ALLEGHENY LAND TRUST

Churchill Valley Greenway

Conceptual Planning Report

January 2022

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Oikos Ecology, LLC

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INTRODUCTION

Goal of Churchill Valley Greenway

Allegheny Land Trust intends to conserve and promote biodiversity and ecosystem function of the Churchill Valley Greenway Conservation Area and utilize existing infrastructure for low-impact public use.

Purpose of the Conceptual Plan

The Concept Plan will help ALT understand the specific challenges, opportunities and stakeholder ideas of this property, which will guide future fundraising, management and programming

Planning Process

To complete this Conceptual Plan, a 2-day public workshop was conducted which included focus groups meetings to discuss specific topics (AMD and streams / municipal leaders / partnerships and volunteers), planning alternatives and idea generation, and a presentation of preliminary findings. The information gathered at the Workshop was crucial to the development of the Conceptual Plan.

What Makes Churchill Valley Greenway Different from Other Allegheny Land Trust Properties?

1. Expansive open meadow habitat (most Allegheny Land Trust properties are wooded)
2. Property is within an urban environment (most Allegheny Land Trust properties are remote)
3. Property is at the intersection of multiple municipalities and easily accessible (most Allegheny Land Trust properties are less visible to the general public)
4. Property has existing infrastructure – parking, paved trails and bridges (most Allegheny Land Trust properties have little/no infrastructure)
5. Given the meadow habitat, infrastructure and stream Churchill Valley Greenway is versatile and offers many opportunities (most Allegheny Land Trust properties don't have this variety of features)

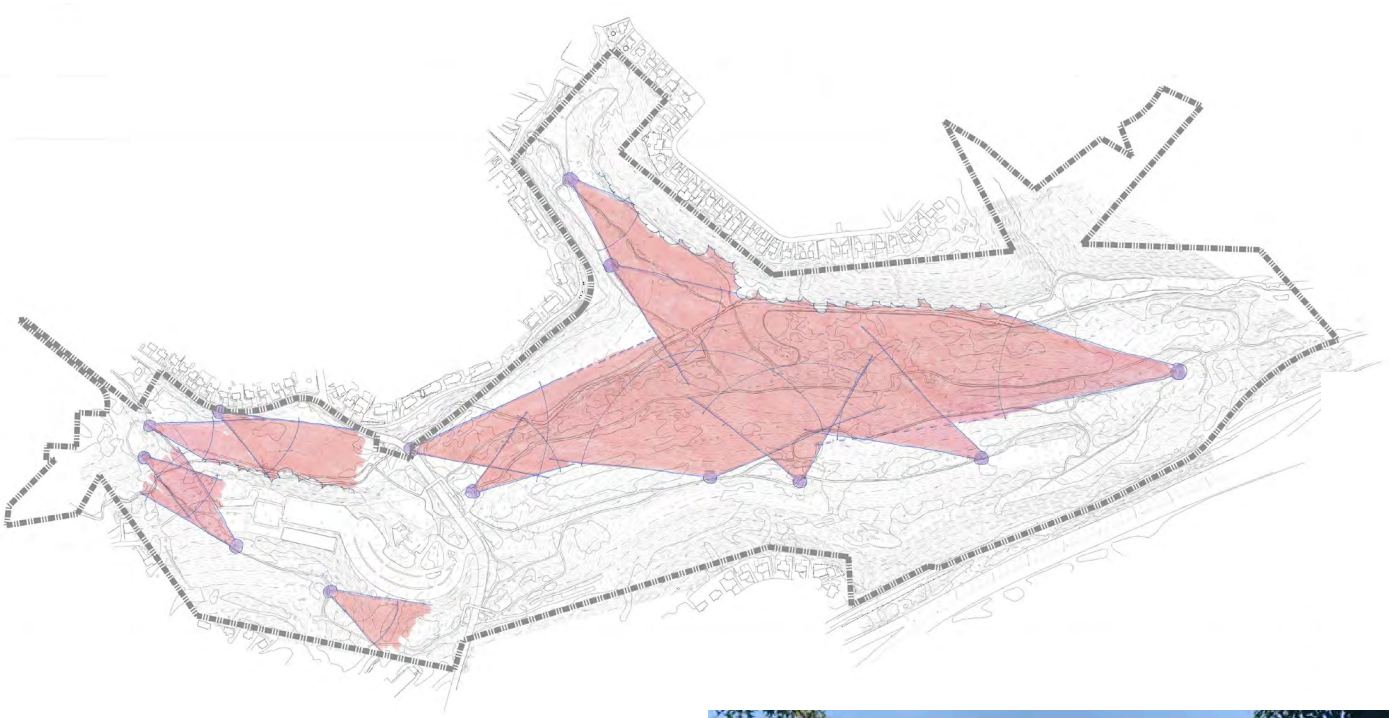
For the above reasons, Churchill Valley Greenway will have more use/public access than other Allegheny Land Trust properties. Thus, access and maintenance will be different from other Allegheny Land Trust properties.

PROPERTY PHOTOGRAPHS

PROPERTY ANALYSIS

The following diagrams were created during the 2-day workshop to explain specific aspects of the property.

Existing View Corridors

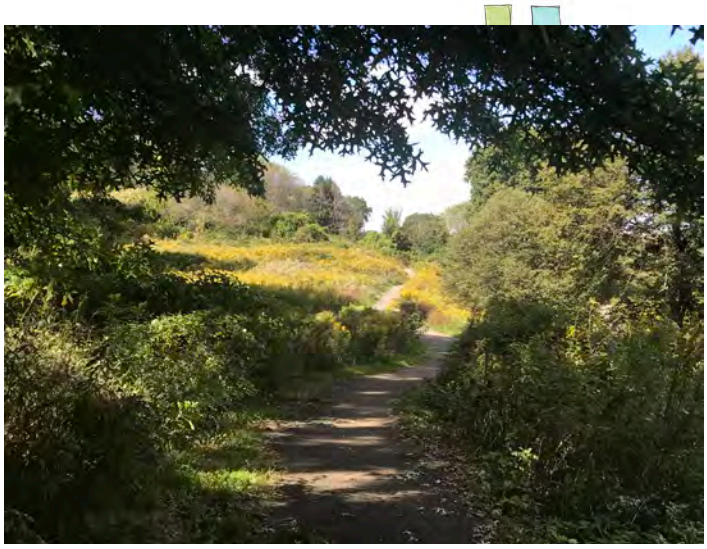


One of the dramatic features of the property is the long-distance views down the former manicured golf fairways which have evolved into meadow. The purple circles indicate locations on the property where these view corridors are most evident.

View across former golf fairway

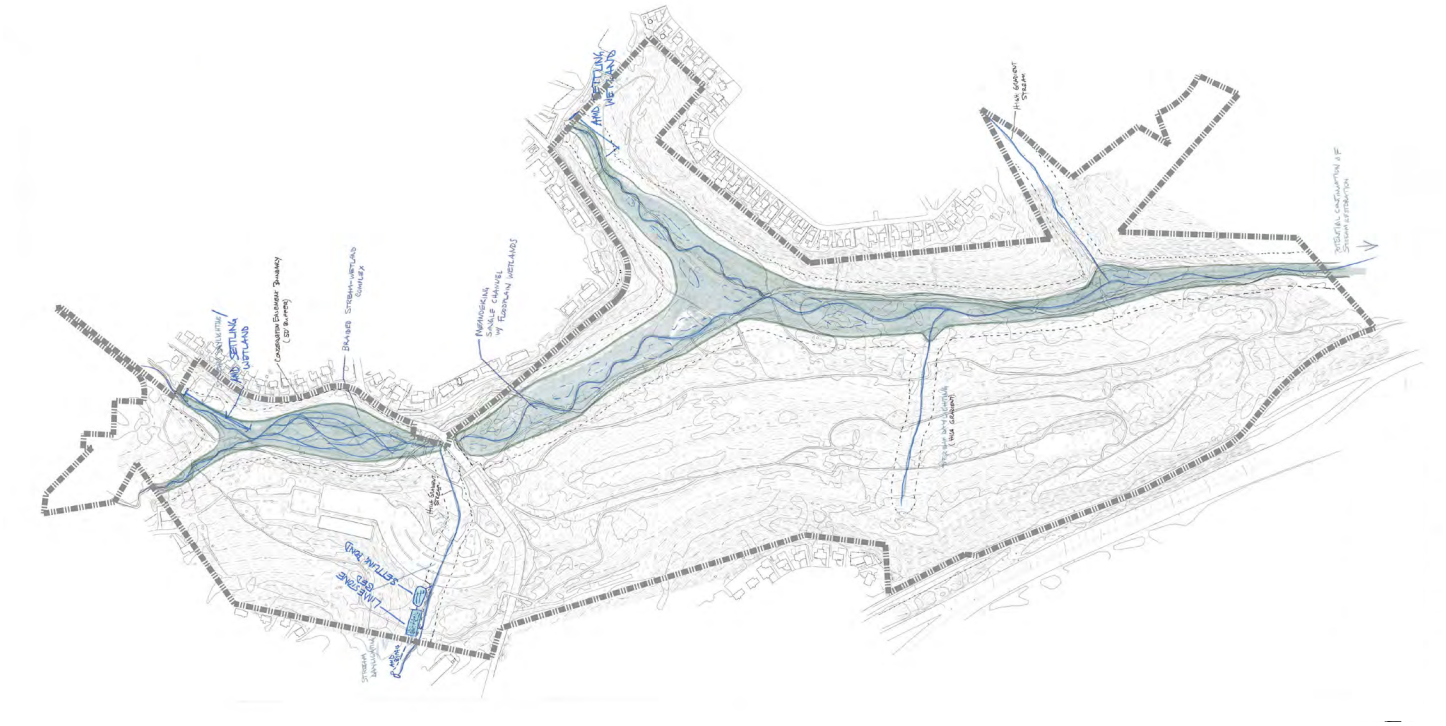
Existing Trails and Pathways

This diagram illustrates existing trails which are former golf cart pathways. Green indicates handicap accessible trails and blue indicates non-handicap accessible trails. Trails within the flood plain of Chalfant Run will need to be removed for restoration to take place.



Portions of some existing trails are handicap accessible

Abandoned Mine Drainage and Stream Restoration Ideas



There are three proposed locations for new facilities to treat AMD before water is discharged back into a restored Chalfant Run channel. The floodplain of the current stream would be excavated to remove legacy sediment and a new, meandering channel constructed.

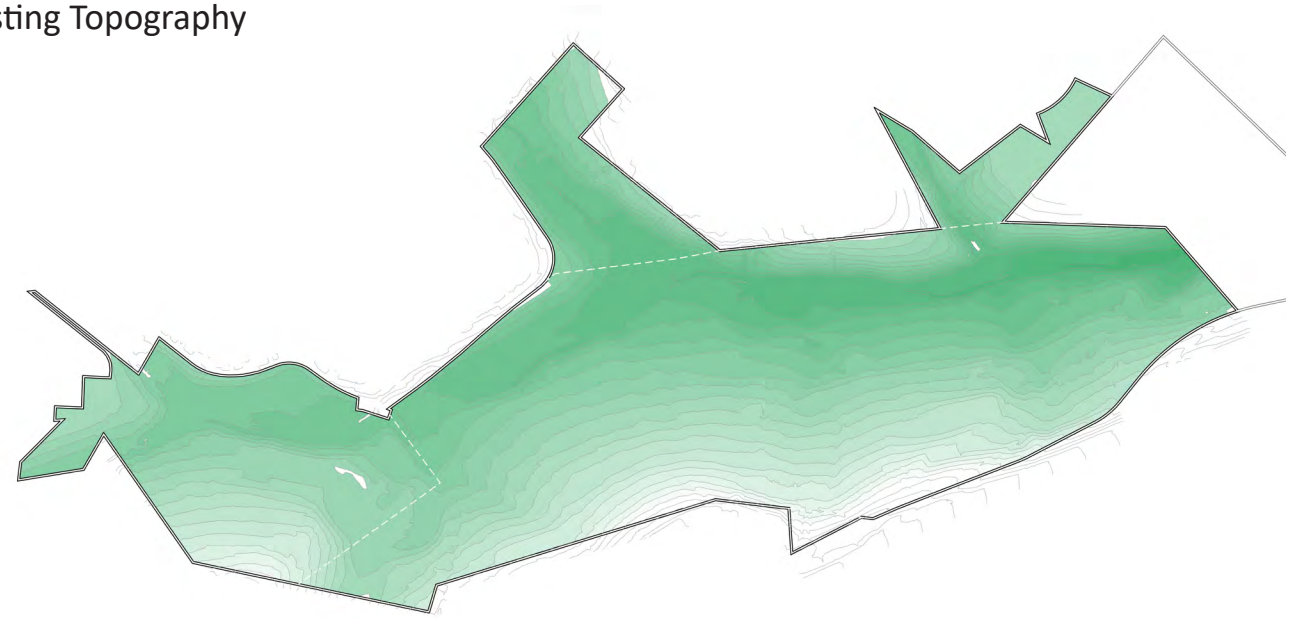
Grey color is aluminum sediment which although non-toxic, is harming the instream habitat of Chalfant Run

Reforestation Ideas

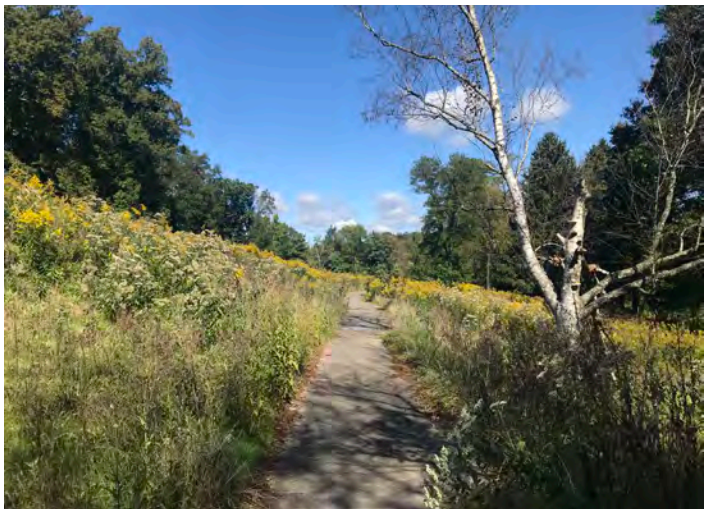
This diagram suggests reforesting select areas of the property to enhance/expand existing forest, buffer adjacent property and create additional woodland habitat. Reforestation efforts will not only sequester carbon but also reduce the amaount of meadow that needs to be maintained.

Large mature oaks are features throughout the property and separated/defined the former golf course fairways. These should be preserved to frame vistas and define meadows.

Existing Topography

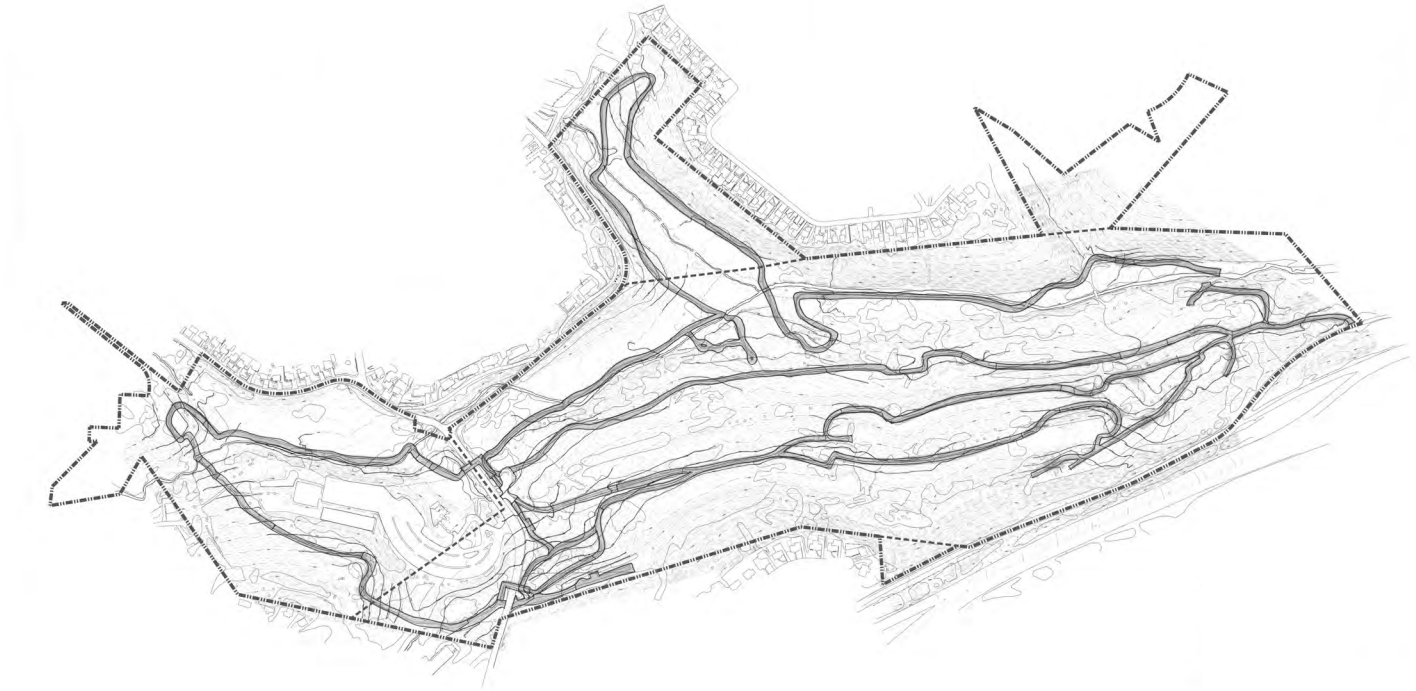


Formerly graded as a golf course, the property has relatively gentle slopes that descend towards Chalfant Run and modest high and low points that were formerly tees or greens. The topography helps define the property and contributes to the long vistas that are so unique to this property.



Former cart path downslope from former tee box

Existing Infrastructure



The property contains remnant infrastructure (parking lots, utilities, bridges, trails) that were necessary for the former golf course. To the greatest extent possible, this infratsructure can be re-used and is one of the property's greatest assets. Golf cart bridges over Chalfant Run will be removed when stream restoration occurs, and only select crossings will be reestablished.

Parking lot on western side of Beulah Road

CONCEPT PLAN

CHURCHILL VALLEY GREENWAY
January 2022

Legend

- EXISTING MEADOW
- EXISTING WOODLANDS
- PROPOSED REFORESTATION
- NEW STREAM CHANNEL
- NEW FLOODPLAIN WETLANDS
- AMD TREATMENT FACILITY
- EXISTING TRAILS TO REMAIN
- NEW TRAILS
- PARKING LOT

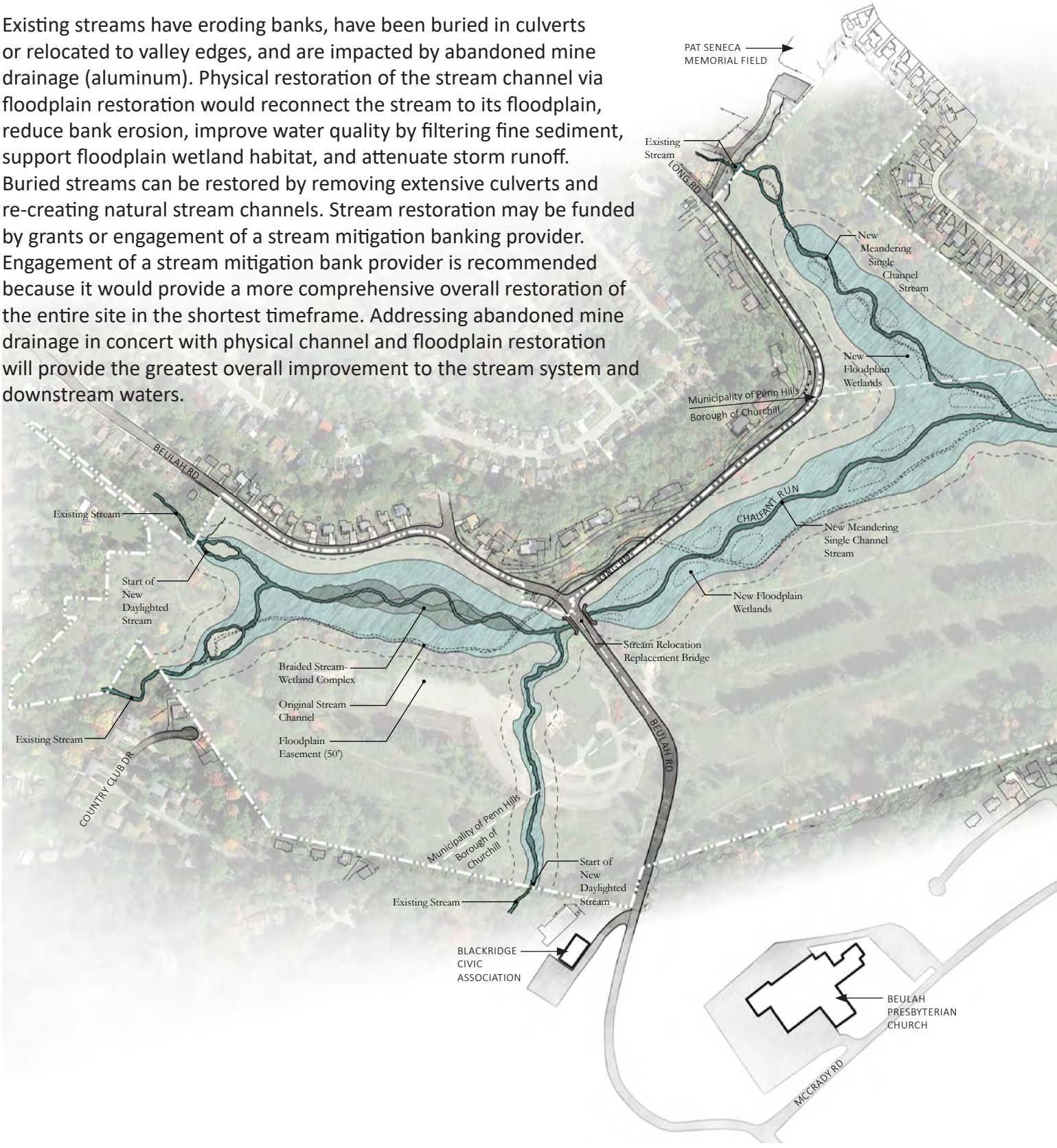
Proposed Abandoned Mine Drainage Strategies

Aluminum precipitate from abandoned mine drainage (AMD) is entering the property from three tributaries. Hedin environmental has indicated that the first and most important contributor would best be addressed by capturing the AMD at its point of inflow to the stream (on the Brackenridge Swim Club property), diverting it via pipe to an AMD treatment system that allows the dissolved aluminum to precipitate and settle out of the water column, and releasing it back to the stream. The other two tributaries consist of aluminum sediment, which is non-toxic but contributes excess sediment to the stream, harming instream habitat. These tributaries can likely be treated by constructed wetlands that filter the aluminum precipitate and other fine sediment out of the water column as it passes through. Additional water chemistry testing is necessary to determine the best approaches and sizing for each of these systems.

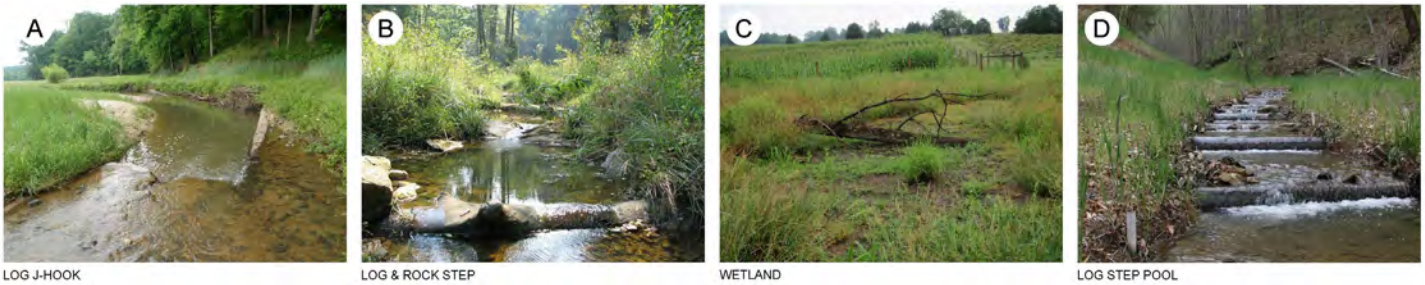
Examples of different techniques to treat low pH (aluminum) abandoned mine drainage

Proposed Stream Restoration Strategies

Existing streams have eroding banks, have been buried in culverts or relocated to valley edges, and are impacted by abandoned mine drainage (aluminum). Physical restoration of the stream channel via floodplain restoration would reconnect the stream to its floodplain, reduce bank erosion, improve water quality by filtering fine sediment, support floodplain wetland habitat, and attenuate storm runoff. Buried streams can be restored by removing extensive culverts and re-creating natural stream channels. Stream restoration may be funded by grants or engagement of a stream mitigation banking provider. Engagement of a stream mitigation bank provider is recommended because it would provide a more comprehensive overall restoration of the entire site in the shortest timeframe. Addressing abandoned mine drainage in concert with physical channel and floodplain restoration will provide the greatest overall improvement to the stream system and downstream waters.



Erosion is degrading former golf cart paths, which were constructed too close to Chalfant Run



Different examples of stream restoration techniques

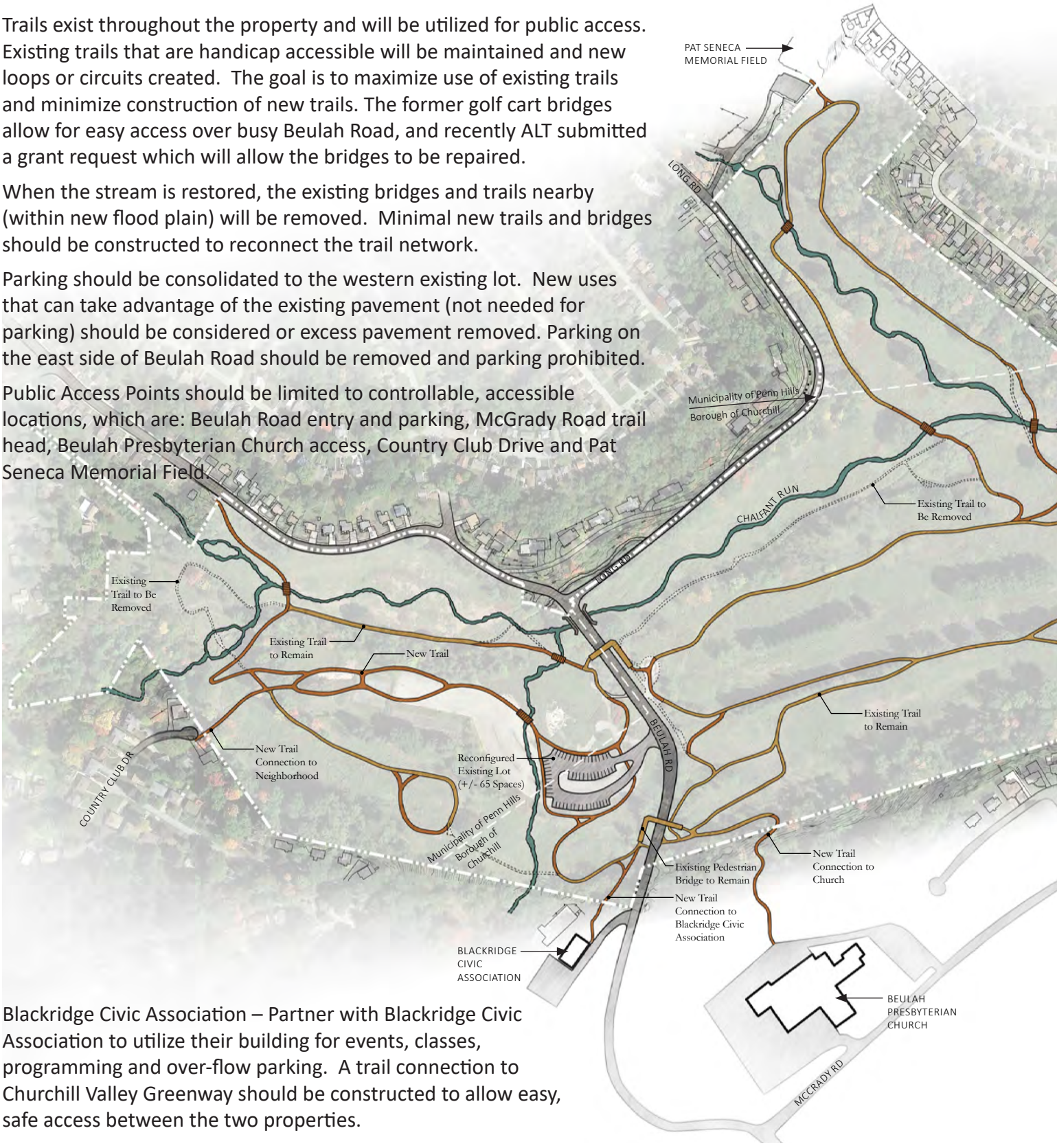
Proposed Trails, Parking and Public Access

Trails exist throughout the property and will be utilized for public access. Existing trails that are handicap accessible will be maintained and new loops or circuits created. The goal is to maximize use of existing trails and minimize construction of new trails. The former golf cart bridges allow for easy access over busy Beulah Road, and recently ALT submitted a grant request which will allow the bridges to be repaired.

When the stream is restored, the existing bridges and trails nearby (within new flood plain) will be removed. Minimal new trails and bridges should be constructed to reconnect the trail network.

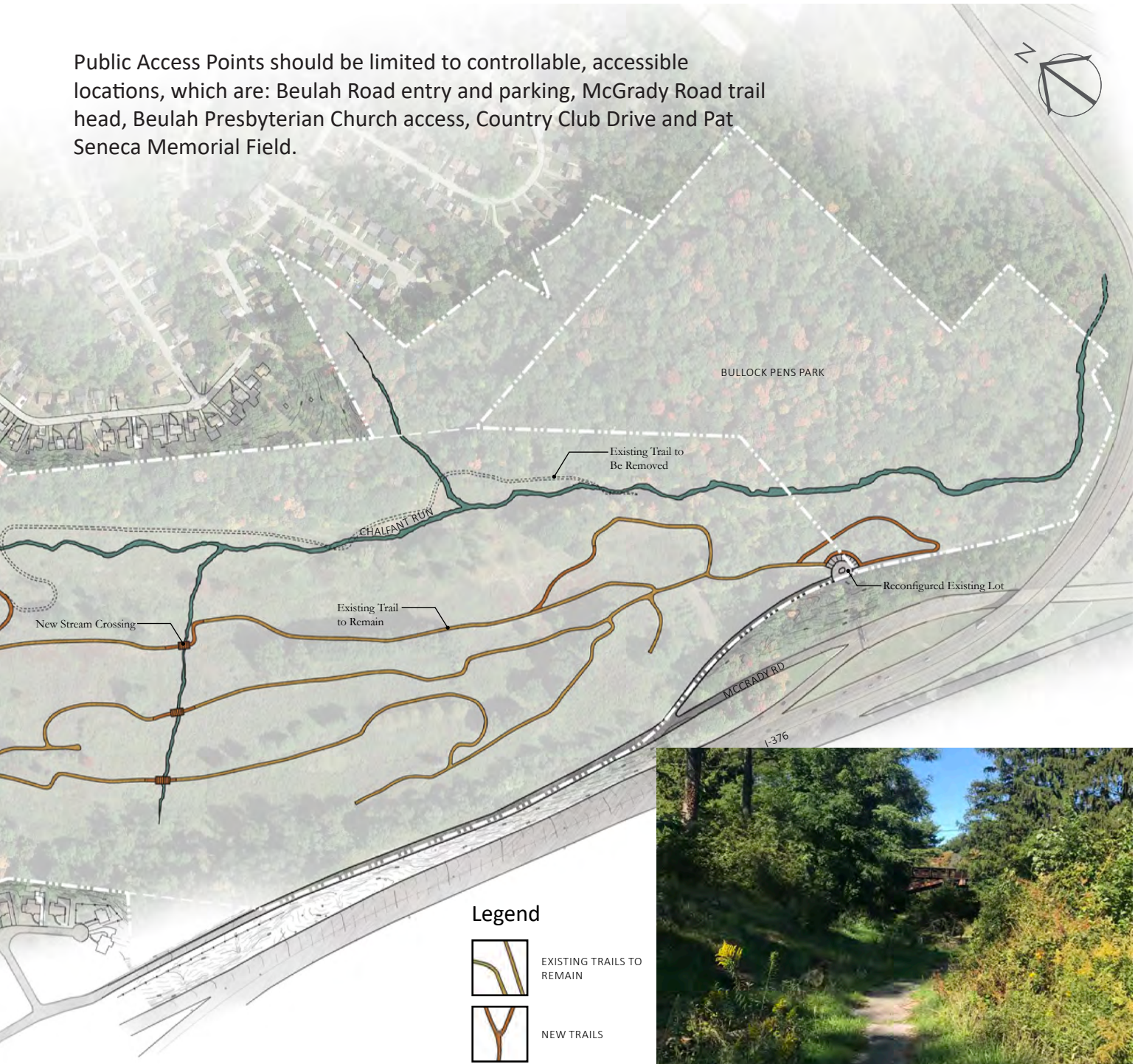
Parking should be consolidated to the western existing lot. New uses that can take advantage of the existing pavement (not needed for parking) should be considered or excess pavement removed. Parking on the east side of Beulah Road should be removed and parking prohibited.

Public Access Points should be limited to controllable, accessible locations, which are: Beulah Road entry and parking, McGrady Road trail head, Beulah Presbyterian Church access, Country Club Drive and Pat Seneca Memorial Field.



Blackridge Civic Association – Partner with Blackridge Civic Association to utilize their building for events, classes, programming and over-flow parking. A trail connection to Churchill Valley Greenway should be constructed to allow easy, safe access between the two properties.

Public Access Points should be limited to controllable, accessible locations, which are: Beulah Road entry and parking, McGrady Road trail head, Beulah Presbyterian Church access, Country Club Drive and Pat Seneca Memorial Field.



Beulah Presbyterian Church – Create trail connection between Churchill Valley Greenway and adjacent Church trails, which lead to their planned outdoor classroom. This would extend/expand the trail system within the Greenway and even allow users to park at the Church or park-and-ride to access the Greenway.

Gently sloping trails are handicap accessible and will remain. The pedestrian bridges (in background) will be rehabiliated for easy pedestrian access over Beulah Road.

Proposed Reforestation Strategies

Areas around the edges of the property present opportunities for reforestation without interfering with the core meadow habitat and views across the valley. Reforestation would provide a visual and noise buffer to busy streets and highways, increase carbon sequestration, and provide habitat for plants and wildlife. Heavily browsed oak brush indicates that need for deer protection (e.g., fencing) but suggests in many areas, sufficient natural regeneration exists to support reforestation without planting. However, supplemental planting would be beneficial to increase forest tree diversity and fill out areas that are farther away from existing seed sources and lack advance regeneration. A long-term monitoring program could be implemented in coordination with local high schools that supports their educational goals while providing valuable data to ALT.

Quality grassland, meadow, and savanna habitats are rare and declining in Pennsylvania, and experience threats due to ongoing commercial, residential, and industrial development. As a result, many species of birds, mammals, and invertebrates (such as butterflies and other pollinators) are in decline in the state. Besides their value for native plant and animal habitat, meadow habitat can also contribute to carbon sequestration, with higher diversity habitats accumulating more carbon each year than low-diversity habitats.

Legend

- EXISTING MEADOW
- EXISTING WOODLANDS
- PROPOSED REFORESTATION
- NEW FLOODPLAIN WETLANDS

Reforestation efforts should focus on reinforcing the perimeter boundary of the property

Inclusive, Accessible Playground

CHURCHILL VALLEY GREENWAY

January 2022

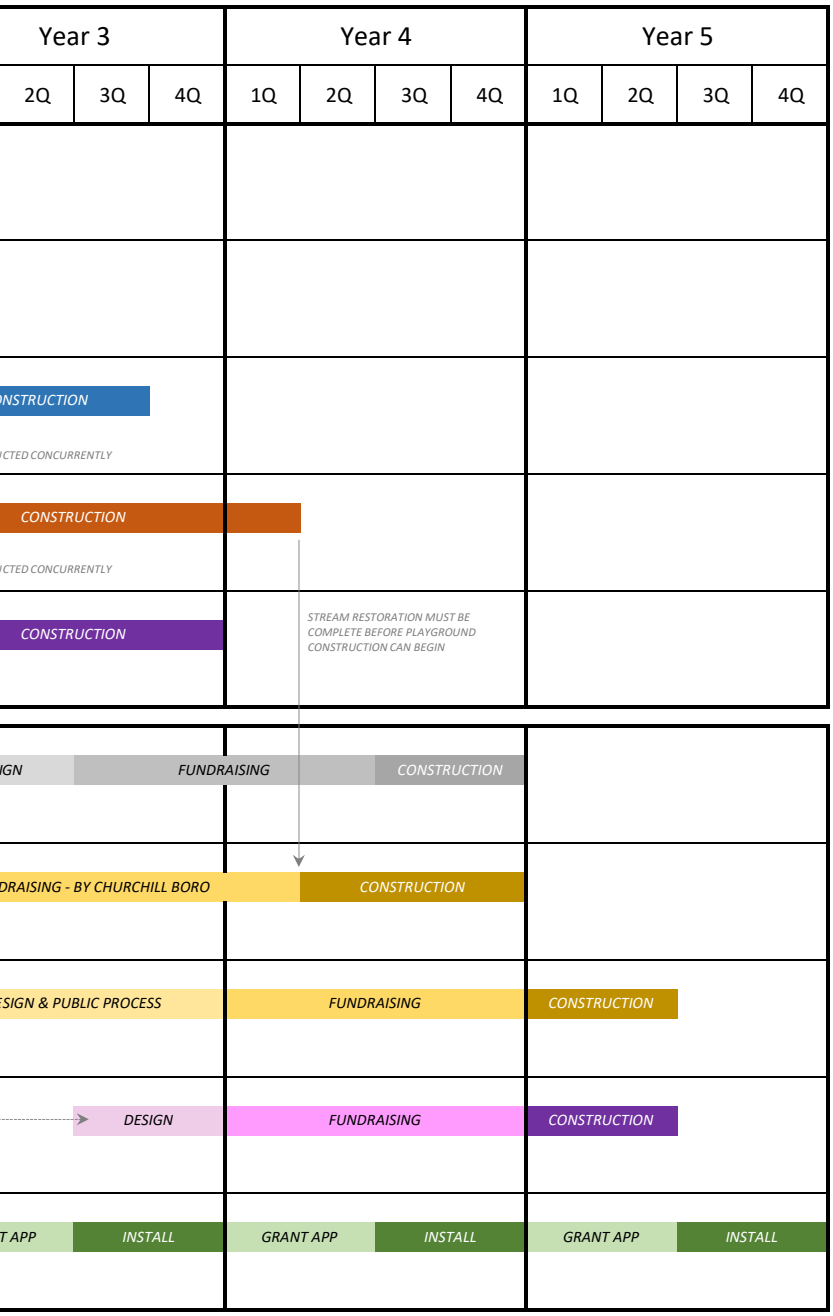
Allegheny Land Trust is open to exploring the possibility of a land swap with Churchill Borough to acquire Bullocks Pens Park and expand the deep valley and dense forests of the Churchill Valley Greenway. Churchill borough has expressed a desire to construct an inclusive, accessible natural play area. The play area should be approximately 6-acres, located near parking and trails, with easy access to adjacent neighborhoods. The playground should be constructed of natural materials and carefully designed to fit into the property's rolling topography and unique vegetation. The following are a few examples of what the playground might look like.

IMPLEMENTATION MATRIX AND PRELIMINARY COST ESTIMATE

The following matrix provides a sequence of implementation projects, including a relative timeline for both engineering ar
over Beulah Road, therefore that has been identified as Project 1. Allegheny Land Trust has also submitted a grant applica
stream restoration and Replace Trails and Bridges need to occur simultaneously so their engineering requirements can be
as they can occur anytime funding is available. The exact timeline for any of these projects is dependent upon funding, pa
durations are subject to change.

Sequence	*Description*	2022				Year 2				
		1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q
1	**Repair (2) Pedestrian Bridges over Beulah Road** Grant application approved in 2021, needs engineering for railing/decking, MPT	ENGINEERING		CONSTRUCTION						
2	**Master Management Plan** Ceate plan to maintain/manage property and 30% design for critical areas		FUNDRAISING			RFP	PLANNING			
3A	**Abandoned Mine Drainage** Additional sampling required before engineering can be completed	SAMPLING & 40% ENGINEERING				PERMITTING & FUNDRAISING				CO
										CONSTRU
3B	**Stream Restoration (assumes mitigation banking)** Assumes mitigation bank partner will fund engineering & construction				ENGINEERING & PERMITTING					
										CONSTRU
3C	**Replace Trails and Pedestrian Bridges in Stream Floodplain** Replace trails and bridges in floodplain, permitted with stream restoration				DESIGN & PERMITTING WITH STREAM					
4	**Beulah Road Safety Improvements** Remove existng parking, install fence and native landscaping		INSTALL BARRIERS EAST SIDE							DESI
5A	**Churchill Land Negotiations** Including Bullock Pens Park and inclusive accessible playground	LAND SWAP DISCUSSION				BULLOCK PENS PARK ADDED TO MANAGEMENT PLAN SCOPE PLAYGROUND PLANNING, DESIGN AND FUN				
5B	**McGrady Road Trailhead** Construct parking and signage, and reduce roadway to trail width									DE
5C	**New Trails and Signage** Create loops, connect to BCA, Church and Bullock Pens, signage									
6	**Reforestation Projects** Assumes yearly partnership with allied group to foster stewardship/ reduce cost	GRANT APP		INSTALL		GRANT APP		INSTALL		GRAN

nd construction as well as estimated costs. Allegheny Land Trust has received grant funding to repair the bridges ation to prepare a Master Management Plan, so that is identified as Project 2. Abandoned mine drainage, coordinated, therefore these projects have been identified as 3A-3B-3C. All other projects are identified as 4 - 6 artnerships with allied organizations and Allegheny Land Trust staffing/capacity, therefore start-dates and



Engineering Cost:	$20 - $25,000
Construction Cost:	$350 - $400,000
Planning Cost:	$150,000
Construction Cost:	$0
Engineering Cost:	$75 - $100,000
Construction Cost:	$300 - $350,000
Engineering Cost:	$200 - $300,00 (mitigation par
Construction Cost:	$2M - $4M (mitigation partner
Design Cost:	$40 - $50,000 (mitigation partn
Construction Cost:	$500 - $550,000 (mitigation pa
Design Cost:	$15 - $20,000
Construction Cost:	$75 - $100,000
Design Cost:	$0 (Churchill)
Construction Cost:	$0 (Churchill)
Design Cost:	$10 - $15,000
Construction Cost:	$50 - $75,000
Design Cost:	$15 - $20,000
Construction Cost:	$175 - $200,000
Design Cost:	$2,500 - $3,500
Construction Cost:	$30 - $60,000 (grants)

FOCUS GROUP SUGGESTIONS

During the Focus Group meetings, a number of ideas for activities and potential

Existing Uses/Activities

- Drone Races
- Walking / Running / Jogging
- Bicycles are permitted on trails
- Dog Walking
- Bird Watching
- Story Walk
- Sled riding slopes
- Hunting and trapping are not permitted

New Uses/Activities:

- Cross-County Practice
- Inclusive/Accessible/Natural Playground
- Sensory Trail with loops and braille signage
- Cross-Country skiing
- No designated off-leash dog areas are proposed.

Signage should be simple and understated, as to not distract from the properties beauty

Suggested Amenities:

- Memorial tree grove to recognize special donors
- Remember former golf course with map of fairway layout and historic pictures
- Benches
- Simple Wayfinding Signage
- Interpretive Signage
- Circuits or identified trail loops with mileage indicated
- Typically trash cans are not provided so users take trash with them

Considerations:
A revenue model should be explored for a farmer's market, food trucks or coffee truck tshat could utilize the existing parking lot. These activities could potentially increase visibility of the property, attract new users and generate income for property maintenance.

"Food Truck Day" would be a fun way to attact new users to the Greenway and generate revenue for maintenance

APPENDIX

Assessment of Abandoned Mine Drainage at the ALT Churchill Valley Country Club Site
(Hedin Environmental - December 2019)

Conceptual Design – Churchill Valley Country Club Mitigation Bank
(Water & Land Solutions)

Assessment of Abandoned Mine Drainage at the ALT Churchill Valley Country Club Site

Technical Report Provided by Hedin Environmental for Allegheny Land Trust through the Trout Unlimited AMD Technical Assistance Program

December 2019

Assessment of Abandoned Mine Drainage at the ALT Churchill Valley Country Club Site

Technical Report Provided by Hedin Environmental for Allegheny Land Trust through the Trout Unlimited AMD Technical Assistance Program
October 2019

Background

The Churchill Valley Country Club (CVCC), located in the Churchill and Penn Hills boroughs in Allegheny County, PA, operated from 1931 to 2013. Since the club's permanent closure and abandonment, the Allegheny Land Trust (ALT) has begun the process of acquiring the 148-acre property and preserving it as a community greenspace. As a part of their environmental consideration of the property, ALT requested that Trout Unlimited's AMD Technical Assistance Program evaluate the presence and significance of abandoned mine drainage on the site.

Chalfant Run and its unnamed tributaries (UNTs) flow through the abandoned country club property and serve as the site's primary water features. The Chalfant Run watershed originates approximately one mile northeast of the property. The stream flows through the site for 0.7 miles and continues for 1.8 miles to Thompson Run which flows into Turtle Creek and ultimately into the Monongahela River. In the central part of the property, the main stem of Chalfant Run receives a large unnamed tributary originating from the northwestern part of the watershed. Figure 1 depicts the site. The property comprises several parcels; the northern part of the property is located in the municipality of Penn Hills, and the southern part of the site is located in the borough of Churchill. A relevant parcel owned by the Blackridge Civic Association is adjacent to the CVCC property. Note that the unnamed tributaries to Chalfant Run have been named UNT #1-3 for the purpose of this report.

Historic mine maps indicate that the Pittsburgh coal seam was deep mined in the Churchill area in the early 1900's. Strip mining followed in the 1940's, however, little evidence of this activity remains due to subsequent reclamation required by the municipality of Penn Hills and the development of the land for housing. Due to these historic mining activities, waters in the Chalfant Run watershed are polluted with abandoned mine drainage (AMD). AMD forms when water flows through abandoned mines and reacts with pyrite and other minerals to form metal-laden pollution that can be highly acidic. Because the mining in the Churchill area occurred before federal mining legislation was in place, no company is held responsible for the ongoing pollution that persists today. All of the waters flowing through the site are listed as impaired by AMD according to the PADEP 2018 Integrated Report.

Operation Scarlift

Operation Scarlift was a Pennsylvania state program that conducted assessments of AMD-influenced watersheds in the 1960s and 1970s. An assessment of the Chalfant Run watershed was published in 1975 as part of this program; it sampled 12 points within the property, and many more locations elsewhere in the watershed. This Scarlift Report serves as the main source of background information on the Chalfant Run watershed. Sampling results from the Report are

shown in Table 1. Sampling points in the table below correspond to the points shown in Figure 2. Only points within or near the CVCC site are shown in this table and figure.

All of the samples given in the table are in-stream samples unless parenthetically noted to contain a discharge (D-#). Discharges D-8 and D-10 are located directly on the property, while discharges D-9, D-11, D-12, D-13, D-14, and D-19 are located within a close vicinity of the property.

Table 1. Operation Scarlift data from Chalfant Run report. Values are averaged from the test results in the Report's appendix. S indicates a sample, SF indicates a sample and flow measurement, and D indicates a discharge sample.

Point Number	Location	Sample Type	pH	Acidity	Alkalinity	Fe	Sulfate	Al	Flow
			s.u.	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(gal/min)
23S	Onsite	Sample	5.85	50	15	0.9	423		
24S	Nearby	Sample, pH only	7.50						
25S	Nearby	Sample, pH only	6.60						
26S	Nearby	Sample, pH only	7.00						
27S (D-8)	Onsite	Sample, pH only	5.00						
28S	Onsite	Sample	5.70	36	58	0.2	175	1.5	
29SF	Onsite	Sample + Flow	6.20	30	49	0.8	222	1.7	561
30S (D-10)	Onsite	Sample	5.34	63	8	0.7	567	14.6	
31SF	Nearby	Sample + Flow	4.97	86	6	1.2	493		132
35S	Onsite	Sample, pH only	5.00						
36 SF	Onsite	Sample + Flow	4.51	126	2	2.1	409	8.9	550
37S	Onsite	Sample	5.19	66	12	1.8	438	7.6	
38S	Onsite	Sample, no data							
39S	Nearby	Sample	3.91	179	1	4.0	416	9	243
40S (D-12)	Nearby	Sample	3.52	289	0	25.2	538		
41SF	Onsite	Sample + Flow	4.70	94	5	1.4	392	4.8	330
42SF	Onsite	Sample + Flow	5.98	42	19	1.3	339	3.9	212
44S	Onsite	Sample	4.58	138	3	2.9	474	5.9	
45SF (D-19)	Nearby	Sample + Flow	3.49	255	0	7.9	529	14.3	278
D-9	Nearby	pH only	4.50						
D-13	Nearby	No Data Presented in Report							
D-14	Nearby	No Data Presented in Report							

The Scarlift Report characterized Chalfant Run as being impaired by AMD from its inception all the way to its confluence with Thompson Run. The report concluded that "the major portion of acid mine drainage results from the discharge of acid mine water flows in the Blackridge areas, Discharge D-12 (Point 40S), and also from Park Avenue, Discharge D-19 (Point 45SF)." The D-12 discharge is located on what is now Blackridge Civic Association property, and the D-19 discharge is located 0.2 miles away from the northern edge of the site near the 2019 location of

Penn Hills Worship on Parkway Ave (not shown on Figure 2). This discharge is likely now culverted into UNT-1 somewhere north of the site.

The report noted the significance of alkaline contributions of raw sewage overflows and treated sewage effluent from the Penn Hills Long Road wastewater treatment plant. This was the main source of the stream's alkalinity at the time of the report.

Mine Drainage Investigation

The mine drainage investigation was conducted by TU's local contractor, Hedin Environmental (HE). The investigation occurred over one primary sampling event in August 2019, and one follow-up sampling event in October 2019. The mine drainage investigation was designed to roughly mirror the Scarlift investigation from 1975 so the results could be compared. Figure 3 shows the 2019 sampling map.

During initial site reconnaissance that occurred earlier in the summer, HE and ALT determined that the mine drainage investigation would need to occur during a period of low flow. Chalfant Run and its unnamed tributaries receive combined sewer overflow from the surrounding area, and a minimal amount of rainfall leads to a flashy response on the CVCC property. For example, in late July, storm flows from several days of heavy rain resulted in the destruction of several bridges and paths near the stream. Initial reconnaissance also determined that, when the area surrounding the property was developed post-Scarlift, AMD discharge pipes were combined with sewer and stormwater pipes. There do not appear to be any sources of AMD onto the property that are separate from the storm sewer, and Chalfant Run and its tributaries are influenced by sewage pollution. Due to the importance of dry-weather sampling, the mine drainage investigation on 8/26 and 10/15 occurred after periods of relative dryness. During both of these sampling events, the stream beds were visibly coated with a white precipitate indicative of precipitated aluminum solids.

Site reconnaissance also determined that several discharges recorded in the Scarlift report are no longer present—both D-10 and D-8 could not be located, and negative effects caused by these discharges were not apparent.

Chemistry was determined by measuring field parameters (pH, conductivity, temperature) on-site, and bottled samples were sent to G&C Laboratory (Summerville, PA) for analysis of standard mine drainage parameters: pH, alkalinity, acidity, conductivity, total suspended solids, aluminum (Al), iron (Fe), manganese (Mn) and sulfate. Both filtered and unfiltered samples were submitted for analysis so that both total and dissolved metals could be analyzed.

Results

The results of the mine drainage investigation are presented in Table 2, and a comparison of common sampling sites and parameters between the 1975 Operation Scarlift study and the 2019 study is presented in Table 3. No AMD discharges were found on the property; the quality of water flowing through the site is impacted by AMD discharges off-site. Conditions in Chalfant Run have improved significantly since the 1975 Scarlift Report. Acidity has decreased by an

average of 141%, pH has increased by an average of 36%, and iron and aluminum have both decreased by an average of approximately 70%. This improvement can be partially attributed to the natural attenuation of AMD discharge chemistry, which is a common phenomenon in the region. The improvement may also be caused by an increase in the inflow of alkaline inputs to the streams arising from sewage (both raw and treated wastewater are alkaline) and runoff from developed land.

Table 2. Sampling results from the 2019 TU TAG mine drainage investigation. All points were sampled on 8/26/19, except for point 23, which was sampled on 10/15/19

2019 Sample	Scarlift Sample	Description	Flow	Field pH	Cond.	Field Alk.	Acidity	Total Iron	Total Mn	Total Al	SO_4	TSS
			gal/min	s.u.	umhos	mg/L as $CaCO_3$	mg/L as $CaCO_3$	mg/L	mg/L	mg/L	mg/L	mg/L
42	42SF	Sample of UNT-2	10	6.96	1392	113	-108	<0.1	<0.05	<0.1	354	<5
44	44S	Upstream sample of UNT-1	390	6.02	943	6	4	0.1	0.4	0.2	302	12
41	41SF	Sample of UNT-1 after it converges with UNT-2		7.09	985	44	-7	0.7	0.4	3.9	254	64
39	39S	Upstream sample of UNT-3	354	4.90	1013	8	21	0.3	0.6	3.1	287	7
36	36SF	Sample of UNT-1 after it converges with UNT-3	744	6.20	990	10	0	0.4	0.5	1.1	199	10
28	28S	Upstream sample of Chalfant Run	36	7.23	1045	71	-50	0.1	0.2	1.4	298	16
D-9	D-9	Small seep of water coming down hillside into channel	5	7.12	911	47	-25	0.4	0.4	1.2	329	9
27.5	---------	In-stream sample of Chalfant Run downstream of its confluence with UNT-1	744	7.06	1048	15	-44	0.1	0.4	1.5	320	10
23	23S	Downstream (final) sampling location of Chalfant Run		7.60	918	31	-21	<0.1	0.2	0.3	236	5

Despite the improvement that has been realized in the 44 years since the Chalfant Run Scarlift Report was published, the stream remains mildly impaired due to AMD. The stream is likely also impaired due to sewage parameters, though these parameters were not studied as part of this

project. At this time, the major source of AMD impairment to the CVCC property is UNT-3 (point 39), which conveys discharge D-12 into the watershed via a storm culvert. Visual evidence and anecdotal reports indicate that this culvert also conveys storm/sewage water during rain events. UNT-1 (point 44) is the other source of mildly acidic water onto the site, with the impairment likely originating from discharge D-19 as discussed above. The acidity from UNT-1 is partially neutralized by alkaline water from UNT-2, but the stream below the confluence of all these tributaries, measured at point 36, has pH 6.2, no net alkalinity, and contains suspended Al solids.

Table 3. Comparison of Scarlift and 2019 sample results for common parameters

Sample Name		**pH**		**Alkalinity**		**Acidity**		**Iron**		**Alum.**		**SO_4**	
		s.u.		mg/L as $CaCO_3$		mg/L as $CaCO_3$		mg/L		mg/L		mg/L	
1975	**2019**	**1975**	**2019**	**1975**	**2019**	**1975**	**2019**	**1975**	**2019**	**1975**	**2019**	**1975**	**2019**
42SF	42	4.70	6.96	5	113	94	-108	1.4	<0.1	4.8	<0.1	392	354
44S	44	4.58	6.02	3	6	138	4	2.9	0.1	5.9	0.2	474	302
41SF	41	4.70	7.09	5	44	94	-7	1.4	0.7		3.9	330	254
39S	39	3.91	4.90	1	8	179	21	4.0	0.3	9.0	3.1	416	287
36SF	36	4.51	6.20	2	10	126	0	2.1	0.4	8.9	1.1	550	199
28S	28	5.70	7.23	58	71	36	-50	0.2	0.1	1.5	1.4	175	298
23S	23	5.85	7.60	15	31	50	-21	0.9	<0.1			423	236

At the upstream Chalfant Run monitoring point (point 28), the main stem of the stream has a neutral pH, low metals, and is and net alkaline. Chalfant Run has a significantly lower flow rate than UNT-1 (36 gpm vs. 744 gpm). When it receives the impaired UNT-1 (measured at point 27.5), Chalfant Run's alkalinity decreases from 71 mg/L to 15 mg/L, pH decreases from 7.23 to 7.06, and total Al increases marginally. By the time Chalfant Run reaches the southern edge of the site (point 23), these parameters have again reached an acceptable level. At point 23, Chalfant run has a pH of 7.6, 31 mg/L alkalinity, and 0.31 mg/L total Al. Between points 27.5 and point 23, Chalfant run receives several small contributions of alkaline water, which is likely a contributing factor in the water quality improvement. Additionally, at the southernmost monitoring point, the water has flowed for long enough to naturally settle out aluminum solids.

Dissolved and total metal concentrations at each of the nine 2019 sampling points are presented in Table 4. For the majority of the sampling points, the metals exist in suspended form, not dissolved. The PADEP warm water fishery in-stream standards for total Fe, Al, and Mn are 1.5 mg/L, 0.75 mg/L, and 1.0 mg/L, respectively. All of the points are within these limits for Fe and Mn, however, every point except for points 42 and 44 are above the limits for Al. The chemical parameters above the in-stream standards are highlighted in Table 4.

Table 4. Metal concentrations for 2019 sampling points. Highlighted cells indicate values above the PA in-stream standards for warm water fisheries.

Sample Name	Description	Total Fe	Dissolved Fe	Total Mn	Dissolved Mn	Total Al	Dissolved Al
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
42	Sample of UNT-2	<0.10	<0.10	<0.05	<0.05	<0.10	<0.10
44	Upstream sample of UNT-1	0.14	<0.10	0.42	0.42	0.23	<0.10
41	Sample of UNT-1 after it converges with UNT-2	0.73	0.25	0.42	0.38	3.86	0.50
39	Upstream sample of UNT-3	0.26	0.13	0.61	0.58	3.10	2.61
36	Sample of UNT-1 after it converges with UNT-3	0.41	<0.10	0.46	0.43	1.09	0.16
28	Upstream sample of Chalfant Run	0.14	<0.10	0.17	<0.05	1.40	0.25
9	Small seep of water coming down hillside into channel	0.36	<0.10	0.42	0.35	1.18	0.16
27.5	In-stream sample of Chalfant Run downstream of its confluence with UNT-1	0.12	<0.10	0.39	0.38	1.47	0.13
23	Downstream (final) sampling location of Chalfant Run	<0.1		0.15		0.34	

It is important to note that, with the exception of UNT-3 (point 39), the points that have Al concentrations higher than the in-stream standards mostly experience this excess in the total Al category rather than in the dissolved Al category. This signifies the presence of aluminum solids that have already precipitated out of solution but haven't settled. The largest source of Al into the watershed is from UNT-3, which captures discharge D-12. The main stem of Chalfant run also contains aluminum but has a relatively low flow compared to the cumulative unnamed tributaries. The common result is that even when samples have a pH greater than 7 and are alkaline, there is 1-4 mg/L total Al. This indicates Al solids that form when low pH AMD mixes with alkaline water. The waters on the property appear to have a whitish/bluish discoloration due to these aluminum solids.

As Chalfant run and its tributaries move through the CVCC property, the water quality naturally improves. By the time the water leaves the site, it is net alkaline with neutral pH and low metals. During the two low flow sampling events, the concentration of Al solids decreases through their settling in the stream bed. Under high flow conditions, these solids are washed downstream. For the duration of its flow through the site, Chalfant Run and its tributaries suffer from low alkalinity and mild aluminum impairment.

Treatment of AMD

Treatment of acid mine water containing aluminum is accomplished by adding alkalinity and removing metals. Since the sources of AMD into the ALT site's waters are intermittently mixed with heavy flows of stormwater runoff and sewage overflow, it will be difficult to isolate the waters for treatment. Despite this limitation, water collection could occur through the use of an in-stream concrete intake structure that allows AMD-contaminated water to enter a treatment system during periods of low-flow, and diluted overflow waters to enter the original channel during storm events. A picture of this type of structure is attached at the end of the report (Photo 1).

As the largest source of pollution loading to the site, the water at point 39 would benefit the most from alkalinity addition and metals removal. Treating this water would bring benefits to the rest of the waters on the site. A variety of chemical and passive techniques are available to accomplish this goal. Chemical treatment involves hazardous reagents and is expensive, while passive treatment utilizes limestone and organic substrates to achieve treatment, typically at much lower cost. The Vertical Flow Pond (VFP) and the Drainable Limestone Bed (DLB) are the passive treatment technologies most commonly used to treat this type of AMD. A VFP is a pond that contains limestone aggregate overlain by alkaline organic substrate which is overlain by standing water. Mine water flows down through the organic matter and limestone and is treated by reactions in both substrates. A DLB is a bed of limestone aggregate flooded with AMD; it treats the water through calcite dissolution. Solids that accumulate in the aggregate are partially removed by draining the bed empty every week. The draining water is typically directed to a settling pond where the solids are retained. The limestone in the DLB must be periodically cleaned (approximately every 3-7 years). Although both technologies achieve similar results, limestone DLBs have a smaller footprint than VFPs but require more frequent maintenance.

A VFP would best serve the chemical and site conditions at UNT-3. A VFP consists of three layers, in order from bottom to top: 1-3' of limestone aggregate, 1-2' of spent mushroom compost mixed with limestone fines ("alkaline organic substrate"), and several feet of standing water. A VFP treats AMD through calcite dissolution in the alkaline organic substrate and in the limestone layer. VFPs are very effective at retaining aluminum solids in the alkaline organic substrate, thus maintaining the competency of the bottommost limestone layer. VFPs produce alkaline water with low metals. Due to flow through compost substrate, VFP effluents contain BOD and nutrients and require a polishing pond/wetland to remediate these factors. VFPs are low-maintenance. Major maintenance, replacement of the alkaline organic substrate, is required every 10-15 years.

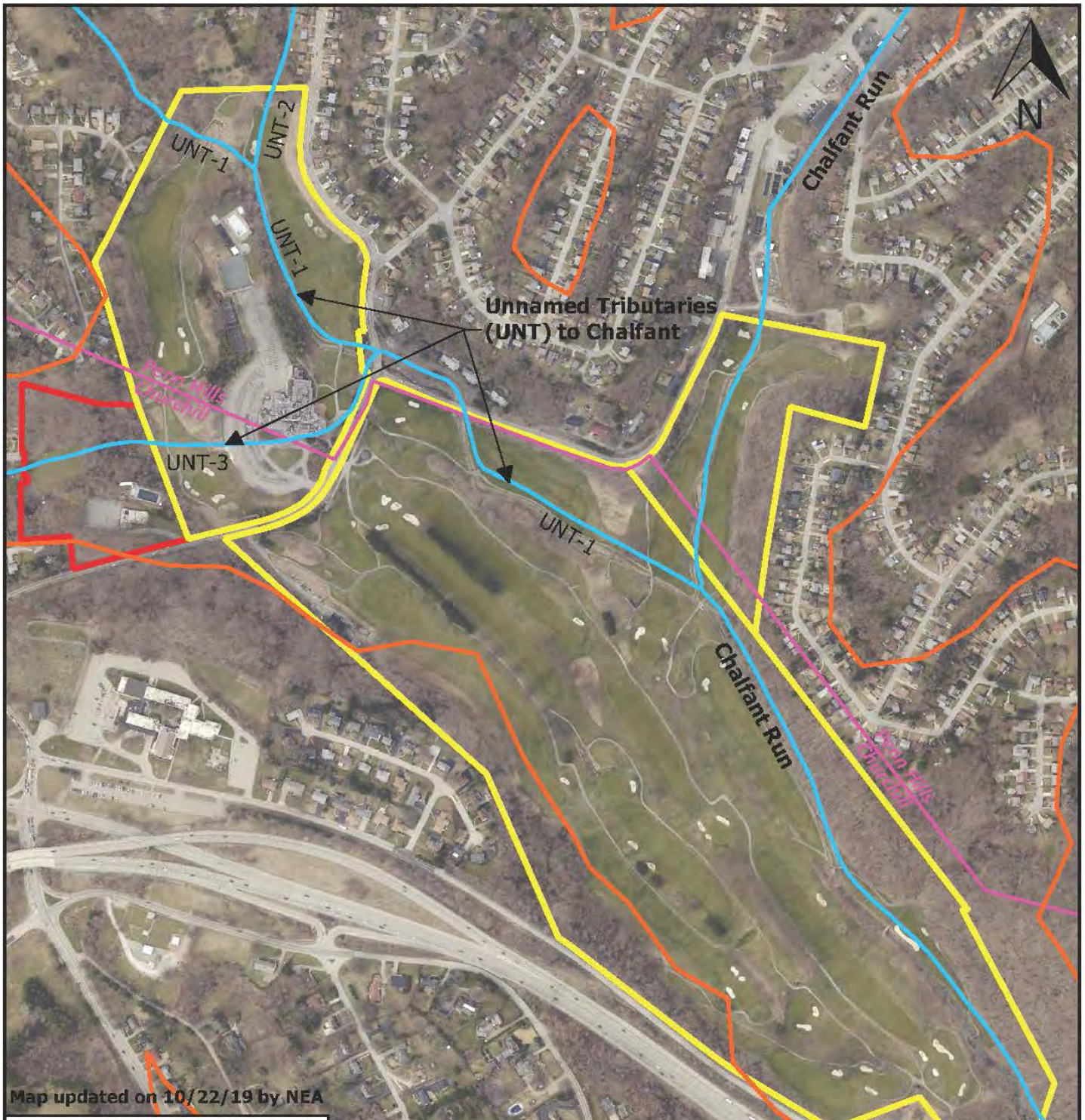
The waters on the CVCC property would also benefit from the installation of one or several constructed wetland features, especially along UNT-1 below its convergence with UNT-3 (point 36) and in the upper portion of Chalfant Run's main stem (upstream of point 28). An additional wetland feature could be constructed along UNT-1 below its convergence with UNT-2 (point 41). At these aforementioned locations, most of the AMD pollution has already entered the watershed and metals primarily exist in particulate form. The gradual decrease in metals concentrations that occurs as the streams move through the site indicates that metals are settling in the channel bed, however, it would be beneficial if this settling occurred in a separate environment. Wetlands can serve to remove particulate metals, as well as providing retention for stormwater during storm events and creating habitat.

Recommendations/Conclusion

An important finding of this investigation was that no AMD discharges exist on the Churchill Valley Country Club property, rather, AMD-impacted streams flow onto the property from elsewhere in the watershed. Additionally, the study found that the main source of AMD impairment originates from UNT-3, which conveys discharge D-12 into the watershed. Treatment efforts should be focused on this tributary. Finally, the heavy influence of stormwater and sewer overflow onto the property was noted.

If ALT seeks to install any treatment for the AMD-impaired waters on the CVCC property, a monitoring plans should be considered that involves the collection of water samples for standard mine drainage parameters every quarter. A monitoring plan can be designed using the sampling points from this study as a basis. The site is affected by stormwater and sewage; separate investigations of these issues is warranted.

Photo 1. A stream intake structure that collects and diverts a maximum flow of water to a treatment facility while bypassing flow above the maximum. The screen prevents debris from plugging the transfer pipe



Notes: Unnamed tributary segments to Chalfant Run have been named UNT #1-3 for this project only.
Property boundaries were obtained from Western PA Regional Data Center, and aerial imagery was obtained from the DCNR PAMAP Program via pasda.psu.edu.

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Figure 1: Site Map

Churchill Valley Country Club
AMD Assessment for
Allegheny Land Trust

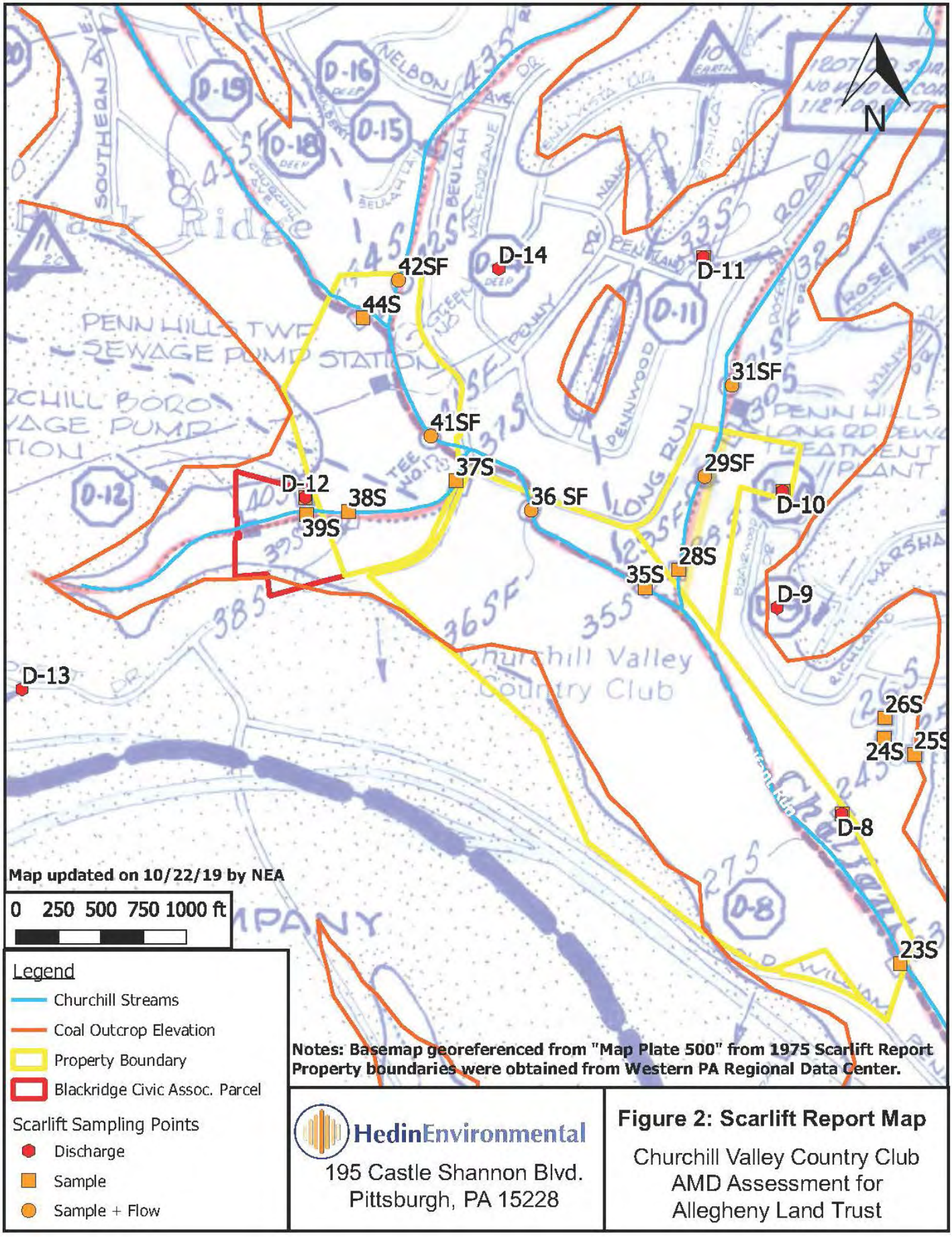

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Figure 2: Scarlift Report Map

Churchill Valley Country Club
AMD Assessment for
Allegheny Land Trust

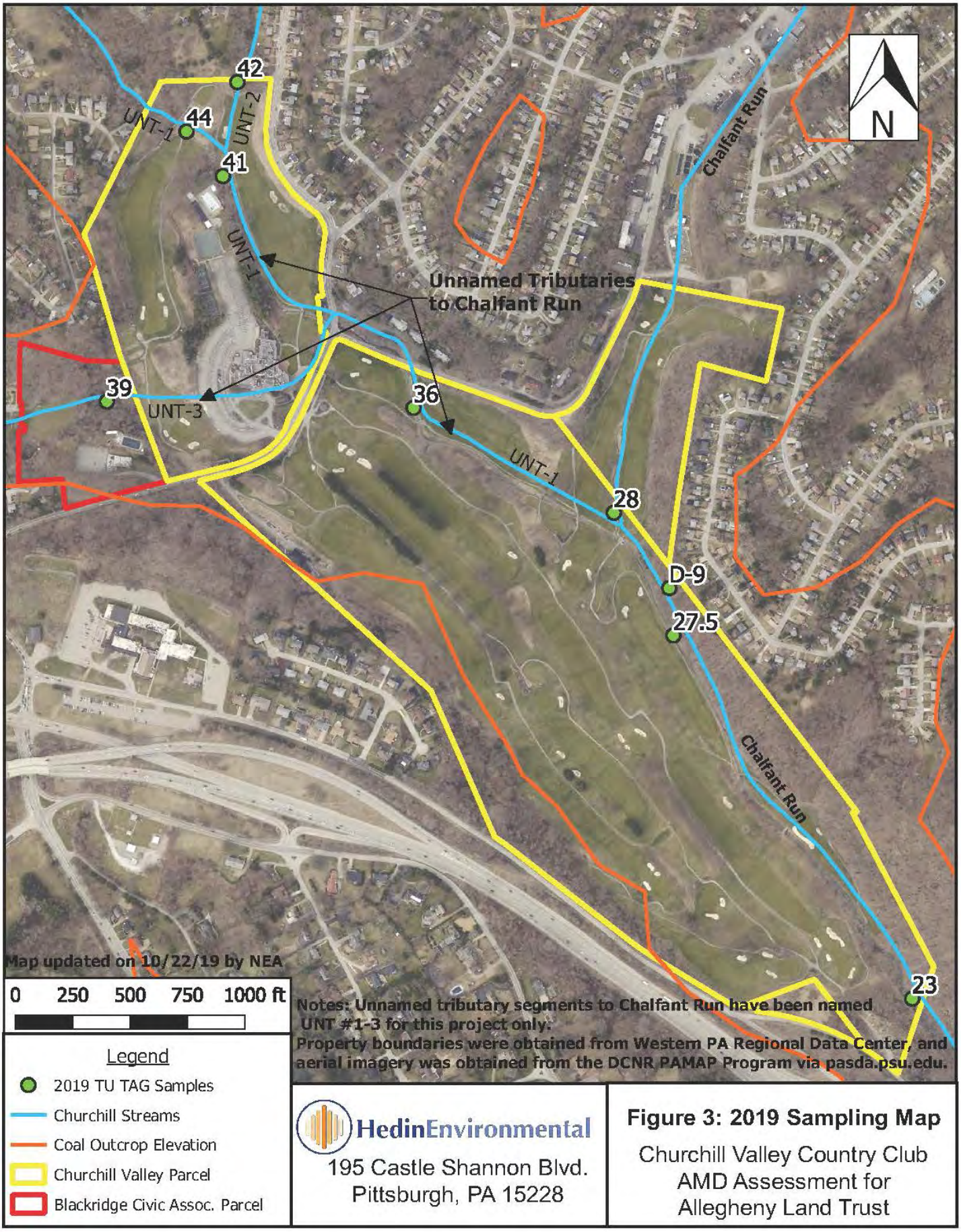

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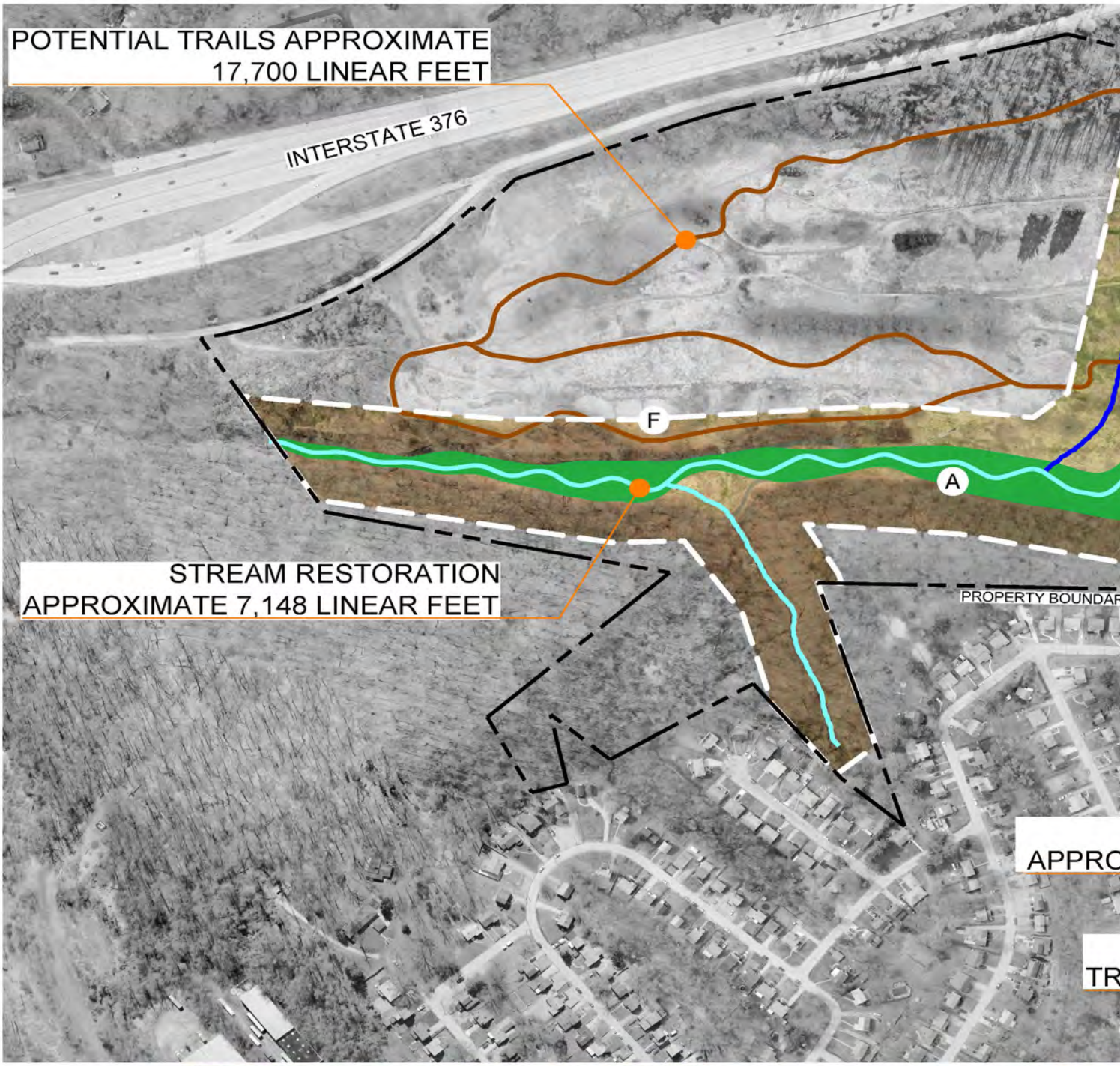
Figure 3: 2019 Sampling Map

Churchill Valley Country Club
AMD Assessment for
Allegheny Land Trust



LOG J-HOOK

LOG & ROCK STEP

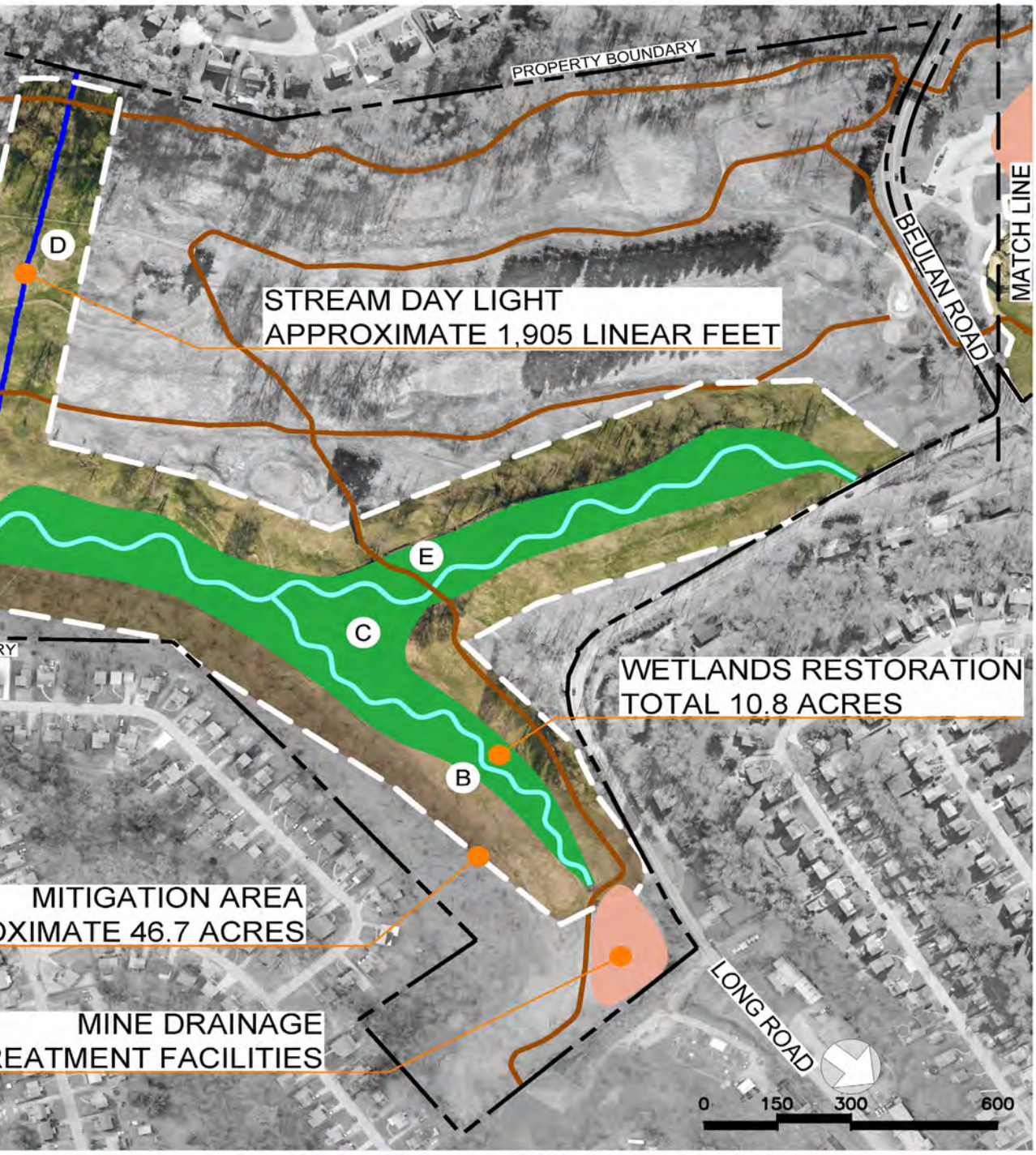
WETLAND

LOG STEP P

CHURCHILL VALLEY COUNTY CLUB MITIGATION BANK

Water & Land Solutions Conceptual Design

ALLEGHENY LAND TRUST

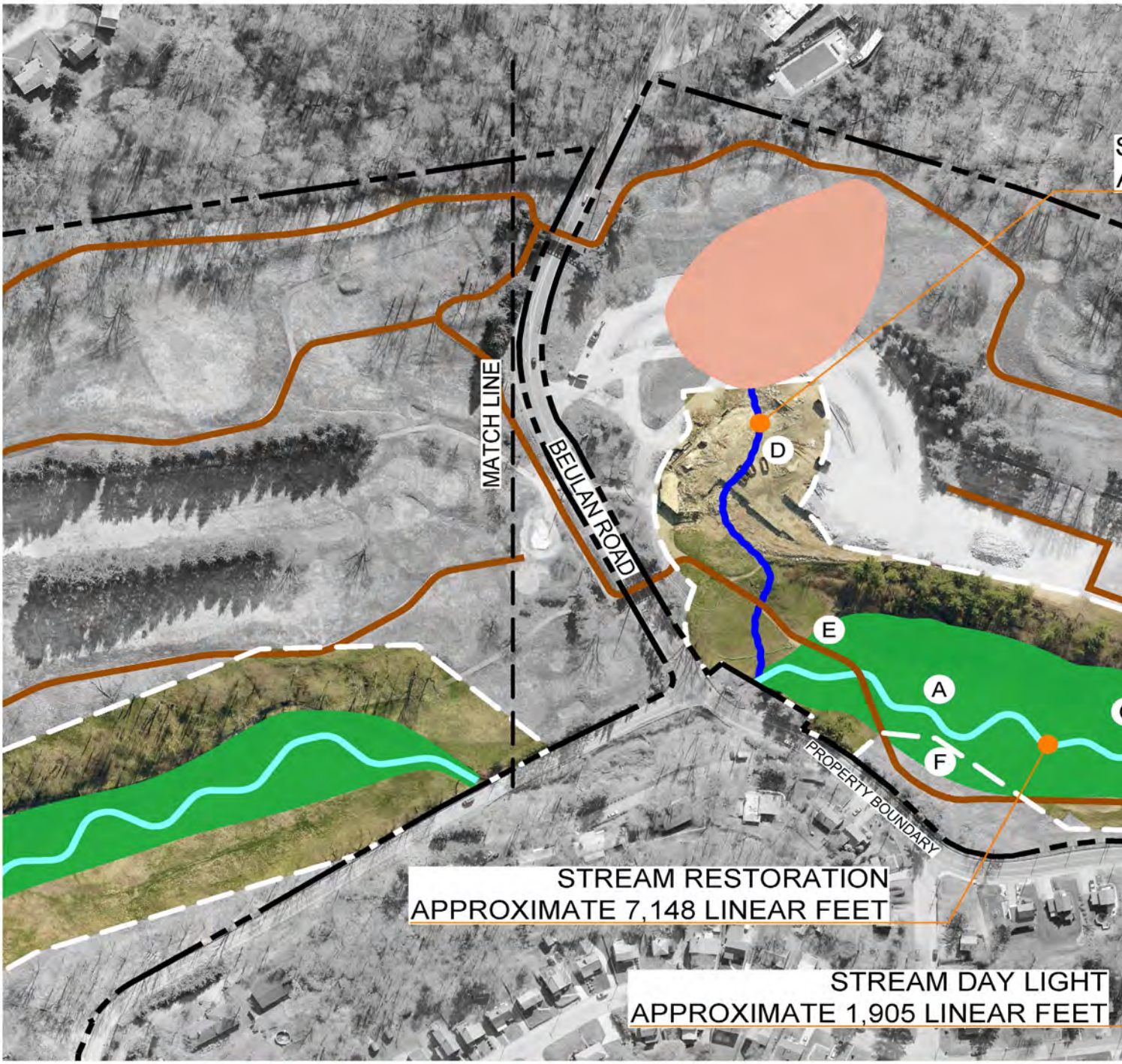


POOL

TRAIL CROSSING

SEATING AREA

WATER & LAND™ SOLUTIONS

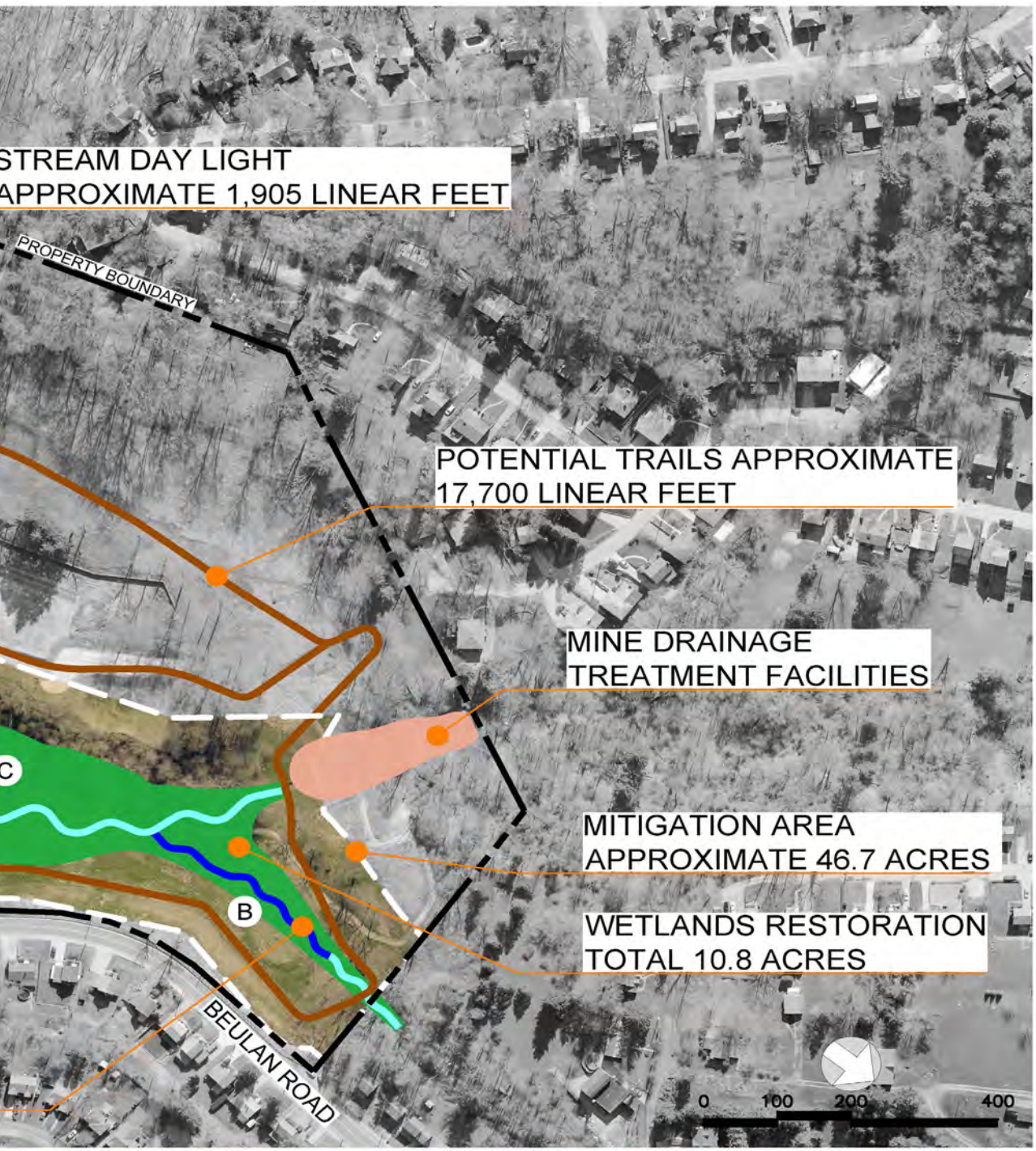


LOG J-HOOK

LOG & ROCK STEP

WETLAND

LOG STEP P



POOL

TRAIL CROSSING

SEATING AREA

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Water & Land Solutions Conceptual Design

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