal reference is estimated to have a bankfull discharge (Q_{bkf}) of 145 cfs.

4.4 Channel Morphology

Long Branch has a bankfull width of 14.4 feet, a bankfull mean depth of 1.2 feet, and a bankfull cross-sectional area of 17.6 square feet. It has a meander length of 97.5 feet, a radius of curvature of 25.3 feet, and a belt width of 42 feet. The channel has a sinuosity of 1.2 and a slope of 0.012.

The Ripshin internal reference has a bankfull width of 17.1 feet, a bankfull mean depth of 0.85 feet, and a bankfull cross-sectional area of 14.5 square feet. It has a meander length of 136 feet, a radius of curvature of over 100 feet, and a belt width of about 22 feet. The water surface slope is 0.020 and its sinuosity is 1.07.

4.5 Channel Stability Assessment

Long Branch scores a 53 which is Good on the Pfankuch channel stability assessment. The Long Branch BEHI rating is 16.9 which is a low score. This translates to a predicted erosion rate of 0.59 ton per year over the entire stream reach. The Ripshin internal reference section scores a 55 which is a Good rating. The internal reference scores a 10.9 on the BEHI which is a low score and translates to a predicted erosion rate of 0.57 ton per year for this stream reach.

4.6 Bankfull Verification

The bankfull dimensions for Long Branch are within the range of the Piedmont Rural Regional Curve and also on the low end of the Mountain Regional Curve. The bankfull dimensions of the Ripshin internal reference are slightly below those indicated by the Mountain Regional Curve. We believe this is a result of the regional curves not being differentiated by stream type and the fact that none of the streams used to derive the regional curves are from the northwest mountains.

4.7 Vegetation

The vegetation in the riparian vicinity of Long Branch is typical of a Mountain/Piedmont Alluvial Forest, with species like Canadian hemlock and white pine being a significant component of the canopy. The forest has been significantly disturbed by logging and past agriculture and would not qualify as a natural community as defined by the NC Natural Heritage Program. The site is significant since this creek channel is home to a federally endangered plant, the Small-anthered bittercress (*Cardamine micranthera*), and is one of the largest populations of this plant of the 31 occurrences known. This plant is rare because it grows in active channels on sand and gravel bars. The vegetation of this reference reach does not provide much guidance for Ripshin Branch, which occurs at an elevation almost 2000 feet higher than Long Branch.

The vegetation of the Ripshin internal reference reach is basically a mixture of pasture grasses, wetland species and a large patch of multiflora rose, none of which provide guidance about what should be planted in the restoration and enhancement reaches.

Because neither reference stream is surrounded by suitable natural communities of vegetation, reference vegetation types are taken from two sources, namely Shafale and Weakley (1990) and Somers, Bridle, et. al. (2000) (see References, Section 9.0). Two natural communities are specified for riparian buffer and wetland restoration, namely Montane Alluvial Forest and Swamp Forest-Bog Complex. Plant materials will be required to come from transplant sites or Mountain region nurseries within 100 miles of the site and located above 2000 feet in elevation.

5.0 Project Site Wetlands (Existing Conditions)

There are areas of existing wetlands and drained wetlands on the Tate property along Ripshin Branch and its tributary. All of the wetlands have historically been impacted by livestock grazing. One of the proposed wetland restoration areas along the Unnamed Tributary is currently active livestock pasture and has been ditched and drained to increase the grazing utility of the pasture. The other wetland area along Ripshin Branch has not been so extensively altered by recent agriculture, but has been routinely mowed for hay and impacted by beaver dam building and feeding.

The proposed wetland restoration areas show signs of significant hydrology, in spite of having been drained and filled. The floodplain along the Unnamed Tributary has drain tiles installed about 18-24 inches below the surface, and water flowed briskly from the tiles during the stream surveys in April and July. The tiles occur beneath what appears to be soil fill, in which pasture grass was planted. In addition, there is a drainage ditch at the head of the valley that intercepts water from several seeps. This ditch merges with the UT restoration reach about halfway down its length. There are existing wetlands to the north of this ditch and a small area of wetland to the north of the Unnamed Tributary. Both of these locations are very wet and show indications of a saturated surface during most (if not all) of the growing season.

5.1 Jurisdictional Wetlands

Along both the Unnamed Tributary and Ripshin Branch there are wetlands located in the floodplains adjacent to the streams. In all cases, these wetlands have been impacted by agriculture, ditching, draining and filling. There are at least two areas along the Unnamed Tributary and three locations along Ripshin Branch that have been delineated according to the 1987 USACE Wetland Manual. These areas were flagged and mapped using a mapping grade GPS unit. Refer to Figure 5.

On February 21, 2007, Amanda Jones of the U.S. Army Corps of Engineers visited and reconnoitered the site and confirmed the wetland identifications and boundaries established by EcoLogic.

5.2 Hydrologic Characterization

5.2.1 Groundwater Modeling

Groundwater modeling of the existing wetlands is ongoing. Eight (8) groundwater monitoring gages were supplied by EEP in October 2006 and installed by EcoLogic in November 2006. Refer to Figure 4 for gage locations. Two (2) gages were relocated in January 2007 due to a revision in the project boundaries following landowner negotiations for a conservation easement. As of this writing, only about six (6) weeks of gage data is available and rainfall monitoring has been erratic. The data will be analyzed along with future data to confirm or refute the hydrology-supported groundwater surface elevations indicated from soil surveys for wetland restoration design.

5.2.2 Surface Water Modeling at Restoration Site

The existing wetlands do not appear to rely on overbank flooding from Ripshin Branch or the Unnamed Tributary for their shallow groundwater hydrology. The hydrology appears to be supported by groundwater and supplemented by small surface tributaries that feed the stream valley, with persistent groundwater indicated about 12 inches below the existing surface. Because overbank flooding is not believed to be critical to the site wetland hydrology, surface water modeling is not indicated at this time.

5.2.3 Hydrologic Budget for Restoration Site

The development of a hydrologic budget for the proposed wetland restoration sites is incomplete at this time.

5.3 Soil Characterization

5.3.1 Taxonomic Classification

A site-specific, preliminary soils investigation relative to wetlands was conducted by Foothills Soils Consulting, LLC under subcontract to EcoLogic. The report of that investigation is attached (Appendix 5).

A large portion of the floodplain along Ripshin Branch contains mapped units of Colvard soils (refer to Figure 3). Colvard soils are well drained and are not themselves hydric soils, but frequently contain hydric soils. The soils in the area of the former beaver activity appear to be near-hydric and hydric. The soil study indicates a floodplain wetland can be sustained, provided it receives sufficient groundwater saturation and periodic inundation from stormwater overflows and occasional flooding.

The soils in the floodplain of the Unnamed Tributary include both hydric and near-hydric. This indicates a more complex soil association than indicated on the Ashe County soils map. Some of the soil test sites show indications of angular fill above native soils. The chroma 2 or less mottles throughout the pasture area indicate sufficient hydrology exists to maintain a wetland about one (1) foot below the original (natural) ground surface.

The soils between Ripshin Road and Ripshin Branch in the upper end of the restoration reach were investigated to assess their potential to support wetland restoration. The particle size, color, and horizon development indicate a near-hydric soil, but not saturated enough to be completely hydric. Some auger probes indicated apparent fill. The soils in the area of the former beaver activity appear to be near-hydric as well. The soil study indicates a floodplain wetland can be sustained, provided it receives sufficient groundwater saturation and inundation from overflow from the confluence of the tributary and the main channel.

The soils observed in the proposed wetland restoration areas are typically inclusions of Iotla, which is a somewhat poorly drained soil, or Toxaway, which is a poorly drained or very poorly drained soil. Depths to a cobble layer were somewhat shallow for these

series. Toxaway soils are typical of wetlands in the area. Iotla soils are not hydric, but have very good potential for wetland creation, and in some cases may be present in wetlands in this area. The extent of these soils was confirmed in the field and used as the basis of restoration strategies.

5.3.2 Profile Description

The soils in the wetland areas have a thick (1-3 inch) and dark A horizon indicative of the high organic contribution of the vegetation and occasional cattle contribution. The B horizon in most delineated areas shows a depleted matrix and mottles with hydric matrix. Other areas, like the former beaver dam area, are less obviously wet (after breaching of the beaver dams), but there are many low chroma mottles at a depth of about 15 inches and a reduced matrix at 22 inches. In some locations, the redox features form at 6 inches below the soil surface.

5.4 Plant Community Characterization

The two areas of existing wetlands are very similar in their vegetation component. One wetland occurs along the Unnamed Tributary and the others along the main channel of Ripshin Branch. In all cases, the landowners have used these remnant wetlands as wet pastures with heavy grazing by livestock. These wetlands do not correspond to any wetland natural community type as described in the Third Approximation (Shafale and Weakley, 1990).

The terms Wet Meadow or Meadow Bog are used to describe a Mountain or Piedmont wetland that has been altered by human use (Somers et. Al, 2000). Wet Meadows are frequently found on agricultural land, primarily in pastures and wet spots in hay fields. These bogs are swampy wet areas vegetated with sedges, herbs, shrubs and sparse trees. The vegetation is a mixture of one or more of the natural communities that occur in the area and in altered fields, forests and farms. Disturbance-sensitive natives are rare or missing, and introduced weedy species are common. Depending on the kind and type of disturbance, Wet Meadows' vegetation patterns can also be modified by increased fertilizer and chemical loading, grazing, pasture grass planting, herbicides, dumping and other alterations.

The project site wetlands have strong components of wetland flora surviving in the areas that are wettest and least accessible to grazing livestock. The wetland vegetation remnants include sedges (*Carex* spp), false nettle (*Boehmeria cylindrica*), seedbox (*Ludwigia* spp), touch-me-not (*Impatiens capensis*), cinnamon fern (*Osmunda cinnamomea*), royal fern (*Osmunda regalis*), green-head coneflower (*Rudbeckia laciniata*), hooked buttercup (*Ranunculus recurvatus*), turtleheads (*Chelone glabra*), and soft rushes (*Juncus* spp.). Shrubs such as tag alder (*Alnus serrulata*) and spicebush (*Lindera benzoin*) and elderberry (*Sambucus canadensis*) also indicate significantly wet conditions. Wetlands in agricultural settings provide habitat for invasive weedy species like Chinese privet (*Ligustrum sinense*), Japanese grass (*Microstegium vimineum*), multiflora rose (*Rosa multiflora*) and Japanese honeysuckle (*Lonicera japonica*), all of which are present in these wetlands.

6.0 Reference Wetlands

All wetlands are unique local adaptations of hydrology, soils and vegetation. They are also dynamic, changing to adjust to changing local conditions. There are several wetlands in the Ripshin Branch area that are not as heavily impacted as the floodplains that are the focus of the restoration and enhancement activity. These include several hillside seeps, a mountain bog and some alluvial wetlands. None of these sites are in the locations of proposed work by EEP, but may be used as reference wetlands for some wetland characteristics. They are not seen as direct references due to the difference in slopes, scale and valley types. No other wetlands suitable for use as reference wetlands and that are accessible for study are known in the region.

6.1 Hydrologic Characterization

Not applicable due to absence of reference wetlands.

6.2 Soil Characterization

Not applicable due to absence of reference wetlands.

6.3 Plant Community Characterization

Because reference wetlands are not available, reference vegetation types are taken from two sources, namely Shafale and Weakley (1990) and Somers, Bridle, et. al. (2000) (refer to References, Section 9.0). Two natural communities are specified for riparian buffer and wetland restoration, namely Montane Alluvial Forest and Swamp Forest-Bog Complex.

6.3.1 Community Descriptions

Montane Alluvial Forest
This community occurs on alluvial soils in floodplains at moderate to high elevations. It is a forest of mesophytic species including Canada hemlock (*Tsuga canadensis*), white pine (*Pinus strobus*) sycamore (*Platanus occidentalis*) and yellow birch (*Betula lutea*), stream birch (*B. nigra*), red maple (*Acer rubrum*), northern red oak (*Quercus rubra* var. *rubra*) and tulip tree (*Liriodendron tulipifera*). Understory species include ironwood (*Carpinus caroliniana*), witch hazel (*Hamamelis virginiana*), and silky and black willow (*Salix* species). Typical shrubs are tag alder, (Alnus serrulata), great rhododendron (*Rhododendron maximum*), doghobble (*Leucothoe axillaris*) and other ericaceous species like blueberries (*Vaccinium* sp.). The herb layer is variable and can include ragwort (*Senicio aureus*), manna grass (*Glycera melicaria*), knotweed (*Polygonum punctatum*), spring beauty (*Claytonia virginica*), trilliums (*Trillium* sp), goldenrods (*Solidago* sp.), Jack-in-the-pulpit (*Arisaema triphyllum*) and violets (*Viola* sp.).

Swamp Forest-Bog Complex

This community occurs in poorly drained bottomlands, generally with visible microtopography of ridges and sloughs or depressions. It is a forest with closed or open canopy and open or dense shrub layer interspersed with small boggy openings in depressions. The canopy consists of Canada hemlock (*Tsuga canadensis*) or red maple (*Acer rubrum*) depending on the location and elevation. Other trees include black willow (*Salix nigra*) and sweet birch (*Betula lenta*), white pine (*Pinus strobus*) and a few other alluvial species. The dominant shrubs are usually great laurel (*Rhododendron maximum*) and mountain laurel (*Kalmea latifolia*), with silky willow (*Salix sericea*), tag alder (*Alnus serrulata*), silky dogwood (*Cornus amomum*), southern wild raisin, (*Viburnum nudum*) and poison sumac (*Toxicodendron vernex*). The herbs in the boggy open areas include seepage goldenrod (*Solidado patula*), New York aster (*Aster novae-angliae*), robin runaway (*Dalibarda repens*), cinnamon fern (O*smunda cinnamomea*), northern long sedge (*Carex folliculata*), mountain fringed sedge (*Carex gynandra*), little bog sedge (*Carex leptalea*), straight sedge (*Carex stricta*), purple pitcher plant (*Sarracenia purpurea*), broadleaf arrowhead (*Saggittaria latifolia*) and rice cutgrass (*Leersia virginica*). In the closed canopy forest areas, melic mannagrass *(Glyceria melicaria*), clubmoss (*Lycopodium obscurum*), sensitive fern (*Onoclea sensibilis*), Canada mayflower (*Maianthemum canadense*), New York fern (*Thelypteris novoboracensis*), and royal fern (*Osmunda regalis*) are common herbs. Scattered *Sphagnum* mats occur in the boggy areas.

7.0 Project Site Restoration Plan

7.1 Restoration Project Goals and Objectives

Project Goals

The design goals of the Ripshin Branch restoration project are as follows:

- Improve stream water quality and ecological function by excluding livestock, restoring pool and riffle sequences, and restoring tree canopy and instream large woody debris;
- Enhance aquatic and terrestrial habitat in the stream corridor and adjacent wetlands;
- Enhance and/or restore the ecological function of riparian wetlands;
- Restore the riparian corridor (forested buffer) for watershed and wildlife benefits;
- Enhance habitat for native brook trout (*Salvelinus fontinalis*) and improve fishery potential; and
- Increase the biodiversity of the stream ecology, riparian buffers and wetlands.

Project Objectives

The design objectives of the Ripshin Branch restoration project are as follows:

- Improve channel geomorphology toward reference conditions by providing watershed-scaled and Rosgen-typed channel dimension, adding floodplain benches where floodplain access is not feasible, restoring sinuous pattern to straightened reaches where possible, and adjusting profile as needed to restore or maintain sediment transport equilibrium;
- Restore streamside floodprone area where appropriate (increase floodwater access to the floodplain);
- Reduce sediment and nutrient loading by reshaping and stabilizing banks, reducing bank scour, excluding livestock, and restoring riparian buffers; and
- Enhance or restore wetland hydrology and vegetation in former pastures and filled wetlands.

7.1.1 Design Channel Classification and Wetland Type

The proposed channel classification for Reach 1 of Ripshin Branch (Stations 0+00 to 14+85) is Rosgen Stream Type B4. The proposed channel classification for Reach 2 of Ripshin Branch (Stations 14+85 to 28+00) is Type C4. The proposed channel classification for Reach 3A of the Unnamed Tributary (Reach 3) is Type B4, while the proposed channel classification for Reach 3B is Type C4.

The existing channels were previously straightened, but have since responded by attempting to adjust laterally, creating zigzagging, erratic channels as evidenced by the existing thalwegs on the restoration plan sheets (Sheets 2-1 through 2-3). As a result, it appears from the design sinuosity values that the proposed restoration is not

dramatically improving channel pattern, but it is providing stable, structure-protected, well vegetated, and habitat-enhanced channels with improved meander pattern that happen to be similar in length to the existing channels.

The proposed wetland restoration and enhancement activity will convert agricultural pasture and wet meadow to forested bottomland hardwood swamp types.

7.1.2 Target Wetland Communities and Buffer Communities

The riparian buffers will be planted to emulate a Montane Alluvial Forest on the riparian margins transitioning to a Swamp Forest-Bog Complex on the floodplain wetlands (Shafale and Weakley, 1990).

7.2 Sediment Transport Analysis

7.2.1 Methodology

Sediment transport capacity and competency was assessed using the sampling procedures specified by Rosgen (1994) and analyzed using Entrainment Calculation forms provided by Wildland Hydrology (Rosgen). Sediment transport validation numbers were generated using the Shields Entrainment Function in RIVERMorph since it provides the ability to generate a data range between Shields lab data and Rosgen field data.

Pebble counts were conducted at riffle cross-sections on the UT and both reaches of Ripshin Branch. In the existing impacted reaches there are few if any stable or diagnostic bars, so in all cases pavement and subpavement samples were collected and the D_{50} for the subpavement was used in the calculations of critical shear stress.

7.2.2 Calculations and Discussion

Nine (9) Sediment Entrainment Calculation Forms are included in Appendix 6. They include existing and proposed conditions for Ripshin Branch (Reaches 1 and 2) and for the Unnamed Tributary (Reach 3).

As evidenced by the calculations, there is very little change between the pre- and post-restoration conditions. This is because the principal forms of instability in Ripshin Branch (Reaches 1 and 2) and the UT (Reach 3) are planform irregularity and resulting bank instability. The channel slopes are being altered only slightly in the restoration reaches, and are essentially unchanged in the enhancement reaches. Inspections of the beds of the project reaches typically indicate stable channel beds.

7.3 HEC-RAS Analysis

7.3.1 No-Rise, LOMR, CLOMR

The project is not in a FEMA mapped waterway, thus no HEC-RAS analysis or other flood modeling was required.

7.3.2 Hydrologic Trespass

Topography and property boundaries preclude hydrologic trespass beyond that which presently occurs on shared boundaries during high water. According to the landowner, who has owned the property since 1967, there have been no instances of overbank flooding on the property. This anecdotal finding is consistent with the first-order character of the stream and its relatively high degree of incision, presumably from upstream migration of head-cutting following channelization. This suggests very low potential for hydrological trespass onto adjacent property or outside the immediate riparian corridor. The only proposed Priority 1 restoration is in Reach 3, which is well confined in the valley by Ripshin Road and not on a shared boundary.

7.4 Stormwater Best Management Practices

7.4.1 Narrative of Site Specific Stormwater Concerns

There are only a few locations where stormwater is collected from impervious surfaces and enters the restoration boundary, all from Ripshin Road parallel to Ripshin Branch. In these cases, existing ditches direct the stormwater from culverts beneath the road directly to the creek. In some cases, these ditches also appear to drain on-site wetland areas.

7.4.2 Device Description and Application

In order to supplement wetland hydrology in areas proposed for enhancement or restoration, the plan calls for filling the existing ditches and installing level spreaders below the culverts to disperse the stormwater across the floodplain. This will offer the added benefit of allowing stormwater pollutants to be attenuated by the wetlands.

Recently promulgated design criteria and details for level spreaders from the NC Division of Water Quality will be used and modified as needed to adapt to site needs.

7.5 Hydrologic Modifications

7.5.1 Proposed Modifications

Proposed modifications to site hydrology for wetland enhancement and restoration include filling drainage ditches, removing subsurface drain tiles, installing grade control in required ditches to raise the water level, building top-of-bank berms along channels adjacent to wetlands, installing level spreaders at culverts, and using small tributaries to wet the floodplain. In addition, it is proposed to raise the level of the stream bed and lower the terrace in some areas to promote overbank flooding as a supplemental contribution to wetland hydrology.

7.5.2 Scaled Schematic of Modifications

Refer to Figures 4B.

7.6 Soil Restoration

7.6.1 Soil Preparation and Amendment

The soils in most of the wetland enhancement and restoration areas are intact and do not require modification beyond removal of some shallow dredge fill and ripping to loosen the soil compacted by years of cattle grazing and the proposed construction traffic. Construction specifications will include mandatory soil ripping as well as disking to promote a rough surface that retains water and supports microhabitats that enhance wetland plant and animal biodiversity.

Riparian areas that are not in wetlands will be limed and fertilized with a low nitrogen fertilizer to promote the growth of planted woody species and temporary and permanent seed mixes, without encouraging excessive weedy vegetation. Soil testing will be required to determine optimum nutrient and amendment levels.

7.7 Natural Plant Community Restoration

7.7.1 Plant Community Restoration

The planting plan calls for a patchy mixture of planting zones that maximizes riparian biodiversity and wildlife habitat (refer to Sheet 4). The planting plan is guided by the natural communities listed in Paragraph 6.3.1. The planting zones include large areas of mixture planting and a few clumps and clusters. There are existing elderberry colonial patches and these will be reflected in other clustered plantings of trees, shrubs and wetland plants.

Table 7 details the proposed planting zones. They include five (5) general zones that relate to different features and habitats along the riparian corridors being restored. There are also two (2) general zones that include the wetland enhancement and restoration areas. In addition to these general, base-condition planting zones, there are three (3) wildlife habitat planting zones, one (1) zone for overhead utility lines, and two (2) zones to add landscape interest to highly visible portions of the project. Each zone is treated as a theme and is used widely or in small patches as needed. Several of the habitat and landscape zones are also replicated a few times thoughout the project area.

It is desired to specify some native sedges and rushes in the wetland restoration areas to get a head start on the seed mixes typically used and also to produce some immediate habitat structure and diversity.

Plant materials will be required to come from transplant sites or Mountain region nurseries within 100 miles of the site and located above 2000 feet in elevation. It is expected that commercial supplies of some desired species will only be available as containerized or possibly balled and burlap specimens of a larger size than typically used for stream and wetland restorations. If larger woody plant materials with containerized roots are used, they should have better survival and be better able to compete with existing herbaceous and invasive vegetation.

7.7.2 On-site Invasive Species Management

There is only one significant invasive species currently present in the vicinity of the restoration project and that is multiflora rose (*Rosa multiflora*). There are several large colonies along Ripshin Branch and a few smaller occurrences in the existing wetlands. It is envisioned that these will be mechanically removed with excavating equipment during construction.

There are mixtures of non-native pasture grasses and forbs that make up a portion of the existing flora in the wet meadow areas, but they are commingled with a diverse and well established native wetland flora. It is anticipated that removal of these species will cause more harm than benefit and that increasing surface hydrology may eliminate them.

8.0 Performance Criteria

8.1 Streams

Channel morphology retains the design stream type over the majority of the reach.
Coarsening of riffle bed material in newly constructed reaches.
Pool/riffle spacing should remain fairly constant.
Maintenance of bankfull width at riffles within +/- 10% of the design.
Maintenance of bank height ratios at 1-1.1.
Bank stability over 90% of altered channel reaches.
Dimension and profile stability over 90% of altered channel reaches.
No significant channel aggradation or degradation.
Minimal development of instream bars.
Biological populations (invertebrate and fish) remain constant or increase and species composition indicates a positive trend.

8.2 Stormwater Management Devices

Stable and effective over 80% of their cumulative length (level spreaders).

8.3 Wetlands

Hydrologic monitoring indicates groundwater within 12 inches of the ground surface for 10% of the growing season.
Increasing wetland vegetation.
Development of hydric soils.
Fulfill USACE criteria for jurisdictional wetlands.

8.4 Vegetation

Survival of planted vegetation should exceed 80% after five (5) years following planting (minimum 260 stems/acre).
Planted vegetation stabilizing at 20 years with distinct canopy, subcanopy and shrub layers.
Establishment of herbaceous cover over 75% of the soil surface in restored wetlands and riparian areas.
Plant biodiversity dominated by native species, with minimal ecological impact from invasive species.

8.5 Schedule and Reporting

Monitoring and reporting in accordance with EEP guidelines annually for at least five (5) years. The site will be subject to additional monitoring and evaluation by NCSU through an EEP research grant.

9.0 References

Hey, R.D., 2006, *Fluvial Geomorphological Methodology for Natural Stable Channel Design*, JAWRA Vol. 42, No. 2, pp 357-374

Rosgen, D., 1994, *Applied Stream Morphology*, Wildland Hydrology

Shafale, M.P and A.S Weakley, 1990, *Classification of the Natural Communities of North Carolina, Third Approximation.* NC Natural Heritage Program

Somers, A.B., K.A. Bridle, D.W. Herman and A.B. Nelson, 2000, *The Restoration & Management of Small Wetlands of the Mountains & Piedmont in the Southeast*, NRCS Watershed and Wetland Science Institutes

Weakley, A.S., Working Draft Jan 2006, *Flora of the Carolinas, Virginia, Georgia and surrounding areas.*, University of North Carolina Herbarium, Chapel Hill, NC.

Table 1. Project Restoration Structure and Objectives
Project Number 372 (Ripshin Branch)

Restoration Segment/ Reach ID	Station Range	Restoration Type	Priority Approach	Existing size acres/lf	Designed size acres/lf	Comments
UT to Ripshin Reach 3A	00+00-1+32	Stream Enhancement	L1	132 lf	132 lf	Benches and structures
UT to Ripshin Reach 3B	1+32-9+12	Stream Restoration	P1	788 lf	780 lf	New channel/ cattle exclusion
UT to Ripshin Wetland 1	0+00-2+00	Wetland Enhancement	NA	0.76 ac	0.88 ac*	Grade work and woody plantings/cattle exclusion
UT to Ripshin Wetland 2	3+25-9+40 stream left	Wetland Restoration	NA	0	0.60 ac	Grade work and planting/cattle exclusion
UT to Ripshin Wetland 3	3+75-9+40 stream right	Wetland Restoration	NA	0	1.03 ac	Grade work and planting/cattle exclusion
UT to Ripshin Wetland 4	6+00-9+40 stream left	Wetland Enhancement	NA	0.48 ac	0.61 ac*	Woody Plants added/cattle exclusion
Ripshin Branch Reach 1A	0+00-6+00	Stream Enhancement	L2	600 lf	600 lf	Benches, structures, invasive removal
Ripshin Branch Wetland 5	3+25-4+50	Wetland Enhancement	NA	0.14 ac	0.14 ac	Woody Plantings
Ripshin Branch Reach 1A	6+00-8+00	Stream Enhancement	L2	200 lf	200 lf	One bench and structures
Ripshin Branch Wetland 6	8+00-15+25	Wetland Enhancement	NA	2.56 ac	2.02 ac	Hydrology improvements and woody plants
Ripshin Branch Reach 1B	8+00-12+00	Stream Restoration	P2	350 lf	400 lf	New channel to fix failure area

Restoration Segment/ Reach ID	Station Range	Restoration Type	Priority Approach	Existing size acres/lf	Designed size acres/lf	Comments
Ripshin Branch Reach 1C	12+00-14+85	Stream Enhancement	L2	285 lf	285 lf	Benches and structures
Ripshin Branch Reach 2A	14+85-23+00	Stream Restoration	P2	785 lf	815 lf	New channel, structures and plantings
Ripshin Branch Wetland 7	15+40-20+00 stream right	Wetland Restoration	NA	0	0.77 ac	Repair beaver damaged floodplain
Ripshin Branch Wetland 8	21+15-22+15 both sides	Wetland Restoration	NA	0	0.16 ac	Grading and new woody plantings
Ripshin Branch Wetland 9	21+15-24+00 stream right	Wetland Enhancement	NA	0.37 ac	0.40 ac	Hydrology improvements and new plantings
Ripshin Branch Reach 2B	23+00-28+18	Stream Preservation	NA	518 lf	518 lf	NA
Ripshin Branch Wetland 10	27+00-28+18	Wetland Enhancement	NA	0.18 ac	0.14 ac	New woody plantings
				Existing	Proposed	
Total Stream Lengths				3,658	3,730	
Total Wetland Areas				4.49	6.75	

* Slight increase in area from proposed filling of the existing channel after relocation.

Key to Priority Approaches:

L1 Enhancement Level 1
L2 Enhancement Level 2
P1 Restoration Priority 1
P2 Restoration Priority 2

Table 2. Drainage Areas
Project Number 372 (Ripshin Branch)

Reach	**Drainage Area (acres)**
Unnamed Tributary to Ripshin Branch	358.4
Ripshin Branch	1024 (includes UT)
Total	**1024**

Table 3. Land Use of the Watershed
Project Number 372 (Ripshin Branch)

Land Use	**Acreage**	**Percentage**
Deciduous forest	378	37%
Evergreen forest	102	10%
Mixed forest	51	5%
Cattle/ goat pasture	409	40%
Residential/ farm buildings	31	3%
Road corridors	51	5%

Table 4a. Morphological Table – Ripshin Branch
Project Number 372 (Ripshin Branch)

Morphological Data, Ripshin Branch								
	Existing	Exisiting	Reference	Reference	Proposed	Proposed	Proposed	Proposed
CLASSIFICATION DATA	**Ripshin Branch Reach 1**	**Ripshin Branch Reach 2**	**Ripshin Internal Reference**	**Long Branch (VA)**	**Ripshin Branch Design Reach 1A**	**Ripshin Branch Design Reach 1B**	**Ripshin Branch Design Reach 1C**	**Ripshin Branch Design Reach 2A**
Rosgen Stream Type	B4c/F4	F4/C4	B4c/1	C4	B4c	B4c	B4c	C4
Drainage Area (sq mi)	1.6	2	1.6	1.7	1.6	1.6	1.6	2
Bankfull Width (W_{bkf}) (ft)	24	21	17.1	14.4	23	23	23	25
Bankfull Mean Depth (d_{bkf}) (ft)	1.3	1.2	1.3	1.2	1.3	1.3	1.3	1.4
Bankfull Cross Sectional Area (A_{bkf}) (sf)	29	26	29.7	17.6	30	30	30	35
Width/Depth ratio (W_{bkf}/d_{bkf})	18.5	21.0	13.2	11.8	17	17	17	18
Maximum depth (d_{mbkf}) (ft)	1.9	1.9	1.9	1.7	2.7	2.7	2.7	2.9
Width of flood prone area (W_{fpa}) (ft)	45	35-60	27	95	25-45	25-45	25-45	44 to 80
Entrenchment ratio (ER)	1.9	2.6	1.6	6.6	1.6	2	1.5	1.9-3.5
Water surface slope (S) (ft/ft)	0.024	0.018	0.020	0.012	0.022	0.022	0.022	0.0187
Sinuosity (stream length/valley length) (K)	1.2	1.2	1.1	1.2	1.1	1.2	1.1	1.3
DIMENSION DATA								
Pool Depth (ft)	3.6	3.6	0.93	2.6	3.6	3.5	3.5	3.6
Riffle Depth (ft)	1.3	1.2	0.85	1.2	1.3	1.3	1.3	1.4
Pool Width (ft)	33	25	16.9	14.5	34	25	25	34
Riffle Width (ft)	24	21	17.1	14.4	22.6	23	23	25
Pool XS Area (sf)	41	30	15.7	18	39	33	33	39
Riffle XS area (sf)	30	26	14.5	14.4	30	30	30	30
Pool depth/mean riffle depth	2.8	2.9	1.1	2.1	2.7	2.7	2.7	2.7
Pool width/riffle width	1.5	1.2	1.0	1.0	1.5	1.1	1.1	1.5
Pool area/riffle area	1.4	1.2	1.1	1.3	1.3	1.1	1.1	1.3
Max pool depth/d_{bkf}	2.8	2.9	1.5	2.2	2.8	1.5	2.2	2.8
Low bankheight/max bankfull depth	1.8	1.8	1.20	1.2	1-1.2	1-1.2	1-1.2	1-1.2
Mean bankfull velocity (V) (fps)	5.50	5.50	4.4	3.43	4.8	4.8	4.8	5
Bankfull discharge (Q) (cfs)	158	158	150	60.4	144	144	144	165
PATTERN DATA								
Meander length (L_m) (ft)	30-240(125)	30-240(125)	120-140(136	97.5	85-184	85-184	85-184	143-365
Radius of curvature (Rc) (ft)	10-160(10)	10-160(22)	45-185(101)	25.3	55-135	55-135	55-135	38-107
Belt width (W_{blt}) (ft)	7-80(20)	20-65(45)	20-26(22)	41.7	29-67	29-67	29-67	66-150
Meander width ratio (W_{blt}/W_{bkf})	0.8	2.1	1.29	2.9	6.6	6.6	6.6	4.4
Radius of curvature/bankfull width	0.4	1.0	5.9	1.8	4.2	4.2	4.2	3
Meander length/bankfull width	5.2	2.1	8.0	6.8	6.7	6.7	6.7	12.1
PROFILE DATA								
Valley slope	0.021	0.024	0.021	0.016	0.02	0.02	0.02	0.02
Average water surface slope	0.020	0.020	0.019	0.012	0.02	0.02	0.02	0.02
Riffle slope	0.04	0.04	0.042	0.017	0.04	0.04	0.04	0.04
Pool slope	0.004	0.004	0.008	0.005	0.005	0.004	0.004	0.005
Pool to pool spacing	33-253(99)	33-253(99)	25.7	69.25	90-102	90-102	90-102	80-130
Pool length	9-43(22)	9-43(22)	11	18.7	20	20	20	70
Riffle slope/avg water surface slope	2.2	2.2	2.19	1.40	2	2	2	2.3
Pool slope/avg water surface slope	0.2	0.2	0.4	5.00	0.25	0.25	0.25	0.28
Run slope/avg water surface slope	1.2	1.2	1	3.00	1	1	1	1
Run depth/d_{bkf}	0.90	0.90	1.1	1.7	1.4	1.4	1.4	1.4
Pool length/bankfull width	0.9	0.9	0.6	1.3	1	1	1	3
Pool to pool spacing/bankfull width	4.1	4.1	1.5	4.8	5.6	5.6	5.6	3.5-5.7
CHANNEL MATERIALS								
D16	0.67	0.67	0.67	8				
D35	7.38	7.38	7.4	11.8				
D50	16.8	16.8	16.8	18.4				
D84	54.4	54.4	54	73				
D95	84.9	84.9	85	100				
PAVEMENT								
D16	39.2	39.2	39					
D35	61	61	61					
D50	75.3	75.3	75					
D84	105.7	105.7	105					
D95	115.5	115.5	115					
Largest #1	120	120	120					
Largest #2	115	115	115					
SUBPAVEMENT								
D16	2.9	2.9	2.9					
D35	7.0	7.0	7					
D50	13.2	13.2	13					
D84	17.6	17.6	17.6					
D95	55	55	55					

Table 4b. Morphological Table – UT to Ripshin Br.
Project Number 372 (Ripshin Branch)

Morphological Data, Unnamed Tributary to Ripshin Branch				
	Exisiting	Reference	Proposed	Proposed
CLASSIFICATION DATA	**UT to Ripshin (Reach 3)**	**Long Branch (VA)**	**UT to Ripshin Reach 3A**	**UT to Ripshin Reach 3B**
Rosgen Stream Type	B4/F4	C4	B4	C4
Drainage Area (sq mi)	0.56	1.7	0.56	0.56
Bankfull Width (W_{bkf}) (ft)	18	14.4	16	16
Bankfull Mean Depth (d_{bkf}) (ft)	0.9	1.2	0.9	0.9
Bankfull Cross Sectional Area (A_{bkf}) (sf)	16.3	17.6	14	14
Width/Depth ratio (W_{bkf}/d_{bkf})	21.8	11.8	18	18
Maximum depth (d_{mbkf}) (ft)	1.4	1.7	1.3	1.4
Width of flood prone area (W_{fpa}) (ft)	28	94.5	16-40	20-80(60)
Entrenchment ratio (ER)	1.6	6.6	1.0-2.5	1.0-2.5
Water surface slope (S) (ft/ft)	0.020	0.012	0.02	0.02
Sinuosity (stream length/valley length) (K)	1.2	1.2	1	1.2
DIMENSION DATA				
Pool Depth (ft)	1.4	2.6	1.9	1.9
Riffle Depth (ft)	0.8	1.2	0.9	0.9
Pool Width (ft)	24	14.5	16	16
Riffle Width (ft)	17	14.4	16	16
Pool XS Area (sf)	16	18	18.5	18.5
Riffle XS area (sf)	13	14.4	14	14
Pool depth/mean riffle depth	1.75	2.1	2.1	2.1
Pool width/riffle width	1.4	1.0	1	1
Pool area/riffle area	1.2	1.3	1.3	1.3
Max pool depth/d_{bkf}	1.28	2.2	2	2
Low bankheight/max bankfull depth	2.3	1.18	1	1
Mean bankfull velocity (V) (fps)	5.10	3.43	4.5	4.5
Bankfull discharge (Q) (cfs)	83.07	60.4	64	64
PATTERN DATA				
Meander length (L_m) (ft)	50-170(88)	97.5	132	120-160
Radius of curvature (Rc) (ft)	2.5-25(15)	25.3	200	40-70
Belt width (W_{blt}) (ft)	12-33(25)	41.7	35	60-100
Meander width ratio (W_{blt}/W_{bkf})	1.4	2.9	2.2	3.6
Radius of curvature/bankfull width	0.8	1.8	14	3.4
Meander length/bankfull width	4.9	6.8	8.3	8.8
PROFILE DATA				
Valley slope	0.020	0.016	0.02	0.02
Average water surface slope	0.020	0.012	0.02	0.02
Riffle slope	0.04	0.017	0.04	0.04
Pool slope	0.007	0.005	0.007	0.007
Pool to pool spacing	11-80(41)	69.25	60	50-90
Pool length	3.6-19(9)	18.7	25	25
Riffle slope/avg water surface slope	2.03	1.40	2	2
Pool slope/avg water surface slope	0.35	5.00	0.35	0.35
Run slope/avg water surface slope	1.13	3.00	0.036	0.036
Run depth/d_{bkf}	2.4	1.7	1.7	1.7
Pool length/bankfull width	0.76	1.3	1.6	1.6
Pool to pool spacing/bankfull width	3.5	4.8	3.2-5.7	3.2-5.7
CHANNEL MATERIALS				
D16	0.23	8		
D35	4.8	11.8		
D50	12.8	18.4		
D84	44.2	73		
D95	78.5	100		
PAVEMENT				
D16	35.8			
D35	52.3			
D50	64.3			
D84	81.8			
D95	87.4			
Largest #1	90			
Largest #2	85			
SUBPAVEMENT				
D16	2.2			
D35	505			
D50	10.7			
D84	31.4			
D95	44.3			

Table 5. BEHI and Sediment Export Estimates
Project Number 372 (Ripshin Branch)

Time Point	Reach	Linear Footage	Extreme		Very high		High		Moderate		Low		Very Low		Sediment Export
			ft	%	ft	%	ft	%	ft	%	ft	%	ft	%	Tons/Year
Preconstruction	UT to Ripshin Branch Reach 3	920	310	35	250	28	110	12	220	25					20.68
	Ripshin Branch Reach 1	1435					45	3	380	25	435	29	625	42	12.66
	Ripshin Branch Reach 2	1303	275	21	310	23	245	18	110	8	300	23	93	7	67.42
	Project Total														100.76

Table 6. BEHI and Sediment Export Estimates
Project Number 372 (Ripshin Branch)

Time Point	Reach	Linear Footage	Extreme		Very high		High		Moderate		Low		Very Low		Sediment Export
			ft	%	ft	%	ft	%	ft	%	ft	%	ft	%	Tons/year
Reference	Long Branch	900							29	3	211	23	680	74	0.25
Reference	Ripshin Branch Internal Reference	300							15	5	285	95			0.59

Table 7. Ripshin Branch Woody Species Planting Zones																			
Location		**Zone Code**																	
Creek banks		A	Line the newly constructed channels																
Top of dry bank		B	Riparin mix levee																
Dry floodplain		C	Alluvial Forest mix																
Wet floodplain		D	Bottomland Forest																
Wetland enhancement		E	Species to add to wetlands																
Wetland restoration		F	Species to start new wetlands																
Habitat 1		G	mast and seed species																
Habitat 2		H	evergreen pine stand																
Habitat 3		I	evergreen hemlock																
Utility 1		J	Short trees and shrubs																
Landscape 1		K	Flowering shrubs																
Landscape 2		L	Blueberries and Azalias																
						A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**		
Species																			
Black willow LS		*Salix nigra*				x					x								
Silky willow LS		*Salix serica*				x					x				x				
Silky Dogwood LS		*Cornus amomum*				x				x	x				x				
Elderberry LS		*Sambucus canadensis*				x				x	x				x				
ninebark LS		*Physocarpus opulifolius*				x					x				x				
Northern Red Oak		*Quercus rubrum var rubrum*					x	x	x		x	x							
Sycamore (Mtn)		*Platanus occidentalis*							x	x	x								
White Oak (Mtn)		*Quescus alba*					x	x				x							
Black Walnut		*Juglans nigra*					x					x							
Black Locust		*Robinia pseudoacacia*					x	x				x							
White Pine		*Pinus stobus*					x	x	x			x	x						
Canada Hemlock		*Tsuga canadensis*					x		x		x	x		x					
Red Maple		*Acer rubrum*					x	x	x	x	x								
White Basswood		*Tillia heterophylla*					x	x	x		x	x							
Tulip Tree (Mtn)		*Liriodendron tulipifera*																	
Sweet Birch		*Betula lenta*					x	x	x	x	x								
Yellow Birch		*Betula alleghaniensis*					x												
River Birch		*Betula nigra*							x	x	x								
Silverbell (Mtn)		*Halesia caroliniana*					x			x	x								
Cucumber Tree		*Magnolia acuminata*					x	x	x		x		x						
Yellow Buckeye		*Aesculus octandra*					x		x		x		x						
Bitternut Hickory		*Carya cordiformis*					x					x							
Mokernut Hickory		*Carya tomentosa*					x					x							
Green Ash		*Fraxinus pennsylvanica*						x	x	x	x								
Wild Plum		*Prunus americana*					x	x							x				
Witchhazel		*Hamamelis virginiana*					x	x							x				
Sourwood		*Oxydendron arboreum*					x	x											
Black cherry		*Prunus serotina*					x	x		x									
Mt. laurel		*Kalmia latifolia*					x	x						x	x				
Drooping Leucothoe		*Leucothoe axillaris*							x	x			x	x	x				
Dentate Viburnum		*Viburnum dentatum*					x	x							x	x			
Serviceberry		*Amelanchier arboria*					x	x	x	x	x				x	x			
Sweetshrub		*Calycanthus floridus*					x								x	x			
Summersweet		*Clethra alnifolia*							x						x	x			
Spicebush		*Lindera benzoin*							x	x	x		x		x				
Sweet Azalia		*Rhododendron canescens*					x										x		
Flame Azalia		*Rhododendron claendulaceum*					x												
Swamp Azalia		*Rhododendron viscosum*							x	x	x						x		
Smooth Azalia		*Rhododendron arborescens*					x	x											
Great rhododendron		*Rhododendron maximum*						x		x				x	x				
American Holly		*Ilex opaca*						x	x	x	x								
Chokeberry		*Aronia arbutifolia*					x	x	x	x	x				x	x			
Blueberry		*Vaccinium sp.*					x	x								x	x		
Tag alder		*Alnus serulata*					x		x	x	x								
Ironwood		*Carplinus caroliniana*					x		x	x	x								
Silky dogwood		*Cornus amomum*							x	x	x								
Swamp Rose		*Rosa palustris*							x		x				x	x			
Winter berry		*Ilex verticillata*					x				x				x	x			
Hazelnut		*Corylus americana*					x	x							x				
With-rod		*Viburnum cassinoides*						x			x				x				

Table 8. Groundwater Monitoring Gage Locations
Project Number 372 (Ripshin Branch)

Gage Number	Northing	Easting
1	1038075.76	1038075.76
2	1233333.7	1037928.02
3	1233543.49	1037954.42
4	1233501.64	1038076.08
5	1233727.18	1038025.75
6	1235194.32	1036956.5
7	1235707.4	1036902
8	1235574.62	1036825.75

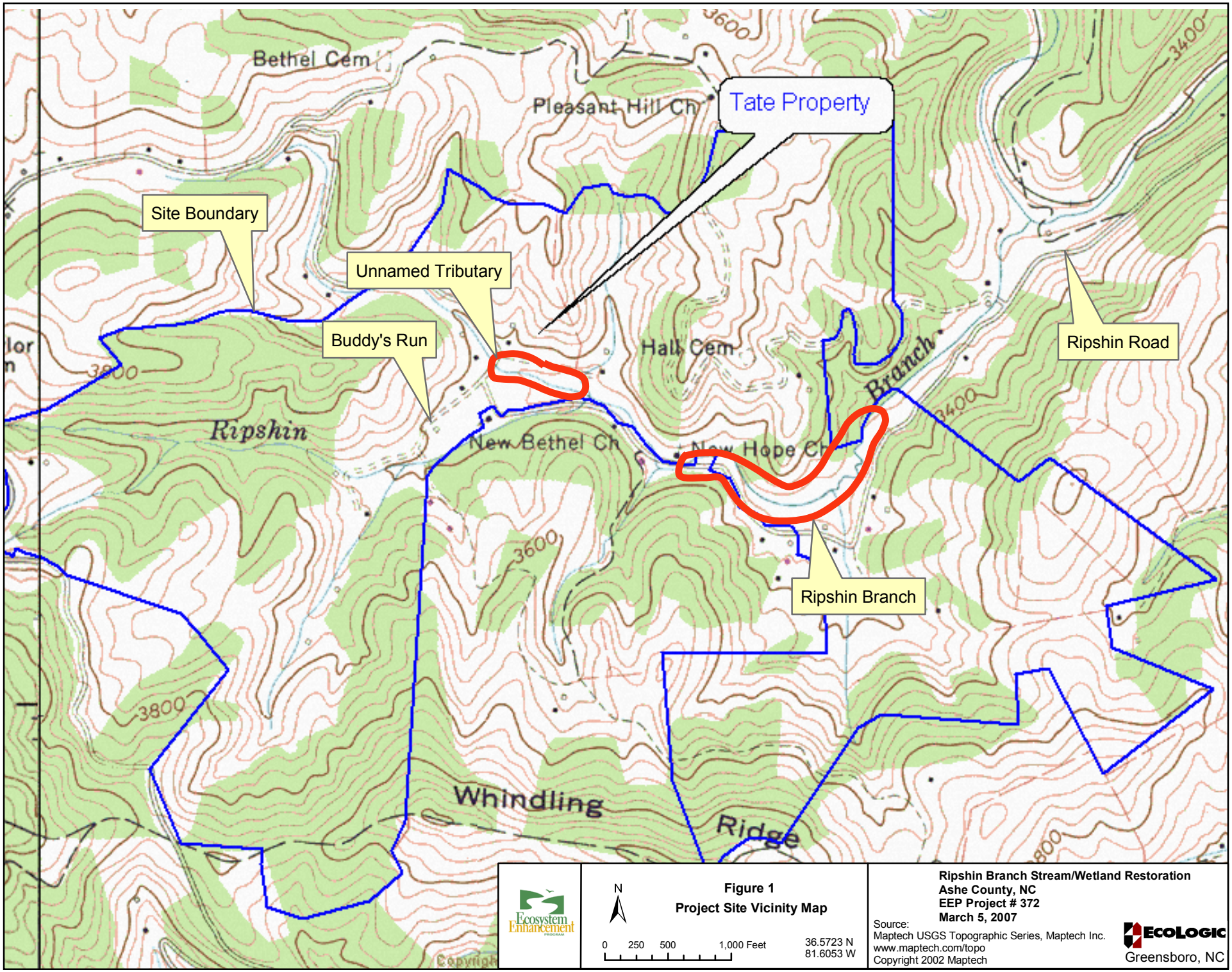

Figure 1
Project Site Vicinity Map

N

0 250 500 1,000 Feet

36.5723 N
81.6053 W

Ripshin Branch Stream/Wetland Restoration
Ashe County, NC
EEP Project # 372
March 5, 2007

Source:
Maptech USGS Topographic Series, Maptech Inc.
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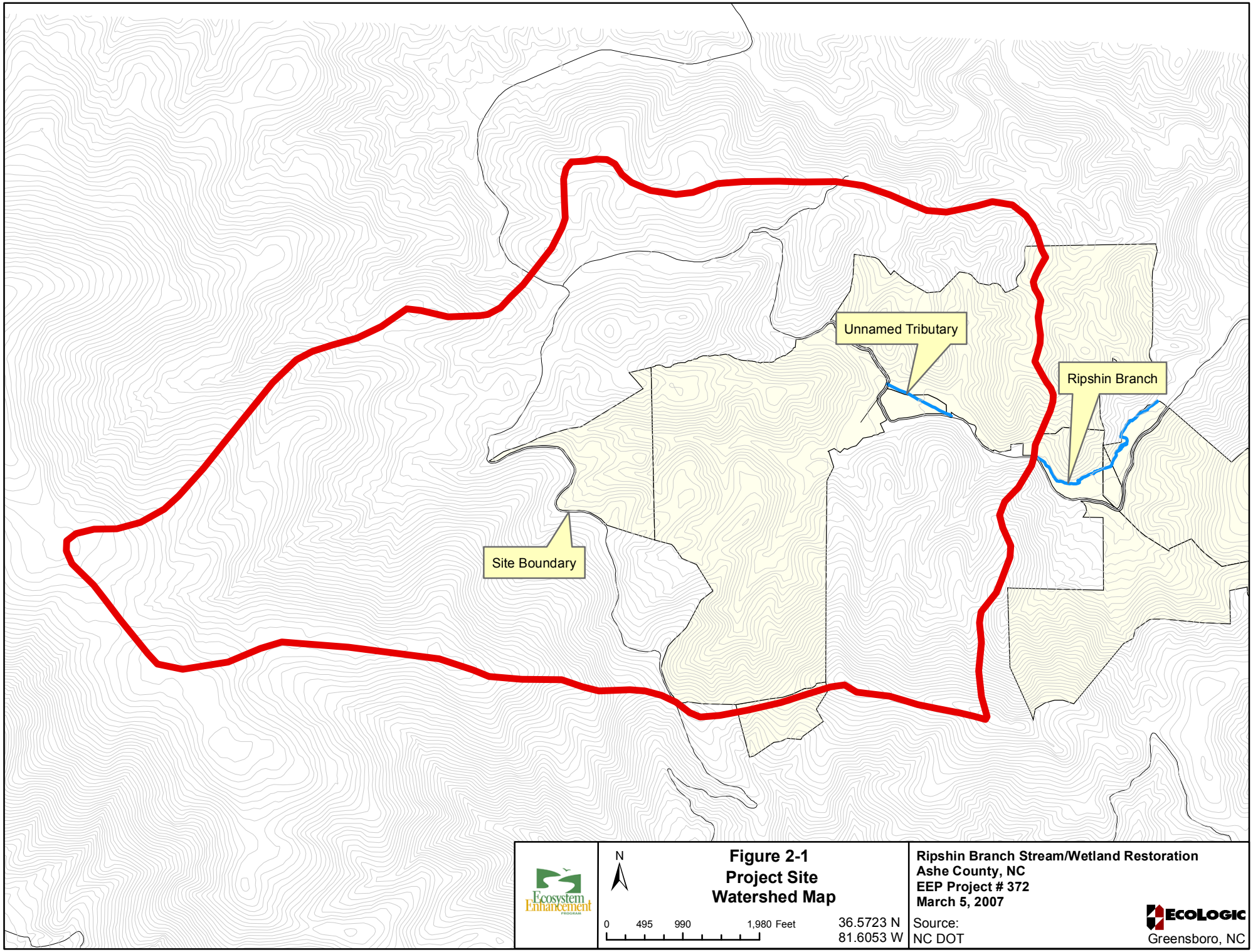


Figure 2-1
Project Site
Watershed Map

Ripshin Branch Stream/Wetland Restoration
Ashe County, NC
EEP Project # 372
March 5, 2007

Source:
NC DOT

ECOLOGIC
Greensboro, NC

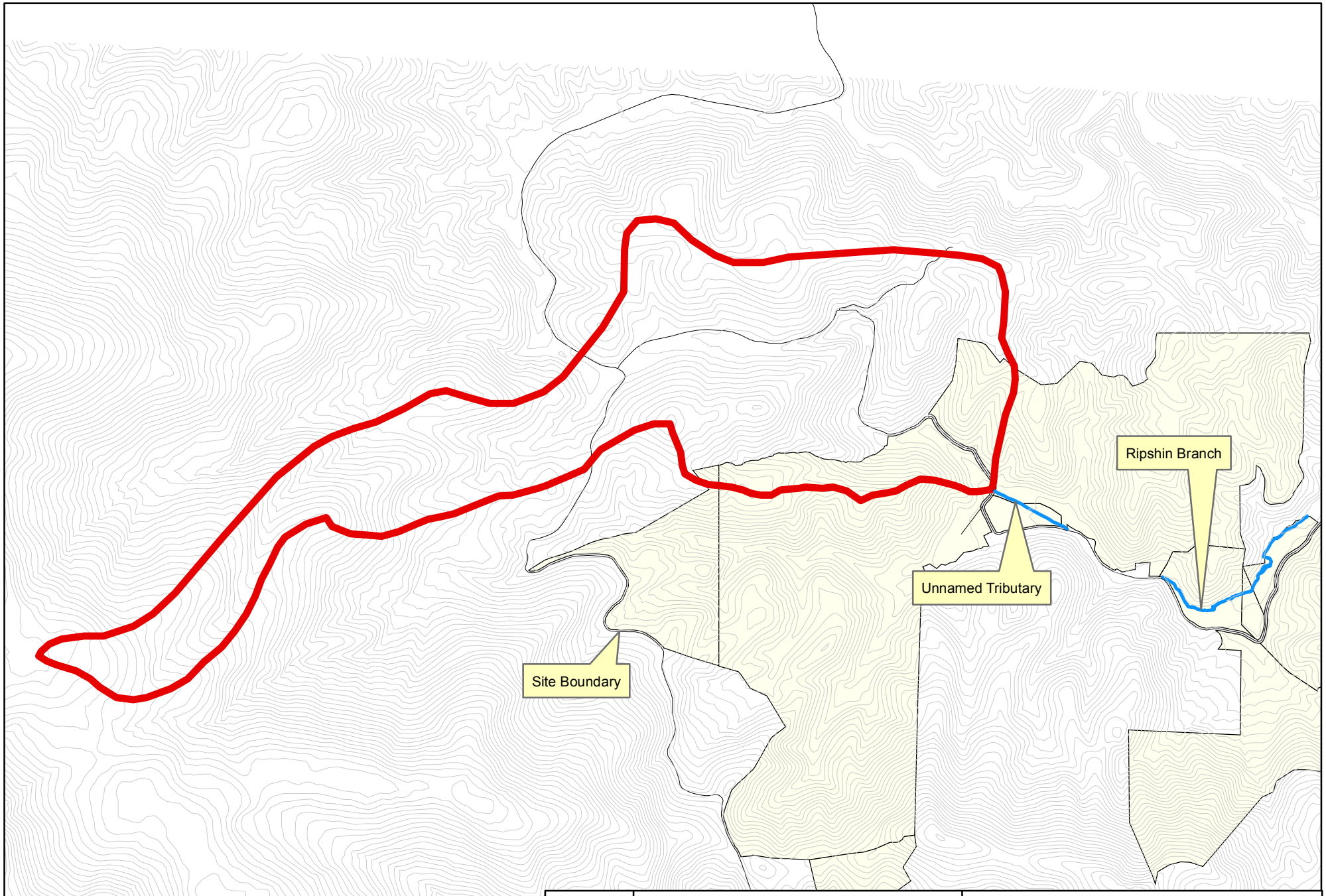


Figure 2-2
Project Site
Watershed Map

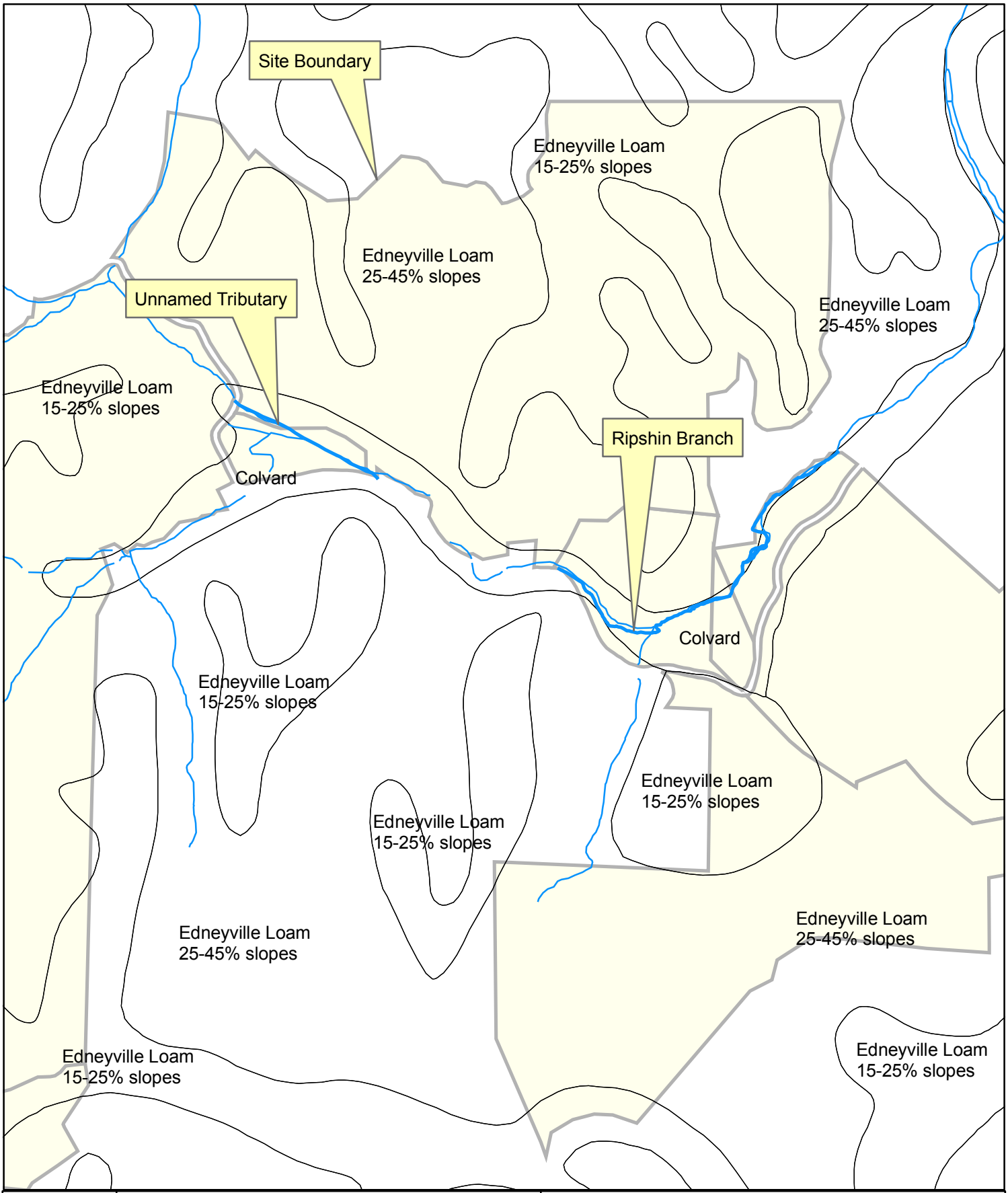
36.5723 N
81.6053 W

Ripshin Branch Stream/Wetland Restoration
Ashe County, NC
EEP Project # 372
March 5, 2007

Source:
NC DOT

Ecosystem Enhancement Program

ECOLOGIC
Greensboro, NC



N

Figure 3
Project Site NRCS
Soil Survey Map

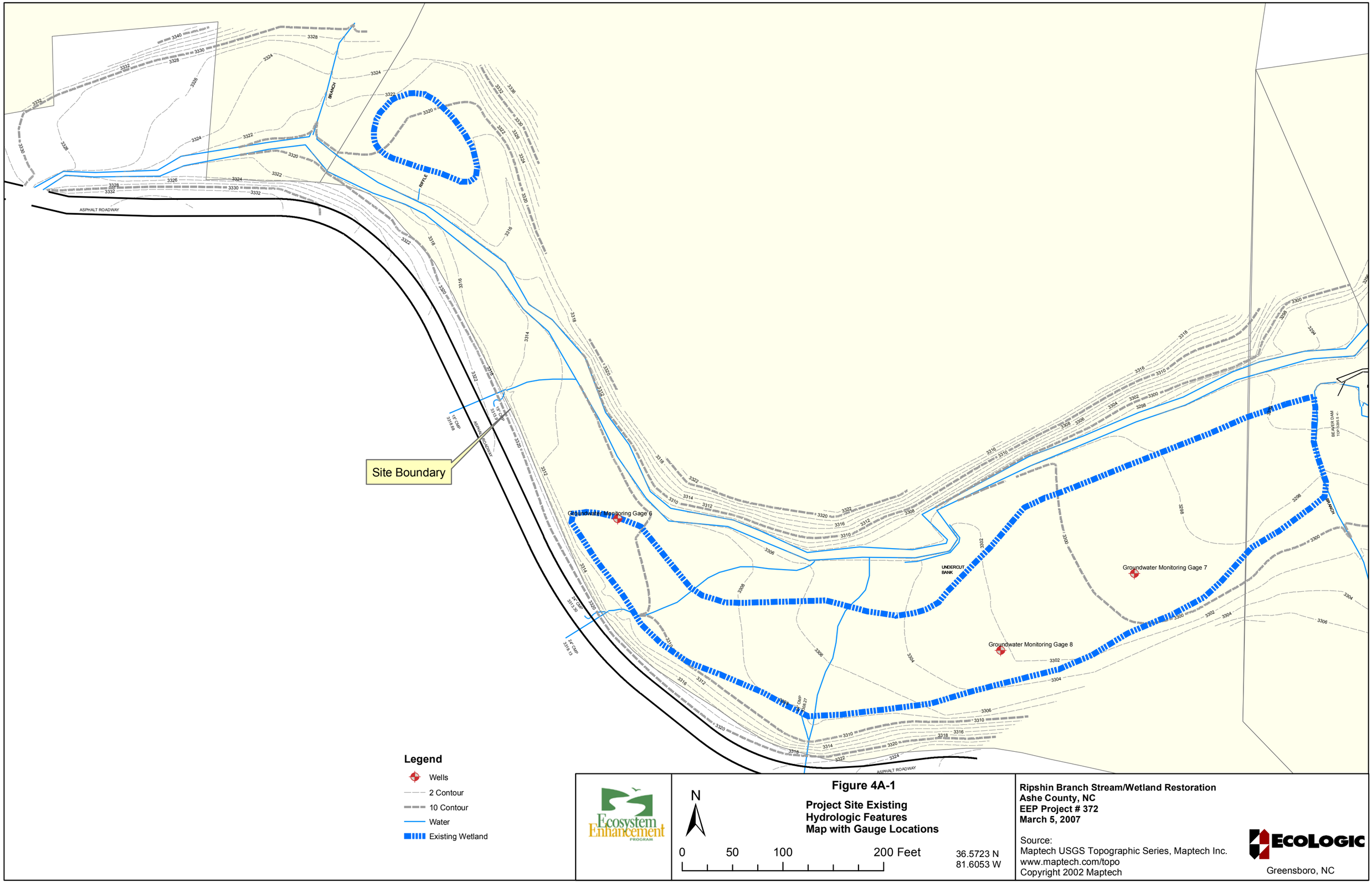
0 250 500 1,000 Feet

36.5723 N
81.6053 W

Ripshin Branch Stream/Wetland Restoration
Ashe County, NC
EEP Project # 372
March 5, 2007

Source:
NRCS Soil Data Mart

Greensboro, NC


Site Boundary
Groundwater Monitoring Gage 6
Groundwater Monitoring Gage 7
Groundwater Monitoring Gage 8
BRANCH
RIPPLE
ASPHALT ROADWAY
UNDERCUT BANK
BEAVER DAM TOP 3289.5 +/-
15" CMP 3314.68
24" CMP 3313.30
24" CMP 3316.91
18" CMP 3308.27
Legend
Wells
2 Contour
10 Contour
Water
Existing Wetland
N
0 50 100 200 Feet
36.5723 N
81.6053 W
Figure 4A-1
Project Site Existing
Hydrologic Features
Map with Gauge Locations
Ripshin Branch Stream/Wetland Restoration
Ashe County, NC
EEP Project # 372
March 5, 2007
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N

Figure 4A-2
Project Site Existing Hydrologic Features Map with Gauge Locations

0 50 100 200 Feet

36.5723 N
81.6053 W

Ripshin Branch Stream/Wetland Restoration
Ashe County, NC
EEP Project # 372
March 5, 2007

Source:
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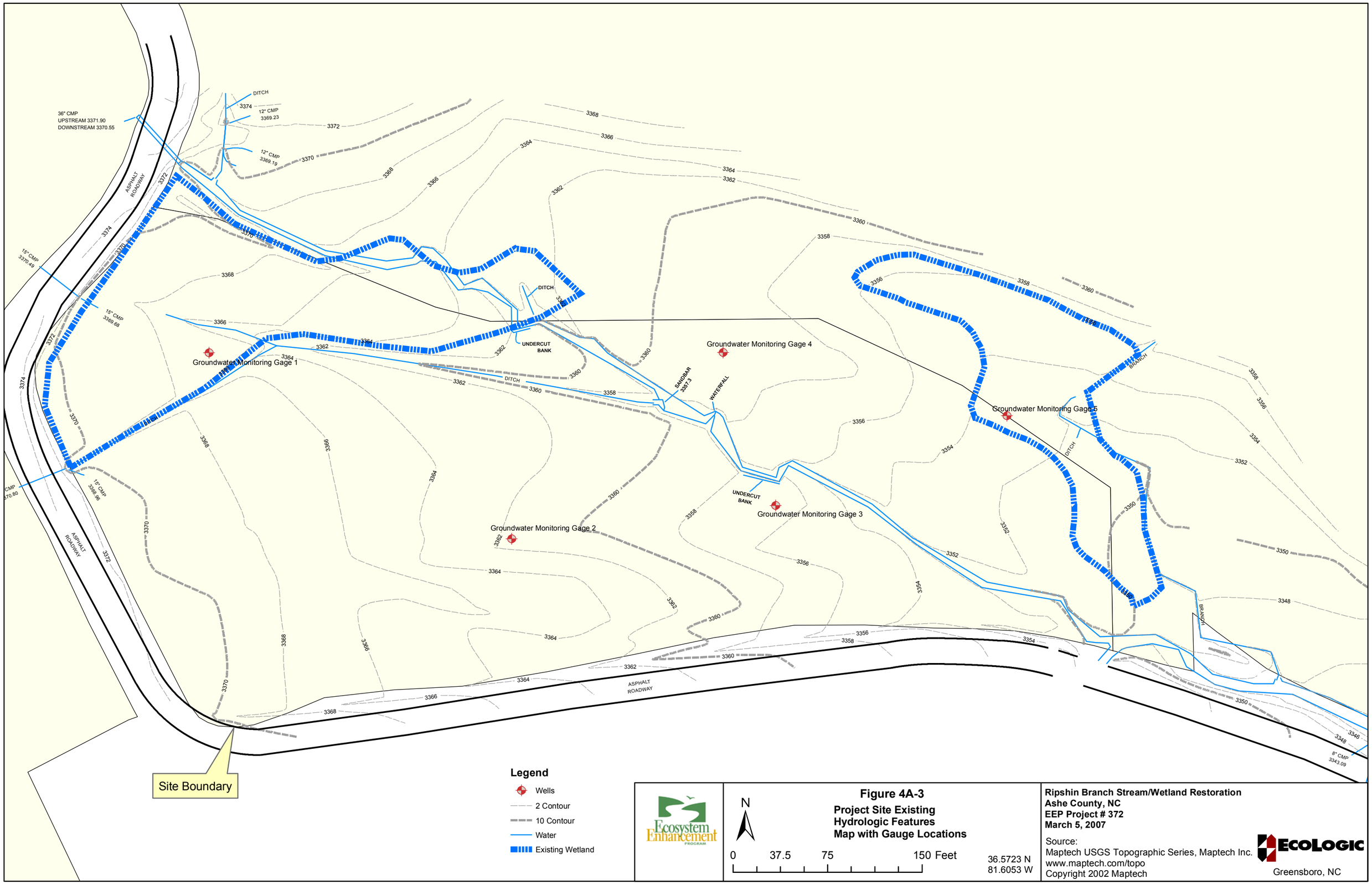
Legend
- 2 Contour
- 10 Contour
- Water
- Existing Wetland

Site Boundary

BRANCH
DITCH
ROCK SHELF
ABANDONED BEAVER DAM
BREACHED BEAVER DAM TOP 3290.1 +/-
FORMER LOWER POND
FORMER UPPER POND
BEAVER DAM TOP 3295.5 +/-
24" CMP 3330.22
24" CMP 3325.06
ASPHALT ROADWAY


36" CMP
UPSTREAM 3371.90
DOWNSTREAM 3370.55
DITCH
12" CMP
3369.23
12" CMP
3369.19
15" CMP
3370.49
15" CMP
3368.68
15" CMP
3368.96
ASPHALT
ROADWAY
Groundwater Monitoring Gage 1
Groundwater Monitoring Gage 2
Groundwater Monitoring Gage 3
Groundwater Monitoring Gage 4
Groundwater Monitoring Gage 5
UNDERCUT
BANK
SANDBAR
3367.3
WATERFALL
BRANCH
8" CMP
3343.09
Site Boundary
Legend
Wells
2 Contour
10 Contour
Water
Existing Wetland
N
0
37.5
75
150 Feet
36.5723 N
81.6053 W
Figure 4A-3
Project Site Existing
Hydrologic Features
Map with Gauge Locations
Ripshin Branch Stream/Wetland Restoration
Ashe County, NC
EEP Project # 372
March 5, 2007
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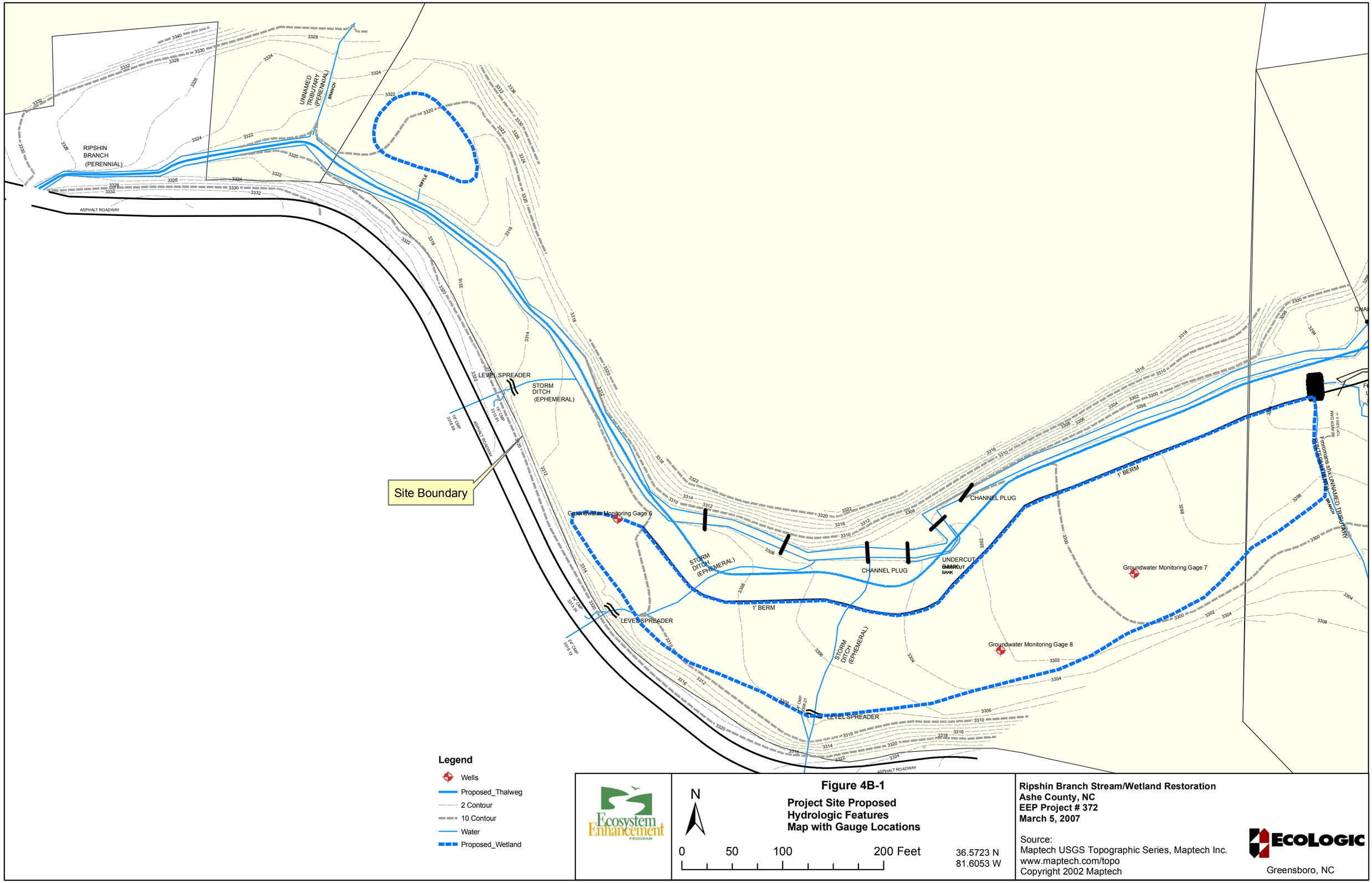
RIPSHIN
BRANCH
(PERENNIAL)
UNNAMED
TRIBUTARY
(PERENNIAL)
BRANCH
RIFFLE
ASPHALT ROADWAY
LEVEL SPREADER
STORM
DITCH
(EPHEMERAL)
15" CMP
3313.91
ASPHALT ROADWAY
Site Boundary
Groundwater Monitoring Gage 6
STORM
DITCH
(EPHEMERAL)
CHANNEL PLUG
UNDERCUT
BANK
1' BERM
Groundwater Monitoring Gage 7
LEVEL SPREADER
24" CMP
3314.38
24" CMP
3314.13
STORM
DITCH
(EPHEMERAL)
Groundwater Monitoring Gage 8
LEVEL SPREADER
18" CMP
3310.27
ASPHALT ROADWAY
CHANNEL PLUG
1' BERM
Emmons s/nx UNNAMED TRIBUTARY
BRANCH
Legend
Wells
Proposed_Thalweg
2 Contour
10 Contour
Water
Proposed_Wetland
N
0
50
100
200 Feet
Figure 4B-1
Project Site Proposed
Hydrologic Features
Map with Gauge Locations
36.5723 N
81.6053 W
Ripshin Branch Stream/Wetland Restoration
Ashe County, NC
EEP Project # 372
March 5, 2007
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Ecosystem Enhancement Program

N

0 50 100 200 Feet

36.5723 N
81.6053 W

Figure 4B-2

Project Site Proposed Hydrologic Features Map with Gauge Locations

Ripshin Branch Stream/Wetland Restoration
Ashe County, NC
EEP Project # 372
March 5, 2007

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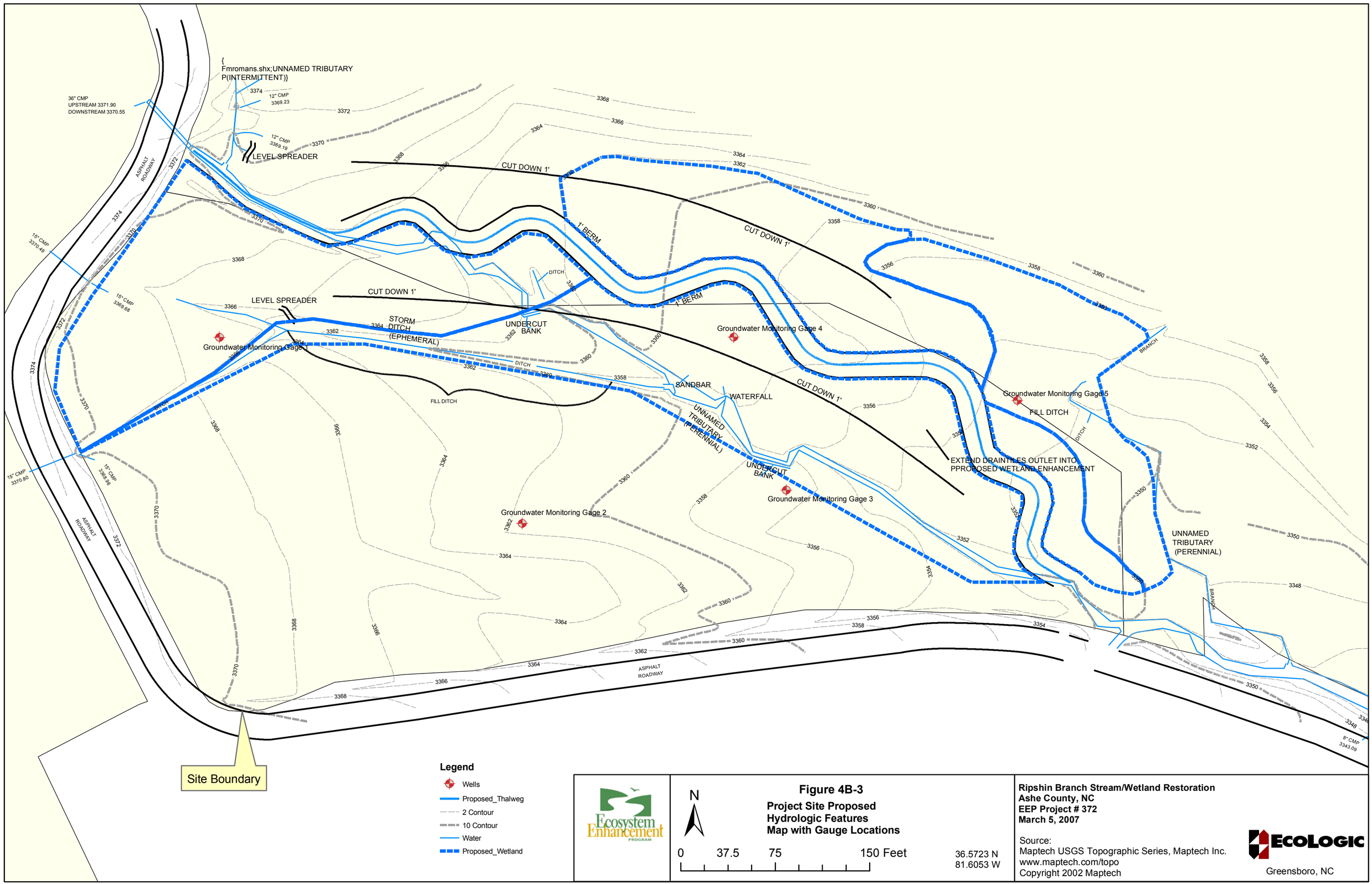
Legend

- Wells
- 2 Contour
- 10 Contour
- Water
- Proposed_Thalweg
- ProposedWetland

Site Boundary

BRANCH
DITCH
1' BERM
ROCK SHELF
ABANDONED BEAVER DAM
BREACHED BEAVER DAM TOP 3284
NEW DITCH
FORMER LOWER POND
FORMER UPPER POND
BREACHED BEAVER DAM TOP ELEV 3286 +/-
BEAVER DAM TOP 3286.5 +/-
24" CMP 3320.22
24" CMP 3325.08
ASPHALT ROADWAY


{
Fmromans.shx;UNNAMED TRIBUTARY
P(INTERMITTENT)}
36" CMP
UPSTREAM 3371.90
DOWNSTREAM 3370.55
12" CMP
3369.23
12" CMP
3369.19
LEVEL SPREADER
CUT DOWN 1'
1' BERM
ASPHALT
ROADWAY
15" CMP
3370.49
15" CMP
3369.88
DITCH
LEVEL SPREADER
CUT DOWN 1'
1' BERM
STORM
DITCH
(EPHEMERAL)
UNDERCUT
BANK
Groundwater Monitoring Gage 1
Groundwater Monitoring Gage 4
DITCH
FILL DITCH
SANDBAR
WATERFALL
UNNAMED
TRIBUTARY
(PERENNIAL)
CUT DOWN 1'
BRANCH
Groundwater Monitoring Gage 5
FILL DITCH
DITCH
EXTEND DRAINTILES OUTLET INTO
PPROPOSED WETLAND ENHANCEMENT
UNDERCUT
BANK
Groundwater Monitoring Gage 3
Groundwater Monitoring Gage 2
UNNAMED
TRIBUTARY
(PERENNIAL)
BRANCH
15" CMP
3370.80
15" CMP
3368.86
ASPHALT
ROADWAY
ASPHALT
ROADWAY
8" CMP
3343.09
Site Boundary
Legend
Wells
Proposed_Thalweg
2 Contour
10 Contour
Water
Proposed_Wetland
N
0
37.5
75
150 Feet
Figure 4B-3
Project Site Proposed
Hydrologic Features
Map with Gauge Locations
36.5723 N
81.6053 W
Ripshin Branch Stream/Wetland Restoration
Ashe County, NC
EEP Project # 372
March 5, 2007
Source:
Maptech USGS Topographic Series, Maptech Inc.
www.maptech.com/topo
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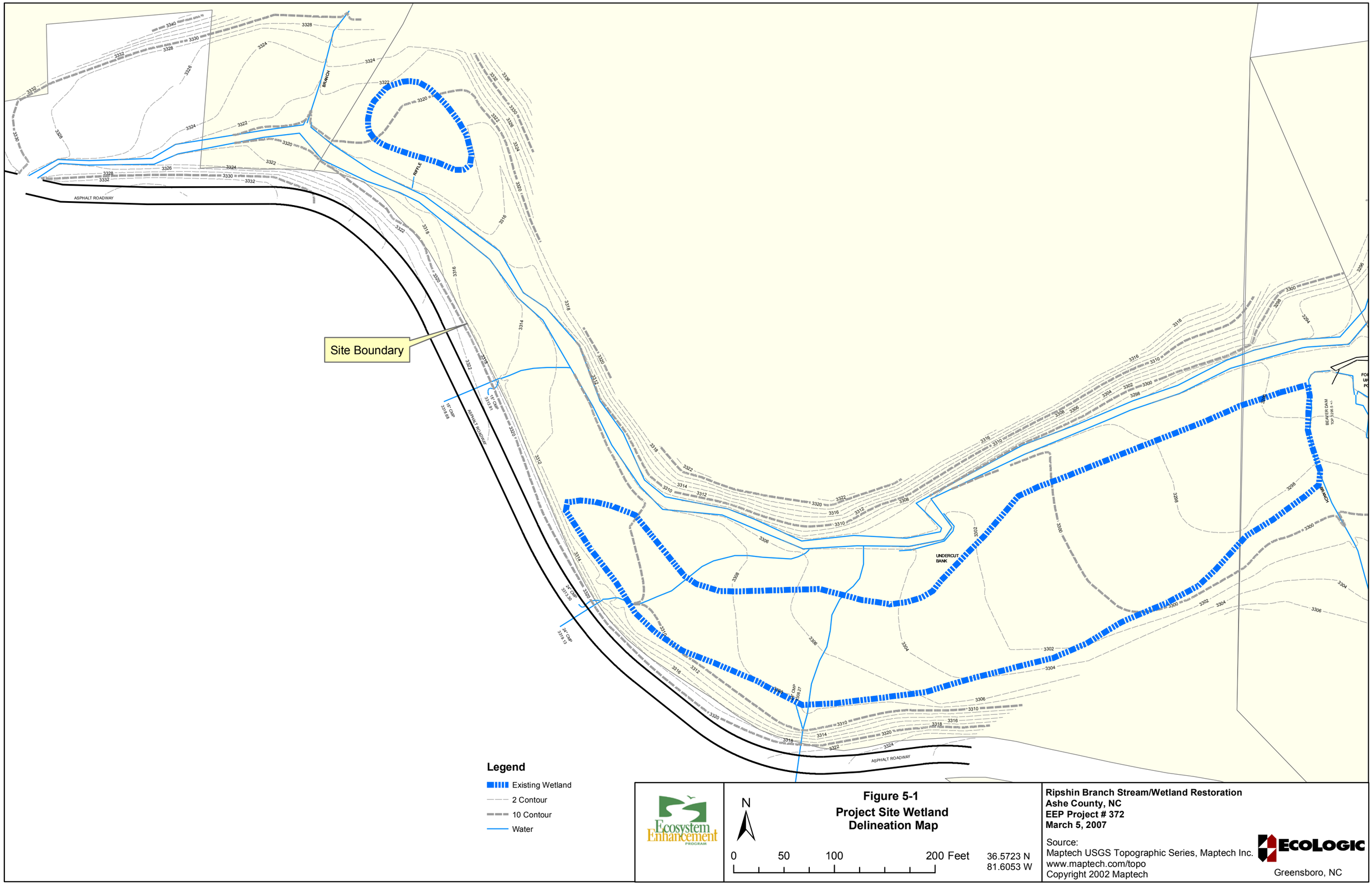
Greensboro, NC


Site Boundary
BRANCH
RIFFLE
ASPHALT ROADWAY
UNDERCUT BANK
BEAVER DAM
TOP 3295.5 +/-
18" CMP 3318.68
18" CMP 3313.91
24" CMP 3313.39
36" CMP 3314.97
36" CMP 3308.37
Legend
Existing Wetland
2 Contour
10 Contour
Water
N
0
50
100
200 Feet
36.5723 N
81.6053 W
Ecosystem Enhancement Program
Figure 5-1
Project Site Wetland
Delineation Map
Ripshin Branch Stream/Wetland Restoration
Ashe County, NC
EEP Project # 372
March 5, 2007
Source:
Maptech USGS Topographic Series, Maptech Inc.
www.maptech.com/topo
Copyright 2002 Maptech
EcoLogic
Greensboro, NC

Ecosystem Enhancement Program

N

Figure 5-2
Project Site Wetland Delineation Map

0 50 100 200 Feet

36.5723 N
81.6053 W

Ripshin Branch Stream/Wetland Restoration
Ashe County, NC
EEP Project # 372
March 5, 2007

Source:
Maptech USGS Topographic Series, Maptech Inc.
www.maptech.com/topo
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Greensboro, NC

Legend

- Existing Wetland
- 2 Contour
- 10 Contour
- Water

Site Boundary

BRANCH
DITCH
ROCK SHELF
ABANDONED BEAVER DAM
BREACHED BEAVER DAM TOP 3290, 1 +/-
FORMER LOWER POND
FORMER UPPER POND
BEAVER DAM TOP 3295, 5 +/-
ASPHALT RAILROAD
24" CMP 3320.22
24" CMP 3325.08

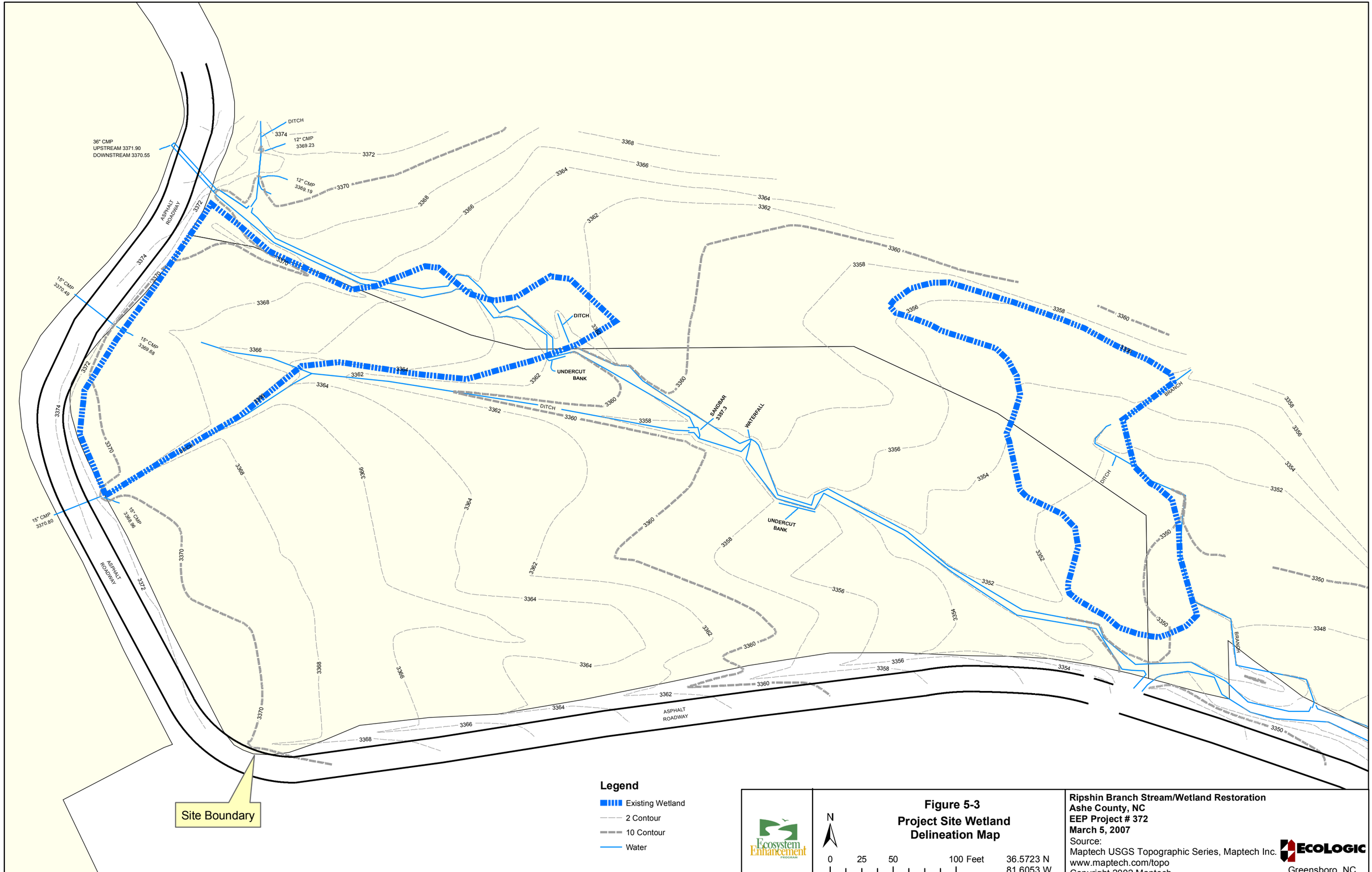


Figure 5-3
Project Site Wetland Delineation Map

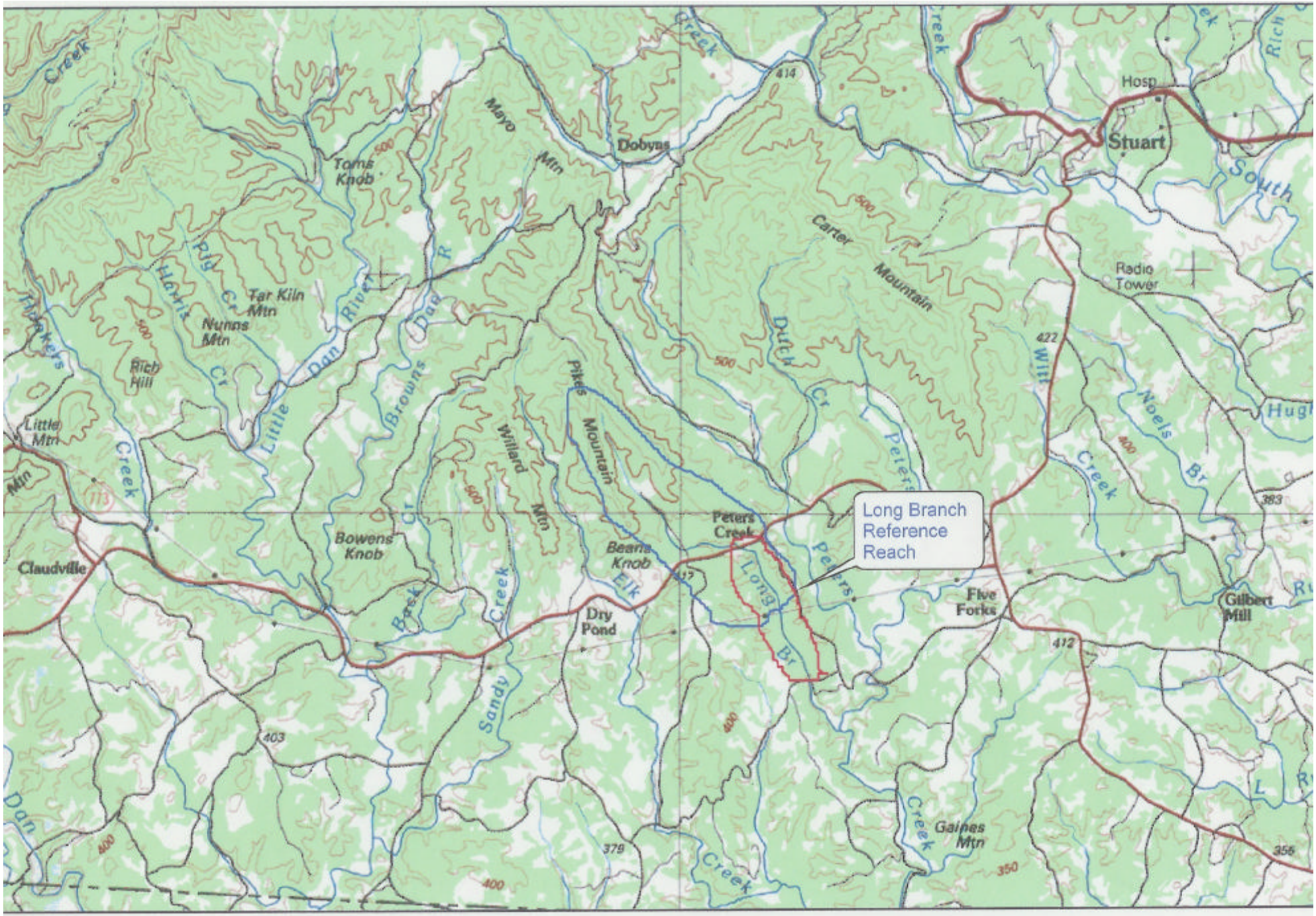
Ripshin Branch Stream/Wetland Restoration
Ashe County, NC
EEP Project # 372
March 5, 2007
Source:
Maptech USGS Topographic Series, Maptech Inc.
www.maptech.com/topo

Ecosystem Enhancement Program

ECOLOGIC
Greensboro, NC

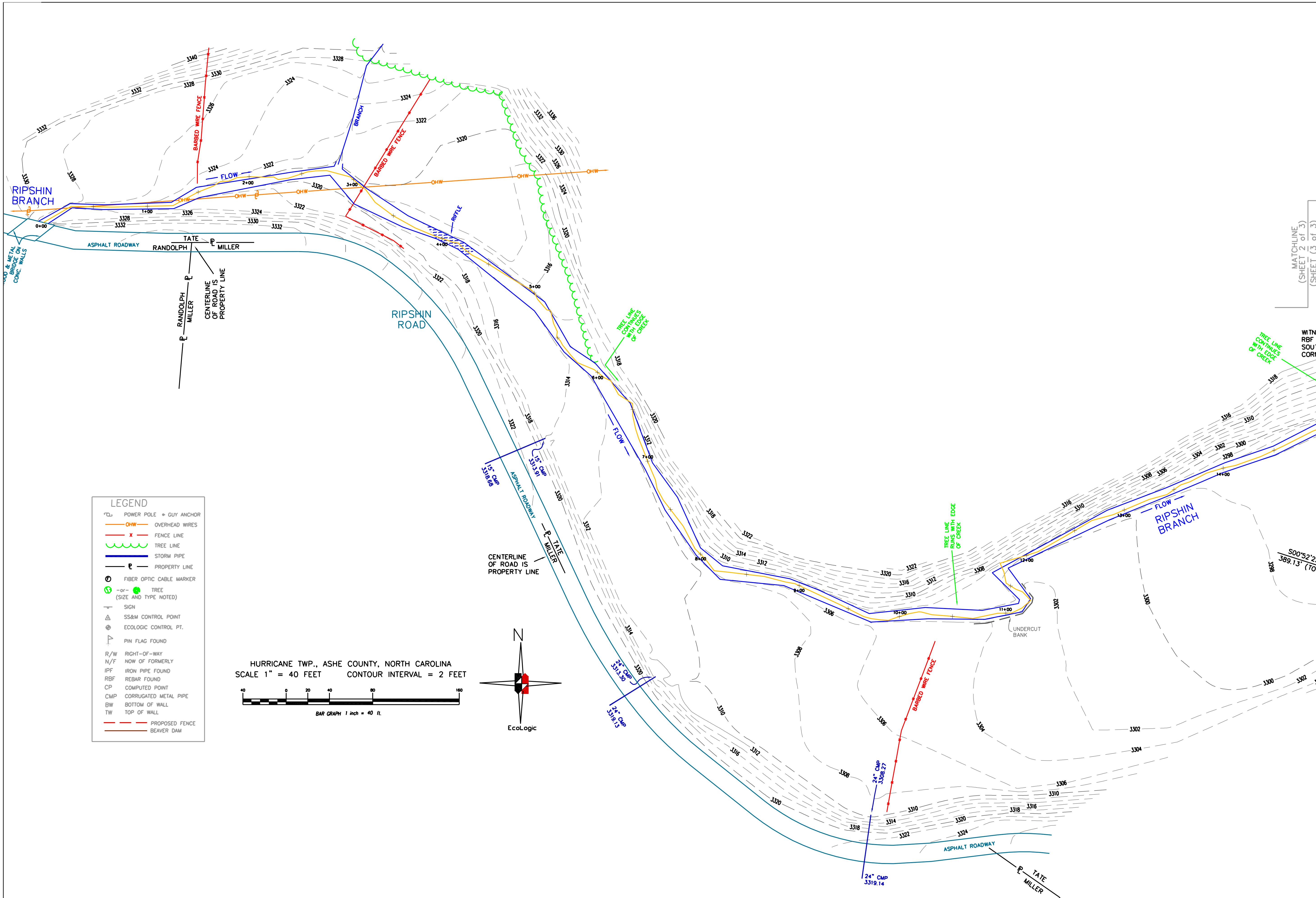
Name: GALAX
Date: 1/29/2007
Scale: 1 inch equals 3.157 miles

Location: 036.6361691° N 080.3839034° W NAD 83
Caption: Figure 6. Long Branch Reference Reach



Name: GALAX
Date: 1/29/2007
Scale: 1 inch equals 1.052 miles

Location: 036.6021001° N 080.3320236° W NAD 83
Caption: Figure 7. Long Branch Reference Reach Watershed



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ECOLOGIC
ECOLOGIC ASSOCIATES, P.C.
4321-A S. ELM-EUGENE ST.
GREENSBORO, NC 27406

PROJECT:

RIPSHIN BRANCH STREAM RESTORATION

PREPARED FOR:

NORTH CAROLINA ECOSYSTEM ENHANCEMENT PROGRAM

NO.	DESCRIPTION	DATE
1	EEP COMMENTS	3-5-07

REVISIONS

EXISTING CHANNEL/SITE CONDITIONS

SCALE: 1" = 40'
DATE: 11/27/06
DRN. BY: KDH
CHECKED BY: MAT

PROJECT NO: –

SHEET 1 OF 3

SHEET

1—1

MATCHLINE
(SHEET 2 of 3)
(SHEET (3 of 3)

TATE
MILLER

BARBED WIRE FENCE

S00°59'25"W
813' (TOTAL)

WITNESS 5/8" REBAR 1.5' SOUTH OF CORNER

N01°28'47"E
258.66'

TATE
MILLER

TATE
LEE

N22°54'06"W
643.59'

TATE
MILLER

TREE LINE RUNS WITH EDGE OF CREEK

BEAVER DAM
TOP 3295.5 +/-

FORMER UPPER POND

BRANCH

DITCH

DITCH

TATE
MILLER

BREACHED BEAVER DAM
TOP 3294.9 +/-

FORMER LOWER POND

BRANCH

BREACHED BEAVER DAM
TOP 3290.1 +/-

TATE
LEE

N89°22'36"E
259.63'

N04°31'24"W
108.70' (TOTAL)

WITNESS IPF 1.0' SOUTH OF CORNER

TREE LINE RUNS WITH EDGE OF CREEK

CP

PROPERTY LINE CONTINUES WITH CENTERLINE OF BRANCH

ROCK SHED

N19°32'39"E
441.19'

RIPSHIN ROAD

ASPHALT ROADWAY

24" CMP
3320.22

24" CMP
3323.06

RIPSHIN BRANCH

FLOW

CENTERLINE OF CREEK IS PROPERTY LINE

DITCH

BRANCH

TATE
LEE

TREE LINE RUNS WITH EDGE OF CREEK

TREE LINE RUNS WITH EDGE OF CREEK

PROPERTY LINE CONTINUES WITH CENTERLINE OF BRANCH

DITCH

N39°47'17"W
100.04'

S82°23'34"W
71.70'

BARBED WIRE FENCE

LEGEND

- POWER POLE ⊕ GUY ANCHOR
- OHW — OVERHEAD WIRES
- x — FENCE LINE
- TREE LINE
- STORM PIPE
- ℄ — PROPERTY LINE
- FIBER OPTIC CABLE MARKER
- –or– TREE (SIZE AND TYPE NOTED)
- SIGN
- SS&M CONTROL POINT
- ECOLOGIC CONTROL PT.
- PIN FLAG FOUND
- R/W RIGHT-OF-WAY
- N/F NOW OF FORMERLY
- IPF IRON PIPE FOUND
- RBF REBAR FOUND
- CP COMPUTED POINT
- CMP CORRUGATED METAL PIPE
- BW BOTTOM OF WALL
- TW TOP OF WALL
- PROPOSED FENCE
- BEAVER DAM

HURRICANE TWP., ASHE COUNTY, NORTH CAROLINA
SCALE 1" = 40 FEET CONTOUR INTERVAL = 2 FEET

40 0 20 40 80 160
BAR GRAPH 1 inch = 40 ft.

N
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EcoLogic

PROJECT:
RIPSHIN BRANCH STREAM RESTORATION

PREPARED FOR:
NORTH CAROLINA ECOSYSTEM ENHANCEMENT PROGRAM

NO.	DESCRIPTION	DATE
1	EEP COMMENTS	3-5-07

REVISIONS

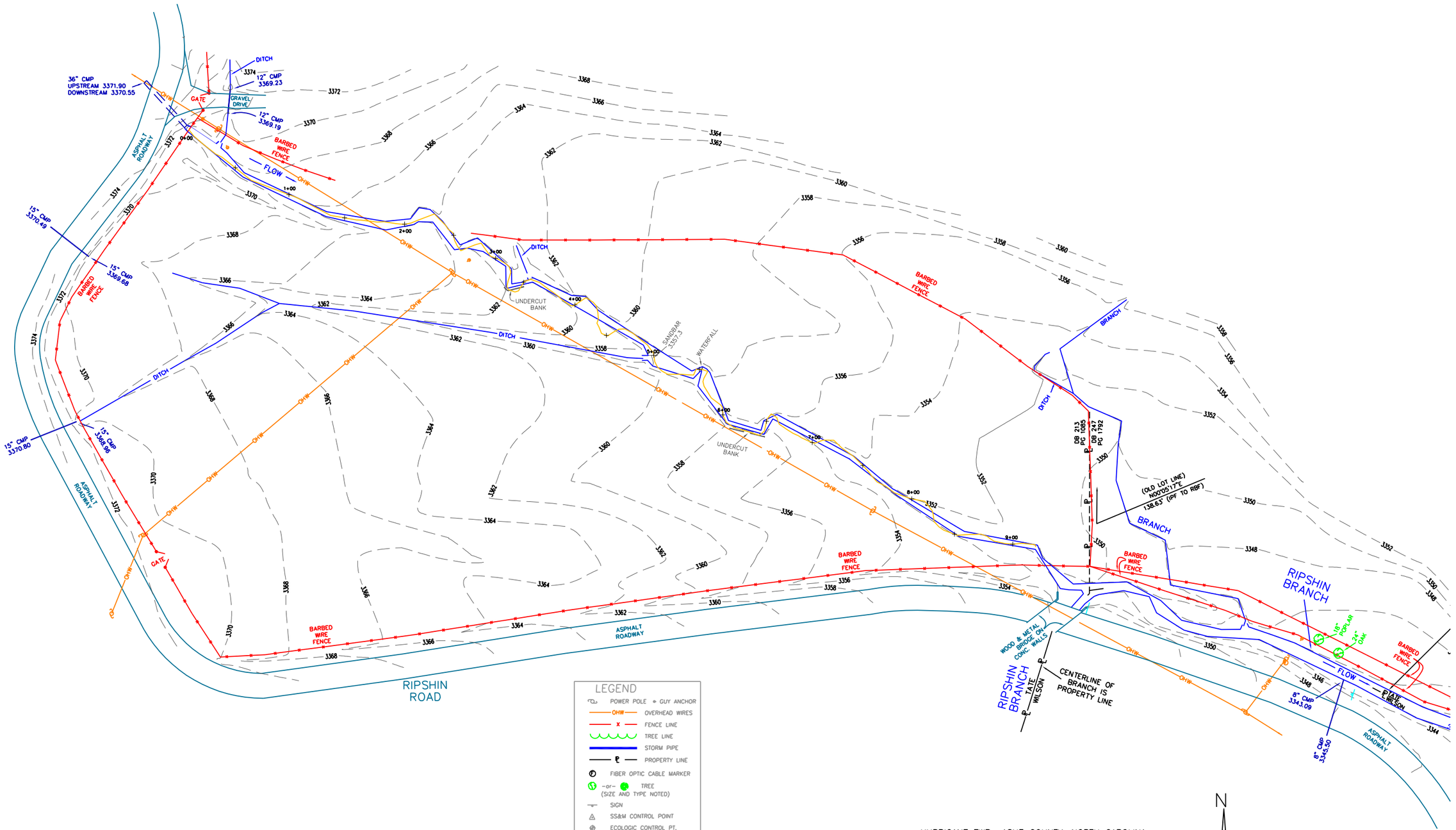
EXISTING CHANNEL/SITE CONDITIONS

SCALE: 1" = 40'
DATE: 11/27/06
DRN. BY: KDH
CHECKED BY: MAT

PROJECT NO:
–

SHEET 1 OF 3

SHEET
1 — 2



LEGEND

- POWER POLE ⊕ GUY ANCHOR
- OHW — OVERHEAD WIRES
- X — FENCE LINE
- TREE LINE
- STORM PIPE
- ℄ — PROPERTY LINE
- FIBER OPTIC CABLE MARKER
- -or- TREE (SIZE AND TYPE NOTED)
- SIGN
- SS&M CONTROL POINT
- ECOLOGIC CONTROL PT.
- PIN FLAG FOUND
- R/W RIGHT-OF-WAY
- N/F NOW OF FORMERLY
- IPF IRON PIPE FOUND
- RBF REBAR FOUND
- CP COMPUTED POINT
- CMP CORRUGATED METAL PIPE
- BW BOTTOM OF WALL
- TW TOP OF WALL
- PROPOSED FENCE
- BEAVER DAM

HURRICANE TWP., ASHE COUNTY, NORTH CAROLINA
SCALE 1" = 40 FEET CONTOUR INTERVAL = 2 FEET

40 0 20 40 80 160
BAR GRAPH 1 inch = 40 ft.

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FAX: 336/335-1141
www.ecologic-nc.com

PROJECT:
RIPSHIN BRANCH
STREAM
RESTORATION

PREPARED FOR:
NORTH CAROLINA
ECOSYSTEM ENHANCEMENT PROGRAM

NO.	DESCRIPTION	DATE
1	EEP COMMENTS	3-5-07

REVISIONS

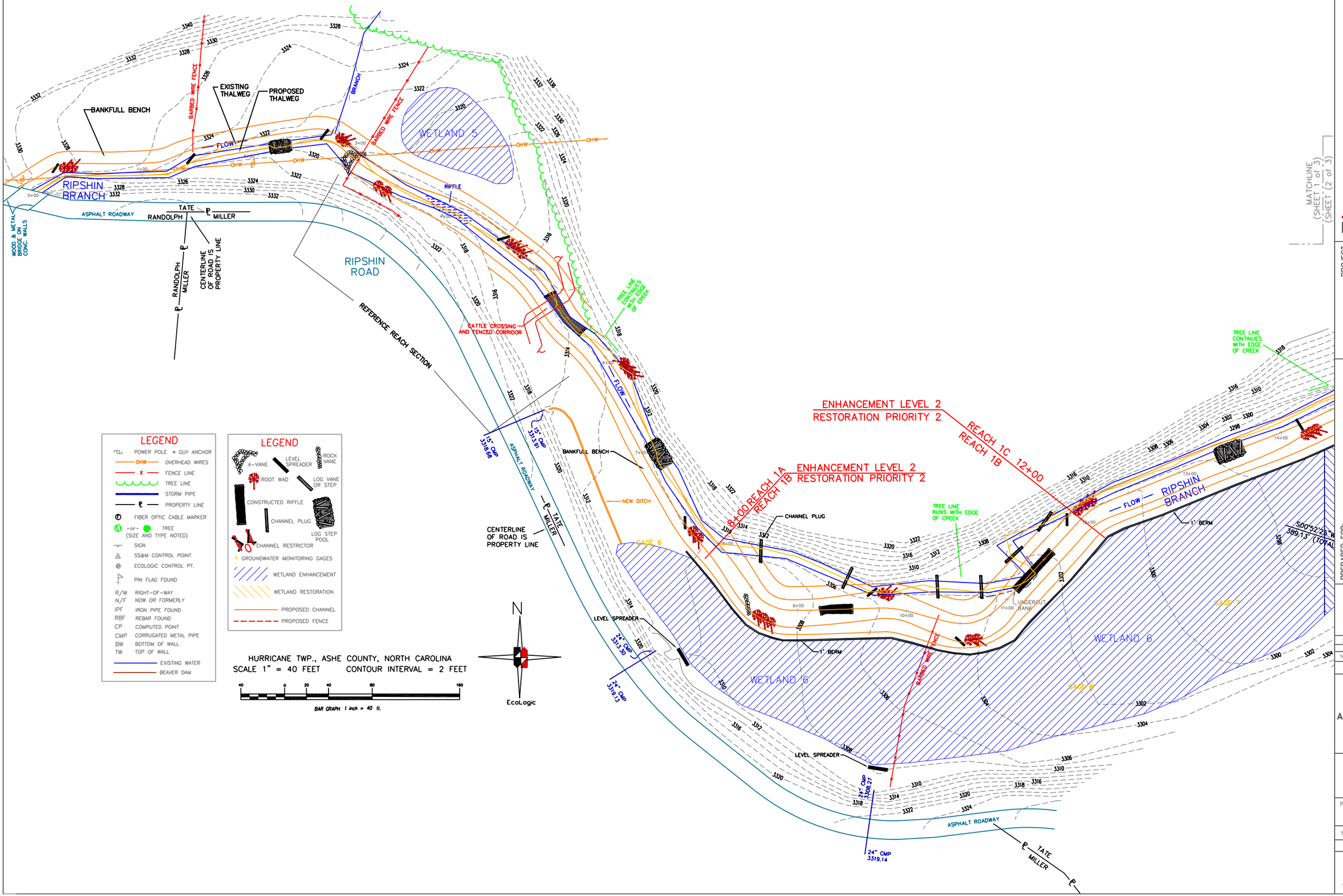
EXISTING CHANNEL/SITE CONDITIONS

SCALE: 1" = 40'
DATE: 11/27/06
DRN. BY: KDH
CHECKED BY: MAT

PROJECT NO:
–

SHEET 1 OF 3

SHEET
1 — 3



LEGEND

- POWER POLE ⊕ GUY ANCHOR
- OHW — OVERHEAD WIRES
- x — FENCE LINE
- TREE LINE
- STORM PIPE
- ℄ — PROPERTY LINE
- FIBER OPTIC CABLE MARKER
- –or– TREE (SIZE AND TYPE NOTED)
- SIGN
- SS&M CONTROL POINT
- ECOLOGIC CONTROL PT.
- PIN FLAG FOUND
- R/W RIGHT-OF-WAY
- N/F NOW OR FORMERLY
- IPF IRON PIPE FOUND
- RBF REBAR FOUND
- CP COMPUTED POINT
- CMP CORRUGATED METAL PIPE
- BW BOTTOM OF WALL
- TW TOP OF WALL
- EXISTING WATER
- BEAVER DAM

LEGEND

- A-VANE
- LEVEL SPREADER
- ROCK VANE
- ROOT WAD
- LOG VANE OR STEP
- CONSTRUCTED RIFFLE
- CHANNEL PLUG
- LOG STEP POOL
- CHANNEL RESTRICTOR
- GROUNDWATER MONITORING GAGES
- WETLAND ENHANCEMENT
- WETLAND RESTORATION
- PROPOSED CHANNEL
- PROPOSED FENCE

HURRICANE TWP., ASHE COUNTY, NORTH CAROLINA
SCALE 1" = 40 FEET CONTOUR INTERVAL = 2 FEET

40 0 20 40 80 160
BAR GRAPH 1 inch = 40 ft.

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PROJECT:
RIPSHIN BRANCH STREAM RESTORATION

PREPARED FOR:
NORTH CAROLINA ECOSYSTEM ENHANCEMENT PROGRAM

NO.	DESCRIPTION	DATE
2	EEP COMMENTS	3-5-07
1	OWNER REVS	12-14-06

REVISIONS

DESIGNED CHANNEL ALIGNMENT/SITE CONDITIONS

SCALE: 1" = 40'
DATE: 11/27/06
DRN. BY: KDH
CHECKED BY: MAT

PROJECT NO:
–

SHEET 1 OF 3

SHEET
2–1

MATCHLINE
(SHEET 1 of 3)
(SHEET (2 of 3)

TATE
MILLER

N01°28'47"E
258.66'

TATE
LEE

N22°54'06"W
643.59'

N86°02'36"E
259.65'

N04°31'24"W
108.70' (TOTAL)

N19°32'39"E
441.19'

N38°47'17"W
100.04'

S82°23'34"W
71.70'

BARBED WIRE FENCE

ENHANCEMENT LEVEL 2 REACH 1C
RESTORATION PRIORITY 2 REACH 2A 14+85

RESTORATION PRIORITY 2
PRESERVATION
REACH 2A 23+00 REACH 2B

WETLAND 6
WETLAND 7
WETLAND 8
WETLAND 9
WETLAND 10

BRANCH
DITCH
NEW DITCH
FORMER UPPER POND
FORMER LOWER POND

BEAVER DAM
TOP 3295.5 +/-

BREACHED
BEAVER DAM
TOP 3494.9 +/-

BREACHED
BEAVER DAM
TOP 3290.1 +/-

1' BERM

ROCK
SHELF

TREE LINE
CONTINUES
WITH EDGE
OF CREEK

TREE LINE
RUNS WITH
EDGE
OF CREEK

TREE LINE
RUNS WITH EDGE
OF CREEK

TREE LINE
RUNS WITH EDGE
OF CREEK

RIPSHIN
ROAD

ASPHALT ROADWAY

24" CMP
3320.22

24" CMP
3325.06

CP

BARBED WIRE FENCE

LEGEND

- POWER POLE
- GUY ANCHOR
- OHW — OVERHEAD WIRES
- x — FENCE LINE
- TREE LINE
- STORM PIPE
- ℄ — PROPERTY LINE
- FIBER OPTIC CABLE MARKER
- --or-- TREE (SIZE AND TYPE NOTED)
- SIGN
- SS&M CONTROL POINT
- ECOLOGIC CONTROL PT.
- PIN FLAG FOUND
- R/W RIGHT-OF-WAY
- N/F NOW OR FORMERLY
- IPF IRON PIPE FOUND
- RBF REBAR FOUND
- CP COMPUTED POINT
- CMP CORRUGATED METAL PIPE
- BW BOTTOM OF WALL
- TW TOP OF WALL
- EXISTING WATER
- BEAVER DAM

LEGEND

- A-VANE
- LEVEL SPREADER
- ROCK VANE
- ROOT WAD
- LOG VANE OR STEP
- CONSTRUCTED RIFFLE
- CHANNEL PLUG
- LOG STEP POOL
- CHANNEL RESTRICTOR
- GROUNDWATER MONITORING GAGES
- WETLAND ENHANCEMENT
- WETLAND RESTORATION
- PROPOSED CHANNEL
- PROPOSED FENCE

HURRICANE TWP., ASHE COUNTY, NORTH CAROLINA
SCALE 1" = 40 FEET CONTOUR INTERVAL = 2 FEET

40 0 20 40 80 160
BAR GRAPH 1 inch = 40 ft.

N

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PREPARED FOR:
NORTH CAROLINA
ECOSYSTEM ENHANCEMENT PROGRAM

PROJECT:
RIPSHIN BRANCH
STREAM
RESTORATION

NO.	DESCRIPTION	DATE
2	EEP COMMENTS	3-5-07
1	OWNER REVS	12-14-06

REVISIONS

DESIGNED
CHANNEL
ALIGNMENT/SITE
CONDITIONS

SCALE: 1" = 40'
DATE: 11/27/06
DRN. BY: KDH
CHECKED BY: MAT

PROJECT NO:
–

SHEET 2 OF 3

SHEET
2 – 2

ENHANCEMENT LEVEL 1
RESTORATION PRIORITY 1

1+32 REACH 3A
REACH 3B

WETLAND 1

WETLAND 2

WETLAND 3

WETLAND 4

36" CMP
UPSTREAM 3371.90
DOWNSTREAM 3370.55

12" CMP
3369.23

12" CMP
3369.19

15" CMP
3370.49

15" CMP
3369.68

15" CMP
3370.80

15" CMP
3368.96

DITCH

GATE

GRAVEL DRIVE

ASPHALT ROADWAY

BARBED WIRE FENCE

FLOW

OHW

CATTLE CROSSING AND FENCED CORRIDOR

CUT DOWN 1'

LEVEL SPREADER

1' BERM

FILL DITCH

UNDERCUT BANK

GAGE 1

GAGE 2

GAGE 3

GAGE 4

GAGE 5

SINGHAM 335.73

WATER

EXTEND DRAIN TILE OUTLETS INTO PROPOSED WETLAND RESTORATION

BRANCH

(OLD LOT LINE)
N00°05'17"E
138.63' (IPF TO RBF)

WOOD & METAL BRIDGE ON CONC. WALLS

RIPSHIN BRANCH

CENTERLINE OF BRANCH IS PROPERTY LINE

DB 315 PG 1065
DB 341 PG 792

16" POPLAR
24" OAK

8" CMP
334.09

8" CMP
334.50

RIPSHIN ROAD

MATCHLINE
(SHEET 3 of 3)
(SHEET 1 of 3)

LEGEND

- POWER POLE
- GUY ANCHOR
- OHW — OVERHEAD WIRES
- x — FENCE LINE
- TREE LINE
- STORM PIPE
- ℄ — PROPERTY LINE
- FIBER OPTIC CABLE MARKER
- -or- TREE (SIZE AND TYPE NOTED)
- SIGN
- SS&M CONTROL POINT
- ECOLOGIC CONTROL PT.
- PIN FLAG FOUND
- R/W RIGHT-OF-WAY
- N/F NOW OR FORMERLY
- IPF IRON PIPE FOUND
- RBF REBAR FOUND
- CP COMPUTED POINT
- CMP CORRUGATED METAL PIPE
- BW BOTTOM OF WALL
- TW TOP OF WALL
- EXISTING WATER

LEGEND

- A-VANE
- LEVEL SPREADER
- ROCK VANE
- ROOT WAD
- LOG VANE OR STEP
- CONSTRUCTED RIFFLE
- CHANNEL PLUG
- LOG STEP POOL
- CHANNEL RESTRICTOR
- GROUNDWATER MONITORING GAGES
- WETLAND ENHANCEMENT
- WETLAND RESTORATION
- PROPOSED CHANNEL
- PROPOSED FENCE

HURRICANE TWP., ASHE COUNTY, NORTH CAROLINA
SCALE 1" = 40 FEET CONTOUR INTERVAL = 2 FEET

40 0 20 40 80 160
BAR GRAPH 1 inch = 40 ft.

N

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PROJECT:
RIPSHIN BRANCH STREAM RESTORATION

PREPARED FOR:
NORTH CAROLINA ECOSYSTEM ENHANCEMENT PROGRAM

NO.	DESCRIPTION	DATE
2	EEP COMMENTS	3-5-07
1	OWNER REVS	12-14-06

REVISIONS

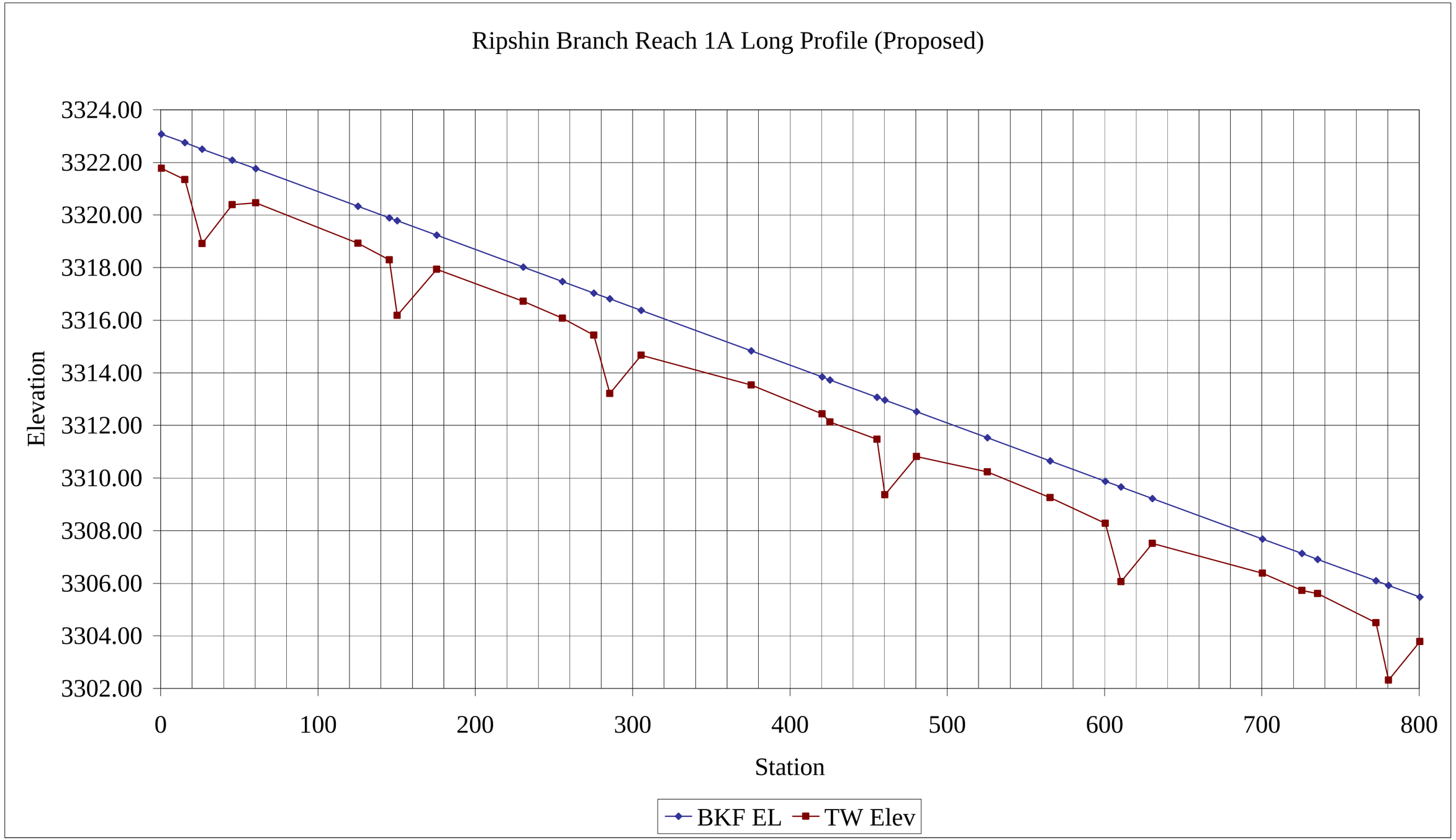
DESIGNED CHANNEL ALIGNMENT/SITE CONDITIONS

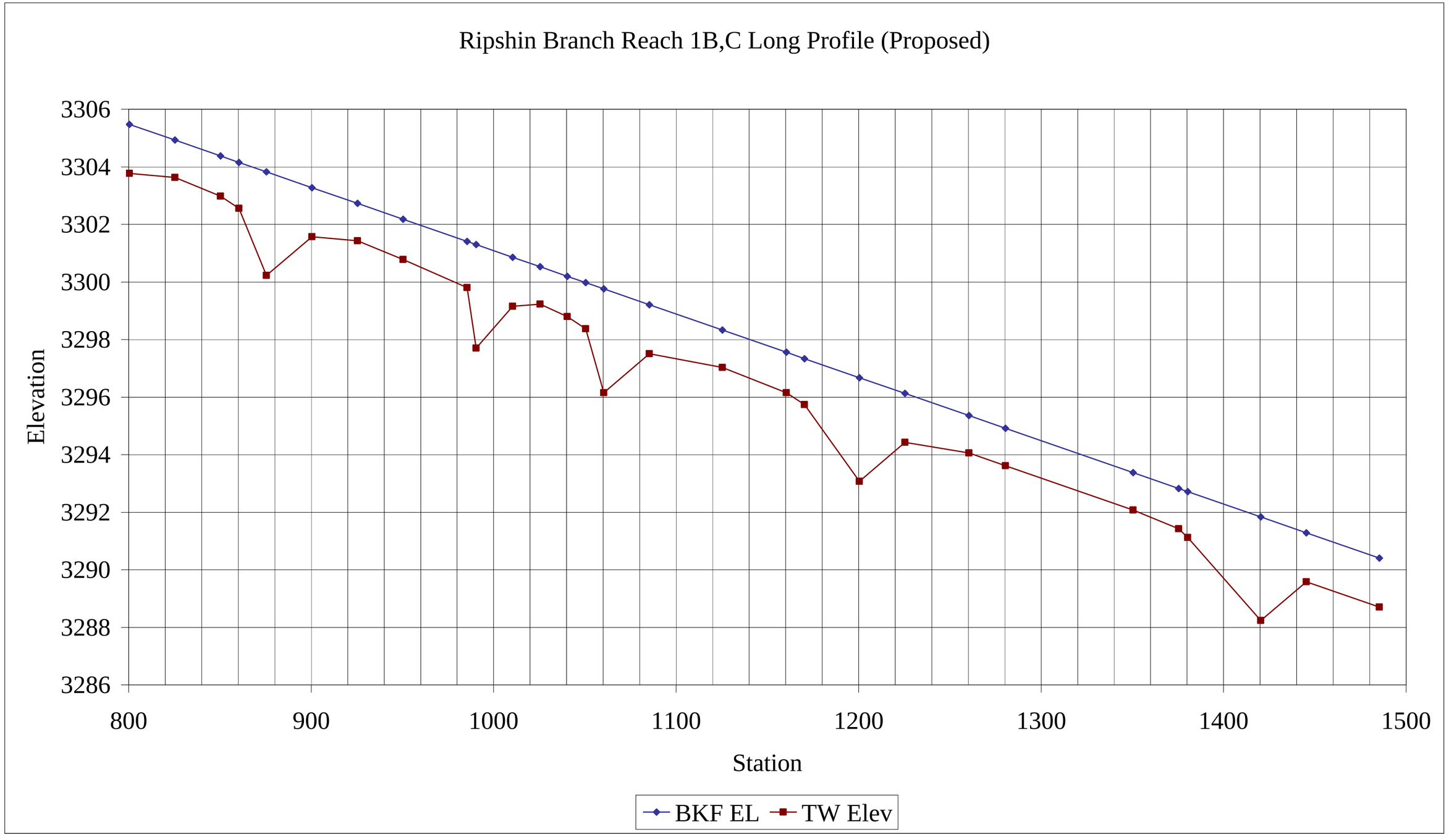
SCALE: 1" = 40'
DATE: 11/27/06
DRN. BY: KDH
CHECKED BY: MAT

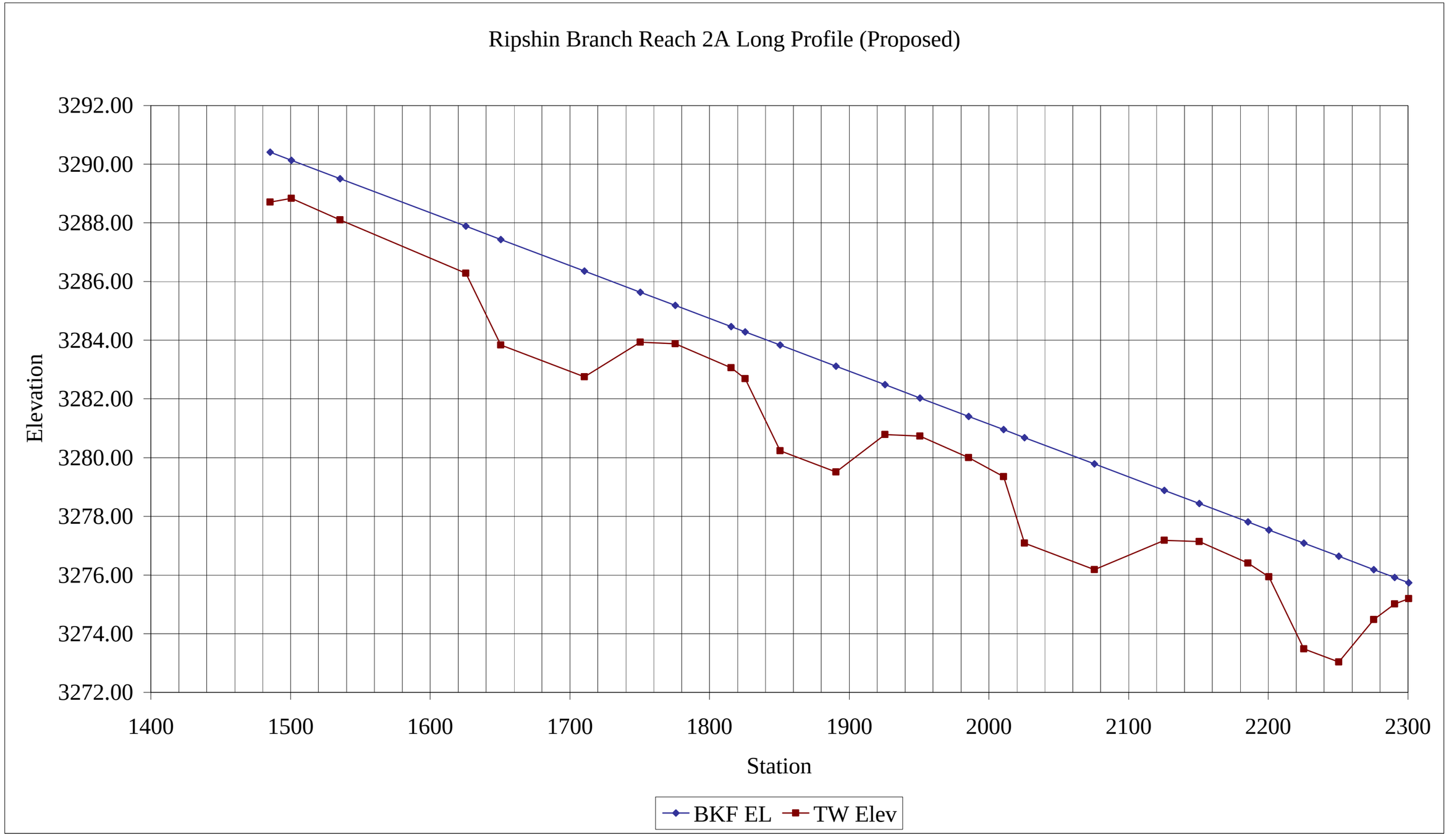
PROJECT NO:
—

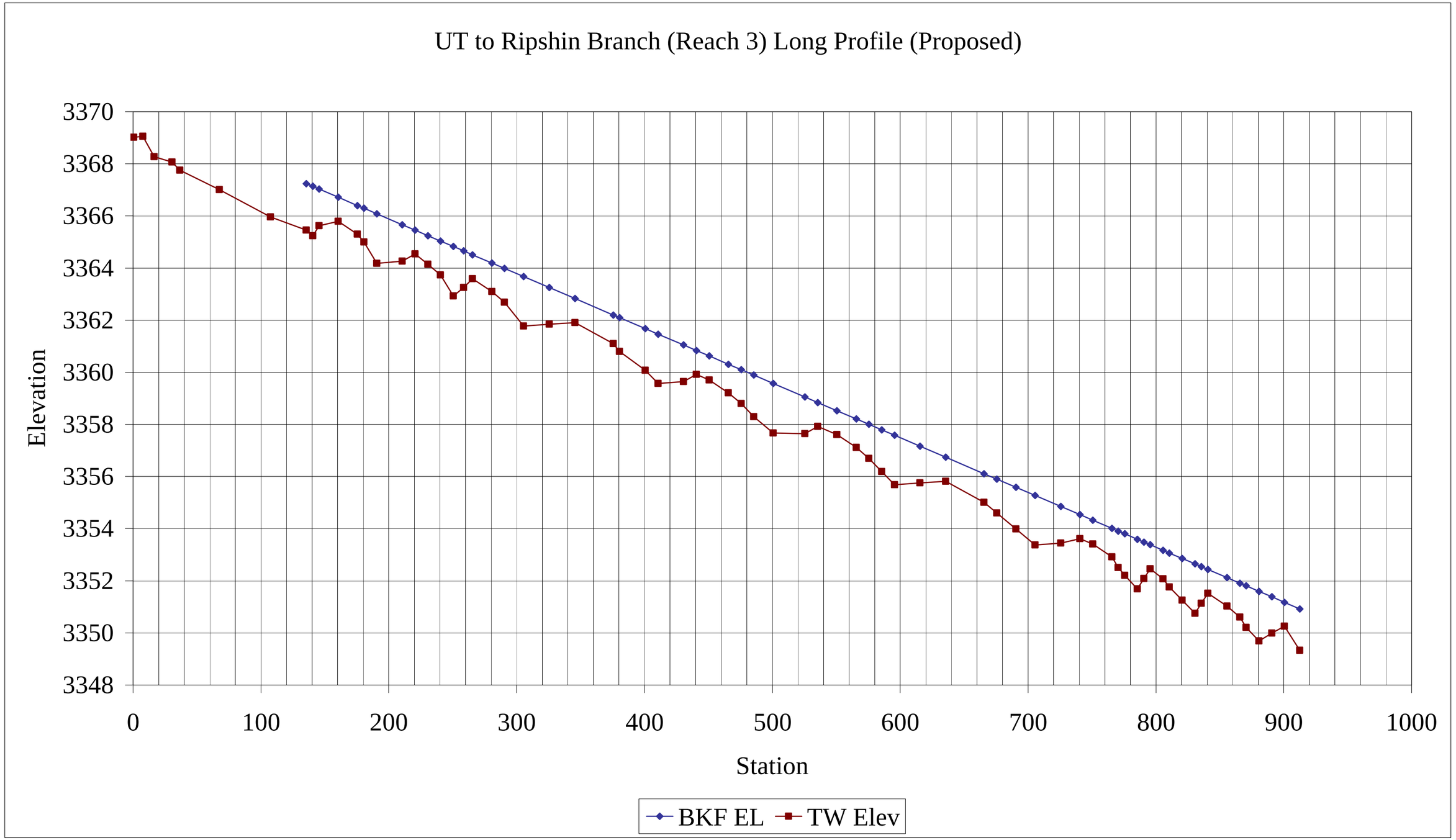
SHEET 3 OF 3

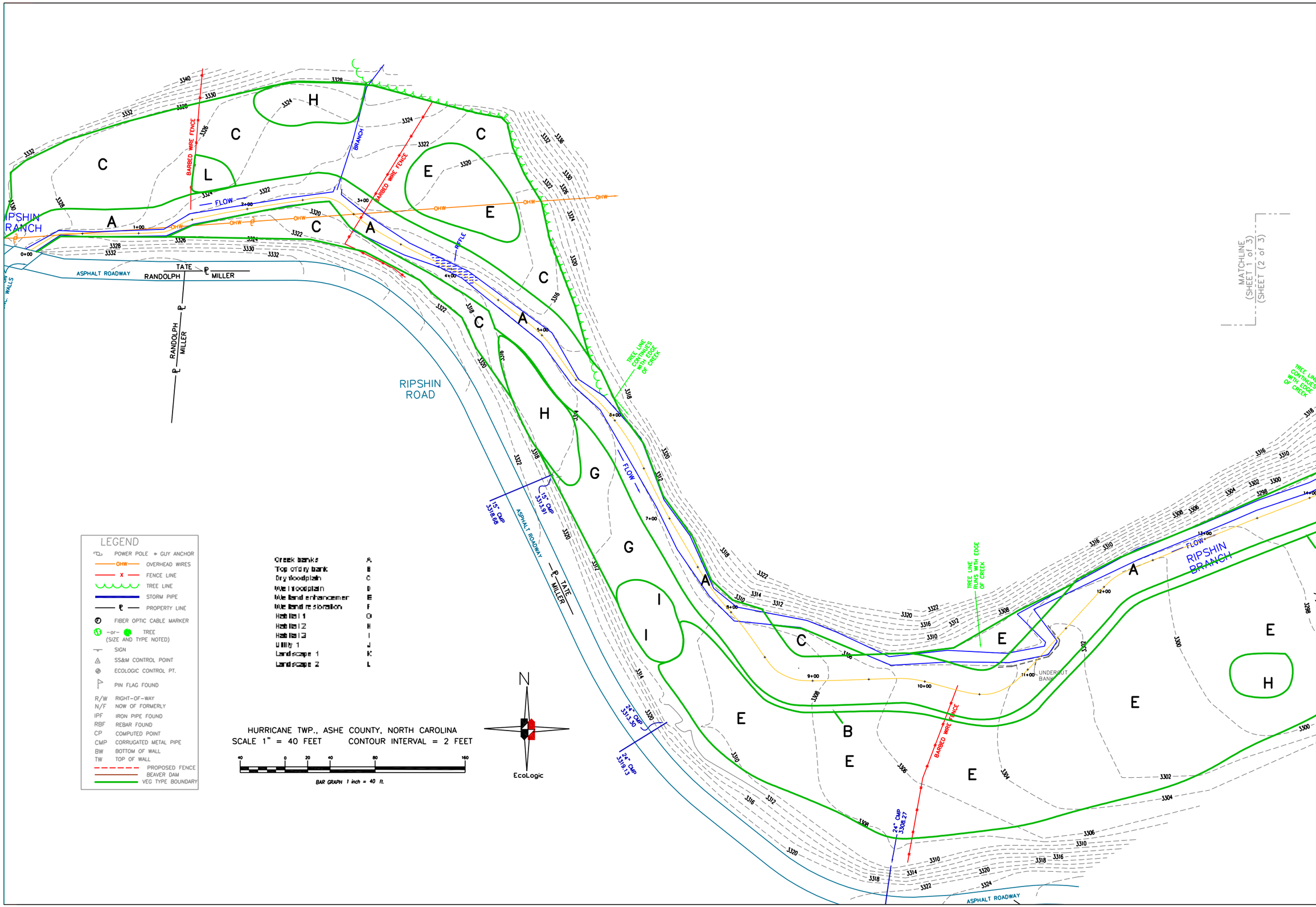
SHEET
2—3


Ripshin Branch Reach 1A Long Profile (Proposed)
Elevation
3324.00
3322.00
3320.00
3318.00
3316.00
3314.00
3312.00
3310.00
3308.00
3306.00
3304.00
3302.00
0
100
200
300
400
500
600
700
800
Station
BKF EL
TW Elev


Ripshin Branch Reach 1B,C Long Profile (Proposed)
Elevation
3306
3304
3302
3300
3298
3296
3294
3292
3290
3288
3286
800
900
1000
1100
1200
1300
1400
1500
Station
BKF EL
TW Elev


Ripshin Branch Reach 2A Long Profile (Proposed)
Elevation
3292.00
3290.00
3288.00
3286.00
3284.00
3282.00
3280.00
3278.00
3276.00
3274.00
3272.00
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
Station
BKF EL
TW Elev


UT to Ripshin Branch (Reach 3) Long Profile (Proposed)
Elevation
3370
3368
3366
3364
3362
3360
3358
3356
3354
3352
3350
3348
0
100
200
300
400
500
600
700
800
900
1000
Station
BKF EL
TW Elev



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www.ecologic-nc.com

PROJECT:
RIPSHIN BRANCH STREAM RESTORATION

PREPARED FOR:
NORTH CAROLINA ECOSYSTEM ENHANCEMENT PROGRAM

NO.	DESCRIPTION	DATE
2	EEP COMMENTS	3-5-07
1	OWNER REVS	12-14-06

REVISIONS

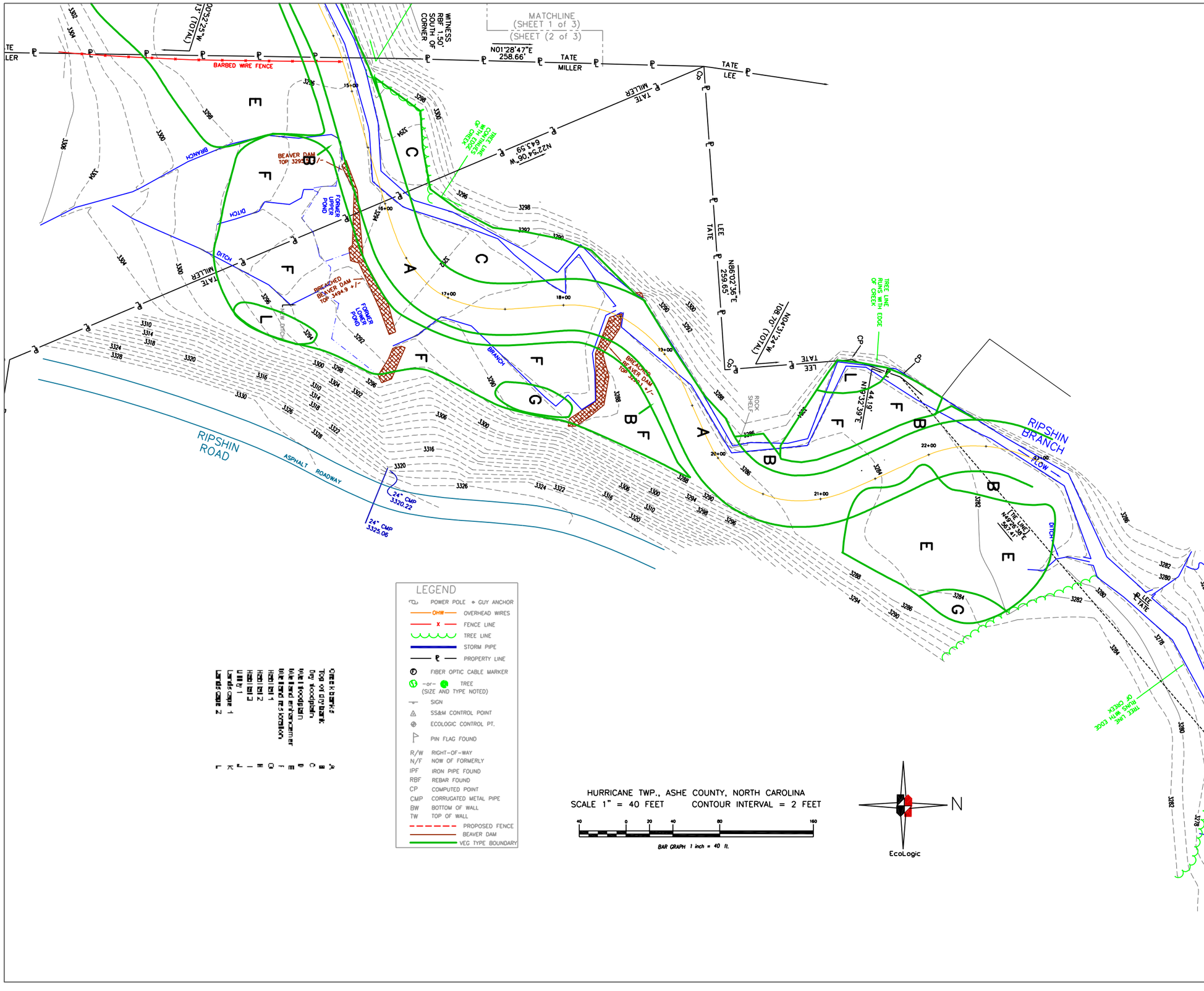
DESIGNED VEGETATIVE COMMUNITIES MAP

SCALE: 1" = 40'
DATE: 11/27/06
DRN. BY: KDH
CHECKED BY: MAT

PROJECT NO:
–

SHEET 1 OF 3

SHEET
4 – 1



LEGEND

- POWER POLE ⌖ GUY ANCHOR
- OHW — OVERHEAD WIRES
- x — FENCE LINE
- TREE LINE
- STORM PIPE
- ℄ — PROPERTY LINE
- FIBER OPTIC CABLE MARKER
- -or- TREE (SIZE AND TYPE NOTED)
- SIGN
- SS&M CONTROL POINT
- ECOLOGIC CONTROL PT.
- PIN FLAG FOUND
- R/W RIGHT-OF-WAY
- N/F NOW OF FORMERLY
- IPF IRON PIPE FOUND
- RBF REBAR FOUND
- CP COMPUTED POINT
- CMP CORRUGATED METAL PIPE
- BW BOTTOM OF WALL
- TW TOP OF WALL
- PROPOSED FENCE
- BEAVER DAM
- VEG TYPE BOUNDARY

HURRICANE TWP., ASHE COUNTY, NORTH CAROLINA
SCALE 1" = 40 FEET CONTOUR INTERVAL = 2 FEET

40 0 20 40 80 160
BAR GRAPH 1 inch = 40 ft.

N
EcoLogic

Check Dates:
Top of Bank
Dry Woodland
Wet Woodland
Wetland Enhancement
Wetland Restoration
Herb Plot 1
Herb Plot 2
Herb Plot 3
Utility 1
Landscape 1
Landscape 2

ECOLOGIC ASSOCIATES, P.C.
4312 W. S. ELM-EUGENE ST.
GREENSBORO, NC 27406
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PROJECT:
RIPSHIN BRANCH STREAM RESTORATION

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NO.	DESCRIPTION	DATE
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PROJECT NO:
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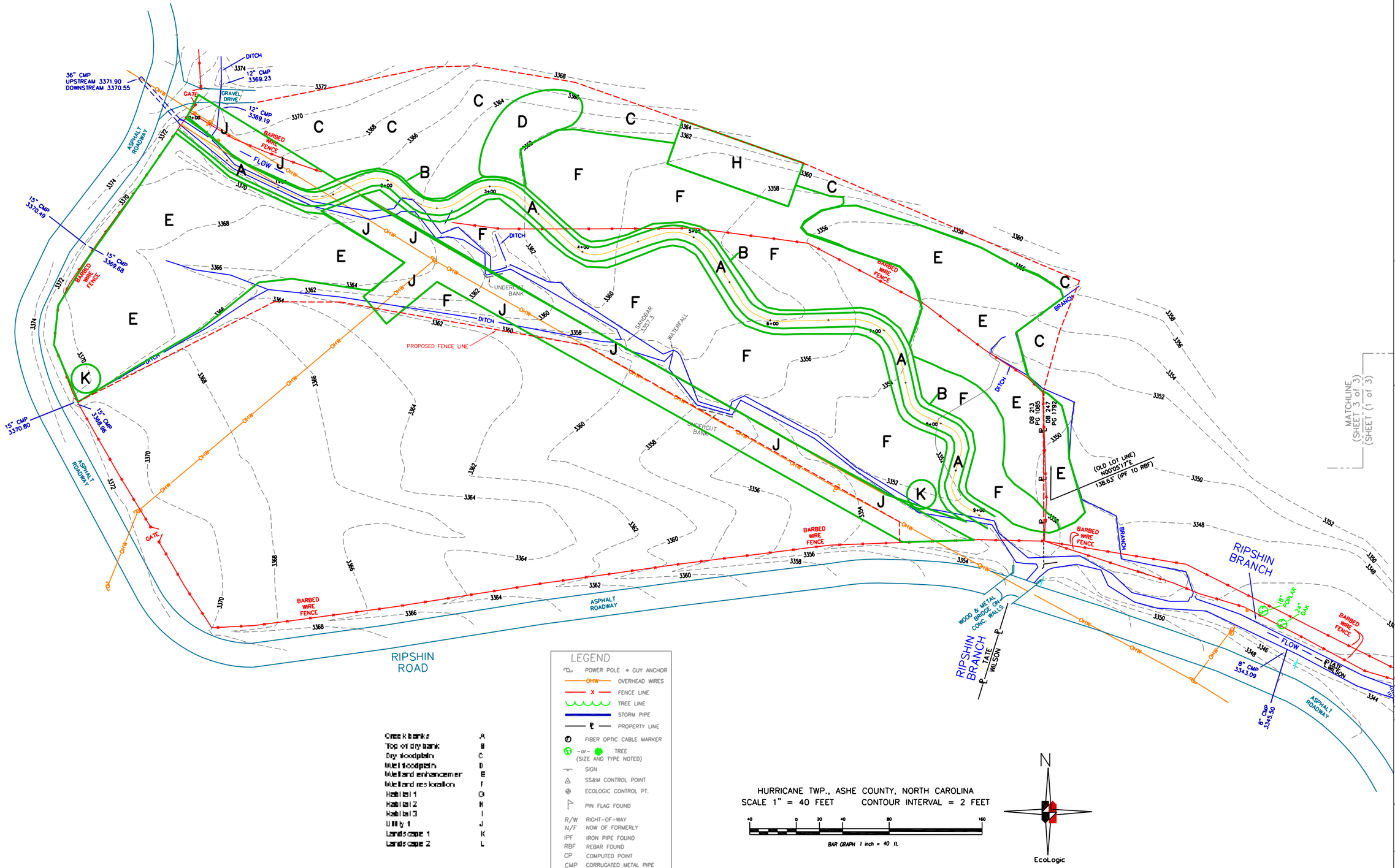
SHEET 1 OF 3

SHEET
4 – 2



Creek banks	A
Top of dry bank	B
Dry floodplain	C
Wet floodplain	D
Wetland enhancement	E
Wetland restoration	F
Habitat 1	G
Habitat 2	H
Habitat 3	I
Utility 1	J
Landscape 1	K
Landscape 2	L

LEGEND

- POWER POLE ⊕ GUY ANCHOR
- OHW — OVERHEAD WIRES
- x — FENCE LINE
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- VEG TYPE BOUNDARY

HURRICANE TWP., ASHE COUNTY, NORTH CAROLINA
SCALE 1" = 40 FEET CONTOUR INTERVAL = 2 FEET

40 0 20 40 80 160
BAR GRAPH 1 inch = 40 ft.

N
EcoLogic

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PROJECT:
RIPSHIN BRANCH STREAM RESTORATION

NORTH CAROLINA ECOSYSTEM ENHANCEMENT PROGRAM

PREPARED FOR:

NO.	DESCRIPTION	DATE
2	EEP COMMENTS	3-5-07
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REVISIONS

DESIGNED VEGETATIVE COMMUNITIES MAP

SCALE: 1" = 40'
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—

SHEET 1 OF 3

SHEET
4 — 3

Appendix 1. Restoration Site Photographs

Ripshin Branch Pre-restoration Conditions

Unnamed Tributary to Ripshin Branch Pre-restoration Conditions

Appendix 2. Restoration Site USACE Routine Wetland Determination Data Forms

DATA FORM

ROUTINE WETLAND DETERMINATION
1987 COE Wetlands Determination Manual

Project/Site: Tate Property/Ripshin ESP Project Date: 11 Feb 05
Applicant/Owner: Michael & Virginia Tate County: Ashe
Investigator: Ken Bridle / EcoLogic State: NC
Do Normal Circumstances exist on this site? (Yes) No Community ID: —
Is the site significantly disturbed (Atypical Situation?) (Yes) No Transect ID: —
Is the area a potential Problem Area? Yes (No) Plot ID: Along Unnamed Trib 4

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Alnus serrulata	S	FACW	9. Sphagnum moss	—	—
2. Cornus amomum	S	FACW+	10. Micro. viminum	h	FAC+
3. Salix nigra	T	OBL	11. Polygonum sagittatum	h	OBL
4. Salix sericea	S	OBL	12. Osmunda cinnamomea	h	FACW+
5. Juncus effusus	h	FACW	13. Lobelia cardenalis	h	FACW+
6. Carex sp	h	FACW	14. Mimulus ringens	h	OBL
7. Chasmanthium Latifolium	h	FAC	15. Ludwigia alternifolia	h	OBL
8. Lycopus virginicus	h	OBL	16. Panicum virgatum	h	FAC

Percent of Dominant Species that are OBL, FACW or FAC (excluding FACU): > 90%

Remarks:
This location is in a cattle grazing area and has a few cattle paths through it, but it appears too wet for them to spend much time

HYDROLOGY

RECORDED DATA (Describe in Remarks):
- ☐ Stream, Lake, or Tide Gauge
- ☐ Aerial Photographs
- ☐ Other
- ☒ No Recorded Data Available

FIELD OBSERVATIONS:
Depth of Surface Water: 0-3" (in.)
Depth to Free Water in Pit: _____ (in.)
Depth to Saturated Soil: 1" (in.)

WETLAND HYDROLOGY INDICATORS:

PRIMARY INDICATORS:
- ☒ Inundated
- ☒ Saturated in Upper 12 Inches
- ☐ Water Marks
- ☐ Drift Lines
- ☐ Sediment Deposits
- ☒ Drainage Patterns in Wetlands

SECONDARY INDICATORS (2 or more required):
- ☒ Oxidized Root Channels in Upper 12 Inches
- ☐ Water Stained Leaves
- ☐ Local Soil Survey Data
- ☐ FAC-Neutral Test
- ☐ Other (Explain in Remarks)

Remarks: This area is often too wet for cattle grazing. Prior landowners have filled, ditched and installed subsurface drains to attempt to dry out this area.

SOILS

Map Unit Name (Series and Phase): Colvard Fine Sandy Loam Drainage Class: Well drained
Taxonomy (Subgroup): Coarse-loamy, mixed, nonacid Mesic Typic Udifluvents
Field Observations Confirm Mapped Type? Yes No

PROFILE DESCRIPTION

Depth (Inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
1	A	7.5YR 4/1			
>2	B	Gley2 5/10B			

HYDRIC SOIL INDICATORS

- ☐ Histosol
- ☐ Histic Epipedon
- ☐ Sulfidic Odor
- ☒ Aquic Moisture Regime
- ☒ Reducing Conditions
- ☒ Gleyed or Low-Chroma Colors
- ☐ Concretions
- ☐ High Organic Streaking in Surface Layer in Sandy Soils
- ☐ Organic Streaking in Sandy Soils
- ☐ Listed on Local Hydric Soils List
- ☐ Listed on National Hydric Soils List
- ☐ Other (Explain in Remarks)

Hydric Soil Present? (Yes) No

Remarks:
Some areas have obvious fill (angular broken rock) and most has Rich organic A layer and gleyed clay below

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No
Wetland Hydrology Present? (Yes) No
Hydric Soils Present? (Yes) No
Is this sampling point a Wetland? (Yes) No

Remarks:

DATA FORM

1987 COE Wetlands Determination Manual

Project/Site: Tate Property/Ripshin EEP — Date: 11 Feb 05
Applicant/Owner: Michael & Virgina Tate — County: Ashe
Investigator: Ken Bridle Ecologic — State: NC
Do Normal Circumstances exist on this site? (Yes) No — Community ID: —
Is the site significantly disturbed (Atypical Situation?) (Yes) No — Transect ID: —
Is the area a potential Problem Area? Yes (No) — Plot ID: Ripshin Road Wet

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Juncus effusus	h	FACW	9. Sambucus canadensis	S	FACW
2. Carex sp	h	FACW	10. Salix nigra	C	OBL
3. Sambucus canadensis	h	FACW	11. Microstegium vimineum	h	Fac+
4. Chasmanthium laxum	h	FAC	12. Cornus amomum	S	FACW+
5. Panicum virgatum	h	FAC	13. Aesculus sylvatica	S	FAC
6. Sorghastrum nutans	h	FACU	14. Alnus serrulata	S	FACW
7. Polygonum sagittatum	h	OBL	15. Sphagnum moss	—	?
8. Lycopus virginicus	h	OBL	16. Polygonum sagittatum	h	OBL

Percent of Dominant Species that are OBL, FACW or FAC (excluding FACU): >66%

Remarks: This wetland area is an old pasture that is bordered by the road and is a mixture of native vegetation and introduced pasture and roadside grass species

HYDROLOGY

RECORDED DATA (Describe in Remarks):
- ☐ Stream, Lake, or Tide Gauge
- ☐ Aerial Photographs
- ☐ Other
- ☒ No Recorded Data Available

FIELD OBSERVATIONS:
- Depth of Surface Water: 0-6" (in.)
- Depth to Free Water in Pit: _____ (in.)
- Depth to Saturated Soil: _____ (in.)

WETLAND HYDROLOGY INDICATORS: Inflowing creeks, drift lines

PRIMARY INDICATORS:
- ☒ Inundated
- ☒ Saturated in Upper 12 Inches
- ☐ Water Marks
- ☒ Drift Lines
- ☐ Sediment Deposits
- ☐ Drainage Patterns in Wetlands

SECONDARY INDICATORS (2 or more required):
- ☒ Oxidized Root Channels in Upper 12 Inches
- ☒ Water Stained Leaves
- ☐ Local Soil Survey Data
- ☐ FAC-Neutral Test
- ☐ Other (Explain in Remarks)

Remarks: Landowner indicates this area is always wet, even in dry summers

SOILS

Map Unit Name (Series and Phase): Colvard fine sandy loam — Drainage Class: Well drained
Field Observations Confirm Mapped Type? (Yes)
Taxonomy (Subgroup): Coarse-loamy, mixed, active, nonacid Typic Udifluvents

PROFILE DESCRIPTION

Depth (Inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Conc Structure,
2	A	7.5YR 3/1			
8	B	Gley2 5/10B			
>10	C	Gley2 3/10B			

HYDRIC SOIL INDICATORS

- ☐ Histosol
- ☐ Histic Epipedon
- ☐ Sulfidic Odor
- ☒ Aquic Moisture Regime
- ☒ Reducing Conditions
- ☒ Gleyed or Low-Chroma Colors
- ☐ Concretions
- ☐ High Organic Streaking in Surface Layer in Sandy Soils
- ☐ Organic Streaking in Sandy S
- ☒ Listed on Local Hydric Soils L
- ☐ Listed on National Hydric Soil
- ☐ Other (Explain in Remarks)

Hydric Soil Present? (Yes)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes)
Wetland Hydrology Present? (Yes)
Hydric Soils Present? (Yes)
Is this sampling point a Wetland? (Yes)

Remarks: This area was used as a pasture and hay field until the current owner removed the animals and beavers ponded up some parts making it too wet to cut hay. The quality of the forage is also low.

Appendix 3. Restoration Site NCDWQ Stream Classification Forms

NCDWQ Stream Classification Form

Project Name: Ripshin Branch Restoration | River Basin: New | County: Ashe | Evaluator: Ken Bridle

DWQ Project Number: — | Nearest Named Stream: Ripshin Branch | Latitude: 36.574348 7N | Signature: [signature]

Date: 27 Feb 2005 | USGS QUAD: Park | Longitude: 81.611800 1W | Location/Directions: Buddy's Run Ditch

PLEASE NOTE:** ***If evaluator and landowner agree that the feature is a man-made ditch, then use of this form is not necessary. Also, if in the best professional judgement of the evaluator, the feature is a man-made ditch and not a modified natural stream—this rating system should not be used*

Primary Field Indicators: *(Circle One Number Per Line)*

I. Geomorphology	Absent	Weak	Moderate	Strong
1) Is There A Riffle-Pool Sequence?	0	(1)	2	3
2) Is The USDA Texture In Streambed Different From Surrounding Terrain?	0	1	(2)	3
3) Are Natural Levees Present?	(0)	1	2	3
4) Is The Channel Sinuous?	(0)	1	2	3
5) Is There An Active (Or Relic) Floodplain Present?	(0)	1	2	3
6) Is The Channel Braided?	(0)	1	2	3
7) Are Recent Alluvial Deposits Present?	0	(1)	2	3
8) Is There A Bankfull Bench Present?	(0)	1	2	3
9) Is A Continuous Bed & Bank Present?	(0)	1	2	3
*(*NOTE: If Bed & Bank Caused By Ditching And **WITHOUT** Sinuosity Then Score=0*)*				
10) Is A 2nd Order Or Greater Channel (As Indicated On Topo Map ***And/Or*** In Field) Present?	***Yes***=3		***No***=(0)	

PRIMARY GEOMORPHOLOGY INDICATOR POINTS: 4

II. Hydrology	Absent	Weak	Moderate	Strong
1) Is There A Groundwater Flow/Discharge Present?	0	1	2	(3)

PRIMARY HYDROLOGY INDICATOR POINTS: 3

III. Biology	Absent	Weak	Moderate	Strong
1) Are Fibrous Roots Present In Streambed?	3	(2)	1	0
2) Are Rooted Plants Present In Streambed?	3	2	(1)	0
3) Is Periphyton Present?	0	1	2	(3)
4) Are Bivalves Present?	(0)	1	2	3

PRIMARY BIOLOGY INDICATOR POINTS: 6

Secondary Field Indicators: *(Circle One Number Per Line)*

I. Geomorphology	Absent	Weak	Moderate	Strong
1) Is There A Head Cut Present In Channel?	(0)	.5	1	1.5
2) Is There A Grade Control Point In Channel?	0	(.5)	1	1.5
3) Does Topography Indicate A Natural Drainage Way?	(0)	.5	1	1.5

SECONDARY GEOMORPHOLOGY INDICATOR POINTS: 0.5

II. Hydrology	Absent	Weak	Moderate	Strong
1) Is This Year's (Or Last's) Leaflitter Present In Streambed?	(1.5)	1	.5	0
2) Is Sediment On Plants (Or Debris) Present?	0	(.5)	1	1.5
3) Are Wrack Lines Present?	0	(.5)	1	1.5
4) Is Water In Channel ***And*** >48 Hrs. Since Last ***Known*** Rain? *(*NOTE: If Ditch Indicated In #9 Above Skip This Step And #5 Below*)*	0	.5	1	(1.5)
5) Is There Water In Channel During Dry Conditions ***Or*** In Growing Season)?	0	.5	1	(1.5)
6) Are Hydric Soils Present In Sides Of Channel (Or In Headcut)?	***Yes***=(1.5)		***No***=0	

SECONDARY HYDROLOGY INDICATOR POINTS: 7

24.5

NCDWQ Stream Classification Form

Project Name: Ripshin Branch Restoration | River Basin: New | County: Ashe | Evaluator: Ken Bridle

DWQ Project Number: | Nearest Named Stream: Ripshin Branch | Latitude: 36.571241 2 N | Signature: [signature]

Date: 27 Feb 2006 | USGS QUAD: Park | Longitude: 81.6032408 W | Location/Directions: Lower Reach Trib from South

PLEASE NOTE:** ***If evaluator and landowner agree that the feature is a man-made ditch, then use of this form is not necessary. Also, if in the best professional judgement of the evaluator, the feature is a man-made ditch and not a modified natural stream—this rating system should not be used*

Primary Field Indicators: *(Circle One Number Per Line)*

I. Geomorphology	Absent	Weak	Moderate	Strong
1) Is There A Riffle-Pool Sequence?	0	(1)	2	3
2) Is The USDA Texture In Streambed Different From Surrounding Terrain?	0	(1)	2	3
3) Are Natural Levees Present?	(0)	1	2	3
4) Is The Channel Sinuous?	(0)	1	2	3
5) Is There An Active (Or Relic) Floodplain Present?	(0)	1	2	3
6) Is The Channel Braided?	(0)	1	2	3
7) Are Recent Alluvial Deposits Present?	0	(1)	2	3
8) Is There A Bankfull Bench Present?	(0)	1	2	3
9) Is A Continuous Bed & Bank Present?	(0)	1	2	3

*(*NOTE: If Bed & Bank Caused By Ditching And **WITHOUT** Sinuosity Then Score=0*)*

10) Is A 2nd Order Or Greater Channel (As Indicated On Topo Map ***And/Or*** In Field) Present? ***Yes***=3 ***No***=(0)

PRIMARY GEOMORPHOLOGY INDICATOR POINTS: 3

II. Hydrology	Absent	Weak	Moderate	Strong
1) Is There A Groundwater Flow/Discharge Present?	0	1	(2)	3

PRIMARY HYDROLOGY INDICATOR POINTS: 2

III. Biology	Absent	Weak	Moderate	Strong
1) Are Fibrous Roots Present In Streambed?	3	2	(1)	0
2) Are Rooted Plants Present In Streambed?	3	2	(1)	0
3) Is Periphyton Present?	0	1	(2)	3
4) Are Bivalves Present?	(0)	1	2	3

PRIMARY BIOLOGY INDICATOR POINTS: 4

Secondary Field Indicators: *(Circle One Number Per Line)*

I. Geomorphology	Absent	Weak	Moderate	Strong
1) Is There A Head Cut Present In Channel?	(0)	.5	1	1.5
2) Is There A Grade Control Point In Channel?	0	(.5)	1	1.5
3) Does Topography Indicate A Natural Drainage Way?	0	.5	(1)	1.5

SECONDARY GEOMORPHOLOGY INDICATOR POINTS: 1.5

II. Hydrology	Absent	Weak	Moderate	Strong
1) Is This Year's (Or Last's) Leaflitter Present In Streambed?	1.5	(1)	.5	0
2) Is Sediment On Plants (Or Debris) Present?	0	(.5)	1	1.5
3) Are Wrack Lines Present?	(0)	.5	1	1.5
4) Is Water In Channel ***And*** >48 Hrs. Since Last ***Known*** Rain? *(*NOTE: If Ditch Indicated In #9 Above Skip This Step And #5 Below*)*	0	.5	1	(1.5)
5) Is There Water In Channel During Dry Conditions ***Or*** In Growing Season)?	0	.5	1	(1.5)

6) Are Hydric Soils Present In Sides Of Channel (Or In Headcut)? ***Yes***=(1.5) ***No***=0

SECONDARY HYDROLOGY INDICATOR POINTS: 6

16.5

NCDWQ Stream Classification Form

Project Name: Ripshin Stream Rest | River Basin: New River | County: Ashe | Evaluator: Ken Bridle

DWQ Project Number: | Nearest Named Stream: Ripshin Branch | Latitude: 36.5746238N | Signature: [signature]

Date: 27 Feb 2005 | USGS QUAD: Park | Longitude: 81.6103869W | Location/Directions: Trib 4, between Ripshin Road crossings

PLEASE NOTE:** ***If evaluator and landowner agree that the feature is a man-made ditch, then use of this form is not necessary. Also, if in the best professional judgement of the evaluator, the feature is a man-made ditch and not a modified natural stream—this rating system should not be used*

Primary Field Indicators: *(Circle One Number Per Line)*

I. Geomorphology	Absent	Weak	Moderate	Strong
1) Is There A Riffle-Pool Sequence?	0	1	2	(3)
2) Is The USDA Texture In Streambed Different From Surrounding Terrain?	0	1	2	(3)
3) Are Natural Levees Present?	0	1	(2)	3
4) Is The Channel Sinuous?	0	1	(2)	3
5) Is There An Active (Or Relic) Floodplain Present?	0	1	2	(3)
6) Is The Channel Braided?	(0)	1	2	3
7) Are Recent Alluvial Deposits Present?	0	1	2	(3)
8) Is There A Bankfull Bench Present?	0	1	2	(3)
9) Is A Continuous Bed & Bank Present?	(0)	1	2	3

*(*NOTE: If Bed & Bank Caused By Ditching And WITHOUT Sinuosity Then Score=0*)*

10) Is A 2nd Order Or Greater Channel (As Indicated On Topo Map ***And/Or*** In Field) Present? ***Yes***=(3) ***No***=0

PRIMARY GEOMORPHOLOGY INDICATOR POINTS: 22

II. Hydrology	Absent	Weak	Moderate	Strong
1) Is There A Groundwater Flow/Discharge Present?	0	1	2	(3)

PRIMARY HYDROLOGY INDICATOR POINTS: 3

III. Biology	Absent	Weak	Moderate	Strong
1) Are Fibrous Roots Present In Streambed?	(3)	2	1	0
2) Are Rooted Plants Present In Streambed?	(3)	2	1	0
3) Is Periphyton Present?	0	1	(2)	3
4) Are Bivalves Present?	(0)	1	2	3

PRIMARY BIOLOGY INDICATOR POINTS: 8

Secondary Field Indicators: *(Circle One Number Per Line)*

I. Geomorphology	Absent	Weak	Moderate	Strong
1) Is There A Head Cut Present In Channel?	0	.5	(1)	1.5
2) Is There A Grade Control Point In Channel?	0	.5	(1)	1.5
3) Does Topography Indicate A Natural Drainage Way?	0	.5	1	(1.5)

SECONDARY GEOMORPHOLOGY INDICATOR POINTS: 3.5

II. Hydrology	Absent	Weak	Moderate	Strong
1) Is This Year's (Or Last's) Leaflitter Present In Streambed?	(1.5)	1	.5	0
2) Is Sediment On Plants (Or Debris) Present?	0	.5	(1)	1.5
3) Are Wrack Lines Present?	0	.5	1	(1.5)
4) Is Water In Channel ***And*** >48 Hrs. Since Last ***Known*** Rain? *(*NOTE: If Ditch Indicated In #9 Above Skip This Step And #5 Below*)*	0	.5	1	(1.5)
5) Is There Water In Channel During Dry Conditions ***Or*** In Growing Season)?	0	.5	1	(1.5)
6) Are Hydric Soils Present In Sides Of Channel (Or In Headcut)? ***Yes***=(1.5) ***No***=0				

SECONDARY HYDROLOGY INDICATOR POINTS: 10.5

III. Biology	Absent	Weak	Moderate	Strong
1) Are Fish Present?	0	.5	1	(1.5)
2) Are Amphibians Present?	0	.5	1	(1.5)
3) Are AquaticTurtles Present?	0	(.5)	1	1.5
4) Are Crayfish Present?	0	.5	1	(1.5)
5) Are Macrobenthos Present?	0	.5	1	(1.5)
6) Are Iron Oxidizing Bacteria/Fungus Present?	0	(.5)	1	1.5
7) Is Filamentous Algae Present?	0	.5	(1)	1.5

8) Are Wetland Plants In Streambed? *(* NOTE: If Total Absence Of All Plants In Streambed As Noted Above Skip This Step UNLESS SAV Present*)*	SAV	Mostly OBL	Mostly FACW	Mostly FAC	Mostly FACU	Mostly UPL
	2	1	(.75)	.5	0	0

8.75

Total 52.75

Appendix 4. Reference Site Photographs

Ripshin Branch On-site B Reference Stream

Ripshin Branch Off-site C Reference Stream (Long Branch, Patrick Co., VA)

Appendix 5. Report of Preliminary Soil Investigation
Foothills Soil Consulting, LLC

Discussion of Preliminary Soil Investigation
Site: The Tate Property near Lansing, NC
Ashe County, North Carolina
Prepared for EcoLogic Engineering/Construction
By Foothills Soil Consulting, LLC

Overview and Methodology: On October 24, 2006 Foothills Soil Consulting performed a brief investigation of the bottomland soils on the Tate Property in Ashe County, North Carolina. The purpose of the investigation was to identify potential for wetland restoration and creation on the site. About 10 soil observations were recorded during the investigation. Soil observations were made using auger to depths ranging from 12 to 30". Observation points were selected based on topography in areas of special interest to EcoLogic. Topographic maps provided by EcoLogic were used as the base map.

Sampling Results:

Upper cow pasture (pits 1-6): Observation 5 was hydric, with a depleted matrix (indicator F3) at 6". This observation was located in the area that was identified by Ken Bridle of EcoLogic as a possible exisisting wetland; this was confirmed by the soil. Observations 1, 3, 4, and 6 were nearly hydric, with common to many chroma 2 or less mottles by 10" and a depleted matrix at 11-12" from the natural soil surface. Although these soils are not hydric, the presence of common low chroma mottles at these depths may suggest that the water table is present at this depth often enough to meet the hydrology criteria. At observation 2 the auger was stopped at 19", with no chroma 2 or less mottles to that depth. South of the existing creek fill thickness ranged from 0" to 15". If needed, fill depths in this area can be mapped more accurately with backhoe pits.

Middle area (obserations 7-9): In pits 7 and 8 low chroma mottles were common by 10-12". This does not indicate a hydric soil, but is a nearly hydric soil. Low chroma mottles at this depth suggest that hydrology may be present, even though the soils are not hydric. Just below the road there was an apparent fill area, probably spoil from the road cut across the street, that is outlined on the map. Observation 9 was located in this apparent fill and had auger refusal at 6".

Beaver dam area (observations 10 and 11): This area was very wet on the surface and had several streams running across the surface. Observation 10 had chroma 1 mottles by 12", and observation 11 had a 14" thick dark A horizon with redox features (indicatorF6). It had low chroma mottles, but no reduced matrix immediately below the A. For a ponded area this soil meets hydric criteria. For a soil which is wet due to subsurface saturation it does not meet hydric criteria.

Lower area (observations 12 and 13): This area was less obviously wet t the time of the investigation than the Beaver Dam area. In pit 12 there were many low chroma mottles at 15", with a reduced matrix at 22". In pit 13 there were chroma 3 redox features from 6", with <2% redox features with chroma 2 or less to a depth of 19".

Potential for hydric soil development

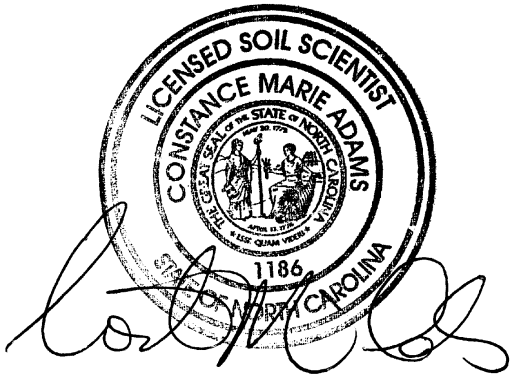
Upper cow pasture and Middle areas: In this area it appears that removing the fill and

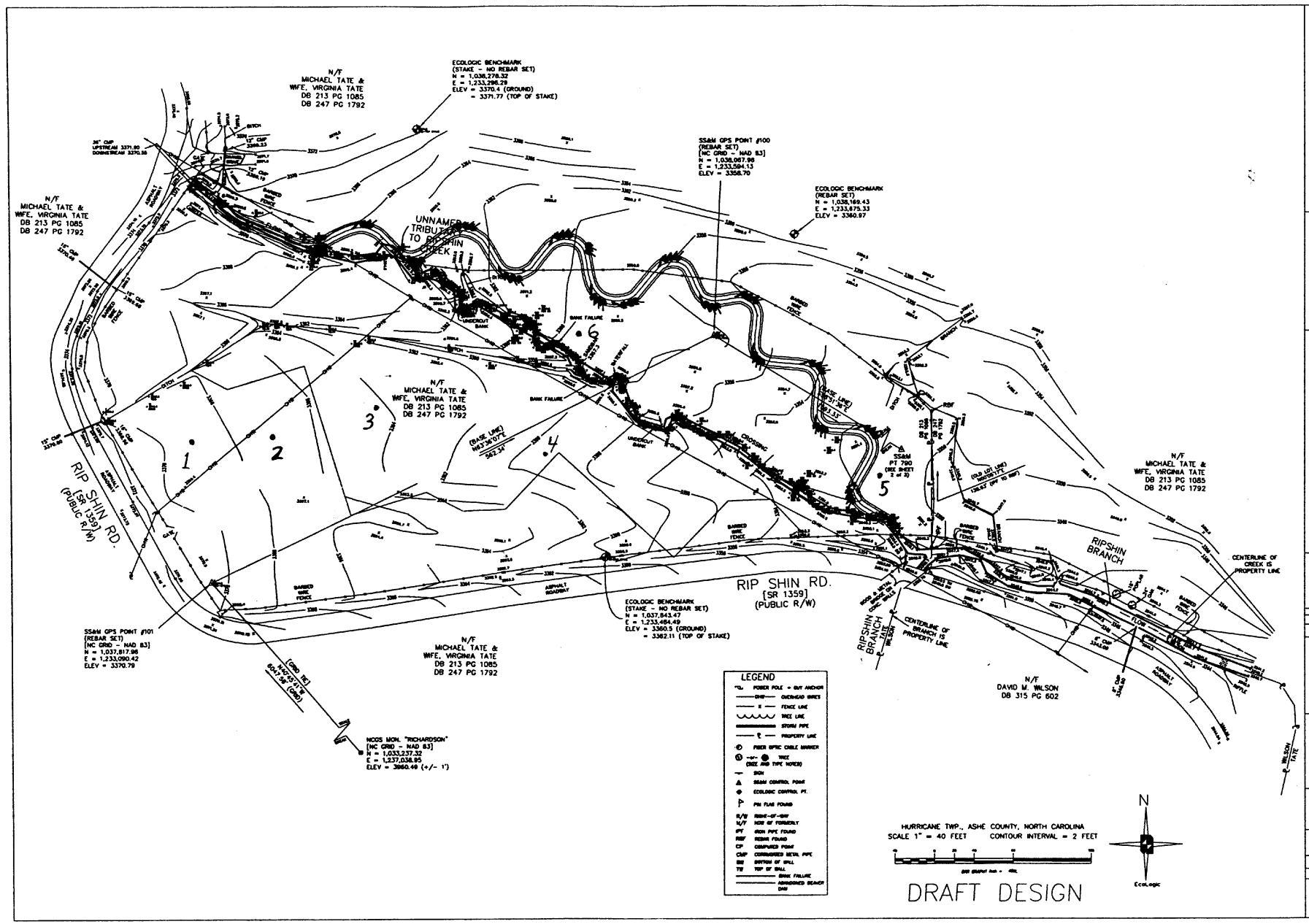
raising the water table by just 2-4 inches should allow a hydric soil to form. As mentioned above, it is possible that the water table is already high enough in the profile to meet the hydrology of a wetland based on common assumptions about redox features and their relation to water tables.

Middle area: In this area it appears that removing the fill and raising the water table by about 6 inches should allow a hydric soil to form.

Beaver dam: Because of recent disturbance in this area it is hard to draw conclusions based on the soils here. The thick dark A horizon observed in this area could well be a product of the flooding from the beaver dam, while the subsoil below had not been flooded long enough to fully reflect the new saturation levels. Nor have the soils had time to reflect the drier situation when the dam was removed. It seems likely that this area either currently meets wetland criteria or could easily have the water table raised enough to allow it to meet wetland criteria. Because this areas has been subject to disturbance and the soils may not have had time to reflect the changes in water table, which it is would be best determined by hydrology and vegetation.

Lower area: Based on the soils in this area it appears that the water table would have to be raised by at least 12" to bring water tables to a level that would allow these soils to meet hydric criteria.





Attachment 1a: Preliminary Soil Investigation Map - Upper Cow Pasture

Site: Ripshin Branch Stream

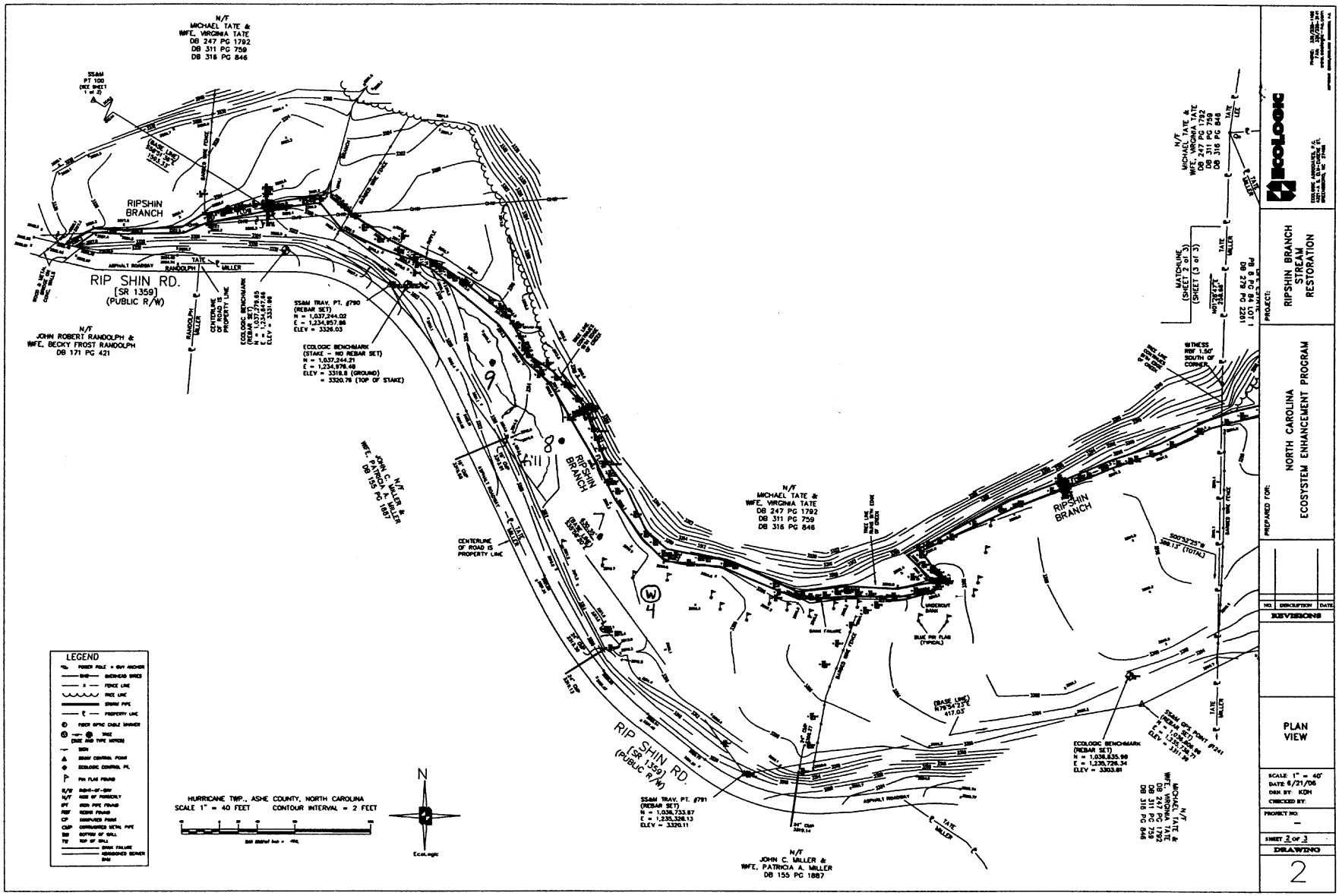
Prepared for EcoLogic

By Foothills Soil Consulting, LLC

Legend

- Auger boring

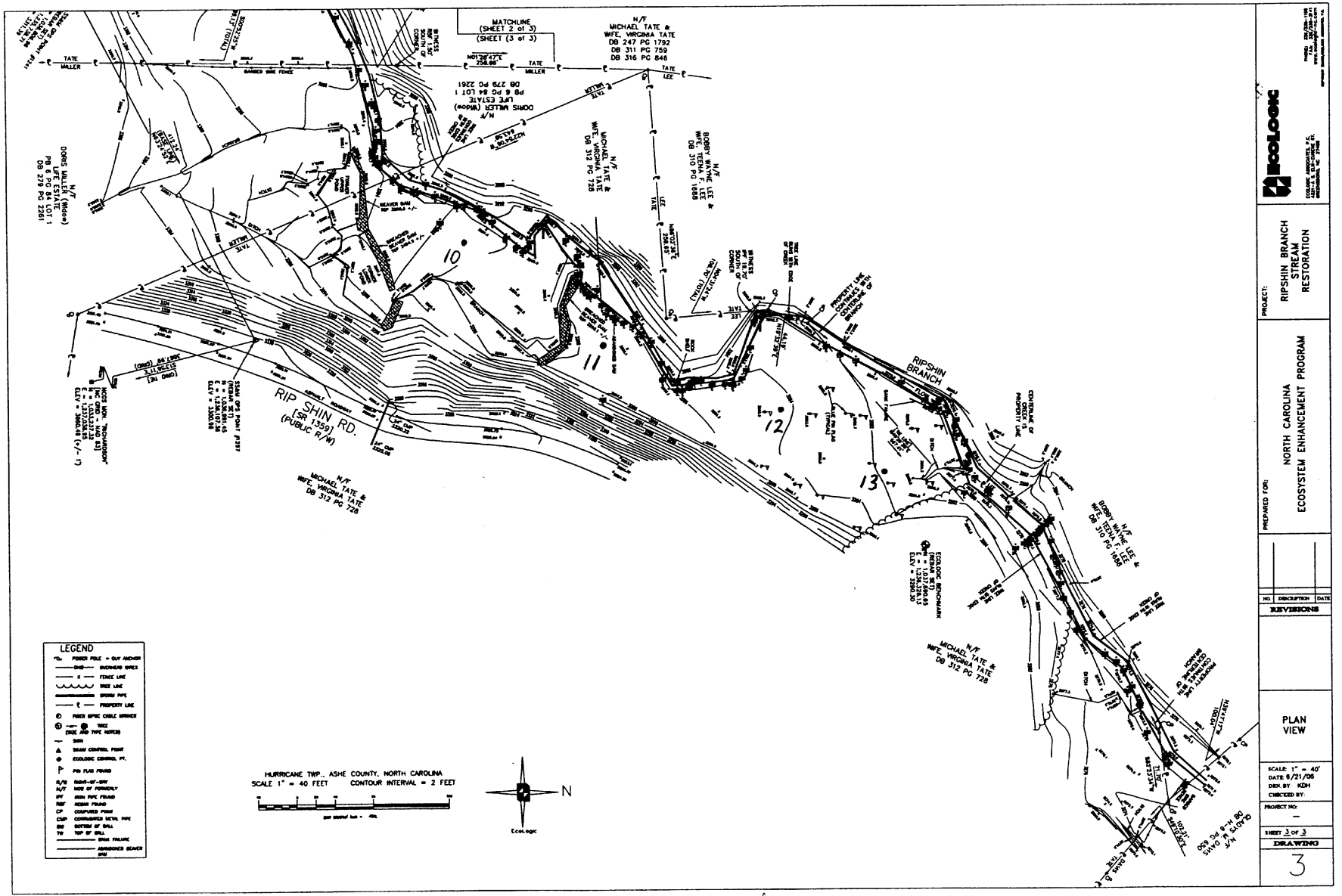
10/31/06



Attachment 1b: Preliminary Soil Investigation Map-Middle Area
Site: Ripshin Branch Stream
Prepared for EcoLogic
By Foothills Soil Consulting, LLC

Legend
- Auger boring

10/31/06



Attachment 1c: Preliminary Soil Investigation Map-Beaver Dam and Lower Areas

Site: Ripshin Branch Stream

Prepared for Ecologic

By: Foothills Soil Consulting, LLC

Legend

• Auger boring

10/31/06

Attachment 2: Non Detailed Descriptions
Prepared for Ecosystem Enhancement Propgram by Foothills Soil Consulting, LLC
Site: The Tate Property, Ashe County, North Carolina

Pit # 1

Depth	Horizon	Texture	Notes
0-7"	Ap	L	
7-12"		SiL/20%	40% 2.5Y 5/2, 4/2; 40% 10YR 5/8
12-19"		L/--	2.5Y 5/2 matrix (→5/3)
AR @ 19"			

Comment: Depleted matrix at 12" (10" needed for hydric soil).

Pit # 2

Depth	Horizon	Texture	Notes
0-5"	Fill		
5-15"	Ap		Fill?
15-19"	Bw	Gr VL	2.5Y 4/3; Angular gravel; fill?
AR @ 19"			

Comment: Backhoe pit needed for determination of depth to hydric indicators.

Pit # 3

Depth	Horizon	Texture	Notes
0-15"	Fill		some x gr
15-22"		L/20%	2.5Y 4/2, 5/2, 6/1 – 15%; 10YR 5/6, 5/8 – 40%, 10YR 5/3, 5/4
22-26"		L/20%	2.5Y 5/2, 6/1 – 40%; 2.5Y 5/3 – 20-30%; 10YR 5/8 – 20%
26-30"		Gr X SCL	angular rock; 2.5Y 5/2 matrix

Comment: Almost depleted matrix at 22". Without fill, almost depleted matrix at 7", depleted matrix at 11" (10" needed for hydric soil). Almost depleted matrix most likely indicates suitable hydrology, but does not meet criteria for hydric soil.

Pit # 4

Depth	Horizon	Texture	Notes
0-6"	A	L	10YR 3/2 w/10YR 4/6 mottle clp
6-12"	Bw		2.5Y 4/2, 5/2, 10YR 4/6 mottles cl2p
12-15"	Ab		stinks, very black; Bwb w/redox by 15"

Comment: Redox dark surface, but no depleted matrix immediately below. Nearly hydric soil. Located near well #3, in swale.

Pit # 5

Depth	Horizon	Texture	Notes
0-6"	Ap	L	10YR 3/2 many roots
6-12"	Bw	L	10YR 4/1 many roots
AR @ 12"			

Comment: depleted matrix at 6". Hydric soil.

Pit # 6

Depth	Horizon	Texture	Notes
			2.5Y 5/2, 4/2 mottles by 10"

Comment: Chroma two iron depletions at 10". Need depleted matrix for hydric soil indicator, but the common reductions suggest that hydrology is present at 10".

Pit # 7

Depth	Horizon	Texture	Notes
			2.5Y 4/1, 10YR 4/6 c2p by 12"

Comment: Chroma one iron depletions by 12". Need depleted matrix for hydric soil indicator, but the common reductions suggest that hydrology is present by 12". Located near well #4.

Pit # 8

Depth	Horizon	Texture	Notes
			Redox features immed. below A (not ≤ chr 2)
10-18"		SL w/L, SiL lenses	2.5Y 4/1, 5/2 f2fp
18-23"		SL	10YR 5/2 matrix w/7.5 YR 4/6 mottles

Comment: Depleted matrix at 18" (need at 10" for hydric soil). Common low chroma mottles at 10", plus the redox features immediately below A horizon suggest that hydrology may be present by 10".

Pit # 9

Depth	Horizon	Texture	Notes
AR @ 6"			

Comment: Appears to be fill—step up, feels built up. This is adjacent to upland, so once fill is removed this area should be similar to or slightly wetter than adjacent soils.

Pit # 10

Depth	Horizon	Texture	Notes
			redox features to surface – at least 1 chr 1 by 12"

Comment: No hydric features observed. Likely common chroma 2 or less mottles just below 12". Not a hydric soil indicator, but likely to have hydrology. Lots of water running on surface nearby.

Pit # 11

Depth	Horizon	Texture	Notes
0-14"	A		10YR 3/2 w/4/6 redox to surface
14-16+"	Bw		Low chroma mottles, 4/6 oxidation features, saturated

Pit # 12

Depth	Horizon	Texture	Notes
0-10"	Ap	L	redox features (mixed from soil below)
10-15"	Bt1	L	10YR 5/6 w/10YR 6/4 red.
15-22"	Bt2	CL	10YR 5/6 m2p 2.5Y 6/2, 6/1, 10YR 5/8 mottles
22"-	Btg	SCL	2.5Y 6/2 matrix

Pit # 13

Depth	Horizon	Texture	Notes
0-6"	A	L	
6-19"	C	LS	10YR 4/3 mostly. redox features <2% w/ ch ≤2.

Note: 3 holes in lower area (between levy and other holes). AR @ 10"; redox,. no ≤2.