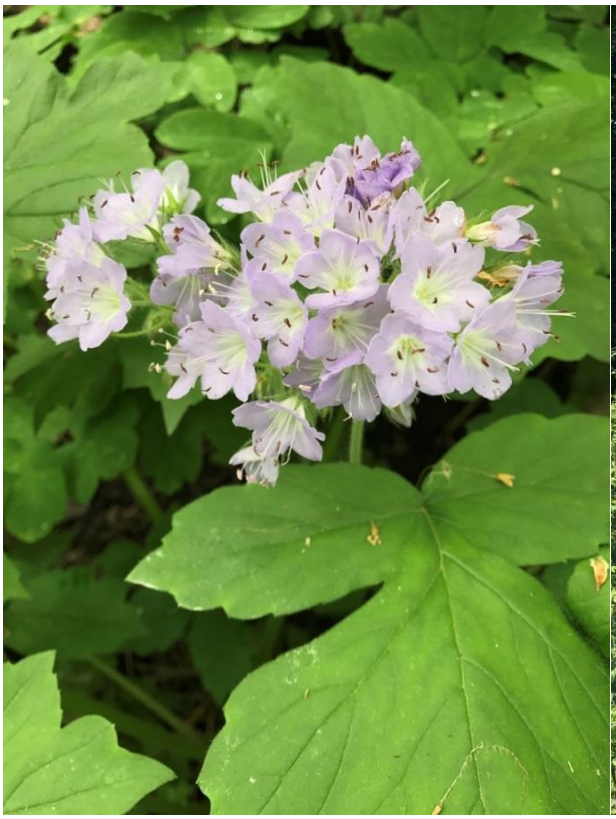
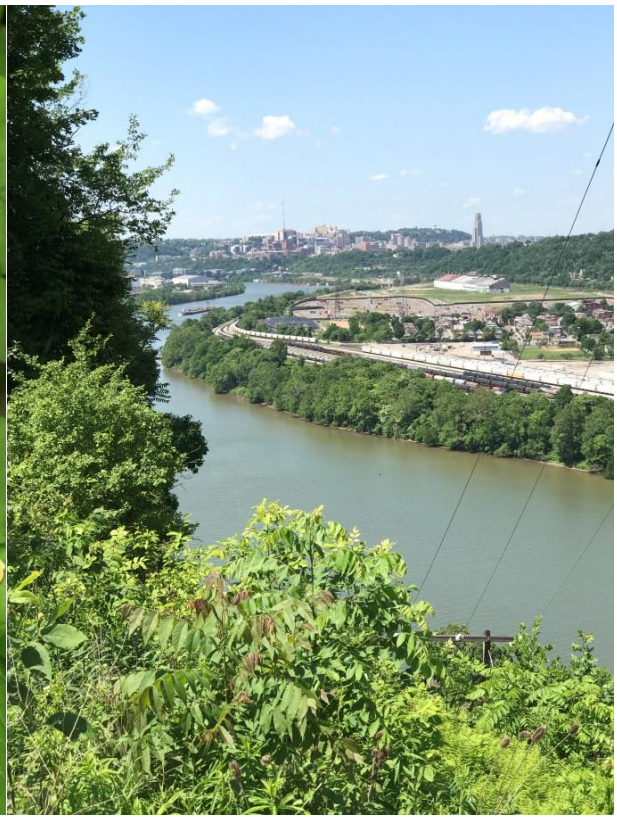
Hays Woods Ecological and Conservation Assessment

City of Pittsburgh
Allegheny County, Pennsylvania





Report to:

Allegheny Land Trust
Sewickley, Pennsylvania

Report by:

Western Pennsylvania Conservancy
Pittsburgh, Pennsylvania

1 July 2017

Hays Woods Ecological and Conservation Assessment

OUTLINE

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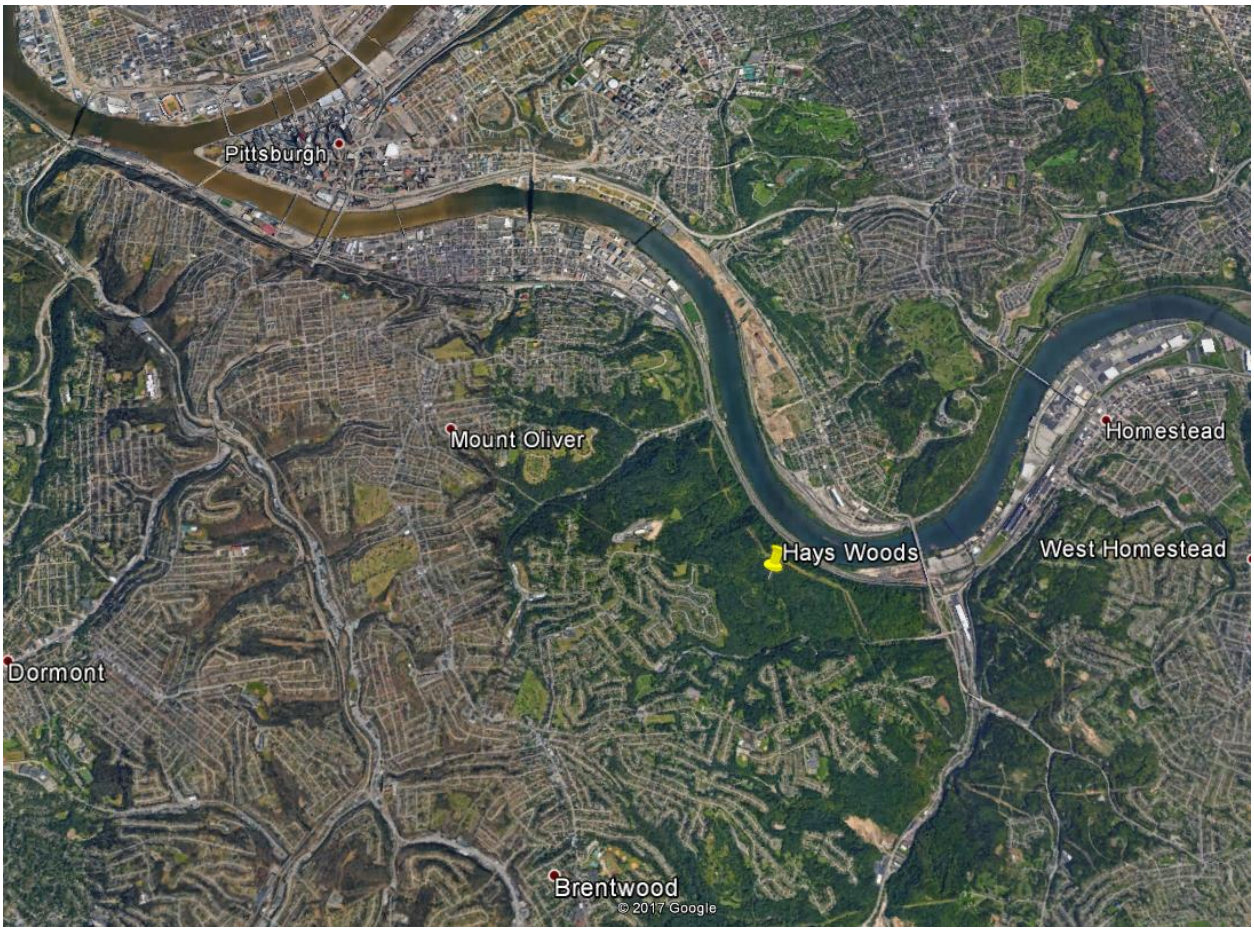
Hays Woods Ecological and Conservation Assessment

Format and Use of this Report

The Western Pennsylvania Conservancy's (WPC) Hays Woods Ecological and Conservation Assessment report is provided in a digital format. This approach allows for an expanded content, e.g. numerous color photographs and copies of references, etc., along with the ease in report sharing. The report consists of a main section and various appendices. All sections of the report remain printable on paper as desired. Not included in the report are the Geographic Information System (GIS) project shape files that were created by WPC as the foundation of the study. The maps provided in the report were all created via the GIS project. The digital GIS information will be made available, including to the future managers of the Hays Woods property, if those files are of interest.



Google image, 2017.

I. Executive Summary

Opportunities to create large tracts of public land within the limits of the City of Pittsburgh are very rare. Such an opportunity was acted upon by the Urban Redevelopment Authority (URA) in 2016, with the acquisition of the approximately 634-acre/257-hectare (also reported as 660-

acre/257-hectare) property known as “Hays Woods”. This tract, at the very southwestern limits of the city, was under active consideration for large scale commercial development in recent years. When the private development plan for the property was abandoned, the URA was able to act to acquire it, with the intention that a majority of the property will be managed by the city’s Department of Parks and Recreation. The Hays Woods tract is roughly the same size as the city’s Frick Park.

Any ground within close proximity to the City of Pittsburgh is likely to have participated in the industrial history of the region, and the Hays Woods tract is no exception. From the time that the H. B. Hays and Brothers railroad was established to haul coal in the Streets Run valley in 1878, through World War II and into the 1970s, there were multiple industries and a variety of uses made of the Hays Woods tract and its surroundings. Those uses are exemplified by ownership of this land over time, which has recently included the LTV Steel Company, and formerly J & L Steel Company. The provision of coal from the surface and from underneath this landscape has had the largest influence on the character and quality of the property as we know it today, although other uses, including roads, buildings, and major utility transmission lines, have also altered the surface terrestrial and aquatic resources. Over the last few decades, the property has been absent of any official commercial uses, other than those related to the utilities. However, during that period it has been appreciated and utilized by the unauthorized public for recreation, including all-terrain vehicle riding, hunting and hiking.

With the recent acquisition of the property by the URA, the future management of the property is now under consideration and more information about ecological resources is of interest to the City and various partners and stakeholders. The arrangements for this study were made with the Allegheny Land Trust late in 2016, with the intention to develop information about habitats, flora and fauna, particular species of special concern, terrestrial and aquatic environmental quality indicators, existing trails and other aspects of the property to be noted for planning and management. Ultimately, the future use and management of Hays Woods has not been determined, and there is the potential for a mix of green space protection along with limited development.

This report provides an assessment of ecological resources at Hays Woods through a perspective that identifies conservation topics of importance to the future protection and management of those resources. The report is arranged spatially by (1) watersheds, (2) habitat patches, (3) flora and fauna, and (4) a few key conservation issues.

The Hays Woods landscape is a mosaic of past disturbances and localized remnants of ecological refugia that have survived, or are recovering over time. All of the property has been influenced by direct and indirect past uses, and has been ecologically degraded over time. However, upon investigation one is also surprised to find that amidst its degraded character, which can be conveyed through descriptions of poor water quality, soil conditions, habitat fragmentation and non-native invasive species, a number of natural qualities and ecological resources continue to exist, which represent the character and natural heritage of Pittsburgh and the southwestern Pennsylvania region.

The highest quality habitats and natural environments of the Hays Woods property are largely

due to the features of rugged terrain; essentially steep slopes. While the overall water quality and stream conditions have suffered to a large extent, the challenging slopes of the property limited historic development and further environmental damage. Without these slopes, the limited remaining ecological character and qualities of the proper would not have survived to any appreciable extent. It is in some of the steepest locations that one finds the most notable remnants of natural habitats and the associated native species, least fragmented forest patches, and occasional small, but rather clean, seepage wetlands. Indeed, some of the trees that have survived at Hays Woods are of impressive sizes, as is demonstrated in some of the photographs with this report.

Stewardship and conservation opportunities at Hays Woods consist of protecting the small least disturbed terrestrial habitats from future disturbance, restoring the margins of those patches of habitats to expand them, as well as creating linkages in between. The ecological conditions vary, patch to patch, and in some cases restoration within patches (e.g. soil conditions) is needed as well as linkage to the best ones. In some patches, non-native invasive plant species are dominant and have largely degraded the native vegetation and habitats. Extensive stewardship will be required if native plants and many of the associated native animals are to be encouraged.

There are more serious conservation challenges related to streams and wetlands on the property, keeping in mind that there is only one semi-permanent stream. The legacy conditions, resulting from the various coal mining plays over the decades, have left no watershed untainted. This study is not the first to highlight these issues on the property, and although it does offer some specifics, it does not provide exhaustive details. In addition to the past mining, another major factor influencing the site's streams and wetlands is the inclusion of urban development within the uplands of many of these watersheds. The surface storm water runoff from these is a significant influence to the quality of the streams.

In conclusion, we find that the Hays Woods property represents a window into the historic interface between the environment and human land use, as well as a future opportunity to secure and improve some of the ecological resources remaining in the Pittsburgh area.

Acknowledgements
A number of people from several organizations have been involved in the overall project surrounding Hays Woods, however, those to be specifically acknowledged for facilitating this study and assisting in data collection and the creation of this report are:

Urban Redevelopment Authority: Kenny Barry
Allegheny Land Trust: Christopher Beichner, Roy Kraynyk
Norfolk Southern Corporation: Jordon Frederick
WPC staff: Jonathon Calderon, Eric Chapman, Brad Georgic, Kathy Gipe, Steve Grund, Mark Killar, Michael Knoop, Alec Layton, Gabryel Malone, Elena Ramsey, Danielle Rihel, Mallory Sarver, Scott Schuette, Maria Sorce, David Yeany.

I extend my personal gratitude to these people for their direct assistance in everything from arranging project details, to field data collection, report writing, interpretation expertise and GIS support.

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Primary investigator and author for the majority of this report:
Charles W. Bier, Senior Director Conservation Science

II. Introduction

The property known as Hays Woods is a 635-acre contiguous tract of land at the far southern limits of the City of Pittsburgh, and is presently owned by the city's Urban Redevelopment Authority. After a past involving various industrial and other human uses, in recent years it has remained largely as an abandoned tract. Although not long ago other plans emerged for its use, the land was acquired by the City of Pittsburgh's Urban Redevelopment Authority (URA) in 2016. Planning for the future use of the property is now underway and this study provides information that may be helpful to guiding options for its use.

The Allegheny Land Trust (ALT) is a local nonprofit conservation organization dedicated to the protection and management of lands in Allegheny and Washington counties, and has protected more than 2,100 acres of the region's unique scenic, landscape, biodiversity and water quality. Additionally, ALT protects land to improve the quality of life for current and future generations by offering recreational and educational opportunities.

The Western Pennsylvania Conservancy (WPC) includes a broad set of conservation programs ranging from community greening, to watershed conservation, to the stewardship of Fallingwater, although the protection and management of land and water is historically its largest program area. Since 1932, WPC has protected more than 250,000 acres, resulting in public parks, forests, game lands and in establishing its own reserves. A key aspect of WPC's programs includes science-based activities and participation in the Pennsylvania Natural Heritage Program (PNHP), which is a statewide effort to collect and provide information for the conservation of biodiversity. It is this capacity that allows WPC to study properties like Hays Woods and provide an ecological assessment.

Over the past decade, or more, ALT and WPC have been involved in discussions focused on the potential future ownership and uses of Hays Woods. With the potential for Hays Woods to become city park land, ALT determined that a broad ecological perspective was needed to inform consideration of options for the property. ALT was able to acquire funding from the Colcom Foundation to establish an agreement with WPC to conduct this study.

III. Results: Description of Hays Woods Tract

Geographic Details

The Hays Woods property is located in southwestern Pennsylvania, Allegheny County, at the extreme southeastern edge of the City of Pittsburgh, at the historic name place of "Hays". The boundaries of the tract are also largely the boundaries of the city in this area. Baldwin Borough nearly surrounds the property except on the eastern side.

Hays Woods is 3.5 airmiles southeast of the confluence of the Allegheny and Monongahela rivers; a location known as 'The Point'. It is situated on the bluff above the southwest bank of the Monongahela River, 4.3 rivermiles upstream from The Point.

Although the tract is situated along a bend in the Monongahela River valley, its borders can roughly be described as north, east, south and west. The northern border is more or less along the lower one mile of Becks Run Road, with the northeast corner of the property at the intersection with East Carson Street (PA Rt. 837). The eastern border runs along the river bluff slope adjacent to and above the Norfolk Southern railroad for about 1.5 miles. The southern border is along Glass Run Road for approximately 1.2 miles, starting at Hays and heading upstream. However, the property is on both sides of this road for the eastern 0.5 miles of the southern border. The western boundary is not as easily described, except to say that it runs from Glass Run Road to Becks Run Road, largely following the boundary between Baldwin Borough and the City of Pittsburgh for approximately 1.8 miles; that boundary is almost that same as the property line for Hays Woods.

The approximate center point of the property is located near -79.995º W longitude and 40.398º N latitude. The property is bounded by a least rectangle of: 40.410º N, 40.388º N, -79.936º W and -79.970º W.

Topography, Geology, Soils and Physical Site Description

The Hays Woods property is located at the very north eastern limits of the Waynesburg Hills Section of the Appalachian Plateaus Province. This physiographic section ranges south and west from Hays Woods to include most of Washington County, almost all of Greene County, as well as north western Fayette and very south western Westmoreland counties. See Map 13 (Department of Conservation and Natural Resources) in the Appendices.

Characteristics of the Waynesburg Hills Section include (per Map 13):

- Dominant Topographic Form: Very hilly with narrow hilltops and steep-sloped, narrow valleys.
- Local Relief: Moderate (601 to 1,000 feet change)
- Underlying Rock Type: Sandstone, shale, red beds, and limestone.
- Geologic Structure: Horizontal beds.
- Approximate Elevations: 848 to 1,638 feet.
- Drainage Pattern: Dendritic
- Boundaries: Arbitrary at change of topography.
- Origin: Fluvial erosion and landslides.

Specifically, at the Hays Woods property, the elevations range from lows of 770 feet and 785 feet in the valleys of Glass Run and Streets Run respectively, to a high of 1210 feet on a knob of the plateau top, where the bluff immediately above the river averages 1100 feet in elevation. Because the property is at the far northeastern boundary of the Waynesburg Hills Section, it can be assumed that some of the landscape characteristics are influenced by those of the adjacent Pittsburgh Low Plateaus Section.

Aspects of the site geology and physiography are key to better understanding environmental and ecological issues related to the "lay of the land". The plane of the geologic bedrock layers is nearly horizontal, which is typical of plateaus. A cross-section of the plateaus reveals successive layers of sandstones, shales, siltstones, limestones and coal seams, one on top of the other. These layers are arranged in two main groupings known as the Casselman Formation (CF) and the Monongahela Group (MG). The historic significance of these formations is that they contain important coal resources, and to a lesser degree, mineable limestone. Presently, the environmental and ecological implications on the Hays Woods property are that the presence of the limestone was the basis for the development of rich soils, and apparently, alkaline (high pH) groundwater and seepages. Furthermore, the juxtaposition of the limestone beds with the coal seams results in a neutralization of the resulting abandoned mine water drainages. This means that more toxic acidic (low pH) mine drainages, often found after coal is mined, are becoming neutralized at Hays Woods and are of a chemical composition that is somewhat less toxic to life. It is also why in this situation, the term abandoned mine drainage (AMD) is used, instead of acid mine drainage, which occurs when coal mine water does not mix with a source of adjacent limestone as it comes to the surface. Unfortunately, this chemical neutralization does not eliminate other toxic constituents, e.g. aluminum, in the case of the Hays Run area.

Synopsis of Human History (1800-2000)

This study did not investigate details of the history of the Hays Woods property and its surrounds, as that information can be found elsewhere. However, to set the stage for an understanding of this report a brief summary is provided.

Wikipedia (https://en.wikipedia.org/wiki/Hays_(Pittsburgh)) has a concise summary of the founding and early years of the location known as Hays, as follows:
"Hays is a neighborhood in the 31st Ward of the east side of Pittsburgh, Pennsylvania. It is represented on the Pittsburgh City Council by the representative of District 5 (Corey O'Connor). It occupies ZIP codes 15227, 15207, and 15236. It is named after James H. Hays, who opened a coal-mining operation called Hays and Haberman Mines in 1828.

Hays was first settled in 1789 when still part of Baldwin Township by John Smalls, who named the area Six Mile Ferry Village. The H.B. Hays and Brothers Coal Railroad was a narrow gauge railroad that ran from the coal mine along Streets Run to the coal tipple at Six Mile Ferry.[2]

The neighborhood was formerly the site of the Hays Army Ammunition Plant, built by the U.S. Navy in 1942. The plant was transferred to the Army in 1966, and during its heyday between World War II and the Vietnam War employed more than a thousand people. In 1970 the plant was put on standby status until disposition in 1988. In 1993 the site was donated to the Urban Redevelopment Authority of Pittsburgh.[3] The closing of the plant has led to an enormous loss of population: in 1940 the population was 2,238, while in 2010 the population was only 362.

In 1901, the Pittsburgh neighborhood of Hays was formed from the northern 201 acres (0.81 km2) of Baldwin Township. Annexation to Pittsburgh was completed on Jan. 7, 1929. "

David Miller, a geologist with Hiser Engineering, Inc., studied the site under contract with the previous landowner to perform the technical evaluation of the site and permit preparation for the

proposed surface mining. Mr. Miller explained the site was used as a research facility by LTV Steel, which conducted testing with slag from their mills. Prior to that, the site had been extensively deep mined before some surface mining took place.

Most of the site had originally been deep mined for Pittsburgh Seam coal. The coal averaged 10 feet thick throughout the site and a clay layer underlies the coal seam with a limestone layer immediately below the clay. There are several collapsed deep mine openings at an elevation consistent with the outcrop of the coal seam at the surface. Large amounts of water were not found to be discharging from the deep mine openings or other locations. The dip of the coal seam is in a general westerly direction, and suggests that most of the water flows away from the collapsed openings and fissures elsewhere.

In addition to the synopsis above, historic aerial maps (source: Penn Pilot) are provided in the appendices of this report. Beginning with the 1938 aerial map, one can see how the more level plateau top was cleared of forest and developed with fields, buildings and roads, while the steeper slopes remain in some sort of forested condition.

Ecological Implications of Site Human History

When considering the protection and management of any chosen piece of landscape it is important to recognize past human uses. For the Hays Woods property those include:

- The property has remained under one ownership, as the property of different steel companies over time, and has not been subdivided. The lack of subdivision has restricted some types of development of the tract and has avoided certain aspects of landscape fragmentation. This allows for today's conservation of a more important set of environmental resources.
- In addition to various development activities on the tract, the urbanization and other development of the surrounding landscape over time has tremendous ecological implications within the tract. Streams on the site are affected by excessive storm water runoff, extra sediments and potential pollutants. All of that influences aquatic life.
- Coal mining is one of the primary historic influences on the ecological condition and quality of Hays Woods. Nearly the entire tract has been under-mined. Mining has resulted in both aquatic and terrestrial impacts. Water quality of surface streams and sub-surface aquifers has become degraded and is a long term issue. Numerous areas of the property were also utilized to support mining infer structure, or upon which to discard mining wastes. These wastes were sometime dumped over slopes, into streams and covered the parent soils.
- The southeastern end of the site contains a significant area of mine subsidence. The coal is very shallow in this area; about 15 feet deep. The hilltops in this area also have the lowest elevations, which would be consistent with the coal being much closer to the surface. There are numerous subsidence depressions that have altered the surface ecology of the landscape here.
- By removing the original vegetation and disturbing soil conditions through a number of human activities, and due to the property's large size and recent vacancy, non-native invasive species have been provided with opportunities to become rampant; challenging native species and their natural restoration attempts.

- Historically, many human activities were limited by the extreme relief of the site. The steep slopes and valleys have dictated where some of the remaining native forests and their associated less disturbed habitats have found refuge.

Watersheds and Streams

The concept of "watershed" is useful as a descriptive approach for landscape summaries, but it is also very functional in ecological terms. Combining watershed descriptions with a complementary terrestrial component, such as habitat patches, can also result in a comprehensive understanding of any landscape of interest. For the most part, this is the approach utilized in this report. For the purposes of this report, the Hays Woods property has been divided into watershed components with mapped polygons. However, due to the nature of landscapes, not all portions of the property can be technically divided into property watershed concepts. As such, there are what might be considered pseudo-drainages, that are not technically watersheds, but their polygons still represent an area with similar characteristics, e.g. the Monongahela River escarpment slope. The mapping of these polygons is provided under "Maps" in the appendices.

The Hays Woods property is located within the large Monongahela River basin. It is situated such that Becks Run and Glass Run, two larger creeks of the area, essentially create the boundaries of the majority of the property on two sides. The property itself is composed of several intermittent streams and at least one perennial stream watersheds. These small watersheds are either direct tributaries to the Monongahela River, or to one of the previously noted river tributary systems: Becks Run and Glass Run (the latter being a tributary to the very lowest reach of Streets Run; with the confluence approximately 0.5 miles upstream of Streets Run's mouth at the river). Both Becks Run and Glass Run have major roads running up their courses. Glass Run and Glass Run Road could be thought of as traveling through the east end of the property, because the tract crosses to the other side of these to include the opposite valley slope.

General Watershed Descriptions

Other than Glass Run and Becks Run, there are no officially named streams, or watersheds, on the property. Thirteen watershed and pseudo-watershed polygons cover the majority of the Hays Woods tract and are referred to in this report. Unofficial names and alphabetic letters (A-M below) have been provided each for the sake of reporting and discussion, and these correspond to the watersheds map provided in the appendix: 1Maps.

A. Falls Run

The property is essentially bisected by this stream, which drains in a northeasterly direction to the Monongahela River. This is apparently the only perennial, or nearly perennial, stream on Hays Woods and also drains the largest area. It is not shown as a blue lined (perennial) stream on the U.S. Geological Survey topographic map, but is represented as a line on the PA Department of Environmental Protection's 305b stream layer. It is identified here as Falls Run, given the approximate 20 foot high waterfall at the far downstream end of the drainage. Given the question about the flow of the stream during drier periods, the waterfall probably ceases to flow. Other than the Monongahela River escarpment (and in particular the Eagle Escarpment section), this watershed includes the highest quality, most intact, example of native forest on the property, including a noteworthy herbaceous layer that includes spring wildflowers. Additionally, the

moist cliff of the waterfall represents a separate distinct habitat to recognize in this valley. Rare plant species were sought on this outcrop during field studies, however, none has been found to date. However, the cliff-face of the waterfall does provide a unique habitat and increased the overall site diversity.

The Falls Run watershed consists of three finger drainages in the headwaters; the north and south of these having mining influence. In the southern finger, abandoned mine drainage (AMD) was observed discharging at the coal outcrop elevation in an area that appeared previously surfaced mined (see photographs). It appears the clay layer associated with the coal seam is serving as an aquatard, limiting the waters ability to move vertically and forcing it to the surface at that elevation. Although this intermittent stream appeared severely degraded at the point of the mine discharge, in the area of the large waterfall downstream, a quick visual survey of the stream showed it inhabited by at least some macroinvertebrates.

B. Academy Run

The Allegheny Academy facility is at the head of this watershed. Although it is not officially mapped as such, this stream appears to be of a near, or semi-permanent, hydrology. There are two main forks in the watershed, and at the head of the western one, there is an area of several acres on the slope just below the academy that consists of relatively recent fill and some construction rubble. There is also a flow of water collecting here of curious origin (given the elevation) that creates patches of wetland habitat. Watercress (*Nasturtium officinale*) is growing here in the flowing waters. Additional wetland habitat is located further downstream at the confluence of the 2 subbasins. This is one of the larger wetland environments on the property.

Legacy attributes of coal mining are evident in this watershed, especially in the eastern fork of the drainage. The soils here are generally disturbed, and AMD seeps are found discharging at the surface, some of which are whitish with aluminum parcipitate.

This watershed also includes half of habitat polygon "D", a large tree canopy that to the north is composed largely of red oak trees, but here consists of a wider diversity of species and is more of the sugar maple-American basswood forest community type.

C. Page

This watershed flows into lower Becks Run. It appears that historically there were many anthropogenic activities in this watershed. A number of surface disturbances are apparent and there are extensive patches of invasive plants that dominate the vegetation. There is a report of a lingering coal mine fire in this area, which should be further investigated in terms of property management considerations. A portion of the watershed is noted as "Area of Mine Fires" on the reference map previously prepared by Lennon, Smith, Souleret Engineering, Inc. This is a continuation of the same mine fire area indicated for the Becks Run (L.) watershed summary.

D. North River Escarpment

This section of the property includes large utility transmission corridors that fragment natural habitats, which also provide a separate set of habitats and stewardship challenges. There are some earth disturbance activities associated with those utilities. The escarpment slope down to the river is quite sheer and eroding in some locations. Recent landslides have taken place above

the railroad and Route 837, and especially the northern section of the escarpment appears to be unstable.

There are two locations within the polygon drawn for this area that are of ecological interest. One of the habitats occupied by the red-fruited hawthorn (*Crataegus pennsylvanica*), detailed elsewhere in this report, is found on the north-facing slope above Becks Run and at the nose of the slopes where the latter meets the river escarpment. Here there is habitat for the species provided by a patch of oak forest, the eastern edge of which is a cut power-line. See the account for red-fruited hawthorn under Species of Special Concern in this report, and in the appendices maps.

The other area of interest is the mid-slope of the escarpment above the river, at the southern (upstream) end of the area mapped. Here, this is evidence of an old limestone quarry that has created a bench on the otherwise steep slope. The rich vegetation here, in part demonstrated by uncommon moss species, is essentially an extension of the diverse natural community found along the area identified as H. Eagle Escarpment.

E. Portal

In addition to the high transmission electrical line that crosses this small watershed, there is clear evidence of historic disturbances. Of particular note is an opening in the ground that is depicted in photo -point #73. This is apparently related to past coal mining. Other evidence of these activities are found on the slopes, and especially the east-facing one includes soils that are mixed with coal mining refuse. The herbaceous vegetation here is of low diversity.

The southern extent of the polygon mapped for this area includes a number of hawthorn trees at edge of the river escarpment. These trees include individuals that have been identified as the rare red-fruited hawthorn, along with some others that could not be fully identified as that taxon.

F. Milky Run

This watershed drains to Glass Run at the southwestern edge of the property. Historic coal mining activities have especially influenced the lower half of this watershed, and presently the western section of the watershed is a developed housing area, off the property. There is a pipeline that parallels the drainage on the eastern side and also functions as one of the unofficial trails on the tract.

There is historic evidence of a coal mine portal within, or adjacent to, the southwestern edge of the property and within this watershed. Mine tailings are evident on aerial photographs and can be observed in the field where they have tumbled into the stream valley. Surface AMD discharges of different sizes exist as seepages within the surrounding forest. At stream level there is an area where the AMD gathers more distinctly and comprises a significant portion of the volume of the otherwise intermittent stream. The resulting whitish tint of the stream water can be detected on some aerial photography and is also documented in the photographs of this report. Note: The water quality of this stream and adjacent Glass Run were sampled during this study and are included in the water quality information.

The forest of lower Milky Run and the adjacent Shoenberger watershed have been mapped as

one of the forest habitats identified in this report. The forest is dominated by oak species, including some large red oaks, and then becomes more mixed moist forest in the Milky Run valley.

G. Shoenberger

This is one of the largest watersheds within the property and it includes the old Shoenberger Road trace that leads from Glass Run Road to the uplands in the area of the Allegheny Academy. In the prior section, a habitat patch of oak forest has been mapped, which includes a canopy formed by large trees, but few other components of quality forest habitat. For the most part, the terrestrial habitats in the rest of the watershed consist of secondary successional forests that include a multitude of invasive plant species. A large polygon has been includes a key area for invasive plants is included in the mapping for this report.

There is a wetland that forms from AMD drainage that runs along the lower roadbed of Shoenberger Road. This is mapped as habitat polygon "I." The water quality of this seepage is not deleterious enough to prevent this small wetland from including a moderate diversity of obligate and facultative-wet palustrine species. A few dragonflies were also noted in this area and might have originated in this habitat.

H. Eagle Escarpment

Given the exceptionally steep nature of the terrain here above the Monongahela River, the past and recent human disturbance of this slope has been limited across much of its length. The large trees and secluded nature of the environment here has been conducive to a pair of bald eagles selecting the site for nesting. The limited disturbance, northeastern aspect, bedrock type, and the rich soil conditions, have produced a diverse sugar maple-American basswood forest community. Along with the habitat found in the lower Falls Run valley, this area is one of the two most significant ecological habitats on the property, and extending onto some adjacent tracts. During this study, field surveys were limited to the eastern section of the polygon mapped and were somewhat limited by the active eagle nest, which includes a restrictive buffer zone.

It is important to note that significant portions of the area included in the habitat and watershed polygons, and in description above, are not within the Hays Woods tract. At the far eastern end is a separate property that is owned by the City of Pittsburgh. Down slope of the Hays Woods tract is property belonging to the Norfolk Southern Corporation, especially at the eastern end.

I. Agnew

This watershed includes the portion of Agnew Road that used to extend across the property and connect to lower Glass Run Road. The old roadbed trace is still identifiable, beginning at the large electric transmission line corridor along the river escarpment. The lower portion of the watershed includes seepages, but otherwise the stream is intermittent. Erosion of the stream channel due to past storm water events is evident, which is probably improving now that the land has been reverting to more vegetative cover and the road has been retired. The human activity in this watershed was previously widespread and old building sites are still visible. One of the selected areas demonstrating the extensive invasive plant species coverage on the property is found in this watershed.

An opening in the ground a few feet wide was located in the western portion of the uplands of this watershed and documented as photo point #84. The seam of coal mined in this area of the property is reported to be rather shallow, and this hole is probably related to past mining. It does represent a potential danger and should be addressed.

J. Lower Glass Run

The Lower Glass Run area is where the Hays Woods property is located on both sides of Glass Run. This area is treated as a watershed area in this study, but it is technically not one. It includes lands draining directly to the Glass Run stream from both north and south slopes, as well as a small unnamed tributary drainage, which has its headwaters in an upland residential area beyond the property to the south, but which drains into the Hays Woods tract. Concentrations of mixed invasive plant species are found throughout much of this area, and one is identified where it mixes with some pine trees on the slope south of the stream (see mapped area "I". Both sides of the stream valley are covered in forest, but the forest habitat has been mapped on along the south facing slope due to the large size of the canopy trees (mostly red oak) in this area, which extends to the east, off the Hays Woods property and, in part, onto an adjacent separate City of Pittsburgh tract. Included in this forest is chinquapin oak (*Quercus muhlenbergii*); one of which is a large canopy tree. The presence of this tree is indicative of the calcium rich soil type found in portions of the local region and is a remnant of the associated, and relatively rare, natural community type here.

K. Glass Run

This slope directly above Glass Run is technically not a watershed, but functions as a descriptive area of the property. The slope is included in habitat mapping as "H", due to the band of forest consisting of large canopy trees extending from the Agnew watershed to the Shoenberger watershed and across this slope. This slope is also a good example of how terrain and past land use have dictated what is observed today as habitats. The lower and mid slope are quite steep and would have been of minimal use historically. Today, there remains a band of large old trees, largely oaks, which were never cut or otherwise directly disturbed. Further up, as the slope, becomes much less steep, there is a zone of younger forest (black cherry, sugar maple, etc.) that has been growing back since use of the land in that area has largely ceased. Finally, as the land levels out, on terrain that probably received the highest level of use and disturbance, there is much younger forest and a profusion of invasive plant species. One of the invasive plant concentration polygons mapped for this study, identified as "H", includes this area.

L. Becks Run

The slope above Becks Run is another example of a large tree canopy habitat on the slopes of the Hays Woods property. This patch consists of a domination of red oak and other trees and continues southwest into the Academy Run watershed, where the diversity increases in a moist mixed species forest. A seepage area is present at mid-slope in this area and flowing downslope to Becks Run. This is likely an AMD influenced wetland, however the water quality appears to be relatively good, as indicated by the presence of northern dusky salamander (*Desmognathus fuscus*).

A portion of the watershed is noted as "Area of Mine Fires" on the reference map previously prepared by Lennon, Smith, Souleret Engineering, Inc. This is a continuation of the same mine

fire area indicated in the Page (C.) watershed summary.

M. Upper Becks Run

Only the far northwestern corner of the Hays Woods property occurs in this watershed polygon. However, if additional green space is protected and added in the future, this is one of the few directions that such opportunities might exist, due to the level of development in this area. Note: There is a significant AMD discharge surfacing on the adjacent property and flowing down slope to Becks Run.

Aquatic Communities, Habitats and Water Quality

The WPC's Watershed Conservation Program (WCP) carried out the majority of the aquatic investigations that are part of this overall study. The WCP has a wide range of expertise in stream monitoring, assessments and abandoned mine drainage remediation. The opportunities for WCP to conduct investigations at Hays Woods were limited to 3 visits to the property. On two dates, an overview of the past coal mining was undertaken, with particular focus upon aspects of water quality, including the collection of water samples for private laboratory analysis. The third visit included a team of aquatic biologists and assistants, who carried out basic stream assessments on Falls Run, Glass Run and Becks Run. Although the findings of these inquiries are summarize below, the full report (Aquatic Habitat Characterization of the Hays Woods Property, Allegheny County, Pennsylvania") and the detailed laboratory results are included in the appendices (see: 6 Aquatic Resources).

The obvious perennial streams associated with the Hays Woods property include the two first order streams bounding the property: Glass Run and Becks Run, which are comprised of watersheds that spread across the surrounding landscape. There are 8 small drainages that cover the property and are detailed in mapping, and in the previous section as part of the A-M watersheds listing. These drainages lead to either of the first order streams mentioned above, or to the Monongahela River. These small drainages can be considered as watersheds, although Falls Run is the only one that is considered to be supporting a near-perennial stream; albeit drying up during periods of lower rainfall in the summer. Two other watersheds (Academy Run and Milky Run) include streams that appear to be intermittent in their flow.

Per the WCP report, a summary of the biotic and water quality (chemical) sampling results follows for certain streams and watershed tributaries that were selected for study (with codes corresponding to the report study sites, e.g. B1, and where laboratory samples were collected = A). See also the map for aquatic sampling in the map appendix.

Sampling Locations:

_Glass Run (B1-lower, B2, A001 - just below Milky Run, B3,A002 - just above Milky Run)
_Milky Run (A003 – at AMD seep head)
_Becks Run (B5)
_Falls Run (A004 – at AMD seep head; A005 – where AMD tributary joins main stem; A006 – low on main stem just above waterfall)
_Academy Run (A007 – main stem of creek; A008 – left (west) tributary split; A009 – right (east) tributary split)

Water Quality
Milky Run, Falls Run and Academy Run are all tributary streams with significant AMD. The AMD discharge at Milky Run comprises most of the volume of that stream, and is also a large proportion of its receiving stream, Glass Run, during low flow periods. The AMD seepage discovered at Falls Run is a great influence on the stream initially, and then higher quality groundwater apparently enters the stream and improves it downstream. The Academy Run stream shows influence by both AMD and excessive sedimentation likely resulting from earth disturbance. The major fork in this drainage was tested and it was determined that the AMD influence is largely from the eastern subbasin, while the excessive sedimentation is the result of land use in the western subbasin.

Macroinvertebrates
Falls Run scored the highest in metrics of macroinvertebrates indicative of water quality. Becks Run had higher scores than Glass Run, although there was some improvement in the latter at the downstream site (B1).

Fishes
Fishes were sampled at Lower Glass Run (B1), Upper Glass Run (B3), Falls Run (B4) and Becks Run (B5). No fish were observed or collected at any of these site.

Salamanders
A specific search for stream-side salamanders under 50 cover rocks along a 30-meter reach of Becks Run resulted in no salamander observations.

Habitats, Natural Terrestrial Communities and Vegetation
The habitats present at Hays Woods are terrestrial, palustrine and aquatic; the latter is covered in previous section. Subterranean habitats might also be present, in the form of caves, mine environments, or habitats in aquifers, but there is no information about these.

Terrestrial Habitats - Forests
1) Mature canopy – that consists of old trees, often on steep slopes
2) Successional forests and woodlands - on previously disturbed lands; abundant in non-native invasive plant species

<u>Select Forest Habitats</u>
The "forests" of Hays Woods are in many cases more or less stands of legacy trees. Large trees are of regular occurrence in the habitat patches mapped, and are demonstrated in a number of the photographs provided in this report. These trees, many significant in size, and of forest-grown form (tall, without lower limbs), represent the basis for forest patches. Often these patches lack full set of forest ecosystem components; or, these components are damaged. Specifically, the forest ecosystem components referred to here are the forest strata (canopy, subcanopy, shrub layer, herbaceous layer, litter/duff, and natural soils). In other cases, the forest ecosystem is compromised, e.g. a canopy of native trees is present, but the shrub layer consists of a dominance of non-native invasive species. The influence of white-tailed deer herbivore was not apparent during this study, but is likely a factor in forest health. Each patch consists of certain condition characteristics that could be described to provide individual patch assessments.

Wetland Habitats

Three of the most notable discrete wetland habitats encountered during this study are identified in this report. A number of the wetlands on the Hays Woods property are not natural and have resulted from human activities, including a number of small pools in human created depressions with impervious soils. These are not included in the report, although two of the wetlands identified are of anthropogenic origin. The wetlands mapped for this report and with the corresponding codes are:

I. Emergent-shrub wetland

This wetlands feature is largely supported by the AMD discharge from underground coal mining. Any pre-mining presence of a wetland at this location is unknown, although the site is within the broad upper valley of the intermittent drainage identified here as the Shoenberger watershed. It consists of an area dominated by herbaceous and woody low vegetation beginning in the switchback crook in the old Shoenberger Road trace and then draining downslope along the road trace. Apparently, due to the chemistry of the AMD drainage (e.g. not overly acidic and iron laden), there is a diversity of native vegetation. Masses of non-native invasive plants exist in the adjacent area. The mapping provided for this wetland is preliminary and should be revisited during more specific planning.

J. Seepage-surface water wetland

Many of the valleys on the Hays Woods property have moist to wetland soils along the lower slopes. That is the case with the Academy Run drainage, where groundwater seepages along with surface waters create an area of wetlands beginning in the two subbasins and extending into the main valley. A portion of the water supporting these wetlands is AMD. Wetlands delineation should be undertaken in order to create specific information for use in future management, e.g. trail design.

K. Human-made pond

Within just the past few years a hole was dug at this location, which has filled with water to form a pond. This water feature consistently retained water during the study. The pond was not investigated for aquatic life, although a frog of an unknown species escaped into the pond during one visit. Likely, other pioneering aquatic life are establishing populations. The pond is along an existing roadbed/trail and could be evaluated as a future educational amenity for the property.

Other Wetlands

Not mapped, but of particular interest, are the additional seepage wetland zones found on the mid and lower slopes of many of the valleys. These are notable in the lower Falls Run valley and along the Eagle Escarpment slope where wetland seeps mix with rich natural soils to create microhabitats supporting lush herbaceous vegetation. Although any seepage on the Hays Woods property is suspect as to be influenced by coal mining, the water quality of these particular seeps appears to be good. The high pH of these seeps indicates that they are emanating from the circumneutral to calcareous native bedrock layers, rather than directly from layers of coal. Note the photographs with this report showing the vegetation mentioned above, including stands of spring wildflowers that are responding to moist soils. There is a related localized seepage in the Falls Run valley, just upstream of the waterfall, where northern dusky salamanders were

observed. Wetlands delineation along the base of valley slopes could be considered in the future to assist in planning and management for the property.

As noted above, there are a few other wetlands on the property that due to their unnatural origin and small size are of limited importance. Nonetheless, these wet areas are supporting some obligate wetland vegetation and likely also are habitat for some palustrine invertebrates. However, some of these fluctuate significantly across the seasons. One such wetland is a pool adjacent to Glass Run at the bottom of Shoenberger Road (see photographs). Other wet areas appear to be in depressions that might have resulted from mine subsidence. These are along some of the jeep trails on the southeastern portion of the property, south of the lip of the escarpment. Here certain sedges, rushes and other emergent vegetation are found.

Habitat Mapping

A select group of forest and wetland sites was identified and mapped. See the Hays Woods Habitats map in the appendix 1 Maps. Eleven such habitats are identified and mapped as A-K: 8 forests and 3 wetlands.

A. Sugar maple-American basswood forest (grades into oak forest on higher nose of slope)
B. Sugar maple-American basswood mixed forest (drier oak-hickory along upper lip of slope)
C. Red oak forest
D. Sugar maple-American basswood mixed forest lower with red oak forest high on slope
E. Sugar maple-American basswood and other mixed moist forest
F. Upland oak-black cherry forest
G. Mixed deciduous forest
H. Mixed deciduous forest
I. Emergent-shrub wetland
J. Seepage-surface water wetland
K. Human-made pond

Invasive Plant Concentrations

The proliferation of numerous invasive non-native plant species is a major negative ecological attribute within the Hays Woods habitats. While there is no official definition for which non-native plant species are considered to be invasive, there are some that clearly fit the concept of detractors of ecological health. The following invasive plant species were found during this study, and are divided into 2 levels related to the degree of the invasion that they represent, and are listed alphabetically by common name within those categories:

Most pervasive:

- Garlic mustard (*Alliaria petiolata*)
- Amur honeysuckle (*Lonicera maackii*)
- Japanese honeysuckle (*Lonicera japonica*)
- Japanese knotweed (*Fallopia cuspidatum* and/or *F. sachaliniense*)
- Japanese stiltgrass (*Microstegium vimineum*)
- Multiflora rose (*Rosa multiflora*)
- Oriental or Asiatic bittersweet (*Celastrus orbiculatus*)
- Porcelain-berry (*Ampelopsis brevipendiculata*)

Tree-of-heaven (*Ailanthus altissima*)

Lower coverage or lesser immediate concern:
- Autumn olive (*Elaeagnus umbellata*)
- Canada thistle (*Cirsium arvense*)
- Common buckthorn (*Frangula cathartica*)
- Common privet (*Ligustrum vulgare*)
- Common reed (*Phragmites australis*)
- Dames Rocket (*Hesperis matronalis*)
- Japanese barberry (*Berberis thunbergii*)
- Jetbead (*Rhodotypos scandens*)
- Marrow's honeysuckle (*Lonicera marrowii*)
- Mile-a-minute weed (*Persicaria perfoliatum*)
- Moneywort (*Lysimachia nummularia*)
- Mugwort (*Artemisia vulgaris*)
- Norway maple (*Acer platanoides*)
- Orange day-lily (*Hemerocallis fulva*)
- Siberian elm? (*Ulmus pumila*)
- Spotted knapweed (*Centurea stoebe*)
- White mulberry (*Morus alba*)

The list of invasive plant species above is not believed to be a complete one for the property, and others will be confirmed in the future. The definition of "invasive species" is not universal, and on the less detrimental end of the spectrum, there are additional species found on the property that could be included above.

Invasive plant species are found on nearly every acre of the Hays Woods property, although generally to a lesser extent in the select forest habitat polygons in this report. Actual mapping of all the invasives was not practical, however, select areas are provided in this report as examples of some of the worst areas for one or more of the most prevalent species. See the Invasive Species Concentration map in the appendix: 1 Maps.

Flora

Lists of plant species are provided in the appendices. Included is a general checklist as well as individual lists generated during certain field surveys to particular areas on the property. The list of flora is not comprehensive and many more species await discovery and addition to the list.

Fauna

Lists of the fauna recorded at Hays Woods are provided in the appendices, along with a few other notes. Certain wild animals were either directly inventoried or otherwise detected during this study. However, due to the limited nature of this study, there is much more inventory work to accomplish in order to describe the fauna, and no attempt was made to undertake even an approximate listing of the invertebrates. Within the vertebrates, birds and salamanders were the two groups that were directly sought, at least in a limited way, but a list of all vertebrates encountered is provided in the appendices. Other wildlife commentary is provided below.

Eastern red-backed salamander (*Plethodon cinereus*)
What is notable to include about this species is that it was not found during this study. A thorough salamander inventory was not undertaken as part of the study, but a deliberate effort was made to search for woodland salamanders during field visits. On a number of occasions, woodland salamanders were found; specifically, the northern slimy salamander (*P. glutinosus*), 8 individuals and the northern ravine salamander (*P. electromorphus*), 4 individuals. These two species often co-occur with the more common red-backed salamander at other Pennsylvania localities, with the red-backed salamander out numbering them by more than 5:1. Indeed, the website for the Pennsylvania Amphibian and Reptile Survey (PARS) project, now underway, lists more than 23,200 records submitted for the red-backed salamander (the most common salamander in the state) and only 6,333 for the also widely spread, but less observed, northern slimy salamander. Furthermore, a query of the PARS dataset reveals that to date the red-backed salamander has not been reported to the project for the region within a few miles surrounding of Hays Woods. Therefore, whatever the reason is that this salamander appears not to be present at Hays Woods, this might be shared across a wider landscape.

White-tailed deer (*Odocoileus virginianus*)
This study did not attempt to assess the deer population level at Hays Woods. Deer, their tracks, scat, and some evidence of browsing, were observed on numerous occasions, but perhaps less than expected. The sense is that there is not a high deer density on the property, and if so, this might be related to habitat quality. The issue of deer population is one to better understand in relationship to the restoration of native vegetation. Generally, the forest patches are already deficient in vegetation components and in the recruitment of tree species. More study is needed to investigate the causal factors and to see if herbivory by deer is of significance.

Species of Special Concern
According to the Pennsylvania Natural Heritage Program databases, there are two records for species of special concern on the property and details for these are provided herein. Another set of such species is also provided for species of special concern documented for nearby areas off the property; in particular along the Monongahela River valley. The two species on the property have been documented recently and information is provided about both.

Extant Occurrences on the Hays Woods Property

Bald eagle (*Haliaeetus leucocephalus*)
A pair of bald eagles began nesting along the edge of the Hays Woods tract overlooking the Monongahela River in 2013. Although our national emblem is no longer listed as endangered or threatened by either state or federal wildlife agencies, the bald eagle remains protected by the federal Bald and Golden Eagle Protection Act. The species also continues to be of great interest to the public. The bald eagle is still deliberately managed by the Pennsylvania Game Commission (PGC), and the agency's law enforcement personnel maintain some vigilance regarding nest sites. When visiting or policing the nest site, PGC staff approach the nest from the Hays Woods property.

Red-fruited hawthorn (*Crataegus pennsylvanica*)
This small tree has been documented in a few locations on the Hays Woods property to date. It

was originally discovered 1 June 2002 by botanist Joe Isaac at the far northwestern corner of the tract. The identification of the specimen collected was made by James Mackalin, an expert in hawthorn species. It was reconfirmed at the original location during the present study, as well as at a few other locations. See the Species of Special Concern map in the appendix: 1 Maps.

The red-fruited hawthorn ranges from Ontario and Ohio to North Carolina. It is ranked as a Globally Rare (code: G3, on the scale of G1-G5) species by NatureServe (http://www.natureserve.org/). This rank generally indicates that it is of interest to biodiversity conservation efforts. In Pennsylvania, there is no official Pennsylvania conservation status, but it is listed as under the proposed status of Tentatively Undermined (TU) by the Pennsylvania Biological Survey-Vascular Plant Technical Committee, and under the rank of State Rare (S2S3) by the Pennsylvania Natural Heritage Program (http://www.naturalheritage.state.pa.us/Species.aspx), per the state conservation ranking system. Although more study is needed of the state status, the global rank (G3) and the state rank (S2S3) suggest that the red-fruited hawthorn will possibly receive a Pennsylvania conservation status designation in the future.

However, *Crataegus* is a large genus with approximately 30 hawthorn species recorded in Pennsylvania. Furthermore, it is a problematic group of plants, with species that are difficult to identify and with hybridization occurring between species, creating some challenge in understanding the genus, its species or "taxa" (e.g. species, subspecies, hybrids and genotypes, etc.). There are at least 3 other hawthorn species occurring on the Hays Woods property, including *C. coccinea*, *C. crus-galli* and *C. viridis*.

Based on the limited opportunity to inspect hawthorns during this study, it appears that in addition to rather pure genotype red-fruited hawthorn being present, some red-fruited hawthorn trees are also representative of this species mixing with the scarlet hawthorn (*C. coccinea*), forming hybrid intergrades of the two.

More study of the hawthorns at Hays Woods is needed, both to determine the extent of the range of the red-fruited hawthorn on the tract, and what importance any hybridization represents in the conservation of this tree at this site.

Other Species of Special Concern (watch-list)
A list of species of biodiversity conservation interest, that have been documented in the Hays Woods property region, was used as a "watch-list" during the field work in this study, and can also be utilized for continued inventory efforts on the property. These are:

Vascular plants:
- Common hop-tree (*Ptelea trifoliata*)
- Goldenseal (*Hydrastis canadensis*)
- Mistflower (*Conoclinium coelestinum*)
- Passion-flower (*Passiflora lutea*)
- Rock skullcap (*Scutellaria saxatilis*)
- Wild senna (*Senna marilandica*)

Wildlife/insects:

Taper-tailed darner (*Gomphaeschna antelope*) – a dragonfly

Records for the species above come from the Pennsylvania Natural Heritage Program database of species listed in some fashion as endangered, threatened, rare, tentatively undetermined, etc.

IV. Discussion of Ecological Resources and Conservation

The property is predominately forested with patches of grassland, sparse-canopy reverting woodlands, along with roads, clearings, pipeline and power line right-of-ways, and other scattered disturbances. The steeper slopes above the Monongahela River, Glass Run, Becks Run, and the lower reaches of certain tributaries, generally hold the most intact forest communities and native species on the property. Typical of many areas along the Monongahela, the site is influenced by limestone strata lying just under a coal seam; with coal mining being the primary historic human use of the site. Likely a rich, mesic forest community at one time, the flora of the site continues to reflect that natural heritage. American Beech (*Fagus grandifolia*), black cherry (*Prunus serotina*), sugar maple (*Acer saccharum*), American basswood (*Tilia americana*), hackberry (*Celtis occidentalis*) are dominant canopy tree species in many of the more mature forested areas. Remnant stands of impressive oak trees, particularly large red oaks (*Quercus* rubra) are somewhat mysterious in their survival here. Some of these areas are contiguous with forested land off-site, especially those forests occurring on the lower escarpment slopes facing the Monongahela River within Baldwin Borough.

General Opportunities for Conservation

The first feature noted when considering the conservation value of the Hays Woods tract is its relative large size and nearly contiguous expanse, in a highly developed landscape. Within this tract are forest habitats and small watersheds that are, in some cases, almost entirely situated on the property. Due to the topography and related macro-environments, there is a variety of elevations, soils and slope gradients. These create an existing diversity of habitats at a variety of scales, and the potential for more. Some of these habitats are supporting pockets of remnant native biodiversity that represent focal areas for protection and management. An objective to expand these areas to more viable natural communities could be involved in future property management. Other areas that are presently dedicated to utilities could be evaluated and managed as habitats more supportive of native species and ecological processes. Opportunities exist to provide for unique aesthetic and recreational activities, so long as these are carefully developed and protect sensitive locations and biodiversity values.

Potential opportunities to expand the protection and management of biodiversity of Hays Woods and the immediate landscape were noted during this study. The protection of the following areas could be explored: (1) a 19.9-acre parcel at the southeastern corner of the property, not far from the eagle nest, that is listed under the ownership of the City of Pittsburgh; (2) four properties in the lower Glass Run valley that range from 8-20 acres: and (3) undeveloped portions of the Allegheny Academy property, and an adjacent 16.7-acre tract. Using some sort of conservation agreement, the protection of these lands will assist in maintaining the ecological landscape of the Hays Woods habitats and watersheds, as well as add to greenway protection in the area.

The last point above speaks to the role that Hays Woods plays in the ecology and biodiversity of regional landscape. Aspects of flora and fauna conservation, watershed protection, green space and the linkage of outdoors recreational opportunities, can be considered spatially for the Monongahela River corridor. Hays Woods is poised to participate in planning to address these perspectives.

Ecological and Conservation Challenges

For the foreseeable future, the management of the Hays Woods property will be challenged by its anthropogenic history. The surface, subsurface, and waterways have been influenced by coal mining, throughout a number of decades and using a number of methods. The mining legacy has significantly altered terrestrial and aquatic environments. Other historic property uses have also combined with the mining to influence site conditions, including agriculture, construction of buildings and roads, dumping of fill, slag and other materials.

On steep slopes and in difficult to access settings, patches of the original rich soils are present on the property. However, some of these patches are tainted with mining overburden and other materials that were either dumped over, or washed down, the slopes to cover or mix with the rich topsoils. This can be seen in nearly every small watershed, but is exemplary in upper Falls Run (A), Academy Run (B, more recent earth moving), Portal (E) and Milky Run (F). In other larger areas, due to prior agriculture, earth moving, dumping of fill and other disturbances, the original soils have also been altered, but not so much covered over. These last areas are particularly vulnerable to the invasion of non-native plant species, which are actually less likely to grow on disturbed areas with a high percentage of coal remnants.

The past creation of utility rights-of-ways (ROW) throughout the property has fragmented both disturbed and relatively undisturbed terrestrial habitats. These ROWs consist of large regional high voltage electric transmission lines, smaller local electric transmission lines, an underground oil pipeline, and a few underground gas pipelines. The ROW width and the maintenance practices involved with each type of utility vary. These lines can be considered permanent features of the property and have to be addressed in the long term management of habitats and watersheds. Generally, ROWs are negative features in landscapes managed for biodiversity and its supporting habitats. Although the influence varies with width and type of ROW management, adjacent forest quality is not considered to be of an "interior condition" unless it is beyond 100 meters from a major fragmenting feature, such as a wide high voltage transmission line ROW. In addition to ROWs displacing natural habitats in those locations, one of the major conservation concerns about such fragmenting features is that they function as habitats for invasive species, and as avenues that introduce invasives into patches of natural habitats that would be more difficult to invade. In this case, the invasive species include brown-headed cowbird, domestic cat and a long roster of non-native plant species. These openings also encourage the imbalance of native species that negatively influence habitats and other native species, e.g. white-tailed deer, meso-predators on bird nests (e.g. raccoon).

Another major fragmenting feature is Glass Run Road, which runs along the southern border of Hays Woods and also divides off a section of the property at the south east corner. Above, consideration of the expansion of the size of the Hays Woods tract south of this road is

suggested. This forested section of the property is presently significant wildlife habitat, in particular for birds, however increasing the patch size of the forest will increase that significance, in part by creating more interior forest habitat.

Hays Woods has a very high diversity and density of non-native invasive plant species that represent one of the largest conservation challenges in managing this property for natural habitats and native biodiversity. These species are found on literally every portion of the tract in the form of one or many species, and often present in high abundance and coverage. The densities are such that in some locations invasive plants are dominant. Generally, the least impact can be found in the areas of large tree canopies and in the rich remnant forest patches, such as lower Falls Run valley and the Eagle Escarpment. At these sites, invasive plants species are present, but often in numbers and coverage that represent some hope that management to eliminate or control them is feasible. In some of the other areas, a massive effort will be need to displace the invasives as part of habitat restoration. A few examples of these infested areas are provided on the appendix map: "Invasive Plant Concentrations".

Streams and Watersheds

The watersheds present on, and incorporated within the surround Hays Woods landscape, are an important unit of ecology and property management. The true watersheds identified in this study (letters A, B, C, E, F, G, and I) vary in their qualities and conditions. None of the streams present are recognized by PA Department of Environmental Resources as perennial, although Falls Run is under consideration for inspection and testing.

The separate report "Aquatic Habitat characterization of the Hays Woods Property" included in appendices provides the details of the aquatic study for the study. The sampling in this study indicates that Falls Run is either perennial, or near-perennial, given the number of taxa present and the number pollution sensitive aquatic macroinvertebrates detected (total taxa and total EPT). Even with this question of the consistent volume of Falls Run, it scored the highest of the streams sampled.

Fish were not detected in the three streams surveyed (Glass Run, Becks Run, Falls Run). The first two of these streams are large enough to support a few fish species. Field observations concluded the presence of aluminum (Al) from AMD sources in all of the streams sampled, and this element is toxic to fish at even low levels. The lack of any stream-side salamander observations along Becks Run might also be attributed to Al, or other toxic AMD pollutants, however, the urban nature of the Becks Run watershed means that there are other significant influences on associated habitats, including the extreme flashy hydrology of this waterway.

As previously noted, the environmental chemistry of Hays Woods related to coal mining, surface and groundwater, is such that the highly acidic waters collecting in the historic caverns of the mines is becoming neutralized before, or shortly after, reaching the surface to join streams or create wetland seeps. AMD tends to be toxic to life in a number of ways, and while the highly acidic waters are not as commonly discharged at Hays Woods, these waters do still include toxic compounds, e.g. aluminum.

Species of Special Concern

Bald eagle nest

The recent recovery and expansion of the population of the bald eagle in North America has included a nesting pair along the northeastern property boundary. Presently, the bald eagle nest is not on the Hays Woods tract, but is above the Monongahela River just downslope of the property boundary. The eagle nest tree blew down in a storm early in the 2017 nesting season. The eagles built a new nest and continued nesting a short distance away. The exact location of the new nest is unknown at the time of this report, and a circular disturbance avoidance zone (roughly 660 feet/200 meters) is provided based upon an approximation of the nest site.

Management of the bald eagle nest includes the PGC establishing a restrictive buffer zone around the nest site to prevent disturbance by humans. Presently, PGC has posted 2 sets of signs that: 1) warn people that they are approaching a restricted zone, and 2) warn people not to enter the restrictive zone under penalty of the law. The PGC should be contacted to learn the radius of any management zones established for this particular nest. Typically the protective zone around the nest is a minimum of 330 feet (100 meters), depending on the particular situation. The PGC will want to continue to work with the City of Pittsburgh in the management of the nest, so long as the pair is nesting on or adjacent to the property. For background information, see the PGC's bald eagle management plan in the Species of Special Concern appendix.

The bald eagle nest is indicative of the character of the escarpment above the Monongahela River. The escarpment is high above the expanse of the river valley, steep, secluded, and supports a forest of large trees. The bald eagle is likely to continue nesting here, or nearby. Other wildlife might also take up nesting here and, for example, it would not be a surprise to find that the site attracts a rookery of the great blue heron in the future.

Red-fruited hawthorn

As previously noted this rare species is found at a number of locations on the property and is likely present in some additional locations. A more complete survey specifically for hawthorns will have to be conducted to understand its complete distribution on the property. Presently, this small tree is considered to be at risk throughout its range; however, it is little known in Pennsylvania and more study is needed to determine its true status in Pennsylvania and in the United States. It is possible that it will become at least state listed (endangered, threatened, etc.) in the future, and its protection on the Hays Woods property will increase in importance.

Utility Right-of-Ways (ROW)

The future presence of electric power lines and gas/oil pipelines is a foregone conclusion. These ROWs represent fragmenting features for forest conservation objectives, and are also habitats and corridors for invasive non-native plants. Developing relationships with ROW owners will provide opportunities to discuss management issues. As open environments, these corridors could be converted to native meadow habitats to the degree possible; providing vegetation species and structure conducive to habitation by native birds, butterflies and more. These sites can also be incorporated into any environmental education programming. Should the opportunity arise, ROWs could be retired from their present uses.

Climate Change

Conservation of the Hays Woods property can interface with matters related to global climate change in a few ways. Some recent studies have indicated that, to be effective in providing suitable habitat for our flora and fauna as they immigrate to new locations due to changing climate, proactive land conservation efforts should be refocused. Specifically, (a) species are predicted to shift their global ranges to find suitable habitats in new places to major degrees, and (b) during that shifting many species will require suitable habitat that is limited in our present portfolio of protected lands. Following this line of analysis and planning, WPC has worked with The Nature Conservancy to develop a spatial representation of the relative ranking of the importance of locations across Pennsylvania for the conservation of biodiversity. The appendix map: Map 9-Geophysical Settings and Climate Change, shows a zoomed in view of that mapping for Hays Woods location, and indicates that the majority of the property ranks in the top tier of this importance and need analysis. Another consideration related to climate change planning is landscape resilience. Again, a zoomed in perspective of the Hays Woods property is provided as Map 10-Site Resilience Climate Change. This map simply indicates the relative flexibility the ecological environment is predicted to have to bounce back from the stresses of climate change.

Another aspect of the Hays Woods property's relationship to climate change has to do with carbon sequestration. Reducing the amount, or the potential increased amount, of atmospheric carbon is a recognized practice in addressing on-going global climate change. Hays Woods is involved in sequestration by (a) retaining stable carbon stores in the form of living trees, woody debris and organic topsoil reserves, and by (b) continuing to support growing vegetation that is capturing atmospheric carbon and fixing a portion of it in the steady reserved forms of woody vegetation and more soil-banked amounts.

V. Conclusion

The acquisition of the striking Hays Woods property as a public asset by a government entity is a major achievement. Having serendipitously survived the industrialization of the Pittsburgh region, including intense utilization and then even recent options for more development, this large tract still retains qualities fitting of a regional parkland, biodiversity reserve and aesthetic green space. What lies ahead are opportunities and challenges to protect and restore the natural attributes of this large tract for the public benefit, beginning with specific planning and management designed to provide the stewardship to achieve conservation objectives.

Primary to the initiation of conservation ownership at Hays Woods property are the perspectives of protection, restoration and careful use, all in the context of the present condition and attributes of the land. A set of existing ecological assets can be immediately recognized as focal areas for protection planning. These assets include (a) forests supporting Neotropical migrant bird species and stands of large trees approaching old growth quality, (b) a few species of special concern discovered to date of biodiversity significance and public interest, (c) patches of rich original soils supporting diverse native flora, (d) a few small watersheds, with their related hydrologic regimes, that are nearly fully encompassed by the tract of parkland, and (d) an enduring example of the dissected Pittsburgh plateaus landscape that represents the natural physiographic heritage of the region. These assets can all be protected via planning and actions that will address their characteristics and vulnerabilities. Planning can be initiated as an overall approach for the tract, along with a prioritized focused on certain areas, e.g. a watershed and forest conservation

scheme for the important Falls Run area.

The above is a feasible assignment when compared to the challenge of addressing the historic legacy consisting of the disturbance of surface and subsurface portions of the land. Fortunately, restoration ecology is a field of conservation science that has been developing now for a number of decades, and its principles and practices are well primed now for use in improving Hays Woods. In particular, the most pertinent restoration issues include (a) the abandoned mine drainages and afflicted streams, (b) subterranean coal mine caverns: surface openings and subsidence, (c) coal mine tailings and overburdens and other cases of tainted soil quality, (d) various incursion levels of invasive non-native plants, (e) lack of the presence and regeneration of the components forest ecosystems. These are the major restoration needs, although there is a set of lesser ones, including the erosion and disturbance of unauthorized vehicles (ATV: all-terrain vehicle) and some trash dumping.

Use and management of the Hays Woods property includes other challenges related to its landscape characteristics. On site, the greatest challenge will be to protect the slopes. Steep slopes are fragile areas, and the slopes at Hays Woods are often very steep and also include features such as the basal seepages and some of the impressive forest patches. Protecting these slopes should include buffer zones extending beyond the slopes themselves. Care should be used in the development of any park facilities, including trail development. As part of a watershed ecology approach for site planning, managers should take into consideration the context of Hays Woods as green space in an otherwise developed landscape. Therefore, while taking a protective approach to managing watersheds on the property, that approach also must include the realization that environmental influences beyond the property will be acting on management goals. This is also the case for forest habitat planning, and might involve on site mitigation to address outside sources of ecological stress, e.g. the influence of urban storm water runoff. The external influence of factors beyond the property borders is also a reason to consider adding additional acreage to Hays Woods where possible.

Lastly, the present study has provided the opportunity to conduct an initial investigation of the Hays Woods tract and to illuminate some of attributes and issues regarding the property. Arranging for a suite of additional studies will benefit efforts to create and implement an effective conservation and management plan that will protect and provide the site for the citizens of Pittsburgh.

VI. Appendices

1. Maps
2. Photographs for the Report
3. Flora Inventory
4. Fauna Inventory
5. Species of Special Concern
6. Aquatic Resources & Water Quality
7. References