Appendix E1

Conservation Values of the Rockview Divestment Lands

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of
the Rockview Divestment Lands

Submitted to Benner Township by the

Technical Advisory Committee

March 24, 2009

Contact ClearWater Conservancy at 814-237-0400
for future updates of this document.

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Executive Summary

In 2007, a bill passed through the Senate and the House of Representatives mandating the divestment of all lands belonging to the State Correctional Institution (S.C.I) at Rockview located north of I-99 to Benner Township, the PA Fish and Boat Commission (PFBC), the Pennsylvania State University, and the Commonwealth of Pennsylvania. The bill caused significant public outcry because of concern for the property's ecological and cultural resources. As a result, protective conservation easements to be held by ClearWater Conservancy and the Pennsylvania Department of Conservation and Natural Resources were added to the bill.

A Technical Advisory Committee (TAC) was formed by Benner Township as part of a multi-stakeholder process to plan for land-use assignments that protect the conservation values of the divestment lands. The purpose of the TAC is to provide scientific ecological information and other technical information to the Spring Creek Canyon Master Plan Project's steering committee. The following report contains a comprehensive description of the natural resource conservation values inherent in the divestment lands as identified by the TAC, as well as the TAC's recommendations for conserving these values.

In particular, this report describes the overall ecosystem functions and environmental services provided by the divestment lands as they relate to groundwater and surface water quantity and quality, resiliency and response to climate change and carbon sequestration. The report also documents the occurrence of specific habitat types, such as springs, wetlands, vernal pools and various forest types. In addition, the report documents the presence or absence of species of plants, fungi, invertebrates, fish, mammals and birds. Finally, the report investigates the cultural values that the land provides to our community.

Recommendations provided by the TAC for managing the Rockview divestment lands to best meet conservation goals are numerous, but examples include: prohibiting the introduction of impervious surfaces and soil compaction to protect groundwater supply; assessing, enhancing and protecting riparian buffer zones along Spring Creek to maintain surface water quality; restoring degraded floodplain and wetland areas; expanding forested habitats; strictly controlling landscape disturbances to protect aquatic organisms from sediment, nutrient, and pesticide runoff; and restoring forest and habitat connectivity to protect populations of various widlife species.

The Rockview property is a unique regional resource. It is home to a number of threatened and endangered species, and is, generally, an area of high species and habitat diversity. The goal of the TAC in writing this report was to document the conservation values inherent in the property and to provide recommendations for meeting its conservation goals. By adhering to these recommendations, the needs of all interested stakeholders will be met, while simultaneously protecting the integrity of this valuable natural resource.

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Introduction

The Technical Advisory Committee (TAC) was formed by Benner Township to provide technical assistance for the Spring Creek Canyon Master Plan Project that was initiated after local legislators proposed to divest all lands located north of I-99 at the State Correctional Institution at Rockview. The *Conservation Values of the Rockview Divestment Lands* was developed by the TAC and is a compilation of existing data and expert opinion that documents the conservation values of these lands. This document also includes threats to these resources, known data gaps, and management recommendations to conserve the conservation values contained on the property.

This information will be used to evaluate proposed land uses and also to guide future management of the property. It will also be incorporated into the baseline documentation of future conservation easements placed on these lands. Although the TAC believes the property's significant ecological, cultural, and economic values merit strong protection and restoration, this document does not specifically identify the extent of restoration activities or suitable locations for proposed land use activities (i.e., agriculture and active recreation) as this was not the role of the TAC.

History and current status of the legislation

Senator Jake Corman introduced Senate Bill 740 to divest three small parcels of land owned Rockview near the Bellefonte interchange of I-99 on April 7, 2007. The bill was passed by the Senate in 2007 and advanced to the House of Representatives. Representative Mike Hanna then amended this bill to include the divestment of 1,582.87 acres of Rockview land located north of I-99 to the Pennsylvania State University (1,124.19 acres), Benner Township (399.44 acres), and the PA Fish and Boat Commission (59.24 acres). The remaining 235.42 acres of Rockview land located north of I-99 would be retained by the Commonwealth, through the Department of General Services (DGS) and leased to Penn State University (Figure 1). The amendments specifically state that land conveyed to Benner Township will be used "solely for passive recreational open space for the benefit of the public at large", land conveyed to the PA Fish and Boat Commission will be used "to carry out their legislatively mandated functions and for no other purpose", and lands conveyed to Penn State University "shall be used solely for agricultural purposes in the furtherance of the Grantees mission of education related to agricultural sciences" (Amendments to Senate Bill No. 740)". The long-term use of the DGS parcel will be determined at a later time.

The proposed Senate Bill No. 740 and the resulting land use caused significant public outcry because of the concern for the property's significant ecological and cultural resources. After many public meetings and negotiations with local legislators, protective conservation easements were added to the Amendments to Senate Bill No. 740 for lands to be conveyed to Penn State University and Benner Township. Additionally, the "Spring Creek Canyon Master Plan Project" was launched by Benner Township in 2008. This planning process is being funded by DCNR, Benner Township, Penn State University, and Don Hamer through the Hamer Foundation.

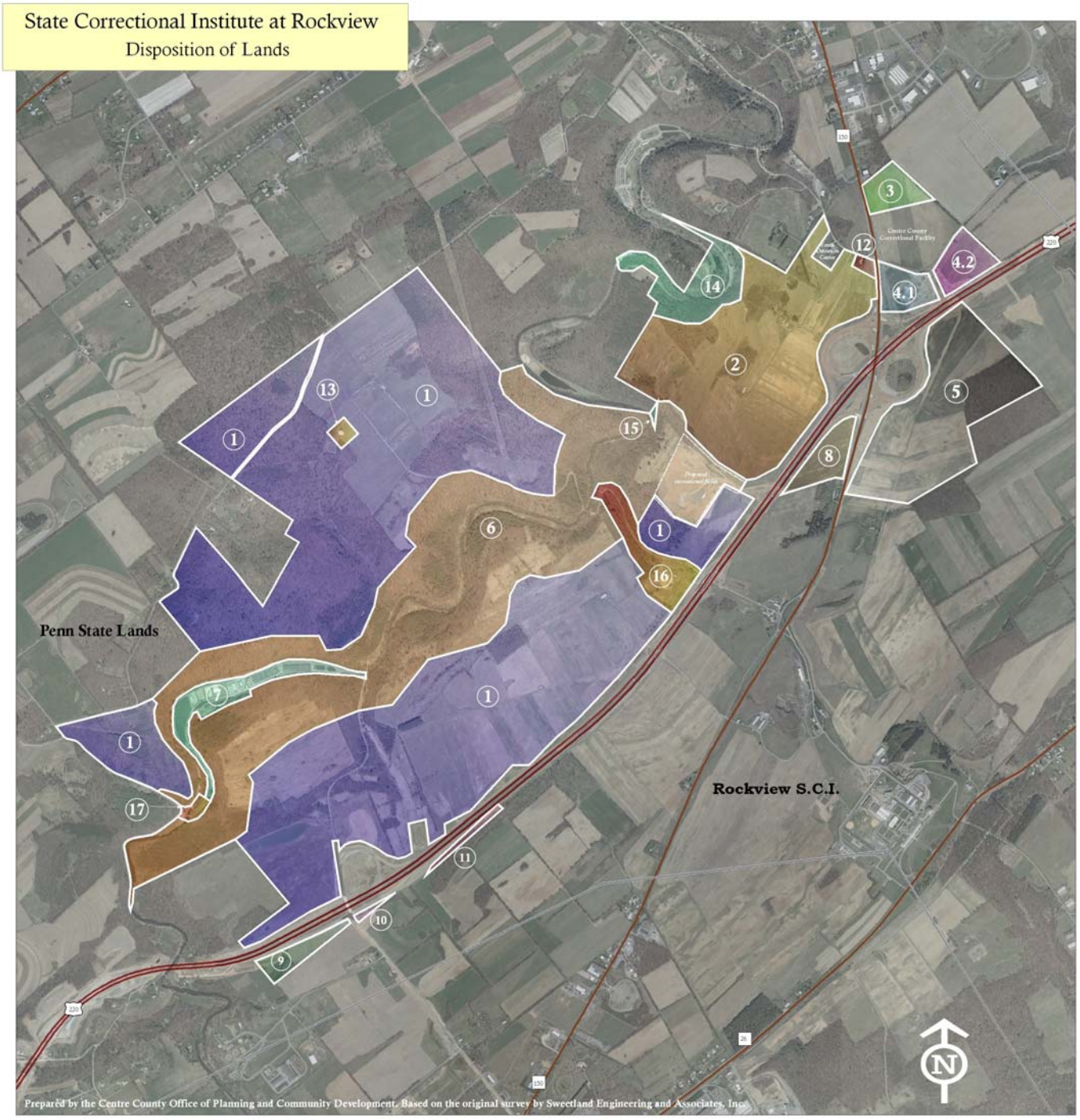

Figure 1. Proposed property boundaries of the Rockview Divestment Lands. Proposed primary future landowners include Penn State University (parcel no. 1), Benner Township (parcel no. 6), Pennsylvania Fish and Boat Commission (parcel no. 7, 14, and 15), and Pennsylvania, Department of General Services (parcel no. 2). Parcel no. 13, 16, and 17 will remain with Rockview. The remaining smaller parcels are being retained by the commonwealth, Centre County, CBICC, or auctioned to the public.

The Amendments to Senate Bill No. 740 state that the conservation easements will be held by ClearWater Conservancy and DCNR and shall be in furtherance of the following conservation goals: *to preserve the property's unique natural resources, including the biological resources, native species and their supporting habitats which include native species that are uncommon in Pennsylvania; and to preserve the integrity of Spring Creek, currently designated as a high-quality cold water fishery which requires the protection of the property's groundwater recharge value and its springs, wetlands, and floodplains, consistent with the master plan to be developed for the property by Benner Township and the Department of Conservation and Natural Resources* (Amendments to Senate Bill No. 740)". The planning consultant, Environmental Planning & Design, LLC, will provide the Steering Committee with a draft of the conservation easements. The final conservation easement language will be negotiated by ClearWater Conservancy, DCNR, Penn State University, and Benner Township.

During the fall session of 2008, Senator Jake Corman supported the wishes of the public to "plan first, divest later", and did not advance the Amendments to Senate Bill No. 740 in the Senate to allow for the planning process to be completed prior to divesting any of the Rockview lands. Although this legislation has been tabled, those involved in the planning process are under the guidance of DCNR to assume that a similar bill divesting Rockview lands located north of I-99 will be reintroduced in 2009.

The Planning Process

The planning process is being led by the Steering Committee. The Steering Committee is comprised of representatives from Benner Township, Penn State University, the PA Fish and Boat Commission, and Rockview. The TAC was formed by Benner Township and is comprised of a cross section of natural resource experts from Penn State University, state agencies, and non-governmental conservation organizations. The TAC is charged with providing scientific ecological information and other technical information to the Steering Committee. The Public Advisory Committee (PAC) was formed by Benner Township and is comprised of representatives from each Spring Creek Watershed municipality. The PAC is charged with providing the Steering Committee with a cross section of municipal input to the planning process and other public opinion. Environmental Planning & Design, LLC is Benner Township's consultant.

The intent of the Spring Creek Canyon master and management plan is to:

1) provide a public process to determine the desired uses of the Spring Creek Canyon and buffer lands (Study Area) compatible with the goal of protecting the landscape's unique natural resources,
2) provide a public process to determine opportunities for the public to access and enjoy the study area with a goal of protecting the landscape's natural resources, and
3) develop a clear understanding of how this unique regional resource will be managed – special effort will focus on building partnership opportunities and capacity building to ensure quality long term stewardship of the lands (Benner Township and DCNR 2007).

The Rockview Divestment Lands – An Important Natural Resource

Several state- and locally-funded plans and studies, including the *Centre County Comprehensive Plan*, *Nittany Valley Comprehensive Plan*, *Centre Region Comprehensive Plan*, *Centre County Natural Heritage Inventory*, and the *Spring Creek Rivers Conservation Plan*, have clearly documented the ecological and cultural importance of the S.C.I. Rockview landholdings and have stressed the need to protect the natural resources found within. The *Centre County Natural Heritage Inventory*, for example, designated a significant portion of the Rockview Divestment Lands (that includes the Spring Creek Canyon) as a Biological Diversity Area (Figure 2). The "Spring Creek Valley Biological Diversity Area" is described by the Western Pennsylvania Conservancy as "one of the most exceptional areas within Centre County for native biodiversity" and as being of "significant biological importance containing some of the most intact examples of limestone-dependent natural community types to be found anywhere in Centre County. These communities host a number of plant and animal species which are extremely uncommon in Pennsylvania, several of which are globally rare". In 1994 ClearWater Conservancy entered into a Registry Agreement with the State Correctional Institution at Rockview as a first step in recognizing and protecting these sensitive natural resources located on penitentiary property.

The *Spring Creek Rivers Conservation Plan* recommended the establishment of "the Spring Creek Canyon Nature Reserve" to protect natural and cultural resources while also allowing for carefully planned public access and recreational opportunities (ClearWater Conservancy 2001).

Benner Township, through a grant from the Department of Conservation and Natural Resources, retained Western Pennsylvania Conservancy in 2006 to conduct an assessment of the Spring Creek Valley and make recommendations to protect its natural resources. The *Ecological Assessment and Planning for the Spring Creek Biological Diversity Area* provides recommendations that pointed to the need to go beyond the limestone cliffs of the canyon in order to protect its uncommon biological diversity. The primary recommendation was to conduct extensive forest restoration to reestablish the now rare calcareous forest type, increase interior forest for area-dependent wildlife species, reduce edge effects, and buffer rare community types and water resources (Western Pennsylvania Conservation 2006).

The property also contains nearly 3.3 miles of Spring Creek, a high-quality coldwater fishery that supports a dense population of wild brown trout and the total biomass and number of quality-size fish make it one of the best Class A wild trout streams in Pennsylvania (Hollender and Kristine 2000). In fact, the data recorded during a 2000 survey for the section of Spring Creek that includes the canyon is the highest brown trout biomass documented for any stream section in Pennsylvania (personal communication, PA Fish and Boat Commission). The canyon area is one of the most popular fishing areas on Spring Creek. Angler-use surveys have documented the economic importance of Spring Creek to the local economy and estimate economic revenues approaching $1 million annually.

Conservation Values of the Rockview Divestment Lands

The purpose of a conservation easement is to protect and preserve the conservation values of a property by restricting certain activities that are not consistent with those values. Likewise, the basic intent of the planning process is to determine to what degree the property can be used by the future landowners and the public while still achieving the goal of conserving both the biological and water resources of the property. To meet the purpose of the conservation easements and to achieve the goals of the planning process, it is necessary to first *document* the resources, or conservation values, of the property. These conservation values must be identified prior to the development of a property's conservation strategy (Land Trust Alliance 2007).

Some of the property's conservation values are well known and understood, such as the Spring Creek fishery. Other values are less publicly known, such as the rare terrestrial plants and animals, and have resulted in a portion of the property receiving the designation of a Biological Diversity Area of "exceptional significance" by the *Centre County Natural Heritage Inventory* (Western Pennsylvania Conservancy 2002). Because the property has been largely inaccessible to the public, little to no inventorying has been conducted. It is likely that other unknown conservation values are present on the property or could be present once again with appropriate restoration activities.

The following report was compiled by TAC members and other technical volunteers to document the conservation values of the Rockview Divestment Lands using existing data and expert opinion. This report was reviewed by the TAC.

Natural Resource Conservation Values

Ecosystem Function and Environmental Services

S.C.I. at Rockview lands contribute value to the following ecosystem functions and environmental services which are significant at local, regional and global scales.

Groundwater

Life within the Spring Creek Watershed is dependent on its high-quality and high-capacity groundwater aquifers. Residents of the Spring Creek Watershed obtain nearly all of their drinking water from groundwater; only small amounts of surface water are collected for drinking water use (e.g., the State College Borough Water Authority's Roaring Run reservoir and S.C.I. at Rockview's McBride Gap reservoir). Approximately 16.8 million gallons of groundwater are pumped daily from the watershed's vast groundwater aquifers by public water supply systems and private wells to meet the drinking water needs of nearly 94,000 residents (ClearWater Conservancy 2002).

Groundwater also maintains the baseflow of Spring Creek and its tributaries through spring flow and gradual discharge directly into the streambed. Spring flow and wetland hydrology are also maintained by groundwater discharge.

Key Ecological Attributes and Threats to Groundwater

Groundwater quantity – All groundwater occurs from the infiltration of rain and snowmelt. When precipitation reaches the ground, a portion of it runs off as surface water and leaves the basin relatively quickly. The ratio of water that enters the ground versus that which runs off as surface water is based on watershed characteristics such as geology, soil type, slope, impervious surfaces, and other factors. Infiltration of water into the aquifer is essential to maintain adequate local drinking water supplies and sustained baseflow of Spring Creek as well as spring flow and wetland hydrology.

The Gatesburg Formation is considered a candidate critical aquifer recharge area that is present throughout the Spring Creek basin including a significant portion of the Rockview property being divested (Figure 3). This formation is likely the source of several high-capacity "Gatesburg springs" located down basin including Benner Spring, Paradise Spring, a series of springs along Logan Branch, and Big Spring, the second largest spring in Pennsylvania. The Benner Spring is located on the Rockview property and provides approximately 4,080 gallons per minute (measured on November 10, 1971) of high-quality groundwater to Spring Creek (Figure 4) (Wood 1980).

Groundwater recharge can be significantly reduced especially when high-infiltration capacity soils are compacted or replaced by impervious surfaces. The sandy nature of soils that form on the Gatesburg Formation (e.g., Morrison series) minimize surface water runoff in response to rainfall and snow melt but maximize groundwater recharge. Almost all of the land being divested located north of Spring Creek is underlain by the Gatesburg Formation (Figure 3) and Morrison Soils (Figure 5). There is currently little impervious surface on these soils with the exception of a section of Barnes Lane, a farm lane, and a barn. The degree to which current land use has compacted these soils is unknown. Compacting soil or introducing impervious surface to the area underlain by the

Gatesburg Formation or on top of Morrison soils would likely cause increased surface water flows during storm or snowmelt events and decrease groundwater recharge. The effect of this would be a net reduction of baseflow of Spring Creek as potential recharge flows off the property rapidly in the form of surface water runoff (i.e., stormwater).

Sinkholes and closed depressions are also considered critical to groundwater recharge in karst areas. These features often naturally occur in drainage ways, accept runoff, and convert it to groundwater recharge. To avoid reduced recharge, stormwater that naturally discharges to sinkholes and closed depressions should not be diverted. The quality of this stormwater, however, can be diminished from the introduction of contaminants (e.g., sediment, nutrients, and pesticides) and impact the quality of groundwater.

All of the geologic formations underlying the property are carbonate in nature and are therefore solution prone and able to form sinkholes and closed depressions. Their number, location, and contributing areas have not been inventoried on the Rockview property.

Significant groundwater withdrawals and spring diversions can divert water from natural groundwater discharge points such as streams, springs, and wetlands. Currently, two groundwater withdrawal wells are located on the Pennsylvania Fish and Boat Commission's Benner Spring Hatchery property and used to augment flow of Benner Spring as a source of water for the hatchery runs. Water from the wells is used for temperature control in the hatchery supply. The extent to which these wells divert groundwater from natural discharge areas is unknown. Rockview is permitted to use Benner Spring as a 1-million gallon per day backup water supply to the correctional institution.

Groundwater Quality – Dependence on groundwater for local drinking water supplies and the direct connection between groundwater and surface water mandates that the quality of groundwater resources be safeguarded.

Risk of groundwater contamination, however, is exceedingly great in karst watersheds because contaminants can easily be transported to the aquifer. Although closed depressions have a stable biological soil mantle that can mitigate contaminates from overland runoff, sinkholes can provide a direct conduit for surface water into the groundwater flow system with minimal renovation of quality. Nutrients, pesticides, and urban runoff can also quickly enter the groundwater aquifer through shallow limestone soils.

Opequon soils are shallow well-drained limestone soils that are formed on limestone residuum. They range from relatively level to very steep in slope and depth to limestone bedrock is generally less than 20 inches. Opequon soils located on the property include Oh and Ox mapping units (Figure 6). The Oh mapping units are actually soil complexes that include both shallow Opequon soils and some deep intermingled Hagerstown soils. Limestone rock outcrops may occur in these Oh mapping units. The Ox soil mapping units are soil complexes that include Opequon soils and rock outcrops. The Opequon soil mapping units are environmentally sensitive because of the shallow depth to limestone bedrock and the presence of limestone outcroppings. Application of nutrients and pesticides on these shallow soils could result in groundwater contamination.

Spreading and storage of livestock manure and fish manure has the potential to negatively affect groundwater quality if runoff is allowed to enter sinkholes, disturbed closed depressions, or if it is applied on shallow limestone soils. Excessive application of manure regardless of the setting is also a concern with regards to groundwater quality.

Recommendations to conserve and protect groundwater

1. Prohibit the introduction any impervious surface or soil compaction on the Gatesburg Formation.
2. Inventory and assess all sinkholes and closed depressions and delineate their contributing areas.
3. Prohibit the alteration or destruction of sinkholes and closed depressions including their contributing areas.
4. Prohibit activities that would introduce dissolved contaminates (e.g., nitrate, chloride, sulfate, etc.) to the Gatesburg Formation, sinkholes, or closed depressions.
5. In areas where sinkholes and closed depressions exist, vegetated buffers should be established (criteria to be determined). In areas where sinkhole occurrence is likely, the application of chemicals (pesticides) and nutrients (fertilizer and animal waste) should be avoided because they can enter the groundwater very quickly with very little renovation.
6. Adding large quantities of stormwater beyond natural conditions to sinkholes and closed depressions should be avoided to prevent destabilization. Destabilization could cause collapse that in turn could causes erosion and turbidity to springs, spring, and wetlands.
7. Limestone soils that overlie the critical aquifer recharge areas (Gatesburg Formation) include Morrison and Opequon soil types. Morrison soils are typically deep and sandy and Opequon are shallow. Both soil types are very permeable and not effective at removing dissolved contaminants from stormwater. Prohibit activities that could introduce dissolved containments (e.g., pesticides, nutrients, etc.) to stormwater that enters these areas.
8. Specifically prohibit the storage and spreading of manure within critical aquifer recharge areas, their contributing areas, and shallow limestone soils (Opequon).
9. Assess threat of current fertilizer application by Pennsylvania Fish and Boat Commission.
10. Install continuous flow monitoring instruments on Benner Spring to monitor current uses (i.e., PFBC and Rockview) and to determine impacts to Spring Creek.

Surface Water Quantity of the Spring Creek Watershed

Baseflow of Spring Creek and wetland hydrology are maintained by spring flow and gradual discharge of groundwater directly into the streambed or wetland. A rough measure of the significance of springs and other groundwater inputs of water to Spring Creek as it flows through the Rockview Divestment Lands can be obtained by looking at

USGS flow records for Spring Creek at the Houserville gauge a few miles above the canyon section and the Axemann gauge a few miles below the canyon section. Long term flow data for 1986-2007 show flows at Houserville average 70 cubic feet per second (cfs) and at Axeman flows average 103 cfs, giving an average long–term increase between the gauges of 33 cfs. The increase in flow between Houserville and Axemann has remained relatively stable over the period of record and appears to gradually increase after years of higher flows and groundwater recharge and decline gradually during intervening periods (Figure 7). Part of this increase is due to the University Area Joint Authority (UAJA) sewage treatment plant input of about 8 cfs just above the Rockview Divestment Lands and part is due to flows from Benner Spring of about 9 cfs within the divestment area. This leaves another approximately 16 cfs or 48% of the increase in flow due to other ungauged springs, seeps, diffuse groundwater flows and ephemeral tributaries between monitoring stations. Benner Spring flow alone represents about 9% and the UAJA discharge is equal to about 8% of the average flow at the Axemann gauge. These data suggest that Spring Creek water flow rates and quality within the Rockview Divestment Area will be quite sensitive to changes in both flow and quality of Benner Spring, the UAJA discharge, and other ungauged water sources within the canyon lands.

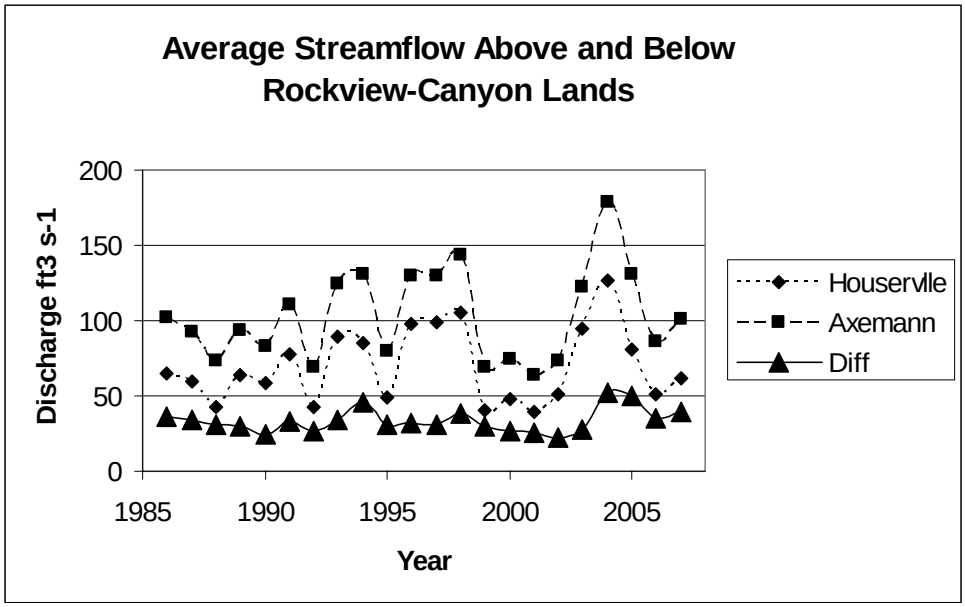

Figure 7. Average stream flow at the USGS Houserville (upstream) and USGS Axemann (downstream) stream gauges from 1986 - 2007.

Baseflow of Spring Creek could be impacted by activities occurring on the Rockview Divestment Lands that decease groundwater recharge. Examples of such activities include altering sinkholes and increasing impervious surfaces, especially over important groundwater aquifer recharge areas.

Surface Water Quality of the Spring Creek Watershed

Historically, water quality in the middle reach of Spring Creek, which includes the Canyon section, has been threatened. The Correctional Institution constructed its first

wastewater treatment plant in 1935 and the effluent was discharged into Spring Creek near the orchard bridge. Starting in the late 1950s, water quality problems were noted downstream of the Rockview treatment plant. Water quality may have also been influenced by wastewater discharge from the Penn State treatment plant in State College. Water quality problems in this middle reach persisted until 1992, when Rockview closed its wastewater treatment plant and piped its sewage to the Bellefonte Wastewater Treatment Plant. Improvements in other wastewater treatment plants upstream and the diversion of Penn State's wastewater to a spray irrigation field have resulted in greatly improved water quality in Spring Creek. It is highly likely that water quality today in the middle reach of Spring Creek is better than it has been in the past 60 or more years.

Because of the high infiltrative capacity of Gatesburg soils (i.e., its sandy texture), it provides filtration (i.e., mechanical removal) of particulates present in the recharge. The relative lack of clay in these soils, however, limits their ability to filter pollutants. There is not a high rate of cation exchange capacity that removes charged particles such as metals and to some degree nutrients such as nitrates. The presence of livestock related activities on Gatesburg soils (e.g., feedlots, manure stacking pads, etc.) could inject high concentrations of nutrients into the groundwater receiving minimal renovation.

Resiliency and Response to Climate Change

Climate change is predicted to further threaten native biodiversity, especially those species and habitats already stressed by fragmented and largely developed landscapes. By maintaining a large area of Spring Creek lands as restored and natural habitat, local and regional biodiversity will become more resilient.

Carbon Sequestration

A major mitigating human response to climate change is the option to manage global carbon. One option for carbon management is carbon sequestration, or the capture and retention of carbon from free reign in the atmosphere. The protection and restoration of natural habitats, especially native forests, is an effective means of carbon retention. Research is revealing that in addition to large obvious quantities of carbon sequestered in biomass (trees), an additional significant amount is stored in undisturbed forest soils. The open lands of S.C.I. at Rockview are potentially a location where forest restoration would provide a mechanism for carbon sequestration.

Retaining and Expanding Forests of the Chesapeake Bay Watershed

Governors of the Pennsylvania, Maryland, Virginia and the mayor of the District of Columbia signed the Chesapeake Bay Program Executive Council Directive No. 06-1 "*Protecting the Forests of the Chesapeake Watershed*" in 2006. The goal of this directive is to conserve those forest lands in the Bay Watershed where conservation to protect water quality is most needed. Priority areas include stream and floodplain forest, forests in headwaters and on steep slopes, forests that protect drinking water supplies, and large contiguous blocks of forest. Conserving and expanding forested habitat on the Rockview Divestment Lands would help Pennsylvania fulfill this commitment.

Other Ecosystem Functions and Services

The Rockview Divestment Lands also provide other ecosystem functions and services including mitigation of flood severity, air quality, nature study and appreciation, and public environmental education. The property could also serve as indicator of regional environmental quality.

Aquatic and Palustrine Habitats

Spring Creek

The headwaters of Spring Creek originate on the sandstone slopes of Tussey, Bald Eagle, and Nittany Mountains. These mountain tributaries frequently disappear into sinkholes at the base of the mountains when the sandstone bedrock interfaces with the karst bedrock of the valley floor. This groundwater then resurfaces in the valley through springs and seeps, mixing with any streamflow from the sandstone uplands and forming calcareous streams. The water chemistry of these valley streams is alkaline and supports different biotic assemblages than the acidic headwater freestone streams in the uplands. Approximately 3.3 miles of Spring Creek flows through the Rockview property. This section of Spring Creek is a medium gradient, 4th order stream (Figure 4).

The middle portion of Spring Creek which includes the canyon lands occurs downstream from communities of Pine Grove Mills, Boalsburg, Linden Hall, Oak Hall, and most importantly State College and associated land development. Thus the hydrologic integrity of the middle portion of the Spring Creek Canyon depends as much on good land management throughout the upland watershed as it does on good management on the immediately adjacent property.

Key Ecological Attributes and Threats to Spring Creek

Hydrologic Regime – Maintaining the natural hydrologic regime of Spring Creek is essential to maintain water quality, stream morphology, and viable aquatic wildlife populations. It is important to understand that hydrologic models developed in non-carbonate watersheds cannot be applied to carbonate watersheds such as Spring Creek. When these models are applied inappropriately, common generalizations such as thresholds of percent impervious surface related to stream degradation, can underestimate the buffering capacity of karst systems. Regardless, urbanization within the Spring Creek watershed has resulted in increases in groundwater withdrawals, spring diversions, and stormwater runoff, all of which can negatively impact the hydrologic regime of Spring Creek.

Stormwater runoff events are natural and caused by precipitation (rainfall and snowmelt). In karst watersheds under natural conditions most precipitation and snowmelt readily infiltrates the soil. Increased stormflow in streams is primarily infiltrated rain and snowmelt that displaces stored subsurface water from soils and rock strata. Some stormflow is also generated by rainfall and snowmelt over the open channel and wetland and seep areas directly connected to the channel. Alteration of sinkholes and the introduction of impervious surfaces, such as pavement, rooftops, and compacted soil, cause increases in stormwater runoff and also increase the duration and frequency of runoff events. Creating conditions (e.g., impervious surfaces) that result in surface-water

runoff to directly enter aquatic systems (e.g., by overland flow or engineered connections) is a significant deviation from the natural hydrologic condition.

Baseflow of Spring Creek is maintained by spring flow and gradual discharge of groundwater directly into the streambed. Altering sinkholes and increasing impervious surfaces, especially over important groundwater aquifer recharge areas, decreases groundwater recharge and could impact the baseflow of Spring Creek. Significant groundwater withdrawals and spring diversions can reduce the baseflow of Spring Creek.

Water Quality – Historically, water quality in the middle reach of Spring Creek, which includes the Canyon section, has been threatened. The Correctional Institution constructed its first wastewater treatment plant in 1935 and the effluent was discharged into Spring Creek near the orchard bridge. Starting in the late 1950s, water quality problems were noted downstream of the Rockview treatment plant. Water quality may have also been influenced by wastewater discharge from the Penn State treatment plant in State College. Water quality problems in this middle reach persisted until 1992, when Rockview closed its wastewater treatment plant and piped its sewage to the Bellefonte Wastewater Treatment Plant. Improvements in other wastewater treatment plants upstream and the diversion of Penn State's wastewater to a spray irrigation field have resulted in greatly improved water quality in Spring Creek. The UAJA Water Treatment Facility also discharges municipal sewage effluent upstream of the Spring Creek Canyon. Effluent from the Fish and Boat Commission hatcheries at Benner Spring and at Fisherman's Paradise contributes, in part, to the impaired status of Spring Creek. (Ryder 2007). Macroinvertebrate Index of Biotic Integrity scores decline below the hatcheries relative to upstream scores (Ryder 2007). Low dissolved oxygen and high nutrient levels occur in Spring Creek below the hatchery outflows (PA DEP 2006). A microscreen water filtration system, slated for installation in 2009, will reduce the particulate organic matter and associated nutrients in the effluents at the Benner Spring State Fish Hatchery and the Bellefonte State Fish Hatchery. It is expected that the filtration will improve the water quality and biological integrity of the Spring Creek. Even before upgrades to the hatchery effluent treatment, it is highly likely that water quality today in the middle reach of Spring Creek is better than it has been in the past 60 or more years. Sediments in Spring Creek were also contaminated in the past with toxic Kepone and Mirex from a small chemical manufacturing plant near State College which led to fish consumption advisories throughout the watershed. Fortunately, the levels of chemical in sediments and hence the aquatic food chain have gradually diminished. Thus the present day quality of Spring Creek is greatly improved over the past, but vigilance is required to maintain and enhance that quality.

Factors that could threaten water quality include urban runoff from paved surfaces (parking lots and roads), construction activity along stream channels, agricultural runoff, sedimentation, hatchery and wastewater effluent, spreading of fish or livestock manure, manure stacking or storage, stormwater runoff from agricultural lands, leakage and spills from industry, gasoline spills, and the removal or reduction of naturally forested riparian buffers.

Any activity that diminishes flow from the springs (e.g., increase in impervious surface), will amplify the effects on water quality of currently permitted discharges into Spring Creek since less baseflow will be available for dilution.

Increased channel erosion and downstream sedimentation can also occur due to increased storm flows. Channels exist in dynamic equilibrium with the natural flow regime and will widen if storm flows increase. Sediment generated by increased erosion in a reach can threaten downstream aquatic environments and may take years to flush through the entire watershed.

Forested Riparian Zone – The middle reaches of Spring Creek have benefited from the relative lack of development, compared to other parts of the watershed. A vegetated riparian buffer zone lateral to Spring Creek filters sediment and other pollutants, provides shading, and adds detritus and woody debris to the stream. It protects and enhances the cool water temperatures, water quality and hydrology.

Currently there is forested riparian buffer along the length of Spring Creek, but it varies in width. The road that parallels the stream between Benner Springs State Fish Hatchery and Bellefonte State Fish Hatchery interrupts the vegetated riparian zone. The width of the riparian buffer is reduced by the infrastructure associated with the hatcheries (e.g. buildings and ponds), and clearing of riparian vegetation in some locations. The removal or alteration of the forested riparian buffer reduces its filtering capacity. Contaminants and sediments in overland flow or subsurface flows more easily reach the stream where the riparian zone is degraded. Alteration of riparian zone vegetation reduces the type and amount of detritus added to the stream, changing the food sources and cover on which stream animals rely.

The question of "How wide should a riparian corridor be?" is often asked, but seldom answered satisfactorily, because complex ecological processes and societal decision-making are involved. If one uses the idiom of "*wider is better*", and focuses on a width that encompasses an array of ecological concerns, then an appropriate range of widths can be determined. This is, of course, highly dependent upon the conservation and management objectives for a given area. Given the moderate to high levels of development (e.g., towns, highways, railroads) outside of the Spring Creek riparian corridor proper, an appropriate objective might be "*as wide as possible given the surrounding land use constraints*".

A review of the literature indicates that a naturalistic riparian corridor > 1,000 ft (including the river channel and both sides) will provide both interior conditions and dispersal pathways. A width of this dimension is recommended because edge effects (e.g., changing microclimates, increased predation and parasitism, etc.) can penetrate interior habitats of any type by 100-300 ft. Also, if the landscape corridor in question serves as both habitat for resident species and as a pathway for dispersing and migratory species, as Spring Creek does, then it needs to be sufficiently wide to maintain suitable interior conditions, whether these are forests and/or wetlands. The maximum expected complement of bird species within a community has been found when forested corridors 333-1,000 feet wide were present (Bierregaard et al. 1992, Croonquist and Brooks 1991, 1993). Minimum dispersal distances from vernal pools for amphibians reportedly range from 350-900 ft (Semlitsch and Bodie 2003, deMaynadier and Houlahan 2008). Reptiles and small mammals will use comparable corridors, but large mammals, particularly carnivores may require wider and more continuous connectivity. Thus, the recommendation is to protect, conserve, and restore the forested riparian corridor to a width of > 1,000 ft wherever possible.

Encroachments, gaps, and early successional portions will occur within corridor, but the number and size of these should not be increased, and should be reduced using appropriate restoration strategies.

Temperature – Shading from riparian zones helps to keep the cool, groundwater-fed water temperatures of Spring Creek in a natural range. Without shading water temperatures can exceed the physiological tolerances of aquatic organisms. Where riparian zone vegetation is removed, the stream temperature alteration harms the cold-water fishery, and other aquatic organisms. Runoff from roads (including I-99), other impervious surfaces, and agricultural sources could alter temperatures. Warm effluent from the hatcheries and decreased contribution of groundwater to Spring Creek because of groundwater withdrawls and spring diversion would also increase the stream temperatures. Such problems are exacerbated during summer low flows when solar radiation peaks, streams are shallow, and flows from springs and seeps are diminished.

Actively Functioning Floodplain – A vegetated riparian zone is an integral component of the floodplain. If vegetation removal and soil compaction occur, the ability of the floodplain to retain and filter water is greatly reduced. The road between Benner Springs State Fish Hatchery and Bellefonte State Fish Hatchery crosses the floodplain and the fish hatcheries and infrastructure encroach on the floodplain (Figure 4).

Biological integrity of the stream – Spring Creek is most noted for its wild brown trout fishery that is popular among fisherman. It has one of the highest biomasses in Pennsylvania, reported to be between 294 and 433 kg/ha (Hollender and Kristine 2000). Other fish reproducing in Spring Creek, such as tessellated darter, white sucker, slimy sculpin, pearl dace, creek chub, blacknose dace, and longnose dace, are typical of cool water stream habitats. Spring Creek's native brook trout are known to occur only in the headwater tributaries.

The macroinvertebrate community in Spring Creek is common to limestone influenced streams. Evaluation of the community above and below the Benner Springs State Fish Hatchery and the Bellefonte State Fish Hatchery indicate that the biological integrity declines are due to the hatcheries' effluents. However, between the hatcheries in the Canyon, Spring Creek's water quality recovers. The planned hatchery filtration systems are expected to improve water quality of the effluent.

Additional pollution inputs that cause changes in water quality or temperature in Spring Creek would likely degrade the biological communities and populations. Any number of aquatic invasive species could also greatly alter the stream ecosystem.

Since the Rockview Canyon lands exist in a mid-watershed position it is important that management plans consider the alterations to Spring Creek that can occur due to activities on the upper part of the watershed as well as within the Rockview Divestment Lands proper. Management plans for karst terrain that the Rockview Divestment Lands represents must also consider the important linkage between soil infiltration and groundwater recharge and the flow and quality of springs, seeps, and diffuse groundwater flows that contribute significantly to Spring Creek baseflow. Primary management goals should be to conserve the natural flow regime of Spring Creek including the peak flows, low flows as well as the total volume of flows *and* to conserve the natural water quality

with special consideration to suspended sediment, temperature and chemical water quality criteria.

Recommendations to Conserve Spring Creek

1. Assess current condition of floodplain along Spring Creek within the Rockview Divestment Lands and prioritize degraded sections for restoration. Work with PA Fish and Boat Commission to do the same on adjacent agency lands.
2. Assess, enhance and protect the riparian buffer zones along Spring Creek. Intact forested riparian corridors should be 1,000 feet wide (includes both sides and the stream channel).
3. Inventory all springs, seeps, and tributaries along Spring Creek within the Rockview Divestment Lands to determine flow and water quality contributions of each.
4. Partner with the Water Resources Monitoring Project of the Spring Creek Watershed Community to monitor flows and water quality within the Rockview Divestment Lands so that changes can be detected.
5. Conserve hydrology and water quality by preventing additional stormwater discharges from the property from entering Spring Creek.
6. Assess and then reduce or eliminate stormwater runoff from existing sources on the property.
7. Prevent land management activities (agricultural, urban, industrial, recreational, etc.) on the property that could increase stream sedimentation and peak flows.
8. Assess upstream threats to water quality in the upper watershed and on the Rockview Divestment Lands proper that discharge, use, handle, or manufacture potentially polluting chemicals.
9. Assess and manage risks to water quality from inadvertent spills, near-channel earth moving, and all types of waste discharges including sewage treatment plants.
10. Work with the Spring Creek Watershed Commission and the Spring Creek Watershed Community to assist with assessing and controlling existing and new threats to Spring Creek flow and quality.

Spring Creek tributaries

Two intermittent tributaries are known from topological maps of the Rockview lands, but there is little information about them (Figure 4). Other intermittent tributaries may exist. An intermittent stream channel begins in the uplands near the penitentiary flowing northwest across agricultural fields and under I-99. It follows a road downslope to Spring Creek. The road and stream pass the former Rockview sewage disposal facility. Another channel begins in the agricultural uplands near the Shiloh Road interchange of I-99. It flows under I-99 and downslope to Spring Creek near the Benner Springs State Fish Hatchery.

Water Quality – The many miles of small and intermittent streams in the Spring Creek watershed greatly contribute to its water quality. Limited information about these tributaries on the Rockview property is known, but they likely carry runoff from agriculture in the uplands and roads (including I-99) and other impervious surfaces.

Forested Riparian Zone – Little forested riparian zone exists along the tributary channels. In the uplands, the channels have been impacted by roads and have sparse riparian vegetation. Native vegetation has been replaced with grass and agricultural fields (as visible in the aerial photos). Buffer widths for the tributaries should be at least 100-150 feet on either side, producing a 300-foot buffer.

Natural stream channel – The channel shapes, carved into the soils and rock, are dictated by the stream hydrology. Increased stormwater runoff from agriculture fields and impervious surfaces is likely to have altered hydrology and erosion in the stream channel likely occurs.

Connectivity to uplands – Forested stream buffers along the tributaries would provide corridors of connectivity from the uplands to the stream valley. The existing sparse vegetation does not provide a sufficient level of connectivity.

Springs

Most of Spring Creek flows through a karst basin that is characterized by discrete contributions of groundwater through springs that are distributed along the length of the stream and are an important contribution to baseflow. Their distribution is somewhat random making any given spring particularly important to the stream segment below it. The number and location of existing springs on the property is currently unknown.

Benner Spring is the only *known* spring to occur on Rockview property located north of I-99 (Figure 4). It is a high-capacity spring that discharges 4,080 gallon per minute (gpm) (measured on November 10, 1971) of high-quality groundwater to Spring Creek (Wood 1980). It is possible that other springs of smaller magnitude exist on the property as well as springs that issue from the actual streambed and therefore are less apparent. Benner Spring is a permitted supply of water for the PA Fish and Boat Commission's Benner Spring Fish Culture Research Station and a backup water supply for S.C.I at Rockview.

<u>Key Ecological Attributes and Threats to Springs</u>

Groundwater quantity – Groundwater recharge occurs across the landscape. Significant groundwater recharge occurs on highly-infiltrative soils (e.g. Morrison Soils) and geologic formations (e.g., Gatesburg Formation) and at discrete locations including sinkholes and closed depressions.

Spring flow is groundwater discharge that is maintained by groundwater recharge. Therefore, activities that reduce groundwater recharge, including increasing impervious surfaces, soil compaction and disturbance, reduction of vegetated land, and alteration of sinkholes and closed depressions, can potentially have a negative impact on spring flow. The probability of impact to any specific spring will depend on activities within that spring's contributing groundwater basin. Defining a spring's groundwater basin in a complex karst environment (e.g. Nitanny Valley) is difficult and often requires highly

technical methodologies (e.g., dye tracing, pumping tests, monitoring wells, etc.). The contributing groundwater basin for the Benner Spring currently is not defined.

Areas underlain by Morrison Soils and the Gatesburg Formation, however, are considered candidate critical aquifer recharge areas that extend over the length of the Spring Creek basin including a significant portion of the Rockview property being divested (Figure 3 and Figure 5). This portion of the Rockview property likely provides some recharge for one or more high-capacity "Gatesburg springs" located down basin including Paradise Spring, a series of large springs along lower Logan Branch, and Big Spring, the second largest spring in Pennsylvania.

Sinkholes and closed depressions also provide significant recharge and are important to spring flow. These focused groundwater recharge areas are frequently covered by development or otherwise destroyed by impervious surface, soil compaction, and disturbance caused by development and agriculture. These activities can convert potential recharge into surface water runoff, reducing flow of individual springs and causing increased stormwater volume.

Groundwater quality – Little renovation (i.e., filtration) of stormwater occurs below the biologically active soil layer. When stormwater runoff from urban or agricultural areas enters sinkholes, it typically bypasses this layer, allowing largely unrenovated stormwater to enter the aquifer. Depending on the location and size of the sinkhole, large quantities of stormwater can move into the aquifer very rapidly, potentially affecting the water quality of groundwater and therefore spring flow.

Inappropriate land use on critical recharge area can also negatively affect groundwater quality. On the Rockview property, soil types that typically overlie critical recharge areas include Morrison and Opequon. Morrison soils are deep, sandy soils that are formed in limey sandstone residuum (e.g., the Gatesburg Formation) that can provide some renovation of stormwater but its capabilities are limited for constituents including nitrates, volatile organic chemicals, and pesticides. Opequon soils are shallow well drained limestone soils that are formed on limestone residuum. They range from relatively level to very steep in slope and depth to limestone bedrock is less than 20 inches. Opequon soils located on the property include Oh and Ox mapping units (Figure 6). The Oh mapping units are actually soil complexes that include both shallow Opequon soils and some deep intermingled Hagerstown soils. Limestone rock outcrops may occur in these Oh mapping units. The Ox soil mapping units are soil complexes that include Opequon soils and rock outcrops. The Opequon soil mapping units are very environmentally sensitive because of the shallow depth to limestone bedrock and the presence of limestone outcroppings. Application of nutrients and pesticides on these shallow soils could result in groundwater contamination.

Natural pool, spring run, and riparian habitat – Spring pools and runs are sensitive riparian habitats that support certain floral and faunal species with limited distributions. Groundwater withdrawals (i.e. wells) and spring diversions can negatively affect spring pool and spring run habitats and also decrease the baseflow of the receiving stream. Physical alterations to these habitats including excavation, channelization, and removal of riparian buffers can significantly degrade or eliminate these habitats. Benner Spring has

been fenced in and covered with metal sheeting and the spring pools have been channalized.

PA Fish and Boat Commission is permitted by the Susquehanna River Basin Commission for a groundwater withdrawal of 2.45 MGD from wells #1 and #2. These wells are used in combination with Benner Spring to meet the water supply requirements of the fish hatchery. Flow from Benner Spring is being partially diverted by PA Fish and Boat Commission and S.C.I at Rockview. The PA Fish and Boat Commission diverts approximately 3,000 GPM (equivalent to 4.32 MGD) from Benner Spring to their Benner Spring Fish Culture Research Station (C. Ramish, PA Fish and Boat Commission, personal communication). Benner Spring is also the back up source of an approximate 1.0 MGD supply for S.C.I at Rockview. S.C.I at Rockview is currently replacing the existing waterline (to be completed in 2009) that transmits water from Benner Spring to their water treatment plant in McBride Gap. This water is then piped into two water towers that are located in McBride Gap and on the north side of Spring Creek and it is eventually used as drinking water for the penitentiary (F. Tennis, S.C.I at Rockview, personal communication). In 1999, PA Department of Environmental Protection designated Benner Spring to be groundwater under the direct influence of surface water. Based on available information the use of Benner Spring predates the Susquehanna River Basin Compact and the Susquehanna River Basin Commission. Consequently, there is not a withdrawal approval on record for Benner Spring.

Recommendations to protect springs

1. Inventory property for springs.
2. Install continuous flow monitoring instruments on Benner Spring to monitor current uses (i.e., PFBC and Rockview) and to determine impacts to Spring Creek.
3. Evaluate the current Rockview water system (Benner Spring diversion, reservoir, treatment facility, water tower, and other infrastructure) to determine system efficiency, impact to conservation values, and short and long-term maintenance costs. Conduct cost-benefit analysis of possible lower-impact options and make long-term recommendations.
4. Any future well development must include a 72-hour pumping test and monitoring of all potentially impacted springs. Withdrawals that exceed 100,000 gpd (or any withdrawal associated with a consumptive use) will be regulated by the Susquehanna River Basin Commission and will be subject to the SRBC regulations.
5. Prohibit the impact to other conservation targets (e.g., forest, wetlands, etc.) from infrastructure development (e.g., waterlines, powerlines, etc.) related to any future water source development or maintenance.

Wetlands

Wetland resources on the Rockview property located north of I-99 are not known. Aside from one pocket of Brinkerton Soils, hydric soils are limited to the stream corridor (Figure 8). Alluvial soils are also primarily limited to the stream corridors except for a few isolated pockets of Nolin and Chagrin Soils (Figure 8). Expected wetland types

include floodplain wetlands along the stream corridor and headwater wetlands that are associated with spring seeps.

Key Ecological Attributes and Threats to Wetlands

Native wetland vegetation composition – Maintaining native wetland vegetation is important to maintain wetland habitat and function. Disturbance, reduction, and removal of natural wetland vegetation can severely impact wetland integrity. These activities are typically associated with draining or grading wetlands and their buffers for other land uses (e.g., agriculture and development).

It is likely that the majority of the wetlands on the Rockview Divestment Lands are within the stream corridor and may have been impacted by the existing road and PFBC hatchery facilities. Wetlands located on the uplands are likely limited to the Brinkerton Soils located on the south side of Spring Creek. It is possible that agricultural activities may have impacted wetlands associated with these hydric soils. A wetland inventory and assessment should be conducted to identify wetland resources on the property and to prioritize restoration activities.

Connectivity and intact wetland buffer – Maintaining connectivity between wetlands and other natural areas allows wildlife to safely disburse and access wetlands. Maintaining intact naturally vegetated buffers around wetlands provides necessary riparian habitat for wetland species. Buffers also help to maintain abiotic conditions of wetlands (e.g., light, moisture, etc.) and protect against invasive species.

The proximity of hydric and alluvial soils on the Rockview Divestment Lands to existing wooded areas or areas that are likely to be restored facilitates the restoration of connective corridors and buffers around wetlands. Wetland buffer widths should be at least 100-150 feet on either side, producing a 300-foot buffer.

Water quality – Water quality of wetlands can be negatively impacted by surface water contaminated with nutrients, pesticides, and sediment. Maintaining wetland buffers significantly reduces this threat.

Water quality can also be negatively impacted by contaminated groundwater. This threat can be minimized by preventing inappropriate land use activities to occur on or near shallow limestone soils, sinkholes, and closed depressions.

Water quantity – Maintaining natural wetland hydrology is important to maintain wetland integrity. Activities that alter the wetland hydrology should be avoided.

Hydrologic regime – Maintaining natural hydrologic regime is important to maintain wetland integrity. Activities that alter the natural hydrologic regime of wetlands should be avoided.

Recommendations for Wetlands

1. Inventory, map, and assess the floodplain and all wetlands.
2. Restore degraded floodplain areas and drained or degraded wetlands.
3. Maintain, restore, or enhance buffers around all wetlands. Wetland buffer widths should be determined by surrounding land use but should be a minimum of 150, producing a 300-foot buffer.

4. Conserve or restore forested connectivity between wetlands and other natural areas (i.e., corridors) to prevent isolation.

Vernal Pools

Vernal pools are seasonal wetlands that provide habitat for a unique assemblage of amphibians and invertebrates. The terrestrial habitat surrounding vernal pools is considered critical habitat for adult amphibians and newly emerged juveniles (Semlitsch 1998). To conserve these unique habitats, both the seasonal pool and surrounding habitats must be protected from disturbances and alterations to hydrology and forest plant communities. There are no known vernal pools on the Rockview property located north of I-99.

Key Ecological Attributes and Threats to Wetlands

Native wetland vegetation composition – Maintaining native vegetation around vernal pools is essential to maintain pool integrity. Activities that disturb, reduce, and remove natural buffering vegetation are most commonly associated with other land uses (e.g., agriculture and development).

Connectivity and intact wetland buffer – Maintaining forested connectivity between vernal pools allows pool-dependent wildlife to safely disburse and access other vernal pools. Buffers also help to maintain abiotic conditions of vernal pools (e.g., light, moisture, etc.) and protect against invasive species. Buffer widths should be at least 300 feet and as much as 1000 feet to provide critical terrestrial habitat for pool-dependent species.

Water quality – Water quality of vernal pools can be negatively impacted by surface water contaminated with nutrients, pesticides, and sediment. Maintaining forested buffers significantly reduces this threat.

Water quality can also be negatively impacted by contaminated groundwater. This threat can be minimized by preventing inappropriate land use activities to occur on or near shallow limestone soils, sinkholes, and closed depressions.

Hydrologic regime – Maintaining natural hydrologic regime is important to maintain vernal pool integrity. Activities that alter the natural hydrologic regime of vernal pool should be avoided.

Recommendations for Vernal Pools

1. Inventory and map all vernal pools on the Rockview Divestment Lands.
2. Maintain, restore, or enhance buffers around all vernal pools. Buffer width should be determined by surrounding land use but should be a minimum of 300 feet but would preferably be up to 1,000 feet to conserve critical terrestrial habitat.
3. Maintain or restore forested connectivity between vernal pools

TERRESTRIAL HABITATS

Historically, Centre County was a forested landscape comprised of many different forest types. The majority of these forests where logged for charcoal and timber and areas with highly productive soils where commonly converted to agricultural uses.

Like the majority of the County, the Rockview divestment area was a forested landscape that likely supported many diverse habitats. The *Soils Survey of Centre County, Pennsylvania* and limited available research indicate that this property likely supported rich riparian forests, low-elevation calcareous forests, calcareous opening/ cliff plant communities, pitch pine-scrub oak barrens, and rich hemlock/white pine-mesic hardwoods forest, among others (SCS 1981, Fike 1999, Western Pennsylvania Conservancy 2002, Western Pennsylvania Conservancy 2006).

Because of past and current land use that occurred on the Rockview Divestment Lands, several of these forest types have been eliminated. Remnants of some forest types however do remain today and are primarily located along the Spring Creek corridor, steep slopes, or low-productivity soil types. The Centre County Natural Heritage Inventory recognized a significant portion of the Rockiew Divestment Area as a Biological Diversity Area in part because of the remaining rare forest plant communities. The construction of I-99 that began in 2000 severed a significant portion of the Biological Diversity Area from the larger Rockview Divestment Area, further degrading the forest resources in this area (Figure 2).

Viable Forest Habitat

Forest size, ratio of interior versus edge forest, and degree of connectivity are three primary characteristics that determine forest health and viability.

Key Ecological Attributes and Threats to Viable Forest Habitat

Viable Forest Patch Size – Maintaining large forested areas is essential to conserve and sustain diverse forest plant communities and their dependent wildlife. Simply stated, larger forests inevitably contain a larger diversity of habitats. These habitats in turn support a wide range of wildlife species. This area-species relationship is well documented.

Current land uses of the Rockview Divestment Lands include 49.59% forest (910.8 acres), 41.10% agriculture (754.8 acres), 4.81% old field (88.3 acres), 2.45% fish hatchery (22.3 acres), 0.73% power line (6.6 acres), 1.35% water (24.8 acres), 0.89% roads and parking (16.3 acres), and 0.66% agricultural facilities (12.2 acres) (Figure 10). There is also 0.02% commercial land use (0.4 acres) along Paradise Road but this area is not visible in Figure 10.

Interior (Core) Forest – As forests become fragmented by roads, utility corridors, and other land use types, there is an increase in edge effects that impact forest plant communities and associated wildlife assemblages. These edge effects extend a significant distance into the forest. Edge effects include changes in abiotic conditions (e.g., light and humidity) that cause changes in microclimate and species composition. Edge effects also include increases in nest predation, brood parasitism, and increases in invasive species. Mid-Atlantic research has shown that edge effects extend into the forest approximately 100 meters (328 ft) (Robbins et al. 1989, Debinski and Holt 2000, Goodrich et al. 2002). Forest habitat that is greater than 100 m from an edge is considered interior or core forest and is critical habitat for area-sensitive, or forest-interior species.

One of the highest conservation priorities for the Rockview Divestment Lands is to increase the amount of core forest by decreasing forest fragmentation and increasing

forest patch size. Currently, the forested habitat is 34% core forest (309.5 acres) and 66% edge forest (601.3 acres) (Figure 12). To protect core forest and area-sensitive forest species, it is imperative to decrease forest fragmentation and to increase the size of forest on the Rockview Divestment Lands property. It is important to note that changes in land use (i.e., removal of forest or conversion to agriculture or residential use) on adjacent forested properties along Barnes Lane would significantly reduce the amount of core forest on the Rockview Divestment Lands.

For illustrative purposes, different restoration scenarios were created to show how the percentages of core to edge forest would change from its current condition by restoring portions of the Rockview Divestment Lands (Table 1). Scenario 1 includes the conversion of old field habitat to forest habitat and results in a 70.7% increase in core forest and a 1.8% decrease in edge forest (Figure 13). Scenario 2 includes the restoration of old field habitat, a 1000-foot riparian buffer on Spring Creek, a 300-foot buffer on the tributaries, and shallow limestone and erodible soils (Figure 14). This scenario results in a 94.8% increase in core forest and a 22.9% increase in edge forest. Scenario 3 is the same as scenario 2 but also include the smoothing of forest edges to reduce edge habitat (Figure 15). This scenario results in a 189.5% increase in core forest habitat and a 4.7% increase in edge habitat. Scenario 4 is the restoration of all Rockview Divestment Lands (Figure 16). This scenario results in a 272.2 % increase in core forest habitat and a 0.2 % increase in edge habitat.

Table 1. Comparison of core and edge forest between the current condition and four restoration scenarios.

	Current		Restoration Scenario 1		Restoration Scenario 2		Restoration Scenario 3		Restoration Scenario 4	
	Forested Acres	Percent of total forested area	Forested Acres	Percent of total forested area	Forested Acres	Percent of total forested area	Forested Acres	Percent of total forested area	Forested Acres	Percent of total forested area
Core Forest	309.5	34.0	528.5	47.2	603.1	44.9	896.13	58.7	1152.0	65.7
Edge Forest	601.3	66.0	590.5	52.8	738.9	55.1	629.37	41.3	602.2	34.3
Total	910.8	100.0	1,119.0	100.0	1,342.0	100.0	1,525.5	100.0	1,754.3	100.0

In all four restoration scenarios, the area of forested habitat increases from the current condition. However, in scenario 1 and scenario 2, there is still a greater percent of edge forest than core forest. In scenario 3, the line between the proposed restored land and the agricultural land was smoothed to reduce edge effects and resulted in a dramatic increase in core forest (Figure 15). Under this scenario 3, the number of acres of core forest finally exceeds the number of acres of edge forest. Scenario 4, restoring all of the Rockview Divestment Lands, results in the greatest number of restored acres and the largest ratio of core to edge forest.

Old-growth Characteristics – The forests of the Rockview Divestment Lands are predominately second growth even-aged forests that regenerated after the original old-

growth forests were cleared for timber, agriculture, and to fuel local iron furnaces. The habitat diversity, habitat quality, and species composition of these new forests are significantly different than the previous old-growth forests. As a result, these forests support a decreased diversity and abundance of many plant and wildlife species, and related ecological processes and values.

Old-growth characteristics, including a diversity of tree ages and sizes (including very large trees 25-30" in diameter), snags, large downed trees, and gaps in the forest canopy, can be restored through either passive or active management. Passive management will result in the most naturally functioning and complete ecosystem. Depending upon the initial conditions this approach might take over 100 years or more to reach this goal. Active management can achieve some old-growth characteristics in a shorter time period using carefully planned management prescriptions but other aspects of old-growth characteristics might be compromised.

Several factors should be considered before identifying specific old-growth restoration areas and prescribing restoration methods including: 1) identify areas on the property that already have enhanced old-growth characteristics, 2) identifying areas that have the highest site quality (water and nutrients) and are therefore the most productive, and 3) identifying how restored old-growth areas could fit into the surrounding landscape.

Connectivity – The Rockview Divestment Lands are located between the forested ridges of Mount Nittany and Bald Eagle Mountain. Maintaining forest connectivity between forest patches is important to maintain viable plant and animal populations. Connectivity opportunities should be evaluated based on management targets, distance between habitats, and surrounding land use (Figure 2 and Figure 11).

Recommendations for Viable Forest Habitat

1. Expanding rare forest habitats identified in the *Ecological Assessment and Planning for the Spring Creek Biological Diversity Area* should be strongly considered. These habitats should be significantly buffered to eliminate edge effects where appropriate.
2. Include the restoration of old-growth characteristics in forest restoration planning especially on high-quality soils (Figure 17).
3. Assess the impact of white-tailed deer overbrowsing on forest regeneration and adopt appropriate management strategies.
4. Establish an invasive species management plan as part of the larger forest restoration and management plan.
5. Determine the feasibility of creating corridors or stepping stones between the Rockview Divestment Lands and Nittany and/or Bald Eagle Mountains (Figure 11).

Existing Forest Plant Communities

The Spring Creek Valley contains some of the most intact examples of limestone-dependent natural community types to be found anywhere in Centre County, and these

communities host a number of plant and animal species that are extremely uncommon in Pennsylvania, several of which are globally rare (Western Pennsylvania 2002). The uniqueness of this property originates from the subsurface limestone geology and its resulting limestone-based, high-pH soils. Further, the Spring Creek Valley's dramatic topographic relief results in many different combinations of slope, aspect, and elevation that provide habitat for a diverse spectrum of natural communities (Western Pennsylvania Conservancy 2006).

The forest communities that occupy the more moderate slopes of the valley are also ecologically important (Western Pennsylvania Conservancy 2002). There are very few areas of limestone-based, high-pH soils remaining in natural vegetation, as this soil type tends to occur in low, rolling or flat valleys that have largely been converted to agricultural use. For the same reason there are also very few remaining areas of lowland forest along mid-sized and larger waterways (Western Pennsylvania Conservancy 2006).

Of the 30 different natural community types (Fike 1999) located within the Spring Creek Valley, the following 12 types are mature natural types; of these, seven are unusual enough in Pennsylvania to be considered of special concern* (Western Pennsylvania Conservancy 2006).

- Calcareous opening/cliff communities*
- Dry oak-mixed hardwood forest*
- Dry red oak-mixed hardwood forest*
- Floodplain
- Floodplain woodland and meadow
- Green ash-mixed hardwood forest*
- Hemlock (white pine) forest
- Red oak-mixed hardwood forest
- Rich dry oak-white pine forest*
- Rich hemlock-mesic hardwood forest*
- Rich hemlock/white pine-mesic hardwoods forest*
- Sugar maple-basswood forest

Many of these forest types are located within the riparian zone and provide several miles of forested riparian habitat in the centre of the Spring Creek Watershed. These forests are essential to protect water quality but they also provide critical habitat for many plant and animal species.

Other Plant Communities: Calcareous opening/cliff

The calcareous opening/cliff plant community occurs exclusively on calcareous cliffs, out-crops, and rocky slopes. These features flank Spring Creek as it passes through the Rockview Divestment Lands and are the basis for the naming of the "Canyon". Plant species change along these landforms with as variations in exposure and shading change temperature, sunlight, and moisture (Fike 1999 and Western Pennsylvania Conservancy 2006).

Key Ecological Attributes and Threats to Calcareous Opening/Cliff Plant Communities

Native Plant Community – Native species assemblages on the calcareous landforms are threatened by excavation that destabilizes the cliffs and out-croppings, invasive species, species collection, rock climbing, and other nearby exploratory activities.

Forest Buffer – Buffers maintain abiotic conditions (e.g., light, moisture, etc.) and protect against the colonization of invasive species.

Connectivity among communities – Maintaining forest connectivity between various calcareous landforms is essential to maintain pollination (pollinators or wind) and species colonization.

Size of ecosystem – Because of its rarity, it is critical to prevent any loss or degradation of this habitat type. Likely causes of habitat loss include excavation that causes destabilization of these landforms and inappropriate recreation (rock climbing, caving, and hiking off of designated trails).

Recommendations for Calcareous Opening/Cliff Plant Communities

1. Prevent any activity that will destabilize calcareous landforms.
2. Maintain forested buffer widths of at least 100 meters around calcareous landforms.
3. Remove all invasive species from calcareous opening/cliff plant communities and surrounding buffer areas using site-appropriate methods.
4. Maintain forested connectivity between calcareous landforms.

Missing Plant Communities: Pitch Pine-Scrub Oak Barrens

Barrens are a naturally occurring thicket/shrub habitats comprised of unique plant communities that support many rare and threatened plant and animal species. There are a few major types of naturally-occurring barrens community complexes in Pennsylvania as well as several minor shrubland community types (Fike 1999, in part, and Pennsylvania Game Commission and Pennsylvania Fish and Boat Commission 2008). State Game Land (SGL) 176 of Centre County (locally known as the Scotia Barrens) contains what is one of the few known remaining examples of low-elevation pitch pine-scrub oak barrens in the state and is known to support 15 rare, threatened or endangered floral and faunal species and it possible that more will be discovered. Naturally occurring shrubland barrens are considered a unique and globally-imperiled habitat in Pennsylvania in need of conservation, restoration and management, and their historic and current extent in the Commonwealth is not known (Pennsylvania Game Commission and Pennsylvania Fish and Boat Commission 2008). In Pennsylvania, it is believed that this habitat was once largely found in Centre, Huntingdon, Blair and Bedford counties, but the number, size and quality of sites has been significantly reduced. This is especially true for the area in and around State College.

ClearWater Conservancy is currently partnering with the Western Pennsylvania Conservancy to complete the *Nittany Valley Conservation Action Plan*. This planning process identified the conservation of low-elevation pitch pine-scrub oak barrens of central Pennsylvania as one of the highest priorities (K. Ombalski, ClearWater

Conservancy, personal communication). Aspects of barrens restoration are also of concern.

The low-elevation pitch pine-scrub oak barrens of central Pennsylvania are believed to coincide with the geologic Gatesburg Formation and Morrison Soils (Fike 1999). Geology and soils maps created for this report show that the portion of the property to be divested located north of Spring Creek is underlain by both the Gatesburg Formation and Morrison Soils (Figure 2 and Figure 4). The majority of the area north of Spring Creek is currently forested, however, approximately 120 acres were managed by Rockiew as a fruit and nut orchard that is now largely abandoned. Barrens indicator species (*Quercus ilicifolia*, *Baptisia tinctoria* and *Comandra umbellata*) were located on the periphery of the orchard during a field survey in late fall 2009 (C. Bier, H. Henderson, and K. Ombalski, personal communication). It is believed that the Rockview property north of Spring Creek is likely to have once supported, or had the ecological potential to support, pockets of rare low-elevation pitch pine-scrub oak barrens habitat and could once again with proper restoration and management.

Missing Plant Communities: Low-Elevation Calcareous Forest Type

Large expanses of low elevation forests have been removed in Pennsylvania during the conversion of these forests for other human uses, largely agriculture, but also urban/suburban development, various industrial uses, and highways. Many of these forest communities existed on soils derived from calcareous bedrock (limestone), which are also ideal for many agricultural uses (Figure 17). The topographic position of these forests on level and gently rolling land made them particularly vulnerable as these areas were desirable for development. Today, there are no good, intact, viable examples of such forest. Remnants of these forest communities remain as very small scattered patches. This situation has caused these natural communities to be largely overlooked, even by ecologists and conservationists during research and conservation planning. The present classification of terrestrial plant communities for Pennsylvania does not adequately address this community type (Fike 1999) and an entire component of regional biodiversity thus remains as only fragments and in need of restoration to a viable condition. The low elevation calcareous forest is an endangered forest community and habitat.

Much of the low elevation lands of the Spring Creek watershed, including a significant area of the Rockview Divestment Lands located between Spring Creek and I-99, are believed to have once harbored this forest community (Figure 17).

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The Rockview Divestment Lands currently support a large diversity of habitat types, some of which are uncommon or rare at local, state, and global scales. Viability of these habitats is in part determined by habitat patch size, with the largest patches being the most ecologically significant. These habitats and the uncommon wildlife that they support should be the focus of conservation priorities for the Rockview Divestment Lands. Other habitat types and wildlife found on the property that are more common are better served as conservation priorities elsewhere in the region.

Aquatic Invertebrates

Invertebrate communities have been sampled in recent years at the upper and lower boundaries of the Canyon section of Spring Creek. On the basis of these samples, one can make some inferences about the invertebrate community in the Canyon section, recognizing that a thorough sampling regime needs to be completed in this section.

Pennsylvania DEP biologists sampled the invertebrate communities near the lower Canyon section in 2005 and 2006, and computed Index of Biotic Integrity scores of 80-90% of reference values. These scores obtained in the lower canyon upstream of the Bellefonte Hatchery were among the highest for any site in Spring Creek and they are rather close to the highest scores attainable for limestone streams. However, the numbers of Ephemeroptera and Trichoptera (mayflies and caddisflies) taxa were relatively low, a condition that is common in most of Spring Creek. The absence of two invertebrate taxa is noteworthy: the green drake mayfly *Ephemera guttulata* and the caddisfly *Brachycentrus*. The green drake was last seen in Spring Creek in 1956, prior to the cyanide spill that killed aquatic organisms from State College to at least as far downstream as the Bellefonte State Fish Hatchery. There are no records to suggest when *Brachycentrus* was extirpated from Spring Creek. Given the much improved water quality in the Canyon section of Spring Creek, there seems to be good potential for re-establishing the green drake and *Brachycentrus* in this section.

The crayfish fauna in the Canyon reach consists of two natives, *Cambarus bartonii* and *Orconectes obscurus*, and one exotic, the rusty crayfish *Orconectes rusticus.* The rusty crayfish was recently found in the lower portion of the Canyon reach, which appears to be the most upstream extent of its invasion in Spring Creek. This species is of particular concern because it often attains high densities and eliminates native crayfish species. Proactive management of rusty crayfish in the Canyon reach may well thwart the expansion of this species.

Key Ecological Attributes and Threats to Aquatic Invertebrate Communities

Water quality – The maintenance of a productive and diverse aquatic macroinvertebrate community is closely tied to the maintenance of excellent water quality. Macroinvertebrates are generally more sensitive to changes in water quality than are fish, so that when water quality begins to deteriorate, macroinvertebrates are usually the first to respond. Increases in concentrations of nutrients, dissolved organic matter, toxic substances, or sediment loading will likely cause a loss of pollution intolerant taxa and an increase in pollution tolerant ones.

Invasive species – The rusty crayfish poses a significant threat to native crayfish species and to smaller bodied macroinvertebrates that are preyed upon by the rusty crayfish. Another potential threat to macroinvertebrates is the diatom *Didymosphenia geminata*. This alga can produce thick mats that completely cover the stream bottom and lead to a reduction in macroinvertebrate diversity. This alga has been found in Pennsylvania streams, but it is not know to occur in Spring Creek.

Recommendations for Aquatic Invertebrate Communities

1. It is recognized that activities in the upper part of the watershed will affect water quality in the Canyon reach of Spring Creek. Management of lands in the Canyon

area, however, can have direct effects on water quality. If lands in the project area are used for agricultural production, it is essential that no surface runoff from these operations reach sinkholes or make direct connection to the stream. Runoff from agricultural fields can carry nutrients, pesticides, and sediment, all of which can have significant negative effects on aquatic communities and drinking water supplies.

2. Runoff from forested lands subjected to logging operations or road building can introduce much sediment to streams. Strict control of landscape disturbances is imperative.
3. Work with the PFBC to define limit of upstream occurrence and explore ways to limit upstream movement of rusty crayfish and possible ways to exercise population control.
4. Work with PFBC to develop an education program and/or regulations to prohibit the use of rusty crayfish as live bait.
5. Work with PFBC to educate anglers about the spread of *Didymosphenia geminata* and how care and cleaning of wading boots and shoes are needed to prevent its spread.
6. Prohibit any activities in the uplands that could potentially cause erosion, e.g., use of ATVs.
7. Prohibit or restrict foot traffic in designated riparian areas that could cause increased erosion, loss of vegetative cover, and degradation to native plant communities.

Fish Communities

The Canyon reach of Spring Creek supports at least six native species of fish including slimy sculpin (*Cottus cognatus*), blacknose dace (*Rhinichthys atratulus*), longnose dace (*Rhinichthys cataractae*), cutlips minnow (*Exoglossum maxillingua*), tessellated darter (*Etheostoma olmstedi*), and white sucker (*Catostomus commersonii*). This fish assemblage is typical of limestone streams. There are also three introduced species – common carp (*Cyprinus carpio*), rainbow trout (*Oncorhynchus mykiss*), and brown trout (*Salmo trutta*). Common carp are not abundant; they are found in a few large pools. Rainbow trout density is low and natural reproduction is not confirmed. Brown trout are abundant and their biomass ranged from 294 to 433 kg/ha in the stream section that includes the canyon reach during surveys conducted by the PA Fish and Boat Commission in 2000 (Hollender and Kristine 2000). These biomass estimates represent an exception wild brown trout population and are the highest of any stream in the state. Brown trout were introduced into the Spring Creek watershed during the late 1800s and by the 1950s they had largely displaced native brook trout from the entire main stem and much of the tributaries. Poor water quality likely also contributed to the displacement of brook trout. Brook trout now persist in five headwater streams (Galbraith Gap Run, Musser Gap (unnamed tributary), Roaring Run, Gap Run, and Logan Branch) in the watershed, and three of these streams are isolated from downstream reaches because the streams sink into the streambed and only a dry channel remains for much of the year.

The exceptional brown trout population attracts huge numbers of anglers to Spring Creek. Recent estimates indicate that fishing pressure on the middle reach of Spring Creek is 29 to 34 times the statewide average (Carline et al. 2009). It has been more than 15 years since the last economic survey of the recreational fishery has been completed. Hence, there are no good estimates of the current value of this sport fishery. The economic revenue generated by the angler use on these stream sections was estimated to be about $14,000/mile for the lower section and $71,000/mile for the middle section, which included the lower end of the canyon at Fisherman's Paradise (Shafer et al. 1993). More careful economic studies are needed. A comprehensive economic and angler use evaluation that includes sections throughout Spring Creek would provide the most up-to-date and useful information regarding the economic revenue and recreational angling generated by the Spring Creek trout fishery.

Key Ecological Attributes and Threats to Fish Communities

Community Productivity – The key ecological attribute of the Canyon reach of Spring Creek is the high fish community productivity. The abundance of brown trout provides a measure of this productivity. Brown trout biomass ranged from 294 to 433 kg/ha in the stream section that includes the canyon during surveys conducted by the PA Fish and Boat Commission in 2000. To put this biomass level into perspective, the PFBC categorizes streams with a wild brown trout biomass of $\geq$40 kg/ha to be considered as Class A, which means that there are sufficient wild trout present to support a viable fishery without stocking. Thus, the Canyon reach of Spring Creek supports about 7 to 10 times the minimum biomass necessary for Class A designation. There are no estimates of density or biomass of other fish species in this reach. Nonetheless, it is safe to assume that the biomass of other species is proportional to that of brown trout.

Beard and Carline (1991) showed that densities of age-0 and of all age-1 and older brown trout were positively correlated with redd densities in Spring Creek. Additionally, they found that redd densities were a function of suitable spawning substrate. Brown trout redd surveys conducted by Penn State, PFBC staff, and other partners from 1987 – 2007 have shown that the section of Spring Creek within the canyon and the adjacent downstream reach have consistently supported the highest density of brown trout redds. Beard and Carline (1991) concluded that juvenile brown trout do not disperse widely from natal areas, and that local population densities are largely a function of the availability of spawning habitat. Thus, if the excellent habitat that currently exists in the canyon section of Spring Creek becomes degraded, it is likely that brown trout reproduction and the population as a whole will be negatively affected. Furthermore, any degradation to the canyon area will also likely have a negative impact on downstream reaches, including Fisherman's Paradise (Detar and Kristine 2008).

One of the major threats to the fish community of Spring Creek is the deterioration of water quality from stormwater that could include increased concentrations of nutrients, dissolved organic matter, toxic substances, and sediment loading. Coldwater fish communities consist of fish species that are generally pollution intolerant. Degradation of water quality is likely to lead to a loss of pollution intolerant species and an increase in pollution tolerant forms. As urbanization in the upper portion of the watershed continues to increase, the threat of declining water quality will increase.

Maintenance of the current coldwater fish community is closely linked to the maintenance of adequate water temperatures, particularly during the summer months. Recent studies have shown that during summers with above normal temperatures, growth rates of brown trout are quite low or negative (Carline et al. 2009). Warm stream temperatures are typically associated with below normal stream flow, which reflects the status of groundwater reserves. Because of this tight linkage between groundwater, stream flow, and stream temperature, any changes in the landscape that negatively affect groundwater recharge will in turn negatively affect stream flow, summer water temperatures, and trout growth.

The threat of invasive fish species displacing native species in Spring Creek is strongly related to water quality and stream temperature. If water quality deteriorates or summer water temperatures increase, coldwater fish species will be stressed and species better adapted to the new conditions are likely to become established. An increase and range expansion of the rusty crayfish poses a potential threat to the fish community of Spring Creek. This crayfish can significantly affect the invertebrate community, but it is not clear if these effects might spiral up to the fish community.

Recommendations for Fish Communities

1. It is recognized that activities in the upper part of the watershed will affect water quantity and quality in the Canyon reach of Spring Creek. Management of lands in the Canyon area, however, can have direct effects on water quality. If lands in the project area are used for agricultural production, it is essential that surface water runoff influenced by these operations does not reach sinkholes or make direct connection to the stream. Runoff from agricultural fields can carry nutrients, pesticides, and sediment, all of which can have significant negative effects on aquatic communities.
2. Runoff from forested lands subjected to logging operations or road building can introduce much sediment to streams. Strict control of landscape disturbances in forested tracts is imperative.
3. There are several stretches of stream bank in the Canyon reach that are unstable and are contributing sediment to the stream, particularly during high flows. Some of these unstable stream banks are related to natural events such as windblown trees that are downed in the channel. In other areas, stream bank erosion is likely due to more rapid increases in stream flow during storm events. Regardless of the cause, eroding stream banks should be restored to a stable condition. Such restoration may be possible with rather simple, non-invasive measures, such as removing windblown trees that divert stream flow to banks vulnerable to erosion. Some reaches may require intensive in-stream work to install structures necessary to protect stream banks and keep stream flow in the middle of the channel.
4. Work with PFBC to develop an education program and/or regulations to prohibit the use of rusty crayfish as live bait.
5. Prohibit any activities in the uplands that could potentially cause erosion, e.g., use of ATVs.

6. Prohibit or restrict foot traffic in designated riparian areas that could cause increased erosion, loss of vegetative cover, and degradation to native plant communities.

Mammals

Although no formal mammal inventories have been conducted on the Rockview Divestment Lands, 51 species of mammals are known or have the potential to occur on the property (Appendix A). This mammal assemblage represents approximately 73% of known mammal species that occur in Pennsylvania.

Due to the presence of steep rocky slopes, mixed early successional forest, and rich riparian forests, a diversity of mammals is and can be supported by the Rockview Divestment Lands. Of the mammals suspected of occurring within or around the property, nine species are considered species with “special concern” status or are uncommon in the state. Special concern status indicates that the species is rare in Pennsylvania and may be further listed as state or federally threatened or endangered. Furthermore, species of special concern usually require special habitat features that may be present on Rockview Divestment Lands.

The rich riparian forests, found along the 3.3 miles of Spring Creek throughout the property, are a main source of habitat for many of mammals. For example, this property potentially supports an especially rich assemblage of mustelids (weasels) with all mustelids native to this region of Pennsylvania potentially represented. The river otter and fisher have recently been re-introduced into Pennsylvania in the last 20 years and reports of otters on Bald Eagle Creek and fishers on Mount Nittany indicate that they could inhabit the Rockview Divestment Lands. The least weasel, northern river otter, and fisher are species with “special concern” status or are uncommon in the state.

Another special concern species that has the potential to inhabit the property is the Appalachian cottontail. The Appalachian cottontail, as its name implies, is endemic to the Appalachian Mountains. The nearby Scotia Barrens supports an especially healthy population of this special concern species and a 1942 Benner Township record (PA: Centre Co.: Benner Township. H. Merritts, 23 Oct 1942. Male. Accession # FR334. PSU) of this species indicates that the early successional/old field habitat found on the Rockview property could support populations of this species with proper management (Pennsylvania Natural Heritage Program database).

The natural habitat found around and within the Spring Creek canyon also serves as an important riparian corridor for mammals amidst an increasingly urbanizing landscape. Mammals often use streams corridors for movements and the sheer size of the continuous and linear riparian habitat along this section of Spring Creek makes this an important wildlife corridor. This corridor may be used by mammals that have large home range requirements such as black bears, bobcats, fishers, and migrating bats. Black bears are regularly sighted on the property. Bobcats have been documented on Scotia Barrens lands and have been killed along the State Route 322 corridor, so the likelihood of them occurring on the Rockview property is very high. In addition fishers recently (2007) have been documented on Mount Nittany and may use the Rockview Divestment Lands as a corridor to move between the expansive forests found on the surrounding ridges.

Another mammal assemblage of particular note is the bat species known or suspected of occurring on the Rockview Divestment Lands. South-facing limestone bluffs along Spring Creek are possible maternity and roosting habitat for big brown bats and eastern small-footed myotis--a Pennsylvania critically imperiled and globally vulnerable species. If present, surrounding forest would be important foraging habitat for these species. The forested areas area also likely to be important roosting and foraging habitat for more common species including little brown bat, eastern red bat, long-eared bat, hoary bat, silver-haired bat, and eastern pipistrelle. Restoring the property's agricultural fields to forest would greatly enhance foraging habitat for eastern small-footed myotis, two PA Maintenance Concern species, and several common bat species. Increasing the forested habitat along Spring Creek corridor may also provide foraging habitat for Indiana bats--a species listed as critically imperiled in Pennsylvania, federally threatened, and globally imperiled.

Threats to Mammals

Small forest patch size – Large carnivores like black bears, bobcats, and fishers need access to large areas of mature forest to provide suitable habitat. Mature forest typically provides these species with minimal human disturbance, abundant prey, and suitable den sites necessary for their persistence in central Pennsylvania. In particular, the forested corridor of the Spring Creek canyon provides access to these large areas of mature forests by providing a potential corridor between forested ridges in an increasingly urbanizing Centre county.

Excessive edge – As forests become fragmented by roads, utility corridors, and other land use types, there is an increase in edge effects that impact forest plant communities and associated wildlife assemblages. Mid-Atlantic research has shown that edge effects extend into the forest approximately 100 meters (328 ft) (Robbins et al. 1989, Debinski and Holt 2000, Goodrich et al. 2002). Forest habitat that is greater than 100 meters from an edge is considered interior or core forest and is critical habitat for area-sensitive, or forest-interior species. Fragmentation will actually benefit many generalist mammalian species (e.g., raccoon, skunk, opossum, etc.) but will severely impact habitat of area-sensitive species. As forest fragmentation becomes more severe, distance between forests patches increases causing islands of habitat with little to no connectivity between them causing isolation between wildlife populations.

Missing native plant communities (e.g., pitch-pine scrub oak barrens, low-elevation calcareous forest type) – Restoration of lost habitat types on the Rockview Divestment Lands significantly increases the potential to enhance existing wildlife populations or support new populations of rare, threatened and endangered species. For example, restoration of pitch-pine scrub oak barrens would significantly increase suitable habitat for Appalachian cottontail and other barrens-dependent species. Restoration of low-elevation calcareous forests would reestablish a now-rare plant community that in turn would support several rare and declining wildlife species. In time, large restored forested areas will increase core forest habitat, providing habitat for many area-sensitive species.

Removal or reduction of naturally forested riparian corridors – The interface between the edge of Spring Creek and the adjacent terrestrial habitat, the riparian zone, provides

vital habitat for mustelids and other aquatic or semi-aquatic mammals. Therefore, water quality must be maintained and habitat fragmenting features such as trails, roads, parking lots, and other habitat disturbances should be minimized within 100 feet of the stream edge. Forested riparian corridors should be maintained or restored along the entire length of Spring Creek and tributaries to ensure the conservation of the riparian mammalian assemblage.

Excessive deer browse – While not the only cause for inadequate regeneration, white-tailed deer can have a profound influence due to their sheer size and density on the landscape. Prior to European settlement, white-tailed deer densities were estimated to have occurred at a natural density of 7-12/mi² but now often occur at twice that (or greater) in many areas. This not only affects the quality of the overall deer herd, but forest health by their direct browse of favorable regeneration. Other wildlife are impacted due to the resulting reduction of available food and cover, but also the reduced structural diversity for species that depend on lower and mid-canopy diversity for nesting and foraging. The impact of white-tailed deer on the Rockview Divestment Lands is currently unknown.

Species-specific threats: Bats are under increasing stress from habitat loss, industrial wind farm development, and a recent disease outbreak called "white nose syndrome". Therefore, potential and known roosting sites and hibernacula present in and around the Rockview Divestment Lands should be protected. In particular rock faces, known caves, and old, large trees (> 80 years) may provide critical habitat for bats and should be protected from recreational uses or disturbance. Furthermore, excessive use of pesticides on agricultural lands in the area may be detrimental to insectivorous bats and other small mammals (e.g., shrews, moles).

<u>Recommendations for Mammals</u>

1. Create a vegetation community map to determine the distribution and extent of the current vegetation communities and existing connectivity.
2. Conduct mammal surveys in each vegetation community type and use data to establish scientifically rigorous management recommendations for the Rockview Divestment Lands.
3. Conduct a deer browse study on the Rockview Divestment Lands to determine the impact of deer on the existing habitat and incorporate this information into forest management (restoration) plans. Work with the Pennsylvania Game Commission to maintain an appropriate deer population as determined by habitat management goals. Also work with adjacent landowners (private and public) to implement deer management recommendations on a landscape scale.
4. Determine feasibility and appropriate methods to reestablish barrens habitat at the former orchard site.
5. Restore and enhance the natural plant communities of the Rockview Divestment Lands to the highest degree possible. Special emphasis should be placed on reestablishing missing plant communities and significantly increasing core forest.

Birds

Although no formal inventories have been conducted, over 100 species of breeding birds are known to occur within or near the Rockview Divestment Lands (Appendix B) (Brauning and Gill 1983-1989 and the Second Breeding Bird Atlas Project 2008, unpublished data). This atlas data has been largely compiled by birdwatchers from two time periods, 1984-1889 and 2004-2008. Of the bird species documented through atlassing efforts in the areas in and around this property, 21 species have been described as "species of greatest conservation need" in the State Wildlife Action Plan (Pennsylvania Game Commission and Pennsylvania Fish and Boat Commission 2008) (Appendix C). Many of these birds are neotropical migrant passerines that rely on large contiguous tracts of forest to establish successful breeding territories.

Of particular interest are the "high-level concern" and "responsibility species" in Appendix C. This designation is assigned to species that are imperiled and have core populations in Pennsylvania and/or a significant proportion (>5-10%) of the regional population so that Pennsylvania has a high responsibility for conserving the species. These conservation tiers include species which may be relatively abundant and/or locally common AND for which Pennsylvania serves as a "population core." It is anticipated that responsibility species which are still currently abundant can be protected through prudent attention to habitat management. In addition, many of these species are of "maintenance concern." This conservation priority tier represents species that are still considered abundant and fairly secure, but have undergone recent declines that should be addressed. Species also were included in this tier if they serve as an indicator for high-quality habitats. The main focus in managing all of these species is to ensure the continued viability of core populations, protect key habitats, and establish monitoring efforts as needed (Pennsylvania Game Commission and Pennsylvania Fish and Boat Commission 2008).

The Rockview Divestment Lands support many bird species of special concern because of its diversity of habitats including steep rocky slopes, early successional forest, mixed deciduous and coniferous forest, and rich riparian forests.

<u>Forest interior species</u>

This property potentially supports an especially rich assemblage of neotropical migrant passerines during their critical breeding season. Many of these species of concern are "area-sensitive" forest-interior species that require large contiguous (i.e., unfragmented) blocks of native forest with minimal edge to nest successfully. Examples include scarlet tanager, black-throated green warbler, wood thrush, and worm-eating warbler. Other migratory species include sharp-shinned and broad-winged hawks, and both may nest in the forested areas of the property.

<u>Riparian species</u>

The sheer size of the continuous and linear habitat along Spring Creek makes this an important wildlife corridor amidst an increasingly urbanizing landscape. Many bird species rely on this habitat type for breeding, nesting, and foraging activities. Several riparian-associated species of concern have been documented in these habitats on or near the Rockview property, including Louisiana waterthrush, willow flycatcher, Kentucky warbler and Acadian flycatcher. Areas in the canyon dominated by Eastern hemlock

(*Tsuga canadensis*) also provide critical habitat for specialists closely associated with the specific microhabitat conditions relatively unique to this forest type. Species of greatest conservation need that are closely associated with hemlock and have been documented by the Breeding Bird Atlas (BBA) on or near the Rockview property include black-throated green warbler, Acadian flycatcher, blue-headed vireo, and Louisiana waterthrush (Brauning and Gill 1983-1989 and the Second Breeding Bird Atlas Project 2008, unpublished data). Although not documented during the BBA, blackburnian warbler is another hemlock-associated species that could feasibly be present in the area. The rock outcrops and cliff faces also add to the habitat diversity in these riparian areas, which are not only important habitats for many bird and mammal species, but also for sensitive plant communities.

Barrens/early-successional species

There are currently documented occurrences of early successional species on and near the Rockview property. The orchard area contains barrens soils and plants (e.g., scrub oak) and is amenable to restoration to further enhance habitat for barrens-associated bird species, such as golden-winged warblers (high-level concern). Brown thrashers and yellow-breasted chats often frequent these habitat types for nesting and foraging, and both species are of maintenance concern. Management and creation of the barrens habitat type has great potential on this property, especially in areas where appropriate soil conditions persist and indicator plant species (Q*uercus ilicifolia, Baptisia tinctoria* and *Comandra umbellata*) are already present (C. Bier, H. Henderson, and K. Ombalski, personal communication). Furthermore, the creation of young forest habitat is also feasible, especially when done in conjunction with other habitat management objectives (e.g., regeneration cuts) that do not conflict with other over-arching goals.

Appendix C provides relevant habitat and management information for the species of greatest conservation need thought to be on the Rockview property. These management recommendations come from peer-reviewed literature where it is known, however it must be acknowledged that significant data gaps exist for many species.

Threats to Birds

Excessive edge (high edge to interior forest ratio) – Forest interior bird species listed in Appendix C require large contiguous forested areas with minimal edge for suitable breeding and foraging habitat. Forest edge habitat is exposed to more dramatic environmental influences (i.e., sun, wind, precipitation) than the forest interior. These influences change the microhabitat quality and creates habitat characteristics unsuitable for forest interior species. These edge habitats also create unfavorable conditions for species sensitive to influences from adjacent land use. There is a significantly higher density of predators in forest edge habitats, such as raccoons, crows, cats, etc., and this is especially detrimental to forest-interior species that nest lower in the canopy, in shrubs, or on/near to the ground. Brood-parasitism of forest-interior bird species by brown-headed cowbirds also increases in these edge habitats, reducing their nest success and further contributing to population declines.

Loss of early successional habitat – While the extent of this habitat type is difficult to quantify due to its transitional nature, we can document its decline in Pennsylvania from a variety of factors (i.e., development, clearing, or lack of management to retain the

developmental stage). Many early successional bird species, such as golden-winged warbler, field sparrow, and American woodcock are showing significant declines in Pennsylvania. A mosaic of natural habitat communities potentially make the Rockview Divestment Lands home to a rich variety of bird species, especially for the golden-winged warbler, a high-level concern species in Pennsylvania.

Degraded riparian forest - The forested riparian zone along Spring Creek provides vital habitat for many bird species of greatest conservation need, many of which are also intrinsically tied to larger interior forest habitats (i.e., Louisiana waterthrush, Acadian flycatcher). Common threats to this habitat type include degraded floodplain habitat, reduced buffer width, reduced native plant and structural diversity, and increased human activities. As with all forested habitats, increased habitat fragmentation caused by trails, roads, parking lots, and other habitat disturbances should not be permitted within these areas. Riparian forests should be maintained or restored along the entire length of Spring Creek to ensure the maintenance of the riparian bird assemblage.

Roads – Roads are problematic because they increase habitat fragmentation. This in turn increases edge habitat and the subsequent increase in predation and brood parasitism, especially on forest interior species. Nearly 58% of forest habitat in Pennsylvania is located within 1,000 feet of an improved road or edge, making fragmentation of forest interior habitat a major cause for concern. Roads also increase the chance of vehicle/wildlife collisions for all wildlife, including birds. All of these side effects from roads influence the population at a local level by decreasing breeding populations of birds and also reducing their nest success.

Excessive deer browse – While not the only cause for inadequate regeneration, white-tailed deer can have a profound influence due to their sheer size and density on the landscape. Prior to European settlement, white-tailed deer densities were estimated to have occurred at a natural density of 7-12/mi² but now often occur at twice that (or greater) in many areas. This not only affects the quality of the overall deer herd, but forest health by their direct browse of favorable regeneration. Other wildlife are impacted due to the resulting reduction of available food and cover, but also the reduced structural diversity for species that depend on lower and mid-canopy diversity for nesting and foraging. The impact of white-tailed deer on the Rockview Divestment Lands is currently unknown.

<u>Recommendations for Birds</u>

1. Further inventories for birds are critical for establishing scientifically rigorous management recommendations for the Rockview Divestment Lands. In addition, an evaluation of the distribution and extent of the current vegetation communities should be conducted, along with evaluations to analyze restoration opportunities of critical habitats.

2. The agricultural fields should be restored to the highest degree possible. This will create early successional habitat in the short-term and increase core forest in the long-term. Restoration should be planned to minimize fragmentation and edge habitat.

3. Areas containing hemlock should be protected and maintained for hemlock-associated birds listed above.

4. Conduct a deer browse study on the Rockview Divestment Lands to determine the impact of deer on the existing habitat and incorporate this information into forest management (restoration) plans. Work with the Pennsylvania Game Commission to maintain an appropriate deer population as determined by habitat management goals. Also work with adjacent landowners (private and public) to implement deer management recommendations on a landscape scale.
5. Inventory threats to forest health. These may include threats to species and structural diversity from excessive deer browse, the spread of hemlock woolly adelgid and other insect pests, present spread of invasive species, damage caused from poor past logging practices, etc. Specific management objectives to abate these threats should be instituted and may include deer herd reduction, control of invasive plant and insect pest species, among other restoration techniques.
6. Existing riparian forests along Spring Creek should be maintained and allowed to expand in critical areas, especially to minimize edge and fragmentation.
7. Barrens/early-successional habitat should be managed and restored, especially where old field and early successional forest is (or could be) located on the upland slopes and on more xeric sites. Of particular interest should be the potential barrens habitat that could be managed in order to support species such as golden-winged warbler and brown thrasher.

In summary, the Spring Creek Canyon and surrounding uplands support a rich and diverse community of birds. Maintaining the diversity of habitat types currently found on these lands (rich riparian forests, old fields/early successional forest, undisturbed rocky slopes, and continuous unfragmented natural habitat) will help ensure that this property continues to support these species, especially species of greatest conservation need that are habitat specialists.

Herptiles

No official reptile or amphibian (herptile) surveys have been conducted on the Rockview property. Limited surveys have been conducted during PFBC Waterways Conservation Officer training and PFBC staff have made observations of certain species at state fish hatcheries on Rockview property. However, based on knowledge of species diversity on nearby properties with similar habitats, the Rockview property likely supports a diversity of amphibians and reptiles including two species that are rare or uncommon in Pennsylvania (Appendix E). Approximately 36 species of herptiles could be expected, which is nearly half of the total herptile species count for the Commonwealth.

The diversity of herptile species present reflects the diversity of habitat types on the Rockview property. The property contains a unique mixture of active farmland, early and mid-stage successional habitats, spring seeps, rocky outcrops, a central stream corridor and a number of manmade ponds and reservoirs. Due to roads, trails and right-of-ways, there has been habitat fragmentation, which in combination with edge-creating farming practices, has resulted in significant habitat diversity.

Spring Creek and any associated rivulets, seeps, or springs should provide habitat for the brook salamanders, including the dusky salamanders (*Desmognathus fuscus, D. ochrophaeus*), the northern two-lined and long-tailed salamanders (*Eurycea bislineata*, *E.*

longicauda), the northern spring salamander (*Gyrinophilus porphyriticus*), as well as the brilliant northern red salamander (*Pseudotriton ruber*). All of the streamside salamanders require high water quality and forested stream edges. Likewise, the pickerel frog (*Lithobates palustris*) and wood frog (*Lithobates sylvaticus*), likely inhabitants of the Spring Creek valley, require heavily vegetated streams and creeks. The creek itself may also be home to the semi-aquatic wood turtle (*Glyptemys insculpta*), a species of special concern. It relies on wooded creeks and rivers, though it seems to prefer broader floodplains than are available in the valley area. Loose soils, crushed shales, road material stockpiles and areas at the base of the canyon slopes where there is a southern or eastern exposure provide nesting sites for these and other aquatic turtles. These sites are frequently used by many nesting females and are easily targeted by raccoons, skunks, and opossums, populations of which can be higher in areas with large amounts of edge habitats.

In addition, there are areas of mature forest with heavy canopy and minimal understory that support upland salamander species such as the red-backed, slimy, and valley and ridge salamanders (*Plethodon cinereus, P. glutinosis, and P. hoffmani*). The terrestrial woodland salamanders depend on canopied forests with adequate amounts of leaf litter and populations would significantly benefit in the long term from restoration of more extensive forested areas. These salamanders are voracious predators of the forest floor. Their role in limiting the numbers of leaf decomposing invertebrates has been shown to be significant in maintaining a rich layer of organic matter on the forest floor. The forested areas also provide habitat for the eastern box turtle (*Terrapene carolina*). While this species is still considered common, with a lifespan that may reach beyond a century, many biologists believe that box turtle populations have been in a steady decline due to road mortality and predation on nests and juveniles.

The field areas, meadows and edge habitat favor species such as the black racer (*Coluber constrictor*), black rat snake (*Pantherophis alleghaniensis*), smooth green snake (*Liochlorophis vernalis*), eastern garter snake (*Thamnophis sirtalis*), and eastern milk snake (*Lampropeltis triangulatum*). Where these habitats are near water, northern water snake (*Nerodia sipedon*) and eastern ribbon snakes (*Thamnophis sauritus*), another species of concern, are prevalent.

The manmade (fish hatchery) ponds provide breeding and foraging habitat for the bull frog (*Lithobates catesbeianus*), northern green frog (*Lithobates clamitans*), pickerel frog (*Lithobates palustris*), as well as snapping turtles (*Chelydra serpentina*) and midland painted turtles (*Chrysemys picta marginata*), American toads (*Anaxyrus americana*), northern water snakes and to a lesser extent, spring peepers (*Hyla crucifer*). If suitable seasonal ponds (i.e., vernal ponds) are located on the property, the mole salamanders such as the spotted and Jefferson salamanders (*Ambystoma maculatum* and *A. jeffersonianum*) can be expected, as well as the wood frog (*Lithobates sylvaticus*).

Threats to Herptiles

Loss or degradation of wetlands, seasonal pools, and riparian habitats – Many of the herptile species likely to occur within the property are dependent on the quality of aquatic habitats for at least part of their life cycle. An inventory of wetlands and seasonal pools should be conducted in order to identify critical habitats for amphibians in particular.

Many of the species in Appendix E may occur in small numbers on the property without these habitats, but populations would be more likely to thrive given the presence of critical wetlands for breeding and refuge. The quality of Spring Creek and its tributaries will affect populations of stream-dwelling herptiles, such as the wood turtle, pickerel frog, and stream salamanders.

Floodplain modification – The above-mentioned stream-dwelling herptiles need vegetated banks and natural areas along the floodplain for forage, nest sites, and refuge. While many of the snakes, turtles, and frogs will use a variety of habitat types, including bare ground and human-modified landscapes, species such as the northern spring salamander require clear, clean, cold water sources to survive and prosper.

Small forest patch size – Species such as wood frogs and mole salamanders need larger areas of mature forest to provide suitable habitat. Mature forest typically supports a substantial quantity of leaf litter and downed timber. Adequate soil moisture and humidity are essential for these species. Small forest patch size can lead to dryer, less favorable habitat for mole salamanders and may favor redback salamanders and more edge related herptiles.

Excessive edge (high edge to interior ratio) – Edge is needed for certain herptile species. Black rat snakes, eastern garter snakes, and eastern milk snakes in particular benefit from edge habitat and use it as foraging and basking habitat. A balance of edge and a mixture of active agriculture, old field and early successional habitats are needed to sustain these and other species. However, too much edge habitat will lead to an overabundance of habitat generalist species such as these and reduce overall species diversity.

Roads – Roads are problematic as they increase habitat fragmentation and lead to death of herptiles when they attempt to cross and are killed by automobiles. Road edges and road surfaces tend to attract snakes during certain periods of the active season as they provide basking opportunities, which may lead to road kills. During rainy evenings in the spring and fall there have been substantial road kill events of frogs and toads along Rock Road and perhaps in other locations. Although currently unknown, if seasonal pools supporting mole salamanders, wood frogs and American toads are discovered on the Rockview property, efforts should be made to consider the impacts to mortality due to road crossings.

Pesticide use – A growing body of research is increasingly linking declines in amphibians to increased use of herbicides and pesticides. Speculatively, the dramatic decline in smooth green snake populations throughout their range may be linked to modern farming practices and chemical usage and its impacts on this grassland species. Integrated Pest Management practices that limit pesticide use should be employed wherever possible.

<u>Recommendations for Herptiles</u>

1. Conduct wetland and vernal pool inventory.
2. Characterize and catalog the existing habitats to establish baseline data for future comparisons. Percent cover types should be recorded and targeted herptile species surveys conducted. Surveys should include a variety of search methods to ensure

that all habitat types are searched and must consider seasonal and diurnal habits of the different species. Pit trapping, opportunistic searching, night-time road cruising, cover board placement, calling surveys and intensive searching should all be employed to thoroughly evaluate herptile presence and distribution. Following setting of goals and objectives for species diversity certain habitat types may need to be manipulated on a regular basis to be maintained. For instance, active farming in certain areas may be beneficial to sustaining a diverse herptile community as long as the methods and chemicals used are not deleterious to herptiles.

3. Restore degraded floodplain areas and drained or degraded wetlands.
4. Maintain, restore, or enhance buffers around all wetlands. Wetland buffer widths should be determined by surrounding land use but should be a minimum of 150, producing a 300-foot buffer.
5. Conserve or restore forested connectivity between wetlands and other natural areas (i.e., corridors) to prevent isolation.

Terrestrial Invertebrates

By far, the largest component of biodiversity can be loosely described as the native terrestrial invertebrates. This "group" consists of arthropods (insects, arachnids, crustaceans, centipedes, etc.) and a number of other phylogenetic groups, such as soil fauna and decomposers (annelid worms, roundworms, flatworms, protists, etc.). In terms of species richness, terrestrial invertebrates typically comprise 70-80% of the total number of species in a given area. Conversely, these mega-diverse animals and protists are little studied, and at Spring Creek even a partial inventory has not been undertaken. Of the terrestrial invertebrates, the best known group is the smaller subsection of the insect order Lepidoptera (moths and butterflies): the butterflies.

The butterflies of Fisherman's Paradise were photographed and identified by just Harry Henderson during the spring and summers of 2007-2008 (Appendix F). With one exception (Crossline Skipper) all species were on PA Fish and Boat Commission property, or property to be conveyed to the PA Fish and Boat Commission from Rockview. All trips were done in the afternoons on weekends, with every weekend being covered from late March to mid October in 2007, and on selected weekends in 2008. Photographs documenting every species were taken with a Nikon D70 + 300mm camera, and are available upon request.

Threats to Terrestrial Invertebrates – this section was not completed

Pesticide use – BT

Native plants - This section was not completed

A comprehensive plant inventory has not been conducted on the property. A plant inventory was conducted along the road from The Rock to SR 550 by Michael Hassler in 2005 (Appendix X).

Fungi (and other decomposers/soil life)

The fungi kingdom (mushrooms, molds, other fungi) includes many species that act as key ecological components within nutrient cycles and control agents for plant and animal populations. These life forms are also critical to soil health and symbiotic relationships with the roots many pant species (mycorrhizal associations). Rough estimates list the number of fungal species in Pennsylvania in excess of 7,000 taxa. Generally speaking, bacteria can also be captured under this concept of including little known but important biodiversity groups in management planning. There is an opportunity for the Spring Creek landscape to include a high diversity (a few to several hundred species). Due to diverse soil types and overall edaphic settings at Spring Creek, the area could represent an important reserve for these taxa. Important management prescriptions for these organisms include the protection and restoration of natural legacy (old growth) forest habitats that will include undisturbed soil structure, coarse wood debris, standing snags, and a diversity of native flora and fauna.

Endangered, threatened, and rare species

This section was not completed

Extirpated Species of Special Concern – potential restoration targets

Data from the Pennsylvania Natural Heritage Program (PNHP) describe 180 historic occurrences of species of special conservation concern from the Spring Creek watershed. These are records for rare, endangered, threatened, etc., species of state or national significance, yet their populations, or specific occurrences, can no longer be found within the watershed or at specific localities within the watershed. Although PNHP has provided this list of occurrences, a review has yet to be undertaken to assess which of these records might represent occurrences that might have existed within the present area of planning for Spring Creek.

Emerging Threats - This section was not completed
Feral swine

Open Space Conservation Values

Outdoor Recreation and Education Conservation Values - Section not finished

Spring Creek as a high-quality coldwater fishery

Scenic Conservation Values - Section not finished

Data Gaps – section not completed

Literature Cited

Format of all citations needs to be reviewed and completed.

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Appendix A. Mammals of central Pennsylvania that are known to occur or may potentially occur in and around the Rockview property located north of I-99.

Common Name	Scientific Name	Conservation Status*	Comments
Virginia Opossum	*Didelphis virginiana*		
Masked shrew	*Sorex cinereus*		
Short-tailed shrew	*Blarina brevicauda*		
Least shrew	*Cryptotis parva*	PA Endangered	Currently only known to occur in southeast PA (Gettysburg area); prefers old sedge meadows and non-agricultural fields
Long-tailed or Rock shrew	*Sorex dispar*	PA Maintenance Concern	Uncommon (rocky habitat)
Smoky shrew	*Sorex fumeus*		
Pygmy shrew	*Sorex hoyi*		
Hairy-tailed mole	*Parascalops breweri*		
Star-nosed mole	*Condylura cristata*		
Big brown bat	*Eptesicus fuscus*		
Silver-haired bat	*Lasionycteris noctivagans*	PA Rare	Rare (present during migration)
Red bat	*Lasiurus borealis*	PA Maintenance Concern	Habitat specialist
Hoary bat	*Lasiurus cinereus*	PA Maintenance Concern	Habitat specialist
Small-footed bat	*Myotis leibii*	PA Threatened	Rock outcrops, talus slopes for roosting, maybe maternity colonies if direct sunlight is present
Northern long-eared bat	*Myotis septentrionalis*	PA Responsibility Species	Rare (present on site)
Little brown bat	*Myotis lucifugus*		
Indiana bat	*Myotis sodalis*	Federally Endangered; PA Endangered	
Eastern pipistrelle	*Perimyotis subflavus*		
Snowshoe hare	*Lepus americanus*	PA Maintenance Concern	Brushy thickets of northern forests
Eastern cottontail	*Sylvilagus floridanus*		

Appalachian cottontail	*Sylvilagus obscurus*	PA At-risk	Habitat specialist, very strong colony at Scotia, thick habitat, could be present on Canyon lands and habitat could be enhanced through management
Woodchuck	*Marmota monax*		
Gray squirrel	*Sciurus carolinensis*		
Eastern chipmunk	*Tamias striatus*		
Fox squirrel	*Sciurus niger vulpinus* and *Sciurus niger rufiventor*	PA High-level Concern	
Red squirrel	*Tamiasciurus hudsonicus*		
Southern flying squirrel	*Glaucomys volans*		
Beaver	*Castor canadensis*		
White-footed mouse	*Peromyscus leucopus*		
Deer mouse	*Peromyscus maniculatus*		
Southern red-backed vole	*Clethrionomys gapperi*		
Meadow vole	*Microtus pennsylvanicus*		
Woodland vole	*Microtus pinetorum*		
Muskrat	*Ondatra zibethicus*		
Bog lemming	*Synaptomys cooperi*		
House mouse	*Mus musculus*		
Norway rat	*Rattus norvegicus*		
Woodland jumping mouse	*Napaeozapus insignis*		
Meadow jumping mouse	*Zapus hudsonius*		
Porcupine	*Erethizon dorsatum*		
Coyote	*Canis latrans*		
Gray fox	*Urocyon cinereoargenteus*		
Red fox	*Vulpes vulpes*		
Raccoon	*Procyon lotor*		
Black bear	*Ursus americanus*		
Fisher	*Martes pennanti*	PA Maintenance Concern	Still establishing
Ermine or Short-tailed weasel	*Mustela erminea*		
Long-tailed weasel	*Mustela frenata*		
Least weasel	*Mustela nivalis*	PA Maintenance Concern	

Mink	*Mustela vison*		
Striped skunk	*Mephitis mephitis*		
River otter	*Lontra Canadensis*	PA Maintenance Concern	Still establishing
Bobcat	*Lynx rufus*		
White-tailed deer	*Odocoileus virginianus*		

*Conservation status is based upon recommendations of the Pennsylvania Biological Survey, the Pennsylvania Game Commission, the U.S. Fish and Wildlife Service, and is outlined in the State Wildlife Plan for Pennsylvania (citation needed).

Appendix B. All birds reported from the first (1984-1998) and second (2004-2008) Breeding Bird Atlas for blocks 62B22, 62B21, and 62A26.

American Crow	Cliff Swallow	House Finch	Ruffed Grouse
American Goldfinch	Common Grackle	House Sparrow	Savannah Sparrow
American Kestrel	*Common Nighthawk*	House Wren	*Scarlet Tanager*
American Redstart	Common Raven	Indigo Bunting	*Sharp-shinned Hawk*
American Robin	*Cooper's Hawk*	*Kentucky Warbler*	Song Sparrow
Bald Eagle	Common Yellowthroat	Killdeer	Spotted Sandpiper
Baltimore Oriole	Downy Woodpecker	*Louisiana Waterthrush*	Tree Swallow
Bank Swallow	Eastern Bluebird	Mallard	Tufted Titmouse
Barn Swallow	Eastern Kingbird	Mourning Dove	Turkey Vulture
Belted Kingfisher	*Eastern Meadowlark*	Northern Cardinal	Veery
Black-and-white Warbler	Eastern Phoebe	Northern Flicker	Vesper Sparrow
Black-capped Chickadee	Eastern Screech-Owl	Northern Mockingbird	Warbling Vireo
Black-throated Green Warbler	Eastern Towhee	Northern Parula	White-breasted Nuthatch
Black-billed Cuckoo	Eastern Wood-Pewee	Orchard Oriole	White-throated Sparrow
Blue Jay	European Starling	*Osprey*	Wild Turkey
Blue-headed Vireo	Field Sparrow	Ovenbird	*Willow Flycatcher*
Bobolink	Fish Crow	Pileated Woodpecker	Wood Duck
Blue-gray Gnatcatcher	*Golden-winged Warbler*	Pine Warbler	*Wood Thrush*
Broad-winged Hawk	*Grasshopper Sparrow*	Red-bellied Woodpecker	*Worm-eating Warbler*
Brown Creeper	Gray Catbird	Red-eyed Vireo	Yellow Warbler
Brown Thrasher	*Great Blue Heron*	*Red-headed Woodpecker*	Yellow-billed Cuckoo
Brown-headed Cowbird	Great Crested Flycatcher	Red-tailed Hawk	*Yellow-breasted Chat*
Canada Goose	Great Horned Owl	Red-winged Blackbird	
Carolina Wren	Green Heron	Ring-necked Pheasant	
Cedar Waxwing	Hairy Woodpecker	Rock Pigeon	
Chimney Swift	Hooded Warbler	Rose-breasted Grosbeak	
Chipping Sparrow	Horned Lark	Ruby-throated Hummingbird	

Appendix C. Avian species of concern that are known to or potentially may occur in and around the Rockview Divestment Lands.

Conservation Status*	Common Name
High-level of Concern	Bald Eagle
	Golden-winged Warbler
PA Vulnerable	Osprey
Responsibility Species	Scarlet Tanager
	Wood Thrush
	Louisiana Waterthrush
	Worm-eating Warbler
Maintenance Concern	Brown Thrasher
	Yellow-breasted Chat
	Black-throated Green Warbler
	Grasshopper Sparrow
	Eastern meadowlark
	Blue-headed Vireo
	Kentucky Warbler
	Willow Flycatcher
	Sharp-shinned Hawk
	Broad-winged Hawk
	Black-billed Cuckoo
	Acadian Flycatcher
	Common Nighthawk

Appendix D. Avian species of greatest conservation need, their reason for concern, preferred habitat types, and general habitat management recommendations.

	Common Name	Rank*	Reason for Concern	Habitat	Size Requirements	Threats	Management Recommendations
FOREST INTERIOR							
	Scarlet Tanager	RS	17% of global population in PA	Mature forests with relatively closed canopies, dense understory with a high diversity of shrubs, and sparse ground cover.	varies based on size of surrounding forested landscape	fragmentation, edge habitat, brood parasitism, overbrowse	protect large tracts of unfragmented suitable habitat, minimize edge, reforestation, promote regeneration in areas with limited vertical structure, manage deer population
	Wood Thrush	RS	2.3% annual decline from 1966-2003, ~9% of global population	Moist closed canopied deciduous forests with a well-developed understory. Forests larger than 250 acres are best suited for nesting success, often nest in spicebush.	>250 acres	fragmentation, edge habitat, habitat degradation	protect large tracts of unfragmented suitable habitat, minimize edge, reforestation
	Worm-eating Warbler	RS	area-sensitive, 10% of global population in PA	Mature forests with >95% canopy cover, but also may be common in young and medium-aged stands. Almost always associated with hillsides, upland deciduous forests, or drier portions of stream swamps with dense understory. Nest in mountain laurel or other shrubs.	unknown; requires large continuous forest blocks	fragmentation, edge habitat, brood parasitism, overbrowse	protect large tracts of unfragmented suitable habitat, minimize edge, reforestation, manage deer population
	Black-throated Green Warbler	MC	habitat degradation of old-growth conifers	Variety of forests, especially where hemlock and white pine mix with northern hardwoods. Requires a large feeding territory and not generally found in small woodlots or elevations below 1000 ft., nest in conifers.	unknown; requires large continuous forest blocks	fragmentation, edge habitat, brood parasitism, hemlock woolly adelgid (HWA)	protect large tracts of unfragmented suitable habitat, minimize edge, reforestation, manage HWA

	Blue-headed Vireo	MC	habitat degradation of old-growth conifers	Middle-aged to mature mixed coniferous-deciduous forests with a sparse understory. Strongly tied to conifers, especially hemlocks. It can also be found in riparian forests. Nest in shrubs or conifers, often lower-canopy.	unknown; requires large continuous forest blocks	fragmentation, edge habitat, brood parasitism, nest predators, hemlock woolly adelgid	preserve old-growth conifer stands, especially in riparian habitats, target advanced coniferous growth, manage HWA
	Kentucky Warbler	MC	2-3% annual decline from1966-2003, habitat degredation of high-quality forests	Inhabits rich, moist, heavily shaded bottomland forests and ravines with dense hardwood understory. Nest on/near ground in shrubs/dense understory.	>1200 acres	fragmentation, edge habitat, brood parasitism, nest predators, overbrowse	protect large tracts of unfragmented suitable habitat, minimize edge, reforestation. Encourage a dense hardwood understory and well-developed ground cover, 40-80 year old bottomland hardwood areas with little or no slope, conifers. Manage deer population
	Sharp-shinned Hawk	MC	decline in nesting and migrating populations	Large coniferous or mixed conifer and deciduous forests, often nest in conifers within 470 ft of an opening.	requires large continuous forest blocks; home ranges of 200-600 acres, inter-nest distance of 0.5-3 miles	forest fragmentation, residential development, loss of conifer component	protect of large tracts of unfragmented suitable habitat, manage HWA
	Broad-winged Hawk	MC	major autumn migratory corridor, decline of large-scale forests	Deciduous and mixed forest, preferring dense canopy near water. Forages at openings, edges, and wet areas.	requires large contiguous forest blocks, home ranges of about 800 acres, inter-nest distance 0.7-1.1 miles	fragmentation, edge habitat	protect of large tracts of unfragmented suitable habitat, especially where water is present

RIPARIAN							
	Bald Eagle	HLC	vulnerable to contaminants, nest disturbance	Forested landscapes bordering large rivers, lakes, and reservoirs.	unknown	human disturbance, contaminants affecting prey	buffer from human disturbances by several hundred meters, predator guards around nest trees, retain large trees and snags near water.
	Osprey	PV	vulnerable to contaminants, nest disturbance	Open water with adequate fish, including rivers, lakes, ponds, and wetlands.		human disturbance, contaminants affecting prey	maintain tall snags for potential nest sites and maintain/enhance wetlands as foraging areas.
	Louisiana Waterthrush	RS	Appalachian Mountain BCR has 44% of the global population	Mature deciduous and mixed floodplain forests, headwater riparian woodlands, rocky streams, swamps, and scrub, thickets and ravines near streams. Prefers areas with moderate to sparse undergrowth near rapid-flowing hill and mountain streams.	>250 acres, or 1200-3100 feet of stream reach	degrading water quality, forest cover, and stream bank integrity, fragmentation, hemlock woolly adelgid	preserve large tracts of unfragmented suitable habitat along deep ravines, establish and/or maintain a buffer of undisturbed riparian forest cover at least 50 meters on each side of the stream, maintain areas of thicker cover well away from the stream (more than 50 meters) for use during the post-fledging stage, improve and protect water quality to maintain healthy aquatic insect populations and diversity.
	Acadian Flycatcher	MC	indicator of high-quality riparian forest, hemlock	Mature moist deciduous lowland forests near streams and in floodplains 400-500 feet wide. Associated with hemlocks. Requires a tall closed canopy, a relatively open understory, and snags (minimum dbh 6 in.) and exposed perches in the midstory for foraging. Nest near streams in lower canopy.	unknown; highly variable in literature (75-2250 ac)	fragmentation, brood parasitism, hemlock woolly adelgid	encourage large mature forests with tall closed canopies, high tree density, and low understory density.

	Bank Swallow	MC	vulnerable colonies	Encountered in migration and around breeding colonies, which may have anywhere from 10-2,000 nests. Excavates nesting tunnels extending 2-3 feet into exposed sand, gravel, dirt, and limestone, most often along streams, rivers, ponds, and lakes. Restricted in distribution by suitable nesting sites.	unknown; habitat dependent - colony nester	loss of natural bluffs, increased application of pesticides decreasing insect prey	prevent the destruction of banks, protect and monitor known colonies
SCRUB/SHRUB							
	Golden-winged Warbler	HLC	8.7% of global population, 16.4% annual decline in PA from 1990-2003, nest parasitism and predation, hybridize & compete with blue-winged warblers	Shrub thickets (e.g., scrub oak, dogwood, alder, aspen, etc.) located near a forest edge that is interspersed by an abundance of herbaceous openings (goldenrod and grasses) containing scattered saplings approximately 2 ft tall, and the shrub layer is generally 5–10 ft tall. Pine-oak barrens containing frost pockets, abandoned farmland. Nest on the ground in a clump of vegetation.	1-15 ac territories	early-successional habitat loss (less old-field development & fencerows, increase in mature forest), brood parasitism	moderately-sized sites of 25-37 acres can support several pairs, and are preferred over both smaller and larger areas. Habitat is ephemeral and requires periodic disturbance (i.e., logging, burning, intermittent farming). A 40-year cycle with about 25% of the managed area burned once each decade may be suitable. A generalization would be that suitable habitat would begin to appear within ten years and last about 10-20 years.
	Brown Thrasher	MC	2% annual decline in PA from 1966-2003, area sensitive	Brush habitats (including hedgerows, roadside thickets, and brushy pastures) and young forest. Often occupies abandoned fields that are overgrown with crabapple and hawthorn. Nest on the ground or low in woody vegetation.	>1 ac of suitable habitat	early-successional habitat loss, brood parasitism	maintain areas >2.5 acres of young, dense brushy habitat with open areas for walking and foraging, thick brushy areas for nesting, and an abundance of song perches. Daylight hawthorn and crabapple where present. Border cut field edges.

	Yellow-breasted Chat	MC	5% annual decline in PA from 1966-2003, area sensitive	Secondary growth, shrubby old pastures, thickets with a few small trees, bushy areas, scrub, woodland undergrowth, and fencerows, including low wet places near streams, pond edges, or swamps. Nest in dense vegetation > 7 ft from ground.	>12 acres	early-successional habitat loss, brood parasitism	periodic habitat management is necessary to maintain this habitat type. Create and maintain shrubby openings greater than 12 acres (including forest openings, abandoned agricultural fields, rights-of-ways). Clear-cutting, shelterwood cutting, and group selection cuts can create these small open areas. Border cut field edges.
	Common Nighthawk	MC	7.7% annual declines in PA from 1966-2003, unsecure nest sites & insect decline	Barren ground; logged & burned areas of forest, open confierous forest, sparsely vegetated grassland, cultivated fields, rock outcrops, cliff faces, large boulders. There is an apparent shift of nesting habitat to gravel rooftops in urban areas, possibly an adaptation to reduce nest predation.	unknown	shift to rubberized roofing material for nesting, decline in nocturnal insects	maintain areas of sparse vegetation, including railroad grades along large stream corridors.
	Black-billed Cuckoo	MC	7% annual decline in PA from 1980-2003	Prefers landscape-level forest cover with open mixed deciduous-coniferous forests, often in pine and hemlock in PA. Frequently forage on gypsy moth. Often nests in forest edge habitat containing dense deciduous thickets, vines, young trees.	unknown; >10 acre patch size	fragmentation, removal of hedgerows/shrubs, use of pesticides	maintain mature second growth forest and wildlife corridors >10 acres, large trees

	Willow Flycatcher	MC	decline in habitat through development, continental importance	Thickets, swamps, wetlands, streamsides, and dense shrubby deciduous habitats, especially riparian areas and meadows with shrubby patches. The presence of water (in the form of running water, pools, or saturated soils) and willow (Salix spp.), alder (Alnus spp.), or other deciduous riparian shrubs are essential habitat components. Below 2000 feet. Nest low to the ground in willow shrub.	0.25-4.5 acres	loss of habitat, changes in land use, brood parasitism	preserve riparian deciduous shrubs 3-6 feet high in patches greater than ¼ acre, maintain more than 40% foliage cover density in the lower 6 feet of the deciduous shrub layer, maintain shrub patches interspersed with openings (opening should be at least 7 ft wide to allow aerial foraging), promote native riparian vegetation communities and maintain wetlands and wet meadows to help sustain willow communities.
GRASSLAND							
	Grasshopper Sparrow	MC	6.1% annual population decline in PA from 1966-2003, indicator of large-scale grassland habitat, sensitive to nest disturbance	Grasslands of intermediate height. Often associated with clumped vegetation interspersed with patches of bare ground; reclaimed strip mines, hayfields, CREP lands. Other habitat requirements include moderately deep litter and sparse coverage of woody vegetation. Nest on the ground or in a clump of vegetation.	>75 acres of suitable habitat, >2.5 ac territory	habitat loss & fragmentation, timing of mowing, woody succession	(1) provide suitable habitat large enough to support breeding populations (25-75 acres minimum), (2) avoid disturbing during the breeding season (approx. mid-April to late August), (3) use a rotational mowing schedule, and (4) discourage woody vegetation.

	Eastern Meadowlark	MC	population declines, indicator of large-scale grassland habitat, sensitive to nest disturbance	Moderately tall grasslands (5-14 inches) with abundant litter cover, high proportion of grass, moderate to high forb density, and low shrub cover (<5%). Nest on the ground in a deprission.	>10 acres	habitat loss & fragmentation, timing of mowing, woody succession	(1) provide suitable habitat large enough to support breeding populations (>10 acres minimum) and promote greater forb density through natural succession, (2) avoid disturbing during the breeding season (approx. mid-April to late August), (3) use a rotational mowing schedule, and (4) discourage woody vegetation.

* IC- Immediate Concern, HLC- High-level Concern, RS- Responsibility Species, PV- PA Vulnerable, MC- Maintenance Concern

Appendix E. Herptiles of central Pennsylvania that are known to occur or may potentially occur in and around the Rockview property located north of I-99.

Common Name	Scientific Name	Pennsylvania Biological Survey Conservation Status	Legal status	Habitat needs	Possible; needs survey
Spotted salamander	*Ambystoma maculatum*				x
Jefferson salamander	*Ambystoma jeffersonianum*				x
Dusky salamander	*Desmognathus fuscus*				
Allegheny dusky salamander	*Desmognathus ochrophaeus*				
Northern two-lined salamander	*Eurycea bislineata*				
Long-tailed salamander	*Eurycea longicauda longicauda*				
Northern spring salamander	*Gyrinophilus porphyriticus*				
Northern red salamander	*Pseudotriton ruber ruber*				
Red-backed salamander	*Plethodon cinereus*				
Slimy salamander	*Plethodon glutinosis*				
Valley and ridge salamander	*Plethodon hoffmani*				x
Red-spotted newt	*Notophthalmus viridescens viridescens*				
Eastern American Toad	*Anaxyrus amercianus americanus*				
Gray Tree Frog	*Hyla versicolor*				x
Northern Spring Peeper	*Pseudacris crucifer crucifer*				
Bullfrog	*Lithobates catesbeianus*				
Northern Green frog	*Lithobates clamitans melanotus*				
Pickerel frog	*Lithobates palustris*				
Wood frog	*Lithobates sylvaticus*				
Snapping turtle	*Chelydra serpentina*				
Midland Painted turtle	*Chrysemys picta marginata*				

Wood Turtle	*Glyptemys insculpta*	S3			x
Eastern box turtle	*Terrapene carolina carolina*				
Five-lined skink	*Plestiodon fasciatus*				x
Northern Black Racer	*Coluber constrictor constrictor*				
Ring-necked Snake	*Diadophus punctatus edwardsii*				
Black Rat Snake	*Pantherophis alleghaniensis*				
Milk Snake	*Lampropeltis triangulum triangulum*				
Northern water snake	*Nerodia sipedon sipedon*				
Northern Brown Snake	*Storeria dekayi dekayi*				x
Red-bellied Snake	*Storeria occipitomaculata occipitomaculata*				
Eastern ribbon snake	*Thamnophis sauritis sauritis*	S3			
Eastern garter snake	*Thamnophis sirtalis*				
Smooth green snake	*Liochlorophis vernalis*				
Northern Copperhead	*Agkistrodon contortrix mokasen*				x
*species names are reflective of recent name changes adopted by the PA Natural Heritage Program and PABS					

Appendix F. Butterflies and skipper of Fisherman's Paradise, 2007 – 2008 (H. Henderson, personal communication).

Common Name	Latin Name	State Rank	Host Plant
Black Swallowtail	*Papilio polyxenes*		Carrot/Parsley family
Giant Swallowtail	*Heraclides cresphontes*	S2	Northern Prickly-ash
Eastern Tiger Swallowtail	*Pterourus glaucus*		Tuliptree, Ash, Cherries
Canadian Tiger Swallowtail	*Pterourus canadensis*		Birch, Aspen, Black Cherry
Spicebush Swallowtail	*Pterourus troilus*		Spicebush, Sassafras
Cabbage White	*Pieris rapae*		Mustard family
Clouded Sulphur	*Colias philodice*		Clover, Alfalfa
Orange Sulphur	*Colias eurytheme*		Alfalfa, Clover
Great Spangled Fritillary	*Speyeria cybele*		Violets
Atlantis Fritillary	*Speyeria atlantis*		Violets
Meadow Fritillary	*Boloria bellona*		Violets
Silvery Checkerspot	*Chlosyne nycteis*	S3S4	Sunflowers, Wingstem
Pearl Crescent	*Phyciodes tharos*		Asters
Question Mark	*Polygonia interrogationis*		Elm, Hackberry, Nettles
Eastern Comma	*Polygonia comma*		Nettles
Compton Tortoiseshell	*Nymphalis vau-album*		Aspen, Willow, Birch
Mourning Cloak	*Nymphalis antiopa*		Aspen, Willow, Birch
Red Admiral	*Vanessa atalanta*		Nettles
White Admiral	*Limenitis arthemis arthemis*		Wild Cherry, Aspen, Birch
Red-spotted Purple	*Limenitis arthemis astyanax*		Wild Cherry, Aspen, Birch
Viceroy	*Limenitis archippus*		Willows, Aspens
Hackberry Emperor	*Asterocampa celtis*		Hackberry
Tawny Emperor	*Asterocampa clyton*	S3S4	Hackberry
Northern Pearly-eye	*Enodia anthedon*	S3S4	Woodland grasses
Little Wood-Satyr	*Megisto cymela*		Grasses
Common Ringlet	*Coenonympha tullia*		Kentucky Bluegrass
Monarch	*Danaus plexippus*		Milkweed
Banded Hairstreak	*Satyrium calanus*		Oak, Walnut, Hickory
Eastern Pine Elfin	*Callophrys niphon*	S3	White Pine
Juniper Hairstreak	*Callophrys gryneus*	S2S4	Red cedar
Gray Hairstreak	*Strymon melinus*		Legumes, Mallows
Eastern Tailed-Blue	*Everes comyntas*		Clover, other legumes

Spring Azure	*Celastrina "ladon"*		Flowering Dogwood
Summer Azure	*Celastrina neglecta*		Wide variety
Northern Metalmark	*Calephelis borealis*	S1S2	Round-leaved Ragwort
Silver-spotted Skipper	*Epargyreus clarus*		Black Locust, Tick-trefoil
Juvenal's Duskywing	*Erynnis juvenalis*		Oak
Columbine Duskywing	*Erynnis lucilius*	S1S3	Wild Columbine
Wild Indigo Duskywing	*Erynnis baptisiae*		Crown Vetch
Least Skipper	*Ancyloxypha numitor*		Grasses, Kentucky Bluegrass
Fiery Skipper	*Hylephila phyleus*		Crabgrass
Peck's Skipper	*Polites peckius*		Kentucky Bluegrass
Crossline Skipper**	*Polites origenes*		Purple-top, Bluestems
Little Glassywing	*Pompeius verna*		Purple-top
Delaware Skipper	*Anatrytone logan*		Grasses, some Sedges
Hobomok Skipper	*Poanes hobomok*		Panic Grasses
Dun Skipper	*Euphyes vestris*		Sedges

*Possibly questionable

**The Rock

State Codes are from PNHP, as of 9/10/08, at URL:
http://www.naturalheritage.state.pa.us/invertebrates.aspx

Appendix G. Conservation Compatibility Analysis Definitions from the November 20, 2008 Technical Advisory Committee meeting.

The following are conservation compatibility analysis definitions that were developed and agreed upon at the November 20, 2008 Technical Advisory Committee Meeting. These definitions are intended to be used by EPD as they develop their Conservation Compatibility Analysis for the Rockview property located north of I-99.

Passive and Active Recreation

Considerations and basis for the definitions of passive and active recreation:

- The difference between the definitions of passive and active recreation is the *impact* that recreation activities will have on conservation values.
- Based on the impact of hunting to conservation values, it is considered a passive recreation activity. Hunting is also an important management tool (e.g., deer management) but is commonly perceived as a conflict or safety issue with recreation. Hunting opportunities (e.g., season, species, designated areas, etc.) can be determined at a later time.
- Significant historic and cultural resources exist on the property. Although these values are not included in the definition of passive recreation, these resources should be considered without conflicting with the conservation values of the property.

Passive Recreation – activities that foster opportunities to explore nature, do not significantly impact conservation values, require only minimal mitigation, and minimal facilities or services that are directly related to access, personal safety and the built environment.

- Safeguards are in place to ensure that significant impacts (e.g., overuse) do not occur to conservation values*.
- Examples of passive recreation activities include footpaths, birding, fishing, and hunting.
- Excludes the use of 4-wheelers

Active Recreation – activities that impact (i.e., displace or damage) conservation values by the construction of recreation facilities and high-intensity use areas. These activities require more intensive development than passive recreation and require the manipulation of land and/or water resources.

- Safeguards are required to minimize the resulting impacts (e.g., stormwater runoff) to conservation values*.

*must be defined before passive recreation activities are planned.

Appropriate agriculture practices

Considerations and basis for the definition of appropriate agriculture practices:

- As discussed at the last TAC, the definition of agriculture is specifically tailored to the Rockview property being divested.
- These are production activities.
- Agriculture practices displace or otherwise impact conservation values (e.g., native plant communities, wildlife populations, water quality, wetlands, hydrologic modifications).
- Fruit and nut orchards (e.g., American Chestnut research) are considered an agricultural activity.
- Concentrated livestock animal operations are likely to have significant impacts to water and air quality. Low stocking rates of rotationally-grazed livestock could have a lower impact on water and air quality.

Appropriate agriculture practices – The science, art, or occupation concerned with the cultivation of crops (i.e., food, fiber, biofuels) for the purposes of research and education using methods** that have the least impact to conservation values.

** sustainable, organic, or permaculture

Habitat Protection and Stewardship

Considerations and basis for the definition of habitat protection and stewardship:

- Management techniques will be determined after more thorough assessments of their impact on conservation values are completed and deemed appropriate.

Habitat Protection and Stewardship – Manage current habitats to improve and sustain native biodiversity and to address threats to conservation values (e.g., invasive species).

Habitat Restoration

Considerations and basis for the definition of restored habitat:

- Restoration activities are intended to restore natural processes and natural communities that are appropriate at this site and at this time (i.e., not pre-settlement conditions).
- Restoration activities are structured to meet ecological goals (e.g., minimum size needed for viable wildlife populations).
- Restored areas can be identified on different maps.

Habitat Restoration – Establish and enhance native plant and animal communities and associated physical attributes where they are absent (e.g., non-native vegetation, plantations, etc.).