Executive Summary

Project Area Characteristics

The 164-acre Buffalo Creek watershed is located in Washington County, Pennsylvania, and Brooke and Ohio counties in West Virginia. The headwaters of Buffalo Creek originate in the vicinity of Pleasant Grove, Pennsylvania, flow north to merge with East Buffalo Creek at the intersection of Routes 221 and 3009, and continue northwest where they eventually empty into the Ohio River near Marshall Terrace in West Virginia.

This portion of the plan describes important natural features, land-use characteristics, and municipal planning information relative to the watershed. This information may be useful in identifying agricultural preservation areas, flood-prone areas, and regional development trends. Maps are included for many natural features. This chapter also gives examples of strategies being used by other municipalities in Pennsylvania to preserve open space and maintain attractive communities while facing development pressures.

The Buffalo Creek watershed is located in the Waynesburg section of the Appalachian Plateau physiographic province. Horizontal folds of alternating sandstone, limestone, and shale characterize this geologically young section. Due to the inability of limestone and shale to hold water, groundwater yields are typically low and water is quickly lost to streams. Water penetrates through sandstone but is forced to travel horizontally when it hits limestone and shale, causing it to come out of hillsides. Flooding events are common.

Approximately 52 percent of the watershed is forested and 47 percent is agricultural, with less than one percent developed. Washington County leads Pennsylvania in sheep, goats and related products and is ranked fifth in equine-related farming. This is reflected in the agricultural activities within the watershed. There are numerous agricultural security areas and two agricultural easement areas in the Pennsylvania portion of the watershed. Agriculture is also important in the West Virginia section of the watershed. However, low depth to bedrock and steep slope limit agricultural activities. Forestry has historically been an important industry within the watershed, though much of the forest on private land has been recently logged and is not currently economically viable. The Pennsylvania Game Commission owns approximately six percent of the Pennsylvania portion of the watershed, or 4,400 acres. In the West Virginia portion, West Virginia Department of Natural Resources operates a 486-acre Wildlife Management Area.

Many active and abandoned oil and gas wells are present in the Pennsylvania portion of the watershed, consisting of 130 unplugged or partially plugged gas wells and 277 unplugged or partially plugged oil wells. These can leak salt and other minerals to groundwater, causing safety hazards. Abandoned wells pose the most serious hazard and can be reported to the Pennsylvania Department of Environmental Protection (DEP) Southwest Regional Manager. Coal mining, and other types of mining, are limited within the watershed, though past records of underground and surface mining are available. Underground mining is currently occurring at locations near the watershed at Bailey Mine, Enlow Fork Mine, and Mine 84. The DEP's California District Office is responsible for underground and longwall mining permits and information in Pennsylvania, while the Greensburg District Office is responsible for surface mining information. Surface mining potential is limited within the watershed because of the hilly land surface. The Bureau of Abandoned Mine Reclamation has records of three problem areas in the

Pennsylvania portion. "Problem Areas" are areas of past mining that pose environmental or safety hazards. None of these three areas is considered to be of high concern.

Recent surveys and personal communication with residents suggest that illegal dumping is a common concern. This mainly occurs on State Game Lands 232, where it poses a safety issue and can be visually displeasing. Many of the dumped items contain harmful chemicals or attract mosquitoes and other insect pests. The Pennsylvania Game Commission has hidden cameras and penalizes violators, if identified. However, there is no PA CleanWays chapter in Washington County and more efforts are needed to clean up current problem areas.

Sensitive areas are places where development and/or agricultural activities should be reduced or eliminated because they pose a safety or environmental hazard. These include floodplains, steep slopes, and some hydric soil areas. There are few municipal measures to prevent activities in these areas. Although most of the municipalities within the watershed have a floodplain ordinance, most are not enforced on a regular basis. Future building should especially be limited in these sensitive areas.

According to the last census, the watershed has not experienced a dramatic change in population. However, populations outside of the watershed's borders are increasing, and municipalities may soon be faced with tough decisions regarding development and appropriate visions for their communities. Development most often follows the path of sewer and water services, which are currently limited within the Buffalo Creek watershed. This should be considered in future planning efforts. All of the municipalities within the watershed have a comprehensive plan and most have a zoning ordinance. Joint municipal comprehensive plans, which involve communities working together, can give municipalities more options and help preserve important open space and agricultural areas by placing land uses in the most appropriate locations. There is currently only one joint zoning document in the Pennsylvania portion of the watershed, the Independence-Hopewell Township Comprehensive Plan.

Some other tools that have been used by municipalities to direct development and protect sensitive areas are easements, environmental advisory boards, and riparian zone ordinances. However, no matter what tools are used in planning, it is important to involve residents in the process of developing a community vision.

Natural Resources Assessment

The fertile lands and abundant geologic resources of southwestern Pennsylvania have caused alterations to the natural landscape. This is evident in Washington County, the second leading producer of coal and one of the least forested counties in the state of Pennsylvania. Though it has also been heavily impacted from disturbance, Buffalo Creek watershed, which also extends to the panhandle of West Virginia, contains example habitats of what was once abundant in this region. Both this and the lack of mining impacts contribute to the uniqueness of this watershed in the region.

WPC's "Natural Resources Assessment" of the Pennsylvania portion of the watershed involved inventories of plants and plant communities, wildlife, and key forest and other lands important to biodiversity. Little information of this kind was available before this study. One previous source of information was the 1996 Washington County Natural Heritage Inventory, a survey of unique wildlife and habitats found in the county. Buffalo Creek watershed was found to contain two exceptionally ranked Biological Diversity Areas (BDA), Dutch Fork Lake BDA and Buffalo Creek BDA. These sites were chosen because of exemplary floodplain forest, acidic cliff, and mesic central plant communities. Both BDAs are located on State Game Lands 232.

Because of the watershed's location and unique geologic history compared to the rest of Pennsylvania, plant communities and other wildlife more typical of West Virginia, and locations farther south, can be found within the watershed. Plant communities include red oak-mixed hardwood forest, dry oak-mixed forest, tulip tree-elm-maple forest, sugar maple-beech forest, post-agricultural successional shrubland, post-agricultural early-successional woodlands, sycamore-box elder floodplain forests, shrub-dominated floodplain wetlands, black maple-elm creek floodplains, and streambanks and sandbars. During WPC's recent inventory of plant species, the watershed was found to house many species at or near the edge of their ranges. This included species like crepis rattlesnake-root, toadshade, appendaged waterleaf, and yellow and smooth buckeye tree species.

Due to its variety of habitats, the watershed is home to an abundance of wildlife. In 2003, Buffalo Creek Valley was named the 80th Important Bird Area in Pennsylvania, and at least 20 bird species found within the watershed are considered to be declining or of conservation concern. Factors contributing to the IBA's designation included the watershed's role in supporting significant populations of wading and migratory forest-interior birds, and its variety of habitat types exemplary of the region. Five bird species are on the Audubon Watch List of Birds of Concern. Additionally, recent surveys conducted in partnership with Westmoreland Bird and Natural Club and Three Rivers Birding Club identified over 39 species of butterflies and 21 species of odonates (dragonflies/damselflies). These included the bronze copper, a butterfly of special concern in Pennsylvania, and the Milbert's tortoisehell, a Washington County record. Uncommon odonates identified included the calico pennant, citrine forktail, and wandering glider. During the development of the plan, 14 new species of amphibians or reptiles were identified within the watershed. This included a county record for the eastern spiny softshell turtle and a potential county record for Fowler's toad. Numerous box turtles were encountered, as well as woodfrogs and spring salamanders. No formal investigation of mammals was conducted for this plan. However, it is estimated that at least 45 of the 70 species found in Pennsylvania can be found within the watershed.

WPC conducted limited surveys of fish, macroinvertebrate, and mussel populations during the development of the plan. It was found that the watershed contains macroinvertebrates common to agricultural streams in the southwestern United States. Fish sampling identified 48 species, of which 18 percent were found to be non-native, introduced species. The most common species identified was the creek chub, and many species were considered to be characteristic of lake or reservoir systems. A review of available mussel information showed that the watershed once contained diverse mussel communities indicative of high water quality. Indications are that many of these species have now disappeared or have low populations. One species that may still remain is the paper pondshell. It is not considered threatened or endangered, but is rather rare in Pennsylvania.

Five species of concern have been identified within the Buffalo Creek watershed, including one species from the Pennsylvania portion and five from the West Virginia portion. The bronze copper butterfly is considered imperiled in Pennsylvania. In West Virginia, the hellbender, slender wheatgrass, barn owl, and meadow jumping mouse are considered to be of concern. The barn owl is considered of highest concern, with the ranking of critically imperiled. Both the meadow jumping mouse and hellbender are also found in the Pennsylvania portion but are not considered of concern in the state.

One of the goals for the plan was to identify additional areas of conservation concern, both on public and private lands. The term "Watershed Conservation Areas" was given to areas deserving of special conservation consideration because of their unique species assemblages and natural communities. Identified areas are located in proximity to Dog Run, Narigan Run, Welch Run, Buck Run, Dutch Fork

Lake, and Green Cove Wetland. Several of these areas are on State Game Lands 232. Common threats to these areas included inappropriate forestry management and invasive species. WPC also used Geographic Information Systems and on-the-ground investigations to identify high quality forest blocks within the watershed. These are healthy forest areas exceeding 100 acres. Because such forest areas are limited within the watershed, they are essential to protecting the area's IBA designation and its importance for wildlife. Included in these are areas named "Welch Hollow tract," "Dog Run tract," "Polecat Hollow tract," "Dutch Fork Lake tract," and "Chapel Hill Road tract" for their proximity to certain natural or manmade features. Several sites were considered to be both Watershed Conservation Areas and high quality forest blocks.

Key needs for protection of natural resources and biodiversity within the watershed are the conservation of high quality forest areas and riparian zones, prevention of invasive species, reduction of sediment to Buffalo Creek and its tributaries, and maintenance of hydrological cycles.

Currently, most of the forested areas are in an early-successional state and not adequate to support migratory forest-interior birds. Most of the higher quality forest is located in State Game Lands 232. However, management plans developed by the Pennsylvania Game Commission do not adequately address the requirements of these species, many of which require older-aged stands and a layered canopy structure. Maintaining a core area of State Game Lands 232 in mature, uneven-aged forest will be important for protecting forest-interior bird species, whose presence is a key reason for the designation of the Important Bird Area. Other areas of State Game Lands 232 could continue to be harvested and kept in even-aged management. Additionally, many private forest owners within the watershed are not educated about sustainable forestry options available to them. For example, some logging practices can cause enough light to penetrate through the canopy to encourage the spread of species such as multiflora rose and ailanthus. This can have a negative effect on wildlife and reduce the value of the forest for future logging. Invasive species can also be carried in on logging equipment and affect the future health of a forest.

Removal of riparian zones, especially along headwater streams, is likely one of the main contributors of sediment to Buffalo Creek. Grazing on steep slopes and lack of best management practices near streams are also contributing factors. Sediment can affect the survival of mussels, fish, and other aquatic organisms. The Natural Resources Conservation Service, Partners for Fish and Wildlife, and other programs provide financial assistance to landowners who use best management practices or keep marginal (i.e. steeply sloped or near streams) land out of production.

Water Quality Assessment

The entire Buffalo Creek watershed is a DEP-designated High Quality Warm Water Fishery. This is the highest designation that can be given to a warm-water fishery. Its High Quality designation grants it special protection under the Clean Water Act. However, prior to this study, little up-to-date water quality information existed for the watershed. One exception includes observations by the Fish and Boat Commission and others suggesting that sedimentation and nutrients may be threatening water quality. In the "Water Quality Assessment" portion of the plan, WPC provides previously collected water quality information and the results of recent stream surveys (conducted by WPC) of the chemical, biological, and physical health of the watershed's streams. The significance of the watershed's High Quality designation and this and other laws protecting water quality are also discussed.

Important components of water quality include floodplains, riparian zones (vegetated stream edges), groundwater, and stormwater. Many people do not realize that maintaining vegetation along streams and leaving floodplains undeveloped can help prevent flooding. Riparian zones both help retain groundwater during dry periods and prevent bank failures and soil loss during flood events, while floodplains dissipate energy from high flows. In addition, groundwater is linked to stream water quality because streams are essentially where groundwater comes to the surface. Because of this, polluted streams can cause polluted groundwater. The reverse is also true.

High Quality streams are those that are able to accommodate all DEP-designated uses, including aquatic life, fish consumption, shellfish harvesting, drinking water supply, primary contact recreation (swimming), secondary contact recreation, and agriculture. If a stream in a high quality watershed does not meet one of these uses, DEP is required by United States Environmental Protection Agency to put in place measures to restore it to these uses. Direct pollutants, or point sources, are not permitted if they violate these designated uses. Total Maximum Daily Loads (TMDL) are studies that identify the maximum amount of pollution that can enter a stream in order to meet water quality standards. In 2001, DEP studied macroinvertebrate populations, an indicator of stream health, and found that four sections of the watershed are not meeting water quality standards. These included 1) a section of Dutch Fork Creek, 2) a tributary to Bonar Creek, 3) a tributary to Buffalo Creek South, and 4) a section of Buffalo Creek near the S-Bridge. TMDLs must be developed for the tributary to Buffalo Creek South and the section near the S-Bridge, but will not be developed for the other two because they are a result of point sources. Point sources are discharges to a waterbody that are direct and identifiable. In the case of point sources, DEP imposes fines or works with polluters to reduce pollution levels. Eight National Pollution Discharge Elimination System (point source) permits have been issued for the Pennsylvania portion of the watershed and numerous permits have been issued for the West Virginia portion.

Besides DEP's recent sampling, other water quality information available includes United States Geological Survey sampling conducted from 1983-1985, Pennsylvania Fish and Boat Commission fish surveys in 1983 and 1992, California University graduate projects measuring chemical and biological parameters in 2001 and 2003, and chemical information from 14 groundwater wells sampled in 1983. Generally, the streams within the watershed have high levels of alkalinity, which can buffer against acidic conditions such as acid rain and mine drainage. However, this high alkalinity can also contribute to algal blooms under high nutrient conditions, which can have a negative effect on stream organisms. Though past mining within the watershed has been limited, groundwater is extremely prone to metal contamination where mining activities occur.

Recent efforts to improve water resources within the watershed include the Buffalo Creek Watershed Restoration Project, a partnership between National Fish and Wildlife Federation and multiple organizations to fund and implement best management practices on private land. At the beginning of the project, it was determined that there was a need to treat 10,000 acres of pasture, 1,000 acres of riparian corridor, and to stabilize 40 miles of streams in the northern portion of the watershed. To date, the project has fenced over 27 miles of streams, protected over 90 acres of wetland, created 45 livestock crossings, and planted over 311 acres of warm season grasses. Farmers interested in this program can contact the Partners for Fish and Wildlife office at California University of Pennsylvania.

Additional efforts within the watershed include a Partners for Fish and Wildlife stream restoration project, which improved a section of stream for fishing and wildlife on Buffalo Creek; the Dirt and Gravel Roads Program offered to municipalities by the Washington County Conservation District; and soil and erosion control and other permitting through the conservation district.

WPC's watershed assessment involved investigation of water flows, chemistry, macroinvertebrate populations, fish populations, and general stream health. It was found that stream discharge varied greatly throughout the sampling period, with extremely low flows in the summer. This is possibly due to

high groundwater withdrawals, removal of streamside vegetation, and the geological characteristics of the watershed. The watershed is prone to extreme flood events and continued monitoring is needed. Related to chemical health, WPC found that water quality standards were met the majority of the time. However, probable water quality problems were identified at sites including Buffalo Creek near the S-Bridge, at the mouth of Dunkle Run, in an agricultural tributary of Brush Run, in Buffalo Creek near Taylorstown, and in Dutch Fork Creek before entering former Dutch Fork Lake. Four sites out of 51 exceeded pH standards, which is possibly caused by nutrient enrichment. Additionally, fecal coliforms exceeded standards 13 out of 16 times. This group of bacteria found in the intestines of humans and other animals may carry harmful microorganisms and is related to livestock access to streams and faulty on-lot septic systems.

WPC collected macroinvertebrates at six sites within the watershed, which were different from sites sampled by DEP. It was found that two of these sites were impaired due to high levels of organisms tolerant to pollution. These findings suggest that two sections designated as "impaired" by DEP, namely Buffalo Creek near Taylorstown and Dutch Fork Creek downstream of Claysville, may need to be extended upstream and that further investigation should be made into the sources of these impairments. The portion of Dutch Fork Creek downstream from Claysville, which is currently not scheduled for a TMDL, should be re-evaluated. Currently, the only waterbody within the watershed for which a TMDL has been completed is Dutch Fork Lake Reservoir, and this is not entirely applicable because the reservoir has been drained.

In addition to chemical and macroinvertebrate sampling, WPC conducted visual assessments of all accessible streams within the watershed. Accessible streams were those that could be evaluated from nearby roadways or on foot through permission of the landowner. Streams were evaluated based on 10 parameters, including channel condition, riparian zone, bank stability, water appearance, nutrient enrichment, fish barriers, instream fish cover, invertebrate habitat, canopy cover, and embeddedness (sedimentation). The area with the highest, or best, score was Lower Buffalo Creek subwatershed. This includes all streams entering Buffalo Creek west of where its meets Buck Run and Brush Run. Tributaries to Buck Run also received a high average score. The lowest scoring area was Buffalo Creek East, which is basically all streams entering the east branch of Buffalo Creek before it meets Buffalo Creek South at the intersection of Route 221 and Route 3009. The lowest scoring parameter overall was embeddedness (sedimentation) and the second lowest scoring parameter was instream fish cover. Nutrient enrichment and bank stability often received low scores in areas where embeddedness was high.

The visual assessment suggests that the biggest contributors of sediment to streams within the watershed are bank erosion from cattle grazing and the removal of riparian zones. In the tributaries to Brush Run and Dunkle Run, extensive streambank fencing and use of best management practices are decreasing sediment loads. However, there are portions of the watershed where these practices are lacking. This is particularly noticeable in Buffalo Creek East and Castleman Run subwatersheds, which are highly agricultural. There are many programs offered by the United States Department of Agriculture and other agencies that can help farmers develop best management practices on their properties. One such program is the Conservation Reserve Enhancement Program, which pays farmers to keep marginal land such as streamsides and steep slopes out of production. Buffalo Creek watershed is a high priority according to this program, because of its many steep slopes and high-quality streams.

Faulty on-lot septic systems may also contribute sediment and nutrients to streams. The stream surveys, including the high levels of fecal coliforms, suggested that there are numerous faulty systems in

the watershed. Under no circumstances are direct sewage discharges to streams legal. Municipalities should be encourage to follow local 527 plans (which detail needed future improvements) and enforce upgrades to on-lot systems, if this is a requirement of the plan.

One of the biggest concerns encountered during this assessment was the lack of landowner awareness. Many landowners thought that removing riparian zones (or streamside vegetation) and straightening the stream would improve conditions during flooding, when these activities more commonly make conditions worse by reducing the capability of streams to handle flood events and causing bank failures. Municipalities could encourage the revegetation of riparian zones by offering tax incentives or other benefits to those who maintain these zones and by stating the benefit of these areas in municipal planning documents.

Outdoor Recreation and Tourism

Outdoor recreation is becoming increasingly popular within the watershed. Many people come from outside the watershed to enjoy its natural settings. Visitation has increased with the nomination of the Buffalo Valley Important Bird Area, which brings frequent visits from bird enthusiasts. Other recreational opportunities exist, including hunting, fishing, and hiking. State Game Lands 232 is considered one of the best public hunting areas in the region. The Pennsylvania Game Commission recently created four wetlands on State Game Lands 232 and maintains fields to support wild game, with crops such as corn, sorghum, buckwheat, rye, millet, and oats. In addition, fishing is available at Pennsylvania Fish and Boat Commission trout-stocked and artificial lures only sections of Buffalo Creek and Dutch Fork Creek. In the West Virginia portion, a trout-stocked section of Buffalo Creek is maintained near the border with Pennsylvania. Additional fishing and hunting opportunities are available at the nearly 500-acre Castleman Run Wildlife Area in West Virginia.

Before Dutch Fork Lake Reservoir was drained in 2004, this trout-stocked lake was extremely popular for fishing. Interviews conducted with visitors to the lake in 2003 found that most people visited from outside the watershed and that some came up to 50 times a year. If the reservoir is restored, some considerations cited by visitors were the lack of litter control, the poor quality road and lack of business facilities at the farthest access (which was also the favorite), and the possibility for campgrounds or bait shops in the area.

Though visitors generally like the watershed for its remoteness and rural character, many have suggested the benefits of a public bathroom facility on the gamelands or at the S-bridge historic site. Others suggested that local restaurants or stores for visitors would be beneficial. In many cases, visitors would prefer not to leave the area to have access to bathrooms or restaurants. However, they also noted that large, chain stores would probably detract from the quaintness of the area.

Baseball parks and community parks are present, though not abundant, within the watershed. Several municipalities suggested the need for these parks to serve residents and suggested that funding was a limitation to having additional open space.