Proposed Impacts and Mitigation

A comprehensive mitigation approach involving restoration, enhancement, establishment, and preservation measures will compensate for unavoidable impacts at the Berry Hill Mega Park.

Streams

A total of 36,135 linear feet (LF) of streams are proposed to be impacted. The impacted stream types consist of 15,600 LF of ephemeral, 20,179 LF of intermittent and 356 LF of perennial. Calculations prepared using the Unified Stream Methodology worksheets determined that 9,456 credits would be required to compensate for ephemeral stream impacts and 24,975 credits needed to compensate for intermittent and perennial stream impacts. The total is 34,431 credits needed for stream impact mitigation.

On-site stream compensation for intermittent and perennial stream impacts is proposed as follows: a total of 58,826 LF of streams and/or river will be preserved or enhanced. On-site preservation will include: 2,002 LF of bank full bench creation along Trotters Creek and lay bank construction proposed along 1,532 LF of McGuff Creek. The remaining LF will be compensated through preservation buffers. The combination of these mitigation options yields 10,071 compensation credits. The proposed on-site compensatory mitigation will maintain important physical, chemical, and biological functions for the watershed. The buffers created by the preservation will ensure the essential protection of wildlife habitat and provide vital travel corridors.

Impacts to ephemeral streams will be mitigated through the creation of on-site rain gardens. The mitigation credit requested is one square foot (SF) of constructed rain garden per one SF of impacted ephemeral stream channel. The total square footage of impacted ephemeral stream proposed under this application is 111,692 SF, with 111,692 SF of constructed rain gardens installed after construction of the graded pads to mitigate this disturbance.

In addition to on-site stream compensatory mitigation, the removal of off-site dams along a section of the Dan River is proposed for compensatory mitigation for on-site stream impacts. The removal of the dams will restore 9,140 LF of the Dan River and 5,280 LF of Fall Creek, a tributary to the Dan River. The total credits requested for dam removal amount to 25,166.

It is requested that remaining credits be retained by the applicant to be utilized if necessary for future impacts.

Wetlands

Proposed wetland acreage (AC) impacts are: 2.0 AC of palustrine emergent (PEM), 2.47 AC of palustrine scrub-shrub (PSS), and 15.42 AC of palustrine forested (PFO) for a total of 19.89 acres of wetland impacts.

Wetland impacts will be compensated through the creation of a wetland mitigation area proposed in the vicinity of Lot 10 (see Conceptual Mitigation Plan drawing). The wetland mitigation area will consist of 2.0 acres of PEM, 3.71 acres of PSS, and 30.84 acres of PFO for a total of 36.71 acres of wetlands.

The Danville Regional Industrial Facility Authority (RIFA) has historically demonstrated the successful creation of mitigation wetlands (USACE 05-V0775 Cane Creek Centre). On-site creation will assist in the

minimization of lost aquatic resources within the watershed. All on wetland creation will be constructed within the limits of the Mega Park. Creating the wetlands within the Mega Park will increase the number of wetlands along the Dan River maintaining or enhancing the watershed of the Dan River. In addition, as with the Anglers Park Bank created for the mitigation for the Cane Creek Centre, the new Mega Park Bank will create an educational opportunity for the community to learn about the importance of wetlands.

Vernal Pools

The unavoidable loss of vernal pools will be mitigated on a two-to-one ratio. The project is proposed to impact 0.02 AC of emergent vernal pools and 0.47 AC of forested vernal pools for a total of 0.49 AC of impacts. To provide mitigation for the vernal pool impacts, the applicant proposes to create 0.98 AC of vernal pools along a section of McGuff Creek in the vicinity of an area that supports existing vernal pools (see Conceptual Mitigation Plan drawing).

River Restoration: Dam Removal along the Dan River

Many communities throughout the U.S. are exploring the feasibility of removing old dams along their waterways. The benefits of decommissioning dams include restoring the natural hydrology of rivers and reestablishing native river species. Left in place, dams must be maintained (whether still in operation or not), and may pose a threat to swimmers, boaters, and others using rivers for recreational use.

The issue is of particular relevance to the City of Danville and residents of the area. The Dan River is one of the region's most cherished and vital natural resources. The river has helped shape the city's history and define its identity. The waterway is also popular as a recreational site, attracting boaters, kayakers, and fishermen. There are currently four dams along the Dan River within the city limits. A fifth, the Brantley Dam, was removed in 2011. The Brantley Dam was deemed the most unsafe of the five, as four drowning deaths had occurred there since 1965. Two of the remaining dams, Schoolfield and White Mill, are privately owned, while the Union Street Bridge Dam and the Industrial Water Treatment Plant Dam are owned by the City of Danville.

The Impact of Dams on Rivers and Riverine Environments

The U.S. Army Corps of Engineers has documented more than 75,000 dams greater than six feet in the United States today. These dams are mostly located on rivers, with many built in the late 19th and early 20th centuries for a variety of reasons, including hydropower production, navigation, irrigation, flood control, and water storage.

Dams can significantly impact rivers and the riverine environment. According to the organization American Rivers, which advocates for river restoration and reforming dam operations, "Dams have depleted fisheries, degraded river ecosystems, and diminished recreational opportunities on nearly all of the nation's rivers. Today, many dams are old, unsafe, and no longer serve their intended purposes."

Rivers provide important connections between upstream and downstream ecosystems. The construction of dams changes the hydrology of free-flowing rivers and alters the physical and chemical characteristics of the water. According to American Rivers, dams can damage rivers in numerous ways, including:

- Reduced river levels, impacting healthy in-stream ecosystems
- River blockage, impacting fish and wildlife migration and recreational use
- Flow reduction, impacting fish species
- Changes in water temperature, impacting native populations of fish and other species
- Decreased oxygen levels
- Accumulation of silt, debris, and nutrients

The U.S. Fish and Wildlife Service has also raised concerns about the impact of dams on the environment: "While well-designed and properly managed dams can provide many benefits, they drastically alter natural river communities. The natural flow of water and sediment is impeded, and populations of native fish, mussels, and other aquatic animals are damaged."

The Benefits of Dam Removal

Over the past several decades, the scientific and environmental community has carefully studied the impact of dam removal on river restoration. When a dam is removed, a river's natural hydrology is restored. This can happen rapidly, as rivers are resilient waterways with diverse ecosystems.

Dam removal restores migratory routes for fish along with the natural cycles that support many aquatic organisms. A study entitled *The Ecology of Dam Removal: A Summary of Impacts and Benefits* (Angela Bednarek, University of Pennsylvania, 2001) indicates that dam removal leads to the restoration of natural flow fluctuations that increase biodiversity and population densities of native aquatic species. Removal also helps to restore a river's natural temperature and oxygen levels, and allow for sediment transport that can benefit many species of fish and wildlife.

In addition to creating a safer environment for boaters and others enjoying the Dan River, the removal of the Brantley Dam in Danville has restored a 7,017-LF stretch of the river back to its natural banks. For the first time since the dam's construction in 1952, striped bass are now able to migrate further up river to the base of the White Mill Dam. The 10.9-mile Fall Creek has also been restored, and the replenishing of the ecosystems along this tributary is now underway.

The promising and environmentally beneficial results of the Brantley Dam removal are not unique. The Norfolk District of the U.S. Army Corps of Engineers has just reported a significant resurgence in the American eel population in an area of the Rappahannock River 73 to 93 miles upstream from where the Embrey Dam was removed nearly eight years ago in Fredericksburg, Virginia. According to Dr. Nathaniel Hitt, a research fish biologist with the U.S. Geological Survey, which conducted the research, "We've known that dams can have significant consequences for movement of shad and striped bass in large rivers, but what we learned in this study is that the effects can reach up into the smallest mountain streams."

Dr. Hitt stated in the January 2012 issue of the *Chesapeake Bay Journal* that biologists had anticipated an increase in the shad and river herring species, but that they also began to see a "steady increase in the number of small eels" about two years after the removal of the Embrey Dam.

The Chesapeake Bay Program Office of the U.S. Environmental Protection Agency recently released figures that indicated that the removal of 11 dams in the Chesapeake Bay watershed in the past year has opened 148 miles of river habitat to migratory fish. Addressing this progress, Mary Andrews, an environmental engineer with the National Oceanic and Atmospheric Administration's Restoration Center, stated "We are by far favoring dam removals over [fish] passage projects, without a doubt."

The *Chesapeake Bay Journal* also reports in a January 2012 article entitled "Dam Demolition Now the Preferred Method for Creating Fish Passage" that "the pace of dam removals in the [Chesapeake Bay] region is among the fastest in the nation, largely because Pennsylvania has been emphasizing removals for nearly two decades." The article notes that the Riverton Dam on the North Fork of the Shenandoah River in Virginia and the Simpkins Dam on the Patapsco River in Maryland have also been removed.

American Rivers cites the removal of the Steeles Mill Dam on Hitchcock Creek in Rockingham, North Carolina, among its nationwide case studies. The dam was removed in 2009, providing the migratory American shad and American eel with 15 new river miles. The first year of monitoring in 2010 demonstrated "excellent fish diversity" above and below the former dam with 45 fish species including

American eel, hickory shad, blueback herring, striped bass, and Atlantic herring. Biologists are currently studying the dam removal's impact on mussel population density as well.

Dam Removal for Stream Channel Mitigation at the Berry Hill Mega Park

The successful removal of the Brantley Dam and the restoration of more than 7,000 LF of the Dan River to its natural flow and banks have not only improved river safety and enjoyment, the improvement has enhanced the native habitat along this stretch of the waterway for numerous fish and wildlife species. Removal of additional dam structures will continue to improve the health of the Dan River, recently approved by the Virginia Department of Conservation and Recreation as a Scenic River.

Since no guidance documents exist for Virginia concerning the removal of dams as a form of compensatory mitigation for unavoidable stream impacts, the 1997 Unified Stream Methodology (USM) handbook was used as a source to help determine an appropriate crediting ratio.

According to the USM handbook, "Restoration is the process of converting an unstable, altered, or degraded stream corridor, including flood-prone areas, to a natural stable condition considering recent and future watershed conditions". Dam removal has been proven to be one of the most successful types of stream restoration. The restoration section contained within the USM form was used as a basis for determining credit amounts. The form allows for a one credit per linear feet of restored stream channel; however the USM form does not compensate for streams of different widths, water volume, flow rates, aquatic life, habitat and other physical and environmental factors. Based on these shortcomings, the proposed river sections restored by the removal of the dams are proposed to be mitigated at the ratios described below.

The removal of the Brantley Dam will help offset stream channel impacts associated with all phases of the Berry Hill Mega Park. Since the dam has already been removed, the proposed credits requested are 2 credits for every LF of the Dan River that has been restored. The Brantley Dam restored 7,017 LF, for a total of 14,034 credits.

Fall Creek, a major tributary of the Dan River, was also re-opened to habitat downstream of the Brantley Dam. The applicant requests 0.5 credits per LF of creek for the first mile of the creek resulting in a total of 2,640 credits for the first mile of the creek.

In addition to the Brantley Dam removal, the applicant has considered removing the White Mill Dam. The distance from the White Mill Dam to the next dam, the Union Street Dam, is 2,123 LF. The applicant proposes to receive 4 credits for every foot of the Dan River restored to its original banks through this step. The proposed credit amount for this dam removal is 8,492.

The total credits requested for dam removal amount to 25,166. Together, the removal of the Brantley Dam and the White Mill Dam represent significant steps forward in restoring and sustaining the health of the Dan River and its related ecosystems.

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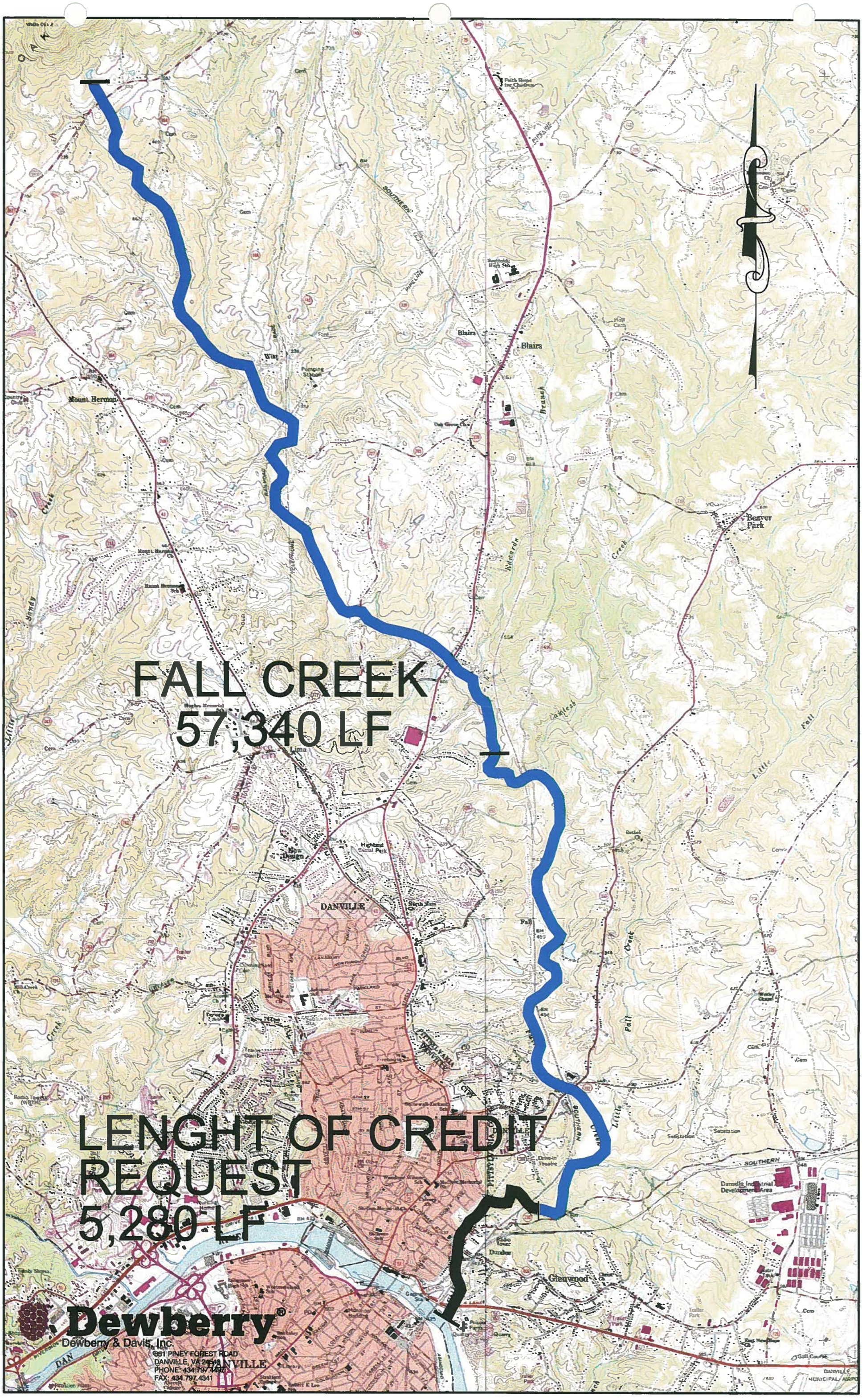

FALL CREEK
57,340 LF
LENGHT OF CREDIT
REQUEST
5,280 LF
Mount Hermon
Blairs
DANVILLE
Glenwood
Beaver Park
Lima
SOUTHERN
Dewberry®
Dewberry & Davis, Inc.
901 PINEY FOREST ROAD
DANVILLE, VA 24540
PHONE: 434.797.4492
FAX: 434.797.4341

http://www2.godanriver.com/news/2012/jul/31/dam-removal-helped-eels-shenandoah-park-ar-2097964/

Published: July 31, 2012

Dam removal helped eels in Shenandoah park

By ASSOCIATED PRESS

The removal of a large dam in Virginia has meant good news for the American eel population, according to a new study by the U.S. Geological Survey, U.S. Fish and Wildlife Service and National Park Service.

The research, published this month in Transactions of the American Fisheries Society, shows that the removal of Embrey Dam on the Rappahannock River increased American eel numbers in headwater streams nearly 100 miles away.

American eels migrate from their spawning grounds in the Atlantic Ocean to freshwater streams along the coast. Dams were thought to slow or even stop the migration.

Researchers studied eel populations in in Shenandoah National Park streams before and after the removal of the large dam in 2004. The study shows significant eel numbers beginning two years after the dam removal and nearly every year since.

"Our study shows that the benefits of dam removal can extend far upstream," said Nathaniel Hitt, a USGS biologist and lead author of the study. "American eels have been in decline for decades and so we're delighted to see them begin to return in abundance to their native streams."

American eel populations elsewhere are declining, and the species is being considered by the U.S. Fish and Wildlife Service for listing as a threatened species under the Endangered Species Act. Migration barriers such as dams have been recognized as contributing to population decreases over the past 50 years.

Embrey Dam, built in 1910 on the Rappahannock River near Fredericksburg, measured 22 feet high and nearly 800 feet wide. The dam provided hydroelectric power for the city until the 1960s. It was removed due to concerns about the hazards it posed and the potential for fish restoration.

"This study demonstrates that multiple benefits can be realized by removing obsolete dams such as Embrey," said Alan Weaver, fish passage coordinator for the Virginia Department of Game and Inland Fisheries.

Weaver said shad, herring and striped bass also have benefited from the dam removal, as their populations have grown.

Nature at Work: Bioretention and Ephemeral Streams

Bioretention and ephemeral streams are two natural forms of stormwater management. In the appropriate settings and conditions, both options allow for effective collection and treatment of stormwater runoff. Rain gardens, a common form of bioretention, are particularly conducive to supporting wildlife and biodiversity, and can add natural beauty and appealing vistas to urbanized or developed sites.

Rain Gardens and the Advantages of Bioretention

Bioretention cells, or rain gardens, are shallow, landscaped depressions that collect and treat stormwater. Frequently recognized as an environmentally sensitive best management practice, these gardens serve as an ideal option for treating stormwater on commercial sites. The vegetated cells enhance biodiversity and preserve the land's organic beauty, yet are cost-effective and relatively easy to maintain.

Bioretention vegetation typically consists of hearty native plants and grasses atop layers of mulch, sand, soil, an organic filter bed, an overflow, and an optional underdrain. When water collects in the garden, the stormwater filters through these layers and undergoes a series of physical, chemical, and biological processes, including filtration, infiltration, absorption, and microbial decomposition. These processes work together to achieve effective stormwater management by reducing runoff and removing pollutants, including excess nutrients.

Given adequate sun and irrigation if needed, rain gardens are robust and practical solutions for stormwater management. Maintenance is similar to that of a typical garden, involving the replacement of dead plants and replenishment of the mulch layer.

Ephemeral Streams and Riparian Ecology

Ephemeral streams also provide a natural form of hydrology and stormwater management. Ephemeral creek beds are located above the water table year-round and are typically dry, with streams briefly flowing water during or immediately following periods of extended rain in the immediate vicinity—usually only a few times per year.

Rainfall is the primary source for these waterways, rather than groundwater. The stream flow begins when the catchment, or drainage area, is saturated and exceeds its capacity to intercept and retain runoff. Ephemeral streams appear at varying flow rates, then diminish and disappear during dry spells. Runoff events may leave floodplain and instream pools, which can spur riparian ecological growth.

Ephemeral streams can also play an important role in the reduction of nutrients and sedimentation, and in supporting catchment ecosystems, including aquatic and terrestrial species. In order to protect these freshwater ecosystems, ephemeral streams should be managed to allow for flow with no blockages. It is also important to control weeds, and to maintain and protect natural seepage areas and springs.

Ephemeral Stream Channel Mitigation at the Mega Park

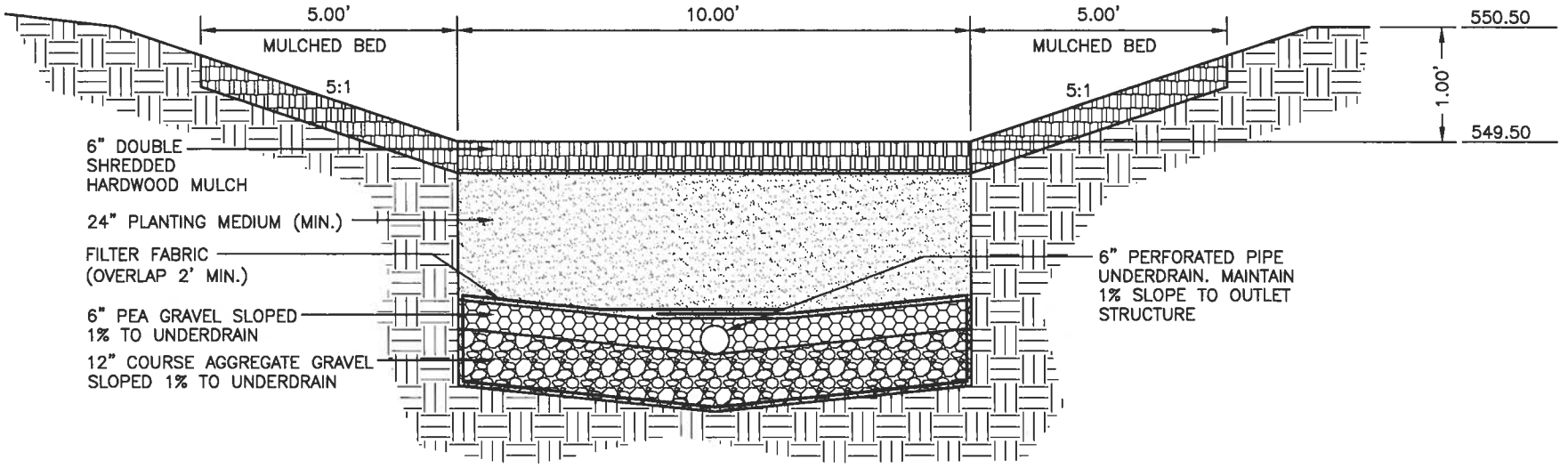
Grading for Lots 3, 4, and 5, as well as installation of the utilities and rail access to serve the lots, will impact 15,712 linear feet of ephemeral stream channel. Constructed rain gardens will mitigate this impact, and will capture runoff from the graded pads prior to being discharged into the receiving stream.

Ephemeral streams, as the least valuable of the regulated stream channels, only carry stormwater during rain events and are not recharged by groundwater. The new rain gardens will provide many benefits to the environment, including filtering pollutants from the runoff prior to discharge and helping to preserve the water quality of the receiving streams. They will also act as a groundwater recharge, with a portion of the runoff in the rain gardens infiltrating the ground. The absorption of this runoff will reduce the quantity of stormwater leaving the site and entering receiving streams and protect the streams from bank damage. Rain gardens will also replace the habitat for macroinvertebrates and amphibians lost by impacts to the ephemeral streams.

Additional stormwater management facilities will also be used to bring the runoff values from the graded areas below the existing runoff conditions. The discharge from these facilities will be placed on site to reintroduce stormwater as close to the natural discharge as possible.

The mitigation credit requested is 1 SF of constructed rain garden per 1 SF of impacted ephemeral stream. The total square footage of impacted ephemeral stream proposed under this permit is 111,692 SF, with 111,692 SF of constructed rain gardens installed after construction of the graded pads to mitigate this disturbance.

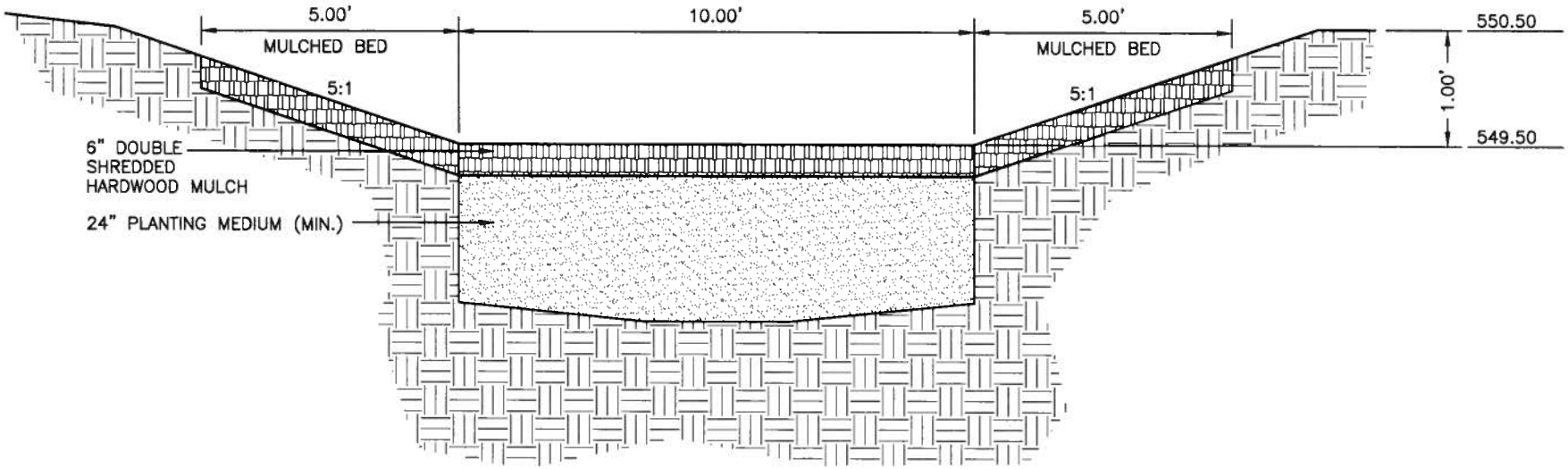
Two types of rain gardens have been proposed for use as mitigation. In soils that are well drained, a rain garden without an under drain will be constructed. Run-off will be allowed to infiltrate into the ground and act as a groundwater recharge. In poorly drained soils, an under drain will be installed to help remove the filtered water out of the rain garden and back into the receiving channel with a controlled release. The exact placement and design of the rain gardens will be prepared and submitted to the Army Corps of Engineers and the Virginia Department of Environmental Quality for approval prior to construction. In addition, as industry facilities are constructed, additional low-impact development practices will be promoted and encouraged to further reduce the impact from the park's development. Low impact development measures that will be encouraged include but are not limited to bioretention swales, green roofs, rainwater harvesting and permeable pavers.



NOTE:
PLANTING MEDIUM IS TO BE TOPSOIL MIXED WITH COMPOST.

RAIN GARDEN SECTION POORLY DRAINED SOIL

SCALE: NTS



NOTE:
PLANTING MEDIUM IS TO BE TOPSOIL MIXED WITH COMPOST.

RAIN GARDEN SECTION
WELL DRAINED SOIL

SCALE: NTS

Berry Hill Mega Park Mitigation Plan	Project: 50018376
Stream Buffer Areas	August 28, 2012

McGuff Creek

Zone	Left 200' Area (sf)	Left 100' Area (sf)	Stream Length (LF)	Right 100' Area (sf)	Right 200' Area (sf)	Total Area (ACRES)
1	636480	662976	7255	761836	82406	49
2	0	0	2255	202425	187990	9
3	0	0	5219	509302	458413	22
Totals:	636480	662976	14729	1473564	728809	80

Trotters Creek

Zone	Left 200' Area (sf)	Left 100' Area (sf)	Stream Length (LF)	Right 100' Area (sf)	Right 200' Area (sf)	Total Area (ACRES)
1	611837	652537	6998	671745	603037	58
2	241016	258637	2611	256712	245813	23
3	210305	253282	3830	373821	390716	28
4	110824	76204	968	129309	60712	9
5	539427	792488	6490	755712	604183	62
Totals:	1713408	2033148	20897	2187299	1904461	180

Unnamed Tributaries

Zone	Left 200' Area (sf)	Left 100' Area (sf)	Stream Length (LF)	Right 100' Area (sf)	Right 200' Area (sf)	Total Area (ACRES)
1	0	151170	6431	566887	0	16
2	0	59770	631	60183	0	3
3	351746	388573	4367	466638	360490	36
Totals:	351746	599513	11429	1093708	360490	55

Dan River

Zone	Left 200' Area (sf)	Left 100' Area (sf)	Stream Length (LF)	Right 100' Area (sf)	Right 200' Area (sf)	Total Area (ACRES)
1	90384	122154	2055	0	0	5
2	319896	309170	3673	0	0	14
Totals:	410280	431324	5728	0	0	19

Bank Full Bench Creation Areas

Trotters Creek

ZONE	AREA (SF)	AREA (ACRES)	(LF)
1	230607	5	1290
5	233069	5	712
Totals:	463675	11	2002

Lay Back Bench Creation Areas

McGuff Creek

ZONE	AREA (SF)	AREA (ACRES)	(LF)
1	502612	12	1532
Totals:	502612	12	1532

Stream/Buffers

Stream	Stream Total (LF)	Stream Buffer (LF)	Percentage of Stream w/ Buffer
McGuff	16747	14729	88%
Trotters Creek	24452	20897	85%
Unnamed Tributary	11898	11429	96%
Dan River	5729	5728	100%
Totals:	58826	52783	90%

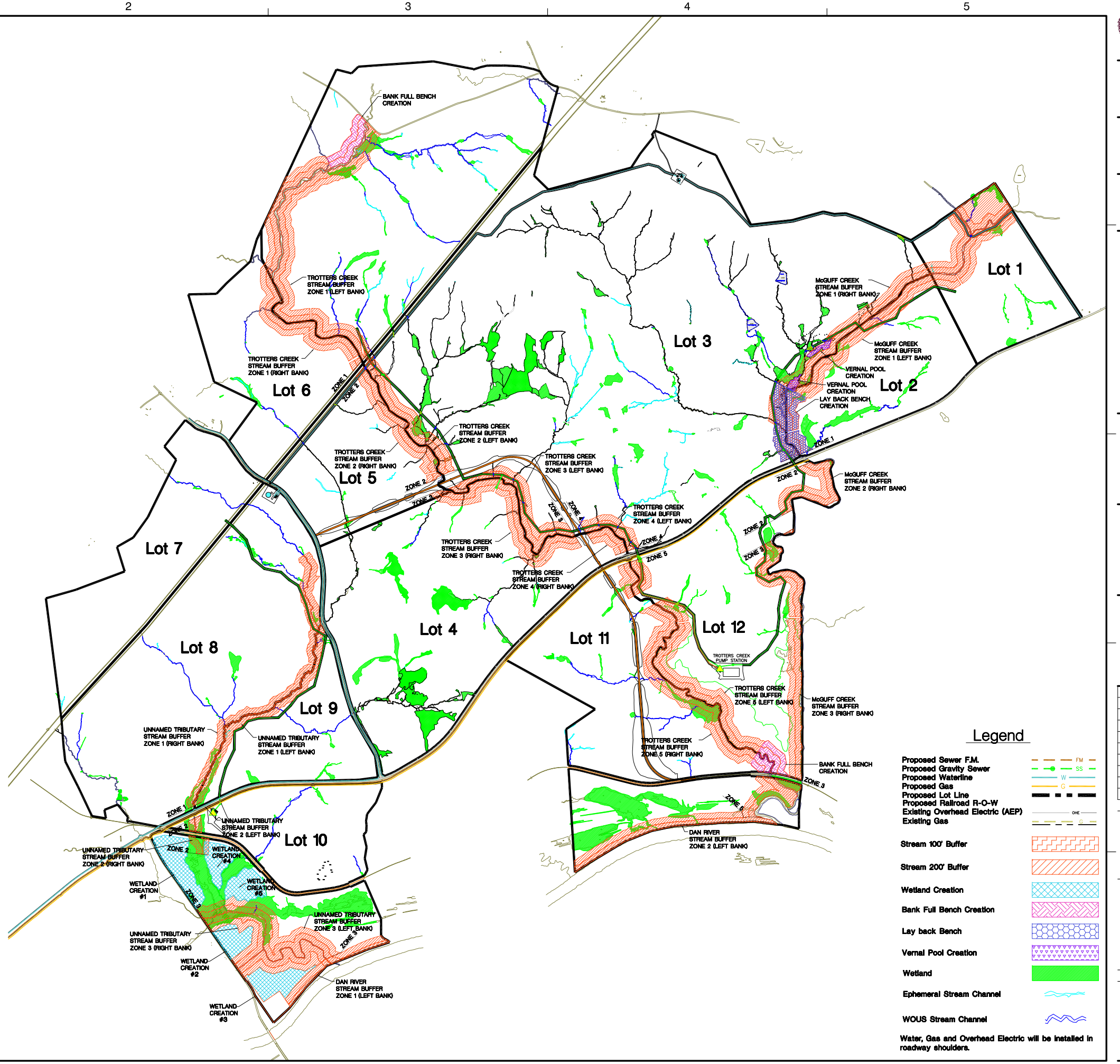
Wetland Creation Areas

Unnamed Tributary

Area #	AREA (SF)	AREA (ACRES)	(LF)
1	489797	11	N/A
2	270567	6	N/A
3	376996	9	N/A
4	269568	6	N/A
5	299893	7	N/A
Totals:	1706822	39	N/A

Total Wetland Impacts and Creations

Cowardin Classification	Impacted (sf)	Impacted (acres)	Required Creation (sf)	Required Creation (acres)
PEM (1x)	87124	2.00	87124	2.00
PSS (1.5x)	107650	2.47	161475	3.71
PFO (2x)	671469	15.41	1342938	30.83
Vernal Pool PEM (2x)	736	0.02	1472	0.04
Vernal Pool PFO (2x)	20563	0.47	41126	0.94
Totals:	887542	20.38	1634135	37.52



Legend

- Proposed Sewer F.M.
- Proposed Gravity Sewer
- Proposed Waterline
- Proposed Gas
- Proposed Lot Line
- Proposed Railroad R-O-W
- Existing Overhead Electric (AEP)
- Existing Gas
- Stream 100' Buffer
- Stream 200' Buffer
- Wetland Creation
- Bank Full Bench Creation
- Lay back Bench
- Vernal Pool Creation
- Wetland
- Ephemeral Stream Channel
- WOUS Stream Channel

Water, Gas and Overhead Electric will be installed in roadway shoulders.

Dewberry

Dewberry & Davis, Inc.
551 PINEY FOREST ROAD
DANVILLE, VA 24540
PHONE: 434.797.4497
FAX: 434.797.4341

Danville, Pittsylvania Co. Regional Industrial Facility Authority

Berry Hill Mega Park

Pittsylvania County, VA

SEAL

KEY PLAN

SCALE

0' 800' 1600'

SCALE: 1" = 800'

No.	DATE	BY	Description

REVISIONS

DRAWN BY MWC

APPROVED BY SRH

CHECKED BY TAS

DATE JUNE 19, 2012

TITLE

Conceptual Mitigation Plan

PROJECT NO. 50018376

1

SHEET NO. OF