2005

Properties and acid risk assessment of soils in two parts of the Cherry River watershed, West Virginia

Cara L. Sponaugle
West Virginia University

Properties and Acid Risk Assessment of Soils in Two Parts of the Cherry River Watershed, West Virginia

Cara L. Sponaugle

Thesis submitted to the
Davis College of Agriculture, Forestry, and Consumer Sciences
at West Virginia University
in partial fulfillment of the requirements for the degree of

Master of Science
in
Plant and Soil Sciences

Jeff Skousen, Ph.D., Chair
John Sencindiver, Ph.D.
James Thompson, Ph.D.
Pamela Edwards, Ph.D.

Division of Plant and Soil Sciences

Morgantown, West Virginia
2005

Keywords: soil acidification, acid deposition, Ca:Al molar ratio, forest soils

ABSTRACT

Properties and Acid Risk Assessment of Soils in Two Parts of the Cherry River Watershed, West Virginia

Cara L. Sponaugle

The Cherry River watershed project area is underlain by acid-forming geology. The objectives of this study were to determine the physical and chemical properties of the soils, classify the soils, and to assess the acid risk to the forests. Sixty-seven soil pedons were sampled by horizon across six landscape positions and the soil samples were analyzed. The soils of the watershed were all acid. The east area soils were more acid than the west area soils. The shoulder soils showed the highest risk and the floodplain soils showed the lowest risk of forest productivity decline. While both areas showed high acidification and forest productivity risk, the east area soils have higher risk for forest productivity decline in the future. While a few forest regeneration failures are known to have occurred after harvesting in this area, further acidification potentially will reduce the regeneration of a marketable timber stand.

Acknowledgments

There are several people who deserve thanks for the help that they have given me on this project.

To start, I would like to thank my committee: Dr. Jeff Skousen, Dr. John Sencindiver, Dr. James Thompson, and Dr. Pamela Edwards. This project would have never become what it did without the guidance and support of all of you.

I would like to thank Stephanie Connolly for taking me under her wing at the Forest Service and for giving me the opportunity to work and learn under her guidance. It has been a pleasure and hopefully will continue.

I would like to thank the staff of the Monongahela National Forest for all of the help and training that I have received while working with them. A special thanks goes to the GIS staff for all the patience that was needed to put up with me.

Pam and Freddie.
You took me in and welcomed me into your home for two summers. I can never thank the two of you enough.

Mom and Dad.
Everything that I have ever accomplished is due to you. You two have been my role models, support group, and the heros of my life.

Derek.
My fiancé. I never would have been able to do this without you. You have given me the best gift, your love and support. You took care of me when I was too busy and stressed out to do so myself.

Sara.
All I have to say is thanks for being there and you know all the rest.

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

Chapter 1.
Introduction, Literature Review, Materials and Methods

Introduction

Acid deposition has played a large role in the acidification of soils in the eastern United States (Binkley et al., 1998). The Monongahela National Forest (MNF) lies downwind of many industries that produce the highest sulfur dioxide emissions in the nation, including those within Ohio, Pennsylvania, Indiana, Illinois, and West Virginia (NADP, 2005). In addition to high deposition of these emissions, the low buffering capacities of certain geologies and soils on the forest have led to increased acidity in streams and possible nutrient depletion of soils (Connolly et al., 2004).

The Cherry River watershed, which lies within the Monongahela National Forest in West Virginia (Figure 1.1), has some of the highest rates of acid deposition in the state (NADP-NRSP-3, 2005). The eastern portion of the watershed has higher loadings of deposition and transitions to lower loads in the western portion of the watershed. Streams on the eastern side show an average pH of 4.7 and acid neutralizing capacity (ANC) of -16.1 μeq L^{-1}, while streams on the western side have an average pH of 5.8 and ANC of 4.0 μeq L^{-1}. This watershed also lies on the Pottsville geology, which is characterized by high moisture, acidic conditions, and low nutrient levels (Rice et al., 1992). The high acid deposition loads combined with acidic geology make the Cherry River watershed an area of concern for soil acidification and nutrient depletion especially with regard to conducting land management activities.

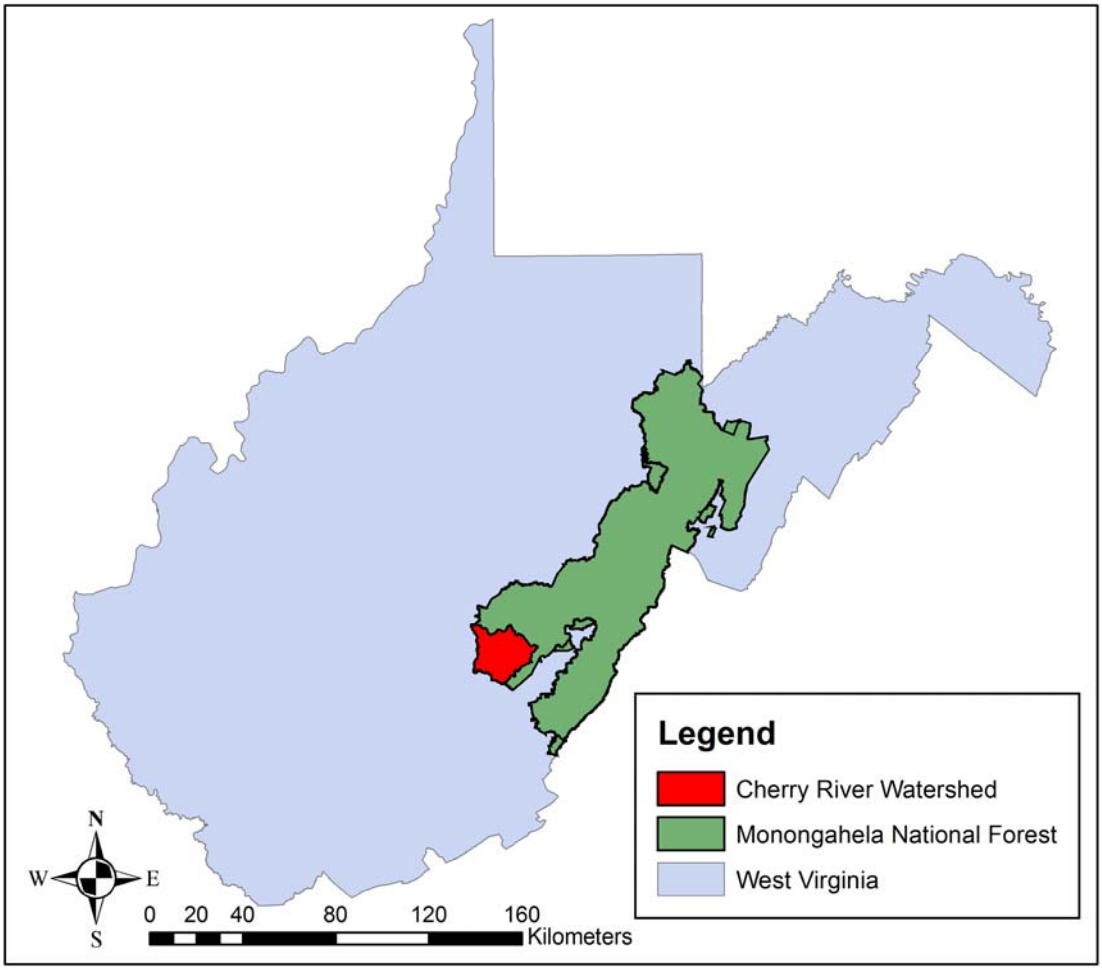


Figure 1.1. The location of the Cherry River watershed within the Monongahela National Forest in West Virginia.

It is important to identify soil acidification parameters that can assist in management decisions for forests throughout the East, particularly for those states that have large forest-based industries. For example, West Virginia forests are a source of over $4.2 billion dollars annually: $3.2 billion from wood products and $1 billion from forest-based tourism. In 1995, one billion board feet were harvested in West Virginia and annual growth still exceeded annual harvests (Adams et al., 2000).

The objectives of this project were to determine the physical and chemical properties of the soils of the two project areas (Figure 1.2), to classify the soils to the Subgroup level of taxonomy, and to evaluate the differences in soils between the two areas. Acid risk to forest productivity and sustainability was determined using the Ca:Al molar ratio and base saturation of the effective cation exchange capacity (BSECEC) and compared among watershed areas, landscape positions, and sampling sites.

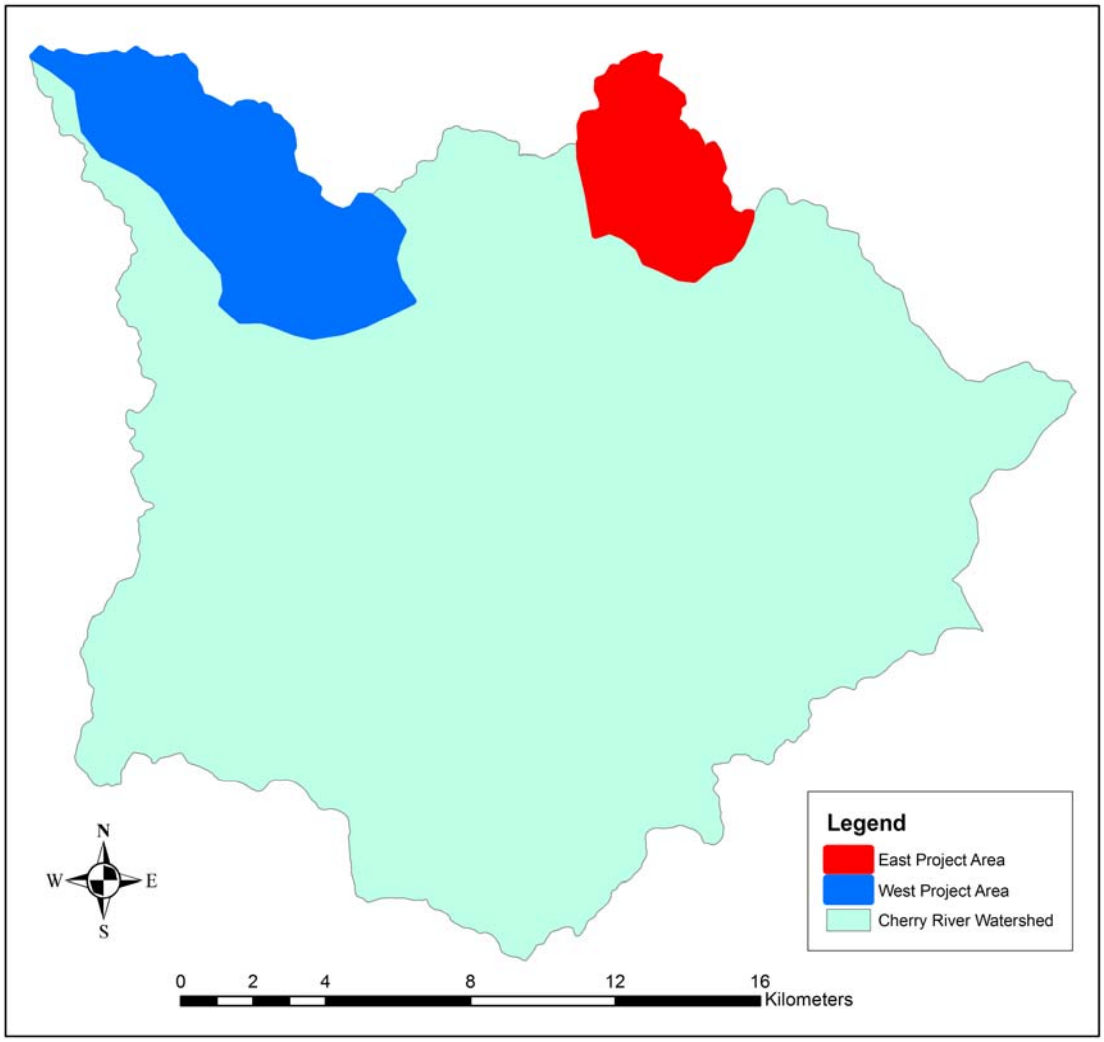


Figure 1.2. Project areas within the Cherry River watershed.

Literature Review

An Overview of Forest Productivity:

Forest productivity and sustainability have been issues of concern in recent years. Forest health decline and decreasing species diversity have been observed across North America and Europe (Binkley et al., 1998). Forest productivity throughout eastern United States and Canada has been declining for the past several decades (Bailey et al., 2004). Several factors influence the productivity and sustainability of forests, including disease, insect infestations, soil moisture, nutrient status, and acidic deposition. These factors rarely act independently, but more often are interrelated (Binkley et al., 1998; Duchesne et al., 2003). For example, nutrient availability for forest trees can be affected deleteriously in areas subject to chronic, high levels of acidic deposition, which in turn can make those same trees susceptible to diseases or insect damage. Federer et al. (1989) stated "continual depletion of the total amount of any nutrient must sooner or later decrease its availability and, consequently, forest productivity." Thus, soil chemistry can play a key role in overall forest health, both directly and indirectly.

Some soil chemical factors that affect forest health and sustainability relative to acidic deposition are base cations (calcium, magnesium, potassium, sodium), effective cation exchange capacity, nutrient availability, acidity, nitrogen and sulfate saturation, and toxic metals, including aluminum and manganese (Adams et al., 2000). Base cations are important to sustaining forest health because they are macronutrients; calcium is particularly important because it is the primary component of bole wood. Base cations also aid in neutralizing soil acidity, thereby making other nutrients more available to forest vegetation.

The main inputs of calcium to soils are weathering, litter fall, and atmospheric deposition (Huntington, 2000). However, the rate at which calcium is replaced by weathering tends to be very slow compared to rates of deposition, uptake, and leaching (USGS, 1999). Schnably (2003) found that the potential replenishment of soil calcium in Appalachia is low due to the highly weathered status of these soils. Soils most susceptible to calcium depletion are older soils that form from base-poor geology. Soils derived from limestone and dolomitic bedrock are the least susceptible to calcium depletion (Huntington et al., 2000).

Specific criteria need to be established for the assessment of forest ecosystem impacts on localized scales. Holmberg et al. (2001) stated, "In general, it would be easier to use a criterion concerning the behaviour of the system as a whole, rather than one isolated feature, such as forest health. The fact that the link between forest health and changes in soil variables is ambiguous supports the use of a simpler criterion, relating to a higher level in the system hierarchy."

Several soil chemical factors, including Ca:Al molar ratio and base saturation, have been related to soil nutrient condition, with fewer of these factors related to forest health. Cronan and Grigal (1995) noted that base saturation of the effective cation exchange capacity (BSECEC) of ≤15% typically is associated with some level of forest decline. However, while relationships have been found, threshold values for each across various situations (i.e., climate, topographic, deposition, soil conditions, bedrock/parent material, physiography, etc.) have not been identified. Consequently, threshold values or at least levels of concern need to be defined regionally or more broadly to model and predict forest productivity (Federer et al., 1989).

Acid Deposition

By the 1950s, acid deposition was thought to be widespread across the northeastern United States (Bailey et al., 2005). The largest contributors to acid deposition are fossil fuel burning power generation plant emissions (EPA, 1998). Acid deposition is formed when sulfur dioxide and nitrogen oxides react with water and oxygen in the atmosphere to form acidic compounds (EPA, 1998). These compounds then fall to the earth in either dry or wet forms as sulfuric and nitric acids. Sixty percent of the precipitation acidity in United States is from sulfuric acid (Sparks, 2003). Nitric acid makes up the majority of the other 40 percent of precipitation acidity. Acidic compounds are only some of the ions in atmospheric deposition. Others include calcium (Ca), magnesium (Mg), potassium (K), sodium (Na), ammonium (NH_4), and chloride (Cl).

There are three sites in WV that participate in the National Atmospheric Deposition Program (NADP) that monitor wet deposition inputs: Babcock State Park operated by United States Geologic Service (USGS), Cedar Creek State Park operated by United States Environmental Protection Agency (USEPA), and Parsons operated by the US Forest Service, Northeastern Research Station. Only Cedar Creek and Parsons participate in dry deposition collections in USEPA's Clean Air Status and Trends Network (CASTNET). The closest site collecting both wet and dry deposition data to Cherry River is the Cedar Creek State Park site. The 2004 annual mean rates of wet nitrogen (N) and sulfate (SO_4) deposition for Cedar Creek State Park were 12.0 kg ha^{-1} and 18.5 kg ha^{-1}, respectively (NADP, 2005). Figures 1.3 and 1.4 show the deposition trends (wet and dry) for the Cedar Creek site from 1989 to 2003. USEPA identified the

Mid-Appalachian region, including WV, to be a sensitive region in their 1998 National Air Quality and Emissions Trend Report, even though deposition of nitrogen and sulfur compounds in this region have been decreasing since the mid 1990s (EPA, 1998).

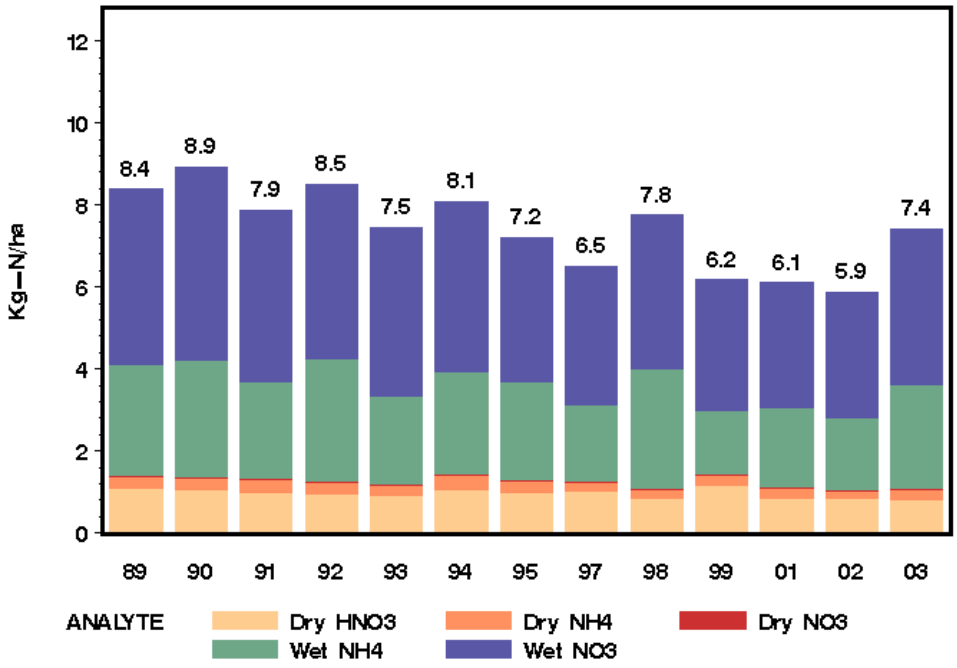


Figure 1.3. Total nitrogen deposition from 1989 to 2003 at Cedar Creek, WV (from CASTNET/NADP-NTN).

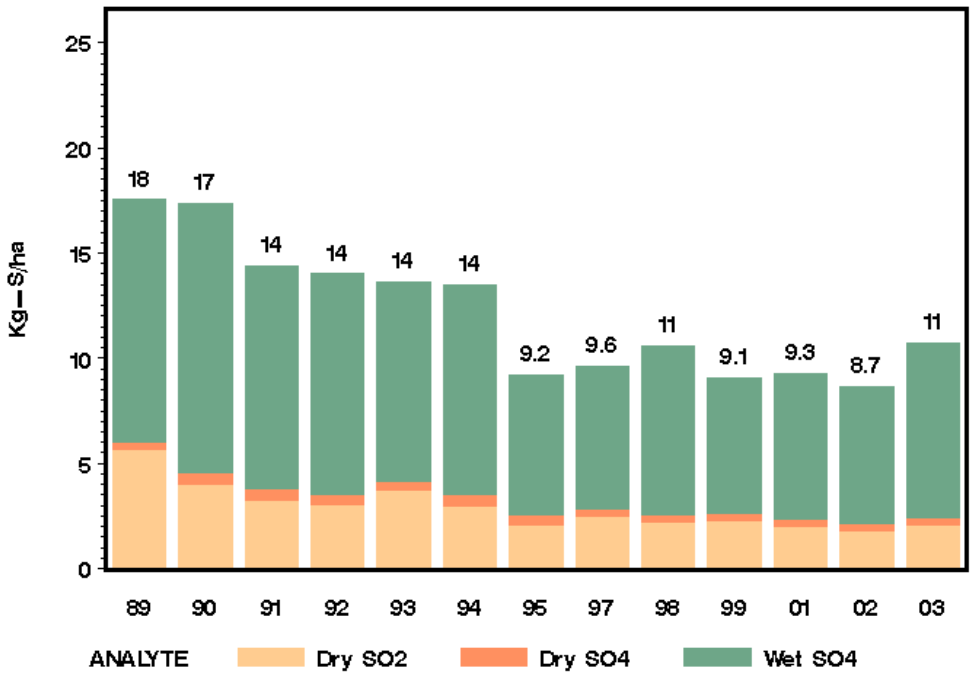


Figure 1.4. Total sulfur deposition from 1989 to 2003 at Cedar Creek, WV (from CASTNET/NADP-NTN).

As shown by Figures 1.3 and 1.4, the total sulfur deposition has decreased by nearly half from 1989 to 2003 due to emission controls that have been set by legislation (EPA, 1998). However, total nitrogen deposition has remained at relatively steady levels for the same time period.

Decreases in the emissions of sulfate and nitrogen oxides were expected to slow acidification of soils and water; however, emissions of base cations, which neutralize the acids, also declined. The annual mean rate of wet base cation deposition in 2004 at Cedar Creek State Park was 2.1 kg ha^{-1}, which translated to base cation deposition being over 10 times less than acidic anion deposition (NADP, 2005). Therefore, even with the decreases in deposition, the net result was that acidic inputs to soil and water increased.

Soil Acidification

In the soil, hydrogen ions dissociate from the sulfate and nitrate ions initially deposited as sulfuric and nitric acids. The dissociated hydrogen ions provide acidity to the soil, which results in pH decreases (Sparks, 2003). The addition of H^+ into the soils by acid deposition further results in soil acidification by displacing base cations from soil exchange sites (Sparks, 2003), as illustrated below using calcium in the example:

$$2H^+ + SO_4^{2-} + Ca^{2+}(\text{on exchange sites}) \rightarrow Ca^{2+} + SO_4^{2-} + 2H^+(\text{on exchange sites})$$

Upon becoming displaced from soil exchange sites, base cations pair with sulfate or nitrate anions to maintain the electroneutrality of the soil solution and can be leached from the soil by subsurface water moving laterally or vertically. Often the result is increased leaching losses to streams so that base cations are permanently lost from watershed soils. As base cations become depleted, additional hydrogen ion inputs release acidic cations from the soil, principally aluminum (Al), but also other metals such as manganese (Mn) and iron (Fe) (Bache, 1986).

Soil acidification reflects an increase of acid cations accompanied by a decrease in base cations (Yanai, 2005). While soil weathering, soil biotic processes, and vegetative uptake are naturally-acidifying processes (Gbondo-Tugbawa and Driscoll, 2003) and acid deposition explains only about 38% of acidic input to ecosystems (Markewitz et al., 1998), there is evidence that acidic deposition has accelerated acidification of some soils. For example, a study of soil acidification in the upper 60 cm of soil in the Calhoun Experimental Forest in South Carolina has shown an accelerated rate of acidification caused by atmospheric deposition from 1962 to 1990 (Markewitz et al., 1998). In England, Blake et al. (1999) determined from a century-long study that

acidic deposition was the main cause of soil acidification in the Geescroft Wilderness and acid deposition had greatly accelerated soil acidification. Calcium has leached at double the natural rate in forests affected by acid deposition (Joslin et al., 1992). If leaching continues at current rates, it is thought that in 150 years there will only be enough calcium in the soil for one hardwood rotation to reach marketable size in the Panola Mountain watershed in Georgia (USGS, 1999). From a model simulation, Gbondo-Tugbawa and Driscoll (2003) found that there has been 20% depletion of soil calcium over the past 40 years in the Hubbard Brook Experimental Forest in New Hampshire.

Acidification of soils increases cation leaching, decreases soil pH and base saturation, and negatively affects many biological processes (Adams and Kochenderfer, 1998). Adams and Kochenderfer (1998) found that the nitrogen content in trees increased from the artificial acidification of forest soils. In another study, Adams (1999) found that calcium losses were particularly large when a forest soil was artificially acidified compared to a non-forest soil. A nine-year acidification study at Bear Brook watershed in Maine found accelerated losses of base cations from the soil into the streams due to fertilizer additions of nitrogen and sulfur (Fernandez et al., 2003). Lawrence et al. (1999) also performed an experiment that showed that calcium concentrations in leachate increased as acid concentrations increased.

The loss of base cations due to acidic deposition also is supported by other studies (Bailey et al., 2005). In an experiment using archived samples from 1967 and resampling in 1997, 1998, and 1999, Bailey et al. (2005) found that forest soils in the Allegheny National Forest had decreases in pH and exchangeable calcium and magnesium, and increases in exchangeable aluminum, though these trends were not observed over the

three-year sampling period. They found that the majority of the change in calcium and magnesium could not be accounted for by forest growth, and they concluded that acid deposition was the driving force behind the cation leaching in the soil.

Another long term forest soils study shows similar results. Drohan and Sharpe (1997) resampled soils in Pennsylvania that had been initially sampled 14 to 36 years prior. They found that the upper soil horizons (O and A) showed decreases in pH, exchangeable calcium, and exchangeable magnesium with increased exchangeable aluminum in the A horizons. The main causes for the increased acidification and loss of base cations from these soils were forest uptake and acidic deposition (Drohan and Sharpe, 1997).

Base cations are replenished in forest soils to some degree by mineralization of litter fall, atmospheric deposition, and weathering (Jenkins, 2002; Johnson and Todd, 1990). Slope position also plays an important role in determining base cation levels. Lower slope positions accumulate more litter fall due to wind and gravity than higher slope positions (Johnson and Todd, 1990), therefore lower slope positions should have higher base cation concentrations.

Ca:Al Molar Ratio

The Ca:Al molar ratio is an indicator of the risk for forest decline due to aluminum antagonism and toxicity (Cronan and Grigal, 1995). Natural soil acidification, intensive tree harvesting, and acid deposition all deplete base cations, and thus, potentially increase soil-solution aluminum. Impaired uptake of already depleted calcium and magnesium supplies, growth reductions, and increased root mortality and turnover all are problems caused by high aluminum concentrations in soil (Cronan and Grigal, 1995).

Soils with low Ca:Al molar ratios are more likely to have forest decline due to aluminum antagonism and toxicity. Cronan and Grigal (1995) estimated that a Ca:Al molar ratio of 1.0 results in a 50% risk of adverse impacts on forest; a Ca:Al molar ratio of 0.5 to 0.6 creates a 75% risk of adverse impacts on forest; while a Ca:Al molar ratio of 0.2 gives a 95% or greater risk of adverse impacts on forest. Jenkins (2002) found that soils in the Otter Creek watershed on the Monongahela National Forest in West Virginia commonly have a Ca:Al molar ratio of <0.2, along with a base saturation of the effective cation exchange capacity (BSECEC) of <15%. He interpreted these findings to mean that the associated forests are at 100% risk for decline.

Lyon and Sharpe (1999) found that the Ca:Al molar ratios in forest soils of Pennsylvania had the highest risk in the B horizons. The B horizons were determined to be the upper rooting zone of most tree species in the study (Lyon and Sharpe, 1999). The Ca:Al molar ratios of the organic horizons were well above the threshold levels and not at risk. This was expected because both momomeric and polymeric aluminum are complexed with organic compounds and calcium is leached slowly from organic horizons (Lyon and Sharpe, 1999). After finding the Ca:Al molar ratios for several sites in Pennsylvania, Lyon and Sharpe (1999) compared them to the status of sugar maple (*Acer saccharum* Marsh.)[*] in the areas the samples were taken. For declining stands, the median Ca:Al molar ratios were 13.2, 0.66, and 0.31, respectively, for the O horizon, A horizon, and B horizon. For non-declining stands, the median Ca:Al molar ratios were 17.6, 1.93, 10.8, respectively, for the O horizon, A horizon, and B horizon. The A and B horizon values were significantly lower in the declining forests.

[*] Scientific names from Strausbaugh and Core, 1977.

Tree Response to Soil Acidification

It is difficult to attribute tree decline and mortality to a single cause (Bailey et al., 2004). Sugar maple has declined significantly in the eastern U.S. in past years, and its response to changes in soil chemistry has been researched extensively. Sugar maple seems to be the species that is lost from stands first during soil acidification (Bailey et al., 2004). They found a correlation between foliar calcium and magnesium and soil exchangeable cations in New York and Pennsylvania. By using the base cation to aluminum ratio, the relationships between foliar and soil parameters were explained even further, suggesting that Ca:Al molar ratios are useful for predicting forest decline. Soil pH also was correlated with base cation concentrations in each horizon. Bailey et al. (2004) determined that the chemistry of the upper B horizon provided the best correlations for all factors.

Two other studies have focused on the effects of acidification on Appalachian forests using a variety of tree species. DeWalle et al. (1991) used tree rings to assess responses to soil chemistry changes. While elements translocate across the rings of some trees, sapwood had the greatest correlation with soil chemistry. Sapwood also was correlated most strongly to soil chemistry when Ca:Mn, Mg:Mn, and Ca:Al ratios in soil were compared to tree ring chemistry (DeWalle et al., 1999). In that study, the Ca:Mn and Mg:Mn ratios correlated most strongly to current soil chemistry.

Materials and Methods

Project Area Description

The Cherry River watershed is located in Nicholas, Webster, and Greenbrier Counties of West Virginia. The watershed is predominantly forested and had timber harvests since the turn of the 20th century (Reger, 1921). The rugged terrain of the watershed limits land use, though small family farms are scattered throughout the watershed in valleys and on ridge tops.

The predominant forest type is eastern deciduous hardwoods. The dominant tree types of the east project area are black cherry (*Prinus serotina* Ehrh.), sugar maple, red maple (*Acer rubrum* L.), American beech (*Fagus grandifolia* Ehrh.), and yellow poplar (*Liriodendron tulipifera* L.). There are large patches of hay-scented fern (*Dennstaedtia punctilobula* (Michx.) Moore) found in this area, which may be a possible indicator of soil acidification (Demchik and Sharpe, 1999). The west project area's dominant tree species are red oak (*Quercus rubra* L.), white oak (*Quercus alba* L.), and hickory (*Carya spp*. Nutt.).

The surface geologies of the study areas are comprised of the Kanawha and New River Formations of the Pottsville Group (Table 1.1). The Pottsville Group belongs to the Pennsylvanian period of the Paleozoic Era. The Kanawha Formation consists of 61.5% sandstone, 30.3% shale, 6.4% coal, and 1.8% impure and siliceous limestone (Reger, 1921). The New River Formation consists of 73.75% sandstone, 22.5% shale, and 3.75% coal (Reger, 1921). The Kanawha Formation, which tends to be slightly more acid-forming than the New River Formation, is found only to a depth of 71 m (250 feet) in the east project area along ridge lines and on side slopes (Price, 1939). The upper most

portion of this geology is the Lower Gilbert Sandstone which was identified near Hanging Rock (Price, 1939). Hanging Rock is located in the east project area at the highest point of the watershed. The Kanawha Formation is mapped as occurring on the ridges of the west project area; however, no members of this formation were recorded in measured sections (Reger, 1921) of the area or noted on field visits (Tracy, 2005). The New River Formation of the Pottsville covers the west project area with the Upper Nuttall Sandstone along the ridges (Reger, 1921). The formations of the Pottsville Group have a greater percentage of shale in the western part of the Gauley Ranger District (Tracy, 2005). The New River Formation consists of only 30% sandstone in the location of the west project area compared to 74% in other areas (Tracy, 2005). Surface water pH in the west project area was much higher (≥6.0) than the surface waters from areas with higher sandstone content (4.0 – 5.0), like those found in the east project area (Tracy, 2005).

Table 1.1. General section of the Pottsville Group for the project areas of the Cherry River watershed (from Price, 1939). Rocks found in the Kanawha and New River Formations are given in order of depth from the surface for the watershed. Depth is in meters; feet given in parenthesis.

Kanawha Formation - 72 m (235 ft)	**Thickness**	**Total**
Sandstone, Lower Gilbert, massive, gray	9 - 24 (30 - 80)	24 (80)
Shale, Gilbert, dark, laminated	0 - 1.5 (0 - 5)	25 (85)
Shale, sandy	0 - 6 (0 - 20)	31 (105)
Sandstone, Dotson, massive, gray	6 - 20 (20 - 65)	51 (170)
Shale, sandy, dark	1.5 - 5 (5 - 15)	56 (185)
Sandstone, Lower Dotson, massive, gray	3 - 8 (10 - 25)	64 (210)
Shale, Douglas, dark, sandy, laminated	1.5 - 5 (5 - 15)	69 (225)
Shale, gray and sandy	0 -3 (0 - 10)	72 (235)
New River Formation - 287 m (940 ft)		
Sandstone, Upper Nuttall, massive to heavy and current-bedded, grayish-white to brown	15 - 21 (50 - 70)	91 (300)
Shale, dark, sandy	0 - 6 (0 - 20)	98 (320)
Coal, laeger "B", multiple-bedded, soft	0 - 0.3 (0 - 1)	98 (320)
Sandstone, Lower Nuttall, massive medium-grained, gray to brown	15 -30 (50 - 100)	128 (420)

Coal, laeger "A", slaty	0 - 0.3 (0 - 1)	128 (420)
Shale, Upper laeger, dark	12 - 15 (40 - 50)	140 (460)
Coal, Hughes Ferry, single-bedded	0.3 - 0.6 (1 - 2)	140 (462)
Shale, sandy	0 - 1.5 (0 - 5)	142 (467)
Sandstone, Middle laeger, grayish-white, medium-grained	3 - 14 (10 - 45)	156 (512)
Shale, sandy	3 - 12 (10 - 40)	159 (522)
Coal, Lower laeger, double-bedded	0 - 0.6 (0 - 2)	160 (524)
Fire clay shale	0 - 0.3 (0 - 1)	160 (525)
Sandstone, Lower laeger, gray and brown	1.5 - 5 (5 - 15)	165 (540)
Shale, Lower laeger, dark-gray	5 - 11 (15 - 35)	176 (575)
Sandstone, Harvey Conglomerate, medium-grained to coarse, grayish-white to brown, lenticular	6 - 18 (20 - 60)	181 (595)
Shale, Sandy Huff, dark-gray	0 - 8 (0 - 25)	189 (620)
Coal, Castle, single bedded, soft, columnar	0 - 0.6 (0 - 2)	189 (620)
Sandstone, Guyandot, massive, grayish-white, coarse-grained	9 - 15 (30 - 50)	204 (670)
Shale, Skelt, sandy and dark	0 - 1.5 (0 - 5)	205 (675)
Coal, Sewell "B", slaty, impure	0 - 1 (0 - 3)	206 (678)
Shale, sandy	6 - 9 (20 - 30)	216 (708)
Coal, Sewell "A", double-bedded, soft, columnar	0 - 0.6 (0 - 2)	216 (710)
Sandstone, Lower Guyandot, massive coarse-grained, grayish-white	3 - 9 (10 - 30)	225 (740)
Shale, Hartridge, dark, with plant fossils carrying fresh or brackish-water fossil shells	0-1.5 (0 - 5)	227 (745)
Coal Sewell, generally double-bedded, soft, columnar	0.6-2 (2 - 7)	229 (752)
Shale, gray, sandy, lenticular	1.5-12 (5 - 40)	231 (757)
Sandstone, Welch, massive to current-bedded, grayish-white	6-14 (20 - 45)	244 (802)
Shale, dark, agrillaceous, lenticular	0-1 (0 - 3)	245 (805)
Coal, Welch, multiple-bedded, soft, columnar	0-0.6 (0 - 2)	246 (807)
Shale, gray, sandy	0-1.5 (0 - 5)	247 (812)
Sandstone, Upper Raleigh, heavy to current bedded, grayish-white to brown	15-23 (50 - 75)	262 (862)
Coal, Little Raleigh "A", impure	0-0.3 (0 - 1)	263 (863)
Shale, sandy, lenticular	0-8 (0 - 25)	270 (888)
Coal, Little Raleigh, multiple-bedded, soft, columnar	0.6-1 (2 - 4)	271 (890)
Shale, sandy, lenticular	1.5-5 (5 - 15)	272 (895)
Sandstone, Lower Raleigh, massive to current-bedded, lenticular	15-30 (50 - 100)	303 (995)
Coal, Beckley "Rider"	0-0.6 (0 - 2)	304 (997)

Shale, dark-gray, argillaceous, lenticular	0-6 (0 - 20)	310 (1017)
Coal, Beckley, multiple-bedded, soft, columnar	0-1 (0 - 3)	311 (1020)
Sandstone, Quinnimont, lenticular	0-21 (0 - 70)	332 (1090)
Shale, Quinnimont, dark-gray, siliceous to argilaceous, laminated, lenticular	1.5-12 (5 - 40)	334 (1095)
Coal, Fire Creek, "Quinnimont", multiple-bedded, soft, columnar	0-2 (0 - 7)	336 (1102)
Shale, sandy, with sandstone layers	3-8.5 (10 - 28)	344 (1130)
Coal, Little Fire Creek, multiple-bedded, soft, columnar	0-0.6 (0 - 2)	345 (1132)
Sandstone, Pineville, massive to current-bedded	9-15 (30 - 50)	360 (1182)
Shale, sandy	0-6 (0 - 20)	360 (1182)
Coal, No. 9 Pocahontas, multiple bedded, soft, columnar	0-0.6 (0 - 2)	360 (1182)
Shale and sandstone mixed	1-5 (4 - 15)	362 (1186)
Coal, No. 8 Pocahontas, impure soft, columnar	0-1 (0 - 4)	363 (1190)

The elevation of the Cherry River watershed varies from 570 to 1375 meters (1875 to 4510 feet) above sea level, with the east area at 790 to 1210 meters (2600 to 3925 feet) and the west area at 570 to 1000 meters (1875 to 3135 feet) (Figure 1.5). Frigid soils are present in the higher elevations of the watershed. Frigid soils are soils that have a mean annual soil temperature of less that 8ºC (Brady and Weil, 2002). However, due to the different dates of soil mapping and the accepted protocol at the time of mapping among the counties, not all of the high elevation soils were mapped as frigid soils. Only the Greenbrier and Webster County Soil Surveys included frigid soils. The east project area was split between Nicholas (Soil Survey Staff, 1992), Webster (Soil Survey Staff, 1998), and Greenbrier County (Soil Survey Staff, 2002) soil surveys, while the west project area was located completely within the Nicholas County Soil Survey.

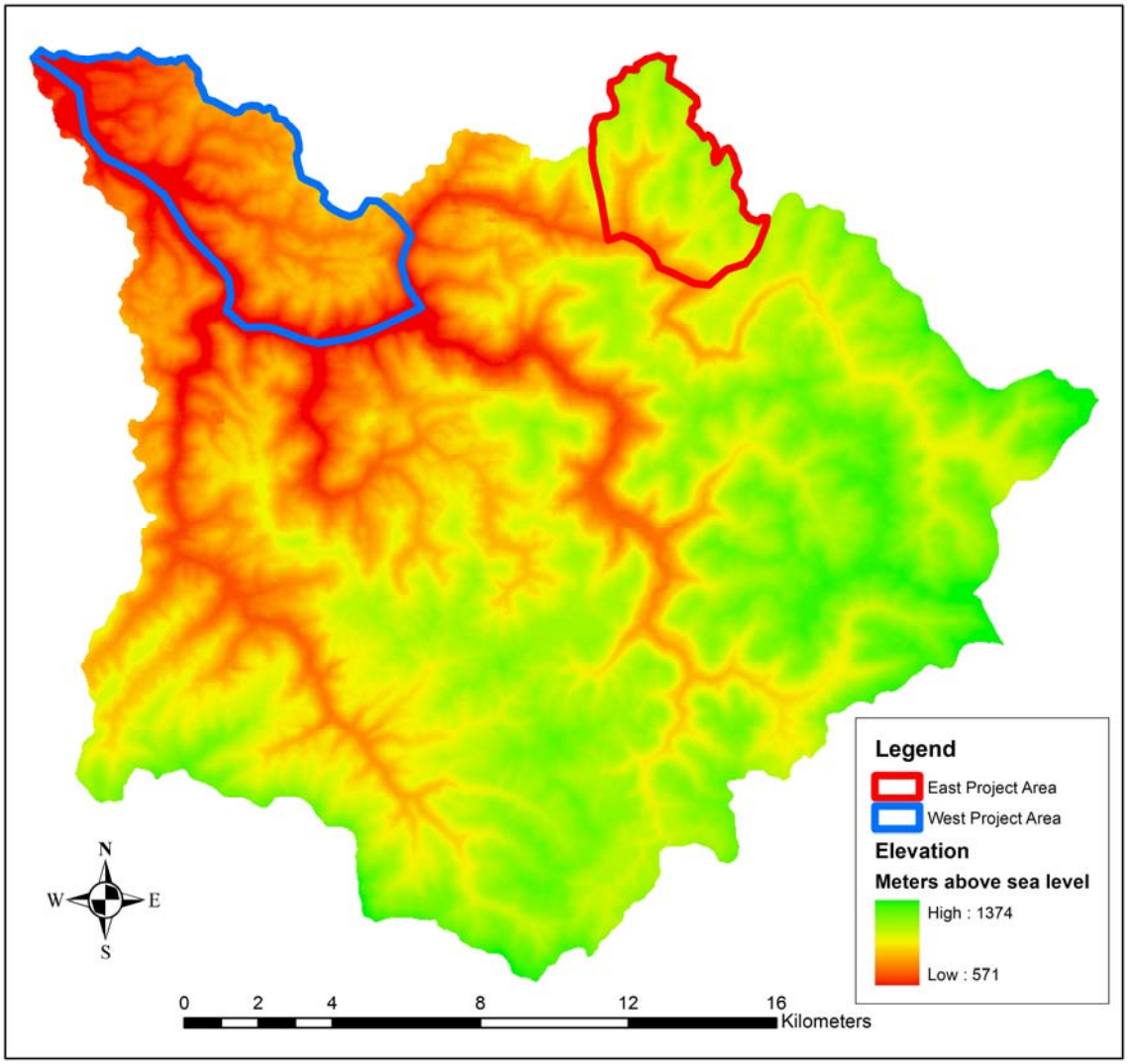


Figure 1.5. Elevation map for the Cherry River watershed.

In a study by Mount and Paetzold (2002), soil temperatures were determined for both project areas; the east area soils were determined to be frigid while the west area soils were found to be mesic. The major soils mapped in the east project area were Mandy (loamy-skeletal, mixed, active, frigid Typic Dystrudepts) and Snowdog (fine-loamy, siliceous, active, frigid Typic Fragiudepts); the west project area was mapped predominately as Buchanan (fine-loamy, mixed, semiactive, mesic Aquic Fragiudults) and Gilpin (fine-loamy, mixed, active, mesic Typic Hapludults) (Table 1.2).

Table 1.2. Soil mapping units for the project areas of the Cherry River watershed.

Project Area	Dominant Soil Mapping Units	Generic Mapping Unit
West	Buchanan Loam, 3 to 8 Percent Slopes	Buchanan
West	Buchanan Channery Fine Sandy Loam, 15 to 35 Percent Slopes, Very Stony	Buchanan
West	Buchanan Channery Fine Sandy Loam, 8 to 15 Percent Slopes, Very Stony	Buchanan
West	Gilpin Channery Silt Loam, 15 to 25 Percent Slopes	Gilpin
West	Gilpin Silt Loam, 15 to 25 Percent Slopes	Gilpin
West	Gilpin Silt Loam, 15 to 35 Percent Slopes, Stony	Gilpin
West	Gilpin Silt Loam, 25 to 35 Percent Slopes	Gilpin
West	Gilpin Silt Loam, 3 to 15 Percent Slopes, Stony	Gilpin
West	Gilpin Silt Loam, 3 to 8 Percent Slopes	Gilpin
West	Gilpin Silt Loam, 35 to 70 Percent Slopes, Stony	Gilpin
West	Gilpin Silt Loam, 8 to 15 Percent Slopes	Gilpin
West	Gilpin-Buchanan Complex, 35 to 70 Percent Slopes, Very Stony	Gilpin-Buchanan
East	Mandy Channery Silt Loam, 15 to 35 Percent Slopes, Extremely Stony	Mandy
East	Mandy Channery Silt Loam, 15 to 35 Percent Slopes, Very Stony	Mandy
East	Mandy Channery Silt Loam, 3 to 15 Percent Slopes, Extremely Stony	Mandy
East	Mandy Channery Silt Loam, 3 to 15 Percent Slopes, Very Stony	Mandy
East	Mandy Channery Silt Loam, 35 to 55 Percent Slopes, Extremely Stony	Mandy
East	Mandy Channery Silt Loam, 35 to 55 Percent Slopes, Very Stony	Mandy
East	Mandy Channery Silt Loam, 55 to 80 Percent Slopes, Very Stony	Mandy
East	Snowdog Channery Loam, 15 to 35 Percent Slopes, Rubbly	Snowdog
East	Snowdog Silt Loam, 15 to 35 Percent Slopes, Extremely Stony	Snowdog
East	Snowdog Silt Loam, 3 to 15 Percent Slopes, Extremely Stony	Snowdog
East	Snowdog Silt Loam, 35 to 55 Percent Slopes, Extremely Stony	Snowdog

The precipitation of the east and west areas of the watershed differs by an average of 13 cm (5 in). An EPA 30-yr average annual precipitation database shows that the east area receives 130 to 145 cm (51 to 57 in) per year with an average of 137 cm (54 in) and the west area receives 117 to 132 cm (46 to 52 in) per year with an average of 125 cm (49 in) (NADP, 2005).

Using a wet sulfate deposition model based on National Oceanic and Atmospheric Administration (NOAA) precipitation data, topographic variables that affect precipitation, and NADP precipitation chemistry data created by Grimm and Lynch (2004), there were differences in sulfate deposition between the two project areas (Figure 1.6); the east area receives 26 to 31 kg ha^{-1} yr^{-1}, and the west area receives 23 to 28 kg ha^{-1} yr^{-1}. As wet sulfate deposition has been estimated to account for half of total sulfate deposition (Driscoll et al, 2001), the east area receives approximately 60 kg ha^{-1} yr^{-1}, and the west area receives approximately 50 kg ha^{-1} yr^{-1}.

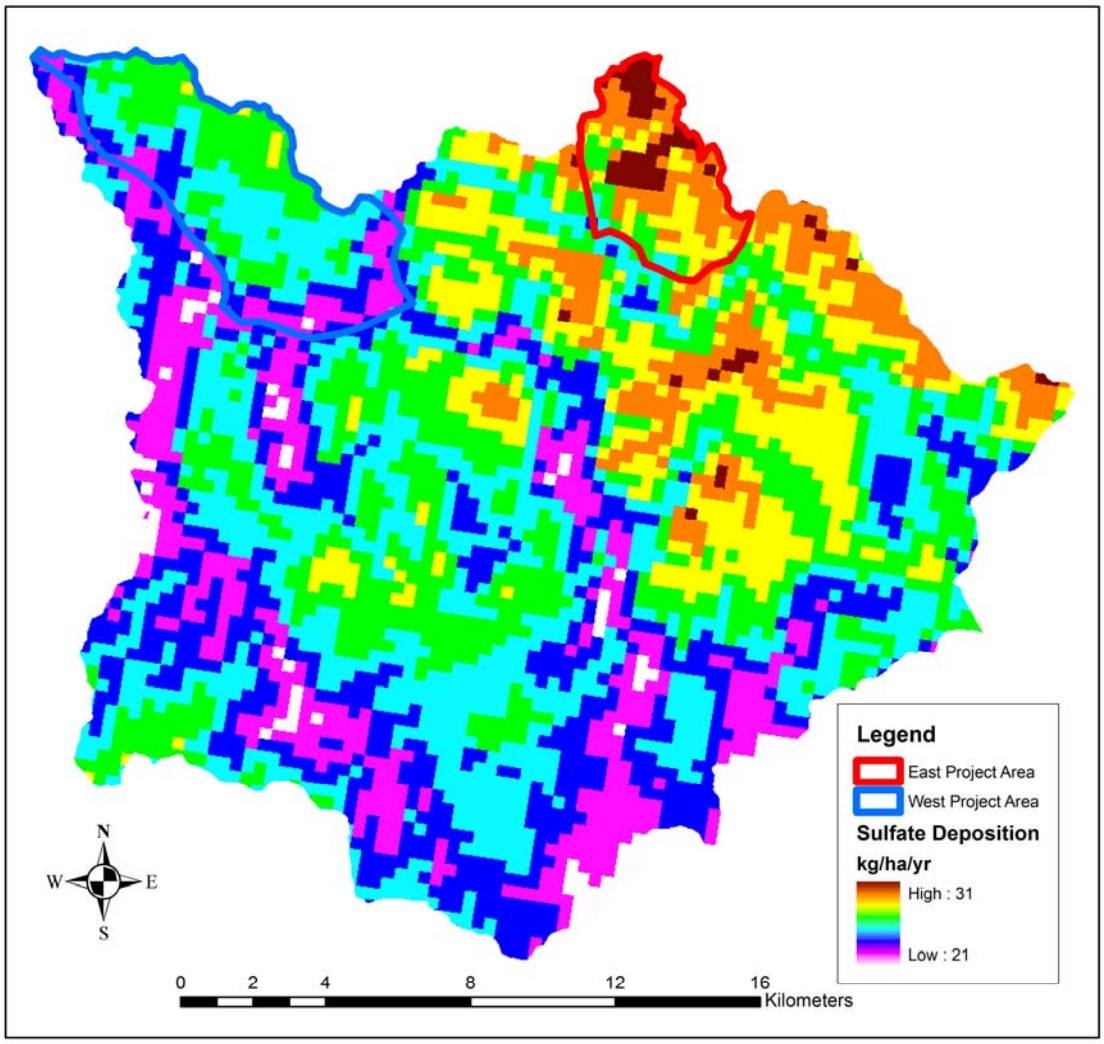


Figure 1.6. Wet sulfate deposition for the Cherry River watershed.

While acidic deposition does not vary much across the watershed, stream water acidity increases east to west in the watershed (Table 1.3, Figure 1.7). A study conducted in the Neversink watershed in the Catskill Mountains of New York showed that the acid neutralizing capacity (ANC) of streams can be related to acidic deposition trends related to elevation (Lawrence et al., 1999). These differences presumably are due to the differences in elevation and soil and geologic differences across the watershed.

Table 1.4 gives a general overview of the east and west area differences discussed in this section.

Table 1.3. Water quality data from several streams in the Cherry River watershed. The streams are listed in order from east to west (see Figure 1.7). The data were generated from water samples taken in spring 2005.

Project Area	Waterbody	pH	ANC*	Na	K	NO_3	SO_4
					$\mu eq\ L^{-1}$		
East	Bear Run	5.23	-0.7	9.1	10.0	46.4	281.1
	Rabbit Run	4.5	-30.0	7.4	7.4	42.8	101.4
	Hunters Run	5.06	-14.2	7.0	6.9	27.1	82.5
	Desert Branch	5.35	-1.1	8.7	7.4	25.7	89.1
	Windy Run	4.5	-34.9	7.0	6.9	29.3	97.6
West	Morris Creek	6.14	12.8	20.0	11.8	27.1	92.2
	Holcomb Run	5.58	-0.1	12.6	10.2	25.7	93.7
	Buckheart Run	5.48	-7.5	23.9	11.8	23.6	87.0
	Coal Siding Run	6.08	24.5	15.2	12.3	30.7	121.0
	Curtain Run	5.47	-9.5	10.9	10.2	18.6	98.3

* ANC = Acid Neutralizing Capacity = (sum of cations) - (sum of anions)

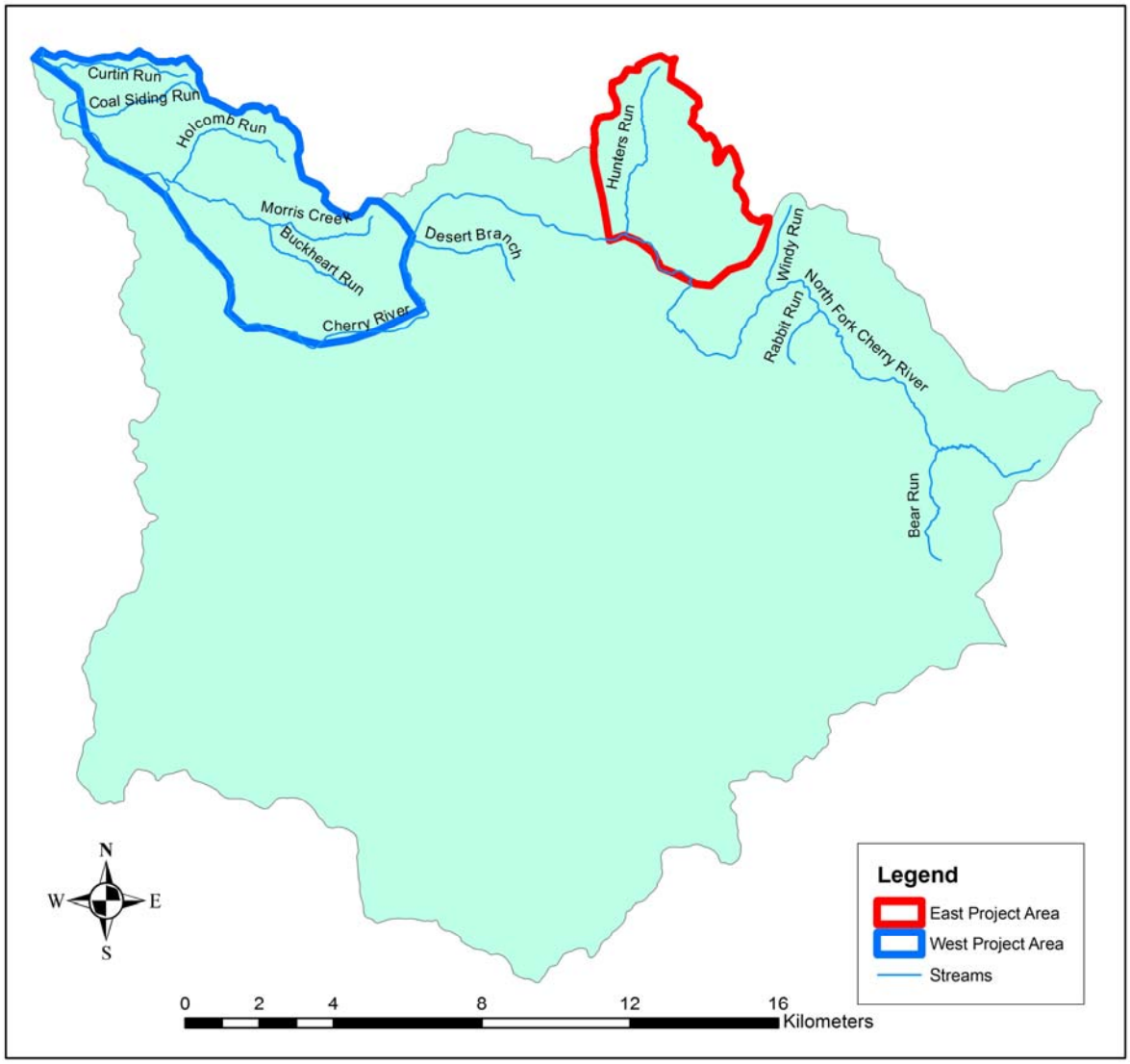


Figure 1.7. Location of streams sampled in the Cherry River watershed.

Table 1.4. A comparison of soils, tree types, geology, and precipitation information between the east and west project areas.

Project Area	East Area	West Area
Dominant Soil Mapping Units	Mandy, Snowdog	Gilpin, Buchanan
Dominant Tree Species	Black cherry, Maple, American beech, Yellow poplar	Oak, Hickory
Bedrock Types	Gray sandstone, black shale	Red sandstone, gray shale
Elevation	790- 1210 m (2600-3925 ft)	570-1000 m (1875-3135 ft)
Geology Group	Pottsville	Pottsville
Geology Formation	Kanawha	New River
Forest Type	Eastern deciduous hardwood	Eastern deciduous hardwood
Precipitation	130-145 cm (51-57 in); Avg. 137 cm (54 in)	117-132 cm (46-52 in); Avg. 125 cm (49 in)
Modeled wet sulfate	26-31 kg ha^{-1} yr^{-1}	23-28 kg ha^{-1} yr^{-1}

Field and Laboratory Methods

Two types of soil pits were dug in the summer of 2004 in the east and west project areas of the Cherry River watershed: full characterization pits and satellite pits. Sixteen full characterization pits were excavated to 150 cm (60 in) or bedrock and a complete soil description was recorded (description guidelines provided in Appendix A, descriptions provided in Appendix B). Fifty-one satellite pits were excavated through the top three horizons of the soil (A, BA or AB or A2, and B), which extended to a depth of 30.5 to 50 cm (12 to 20 in), and brief descriptions, including soil color, texture, and structure, were noted (descriptions provided in Appendix C).

There were five criteria used for selecting sites. First, the site had to be on U.S. Forest Service property. Second, the site needed to be relatively accessible by a Forest Service road. Third, the site needed to be representative of the landscape position on which it was found. Fourth, the site could not to be located below a road culvert or other type of cross drain. And finally, the site needed to show no signs of recent disturbance.

Six landscape positions were identified for use in this project: ridge top, shoulder, back slope, bench, foot slope, and floodplain (Figure 1.8). Full characterization pits were excavated in each of these landscape positions in both project areas. In the east project area, nine full characterization pits were located: one on the ridge top, two on shoulders, two on back slopes, one on a bench, two on foot slopes, and one in a floodplain. The west project area had seven sites: two ridge top, one shoulder, one back slope, one bench, one foot slope, and one floodplain. Satellite pits also were located on each of these landscape positions in both project areas: 27 in the east project area and 23 in the west project area. (Table 1.5).

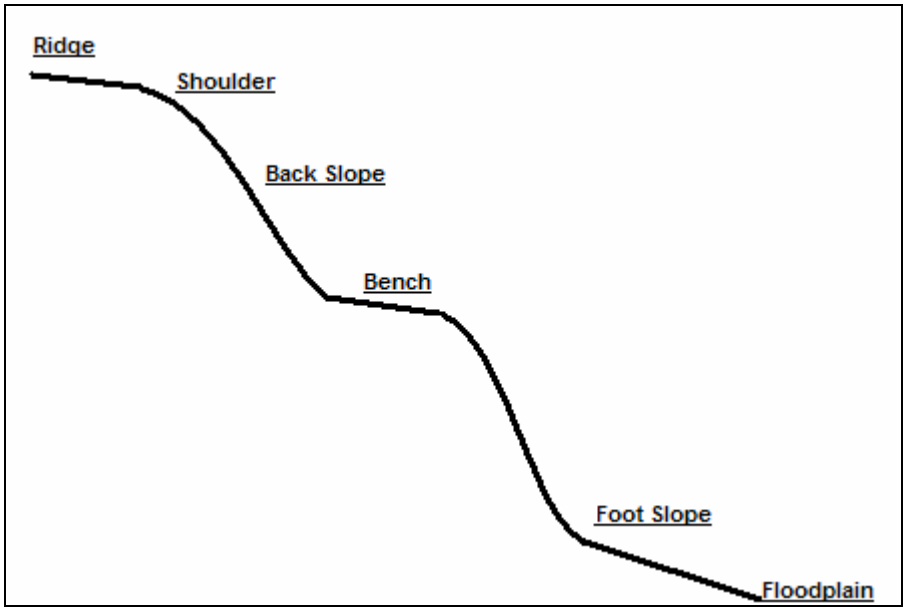


Figure 1.8. Landscape positions on which soils were sampled.

After field evaluation the parent material of all soil pits was identified as residuum, colluvium, or alluvium. Residuum is the parent material of a soil that has formed in place. Colluvium is the parent material of a soil that has moved down slope due to gravity. Alluvium is the parent material of a soil that has formed from deposits from moving water. Ridge top pits, some of the back slope pits, and some of the bench pits were residuum. The remaining back slope and bench pits were colluvium along with the foot slope pits. Floodplain pits were classified as alluvium.

Table 1.5. Number of soil pits in each landscape position by project area

Landscape Position	East project area pits		West project area pits	
	Full	Satellite	Full	Satellite
Ridge	2	4	2	6
Shoulder	2	3	1	4
Back Slope	2	7	1	5
Bench	1	6	1	4
Foot Slope	1	4	1	3
Floodplain	1	3	1	2
Total	9	27	7	24

Soil pits were identified using a 5-part code. "FS" was used to specify that all samples were collected from Forest Service lands. A two digit number was used to designate the year of collection (i.e., "04" for 2004). "WV" was used to show the sample was collected in West Virginia. The fourth part of the code was the three digit NRCS County SURGO code (http://www.ncgc.nrcs.usda.gov/products/datasets/ssurgo /index.html), and the fifth part of the code (three digit) was used to identify the sample number within the county. For example, the first pit in Nicholas County was labeled FS04WV067001.

The coordinates for each pit were recorded in Universal Transverse Mercator (UTM) North American Datum of 1983 (NAD83) Zone North 17 using a Magellan

SporTrak GPS unit (Forestry Suppliers Inc., Jackson, MS). GPS readings were taken within 1.5 m (5 ft) of each soil pit (Figure 1.9). Two sites appear to be outside of the watershed. The site near the east area was on the ridgeline forming the border of the watershed and therefore in the project area. The site near the west area was located in the Cranberry River watershed. However, due to the similarity of the location to the west project area, the data was used.

In summer 2004, soils from the pits were sampled by horizon starting with the bottom of the soil profile. A soil knife was used to chip or excavate the soil into a dust pan. The sample was taken from multiple areas across the soil pit face until an estimated mass >2 kg was obtained. This large sample then was divided into four subsamples, three of which were sent for analysis to West Virginia University, The Pennsylvania State University Agricultural Analytical Services Laboratory, and the University of Maine Analytical Laboratory. The fourth subsample was retained as an archive sample.

In summer 2005, bulk density samples of surface horizons were collected by the frame excavation method at all 16 full characterization pits (Grossman et al. 2001). Bulk density by the clod method (Soil Survey Staff, 1996) was measured on subsurface horizons with three clods taken per horizon.

At The Pennsylvania State University Agricultural Analytical Services Laboratory, aluminum and calcium were determined by 0.1 M $SrCl_2$ extraction (Joslin and Wolfe, 1989). The Ca:Al molar ratio used to assess risk for forest productivity decline was calculated from this extraction. The University of Maine Analytical Laboratory determined soil pH measured in distilled water, organic matter by loss on ignition (LOI), percent total carbon (TC) and percent total nitrogen (TN) by dry

combustion. Maine also determined extractable calcium, potassium, magnesium, aluminum, iron, manganese, and sodium by ammonium acetate extraction, exchangeable acidity by potassium chloride extraction, and effective cation exchange capacity (ECEC) by summation of calcium, potassium, magnesium, sodium by ammonium acetate, and exchangeable acidity by potassium chloride in meq $100g^{-1}$. At West Virginia University, soil texture by pipette method (method 3A1a), bulk density by the frame excavation method (method 3B5), and bulk density by the saran-coated clod method (method 3B1) were determined (Soil Survey Staff, 1996).

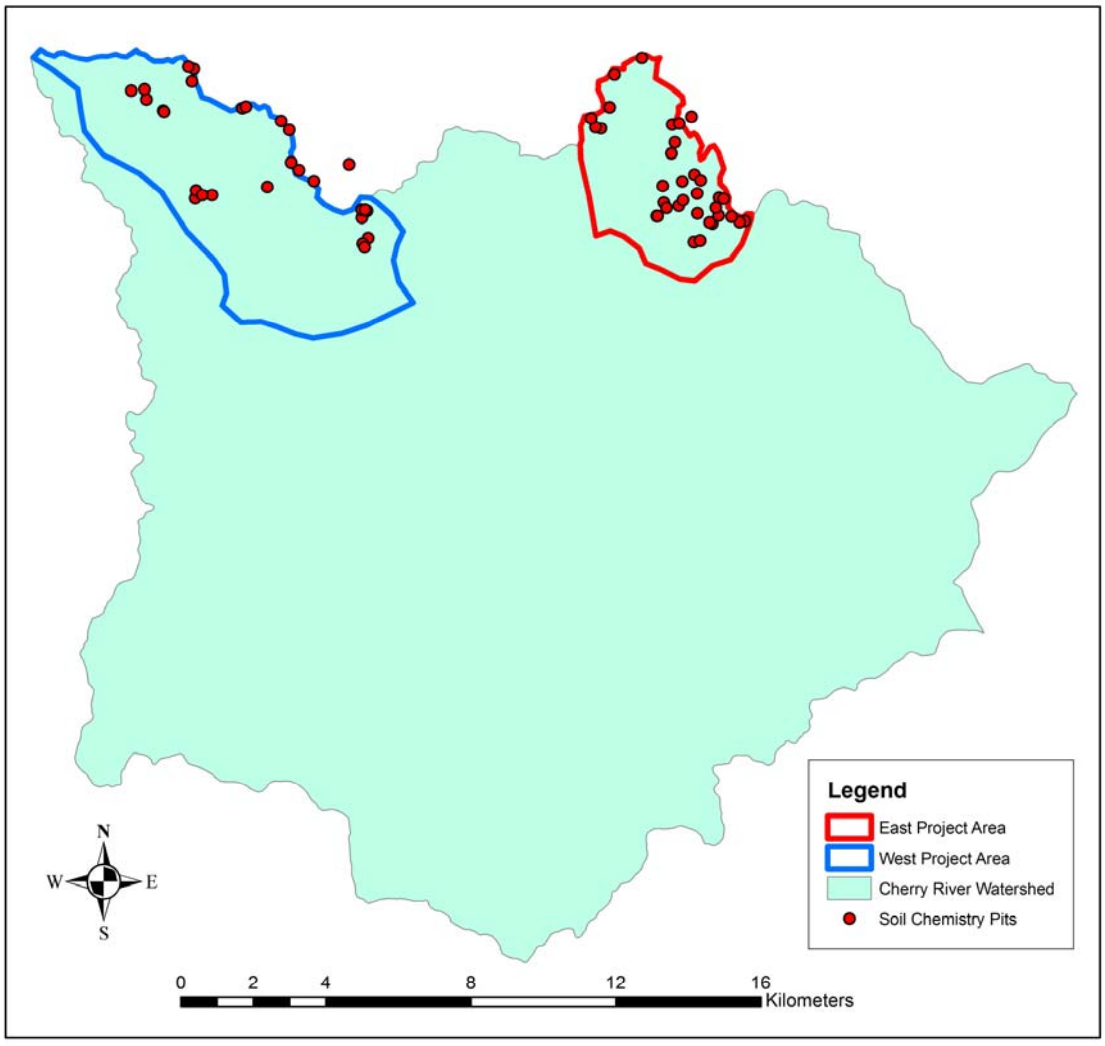


Figure 1.9. Soil pit locations on the Cherry River watershed in West Virginia.

Base saturation of the effective cation exchange capacity (BSECEC) was calculated by summation of base cations (ammonium acetate) divided by the ECEC. Base saturation values were used in conjunction with the Ca:Al molar ratios to assess risk to forest productivity. Risk was determined using the criteria set by Cronan and Grigal (1995): a 50% risk exists for aluminum toxicity if the Ca:Al molar ratio is ≤1.0; a 75% risk exists if the Ca:Al molar ratio is ≤0.5; a 95% risk exists when the Ca:Al molar ratio is ≤0.2. If the BSECEC is ≤15% when the Ca:Al molar ratio is ≤0.2, there is a 100% risk of aluminum toxicity.

For classification of the soils, the BSECEC was assumed to represent the base saturation of the cation exchange capacity (CEC). In standard soil survey classification, two methods are used to determine CEC: the first being, ammonium acetate extraction at pH 7, and the second, summation of base cations extracted by ammonium acetate and acidity extracted by barium chloride-triethanolamine (Soil Survey Staff, 2003). The base cation extraction used by Soil Survey is the same as in this study. Both Soil Survey standard methods overestimate the CEC of acid soils (Skinner et al., 2001; Thomas, 1982). The ECEC used in this study provided an estimate of CEC at field pH that is lower than the standard methods. Therefore, the BSECEC as determined in the present study should give a higher percent base saturation than using the CEC methods (Skinner et al., 2001; Thomas, 1982). All BSECEC found for these soils were less than 35% or 60%, and therefore the methods used in the present study are predicted to give similar results as standard methods for the classification of the soils.

Analysis of variance (ANOVA) was used to make several comparisons. The SAS GLM procedure was used to compare the east and west values of the A, transition, and

uppermost B horizons. The sample size of the lower horizons was too small to analyze statistically. No comparisons were made between C horizons of the project areas because there were no C horizons sampled in the east area. The SAS GLM procedure also was used to compare the A horizon to the upper B horizon. The data were not analyzed statistically among landscape positions due to the small sample sizes when the positions were split between project areas; however, trends were identified visually. Regression slopes of related parameters were tested against pH to determine if they were significantly different from zero.

Chapter 2.
Physical Soil Properties

Results and Discussion

Physical Properties

The physical properties analyzed for this study were texture and bulk density. Bulk densities were determined for only the full characterization pits.

East versus West

The mean soil physical properties are shown by horizon in Table 2.1 for the east and west project area comparison. Both sand and clay percentages were significantly different between project areas for all of the soil horizons, except the BC horizons. The silt percentages were significantly different between areas only in the B horizons. In the BC horizons, the mean percentages for sand, silt, and clay were not statistically different between project areas.

Clay content was higher in east area soils, while sand was higher in west area soils. Therefore, it is assumed that the soils of the east area were formed from parent material such as shale or mudstone, and the west area soils were formed from coarser parent material like sandstone.

Mean clod bulk densities for the project areas were statistically different (Table 2.1). The east area soils were less dense in the subsurface horizons than those of the west areas. Soils in the east also had higher organic matter content throughout the horizons (Chapter 3), contributing to the lower bulk densities. Frigid soils in Virginia were found to have lower bulk densities than mesic soils (Miller et al., 2004). However, frame bulk density values were not statistically different between areas.

Table 2.1. Mean texture and bulk density data for the soils by horizon for east and west areas.

Project Area	Horizon	Sand %	Silt %	Clay %	Bulk Density g cm^{-3}	
					Clod	Frame
Range		7 – 84	12 – 72	1 - 44	0.78 – 1.82	0.26 – 1.23
East	A	30*	47	23*	--	0.69
West	A	42*	43	15*	--	0.61
East	Transition	33*	42	26*	1.07*	0.85
West	Transition	42*	40	18*	1.28*	0.77
East	Upper B	27*	45*	28*	1.22*	--
West	Upper B	42*	41*	17*	1.38*	--
East	Lower B	26*	53*	21*	1.45*	--
West	Lower B	41*	42*	17*	1.52*	--
East	BC	38	42	19	1.33*	--
West	BC	38	47	15	1.58*	--
East	C	--	--	--	--	--
West	C	69	22	9	1.72	--

*** shows significant difference between east and west at α=0.05.**

Bulk densities increased with depth in the soil for both project areas. This is a common trend in natural soils (Brady and Weil, 2002; Logsdon and Cambardella, 2000) because the gravitational pressure of the upper horizons compacts the lower soil horizons, thereby increasing the bulk density. Soils studied in Otter Creek, West Virginia, showed the same trend (Schnably, 2003).

Landscape Positions
East Area

The texture and bulk density data of the east landscape positions are shown in Table 2.2. There were no apparent differences between landscape positions for the physical properties of the east area. The floodplain soil was not sampled for bulk density in the east area due to high water in the soil pit that could not be pumped out.

Table 2.2. Texture and bulk density data for east area landscape positions.

Landscape Position	Horizon	Sand %	Silt %	Clay %	Bulk Density g cm^{-3}	
					Clod	Frame
Range		7 - 84	12 – 72	1 – 44	0.78 – 1.82	0.26 – 1.23
Ridge	A	25	55	20	--	0.83
Shoulder	A	21	53	26	--	0.65
Back slope	A	33	44	22	--	0.47
Bench	A	37	43	20	--	0.36
Foot slope	A	31	48	21	--	1.23
Floodplain	A	34	33	33	--	--
Ridge	Transition	30	44	26	1.17	--
Shoulder	Transition	21	54	26	1.18	--
Back slope	Transition	29	42	29	1.01	--
Bench	Transition	46	32	22	0.78	--
Foot slope	Transition	29	47	24	1.09	--
Floodplain	Transition	42	33	24	--	--
Ridge	Upper B	22	48	30	1.38	--
Shoulder	Upper B	21	48	31	1.27	--
Back slope	Upper B	27	44	29	1.13	--
Bench	Upper B	34	41	25	1.03	--
Foot slope	Upper B	24	49	27	1.21	--
Floodplain	Upper B	36	36	28	--	--
Ridge	Lower Horizons	12	66	21	1.39	--
Shoulder	Lower Horizons	26	55	19	1.41	--
Back slope	Lower Horizons	45	36	19	1.19	--
Bench	Lower Horizons	24	48	28	1.59	--
Foot slope	Lower Horizons	38	46	16	1.58	--
Floodplain	Lower Horizons	44	41	15	--	--

West Area

The data for the physical properties for the west area landscape positions are shown in Table 2.3. The floodplain soils appeared to have less silt in the upper three horizons than the other landscape positions. There were no apparent trends in other physical properties.

Table 2.3. Texture and bulk density data for west area landscape positions.

Landscape Position	Horizon	Sand %	Silt %	Clay %	Bulk Density g cm^{-3}	
					Clod	Frame
Range		7 - 84	12 – 72	1 – 44	0.78 – 1.82	0.26 – 1.23
Ridge	A	39	47	14	--	0.68
Shoulder	A	55	31	14	--	0.56
Back slope	A	39	44	17	--	0.49
Bench	A	33	50	17	--	0.56
Foot slope	A	36	44	20	--	0.58
Floodplain	A	56	34	9	--	0.70
Ridge	Transition	43	39	18	1.19	--
Shoulder	Transition	54	33	13	1.21	--
Back slope	Transition	37	44	19	1.52	--
Bench	Transition	34	45	21	1.30	--
Foot slope	Transition	32	47	22	1.00	--
Floodplain	Transition	63	25	12	1.28	--
Ridge	Upper B	41	41	18	1.45	--
Shoulder	Upper B	51	35	14	1.25	--
Back slope	Upper B	38	44	19	1.55	--
Bench	Upper B	28	52	20	1.44	--
Foot slope	Upper B	36	44	20	1.27	--
Floodplain	Upper B	61	29	10	1.22	--
Ridge	Lower Horizons	51	37	12	1.65	--
Shoulder	Lower Horizons	35	51	13	1.53	--
Back slope	Lower Horizons	62	26	12	1.56	--
Bench	Lower Horizons	32	52	15	1.65	--
Foot slope	Lower Horizons	25	54	21	1.44	--
Floodplain	Lower Horizons	60	26	14	1.43	--

Conclusions

The physical properties of the soils showed few differences between project areas and no apparent trends among landscape positions. The west area had coarser textured soils than the east area. The bulk density of the east area subsoils was less than that of the west area, which was attributed to organic matter incorporation (Chapter 3).

Chapter 3.
General Soil Chemistry

Results and Discussion

East area versus West area

General soil chemistry variables are divided into sets for examination: these include soil acidity, base cations, acid cations, and carbon and nitrogen. Each set of variables was compared between watershed areas in the A, transition (AB, BA, BE, or AE), and upper B horizons. Due to the small number of samples in the lower horizons, they were not analyzed statistically.

Soil Acidity

The parameters included in the soil acidity set are pH, acidity, effective cation exchange capacity (ECEC), and base saturation of the effective cation exchange capacity (BSECEC). Mean acidity and ECEC were significantly higher in the east than in the west for the A, transition, and upper B horizons (Table 3.1), and mean pH was significantly lower in the east for the same horizons. The BSECEC of the transition and upper B horizons was significantly higher in the west than in the east. The BSECEC also was higher in the west in the lower B and BC horizons. These differences are explainable by geology with higher base status in the west area.

Soil pH increased with depth, and acidity and ECEC decreased with depth. BSECEC showed no consistent trend (Table 3.1). For all of the variables, the A horizon and upper B horizon were significantly different between areas.

Table 3.1. Acidity by horizon compared between watershed areas.

Area	Horizon	Soil pH	Acidity	ECEC	BSECEC
			meq $100g^{-1}$	Meq $100g^{-1}$	%
	Range	3.1-5.1	0.4-16.4	1.1-27.3	2.1-75.0
East	A	3.7+ **	9.4+**	10.7+**	12.9+
West	A	4.0+**	6.2+**	7.2+**	15.1+
East	Transition	4.1**	8.5**	9.0**	5.9*
West	Transition	4.3**	4.3**	4.7**	7.9*
East	Upper B	4.3+*	6.9+**	7.3+**	6.0+*
West	Upper B	4.5+*	3.7+**	4.0+**	7.0+*
East	Lower B	4.6	4.7	5.0	5.5
West	Lower B	4.5	4.2	4.5	7.2
East	BC	4.6	4.2	4.5	7.3
West	BC	4.5	3.3	3.6	9.9
East	C	--	--	--	--
West	C	4.7	1.6	2.1	28.6

*** shows significant difference between project areas at α=0.05.**
**** shows significant difference between project areas at α=0.0001.**
+ shows significant difference between A and Upper B horizon at α=0.05.

The effective cation exchange capacity (ECEC) was partially explained by soil pH (Figure 3.1). As pH increased, ECEC decreased. However, the normal trend for soils is an increase in ECEC as pH increases (Brady and Weil, 2002). The low range of pH values maintained an aluminum-controlled ECEC rather than base-cation controlled ECEC which occurs at a pH of ≥5.5 (Brady and Weil, 2002). With these soils, higher ECEC values were found in the east area where soil pH values are lower. C.E. Johnson (2002) also found this negative relationship in soils in the northeastern United States. The trend was explained by pH and organic matter relationships. It was seen that the carboxyl groups in humus provided H^+ increasing the ECEC and buffering capacity retaining the higher pH (Johnson, 2002).

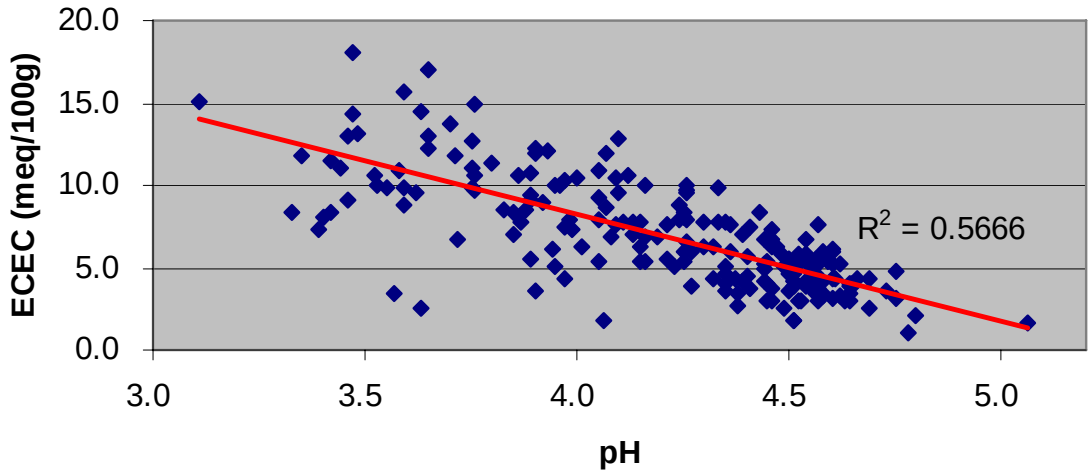


Figure 3.1. The relationship between soil pH and effective cation exchange capacity (ECEC) for both project areas in the Cherry River watershed. The slope of the regression line is significantly different than zero.

Soil pH in the Cherry River watershed increased with depth (Figure 3.2). This pattern is explained by the incorporation of organic matter and deposition of acids to the surface. Organic matter inputs provide nutrients as well as organic acids to the soil (Brady and Weil, 2002; Johnson, 2002). The lower soil horizons apparently have retained nutrients as a result of the weathering process and accumulation from leaching from higher horizons. Typically, the pH of most soils in the northeast decrease with depth due to the low base status parent material of the region (Drohan and Sharpe, 1997). The increase with depth suggests that the majority of acidic inputs to the soils came from acidic deposition and biochemical processes occurring near the soil surface.

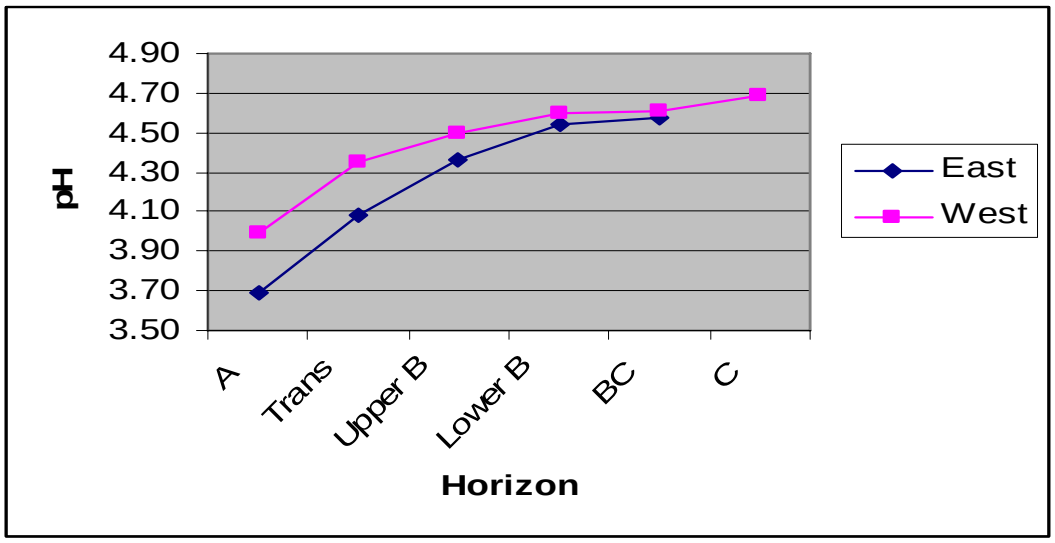


Figure 3.2. Soil pH with depth for both project areas.

Base Cations

Base cations are the weak acid cations found on soil exchange sites. These cations are calcium, magnesium, potassium, and sodium. Calcium was the dominant base cation in these soils, and potassium was the second most abundant (Table 3.2).

The east area had higher concentrations than the west of each cation in the upper three horizons, but the only significant difference in the A horizon was magnesium concentration. Calcium, magnesium, and potassium were all significantly different between areas in the transition horizon. Magnesium, potassium, and sodium were significantly different between areas in the upper B horizon. In the lower B and BC horizons, the west area had higher values of calcium, magnesium, and sodium. This pattern could be attributed to the higher base status parent material found in the west area. Also, the composition of tree species from east to west in the watershed may have affected the base cation concentrations (Prescott, 2002). Maple species, especially sugar maple, which are more prevalent in the east area, have higher amounts of the base cations

in leaf litter than oak species (Washburn and Arthur, 2003), which are more common in the west area (see Table 1.4).

Table 3.2. Mean base cation concentrations by horizon compared between watershed areas.

Area	Horizon	Ca	Mg	K	Na
		mg kg^{-1}			
	Range	8.0 – 905.3	2.0 – 120.7	12.4 – 206.4	2.0 – 35.2
East	A	160.4+	36.7+*	79.8+	12.4+
West	A	136.7+	26.5+*	77.9+	11.6+
East	Transition	44.9*	14.5**	45.4*	8.2
West	Transition	41.3*	8.2**	40.2*	7.8
East	Upper B	34.9+	10.2+*	36.4+*	8.6+**
West	Upper B	28.3+	6.2+*	30.0+*	6.1+**
East	Lower B	19.6	5.9	36.4	5.7
West	Lower B	25.1	11.0	30.8	5.9
East	BC	24.9	9.0	36.5	5.8
West	BC	37.4	11.5	29.5	4.4
East	C	--	--	--	--
West	C	42.2	22.2	17.77	3.3

*** shows significant difference between project areas at α=0.05.**
**** shows significant difference between project areas at α=0.0001.**
+ shows significant difference between A and Upper B horizon at α=0.05.

All four base cations were significantly different between the A and upper B horizons in both the east and west areas. Calcium and magnesium both decreased initially with depth and then increased in the lowest two horizons. Jenkins (2000) also found that calcium and magnesium decreased with depth in soils formed from the Pottsville geology. Calcium and magnesium sources for these soils were litter fall, parent material weathering, and ambient deposition (Jenkins, 2002; Johnson and Todd, 1990). Potassium and sodium decreased with depth throughout the entire profile.

Acid Cations

The acid cations included aluminum (Al), iron (Fe), and manganese (Mn). Aluminum and iron were significantly higher in the east area than the west area for the

upper three horizons (Table 3.3). This difference also occurred for the lower B and BC horizons. No differences were found for manganese.

The acid cations were significantly higher in the A horizon than the upper B horizon in both areas. Aluminum and iron decreased with depth throughout the soil profile, while manganese generally decreased with depth but without the consistency of aluminum and iron. The aluminum and iron decreases were partially explained by the pH and acidity of the soils (Figure 3.3). As pH decreases below 5.5, aluminum controls the acidity and ECEC of a soil system (Skyllberg, 1999). Between pH 4.0 and 5.5, hydrolysis and dissolution of aluminum and iron hydroxyoxide minerals occurs (Skyllberg, 1999). These processes release iron and aluminum oxides into the soil solution. The low pH range of 3.0-5.0 in these soils promoted these reactions, thus releasing increasingly greater quantities of aluminum and iron. The east area had a lower pH and higher acidity content than the west area that corresponded to higher aluminum and iron contents (Table 3.3). Jenkins (2000) found similar results on soils formed from the same geology in other areas of West Virginia.

Table 3.3. Mean acid cation concentrations by horizon compared between watershed areas.

Area	Horizon	Al	Fe	Mn
		mg kg^{-1}		
	Range	27.3 – 1142.1	0.3 – 142.7	0.3 – 223.2
East	A	650.1+**	50.9+**	44.7+
West	A	538.1+**	23.4+**	77.1+
East	Transition	616.5**	30.1**	13.9
West	Transition	335.3**	4.3**	17.3
East	Upper B	500.5+**	14.7+**	9.5+
West	Upper B	324.7+**	5.2+**	4.9+
East	Lower B	355.6	3.3	7.2
West	Lower B	295.1	4.0	4.6
East	BC	303.10	3.3	11.8
West	BC	248.5	3.3	11.8
East	C	--	--	--
West	C	112.8	3.9	3.7

*** shows significant difference between project areas at α=0.05.**
**** shows significant difference between project areas at α=0.0001.**
+ shows significant difference between A and Upper B horizon at α=0.05.

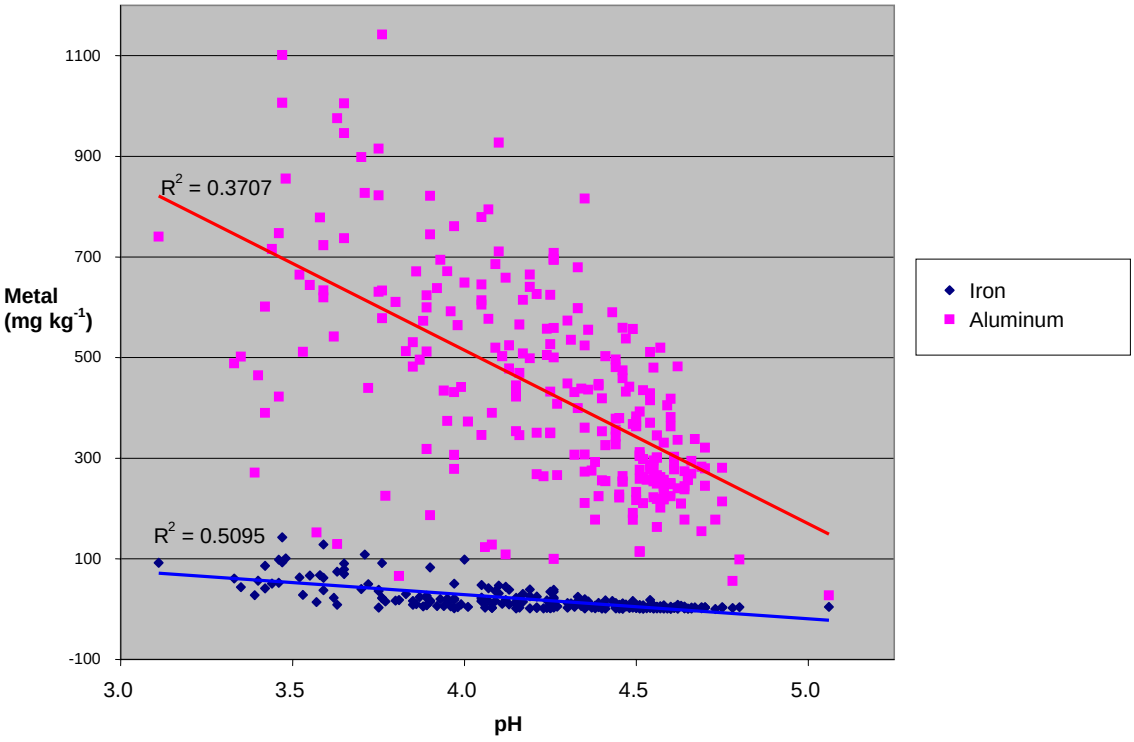


Figure 3.3. Iron and aluminum relationships with soil pH for both east and west areas. The slopes of both regression lines are significantly different than zero.

Carbon and Nitrogen

Table 3.4 shows the mean percentages of carbon and nitrogen by horizon for both project areas. As is common for most soils, the organic matter content was highest at the surface and decreased with depth in the soil profile (Yang et al., 2004). LOI, TC, and TN were all significantly different between the A and upper B horizons in both areas.

The east area had significantly higher amounts of organic matter (LOI), total organic carbon, and total organic nitrogen in the upper three horizons compared to the west area. Higher values also continued in the lower B and BC horizons. The higher organic matter content in the east area could be attributed to lower soil temperatures.

Table 3.4. Mean carbon and nitrogen by horizon for both watershed areas.

Area	Horizon	LOI	TN	TC
			%	
	Range	1.0 – 34.0	0.0 – 0.9	0.1 – 18.5
East	A	15.8+*	0.5+*	7.5+*
West	A	15.6+*	0.4+*	8.1+*
East	Transition	8.6*	0.2*	3.4*
West	Transition	6.6*	0.1*	2.6*
East	Upper B	7.2+**	0.2+**	2.4+**
West	Upper B	4.5+**	0.1+**	1.3+**
East	Lower B	5.3	0.1	1.3
West	Lower B	3.8	0.1	0.6
East	BC	4.2	0.1	0.7
West	BC	2.9	0.0	0.3
East	C	--	--	--
West	C	1.5	0.0	0.3

*** shows significant difference between project areas at α=0.05.**
**** shows significant difference between project areas at α=0.0001.**
+ shows significant difference between A and Upper B horizon at α=0.05.

The frigid soil temperatures in the east area should have slowed biological processes including organic matter decomposition (Brady and Weil, 2002; Miller et al., 2004). As a result, organic matter accumulated in the east. In the Appalachian Mountains in Virginia,

similar results were found with frigid soils having higher organic matter accumulation and incorporation (Miller et al., 2004).

Landscape Position
East Area
Chemical Properties

The east area soil acidity parameters showed only one possible difference for the landscape positions (Table 3.5). The lower horizons of the floodplain soils appeared to have a higher BSECEC than the other landscape positions. This possibly was due to buried surface horizons in the floodplain soils. Surface horizons typically have higher organic matter content providing base cations.

Table 3.5. Mean soil acidity parameters for the east area landscape positions.

Landscape Position	Horizon	Soil pH	Acidity meq $100g^{-1}$	ECEC meq $100g^{-1}$	BSECEC %
Range		3.1-5.1	0.4-16.4	1.1-27.3	2.1-75.0
Ridge	A	3.6	8.7	10.3	16.7
Shoulder	A	3.8	9.6	10.9	11.6
Back slope	A	3.7	9.0	10.9	16.3
Bench	A	3.8	8.4	9.3	10.9
Foot slope	A	3.7	8.7	9.8	11.6
Floodplain	A	3.7	11.2	12.7	11.8
Ridge	Transition	3.9	9.3	9.9	6.8
Shoulder	Transition	4.2	8.0	8.5	5.9
Back slope	Transition	4.1	8.7	9.2	5.3
Bench	Transition	4.1	7.9	8.3	5.8
Foot slope	Transition	3.9	8.9	9.4	4.7
Floodplain	Transition	4.1	8.5	9.1	7.6
Ridge	Upper B	4.4	7.2	7.7	6.9
Shoulder	Upper B	4.3	7.7	8.1	4.7
Back slope	Upper B	4.4	6.3	6.6	5.1
Bench	Upper B	4.4	5.9	6.3	6.2
Foot slope	Upper B	4.2	7.1	7.5	4.5
Floodplain	Upper B	4.2	8.3	8.7	6.3
Ridge	Lower Horizons	4.5	5.5	5.7	4.0
Shoulder	Lower Horizons	4.6	5.2	5.6	6.6
Back slope	Lower Horizons	4.6	4.3	4.6	5.6
Bench	Lower Horizons	4.5	5.8	6.2	5.2
Foot slope	Lower Horizons	4.6	3.4	3.6	6.6
Floodplain	Lower Horizons	4.7	2.8	3.6	22.1

The floodplain soils in the east area also appeared to have higher concentrations of calcium and magnesium in the lower horizons of the soil (Table 3.6). This was possibly also due to buried horizons in the floodplain soils.

Table 3.6. Mean base cation concentrations for the east area landscape positions.

Landscape Position	Horizon	Ca	Mg	K	Na
		mg kg^{-1}			
	Range	7.8 – 905.3	2.0 – 120.7	12.4 – 206.4	2.0 – 35.2
Ridge	A	204.1	35.2	88.2	11.5
Shoulder	A	133.3	42.3	90.5	12.2
Back slope	A	248.5	50.2	84.6	13.7
Bench	A	101.2	26.3	69.2	9.3
Foot slope	A	121.0	30.5	74.4	11.3
Floodplain	A	178.6	42.1	79.4	15.8
Ridge	Transition	72.9	14.8	48.4	9.3
Shoulder	Transition	40.9	15.2	54.9	7.1
Back slope	Transition	40.1	14.5	45.3	7.7
Bench	Transition	36.4	11.1	40.5	7.9
Foot slope	Transition	37.0	12.0	46.4	8.5
Floodplain	Transition	49.9	21.1	45.6	7.2
Ridge	Upper B	55.4	9.4	40.8	11.6
Shoulder	Upper B	26.2	10.0	40.0	6.8
Back slope	Upper B	26.3	8.3	35.7	8.6
Bench	Upper B	36.3	7.9	33.6	9.1
Foot slope	Upper B	25.8	7.6	37.1	8.1
Floodplain	Upper B	37.0	14.5	40.0	7.7
Ridge	Lower Horizons	13.7	3.8	39.2	6.3
Shoulder	Lower Horizons	29.9	11.5	41.6	3.8
Back slope	Lower Horizons	20.9	4.8	27.8	8.4
Bench	Lower Horizons	20.3	7.2	54.3	6.0
Foot slope	Lower Horizons	18.7	4.2	33.3	5.2
Floodplain	Lower Horizons	76.3	36.1	39.4	3.8

Floodplain soils appeared to have higher concentrations of manganese in the lower horizons than the other landscape positions (Table 3.7). As the floodplain soils were saturated for a large portion of the year, the oxidation-reduction nature of

manganese caused a higher concentration of this metal in the soil because manganese is more available to the soil solution in its reduced state (Brady and Weil, 2002; Singer and Havill, 1985).

Table 3.7. Mean acid cation concentrations for the east area landscape positions.

Landscape Position	Horizon	Al	Fe	Mn
		mg kg^{-1}		
Range		27.3 – 1142.1	0.3 – 142.7	0.3 – 223.2
Ridge	A	573.9	41.6	54.5
Shoulder	A	693.8	48.7	45.4
Back slope	A	623.5	47.0	51.9
Bench	A	577.8	30.7	40.8
Foot slope	A	593.4	45.8	54.2
Floodplain	A	797.5	78.3	38.4
Ridge	Transition	663.6	30.6	11.8
Shoulder	Transition	568.7	14.4	15.5
Back slope	Transition	647.7	25.9	16.6
Bench	Transition	548.1	26.9	11.5
Foot slope	Transition	680.9	44.6	5.9
Floodplain	Transition	623.9	35.4	28.2
Ridge	Upper B	550.4	13.2	9.7
Shoulder	Upper B	546.7	17.7	5.9
Back slope	Upper B	476.4	8.0	7.9
Bench	Upper B	435.4	10.9	7.6
Foot slope	Upper B	521.5	14.5	10.4
Floodplain	Upper B	548.3	23.0	14.8
Ridge	Lower Horizons	445.9	4.7	3.1
Shoulder	Lower Horizons	372.4	1.8	16.0
Back slope	Lower Horizons	313.4	4.6	5.9
Bench	Lower Horizons	426.2	2.6	9.1
Foot slope	Lower Horizons	258.5	2.5	3.6
Floodplain	Lower Horizons	178.0	0.3	40.2

There were no apparent differences in the carbon and nitrogen parameters for the east area landscape positions (Table 3.8).

Table 3.8. Mean carbon and nitrogen for the east area landscape positions.

Landscape Position	Horizon	LOI %	TN %	TC %
	Range	1.0 – 34.0	0.1 – 0.3	0.1 – 18.5
Ridge	A	15.2	0.5	7.2
Shoulder	A	15.4	0.5	6.6
Back slope	A	17.4	0.5	8.1
Bench	A	14.3	0.5	7.4
Foot slope	A	13.3	0.4	6.2
Floodplain	A	19.9	0.6	9.8
Ridge	Transition	9.0	0.2	3.7
Shoulder	Transition	7.1	0.2	2.1
Back slope	Transition	8.4	0.2	3.1
Bench	Transition	8.6	0.2	4.1
Foot slope	Transition	7.3	0.2	2.6
Floodplain	Transition	10.8	0.3	4.3
Ridge	Upper B	8.2	0.2	2.7
Shoulder	Upper B	6.5	0.1	1.7
Back slope	Upper B	6.8	0.2	2.1
Bench	Upper B	7.4	0.2	2.6
Foot slope	Upper B	6.4	0.2	1.9
Floodplain	Upper B	8.8	0.2	3.4
Ridge	Lower Horizons	4.8	0.1	0.9
Shoulder	Lower Horizons	4.4	0.1	0.6
Back slope	Lower Horizons	5.1	0.1	1.1
Bench	Lower Horizons	7.0	0.1	2.0
Foot slope	Lower Horizons	3.6	0.1	0.6
Floodplain	Lower Horizons	2.7	0.0	0.4

West Area

Chemical Properties

The lower horizons of the floodplain soils appeared to have a higher BSECEC than the other landscape positions (Table 3.9). This possibly was due to buried horizons in the soil.

Table 3.9. Mean soil acidity for the west area landscape positions.

Landscape Position	Horizon	Soil pH	Acidity meq $100g^{-1}$	ECEC meq $100g^{-1}$	BSECEC %
Range		3.1-5.1	0.4-16.4	1.1-27.3	2.1-75.0
Ridge	A	3.8	7.8	9.0	13.4
Shoulder	A	3.9	5.8	6.5	11.6
Back slope	A	4.2	6.5	7.6	14.5
Bench	A	4.1	6.2	7.8	20.7
Foot slope	A	4.0	6.9	8.1	14.1
Floodplain	A	4.1	3.5	4.2	15.9
Ridge	Transition	4.4	5.1	5.5	7.8
Shoulder	Transition	4.3	4.1	4.4	6.7
Back slope	Transition	4.5	3.8	4.2	8.7
Bench	Transition	4.4	4.6	5.1	8.9
Foot slope	Transition	4.2	5.9	6.3	6.6
Floodplain	Transition	4.3	2.4	2.6	8.9
Ridge	Upper B	4.5	4.3	4.6	6.6
Shoulder	Upper B	4.4	3.4	3.7	6.9
Back slope	Upper B	4.6	3.5	3.8	8.0
Bench	Upper B	4.6	4.1	4.5	7.0
Foot slope	Upper B	4.5	4.2	4.4	5.6
Floodplain	Upper B	4.4	2.3	2.5	7.8
Ridge	Lower Horizons	4.5	3.3	3.6	7.3
Shoulder	Lower Horizons	4.4	3.4	3.6	4.4
Back slope	Lower Horizons	4.5	2.3	2.5	7.5
Bench	Lower Horizons	4.6	4.0	4.4	9.8
Foot slope	Lower Horizons	4.7	4.1	4.8	13.2
Floodplain	Lower Horizons	4.7	2.2	2.7	28.5

There were no apparent differences among landscape positions for base cations in the west area (Table 3.10), and no apparent differences among landscape positions for acid cations in the west area (Table 3.11).

Table 3.10. Mean base cation concentrations for the west area landscape positions.

Landscape Position	Horizon	Ca	Mg	K	Na
		mg kg^{-1}			
	Range	8.0 – 905.3	2.0 – 120.7	12.4 – 206.4	2.0 – 35.2
Ridge	A	136.7	26.5	77.9	11.6
Shoulder	A	69.6	20.5	53.5	8.2
Back slope	A	127.8	25.5	72.2	11.7
Bench	A	213.2	33.0	78.5	10.3
Foot slope	A	149.0	28.1	53.6	9.7
Floodplain	A	80.8	18.4	37.4	7.7
Ridge	Transition	40.3	8.9	40.7	7.9
Shoulder	Transition	26.7	7.1	30.8	5.6
Back slope	Transition	33.0	8.6	37.3	7.5
Bench	Transition	51.6	11.4	41.6	6.8
Foot slope	Transition	44.9	8.2	37.6	8.0
Floodplain	Transition	21.0	5.3	19.5	4.3
Ridge	Upper B	28.3	6.2	30.0	6.1
Shoulder	Upper B	23.7	5.1	26.2	5.5
Back slope	Upper B	26.2	6.3	33.1	7.3
Bench	Upper B	29.9	6.2	35.0	6.4
Foot slope	Upper B	23.5	4.3	24.7	6.2
Floodplain	Upper B	16.9	3.9	17.8	3.7
Ridge	Lower Horizons	29.3	5.1	22.2	4.6
Shoulder	Lower Horizons	8.8	4.3	25.8	2.3
Back slope	Lower Horizons	16.8	3.9	18.9	3.3
Bench	Lower Horizons	26.0	22.9	36.1	4.4
Foot slope	Lower Horizons	75.3	13.6	41.3	5.1
Floodplain	Lower Horizons	53.4	23.5	23.1	4.7

Table 3.11. Mean acid cation concentrations for the west area landscape positions.

Landscape Position	Horizon	Al	Fe	Mn
		mg kg^{-1}		
	Range	27.3 – 1142.1	0.3 – 142.7	0.3 – 223.2
Ridge	A	538.2	23.4	77.1
Shoulder	A	405.1	28.1	40.0
Back slope	A	475.6	15.0	65.9
Bench	A	414.9	9.1	84.4
Foot slope	A	490.6	13.8	59.1
Floodplain	A	267.4	12.0	32.5
Ridge	Transition	381.8	8.5	15.9
Shoulder	Transition	288.3	8.6	15.1
Back slope	Transition	293.0	5.0	14.9
Bench	Transition	333.1	8.1	22.5
Foot slope	Transition	405.2	7.4	17.9
Floodplain	Transition	181.7	3.8	13.6
Ridge	Upper B	324.7	5.2	4.9
Shoulder	Upper B	240.7	5.6	7.0
Back slope	Upper B	262.1	4.3	9.3
Bench	Upper B	298.7	2.7	6.9
Foot slope	Upper B	290.4	3.5	6.6
Floodplain	Upper B	154.1	3.2	10.0
Ridge	Lower Horizons	254.9	5.9	2.2
Shoulder	Lower Horizons	273.3	7.1	0.7
Back slope	Lower Horizons	181.5	3.6	0.3
Bench	Lower Horizons	262.6	1.6	6.9
Foot slope	Lower Horizons	300.1	1.8	12.4
Floodplain	Lower Horizons	129.6	3.4	19.3

There also were no apparent differences among landscape positions for carbon and nitrogen parameters for the west area (Table 3.12).

Table 3.12. Mean carbon and nitrogen parameters for the west area landscape positions.

Landscape Position	Horizon	LOI %	TN %	TC %
	Range	1.0 – 34.0	0.0 – 1.0	0.1 – 18.5
Ridge	A	15.6	0.4	8.1
Shoulder	A	9.4	0.3	5.0
Back slope	A	12.9	0.4	6.6
Bench	A	12.5	0.4	6.4
Foot slope	A	9.5	0.3	4.6
Floodplain	A	6.4	0.2	3.5
Ridge	Transition	7.3	0.2	3.0
Shoulder	Transition	5.5	0.1	2.5
Back slope	Transition	6.9	0.2	2.7
Bench	Transition	6.8	0.2	2.8
Foot slope	Transition	6.7	0.2	2.4
Floodplain	Transition	3.2	0.1	1.5
Ridge	Upper B	4.5	0.1	1.3
Shoulder	Upper B	4.1	0.1	1.4
Back slope	Upper B	5.4	0.1	1.7
Bench	Upper B	4.7	0.1	1.3
Foot slope	Upper B	4.4	0.1	1.2
Floodplain	Upper B	2.9	0.1	1.2
Ridge	Lower Horizons	2.2	0.0	0.3
Shoulder	Lower Horizons	2.3	0.0	0.4
Back slope	Lower Horizons	1.7	0.0	0.1
Bench	Lower Horizons	3.9	0.0	0.2
Foot slope	Lower Horizons	3.8	0.1	0.4
Floodplain	Lower Horizons	2.5	0.1	0.6

Conclusions

The general soil chemistry for the Cherry River watershed showed some definite trends with acid-base implications. The east area was higher in nutrient and organic matter content but also higher in acidity and acid cations, which is explained by the frigid soil temperature and higher organic matter content. There were very few possible differences seen with the landscape positions for either area. However, the buried horizons of the floodplain soils in both areas had higher BSECEC than the lower horizons of the soils in other landscape positions.

Chapter 4.
Soil Classification

Using the data presented in the previous two chapters, the full characterization pits were classified to the Subgroup level of Soil Taxonomy (Soil Survey Staff, 1975) (Table 4.1). Due to the lack of cation exchange capacity data required by Soil Taxonomy, the soils were not classified to the family level. An assumption was made in order to classify the soils to the Subgroup level. The assumption was that the soils had a base saturation of the cation exchange capacity of less than 35%. This assumption was based on the methods used to determine BSECEC of the soils (see Chapter 1, page 27). The BSECEC was much less than 35% for all of the soils, and therefore the base saturation of the cation exchange capacity (which is used in Soil Survey procedures) was assumed to be less than 35% as well.

All but two of the soils were Inceptisols (Table 4.1). Only two argillic horizons were found in the soils. Both of these argillic horizons were found in the east area, one ridge and one shoulder soil. These soils were classified to Typic Hapludults and Typic Fragiudults, respectively. The most common Subgroup was Typic Dystrudepts (6 soils). The second most common Subgroup was the Typic Fragiudepts (3 soils) followed by Fragic Dystrudepts (2 soils). The floodplain soils and one foot slope soil had different classifications than the other soils: Oxyaquic Dystrudepts and Fluventic Dystrudepts for the floodplain soils, and Aquic Dystrudepts for the wet foot slope soil (Table 4.1). Overall, the Subgroup classification of the soils were similar throughout the watershed, with all the soils classifying as low base saturation soils with weak development of diagnostic horizons.

While the soils were only classified to the Subgroup level, two family level classes were determined: particle size class and soil temperature class (Table 4.1). Mount and Paetzold (2002) determined soil temperatures for both project areas; the east area soils were determined to be frigid while the west area soils were found to be mesic. The particle size classes of the watershed were similar, though the west area had more rock fragments.

Table 4.1. Subgroup classification and family classes for the Cherry River watershed soils.

Project Area	Landscape Position	Site ID	Subgroup	Particle Size Class	Soil Temp. Class
East	Back slope	FS04WV025001	Typic Dystrudepts	Fine-loamy	Frigid
East	Back slope	FS04WV025002	Typic Dystrudepts	Fine-loamy	Frigid
East	Ridge	FS04WV025003	Typic Fragiudepts	Fine-loamy	Frigid
East	Foot slope	FS04WV025004	Fragic Dystrudepts	Fine-loamy	Frigid
East	Bench	FS04WV025005	Typic Fragiudepts	Fine-loamy	Frigid
East	Shoulder	FS04WV025010	Typic Fragiudults	Fine-loamy	Frigid
East	Floodplain	FS04WV025019	Oxyaquic Dystrudepts	Loamy-skeletal	Frigid
East	Ridge	FS04WV101001	Typic Hapludults	Fine-loamy	Frigid
East	Shoulder	FS04WV067007	Typic Dystrudepts	Coarse-loamy	Frigid
West	Back slope	FS04WV067001	Fragic Dystrudepts	Loamy-skeletal	Mesic
West	Ridge	FS04WV067002	Typic Dystrudepts	Loamy-skeletal	Mesic
West	Ridge	FS04WV067003	Typic Dystrudepts	Coarse-loamy	Mesic
West	Floodplain	FS04WV067004	Fluventic Dystrudepts	Loamy-skeletal	Mesic
West	Bench	FS04WV067005	Typic Fragiudepts	Loamy-skeletal	Mesic
West	Foot slope	FS04WV067006	Aquic Dystrudepts	Loamy-skeletal	Mesic
West	Shoulder	FS04WV067017	Typic Dystrudepts	Coarse-loamy	Mesic

Chapter 5.
Acid Risk Assessment and Management Implications

Acid Risk Assessment

The Ca:Al molar ratio of the soil solution can be used as an indicator of forest damage from aluminum stress. Ca:Al molar ratio of 1.0 results in a 50% risk of adverse impacts on forest; a Ca:Al molar ratio of 0.5 to 0.6 causes a 75% risk of adverse impacts on forest; a Ca:Al molar ratio of 0.2 gives a 95% or greater risk of adverse impacts on forest. But a ratio of 0.2 plus a BSECEC of less than 15% equates to a 100% risk of adverse forest impacts (Cronan and Grigal, 1995). These threshold values were set using tree seedling growth and mortality. Thus, this risk is interpreted to be a risk for regeneration failures thus causing forest productivity decline.

The values set by Cronan and Grigal (1995) were based on soil solution sampling. However, the calcium and aluminum data obtained from $SrCl_2$ extraction method (Joslin and Wolfe, 1989) performed by The Pennsylvania State University Agricultural Analytical Laboratory was used for the assessment because it approximates the values obtained from soil water samples. This extraction method is thought to extract only the "plant available" calcium and aluminum. The BSECEC used in the assessment came from the extractions performed by the University of Maine.

Risk for the soils of the Cherry River watershed was set according to the thresholds shown in Table 5.1.

Table 5.1. Thresholds used for risk assessment in the Cherry River watershed.

Risk	Ca:Al Molar Ratio	BSECEC
0 %	3.0+	--
>50 %	1.1-2.9	--
50 %	0.7-1.0	--
75 %	0.5-0.6	--
>75 %	0.3-0.4	<15.0
100%	0.0-0.2	<15.0

East versus West Areas

When the soil profiles from the east and west project areas were compared, the acid risks were similar. The risks for the transition and upper B horizons were 50% (Table 5.2). However, the lower B and BC horizons in the east area were at a higher risk than the west. Only the A and C horizons of both areas did not suggest risk to forest productivity. Risk increased initially for the upper horizons through the upper B with depth. This trend was predicted by the decrease in organic matter with depth discussed in Chapter 3.

Table 5.2. The soil acidification parameters used for the acid risk assessment of the soils in Cherry River watershed for the east and west project areas by horizon.

Area	Horizon	Ca:Al Molar Ratio	BSECEC %	Risk %
East	A	1.4	12.9	<50
West	A	2.0	15.1	<50
East	Transition	0.6	5.9	50
West	Transition	0.6	7.9	50
East	Upper B	0.3	6.0	>75
West	Upper B	0.3	7.0	>75
East	Lower B	0.3	5.5	>75
West	Lower B	0.8	7.2	50
East	BC	0.5	7.3	75
West	BC	3.8	9.9	0
East	C	--	--	--
West	C	6.9	28.6	0

Although both project areas were underlain by Pottsville geology, the formations were slightly different. The parent material in the west project area (primarily New River Formation) has a higher base status than the parent material in the east area (primarily Kanawha Formation) (Price, 1939). There were significant differences in BSECEC between the two project areas in more than one horizon which indicated that the degree of acidification between the two areas was different (Chapter 3). The east project area had a higher percentage of risk as well as significantly higher aluminum content and lower BSECEC than the west area.

Landscape Position

The shoulder positions have a 100% risk in both areas (Table 5.3). The ridge and floodplain horizons have a 75% risk in both areas. The back slope and bench positions have a 100% risk in the west area and only a >75% risk in the east area. The foot slopes have a 75% risk in the east area and a >75% risk in the west area.

Table 5.3. Risk to forest productivity by landscape position based on Ca:Al molar ratios and % BSECEC in the upper B horizon.

Area	Landscape position	Ca:Al Molar Ratio	BSECEC %	Risk %
East	Ridge	0.4	9.1	>75
	Shoulder	0.2	6.4	100
	Back slope	0.3	7.2	>75
	Bench	0.3	6.9	>75
	Foot slope	0.6	6.8	75
	Floodplain	0.5	12.7	75
West	Ridge	0.5	8.6	75
	Shoulder	0.2	6.9	100
	Back slope	0.2	9.1	100
	Bench	0.2	11.4	100
	Foot slope	0.4	10.9	>75
	Floodplain	0.3	19.6	>75

When these landscape positions are further separated into parent material categories, more trends can be seen. The BSECEC decreased with depth in the residual soils (mostly ridge and shoulder) for both project areas (Tables 3.5 and 3.9) as did the Ca:Al molar ratio. Most of these soils were mapped as Mandy and Gilpin mapping units.

The colluvial soils (most back slope and bench, and all foot slope) did not show a consistent trend in Ca:Al molar ratios and BSECEC (Tables 3.5 and 3.9), presumably because of the mixed parent materials involved. This mixing of materials in colluvium during down slope movement gives a less defined character of weathering material. These soils were predominantly mapped as Snowdog and Buchanan mapping units.

The alluvial soils (floodplain) in both project areas were very bouldery and were present in small drainages. These soils were also included in the Snowdog and Buchanan mapping units. They had water tables present within the upper 1.5 m (60 in) of the profile, and therefore, remained saturated throughout much of the year. Both the Ca:Al molar ratio and the BSECEC were above 3.0 and 15, respectively, near the surface and decreased through the A and B horizons, then they increased to similar values in the BC and C horizons (Tables 3.5 and 3.9). These soils contained buried horizons, which had elevated organic matter and base cations in the lower portions of the soil profiles.

Risk by Soil Pit

The percentage of risk by soil pits shows that the east area has a slightly higher level of acidification than the west area (Figure 5.1; Table 5.4). The percentage of pits at some level of risk in the east area is 92%, while the west area has 86%. The degree of risk between the two areas differs as well, with 72% of pits in the east area having greater than 75% risk compared to 55% of the west area pits having the same risk. However, the

percentages of pits with a 75% or greater risk were similar for the two areas, 81% for the east area and 79% for the west area.

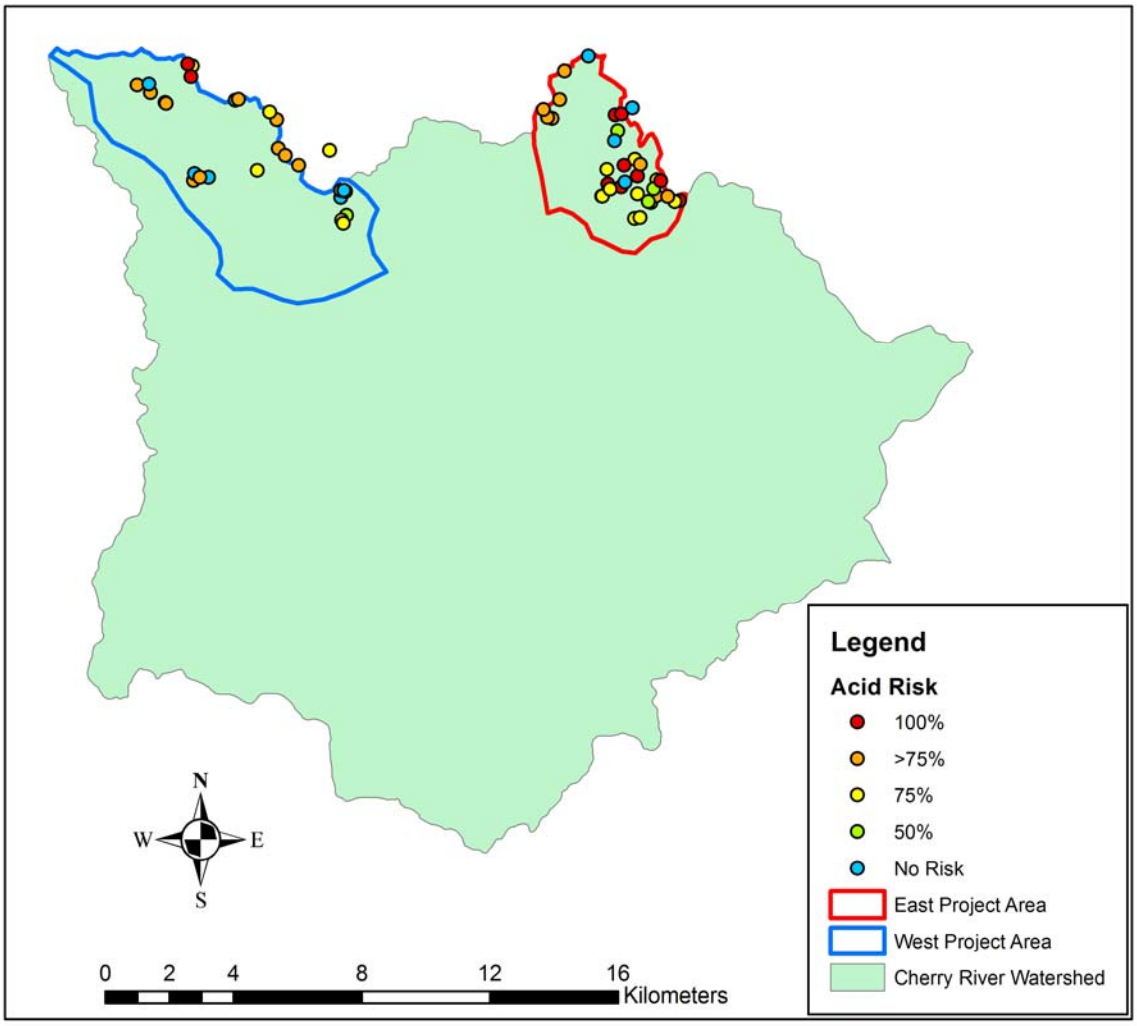


Figure 5.1. Acid risk by soil sampling location. Acid risk was based on the upper B horizon in the soil pit.

Table 5.4. The percentage of soil pits for each level of risk in each project area. Risk assessment was based on upper B horizon data.

	East Area Pits %	West Area Pits %
No risk	8	14
50% risk	11	7
75% risk	8	24
>75 % risk	53	45
100% risk	19	10

Management Implications

This risk assessment of the soils in the watershed can lead to management implications. For example, timber harvesting practices can be modified to take into account areas with low Ca:Al molar ratios. Harvest methods affect the nutrient cycling of the forest floor differently (Elliott and Knoepp, 2005). Methods, such as whole-tree harvesting, that remove excess organic material have more detrimental effects on nutrient availability than methods , stem-only, that leave organic material (branches, leaves, tree crowns) at the harvest site (Elliott and Knoepp, 2005). Short harvest rotations also have shown decreases in soil base cations due to the lower accumulation of organic matter and higher soil disturbance (Grigal, 2000). Likewise, soil disturbing activities, including skidding and log yarding, decrease soil productivity by removing soil organic matter and compacting the soil (Berger et al., 2004). Thus, the Ca:Al molar ratio can be used to guide the placement of soil disturbing activities and determine harvest method and rotation length.

The majority of tree roots occur within 90 cm of the surface of the soil with feeder roots in the upper 60 cm (McDaniel, 1997; Oettinger, 2005). The upper B horizons of the soils sampled in Cherry River watershed were above 60 cm in the zone of the feeder roots. The upper B horizon chemistry also has been correlated most strongly with foliar chemistry in sugar maple (Bailey et al., 2004). Therefore, the upper B horizon data were used for making management recommendations.

Both project areas had similar Ca:Al molar ratios and BSECEC in the upper B horizons. Therefore, the management recommendations for the areas are the same.

Because the majority of the base cations in the watershed come from litter fall, soil disturbance should be limited as much as reasonably possible.

Methods for harvesting also should leave woody debris and slash material on site to augment nutrient and organic matter input (Mann et al., 1988). Whole-tree harvesting should be avoided, and instead stem-only or sawlog harvesting should be used. The most effective way to preserve organic matter on the soil surface is by helicopter or skyline logging. On average, helicopter and skyline logging disturb only 2.5% of a site compared to ≥ 10% for more conventional harvest methods (Grigal, 2000).

The rotation of harvest for these areas should be extended in order for the base cations in the soil to be replenished (Blanco et al., 2005). Longer rotations have the higher percentages of base cation return (Blanco et al., 2005). Because the Cherry River watershed soils have low antecedent base cation concentrations, the longest reasonable rotation should be used.

Soil disturbance should be prohibited or limited on landscape positions that have higher Ca:Al molar ratios. For positions with low Ca:Al ratios such as the shoulder positions for both project areas and the bench and back slope positions in the west area, the mitigation costs for forest productivity would be high. Because forest productivity is at the highest risk on these positions, they would be the best places to place skid roads and log landings. Further disturbing these areas would have the least effect on productivity. The positions with lower risk should have better potential for vegetative growth, and therefore, the soil should not be disturbed (Mann et al., 1998; Grigal, 2000).

Management recommendations cannot be made based on the site specific risk assessment due to the variability of the soils. Although there is a large number of soil

pits in the watershed, the density of sampling does not show the risk to forest productivity at a sufficient level to make project level decisions. For making this type of decision, more soil samples would need to be taken within the project boundaries with a higher sample density. In general, areas that show a high density of samples with low or no risk should not have soil disturbance and should be harvested by methods like helicopter or sky-line logging. Also, areas with a high density of samples at high risk would be optimum for placement of skid roads and log landings.

One possible mitigation for these high risk areas is liming. There have been several research projects focusing on the liming of forest soils. However, the results from these studies have been mixed and many could not be replicated (Rengel, 2003). If liming is used for mitigation, there are considerations that should be taken into account. Pelletized lime and limestone sands are the only products that can currently be used in ground spreading equipment (Mizel, 2005). The liming materials that have worked the best in the studies have been dolomitic limestone (Rengel, 2003) and coarse limestone sands have been found to be more cost efficient than pelletized lime (Mizel, 2005). Detrimental effects of liming forest soils have been noted in these studies as well. Liming has been seen to cause the leaching of organic carbon and nitrogen from the soil due to increased microbial activity (Rengel, 2003). Therefore, liming is a possible mitigation for these high risk soils; however, due to the associated unknowns more research is needed.

Conclusions

The majority of soils in the Cherry River watershed showed some level of forest productivity risk. East area soils were at a higher degree of risk than the west area soils. Ridge and shoulder soils (residual soils) showed fewer signs of base cation input than the colluvial and alluvial soils. Soils showing the highest risk to forest productivity were these located on the shoulders. These soils also had a very low pool of base cations in the soil profile. Soils on the ridge and shoulder positions were mapped as Mandy in the east and Gilpin in the west; these mapping units were at the highest risk to forest productivity. The Snowdog and Buchanan soils were mapped on the majority of the rest of the areas, including the floodplain locations. The floodplain soils showed the lowest risk to forest productivity and the highest amount of base cations.

The results of this study indicate these soils have a high risk for future regeneration of marketable timber. With harvesting and organic matter removal, base cations are removed from the system causing these soils to become more acidified. This additional acidification raises the risk of regeneration failure. Therefore, the forest potentially will not regenerate a valuable timber stand to replace the one that was removed.

Chapter 6.
Bibliography

Adams, Mary B. 1999. Acidic deposition and sustainable forest management in the central Appalachians, USA, Forest Ecology and Management 122(1-2): 17-28.

Adams, Mary B. and J.N. Kochenderfer. 1998. The Fernow Whole-watershed Acidification Study: Soil Chemistry. *In* "The Effects of Acid Deposition on Pennsylvania's Forests." (W.E. Sharpe and J.R. Drohan, eds.) Proceedings of the 1998 PA Acidic Deposition Conference, Vol. 1. Environmental Resources Research Institute, University Park, PA.

Adams, M.B., J.A. Burger, A.B. Jenkins, and L. Zelazny. 2000. Impact of harvesting and atmospheric pollution on nutrient depletion of eastern U.S. hardwood forests. Forest Ecology and Management 138:301-319.

Bache, B.W. 1986. Aluminum mobilization in soils and waters. Journal of the Geologic Society, London 143:699-706.

Bailey, S.W., S.B. Horsley, and R.P. Long. 2005. Thirty years of change in forest soils of the Allegheny Plateau, Pennsylvania. Soil Sci. Soc. Am. J. In Process.

Bailey, S.W., S.B. Horsley, R.P. Long, and R.A. Hallett. 2004. Influence of edaphic factors on Sugar Maple nutrition and health on the Allegheny Plateau. Soil Sci. Soc. Am. J. 68:243-252.

Berger, A.L., K.J. Puettmann, and G.E. Host. 2004. Harvesting impacts on soil and understory vegetation: the influence of season of harvest and within-site disturbance patterns on clear-cut aspen stands in Minnesota. Can. J. For.Res. 34:2159-2168.

Binkley, D., C.T. Driscoll, H.L. Allen, P. Schoeneberger, and D. McAvory. 1989. Acidic deposition and forest soils: Context and case studies in the southeastern United States. Springer-Verlag, New York.

Blake, L, K.W.T Goulding, C.J.B. Mott, and A.E. Johnston. 1999. Changes in soil chemistry accompanying acidification over more than 100 years under woodland and grass at Rothamsted Experimental Station, UK. European J. of Soil Science 50:401-412.

Blanco, J.A., M.A. Zavala, J.B. Imbert, and F.J. Castillo. 2005. Sustainability of forest management practices: evaluation through a simulation model of nutrient cycling. Forest Ecology and Management 213:209-228.

Brady, N.C. and R.R. Weil. 2002. The nature and properties of soils, 3rd ed. Prentice Hall, New Jersey.

Clean Air Status and Trends Network (CASNET). (2005). Environmental Protection Agency. <http://www.epa.gov/castnet/>.

Connolly, S.J., T.C. Cain, J.S. Vestal, and P.J. Edwards. 2004. The potential effects of acid deposition: What is a national forest to do? Proceedings of Advancing the Fundamental Sciences Conference. San Diego, CA. In Process.

Cronan, C.S., and D.F. Grigal. 1995. Use of Calcium/Aluminum ratios as indicators of stress in forest ecosystems. J. Environ. Qual. 24:209-226.

Danehy, R.J., C.G. Colson, K.B. Parrett, and S.D. Duke. 2005. Patterns and sources of thermal heterogeneity in small mountain streams within a forested setting. Forest Ecology and Management 208:287-302.

Demchik, M.C. and Sharpe, W.E. 1999. Foliar and root chemistry response of hay-scented fern to liming and fertilization. Northern J. Appl. For. 16(1):33-35.

DeWalle, D.R., B.R. Swistock, R.G. Sayre, and W.E. Sharpe. 1991. Spatial variations of sapwood chemistry with soil acidity in Appalachian forests. J. Environ. Qual. 20:486-491.

DeWalle, D.R., J.S. Tepp, B.R. Swistock, W.E. Sharpe, and P.J. Edwards. 1999. Tree-ring cation response to experimental watershed acidification in West Virginia and Maine. J. Environ. Qual. 28:299-309.

Driscoll, C.T., G.B. Lawrence, A.J. Bulger, T.J. Butler, C.S. Cronan, C. Eagar, K.F. Lambert, G.E. Likens, J.L. Stoddard, and K.C. Weathers. 2001. Acidic deposition in the northeastern United States: Sources and inputs, ecosystem effects, and management strategies. BioScience 51(3):180-198.

Drohan, J.R. and W.E. Sharpe. 1997. Long-term changes in forest soil acidity in Pennsylvania, U.S.A. Water, Air, and Soil Pollution 95:299-311.

Duchesne, L., R. Ouimet, and C. Morneau. 2003. Assessment of Sugar Maple health based on basal area growth pattern. Can. J. For. Res. 33:2074-2080.

Elliott, K.J. and J.D. Knoepp. 2005. The effects of three regeneration harvest methods on plant diversity and soil characteristics in the southern Appalachians. Forest Ecology and Management 211:296-317.

EPA (U.S. Environmental Protection Agency). 1998. National air quality and emissions trends report. EPA 454/R-00-003.

Federer, C.A., J.W. Hornbeck, L.M. Tritton, C.W. Martin, R.S. Pierce, and C.T. Smith. 1989. Long-term depletion of calcium and other nutrients in Eastern US forests. Environmental Management 13(5):593-601.

Fernandez, I.J., L.E. Rustad, S.A. Norton, J.S. Kahl, and B.J. Cosby. 2003. Experimental acidification causes soil base-cation depletion at the Bear Brook watershed in Maine. Soil Sci. Soc. Am. J. 69:1909-1919.

Gbondo-Tugbawa, S.S., and C.T. Driscoll. 2003. Factors controlling long-term changes in soil pools of exchangeable basic cations and stream acid neutralizing capacity in a northern hardwood forest ecosystem. Biogeochemistry 63:161-185.

Grigal, D.F. 2000. Effects of extensive forest management on soil productivity. Forest Ecology and Management 138:167-185.

Grimm, J.W., and J.A. Lynch. 2004. Enhanced wet deposition estimates using modeled precipitation inputs. Environmental Monitoring and Assessment 90:243-268.

Grossman, R.B, D.S. Harms, D.F. Kingsbury, R.K. Shaw, and A.B. Jenkins. 2001. Assessment of soil organic carbon using the U.S. soil survey. p. 87 – 104. *In* Lal et al. (ed) Assessment Methods for Soil Carbon. Lewis Publishers, Boca Raton, Florida.

Holmberg, M., J. Mulder, M. Posch, M. Starr, M. Forsius, M. Johansson, J. Bak, H. Ilvesniemi, and H. Sverdrup. 2001. Critical Loads of Acidity for Forest Soils: Tentative Modifications. Water, Air, and Soil Pollution: Focus 1:91-101.

Huntington, T.G. 2000. The potential for calcium depletion in forest ecosystems of southeastern United States: review and analysis. Global Biogeochemical Cycles 14(2):623-638.

Huntington, T.G., R.P. Hooper, C.E. Johnson, B.T. Aulenbach, R. Cappellato, and A.E. Blum. 2000. Calcium depletion in a southeastern United States forest ecosystem. Soil Sci. Soc. Am. J. 64:1845-1858.

Jandl, R., C. Alewell, and J. Prietzel. 2004. Calcium loss in central European forest soils. Soil Sci. Soc. Am. J. 68:588-595.

Jenkins, A.B. (2002). Organic carbon and fertility of forest soils on the Allegheny Plateau of West Virginia, West Virginia University, [On-line Abstract]. Available: https://etd.wvu.edu/etd/etdDocumentData.jsp?jsp_etdId=2486

Johnson, C.E. 2002. Cation exchange properties of acid forest soils of the northeastern USA. European Journal of Soil Science 53:271-282.

Johnson, D.W., and D.E. Todd. 1990. Nutrient cycling in forests of Walker Branch watershed, Tennessee: roles of uptake and leaching in causing soil changes. J. Environ. Qual. 19:97-104.

Joslin, J.D., J.M. Kelly, and H. Van Miegroet. 1992. Soil chemistry and nutrition of North American spruce-fir stands: evidence for recent change. J. Environ. Qual. 21:12-30.

Joslin, J.D. and M.H. Wolfe. 1989. Aluminum effects on Northern Red Oak seedling growth in six forest soil horizons. Soil Sci Soc. Am. J. 53: 274-281.

Lawrence, G.B., M.B. David, G.M. Lovett, P.S. Murdoch, D.A. Burns, J.L. Stoddard, B.P. Baldigo, J.H. Porter, and A.W. Thompson. 1999. Soil calcium status and the response of stream chemistry to changing acidic deposition rates. Ecological Applications 9(3):1059-1072.

Logsdon, S.D. and C.A. Cambardella. 2000. Temporal Changes in Small Depth-Incremental Soil Bulk Density. Soil Sci. Soc. Am. J. 64: 710-714.

Lyon, J., and W.E. Sharpe. 1999. An assessment of the Ca:Al ratios of selected Pennsylvania forest soils. Water, Air, and Soil Pollution 109:53-65.

Mann, L.K., D.W. Johnson. D.C. West, D.W. Cole, J.W. Hornbeck, C.W. Martin, H. Riekerk, C.T. Smith, W.T. Swank, L.M. Tritton, and D.H. Van Lear. (1988). Effects of whole-tree and stem-only clearcutting on postharvest hydrologic losses, nutrient capital, and regrowth. Forest Science 34:412-428.

Markewitz, D., D.D. Richter, H.L. Allen, and J.B. Urrego. 1998. Three decades of observed soil acidification in the Calhoun Experimental Forest: Has acid rain made a difference? Soil Sci. Soc. Am. J. 62:1428-1439.

McDaniel, A. 1997. Tree roots - where are they? The Virginia Gardener Newsletter 6(8).

Miller, J.O., J.M. Galbraith, and W.L. Daniels. 2004. Soil organic carbon content in frigid southern Appalachian mountain soils. Soil Sci. Soc. Am. J. 68:194-203.

Mizel, N. 2005.The transport and fate of applied limestone sand and palletized lime following timber harvesting. Master's Thesis, The Pennsylvania State University. 64 p.

Mount, H. R., and R.F. Paetzold. 2002. The temperature regime for selected soils in the United States. United States Department of Agriculture, Natural Resources Conservation Service, National Soil Survey Center, Lincoln, Nebraska, Soil Survey Investigation Report No. 48.

National Atmospheric Deposition Program (NADP). 2005. National Atmospheric Deposition Program. <http://nadp.sws.uiuc.edu/>.

National Atmospheric Deposition Program (NADP-NRSP-3). 2005. NADP Program Office, Illinois State Water Survey, 2204 Griffith Dr., Champaign, IL 61820.

Oettinger, D. 2005. Planting under trees: protecting tree roots from damage is important when creating beds under trees. Landscape Architecture April:56-68.

Pelle. E. 1990. Elemental organic analysis. Part 1. Am. Lab. 22:116-125.

Prescott, C.E. 2002. The influence of the forest canopy on nutrient cycling. Tree Physiology 22(15/16):1193-1200.

Price, P.H.. West Virginia Geologic Survey: Greenbrier County. Wheeling News Litho. Co.: Wheeling, WV. 1939.

Reger, D.B. West Virginia Geologic Survey: Nicholas County. Wheeling News Litho. Co.: Wheeling, WV. 1921.

Reger, D.B. West Virginia Geologic Survey: Webster County and Portion of Mingo District, Randolph County, South of Valley Fork of the Elk River. Wheeling News Litho. Co.: Wheeling, WV. 1920.

Rengel, Z. (ed). 2003. Handbook of Soil Acidity. Marcel Dekker, Inc.: New York.

Rice, C.L., R.L. Martino, and E.R. Slucher. 1992. Regional aspects of Pottsville and Allegheny stratigraphy and depositional environments; Ohio and Kentucky. U. S. Geological Survey: Reston, VA. No.OF 92-0558.

Schnably, Jamie .2003.. Soil characterization, classification, and ciomass accumulation in the Otter Creek Wilderness. Master's Thesis, West Virginia University, [On-line Abstract]. Available: https://etd.wvu.edu/etd/etdDocumentData.jsp?jsp_etdId=3215

Singer, C.E., and D. C. Havill. 1985. Manganese as an ecological factor in salt marshes, Plant Ecology 62(1-3):287-292.

Skinner, M.F., D. Zabowski, R. Harrison, A. Lowe, and D. Xue. 2001. Measuring the cation exchange capacity of forest soils. Commun. Soil Sci. Plant Anal. 32(11-12):1751-1764.

Skyllberg U. 1999. pH and solubility of aluminum in acidic forest soils: a consequence of reactions between organic acidity and aluminum alkalinity. European Journal of Soil Science 50:95-106.

Soil Survey Staff. 2003. Keys to Soil Taxonomy. 9th ed. National Cooperative Soil Survey. U.S. Government Printing Office, Washington, D.C.

Soil Survey Staff, 1996. Soil Laboratory Methods Manual. Soil Survey Investigations Report No. 42. Version 3.0. USDA Natural Resources Conservation Service. National Soil Survey Center. Lincoln, Nebraska

Soil Survey Staff. 2002. Soil Survey of Greenbrier County, West Virginia. National Cooperative Soil Survey. U.S. Government Printing Office, Washington, D.C.

Soil Survey Staff. 1992. Soil Survey of Nicholas County, West Virginia. National Cooperative Soil Survey. U.S. Government Printing Office, Washington, D.C.

Soil Survey Staff. 1998. Soil Survey of Webster, West Virginia. National Cooperative Soil Survey. U.S. Government Printing Office, Washington, D.C.

Soil Survey Staff. 1975. Soil Taxonomy. A basic system of soil classification for making and interpreting soil surveys. USDA - Soil Conservation Service Agricultural Handbook #436, U.S. Gov. Print. Office, Washington, DC, 754 p.

Sparks, D.L. 2003. Environmental Soil Chemistry. 2nd ed. Academic Press, San Diego.

Strausbaugh, P.D. and E.L. Core. 1977. Flora of West Virginia. 2nd Ed. Seneca Books, Inc, Grantsville, WV.

Thomas, G.W. 1982. Exchangeable cations. In: A.L. Page (ed.) Methods of soil analysis, Part 2 Chemical and microbiological properties, 2nd edition. Agronomy 9: 159-165.

Tracy, L. 2005. MNF Geologist, personal communication.

U.S. Geological Survey. 1999. Soil-calcium depletion linked to acid rain and forest growth in the eastern United States. USGS 98-4267.

Washburn, C.S. and M. Arthur. 2002. Spatial variability in soil nutrient availability in an oak-pine forest: potential effects of tree species. Canadian Journal of Forest Research 33(12):2321-2330.

Yanai, R.D., R.P. Phillips, M.A. Arthur, T.G. Siccama, and E.N. Hane. 2005. Spatial and temporal variation in calcium and aluminum in northern hardwood forest floors. Water, Air, and Soil Pollution 160:109-118.

Yang, Z.H., B.R. Singh, and B.K Sitaula. 2004. Soil organic carbon fractions under different land uses in Mardi watershed of Nepal. Commun. Soil Sci. Plant Anal. 35(5-6):615-629.

Appendices
APPENDIX A
SOIL DECRIPTION GUIDLINES

The following list of physical and morphological features, as outlined in the Soil Survey Manual (Soil Survey Staff, 1993) will be noted when describing field soil properties:

1. The presence of horizons or layers
2. Depth and thickness of each horizon (in, cm)
3. Boundary of each horizon (Distinction and Topography)
4. Matrix color (Hue, value, and chroma as represented by the Munsell Soil Color notations)
5. Pockets of dissimilar material (Abundance, contrast, size, and color)
6. Mottling (Abundance, contrast, size, and color)
7. Texture class by feel (% sand silt, and clay)
8. Structure (Type, strength, and grade)
9. Consistence
10. Field pH of each horizon
11. Roots (Size and abundance)
12. Presence of artifacts
13. Presence of rock fragments for each horizon (Size and type)
14. Other field observations may include the presence of clay films, redoximorphic features, and bridged voids.
15. Slope; the presence of rills, gulleys, and compacted zones will also be noted.
16. Dominant overstory, midstory, and ground vegetation within 1 meter area surrounding the soil pit.

APPENDIX B
FULL CHARACTERIZATION PROFILE DESCRIPTIONS

Profile Number: 1
Soil Description Number: FS04WV025001
Sample Date: June 30, 2004
Soil Family: Typic Dystrudepts
Area: Summit Lake Rec. Area FS rd.77
Location: (GPS) NAD27 38º15.167N 80º25.639W
EPE 62ft
17550108E 4233811N
Natural Vegetation: Black cherry, red maple, striped maple, beech, birch, hemlock
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone/ gray shale, colluvium
Physiography: Allegheny Plateau (back slope)
Relief: concave
Drainage: well-drained
Elevation: 1092 m (3580 ft)
Slope: 23%
Aspect: NW
Surface stoniness: <0.01%

Site: FS04WV025001 described and sampled by Stephanie Connolly and Cara Sponaugle
Oi -- 2.5 to 0 cm (1 to 0 in)
Oe -- 0 to 2.5 cm (0 to 1 in)
A1 -- 2.5 to 7.5 cm (1 to 3 in); very dark brown (10YR 2/2) channery loam; moderate very fine and fine granular structure; very friable; many very fine and fine roots; 25% channers; clear wavy boundary.
A2 -- 7.5 to 12.5 cm (3 to 5 in); dark grayish brown (10YR 4/2) channery loam; moderate very fine and fine granular structure; very friable; many very fine and fine and common medium roots; 25% channers; clear wavy boundary.
AB -- 12.5 to 20 cm (5 to 8 in); very dark grayish brown (10YR 3/2) channery loam; weak medium subangular blocky and moderate medium granular structure; friable; few fine and common medium roots; 15% channers; clear wavy boundary.
Bw1 -- 20 to 40.5 cm (8 to 16 in); yellowish brown (10YR 5/8) channery clay loam; moderate medium subangular blocky structure; friable; few fine and common medium roots; common faint clay films on rock and ped faces; 25% channers; clear wavy boundary.
Bw2 -- 40.5 to 58.5 cm (16 to 23 in); dark yellowish brown (10YR 4/6) channery clay loam; moderate medium subangular blocky structure; friable; few fine and common medium roots; common faint clay films on rock and ped faces; 25% channers; clear wavy boundary.

2Bw3 -- 58.5 to 89 cm (23 to 35 in); dark yellowish brown (10YR 4/6) very channery loam; weak medium subangular blocky structure; friable; few fine roots; 40% channers; clear wavy boundary.
2Bw4 -- 89 to 109 cm (35 to 43 in); dark yellowish brown (10YR 4/4) very channery sandy loam; weak medium subangular blocky structure; friable; few fine roots; 40% channers; clear wavy boundary.
2BC -- 109 to 152.5+ cm (43 to 60+ in); dark yellowish brown (10YR 4/4) extremely channery sandy loam; weak fine subangular blocky structure; loose; few fine roots matted around rock fragments; 65% channers.

Notes: This site is located down slope west of FS road 77 towards Coats Run. The understory contains heavily browsed remnants of trillium, cucumber root, and greenbrier. There is an increase in sand at the discontinuity. Rounded stones were found in the Bt1 as well as a large boulder in the BC horizon. There was no fragipan or dense layer found.

Profile Number: 2
Soil Description Number: FS04WV025002
Sample Date: August 20, 2004
Soil Family: Typic Dystrudepts
Area: Summit Lake Rec. Area
Location: (GPS) NAD83 38º15.501N 80º26.046W
EPE 33ft
Natural Vegetation: Black cherry, sugar maple,
yellow poplar
Soil Temp. Regime: frigid
Parent Material: Pottsville gray shale, residuum
Physiography: Allegheny Plateau (Back slope)
Relief: concave
Drainage: well-drained
Elevation: 1056 m (3465 ft)
Slope: 27%
Aspect: ESE
Surface stoniness: 0.01%

Site: FS04WV025002 described and sampled by Stephanie Connolly
O -- 5 to 0 cm (2 to 0 in).
A -- 0 to 5 cm (0 to 2 in); dark brown (10YR 3/3) channery loam; moderate very fine and fine granular structure; very friable; many very fine to medium and few coarse roots; 20% rock fragments (10% channers, 10% gravels); clear smooth boundary.
AB -- 5 to 7.5 cm (2 to 3 in); dark yellowish brown (10YR 4/4) channery loam; weak fine granular and moderate fine and weak medium subangular blocky structure; friable; many fine and common very fine and medium roots; 30% rock fragments (15% channers, 15% gravels); clear wavy boundary.
Bw1 -- 7.5 to 18 cm (3 to 7 in); dark yellowish brown (10YR 4/6) channery loam; moderate medium subangular blocky structure; friable; many fine and common very fine and medium roots; 30% rock fragments (15% channers, 15% gravels); clear wavy boundary.
Bw2 -- 18 to 33 cm (7 to 13 in); yellowish brown (10YR 5/6) channery loam; moderate medium subangular blocky structure; friable; few fine and common medium roots; few faint clay films on rock and ped faces; 30% rock fragments (20% channers, 10% cobbles); clear wavy boundary.
Bw3 -- 33 to 66 cm (13 to 26 in); yellowish brown (10YR 5/6) channery loam; moderate medium subangular blocky structure; friable; few fine and common medium roots; few faint clay films on rock and ped faces; 30% channers; clear wavy boundary.
BC1 -- 66 to 94 cm (26 to 37 in); dark yellowish brown (10YR 4/6) and yellowish brown (10YR 5/8) very channery silt loam; weak medium subangular blocky structure; friable; few medium roots; 50% rock fragments (40% channers, 10% flagstones); clear wavy boundary.
BC2 -- 94 to 122 cm (37 to 48 in); yellowish brown (10YR 5/6) very flaggy silt loam; weak medium subangular blocky structure; friable; few fine and medium roots; 60% rock fragments (40% flagstones, 20% channers); abrupt smooth boundary.

2R -- 122+ cm (60+ in); gray shale bedrock.

Notes: This site is located up the skid trail from the final log landing on FS rd. 944. The understory contains heavily browsed remnants of hay-scented fern, striped maple, wild yam, and greenbrier. There was no fragipan or dense layer found.

Profile Number: 3
Soil Description Number: FS04WV025003
Sample Date: July 12, 2004
Soil Family: Typic Fragiudepts
Area: Summit Lake Rec. Area FS rd. 946
Location: (GPS) NAD27 38º14.820N 80º25.147W
EPE 89ft
Natural Vegetation: Black cherry, sugar maple, beech, red maple,
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone, residuum
Physiography: Allegheny Plateau (ridge)
Relief: convex
Drainage: moderately well drained
Elevation: 1123 m (3685 ft)
Slope: 15%
Aspect: E
Surface stoniness: <0.01%

Site: FS04WV025003 described and sampled by Stephanie Connolly and Cara Sponaugle
O -- 0 to 5 cm (0 to 2 in).
A -- 5 to 10 cm (2 to 4 in); very dark grayish brown (10YR 3/2) loam; moderate medium granular and weak medium subangular blocky structure; very friable; many very fine to medium roots and few coarse roots; <5% gravel; clear wavy boundary.
Bw1-- 10 to 20.5 cm (4 to 8 in); yellowish brown (10YR 5/6) heavy loam; moderate medium subangular blocky parting to moderate medium granular structure; friable; many medium roots and common very fine and fine roots; <5% gravel; clear wavy boundary.
Bw2 -- 20.5 to 53 cm (8 to 21 in); yellowish brown (10YR 5/8) clay loam; moderate medium subangular blocky structure; friable; common fine roots; few faint clay films on rock and ped faces; <5% gravel; clear wavy boundary.
Bx1 -- 53 to 73.5 cm (21 to 29 in); yellowish brown (10YR 5/8) clay loam; moderate coarse subangular blocky structure; firm; common medium distinct light brownish gray (10YR 6/2) depletions and common medium distinct strong brown (7.5YR 5/8) concentrations; few fine roots; few clear clay films on ped faces; <5% gravel; clear wavy boundary.
Bx2 -- 73.5 to 91.5 cm (29 to 36 in); yellowish brown (10YR 5/4) clay loam; weak coarse prismatic parting to moderate coarse subangular blocky structure; firm; many medium distinct light and dark brownish gray (10YR 6/2 and 10YR 4/2) depletions and common medium distinct reddish yellow (7.5YR 6/8) concentrations on ped faces; many distinct clay films on rock and ped faces; <5% gravel; clear wavy boundary.
Cr -- 91.5 to 96.5 cm (36 to 38 in); soft sandstone.
R -- 96.5+ cm (38+ in); sandstone.

Notes: This site is located above the final log landing on Forest Service Road 946. The understory consists of hay scented fern, greenbrier, red maple seedlings, moss, and beech

regeneration but is affected by heavy deer browse. The midstory consists of beech, striped maple, and red spruce. This site has remnants of a past fire.

Profile Number: 4
Soil Description Number: FS04WV025004
Sample Date: June 30, 2004
Soil Family: Fragic Dystrudepts
Area: Summit Lake Rec. Area
Location: (GPS) NAD27 38º15.045N 80º26.402W
EPE 56ft
Natural Vegetation: Sugar maple, ash, white oak, black cherry, tulip poplar, red oak, cucumber magnolia, basswood
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone/ shale, colluvium
Physiography: Allegheny Plateau (foot slope)
Relief: concave
Drainage: well-drained
Elevation: 1056 m (3465 ft)
Slope: 20%
Aspect: ESE
Surface stoniness: 0.001%

Site: FS04WV025004 described and sampled by Stephanie Connolly and Cara Sponaugle
A -- 0 to 2.5 cm (0 to 1 in); black (10YR 2/1) mucky silt loam; moderate fine granular structure; very friable; many very fine and fine, common medium roots; 3% gravels; abrupt wavy boundary.
AB -- 2.5 to 12.5 cm (1 to 5 in); very dark grayish brown (10YR 3/2) loam; weak medium subangular blocky structure parting to moderate medium granular structure; friable; many fine and medium roots; 5% gravels; clear wavy boundary.
Bw1 -- 12.5 to 30.5 cm (5 to 12 in); dark yellowish brown (10YR 4/6) loam; weak and moderate medium subangular blocky structure; friable; common fine and medium roots; few faint clay films on rock faces; 8% rock fragments; clear wavy boundary.
Bw2 -- 30.5 to 51 cm (12 to 20 in); yellowish brown (10YR 5/4) gravelly loam; moderate medium and coarse subangular blocky structure; friable; few fine and medium roots; common faint clay films on rock and ped faces; 15% rock fragments (10% gravel, 5% cobble); clear wavy boundary.
Bw3 -- 51 to 79 cm (20 to 31 in); yellowish brown (10YR 5/8) very gravelly clay loam; moderate medium and coarse subangular blocky structure; friable; 35% rock fragments (20% gravel, 15% channers); common faint clay films on rock and ped faces; clear wavy boundary.
2Bw4 -- 79 to 109 cm (31 to 43 in); yellowish brown (10YR 5/6) gravelly loam; moderate medium and coarse subangular blocky structure; friable; common faint clay films on rock and ped faces; 20% rock fragments (15% gravel, 5% channers); clear wavy boundary.
2Bx -- 109 to 129.5 cm (43 to 51 in); yellowish brown (10YR 5/8) gravelly clay loam; moderate medium and coarse subangular blocky structure; firm; many medium and few fine distinct light gray (10YR 7/1) depletions and common medium distinct yellowish red

(5YR 5/6) concentrations; common faint clay films on rock and ped faces; 20% rock fragments (15% gravel, 5% channers); clear wavy boundary.
3BC -- 129.5 to 145+ cm (51 to 57+ in); yellowish brown (10YR 5/6) very channery loam; weak medium subangular blocky structure; firm; few medium and fine distinct light gray (10YR 7/1) depletions; 40% rock fragments (25% channers, 15% gravel).

Notes: This site is located north of lower campground and west of Summit Lake. The understory is made up of witch hazel, hay scented fern and forest grasses. The 2Bt and 2Btx have glitter in them that appears to be mica flakes. The 2Btx horizon has fragic characteristics but is not a true fragipan.

Profile Number: 5
Soil Description Number: FS04WV025005
Sample Date: June 30, 2004
Soil Family: Typic Fragiudepts
Area: Summit Lake Rec. Area
Location: (GPS) NAD27 38º15.104N 80º26.688W
EPE 75ft
Natural Vegetation: Black cherry, red oak, sugar maple
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone/ shale, colluvium
Physiography: Allegheny Plateau (bench)
Relief: concave
Drainage: well-drained
Elevation: 1102 m (3615 ft)
Slope: 24-25%
Aspect: SW
Surface stoniness: 0.001%

Site: FS04WV025005 described and sampled by Stephanie Connolly and Cara Sponaugle
O -- 2.5 to 0 cm (1 to 0 in); decaying oak leaves.
A -- 0 to 2.5 cm (0 to 1 in); black (10YR 2/1) mucky silt loam; moderate fine granular structure; very friable; many very fine and fine, and common medium roots; <5% channers; abrupt wavy boundary.
AB-- 2.5 to 13 cm (1 to 5 in); dark yellowish brown (10YR 4/4) and dark brown (10YR 3/3) silt loam; weak medium subangular blocky parting to moderate fine granular structure; friable; many very fine and fine, common medium, and few coarse roots; <5% channers; clear wavy boundary.
Bw1 -- 13 to 25.5 cm (5 to 10 in); dark yellowish brown (10YR 4/4) silt loam; moderate fine and medium subangular blocky structure; friable; many very fine and fine, common medium, few coarse roots; 10% gravels; clear wavy boundary.
Bw2 -- 25.5 to 48 cm (10 to 19 in); dark yellowish brown (10YR 4/6) gravelly loam; moderate fine and medium subangular blocky structure; friable; few fine and common medium roots; common distinct clay films on rock and ped faces; 25% rock fragments (15% gravels, 10% cobbles); clear wavy boundary.
2Bx1 -- 48 to 79 cm (19 to 31 in); brown (10YR 5/3) very gravelly clay loam; moderate medium subangular blocky structure; firm; few fine roots; many distinct clay films on rock and ped faces; 45% rock fragments (30% gravels, 15% shale channers); clear wavy boundary.
2Bx2 -- 79 to 104 cm (31 to 41 in); dark brown (10YR 4/3) extremely gravelly clay loam; moderate medium subangular blocky structure; firm; common medium gray (10YR 5/1) depletions and common medium reddish yellow (5YR 6/8) concentrations; 65% rock fragments (50% gravels, 15% shale channers); many distinct clay films on rock and ped faces; clear wavy boundary.

3Bx3 -- 109 to 127 cm (41 to 50 in); yellowish brown (10YR 5/6) channery clay; moderate medium subangular blocky structure; firm; common medium light grayish brown (10YR 6/2) depletions and common medium strong brown (7.5YR 5/8) concentrations; 30% rock fragments (20% channers, 10% gravels); many distinct clay films on rock and ped faces; clear wavy boundary.
3BC -- 127 to 152.5+ cm (50 to 60+ in); dark yellowish brown (10YR 4/4) very channery clay; weak coarse subangular blocky structure; firm; common medium light grayish brown (10YR 6/2) depletions and common medium strong brown (7.5YR 5/6) concentrations; 40% rock fragments (30% channers, 10% gravels).

Notes: This site is located NW of the upper campground in the bank of an old forest road. The understory consists of hay scented fern, greenbrier, and violet. The Btx horizons all show fragic characteristics but are not true fragipans.

Profile Number: 17
Soil Description Number: FS04WV025010
Sample Date: June 20, 2004
Soil Family: Typic Fragiudults
Area: Summit Lake Rec. Area FS rd. 943
Location: (GPS) NAD83 38º14.904N 80º25.648W
EPE 52ft
Natural Vegetation: Red maple, beech, sugar maple, black cherry
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone/shale, residuum
Physiography: Allegheny Plateau (shoulder)
Relief: convex
Drainage: moderately well drained
Elevation: 1126 m (3695 ft)
Slope: 17%
Aspect: WSW
Surface stoniness: <0.01%

Site: FS04WV025010 described and sampled by Stephanie Connolly and Cara Sponaugle
Oi -- 0 to 2.5 cm (0 to 1 in).
A/E -- 2.5 to 7.5 cm (1 to 3 in); dark brown (10YR 3/3) and dark grayish brown (10YR4/2) loam; moderate medium granular and weak medium subangular blocky structure; friable; many very fine and fine, and common medium roots; <5% channers; abrupt wavy boundary.
BA-- 7.5 to 20 cm (3 to 8 in); yellowish brown (10YR 5/4 and 10YR 5/6) loam; weak medium subangular blocky structure; friable; common very fine and many fine and medium roots; <5% channers; clear wavy boundary.
Bt -- 20 to 53 cm (8 to 21 in); yellowish brown (10YR 5/6) very flaggy loam; moderate medium subangular blocky structure; friable; few very fine, common fine, and many medium roots; common faint clay films on rock and ped faces; 35% flagstones; clear wavy boundary.
Btx1 -- 53 to 73.5 cm (21 to 29 in); yellowish brown (10YR 5/4) cobbly loam; weak medium subangular blocky parting to weak medium platy structure; firm; common distinct light brownish gray (10YR 6/2) depletions and brownish yellow (10YR 6/6) and reddish yellow (7.5YR 5/8) concentrations; many distinct clay films on rock and ped faces; 15% cobbles; clear wavy boundary.
Btx2 -- 73.5 to 124.5 cm (29 to 49 in); brownish yellow (10YR 6/8) very stony loam; weak medium subangular blocky parting to weak medium platy structure; firm; many distinct light gray (10YR 7/1) and light brownish gray (10YR 6/2) depletions and brownish yellow (10YR 6/6) and reddish yellow (5YR 6/8) concentrations; many distinct manganese concentrations on rock faces; many distinct clay films on rock and ped faces; 40% rock fragments (35% stones, 5% cobbles); clear wavy boundary.
BC -- 124.5 to 13 cm (49 to 54 in); yellowish brown (10YR 5/8) cobbly loam; weak coarse subangular blocky structure; firm; many distinct light gray (10YR 7/1) and light

brownish gray (10YR 6/2) depletions and reddish yellow (5YR 6/8) concentrations; many distinct manganese concentrations on rock faces; 15% cobbles; clear wavy boundary. **Cr** -- 137+ cm (54+ in); sandstone.

Notes: This site is located NW above the final log landing on Forest Service Rd. 943. The understory consists of hay-scented fern, cherry seedlings, grasses, moss, red maple, beech, sugar maple, and violet. The midstory consists of striped maple, red maple, yellow birch, and beech.

Profile Number: 37
Soil Description Number: FS04WV025019
Sample Date: July 20, 2004
Soil Family: Oxyaquic Dystrudepts
Area: Summit Lake Rec. Area FS rd. 945
Location: (GPS) NAD83 38º14.812N 80º25.801W
EPE 62ft
Natural Vegetation: Black cherry, red maple, sugar maple, yellow birch, basswood, magnolia
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone/ shale, alluvium
Physiography: Allegheny Plateau (floodplain)
Relief: convex
Drainage: well-drained
Elevation: 1067 m (3500 ft)
Slope: 8%
Aspect: SW
Surface stoniness: <0.01%

Site: FS04WV025019 described and sampled by Stephanie Connolly and Cara Sponaugle
O -- 0 to 2.5 cm (0 to 1 in).
A -- 2.5 to 13 cm (1 to 5 in); dark brown (10YR 3/3) silt loam; moderate medium granular structure; very friable; many very fine to medium and common coarse roots; 1% boulders; abrupt wavy boundary.
Bw1-- 13 to 30.5 cm (5 to 12 in); dark yellowish brown (10YR 4/4) very channery loam; weak medium subangular blocky and moderate fine granular structure; very friable; common very fine and many fine and medium, and few coarse roots around rocks; 55% rock fragments (40% channers, 15% gravels); clear wavy boundary.
Bw2 -- 30.5 to 58.5 cm (12 to 23 in); brown (10YR 4/3) extremely gravelly loam; weak medium subangular blocky parting to moderate fine granular structure; very friable; few very fine and coarse, and many fine and medium roots around rocks; 80% rock fragments (30% cobbles, 50% gravels); clear wavy boundary.
Bw3 -- 58.5 to 73.5 cm (23 to 29 in); dark yellowish brown (10YR 5/4) extremely gravelly silt loam; weak medium subangular blocky parting to moderate fine granular structure; very friable; 80% rock fragments (30% cobbles, 50% gravels); abrupt wavy boundary.
BC -- 73.5+ cm (29+ in); brownish yellow (10YR 6/8) very gravelly loam; weak medium subangular blocky parting to weak medium platy structure; firm; many distinct light gray (10YR 7/1) depletions and brownish yellow (10YR 6/8) and yellowish brown (10YR 5/8) concentrations; many distinct black manganese concentrations throughout; 50% rock fragments (40% gravels, 10% cobbles).

Notes: This site is located NW beyond the log landing on Forest Service Road 945. The understory consists of hay-scented fern, striped maple, and beech. The midstory consists of magnolia, red maple, ironwood, and beech. There is a perched water table with free

flowing water at one gallon per minute in the BA and Ab horizons. Water does not flow through the BC horizon.

Profile Number: 7
Soil Description Number: FS04WV101001
Sample Date: June 30, 2004
Soil Family: Typic Hapludults
Area: Summit Lake Rec. Area FS rd. 99
Location: (GPS) NAD27 38º16.286N 80º26.387W EPE 58ft
17548996E 4235883N
Natural Vegetation: Black cherry, sugar maple, striped maple
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone/ gray shale, residuum
Physiography: Allegheny Plateau (ridge)
Relief: convex
Drainage: well-drained
Elevation: 1132 m (3715 ft)
Slope: 12-13%
Aspect: NW
Surface stoniness: <0.01%

Site: FS04WV101001 described and sampled by Stephanie Connolly and Cara Sponaugle
Oi -- 2.5 to 0 cm (1 to 0 in).
Oe -- 0 to 2.5 cm (0 to 1 in); many very fine and fine and common coarse roots; abrupt wavy boundary.
A -- 2.5 to 5 cm (1 to 2 in); black (10YR 2/1) loam; moderate very fine and fine granular structure; very friable; many very fine to medium roots; <5% channers; abrupt wavy boundary.
BA-- 5 to 10 cm (2 to 4 in); dark grayish brown (10YR 4/2) loam; weak and moderate medium subangular blocky structure; friable; many very fine to medium roots; 5% channers; abrupt wavy boundary.
Bt1 -- 10 to 25.5 cm (4 to 10 in); dark yellowish brown (10YR 4/6) loam; moderate medium subangular blocky; friable; common very fine to medium roots; 10% channers; few faint clay films on rock and ped faces; abrupt wavy boundary.
Bt2 -- 25.5 to 48 cm (10 to 19 in); yellowish brown (10YR 5/8) loam; moderate medium subangular blocky structure; firm; common very fine to medium roots; many distinct clay films on rock and ped faces; 13% channers; clear wavy boundary.
Bt3 -- 48 to 61 cm (19 to 24 in); dark yellowish brown (10YR 4/6) loam; moderate medium subangular blocky structure; friable; few fine and medium roots matted around rock fragments; common distinct clay films on rock and ped faces; 10% channers; abrupt wavy boundary.
Cr -- 61 to 79 cm (24 to 31 in); soft gray shale.
R -- 79+ cm (31+ in); gray shale.

Notes: This site is located SE of the intersection of FS Road 99 and FS road 786. This is the highest point of the Summit Lake area. The understory consists of hay scented fern, greenbrier, cherry regeneration, and several forest grasses but is affected by heavy deer browse. In both the BA and Bt1 horizons organic matter follows the root channels.

Profile Number: 23
Soil Description Number: FS04WV067007
Sample Date: September 22, 2004
Soil Family: Typic Dystrudepts
Area: Summit Lake Rec. Area FS rd.99A
Location: (GPS) NAD27 38º16.152N 80º27.831W
EPE 52ft
Natural Vegetation: Red maple, red oak, beech, cucumber magnolia
Soil Temp. Regime: frigid
Parent Material: Pottsville gray shale, residuum
Physiography: Allegheny Plateau (shoulder)
Relief: concave
Drainage: well-drained
Elevation: 1094 m (3590 ft)
Slope: 13%
Aspect: SW
Surface stoniness: <0.01%

Site: FS04WV067007 described and sampled by Cara Sponaugle
Oi -- 0 to 2.5 cm (0 to 1 in).
A -- 2.5 to 7.5 cm (1 to 3 in); very dark grayish brown (10YR 3/2) loam; moderate medium granular structure; very friable; many very fine and fine roots; <10% channers; abrupt wavy boundary.
BA -- 7.5 to 23 cm (3 to 9 in); dark yellowish brown (10YR 4/6) loam; moderate medium granular and moderate medium subangular blocky structure; very friable; many very fine and fine and common medium roots; <10% channers; abrupt wavy boundary.
Bw1 -- 23 to 33 cm (9 to 13 in); yellowish brown (10YR 5/6) loam; moderate medium subangular blocky structure; friable; many very fine and fine and common medium roots; few faint clay skins on rock and ped faces; <10% channers; clear wavy boundary.
Bw2 -- 33 to 48 cm (13 to 19 in); yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; friable; common fine and few coarse roots; common faint clay films on rock and ped faces; 10% channers; clear wavy boundary.
Bw3 -- 48 to 73.5 cm (19 to 29 in); yellowish brown (10YR 5/6) channery clay loam; moderate medium subangular blocky structure; friable; few fine roots; common distinct clay films on rock and ped faces; 30% channers; clear wavy boundary.
BC -- 73.5 to 101.5 cm (29 to 40 in); yellowish brown (10YR 5/6) very channery clay loam; weak medium subangular blocky structure; friable; few fine roots around rock fragments; 45% channers; clear wavy boundary.
Cr -- 101.5 to 117 cm (40 to 46 in); soft weathered shale.
R -- 117+ cm (46+ in); black shale bedrock.

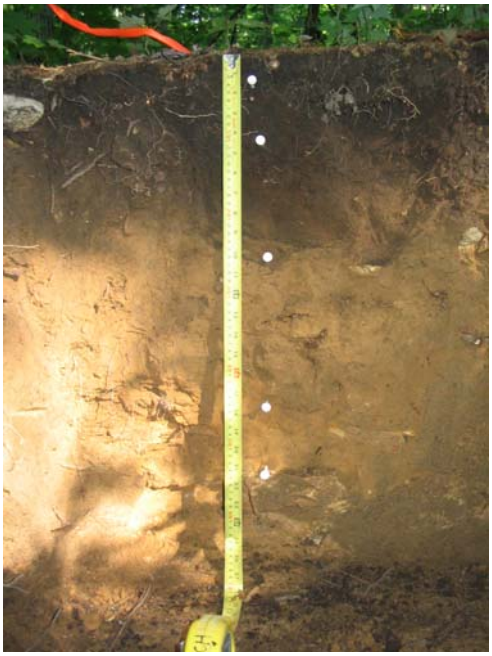
Notes: This site is located above the final log landing on FS Rd 99A. The understory contains beech seedlings, oak seedlings, and greenbrier.

Profile Number: 6
Soil Description Number: FS04WV067001
Sample Date: September 2, 2004
Soil Family: Fragic Dystrudepts
Area: Summit Lake Rec. Area FS rd. 943
Location: (GPS) NAD27 38º16.779N 80º36.683W
EPE 52ft
Natural Vegetation: White oak, yellow poplar, chestnut oak
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone, colluvium
Physiography: Allegheny Plateau (back slope)
Relief: concave
Drainage: well-drained
Elevation: 1125 m (3690 ft)
Slope: 30%
Aspect: NW
Surface stoniness: 0.01%

Site: FS04WV067001 described and sampled by Stephanie Connolly
Oi -- 5 to 0 cm (2 to 0 in).
A -- 0 to 13 cm (0 to 5 in); black (10YR 2/2) very channery loam; moderate very fine and fine granular structure; very friable; many very fine and fine, and few coarse and medium roots throughout; 40% rock fragments (30% channers, 10% gravels); clear wavy boundary.
AB-- 13 to 25.5 cm (5 to 10 in); dark yellowish brown (10YR 4/4 and 10YR 4/6) channery loam; weak fine granular and weak medium subangular blocky structure; very friable; many very fine and common fine and medium roots; 20% rock fragments (15% channers, 5% gravels); clear wavy boundary.
BA -- 25.5 to 38 cm (10 to 15 in); dark yellowish brown (10YR 4/6) very channery loam; weak medium subangular blocky structure; friable; many fine, common medium, and few coarse roots; 40% rock fragments (30% channers, 10% gravels); clear wavy boundary.
Bw1 -- 38 to 61 cm (15 to 24 in); yellowish brown (10YR 5/6) very channery loam; moderate medium subangular blocky structure; friable; common faint clay films on rock and ped faces; common fine roots; 40% rock fragments (30% channers, 10% gravels); clear wavy boundary.
Bw2 -- 61 to 91.5 cm (24 to 36 in); yellowish brown (10YR 5/6) very channery sandy loam; weak fine prismatic and weak medium subangular blocky structure; firm; few fine roots; few faint clay films on rock faces; 50% rock fragments (35% channers, 10% gravels, 5% flagstones); clear wavy boundary.
Bw3 -- 91.5 to 106.5 cm (36 to 42 in); yellowish brown (10YR 5/8) very channery sandy loam; weak medium subangular blocky structure; firm; few fine roots; 37% rock fragments (35% channers, 2% flagstones); abrupt wavy boundary.
C -- 106.5 to 129.5 cm (42 to 51 in); yellowish brown (10YR 5/8) very channery sandy loam; massive; firm; 37% rock fragments (35% channers, 2% flagstones); clear wavy boundary.

Cr -- 129.5+ cm (51+ in); paralithic sandstone.

Notes: This site is located below Forest Service Rd. 943. The understory consists of hay-scented fern, moss, red oak, white oak, mountain laurel, greenbrier, and rubus.



Profile Number: 8
Soil Description Number: FS04WV067002
Sample Date: July 29, 2004
Soil Family: Typic Dystrudepts
Area: Holcom Rd.
Location: (GPS) NAD83 38º16.225N 80º33.759W
EPE 62ft
Natural Vegetation: White oak, red oak,
sugar maple, beech
Soil Temp. Regime: mesic
Parent Material: Pottsville sandstone, residuum
Physiography: Allegheny Plateau (ridge)
Relief: concave
Drainage: well-drained
Elevation: 914.5 m (3000 ft)
Slope: 2%
Aspect: W aspect
Surface stoniness: <1%

Site: FS04WV067002 described and sampled by Stephanie Connolly and Cara Sponaugle
O -- 0 to 2.5 cm (0 to 1 in).
A -- 2.5 to 10 cm (1 to 4 in); very dark brown (10YR 2/2) loam; moderate medium granular structure; very friable; many very fine and fine roots and few medium roots; 10% stones; clear wavy boundary.
BA-- 10 to 25.5 cm (4 to 10 in); dark brown (10YR 4/3) loam; moderate medium granular and moderate medium subangular blocky structure; friable; common very fine and fine roots; 5% channers; clear wavy boundary.
Bw1 -- 25.5 to 43 cm (10 to 17 in); yellowish brown (10YR 5/6) very channery sandy loam; moderate medium subangular blocky structure; friable; few fine and medium roots throughout; 30% channers; clear wavy boundary.
Bw2 -- 43 to 53 cm (17 to 21 in); yellowish brown (10YR 5/8) extremely channery sandy loam; moderate medium subangular blocky structure; friable; few fine roots on rock faces; 60% channers; clear wavy boundary.
Cr -- 53 to 71 cm (21 to 28 in); soft sandstone.
R -- 71+cm (28+ in); sandstone.

Notes: This site is located on the ridge at the top of Holcom Rd. The understory consists of striped maple, witch hazel, red oak seedlings, greenbrier, and hay-scented fern.

Profile Number: 9
Soil Description Number: FS04WV067003
Sample Date: September 2, 2004
Soil Family: Typic Dystrudepts
Area: Morris Creek, Holcom Rd.
Location: (GPS) NAD83 38º15.548N 80º33.751W
EPE 33ft
Natural Vegetation: White oak, red oak, sugar maple, white ash
Soil Temp. Regime: mesic
Parent Material: Pottsville sandstone, residuum
Physiography: Allegheny Plateau (ridge)
Relief: concave
Drainage: moderately well drained
Elevation: 859.5 m (2820 ft)
Slope: 1%
Aspect: N
Surface stoniness: 0.1% boulders and stones

Site: FS04WV067003 described and sampled by Stephanie Connolly
Oi -- 2.5 to 0 cm (1 to 0 in). Leaf litter and very dense root mat of very fine roots.
A -- 0 to 7.5 cm (0 to 3 in); very dark brown (10YR 2/2) loam; moderate very fine and fine granular structure; very friable; many very fine and fine and few medium roots; 10% gravels; clear wavy boundary.
AB -- 7.5 to 18 cm (3 to 7 in); dark brown (10YR 4/3) loam; moderate medium granular and weak medium subangular blocky structure; friable; common fine and medium and few very fine roots; 5% gravels; clear wavy boundary.
Bw1 -- 18 to 35.5 cm (7 to 14 in); dark yellowish brown (10YR 4/6) loam; moderate medium subangular blocky structure; friable; common distinct clay skins on ped faces; common fine and coarse and few medium roots; 5% gravels; clear wavy boundary.
Bw2 -- 35.5 to 73.5 cm (14 to 29 in); yellowish brown (10YR 5/6) very bouldery loam; moderate medium subangular blocky structure; friable; common distinct clay skins on ped faces; few fine roots on rock faces; 50% boulder; clear wavy boundary.
BC -- 73.5 to 89 cm (29 to 35 in); yellowish brown (10YR 5/6) very bouldery sandy loam; weak medium subangular blocky structure; friable; common distinct light brown (10YR 6/4) depletions and weak faint strong brown (7.5YR 5/8) concentrations; 50% boulders; abrupt smooth boundary.
R -- 89+ cm (35+ in); coarse red sandstone boulder or bedrock.

Notes: This site is located above St Road 39 above the rock wall. The understory consists of blue cohosh, sugar maple seedlings, red maple seedlings, trillium, and jack-in-the-pulpit. Large pockets of A horizon material is translocated through the profile along boulders.

Profile Number: 10
Soil Description Number: FS04WV067004
Sample Date: July 13, 2004
Soil Family: Fluventic Dystrudepts
Area: FS rd 943 – Coal Siding Run
Location: (GPS) NAD83 38º16.693N 80º36.462W EPE 43ft
Natural Vegetation: Tulip poplar, yellow birch, red maple, black birch, shagbark hickory
Soil Temp. Regime: mesic
Parent Material: Pottsville sandstone, alluvium
Physiography: Allegheny Plateau (floodplain)
Relief: concave
Drainage: somewhat poorly drained
Elevation: 731.5 m (2400 ft)
Slope: 8%
Aspect: WSW aspect
Surface stoniness: 70% bouldery

Site: FS04WV067004 described and sampled by Stephanie Connolly and Cara Sponaugle
O -- 0 to 5 cm (0 to 2 in).
A -- 5 to 13 cm (2 to 5 in); dark brown (10YR 3/3) extremely bouldery silt loam; moderate medium granular structure; very friable; many very fine and fine and few coarse roots; 80% rock fragments (60% boulders, 20% cobbles); gradual wavy boundary.
BA-- 13 to 30 cm (5 to 11 in); yellowish brown (10YR 5/4) extremely bouldery silt loam; weak fine granular and moderate medium subangular blocky structure; friable; common distinct black manganese coatings on rock faces; many very fine and fine and few coarse roots around rocks; 80% rock fragments (60% boulders, 20% cobbles); gradual wavy boundary.
Bw1 -- 30 to 48 cm (11 to 19 in); yellowish brown (10YR 5/8) extremely bouldery loam; moderate medium subangular blocky structure; friable; many distinct black manganese coatings on rock faces; common very fine and fine roots around rocks; 85% rock fragments (60% boulders, 25% cobbles); gradual wavy boundary.
Bw2 -- 48 to 84 cm (19 to 33 in); yellowish brown (10YR 5/6) extremely bouldery loam; moderate medium subangular blocky structure; friable; common light yellowish brown (10YR 6/4) depletions in pores; common distinct black manganese coatings on rock faces; common very fine and fine roots around rocks; 85% rock fragments (60% boulders, 25% cobbles); gradual wavy boundary.
2Ab -- 84 to 101.5 cm (33 to 40 in); dark yellowish brown (10YR 4/4) extremely bouldery silt loam; weak medium subangular blocky structure; friable; common fine roots around rocks; 85% rock fragments (60% boulders, 25% cobbles); gradual wavy boundary.
2C1 -- 101.5 to 107 cm (40 to 42 in); dark brown (10YR 4/3) extremely bouldery loamy sand; single grain; loose; common distinct light gray (10YR 7/2) depletions and common distinct yellowish brown (10YR 5/8) concentrations; 85% rock fragments (60% boulders, 25% cobbles); gradual irregular boundary.

2C2 -- 107 to 127 cm (42 to 50 in); yellowish brown (10YR 5/6) extremely bouldery loamy sand; single grain; loose; 85% rock fragments (60% boulders, 25% cobbles); clear wavy boundary.
2C3 – 127 to 157.5+ cm (50 to 62+ in); yellowish brown (10YR 5/6) extremely bouldery sand; single grain; loose; 85% rock fragments (60% boulders, 25% cobbles).

Notes: This site is located in the Coal Siding Run floodplain off of Forest Service Rd. 943. The understory consists of rhododendron, hemlock, service berry, red maple, basswood, Frasier fir, hay-scented fern, red oak, moss, lichen, and greenbrier. The midstory consists of yellow birch, red maple, beech, sugar maple, and hemlock. The water table is located at 102 cm (40 in) with free water at 127 cm (50 in).

Profile Number: 11
Soil Description Number: FS04WV067005
Sample Date: July 14, 2004
Soil Family: Typic Fragiudepts
Area: Pocahontas Road above Richwood
Location: (GPS) NAD83 38º14.902N 80º32.391W EPE 89ft
Natural Vegetation: Chestnut oak, white oak, red oak, red maple, tulip poplar, black birch
Soil Temp. Regime: mesic
Parent Material: Pottsville sandstone, colluvium over residuum
Physiography: Allegheny Plateau (bench)
Relief: convex
Drainage: well-drained
Elevation: 881 m (2890 ft)
Slope: 20%
Aspect: SE aspect
Surface stoniness: 1%

Site: FS04WV067005 described and sampled by Stephanie Connolly and Cara Sponaugle
O -- 0 to 2.5 cm (0 to 1 in).
A -- 2.5 to 7.5 cm (1 to 3 in); very dark grayish brown (10YR 3/2) silt loam; moderate medium granular structure; very friable; many very fine and fine roots and few medium roots; 10% stones; clear wavy boundary.
AB -- 7.5 to 20 cm (3 to 8 in); dark brown (10YR 3/3) very gravelly silt loam; moderate medium granular and weak fine subangular blocky structure; very friable; many very fine to medium roots; 55% rock fragments (35% gravel, 20% channers); clear wavy boundary.
Bw1 -- 20 to 30.5 cm (8 to 12 in); dark yellowish brown (10YR 4/4) very gravelly loam; moderate medium subangular blocky parting to weak medium granular structure; very friable; common very fine roots and many fine and medium roots; 45% rock fragments (35% gravels, 10% channers); clear wavy boundary.
Bw2 -- 30.5 to 51 cm (12 to 20 in); yellowish brown (10YR 5/6) very gravelly loam; moderate medium subangular blocky structure; friable; common fine and few medium roots; common distinct clay films on rocks; 40% rock fragments (35% gravels, 5% cobbles); clear wavy boundary.
Bw3 -- 51 to 94 cm (20 to 37 in); yellowish brown (10YR 5/6) very gravelly loam; moderate coarse subangular blocky structure; friable; common distinct clay films on rock and ped faces; 50% rock fragments (40% gravel, 10% cobble); abrupt wavy boundary.
Bx1 -- 94 to 124.5 cm (37 to 49 in); yellowish brown (10YR 5/6) gravelly silt loam; weak coarse prismatic structure to moderate medium platy structure; firm; common distinct light brownish gray (10YR 6/2) depletions on ped faces and few distinct yellowish red (5YR 4/6) concentration streaks; common distinct clay films on rock and ped faces; 25 rock fragments (15% gravel, 10% cobble); clear wavy boundary.
Bx2 – 124.5 to 145 cm (49 to 57 in); strong brown (7.5YR 5/8) gravelly silt loam; weak coarse prismatic parting to moderate medium platy structure; firm; few distinct light pinkish gray (10YR 7/2) depletions and few distinct yellowish red (5YR 4/6)

concentrations; common distinct clay films on rock and ped faces; 15% gravel; clear wavy boundary.
C -- 145 to 152.5 cm (57 to 60 in); strong brown (10YR 4/6) very cobbly silt loam; massive; firm; common distinct light gray (10YR 7/1) depletions; 50% cobbles; clear wavy boundary.
2R -- 152.5+ cm (60+ in); sandstone.

Notes: This site is located below Pocahontas Road above Richwood. The understory consists of hay scented fern, greenbrier, red maple seedlings, moss, striped maple, witch hazel, red oak seedlings, sugar maple seedlings, wild yarn, chestnut oak seedlings, New York fern, black cherry seedlings, and beech regeneration. The midstory consists of beech, sugar maple, black cherry, witch hazel, black gum, and red maple.

Profile Number: 12
Soil Description Number: FS04WV067006
Sample Date: August 20, 2004
Soil Family: Aquic Dystrudepts
Area: Morris Creek, State Road 39
Location: (GPS) NAD27 38º15.200N 80º35.530W EPE 115ft
Natural Vegetation: Sugar maple, tulip poplar, red oak, hemlock
Soil Temp. Regime: mesic
Parent Material: Pottsville sandstone/ shale, colluvium
Physiography: Allegheny Plateau (foot slope)
Relief: concave
Drainage: Somewhat poorly drained
Elevation: 670.5 m (2200 ft)
Slope: 36%
Aspect: N
Surface stoniness: 0.001%

Site: FS04WV067006 described and sampled by Stephanie Connolly
Oi -- 2.5 to 0 cm (1 to 0 in).
A -- 0 to 5 cm (0 to 2 in); very dark brown (10YR 3/3) channery silt loam; moderate very fine and fine granular structure; friable; common very fine and fine roots; 20% rock fragments (5% cobbles, 5% gravels, 10% channers); clear smooth boundary.
AB -- 5 to 15 cm (2 to 6 in); dark yellowish brown (10YR 4/4) channery silt loam; weak fine subangular blocky and moderate fine granular structure; friable; common very fine and many fine and medium roots; 25% rock fragments (5% cobbles, 20% channers); clear wavy boundary.
Bw1 -- 15 to 33 cm (6 to 13 in); dark yellowish brown (10YR 4/6) very gravelly silt loam; moderate medium and weak fine subangular blocky structure; friable; few medium and coarse and medium fine roots; 35% rock fragments (20% gravels, 15% channers); clear wavy boundary.
2Bw2 -- 33 to 79 cm (13 to 31 in); dark yellowish brown (10YR 4/6) channery loam; moderate medium and coarse subangular blocky structure; firm; common distinct light brownish gray (10YR 6/2) depletions and reddish yellow (5YR 5/8) concentrations; common fine and few medium roots; 25% rock fragments (5% cobbles, 20% channers); clear wavy boundary.
2Bw3 -- 79 to 114 cm (31 to 45 in); yellowish brown (10YR 5/6) gravelly and channery sandy clay loam; moderate medium and coarse subangular blocky structure; firm; common distinct light brownish gray (10YR 6/2) depletions and reddish yellow (5YR 5/8) concentrations; few fine and medium roots; 40% rock fragments (20% gravels, 20% channers); clear wavy boundary.
2BC -- 114 to 152.5+ cm (45 to 60+ in); yellowish brown (10YR 5/6) extremely bouldery sandy clay loam; weak medium and coarse subangular blocky structure; firm;

common distinct reddish yellow (5YR 5/8) concentrations; few fine roots around rock fragments; 90% rock fragments (70% boulders, 20% cobbles).

Notes: This site is located above the state road at the bridge crossing Morris Creek. The understory is made up of witch hazel, hay scented fern, sharp lobed hepatica, Christmas fern, wood nettle, trillium, and mountain magnolia. There are several springs in the surrounding area

Profile Number: 33
Soil Description Number: FS04WV067017
Sample Date: July 29, 2004
Soil Family: Typic Dystrudepts
Area: Holcom Rd.
Location: (GPS) NAD83 38º16.963N 80º35.585W EPE 43ft
Natural Vegetation: White oak, red oak, sugar maple
Soil Temp. Regime: mesic
Parent Material: Pottsville sandstone, residuum
Physiography: Allegheny Plateau (shoulder)
Relief: convex
Drainage: well-drained
Elevation: 859.5 m (2820 ft)
Slope: 2%
Aspect: W aspect
Surface stoniness: <1%

Site: FS04WV067017 described and sampled by Stephanie Connolly and Cara Sponaugle
O -- 0 to 2.5 cm (0 to 1 in).
A1 -- 2.5 to 7.5 cm (1 to 3 in); very dark brown (10YR 2/2) loam; moderate medium granular structure; very friable; many very fine to medium roots; <5% channers; clear wavy boundary.
A2-- 7.5 to 13 cm (3 to 5 in); dark grayish brown (10YR 4/2) loam; moderate medium granular structure; very friable; many very fine to medium roots; <5% channers; clear wavy boundary.
BA -- 13 to 23 cm (5 to 9 in); dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky parting to moderate medium granular structure; friable; many very fine to medium roots; 5% channers; clear wavy boundary.
Bw -- 23 to 43 cm (9 to 17 in); yellowish brown (10YR 5/6) loam; moderate medium subangular blocky structure; friable; common fine and few medium roots; 10% channers; clear wavy boundary.
BC -- 43 to 66 cm (17 to 26 in); yellowish brown (10YR 5/8) very channery sandy loam; weak medium subangular blocky structure; very friable; few fine roots on rock faces; 40% channers; clear wavy boundary.
C -- 66 to 76 cm (26 to 30 in); yellowish brown (10YR 5/8) sandy loam; massive; very friable; few fine roots on rock faces; abrupt irregular boundary; <5% channers.
R -- 76+ cm (30+ in); sandstone.

Notes: This site is located on the ridge off of Holcom Rd in clear cut unit near FS road 908. The understory consists of rhododendron, mountain laurel, and greenbrier.

APPENDIX C
SATELLITE PIT DESCRIPTIONS

Satellite Sites – Field Descriptions

Organic layers not sampled or described in these Sites.

Site Number: 13
Soil Description Number: FS04WV025006
Sample Date: July 6, 2004
Area: Summit Lake Rec. Area below upper campground
Location: (GPS) NAD27 38º14.896N 80º26.816W EPE 30ft
Natural Vegetation: Black cherry, sugar maple, red oak
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone, colluvium
Physiography: Allegheny Plateau (side slope)
Slope: 40%
Aspect: NE
Surface Stoniness: 60%

A -- 0 to 7.5 cm (0 to 3 in); very dark gray (10YR 3/1) mucky loam; moderate medium granular structure; very friable.
BA -- 7.5 to 18 cm (3 to 7 in); very dark grayish brown (10YR 3/2) loam; moderate medium granular and moderate medium subangular blocky structure; friable.
Bt -- 18 to 25.5+ cm (7 to 10+ in); dark yellowish brown (10YR 4/6) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located down slope of campsite 21 of the upper campground at Summit Lake. The understory consists of hay-scented fern and greenbrier.

Site Number: 14
Soil Description Number: FS04WV025007
Sample Date: July 6, 2004
Area: Summit Lake Rec. Area below upper campground
Location: (GPS) NAD27 38º14.899N 80º26.797W EPE 131ft
Natural Vegetation: Black cherry, sugar maple, red oak
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone, residuum
Physiography: Allegheny Plateau (bench)
Slope: 4%
Aspect: NE
Surface Stoniness: 60%

A -- 0 to 5 cm (0 to 2 in); black (10YR 2/1) mucky loam; moderate medium granular structure; very friable.
BA -- 5 to 15 cm (2 to 6 in); dark yellowish brown (10YR 4/4) loam; moderate medium granular and moderate medium subangular blocky structure; friable.

Bw -- 15 to 25.5+ cm (6 to 10+ in); yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located down slope of campsite 21 of the upper campground at Summit Lake. The understory consists of hay-scented fern and greenbrier. There is a large rock outcrop in the slope above this site.

Site Number: 15
Soil Description Number: FS04WV025008
Sample Date: July 6, 2004
Area: Summit Lake Rec. Area upper campground
Location: (GPS) NAD27 38º15.020N 80º26.631W EPE 82ft
Natural Vegetation: Black cherry, sugar maple, striped maple, hemlock, beech
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone, alluvial
Physiography: Allegheny Plateau (alluvial)
Slope: 8%
Aspect: NE
Surface Stoniness: <0.01%

A -- 0 to 7.5 cm (0 to 3 in); very dark grayish brown (10YR 3/2) loam; moderate medium granular structure; very friable.
Bt -- 7.5 to 20+ cm (3 to 8+ in); dark yellowish brown (10YR 4/6) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off the trail above campsite 14 at the upper Summit Lake campground. The understory consists of hay-scented fern, greenbrier, striped maple seedlings, and beech seedlings.

Site Number: 16
Soil Description Number: FS04WV025009
Sample Date: July 6, 2004
Area: Summit Lake Rec. Area FS rd. 945
Location: (GPS) NAD27 38º14.778N 80º25.788W EPE 46ft
Natural Vegetation: Black cherry, sugar maple
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone, colluvium
Physiography: Allegheny Plateau (toeslope)
Slope: 18%
Aspect: NE
Surface Stoniness: <0.01%

A -- 0 to 10 cm (0 to 4 in); very dark grayish brown (10YR 3/2) silt loam; moderate medium granular structure; very friable.
Bt --10 to 20+ cm (4 to 8+ in); dark yellowish brown (10YR 4/6) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off the landing on Forest Service road 945. The understory consists of hay-scented fern, sugar maple seedlings, and violets.

Site Number: 18
Soil Description Number: FS04WV025011
Sample Date: July 28, 2004
Area: Summit Lake – FS rd 788
Location: (GPS) NAD83 38º14.533N 80º26.113W EPE 85ft
Natural Vegetation: sugar maple, beech, black cherry
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone, colluvium
Physiography: Allegheny Plateau (shoulder)
Slope: 14%
Aspect: E
Surface Stoniness: <0.01%

A -- 0 to 5 cm (0 to 2 in); very dark grayish brown (10YR 3/2) loam; moderate medium granular structure; very friable.
BA -- 5 to 20 cm (2 to 8 in); dark yellowish brown (10YR 4/4) loam; moderate medium granular and moderate medium subangular blocky structure; friable.
Bt -- 20 to 30.5+ cm (8 to 12 + in); yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Forest Service Road 788. The understory consists of hay-scented fern, forest grasses, striped maple, and sugar maple seedlings.

Site Number: 19
Soil Description Number: FS04WV025012
Sample Date: July 7, 2004
Area: Summit Lake Rec. Area above lake
Location: (GPS) NAD27 38º15.523N 80º26.105W EPE 52ft
Natural Vegetation: Black cherry, sugar maple, striped maple
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone, residuum
Physiography: Allegheny Plateau (bench)
Slope: 5%
Aspect: NE
Surface Stoniness: <0.01%

A -- 0 to 13 cm (0 to 5 in); very dark grayish brown (10YR 3/2) mucky loam; moderate medium granular structure; very friable.
Bw -- 13 to 23+ cm (5 to 9+ in); dark yellowish brown (10YR 4/6) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located above the lake off of Forest Service road 944. The understory consists of hay-scented fern. There is a "rock city" on the bench within view of the sample site.

Site Number: 20
Soil Description Number: FS04WV025013
Sample Date: July 7, 2004
Area: Summit Lake Rec. Area FS rd 99
Location: (GPS) NAD27 38º15.344N 80º25.696W EPE 72ft
Natural Vegetation: Black cherry, striped maple, hemlock, beech
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone, residuum
Physiography: Allegheny Plateau (ridge)
Slope: 14%
Aspect: NE
Surface Stoniness: <0.01%

A -- 0 to 5 cm (0 to 2 in); very dark brown (10YR 2/2) loam; moderate medium granular structure; very friable.
BA -- 5 to 10 cm (2 to 4 in); dark brown (10YR 4/3) loam; moderate medium granular and weak medium subangular blocky structure; friable.
Bt -- 10 to 23+ cm (4 to 9+ in); dark yellowish brown (10YR 4/6) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located on the ridge above Forest Service road 99. The understory consists of hay-scented fern, greenbrier, and cucumber root. There are several large boulders in the area.

Site Number: 21
Soil Description Number: FS04WV025014
Sample Date: July 7, 2004
Area: Summit Lake – FS rd 788
Location: (GPS) NAD27 38º14.545N 80º25.987W EPE 102ft
Natural Vegetation: Sugar maple, hemlock, beech
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone, colluvium
Physiography: Allegheny Plateau (midslope)
Slope: 24%
Aspect: E
Surface Stoniness: <0.01%

A -- 0 to 7.5 cm (0 to 3 in); very dark grayish brown (10YR 3/2) loam; moderate medium granular structure; very friable.
BA -- 7.5 to 25.5 cm (3 to 10 in); dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky parting to moderate medium granular structure; friable.

Bt -- 25.5 to 36+ cm (10 to 14+ in); yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located below Forest Service road 788. The understory consists of hay-scented fern, violets, and forest grasses.

Site Number: 22
Soil Description Number: FS04WV025015
Sample Date: July 7, 2004
Area: Summit Lake Rec. Area FS rd 786
Location: (GPS) NAD27 38º16.268N 80º26.512W EPE 30ft
Natural Vegetation: Black cherry, sugar maple, striped maple, basswood
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone, colluvium
Physiography: Allegheny Plateau (shoulder)
Slope: 28%
Aspect: E
Surface Stoniness: <0.01%

A -- 0 to 10 cm (0 to 4 in); very dark grayish brown (10YR 3/2) mucky loam; moderate medium granular structure; very friable.
Bt -- 10 to 25.5+ cm (4 to 10+ in); yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located below Forest Service road 786. The understory consists of hay-scented fern, forest grasses, and cherry seedlings.

Site Number: 24
Soil Description Number: FS04WV067008
Sample Date: July 27, 2004
Area: Holcom Rd before bridge
Location: (GPS) NAD83 38º15.208N 80º35.535W EPE 69ft
Natural Vegetation: sugar maple, red maple, yellow poplar, beech
Soil Temp. Regime: mesic
Parent Material: Pottsville sandstone, colluvium
Physiography: Allegheny Plateau (toeslope)
Slope: 28%
Aspect: N
Surface Stoniness: <0.01%

A -- 0 to 13 cm (0 to 5 in); very dark grayish brown (10YR 3/2) loam; moderate medium granular structure; very friable.
BA -- 13 to 28 cm (5 to 11 in); dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky parting to moderate medium granular structure; friable.
Bw -- 28 to 38+ cm (11 to 15+ in); yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located on the Holcom side of the project area. The understory consists of greenbrier, hay-scented fern, and maple seedlings, and violets.

Site Number: 25
Soil Description Number: FS04WV067009
Sample Date: July 27, 2004
Area: Holcom Rd above bridge
Location: (GPS) NAD83 38º15.317N 80º35.530W EPE 121ft
Natural Vegetation: sugar maple, red maple, birch, beech, cucumber magnolia, white oak, red oak
Soil Temp. Regime: mesic
Parent Material: Pottsville sandstone, alluvium
Physiography: Allegheny Plateau (floodplain)
Slope: 2%
Aspect: N
Surface Stoniness: <0.01%

A -- 0 to 7.5 cm (0 to 3 in); very dark grayish brown (10YR 3/2) sandy loam; weak medium granular structure; very friable.
BA -- 7.5 to 20 cm (3 to 8 in); dark brown (10YR 4/3) sandy loam; weak medium subangular blocky and moderate medium granular structure; very friable.
Bg -- 20 to 33+ cm (8 to 13+ in); dark gray (10YR 3/1) sandy loam; weak medium subangular blocky structure; very friable.

Notes: This site is located above the bridge on Holcom Rd. in the Morris Creek floodplain. The understory consists of greenbrier, NY fern, rhododendron, mountain laurel, forest grasses, and maple, beech, and oak seedlings. Other colors found in the Bwg horizon are 10YR 4/1, 10YR 4/4, and 5YR 4/6.

Site Number: 26
Soil Description Number: FS04WV067010
Sample Date: July 27, 2004
Area: Holcom Rd.
Location: (GPS) NAD83 38º15.257N 80º35.219W EPE 43ft
Natural Vegetation: sugar maple, beech, cucumber magnolia, white oak, red oak
Soil Temp. Regime: mesic
Parent Material: Pottsville sandstone, colluvium
Physiography: Allegheny Plateau (midslope)
Slope: 28%
Aspect: S
Surface Stoniness: <0.01%

A -- 0 to 10 cm (0 to 4 in); very dark grayish brown (10YR 3/2) loam; moderate medium granular structure; very friable.

BA -- 10 to 25.5 cm (4 to 10 in); dark yellowish brown (10YR 4/4) loam; weak medium subangular blocky structure; friable.
Bw -- 25.5 to 38+ cm (10 to 15+ in); yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located above Holcom road. The understory consists of witch hazel, NY fern, and maple and oak seedlings.

Site Number: 27
Soil Description Number: FS04WV067011
Sample Date: July 27, 2004
Area: Holcom Rd – headwaters of Morris Creek
Location: (GPS) NAD83 38º15.382N 80º34.174W EPE 72ft
Natural Vegetation: sugar maple, white oak, red oak, fire cherry
Soil Temp. Regime: mesic
Parent Material: Pottsville sandstone, alluvium
Physiography: Allegheny Plateau (floodplain)
Slope: 13%
Aspect: SE
Surface Stoniness: <0.01%

BA -- 0 to 13 cm (0 to 5 in); dark yellowish brown (10YR 4/4) sandy loam; weak medium subangular blocky structure; friable.
Bw -- 13 to 23+ cm (5 to 9+ in); yellowish brown (10YR 5/6) sandy loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Holcom road before the stone bridge in the headwaters of Morris Creek. The understory consists of NY fern, violets, forest grasses, trillium, and rhododendron.

Site Number: 28
Soil Description Number: FS04WV067012
Sample Date: July 27, 2004
Area: Holcom Rd.
Location: (GPS) NAD83 38º16.365N 80º33.905W EPE 62ft
Natural Vegetation: sugar maple, red maple, hickory, red oak
Soil Temp. Regime: mesic
Parent Material: Pottsville sandstone, residuum
Physiography: Allegheny Plateau (ridge)
Slope: 1%
Aspect: SW
Surface Stoniness: <0.01%

A -- 0 to 7.5 cm (0 to 3 in); very dark grayish brown (10YR 3/2) loam; moderate medium granular structure; very friable.

BA -- 7.5 to 23 cm (3 to 9 in); dark yellowish brown (10YR 4/4) loam; moderate medium granular and moderate medium subangular blocky structure; friable.
Bw -- 23 to 35.5+ cm (9 to 14+ in); yellowish brown (10YR 5/8) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Holcom Rd across from intersection with Pocahontas Rd. The understory consists of greenbrier, witch hazel, and maple seedlings.

Site Number: 29
Soil Description Number: FS04WV067013
Sample Date: July 27, 2004
Area: Holcom Rd
Location: (GPS) NAD83 38º17.148N 80º35.560W EPE 141ft
Natural Vegetation: sugar maple, red maple, beech, white oak, red oak
Soil Temp. Regime: mesic
Parent Material: Pottsville sandstone, colluvium
Physiography: Allegheny Plateau (midslope)
Slope: 33%
Aspect: NE
Surface Stoniness: <0.01%

A -- 0 to 15 cm (0 to 6 in); very dark grayish brown (10YR 3/2) loam; moderate medium granular structure; very friable.
BA -- 15 to 25.5 cm (6 to 10 in); dark yellowish brown (10YR 4/6) loam; moderate medium subangular blocky and moderate medium granular structure; friable.
Bw -- 25.5 to 41 cm (10 to 16+ in); yellowish brown (10YR 5/8) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Holcom Rd. on the right side. The understory consists of striped maple, hay-scented fern, and maple and oak seedlings.

Site Number: 30
Soil Description Number: FS04WV067014
Sample Date: July 27, 2004
Area: Holcom Rd
Location: (GPS) NAD83 38º16.556N 80º34.643W EPE 112ft
Natural Vegetation: sugar maple, red maple, yellow poplar, white oak, red oak
Soil Temp. Regime: mesic
Parent Material: Pottsville sandstone, residuum
Physiography: Allegheny Plateau (bench)
Slope: 8%
Aspect: SE
Surface Stoniness: <0.01%

A -- 0 to 5 cm (0 to 2 in); very dark grayish brown (10YR 3/2) silt loam; moderate medium granular structure; very friable.

BA -- 5 to 15 cm (2 to 6 in); dark yellowish brown (10YR 4/4) loam; moderate medium granular and moderate medium subangular blocky structure; friable.
Bw -- 15 to 25.5+ cm (6 to 10+ in); brownish yellow (10YR 6/8) loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Holcom Rd. The understory consists of greenbrier, hay-scented fern, striped maple, and maple and oak seedlings.

Site Number: 31
Soil Description Number: FS04WV067015
Sample Date: July 27, 2004
Area: County Rt. 74 above Richwood
Location: (GPS) NAD83 38º14.604N 80º32.277W EPE 66ft
Natural Vegetation: sugar maple, basswood, hickory, white oak, red oak
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone, colluvium
Physiography: Allegheny Plateau (shoulder)
Slope: 9%
Aspect: NNE
Surface Stoniness: <0.01%

A -- 0 to 13 cm (0 to 5 in); very dark brown (10YR 2/2) silt loam; moderate medium granular structure; very friable.
BA -- 13 to 33 cm (5 to 13 in); dark brown (10YR 3/3) loam; weak medium subangular blocky parting to moderate medium granular structure; friable.
Bw -- 33 to 43+ cm (13 to 17+ in); dark yellowish brown (10YR 4/4) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Holcom Rd. The understory consists of hat-scented fern, poison ivy, bloodroot, and maple, beech, and oak seedlings.

Site Number: 32
Soil Description Number: FS04WV067016
Sample Date: July 27, 2004
Area: County Rt. 74 above Richwood
Location: (GPS) NAD83 38º14.521N 80º32.376W EPE 143ft
Natural Vegetation: sugar maple, beech, white oak, red oak
Soil Temp. Regime: mesic
Parent Material: Pottsville sandstone, residuum
Physiography: Allegheny Plateau (ridge)
Slope: <1%
Aspect: NNE
Surface Stoniness: <0.01%

A -- 0 to 10 cm (0 to 4 in); very dark brown (10YR 2/2) loam; moderate medium granular structure; very friable.

BA -- 10 to 23 cm (4 to 9 in); dark yellowish brown (10YR 4/4) loam; weak medium subangular blocky parting to moderate medium granular structure; friable.
Bt -- 23 to 30.5+ cm (9 to 12+ in); yellowish brown (10YR 5/8) loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of County Rt. 74. The understory consists of greenbrier, hay-scented fern, witch hazel, striped maple, and maple and oak seedlings.

Site Number: 34
Soil Description Number: FS04WV025016
Sample Date: July 28, 2004
Area: Summit Lake – in floodplain at FS rd 944 gate
Location: (GPS) NAD83 38º14.941N 80º26.048W EPE 72ft
Natural Vegetation: birch, beech, cucumber magnolia, hemlock
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone, alluvium
Physiography: Allegheny Plateau (floodplain)
Slope: 4%
Aspect: NW
Surface Stoniness: <0.01%

A1 -- 0 to 7.5 cm (0 to 3 in); very dark brown (10YR 2/2) loam; moderate medium granular structure; very friable.
A2 -- 7.5 to 15 cm (3 to 6 in); dark grayish brown (10YR 3/2) loam; moderate medium granular structure; very friable.
Bw -- 15 to 28+ cm (6 to 11+ in); yellowish brown (10YR 5/8) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located in the floodplain at Forest Service Road 944 gate. The understory consists of hay-scented fern, forest grasses, ground pine, trillium, and violets.

Site Number: 35
Soil Description Number: FS04WV025017
Sample Date: July 28, 2004
Area: Summit Lake – FS rd 944
Location: (GPS) NAD83 38º15.234N 80º26.035W EPE 52ft
Natural Vegetation: sugar maple, beech, black cherry
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone, colluvium
Physiography: Allegheny Plateau (midslope)
Slope: 23%
Aspect: NW
Surface Stoniness: <0.01%

A -- 0 to 7.5 cm (0 to 3 in); very dark grayish brown (10YR 3/2) loam; moderate medium granular structure; very friable.

BA -- 7.5 to 23 cm (3 to 9 in); dark yellowish brown (10YR 4/4) loam; moderate medium granular and moderate medium subangular blocky structure; friable.
Bt -- 23 to 33+ cm (9 to 13+ in); yellowish brown (10YR 4/6) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Forest Service Road 944. The understory consists of hay-scented fern, striped maple, and beech seedlings.

Site Number: 36
Soil Description Number: FS04WV025018
Sample Date: July 28, 2004
Area: Summit Lake – FS rd 944
Location: (GPS) NAD83 38º15.435N 80º25.982W EPE 89ft
Natural Vegetation: red maple, beech, hemlock
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone, colluvium
Physiography: Allegheny Plateau (toeslope)
Slope: 14%
Aspect: NW
Surface Stoniness: <0.01%

A -- 0 to 10 cm (0 to 4 in); very dark grayish brown (10YR 3/2) loam; moderate medium granular structure; very friable.
Bw -- 10 to 25.5+ cm (4 to 10+ in); yellowish brown (10YR 5/8) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Forest Service Road 944. The understory consists of hay-scented fern, striped maple, and beech seedlings.

Site Number: 38
Soil Description Number: FS04WV067018
Sample Date: July 26, 2004
Area: Holcom Rd. end of FS Rd. 908
Location: (GPS) NAD83 38º16.526N 80º36.146W EPE 85ft
Natural Vegetation: Cucumber magnolia, yellow poplar, beech, sugar maple, red oak
Soil Temp. Regime: mesic
Parent Material: Pottsville sandstone, colluvium
Physiography: Allegheny Plateau (toeslope)
Slope: 14%
Aspect: NW
Surface Stoniness: <0.01%

A -- 0 to 7.5 cm (0 to 3 in); very dark brown (10YR 2/2) loam; moderate medium granular structure; very friable.
BA -- 7.5 to 20 cm (3 to 8 in); dark yellowish brown (10YR 3/4) loam; moderate medium subangular blocky parting to moderate medium granular structure; friable.

Bt -- 20 to 30.5 cm (8 to 12+ in); yellowish brown (10YR 5/6) loam; moderate medium subangular blocky structure; friable.

Notes: This site is located beyond the final log landing on Forest Service road 908. The understory consists of hay-scented fern, greenbrier, sugar maple seedlings, magnolia seedlings, and violets.

Site Number: 39
Soil Description Number: FS04WV067019
Sample Date: July 26, 2004
Area: Holcom Rd. FS Rd. 908
Location: (GPS) NAD83 38º16.512N 80º36.125W EPE 69ft
Natural Vegetation: Cucumber magnolia, yellow poplar, beech, sugar maple, red oak
Soil Temp. Regime: mesic
Parent Material: Pottsville sandstone, residuum
Physiography: Allegheny Plateau (bench)
Slope: 12%
Aspect: NW
Surface Stoniness: <0.01%

A -- 0 to 15 cm (0 to 6 in); very dark grayish brown (10YR 3/2) silt loam; moderate medium granular structure; very friable.
BA -- 15 to 33 cm (6 to 13 in); dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky and moderate medium granular structure; friable.
Bw -- 33 to 46+ cm (13 to 18+ in); yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Forest Service road 908. The understory consists of hay-scented fern, cucumber root, striped maple, sugar maple seedlings, red oak seedlings, and violets.

Site Number: 40
Soil Description Number: FS04WV067020
Sample Date: July 26, 2004
Area: Holcom Rd. FS Rd. 908
Location: (GPS) NAD83 38º16.823N 80º36.747W EPE 49ft
Natural Vegetation: red maple, white oak, red oak
Soil Temp. Regime: mesic
Parent Material: Pottsville sandstone, colluvium
Physiography: Allegheny Plateau (shoulder)
Slope: 14%
Aspect: SW
Surface Stoniness: <0.01%

A -- 0 to 10 cm (0 to 4 in); black (10YR 2/1) loam; moderate medium granular structure; very friable.

BA -- 10 to 20 cm (4 to 8 in); dark yellowish brown (10YR 3/4) sandy loam; moderate medium subangular blocky and moderate medium granular structure; friable.
Bt -- 20 to 33+ cm (8 to 13+ in); dark yellowish brown (10YR 4/4) sandy loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Forest Service road 908. The understory consists of greenbrier, mountain laurel, rhododendron, tea berry, oak seedlings, and violets.

Site Number: 41
Soil Description Number: FS04WV067021
Sample Date: July 26, 2004
Area: Holcom Rd. FS Rd. 908
Location: (GPS) NAD83 38º16.982N 80º36.488W EPE 49ft
Natural Vegetation: sugar maple, basswood, white oak, red oak
Soil Temp. Regime: mesic
Parent Material: Pottsville sandstone, residuum
Physiography: Allegheny Plateau (ridge)
Slope: 3%
Aspect: SE
Surface Stoniness: <0.01%

A -- 0 to 7.5 cm (0 to 3 in); very dark gray (10YR 3/1) loam; moderate medium granular structure; very friable.
BA -- 75 to 20 cm (3 to 8 in); dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; friable.
Bw -- 20 to 28+ cm (8 to 11+ in); yellowish brown (10YR 5/6) sandy loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Forest Service road 908. The understory consists of greenbrier, striped maple, and sugar maple seedlings.

Site Number: 42
Soil Description Number: FS04WV067022
Sample Date: July 26, 2004
Area: Holcom Rd.
Location: (GPS) NAD83 38º15.737N 80º33.722W EPE 49ft
Natural Vegetation: sugar maple, white oak, yellow poplar
Soil Temp. Regime: mesic
Parent Material: Pottsville sandstone, colluvium
Physiography: Allegheny Plateau (shoulder)
Slope: 24%
Aspect: WNW
Surface Stoniness: <0.01%

A1 -- 0 to 13 cm (0 to 5 in); black (10YR 2/1) sandy loam; moderate medium granular structure; very friable.

A2 -- 13 to 33 cm (5 to 13 in); very dark gray (10YR 3/1) sandy loam; moderate medium granular structure; very friable.
AB -- 33 to 43+ cm (13 to 17+ in); dark grayish brown (10YR 3/2) sandy loam; moderate medium subangular blocky and moderate medium granular structure; friable.

Notes: This site is located off Holcom road above the rock wall. The understory consists of hay-scented fern, NY fern, striped maple, and oak seedlings.

Site Number: 43
Soil Description Number: FS04WV067023
Sample Date: July 26, 2004
Area: Pocahontas Rd. Holcom side
Location: (GPS) NAD83 38º15.617N 80º33.583W EPE 75ft
Natural Vegetation: sugar maple, red maple, yellow poplar, white oak, red oak
Soil Temp. Regime: mesic
Parent Material: Pottsville sandstone, residuum
Physiography: Allegheny Plateau (ridge)
Slope: 3%
Aspect: NW
Surface Stoniness: <0.01%

A -- 0 to 7.5 cm (0 to 3 in); very dark grayish brown (10YR 3/2) loam; moderate medium granular structure; very friable.
BA -- 7.5 to 15 cm (3 to 6 in); dark brown (10YR 4/3) loam; weak medium subangular blocky structure; friable.
Bw -- 15 to 30.5+ cm (6 to 12+ in); yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Pocahontas road – Holcom side. The understory consists of greenbrier, NY fern, and maple and oak seedlings.

Site Number: 44
Soil Description Number: FS04WV067024
Sample Date: July 26, 2004
Area: Pocahontas road – Holcom side
Location: (GPS) NAD83 38º15.021N 80º32.397W EPE 52ft
Natural Vegetation: sugar maple, beech, white oak, red maple
Soil Temp. Regime: mesic
Parent Material: Pottsville sandstone, colluvium
Physiography: Allegheny Plateau (midslope)
Slope: 13%
Aspect: N
Surface Stoniness: <0.01%

BA -- 0 to 7.5 cm (0 to 3 in); dark brown (10YR 4/3) loam; moderate medium granular and weak medium subangular blocky structure; very friable.

Bt -- 7.5 to 20+ cm (3 to 8+ in); yellowish brown (10YR 5/4) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Pocahontas road – Holcom side. The understory consists of greenbrier, cucumber root, blood root, and beech seedlings.

Site Number: 45
Soil Description Number: FS04WV025020
Sample Date: July 28, 2004
Area: Summit Lake – FS rd 77
Location: (GPS) NAD83 38º15.030N 80º25.698W EPE 39ft
Natural Vegetation: sugar maple, beech, black cherry
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone, residuum
Physiography: Allegheny Plateau (bench)
Slope: 8%
Aspect: NNW
Surface Stoniness: <0.01%

A -- 0 to 7.5 cm (0 to 3 in); dark brown (10YR 3/3) loam; moderate medium granular structure; very friable.
BA -- 7.5 to 20 cm (3 to 8 in); dark yellowish brown (10YR 4/4) loam; moderate medium granular and weak medium subangular blocky structure; friable.
Bt -- 20 to 30.5+ cm (8 to 12+ in); yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Forest Service Road 77. The understory consists of hay-scented fern, forest grasses, striped maple, and violets.

Site Number: 46
Soil Description Number: FS04WV025021
Sample Date: July 28, 2004
Area: Summit Lake – FS rd 786
Location: (GPS) NAD83 38º16.004N 80º26.452W EPE 49ft
Natural Vegetation: sugar maple, red maple, black cherry
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone, colluvium
Physiography: Allegheny Plateau (midslope)
Slope: 26%
Aspect: NW
Surface Stoniness: <0.01%

A -- 0 to 5 cm (0 to 2 in); dark brown (10YR 3/3) loam; moderate medium granular structure; very friable.
BA -- 5 to 15 cm (2 to 6 in); dark yellowish brown (10YR 4/6) loam; weak medium subangular blocky structure; friable.

Bw -- 15 to 25.5 cm (6 to 10+ in); yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Forest Service Road 786. The understory consists of hay-scented fern, violets, striped maple, and red maple seedlings.

Site Number: 47
Soil Description Number: FS04WV101002
Sample Date: July 28, 2004
Area: Summit Lake – FS rd 99 Pocahontas Rd
Location: (GPS) NAD83 38º17.274N 80º27.080W EPE 26ft
Natural Vegetation: sugar maple, beech, black cherry
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone, residuum
Physiography: Allegheny Plateau (bench)
Slope: 3%
Aspect: N
Surface Stoniness: <0.01%

A -- 0 to 13 cm (0 to 5 in); very dark grayish brown (10YR 3/2) loam; moderate medium granular structure; very friable.
BA -- 13 to 30.5 cm (5 to 12 in); dark yellowish brown (10YR 4/4) loam; moderate medium granular and weak medium subangular blocky structure; friable.
Bt -- 30.5 to 40.5+ cm (12 to 16+ in); dark yellowish brown (10YR 4/4) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Forest Service Road 99. The understory consists of hay-scented fern, forest grasses, and sugar maple seedlings.

Site Number: 48
Soil Description Number: FS04WV067025
Sample Date: August 1, 2004
Area: Holcom Rd. – at intersection with FS rd 908
Location: (GPS) NAD83 38º17.180N 80º35.660W EPE 112ft
Natural Vegetation: hemlock, white oak, beech
Soil Temp. Regime: mesic
Parent Material: Pottsville sandstone, residuum
Physiography: Allegheny Plateau (ridge)
Slope: <1%
Aspect: NW
Surface Stoniness: <0.01%

A -- 0 to 7.5 cm (0 to 3 in); very dark grayish brown (10YR 3/2) loam; moderate medium granular structure; very friable.
BA -- (7.5 to 18 cm 3 to 7 in); dark yellowish brown (10YR 4/6) sandy loam; weak medium subangular blocky structure; friable.

Bw -- 18 to 25.5+ cm (7 to 10+ in); yellowish brown (10YR 5/6) sandy loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Holcom Rd at the intersection with FS road 908. The understory consists of hay-scented fern, greenbrier, and red maple, white oak, and beech seedlings.

Site Number: 49
Soil Description Number: FS04WV067026
Sample Date: August 1, 2004
Area: Holcom Rd.
Location: (GPS) NAD83 38º15.459N 80º33.297W EPE 39ft
Natural Vegetation: sugar maple, beech, red maple, red oak
Soil Temp. Regime: mesic
Parent Material: Pottsville sandstone, residuum
Physiography: Allegheny Plateau (ridge)
Slope: <1%
Aspect: NW
Surface Stoniness: <0.01%

A -- 0 to 13 cm (0 to 5 in); very dark brown (10YR 2/2) loam; moderate medium granular structure; very friable.
BA -- 13 to 28 cm (5 to 11 in); dark yellowish brown (10YR 4/3) loam; moderate medium subangular blocky structure; friable.
Bw -- 28 to 38+ cm (11 to 15+ in); yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Holcom Road. The understory consists of greenbrier, oak seedlings, and red maple seedlings.

Site Number: 50
Soil Description Number: FS04WV067027
Sample Date: August 1, 2004
Area: Holcom Rd.
Location: (GPS) NAD83 38º16.579N 80º34.575W EPE 43ft
Natural Vegetation: sugar maple, red maple, red maple, red oak, beech, chestnut
Soil Temp. Regime: mesic
Parent Material: Pottsville sandstone, colluvium
Physiography: Allegheny Plateau (bench)
Slope: 17%
Aspect: NNW
Surface Stoniness: <0.01%

A -- 0 to 5 cm (0 to 2 in); very dark grayish brown (10YR 3/2) loam; moderate medium granular structure; very friable.

BA -- 5 to 15 cm (2 to 6 in); dark yellowish brown (10YR 4/4) loam; moderate medium granular and moderate medium subangular blocky structure; friable.
Bt -- 15 to 28+ cm (6 to 11+ in); yellowish brown (10YR 5/8) loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Holcom Road. The understory consists of greenbrier, hay-scented fern, white oak seedlings, and red oak seedlings.

Site Number: 51
Soil Description Number: FS04WV067028
Sample Date: August 1, 2004
Area: Pocahontas Rd - Holcom
Location: (GPS) NAD83 38º15.712N 80º32.617W EPE 36ft
Natural Vegetation: sugar maple, beech
Soil Temp. Regime: mesic
Parent Material: Pottsville sandstone, colluvium
Physiography: Allegheny Plateau (midslope)
Slope: 14%
Aspect: NE
Surface Stoniness: <0.01%

A1 -- 0 to 5 cm (0 to 2 in); very dark grayish brown (10YR 3/2) loam; moderate medium granular structure; very friable.
A2 -- 5 to 20 cm (2 to 8 in); dark brown (10YR 3/3) loam; moderate medium granular structure; very friable.
Bw -- 20 to 30.5+ cm (8 to 12+ in); dark yellowish brown (10YR 4/6) loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Pocahontas Road above Holcom. The understory consists of hay-scented fern, cucumber root, beech seedlings, red oak seedlings, and sugar maple seedlings.

Site Number: 52
Soil Description Number: FS04WV067029
Sample Date: August 1, 2004
Area: Pocahontas Rd - Holcom
Location: (GPS) NAD83 38º15.004N 80º32.285W EPE 38ft
Natural Vegetation: sugar maple, beech, red oak
Soil Temp. Regime: mesic
Parent Material: Pottsville sandstone, colluvium
Physiography: Allegheny Plateau (midslope)
Slope: 18%
Aspect: W
Surface Stoniness: <0.01%

A -- 0 to 2.5 cm (0 to 1 in); dark brown (10YR 3/3) loam; moderate medium granular structure; very friable.
BA -- 2.5 to 18 cm (1 to 7 in); dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; friable.
Bw -- 18 to 30.5+ cm (7 to 12+ in); yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Pocahontas Road above Holcom. The understory consists of greenbrier, oak seedlings, maple seedlings, hay-scented fern, mountain laurel, and rhododendron.

Site Number: 53
Soil Description Number: FS04WV067030
Sample Date: August 1, 2004
Area: Pocahontas Rd. Holcom
Location: (GPS) NAD83 38º15.028N 80º32.322W EPE 46ft
Natural Vegetation: sugar maple, beech, red oak
Soil Temp. Regime: mesic
Parent Material: Pottsville sandstone, residuum
Physiography: Allegheny Plateau (bench)
Slope: 3%
Aspect: W
Surface Stoniness: <0.01%

A -- 0 to 5 cm (0 to 2 in); very dark grayish brown (10YR 3/2) loam; moderate medium granular structure; very friable.
BA -- 5 to 20 cm (2 to 8 in); dark yellowish brown (10YR 4/3) loam; moderate medium subangular blocky structure; friable.
Bt -- 20 to 33+ cm (8 to 13+ in); yellowish brown (10YR 5/4) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Pocahontas Road above Holcom. The understory consists of greenbrier, oak seedlings, maple seedlings, hay-scented fern, mountain laurel, and rhododendron.

Site Number: 54
Soil Description Number: FS04WV067031
Sample Date: August 1, 2004
Area: County Rt 74 above Richwood
Location: (GPS) NAD83 38º14.470N 80º32.346W EPE 75ft
Natural Vegetation: sugar maple, beech, red oak, white oak
Soil Temp. Regime: mesic
Parent Material: Pottsville sandstone, residuum
Physiography: Allegheny Plateau (bench)
Slope: 3%
Aspect: N

Surface Stoniness: <0.01%

A -- 0 to 5 cm (0 to 2 in); dark brown (10YR 3/3) loam; moderate medium granular structure; very friable.
BA -- 5 to 15 cm (2 to 6 in); dark yellowish brown (10YR 5/4) loam; moderate medium subangular blocky parting to moderate medium granular structure; friable.
Bw -- 15 to 25.5+ cm (6 to 10+ in); brownish yellow (10YR 6/6) loam; moderate medium subangular blocky structure; friable.

Notes: This site is located above Richwood on County Rt.74. The understory consists of greenbrier, oak seedlings, maple seedlings, hay-scented fern, witch hazel, and rhododendron.

Site Number: 55
Soil Description Number: FS04WV067032
Sample Date: August 1, 2004
Area: Holcom Rd
Location: (GPS) NAD83 38º15.262N 80º35.414W EPE 39ft
Natural Vegetation: sugar maple, beech, red oak, white oak, hemlock
Soil Temp. Regime: mesic
Parent Material: Pottsville sandstone, colluvium
Physiography: Allegheny Plateau (toeslope)
Slope: 8%
Aspect: SSW
Surface Stoniness: <0.01%

A -- 0 to 7.5 cm (0 to 3 in); dark brown (10YR 3/3) loam; moderate medium granular structure; very friable.
Bt -- 7.5 to 20+ cm (3 to 8+ in); dark yellowish brown (10YR 4/6) loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Holcom Road above intersection with FS rd 908. The understory consists of greenbrier, oak seedlings, striped maple, and poison ivy.

Site Number: 56
Soil Description Number: FS04WV025023
Sample Date: August 2, 2004
Area: Summit Lake – FS rd 943
Location: (GPS) NAD83 38º14.803N 80º25.242W EPE 82ft
Natural Vegetation: sugar maple, beech, black cherry
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone, colluvium
Physiography: Allegheny Plateau (shoulder)
Slope: 8%
Aspect: SW
Surface Stoniness: <0.01%

A -- 0 to 5 cm (0 to 2 in); dark brown (10YR 3/3) loam; moderate medium granular structure; very friable.
BA -- 5 to 15 cm (2 to 6 in); dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; friable.
Bt -- 15 to 30.5+ cm (6 to 12+ in); dark yellowish brown (10YR 4/6) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Forest Service Road 943. The understory consists of striped maple and hay-scented fern.

Site Number: 57
Soil Description Number: FS04WV025024
Sample Date: August 2, 2004
Area: Summit Lake – FS rd 943
Location: (GPS) NAD83 38º14.895N 80º25.386W EPE 92ft
Natural Vegetation: sugar maple, beech, black cherry
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone, colluvium
Physiography: Allegheny Plateau (midslope)
Slope: 22%
Aspect: SW
Surface Stoniness: <0.01%

A -- 0 to 2.5 cm (0 to 1 in); very dark grayish brown (10YR 3/2) silt loam; moderate medium granular structure; very friable.
BA -- 2.5 to 15 cm (1 to 6 in); dark yellowish brown (10YR 4/6) loam; moderate medium subangular blocky parting to moderate medium subangular blocky structure; friable.
Bw -- 15 to 25.5+ cm (6 to 10+ in); yellowish brown (10YR 5/8) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Forest Service Road 943. The understory consists of striped maple, beech seedlings, and hay-scented fern.

Site Number: 58
Soil Description Number: FS04WV025025
Sample Date: August 2, 2004
Area: Summit Lake – FS rd 943
Location: (GPS) NAD83 38º15.151N 80º25.544W EPE 33ft
Natural Vegetation: sugar maple, beech, black cherry, cucumber magnolia
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone, residuum
Physiography: Allegheny Plateau (bench)
Slope: 7%
Aspect: SW
Surface Stoniness: <0.01%

A -- 0 to 7.5 cm (0 to 3 in); very dark brown (10YR 2/2) loam; moderate medium granular structure; very friable.
BA -- 7.5 to 15 cm (3 to 6 in); dark yellowish brown (10YR 4/3) loam; moderate medium granular and moderate medium subangular blocky structure; friable.
Bt -- 15 to 28+ cm (6 to 11+ in); yellowish brown (10YR 5/6) loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Forest Service Road 943. The understory consists of striped maple, witch hazel, ground pine, and hay-scented fern. The water table is found at 12 in.

Site Number: 59
Soil Description Number: FS04WV067033
Sample Date: August 2, 2004
Area: Morris Creek – FS rd 99A
Location: (GPS) NAD83 38º16.232N 80º27.857W EPE 33ft
Natural Vegetation: hickory, red oak
Soil Temp. Regime: mesic
Parent Material: Pottsville sandstone, colluvium/alluvium
Physiography: Allegheny Plateau (floodplain)
Slope: 5%
Aspect: S
Surface Stoniness: <0.01%

A1 -- 0 to 10 cm (0 to 4 in); very dark brown (10YR 2/2) loam; moderate medium granular structure; very friable.
A2 -- 10 to 15 cm (4 to 6 in); dark brown (10YR 3/3) loam; moderate medium granular structure; very friable.
BA -- 15 to 23+ cm (6 to 9+ in); dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Forest Service Road 99A. The understory consists of striped maple, hay-scented fern, greenbrier, witch hazel, and maple, beech, and oak seedlings.

Site Number: 60
Soil Description Number: FS04WV067034
Sample Date: August 2, 2004
Area: Summit Lake – FS rd 99A
Location: (GPS) NAD83 38º16.241N 80º27.964W EPE 43ft
Natural Vegetation: yellow poplar, red oak, red maple, beech
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone, colluvium
Physiography: Allegheny Plateau (midslope)
Slope: 18%

Aspect: SE
Surface Stoniness: <0.01%

A -- 0 to 7.5 cm (0 to 3 in); very dark grayish brown (10YR 3/2) loam; moderate medium granular structure; very friable.
BA -- 7.5 to 20 cm (3 to 8 in); dark yellowish brown (10YR 4/3) loam; moderate medium granular and moderate medium subangular blocky structure; friable.
Bt -- 20 to 33+ cm (8 to 13+ in); yellowish brown (10YR 5/6) loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Forest Service Road 99A. The understory consists of striped maple, greenbrier, and beech, maple, and oak seedlings.

Site Number: 61
Soil Description Number: FS04WV101003
Sample Date: August 2, 2004
Area: Summit Lake – FS rd 99
Location: (GPS) NAD83 38º16.372N 80º28.036W EPE 36ft
Natural Vegetation: sugar maple, red maple, red oak, yellow poplar
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone, colluvium
Physiography: Allegheny Plateau (midslope)
Slope: 17%
Aspect: S
Surface Stoniness: <0.01%

A -- 0 to 5 cm (0 to 2 in); dark brown (10YR 3/3) loam; moderate medium granular structure; very friable.
BA -- 5 to 15 cm (2 to 6 in); dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; friable.
Bt -- 15 to 25.5+ cm (6 to 10+ in); yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Forest Service Road 943. The understory consists of striped maple and hay-scented fern.

Site Number: 62
Soil Description Number: FS04WV101004
Sample Date: August 2, 2004
Area: Summit Lake – FS rd 99
Location: (GPS) NAD83 38º16.548N 80º27.685W EPE 43ft
Natural Vegetation: sugar maple, red maple, black cherry, hickory, red oak
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone, residuum
Physiography: Allegheny Plateau (ridge)
Slope: 2%

Aspect: SE
Surface Stoniness: <0.01%

A -- 0 to 7.5 cm (0 to 3 in); very dark brown (10YR 2/2) silt loam; moderate medium granular structure; very friable.
BA -- 7.5 to 18 cm (3 to 7 in); dark yellowish brown (10YR 4/3) silt loam; moderate medium subangular blocky parting to moderate medium granular structure; friable.
Bt -- 18 to 30.5+ cm (7 to 12+ in); yellowish brown (10YR 5/6) loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Forest Service Road 99. The understory consists of hay-scented fern, forest grasses, and red maple seedlings.

Site Number: 63
Soil Description Number: FS04WV101005
Sample Date: August 2, 2004
Area: Summit Lake – FS rd 99
Location: (GPS) NAD83 38º17.030N 80º27.585W EPE 43ft
Natural Vegetation: sugar maple, beech, black cherry
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone, colluvium
Physiography: Allegheny Plateau (bench)
Slope: 4%
Aspect: SE
Surface Stoniness: <0.01%

1A1 -- 0 to 10 cm (0 to 4 in); very dark grayish brown (10YR 3/2) sandy loam; moderate medium granular structure; very friable.
1A2 -- 10 to 30.5 cm (4 to 12 in); dark brown (10YR 3/3) sandy loam; moderate medium granular blocky structure; friable.
2Ab -- 30.5 to 43+ cm (12 to 17+ in); very dark brown (10YR 2/2) silt loam; moderate medium granular structure; friable.

Notes: This site is located off of Forest Service Road 99. The understory consists of striped maple, hay-scented fern, violets, witch hazel, and maple and beech seedlings.

Site Number: 64
Soil Description Number: FS04WV101006
Sample Date: August 2, 2004
Area: Summit Lake – FS rd 99
Location: (GPS) NAD83 38º16.388N 80º26.418W EPE 62ft
Natural Vegetation: sugar maple, beech, black cherry, red oak
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone, residuum
Physiography: Allegheny Plateau (bench)
Slope: 5%

Aspect: W
Surface Stoniness: <0.01%

A -- 0 to 5 cm (0 to 2 in); dark brown (10YR 3/3) loam; moderate medium granular structure; very friable.
BA -- 5 to 20 cm (2 to 8 in); dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky parting to moderate medium granular structure; friable.
Bt -- 20 to 33+ cm (8 to 13+ in); yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Forest Service Road 99. The understory consists of striped maple, hay-scented fern, violets, and forest grasses.

Site Number: 65
Soil Description Number: FS04WV025026
Sample Date: August 4, 2004
Area: Summit Lake – lake path
Location: (GPS) NAD83 38º15.419N 80º26.326W EPE 105ft
Natural Vegetation: Beech, red oak, red maple, black cherry
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone, colluvium
Physiography: Allegheny Plateau (toeslope)
Slope: 2%
Aspect: E
Surface Stoniness: <0.01%

A -- 0 to 10 cm (0 to 4 in); dark brown (10YR 3/3) loam; moderate medium granular structure; very friable.
BA -- 10 to 23 cm (4 to 9 in); dark yellowish brown (10YR 5/4) loam; moderate medium subangular blocky parting to moderate medium granular structure; friable.
Bt -- 23 to 35.5+ cm (9 to 14+ in); yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located west of Summit Lake along the path bordering the lake. The understory consists of hay-scented fern, striped maple, cucumber root, and beech, maple, and cherry seedlings. There are white 10YR 7/1 mottles in the BA horizon only.

Site Number: 66
Soil Description Number: FS04WV025027
Sample Date: August 4, 2004
Area: Summit Lake – lake path
Location: (GPS) NAD83 38º15.1N42 80º26.313W EPE 105ft
Natural Vegetation: Beech, red oak, red maple, black cherry
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone, colluvium
Physiography: Allegheny Plateau (toeslope)

Slope: 6%
Aspect: E
Surface Stoniness: <0.01%

A -- 0 to 5 cm (0 to 2 in); dark brown (10YR 3/3) mucky loam; moderate medium granular structure; very friable.
BA -- 5 to 10 cm (2 to 4 in); dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky parting to moderate medium granular structure; friable.
Bt -- 10 to 20+ cm (4 to 8+ in); yellowish brown (10YR 5/8) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located west of Summit Lake along the path that borders the lake. The understory consists of hay-scented fern, striped maple, forest grasses, and beech, maple, and oak seedlings.

Site Number: 67
Soil Description Number: FS04WV025022
Sample Date: July 28, 2004
Area: Summit Lake – FS rd 786
Location: (GPS) NAD83 38º15.849N 80º26.517W EPE 85ft
Natural Vegetation: sugar maple, beech, black cherry
Soil Temp. Regime: frigid
Parent Material: Pottsville sandstone, residuum
Physiography: Allegheny Plateau (ridge)
Slope: <1%
Aspect: NW
Surface Stoniness: <0.01%

A -- 0 to 10 cm (0 to 4 in); very dark grayish brown (10YR 3/2) loam; moderate medium granular structure; very friable.
Bt -- 10 to 23+ cm (4 to 9+ in); dark yellowish brown (10YR 4/6) clay loam; moderate medium subangular blocky structure; friable.

Notes: This site is located off of Forest Service Road 786. The understory consists of forest grasses, striped maple, and sugar maple seedlings.

APPENDIX D
PHYSICAL PROPERTIES DATA

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Sand %	Silt %	Clay %	Texture	Bulk Density g cm^{-3} Clod	Bulk Density g cm^{-3} Frame
69	FS04WV025001A1	East	Back slope	38	38	24	Loam		0.26
	FS04WV025001A2	East	Back slope	37	37	25	Loam		0.63
	FS04WV025001AB	East	Back slope	35	34	31	Clay Loam		1.13
	FS04WV025001Bw1	East	Back slope	43	33	24	Loam	1.36	
	FS04WV025001Bw2	East	Back slope	43	33	24	Loam	1.26	
	FS04WV025001Bw3	East	Back slope	51	29	20	Loam	1.00	
	FS04WV025001Bw4	East	Back slope	62	24	14	Sandy Loam	1.19	
	FS04WV025001BC	East	Back slope	67	25	8	Sandy Loam	1.11	
71	FS04WV025002A	East	Back slope	21	50	30	Clay Loam		0.68
	FS04WV025002AB	East	Back slope	23	51	26	Silt Loam	1.01	0.72
	FS04WV025002Bw1	East	Back slope	26	44	30	Clay Loam	1.01	
	FS04WV025002Bw2	East	Back slope	25	46	29	Clay Loam	1.03	
	FS04WV025002Bw3	East	Back slope	31	44	26	Loam	1.30	
	FS04WV025002BC1	East	Back slope	31	49	20	Loam	1.20	
	FS04WV025002BC2	East	Back slope	27	51	22	Silt Loam	1.26	
73	FS04WV025003A	East	Ridge	8	58	33	Silty Clay Loam		1.15
	FS04WV025003Bw1	East	Ridge	10	60	30	Silty Clay Loam	1.17	
	FS04WV025003Bw2	East	Ridge	14	57	29	Silty Clay Loam	1.37	
	FS04WV025003Bx1	East	Ridge	13	69	18	Silt Loam	1.50	
	FS04WV025003Bx2	East	Ridge	11	65	23	Silt Loam	1.77	
75	FS04WV025004A	East	Foot	37	42	21	Loam		1.23
	FS04WV025004AB	East	Foot	32	52	16	Silt Loam	1.09	
	FS04WV025004Bw1	East	Foot	27	49	24	Loam	1.02	
	FS04WV025004Bw2	East	Foot	26	56	18	Silt Loam	1.40	
	FS04WV025004Bw3	East	Foot	34	50	17	Loam	1.47	
	FS04WV025004Bw4	East	Foot	42	40	18	Loam	1.63	
	FS04WV025004Bx	East	Foot	33	49	18	Loam	1.60	
	FS04WV025004BC	East	Foot	44	43	13	Loam	1.62	
77	FS04WV025005A	East	Bench	26	53	21	Silt Loam		0.36
	FS04WV025005AB	East	Bench	25	39	36	Silt Loam	0.78	
	FS04WV025005Bw1	East	Bench	20	47	33	Silty Clay Loam	1.03	

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Sand %	Silt %	Clay %	Texture	Bulk Density g cm^{-3} Clod	Bulk Density g cm^{-3} Frame
	FS04WV025005Bw2	East	Bench	23	51	26	Loam	1.50	
	FS04WV025005Bx1	East	Bench	28	51	22	Loam	1.48	
	FS04WV025005Bx2	East	Bench	34	45	22	Loam	1.62	
	FS04WV025005Bx3	East	Bench	21	47	31	Clay Loam	1.72	
	FS04WV025005BC	East	Bench	15	45	40	Clay	1.65	
79	FS04WV025010A/E	East	Shoulder	13	69	18	Silt Loam		0.91
	FS04WV025010BA	East	Shoulder					1.32	
	FS04WV025010Bt	East	Shoulder	13	46	41	Silty Clay Loam	1.46	
	FS04WV025010Btx1	East	Shoulder	24	57	19	Silt Loam	1.58	
	FS04WV025010Btx2	East	Shoulder	21	51	28	Clay Loam	1.58	
	FS04WV025010BC	East	Shoulder	13	55	32	Silty Clay Loam	1.58	
81	FS04WV025019A	East	Floodplain						
	FS04WV025019Bw1	East	Floodplain	49	27	24	Loam		
	FS04WV025019Bw2	East	Floodplain	45	31	24	Loam		
	FS04WV025019Bw3	East	Floodplain	50	36	14	Loam		
	FS04WV025019BC	East	Floodplain	38	47	15	Loam		
83	FS04WV101001A	East	Ridge	11	66	23	Silt Loam		0.51
	FS04WV101001BA	East	Ridge	13	58	29	Silty Clay Loam		0.91
	FS04WV101001Bt1	East	Ridge	49	22	29	Sandy Clay Loam	1.40	
	FS04WV101001Bt2	East	Ridge	13	61	26	Silt Loam	0.95	
	FS04WV101001Bt3	East	Ridge	13	70	17	Silt Loam	1.33	
84	FS04WV067007A	East	Shoulder	34	46	20	Loam		0.38
	FS04WV067007BA	East	Shoulder	30	58	12	Silt Loam	1.04	
	FS04WV067007Bw1	East	Shoulder	33	52	15	Silt Loam	1.07	
	FS04WV067007Bw2	East	Shoulder	29	55	16	Silt Loam	1.12	
	FS04WV067007Bw3	East	Shoulder	32	60	8	Silt Loam	1.21	
	FS04WV067007BC	East	Shoulder	35	54	11	Silt Loam	1.37	
85	FS04WV067001A	West	Back slope	39	49	12	Loam		0.49
	FS04WV067001AB	West	Back slope	43	44	13	Loam	1.48	
	FS04WV067001BA	West	Back slope	44	43	13	Loam	1.56	
	FS04WV067001Bw1	West	Back slope	45	41	14	Loam	1.55	
	FS04WV067001Bw2	West	Back slope	61	23	16	Sandy Loam	1.27	
	FS04WV067001BC	West	Back slope	61	27	12	Sandy Loam	1.58	
	FS04WV067001C	West	Back slope	65	27	8	Sandy Loam	1.82	

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Sand %	Silt %	Clay %	Texture	Bulk Density g cm^{-3} Clod	Bulk Density g cm^{-3} Frame
87	FS04WV067002A	West	Ridge	42	38	20	Loam	1.15	0.74
	FS04WV067002BA	West	Ridge	52	32	15	Sandy Loam	1.30	
	FS04WV067002Bw1	West	Ridge	55	31	14	Sandy Loam	1.36	
	FS04WV067002Bw2	West	Ridge	62	28	10	Sandy Loam	1.50	
88	FS04WV067003A	West	Ridge	35	49	15	Loam	0.85	0.62
	FS04WV067003AB	West	Ridge	38	43	19	Loam	1.09	
	FS04WV067003Bw1	West	Ridge	42	40	18	Loam	1.55	
	FS04WV067003Bw2	West	Ridge	46	44	10	Loam	1.68	
	FS04WV067003BC	West	Ridge	43	38	18	Loam	1.75	
89	FS04WV067004A	West	Floodplain	61	28	11	Sandy Loam	1.11	0.70
	FS04WV067004BA	West	Floodplain	52	31	16	Sandy Loam	1.28	
	FS04WV067004Bw1	West	Floodplain	48	32	19	Loam	1.22	
	FS04WV067004Bw2	West	Floodplain	32	33	35	Clay Loam	1.43	
	FS04WV067004Ab	West	Floodplain	49	37	14	Loam		
	FS04WV067004C1	West	Floodplain	65	30	6	Sandy Loam		
	FS04WV067004C2	West	Floodplain	79	13	8	Loamy Sand		
	FS04WV067004C3	West	Floodplain	74	17	10	Sandy Loam		
91	FS04WV067005A	West	Bench	45	43	12	Loam		0.56
	FS04WV067005AB	West	Bench	47	39	14	Loam	1.22	
	FS04WV067005Bw1	West	Bench	45	33	22	Loam	1.39	
	FS04WV067005Bw2	West	Bench					1.44	
	FS04WV067005Bw3	West	Bench	58	32	10	Sandy Loam	1.50	
	FS04WV067005Bx1	West	Bench	26	63	11	Silt Loam	1.68	
	FS04WV067005Bx2	West	Bench	13	62	25	Silt Loam	1.71	
	FS04WV067005C	West	Bench	33	52	16	Silt Loam	1.73	
93	FS04WV067006A	West	Foot	19	50	31	Silty Clay Loam		0.58
	FS04WV067006AB	West	Foot	23	47	30	Clay Loam	1.00	
	FS04WV067006Bw1	West	Foot	18	58	24	Silt Loam	1.27	
	FS04WV067006Bw2	West	Foot	19	52	30	Silty Clay Loam	1.42	
	FS04WV067006Bw3	West	Foot	27	56	17	Silt Loam	1.47	
	FS04WV067006BC	West	Foot	31	54	16	Silt Loam	1.43	
95	FS04WV067017A1	West	Shoulder	49	40	11	Loam		0.56
	FS04WV067017A2	West	Shoulder	47	42	11	Loam		0.77
	FS04WV067017BA	West	Shoulder	44	40	16	Loam	1.21	
	FS04WV067017Bw	West	Shoulder	43	37	20	Loam	1.25	

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Sand %	Silt %	Clay %	Texture	Bulk Density g cm^{-3} Clod	Bulk Density g cm^{-3} Frame
	FS04WV067017BC	West	Shoulder	12	72	17	Silt Loam	1.43	
	FS04WV067017C	West	Shoulder	59	31	10	Sandy Loam	1.63	
96	FS04WV025006A	East	Back slope	52	37	11	Loam		
	FS04WV025006BA	East	Back slope	46	41	13	Loam		
	FS04WV025006Bt	East	Back slope	43	37	20	Loam		
96	FS04WV025007A	East	Bench	46	35	18	Loam		
	FS04WV025007BA	East	Bench	46	33	21	Loam		
	FS04WV025007Bw	East	Bench	52	32	16	Loam		
97	FS04WV025008A	East	Floodplain	22	43	35	Clay Loam		
	FS04WV025008Bt	East	Floodplain	23	36	41	Clay		
97	FS04WV025009A	East	Foot	22	55	23	Silt Loam		
	FS04WV025009Bt	East	Foot	13	51	37	Silty Clay Loam		
98	FS04WV025011A	East	Shoulder	22	43	34	Clay Loam		
	FS04WV025011BA	East	Shoulder	23	49	28	Clay Loam		
	FS04WV025011Bt	East	Shoulder	34	44	22	Loam		
98	FS04WV025012A	East	Bench	19	49	31	Clay Loam		
	FS04WV025012Bw	East	Bench	32	47	22	Loam		
99	FS04WV025013A	East	Ridge	60	25	15	Sandy Loam		
	FS04WV025013BA	East	Ridge	48	35	17	Loam		
	FS04WV025013Bt	East	Ridge	18	46	36	Clay Loam		
99	FS04WV025014A	East	Back slope						
	FS04WV025014BA	East	Back slope	14	55	31	Silty Clay Loam		
	FS04WV025014Bt	East	Back slope	12	51	37	Silty Clay Loam		
100	FS04WV025015A	East	Shoulder	22	49	28	Clay Loam		
	FS04WV025015Bt	East	Shoulder	15	52	33	Silty Clay Loam		
100	FS04WV067008A	West	Foot	23	57	20	Silt Loam		
	FS04WV067008BA	West	Foot	17	59	24	Silt Loam		
	FS04WV067008Bw	West	Foot	20	56	24	Silt Loam		

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Sand %	Silt %	Clay %	Texture	Bulk Density g cm^{-3} Clod	Bulk Density g cm^{-3} Frame
101	FS04WV067009A	West	Floodplain	54	38	8	Sandy Loam		
	FS04WV067009BA	West	Floodplain	74	19	7	Sandy Loam		
	FS04WV067009Bg	West	Floodplain	65	30	5	Sandy Loam		
101	FS04WV067010A	West	Back slope	31	46	23	Loam		
	FS04WV067010BA	West	Back slope	28	47	25	Loam		
	FS04WV067010Bw	West	Back slope	32	50	18	Silt Loam		
102	FS04WV067011BA	West	Floodplain	54	37	9	Sandy Loam		
	FS04WV067011Bw	West	Floodplain	71	24	5	Sandy Loam		
102	FS04WV067012A	West	Ridge	8	71	21	Silt Loam		
	FS04WV067012BA	West	Ridge						
	FS04WV067012Bw	West	Ridge	9	64	27	Silt Loam		
103	FS04WV067013A	West	Back slope	54	34	11	Sandy Loam		
	FS04WV067013BA	West	Back slope	51	37	12	Loam		
	FS04WV067013Bw	West	Back slope	51	39	11	Loam		
103	FS04WV067014A	West	Bench	19	66	15	Silt Loam		
	FS04WV067014BA	West	Bench	20	55	25	Silt Loam		
	FS04WV067014Bw	West	Bench	23	53	25	Silt Loam		
104	FS04WV067015A	West	Shoulder	35	38	27	Loam		
	FS04WV067015BA	West	Shoulder	39	36	25	Loam		
	FS04WV067015Bw	West	Shoulder	33	51	16	Silt Loam		
104	FS04WV067016A	West	Ridge	52	39	10	Loam		
	FS04WV067016BA	West	Ridge	48	39	13	Loam		
	FS04WV067016Bt	West	Ridge	49	36	15	Loam		
105	FS04WV025016A1	East	Floodplain	41	19	40	Clay		
	FS04WV025016A2	East	Floodplain	32	43	26	Loam		
	FS04WV025016Bw	East	Floodplain	42	40	18	Loam		
105	FS04WV025017A	East	Back slope	37	32	31	Clay Loam		
	FS04WV025017BA	East	Back slope	16	48	35	Silty Clay Loam		
	FS04WV025017Bt	East	Back slope	11	48	41	Silty Clay		
106	FS04WV025018A	East	Foot	27	46	27	Clay Loam		
	FS04WV025018Bw	East	Foot	29	47	24	Loam		

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Sand %	Silt %	Clay %	Texture	Bulk Density g cm^{-3} Clod	Bulk Density g cm^{-3} Frame
106	FS04WV067018A	West	Foot	53	32	15	Sandy Loam		
	FS04WV067018BA	West	Foot	54	35	11	Sandy Loam		
	FS04WV067018Bt	West	Foot	54	35	12	Sandy Loam		
107	FS04WV067019A	West	Bench	37	48	15	Loam		
	FS04WV067019BA	West	Bench	37	40	23	Loam		
	FS04WV067019Bw	West	Bench	37	56	7	Silt Loam		
107	FS04WV067020A	West	Shoulder	58	35	6	Sandy Loam		
	FS04WV067020BA	West	Shoulder	60	30	10	Sandy Loam		
	FS04WV067020Bt	West	Shoulder	56	31	13	Sandy Loam		
108	FS04WV067021A	West	Ridge	46	39	15	Loam		
	FS04WV067021BA	West	Ridge	44	42	14	Loam		
	FS04WV067021Bw	West	Ridge	42	45	13	Loam		
108	FS04WV067022A1	West	Shoulder	82	12	6	Loamy Sand		
	FS04WV067022A2	West	Shoulder	84	13	3	Loamy Sand		
	FS04WV067022AB	West	Shoulder	82	16	2	Loamy Sand		
109	FS04WV067023A	West	Ridge	27	51	22	Silt Loam		
	FS04WV067023BA	West	Ridge	32	38	30	Clay Loam		
	FS04WV067023Bw	West	Ridge	27	46	26	Loam		
109	FS04WV067024BA	West	Back slope	18	57	25	Silt Loam		
	FS04WV067024Bt	West	Back slope	19	54	28	Silty Clay Loam		
110	FS04WV025020A	East	Bench	43	40	16	Loam		
	FS04WV025020BA	East	Bench	62	20	18	Sandy Loam		
	FS04WV025020Bt	East	Bench	32	38	30	Clay Loam		
110	FS04WV025021A	East	Back slope	19	50	31	Silty Clay Loam		
	FS04WV025021BA	East	Back slope	15	44	41	Silty Clay		
	FS04WV025021Bw	East	Back slope	16	53	31	Silty Clay Loam		
111	FS04WV101002A	East	Ridge	7	71	23	Silt Loam		
	FS04WV101002BA	East	Ridge	23	44	33	Clay Loam		
	FS04WV101002Bt	East	Ridge	12	51	37	Silty Clay Loam		

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Sand %	Silt %	Clay %	Texture	Bulk Density g cm^{-3} Clod	Bulk Density g cm^{-3} Frame
111	FS04WV067025A	West	Ridge	65	22	12	Sandy Loam		
	FS04WV067025BA	West	Ridge	50	36	14	Loam		
	FS04WV067025Bw	West	Ridge	60	24	16	Sandy Loam		
112	FS04WV067026A	West	Ridge	36	63	1	Silt Loam		
	FS04WV067026BA	West	Ridge	36	47	17	Loam		
	FS04WV067026Bw	West	Ridge	40	45	15	Loam		
112	FS04WV067027A	West	Shoulder	50	32	18	Loam		
	FS04WV067027BA	West	Shoulder	48	36	16	Loam		
	FS04WV067027Bt	West	Shoulder	43	38	19	Loam		
113	FS04WV067028A1	West	Back slope	35	46	19	Loam		
	FS04WV067028A2	West	Back slope	34	39	27	Loam		
	FS04WV067028Bw	West	Back slope	36	42	22	Loam		
113	FS04WV067029A	West	Back slope	34	46	20	Loam		
	FS04WV067029BA	West	Back slope	42	39	19	Loam		
	FS04WV067029Bw	West	Back slope	44	37	19	Loam		
114	FS04WV067030A	West	Bench	30	47	23	Loam		
	FS04WV067030BA	West	Bench	22	56	22	Silt Loam		
	FS04WV067030Bt	West	Bench	20	52	28	Silty Clay Loam		
114	FS04WV067031A	West	Bench	35	45	20	Loam		
	FS04WV067031BA	West	Bench	33	46	21	Loam		
	FS04WV067031Bw	West	Bench	34	45	21	Loam		
115	FS04WV067032A	West	Foot	51	35	13	Loam		
	FS04WV067032Bt	West	Foot	52	27	21	Sandy Clay Loam		
115	FS04WV025023A	East	Shoulder	11	58	31	Silty Clay Loam		
	FS04WV025023BA	East	Shoulder	9	54	37	Silty Clay Loam		
	FS04WV025023Bt	East	Shoulder	10	46	44	Silty Clay		
116	FS04WV025024A	East	Back slope	33	55	12	Silt Loam		
	FS04WV025024BA	East	Back slope	35	34	31	Clay Loam		
	FS04WV025024Bw	East	Back slope	35	41	23	Loam		

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Sand %	Silt %	Clay %	Texture	Bulk Density g cm^{-3} Clod	Bulk Density g cm^{-3} Frame
116	FS04WV025025A	East	Bench	35	43	22	Loam		
	FS04WV025025BA	East	Bench	38	35	27	Loam		
	FS04WV025025Bt	East	Bench	36	33	31	Clay Loam		
117	FS04WV067033A1	East	Floodplain	39	37	25	Loam		
	FS04WV067033A2	East	Floodplain	43	33	24	Loam		
	FS04WV067033BA	East	Floodplain	44	32	24	Loam		
117	FS04WV067034A	East	Back slope	32	53	15	Silt Loam		
	FS04WV067034BA	East	Back slope	33	45	22	Loam		
	FS04WV067034Bt	East	Back slope	32	45	23	Loam		
118	FS04WV101003A	East	Back slope	33	41	26	Loam		
	FS04WV101003BA	East	Back slope	32	35	34	Clay Loam		
	FS04WV101003Bt	East	Back slope	23	43	34	Clay Loam		
118	FS04WV101004A	East	Ridge	43	39	18	Loam		
	FS04WV101004BA	East	Ridge	38	37	25	Loam		
	FS04WV101004Bt	East	Ridge	12	59	29	Silty Clay Loam		
119	FS04WV101005A1	East	Bench	74	25	1	Loamy Sand		
	FS04WV101005A2	East	Bench	68	23	10	Sandy Loam		
	FS04WV101005Ab	East	Bench	53	33	14	Sandy Loam		
119	FS04WV101006A	East	Bench	18	54	29	Silty Clay Loam		
	FS04WV101006BA	East	Bench	38	39	23	Loam		
	FS04WV101006Bt	East	Bench	12	60	29	Silty Clay Loam		
120	FS04WV025026A	East	Foot	37	48	15	Loam		
	FS04WV025026BA	East	Foot	29	42	29	Clay Loam		
120	FS04WV025027A	East	Foot	30	50	20	Loam		
	FS04WV025027BA	East	Foot	27	46	27	Clay Loam		
	FS04WV025027Bt	East	Foot	27	41	31	Clay Loam		
121	FS04WV025022A	East	Ridge	18	71	11	Silt Loam		
	FS04WV025022Bt	East	Ridge	28	52	19	Silt Loam		

APPENDIX E
ACIDITY AND BUFFERING DATA

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	soil pH	acidity meq/100g	ECEC meq/100g	BSECEC
69	FS04WV025001A1	East	Back slope	3.6	9.6	15.6	38.3
	FS04WV025001A2	East	Back slope	3.4	9.6	11.5	16.4
	FS04WV025001AB	East	Back slope	3.7	12.4	13.0	4.6
	FS04WV025001Bw1	East	Back slope	4.5	5.2	5.4	4.5
	FS04WV025001Bw2	East	Back slope	4.6	3.6	3.8	5.9
	FS04WV025001Bw3	East	Back slope	4.5	3.6	3.8	5.4
	FS04WV025001Bw4	East	Back slope	4.6	2.8	3.0	5.5
	FS04WV025001BC	East	Back slope	4.7	2.4	2.6	6.5
71	FS04WV025002A	East	Back slope	3.9	10.0	12.0	16.4
	FS04WV025002AB	East	Back slope	4.3	7.2	7.8	7.1
	FS04WV025002Bw1	East	Back slope	4.5	6.0	6.3	5.2
	FS04WV025002Bw2	East	Back slope	4.6	5.6	6.1	7.5
	FS04WV025002Bw3	East	Back slope	4.5	5.6	5.9	4.5
	FS04WV025002BC1	East	Back slope	4.5	5.6	5.9	4.9
	FS04WV025002BC2	East	Back slope	4.6	5.2	5.4	4.5
73	FS04WV025003A	East	Ridge	3.5	13.2	14.3	7.6
	FS04WV025003Bw1	East	Ridge	4.1	10.0	10.4	3.8
	FS04WV025003Bw2	East	Ridge	4.5	6.0	6.2	3.8
	FS04WV025003Bx1	East	Ridge	4.5	4.4	4.6	5.0
	FS04WV025003Bx2	East	Ridge	4.5	6.4	6.7	3.8
75	FS04WV025004A	East	Foot	3.5	7.2	9.1	20.4
	FS04WV025004AB	East	Foot	3.6	9.2	9.9	6.8
	FS04WV025004Bw1	East	Foot	4.2	6.0	6.3	5.2
	FS04WV025004Bw2	East	Foot	4.6	2.8	3.0	6.4
	FS04WV025004Bw3	East	Foot	4.5	2.8	3.0	7.0
	FS04WV025004Bw4	East	Foot	4.6	3.6	3.8	6.2
	FS04WV025004Bx	East	Foot	4.7	4.0	4.3	6.0
	FS04WV025004BC	East	Foot	4.7	3.6	3.9	7.3
77	FS04WV025005A	East	Bench	3.5	11.6	13.1	11.6
	FS04WV025005AB	East	Bench	3.7	16.4	17.0	3.6
	FS04WV025005Bw1	East	Bench	4.4	6.4	6.7	4.7
	FS04WV025005Bw2	East	Bench	4.5	5.2	5.4	4.4
	FS04WV025005Bx1	East	Bench	4.5	5.2	5.4	4.4
	FS04WV025005Bx2	East	Bench	4.6	4.8	5.0	4.6
	FS04WV025005Bx3	East	Bench	4.6	7.2	7.6	5.7

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	soil pH	acidity meq/100g	ECEC meq/100g	BSECEC
	FS04WV025005BC	East	Bench	4.5	6.8	7.3	6.7
79	FS04WV025010A/E	East	Shoulder	3.5	10.8	13.0	17.0
	FS04WV025010BA	East	Shoulder	4.1	8.8	9.3	5.6
	FS04WV025010Bt	East	Shoulder	4.4	5.6	5.9	5.3
	FS04WV025010Btx1	East	Shoulder	4.6	4.8	5.2	6.9
	FS04WV025010Btx2	East	Shoulder	4.6	5.6	6.0	6.0
	FS04WV025010BC	East	Shoulder	4.5	5.2	5.6	7.0
81	FS04WV025019A	East	Floodplain	3.9	7.2	8.3	13.7
	FS04WV025019Bw1	East	Floodplain	4.2	4.8	5.4	10.5
	FS04WV025019Bw2	East	Floodplain	4.3	4.8	5.4	10.8
	FS04WV025019Bw3	East	Floodplain	4.6	3.6	4.2	13.3
	FS04WV025019BC	East	Floodplain	4.7	2.8	3.6	22.1
83	FS04WV101001A	East	Ridge	3.4	9.2	11.7	21.4
	FS04WV101001BA	East	Ridge	3.6	13.6	14.4	5.9
	FS04WV101001Bt1	East	Ridge	4.5	5.6	5.8	3.9
	FS04WV101001Bt2	East	Ridge	4.3	9.2	9.6	3.7
	FS04WV101001Bt3	East	Ridge	4.5	5.6	5.8	3.4
84	FS04WV067007A	East	Shoulder	3.7	11.2	11.8	5.3
	FS04WV067007BA	East	Shoulder	4.5	6.4	6.7	4.2
	FS04WV067007Bw1	East	Shoulder	4.6	3.2	3.4	5.9
	FS04WV067007Bw2	East	Shoulder	4.6	3.2	3.3	3.9
	FS04WV067007Bw3	East	Shoulder	4.6	3.6	3.7	3.4
	FS04WV067007BC	East	Shoulder	4.5	4.0	4.2	3.6
85	FS04WV067001A	West	Back slope	4.3	5.6	7.7	27.1
	FS04WV067001AB	West	Back slope	4.6	2.8	3.1	8.6
	FS04WV067001Bw1	West	Back slope	4.6	2.8	3.0	7.1
	FS04WV067001Bw2	West	Back slope	4.6	3.6	3.8	5.4
	FS04WV067001Bw3	West	Back slope	4.5	2.8	3.0	6.2
	FS04WV067001BC	West	Back slope	4.5	2.4	2.6	7.3
	FS04WV067001C	West	Back slope	4.5	1.6	1.8	9.1
87	FS04WV067002A	West	Ridge	3.9	5.6	6.1	7.5
	FS04WV067002BA	West	Ridge	4.6	3.2	3.4	5.5
	FS04WV067002Bw1	West	Ridge	4.8	2.8	3.1	10.8
	FS04WV067002Bw2	West	Ridge	4.5	2.8	3.0	6.1
88	FS04WV067003A	West	Ridge	3.9	6.8	9.2	25.7
	FS04WV067003AB	West	Ridge	4.3	5.2	6.0	13.7

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	soil pH	acidity meq/100g	ECEC meq/100g	BSECEC
	FS04WV067003Bw1	West	Ridge	4.4	4.4	4.9	9.6
	FS04WV067003Bw2	West	Ridge	4.5	3.6	3.9	8.4
	FS04WV067003BC	West	Ridge	4.5	3.6	3.9	7.3
89	FS04WV067004A	West	Floodplain	4.1	4.4	5.3	17.7
	FS04WV067004BA	West	Floodplain	4.3	4.0	4.3	6.9
	FS04WV067004Bw1	West	Floodplain	4.6	3.2	3.4	5.2
	FS04WV067004Bw2	West	Floodplain	4.6	4.8	5.0	4.9
	FS04WV067004Ab	West	Floodplain	4.5	3.2	3.6	10.9
	FS04WV067004C1	West	Floodplain	4.8	1.6	2.1	25.3
	FS04WV067004C2	West	Floodplain	4.8	0.8	1.1	26.5
	FS04WV067004C3	West	Floodplain	5.1	0.4	1.6	75.0
91	FS04WV067005A	West	Bench	3.9	8.4	9.5	11.1
	FS04WV067005AB	West	Bench	4.0	6.8	7.3	6.2
	FS04WV067005Bw1	West	Bench	4.4	4.0	4.2	5.3
	FS04WV067005Bw2	West	Bench	4.6	4.0	4.2	5.7
	FS04WV067005Bw3	West	Bench	4.6	4.0	4.3	7.9
	FS04WV067005Bx1	West	Bench	4.7	3.6	4.1	11.5
	FS04WV067005Bx2	West	Bench	4.5	4.8	5.2	7.8
	FS04WV067005BC	West	Bench	4.6	3.6	4.1	12.1
93	FS04WV067006A	West	Foot	4.0	8.4	10.0	16.3
	FS04WV067006AB	West	Foot	4.2	7.2	7.9	8.4
	FS04WV067006Bw1	West	Foot	4.6	5.2	5.5	6.3
	FS04WV067006Bw2	West	Foot	4.6	4.8	5.2	7.9
	FS04WV067006Bw3	West	Foot	4.8	4.0	4.7	15.1
	FS04WV067006BC	West	Foot	4.7	3.6	4.3	16.6
95	FS04WV067017A	West	Shoulder	4.1	7.2	7.6	5.5
	FS04WV067017AE	West	Shoulder	4.5	4.4	4.7	6.2
	FS04WV067017BA	West	Shoulder	4.6	3.6	3.8	5.8
	FS04WV067017Bw1	West	Shoulder	4.5	4.0	4.2	4.2
	FS04WV067017BC	West	Shoulder	4.4	3.2	3.4	5.0
	FS04WV067017C	West	Shoulder	4.4	3.6	3.7	3.7
96	FS04WV025006A	East	Back slope	3.3	7.2	8.3	13.4
	FS04WV025006BA	East	Back slope	3.6	10.4	10.8	3.9
	FS04WV025006Bt	East	Back slope	4.2	6.4	6.7	4.2
96	FS04WV025007A	East	Bench	3.6	8.0	9.5	15.9
	FS04WV025007BA	East	Bench	4.4	4.0	4.3	7.2
	FS04WV025007Bw	East	Bench	4.5	4.4	4.8	8.6

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	soil pH	acidity meq/100g	ECEC meq/100g	BSECEC
97	FS04WV025008A	East	Floodplain	3.5	15.6	18.0	13.3
	FS04WV025008Bt	East	Floodplain	3.9	11.6	12.1	4.2
97	FS04WV025009A	East	Foot	3.8	8.8	9.8	10.6
	FS04WV025009Bt	East	Foot	4.2	6.4	6.8	6.4
98	FS04WV025011A	East	Shoulder	3.8	8.4	9.7	13.0
	FS04WV025011BA	East	Shoulder	4.1	7.2	7.8	7.2
	FS04WV025011Bt	East	Shoulder	4.4	5.6	6.0	6.8
98	FS04WV025012A	East	Bench	3.8	10.8	11.4	5.3
	FS04WV025012Bw	East	Bench	4.6	4.4	4.6	5.3
99	FS04WV025013A	East	Ridge	3.4	5.2	7.4	29.5
	FS04WV025013BA	East	Ridge	3.6	8.4	8.8	4.3
	FS04WV025013Bt	East	Ridge	4.1	9.6	9.9	2.7
99	FS04WV025014A	East	Back slope	3.8	9.2	10.5	12.6
	FS04WV025014BA	East	Back slope	4.4	7.2	7.6	5.8
	FS04WV025014Bt	East	Back slope	4.6	6.8	7.3	6.7
100	FS04WV025015A	East	Shoulder	3.4	10.0	11.1	9.7
	FS04WV025015Bt	East	Shoulder	4.1	11.6	11.9	2.4
100	FS04WV067008A	West	Foot	3.9	6.8	7.8	13.0
	FS04WV067008BA	West	Foot	4.2	6.8	7.2	5.1
	FS04WV067008Bw	West	Foot	4.3	6.0	6.3	4.9
101	FS04WV067009A	West	Floodplain	4.0	3.6	4.4	17.6
	FS04WV067009BA	West	Floodplain	4.1	1.6	1.8	10.4
	FS04WV067009Bw	West	Floodplain	4.1	2.0	2.2	8.7
101	FS04WV067010A	West	Back slope	4.3	4.8	5.9	18.6
	FS04WV067010BA	West	Back slope	4.6	2.8	3.3	14.1
	FS04WV067010Bw	West	Back slope	4.6	2.8	3.3	15.0
102	FS04WV067011BA	West	Floodplain	4.4	2.4	2.7	12.3
	FS04WV067011Bw	West	Floodplain	4.5	1.6	1.8	9.5
102	FS04WV067012A	West	Ridge	3.9	9.2	10.5	12.5
	FS04WV067012BA	West	Ridge	4.3	6.0	6.5	7.7
	FS04WV067012Bw	West	Ridge	4.4	6.4	6.8	6.4

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	soil pH	acidity meq/100g	ECEC meq/100g	BSECEC
103	FS04WV067013A	West	Back slope	3.8	7.2	8.5	15.0
	FS04WV067013BA	West	Back slope	4.5	2.8	3.0	7.5
	FS04WV067013Bw	West	Back slope	4.6	2.4	2.6	6.9
103	FS04WV067014A	West	Bench	4.0	5.2	7.4	29.8
	FS04WV067014BA	West	Bench	4.4	4.0	4.5	11.1
	FS04WV067014Bw	West	Bench	4.4	4.4	4.8	8.6
104	FS04WV067015A	West	Shoulder	4.1	5.6	6.8	17.6
	FS04WV067015BA	West	Shoulder	4.2	4.8	5.4	10.7
	FS04WV067015Bw	West	Shoulder	4.6	3.6	4.0	9.0
104	FS04WV067016A	West	Ridge	4.0	4.8	6.3	23.6
	FS04WV067016BA	West	Ridge	4.4	3.2	3.5	9.6
	FS04WV067016Bt	West	Ridge	4.5	3.6	3.8	6.1
105	FS04WV025016A1	East	Floodplain	3.7	10.8	12.3	11.9
	FS04WV025016A2	East	Floodplain	3.8	14.4	15.0	3.8
	FS04WV025016Bw	East	Floodplain	4.2	9.2	9.4	2.1
105	FS04WV025017A	East	Back slope	3.6	8.8	9.9	11.1
	FS04WV025017BA	East	Back slope	4.1	12.4	12.8	2.9
	FS04WV025017Bt	East	Back slope	4.4	10.4	10.8	3.4
106	FS04WV025018A	East	Foot	3.7	12.8	13.7	6.4
	FS04WV025018Bw	East	Foot	4.1	8.4	8.6	2.7
106	FS04WV067018A	West	Foot	3.9	4.8	5.6	13.6
	FS04WV067018BA	West	Foot	4.3	3.6	3.8	6.4
	FS04WV067018Bt	West	Foot	4.6	2.8	3.0	5.7
107	FS04WV067019A	West	Bench	4.1	6.0	7.0	14.3
	FS04WV067019BA	West	Bench	4.4	4.8	5.1	6.5
	FS04WV067019Bw	West	Bench	4.6	4.0	4.3	6.2
107	FS04WV067020A	West	Shoulder	3.7	6.0	6.7	10.4
	FS04WV067020BA	West	Shoulder	4.4	4.4	4.6	5.2
	FS04WV067020Bt	West	Shoulder	4.5	2.8	3.0	7.8
108	FS04WV067021A	West	Ridge	3.9	6.0	7.1	14.8
	FS04WV067021BA	West	Ridge	4.4	3.6	4.1	11.2
	FS04WV067021Bw	West	Ridge	4.5	3.2	3.4	6.7

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	soil pH	acidity meq/100g	ECEC meq/100g	BSECEC
108	FS04WV067022A1	West	Shoulder	3.6	2.8	3.4	17.5
	FS04WV067022A2	West	Shoulder	3.6	2.4	2.6	6.9
	FS04WV067022AB	West	Shoulder	3.8	3.6	3.8	6.0
109	FS04WV067023A	West	Ridge	3.9	9.6	10.7	10.0
	FS04WV067023BA	West	Ridge	4.3	6.0	6.3	5.3
	FS04WV067023Bw	West	Ridge	4.5	5.2	5.5	4.9
109	FS04WV067024BA	West	Back slope	4.4	6.8	7.5	9.4
	FS04WV067024Bt	West	Back slope	4.5	5.2	5.6	6.9
110	FS04WV025020A	East	Bench	4.2	4.0	5.0	19.9
	FS04WV025020BA	East	Bench	4.5	3.6	4.0	9.2
	FS04WV025020Bt	East	Bench	4.6	4.0	4.3	7.2
110	FS04WV025021A	East	Back slope	3.5	8.4	10.0	16.2
	FS04WV025021BA	East	Back slope	3.9	8.4	9.0	6.2
	FS04WV025021Bw	East	Back slope	4.3	8.0	8.4	4.9
111	FS04WV101002A	East	Ridge	3.9	7.2	8.6	15.7
	FS04WV101002BA	East	Ridge	4.3	6.8	8.1	15.7
	FS04WV101002Bt	East	Ridge	4.6	6.4	7.7	17.2
111	FS04WV067025A	West	Ridge	4.2	6.4	6.8	5.9
	FS04WV067025BA	West	Ridge	4.5	4.0	4.2	5.4
	FS04WV067025Bw	West	Ridge	4.6	3.2	3.3	3.6
112	FS04WV067026A	West	Ridge	3.1	14.0	15.1	7.1
	FS04WV067026BA	West	Ridge	4.3	9.6	10.0	4.3
	FS04WV067026Bw	West	Ridge	4.4	5.6	5.9	4.4
112	FS04WV067027A	West	Shoulder	4.1	7.2	7.7	6.9
	FS04WV067027BA	West	Shoulder	4.5	4.8	5.1	5.1
	FS04WV067027Bt	West	Shoulder	4.7	3.2	3.5	7.5
113	FS04WV067028A1	West	Back slope	4.0	7.2	7.9	9.4
	FS04WV067028A2	West	Back slope	4.4	4.8	5.2	7.4
	FS04WV067028Bw	West	Back slope	4.7	3.6	3.8	6.0
113	FS04WV067029A	West	Back slope	4.4	7.2	7.8	7.7
	FS04WV067029BA	West	Back slope	4.6	4.0	4.3	6.8
	FS04WV067029Bw	West	Back slope	4.7	3.6	3.9	7.7

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	soil pH	acidity meq/100g	ECEC meq/100g	BSECEC
114	FS04WV067030A	West	Bench	4.2	4.8	7.5	36.3
	FS04WV067030BA	West	Bench	4.6	5.2	6.0	12.7
	FS04WV067030Bt	West	Bench	4.7	4.4	4.9	9.7
114	FS04WV067031A	West	Bench	4.2	6.8	7.7	11.9
	FS04WV067031BA	West	Bench	4.2	5.2	5.5	6.2
	FS04WV067031Bw	West	Bench	4.6	4.0	4.2	5.8
115	FS04WV067032A	West	Foot	4.2	7.6	8.8	13.7
	FS04WV067032Bt	West	Foot	4.4	4.0	4.2	5.2
115	FS04WV025023A	East	Shoulder	4.3	9.2	9.8	6.5
	FS04WV025023BA	East	Shoulder	4.4	8.0	8.4	5.0
	FS04WV025023Bt	East	Shoulder	4.5	8.0	8.4	4.5
116	FS04WV025024A	East	Back slope	3.8	10.4	11.1	6.2
	FS04WV025024BA	East	Back slope	4.3	6.0	6.2	3.8
	FS04WV025024Bw	East	Back slope	4.4	6.0	6.3	4.4
116	FS04WV025025A	East	Bench	3.8	12.0	12.8	5.9
	FS04WV025025BA	East	Bench	4.1	9.2	9.6	3.9
	FS04WV025025Bt	East	Bench	4.2	8.4	8.7	3.9
117	FS04WV067033A1	East	Floodplain	3.9	11.2	12.2	8.4
	FS04WV067033A2	East	Floodplain	4.1	10.0	10.6	5.3
	FS04WV067033BA	East	Floodplain	4.2	8.8	9.3	5.4
117	FS04WV067034A	East	Back slope	4.1	10.4	10.9	4.8
	FS04WV067034BA	East	Back slope	4.3	8.0	8.3	3.9
	FS04WV067034Bt	East	Back slope	4.5	3.6	3.8	5.5
118	FS04WV101003A	East	Back slope	4.2	8.4	10.1	16.4
	FS04WV101003BA	East	Back slope	4.4	6.4	7.1	9.2
	FS04WV101003Bt	East	Back slope	4.7	4.4	4.8	7.5
118	FS04WV101004A	East	Ridge	3.5	9.6	10.6	9.3
	FS04WV101004BA	East	Ridge	4.1	7.6	8.0	4.6
	FS04WV101004Bt	East	Ridge	4.3	6.8	7.1	4.6
119	FS04WV101005A1	East	Bench	3.9	3.2	3.5	9.2
	FS04WV101005A2	East	Bench	4.0	4.8	5.1	5.0
	FS04WV101005Ab	East	Bench	4.0	5.6	6.0	6.4

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	soil pH	acidity meq/100g	ECEC meq/100g	BSECEC
119	FS04WV101006A	East	Bench	4.0	9.2	10.1	8.5
	FS04WV101006BA	East	Bench	4.3	9.2	9.8	5.6
	FS04WV101006Bt	East	Bench	4.3	8.0	8.6	6.9
120	FS04WV025026A	East	Foot	3.4	7.2	8.1	10.7
	FS04WV025026BA	East	Foot	4.0	10.0	10.3	2.8
	FS04WV025026Bt	East	Foot	4.2	8.8	9.1	3.2
120	FS04WV025027A	East	Foot	4.0	9.6	10.5	8.6
	FS04WV025027BA	East	Foot	4.3	7.6	8.0	4.5
	FS04WV025027Bt	East	Foot	4.5	7.2	7.5	4.3
121	FS04WV025022A	East	Ridge	3.4	6.0	8.4	28.4
	FS04WV025022Bt	East	Ridge	4.4	5.2	5.7	9.2

APPENDIX F
BASE CATION DATA

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Ca	Mg	K	Na
					mg/kg		
69	FS04WV025001A1	East	Back slope	905	95.1	206	35
	FS04WV025001A2	East	Back slope	257	37.6	93	13
	FS04WV025001AB	East	Back slope	57	14.5	57	10
	FS04WV025001Bw1	East	Back slope	17	4.3	34	8
	FS04WV025001Bw2	East	Back slope	18	4.1	26	8
	FS04WV025001Bw3	East	Back slope	16	3.9	23	7
	FS04WV025001Bw4	East	Back slope	15	3.1	15	6
	FS04WV025001BC	East	Back slope	14	3.6	15	6
71	FS04WV025002A	East	Back slope	261	40.1	97	19
	FS04WV025002AB	East	Back slope	49	11.3	56	16
	FS04WV025002Bw1	East	Back slope	24	6.8	42	11
	FS04WV025002Bw2	East	Back slope	44	8.7	40	15
	FS04WV025002Bw3	East	Back slope	20	4.7	34	9
	FS04WV025002BC1	East	Back slope	22	5.9	34	10
	FS04WV025002BC2	East	Back slope	18	4.2	36	7
73	FS04WV025003A	East	Ridge	110	30.8	83	15
	FS04WV025003Bw1	East	Ridge	24	10.4	54	11
	FS04WV025003Bw2	East	Ridge	15	4.7	37	7
	FS04WV025003Bx1	East	Ridge	13	4.1	41	6
	FS04WV025003Bx2	East	Ridge	13	4.8	52	4
75	FS04WV025004A	East	Foot	227	44.7	114	13
	FS04WV025004AB	East	Foot	62	20.0	61	11
	FS04WV025004Bw1	East	Foot	26	8.0	37	9
	FS04WV025004Bw2	East	Foot	16	3.8	20	7
	FS04WV025004Bw3	East	Foot	17	4.0	28	5
	FS04WV025004Bw4	East	Foot	17	4.4	37	5
	FS04WV025004Bx	East	Foot	20	4.5	41	4
	FS04WV025004BC	East	Foot	24	4.4	40	6
77	FS04WV025005A	East	Bench	146	53.1	118	13
	FS04WV025005AB	East	Bench	44	21.0	69	11
	FS04WV025005Bw1	East	Bench	24	7.2	38	10
	FS04WV025005Bw2	East	Bench	18	4.5	33	7
	FS04WV025005Bx1	East	Bench	17	4.8	33	7
	FS04WV025005Bx2	East	Bench	17	4.3	33	6
	FS04WV025005Bx3	East	Bench	23	9.7	83	6
	FS04WV025005BC	East	Bench	26	12.9	90	5

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Ca	Mg	K	Na
					mg/kg		
79	FS04WV025010A/E	East	Shoulder	235	67.4	152	23
	FS04WV025010BA	East	Shoulder	37	16.2	62	10
	FS04WV025010Bt	East	Shoulder	23	8.0	38	8
	FS04WV025010Btx1	East	Shoulder	34	9.5	36	4
	FS04WV025010Btx2	East	Shoulder	27	11.9	41	4
	FS04WV025010BC	East	Shoulder	29	13.2	47	3
81	FS04WV025019A	East	Floodplain	102	35.3	100	20
	FS04WV025019Bw1	East	Floodplain	49	21.5	47	6
	FS04WV025019Bw2	East	Floodplain	52	22.5	48	4
	FS04WV025019Bw3	East	Floodplain	51	19.8	43	6
	FS04WV025019BC	East	Floodplain	76	36.1	39	4
83	FS04WV101001A	East	Ridge	345	47.7	128	15
	FS04WV101001BA	East	Ridge	97	19.4	55	15
	FS04WV101001Bt1	East	Ridge	28	7.7	37	14
	FS04WV101001Bt2	East	Ridge	16	3.9	31	8
	FS04WV101001Bt3	East	Ridge	13	2.5	33	7
84	FS04WV067007A	East	Shoulder	47	26.1	52	12
	FS04WV067007BA	East	Shoulder	20	7.9	23	13
	FS04WV067007Bw1	East	Shoulder	17	4.7	14	9
	FS04WV067007Bw2	East	Shoulder	11	2.7	13	5
	FS04WV067007Bw3	East	Shoulder	8.5	2.5	17	4
	FS04WV067007BC	East	Shoulder	8.0	3.0	26	4
85	FS04WV067001A	West	Back slope	301	44.2	62	14
	FS04WV067001AB	West	Back slope	26	5.2	23	7
	FS04WV067001Bw1	West	Back slope	21	4.4	21	4
	FS04WV067001Bw2	West	Back slope	19	4.2	23	5
	FS04WV067001Bw3	West	Back slope	16	3.7	24	3
	FS04WV067001BC	West	Back slope	18	4.0	20	3
	FS04WV067001C	West	Back slope	16	4.0	13	3
87	FS04WV067002A	West	Ridge	40	14.1	43	6
	FS04WV067002BA	West	Ridge	19	4.2	14	5
	FS04WV067002Bw1	West	Ridge	46	6.3	14	6
	FS04WV067002Bw2	West	Ridge	17	3.8	17	5
88	FS04WV067003A	West	Ridge	370	26.6	93	12
	FS04WV067003AB	West	Ridge	115	10.2	44	12
	FS04WV067003Bw1	West	Ridge	63	6.7	28	7
	FS04WV067003Bw2	West	Ridge	39	6.0	24	5

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Ca	Mg	K	Na
					mg/kg		
	FS04WV067003BC	West	Ridge	31	5.5	26	4
89	FS04WV067004A	West	Floodplain	118	26.4	42	7
	FS04WV067004BA	West	Floodplain	25	8.0	30	7
	FS04WV067004Bw1	West	Floodplain	13	4.6	23	3
	FS04WV067004Bw2	West	Floodplain	19	6.7	31	4
	FS04WV067004Ab	West	Floodplain	41	10.6	28	7
	FS04WV067004C1	West	Floodplain	62	18.5	23	5
	FS04WV067004C2	West	Floodplain	30	10.9	14	3
	FS04WV067004C3	West	Floodplain	114	70.6	20	5
91	FS04WV067005A	West	Bench	108	40.9	53	9
	FS04WV067005AB	West	Bench	33	17.8	43	6
	FS04WV067005Bw1	West	Bench	12	6.8	35	4
	FS04WV067005Bw2	West	Bench	14	7.7	35	4
	FS04WV067005Bw3	West	Bench	22	15.4	34	5
	FS04WV067005Bx1	West	Bench	30	25.4	35	4
	FS04WV067005Bx2	West	Bench	19	24.5	38	3
	FS04WV067005C	West	Bench	33	26.2	37	6
93	FS04WV067006A	West	Foot	212	37.5	84	13
	FS04WV067006AB	West	Foot	72	12.9	57	11
	FS04WV067006Bw1	West	Foot	32	5.3	45	7
	FS04WV067006Bw2	West	Foot	42	7.4	46	6
	FS04WV067006Bw3	West	Foot	92	16.3	39	5
	FS04WV067006BC	West	Foot	92	17.2	39	5
95	FS04WV067017A1	West	Shoulder	34	13.5	38	10
	FS04WV067017A2	West	Shoulder	22	8.9	31	7
	FS04WV067017BA	West	Shoulder	18	5.7	24	5
	FS04WV067017Bw	West	Shoulder	12	4.9	25	3
	FS04WV067017BC	West	Shoulder	10	5.2	27	2
	FS04WV067017C	West	Shoulder	8.1	3.3	24	2.0
96	FS04WV025006A	East	Back slope	138	30.0	54	8
	FS04WV025006BA	East	Back slope	39	13.1	34	7
	FS04WV025006Bt	East	Back slope	24	6.6	23	10
96	FS04WV025007A	East	Bench	179	37.8	101	12
	FS04WV025007BA	East	Bench	27	9.7	29	6
	FS04WV025007Bw	East	Bench	43	9.7	31	9
97	FS04WV025008A	East	Floodplain	330	61.1	77	12
	FS04WV025008Bt	East	Floodplain	49	14.9	43	6

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Ca	Mg	K	Na
					mg/kg		
97	FS04WV025009A	East	Foot	98	34.2	88	11
	FS04WV025009Bt	East	Foot	34	12.9	52	7
98	FS04WV025011A	East	Shoulder	146	37.5	73	9
	FS04WV025011BA	East	Shoulder	56	17.3	45	5
	FS04WV025011Bt	East	Shoulder	41	11.9	33	6
98	FS04WV025012A	East	Bench	39	25.2	73	5
	FS04WV025012Bw	East	Bench	19	6.4	28	7
99	FS04WV025013A	East	Ridge	311	46.3	76	12
	FS04WV025013BA	East	Ridge	34	12.4	33	4
	FS04WV025013Bt	East	Ridge	16	8.4	34	8
99	FS04WV025014A	East	Back slope	177	32.8	57	6
	FS04WV025014BA	East	Back slope	38	14.4	44	4
	FS04WV025014Bt	East	Back slope	47	14.8	40	6
100	FS04WV025015A	East	Shoulder	100	44.5	68	8
	FS04WV025015Bt	East	Shoulder	13	10.8	40	6
100	FS04WV067008A	West	Foot	131	23.2	54	9
	FS04WV067008BA	West	Foot	38	7.0	33	7
	FS04WV067008Bw	West	Foot	30	5.1	31	8
101	FS04WV067009A	West	Floodplain	81	23.3	49	11
	FS04WV067009BA	West	Floodplain	18	5.3	16	3
	FS04WV067009Bg	West	Floodplain	18	4.6	18	5
101	FS04WV067010A	West	Back slope	130	28.4	68	9
	FS04WV067010BA	West	Back slope	40	14.6	44	7
	FS04WV067010Bw	West	Back slope	52	11.7	43	7
102	FS04WV067011BA	West	Floodplain	43	5.6	21	5
	FS04WV067011Bw	West	Floodplain	20	2.6	13	3
102	FS04WV067012A	West	Ridge	141	32.6	112	14
	FS04WV067012BA	West	Ridge	38	13.9	62	9
	FS04WV067012Bw	West	Ridge	36	12.1	49	8
103	FS04WV067013A	West	Back slope	139	31.4	96	17
	FS04WV067013BA	West	Back slope	19	5.2	22	7
	FS04WV067013Bw	West	Back slope	16	3.1	17	7

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Ca	Mg	K	Na
					mg/kg		
103	FS04WV067014A	West	Bench	321	34.0	108	12
	FS04WV067014BA	West	Bench	51	9.1	56	6
	FS04WV067014Bw	West	Bench	42	7.4	46	7
104	FS04WV067015A	West	Shoulder	138	25.3	99	11
	FS04WV067015BA	West	Shoulder	68	10.2	47	7
	FS04WV067015Bw	West	Shoulder	40	5.0	35	6
104	FS04WV067016A	West	Ridge	201	26.5	82	12
	FS04WV067016BA	West	Ridge	35	6.7	30	8
	FS04WV067016Bt	West	Ridge	21	4.5	27	5
105	FS04WV025016A1	East	Floodplain	196	37.8	53	9
	FS04WV025016A2	East	Floodplain	58	18.6	37	9
	FS04WV025016Bw	East	Floodplain	12	6.2	24	6
105	FS04WV025017A	East	Back slope	136	28.5	61	7
	FS04WV025017BA	East	Back slope	23	11.3	52	8
	FS04WV025017Bt	East	Back slope	24	8.6	53	10
106	FS04WV025018A	East	Foot	80	28.8	71	14
	FS04WV025018Bw	East	Foot	17	6.9	29	4
106	FS04WV067018A	West	Foot	91	16.6	48	9
	FS04WV067018BA	West	Foot	25	4.6	23	6
	FS04WV067018Bt	West	Foot	18	2.0	17	5
107	FS04WV067019A	West	Bench	116	22.4	75	10
	FS04WV067019BA	West	Bench	31	7.4	34	7
	FS04WV067019Bw	West	Bench	26	4.1	27	7
107	FS04WV067020A	West	Shoulder	59	25.4	61	8
	FS04WV067020BA	West	Shoulder	17	5.7	36	5
	FS04WV067020Bt	West	Shoulder	19	4.9	29	6
108	FS04WV067021A	West	Ridge	109	31.1	86	7
	FS04WV067021BA	West	Ridge	42	6.3	67	5
	FS04WV067021Bw	West	Ridge	18	2.9	38	4
108	FS04WV067022A1	West	Shoulder	70	18.1	29	6
	FS04WV067022A2	West	Shoulder	18	5.1	12	3
	FS04WV067022AB	West	Shoulder	24	6.3	13	5
109	FS04WV067023A	West	Ridge	101	33.3	92	14

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Ca	Mg	K	Na
					mg/kg		
	FS04WV067023BA	West	Ridge	24	9.9	41	7
	FS04WV067023Bw	West	Ridge	19	6.7	37	6
109	FS04WV067024BA	West	Back slope	64	17.4	78	11
	FS04WV067024Bt	West	Back slope	26	8.8	54	10
110	FS04WV025020A	East	Bench	145	20.0	37	4
	FS04WV025020BA	East	Bench	45	6.3	27	4
	FS04WV025020Bt	East	Bench	38	5.4	23	4
110	FS04WV025021A	East	Back slope	220	33.7	85	8
	FS04WV025021BA	East	Back slope	60	11.3	53	5
	FS04WV025021Bw	East	Back slope	37	8.9	47	7
111	FS04WV101002A	East	Ridge	173	29.3	79	9
	FS04WV101002BA	East	Ridge	182	22.2	55	8
	FS04WV101002Bt	East	Ridge	194	19.2	53	16
111	FS04WV067025A	West	Ridge	26	13.3	43	12
	FS04WV067025BA	West	Ridge	17	6.4	23	8
	FS04WV067025Bw	West	Ridge	8.6	2.6	13	5
112	FS04WV067026A	West	Ridge	107	34.8	72	15
	FS04WV067026BA	West	Ridge	33	13.6	45	9
	FS04WV067026Bw	West	Ridge	16	7.6	34	7
112	FS04WV067027A	West	Shoulder	48	20.2	40	6
	FS04WV067027BA	West	Shoulder	17	7.0	34	7
	FS04WV067027Bt	West	Shoulder	23	4.2	30	8
113	FS04WV067028A1	West	Back slope	73	17.3	78	9
	FS04WV067028A2	West	Back slope	35	7.3	43	9
	FS04WV067028Bw	West	Back slope	20	3.7	26	7
113	FS04WV067029A	West	Back slope	60	14.3	51	11
	FS04WV067029BA	West	Back slope	26	6.3	31	7
	FS04WV067029Bw	West	Back slope	25	6.1	35	8
114	FS04WV067030A	West	Bench	432	43.4	68	11
	FS04WV067030BA	West	Bench	97	15.1	44	8
	FS04WV067030Bt	West	Bench	55	7.9	37	9
114	FS04WV067031A	West	Bench	89	24.3	90	10
	FS04WV067031BA	West	Bench	25	9.6	46	6

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Ca	Mg	K	Na
					mg/kg		
	FS04WV067031Bw	West	Bench	16	5.7	38	5
115	FS04WV067032A	West	Foot	162	35.2	29	8
	FS04WV067032Bt	West	Foot	20	7.4	14	6
115	FS04WV025023A	East	Shoulder	53	19.8	69	9
	FS04WV025023BA	East	Shoulder	30	12.1	58	7
	FS04WV025023Bt	East	Shoulder	28	9.4	50	8
116	FS04WV025024A	East	Back slope	56	20.8	64	17
	FS04WV025024BA	East	Back slope	20	4.4	27	7
	FS04WV025024Bw	East	Back slope	25	5.0	25	10
116	FS04WV025025A	East	Bench	64	22.2	68	18
	FS04WV025025BA	East	Bench	28	10.3	43	8
	FS04WV025025Bt	East	Bench	28	8.0	39	7
117	FS04WV067033A1	East	Floodplain	86	34.2	88	22
	FS04WV067033A2	East	Floodplain	40	21.5	51	11
	FS04WV067033BA	East	Floodplain	35	17.0	50	13
117	FS04WV067034A	East	Back slope	52	15.2	44	7
	FS04WV067034BA	East	Back slope	22	9.5	39	7
	FS04WV067034Bt	East	Back slope	14	3.8	30	8
118	FS04WV101003A	East	Back slope	95	121	52	10
	FS04WV101003BA	East	Back slope	33	44.2	37	7
	FS04WV101003Bt	East	Back slope	24	15.8	28	8
118	FS04WV101004A	East	Ridge	116	23.2	66	11
	FS04WV101004BA	East	Ridge	28	9.4	44	8
	FS04WV101004Bt	East	Ridge	26	6.1	37	13
119	FS04WV101005A1	East	Bench	40	6.3	21	5
	FS04WV101005A2	East	Bench	24	5.6	21	8
	FS04WV101005Ab	East	Bench	44	8.1	24	9
119	FS04WV101006A	East	Bench	97	19.5	67	8
	FS04WV101006BA	East	Bench	51	13.5	55	10
	FS04WV101006Bt	East	Bench	59	10.6	53	17
120	FS04WV025026A	East	Foot	91	29.3	51	9
	FS04WV025026BA	East	Foot	20	8.1	36	7

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Ca	Mg	K	Na
					mg/kg		
	FS04WV025026Bt	East	Foot	21	7.3	34	9
120	FS04WV025027A	East	Foot	98	22.5	69	12
	FS04WV025027BA	East	Foot	30	8.0	42	8
	FS04WV025027Bt	East	Foot	27	5.5	39	11
121	FS04WV025022A	East	Ridge	334	43.9	113	14
	FS04WV025022Bt	East	Ridge	55	9.9	47	13

APPENDIX G
ACID CATION DATA

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Al	Fe	Mn
					mg/kg	
69	FS04WV025001A1	East	Back slope	634	128	65.7
	FS04WV025001A2	East	Back slope	601	86	16.3
	FS04WV025001AB	East	Back slope	946	70	8.7
	FS04WV025001Bw1	East	Back slope	380	9.0	1.5
	FS04WV025001Bw2	East	Back slope	286	7.3	1.4
	FS04WV025001Bw3	East	Back slope	253	12	1.5
	FS04WV025001Bw4	East	Back slope	178	3.7	1.0
	FS04WV025001BC	East	Back slope	155	4.0	1.6
71	FS04WV025002A	East	Back slope	745	14	119
	FS04WV025002AB	East	Back slope	573	2.8	22.0
	FS04WV025002Bw1	East	Back slope	432	5.2	12.1
	FS04WV025002Bw2	East	Back slope	418	4.8	11.3
	FS04WV025002Bw3	East	Back slope	442	2.1	9.8
	FS04WV025002BC1	East	Back slope	370	2.3	12.8
	FS04WV025002BC2	East	Back slope	405	1.1	7.8
73	FS04WV025003A	East	Ridge	1006	93	16.2
	FS04WV025003Bw1	East	Ridge	686	16	15.5
	FS04WV025003Bw2	East	Ridge	459	3.0	5.1
	FS04WV025003Bx1	East	Ridge	363	3.3	4.3
	FS04WV025003Bx2	East	Ridge	475	0.9	2.2
75	FS04WV025004A	East	Foot	422	52	37.7
	FS04WV025004AB	East	Foot	723	62	9.5
	FS04WV025004Bw1	East	Foot	433	22	3.6
	FS04WV025004Bw2	East	Foot	210	6.6	1.6
	FS04WV025004Bw3	East	Foot	257	2.0	1.9
	FS04WV025004Bw4	East	Foot	274	1.7	3.8
	FS04WV025004Bx	East	Foot	295	1.0	3.8
	FS04WV025004BC	East	Foot	256	1.1	6.7
77	FS04WV025005A	East	Bench	855	101	20.1
	FS04WV025005AB	East	Bench	1005	90	8.0
	FS04WV025005Bw1	East	Bench	481	4.1	16.3
	FS04WV025005Bw2	East	Bench	393	3.3	5.2
	FS04WV025005Bx1	East	Bench	364	2.7	6.4
	FS04WV025005Bx2	East	Bench	295	3.8	6.6

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Al	Fe	Mn
					mg/kg	
	FS04WV025005Bx3	East	Bench	520	1.4	12.0
	FS04WV025005BC	East	Bench	559	1.6	15.1
79	FS04WV025010A/E	East	Shoulder	747	98	65.2
	FS04WV025010BA	East	Shoulder	614	16	14.9
	FS04WV025010Bt	East	Shoulder	436	15	3.6
	FS04WV025010Btx1	East	Shoulder	363	0.8	10.8
	FS04WV025010Btx2	East	Shoulder	382	1.6	14.0
	FS04WV025010BC	East	Shoulder	372	3.1	23.2
81	FS04WV025019A	East	Floodplain	530	8.6	82.8
	FS04WV025019Bw1	East	Floodplain	345	3.1	39.4
	FS04WV025019Bw2	East	Floodplain	350	2.2	53.5
	FS04WV025019Bw3	East	Floodplain	244	2.5	39.2
	FS04WV025019BC	East	Floodplain	178	0.3	40.2
83	FS04WV101001A	East	Ridge	502	44	30.3
	FS04WV101001BA	East	Ridge	976	74	5.9
	FS04WV101001Bt1	East	Ridge	694	23	8.6
	FS04WV101001Bt2	East	Ridge	511	9.3	2.5
	FS04WV101001Bt3	East	Ridge	435	5.4	3.5
84	FS04WV067007A	East	Shoulder	827	109	3.8
	FS04WV067007BA	East	Shoulder	429	18	0.7
	FS04WV067007Bw1	East	Shoulder	234	7.4	0.6
	FS04WV067007Bw2	East	Shoulder	240	5.0	0.6
	FS04WV067007Bw3	East	Shoulder	262	5.4	0.8
	FS04WV067007BC	East	Shoulder	304	3.9	8.6
85	FS04WV067001A	West	Back slope	399	16	51.7
	FS04WV067001AB	West	Back slope	248	3.5	1.1
	FS04WV067001Bw1	West	Back slope	202	5.4	0.6
	FS04WV067001Bw2	West	Back slope	254	6.7	0.5
	FS04WV067001Bw3	West	Back slope	253	6.2	0.25
	FS04WV067001BC	West	Back slope	177	3.0	0.25
	FS04WV067001C	West	Back slope	114	1.6	0.25
87	FS04WV067002A	West	Ridge	434	6.5	35.2
	FS04WV067002BA	West	Ridge	238	5.1	2.6
	FS04WV067002Bw1	West	Ridge	214	3.9	2.9
	FS04WV067002Bw2	West	Ridge	210	7.6	1.4

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Al	Fe	Mn
					mg/kg	
88	FS04WV067003A	West	Ridge	512	8.4	187
	FS04WV067003AB	West	Ridge	408	5.4	42.8
	FS04WV067003Bw1	West	Ridge	378	6.5	7.1
	FS04WV067003Bw2	West	Ridge	277	6.8	1.7
	FS04WV067003BC	West	Ridge	278	3.5	3.5
89	FS04WV067004A	West	Floodplain	346	16	39.4
	FS04WV067004BA	West	Floodplain	307	6.3	11.3
	FS04WV067004Bw1	West	Floodplain	219	4.6	1.2
	FS04WV067004Bw2	West	Floodplain	249	3.9	7.1
	FS04WV067004Ab	West	Floodplain	217	2.8	41.6
	FS04WV067004C1	West	Floodplain	99	3.8	34.2
	FS04WV067004C2	West	Floodplain	56	2.5	10.2
	FS04WV067004C3	West	Floodplain	27	4.2	3.4
91	FS04WV067005A	West	Bench	599	22	43.5
	FS04WV067005AB	West	Bench	442	10	23.9
	FS04WV067005Bw1	West	Bench	327	5.4	6.1
	FS04WV067005Bw2	West	Bench	301	4.3	3.2
	FS04WV067005Bw3	West	Bench	250	2.8	3.3
	FS04WV067005Bx1	West	Bench	257	1.2	3.2
	FS04WV067005Bx2	West	Bench	298	0.7	3.5
	FS04WV067005C	West	Bench	244	1.7	17.7
93	FS04WV067006A	West	Foot	592	5.6	102
	FS04WV067006AB	West	Foot	505	2.2	42.1
	FS04WV067006Bw1	West	Foot	345	1.3	13.7
	FS04WV067006Bw2	West	Foot	336	0.8	20.6
	FS04WV067006Bw3	West	Foot	281	2.7	9.4
	FS04WV067006BC	West	Foot	283	1.8	7.3
95	FS04WV067017A1	West	Shoulder	520	36	10.0
	FS04WV067017A2	West	Shoulder	312	8.5	4.5
	FS04WV067017BA	West	Shoulder	260	5.7	2.0
	FS04WV067017Bw	West	Shoulder	259	5.3	1.0
	FS04WV067017BC	West	Shoulder	292	7.1	0.6
	FS04WV067017C	West	Shoulder	254	7.2	0.8
96	FS04WV025006A	East	Back slope	488	61	13.4
	FS04WV025006BA	East	Back slope	778	67	4.2
	FS04WV025006Bt	East	Back slope	508	15	2.6

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Al	Fe	Mn
					mg/kg	
96	FS04WV025007A	East	Bench	542	22	112
	FS04WV025007BA	East	Bench	275	3.3	18.5
	FS04WV025007Bw	East	Bench	306	5.3	10.5
97	FS04WV025008A	East	Floodplain	1101	143	23.2
	FS04WV025008Bt	East	Floodplain	694	20	7.3
97	FS04WV025009A	East	Foot	631	3.1	182
	FS04WV025009Bt	East	Foot	499	1.6	41.9
98	FS04WV025011A	East	Shoulder	633	22	78.6
	FS04WV025011BA	East	Shoulder	503	11	25.4
	FS04WV025011Bt	East	Shoulder	419	5.2	12.1
98	FS04WV025012A	East	Bench	610	17	71.3
	FS04WV025012Bw	East	Bench	301	3.3	12.2
99	FS04WV025013A	East	Ridge	271	28	69.4
	FS04WV025013BA	East	Ridge	619	37	12.2
	FS04WV025013Bt	East	Ridge	779	23	17.0
99	FS04WV025014A	East	Back slope	578	23	43.2
	FS04WV025014BA	East	Back slope	555	7.8	19.3
	FS04WV025014Bt	East	Back slope	480	2.3	15.9
100	FS04WV025015A	East	Shoulder	715	51	15.3
	FS04WV025015Bt	East	Shoulder	794	41	3.5
100	FS04WV067008A	West	Foot	495	24	50.8
	FS04WV067008BA	West	Foot	445	15	8.1
	FS04WV067008Bw	West	Foot	438	5.9	3.5
101	FS04WV067009A	West	Floodplain	279	19	47.3
	FS04WV067009BA	West	Floodplain	123	3.1	23.7
	FS04WV067009Bg	West	Floodplain	128	2.9	22.9
101	FS04WV067010A	West	Back slope	351	2.9	98.5
	FS04WV067010BA	West	Back slope	218	0.9	37.9
	FS04WV067010Bw	West	Back slope	224	1.1	26.6
102	FS04WV067011BA	West	Floodplain	178	1.8	10.9
	FS04WV067011Bw	West	Floodplain	115	2.0	5.8

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Al	Fe	Mn
					mg/kg	
102	FS04WV067012A	West	Ridge	671	10	157
	FS04WV067012BA	West	Ridge	500	2.6	37.1
	FS04WV067012Bw	West	Ridge	496	3.2	15.9
103	FS04WV067013A	West	Back slope	513	30	107
	FS04WV067013BA	West	Back slope	221	3.1	8.7
	FS04WV067013Bw	West	Back slope	163	2.3	5.3
103	FS04WV067014A	West	Bench	306	1.9	223
	FS04WV067014BA	West	Bench	256	1.0	42.6
	FS04WV067014Bw	West	Bench	326	1.0	24.0
104	FS04WV067015A	West	Shoulder	390	2.4	163
	FS04WV067015BA	West	Shoulder	354	1.6	75.3
	FS04WV067015Bw	West	Shoulder	283	1.2	25.5
104	FS04WV067016A	West	Ridge	373	4.3	118
	FS04WV067016BA	West	Ridge	211	1.7	19.6
	FS04WV067016Bt	West	Ridge	262	1.9	6.2
105	FS04WV025016A1	East	Floodplain	737	79	29.7
	FS04WV025016A2	East	Floodplain	1142	92	5.8
	FS04WV025016Bw	East	Floodplain	640	39	2.1
105	FS04WV025017A	East	Back slope	644	67	30.2
	FS04WV025017BA	East	Back slope	927	47	12.9
	FS04WV025017Bt	East	Back slope	816	13	8.2
106	FS04WV025018A	East	Foot	898	40	34.2
	FS04WV025018Bw	East	Foot	577	16	4.7
106	FS04WV067018A	West	Foot	318	8.1	33.2
	FS04WV067018BA	West	Foot	266	5.3	3.5
	FS04WV067018Bt	West	Foot	222	3.3	1.0
107	FS04WV067019A	West	Bench	478	9.5	34.5
	FS04WV067019BA	West	Bench	361	3.1	7.5
	FS04WV067019Bw	West	Bench	278	2.7	1.8
107	FS04WV067020A	West	Shoulder	440	50	7.3
	FS04WV067020BA	West	Shoulder	307	14	3.6
	FS04WV067020Bt	West	Shoulder	191	3.7	2.1

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Al	Fe	Mn
					mg/kg	
108	FS04WV067021A	West	Ridge	482	16	62.4
	FS04WV067021BA	West	Ridge	273	4.4	6.2
	FS04WV067021Bw	West	Ridge	233	2.8	1.8
108	FS04WV067022A1	West	Shoulder	152	14	13.5
	FS04WV067022A2	West	Shoulder	129	8.8	1.6
	FS04WV067022AB	West	Shoulder	225	15	2.8
109	FS04WV067023A	West	Ridge	624	27	47.0
	FS04WV067023BA	West	Ridge	431	4.8	11.6
	FS04WV067023Bw	West	Ridge	415	6.8	3.2
109	FS04WV067024BA	West	Back slope	503	17	13.3
	FS04WV067024Bt	West	Back slope	383	8.9	6.9
110	FS04WV025020A	East	Bench	264	1.7	38.4
	FS04WV025020BA	East	Bench	228	1.0	21.0
	FS04WV025020Bt	East	Bench	266	2.6	2.4
110	FS04WV025021A	East	Back slope	511	28	93.6
	FS04WV025021BA	East	Back slope	638	6.2	38.5
	FS04WV025021Bw	East	Back slope	625	1.7	18.6
111	FS04WV101002A	East	Ridge	573	5.5	74.4
	FS04WV101002BA	East	Ridge	432	4.5	15.5
	FS04WV101002Bt	East	Ridge	482	8.7	10.4
111	FS04WV067025A	West	Ridge	469	23	3.2
	FS04WV067025BA	West	Ridge	286	5.9	1.0
	FS04WV067025Bw	West	Ridge	257	4.1	0.25
112	FS04WV067026A	West	Ridge	740	92	7.1
	FS04WV067026BA	West	Ridge	708	38	5.8
	FS04WV067026Bw	West	Ridge	343	12	1.8
112	FS04WV067027A	West	Shoulder	524	39	6.2
	FS04WV067027BA	West	Shoulder	368	13	3.3
	FS04WV067027Bt	West	Shoulder	245	2.7	3.5
113	FS04WV067028A1	West	Back slope	564	3.7	107
	FS04WV067028A2	West	Back slope	356	1.5	29.9
	FS04WV067028Bw	West	Back slope	269	3.1	10.9

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Al	Fe	Mn
					mg/kg	
113	FS04WV067029A	West	Back slope	524	20	18.4
	FS04WV067029BA	West	Back slope	303	3.4	12.5
	FS04WV067029Bw	West	Back slope	280	3.9	5.7
114	FS04WV067030A	West	Bench	268	2.5	66.7
	FS04WV067030BA	West	Bench	331	2.5	17.6
	FS04WV067030Bt	West	Bench	321	3.2	6.1
114	FS04WV067031A	West	Bench	422	9.0	54.0
	FS04WV067031BA	West	Bench	351	3.4	24.9
	FS04WV067031Bw	West	Bench	289	2.2	4.5
115	FS04WV067032A	West	Foot	557	17	50.6
	FS04WV067032Bt	West	Foot	224	3.8	13.7
115	FS04WV025023A	East	Shoulder	679	24	22.4
	FS04WV025023BA	East	Shoulder	590	16	6.1
	FS04WV025023Bt	East	Shoulder	538	9.2	4.2
116	FS04WV025024A	East	Back slope	822	36	21.3
	FS04WV025024BA	East	Back slope	448	12	2.7
	FS04WV025024Bw	East	Back slope	444	12	2.7
116	FS04WV025025A	East	Bench	915	38	8.5
	FS04WV025025BA	East	Bench	711	32	4.0
	FS04WV025025Bt	East	Bench	665	26	3.9
117	FS04WV067033A1	East	Floodplain	822	83	17.9
	FS04WV067033A2	East	Floodplain	658	44	14.1
	FS04WV067033BA	East	Floodplain	615	30	10.6
117	FS04WV067034A	East	Back slope	645	48	4.0
	FS04WV067034BA	East	Back slope	526	35	1.8
	FS04WV067034Bt	East	Back slope	264	10	1.0
118	FS04WV101003A	East	Back slope	565	19	29.0
	FS04WV101003BA	East	Back slope	448	5.3	17.2
	FS04WV101003Bt	East	Back slope	338	3.5	8.0
118	FS04WV101004A	East	Ridge	665	63	18.3
	FS04WV101004BA	East	Ridge	605	21	10.1
	FS04WV101004Bt	East	Ridge	535	12	4.8

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Al	Fe	Mn
					mg/kg	
119	FS04WV101005A1	East	Bench	187	17	6.6
	FS04WV101005A2	East	Bench	374	21	5.6
	FS04WV101005Ab	East	Bench	431	21	2.1
119	FS04WV101006A	East	Bench	672	18	28.3
	FS04WV101006BA	East	Bench	696	14	11.7
	FS04WV101006Bt	East	Bench	598	14	5.8
120	FS04WV025026A	East	Foot	465	57	7.8
	FS04WV025026BA	East	Foot	761	51	3.9
	FS04WV025026Bt	East	Foot	626	25	6.0
120	FS04WV025027A	East	Foot	649	99	12.9
	FS04WV025027BA	East	Foot	559	21	4.4
	FS04WV025027Bt	East	Foot	557	16	2.8
121	FS04WV025022A	East	Ridge	390	41	102
	FS04WV025022Bt	East	Ridge	353	10	12.6

APPENDIX H
CARBON AND NITROGEN DATA

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	LOI %	TN %	TC %
69	FS04WV025001A1	East	Back slope	34.0	0.93	15.4
	FS04WV025001A2	East	Back slope	17.1	0.54	9.92
	FS04WV025001AB	East	Back slope	10.9	0.27	4.56
	FS04WV025001Bw1	East	Back slope	6.2	0.14	1.85
	FS04WV025001Bw2	East	Back slope	4.9	0.09	1.13
	FS04WV025001Bw3	East	Back slope	5.6	0.11	1.50
	FS04WV025001Bw4	East	Back slope	4.2	0.07	0.93
	FS04WV025001BC	East	Back slope	3.4	0.05	0.72
71	FS04WV025002A	East	Back slope	18.0	0.57	7.67
	FS04WV025002AB	East	Back slope	9.3	0.24	2.78
	FS04WV025002Bw1	East	Back slope	7.5	0.17	1.90
	FS04WV025002Bw2	East	Back slope	6.3	0.12	1.37
	FS04WV025002Bw3	East	Back slope	6.0	0.12	1.38
	FS04WV025002BC1	East	Back slope	5.4	0.10	1.04
	FS04WV025002BC2	East	Back slope	5.0	0.09	0.87
73	FS04WV025003A	East	Ridge	14.0	0.41	6.33
	FS04WV025003Bw1	East	Ridge	7.8	0.19	2.32
	FS04WV025003Bw2	East	Ridge	5.3	0.11	1.16
	FS04WV025003Bx1	East	Ridge	4.0	0.06	0.57
	FS04WV025003Bx2	East	Ridge	3.8	0.04	0.46
75	FS04WV025004A	East	Foot	13.8	0.44	6.54
	FS04WV025004AB	East	Foot	8.4	0.25	3.54
	FS04WV025004Bw1	East	Foot	6.9	0.17	2.52
	FS04WV025004Bw2	East	Foot	4.5	0.08	1.01
	FS04WV025004Bw3	East	Foot	3.5	0.06	0.69
	FS04WV025004Bw43	East	Foot	3.2	0.04	0.44
	FS04WV025004Bx	East	Foot	3.2	0.04	0.47
	FS04WV025004BC	East	Foot	3.4	0.03	0.31
77	FS04WV025005A	East	Bench	20.1	0.64	10.9
	FS04WV025005AB	East	Bench	13.9	0.37	7.13
	FS04WV025005Bw1	East	Bench	8.7	0.17	3.00
	FS04WV025005Bw2	East	Bench	8.3	0.13	3.01
	FS04WV025005Bx1	East	Bench	7.3	0.12	2.76
	FS04WV025005Bx2	East	Bench	8.9	0.11	3.53
	FS04WV025005Btx3	East	Bench	5.5	0.05	0.38

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	LOI %	TN %	TC %
	FS04WV025005BC	East	Bench	5.0	0.05	0.31
79	FS04WV025010A/E	East	Shoulder	21.6	0.72	10.3
	FS04WV025010BA	East	Shoulder	7.2	0.21	2.27
	FS04WV025010Bt	East	Shoulder	5.6	0.12	1.15
	FS04WV025010Btx1	East	Shoulder	4.7	0.06	0.75
	FS04WV025010Btx2	East	Shoulder	4.5	0.05	0.65
	FS04WV025010BC	East	Shoulder	3.9	0.05	0.42
81	FS04WV025019A	East	Floodplain	15.2	0.53	8.09
	FS04WV025019Bw1	East	Floodplain	8.7	0.24	3.02
	FS04WV025019Bw2	East	Floodplain	9.6	0.25	3.14
	FS04WV025019Bw3	East	Floodplain	7.2	0.19	2.57
	FS04WV025019BC	East	Floodplain	2.7	0.04	0.36
83	FS04WV101001A	East	Ridge	19.4	0.61	9.71
	FS04WV101001BA	East	Ridge	13.7	0.35	6.72
	FS04WV101001Bt1	East	Ridge	8.5	0.18	2.85
	FS04WV101001Bt2	East	Ridge	5.8	0.10	1.25
	FS04WV101001Bt3	East	Ridge	5.6	0.09	1.15
84	FS04WV067007A	East	Shoulder	14.7	0.38	7.82
	FS04WV067007BA	East	Shoulder	8.3	0.16	3.14
	FS04WV067007Bw1	East	Shoulder	7.1	0.11	2.00
	FS04WV067007Bw2	East	Shoulder	5.8	0.08	1.36
	FS04WV067007Bw3	East	Shoulder	3.5	0.04	0.52
	FS04WV067007BC	East	Shoulder	3.7	0.04	0.41
85	FS04WV067001A	West	Back slope	13.6	0.43	8.09
	FS04WV067001AB	West	Back slope	5.1	0.09	1.84
	FS04WV067001Bw1	West	Back slope	3.0	0.04	0.71
	FS04WV067001Bw2	West	Back slope	2.7	0.03	0.30
	FS04WV067001Bw3	West	Back slope	2.0	0.02	0.16
	FS04WV067001BC	West	Back slope	1.8	0.02	0.13
	FS04WV067001C	West	Back slope	1.3	0.01	0.07
87	FS04WV067002A	West	Ridge	9.8	0.29	4.79
	FS04WV067002BA	West	Ridge	5.5	0.10	1.74
	FS04WV067002Bw1	West	Ridge	3.6	0.08	1.14
	FS04WV067002Bw2	West	Ridge	2.1	0.04	0.39
88	FS04WV067003A	West	Ridge	18.8	0.44	7.70
	FS04WV067003AB	West	Ridge	8.3	0.23	3.45

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	LOI %	TN %	TC %
	FS04WV067003Bw1	West	Ridge	3.5	0.06	0.86
	FS04WV067003Bw2	West	Ridge	2.3	0.03	0.31
	FS04WV067003BC	West	Ridge	2.1	0.02	0.19
89	FS04WV067004A	West	Floodplain	7.3	0.23	3.69
	FS04WV067004BA	West	Floodplain	4.5	0.11	1.69
	FS04WV067004Bw1	West	Floodplain	3.0	0.04	0.48
	FS04WV067004Bw2	West	Floodplain	4.2	0.07	0.82
	FS04WV067004Ab	West	Floodplain	3.2	0.06	0.76
	FS04WV067004C1	West	Floodplain	2.7	0.08	1.02
	FS04WV067004C2	West	Floodplain	1.0	0.02	0.24
	FS04WV067004C3	West	Floodplain	1.4	0.02	0.26
91	FS04WV067005A	West	Bench	11.9	0.34	6.39
	FS04WV067005AB	West	Bench	7.8	0.20	3.68
	FS04WV067005Bw1	West	Bench	5.6	0.12	1.97
	FS04WV067005Bw2	West	Bench	3.9	0.07	0.88
	FS04WV067005Bw3	West	Bench	2.9	0.03	0.23
	FS04WV067005Bx1	West	Bench	3.9	0.03	0.16
	FS04WV067005Bx2	West	Bench	4.1	0.04	0.13
	FS04WV067005C	West	Bench	4.6	0.03	0.17
93	FS04WV067006A	West	Foot	12.1	0.44	5.07
	FS04WV067006AB	West	Foot	7.9	0.23	2.52
	FS04WV067006Bw1	West	Foot	5.1	0.09	1.01
	FS04WV067006Bw2	West	Foot	4.3	0.06	0.60
	FS04WV067006Bw3	West	Foot	3.7	0.04	0.40
	FS04WV067006BC	West	Foot	3.4	0.04	0.31
95	FS04WV067017A1	West	Shoulder	9.8	0.20	4.73
	FS04WV067017A2	West	Shoulder	6.4	0.13	2.85
	FS04WV067017BA	West	Shoulder	5.2	0.09	1.89
	FS04WV067017Bw	West	Shoulder	3.7	0.05	0.85
	FS04WV067017BC	West	Shoulder	2.1	0.03	0.25
	FS04WV067017C	West	Shoulder	2.4	0.03	0.50
96	FS04WV025006A	East	Back slope	15.7	0.45	7.65
	FS04WV025006BA	East	Back slope	10.9	0.28	5.07
	FS04WV025006Bt	East	Back slope	7.6	0.21	3.97
96	FS04WV025007A	East	Bench	22.4	0.73	11.8
	FS04WV025007BA	East	Bench	8.4	0.22	3.20
	FS04WV025007Bw	East	Bench	8.3	0.19	2.88

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	LOI %	TN %	TC %
97	FS04WV025008A	East	Floodplain	24.3	0.65	11.8
	FS04WV025008Bt	East	Floodplain	11.0	0.24	3.78
97	FS04WV025009A	East	Foot	16.7	0.56	7.65
	FS04WV025009Bt	East	Foot	8.5	0.25	2.58
98	FS04WV025011A	East	Shoulder	12.6	0.43	5.22
	FS04WV025011BA	East	Shoulder	7.7	0.20	2.46
	FS04WV025011Bt	East	Shoulder	6.3	0.14	1.92
98	FS04WV025012A	East	Bench	17.1	0.62	8.01
	FS04WV025012Bw	East	Bench	8.9	0.25	3.03
99	FS04WV025013A	East	Ridge	15.8	0.47	7.46
	FS04WV025013BA	East	Ridge	6.7	0.19	2.88
	FS04WV025013Bt	East	Ridge	7.9	0.18	2.28
99	FS04WV025014A	East	Back slope	12.4	0.43	5.25
	FS04WV025014BA	East	Back slope	6.7	0.17	1.93
	FS04WV025014Bt	East	Back slope	6.4	0.14	1.47
100	FS04WV025015A	East	Shoulder	17.1	0.45	7.16
	FS04WV025015Bt	East	Shoulder	8.0	0.18	2.41
100	FS04WV067008A	West	Foot	8.1	0.29	3.73
	FS04WV067008BA	West	Foot	5.8	0.16	1.93
	FS04WV067008Bw	West	Foot	5.1	0.10	1.18
101	FS04WV067009A	West	Floodplain	8.0	0.24	4.78
	FS04WV067009BA	West	Floodplain	2.8	0.08	2.01
	FS04WV067009Bg	West	Floodplain	3.5	0.09	2.18
101	FS04WV067010A	West	Back slope	11.0	0.30	5.01
	FS04WV067010BA	West	Back slope	6.8	0.17	2.28
	FS04WV067010Bw	West	Back slope	6.2	0.14	1.86
102	FS04WV067011BA	West	Floodplain	3.8	0.09	1.89
	FS04WV067011Bw	West	Floodplain	2.2	0.05	0.78
102	FS04WV067012A	West	Ridge	18.0	0.53	8.52
	FS04WV067012BA	West	Ridge	9.4	0.22	3.31
	FS04WV067012Bw	West	Ridge	6.7	0.13	1.69

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	LOI %	TN %	TC %
103	FS04WV067013A	West	Back slope	16.4	0.48	8.98
	FS04WV067013BA	West	Back slope	5.9	0.13	2.20
	FS04WV067013Bw	West	Back slope	4.3	0.08	1.33
103	FS04WV067014A	West	Bench	15.0	0.44	6.95
	FS04WV067014BA	West	Bench	6.5	0.14	2.05
	FS04WV067014Bw	West	Bench	5.2	0.10	1.30
104	FS04WV067015A	West	Shoulder	11.9	0.42	5.70
	FS04WV067015BA	West	Shoulder	7.8	0.24	2.99
	FS04WV067015Bw	West	Shoulder	5.1	0.13	1.43
104	FS04WV067016A	West	Ridge	11.7	0.35	6.79
	FS04WV067016BA	West	Ridge	6.6	0.15	2.86
	FS04WV067016Bt	West	Ridge	3.2	0.06	0.73
105	FS04WV025016A	East	Floodplain	19.7	0.53	8.67
	FS04WV025016BA	East	Floodplain	12.0	0.31	4.73
	FS04WV025016Bw	East	Floodplain	6.5	0.13	1.94
105	FS04WV025017A	East	Back slope	13.3	0.41	6.80
	FS04WV025017BA	East	Back slope	8.8	0.22	2.97
	FS04WV025017Bt	East	Back slope	8.0	0.19	2.50
106	FS04WV025018A	East	Foot	19.8	0.53	9.26
	FS04WV025018Bw	East	Foot	4.2	0.09	1.06
106	FS04WV067018A	West	Foot	8.9	0.30	4.77
	FS04WV067018BA	West	Foot	6.3	0.13	2.60
	FS04WV067018Bt	West	Foot	3.6	0.07	1.24
107	FS04WV067019A	West	Bench	12.7	0.43	7.32
	FS04WV067019BA	West	Bench	6.7	0.16	2.82
	FS04WV067019Bw	West	Bench	3.7	0.07	1.01
107	FS04WV067020A	West	Shoulder	10.3	0.30	6.66
	FS04WV067020BA	West	Shoulder	5.5	0.14	3.16
	FS04WV067020Bt	West	Shoulder	4.5	0.09	1.85
108	FS04WV067021A	West	Ridge	9.8	0.31	5.60
	FS04WV067021BA	West	Ridge	5.1	0.13	2.43
	FS04WV067021Bw	West	Ridge	4.2	0.09	1.54

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	LOI %	TN %	TC %
108	FS04WV067022A1	West	Shoulder	6.5	0.19	3.45
	FS04WV067022A2	West	Shoulder	2.3	0.07	1.38
	FS04WV067022AB	West	Shoulder	2.7	0.08	1.50
109	FS04WV067023A	West	Ridge	15.9	0.43	8.86
	FS04WV067023BA	West	Ridge	7.4	0.16	2.98
	FS04WV067023Bw	West	Ridge	5.2	0.08	1.31
109	FS04WV067024BA	West	Back slope	12.6	0.31	5.94
	FS04WV067024Bt	West	Back slope	8.6	0.17	3.39
110	FS04WV025020A	East	Bench	8.0	0.25	4.91
	FS04WV025020BA	East	Bench	6.5	0.16	5.03
	FS04WV025020Bt	East	Bench	3.9	0.08	0.71
110	FS04WV025021A	East	Back slope	14.9	0.49	6.83
	FS04WV025021BA	East	Back slope	7.3	0.25	2.48
	FS04WV025021Bw	East	Back slope	6.5	0.19	1.76
111	FS04WV101002A	East	Ridge	11.2	0.35	4.27
	FS04WV101002BA	East	Ridge	8.2	0.24	3.01
	FS04WV101002Bt	East	Ridge	9.2	0.24	3.12
111	FS04WV067025A	West	Ridge	8.5	0.18	4.35
	FS04WV067025BA	West	Ridge	3.9	0.07	1.30
	FS04WV067025Bw	West	Ridge	2.6	0.04	0.68
112	FS04WV067026A	West	Ridge	32.3	0.54	18.5
	FS04WV067026BA	West	Ridge	11.9	0.24	6.06
	FS04WV067026Bw	West	Ridge	6.6	0.13	2.71
112	FS04WV067027A	West	Shoulder	8.6	0.19	4.23
	FS04WV067027BA	West	Shoulder	5.6	0.10	2.41
	FS04WV067027Bt	West	Shoulder	4.3	0.07	1.18
113	FS04WV067028A1	West	Back slope	13.1	0.44	6.57
	FS04WV067028A2	West	Back slope	8.7	0.26	3.58
	FS04WV067028Bw	West	Back slope	5.1	0.12	1.67
113	FS04WV067029A	West	Back slope	10.9	0.23	4.90
	FS04WV067029BA	West	Back slope	6.4	0.12	2.17
	FS04WV067029Bw	West	Back slope	5.5	0.09	1.44

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	LOI %	TN %	TC %
114	FS04WV067030A	West	Bench	9.8	0.31	4.15
	FS04WV067030BA	West	Bench	8.6	0.23	3.55
	FS04WV067030Bt	West	Bench	6.9	0.15	2.31
114	FS04WV067031A	West	Bench	13.3	0.41	7.11
	FS04WV067031BA	West	Bench	8.9	0.23	3.87
	FS04WV067031Bw	West	Bench	4.6	0.08	1.06
115	FS04WV067032A	West	Foot	8.9	0.25	4.72
	FS04WV067032Bt	West	Foot	4.5	0.09	1.42
115	FS04WV025023A	East	Shoulder	10.3	0.30	3.54
	FS04WV025023BA	East	Shoulder	6.4	0.13	1.47
	FS04WV025023Bt	East	Shoulder	6.1	0.12	1.28
116	FS04WV025024A	East	Back slope	19.7	0.52	10.1
	FS04WV025024BA	East	Back slope	7.9	0.16	2.71
	FS04WV025024Bw	East	Back slope	7.4	0.15	2.62
116	FS04WV025025A	East	Bench	19.3	0.61	10.9
	FS04WV025025BA	East	Bench	8.6	0.22	3.32
	FS04WV025025Bt	East	Bench	6.8	0.16	2.53
117	FS04WV067033A1	East	Floodplain	20.2	0.58	10.5
	FS04WV067033A2	East	Floodplain	13.0	0.34	6.18
	FS04WV067033BA	East	Floodplain	10.6	0.30	5.23
117	FS04WV067034A	East	Back slope	12.1	0.27	5.98
	FS04WV067034BA	East	Back slope	7.8	0.16	3.47
	FS04WV067034Bt	East	Back slope	6.0	0.10	1.65
118	FS04WV101003A	East	Back slope	11.0	0.32	5.20
	FS04WV101003BA	East	Back slope	6.9	0.16	2.41
	FS04WV101003Bt	East	Back slope	5.5	0.11	1.38
118	FS04WV101004A	East	Ridge	14.6	0.44	7.42
	FS04WV101004BA	East	Ridge	8.5	0.23	3.64
	FS04WV101004Bt	East	Ridge	7.6	0.20	2.98
119	FS04WV101005A1	East	Bench	3.4	0.11	1.56
	FS04WV101005A2	East	Bench	4.7	0.13	2.05
	FS04WV101005Ab	East	Bench	5.9	0.16	3.11

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	LOI %	TN %	TC %
119	FS04WV101006A	East	Bench	9.7	0.27	3.76
	FS04WV101006BA	East	Bench	9.4	0.28	3.65
	FS04WV101006Bt	East	Bench	9.1	0.23	3.06
120	FS04WV025026A	East	Foot	10.6	0.33	5.76
	FS04WV025026BA	East	Foot	5.9	0.12	1.82
	FS04WV025026Bt	East	Foot	6.8	0.13	2.02
120	FS04WV025027A	East	Foot	10.5	0.29	4.36
	FS04WV025027BA	East	Foot	7.6	0.17	2.38
	FS04WV025027Bt	East	Foot	7.1	0.15	2.21
121	FS04WV025022A	East	Ridge	14.6	0.52	7.16
	FS04WV025022Bt	East	Ridge	10.4	0.30	3.64

APPENDIX I
ACID RISK DATA

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Ca mg/kg	Al mg/kg	Ca:Al Ratio	BSECEC %
69	FS04WV025001A1	East	Back slope	75.83	9.80	5.10	38.3
	FS04WV025001A2	East	Back slope	45.11	15.40	1.90	16.4
	FS04WV025001AB	East	Back slope	30.51	56.90	0.40	4.6
	FS04WV025001Bw1	East	Back slope	8.42	19.10	0.30	4.5
	FS04WV025001Bw2	East	Back slope	4.87	12.60	0.30	5.9
	FS04WV025001Bw3	East	Back slope	5.19	13.60	0.30	5.4
	FS04WV025001Bw4	East	Back slope	2.63	12.80	0.10	5.5
	FS04WV025001BC	East	Back slope	6.28	10.30	0.40	6.5
71	FS04WV025002A	East	Back slope	49.72	19.09	1.72	16.4
	FS04WV025002AB	East	Back slope	16.41	31.78	0.34	7.1
	FS04WV025002Bw1	East	Back slope	8.96	27.96	0.21	5.2
	FS04WV025002Bw2	East	Back slope	8.26	27.89	0.20	7.5
	FS04WV025002Bw3	East	Back slope	22.02	22.57	0.64	4.5
	FS04WV025002BC1	East	Back slope	6.08	26.44	0.15	4.9
	FS04WV025002BC2	East	Back slope	5.71	29.50	0.13	4.5
73	FS04WV025003A	East	Ridge	27.93	23.40	0.80	7.6
	FS04WV025003Bw1	East	Ridge	11.59	45.50	0.20	3.8
	FS04WV025003Bw2	East	Ridge	5.83	26.90	0.10	3.8
	FS04WV025003Bx1	East	Ridge	5.15	25.90	0.10	5.0
	FS04WV025003Bx2	East	Ridge	4.25	35.50	0.10	3.8
75	FS04WV025004A	East	Foot	34.11	12.60	1.80	20.4
	FS04WV025004AB	East	Foot	22.10	42.90	0.30	6.8
	FS04WV025004Bw1	East	Foot	43.05	25.00	1.10	5.2
	FS04WV025004Bw2	East	Foot	4.38	17.90	0.20	6.4
	FS04WV025004Bw3	East	Foot	2.69	17.60	0.10	7.0
	FS04WV025004Bw4	East	Foot	3.40	27.10	0.10	6.2
	FS04WV025004Bx	East	Foot	7.89	27.10	0.20	6.0
	FS04WV025004BC	East	Foot	5.69	24.30	0.20	7.3
77	FS04WV025005A	East	Bench	17.50	18.60	0.60	11.6
	FS04WV025005AB	East	Bench	3.77	24.00	0.10	3.6
	FS04WV025005Bw1	East	Bench	4.20	19.40	0.10	4.7
	FS04WV025005Bw2	East	Bench	3.98	22.10	0.10	4.4
	FS04WV025005Bx1	East	Bench	3.88	25.00	0.10	4.4
	FS04WV025005Bx2	East	Bench	1.59	24.60	0.00	4.6
	FS04WV025005Bx3	East	Bench	5.61	36.90	0.10	5.7

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Ca mg/kg	Al mg/kg	Ca:Al Ratio	BSECEC %
	FS04WV025005BC	East	Bench	7.78	42.50	0.10	6.7
79	FS04WV025010A/E	East	Shoulder	39.93	23.80	1.10	17.0
	FS04WV025010BA	East	Shoulder	12.45	39.40	0.20	5.6
	FS04WV025010Bt	East	Shoulder	9.26	31.40	0.20	5.3
	FS04WV025010Btx1	East	Shoulder	8.93	26.50	0.20	6.9
	FS04WV025010Btx2	East	Shoulder	10.76	29.20	0.20	6.0
	FS04WV025010BC	East	Shoulder	11.32	27.40	0.30	7.0
81	FS04WV025019A	East	Floodplain	18.30	23.10	0.50	13.7
	FS04WV025019Bw1	East	Floodplain	22.91	20.30	0.70	10.5
	FS04WV025019Bw2	East	Floodplain	24.10	14.10	1.10	10.8
	FS04WV025019Bw3	East	Floodplain	7.33	6.70	0.70	13.3
	FS04WV025019BC	East	Floodplain	33.33	13.90	1.60	22.1
83	FS04WV101001A	East	Ridge	67.90	12.20	3.70	21.4
	FS04WV101001BA	East	Ridge	38.63	46.40	0.50	5.9
	FS04WV101001Bt1	East	Ridge	7.88	39.30	0.10	3.7
	FS04WV101001Bt2	East	Ridge	4.15	31.40	0.10	3.9
	FS04WV101001Bt3	East	Ridge	3.40	31.20	0.10	3.4
84	FS04WV067007A	East	Shoulder	20.94	49.60	0.28	5.3
	FS04WV067007BA	East	Shoulder	10.66	21.49	0.33	4.2
	FS04WV067007Bw1	East	Shoulder	4.75	8.69	0.36	5.9
	FS04WV067007Bw2	East	Shoulder	3.43	10.10	0.22	3.9
	FS04WV067007Bw3	East	Shoulder	3.63	22.44	0.11	3.4
	FS04WV067007BC	East	Shoulder	2.14	27.95	0.05	3.6
85	FS04WV067001A	West	Back slope	49.58	10.16	3.23	27.1
	FS04WV067001AB	West	Back slope	14.45	17.97	0.53	8.6
	FS04WV067001Bw1	West	Back slope	7.00	22.46	0.21	7.1
	FS04WV067001Bw2	West	Back slope	4.58	27.49	0.11	5.4
	FS04WV067001Bw3	West	Back slope	5.91	28.32	0.14	6.2
	FS04WV067001BC	West	Back slope	7.52	26.85	0.19	7.3
	FS04WV067001C	West	Back slope	5.00	19.22	0.17	9.1
87	FS04WV067002A	West	Ridge	6.48	18.70	0.20	7.5
	FS04WV067002BA	West	Ridge	7.02	13.10	0.40	5.5
	FS04WV067002Bw1	West	Ridge	4.46	17.80	0.20	10.8
	FS04WV067002Bw2	West	Ridge	2.54	24.00	0.10	6.1
88	FS04WV067003A	West	Ridge	74.97	16.12	3.07	25.7
	FS04WV067003AB	West	Ridge	55.51	29.86	1.23	13.7

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Ca mg/kg	Al mg/kg	Ca:Al Ratio	BSECEC %
	FS04WV067003Bw1	West	Ridge	34.71	32.47	0.71	9.6
	FS04WV067003Bw2	West	Ridge	18.71	27.95	0.44	8.4
	FS04WV067003BC	West	Ridge	14.02	28.59	0.32	7.3
89	FS04WV067004A	West	Floodplain	17.37	9.60	1.20	17.7
	FS04WV067004BA	West	Floodplain	8.88	19.20	0.30	6.9
	FS04WV067004Bw1	West	Floodplain	6.32	19.60	0.20	5.2
	FS04WV067004Bw2	West	Floodplain	7.93	23.20	0.20	4.9
	FS04WV067004Ab	West	Floodplain	15.84	16.20	0.60	10.9
	FS04WV067004C1	West	Floodplain	37.02	4.30	5.60	25.3
	FS04WV067004C2	West	Floodplain	19.06	8.60	1.50	26.5
	FS04WV067004C3	West	Floodplain	53.40	0.90	39.40	75.0
91	FS04WV067005A	West	Bench	16.48	13.10	0.80	11.1
	FS04WV067005AB	West	Bench	17.65	27.20	0.40	6.2
	FS04WV067005Bw1	West	Bench	7.92	17.20	0.30	5.3
	FS04WV067005Bw2	West	Bench	6.29	24.50	0.20	5.7
	FS04WV067005Bw3	West	Bench	8.87	21.60	0.30	7.9
	FS04WV067005Bx1	West	Bench	13.21	23.40	0.40	11.5
	FS04WV067005Bx2	West	Bench	9.59	28.00	0.20	7.8
	FS04WV067005C	West	Bench	8.66	21.80	0.30	12.1
93	FS04WV067006A	West	Foot	102.05	27.03	2.50	16.3
	FS04WV067006AB	West	Foot	37.28	32.82	0.75	8.4
	FS04WV067006Bw1	West	Foot	19.74	27.13	0.48	6.3
	FS04WV067006Bw2	West	Foot	19.13	23.69	0.53	7.9
	FS04WV067006Bw3	West	Foot	42.12	19.20	1.45	15.1
	FS04WV067006BC	West	Foot	37.47	19.77	1.25	16.6
95	FS04WV067017A1	West	Shoulder	3.48	20.00	0.10	5.5
	FS04WV067017A2	West	Shoulder	5.87	21.00	0.20	6.2
	FS04WV067017BA	West	Shoulder	5.47	14.30	0.30	5.8
	FS04WV067017Bw	West	Shoulder	4.06	22.70	0.10	4.2
	FS04WV067017BC	West	Shoulder	1.25	29.80	0.00	5.0
	FS04WV067017C	West	Shoulder	2.01	25.00	0.10	3.7
96	FS04WV025006A	East	Back slope	25.63	12.70	1.30	13.4
	FS04WV025006BA	East	Back slope	4.53	19.60	0.20	3.9
	FS04WV025006Bt	East	Back slope				4.2
96	FS04WV025007A	East	Bench	30.32	14.90	1.30	15.9
	FS04WV025007BA	East	Bench	13.62	12.30	0.70	7.2
	FS04WV025007Bw	East	Bench				8.6

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Ca mg/kg	Al mg/kg	Ca:Al Ratio	BSECEC %
97	FS04WV025008A	East	Floodplain	62.96	20.80	2.00	13.3
	FS04WV025008Bt	East	Floodplain	19.66	41.00	0.30	4.2
97	FS04WV025009A	East	Foot	14.91	21.50	0.50	10.6
	FS04WV025009Bt	East	Foot	14.30	22.10	0.40	6.4
98	FS04WV025011A	East	Shoulder	52.80	32.10	1.10	13.0
	FS04WV025011BA	East	Shoulder	24.83	29.30	0.60	7.2
	FS04WV025011Bt	East	Shoulder				6.8
98	FS04WV025012A	East	Bench	10.60	25.30	0.30	5.3
	FS04WV025012Bw	East	Bench	6.98	13.10	0.40	5.3
99	FS04WV025013A	East	Ridge	40.67	6.00	4.40	29.5
	FS04WV025013BA	East	Ridge	18.44	28.70	0.40	4.3
	FS04WV025013Bt	East	Ridge				2.7
99	FS04WV025014A	East	Back slope	86.52	28.50	2.00	12.6
	FS04WV025014BA	East	Back slope	19.34	27.50	0.50	5.8
	FS04WV025014Bt	East	Back slope				6.7
100	FS04WV025015A	East	Shoulder	18.79	17.10	0.70	9.7
	FS04WV025015Bt	East	Shoulder	6.62	36.00	0.10	2.4
100	FS04WV067008A	West	Foot	71.37	21.80	2.20	13.0
	FS04WV067008BA	West	Foot	188.85	1.60		5.1
	FS04WV067008Bw	West	Foot				4.9
101	FS04WV067009A	West	Floodplain	10.23	7.80	0.90	17.6
	FS04WV067009BA	West	Floodplain	6.60	16.30	0.30	10.4
	FS04WV067009Bg	West	Floodplain				8.7
101	FS04WV067010A	West	Back slope	47.67	18.60	1.70	18.6
	FS04WV067010BA	West	Back slope	22.18	8.60	1.70	14.1
	FS04WV067010Bw	West	Back slope				15.0
102	FS04WV067011BA	West	Floodplain	23.10	17.50	0.90	12.3
	FS04WV067011Bw	West	Floodplain	8.95	15.70	0.40	9.5
102	FS04WV067012A	West	Ridge	29.68	24.10	0.80	12.5
	FS04WV067012BA	West	Ridge	18.77	25.00	0.50	7.7
	FS04WV067012Bw	West	Ridge				6.4

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Ca mg/kg	Al mg/kg	Ca:Al Ratio	BSECEC %
103	FS04WV067013A	West	Back slope	22.48	17.10	0.90	15.0
	FS04WV067013BA	West	Back slope	6.59	8.80	0.50	7.5
	FS04WV067013Bw	West	Back slope				6.9
103	FS04WV067014A	West	Bench	63.22	7.20	5.80	29.8
	FS04WV067014BA	West	Bench	33.67	11.90	1.90	11.1
	FS04WV067014Bw	West	Bench				8.6
104	FS04WV067015A	West	Shoulder	64.05	15.90	2.70	17.6
	FS04WV067015BA	West	Shoulder	31.36	21.40	1.00	10.7
	FS04WV067015Bw	West	Shoulder				9.0
104	FS04WV067016A	West	Ridge	33.32	8.80	2.50	23.6
	FS04WV067016BA	West	Ridge	15.75	11.20	0.90	9.6
	FS04WV067016Bt	West	Ridge				6.1
105	FS04WV025016A1	East	Floodplain	38.33	16.90	1.50	11.9
	FS04WV025016A2	East	Floodplain	21.07	41.80	0.30	3.8
	FS04WV025016Bw	East	Floodplain				2.1
105	FS04WV025017A	East	Back slope	72.89	32.10	1.50	11.1
	FS04WV025017BA	East	Back slope	8.08	43.60	0.10	2.9
	FS04WV025017Bt	East	Back slope				3.4
106	FS04WV025018A	East	Foot	9.96	25.40	0.30	6.4
	FS04WV025018Bw	East	Foot	9.48	32.90	0.20	2.7
106	FS04WV067018A	West	Foot	43.45	19.40	1.50	13.6
	FS04WV067018BA	West	Foot	11.56	16.50	0.50	6.4
	FS04WV067018Bt	West	Foot				5.7
107	FS04WV067019A	West	Bench	16.74	12.90	0.90	14.3
	FS04WV067019BA	West	Bench	10.51	18.70	0.40	6.5
	FS04WV067019Bw	West	Bench				6.2
107	FS04WV067020A	West	Shoulder	12.34	16.20	0.50	10.4
	FS04WV067020BA	West	Shoulder	6.36	24.50	0.20	5.2
	FS04WV067020Bt	West	Shoulder				7.8
108	FS04WV067021A	West	Ridge	20.05	13.90	1.00	14.8
	FS04WV067021BA	West	Ridge	24.71	14.00	1.20	11.2
	FS04WV067021Bw	West	Ridge				6.7

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Ca mg/kg	Al mg/kg	Ca:Al Ratio	BSECEC %
108	FS04WV067022A1	West	Shoulder	13.29	7.50	1.20	17.5
	FS04WV067022A2	West	Shoulder	2.99	7.00	0.30	6.9
	FS04WV067022AB	West	Shoulder				6.0
109	FS04WV067023A	West	Ridge	12.39	19.70	0.40	10.0
	FS04WV067023BA	West	Ridge	7.79	28.30	0.20	5.3
	FS04WV067023Bw	West	Ridge				4.9
109	FS04WV067024BA	West	Back slope	24.99	33.80	0.50	9.4
	FS04WV067024Bt	West	Back slope	10.58	26.00	0.30	6.9
110	FS04WV025020A	East	Bench	64.11	12.10	3.50	19.9
	FS04WV025020BA	East	Bench	15.98	15.50	0.70	9.2
	FS04WV025020Bt	East	Bench				7.2
110	FS04WV025021A	East	Back slope	49.63	10.70	3.10	16.2
	FS04WV025021BA	East	Back slope	25.58	32.50	0.50	6.2
	FS04WV025021Bw	East	Back slope				4.9
111	FS04WV101002A	East	Ridge	92.21	30.90	2.00	15.7
	FS04WV101002BA	East	Ridge	87.67	19.80	2.90	15.7
	FS04WV101002Bt	East	Ridge				17.2
111	FS04WV067025A	West	Ridge	12.93	40.60	0.20	5.9
	FS04WV067025BA	West	Ridge	2.31	24.90	0.10	5.4
	FS04WV067025Bw	West	Ridge				3.6
112	FS04WV067026A	West	Ridge	18.17	25.60	0.50	7.1
	FS04WV067026BA	West	Ridge	14.98	41.00	0.20	4.3
	FS04WV067026Bw	West	Ridge				4.4
112	FS04WV067027A	West	Shoulder	30.75	27.90	0.70	6.9
	FS04WV067027BA	West	Shoulder	9.88	23.70	0.30	5.1
	FS04WV067027Bt	West	Shoulder				7.5
113	FS04WV067028A1	West	Back slope	15.99	16.10	0.70	9.4
	FS04WV067028A2	West	Back slope	16.91	18.90	0.60	7.4
	FS04WV067028Bw	West	Back slope				6.0
113	FS04WV067029A	West	Back slope	26.15	31.80	0.50	7.7
	FS04WV067029BA	West	Back slope	13.92	15.20	0.60	6.8
	FS04WV067029Bw	West	Back slope				7.7

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Ca mg/kg	Al mg/kg	Ca:Al Ratio	BSECEC %
114	FS04WV067030A	West	Bench	156.00	6.20	16.50	36.3
	FS04WV067030BA	West	Bench	61.16	13.40	3.00	12.7
	FS04WV067030Bt	West	Bench				9.7
114	FS04WV067031A	West	Bench	15.66	14.20	0.70	11.9
	FS04WV067031BA	West	Bench	17.80	20.70	0.60	6.2
	FS04WV067031Bw	West	Bench				5.8
115	FS04WV067032A	West	Foot	66.30	16.30	2.70	13.7
	FS04WV067032Bt	West	Foot	9.03	19.10	0.30	5.2
115	FS04WV025023A	East	Shoulder	40.43	33.20	0.80	6.5
	FS04WV025023BA	East	Shoulder	23.16	36.40	0.40	5.0
	FS04WV025023Bt	East	Shoulder				4.5
116	FS04WV025024A	East	Back slope	7.66	21.80	0.20	6.2
	FS04WV025024BA	East	Back slope	9.39	28.00	0.20	3.8
	FS04WV025024Bw	East	Back slope				4.4
116	FS04WV025025A	East	Bench	13.95	25.30	0.40	5.9
	FS04WV025025BA	East	Bench	8.30	40.70	0.10	3.9
	FS04WV025025Bt	East	Bench				3.9
117	FS04WV067033A1	East	Floodplain	10.23	22.20	0.30	8.4
	FS04WV067033A2	East	Floodplain	15.87	42.20	0.20	5.3
	FS04WV067033BA	East	Floodplain				5.4
117	FS04WV067034A	East	Back slope	28.93	17.60	1.10	4.8
	FS04WV067034BA	East	Back slope	10.63	36.10	0.20	3.9
	FS04WV067034Bt	East	Back slope				5.5
118	FS04WV101003A	East	Back slope	23.98	6.90	2.30	16.4
	FS04WV101003BA	East	Back slope	14.21	23.80	0.40	9.2
	FS04WV101003Bt	East	Back slope				7.5
118	FS04WV101004A	East	Ridge	23.93	20.80	0.80	9.3
	FS04WV101004BA	East	Ridge	16.69	43.90	0.30	4.6
	FS04WV101004Bt	East	Ridge				4.6
119	FS04WV101005A1	East	Bench	37.47	32.32	0.77	9.2
	FS04WV101005A2	East	Bench	15.71	37.14	0.28	5.0
	FS04WV101005Ab	East	Bench				6.4

Descrip. Page #	Sample ID	Wshed Area	Landscape Position	Ca mg/kg	Al mg/kg	Ca:Al Ratio	BSECEC %
119	FS04WV101006A	East	Bench	38.27	44.53	0.57	8.5
	FS04WV101006BA	East	Bench	19.10	36.27	0.35	5.6
	FS04WV101006Bt	East	Bench				6.9
120	FS04WV025026A	East	Foot	46.96	25.30	1.20	10.7
	FS04WV025026BA	East	Foot	6.36	41.00	0.10	2.8
	FS04WV025026Bt	East	Foot				3.2
120	FS04WV025027A	East	Foot	44.90	38.60	0.80	8.6
	FS04WV025027BA	East	Foot	89.08	17.90	3.30	4.5
	FS04WV025027Bt	East	Foot				4.3
121	FS04WV025022A	East	Ridge	109.22	16.50	4.40	28.4
	FS04WV025022Bt	East	Ridge	26.39	17.30	1.00	9.2