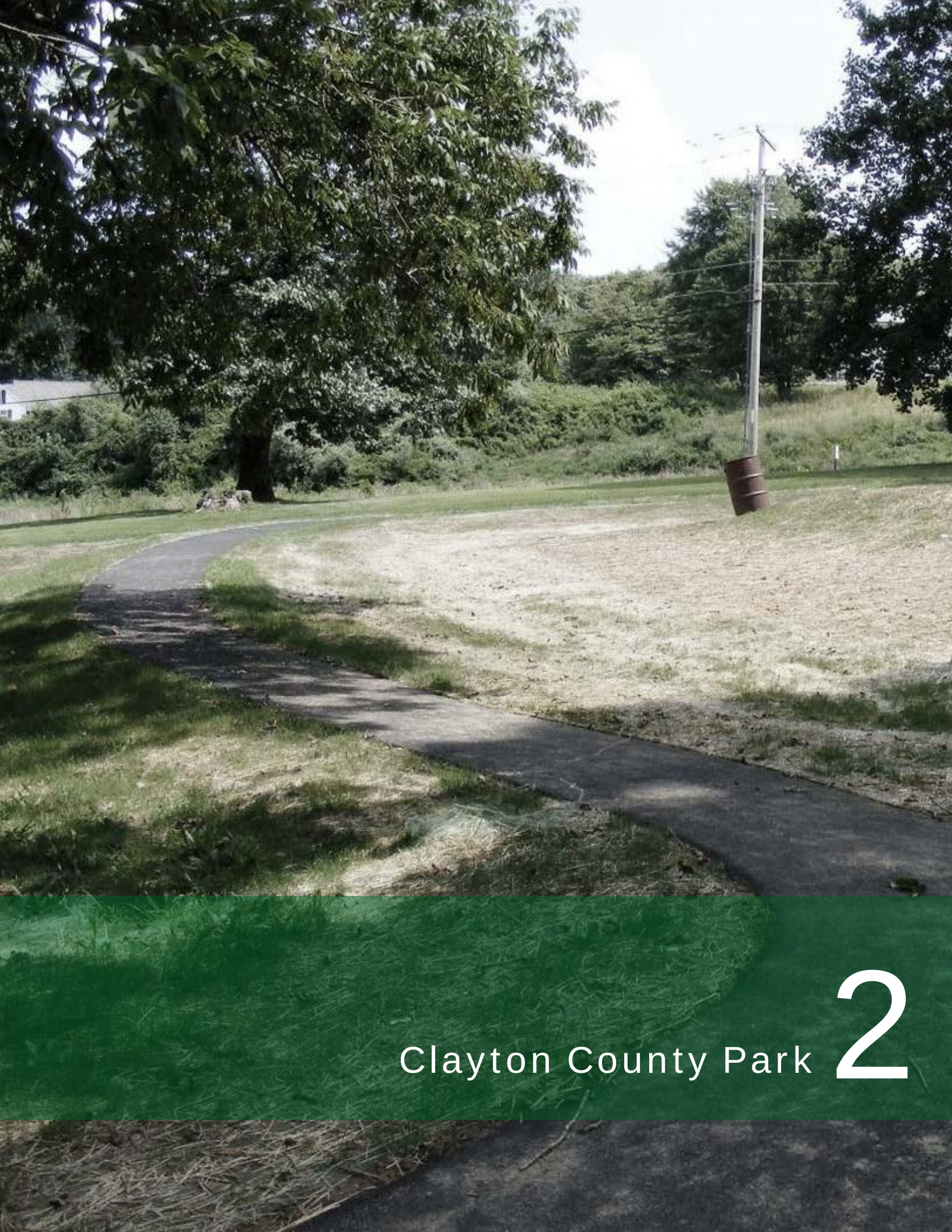


Clayton County Park 2

Chapter 2: Clayton County Park

INTRODUCTION

BRIEF HISTORY

Clayton County Park came into the possession of the Delaware County Parks and Recreation Department as a donation of 59 acres from the Nelson family in 1957. The property was originally part of the family farm that was bisected by the then newly constructed Conchester Highway. The County then purchased another 15 acres from the Clayton family that same year. Once the County had 74 acres of land in its possession, it started planning for the construction of a 9-hole golf course. The course was constructed and opened in 1963. Additional acquisitions between the years of 1963 to 1975 yielded another 74.3 acres to Clayton County Park. In all, this proved to be the last acreage added to the park which currently sits at 148.3 acres.

CONTEXT WITHIN THE DELAWARE COUNTY PARKS SYSTEM

Clayton County Park is a very diverse county park and offers a great combination of active and passive recreation opportunities. Facilities within the park include a tot-lot/playground, ballfields, open playing fields for football or soccer, picnic areas, open lawn for passive activities (Frisbee, dog walking, sunbathing, etc.) and the 9-hole golf course, which is the featured attraction at Clayton County Park. The park also contains large areas of mature mixed deciduous woodlands on the eastern side of the park. In the context of the overall Delaware County Park System, Clayton County Park is the largest County Park in the system at 148.3 acres and exhibits extremely desirable facilities and natural resources that make a county park successful.

CURRENT SERVICE AREA

Clayton County Park is large Regional Park that, with its golf course, attracts users from all over Delaware County and users from out of County as well. Clayton County Park is a destination park that

Figure 2-1: Clayton County Park with 9-hole golf course as it exists today
Source: Bing Maps

almost all users access by vehicle. Very few of the park users access the facility by foot. There are some residential neighborhoods that border the park that provide some pedestrian usage of Clayton.

The current service area of Clayton County Park supports a portion of northern Delaware and the municipalities of Chester Heights Borough, Concord Townships, Aston Township, Bethel Township, Upper Chichester Township, and Chadds Ford Township.

Clayton County Park's current service area also includes many other similar open space resources and user constituencies that benefit the park. These resources include: Neumann University, Upper Chichester Township Park, and Newlin/Grist Mill Park.

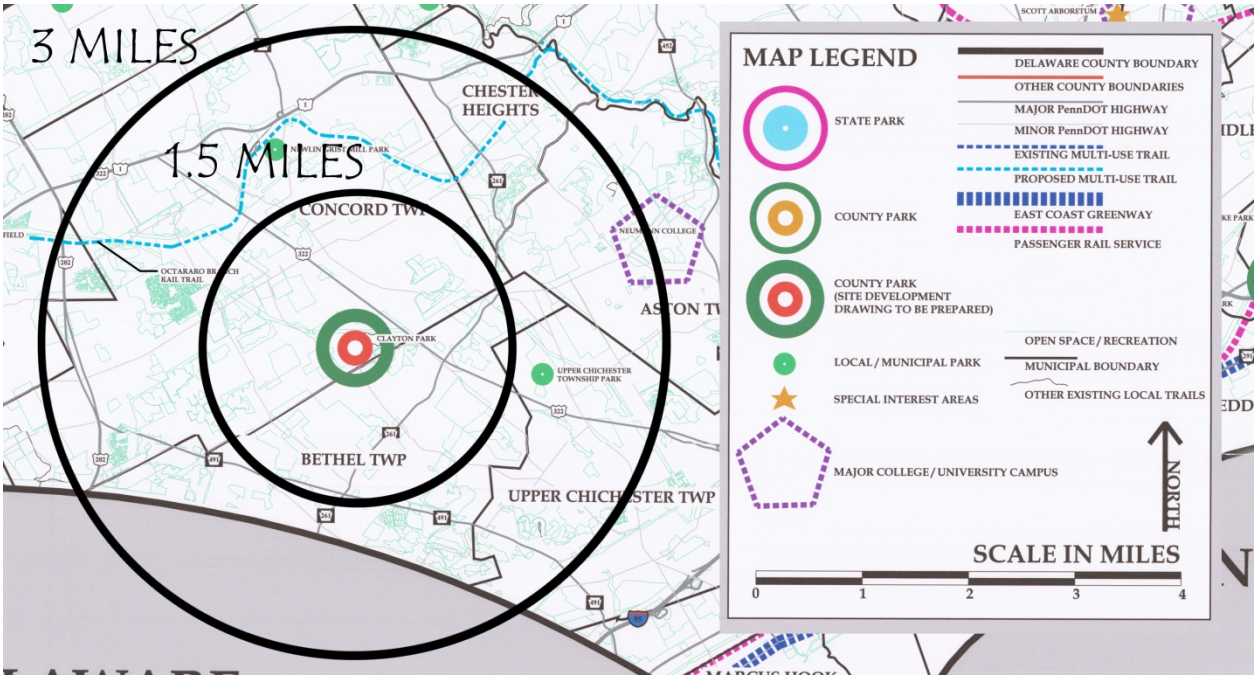


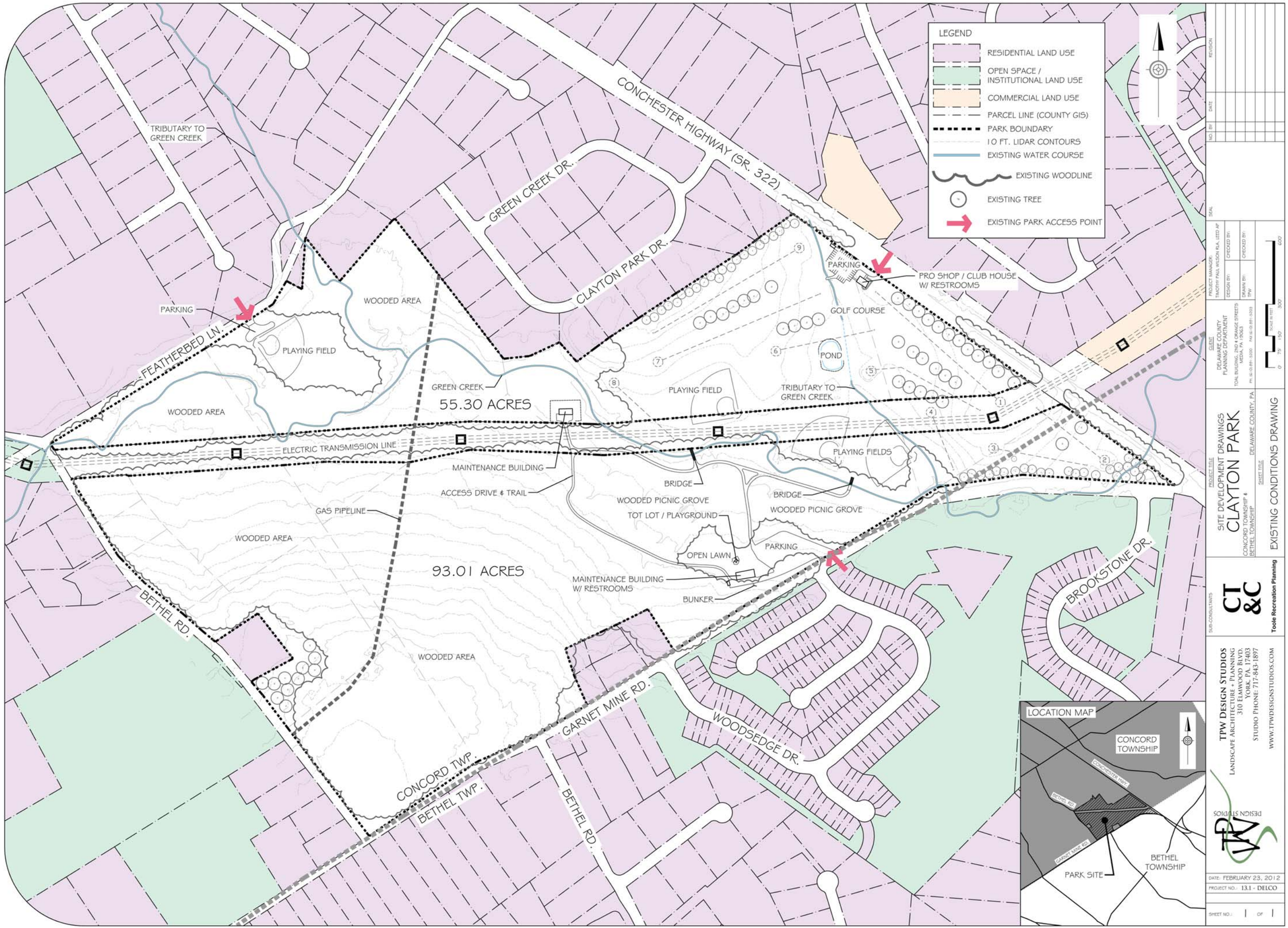
Figure 2-2: Clayton County Park Service Area

EXISTING CONDITIONS AND INVENTORY

SURROUNDING LAND USE

Clayton County Park is set mostly in Concord Township with a small part in the eastern end of the park in Bethel Township. The park is surrounded by an area of Delaware County that is almost exclusively residential along the busy Conchester Highway (Rt. 322). Near the park, to the northwest off of Bethel Road, are Garnet Valley School district facilities. See the Existing Conditions Drawing on the previous page.

Figure 2-3: Aerial of the rural nature and residential development around Clayton County Park
Source: Bing Maps



NO. BY | DATE | REVISION

SEAL

PROJECT MANAGER: TIMOTHY PAUL WILSON RLA, LEED AP
DESIGN BY: | CHECKED BY:
DRAWN BY: TPW | CHECKED BY:

CLIENT
DELAWARE COUNTY PLANNING DEPARTMENT
TOAL BUILDING, 2ND & ORANGE STREETS
MEDIA, PA 19063
PH: 610-891-5200 FAX: 610-891-5293

0' 75' 150' 300' 600'
GRAPHIC SCALE

PROJECT TITLE
SITE DEVELOPMENT DRAWINGS
CLAYTON PARK
CONCORD TOWNSHIP & BETHEL TOWNSHIP | DELAWARE COUNTY, PA.

SHEET TITLE
EXISTING CONDITIONS DRAWING

SUB-CONSULTANTS
CT &C
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TPW DESIGN STUDIOS
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STUDIO PHONE: 717-843-1897
WWW.TPWDESIGNSTUDIOS.COM

DESIGN STUDIOS

DATE: FEBRUARY 23, 2012
PROJECT NO.: 13.1 - DELCO
SHEET NO.: 1 OF 1

NATURAL RESOURCES

Vegetation

Most of the land west of the golf course is wooded. Over the years, this area has been ignored by farmers because of the boulder outcroppings associated with the Neshaminy soil types. These boulders and the mature forest that grew up around them is the most unique natural feature of the Clayton County Park. This area of the park easily possesses the oldest forest growth.

The wooded area provides the western end of the park with a dense climax forest canopy that is mostly made up of maple and beech with some tulip poplar, red oak, sassafras, ash and sycamore sprinkled in.

There is a diverse and dense understory plant community consisting of both native and invasive deciduous and evergreen species.

The remainder of Clayton County Park in the areas of the golf course and the ballfields is sparsely vegetated with pines and other evergreens. This is probably due in part to screening the active recreation use from other park users.

There is a large swath of common reed (Phragmites australis) and multiflora rose (Rosa multiflora) east of the ballfields in the eastern portion and south of the golf course. Both of these plants are listed as invasive species by the Pennsylvania Department of Conservation and Natural Resources (DCNR).

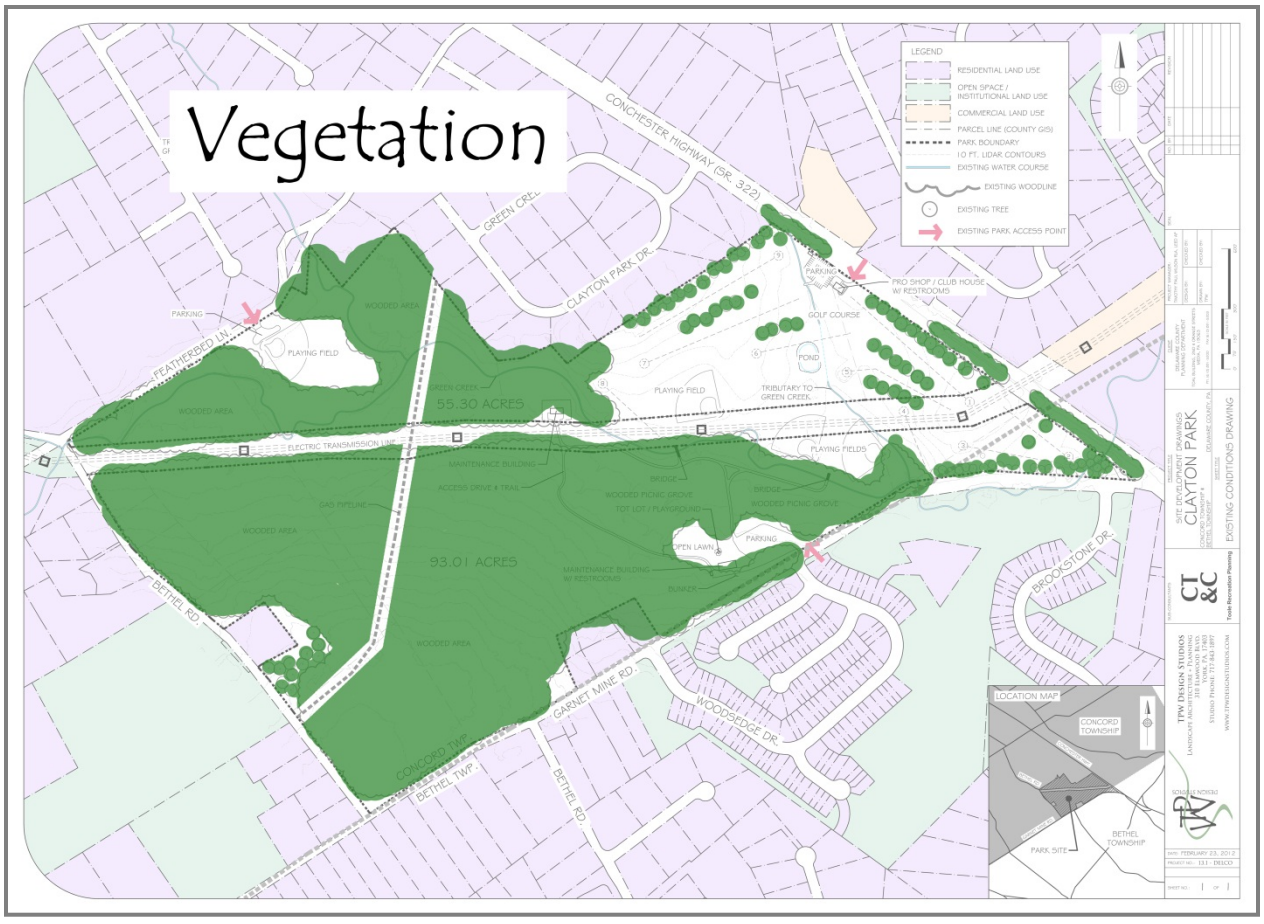


Figure 2-4: Existing Vegetation at Clayton County Park

Wildlife and Pennsylvania Natural Diversity Inventory

Wildlife

The main wildlife habitat within Clayton County Park is on the wooded western side of the park and the Green Creek corridor that runs through the center of the park from northwest to southeast. The woodlands and creek corridor provides fauna, such as deer, a location to access and find refuge in the park.

Various birds were spotted nesting and using the tree canopy of Clayton County Park as layover in flight. Some of these birds included blackbirds, robins, cardinals, red-winged black birds, and various finches. There was evidence of burrowing rodents present in the park, and two groundhogs were seen near the ball fields and Green Creek.

Preliminary Environmental Review

The Pennsylvania Natural Diversity Inventory (PNDI) records for Clayton County Park indicate that there are potential impacts to threatened and endangered species and/or special concern species and resources within the Park boundary. Further coordination with PA Department of Conservation and Natural Resources would be necessary at the time of construction and plan implementation. (See Appendix C-2 for details of the review and limits). The agencies typically needing coordination in regards to a PNDI are: PA Game Commission; PA Department of Conservation and Natural Resources; PA Fish and Boat Commission; and the U.S. Fish and Wildlife Service.

Soils and Topography

Soils

According to the United States Department of Agriculture (USDA) Soils Survey, the soils present within Clayton County Park are as follows:

CdB2 – Chester silt loam, 3 to 8 percent slopes
Ch – Chewacla silt loam (Hydric Soil)
GeB2 - Glenelg channery silt loam, 3 to 8 percent slopes, moderately eroded
GeB3 - Glenelg channery silt loam, 3 to 8 percent slopes, severely eroded
GeC – Glenelg channery silt loam, 8 to 15 percent slopes
GeC2 – Glenelg channery silt loam, 8 to 15 percent slopes, moderately eroded
GeC3 – Glenelg channery silt loam, 8 to 15 percent slopes, severely eroded
GeD2 – Glenelg channery silt loam, 15 to 25 percent slopes, moderately eroded
GeD3 – Glenelg channery silt loam, 15 to 25 percent slopes, severely eroded
GeE2 – Glenelg channery silt loam, 25 to 35 percent slopes, severely eroded
GnB – Glenville channery silt loam, 3 to 8 percent slopes (Hydric Soil)
GnB2 – Glenville channery silt loam, 3 to 8 percent slopes, moderately eroded (Hydric Soil)
GsB – Glenville very stony silt loam, 0 to8 percent slopes
Me – Made land, schist and gneiss material (Hydric Soil)
MhE – Manor loam and channery loam, 25 to 35 percent slopes
NaB2 – Neshaminy gravelly silt loam, 3 to 8 percent slopes, moderately eroded
NaC2 – Neshaminy gravelly silt loam, 8 to 15 percent slopes, moderately eroded
NaC3 – Neshaminy gravelly silt loam, 8 to 15 percent slopes, severely eroded
NaD3 – Neshaminy gravelly silt loam, 15 to 25 percent slopes, severely eroded
NsD – Neshaminy very stony silt loam, 8 to 25 percent slopes (Hydric Soil)
We – Wehadkee silt loam

Figure 2-5: Waterway and floodplain

Figure 2-6: Wetland

Hydric Soils are those soils that are sufficiently wet in the upper part to develop anaerobic conditions during the growing season. Hydric Soils are generally associated with wetland conditions, but do not necessarily mean there are wetlands present within an area of Hydric Soil. The soils identified above are detailed further in Appendix C-1.

Numerous floodplain wetlands were observed along Green Creek. There are several wetlands and small tributaries along the floodplain of Green Creek in the eastern portion of the park and that are primarily spring fed.

The wetlands located along the floodplain of Green Creek in the eastern portion of the park near the picnic area are a valuable resource. These wetlands provide an opportunity for wetland ecology education. Interpretive signs can provide education to the benefits of wetlands and challenge visitors to locate flora or fauna found within the area. Wetlands have the natural ability to store, treat, and eventually infiltrate stormwater.

One wetland was found on National Wetland Inventory (NWI) mapping of the park. This wetland is the pond located on the golf course. No wetlands were delineated or identified by the three parameter approach outlined in the 1987 United States Army Corps of Engineer Wetland Manual and corresponding regional supplement. A detailed wetland investigation was not practical for the level of detail for this survey report and NWI mapping often does not show smaller wetland pockets. Preliminary wetland investigation criteria used for the sake of this report consisted of visual identification and rapid test of hydrophytic vegetation, landforms and visible signs of hydrology. It is recommended that prior to any park improvements including land disturbance that a wetland investigation and updated Pennsylvania Natural Diversity Inventory (PNDI) inquiry be conducted to the presence of or potential habitat belonging to rare, threatened, and/or endangered species. A wetland investigation and, if necessary, wetland delineation may be required to be submitted with PADEP and NPDES permits for disturbances in wetlands and streams.

Figure 2-7: National Wetlands Inventory of Clayton County Park

Topography

Clayton County Park has varying topographic relief. The grades are relatively steep in the densely wooded areas of the park and tend to roll across the golf course. The high point of the park is in the southwest corner near the intersection of Bethel Road and Garnet Mine Road. From this knob, the grades fall off in a northerly direction to the creek bed of Green Creek. The immediate area of Green Creek and the northern side of the creek are the flattest areas of the park.

Hydrology

The major hydrological feature of Clayton County Park is Green Creek and its low lying floodplain area. The creek is a prominent feature that carries through the park from west to east. There are two unnamed tributaries to Green Creek that flow and connect to Green Creek within the park. One of the unnamed tributaries flows from a small man-made pond in the golf course. That pond is the only other hydrologic feature in the park.

There is a combination of well drained and not so well drained soils within the park typically associated with elevation and slope. Stormwater that is not infiltrated generally sheet flows to small drainage swales and tributaries to Green Creek.

Figure 2-8: Unnamed tributary channel to Green Greek through golf course

There is some stormwater management on the Clayton County Park site. They are mostly associated with the golf course. There is the pond and small channelized swales that flow during significant rain events. The lack of riparian buffer and runoff from the parking lot and roadway has reduced the headwaters of Green Creek to an entrenched storm swale. A damaged culvert is located in the stream. It appears that a cart path washed out and the culvert was left behind. Another culvert and springhouse are located immediately downstream of the previous culvert channel. This second culvert carries the flow to the pond. The pond is aerated and two species of frogs were observed within the pond and adjacent stream channels. The channel downstream of the pond appeared to be recently dredged by an excavator. The watercourse was channelized and void of any natural stream morphology. The channel contained no natural features or vegetation.

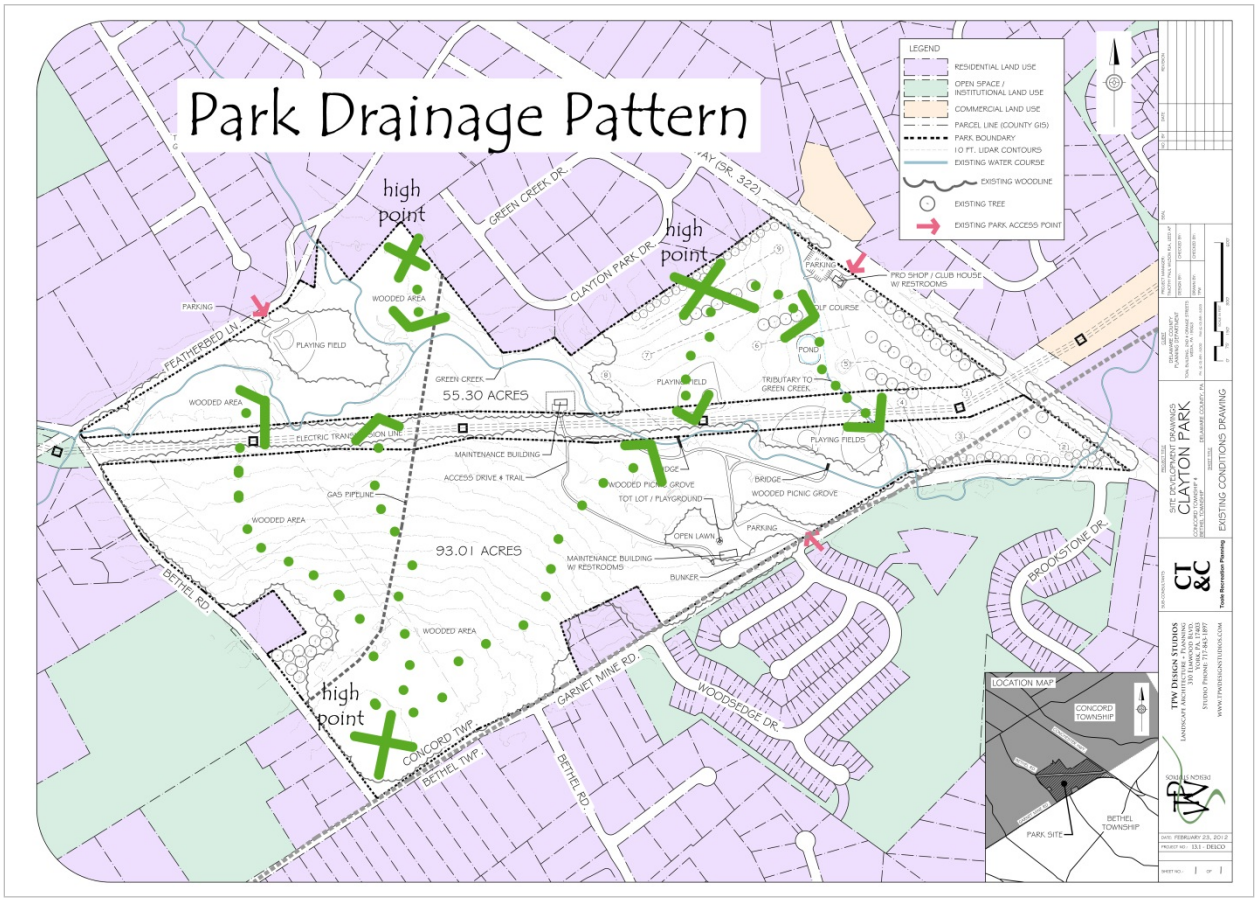


Figure 2-9: Existing drainage pattern at Clayton County Park

Green Creek / Unnamed Tributaries to Green Creek and Chapter 93 Designation

Green Creek originates about a mile southwest of Clayton County Park.

The Chapter 93 Protected Use Designation for the Green Creek in the area of Clayton County Park are:

CWF – Cold Water Fishes
MF – Migratory Fishes

This section of Green Creek is designated as a Cold Water Fishery (CWF) by the Pennsylvania Department of Environmental Protection (PADEP). Designated use of a CWF is defined as "Maintenance or propagation, or both, of fish species including the family Salmonidae and additional flora and fauna which are indigenous to a cold water habitat" according to PADEP's Chapter 93 guidelines. This section of Green Creek is not listed as impaired by PADEP.

There are no exceptions to specific criteria, and the waters of Green Creek in this area are not "HQ" High Quality or "EV" Exceptional Value waters.

Figure 2-10: Green Creek

Figure 2-11: Golf Course Pond

EXISTING FACILITIES

Figure 2-19: Tot-Lot/Playground

Figure 2-18: Multi-Use Trail

Figure 2-17: 9-Hole Golf Course and Clubhouse

Figure 2-12: Baseball/Softball Fields

Figure 2-16: Two Paved Parking Lots and One Crushed Stone Parking Lot

Figure 2-14: Picnic Grove with Pavilion

Figure 2-13: Soccer/Ballfield

Figure 2-15: Open Utility Corridors

HISTORICAL AND CULTURAL RESOURCES

There are no significant historical resources associated with Clayton County Park.

STRUCTURES

1. Pro Shop and Club House with Restrooms
Masonry and wood frame, contemporary construction. In use and well maintained.

2. Maintenance Building 1 With Toiletrooms
Masonry and wood frame, contemporary construction. In use and well maintained.

3. Maintenance Building 2
Masonry and wood frame, contemporary construction. In use and well maintained.

4. "Bunker" Building
Cinder block and concrete construction. Used for storage.

Figure 2-20: Pro Shop and Club House

Figure 2-21: Maintenance Building 1

Figure 2-22: Maintenance Building 2

Figure 2-23: "Bunker" Building

PARK ACCESS

Pedestrian

Clayton County Park is a destination park and most users drive to the park. The facts are that there is not an existing trail connection to the park and the surrounding pedestrian and sidewalk network is fractured at best. Currently, there is not an existing pedestrian connection to or from Concord Township's municipal park, Bush Hill Farm Dog Park, across Bethel Road from Clayton Park. On most of the surrounding roads, there are not even sidewalks. It is tough for pedestrians to access the park unless their property adjoins the park directly.

Trails and Greenways

Internally, Clayton County Park has a decent network of trail and earthen paths. Externally, the park is a stand-alone piece of County owned green space. Currently, there are no trails or greenways that directly tie into Clayton County Park.

Public Transit

Delaware County has an extensive public transit system, and Clayton County Park is directly on SEPTA Bus Route 119 – Chester to Cheyney University. The bus service frequency during peak park use times of the day are every hour to 90 minutes on Monday – Saturday, and every 90 minutes on Sundays.

Figure 2-24: Transit connections to Clayton County Park
(Base map source: DCPD 2013)

Vehicular

There are three vehicular entrances and subsequent parking areas to Clayton County Park: 1) the golf course club house parking lot off of the extremely busy Conchester Highway; 2) the paved parking area off of Garnet Mine Road; and 3) the crushed stone parking area off of Featherbed Lane.

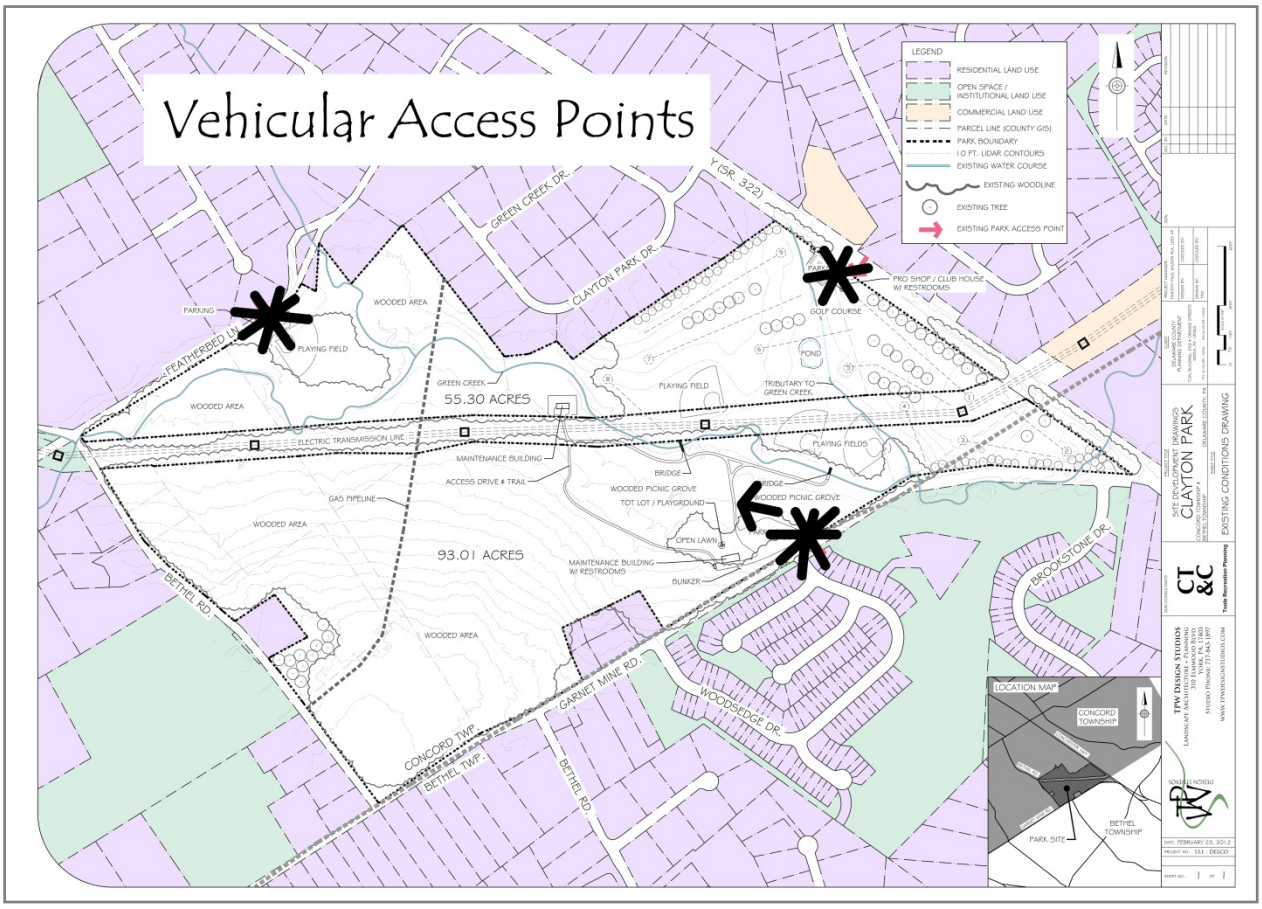


Figure 2-26: Existing Vehicular Access Points at Clayton County Park

PARK NEEDS ANALYSIS

PARK USE, PROGRAMS, AND VISITATION IN 2015

As far as what is known, there is currently no documented visitation data for Clayton County Park, so no visitation data was acquired or analyzed. The last visitation estimate was that over 60,000 people visit the park yearly. Based on information from Delaware County and what has been visually attained from numerous park visits, the following are points and analysis regarding park use, programs and visitation in 2015.

1) A majority of everyday use comes from a mixture of local residents and users that drive to the park to use the golf course. These park users typically make a specific trip to the park to recreate and enjoy the many resources Clayton County Park has to offer.

   This use will continue to increase based on development and facility improvements in Clayton County Park.

2) Mostly on week nights and weekends, loosely organized active recreation sports (softball, football, baseball, soccer) are played on the playing field areas.

   This use and constituency presents the opportunity to organize and increase this use with improving and defining the playing field areas and coordinating with local recreation organizations.

   During the day, a majority of the parks passive recreation users enjoy walking / hiking the parks trail system, picnicking and using the playground / tot-lot area.

3) Programs:
   - Active recreation Leagues (soccer, baseball, softball)
   - 9-hole golf course with greens fees and a PGA Certified Golf Pro; the County also sponsors the Senior Citizens Golf Olympic Games at Clayton County Park
   - Boy Scout troops / overnight stays

PARK NEEDS

The needs of Clayton County Park have been compiled objectively and have been identified based on many variables including numerous consultant site visits and visual observations, public participation and input, Delaware County Planning and Parks and Recreation needs, and user demographics. Public survey information relating to Clayton County Park can be found in Volume IV of the comprehensive Delaware County Open Space Recreation Plan.

The Clayton County Park's needs are as follows:

1) Better pedestrian circulation improvements
2) Improved signage
3) Build upon existing resources and structures
4) Better defined open space and playing fields
5) Build upon existing park programming
6) Promote park facilities and programs
7) Develop a more efficient and cost effective maintenance program
8) Improve parking lots and access
9) Enhance the user experience / make continuously interesting
10) Enhance "Curb appeal"
11) Enhance gathering areas (picnic groves)
12) Emphasize and promote SEPTA's Public Transit System as it relates to park use
13) Preserve and steward site woodlands and riparian areas (Green Creek)
14) Site stormwater management facilities and erosion remediation
15) Install children's play area
16) Develop relationships between Delaware County and local community oriented and business organizations in the area of Clayton County Park
17) Connect the park to other outside open space resources

PARK DEVELOPMENT OPPORTUNITIES

Based on all information gathered and input attained, the following opportunities have been identified as Clayton County Park existing features, facilities or connections that should be built upon within the Site Development Plan:

1) Pro Shop and Club House
2) 9-hole golf course and programming
3) Utility corridors (gas and transmission lines)
4) Build upon tot-lot / playground
5) Playing fields
6) Various park entrances on all bordering roads
7) Delaware County maintenance resources
8) Green Creek and park natural resources

MANAGEMENT, MAINTENANCE, AND OPERATIONS

Management

Currently, Clayton County Park is managed by the Delaware County Parks and Recreation Department, located in Rose Tree County Park, but there is a County presence at the park with the Golf Course and staffing. This method of park management is sufficient for the size and use of Clayton County Park.

No future improvement or development would necessitate offices or additional everyday presence of Delaware County Parks and Recreation staff.

Figure 2-27: Clayton County Park Playground

Maintenance & Operations

Delaware County crews have two maintenance facilities on site at Clayton County Park and currently perform weekly maintenance duties that include trash pick-up, mowing, preventative maintenance, and incident maintenance.

As Clayton County Park is improved and programming increases, use will increase, but not to levels that the current maintenance and operations will be insufficient. A detailed maintenance and operation task schedule and frequencies should be implemented in order to effectively manage park upkeep tasks and coordinate with other County Park facility schedules.

PARK SITE DEVELOPMENT PLAN AND RECOMMENDATIONS

THE SITE DEVELOPMENT PLAN "CONCEPT"

The concept of the Clayton County Park Site Development Plan is to provide a first class well-balanced passive and active recreation destination in the Delaware County Park system, while protecting its natural resources and character. The idea is centered around the 9-hole golf course and its programming.

The concept places emphasis on the golf course, the internal park pedestrian movement, and creating a park experience that is consistently interesting and pleasing to the senses.

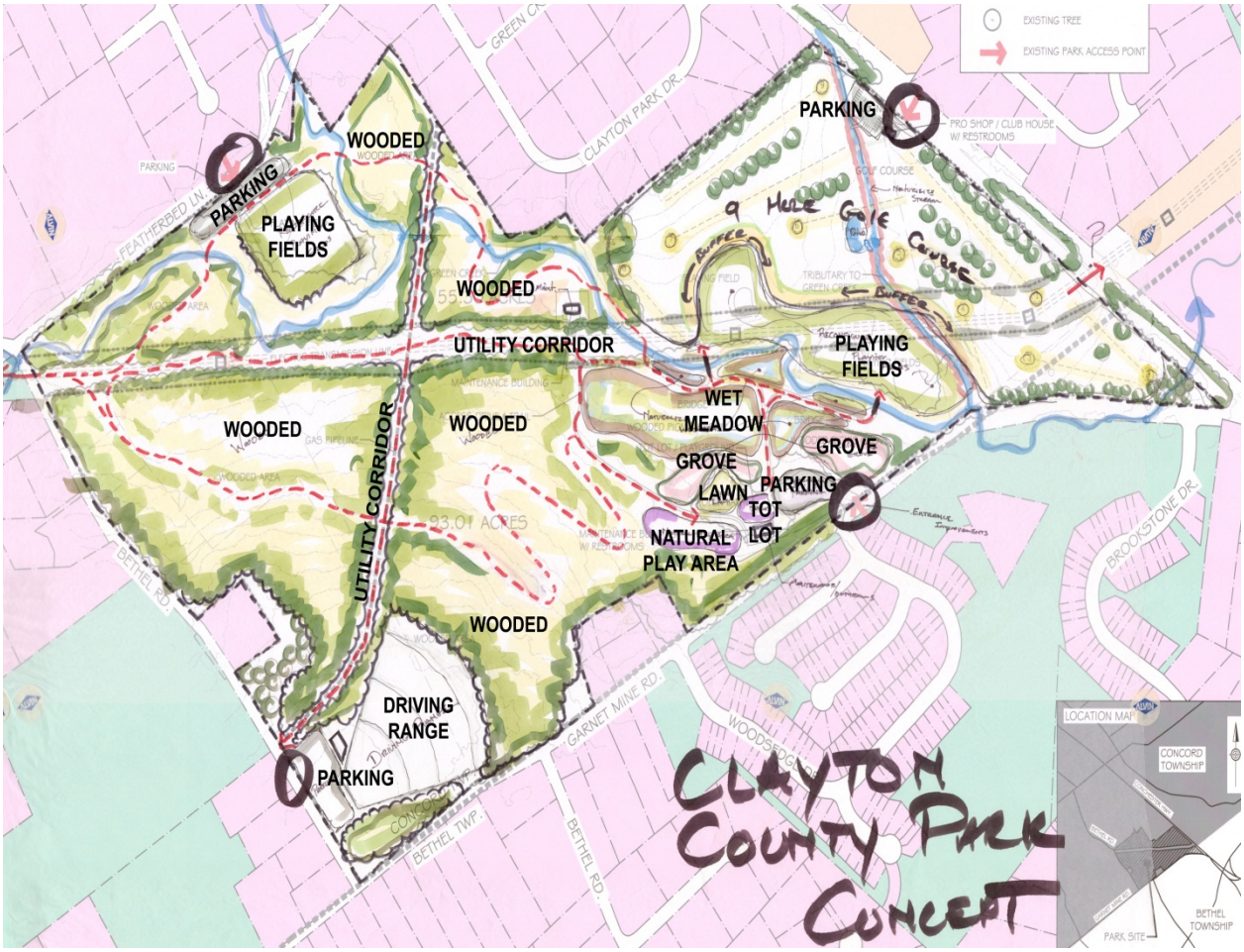


Figure 2-28: Clayton County Park Concept Sketch

RECOMMENDATIONS

All recommendations suggested in this narrative are the result of an extensive analysis of existing park and Delaware County resources, public involvement (and surveys), and potential park user demand.

Facilities & Park Site Development

The following Clayton County Park Recommendations are in no particular order based on needs or priority. Phasing and implementation priority will be discussed further along in this park narrative.

Recommended Clayton County Park improvements are as follows:

1) Improve Clayton County Park (and overall County Park) signage to a standardized system that is identifiable and recognizable as such, including interpretive signage
2) Buffer playing fields from golf course
3) Buffer pond and re-vegetate swale through golf course

4) Improve and develop the park pedestrian circulation network including multi-use paths, sidewalk improvements and crosswalk improvements
5) Develop utility corridors for trails
6) New pedestrian bridges
7) Expand golf course clubhouse
8) New “natural” play area
9) Install park / County park system kiosks (signage), benches and seating areas (including picnic groves)
10) Driving range with parking area and clubhouse
11) Define open spaces and lawn areas with native plant material and meadows, which will provide the opportunity to naturalize previously regularly maintained areas and reduce maintenance expenditures
12) Redesign of the existing ball fields / soccer fields
13) New concessions and restroom building
14) Advocate for park “friends” groups and foster partnerships with local business and recreation organizations that could be park stewards and potentially work with Delaware County on park upkeep, maintenance, and/or security
15) Establish a 50’ riparian buffer and floodplain restoration along Green Creek
16) A redesign / improvement of existing parking facilities
17) An on-site compost and recycling area
18) Improve park entrances / access

The Site Development Plan

The site development plan is an illustrative rendering of Clayton County Park that reflects the recommended improvements at full park “build out.” The plan incorporates all phases of development including “long-range” concepts.

Many factors play a role in the development and timeframe of park improvements: available funds and funding sources, County needs, park use demands, and the like. It is recognized that priorities change over time. That being said, a recommended phasing plan for the Clayton County Park development has been laid out further along in this section of the park narrative.

CLAYTON COUNTY PARK

SITE DEVELOPMENT PLAN

JANUARY 2015

FEATHERBED LANE
CONCHESTER HIGHWAY
BETHEL ROAD
GARNET MINE ROAD
BUSH HILL FARM PARK (DOG PARK)
CONCORD TOWNSHIP
BETHEL TOWNSHIP
9 HOLE GOLF COURSE
TRIBUTARY TO GREEN CREEK
GREEN CREEK
MAINTENANCE BUILDING
SITE COMPOST & RECYCLING AREA
POND
BUFFER
PLAYING FIELD
BRIDGE
10' MULTI-USE PATH
8' EARTHEN PATH
ELECTRIC TRANSMISSION LINE CORRIDOR
GAS PIPELINE CORRIDOR
WOODED
LAWN
RIPARIAN
PICNIC GROVE
TOT LOT
"NATURAL" PLAY AREA
DRIVING RANGE
MAINTENANCE BUILDING & RESTROOMS
POTENTIAL CONNECTION TO BUSH HILL FARM PARK (DOG PARK)

1. RENOVATED GOLF COURSE CLUB HOUSE WITH TEACHING ROOMS AND RESTROOMS
2. RE-ESTABLISH CREEK RIPARIAN BUFFER THROUGH GOLF COURSE. STABILIZE AND VEGETATE BANKS (INCLUDING POND)
3. DRIVING RANGE COMPLEX WITH PARKING, CLUBHOUSE (INCLUDING RESTROOMS, CONCESSIONS, & ARCADE) AND TRAIL CONNECTION TO PARK
4. POTENTIAL CONNECTION TO UTILITY CORRIDOR ON EAST SIDE OF CONCHESTER HWY. (USING PEDESTRIAN OVERPASS)
5. SOCCER FIELD WITH PARKING, BUILDING (INCLUDING RESTROOMS & CONCESSIONS) AND TRAIL CONNECTION TO PARK
6. RE-FORESTATION (BUFFER) AROUND BALL FIELDS IS TO MITIGATE THE FOREST LOST IN THE DEVELOPMENT OF THE DRIVING RANGE
7. IMPROVE PARKING AREA AND PARK ACCESS WITH SIDEWALKS, PEDESTRIAN CROSSINGS, AND A BRIDGE OVER GREEN CREEK

VEGETATION

- LAWN
- RIPARIAN CONSERVATION
- NATIVE MEADOW
- FOREST / WOODED AREA

FEATURES & AMENITIES

- POTENTIAL TRAIL / PED. CONNECTION
- BENCHES
- INTERPRETIVE SIGNAGE
- PARK KIOSK
- SMALL PARK KIOSK
- PARKING
- NEW PEDESTRIAN CROSSING

ADDITIONAL PLAN INFORMATION

PARK ACREAGE - 148.30 ACRES
IN CONCORD TOWNSHIP AND BETHEL TOWNSHIP

- PARK BOUNDARY
- EXISTING 10 FOOT CONTOUR
- 100 YEAR FLOODPLAIN
- MUNICIPAL BOUNDARY

NOTE: ITALIC LABELS REPRESENT EXISTING SITE INFORMATION

SCALE IN FEET
0' 70' 140' 280' 420'

TPW DESIGN STUDIOS
LANDSCAPE ARCHITECTURE & PLANNING
310 ELMWOOD BOULEVARD YORK, PA.
STUDIO PHONE: 717.843.1897

TOOLE RECREATION PLANNING

Trail & Greenway Connections

There are very few trail and greenway connections with Clayton County Park. The area surrounding the park has no sidewalk system and very dangerous roads for pedestrians to cross.

It is recommended that, within future improvements to Conchester Highway and surrounding roadways, that pedestrian links, sidewalks and facilities for bicycle use be considered. This will begin to connect Clayton County Park to the regional network.

It is also recommended that the transmission line utility corridor that bisects Clayton County Park be studied for trail use. This corridor extends across most of southwest Delaware County and could be of great importance to the regional greenway network.

To co-locate a trail with the transmission line utility within its corridor, the trail will have to be planned around the park's golf course, not through it.

Figure 2-29: Utility corridor in relation to Clayton County Park
Aerial image source: Bing Maps

Park Programming

With the long range Clayton County Park site development plan and the idea of the park building on the identity of an active and passive recreation destination in Delaware County, there are many opportunities to increase park programming and potentially capitalize on revenues associated with certain programs.

Park programming can take on so many different meanings, and programming can change from season to season and year to year. Some general park programming elements as they relate to the Clayton County Park Site Development Plan are as follows:

1) Golf – driving range, lessons, First Tee programs
2) Organized active recreation leagues and field rentals
3) Environmental lessons and Boy Scout camp outs
4) Concessions
6) Pavilion use and rental

Management

It is recommended that Clayton County Park, at full build out, have on-site staffing to manage the park's everyday operations. At a minimum, the park should have a program manager, maintenance manager and staff. Clayton County Park will eventually not be able to be operated remotely (as it currently operates in 2014). The level of proposed facilities and operation of those facilities would constitute a team to efficiently run the park. Delaware County Parks and Recreation staff would also create a presence in the park which inherently provides a certain level of security and awareness.

Maintenance and Operations

The mission of an operation and maintenance program for Clayton County Park is to create a regularly scheduled routine, reactive and preventative maintenance system that guides the stewardship of the park in a way that provides a safe, sustainable, and aesthetically pleasing County and community asset that is operational for public use.

Clayton County Park is, and will continue to be, a major part of the Delaware County Park system. This fact points to the park garnering high use and visitation rates. With improved park access, amenities and increased awareness, the usage rates of the park shall steadily increase over time. Keeping the park well maintained will prove to be an important task in the sustainable success of the park.

Maintenance and Operations Tasks

Clayton County Park maintenance tasks and schedule typically involves mowing, keeping the grounds free of trash and debris, removal of downed limbs or dead trees, snow removal, inspection and repair of permanent structures, fencing, park amenities and parking areas on a per year basis.

Grass & Turf Care

Cut once every 10 working days. A grass clipping deposit area should be designated on site for composting located away from park waterbodies. Aeration of grass area is not necessary unless grass quality indicates a need or an application of fertilizer is anticipated. Reseed and sod only when major bare spots are present. Weeding shall ensue when grass is 50% weed infested or grass quality is low in 15% or more of the surface.

Fertilizer

Apply only when grass vigor seems low. Low level applications can be administered on a once per year basis.

Irrigation

No irrigation should be anticipated.

Planting Beds

Landscape bed areas should be kept in a weed, leaf, and debris-free condition. Plants should be trimmed to maintain desired shape and to maintain natural growth habit of plant species.

Litter Control

Litter service is needed two times a week or as necessary. In times of warmer weather and increased use, litter control may be more frequent.

Disease and Insect Control
Done only on epidemic or serious complaint basis. Pest, weed, and rodent control measures may be put into effect when the health or survival of the plant material is threatened or where public's comfort is concerned.

Snow Removal
Snow removal shall only be necessary after all snowfall events. Snow removal shall be accomplished by the day following the snowfall.

Lighting
Replacement or repair of fixtures when a report is filed or when a malfunction is detected by inspection staff.

Amenity and Permanent Structure Repairs
Should be accomplished immediately when safety or function is at question.

General Inspection
Once per week.

The following routine preventative maintenance program and schedule has been fashioned to reflect the projected amount of park use at full park build out.

Table 2-1: General Maintenance and Operation Frequencies

Operation	Frequency					
	Daily	Weekly	Monthly	Quarterly	Annually	As Needed
Parking Areas						
Inspection		x				
Repair						x
Remove Litter						x
Remove Snow						x
Permanent Structures						
New & Rehabilitated Bridges						
Inspection				x		
Repair						x
Stormwater Management Facilities						
Inspection / Clear Obstructions				x		
Repair						x
Landscape Maintenance						
Mowing			2x			
Trimming						x
Leaf Removal					x	
Tree Pruning					x	x
Tree Replacement						x
Seasonal Plantings				x		

Table 2-1: General Maintenance and Operation Frequencies (cont.)

Operation	Frequency					
	Daily	Weekly	Monthly	Quarterly	Annually	As Needed
Weeding				x		
Mulching					x	
Fertilizing / Treatment					x	x
Watering / Irrigation						x
Cleaning						
Empty Trash Cans		2x				
Restroom Facilities		x				x
Remove Litter		2x				x
Amenity Maintenance						
Lighting						
Inspection			x			
Repair / Replace						x
Signage						
Inspection			x			
Cleaning					x	
Repair / Replace						x
Railings / Fencing						
Inspection			x			
Repair / Replace						x
Furnishings						
Inspection			x			
Repair / Replace						x
Bollards / Gates						
Inspection			x			
Repair / Replace						x
Other Services						
Update Park Kiosk Information						x
Security Patrol	x					
Graffiti Removal						x
Riparian Repair & Rehabilitation						x

Tree Care

Tree care is important to sustaining and guiding responsible tree growth within Clayton County Park. Trees and other woody plant material respond biologically to pruning in specific and predictable ways. Careful study of these responses has led to pruning practices that can best develop, preserve, and enhance the structural integrity, beauty and functional value of trees. Through pruning, one can: maintain or direct plant form; enhance health and appearance; influence flowering, fruiting, and vigor; regulate growth; control plant size; and invigorate declining plants. Tree pruning should occur annually but may be needed in emergency situations. The following are high and medium to low priorities for emergency pruning:

High Priority

1) Trees or limbs that have fallen and caused accidents or personal injury.
2) Trees or limbs that have fallen and caused damage to the trail, vehicles or structures.
3) Trees or limbs which are in immediate danger of falling or breaking.
4) Broken hanging limbs adjacent to the trail, structures, roads, or picnic or play areas.
5) Trees or limbs that block roads or access points.

Medium to Low Priority:

1) Trees or limbs that have fallen and are not an immediate hazard.
2) Trees or limbs that have fallen and are not blocking the trail, roads or access points.
3) Hanging tree limbs that may not be in immediate danger of falling.
4) Dead or severely declining trees without a target present.

Timing or tree pruning can vary. Trees deemed as hazardous should be pruned immediately and during any season. Generally, light pruning can be done at any to during the year on most species if the trees are in good health. Most deciduous plants can be pruned during the dormant period between leaf fall and the end of wither. This can minimize the risk of pest problems. Avoid pruning broadleaf trees in early to late spring. Evergreens will be set back the least if they are pruned in the late winter. It is recommended to evaluate each tree before pruning and avoid large scale pruning efforts during the bird nesting season. There are many types of tree pruning practices to achieve certain desired results. Pruning can be performed for structure, general cleaning, thinning, raising, reducing, and/or restorations.

Pruning for Structure

Structural pruning is the removal of live branches and stems to influence structural integrity. It usually follows four procedures: 1) Canopy cleaning by removing dead, broken, diseased and dying branches, 2) development or re-establishment of a dominant leader, 3) establishment of the lowest permanent scaffold limb and 4) establishment of scaffold limbs by removing competing stems or branches.

Pruning to Clean

Cleaning is the selective removal of dead, diseased, detached, rubbing and broken branches. This type of pruning is done to reduce the risk of branch failure and the transmission of decay, insects and diseases.

Pruning to Thin

Thinning is the selective removal of small live branches to reduce crown density. Branches are 0.25 to 1.00 inches in diameter. 10-15 percent of live foliage can be removed at one time. If more pruning is desired, it should not exceed 25 percent in a single year. Excessive removal of small branches on the lower two-thirds of a branch or stem is called lion tailing and may have an adverse effect on the tree – it is not an accepted practice.

Pruning to Raise

Raising is the selective removal of branches to provide vertical clearance. Caution must be taken to not remove too many lower branches. This can cause slow development of trunk taper, cause cracks or decay in the trunk, or transfer too much weight to the top of the tree.

Pruning to Reduce (Drop Crotch)

Reduction is the selective removal of branches and stems to decrease the height and/or spread of a tree. This type of pruning is done to minimize the risk of failure, to reduce height or spread, for utility

clearance, to clear vegetation from buildings or other structures, or to improve tree appearance. Crown reduction shall be accomplished with reduction cuts rather than heading cuts.

Pruning to Restore

Restoration is the selective removal of branches, sprouts, and stubs from trees that have been topped, severely headed, vandalized, lion –tailed, broken during a storm, or otherwise damaged. Full restoration usually requires several pruning events over a number of years.

Pruning Conifers

Conifers are primarily pruned to control the density of branching, the shape of young trees, and the size of older ones. They are intolerant of topping or heading. Conifers typically have an ex-current growth habit, which is usually maintained throughout the lifespan of the tree. Thinning, by the selective removal of small branches, is the most appropriate method when pruning conifers.

Tree Removal and Replacement

Trees should be removed in Clayton County Park for the following reasons: the tree is dead or dying; it is diseased; it is damaged or injured to the extent that is likely to die and become a hazard; or constitute a hazard. Nuisance trees should be removed when the tree causes or is about to cause impairment to the park.

It is most desirable to replace a tree of the same (native) species in the same place it was removed, but sometimes crowding and other physical constraints make it impossible to replace the tree in the same spot. In this case, finding an alternate location is the best option. Undesirable species (non-native) are not to be replaced. It is a responsible and environmentally friendly idea to plant desirable, sustainable trees within the park.

Recommended Native Plant Material

It is a sustainable practice to design with and use native plant material within Clayton County Park whenever possible. Native plant material is hardy and requires less watering and general care because it is naturally acclimated to the seasons and weather cycles of the region. The following is a list of plant material native to Pennsylvania:

Table 2-2: Native Plant Material for Clayton County Park

Medium to Large Trees

Common Name	Scientific Name	Bloom Period	Height	Notes
Red Maple	*Acer rubrum*	Mar-Apr	40-60 ft.	Red flowers; adaptable; fall color
Sugar Maple	*acer saccharum*	Apr-May	60-75 ft.	Yellow flowers in spring; fall color; maple syrup
Yellow Birch	*Betula alleghaniensis*	Apr-May	60-80 ft.	Catkins in winter
Black Birch	*Betula lenta*	Apr-May	45-55 ft.	Catkins in winter
River Birch	*Betula nigra*	Apr-May	60-80 ft.	Catkins; striking bark
Eastern White Pine	*Pinus strobus*	N/A	50-80 ft.	N/A
White Oak	*Quercus alba*	Mar-Jun	50-100 ft.	Edible nuts
Chestnut Oak	*Quercus montana*	May-Jun	40-75 ft.	Fall color; nuts attractive to wildlife

Small Trees and Shrubs

Common Name	Scientific Name	Bloom Period	Height	Notes
Smooth Alder	*Alnus serrulata*	Mar-Apr	6-10 ft.	Yellow catkins; multi-stemmed; needs wet soil
Serviceberry	*Amelanchier arborea*	Mar-May	15-25 ft.	White flowers in spring; edible berries; fall color
Alternate-leaved Dogwood	*Cornus alternifolia*	May-Jun	15-25 ft.	White flowers in early summer; blue berries
Flowering Dogwood	*Cornus florida*	Apr-Jun	10-30 ft.	White branchts in spring; red berries
Winterberry	*Ilex verticillata*	May-Jun	6-10 ft.	Showy berries in winter; multi-stemmed
Mountain Laurel	*Kalmia latifolia*	May-Jul	7-15 ft.	White flowers; evergreen; multi-stemmed; PA state flower
Spicebush	*Lindera benzoin*	Mar-May	6-12 ft.	Berries and foliage in fall; multi-stemmed; ferbal uses
Wild Plum	*Prunus americana*	Apr-May	15-25 ft.	White flowers; edible fruit; nulti-stemmed
Elderberry	*Sambucus canadensis*	Jun-Jul	5-15 ft.	White flowers; multi-stemmed; edible berries & flowers
Highbush Blueberry	*Vaccinium corymbosum*	May-Jun	6-12 ft.	White flowers; multi-stemmed; edible berries; fall colors
Arrow-wood	*Viburmun recognitum*	May-Jun	3-15 ft.	White flowers in late spring; multi-stemmed
Virginia Creeper	*Parthenocissus quinquefolia*	July	10-40 ft.	Fall color; berries improtant for wildlife; considered a vine

Grasses (Perennial)

Common Name	Scientific Name	Bloom Period	Height	Notes
Lurid Sedge	*Carex lurida*	Jun-Oct	1-2 ft.	Wetland plant; interseting seeds
Bottlebrush Grass	*Elymus hystix*	Jun-Aug	2-4 ft.	Grass that grows in shade
Virginia Wild-rye	*Elymus virginicus*	Jul-Sep	2-4 ft.	Grass that tolerates a wide range of conditions

Ferns (Perennial)

Common Name	Scientific Name	Bloom Period	Height	Notes
Maidenhair Fern	*Adiantum pedatum*	N/A	1-2 ft.	Grows in clumps; delicate texture; herbal uses
Evergreen Shield Fern	*Dryopteris marginalis*	N/A	1-3 ft.	Evergreen; clump-forming; attractive
Interrupted Fern	*Osmunda claytoniana*	N/A	2-4 ft.	Grows in clumps; distinctive fronds
Christmas Fern	*Polystichum achrostichoides*	N/A	1-2 ft.	Evergreen; grows in clumps

Showy Flowers (Perennial)

Common Name	Scientific Name	Bloom Period	Height	Bloom Color & Notes
Wild Columbine	*Aquilegia canadensis*	Apr-Jun	1-3 ft.	Red & Yellow - Commonly cultivated; spreads by seeds; hummingbirds
Jack-in-the-pulpit	*Arisaema triphyllum*	Apr-Jun	1-3 ft.	Green-purple - Unusual flower; bright red berries
Wild Ginger	*Asarum canadense*	Apr-May	< 1 ft.	Maroon - Edible and herbal uses
Butterfly-weed	*Asclepias tuberosa*	May-Sep	1-3 ft.	Orange - Butterfly plant; tolerates dry conditions; taproot
Turtlehead	*Chelone glabra*	Jul-Sep	1-3 ft.	Whitish - Tolerates wet areas; strong grower; herbal uses; hummingbirds
White snakeroot	*Eupatorium rugosum*	Jul-Oct	2-3 ft.	White - Tough plant; can grow in dry shade; cultivars availible
Wood Geranium	*Geranium maculatum*	Apr-Jul	1-2 ft.	Rose - Adaptable plant; long bloom time spreader; herbal uses
Common Sneezeweed	*Helenium autumnale*	Aug-Oct	2-6 ft.	Yellow - Tolerates wet areas; showy flowers; herbal uses
Sunflowers	*Helianthus sp.*	Jul-Sep	4-6 ft.	Yellow - Perennials; often aggressive; showy flowers; good for birds
Oxeye Sunflower	*Heliopsis helianthoides*	Jul-Sep	1-5 ft.	Yellow - long bloom time; butterfly plant
Alum-root	*Heuchera americana*	May-Aug	1-2 ft.	Greenish - Long bloom time; many culitvars and hybrids
Cardinal Flower	*Lobelia cardinalis*	Jul-Sep	2-5 ft.	Scarlet - Long bloom time; butterfly and hummingbird plant
Great Blue Lobelia	*Lobelia siphilitica*	Jul-Oct	1-3 ft.	Blue - Long bloom time; white cultivars; hummingbirds
Partridge-berry	*Mitchella repens*	Jun-Jul	< 1 ft.	White - Evergreen; ground cover; berry edible and showy
Bee-balm	*Monarda didyma*	Jul-Aug	2-5 ft.	Red - Showy flowers; aromatic; butterfly plant; herbal uses
Phlox	*Phlox divaricata*	May-jun	1-2 ft.	Lilac - Aromatic; butterfly plant
Phlox	*Phlox maculata*	Jul-Sep	1-3 ft.	Purple - Aromatic; showy flowers; butterfly plant
Phlox	*Phlox paniculata*	Jul-Oct	2-5 ft.	Pink - Aromatic; showy flowers; butterly plant
May-apple	*Podophyllum petatum*	May	1-2 ft.	White - Ground cover, edible fruit; mottled foliage
Jacob's Ladder	*Polemonium reptans*	Apr-Jun	1-2 ft.	Blue - Attractive flowers; slow spreader; herbal uses
Solomon's Seal	*Polygonatum pubescens*	Apr-Jun	1-3 ft.	Yellow - Not fussy; blue berries; herbal and edible uses
Black-eyes Susan	*Rudbeckia hirta*	May-Sep	2-3 ft.	Orange - Bright daisy-like flowers; long bloom time; many cultivars
Bloodroot	*Sanguinaria canadensis*	Mar-May	< 1 ft.	White - Red juice; herbal uses
Golden Ragwort	*Senecio aureus*	May-Jul	1-2 ft.	Yellow - Wetland plant; long bloom time; early daisy-like flowers
False Solomon's Seal	*Smilacina racemosa*	May-Jul	1-2 ft.	White - Plume like flower; re berries; herbal uses
Wrinkle-leaf Goldenrod	*Solidago rugosa*	Jul-Nov	2-6 ft.	Yellow - Aggressive; tough plant; butterfly plant
Tall Meadow-rue	*Thalictrum pubescens*	May-Jun	2-8 ft.	White - Wet to moist soil; tall plant; delicate flowers
Foamflower	*Tiarella cordifolia*	Apr-Jun	< 1 ft.	White - Attractive, long-blooming flower; many cultivars
Trillium	*Trillium grandiflorum*	Apr-Jun	1-2 ft.	White - Showy flowers
American Dog Violet	*Viola conspersa*	Apr-May	< 1 ft.	Violet - Delicate plant and flower; edible
Common Blue Violet	*Viola sororia*	Apr-May	< 1 ft.	Violet - Delicate plant and flower; edible
Golden-alexanders	*Zizia aurea*	Apr-Jun	1-2 ft.	Gold - Not fussy; attracts good insects

RECOMMENDED PHASING & COST PROJECTIONS (ESTIMATES)

The following are recommended phasing and estimated cost projections for each phase of development for Clayton County Park. The Phases have been broken down into three different phases: Phase I – Short Term (0-5 years); Phase II – Medium Term (5-15 Years); and Phase III – Long Term (15-30 Years).

The following phasing recommendations and estimated costs are based on 2014 dollars, the current park condition, outlook of capital expenditure and funding, and proposed development. Recommendations are fluid and always susceptible to change for any number of reasons: cost increases in materials, priorities change, use and demographic changes, and unexpected funding sources (or lack thereof). Phasing recommendations are always a best guess of how the park will most likely develop over the next 30 or 40 years and the phases will most likely overlap somewhat. All estimated costs assume furnish and install prices.

Phase I – Short Term (0-5 Years)

1) Improve Clayton County Park (and overall County Park) signage
2) Buffer Pond and re-vegetate swale through golf course
3) Begin improvement and development of the park pedestrian circulation network
4) Begin installation of park amenities, benches and seating areas (including picnic groves)
5) Define open spaces and lawn areas with native plant material and naturalized meadows
6) Implement on-site compost and recycling area
7) New “natural” play area
8) Establish a 50’ riparian buffer and floodplain restoration along Green Creek
9) Advocate for park “friends” groups and foster partnerships with local business and recreation organizations

Table 2-3: Clayton County Park - Phase I: Short Term (0-5 Years) Cost Estimate

Description	Cost Basis	Quantity	Unit Price	Total Cost
1) Clayton County Park Signage				
Kiosks	LS	1	$17,000.00	**$17,000.00**
Roadway	LS	1	$5,200.00	**$5,200.00**
Interpretive	LS	1	$4,600.00	**$4,600.00**
Directional, Informational & General Park	LS	1	$8,500.00	**$8,500.00**
2) Pond and Swale Buffer Planting				
Implement	LS	1	$11,000.00	**$11,000.00**
3) Begin Park Pedestrian Circulation Network				
Paved Multi-use Path	SY	1600	$52.00	**$83,200.00**
Concrete Sidewalk	SY	200	$63.00	**$12,600.00**
Road Crossings	Each	1	$1,200.00	**$1,200.00**
Earthen Path	SY	275	$19.00	**$5,225.00**
4) Begin Implementing Park Amenities				
Benches	Each	16	$725.00	**$11,600.00**
Trash Cans	Each	8	$560.00	**$4,480.00**
Picnic Grove & Tables	Each	2	$6,800.00	**$13,600.00**
5) Begin Developing Open Space, Meadows, Lawn Areas				
landscaping, planting and seeding	LS	1	$13,500.00	**$13,500.00**
6) On-site Compost and Recycling Area				
Building On-site Compost and Recycling Area	LS	1	$3,800.00	**$3,800.00**
7) New Natural Play Area				
Install	LS	1	$7,800.00	**$7,800.00**
8) Riparian Buffer & Floodplain Restoration				
Green Creek Restoration	LS	1	$55,000.00	**$55,000.00**
9) Develop Local Partnerships				
Delaware County Staff Time	LS	1	$14,000.00	**$14,000.00**
Phase I Total				**$272,305.00**

Note: Costs associated with Design and Maintenance have not been built into the costs per phase. Design work needed for any park improvement items would carry a cost of approximately 15% of the estimated construction/installation cost of the improvement.

Phase II – Medium Term (5-15 Years)

1) Continue improvement and development of the park pedestrian circulation network
2) Continue installation of park amenities, benches and seating areas
3) Buffer playing fields from golf course
4) Develop utility corridors for trails
5) A redesign / improvement of existing parking facilities
6) Redesign of the existing ball fields / soccer fields
7) Improve park entrances / access
8) Continue developing open spaces and lawn areas with native plant material and naturalized meadows

Table 2-4: Clayton County Park - Phase II: Medium Term (5-15 Years) Cost Estimate

Description	Cost Basis	Quantity	Unit Price	Total Cost
1) Continue Park Pedestrian Circulation Network				
Paved Multi-use Path	Y	800	$52.00	**$41,600.00**
Concrete Sidewalk	SY	150	$63.00	**$9,450.00**
Road Crossings	Each	1	$1,200.00	**$1,200.00**
Earthen Path	SY	1600	$19.00	**$30,400.00**
2) Continue Implementing Park Amenities				
Benches	Each	6	$725.00	**$4,350.00**
Trash Cans	Each	3	$560.00	**$1,680.00**
3) Buffer Playing Fields From Golf Course				
Install	LS	1	$24,000.00	**$24,000.00**
4) Develop Utility Corridor for Trail Use				
Install	SY	2500	$52.00	**$130,000.00**
5) Improve Three Existing Parking Areas				
Improve Existing Parking Areas	LS	1	$275,000.00	**$275,000.00**
6) Redesign of Existing Ball Fields & Soccer Fields				
Playing Field Improvements	LS	1	$170.00	**$170.00**
7) Improve Park Entrances / Access				
Garnet Mine Road Entrance	LS	1	$78,000.00	**$78,000.00**
Conchester Highway Entrance	LS	1	$135,000.00	**$135,000.00**
Featherbed Lane Entrance	LS	1	$52,000.00	**$52,000.00**
9) Continue Developing Open Space, Meadows, Lawn Areas				
Landscaping, Planting and Seeding	LS	1	$9,000.00	**$9,000.00**
Phase II Total				**$791,850.00**

Phase III – Long Term (15-30 Years)

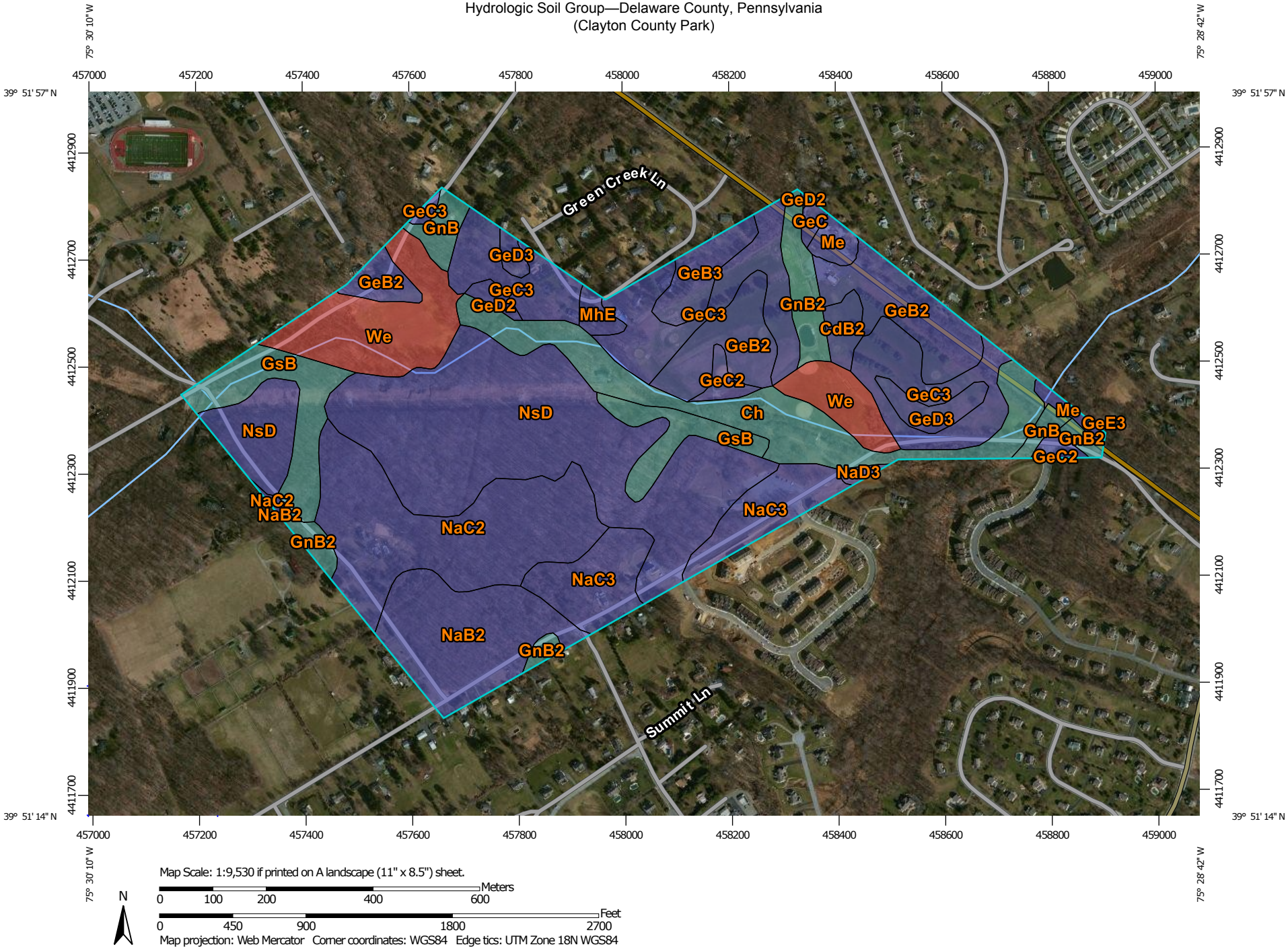
1) Continue improvement and development of the park pedestrian circulation network
2) Continue installation of park amenities, benches and seating areas (including picnic groves)
3) Driving range with parking area and clubhouse
4) New pedestrian Bridges
5) New concessions and restroom building
6) Expand golf course clubhouse
7) Continue developing open spaces and lawn areas with native plant material and naturalized meadows

Table 2-5: Clayton County Park - Phase III: Long Term (15-30 Years) Cost Estimate

Description	Cost Basis	Quantity	Unit Price	Total Cost
1) Continue Park Pedestrian Circulation Network				
Paved Multi-use Path	SY	450	$52.00	**$23,400.00**
Concrete Sidewalk	SY	400	$63.00	**$25,200.00**
Earthen Path Trail	SY	1800	$19.00	**$34,200.00**
2) Continue Implementing Park Amenities				
Benches	Each	4	$725.00	**$2,900.00**
Trash Cans	Each	2	$560.00	**$1,120.00**
3) Driving Range Complex				
Driving Range	LS	1	$580,000.00	**$580,000.00**
Club House	LS	1	$275,000.00	**$275,000.00**
Parking Area	LS	1	$185,000.00	**$185,000.00**
4) New Pedestrian Bridges or Culverts				
Install	LS	4	$35,000.00	**$140,000.00**
5) New Concessions and Restroom Building				
Construct	LS	1	$110,000.00	**$110,000.00**
6) Expand Existing Golf Course Club House				
Building Expansion	LS	1	$85,000.00	**$85,000.00**
7) Continue Developing Open Space, Meadows, Lawn Areas				
Landscaping, Planting and Seeding	LS	1	$14,500.00	**$14,500.00**
Phase III Total				**$1,476,320.00**

APPENDIX C-1: CLAYTON COUNTY PARK SOILS

Hydrologic Soil Group—Delaware County, Pennsylvania
(Clayton County Park)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Delaware County, Pennsylvania
Survey Area Data: Version 7, Dec 14, 2013

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 17, 2010—May 10, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Delaware County, Pennsylvania (PA045)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
CdB2	Chester silt loam, 3 to 8 percent slopes, moderately eroded	B	1.9	0.9%
Ch	Chewacla silt loam	C	16.7	7.8%
GeB2	Glenelg channery silt loam, 3 to 8 percent slopes, moderately eroded	B	17.2	8.0%
GeB3	Glenelg channery silt loam, 3 to 8 percent slopes, severely eroded	B	4.0	1.8%
GeC	Glenelg channery silt loam, 8 to 15 percent slopes	B	0.6	0.3%
GeC2	Glenelg channery silt loam, 8 to 15 percent slopes, moderately eroded	B	2.0	0.9%
GeC3	Glenelg channery silt loam, 8 to 15 percent slopes, severely eroded	B	25.6	11.9%
GeD2	Glenelg channery silt loam, 15 to 25 percent slopes, moderately eroded	B	0.9	0.4%
GeD3	Glenelg channery silt loam, 15 to 25 percent slopes, severely eroded	B	3.2	1.5%
GeE3	Glenelg channery silt loam, 25 to 35 percent slopes, severely eroded	B	0.0	0.0%
GnB	Glenville silt loam, 3 to 8 percent slopes	C	3.0	1.4%
GnB2	Glenville silt loam, 3 to 8 percent slopes, moderately eroded	C	6.5	3.0%
GsB	Glenville very stony silt loam, 0 to 8 percent slopes	C	12.5	5.8%
Me	Made land, schist and gneiss materials	B	2.3	1.1%

Hydrologic Soil Group— Summary by Map Unit — Delaware County, Pennsylvania (PA045)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
MhE	Manor loam and channery loam, 25 to 35 percent slopes	B	1.2	0.6%
NaB2	Neshaminy gravelly silt loam, 3 to 8 percent slopes, moderately eroded	B	15.0	7.0%
NaC2	Neshaminy gravelly silt loam, 8 to 15 percent slopes, moderately eroded	B	24.4	11.3%
NaC3	Neshaminy gravelly silt loam, 8 to 15 percent slopes, severely eroded	B	12.9	6.0%
NaD3	Neshaminy gravelly silt loam, 15 to 25 percent slopes, severely eroded	B	0.5	0.2%
NsD	Neshaminy very stony silt loam, 8 to 25 percent slopes	B	48.3	22.4%
We	Wehadkee silt loam	D	16.6	7.7%
Totals for Area of Interest			**215.2**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Physical Soil Properties

This table shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In this table, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In this table, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, saturated hydraulic conductivity (Ksat), plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3- or 1/10-bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute linear extensibility, shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates in the table are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity (Ksat) is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at 1/3- or 1/10-bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent change for the whole soil. The amount and type of clay minerals in the soil influence volume change.

Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In this table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The content of organic matter in a soil can be maintained by returning crop residue to the soil.

Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

Erosion factors are shown in the table as the K factor (Kw and Kf) and the T factor. Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and Ksat. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor Kw indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind and/or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are described in the "National Soil Survey Handbook."

Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Reference:
United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. (http://soils.usda.gov)

Report—Physical Soil Properties

Physical Soil Properties–Delaware County, Pennsylvania														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
CdB2—Chester silt loam, 3 to 8 percent slopes, moderately eroded														
Chester	0-8	-30-	-54-	10-17- 23	1.10-1.30	4.23-14.11	0.12-0.16	0.0-2.9	1.0-3.0	.32	.37	5	5	56
	8-33	-18-	-55-	18-28- 35	1.20-1.50	4.23-14.11	0.10-0.14	0.0-2.9	0.0-0.5	.43	.49			
	33-64	-43-	-40-	10-17- 24	1.40-1.60	4.23-14.11	0.08-0.12	0.0-2.9	0.0-0.5	.49	.55			
Ch—Chewacla silt loam														
Chewacla	0-9	-27-	-54-	15-20- 25	1.20-1.40	4.23-14.11	0.14-0.20	0.0-2.9	2.0-4.0	.37	.37	5	5	56
	9-60	-19-	-54-	18-27- 35	1.20-1.50	4.23-14.11	0.14-0.18	0.0-2.9	0.0-0.5	.37	.37			
	60-64	—	—	5- 9- 12	1.20-1.50	14.11-141.14	0.04-0.08	0.0-2.9	0.0-0.5	.24	.24			
GeB2—Glenelg channery silt loam, 3 to 8 percent slopes, moderately eroded														
Glenelg	0-8	-27-	-54-	15-20- 25	1.10-1.40	4.23-14.11	0.14-0.17	0.0-2.9	1.0-3.0	.32	.64	5	6	48
	8-26	-20-	-54-	20-26- 32	1.20-1.60	4.23-14.11	0.14-0.20	0.0-2.9	0.0-0.5	.43	.64			
	26-60	-46-	-42-	5-13- 20	1.20-1.40	4.23-14.11	0.10-0.20	0.0-2.9	0.0-0.5	.49	.64			

Physical Soil Properties–Delaware County, Pennsylvania														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
GeB3—Glenelg channery silt loam, 3 to 8 percent slopes, severely eroded														
Glenelg	0-8	-27-	-54-	15-20- 25	1.10-1.40	4.23-14.11	0.14-0.17	0.0-2.9	1.0-3.0	.32	.64	4	6	48
	8-26	-20-	-54-	20-26- 32	1.20-1.60	4.23-14.11	0.14-0.20	0.0-2.9	0.0-0.5	.43	.64			
	26-60	-46-	-42-	5-13- 20	1.20-1.40	4.23-14.11	0.10-0.20	0.0-2.9	0.0-0.5	.49	.64			
GeC—Glenelg channery silt loam, 8 to 15 percent slopes														
Glenelg	0-8	-27-	-54-	15-20- 25	1.10-1.40	4.23-14.11	0.14-0.17	0.0-2.9	1.0-3.0	.32	.32	5	6	48
	8-29	-20-	-54-	20-26- 32	1.20-1.60	4.23-14.11	0.14-0.20	0.0-2.9	0.0-0.5	.43	.49			
	29-50	-46-	-42-	5-13- 20	1.20-1.40	4.23-14.11	0.10-0.20	0.0-2.9	0.0-0.5	.49	.55			
GeC2—Glenelg channery silt loam, 8 to 15 percent slopes, moderately eroded														
Glenelg	0-8	-27-	-54-	15-20- 25	1.10-1.40	4.23-14.11	0.14-0.17	0.0-2.9	1.0-3.0	.32	.64	5	6	48
	8-26	-20-	-54-	20-26- 32	1.20-1.60	4.23-14.11	0.14-0.20	0.0-2.9	0.0-0.5	.43	.64			
	26-60	-46-	-42-	5-13- 20	1.20-1.40	4.23-14.11	0.10-0.20	0.0-2.9	0.0-0.5	.49	.64			

Physical Soil Properties–Delaware County, Pennsylvania														
Map symbol and soil name	**Depth**	**Sand**	**Silt**	**Clay**	**Moist bulk density**	**Saturated hydraulic conductivity**	**Available water capacity**	**Linear extensibility**	**Organic matter**	**Erosion factors**			**Wind erodibility group**	**Wind erodibility index**
										Kw	**Kf**	**T**		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
GeC3—Glenelg channery silt loam, 8 to 15 percent slopes, severely eroded														
Glenelg	0-8	-27-	-54-	15-20- 25	1.10-1.40	4.23-14.11	0.14-0.17	0.0-2.9	1.0-3.0	.32	.64	4	6	48
	8-26	-20-	-54-	20-26- 32	1.20-1.60	4.23-14.11	0.14-0.20	0.0-2.9	0.0-0.5	.43	.64			
	26-60	-46-	-42-	5-13- 20	1.20-1.40	4.23-14.11	0.10-0.20	0.0-2.9	0.0-0.5	.49	.64			
GeD2—Glenelg channery silt loam, 15 to 25 percent slopes, moderately eroded														
Glenelg	0-8	-27-	-54-	15-20- 25	1.10-1.40	4.23-14.11	0.14-0.17	0.0-2.9	1.0-3.0	.32	.64	5	6	48
	8-26	-20-	-54-	20-26- 32	1.20-1.60	4.23-14.11	0.14-0.20	0.0-2.9	0.0-0.5	.43	.64			
	26-60	-46-	-42-	5-13- 20	1.20-1.40	4.23-14.11	0.10-0.20	0.0-2.9	0.0-0.5	.49	.64			
GeD3—Glenelg channery silt loam, 15 to 25 percent slopes, severely eroded														
Glenelg	0-8	-27-	-54-	15-20- 25	1.10-1.40	4.23-14.11	0.14-0.17	0.0-2.9	1.0-3.0	.32	.64	4	6	48
	8-26	-20-	-54-	20-26- 32	1.20-1.60	4.23-14.11	0.14-0.20	0.0-2.9	0.0-0.5	.43	.64			
	26-60	-46-	-42-	5-13- 20	1.20-1.40	4.23-14.11	0.10-0.20	0.0-2.9	0.0-0.5	.49	.64			

Physical Soil Properties–Delaware County, Pennsylvania														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
GeE3—Glenelg channery silt loam, 25 to 35 percent slopes, severely eroded														
Glenelg	0-8	-27-	-54-	15-20- 25	1.10-1.40	4.23-14.11	0.14-0.17	0.0-2.9	1.0-3.0	.32	.64	4	6	48
	8-26	-20-	-54-	20-26- 32	1.20-1.60	4.23-14.11	0.14-0.20	0.0-2.9	0.0-0.5	.43	.64			
	26-60	-46-	-42-	5-13- 20	1.20-1.40	4.23-14.11	0.10-0.20	0.0-2.9	0.0-0.5	.49	.64			
GnB—Glenville silt loam, 3 to 8 percent slopes														
Glenville	0-9	-30-	-55-	10-15- 20	1.20-1.40	4.23-14.11	0.16-0.20	0.0-2.9	2.0-4.0	.32	.32	3	5	56
	9-19	-22-	-55-	20-23- 35	1.40-1.60	4.23-14.11	0.12-0.16	0.0-2.9	0.0-0.5	.24	.28			
	19-39	-27-	-54-	15-19- 35	1.60-1.80	0.42-4.23	0.08-0.12	0.0-2.9	0.0-0.5	.24	.28			
	39-82	-43-	-39-	5-18- 25	1.40-1.60	1.41-4.23	0.06-0.12	0.0-2.9	0.0-0.5	.24	.32			
GnB2—Glenville silt loam, 3 to 8 percent slopes, moderately eroded														
Glenville	0-10	-30-	-55-	10-15- 20	1.20-1.40	4.23-14.11	0.16-0.20	0.0-2.9	2.0-4.0	.32	.32	3	5	56
	10-16	-19-	-54-	20-27- 35	1.40-1.60	4.23-14.11	0.12-0.16	0.0-2.9	0.0-0.5	.24	.32			
	16-50	-20-	-54-	20-26- 35	1.60-1.80	0.42-4.23	0.08-0.12	0.0-2.9	0.0-0.5	.24	.32			
	50-70	-44-	-41-	5-15- 25	1.40-1.60	1.41-4.23	0.06-0.12	0.0-2.9	0.0-0.5	.24	.64			

Physical Soil Properties–Delaware County, Pennsylvania														
Map symbol and soil name	**Depth**	**Sand**	**Silt**	**Clay**	**Moist bulk density**	**Saturated hydraulic conductivity**	**Available water capacity**	**Linear extensibility**	**Organic matter**	**Erosion factors**			**Wind erodibility group**	**Wind erodibility index**
										Kw	**Kf**	**T**		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
GsB—Glenville very stony silt loam, 0 to 8 percent slopes														
Glenville, extremely stony	0-8	-30-	-55-	10-15- 20	1.20-1.40	4.23-14.11	0.14-0.20	0.0-2.9	2.0-4.0	.24	.32	3	8	0
	8-12	-18-	-55-	20-28- 35	1.40-1.60	4.23-14.11	0.12-0.16	0.0-2.9	0.0-0.5	.24	.28			
	12-29	-18-	-55-	20-28- 35	1.60-1.80	0.42-4.23	0.08-0.12	0.0-2.9	0.0-0.5	.24	.28			
	29-45	-30-	-55-	10-15- 20	1.20-1.40	4.23-14.11	0.16-0.20	0.0-2.9	2.0-4.0	.32	.32			
	45-70	-44-	-41-	5-15- 25	1.40-1.60	1.41-4.23	0.06-0.12	0.0-2.9	0.0-0.5	.24	.32			
Me—Made land, schist and gneiss materials														
Udorthents, schist and gneiss	0-3	-27-	-54-	15-20- 25	1.00-1.45	0.42-4.23	0.14-0.18	0.0-2.9	1.0-2.0	.37	.43	4	5	56
	3-40	-20-	-54-	25-26- 35	1.30-1.60	0.42-1.41	0.14-0.20	3.0-5.9	1.0-2.0	.37	.37			
	40-60	-20-	-54-	25-26- 35	1.30-1.60	0.42-1.41	0.14-0.20	3.0-5.9	1.0-2.0	.37	.37			
MhE—Manor loam and channery loam, 25 to 35 percent slopes														
Manor	0-4	-43-	-40-	10-18- 25	1.10-1.40	4.23-14.11	0.17-0.21	0.0-2.9	1.0-3.0	.37	.37	5	6	48
	4-19	-43-	-40-	10-18- 25	1.20-1.50	4.23-14.11	0.14-0.20	0.0-2.9	0.0-0.5	.32	.37			
	19-60	-64-	-24-	5-13- 20	1.25-1.50	4.23-42.34	0.10-0.20	0.0-2.9	0.0-0.5	.49	.55			

Physical Soil Properties–Delaware County, Pennsylvania														
Map symbol and soil name	**Depth**	**Sand**	**Silt**	**Clay**	**Moist bulk density**	**Saturated hydraulic conductivity**	**Available water capacity**	**Linear extensibility**	**Organic matter**	**Erosion factors**			**Wind erodibility group**	**Wind erodibility index**
										Kw	**Kf**	**T**		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
NaB2—Neshaminy gravelly silt loam, 3 to 8 percent slopes, moderately eroded														
Neshaminy	0-9	-29-	-53-	10-18- 25	1.20-1.40	4.23-14.11	0.14-0.18	0.0-2.9	1.0-3.0	.28	.32	5	5	56
	9-60	-34-	-37-	20-29- 40	1.40-1.60	1.41-4.23	0.10-0.14	0.0-2.9	0.0-0.5	.17	.20			
	60-64	—	—	—	—	1.41-14.11	—	—	—					
NaC2—Neshaminy gravelly silt loam, 8 to 15 percent slopes, moderately eroded														
Neshaminy	0-9	-29-	-53-	10-18- 25	1.20-1.40	4.23-14.11	0.14-0.18	0.0-2.9	1.0-3.0	.28	.32	5	5	56
	9-60	-34-	-37-	20-29- 40	1.40-1.60	1.41-4.23	0.10-0.14	0.0-2.9	0.0-0.5	.17	.20			
	60-64	—	—	—	—	1.41-14.11	—	—	—					

Physical Soil Properties–Delaware County, Pennsylvania														
Map symbol and soil name	**Depth**	**Sand**	**Silt**	**Clay**	**Moist bulk density**	**Saturated hydraulic conductivity**	**Available water capacity**	**Linear extensibility**	**Organic matter**	**Erosion factors**			**Wind erodibility group**	**Wind erodibility index**
										Kw	**Kf**	**T**		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
NaC3—Neshaminy gravelly silt loam, 8 to 15 percent slopes, severely eroded														
Neshaminy	0-8	-29-	-53-	10-18- 25	1.20-1.40	4.23-14.11	0.14-0.18	0.0-2.9	2.0-4.0	.28	.32	4	6	48
	8-37	-17-	-53-	20-30- 40	1.40-1.60	1.41-4.23	0.10-0.14	0.0-2.9	0.0-0.5	.17	.32			
	37-60	—	—	—	—	1.41-14.11	—	—	—					
NaD3—Neshaminy gravelly silt loam, 15 to 25 percent slopes, severely eroded														
Neshaminy	0-8	-29-	-53-	10-18- 25	1.20-1.40	4.23-14.11	0.14-0.18	0.0-2.9	2.0-4.0	.28	.32	4	6	48
	8-37	-17-	-53-	20-30- 40	1.40-1.60	1.41-4.23	0.10-0.14	0.0-2.9	0.0-0.5	.17	.32			
	37-60	—	—	—	—	1.41-14.11	—	—	—					

Physical Soil Properties–Delaware County, Pennsylvania														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
NsD—Neshaminy very stony silt loam, 8 to 25 percent slopes														
Neshaminy, extremely bouldery	0-11	-30-	-55-	10-15- 20	1.20-1.40	4.23-14.11	0.12-0.20	0.0-2.9	3.0-5.0	.24	.32	5	6	48
	11-39	-33-	-32-	20-35- 40	1.40-1.60	1.41-4.23	0.10-0.14	0.0-2.9	0.0-0.5	.17	.20			
	39-65	-34-	-37-	20-30- 40	1.40-1.60	1.41-4.23	0.10-0.14	0.0-2.9	0.0-0.5	.17	.20			
	65-80	—	—	—	—	1.41-14.11	0.00	—	0.0-0.5					
We—Wehadkee silt loam														
Wehadkee	0-9	-30-	-55-	10-15- 20	1.20-1.40	4.23-14.11	0.16-0.22	0.0-2.9	2.0-4.0	.37	.37	5	5	56
	9-28	-21-	-55-	15-25- 35	1.20-1.40	4.23-14.11	0.16-0.20	0.0-2.9	0.0-0.5	.20	.20			
	28-60	-18-	-55-	10-28- 35	1.20-1.50	4.23-14.11	0.10-0.14	0.0-2.9	0.0-0.5	.20	.20			
	60-64	—	—	5-25- 45	1.10-1.60	14.11-42.34	0.04-0.08	0.0-2.9	0.0-0.5	.20	.20			

Data Source Information

Soil Survey Area: Delaware County, Pennsylvania
Survey Area Data: Version 7, Dec 14, 2013

Engineering Properties

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Hydrologic group is a group of soils having similar runoff potential under similar storm and cover conditions. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. The influence of ground cover is treated independently. There are four hydrologic soil groups, A, B, C, and D, and three dual groups, A/D, B/D, and C/D. In the dual groups, the first letter is for drained areas and the second letter is for undrained areas.

The four hydrologic soil groups are described in the following paragraphs:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

References:

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Report—Engineering Properties

Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash.

Engineering Properties–Delaware County, Pennsylvania														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
CdB2—Chester silt loam, 3 to 8 percent slopes, moderately eroded														
Chester	90	B	0-8	Silt loam	CL, ML	A-4, A-7	0	0-10	85-100	80-100	70-100	50-90	22-27	5-10
			8-33	Silty clay loam, silt loam, clay loam	CL, ML	A-4, A-6, A-7	0	0-10	85-100	80-100	70-100	55-95	30-50	8-17
			33-64	Silt loam, loam, sandy loam	ML, SC, SM	A-2, A-4, A-7	0	0-10	80-100	80-100	60-100	30-90	15-47	4-12
Ch—Chewacla silt loam														
Chewacla	85	C	0-9	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	80-100	70-100	65-100	55-95	22-35	2-12
			9-60	Silt loam, loam, silty clay loam	CL, CL-ML, ML	A-4, A-6	0	0	80-100	75-100	65-100	55-85	22-35	2-12
			60-64	Stratified sand to silt	GM, ML, SM	A-1, A-2, A-4	0	0	25-100	20-100	20-85	15-65	15-35	NP-7

Engineering Properties–Delaware County, Pennsylvania														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
GeB2—Glenelg channery silt loam, 3 to 8 percent slopes, moderately eroded														
Glenelg	85	B	0-8	Channery silt loam	GM, ML, SM	A-2-4, A-2-6, A-4, A-6	0	0-10	60-100	50-75	40-75	30-70	32-40	7-12
			8-26	Channery silt loam, silty clay loam, loam	GM, ML, SM	A-4, A-6, A-7	0	0-10	60-100	50-100	45-100	35-95	34-46	9-15
			26-60	Loam, sandy loam, channery loam	GM, ML, SM	A-2, A-4	0	0-50	60-100	50-100	40-95	25-75	15-40	NP-6
GeB3—Glenelg channery silt loam, 3 to 8 percent slopes, severely eroded														
Glenelg	85	B	0-8	Channery silt loam	GM, ML, SM	A-2-4, A-2-6, A-4, A-6	0	0-10	60-100	50-75	40-75	30-70	32-40	7-12
			8-26	Channery silt loam, silty clay loam, loam	GM, ML, SM	A-4, A-6, A-7	0	0-10	60-100	50-100	45-100	35-95	34-46	9-15
			26-60	Loam, sandy loam, channery loam	GM, ML, SM	A-2, A-4	0	0-50	60-100	50-100	40-95	25-75	15-40	NP-6

Engineering Properties–Delaware County, Pennsylvania														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
GeC—Glenelg channery silt loam, 8 to 15 percent slopes														
Glenelg	85	B	0-8	Channery silt loam	GM, ML, SM	A-4, A-6, A-2-4, A-2-6	0	0-10	60-100	50-75	40-75	30-70	32-40	7-12
			8-29	Channery silt loam, silty clay loam, loam	ML, SM, GM	A-4, A-6, A-7	0	0-10	60-100	50-100	45-100	35-95	34-46	9-15
			29-50	Loam, sandy loam, very channery loam	GM, ML, SM	A-2, A-4	0	0-50	60-100	50-100	40-95	25-75	0-40	NP-6
GeC2—Glenelg channery silt loam, 8 to 15 percent slopes, moderately eroded														
Glenelg	85	B	0-8	Channery silt loam	GM, ML, SM	A-2-4, A-2-6, A-4, A-6	0	0-10	60-100	50-75	40-75	30-70	32-40	7-12
			8-26	Channery silt loam, silty clay loam, loam	GM, ML, SM	A-4, A-6, A-7	0	0-10	60-100	50-100	45-100	35-95	34-46	9-15
			26-60	Loam, sandy loam, channery loam	ML, SM, GM	A-2, A-4	0	0-50	60-100	50-100	40-95	25-75	15-40	NP-6

Engineering Properties–Delaware County, Pennsylvania														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
GeC3—Glenelg channery silt loam, 8 to 15 percent slopes, severely eroded														
Glenelg	85	B	0-8	Channery silt loam	GM, ML, SM	A-2-4, A-2-6, A-4, A-6	0	0-10	60-100	50-75	40-75	30-70	32-40	7-12
			8-26	Channery silt loam, silty clay loam, loam	GM, ML, SM	A-4, A-6, A-7	0	0-10	60-100	50-100	45-100	35-95	34-46	9-15
			26-60	Loam, sandy loam, channery loam	GM, ML, SM	A-2, A-4	0	0-50	60-100	50-100	40-95	25-75	15-40	NP-6
GeD2—Glenelg channery silt loam, 15 to 25 percent slopes, moderately eroded														
Glenelg	85	B	0-8	Channery silt loam	GM, ML, SM	A-2-4, A-2-6, A-4, A-6	0	0-10	60-100	50-75	40-75	30-70	32-40	7-12
			8-26	Channery silt loam, silty clay loam, loam	GM, ML, SM	A-4, A-6, A-7	0	0-10	60-100	50-100	45-100	35-95	34-46	9-15
			26-60	Loam, sandy loam, channery loam	GM, ML, SM	A-2, A-4	0	0-50	60-100	50-100	40-95	25-75	15-40	NP-6

Engineering Properties–Delaware County, Pennsylvania														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
GeD3—Glenelg channery silt loam, 15 to 25 percent slopes, severely eroded														
Glenelg	85	B	0-8	Channery silt loam	GM, ML, SM	A-2-4, A-2-6, A-4, A-6	0	0-10	60-100	50-75	40-75	30-70	32-40	7-12
			8-26	Channery silt loam, silty clay loam, loam	GM, ML, SM	A-4, A-6, A-7	0	0-10	60-100	50-100	45-100	35-95	34-46	9-15
			26-60	Loam, sandy loam, channery loam	GM, ML, SM	A-2, A-4	0	0-50	60-100	50-100	40-95	25-75	15-40	NP-6
GeE3—Glenelg channery silt loam, 25 to 35 percent slopes, severely eroded														
Glenelg	85	B	0-8	Channery silt loam	GM, ML, SM	A-2-4, A-2-6, A-4, A-6	0	0-10	60-100	50-75	40-75	30-70	32-40	7-12
			8-26	Channery silt loam, silty clay loam, loam	GM, ML, SM	A-4, A-6, A-7	0	0-10	60-100	50-100	45-100	35-95	34-46	9-15
			26-60	Loam, sandy loam, channery loam	GM, ML, SM	A-2, A-4	0	0-50	60-100	50-100	40-95	25-75	15-40	NP-6

Engineering Properties–Delaware County, Pennsylvania														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
GnB—Glenville silt loam, 3 to 8 percent slopes														
Glenville	90	C	0-9	Silt loam	ML, SM	A-4	0	0	85-100	85-100	70-95	45-80	25-35	3-10
			9-19	Silt loam, channery loam, channery silty clay loam	ML, CL, CL-ML, GM, SC	A-4, A-6	0	0-10	70-100	60-100	60-95	45-80	25-40	5-13
			19-39	Silt loam, channery loam, silty clay loam	ML, CL, CL-ML, GM, SC	A-4, A-6	0	0-10	65-100	60-100	55-95	45-80	25-40	5-13
			39-82	Channery loam, very channery sandy loam	CL-ML, GM, ML, SM, GC, SC	A-1, A-2, A-4, A-2-4	0	0-20	45-90	20-75	10-75	5-65	25-35	5-10
GnB2—Glenville silt loam, 3 to 8 percent slopes, moderately eroded														
Glenville	85	C	0-10	Silt loam	ML, SM	A-4	0	0	85-100	85-100	70-95	45-80	25-35	3-10
			10-16	Silt loam, channery loam, channery silty clay loam	ML, CL, CL-ML, GM, SC	A-4, A-6	0	0-10	70-100	60-100	60-95	45-80	25-40	5-13
			16-50	Silt loam, channery loam, silty clay loam	ML, CL, CL-ML, GM, SC	A-4, A-6	0	0-10	65-100	60-100	55-95	45-80	25-40	5-13
			50-70	Channery fine sandy loam, channery loam, very channery sandy loam	CL-ML, GM, ML, SM, GC, SC	A-1, A-2, A-4	0	0-20	45-90	20-75	10-75	5-65	25-35	5-10

Engineering Properties–Delaware County, Pennsylvania														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
GsB—Glenville very stony silt loam, 0 to 8 percent slopes														
Glenville, extremely stony	100	C	0-8	Channery silt loam	ML, SM	A-4	1-5	3-10	70-100	65-100	50-95	35-80	25-35	3-10
			8-12	Silt loam, channery loam, channery silty clay loam	ML, CL, CL-ML, GM	A-4, A-6	0	0-10	70-100	60-100	60-95	45-80	25-40	5-13
			12-29	Silt loam, channery loam, silty clay loam	ML, CL, CL-ML, GM	A-4, A-6	0	0-10	65-100	60-100	55-95	45-80	25-40	5-13
			29-45	Silt loam	ML, SM	A-4	0	0	85-100	85-100	70-95	45-80	25-35	3-10
			45-70	Channery fine sandy loam, channery loam, very channery sandy loam	GC, SC, CL-ML, GM, ML, SM	A-1, A-2, A-4	0-1	0-20	45-90	20-75	10-75	5-65	25-35	5-10
Me—Made land, schist and gneiss materials														
Udorthents, schist and gneiss	95	B	0-3	Silt loam	CL, CL-ML, ML	A-4	0	0-5	85-100	80-100	70-95	50-75	25-35	5-10
			3-40	Loam, gravelly silt loam, clay loam	ML	A-6, A-7-6	0	0-5	90-100	80-100	70-100	55-95	35-45	10-15
			40-60	Loam, gravelly silt loam, clay loam	ML	A-6, A-7-6	0	0-5	90-100	80-100	70-100	55-95	35-45	10-15

Engineering Properties–Delaware County, Pennsylvania														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
MhE—Manor loam and channery loam, 25 to 35 percent slopes														
Manor	98	B	0-4	Loam	ML	A-4, A-6	0	0	85-100	80-100	70-100	50-90	32-40	6-12
			4-19	Loam, silt loam, channery loam	SM, GM, ML	A-2-4, A-2-6, A-4, A-6	0	0-10	65-100	50-100	40-100	30-90	26-40	4-12
			19-60	Loam, very fine sandy loam, channery sandy loam	CL-ML, ML, SC-SM, SM	A-1, A-2, A-4, A-6	0	0-5	65-100	50-100	30-95	15-75	20-40	2-12
NaB2—Neshaminy gravelly silt loam, 3 to 8 percent slopes, moderately eroded														
Neshaminy	85	B	0-9	Gravelly silt loam	CL, ML	A-4, A-6	0	0-10	70-90	65-80	60-75	55-65	22-41	6-17
			9-60	Silt loam, gravelly silty clay loam, gravelly clay loam	GM, MH, ML, SM, CL	A-2, A-4, A-6, A-7	0	0-40	60-100	55-100	45-100	30-75	29-48	13-28
			60-64	Bedrock	—	—	—	—	—	—	—	—	—	—
NaC2—Neshaminy gravelly silt loam, 8 to 15 percent slopes, moderately eroded														
Neshaminy	85	B	0-9	Gravelly silt loam	CL, ML	A-4, A-6	0	0-10	70-90	65-80	60-75	55-65	22-41	6-17
			9-60	Silt loam, gravelly silty clay loam, gravelly clay loam	GM, MH, ML, SM, CL	A-2, A-4, A-6, A-7	0	0-40	60-100	55-100	45-100	30-75	29-48	13-28
			60-64	Bedrock	—	—	—	—	—	—	—	—	—	—

Engineering Properties–Delaware County, Pennsylvania														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
NaC3—Neshaminy gravelly silt loam, 8 to 15 percent slopes, severely eroded														
Neshaminy	90	B	0-8	Gravelly silt loam	CL, ML	A-4, A-6	0	0-10	70-90	65-80	60-75	55-65	—	—
			8-37	Silt loam, gravelly silty clay loam, gravelly sandy clay loam	GM, MH, ML, SM	A-2, A-4, A-6, A-7	0-1	0-40	60-100	55-100	45-100	30-75	25-55	NP-22
			37-60	Bedrock	—	—	—	—	—	—	—	—	—	—
NaD3—Neshaminy gravelly silt loam, 15 to 25 percent slopes, severely eroded														
Neshaminy	90	B	0-8	Gravelly silt loam	CL, ML	A-4, A-6	0	0-10	70-90	65-80	60-75	55-65	—	—
			8-37	Silt loam, gravelly silty clay loam, gravelly sandy clay loam	GM, MH, ML, SM	A-2, A-4, A-6, A-7	0-1	0-40	60-100	55-100	45-100	30-75	25-55	NP-22
			37-60	Bedrock	—	—	—	—	—	—	—	—	—	—

Engineering Properties–Delaware County, Pennsylvania														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
NsD—Neshaminy very stony silt loam, 8 to 25 percent slopes														
Neshaminy, extremely bouldery	97	B	0-11	Gravelly silt loam	CL, ML	A-4, A-6	1-20	5-20	80-100	70-100	60-100	55-85	27-41	6-13
			11-39	Gravelly silty clay loam, gravelly sandy clay loam, channery clay loam	GM, MH, ML, SM, CL	A-2, A-4, A-6, A-7, A-7-6	0-2	0-40	60-100	55-100	45-100	30-75	29-49	13-28
			39-65	Gravelly silty clay loam, very gravelly sandy clay loam, channery clay loam	GM, MH, ML, SM, CL	A-2, A-4, A-6, A-7	0-2	0-40	60-100	55-100	45-100	30-75	29-49	13-28
			65-80	Bedrock	—	—	—	—	—	—	—	—	—	—
We—Wehadkee silt loam														
Wehadkee	90	D	0-9	Silt loam	CL-ML	A-4	0	0	95-100	90-100	70-100	60-90	22-35	2-12
			9-28	Silt loam	CL-ML	A-4	0	0	85-100	80-100	70-95	55-85	22-35	2-12
			28-60	Sandy clay loam, silty clay loam	CL-ML	A-4	0	0	75-100	70-100	60-90	45-60	22-30	2-10
			60-64	Stratified clay	SC-SM	A-2	0	0	50-85	45-80	45-80	15-35	15-32	NP-14

Data Source Information

Soil Survey Area: Delaware County, Pennsylvania
Survey Area Data: Version 7, Dec 14, 2013

APPENDIX C-2: CLAYTON COUNTY PARK ENVIRONMENTAL SURVEY

Delaware County Park Study
Clayton Park
Environmental Resource Survey

Clayton Park

Clayton Park is located in Concord and Bethel Townships on an approximate 148.3 acres. This large park consists of a 9 hole golf course, 4 baseball fields and an expansive wooded area. The surrounding land uses consists primarily of low to high density residential. The northern half of the park consists of gently rolling hills along a stream valley. Green Creek and several unnamed tributaries (UNT) are located primarily in the northern portion of the park. The southern portion is steep wooded slope. This section of Green Creek is designated as a Cold Water Fishery (CWF) by the Pennsylvania Department of Environmental Protection (PADEP). Designated use of a CWF is defined as "Maintenance or propagation, or both, of fish species including the family Salmonidae and additional flora and fauna which are indigenous to a cold water habitat" according to PADEP's Chapter 93 guidelines. This section of Green Creek is not listed as impaired by PADEP. There are two main utility lines that bisect the park. A gas pipeline runs north and south. An electric transmission line runs east and west. Both of these lines are maintained and are free from trees and tall shrubs. The electric transmission clearing has a 100' wide clearing and the gas pipeline has an approximate 50' clearing.

An environmental survey was conducted to provide a preliminary inventory and assessment of the existing environmental features within the park to assist future planning decisions. There are several environmental resources within the park. These resources include forest, streams, and wetlands. There are few non forested areas beyond the golf course and baseball fields.

Green Creek flows through the property from the west near the intersection of Bethel Road and Featherbed Lane. This segment continues east just south of a baseball field off of Featherbed Lane. Numerous floodplain wetlands were observed along this branch. There was a small undeveloped trail that starts from the eastern edge of the baseball clearing, through the creek to the clearing for the electric transmission line. Two unnamed tributaries (UNTs) empty into Green Creek within park boundaries. There are several wetlands and small tributaries along the floodplain of Green Creek in the eastern portion of the park and are primarily spring fed.

An UNT of Green Creek enters the park north of the baseball field and flows southeast to the confluence with Green Creek. The surrounding suburban runoff from the surrounding land use was evident within the stream in the form of erosion.

A small UNT originates north of the pro shop to the public golf course. This UNT flows south from Conchester Highway towards a man made pond. The UNT then flows southeast towards Green Creek. This channel was highly impaired. The lack of riparian buffer and runoff from the parking lot and roadway has reduced the headwaters to an entrenched

storm swale. A damaged culvert is located in the stream. It appears that a cart path washed out and the culvert was left behind. Another culvert and springhouse are located immediately downstream of the previous culvert channel. This second culvert carries the flow to the pond. The pond is aerated and two species of frogs were observed within the pond and adjacent stream channels. The channel downstream of the pond appeared to be recently dredged by an excavator. The entrenched channel was channelized and void of any natural stream morphology. The spoils of the excavated channel were placed along the top of bank unstabilized. The channel contained no natural features or vegetation.

There is a large path of common reed (*Phragmites australis*) and multiflora rose (*Rosa multiflora*) located east of the ballfields in the eastern portion of the park and south of the golf course. Both of these plants are listed by the Pennsylvania Department of

Conservation and Natural Resources (DCNR).
Recommendations:

The UNT to Green Creek that flows through the golf course is the largest environmental concern within the park. It is recommended that the entire reach of the UNT that flows through the park be restored and a riparian buffer established as much as feasible and practical for the surrounding golf course. The entire course of the tributary has been channelized or straightened and is reduced to a trapezoidal channel. Natural stream design should be incorporated into the design. The non-functioning culvert should be removed before additional associated erosion occurs. It is required that the County contact the Pennsylvania Department of Environmental Protection prior to any work within the channel or floodplain to determine what if any type of permit(s) are required. It appeared that the channel has been dredge recently by the presence of a freshly dug channel and exposed soils spread along the top of bank. It likely that this was in response to sediment removal that may have washed into the channel the tropical

storm flooding events that occurred in September 2011. All soils should be stabilized using seed and some sort of protection to prevent sediment from washing into the stream. Sediment is a major pollutant in Pennsylvania and within this watershed. It is recommended that any stream plan address the stand of phragmities and multiflora rose.

Green Creek has a well established riparian buffer through most of the park. It is recommended to continue to avoid disturbance and reduce clearing activities as much as possible in the riparian areas. Utility clearings cannot be avoided. It is recommended that the stream banks be assessed for extent of erosion along utility clearings.

The wetlands located along the floodplain of Green Creek in the eastern portion of the park near the picnic area are a valuable resource. These wetlands provide an opportunity for wetland ecology education. Interpretive signs can provide education to the benefits of wetlands and challenge visitors to locate flora or fauna found within the area. Wetlands have the natural ability to store, treat, and eventually infiltrate stormwater. Stormwater is being diverted through the wetlands. Additional stormwater can be stored with slight adjustments of the invert of the culverts. It is recommended that culvert adjustments and realignments be evaluated. This will increase water quality within Green Creek and demonstrate the usefulness of wetland habitat.

One wetland was found on National Wetland Inventory (NWI) mapping of the park. This wetland is the pond located on the golf course. No wetlands were delineated or identified by the three parameter approach outlined in the 1987 United States Army Corps of Engineer Wetland Manual and corresponding regional supplement. A detailed wetland investigation was not practical for the level of detail for this survey report and NWI mapping often does not show smaller wetland pockets. Preliminary wetland investigation criteria used for the sake of this report consisted of visual identification and rapid test of hydrophytic vegetation, landforms and visible signs of hydrology. It is recommended that prior to any park improvements including land disturbance that a wetland investigation and updated Pennsylvania Natural Diversity Inventory (PNDI) inquiry be conducted to the presence of or potential habitat belonging to rare, threatened, and/or endangered species. A wetland investigation and, if necessary, wetland delineation may be required to be submitted with PADEP and NPDES permits for disturbances in wetlands and streams.

1. PROJECT INFORMATION

Project Name: **Clayton Park**
Date of review: **8/16/2011 11:37:43 AM**
Project Category: **Recreation,Other**
Project Area: **178.0** acres
County: **Delaware** Township/Municipality: **Bethel,Concord**
Quadrangle Name: **WILMINGTON NORTH** ~ ZIP Code: **19061,19342**
Decimal Degrees: **39.860373 N, -75.491223 W**
Degrees Minutes Seconds: **39° 51' 37.3" N, -75° 29' 28.4" W**

2. SEARCH RESULTS

Agency	Results	Response
PA Game Commission	No Known Impact	No Further Review Required
PA Department of Conservation and Natural Resources	**Potential Impact**	**FURTHER REVIEW IS REQUIRED, See Agency Response**
PA Fish and Boat Commission	No Known Impact	No Further Review Required
U.S. Fish and Wildlife Service	No Known Impact	No Further Review Required

As summarized above, Pennsylvania Natural Diversity Inventory (PNDI) records indicate there may be potential impacts to threatened and endangered and/or special concern species and resources within the project area. If the response above indicates "No Further Review Required" no additional communication with the respective agency is required. If the response is "Further Review Required" or "See Agency Response," refer to the appropriate agency comments below. Please see the DEP Information Section of this receipt if a PA Department of Environmental Protection Permit is required.

Note that regardless of PNDI search results, projects requiring a Chapter 105 DEP individual permit or GP 5, 6, 7, 8, 9 or 11 in certain counties (Adams, Berks, Bucks, Carbon, Chester, Cumberland, Delaware, Lancaster, Lebanon, Lehigh, Monroe, Montgomery, Northampton, Schuylkill and York) must comply with the bog turtle habitat screening requirements of the PASPGP.

3. AGENCY COMMENTS

Regardless of whether a DEP permit is necessary for this proposed project, any potential impacts to threatened and endangered species and/or special concern species and resources must be resolved with the appropriate jurisdictional agency. In some cases, a permit or authorization from the jurisdictional agency may be needed if adverse impacts to these species and habitats cannot be avoided.

These agency determinations and responses are **valid for one year** (from the date of the review), and are based on the project information that was provided, including the exact project location; the project type, description, and features; and any responses to questions that were generated during this search. If any of the following change: 1) project location, 2) project size or configuration, 3) project type, or 4) responses to the questions that were asked during the online review, the results of this review are not valid, and the review must be searched again via the PNDI Environmental Review Tool and resubmitted to the jurisdictional agencies. The PNDI tool is a primary screening tool, and a desktop review may reveal more or fewer impacts than what is listed on this PNDI receipt. The jursidictional agencies **strongly advise against** conducting surveys for the species listed on the receipt prior to consultation with the agencies.

PA Game Commission

RESPONSE: No Impact is anticipated to threatened and endangered species and/or special concern species and resources.

PA Department of Conservation and Natural Resources

RESPONSE: Further review of this project is necessary to resolve the potential impacts(s). Please send project information to this agency for review (see WHAT TO SEND).

DCNR Species: (Note: The PNDI tool is a primary screening tool, and a desktop review may reveal more or fewer species than what is listed below. After desktop review, if a botanical survey is required by DCNR, we recommend the DCNR Botanical Survey Protocols, available here: http://www.gis.dcnr.state.pa.us/hgis-er/PNDI_DCNR.aspx.)
Scientific Name: Baccharis halimifolia
Common Name: Eastern Baccharis
Current Status: Special Concern Species*
Proposed Status: Special Concern Species*

Scientific Name: Bartonia paniculata
Common Name: Screw-stem
Current Status: Special Concern Species*
Proposed Status: Special Concern Species*

Scientific Name: Desmodium nuttallii
Common Name: Nuttalls' Tick-trefoil
Current Status: Special Concern Species*

Proposed Status: Special Concern Species*

Scientific Name: Euthamia tenuifolia
Common Name: Grass-leaved Goldenrod
Current Status: Threatened
Proposed Status: Threatened

Scientific Name: Juncus biflorus
Common Name: Grass-leaved Rush
Current Status: Special Concern Species*
Proposed Status: Threatened

Scientific Name: Oxypolis rigidior
Common Name: Stiff Cowbane
Current Status: Special Concern Species*
Proposed Status: Threatened

Scientific Name: Sensitive Species**
Common Name:
Current Status: Special Concern Species*
Proposed Status: Threatened

Scientific Name: Woodwardia areolata
Common Name: Netted Chainfern
Current Status: Special Concern Species*
Proposed Status: Threatened

PA Fish and Boat Commission

RESPONSE: No Impact is anticipated to threatened and endangered species and/or special concern species and resources.

U.S. Fish and Wildlife Service

RESPONSE: No impacts to **federally** listed or proposed species are anticipated. Therefore, no further consultation/coordination under the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.* is required. Because no take of federally listed species is anticipated, none is authorized. This response does not reflect potential Fish and Wildlife Service concerns under the Fish and Wildlife Coordination Act or other authorities.

* Special Concern Species or Resource - Plant or animal species classified as rare, tentatively undetermined or candidate as well as other taxa of conservation concern, significant natural communities, special concern populations (plants or animals) and unique geologic features.
** Sensitive Species - Species identified by the jurisdictinal agency as collectible, having economic value, or

being susceptible to decline as a result of visitation.

WHAT TO SEND TO JURISDICTIONAL AGENCIES

If project information was requested by one or more of the agencies above, send the following information to the agency(s) seeking this information (see AGENCY CONTACT INFORMATION).

Check-list of *Minimum* Materials to be submitted:

____**SIGNED** copy of this Project Environmental Review Receipt
____Project narrative with a description of the overall project, the work to be performed, current physical characteristics of the site and acreage to be impacted.
____Project location information (name of USGS Quadrangle, Township/Municipality, and County)
____USGS 7.5-minute Quadrangle with project boundary clearly indicated, and quad name on the map

The inclusion of the following information may expedite the review process.
____A basic site plan(particularly showing the relationship of the project to the physical features such as wetlands, streams, ponds, rock outcrops, etc.)
____Color photos keyed to the basic site plan (i.e. showing on the site plan where and in what direction each photo was taken and the date of the photos)
____Information about the presence and location of wetlands in the project area, and how this was determined (e.g., by a qualified wetlands biologist), if wetlands are present in the project area, provide project plans showing the location of all project features, as well as wetlands and streams
____The DEP permit(s) required for this project

4. DEP INFORMATION

The Pa Department of Environmental Protection (DEP) requires that a signed copy of this receipt, along with any required documentation from jurisdictional agencies concerning resolution of potential impacts, be submitted with applications for permits requiring PNDI review. For cases where a "Potential Impact" to threatened and endangered species has been identified before the application has been submitted to DEP, the application should not be submitted until the impact has been resolved. For cases where "Potential Impact" to special concern species and resources has been identified before the application has been submitted, the application should be submitted to DEP along with the PNDI receipt, a completed PNDI form and a USGS 7.5 minute quadrangle map with the project boundaries delineated on the map. The PNDI Receipt should also be submitted to the appropriate agency according to directions on the PNDI Receipt. DEP and the jurisdictional agency will work together to resolve the potential impact(s). See the DEP PNDI policy at http://www.naturalheritage.state.pa.us.

5. ADDITIONAL INFORMATION

The PNDI environmental review website is a **preliminary** screening tool. There are often delays in updating species status classifications. Because the proposed status represents the best available information regarding the conservation status of the species, state jurisdictional agency staff give the proposed statuses at least the same consideration as the current legal status. If surveys or further information reveal that a threatened and endangered and/or special concern species and resources exist in your project area, contact the appropriate jurisdictional agency/agencies immediately to identify and resolve any impacts.

For a list of species known to occur in the county where your project is located, please see the species lists by county found on the PA Natural Heritage Program (PNHP) home page (www.naturalheritage.state.pa.us). Also note that the PNDI Environmental Review Tool only contains information about species occurrences that have actually been reported to the PNHP.

6. AGENCY CONTACT INFORMATION

PA Department of Conservation and Natural Resources

Bureau of Forestry, Ecological Services Section
400 Market Street, PO Box 8552, Harrisburg, PA. 17105-8552
Fax:(717) 772-0271

U.S. Fish and Wildlife Service

Endangered Species Section
315 South Allen Street, Suite 322, State College, PA. 16801-4851
NO Faxes Please.

PA Fish and Boat Commission

Division of Environmental Services
450 Robinson Lane, Bellefonte, PA. 16823-7437
NO Faxes Please

PA Game Commission

Bureau of Wildlife Habitat Management
Division of Environmental Planning and Habitat Protection
2001 Elmerton Avenue, Harrisburg, PA. 17110-9797
Fax:(717) 787-6957

7. PROJECT CONTACT INFORMATION

Name:_____
Company/Business Name:_____
Address:_____
City, State, Zip:_____
Phone:(_____)_____Fax:(_____)_____
Email:_____

8. CERTIFICATION

I certify that ALL of the project information contained in this receipt (including project location, project size/configuration, project type, answers to questions) is true, accurate and complete. In addition, if the project type, location, size or configuration changes, or if the answers to any questions that were asked during this online review change, I agree to re-do the online environmental review.

_____ _____
applicant/project proponent signature date