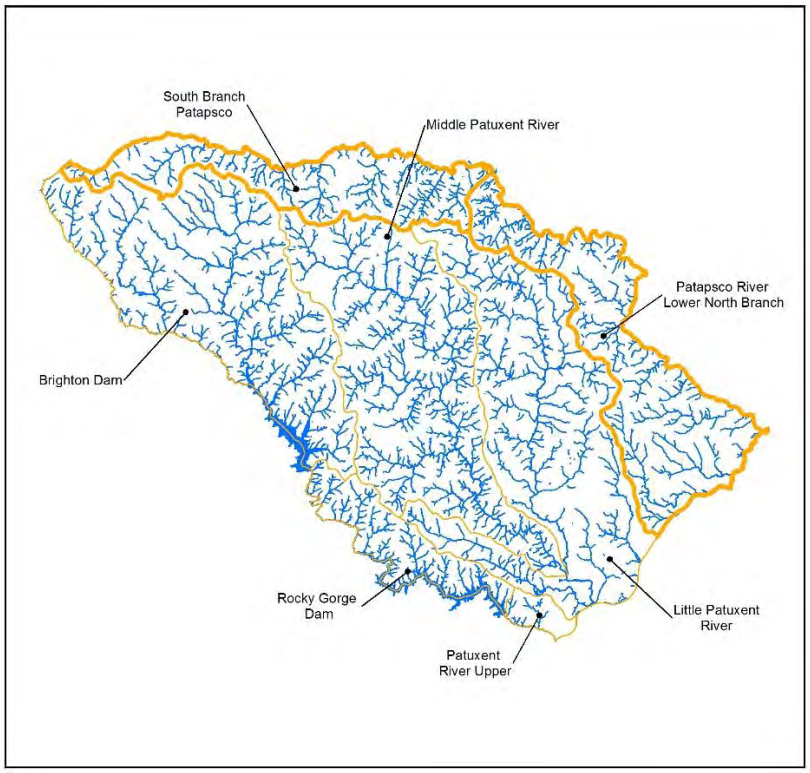
PATAPSCO RIVER

SOUTH BRANCH AND LOWER NORTH BRANCH

WATERSHED ASSESSMENT



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EXECUTIVE SUMMARY

Howard County, Maryland, is developing Watershed Assessments to identify specific restoration opportunities to provide greater treatment of stormwater from urban impervious areas and to reduce pollutant loads associated with urban runoff. The assessment of the Middle and Little Patuxent River was completed in 2015 and served as an example for the current assessments of the Patapsco River Watershed, which includes South Branch Patapsco and Patapsco Lower North Branch watersheds. The main purpose of these assessments is to (1) assess current conditions and (2) recommend watershed restoration opportunities. Implementation of recommendations will assist the County in meeting its 20% impervious restoration goal by December 2019 and Total Maximum Daily Load (TMDL) targets established for nutrients (nitrogen and phosphorus), sediment, and bacteria in the Patapsco River watersheds.

Employing GIS analysis and field investigations, the project team recommended a suite of opportunities including upgrades to existing stormwater Best Management Practices (BMPs), new BMPs, tree plantings, stream restoration, and stabilization of stormwater outfalls. These structural practices will be combined with non-structural programmatic practices (e.g. street sweeping, septic system upgrades) that the County is implementing as part of its overall strategy. The assessment for South Branch Patapsco yielded 60 potential projects and produced concept plans for 15 top ranked opportunities. The assessment for Patapsco Lower North Branch yielded 269 potential projects and produced concept plans for 130 top ranked opportunities.

GIS data, including data compiled from studies previously conducted within the watersheds, were used as the first step to identify candidate retrofit and restoration sites for further investigation in the field. Candidates initially selected were reviewed by Howard County staff to finalize the suite of field sites to be visited.

Field data collection was customized for each of the five site types and focused on assessing current conditions and identifying and describing restoration opportunities. Field data were collected with mobile tablet devices via an ESRI ArcCollector application. Some previously visited sites were evaluated via desktop assessment only, making use of prior data collected. In South Branch Patapsco, a total of 32 sites and 11.4 stream miles were assessed. In Patapsco Lower North Branch, a total of 230 sites and 33.6 stream miles were assessed.

A standardized method was developed for comparing, ranking, and prioritizing the proposed project opportunities identified. Projects were ranked in two ways. First, each project was ranked against all other projects of the same type. Second, all projects were pooled together and ranked against one another, to enable ranking across project type, and to determine those projects that should be taken to the next design stage.

Ranking criteria were developed within the following categories of factors:

- Permit contribution – how a project will help towards the County meeting the impervious surface treatment requirements and pollutant reduction goals;
- Biological uplift – if a project will provide additional benefits, such as building onto existing green infrastructure or protecting wetlands;

- Programmatic benefit – how project has added value such as visible demonstration projects or public education; and
- Feasibility – estimation of the ease or difficulty of project implementation, including public versus private ownership, site accessibility, or whether a repair is already required at a site.

For the pooled project type ranking, scores were based on permit contribution criteria—specifically, acres of impervious treatment, pollutant load reduction, and cost per acre of impervious treatment—along with a combined score for the remaining three factor categories.

Ranking scores were used to select the highest-ranked projects for concept plan development at this time. A four-page concept plan was developed for each of the projects, providing location information, description of existing condition (including photos), details of the proposed project (including a design drawing), implementation information (such as utility constraints and other nearby projects), potential impervious treatment credits, and cost estimate.

A pollutant load model was created to calculate nitrogen, phosphorus, and sediment load reductions for each project concept. Results included a summary of estimated pollutant load reductions for the implementation of recommended projects, including how reductions were credited, pollutant removal efficiencies, and potential load reductions. This information has been incorporated into the County's restoration plan, Countywide Implementation Strategy (KCI, 2017b), where implementation timeframes and overall TMDL goals, milestones, and progress is discussed in more detail.

ACKNOWLEDGEMENTS

The Patapsco River Watershed Assessment report was prepared by KCI staff: Susanna Brellis and Mike Pieper. The complete Patapsco River Watershed Assessment effort was a collaborative effort among the Howard County Stormwater Management Division, Biohabitats, KCI Technologies, Inc., McCormick Taylor Inc., and Straughan Environmental, Inc. The following staff were instrumental in the completion of the watershed assessment.

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1. Introduction

1.1 Overview

The Patapsco River watershed assessment was conducted to identify restoration opportunities to treat stormwater from urban impervious areas in Howard County, Maryland. This assessment is part of a larger effort to assess all watersheds within Howard County. The Little Patuxent River and Middle Patuxent River watershed assessments were completed in 2015 (Versar, 2016a and Versar, 2016b). The remaining subwatersheds of the Patuxent River (Brighton Dam, Rocky Gorge Dam, and Patuxent River Upper) were assessed in 2016 and are described in a separate report (KCI, 2017a). The Patapsco River watershed assessment was also conducted in 2016 and is described in this report. The Patapsco River is divided into two subwatersheds within Howard County- South Branch Patapsco and Patapsco Lower North Branch (Figure 1). The goals of the watershed assessments are to assess current conditions and recommend restoration opportunities. The Patapsco River watershed assessment resulted in 329 potential projects and 145 concept plans for the top-ranked projects. Recommended restoration opportunities include new best management practices (BMPs), BMP conversions, tree plantings, stream restoration, and outfall stabilization.

1.2 Background

Howard County, along with other medium sized jurisdictions in Maryland, has been operating its municipal separate storm sewer system (MS4) under a National Pollutant Discharge Elimination System (NPDES) permit issued by the Maryland Department of the Environment (MDE). In recent years these permits and other stormwater regulations have expanded. The County's current permit requires compliance with pollutant load limits from both the Chesapeake Bay Total Maximum Daily Load (TMDL) and local TMDLs. The County is also required to meet an impervious surface treatment goal of 20% of the impervious surface not treated to the maximum extent practicable (MEP) by the end of the current 5-year permit term (December 17, 2019).

Howard County drafted a Countywide Implementation Strategy (CIS) in December 2015 to address the planning elements related to the restoration goals. The CIS was based on watershed assessments completed in 2015 for the Little Patuxent and Middle Patuxent watersheds. In order to fully meet the goals detailed in the CIS, the County initiated the Patapsco and Patuxent watershed assessments in 2016.

The main regulatory objective of the watershed assessments is to meet the County's MS4 NPDES permit requirements for Restoration Plans and Total Maximum Daily Loads per permit condition III.E.1.a-b – Watershed Assessments. The County must complete assessments by the end of the permit term in December 2019. According to the permit, the assessment shall include determination of water quality conditions, visual watershed inspection, rank of problems, prioritization of improvement projects, and will specify load reduction benchmarks and deadlines.

MDE considers the MS4 Permit for Howard County to be the entire county with the exception of lands which have their own NPDES stormwater permits, including federal lands, state highway lands, and other state lands, which are shown in gray in Figure 1. NPDES regulated industrial facilities are also excluded from the County's permit coverage. MDE notes that the inclusion of private and non-urban land in the MS4 permit is based on the rationale that stormwater management for private property in Maryland is locally administered for plan approval, inspection, and enforcement, and that these facilities

are inherently a part of a locality's storm drain system. The County's stormwater waste load allocation (SW-WLA) responsibilities are only for those areas included in the MS4 area.

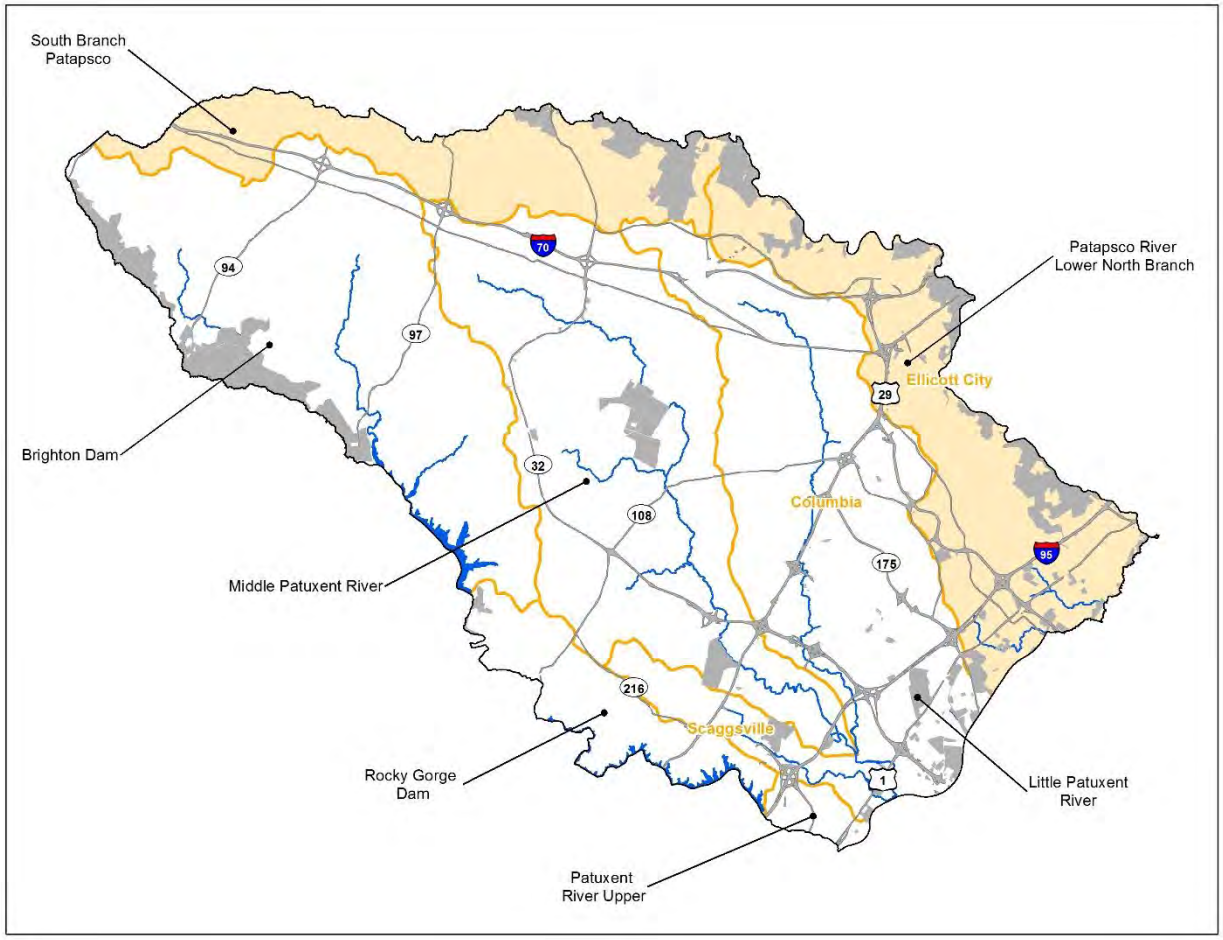

Figure 1. Major watersheds of Howard County and non-County MS4 permit areas in gray.

1.3 Report Structure

The report structure is consistent with the previous watershed assessment reports (Versar, 2016a and Versar, 2016b). The following seven sections outline the process used to identify, assess, and prioritize restoration opportunities in the South Branch Patapsco and Patapsco Lower North Branch watersheds.

Section 1: Introduction provides context for the project and describes the regulatory drivers for the watershed assessments and pollutant reduction planning, as well as the overall structure of this report.

Section 2: Assessment of Current Watershed Conditions provides information about the physical characteristics such as impervious cover, existing stormwater BMPs, and assessments of stream biotic health. This section also provides descriptions of the five types of potential restoration opportunities considered in this study.

Section 3: Desktop Analysis explains the process used to synthesize and analyze past data in order to select sites for field investigation.

Section 4: Field Assessments describes the field work methodology, calibration, and QA/QC employed by consultant teams conducting the fieldwork within the geographic scope of this study. Assessment data, including the desktop revisits of previously assessed sites and public input/feedback, are reported for each of the five types of potential restoration opportunities in the study area are depicted spatially and in tabular form.

Section 5: Restoration Project Ranking and Prioritization sequences the steps and results of scoring and ranking individual potential restoration opportunities among all the individual opportunities of that type. Further, this chapter details the scoring and comparative ranking of individual opportunities across all five types of potential restoration for prioritization. By identifying the high priority opportunities, this process produced a more limited set of candidates for development of Concept Plans, which are included as four-page summaries in Appendix G.

Section 6: Pollutant Load Modeling reports the calculations of potential pollutant loading reductions for the recommended projects. Pollutant loads for nitrogen, phosphorus, and sediment were modeled at the planning level for the South Branch Patapsco and Patapsco Lower North Branch watersheds.

Section 7: References documents other works cited throughout the report.

1.4 Previous Studies

Several previous studies conducted within the Patapsco River watershed were integrated into this study. Data from these studies were made available to KCI to aid in initial site selection, to avoid redundancy, and to incorporate recommended projects into the prioritization and concept plan selection process.

- Howard County Dry Pond and Extended Detention Pond Retrofits Summary Report (Versar, 2013a)

This study identified and prioritized dry ponds and extended detention stormwater management ponds to consider for retrofit in order to provide and/or enhance water quality control. This study included ponds throughout the entire County and resulted in 53 conceptual designs.

- Howard County Low Impact Development (LID) Retrofits and Tree Planting Summary Report (Versar, 2013b)

This study identified opportunities for LID practices on Howard County-owned properties, including Howard County Public School System sites. The study also identified potential tree planting sites. Thirty-four sites were identified as potential candidates for LID implementation and 32 sites were selected for potential tree planting opportunities throughout the County.

- Lower Patapsco River Watershed Restoration Action Strategy (Howard County Department of Planning and Zoning, 2006)

The Lower Patapsco Watershed Restoration Action Strategy (WRAS) includes a watershed restoration plan and implementation strategy for protecting and restoring water quality and aquatic and terrestrial habitats, and for addressing the need for environmental outreach and education within the watershed. This plan identifies projects such as land conservation, riparian buffers, better site design, erosion and sediment control, stormwater BMPs, stream restoration, and watershed stewardship programs. The plan prioritizes these projects to establish a work plan for the next fifteen years. These projects were

further investigated in the Rockburn and Sucker Branch Assessments for Restoration Opportunities, described below.

- Deep Run and Patapsco River Stream Corridor Survey (Pellicano and Yetman, 2005)

A Stream Corridor Assessment (SCA) was conducted as part of the WRAS and consisted of walking approximately 57 miles in Deep Run and 21 miles of the mainstem of the Patapsco River. Environmental problems were identified, such as pipe outfalls, erosion, inadequate buffers, exposed pipes, trash dumping, and fish barriers. To aid in prioritizing future restoration work, each problem site was rated in three categories: severity, correctability, and accessibility.

- Characterization of the Patapsco River Lower North Branch Watershed in Howard County, Maryland (DNR, 2005a)

As part of the WRAS, the Patapsco River Lower North Branch watershed was characterized, including information on water quality, natural resources, living resources and habitat, and land use/ land cover. This characterization helps summarize information and issues, identify sources for future analysis, and suggest opportunities for restoration work.

- Report on Nutrient Synoptic Surveys in the Lower Patapsco River Watershed, Howard County, Maryland, March 2004 as part of a Watershed Restoration Action Strategy (DNR, 2005b)

As part of the WRAS, a nutrient synoptic survey was conducted in the Lower Patapsco watershed which included 37 sites throughout the watershed. This document summarizes the water quality results of this survey, which can be used to target restoration projects in areas with poor water quality.

- Assessing the Rockburn Branch Subwatershed of the Lower Patapsco River for Restoration Opportunities (Lessard and Stribling, 2006a) and Assessing the Sucker Branch Subwatershed of the Lower Patapsco River for Restoration Opportunities (Lessard and Stribling, 2006b)

Two subwatersheds were selected for further assessment as part of the Lower Patapsco River WRAS. Rockburn Branch (less developed) and Sucker Branch (urban/suburban) were selected to evaluate stream corridor problem sites, identify opportunities for stormwater retrofits and new stormwater management facilities, and to evaluate neighborhoods and businesses for pollutant-producing behaviors. A list of restoration recommendations was made for each watershed.

- Tiber Hudson Subwatershed Restoration Action Plan (Center for Watershed Protection, 2013)

The Tiber Hudson subwatershed was investigated for potential upland pollution sources in residential and commercial areas, and for opportunities for new BMP and BMP conversion. Approximately 48 potential stormwater retrofit sites, 27 potential hotspot locations, and 23 residential neighborhoods were assessed. The proposed projects were ranked and prioritized, and the associated costs and pollutant load reductions of the projects were calculated.

- Tiber Branch and Sucker Branch Interceptor Improvements (Century Engineering, 2016)

In support of the Tiber Branch and Sucker Branch Interceptor Improvements project, a full reconnaissance of the 3.4 mile sewer alignment corridor was conducted to identify potential

stormwater management, outfall stabilization, and stream restoration projects. A total of 29 projects were identified, and 12 projects were selected for concept design.

1.5 Regulatory Context

Under the Federal Clean Water Act (CWA), the State of Maryland is required to assess and report on the quality of waters throughout the state. Where Maryland's water quality standards are not fully met, Section 303(d) of the CWA requires the state to list these water bodies as impaired waters. States are then required to estimate the maximum allowable pollutant load, or TMDL, that the listed water body can receive and still meet water quality standards.

1.5.1 Howard County MS4 Permit

Section 402(p) of the CWA required the EPA to add MS4 discharges to the NPDES permit program. In 2002, EPA directed permit writers to include WLA requirements in NPDES permits, including those for MS4 discharges. Howard County is one of five medium jurisdictions in Maryland that is regulated by a NPDES MS4 Discharge Permit (Section 402(p) of the Water Quality Act of 1987 and NPDES Permit Application Regulations for Storm Water Discharges of November 16, 1990). Howard County's first permit went into effect on April 17, 1995 and the County received its fourth permit on December 18, 2014 (11-DP-3318, MD0068322). This fourth permit includes the following new requirements related to Restoration Plans, impervious surface treatment, and TMDLs among others.

Under Howard County's current MS4 permit (Permit Number 11-DP-3318, MD0068322, issued December 18, 2014), the County is required to develop Watershed Assessments and Restoration Plans to address the pollutant reductions required by the approved TMDLs. The County has developed a Countywide Implementation Strategy (CIS, KCI, 2017b) that demonstrates ways to meet the TMDL SW-WLAs and illustrates a strategy to treat 20% of impervious area currently not managed to the Maximum Extent Practicable (MEP).

Under the MS4 permit, the County is also required to provide watershed assessments for each watershed within the County, which address the following:

i. Determine current water quality conditions;
ii. Include the results of a visual watershed inspection;
iii. Identify and rank water quality problems;
iv. Prioritize all structural and nonstructural water quality improvement projects; and
v. Specify pollutant load reduction benchmarks and deadlines that demonstrate progress towards meeting all applicable stormwater WLAs.

1.5.2 Water Quality Impairments

Both Patapsco Lower North Branch and South Branch Patapsco watersheds are listed as impaired for various pollutants (MDE, 2015), as of November 2016. The following statuses shown in Table 1 correspond to the following categories used by MDE to describe water quality impairment listings (MDE, 2015):

- WQA – Category 2; waters meeting the standards for which they have been assessed based on a completed Water Quality Assessment (WQA)
- Insufficient data – Category 3; waters that have insufficient data or information to determine whether any water quality standard is being attained

- TMDL developed – Category 4a; waters that are still impaired by have a TMDL developed that establishes pollutant loading limits designed to bring the water body back into compliance.
- Impaired – Category 5; water bodies that may require a TMDL

Table 1. MDE Water Quality Impairment Listings and Status of Local Impairments and TMDLs in the Patapsco River

Impairment	Applicable Segment	Status	Approval Date
PCB in fish Tissue	Patapsco LNB	Insufficient data	
Chlorides	Patapsco LNB	Impaired	
Sulfates	Patapsco LNB	Impaired	
Heavy Metals	Patapsco LNB	WQA	January 2005
Phosphorus	Patapsco LNB	WQA	September 2009
Escherichia coli	**Patapsco LNB**	**TMDL developed**	**December 2009**
Sediment	**Patapsco LNB**	**TMDL developed**	**September 2009**
Escherichia coli	S Branch Patapsco	Insufficient data	
Biological	S Branch Patapsco	Impaired	

Final approved TMDLs within Howard County with either an individual or aggregate SW-WLA, shown in bold text

Source: Maryland's Final 2014 Integrated Report of Surface Water Quality (MDE, 2015)

1.5.3 Local Total Maximum Daily Loads (TMDLs)

This section provides a brief overview of the TMDLs assigned to the Patapsco watershed. Refer to Howard County's restoration plan, the CIS (KCI, 2017b) for a more detailed description of the TMDLs, derivation of the County's specific targets, and the plan to address the requirements. Howard County has several watersheds where an EPA-approved quantitative assessment study (the TMDL) has established pollutant loading limits for waterbodies. These loading limits represent a maximum amount of a pollutant that the water body can receive and still meet water quality standards, and an allocation of that load among the various sources of that pollutant (e.g., point sources or nonpoint sources). Pollutant loads from point and nonpoint sources must be reduced by implementing a variety of control measures. Responsibility for TMDL reductions is divided among various contributing jurisdictions within the area draining to the water body. The TMDL loading targets, or allocations, are also divided among the pollution source categories, which in this case includes non-point sources (termed load allocation or LA) and point sources (termed waste load allocation or WLA). The WLA consists of loads attributable to regulated process water or wastewater treatment and to regulated stormwater. For the purposes of the TMDL and consistent with implementation of the NPDES MS4 permit, stormwater runoff from MS4 areas is considered a point source contribution.

There are currently two final approved TMDLs for sediment (MDE, 2011) and bacteria (MDE, 2009) within Howard County with either an individual or aggregate SW-WLA for Patapsco Lower North Branch, shown in Table 2 and Figure 2. Additionally, both the Patapsco River Lower North Branch and the South Branch Patapsco fall under the Baltimore Harbor TMDL for nitrogen and phosphorus (MDE, 2006), shown in Table 2 and Figure 2.

The Patapsco River LNB bacteria TMDL requires a 54% reduction in the most downstream portion of the watershed in a subwatershed (PAT0148sub) defined by MDE based on monitoring locations. For Howard County, the SW-WLA for this subwatershed is based on a 75% reduction from the domestic pet source.

Diaggregation of the TMDL based on Howard County's MS4 area results in the baseline and allocation values in Table 2.

Table 2. Local TMDL SW-WLAs and Location Reductions

Watershed Name	Patapsco River Lower North Branch		Baltimore Harbor (Patapsco R LN Br + S Br Patapsco)			
Watershed Number	2130906		2130906	2130908	2130906	2130908
Baseline Year	2005	2003	1995		1995	
Pollutant	Sediment	Bacteria	Nitrogen		Phosphorus	
Unit[1]	EOS-lbs/yr	Billion MPN/yr	EOS-lbs/yr		EOS-lbs/yr	
Reduction %[2]	10%	75%	15%		15%	
Baseline Loads[3]	6,123,442	21,826	81,058	26,001	5,530	1,016
Load Reductions[4]	**612,344**	**16,370**	**16,059**		**982**	
SW-WLA[5]	5,511,098	5,457	91,000		5,564	

1) An EOS load is the amount of a pollutant load that is transported from a source to the nearest stream annually.

2) Published Reduction % from the MDE TMDL Data Center SW-WLAs for County Storm Sewer Systems in Howard County. Bacteria reduction value from Tables 4.7.2 and 4.7.3 of the Patapsco LNB TMDL (MDE, 2009).

3) Baseline loads modeled in BayFAST using County BMPs installed prior to the TMDL baseline year on top of baseline land use background load. Additional load reductions from Howard County lakes installed prior to the baseline year and rooftop/non-rooftop disconnects were included outside of BayFAST. Bacteria baseline is back-calculated from the disaggregated SW-WLA using the 75% reduction.

4) Calibrated reductions calculated by applying the MDE published percent reduction to the BayFAST calibrated baseline loads. Bacteria reduction is back-calculated from the disaggregated SW-WLA using the 75% reduction.

5) Calibrated SW-WLAs calculated by subtracting the calibrated reduction from the BayFAST calibrated baseline load. Bacteria SW-WLA is calculated by diaggregating the SW-WLA provide by MDE in the TMDL (2009, MDE). Refer to the County's CIS restoration plan (KCI, 2017b) for more details.

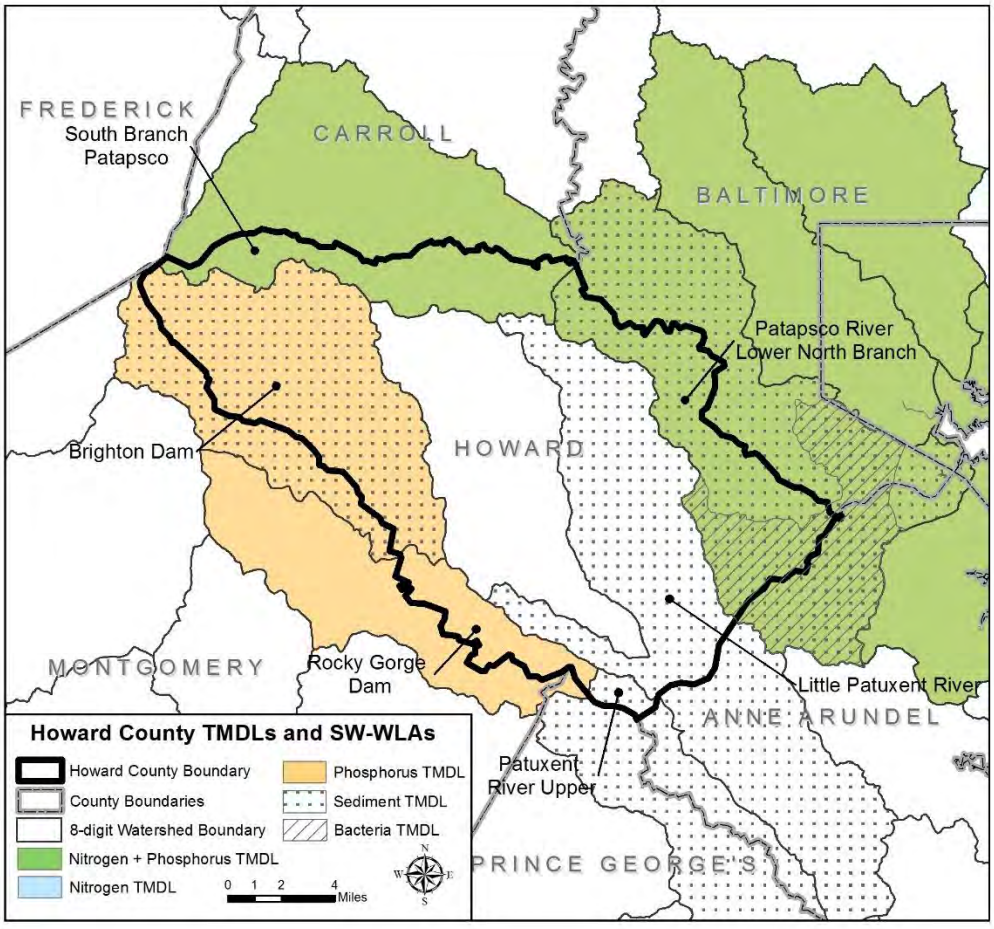

Figure 2. Howard County Local TMDLs with SW-WLAs.

1.5.4 Chesapeake Bay Total Maximum Daily Load (TMDL)

The Chesapeake Bay TMDL, established by the EPA (EPA, 2010), sets pollution limits for nitrogen, phosphorus, and sediment in the Chesapeake Bay watershed. Total limits set in the Bay TMDL for the states of Delaware, Maryland, New York, Pennsylvania, Virginia, West Virginia, and the District of Columbia are "185.9 million pounds of nitrogen, 12.5 million pounds of phosphorus and 6.45 billion pounds of sediment per year—a 25 percent reduction in nitrogen, 24 percent reduction in phosphorus and 20 percent reduction in sediment" (EPA, 2010). The TMDL also sets "rigorous accountability measures" for state compliance.

1.5.5 Impervious Surface Treatment Strategy

The County's MS4 permit is requiring compliance with the Chesapeake Bay TMDL through the use of the 20% impervious surface treatment strategy. As a requirement of section PART IV.E.2.a of the NPDES MS4 Discharge Permit issued by MDE to Howard County, the County must conduct an impervious area assessment to define the restoration efforts required under the permit to restore 20% of remaining Countywide baseline impervious acres not already restored to the MEP. The restoration is required to be complete by 2019, the end of the current permit term.

2. Assessment of Current Watershed Conditions

This section describes the current conditions of South Branch Patapsco and Patapsco Lower North Branch watersheds (Figure 3), including information from geographic information system (GIS) data and existing stream monitoring efforts. GIS data were compiled from Howard County and other sources for use throughout the watershed assessment and planning process; see Appendix A for an inventory of GIS data gathered. The initial watershed characterization and desktop assessment step is described in this section. Subsequent sections detail the remaining steps of the project, for which GIS was integral: GIS screening analysis to select sites for field visits (Section 3), planning and conducting field investigations (Section 4), prioritization of restoration opportunities identified (Section 5), and development of concept plans (Section 5.4).

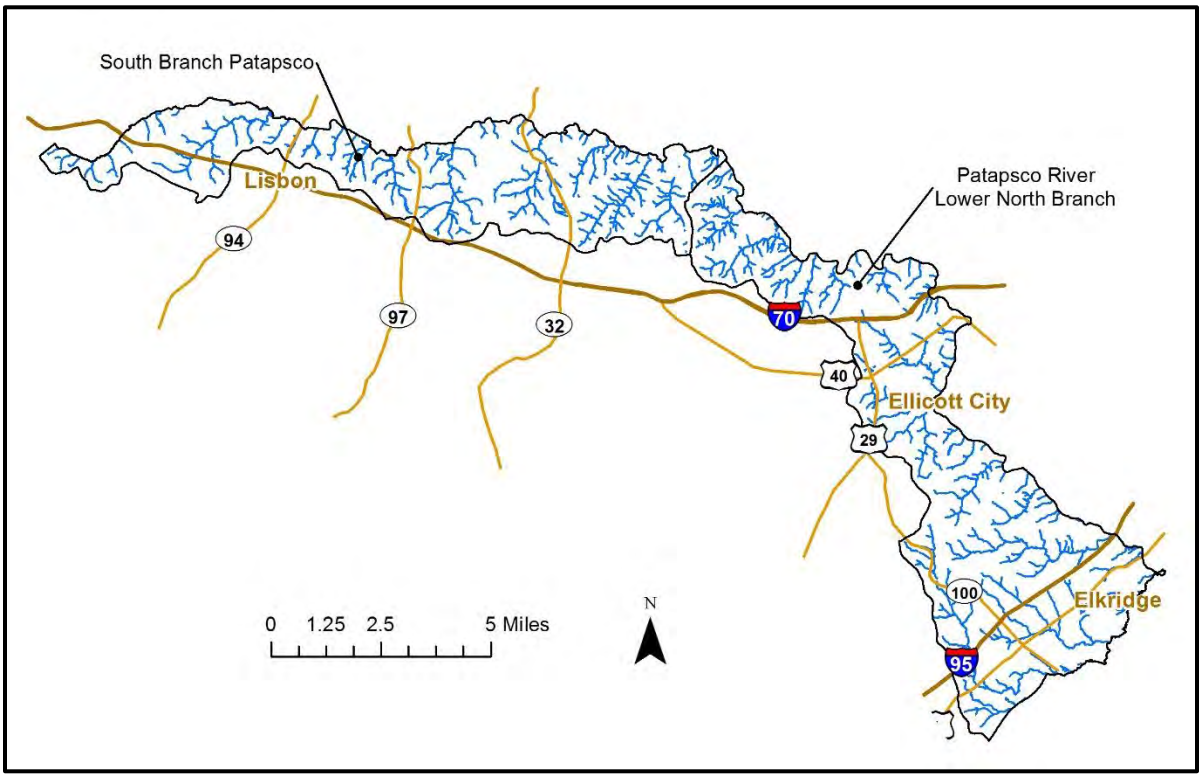

Figure 3. South Branch Patapsco and Patapsco Lower North Branch watersheds in Howard County, Maryland

2.1 Impervious Surfaces

Studies have shown a correlation between the amount of impervious surface within a watershed and stream quality (e.g., Schueler et al., 2009). Impervious surfaces, including roads, parking areas, roofs, and other paved surfaces, prevent precipitation from naturally infiltrating the ground. This prohibits the natural filtration of pollutants and conveys concentrated, accelerated stormwater runoff directly to the stream system. Consequently, stormwater runoff from impervious surfaces can cause stream erosion and habitat degradation from the high energy flow. Furthermore, such runoff is likely more polluted than runoff generated from pervious areas.

Percent impervious cover is the most commonly used single measure of urban impacts to streams. Schueler (2009) defines the following general categories, using the Impervious Cover Model (Figure 4)

describing the general relationship between the amount of impervious cover in a watershed and stream quality:

- Sensitive Streams: 2 - 10% impervious cover
- Impacted: 10 - 24%
- Damaged (Non-Supporting): 25 - 59%
- Severely Damaged (Urban Drainage): 60% or more

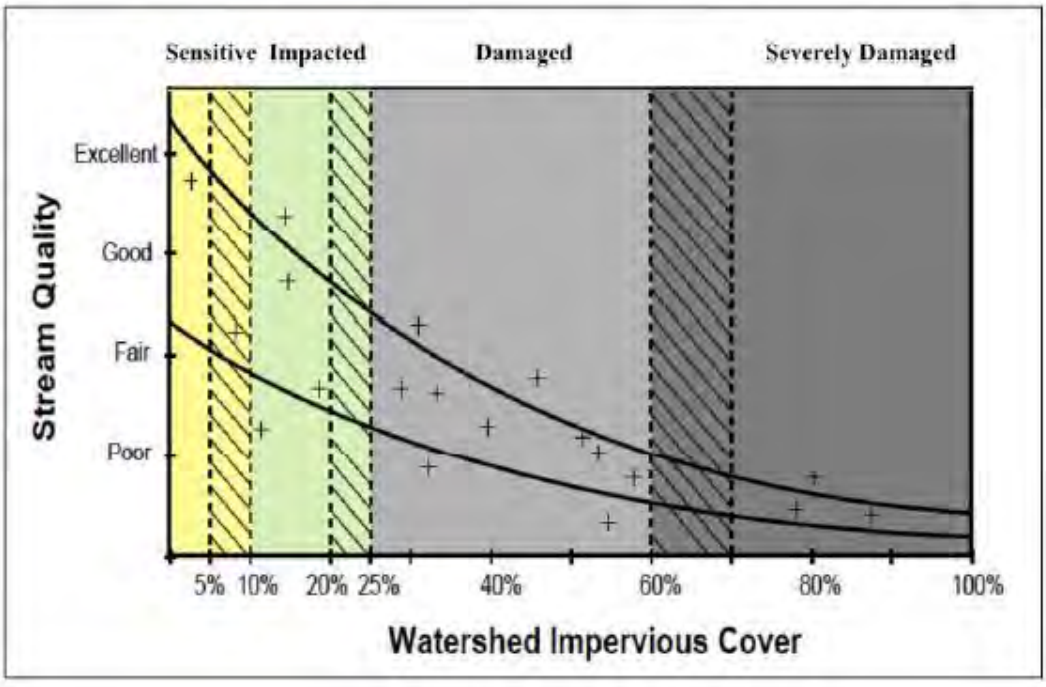

Figure 4. Impervious Cover Model (adapted from Schueler et al., 2009)

Howard County's impervious cover GIS data were used to map and quantify impervious cover within the Patapsco River Watershed (Figure 5). The impervious GIS layer, updated October 2, 2015, includes roads, parking lots, driveways, major buildings, bridge decks, sidewalks, pathways, and swimming pools. Table 3 outlines the impervious area of each watershed.

Table 3. Watershed Impervious Area

Watershed	Total Area (square miles)	Impervious Area (square miles)	Impervious Percent	Wooded Area (square miles)	Wooded Percent
South Branch Patapsco	25.1	1.2	4.8	7.0	27.9
Patapsco River Lower North Branch	37.9	6.9	18.2	13.0	34.3

While the Impervious Cover Model provides a general indication of stream conditions under varying degrees of impervious cover, it does not explicitly account for the effectiveness of BMPs that are in place to treat runoff from those impervious areas. Table 4 presents the number of stormwater BMPs (includes septic practices, tree planting, outfall stabilization, stream restoration and stormwater structures) and treated area in each watershed. Figure 6 shows impervious cover and areas treated by existing BMPs.

Table 4. Number of stormwater BMPs and treated area in each watershed

Watershed	Stormwater BMPs	Treated Area (acres)	Treated Area (square miles)
South Branch Patapsco	181	164.1	0.3
Patapsco River Lower North Branch	2,696	880.8	1.4

Howard County's current MS4 permit requires restoration of an additional 20% of impervious cover, countywide, not already restored to the MEP. Following MDE guidance (MDE, 2014b), impervious cover not restored to the MEP can be defined, in practice, as any impervious acres not draining to BMPs constructed after 2001. Beginning in 2002, Maryland regulations and local ordinances required BMPs to address a specific stormwater volume equivalent to providing water quality treatment to the MEP. Additional information pertaining to this requirement and planned implementation can be found in the County's restoration plan, Countywide Implementation Strategy (KCI, 2017b).

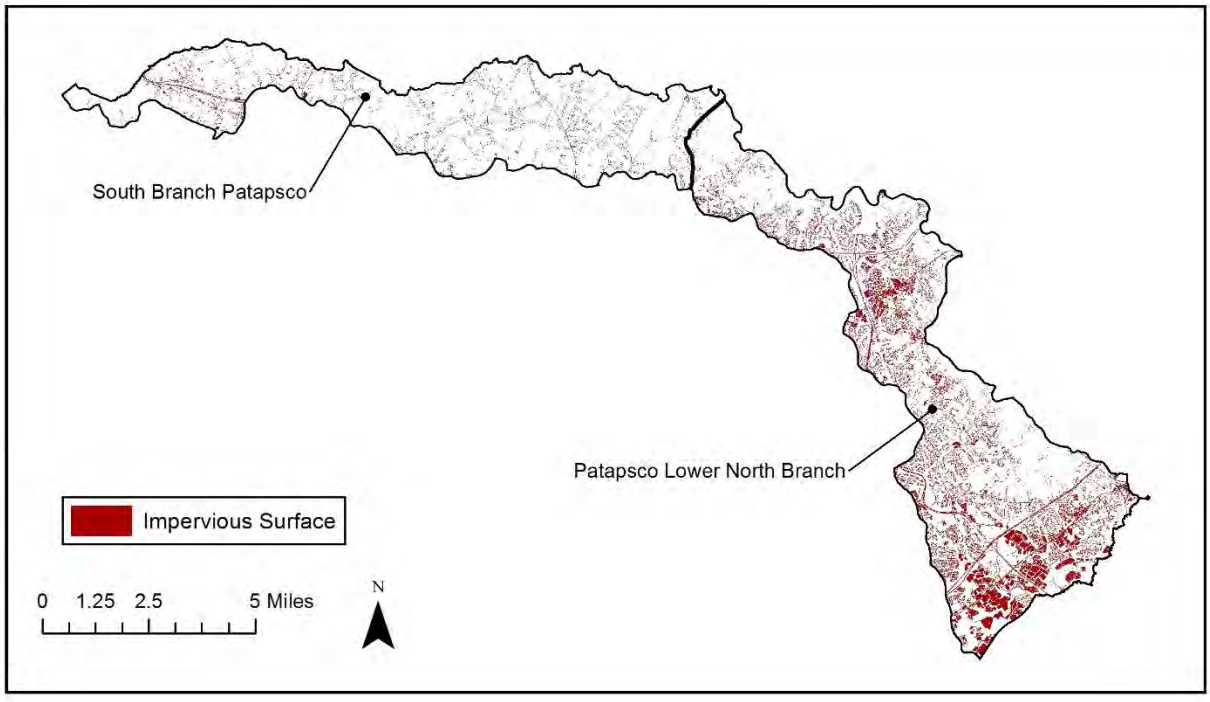

Figure 5. Impervious surfaces in Patapsco River watershed (Howard County 2015 impervious GIS data)

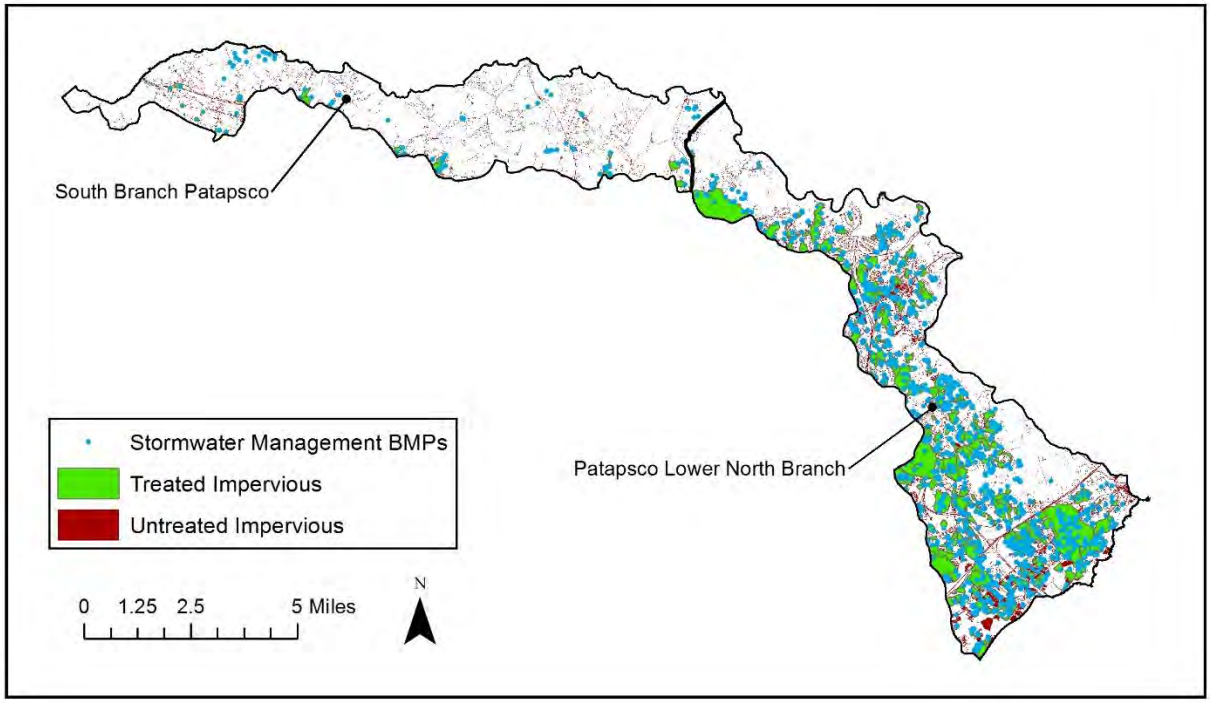

Figure 6. BMP Locations, Treated and Untreated Impervious Surfaces

2.2 Land Use

Land use within Patapsco River Watershed was derived from Maryland Department of Planning, 2010 data (Figure 7, Table 5). The two watersheds vary greatly in land use. Primary land uses in South Branch Patapsco are agriculture, residential, and forest. Patapsco Lower North Branch is primarily residential and commercial, with some forest and agriculture. Residential is the primary land use under the "urban" category in both of these watersheds.

Table 5. Land use of South Branch Patapsco and Patapsco Lower North Branch

Watershed	Urban		Agriculture		Forest		Water		Other	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
South Branch Patapsco	5,749.5	35.8	5,791.1	36.1	4,498.2	28.0	3.6	0.0	14.8	0.1
Patapsco River Lower North Branch	13,988.1	57.7	1,593.7	6.6	8,340.0	34.4	0.0	0.0	310.2	1.3

Future land use will be influenced by zoning (Figure 8). The vast majority of South Branch Patapsco watershed is designated rural residential with a few office/commercial zones. The Patapsco Lower North Branch watershed is more mixed, with majority of the watershed zoned low density residential, along with portions of medium and high density residential, office/commercial, mixed use, industrial, and commercial/residential zoning.

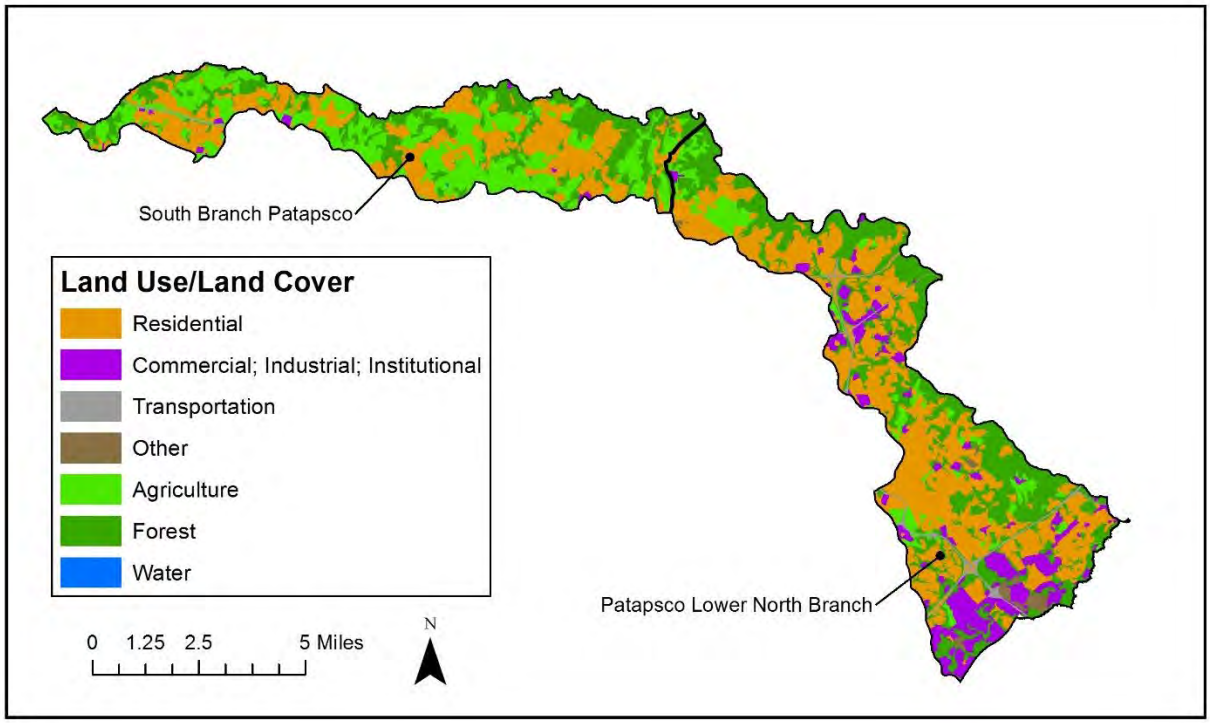

Figure 7. Land use in Patapsco River watershed.

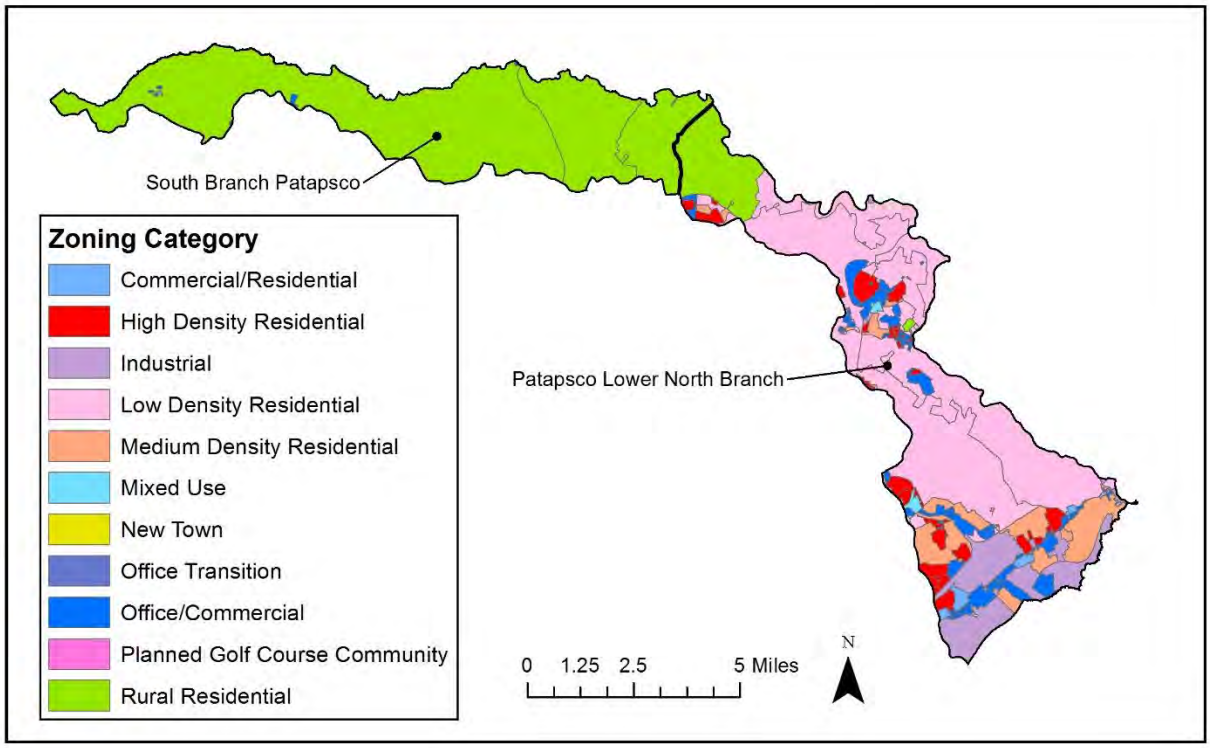

Figure 8. Zoning in the Patapsco River watershed

2.3 Soils

Soil conditions are important when evaluating how a watershed affects water quantity and quality in streams and rivers. Soil type and moisture conditions impact how land may be used and its potential for infiltration or various types of plants. Howard County's GIS soils layer was used for the soils data analysis and is a representation of the Howard County Soil Survey.

The Natural Resource Conservation Service (NRCS) classifies soils into four hydrologic soil groups based on runoff potential. Runoff potential refers to the tendency of soils to produce surface runoff; it is the opposite of infiltration capacity (i.e., the ability for the soil to absorb precipitation). Soils with high infiltration capacity will have low runoff potential, and vice versa. Infiltration rates are highly variable among soil types and are also influenced by disturbances to the soil profile (e.g., land development activities). For example, urbanization in watersheds with high infiltration rates (e.g., sands and gravels) will have a greater impact than urbanization in watersheds consisting mostly of silts and clays, which have low infiltration rates. Factors that affect infiltration rate include soil permeability (influenced mostly by texture and structure), slope, degree of soil saturation, and percentage of leaf litter cover. The four hydrologic soil groups are A, B, C, and D, where Group A soils generally have the lowest runoff potential and Group D soils have the greatest.

Brief descriptions of each hydrologic soil group are provided as follows. Further explanation of each can be found in the U.S. Department of Agriculture (USDA)/NRCS publication, Urban Hydrology for Small Watersheds, also called Technical Release 55 (USDA, 1986).

- Group A soils include sand, loamy sand, or sandy loam types. These soils have a high infiltration rate and low runoff potential even when thoroughly wet. These consist mainly of deep, well to excessively drained sands or gravel. These soils have a high rate of water transmission.
- Group B soils include silt loam or loam types. They have a moderate infiltration rate when thoroughly wet. These soils mainly consist of somewhat deep to deep, moderately well to well drained soils with moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.
- Group C soils are sandy clay loam. These soils have a low infiltration rate when thoroughly wet. These types of soils typically have a layer that hinders downward movement of water and soils with moderately fine or fine texture. These soils have a low rate of water transmission.
- Group D soils include clay loam, silty clay loam, sandy clay, silty clay, or clay types. These soils have a very low infiltration rate and high runoff potential when thoroughly wet. These consist mainly of clays with high swell potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very low rate of water transmission.

As shown in Figure 9, the majority of South Branch Patapsco and Patapsco Lower North Branch watersheds fall into soil group B with moderate infiltration rates. Patapsco Lower North Branch watershed has a much larger proportion of soil groups with higher runoff potential, in hydrologic groups C and D. The low infiltration rates of these soils mean that they are more susceptible to flooding and provide a poor porous medium for stormwater ponds and Environmental Site Design (ESD) opportunities, so opportunities should be considered carefully, using local-scale information.

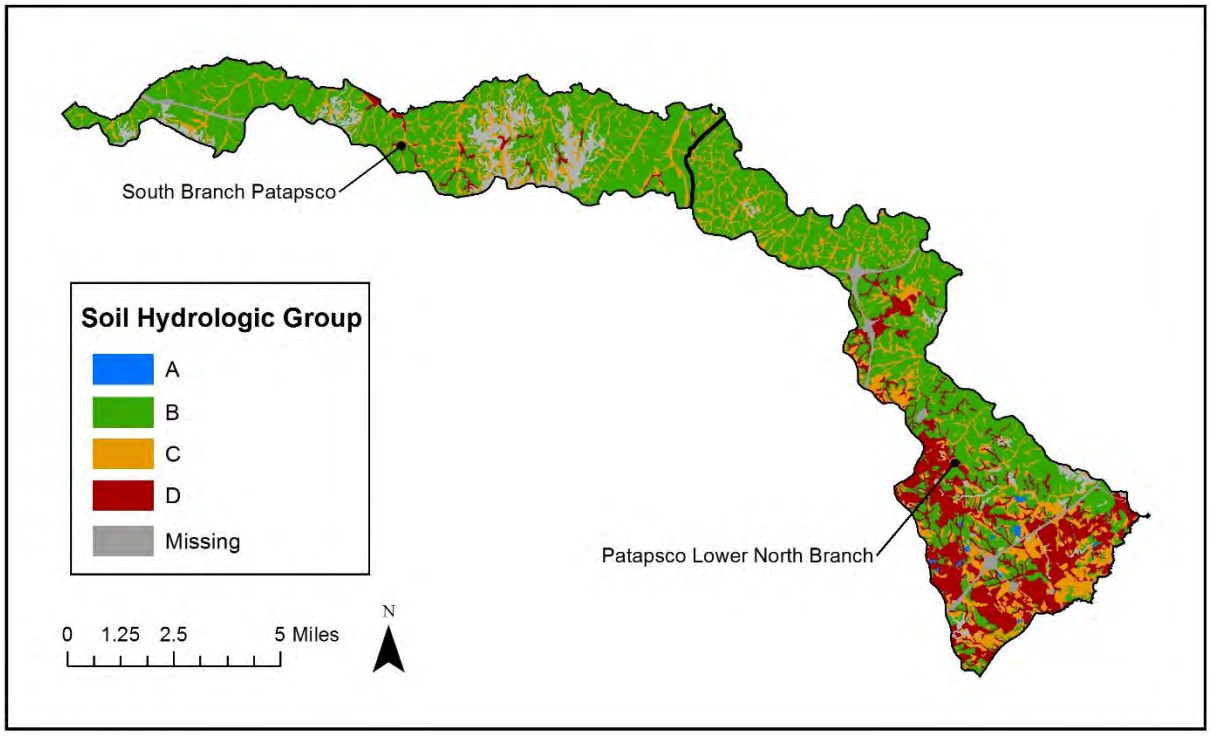

Figure 9. Soil hydrologic groups in Patapsco River watershed

2.4 Stream Condition

Howard County conducts biological monitoring at randomly selected stations in its Countywide monitoring program which began in 2001. In addition, the Maryland Department of Natural Resources (DNR) Maryland Biological Stream Survey (MBSS) has performed stream monitoring statewide since 1995, using similar monitoring methods as the County. Since 2000, the DNR Stream Waders volunteer program has performed benthic macroinvertebrate monitoring throughout the County. The results of all of these assessments are shown in Figure 10.

Of the 219 sites in South Branch Patapsco and Patapsco Lower North Branch watersheds, only 22 (10%) were in Good condition, 64 (29%) were in Fair condition, 64 (29%) were in Poor condition, and 70 (32%) were in Very Poor condition. The distribution of these four ratings are very scattered throughout the watershed, however there is a notable cluster of sites with Very Poor and Poor ratings in the southern portion of the Patapsco Lower North Branch watershed where there is more heavily development.

Stream habitat condition was also evaluated by Howard County and MBSS using the MBSS Physical Habitat Index (PHI) for habitat assessment. Of the 45 sites assessed (Figure 11), 5 sites (11%) were rated as severely degraded (the lowest scoring category), 12 sites (27%) were rated as degraded, and 26 sites (58%) were rated as partially degraded, and 2 sites were rated as minimally degraded (4%). These scores indicate that many streams in the Patapsco River watershed show evidence of habitat degradation.

While stream conditions vary across the county, degradation is more prevalent in the heavily developed urban areas. This reflects the history of urban and suburban development prior to effective stormwater management regulations. Watershed condition is generally better in the more rural parts of the county, but stream degradation still occurs in these areas as a result of large lot development and agricultural

impacts. By reducing the adverse effects of stormwater runoff throughout the county, the process of watershed assessment, restoration planning, and implementation of prioritized BMPs should improve the water quality condition in the Patapsco River Watershed over time.

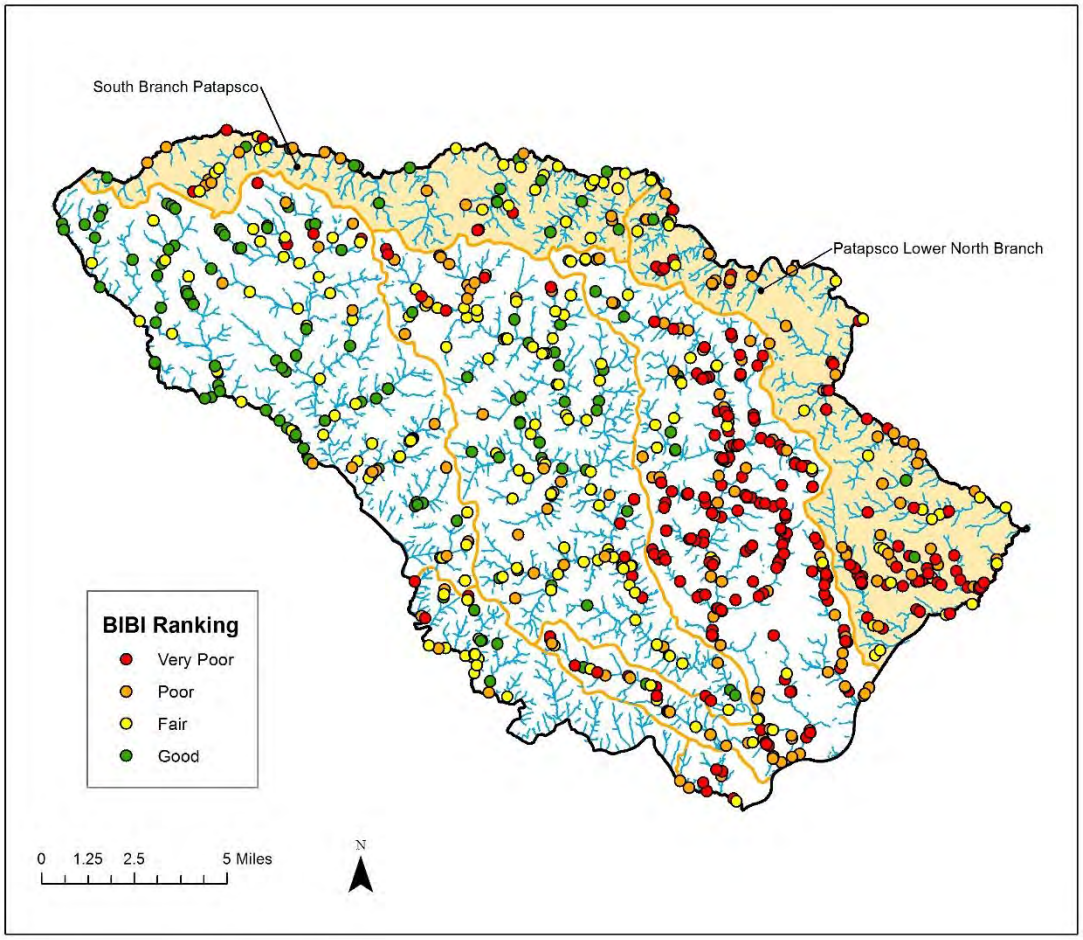

Figure 10. Benthic Index of Biotic Integrity ratings at sites assessed by Howard County, MBSS, and Stream Waders 1995-2016

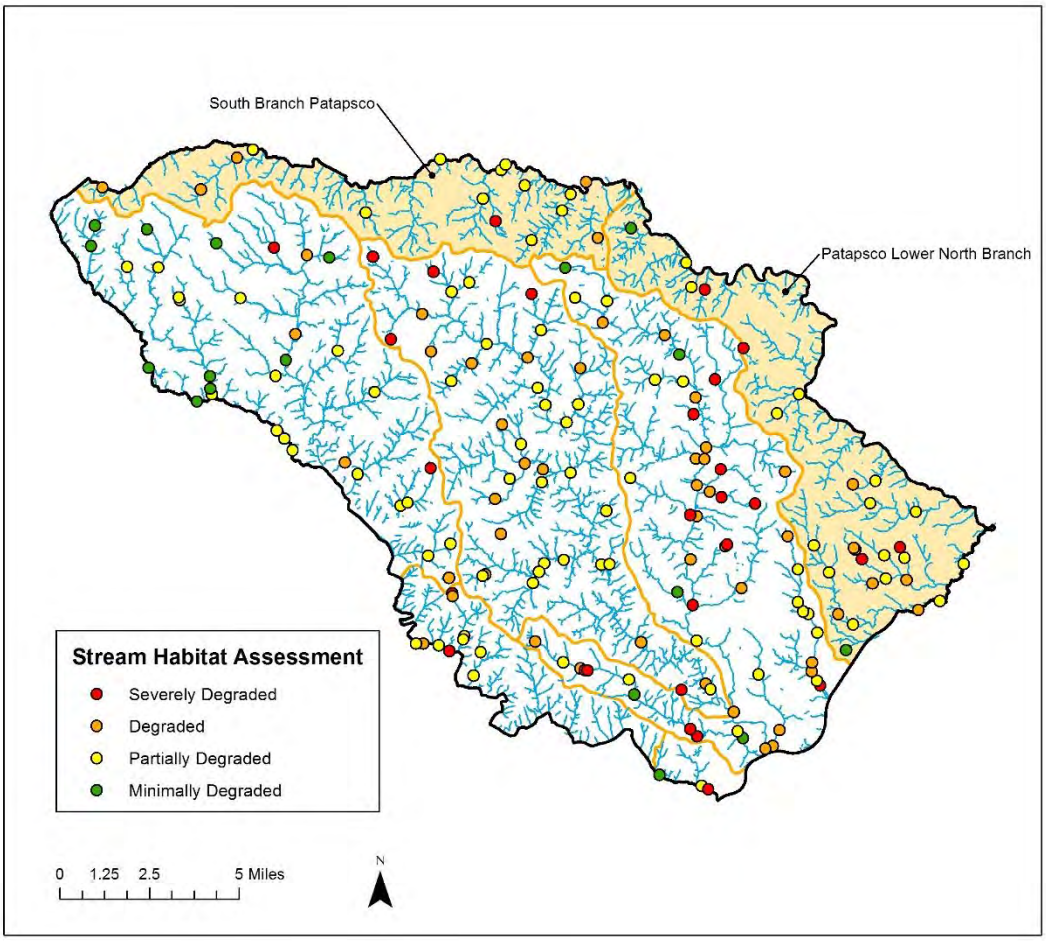

Figure 11. Habitat Assessments based on Physical Habitat Index (PHI) protocol at sites monitored by Howard County and MBSS, 1995-2016

2.5 Best Management Practices: Opportunities for Retrofit and Restoration

The same five types of retrofit and restoration opportunities were considered for the current watershed assessment as the previous watershed assessments (Versar, 2016a and 2016b): (1) upgrading and retrofitting existing BMPs, (2) proposing new BMPs, (3) planting trees, (4) restoring streams, and (5) stabilizing storm drain outfalls. These structural practices will be combined with non-structural programmatic practices (e.g. street sweeping, septic system upgrades) that the County is implementing as part of its overall strategy. The following describes these structural practices in more detail.

2.5.1 BMP Conversions

Howard County has implemented BMPs and other watershed management practices since the 1980s. The initial focus of stormwater management was detention of large flows to reduce flooding using dry ponds and extended detention dry ponds. Conversion of these facilities to wet ponds and wetlands that meet current water quality volume treatment requirements and provide greater pollutant removal efficiencies is a cost effective restoration practice. These conversion types include:

- Extended detention dry ponds (if dry pond is present and no other viable option is available)
- Extended detention wet pond/wetlands, shallow wetlands

- Bioretention
- Non-bioretention filtering practices
- Infiltration practices
- Swales
- Addition of pre-treatment or post-treatment BMPs within existing dry or wet pond boundaries
- New BMP retrofits outside of existing dry or wet pond boundaries but which would drain into an existing pond or capture and treat stormwater just outside of the existing pond (e.g. step pool conveyance).

Stormwater pond conversions can include the following general options for the re-design of existing stormwater ponds to provide additional water quantity control or water quality treatment:

- Increasing storage capacity by additional excavation
- Providing water quality treatment features at facilities that currently have only water quantity control, if the space is available. Examples include: micropools, sediment forebays, or constructed stormwater wetlands.
- Modifying or replacing existing outlet controls to reduce the discharge rate from the stormwater management facility.
- Where soil types are appropriate, adding infiltration (sometime referred to as exfiltration) features to promote groundwater recharge and improve pollutant removal.
- Where water quality flows can be split or separated from larger events, vegetated areas with engineered soils and underdrain, referred to as bioretention, can sometimes be retrofit into an existing pond as pretreatment or post treatment and yield a significant increase in pollutant removal efficiency.
- Installing proprietary settling, filtering or hydrodynamic devices in parking lots or other areas with a large percentage of impervious area to trap sediments, trash and petroleum products before they flow into a pond. These tend to have low pollutant removal efficiencies but can be good options in the highly urban context, particularly where subterranean treatment is the only option.

2.5.2 New BMPs

New BMP practices include retrofitting untreated impervious with new stormwater BMP facilities. This can include locations that currently have no stormwater quantity or quality controls or where existing BMPs are inadequate and where space is available for a new BMP. New BMP practices include:

- Extended detention wet ponds/wetlands, shallow wetlands
- Bioretention
- Non-bioretention filtering practices
- Infiltration practices
- Swales
- Replacement of impervious cover with pervious pavement
- Impervious surface removal
- Rain gardens

2.5.3 Tree Planting

Reforestation opportunities at stream buffers or in upland areas provide ancillary benefits of enhancing wildlife and amenity values, as well as reducing runoff from interception and uptake/transpiration of precipitation, providing soil stability, heat island reduction, and wildlife habitat benefits. Riparian forest buffers are typically at least 35 feet on each side of the stream and provide benefits such as filtering sediments and pollutants from stormwater runoff, moderating water temperatures in streams, and providing shelter and food to both terrestrial and stream organisms. Upland tree plantings provide many of the same benefits along with increasing wildlife habitat and aesthetics.

2.5.4 Stream Restoration

Stream restoration is used to improve the ecosystem condition in degraded streams by restoring the natural hydrology and landscape of a stream and by enhancing habitat and water quality. Streams damaged by erosive flows, excess sedimentation, and disruptive human activities are often not capable of re-establishing a stable form. Preferred techniques to repair these damaged or degraded streams are based on mimicking natural stream channels and the range of natural variability exhibited by nearby stable streams. Termed natural stream channel design, such repairs focus on establishing natural stream channel shape, size, and habitat features. Restoration can range from minor repairs to bank stability restoration to complete reconstruction of the stream channel. Stream restoration also provides significant ancillary benefits through habitat enhancement and improved ecosystem services.

2.5.5 Outfall Stabilization

Outfall stabilization includes the restoration of degraded ephemeral and intermittent outfall channels through stabilization techniques which include:

- *Step Pool Stormwater Conveyances / Regenerative Stormwater Conveyances* are open-channel conveyance systems that convert surface stormwater flow to shallow ground water flow through surface pools and subsurface sand seepage filters (Anne Arundel County, 2012). These practices can be used to stabilize degraded ephemeral and intermittent channels while also providing water quality treatment for the contributing drainage area, allowing for pollutant removal opportunities that do not exist with traditional outfall stabilization techniques. Specific site conditions will dictate whether these practices are appropriate. Pollutant reductions for regenerative stormwater conveyances will be credited using the Expert Panel's Protocol 4, as described in Section 6.1.1.
- *Other Stabilization Practices*. Where step pool conveyances are not feasible, simpler outfall channelization practices such as riprap or drop structures may be implemented to reduce erosion.

3. Desktop Analysis and Field Site Selection

Potential retrofit and restoration sites for field investigation were selected through a desktop analysis using a suite of GIS data and data compiled from previous studies. Specific methods for each BMP type are described in the following sections. In general, areas within non-County NPDES MS4 stormwater regulation were not investigated, including State property.

3.1 Conducting Desktop Analysis- Methods

3.1.1 BMP Conversion Assessments

The County's stormwater BMP facility database was used, which includes BMP types and BMP drainage area polygons, to identify BMPs that could be converted to a design with increased pollutant removal efficiencies. The desktop analysis was conducted with the most complete BMP database update available at the time, in December 2015. Facilities that were identified as being either a dry pond or dry extended detention pond that did not comply with current water quality volume treatment criteria of treating 1 inch of rainfall (MDE, 2014b) were selected. Facilities that had been identified and assessed in previous County assessment efforts and studies were not included in the selection for field assessment. The initial selection process resulted in a very large pool of candidate sites in Patapsco Lower North Branch, so ponds with larger drainage areas were prioritized; 43 sites with drainage areas over 10 acres were selected while only 17 sites with drainage areas less than 10 acres were selected.

Desktop assessments were reserved for sites of interest that had been previously visited during recent County studies conducted to identify retrofit and restoration opportunities: Howard County Dry Pond and Extended Detention Pond Retrofits Summary Report (Versar, 2013a), the Howard County Low Impact Development (LID) Retrofits and Tree Planting Summary Report (Versar, 2013b), and the Tiber Hudson Subwatershed Restoration Action Plan (Center for Watershed Protection, 2013). These desktop assessments were included to put all previously studied sites into the same frame of reference, so that previously identified opportunities could be ranked and evaluated alongside the new opportunities identified during this Watershed Assessment.

During a two day review of all sites selected via the GIS desktop analysis, Howard County Stormwater Management and KCI staff reviewed each potential project site and removed sites where conditions were known to be not conducive for a project. The County also added sites that citizens had brought to the County's attention.

3.1.2 New BMP Assessments

Prior to 1982, when the State's first Stormwater Management law was passed, there were no requirements for quantity or quality control of urban runoff. This means that when land development occurred before this law's enactment, there were very few BMPs built to control the runoff from new impervious surfaces. Controlling runoff from impervious surfaces in areas of older development presents unique challenges – there must be adequate open space available for a new BMP and the open space must be in the correct landscape location for receiving impervious runoff (or costly changes need to be made to site grading or stormwater infrastructure to re-direct runoff to the available open space). Because of this, when selecting assessment sites for new BMPs, efforts were made to limit assessments to areas where implementation of new practices would allow for treatment of significant areas of impervious surface.

The County's latest planimetric GIS layers (including roads, buildings, parking lots, driveways and major sidewalks) were combined to identify where there were contiguous blocks of impervious surface. These blocks of impervious were then overlaid with the drainage areas treated by current or planned BMPs; the potential pool of candidates was limited to those areas not treated by an existing or planned BMP, as per the County's BMP and Water Quality Improvement Projects data. Older or underutilized properties were prioritized. Sites that were previously identified during other studies were not included

for field assessment. Sites with poor access, or projects that would cause major interruptions to business operations were also eliminated.

Similar to BMP Conversion desktop sites, New BMP desktop sites were selected from previous studies: the Howard County Low Impact Development (LID) Retrofits and Tree Planting Summary Report (Versar, 2013b), the Tiber Hudson Subwatershed Restoration Action Plan (Center for Watershed Protection, 2013), and Tiber Branch and Sucker Branch Interceptor Improvements (Century Engineering, 2016). These desktop assessments were included to put all previously studied sites into the same frame of reference, so that previously identified opportunities could be ranked and evaluated alongside the new opportunities identified during this Watershed Assessment.

A list and geodatabase of candidate sites were prepared for presentation to Howard County staff during a site-by-site review of opportunities selected by the GIS desktop analysis.

3.1.3 Tree Planting Assessments

Howard County GIS data were used to identify parcels that are good candidates for tree planting projects. The County's forest conversation easement GIS layer was used in conjunction with recent aerial imagery to identify easements that appeared to either not be planted, or to not be currently forested as some sites may have been planted initially but were unsuccessful. County owned properties (open space, parks, schools) were prioritized by identifying all public and County-owned properties and locating areas on aerial photography that appeared to be open space. Additionally, a search using aerial imagery and the stream layer was conducted to find sites on private property in need of a riparian buffer or buffer enhancement. Larger sites were prioritized over sites on smaller parcels. Sites that had been previously planted (coded FPU in County BMP database) were excluded. Desktop sites were identified from the Howard County Low Impact Development (LID) Retrofits and Tree Planting Summary Report (Versar, 2013b), so that they could be ranked and evaluated alongside the new opportunities identified during this Watershed Assessment.

During a comprehensive review of sites selected by the GIS desktop analysis, Howard County Stormwater Management Division staff had a chance to remove sites where conditions were known to be not conducive for a tree planting project. As an additional step following this meeting, staff of the Howard County Department of Recreation and Parks and Howard County Soil Conservation District were also provided with maps and given the opportunity to review the candidate sites and remove/add sites based on their local knowledge of the sites. Additionally, sites on school properties were sent to the Howard County Public Schools Grounds Services Manager for any additional input.

3.1.4 Stream Restoration Assessments

Howard County GIS data were used to isolate stream segments within the watershed where environmental problems are known to exist. Specific GIS data were used to identify stream segments containing known problems, particularly where erosion had been observed, such that sites would be good candidates for further investigation of restoration potential. Existing data that were used as the first step to flag potential sites included: erosion and channel alteration points from the Deep Run and Patapsco River Stream Corridor Assessment (SCA) and bank stability scores collected during annual Countywide biological monitoring surveys conducted every spring (years 2012-2015). Sites with fair to low bank stability scores were identified as potential assessment sites. During the desktop analysis, streams on County-owned properties were prioritized, as were longer segments of potential

impairment. Using the most recent aerial imagery, a visual search for streams with minimal or deficient buffers were identified, and those streams were selected for investigation.

During a two-day review of sites selected by the GIS desktop analysis, staff from Howard County's Stormwater Management Division had a chance to remove sites where stream restoration work was already completed or planned, or sites where conditions were known to be not conducive for a restoration project. The County staff also had a chance to add sites that citizens had brought to the County's attention that had not made the initial list of candidates. Additionally, maps of sites on agricultural use properties were sent to Howard County Soil Conservation District for their review.

3.1.5 Outfall Stabilization Assessments

GIS data from previous watershed studies, BMP inspections, Illicit Discharge Detection and Elimination (IDDE) investigations, and previous SCA efforts were used to identify an initial pool of outfall stabilization candidates. The GIS data were used to select outfalls that had been previously identified as having an erosion issue. Data used for outfall selection includes Howard County IDDE data (2000-2014), BMP inspections (2014-2016), and the Deep Run and Patapsco River SCA. Outfalls with IDDE erosion scores of moderate or severe were selected. BMP inspection notes were investigated for BMPs with outfall ratings of 3 or 4 to identify sites with erosion issues, rather than general maintenance requirements. SCA pipe outfall points with severity scores of moderate or severe were also selected.

Outfalls were removed from the initial pool of candidates if they were associated with an outfall stabilization project identified in a previous study or were within Howard County's Water Quality Improvement Project database as a planned or completed project.

Several of the candidate outfalls were close enough to another candidate outfall that it was possible that they were the same outfall surveyed during multiple studies or over multiple IDDE investigations. All obvious duplicate outfalls were removed prior to the merging of candidate outfall GIS layers from previous studies, but the duplication of several proximate outfalls could not be verified due to a lack of a unique identifier and inconsistencies with surveyed outfalls matching the location of outfalls and pipes contained within the County's stormwater infrastructure GIS layers. These situations were individually investigated and assumptions were made based on all available GIS data. These assumptions were verified during the field investigation and exact pipe locations and quantities were recorded.

3.2 Desktop Analysis Summary- Results

Table 6 and Table 7 show the final breakdown of sites selected for field and desktop assessments. The final number of sites that were actually assessed, which are presented in Section 4, do not match the numbers shown in these tables for two reasons. First, in addition to the sites selected through the desktop analysis, field teams had the ability to add new sites that they found in the field, increasing the number of assessed sites. Second, some of the sites selected through the desktop analysis were not able to be visited due to issues such as property owner constraints and sites not being found, decreasing the number of assessed sites. Explanations of why sites could not be assessed can be found in the consultant field reports located in Appendix E.

Table 6. Number of sites selected for field assessments

Assessment Type	Unit	Number of Sites (or Stream Miles)	
		South Branch Patapsco	Patapsco Lower North Branch
BMP Conversion	Number of sites	1	34
New BMP	Number of sites	0	17
Tree Planting	Number of sites	10	26
Stream Restoration	Stream miles	12.8	30.9
Outfall Stabilization	Number of sites	13	71

Table 7. Number of sites selected for desktop assessments

Assessment Type	Number of Sites	
	South Branch Patapsco	Patapsco Lower North Branch
BMP Conversion	0	14
New BMP	0	20
Tree Planting	0	3
Stream Restoration	0	5
Outfall Stabilization	0	6

4. Field Assessments

Field assessments were conducted in 2016 to gather data on existing conditions in the Patapsco River watershed and to recommend sites with potential restoration and stormwater retrofit opportunities. Teams from four consultant groups were assigned portions of the Patapsco River watershed to assess. The South Branch Patapsco watershed was assessed by Biohabitats, and the Patapsco Lower North Branch watershed was split between KCI and McCormick Taylor. Additional desktop assessments were performed by Straughan Environmental, Inc.

4.1 Field Methods and Calibration

4.1.1 Field Protocols

Howard County Watershed Assessment field protocols were developed by Versar prior to the Little and Middle Patuxent River watershed assessments, in consultation with Howard County Stormwater Management Division and the other three consultant teams. Only minor changes to field protocols were made for the current watershed assessment study. Data collection was customized for each of the five BMP types and focused on (1) assessing current conditions and (2) identifying and describing restoration opportunities.

Specific protocols for each type in many instances drew from existing methodologies, but with customization to ensure that data collected in the field met the needs for this project. Custom data collection protocols were developed to document the following types of assessments and recommendations.

- Conversion of existing stormwater BMPs - methods were derived from the Center for Watershed Protection's Retrofit Reconnaissance Investigation (RRI) protocol, from the Urban Subwatershed Restoration Manual 3 (CWP 2007);
- Establishment of new stormwater BMPs for impervious surfaces not currently treated –similar to BMP conversions, methods were derived from RRI (CWP 2007);
- Tree planting - methods were drawn from Pervious Area Assessments (PAA), Unified Subwatershed and Site Reconnaissance, Manual 11 (CWP 2005) and Urban Reforestation Site Assessment (URSA), Urban Watershed Forestry Manual, Part 3: Urban Tree Planting Guide (CWP 2006);
- Stream restoration - methods were a combination of Stream Corridor Assessment (SCA, Yetman 2001) for characterizing erosion and other stream features, EPA's Rapid Bioassessment Protocol (RBP, Barbour et al. 1999) for habitat assessment, Rosgen (1996, 2001) methods for Bank Erosion Hazard Index (BEHI) and other geomorphic indicators; and
- Outfall stabilization - methods were primarily derived from the SCA protocols (SCA, Yetman 2001).

A complete field packet was distributed to each of the consultant teams to ensure that assessments were being conducted in a consistent manner. The packet included guidance on naming sites added in the field, a list of sites with special notes that field crews were to read prior to assessing the sites, a field assessment decision flow chart, field names and domains for field assessment layers, Rapid Bioassessment Protocol habitat scoring sheets, and Bank Erosion Hazard Index (BEHI) diagrams. A complete copy of the packet can be found in Appendix C.

4.1.2 Electronic Data Collection

Field assessment data were collected with mobile tablet devices through the ESRI ArcCollector application. Digital photographs were taken at each assessment site and appended to the database. The electronic collection of data allowed for data to be entered directly into a geodatabase in the field and removed the step of having to manually enter data from paper datasheets in the office. ESRI Web Maps that were linked to the field assessment geodatabases were accessed from desktop computers to complete desktop assessment data entries, and to edit the field data. An ArcCollector Field Data Collection Instructions packet was developed and distributed to each of the consultant teams to be used as a reference guide while working with the geodatabases and the associated background data layers.

4.1.3 Calibration of Field Teams

Prior to beginning data collection, two field assessment training and calibration days were held to ensure that field personnel from each of the consultant teams were familiar with the methods being used to collect field data and to create a consistent perspective among all consultant personnel for recording field observations. The first training and calibration day covered BMP Conversion, New BMP, and Tree Planting field assessment protocols, and was held on March 22, 2016. The second day covered Stream Restoration and Outfall Stabilization field assessment protocols, and was held on March 24, 2016. Each of the training days consisted of a review, discussion, and revisions to field assessment protocols, review of data download, collection, and upload procedures with the tablets and the ArcCollector application. Brief visits to representative field sites for each of the five assessment types were also conducted.

4.1.4 Landowner Permissions

Once the final list of field sites was completed, the GIS parcel layer was used to identify all properties containing field sites. Property ownership data was populated for these properties and was used to send notification letters to request property permission. The following steps were taken to refine the mailing list:

- For public property (e.g., county-owned parklands, schools), County staff confirmed that sites were accessible and no letter was sent.
- School system personnel were contacted separately and the Howard County Public Schools Assistant Manager of Grounds Services was present during the field investigations. Field staff were also instructed to visit the school office, upon arrival at each school site, in order to present identification and sign in.
- Parcels containing more than one site were reduced to a single entry, to avoid duplicate mailings.
- For multiple-tenant commercial properties, a single letter was sent for the whole unit.
- Multi-owner or publicly accessible facilities (e.g., a commercial complex that would be readily accessible from a parking lot) were removed from the mailing list.
- Sites on agricultural properties were reviewed by the Soil Conservation District staff, who helped identify appropriate sites to visit, prior to letters being sent.

Howard County Stormwater Management Division staff developed a letter to send to property owners (see Appendix D). County staff sent out letters and field staff were instructed to wait an initial period of two weeks after letters were sent before beginning field work on private properties, to allow time for responses to be received by the County.

A web-based map was developed by the project team for County staff to use in recording permission responses and kept up-to-date as responses were received. Data fields were added to the data for each parcel to capture permission status (Granted, Notify Prior to Accessing, or Denied), comments, and contact name, address, and phone/email information. The map was color-coded to reflect parcel permission status. All information was readily available to field crews through the web map and ArcCollector application.

4.1.5 Field and Desktop Data Collection

The four field teams collected data during the period of March through May 2016. Teams communicated with KCI and County staff as needed to answer questions that arose about BMP data, site access, or other issues. Data were collected using field tablets, by working locally (with daily backups) or by collecting data live, on-line, and saving directly to the server.

In addition to the field assessments, three of the consultant teams (McCormick Taylor, KCI, and Straughan) conducted desktop reviews of sites that were visited during the Howard County Dry Pond and Extended Detention Pond Retrofits Summary Report (Versar, 2013a), the Howard County Low Impact Development (LID) Retrofits and Tree Planting Summary Report (Versar, 2013b), the Tiber Hudson Subwatershed Restoration Action Plan (Center for Watershed Protection, 2013), and the Tiber Branch and Sucker Branch Interceptor Improvements (Century Engineering, 2016). Desktop assessments consisted of BMP conversion, new BMP, tree planting, stream restoration, and outfall stabilization sites.

Data for desktop assessment sites were entered using the same data system along with field data, based on information available from prior studies and, in a few cases, a brief field visit.

4.1.6 Field Summary Reports

At the conclusion of the field visits, the consultant teams were asked to prepare a field summary report, summarizing field and desktop assessments completed, including the following information:

- Summary of the number of field assessments completed, by type;
- If there were sites that could not be assessed in the field, a summary of primary reasons;
- Comments about data or assumptions made;
- Summary of the number of recommendations made at field sites, with initial field rating of restoration potential (high, medium, or low);
- General comments about the types of recommendations made;
- List of sites reported to Howard County for follow-up because of suspected illicit discharges, safety concerns, or other reasons;
- Other comments/explanations related to data collected; and
- Summary of sites evaluated via desktop assessments.

Consultant team Field Summary Reports are included in Appendix E.

4.1.7 Field Data Quality Assurance/Quality Control

At the completion of the field and desktop assessments, all of the data for a given area were copied from the ESRI ArcGIS Server and sent to each of the consultant teams in the form of a file geodatabase. Each team had an opportunity to make any additions or edits to the geodatabases before they were sent to KCI for Quality Assurance/Quality Control (QA/QC). Once the file geodatabases were received, KCI reviewed each and checked for logical data (e.g., checking for stream bed particle size distributions that do not sum to 100%), use of correct site IDs, matching assessment and recommendation data, and overall completeness. Once the QA/QC process was complete, all of the file geodatabases were merged into a single personal geodatabase that could be used for the prioritization analysis.

4.2 Summary – Patapsco River Watershed Field and Desktop Site Assessments

Table 8 and Table 9 present the number of BMP conversion, new BMP, tree planting, stream restoration, and outfall stabilization field and desktop assessments conducted in each watershed. Further details are presented below, organized by BMP type.

Locations of assessments for BMP Conversion, New BMPs, Stream Restoration, Tree Planting, and Outfall Stabilization based on field and desktop assessments are shown in Figure 12.

BMP Conversion Assessments

A majority of the BMP facilities evaluated for conversion potential were existing dry ponds or extended detention dry ponds (Figure 13).

New BMP Assessments

No new BMP assessments were conducted in the South Branch Patapsco watershed. The majority of areas evaluated in the Patapsco Lower North Branch watershed were small commercial parking lots and industrial/commercial warehouse buildings and parking lots (Figure 14).

Tree Planting Assessments

Tree planting assessments were conducted in open grass areas, unplanted forest conservation lots, and in areas with absent or inadequate riparian buffers (Figure 15). Many tree planting assessments were conducted in riparian areas that were identified while conducting the stream restoration assessments.

Stream Restoration Assessments

Areas of erosion were identified and considered for stream restoration projects (Figure 16).

Outfall Stabilization Assessments

The majority of outfall stabilization assessments were located in the Patapsco Lower North Branch watershed due to its higher density of impervious surfaces and stormwater infrastructure. Outfall sizes ranged from 6 to 60 inches, with the majority of the pipes being in the 24-36 inch range. Photos of typical outfalls assessed are presented in Figure 17.

Table 8. Summary of Assessments in the South Branch Patapsco watershed

Type	Unit	Field Assessments	Desktop Assessments
BMP Conversion	Number of sites	1	0
New BMP	Number of sites	0	0
Tree Planting	Number of sites	20	0
Stream Restoration	Stream miles	11.4	0
Outfall Stabilization	Number of sites	11	0
	Total Assessments	**32 sites + 11.4 stream miles**	**0 sites**

Table 9. Summary of Assessments in the Patapsco Lower North Branch watershed

Type	Unit	Field Assessments	Desktop Assessments
BMP Conversion	Number of sites	34	14
New BMP	Number of sites	20	20
Tree Planting	Number of sites	33	3
Stream Restoration	Stream miles	33.0	0.6
Outfall Stabilization	Number of sites	100	6
	Total Assessments	**187 sites + 33.0 stream miles**	**43 sites + 0.6 stream miles**

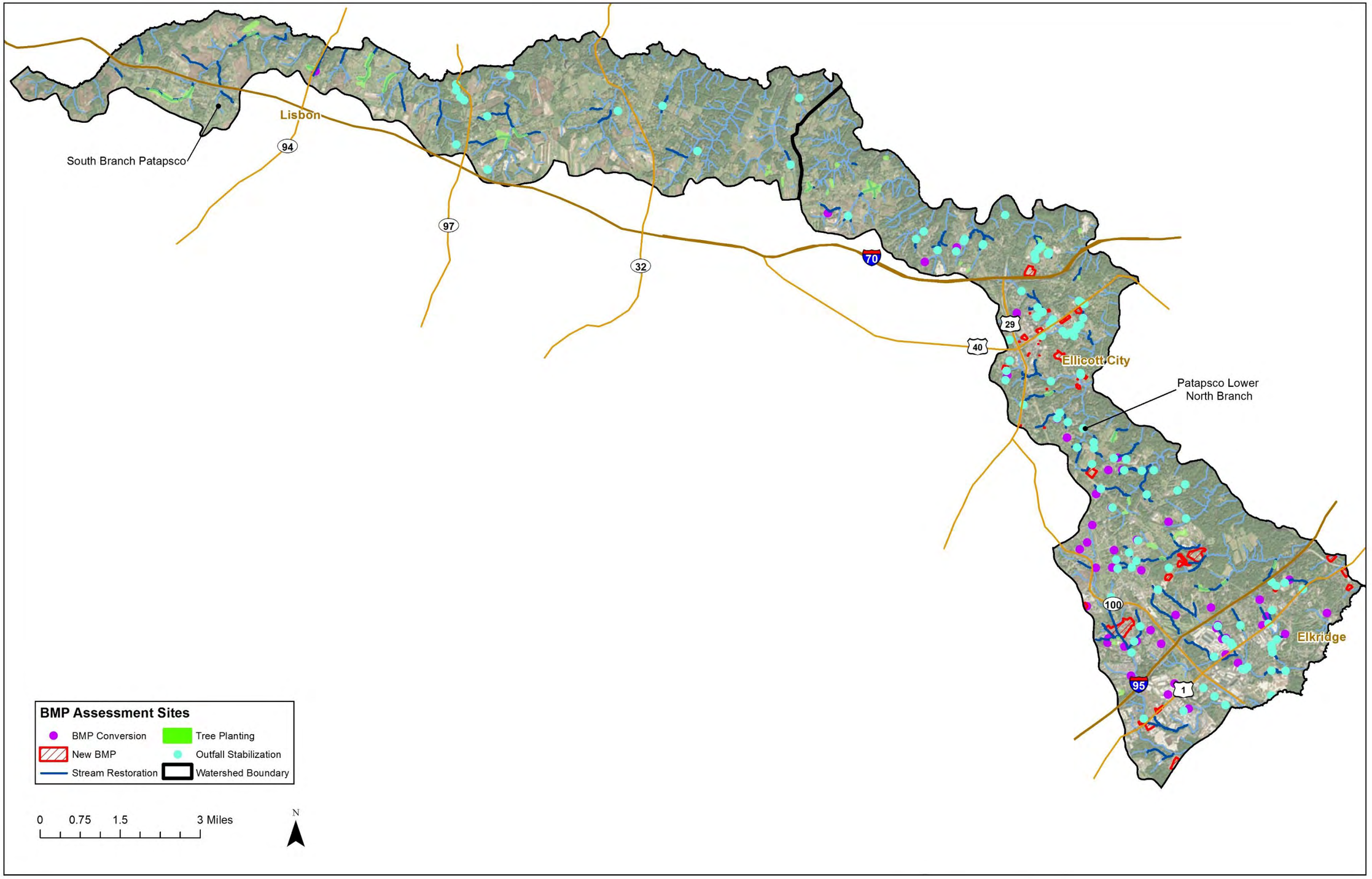

Figure 12. Location of Assessments

Figure 13. Typical BMP conversion recommendation sites

Figure 14. Typical new BMP recommendation sites

Figure 15. Typical tree planting recommendation sites

Figure 16. Typical stream restoration recommendation sites

Figure 17. Typical outfall stabilization recommendation sites

4.3 Summary – Patapsco River Watershed Restoration and Retrofit Recommendations

As part of the field and desktop assessments, staff had the opportunity to make preliminary recommendations for potential restoration opportunities and rate the restoration potential of each project. As part of the BMP Conversion assessment, the type of proposed treatment was selected, and notes on feasibility, construction, and conflicts were recorded. For New BMP sites assessments, the footprint and drainage area of the recommended project were drawn, the treatment type options were selected, and notes on feasibility, construction and conflicts were recorded. Proposed tree planting areas were sketched, and notes on the degree of site preparation required were recorded. Recommended stream restoration projects were identified by drawing a polygon around the project area, and information on constraints, access, impact to trees, and potential for public demonstration/education were recorded. Finally, outfall stabilization recommendations were recorded by drawing a line along the extent of the outfall channel in need of restoration. Type of recommended outfall stabilization, constraints, impact to existing trees, ease of access, and potential for public demonstration/education were recorded. These project recommendations were later ranked and prioritized to determine which projects should continue to concept plan development, as described in Section 5.

Locations of recommendations for BMP Conversion, New BMPs, Stream Restoration, Tree Planting, and Outfall Stabilization made based on field and desktop assessments are shown in Figure 18. For all recommendations made, field crews assigned an initial assessment of restoration potential, rating the recommendation as High, Medium, or Low potential, based on field observations. Table 10 and Table 11 summarize the total number and restoration potential ratings for all recommendations made within the South Branch Patapsco and Patapsco Lower North Branch watersheds, respectively.

Table 10. Summary of Recommendations in the South Branch Patapsco watershed

Type	Number of Recommendations	High Potential Sites	Medium Potential Sites	Low Potential Sites
Field Recommendations				
BMP Conversion	1	0	1	0
New BMP	0	0	0	0
Tree Planting	26	15	9	2
Stream Restoration	31	10	14	7
Outfall Stabilization	2	1	1	0
Total Field Recommendations	**60**	**26**	**25**	**9**
No Desktop Recommendations				

Table 11. Summary of Recommendations in the Patapsco Lower North Branch watershed

Type	Number of Recommendations	High Potential Sites	Medium Potential Sites	Low Potential Sites
Field Recommendations				
BMP Conversion	33	18	9	6
New BMP	35	7	14	14
Tree Planting	24	18	5	1
Stream Restoration	91	29	32	30
Outfall Stabilization	38	18	7	13
Total Field Recommendations	**221**	**90**	**67**	**64**
Desktop Recommendations				
BMP Conversion	14	9	4	1
New BMP	25	1	13	11
Tree Planting	0	0	0	0
Stream Restoration	3	3	0	0
Outfall Stabilization	6	5	0	1
Total Desktop Recommendations	**48**	**18**	**17**	**13**
Total Recommendations	**269**	**108**	**84**	**77**

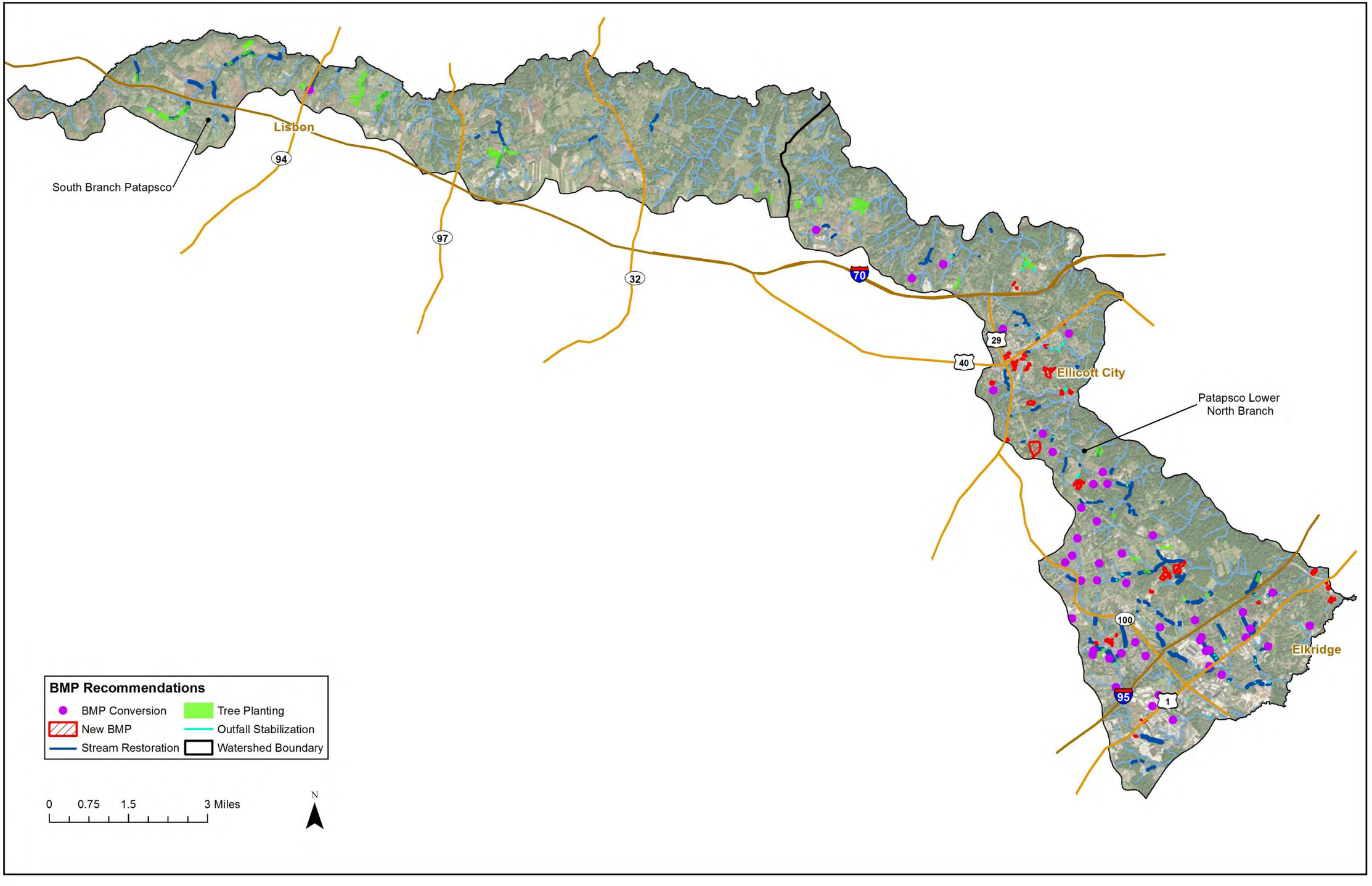

Figure 18. Location of Recommendations

4.3.1 Recommendations

Table 10 and Table 11 summarize the total number and restoration potential ratings for all recommendations made within the South Branch Patapsco and Patapsco Lower North Branch watersheds, respectively.

Proposed BMP conversion options include extended detention, wet pond, created wetland, and bioretention. Multiple conversion options were identified at the majority of the assessed sites.

The most common BMP types recommended were bioretention, filtering practice other than bioretention, infiltration, swale, and impervious surface removal. Multiple new BMP facility types were recommended at most of the assessed sites.

Tree planting areas ranged in size from 1.3 to 25 acres. The total area of all proposed tree planting projects in the three watersheds is approximately 136 acres.

In general, stream reaches recommended for restoration contained either one (or multiple) instance(s) of severe bank erosion, consistent minor to moderate bank erosion, or threatened infrastructure (e.g. exposed utility pipes, road embankment, etc.).

SPSC was recommended at majority of the proposed outfall stabilization projects, followed by rip rap stabilization, and drop structure.

4.4 Public Input and Feedback (Additional Sites)

Field assessment results were presented during a set of public meetings that were held by Howard County Stormwater Management Division in June 2016. During the meetings, citizens had the opportunity to review assessment findings and recommendations developed to date, and to bring issues to the attention of the County that could be investigated. Meetings included a County presentation of background information, an overview of the watershed assessment process, and highlights of findings to date. During an interactive discussion period, County and consultant team staff were available to talk with participants about particular sites or concerns. Large map display posters and data tablets were available for viewing field assessment data and recommendations. As a result of the citizen input, additional sites were identified for field assessment.

5. Restoration Project Ranking and Prioritization

5.1 Ranking Methods- Overview

The sites recommended during the assessments were ranked and prioritized to determine the best opportunities for implementation, beginning with concept plan development. During the various field assessments, crews determined which locations were best suited for potential projects, as reported in Section 4. In all, 329 potential projects were identified between the Patapsco and Patuxent River watershed assessments. The large list of possible projects generated, as well as the multiple goals this watershed assessment aims to address (e.g., impervious surface treatment, pollutant reductions, etc.), makes it challenging to select the best projects for implementation. To address this challenge, a standardized method was developed for comparing, ranking, and prioritizing projects during the previous watershed study, the Little and Middle Patuxent Rivers (Versar, 2016a and 2016b), and this same method was used again with only minor changes. The method relies on a combination of field data, the known costs and benefits of various BMP types, and GIS analyses. The prioritization process

combined projects from all subwatersheds within the 2016 study areas (Brighton Dam, Patapsco Lower North Branch, South Branch Patapsco, Patuxent River Upper, and Rocky Gorge Dam).

Potential projects were ranked in two different ways, the details of which will be discussed in the following sections. Potential projects identified in all watersheds were combined into one prioritization process. First, each potential project was ranked against all other projects of the same type. This will allow Howard County, for example, to target grant funding that must be applied to forest canopy improvement to the areas in the watershed that were identified as having the best tree planting opportunities. This type of ranking also allows for the incorporation of more specialized ranking factors. For example, the length and severity of erosion at an outfall is a useful way to compare stabilization projects, but would not apply to rankings that also include tree planting sites or locations for new BMP installations.

Second, all potential projects were pooled together and every potential project was ranked against each other. In this way, the County can compare the relative costs and benefits of the complete project list. This list can help to determine those projects which have the highest potential value and should be taken to the next design stage, as well as aid in modeling scenarios to determine which combination of projects will help to meet TMDL and other goals, and at what cost.

Ranking factors included the amount of impervious area restoration that would be achieved by the project (Table 12) and other benefits and constraints. There were some factors that were generally applicable across all project types (see details noted as level "A" in Table 13 through Table 17). Level "A" factors were divided into four main categories:

- Permit contribution – how a project will help towards the County meeting the impervious surface restoration requirements in its NPDES MS4 permit, as well as its TMDL goals
- Biological uplift – if a project will provide additional benefits, such as building onto existing green infrastructure or protecting wetlands
- Programmatic benefit – if a project has value beyond its primary functional purpose, such as visible demonstration projects or public education
- Feasibility – estimation of the ease or difficulty of project implementation, including public versus private ownership, site accessibility, or whether a repair is already required at a site providing an opportunity to minimize costs by upgrading the facility during the course of other required construction activities

Each factor was scored according to various criteria (see Tables in Section 5.2 and 5.3). The sum of all the factor scores was used to rank each project, with higher total scores representing higher priority projects. A table of all projects, with scores, is found in Appendix F.

5.2 Impervious Area Credits

For all opportunities identified, the potential benefits in terms of impervious area restoration credit were calculated in accordance with MDE's accounting guidance (MDE, 2014b). For stormwater BMPs, according to MDE criteria the target is treatment of the water quality volume (WQv), typically associated with the 1-inch rainfall event. When the practice is able to provide treatment for the full WQv, full impervious area credit is given based the total impervious area within the BMP drainage area. When less than 1 inch of rainfall is treated, impervious area treatment credit is based on the proportion of the full WQv treated. For alternative BMPs such as tree plantings and stream restoration, impervious acre

equivalents were calculated based on factors provided by MDE (2014b), as summarized in Table 12. Impervious acre credits (and impervious acre equivalents, for alternative BMPs) are used to plan for and estimate progress toward meeting the 20% impervious area restoration requirement in Howard County's MS4 Permit (MDE, 2014a).

Table 12. Impervious acre credits for alternative BMPs (from MDE, 2014b)

BMP	Notes	Impervious Acre Equivalent
Reforestation on Pervious Urban	Survival rate of 100 trees/acre or greater; at least 50% of trees have two-inch diameter or greater (4.5 feet above ground).	0.38 acre credit / acre reforested
Impervious Urban to Pervious	Remove pavement and provide vegetative cover for 95% of area.	0.75 acre credit / acre revegetated
Impervious Urban to Forest	Survival rate of 100 trees/acre or greater; at least 50% of trees have two-inch diameter or greater (4.5 feet above ground).	1.00 acre credit / acre reforested
Regenerative Step Pool Storm Conveyance (SPSC)	Located in dry or ephemeral channels; impervious area credit is based on runoff depth treated. When less than 1 inch of rainfall is treated, a proportion of credit is taken.	1.00 acre credit / impervious acre treated, based on treating 1 inch of rainfall.
Stream Restoration	Planning level estimate	0.01 acre credit / linear foot restored
Outfall Stabilization	Stabilization or repair of localized areas of erosion below a storm drain outfall; max credit is two acres per project (200 ft of stabilization).	0.01 acre credit / linear foot restored

5.3 Ranking and Prioritization Within Project Types

5.3.1 BMP Conversion and New BMP

The similar nature of these two project categories led to them sharing a set of ranking criteria (Table 13), though they were ranked separately. Prior to scoring and ranking, some projects were eliminated from the candidate pool. Pond conversion candidates that seemed to be naturally converting to a wetland facility were not included in the ranking, as it was unlikely that the County would want to disturb an area that was already providing additional water quality benefits. Howard County intends to focus on projects that would have larger-scale benefits, and so new BMP projects that were determined to address less than 2 acres of impervious surface were also removed from the ranking.

Table 13. Ranking factors, criteria, and scoring for BMP conversion and new BMP projects

	Factor	Criteria	Score
A. Factors for all site types			
1. Permit contribution			
1.a.	Acres of impervious treatment	> 10 acres	20
		5-10 acres	15
		1-5 acres	10
		< 1 acre	5
1.b.	Pollutant load reduction factor (Sum of % load reductions for TN, TP, and sediment)	181-260	10
		101-180	6
		0-100	3
1.c	Cost per acre of impervious treatment	< $50,000	10
		$50,000 - $100,000	8
		$100,000 - $200,000	5
		> $200,000	2
2. Biological uplift			
2.a	BMP in a subwatershed with 45-65% of sites with IBI scores below degradation threshold	Yes	5
		No	0
2.b	BMP is within 500 feet of Green Infrastructure Network or Tier II waters	Yes	5
		No	0
3. Programmatic benefit			
3.a	Site has educational value and/or is visible for public demonstration	Yes	2
3.b	Site is near 2 or more other potential projects allowing for easier monitoring and demonstration of benefit	Yes	3
4. Feasibility			
4.a	Ease of access	Easy	10
		Moderate	6
		Difficult	3
4.b	Conflicts with infrastructure or other site constraints	None	10
		Some	6
		Many	3
4.c	Adverse impacts to nearby trees	Minimal	10
		Moderate	6
		Significant	3
4.d	Ownership – public vs. private	Public	10
		Private, other	0
4.e	Pond/infrastructure already in need of repair	Yes	15
4.f	Field assessment – high potential for restoration/retrofit	Yes	5

5.3.2 Tree Planting

In the case of tree plantings, there were a few minor variations from the standard factor scoring. In the case of structural and pond BMPs, there are many different types, allowing for a wide range of pollutant reduction efficiencies per drainage acre and costs per unit treatment across different projects. In the case of tree planting projects, these values would be the same across all projects; for this reason factors 1.b and 1.c were not scored (Table 14). Additionally, for tree planting projects, where the impact to surrounding trees would not be a concern, the level of site preparation required for planting was substituted as a factor (see 4.c in Table 14).

Table 14. Ranking factors, criteria, and scoring for tree planting projects

	Factor	Criteria	Score
A. Factors for all site types			
1. Permit contribution			
1.a.	Impervious Acre Equivalent	> 2 acres	20
		0.75 - 2 acres	15
		0.38 – 0.75 acres	10
		< 0.38 acres	5
1.b.	Pollutant load reduction factor (Sum of % load reductions for TN, TP, and sediment)	N/A – same for all sites	
1.c	Cost per acre of impervious treatment	N/A – same for all sites	
2. Biological uplift			
2.a	Planting in a subwatershed with 45-65% of sites with IBI scores below degradation threshold	Yes	5
		No	0
2.b	Planting is within 500 feet of Green Infrastructure Network or Tier II waters	Yes	10
		No	0
2.c	Planting is within 100 feet of wetlands	Yes	5
		No	0
3. Programmatic benefit			
3.a	Site has educational value and/or is visible for public demonstration	Yes	2
3.b	Site is near 2 or more other potential projects allowing for easier monitoring and demonstration of benefit	Yes	3
4. Feasibility			
4.a	Ease of access	Easy	10
		Moderate	6
		Difficult	3
4.b	Conflicts with infrastructure or other site constraints	None	10
		Some	6
		Many	3
4.c	Site preparation required before planting	None	10
		Minimal	8
		Moderate	5
		Extensive	2

	Factor	Criteria	Score
A. Factors for all site types			
1. Permit contribution			
4.d	Ownership – public vs. private	Public	10
		Private, other	0
4.e	Infrastructure in need of repair	N/A	
4.f	Field assessment – high potential for restoration/retrofit	Yes	5

5.3.3 Outfall Stabilization

Outfall stabilization projects, for the purposes of ranking, were divided into broad categories: traditional stabilizations (e.g., riprap) and step pool stormwater conveyances (SPSC, or regenerative stormwater conveyances, RSC). These two methods of stabilization vary greatly from one another in both cost and benefit and were thus used to help differentiate the projects in scoring (Table 15). Beyond the standard level "A" ranking factors, an additional level "B" factor was included, in order to characterize the length and severity of erosion each project would address.

Table 15. Ranking factors, criteria, and scoring for outfall stabilization projects

	Factor	Criteria	Score
A. Factors for all site types			
1. Permit contribution			
1.a.	Impervious Acre Equivalent	1.5 - 2 acres	20
		1 – 1.5 acres	15
		0.5 - 1 acres	10
		< 0.5 acres	5
1.b.	Pollutant load reduction factor (Note: standard outfall stabilizations receive no pollution reduction credits)	SPSC	10
		All other types	0
1.c	Cost per acre of impervious treatment (Note: Riprap is the less expensive option and receives more points)	Riprap	10
		SPSC	3
		All other types	0
2. Biological uplift			
2.a	Stabilization in a subwatershed with 45%-65% of sites with IBI scores below degradation threshold	Yes	5
		No	0
2.b	Stabilization is within 500 feet of Green Infrastructure Network or Tier II waters	Yes	5
		No	0
2.c	Stabilization is within 100 feet of wetlands	Yes	5
		No	0
3. Programmatic benefit			
3.a	Site has educational value/visible for public demonstration	Yes	2
3.b	Site is near 2 or more other potential projects allowing for easier monitoring and demonstration of benefit	Yes	3
4. Feasibility			

	Factor	Criteria	Score
A. Factors for all site types			
1. Permit contribution			
4.a	Ease of access	Easy	10
		Moderate	6
		Difficult	3
4.b	Conflicts with infrastructure or other site constraints	None	10
		Some	6
		Many	3
4.c	Adverse impacts to nearby trees	Minimal	10
		Moderate	6
		Significant	3
4.d	Ownership – public vs. private	Public	10
		Private, other	0
4.e	Outfall/infrastructure already in need of repair	Yes	15
4.f	Field assessment – high potential for restoration/retrofit	Yes	5
B. Erosion factor			
1	Length and severity of erosion (Length of erosion in feet x erosion severity rating)	> 1,000	15
		500 – 1,000	10
		< 500	5

5.3.4 Stream Restoration

As noted for the tree planting project ranking, pollutant reduction efficiencies and costs per unit treatment are the same among all stream restoration projects, and therefore 1.b and 1.c were not scored (Table 16). Beyond the standard level "A" ranking factors, two additional levels of factors were incorporated into the stream restoration prioritization. A level "B" factor was included, similar to that used for the outfall stabilization ranking, which characterizes the length and severity of erosion each project would be able to address. Three level "C" factors were also included, which address factors unique to streams, such as habitat quality and other problems identified during stream corridor assessments.

Table 16. Ranking factors, criteria, and scoring for stream restoration projects

	Factor	Criteria	Score
A. Factors for all site types			
1. Permit contribution			
1.a.	Impervious Acre Equivalent	> 9 acres	20
		6 – 9 acres	15
		3 – 6 acres	10
		< 3 acres	5
1.b.	Pollutant load reduction factor (Sum of % load reductions for TN, TP, and sediment)	N/A – same for all sites	
1.c	Cost per acre of impervious treatment	N/A – same for all sites	

	Factor	Criteria	Score
A. Factors for all site types			
1. Permit contribution			
2. Biological uplift			
2.a	Restoration in a subwatershed with 45%-65% of sites with IBI scores below degradation threshold	Yes	5
		No	0
2.b	Restoration is within 500 feet of Green Infrastructure Network or Tier II waters	Yes	5
		No	0
2.c	Restoration is within 100 feet of wetlands	Yes	5
		No	0
3. Programmatic benefit			
3.a	Site has educational value/visible for public demonstration	Yes	2
3.b	Site is near 2 or more other potential projects allowing for easier monitoring and demonstration of benefit	Yes	3
4. Feasibility			
4.a	Ease of access	Easy	10
		Moderate	6
		Difficult	3
4.b	Conflicts with infrastructure or other site constraints	None	5
		Some	3
		Many	1
4.c	Adverse impacts to nearby trees	Minimal	10
		Moderate	6
		Significant	3
4.d	Ownership – public vs. private	Public	10
		Private, other	0
4.e	Already in need of repair	N/A	
4.f	Field assessment – high potential for restoration/retrofit	Yes	5
B. Erosion factor			
1	Length and severity of erosion (Length of erosion in feet x erosion severity rating)	>8,400	15
		4,200-8,400	10
		<4,200	5
C. Stream condition factors			
1	Average BEHI score (length-weighted) along reach	46 - 50	10
		40 - 45	8
		30 - 39	6
		20 - 29	4
		< 20	2
2	Average Habitat Assessment score (length-weighted) within a reach rated site as non-supporting or only partially supporting aquatic biota	Yes	5
3	Number of other problems along reach (exposed	Other problems > 2	10

	Factor	Criteria	Score
A.	**Factors for all site types**		
1.	*Permit contribution*		
	pipes, eroded pipe outfalls, unusual conditions, etc.)		

5.4 Ranking and Prioritization across All Project Types

To develop a fair comparison of all projects, factors were limited to those that were common to all project types (level "A"), as shown in Table 17. Due to minor variations in the number of factors used for the different project types (e.g., factor 4.e, which determines if repairs are already recommended at an existing facility, only applied to outfalls and BMP conversions) the sum of individual scores for categories 2 through 4 were converted to a proportion so that each project was judged based on highest possible score for its own project type. After looking at the final ranked list of all projects, the highest ranking projects were selected based on the goals established in the Howard County Countywide Implementation Strategy for each watershed.

Table 17. Ranking factors, criteria, and scoring used for ranking all projects and selecting project concept plans.

	Factor	Criteria	Score
A.	**Factors for all site types**		
1.	*Permit contribution*		
1.a.	Acres of impervious treatment/ Impervious Acre Equivalent	> 10 acres	10
		5 – 10 acres	8
		3 – 5 acres	5
		1 – 3 acres	4
		< 1 acre	2
1.b.	Pollutant load reduction factor (Sum of % load reductions for TN, TP, and sediment)	201 - 260	10
		151 - 200	6
		1 - 150	3
		0	0
1.c	Cost per acre of impervious treatment	< $50,000	10
		$50,000 - $100,000	8
		$100,000 - $200,000	5
		> $200,000	2
2.	*Biological uplift*		
3.	*Programmatic benefit*		
4.	*Feasibility*		
2.a – c 3.a – c 4.a – f	Sum of scores, as a proportion of total possible points (Note: Total possible points is dependent of type of site	> 0.8	10
		0.6 – 0.8	8
		0.4 – 0.6	6
		0.2 – 0.4	4
		0.01 – 0.2	2
		0	0

5.5 Concept Plans

After the County approved the results of the ranking, a four-page concept plan was developed for each of the highest ranked projects (Table 18) with the same template used for the concept plans for the Little and Middle Patuxent River watershed assessments (Versar, 2016a and 2016b). In the process of developing concepts, a few sites were identified as not feasible projects and concepts for those projects were not completed. A total of 145 concepts were completed. These concept plans include:

- Location information (including a site locator map),
- Existing site conditions (including photos),
- Details of the proposed project (including a concept design drawing),
- Implementation information, such as utility constraints and other nearby projects,
- Potential impervious treatment and pollutant reduction credits, and
- Cost estimate.

Each concept plan provides a complete picture of the potential project, including costs and benefits. They may be used by the County to communicate with the public about a particular project, to apply for a grant for funds to move forward with project implementation, or to aid in the allocation of funds during the County's budget process. The complete set of concept plans is available in Appendix G.

Table 18. Number of projects, by type, developed for concept plans in South Branch Patapsco and Patapsco Lower North Branch

Project Type	Number of Concept Plans Developed	
	South Branch Patapsco	Patapsco Lower North Branch
BMP Conversion	0	41
New BMP	0	12
Tree Planting	2	10
Outfall Stabilization	2	23
Stream Restoration	11	44
Total	**15**	**130**

6. Pollutant Load Modeling and Impervious Restoration

Potential pollutant load reductions and impervious surface credits were calculated for the stormwater projects for which concept plans were developed. The calculations are based on the level of design and analysis completed, which at this stage is a concept design. Load reduction and impervious credit results for each project will likely change as the projects move through full design and construction.

6.1 Modeling Approach

6.1.1 Pollutant Load Reductions

Pollutant load reductions for planned stormwater projects (i.e., new BMPs and BMP conversions) were calculated using revised removal rate curve equations for runoff reduction (RR) and stormwater treatment (ST) practices prepared by Chesapeake Stormwater Network (Schueler and Lane, 2015). Reductions are calculated based on rainfall treatment, whether noted in project concepts or as an assumption of 1-inch treatment, and removal efficiencies per RR and ST practice (Table 19). Following

MDE guidelines, additional credit is given when the rainfall depth treated exceeds 1 inch, with a maximum of 2.6 inches credited (MDE, 2014b).

Load reductions for planned outfall stabilization projects with the use of SPSC are also calculated using ST practice removal rate reductions based on the rainfall treatment of each site. Planned outfall stabilization projects without SPSC are not credited with load reductions.

Table 19. Runoff Reduction and Stormwater Treatment Practices Removal Rate Reductions

Practice	Rainfall Treatment	Nitrogen Reduction	Phosphorus Reduction	Sediment Reduction
Runoff Reduction (RR)	1"	60%	70%	75%
Stormwater Treatment (ST)	1"	35%	55%	70%

Nitrogen, phosphorus, and sediment load reductions from planned tree planting and stream restoration projects were calculated with estimated removal efficiencies per acre and pounds reduced per linear foot, respectively, from *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated* (MDE, 2014b; Table 20).

To claim the tree planting credit, a survival of 100 trees per acre or greater is necessary with at least 50% of the trees having a diameter at breast height (DBH) of 2 inches or greater (DNR, 2009).

It is noted that the proposed stream restoration projects use MDE's revised interim reduction rates for planning purposes; however selected and implemented projects will ultimately use the Chesapeake Bay Program's (CBP) methods to calculate pollutant removal. The CBP Expert Panel to Define Removal Rates for Individual Stream Restoration Projects (Schueler and Stack, 2014) has defined these rates, which are acceptable for watershed planning purposes (for further details, see Section 6.7). However, recognizing that every stream restoration project is unique with respect to its design, stream order, landscape position and function, the Panel developed four protocols for determining pollutant reduction credits for individual projects, once site-specific design details are known. These protocols are as follows (from Schueler and Stack, 2014):

- Protocol 1: Credit for Prevented Sediment during Storm Flow. This protocol provides an annual mass nutrient and sediment reduction credit for qualifying stream restoration practices that prevent channel or bank erosion that would otherwise be delivered downstream from an actively enlarging or incising urban stream.
- Protocol 2: Credit for Instream and Riparian Nutrient Processing during Base Flow. This protocol provides an annual mass nitrogen reduction credit for qualifying projects that include design features to promote denitrification during base flow within the stream channel through hyporheic exchange within the riparian corridor.
- Protocol 3: Credit for Floodplain Reconnection Volume. This protocol provides an annual mass sediment and nutrient reduction credit for qualifying projects that reconnect stream channels to their floodplain over a wide range of storm events.
- Protocol 4: Credit for Dry Channel Regenerative Stormwater Conveyance (RSC) as an Upland Stormwater Retrofit. This protocol provides an annual nutrient and sediment reduction rate for the contributing drainage area to a qualifying dry channel RSC project. The rate is determined by

the degree of stormwater treatment provided in the upland area using the retrofit rate adjustor curves developed by the Stormwater Retrofit Expert Panel.

An individual stream restoration project may qualify for credit under one or more of the protocols, depending on its design and overall restoration approach.

Table 20. Efficiencies and Load Reductions for Tree Planting and Stream Restoration Projects

BMP	Unit	Nitrogen Reduction	Phosphorus Reduction	Sediment Reduction
Reforestation on Pervious Urban	Efficiency per acre	66%	77%	57%
Stream Restoration	Lbs Reduced/Linear ft	0.075	0.068	45

Table 21 presents the bacteria reduction efficiency of structural and non-structural BMPs (International Stormwater BMP Database, 2014).

Table 21. Typical Bacteria Reductions from Structural and Non-Structural BMPs

BMP	Bacteria
Bioretention A/B soils	70%
Bioretention C/D soils	70%
Bioswales	-5%
Dry Detention Ponds	66%
Dry Extended Detention Ponds	60%
Impervious Surface Reduction*	-
Infiltration w/ sand, veg.	90%
Infiltration w/o sand, veg.	90%
Outfall Enhancement with SPSC**	70%
Permeable Pavement w/ sand, veg.	-
Permeable Pavement w/o sand, veg.	-
Septic Systems (pumping, upgrades, connections)	1.9 billion MPN/ 100mL each
Stream Restoration	-
Street Sweeping	-
Urban Filtering	60%
Urban Tree Plantings*	-
Vegetated Open Channels	-
Wet Ponds or Wetlands	95%

Source: International Stormwater BMP Database, Watershed Treatment Model
* Calculated as a land use change to a lower loading land use
**Outfall enhancement with SPSC modeled as sand filters for bacteria

6.1.2 Impervious Restoration

Impervious acre equivalences from *Accounting for Stormwater Wasteload Allocations and Impervious Ares Treated* (MDE, 2014b) were used to calculate impervious credit from concept plan potential projects. Impervious acre equivalences, by project type, are presented in Table 22, below. Appendix H includes pollutant load reductions and impervious credit for each planned project.

Table 22. Impervious Acre Equivalent for Structural and Non-Structural BMPs

BMP	Treatment Unit	Impervious Acre Equivalent*
New BMPs	WQv (provided)/WQv (required)	1.00
BMP Conversion	WQv (provided)/WQv (required)	1.00
Outfall Stabilization	WQv (provided)/WQv (required)	0.01
Step Pool Storm Conveyance (SPSC)	WQv (provided)/WQv (required)	1.00
Stream Restoration	Linear foot	0.01
Tree Plantings	Acres planted	0.38

*Assuming full 1-inch rainfall treatment, full WQv is provided. Acres of impervious in BMP drainage area is multiplied by the equivalent acres to determine credited acres

6.2 Summary of Pollutant Loading Reductions and Impervious Restoration

Nitrogen, phosphorus, and sediment load reductions and impervious credit for concept plan potential projects within the Patapsco Lower North Branch and South Branch Patapsco watersheds are presented in Table 23.

Table 23. Pollutant Load Reductions and Impervious Credit

	Number of Projects	Impervious Credit	Estimated Load Reductions		
			TN-EOS lbs	TP-EOS lbs	TSS-EOS lbs
Patapsco Lower North Branch	130	1,133	8,855	5,291	3,896,464
BMP Conversion	41	355	2,971	395	604,793
New BMP	12	15	150	17	23,535
Stream Restoration	44	711	5,329	4,832	3,197,385
Tree Planting	10	5	60	3	2,032
Outfall Stabilization	6	2	0	0	0
Outfall Stabilization - SPSC	17	46	345	45	68,719
South Branch Patapsco	15	178	1,488	1,162	770,614
Stream Restoration	11	165	1,275	1,156	765,135
Tree Planting	2	10	204	6	4,701
Outfall Stabilization	1	1	0	0	0
Outfall Stabilization - SPSC	1	1	9	1	778
Grand Total	**145**	**1,310**	**10,343**	**6,453**	**4,667,078**

Bacteria load reductions for concept plan potential projects within the bacteria TMDL subwatershed (PAT0148sub) in the Patapsco Lower North Branch watershed are presented in Table 24.

Table 24. Bacteria Load Reduction in PAT0148

Patapsco Lower North Branch- PAT0148 BMP Type	Number of Projects	Estimated Load Reduction- Bacteria (MPN/100mL/yr)
BMP Conversion	26	2,864.6
New BMP	5	30.6
Stream Restoration	16	0.0
Tree Planting	1	0.0
Outfall Stabilization	6	0.0
Outfall Stabilization - SPSC	2	0.0
Grand Total	**56**	**2,895.2**

6.3 Summary of Cost Estimates

Estimated total cost of concept plan potential projects within the Patapsco Lower North Branch and South Branch Patapsco watersheds are presented in Table 25. The County's restoration plan, Countywide Implementation Strategy (KCI, 2017b), presents the cost of the projects selected for implementation based on the goals outlined in the plan.

Table 25. Estimated Total Cost of Concept Plan Projects

	Number of Projects	Total Cost
Patapsco Lower North Branch	130	$96,749,890
BMP Conversion	41	$27,958,558
New BMP	12	$4,685,914
Stream Restoration	44	$55,996,005
Tree Planting	10	$657,488
Outfall Stabilization	6	$860,925
Outfall Stabilization - SPSC	17	$6,591,000
South Branch Patapsco	15	$15,445,105
Stream Restoration	11	$13,716,755
Tree Planting	2	$1,159,600
Outfall Stabilization	1	$165,750
Outfall Stabilization - SPSC	1	$403,000
Grand Total	**145**	**$112,194,995**

6.4 Proposed Implementation Timeframe

Project schedules and implementation milestones are discussed in detail in Section 7 Implementation Schedule and Milestones of the County's restoration plan, Countywide Implementation Strategy (KCI, 2017b).

6.5 Conclusion

Howard County is required to conduct watershed assessments for each watershed within the County under the MS4 permit (Permit Number 11-DP-3318, MD0068322, issued December 18, 2014) to identify specific restoration opportunities to provide greater treatment of stormwater runoff from impervious areas and to reduce pollutant loads associated with urban runoff. The Little and Middle Patuxent watershed assessments were completed in 2015, and the remaining watersheds, including South Branch Patapsco and Patapsco Lower North Branch watersheds summarized in this report, and Brighton Dam, Rocky Gorge Dam, and Patuxent River Upper (KCI, 2017a) have been completed, thus satisfying the permit requirement.

The watershed assessments evaluate current conditions and recommend watershed restoration opportunities. Implementation of these projects will assist the County in meeting its 20% impervious restoration goal by December 2019 and Total Maximum Daily Load (TMDL) targets established for nutrients (nitrogen and phosphorus), sediment, and bacteria in the Patapsco River watersheds.

The results of the assessment support the completion of Howard County's Countywide Implementation Strategy (CIS) (KCI, 2017b) being completed concurrently with this Patapsco River assessment. The CIS presents the County's overall plan to meet its regulatory impervious restoration and TMDL goals, The CIS includes the practices outlined in this assessment, in addition to other programs designed to treat the subject pollutants including street sweeping, septic programs, and educational activities. Restoration targets, current progress, planned milestones, cost estimates, and tracking and evaluation mechanisms are all detailed in the CIS.

The County will continue to evaluate implementation progress, costs, and program success on an on-going basis with reporting to MDE on at least an annual basis on NPDES and TMDL compliance with the County's annual NPDES report.

7. References

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APPENDIX A: INVENTORY OF GIS DATA

Analysis data sets:

Data Set	Date	Data Source	File Name
8-digit watershed	2005	MDE	md8digit18may2005aggregated.shp
Current aerial photography	Unknown	ESRI Basemap	N/A
Impervious areas	2015	County	HoCo_Impervious
Land use	2010	Maryland Department of Planning	MDP_LULC_2010.shp
Property	2016	County	Property.shp
Zoning	2016	County	Zoning.shp
Forest Conservation areas	2016, assumed	County	ForestConservationEasement.shp
Natural resource areas	2016, assumed	County	NaturalResourceOpenSpace.shp
County parks	2016, assumed	County	CountyParks.shp
Storm drain pipes	2015	County	final_pipes.shp
Storm drain inlets	2015	County	final_inlet.shp
Storm drain oulets	2015	County	final_outlet.shp
Public water system	2015	County	Water_lines_master.shp
Public sewer system	2015	County	Sewer_lines_master.shp
Streams		County	Stream_CenterlineLine.shp
Drainage complaints (frequent flooding)	2016	County	SWM Complaints.mdb
MS4 Boundary	2016	Updates from McCormick Taylor	MD_NPDES_regulated_urban_stormwater_source_sectors_updated_v10.shp, Impervious_2016.gdb
Howard County biological monitoring program data	2016	Versar	HoCoCountywideSites_sp83m.shp
MBSS IBI Scores	2016	MD DNR	MBSSCSV.xls, WadersCSV.xls
2ft Contour lines	2011	County	Multiple tiles: contours_tile_1(-50).shp
BMPs	2015	KCI	TableB_points
Potential BMP and Stream restoration projects	2015	County	FY16 Projects Query.xls
DNR Wetlands Inventory	2005	MD DNR	DNR_wetlands.shp
Green Infrastructure	2012	Howard's GI Plan	Cooridors_All_Merged.shp
Tier II Streams and Catchments	2012	MDE	Stream_TierII.shp TierII_Catchments_2012.shp
Howard County IDDE Geodatabases	2000-2010, 2011-2014	County	IDDE2000thru2010.shp IDDE2011thru2014.shp
Road Centerlines	2016	County	centerln.shp

APPENDIX B: DESCRIPTIONS OF BMP TYPES

Appendix B: Stormwater Treatment BMP Definitions

BMP definitions are taken from the Maryland Assessment and Scenario Tool (MAST) guidance as provided on mastonline.org and edited, with the exception of regenerative step pool conveyance (RSC) which is provided by Anne Arundel County (2012) and outfall stabilization, described in the August 2014 MDE guidance entitled Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated. Names in "()" next to BMP types are the MAST BMP Short Name. Not all BMPs considered here have been recognized by MAST and therefore may not have an official MAST-designated Short Name.

Wet Ponds and Wetlands (WetPondWetland)

A wet pond and stormwater treatment wetland are water impoundment structures that intercept stormwater runoff then release it to the receiving stream or stormsewer system at a specified flow rate. These structures retain a permanent pool and usually have retention times sufficient to allow settlement of some portion of the intercepted sediments and attached nutrients/toxics. Until recently, these practices were designed specifically to meet water quantity, not water quality objectives. There is little or no vegetation living within the pooled area nor are outfalls directed through vegetated areas prior to open water release. Nitrogen reduction is minimal.

Bioretention

Bioretention/raingardens - A/B soils, no underdrain (BioRetNoUDAB)

An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These excavated, planted areas are installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components consisting of the engineered media, topsoil, mulch, and vegetation, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. This BMP has no underdrain and is in A or B soil which assumes that all water will infiltrate into the subsoils.

Bioretention/raingardens - A/B soils, underdrain (BioRetUDAB)

An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. This BMP has an underdrain and is in A or B soil, in order to more carefully control dewatering of the system.

Bioretention/raingardens - C/D soils, underdrain (BioRetUDCD)

An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. This BMP is in C or D soil and has an underdrain in order to more assure dewatering of the system in timely fashion in these poorly draining soils.

Non-Bioretention Filtering Practices

Urban Filtering Practices (Filter)

These are practices that capture and temporarily store runoff and pass it through a filter bed of either sand or an organic media. There are various designs, such as above ground, below ground, perimeter, etc. An organic media filter uses another medium besides sand to enhance pollutant removal for many compounds due to the increased cation exchange capacity (CEC) achieved by increasing the organic matter. These systems require yearly inspection and maintenance to receive pollutant reduction credit.

Urban Filter Strip Runoff Reduction (UrbFilterRR)

Urban filter strips are stable areas with vegetated cover on flat or gently sloping land. Runoff entering the filter strip must be in the form of sheet-flow and must enter at a non-erosive rate for the site-specific soil conditions. A 0.4 design ratio of filter strip length to impervious flow length is recommended for runoff reduction urban filter strips. These filter strips allow for infiltration into subsoils and therefore significant pollutant removal compared to Urban Filter Strip Storm Water Treatment.

Urban Filter Strip Storm Water Treatment (UrbFilterST)

Urban filter strips are stable areas with vegetated cover on flat or gently sloping land. Runoff entering the filter strip must be in the form of sheet-flow and must enter at a non-erosive rate for the site-specific soil conditions. A 0.2 design ratio of filter strip length to impervious flow length is recommended for stormwater treatment urban filter strips. These filter strips do not allow for infiltration of subsoils and therefore only allow for reductions in sediment load.

Regenerative Step Pool Storm Conveyance (SPSC)

Regenerative Step Pool Storm Conveyance (SPSC) practices developed by Anne Arundel County Department of Public Works, Bureau of Engineering, have been used for retrofitting unstable and degraded stormwater conveyance channels in steep conveyance circumstances. SPSC systems are open-channel conveyance structures that convert, through attenuation ponds and a sand seepage filter, surface storm flow to shallow groundwater flow. These systems safely convey, attenuate, and treat the quality of storm flow. These structures utilize a series of constructed shallow aquatic pools, riffle grade control, native vegetation, and an underlying sand/woodchip mix filter bed media. The physical characteristics of the SPSC channel are best characterized by the Rosgen A or B stream classification types, where “bedform occurs as a step/pool, cascading channel which often stores large amounts of sediment in the pools associated with debris dams” (Rosgen, 1996). The pretreatment, recharge, and water quality sizing criteria closely follow the State of Maryland’s criteria for a typical stormwater filtering device. These structures feature surface / subsurface runoff storage seams and an energy dissipation design that is aimed at attenuating the flow to a desired level through energy and hydraulic power equivalency principles.

Vegetated Channels

Vegetated Open Channels - A/B soils, no underdrain (VegOpChanNoUDAB)

Open channels are practices that convey stormwater runoff and provide treatment as the water is conveyed, and includes bioswales. Runoff passes through either vegetation in the channel, subsoil matrix, and/or is infiltrated into the underlying soils. This BMP has no underdrain, allowing for infiltration into subsoils; however, because the system is within A or B soil infiltration is better than in a similar channel in C or D soils and allows for higher pollutant removal rates.

Vegetated Open Channels - C/D soils, no underdrain (VegOpChanNoUDCD)

Open channels are practices that convey stormwater runoff and provide treatment as the water is conveyed, includes bioswales. Runoff passes through either vegetation in the channel, subsoil matrix, and/or is infiltrated into the underlying soils. This BMP has no underdrain, allowing for infiltration into subsoils; however, C or D soils have lower infiltration rates and therefore lower pollutant removal rates relative to vegetated open channels in A or B soils.

Bioswale (BioSwale)

With a bioswale the load is reduced because, unlike other open channel designs, there is now treatment through the soil. A bioswale is designed to function as a bioretention area and therefore has much higher pollutant removal rates compared to the vegetated open channels in A/B and C/D soils.

Infiltration Practices

An infiltration practice generally is a depression to form an infiltration basin where sediment is trapped and water infiltrates into the soil. No underdrains are associated with infiltration basins and trenches, because by definition these systems provide complete infiltration. Design specifications require infiltration basins and trenches to be built in good soil (A/B soils). They are not constructed on poor soils, such as C and D soil types. Engineers are required to test the soil before approved to build is issued. To receive credit over the longer term, jurisdictions must conduct yearly inspections to determine if the basin or trench is still infiltrating runoff.

Urban Infiltration Practices w/ Sand, Veg. - A/B soils, no underdrain (InfiltWithSV)

A depression to form an infiltration basin where sediment is trapped and water infiltrates the soil. No underdrains are associated with infiltration basins and trenches, because by definition these systems provide complete infiltration. Sand provides additional surface area for more complete filtration and vegetation provides root system uptake and additional biological activity for more complete pollutant processing.

Urban Infiltration Practices w/o Sand, Veg. - A/B soils, no underdrain (Infiltration)

A depression to form an infiltration basin where sediment is trapped and water infiltrates the soil. No underdrains are associated with infiltration basins and trenches, because by definition these systems provide complete infiltration. Sand or vegetation are not included in these system.

Impervious Surface Reduction (ImpSurRed)

Reducing impervious surfaces to promote infiltration and percolation of runoff storm water by removing pavement and providing vegetative cover for 95% of the area that was previously impervious surface. MDE 2014 guidance offers 0.75 impervious acre equivalent credit for every acre of impervious cover removed and replaced with vegetation.

Urban Stream Restoration (UrbStrmRest)

Stream restoration is a change to the stream corridor that improves the stream ecosystem by restoring the natural hydrology and landscape of a stream, and helps improve habitat and water quality conditions in degraded streams. Credit is provided in the form of 0.01 impervious reduction equivalents of 0.01 acre per linear foot of outfall stabilization.

Urban Tree Planting (UrbanTreePlant)

Urban tree planting is planting trees on urban pervious areas at a rate that would produce a forest-like condition over time. The intent of the planting is to eventually convert the urban area to forest. If the trees are planted as part of the urban landscape, with no intention to covert the area to forest, then this would not count as urban tree planting. Credit given is 0.38 impervious equivalent removed per acre planted with a survival rate of 100 trees/acre or greater and where at least 50% of trees have two-inch diameter or greater when measured at 4.5 ft. above ground level. (MDE 2014)

Urban Forest Buffers (ForestBufUrban)

An urban forest buffer is area of trees at least 35 feet wide on one side of a stream, usually accompanied by trees, shrubs, and other vegetation that is adjacent to a body of water. The riparian area is managed to maintain the integrity of stream channels and shorelines, to reduce the impacts of upland sources of pollution by trapping, filtering, and converting sediments, nutrients, and other chemicals.

Outfall stabilization

Outfall stabilization or repair of localized areas of erosion below a storm drain outfall will received a maximum credit is 2 acres per project as per MAST. Credit is provided in the form of 0.01 impervious reduction equivalents of 0.01 acre per linear foot of outfall stabilization. No direct pollutant reduction credits are appropriated.

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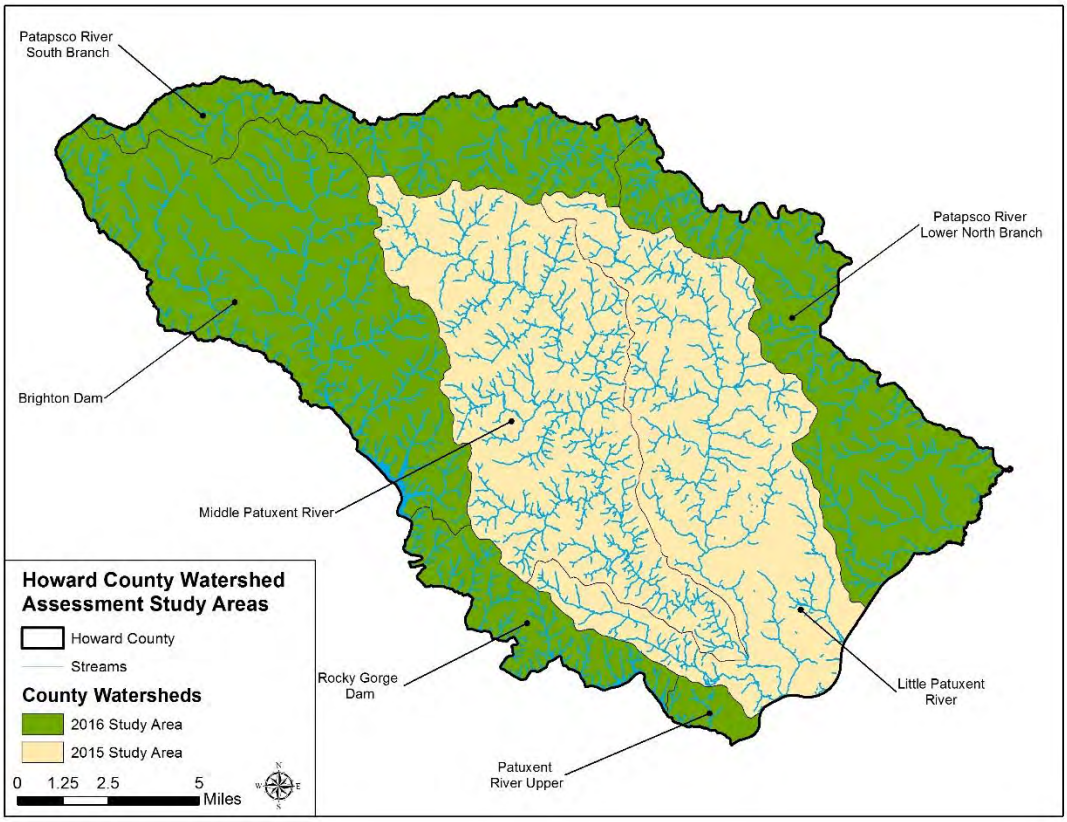
APPENDIX C: FIELD PROTOCOLS AND DATA COLLECTION GUIDE

Field Protocols and Data Collection Guide

Howard County Watershed Assessments 2016

Patapsco River Lower North Branch
Patuxent River Upper
Rocky Gorge Dam
Brighton Dam
Patapsco River South Branch



Prepared for
Howard County Watershed Management Program
Howard County Department of Public Works
Bureau of Environmental Services
Stormwater Management Division

Prepared by
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March 29, 2016

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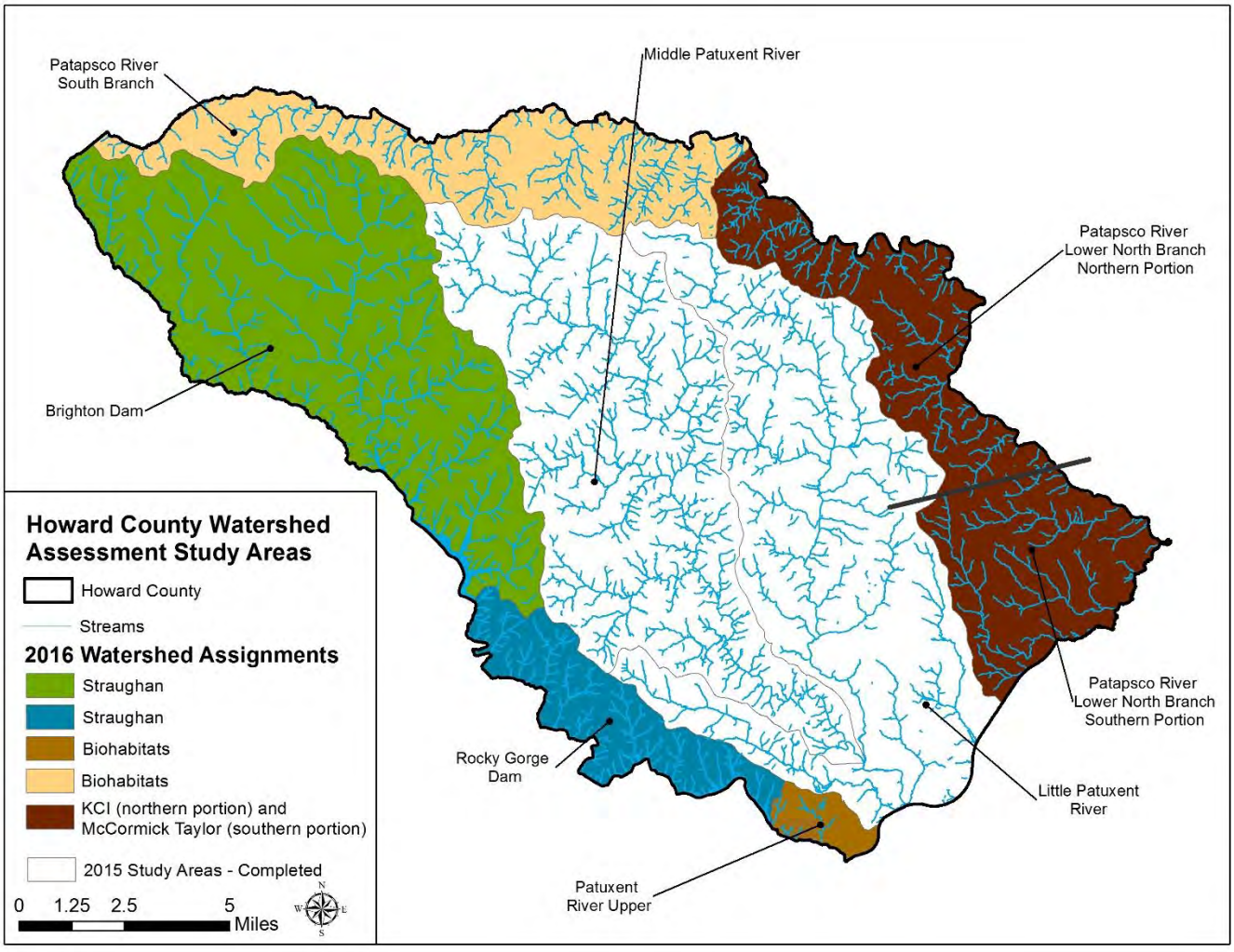
Howard County Watershed Assessments in 2016

Study Areas and Consultant Assignments for Field Assessments

March 29, 2016

Watershed Assessment Study Area	Consultant for Field Assessments
Patapsco River Lower North Branch (LNB)- southern portion	McCormick Taylor
Patapsco River Lower North Branch (LNB)- northern portion	KCI
Patuxent River Upper (PRU)	Biohabitats
Rocky Gorge Dam (RGD)	Straughan
Brighton Dam (BRD)	Straughan
Patapsco River South Branch (SBP)	Biohabitats



Howard County Watershed Assessments Site Naming Conventions

March 29, 2016

Purpose: to name all field sites so they are readily recognizable by their location, site type, and unique identifier.

1. Standard site names

AAA-SS-Fxxx (Example LNB-SR-F501)

AAA = Study Area (which will also point us to which consultant team collected the data, should there be any questions)

- LNB = Patapsco River Lower North Branch
- PRU = Patuxent River Upper
- RGD = Rocky Gorge Dam
- BRD = Brighton Dam
- SBP = Patapsco River South Branch

SS = Site type for the 5 types of opportunities

- BC = BMP Conversion (to upgrade existing stormwater BMP)
- NB = New BMP for currently untreated areas
- TP = Tree Planting
- OF = Outfall Stabilization
- SR = Stream Restoration

F = Field or desktop assessment

- F = Field assessment
- D = Desktop assessment (sites that will be evaluated based on past data)

xxx = 3-digit number that will be unique identifier within each type of opportunity (001, 002, etc.). These will be assigned as described in the following table. To avoid duplication, use the following guidance for any new site names added in the field:

Field Site numbering convention		
Consultant	**Series starting with:**	**Study Area and Site Type (pre-assigned v. added in the field)**
Straughan	101	BRD pre-assigned sites
	151	BRD sites added in the field
Straughan	201	RGD pre-assigned sites
	251	RGD sites added in the field
Biohabitats	301	PRU pre-assigned sites
	351	PRU sites added in the field
Biohabitats	401	SBP pre-assigned sites
	451	SBP sites added in the field
McCormick Taylor	501	LNB pre-assigned sites
	551	LNB sites added in the field
KCI	601	LNB pre-assigned sites
	651	LNB sites added in the field

Desktop Site numbering convention		
Consultant	**Numbers:**	**Study Area and Site Type (pre-assigned v. added in the field)**
Straughan	001-015	ALL Watersheds pre-assigned sites
McCormick Taylor	020-032	ALL Watersheds pre-assigned sites
KCI	040-073	ALL Watersheds pre-assigned sites

2. For specific types of data, there will be additional codes added:

AAA-SS-FxxxL (Example LNB-BC-F505A)

L = Letter for multiple recommendations/options (BMP conversion or new BMP Assessment) or reaches (Stream Restoration Assessment) within a site

- A = First recommendation/option or reach
- B = Second recommendation/option or reach
- C = Third recommendation/option or reach, etc.

2a. For BMP opportunities, there may be a need to keep track of multiple recommendations/options for the same site. Append A, B, C as needed to distinguish separate options.

- Example: LNB-BC-F505 has two options. Call them LNB-BC-F505A and LNB-BC-F505B

2b. For stream reaches, the first reach break along a reach will be named at the downstream end with the letter A. The upstream end will be named with the letter Z.

- Example: For stream reach LNB-SR-F501, the reach break at the downstream end will be called LNB-SR-F501A. A final reach break will be placed at the upstream end of the entire reach and be called LNB-SR-F501Z. No additional data is collected at F501Z.

If conditions vary within the reach, field crew should break the pre-selected stream restoration reach into two or more separate reaches if stream conditions warrant it.

- Example: if LNB-SR-F501 is broken into two reaches, the reach breaks at the bottom end of each will be named LNB-SR-F501A and LNB-SR-F501B. The reach break at the upstream end of Reach B will be marked LNB-SR-F501C, unless this is the final reach break, in which case it will be mark LNB-SR-F501Z.

2c. For stream assessment data, names will include additional digits as follows.

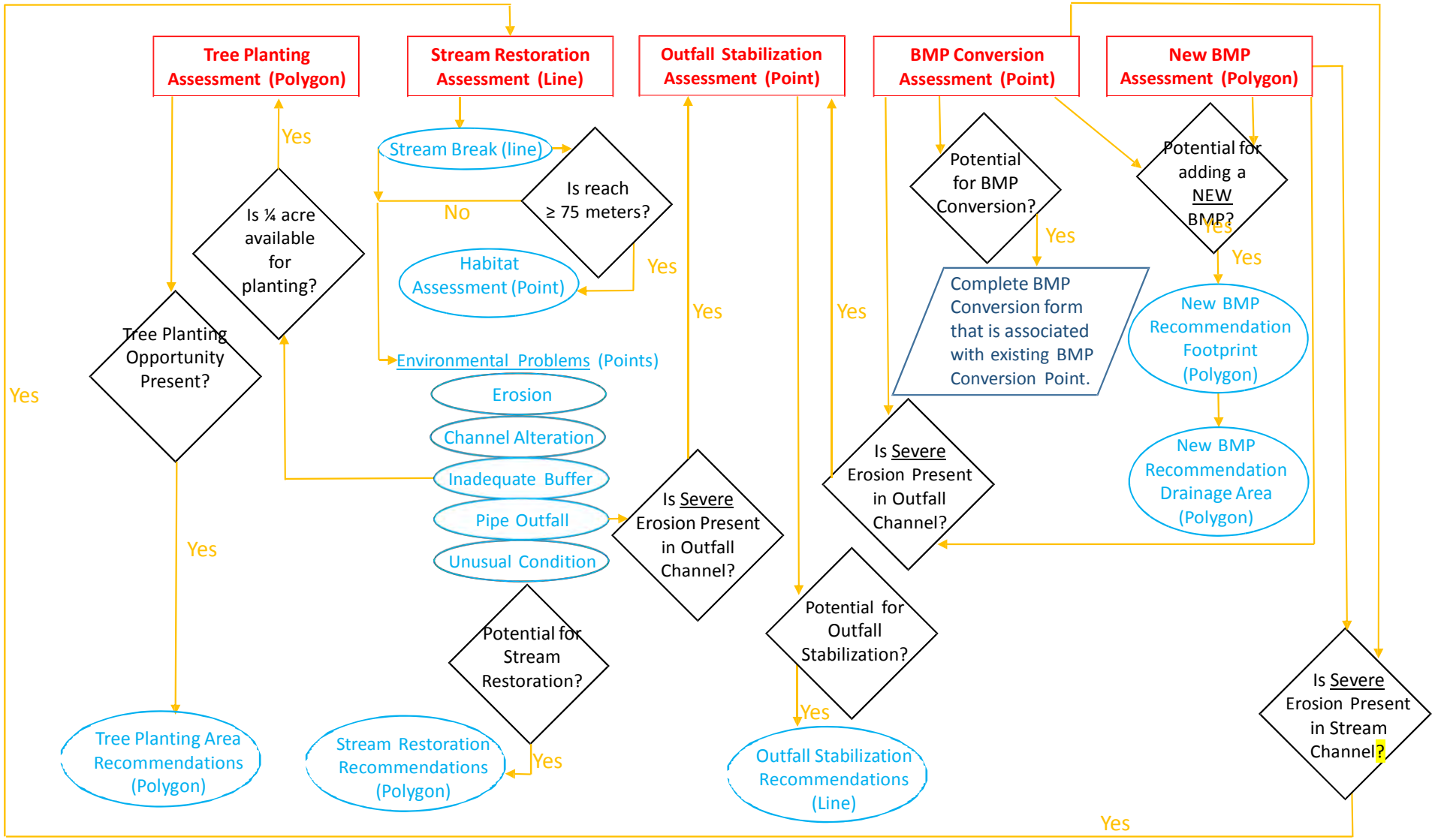
AAA-SS-FxxxL-TTyyy - For example at a stream restoration site (LNB-SR-F501A) with 3 erosion points, the erosion points would be recorded as LNB-SR-F501A-ES001, LNB-SR-F501A-ES002, LNB-SR-F501A-ES003]

TT = site type for specific stream data

- RE = Representative site - Habitat assessment
- ES = Erosion Site point
- CA = Channel Alteration point
- IB = Inadequate Buffer point
- EP = Exposed Pipe point
- UC = Unusual Condition or Comment
- PO = Pipe Outfall point
- XS = representative cross-section data

yyy = 3-digit number that will be unique identifier within each type of specific data (001, 002, etc.)

Howard County Field Assessment Decision Flow Chart



BMP Conversion Assessment

March 29, 2016

General Data Collection Instructions

- If any illicit discharges or other safety concerns (e.g., missing manhole cover) are observed in the field, notify the County as soon as possible by contacting Christine Lowe (cslowe@howardcountymd.gov Office 410-313-0522, or Cell 301-806-3597). Provide location, information about the problem observed, and a photograph.
- Locate site on map layer for BMP Conversion Assessment **(*point*)** and fill in data for the fields below.

Fields - BMP Conversion Assessment *(Point)*

Overall

- Site ID (pre-assigned, unique number. Example: LNB-BC-F501)
- Field Crew [initials]
- Create a site name [This will be considered the common name for the site. Example: name of school, business, or nearest road.]
- Can site be evaluated? (if no, do not fill out other data)
    - Yes
    - No, landowner did not grant access
    - No, fence or other barrier
    - No, BMP does not exist at present
    - No, another reason
- Other reason site cannot be evaluated (describe)
- Can existing BMP be converted? [Answer this question after assessing the site and constraints. Use CONSTRAINTS SECTION BELOW to document constraints.]
    - Yes
    - No
- Notes: Reason BMP cannot be converted

General Site Description – Existing Conditions

- BMP Structure ID of existing pond [pre-filled from GIS data]
- BMP type from database [e.g., Dry Pond or Extended Detention Dry Pond]
- Owner Name [pre-filled from GIS data]
- BMP Address [pre-filled from GIS data]
- Drainage Area of Existing BMP (ac) [pre-filled from GIS data]
- Impervious Area of Existing BMP Drainage Area (ac) [pre-filled from GIS data]
- Study Area [pre-filled from GIS data]
- Contractor [pre-filled from GIS data]
- Comments [pre-filled from GIS data; information for field crew]
- Ownership [In most cases, this should be evident in GIS parcel layer.]
    - County School
    - County Parks
    - County – other

    - Private
    - Other
    - Unknown
- Notes, if ownership other
- Existing Pond Type (as YOU see it in field)
    - Dry Pond
    - Wet Pond
    - Other
- Describe type, if Other
- Is pond type same as listed in County database?
    - Yes/no
- Is repair needed?
    - Yes/No
- Woody vegetation within woody free zone?
    - Yes/No
- Other information describing existing pond condition (describe) [Such as need for maintenance, invasive vegetation removal, under construction, etc.]
- Existing Drainage area land use (predominant type)
    - Residential – single family homes <1 ac lots
    - Residential – single family homes > 1 ac lots
    - Townhouses
    - Multi-Family
    - Institutional
    - Industrial (not necessarily related to 02-SW or 12-SW permits)
    - Commercial
    - Transport-Related
    - Park
    - Undeveloped
    - Other
- Other information related to land use type within existing drainage area (describe) [This is a super-hotspot, lots of floatables or pet/goose waste, or other major issue.]

<u>Downstream or Outfall Condition</u>

Note: sites with < 200 feet of erosion below outfall will be considered *outfall channels*. Sites with >200-300 feet of erosion below outfall will be considered for stream restoration and evaluated for *downstream condition*.)

- Condition of outfall channel
    - 0: No erosion
    - 1-3: Minor erosion. Less than 1 foot of eroded banks. Healing may be present.
    - 4-6: Moderate erosion. Eroded banks are 1-2 feet in height. Erosion looks relatively recent.
    - 7-10: Severe Erosion. Eroded banks are greater than 2 feet in height. Erosion typically recent/active. (Fill out Outfall Stabilization Evaluation form)
- Reason Condition of outfall channel could not be inspected
    - Not applicable - discharges directly into MS4
    - Not applicable – discharges directly into large perennial stream
    - Could not inspect outfall [If behind fence etc.]
- Length of outfall channel erosion (ft.)

- Condition of stream channel [extending beyond 200 feet from discharge point]
    - 1-3: Minor erosion. 2-3 feet in eroded bank height, not causing significant stream degradation. Showing signs of healing.
    - 4-6: Moderate erosion. 3-5 feet in eroded bank height. Relatively recent/raw.
    - 7-10: Severe Erosion. 5 ft or greater eroded bank height. Erosion typically recent/active. Obvious instream degradation. If threatening utilities or structures rate 9-10. (Fill in Stream Restoration Assessment Form)
- Reason Condition of stream channel could not be inspected
    - Not applicable [make N/A the default]
    - Too far to warrant inspection
- Length of stream erosion (ft.)
- Notes: Describe Existing Site Conditions, Including Existing Site Drainage and Conveyance

Candidate BMP Constraints

- Property for Sale or Lease?
    - Yes/No
- Type (check all that apply)
    - Slope
    - Utilities
    - Structures
    - Space insufficient
    - Significant impact to trees
    - Specimen tree removal
    - Property Ownership
    - Access
    - Proximity to neighboring properties
    - Other adjacent landowner issues
    - Safety
    - Aesthetics
    - Other
- Other information on BMP project constraints or conflicts (describe)
- Impact to Existing Trees
    - Minimal
    - Moderate
    - Significant
- Ease of access
    - Easy
    - Moderate
    - Difficult
- Conflicts with Existing Utilities – Sewer
    - Yes
    - No
    - Possible
- Conflicts with Existing Utilities – Water
    - Yes

    - No
    - Possible
- Conflicts with Existing Utilities – Gas
    - Yes
    - No
    - Possible
- Conflicts with Existing Utilities – Cable
    - Yes
    - No
    - Possible
- Conflicts with Existing Utilities – Electric
    - Yes
    - No
    - Possible
- Conflicts with Existing Utilities – Electric to Streetlights
    - Yes
    - No
    - Possible
- Conflicts with Existing Utilities – Overhead Wires
    - Yes
    - No
    - Possible
- Conflicts with Existing Utilities – Other
    - Yes
    - No
    - Possible
- Other information on conflicts with existing utilities (describe)

[Whatever additional details you can think of which are relevant to conflicts which cannot be answered by YES or NO]

Potential Permitting Factors

- Dam Safety Permits Necessary [make "not probable" the default] (height of the pond measured from the upstream toe to the top of dam is more than 20 feet, or is a public road)
    - Probable
    - Not probable
- Impacts to Wetlands [make "not probable" the default]
    - Probable
    - Not probable
- Impacts to a Stream [make "not probable" the default]
    - Probable
    - Not probable
- Floodplain Fill [make "not probable" the default] (Will new BMP cause changes to floodplain elevation?)
    - Probable
    - Not probable
- Impacts to Specimen Trees (≥30 inch DBH)
    - Probable
    - Not probable
- Number of Specimen Trees Impacted (number)
- Other permitting or impact factors (describe)

Soils

- Evidence of poor infiltration [clays, fines]

    - Yes/No/Unknown
- Evidence of shallow bedrock
    - Yes/No/Unknown
- Evidence of high water table [gleying, saturation]
    - Yes/No/Unknown
- Notes on soils

Other Project Types

- Is Site a Candidate for Other Restoration Projects?
    - No
    - Yes, BMP conversion
    - Yes, Tree planting
    - Yes, Stream restoration
    - Yes, Outfall stabilization
- Other Types of Projects Appropriate Here (describe)

Recommendations Summary

Proposed BMP Conversion Recommendations

- Proposed Treatment Option within pond boundary (check all that apply)
    - Extended Detention
    - Wet Pond
    - Created Wetland
    - Bioretention
    - Step Pool Conveyance
    - Filtering Practice other than Bioretention
    - Infiltration (not recommended for hotspots)
    - Swale (engineered)
    - Other
- If other type, describe proposed treatment option
- Will new BMP drainage area be the same as existing drainage area?
    - Yes/No
- If no, describe area to be treated by newly converted BMP
- Describe Elements of Proposed Retrofit, Including Surface Area, Maximum Depth of Treatment, and Conveyance. Give a short narrative of BMP conversion to be done, as would be given on the first page of construction drawings.
- Notes on BMP conversion proposed. [Space for anything more that could not fit above.]
- Initial Feasibility and Construction Considerations (describe)

  Summarize some of the above criteria such as utility conflicts, neighborhood aesthetics consideration, treatment trains, technical complexity such as need for flow splitters etc.
- BMP Conversion Potential [This is a quick evaluation of "convertibility", not the pollutant removal efficiency gains anticipated.]
    - High
    - Medium
    - Low

- Optional: Sketch the proposed BMP conversion and attach sketch as photo. Sketch elements may include existing head available, surface area, minimum depth of treatment, conveyance, inlet, outlet, utility lines / other constraints, flow lines, property lines

New BMP Assessment

March 29, 2016

General Data Collection Instructions

- If any illicit discharges or other safety concerns (e.g., missing manhole cover) are observed in the field, notify the County as soon as possible by contacting Christine Lowe (cslowe@howardcountymd.gov, Office 410-313-0522 or Cell 301-806-3597). Provide location, information about the problem observed, and a photograph.
- Locate site on map layer for New BMP Assessment **(*polygon*)** and fill in data for the fields below.

Fields – New BMP Assessment *(Polygon)*

Overall

- Site ID (pre-assigned, unique number. Example: LNB-NB-F501)
- Field Crew [initials]
- Create a site name [This will be considered the site's common name. Example: name of school, business, or nearest road.]
- Can site be evaluated? (if no, do not fill out other data)
    - Yes
    - No, landowner did not grant access
    - No, fence or other barrier
    - No, another reason
    - Other reason site cannot be evaluated (describe)
- Is a new BMP retrofit possible on this site? Answer this question after assessing the site and constraints. Use CONSTRAINTS SECTION BELOW to document constraints.
    - Yes
    - No, too many constraints

General Site Description – Existing Conditions

- Study Area [pre-filled from GIS data]
- Contractor [pre-filled from GIS data]
- Comments [pre-filled from GIS data; information for field crew]
- Site Area - acres [prefilled from GIS]
- Ownership [In most cases, this should be evident in GIS parcel layer]
    - County School
    - County Parks
    - County – other
    - Private
    - Other
    - Unknown
- Notes, if ownership other
- Existing Land Use in Site Vicinity [predominant type]
    - Residential – single family homes <1 ac lots
    - Residential – single family homes > 1 ac lots
    - Townhouses
    - Multi-Family

    - Institutional
    - Industrial (not necessarily related to 02-SW or 12-SW permits)
    - Commercial
    - Transport-Related
    - Park
    - Undeveloped
    - Other
- Additional information about the land use type within existing drainage area (describe)
- Adjacent Land Use (check all that apply)
    - Residential
    - Commercial
    - Institutional
    - Industrial
    - Transport-Related
    - Park
    - Undeveloped
    - Other
- Other information on adjacent land use (describe)
- Is repair/replacement of an existing structure needed? [example: older pipe or parking lot in need of replacement]
    - Yes/No
- Other information describing existing conditions (describe) such as need for maintenance, invasive vegetation removal.

Downstream or Outfall Condition

Note that sites with < 200 feet of erosion below outfall will be considered *outfall channels*. Sites with >200-300 feet of erosion below outfall will be considered for stream restoration and evaluated for *downstream condition*.

- Condition of outfall channel
    - 0: No erosion
    - 1-3: Minor erosion. Less than 1 foot of eroded banks. Healing may be present.
    - 4-6: Moderate erosion. Eroded banks are 1-2 feet in height. Erosion looks relatively recent.
    - 7-10: Severe Erosion. Eroded banks are greater than 2 feet in height. Erosion typically recent/active. [Fill out Outfall Stabilization Assessment form]
- Reason Condition of outfall channel could not be inspected
    - Not applicable – discharges directly into MS4
    - Not applicable – discharges directly into large perennial stream
    - Could not inspect outfall [If behind fence etc.]
- Length of outfall channel erosion (ft.)
- Condition of stream channel [extending beyond 200 feet from discharge point]
    - 0: No erosion
    - 1-3: Minor erosion. 2-3 feet in eroded bank height, not causing significant stream degradation. Showing signs of healing.
    - 4-6: Moderate erosion. 3-5 feet in eroded bank height. Relatively recent/raw.
    - 7-10: Severe Erosion. 5 ft or greater eroded bank height. Erosion typically recent/active. Obvious instream degradation. If threatening utilities or structures rate 9-10. [Fill in Stream Restoration Assessment Form]
- Reason Condition of stream channel could not be inspected

    - Not applicable
    - Too far away, no access, to warrant inspection
- Length of stream erosion (ft.)
- Notes: Describe Existing Site Conditions, Including Existing Site Drainage and Conveyance

Candidate BMP Constraints

- Property for Sale or Lease?
    - Yes/No
- Constraint Type [check all that apply]
    - Slope
    - Utilities
    - Structures
    - Space insufficient
    - Significant impact to trees
    - Specimen tree removal
    - Property Ownership
    - Access
    - Proximity to neighboring properties
    - Other adjacent landowner issues
    - Safety
    - Aesthetics
    - Other
- Other information on BMP project constraints or conflicts (describe)

- Impact to Existing Trees
    - Minimal
    - Moderate
    - Significant
- Ease of access
    - Easy
    - Moderate
    - Difficult
- Conflicts with Existing Utilities – Sewer
    - Yes
    - No
    - Possible
- Conflicts with Existing Utilities – Water
    - Yes
    - No
    - Possible
- Conflicts with Existing Utilities – Gas
    - Yes
    - No
    - Possible
- Conflicts with Existing Utilities – Cable
    - Yes
    - No
    - Possible
- Conflicts with Existing Utilities – Electric
    - Yes
    - No
    - Possible
- Conflicts with Existing Utilities – Electric to Streetlights

    - Yes
    - No
    - Possible
- Conflicts with Existing Utilities – Overhead Wires
    - Yes
    - No
    - Possible
- Conflicts with Existing Utilities – Other
    - Yes
    - No
    - Possible

- Other information on conflicts with existing utilities (describe)

Potential Permitting Factors

- Dam Safety Permits Necessary [make "not probable" the default] (height of the pond measured from the upstream toe to the top of dam is more than 20 feet)
    - Probable
    - Not probable
- Impacts to Wetlands [make "not probable" the default]
    - Probable
    - Not probable
- Impacts to a Stream [make "not probable" the default]
    - Probable
    - Not probable
- Floodplain Fill [make "not probable" the default] (Will new BMP cause changes to floodplain elevation?)
    - Probable
    - Not probable
- Impacts to Specimen Trees [≥30 inch DBH]
    - Probable
    - Not probable
- Number of Trees Impacted (number)
- Other permitting or impact factors (describe)

Soils

- Evidence of poor infiltration [clays, fines]
    - Yes/No/Unknown
- Evidence of shallow bedrock
    - Yes/No/Unknown
- Evidence of high water table [gleying, saturation]
    - Yes/No/Unknown
- Notes on soils

Other Project Types

- Is Site a Candidate for Other Restoration Projects?
    - No
    - Yes, BMP conversion
    - Yes, Tree planting
    - Yes, Stream restoration
    - Yes, Outfall stabilization
- Other Types of Projects Appropriate Here (describe)

Recommendations: New BMP (Polygon) and Drainage Area (DA) (Polygon) [This will be 2 polygons – one for the project footprint, one for the DA.]

- Draw footprint of proposed project – on tablet in layer called "Sketch – Proposed New BMP Footprint"
- Draw proposed Drainage Area in layer called "Sketch – Proposed New BMP – Drainage Area"
- Comments
- Drainage Area Estimate [No need to enter - will be calculated with hand drawn polygon.]

NEW BMP Recommendation Summary – complete the form in the layer "New BMP Recommendation Footprint" (polygon)"

- Site ID (Example: LNB-NB-F501A)
- Proposed Treatment Option (check all that apply)
  - Extended Detention
  - Wet Pond
  - Created Wetland
  - Bioretention
  - Step Pool Conveyance
  - Filtering Practice other than Bioretention
  - Infiltration
  - Swale
  - Green roof
  - Impervious surface removal
  - Impervious pavement replacement
  - Other
- If other proposed treatment, describe type.
- Demonstration/Education value?
  - Yes/no
- Notes: Describe Elements of Proposed Retrofit, Including Surface Area, Maximum Depth of Treatment, and Conveyance.

  Give a short narrative of BMP to be built, as would be given on the first page of construction drawings
- Initial Feasibility and Construction Considerations (describe)

  Summarize some of the above criteria such as utility conflicts, neighborhood aesthetics consideration, technical complexity such as need for flow splitters etc.
- Other notes on new BMP proposed: [Space for anything more that could not fit above.]
- New Stormwater BMP – Retrofit Potential [This is quick evaluation of retrofitability / feasibility of constructing this BMP - not a ranking of quality of the BMP to remove pollutants]
  - High
  - Medium
  - Low

- Optional: Sketch the proposed BMP and attach sketch as photo. Sketch elements may include existing head available, surface area, minimum depth of treatment, conveyance, inlet, outlet, utility lines / other constraints, flow lines, property lines.

NEW BMP Recommendation Drainage Area – complete the form in the layer “New BMP Recommendation Drainage Area” (Polygon)”

- Site ID (Example: LNB-NB-F501A)
- Comments

Tree Planting

March 29, 2016

General Data Collection Instructions

- If any illicit discharges or other safety concerns (e.g., missing manhole cover) are observed in the field, notify the County as soon as possible by contacting Christine Lowe (cslowe@howardcountymd.gov, Office 410-313-0522 or Cell 301-806-3597). Provide location, information about the problem observed, and a photograph.
- Locate site on map layer for opportunity for Tree Planting Assessment **(*polygon*)** and fill in data for the fields below.

Fields – Tree Planting Assessment *(Polygon)*

Overall

- Site ID (pre-assigned or new ID, unique number. Example: LNB-TP-F501)
- Field Crew [Initials]
- Create a site name [This will be considered the common name of the site. Example: name of school, business, or nearest road.]
- Can site be evaluated? (if no, do not fill out other data)
  - Yes
  - No, landowner did not grant access
  - No, fence or other barrier
  - No, another reason
- Other reason site cannot be evaluated (describe)
- Is tree planting possible on this site? Answer this question after assessing the site and constraints. Use CONSTRAINTS SECTION BELOW to document constraints.
  - Yes
  - No, too many constraints
  - No, another reason (describe)
- Is tree planting opportunity at least 0.25 acres?
  - Yes/No

General Site Description

- Ownership [In most cases, this should be evident in GIS parcel layer.]
  - County School
  - County Parks
  - County – other
  - Private
  - Other
  - Unknown
- Notes, if ownership other
- Study Area [pre-filled from GIS data]
- Contractor [pre-filled from GIS data]
- Comments [pre-filled from GIS data; information for field crew]
- Parcel size: ____acre(s) [prefilled - from GIS]
- Access to site (check all that apply)

    - Foot access
    - Vehicle access
    - Heavy equipment access
- Current Management
    - School District
    - Charter School
    - Park
    - Tot Lot
    - Public Right-of-way
    - Private Right-of-way
    - Vacant land
    - Other

Climate

- Sunlight exposure
    - Full sun (6 hours or more of direct sun per day)
    - Part sun or filtered light (<6 hours per day)
    - Shade (<3 hours of direct sun per day)
- Microclimate features: High wind exposure (Yes/No)
- Microclimate features: Re-reflected heat load (Yes/No)
- Microclimate features: Other (describe)

Topography

- Any slopes >15% present in proposed planting area? (Yes/No)
- If yes, estimate slope
- Any low-lying areas present in proposed planting area? (Yes/No)
- If yes, notes on low lying area

Vegetation

- Current vegetative cover (estimate percent)
    - Mowed Turf _____% [1,2,3,4,5, 10, 15, 20, 25, 30 …100 by 5's]
    - Other Herbaceous _____% [as above]
    - Trees/Shrubs _____% [as above]
    - None (bare soil) _____% [as above]
- Note species to be preserved
- Are invasive species or noxious weeds present in proposed planting area? (Yes/No)
- % coverage by invasives in proposed planting area: _____
- List dominant types of invasive species in proposed planting area, if any _____
- Adjacent vegetative cover: is forest present? (Yes/No)
- If yes, note dominant forest species
- Are invasive species or noxious weeds present in adjacent vegetated area? (Yes/No)
- % coverage by invasives in adjacent area: _____
- List dominant types of invasive species in adjacent area, if any _____
- Is there heavy browsing by deer? (Yes/No)
- Is there beaver activity? (Yes/No)
- Evidence of previous tree planting? (Yes/No)
- Comment on success of previous tree planting, if evidence present
- Notes

Soils

- Soil texture
  - Clay
  - Loam
  - Sand
- Soil Compaction
  - None
  - Moderate
  - Severe
- Active or severe soil erosion? (Yes/No)
- Potential soil contamination? (Yes/No)
- Debris and rubble in soil? (Yes/No)
- Recent construction or other soil disturbance? (Yes/No)
- Other soil characteristics (describe)

Hydrology

- Site hydrology
  - Upland
  - Riparian
  - Both
- Stormwater runoff to planting site – bypasses site in pipe? (Yes/No)
- Stormwater runoff to planting site – Upslope drainage area outfalls to site? (Yes/No)
- Note diameter of pipe outfall, if present (inches)
- Stormwater runoff to planting site – Open channel directs flow across or around site? (Yes/No)
- Stormwater runoff to planting site – Shallow concentrated flow (for example, evidence of rills, gullies, sediment deposits)? (Yes/No)
- Stormwater runoff to planting site – Sheetflow? (Yes/No)
- Floodplain connection (riparian areas only) – bank height (ft)
- If riparian planting is proposed on both sides of stream, explain/describe differences in hydrology or flow path.

Potential Planting Conflicts or Constraints

- Space Limitations
  - Overhead wires? (Yes/No)
  - Height of overhead wires, if present (ft)
  - Pavement? (Yes/No)
  - Structures? (Yes/No)
  - Signs? (Yes/No)
  - Height of signs, if present (ft)
  - Lighting? (Yes/No)
  - Height of lighting, if present (ft)
  - Underground Utilities? (Yes/No)

    - Note type of underground utilities present
    - Other space limitations (describe)
- Other limiting factors or constraints
    - Trash dumping/debris (Yes/No)
    - If trash present, note type, volume (estimated number pickup truck loads) and source if known.
    - Deer, beaver, or other animal impacts (Yes/No)
    - Site mowed regularly (Yes/No)
    - Wetland present (Yes/No)
    - Insect infestation or disease (Yes/No)
    - Access (Yes/No)
    - Ownership (Yes/No)
    - Heavy pedestrian traffic (Yes/No)
- Other limiting factors/constraints (describe)
- Notes

Planting and Maintenance Logistics

- Site Access
    - Delivery Access for planting materials present? (Yes/No)
    - Temporary storage areas for soils, mulch, etc. present? (Yes/No)
    - Heavy equipment access? (Yes/No)
    - Volunteer parking area available? (Yes/No)
    - Nearby facilities for volunteers? (Yes/No)
- Water source
    - Rainfall only? (Yes/No)
    - Stormwater runoff? (Yes/No)
    - Hose hook-up nearby? (Yes/No)
    - Irrigation system in place? (Yes/No)
    - Overbank flow from river or stream? (Yes/No)
    - Fire hydrant nearby? (Yes/No)
- Other water source (describe)
- Estimated distance to nearest water source (ft)

TREE PLANTING RECOMMENDATIONS

Tree Planting Recommendation Summary – complete the form in the layer "Tree Planting Area Recommendations" [polygon]

Sketch footprint of proposed tree planting area – on tablet, outline area(s) to be planted

- Site ID (Example: LNB-TP-F501A)
- Site Preparation Required
    - High (e.g., clearing of dumpsite)
    - Medium (e.g., extensive clearing of invasives)
    - Low
    - None
- Type of site prep needed (describe)
- Potential Demonstration/Education Project? (Is site public/highly visited v. remote location?)
    - Yes/No/Maybe

- Notes: _____
- Tree Planting Areas - Restoration Potential [This is quick, overall evaluation of feasibility of tree planting at this site.]

    - High
    - Medium
    - Low

- Comments

- Optional: Sketch the proposed tree planting area and attach sketch as photo. Sketch elements may include:
    - Property boundary and features such as roads, streams, and adjacent land use/cover
    - Boundary and approximate dimensions of proposed planting area
    - Variations in sun exposure, microclimate, and topography within planting area
    - Current vegetative cover, location of trees to be preserved, and invasive species
    - Flow paths to planting area and contributing flow length
    - Above or below ground space limitations (e.g., utilities, structures)
    - Other limited factors such as trash dumping, pedestrian paths
    - Water source and access points
    - Scale bar and north arrow.

Stream Restoration Assessment

March 29, 2016

General Data Collection Instructions

- All reaches are assessed while walking upstream
- If there is a significant change in biological, physical or geomorphic conditions within a reach, then the field team has the ability to draw a Stream Reach Break Line to designate separate reaches.
- Each reach, including new reaches designated in the field, must have a habitat assessment point if reach is at least 75 meters long.
- If a portion of a reach cannot be assessed due to access or safety issues, then place a Reach Break Line at the point in the reach where the team can no longer walk upstream. Place a new Reach Break Line when the reach is assessable again.
- Right and left bank are determined while facing downstream.
- A minimum of two photos must be taken at each feature (point, line or polygon). First photo is taken looking upstream (or upslope in the case of outfalls), second photo is taken while looking downstream. Additional photos may be taken at the discretion of the field team.
- If it is immediately obvious that the site is not a good stream restoration candidate - only complete form up to the "Can/should site be evaluated" field and do not spend a significant amount of time walking the stream.
- If any illicit discharges or other safety concerns (e.g., missing manhole cover) are observed in the field, notify the County as soon as possible by contacting Christine Lowe (cslowe@howardcountymd.gov, Office 410-313-0522 or Cell 301-806-3597). Provide location, information about the problem observed, and a photograph.

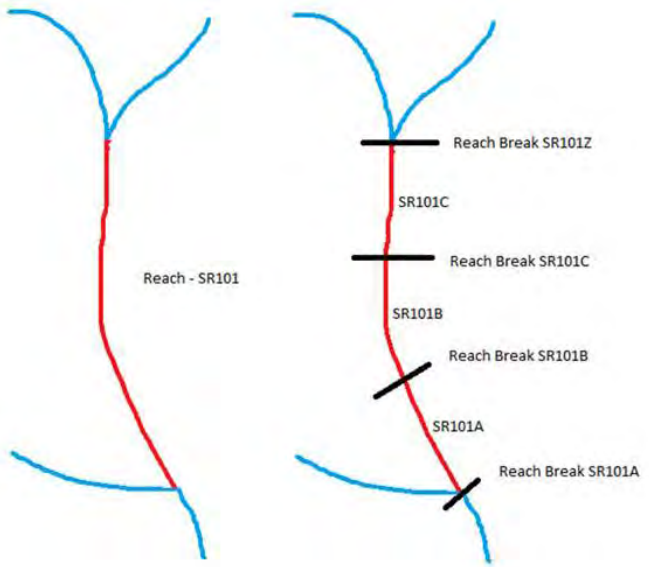
Stream Restoration Assessment Data Layers

Stream Restoration Assessment (line) – No editing; base layer with Site IDs. Check here for comments that may contain special notes for field crews.

Stream Reach Break Data *(line)*

Data Collection Instructions

Add a Stream Reach Break line at the beginning of a new stream reach assessment for either a pre-selected reach or a new reach within a pre-selected reach. This line signifies the downstream end of a new section of stream that is assessed. Each line will be perpendicular to and crossing the stream reach. Break line may be at or slightly below the downstream end of the stream reach. The last reach break will be labelled with Z to signify the upstream end of the study reach; do not fill in any other data for the "Z" reach.



Fill out all fields prior to assessing reach, except for the final field, Stream Restoration Opportunities Present, which you will complete after the assessment.

Fields

- Site ID of Stream Reach [fill in ID from the Stream Reach base layer, in which the number will be pre-assigned (e.g., LNB-SR-F001); add A for the first reach break. Add B, C, D, etc. for each additional break. Assign Z to the break at the end of reach.]
- Field Crew [Initials]
- Can/should site be evaluated? (if no, do not fill out other data)
    - Yes
    - No, landowner did not grant access
    - No, fence or other barrier
    - No, another reason
    - Site in good condition, no reason to assess
- Notes
- Create a site name [This wil be considered the common name for the site. Example: name of school, business, or nearest road.]
- Past Weather (24 hours) – yes/no for all [Fill out only once per day]
    - Clear
    - Cloudy
    - Trace of Rain
    - Rain
    - Snow
    - Extreme Cold [consistently < 32 degrees F]
    - Extreme Hot ([consistently > 80 degrees F])

    - Other
- Current Weather [Fill out only once per day unless weather changes throughout the day]
    - Same Options as above
- Stream Type – check one
    - Perennial
    - Intermittent
    - Ephemeral
    - Unknown
    - If stream type is unknown, explain
- Notes
- Stream Restoration Opportunities Present (Filled out after walking reach) [Note if opportunities present, then also fill in Stream Restoration Recommendations form.]
    - None
    - One
    - Several

Rapid Biology/Habitat Assessment Data *(Point)*

Data Collection Instructions

At least one Habitat Assessment point needs to be placed within each stream reach. If a reach is >1000 ft long, place a Stream Reach Break and collect another Habitat Assessment Point.

The assessment is conducted within a representative 75-meter reach. It is at the discretion of the field crew to choose a representative location for the 75-m reach assessment.

See example RBP data form for habitat parameter scoring guidance. For each RBP parameter, scale runs from 1 (worst condition) to 10 or 20 (best condition).

Fields

- Site ID (e.g. LNB-SR-F501A-RE001) [Fill in, using Stream Reach ID and adding RE###, RE for Representative Site]
- Stream Bed Particle Size (note percentage, estimate to the nearest 5%)
    - Clay
    - Silt
    - Sand
    - Gravel
    - Cobble
    - Boulder
    - Bedrock
    - Concrete
- Epifaunal Substrate/Available Cover (0-20 score)
- Embeddedness (0-20)
- Velocity/Depth Regime (0-20)
- Sediment Deposition (0-20)
- Channel Flow Status (0-20)
- Channel Alteration (0-20)
- Frequency of Riffles (or bends) (0-20)
- Bank Stability (Right) (0-10)
- Bank Stability (Left) (0-10)
- Vegetative Protection (Right) (0-10)
- Vegetative Protection (Left) (0-10)
- Riparian Vegetative Zone Width (Right) (0-10)
- Riparian Vegetative Zone Width (Left) (0-10)
- Percent Shading (estimate to nearest 10%, assuming leaf-on)
- Trash Rating (0-20)
- Notes

Erosion Site (*Point, placed at downstream end of erosion)*

Data Collection Instructions

Document all stream bank erosion that has an eroded surface of at least 2 feet high and 10 feet long. Shorter instances of erosion can be documented if the erosion is threatening a utility, property, or structure. Erosion points are placed at the downstream end of erosion. A new erosion point is placed on the map if the average height of erosion changes by more than 2-3 feet, or any of the erosion point parameters have a significant change. See BEHI diagram for guidance on collecting the applicable parameters. If there is erosion on both banks, record BEHI parameters for whichever bank is more extreme. If there are multiple areas of erosion that are vastly different in degree of erosion hazard, additional erosion points may be added if needed.

A gully associated with an outfall channel will be recorded as an erosion point. If the actual outfall is located, that will also be recorded, as a pipe outfall. If the erosion is a headcut, only the headcut fields need to be completed.

Fields

- Site ID (e.g. LNB-SR-F501A-ES001) [Fill in using Stream Reach ID and adding ES###, ES for Erosion Site]
- Type of Erosion (check all that apply)
    - Headcutting
    - Downcutting
    - Widening
    - Other
- Right Bank Length of Erosion (ft) - extending upstream of point, estimate or measure to the nearest 10 ft the length along bank
- Left Bank Length of Erosion (ft) - extending upstream of point, estimate or measure to the nearest 10 ft the length along bank
- Height of Erosion on Right Bank (ft) – to nearest 0.1 ft
- Height of Erosion on Left Bank (ft) – to nearest 0.1 ft
- Right Bank Total Height (ft) – to nearest 0.1 ft, measure from thalweg to top of bank
- Left Bank Total Height (ft) – to nearest 0.1 ft, measure from thalweg to top of bank
- Bankfull Depth (ft) – to nearest 0.1 ft, measure from thalweg to bankfull
- Note bankfull indicators
- Predominant Bank Material
    - Clay
    - Silt
    - Sand
    - Gravel
    - Cobble
    - Boulder
    - Bedrock
- Bank angle as degrees, Bank Erosion Potential category
    - 0 – 20 degrees, Very Low
    - 21 – 60 degrees, Low
    - 61 – 80 degrees, Moderate
    - 81 – 90 degrees, High
    - 90 – 119 degrees, Very High
    - >119 degrees, Extreme

- Root Density as percentage, Bank Erosion Potential category
  - 80 - 100% Very Low
  - 55 - 79% Low
  - 30 - 54% Moderate
  - 15 - 29% High
  - 5 – 14% Very High
  - <5% Extreme
- Root Depth as proportion of bank height, Bank Erosion Potential category
  - 0.90 – 1.0 Very Low
  - 0.50 – 0.89 Low
  - 0.30 - 0.49 Moderate
  - 0.15 – 0.29 High
  - 0.05 - 0.14 Very High
  - <0.05 Extreme
- Surface protection as percentage, Bank Erosion Potential category
  - 80 - 100% Very Low
  - 55 - 79% Low
  - 30 - 54% Moderate
  - 15 - 29% High
  - 10 – 14% Very High
  - <10% Extreme
- Near Bank Stress Rating [narrative category]
  - Very Low
  - Low
  - Moderate
  - High
  - Very High
  - Extreme
- Soil Stratification
  - None/Low
  - Medium
  - High
- Headcut height, ft, to the nearest 0.5 ft [if applicable]
- Headcut angle, degrees [if applicable]
  - 0 – 30 degrees o
  - 31 - 60 degrees o
  - 61 – 90 degrees
- Headcut length, ft [bottom to top; if applicable]
- Overall Erosion Severity Rating (1-10)
  - 1-3: Minor erosion. 2-3 feet in eroded bank height, not causing significant stream degradation. Showing signs of healing.
  - 4-6: Moderate erosion. 3-5 feet in eroded bank height. Relatively recent/raw.
  - 7-10: Severe Erosion. 5 ft or greater eroded bank height. Erosion typically recent/active. Obvious instream degradation. If threatening utilities or structures rate 9-10.
- Notes

Channel Alteration Site *(Point, placed at downstream end of channel alteration)*

Data Collection Instructions

Document instances of the channel bed, bank, or nearby floodplain being altered by placing a Channel Alteration point at the downstream extent of the alteration and completing the electronic form. Only document instances where the alteration is detrimental to the stream (e.g. concrete-lined channel) or needs to be fixed (e.g. failing bank stabilization project). Do not document stable utility line protection or successful stream restoration projects. Channel Alteration points are placed at the downstream end of erosion.

Fields

- Site ID (e.g. LNB-SR-F501A-CA001) [Fill in using Stream Reach ID and adding CA###, CA for Channel Alteration]
- Type
    - Concrete
    - Riprap
    - Gabion Basket
    - Earthen Channel
    - Channelization/Straightening
    - Other
- Alteration Length (ft) (extending upstream of point, estimate or measure to the nearest 10 ft)
- Alteration Width (ft) (Bed only)
- Alteration Location
    - Bed
    - Bank
    - Bed and Bank
    - Floodplain
- Signification vegetation in channel?
    - Yes, No, Unknown
- Signification Aggradation
    - Yes, No, Unknown
- Significant Degradation
    - Yes, No, Unknown
- Associated with a Road Crossing
    - Yes, No, Unknown
- Alteration Severity (1-10)
    - 1-3: Alteration is detrimental to the health of the stream, but alteration is relatively short and is not causing any current channel instability.
    - 4-6: Alteration is causing noticeable channel instability (e.g. channel starting to erode around riprap placed on bank or channelized stream banks slumping in stream) and should be corrected.
    - 7-10: Alteration is relatively long, causing significant channel instability/loss of habitat and should be corrected as soon as possible.
- Notes

Inadequate Buffer Site *(Point, placed at downstream end of inadequate buffer)*

Data Collection Instructions

Document non-natural areas with a minimum length along the stream (parallel to the channel) of 100 feet. A buffer will be considered adequate if it is tree-covered within 75 ft of the stream.

A more detailed assessment of the area can be completed with the Tree Planting Area form (polygon feature) if adequate space is available for planting (at least 0.25 acre).

Inadequate buffer points are placed at the downstream end of the inadequate buffer.

Fields

- Site ID (e.g. LNB-SR-F501A-IB001) [Fill in using Stream Reach ID and adding IB###, IB for Inadequate Buffer]
- Inadequate buffer length – Right (ft)
- Inadequate buffer length – Left (ft)
- Existing Buffer width – Right (ft) (to 150 ft maximum)
- Existing Buffer width – Left (ft) (to 150 ft maximum)
- Opportunity for tree planting project? (yes/no) – If Yes, fill out Tree Planting assessment form
- Notes

Pipe Outfall Site *(Point)*

Data Collection Instructions

Document all outfall pipes or channels that can be seen from the stream by placing an outfall point on the map. If the outfall is a pipe then place the point at the opening of the pipe, if the outfall is a channel then place the point at the termination of the formal conveyance (i.e. do not place point at end of erosional gully, this will be documented within the field form).

Use this form to record unmapped outfalls and problematic outfalls observed while conducting stream assessment. This is not intended to be a comprehensive inventory of outfalls.

Fields

- Site ID (e.g. LNB-SR-F501A-PO001) [Fill in using Stream Reach ID and adding PO###, PO for Pipe Outfall]
- Mapped outfall number, if available [MSLINK from GIS]
- Type of Outfall
    - Stormwater BMP Outfall
    - Stormwater Outfall, no BMP
    - BMP Overflow Channel / Spillway
    - Agricultural Drainage Pipe
    - Roof Drains (only record if there are major problems to address)
    - Sewage Plant
    - Unknown
    - Other
- Enclosed Pipe or Open Channel (choose one)
- Material
    - Earth Channel
    - Concrete Channel
    - Concrete Pipe
    - Smooth Metal Pipe
    - Corrugated Metal Pipe
    - Smooth Plastic Pipe
    - Corrugated Plastic Pipe
    - Unknown
    - Other
- Pipe Diameter [inside – inches]
- Location in relation to stream channel (choose one, facing downstream)
    - Right side
    - Left side
    - In-line with stream
- Evidence of dry weather flow (e.g. staining, excessive vegetation, oil sheen, etc.)?
    - Yes, No
- Is there a suspected illicit discharge that needs to be addressed?
    - Yes, No – If yes, notify Howard County
- Trash Rating (0-20, refer to RBP ratings)
- Evidence of Erosion below outfall?
    - Yes, No - If moderate or severe erosion is observed, fill out Outfall Stabilization Assessment form [point feature].
- Notes

Unusual Condition/Other *(Point)*

Data Collection Instructions

Document any unusual conditions found during the stream assessments. These may not necessarily be good indicators for targeting restoration sites, but these conditions may be leading to (or indicative of) instream degradation and are worth documenting for the County's use if the condition is severe. Place a new point on the map where the unusual condition is found.

Fields

- Site ID (e.g. LNB-SR-F501A-UC001) [Fill in using Stream Reach ID and adding UC###, UC for Unusual Condition]
- Near-stream construction with poor ESC (yes/no)
- Suspected illicit discharge (Contact County) (yes/no)
- Illegal Dumping (yes/no)
- Exposed Pipe (yes/no)
- Unusual Water Color (yes/no)
- Unusual Water Clarity (yes/no)
- Unusual Water Odor (yes/no)
- Excessive Algae (yes/no)
- Excessive Bacteria Indicators (yes/no)
- Severe Fish Blockage/Barrier (yes/no)
- Other (describe) (yes/no)
- Notes

Stream Restoration Recommendations *(Polygon)*

Data Collection Instructions

Use this feature to indicate the location and extent of one or many potential stream restoration projects within the assessed reach. Draw a polygon that includes the extent of stream length to be restored, including side tributaries if they are to be included in project.

Also, document the potential of adding one or many restoration projects in the Stream Reach Break line shapefile.

Fields

- Site ID (e.g., LNB-SR-F501A)
- Instream Restoration Potential
    - High
    - Medium
    - Low
- Restoration Length (ft) [will be calculated later in GIS]
- Percent of channel included in polygon in need of restoration
- Stream Restoration Project Constraints - Type
    - Utility
    - Roadway
    - Buildings
    - Other Structure
    - Ownership
    - Access
    - Significant Impact to Trees
    - Specimen Tree Removal
    - Wetland Impacts
    - Other
- Approximate length of project affected by constraint (ft)
- Impact to Existing Trees
    - Minimal
    - Moderate
    - Significant
- Ease of access
    - Easy
    - Moderate
    - Difficult
- Potential Demonstration/Educational Value? (yes/no)
- Notes

Outfall Stabilization Assessment (Point)

March 29, 2016

General Data Collection Instructions

- If any illicit discharges (any discharge after 3 days of dry time) or other safety concerns (e.g., missing manhole cover) are observed in the field, notify the County as soon as possible by contacting Christine Lowe (cslowe@howardcountymd.gov, Office 410-313-0522 or Cell 301-806-3597). Provide location, information about the problem observed, and a photograph.

- Edit an existing (preselected) outfall stabilization point OR add a new outfall stabilization point. If adding a new point and the outfall is a pipe then place the point at the opening of the pipe. If the outfall is a channel then place the point at the termination of the formal conveyance (i.e. do not place point at end of erosional gully, this will be documented within the field form).

Fields – Outfall Stabilization Assessment (*Point)*

- Site ID (prefilled) (example: LNB-OF-F501). If site was a Pipe Outfall Site in Stream Restoration reach, use that outfall point site ID (example: SR-F501-PO103).
- Field Crew [Initials]
- Create a site name [This will be considered the common name of the site. Example: name of school, business, or nearest road.]
- Study Area [pre-filled from GIS data]
- Contractor [pre-filled from GIS data]
- Comments [pre-filled from GIS data; information for field crew]
- Can site be evaluated? (if no, do not fill out other data)
    - Yes
    - No, landowner did not grant access
    - No, fence or other barrier
    - No, another reason
- Point moved? (If point is in incorrect location, move the point and indicate here)
    - Yes
    - No
- Notes
- Past Weather (24 hours) – yes/no for all [Fill out only once per day]
    - Clear
    - Cloudy
    - Trace of Rain
    - Rain
    - Snow
    - Extreme Cold (consistently < 32 degrees F)
    - Extreme Hot (consistently > 80 degrees F)
    - Other
- Current Weather [Fill out only once per day unless weather changes throughout the day]
    - Same Options as above
- Outfall Pipe Height (inches)
- Outfall Pipe Width (inches)
- Outfall Pipe Shape
    - Round
    - Rectangular
    - Elliptical
- Outfall Type
    - Pipe only
    - Headwall/Endsection
- Is repair needed?
    - Yes/No

- Is sediment removal needed?
    - Yes/No
- Is there baseflow?
    - Yes/No
- Outfall Material
    - Earth Channel
    - Concrete Channel
    - Concrete Pipe
    - Smooth Metal Pipe
    - Corrugated Metal Pipe
    - Smooth Plastic Pipe
    - Corrugated Plastic Pipe
    - Unknown
    - Other
- Trash Rating (0-20, refer to RBP rating)
- Evidence of Erosion below outfall?
    - Yes, No
- Location of Erosion
    - Outfall Channel (yes/no)
    - Main Stream Channel (yes/no)
- Length of outfall channel erosion (ft)
- Length of stream channel erosion that is attributable to the outfall (ft)
- Distance from outfall to Stream Channel (ft)
- Height of pipe above channel bed (ft)
- Severity of outfall channel Erosion/degradation (1-10)
    - 1-3: Minor erosion. Less than 1 foot of eroded banks. Healing may be present.
    - 4-6: Moderate erosion. Eroded banks are 1-2 feet in height. Erosion looks relatively recent.
    - 7-10: Severe Erosion. Eroded banks are greater than 2 feet in height. Erosion is typically recent/active.
- Does this site have potential for outfall stabilization?
    - Yes (if yes, go to Outfall Stabilization Recommendation, add line, and fill out form)
    - No
- Does this site have potential for stream restoration?
    - Yes (if yes, go to Stream Restoration Assessment, beginning with Stream Reach Break Data and fill out forms, including Erosion Site form)
    - No
- Notes

Outfall Stabilization Recommendation *(Line)*

Data Collection Instructions

Add line to map and fill out the form below if "Yes" was answered for "potential for outfall stabilization". Draw line to indicate proposed location and length of outfall stabilization project. Note: portions of Outfall Stabilization projects that extend beyond 200-300 feet will be categorized as stream restoration projects.

Fields

- Site ID (e.g. LNB-OF-F501) (match Outfall Stabilization Assessment Site ID)
- Overall Outfall Stabilization Potential
    - High
    - Medium
    - Low
- Type of Outfall Stabilization Project
    - Rip Rap
    - Drop Structure
    - Regenerative Stormwater Conveyance
    - Other
- Describe Other type of stabilization
- Proposed project length (ft) (estimate to nearest 10 ft)
- Outfall Stabilization Project Constraints - Type
    - Utility
    - Roadway
    - Buildings
    - Other Structure
    - Ownership
    - Access
    - Draining a hotspot
    - Significant impact to trees
    - Specimen tree removal
    - Wetland Impacts
    - Other
- Approximate length of project affected by constraint (ft)
- Impact to Existing Trees
    - Minimal
    - Moderate
    - Significant
- Ease of access
    - Easy
    - Moderate
    - Difficult
- Potential Demonstration/Educational Value? (yes/no)
- Note

APPENDIX D: LANDOWNER NOTIFICATION LETTER

HOWARD COUNTY DEPARTMENT OF PUBLIC WORKS
6751 Columbia Gateway Drive, Suite 514 ▪ Columbia Maryland 21046 ▪ 410-313-6444

Mark DeLuca, P.E., Deputy Director
Chief, Bureau of Environmental Services
mdeluca@howardcountymd.gov

FAX 410-313-6490
TDD 410-313-2323

March 25, 2016

Re: Patapsco River and Patuxent River Watershed Study

Dear Resident:

The Howard County Department of Public Works Stormwater Management Division will soon be undertaking a comprehensive watershed assessment within the Patapsco River and the Main Stem Patuxent River watersheds. The watershed assessment is being performed to create an inventory of the natural resources as well as existing problems (erosion, trash, lack of wooded stream buffers, etc.) within these watersheds. Another result of the assessment will be a list of potential projects that can be done to protect and restore these resources, address the problems, and ultimately improve water quality in our streams and water bodies.

The County welcomes participation in development of the study from watershed residents, businesses, and organizations. Public workshops will be planned after the initial field work has been completed to present the results from the assessment and to discuss proposed restoration projects suggested by the study. Exact workshop dates will be advertised when the dates are finalized.

Field crews of two or three County employees or consultants will conduct their assessments on public property to the extent possible but there may be a need for them to be on private property briefly to access certain sites. You may see a crew briefly in your neighborhood. The field crews will be there only to assess existing conditions through visual observations, taking photos, and preparing sketches. Field crews will use extreme care when on private property.

The County anticipates that the majority of the field assessment work will occur during the April to June 2016 time frame with the possibility of a quick second visit to verify field information later in summer 2016.

If you have any specific questions or concerns or would like additional information regarding the watershed assessment, please contact the County by emailing cslowe@howardcountymd.gov or calling 410-313-6444.

APPENDIX E: FIELD REPORTS FROM CONSULTANT FIELD TEAMS

Biohabitats
The Stables Building
2081 Clipper Park Road
Baltimore, MD 21211
410.554.0156
www.biohabitats.com

MEMORANDUM

Date: May 27, 2016 (Revised June 28, 2016)

To: Christine Lowe, Howard County, Stormwater Management Division

From: Biohabitats, Inc.

RE: **Howard County Watershed Assessments in 2016**

Subject: **Patapsco River South Branch and Upper Patuxent River Field Summary Report**

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1. Number of Field Assessments Completed

Table 1. Number of field assessments completed				
Consultant Firm Name	**Biohabitats**			
Study Area Name	**Patapsco River South Branch**			
Type	**# Sites (or Stream Miles) Assigned (from Table A below)**	**# Pre-Assigned Sites (or Stream Miles) that Were Completed**	**# Additional Sites (or Stream Miles), Added in the Field and Completed**	**Total # Sites (or Stream Miles) Completed**
BMP conversion	1	1	0	1
New BMP	0	0	0	0
Stream Restoration	12.77 miles	11.35 miles	0	11.35 miles
Tree Planting	10	9	11	20
Outfall stabilization	13	11	0	11

Table 1. Number of field assessments completed				
Consultant Firm Name	**Biohabitats**			
Study Area Name	**Upper Patuxent River**			
Type	**# Sites (or Stream Miles) Assigned (from Table A below)**	**# Pre-Assigned Sites (or Stream Miles) that Were Completed**	**# Additional Sites (or Stream Miles), Added in the Field and Completed**	**Total # Sites (or Stream Miles) Completed**
BMP conversion	3	3	0	3
New BMP	1	1	0	1
Stream Restoration	3.24 miles	2.87 miles	0	2.87 miles
Tree Planting	2	2	0	2
Outfall stabilization	2	2	2	4

2. Primary Reasons that Sites Could Not be Assessed

Stream Restoration

- PRU-SR-F301 (0.37 miles) was not assessed as there were horses fenced in within the stream assessment area that prevented safe access to the stream.
- SBP-SR-F407 (0.37 miles) was only partially assessed as access was denied for one of the properties adjacent to the stream.
- SBP-SR-F412 (0.56 miles) was only partially assessed as there were bison within the stream assessment area that prevented safe access to a portion of the stream.
- SBP-SR-F414 (0.49) miles was not assessed as there were several dogs loose on the property that prevented safe access to the stream.

Outfall Stabilization

- SBP-OF-F405 was not assessed as the outfall was already in good condition.
- SBP-OF-F412 was not assessed as there was a fence which prevented access.

Tree Planting

- SBP-TP-F401 was not assessed as the site had been planted with trees in recent years and was still in good condition. An adjacent site (SBP-TP-F401A) presented a better opportunity and was assessed for tree planting feasibility instead.
- PRU-TP-F302A was not assessed as the site had a surrounding fence that prevented access by the field team, however the site was still assessed for feasibility from behind the fence boundary.

3. Other Comments about Data or Assumptions Made

Stream Restoration

- In cases where the bank erosion was similar in character and flip flopped from left bank to right bank the length of erosion on left and right banks was summed for the respective banks and a total length of erosion was included in the notes. This total length of erosion may be less than the sum of erosion on left and right banks if overlap occurred.

Tree Planting

- For sites on private property, it was assumed that property owners would be receptive to tree planting.
- Watering was assessed as onsite sources available or access for a truck.
- Additional sites added in the field were identified during the stream restoration assessment. The tree planting assessment polygon for the additional sites did not always match property boundaries like for the assigned sites. Since the additional sites were identified during the stream restoration assessment, the tree planting assessment polygons for additional sites could cross several properties and/or only include portions of properties adjacent to a stream.
- Regional forest association was based on USDA Forest Service Potential Natural Vegetation Groups, version 2000, available at http://www.firelab.org/sites/default/files/images/downloads/pnv2000.pdf.
- No optional sketches of the tree planting areas were completed.
- An additional eight Tree Planting Recommendation sites were added during Stream Restoration Assessment field visits where potential tree planting opportunities were present adjacent to streams. These Tree Planting Recommendation sites were named corresponding to their adjacent streams. Because there was overlap between assigned Tree Planting Assessment site IDs and Stream Restoration Assessment site IDs (i.e. SBP-SR-F401 and SBP-TP-F401), there is consequential overlap in Tree Planting Recommendation site IDs. Sites that were recommended in the field during stream restoration assessment are clearly called out as such in the notes sections of their site assessment forms.

Outfall Stabilization

- It was assumed that ‘distance from outfall to stream channel’ was the vertical distance from the invert of the outfall pipe to the immediate receiving channel (outfall channel).
- PRU-OF-F306 was added as an outfall stabilization recommendation during a stream restoration assessment.
- SBP-OF-F413 is located at the upstream end of SBP-SR-F421 and was evaluated during field assessment of this stream reach; consequently, no additional Outfall Stabilization Recommendation form was submitted for this outfall as its recommendation was incorporated into the Stream Restoration Recommendation form for SBP-SR-F421.

4. Number of Recommendations Made at Field Sites

Table 2. Number of site recommendation forms completed for field sites assessed				
Consultant Firm Name	**Biohabitats**			
Study Area Name	**Patapsco River South Branch**			
		Field Assessment of Restoration/Retrofit Potential (# Sites)		
Type	**# Recommendations**	**High**	**Medium**	**Low**
BMP conversion recommendations	1	0	1	0
New BMP recommendations	0	0	0	0
Stream Restoration recommendations	31	10	14	7
Tree Planting recommendations	26	15	9	2
Outfall stabilization recommendations	2	1	1	0

Table 2. Number of site recommendation forms completed for field sites assessed				
Consultant Firm Name	**Biohabitats**			
Study Area Name	**Upper Patuxent River**			
		Field Assessment of Restoration/Retrofit Potential (# Sites)		
Type	**# Recommendations**	**High**	**Medium**	**Low**
BMP conversion recommendations	3	0	2	1
New BMP recommendations	4	0	0	4
Stream Restoration recommendations	4	1	1	2
Tree Planting recommendations	1	0	1	0
Outfall stabilization recommendations	2	0	0	2

5. General Comments about the Types of Recommendations Made

Stream Restoration

- Over 4.5 miles of stream restoration opportunities were identified by the field crews. The average project length was approximately 900 LF. These opportunities varied widely

from livestock fencing and straight forward gully or bank repairs to significant restoration projects along the higher order stream reaches. Field crews generally thought that tree impacts could be minimized and no sites were predicted to result in significant tree impacts. The overall access ratings were moderate to easy, with only two sites (approximately 0.4 miles) rating in the difficult range.

- The Upper Patuxent River watershed presents better opportunities overall for stream restoration. The heavy urbanization of this watershed has resulted in widespread erosion and trash throughout the streams. Additionally, due to the stream's proximity to roads within County right-of-way, access will be straightforward for most sites in this watershed. Conversely, the Patapsco River South Branch watershed is predominantly farmland which will require both property owner coordination and working around livestock for a large percentage of the sites.

Tree Planting

- Of the sites that were rated high restoration potential, two (SBP-TP-F401A and F408C) appeared to be the best opportunities. SBP-TP-401A is directly adjacent to a previous restoration project and the landowner expressed high interest in expanding the previous project.

Outfall Stabilization

- All of the outfall stabilization recommendations were proposed as Regenerative Stormwater Conveyance. One of the assessed outfalls (SBP-OF-F413) was accounted for with a stream restoration recommendation polygon.

New BMP Opportunities

- New BMP Recommendations were typically filtering practices or bioretention. Some site recommendations require parking spot elimination.

BMP Conversions

- BMP Conversion recommendations were typically bioretention for existing dry pond conditions. If soils appear hydric with wetland vegetation, recommended to convert to wet pond or wetland.

6. List of Sites Reported to Howard County Because of Suspected Illicit Discharges, Safety Concerns, or Other Reasons for County Follow-Up

Overall

- No sites were reported to Howard County because of suspected illicit discharges, safety concerns, or any other reason.

7. Other Comments/Explanations Related to Data Collected

Overall

- Field crews encountered several property owners who were unaware of the planned field assessments. It is the recommendation of Biohabitats that the current method of sending notification letters to private property owners as a means of informing them of the impending work be reevaluated and augmented with a less passive approach in rural areas. For future assessment work, field crews should be provided with contact information for property owners that they will be interacting with so as to ensure that property owners fully consent before field crews access the property.
- Unless a unique opportunity was presented, photos were not generally attached to Stream Restoration Opportunities, New BMP Recommendations, and Outfall Stabilization Recommendations because they are attached to the relevant assessment features.

Outfall Stabilization

- Two outfall stabilization assessment sites require local repair or stabilization, but did not warrant a full outfall stabilization recommendation as the receiving channel appears stable. These include:

Site ID	Name	Local Repair required
PRU-OF-F301	First and Decatur	portion of outfall pipe and headwall broken
SBP-OF-F407	13858 Forsythe	corroded CMP barrel

New BMP Opportunities

- PRU-NB-F301 is a heavily industrial site and may be subject to NPDES 12SW General Permit.

Howard County Watershed Assessments

Patapsco River Lower North Branch Northern Portion

Upper Patuxent River

June 2016

KCI Technologies, Inc.
936 Ridgebrook Road
Sparks, MD 21152

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1 Introduction

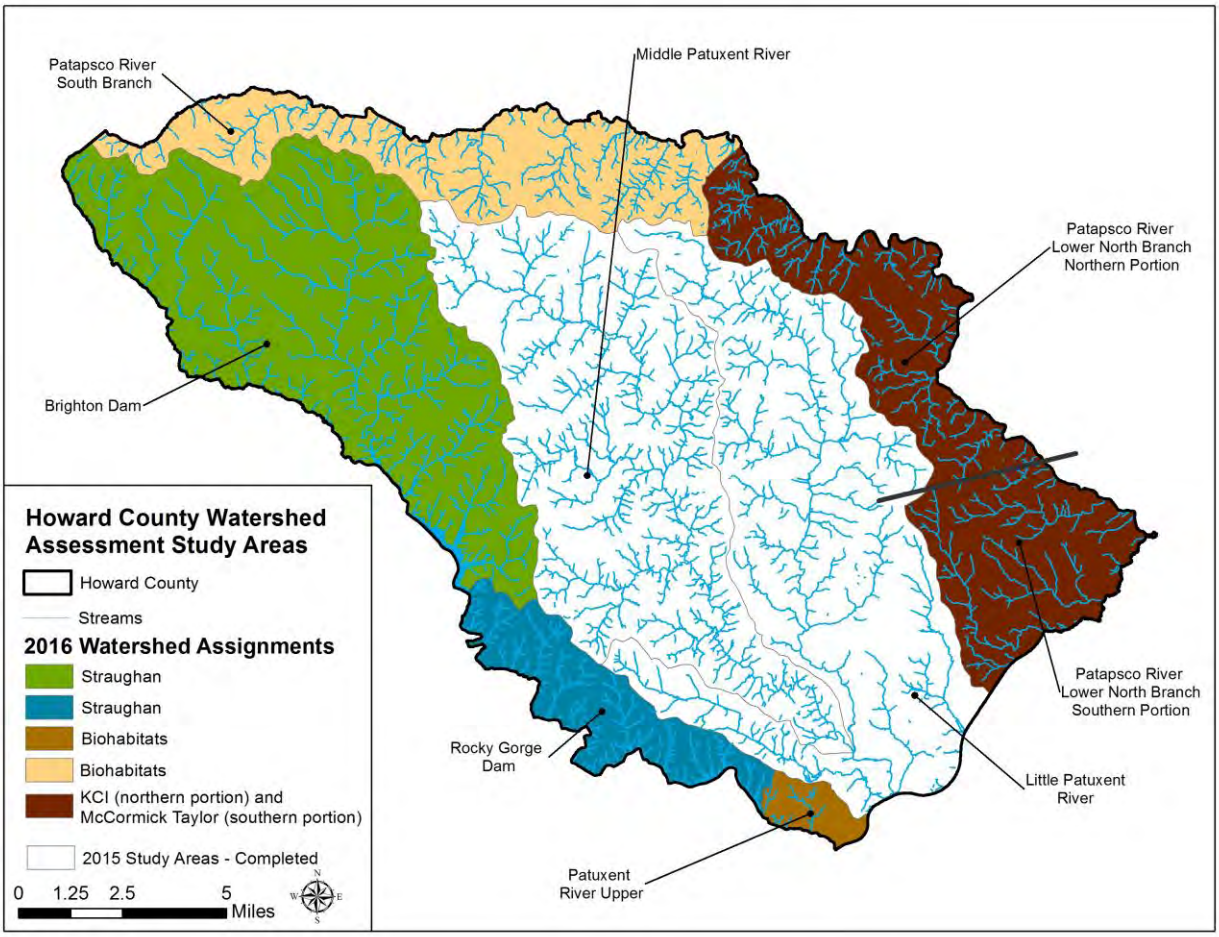
KCI Technologies, Inc. (KCI) completed detailed field and desktop watershed assessments in the northern portion of the Patapsco River Lower North Branch (LNB) watershed and a small portion of the Upper Patuxent River watershed in the Spring of 2016 in support of Howard County's efforts to complete Countywide watershed assessments (Figure 1).

The assessments are designed to meet the County's National Pollutant Discharge Elimination System (NPDES) permit conditions under section III.E.1.a which requires the County to complete detailed watershed assessments for the entire County by the end of the current permit term (December 2019).

The goal of the project is to identify feasible and meaningful restoration and retrofit projects that when implemented, provide progress towards meeting the County's local and Chesapeake Bay Total Maximum Daily Load (TMDL) goals and progress toward impervious surface treatment targets. In addition to the Bay TMDL targets there are currently final approved TMDLs and Stormwater Waste Load Allocations (SW-WLA) for the Patapsco River Lower North Branch for sediment, bacteria, phosphorus, and nitrogen.

Assessments and recommendations will be evaluated and sites will be selected and prioritized for further study, design and implementation. Results of the initial assessments are included below.

Figure 1. Watershed Assessment Study Areas



2 Field Assessment Results

The following sub-sections describe the results of the assessments in terms of the total number of sites per category completed with detail on the numbers assigned, those assigned sites completed, and any additional sites that were added and assessed through the course of the field effort. Results are summarized in Table 1.

Table 1. Number of Field Assessments Completed

Consultant Firm	**KCI Technologies, Inc.**			
Study Area	**Patapsco River Lower North Branch**			
Type	**# Sites (or Stream Miles) Assigned**	**# Pre-Assigned Sites (or Stream Miles) that Were Completed**	**# Additional Sites (or Stream Miles), Added in the Field and Completed**	**Total # Sites (or Stream Miles) Completed**
BMP Conversion	10	10	0	10
New BMP	6	6	3	9
Stream Restoration	14.3 miles	14.3 miles	0.7 miles	15.0 miles
Tree Planting	18	18	3	21
Outfall stabilization	44	44	15	59
Study Area	**Upper Patuxent River**			
Type	**# Sites (or Stream Miles) Assigned**	**# Pre-Assigned Sites (or Stream Miles) that Were Completed**	**# Additional Sites (or Stream Miles), Added in the Field and Completed**	**Total # Sites (or Stream Miles) Completed**
BMP Conversion	0	0	0	0
New BMP	0	0	0	0
Stream Restoration	0.0 miles	0.0 miles	0.3 miles	0.3 miles
Tree Planting	0	0	0	0
Outfall stabilization	0	0	5	5

2.1 BMP Conversion Field Assessments

A total of 10 BMP conversion field assessments were assigned. Site access permissions were obtained for all sites and each was evaluated in the field. The facility type documented in the County database matched the observed conditions at all of the visited ponds. A breakdown of the number of field assessment sites assigned and completed can be found in Table 1.

2.2 New BMP Field Assessments

A total of 6 new BMP field assessments were initially assigned and 3 additional sites were added. Assessments were completed at all 9 sites. A breakdown of the number of field assessment sites assigned and completed can be found in Table 1.

2.3 Stream Restoration Assessment

A total of 14.3 miles of stream were assigned for evaluation. All pre-assigned sites were able to be assessed. A total of 0.7 miles of stream were added in the field. Those areas that were added include pre-assigned reaches that were extended to capture continued erosion that existed beyond the assigned reach; as well as degraded tributaries that drain to a pre-assigned reach. In total, 15.3 miles of stream were evaluated during the field efforts. KCI conducted a stream assessment on an additional 0.3 mile reach in the Upper Patuxent River watershed, PRU-SR-F685, at the request of the County.

A total of 29 unusual condition points were captured. Of those points, 16 were taken to document an exposed pipe. Pipe conditions ranged from small roof drain pipes to exposed sewer pipes. Other documented unusual conditions included road culverts, fish blockages, and debris jams.

In general, erosion was typically found to be segmented throughout a reach, with the eroded bank alternating as the channel meanders. In these cases, the erosion was typically found to be very similar throughout and therefore, one erosion point was used to identify the total reach of observed erosion. The total length of erosion noted per bank is provided based on an estimate of actual erosion and excluding the areas that did not contain erosion.

2.4 Tree Planting Field Assessments

A total of 18 tree planting field assessments were initially assigned. Two sites, LNB-TP-F605 and LNB-TP-F606 were combined into one site due to their proximity and similarity. One assigned planting area, LNB-TP-F617, was located at Mt Hebron High School and was visited but a full assessment was not conducted. The field crew visited this site with Greg Connor (Assistant Manager- Grounds Services at Howard County Public Schools), and it was determined to be unsuitable for planting due to the school's current use of the area. Eight of the sites had been recently planted and a full assessment was not completed.

An additional three sites were added in the field. Two sites, LNP-TP-F651 and LNP-TP-F652 were identified while driving between tree planting assessment sites and the remaining site, LNP-TP-F653, was added and assessed during the stream restoration assessment effort.

A total of 20 tree planting assessments were completed. A breakdown of the number of field assessment sites assigned and completed can be found in Table 1.

2.5 Outfall Stabilization Field Assessments

A total of 40 outfall stabilization sites were assigned for evaluation. Of those, 18 sites were in good condition and a full assessment was not conducted. An additional 5 sites were not assessed because the field crew was unable to locate the outfalls in the field. In these cases, the areas at and around the mapped location of the outfall was traversed; however, no sign of the outfall was observed. One site, LNB-OF-F618, was a duplicate with site LNB-OF-F642, and only one assessment was conducted at this outfall. Full assessments were conducted at the remaining 20 sites.

A total of 14 sites were added during the assessments and are linked to Pipe Outfall points that were assessed as part of the stream restoration assessments, with the exception of one site, LNB-OF-F680 which was adjacent to another outfall stabilization point, LNB-OF-F617. In total, 59 outfall stabilization assessments were performed.

KCI conducted a stream assessment on an additional reach in the Upper Patuxent River watershed, in which five outfall stabilization assessments were conducted and are linked to Pipe Outfall points.

3 Field Recommendations Results

The following sub-sections describe the recommendations made as a result of the field assessments in terms of the total number of recommendations per category and a breakdown of the general restoration/retrofit potential within each category. Results are summarized in Table 2.

Table 2. Number of Site Recommendations Completed for Field Sites Assessed

Consultant Firm	**KCI Technologies, Inc.**			
Study Area	**Patapsco River Lower North Branch**			
		Field Assessment of Restoration/Retrofit Potential (# Sites)		
Type	**# Recommendations**	**High**	**Medium**	**Low**
BMP conversion	9	7	0	2
New BMP	5	1	3	1
Stream Restoration	38	13	19	6
Tree Planting	12	11	1	0
Outfall stabilization	18	12	4	2
Study Area	**Upper Patuxent River**			
		Field Assessment of Restoration/Retrofit Potential (# Sites)		
BMP conversion	0	0	0	0
New BMP	0	0	0	0
Stream Restoration	1	1	0	0
Tree Planting	0	0	0	0
Outfall stabilization	4	2	2	0

3.1 BMP Conversion Recommendations

Of the 10 sites assessed, 9 sites were recommended for conversion. The one site not recommended for conversion, LNB-BC- F609, had a drainage area of approximately 100 acres and was not determined to be feasible for retrofit.

At site LNB-BC-F606, an adjacent homeowner expressed concern to the field crew about trees and invasive bamboo growing aggressively near the residential property.

Five sites with existing dry ponds can be converted to wet ponds to provide water quality volume treatment for their contributing drainage area. Created wetland conversions were recommended at two sites, and SPSC and infiltration conversion were recommended at the remaining two sites. Seven out of the nine sites were considered to have high conversion potential. A breakdown of the number of field assessment of retrofit potential can be found in Table 2. The existing site soils should be investigated to determine the best conversion options for next design phase.

3.2 New BMP Recommendations

Six sites were not recommended with any new BMP practices. The most common reason new BMPs were not recommended was a lack of open space within the study area. Many commercial sites were found to have large impervious areas draining directly into existing stormwater drainage systems with little or no open space available.

Three sites were considered feasible for new BMP practices. Two sites were recommended with one BMP footprint (LNB-NB-F511A and LNB-NB-F603) and one site had three bioretention BMP footprints recommended (LNB-NB-F605A, B, and C). The most common recommendations were biorentention and filtering practices. Further investigations regarding soils, water balance analysis, and contributing drainage areas are needed to determine the best retrofit options for the next design phase. Of these sites, one was found to have a high retrofit potential, 3 sites have medium potential, and one site has low potential (Table 2).

3.3 Stream Restoration Recommendations

Stream restoration recommendations were created for 41 sites. Of these, 16 sites were rated as having high restoration potential, 19 as medium potential, and 6 as low potential. In many cases, each stream restoration recommendation site includes multiple stream reaches. These areas were lumped together to better represent a complete and practical restoration project where similar conditions exist, the general restoration approach would be similar, and it would be cost effective to prepare design plans and mobilize construction for the entire site.

One stream restoration recommendation was made in the Upper Patuxent River watershed, PRU-SR-F685B.

Stream restoration recommendations were made for all areas that the field crews felt would result in a project which was feasible to move forward. Overall, many of the sites assessed contained only moderate erosion, but in these areas, the erosion conditions typically existed over a long distance. As a result, many of the restoration recommendations include sites that may not appear severely degraded or be considered a high priority, but due to the consistent conditions over a long distance, are expected to result in a feasible project that will yield significant restoration credit.

3.4 Tree Planting Recommendations

A total of 12 tree planting recommendation sites were created at the field assessment sites (Table 2). Of these, 11 sites were evaluated to have a high restoration potential and one site had medium potential. Sites with high restoration potential were generally open, mowed fields with minimal site preparation required. Sites with medium or low restoration potential generally had more site preparation required, included mowing, trash and debris removal, and invasive removal that would reduce the survival potential of planted trees.

The most common reason for not recommending a site for planting was that the area had already recently been planted. Aside from the one site at Mt Hebron High School, LNB-TP-F617, which was determined to not be suitable for planting due to current use of the area, all other sites not recommended for planting had recently already been planted. If it was immediately obvious that planting was not possible at the site, the complete assessment was not conducted.

3.5 Outfall Stabilization Recommendations

A total of 18 outfall stabilization recommendation sites were created during the field assessments. Of these, 12 sites were rated as having high restoration potential, 4 as medium potential, and 2 as low potential. In general, the outfall stabilization recommendations included stabilization of a degraded outfall channel located immediately downstream of the outfall. Of the 18 recommendations, one recommendation for drop structures was made, rip-rap stabilization was made at 2 sites, and RSC was recommended at 15 sites.

A total of 4 outfall stabilization recommendation sites were created during the Upper Patuxent River field assessment. Of these, two sites were rated as having high restoration potential, and two were rated as having medium potential. Of the 5 recommendations, rip-rap stabilization was recommended at two sites and RSC was recommended at two sites.

4 Desktop Assessment Results

KCI was asked to prepare assessments and generate recommendations for BMP, stream restoration, tree planting, and outfall stabilization sites that were visited previously during various studies. Data from site visits, photos, and concept plans were used to complete the assessments. The following sub-sections describe the results of the desktop assessments in terms of the total number of sites per category completed with detail on the numbers assigned, those assigned sites completed, and any additional sites that were added and assessed through the course of the desktop effort. Results are summarized in Table 3.

Table 3. Number of Desktop Assessments Completed

Consultant Firm	**KCI Technologies, Inc.**		
Study Area	**Patapsco River Lower North Branch**		
Type	**# Sites (or Stream Miles) Assigned**	**# Sites (or Stream Miles) for Which Desktop Assessment Was Completed**	**For These Sites, Number of Concept Plans Previously Prepared**
BMP conversion	1	1	1
New BMP	16	16	0
Stream Restoration	0.6 miles	0.6 miles	0.0 miles
Tree Planting	3	3	3
Outfall stabilization	5	5	0

4.1 BMP Conversion Desktop Assessments

One BMP conversion desktop assessment was assigned. This pond retrofit site was identified in the Tiber-Hudson Subwatershed Restoration Action Plan, prepared by the Center for Watershed Protection in 2013. The Retrofit Reconnaissance Investigation form from the previous study was used to complete the desktop analysis. A breakdown of the number of desktop assessment sites assigned and completed can be found in Table 3.

4.2 New BMP Desktop Assessments

A total of 16 new BMP desktop assessments were assigned. Of these, 15 sites were identified in the Tiber-Hudson Subwatershed Restoration Action Plan, prepared by the Center for Watershed Protection in 2013, and one site was identified in the Tiber Branch and Sucker Branch Interceptor Improvements MS4 Site Identification project, conducted by Century Engineering in 2016. The Retrofit Reconnaissance Investigation forms for 14 sites were used to complete the desktop analysis. A breakdown of the number of field assessment sites assigned and completed can be found in Table 3.

4.3 Stream Restoration Desktop Assessments

A total of 0.6 miles of stream restoration desktop assessments were assigned. These sites were identified in the Tiber Branch and Sucker Branch Interceptor Improvements MS4 Site Identification project, conducted by Century Engineering in 2016. A breakdown of the number of field assessment sites assigned and completed can be found in Table 3.

4.4 Tree Planting Desktop Assessments

A total of three tree planting desktop assessment sites were assigned. These three planting areas are located within Waterloo Park. These sites had been identified in the Low Impact Development Retrofits and Tree Planting Summary Report, prepared by Versar in 2013. A field assessment was conducted and the planting areas were determined to be unsuitable for planting. Two of the planting areas were too narrow and close to the walking path and baseball field, and natural reforestation was already occurring in the third planting area. A breakdown of the number of field assessment sites assigned and completed can be found in Table 3.

4.5 Outfall Stabilization Desktop Assessments

A total of five outfall stabilization desktop assessments sites were assigned. These sites were identified in the Tiber Branch and Sucker Branch Interceptor Improvements MS4 Site Identification project, conducted by Century Engineering in 2016. Information provided in the report was used to complete the assessment.

5 Desktop Recommendations Results

The following sub-sections describe the recommendations made as a result of the desktop assessments in terms of the total number of recommendations per category and a breakdown of the restoration/retrofit potential within each category. Results are summarized in Table 4.

Table 4. Number of Site Recommendations Completed for Desktop Sites Assessed

Consultant Firm	**KCI Technologies, Inc.**			
Study Area	**Patapsco River Lower North Branch**			
		Desktop Assessment of Restoration/Retrofit Potential (# Sites)		
Type	**# Recommendations**	**High**	**Medium**	**Low**
BMP conversion	1	0	0	1
New BMP	17	1	7	9
Stream Restoration	3	3	0	0
Tree Planting	0	0	0	0
Outfall stabilization	5	5	0	0

5.1 BMP Conversion Recommendations

The one assigned desktop assessment site was recommended for retrofit. The site is an existing dry ponds and is proposed to be converted to a wet pond to provide water quality volume treatment for the contributing drainage area. The site was found to have a low conversion potential due to its location on private property, and the presence of water/wastewater utilities. A breakdown of the number of desktop assessment sites and retrofit potential can be found in Table 4. The existing site soils and water balance analysis should be investigated to decide the best conversion options for the next design phase.

5.2 New BMP Recommendations

A total of 17 new BMPs were recommended from the 16 desktop assessments. One site had two BMPs recommended at the site. Only one of these site was found to have a high restoration potential, 7 had medium potential, and 9 had low potential. Bioretention was the most commonly recommended BMP. Further investigations of soils and contributing drainage areas are recommended to decide the best retrofit option for the next design phase. A breakdown of the number of desktop assessment sites and retrofit potential can be found in Table 4.

5.3 Stream Restoration Recommendations

All five assigned stream reaches, totaling 0.6 miles, were recommended for restoration. Reaches were grouped by proximity into three distinct sites, all of which were determined to have a high restoration potential (Table 4).

5.4 Outfall Stabilization Recommendations

All five outfall desktop assessment sites were recommended for stabilization and were determined to have a high outfall stabilization potential. RSC was recommended for one site, drop structure was recommended for three sites, and rip rap stabilization was recommended for one site. A breakdown of the number of desktop assessment sites and retrofit potential can be found in Table 4.

Howard County Watershed Assessments
Field Summary Report

Patapsco River Lower North Branch Watershed
Southern Portion

July 1, 2016

Prepared for:

Howard County Government

Stormwater Management Division

Bureau of Environmental Services

6751 Columbia Gateway Drive, Suite 514

Columbia, Maryland 21046-3143

Prepared by:

McCORMICK TAYLOR

509 South Exeter Street, 4th Floor

Baltimore, Maryland 21202

1.

Table 1. Number of field assessments completed				
Consultant Firm Name	**McCormick Taylor**			
Study Area Name*	**Patapsco River Lower North Branch (LNB) – southern portion**			
Type	**# Sites (or Stream Miles) Assigned (from Table A below)**	**# Pre-Assigned Sites (or Stream Miles) that Were Completed**	**# Additional Sites (or Stream Miles), Added in the Field and Completed**	**Total # Sites (or Stream Miles) Completed**
BMP conversion	24	24	0	24
New BMP	11	11	0	11
Stream Restoration	16.6 miles	16.6 miles	1.4 miles	18.0 miles
Tree Planting	8	8	4	12
Outfall stabilization	27	27	14	41

2. If there were sites that could not be assessed in the field, please summarize primary reasons.

BMP Sites:
All sites were evaluated.

Stream Restoration Sites:
Portions of 14 stream assessment sites (1.39 miles total) did not include completion of the detailed assessment form because these reaches were observed with existing good/stable condition.

Tree Planting Sites:
4 tree planting sites did not include completion of the detailed assessment form primarily due to future residential development or the sites were in existing good/forested condition with little or no opportunity for planting.

Outfall Stabilization Sites:
7 outfall sites did not include completion of the detailed assessment form primarily due to no outfall within vicinity of the point or the sites were in existing good/stable condition.

3. Other comments about data or assumptions made.

BMP Sites:

- Facility type does not match County database:
  - LNB-BC-F501 is a wet pond in current conditions.
  - LNB-BC-F502 is a wet pond in current conditions.

  - LNB-BC-F510 has been retrofitted (SDP-02-157). Notes say it is a dry pond, but with PVC underdrain/observation wells in the facility, it appears to be a sand filter or bioretention.
  - LNB-BC-F511 is a wet pond in current conditions.
  - LNB-BC-F514 is a wet pond in current conditions.
  - LNB-BC-F520 is a wet pond in current conditions.
- Sites with new facilities/already treated:
  - LNB-NB-F503 has two new infiltration facilities that are not identified in the County database. These facilities were added as new BMP recommendation footprints and drainage areas for ease of input into the database, and are labeled with the suffixes "EX 1" and "EX 2".
  - LNB-NB-F607 has a new bioretention facility near the baseball fields. It is listed in the County database under the future projects layer with an associated existing BMP drainage area.

Outfall Stabilization Sites:
Outfall stabilization points at 15 sites were moved due to the point being in an incorrect location. In 1 case, the outfall could not be found within the vicinity of the point provided; instead the stormwater pond structure was assessed.

Desktop Sites:
Data for the desktop BMP conversion, new BMP footprints, and outfall stabilization assessments were taken from the Howard County Low Impact Development (LID) Retrofits and Tree Planting Summary Report completed for Howard County by Versar and McCormick Taylor in May, 2013.

4.

Table 2. Number of site recommendation forms completed for field sites assessed				
Consultant Firm Name	**McCormick Taylor**			
Study Area Name*	**Patapsco River Lower North Branch (LNB) – southern portion**			
		Field Assessment of Restoration/Retrofit Potential (# Sites)		
Type	**# Recommendations**	**High**	**Medium**	**Low**
BMP conversion recommendations	24	11	9	4
New BMP recommendations	30	6	11	13
Stream Restoration recommendations	53	16	13	24
Tree Planting recommendations	12	7	4	1
Outfall stabilization recommendations	20	6	3	11

5. General comments about the types of recommendations made.

BMP Sites:

- Recommended BMP conversion sites include wet ponds, wetlands, bioretention facilities, sand filters, and rain gardens. These facilities were recommended based on the land use in the area, existing conditions (soil, standing water, vegetation, etc.), and depth of outfall, riser, or inlet structure.
- Recommended new BMP sites primarily include bioretention facilities, sand filters, and swales. Additional facilities include underground sand filters/detention facilities, infiltration facilities, rain gardens, pervious pavement, and roof drain disconnection. New BMP sites were recommended based on available space with a reasonable drainage area, existing utilities (avoiding significant visible conflicts), storm drain location, and existing land use.
- Overall, 17 BMP conversions and new BMP sites have high potential based on the need for repair, the feasibility of construction and access, minimal conflicts, size of impervious drainage area, and land use in the vicinity. Of these high priority facilities, those with the most potential are listed below:
    - LNB-BC-F501 has several feet of sediment accumulation (outfall/low flow is large 42 inch pipe nearly buried).
    - LNB-BC-F506 has a severe headcut and erosion at the outfall channel.

- LNB-BC-F513 - the manhole cover was off of the pond riser and has since been placed back on the riser top. There is one foot of standing water in the forebay.
- LNB-BC-F514 corrosion was found at the pond barrel and CMP that goes under the road just downstream of the pond barrel.
- LNB-NB-F505 has several recommended BMP opportunities, homeowners association property ownership, and existing storm drain with facilities.
- LNB-NB-F607 has several recommended BMP opportunities, county property and available open space, and existing storm drain infrastructure to tie into.
- LNB-NB-F609 has several recommended BMP opportunities, county property and available open space, and existing storm drain infrastructure to tie into.

Stream Restoration Sites:

- Stream restoration is generally recommended in reaches with moderate to severe active erosion, threatened infrastructure, impaired habitat, and limited to moderate constraints.
- Overall, 14 stream reaches in the Lower North Branch watershed have high stream restoration potential. Of these high priority reaches, those with the most potential are listed below:
  - LNB-SR-F501 has moderate to severe bank erosion predominantly located on the right bank side. A 580 linear foot upstream section of concrete channel has been recommended for impervious surface removal. A downstream section is lacking riparian buffer.
  - LNB-SR-F505 includes two actively eroding channels with extensive moderate bank erosion at the upstream extents. Constraints appear to be fairly limited, with the exception of a young forest. One of the recommendation polygons (505C) has limited erosion and high constraints, but is included due to a significant debris blockage that is likely to release a large amount of sediment and cause additional erosion problems in the future. This segment is also causing frequent flooding on the adjacent auto property and may be associated with an owner complaint.
  - LNB-SR-F510 is an actively eroding channel that is experiencing moderate to severe bank erosion, an abundance of sediment depositional areas, and numerous tree falls. Bank erosion is most severe along sharp meander bends with minimal vegetative protection.
  - LNB-SR-F513 includes two actively eroding channels that are experiencing moderate to severe bank erosion and headcutting. Private property and a utility crossing are threatened at the upstream extent of the northern channel. Potential educational opportunity for middle school students. Ownership constraints are low as the majority of the recommended project occurs on County property.
  - LNB-SR-F517 includes two channels experiencing moderate to severe erosion. An outfall at the downstream extent needs stabilization and may undermine the roadway if left untreated. An exposed pipe crosses the western channel. Portions of the recommended project occur on County property.
  - LNB-SR-F554 and LNB-SR-F635 are actively eroding channels with severe erosion. Each channel has a severe headcut located at the upstream extent, within close proximity of an outfall or road crossing. Also associated with LNB-BC-F506 BMP conversion recommendation.

Tree Planting Sites:

- Tree planting recommendations were ranked high when located in cleared areas that are owned by Howard County and some sites that are located in areas adjacent to eroded stream segments. None of the cleared areas assessed contained recent tree plantings.

Outfall Stabilization Sites:

- Outfall stabilization recommendation types include riprap, outfall and apron replacement, drop structures, and regenerative stormwater conveyance.
- Overall, 6 outfalls located in the Lower North Branch watershed have high outfall stabilization potential. Four of these outfalls were recommended for regenerative stormwater conveyance since they are associated with steep slopes and moderate to severe erosion within the outfall channel. One of the outfalls is in need of a drop structure due to a steep slope and severe erosion. One outfall is recommended for stream stabilization and outfall repair due to an undercut outfall apron and moderately eroded outfall channel.

6. List of sites reported to Howard County because of suspected illicit discharges, safety concerns, or other reasons for County followup.

- LNB-BC-F506 is a BMP with a severe headcut and erosion at the outfall channel.
- LNB-BC-F513 - the manhole cover was off of the riser at this pond and has since been placed back on the riser top.
- LNB-SR-F522 had a suspected illicit discharge from an outfall on the floodplain. During the field assessment, the pipe was flowing with no recent rainfall and a man was found digging a trench by hand to convey flow through the outfall directly into a tributary.

7. Other comments/explanations related to data collected.

- Site selection of streams was much improved for this round of assessments. Could still consider performing stream assessments on larger drainage network within local drainage areas or subwatershed areas.
- Consider simplifying database entries and/or incorporating automated data population where possible. For example, fields that occur multiple times for a given site could be autopopulated (e.g. weather for stream reach breaks) and fields that require multiple inputs for limited information could be simplified (e.g. utilities and conflicts for new BMP sites).
- Consider adding contours to reference data as well as all stream network data (hydrology) associated with the watershed.
- Consider adding a layer for existing BMPs not found in County database.

8.

Table 3. Number of desktop assessments completed			
Consultant Firm Name	**McCormick Taylor**		
Study Area Name	**Patapsco River Lower North Branch (LNB) – southern portion**		
Type	**# Sites (or Stream Miles) Assigned – see Table B below**	**Total # Sites (or Stream Miles) For Which Desktop Assessment was Completed**	**For These Sites, Number of Concept Plans Previously Prepared**
BMP conversion	1	1	1
New BMP	4	4	8
Stream Restoration	N/A	N/A	N/A
Tree Planting	N/A	N/A	N/A
Outfall stabilization	1	1	1

Table 4. Number of desktop assessments completed			
Consultant Firm Name	**McCormick Taylor**		
Study Area Name	**Brighton Dam**		
Type	**# Sites (or Stream Miles) Assigned – see Table B below**	**Total # Sites (or Stream Miles) For Which Desktop Assessment was Completed**	**For These Sites, Number of Concept Plans Previously Prepared**
BMP conversion	N/A	N/A	N/A
New BMP	1	1	3
Stream Restoration	N/A	N/A	N/A
Tree Planting	N/A	N/A	N/A
Outfall stabilization	N/A	N/A	N/A

9.

Table 5. Number of site recommendation forms completed for desktop assessment sites				
Consultant Firm Name	**McCormick Taylor**			
Study Area Name	**Patapsco River Lower North Branch (LNB) – southern portion**			
		Desktop Assessment of Restoration/Retrofit Potential (# Sites)		
Type	**# Recommendations**	**High**	**Medium**	**Low**
BMP conversion recommendations	1	0	1	0
New BMP recommendations	8	0	6	2
Stream Restoration recommendations	N/A	N/A	N/A	N/A
Tree Planting recommendations	N/A	N/A	N/A	N/A
Outfall stabilization recommendations	1	0	0	1

Table 6. Number of site recommendation forms completed for desktop assessment sites				
Consultant Firm Name	**McCormick Taylor**			
Study Area Name	**Brighton Dam**			
		Desktop Assessment of Restoration/Retrofit Potential (# Sites)		
Type	**# Recommendations**	**High**	**Medium**	**Low**
BMP conversion recommendations	N/A	N/A	N/A	N/A
New BMP recommendations	3	0	3	0
Stream Restoration recommendations	N/A	N/A	N/A	N/A
Tree Planting recommendations	N/A	N/A	N/A	N/A
Outfall stabilization recommendations	N/A	N/A	N/A	N/A

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Revised June 28, 2016

RE: Howard County NPDES Support Services
Rocky Gorge Dam and Brighton Dam Watershed Assessments
KCI Project Number: 16158563.12 KCI Task Number: 12
KCI Project Manager: Mike Pieper
Straughan Project No. 4970-001

Rocky Gorge Dam and Brighton Dam Watersheds
Preliminary Site Assessment Summary Report

1. Number of assessments completed

Table 1.1 Number of Field Assessments Completed				
Consultant Name	Straughan Environmental			
Study Area Name	Brighton Dam			
Type	**No. Sites (or Stream Miles) Assigned**	**No. Assigned Sites (or Stream Mi.) Completed**	**No. Add'l Sites (or Stream Mi.) Added in Field**	**Total No. Sites (or Stream Mi.) Completed**
BMP Conversion	8	8	0	8
New BMP	8	8	0	8
Stream Restoration	13.5 mi	2.5 mi	0.4 mi	2.9 mi
Tree Planting	3	3	19	22
Outfall Stabilization	3	3	1	4

Table 1.2 Number of Field Assessments Completed				
Consultant Name	Straughan Environmental			
Study Area Name	Rocky Gorge Dam			
Type	**No. Sites (or Stream Miles) Assigned**	**No. Assigned Sites (or Stream Mi.) Completed**	**No. Add'l Sites (or Stream Mi.) Added in Field**	**Total No. Sites (or Stream Mi.) Completed**
BMP Conversion	1	1	1	2
New BMP	1	1	0	1
Stream Restoration	3.2 mi	1.2 mi	0.2 mi	1.4 mi
Tree Planting	3	3	5	8
Outfall Stabilization	0	0	0	0

Table 1.3 Number of Desktop Assessments Completed				
Consultant Name	Straughan Environmental			
Study Area Name	Howard County			
Type	**No. Sites Assigned**	**No. Assigned Sites Completed**	**No. Add'l Sites Added**	**Total No. Sites Completed**
BMP Conversion	15	15	0	15

2. Primary reasons that sites could not be assessed

All BMP, Outfall, and Tree planting sites were assessed, but there were a number of stream restoration sites or portions of sites for which assessments could not be completed. The primary reason was lack of site access.. Most sites that were not assessed had fences or "No Trespassing" signs posted. For many sites, notification had been sent to a landowner who did not live at the property, and the individuals managing and/or residing at the property had not been notified, which created a few confusing or tense situations with farmers who were suspicious of our intent. Field crews left the property when requested to do so. A number of sites appeared to be good candidates for stream assessments from a distance, but active permission should be obtained before completing them.

Seven sites were not assessed, or had portions that were not assessed, due to being in good condition.

The centerline for RGD-SR-F204 appeared to follow a historic access road or trail. A shorter potential channel was identified that led from the southeast edge of the existing field and then joined with the identified path. Neither the identified path nor the potential channel had flow at the time of inspection, and areas of erosion did not appear recent based on the extent of vegetation growth. The site was documented with photos.

3. Other comments about data or assumptions made

BMP Sites

- RGD-BC-F251 was added in the field.
- Two existing BMP assessments noted that repairs were needed to the facilities:
    - BRD-BC-F103: rocks missing in gabion channel from forebay to pond; channel from street to forebay starting to erode adjacent to neighboring property
    - BRD-BC-F105: low-flow PVC pipe is cracked and broken at weir; several rodent holes observed along pond berm

- Readily observed structures or markers (manhole, electric lines, etc.) were used to determine conflicts at BMP sites. Stream impacts were assigned if the site contained an observed stream or GIS demarcated stream. For data fields about evidence of water table, bedrock, and poor infiltration, a "Yes" value was only assigned if standing water or bedrock was observed in the field; otherwise "Unknown" or "No" was selected. No outfall could be located at BRD-NB-F101; this was noted in the assessment. Three other site outfalls (BRD-NB-F103, BRD-NB-F104 and BRD-NB-F108) could not be inspected due to fences or obstacles.

Stream Sites

- Four stream sites (0.6 miles total) were added in the field: BRD-SR-F151, BRD-SR-F152, BRD-SR-F153, and RGD-SR-F251.
    - Due to dense overhead vegetation at BRD-SR-F153, both in the field and in aerial imagery, the stream centerline location had to be approximated and may not be accurate along the full length.
- Adjustments were made to assessment centerlines of six stream sites:
    - BRD-SR-F121: minor upstream extension to roadway culvert
    - RGD-SR-F201: correction of path to show where stream flowed through large CMP rather than the existing agricultural pond as originally believed
    - RGD-SR-F204 and RGD-SR-F206: extension of downstream ends to mouth of assessed stream
    - RGD-SR-F205: correction to location of downstream end of stream
    - RGD-SR-F207: correction of stream paths along both branches
- Two stream reaches had data collected from a distance due to fences: BRD-SR-F104A, BRD-SR-F109A; because of this, not all assessment fields could be completed for some data points.
- Three sites could be assessed, but not all assessment fields were able to be completed due to murky high water after rains (i.e., bankfull depth, epifaunal substrate): BRD-SR-F111, BRD-SR-F113, and BRD-SR-F152.
- In addition to documenting unusual or problem conditions, the "Unusual Conditions" point type was also used to document several positive field conditions that would be useful when developing initial designs (i.e., wetlands or groundwater entering from high on stream bank).
- Due to heavy rains preceding the assessments, there was a degree of uncertainty in determining the stream type for three sites: BRD-SR-F117 (marked unknown), BRD-SR-F112, and BRD-SR-F153 (best judgement for both indicates perennial).
- The larger streams downstream of BRD-SR-F121 and RGD-SR-F204 would likely be good candidates for further stream restoration opportunities if they have not already been assessed during previous portions of the Howard County NPDES Watershed Assessments.

Tree Planting Sites

- 24 tree planting sites were added in the field: BRD-TP-F151 through BRD-TP-F169 and RGD-TP-F251 through RGD-TP-F255.
- 11 tree planting sites were evaluated from a distance due to barriers.

Outfall Sites

- BRD-OF-F151 was added in the field.

4. Number of recommendation forms completed for sites assessed

Table 4.1 Number of Recommendation Forms Completed for Field Sites Assessed				
Consultant Name	Straughan Environmental			
Study Area Name	Brighton Dam			
Type	**No. Recommendations**	**High**	**Medium**	**Low**
BMP Conversion	8	4	4	0
New BMP	24	7	11	6
Stream Restoration	17	3	9	5
Tree Planting	26	15	11	0
Outfall Stabilization	3	0	2	1

Table 4.2 Number of Recommendation Forms Completed for Field Sites Assessed				
Consultant Name	Straughan Environmental			
Study Area Name	Rocky Gorge Dam			
		Retrofit Potential (No. Sites)		
Type	**No. Recommendations**	**High**	**Medium**	**Low**
BMP Conversion	2	0	2	0
New BMP	2	0	1	1
Stream Restoration	8	1	4	3
Tree Planting	8	6	2	0
Outfall Stabilization	0	0	0	0

Table 4.3 Number of Recommendation Forms Completed for Desktop Sites Assessed				
Consultant Name	Straughan Environmental			
Study Area Name	Howard County			
Type	**No. Recommendations**	**High**	**Medium**	**Low**
BMP Conversion	15	10	4	1

5. General comments about types of recommendations made

BMP Sites

- Drainage areas (DA) for BMP conversion sites ranged from 8 to 41 acres. Table 4.4 of the "2000 Maryland Stormwater Design Manual" recommends minimum or maximum feasible drainage area limits by BMP type; this table was referenced when developing BMP conversion recommendations (bioretention, wet pond, wetland, micro-pool extended detention, etc.).
- New BMP feasibility determinations were based on the observed existing land use and potential drainage issues. Two sites, BRD-NB-F108 and RGD-NB-F201, were not viable for new BMPs.
    - BRD-NB-F108: Existing land use is a nursery and landscaping business with a large number of constraints.
    - RGD-NB-F201: Proposed location is between two existing BMPs and should be considered for a conversion site (added as assessment site RGD-BC-F251).
- At sites where new BMPs were deemed viable, drainage area recommendations in Table 4.4 of the "2000 Maryland Stormwater Design Manual" were again referenced when recommending BMP types (swale, micro-bioretention, rain garden, etc.).
- Replacement of impervious pavement with a pervious paving alternative or complete pavement removal was also recommended for sites with excessive pavement.
- Green roofs were recommended in two instances (BRD-NB-F103D and BRD-NB-F105E). This was based only on the large roof area available, and structural analysis is required for further determination of feasibility.

Stream Sites

- Most sites, even those that could not be accessed for an assessment, were very small first order streams through crop fields or pastures, and would primarily benefit from animal exclusion and vegetative buffer establishment. Buffers could include trees, brush, and/or wetland planting.
- All of the sites with completed assessments had areas of notable erosion (2' or more high over a length of 10' or more). There are three sites where buffer creation is expected to be the best

on-site method to enhance bank stability, while the rest of the sites would benefit from more substantial bank stabilization efforts.

- Site RGD-SR-F201 is located on Howard County Park Property and has the unique restoration opportunity to daylight approximately 250' of stream that is currently flowing through a large (42 or 48 inch) CMP pipe. This, however, would likely involve changes to a historic agricultural pond (also on park property), which may spark concerns about accumulated nutrients or sediments.
- Restoration recommendations included stabilizing banks, controlling stream grade, raising bed elevations, and reconnecting floodplains through bank grading, bioengineering bank stabilization measures, riffle grade controls, step pool systems, and rock and log vane structures.
- Recommendations at various sites also included additional habitat improvements through the use of root-wads and felled trees, the creation and enhancement of wetlands along banks, and the creation of vernal pools and oxbow wetlands.
- Further assessment upstream or downstream of two sites would increase the restoration potential and create more viable restoration opportunities at the sites: BRD-SR-F102 and BRD-SR-F105. Further assessments could not be completed at this time due to access issues.
- Restoration at site RGD-SR-F207 is only recommended if nutrient problem from upstream in-line BMP is also addressed.
- Two sites are on property owned by nursery or landscaping companies, which may offer unique opportunities for partnering: BRD-SR-F120 and BRD-SR-F104.

Tree Planting Sites

- 19 sites require invasive plant removal within the planting area or along existing adjacent tree lines.
- 7 sites likely require livestock exclusion fencing.
- Roughly one quarter of the sites may have the opportunity for wetland tree and brush planting based on the hydrology.
- While assessing site BRD-TP-F102, a neighbor noted that "droves" of birdwatchers come to see a unique bird in the adjacent woods in early spring. A planting opportunity here could be used to enhance the habitat for that species, which may be of particular benefit if it is considered a rare species by the State.
- Additional tree planting areas may be viable within BRD-TP-F103, but the full site could not be assessed due to access limitations.

Outfall Sites

- Restoration potential at outfall sites was not classified as "High" due to limited access, ownership problems, and significant tree impact potential.

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6. List of sites reported to Howard County because of suspected illicit discharges, safety concerns, or other reasons for county follow-up

Two observations were reported to Howard County for follow-up:

- A potential illicit discharge at point RGD-SR-F207C-PO001, which is a 4" PVC pipe that extends 5 feet out from the right bank to discharge along the stream centerline. The only nearby structure was a horse barn on top of the hill, and it is expected this pipe connects to that building. The pipe was discharging water at the time of inspection despite no recent rains.
- According to one of the property owners at site BRD-SR-F121, some of his new neighbors have been cutting trees from a forest conservation easement and burning them. The field team reported this information along with point BRD-SR-F121A-UC004, which is an area of recently burnt vegetation along the streambank. Later investigation revealed that the conservation easement in question is located away from the stream. No further information was gained about the burnt area.

7. Other comments/explanations related to data collected

- BMP site visits were done during the first week of May 2016, which involved consistent rainfall. Thus, the dry pond definition given in the Howard County database may not have been observed upon visiting existing BMP sites. This also applies to the Outfall sites visited in that timeframe with respect to "baseflow."
- Straughan has several recommendations for future NPDES assessments that take place on private property:
    - Send notifications to *both* the landowner's address and the physical address when these two are different
    - Revise the notification letter to accurately reflect the extent to which private property will be accessed
    - Consider enclosing pre-stamped return postcards to obtain active permission for assessments on farm properties

Appendix F: Tables Listing Individual Retrofit and Restoration Opportunities with Scores and Rankings

Rankings and Scores for Patapsco River Watershed Project Recommendations
Appendix F

Site ID	Type	Contractor	Acres of Impervious Treated	Acres of Impervious Treated Score	Pollutant Load Reduction Score	Cost Per Acre Score	Biological uplift-Programmatic Benefit-Feasbility Proportional Score	Total Score Combined Metrics	Watershed	2016 Concept
LNB-BC-F605	BMP Conversion	KCI	8.3	8	6	10	6	30	Patapsco Lower North Branch	Yes
LNB-OF-D032	SPSC	McCormick Taylor	5.2	8	6	10	6	30	Patapsco Lower North Branch	Yes
LNB-OF-F602	SPSC	KCI	1.9	4	6	10	10	30	Patapsco Lower North Branch	Yes
LNB-BC-D013	BMP Conversion	Straughan	9.6	8	3	10	8	29	Patapsco Lower North Branch	Yes
LNB-BC-F501	BMP Conversion	McCormick Taylor	52.7	10	3	10	6	29	Patapsco Lower North Branch	Yes
LNB-BC-F502	BMP Conversion	McCormick Taylor	21.9	10	3	10	6	29	Patapsco Lower North Branch	Yes
LNB-BC-F506	BMP Conversion	McCormick Taylor	5.6	8	3	10	8	29	Patapsco Lower North Branch	Yes
LNB-BC-F508	BMP Conversion	McCormick Taylor	6.1	8	3	10	8	29	Patapsco Lower North Branch	Yes
LNB-BC-F514	BMP Conversion	McCormick Taylor	58.2	10	3	10	6	29	Patapsco Lower North Branch	Yes
LNB-BC-F524	BMP Conversion	McCormick Taylor	16.7	10	3	10	6	29	Patapsco Lower North Branch	Yes
LNB-BC-F516	BMP Conversion	McCormick Taylor	8.3	8	6	8	6	28	Patapsco Lower North Branch	Yes
LNB-BC-F603	BMP Conversion	KCI	3.4	5	10	5	8	28	Patapsco Lower North Branch	Yes
LNB-NB-F607d	New BMP	KCI	0.1	2	10	8	8	28	Patapsco Lower North Branch	Yes
LNB-NB-F609b	New BMP	KCI	0.1	2	10	8	8	28	Patapsco Lower North Branch	Yes
LNB-NB-F609c	New BMP	KCI	0.5	2	10	8	8	28	Patapsco Lower North Branch	Yes
LNB-OF-F601	SPSC	KCI	0.6	2	6	10	10	28	Patapsco Lower North Branch	Yes
LNB-OF-F615	SPSC	KCI	0.6	2	6	10	10	28	Patapsco Lower North Branch	Yes
LNB-SR-F613C-PO001	SPSC	KCI	1.2	4	6	10	8	28	Patapsco Lower North Branch	Yes
LNB-SR-F613D-PO001	SPSC	KCI	1.2	4	6	10	8	28	Patapsco Lower North Branch	Yes
LNB-BC-D002	BMP Conversion	Straughan	15.8	10	3	8	6	27	Patapsco Lower North Branch	Yes
LNB-BC-F505	BMP Conversion	McCormick Taylor	7.3	8	3	8	8	27	Patapsco Lower North Branch	Yes
LNB-BC-F509	BMP Conversion	McCormick Taylor	15.8	10	3	8	6	27	Patapsco Lower North Branch	Yes
LNB-BC-F510	BMP Conversion	McCormick Taylor	4.2	5	6	8	8	27	Patapsco Lower North Branch	Yes
LNB-BC-F511	BMP Conversion	McCormick Taylor	7.9	8	3	10	6	27	Patapsco Lower North Branch	Yes
LNB-BC-F522	BMP Conversion	McCormick Taylor	5.4	8	3	10	6	27	Patapsco Lower North Branch	Yes
LNB-BC-F601	BMP Conversion	KCI	7.3	8	3	10	6	27	Patapsco Lower North Branch	Yes
LNB-BC-F602	BMP Conversion	KCI	5.2	8	3	8	8	27	Patapsco Lower North Branch	Yes
LNB-SR-F510	Stream Restoration	McCormick Taylor	36.3	10	3	8	6	27	Patapsco Lower North Branch	Yes
LNB-SR-F517	Stream Restoration	McCormick Taylor	19.8	10	3	8	6	27	Patapsco Lower North Branch	Yes
LNB-SR-F607	Stream Restoration	KCI	26.9	10	3	8	6	27	Patapsco Lower North Branch	Yes
LNB-SR-F626	Stream Restoration	KCI	18.6	10	3	8	6	27	Patapsco Lower North Branch	Yes
SBP-OF-F402	SPSC	Biohabitats	0.5	2	6	10	8	26	Patapsco River South Branch	Yes
SBP-OF-F408	SPSC	Biohabitats	1.1	4	6	10	6	26	Patapsco River South Branch	Yes
LNB-BC-F507	BMP Conversion	McCormick Taylor	4.9	5	3	10	8	26	Patapsco Lower North Branch	Yes
LNB-BC-F523	BMP Conversion	McCormick Taylor	3.8	5	3	10	8	26	Patapsco Lower North Branch	Yes
LNB-BC-F608	BMP Conversion	KCI	3.6	5	3	10	8	26	Patapsco Lower North Branch	Yes
LNB-BC-F610	BMP Conversion	KCI	3.1	5	3	10	8	26	Patapsco Lower North Branch	Yes
LNB-NB-F608a	New BMP	KCI	0.7	2	10	8	6	26	Patapsco Lower North Branch	Yes
LNB-NB-F609a	New BMP	KCI	0.5	2	6	10	8	26	Patapsco Lower North Branch	Yes
LNB-OF-F644	SPSC	KCI	0.9	2	6	10	8	26	Patapsco Lower North Branch	Yes
LNB-SR-F613D-PO003	SPSC	KCI	0.6	2	6	10	8	26	Patapsco Lower North Branch	Yes
LNB-SR-F616A-PO002	SPSC	KCI	1.1	4	6	10	6	26	Patapsco Lower North Branch	Yes

Site ID	Type	Contractor	Acres of Impervious Treated	Acres of Impervious Treated Score	Pollutant Load Reduction Score	Cost Per Acre Score	Biological uplift-Programmatic Benefit-Feasbility Proportional Score	Total Score Combined Metrics	Watershed	2016 Concept
SBP-SR-F403	Stream Restoration	Biohabitats	12.9	10	3	8	6	27	Patapsco River South Branch	Yes
SBP-SR-F411B	Stream Restoration	Biohabitats	5.4	8	3	8	8	27	Patapsco River South Branch	Yes
SBP-SR-F417	Stream Restoration	Biohabitats	8.2	8	3	8	8	27	Patapsco River South Branch	Yes
LNB-BC-D003	BMP Conversion	Straughan	6.5	8	3	8	6	25	Patapsco Lower North Branch	Yes
LNB-BC-F518	BMP Conversion	McCormick Taylor	7.5	8	3	10	4	25	Patapsco Lower North Branch	Yes
LNB-BC-F519	BMP Conversion	McCormick Taylor	2.2	4	3	10	8	25	Patapsco Lower North Branch	Yes
LNB-BC-F607	BMP Conversion	KCI	3.0	4	10	5	6	25	Patapsco Lower North Branch	Yes
LNB-NB-D072	New BMP	KCI	5.2	8	3	10	4	25	Patapsco Lower North Branch	Yes
LNB-NB-F502a	New BMP	McCormick Taylor	2.2	4	10	5	6	25	Patapsco Lower North Branch	Yes
LNB-NB-F607f	New BMP	KCI	0.8	2	10	5	8	25	Patapsco Lower North Branch	Yes
LNB-SR-D046	Stream Restoration	KCI	15.9	10	3	8	4	25	Patapsco Lower North Branch	Yes
lnb-sr-f501a	Stream Restoration	McCormick Taylor	6.1	8	3	8	6	25	Patapsco Lower North Branch	Yes
lnb-sr-f501d	Stream Restoration	McCormick Taylor	6.1	8	3	8	6	25	Patapsco Lower North Branch	Yes
LNB-SR-F506	Stream Restoration	McCormick Taylor	8.4	8	3	8	6	25	Patapsco Lower North Branch	Yes
LNB-SR-F511	Stream Restoration	McCormick Taylor	7.0	8	3	8	6	25	Patapsco Lower North Branch	Yes
LNB-SR-F513	Stream Restoration	McCormick Taylor	8.9	8	3	8	6	25	Patapsco Lower North Branch	Yes
lnb-sr-f514a	Stream Restoration	McCormick Taylor	6.5	8	3	8	6	25	Patapsco Lower North Branch	Yes
LNB-SR-F515B	Stream Restoration	McCormick Taylor	13.9	10	3	8	4	25	Patapsco Lower North Branch	Yes
LNB-SR-F516	Stream Restoration	McCormick Taylor	11.1	10	3	8	4	25	Patapsco Lower North Branch	Yes
lnb-sr-f518	Stream Restoration	McCormick Taylor	7.0	8	3	8	6	25	Patapsco Lower North Branch	Yes
LNB-SR-F519X	Stream Restoration	McCormick Taylor	5.7	8	3	8	6	25	Patapsco Lower North Branch	Yes
LNB-SR-F523	Stream Restoration	McCormick Taylor	10.2	10	3	8	4	25	Patapsco Lower North Branch	Yes
lnb-sr-f552a	Stream Restoration	McCormick Taylor	15.0	10	3	8	4	25	Patapsco Lower North Branch	Yes
LNB-SR-F604A	Stream Restoration	KCI	8.6	8	3	8	6	25	Patapsco Lower North Branch	Yes
LNB-SR-F605B	Stream Restoration	KCI	5.7	8	3	8	6	25	Patapsco Lower North Branch	Yes
LNB-SR-F616	Stream Restoration	KCI	30.5	10	3	8	4	25	Patapsco Lower North Branch	Yes
LNB-SR-F623A	Stream Restoration	KCI	5.2	8	3	8	6	25	Patapsco Lower North Branch	Yes
LNB-SR-F624E	Stream Restoration	KCI	6.6	8	3	8	6	25	Patapsco Lower North Branch	Yes
LNB-SR-F627D	Stream Restoration	KCI	15.3	10	3	8	4	25	Patapsco Lower North Branch	Yes
LNB-SR-F628	Stream Restoration	KCI	11.9	10	3	8	4	25	Patapsco Lower North Branch	Yes
LNB-SR-F632	Stream Restoration	KCI	8.1	8	3	8	6	25	Patapsco Lower North Branch	Yes
SBP-SR-F418	Stream Restoration	Biohabitats	24.2	10	3	8	6	27	Patapsco River South Branch	Yes
SBP-SR-F422	Stream Restoration	Biohabitats	10.2	10	3	8	6	27	Patapsco River South Branch	Yes
SBP-SR-F402A	Stream Restoration	Biohabitats	11.5	10	3	8	4	25	Patapsco River South Branch	Yes
SBP-SR-F404A	Stream Restoration	Biohabitats	9.9	8	3	8	6	25	Patapsco River South Branch	Yes
SBP-SR-F405X	Stream Restoration	Biohabitats	8.6	8	3	8	6	25	Patapsco River South Branch	Yes
SBP-SR-F405Z	Stream Restoration	Biohabitats	9.2	8	3	8	6	25	Patapsco River South Branch	Yes
LNB-BC-D012	BMP Conversion	Straughan	3.2	5	3	8	8	24	Patapsco Lower North Branch	Yes
LNB-BC-F513	BMP Conversion	McCormick Taylor	3.5	5	3	10	6	24	Patapsco Lower North Branch	Yes
LNB-BC-F517	BMP Conversion	McCormick Taylor	3.6	5	3	10	6	24	Patapsco Lower North Branch	Yes
LNB-BC-F520	BMP Conversion	McCormick Taylor	4.8	5	3	10	6	24	Patapsco Lower North Branch	Yes
LNB-BC-F604	BMP Conversion	KCI	3.5	5	3	10	6	24	Patapsco Lower North Branch	Yes

Site ID	Type	Contractor	Acres of Impervious Treated	Acres of Impervious Treated Score	Pollutant Load Reduction Score	Cost Per Acre Score	Biological uplift-Programmatic Benefit-Feasbility Proportional Score	Total Score Combined Metrics	Watershed	2016 Concept
LNB-NB-D030	New BMP	McCormick Taylor	0.1	2	10	8	4	24	Patapsco Lower North Branch	Yes
LNB-NB-D057	New BMP	KCI	1.1	4	6	10	4	24	Patapsco Lower North Branch	Yes
LNB-NB-F501a	New BMP	McCormick Taylor	0.7	2	10	8	4	24	Patapsco Lower North Branch	Yes
LNB-OF-F509	SPSC	McCormick Taylor	1.0	4	6	10	4	24	Patapsco Lower North Branch	Yes
lnb-of-f558	SPSC	McCormick Taylor	0.4	2	6	10	6	24	Patapsco Lower North Branch	Yes
LNB-OF-F561	Outfall Stabilization	McCormick Taylor	0.3	2	6	10	6	24	Patapsco Lower North Branch	Yes
LNB-OF-F562	SPSC	McCormick Taylor	0.2	2	6	10	6	24	Patapsco Lower North Branch	Yes
LNB-OF-F617	SPSC	KCI	1.6	4	6	10	4	24	Patapsco Lower North Branch	Yes
LNB-OF-F635	SPSC	KCI	2.2	4	6	10	4	24	Patapsco Lower North Branch	Yes
LNB-OF-F680	SPSC	KCI	1.3	4	6	10	4	24	Patapsco Lower North Branch	Yes
LNB-SR-F613D-PO002	SPSC	KCI	0.3	2	6	10	6	24	Patapsco Lower North Branch	Yes
LNB-SR-F626A-PO001	SPSC	KCI	0.7	2	6	10	6	24	Patapsco Lower North Branch	Yes
LNB-SR-F634D-PO001	SPSC	KCI	0.4	2	6	10	6	24	Patapsco Lower North Branch	Yes
SBP-SR-F413A	Stream Restoration	Biohabitats	5.6	8	3	8	6	25	Patapsco River South Branch	Yes
SBP-SR-F407A	Stream Restoration	Biohabitats	3.5	5	3	8	8	24	Patapsco River South Branch	Yes
SBP-TP-F458	Tree Planting	Biohabitats	5.3	8	6	5	8	27	Patapsco River South Branch	Yes
LNB-BC-D008	BMP Conversion	Straughan	1.3	4	3	8	8	23	Patapsco Lower North Branch	Yes
LNB-BC-D010	BMP Conversion	Straughan	2.0	4	10	5	4	23	Patapsco Lower North Branch	Yes
LNB-NB-F503A	New BMP	McCormick Taylor	0.8	2	10	5	6	23	Patapsco Lower North Branch	Yes
LNB-NB-f503b	New BMP	McCormick Taylor	0.2	2	10	5	6	23	Patapsco Lower North Branch	Yes
LNB-SR-D048	Stream Restoration	KCI	8.2	8	3	8	4	23	Patapsco Lower North Branch	Yes
LNB-SR-F505A	Stream Restoration	McCormick Taylor	8.1	8	3	8	4	23	Patapsco Lower North Branch	Yes
LNB-SR-F505D	Stream Restoration	McCormick Taylor	5.5	8	3	8	4	23	Patapsco Lower North Branch	Yes
lnb-sr-f507a	Stream Restoration	McCormick Taylor	5.3	8	3	8	4	23	Patapsco Lower North Branch	Yes
lnb-sr-f512a	Stream Restoration	McCormick Taylor	7.8	8	3	8	4	23	Patapsco Lower North Branch	Yes
LNB-SR-F519Z	Stream Restoration	McCormick Taylor	5.9	8	3	8	4	23	Patapsco Lower North Branch	Yes
LNB-SR-F522B	Stream Restoration	McCormick Taylor	17.3	10	3	8	2	23	Patapsco Lower North Branch	Yes
LNB-SR-F651A	Stream Restoration	KCI	1.0	4	3	8	8	23	Patapsco Lower North Branch	Yes
LNB-SR-F681A	Stream Restoration	KCI	5.1	8	3	8	4	23	Patapsco Lower North Branch	Yes
LNB-TP-F552a	Tree Planting	McCormick Taylor	0.1	2	6	5	10	23	Patapsco Lower North Branch	Yes
LNB-TP-F552b	Tree Planting	McCormick Taylor	0.1	2	6	5	10	23	Patapsco Lower North Branch	Yes
LNB-TP-F602	Tree Planting	KCI	0.2	2	6	5	10	23	Patapsco Lower North Branch	Yes
LNB-TP-F603	Tree Planting	KCI	0.4	2	6	5	10	23	Patapsco Lower North Branch	Yes
LNB-TP-F604	Tree Planting	KCI	0.7	2	6	5	10	23	Patapsco Lower North Branch	Yes
LNB-TP-F605A	Tree Planting	KCI	0.1	2	6	5	10	23	Patapsco Lower North Branch	Yes
LNB-TP-F605B	Tree Planting	KCI	0.0	2	6	5	10	23	Patapsco Lower North Branch	Yes
SBP-TP-F408	Tree Planting	Biohabitats	5.0	8	6	5	6	25	Patapsco River South Branch	Yes
SBP-SR-F406	Stream Restoration	Biohabitats	9.8	8	3	8	4	23	Patapsco River South Branch	No
SBP-SR-F410A	Stream Restoration	Biohabitats	7.0	8	3	8	4	23	Patapsco River South Branch	No
SBP-SR-F410C	Stream Restoration	Biohabitats	7.2	8	3	8	4	23	Patapsco River South Branch	No
SBP-TP-F401	Tree Planting	Biohabitats	2.8	4	6	5	8	23	Patapsco River South Branch	No
SBP-TP-F459	Tree Planting	Biohabitats	1.4	4	6	5	8	23	Patapsco River South Branch	No

Site ID	Type	Contractor	Acres of Impervious Treated	Acres of Impervious Treated Score	Pollutant Load Reduction Score	Cost Per Acre Score	Biological uplift-Programmatic Benefit-Feasbility Proportional Score	Total Score Combined Metrics	Watershed	2016 Concept
LNB-BC-D004	BMP Conversion	Straughan	3.4	5	3	8	6	22	Patapsco Lower North Branch	Yes
LNB-BC-D005	BMP Conversion	Straughan	3.9	5	3	8	6	22	Patapsco Lower North Branch	Yes
LNB-BC-D007	BMP Conversion	Straughan	3.9	5	3	8	6	22	Patapsco Lower North Branch	Yes
LNB-BC-D009	BMP Conversion	Straughan	3.1	5	3	8	6	22	Patapsco Lower North Branch	Yes
LNB-BC-F504	BMP Conversion	McCormick Taylor	10.3	10	3	5	4	22	Patapsco Lower North Branch	Yes
LNB-BC-F515	BMP Conversion	McCormick Taylor	3.9	5	3	10	4	22	Patapsco Lower North Branch	Yes
LNB-OF-F515	SPSC	McCormick Taylor	0.1	2	6	10	4	22	Patapsco Lower North Branch	Yes
LNB-OF-F555	SPSC	McCormick Taylor	0.9	2	6	10	4	22	Patapsco Lower North Branch	Yes
lnb-of-f557	SPSC	McCormick Taylor	0.9	2	6	10	4	22	Patapsco Lower North Branch	Yes
LNB-OF-F643	Outfall Stabilization	KCI	0.3	2	6	10	4	22	Patapsco Lower North Branch	No
LNB-SR-D053	Stream Restoration	KCI	4.2	5	3	8	6	22	Patapsco Lower North Branch	Yes
lnb-sr-f501b	Stream Restoration	McCormick Taylor	3.7	5	3	8	6	22	Patapsco Lower North Branch	Yes
lnb-sr-f508a	Stream Restoration	McCormick Taylor	3.7	5	3	8	6	22	Patapsco Lower North Branch	Yes
lnb-sr-f508b	Stream Restoration	McCormick Taylor	3.3	5	3	8	6	22	Patapsco Lower North Branch	Yes
lnb-sr-f554	Stream Restoration	McCormick Taylor	4.5	5	3	8	6	22	Patapsco Lower North Branch	Yes
LNB-SR-F627E-PO001	SPSC	KCI	0.2	2	6	10	4	22	Patapsco Lower North Branch	Yes
LNB-SR-F634D	Stream Restoration	KCI	4.9	5	3	8	6	22	Patapsco Lower North Branch	Yes
SBP-SR-F415A	Stream Restoration	Biohabitats	3.4	5	3	8	6	22	Patapsco River South Branch	No
SBP-SR-F419	Stream Restoration	Biohabitats	4.6	5	3	8	6	22	Patapsco River South Branch	No
SBP-TP-F455	Tree Planting	Biohabitats	3.1	5	6	5	6	22	Patapsco River South Branch	No
LNB-BC-F521	BMP Conversion	McCormick Taylor	2.9	4	3	8	6	21	Patapsco Lower North Branch	Yes
LNB-BC-F606	BMP Conversion	KCI	2.9	4	3	8	6	21	Patapsco Lower North Branch	Yes
LNB-NB-D026	New BMP	McCormick Taylor	0.9	2	10	5	4	21	Patapsco Lower North Branch	Yes
LNB-NB-D027	New BMP	McCormick Taylor	0.4	2	10	5	4	21	Patapsco Lower North Branch	Yes
LNB-NB-D059	New BMP	KCI	3.0	4	3	10	4	21	Patapsco Lower North Branch	Yes
LNB-NB-F502b	New BMP	McCormick Taylor	1.1	4	6	5	6	21	Patapsco Lower North Branch	Yes
LNB-NB-F504b	New BMP	McCormick Taylor	1.1	4	6	5	6	21	Patapsco Lower North Branch	Yes
LNB-NB-F505d	New BMP	McCormick Taylor	0.2	2	3	10	6	21	Patapsco Lower North Branch	Yes
LNB-SR-F504A	Stream Restoration	McCormick Taylor	9.3	8	3	8	2	21	Patapsco Lower North Branch	Yes
lnb-sr-f518a	Stream Restoration	McCormick Taylor	1.9	4	3	8	6	21	Patapsco Lower North Branch	Yes
LNB-SR-F610C	Stream Restoration	KCI	2.2	4	3	8	6	21	Patapsco Lower North Branch	Yes
LNB-SR-F628A	Stream Restoration	KCI	2.5	4	3	8	6	21	Patapsco Lower North Branch	Yes
LNB-TP-F501	Tree Planting	McCormick Taylor	0.2	2	6	5	8	21	Patapsco Lower North Branch	Yes
LNB-TP-F504a	Tree Planting	McCormick Taylor	0.4	2	6	5	8	21	Patapsco Lower North Branch	Yes
LNB-TP-F504b	Tree Planting	McCormick Taylor	0.1	2	6	5	8	21	Patapsco Lower North Branch	Yes
LNB-TP-F504c	Tree Planting	McCormick Taylor	0.1	2	6	5	8	21	Patapsco Lower North Branch	Yes
LNB-TP-F550a	Tree Planting	McCormick Taylor	0.2	2	6	5	8	21	Patapsco Lower North Branch	Yes
LNB-TP-F550b	Tree Planting	McCormick Taylor	0.2	2	6	5	8	21	Patapsco Lower North Branch	Yes
LNB-TP-F616	Tree Planting	KCI	1.2	4	6	5	6	21	Patapsco Lower North Branch	Yes
LNB-TP-F618	Tree Planting	KCI	0.7	2	6	5	8	21	Patapsco Lower North Branch	Yes
SBP-SR-F401	Stream Restoration	Biohabitats	2.5	4	3	8	6	21	Patapsco River South Branch	No
SBP-SR-F415D	Stream Restoration	Biohabitats	2.4	4	3	8	6	21	Patapsco River South Branch	No

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SBP-TP-F402A	Tree Planting	Biohabitats	1.4	4	6	5	6	21	Patapsco River South Branch	No
SBP-TP-F405	Tree Planting	Biohabitats	0.2	2	6	5	8	21	Patapsco River South Branch	No
SBP-TP-F406	Tree Planting	Biohabitats	0.5	2	6	5	8	21	Patapsco River South Branch	No
SBP-TP-F453	Tree Planting	Biohabitats	0.5	2	6	5	8	21	Patapsco River South Branch	No
SBP-TP-F456	Tree Planting	Biohabitats	2.5	4	6	5	6	21	Patapsco River South Branch	No
SBP-TP-F460	Tree Planting	Biohabitats	1.2	4	6	5	6	21	Patapsco River South Branch	No
LNB-BC-D006	BMP Conversion	Straughan	3.9	5	3	8	4	20	Patapsco Lower North Branch	No
LNB-OF-F516	SPSC	McCormick Taylor	0.6	2	6	10	2	20	Patapsco Lower North Branch	Yes
LNB-OF-F616	Outfall Stabilization	KCI	2.0	4	3	5	8	20	Patapsco Lower North Branch	No
LNB-SR-F504	Stream Restoration	McCormick Taylor	3.6	5	3	8	4	20	Patapsco Lower North Branch	No
LNB-SR-F513E	Stream Restoration	McCormick Taylor	4.4	5	3	8	4	20	Patapsco Lower North Branch	No
lnb-sr-f514f	Stream Restoration	McCormick Taylor	3.3	5	3	8	4	20	Patapsco Lower North Branch	No
LNB-SR-F521C	Stream Restoration	McCormick Taylor	4.6	5	3	8	4	20	Patapsco Lower North Branch	No
LNB-SR-F686	Stream Restoration	KCI	3.9	5	3	8	4	20	Patapsco Lower North Branch	No
SBP-BC-F401	BMP Conversion	Biohabitats	4.4	5	3	8	4	20	Patapsco River South Branch	No
LNB-BC-D066	BMP Conversion	KCI	0.8	2	3	10	4	19	Patapsco Lower North Branch	No
LNB-NB-D069	New BMP	KCI	1.7	4	3	8	4	19	Patapsco Lower North Branch	No
LNB-NB-D070	New BMP	KCI	0.9	2	3	10	4	19	Patapsco Lower North Branch	No
LNB-NB-D071	New BMP	KCI	0.3	2	3	10	4	19	Patapsco Lower North Branch	No
LNB-NB-F504a	New BMP	McCormick Taylor	0.7	2	6	5	6	19	Patapsco Lower North Branch	No
LNB-NB-F504c	New BMP	McCormick Taylor	0.6	2	6	5	6	19	Patapsco Lower North Branch	No
LNB-SR-F505C	Stream Restoration	McCormick Taylor	1.4	4	3	8	4	19	Patapsco Lower North Branch	No
lnb-sr-f512g	Stream Restoration	McCormick Taylor	0.7	2	3	8	6	19	Patapsco Lower North Branch	No
lnb-sr-f523b	Stream Restoration	McCormick Taylor	2.0	4	3	8	4	19	Patapsco Lower North Branch	No
lnb-sr-f550a	Stream Restoration	McCormick Taylor	1.7	4	3	8	4	19	Patapsco Lower North Branch	No
lnb-sr-f551a	Stream Restoration	McCormick Taylor	1.6	4	3	8	4	19	Patapsco Lower North Branch	No
LNB-SR-F611D	Stream Restoration	KCI	0.7	2	3	8	6	19	Patapsco Lower North Branch	No
LNB-SR-F617C	Stream Restoration	KCI	1.9	4	3	8	4	19	Patapsco Lower North Branch	No
LNB-SR-F621C	Stream Restoration	KCI	2.2	4	3	8	4	19	Patapsco Lower North Branch	No
LNB-SR-F623D	Stream Restoration	KCI	1.0	4	3	8	4	19	Patapsco Lower North Branch	No
LNB-SR-F630E	Stream Restoration	KCI	1.3	4	3	8	4	19	Patapsco Lower North Branch	No
LNB-SR-F633A	Stream Restoration	KCI	1.8	4	3	8	4	19	Patapsco Lower North Branch	No
LNB-SR-F633B	Stream Restoration	KCI	1.9	4	3	8	4	19	Patapsco Lower North Branch	No
LNB-SR-F680A	Stream Restoration	KCI	2.2	4	3	8	4	19	Patapsco Lower North Branch	No
LNB-SR-F683	Stream Restoration	KCI	1.4	4	3	8	4	19	Patapsco Lower North Branch	No
LNB-TP-F506	Tree Planting	McCormick Taylor	0.5	2	6	5	6	19	Patapsco Lower North Branch	No
LNB-TP-F507	Tree Planting	McCormick Taylor	0.7	2	6	5	6	19	Patapsco Lower North Branch	No
LNB-TP-F553	Tree Planting	McCormick Taylor	0.8	2	6	5	6	19	Patapsco Lower North Branch	No
LNB-TP-F615	Tree Planting	KCI	1.7	4	6	5	4	19	Patapsco Lower North Branch	No
LNB-TP-F652	Tree Planting	KCI	0.1	2	6	5	6	19	Patapsco Lower North Branch	No
SBP-SR-F413C	Stream Restoration	Biohabitats	2.7	4	3	8	4	19	Patapsco River South Branch	No
SBP-SR-F421B	Stream Restoration	Biohabitats	0.5	2	3	8	6	19	Patapsco River South Branch	No

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SBP-TP-F402B	Tree Planting	Biohabitats	0.7	2	6	5	6	19	Patapsco River South Branch	No
SBP-TP-F402C	Tree Planting	Biohabitats	0.7	2	6	5	6	19	Patapsco River South Branch	No
SBP-TP-F404A	Tree Planting	Biohabitats	0.4	2	6	5	6	19	Patapsco River South Branch	No
SBP-TP-F404B	Tree Planting	Biohabitats	0.3	2	6	5	6	19	Patapsco River South Branch	No
SBP-TP-F404C	Tree Planting	Biohabitats	0.0	2	6	5	6	19	Patapsco River South Branch	No
SBP-TP-F409	Tree Planting	Biohabitats	1.9	4	6	5	4	19	Patapsco River South Branch	No
SBP-TP-F410	Tree Planting	Biohabitats	1.0	2	6	5	6	19	Patapsco River South Branch	No
SBP-TP-F451	Tree Planting	Biohabitats	0.6	2	6	5	6	19	Patapsco River South Branch	No
SBP-TP-F452	Tree Planting	Biohabitats	0.1	2	6	5	6	19	Patapsco River South Branch	No
SBP-TP-F454	Tree Planting	Biohabitats	0.3	2	6	5	6	19	Patapsco River South Branch	No
SBP-TP-F457	Tree Planting	Biohabitats	0.8	2	6	5	6	19	Patapsco River South Branch	No
LNB-BC-D020	BMP Conversion	McCormick Taylor	0.8	2	3	5	8	18	Patapsco Lower North Branch	No
LNB-NB-F607a	New BMP	KCI	0.4	2	3	5	8	18	Patapsco Lower North Branch	No
LNB-NB-F607b	New BMP	KCI	0.4	2	3	5	8	18	Patapsco Lower North Branch	No
LNB-NB-F609e	New BMP	KCI	0.6	2	3	5	8	18	Patapsco Lower North Branch	No
LNB-SR-F682A	Stream Restoration	KCI	3.7	5	3	8	2	18	Patapsco Lower North Branch	No
LNB-BC-D011	BMP Conversion	Straughan	3.8	5	3	5	4	17	Patapsco Lower North Branch	No
LNB-NB-D064	New BMP	KCI	3.0	5	3	5	4	17	Patapsco Lower North Branch	No
LNB-SR-F633C	Stream Restoration	KCI	2.2	4	3	8	2	17	Patapsco Lower North Branch	No
LNB-TP-F551	Tree Planting	McCormick Taylor	0.2	2	6	5	4	17	Patapsco Lower North Branch	No
LNB-TP-F609	Tree Planting	KCI	0.9	2	6	5	4	17	Patapsco Lower North Branch	No
LNB-TP-F651	Tree Planting	KCI	0.2	2	6	5	4	17	Patapsco Lower North Branch	No
SBP-TP-F403	Tree Planting	Biohabitats	0.2	2	6	5	4	17	Patapsco River South Branch	No
SBP-TP-F407A	Tree Planting	Biohabitats	0.2	2	6	5	4	17	Patapsco River South Branch	No
SBP-TP-F407B	Tree Planting	Biohabitats	0.1	2	6	5	4	17	Patapsco River South Branch	No
SBP-TP-F461	Tree Planting	Biohabitats	0.8	2	6	5	4	17	Patapsco River South Branch	No
LNB-NB-D061	New BMP	KCI	1.2	4	3	5	4	16	Patapsco Lower North Branch	No
LNB-NB-D063	New BMP	KCI	2.3	4	3	5	4	16	Patapsco Lower North Branch	No
LNB-NB-F504d	New BMP	McCormick Taylor	0.8	2	3	5	6	16	Patapsco Lower North Branch	No
LNB-NB-F505a	New BMP	McCormick Taylor	0.4	2	3	5	6	16	Patapsco Lower North Branch	No
LNB-NB-F505g	New BMP	McCormick Taylor	0.6	2	3	5	6	16	Patapsco Lower North Branch	No
LNB-NB-F507a	New BMP	McCormick Taylor	1.3	4	3	5	4	16	Patapsco Lower North Branch	No
LNB-NB-F605A	New BMP	KCI	1.2	4	3	5	4	16	Patapsco Lower North Branch	No
LNB-NB-F609d	New BMP	KCI	0.0	2	3	5	6	16	Patapsco Lower North Branch	No
LNB-OF-F507	Outfall Stabilization	McCormick Taylor	0.9	2	3	5	6	16	Patapsco Lower North Branch	No
LNB-OF-F521	Outfall Stabilization	McCormick Taylor	0.1	2	3	5	6	16	Patapsco Lower North Branch	No
LNB-OF-F522	Outfall Stabilization	McCormick Taylor	0.0	2	3	5	6	16	Patapsco Lower North Branch	No
LNB-OF-F524	Outfall Stabilization	McCormick Taylor	0.4	2	3	5	6	16	Patapsco Lower North Branch	No
LNB-OF-F527	Outfall Stabilization	McCormick Taylor	0.3	2	3	5	6	16	Patapsco Lower North Branch	No
LNB-OF-F551	Outfall Stabilization	McCormick Taylor	0.2	2	3	5	6	16	Patapsco Lower North Branch	No
LNB-OF-F552	Outfall Stabilization	McCormick Taylor	0.1	2	3	5	6	16	Patapsco Lower North Branch	No
lnb-of-f554	Outfall Stabilization	McCormick Taylor	0.5	2	3	5	6	16	Patapsco Lower North Branch	No

Site ID	Type	Contractor	Acres of Impervious Treated	Acres of Impervious Treated Score	Pollutant Load Reduction Score	Cost Per Acre Score	Biological uplift-Programmatic Benefit-Feasbility Proportional Score	Total Score Combined Metrics	Watershed	2016 Concept
LNB-OF-F563	Outfall Stabilization	McCormick Taylor	0.8	2	3	5	6	16	Patapsco Lower North Branch	No
LNB-NB-F607c	New BMP	KCI	0.1	2	3	2	8	15	Patapsco Lower North Branch	No
LNB-NB-D024	New BMP	McCormick Taylor	0.3	2	3	5	4	14	Patapsco Lower North Branch	No
LNB-NB-D025	New BMP	McCormick Taylor	0.8	2	3	5	4	14	Patapsco Lower North Branch	No
LNB-NB-D028	New BMP	McCormick Taylor	0.4	2	3	5	4	14	Patapsco Lower North Branch	No
LNB-NB-D029	New BMP	McCormick Taylor	0.2	2	3	5	4	14	Patapsco Lower North Branch	No
LNB-NB-D031	New BMP	McCormick Taylor	0.3	2	3	5	4	14	Patapsco Lower North Branch	No
LNB-NB-D040	New BMP	KCI	0.7	2	3	5	4	14	Patapsco Lower North Branch	No
LNB-NB-D058A	New BMP	KCI	0.5	2	3	5	4	14	Patapsco Lower North Branch	No
LNB-NB-D058B	New BMP	KCI	0.6	2	3	5	4	14	Patapsco Lower North Branch	No
LNB-NB-D062	New BMP	KCI	0.6	2	3	5	4	14	Patapsco Lower North Branch	No
LNB-NB-D065	New BMP	KCI	0.6	2	3	5	4	14	Patapsco Lower North Branch	No
LNB-NB-D068	New BMP	KCI	1.0	2	3	5	4	14	Patapsco Lower North Branch	No
LNB-NB-F505b	New BMP	McCormick Taylor	0.1	2	3	5	4	14	Patapsco Lower North Branch	No
LNB-NB-F505c	New BMP	McCormick Taylor	0.3	2	3	5	4	14	Patapsco Lower North Branch	No
LNB-NB-F507b	New BMP	McCormick Taylor	0.2	2	3	5	4	14	Patapsco Lower North Branch	No
LNB-NB-F511A	New BMP	KCI	0.2	2	3	5	4	14	Patapsco Lower North Branch	No
LNB-NB-F603	New BMP	KCI	0.6	2	3	5	4	14	Patapsco Lower North Branch	No
LNB-NB-F605B	New BMP	KCI	0.2	2	3	5	4	14	Patapsco Lower North Branch	No
LNB-NB-F605C	New BMP	KCI	0.2	2	3	5	4	14	Patapsco Lower North Branch	No
LNB-OF-D041	Outfall Stabilization	KCI	0.9	2	3	5	4	14	Patapsco Lower North Branch	No
LNB-OF-F513	Outfall Stabilization	McCormick Taylor	0.6	2	3	5	4	14	Patapsco Lower North Branch	No
LNB-OF-F560	Outfall Stabilization	McCormick Taylor	0.0	2	3	5	4	14	Patapsco Lower North Branch	No
LNB-OF-F611	Outfall Stabilization	KCI	0.6	2	3	5	4	14	Patapsco Lower North Branch	No
LNB-NB-D060	New BMP	KCI	0.6	2	3	2	4	11	Patapsco Lower North Branch	No
LNB-NB-D067	New BMP	KCI	0.5	2	3	2	4	11	Patapsco Lower North Branch	No
LNB-NB-F505e	New BMP	McCormick Taylor	0.2	2	3	2	4	11	Patapsco Lower North Branch	No
LNB-NB-F505f	New BMP	McCormick Taylor	0.2	2	3	2	4	11	Patapsco Lower North Branch	No

Appendix G: Individual Concept Plans for Top-Ranked Opportunities

List of Concept Plans in Patapsco River Watershed

Site ID	Site Name	Project Type	Watershed
LNB-BC-D002	Waterloo Road	BMP Conversion	Patapsco Lower North
LNB-BC-D003	Green Tree Court	BMP Conversion	Patapsco Lower North
LNB-BC-D004	Woodcrest Drive	BMP Conversion	Patapsco Lower North
LNB-BC-D005	Karas Walk	BMP Conversion	Patapsco Lower North
LNB-BC-D007	Fetlock Court	BMP Conversion	Patapsco Lower North
LNB-BC-D008	Hunting Horn Dr	BMP Conversion	Patapsco Lower North
LNB-BC-D009	Debbie Court	BMP Conversion	Patapsco Lower North
LNB-BC-D010	East Glen Road	BMP Conversion	Patapsco Lower North
LNB-BC-D012	Kesting Court	BMP Conversion	Patapsco Lower North
LNB-BC-D013	Thornbrook Road	BMP Conversion	Patapsco Lower North
LNB-BC-F501	Britt Ct (Deep Run)	BMP Conversion	Patapsco Lower North
LNB-BC-F502	Troy Hill 2	BMP Conversion	Patapsco Lower North
LNB-BC-F504	Quail Ridge	BMP Conversion	Patapsco Lower North
LNB-BC-F505	Bonnie Branch Middle School	BMP Conversion	Patapsco Lower North
LNB-BC-F506	Latchlift Ct	BMP Conversion	Patapsco Lower North
LNB-BC-F507	Radel Court	BMP Conversion	Patapsco Lower North
LNB-BC-F508	Greenmount Drive	BMP Conversion	Patapsco Lower North
LNB-BC-F509	Baltimore Washington Commerce Park	BMP Conversion	Patapsco Lower North
LNB-BC-F510	Briarstone Court	BMP Conversion	Patapsco Lower North
LNB-BC-F511	Orchard Club	BMP Conversion	Patapsco Lower North
LNB-BC-F513	Merle Way	BMP Conversion	Patapsco Lower North
LNB-BC-F514	Business Parkway 1	BMP Conversion	Patapsco Lower North
LNB-BC-F515	Manchester Way	BMP Conversion	Patapsco Lower North
LNB-BC-F516	Santa Barbara Rd	BMP Conversion	Patapsco Lower North
LNB-BC-F517	Gatepost Way	BMP Conversion	Patapsco Lower North
LNB-BC-F518	Troy Hill 3	BMP Conversion	Patapsco Lower North
LNB-BC-F519	Ruxton Drive	BMP Conversion	Patapsco Lower North
LNB-BC-F520	Troy Hill 1	BMP Conversion	Patapsco Lower North
LNB-BC-F521	Milk Shed Place	BMP Conversion	Patapsco Lower North
LNB-BC-F522	Business Parkway 2	BMP Conversion	Patapsco Lower North
LNB-BC-F523	Huntshire Drive	BMP Conversion	Patapsco Lower North
LNB-BC-F524	Marble Hill	BMP Conversion	Patapsco Lower North
LNB-BC-F601	Tiber Ridge Ct Pond	BMP Conversion	Patapsco Lower North
LNB-BC-F602	Glenmar Road Pond	BMP Conversion	Patapsco Lower North
LNB-BC-F603	Pasture Court pond	BMP Conversion	Patapsco Lower North
LNB-BC-F604	Terry Drive Pond	BMP Conversion	Patapsco Lower North
LNB-BC-F605	Chews Vineyard Pond	BMP Conversion	Patapsco Lower North
LNB-BC-F606	Autumn Rust Road Pond	BMP Conversion	Patapsco Lower North
LNB-BC-F607	Governor Thomas Pond	BMP Conversion	Patapsco Lower North
LNB-BC-F608	Old Mill Road Pond	BMP Conversion	Patapsco Lower North
LNB-BC-F610	Roberts Road Pond	BMP Conversion	Patapsco Lower North
LNB-NB-D026	Worthington Elementary	New BMP	Patapsco Lower North
LNB-NB-D027	Worthington Elementary	New BMP	Patapsco Lower North
LNB-NB-D030	Patapsco Middle School	New BMP	Patapsco Lower North
LNB-NB-D072	George Howard Building Parking Lot	New BMP	Patapsco Lower North
LNB-NB-F501	Elite Spice	New BMP	Patapsco Lower North
LNB-NB-F502	Levering Ave	New BMP	Patapsco Lower North
LNB-NB-F503	Furnace Ave 1	New BMP	Patapsco Lower North
LNB-NB-F504	Furnace Ave 2	New BMP	Patapsco Lower North
LNB-NB-F505	The Woodlands	New BMP	Patapsco Lower North
LNB-NB-F607	Rockburn Park 1	New BMP	Patapsco Lower North
LNB-NB-F608	Elkridge Elementary	New BMP	Patapsco Lower North
LNB-NB-F609	Rockburn Park 2	New BMP	Patapsco Lower North
LNB-OF-D032	Worthington Elementary	Outfall Stabilization	Patapsco Lower North
LNB-OF-F509	Coca Cola Drive Pond	Outfall Stabilization	Patapsco Lower North
LNB-OF-F515	Deer Path Road	Outfall Stabilization	Patapsco Lower North
LNB-OF-F516	Tyson Place	Outfall Stabilization	Patapsco Lower North
LNB-OF-F555	Mayfield Woods	Outfall Stabilization	Patapsco Lower North
LNB-OF-F557	Ducketts Lane Gabion South	Outfall Stabilization	Patapsco Lower North
LNB-OF-F558	Ducketts Lane Gabion North	Outfall Stabilization	Patapsco Lower North
LNB-OF-F561	Rowanberry Drive Outfall	Outfall Stabilization	Patapsco Lower North
LNB-OF-F562	Capitol Mobile Outfall	Outfall Stabilization	Patapsco Lower North
LNB-OF-F601	Carroll Wind Drive	Outfall Stabilization	Patapsco Lower North

Site ID	Site Name	Project Type	Watershed
LNB-OF-F602	Stonehouse Drive B	Outfall Stabilization	Patapsco Lower North
LNB-OF-F615	Thornbrook Road	Outfall Stabilization	Patapsco Lower North
LNB-OF-F617	Courthouse Parking Lot A	Outfall Stabilization	Patapsco Lower North
LNB-OF-F635	Normandy Woods	Outfall Stabilization	Patapsco Lower North
LNB-OF-F644	Millers Way A	Outfall Stabilization	Patapsco Lower North
LNB-OF-F680	Courthouse Parking B	Outfall Stabilization	Patapsco Lower North
LNB-SR-D046	Tiber Branch Concept A	Stream Restoration	Patapsco Lower North
LNB-SR-D048	Sucker Branch Concept B	Stream Restoration	Patapsco Lower North
LNB-SR-D053	Sucker Branch Concept E	Stream Restoration	Patapsco Lower North
LNB-SR-F501A	Elibank Drive A	Stream Restoration	Patapsco Lower North
LNB-SR-F501B	Elibank Drive B	Stream Restoration	Patapsco Lower North
LNB-SR-F501D	Elibank Drive D	Stream Restoration	Patapsco Lower North
LNB-SR-F504A	Smith Avenue	Stream Restoration	Patapsco Lower North
LNB-SR-F505A	Montevideo Road	Stream Restoration	Patapsco Lower North
LNB-SR-F505D	Montevideo Road North	Stream Restoration	Patapsco Lower North
LNB-SR-F506	Coca Cola Drive	Stream Restoration	Patapsco Lower North
LNB-SR-F507A	Montgomery Run Road	Stream Restoration	Patapsco Lower North
LNB-SR-F508A	Sunny Field Court A	Stream Restoration	Patapsco Lower North
LNB-SR-F508B	Sunny Field Court B	Stream Restoration	Patapsco Lower North
LNB-SR-F510	Rockburn Park	Stream Restoration	Patapsco Lower North
LNB-SR-F511	Rockburn Branch/Landing Road	Stream Restoration	Patapsco Lower North
LNB-SR-F512A	Timbers of Troy Golf Course	Stream Restoration	Patapsco Lower North
LNB-SR-F513	Woodcrest Drive	Stream Restoration	Patapsco Lower North
LNB-SR-F514A	Mayfield Woods	Stream Restoration	Patapsco Lower North
LNB-SR-F515B	Troy Hill Drive	Stream Restoration	Patapsco Lower North
LNB-SR-F516	Capitol Mobile	Stream Restoration	Patapsco Lower North
LNB-SR-F517	Rowanberry Drive	Stream Restoration	Patapsco Lower North
LNB-SR-F518	Koffel Court	Stream Restoration	Patapsco Lower North
LNB-SR-F518A	Landing Road	Stream Restoration	Patapsco Lower North
LNB-SR-F519X	Brandons Way	Stream Restoration	Patapsco Lower North
LNB-SR-F519Z	Gardenview Drive	Stream Restoration	Patapsco Lower North
LNB-SR-F522B	Kit Kat Road	Stream Restoration	Patapsco Lower North
LNB-SR-F523	Wesley Lane	Stream Restoration	Patapsco Lower North
LNB-SR-F552A	Ducketts Lane	Stream Restoration	Patapsco Lower North
LNB-SR-F554	Summer Home Terrace	Stream Restoration	Patapsco Lower North
LNB-SR-F604A	Taylor Farm	Stream Restoration	Patapsco Lower North
LNB-SR-F605B	Dorchester Way	Stream Restoration	Patapsco Lower North
LNB-SR-F607	Gudel Drive	Stream Restoration	Patapsco Lower North
LNB-SR-F610C	Carrie Way	Stream Restoration	Patapsco Lower North
LNB-SR-F613D-PO001	Millers Way B	Outfall Stabilization	Patapsco Lower North
LNB-SR-F613D-PO002	Milldam Ct	Outfall Stabilization	Patapsco Lower North
LNB-SR-F613D-PO003	Stone Hollow Ct	Outfall Stabilization	Patapsco Lower North
LNB-SR-F616	North Ridge Road	Stream Restoration	Patapsco Lower North
LNB-SR-F616A-PO002	Town and Country	Outfall Stabilization	Patapsco Lower North
LNB-SR-F623A	Tiber Falls Drive	Stream Restoration	Patapsco Lower North
LNB-SR-F624E	Taylor Family Association	Stream Restoration	Patapsco Lower North
LNB-SR-F626	Bonnie Branch Tributary	Stream Restoration	Patapsco Lower North
LNB-SR-F626A-PO001	Bonnie Branch Tributary	Outfall Stabilization	Patapsco Lower North
LNB-SR-F627D	Wharff Lane	Stream Restoration	Patapsco Lower North
LNB-SR-F627E-PO001	Bonnie Branch	Outfall Stabilization	Patapsco Lower North
LNB-SR-F628	Worthington Way	Stream Restoration	Patapsco Lower North
LNB-SR-F628A	Twin Stream Drive	Stream Restoration	Patapsco Lower North
LNB-SR-F632	New Cut Road	Stream Restoration	Patapsco Lower North
LNB-SR-F634D	Autumn Rust Road	Stream Restoration	Patapsco Lower North
LNB-SR-F634D-PO001	Cedar Creek Ct	Outfall Stabilization	Patapsco Lower North
LNB-SR-F651A	Millers Way	Stream Restoration	Patapsco Lower North
LNB-SR-F681A	Doncaster Drive	Stream Restoration	Patapsco Lower North
LNB-TP-F501	Landing Road	Tree Planting	Patapsco Lower North
LNB-TP-F504	Mayfield Woods Oaks	Tree Planting	Patapsco Lower North
LNB-TP-F550	Rockburn Park Disc Golf	Tree Planting	Patapsco Lower North
LNB-TP-F552	Landing Road	Tree Planting	Patapsco Lower North
LNB-TP-F602	Old Frederick Road Pumping Station	Tree Planting	Patapsco Lower North
LNB-TP-F603	Dorsey Spring Court	Tree Planting	Patapsco Lower North
LNB-TP-F604	Carroll Wind Drive	Tree Planting	Patapsco Lower North
LNB-TP-F605	Kidwell Place	Tree Planting	Patapsco Lower North
LNB-TP-F616	College Ave	Tree Planting	Patapsco Lower North

Site ID	Site Name	Project Type	Watershed
LNB-TP-F618	Mt Hebron High School	Tree Planting	Patapsco Lower North
SBP-OF-F402	High Stepper Trail	Outfall Stabilization	South Branch Patapsco
SBP-OF-F408	Hoods Mill 1	Outfall Stabilization	South Branch Patapsco
SBP-SR-F402A	Elm Forest	Stream Restoration	South Branch Patapsco
SBP-SR-F403	Camalo	Stream Restoration	South Branch Patapsco
SBP-SR-F404A	Hay Meadow Branch	Stream Restoration	South Branch Patapsco
SBP-SR-F405X	Blooms Lane - A	Stream Restoration	South Branch Patapsco
SBP-SR-F405Z	Blooms Lane - B	Stream Restoration	South Branch Patapsco
SBP-SR-F407A	Woodbine Morgan	Stream Restoration	South Branch Patapsco
SBP-SR-F411B	Poplar Spring Park	Stream Restoration	South Branch Patapsco
SBP-SR-F413A	The Old Station Court	Stream Restoration	South Branch Patapsco
SBP-SR-F417	Old Frederick Road Tributary 1	Stream Restoration	South Branch Patapsco
SBP-SR-F418	Forsythe Road	Stream Restoration	South Branch Patapsco
SBP-SR-F422	High Stepper Trail	Stream Restoration	South Branch Patapsco
SBP-TP-F408	Morgan Station	Tree Planting	South Branch Patapsco
SBP-TP-F458	14006 Old Frederick Road A	Tree Planting	South Branch Patapsco

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D002
Site Name: Waterloo Road

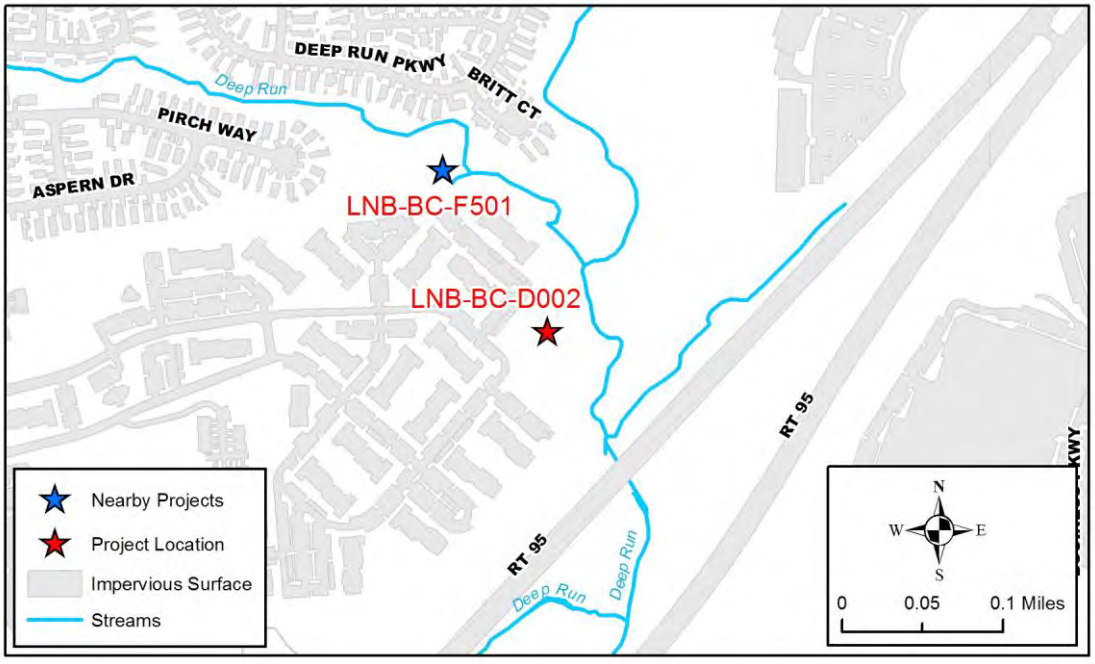
Contractor: Straughan
Watershed: Patapsco Lower North

Proposed BMP Type: Extended Detention Pond - Wetland
Ownership: Private- Residential
Single Owner

BMP Structure ID: HO104779
Existing BMP Type: DP

Existing Conditions:

This facility, built in 1987, is designed as a dry pond to provide storm water management associated with the Sherwood Crossing Subdivision. Most of the subdivision runoff is from parking areas and secondary roads which drain into a major storm drain system. This system discharges into the pond via a 21 in. BCCMP, a 27 in. BCCMP, and a 42 in. BCCMP pipe. There is a riser structure at the west side of the pond which discharges to a 54 in. RCP spillway then to a rip rap channel before flow enters Deep Run. The pond is providing limited water quality improvement. Erosion was noted at the pond outfall.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D002
Site Name: Waterloo Road

Contractor: Straughan
Watershed: Patapsco Lower North

Pond view from berm.

Riser structure.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D002
Site Name: Waterloo Road
Contractor: Straughan
Watershed: Patapsco Lower North

Constraints/Utilities:

A sewer line is present downstream of the pond outfall.

Concept Description:

Expansion of the facility and conversion to an extended detention shallow wetland is proposed to improve water quality performance. This retrofit will require replacement of the existing riser structure. A shallow wetland was chosen because the drainage area should be sufficient to support a wetland, there is adequate head, and retaining existing vegetation was desirable. Shallow wetlands have high community acceptance, provide high habitat quality, are relatively easy to maintain, and are usually not a safety concern. Outfall stabilization is recommended to prevent further outfall undercutting. Ensure compliance with MD Pond Code 378.

Nearby Opportunities:

LNB-BC-F501

Proposed Project Credit	
Drainage Area (ac.):	31.15
Impervious Area within Drainage (ac.):	15.51
Impervious Area Treated (ac.):	15.5
Impervious Area Treated Credit (ac.):	15.5

Water Quality Volume	
WQVolume Target (cft.):	51,642
Max Treated (cft.):	53,140
Percent Treated:	103%
Rainfall Depth Treated (in.):	1.03

Costs	
Estimated Design Cost:	$220,000
Estimated Construction Cost:	$448,500
30% Contingency:	$200,550
Estimated Total Cost	$869,050
Cost per Impervious Credit Acre:	$56,032

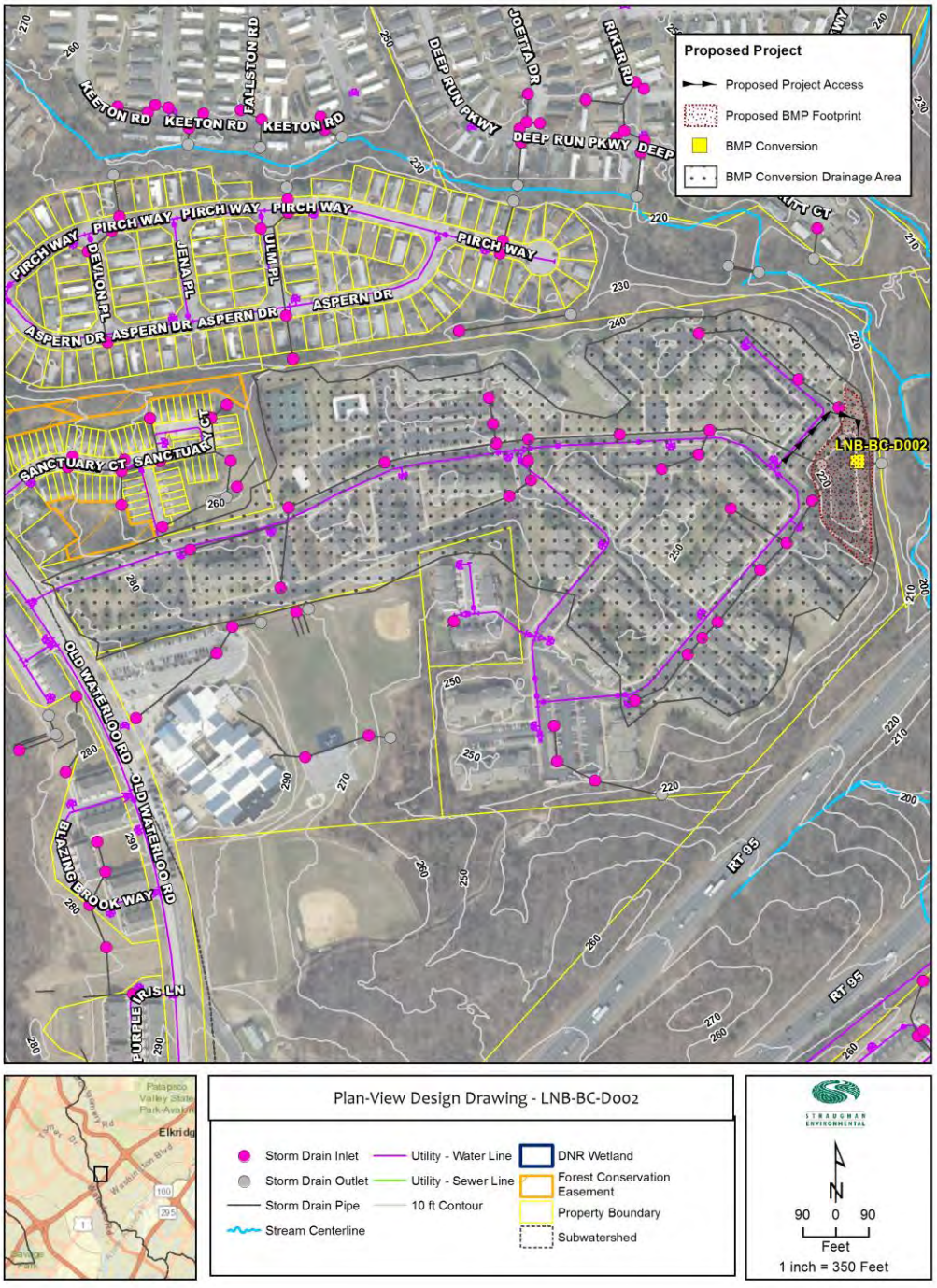
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D002

Site Name: Waterloo Road

Contractor: Straughan

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D003
Site Name: Green Tree Court

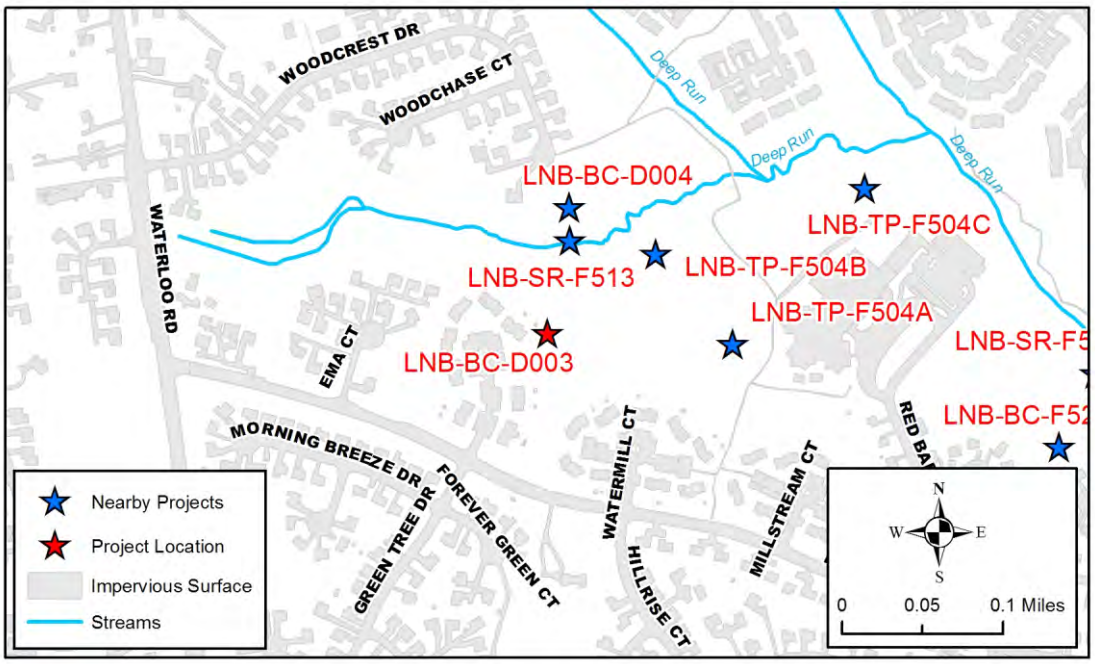
Contractor: Straughan
Watershed: Patapsco Lower North

Proposed BMP Type: Micropool Extended Detention Pond
Ownership: Private- HOA
Single Owner

BMP Structure ID: HO103446
Existing BMP Type: DP

Existing Conditions:

The facility, built in 1985, is private and is owned by the homeowners association of the surrounding community. Drainage is collected from all main roads of the subdivision via two major stormdrain systems. Most of the runoff enters the facility to the south via a grass swale north of Mayfield Avenue; the remainder of the flow discharges into the dry pond via a CMP pipe west of the facility. The principal spillway consists of two CMP pipe outflows that discharge north into a nearby stream. This facility is not providing any water quality treatment. Dense vegetation and accumulated sediment were observed in the pond.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D003
Site Name: Green Tree Court

Contractor: Straughan
Watershed: Patapsco Lower North

Pond view from downstream berm.

Pond view from upstream.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D003
Site Name: Green Tree Court
Contractor: Straughan
Watershed: Patapsco Lower North

Constraints/Utilities:

Howard County GIS data indicates that an existing sewer main crosses the channel downstream of the existing drainage ditch.

Concept Description:

The proposed retrofit concept is to convert existing dry pond into a Micropool extended detention facility with a forebay and a Micropool. A principal spillway including a new riser structure is proposed to replace the existing dual CMP pipe outfall. An extended detention pond with micropool was chosen because the drainage area to the facility is greater than 10 ac. and the available dry storage capacity that can be reallocated to meet the current regulations to the maximum extent practicable. Ensure compliance with current MD Pond Code 378.

Nearby Opportunities:

LNB-SR-F513, LNB-BC-D004

Proposed Project Credit	
Drainage Area (ac.):	23.99
Impervious Area within Drainage (ac.):	7.29
Impervious Area Treated (ac.):	7.29
Impervious Area Treated Credit (ac.):	7.29

Water Quality Volume	
WQVolume Target (cft.):	28,171
Max Treated (cft.):	28,674
Percent Treated:	102%
Rainfall Depth Treated (in.):	1.02

Costs	
Estimated Design Cost:	$200,000
Estimated Construction Cost:	$236,729
30% Contingency:	$131,019
Estimated Total Cost	$567,748
Cost per Impervious Credit Acre:	$77,880

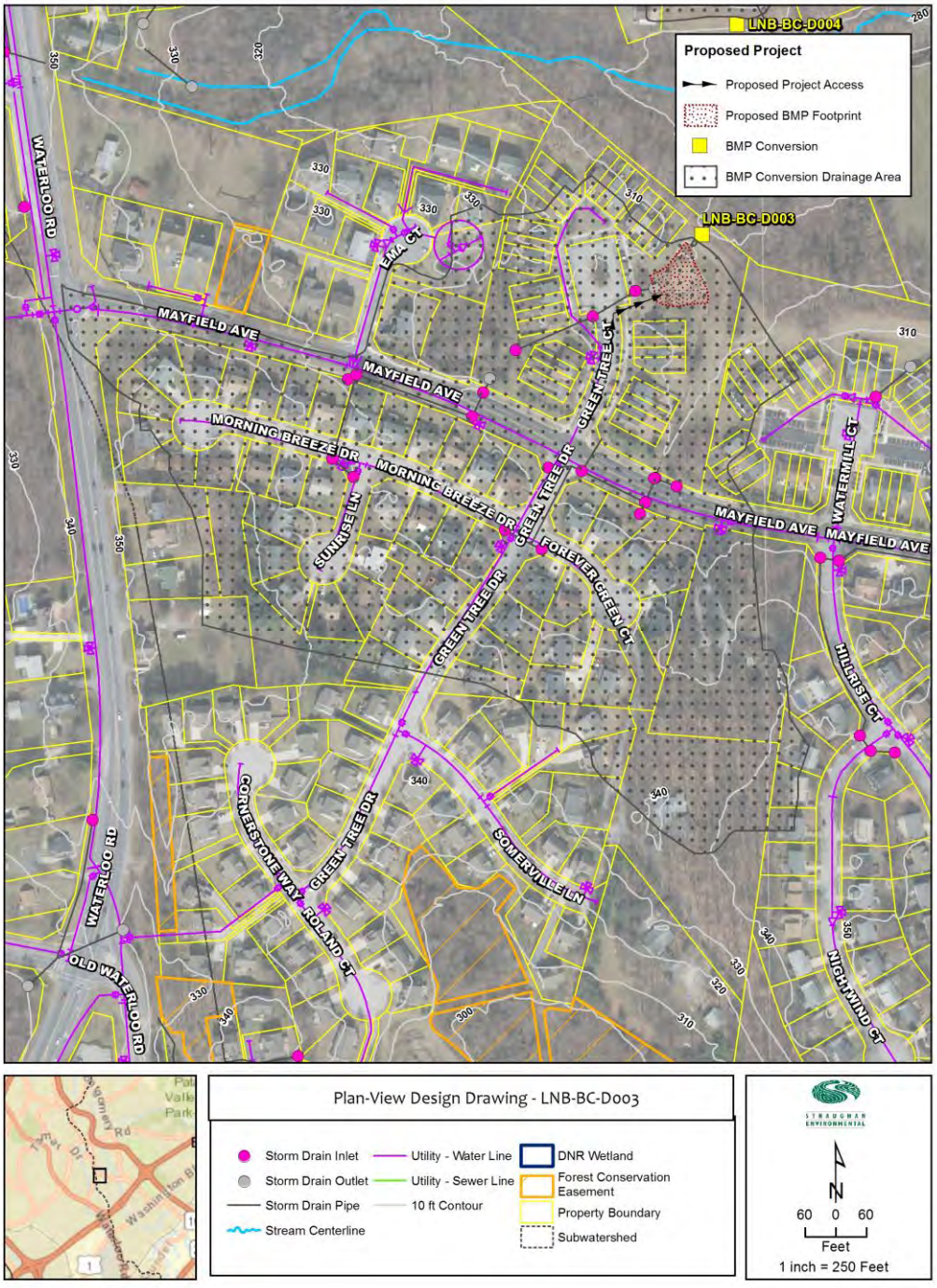
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D003

Site Name: Green Tree Court

Contractor: Straughan

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D004
Site Name: Woodcrest Drive

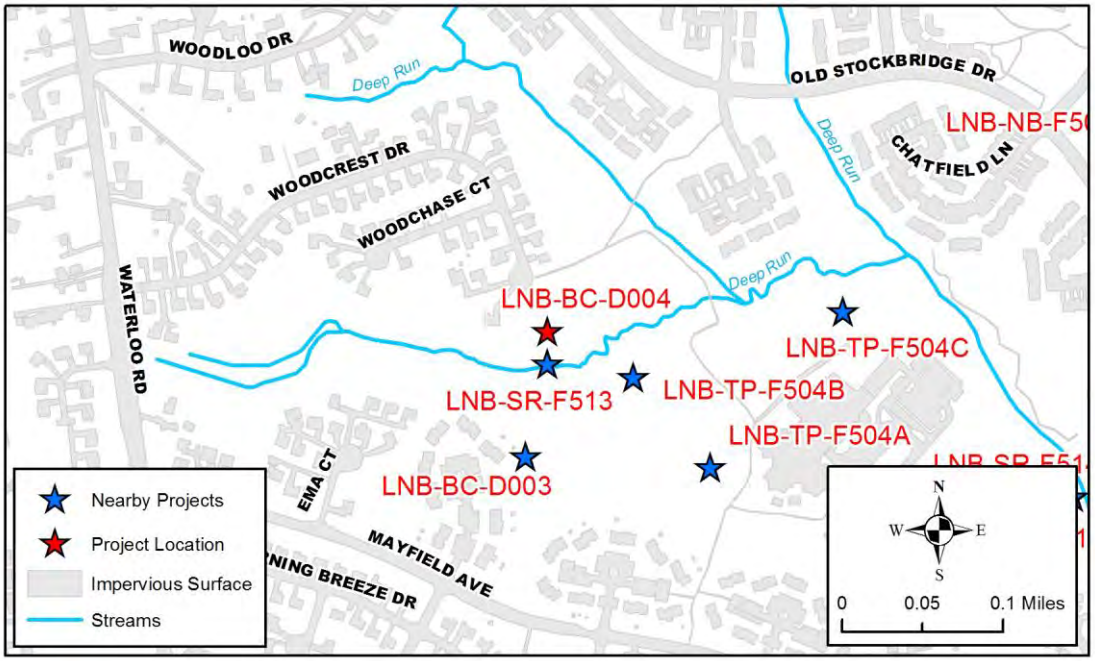
Contractor: Straughan
Watershed: Patapsco Lower North

Proposed BMP Type: Micropool Extended Detention Pond
Ownership: County Owned
Single Owner

BMP Structure ID: HO102988
Existing BMP Type: EDSD

Existing Conditions:

This facility, built in 1991, is a dry detention facility with a forebay downstream of the main storm drainage system that provides management for almost the entire Woodbrook subdivision, including all of the roadways. Only a small area bypasses the forebay and enters the pond via a grass swale located along the western property line. The current forebay spillway requires repairs to the wire mesh and replacement of rock. Existing anti-seep collar and core trench was noted on as-builts.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D004
Site Name: Woodcrest Drive
Contractor: Straughan
Watershed: Patapsco Lower North

Pond view from berm.

Pond forebay from upslope bank.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D004
Site Name: Woodcrest Drive
Contractor: Straughan
Watershed: Patapsco Lower North

Constraints/Utilities:

Howard County GIS suggests that there is a sewer line present on the west and south side of the facility but should not cause any conflict.

Concept Description:

The proposed retrofit is to excavate to increase capacity to provide for the water quality volume. The capacity of the existing forebay within the pond basin will also be increased and the riser structure will be replaced to provide the necessary storage volume and safely pass the higher storm events. An extended detention pond with micropool was chosen because the drainage area is sufficient if an anti-clogging device is installed and the available dry storage capacity can be reallocated to meet the current regulations to the maximum extent practicable. Repair to current forebay spillway components is recommended. Ensure compliance with current MD Pond Code 378.

Nearby Opportunities:

LNB-SR-F513, LNB-BC-D003

Proposed Project Credit	
Drainage Area (ac.):	10.77
Impervious Area within Drainage (ac.):	4.16
Impervious Area Treated (ac.):	4.16
Impervious Area Treated Credit (ac.):	4.16

Water Quality Volume	
WQVolume Target (cft.):	15,546
Max Treated (cft.):	15,731
Percent Treated:	101%
Rainfall Depth Treated (in.):	1.01

Costs	
Estimated Design Cost:	$200,000
Estimated Construction Cost:	$414,336
30% Contingency:	$184,301
Estimated Total Cost	$798,637
Cost per Impervious Credit Acre:	$191,980

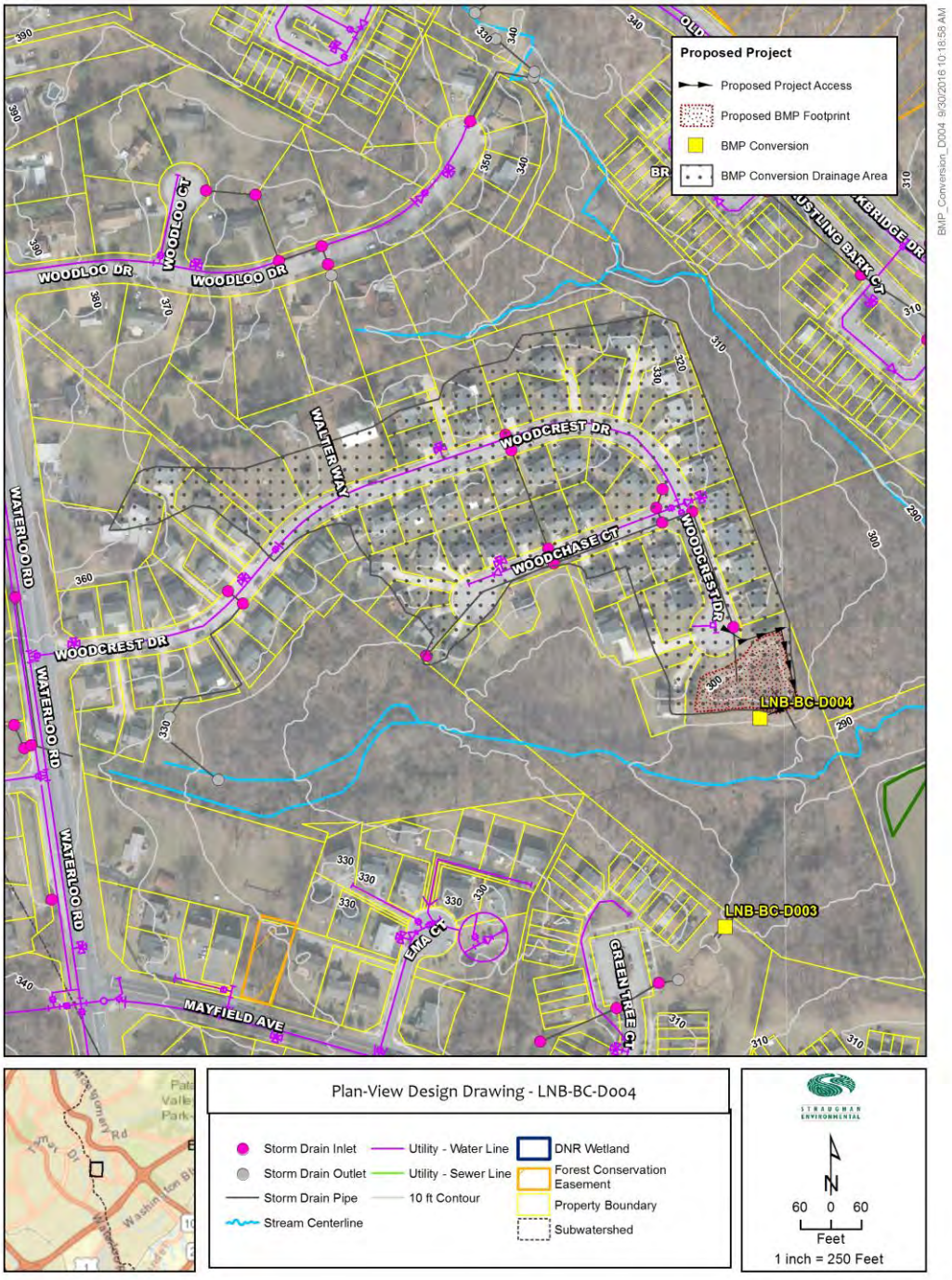
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D004

Site Name: Woodcrest Drive

Contractor: Straughan

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D005
Site Name: Karas Walk

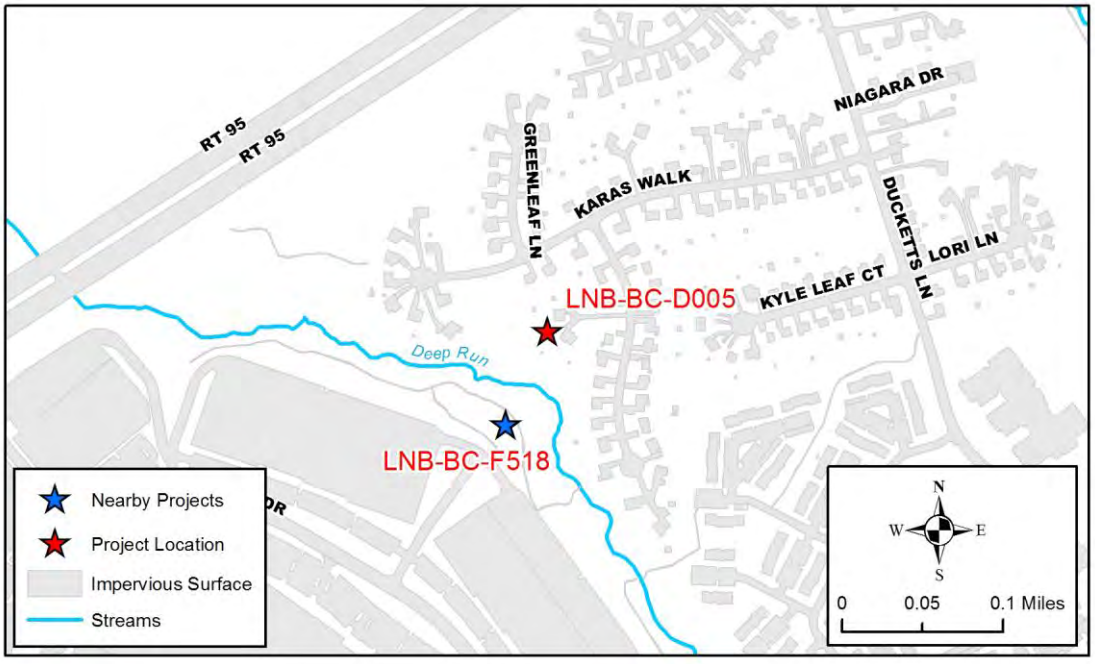
Contractor: Straughan
Watershed: Patapsco Lower North

Proposed BMP Type: Micropool Extended Detention Pond
Ownership: Private- HOA
Single Owner

BMP Structure ID: HO103080
Existing BMP Type: DP

Existing Conditions:

This facility, built in 1989, is designed as a dry pond to provide stormwater management associated with the Melbourne subdivision development and the drainage area to the stream. The facility is owned by this homeowners association. Runoff is conveyed via two main stormdrain systems that discharge at two locations into the pond. Twin RCP cross culverts convey the stream across Kara's Walk into the facility. The existing concrete riser structure discharges directly into a stream. There appears to be a measure of intended water quality pre-treatment shown on the as-built plans; however, clogging of the riser has created a permanent pool throughout the facility. Existing anti-seep collar and core trench were noted on as-builts.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D005
Site Name: Karas Walk

Contractor: Straughan
Watershed: Patapsco Lower North

Overall pond view from outlet structure.

Forebay and pond view from Karas Walk.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D005
Site Name: Karas Walk
Contractor: Straughan
Watershed: Patapsco Lower North

Constraints/Utilities:

Howard County GIS suggests that there is a 10 in. sanitary sewer immediately south of the facility that crosses the outfall of the existing principal spillway.

Concept Description:

The proposed retrofit concept is to improve water quality performance by converting the existing dry, in-line pond to a "micropool" extended detention pond. The forebays, pilot channel, and micropool (3 to 4 ft. deep) will be designed to retain adjacent vegetation to the maximum extent possible. The pond bottom is to be excavated to increase capacity and the existing outfall structure modified to store the required management volumes. A more detailed analysis may show that this design could provide channel protection while satisfying freeboard requirements.An extended detention with micropool was chosen because the drainage area is greater than 10 ac., because adequate head is available, and a micropool ED requires a relatively small footprint. Soils borings will be required to determine the water table elevation. Ensure compliance with current MD Pond Code 378.

Nearby Opportunities:

None recommended

Proposed Project Credit	
Drainage Area (ac.):	24.93
Impervious Area within Drainage (ac.):	4.37
Impervious Area Treated (ac.):	4.37
Impervious Area Treated Credit (ac.):	4.37

Water Quality Volume	
WQVolume Target (cft.):	18,802
Max Treated (cft.):	19,705
Percent Treated:	105%
Rainfall Depth Treated (in.):	1.05

Costs	
Estimated Design Cost:	$200,000
Estimated Construction Cost:	$391,963
30% Contingency:	$177,589
Estimated Total Cost	$769,552
Cost per Impervious Credit Acre:	$176,099

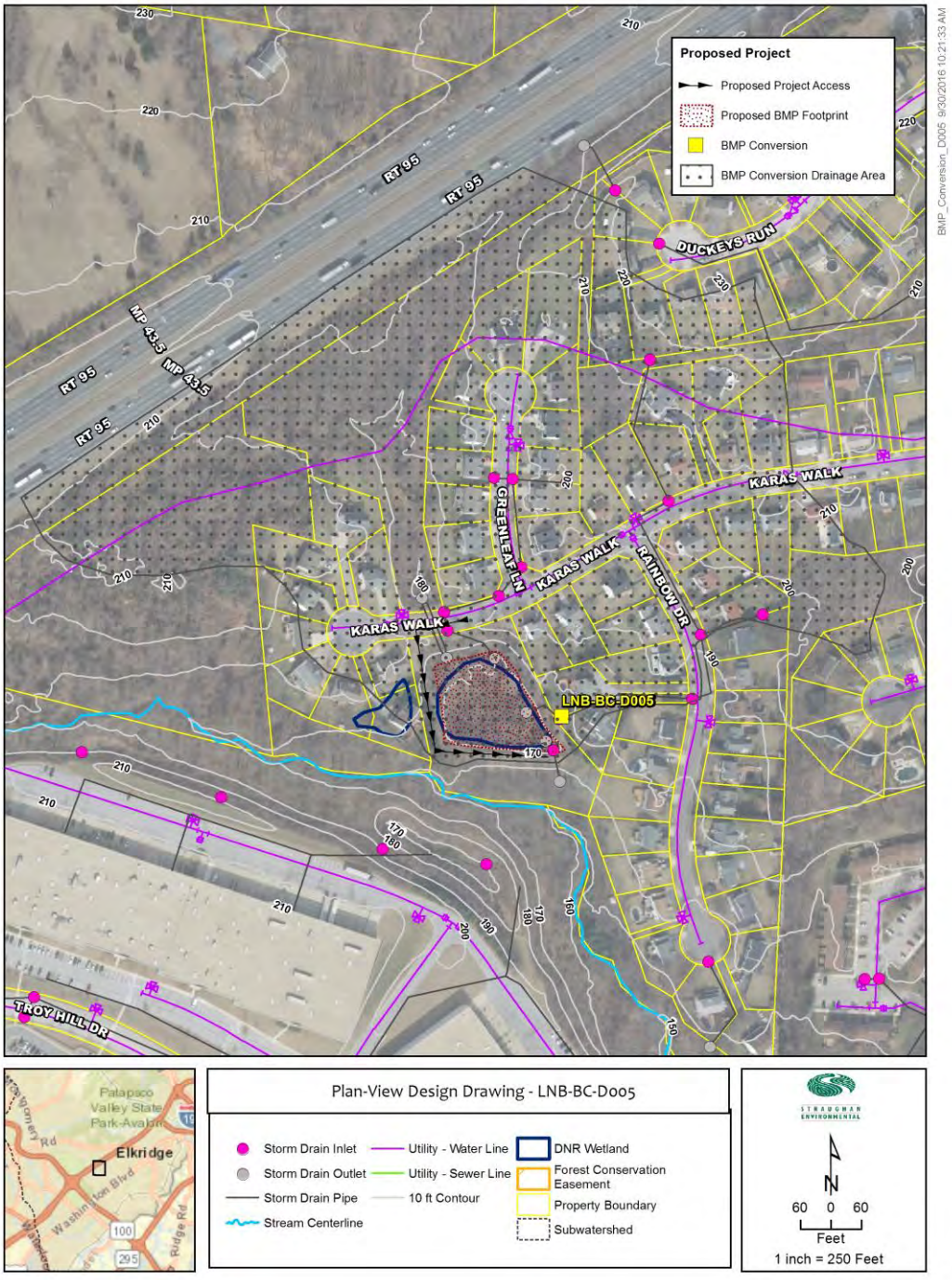
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D005

Site Name: Karas Walk

Contractor: Straughan

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D007
Site Name: Fetlock Court

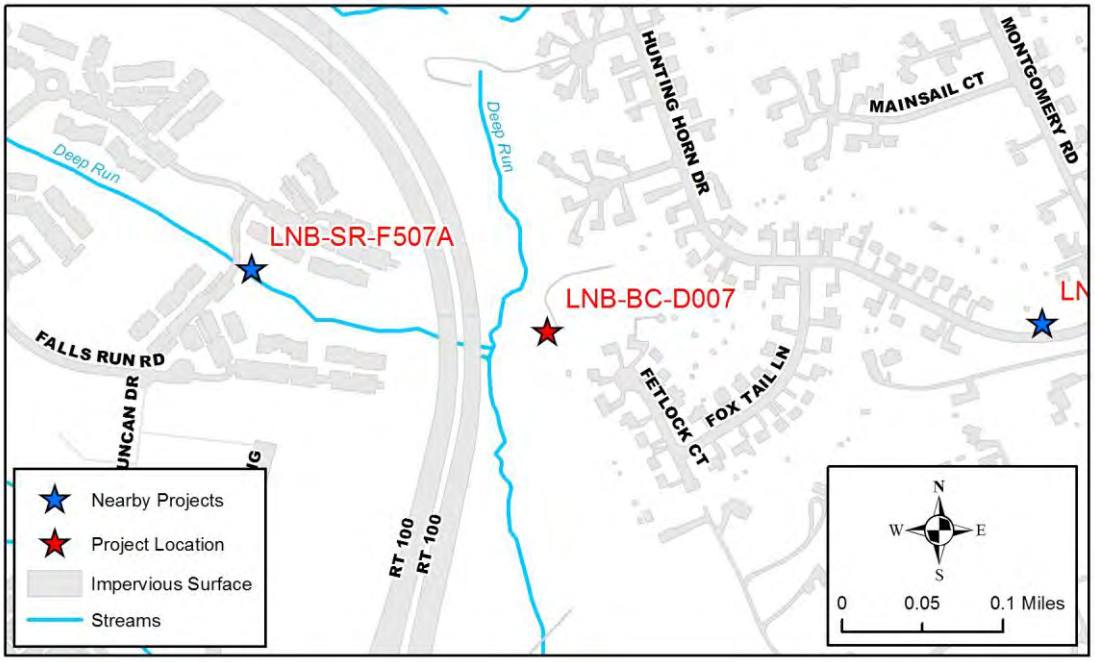
Contractor: Straughan
Watershed: Patapsco Lower North

Proposed BMP Type: Micropool Extended Detention Pond
Ownership: County Owned
Single Owner

BMP Structure ID: HO104200
Existing BMP Type: DP

Existing Conditions:

This facility, built 1983, is designed as a dry pond to provide storm water management associated with the Hunt County Estates Subdivision. Most of the development runoff is from Hunting Horn Drive, which is collected into a major storm drain system and discharges into the pond, via a 27 in. RCP pipe. The pipe leads to a swale which then leads to the riser at west side of the pond. Plans for a future 15 in. pipe to outfall into the south side of the pond are depicted on the as-built drawings. A 36 in. BCCMP spillway then discharges to a riprap channel before entering a nearby stream. No water quality improvement is being provided by the pond. At the outfall and downstream of the outfall, erosion was observed. Siltation and standing water was observed at the inlet to the outfall.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D007
Site Name: Fetlock Court

Contractor: Straughan
Watershed: Patapsco Lower North

Pond view from embankment.

Upstream view of pond inflow ditch.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D007
Site Name: Fetlock Court
Contractor: Straughan
Watershed: Patapsco Lower North

Constraints/Utilities:

No apparent utility conflicts; however, a sewer line is present on north and west sides of the facility.

Concept Description:

The proposed retrofit concept is to improve water quality performance by converting the existing dry pond to a "micropool" extended detention pond. The forebay, pilot channel, and micropool (3 to 4 ft. deep) will be designed to retain adjacent vegetation to the maximum extent possible. The existing mature vegetation within the pond will be removed and the pond bottom is to be excavated to increase capacity and the existing outfall structure modified to store the required management volumes. A more detailed analysis may show that this design could provide channel protection while satisfying freeboard requirements.An extended detention pond with micropool was chosen because the drainage area to the facility is greater than 10 ac. and the available dry storage capacity that can be reallocated to meet the current regulations to the maximum extent practicable. Ensure compliance with current MD Pond Code 378.

Nearby Opportunities:

None recommended

Proposed Project Credit	
Drainage Area (ac.):	19.24
Impervious Area within Drainage (ac.):	4.41
Impervious Area Treated (ac.):	4.41
Impervious Area Treated Credit (ac.):	4.41

Water Quality Volume	
WQVolume Target (cft.):	17,900
Max Treated (cft.):	18,250
Percent Treated:	102%
Rainfall Depth Treated (in.):	1.02

Costs	
Estimated Design Cost:	$200,000
Estimated Construction Cost:	$335,775
30% Contingency:	$160,733
Estimated Total Cost	$696,508
Cost per Impervious Credit Acre:	$157,938

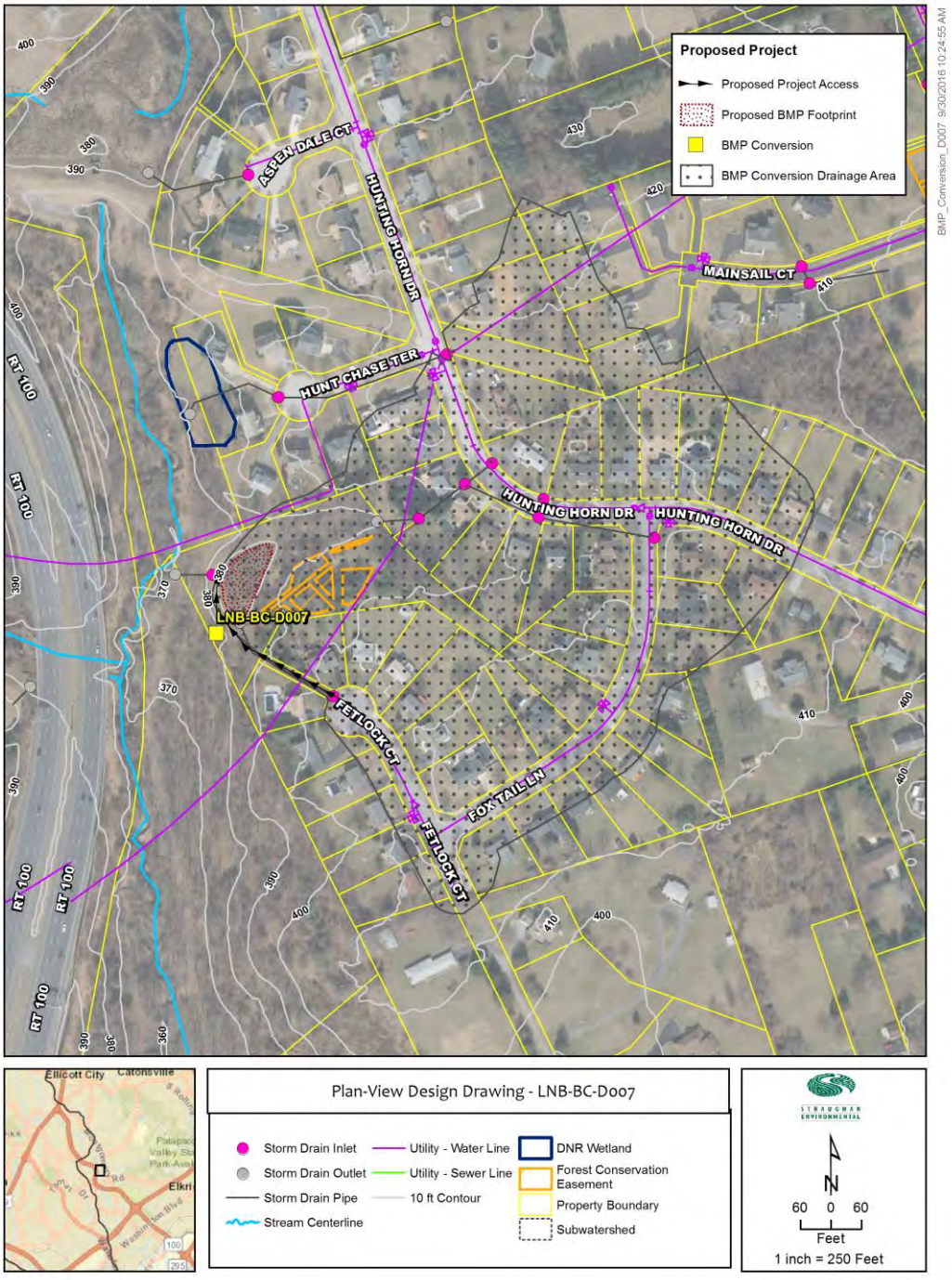
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D007

Site Name: Fetlock Court

Contractor: Straughan

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D008
Site Name: Hunting Horn Dr

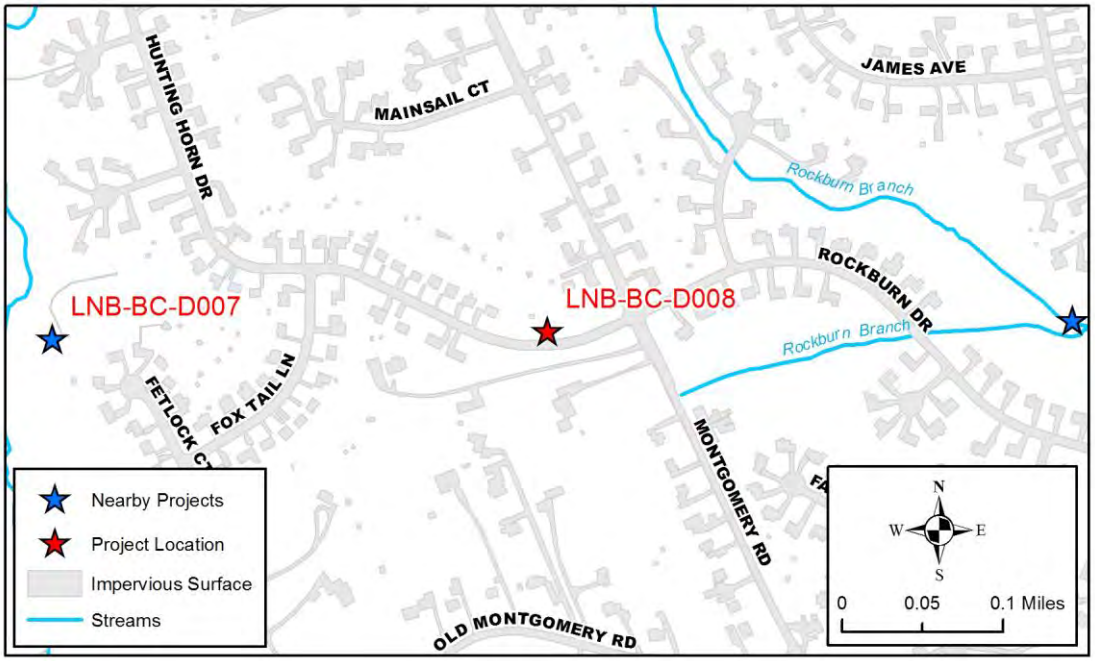
Contractor: Straughan
Watershed: Patapsco Lower North

Proposed BMP Type: Micropool Extended Detention Pond
Ownership: County Owned
Single Owner

BMP Structure ID: HO102506
Existing BMP Type: DP

Existing Conditions:

The facility, built 1984, is in public ownership. Drainage is collected from Hunting Horn Drive and Montgomery Road via a stormdrain system that is designed to flow into the dry pond through an inlet and 21 in. RCP. A concrete structure with an internal weir and low flow orifice within the downstream stormdrain system restricts flows draining to the downstream 18 in. RCP under Montgomery Road. The downstream storm drain system ultimately discharges into a stream that connects to Rockburn Branch.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D008
Site Name: Hunting Horn Dr

Contractor: Straughan
Watershed: Patapsco Lower North

Downstream view of earthen berm.

Upstream view of pond.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D008
Site Name: Hunting Horn Dr
Contractor: Straughan
Watershed: Patapsco Lower North

Constraints/Utilities:

None.

Concept Description:

The proposed retrofit concept is to improve water quality performance by converting the existing dry pond to a "micropool" extended detention pond. The forebay, pilot channel, and micropool (3 to 4 ft. deep) will be designed to retain adjacent vegetation to the maximum extent possible. The pond bottom is to be excavated to increase capacity and the existing outfall structure modified to store the required management volumes. The existing inlet to the south of the pond is to be replaced with a splitter structure to allow runoff to be diverted during low flow events. A more detailed analysis may show that this design could provide channel protection. A detailed hydraulic gradient analysis of this downstream storm drain is necessary to determine the effects on peak discharge capacity and on water surface elevations in the pond. Soil borings may be required to determine water table elevation.

An extended detention pond with micropool with a forebay was chosen because an anti-clogging device will be installed (since the drainage area is less than 10 ac.), adequate head is available, and since space is limited a micropool ED requires a relatively small footprint. Ensure compliance with current MD Pond Code 378.

Nearby Opportunities:

None Recommended

Proposed Project Credit	
Drainage Area (ac.):	3.9
Impervious Area within Drainage (ac.):	0.9
Impervious Area Treated (ac.):	0.9
Impervious Area Treated Credit (ac.):	1

Water Quality Volume	
WQVolume Target (cft.):	3,649
Max Treated (cft.):	6,092
Percent Treated:	167%
Rainfall Depth Treated (in.):	1.67

Costs

Estimated Design Cost:	$200,000
Estimated Construction Cost:	$188,831
30% Contingency:	$116,649
Estimated Total Cost	$505,480
Cost per Impervious Credit Acre:	$505,480

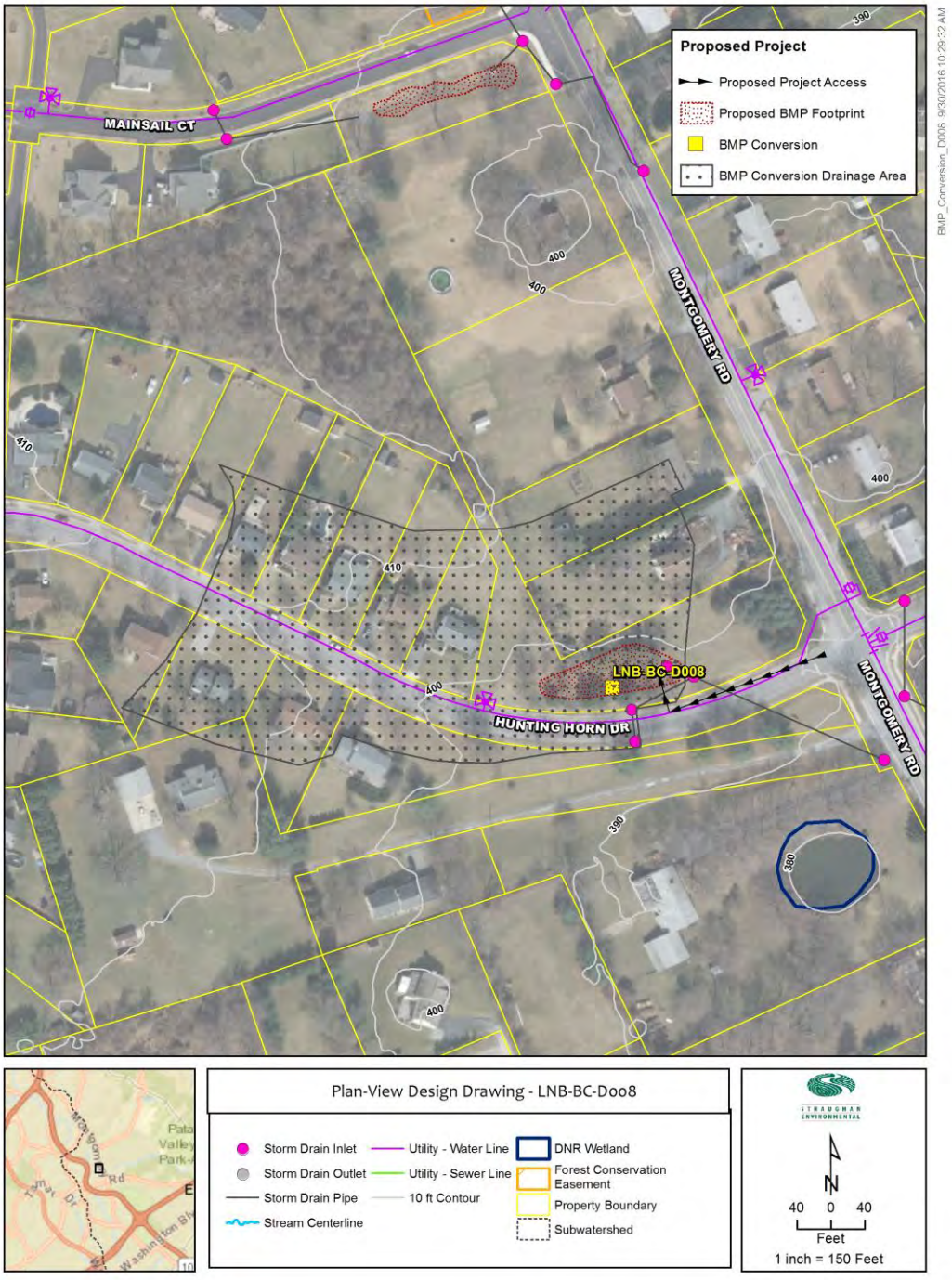
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D008

Site Name: Hunting Horn Dr

Contractor: Straughan

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D009
Site Name: Debbie Court

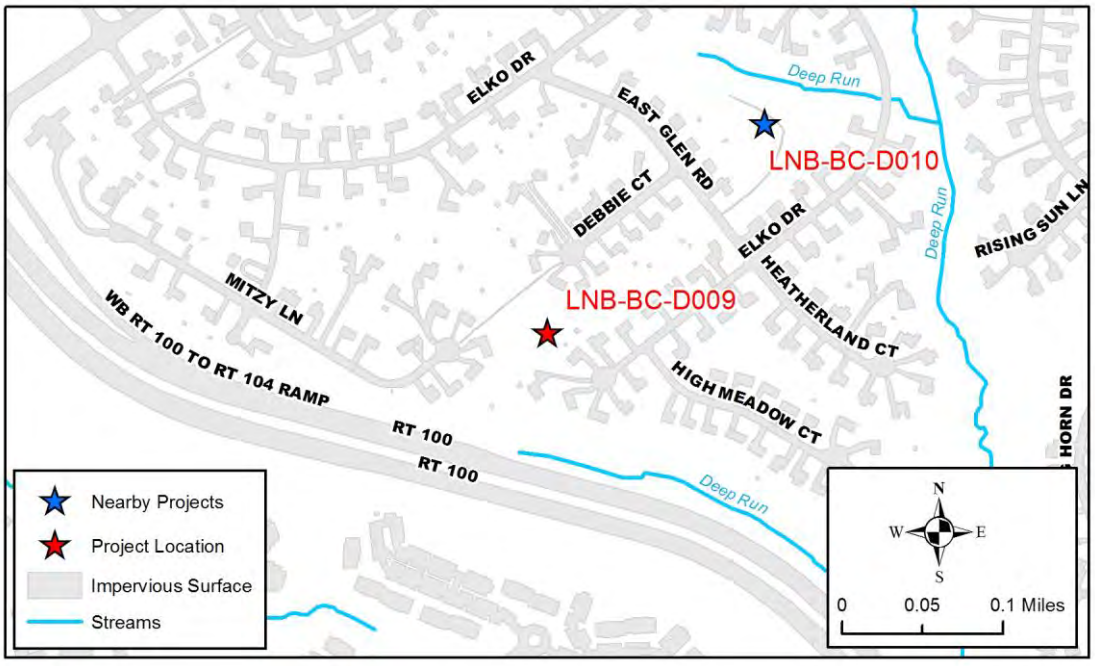
Contractor: Straughan
Watershed: Patapsco Lower North

Proposed BMP Type: Micropool Extended Detention Pond
Ownership: County Owned
Single Owner

BMP Structure ID: HO103177
Existing BMP Type: DP

Existing Conditions:

The facility, built 1984, is in public ownership. Drainage is collected from Mitzy Lane via a stormdrain system that discharges into a riprap apron at the northwest side of the pond. The dry pond outfalls through a riser structure ultimately flowing to a nearby open field.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D009
Site Name: Debbie Court

Contractor: Straughan
Watershed: Patapsco Lower North

Overall pond view from berm.

Downstream view to receiving storm drain pipe.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D009
Site Name: Debbie Court
Contractor: Straughan
Watershed: Patapsco Lower North

Constraints/Utilities:

A sanitary sewer line is running parallel to the existing stormdrain. A house was noted downstream and below the pond bottom elevation.

Concept Description:

The proposed retrofit concept is to improve water quality performance by converting the existing dry pond to a "micropool" extended detention pond. The forebay, pilot channel, and micropool (4 ft. deep) will be designed to retain adjacent vegetation to the maximum extent possible. A manhole and pipe is to be connected to the existing 18 in. RCP stormdrain pipe at the northwest end of the pond. The existing pond bottom is to be excavated to provide a flatter slope for the pilot channel. The existing outfall structure is in excellent condition and is to be modified to store the required management volumes. A more detailed analysis may show that this design could provide channel protection while satisfying freeboard requirements. An extended detention pond with micropool was chosen because the drainage area is greater than 10 ac., and since space is limited a micropool ED requires a relatively small footprint. Ensure compliance with current MD Pond Code 378.

Nearby Opportunities:

None recommended

Proposed Project Credit	
Drainage Area (ac.):	13.35
Impervious Area within Drainage (ac.):	3.39
Impervious Area Treated (ac.):	3.39
Impervious Area Treated Credit (ac.):	3.39

Water Quality Volume	
WQVolume Target (cft.):	13,499
Max Treated (cft.):	14,192
Percent Treated:	105%
Rainfall Depth Treated (in.):	1.05

Costs

Estimated Design Cost:	$200,000
Estimated Construction Cost:	$235,760
30% Contingency:	$130,728
Estimated Total Cost	$566,488
Cost per Impervious Credit Acre:	$167,106

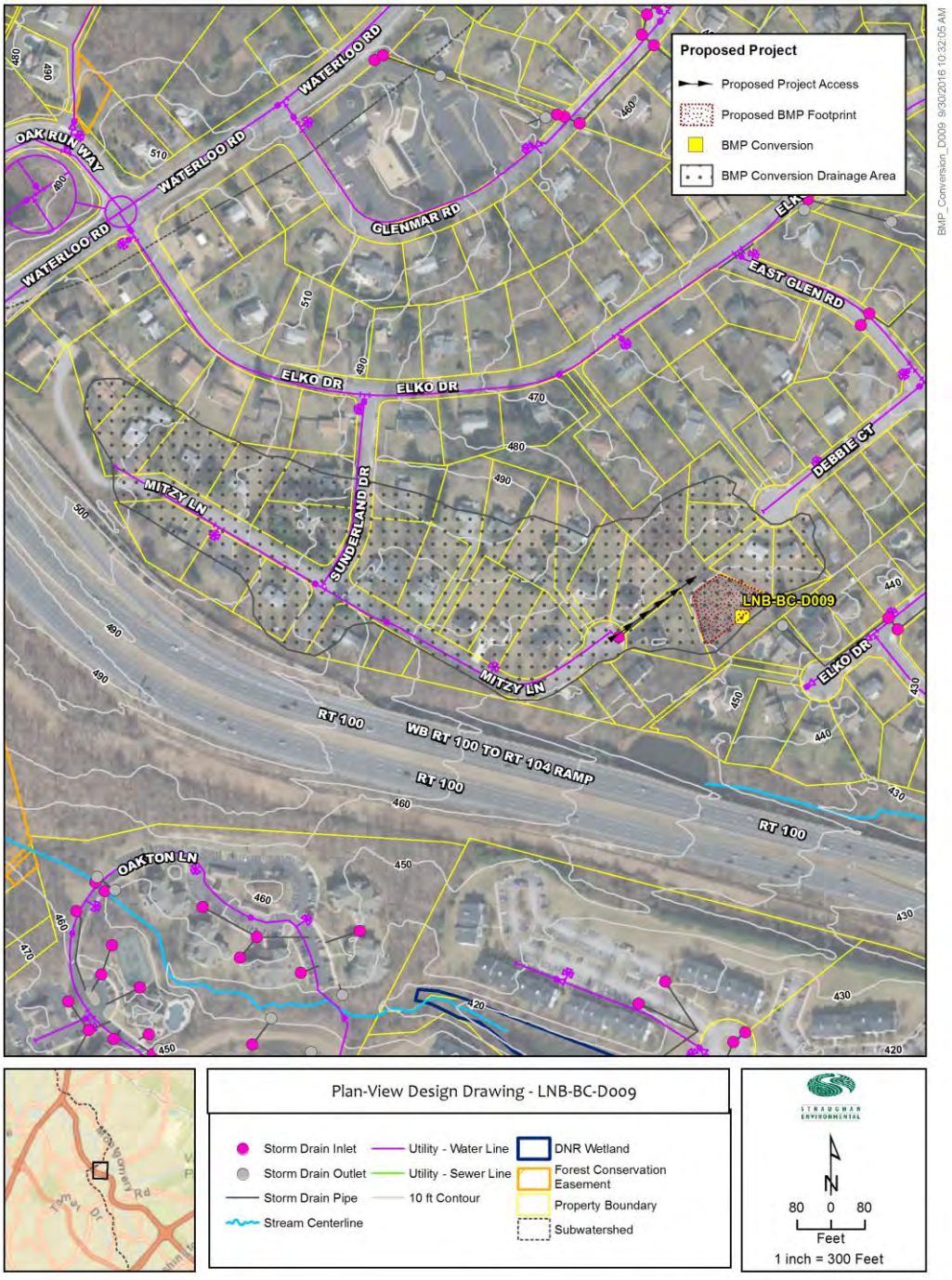
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D009

Site Name: Debbie Court

Contractor: Straughan

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D010
Site Name: East Glen Road

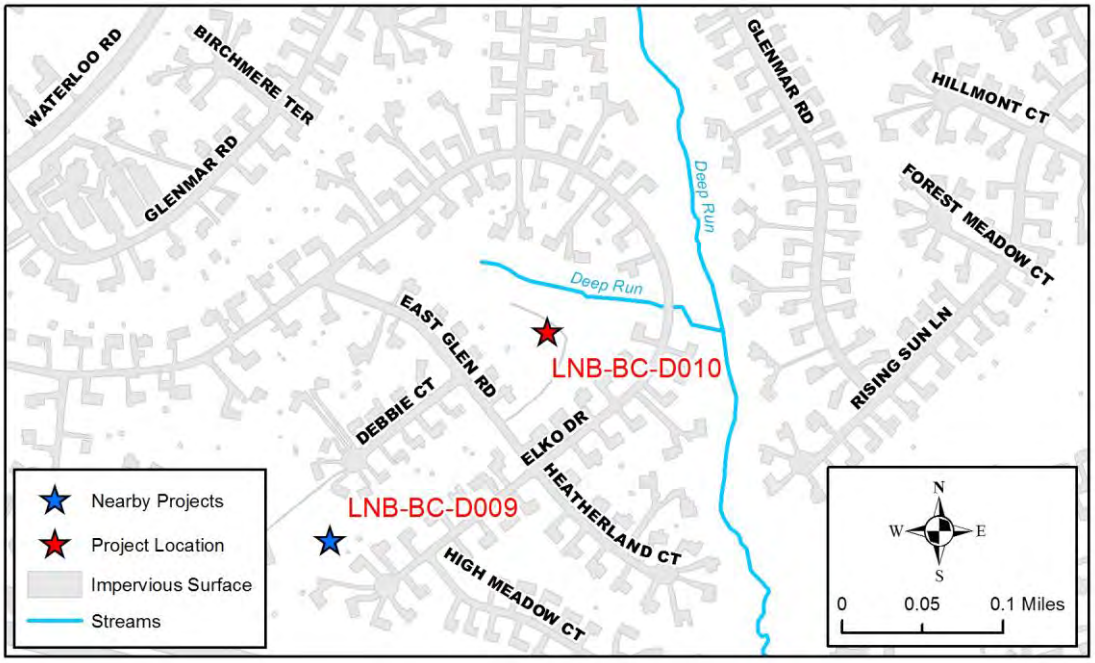
Contractor: Straughan
Watershed: Patapsco Lower North

Proposed BMP Type: Infiltration Basin
Ownership: County Owned
Single Owner

BMP Structure ID: HO103176
Existing BMP Type: DP

Existing Conditions:

The facility, built 1984, is in public ownership according to County GIS property data. Drainage is collected from East Glen Road and discharged into a small drainage swale located between two residences. Eventually, stormwater runoff is conveyed to a dry stormwater management pond and ultimately discharged into the county drainage system.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D010
Site Name: East Glen Road

Contractor: Straughan
Watershed: Patapsco Lower North

Pond view from access path.

Outfall into stream.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D010
Site Name: East Glen Road
Contractor: Straughan
Watershed: Patapsco Lower North

Constraints/Utilities:

Based on as-built drawings, there no utilities within the limit of disturbance, except for the overflow structure to be replaced. All other utilities appear to be within the right-of-way. The ultimate discharge location for the infiltration pond may encroach onto the adjacent property. If so, a quick claim deed or easement may be required prior to construction.

Concept Description:

This project will convert a dry stormwater detention pond into an infiltration basin with a forebay. The concept requires the removal of 3.5 ft. of existing soil and the installation of underground perforated pipes. The excavated soils will be replaced with 1 ft. of crushed stone, 15 in. of sand with 3 in. of topsoil. The proposed basin will have an elevation approximately 1 ft. lower than the existing pond. To provide pre-treatment, the existing drainage ditch will be upgraded with the installation of synthetic erosion control blankets and construction of a dry forebay with a concrete level spreader. The infiltration basin is sized to provide water quality (WQv) for the greater than 1-in. storm event. Given the available pond bed surface, only a portion will need to be converted to infiltration media. Recharge volume (to the aquifer) is provided within a stone-filled reservoir directly below the basin. A new overflow structure and discharge pipe will be constructed to provide flow for the underground pipes. Since the elevation of the outfall is lower than the existing conditions, the discharge pipe needs to be extended farther from the pond and may require an easement for construction. An infiltration basin was chosen because the drainage area is under the maximum threshold, there is adequate head, and there is recharge availability. Infiltration basins are relatively moderately easy to maintain and are not a safety concern. A geotechnical investigation is required to confirm infiltration rates. If the geotechnical analysis shows inadequate infiltration rates, then a secondary option, such as micropool extended detention pond or retention pond, should be considered. Ensure compliance with current MD Pond Code 378.

Nearby Opportunities:

None recommended

Proposed Project Credit	
Drainage Area (ac.):	8.76
Impervious Area within Drainage (ac.):	2.11
Impervious Area Treated (ac.):	2.11
Impervious Area Treated Credit (ac.):	2.32

Water Quality Volume	
WQVolume Target (cft.):	8,483
Max Treated (cft.):	12,413
Percent Treated:	146%
Rainfall Depth Treated (in.):	1.46

Costs

Estimated Design Cost:	$220,000
Estimated Construction Cost:	$383,362
30% Contingency:	$181,009
Estimated Total Cost	$784,371
Cost per Impervious Credit Acre:	$338,091

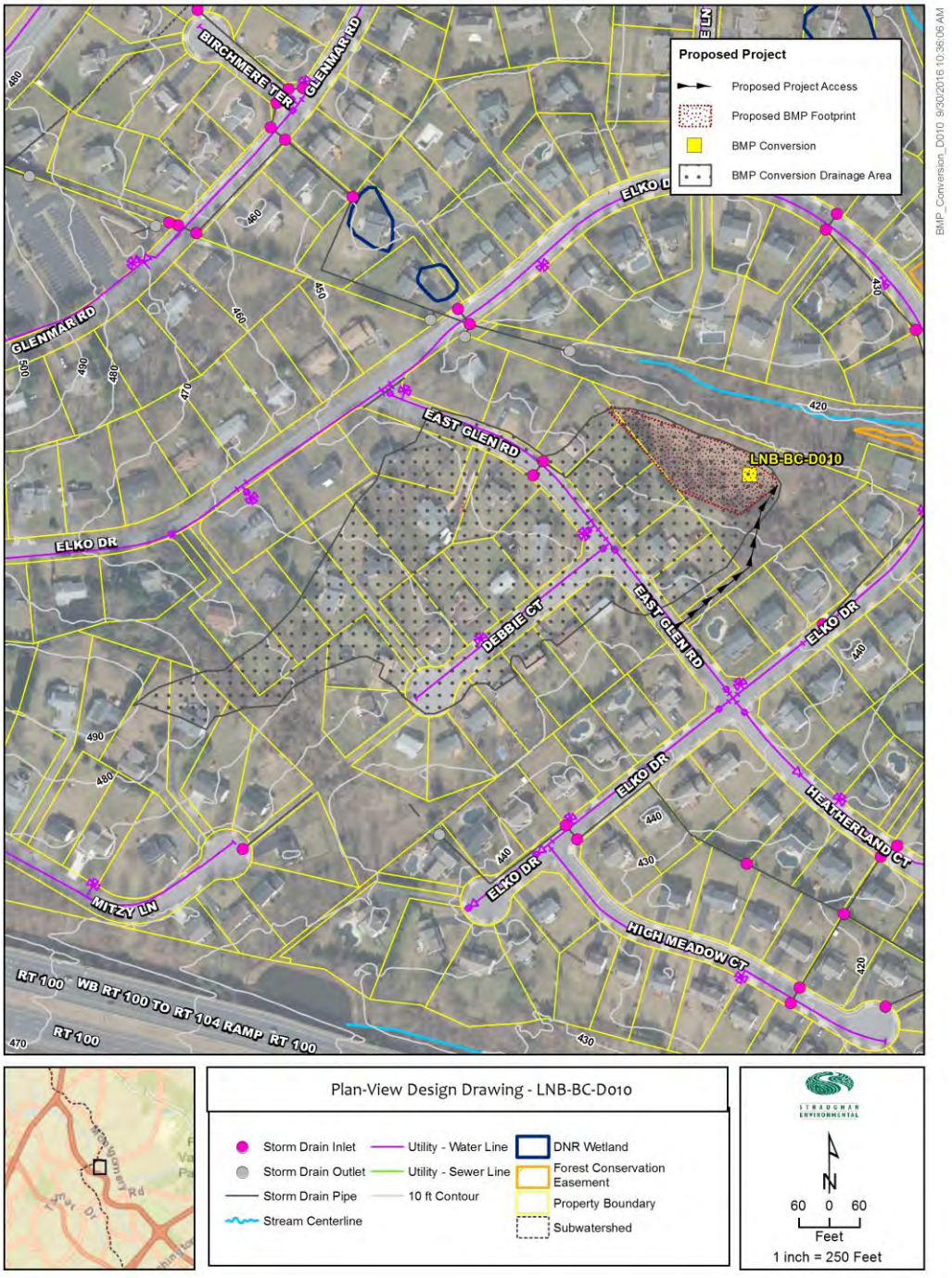
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D010

Site Name: East Glen Road

Contractor: Straughan

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D012
Site Name: Kesting Court

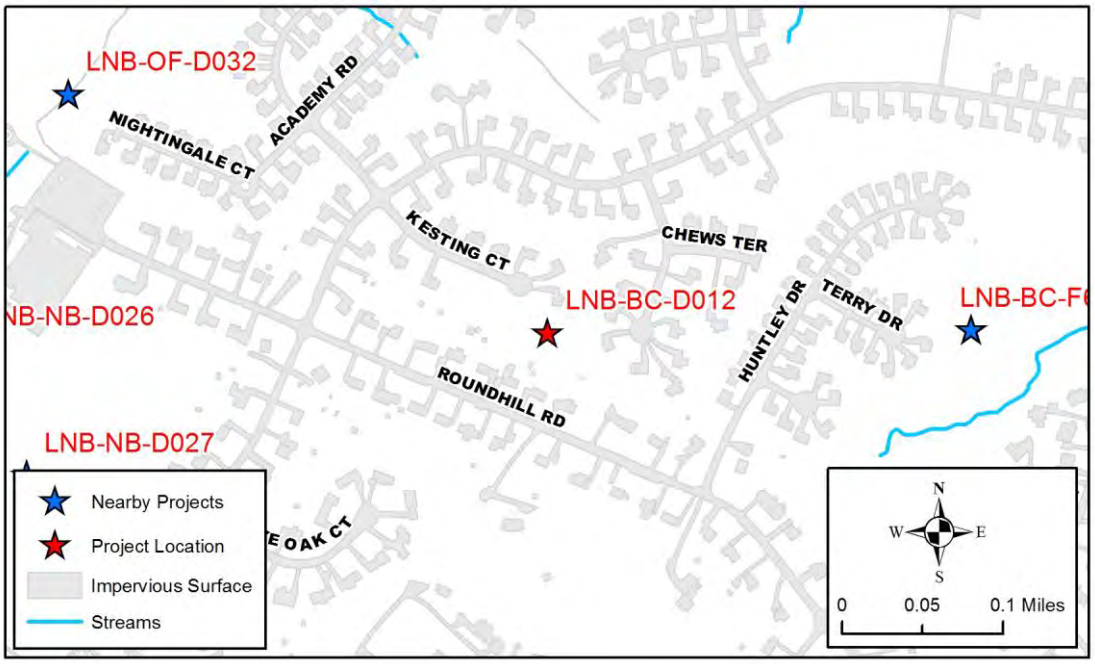
Contractor: Straughan
Watershed: Patapsco Lower North

Proposed BMP Type: Extended Detention Pond - Wetland
Ownership: County Owned
Single Owner

BMP Structure ID: HO103224
Existing BMP Type: DP

Existing Conditions:

This existing dry pond, built 1992, is labeled SWM #1 on the as-built plan and is adjacent to Kesting Court cul-de-sac. The pond receives runoff from two separate storm drain systems that discharge to the west through two 24 in. pipes. The low orifice of the riser is currently clogged and causing standing water. The pond outfalls via a 36 in. spillway to an unstable ditch that runs through residential backyards to a nearby public storm drain system.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D012
Site Name: Kesting Court

Contractor: Straughan
Watershed: Patapsco Lower North

Pond view from riser side berm.

Upstream view of outfall channel.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D012
Site Name: Kesting Court
Contractor: Straughan
Watershed: Patapsco Lower North

Constraints/Utilities:

Howard County GIS data suggests that there is are existing sewer and water lines within the 20 ft. easement where the channel outfall is proposed.

Concept Description:

This facility is proposed to be retrofit to an extended detention shallow wetland with micro pools downstream of both 24 in. pipes with low and high march zones as shown on the plan view. Moving the riser and embankment closer to the downstream property line will expand the facility capacity. A stable outfall will be provided upstream within the existing 20 ft. utility easement.A shallow wetland was chosen because the drainage area is sufficient if an anti-clogging device is installed, because there is adequate head, and because retaining existing vegetation was desirable. Shallow wetlands provide high habitat quality, are relatively easy to maintain, and are not a safety concern. Ensure compliance with current MD Pond Code 378.

Nearby Opportunities:

None Recommended

Proposed Project Credit	
Drainage Area (ac.):	16.38
Impervious Area within Drainage (ac.):	3.97
Impervious Area Treated (ac.):	3.97
Impervious Area Treated Credit (ac.):	3.97

Water Quality Volume	
WQVolume Target (cft.):	15,943
Max Treated (cft.):	18,322
Percent Treated:	115%
Rainfall Depth Treated (in.):	1.15

Costs	
Estimated Design Cost:	$220,000
Estimated Construction Cost:	$242,090
30% Contingency:	$138,627
Estimated Total Cost	$600,717
Cost per Impervious Credit Acre:	$151,314

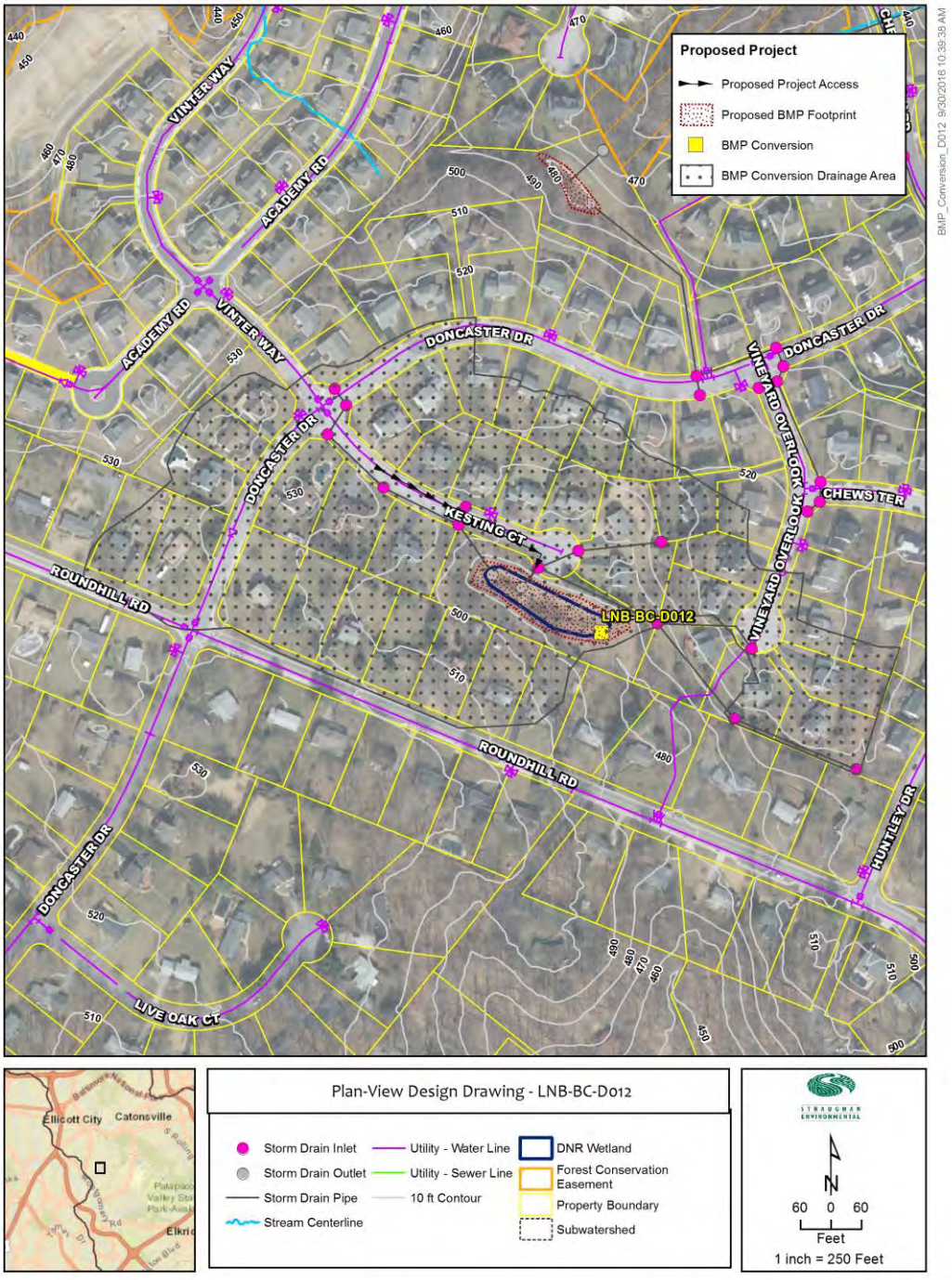
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D012

Site Name: Kesting Court

Contractor: Straughan

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D013
Site Name: Thornbrook Road

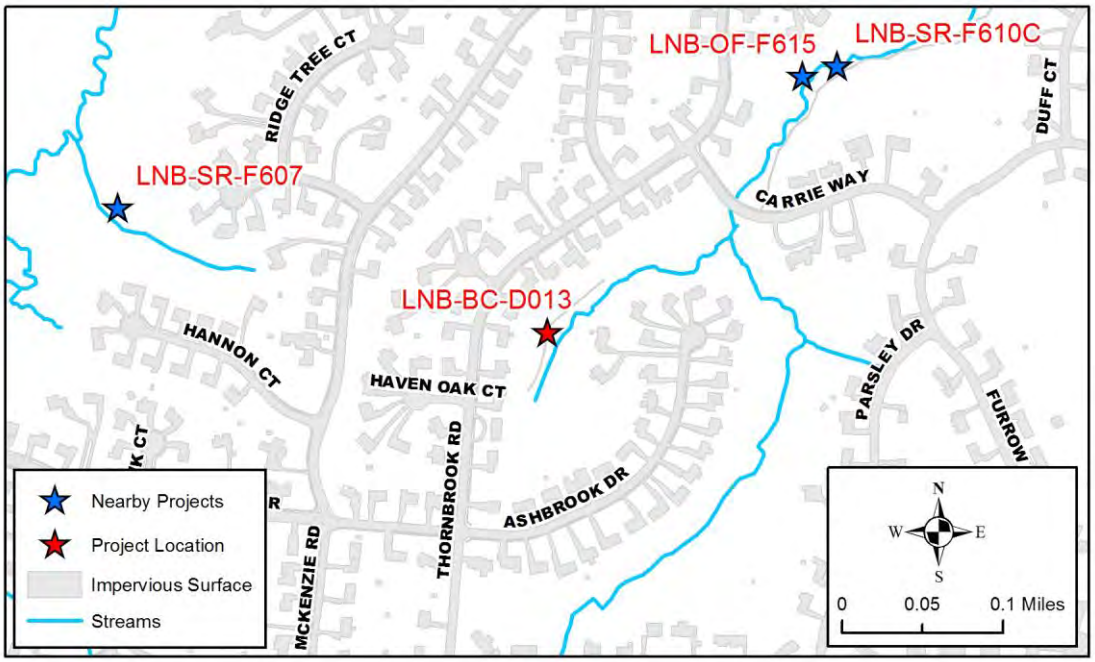
Contractor: Straughan
Watershed: Patapsco Lower North

Proposed BMP Type: Extended Detention Structure, Wet
Ownership: County Owned
Single Owner

BMP Structure ID: HO103412
Existing BMP Type: DP

Existing Conditions:

This facility, built 1988, is noted as a water quality wet pond on the as-built drawings for the Mt. Hebron Subdivision development; however,photographs, field investigation, and the county's database indicate it is a dry pond. Most of the subdivision runoff is from the southern portion of Thornbrook Road, Haven Oak Court, and Sara Beth Court which drain into a major storm drain system. This system discharges into the pond via a 33 in. CMP pipe. The pond outfalls its high flow via a weir with a crest elevation of 402.1 ft. which discharges against the receiving stream flow. The pond outfalls its low flow via a 12 in. BCCMP spillway. The spillway is severely eroded with crumbling concrete and displaced riprap. The field photos do not depict the weir nor do they depict the plate with a 3 in. diameter hole welded to the face of the 12 in. BCCMP pipe as shown on the as-built drawings for the facility. The pond appears to provide very limited water quality benefit.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D013
Site Name: Thornbrook Road
Contractor: Straughan
Watershed: Patapsco Lower North

Pond view upstream from streamside berm.

Outfall channel looking upstream to SWM facility. Spillway erosion noted.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D013
Site Name: Thornbrook Road
Contractor: Straughan
Watershed: Patapsco Lower North

Constraints/Utilities:

There are no apparent conflicts with existing utilities.

Concept Description:

The concept retrofit design is to replace the dry pond with a wet extended detention pond. Either full water quality treatment or a pretreatment forebay will not be provided due to limited available space. The ponding will require excavation for the water quality volume storage. The low-flow orifice invert will have to be raised. A wet extended detention pond was chosen because the drainage area to the facility is greater than 10 ac. and the available dry storage capacity that can be reallocated to meet the current regulations to the maximum extent practicable. The estimate also includes embankment repair at an outfall at the upstream end of the pond that is not shown on the as-builts. Ensure compliance with current MD Pond Code 378.

Nearby Opportunities:

None Recommended

Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	19.63	WQVolume Target (cft.):	23,198
Impervious Area within Drainage (ac.):	6.01	Max Treated (cft.):	23,365
Impervious Area Treated (ac.):	6.01	Percent Treated:	101%
Impervious Area Treated Credit (ac.):	6.01	Rainfall Depth Treated (in.):	1.01

Costs

Estimated Design Cost:	$200,000
Estimated Construction Cost:	$264,608
30% Contingency:	$139,382
Estimated Total Cost	$603,990
Cost per Impervious Credit Acre:	$100,498

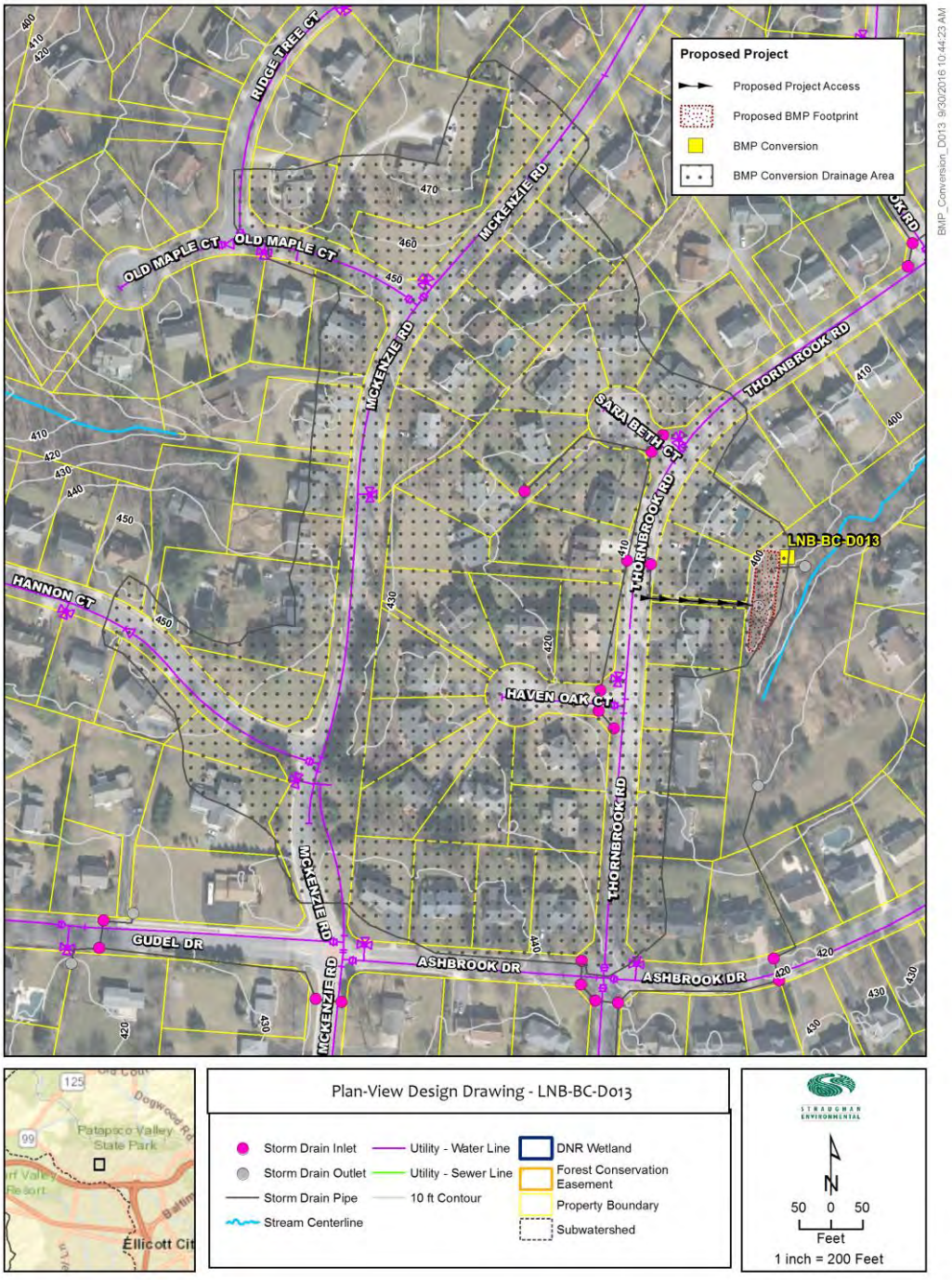
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-D013

Site Name: Thornbrook Road

Contractor: Straughan

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F501
Site Name: Britt Ct (Deep Run)

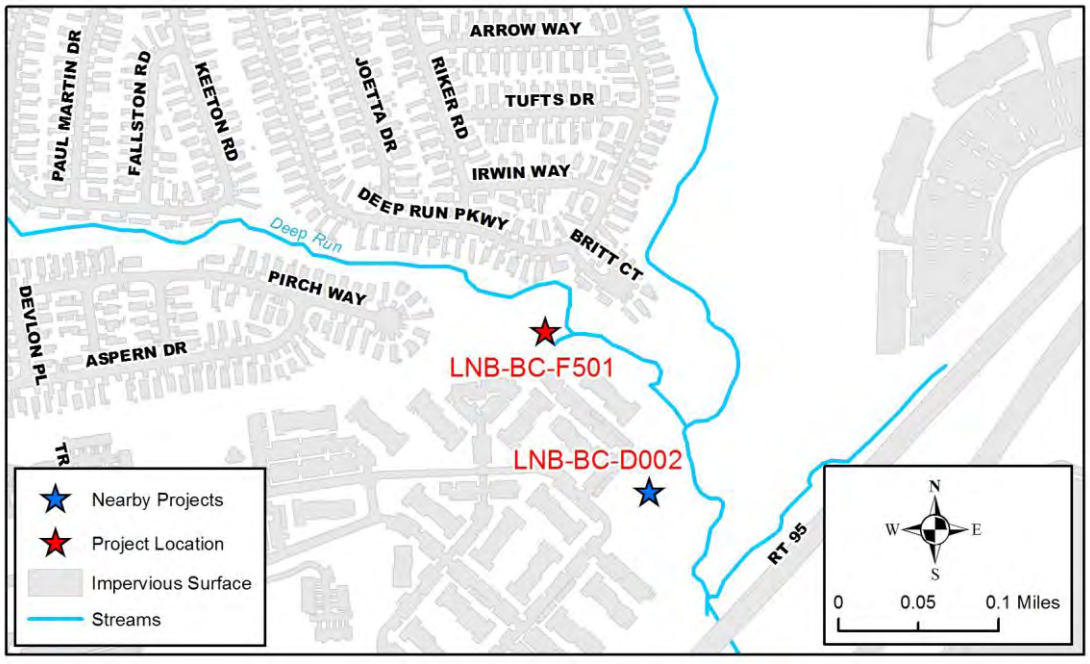
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Retention Pond (Wet Pond)
Ownership: Private- HOA
Single Owner

BMP Structure ID: HO104778
Existing BMP Type: DP

Existing Conditions:

The site consists of a residential neighborhood and the pond appears to be online with a channel running through the facility. Currently, the 169.65 ac. drainage area includes the bordering neighborhoods along with portions of Old Waterloo Road and commercial and residential buildings west of Old Waterloo Road. Discharge enters the facility from the stream from the west/northwest and a storm drain outfall from the west/southwest. The stream channel has a large number of storm drain outfall points from the residential neighborhoods both south and north of the channel. The existing pond has a severe amount of sediment (estimated 2+ ft.) and is swamp-like with standing water and trees in the pond bottom. A significant amount of trash was observed on the pond perimeter and at the embankment. Per the original design plans F-80-162, a 30 in. low flow RCP pipe with an end section is to convey the stream baseflow. As observed in the field, the pipe and end section are almost buried in sediment. The sediment has built up around the end section resulting in a depression for the constant flow to leave the facility. The large concrete riser structure with weirs on all sides appears to be in good condition along with the twin 30 in. RCP principal spillway pipes. An emergency spillway to the north has riprap stabilization with vegetation growing. A large scour hole is present at the outfall and moderate erosion is occurring in the stream banks downstream. No utilities were observed in the field, but per the plans and County data, a sewer line runs along the north edge of the existing pond.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F501
Site Name: Britt Ct (Deep Run)

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking north along the embankment toward the riser structure.

Looking west toward the pond area from the emergency spillway/embankment.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F501
Site Name: Britt Ct (Deep Run)
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include the property ownership, available surface area, proximity to homes, and limited access. The pond is on private property and is contained within Deep Run Associates owned land. Access will be difficult with steep slopes and density of homes with limited easements. No utilities were observed in the pond vicinity during the initial site assessment; however, a sewer line is shown in the map and design plans along the northern side of the facility and will need to be considered during final design.

Concept Description:

A wet retention pond is proposed within the existing footprint of the dry pond. The permanent pool elevation is proposed at 217.00 ft. and will be 7 ft. deep at 3:1 slopes to a bottom elevation of 210.00 ft, providing 204,647 cf. of wet storage. Due to limited project area, sewer line, and the in-line nature of the facility, no forebay is provided. The permanent pool of the facility is proposed south of the sewer line, but survey verification of the sewer location and depth is required prior to final design to ensure a sufficient buffer is provided. Restrictions based on the determined sewer location and elevation may reduce the provided treatment. No maintenance benches are currently proposed along the south side of the facility, but one could be added, resulting in a reduction of the WQv treatment in the permanent pool. Due to the current condition of the pond bottom with severe sedimentation and a large number of unhealthy trees, anticipated excavation will be extensive. The emergency spillway will remain and a new concrete riser structure will be added with weirs to maintain the current discharges and provide sufficient freeboard. The outfall will be stabilized utilizing outfall stabilization treatment methods due to the existing erosion downstream. The facility will need to comply with Code 378, so a clay liner is proposed along the upstream side of the embankment; alternatively a clay core could be installed. Access to the pond is proposed along the apparent easement located between the residential structures located at 8004 and 8006 Britt Court (Property owned by Fourth Deep Run Associates). The existence of an easement will need to be verified. Alternative access could be considered from Pirch Way or Old Waterloo Rd south of the pond.

Nearby Opportunities:

None recommended.

Proposed Project Credit	
Drainage Area (ac.):	169.7
Impervious Area within Drainage (ac.):	52.74
Impervious Area Treated (ac.):	52.7
Impervious Area Treated Credit (ac.):	52.8

Water Quality Volume	
WQVolume Target (cft.):	203,093
Max Treated (cft.):	204,647
Percent Treated:	101%
Rainfall Depth Treated (in.):	1.01

Costs

Estimated Design Cost:	$320,000
Estimated Construction Cost:	$1,052,703
30% Contingency:	$411,811
Estimated Total Cost	$1,784,514
Cost per Impervious Credit Acre:	$33,772

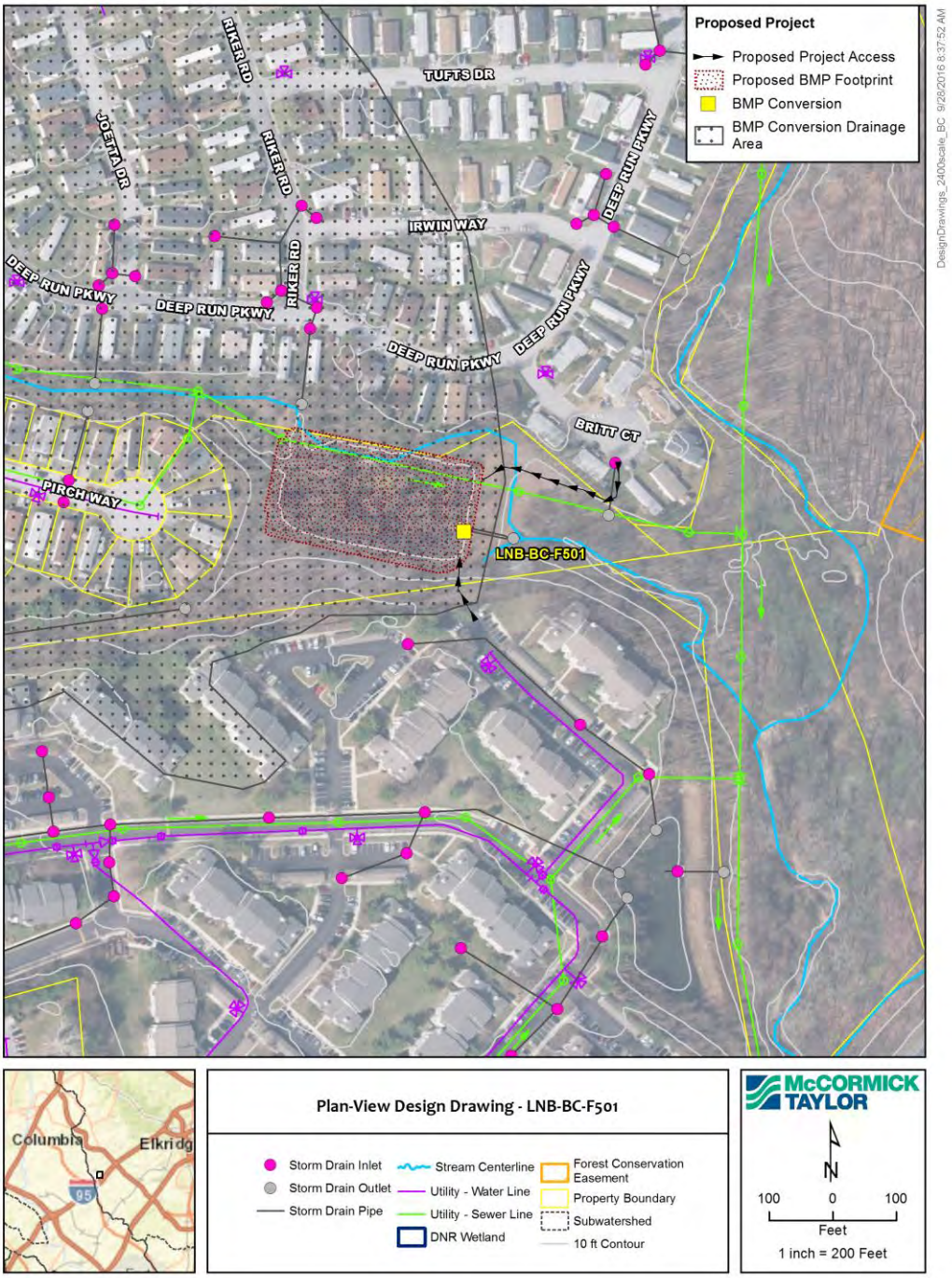
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F501

Site Name: Britt Ct (Deep Run)

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F502
Site Name: Troy Hill 2

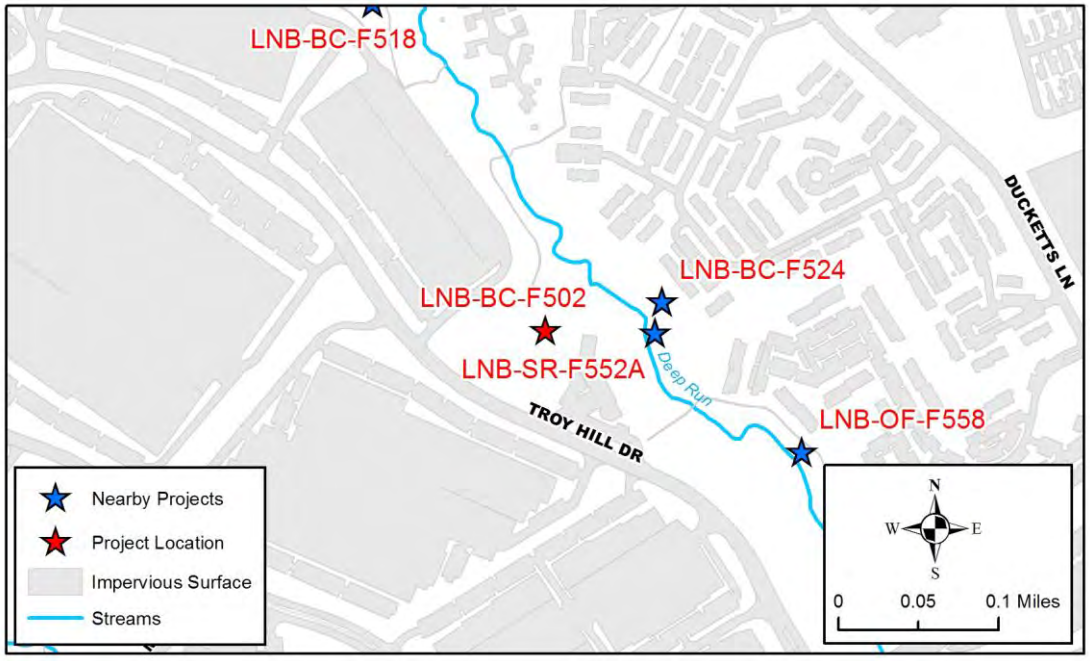
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Retention Pond (Wet Pond)
Ownership: Private- Commerical/Industrial
Single Owner

BMP Structure ID: HO103926
Existing BMP Type: DP

Existing Conditions:

The site is a commercial business park with large warehouses, loading docks, and parking lots. Currently, flows enter the pond from three storm drain inflows. Two of the inflows enter into a forebay in the southwestern corner of the pond and the other storm drain inflow outfalls into an elevated and vegetated area; the inflows in the forebay are partially submerged. The forebay and primary pond area have some silt and sediment deposition and are wet with about 1 ft. or more of standing water. The low flow riprap shown in the design plans (F-96-136) was not visible, but there was a steady flow observed through the orifice plate in the riser. Some erosion is occurring in the pond bottom from the third inflow. The riser is in good condition, but there is not 1 ft. of clearance between the trash rack and the embankment. Per the design plans, the riser has weirs on all four sides and a 48 in. RCP principal spillway. The outfall is stable with riprap, but downstream prior to the stream confluence, a pilot channel is actively eroding and small headcuts are forming. Steep slopes surround a majority of the pond and a sewer line runs along the western side of the facility. Access would likely be from the eastern side of the facility.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F502
Site Name: Troy Hill 2

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking southeast toward the embankment and riser structure from the building parking lot.

Looking northeast toward the pond area and riser structure from the slope along Troy Hill Drive.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F502
Site Name: Troy Hill 2

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include the property ownership and potential wetland impacts at the outfall. The pond is on private property and a sewer line runs along the western edge of the facility.

Concept Description:

A wet retention pond is proposed with the existing footprint of the dry pond. The permanent pool elevation is proposed at 163.00 ft. and will be 5 ft. deep to a bottom elevation of 158.00 ft. in a portion of the facility. Side slopes are 3:1 above the permanent pool and 2:1 below. Two 3 ft. deep forebays will provide 16,800 cf. (211%) of the required pretreatment storage. Excluding the forebays, the facility will provide approximately 133,458 cf. of wet storage in the permanent pool, 171% of the required WQv. A riprap weir will be provided between the forebays and pond area. A 10 ft. dry bench is provided at the permanent pool elevation and an additional bench could be considered, but will reduce the wet storage in the facility. The emergency spillway will remain and a new concrete riser structure will be added with weirs to maintain the current discharges and provide sufficient freeboard. The outfall will be stabilized utilizing outfall stabilization treatment methods due to the erosion and headcuts prior to the stream confluence. The facility will need to comply with Code 378, so a clay liner is proposed along the upstream side of the embankment; alternatively a clay core could be installed. Access to the pond will be from the entrance to Larry T. Weiss Co., Inc. off of Troy Hill Road located southeast of the pond.

Nearby Opportunities:

LNB-BC-F518, LNB-BC-F524, LNB-OF-F557, LNB-OF-F558, LNB-SR-F552A

Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	34.1	WQVolume Target (cft.):	77,867
Impervious Area within Drainage (ac.):	21.94	Max Treated (cft.):	133,458
Impervious Area Treated (ac.):	21.9	Percent Treated:	171%
Impervious Area Treated Credit (ac.):	25.9	Rainfall Depth Treated (in.):	1.71

Costs	
Estimated Design Cost:	$320,000
Estimated Construction Cost:	$806,802
30% Contingency:	$338,041
Estimated Total Cost	$1,464,843
Cost per Impervious Credit Acre:	$56,645

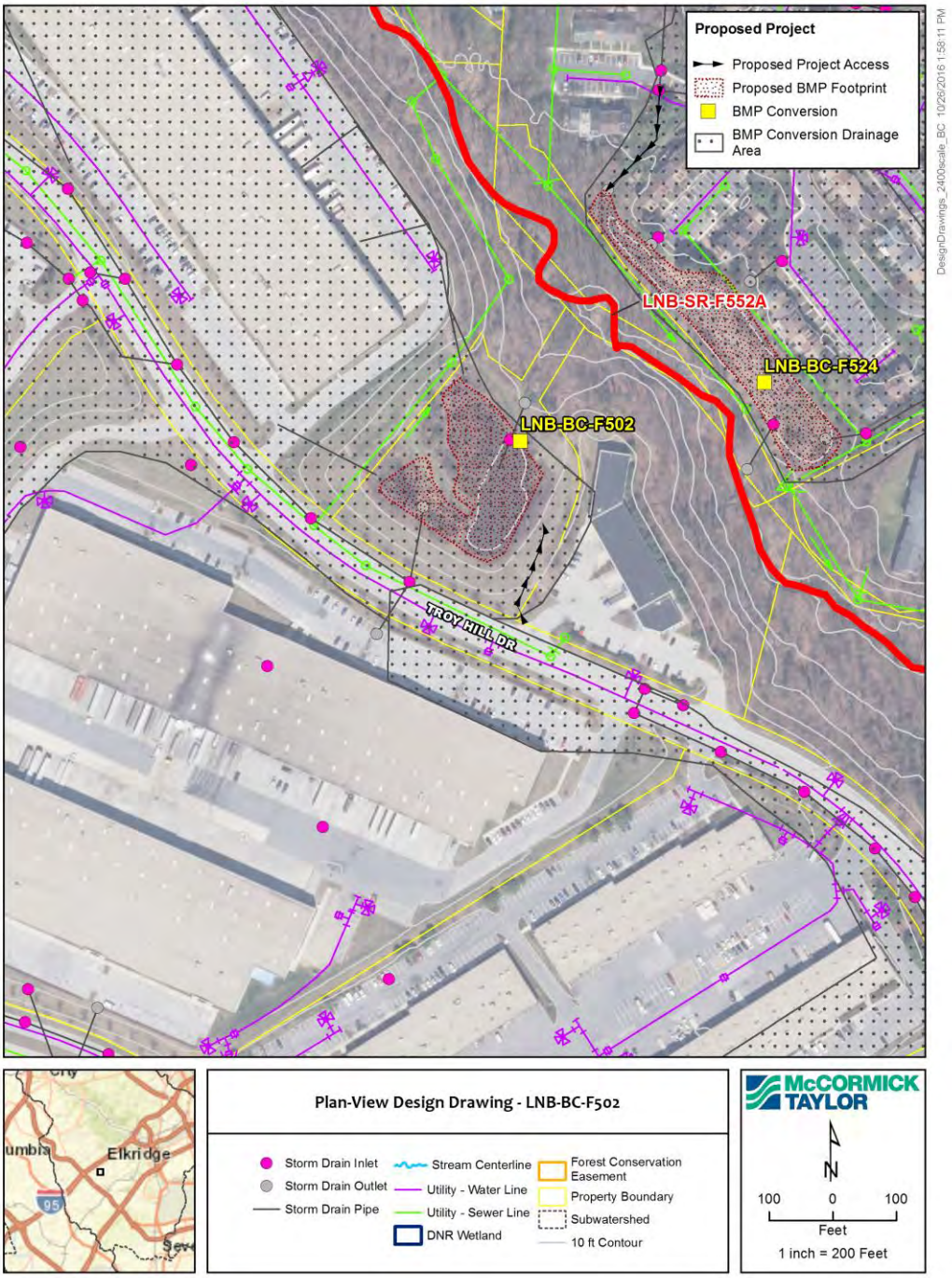
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F502

Site Name: Troy Hill 2

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F504
Site Name: Quail Ridge

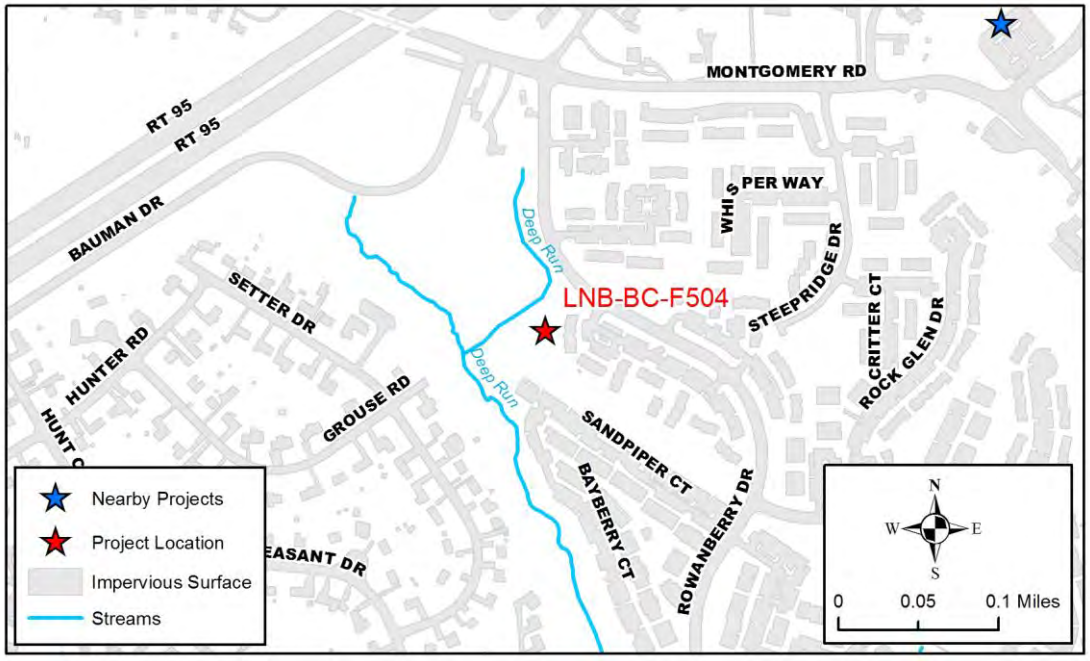
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Extended Detention Structure, Wet
Ownership: Private- HOA
Single Owner

BMP Structure ID: HO103485
Existing BMP Type: DP

Existing Conditions:

The site is a residential neighborhood with townhomes. The pond receives runoff from rooftops and sidewalks that sheet flows directly toward the facility or into a swale that enters the pond from the east. Per field observations and the design plans (F-81-053), a 36 in. RCP pipe and end section serve as the primary outlet structure for the pond. Two manholes are located in the embankment. The first joins the pond spillway and the neighborhood storm drain network, and the second manhole contains a weir structure to control the flow release. This weir will cause larger storms to backwater up the storm drain network and into the facility via the 36 in. RCP pipe. The outfall for the network is a concrete end section and a stable scour pool is lined with large riprap. The outfall channel continues through BGE right-of-way where there is a failed ford crossing prior to the outfall channel's confluence with the larger stream. The pond is located in close proximity to the townhomes and several utilities were observed including electric and overhead lights. According to GIS data, a sewer line runs along the embankment. Access to the site is moderate with some utilities (light poles) and moderate slopes from Rowanberry Drive.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F504
Site Name: Quail Ridge

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking west toward the pond area, embankment, and outfall end section structure.

Looking southeast toward the pond area, inflow swale, and embankment from the outfall end section.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F504
Site Name: Quail Ridge

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include the property ownership and utilities. The pond is on private property and sewer and electric are possible conflicts. It is also in close proximity to several homes.

Concept Description:

A wet extended detention pond is proposed within the existing footprint of the dry pond. The permanent pool elevation is proposed at 173.00 ft. and will be 3 ft. feet deep to a bottom elevation of 170.00 ft.; side slopes are 3:1 above the permanent pool and 2:1 below. A 2 ft. deep forebay is proposed to provide the required 3,753 cf. of pretreatment. Excluding the forebay, the facility will provide approximately 17,923 cf. of wet storage in the permanent pool, 46% of the required WQv. An additional 21,366 cf. is provided in 1.85 ft. of extended detention to elevation 174.85 ft., which provides a total of 101% of the WQv. No bench is provided due to the limited space in facility footprint, but one could be added, which would reduce the provided WQv. A new concrete riser and RCP principal spillway is proposed at a new location in the embankment to allow space for a forebay. The facility will need to comply with Code 378, so a clay liner is proposed along the upstream side of the embankment; alternatively a clay core could be installed. The emergency spillway is expected to be maintained. Access to the pond is proposed near 5902 Rowanberry Drive, but alternatively could utilize the existing BGE easement beginning near the intersection of Rowanberry Drive and Greenfield Road.

Nearby Opportunities:

None recommended.

Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	28.65	WQVolume Target (cft.):	38,981
Impervious Area within Drainage (ac.):	10.34	Max Treated (cft.):	39,289
Impervious Area Treated (ac.):	10.3	Percent Treated:	101%
Impervious Area Treated Credit (ac.):	10.3	Rainfall Depth Treated (in.):	1.01

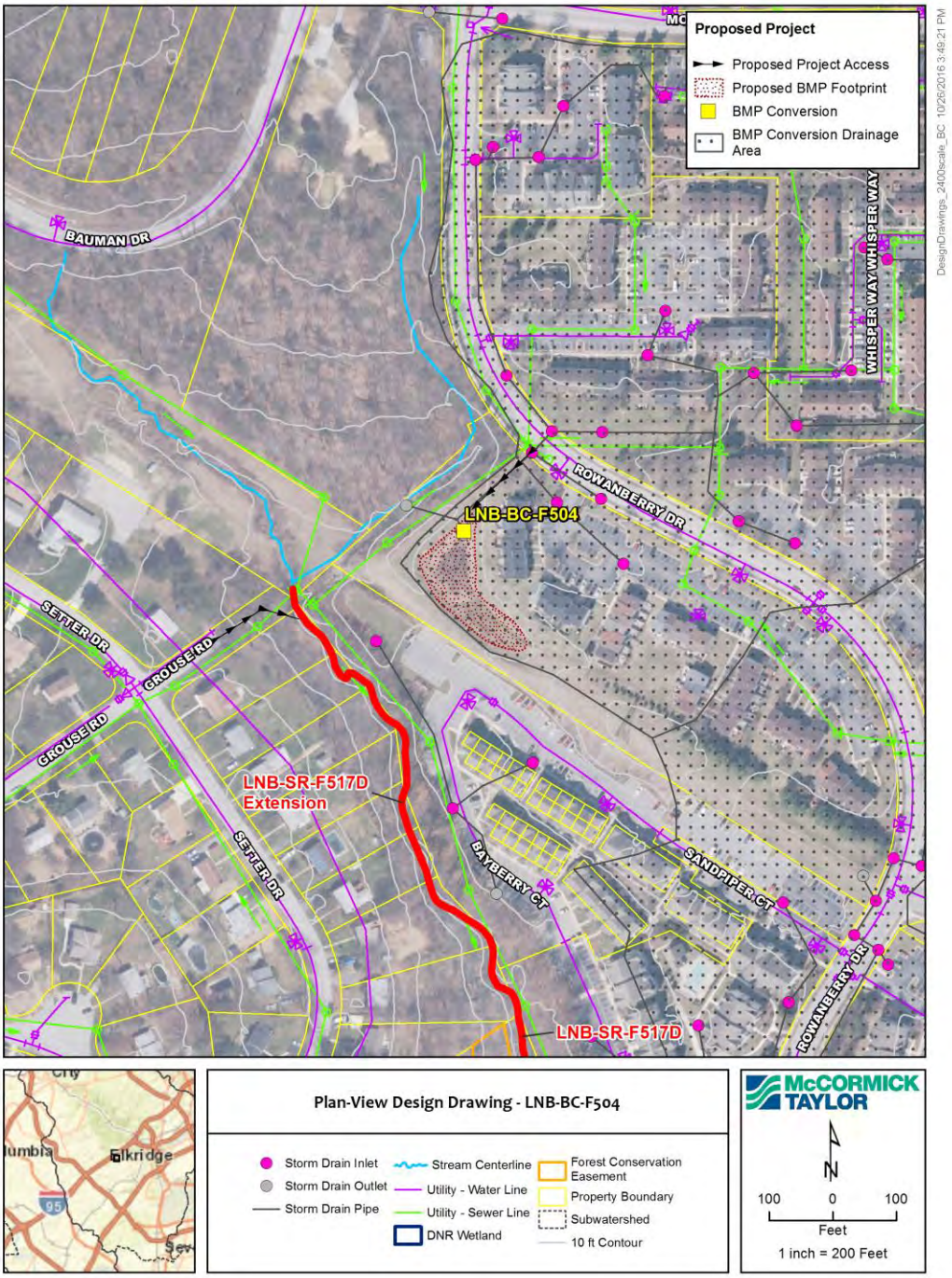
Costs

Estimated Design Cost:	$220,000
Estimated Construction Cost:	$342,569
30% Contingency:	$168,771
Estimated Total Cost	$731,340
Cost per Impervious Credit Acre:	$70,729

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F504
Site Name: Quail Ridge

Contractor: McCormick Taylor
Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F505
Site Name: Bonnie Branch Middle School

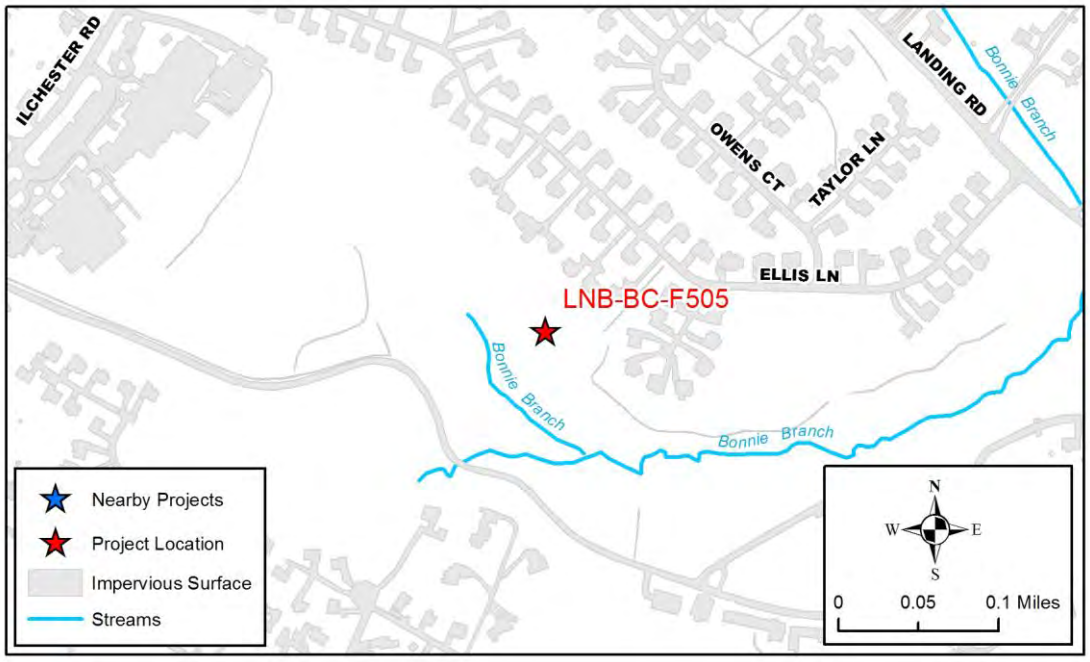
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Extended Detention Structure, Wet
Ownership: County School
Single Owner

BMP Structure ID: HO104526
Existing BMP Type: EDSD

Existing Conditions:

The site is in the back of the Bonnie Branch Middle School property behind the athletic fields. As observed in the field and per the design plans (SDP-95-055), there is a 42 in. RCP and a 21 in. RCP storm drain inflow. In the field, it was noted that each inflow had a forebay created with gabion weir structures. A concrete low flow with a small headwall, concrete riser, and 36 in. RCP principal spillway appeared in good condition. A significant amount of leaves and woody debris were in the pond along with some sediment, which may be clogging the pond bottom and causing the few inches of standing water near the riser. The outfall appeared to have been somewhat recently repaired with new riprap placed near the endwall and along the embankment slopes. Erosion and headcuts are occurring downstream of the outfall pool. Access to the pond would be either a long path from the school parking lot and through the athletic fields or from the private road to the south which currently has a clear access path directly to the pond.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F505
Site Name: Bonnie Branch Middle School
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking north from the south inflow toward the pond area, riser, and embankment.

Looking east at the pond outfall from the embankment.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F505
Site Name: Bonnie Branch Middle School
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

There are no apparent utility conflicts for this site, but construction will need to be completed during summer months while school is not in session.

Concept Description:

A wet extended detention pond is proposed within the existing footprint of the dry pond. The permanent pool elevation is proposed at 418.00 ft. and will be 3 ft. feet deep to a bottom elevation of 415.00 ft.; side slopes are 3:1 above the permanent pool and 2:1 below. Two 2 ft. deep forebays will provide 4,787cf (180%) of the required pretreatment storage. Excluding the forebays, the facility will provide approximately 14,946 cf. of wet storage in the permanent pool, 52% of the required WQv. An additional 13,889 cf. is provided in 1.60 ft. of extended detention to elevation 419.60 ft., which provides a total of 100% of the WQv. No bench is provided due to the limited space in facility footprint, but one could be added, which would reduce the provided WQv. A riprap weir will be provided between the forebays and pond area. A new concrete riser structure will be added with weirs to maintain the current discharges and provide sufficient freeboard. The facility will need to comply with Code 378, so a clay liner is proposed along the upstream side of the embankment; alternatively a clay core could be installed. The pond outfall will be stabilized utilizing outfall stabilization efforts due to the existing erosion and headcuts. Access to the pond will be along the existing 12 ft. wide path extending from the Trinity School entrance road which runs south of the pond.

Nearby Opportunities:

None recommended.

Proposed Project Credit	
Drainage Area (ac.):	27.44
Impervious Area within Drainage (ac.):	7.31
Impervious Area Treated (ac.):	7.31
Impervious Area Treated Credit (ac.):	7.31

Water Quality Volume	
WQVolume Target (cft.):	28,862
Max Treated (cft.):	28,835
Percent Treated:	100%
Rainfall Depth Treated (in.):	1

Costs

Estimated Design Cost:	$320,000
Estimated Construction Cost:	$599,014
30% Contingency:	$275,704
Estimated Total Cost	$1,194,718
Cost per Impervious Credit Acre:	$163,436

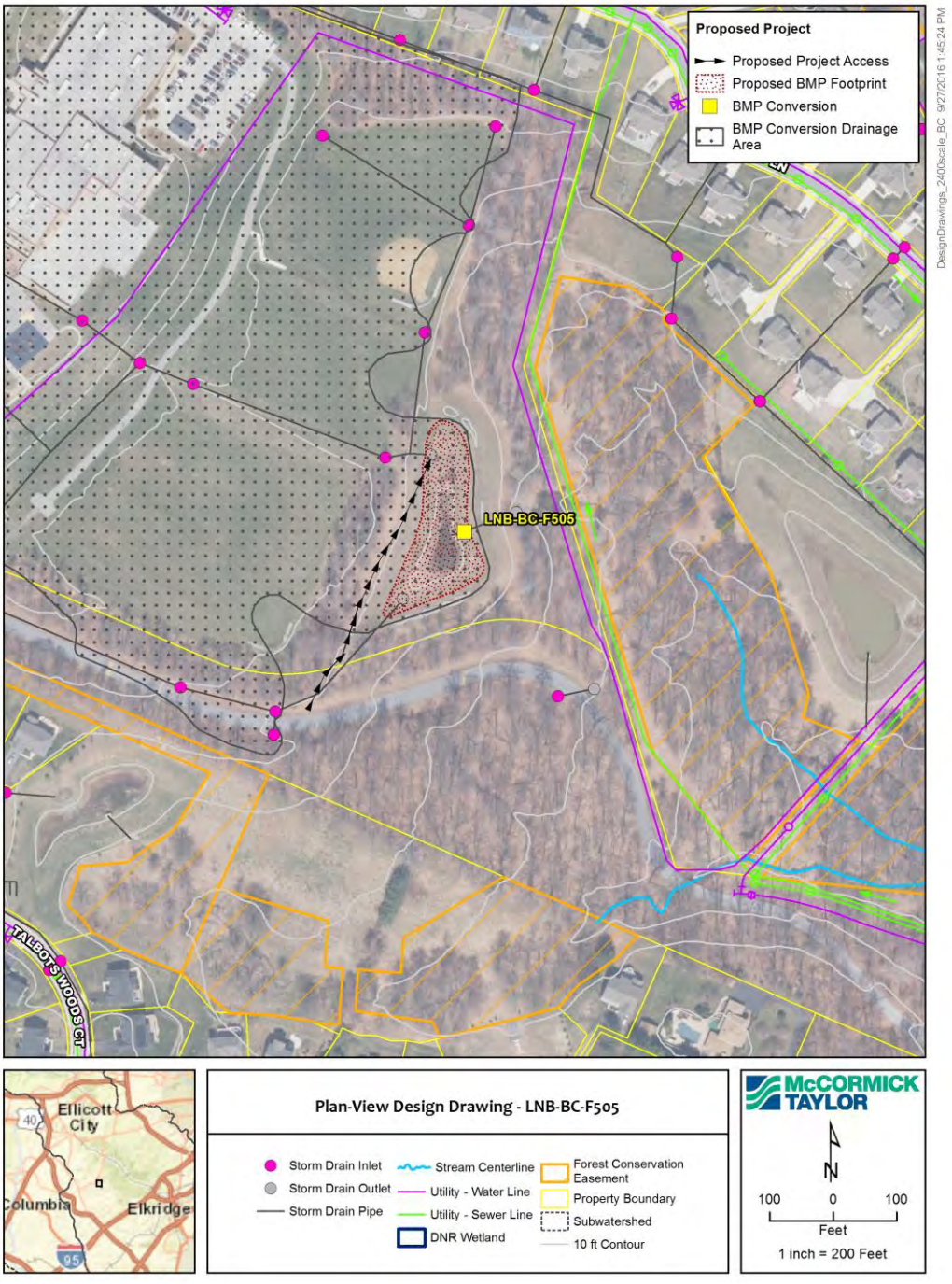
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F505

Site Name: Bonnie Branch Middle School

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F506
Site Name: Latchlift Ct

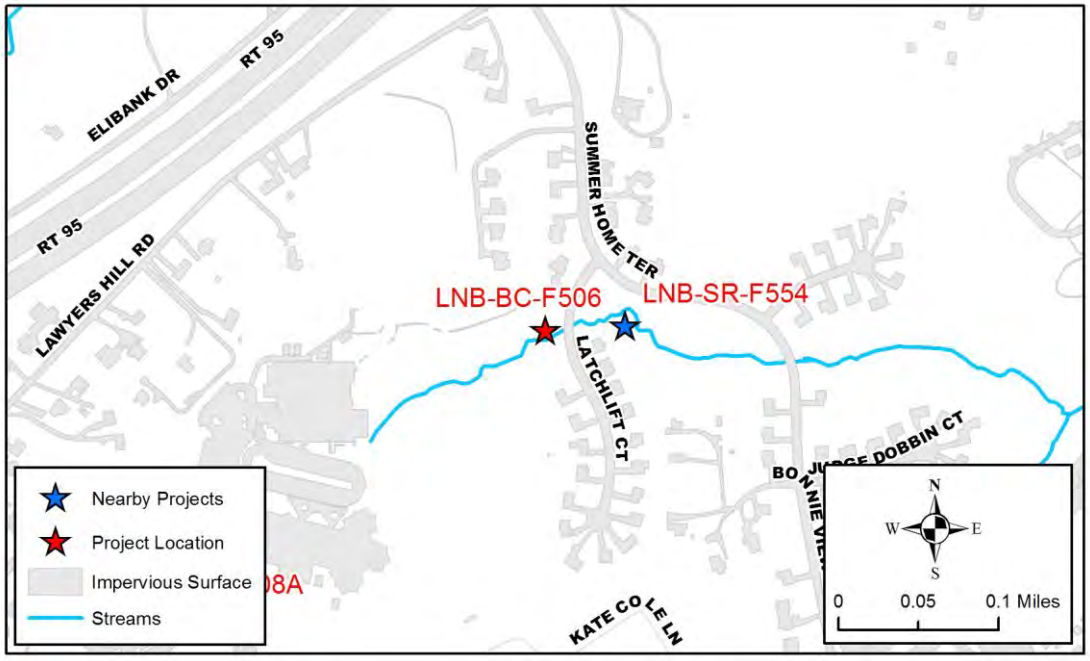
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Extended Detention Structure, Wet
Ownership: Private- HOA
Single Owner

BMP Structure ID: HO104982
Existing BMP Type: EDSD

Existing Conditions:

The site is located in The Gables at Lawyers Hill neighborhood and receives runoff from a small stream channel to the west and from one 21 in. RCP inflow pipe. The storm drain inflow outfalls into a forebay with riprap followed by a gabion channel down the slope into the pond area. The small stream from the west originates as a storm drain outfall from the Elkridge Elementary School and Elkridge Landing Middle School. Although it travels through a wooded area, the channel from the schools is eroded and is causing sediment deposition in the pond. The concrete riser structure, per the design plans F-91-030, has 6 in. low flow orifice and notched weirs with an open top. The riser and 33 in. RCP barrel appear in good condition. The principal spillway goes under Latchlift Ct and outfalls on the eastern side of the roadway embankment. The outfall is relatively stable with a large scour pool and standing water; however, just a few feet downstream, the outfall channel is severely eroded with large headcuts. Aside from a street light along the road, no utilities were observed in the pond area. Access is anticipated on the northern side of the pond and may require a small tree to be removed and guardrail to be removed and reset.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F506
Site Name: Latchlift Ct

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking north from the forebay at the inflow, gabion channel, and riser structure.

Looking west toward the outfall from the area where erosion and headcuts begin.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F506
Site Name: Latchlift Ct

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include the property ownership, tree removal, and the pond proximity to homes. The pond and downstream channel are on private property.

Concept Description:

A wet extended detention pond is proposed within the existing footprint of the dry pond. The permanent pool elevation is proposed at 200.00 ft. and will be 4 ft. feet deep to a bottom elevation of 196.00 ft.; side slopes are 3:1 above the permanent pool and 2:1 below. Due to limited project area, a 2 ft. deep forebay at the storm drain inflow will provide 1,505 cf. (75%) of the required pretreatment storage. A second forebay could be considered from the channel inflow for additional pretreatment and sediment removal. Excluding the forebay, the facility will provide approximately 9,428 cf. of wet storage in the permanent pool, 31% of the required WQv. An additional 13,939 cf. is provided in 2.25 ft. of extended detention to elevation 202.25 ft., which provides a total of 101% of the WQv. No bench is provided due to the limited space of the facility footprint, but one could be added, reducing the provided WQv. A riprap weir will be provided between the forebay and pond area. Construction of the wet pond will require a large number of trees to be cleared, so this impact should be considered. The pond area could be reduced to minimize impacts and reduce provided WQv. A new concrete riser structure will be added with weirs to maintain the current discharges and provide sufficient freeboard. The facility will need to comply with Code 378, so a clay liner is proposed along the upstream side of the embankment; alternatively a clay core could be installed. The pond outfall stabilization will be completed in conjunction with stream restoration LNB-SR-F554 to address the existing erosion and headcut. Access to the pond will be from Latchlift Court and will continue along an existing 12 ft. wide access path.

Nearby Opportunities:

LNB-SR-F554

Proposed Project Credit	
Drainage Area (ac.):	27.15
Impervious Area within Drainage (ac.):	5.56
Impervious Area Treated (ac.):	5.56
Impervious Area Treated Credit (ac.):	5.58

Water Quality Volume	
WQVolume Target (cft.):	23,092
Max Treated (cft.):	23,367
Percent Treated:	101%
Rainfall Depth Treated (in.):	1.01

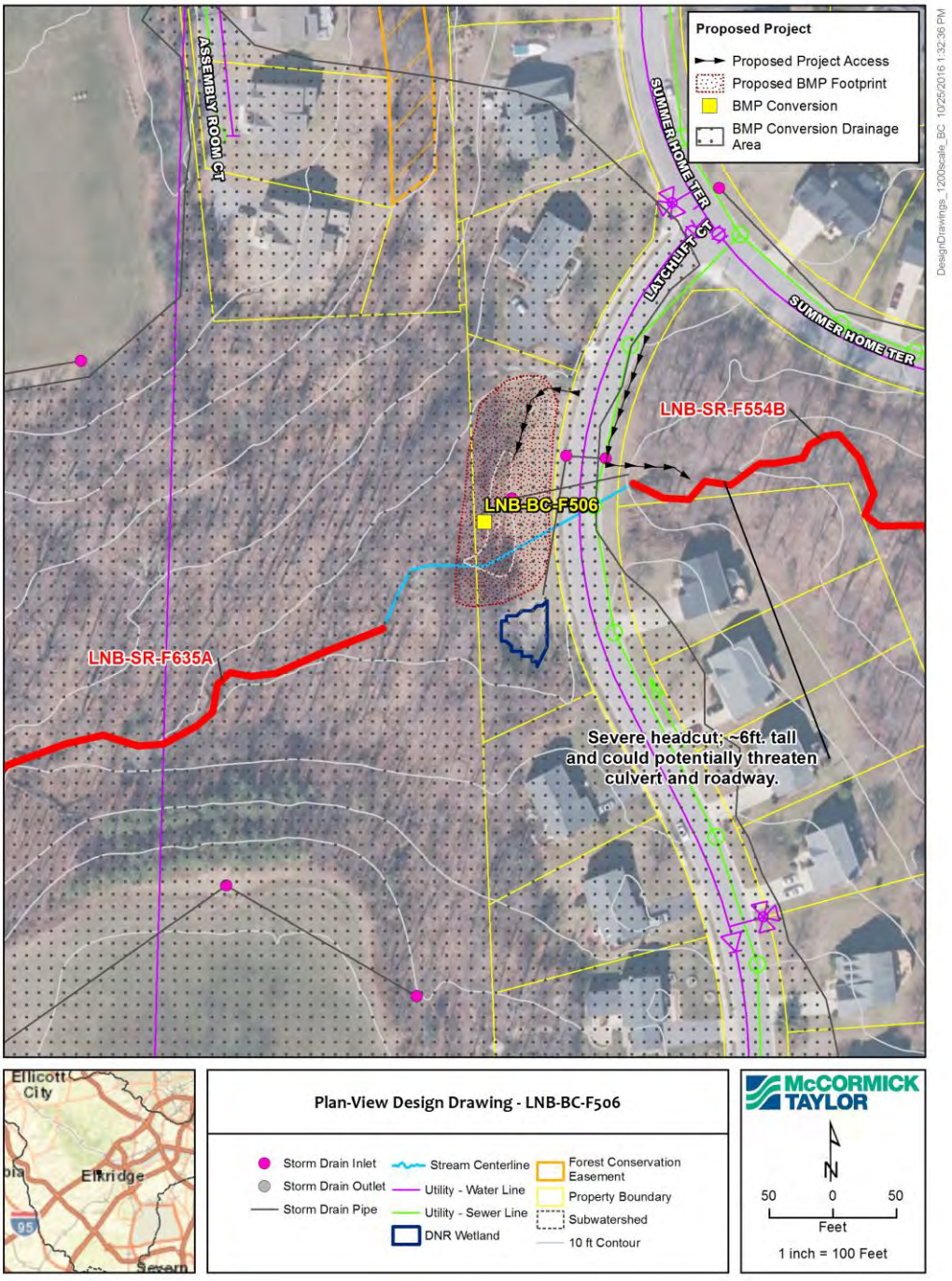
Costs

Estimated Design Cost:	$220,000
Estimated Construction Cost:	$292,430
30% Contingency:	$153,729
Estimated Total Cost	$666,159
Cost per Impervious Credit Acre:	$119,383

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F506
Site Name: Latchlift Ct

Contractor: McCormick Taylor
Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F507
Site Name: Radel Court

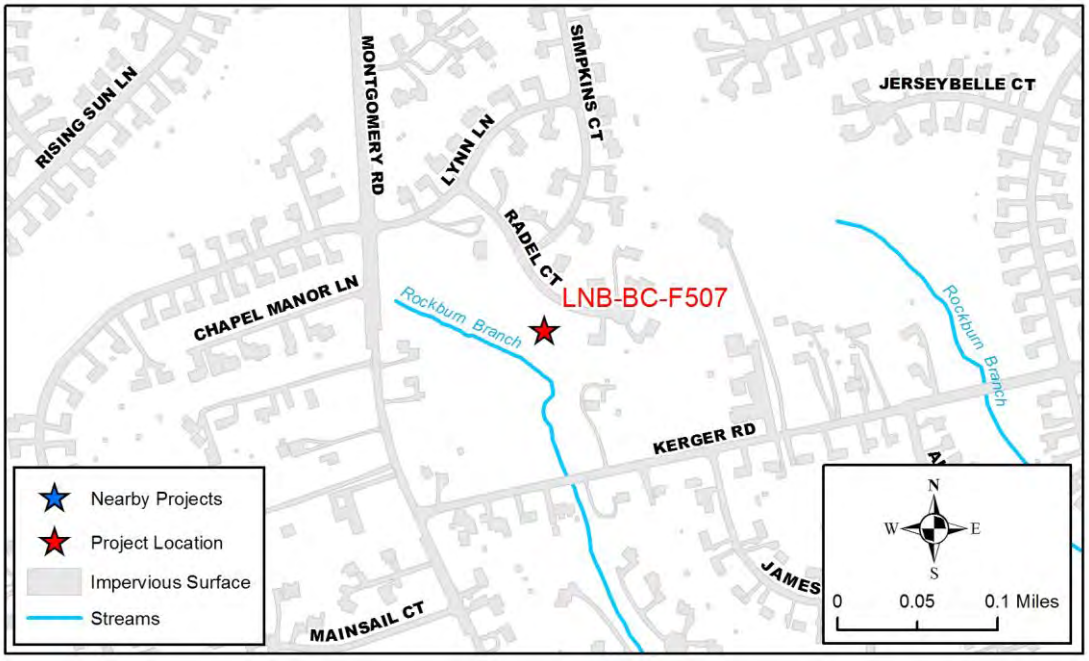
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Extended Detention Structure, Wet
Ownership: County Owned
Single Owner

BMP Structure ID: HO102507
Existing BMP Type: EDSD

Existing Conditions:

The site is located in Abbeyfield Estates neighborhood and receives runoff from one 30 in. RCP inflow pipe. The storm drain outfalls into a small, elevated forebay with a riprap weir leading to the pond area. The forebay has several inches of standing water and cattails around the perimeter. The end section is slightly separated from the pipe. Tall grasses are located around the pond perimeter and in patches throughout the bottom. Minor standing water was observed in the field along with sediment and fines that may be clogging the bottom. The concrete riser structure, per the design plans F-94-099 and field observation, has 6 in. PVC low flow with stand pipe and weirs on the front face. The riser and 18 in. RCP barrel appear in good condition, although the inside of the riser was not observed closely due to the top being inaccessible. An emergency spillway with a large amount of riprap is located on the southeastern corner of the facility and with that spillway, the embankment was designed with just over 1 ft. of freeboard for the 100-year storm event. The outfall is relatively stable with riprap and vegetation. Erosion is occurring in the downstream channel. Some large trees within 15 ft. of the embankment should be removed. No utilities were observed within the pond area and access is easy from Radel Court.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F507
Site Name: Radel Court

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking southeast toward the inflow forebay, riser structure, and embankment.

Looking southeast along the downstream side of the embankment at the principal spillway outfall (near riprap) and emergency spillway outfall (far riprap).

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F507
Site Name: Radel Court

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include the proximity to homes and the potential wetland impacts outside of the pond area.

Concept Description:

A wet extended detention pond is proposed within the existing footprint of the dry pond. The permanent pool elevation is proposed at 402.00 ft. and will be 3 ft. feet deep to a bottom elevation of 399.00 ft.; side slopes are 3:1 above the permanent pool and 2:1 below. A 2 ft. deep forebay is proposed to provide the required 1,786 cf. of pretreatment. Excluding the forebay, the facility will provide approximately 9,730 cf. of wet storage in the permanent pool, 48% of the required WQv. An additional 10,617 cf. is provided in 2.16 ft. of extended detention to elevation 404.16 ft., which provides a total of 100% of the WQv. No bench is provided due to the limited space in the facility footprint, but one could be added, reducing the provided WQv. A new concrete riser and RCP principal spillway is proposed. The facility will need to comply with Code 378, so a clay liner is proposed along the upstream side of the embankment; alternatively a clay core could be installed. The emergency spillway is expected to be maintained. Access to the pond will be along the existing 20 ft. wide utility easement from Radel Court on the north side of the facility.

Nearby Opportunities:

None recommended.

Proposed Project Credit	
Drainage Area (ac.):	23.83
Impervious Area within Drainage (ac.):	4.92
Impervious Area Treated (ac.):	4.92
Impervious Area Treated Credit (ac.):	4.92

Water Quality Volume	
WQVolume Target (cft.):	20,399
Max Treated (cft.):	20,402
Percent Treated:	100%
Rainfall Depth Treated (in.):	1

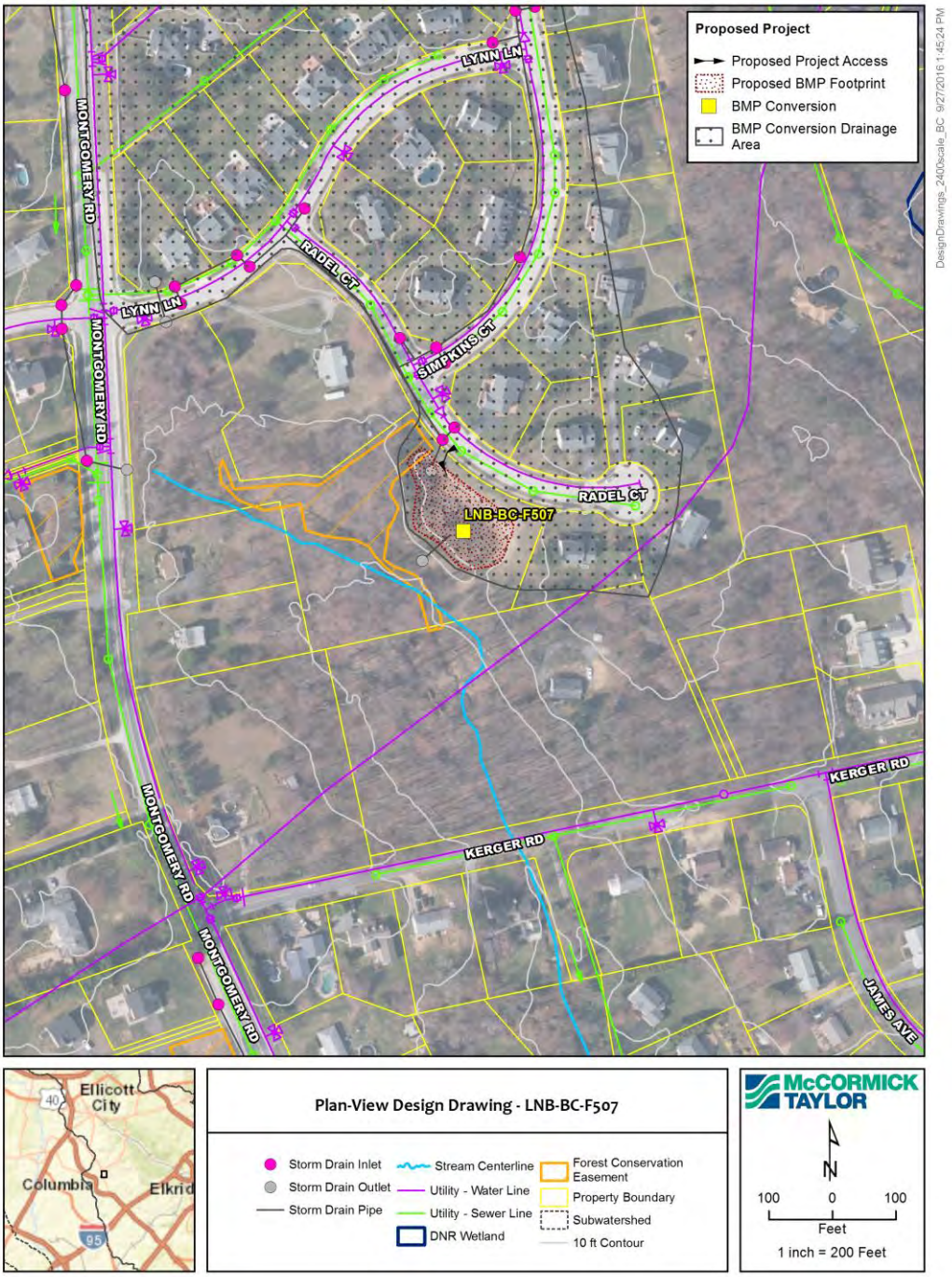
Costs

Estimated Design Cost:	$220,000
Estimated Construction Cost:	$199,679
30% Contingency:	$125,904
Estimated Total Cost	$545,582
Cost per Impervious Credit Acre:	$110,891

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F507
Site Name: Radel Court

Contractor: McCormick Taylor
Watershed: Patapsco Lower North



Plan-View Design Drawing - LNB-BC-F507

Storm Drain Inlet
Storm Drain Outlet
Storm Drain Pipe
Stream Centerline
Utility - Water Line
Utility - Sewer Line
DNR Wetland
Forest Conservation Easement
Property Boundary
Subwatershed
10 ft Contour

McCORMICK TAYLOR

N

100 0 100
Feet

1 inch = 200 Feet

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F508
Site Name: Greenmount Drive

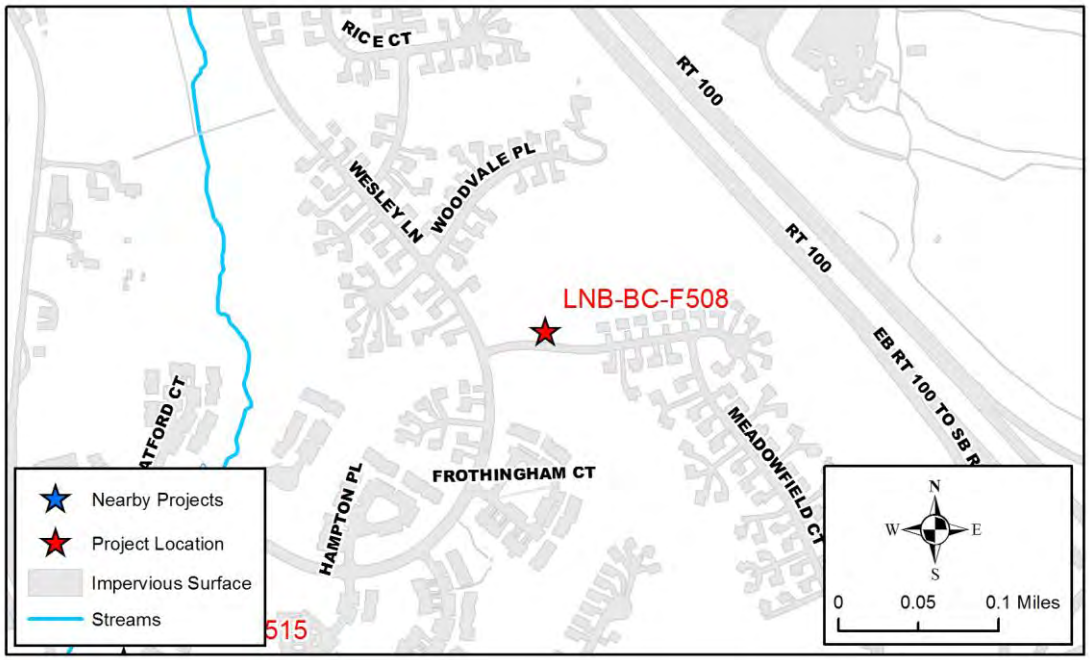
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Retention Pond (Wet Pond)
Ownership: County Owned
Single Owner

BMP Structure ID: HO104776
Existing BMP Type: DP

Existing Conditions:

The site is located in the Willowood neighborhood and receives runoff from multiple sources. Three small water quality facilities receive the direct storm drain runoff and then outfall into the pond; sheet flow from the roofs and wooded area within the drainage area also drain to the pond. The pond bottom is largely vegetated with trees and brush, and the riser structure is in the roadway embankment of Greenmount Drive. Per the design plans (F-92-082) and field observation, the concrete riser has a buried 6 in. low flow orifice and weirs on all sides. Seepage through the riser walls was observed in the field, there is vegetation growing on the trash racks and there is less than 1 ft. of clearance between the bottom of the trash racks and the embankment. The 48 in. RCP barrel is in good condition and the outfall is stable with a large apron. Downstream of the outfall pool, however, erosion on the channel banks is occurring and several trees are located within the outfall channel flow path. No utilities were observed in the pond area and access is easy from Greenmount Drive.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F508
Site Name: Greenmount Drive

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking northwest at the riser, western inflow, and a portion of the wooded pond bottom.

Looking south toward the riser and embankment (Greenmount Drive) from inside the facility bottom.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F508
Site Name: Greenmount Drive
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include the proximity to homes and the potential tree removal in the pond.

Concept Description:

A wet retention pond is proposed within the existing footprint of the dry pond. The permanent pool elevation is proposed at 280.00 ft. and will be 6 ft. deep to a bottom elevation of 274.00 ft. Two 2 ft. deep forebays are proposed to provide the required 2,207 cf. of pretreatment. The existing water quality facility will remain in the northern area of the pond for pretreatment. Excluding the forebay, the facility will provide approximately 25,045 cf. of wet storage in the permanent pool, 105% of the WQv. A 10 ft. dry maintenance bench is included around the pond perimeter at the permanent pool elevation. A riprap weir will be provided between the forebays and pond area. Construction of the wet pond will require a large number of trees to be cleared, so this impact should be considered. The pond area could be reduced to minimize impacts. A new concrete riser structure will be added with weirs to maintain the current discharges and provide sufficient freeboard. The barrel will not be replaced due to the embankment being a residential roadway and the outfall will be stabilized with riprap. Trees and vegetation in the outfall channel and within 15 ft. of the embankment toe will be removed. The facility will need to comply with Code 378, so a clay liner is proposed along the upstream side of the embankment; alternatively a clay core could be installed. Access to the pond will be from Greenmount Drive.

Nearby Opportunities:

None recommended.

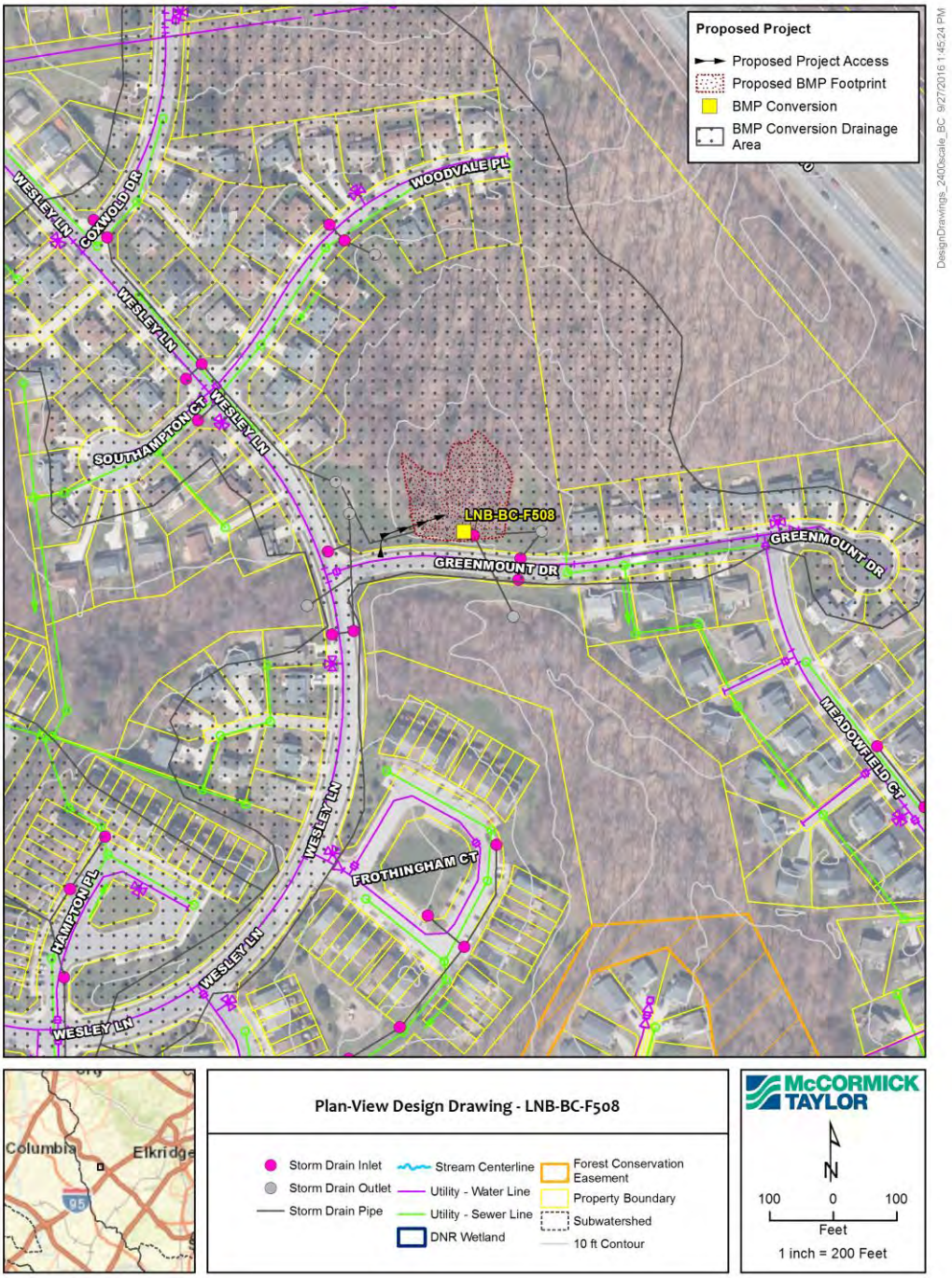
Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	22.29	WQVolume Target (cft.):	23,909
Impervious Area within Drainage (ac.):	6.08	Max Treated (cft.):	25,045
Impervious Area Treated (ac.):	6.08	Percent Treated:	105%
Impervious Area Treated Credit (ac.):	6.15	Rainfall Depth Treated (in.):	1.05

Costs	
Estimated Design Cost:	$220,000
Estimated Construction Cost:	$195,585
30% Contingency:	$124,676
Estimated Total Cost	$540,261
Cost per Impervious Credit Acre:	$87,847

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F508
Site Name: Greenmount Drive

Contractor: McCormick Taylor
Watershed: Patapsco Lower North



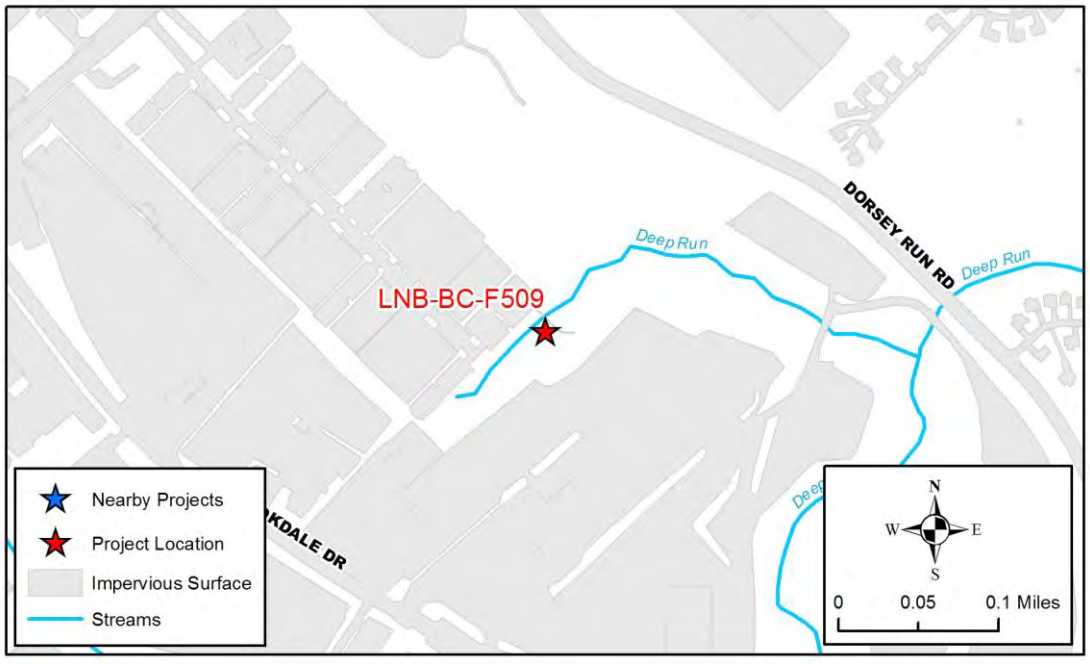
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F509
Site Name: Baltimore Washington Commerce Park
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Extended Detention Structure, Wet
Ownership: Private- Commerical/Industrial
Single Owner
BMP Structure ID: HO103611
Existing BMP Type: EDSD

Existing Conditions:

The pond is located in the Baltimore Washington Commerce Park business park and receives runoff from the commercial buildings and parking lots. The majority of the property is impervious surface and there is one large, 42 in. CMP inflow with the bottom half of the pipe poured with concrete. A very large, eroded scour hole was observed at the inflow with over 1 ft. of ponded water. The pond grading continues southwest of the CMP inflow and there is significant seepage from this wooded area as well as seepage near the inflow scour pool. In the bottom of the pond, there is an eroded pilot channel with small stones leading to the low flow near the riser structure. The concrete riser appears in good condition, although there is some sediment and debris partially blocking the flow orifice. Some erosion is occurring on the upstream pond slope near the top of the southeastern side of the embankment and emergency spillway. The emergency spillway has what appears to be recent riprap placed at the downstream end. A sewer line was observed near the emergency spillway as well. Two gates provide access to the facility from the parking lot, but the access path form the gate on the southwestern side is filled with trees. The access from the gate on the northeastern side is at the embankment where the steep slopes are located. The outfall is stable although some moderate erosion is occurring in the downstream outfall channel. Per the plans (SDP-88-205) the open top concrete riser has several weirs and the 72 in. BCCMP barrel is in good condition with little corrosion.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F509
Site Name: Baltimore Washington Commerce Park
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking southwest toward the pond inflow from the embankment near the parking lot.

Looking southeast along the embankment toward the riser structure and outfall from the top of the embankment near the parking lot and access gate.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F509
Site Name: Baltimore Washington Commerce Park
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include the potential bedrock, limited space for the pond footprint, steep slopes, and property ownership.

Concept Description:

A wet extended detention pond is proposed within the existing footprint of the dry pond. The permanent pool elevation is proposed at 148.00 ft. and will be 6 ft. feet deep to a bottom elevation of 142.00 ft.; side slopes are 3:1 above the permanent pool and 2:1 below. A 3 ft. deep forebay is proposed to provide the required 5,735 cf. of pretreatment. Excluding the forebay, the facility will provide approximately 18,342 cf. of wet storage in the permanent pool, 33% of the required WQv. An additional 37,364 cf. is provided in 3.5 ft. of extended detention to elevation 151.50 ft., which provides a total of 100% of the WQv. A 5 ft. dry bench is included in the proposed design and an aquatic bench could be added, which would reduce the provided WQv. A new concrete riser and RCP principal spillway is proposed. The facility will need to comply with Code 378, so a clay liner is proposed along the upstream side of the embankment; alternatively a clay core could be installed. The emergency spillway is expected to be maintained. Access to the pond will be from the northeast corner of the last parking lot off Cooney Lane through a locked gate. An additional access gate exists toward the southwestern corner of the parking lot, but the access path is vegetated with large trees.

Nearby Opportunities:

None recommended.

Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	21.57	WQVolume Target (cft.):	55,534
Impervious Area within Drainage (ac.):	15.8	Max Treated (cft.):	55,706
Impervious Area Treated (ac.):	15.8	Percent Treated:	100%
Impervious Area Treated Credit (ac.):	15.8	Rainfall Depth Treated (in.):	1

Costs

Estimated Design Cost:	$220,000
Estimated Construction Cost:	$314,316
30% Contingency:	$160,295
Estimated Total Cost	$694,610
Cost per Impervious Credit Acre:	$43,963

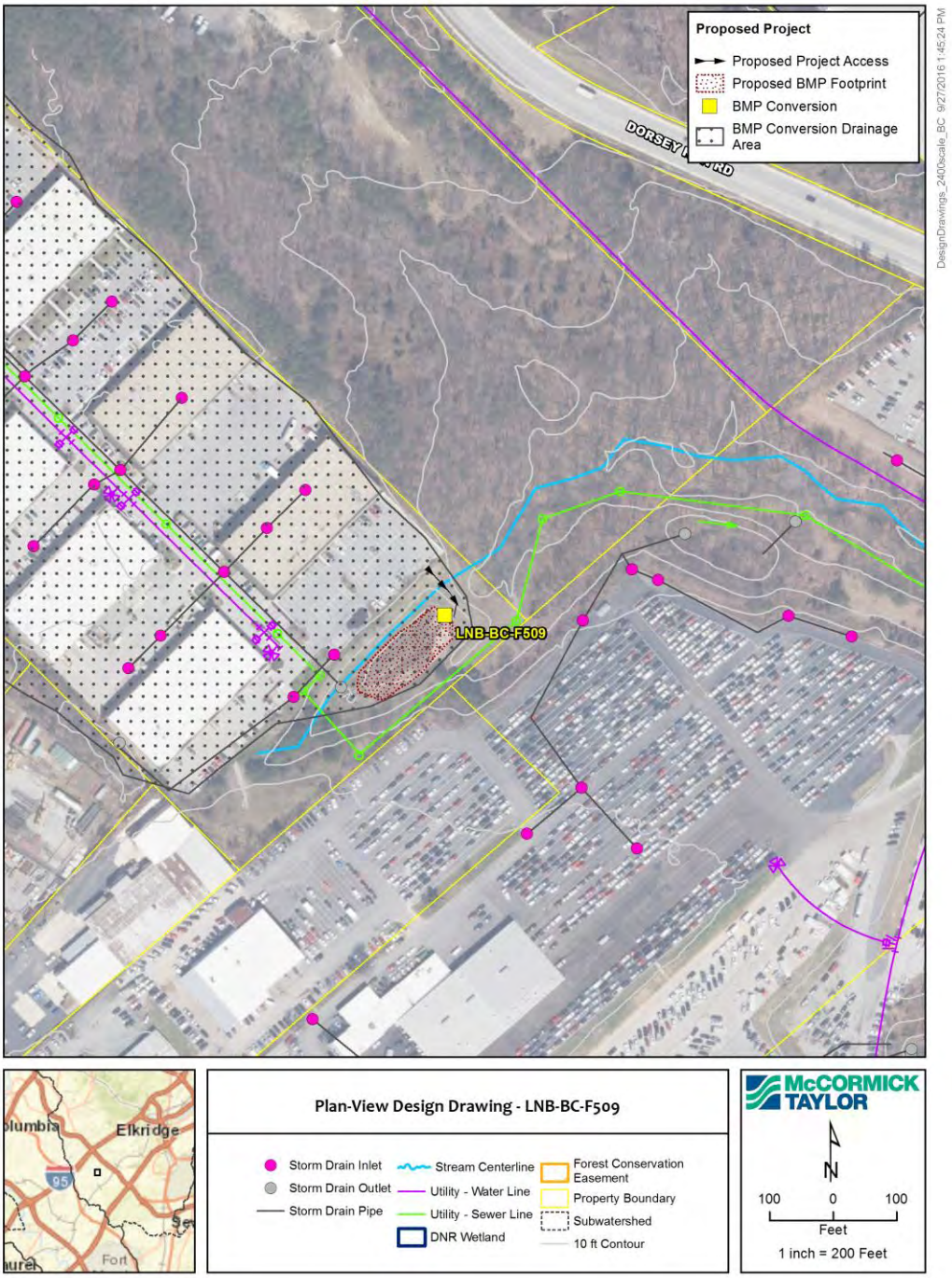
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F509

Site Name: Baltimore Washington Commerce Park

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F510
Site Name: Briarstone Court

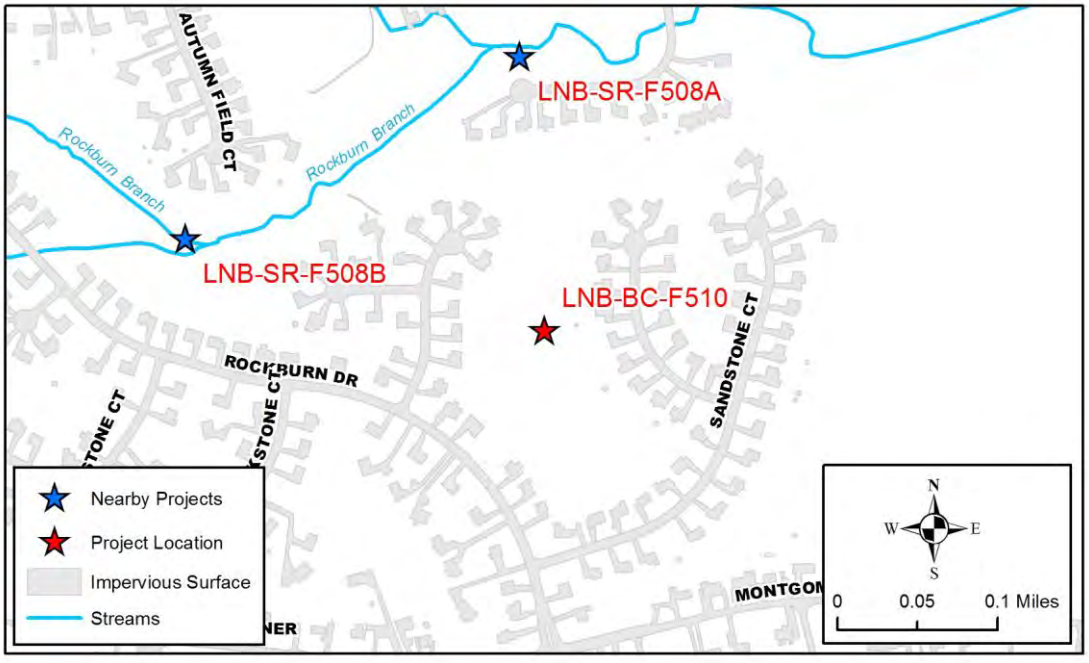
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Retention Pond (Wet Pond)
Ownership: County Owned
Single Owner

BMP Structure ID: HO103158
Existing BMP Type: DP

Existing Conditions:

The site is located in the Rockburn Township development between Briarstone Court and Rockburn Drive. The facility is completely surrounded by homes and currently receives runoff from two storm drain inflows, an 18 in. RCP from Sandstone Ct with an eroded inflow channel and a 24 in. CMP from Rockburn Dr with severe corrosion and trees growing at the pipe. The facility and inflows are located within an existing drainage and utility easement according to the original plans (F-88-273). Pond retrofit design plans (SDP-02-157) proposed improvements to include a new riser structure for extended detention resulting in increased storage and reduced discharges. The concrete riser structure is in good condition except there is less than 1 ft. of clearance between the bottom of the trash rack and the embankment. The embankment appears to be designed per Code 378 standards with an anti-seep collar, concrete cradle, and clay core. Underdrains were also installed throughout the pond bottom. The immediate outfall with riprap is stable; however, just downstream of the riprap, the channel is eroded and beginning to headcut into the riprap. Downstream, most of the channel has several feet of erosion occurring along the banks. Tree roots are exposed, and trees are falling over the channel.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F510
Site Name: Briarstone Court

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking north toward the emergency spillway (left), embankment, and riser structure.

Looking south toward the riser, upland area of the pond, and riser structure from the embankment.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F510
Site Name: Briarstone Court
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include the proximity of the facility to homes, the forest conservation area, and the limited easement area.

Concept Description:

A wet retention pond is proposed within the existing footprint of the dry pond if no WQv treatment is currently provided. The permanent pool elevation is proposed at 372.00 ft. and will be 3 ft. feet deep to a bottom elevation of 369.00 ft. Two 2 ft. deep forebays are proposed to provide the required 1,539 cf. of pretreatment. Excluding the forebay, the facility will provide approximately 24,614 cf. of wet storage in the permanent pool, 139% of the required WQv. A 10 ft. dry maintenance bench is included in the proposed design and an aquatic bench could be added, reducing the provided WQv. The concrete riser and spillway are in good condition and should remain and be modified as needed. It should be considered that the facility was retrofitted per 2002 design plans. The inflows, however, were not stabilized during this retrofit. The area outside of the pond appears to be a forest conservation area, but the inflows have severe erosion and the western CMP inflow is corroded the trees are growing at the pipe end section should be removed. Access to the pond will be along the open space area off Rockburn Drive and will continue northwest to the stormwater management facility, drainage and utility easement on the south end of the existing pond.

Nearby Opportunities:

None recommended.

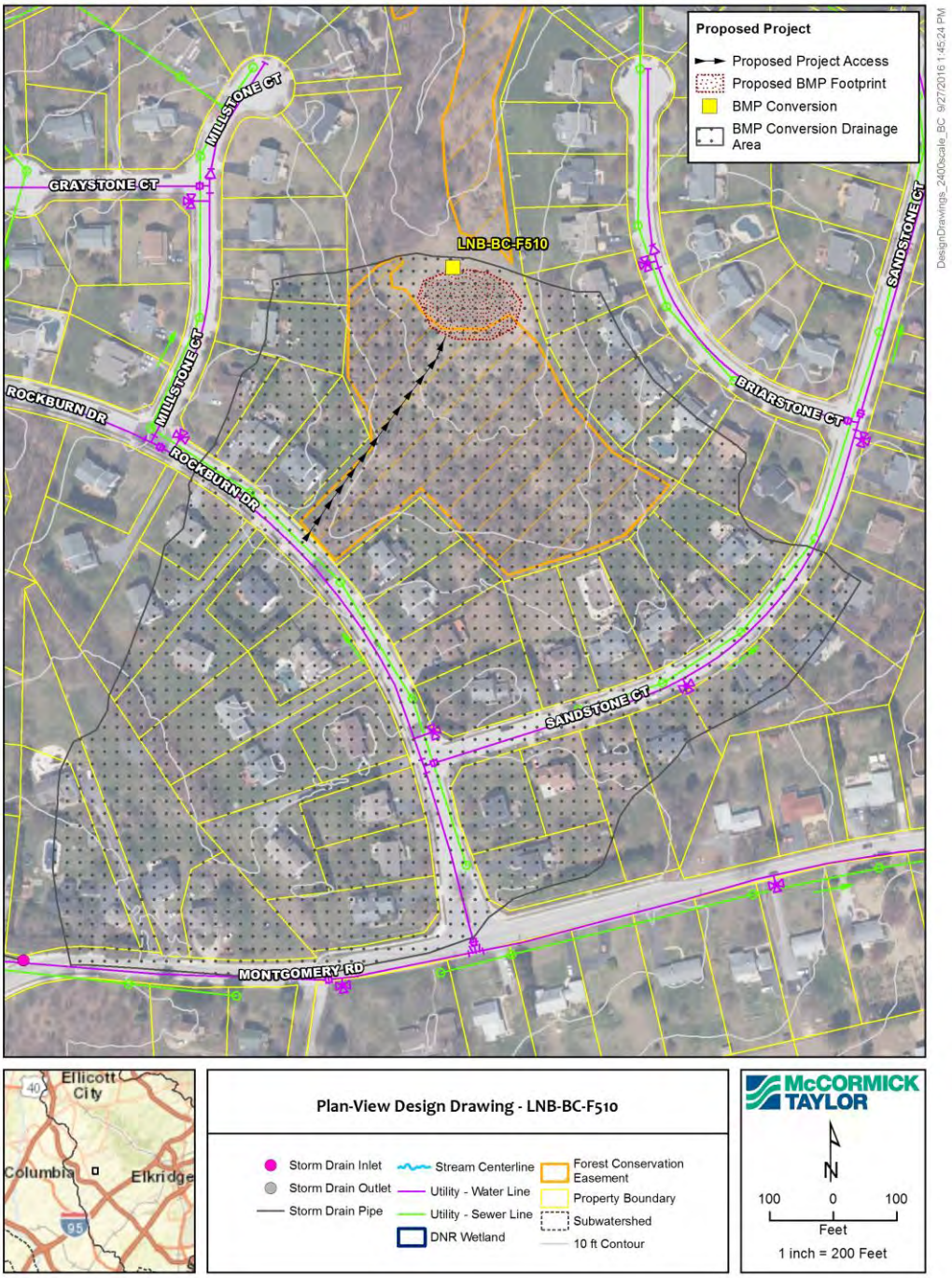
Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	21.34	WQVolume Target (cft.):	17,725
Impervious Area within Drainage (ac.):	4.24	Max Treated (cft.):	24,614
Impervious Area Treated (ac.):	4.24	Percent Treated:	139%
Impervious Area Treated Credit (ac.):	4.65	Rainfall Depth Treated (in.):	1.39

Costs	
Estimated Design Cost:	$220,000
Estimated Construction Cost:	$176,775
30% Contingency:	$119,033
Estimated Total Cost	$515,808
Cost per Impervious Credit Acre:	$110,926

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F510
Site Name: Briarstone Court

Contractor: McCormick Taylor
Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F511
Site Name: Orchard Club

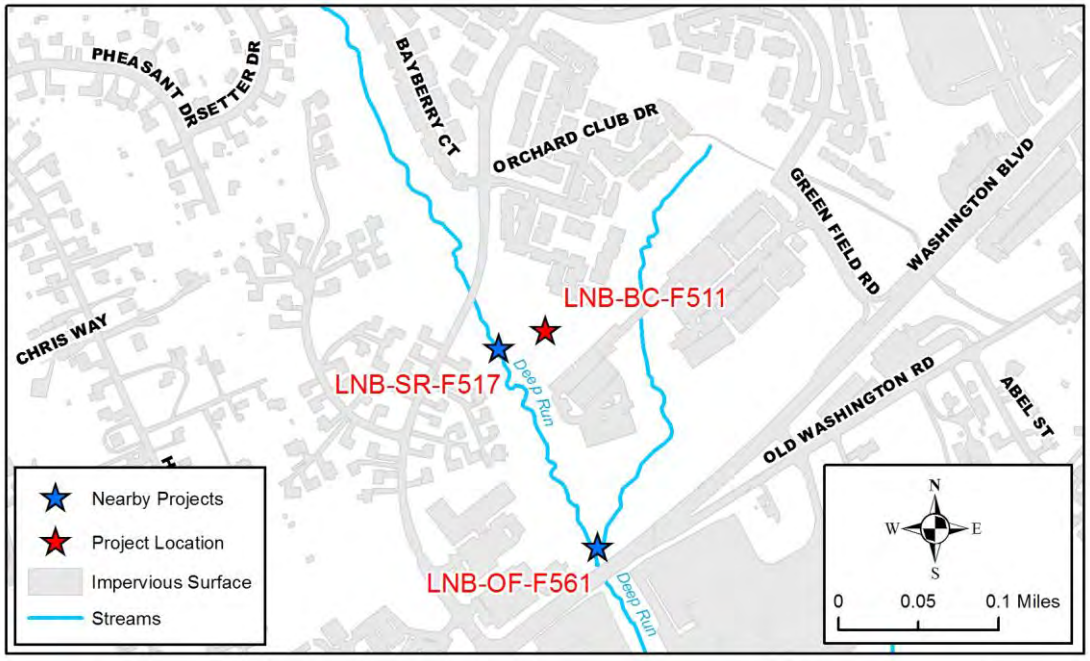
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Extended Detention Structure, Wet
Ownership: Private- HOA
Single Owner

BMP Structure ID: HO103488
Existing BMP Type: DP

Existing Conditions:

The site is located in the Orchard Club apartment complex near the parking lot and playground area. Per the site plans (SDP-90-006), there are three storm drain inflows at the north side of the facility (two 15 in. and one 30 in.). Although this pond was designed as a dry pond, field crews noted standing water in the pond estimated at several feet deep. The inflows were not visible during the field visit and are currently submerged under standing water. The pond is fenced in with several locked gates for access and the water appears to be several feet deep. Cattails and trees line the edge of the water. The riser could not be closely observed, so the overall condition of the concrete structure is unknown, but the trash racks are beginning to corrode. The 36 in. RCP barrel is in good condition, but erosion is occurring at the outfall and a headcut is starting to undermine the outfall end section. Minor erosion in the outfall continues until the outfall channel reaches the main channel downstream. No utilities were observed in the immediate pond area, but there is a sewer line under the playground and along the southeastern edge of the facility. Access is easy from the parking lots and through the gates.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F511
Site Name: Orchard Club

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking southeast toward the riser structure from the area just uphill of the inflows.

Looking west toward the riser structure and embankment.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F511
Site Name: Orchard Club

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include the private property ownership, the proximity of the facility to homes and common space areas used for recreation, the 100-year floodplain of the downstream channel to the west of the facility, and the limited surface area to provide sufficient storage.

Concept Description:

A wet extended detention pond is proposed within the existing footprint of the dry pond. The permanent pool elevation is proposed at 138.00 ft. and will be 4 ft. feet deep to a bottom elevation of 134.00 ft. A small 3 ft. forebay is proposed due to the limited footprint of the facility to provide 1,456 cf. of the required 2,868 cf. of storage for pretreatment. Approximately 17,686 cf. of wet storage is proposed within the permanent pool and an additional 1.52 ft. of extended detention to elevation 139.52 ft. provides 11,367 cf., resulting in a total equal to 100% of the WQv. No benches were provided due to the limited space of this facility. If desired, a bench could be added to the design, but will significantly reduce the provided WQv. A new concrete riser and RCP principal spillway is proposed. The facility will need to comply with Code 378, so a clay liner is proposed along the upstream side of the embankment; alternatively a clay core could be installed. The emergency spillway is expected to be maintained. Woody vegetation will be removed within 15 ft. of the embankment toe and the outfall will be stabilized with riprap. Access to the pond will be from the southwest corner of the Orchard Club parking lot and will follow the existing sewer easement.

Nearby Opportunities:

LNB-SR-F517, LNB-OF-F561

Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	17.81	WQVolume Target (cft.):	29,042
Impervious Area within Drainage (ac.):	7.9	Max Treated (cft.):	29,053
Impervious Area Treated (ac.):	7.9	Percent Treated:	100%
Impervious Area Treated Credit (ac.):	7.9	Rainfall Depth Treated (in.):	1

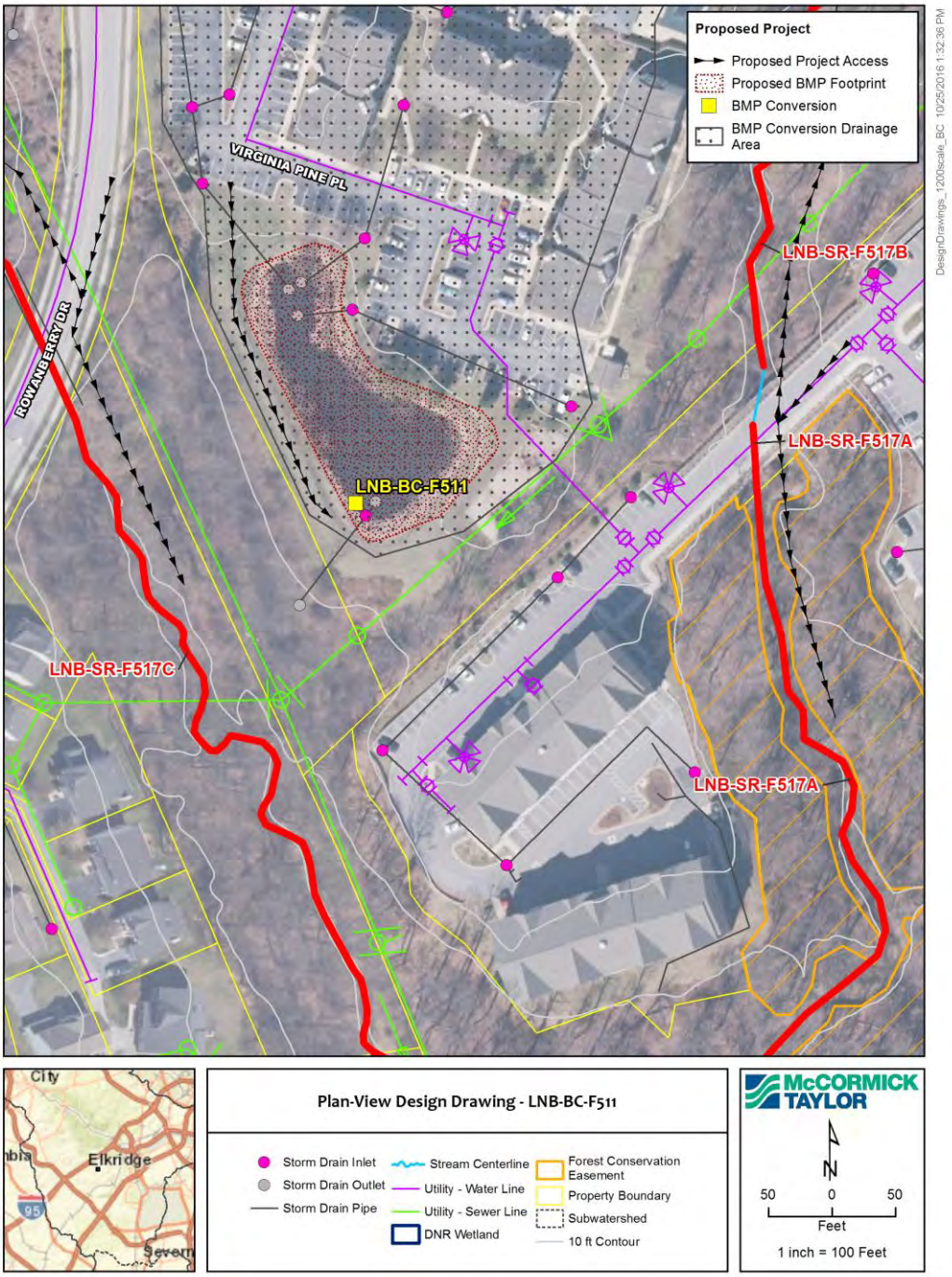
Costs

Estimated Design Cost:	$320,000
Estimated Construction Cost:	$503,636
30% Contingency:	$247,091
Estimated Total Cost	$1,070,727
Cost per Impervious Credit Acre:	$135,535

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F511
Site Name: Orchard Club

Contractor: McCormick Taylor
Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F513
Site Name: Merle Way

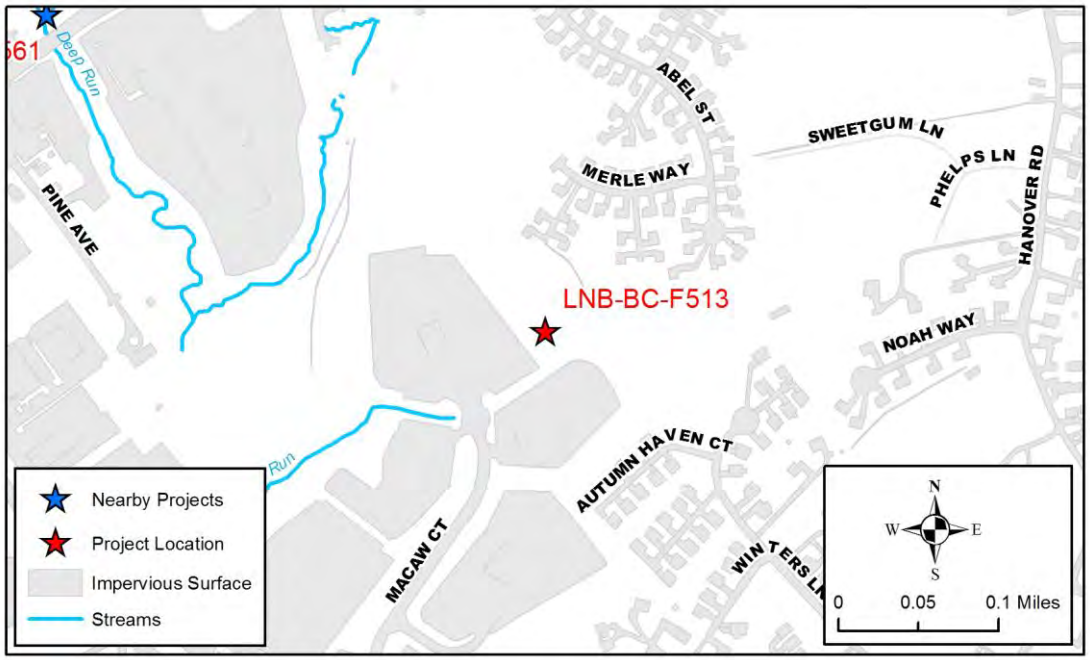
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Retention Pond (Wet Pond)
Ownership: Private- HOA
Multiple Owners

BMP Structure ID: HO103904
Existing BMP Type: EDSD

Existing Conditions:

The site is located in the Williams Knoll neighborhood and borders the backyards of several homes and the neighboring industrial property. Per the design plans (F-97-110) and field observation, the pond receives runoff from one 30 in. RCP storm drain inflow which outfalls into a forebay with a riprap weir. The forebay was observed to have several inches of standing water and a significant amount of cattails were located in the forebay and throughout the pond bottom. Several trees were also observed in the pond bottom and several areas of erosion and slumps were noted in the upstream slopes of the excavated facility. The concrete riser is in good condition with weirs on all sides, although some seepage may be occurring at the riser base. The riser manhole lid was observed off the riser and on the ground, but has since been replaced by facilities. An emergency spillway in the embankment is in good condition and outfalls into the wooded forest conservation area to the east. The 36 in. RCP barrel is in good condition along with the concrete outfall channel. No utilities were observed near the pond, and although there is an open access path, the slopes down to the facility are steep.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F513
Site Name: Merle Way

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking south toward the pond with the inflow, forebay, riser structure, and embankment included in the photo.

Looking north toward the riser and pond area from the embankment with areas of erosion and the access in the distance.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F513
Site Name: Merle Way

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include the private property ownership over multiple properties, the proximity of the facility to homes, steep access slopes, and the forest conservation area.

Concept Description:

A wet retention pond is proposed within the existing footprint of the dry pond. The permanent pool elevation is proposed at 132.00 ft. and to be 3 ft. feet deep to a bottom elevation of 129.00 ft. A 2ft deep forebay is proposed to provide the required 1,278 cf. of pretreatment. Excluding the forebay, the facility will provide approximately 49,510 cf. of wet storage in the permanent pool, 351% of the required WQv. A 10 ft. dry bench is included in the proposed design and an aquatic bench could be added, which would reduce the provided WQv. The cattails and trees in the pond bottom are to be removed. The concrete riser and spillway are in good condition and should remain but modified or replaced as needed. The concrete outfall channel is proposed to be replaced with riprap to dissipate energy and provide an opportunity for infiltration. The facility will need to comply with Code 378, so a clay liner is proposed along upstream side of the embankment if needed. Access to the pond is proposed from the easement at the end of Merle Way. This access is steep and an alternate access could be requested from the neighboring property (Allied Systems) near the pond riser.

Nearby Opportunities:

None recommended.

Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	14.25	WQVolume Target (cft.):	14,086
Impervious Area within Drainage (ac.):	3.52	Max Treated (cft.):	49,510
Impervious Area Treated (ac.):	3.52	Percent Treated:	351%
Impervious Area Treated Credit (ac.):	5.73	Rainfall Depth Treated (in.):	3.51

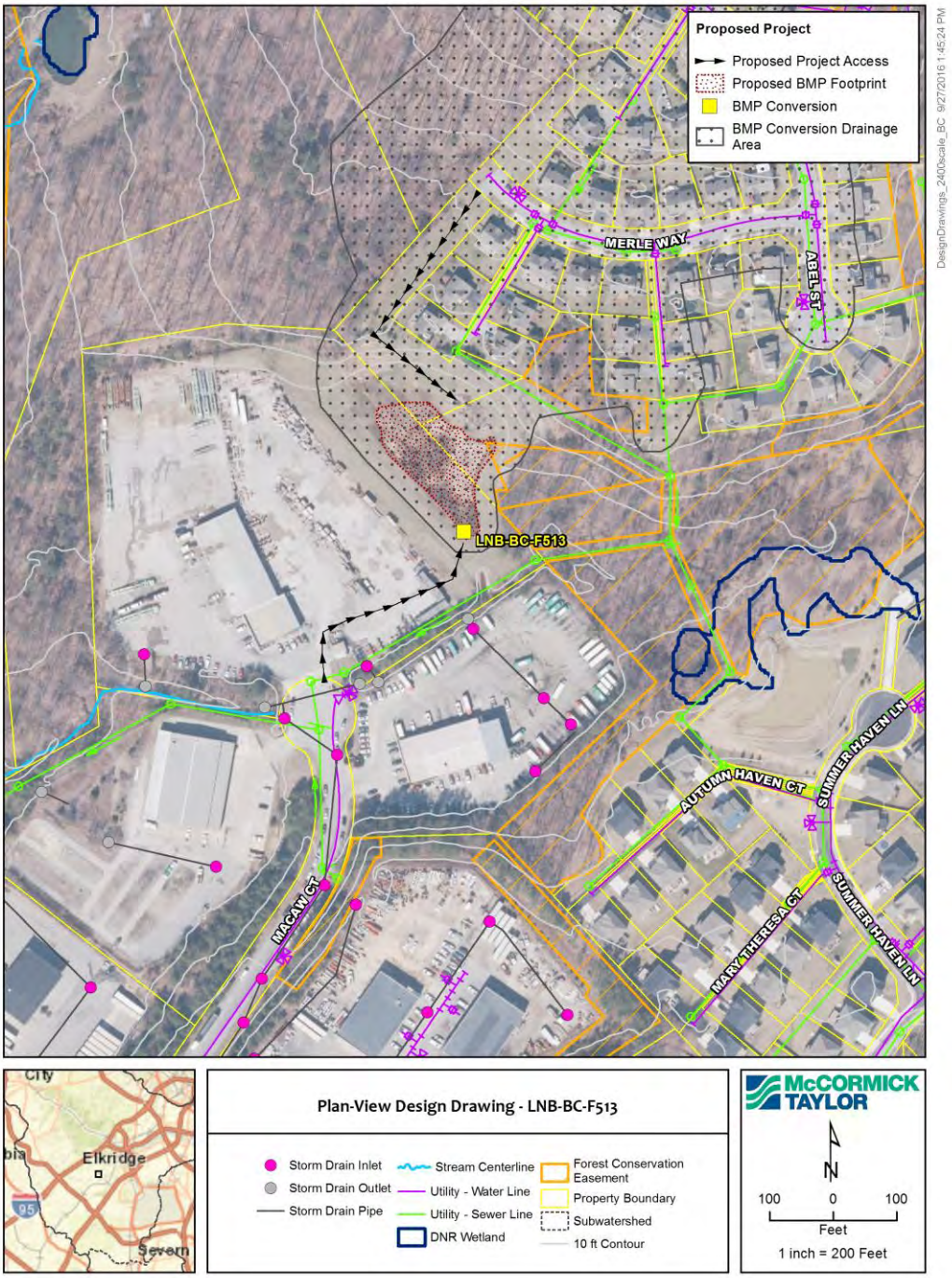
Costs

Estimated Design Cost:	$220,000
Estimated Construction Cost:	$217,690
30% Contingency:	$131,307
Estimated Total Cost	$568,997
Cost per Impervious Credit Acre:	$99,301

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F513
Site Name: Merle Way

Contractor: McCormick Taylor
Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F514
Site Name: Business Parkway 1

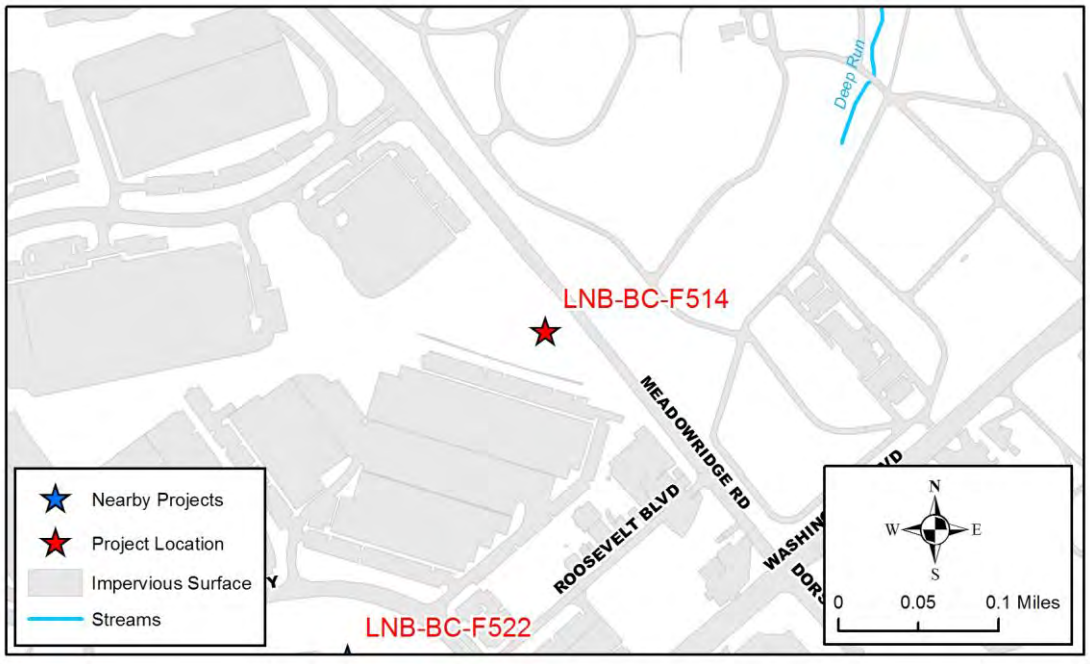
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Retention Pond (Wet Pond)
Ownership: Private- Commerical/Industrial
Single Owner

BMP Structure ID: HO103837
Existing BMP Type: DP

Existing Conditions:

The site is located within the Meadowridge Business Park along Meadowridge Road. Although this pond was designed as a dry pond field crews observed standing water in the pond and the water appeared to be several feet deep. Three storm drain inflows (two 48 in. RCP and one 27 in. RCP) were observed in the field along with an additional swale in the western corner that is likely the contribution of several storm drain outfalls along a small channel leading to the pond. Several PVC outfalls, assumed to be from building roofs, were also observed along the pond perimeter. Per several design plans (F-89-163, SDP-89-069, 98-075-p07), the development in the business park increased the storm drain inflows and pond impervious drainage area over several years. The BCCMP riser and 30 in. BCCMP spillway pipe are corroding. The 30 in. barrel has several holes along the sides and bottom and outfalls for a few feet before entering a corroding 24 in. CMP pipe that goes under Meadowridge Road. The 24 in. CMP also has holes from severe corrosion. An emergency spillway exists in the southeastern corner of the facility, but it is unclear where any overflow would easily continue to flow. The area appears to be a sump and likely this causes localized roadway flooding during larger storm events. No utilities were observed in the pond area, although water and sewer lines likely run along the bottom of the embankment and Meadowridge Road. Access is easy from Meadowridge Road, although getting around the entire pond may be difficult with some areas of steeper slopes and thick vegetation.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F514
Site Name: Business Parkway 1

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking southeast along the embankment toward the riser structure and emergency spillway.

Looking northwest along the embankment toward the riser structure.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F514
Site Name: Business Parkway 1
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include the private property ownership, the proximity of the facility to a major roadway, and the slopes along some of the upstream areas.

Concept Description:

A wet retention pond is proposed within the existing footprint of the dry pond. The permanent pool elevation is proposed at 176.00 ft. and to be 6 ft. feet deep to a bottom elevation of 170.00 ft. Two 2 ft. and one 3 ft. deep forebays provide the required 21,123 cf. of pretreatment. Excluding the forebays, the facility will provide approximately 406,147 cf. of wet storage in the permanent pool, 150% of the required WQv. A 10ft dry bench is provided at the permanent pool elevation. If desired, an additional wet bench could be added to the design, but will reduce the provided WQv. It is anticipated that facility excavation will be difficult due to the sedimentation of the pond and existing ponded water. A new concrete riser and RCP principal spillway is proposed to replace the corroding BCCMP riser and barrel. The facility will need to comply with Code 378, so a clay liner is proposed along the upstream side of the embankment; alternatively a clay core could be installed. The emergency spillway is expected to be maintained, although additional storm drain improvements along Meadowridge Road may be necessary to ultimately reduce localized flooding. The outfall will be stabilized with riprap to the downstream roadway culvert. Access to the pond will be from Meadowridge Road near the northeastern corner of the existing facility.

Nearby Opportunities:

None recommended.

Proposed Project Credit	
Drainage Area (ac.):	92.98
Impervious Area within Drainage (ac.):	58.19
Impervious Area Treated (ac.):	58.2
Impervious Area Treated Credit (ac.):	65.4

Water Quality Volume	
WQVolume Target (cft.):	206,983
Max Treated (cft.):	406,147
Percent Treated:	150%
Rainfall Depth Treated (in.):	1.5

Costs

Estimated Design Cost:	$320,000
Estimated Construction Cost:	$1,128,066
30% Contingency:	$434,420
Estimated Total Cost	$1,882,485
Cost per Impervious Credit Acre:	$28,767

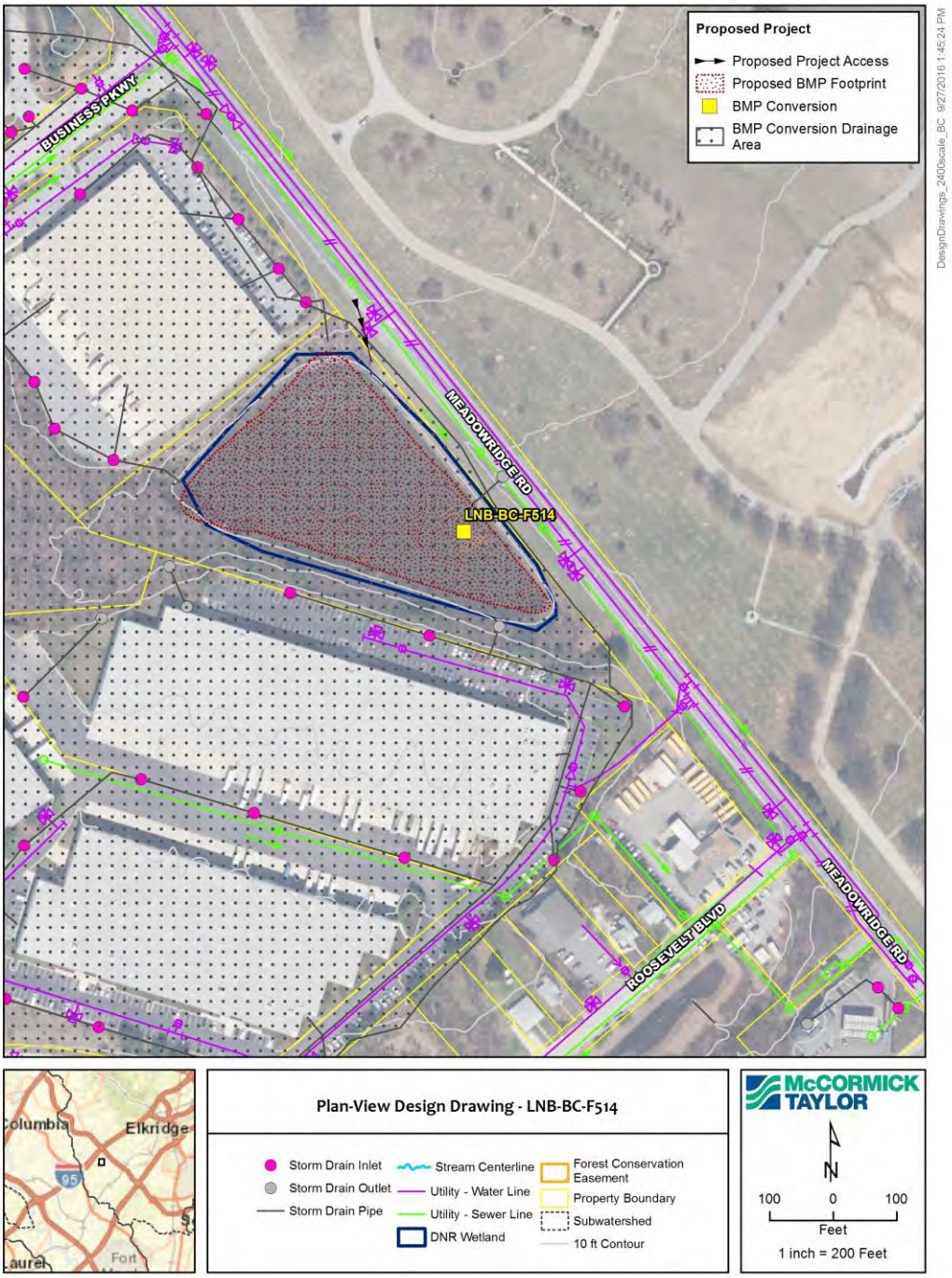
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F514

Site Name: Business Parkway 1

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F515
Site Name: Manchester Way

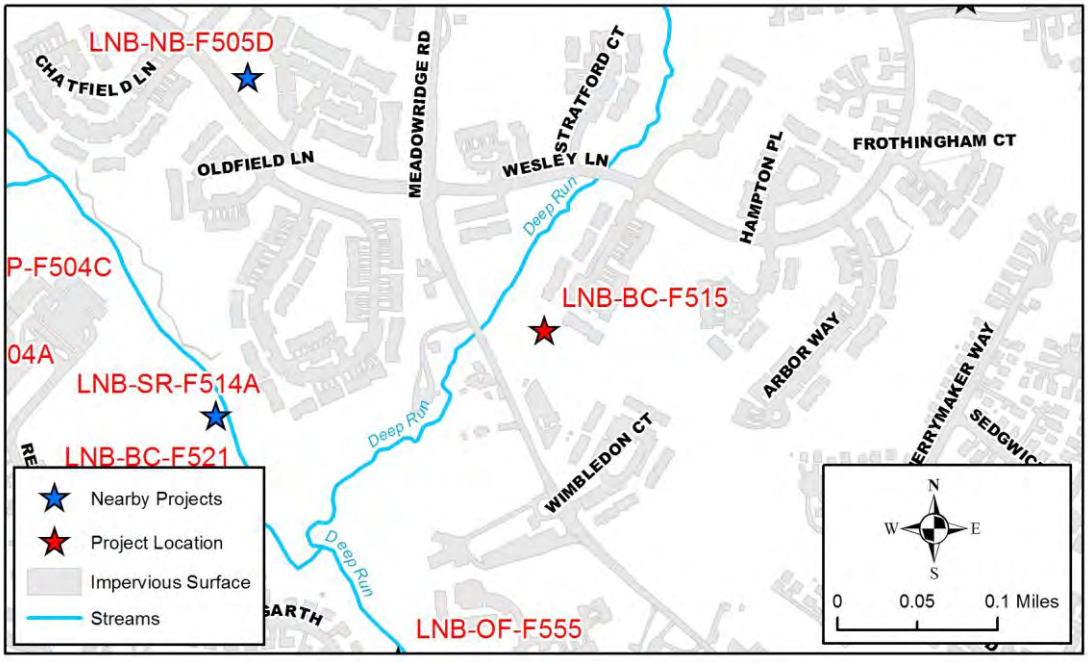
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Extended Detention Structure, Wet
Ownership: Private- HOA
Multiple Owners

BMP Structure ID: HO103467
Existing BMP Type: DP

Existing Conditions:

The site is located in the Willowood neighborhood behind the Manchester Way cul-de-sac. The pond is within the Willowood Homeowners Association property and the outfall is on Howard County property. The pond appears small for the drainage area and is heavily vegetated with trees and tall shrubs. One 30 in. RCP storm drain inflow enters the pond at the north end. The inflow is submerged with several trees growing around the concrete end section. The pond also has a significant amount of sediment throughout the bottom. Per design plans (F-87-041) and field observation, the outfall is a CMP end section and 30 in. BCCMP pipe leading to a manhole structure with a concrete control weir in the center of the embankment. Downstream of the weir, another section of 30 in. BCCMP completes the spillway. At the outfall, a large tree is growing into the pipe and end section. The 30 in. BCCMP pipes and end sections are actively corroding. The outfall is relatively stable with a small channel leading downstream through a wooded area. An emergency spillway is present on the south side of the facility. The backyards of several townhomes are in close proximity to the pond. A sewer manhole was observed near the parking lot, but access to the embankment is easy from Manchester Way or Meadowridge Road.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F515
Site Name: Manchester Way

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking south toward the pond and the area of the storm drain inflow.

Looking south toward the pond and Meadowridge Road from the embankment near the outlet structure manhole.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F515
Site Name: Manchester Way
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include the private property ownership, the proximity of the facility to homes, and possibly the 100-year floodplain of the downstream channel.

Concept Description:

A wet extended detention pond is proposed within the existing footprint of the dry pond. The permanent pool elevation is proposed at 272.00 ft. and to be 2 ft. feet deep to a bottom elevation of 270.00 ft. No forebay is proposed due to the limited footprint of the facility. Approximately 3,669 cf. of wet storage is proposed within the permanent pool and an additional 3 ft. of extended detention to elevation 275.00 ft. provides 12,607 cf., resulting in 109% of the WQv. No benches were provided due to the limited space of this facility, but the permanent pool is only 2 ft. deep. If desired, a bench could be added to the design, but will reduce the provided WQv. A new concrete riser and RCP principal spillway is proposed. The facility will need to comply with Code 378, so a clay liner is proposed along the upstream side of the embankment; alternatively a clay core could be installed. The emergency spillway is expected to be maintained. Woody vegetation will be removed within 15 ft. of the embankment toe and the outfall will be stabilized with riprap. Access to the pond will be along the existing 20 ft. wide path from Meadowridge Road on the southwest side of the facility. Existing boulders along Meadowridge Road may need to be moved to allow access.

Nearby Opportunities:

None recommended.

Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	12.27	WQVolume Target (cft.):	14,936
Impervious Area within Drainage (ac.):	3.89	Max Treated (cft.):	16,276
Impervious Area Treated (ac.):	3.89	Percent Treated:	109%
Impervious Area Treated Credit (ac.):	3.98	Rainfall Depth Treated (in.):	1.09

Costs

Estimated Design Cost:	$220,000
Estimated Construction Cost:	$232,051
30% Contingency:	$135,615
Estimated Total Cost	$587,667
Cost per Impervious Credit Acre:	$147,655

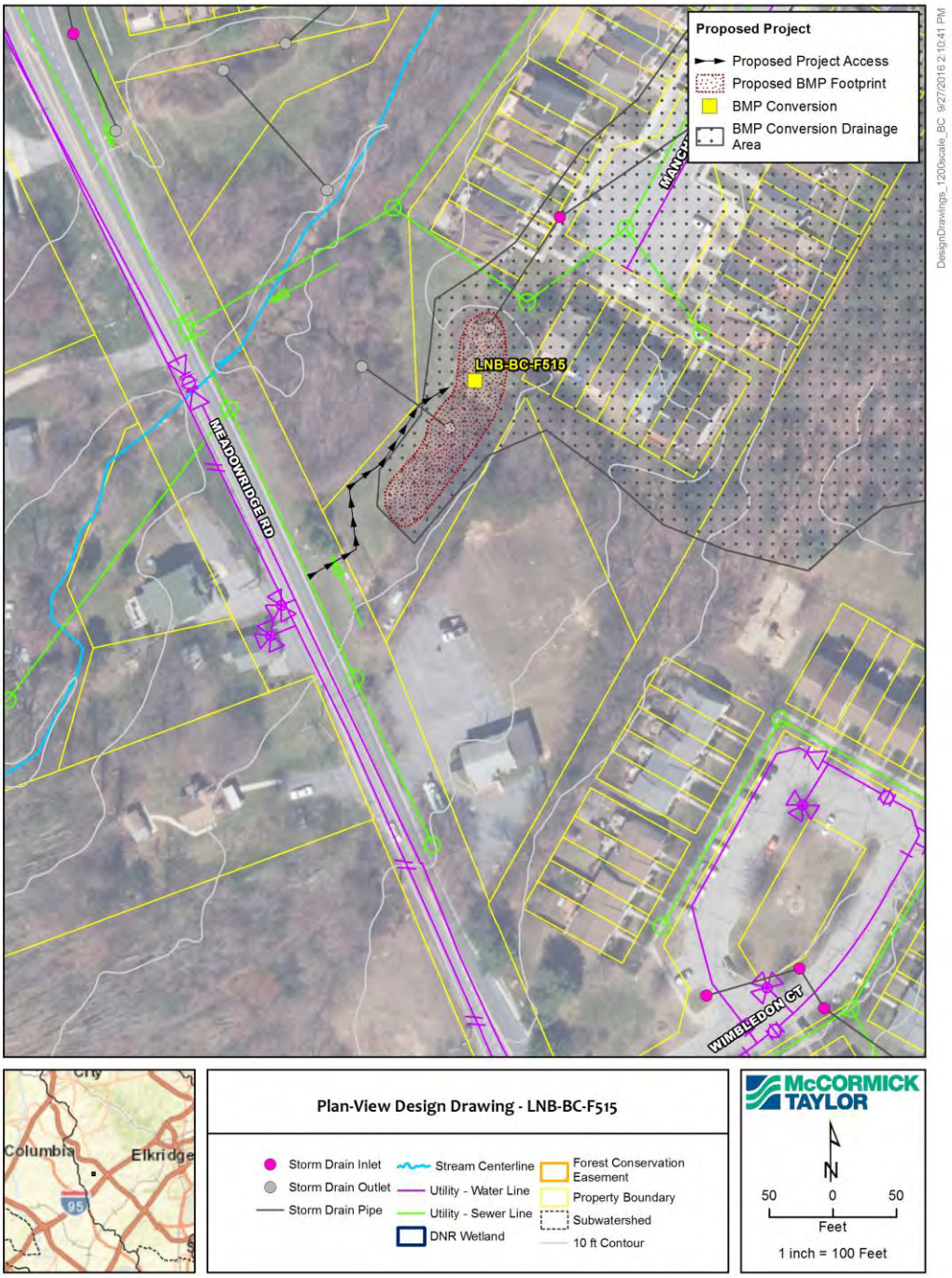
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F515

Site Name: Manchester Way

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F516
Site Name: Santa Barbara Rd

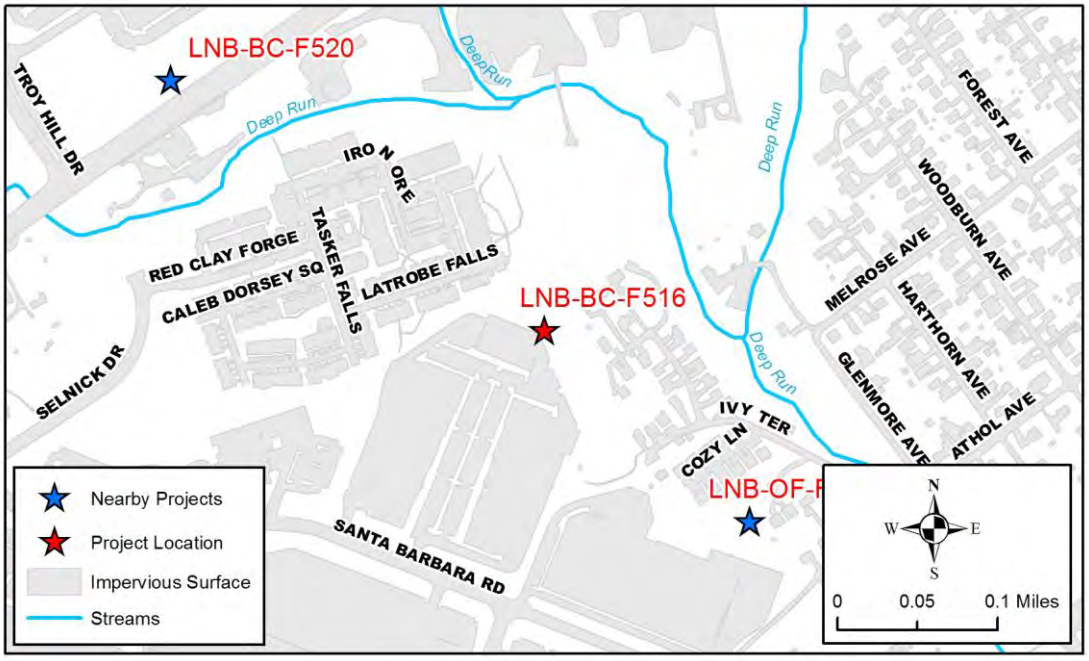
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Retention Pond (Wet Pond)
Ownership: Private- Commerical/Industrial
Single Owner

BMP Structure ID: HO103878
Existing BMP Type: DP

Existing Conditions:

The site is located behind the Tech 100 business complex on Santa Barbara Road. The pond receives runoff from three storm drain inflows. The pond footprint is large and has several elevation changes within the bottom; the elevation of the bottom decreases from south to north. The pond bottom is heavily vegetation with trees, large brush, and tall grasses. Significant amounts of phragmites are located in the pond, and particularly at the two inflows that are submerged in water. A pilot channel flows from the inflows to the riser. The concrete riser is in good condition and per the design plans (SDP-88-141) and field visit, there are weirs on three sides along with the low flow. The 36 in. BCCMP principal spillway is corroding, but the outfall is stable. The outfall channel is steep, but the approximately 75 ft. long gabion riprap channel is in good condition with little to no erosion until the end where a headcut at the gabion is forming. Following the confluence with the downstream channel, moderate erosion is occurring and causing an incised channel. No utilities were visible in the pond vicinity and access from the business complex parking lot is easy in most areas. The pond does, however, border some homes on the eastern side.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F516
Site Name: Santa Barbara Rd

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking north toward the area of phragmites at the inflows from the upland area of the pond.

Looking north toward the riser structure and embankment.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F516
Site Name: Santa Barbara Rd

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include the private property ownership and the proximity of the facility to homes.

Concept Description:

A wet retention pond is proposed within the existing footprint of the dry pond. Two permanent pools separated by an elevated earth berm are proposed at elevations 153.00 ft. and 152.00 ft. and combined provide 30,207 cf. of storage, approximately 103% of the required WQv. Two forebays, located at the southern two inflows, are each proposed 2 ft. deep to provide a total of 2,105 cf. of pretreatment. No forebay was proposed at the northern inflow due to the narrow footprint of the facility in this area. A 10 ft. dry bench is provided at the upper permanent pool elevation 153.00 ft. If desired, an additional wet bench could be added to the design, but will reduce the provided WQv. A new concrete riser and RCP principal spillway is proposed. The facility will need to comply with Code 378, so a clay liner is proposed along the upstream side of the embankment; alternatively a clay core could be installed. Woody vegetation will be removed within 15ft of the embankment toe and the outfall will be stabilized with riprap. The downstream slope of the embankment is steep and access in this area may be difficult. Access to the facility will be from the northeast corner of the parking lot of the business park at 6679 Santa Barbara Road.

Nearby Opportunities:

None recommended.

Proposed Project Credit	
Drainage Area (ac.):	12.11
Impervious Area within Drainage (ac.):	8.28
Impervious Area Treated (ac.):	8.28
Impervious Area Treated Credit (ac.):	8.87

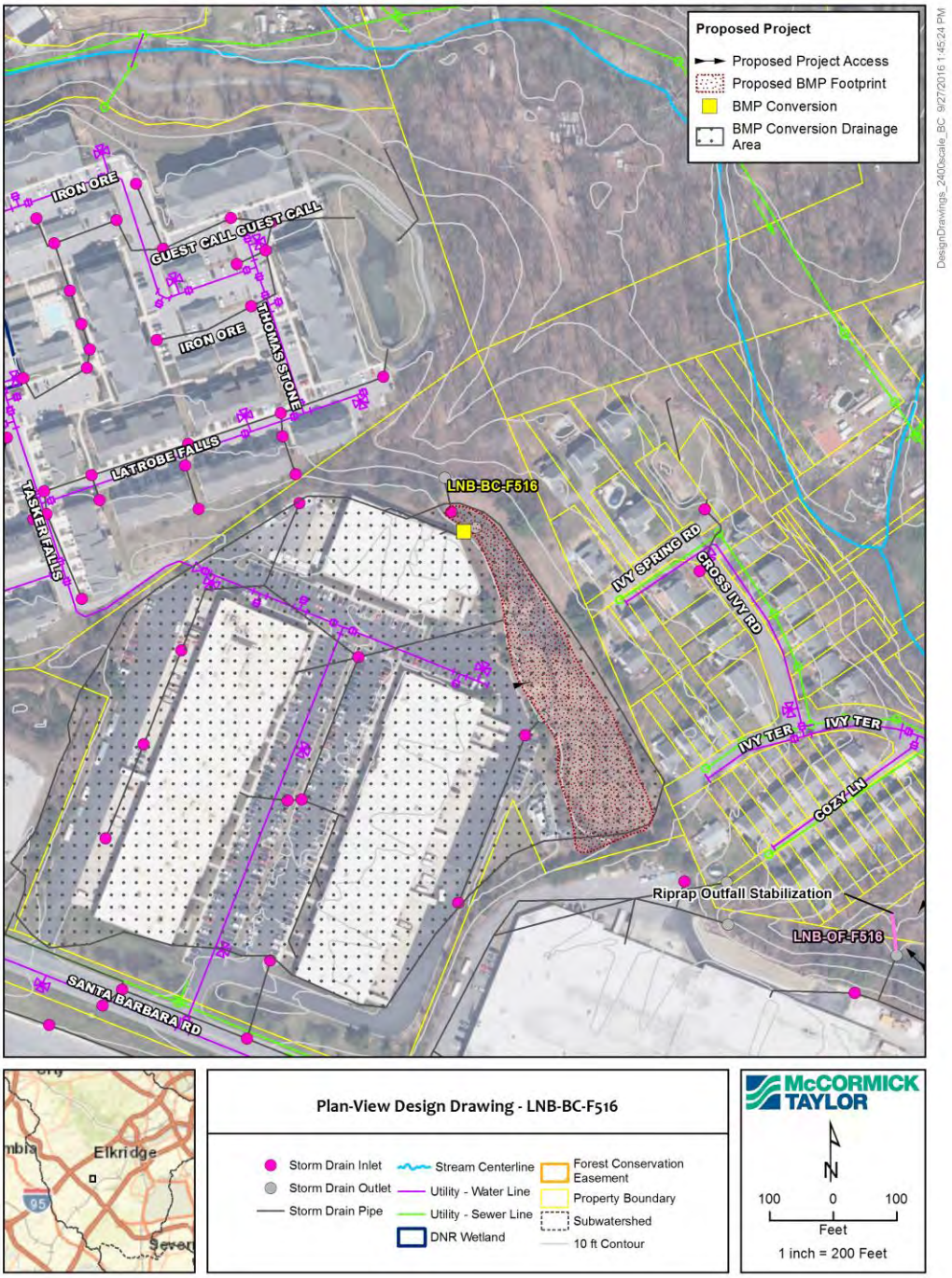
Water Quality Volume	
WQVolume Target (cft.):	29,249
Max Treated (cft.):	37,593
Percent Treated:	129%
Rainfall Depth Treated (in.):	1.29

Costs	
Estimated Design Cost:	$220,000
Estimated Construction Cost:	$341,959
30% Contingency:	$168,588
Estimated Total Cost	$730,546
Cost per Impervious Credit Acre:	$82,361

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F516
Site Name: Santa Barbara Rd

Contractor: McCormick Taylor
Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F517
Site Name: Gatepost Way

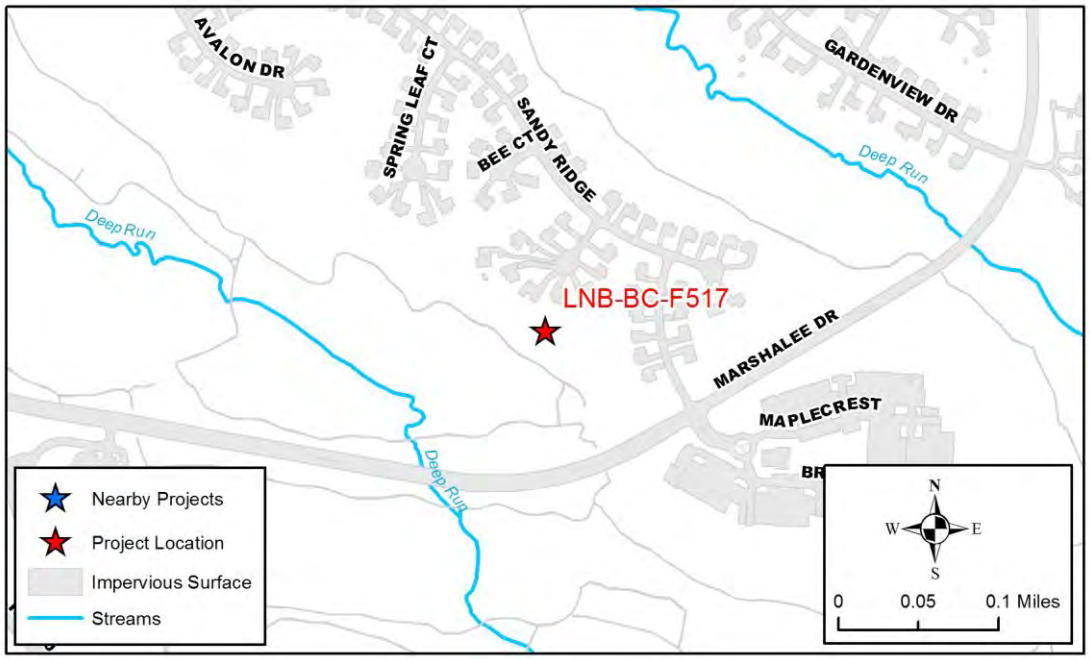
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Retention Pond (Wet Pond)
Ownership: Private- HOA
Single Owner

BMP Structure ID: HO104132
Existing BMP Type: EDSD

Existing Conditions:

The site is located west of Gatepost Way in the Lynwood Manor neighborhood. The pond receives runoff from an 18 in. RCP storm drain inflow from Gatepost Way and a 27 in. RCP storm drain from Nightrose Court and Sandy Ridge Court. The 18 in. inflow is open with sedimentation and vegetation growing, but the 27 in. inflow is blocked and buried in vegetation and woody debris. It appears homeowners dump leaves and plants in the area. The headwall was only slightly visible. Both inflows outfall into a small forebay that has several inches of standing water along with cattails, trees, and tall grasses growing. A riprap weir from the forebay also serves as a pilot channel to the riser. The existing concrete and brick riser structure per design plans (F-94-094 and F-94-095) and field observation has a low flow standpipe and one weir opening on the front face. The riser concrete and brick are overall in good condition, but some seepage may be occurring and there is ground erosion around the back of the structure. The 15 in. RCP barrel is in good condition and the riprap outfall is stable. The outfall is open for approximately 30 ft. before entering another, larger RCP culvert which goes under a fairway on the bordering golf course. An existing emergency spillway is located along the southwestern portion of the embankment. No conflicting utilities were observed, but the pond is in close proximity to several homes and the golf cart path. An access path from Gatepost Way is open, although slightly sloped.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F517
Site Name: Gatepost Way

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking northwest toward the pond from the access path with the inflows and forebay to the right, riser in the center, and embankment on the left.

Looking southeast toward the access path, pond area, and low flow standpipe from the riser structure.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F517
Site Name: Gatepost Way

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include the private property ownership and the proximity of the facility to homes and the Timbers at Troy golf course.

Concept Description:

A wet retention pond is proposed within the existing footprint of the dry pond. The permanent pool elevation is proposed at 276.00 ft. and to be 4 ft. feet deep to a bottom elevation of 272.00 ft. A 1 ft. deep forebay is proposed to provide the required 1,303 cf. of pretreatment. Excluding the forebay, the facility will provide approximately 15,247 cf. of wet storage in the permanent pool, 110% of the required WQv. A 10 ft. dry maintenance bench is provided at the permanent pool elevation. If desired, an additional wet bench could be added to the design, but will reduce the provided WQv. A new concrete riser and RCP principal spillway is proposed. The facility will need to comply with Code 378, so a clay liner is proposed along the upstream side of the embankment; alternatively a clay core could be installed. The emergency spillway is expected to be maintained. Woody vegetation will be removed within 15ft of the embankment toe and the outfall will be stabilized with riprap to the downstream culvert at the golf course. Access to the pond will be along the existing public stormwater facility access, drainage and utility easement extending from Gatepost Way.

Nearby Opportunities:

None recommended.

Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	11.46	WQVolume Target (cft.):	13,809
Impervious Area within Drainage (ac.):	3.59	Max Treated (cft.):	15,247
Impervious Area Treated (ac.):	3.59	Percent Treated:	110%
Impervious Area Treated Credit (ac.):	3.68	Rainfall Depth Treated (in.):	1.1

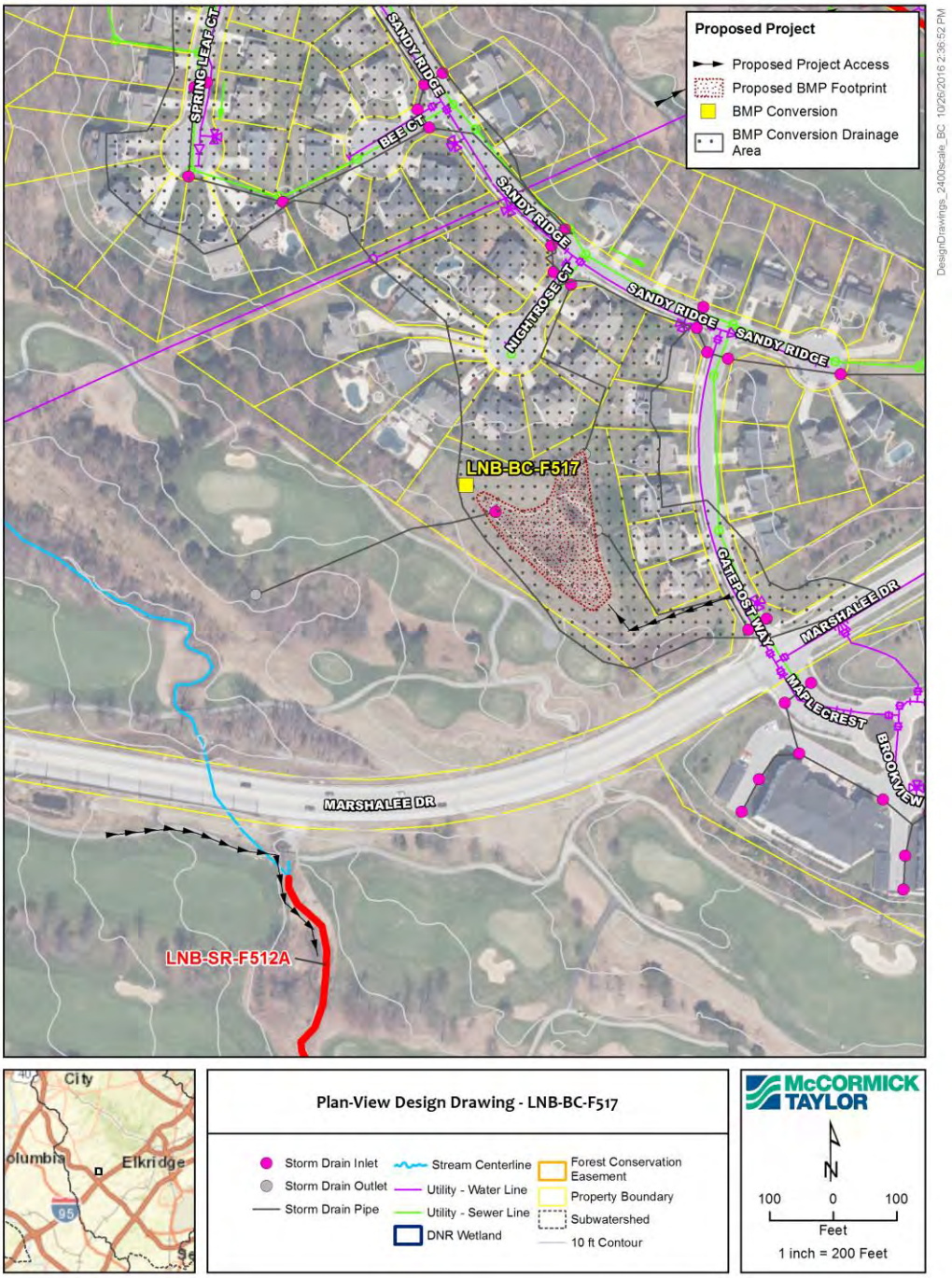
Costs

Estimated Design Cost:	$220,000
Estimated Construction Cost:	$332,017
30% Contingency:	$165,605
Estimated Total Cost	$717,623
Cost per Impervious Credit Acre:	$195,006

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F517
Site Name: Gatepost Way

Contractor: McCormick Taylor
Watershed: Patapsco Lower North



Plan-View Design Drawing - LNB-BC-F517

Storm Drain Inlet
Storm Drain Outlet
Storm Drain Pipe
Stream Centerline
Utility - Water Line
Utility - Sewer Line
DNR Wetland
Forest Conservation Easement
Property Boundary
Subwatershed
10 ft Contour

McCORMICK TAYLOR

N

100 0 100
Feet
1 inch = 200 Feet

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F518
Site Name: Troy Hill 3

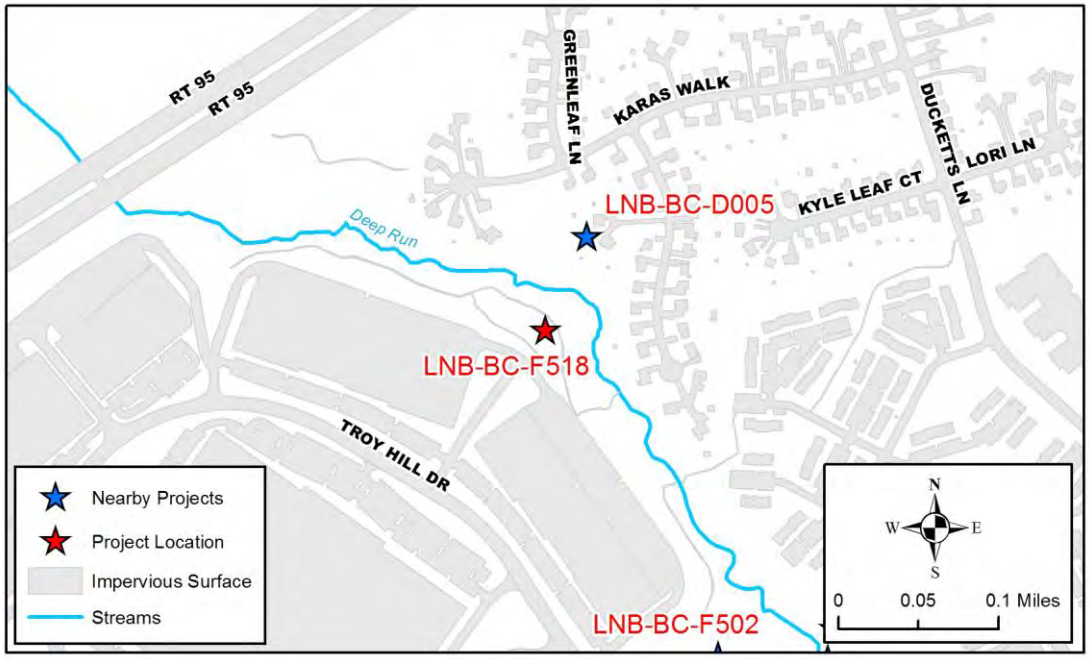
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Retention Pond (Wet Pond)
Ownership: Private- HOA
Single Owner

BMP Structure ID: HO103924
Existing BMP Type: EDSD

Existing Conditions:

The site is a commercial business park with large warehouses, loading docks, and parking lots. Currently, flows enter the pond from two 24 in. RCP storm drain inflows and concrete channels from both inflows direct runoff to the riser. The pond was observed dry with some water in and around the concrete channels. A bedrock outcrop was observed near the western inflow. The large riser has a concrete low flow pipe that was not observed to match the drawdown device per the plans (SDP-98-114-p19). The concrete riser is in good condition with weirs on all four sides, but there is not 1 ft. of clearance between the trash rack and the embankment. The 48 in. RCP principal spillway is also in good condition. The outfall is stable with gabion outfall protection and riprap. The downstream channel, however, has moderate erosion. There is a narrow grass access path from the warehouse parking lot to the facility.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F518
Site Name: Troy Hill 3

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking northwest from the access path toward the pond area, concrete inflow channels, riser structure, and embankment.

Looking east at the outfall gabion weir channel from the embankment.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F518
Site Name: Troy Hill 3

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include the property ownership and potential wetland impacts at the outfall. The pond is on private property and a sewer line runs along the western edge of the facility.

Concept Description:

A wet retention pond is proposed within the existing footprint of the dry pond. The permanent pool elevation is proposed at 169.00 ft. and to be 4 ft. feet deep to a bottom elevation of 165.00 ft. The pond area will be graded to provide approximately 11,846 cf. of wet storage, approximately 34% of the required WQv. No forebays or benches are proposed due to the limited footprint of the facility. A new concrete structure or modifications to the existing structure if feasible are proposed. The facility will need to comply with Code 378, so a clay liner is proposed along the upstream side of the embankment; alternatively a clay core could be installed. Excavation at this site may be difficult due to the presence of bedrock. Access to the pond will be along the existing grassed path beginning in the northwestern corner of the rear parking lot of the southeastern building structure located off Troy Hill Drive.

Nearby Opportunities:

LNB-BC-F502, LNB-BC-F524, LNB-OF-F557, LNB-OF-F558, LNB-SR-F552A

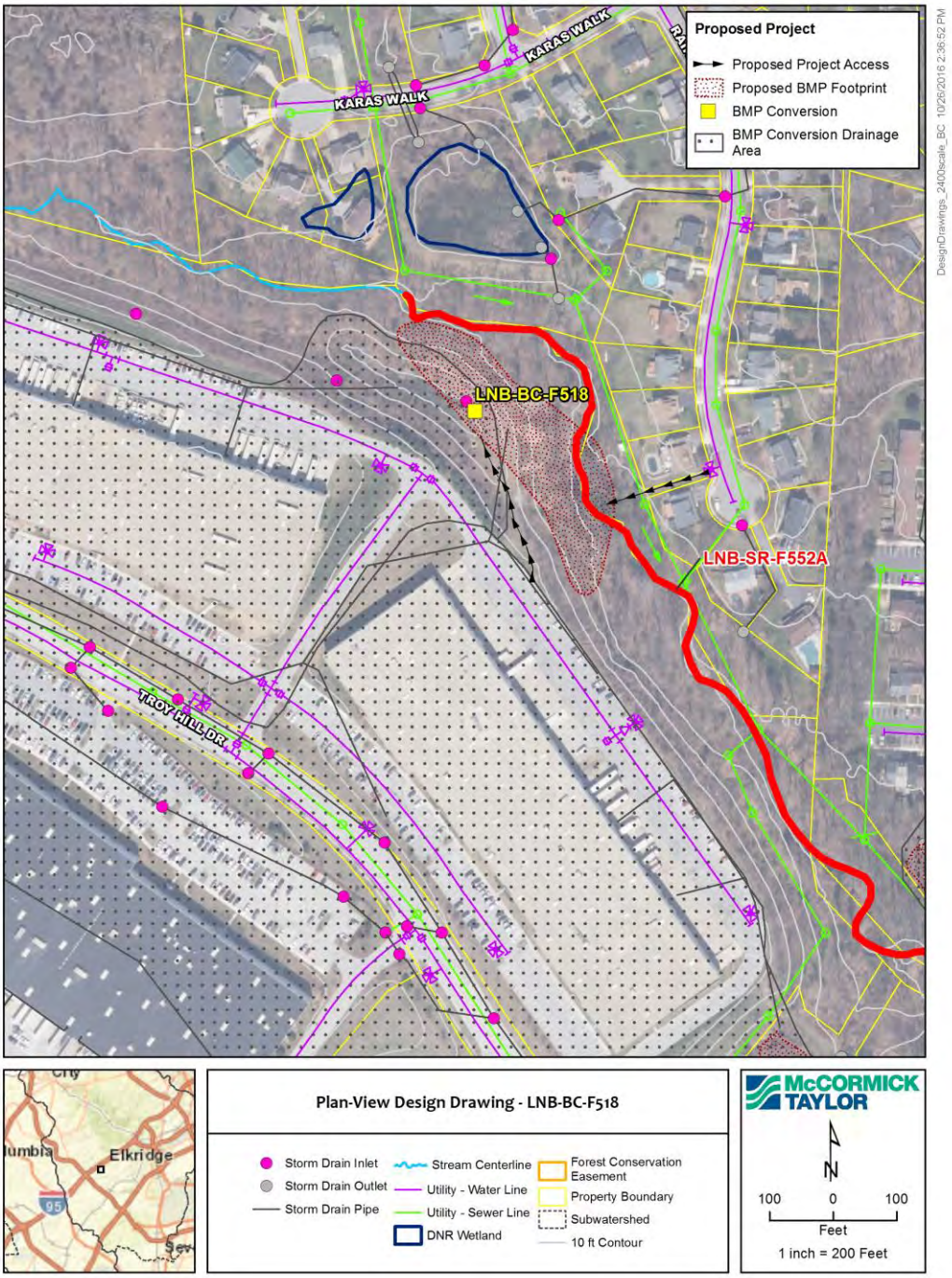
Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	11.33	WQVolume Target (cft.):	26,624
Impervious Area within Drainage (ac.):	7.52	Max Treated (cft.):	11,846
Impervious Area Treated (ac.):	2.57	Percent Treated:	34%
Impervious Area Treated Credit (ac.):	2.57	Rainfall Depth Treated (in.):	0.34

Costs	
Estimated Design Cost:	$220,000
Estimated Construction Cost:	$251,947
30% Contingency:	$141,584
Estimated Total Cost	$613,531
Cost per Impervious Credit Acre:	$238,728

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F518
Site Name: Troy Hill 3

Contractor: McCormick Taylor
Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F519
Site Name: Ruxton Drive

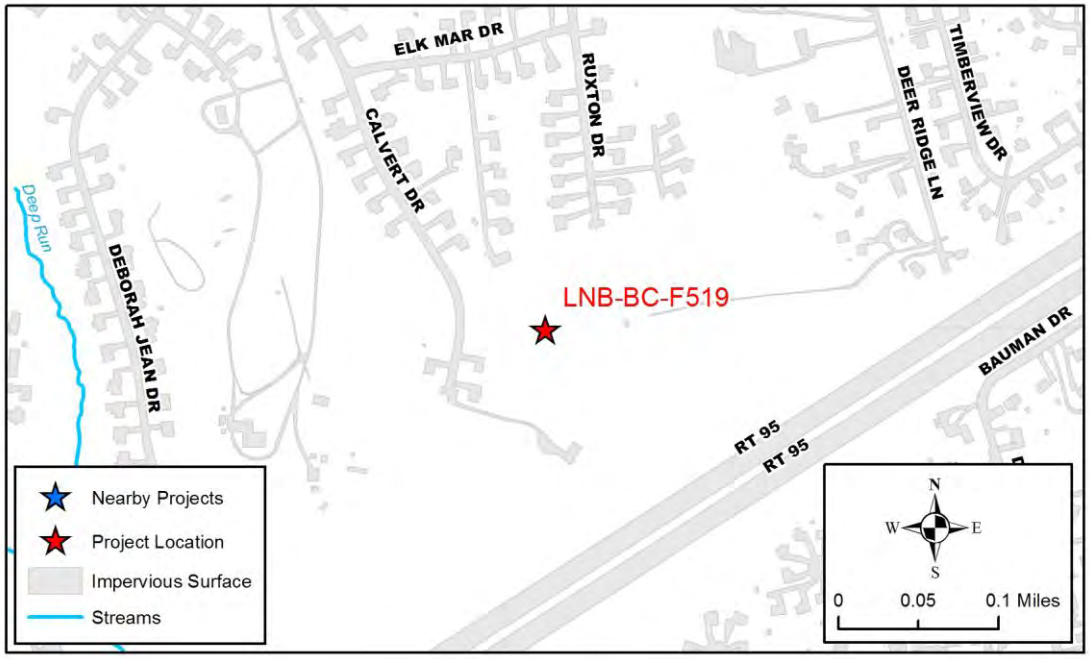
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Retention Pond (Wet Pond)
Ownership: County Owned
Single Owner

BMP Structure ID: HO103110
Existing BMP Type: EDSD

Existing Conditions:

The site is located southwest of the Ruxton Drive cul-de-sac in a residential neighborhood with approximately 1 ac. lots. Per design plans (96-165-p26) and field observation, the pond receives runoff from one 24 in. RCP storm drain inflow. A small forebay is elevated above the pond bottom elevation and a gabion riprap mattress serves as the weir between the forebay and pond area. Standing water and cattails were observed in the forebay and throughout the pond, although a majority of the pond bottom was dry. The forebay gabion weir is actively failing due to erosion and debris. The outfall structure is a small concrete weir which is in good condition. The riprap outfall is stable and there is no defined outfall channel. Flow from the pond sheet flows into an open space, wooded area. Sewer lines run along the access easement from Ruxton Drive and along the western side of the facility. Access is mostly clear through an existing easement from Ruxton Drive next to a residential property.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F519
Site Name: Ruxton Drive

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking south toward the pond with the inflow and forebay on the right and embankment and weir structure on the left.

Looking west toward the weir structure from the downstream side.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F519
Site Name: Ruxton Drive
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include the proximity of the facility to homes, and the sanitary sewer located along the west of the facility.

Concept Description:

A wet retention pond is proposed within the existing footprint of the dry pond. The permanent pool elevation is proposed at 228.00 ft. and to be 2 ft. feet deep to a bottom elevation of 226.00 ft. A 2 ft. deep forebay is proposed to provide the required 795 cf. of pretreatment. Excluding the forebay, the facility will provide approximately 26,355 cf. of wet storage in the permanent pool, 287% of the required WQv. A 10 ft. dry bench at the permanent pool is provided along with a 5ft wet bench. A new concrete outlet structure is proposed to provide the maximum storage possible while maintaining sufficient freeboard. The facility will need to comply with Code 378, so a clay liner is proposed along the upstream side of the embankment; alternatively a clay core could be installed. Access to the pond will be along the existing 30 ft. wide unpaved public water, sewer, drainage and utility easement extending from the end of Ruxton Drive.

Nearby Opportunities:

None recommended.

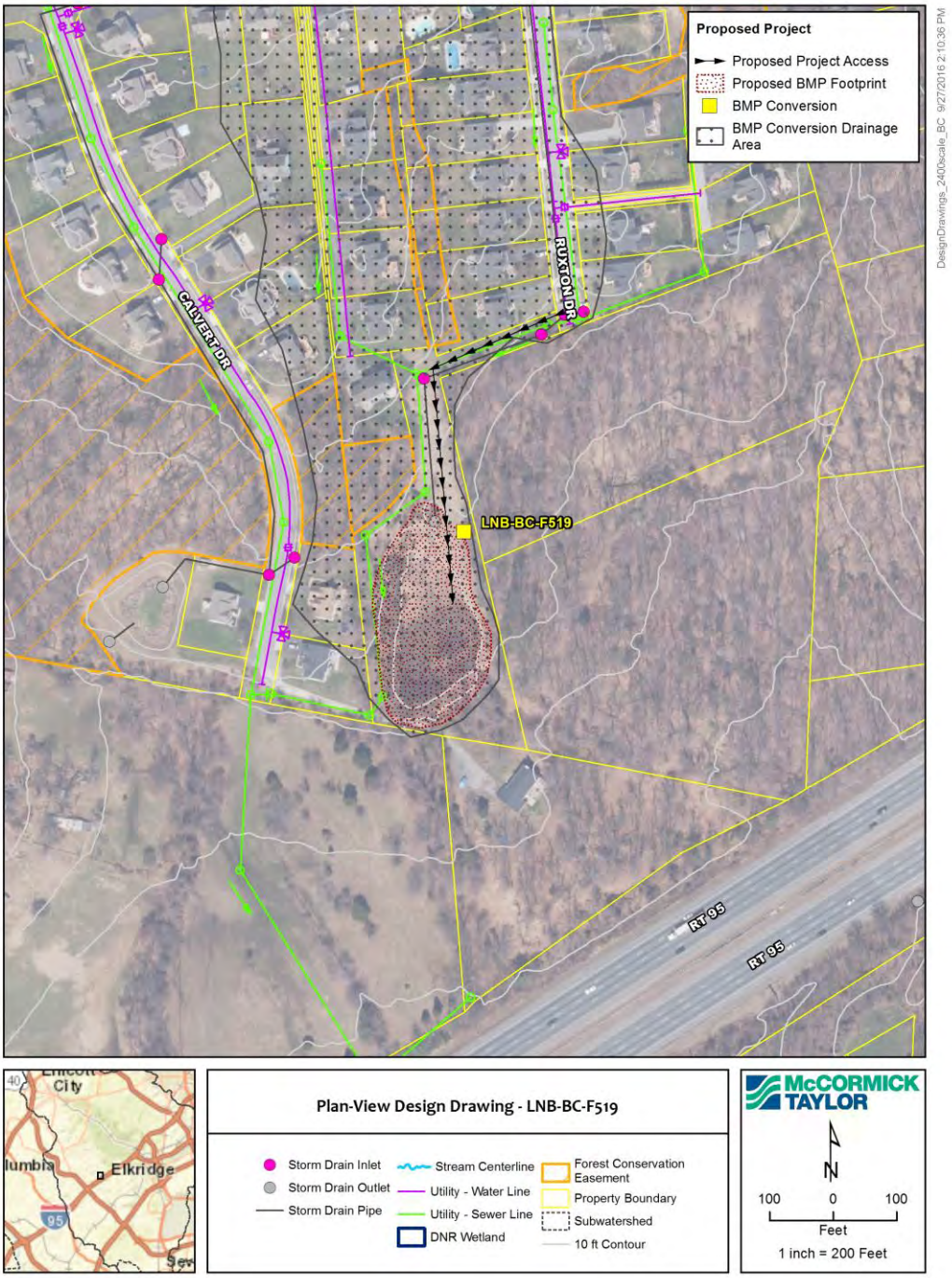
Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	11.26	WQVolume Target (cft.):	9,198
Impervious Area within Drainage (ac.):	2.19	Max Treated (cft.):	26,355
Impervious Area Treated (ac.):	2.19	Percent Treated:	287%
Impervious Area Treated Credit (ac.):	3.21	Rainfall Depth Treated (in.):	2.87

Costs	
Estimated Design Cost:	$220,000
Estimated Construction Cost:	$121,145
30% Contingency:	$102,344
Estimated Total Cost	$443,840
Cost per Impervious Credit Acre:	$138,268

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F519
Site Name: Ruxton Drive

Contractor: McCormick Taylor
Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F520
Site Name: Troy Hill 1

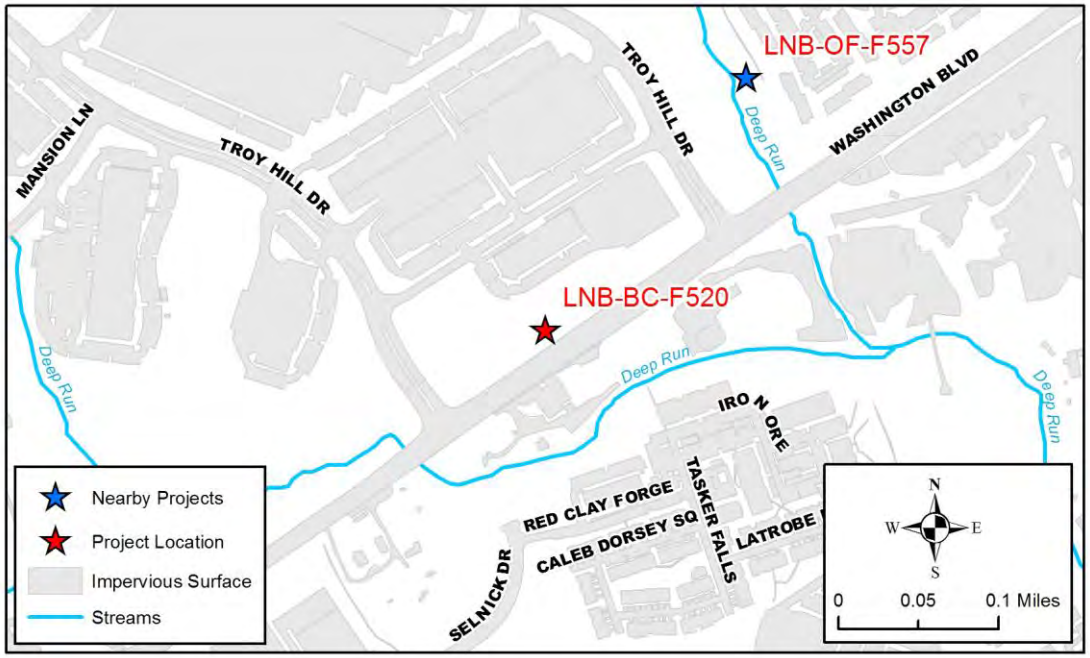
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Retention Pond (Wet Pond)
Ownership: Private- Commerical/Industrial
Single Owner

BMP Structure ID: HO103925
Existing BMP Type: DP

Existing Conditions:

The site is a commercial business park with large warehouses, loading docks, and parking lots. Currently, runoff is collected from the Fesco Emergency Sales building and parking lot and is directed into a flow splitter. The WQv is directed toward a surface sand filter facility located west of the pond. Bypass flow is diverted into the pond in addition to runoff from storm drains along US 1. There are two riser structures in the pond and approximately 1-2 ft. of standing water was observed along with sediment and cattails. Both inflows are almost completely submerged and a large portion of the pond footprint had exposed earth, which may be submerged during wet seasons. The concrete risers are overall in good condition, but the orifice plate in the western riser is corroded with some seepage at the bottom. Access to the pond could be from the business park although the slopes are steep, or from US 1.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F520
Site Name: Troy Hill 1

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking northeast toward the facility showing one of the inflows and one of the riser structures.

Looking southwest toward the facility showing a second inflow and riser structure.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F520
Site Name: Troy Hill 1

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include the property ownership and potential wetland impacts at the outfall. The pond is on private property and a sewer line runs along the western edge of the facility.

Concept Description:

A wet retention pond is proposed within the existing footprint of the dry pond, with some expansion of the footprint toward US 1. The permanent pool elevation is proposed at 122.00 ft. and to be 3.5 ft. feet deep to a bottom elevation of 118.50 ft. A 2 ft. deep forebay is proposed to provide the required 1,724 cf. of pretreatment. Excluding the forebay, the facility will provide approximately 18,429 cf. of wet storage in the permanent pool, 106% of the required WQv. Due to limited space, no benches are provided in the design and if required will significantly reduce the provided WQv. A new concrete riser is proposed, but the spillway pipes tie into the roadway storm drain, so they are not proposed to be modified. The facility will need to comply with Code 378, so a clay liner is proposed along the upstream side of the embankment; alternatively a clay core could be installed. Access to the pond will be along the existing stormwater management easement from Baltimore-Washington Boulevard (US 1) located on the eastern end of the existing facility.

Nearby Opportunities:

None recommended.

Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	10.16	WQVolume Target (cft.):	17,362
Impervious Area within Drainage (ac.):	4.75	Max Treated (cft.):	18,429
Impervious Area Treated (ac.):	4.75	Percent Treated:	106%
Impervious Area Treated Credit (ac.):	4.82	Rainfall Depth Treated (in.):	1.06

Costs	
Estimated Design Cost:	$220,000
Estimated Construction Cost:	$147,295
30% Contingency:	$110,189
Estimated Total Cost	$477,484
Cost per Impervious Credit Acre:	$99,063

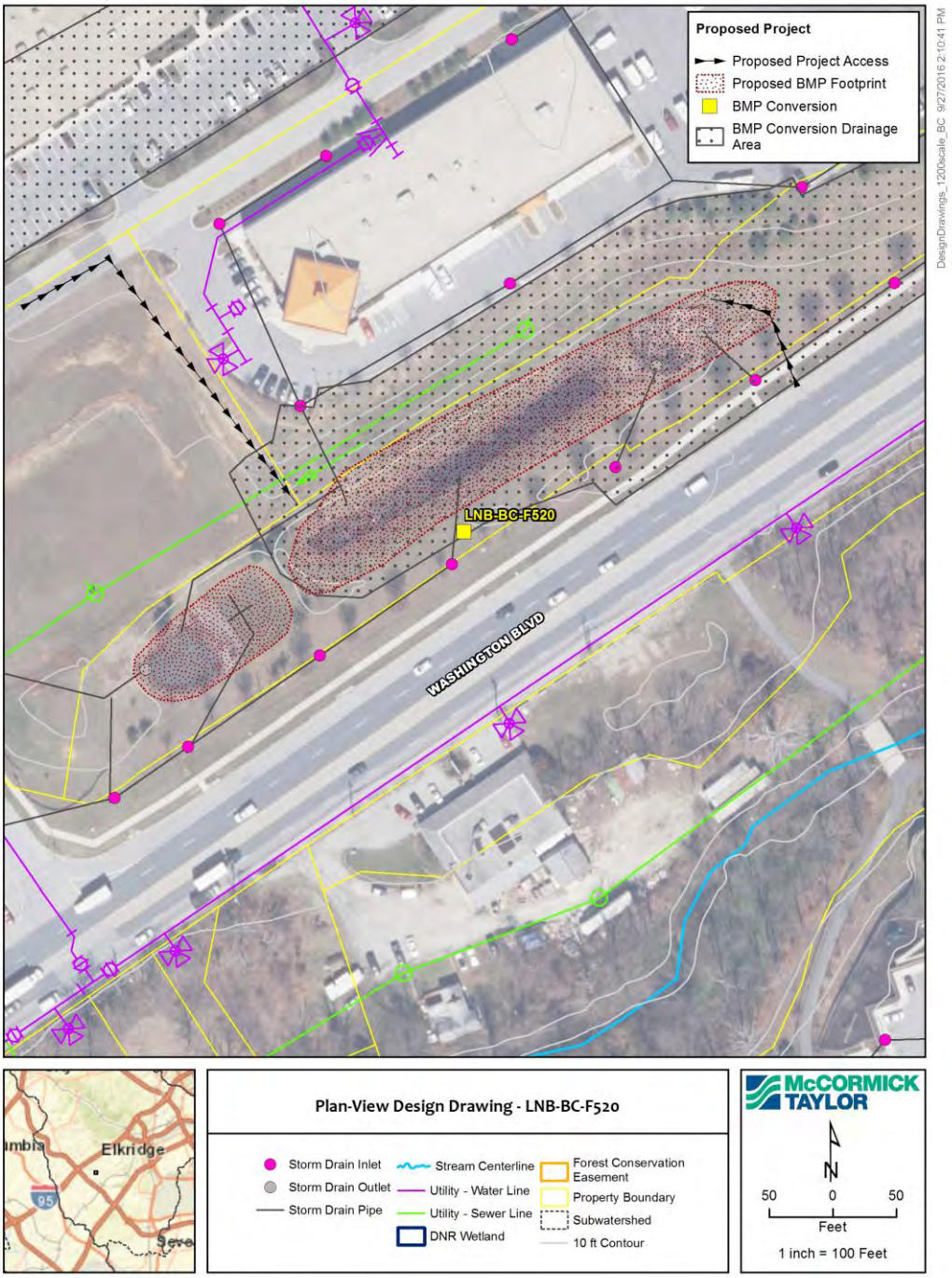
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F520

Site Name: Troy Hill 1

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F521
Site Name: Milk Shed Place

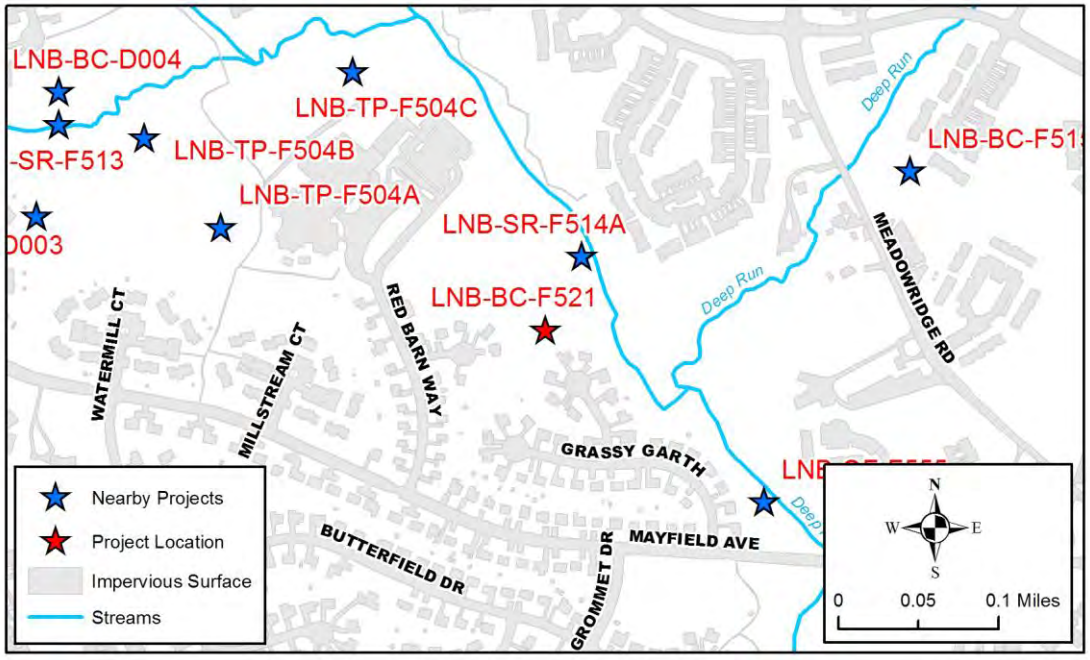
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Retention Pond (Wet Pond)
Ownership: County Owned
Single Owner

BMP Structure ID: HO105622
Existing BMP Type: DP

Existing Conditions:

The site is located between the cul-de-sacs of Well Water Way and Milk Shed Place in a residential neighborhood. Per design plans (F-87-043) and field observation, the pond receives runoff from one 15 in. RCP storm drain inflow and one 24 in. RCP storm drain inflow. Pilot channels from both inflows go directly toward the low flow orifice in the riser. The pond bottom contains a significant amount of phragmites, trees, and other vegetation. Leaf debris and sediment also cover a majority of the visible pond bottom. The large concrete riser has a brick channel to direct discharge from the low flow orifice to the barrel. The 48 in. BCCMP barrel is showing signs of corrosion. The downstream slope of the embankment is very steep and ties into the outfall channel and downstream channel. The outfall is stable with large riprap. Sewer manholes were observed near the outfall and access to the site is difficult with the significant vegetation growth and steep slopes.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F521
Site Name: Milk Shed Place

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking west toward the pond area and Well Water Way from the embankment.

Looking northwest at the riser structure from the embankment.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F521
Site Name: Milk Shed Place
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include the proximity of the facility to homes.

Concept Description:

A wet retention pond is proposed within the existing footprint of the dry pond. The permanent pool elevation is proposed at 258.00 ft. and to be 3 ft. feet deep to a bottom elevation of 255.00 ft. Two 2 ft. deep forebays are proposed to provide the required 1,042 cf. of pretreatment. Excluding the forebay, the facility will provide approximately 19,229 cf. of wet storage in the permanent pool, 172% of the required WQv. A 10 ft. dry maintenance bench is provided at the permanent pool elevation. If desired, an additional wet bench could be added to the design, but will reduce the provided WQv. A new concrete riser and RCP principal spillway is proposed. The facility will need to comply with Code 378, so a clay liner is proposed along the upstream side of the embankment; alternatively a clay core could be installed. Woody vegetation will be removed within 15 ft. of the embankment toe and the outfall will be stabilized with riprap. The downstream slope of the embankment is steep and access may be difficult. Outfall stabilization may be considered in conjunction with proposed stream restoration downstream. Access to the pond is proposed from the drainage easement near the inlet at the end of the Well Water Way cul-de-sac. An alternative access could be from the utility easement at the end of the Milk Shed Place cul-de-sac, but slopes are steeper at this location.

Nearby Opportunities:

LNB-SR-F514A

Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	10.1	WQVolume Target (cft.):	11,209
Impervious Area within Drainage (ac.):	2.87	Max Treated (cft.):	19,229
Impervious Area Treated (ac.):	2.87	Percent Treated:	172%
Impervious Area Treated Credit (ac.):	3.38	Rainfall Depth Treated (in.):	1.72

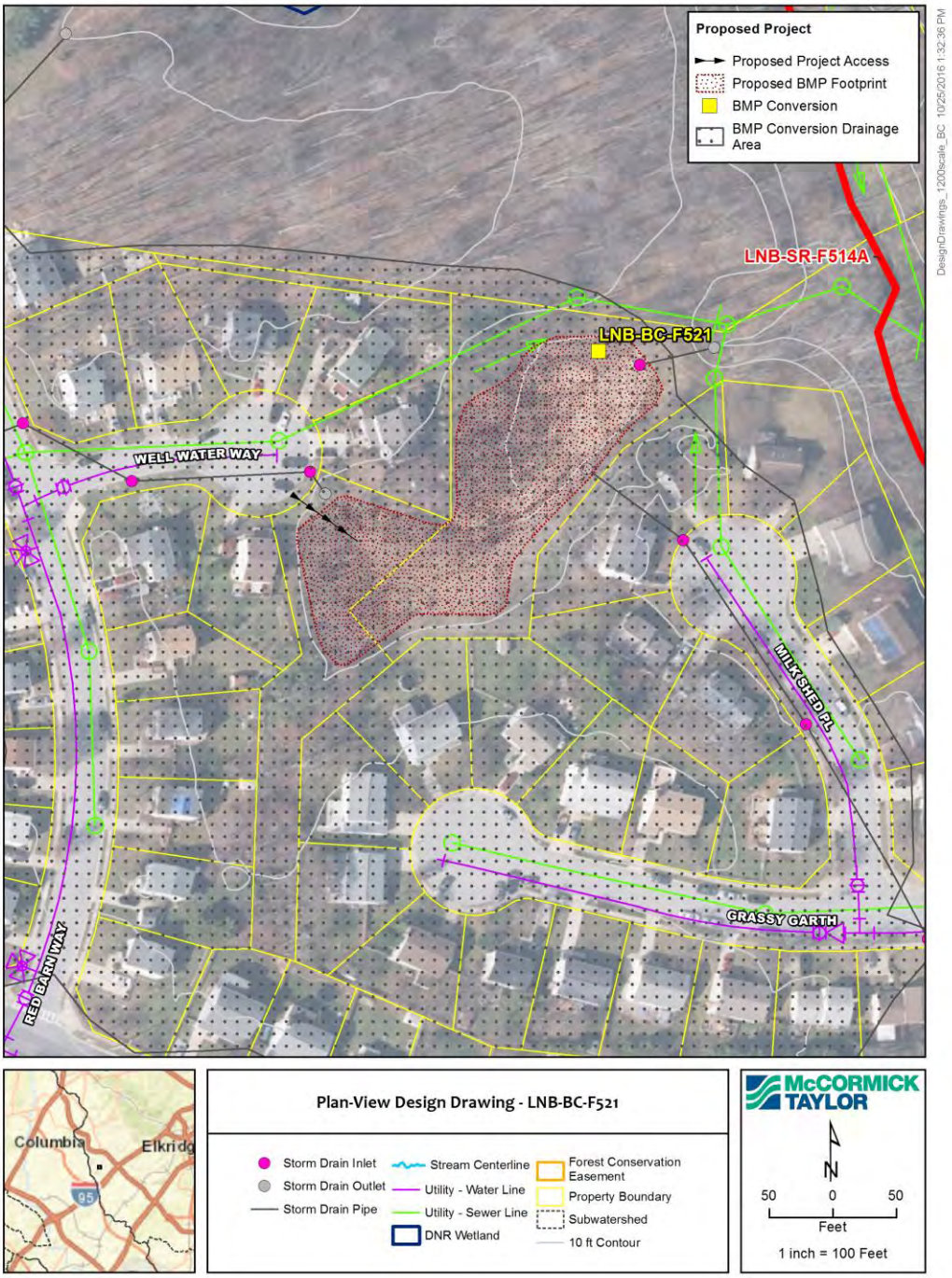
Costs

Estimated Design Cost:	$220,000
Estimated Construction Cost:	$343,450
30% Contingency:	$169,035
Estimated Total Cost	$732,485
Cost per Impervious Credit Acre:	$216,712

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F521
Site Name: Milk Shed Place

Contractor: McCormick Taylor
Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F522
Site Name: Business Parkway 2

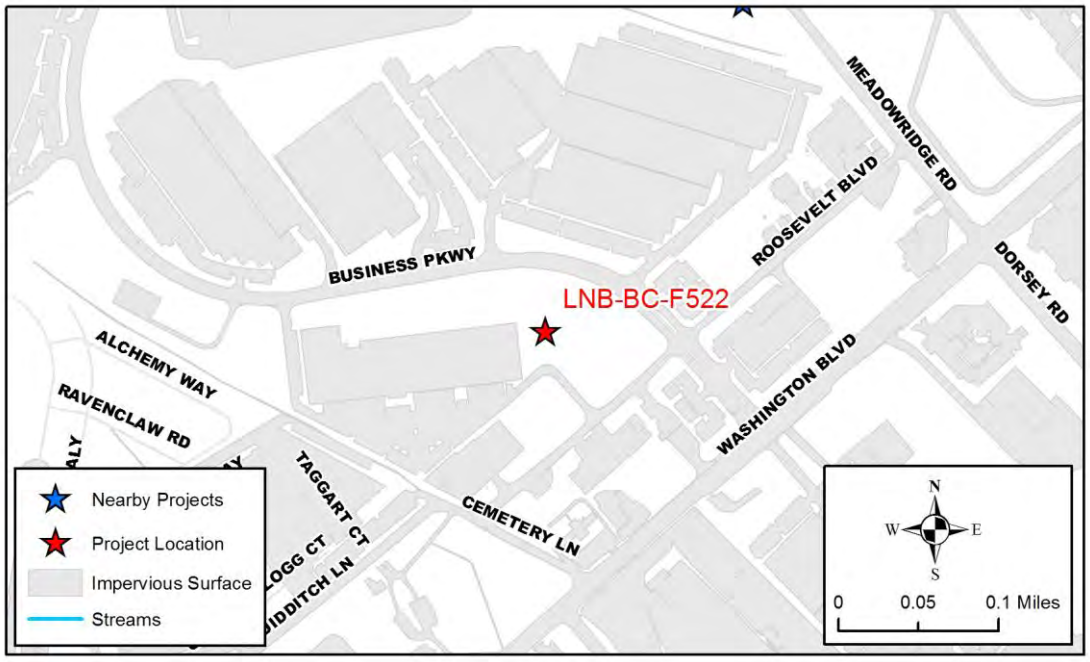
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Retention Pond (Wet Pond)
Ownership: Private- Commerical/Industrial
Single Owner

BMP Structure ID: HO103833
Existing BMP Type: EDSD

Existing Conditions:

The site is located within the Meadowridge Business Park along Meadowridge Road. The pond has one 36 in. RCP storm drain inflow and a curb cut inflow from the access driveway and small PVC drain; both inflows have riprap protection. The pond bottom has a large amount of cattails along with some sediment and trash. Per the design plans (SDP-91-049) and field observation, the pond has a 48 in. BCCMP riser with a standpipe low flow and 10 in. orifice weir along with a 36 in. BCCMP principal spillway. The connection between the riser and spillway in the pond is exposed and corroding; visible portions of the barrel at the downstream end show minor corrosion with most of the BCCMP liner still intact. The large riprap apron at the outfall is stable and flow continues as sheet flow into a stable, flat area, with no defined connection to the downstream channel. An emergency spillway with gabion protection is also stable on the northwest corner of the pond. No visible utilities were located within the pond area. Access from the driveway is easy.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F522
Site Name: Business Parkway 2

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking west toward the facility with the two inflows on the left and the riser and embankment on the right.

Looking west along the embankment with the riser on the left, outfall on the right, and emergency spillway in the distance.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F522
Site Name: Business Parkway 2
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include the private property ownership and the proximity of the facility to the adjacent warehouse building.

Concept Description:

A wet retention pond is proposed within the existing footprint of the dry pond. The permanent pool elevation is proposed at 196.00 ft. and to be 5 ft. feet deep to a bottom elevation of 191.00 ft. A 2 ft. deep forebay is proposed to provide 1,867 cf. of pretreatment, 95% of the required. Excluding the forebay, the facility will provide approximately 17,913 cf. of wet storage in the permanent pool, 92% of the required WQv. Benches were not provided due to the limited footprint and required WQv of the facility. If required, benches will significantly reduce the treatment potential of the facility. The BCCMP riser and barrel will be replaced with concrete structures. The facility will need to comply with Code 378, so a clay liner is proposed along the upstream side of the embankment; alternatively a clay core could be installed. Woody vegetation will be removed within 15ft of the embankment toe and the outfall will be stabilized with riprap. Access to the pond will be from Roosevelt Boulevard, just southwest of the intersection of Roosevelt Boulevard and Business Parkway.

Nearby Opportunities:

None recommended.

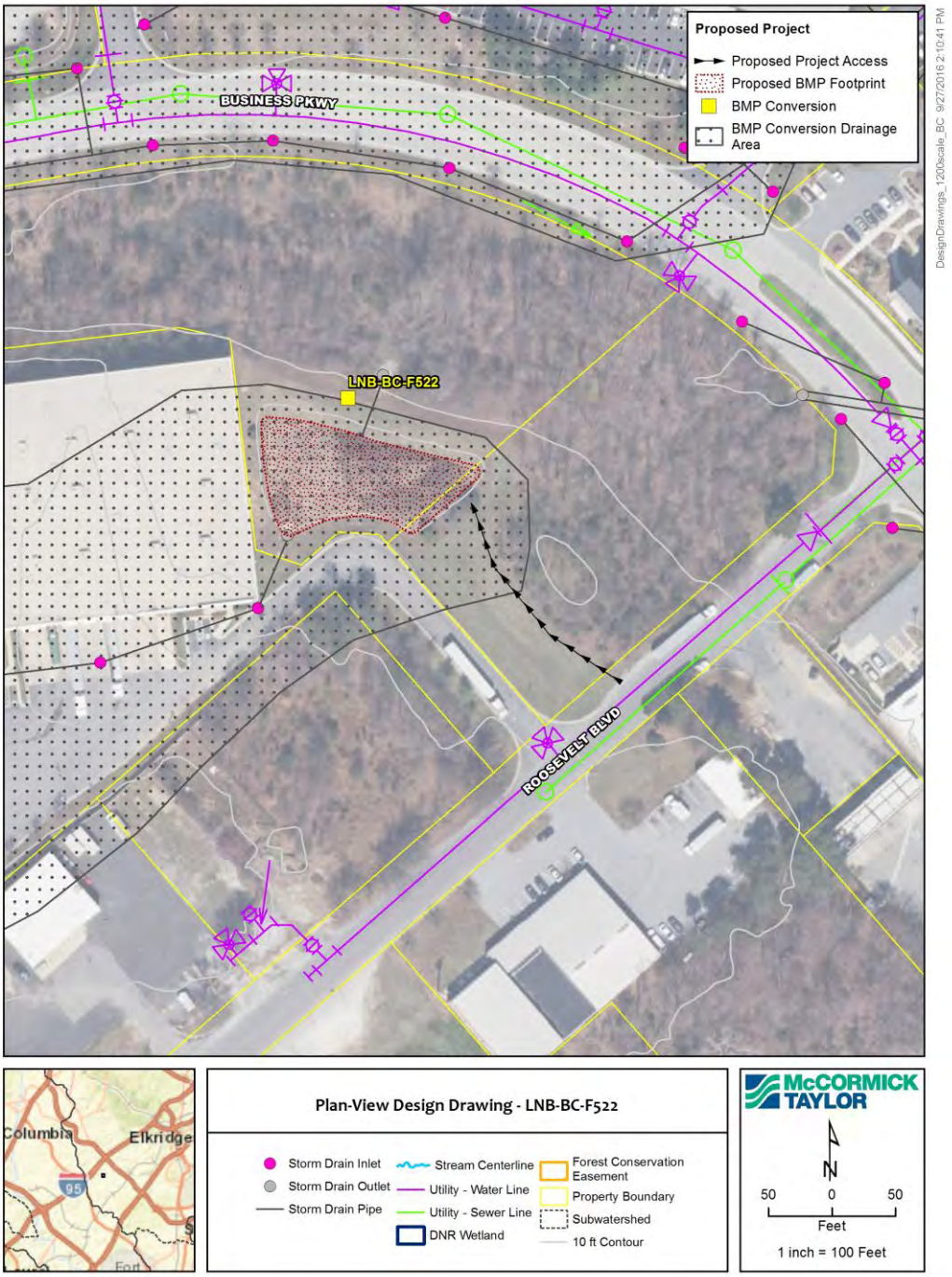
Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	9.91	WQVolume Target (cft.):	19,473
Impervious Area within Drainage (ac.):	5.41	Max Treated (cft.):	17,913
Impervious Area Treated (ac.):	4.98	Percent Treated:	92%
Impervious Area Treated Credit (ac.):	4.98	Rainfall Depth Treated (in.):	0.92

Costs	
Estimated Design Cost:	$220,000
Estimated Construction Cost:	$258,857
30% Contingency:	$143,657
Estimated Total Cost	$622,514
Cost per Impervious Credit Acre:	$125,003

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F522
Site Name: Business Parkway 2

Contractor: McCormick Taylor
Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F523
Site Name: Huntshire Drive

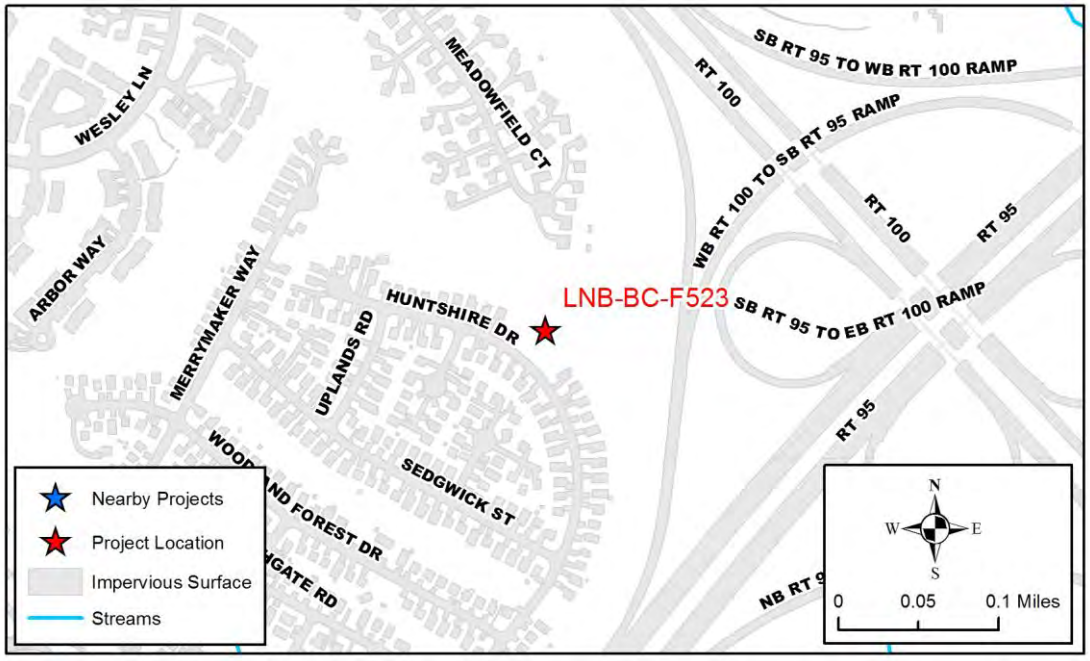
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Retention Pond (Wet Pond)
Ownership: County Owned
Single Owner

BMP Structure ID: HO103472
Existing BMP Type: EDSD

Existing Conditions:

The site is located along Huntshire Drive in the residential neighborhood of Nottingham Village. Per the design plans (F-95-016) and field observations, the pond receives runoff from one 24 in. RCP storm drain inflow and one 18 in. RCP storm drain inflow. Both outfall into a forebay with an earth berm and a gabion weir. There is about 1 ft. of standing water in the forebay along with a significant amount of sediment. Some cattails and a lot of trash were observed throughout the facility. The concrete riser is in good condition and has a 3 in. low flow along with a notched weir. The low flow stand pipe in the design plan was not visible in the field, although the opening in the riser was observed. The trash rack does not have 1 ft. of clearance between the bottom and the embankment. The 24 in. RCP barrel is in good condition except for a minor joint separation between the end section and upstream section of pipe. The riprap outfall is stable and there is not a defined channel downstream. There are forest conservation signs at the bottom of the embankment, but still may require some clearance within 15 ft. of the embankment. No utilities were observed in the pond area, but access may require tree removal.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F523
Site Name: Huntshire Drive

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking northwest at the pond area with the inflows and forebay on the left and riser structure and embankment on the right.

Looking southeast at the forebay from the inflow on the western side of the pond.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F523
Site Name: Huntshire Drive
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

The only constraint for this facility is the proximity to the nearby homes.

Concept Description:

A wet retention pond is proposed within the existing footprint of the dry pond. The permanent pool elevation is proposed at 248.00 ft. and will be 4 ft. feet deep to a bottom elevation of 244.00 ft.; side slopes are 3:1 above the permanent pool and 2:1 below. A 2 ft. deep forebay is proposed to provide the required 1,365 cf. of pretreatment. Excluding the forebay, the facility will provide approximately 15,298 cf. of wet storage in the permanent pool, 110% of the required WQv. If a maintenance bench is required, the treatment potential of the facility will be significantly reduced. The riser and barrel will be replaced and designed for maximum storage while providing sufficient freeboard in the pond. The facility will need to comply with Code 378, so a clay liner is proposed along the upstream side of the embankment; alternatively a clay core could be installed. Woody vegetation will be removed within 15 ft. of the embankment toe and the outfall will be stabilized with riprap. Access to the pond will be from Huntshire Drive which runs along the south/ southwest portion of the facility.

Nearby Opportunities:

None recommended.

Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	9.2	WQVolume Target (cft.):	13,954
Impervious Area within Drainage (ac.):	3.76	Max Treated (cft.):	15,298
Impervious Area Treated (ac.):	3.76	Percent Treated:	110%
Impervious Area Treated Credit (ac.):	3.85	Rainfall Depth Treated (in.):	1.1

Costs	
Estimated Design Cost:	$220,000
Estimated Construction Cost:	$250,346
30% Contingency:	$141,104
Estimated Total Cost	$611,449
Cost per Impervious Credit Acre:	$158,818

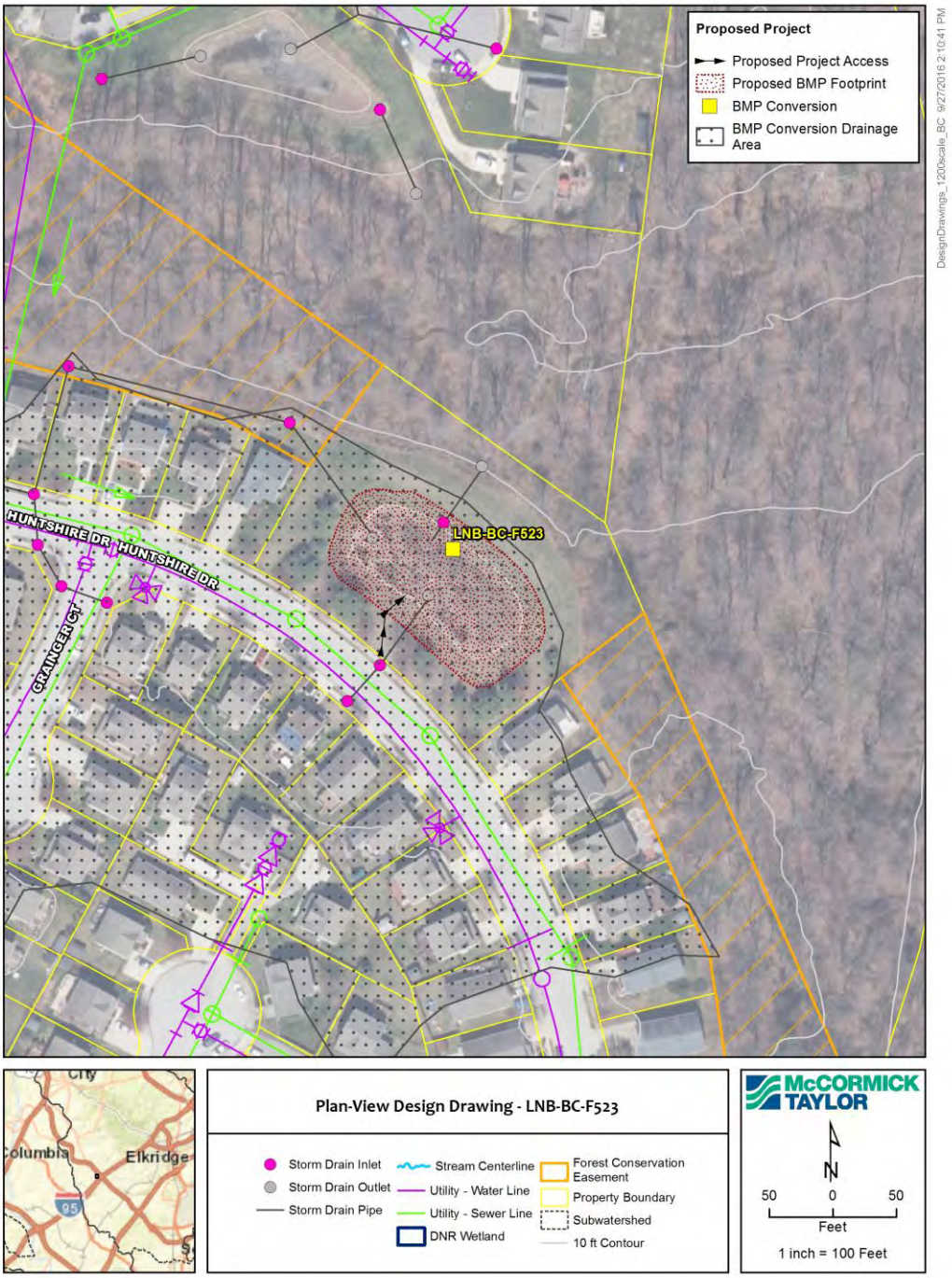
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F523

Site Name: Huntshire Drive

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F524
Site Name: Marble Hill

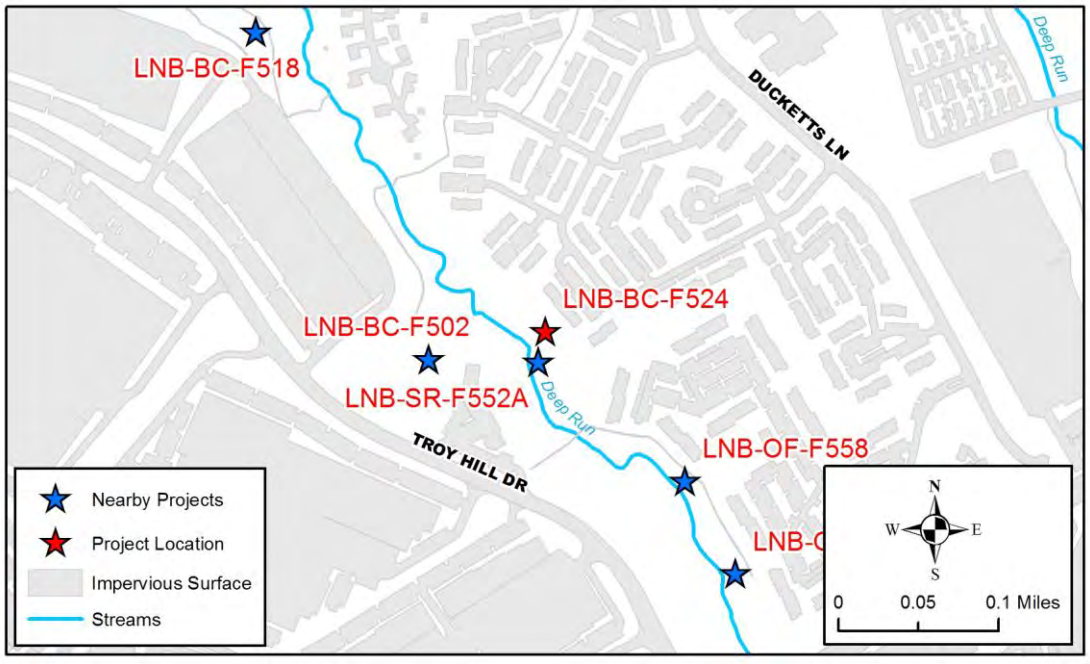
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Retention Pond (Wet Pond)
Ownership: County Owned
Single Owner

BMP Structure ID: HO105422
Existing BMP Type: DP

Existing Conditions:

The site is located behind the homes on Ducketts Lane in the residential townhome community of Marble Hill. Per the design plans (SDP-78-115) and field observations, the pond receives runoff from four storm drain inflows (one 36 in. RCP, two 15 in. RCP, and one 24 in. BCCMP). All inflows were originally designed with riprap protection and it was observed during the site visit riprap was also recently placed at the two larger inflows where erosion was likely occurring. The large pond has a severe amount of sediment throughout the bottom, some trees and vegetation in the pond, and erosion at inflows and rills in areas of the upstream side of the embankment. The pond footprint borders the backyards of numerous homes and the embankment also serves as access to a sewer line and the downstream slope ties into a stream bank. The existing brick riser structure is in poor condition with several areas of concrete patchwork. There are weirs on all four sides of the structure, a temporary pipe from construction entering the riser, and a 36 in. RCP barrel leaving the riser. There is possible seepage through the riser from the area of the original 24 in. release pipe used during construction. The riprap outfall is stable and extends approximately 20 ft. before the confluence with the larger stream channel. Sewer lines were observed along the embankment of the pond and there are several access points, although some have steep slopes and heavy vegetation. An emergency spillway is noted on the original plans, but this was not observed during the initial site visit. It is possible that it was filled for the sewer access path along the embankment.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F524
Site Name: Marble Hill

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking southeast toward the pond from the inflow in the northwest corner of the pond.

Looking southeast toward the riser structure from the center of the pond.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F524
Site Name: Marble Hill

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

The constraints for this facility include private ownership, the proximity to the nearby homes, sewer lines, and the proximity and potential impacts to the stream at the bottom of the embankment.

Concept Description:

A wet retention pond is proposed within the existing footprint of the dry pond. The permanent pool elevation is proposed at 134.00 ft. and will be 4 ft. feet deep to a bottom elevation of 130.00 ft.; side slopes are 3:1 above the permanent pool and 2:1 below. No forebays or benches are currently proposed since the space is limited due to the linear geometry of the facility. The sediment that has deposited into the pond will be removed along with additional excavation to provide wet storage. The facility will provide approximately 32,144 cf. of wet storage in the permanent pool, 41% of the required WQv. The emergency spillway will be utilized if it is determined to exist since a gravel access path has been added to the embankment. A new concrete riser structure with a new principal spillway will be added with weirs to maintain the current discharges and provide sufficient freeboard. The pond outfall will be stabilized with riprap to the confluence with the stream. The proposed embankment will remain the same, but the facility will need to comply with Code 378, so a clay liner is proposed along the upstream side of the embankment; alternatively a clay core could be installed. Access to the pond will be from a storm drain easement near 6466 Ducketts Lane and may require the removal of a tree depending on the location of the easement.

Nearby Opportunities:

LNB-BC-F502, LNB-BC-F518, LNB-OF-F557, LNB-OF-F558, LNB-SR-F552A

Proposed Project Credit	
Drainage Area (ac.):	47.39
Impervious Area within Drainage (ac.):	16.68
Impervious Area Treated (ac.):	6.9
Impervious Area Treated Credit (ac.):	6.9

Water Quality Volume	
WQVolume Target (cft.):	63,095
Max Treated (cft.):	26,090
Percent Treated:	41%
Rainfall Depth Treated (in.):	0.41

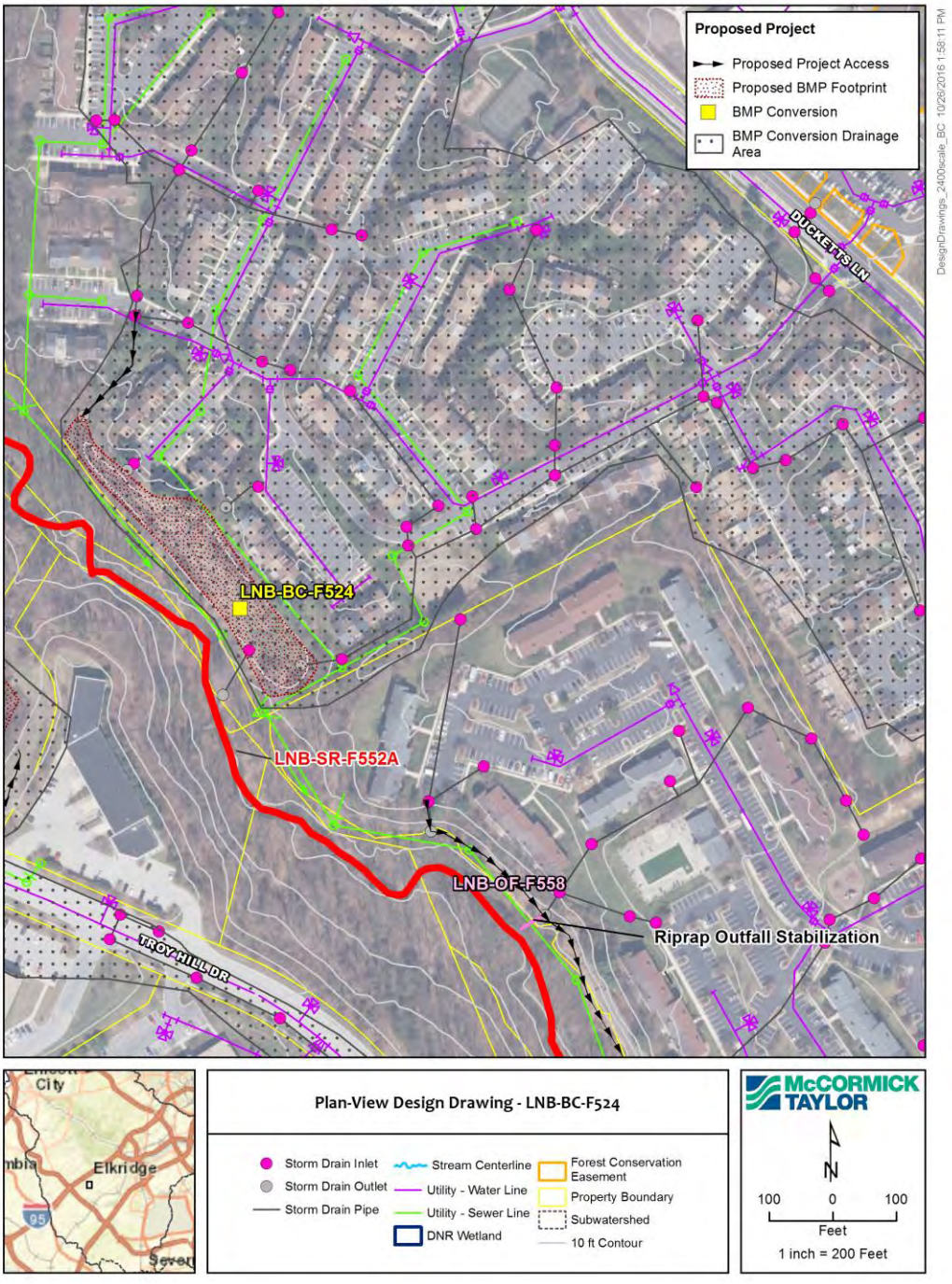
Costs

Estimated Design Cost:	$320,000
Estimated Construction Cost:	$510,777
30% Contingency:	$249,233
Estimated Total Cost	$1,080,010
Cost per Impervious Credit Acre:	$156,523

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F524
Site Name: Marble Hill

Contractor: McCormick Taylor
Watershed: Patapsco Lower North



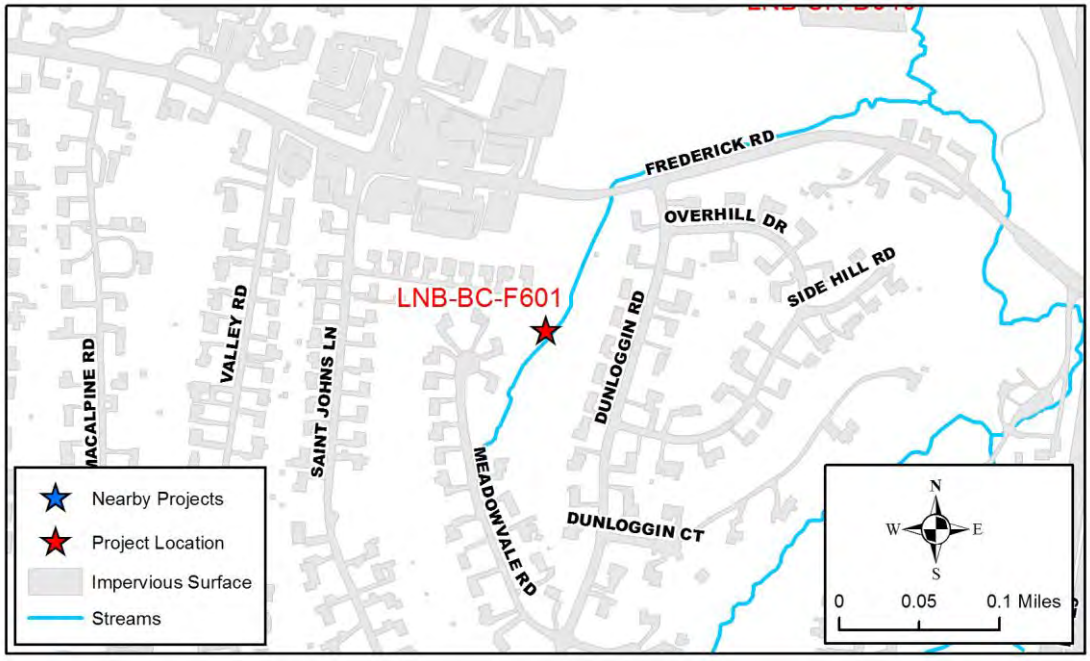
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F601
Site Name: Tiber Ridge Ct Pond
Contractor: KCI
Watershed: Patapsco Lower North

Proposed BMP Type: Retention Pond (Wet Pond)
Ownership: County Owned
Single Owner
BMP Structure ID: HO104646
Existing BMP Type: EDSD

Existing Conditions:

The existing BMP is a dry pond which is not functioning as designed. Water bypasses the riser structure and drains through the embankment. The outfall channel has about 5 lf. of eroded banks but there is no erosion along the stream channel downstream of the outfall. The pond bottom is over vegetated.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F601
Site Name: Tiber Ridge Ct Pond
Contractor: KCI
Watershed: Patapsco Lower North

Outfall channel looking northeast.

Pond inflow looking south.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F601
Site Name: Tiber Ridge Ct Pond
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints include limited access to the site, close proximity to neighboring properties, and adjacent landowner issues. The project may impact existing trees, wetlands, streams, and floodplain elevation.

Concept Description:

The dry pond can be converted to a wet pond by removing the riser structure and barrel pipe. The embankment will be reconstructed and the pond regraded to address potential embankment failure. However, the project would be confined to a small area which may cause complications in the design phase and ultimately would not provide much water treatment. If the pond is not chosen to be converted, the embankment and riser structure should be repaired.

Nearby Opportunities:

None

Proposed Project Credit	
Drainage Area (ac.):	33.27
Impervious Area within Drainage (ac.):	7.29
Impervious Area Treated (ac.):	7.29
Impervious Area Treated Credit (ac.):	7.39

Water Quality Volume	
WQVolume Target (cft.):	29,855
Max Treated (cft.):	31,522
Percent Treated:	106%
Rainfall Depth Treated (in.):	1.06

Costs	
Estimated Design Cost:	$200,000
Estimated Construction Cost:	$170,411
30% Contingency:	$111,123
Estimated Total Cost	$481,535
Cost per Impervious Credit Acre:	$65,160

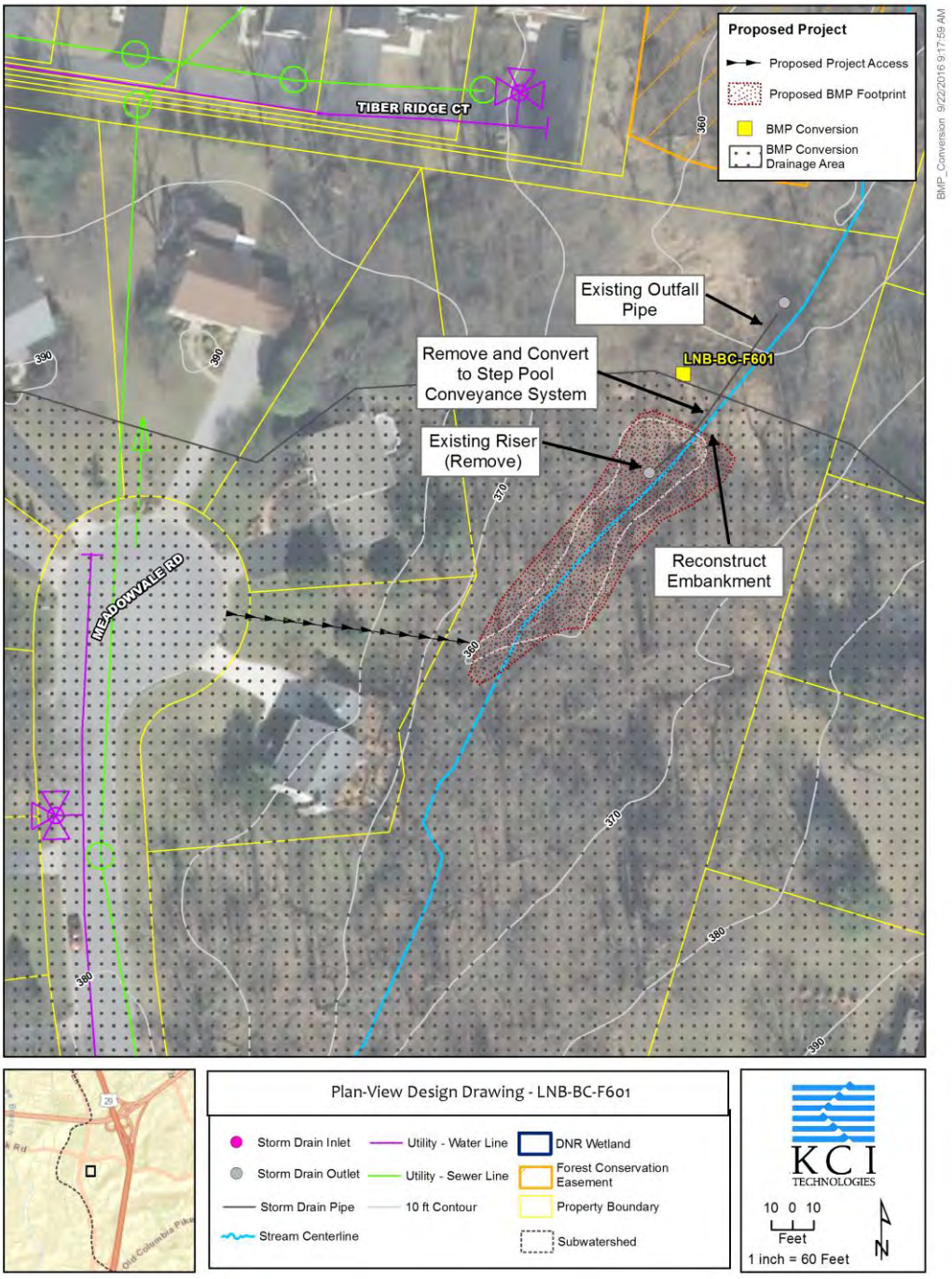
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F601

Site Name: Tiber Ridge Ct Pond

Contractor: KCI

Watershed: Patapsco Lower North



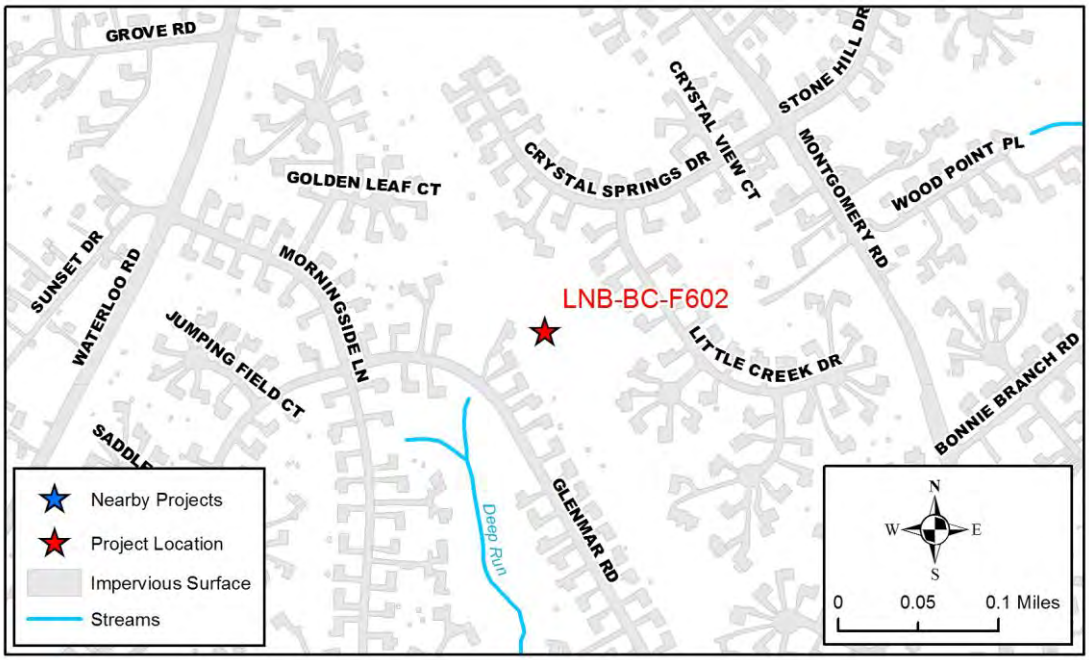
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F602
Site Name: Glenmar Road Pond
Contractor: KCI
Watershed: Patapsco Lower North

Proposed BMP Type: Shallow Marsh
Ownership: County Owned
Single Owner
BMP Structure ID: HO103175
Existing BMP Type: DP

Existing Conditions:

The existing BMP is a dry pond in good condition. At the time of assessment, the pond had standing water and flow through the low flow orifice. The low flow orifice has been buried and partially clogged, causing water to pond at the surface and the invasion of cattails. The riser structure was in good condition. There was no erosion noted at the site.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F602
Site Name: Glenmar Road Pond
Contractor: KCI
Watershed: Patapsco Lower North

Overview of pond facing northwest.

View of existing forebay.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F602
Site Name: Glenmar Road Pond
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints include proximity to neighboring properties, and minimal impact to existing trees.

Concept Description:

Since this site is large and suitable for a wetland type environment, the site is proposed to be converted to a shallow wetland. The wetland will be graded to include a forebay micropool, high marsh and low marsh zones, a deep pool near the riser, and a low flow channel. The riser will be modified to provide ponding depth. Overgrown vegetation and trees will be removed and replaced with wetland vegetation.

Nearby Opportunities:

None

Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	23.76	WQVolume Target (cft.):	21,203
Impervious Area within Drainage (ac.):	5.17	Max Treated (cft.):	25,242
Impervious Area Treated (ac.):	5.17	Percent Treated:	119%
Impervious Area Treated Credit (ac.):	5.42	Rainfall Depth Treated (in.):	1.19

Costs	
Estimated Design Cost:	$120,000
Estimated Construction Cost:	$92,000
30% Contingency:	$63,600
Estimated Total Cost	$249,600
Cost per Impervious Credit Acre:	$46,052

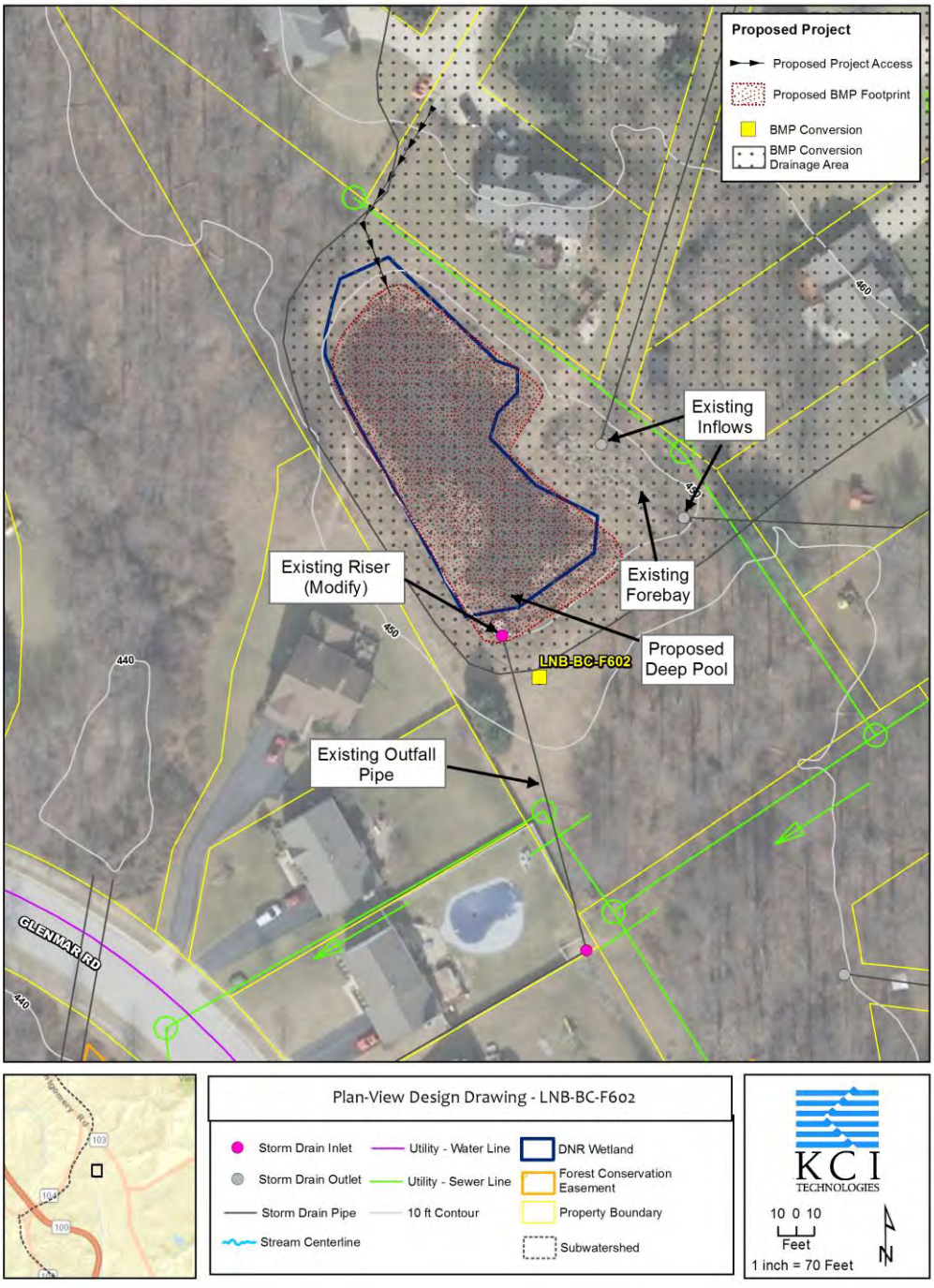
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F602

Site Name: Glenmar Road Pond

Contractor: KCI

Watershed: Patapsco Lower North



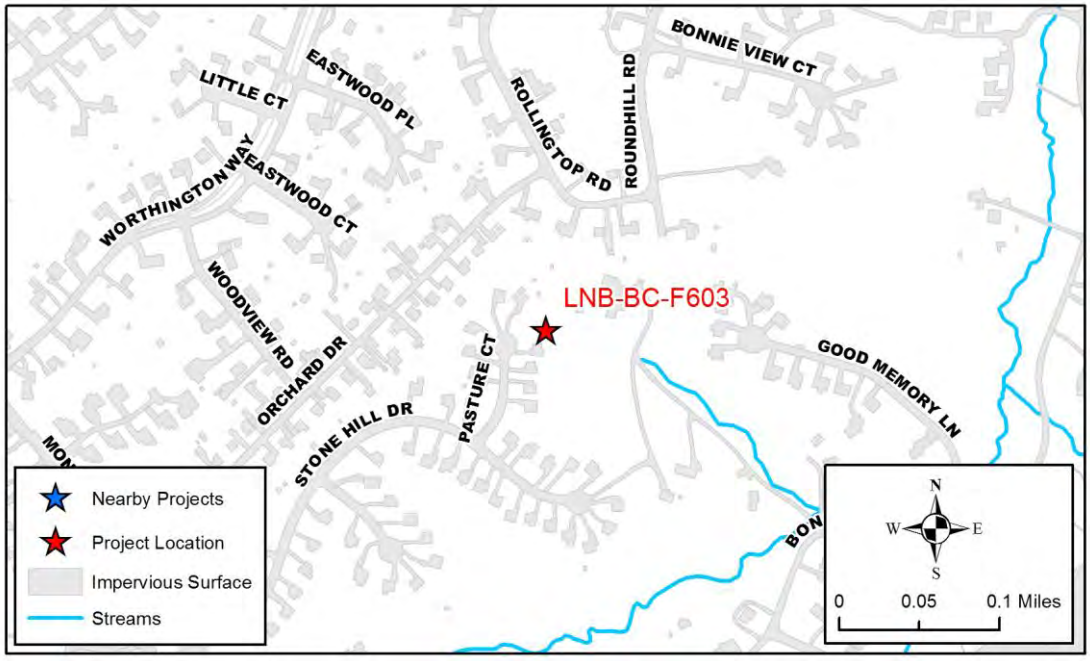
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F603
Site Name: Pasture Court pond
Contractor: KCI
Watershed: Patapsco Lower North

Proposed BMP Type: Infiltration Basin
Ownership: Private- Residential
Single Owner
BMP Structure ID: HO103174
Existing BMP Type: DP

Existing Conditions:

The existing site is a dry pond with a straight rip rap conveyance channel in good condition. The existing riser is functioning well but the inflow and outflow metal structures are corroded and need repair. No erosion was found at the site.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F603
Site Name: Pasture Court pond
Contractor: KCI
Watershed: Patapsco Lower North

Existing pond overview looking east.

Existing riser structure and inlet.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F603
Site Name: Pasture Court pond
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints include proximity to neighboring properties and minimal impact to existing trees.

Concept Description:

The conversion of this site to an infiltration basin is proposed. A stilling basin is proposed near the inflow of the pond and the main basin near the riser structure. The existing riser structure will be replaced to address corrosion issues. An investigation of the existing soils will be required to determine infiltration capability, but at the time of assessment, the pond was relatively dry even after several days of rain.

Nearby Opportunities:

None

Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	14.03	WQVolume Target (cft.):	13,785
Impervious Area within Drainage (ac.):	3.44	Max Treated (cft.):	12,720
Impervious Area Treated (ac.):	3.37	Percent Treated:	92%
Impervious Area Treated Credit (ac.):	3.37	Rainfall Depth Treated (in.):	0.92

Costs	
Estimated Design Cost:	$200,000
Estimated Construction Cost:	$126,102
30% Contingency:	$97,831
Estimated Total Cost	$423,932
Cost per Impervious Credit Acre:	$125,796

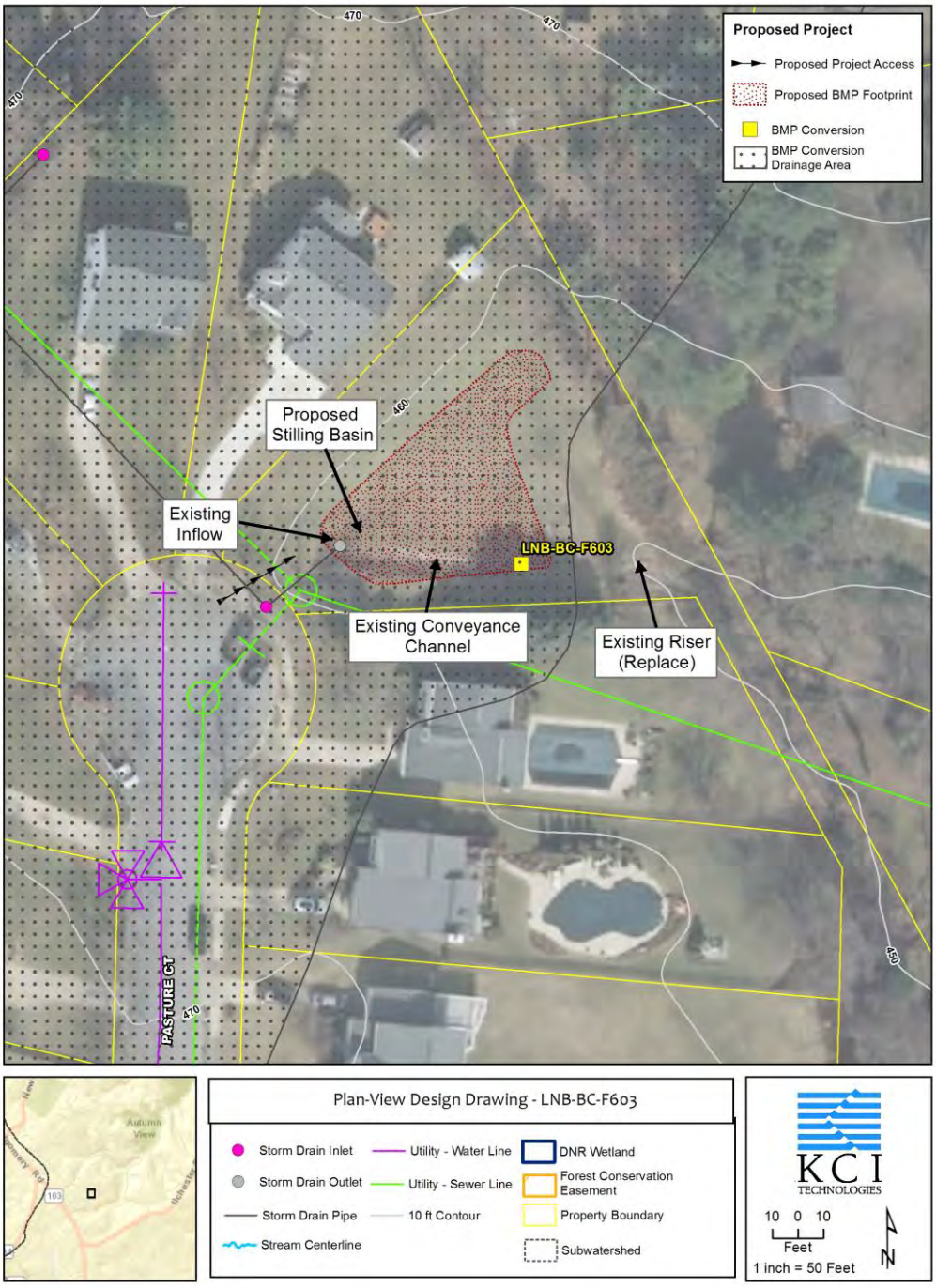
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F603

Site Name: Pasture Court pond

Contractor: KCI

Watershed: Patapsco Lower North



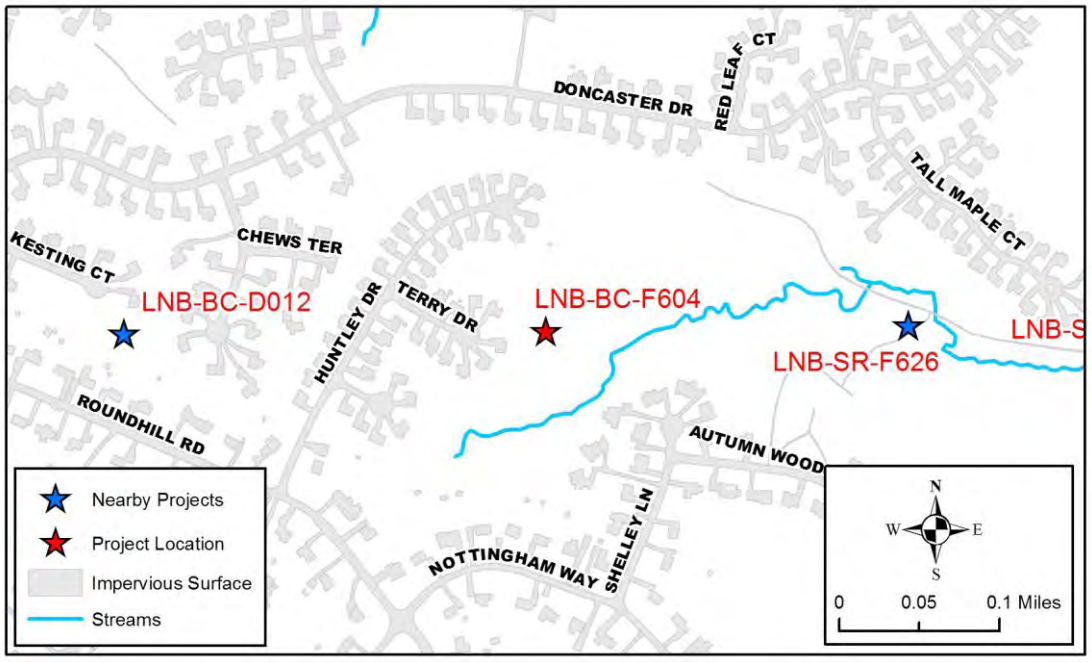
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F604
Site Name: Terry Drive Pond
Contractor: KCI
Watershed: Patapsco Lower North

Proposed BMP Type: Wet Pond
Ownership: County Owned
Single Owner
BMP Structure ID: HO104542
Existing BMP Type: EDSD

Existing Conditions:

This BMP was designed as a extended detention dry pond. The riser structure is in good condition. However, the low flow orifice is partially clogged, causing water to pond. The inlet pipe may be buried or below the water surface. There is 10 ft. of minor erosion at the outfall and 20 ft. of minor stream channel erosion downstream of the outfall.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F604
Site Name: Terry Drive Pond
Contractor: KCI
Watershed: Patapsco Lower North

Overview of pond looking east.

Channel erosion downstream of outfall.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F604
Site Name: Terry Drive Pond
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints include close proximity to neighboring properties and minimal impact to existing trees.

Concept Description:

The facility is proposed to be converted to a wet pond to treat stormwater. A forebay is proposed at the inflow and the riser will be modified to increase storage volume. The pond may need excavation to increase pond depth without flooding nearby properties. This site has easy access and is in good condition. Therefore, this BMP is a good candidate for conversion for water quality credit.

Nearby Opportunities:

None

Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	11.42	WQVolume Target (cft.):	13,573
Impervious Area within Drainage (ac.):	3.52	Max Treated (cft.):	50,820
Impervious Area Treated (ac.):	3.52	Percent Treated:	374%
Impervious Area Treated Credit (ac.):	4.93	Rainfall Depth Treated (in.):	3.74

Costs	
Estimated Design Cost:	$100,000
Estimated Construction Cost:	$73,633
30% Contingency:	$52,090
Estimated Total Cost	$225,723
Cost per Impervious Credit Acre:	$45,786

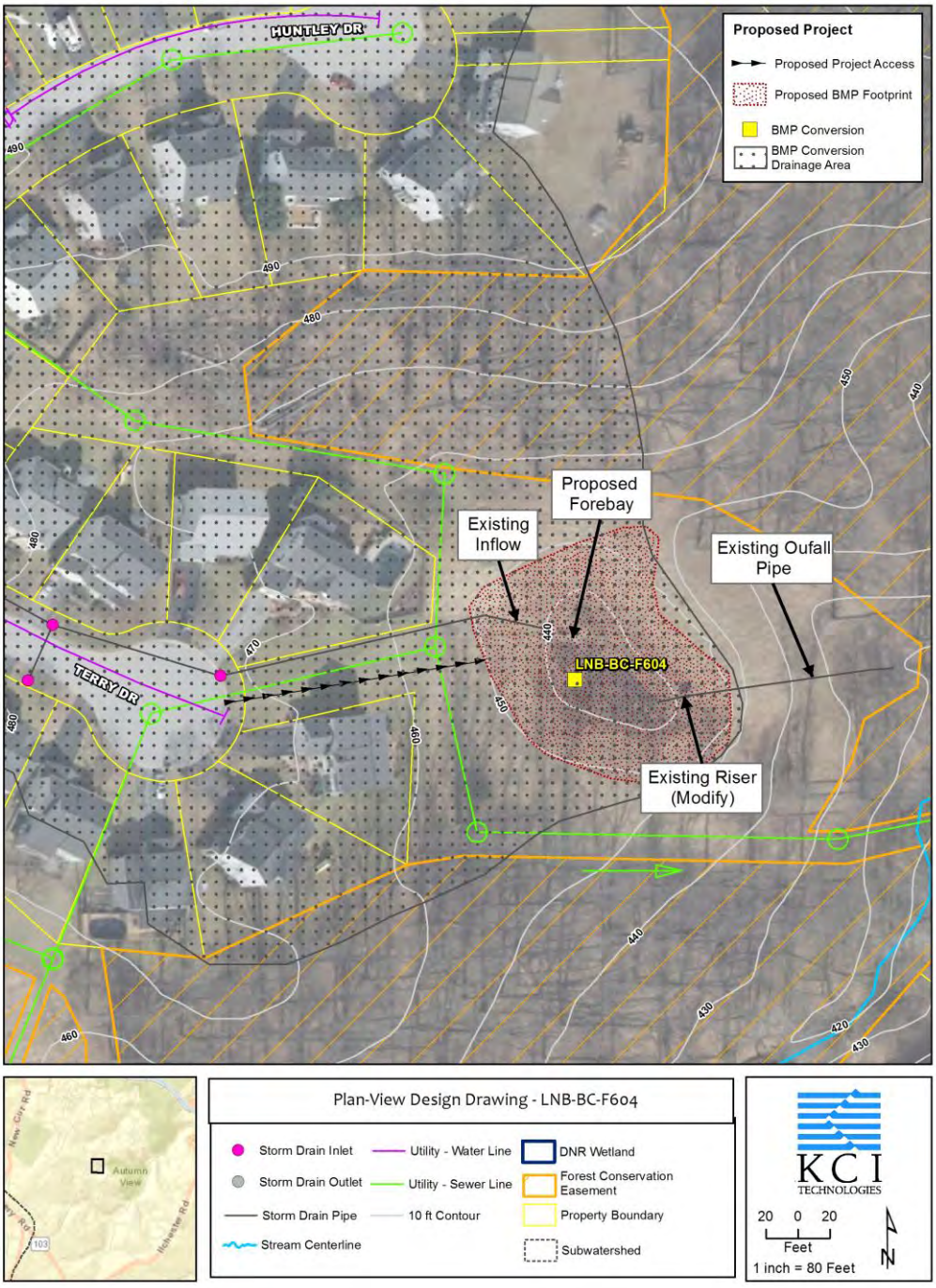
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F604

Site Name: Terry Drive Pond

Contractor: KCI

Watershed: Patapsco Lower North



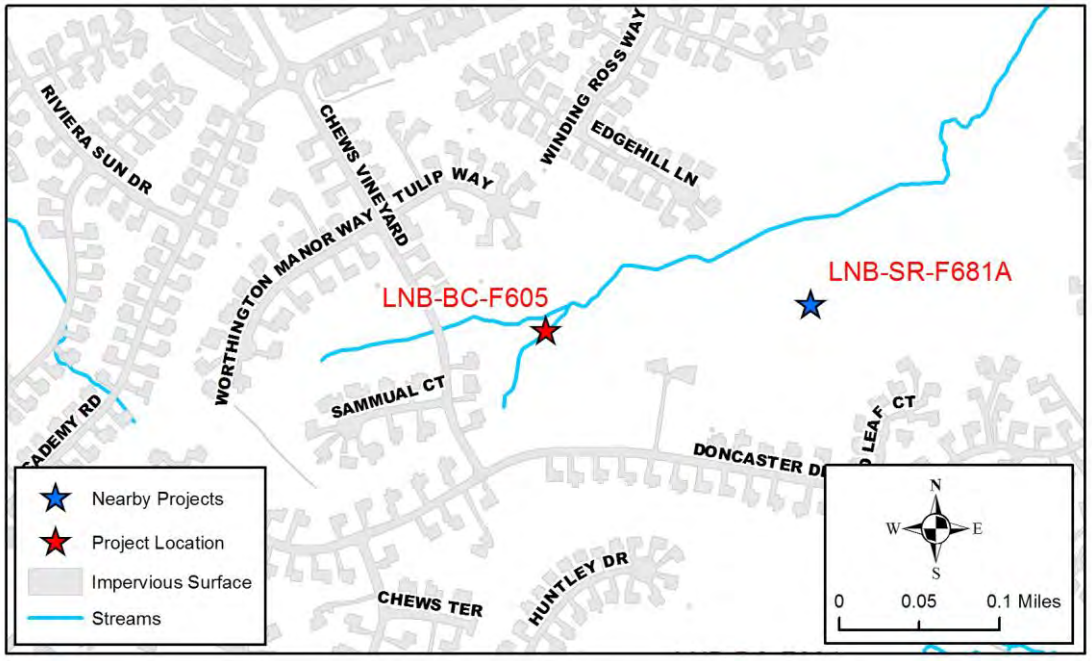
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F605
Site Name: Chews Vineyard Pond
Contractor: KCI
Watershed: Patapsco Lower North

Proposed BMP Type: Step Pool Conveyance System
Ownership: County Owned
Single Owner
BMP Structure ID: HO103288
Existing BMP Type: DP

Existing Conditions:

The existing pond is in line with the stream and is very narrow. The pond is functioning and the structure is in good condition. There was no erosion found at or downstream of the outfall. Minor maintenance is needed.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F605
Site Name: Chews Vineyard Pond
Contractor: KCI
Watershed: Patapsco Lower North

Overall view of pond with riser looking west.

Outfall channel on east side of Chews Vineyard looking east.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F605
Site Name: Chews Vineyard Pond
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints include limited space, significant impact to trees, close proximity to neighboring properties, and impact to wetlands and streams.

Concept Description:

A step pool conveyance system at the downstream outfall of the pond is proposed to treat water leaving the structure. Since the pond is narrow, a wet pond or wetland is not feasible. The site has easy access and is on public land.

Nearby Opportunities:

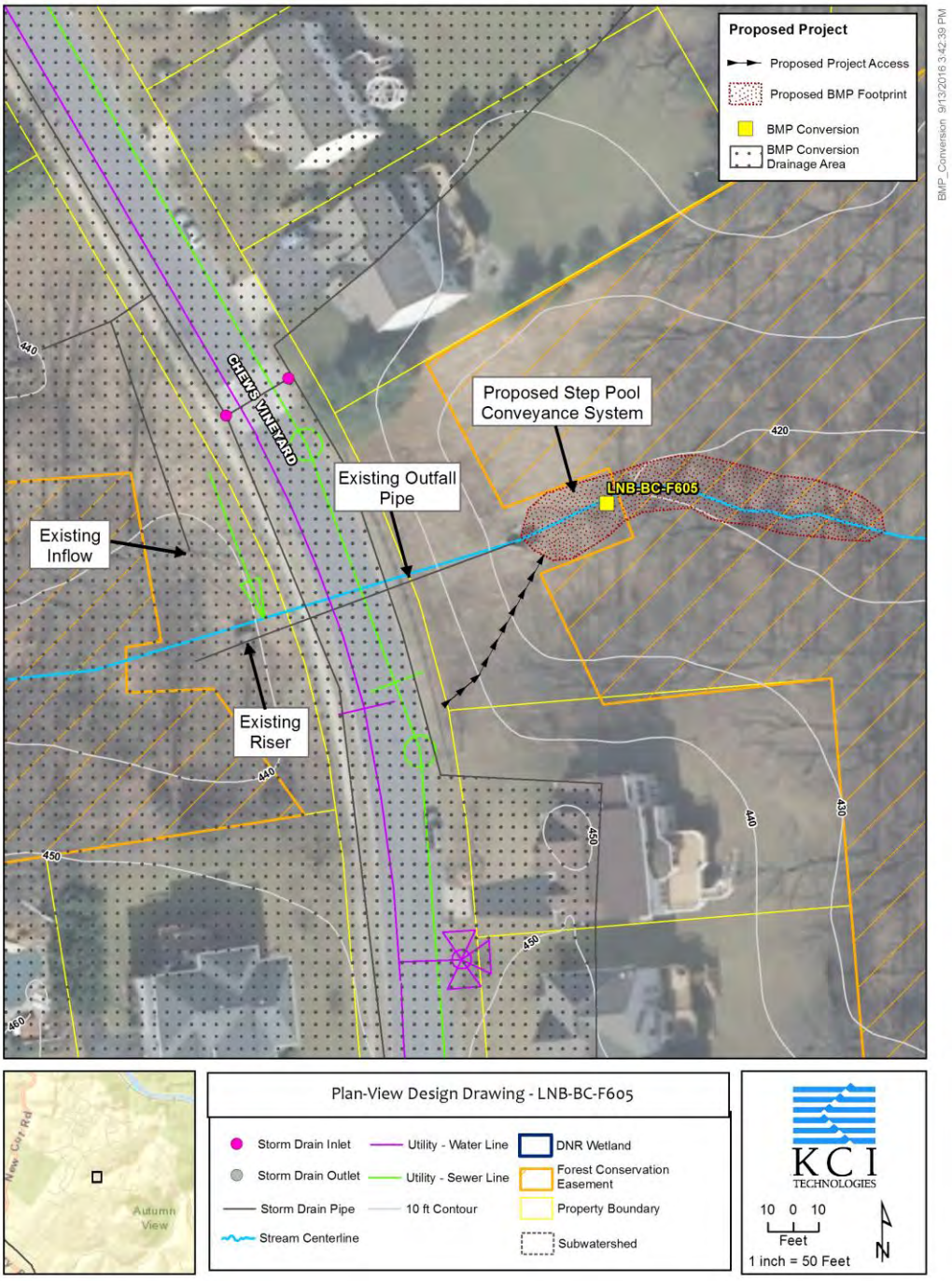
None

Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	30.33	WQVolume Target (cft.):	32,556
Impervious Area within Drainage (ac.):	8.28	Max Treated (cft.):	30,686
Impervious Area Treated (ac.):	8.16	Percent Treated:	94%
Impervious Area Treated Credit (ac.):	8.16	Rainfall Depth Treated (in.):	0.94

Costs	
Estimated Design Cost:	$200,000
Estimated Construction Cost:	$128,000
30% Contingency:	$98,400
Estimated Total Cost	$426,400
Cost per Impervious Credit Acre:	$52,255

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F605
Site Name: Chews Vineyard Pond
Contractor: KCI
Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F606
Site Name: Autumn Rust Road Pond

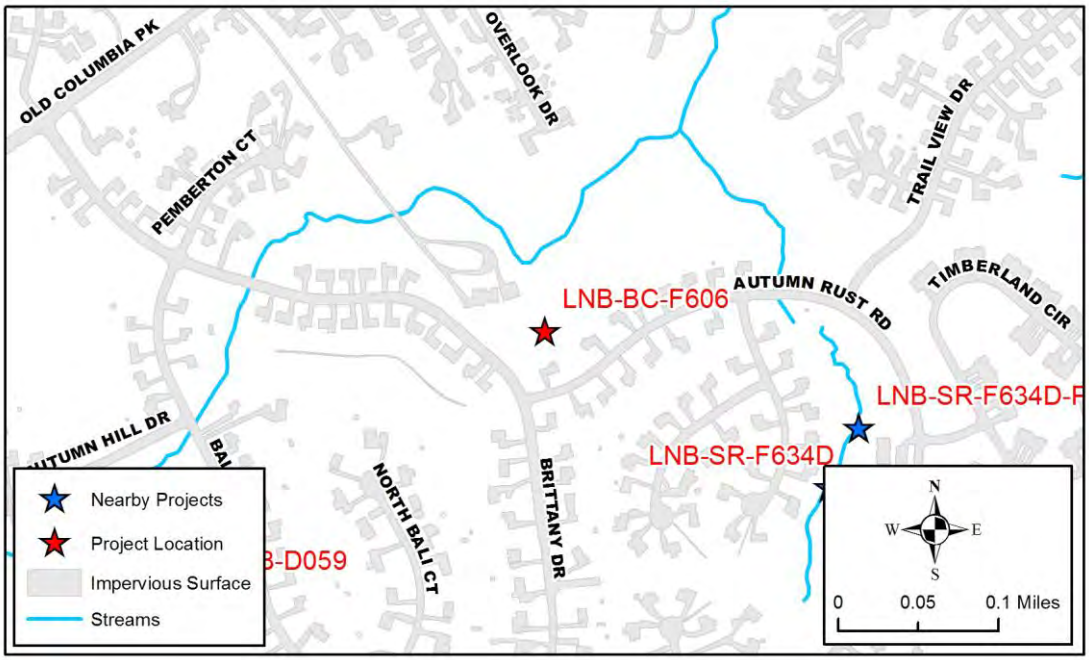
Contractor: KCI
Watershed: Patapsco Lower North

Proposed BMP Type: Created Wetland
Ownership: County Owned
Single Owner

BMP Structure ID: HO103324
Existing BMP Type: DP

Existing Conditions:

Limited information on existing pond condition. Adjacent property owner made a complaint about trees and bamboo on the southeast side of the pond encroaching into the adjacent southern property. There is 50 ft. of minor erosion at outfall and 200 ft. of moderate stream channel erosion downstream of the outfall. The pond needs maintenance for invasive species.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F606
Site Name: Autumn Rust Road Pond
Contractor: KCI
Watershed: Patapsco Lower North

Existing pond and riser structure looking north.

Trees and invasive vegetation growing into nearby residential property looking south.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F606
Site Name: Autumn Rust Road Pond
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints include significant impact to existing trees and streams and close proximity to neighboring properties. Affected trees include 5 trees with a diameter greater than 30 in.

Concept Description:

A created wetland is proposed at this site with a forebay near the inflow, micropool near the riser structure, and high marsh/low marsh zones at the pond bottom. The existing riser structure will be modified to provide water quality volume storage. Invasive species will be removed.

Nearby Opportunities:

None

Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	14.46	WQVolume Target (cft.):	12,099
Impervious Area within Drainage (ac.):	2.9	Max Treated (cft.):	14,367
Impervious Area Treated (ac.):	2.9	Percent Treated:	119%
Impervious Area Treated Credit (ac.):	3.04	Rainfall Depth Treated (in.):	1.19

Costs	
Estimated Design Cost:	$200.000
Estimated Construction Cost:	$119,324
30% Contingency:	$95,797
Estimated Total Cost	$415,122
Cost per Impervious Credit Acre:	$136,553

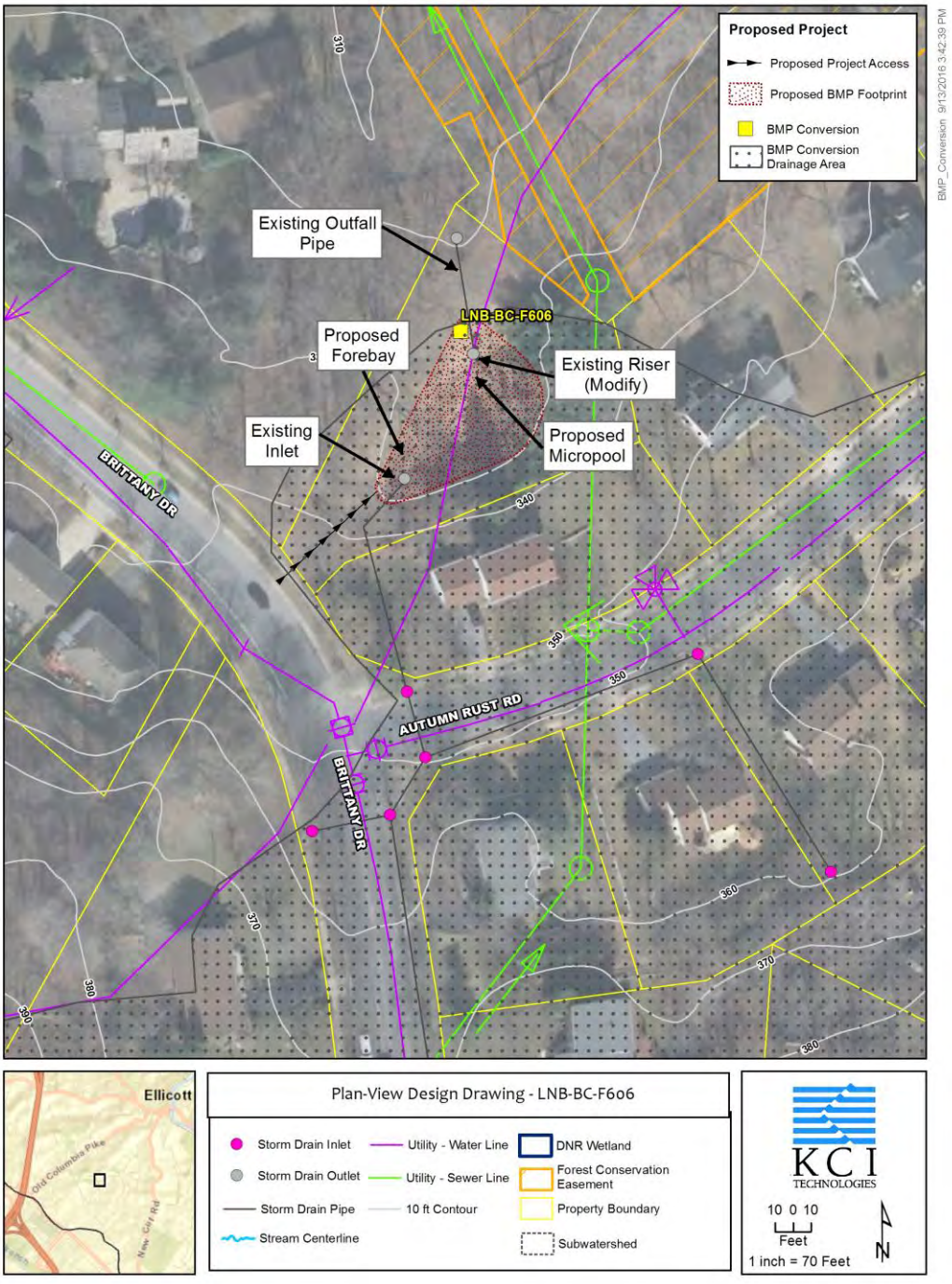
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F606

Site Name: Autumn Rust Road Pond

Contractor: KCI

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F607
Site Name: Governor Thomas Pond

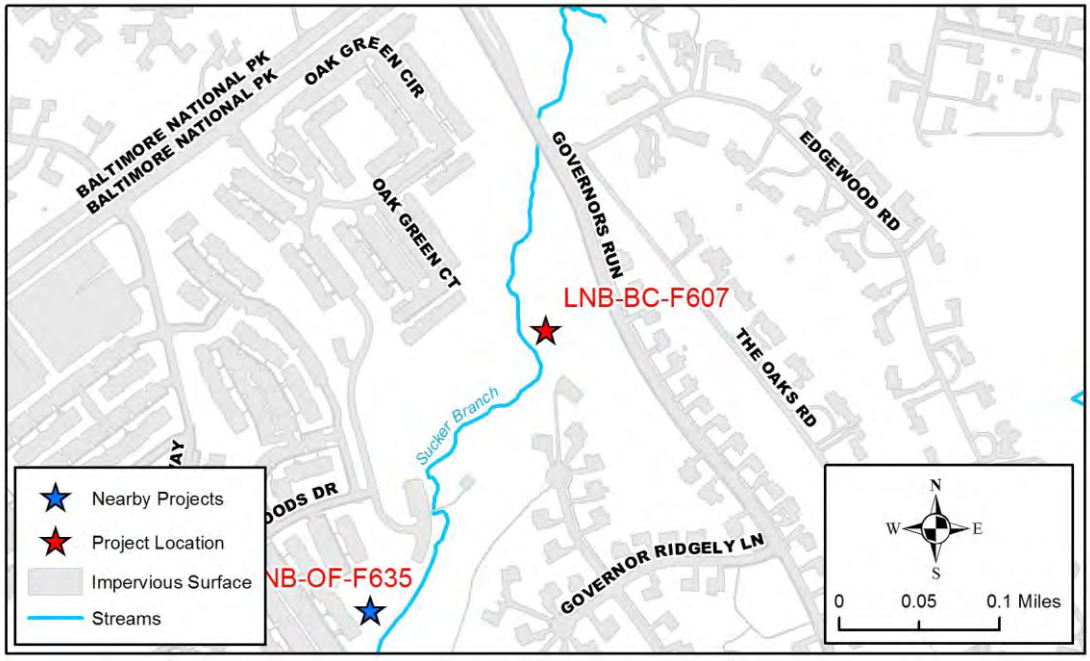
Contractor: KCI
Watershed: Patapsco Lower North

Proposed BMP Type: Wet Pond or Infiltration Basin
Ownership: County Owned
Single Owner

BMP Structure ID: HO104686
Existing BMP Type: DP

Existing Conditions:

The existing pond and riser structure are in good condition and functioning as a dry pond with a little bit of ponding water due to recent storms. No erosion was noted at the outfall but 50 ft. of minor stream channel erosion downstream of the outfall was noted.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F607
Site Name: Governor Thomas Pond
Contractor: KCI
Watershed: Patapsco Lower North

Overview of pond and riser structure looking southeast.

Inflow pipe to pond looking south.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F607
Site Name: Governor Thomas Pond
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints include limited surface area, proximity to neighboring properties, and minimal impact to existing trees.

Concept Description:

Due to limited surface area, this pond is proposed to be converted to a wet pond or infiltration basin depending on infliltration capability of the soils. The riser structure will be modified to increase water storage.

Nearby Opportunities:

None

Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	11.59	WQVolume Target (cft.):	11,872
Impervious Area within Drainage (ac.):	2.99	Max Treated (cft.):	26,344
Impervious Area Treated (ac.):	2.99	Percent Treated:	222%
Impervious Area Treated Credit (ac.):	3.9	Rainfall Depth Treated (in.):	2.22

Costs	
Estimated Design Cost:	$100,000
Estimated Construction Cost:	$86,551
30% Contingency:	$55,965
Estimated Total Cost	$242,516
Cost per Impervious Credit Acre:	$62,184

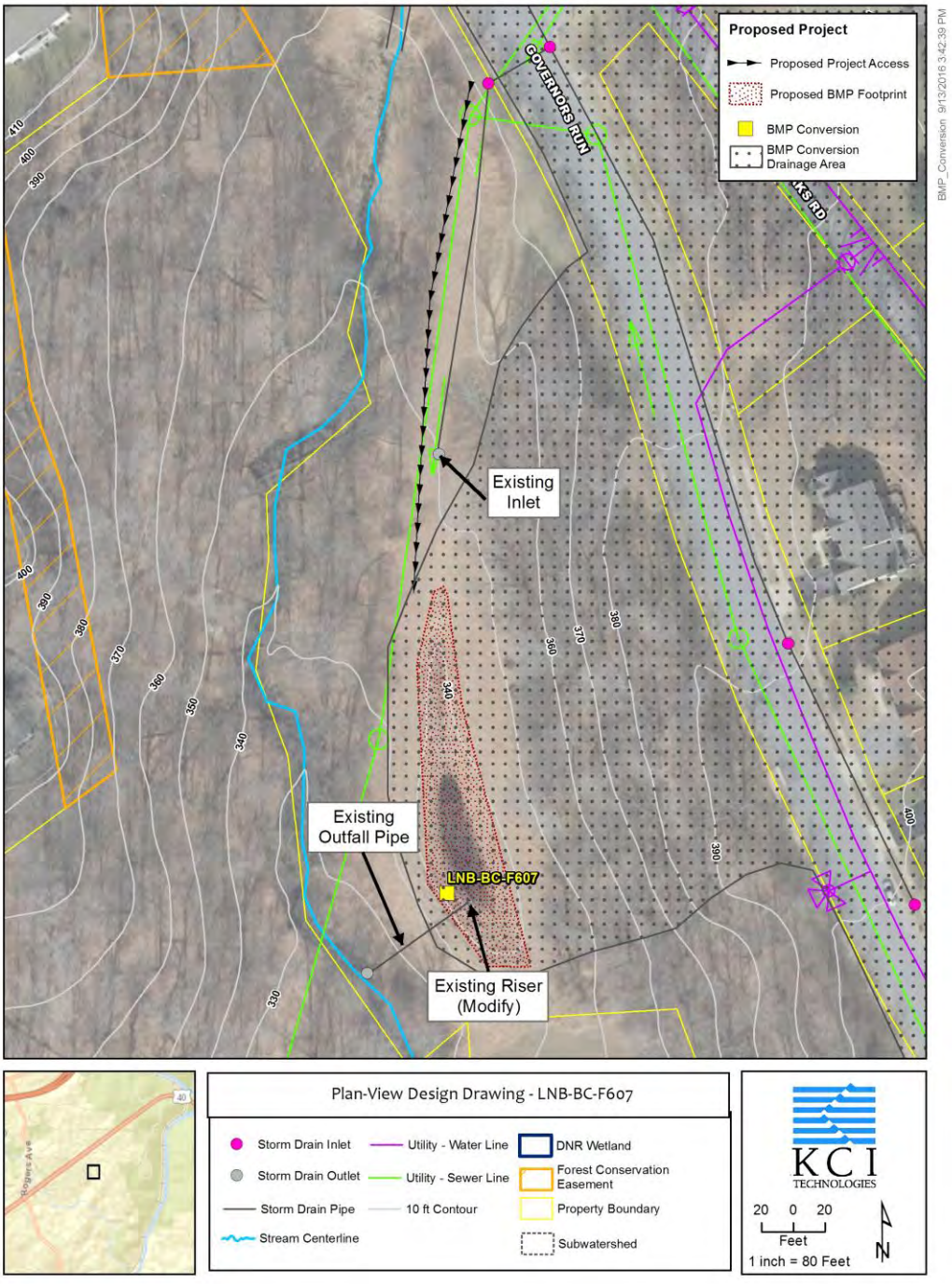
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F607

Site Name: Governor Thomas Pond

Contractor: KCI

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F608
Site Name: Old Mill Road Pond

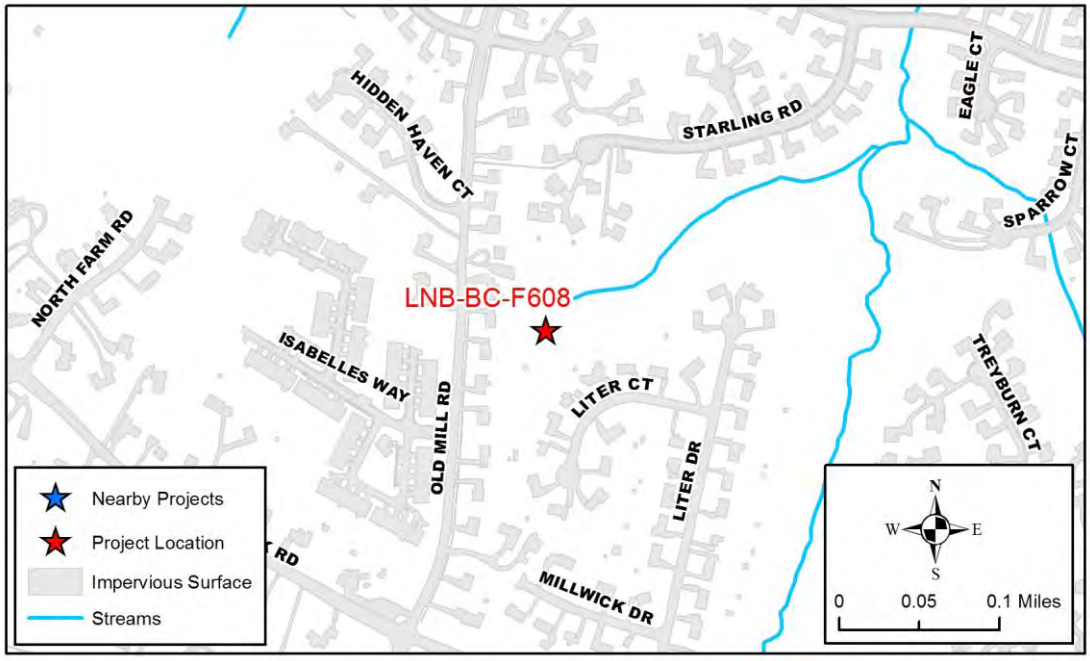
Contractor: KCI
Watershed: Patapsco Lower North

Proposed BMP Type: Wet Pond
Ownership: County Owned
Single Owner

BMP Structure ID: HO103360
Existing BMP Type: DP

Existing Conditions:

The existing pond is in good condition and the riser structure is new. The inflow and outfall structures are also in good condition. No erosion was noted at the site.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F608
Site Name: Old Mill Road Pond
Contractor: KCI
Watershed: Patapsco Lower North

Overview of pond looking east.

Pond riser structure looking north.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F608
Site Name: Old Mill Road Pond
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints include close proximity to neighboring properties and minimal impact to existing trees.

Concept Description:

The conversion of this site to a wet pond is proposed with a forebay near the inflow. The existing riser will be modified and the pond may be excavated to provide greater water storage.

Nearby Opportunities:

None

Proposed Project Credit	
Drainage Area (ac.):	12.1
Impervious Area within Drainage (ac.):	3.63
Impervious Area Treated (ac.):	3.63
Impervious Area Treated Credit (ac.):	4.08

Water Quality Volume	
WQVolume Target (cft.):	14,055
Max Treated (cft.):	21,086
Percent Treated:	150%
Rainfall Depth Treated (in.):	1.5

Costs	
Estimated Design Cost:	$100,000
Estimated Construction Cost:	$74,223
30% Contingency:	$52,267
Estimated Total Cost	$226,490
Cost per Impervious Credit Acre:	$55,512

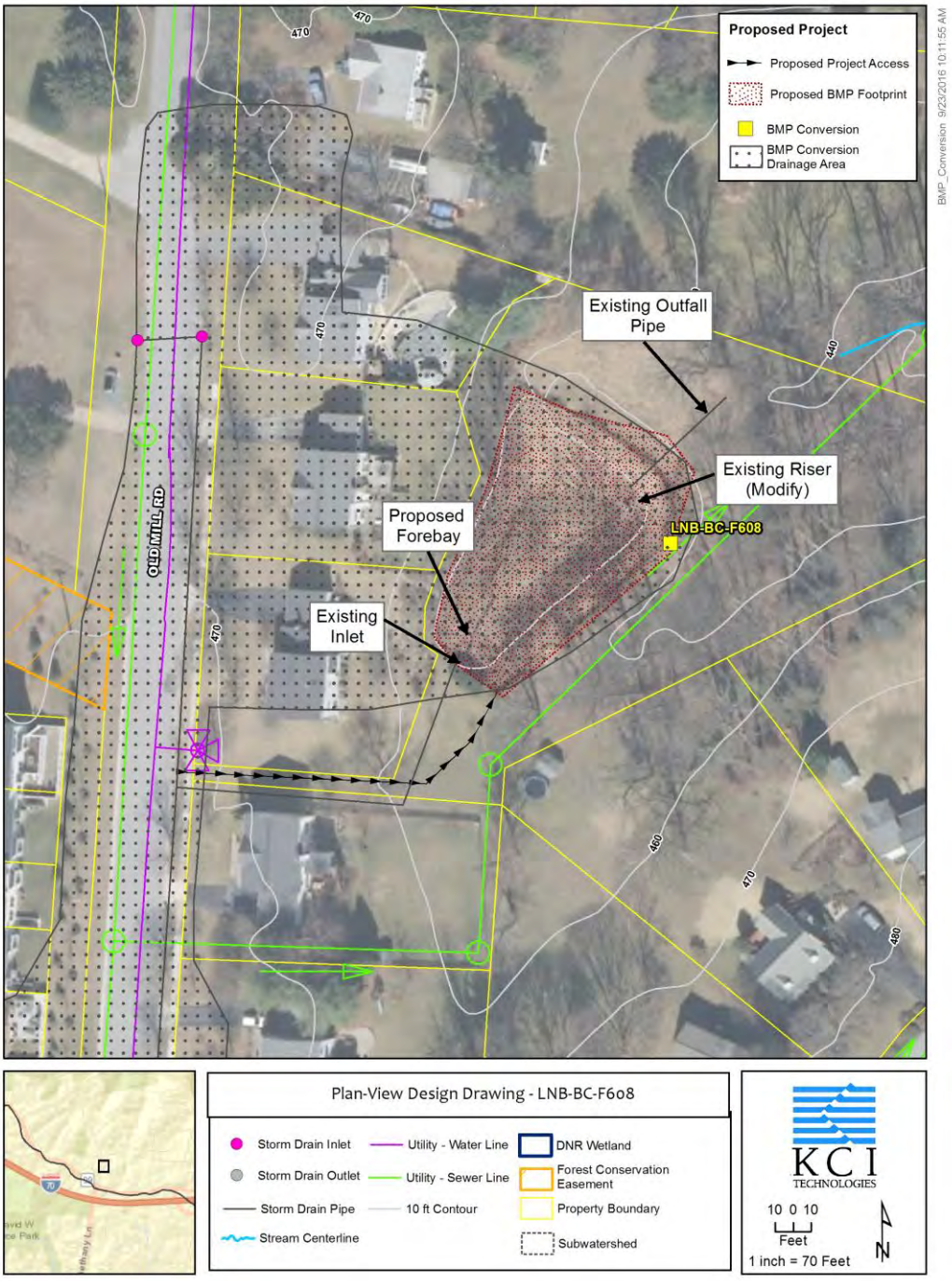
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F608

Site Name: Old Mill Road Pond

Contractor: KCI

Watershed: Patapsco Lower North



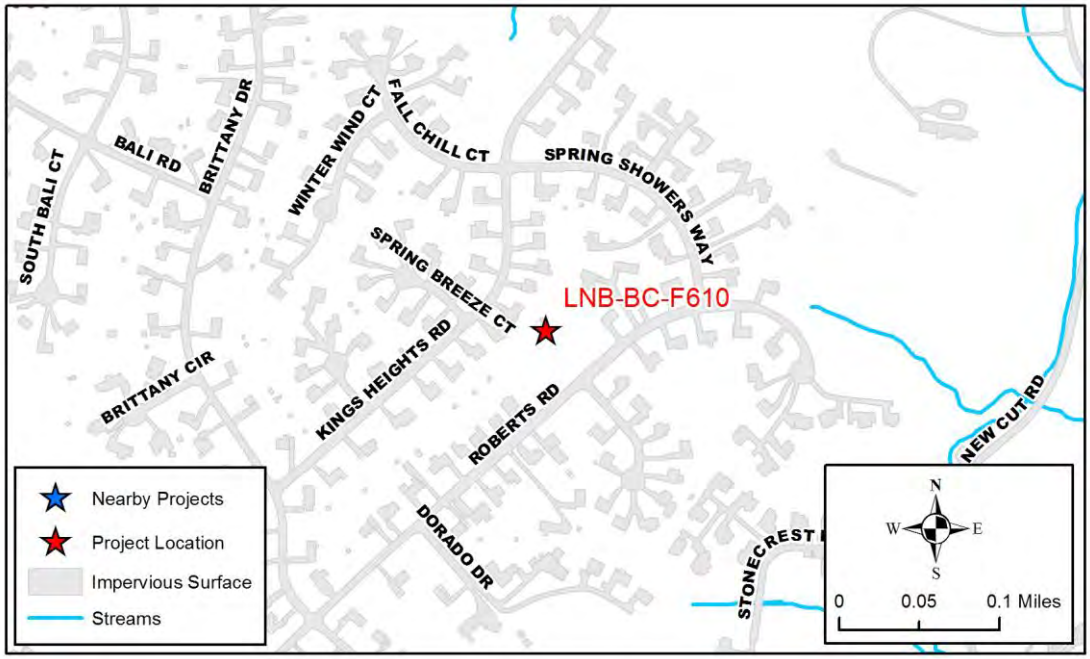
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F610
Site Name: Roberts Road Pond
Contractor: KCI
Watershed: Patapsco Lower North

Proposed BMP Type: Wet Pond
Ownership: County Owned
Single Owner
BMP Structure ID: HO103320
Existing BMP Type: DP

Existing Conditions:

The existing dry pond is in good condition. The structures are new and funcitoning well. There was no erosion at the site.



Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F610
Site Name: Roberts Road Pond
Contractor: KCI
Watershed: Patapsco Lower North

Overview of pond looking south.

Pond outfall looking north.

Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F610
Site Name: Roberts Road Pond
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

The only constraint at this site is close proximity of the pond to neighboring properties.

Concept Description:

The conversion of this dry pond to a wet pond is proposed with a forebay near the inflow pipe. The riser structure will be modified and the pond may be excavated to increase storage in the pond.

Nearby Opportunities:

None

Proposed Project Credit	
Drainage Area (ac.):	12.02
Impervious Area within Drainage (ac.):	3.05
Impervious Area Treated (ac.):	3.05
Impervious Area Treated Credit (ac.):	3.13

Water Quality Volume	
WQVolume Target (cft.):	12,146
Max Treated (cft.):	13,354
Percent Treated:	110%
Rainfall Depth Treated (in.):	1.1

Costs	
Estimated Design Cost:	$100,000
Estimated Construction Cost:	$75,006
30% Contingency:	$52,502
Estimated Total Cost	$227,508
Cost per Impervious Credit Acre:	$72,686

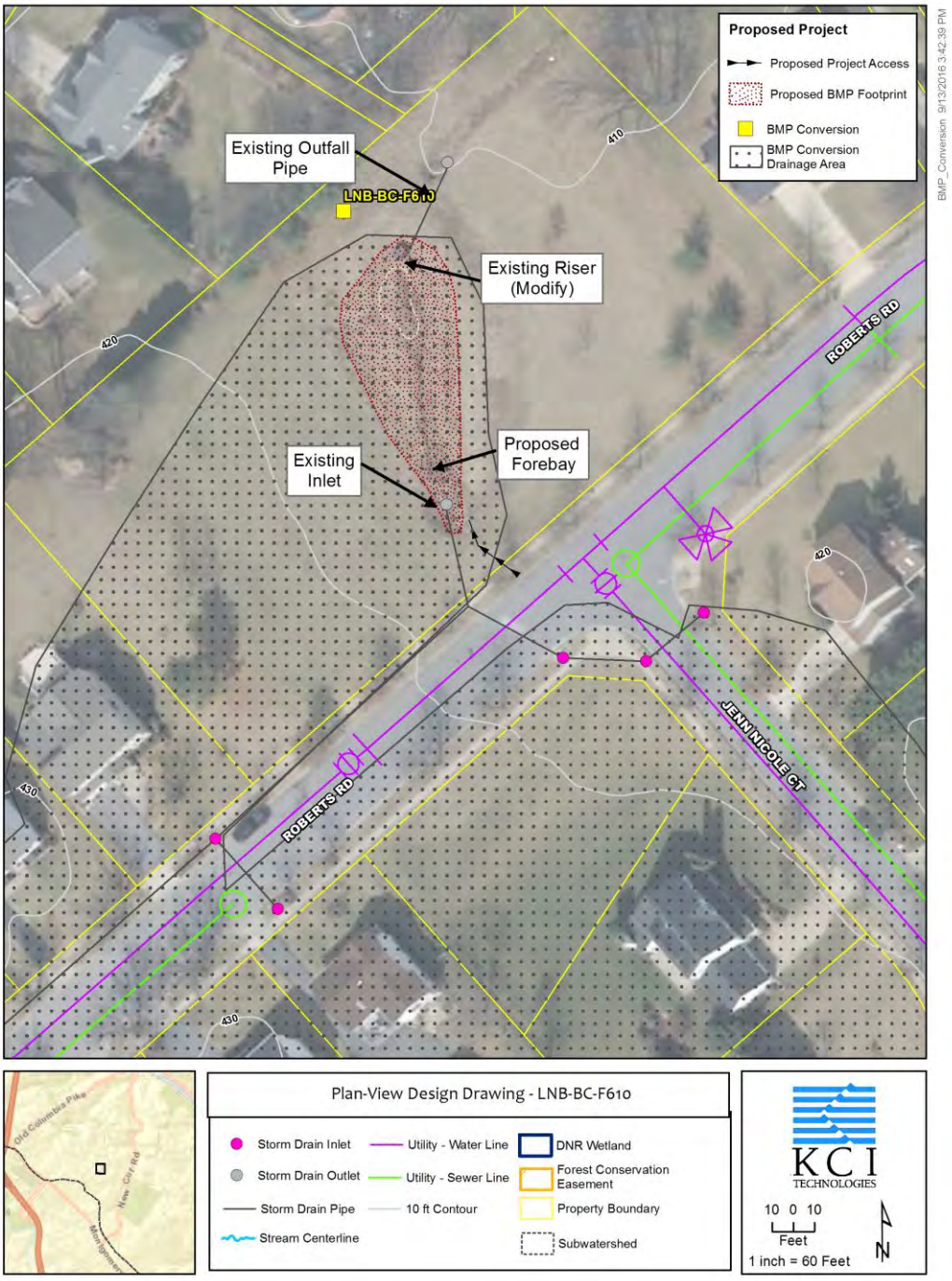
Howard County Watershed Assessment Concept Plan: BMP Conversion

Site ID: LNB-BC-F610

Site Name: Roberts Road Pond

Contractor: KCI

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: New BMP

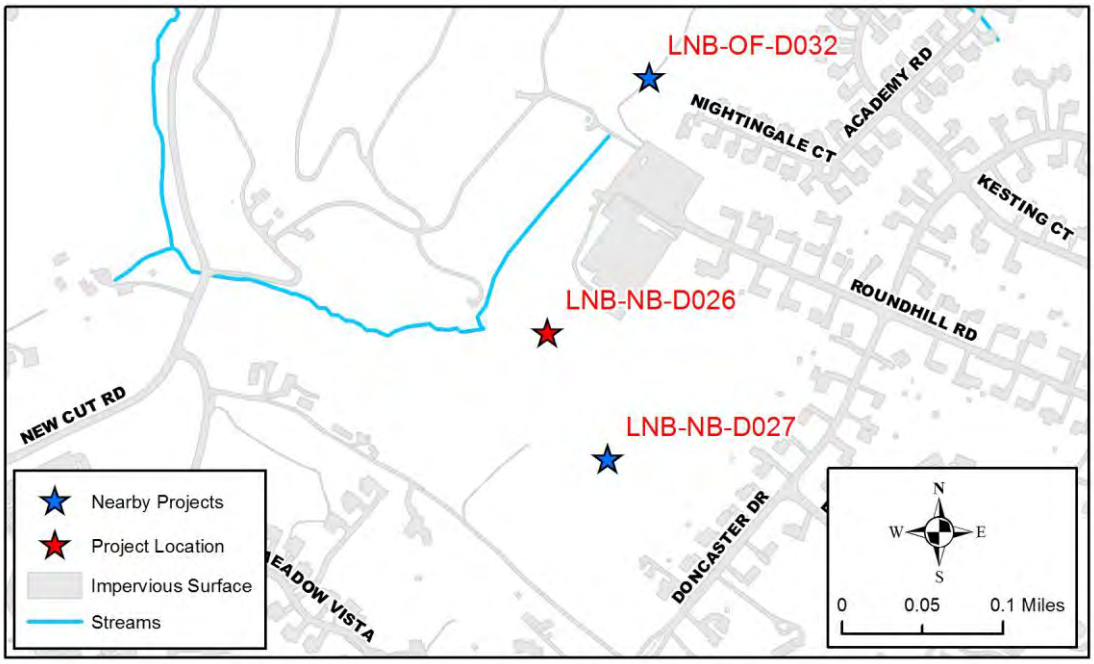
Site ID: LNB-NB-D026
Site Name: Worthington Elementary

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Underground Filter
Ownership: County School
Single Owner

Existing Conditions:

The site is Worthington Elementary school and includes the school building, parking lot, and paved and unpaved recreational areas. Currently, three storm drain networks carry runoff to three outfall locations around the property. The first is from the parking lot, which outfalls in the northern corner of the property, the second collects from the building and recreational areas and outfalls in the wooded area to the west of the softball field, and the third collects runoff from the building and recreational areas and outfalls in the wooded area at the southern edge of the property. Per the original design plans (SDP-75-041), the existing storm drain at the downstream section of the second system is 18in ACCMP pipe and at the downstream sections of the third system are 18 in. and 24 in. RCP.



Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-D026
Site Name: Worthington Elementary

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking south toward the area of the proposed underground sand filter.

Looking northwest toward the existing inlet.

Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-D026
Site Name: Worthington Elementary

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

There are no apparent utility conflicts for this site, but construction will need to be completed during summer months while school is not in session. Existing storm drain and ground surface elevations will need to be verified to ensure adequate elevations for proposed tie-ins and structure placement.

Concept Description:

The proposed underground facility location utilizes the second existing storm drain network from the school building and recreational areas which outfalls on the western side of the property. The facility would be installed near the existing yard inlet at the edge of the softball field and the wooded area. A proposed underground sand filter (USF) would be installed with a flow splitter to divert the water quality storm into the chamber. A new outfall in the wooded area west of the softball field is proposed from the USF. The original outfall will also remain for the bypass runoff. The USF would provide 840 cf. of pretreatment in a sedimentation chamber with a surface area of approximately 210 sf. The sand filter area would cover 705 sf. with 2 ft. of media for treatment. An additional 4 ft. of temporary ponding over the facility area (705 sf.) is also considered to treat 102% of the WQv (3,384 cf.). The total size of the USF would be approximately 30 ft. wide and 35 ft. long (interior dimensions). This area includes the three chambers for sedimentation, treatment, and overflow as typical per the MDE stormwater design manual. Non-standard underground facilities, such as StormChamber, could be considered as previously describe in the 2013 Howard County LID Retrofits and Tree Planting Summary Report. Access to the proposed site location would be from the Worthington Elementary School recreation area.

Nearby Opportunities:

LNB-NB-D027, LNB-OF-D032

Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	1.61	WQVolume Target (cft.):	3,331
Impervious Area within Drainage (ac.):	0.93	Max Treated (cft.):	3,384
Impervious Area Treated (ac.):	0.93	Percent Treated:	102%
Impervious Area Treated Credit (ac.):	0.93	Rainfall Depth Treated (in.):	1.02

Costs

Estimated Design Cost:	$120,000
Estimated Construction Cost:	$87,314
30% Contingency:	$62,194
Estimated Total Cost	$269,508
Cost per Impervious Credit Acre:	$289,794

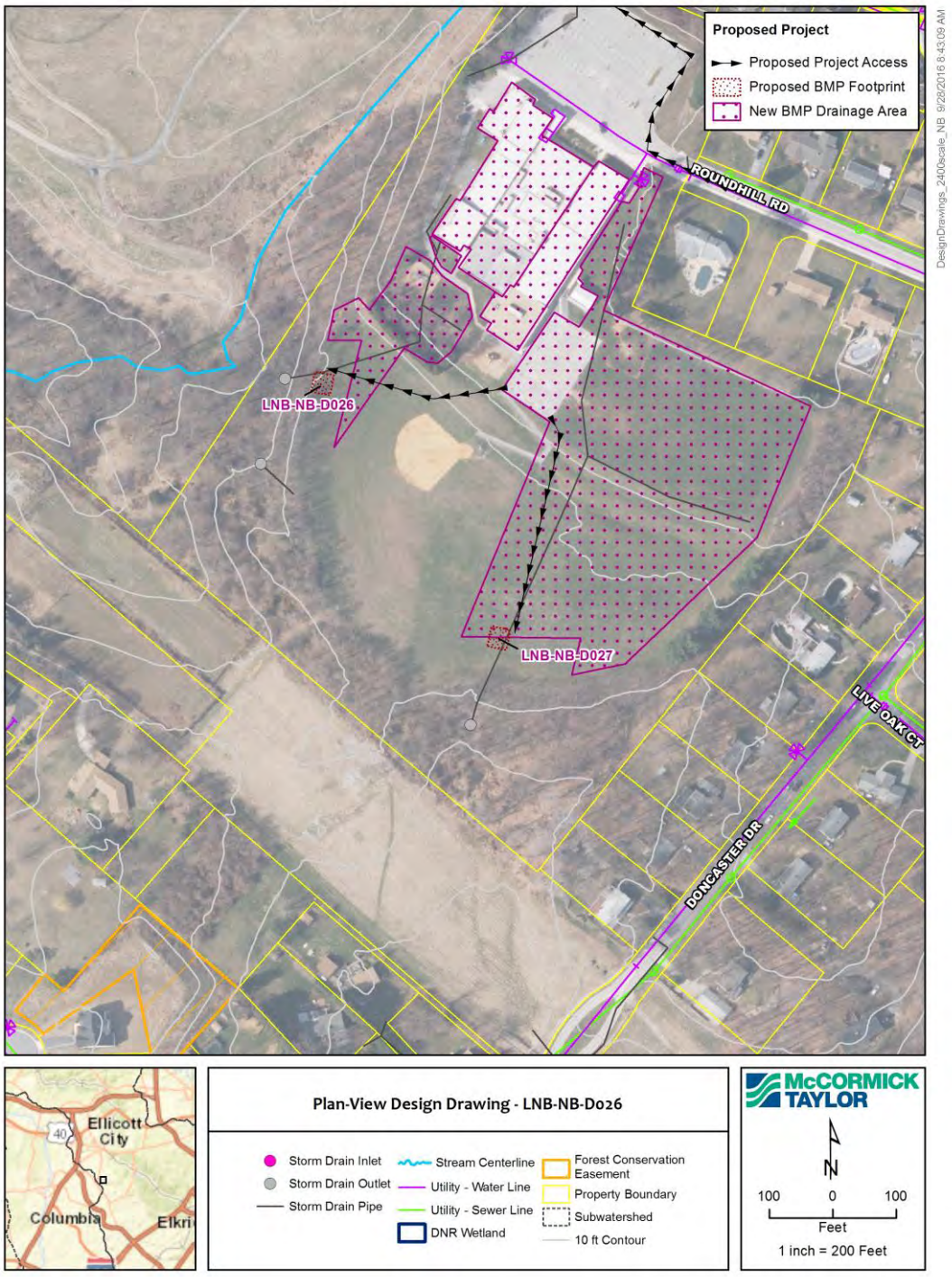
Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-D026

Site Name: Worthington Elementary

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: New BMP

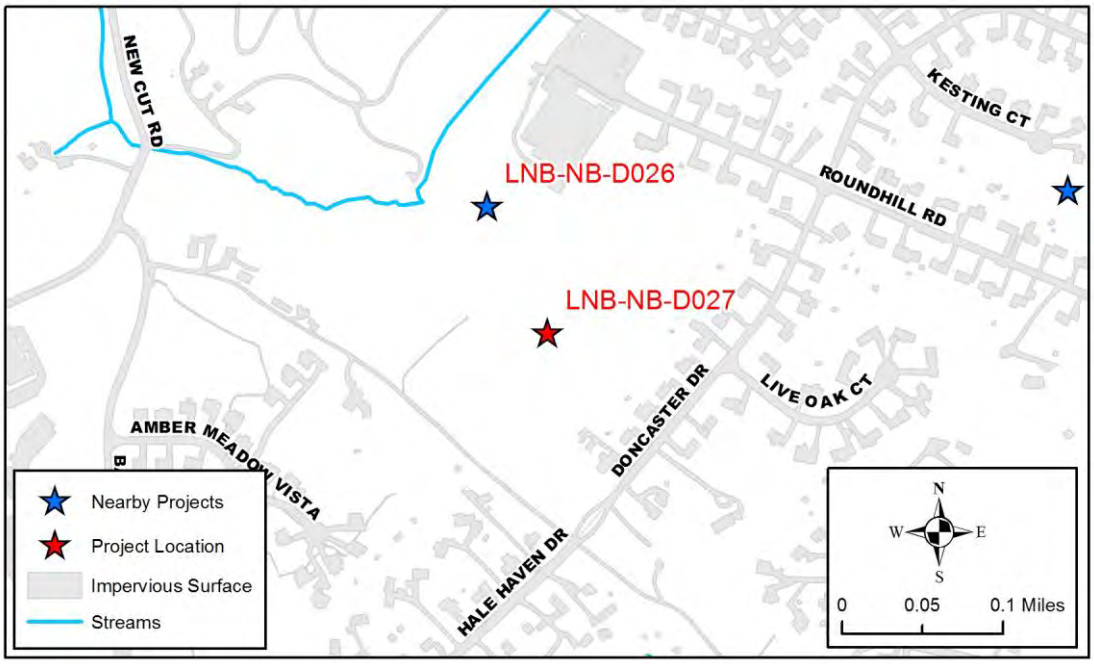
Site ID: LNB-NB-D027
Site Name: Worthington Elementary

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Underground Sand Filter
Ownership: County School
Single Owner

Existing Conditions:

The site is Worthington Elementary school and includes the school building, parking lot, and paved and unpaved recreational areas. Currently, three storm drain networks carry runoff to three outfall locations around the property. The first is from the parking lot, which outfalls in the northern corner of the property, the second collects from the building and recreational areas and outfalls in the wooded area to the west of the softball field, and the third collects runoff from the building and recreational areas and outfalls in the wooded area at the southern edge of the property. Per the original design plans (SDP-75-041), the existing storm drain at the downstream section of the second system is 18in ACCMP pipe and at the downstream sections of the third system are 18 in. and 24 in. RCP.



Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-D027
Site Name: Worthington Elementary

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking west toward the area of the proposed underground sand filter.

Looking east toward the existing inlet.

Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-D027
Site Name: Worthington Elementary
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

There are no apparent utility conflicts for this site, but construction will need to be completed during summer months while school is not in session. Existing storm drain and ground surface elevations will need to be verified to ensure adequate elevations for proposed tie-ins and structure placement.

Concept Description:

The proposed underground facility location utilizes the third existing storm drain network from the school building and recreational areas which outfalls on the south side of the property. The facility would be installed near the inlet at the edge of the athletic field and the wooded area. A proposed underground sand filter (USF) would be installed with a flow splitter to divert the water quality storm into the chamber. A new outfall in the wooded area south of the athletic fields is proposed from the USF. The original outfall will also remain for the bypass runoff. The USF would provide 870 cf. of pretreatment in a sedimentation chamber with a surface area of approximately 218 sf. The sand filter area would cover 720 sf. with 2 ft. of media for treatment. An additional 4 ft. of temporary ponding over the facility area (720 sf.) is also considered to treat 110% of the WQv (3,456 cf.). The total size of the USF would be approximately 30 ft. wide and 36 ft. long (interior dimensions). This area includes the three chambers for sedimentation, treatment, and overflow as typical per the MDE stormwater design manual. Non-standard underground facilities, such as StormChamber, could be considered as previously describe in the 2013 Howard County LID Retrofits and Tree Planting Summary Report. Access to the proposed site location would be from the Worthington Elementary School recreation area

Nearby Opportunities:

LNB-NB-D027

Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	4.99	WQVolume Target (cft.):	3,421
Impervious Area within Drainage (ac.):	0.77	Max Treated (cft.):	3,456
Impervious Area Treated (ac.):	0.77	Percent Treated:	101%
Impervious Area Treated Credit (ac.):	0.77	Rainfall Depth Treated (in.):	1.01

Costs

Estimated Design Cost:	$120,000
Estimated Construction Cost:	$89,310
30% Contingency:	$62,793
Estimated Total Cost	$272,103
Cost per Impervious Credit Acre:	$353,381

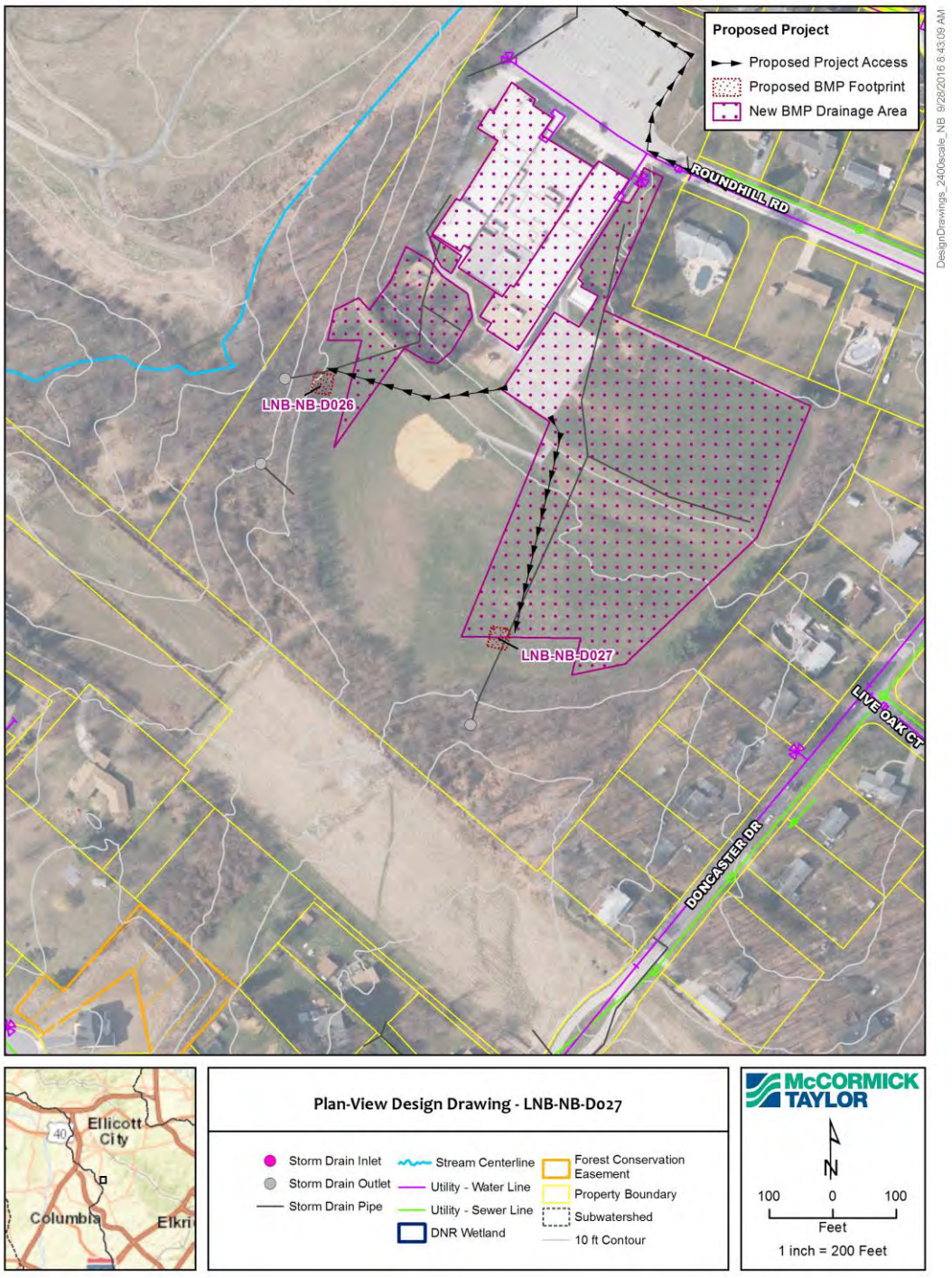
Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-D027

Site Name: Worthington Elementary

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: New BMP

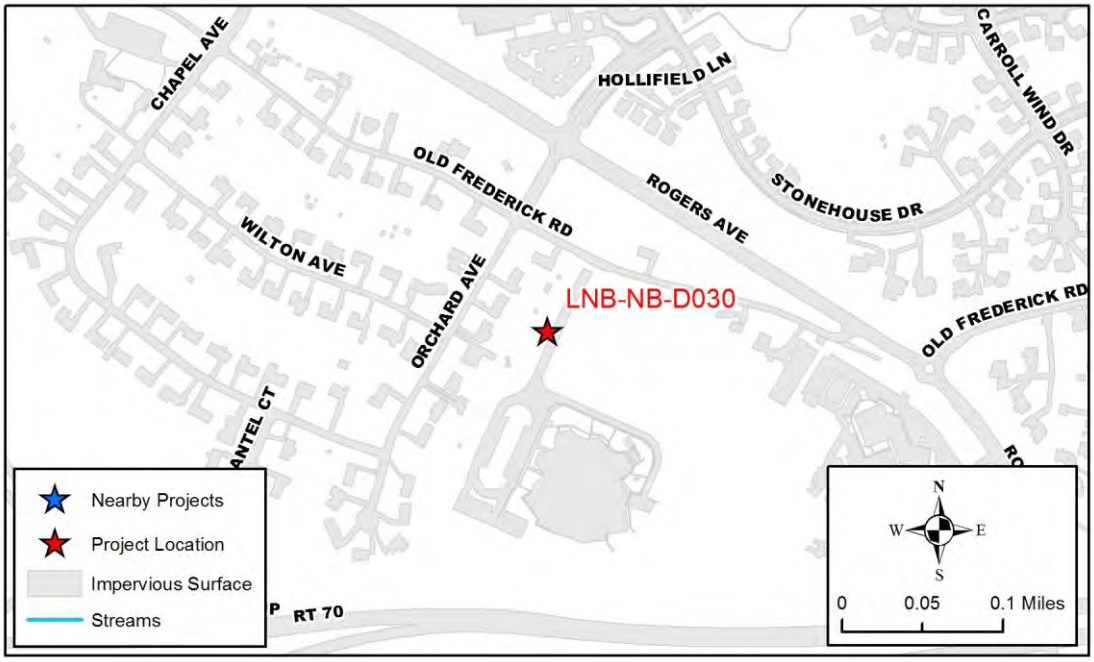
Site ID: LNB-NB-D030
Site Name: Patapsco Middle School

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Bio-Swale
Ownership: County School
Single Owner

Existing Conditions:

The site is located on Patapsco Middle School property. No existing digital storm drain information is available for this site, but after reviewing the available design plans (SDP-75-020 and SDP-02-114) and 2012 field investigation photos, it appears runoff from the parking lots and driveway is captured in several curb inlets. Existing inlets are located on either side of the bottom of the driveway. A defined storm drain outfall channel was not located during the 2012 field visits.



Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-D030
Site Name: Patapsco Middle School

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking north along the school entrance driveway toward the area of the proposed bioswale.

Looking west toward the downstream inlet the bioswale underdrain should tie into.

Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-D030
Site Name: Patapsco Middle School

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

There are no apparent utility conflicts for this site, but construction will need to be completed during summer months while school is not in session. Existing storm drain and ground surface elevations will need to be verified to ensure adequate elevations for proposed tie-ins and structure placement.

Concept Description:

A bioswale is proposed along the western side of the driveway entrance to the school. Curb cuts or open back inlets will be installed to convey runoff from the driveway into the bioswale. The proposed curb cuts or open back inlets will be sized and installed to convey the one-inch water quality storm event and bypass larger storm events. The bioswale will require a perforated underdrain to ensure the facility drains properly and will connect to the existing inlet at the bottom of the school driveway. For concept design purposes, the proposed swale was assumed to be 300 ft. long with a bottom width of 5 ft. and 3:1 side slopes. Check dams are assumed every 50 ft. to store 1 ft. of water behind each cell. With these assumptions, 682 cf. (105% WQv) is provided in the bioswale.

Nearby Opportunities:

None recommended.

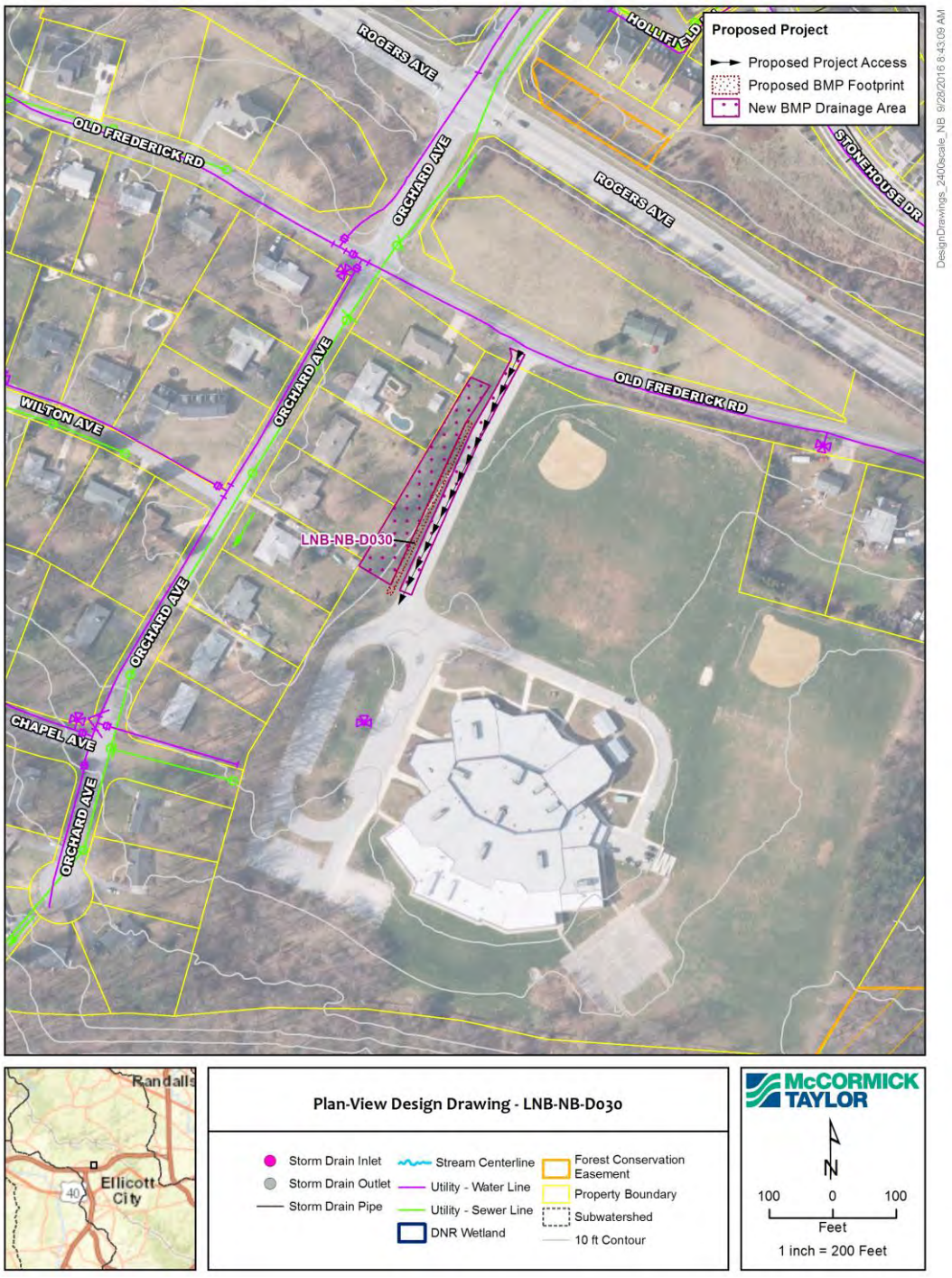
Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	0.5	WQVolume Target (cft.):	646
Impervious Area within Drainage (ac.):	0.17	Max Treated (cft.):	682
Impervious Area Treated (ac.):	0.17	Percent Treated:	105%
Impervious Area Treated Credit (ac.):	0.17	Rainfall Depth Treated (in.):	1.05

Costs	
Estimated Design Cost:	$120,000
Estimated Construction Cost:	$68,785
30% Contingency:	$56,636
Estimated Total Cost	$245,421
Cost per Impervious Credit Acre:	$1,443,650

Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-D030
Site Name: Patapsco Middle School

Contractor: McCormick Taylor
Watershed: Patapsco Lower North



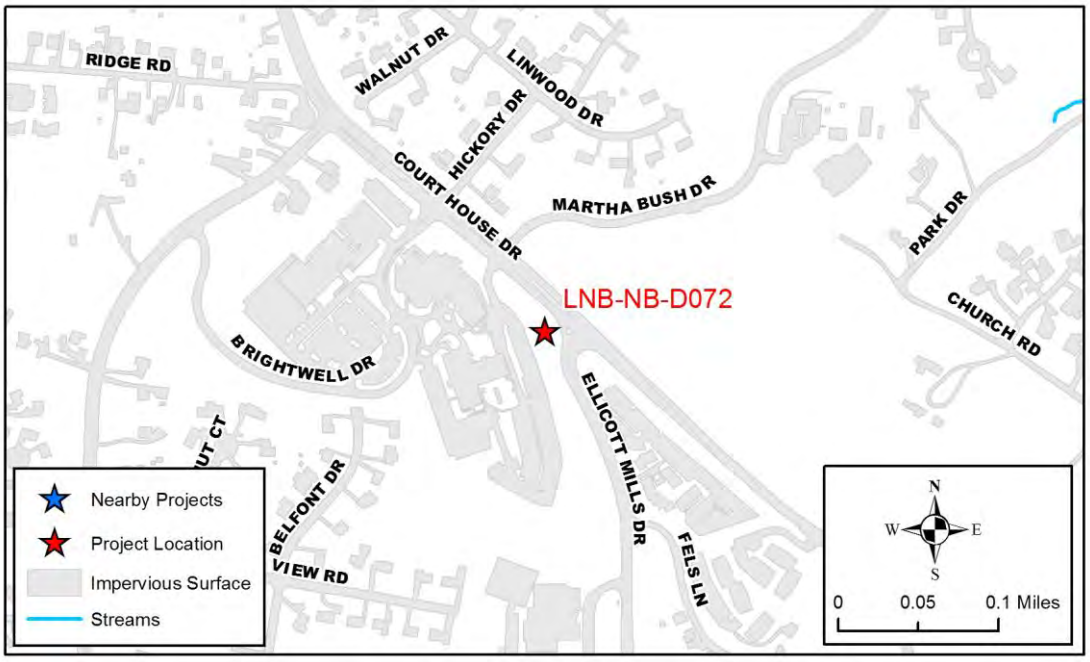
Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-D072
Site Name: George Howard Building Parking Lot
Contractor: KCI
Watershed: Patapsco Lower North

Proposed BMP Type: Bioretention
Ownership: County Owned
Single Owner

Existing Conditions:

This is a concept from the Tiber-Hudson Subwatershed Restoration Action Plan- site RRI_8. There is an existing grass area on the east side of the parking lot receiving water from buildings, parking lots, and driveways of the County office complex. The slopes of the area between the parking lot and the grass area are steep. There is an existing stormdrain manhole and inlet near this site that can be used for proposed facility underdrain connection.



Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-D072
Site Name: George Howard Building Parking Lot
Contractor: KCI
Watershed: Patapsco Lower North

Existing grass area for proposed bioretention

Steep slope area between the parking lot and grass area

Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-D072
Site Name: George Howard Building Parking Lot
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

The existing stormdrain structures need to be investigated for connection to the proposed bioretention. The trees on the steep slopes will be impacted significantly.

Concept Description:

A bioretention is proposed in the open grass area. The steep area between the parking lot and the proposed site will be regraded to a stable slope, and the trees here will be removed. The stormdrain structures near this site will be investigated for connection to the bioretention underdrain. The proposed bioretention basin is approximately 4,300 sf. with 4 ft. of filter bed.

Nearby Opportunities:

None recommended.

Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	2.74	WQVolume Target (cft.):	5,371
Impervious Area within Drainage (ac.):	1.49	Max Treated (cft.):	13,964
Impervious Area Treated (ac.):	2.03	Percent Treated:	242%
Impervious Area Treated Credit (ac.):	2.03	Rainfall Depth Treated (in.):	2.42

Costs

Estimated Design Cost:	$220,000
Estimated Construction Cost:	$156,450
30% Contingency:	$112,935
Estimated Total Cost	$489,385
Cost per Impervious Credit Acre:	$241,076

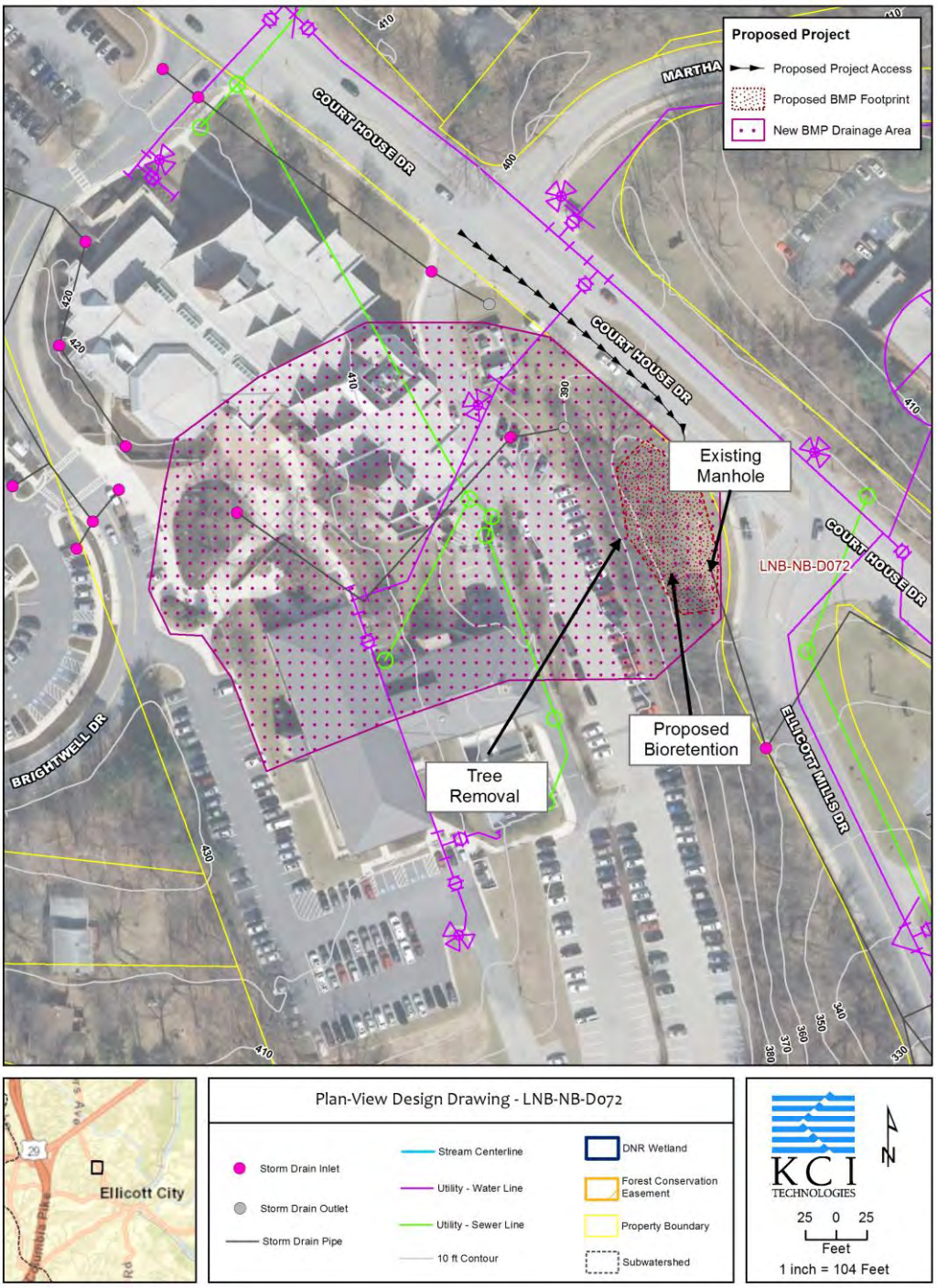
Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-D072

Site Name: George Howard Building Parking Lot

Contractor: KCI

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: New BMP

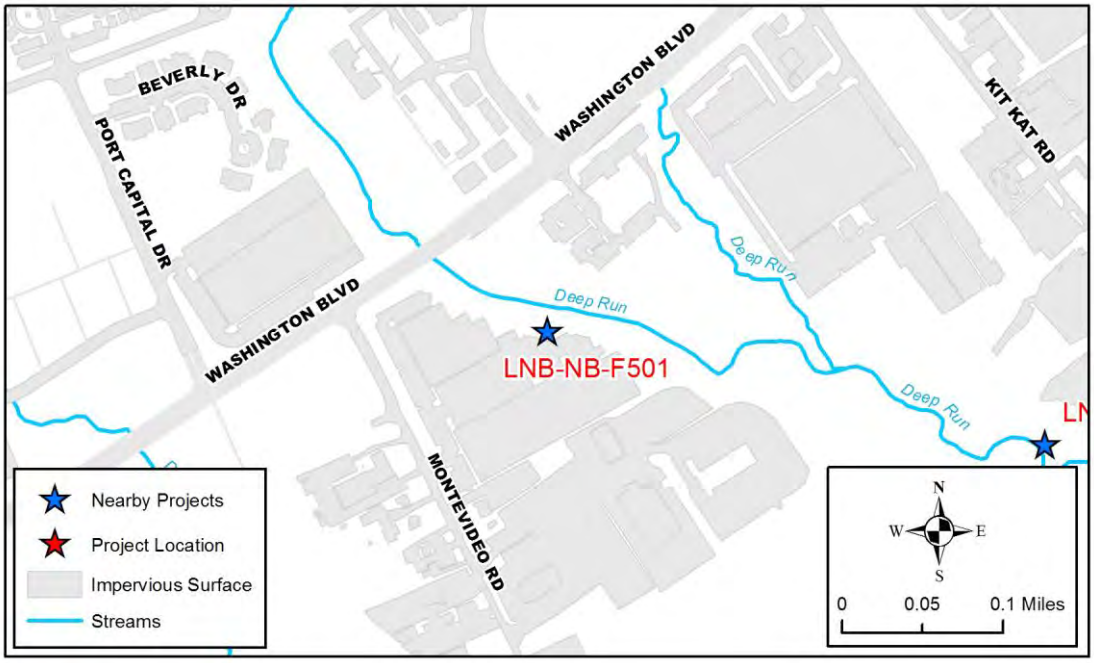
Site ID: LNB-NB-F501
Site Name: Elite Spice

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Bio-Swale
Ownership: Private- Commerical/Industrial
Single Owner

Existing Conditions:

The site is an office building and warehouse for commercial use, currently Elite Spice, in Jessup, MD. Per the original plans (SDP-87-008), two storm drain networks drain the runoff from the site to two outfalls right along the river. Adjacent to the curbed parking lot is an existing grass swale on the eastern side of the property. There are two existing storm drain inlets near this area as the parking lot is sloped to the east.



Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-F501
Site Name: Elite Spice

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking west toward the upstream area of the existing swale.

Looking east toward the downstream area of the existing swale.

Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-F501
Site Name: Elite Spice

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include property ownership and current land use with limited space during working hours, potential water lines, and steep slopes.

Concept Description:

A bioswale is proposed to utilize an existing grass swale along the northern edge of the facility parking lot and loading dock area between the two warehouse buildings on the property. Curb cuts or open back inlets will be installed on either side of the two inlets in this area to convey runoff into the bioswale. The proposed curb cuts or open back inlets will be sized and installed to convey the one-inch water quality storm event and bypass larger storm events. The bioswale will require a perforated underdrain to ensure the facility drains properly and will connect to the existing storm drain or outfall into the wooded area to the north. For concept design purposes, the proposed swale was assumed to be 280 ft. long with a bottom width of 3 ft. and 2:1 side slopes. Check dams are assumed every 70 ft. to store 1.5 ft. of water behind each cell. With these assumptions, 1,981 cf. (85% WQv) is provided in the bioswale.

Nearby Opportunities:

None recommended.

Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	0.74	WQVolume Target (cft.):	2,323
Impervious Area within Drainage (ac.):	0.67	Max Treated (cft.):	1,981
Impervious Area Treated (ac.):	0.67	Percent Treated:	85%
Impervious Area Treated Credit (ac.):	0.67	Rainfall Depth Treated (in.):	0.85

Costs

Estimated Design Cost:	$120,000
Estimated Construction Cost:	$63,330
30% Contingency:	$54,999
Estimated Total Cost	$238,329
Cost per Impervious Credit Acre:	$355,715

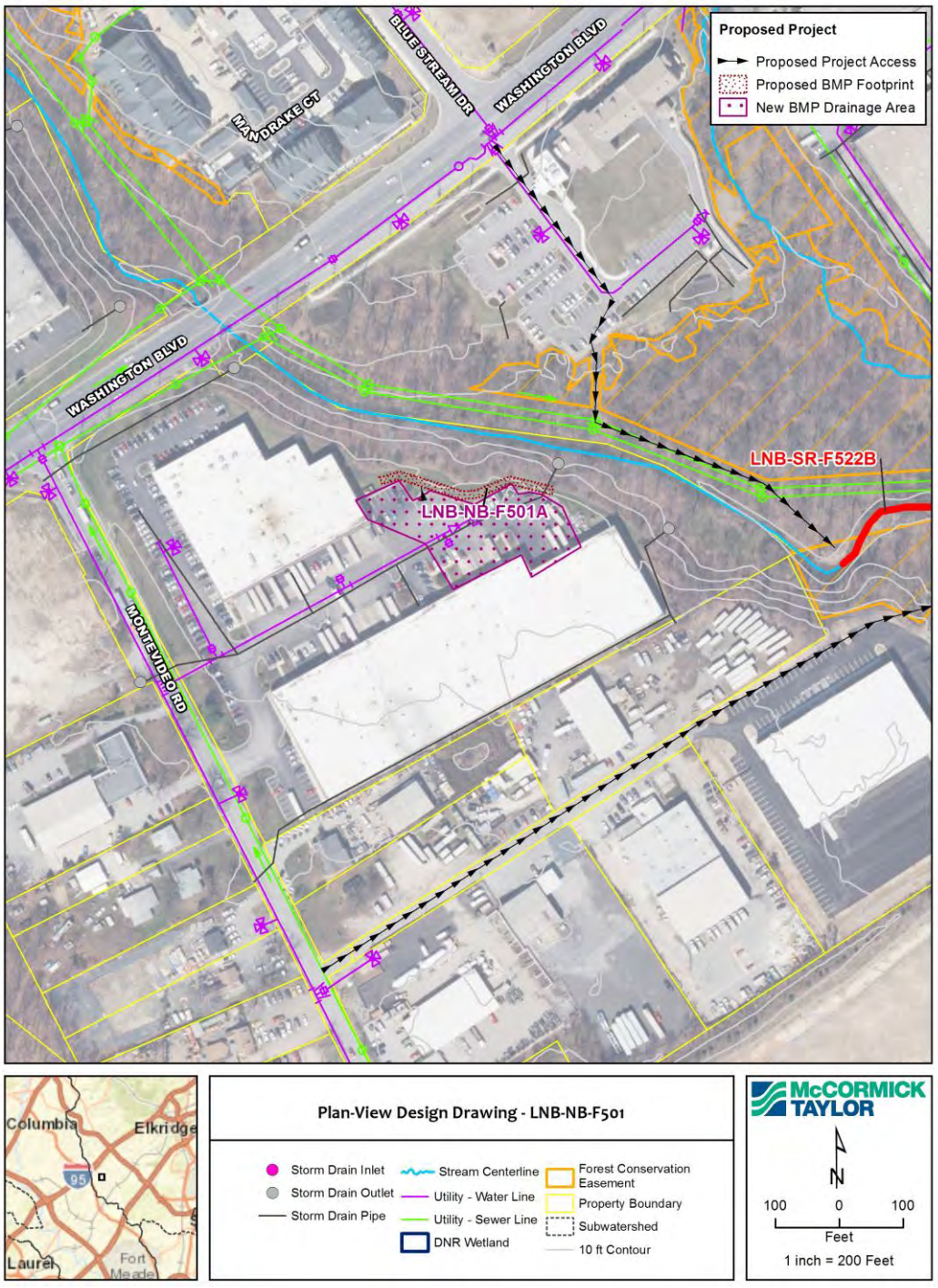
Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-F501

Site Name: Elite Spice

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: New BMP

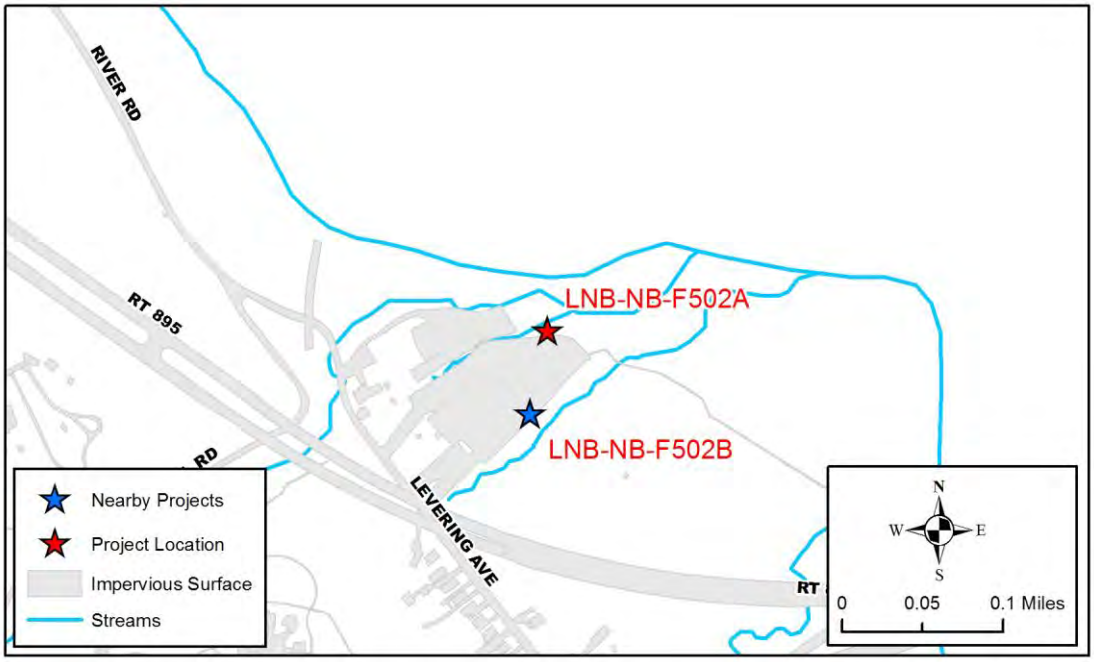
Site ID: LNB-NB-F502
Site Name: Levering Ave

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Infiltration Trench, Underground Filter
Ownership: Private- Commerical/Industrial
Single Owner

Existing Conditions:

The site is an office and warehouse building with a large parking lot. The property is currently occupied by Davis H. Elliot Company, Inc, which uses the office space and the warehouse space for vehicle and equipment storage. Electric trucks, trailers, and equipment are parked throughout the gated lot surrounding the building. No existing storm drain features were observed on site, and runoff sheet flows to the north and east into wetlands and the Patapsco River.



Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-F502
Site Name: Levering Ave

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking northeast toward the back of the property from the parking lot (LNB-NB-502A).

Looking northeast toward the area of the proposed facility (LNB-NB-502B).

Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-F502
Site Name: Levering Ave

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Site constraints include property ownership, utilities, sufficient space, and natural resources. The property is privately owned, equipment is frequently active around the property, there are overhead lines and lights, and there is a BGE easement which requires access from the back area of the parking lot. The property is also in close proximity to the Patapsco River and its floodplain along with several wetland features.

Concept Description:

LNB-NB-F502A - An infiltration trench is proposed along the northeastern edge of the property. An infiltration test should be completed to determine if the soil has sufficient drainage and the water table will need to be verified to ensure a 5ft vertical separation between the facility bottom and the water table. These parameters may result in this facility being unfeasible. For this concept, a 141 lf. level spreader is assumed for the pretreatment of 635 cf. at 3 ft. wide and 1.5 ft. deep. Following the level spreader, a 20 ft. grass buffer is proposed, and finally a 51 ft. wide by 42 ft. long infiltration trench area. The infiltration trench is assumed to be 8 ft. deep with 40% porosity, providing 6,854 cf. of treatment, 88% of the WQv for the drainage area.
LNB-NB-F502B - An underground sand filter (USF) is recommended along the eastern edge of the parking lot in an existing low area. Along with the proposed facility, the addition of curb and gutter is proposed along the perimeter of the parking lot with new storm drain inlets to divert runoff into the facility. The USF would provide 1,080 cf. of pretreatment in a sedimentation chamber with a surface area of approximately 216 sf.. The sand filter area would be 1,044 sf. With 2 ft. of media for treatment. An additional 3 ft. of temporary ponding over the facility area (1,044 sf.) is also considered to treat 100% of the WQv (3,967 cf.). The total size of the USF would be approximately 36 ft. wide and 40 ft. long (interior dimensions). This area includes the three chambers for sedimentation, treatment, and overflow as typical per the MDE stormwater design manual. A storm drain outfall would need to be added to provide an outfall for the facility near the wetland to the east of the parking lot.

Nearby Opportunities:

None recommended.

Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	3.89	WQVolume Target (cft.):	11,743
Impervious Area within Drainage (ac.):	3.37	Max Treated (cft.):	10,821
Impervious Area Treated (ac.):	3.11	Percent Treated:	92%
Impervious Area Treated Credit (ac.):	3.11	Rainfall Depth Treated (in.):	0.92

Costs

Estimated Design Cost:	$240,000
Estimated Construction Cost:	$211,490
30% Contingency:	$135,447
Estimated Total Cost	$586,937
Cost per Impervious Credit Acre:	$188,726

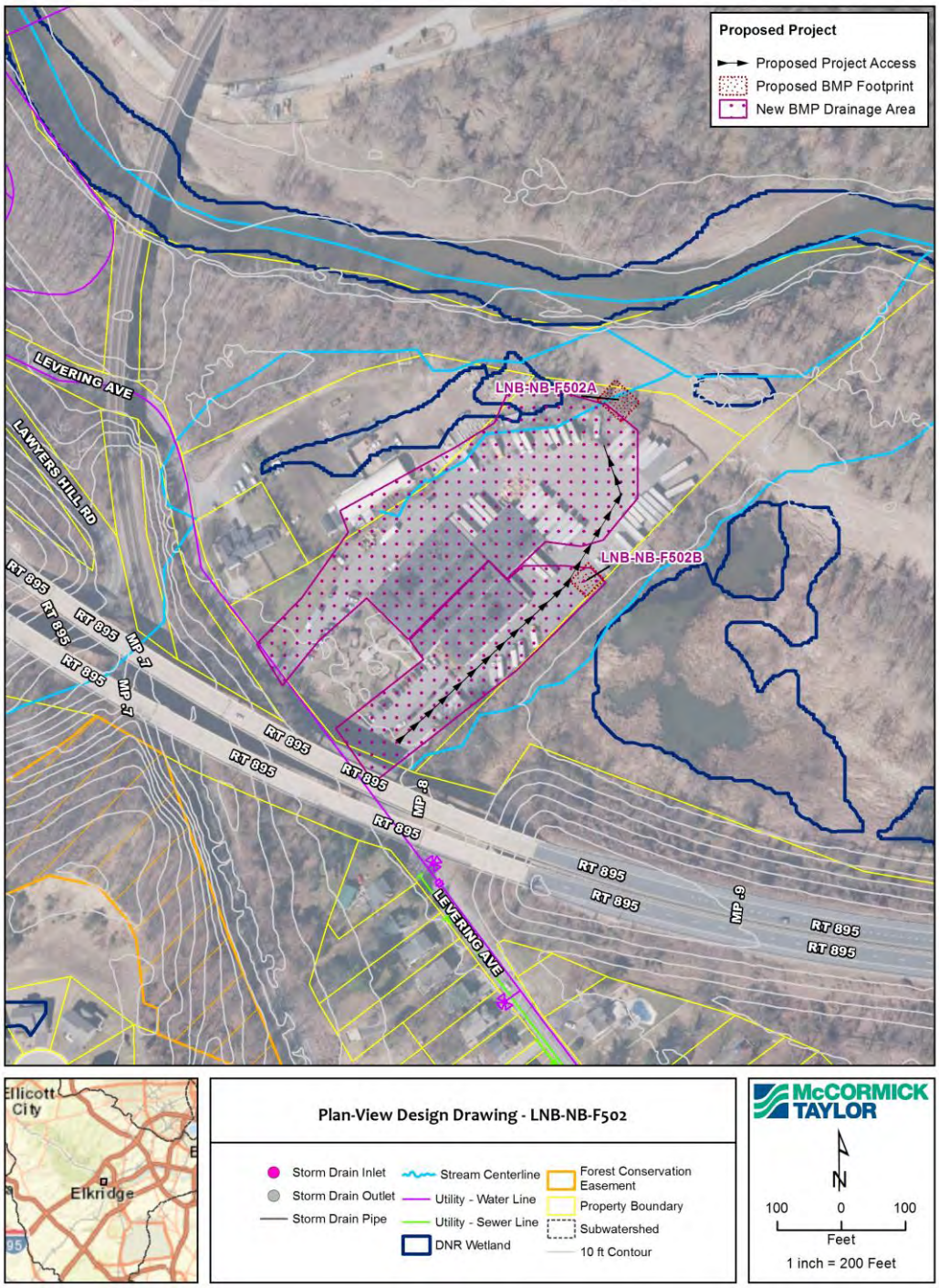
Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-F502

Site Name: Levering Ave

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: New BMP

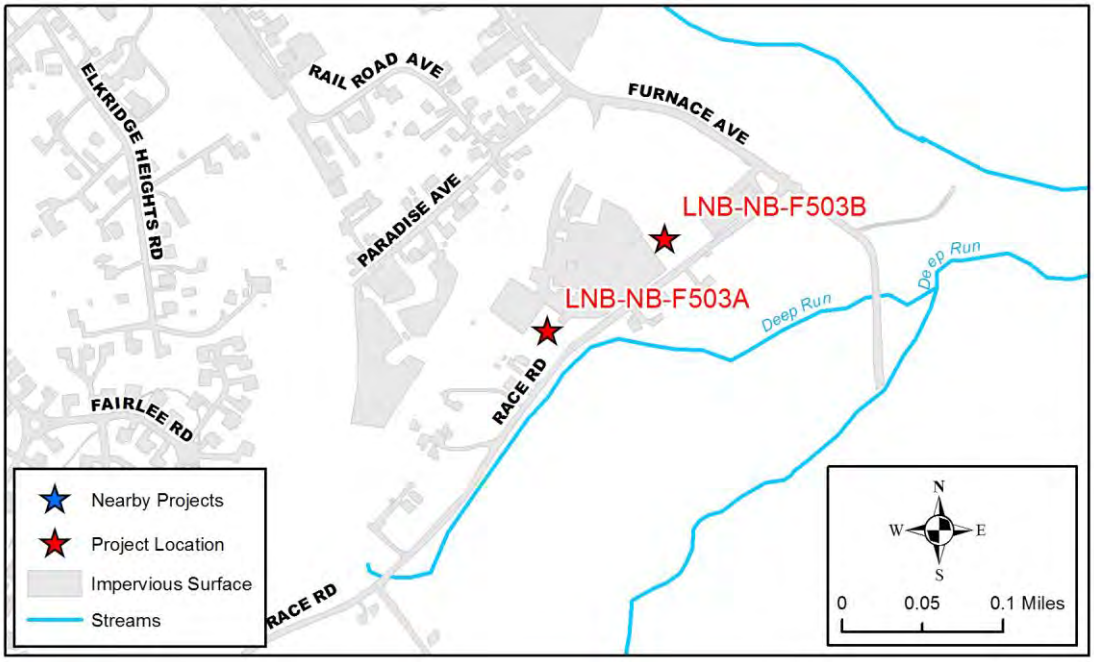
Site ID: **LNB-NB-F503**
Site Name: **Race Road**

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Infiltration Trench
Ownership: Private- Commerical/Industrial
Single Owner

Existing Conditions:

The site is a commercial property with several businesses in the building. No storm drain was observed on the property, but two infiltration BMPs were recorded that were not in the database. Both appear to be infiltration trenches with curb cuts and class I riprap at the surface along with PVC observation wells. Roof drains are disconnected and flow toward the grass open space areas or the infiltration facilities. Parking lot runoff in the southern portions of the property sheet flows toward the open space grass area bordering Race Road.



Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-F503
Site Name: Race Road

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking southeast toward the open space where the facility is proposed (LNB-NB-503A).

Looking southeast toward the building, roof drains, and grass open space for the proposed facility (LNB-NB-503B).

Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-F503
Site Name: Race Road

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include property ownership and utilities. Utilities including electric, overhead streetlights, and water were observed within proximity of the proposed facility sites.

Concept Description:

LNB-NB-F503A - An infiltration trench is proposed in the existing grass space in the southern area of the property. Due to the flat grade, there is no opportunity for an outfall, so an infiltration trench is proposed that would allow flow to enter the treatment area and overflow runoff to continue down gradient. An infiltration test should be completed to determine if the soil has sufficient drainage and the water table will need verified to ensure a 5 ft. vertical separation between the facility bottom and the water table. These parameters may result in this facility being unfeasible. For this concept, two inflows from two different locations in the parking lot along with new curb and gutter are assumed and a riprap swale is proposed from each to provide pretreatment. Together, the swales provide 770 cf. of storage in 1 ft. of depth. Beyond each riprap pretreatment swale, a small grass channel will be designed to ensure runoff reaches the infiltration trench area and provide a 20 ft. grass buffer. The infiltration trench is assumed to be 8 ft. deep with 40% porosity, providing 3,072 cf. of treatment (100%) of the WQv for the drainage area in a 32 ft. by 30 ft. footprint.
LNB-NB-F503B - An infiltration trench is proposed in the existing grass space in the eastern area of the property. An infiltration test should be completed to determine if the soil has sufficient drainage due to the type 'D' soils at this location and the water table will need verified to ensure a 5 ft. vertical separation between the facility bottom and the water table. These parameters may result in this facility being unfeasible. For this concept, a riprap level spreader is proposed along the building sidewalk to provide pretreatment from the roof drains. The riprap provides 230 cf. of storage in 1 ft. of depth. A grass buffer of 20 ft. is provided beyond the level spreader. The infiltration trench is assumed to be 4 ft. deep with 40% porosity, providing 960 cf. of treatment (100%) of the WQv for the drainage area in a 6 ft. by 100 ft. footprint.

Nearby Opportunities:

None recommended.

Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	2.41	WQVolume Target (cft.):	3,999
Impervious Area within Drainage (ac.):	1.09	Max Treated (cft.):	4,032
Impervious Area Treated (ac.):	1.1	Percent Treated:	101%
Impervious Area Treated Credit (ac.):	1.09	Rainfall Depth Treated (in.):	1.01

Costs

Estimated Design Cost:	$240,000
Estimated Construction Cost:	$118,335
30% Contingency:	$107,501
Estimated Total Cost	$465,836
Cost per Impervious Credit Acre:	$427,372

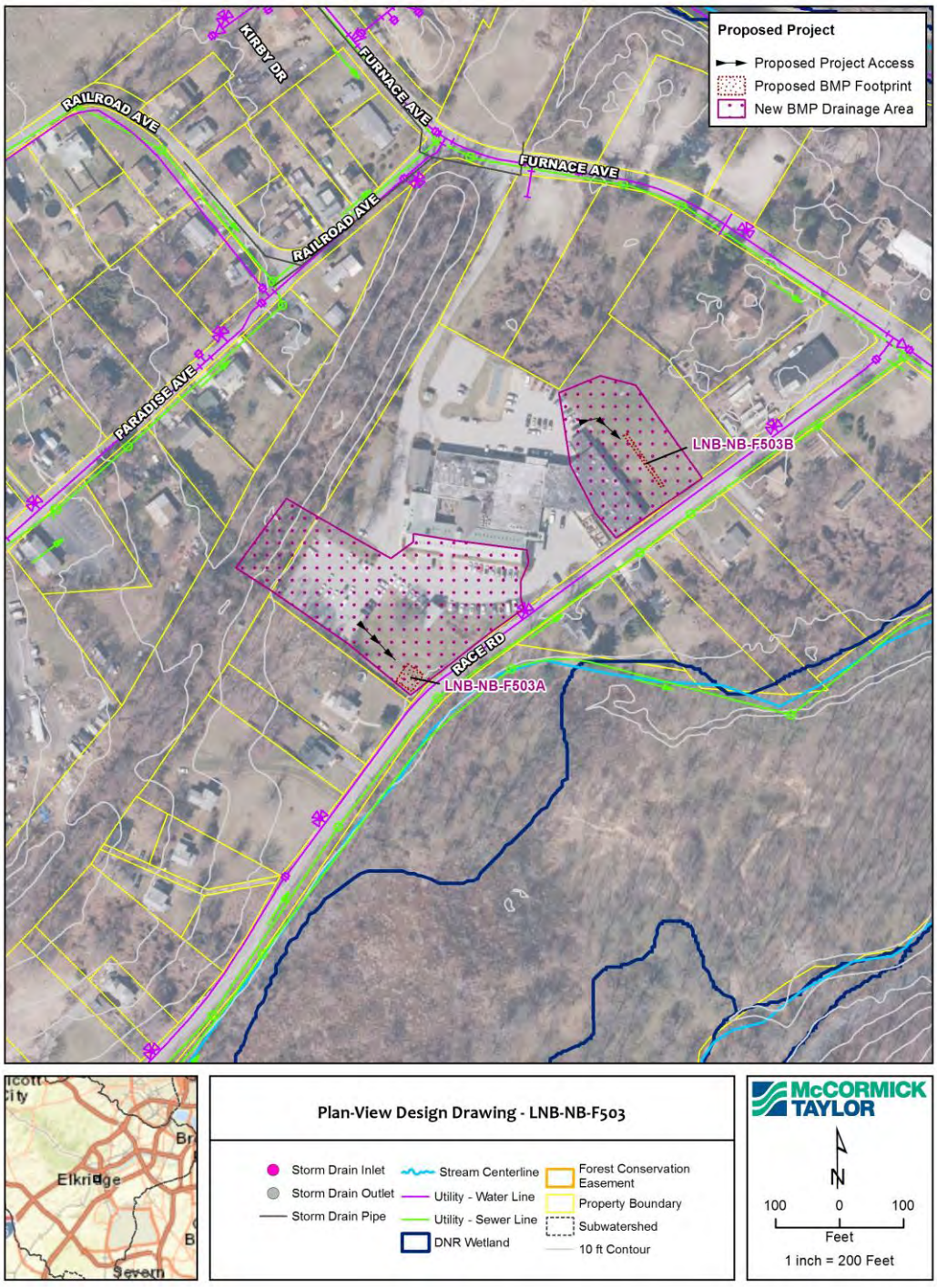
Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-F503

Site Name: Race Road

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: New BMP

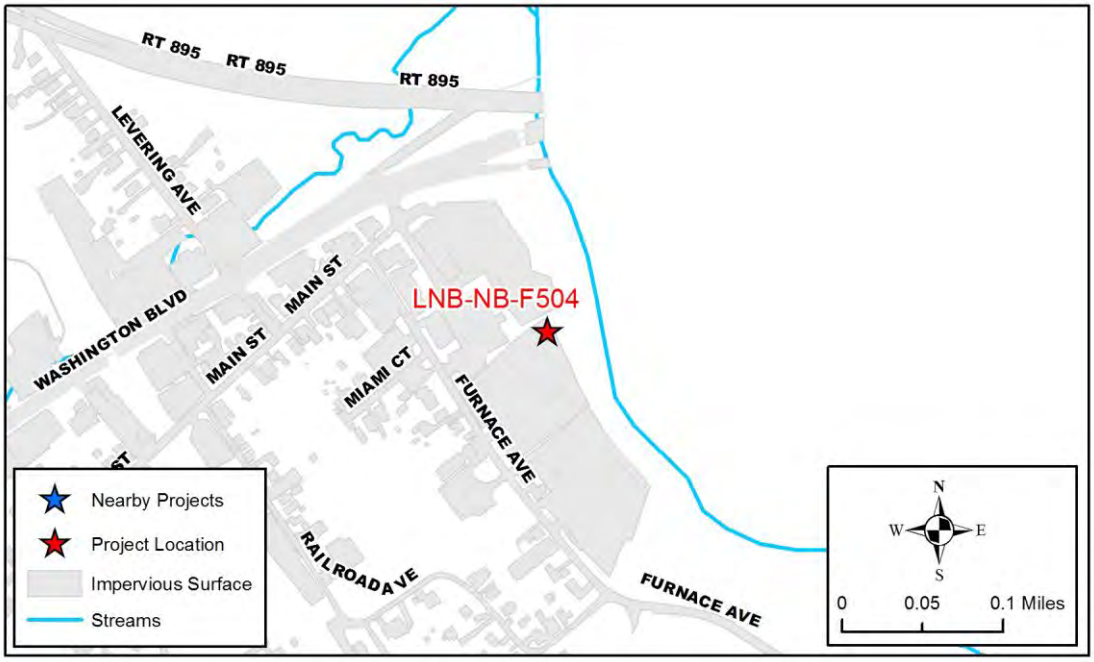
Site ID: LNB-NB-F504
Site Name: Furnace Ave

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Underground Filter
Ownership: Private- Commerical/Industrial
Single Owner

Existing Conditions:

The site is a commercial property that is occupied by Volleyball House LLC and is used for recreational purposes. The front portion of the building where the indoor sports arena is located has a green roof system, but the remaining runoff flows toward the back of the property and sheet flows directly into the banks of the Patapsco River or into the failing concrete swale and outfall in the southeastern corner of the property. The roof drains of the rear building are disconnected and outfall into the parking lot driveway along the eastern side of the structure.



Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-F504
Site Name: Furnace Ave

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking east toward the northern corner of the property at the proposed facility location.

Looking south along the back of the building at the roof drains that will be connected and directed into the proposed facility.

Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-F504
Site Name: Furnace Ave

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this property include property ownership, sufficient space, and the proximity to the river and structure. The property is privately owned and the parking lot is likely to be frequently busy year round. The available space to install a new underground facility is limited by the location of the Patapsco River, building, and parking lot.

Concept Description:

An underground sand filter (USF) is recommended in the northern corner of the parking lot. The roof drains are proposed to be connected using PVC pipe and routed to a flow splitter along with a proposed trench drain along the driveway on the northwestern side of the building. The flow splitter will divert the WQv storm to the USF and the remaining runoff will bypass the facility and outfall into the wooded area to the east. This new outfall will reduce the erosive flows at the existing outfall structure in the eastern corner of the property. The USF would provide 945 cf. of pretreatment in a sedimentation chamber with a surface area of approximately 158 sf. The sand filter area would be 788 sf. with 2 ft. of media for treatment. An additional 4 ft. of temporary ponding over the facility area (788 sf.) is also considered to treat 100% of the WQv (3,780 cf.). The total size of the USF would be approximately 15 ft. wide and 68 ft. long (interior dimensions). This area includes the three chambers for sedimentation, treatment, and overflow as typical per the MDE stormwater design manual. If impacts are too significant with the close proximity to the building, the drainage area could be reduced by diverting a portion of the roof drains and/or eliminating the trench drain and a smaller facility could be proposed. A storm drain outfall would need to be added to provide an outfall for the facility near the wetland to the east of the parking lot. Access to the site is from the property parking lot.

Nearby Opportunities:

None recommended.

Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	1.12	WQVolume Target (cft.):	3,764
Impervious Area within Drainage (ac.):	1.09	Max Treated (cft.):	3,780
Impervious Area Treated (ac.):	1.09	Percent Treated:	100%
Impervious Area Treated Credit (ac.):	1.09	Rainfall Depth Treated (in.):	1

Costs	
Estimated Design Cost:	$220,000
Estimated Construction Cost:	$123,295
30% Contingency:	$102,989
Estimated Total Cost	$446,284
Cost per Impervious Credit Acre:	$409,434

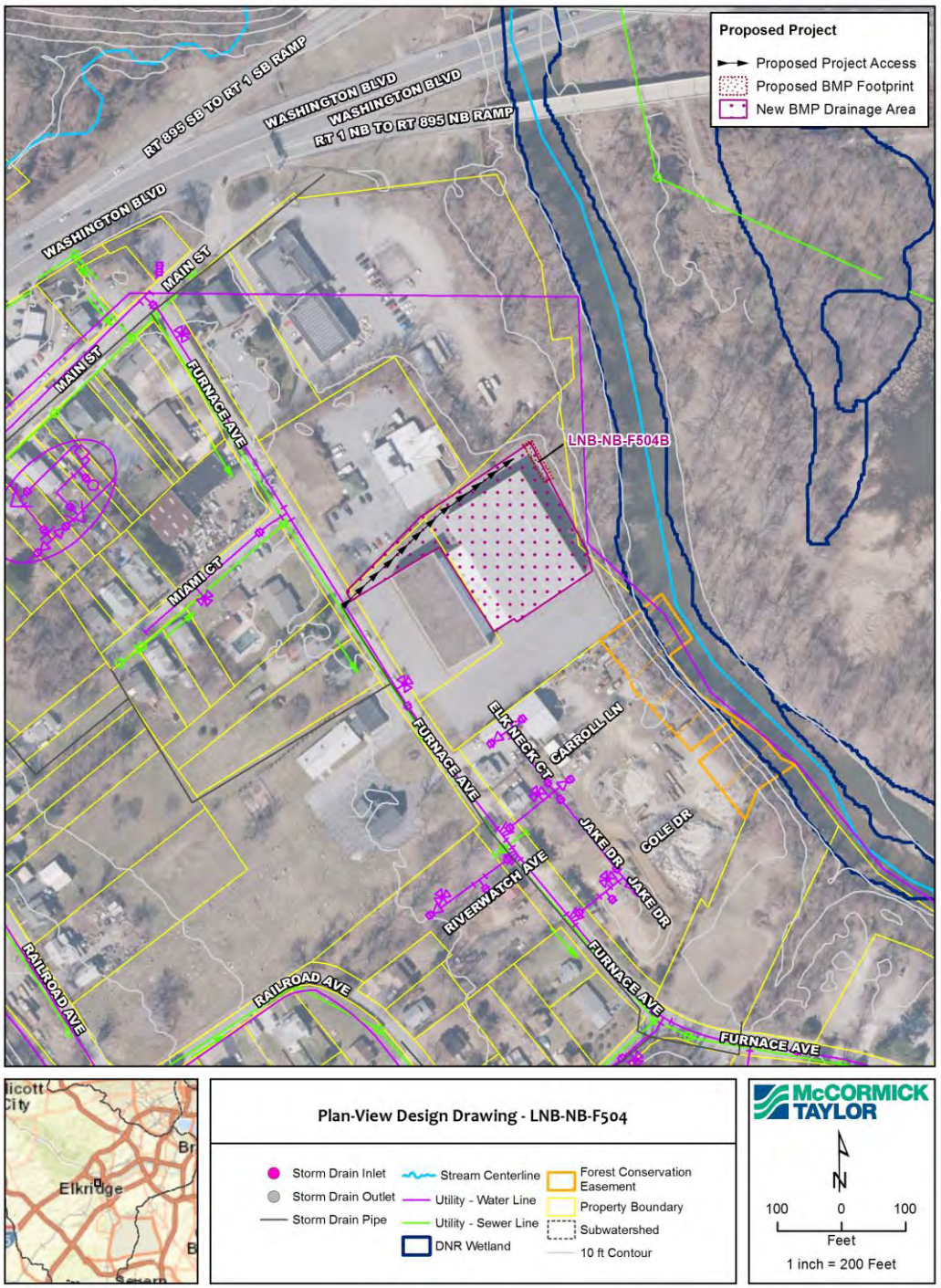
Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-F504

Site Name: Furnace Ave

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-F505

Site Name: The Woodlands

Contractor: McCormick Taylor

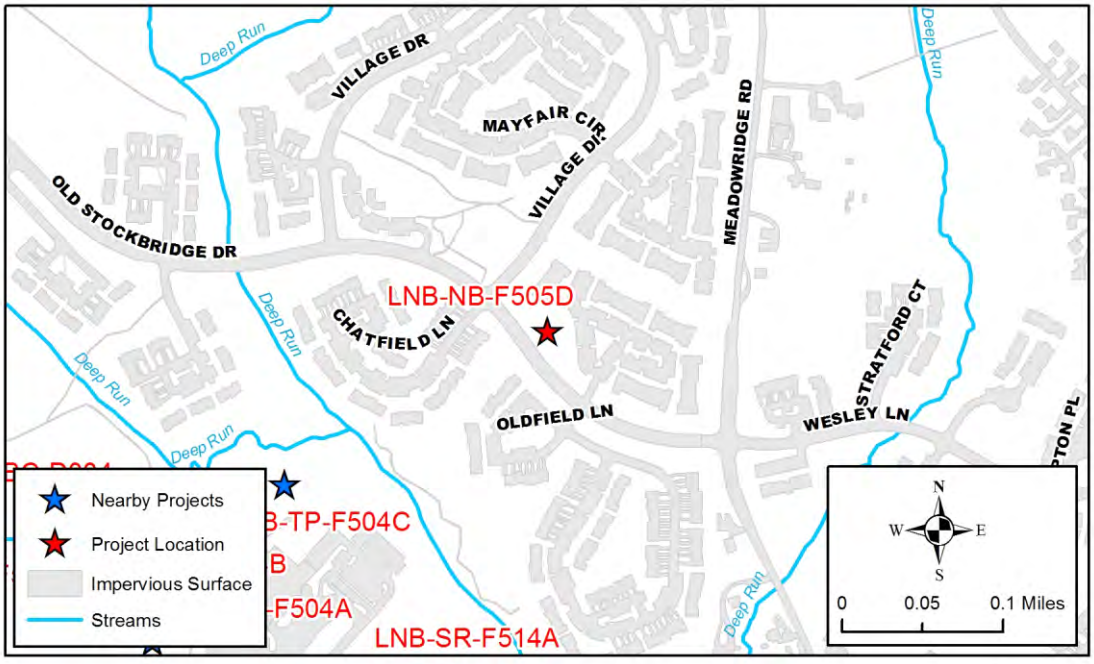
Watershed: Patapsco Lower North

Proposed BMP Type: Wet Pond - Wetland

Ownership: Private- HOA
Single Owner

Existing Conditions:

The site is in the residential townhome and condominium community of The Woodlands. An existing forested wetland is located between Old Stockbridge Drive and Coachlight Lane. Currently, the wetland receives surface runoff from the nearby townhomes and grass open space areas. There are no storm drain inflows. Approximately 24,000 cf. of storage is currently provided in 4 ft. of depth within this vegetated depressed area. A modified k-inlet collects ponded water and the downstream storm drain network ultimately outfalls into a water quality facility located between Oldfield Lane and Blueberry Hill Lane. The existing conditions of this forested wetland may prevent permitting of a stormwater facility at this location.



Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-F505
Site Name: The Woodlands

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking northwest along Old Stockbridge Drive toward the area of the existing wetland.

Looking north at the existing k-inlet within the wetland.

Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-F505
Site Name: The Woodlands
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

The major constraint at this site is the presence of an existing forested wetland which will impact the permit approvals required for this facility. No utilities are located within the footprint and access is easy from the parking lot.

Concept Description:

The existing forested wetland sump is proposed to be used for water quality treatment and quantity storage. Re-directing storm drain from the adjacent parking lot to outfall into this area will increase the drainage area to 3.11 ac. with 1.08 ac. impervious area, resulting in a required WQv of 4,094 cf. If the forested wetland is not graded and only the outlet control structure is replaced, the total WQv is provided in the bottom 2 ft. of the existing sump (elev 304.00 ft. to 306.00 ft.). If instead the area is graded to the maximum extent possible from elevation 308.00 ft. to a facility bottom of 303.00 ft. with 3:1 side slopes, approximately 6,281 cf. of storage is provided in a 1 ft. permanent pool between elevation 303.00 ft. and 304.00 ft. Two forebays, each 1 ft. deep, provide a total of 651 cf. of pretreatment. Above the graded permanent pool, an additional 43,000 cf. is provided in 4 ft. of storage for extended detention. The existing k-inlet would be replaced for a new concrete outlet structure to provide sufficient storage and freeboard without increasing the discharges downstream.

Nearby Opportunities:

None recommended.

Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	3.11	WQVolume Target (cft.):	4,094
Impervious Area within Drainage (ac.):	1.08	Max Treated (cft.):	6,281
Impervious Area Treated (ac.):	1.08	Percent Treated:	153%
Impervious Area Treated Credit (ac.):	1.22	Rainfall Depth Treated (in.):	1.53

Costs

Estimated Design Cost:	$220,000
Estimated Construction Cost:	$126,925
30% Contingency:	$104,078
Estimated Total Cost	$451,003
Cost per Impervious Credit Acre:	$369,674

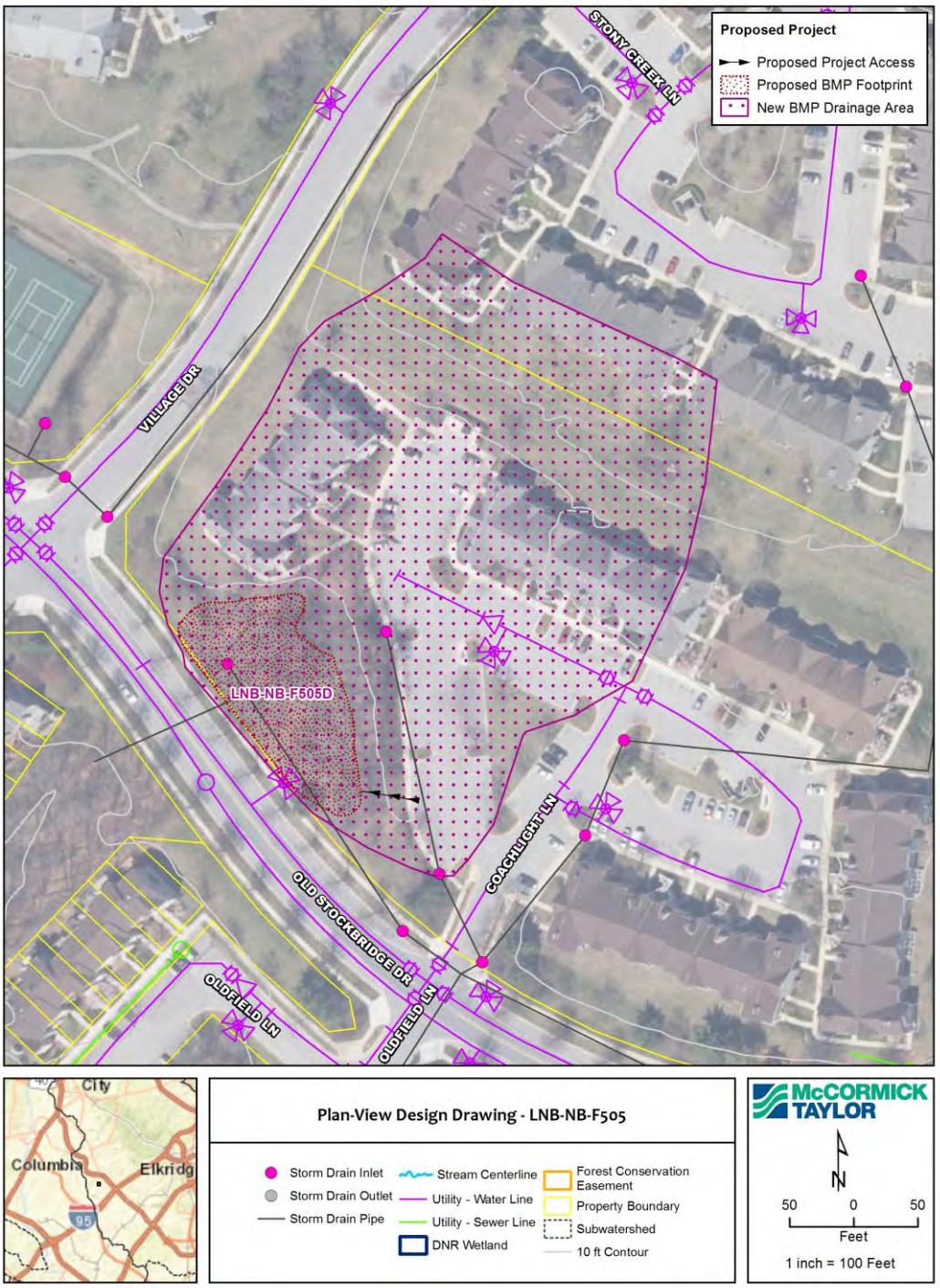
Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-F505

Site Name: The Woodlands

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



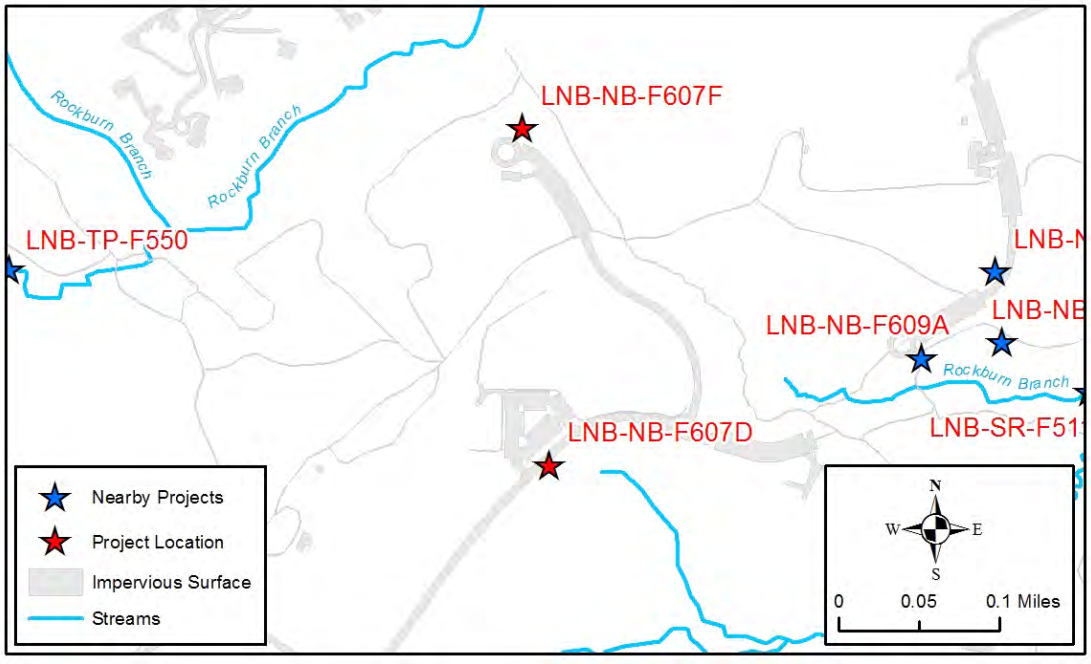
Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-F607
Site Name: Rockburn Park 1
Contractor: KCI
Watershed: Patapsco Lower North

Proposed BMP Type: Bioswale and Bioretention
Ownership: County Park
Single Owner

Existing Conditions:

LNB-NB-F607d: This site is located in the grass area on the south side of the park driveway. The driveway is crowned in the center, and water drains towards the road curb and gutter and is collected by an existing inlet downstream of this site. The grass area is approximately 15 ft. wide and consists of well maintained grass. LNB-NB-F607f: This site is located at the grass area north of the circle driveway at the end of the park. There are two existing curb cuts directing flow into the grass area. Water is draining back towards the forested area north of the site. The grass area downstream of two existing curb cuts will be used to create riprap outfalls. The area has sediment in the grass and the ground was wet during the field visit.



Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-F607
Site Name: Rockburn Park 1

Contractor: KCI
Watershed: Patapsco Lower North

Existing grass area for proposed swale, LNB-NB-F607d

Existing grass area for proposed bioretention, LNB-NB-F607f

Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-F607
Site Name: Rockburn Park 1
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

LNB-NB-F607d: The dimensions of existing inlet are unknown and may affect the connection to the proposed bioswale underdrain. There is a utility box close to the inlet and it should not be impacted during construction. LNB-NB-F607f: The soil needs to be investigated to see if it is feasible for bioretention. Due to the heavy sediment observed during the site visit, the bioretention will be proposed with pretreatment to avoid clogging at the main bioretention basin. No utilities are anticipated to impact at this site.

Concept Description:

LNB-NB-F607d: The proposed swale is 8 ft. wide and 190 ft. long within the existing 15 ft. wide grass area along Rockburn Branch Park Rd. The swale will have one check dam and the proposed underdrain will be connected to the existing storm drain adjacent to this site. Two curb cuts in the roadway will be added to direct flow into the facility. This site has enough space to meet the maximum water quality treatment (2.6 in. of rainfall).LNB-NB-F607f: A bioretention is proposed in the grass area downstream of the two existing curb cuts. The underdrain of the proposed bioretention will be directed toward the existing riprap channel and CMP culvert downstream of the site in the adjacent forested area. This site has enough space to meet the maximum water quality treatment (2.6 in. of rainfall).

Nearby Opportunities:

None recommended.

Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	3.5	WQVolume Target (cft.):	3,699
Impervious Area within Drainage (ac.):	0.95	Max Treated (cft.):	9,617
Impervious Area Treated (ac.):	0.95	Percent Treated:	260%
Impervious Area Treated Credit (ac.):	1.33	Rainfall Depth Treated (in.):	2.6

Costs	
Estimated Design Cost:	$220,000
Estimated Construction Cost:	$151,420
30% Contingency:	$111,426
Estimated Total Cost	$482,846
Cost per Impervious Credit Acre:	$363,042

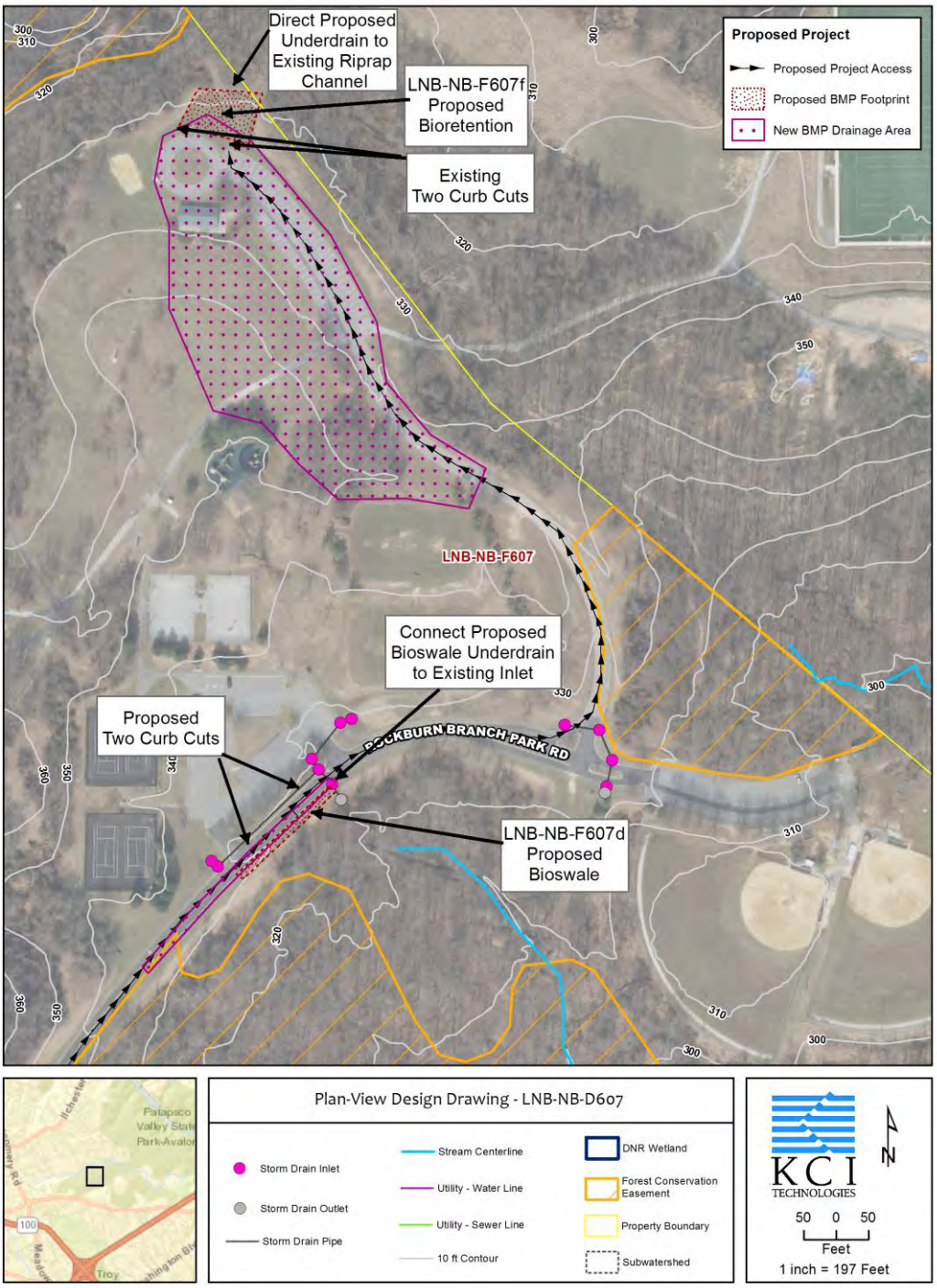
Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-F607

Site Name: Rockburn Park 1

Contractor: KCI

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: New BMP

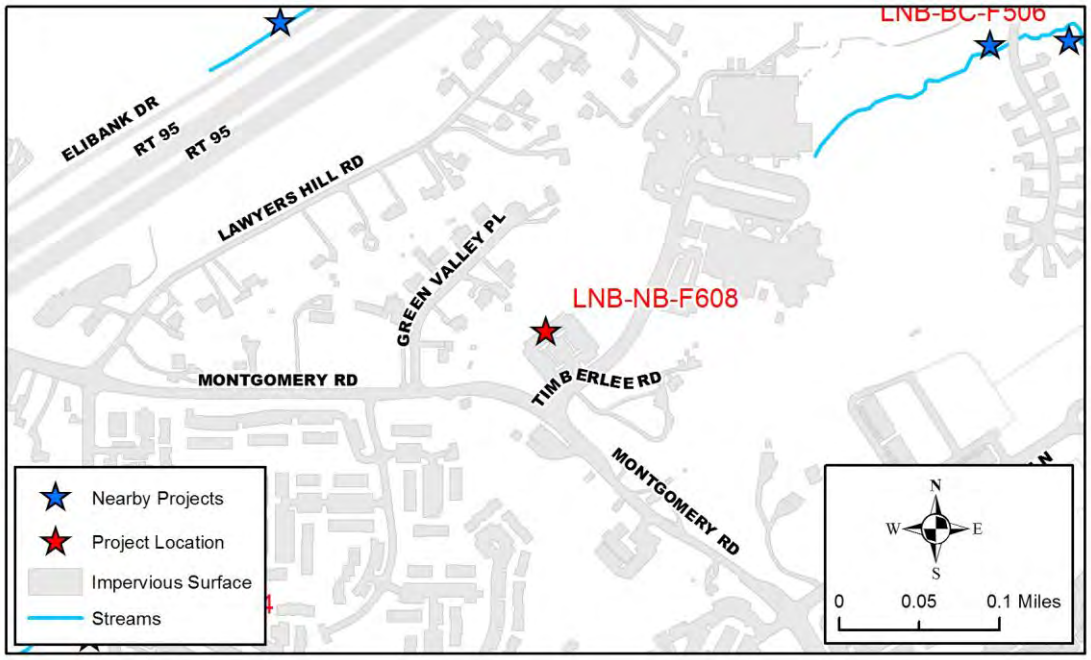
Site ID: LNB-NB-F608
Site Name: Elkridge Elementary

Contractor: KCI
Watershed: Patapsco Lower North

Proposed BMP Type: Bioretention and Impervious Surface Removal
Ownership: County School
Single Owner

Existing Conditions:

This site is located at the Elkridge Elementary School parking lot near the school entrance. The parking lot appears to be rarely used and is in fair condition. Runoff flows toward the north/back end of the parking lot and outfalls through two existing curb cuts in the corners of the parking lot. The outfall behind the parking lot is an eroded channel. There is dense vegetation, steep slopes, and eroded channels which should be investigated further.



Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-F608
Site Name: Elkridge Elementary
Contractor: KCI
Watershed: Patapsco Lower North

Parking space along the back of the parking lot that can be removed for bioretention

Dense vegetation behind the parking lot

Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-F608
Site Name: Elkridge Elementary
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

The existing parking lot use needs to be discussed with school. The space is limited for the proposed bioretention facility. Trees behind the parking lot will be impacted and the streetlights will be relocated if needed.

Concept Description:

Parking spaces along the back of the lot appear unused and can be removed to make space for the proposed bioretention facility. There is an approximately 1,600 sf. space in the parking lot that could be used for bioretention. This space is not large enough to temporarily hold 75% of the water quality volume. Further investigation of the grass area behind the parking lot will be needed for bioretention use. The footprint of the current proposed bioretention will be extended to the grass area if feasible. The facility outfall would be in the existing channel with riprap stabilization.

Nearby Opportunities:

None recommended.

Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	0.87	WQVolume Target (cft.):	2,564
Impervious Area within Drainage (ac.):	0.74	Max Treated (cft.):	6,666
Impervious Area Treated (ac.):	0.74	Percent Treated:	163%
Impervious Area Treated Credit (ac.):	0.86	Rainfall Depth Treated (in.):	1.63

Costs

Estimated Design Cost:	$120,000
Estimated Construction Cost:	$65,020
30% Contingency:	$55,506
Estimated Total Cost	$240,526
Cost per Impervious Credit Acre:	$279,681

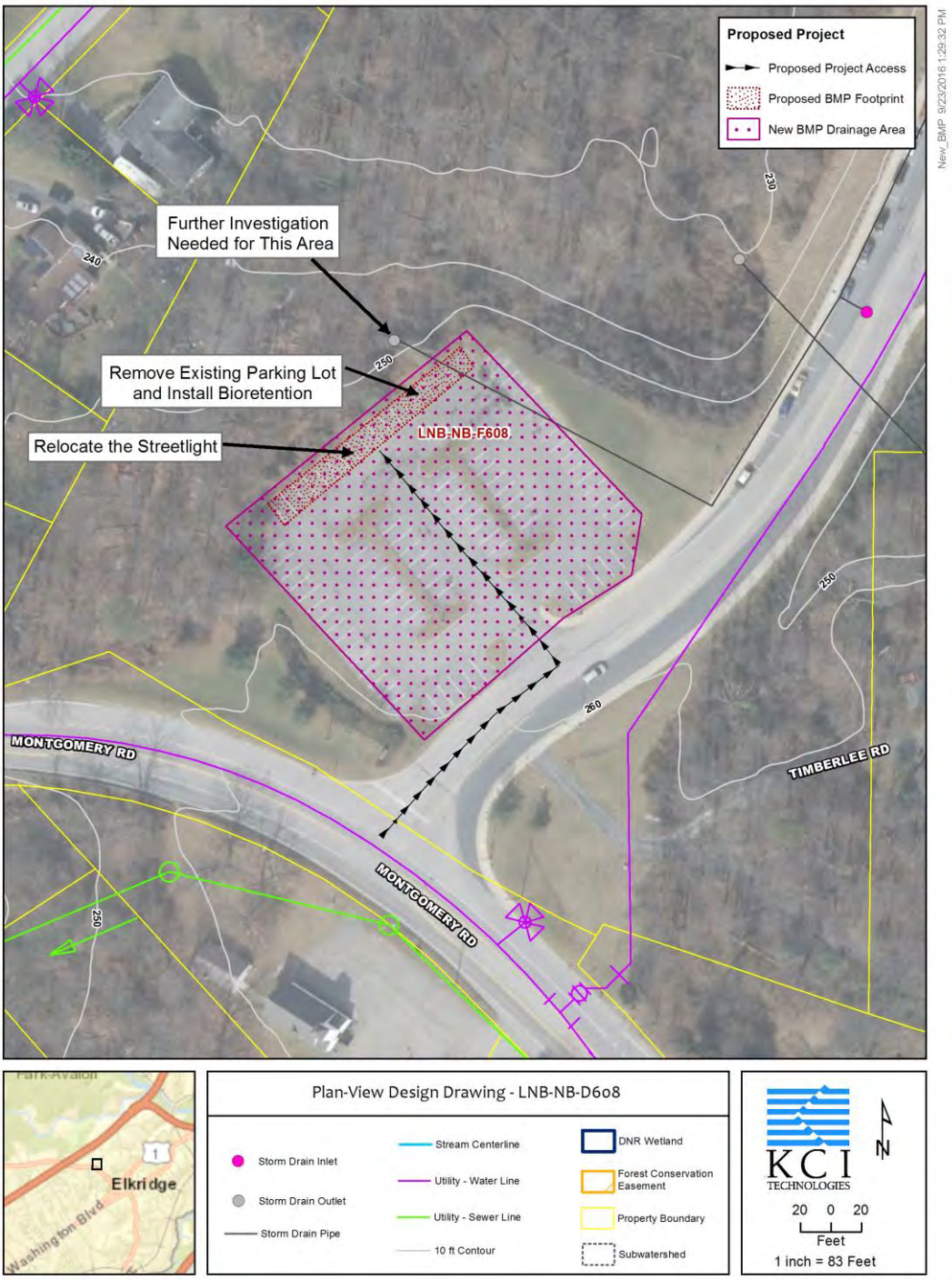
Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-F608

Site Name: Elkridge Elementary

Contractor: KCI

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: New BMP

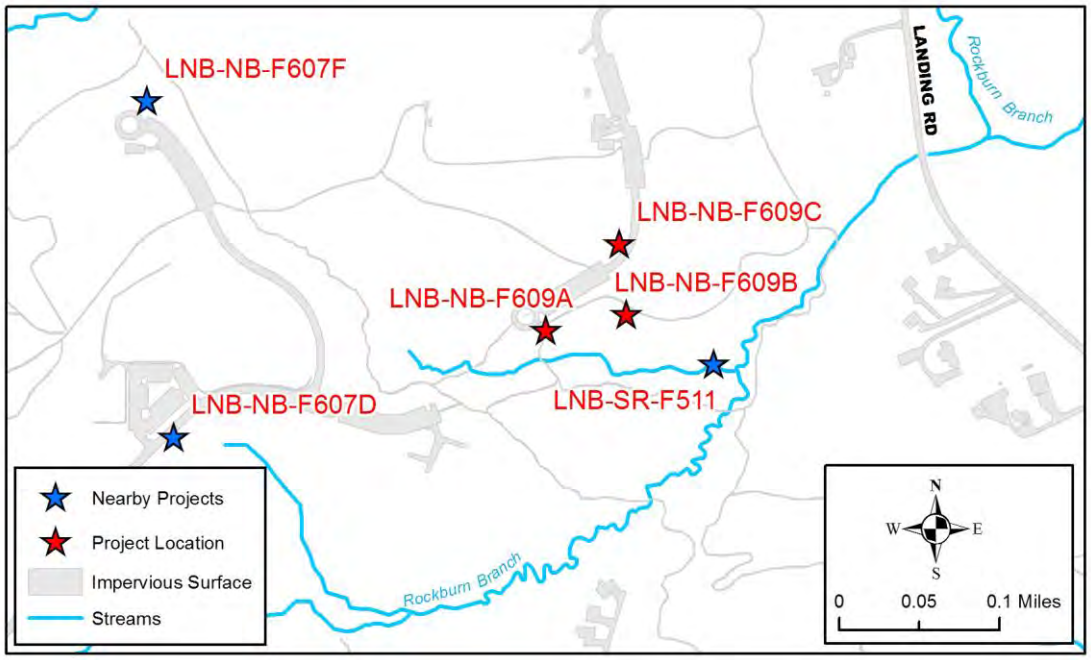
Site ID: LNB-NB-F609
Site Name: Rockburn Park 2

Contractor: KCI
Watershed: Patapsco Lower North

Proposed BMP Type: SPSC, Bioretention, and Bioswale
Ownership: County Park
Single Owner

Existing Conditions:

Overall drainage structures are in good condition. Significant sand/gravel from the baseball fields travels through the storm drain and is present at the outfalls.LNB-NB-F609a: The existing outfall channel is receiving water from upstream driveway and open space. It has erosion and headcuts issues.LNB-NB-F609b: This site is a large open space by the side of the park driveway.LNB-NB-F609c: This site is a riprap channel receiving water from the baseball field by the side of the driveway. An existing inlet and culvert is on the downstream end of this site.



Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-F609
Site Name: Rockburn Park 2

Contractor: KCI
Watershed: Patapsco Lower North

Eroded channel at site LNB-NB-F609a

Open area for proposed bioretention, LNB-NB-F609b

Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-F609
Site Name: Rockburn Park 2
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

LNB-NB-F609a: The depth difference of the proposed SPSC system needs to be verified. The slope of the system should not be steeper than 5% in order to claim water quality credit. The trees around this site will be significantly impacted. LNB-NB-F609b: This site needs to be verified if it is a wetland. The trees around this site might be impacted. No utility impacts are anticipated.
LNB-NB-F609c: Large trees adjacent to this site should not be impacted during construction. No utility impacts are anticipated.

Concept Description:

LNB-NB-F609a: SPSC is proposed at this site downstream of the driveway. The channel is approximately 100 ft. long and 20 ft. wide with five riffle weir structures and five step pools. The pools will be 3 ft. deep and graded with volume to hold at least 75% of the required water quality volume.LNB-NB-F609b: A bioretention is proposed in the open space southwest of the baseball field access path. The existing storm drain will be extended and the outfall relocated to the other side of the access road. The relocation of the outfall should help with apparent erosion behind the baseball field and will allow for a larger outfall area and space for the proposed facility. In addition, this facility will receive water from LNB-NB-F609c. This site has enough space for maximum treatment (2.6 in. of rainfall) for both LNB-NB-F609b and LNB-NB-F609c sites.LNB-NB-F609c: A bioswale with check dams is proposed to replace the existing riprap swale to slow runoff. The site area should be wide enough to avoid removing the adjacent large trees. In addition, a sediment catch trap should be added to the outfall to capture the sand/gravel in runoff from the baseball field upstream. The water will be directed to LNB-NB-F609b with the existing stormdrain modification.

Nearby Opportunities:

LNB-SR-F511J, LNB-SR-F511H

Proposed Project Credit		Water Quality Volume	
Drainage Area (ac.):	6.8	WQVolume Target (cft.):	4,723
Impervious Area within Drainage (ac.):	1.06	Max Treated (cft.):	12,280
Impervious Area Treated (ac.):	1.06	Percent Treated:	260%
Impervious Area Treated Credit (ac.):	1.48	Rainfall Depth Treated (in.):	2.6

Costs	
Estimated Design Cost:	$220,000
Estimated Construction Cost:	$162,875
30% Contingency:	$114,863
Estimated Total Cost	$497,738
Cost per Impervious Credit Acre:	$336,309

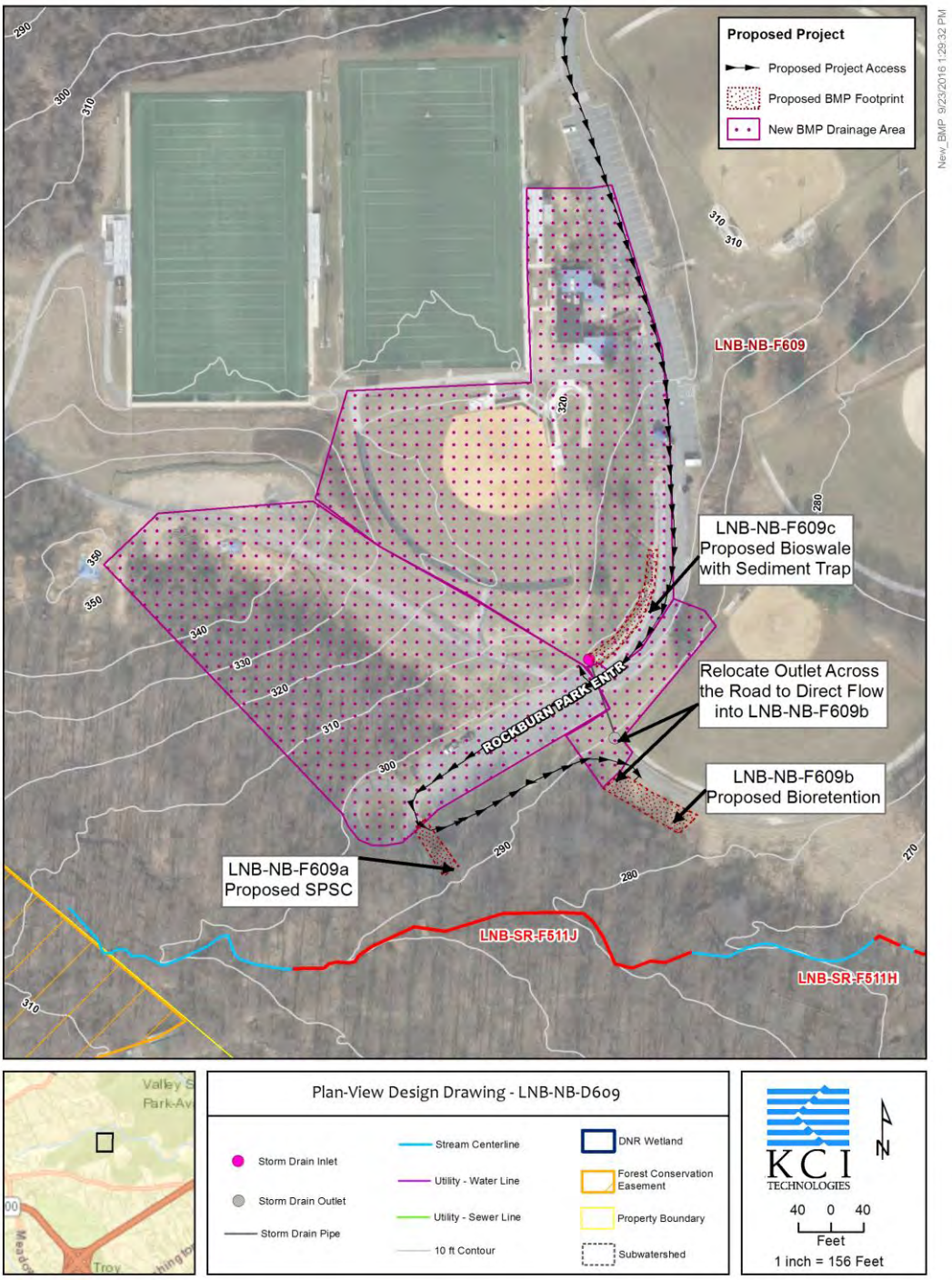
Howard County Watershed Assessment Concept Plan: New BMP

Site ID: LNB-NB-F609

Site Name: Rockburn Park 2

Contractor: KCI

Watershed: Patapsco Lower North



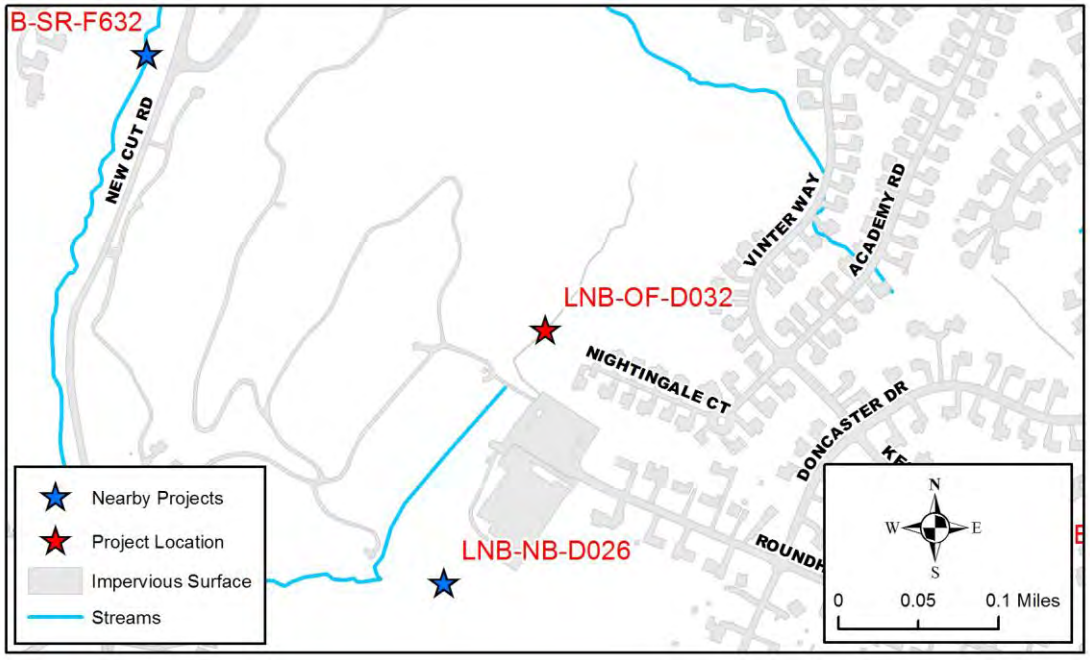
Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-D032
Site Name: Worthington Elementary
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Outfall Stablization
Stabilization Type: Step Pool Storm Converyance
Ownership: County School
Single Owner

Existing Conditions:

The stormwater outfall site is located adjacent to the Worthington Elementary School parking lot on the north side. The entire project site falls within Howard County Board of Education property. The site contains at least three drainage systems with three separate outfall pipes. Two of the drainage networks for the school outfall into a grouted riprap channel that extends approximately 500 ft. downstream (northwest) and has a significant grade change as it continues onto the New Cut Landfill. The 1.75 ac. drainage area is 94% impervious.



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-D032
Site Name: Worthington Elementary
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Facing upstream toward stormwater outfalls and headwalls.

Facing downstream toward grouted riprap outfall channel.

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-D032
Site Name: Worthington Elementary
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:
Constraints for this project include county school coordination, avoiding or minimizing disturbance to the landfill, and avoiding or minimizing construction when school is in session.

Concept Description:
A step pool storm conveyance structure (SPSC) is proposed to replace the 500 ft. of grouted riprap channel. The goal of this structure is to improve infiltration and reduce erosive velocities through modification of the channel profile and underlying filter material in constructed pools. For concept design purposes, a sequence of 27 boulder step-pools is proposed, with pool dimensions of 12.5 x 10 x 1.5 ft., riffle drops of 2.0 ft., and a filter depth of 2 ft. With these assumptions, 3,375 cf. of storage (59.1% WQv) is provided in the pools and 1,200 cf. (21% WQv) is provided in the void space sand filter. The site should be considered medium priority due to limited erosion offset by high impervious acres treated. Access is proposed from the school parking lot.

Nearby Opportunities:
LNB-NB-D026, LNB-NB-D027

Proposed Project Credit	
Drainage Area (ac.):	1.75
Impervious Area within Drainage (ac.):	1.65
Impervious Area Treated (ac.):	1.32
Impervious Area Treated Credit (ac.):	1.32

Water Quality Volume	
WQVolume Target (cf.):	5,708
Max Treated (cf.):	4,575
Percent Treated:	76%
Rainfall Depth Treated (in.):	0.76

Costs

Estimated Design Cost:	$200,000
Estimated Construction Cost:	$200,000
30 % Contingency:	$120,000
Estimated Total Cost:	$520,000
Cost per Impervious Credit Acre:	$393,939

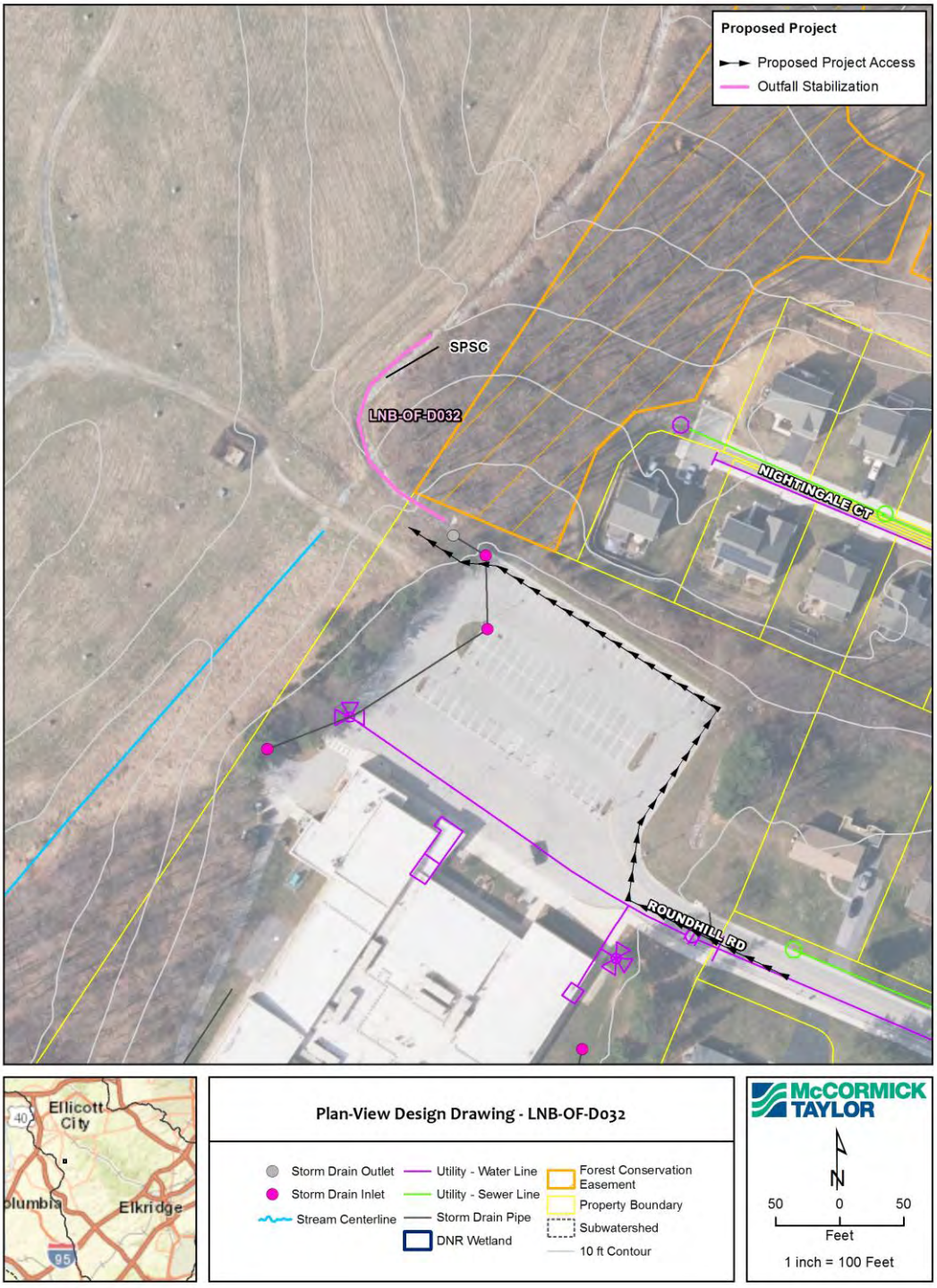
Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-D032

Site Name: Worthington Elementary

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F509

Site Name: Coca Cola Drive Pond

Contractor: McCormick Taylor

Watershed: Patapsco Lower North

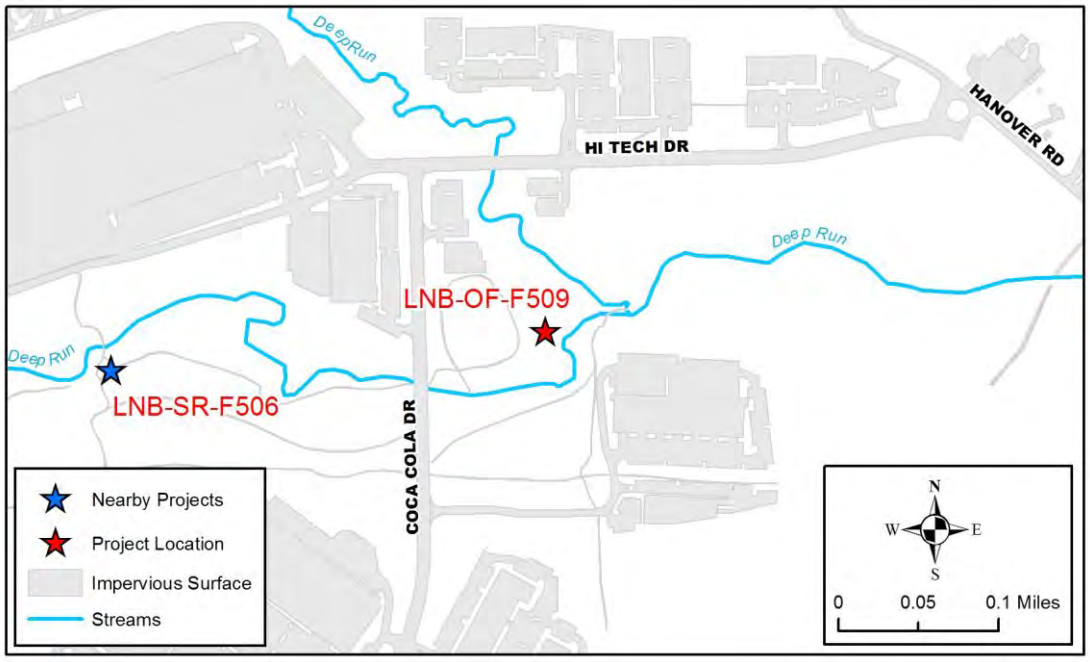
Proposed BMP Type: Outfall Stablization

Stabilization Type: Step Pool Storm Converyance

Ownership: Private- Commerical/Industrial
Single Owner

Existing Conditions:

The stormwater pond outfall site is located in a commercial development and provides drainage to Deep Run. Debris is blocking the outfall pipe, which is estimated to be a round 36 in. concrete pipe with no headwall or endsection. The stormwater pond data shows an 8.73 ac. drainage area with 51% impervious, including commercial drainage and the stormwater pond itself. The Deep Run confluence is 110 ft. downstream (east) from the outfall and includes some areas of severe erosion. Bank heights range from 4 to 10 ft. and the pipe is approximately 10 ft. above the stream bed.



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F509
Site Name: Coca Cola Drive Pond
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Facing upstream in outfall channel toward left bank erosion.

Facing upstream in outfall channel toward right bank erosion.

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F509
Site Name: Coca Cola Drive Pond
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:
Constraints for this project include private property ownership, avoiding or minimizing disturbance to the stormwater embankment, and minimizing impacts to tree and forest areas during access and construction.

Concept Description:
A step pool storm conveyance structure (SPSC) is proposed for 104 ft. of the outfall channel. The goal of this structure is to improve infiltration and reduce erosive velocities through modification of the channel profile and underlying of filter material in constructed pools. For concept design purposes, a sequence of 7 boulder step-pools is proposed, with pool dimensions of 10 x 12 x 1.5 ft., riffle drops of 1.7 ft., and a filter depth of 2 ft. With these assumptions, 840 cf. of storage (5.2% WQv) is provided in the pools and 374 cf. (2.3% WQv) is provided in the void space of the sand filter. If combined with the Deep Run stream restoration site (LNB-SR-F506), this project should be considered high priority due to outfall instability and erosion. Access is proposed from Coca Cola Drive east across the downstream edge of the pond embankment. It will likely require the closure of a lane.

Nearby Opportunities:
LNB-SR-F506

Proposed Project Credit	
Drainage Area (ac.):	8.73
Impervious Area within Drainage (ac.):	4.45
Impervious Area Treated (ac.):	0.34
Impervious Area Treated Credit (ac.):	0.34

Water Quality Volume	
WQVolume Target (cf.):	16,123
Max Treated (cf.):	1,214
Percent Treated:	8%
Rainfall Depth Treated (in.):	0.08

Costs

Estimated Design Cost:	$200,000
Estimated Construction Cost:	$104,000
30 % Contingency:	$91,200
Estimated Total Cost:	$395,200
Cost per Impervious Credit Acre:	$1,162,353

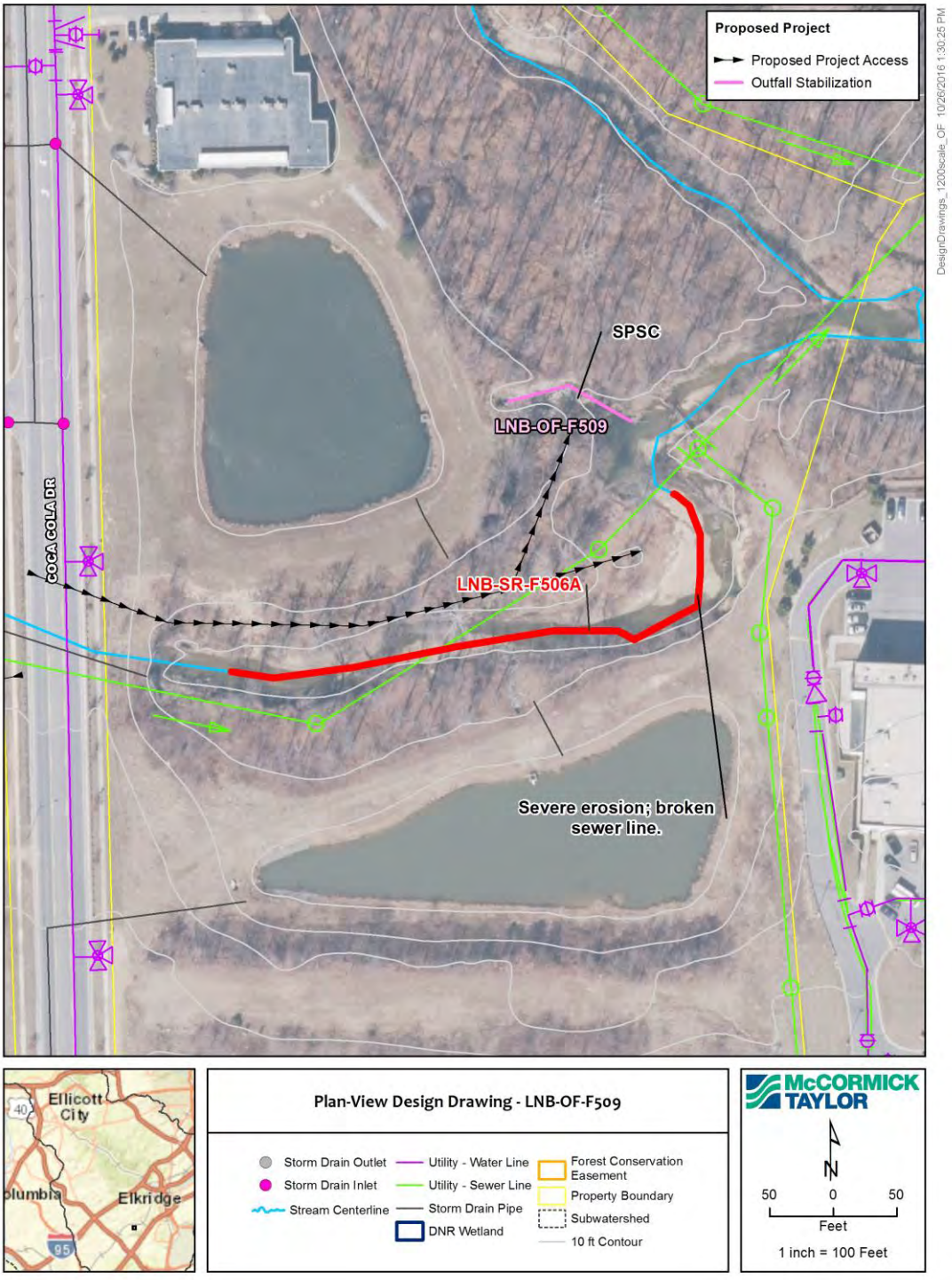
Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F509

Site Name: Coca Cola Drive Pond

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



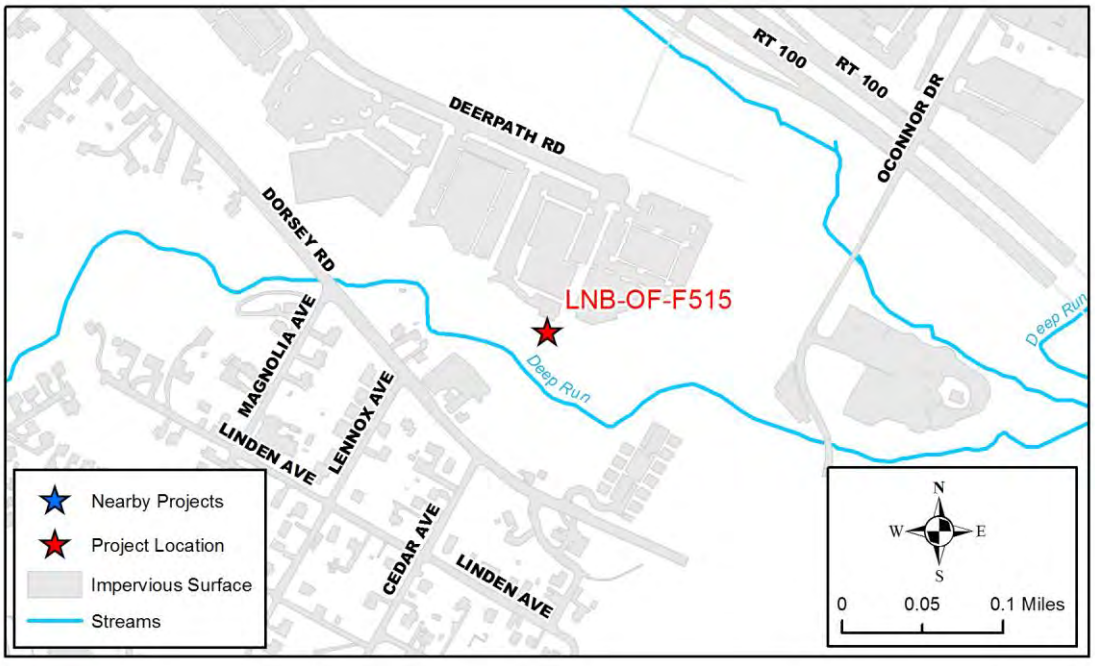
Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F515
Site Name: Deer Path Road
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Outfall Stablization
Stabilization Type: Rip Rap
Ownership: Private- Commerical/Industrial Single Owner

Existing Conditions:

The stormwater outfall site is located south of a commercial development in a forested plot and provides drainage to Deep Run. The outfall is a 24 in. round concrete pipe with endsection. The Deep Run confluence is approximately 130 ft. downstream (south) from the outfall and moderate erosion extends for 10 ft., with bank heights ranging from 1 to 2 ft. If the existing riprap further destabilizes, the channel degradation could migrate upstream toward the outfall. At the downstream extent of the outfall, the channel dissipates into the floodplain with no direct channel connection to Deep Run observed.



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F515
Site Name: Deer Path Road

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Facing upstream in outfall channel toward pipe.

Facing downstream in outfall channel toward right bank erosion.

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F515
Site Name: Deer Path Road
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:
Constraints within the project include private property ownership, impacts to existing trees or forest areas, and steep slopes with access.

Concept Description:
Riprap stabilization is proposed for approximately 11 ft. of the outfall channel. The goal of this project is to reduce erosive forces on channel bed and banks. This project should be considered low priority due to minimal length and limited erosion. Access is proposed from the commercial parking lot and special care should be taken as slopes are steep in this area.

Nearby Opportunities:
None recommended

Proposed Project Credit	
Length Restored (ft):	11
Impervious Area Treated Credit (ac.):	0.11
Cost Per Impervious Credit Acre:	$1,214,318

Costs	
Estimated Design Cost:	$100,000
Estimated Construction Cost:	$2,750
30% Contingency:	$30,825
Estimated Total Cost:	$133,575

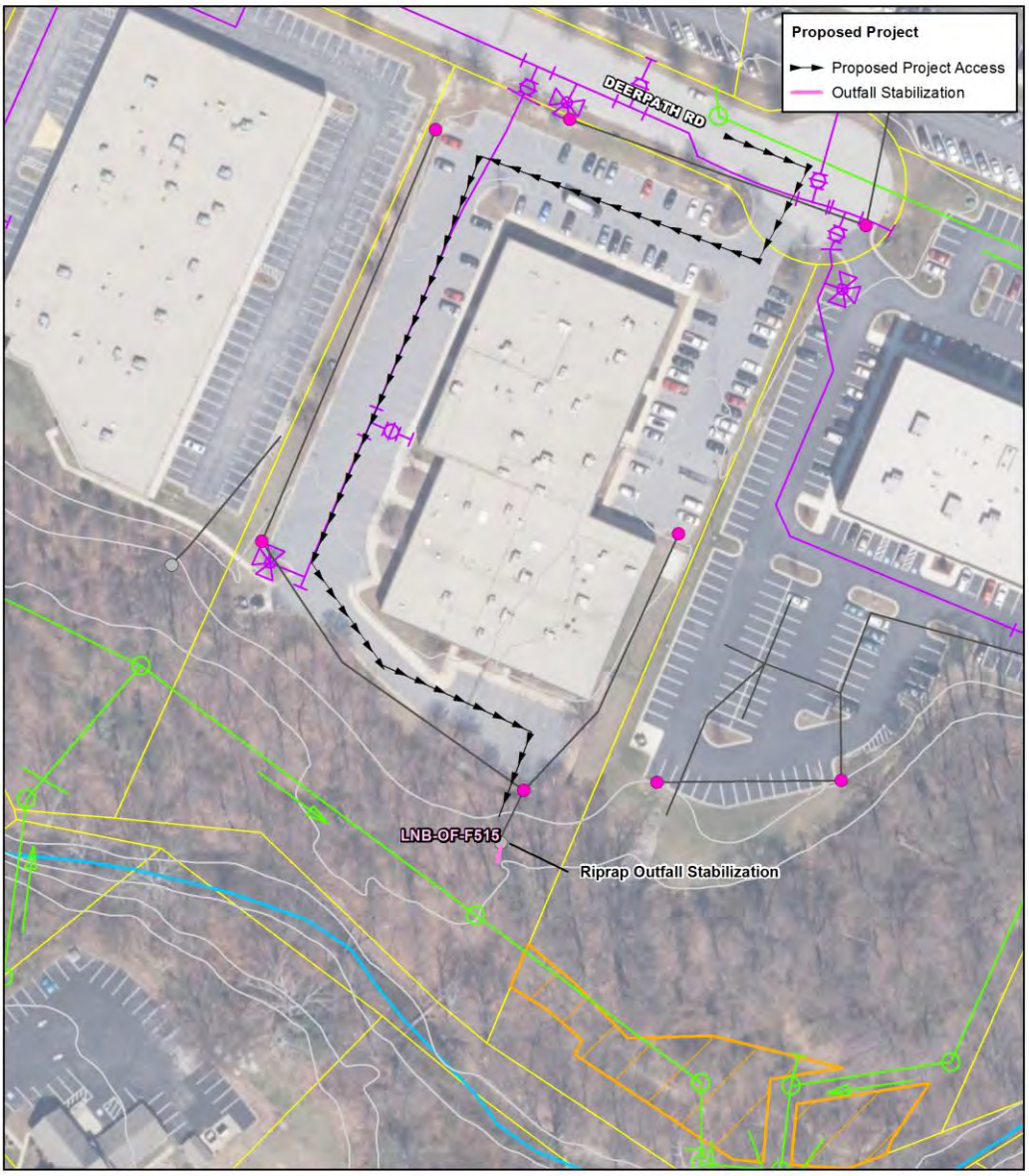
Howard County Watershed Assessment Concept Plan: Outfall Stabilization

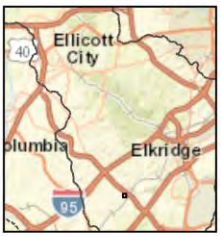
Site ID: LNB-OF-F515

Site Name: Deer Path Road

Contractor: McCormick Taylor

Watershed: Patapsco Lower North





Plan-View Design Drawing - LNB-OF-F515

Storm Drain Outlet
Storm Drain Inlet
Stream Centerline
Utility - Water Line
Utility - Sewer Line
Storm Drain Pipe
DNR Wetland
Forest Conservation Easement
Property Boundary
Subwatershed
10 ft Contour

McCORMICK TAYLOR

N

50 0 50

Feet

1 inch = 100 Feet

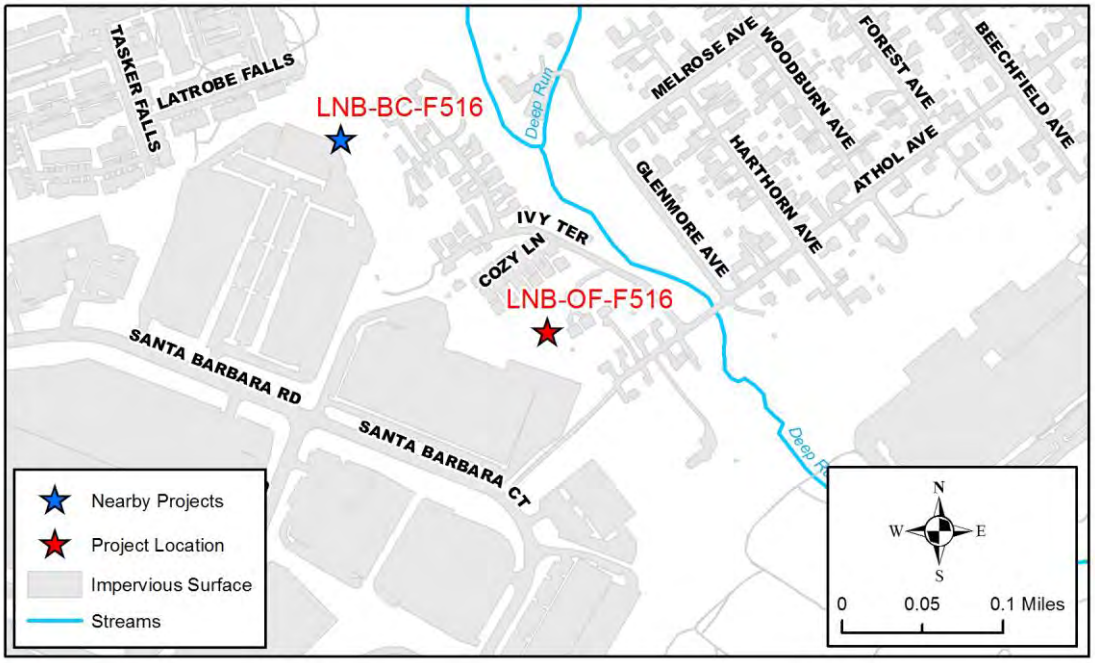
Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F516
Site Name: Tyson Place
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Outfall Stablization
Stabilization Type: Rip Rap
Ownership: Private- Mixed Use
Multiple Owners

Existing Conditions:

The stormwater outfall site is located on commercial property, adjacent to residential property and provides drainage to an unnamed tributary to Deep Run. The outfall is an 18 in. round concrete pipe with headwall. The unnamed tributary confluence is 70 ft. downstream (north) from the outfall and severe erosion extends for 60 ft. Both the outfall and stream channel are deeply incised and actively eroding. The 3.37 ac. drainage area is 89% impervious.



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F516
Site Name: Tyson Place

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Facing upstream toward outfall.

Facing downstream toward outfall channel.

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F516
Site Name: Tyson Place
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:
Constraints within the project include private property ownership, steep slopes with access, and impacts to existing trees or forest areas.

Concept Description:
Rip rap stabilization is proposed for 60 ft. of the outfall channel. The goal of this project is to reduce erosive forces and stabilize the channel bed and banks. This project should be considered medium priority due to severe erosion offset by difficult access. Access is proposed from the utility road at Athol Avenue. The project could be combined with stream restoration associated with the unnamed tributary (LNB-SR-F551a).

Nearby Opportunities:
None recommended

Proposed Project Credit	
Length Restored (ft):	58
Impervious Area Treated Credit (ac.):	0.58
Cost Per Impervious Credit Acre:	$257,759

Costs	
Estimated Design Cost:	$100,000
Estimated Construction Cost:	$15,000
30% Contingency:	$34,500
Estimated Total Cost:	$149,500

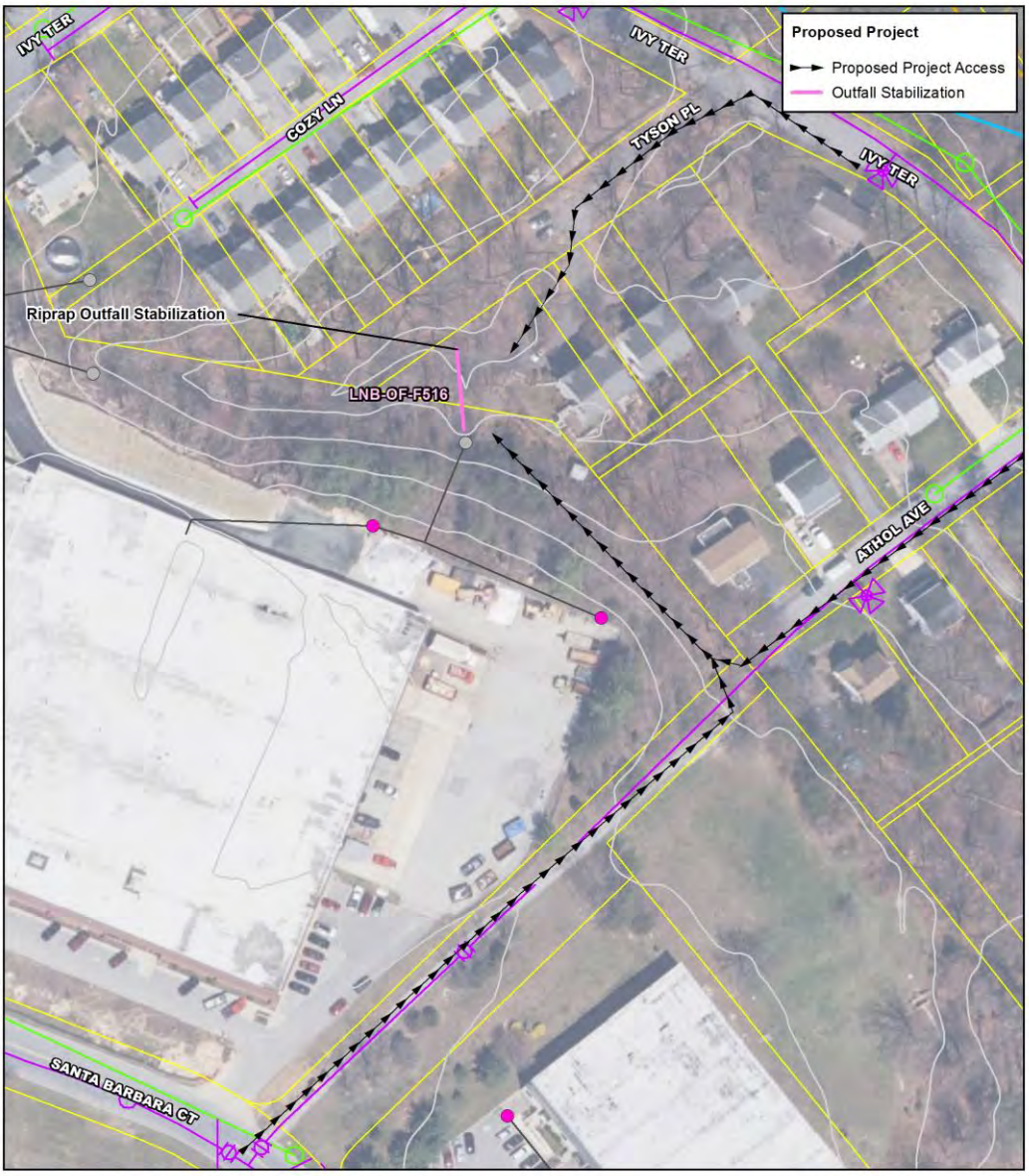
Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F516

Site Name: Tyson Place

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



Plan-View Design Drawing - LNB-OF-F516

- Storm Drain Outlet
- Storm Drain Inlet
- Stream Centerline
- Utility - Water Line
- Utility - Sewer Line
- Storm Drain Pipe
- DNR Wetland
- Forest Conservation Easement
- Property Boundary
- Subwatershed
- 10 ft Contour

McCORMICK TAYLOR

N

50 0 50

Feet

1 inch = 100 Feet

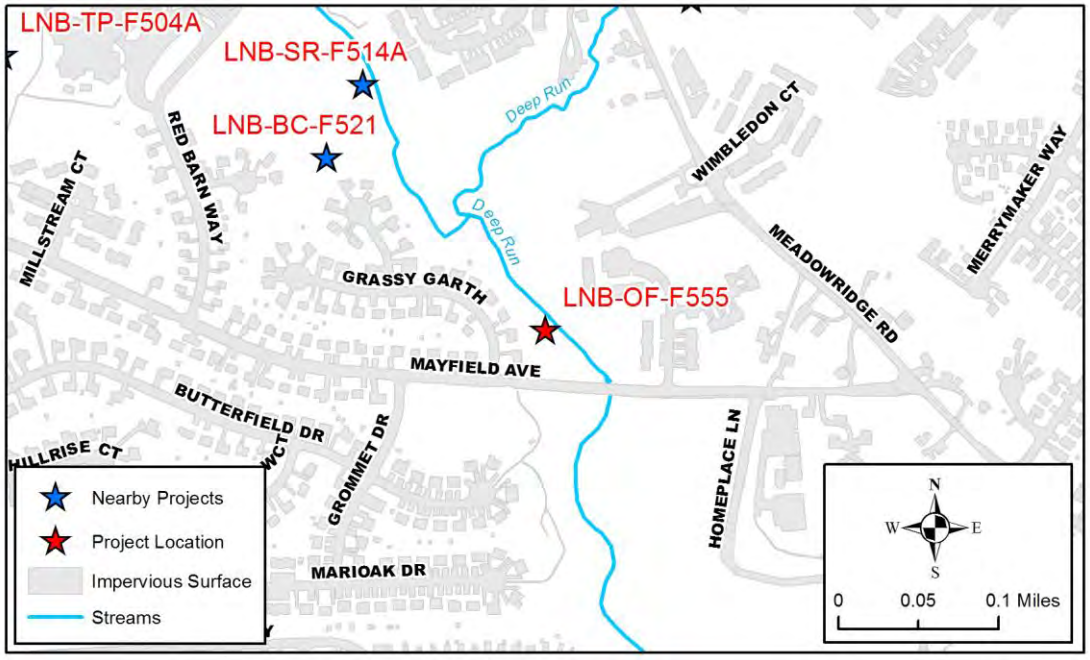
Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F555
Site Name: Mayfield Woods
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Outfall Stablization
Stabilization Type: Step Pool Storm Converyance
Ownership: Private- Residential
Multiple Owners

Existing Conditions:

The stormwater outfall site is located on County and residential property and provides drainage to Deep Run. The outfall is a 15 in. round concrete pipe with headwall. The confluence with Deep Run is 88 ft. downstream (northeast) from the outfall and minor to moderate erosion extends for approximately 50 ft. The site already has riprap stabilization at the outfall; however there is bank erosion downstream of the slope. The 4.5 ac. Drainage area is 44% impervious.



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F555
Site Name: Mayfield Woods

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Facing upstream toward outfall.

Facing downstream toward end of riprap stabilization in outfall channel.

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F555
Site Name: Mayfield Woods
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:
Constraints within the project include private property ownership and impacts to existing trees or forest areas.

Concept Description:
A step pool storm conveyance structure (SPSC) is proposed for approximately 88 ft. of the outfall channel. The goal of this structure is to improve infiltration and reduce erosive velocities through modification of the channel profile and underlying with filter material in constructed pools. For concept design purposes, a sequence of 5 boulder step-pools is proposed, with pool dimensions of 12 x 15 x 1.5 ft., riffle drops of 2.0 ft., and a filter depth of 2 ft. With these assumptions, 900 cf. of storage (12.2% WQv) is provided in the pools and 475 cf. (6.5% WQv) is provided in the void space of the sand filter. This project should be considered low priority due to minimal erosion. A stream stabilization project (LNB-SR-F514A) and BMP conversion project (LNB-BC-F521) are within close proximity to the site. It is recommended that these projects be implemented concurrently to improve efficiency, reduce costs and maximize TMDL credit. Access is proposed through county property from Mayfield Avenue.

Nearby Opportunities:
LNB-SR-F514A, LNB-BC-F521

Proposed Project Credit	
Drainage Area (ac.):	4.5
Impervious Area within Drainage (ac.):	2
Impervious Area Treated (ac.):	0.37
Impervious Area Treated Credit (ac.):	0.37

Water Quality Volume	
WQVolume Target (cf.):	7,351
Max Treated (cf.):	1,375
Percent Treated:	19%
Rainfall Depth Treated (in.):	0.19

Costs

Estimated Design Cost:	$100,000
Estimated Construction Cost:	$88,000
30 % Contingency:	$56,400
Estimated Total Cost:	$244,400
Cost per Impervious Credit Acre:	$660,541

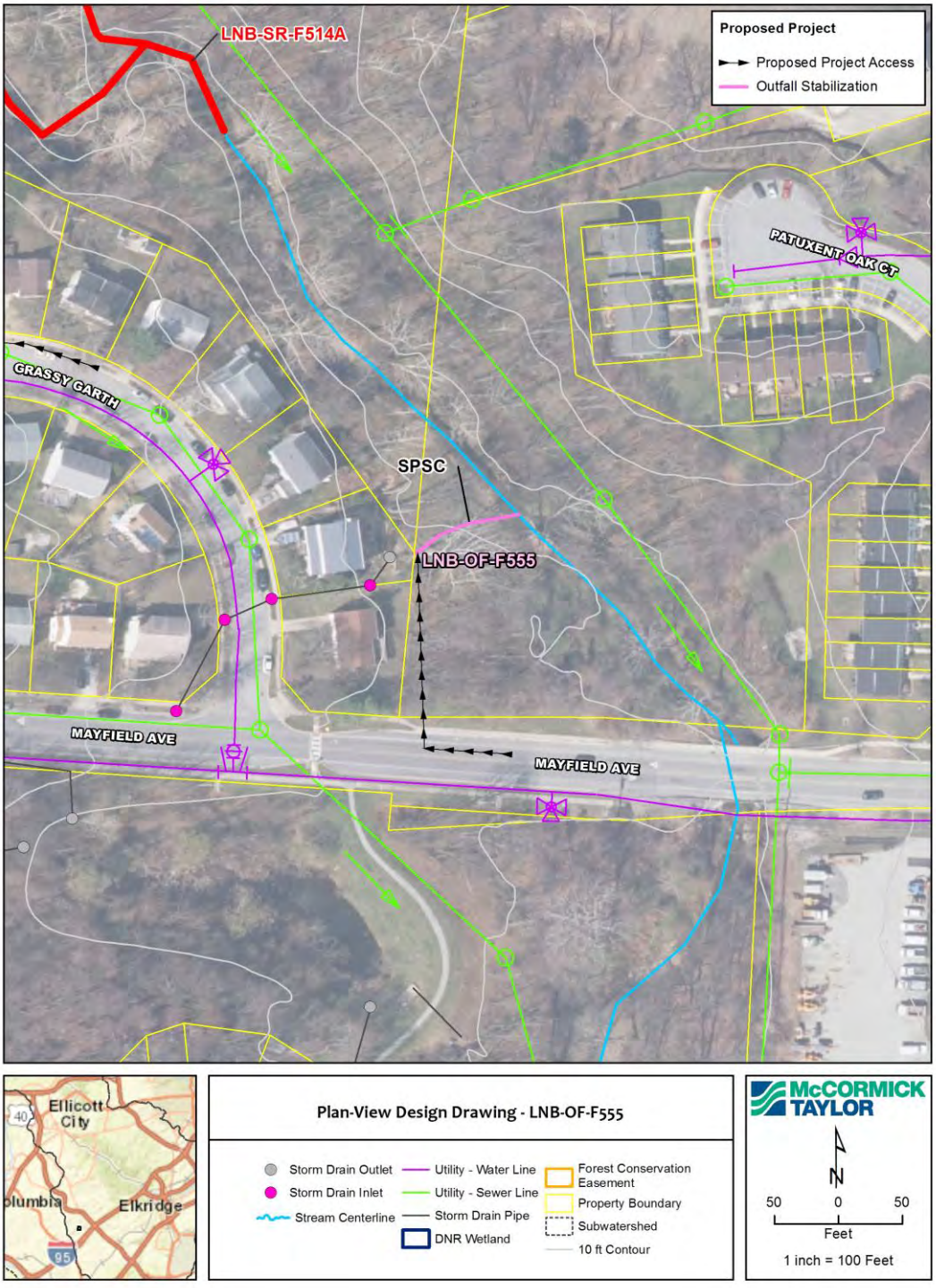
Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F555

Site Name: Mayfield Woods

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F557
Site Name: Ducketts Lane Gabion South

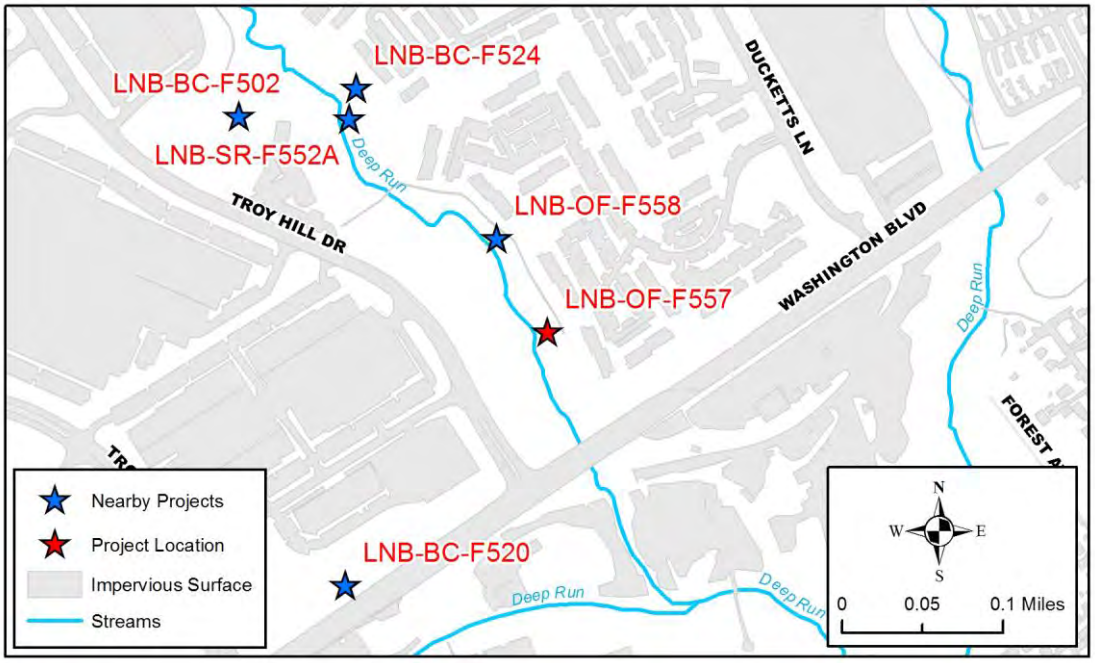
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Outfall Stablization
Stabilization Type: Rip Rap

Ownership: Private- HOA
Multiple Owners

Existing Conditions:

The stormwater outfall site is located on County and residential property and provides drainage to an unnamed tributary to Deep Run. The outfall is an 18 in. corrugated metal pipe without headwall or endsection perched in gabion baskets approximately 11 ft. above the ground. The gabion baskets extend 40 lf. from the end section of the pipe to earthen channel that contains riprap. Moderate erosion and destabilization of the riprap extends for approximately 46 ft. downstream (southwest) to the confluence with the unnamed tributary.



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F557
Site Name: Ducketts Lane Gabion South

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Facing upstream toward outfall and gabion.

Facing upstream toward outfall channel.

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F557
Site Name: Ducketts Lane Gabion South
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:
Constraints within the project include private property ownership and impacts to existing trees or forest areas.

Concept Description:
Outfall stabilization is proposed for 46 ft. of the earthen channel. The goal of this project is to reduce erosive forces on channel bed and banks and stabilize the outfall pipe. This project should be considered medium priority due to moderate erosion and constraints. It is recommended that outfall stabilizations for LNB-OF-F557 and LNB-OF-F558 only be performed if LNB-SR-F552A is selected for stream restoration construction due to costs, limited crediting, and access issues. Access is proposed through steeply sloped private property.

Nearby Opportunities:
LNB-BC-F502, LNB-BC-F518, LNB-BC-F524, LNB-OF-F558, LNB-SR-F552A

Proposed Project Credit	
Length Restored (ft):	46
Impervious Area Treated Credit (ac.):	0.46
Cost Per Impervious Credit Acre:	$315,109

Costs	
Estimated Design Cost:	$100,000
Estimated Construction Cost:	$11,500
30% Contingency:	$33,450
Estimated Total Cost:	$144,950

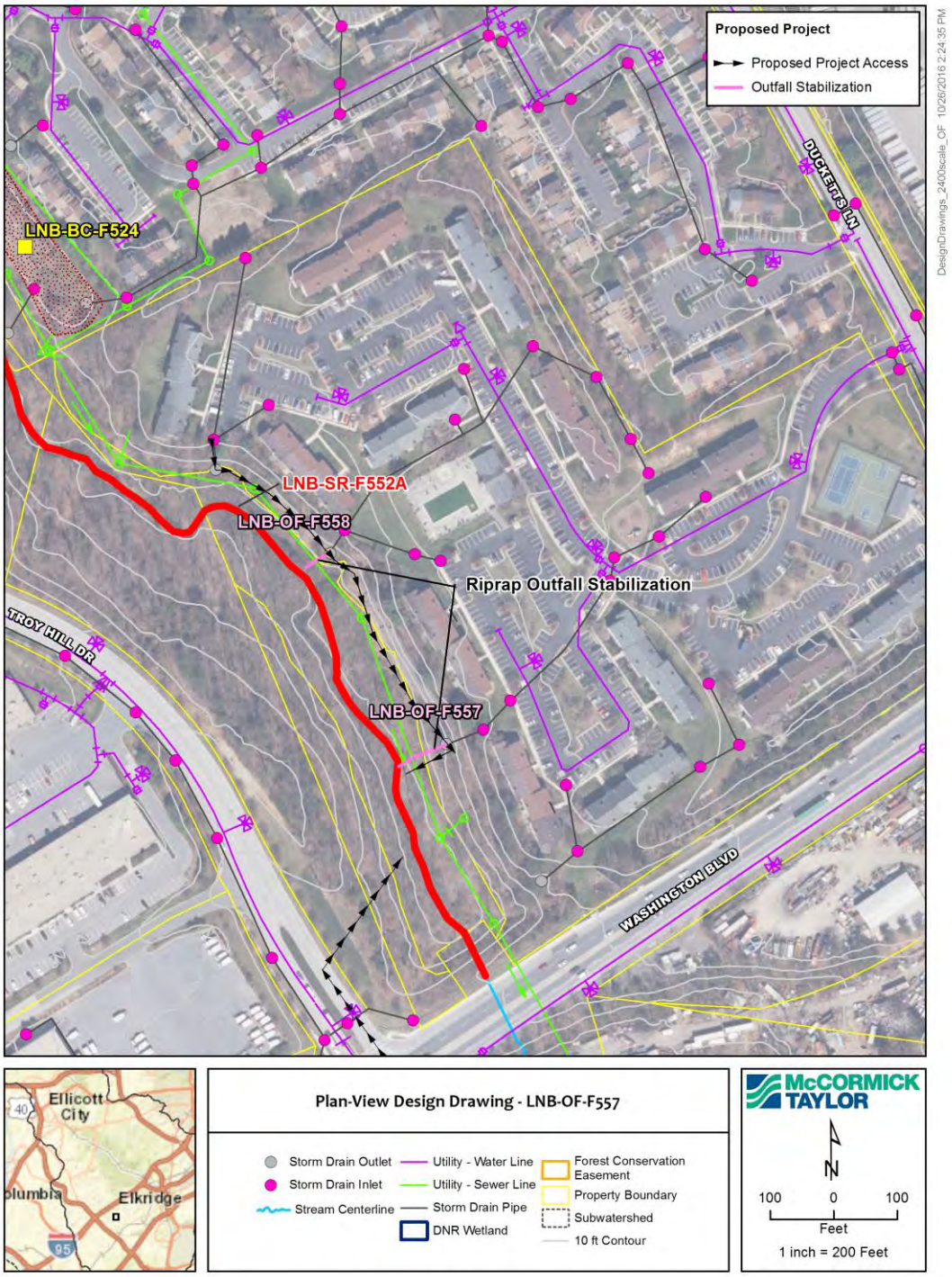
Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F557

Site Name: Ducketts Lane Gabion South

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F558
Site Name: Ducketts Lane Gabion North

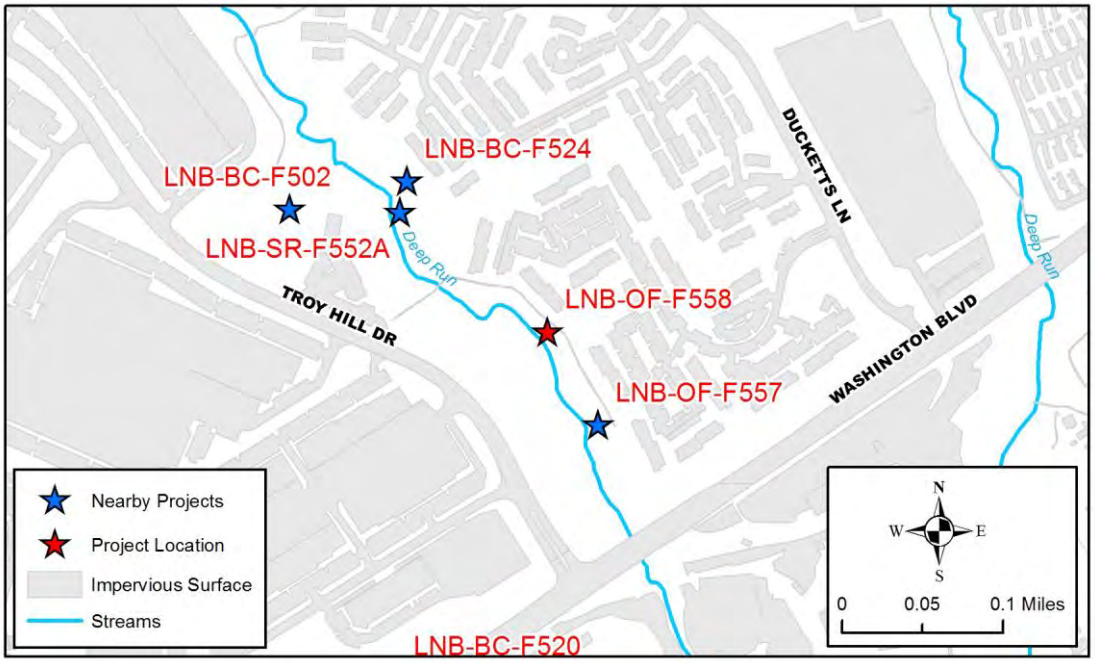
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Outfall Stablization
Stabilization Type: Rip Rap

Ownership: Private- HOA
Multiple Owners

Existing Conditions:

The stormwater outfall site is located on County and residential property and provides drainage to an unnamed tributary to Deep Run. The outfall is a 24 in. corrugated metal pipe without headwall or endsection perched in gabion baskets approximately 8 ft. above the ground. The gabion baskets extend 5 lf. from the endsection of the pipe to earthen channel that contians riprap. Severe erosion and destabilization of riprap extends approximately 38 ft. downstream (southwest) to the confluence with the unnamed tributary.



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F558

Site Name: Ducketts Lane Gabion North

Contractor: McCormick Taylor

Watershed: Patapsco Lower North

Facing upstream toward outfall and gabion.

Facing downstream toward outfall channel erosion.

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F558
Site Name: Ducketts Lane Gabion North
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:
Constraints within the project include private property ownership, impacts to existing trees or forest areas, and steep slopes with access.

Concept Description:
Outfall stabilization is proposed for 38 ft. of the earthen channel. The goal of this project is to reduce erosive forces on channel bed and banks and stabilize the outfall pipe. This project should be considered medium priority due to severe erosion, offset by constraints. It is recommended that outfall stabilizations for LNB-OF-F558 and LNB-OF-F557 only be performed if LNB-SR-F552A is selected for stream restoration construction due to costs, limited crediting, and access issues. Access is proposed through steeply sloped private property.

Nearby Opportunities:
LNB-BC-F502, LNB-BC-F518, LNB-BC-F524, LNB-OF-F557, LNB-SR-F552A

Proposed Project Credit	
Length Restored (ft):	38
Impervious Area Treated Credit (ac.):	0.38
Cost Per Impervious Credit Acre:	$374,605

Costs	
Estimated Design Cost:	$100,000
Estimated Construction Cost:	$9,500
30% Contingency:	$32,850
Estimated Total Cost:	$142,350

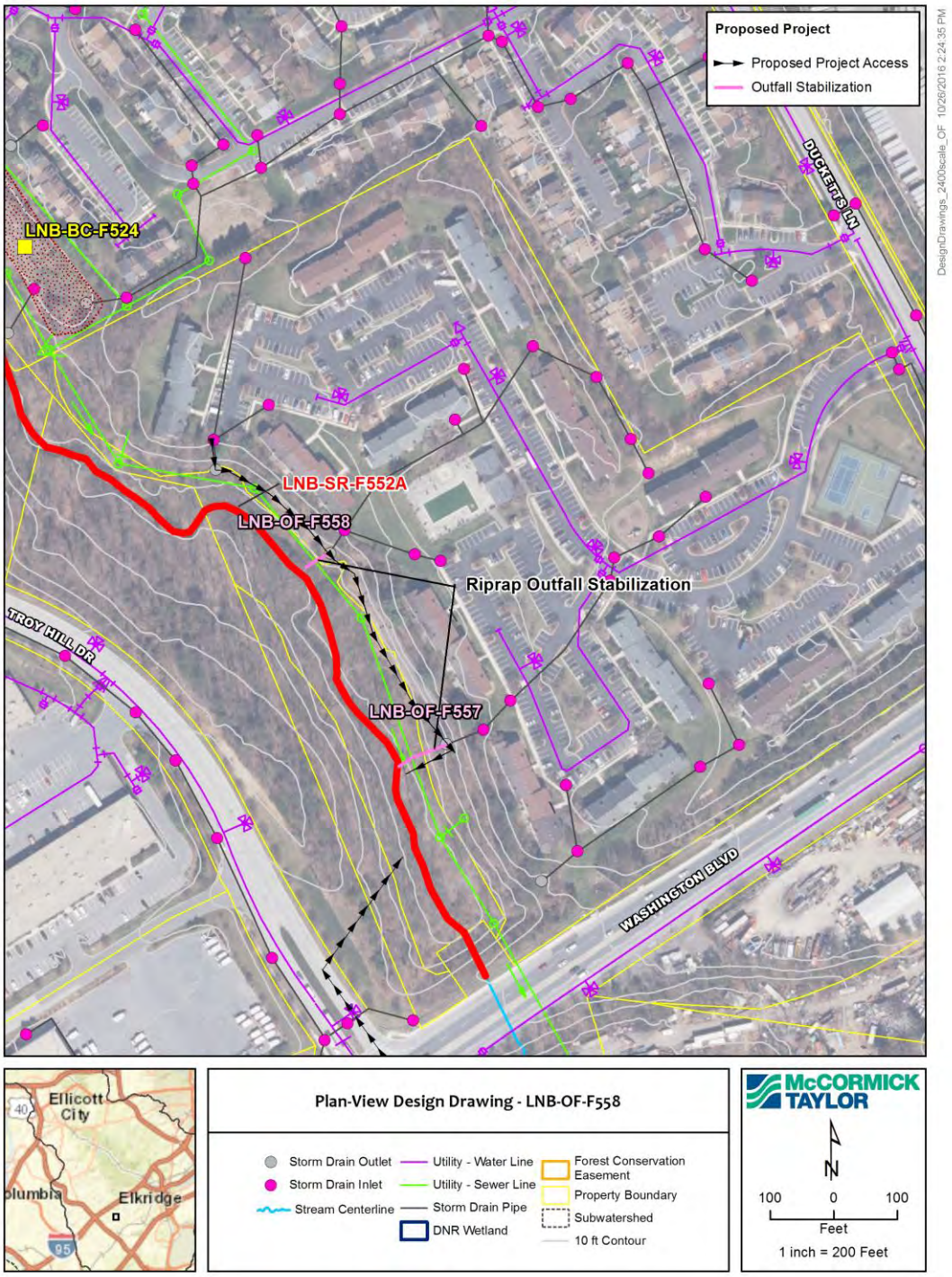
Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F558

Site Name: Ducketts Lane Gabion North

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F561
Site Name: Rowanberry Drive

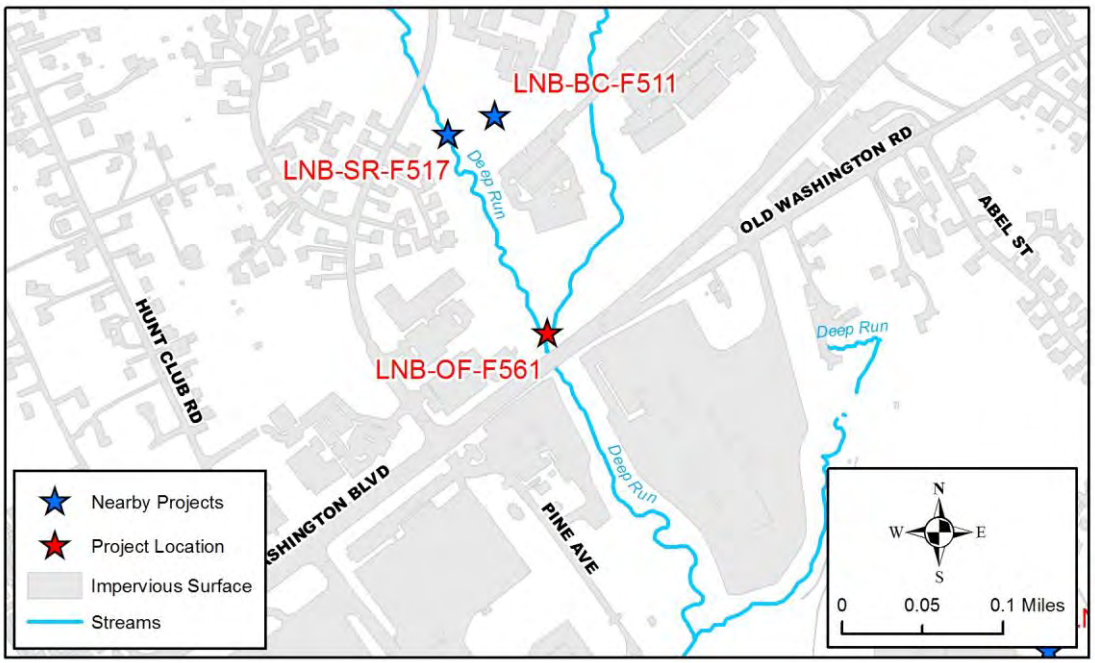
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Outfall Stablization
Stabilization Type: Drop Structure

Ownership: County Owned
Single Owner

Existing Conditions:

LNB-OF-F561 is a stormwater outfall that is located adjacent to US 1 (Washington Boulevard) and drains to LNB-SR-F517. Land use surrounding the project site is primarily forest and residential. The project site itself on situated on land owned by Howard County. The outfall stabilization site extends approximately 30 lf. downstream (northwest). The outfall pipe is a 36 in. corrugated plastic pipe that lacks an apron or headwall. The outfall pipe is associated with an 8 ft. drop in elevation from the edge of the pipe to the stream bed. The stream bed directly below the apron is severely eroded, as evidenced by entrenched channel banks and exposed geotextiles at the outfall pipe. Continued channel erosion could threaten the stability of an existing manhole and the existing roadway (US 1).



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F561
Site Name: Rowanberry Drive
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

From channel facing upstream toward outfall.

From outfall facing downstream toward channel.

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F561
Site Name: Rowanberry Drive
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:
Constraints within the project include access and impacts to existing trees.

Concept Description:
The proposed project would include approximately 29 lf. of outfall stabilization using a drop structure. This outfall stabilization project would be more recommended to coincide with construction of the adjacent stream restoration project (LNB-SR-F517). Ease of access to the project is moderate due to abutting major roadway and impacts to existing trees. Access to the site is proposed off of US 1. It is likely that a lane closure would be required for access purposes.

Nearby Opportunities:
LNB-SR-F517, LNB-BC-F511

Proposed Project Credit	
Length Restored (ft):	29
Impervious Area Treated Credit (ac.):	0.29
Cost Per Impervious Credit Acre:	$512,155

Costs	
Estimated Design Cost:	$100,000
Estimated Construction Cost:	$14,250
30% Contingency:	$34,275
Estimated Total Cost:	$148,525

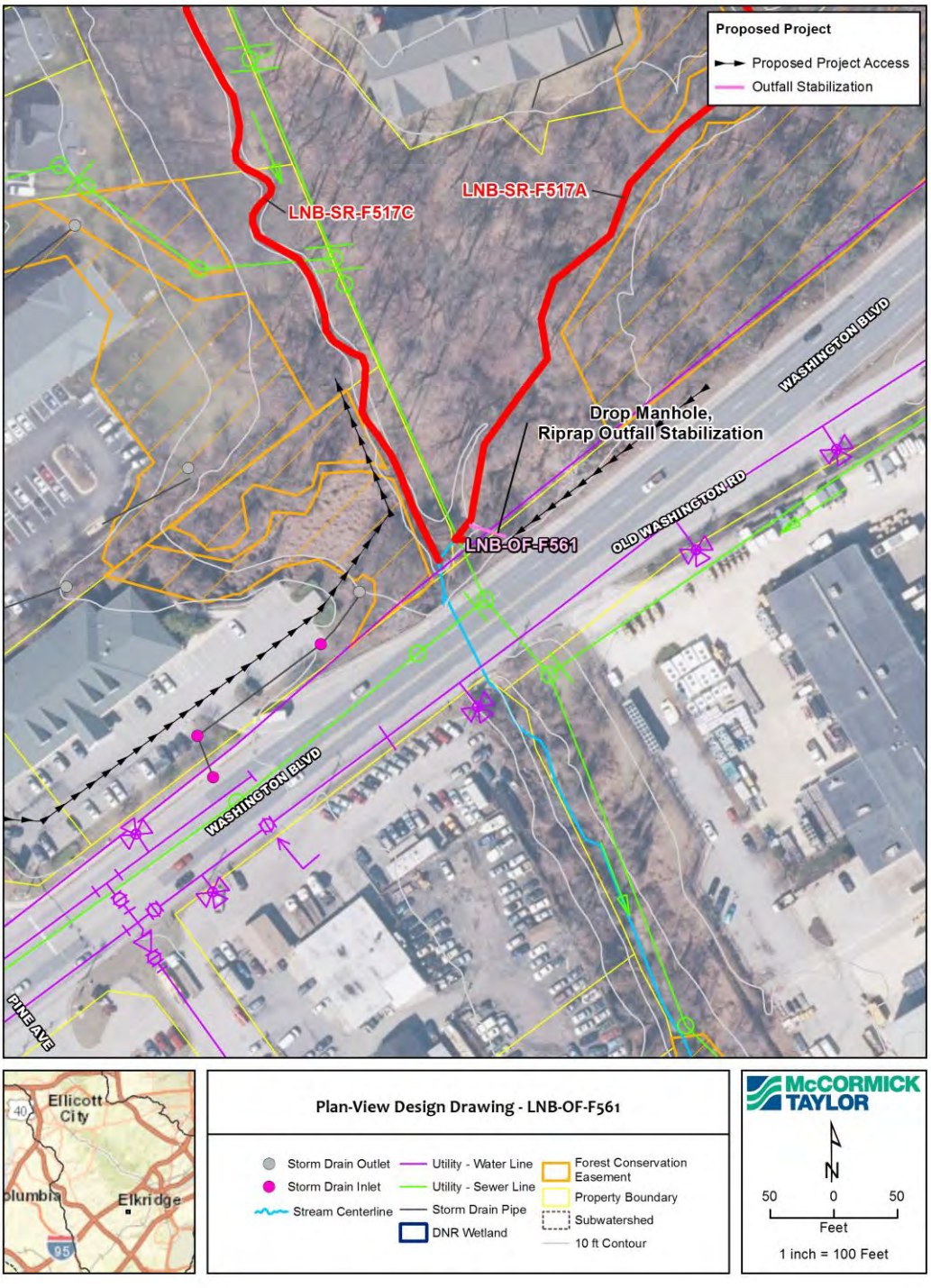
Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F561

Site Name: Rowanberry Drive

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F562
Site Name: Capitol Mobile

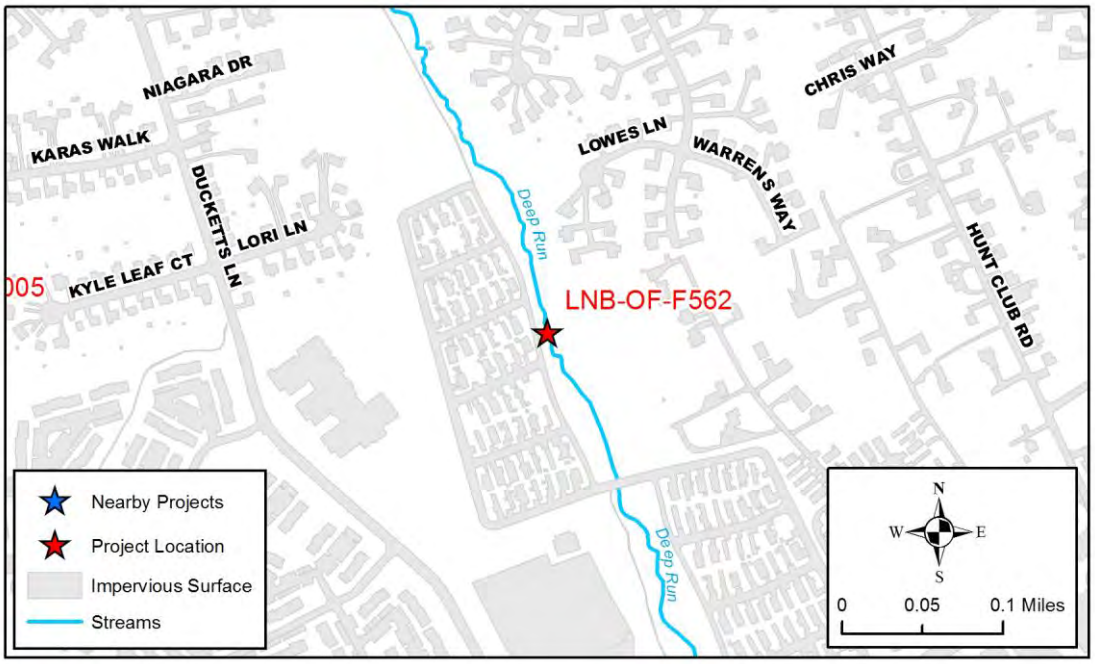
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed BMP Type: Outfall Stablization
Stabilization Type: Rip Rap

Ownership: Private- Residential
Multiple Owners

Existing Conditions:

The stormwater outfall site is located on residential property and provides drainage to an unnamed tributary to Deep Run. The outfall is a severely undercut 24 in. round concrete pipe with a disconnected endsection. The confluence with Deep Run is 17 ft. downstream (east) from the outfall and severe erosion extends for the entire length of the outfall channel.



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F562
Site Name: Capitol Mobile

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Facing upstream toward destabilized outfall.

Facing downstream toward erosion in outfall channel and tributary confluence.

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F562
Site Name: Capitol Mobile
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:
Constraints for this project include private property ownership, access, and impacts to existing trees.

Concept Description:
Endsection repair, vertical realignment of the outfall channel, and riprap stabilization is proposed for the 17 ft. stabilization project. The goal of this project is to reduce erosive forces on channel bed and banks and stabilize the outfall pipe. This project should be considered high priority due to severe erosion and outfall instability. Access is proposed from Capitol Mobile property. This outfall stabilization project could be implemented concurrently with a stream resotration (LNB-SR-F516) to improve efficiency and reduce costs.

Nearby Opportunities:
LNB-SR-F516

Proposed Project Credit	
Length Restored (ft):	17
Impervious Area Treated Credit (ac.):	0.17
Cost Per Impervious Credit Acre:	$835,441

Costs	
Estimated Design Cost:	$100,000
Estimated Construction Cost:	$9,250
30% Contingency:	$32,775
Estimated Total Cost:	$142,025

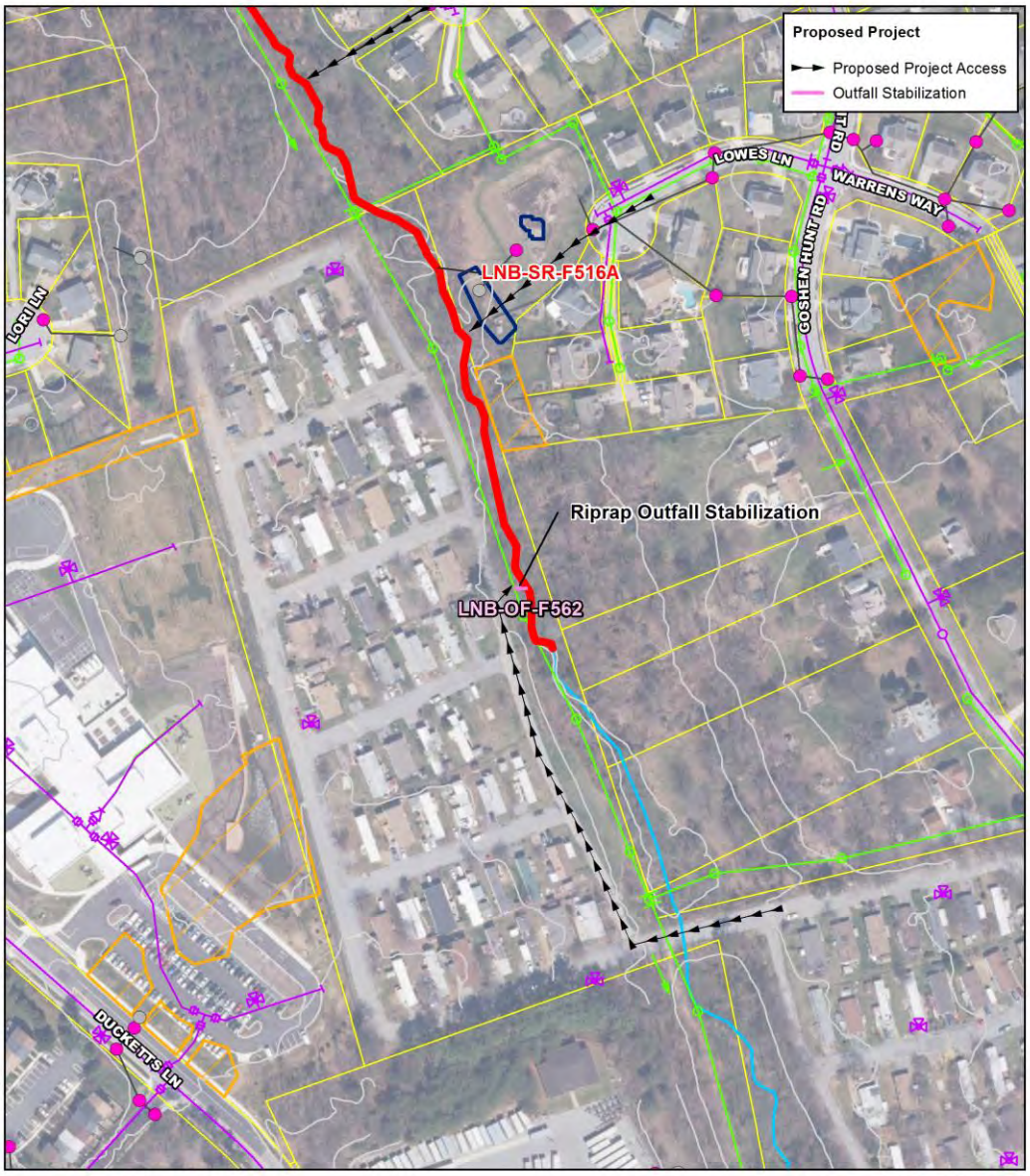
Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F562

Site Name: Capitol Mobile

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



Plan-View Design Drawing - LNB-OF-F562

- Storm Drain Outlet
- Storm Drain Inlet
- Stream Centerline
- Utility - Water Line
- Utility - Sewer Line
- Storm Drain Pipe
- DNR Wetland
- Forest Conservation Easement
- Property Boundary
- Subwatershed
- 10 ft Contour

McCORMICK TAYLOR

N

100 0 100

Feet

1 inch = 200 Feet

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F601

Site Name: Carroll Wind Drive

Contractor: KCI

Watershed: Patapsco Lower North

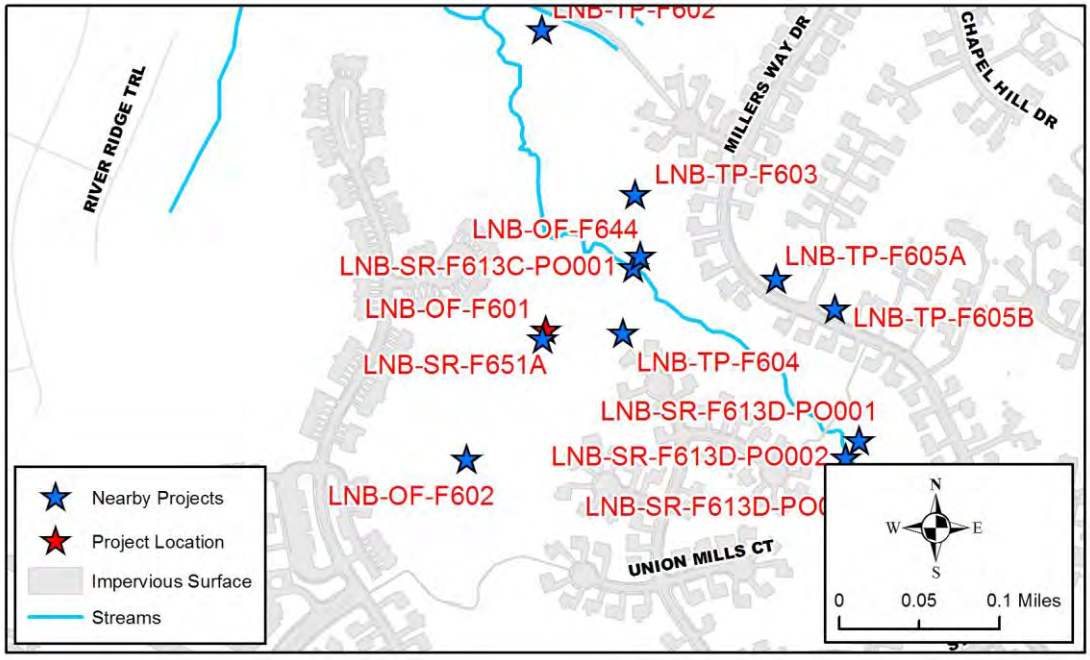
Proposed BMP Type: Outfall Stabilization

Stabilization Type: Step Pool Stormwater Conveyance

Ownership: County Owned
Single Owner

Existing Conditions:

The proposed outfall stabilization begins at a pond emergency spillway and flows west for approximately 43 ft. until it meets an unnamed tributary to the Patapsco River. The outfall is approximately 10 ft. higher than the stream channel bed, resulting in several headcuts to form. The outfall is adjacent to multiple residential neighborhoods so access is easy through open fields. The adjacent stream bank on the west side of the pond is severely eroded and if not repaired could erode into the pond basin.



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F601
Site Name: Carroll Wind Drive
Contractor: KCI
Watershed: Patapsco Lower North

View facing downstream at headcut.

View of pond and severe bank erosion on the adjacent stream on the west side of the pond.

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F601
Site Name: Carroll Wind Drive
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:
Constraints are minimal and include minor impact to trees.

Concept Description:
The proposed stabilization BMP is a Step Pool Storm Conveyance system (SPSC) with 2 cascades, 1 pool, and 1 riffle. The SPSC will be 8 ft. wide and span the full 43 ft. of erosion starting from the outfall. The eroded pond bank will also be repaired to prevent facility faliure. Since this outfall is downstream of a wet pond, the water quality treatment provided is in addition to what the wet pond provides. However, since the channel is eroded 10 ft. vertically, cascading structures may be necessary which do not provide water quality credit.

Nearby Opportunities:
LNB-SR-F651, LNB-TP-F604

Proposed Project Credit	
Drainage Area (ac.):	4.98
Impervious Area within Drainage (ac.):	1.56
Impervious Area Treated (ac.):	1.34
Impervious Area Treated Credit (ac.):	1.34

Water Quality Volume	
WQVolume Target (cf.):	6,000
Max Treated (cf.):	2,561
Percent Treated:	43%
Rainfall Depth Treated (in.):	0.43

Costs

Estimated Design Cost:	$100,000
Estimated Construction Cost:	$61,000
30 % Contingency:	$48,300
Estimated Total Cost:	$209,300
Cost per Impervious Credit Acre:	$156,194

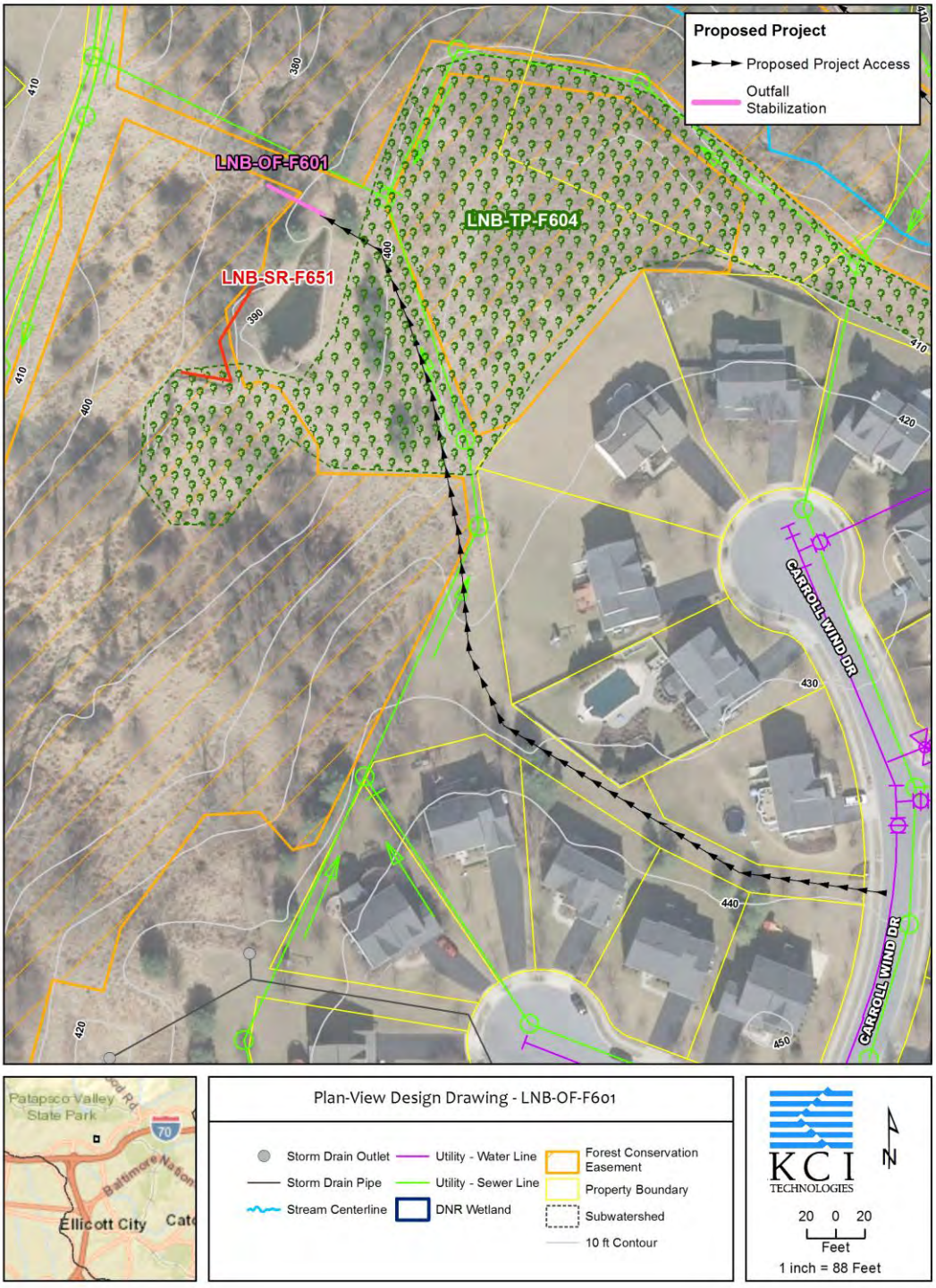
Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F601

Site Name: Carroll Wind Drive

Contractor: KCI

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F602

Site Name: Stonehouse Drive B

Contractor: KCI

Watershed: Patapsco Lower North

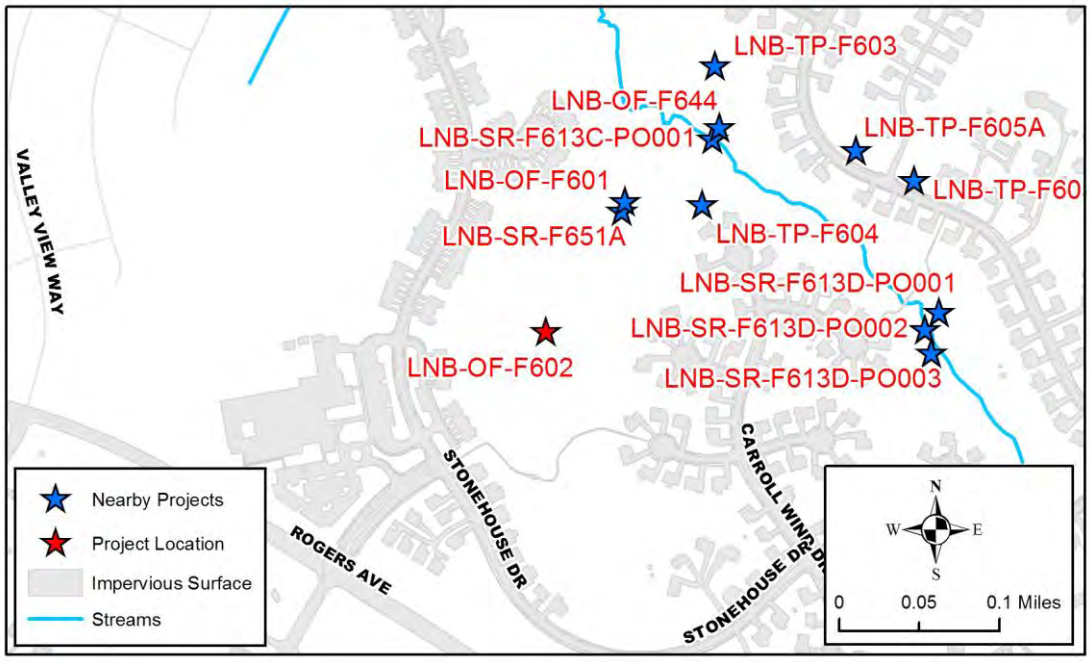
Proposed BMP Type: Outfall Stabilization

Stabilization Type: Step Pool Stormwater Conveyance

Ownership: County Owned
Single Owner

Existing Conditions:

The proposed outfall stabilization is an eroded outfall channel of a stormwater management pond east of Stonehouse Drive. The channel begins at a gabion basket weir of the stormwater management pond and drains to an unnamed tributary to the Patapsco River. An approximate 4 ft. headcut has formed immediately downstream of the gabion weir. The first 30 ft. of the outfall channel has approximately 4 ft. high banks and severe erosion, the following 170 ft. of the channel has approximately 3 ft. high banks and moderate erosion. The outfall is adjacent to a fairly open field near residential properties. The lower portion of the channel is forested.



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F602
Site Name: Stonehouse Drive B
Contractor: KCI
Watershed: Patapsco Lower North

View facing upstream at headcut below gabion weir.

View facing downstream of eroded outfall channel.

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F602
Site Name: Stonehouse Drive B
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:
Constraints include impact to the forest at the lower portion of the proposed SPSC system, and the sewer line on the east side of the pond.

Concept Description:
The proposed stabilization BMP is a Step Pool Storm Conveyance system (SPSC) with 1 cascade, 8 pools, and 8 riffles. The SPSC will be 10 ft. wide and span the full 200 ft. of erosion starting from the gabion weir structure. Since this outfall is downstream of a wet pond, the water quality treatment provided is in addition to what the wet pond provides.

Nearby Opportunities:
None

Proposed Project Credit	
Drainage Area (ac.):	9.78
Impervious Area within Drainage (ac.):	4.85
Impervious Area Treated (ac.):	4.99
Impervious Area Treated Credit (ac.):	4.99

Water Quality Volume	
WQVolume Target (cf.):	17,620
Max Treated (cf.):	19,639
Percent Treated:	111%
Rainfall Depth Treated (in.):	1.11

Costs

Estimated Design Cost:	$200,000
Estimated Construction Cost:	$218,000
30 % Contingency:	$125,400
Estimated Total Cost:	$543,400
Cost per Impervious Credit Acre:	$108,898

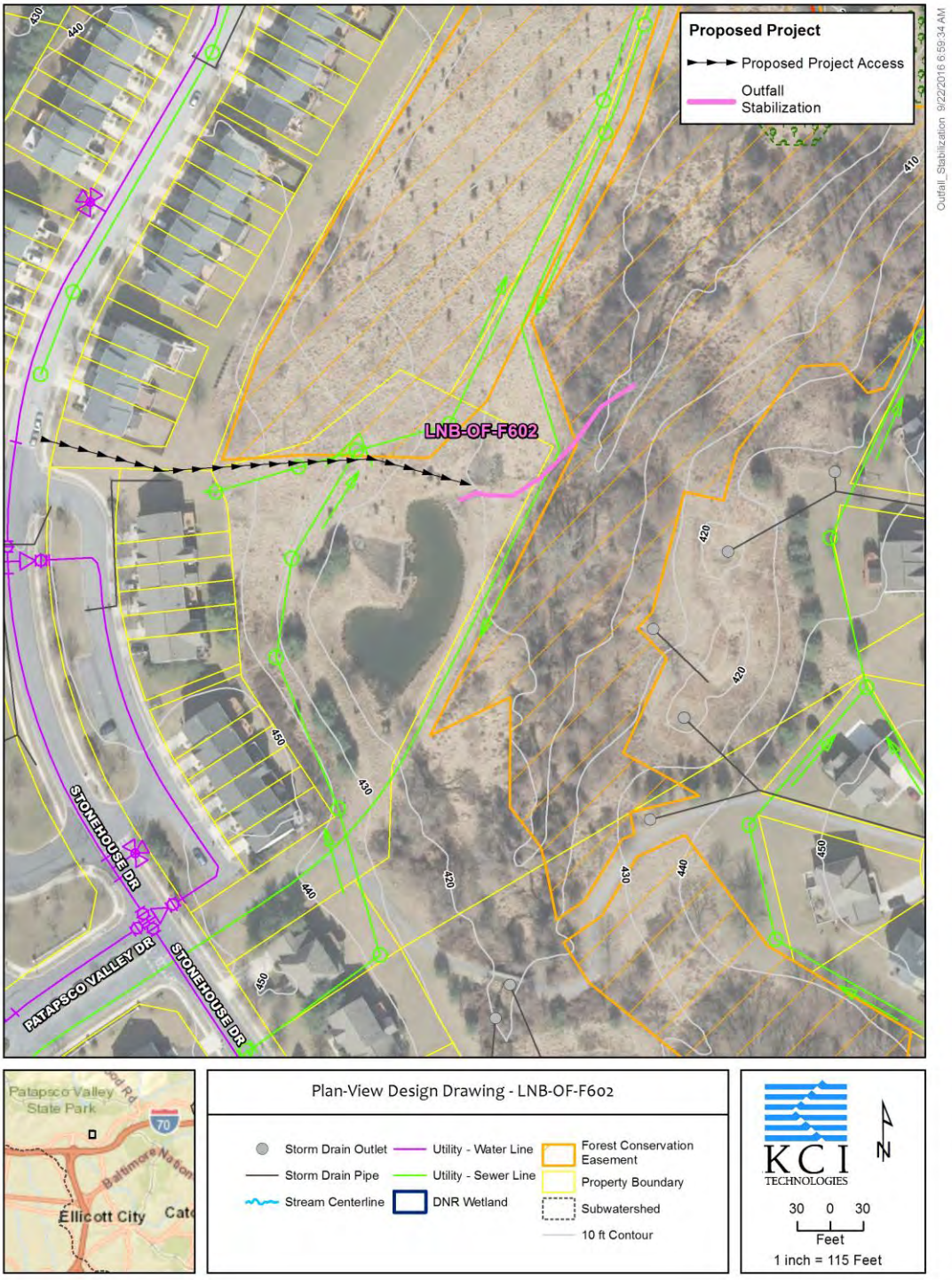
Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F602

Site Name: Stonehouse Drive B

Contractor: KCI

Watershed: Patapsco Lower North



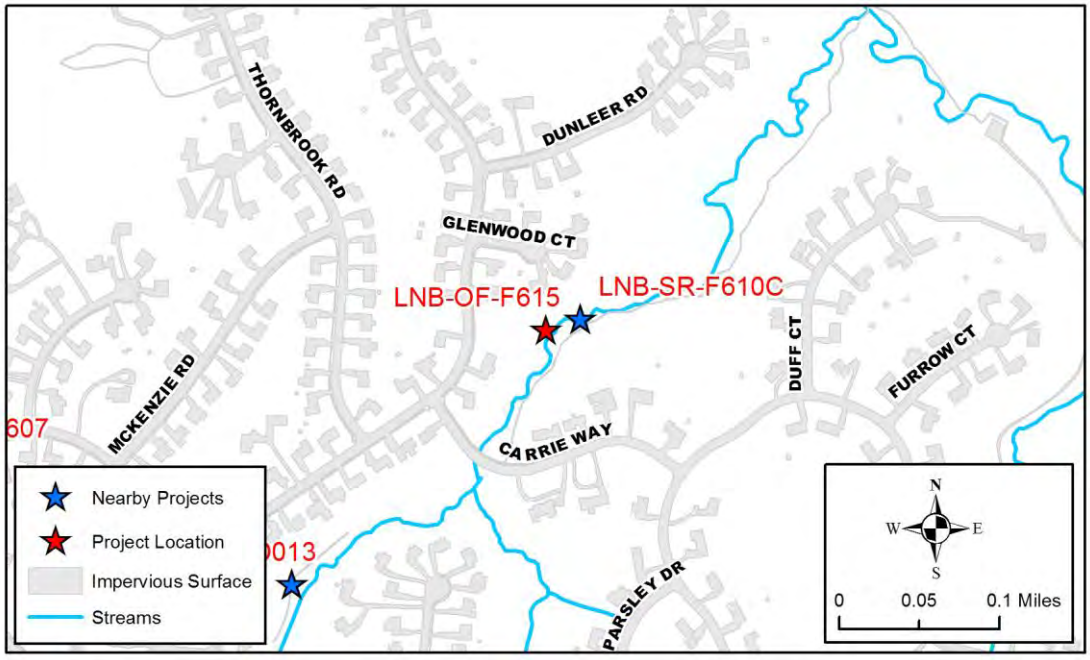
Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F615
Site Name: Thornbrook Road
Contractor: KCI
Watershed: Patapsco Lower North

Proposed BMP Type: Outfall Stabilization
Stabilization Type: Step Pool Stormwater Conveyance
Ownership: County Owned
Single Owner

Existing Conditions:

The proposed outfall stabilization is an eroded outfall channel of a stormwater management pond east of Thornbrook Road. The channel begins at the minorly corroded 24 in. corrugated metal pipe of the stormwater management pond and drains to an unnamed tributary to the Patapsco River. The outfall channel is very steep and the rip rap stabilization has washed out and exposed the underlying geotextile fabric. Approximately 43 ft. of the channel is in need of stabilization.



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F615
Site Name: Thornbrook Road
Contractor: KCI
Watershed: Patapsco Lower North

View facing upstream outfall channel at confluence with stream.

View of outfall pipe.

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F615
Site Name: Thornbrook Road
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:
Access could be difficult due to the adjacent residential properties and slope of the pond embankment.

Concept Description:
The proposed stabilization BMP is a Step Pool Storm Conveyance system (SPSC) with 2 cascades, 1 pool, and 1 riffle. The SPSC will be 10 ft. wide and span the full 43 ft. of erosion starting from the pond outfall. Since this outfall is downstream of a wet pond, the water quality treatment provided is in addition to what the wet pond provides.

Nearby Opportunities:
LNB-SR-F610C

Proposed Project Credit

Drainage Area (ac.):	22.9
Impervious Area within Drainage (ac.):	5.87
Impervious Area Treated (ac.):	4.6
Impervious Area Treated Credit (ac.):	4.6

Water Quality Volume

WQVolume Target (cf.):	23,334
Max Treated (cf.):	3,202
Percent Treated:	14%
Rainfall Depth Treated (in.):	0.14

Costs

Estimated Design Cost:	$100,000
Estimated Construction Cost:	$61,000
30 % Contingency:	$48,300
Estimated Total Cost:	$209,300
Cost per Impervious Credit Acre:	$45,500

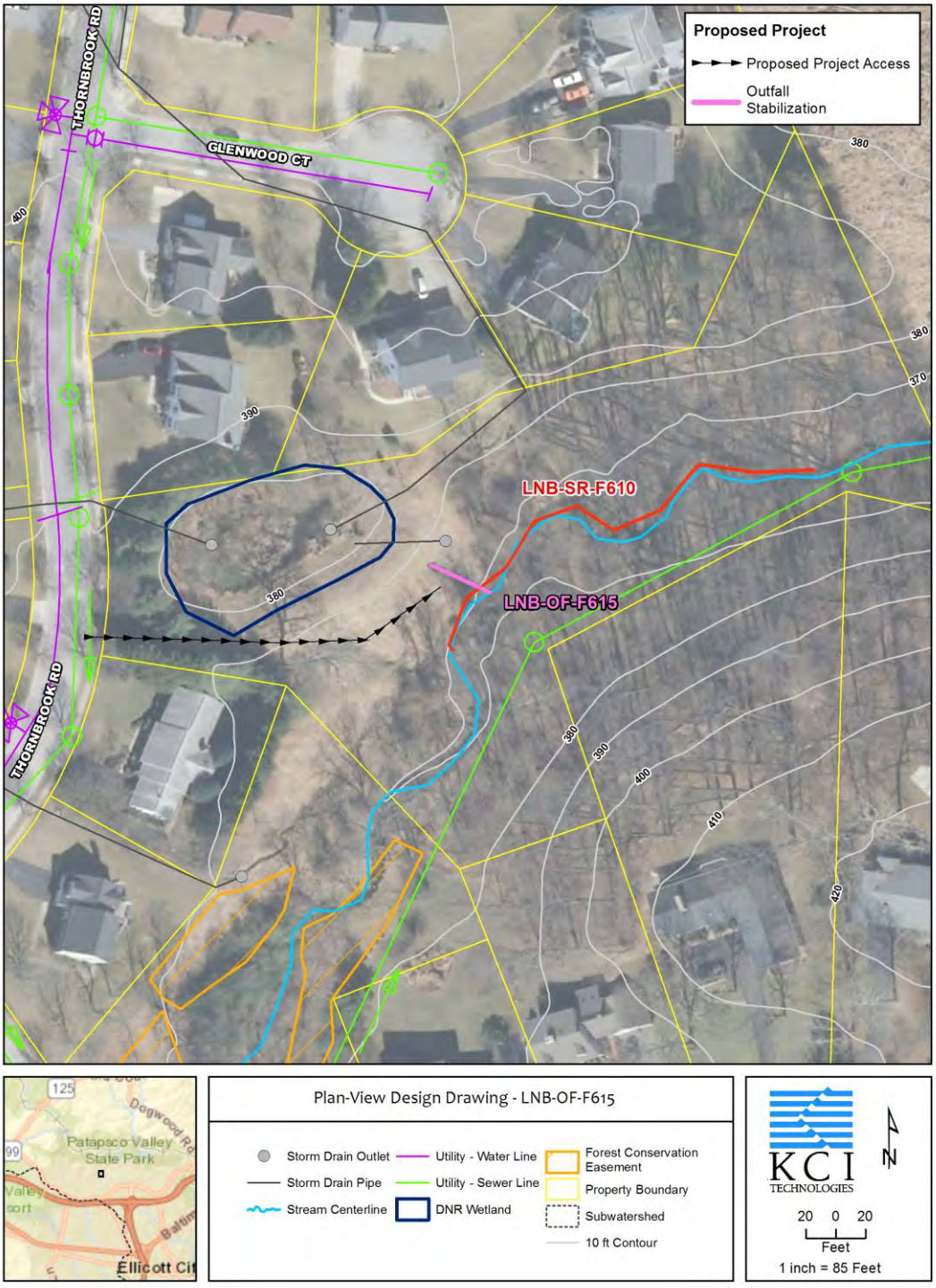
Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F615

Site Name: Thornbrook Road

Contractor: KCI

Watershed: Patapsco Lower North



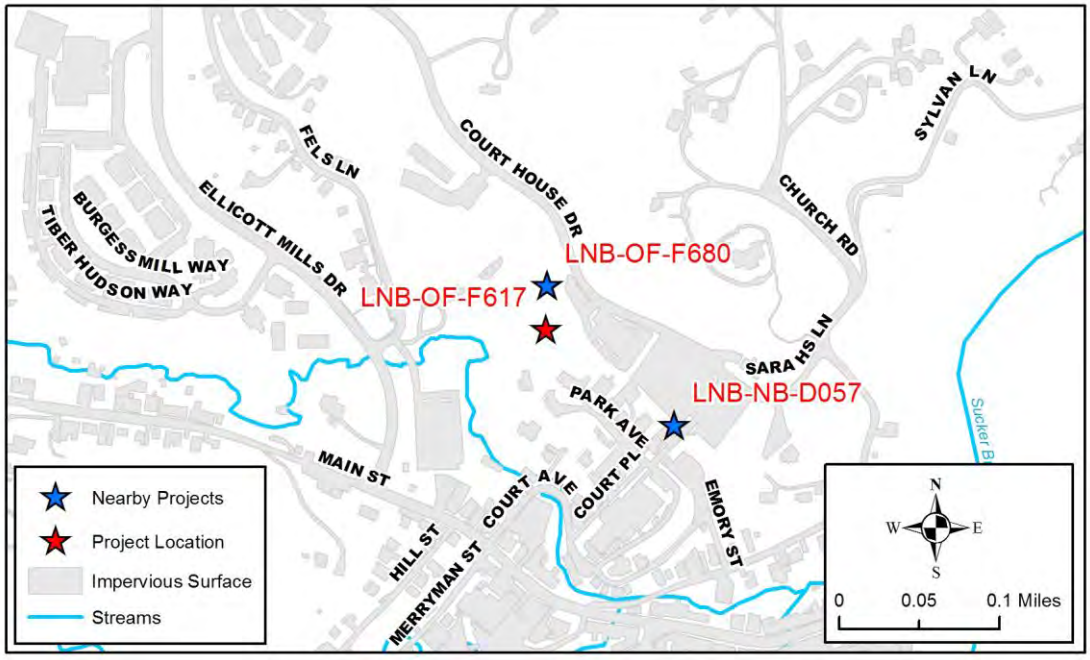
Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F617
Site Name: Courthouse Parking Lot A
Contractor: KCI
Watershed: Patapsco Lower North

Proposed BMP Type: Outfall Stabilization
Stabilization Type: Step Pool Stormwater Conveyance
Ownership: County Owned
Single Owner

Existing Conditions:

The proposed outfall stabilization is a drainage channel originating from a parking lot curb cut in the Howard County courthouse parking lot in Ellicott City off Court House Drive. The channel is approximately 250 ft. long and has approximately 5 ft. high banks with highly erodible soils. The channel originates at the parking lot curb cut and drains down a steep slope to Hudson Branch. The site is adjacent to an active parking lot and has high public education and demonstration potential.



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F617
Site Name: Courthouse Parking Lot A
Contractor: KCI
Watershed: Patapsco Lower North

View of curb cut in parking lot at top of eroded channel.

View facing upstream eroded channel.

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F617
Site Name: Courthouse Parking Lot A
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:
The site is immediately adjacent to a parking lot; however the steep slope will make access very difficult. The project would result in a moderate impact to trees.

Concept Description:
The proposed stabilization BMP is a Step Pool Storm Conveyance system (SPSC) with 12 cascades, 6 pools, and 6 riffles. The SPSC will be 8 ft. wide and span the full 250 ft. of erosion starting from the parking lot outfall.

Nearby Opportunities:
Outfall stabilization LNB-OF-F680 is immediately adjacent and is a very similar eroded channel originating at a parking lot curb cut.

Proposed Project Credit

Drainage Area (ac.):	0.83
Impervious Area within Drainage (ac.):	0.64
Impervious Area Treated (ac.):	0.9
Impervious Area Treated Credit (ac.):	0.9

Water Quality Volume

WQVolume Target (cf.):	2,242
Max Treated (cf.):	5,828
Percent Treated:	260%
Rainfall Depth Treated (in.):	2.6

Costs

Estimated Design Cost:	$200,000
Estimated Construction Cost:	$268,000
30 % Contingency:	$140,400
Estimated Total Cost:	$608,400
Cost per Impervious Credit Acre:	$676,000

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F617

Site Name: Courthouse Parking Lot A

Contractor: KCI

Watershed: Patapsco Lower North

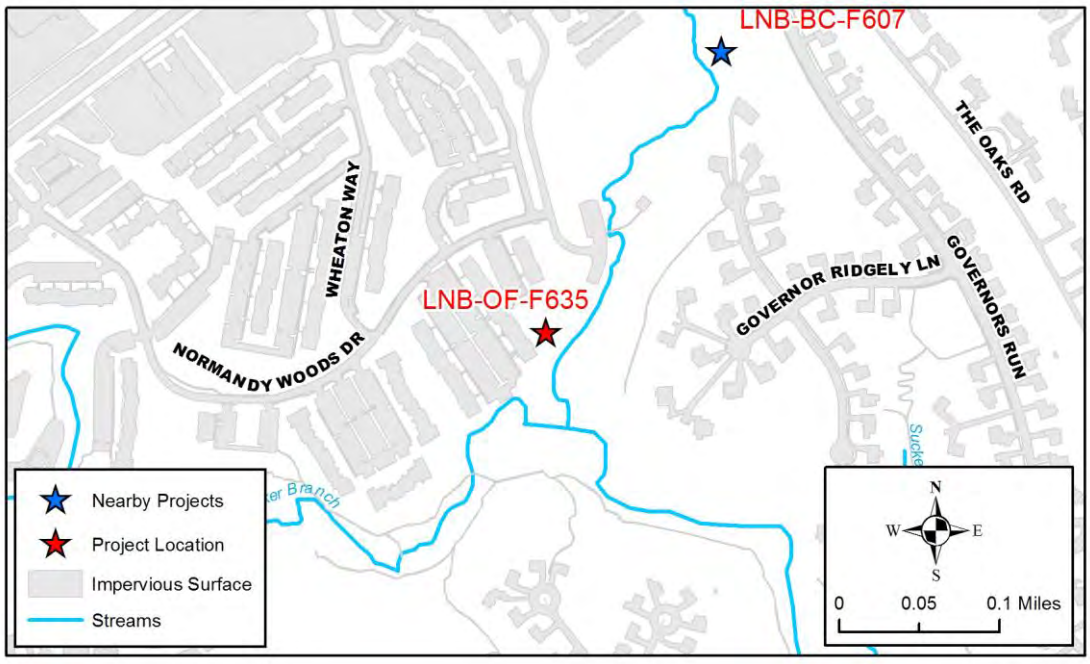
Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F635
Site Name: Normandy Woods
Contractor: KCI
Watershed: Patapsco Lower North

Proposed BMP Type: Outfall Stabilization
Stabilization Type: Step Pool Stormwater Conveyance
Ownership: Private- Residential Single Owner

Existing Conditions:

The proposed outfall stabilization is a severely eroded channel originating from a 36 in. concrete storm drain pipe with no stormwater management treatment. The channel erosion starts 50 ft. downstream of the outfall and extends approximately 217 ft. downstream until it meets Sucker Branch. Site access is easy from the adjacent parking lot off Normandy Woods Drive.



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F635
Site Name: Normandy Woods
Contractor: KCI
Watershed: Patapsco Lower North

View facing downstream in eroded outfall channel.

View facing right bank of eroded outfall channel.

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F635
Site Name: Normandy Woods
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:
Constraints include a moderate impact to trees and private ownership. A sanitary sewer line bisects the channel at the downstream end near Sucker Branch.

Concept Description:
The proposed stabilization BMP is a Step Pool Storm Conveyance system (SPSC) with 8 pools and 8 riffles. The SPSC will be 10 ft. wide and span the full 217 ft. of erosion starting from the storm drain outfall.

Nearby Opportunities:
None

Proposed Project Credit	
Drainage Area (ac.):	27.62
Impervious Area within Drainage (ac.):	13.44
Impervious Area Treated (ac.):	11.6
Impervious Area Treated Credit (ac.):	11.6

Water Quality Volume	
WQVolume Target (cf.):	48,922
Max Treated (cf.):	22,196
Percent Treated:	45%
Rainfall Depth Treated (in.):	0.45

Costs	
Estimated Design Cost:	$200,000
Estimated Construction Cost:	$235,000
30 % Contingency:	$130,500
Estimated Total Cost:	$565,500
Cost per Impervious Credit Acre:	$48,750

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F635

Site Name: Normandy Woods

Contractor: KCI

Watershed: Patapsco Lower North

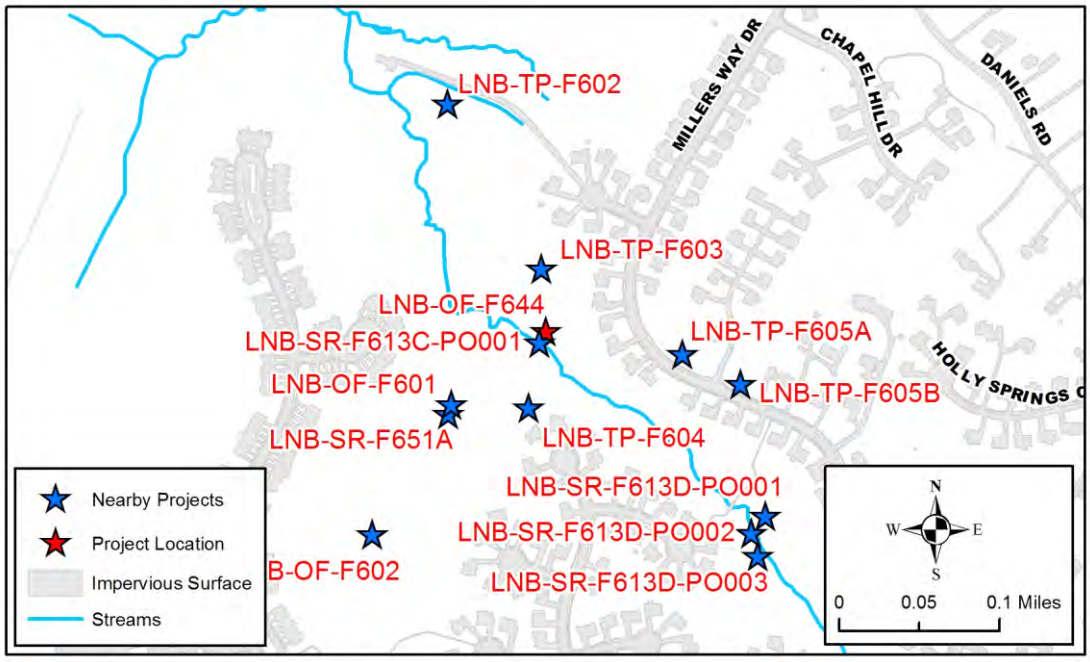
Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F644
Site Name: Millers Way A
Contractor: KCI
Watershed: Patapsco Lower North

Proposed BMP Type: Outfall Stabilization
Stabilization Type: Step Pool Stormwater Conveyance
Ownership: County Owned
Single Owner

Existing Conditions:

The proposed outfall stabilization project includes two assessment and recommendation sites, LNB-OF-F644 and LNB-SR-F613C PO001. The project includes three eroded channels that drain to an unnamed tributary to the Patapsco River. The eroded channel to the west originates from a storm drain pipe with no stormwater management, and is eroded for approximately 55 ft. The center channel originates from a 24 in. plastic pipe outfall from the adjacent stormwater management pond and is eroded for approximately 90 ft. The channel to the east originates from the emergency spillway of the stormwater management facility and is eroded for its entire length, approximately 65 ft. The surrounding area is relatively open and impact to the surrounding trees would be minimal.



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F644
Site Name: Millers Way A
Contractor: KCI
Watershed: Patapsco Lower North

View facing upstream of outfall pipe of center channel.

View facing upstream of outfall erosion on western channel.

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F644
Site Name: Millers Way A
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:
Access may be difficult due to the surrounding residential properties. There are also moderate impacts to trees in the lower portion of the SPSC system.

Concept Description:
The proposed stabilization BMP is a SPSC with the left branch having 3 cascades, 1 pool, and 1 riffle; the center branch having 3 cascades, 3 pools and 3 riffles; and the right branch having 2 cascades, 2 pools, and 2 riffles. The SPSC will be 10 ft. wide and span the full total 210 ft. of erosion of the three branches. The three branches will start at the two storm drain outfalls and the emergency spillway outfall respectively and merge into one channel just upstream of the main tributary channel.

Nearby Opportunities:
LNB-TP-F603, LNB-TP-F604, LNB-TP-F605, LNB-OF-601, LNB-SR-F651

Proposed Project Credit	
Drainage Area (ac.):	11.17
Impervious Area within Drainage (ac.):	3.17
Impervious Area Treated (ac.):	3.39
Impervious Area Treated Credit (ac.):	3.39

Water Quality Volume	
WQVolume Target (cf.):	12,384
Max Treated (cf.):	15,855
Percent Treated:	128%
Rainfall Depth Treated (in.):	1.28

Costs

Estimated Design Cost:	$200,000
Estimated Construction Cost:	$228,000
30 % Contingency:	$128,400
Estimated Total Cost:	$556,400
Cost per Impervious Credit Acre:	$164,130

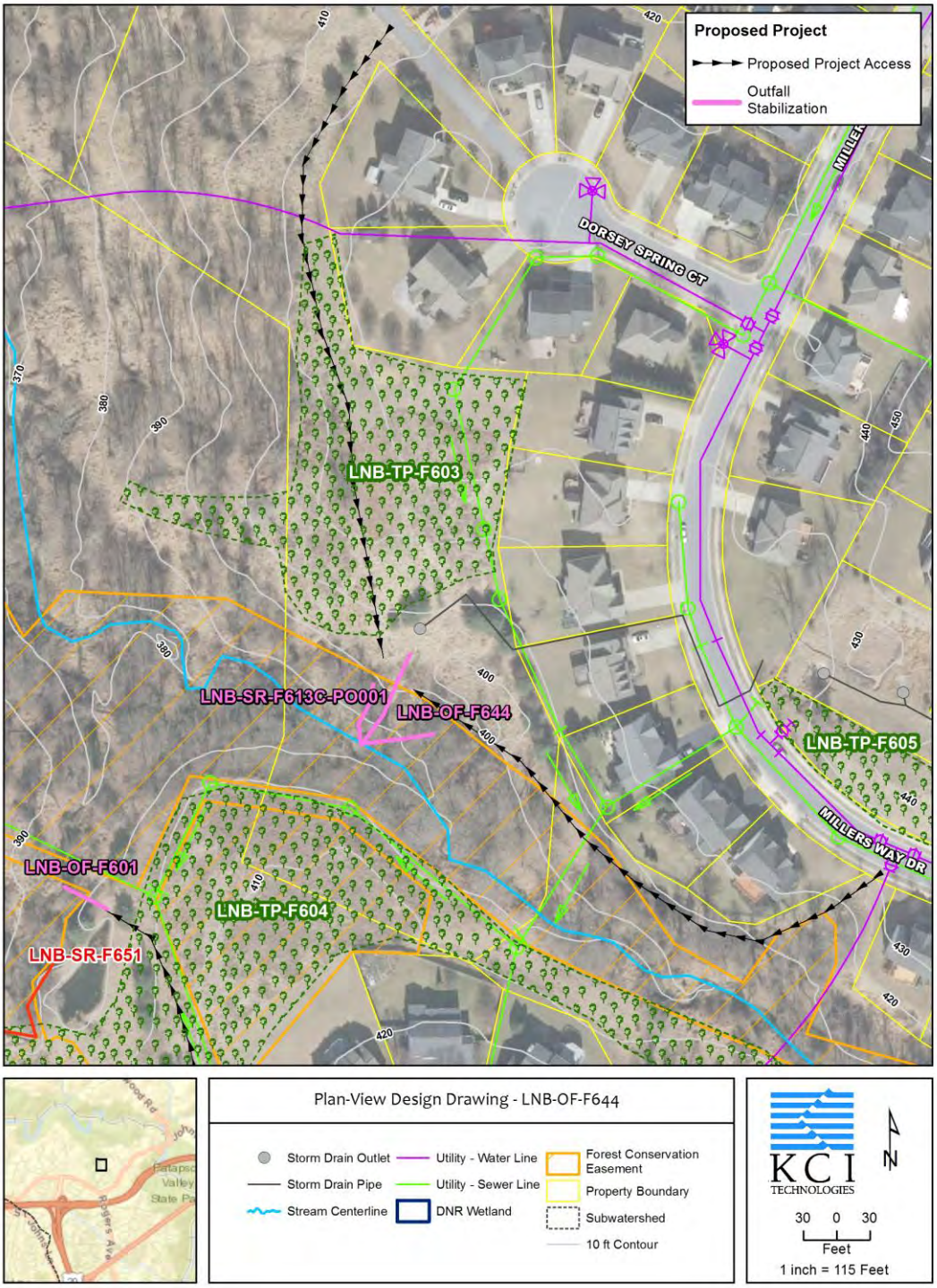
Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F644

Site Name: Millers Way A

Contractor: KCI

Watershed: Patapsco Lower North



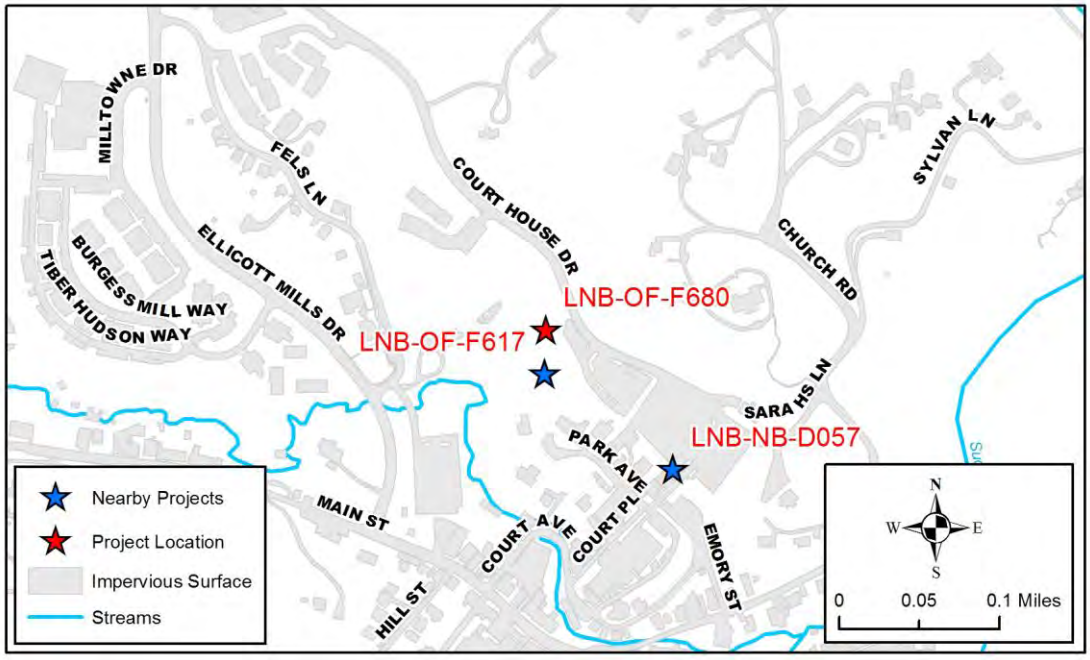
Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F680
Site Name: Courthouse Parking B
Contractor: KCI
Watershed: Patapsco Lower North

Proposed BMP Type: Outfall Stabilization
Stabilization Type: Step Pool Stormwater Conveyance
Ownership: County Owned
Single Owner

Existing Conditions:

The proposed outfall stabilization is a drainage channel originating from a parking lot curb cut in the Howard County courthouse parking lot in Ellicott City off Court House Drive. The channel is approximately 166 ft. long and has approximately 7 ft. high banks with highly erodible soils. The channel originates at the parking lot curb cut and drains down a steep slope to Hudson Branch. The site is adjacent to an active parking lot and has high public education and demonstration potential.



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F680
Site Name: Courthouse Parking B
Contractor: KCI
Watershed: Patapsco Lower North

View of curb cut in parking lot at top of eroded channel.

View facing downstream of eroded channel.

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F680
Site Name: Courthouse Parking B
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:
The site is immediately adjacent to a parking lot; however the steep slope will make access very difficult. The project would result in a moderate impact to trees.

Concept Description:
The proposed stabilization BMP is a Step Pool Storm Conveyance system (SPSC) with 13 cascades, 2 pools, and 2 riffles. The SPSC will be 8 ft. wide and span the full 166 ft. of erosion starting from the storm drain outfall.

Nearby Opportunities:
Outfall stabilization LNB-OF-F617 is immediately adjacent and is a very similar eroded channel originating at a parking lot curb cut.

Proposed Project Credit

Drainage Area (ac.):	0.38
Impervious Area within Drainage (ac.):	0.27
Impervious Area Treated (ac.):	0.38
Impervious Area Treated Credit (ac.):	0.38

Water Quality Volume

WQVolume Target (cf.):	951
Max Treated (cf.):	2,473
Percent Treated:	260%
Rainfall Depth Treated (in.):	2.6

Costs

Estimated Design Cost:	$200,000
Estimated Construction Cost:	$184,000
30 % Contingency:	$115,200
Estimated Total Cost:	$499,200
Cost per Impervious Credit Acre:	$1,313,684

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-OF-F680

Site Name: Courthouse Parking B

Contractor: KCI

Watershed: Patapsco Lower North

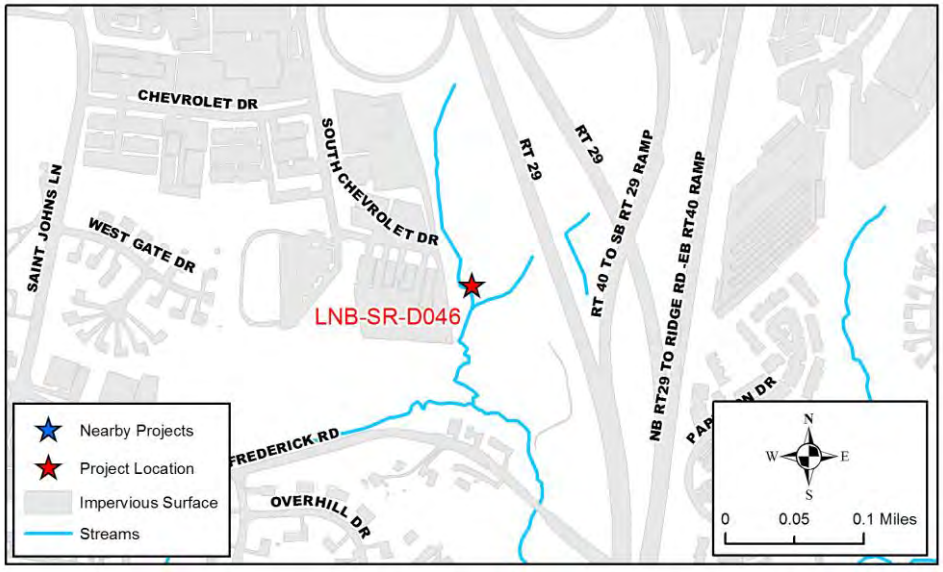
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-D046
Site Name: Tiber Branch Concept A
Contractor: KCI
Watershed: Patapsco Lower North

Ownership: Private- Mixed Use
Multiple Owners

Existing Conditions:

From Century Tiber Branch and Sucker Branch Interceptor Improvement Project, March 2016 - "This concept reach originates at an outfall under Columbia Pike (US-29) and encompasses approximately 2,000 lf. of the Tiber Branch downstream to Frederick Road. Additionally, a tributary originating at an outfall located further south along US-29 is also included as part of this concept reach. The portion of Tiber Branch within the concept reach primarily flows parallel along the BGE right-of-way. Under the existing conditions, the channel valley and drainage network has been significantly altered, leaving the channel pinned against the west hillslope and the existing sanitary sewer line. The channel has become deeply entrenched with 5 to 8 ft. banks in the upper extents before flowing behind several residential properties containing little to no riparian buffer, leading to significant bank erosion. In addition, several utilities have become exposed from both bed and bank erosion throughout the reach. A cross culvert maintained as part of the BGE right-of-way is currently perched 3 to 4 ft. above the invert of the tributary. This is likely the result of a head cut that has migrated up the tributary from the mainstem. In summary, this reach is considered to be significantly degraded, showing signs of both active bed and bank erosion with little to no regular floodplain access and multiple exposed utilities."



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-D046
Site Name: Tiber Branch Concept A
Contractor: KCI
Watershed: Patapsco Lower North

Looking downstream along Tiber Branch at typical conditions within Concept A reach (photo courtesy of Century Eng.)

Looking upstream at perched culvert where tributary enters the concept reach (photo courtesy of Century Eng.)

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-D046
Site Name: Tiber Branch Concept A
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

This concept reach is on land owned by several commercial entities, several private landowners, and is partially on BG&E right-of-way. A sewer line roughly parallels Tiber Branch, crossing under the stream three times. A BG&E power line right of way is located to the east of Tiber Branch and limits the availability of the valley bottom for design and construction. Impacts to the existing forest were rated as high, the middle portion of the concept reach is located in the only forest stand in the area requiring the removal of many trees.

Concept Description:

From the Century report - "The design approach for this reach focuses on providing regular floodplain access by reducing channel incision and creating floodplain benches. Improved planform geometry and riffle-pool sequences will both reduce in-stream sediment sources and improve ecological habitat, while protecting the sanitary sewer lines and enhancing the riparian buffer. In the mainstem, a pre-formed scour pool at the outfall would dissipate energy and floodplain benches could be graded out to reduce shear stress resulting from entrenchment. Riffle grade control structures located throughout the mainstem would protect existing/proposed utilities and prevent any future bed degradation. In the tributary, a series of rock cascade structures would provide energy dissipation and help make up the grade difference between the existing perched culvert and the mainstem. From there, a low gradient channel would connect the tributary to the mainstem. Two potential wetland creation areas would be located within existing open and low-lying areas along the reach to provide additional habitat enhancement and water quality benefits. These areas would consist of scrub-shrub wetlands within the BGE transmission right-of-way, a 20 ft. wide emergent wetland over the sanitary sewer, and forested wetlands where practicable along the stream channel. Construction access would be located off of Frederick Rd, utilizing the BGE Right-of-Way. These proposed improvements would provide long-term stability for the existing/proposed utilities and reduce sediment/nutrient loads to downstream reaches."

Nearby Opportunities:

LNB-SR-F621C

Proposed Project Credit		Costs	
Length Restored (ft):	2,129	Estimated Design Cost:	$300,000.00
Impervious Area Treated Credit (ac.):	21.29	Estimated Construction Cost:	$958,050.00
Cost per Impervious Credit Acre:	$76,818	30% Contingency:	$377,415.00
		Estimated Total Cost:	$1,635,465.00

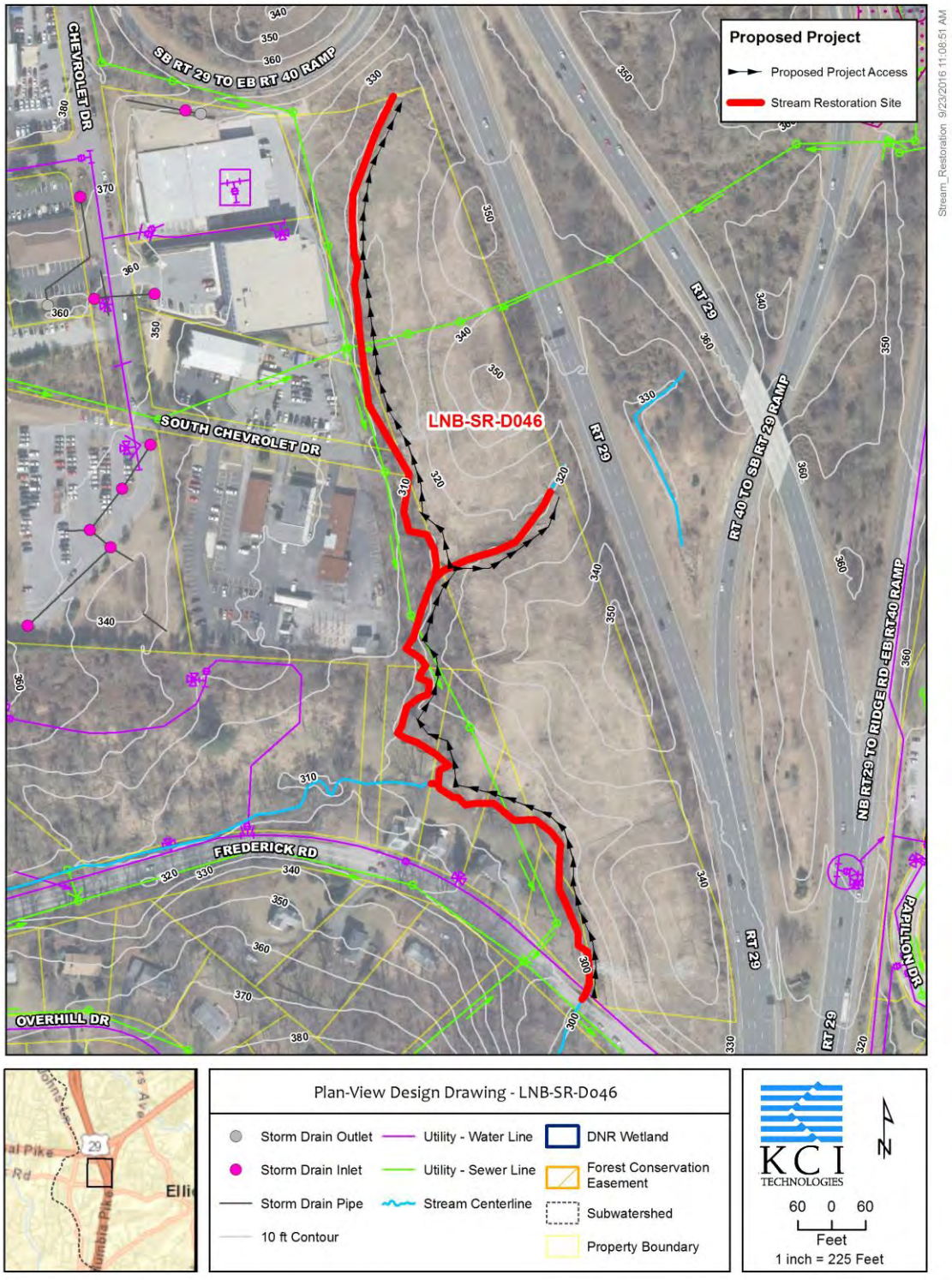
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-D046

Site Name: Tiber Branch Concept A

Contractor: KCI

Watershed: Patapsco Lower North



Plan-View Design Drawing - LNB-SR-D046

- Storm Drain Outlet
- Storm Drain Inlet
- Storm Drain Pipe
- 10 ft Contour
- Utility - Water Line
- Utility - Sewer Line
- Stream Centerline
- DNR Wetland
- Forest Conservation Easement
- Subwatershed
- Property Boundary

KCI TECHNOLOGIES

N

60 0 60

Feet

1 inch = 225 Feet

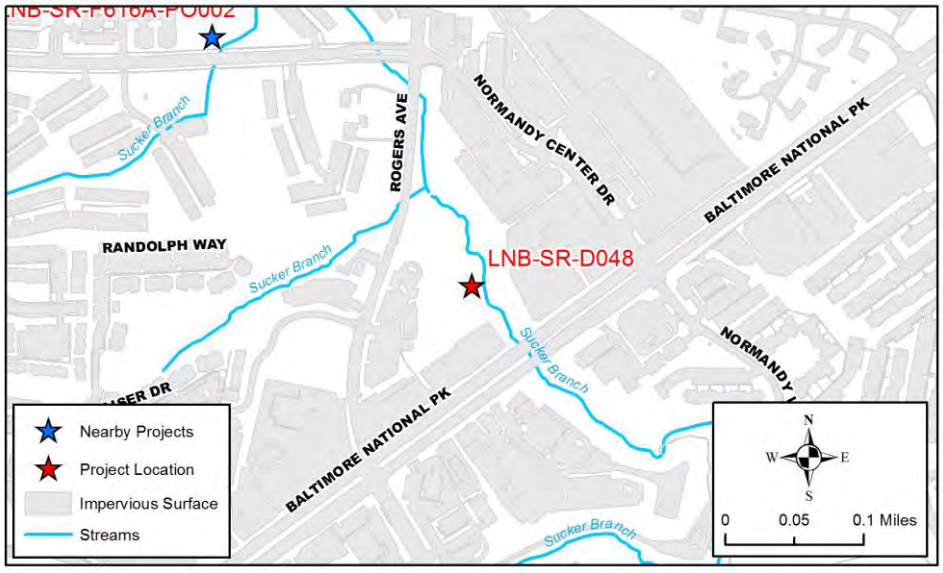
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-D048
Site Name: Sucker Branch Concept B
Contractor: KCI
Watershed: Patapsco Lower North

Ownership: Private- Commerical/Industrial
MultipleOwners

Existing Conditions:

From Century Tiber Branch and Sucker Branch Interceptor Improvement Project, March 2016 - "This reach begins approximately 600 lf. downstream of Rogers Avenue along Sucker Branch and continues to flow south approximately 450 lf. before entering a culvert under Baltimore National Pike (MD 40). This concept reach also includes two tributaries that originate at stormwater outfalls along both the left and right banks, totaling 400 lf. While the left bank within this reach appears to have been previously stabilized with MDSHA Class II riprap to protect the existing sanitary sewer line, the right bank continues to exhibit signs of lateral migration. The formation of several mid-channel bars within this vicinity indicates that the culverts are likely incapable of freely passing large storm events, thus resulting in backwater conditions and sediment depositions just upstream. Both of the tributaries show signs of active down-cutting, as headcuts continue to migrate up from mainstem to the perched outfalls. Specifically, Tributary 2 located along the right bank floodplain has begun to drain the adjacent wetland system and will likely continue to reduce the available hydrology for this system."



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-D048
Site Name: Sucker Branch Concept B
Contractor: KCI
Watershed: Patapsco Lower North

View of typical conditions along Sucker Branch within the concept reach (photo courtesy of Century Eng.)

View looking upstream within Tributary 2 (photo courtesy of Century Eng.)

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-D048
Site Name: Sucker Branch Concept B
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

This concept reach is on land owned by several commercial entities. A sewer line roughly parallels Sucker Branch to the east, and may cross under the stream at the downstream end of the concept reach. Impacts to the existing forest were rated as high, the entire concept reach is located in a forest stand, requiring the removal of many trees for access and construction.

Concept Description:

From the Century report - "The Concept B design approach focuses on preventing further bank erosion, stabilizing the adjacent outfalls/tributaries, and improving water quality by restoring and enhancing the adjacent wetland system. The right bank of Sucker Branch could be graded and protected with imbricated stone to prevent any future lateral migration. This hard armoring technique will help protect the bank as the thalweg of the channel continues to shift from side to side due to post-storm event sediment deposition. The invert of Tributary 1 along the left bank could be raised, filling the existing head cut channel before dropping the flows back down to the elevation of the mainstem utilizing a stabilized stone outfall structure. Tributary 2 along the right bank would initially utilize a pre-formed scour pool to dissipate energy downstream of the outfall before flow enters a series of rock cascades down to the elevation of the existing floodplain. Flow will then be routed along a low gradient pilot channel through the enhanced/restored wetland system to provide increased hydrology before entering a stabilized stone outfall structure that will drain into the mainstem. Flow from the low gradient channel will have access to the floodplain and provide increased hydrology to the existing wetland system. Construction access and stockpile area will be located off of Rogers Avenue, following an existing sanitary sewer right-of-way and utilizing a temporary bridge to allow access to the left floodplain of Sucker Branch."

Nearby Opportunities:

None recommended

Proposed Project Credit		Costs	
Length Restored (ft):	823	Estimated Design Cost:	$200,000.00
Impervious Area Treated Credit (ac.):	8.23	Estimated Construction Cost:	$370,350.00
Cost per Impervious Credit Acre:	$90,092	30% Contingency:	$171,105.00
		Estimated Total Cost:	$741,455.00

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-D048

Site Name: Sucker Branch Concept B

Contractor: KCI

Watershed: Patapsco Lower North

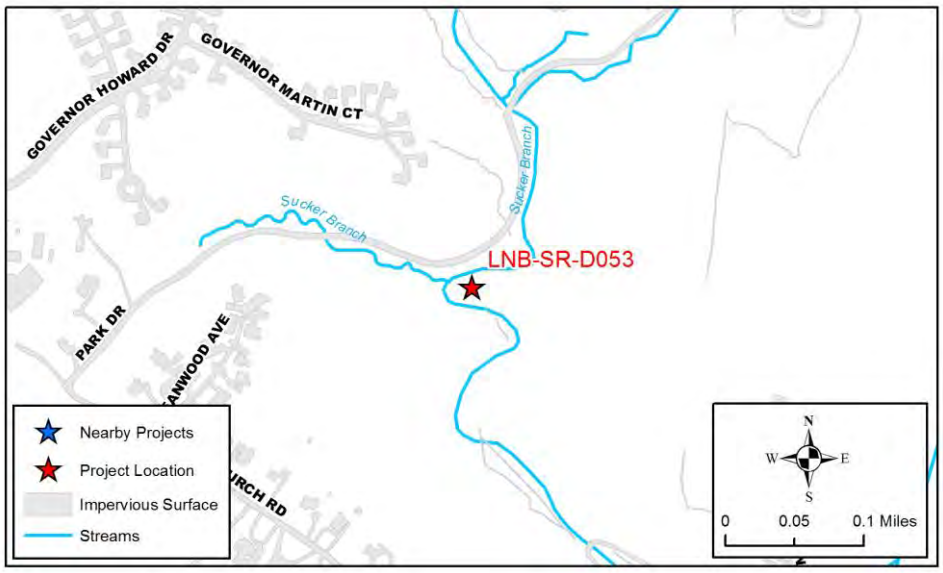
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-D053
Site Name: Sucker Branch Concept E
Contractor: KCI
Watershed: Patapsco Lower North

Ownership: County Owned
Multiple Owners

Existing Conditions:

From Century Tiber Branch and Sucker Branch Interceptor Improvement Project, March 2016 - "The Concept E reach is located adjacent to Park Drive where an unnamed tributary flows into Sucker Branch. This approximately 415 lf. reach is located along Sucker Branch within a compressed meander bend. Here, a large steep point bar has formed as a result of the planform geometry within the valley, forcing flows into the right bank and creating a raw vertical 5 to 6 ft. bank along the outside of the meander bend. Within this meander bend, an unnamed tributary to Sucker Branch enters along the right bank, cascading 4 to 5 ft. to the channel invert of the mainstem. While grade within the tributary is currently being held by existing tree roots, there is a likely potential that a headcut will begin to develop, leading to considerable bed and bank erosion."



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-D053
Site Name: Sucker Branch Concept E
Contractor: KCI
Watershed: Patapsco Lower North

View of Sucker Branch facing downstream from tributary confluence (photo courtesy of Century Eng.)

View of tributary perched on right bank of Sucker Branch (photo courtesy of Century Eng.)

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-D053
Site Name: Sucker Branch Concept E
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

A sewer line crosses under the stream at both the downstream and upstream ends of the concept reach. Impacts to the existing forest were rated as high because the entire concept reach is located in a forest stand. This will require the removal of many trees for access and construction.

Concept Description:

From the Century report - "The design approach for this reach would focus on stabilizing the right bank of Sucker Branch and preventing the tributary from head cutting up the valley. An imbricated riprap wall could be installed along the right bank to stabilize the meander bend and prevent further bank erosion, while an imbricated stone drop structure could be utilized to safely convey flows from the tributary to the mainstem and prevent any potential headcuts from migrating up the tributary. The existing point bar in this reach would also be removed to provide temporary sediment storage during future storm events. Construction access and stockpile area will be located off of Park Drive."

Nearby Opportunities:

None recommended

Proposed Project Credit		Costs	
Length Restored (ft):	415	Estimated Design Cost:	$200,000.00
Impervious Area Treated Credit (ac.):	4.15	Estimated Construction Cost:	$186,750.00
Cost per Impervious Credit Acre:	$121,151	30% Contingency:	$116,025.00
		Estimated Total Cost:	$502,775.00

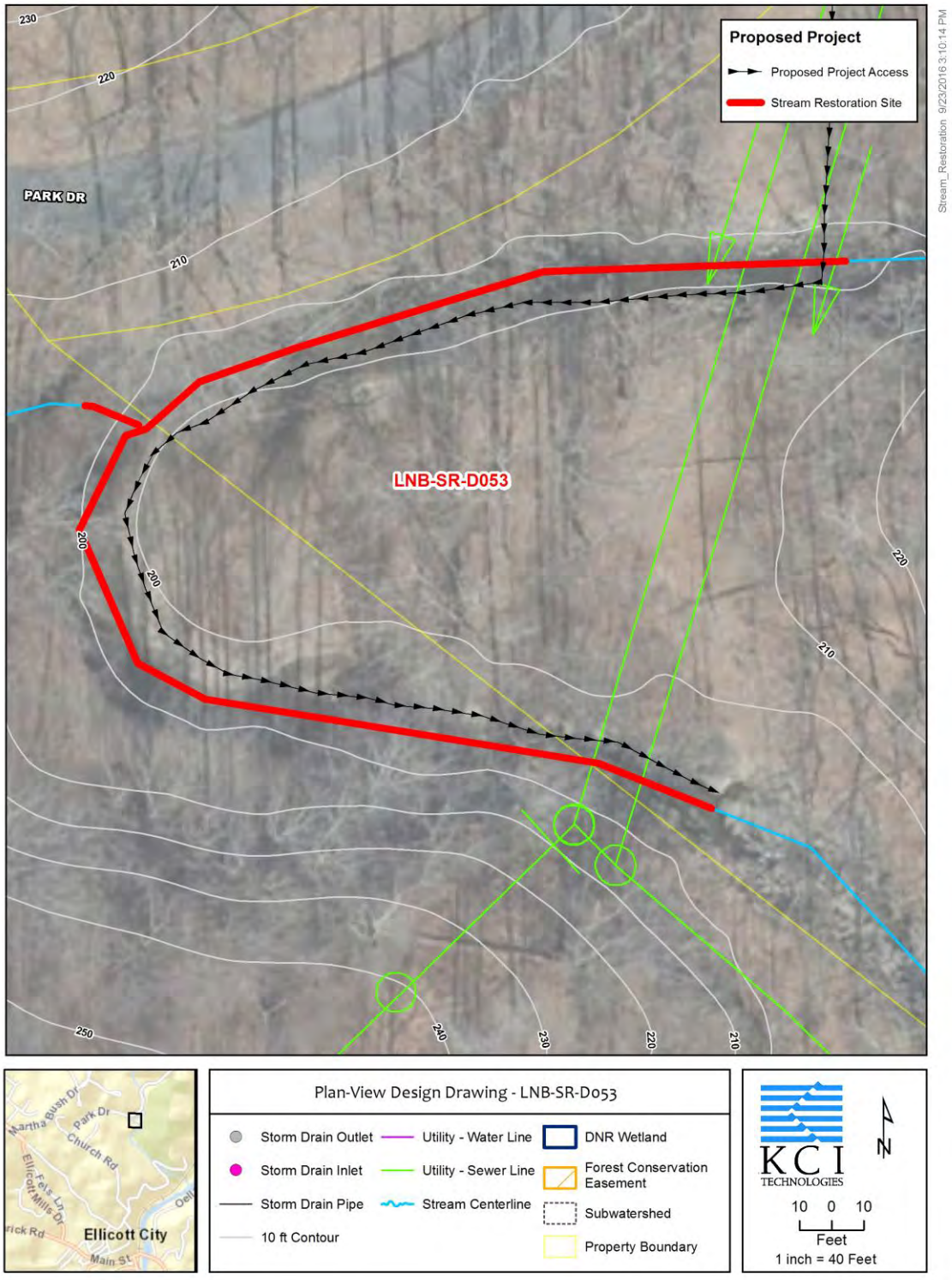
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-D053

Site Name: Sucker Branch Concept E

Contractor: KCI

Watershed: Patapsco Lower North



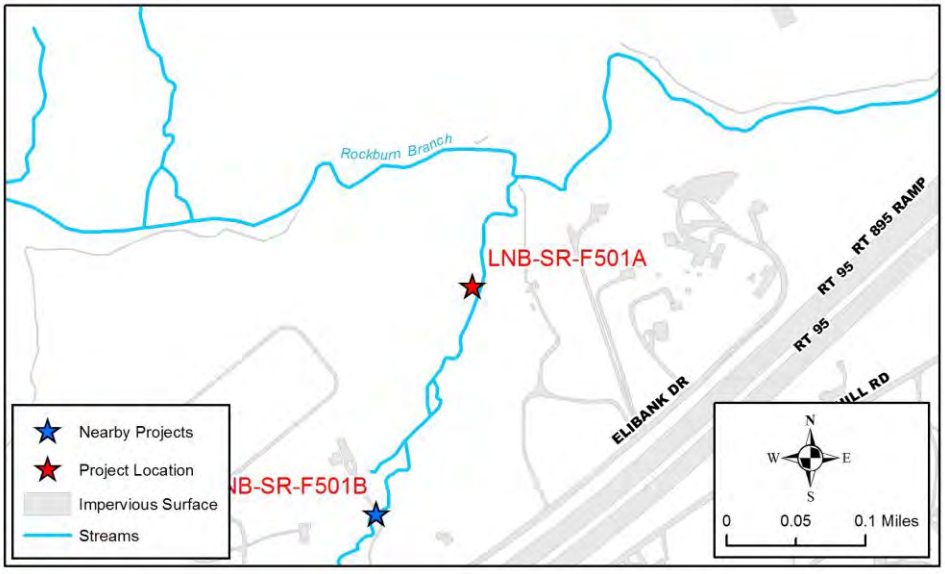
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F501A
Site Name: Elibank Drive A
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Ownership: Private- Commerical/Industrial
Multiple Owners

Existing Conditions:

The site is located on forested agriculture and church property. The downstream extent of the site begins at the confluence with Rockburn Branch and the upstream extent ends as the stream enters an entirely forested floodplain condition. The majority of the channel is experiencing moderate to severe bank erosion. The eroding portions of the channel exhibit nearly vertical banks with heights of 3 to 7 ft., low root density and surface protection, and a primary material of silt. An old concrete culvert is causing a stream blockage and fish passage issue. The site appears to have been historically straightened. In-stream habitat is lacking, with high amounts of fine sediment and embeddedness in the system, inadequate diversity and cover, and low bank stability. Bed substrate is primarily gravel, sand, and silt. Riparian buffer is severely lacking on the right bank due to adjacent property mowing.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F501A
Site Name: Elibank Drive A

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Erosion at the downstream extent of the site.

Typical erosion and lack of right bank riparian buffer.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F501A
Site Name: Elibank Drive A
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include private property ownership, access, and wetlands.

Concept Description:

The proposed project consists of 1,010 lf. of the tributary to Rockburn Branch. The project goal is to increase in-stream habitat, floodplain connectivity, and decrease erosion through the creation of stable channel dimensions, restoration of natural channel sinuosity, and bank stabilization treatments. The addition of terraced bench features and in-channel woody debris will increase floodplain deposition of fine sediment, improve in-stream cover, aid in diversification of stream features, reduce risk of erosion, and increase uplift potential. Removal of abandoned concrete culverts and stabilization of the channel bed is recommended. Establishment of a riparian buffer is proposed on the agricultural property. Access is proposed through private property from Elibank Drive. Two proposed stream restoration projects upstream of this site can be implemented concurrently to reduce costs and increase efficiency.

Nearby Opportunities:

LNB-SR-F501B, LNB-SR-F501D

Proposed Project Credit		Costs	
Length Restored (ft):	1,010	Estimated Design Cost:	$200,000
Impervious Area Treated Credit (ac.):	10.1	Estimated Construction Cost:	$454,500
Cost per Impervious Credit Acre:	$84,243	30% Contingency:	$196,350
		Estimated Total Cost:	$850,850

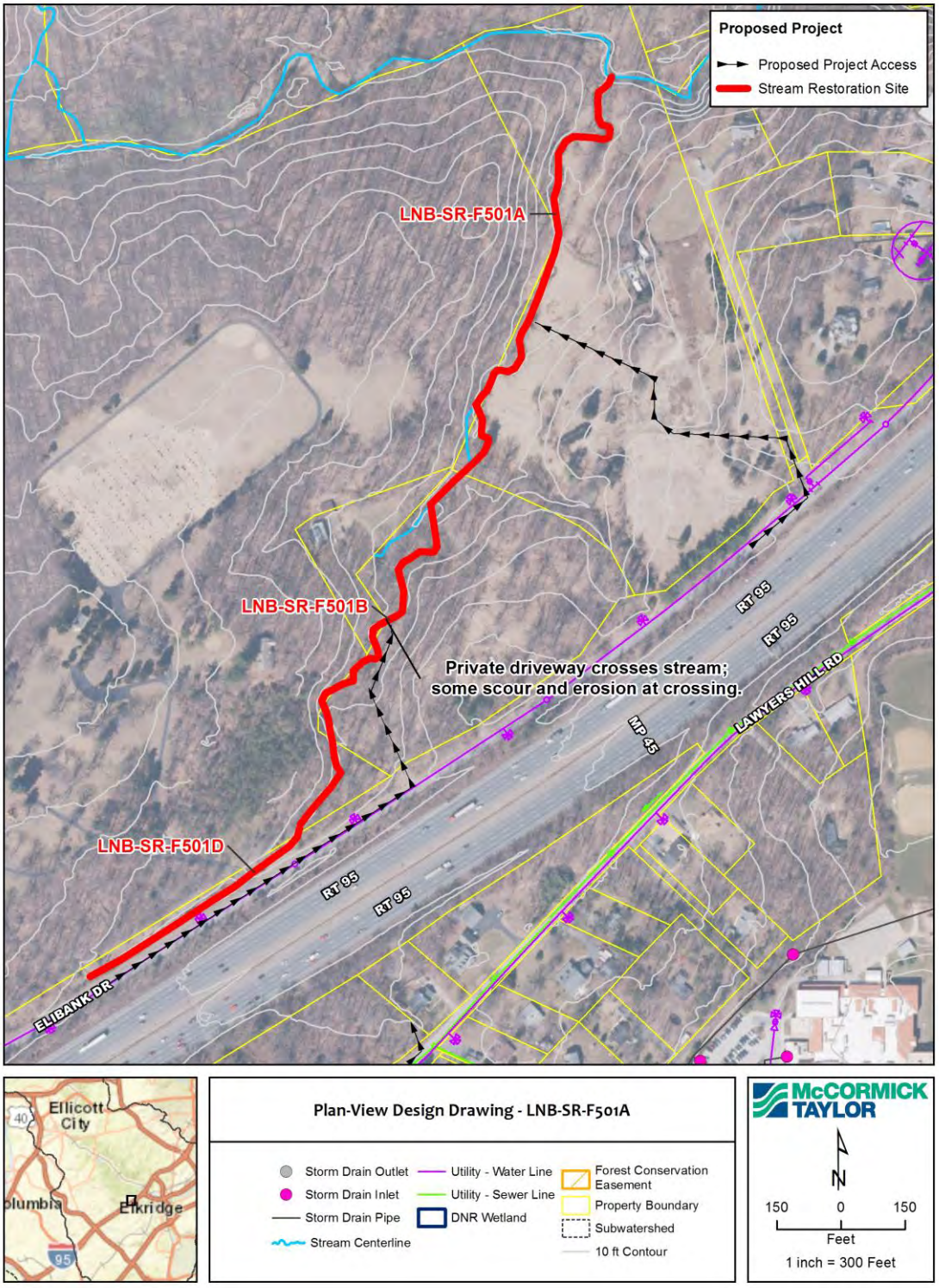
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F501A

Site Name: Elibank Drive A

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



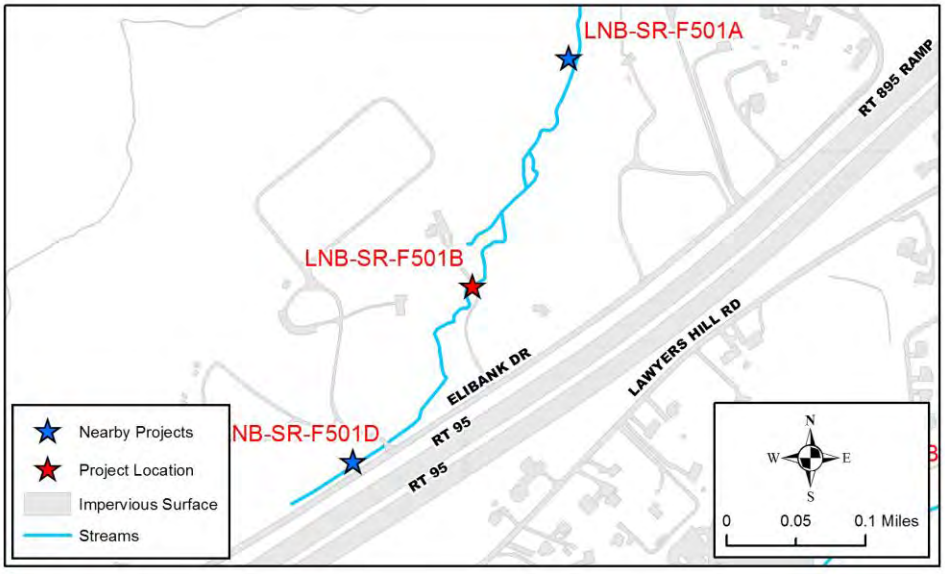
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F501B
Site Name: Elibank Drive B
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Ownership: Private- Mixed Use
Multiple Owners

Existing Conditions:

The site is located on forested residential and church property. The downstream extent of the site begins as the stream enters an entirely forested floodplain condition and the upstream extent ends at riprap and concrete channelization. The channel is experiencing localized spots of moderate bank erosion and bed headcutting over approximately 30% of the reach. The eroding portions of the channel exhibit nearly vertical banks with heights of 3 to 9 ft., low to moderate root density and surface protection, and a primary material of silt. Two 90 degree headcuts with 2 ft. of drop occur through the site. Broken concrete is located in the channel associated with a driveway crossing. There is evidence of an overflow connection to a small tributary. In-stream habitat is lacking, with high amounts of sediment and embeddedness in the system, inadequate diversity and cover, and moderate bank stability. Bed substrate is primarily gravel and sand. Riparian buffer is good throughout the site.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F501B
Site Name: Elibank Drive B

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Low to moderate erosion, poor in-stream habitat, and forested banks typical of this site.

Moderate erosion at the downstream extent of the site.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F501B
Site Name: Elibank Drive B
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include private property ownership, access, and impacts to existing trees.

Concept Description:

The proposed project consists of 1,247 lf. of the tributary to Rockburn Branch. The project goal is to increase in-stream habitat, floodplain connectivity, and decrease erosion through the creation of stable channel dimensions and spot treatments of bed and bank erosion. The addition of terraced bench features and in-channel woody debris will increase floodplain deposition of fine sediment, improve in-stream cover, aid in diversification of stream features, reduce risk of erosion, and increase uplift potential. Removal of broken concrete and stabilization of the driveway crossing is recommended. Access is proposed through private property from Elibank Drive. Two proposed stream restoration projects upstream and downstream of this site can be implemented concurrently to reduce costs and increase efficiency.

Nearby Opportunities:

LNB-SR-F501A, LNB-SR-F501D

Proposed Project Credit		Costs	
Length Restored (ft):	1,247	Estimated Design Cost:	$300,000
Impervious Area Treated Credit (ac.):	12.5	Estimated Construction Cost:	$561,150
Cost per Impervious Credit Acre:	$89,775	30% Contingency:	$258,345
		Estimated Total Cost:	$1,119,495

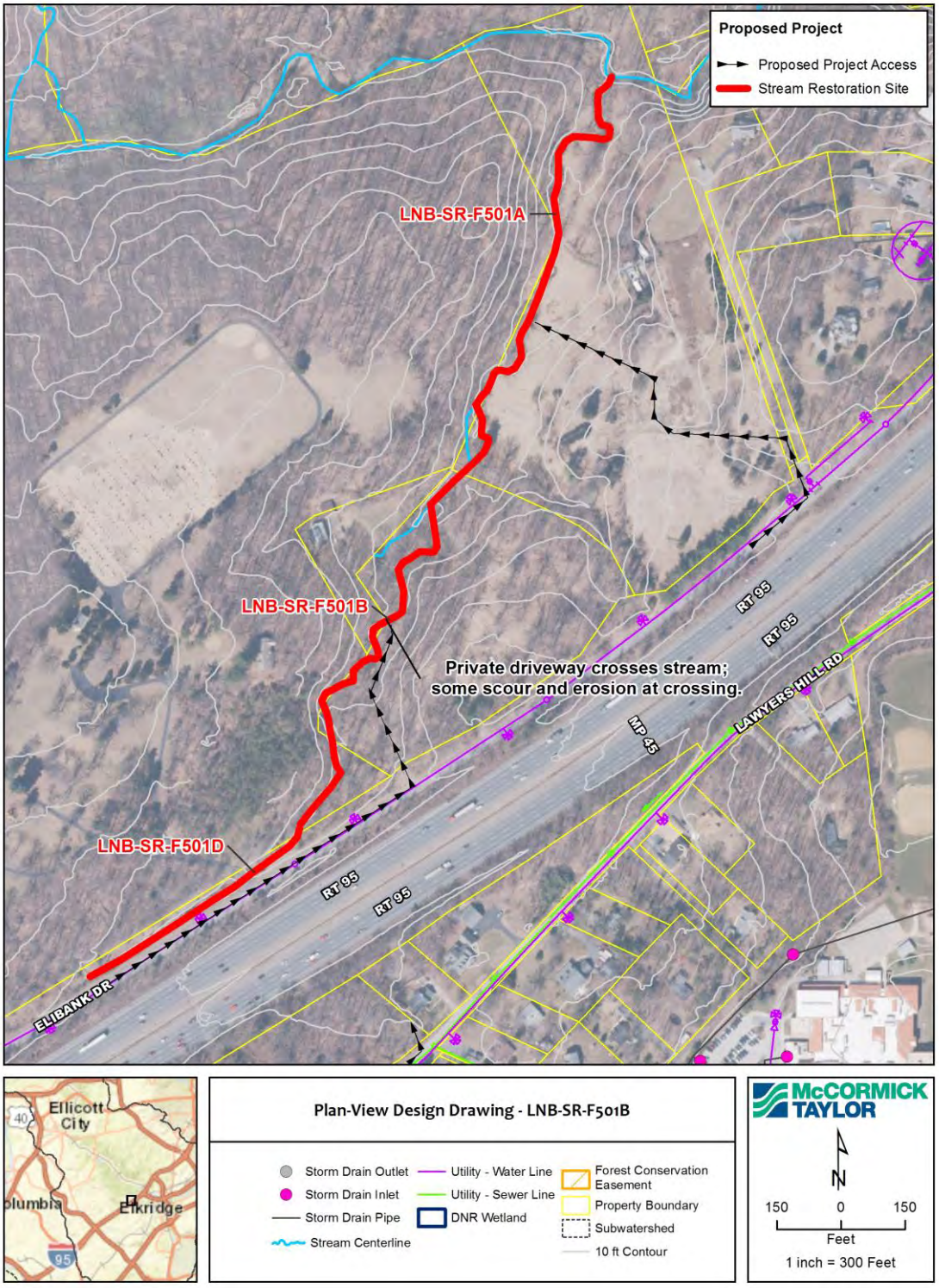
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F501B

Site Name: Elibank Drive B

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



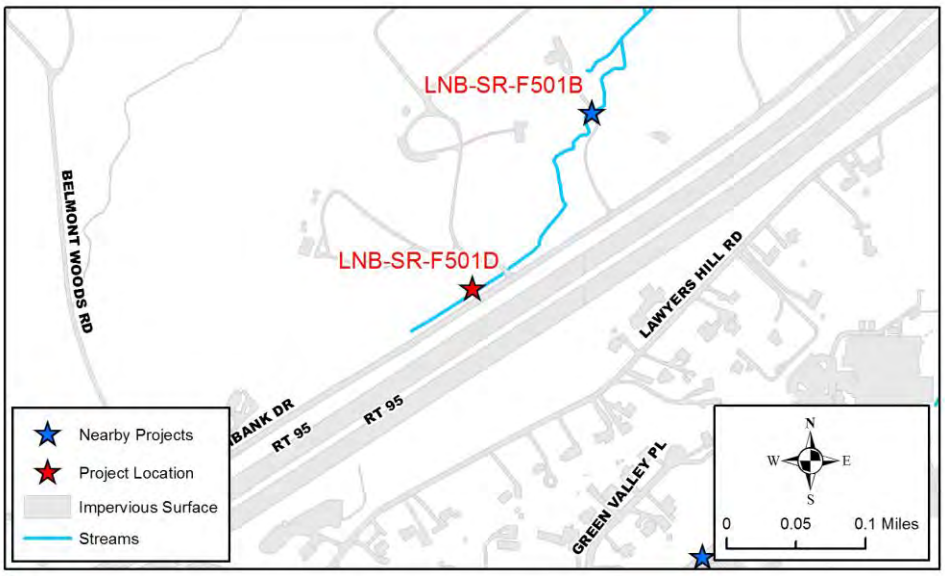
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F501D
Site Name: Elibank Drive D
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Ownership: County Owned
Multiple Owners

Existing Conditions:

The site is located primarily on county property, with portions of the left bank and floodplain within forested church property. The downstream extent of the site begins as the stream is channelized adjacent to Elibank Drive and the upstream extent ends at the Elibank Drive culvert. The channel has been straightened and lined on both the bed and banks by riprap at the downstream extent and concrete through the remainder of the site. Instream habitat is minimal, although some sediment has been deposited into the channel and wetland vegetation grows within portions of the concrete. Erosion is not present, due to the extent of channelization. The bed is approximately 10 ft. wide. Riparian buffer is entirely lacking on the right bank due to the adjacent roadway.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F501D
Site Name: Elibank Drive D

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Concrete channelization with wetland vegetation.

Concrete and riprap channelization at downstream extent of site.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F501D
Site Name: Elibank Drive D
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include private property ownership and access.

Concept Description:

The proposed project consists of 607 lf. of the tributary to Rockburn Branch. The project goal is to increase in-stream habitat, floodplain connectivity, and nutrient processing through concrete and riprap removal. Restoration of natural channel bed material and a natural sinuous pattern to the stream will aid in the diversification of stream features, reduce slope and velocities, and increase uplift potential. Relocating the stream away from the road where possible will reduce stress on the roadway embankment and allow for the establishment of a riparian buffer. Access is proposed off Elibank Drive. Two proposed stream restoration projects downstream of this site can be implemented concurrently to reduce costs and increase efficiency.

Nearby Opportunities:

LNB-SR-F501A, LNB-SR-F501B

Proposed Project Credit		Costs	
Length Restored (ft):	607	Estimated Design Cost:	$200,000
Impervious Area Treated Credit (ac.):	6.07	Estimated Construction Cost:	$273,150
Cost per Impervious Credit Acre:	$101,334	30% Contingency:	$141,945
		Estimated Total Cost:	$615,095

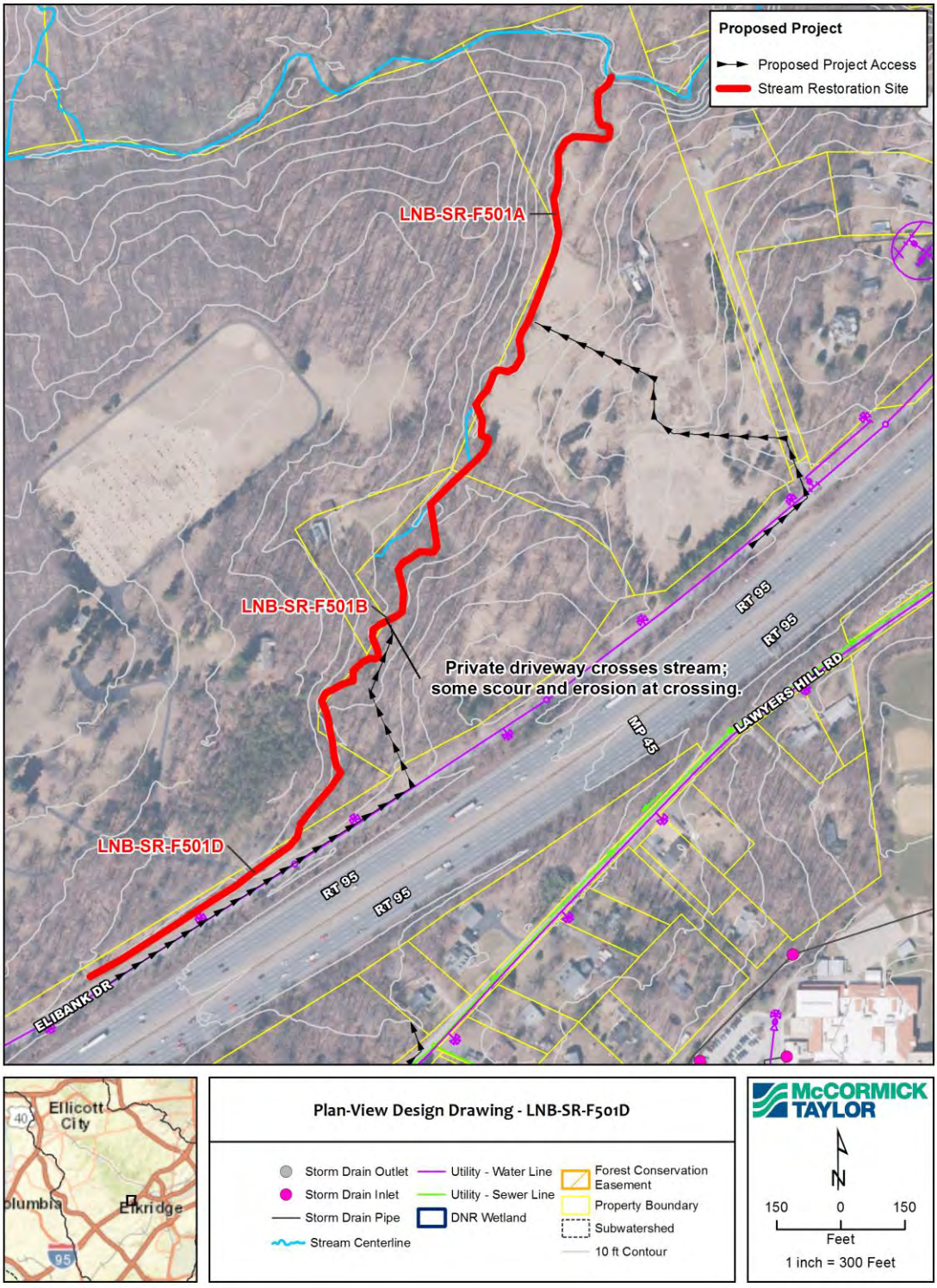
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F501D

Site Name: Elibank Drive D

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



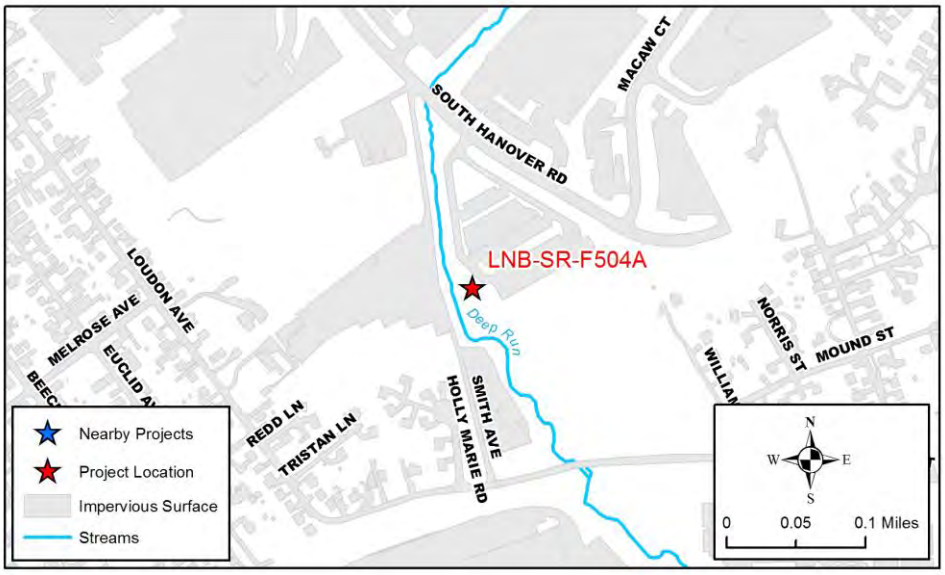
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F504A
Site Name: Smith Avenue
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Ownership: Private- Commerical/Industrial
Multiple Owners

Existing Conditions:

The site is located on private commercial and State Highway Administration mitigation property. The downstream extent of the site begins downstream of the Loudon Avenue roadway protection and the upstream extent ends at the South Hanover Road culvert. Tall shear clay banks threaten a private road and parking lot. The majority of the channel is experiencing moderate to severe bank erosion. The eroding portions of the channel exhibit moderate to nearly vertical banks with heights of 6 to 16 ft., very low to moderate root density and surface protection, and a primary material of silt. Sloughing of gravel and pavement materials from adjacent parking lots is evident along the right bank. Numerous pipes outfall directly into the channel and have disconnected from their end sections due to downcutting. Riprap bed and bank protection is common along utilities and riprap and asphalt is found in locations of failing banks. The upstream extent of the site has been straightened. In-stream habitat is lacking, with high embeddedness in the system, inadequate diversity and cover, and low bank stability. Bed substrate is primarily gravel, sand, and silt. Refuse is extensive. Riparian buffer is lacking along both banks at the upstream extent due to adjacent commercial properties.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F504A
Site Name: Smith Avenue
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Typical erosion threatening private road.

Riprap stabilization and disconnected outfall end section.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F504A
Site Name: Smith Avenue
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include private property ownership, access, utility crossings, wetlands, and impacts to existing trees or forest areas. SHA mitigation on the same property will be a constraint.

Concept Description:

The proposed project consists of 1,541 lf. of Deep Run. The project goal is to decrease erosion and protect existing infrastructure through bank stabilization treatments. Due to extensive constraints and poor water quality, in-stream habitat is not expected to significantly improve. Removal of asphalt stabilization and outfall end sections is recommended. Access is proposed from South Hanover Road and Loudon Avenue through private commercial and State Highway property.

Nearby Opportunities:

None recommended.

Proposed Project Credit		Costs	
Length Restored (ft):	1,541	Estimated Design Cost:	$300,000
Impervious Area Treated Credit (ac.):	15.4	Estimated Construction Cost:	$693,450
Cost per Impervious Credit Acre:	$83,808	30% Contingency:	$298,035
		Estimated Total Cost:	$1,291,485

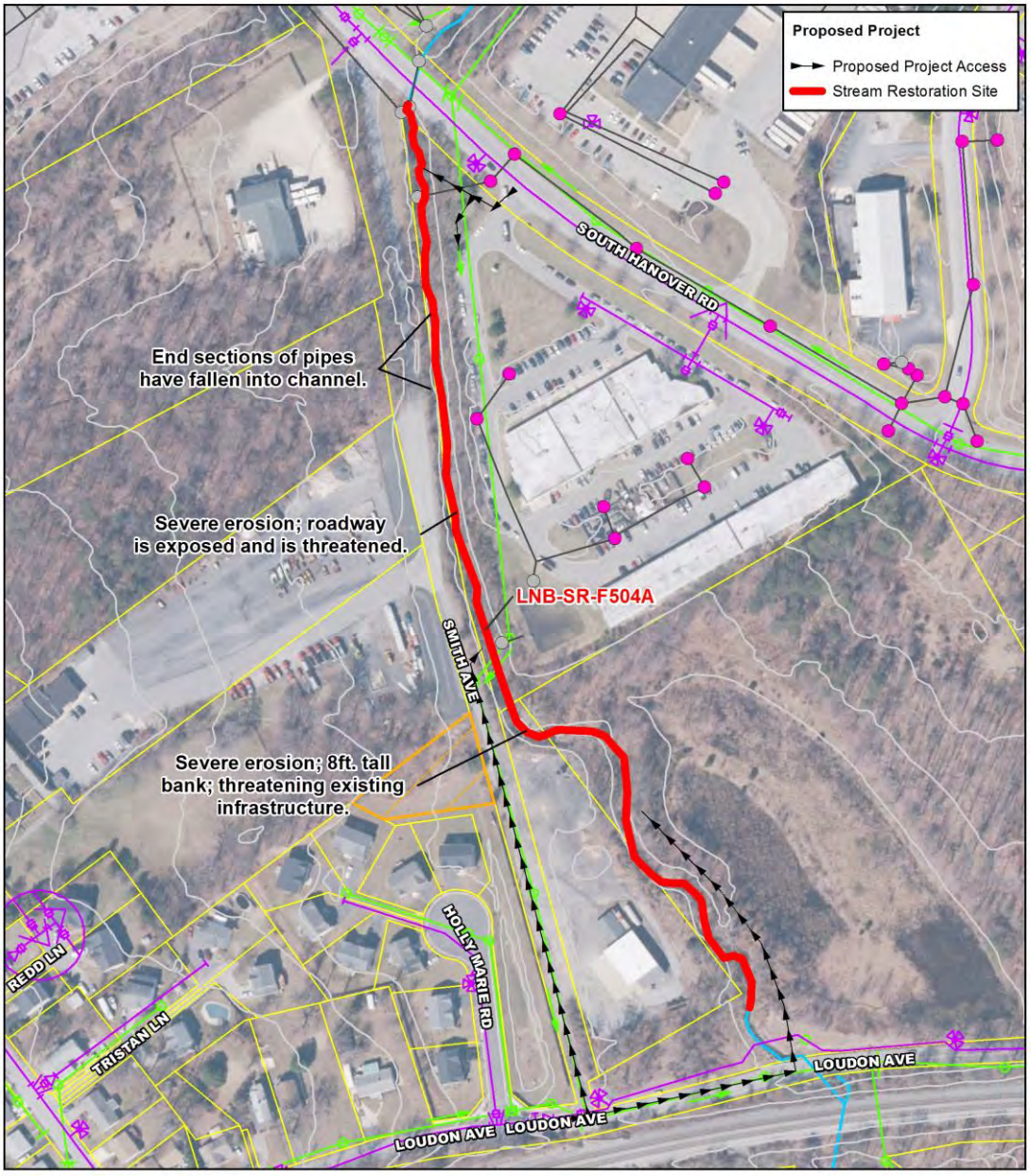
Howard County Watershed Assessment Concept Plan: Stream Restoration

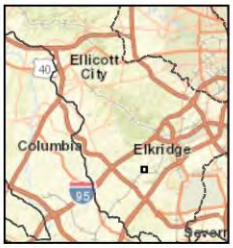
Site ID: LNB-SR-F504A

Site Name: Smith Avenue

Contractor: McCormick Taylor

Watershed: Patapsco Lower North





Plan-View Design Drawing - LNB-SR-F504A

- Storm Drain Outlet
- Storm Drain Inlet
- Storm Drain Pipe
- Stream Centerline
- Utility - Water Line
- Utility - Sewer Line
- DNR Wetland
- Forest Conservation Easement
- Property Boundary
- Subwatershed
- 10 ft Contour

McCORMICK TAYLOR

N

100 0 100

Feet

1 inch = 200 Feet

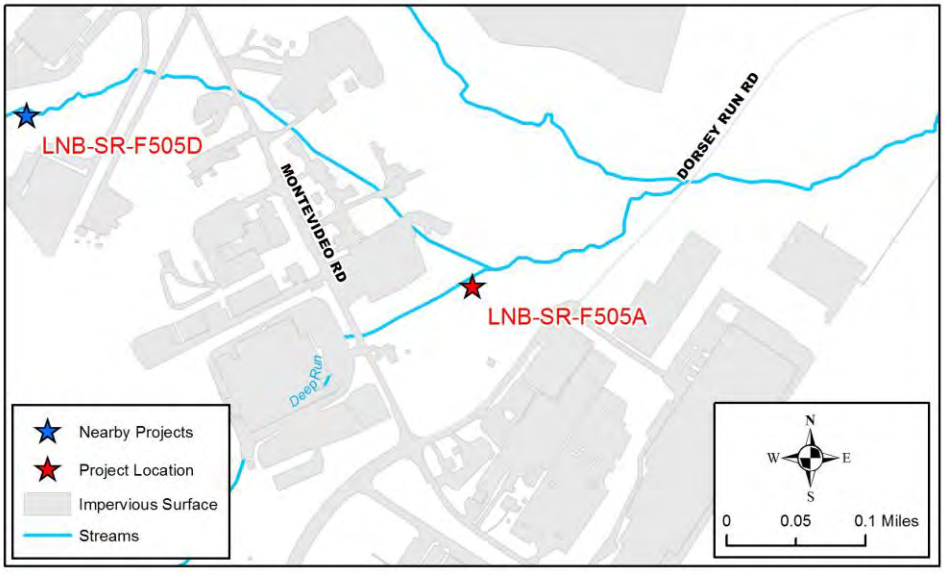
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F505A
Site Name: Montevideo Road
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Ownership: Private- Mixed Use
Multiple Owners

Existing Conditions:

The site is located on forested private commercial and residential property. The downstream extent of the site begins downstream of the downcutting portion of channel and the upstream extent ends at the Montevideo Road culvert. Low to moderate erosion extends the length of both banks throughout much of the site. The eroding portions of the channel exhibit moderate to nearly vertical banks with heights of 3 to 5 ft., moderate root density, low surface protection, and a primary material of clay. Dumping is present in the floodplain and a broken residential sewer connection is located in the stream. The upstream extent of the site has been straightened. The concrete apron at the Montevideo Road is threatened by scour. Moderate in-stream habitat is present, with the substrate slightly embedded, moderate in-stream diversity and cover, and low bank stability. Bed substrate is primarily gravel. Riparian buffer is good throughout the site.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F505A
Site Name: Montevideo Road
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Typical erosion throughout project site.

Montevideo Road undercut concrete apron.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F505A
Site Name: Montevideo Road
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include private property ownership, access, utilities, existing forest conservation easements, and impacts to existing trees.

Concept Description:

The proposed project consists of 953 lf. of an unnamed tributary to Deep Run. The project goal is to increase in-stream habitat, floodplain connectivity, and decrease erosion through the creation of stable channel dimensions, restoration of natural channel sinuosity, and bank stabilization treatments. The addition of terraced bench features and in-channel woody debris will increase floodplain deposition of fine sediment, improve in-stream cover, aid in diversification of stream features, reduce risk of erosion, and increase uplift potential. Access is proposed through private property from Montevideo Road and Dorsey Run Road.

Nearby Opportunities:

None recommended.

Proposed Project Credit		Costs	
Length Restored (ft):	953	Estimated Design Cost:	$200,000
Impervious Area Treated Credit (ac.):	9.53	Estimated Construction Cost:	$428,850
Cost per Impervious Credit Acre:	$85,782	30% Contingency:	$188,655
		Estimated Total Cost:	$817,505

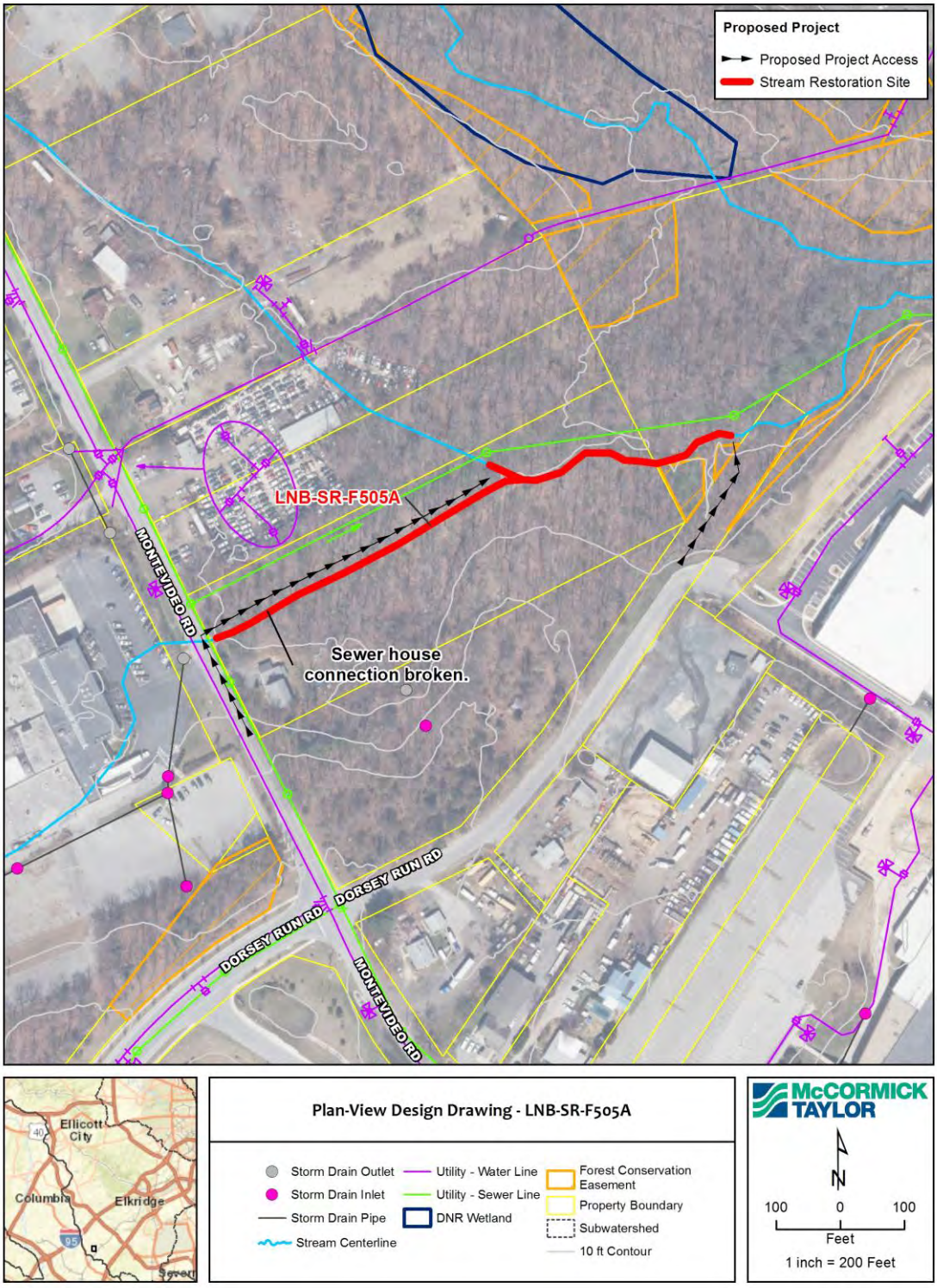
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F505A

Site Name: Montevideo Road

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



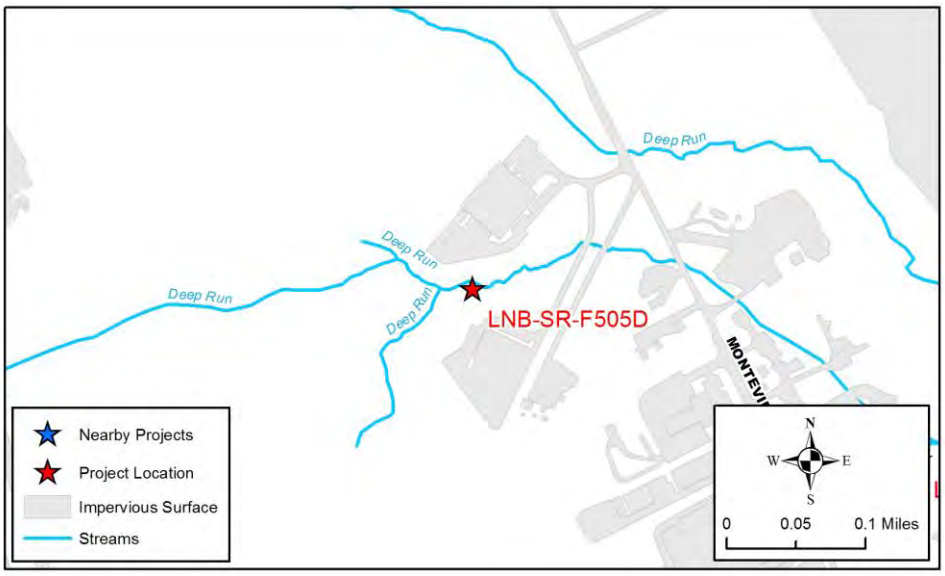
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F505D
Site Name: Montevideo Road North
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Ownership: Private- Commerical/Industrial
Single Owner

Existing Conditions:

The site is located on private commercial property within a forest conservation easement. The downstream extent of the site begins downstream of the eroding portion of channel and the upstream extent ends at state correctional property, although erosion extends upstream of the property line. Almost the entire length of both banks within site limits are experiencing moderate to severe erosion. The eroding portions of the channel exhibit nearly vertical banks with heights of 4 to 5 ft., moderate root density, low to moderate surface protection, and a primary material of clay. In-stream habitat is lacking, with the substrate highly embedded, low in-stream diversity and cover, and low bank stability. Bed substrate is primarily sand and gravel.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F505D
Site Name: Montevideo Road North
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Typical erosion on both banks.

Typical erosion on both banks.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F505D
Site Name: Montevideo Road North
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include private property ownership, access, existing forest conservation easements, and impacts to existing trees.

Concept Description:

The proposed project consists of 616 lf. of an unnamed tributary to Deep Run. The project goal is to increase in-stream habitat, regulate floodplain connectivity, and decrease erosion through the creation of stable channel dimensions and profile and bank stabilization treatments. The addition of terraced bench features and in-channel woody debris will increase floodplain deposition of fine sediment, improve in-stream cover, aid in diversification of stream features, reduce risk of erosion, and increase uplift potential. Access is proposed through Soccer Dome property.

Nearby Opportunities:

None recommended.

Proposed Project Credit		Costs	
Length Restored (ft):	616	Estimated Design Cost:	$200,000
Impervious Area Treated Credit (ac.):	6.16	Estimated Construction Cost:	$277,200
Cost per Impervious Credit Acre:	$100,708	30% Contingency:	$143,160
		Estimated Total Cost:	$620,360

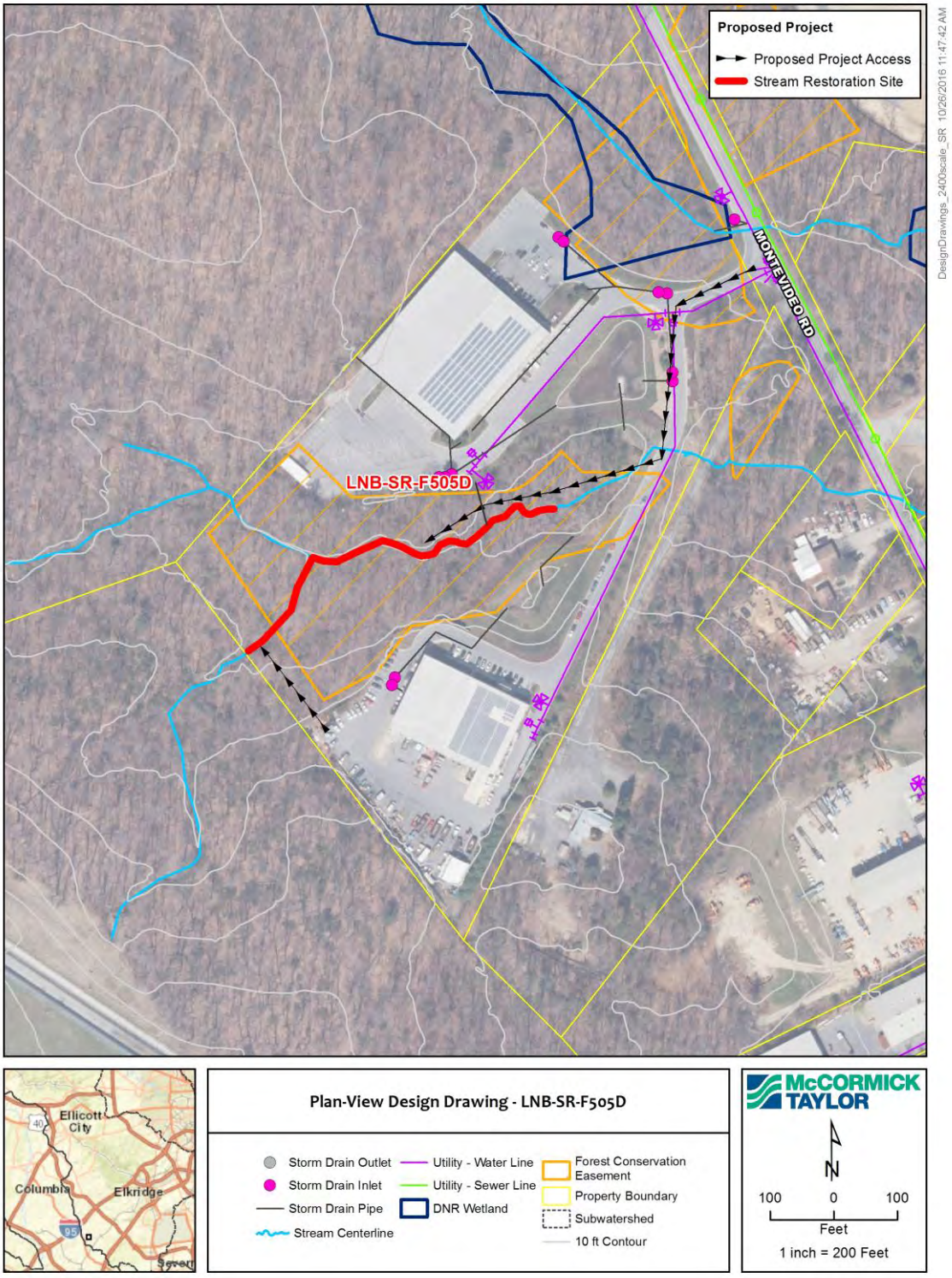
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F505D

Site Name: Montevideo Road North

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



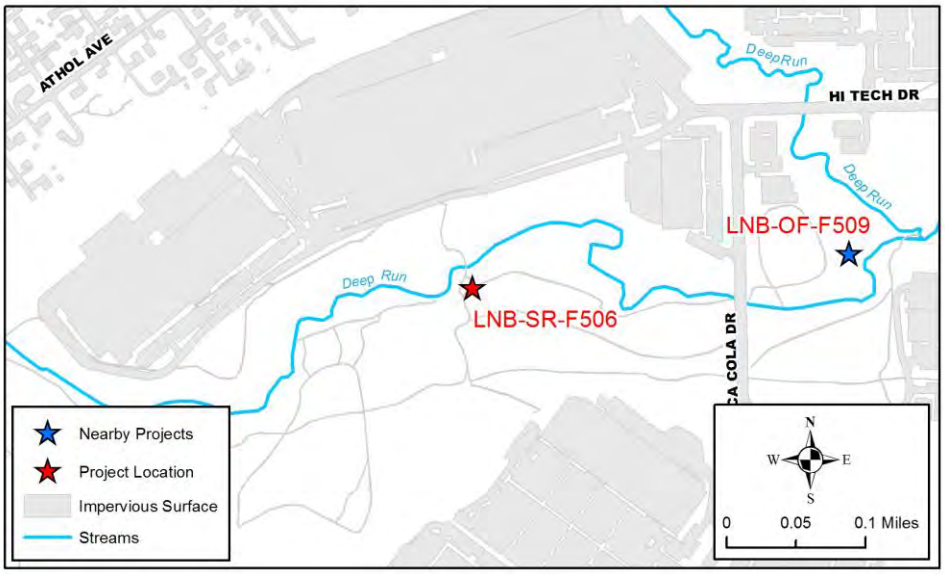
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F506
Site Name: Coca Cola Drive
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Ownership: Private- Commerical/Industrial
Multiple Owners

Existing Conditions:

The site is broken into two reaches and is located on forested commercial property. The downstream extent of the first reach begins upstream of the confluence with Deep Run and ends downstream of Coca Cola Drive. The second reach begins upstream of Coca Cola Drive and continues for 2,390 ft. Erosion continues upstream of the project limit. Approximately 50% of the first reach and 25% of the second reach is experiencing moderate to severe bank erosion. The eroding portions of the channel exhibit moderate to nearly vertical banks with heights of 6 to 20 ft., very low to moderate root density and surface protection, and a primary material which switches between sand, silt, and clay. Erosion at the downstream extent of the first reach is threatening a stormwater pond embankment and has broken an 8 in. sewer line. The second reach alternates between areas of severe erosion and recent bed and bank stabilization for adjacent sewer lines and crossings. One corroded and destabilized pipe outfalls directly into the second reach. Moderate in-stream habitat is present, with partially embedded substrate, fair diversity and cover, and somewhat unstable banks. Substrate is primarily gravel and sand. Riparian buffer alternates between good coverage and inadequate width.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F506
Site Name: Coca Cola Drive
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Reach one erosion threatening stormwater pond embankment.

Typical erosion in reach two, upstream and downstream of recent bank stabilization.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F506
Site Name: Coca Cola Drive
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include private property ownership, access, utilities, wetlands, stormwater ponds, and impacts to existing trees or forest areas.

Concept Description:

The proposed project consists of 2,865 lf. of Deep Run. The project goal is to enhance in-stream habitat, increase floodplain connectivity, decrease erosion, and protect existing infrastructure through creation of stable channel dimensions and bank stabilization treatments. The addition of terraced bench features and in-channel woody debris will increase floodplain deposition, aid in diversification of stream features, reduce risk of erosion, and increase uplift potential. In reach one, shifting of the channel away from the stormwater pond embankment is recommended. In reach two, restoration opportunity is limited by sewer stabilization. Access is proposed from Coca Cola Drive west along the sewer access road and east across the downstream edge of the pond embankment. It will likely require the closure of a lane.

Nearby Opportunities:

LNB-OF-F509

Proposed Project Credit		Costs	
Length Restored (ft):	2,865	Estimated Design Cost:	$300,000
Impervious Area Treated Credit (ac.):	28.7	Estimated Construction Cost:	$1,289,250
Cost per Impervious Credit Acre:	$72,113	30% Contingency:	$476,775
		Estimated Total Cost:	$2,066,025

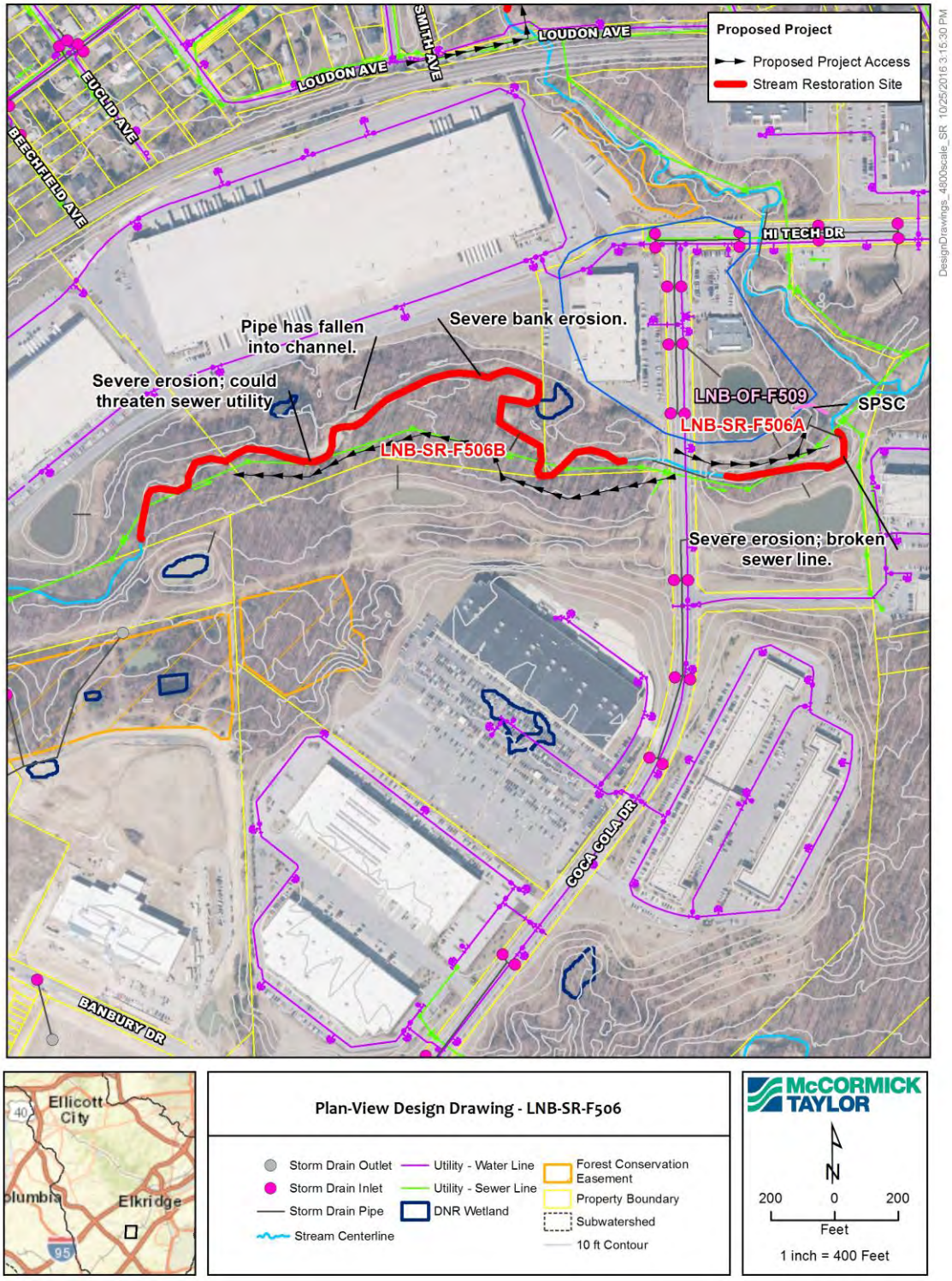
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F506

Site Name: Coca Cola Drive

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



Plan-View Design Drawing - LNB-SR-F506

Storm Drain Outlet
Storm Drain Inlet
Storm Drain Pipe
Stream Centerline
Utility - Water Line
Utility - Sewer Line
DNR Wetland
Forest Conservation Easement
Property Boundary
Subwatershed
10 ft Contour

McCORMICK TAYLOR

N

200 0 200

Feet

1 inch = 400 Feet

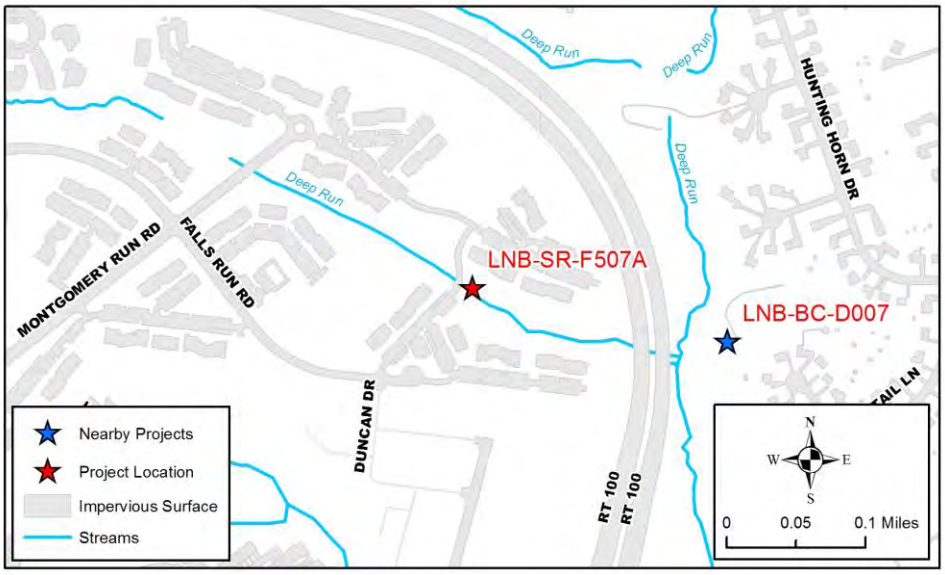
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F507A
Site Name: Montgomery Run Road
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Ownership: Private- HOA
Multiple Owners

Existing Conditions:

The site is located on forested county, residential, and utility right-of-way property. The downstream extent of the site begins upstream of the Route 100 culvert and the upstream extent ends just upstream of the utility right-of-way. Moderate erosion is consistent on the right bank throughout the reach and the stream is headcutting at the upstream extent. The eroding portions of the channel exhibit nearly vertical banks with heights of 3 to 6 ft., low to moderate root density, low surface protection, and a primary material of silt. The headcut is approximately 2.5 ft. in height. A large debris jam is causing instability at the downstream end near the stormwater facility outfall pipe. Riprap and gabion stabilization appear throughout the site and the stream appears to have been historically straightened. Moderate in-stream habitat is present, with partially embedded substrate, fair diversity and cover, and somewhat unstable banks. Bed substrate is primarily sand and gravel. Riparian buffer width is severely lacking upstream of the road crossing and slightly inadequate elsewhere.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F507A
Site Name: Montgomery Run Road
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Right bank erosion and adjacent wetland.

Headcut at upstream extent of site.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F507A
Site Name: Montgomery Run Road
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include private property ownership, access, underground and overhead utilities, wetlands, and impacts to existing trees or forest areas.

Concept Description:

The proposed project consists of 1,065 lf. of the tributary to Deep Run. The project goal is to increase in-stream habitat, floodplain connectivity, and decrease erosion through the creation of stable channel dimensions, restoration of natural channel sinuosity, and bank stabilization treatments. The addition of terraced bench features and in-channel woody debris will increase floodplain deposition of fine sediment, improve in-stream cover, aid in diversification of stream features, reduce risk of erosion, and increase uplift potential. Removal of the debris jam is recommended. Access is proposed through private residential property.

Nearby Opportunities:

None recommended.

Proposed Project Credit		Costs	
Length Restored (ft):	1,065	Estimated Design Cost:	$200,000
Impervious Area Treated Credit (ac.):	10.7	Estimated Construction Cost:	$479,250
Cost per Impervious Credit Acre:	$82,913	30% Contingency:	$203,775
		Estimated Total Cost:	$883,025

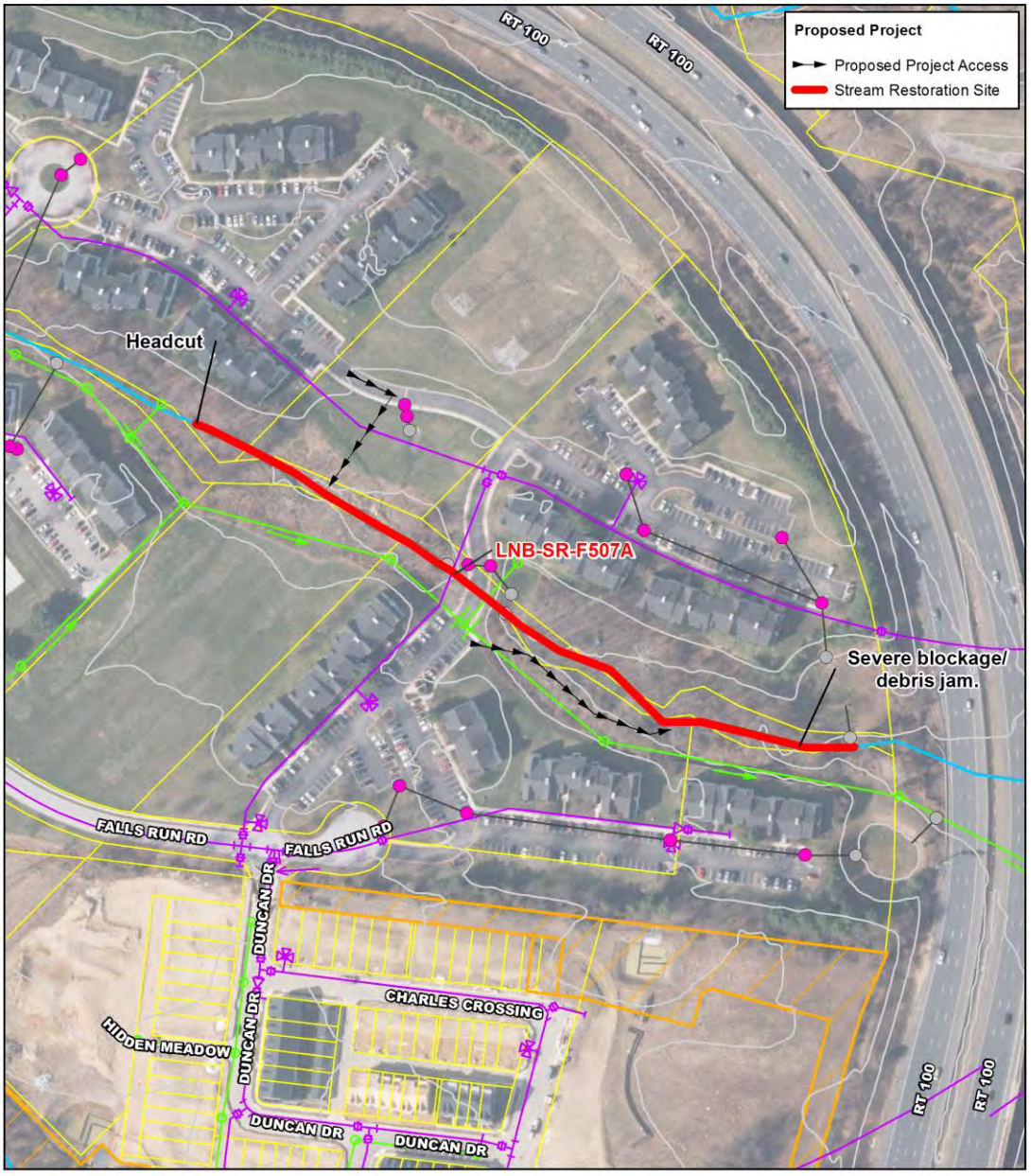
Howard County Watershed Assessment Concept Plan: Stream Restoration

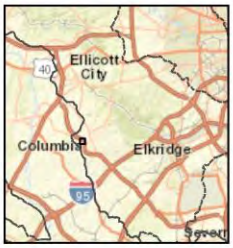
Site ID: LNB-SR-F507A

Site Name: Montgomery Run Road

Contractor: McCormick Taylor

Watershed: Patapsco Lower North





Plan-View Design Drawing - LNB-SR-F507A

Storm Drain Outlet
Storm Drain Inlet
Storm Drain Pipe
Stream Centerline
Utility - Water Line
Utility - Sewer Line
DNR Wetland
Forest Conservation Easement
Property Boundary
Subwatershed
10 ft Contour

McCORMICK TAYLOR

N

100 0 100

Feet

1 inch = 200 Feet

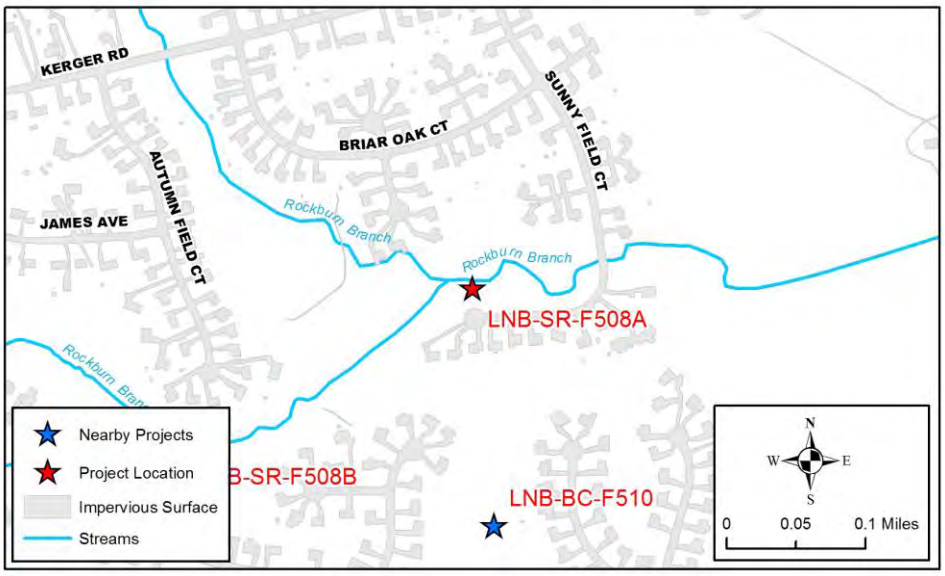
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F508A
Site Name: Sunny Field Court A
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Ownership: County Owned
Single Owner

Existing Conditions:

The site is located on forested county property. The downstream extent of the site begins at the Sunny Field Court culvert and the upstream extent ends south of the stormwater pond. Approximately 35% of the channel is experiencing low to moderate bank erosion. The eroding portions of the channel exhibit nearly vertical banks with heights of 3 to 6 ft., moderate to low root density and surface protection, and a primary material of sand or silt. One pipe which outfalls directly into the stream is experiencing minor erosion. Moderate in-stream habitat is present, with partially embedded substrate, fair diversity and cover, and somewhat stable banks. Bed substrate is primarily sand and gravel. Riparian buffer alternates between good coverage and inadequate width.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F508A
Site Name: Sunny Field Court A
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Moderate bank erosion.

Typical erosion pattern at the site.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F508A
Site Name: Sunny Field Court A
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include utilities, wetlands, existing forest conservation easements, and impacts to existing trees or forest areas.

Concept Description:

The proposed project consists of 1,061 lf. of Rockburn Branch. The project goal is to enhance in-stream habitat, floodplain connectivity, and decrease erosion through the creation of stable channel dimensions and bank stabilization treatments. The addition of terraced bench features and in-channel woody debris will increase floodplain deposition of fine sediment, improve in-stream cover, aid in diversification of stream features, reduce risk of erosion, and increase uplift potential. Access is proposed from Sunny Field Court.

Nearby Opportunities:

None recommended.

Proposed Project Credit		Costs	
Length Restored (ft):	1,061	Estimated Design Cost:	$200,000
Impervious Area Treated Credit (ac.):	10.6	Estimated Construction Cost:	$477,450
Cost per Impervious Credit Acre:	$83,005	30% Contingency:	$203,235
		Estimated Total Cost:	$880,685

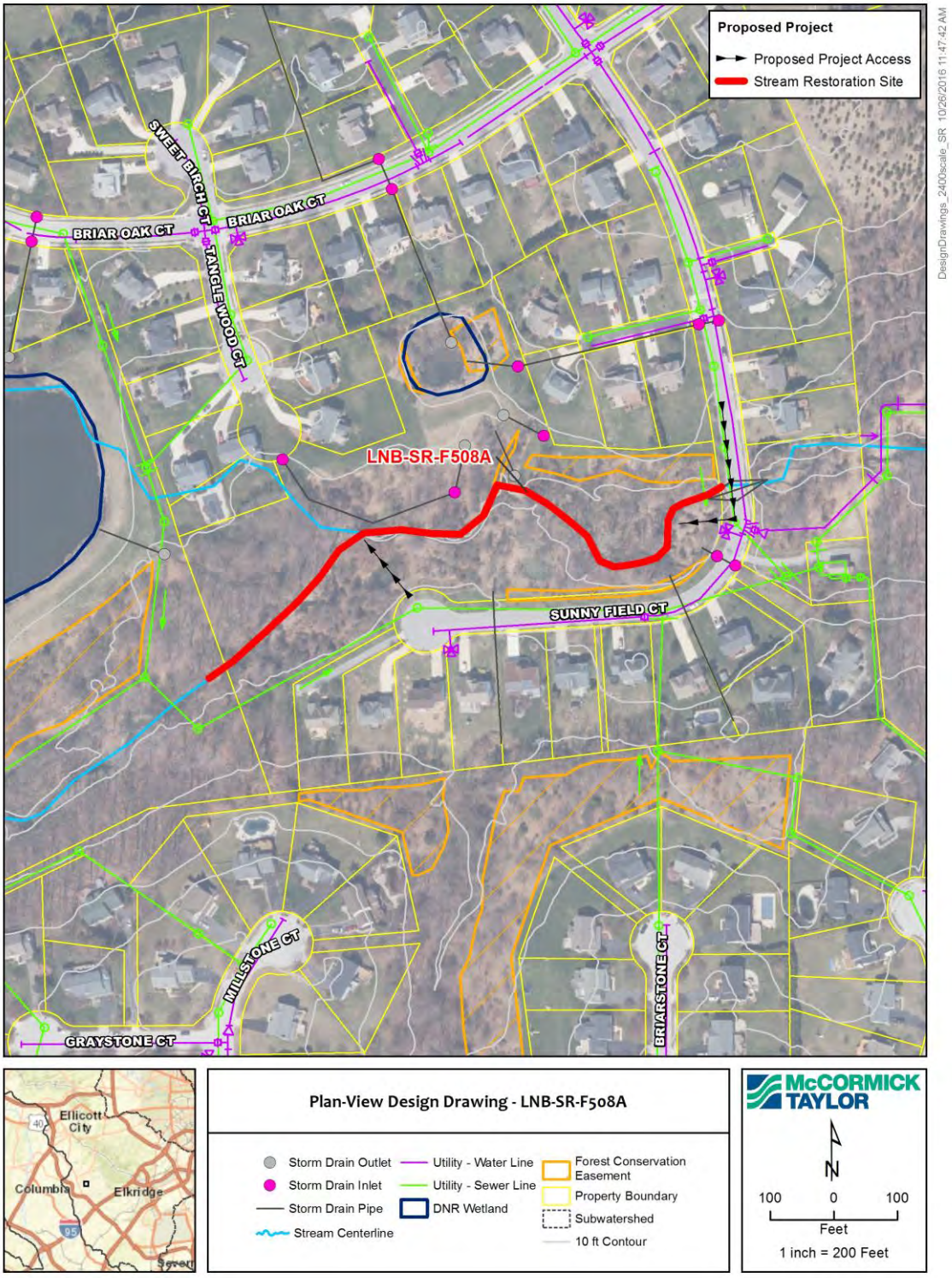
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F508A

Site Name: Sunny Field Court A

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



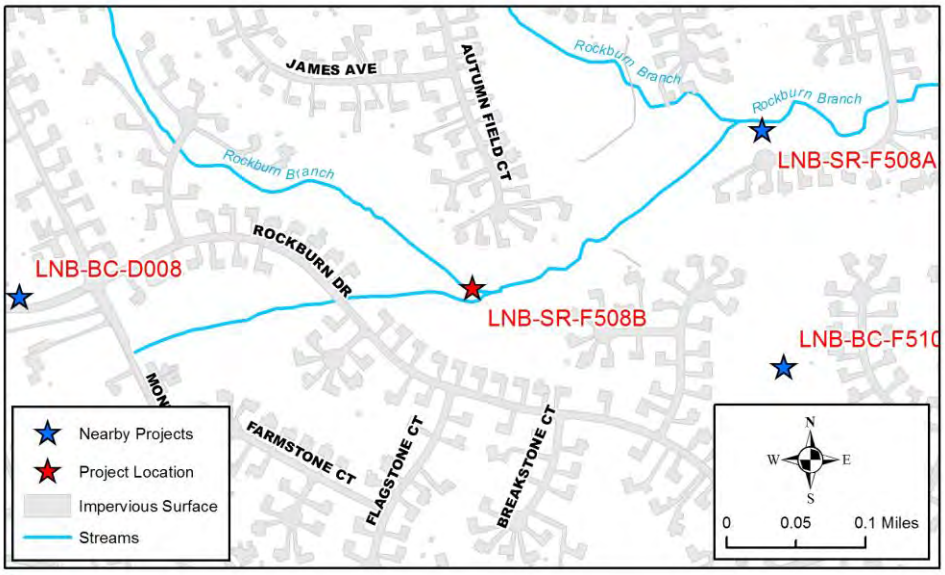
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F508B
Site Name: Sunny Field Court B
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Ownership: County Owned
Multiple Owners

Existing Conditions:

The site is located primarily on forested county property, with a small portion on private residential property. The site begins on Rockburn Branch north of the Graystone Court cul-de-sac and extends upstream until approximately 350 ft. upstream of the confluence with an unnamed tributary. The site also extends up the tributary approximately 350 ft. as well. Approximately 35% of the channel is experiencing moderate to severe bank erosion. The eroding portions of the channel exhibit nearly vertical to moderate banks with heights of 3 to 9 ft., very low to high root density and surface protection, and a primary material of sand or silt. Two outfall channels adjacent to the stream are experiencing minor erosion. Riprap and gabion line the channel in a few locations and a large debris jam is present at the upstream extent of the northern branch. Moderate in-stream habitat is present, with partially embedded substrate, fair diversity and cover, and somewhat stable banks. Bed substrate is primarily sand and gravel. Riparian buffer is inadequate along the southern floodplain due to the stormwater pond embankment.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F508B
Site Name: Sunny Field Court B
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Severe bank erosion and gabion slumping.

Typical erosion pattern at the site.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F508B
Site Name: Sunny Field Court B
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include private property ownership, utilities, wetlands, existing forest conservation easements, and impacts to existing trees or forest areas.

Concept Description:

The proposed project consists of 945 lf. of Rockburn Branch and its tributary. The project goal is to enhance in-stream habitat, floodplain connectivity, and decrease erosion through the creation of stable channel dimensions and bank stabilization treatments. The addition of terraced bench features and in-channel woody debris will increase floodplain deposition of fine sediment, improve in-stream cover, aid in diversification of stream features, reduce risk of erosion, and increase uplift potential. Access is proposed from Rockburn Drive and Autumn Field Court.

Nearby Opportunities:

None recommended.

Proposed Project Credit		Costs	
Length Restored (ft):	945	Estimated Design Cost:	$200,000
Impervious Area Treated Credit (ac.):	9.45	Estimated Construction Cost:	$425,250
Cost per Impervious Credit Acre:	$86,013	30% Contingency:	$187,575
		Estimated Total Cost:	$812,825

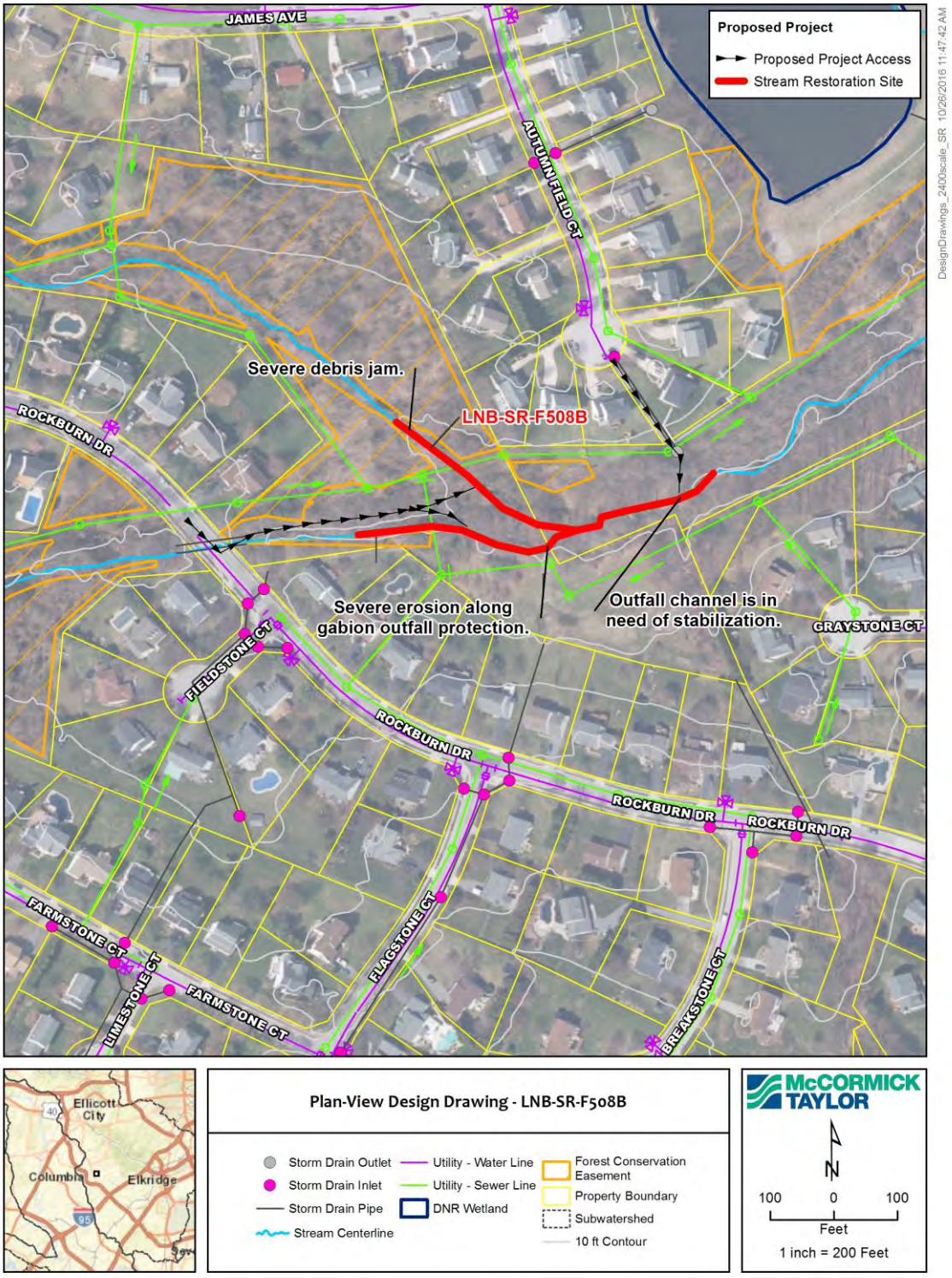
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F508B

Site Name: Sunny Field Court B

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



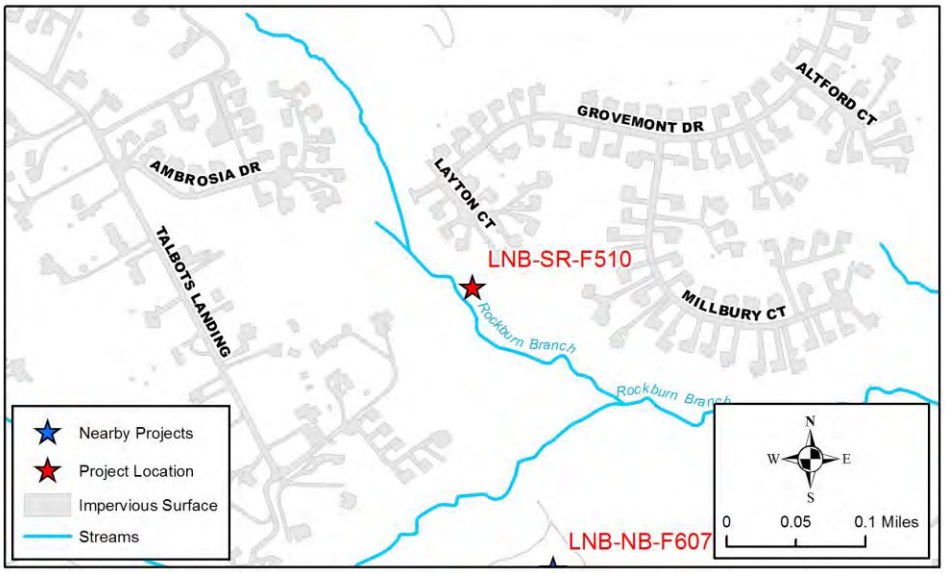
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F510
Site Name: Rockburn Park
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Ownership: County Park
Multiple Owners

Existing Conditions:

The project consists of approximately 6,892 lf. of stream. About 5,296 lf. is associated with Rockburn Branch and approximately 1,596 lf. is associated with a tributary to Rockburn Branch. The majority of this reach is located on Howard County land with a small portion abutting residential properties to the north. Long lengths of stream are eroded with minimal vegetative protection. The most severe erosion occurs along meander bends with erosion heights ranging from 2-7 ft. These eroding portions of the channel exhibit nearly vertical banks, low root density and surface protection, and a primary bank material of sand or silt. The tributary to Rockburn Branch exhibits multiple headcuts that are causing channel instability and an abandoned concrete channel that is causing a stream blockage. Erosion lengths in the tributary do not extend for long stretches, but are severe for the size of the channel. In-stream habitat along the overall project is lacking, with high amounts of fine sediment deposition and embeddedness within the system. Available substrate for macroinvertebrates and fish is sub-optimal due to the stable cobble bed substrate and undercut banks and lack of in-stream vegetative protection and cover. Buffer inadequacies exist where the stream abuts residential properties, the Rockburn Branch Park Disc Golf Course, and within the power line right of way.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F510
Site Name: Rockburn Park
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Typical erosion and lack of left bank riparian buffer near residential property.

Typical erosion and lack of left bank riparian buffer within county park property.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F510
Site Name: Rockburn Park
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include private property ownership, underground utilities, wetlands, and impacts to existing trees or forest areas.

Concept Description:

The proposed project consists of 5,296 lf. of Rockburn Branch and 1,596 lf. of a tributary to Rockburn Branch. The project goals are to increase in-stream habitat, floodplain connectivity, and nutrient processing while decreasing erosion and protecting existing infrastructure through the creation of stable channel dimensions, restoration of natural channel sinuosity, and bank stabilization treatments. The addition of terraced bench features and in-channel woody debris will increase floodplain deposition of fine sediment, improve in-stream cover, aid in diversification of stream features, reduce risk of erosion, and increase uplift potential. Removal of the concrete channel in the tributary to Rockburn Branch is recommended. Access is proposed through county park property, sewerline utility easements, and private residential property. One proposed tree planting project adjacent to this site can be implemented concurrently to reduce costs and increase efficiency.

Nearby Opportunities:

LNB-TP-F550A, LNB-TP-550B

Proposed Project Credit		Costs	
Length Restored (ft):	6,892	Estimated Design Cost:	$300,000
Impervious Area Treated Credit (ac.):	68.9	Estimated Construction Cost:	$3,101,400
Cost per Impervious Credit Acre:	$64,159	30% Contingency:	$1,020,420
		Estimated Total Cost:	$4,421,820

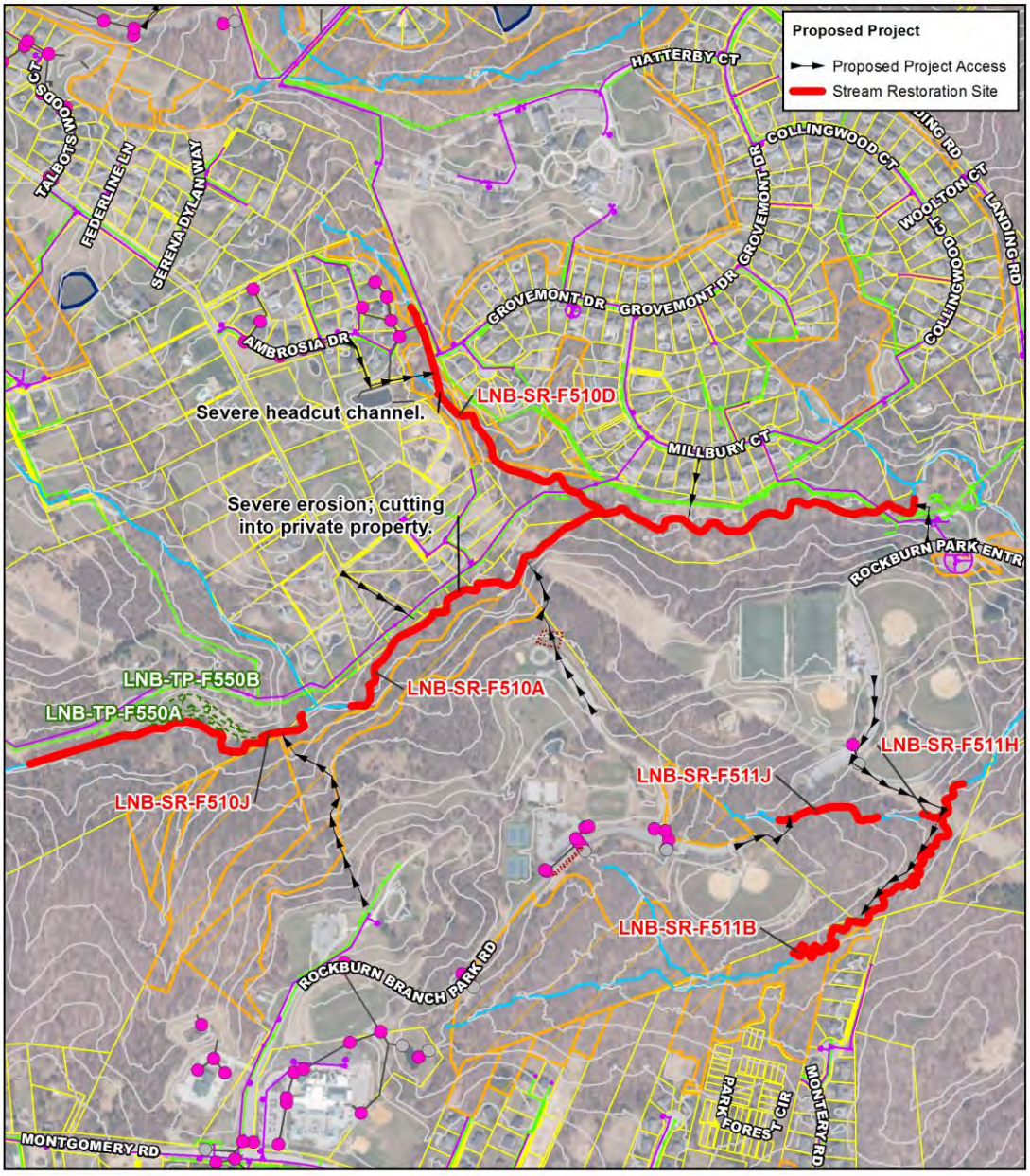
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F510

Site Name: Rockburn Park

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



Plan-View Design Drawing - LNB-SR-F510

Storm Drain Outlet
Storm Drain Inlet
Storm Drain Pipe
Stream Centerline
Utility - Water Line
Utility - Sewer Line
DNR Wetland
Forest Conservation Easement
Property Boundary
Subwatershed
10 ft Contour

McCORMICK TAYLOR

N

350 0 350

Feet

1 inch = 700 Feet

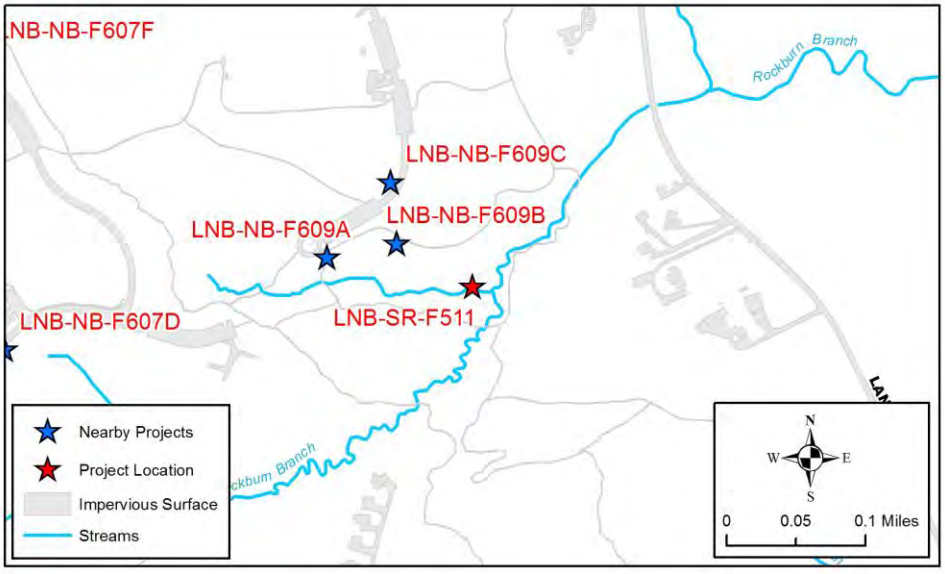
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F511
Site Name: Rockburn Branch/Landing Road
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Ownership: County Park
Single Owner

Existing Conditions:

The site consists of approximately 2,471 lf. of two unnamed tributaries to Rockburn Branch. The site consists of forested county park property. The majority of the channel is experiencing moderate to severe erosion, with the most severe erosion occurring on meander bends. The eroding portions of the channel exhibit nearly vertical banks with heights of 2.5 to 7 ft., low to moderate root density, low surface protection, and a primary material of silt. The southern tributary contains a severe debris blockage. The northern tributary contains multiple headcuts that are causing minor channel instability and severe erosion along the valley wall. In-stream habitat is lacking, with high amounts of fine sediment and embeddedness in the system, inadequate substrate diversity and cover, and marginal bank stability. Bed substrate is primarily gravel and sand. Riparian buffer is lacking along the powerline right-of-way due to mowing.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F511

Site Name: Rockburn Branch/Landing Road

Contractor: McCormick Taylor

Watershed: Patapsco Lower North

Erosion at the southern extent of the site.

Typical minor erosion in northern reach.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F511
Site Name: Rockburn Branch/Landing Road
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include wetlands, impacts to existing trees or forest areas, and power line right-of-way.

Concept Description:

The proposed project consists of 2,471 lf. of two tributaries to Rockburn Branch. The project goal is to increase in-stream habitat and floodplain connectivity, while decreasing erosion through stable channel dimensions, restoration of natural channel sinuosity and bank stabilization treatments. Restoration of a natural sinuous pattern and in-channel woody debris to the stream will increase floodplain deposition of fine sediment, improve in-stream cover, aid in diversification of stream features, reduce risk of erosion, and increase uplift potential. Access is proposed using the existing park roads or trails.

Nearby Opportunities:

LNB-NB-F609A, LNB-NB-F609B, LNB-NB-F609C

Proposed Project Credit		Costs	
Length Restored (ft):	2,471	Estimated Design Cost:	$300,000
Impervious Area Treated Credit (ac.):	24.7	Estimated Construction Cost:	$1,111,950
Cost per Impervious Credit Acre:	$74,283	30% Contingency:	$423,585
		Estimated Total Cost:	$1,835,535

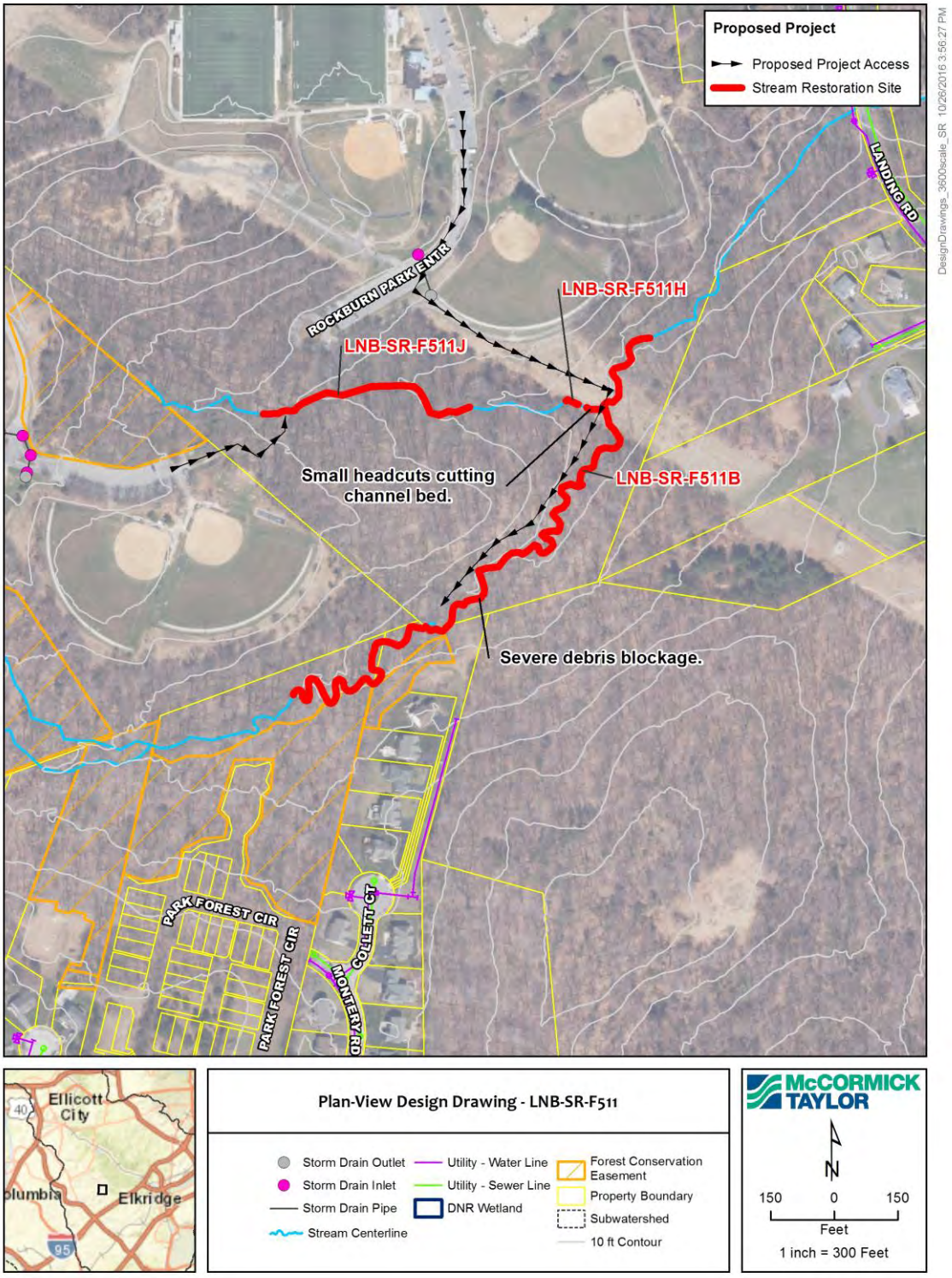
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F511

Site Name: Rockburn Branch/Landing Road

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



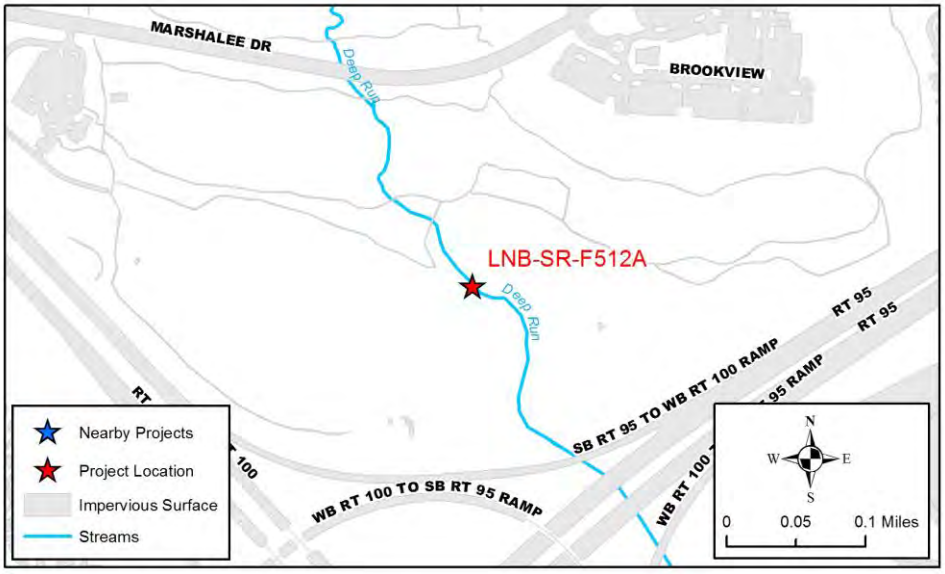
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F512A
Site Name: Timbers of Troy Golf Course
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Ownership: County Owned
Single Owner

Existing Conditions:

The site bisects Timbers at Troy Golf Course, between Interstate 95 and Marshalee Dr. The majority of the channel is experiencing moderate erosion. The eroding portions of the channel exhibit nearly vertical banks with heights of 5 to 7 ft., low root density and surface protection, and a primary material of silt. Approximately 130 lf. of the restoration length has recently undergone stream restoration and stabilization. In-stream habitat is marginal, with high amounts of fine sediment deposition and embeddedness in the system, marginal substrate diversity and cover, and minimal vegetative protection. Bed substrate is primarily gravel and sand. The riparian buffer is severely lacking within the upstream extent; however, the land is currently being used as part of the golf course, preventing plantings.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F512A
Site Name: Timbers of Troy Golf Course
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Typical erosion along the downstream extent.

Typical erosion within golf course.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F512A
Site Name: Timbers of Troy Golf Course
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include construction coordination with county golf course, wetland, and impacts to existing trees or forest areas.

Concept Description:

The proposed project consists of 1,564 lf. of an unnamed tributary to Deep Run. The project goal is to increase in-stream habitat and floodplain connectivity, while decreasing erosion through stable channel dimensions, restoration of natural channel sinuosity and bank stabilization treatments. The addition of terraced bench features and in-channel woody debris will increase floodplain deposition, aid in diversification of stream features, reduce risk of erosion, and increase uplift potential. Access is proposed using existing golf course roads. It is recommended that the golf course be investigated for BMP opportunities to reduce sediment loads.

Nearby Opportunities:

None recommended.

Proposed Project Credit		Costs	
Length Restored (ft):	1,564	Estimated Design Cost:	$300,000
Impervious Area Treated Credit (ac.):	15.6	Estimated Construction Cost:	$703,800
Cost per Impervious Credit Acre:	$83,436	30% Contingency:	$301,140
		Estimated Total Cost:	$1,304,940

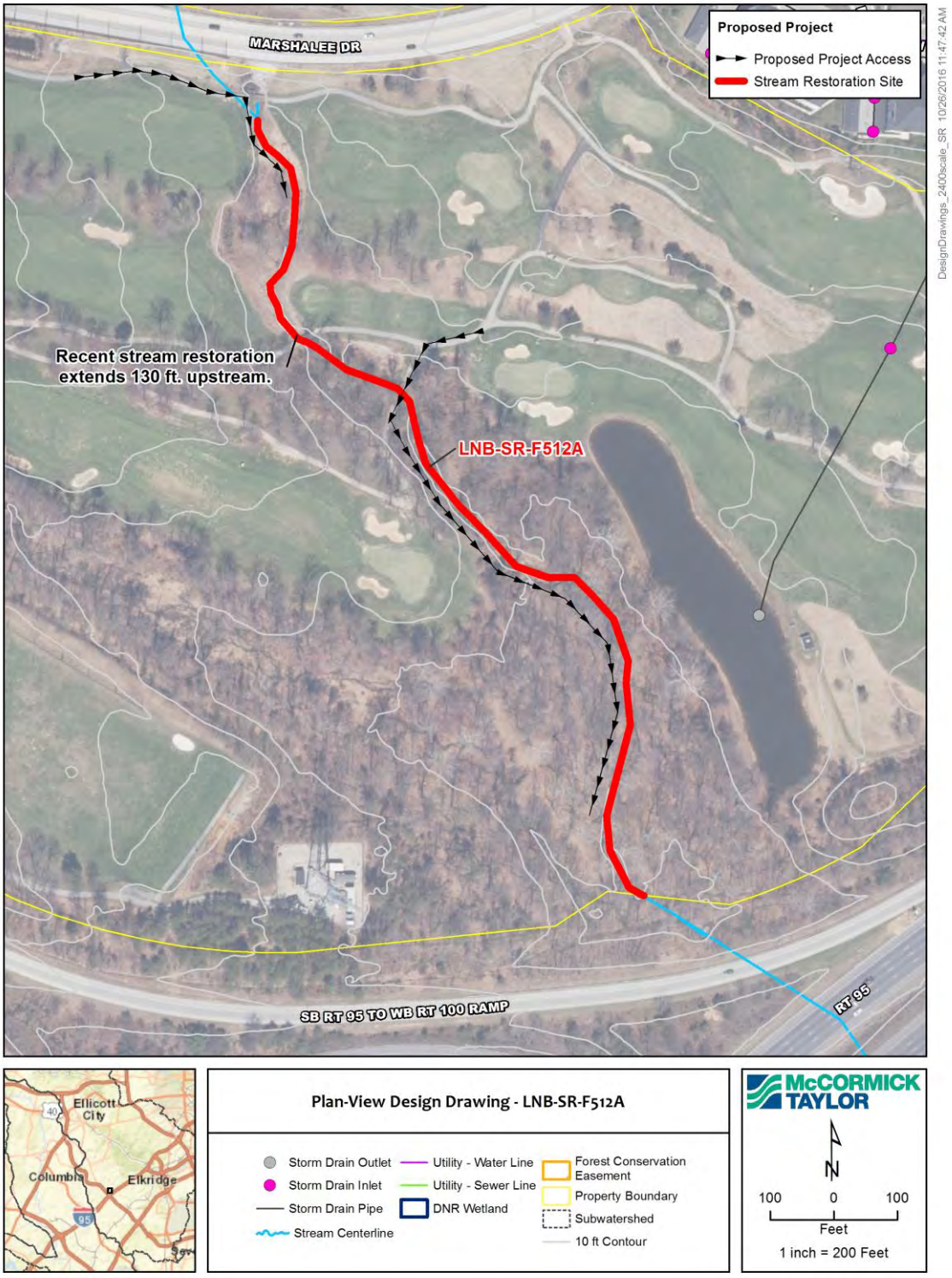
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F512A

Site Name: Timbers of Troy Golf Course

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



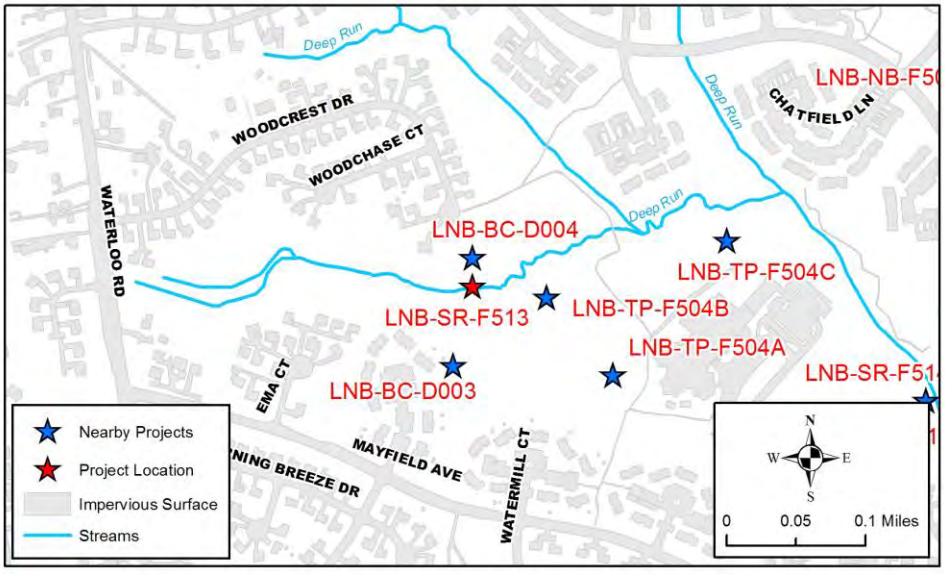
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F513
Site Name: Woodcrest Drive
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Ownership: County Owned
Multiple Owners

Existing Conditions:

This section consists of the mainstem running west to east and a tributary running from the northwest to southeast ending at the confluence with the mainstem. The site is primarily on county property, with a portion of the tributary being owned by a private homeowners association. The majority of the site is experiencing downcutting and headcutting, and is in need of stabilization. The moderate to severely eroded portions of the channel exhibit nearly vertical or undercut banks with heights of 4 to 8 ft., moderate root density and vegetative cover, and high near bank stress. Multiple headcuts ranging from 3 to 8 ft. in height are causing channel instability within the upstream extent of the mainstem. In-stream habitat is lacking, with high sediment deposition in the system, inadequate bed diversity and available cover, low bank stability, and low vegetative protection. Bed substrate is primarily gravel and sand. The riparian buffer is inadequate along the tributary due to the adjacent residential properties.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F513
Site Name: Woodcrest Drive
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking upstream from tributary confluence at headcut and active bank erosion.

Typical erosion within mainstem.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F513
Site Name: Woodcrest Drive
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include private property ownership, access, wetlands, underground utilities, existing forest conservation easements, and impacts to existing trees or forest areas.

Concept Description:

The proposed project consists of 1,980 lf. of two unnamed tributaries to Deep Run. The project goals are to increase in-stream habitat and floodplain connectivity while decreasing erosion through the creation of stable channel dimensions, restoration of natural channel sinuosity, headcut stabilization, and bank stabilization treatments. The addition of terraced bench features and in-channel woody debris will increase floodplain deposition of fine sediment, improve in-stream cover, aid in diversification of stream features, reduce risk of erosion, and increase uplift potential. Proposed access is recommended using an existing trail southwest of Falling Leaves Court, a stormwater easement from Woodcrest Drive, and an existing trail located behind Mayfield Woods Middle School. A stream restoration project and BMP conversion on the southeast side of Mayfield Woods Middle School and a proposed tree planting project on school grounds can be implemented concurrently to reduce costs and increase efficiency.

Nearby Opportunities:

LNB-TP-F504, LNB-BC-F521, LNB-SR-F514A

Proposed Project Credit		Costs	
Length Restored (ft):	1,980	Estimated Design Cost:	$300,000
Impervious Area Treated Credit (ac.):	19.8	Estimated Construction Cost:	$891,000
Cost per Impervious Credit Acre:	$78,197	30% Contingency:	$357,300
		Estimated Total Cost:	$1,548,300

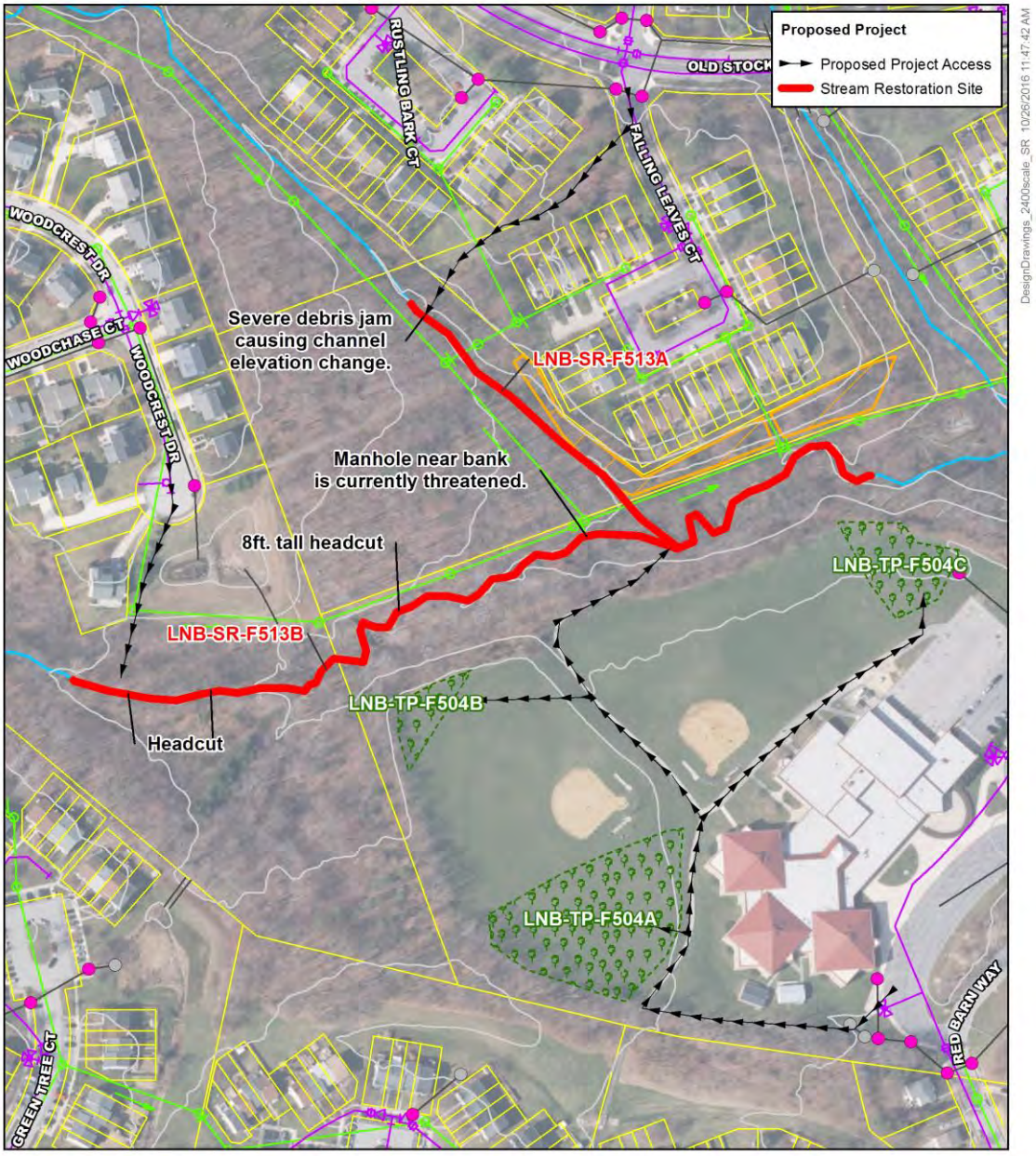
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F513

Site Name: Woodcrest Drive

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



Plan-View Design Drawing - LNB-SR-F513

Storm Drain Outlet
Storm Drain Inlet
Storm Drain Pipe
Stream Centerline
Utility - Water Line
Utility - Sewer Line
DNR Wetland
Forest Conservation Easement
Property Boundary
Subwatershed
10 ft Contour

McCORMICK TAYLOR

N

100 0 100

Feet

1 inch = 200 Feet

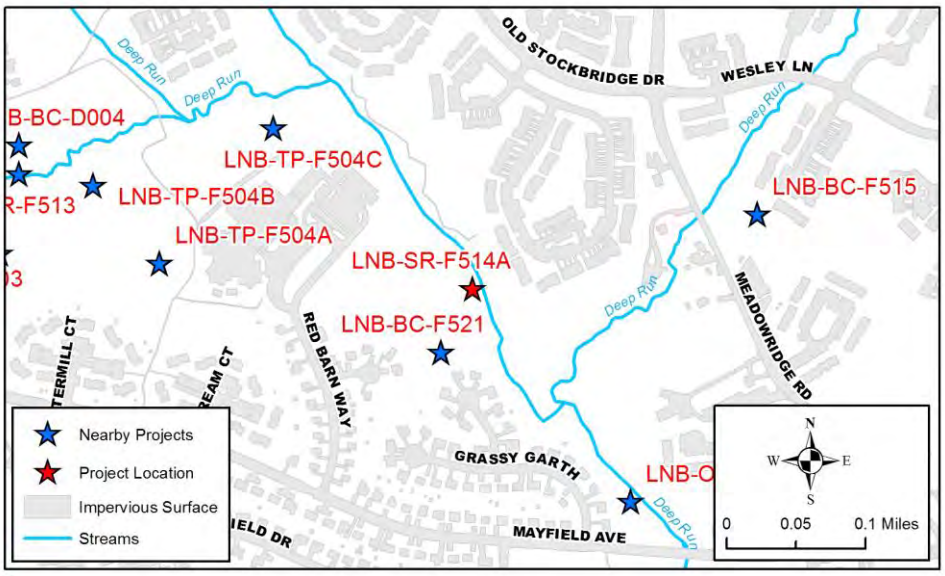
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F514A
Site Name: Mayfield Woods
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Ownership: County Owned
Single Owner

Existing Conditions:

This site is associated with Deep Run and is located within a heavily forested area north of Mayfield Avenue. The majority of the site exhibits moderate to severe bank erosion. The eroding portions of the channel exhibit nearly vertical banks with heights of 3 to 8 ft., low to moderate root density, low surface protection, and a primary material of sand. A large debris jam is causing instability at the downstream end near the confluence with a tributary. In some areas, the bank erosion is within close proximity to a trail and the sewerline utility easement along the left bank. Marginal in-stream habitat is present, with fairly embedded substrate, fair diversity and cover, and somewhat unstable banks. Bed materials are dominated by cobble, gravel, and sand.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F514A
Site Name: Mayfield Woods
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Erosion which may threaten sewer if untreated.

Typical erosion along downstream extent.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F514A
Site Name: Mayfield Woods
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include impacts to existing trees or forest areas, wetlands, and underground utilities.

Concept Description:

The proposed project consists of 1,418 lf. of Deep Run. The project goals are to increase in-stream habitat and floodplain connectivity while decreasing erosion and protecting existing infrastructure through the creation of stable channel dimensions, restoration of natural channel sinuosity, and bank stabilization treatments. The addition of terraced bench features and in-channel woody debris will increase floodplain deposition of fine sediment, improve in-stream cover, aid in diversification of stream features, reduce risk of erosion, and increase uplift potential. Access will be gained to the project through an existing sewer line easement off of Blueberry Hill Lane and through county property off of Red Barn Way and Grassy Garth. One proposed BMP conversion is within close proximity to the site, and a tree planting opportunity and additional stream restoration project are located on the northwest side of Mayfield Woods Middle School. These projects can be implemented concurrently to reduce costs and increase efficiency.

Nearby Opportunities:

LNB-BC-F521, LNB-TP-F504, LNB-SR-F513

Proposed Project Credit		Costs	
Length Restored (ft):	1,418	Estimated Design Cost:	$300,000
Impervious Area Treated Credit (ac.):	14.2	Estimated Construction Cost:	$638,100
Cost per Impervious Credit Acre:	$86,004	30% Contingency:	$281,430
		Estimated Total Cost:	$1,219,530

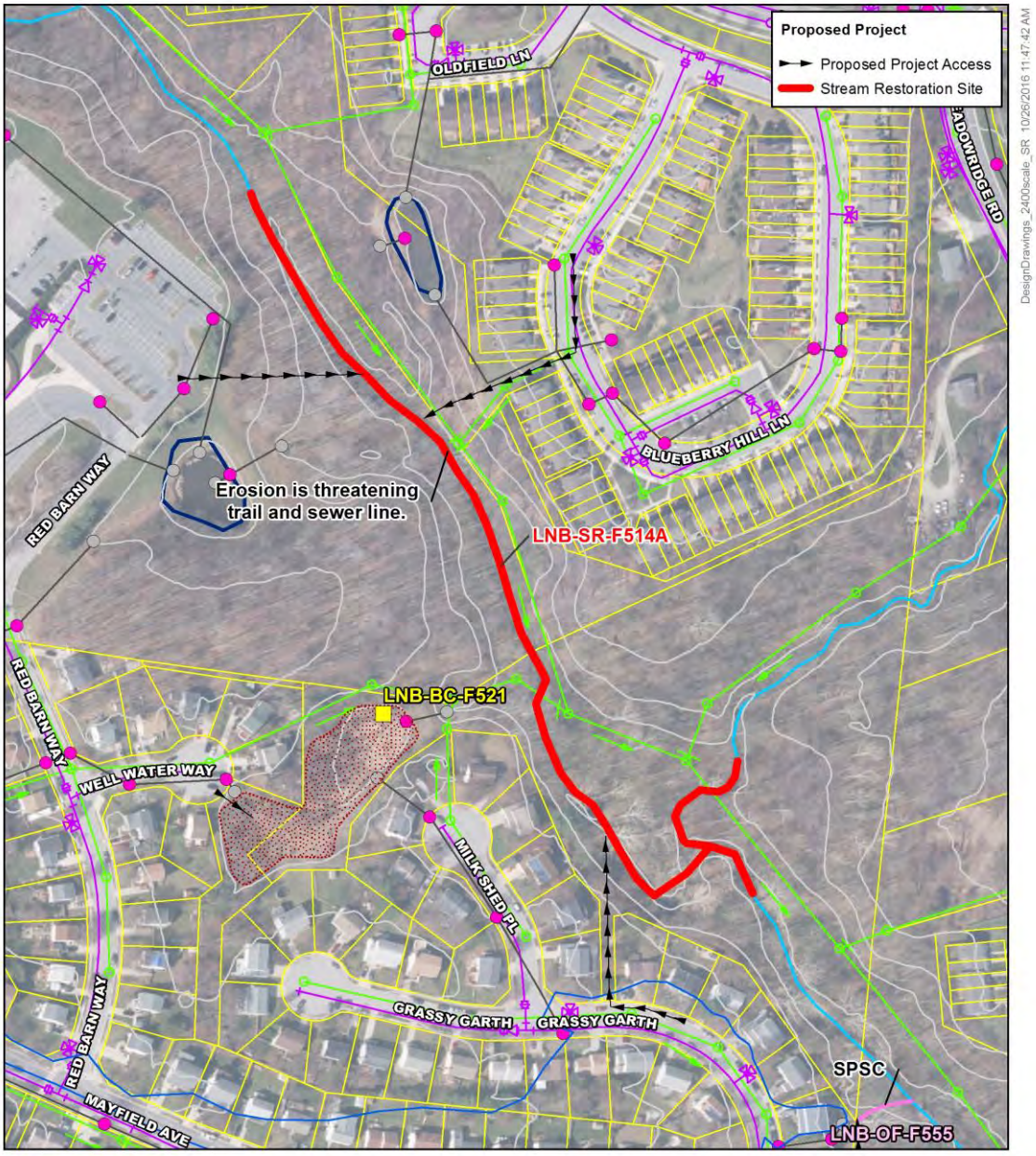
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F514A

Site Name: Mayfield Woods

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



Plan-View Design Drawing - LNB-SR-F514A

- Storm Drain Outlet
- Storm Drain Inlet
- Storm Drain Pipe
- Stream Centerline
- Utility - Water Line
- Utility - Sewer Line
- DNR Wetland
- Forest Conservation Easement
- Property Boundary
- Subwatershed
- 10 ft Contour

McCORMICK TAYLOR

N

100 0 100

Feet

1 inch = 200 Feet

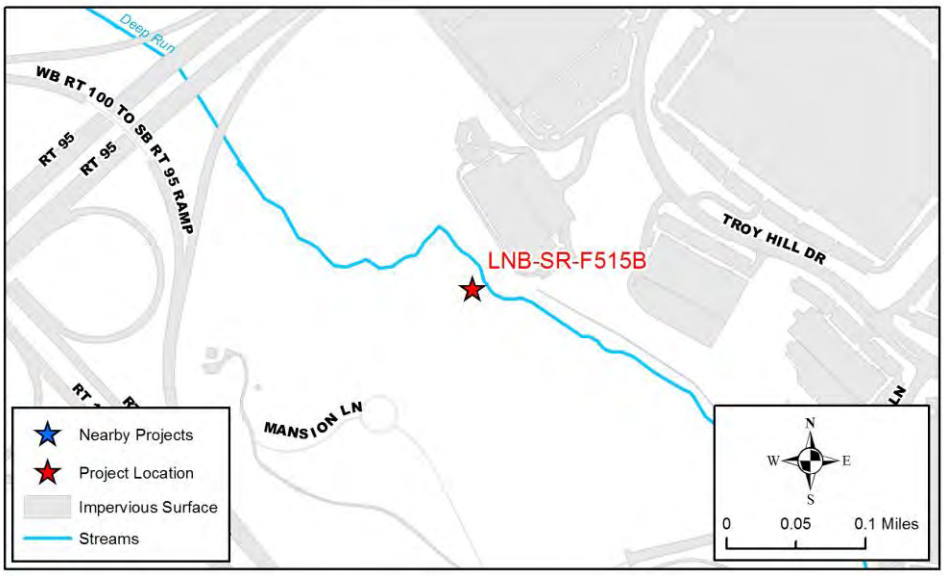
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F515B
Site Name: Troy Hill Drive
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Ownership: County Owned
Multiple Owners

Existing Conditions:

The site is located primarily on county property, with portions the left bank within industrial property. The downstream extent begins north of Mansion Lane and the upstream extent ends near the westbound Route 100 ramp to Interstate 95. The majority of the channel contains vertical eroding banks with heights of 4-10 ft. The eroding portions of the channel exhibit low root density and surface protection, and a primary material of clay/bedrock. Moderate in-stream habitat is present, with somewhat embedded substrate, fair diversity and cover, and unstable banks. Bed material is dominated by cobble, gravel, and sand. Riparian buffer is lacking primarily on the left bank within the downstream extent due to recent development.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F515B
Site Name: Troy Hill Drive
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Typical erosion at upstream extent of site.

Typical erosion at upstream extent of site.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F515B
Site Name: Troy Hill Drive
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include private property ownership, access, wetlands, and impacts to existing trees or forest areas.

Concept Description:

The proposed project consists of 2,321 lf. of an unnamed tributary to Deep Run. The project goals are to increase in-stream habitat and floodplain connectivity while decreasing erosion and protecting private property through the creation of stable channel dimensions, restoration of natural channel sinuosity, and bank stabilization treatments. The addition of terraced bench features and in-channel woody debris will increase floodplain deposition of fine sediment, improve in-stream cover, aid in diversification of stream features, reduce risk of erosion, and increase uplift potential. Access is proposed from Mansion Lane through the park development and from a commercial property.

Nearby Opportunities:

None recommended.

Proposed Project Credit		Costs	
Length Restored (ft):	2,321	Estimated Design Cost:	$300,000
Impervious Area Treated Credit (ac.):	23.2	Estimated Construction Cost:	$1,044,450
Cost per Impervious Credit Acre:	$75,303	30% Contingency:	$403,335
		Estimated Total Cost:	$1,747,785

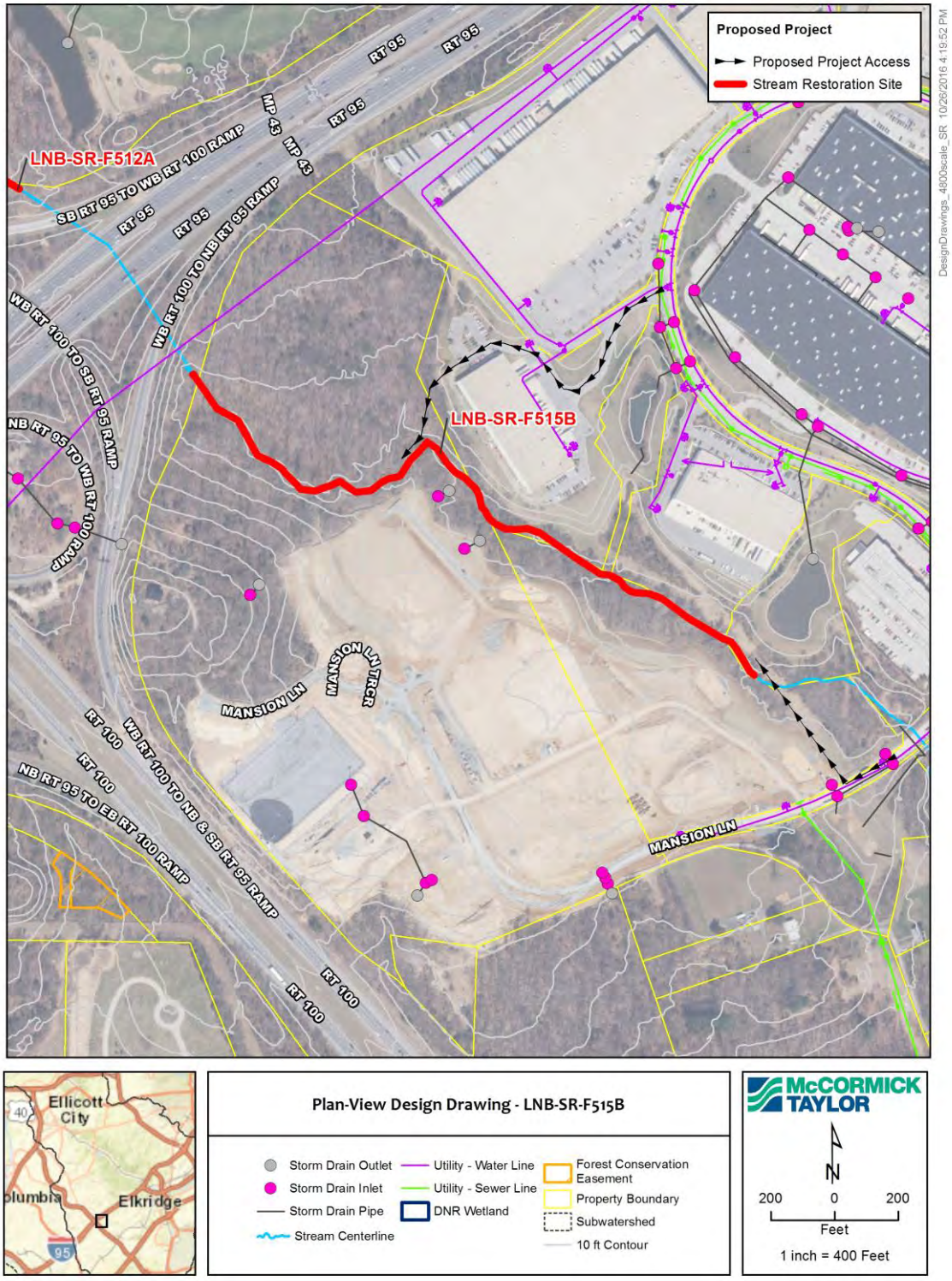
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F515B

Site Name: Troy Hill Drive

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



Plan-View Design Drawing - LNB-SR-F515B

Storm Drain Outlet
Storm Drain Inlet
Storm Drain Pipe
Stream Centerline
Utility - Water Line
Utility - Sewer Line
DNR Wetland
Forest Conservation Easement
Property Boundary
Subwatershed
10 ft Contour

McCORMICK TAYLOR

N

200 0 200

Feet

1 inch = 400 Feet

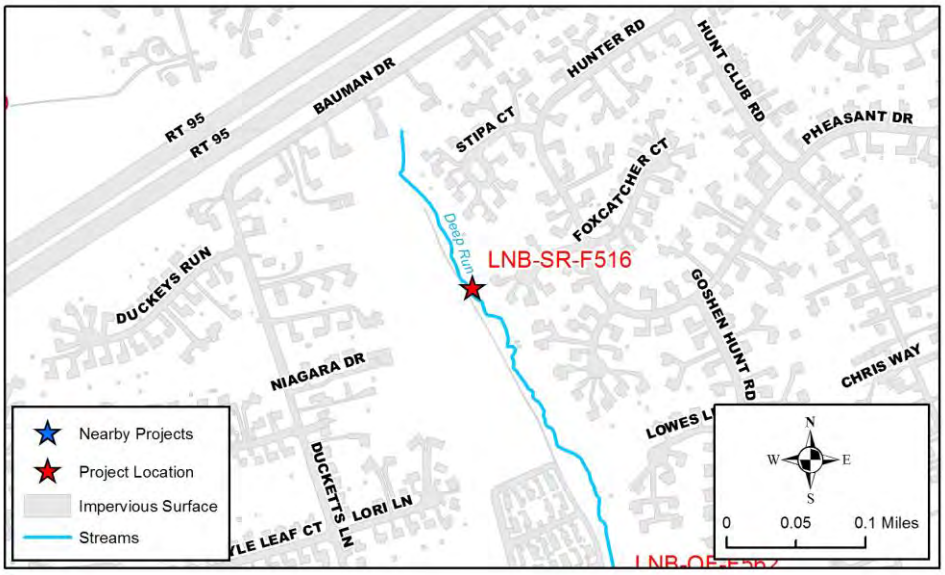
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F516
Site Name: Capitol Mobile
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Ownership: Private- HOA
Multiple Owners

Existing Conditions:

The site is located on private property with forested and residential landuse. The downstream extent of the site begins adjacent to Capitol Mobile Park and the upstream extent ends downstream of Bauman Drive. A majority of the channel is experiencing moderate to severe bank erosion, which worsens towards the upstream extent. The eroding portions of the channel exhibit nearly vertical banks with heights of 2 to 7 ft., low to moderate root density and surface protection, and primarily associated with loamy soils. Downcutting and headcutting threaten a sewer crossing and private property. One outfall adjacent to the stream is experiencing severe erosion. Riprap lines the channel in a few locations and an exposed sewer house connection is located midway through the site. In-stream habitat is lacking, although it improves towards the upstream extent. Through the majority of the site, the stream has highly embedded substrate and poor diversity and cover. Bed substrate is primarily sand with some gravel and silt. Riparian buffer is inadequate along long lengths of the site due to adjacent property owner mowing and roadways.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F516
Site Name: Capitol Mobile

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Typical erosion at the downstream extent.

Downcutting threatening sewer crossing and private property.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F516
Site Name: Capitol Mobile
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include private property ownership, access, wetlands, underground utilities, existing forest conservation easements, and impacts to existing trees or forest areas.

Concept Description:

The proposed project consists of 1,676 lf. of a tributary to Deep Run. The project goal is to decrease erosion, enhance in-stream habitat and floodplain connectivity, and protect existing infrastructure through the creation of stable channel dimensions and bank stabilization treatments. The addition of terraced bench features and in-channel woody debris will increase floodplain deposition of fine sediment, improve in-stream cover, aid in diversification of stream features, reduce risk of erosion, and increase uplift potential. Access is proposed from Lowes Lane and Burnbridge Hunt Court through community association property. A severely eroded outfall stabilization project (LNB-OF-F562) at the downstream extent can be implemented concurrently to improve efficiency, reduce costs and maximize TMDL credit.

Nearby Opportunities:

LNB-OF-F562

Proposed Project Credit		Costs	
Length Restored (ft):	1,676	Estimated Design Cost:	$300,000
Impervious Area Treated Credit (ac.):	16.8	Estimated Construction Cost:	$754,200
Cost per Impervious Credit Acre:	$81,770	30% Contingency:	$316,260
		Estimated Total Cost:	$1,370,460

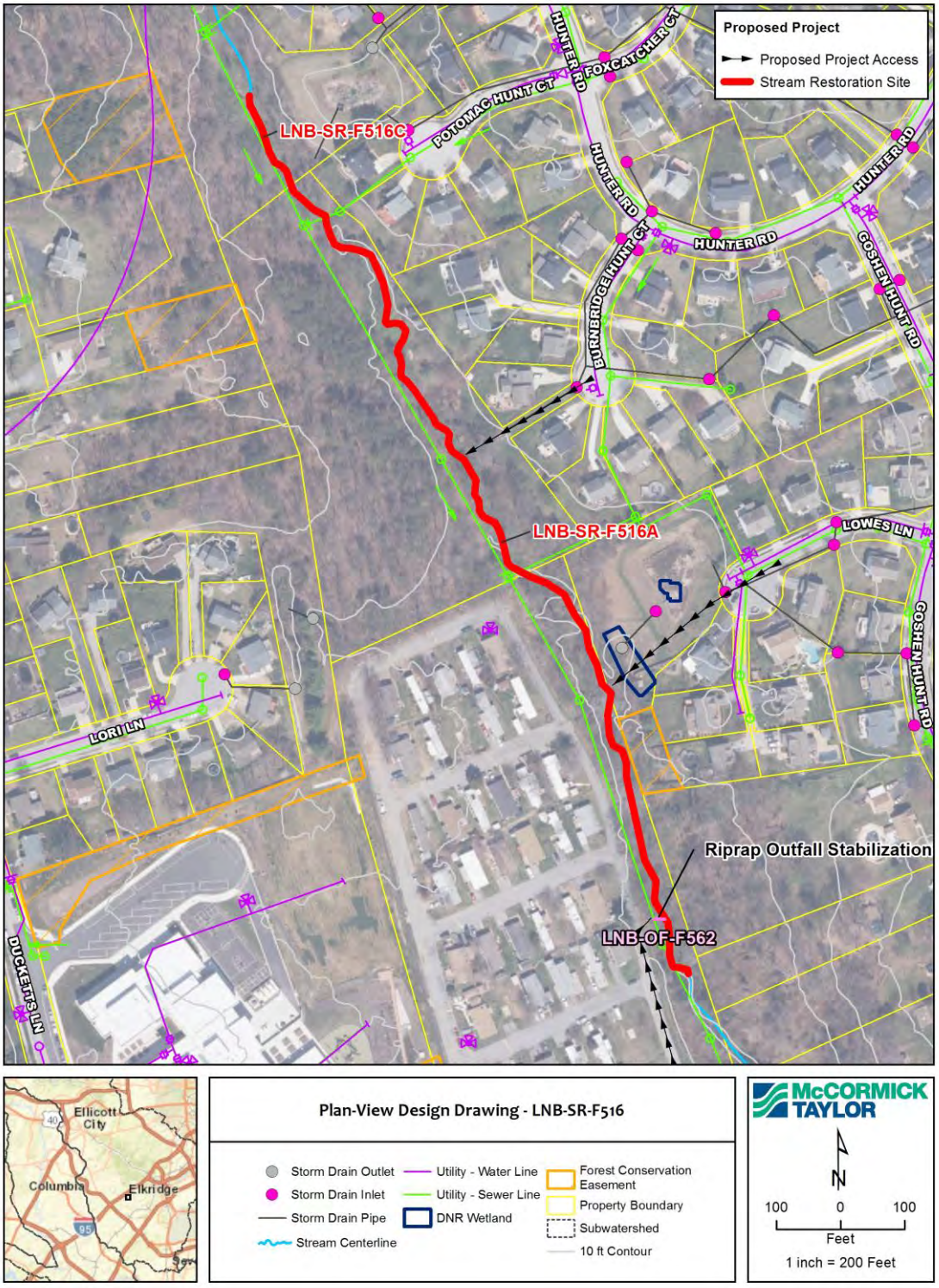
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F516

Site Name: Capitol Mobile

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



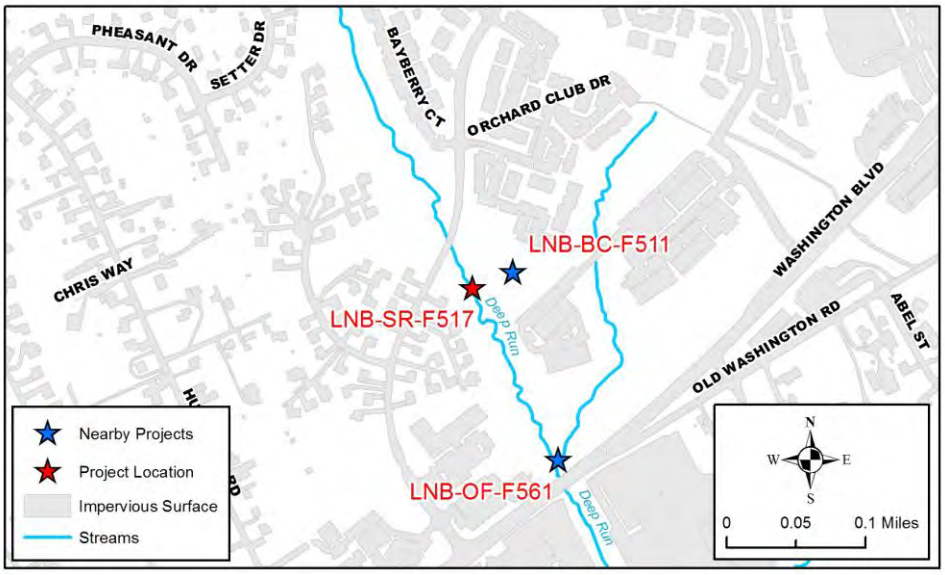
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F517
Site Name: Rowanberry Drive
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Ownership: Private- HOA
Multiple Owners

Existing Conditions:

The site is composed of two tributaries located on forested private and county property. The downstream extent of both reaches begins at Washington Boulevard (US 1). The upstream extent of the east reach ends at the powerline corridor and the west reach ends just downstream of the powerline corridor. A majority of all reaches are experiencing erosion of varying severity. Banks along the eroded portions of the project exhibit severely undercut to moderately angled banks with heights of 2 to 9 ft. and composed primarily of clay and loam soils . The east reach is experiencing some headcutting throughout, with drops of 1 to 2 ft. An outfall to the east reach at Washington Boulevard needs stabilization (LNB-OF-F561). Two exposed sewer lines and a threatened manhole are located in the west reach. Moderate in-stream habitat is present, with low substrate embeddedness, moderate in-stream diversity and cover, and somewhat stable banks. Substrate is primarily gravel, sand, and cobble. Riparian buffer width is slightly inadequate in several locations throughout the project area.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F517
Site Name: Rowanberry Drive
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Erosion in east reach.

Erosion in west reach.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F517
Site Name: Rowanberry Drive
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include private property ownership, access, underground utilities, existing forest conservation easements, and impacts to existing trees or forest areas.

Concept Description:

The proposed project consists of 4,201 lf. of two unnamed tributaries to Deep Run. The project goal is to decrease erosion, enhance in-stream habitat and floodplain connectivity, and protect existing infrastructure through the creation of stable channel dimensions and bank stabilization treatments. The addition of terraced bench features and in-channel woody debris will increase floodplain deposition of fine sediment, improve in-stream cover, aid in diversification of stream features, reduce risk of erosion, and increase uplift potential. Access is proposed through private residential, commercial, and county property. An outfall stabilization project at the downstream extent (LNB-OF-F561) and BMP conversion project adjacent to the west reach (LNB-BC-F511) can be implemented concurrently to improve efficiency and reduce costs.

Nearby Opportunities:

LNB-BC-F511, LNB-OF-F561

Proposed Project Credit		Costs	
Length Restored (ft):	4,201	Estimated Design Cost:	$300,000
Impervious Area Treated Credit (ac.):	42.0	Estimated Construction Cost:	$1,890,450
Cost per Impervious Credit Acre:	$67,784	30% Contingency:	$657,135
		Estimated Total Cost:	$2,847,585

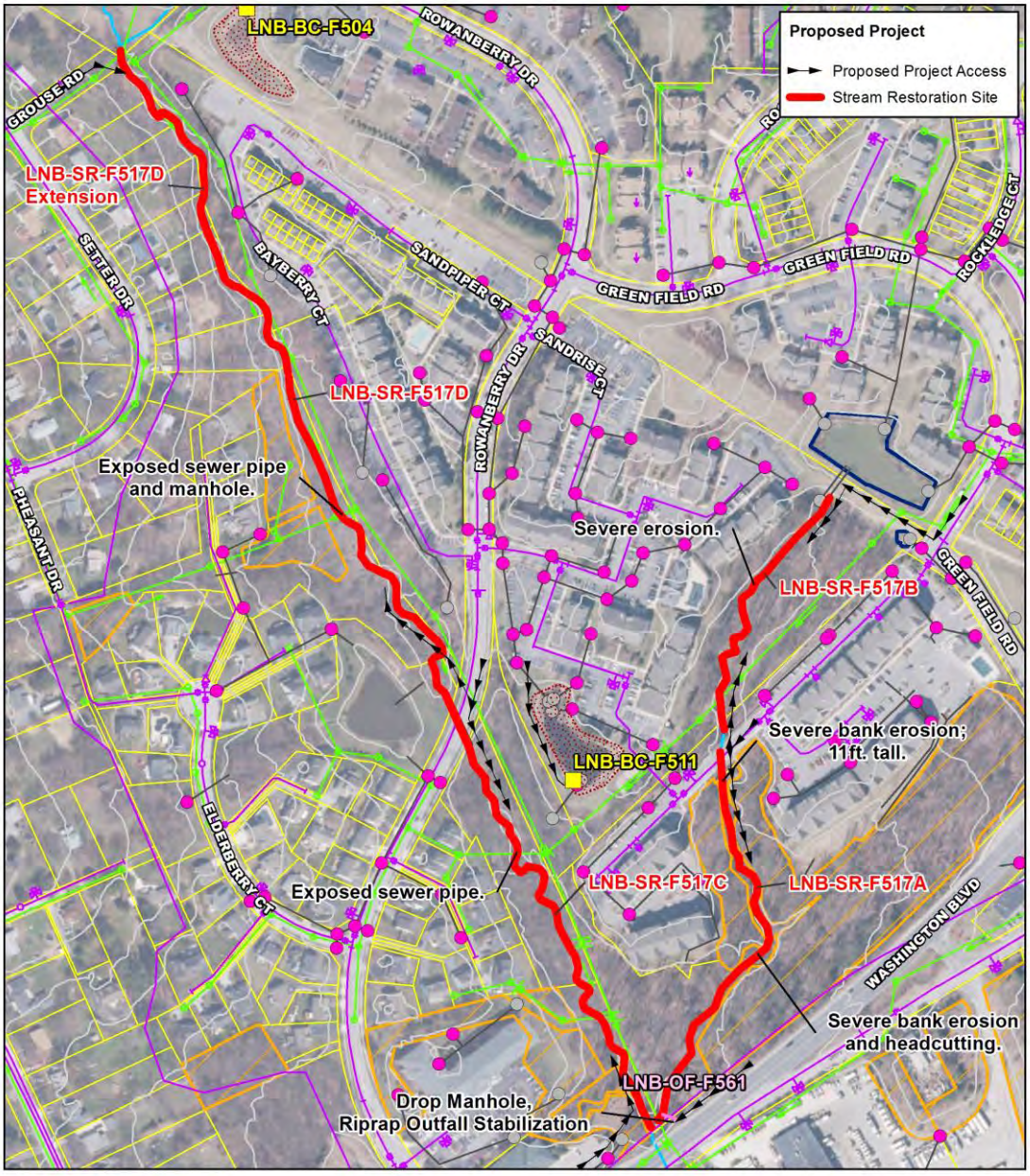
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F517

Site Name: Rowanberry Drive

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



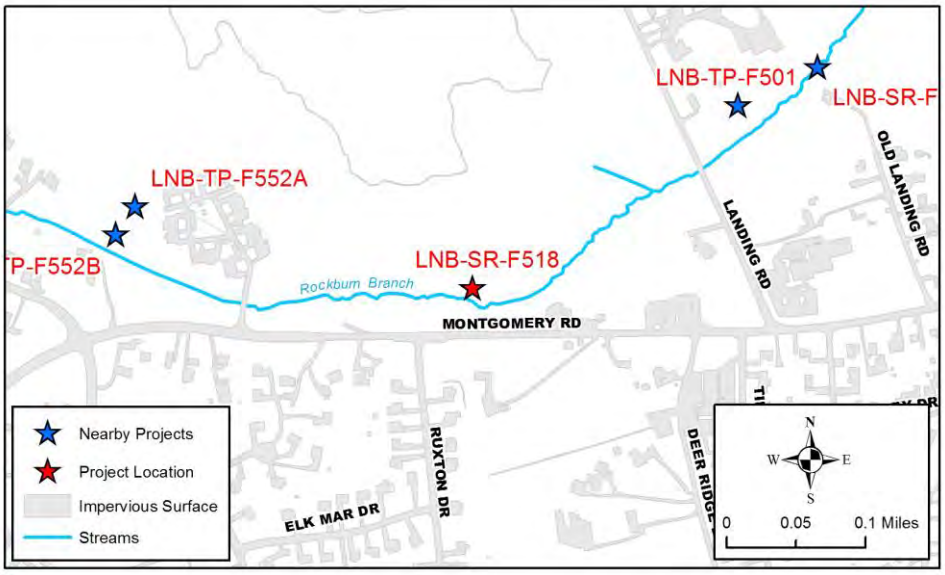
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F518
Site Name: Koffel Court
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Ownership: Private- Residential
Multiple Owners

Existing Conditions:

The site is broken into two reaches primarily on forested private and county property. The downstream extent begins as erosion becomes frequent and the upstream extent ends upstream of a severe fish blockage, with approximately 275 ft. of stable stream splitting the two reaches. Approximately 50% of the downstream reach and 30% of the upstream reach are experiencing moderate erosion. Banks along the eroded portion of the project exhibit nearly vertical to moderately angled banks with heights of 3 to 6 ft., low to moderate root density and surface protection, and a primary material of silt. The downstream reach is incised and multiple areas of moderately angled headcutting occur with drops of 3 to 4 ft. A debris jam is causing a fish blockage in the upstream reach. In-stream habitat is lacking, with the substrate highly embedded, low in-stream diversity and cover, and somewhat stable banks. Substrate is primarily sand and gravel. Riparian buffer is lacking on the right bank at the downstream extent and on the left bank in the upstream reach.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F518
Site Name: Koffel Court
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Erosion and adjacent wetland in the downstream reach.

Incision and erosion in the upstream reach.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F518
Site Name: Koffel Court
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include private property ownership, access, wetlands, underground utilities, existing forest conservation easements, and impacts to existing trees or forest areas.

Concept Description:

The proposed project consists of 1,512 lf. of an unnamed tributary to Rockburn Branch. The project goal is to enhance in-stream habitat, floodplain connectivity, and decrease erosion through the creation of stable channel dimensions and bank stabilization treatments. The addition of terraced bench features and in-channel woody debris will increase floodplain deposition of fine sediment, improve in-stream cover, aid in diversification of stream features, reduce risk of erosion, and increase uplift potential. Access is proposed through private and county property from Landing Road and Koffel Court. A riparian tree planting site upstream of the stream project (LNB-TP-F552) can be implemented concurrently to improve efficiency and reduce costs.

Nearby Opportunities:

LNB-TP-F552

Proposed Project Credit		Costs	
Length Restored (ft):	1,512	Estimated Design Cost:	$300,000
Impervious Area Treated Credit (ac.):	15.1	Estimated Construction Cost:	$680,400
Cost per Impervious Credit Acre:	$84,294	30% Contingency:	$294,120
		Estimated Total Cost:	$1,274,520

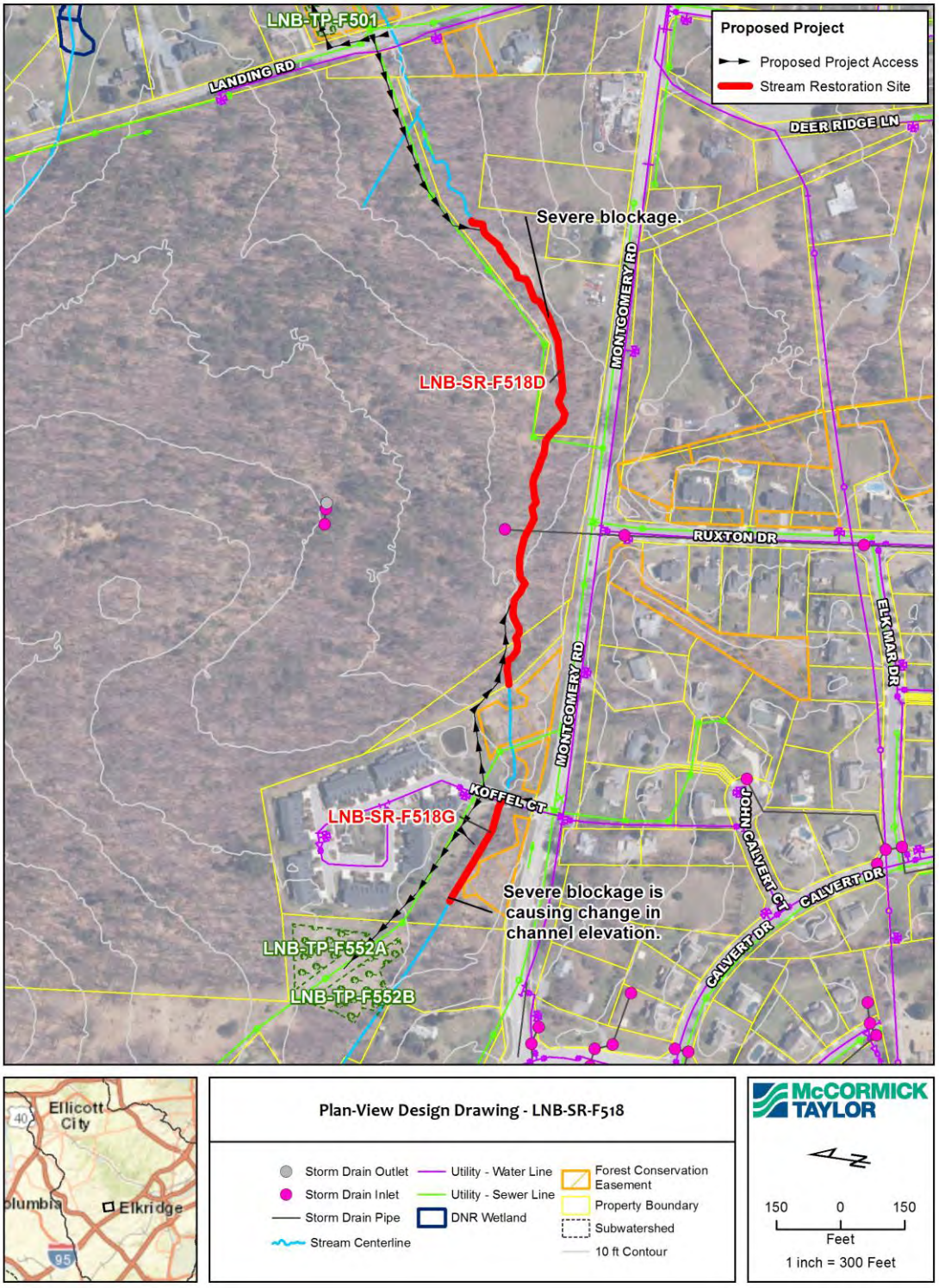
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F518

Site Name: Koffel Court

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



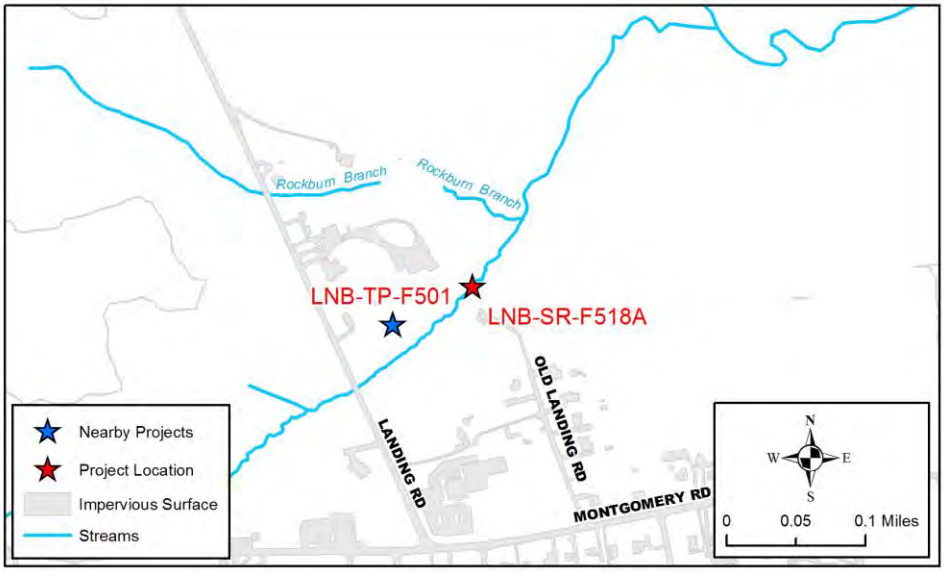
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F518A
Site Name: Landing Road
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Ownership: Private- Residential
Multiple Owners

Existing Conditions:

The site is located on private and county property and falls within a utility right-of-way that is mowed regularly. The majority of the channel is incised and experiencing moderate bank erosion and headcutting. The eroding portions of the channel exhibit nearly vertical banks with heights of 5 to 6 ft., low root density, low to high surface protection, and a primary material of silt. Two 90 degree headcuts with drops of 1 ft. are located within the project limits. Sewer crossing stabilization is constricting flow and causing erosion and scour at the upstream extent. In-stream habitat is lacking, with high amounts of fine sediment and embeddedness in the system, inadequate diversity and cover, and low bank stability. Bed substrate is primarily sand and gravel. Riparian buffer is severely lacking on both banks due to right-of-way mowing.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F518A
Site Name: Landing Road
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Typical pattern of erosion in site.

Erosion with bedrock protection.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F518A
Site Name: Landing Road
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include private property ownership, access, and underground and overhead utilities.

Concept Description:

The proposed project consists of 271 lf. of the tributary to Rockburn Branch. The project goal is to increase in-stream habitat and decrease erosion through the creation of stable channel dimension and bank stabilization treatments. The addition of in-channel woody debris will improve in-stream cover, aid in diversification of stream features, and increase uplift potential. Bed stabilization of the sewer crossing and headcuts is recommended. Access is proposed from Landing Road. A riparian tree planting site upstream of the stream project can be implemented concurrently to improve efficiency and reduce costs.

Nearby Opportunities:

LNB-TP-F501

Proposed Project Credit		Costs	
Length Restored (ft):	271	Estimated Design Cost:	$200,000
Impervious Area Treated Credit (ac.):	2.71	Estimated Construction Cost:	$121,950
Cost per Impervious Credit Acre:	$154,441	30% Contingency:	$96,585
		Estimated Total Cost:	$418,535

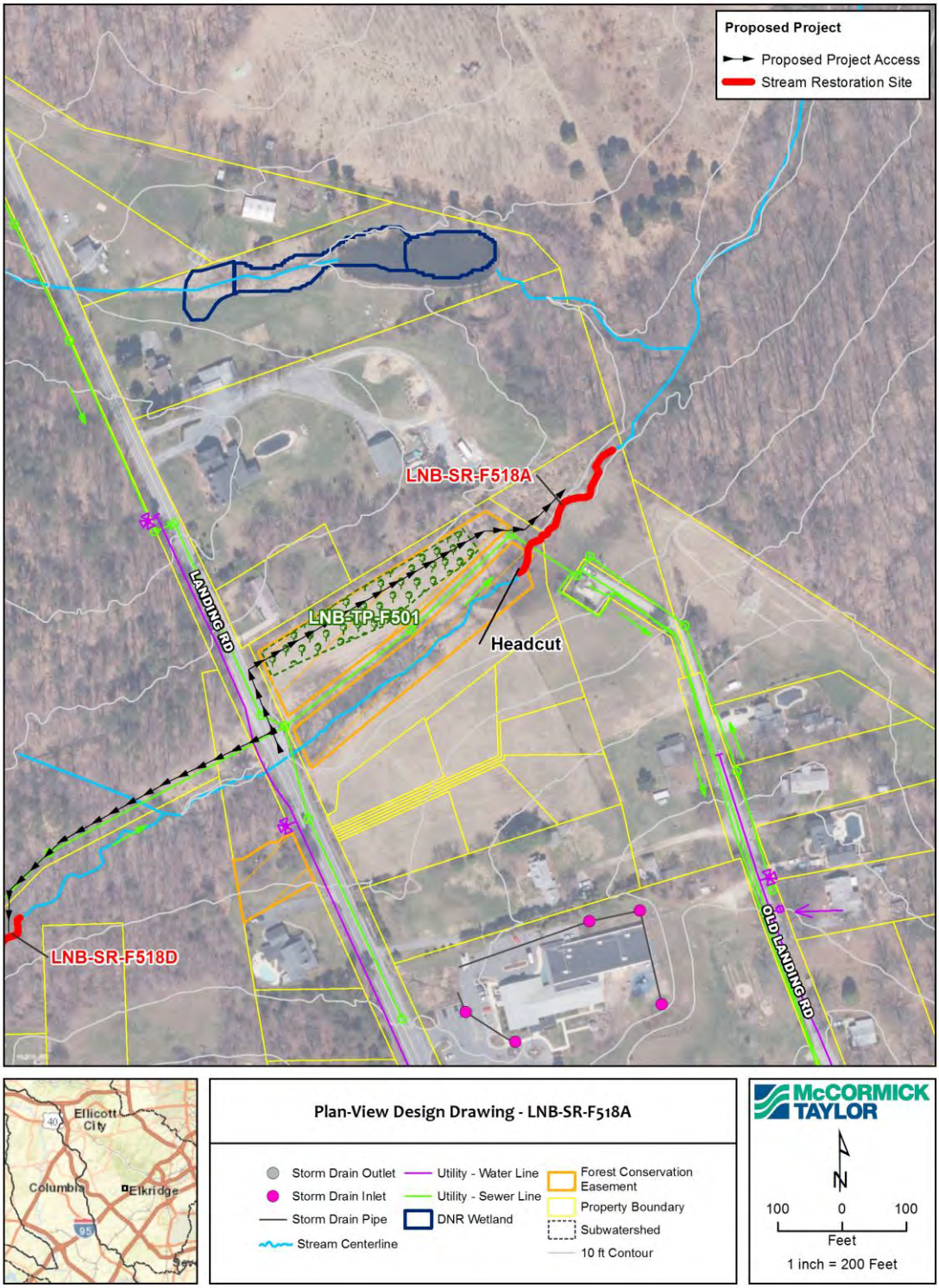
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F518A

Site Name: Landing Road

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



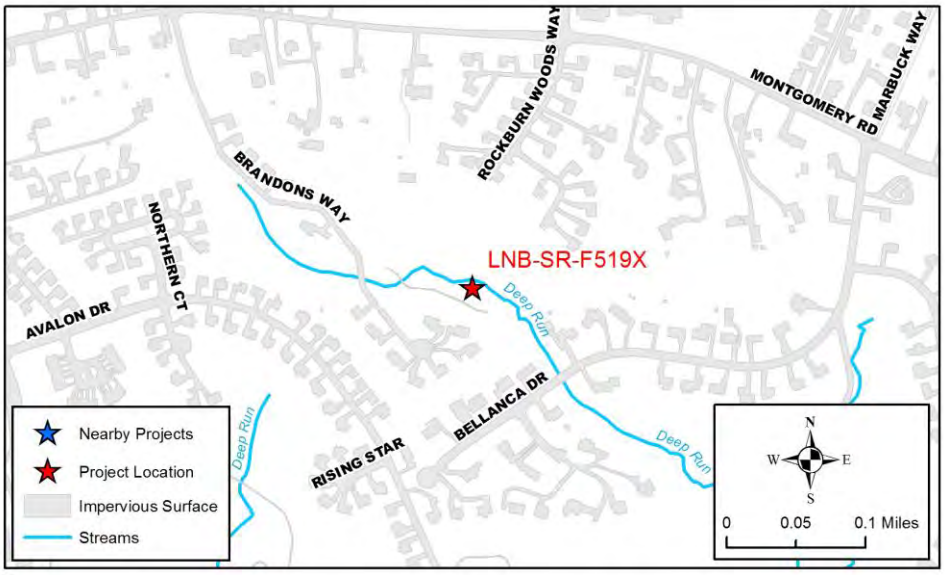
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F519X
Site Name: Brandons Way
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Ownership: County Owned
Multiple Owners

Existing Conditions:

The site is broken into two reaches primarily on county property within forest conservation easements. The downstream extent begins at the Bellanca Drive culvert and the upstream extent ends near the northern Brandons Way crossing, with approximately 400 ft. of stable stream splitting the two reaches. At the downstream extent, 245 ft. of channel is lined with concrete. The remainder of the downstream reach is experiencing small amounts of moderate bank erosion, which exhibit nearly vertical banks with heights of 4 to 6 ft., low to moderate root density and surface protection, and primary materials of silt and bedrock. The majority of the upstream reach is experiencing moderate bank erosion. The channel is incised and appears to be experiencing a relatively high rate of erosion, with eroding portions exhibiting nearly vertical to moderate sand banks that have heights of 3 to 4 ft. and low root density and surface protection. Multiple areas of headcutting occur with drops of 1 to 3 ft. In-stream habitat is lacking in the natural-bedded channel. Substrate is highly embedded and diversity and cover are poor. Substrate is primarily sand and gravel in the downstream reach and sand and silt upstream. Riparian buffer provides good coverage throughout the site.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F519X
Site Name: Brandons Way
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Concrete channel at downstream extent.

Incision and erosion in upstream reach.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F519X
Site Name: Brandons Way
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include private property ownership, underground utilities, existing forest conservation easements, and impacts to existing trees or forest areas.

Concept Description:

The proposed project consists of 1,041 lf. of an unnamed tributary to Deep Run. The project goal is to increase in-stream habitat, floodplain connectivity, and nutrient processing while decreasing erosion through concrete removal, the creation of stable channel dimensions, restoration of natural channel sinuosity, and bank stabilization treatments. Restoration of natural channel bed material and a natural sinuous pattern to the stream, along with the addition of terraced bench features and in-channel woody debris will increase floodplain deposition of fine sediment, aid in diversification of stream features, reduce slope and velocities, and increase uplift potential. Access is proposed through county property and the utility right-of-way from Bellanca Drive and Brandon's Way.

Nearby Opportunities:

None recommended.

Proposed Project Credit		Costs	
Length Restored (ft):	1,041	Estimated Design Cost:	$200,000
Impervious Area Treated Credit (ac.):	10.4	Estimated Construction Cost:	$468,450
Cost per Impervious Credit Acre:	$83,476	30% Contingency:	$200,535
		Estimated Total Cost:	$868,985

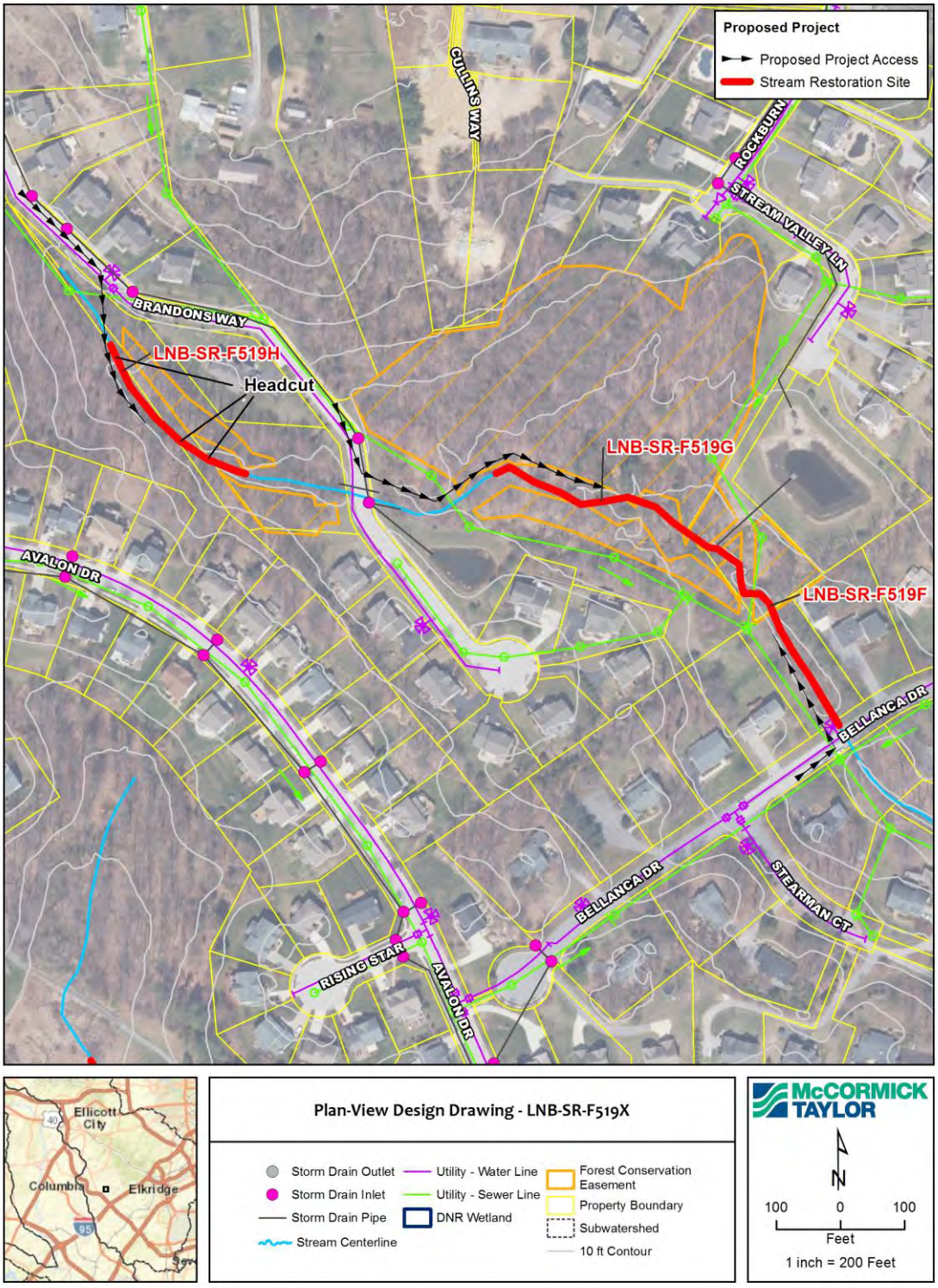
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F519X

Site Name: Brandons Way

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



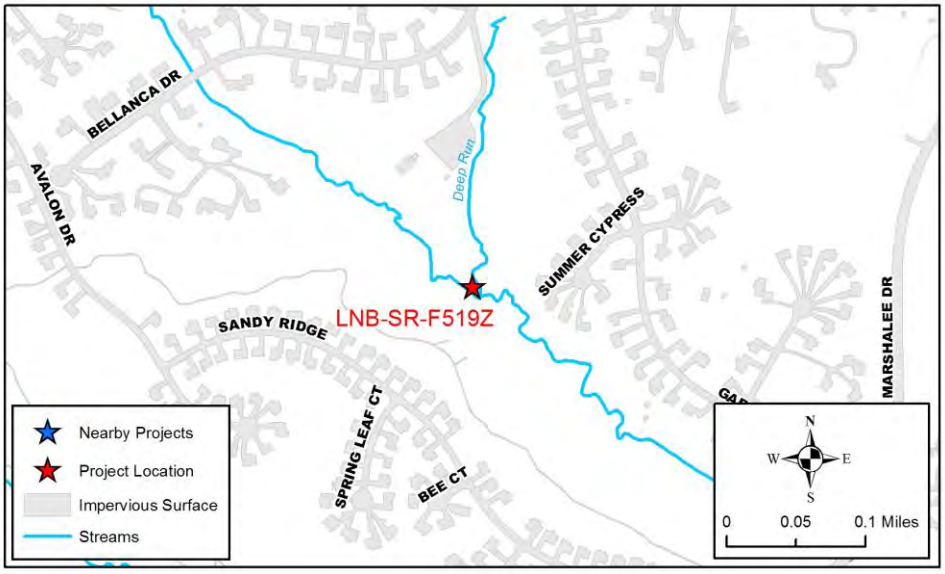
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F519Z
Site Name: Gardenview Drive
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Ownership: Private- HOA
Multiple Owners

Existing Conditions:

The site is broken into two reaches and is located on forested county and private property. The downstream extent begins at the Marshalee Drive culvert and the upstream extent ends near the northern extent of the golf course, with approximately 580 ft. of stable stream splitting the two reaches. Approximately 30% of the proposed project area is experiencing moderate bank erosion. The eroding portions of the channel exhibit undercut to nearly vertical banks with an average height of 4.5 ft., low to moderate root density, low surface protection, and a primary material of silt or sand. At the upstream extent, a woody debris jam is causing a fish blockage and channel alteration at a sewer crossing is causing a 90 degree headcut with a drop of 2 ft. The southern reach appears to have been historically straightened. Moderate in-stream habitat is present, with partially embedded substrate, fair diversity and cover, and somewhat unstable banks. Substrate is primarily sand and gravel. Riparian buffer width is inadequate along portions of the left bank. The tributary at the upstream extent and the adjacent golf course appear to be contributing large sediment loads to the system.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F519Z
Site Name: Gardenview Drive
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Threatened manhole in southern reach.

Typical erosion in northern reach.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F519Z
Site Name: Gardenview Drive
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include private property ownership, underground utilities, existing forest conservation easements, and impacts to existing trees or forest areas.

Concept Description:

The proposed project consists of 2,074 lf. of two unnamed tributaries to Deep Run. The project goal is to increase in-stream habitat, floodplain connectivity, and decrease erosion through the creation of stable channel dimensions, restoration of natural channel sinuosity, and bank stabilization treatments. The addition of terraced bench features and in-channel woody debris will increase floodplain deposition of fine sediment, improve in-stream cover, aid in diversification of stream features, reduce risk of erosion, and increase uplift potential. Access is proposed through county golf course and private swim club property. The adjacent golf course should be investigated for BMP opportunities to reduce sediment loads.

Nearby Opportunities:

None recommended.

Proposed Project Credit		Costs	
Length Restored (ft):	2,074	Estimated Design Cost:	$300,000
Impervious Area Treated Credit (ac.):	20.7	Estimated Construction Cost:	$933,300
Cost per Impervious Credit Acre:	$77,304	30% Contingency:	$369,990
		Estimated Total Cost:	$1,603,290

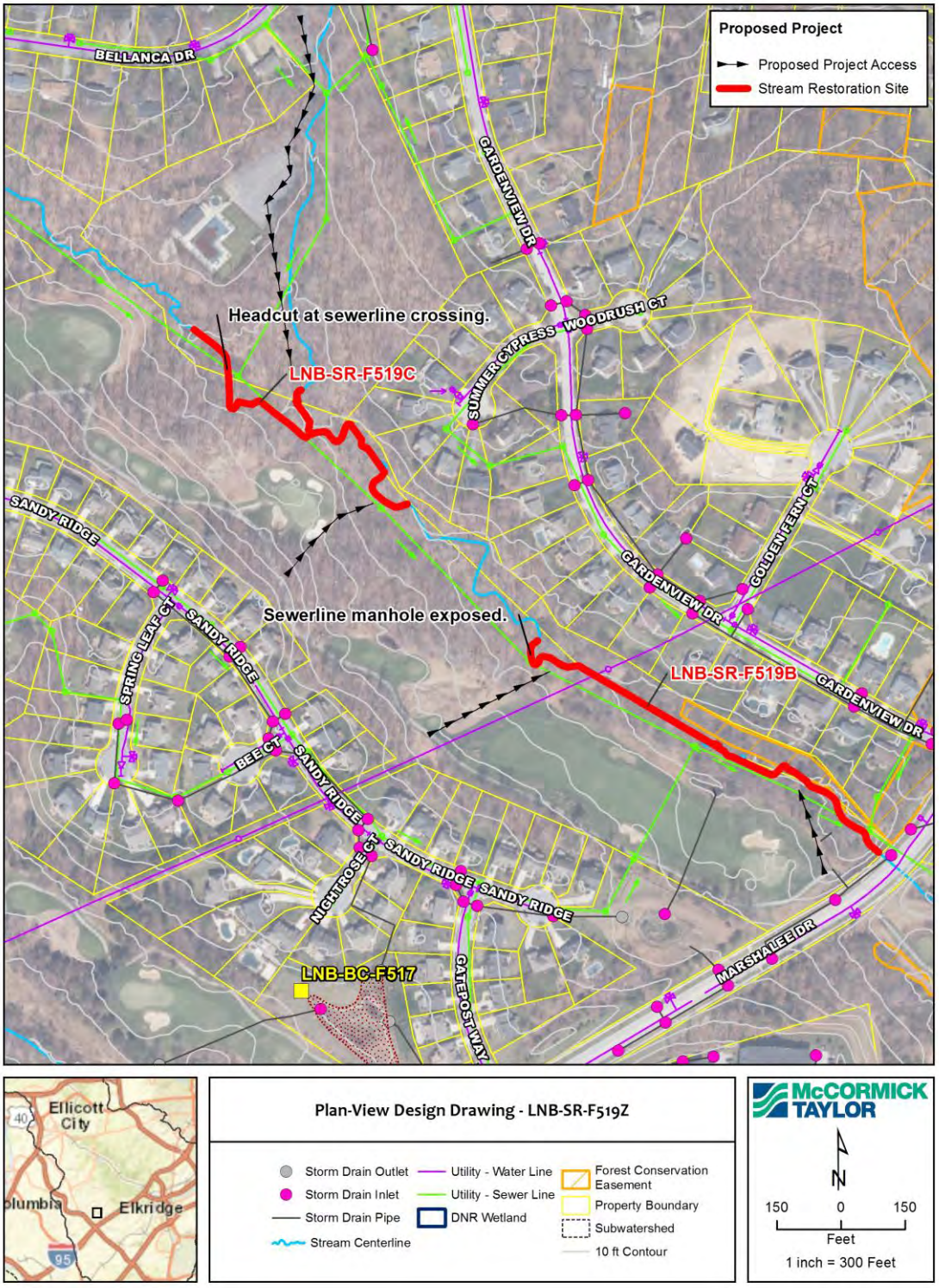
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F519Z

Site Name: Gardenview Drive

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



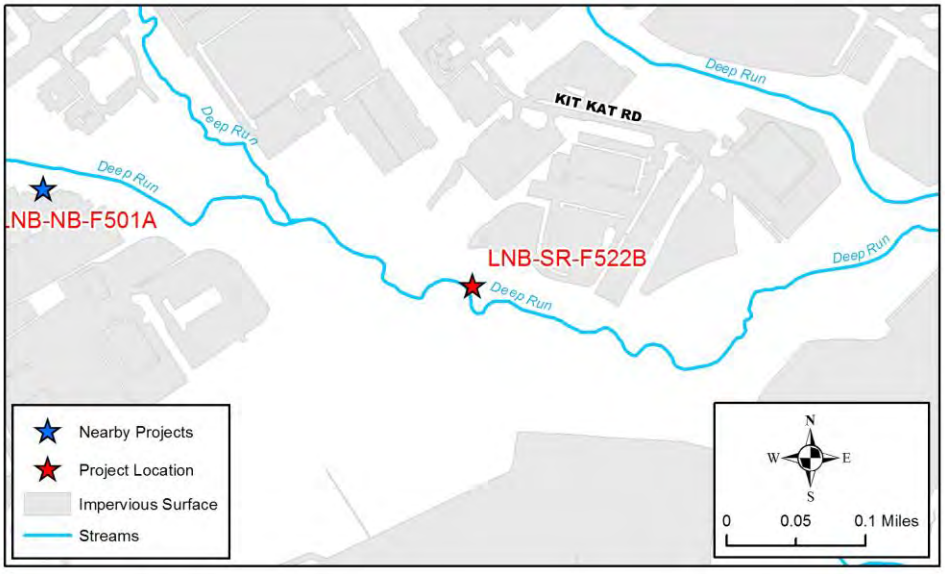
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F522B
Site Name: Kit Kat Road
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Ownership: Private- Commerical/Industrial
Multiple Owners

Existing Conditions:

The site is located on forested commercial property. The downstream extent of the site begins at the start of consistent moderate erosion and the upstream extent ends as the stream regains bank stability. The majority of the channel is experiencing minor to moderate bank erosion. The eroding portions of the channel exhibit undercut to nearly vertical banks with heights of 2 to 9 ft., low to high root density and surface protection, and a primary material of silt or clay. Debris from an old stream crossing is present towards the downstream extent and a large debris jam splits flow at the upstream extent. An outfall at the upstream extent is experiencing minor erosion. Moderate in-stream habitat is present, with minor embeddedness, fair diversity and cover, and somewhat stable banks. Bed substrate is primarily sand and gravel. Riparian buffer provides good coverage.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F522B
Site Name: Kit Kat Road
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Moderate bank erosion.

Typical pattern of erosion at site.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F522B
Site Name: Kit Kat Road
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include private property ownership, access, wetlands, underground utilities, existing forest conservation easements, and impacts to existing trees or forest areas.

Concept Description:

The proposed project consists of 2,629 lf. of Deep Run. The project goal is to increase in-stream habitat, floodplain connectivity, and decrease erosion through the creation of stable channel dimensions, restoration of natural channel sinuosity, and bank stabilization treatments. The addition of terraced bench features and in-channel woody debris will increase floodplain deposition of fine sediment, improve in-stream cover, aid in diversification of stream features, reduce risk of erosion, and increase uplift potential. Stabilization of the eroding outfall and removal of remnant debris is recommended. Access is proposed through private commercial property off of Montevideo Road and Washington Boulevard.

Nearby Opportunities:

None recommended.

Proposed Project Credit		Costs	
Length Restored (ft):	2,629	Estimated Design Cost:	$300,000
Impervious Area Treated Credit (ac.):	26.3	Estimated Construction Cost:	$1,183,050
Cost per Impervious Credit Acre:	$73,335	30% Contingency:	$444,915
		Estimated Total Cost:	$1,927,965

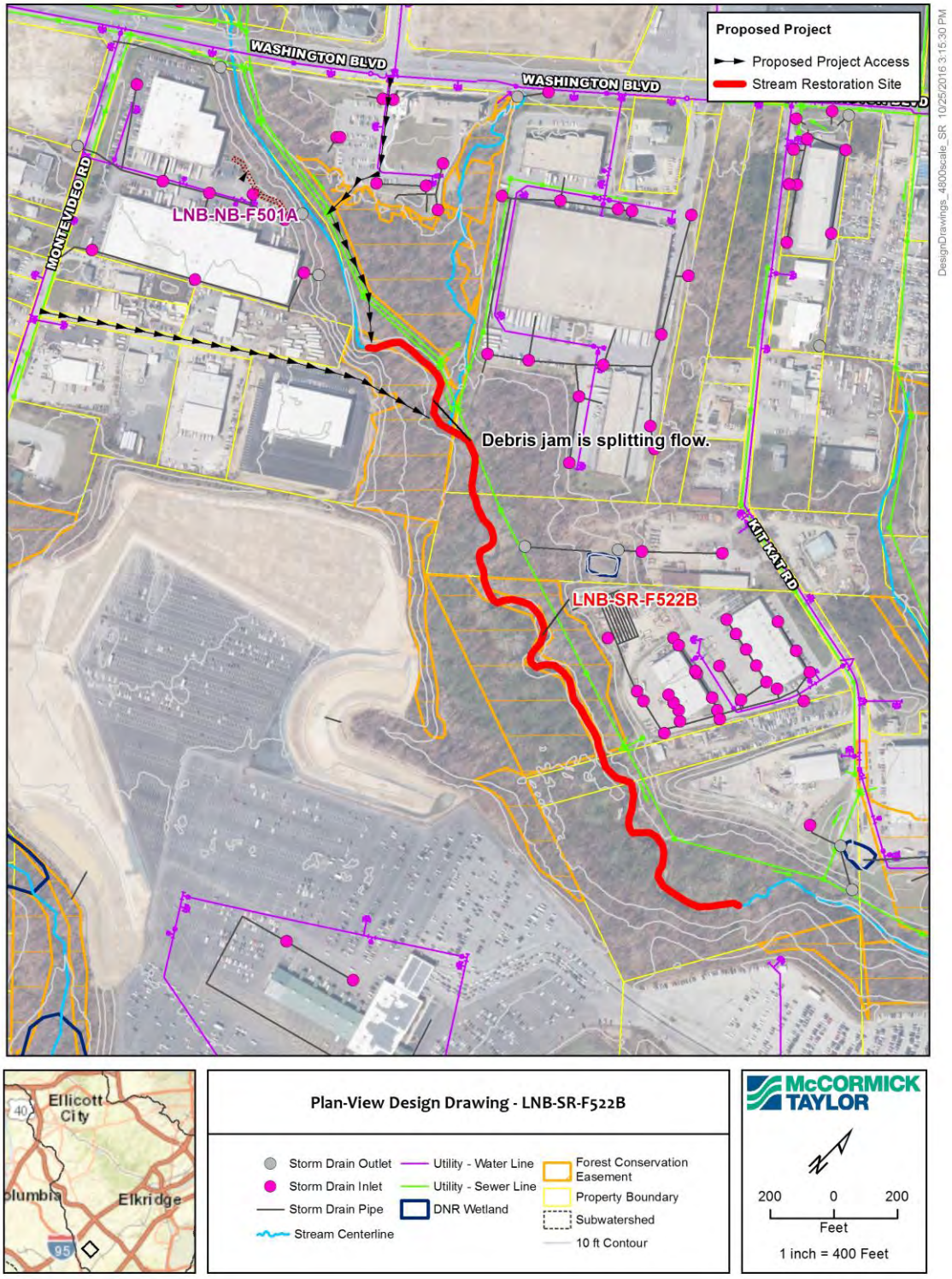
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F522B

Site Name: Kit Kat Road

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



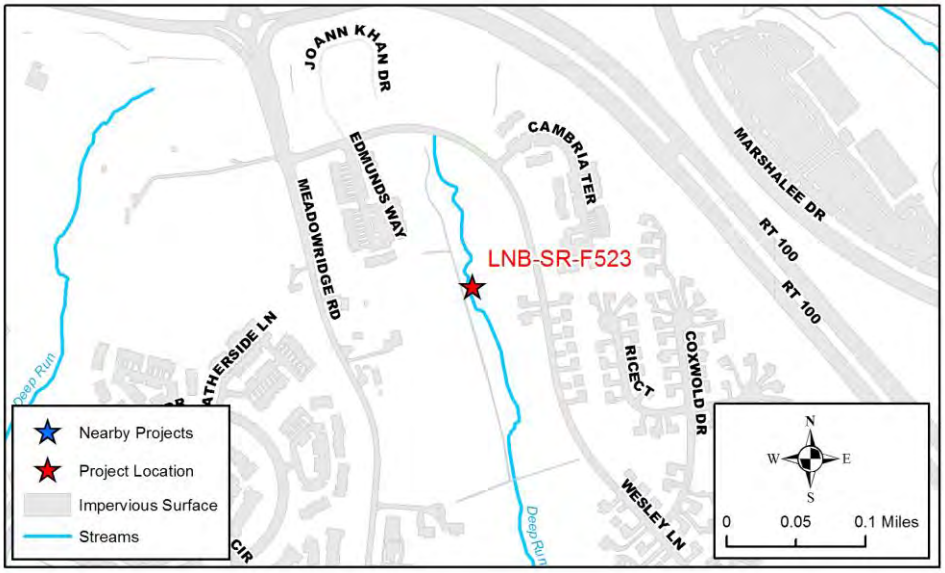
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F523
Site Name: Wesley Lane
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Ownership: Private- HOA
Multiple Owners

Existing Conditions:

The site is located on forested residential and county property. The downstream extent of the site begins upstream of the south Wesley Lane culvert and the upstream extent ends at the north Wesley Lane culvert. Approximately 20% of the downstream extent and 60% of the upstream extent are experiencing minor to severe erosion, typically associated with meander bends, valley wall confinement, or utility right-of-ways. The eroding portions of the channel exhibit undercut to nearly vertical banks with heights of 2 to 6 ft., low to moderate root density, very low to low surface protection, and a primary material of silt. Four 90 degree headcuts are present throughout the site with heights ranging from 1.5 to 3 ft. A significant stream blockage exists in the downstream extent, a severely eroded pipe outfall is located on the left bank near the midpoint, and degraded riprap bank protection is located near the upstream extent. In-stream habitat is lacking, with the substrate highly embedded, low in-stream diversity and cover, and moderate bank stability. Bed substrate is primarily gravel and sand. Riparian buffer is lacking on the right bank at the upstream-most extent due to the adjacent stormwater facility.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F523
Site Name: Wesley Lane
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Typical erosion in upstream extent.

Typical erosion in downstream extent.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F523
Site Name: Wesley Lane
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include private property ownership, wetlands, underground utilities, and impacts to existing trees or forest areas.

Concept Description:

The proposed project consists of 2,659 lf. of an unnamed tributary to Deep Run. The project goal is to increase in-stream habitat, floodplain connectivity, decrease erosion, and protect existing infrastructure through the creation of stable channel dimensions and bank stabilization treatments. The addition of terraced bench features and in-channel woody debris will increase floodplain deposition of fine sediment, improve in-stream cover, aid in diversification of stream features, reduce risk of erosion, and increase uplift potential. Access is proposed primarily through county property from Wesley Lane.

Nearby Opportunities:

None recommended.

Proposed Project Credit		Costs	
Length Restored (ft):	2,659	Estimated Design Cost:	$300,000
Impervious Area Treated Credit (ac.):	26.6	Estimated Construction Cost:	$1,196,550
Cost per Impervious Credit Acre:	$73,167	30% Contingency:	$448,965
		Estimated Total Cost:	$1,945,515

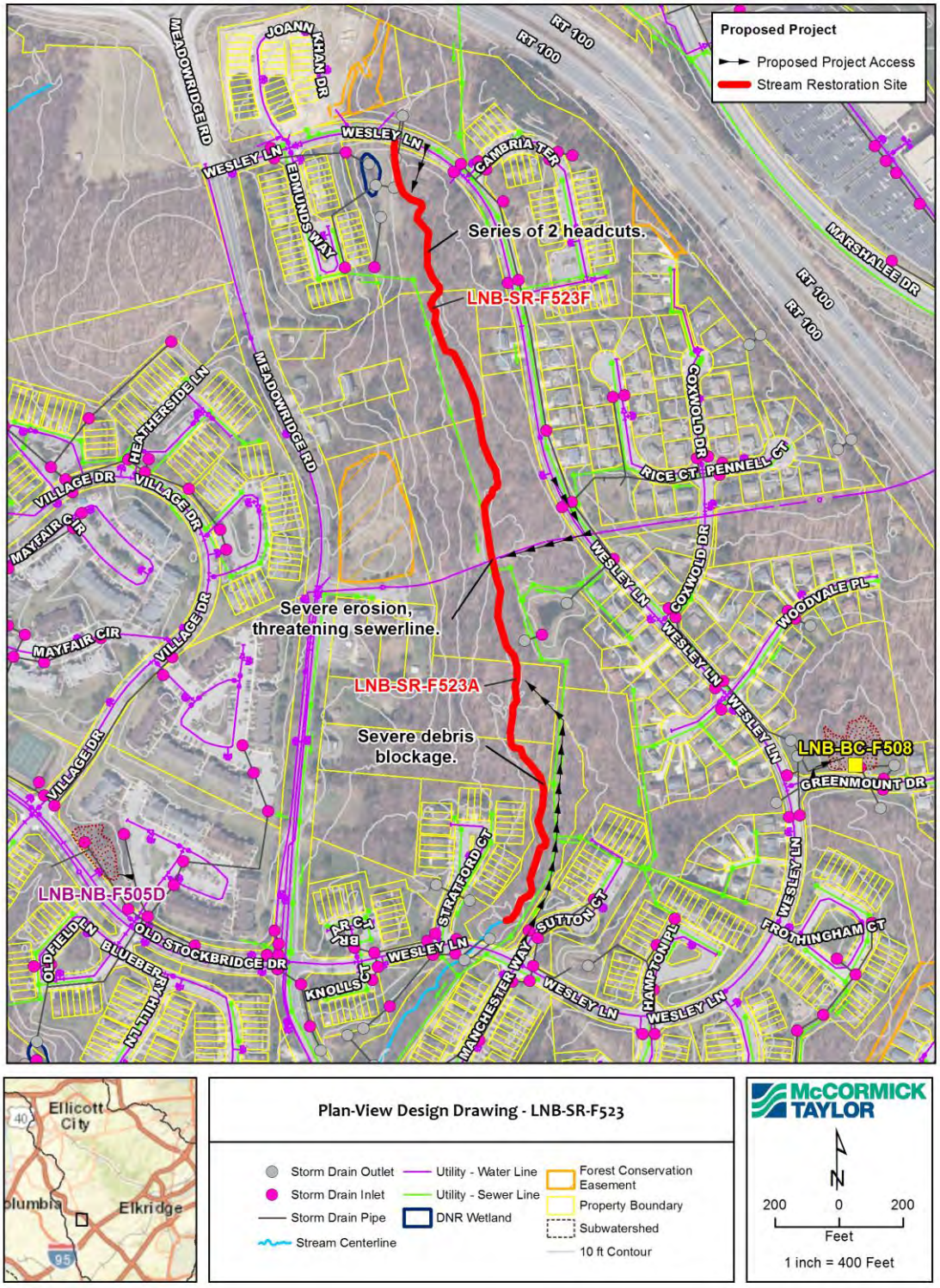
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F523

Site Name: Wesley Lane

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



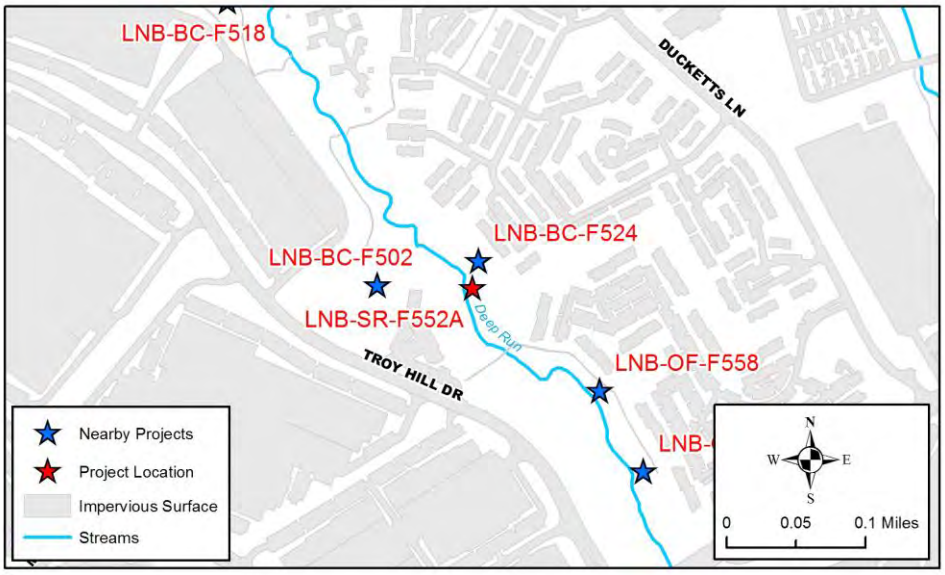
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F552A
Site Name: Ducketts Lane
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Ownership: Private- HOA
Multiple Owners

Existing Conditions:

The site is located on forested commercial, residential, and county property. The downstream extent of the site begins at the Washington Boulevard culvert and the upstream extent ends downstream of I-95. Approximately 45% of the channel is experiencing long lengths of moderate to severe erosion, typically associated with tight meander bends or valley wall confinement. The eroding portions of the channel exhibit undercut to moderately angled banks with heights of 2 to 10 ft., low to moderate root density and surface protection, and a range of stratified primary materials from silt to bedrock. Two severely eroded pipe outfalls are located on the left bank at the downstream extent and failing sewer crossing protection is found at upstream extent. Moderate in-stream habitat is present, with partially embedded substrate, fair diversity and cover, and somewhat stable banks. Habitat at the downstream extent is higher quality than at the upstream extent. Bed substrate is primarily gravel, sand, and cobble. Riparian buffer is lacking on the right bank at the upstream extent due to adjacent sewer line.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F552A
Site Name: Ducketts Lane

Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Typical erosion pattern at site.

Active severe bank erosion.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F552A
Site Name: Ducketts Lane
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include private property ownership, access, wetlands, underground utilities, and impacts to existing trees or forest areas.

Concept Description:

The proposed project consists of 3,324 lf. of an unnamed tributary to Deep Run. The project goal is to increase in-stream habitat, floodplain connectivity, decrease erosion, and protect existing infrastructure through the creation of stable channel dimensions and bank stabilization treatments. The addition of terraced bench features and in-channel woody debris will increase floodplain deposition of fine sediment, improve in-stream cover, aid in diversification of stream features, reduce risk of erosion, and increase uplift potential. Access is proposed from several locations through private property.

Nearby Opportunities:

LNB-BC-F502, LNB-BC-F518, LNB-BC-F524, LNB-OF-F557, LNB-OF-F558

Proposed Project Credit		Costs	
Length Restored (ft):	3,324	Estimated Design Cost:	$300,000
Impervious Area Treated Credit (ac.):	33.2	Estimated Construction Cost:	$1,495,800
Cost per Impervious Credit Acre:	$70,233	30% Contingency:	$538,740
		Estimated Total Cost:	$2,334,540

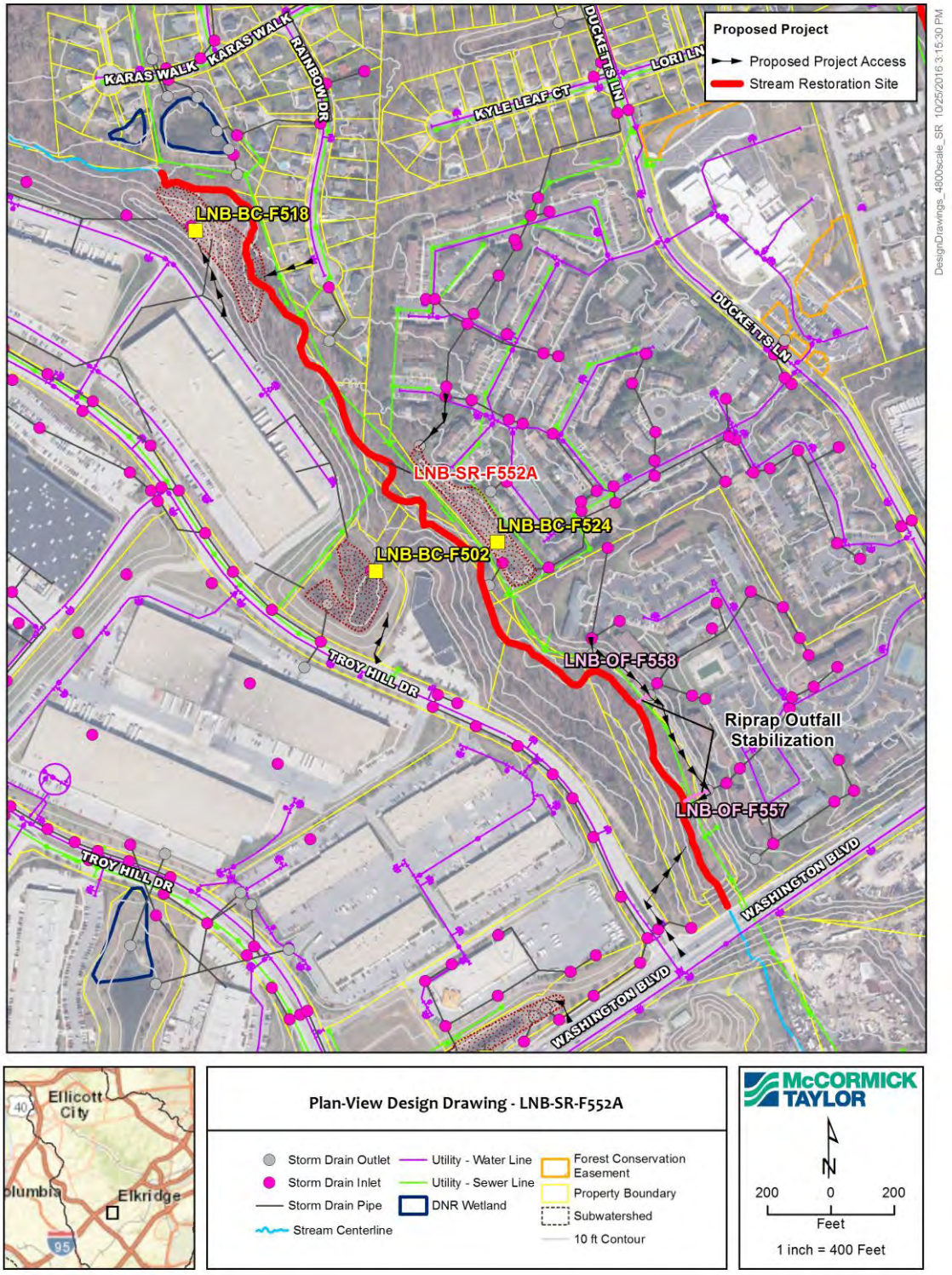
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F552A

Site Name: Ducketts Lane

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



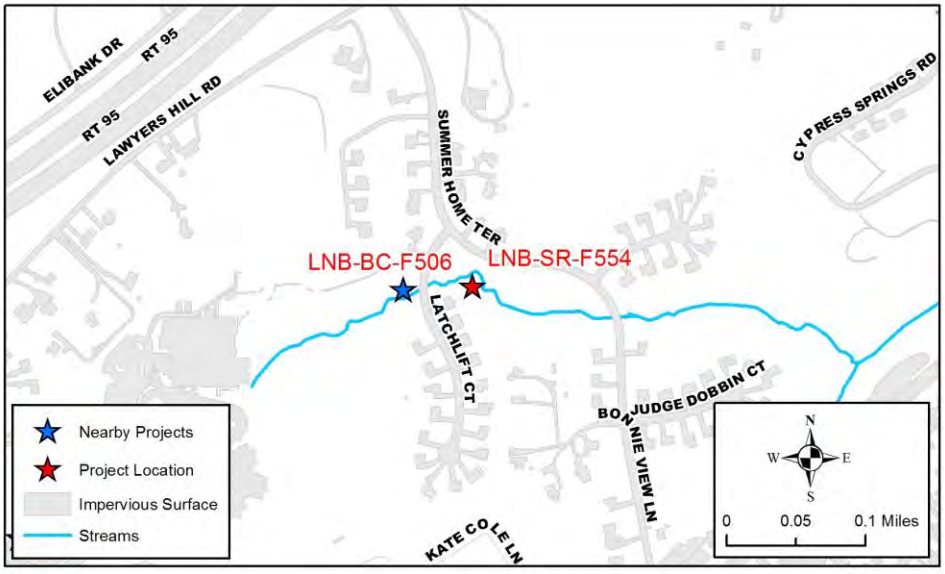
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F554
Site Name: Summer Home Terrace
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Ownership: County School
Multiple Owners

Existing Conditions:

The site is located on forested county school and residential property. The downstream extent of the site begins within a forested area off of Summer Home Terrace and the upstream extend ends at a stormwater pond outfall at Elkridge Elementary. The majority of the channel is experiencing moderate to severe bank erosion. The eroding portions of the channel exhibit vertical banks with heights of 3 to 6 ft., low root density and surface protection, and a primary material of sand or silt. Multiple headcuts are present throughout the channel that are causing nearly vertical, 1 to 6 ft. drops in the channel bed elevation. The riprap stabilization downstream of the outfall at Elkridge Elementary has eroded in multiple areas and is causing channel instability. In-stream habitat is lacking, with high amounts of fine sediment and embeddedness in the system, inadequate diversity and cover, and low bank stability. Bed substrate is primarily gravel, sand, and silt.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F554
Site Name: Summer Home Terrace
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Looking upstream from downstream extent toward typical bank erosion.

Erosion and headcutting at the upstream extent of the site.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F554
Site Name: Summer Home Terrace
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints for this project include private property ownership, access, underground utilities, and impacts to existing trees or forest areas.

Concept Description:

The proposed project consists of 893 lf. of the unnamed tributary to Patapsco River. The project goal is to increase in-stream habitat, floodplain connectivity, and decrease erosion through the creation of stable channel dimensions, restoration of natural channel sinuosity, and bank stabilization treatments. The addition of terraced benches and in-channel woody debris will increase floodplain deposition of fine sediment, improve in-stream cover, aid in diversification of stream features, reduce risk of erosion, and increase uplift potential. Stabilization of the channel bed and restoration of a natural sinuous pattern to the stream are recommended to reduce slope and storm event velocities. Access is proposed through county school and private residential property. One proposed BMP conversion project located at Latchlift Court can be implemented concurrently to reduce costs and increase efficiency.

Nearby Opportunities:

LNB-BC-F506

Proposed Project Credit		Costs	
Length Restored (ft):	893	Estimated Design Cost:	$200,000
Impervious Area Treated Credit (ac.):	8.93	Estimated Construction Cost:	$401,850
Cost per Impervious Credit Acre:	$87,615	30% Contingency:	$180,555
		Estimated Total Cost:	$782,405

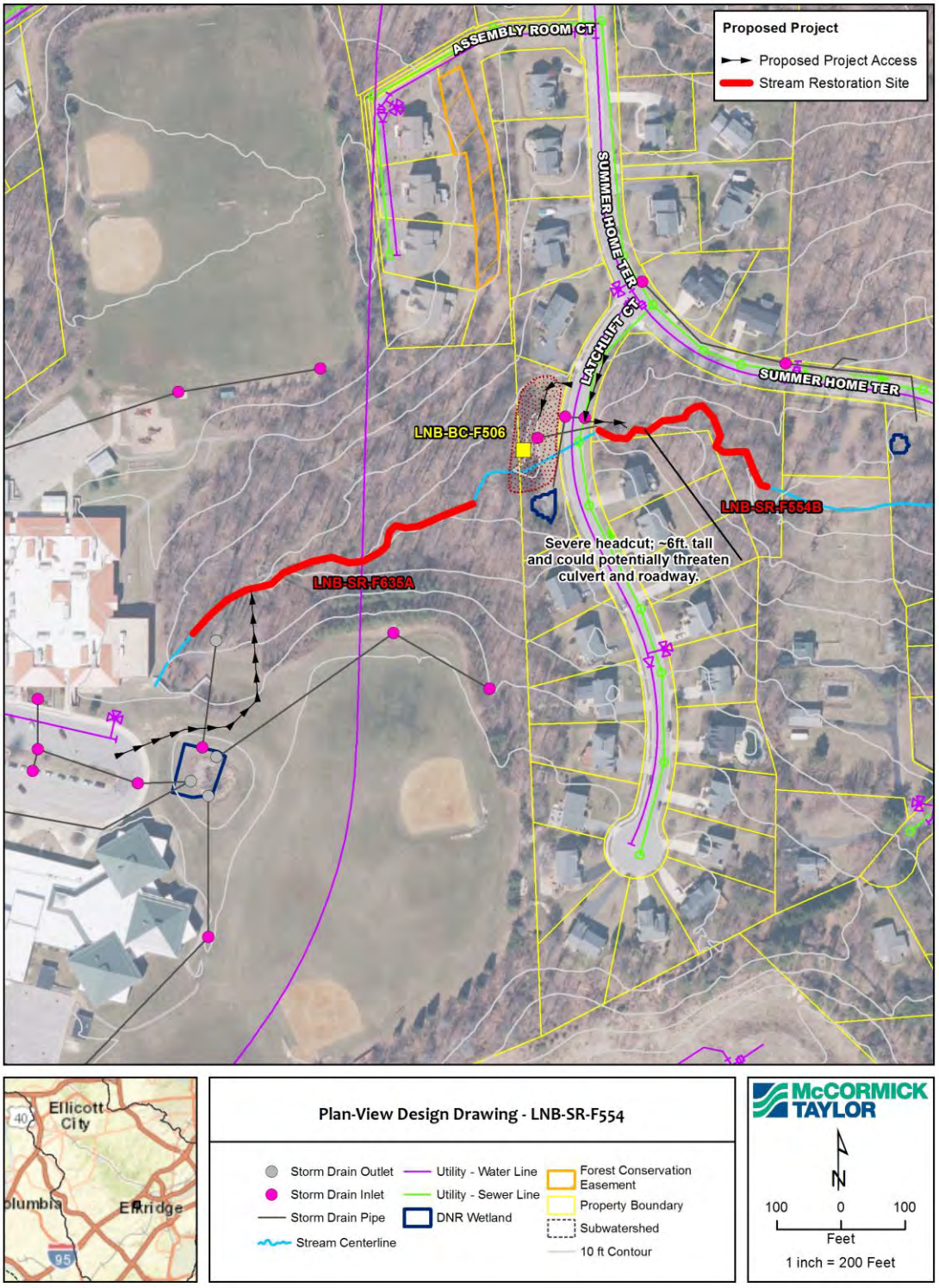
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F554

Site Name: Summer Home Terrace

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



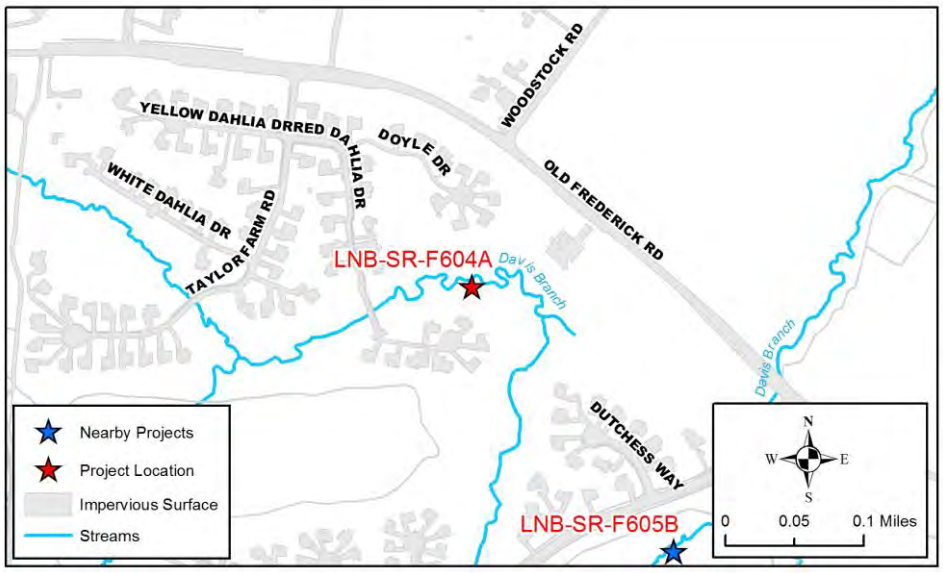
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F604A
Site Name: Taylor Farm
Contractor: KCI
Watershed: Patapsco Lower North

Ownership: County Park
Multiple Owners

Existing Conditions:

The site is located on Davis Branch on property owned by Howard County Department of Parks and Rec and Warfield Woods LLC. In this location, Davis Branch has downcut and eroded laterally, resulting in frequent areas of bank erosion. The banks along this reach are near vertical and have an average height of 4 ft. The banks are primarily composed of silt and have low root density and shallow root depth. Stream sinuosity has increased over time and has resulted in compressed meanders throughout the site. Stream habitat is poor at this site, lacking both suitable cover for fish and stable substrates for stream insects. Habitat diversity is low, with the majority of the available habitat of one velocity and depth combination. The habitat is also impaired by a high amount of fine material covering the stream bed. The stream substrate is comprised mostly of sand and gravel.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F604A
Site Name: Taylor Farm
Contractor: KCI
Watershed: Patapsco Lower North

Typical eroding banks, facing left bank

Typical eroding banks, facing right bank

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F604A
Site Name: Taylor Farm
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

Property ownership is a constraint at this site; the lower portion of the proposed restoration reach is located on private property. A sewer line parallels the stream for the entire length of the site, and crosses the stream at the downstream end of the reach. The site is located along a forested reach of stream and would require a significant level of clearing for access and construction. Specimen trees are located close to the project site. Field crews identified wetlands which may be impacted by construction activities along this reach.

Concept Description:

The proposed stream restoration design will focus on stabilizing eroding banks, relieving the compressed meanders, and reconnecting the stream to its floodplain. Banks will be graded to create a new lower elevation floodplain and to allow the stream access to its historical floodplain during high-flow events. Bank protection will include natural channel design and bioengineering techniques, but may need stone treatments in some areas especially where the stream is crossed by the sanitary sewer line. The channel will be realigned to reduce the compressed meanders. Cobble brought in from off-site will be added to the existing sand and gravel substrates in constructed riffles to increase velocity and habitat diversity. Existing rootwads will be retained when possible to provide habitat and overhead cover for fish and benthic macroinvertebrates. A sanitary sewer line parallels the stream and crosses the stream channel in one location. Consideration will be given to protecting the existing infrastructure in the proposed design. A planting plan will be developed for the site to revegetate the stream banks and areas disturbed during construction using native plant species.

Nearby Opportunities:

None recommended

Proposed Project Credit		Costs	
Length Restored (ft):	1,260	Estimated Design Cost:	$300,000.00
Impervious Area Treated Credit (ac.):	12.6	Estimated Construction Cost:	$567,000.00
Cost per Impervious Credit Acre:	$89,452	30% Contingency:	$260,100.00
		Estimated Total Cost:	$1,127,100.00

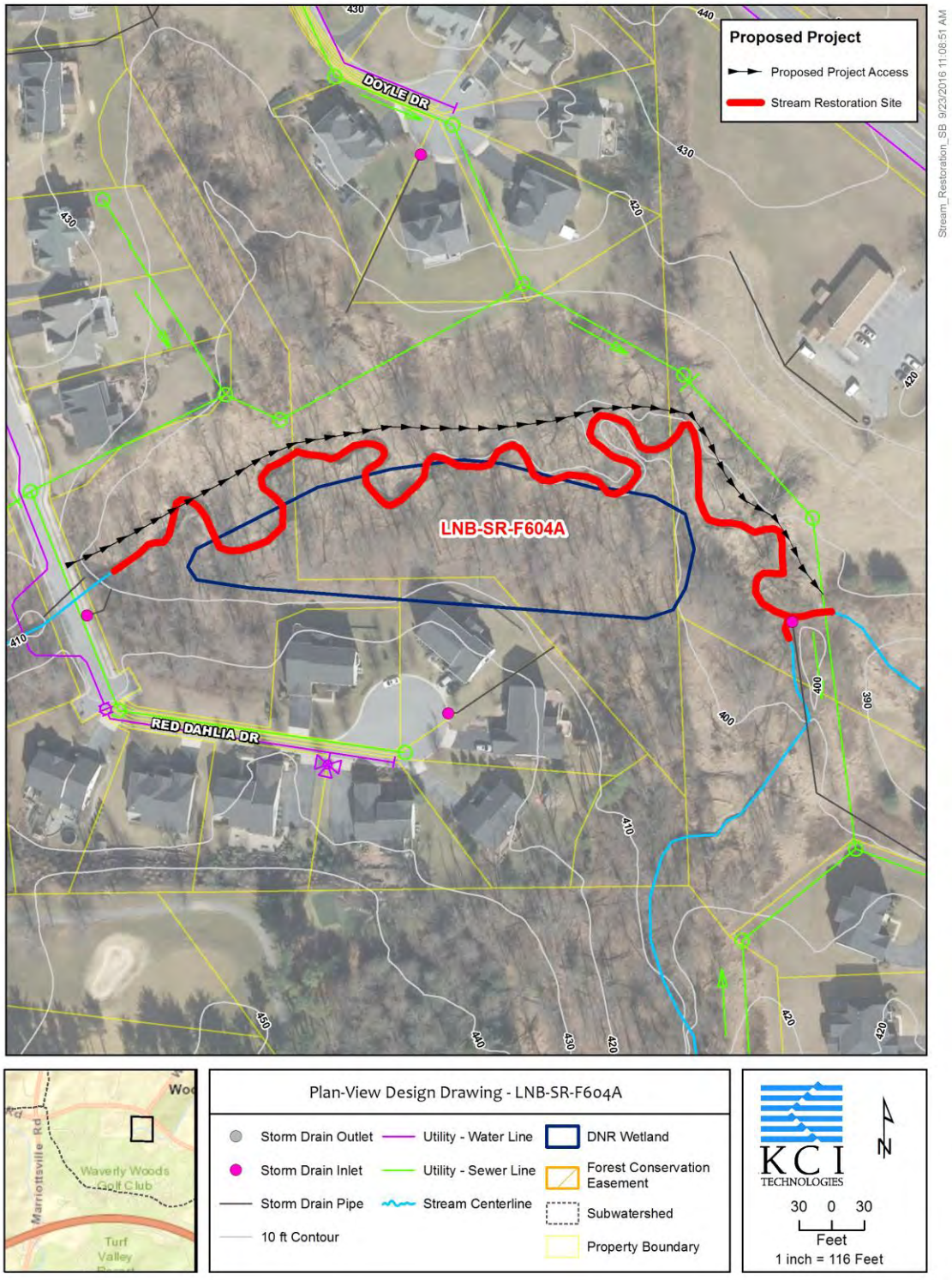
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F604A

Site Name: Taylor Farm

Contractor: KCI

Watershed: Patapsco Lower North



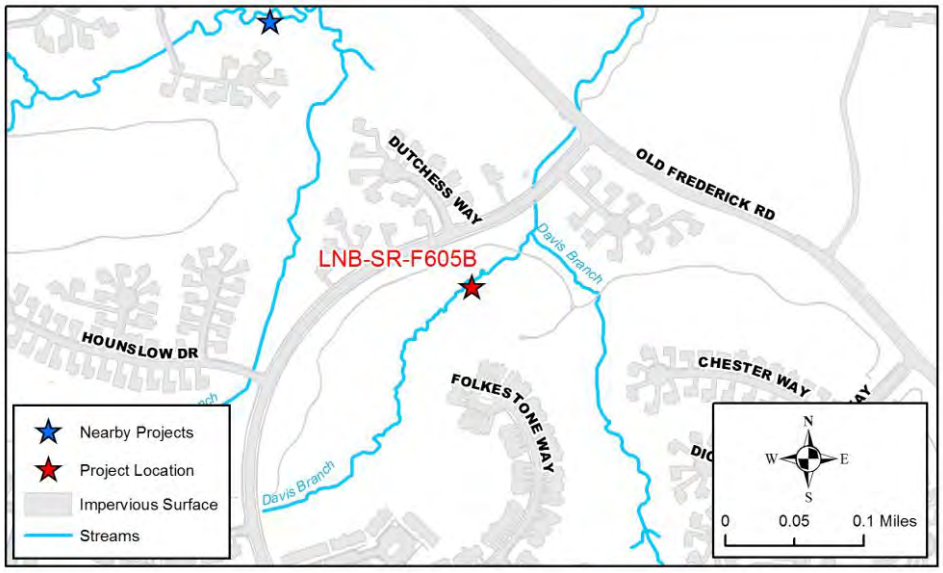
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F605B
Site Name: Dorchester Way
Contractor: KCI
Watershed: Patapsco Lower North

Ownership: Private- Residential
Multiple Owners

Existing Conditions:

The site is located on a tributary to Davis Branch on property owned by Waverly Woods Owners Association and the Waverly Woods Golf Club. The stream in this location has downcut and eroded laterally, resulting in several areas of bank erosion. The eroded banks along this reach are near vertical and have a height of 3 to 4.5 ft. The banks are primarily composed of silt and have extremely low root density and very shallow root depth. A 1 ft. headcut is present within the reach. Stream habitat is poor at this site, lacking both suitable cover for fish and stable substrates for stream insects. Habitat diversity is low, with the majority of the available habitat consisting of shallow pools with intermittent short, shallow riffles. The habitat is also impaired by a high amount of fine material covering the stream bed. The stream substrate is comprised mostly of sand and gravel with some cobble present. Mowing occurs right up to the top of bank along most of the site. In areas where there is a narrow buffer, the buffer consists of only tall grasses.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F605B
Site Name: Dorchester Way
Contractor: KCI
Watershed: Patapsco Lower North

Typical stream erosion along the site

Mowing to edge of stream at golf course throughout site

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F605B
Site Name: Dorchester Way
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

Ownership may be a constraint for this site as the site is located on the Waverly Woods Golf Club. Construction would impact the use of the hole around the project site. The fairway on both sides of the stream at this site would limit the types of vegetation used for riparian plantings and would likely limit the width of the riparian planting along both sides of the stream. The golf cart path crosses the stream on a small bridge near the downstream extent of this project site. A drinking water supply crosses under the stream near the midpoint, and two sewer lines cross the stream in the lower third of the site.

Concept Description:

The proposed stream restoration design will focus on stabilizing eroding banks and reconnecting the stream to its floodplain. Banks will be graded to create a new lower elevation floodplain. Bank protection will include natural channel design and bioengineering techniques, but may need stone treatments in some areas especially where the stream is crossed by infrastructure. Riffle length and frequency will be increased to create habitat. Additional cobble brought in from off-site will be added to the existing sand and gravel substrates in constructed riffles to increase velocity and habitat diversity. A sanitary sewer line crosses the stream channel in two locations and a drinking water supply line crosses at another location. Consideration will be given to protecting the existing infrastructure in the proposed design. A planting plan consisting of native plant species will be developed for the site to revegetate the stream banks and areas disturbed during construction. Plant species will be selected to minimize interference with play on the golf course.

Nearby Opportunities:

None recommended

Proposed Project Credit		Costs	
Length Restored (ft):	640	Estimated Design Cost:	$200,000.00
Impervious Area Treated Credit (ac.):	6.4	Estimated Construction Cost:	$288,000.00
Cost per Impervious Credit Acre:	$99,125	30% Contingency:	$146,400.00
		Estimated Total Cost:	$634,400.00

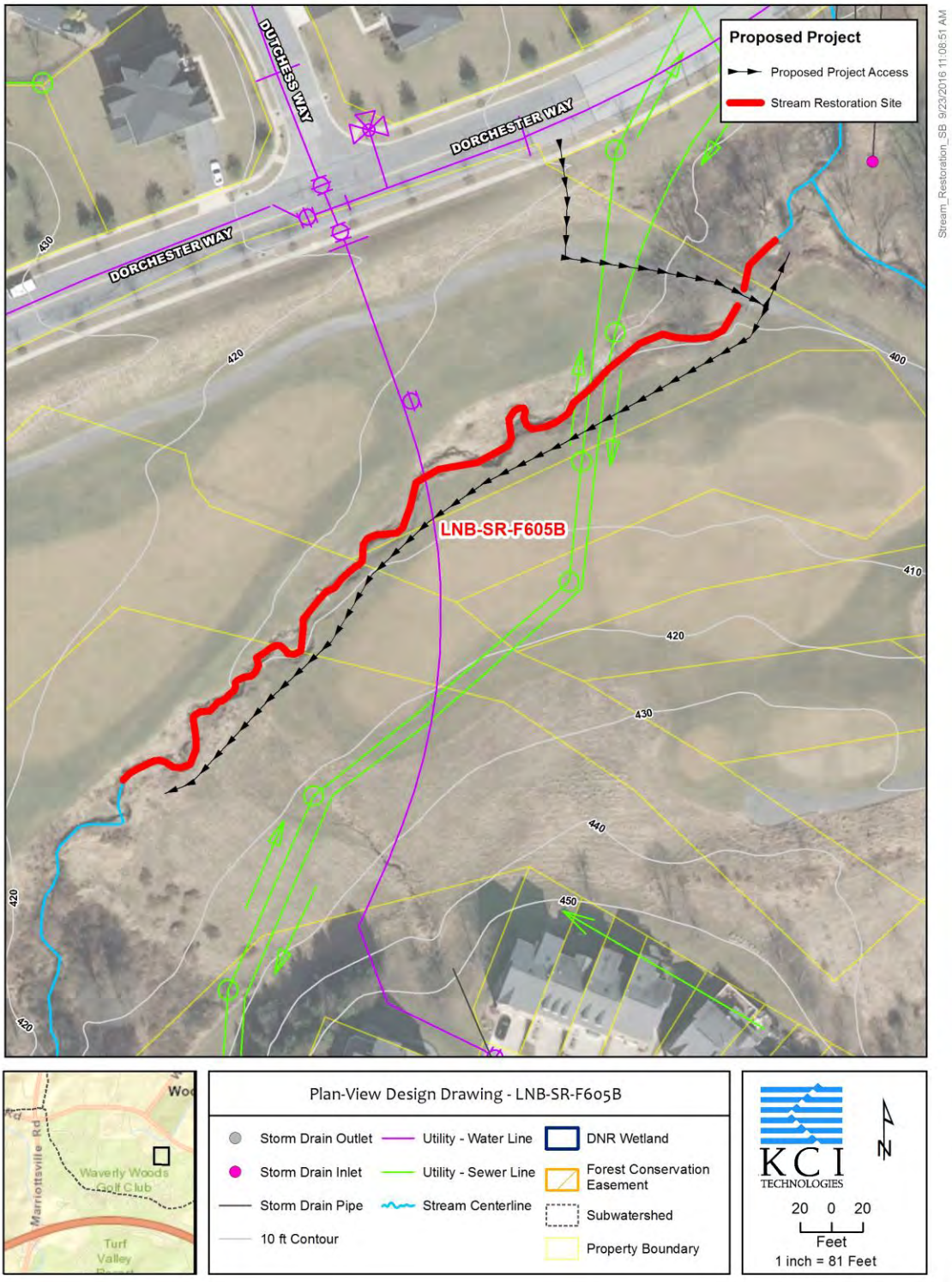
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F605B

Site Name: Dorchester Way

Contractor: KCI

Watershed: Patapsco Lower North



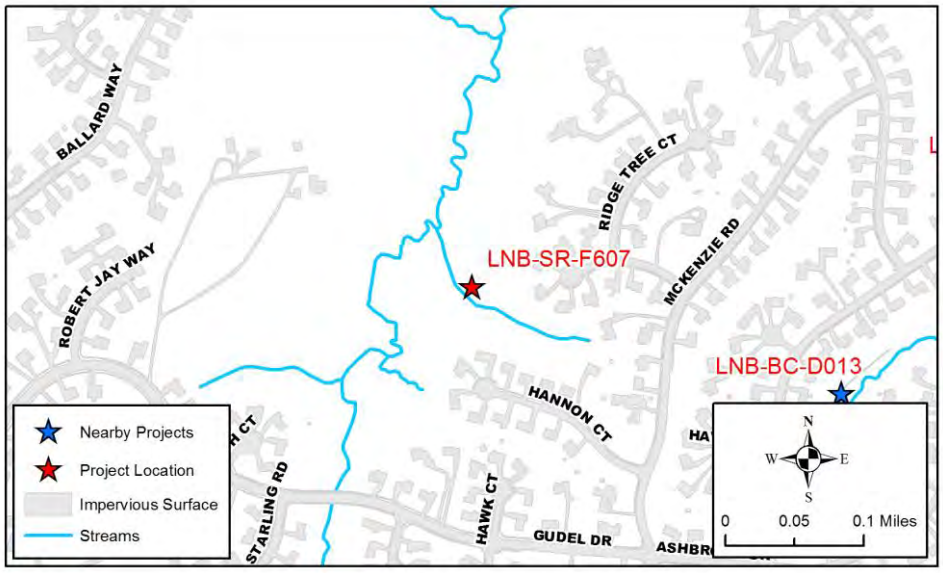
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F607
Site Name: Gudel Drive
Contractor: KCI
Watershed: Patapsco Lower North

Ownership: County Park
Multiple Owners

Existing Conditions:

This site is located on an unnamed direct-drainage tributary to the Patapsco River. The site is located on land owned by Howard County Department of Parks and Recreation and a private landowner. The stream in this location has downcut and eroded laterally, resulting in several areas of bank erosion. The eroded banks along this reach are near vertical and have an average height of 5.5 ft. in the downstream portion and 3.5 ft. in the upstream portion of the site. The banks are primarily composed of silt and have very low root density and very shallow root depth. Stream habitat is poor at this site, lacking both suitable cover for fish and stable substrates for stream insects. Habitat diversity is low, with the majority of the available habitat consisting of shallow pools with intermittent short, shallow riffles. The habitat is also impaired by a moderate amount of fine material covering the stream bed. The stream substrate is comprised mostly of sand and gravel with some cobble present.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F607
Site Name: Gudel Drive
Contractor: KCI
Watershed: Patapsco Lower North

Facing downstream showing typical erosion in the site

Typical stream bank erosion on the right bank

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F607
Site Name: Gudel Drive
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

Access may be difficult at this site as it is located in a wooded area away from roads. Utilities are listed as a possible constraint at this site. A sewer line parallels the stream for most of the length of the site, and crosses the stream at no fewer than four locations. The site is located along a forested reach of stream and would require a significant level of clearing for access and construction. Specimen trees are located close to the project site and could be impacted. Field crews identified wetlands which may be impacted by construction activities along this reach.

Concept Description:

The proposed stream restoration design will focus on stabilizing eroding banks and reconnecting the stream to its floodplain. Banks will be graded to create a new lower elevation floodplain and to allow access to the historical floodplain during high-flow events. Bank protection will include natural channel design and bioengineering techniques, but may need stone treatments in some areas especially where the stream is close to or crossed by infrastructure. Riffle length and frequency will be increased to create habitat. Additional cobble brought in from off-site will be added to the existing sand and gravel substrates in constructed riffles to increase velocity and habitat diversity. A sanitary sewer line parallels the stream and crosses the stream channel in four locations. Consideration will be given to protecting the existing infrastructure in the proposed design. A planting plan will be developed for the site to revegetate the stream banks and areas disturbed during construction using native plant species.

Nearby Opportunities:

None recommended

Proposed Project Credit		Costs	
Length Restored (ft):	3,565	Estimated Design Cost:	$300,000.00
Impervious Area Treated Credit (ac.):	35.65	Estimated Construction Cost:	$1,604,250.00
Cost per Impervious Credit Acre:	$69,440	30% Contingency:	$571,275.00
		Estimated Total Cost:	$2,475,525.00

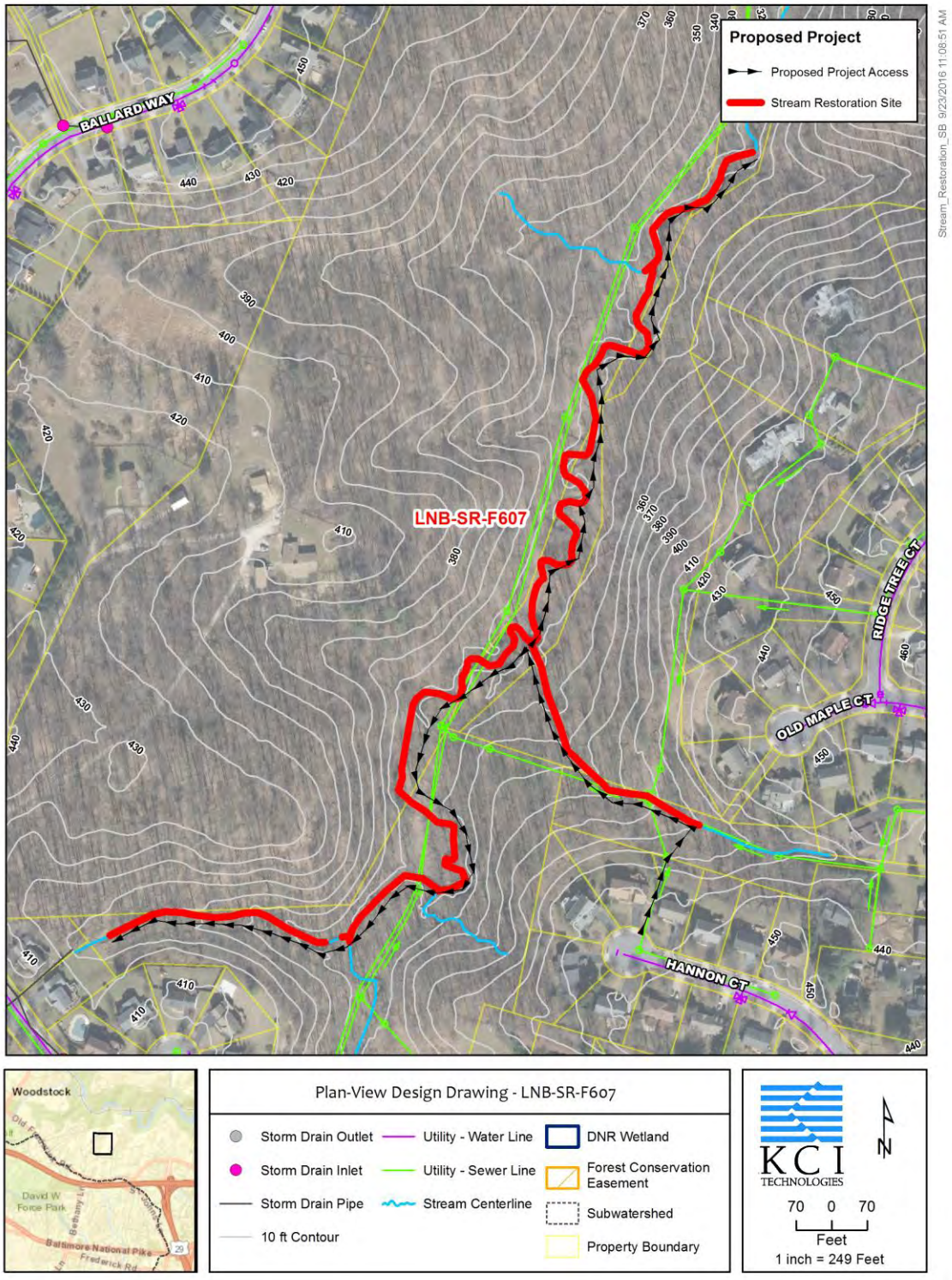
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F607

Site Name: Gudel Drive

Contractor: KCI

Watershed: Patapsco Lower North



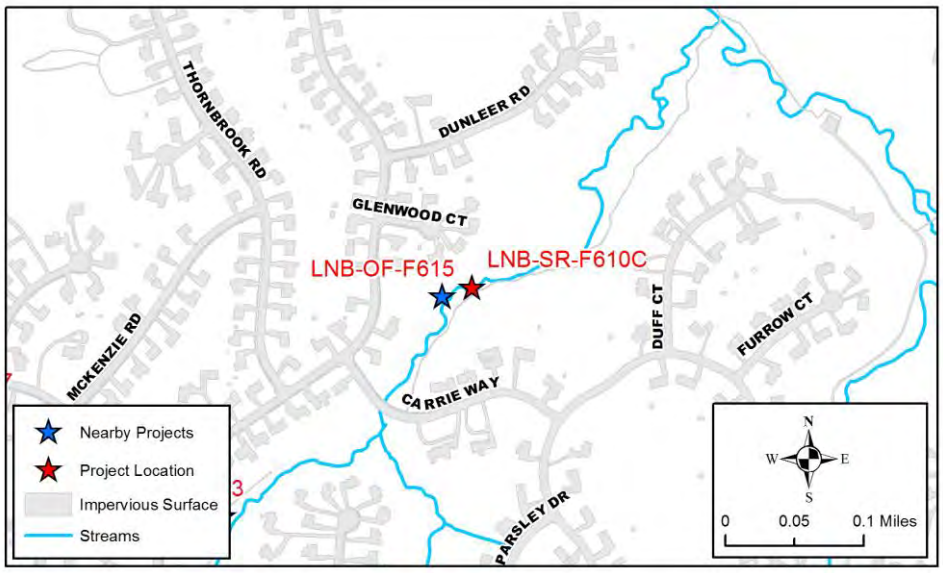
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F610C
Site Name: Carrie Way
Contractor: KCI
Watershed: Patapsco Lower North

Ownership: County Park
Single Owner

Existing Conditions:

This site is located on an unnamed direct-drainage tributary to the Patapsco River. The site is located on land owned by Howard County Department of Parks and Recreation. The stream in this location has eroded laterally, resulting in several areas of bank erosion. The eroded banks along this reach are near vertical and have an average height of 4 ft. The banks are primarily composed of silt and have low root density and shallow root depth. Stream habitat is poor at this site, lacking both suitable cover for fish and stable substrates for stream insects. Habitat diversity is low, with the majority of the available habitat consisting of shallow pools with intermittent short, shallow riffles. The habitat is also impaired by a high amount of fine material covering the stream bed. The stream substrate is comprised mostly of sand and gravel with some cobble present.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F610C
Site Name: Carrie Way
Contractor: KCI
Watershed: Patapsco Lower North

Typical stream bank erosion on the right bank

Typical stream bank erosion on the left bank

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F610C
Site Name: Carrie Way
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

Access may be a constraint at this site, as it is located approximately 250 ft. away from the nearest road. The site is located in forest and will require the removal of many trees for access and construction. The field crew noted possible impacts to specimen trees and wetlands. A sanitary sewer parallels the stream for the entire length of the site.

Concept Description:

The proposed stream restoration design will focus on stabilizing eroding banks and reconnecting the stream to its floodplain. Banks will be graded to create a new lower elevation floodplain and to allow the stream access to its historical floodplain during high-flow events. Bank protection will include natural channel design and bioengineering techniques, but may need stone treatments in some areas. Existing rootwads will be retained when possible to provide habitat and overhead cover for fish and benthic macroinvertebrates. Riffles will be lengthened to create additional habitat at this site. A sanitary sewer line parallels the stream at this site. Consideration will be given to protecting the existing infrastructure in the proposed design. A planting plan will be developed for the site to revegetate the stream banks and areas disturbed during construction using native plant species.

Nearby Opportunities:

LNB-OF-F615

Proposed Project Credit		Costs	
Length Restored (ft):	320	Estimated Design Cost:	$200,000.00
Impervious Area Treated Credit (ac.):	3.2	Estimated Construction Cost:	$144,000.00
Cost per Impervious Credit Acre:	$139,750	30% Contingency:	$103,200.00
		Estimated Total Cost:	$447,200.00

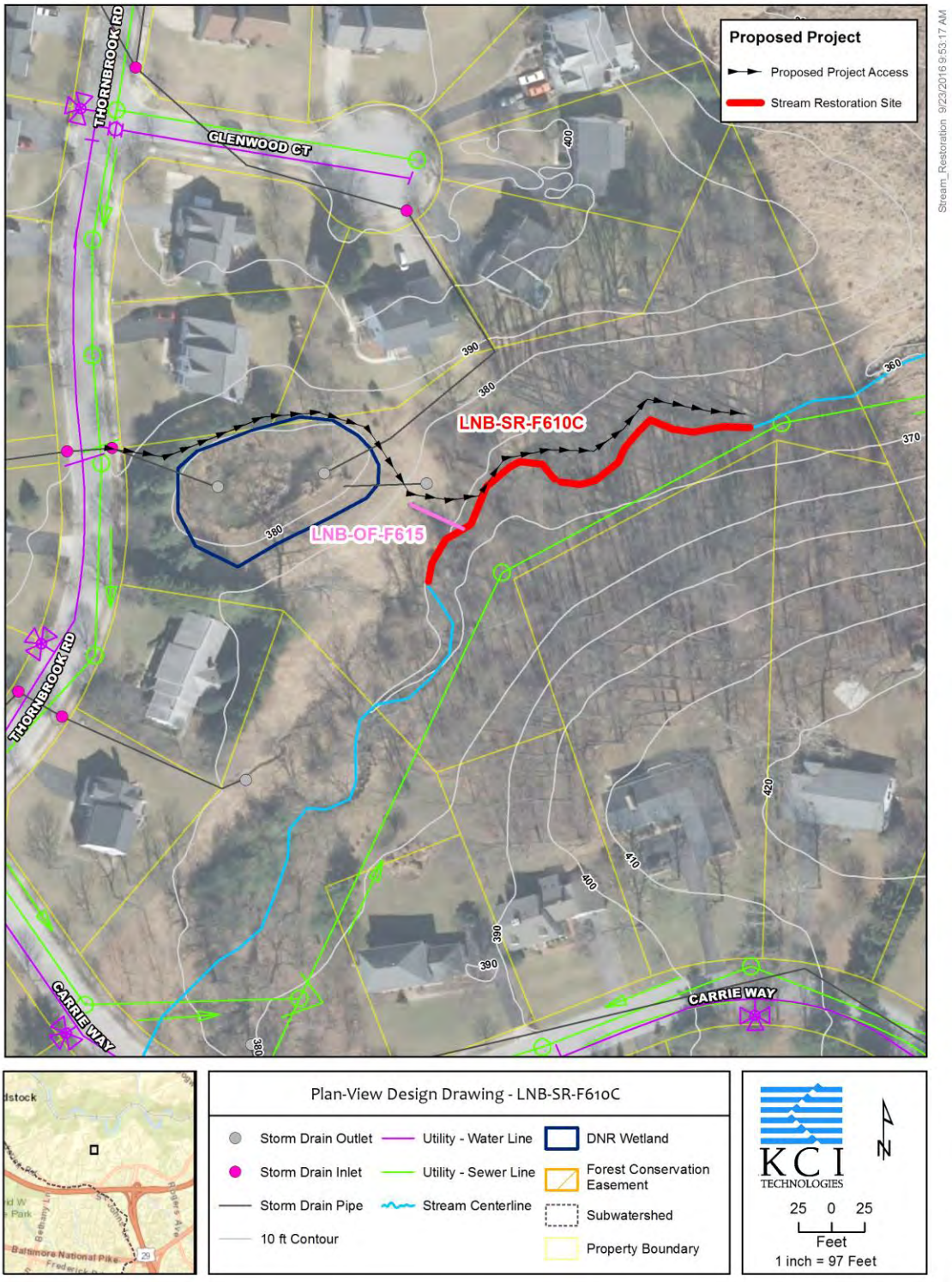
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F610C

Site Name: Carrie Way

Contractor: KCI

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-SR-F613D-PO001

Site Name: Millers Way B

Contractor: KCI

Watershed: Patapsco Lower North

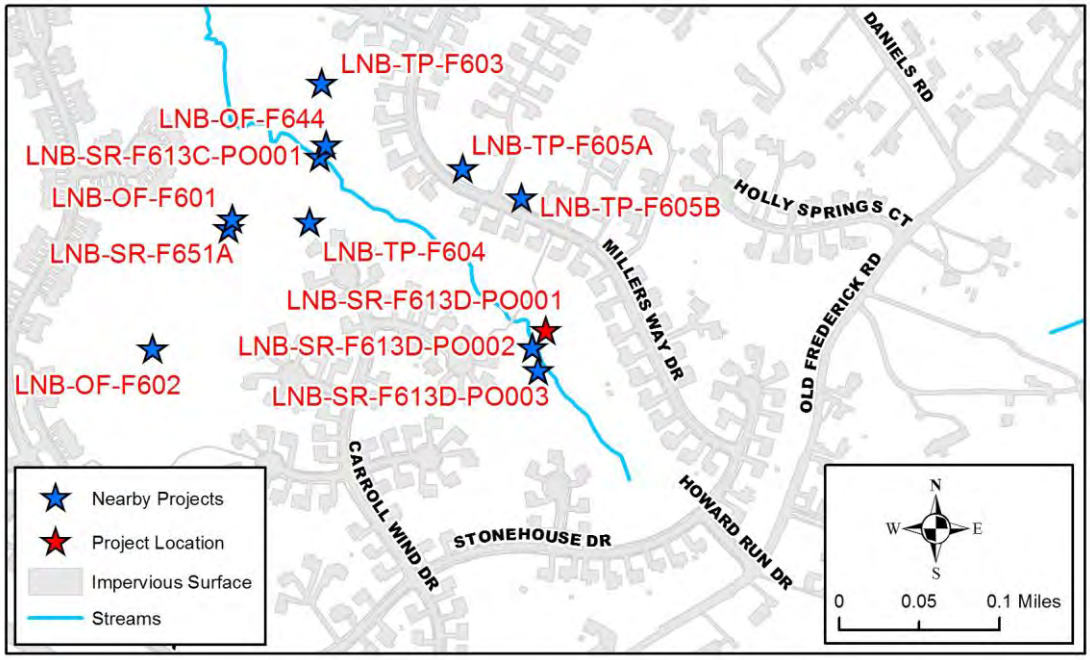
Proposed BMP Type: Outfall Stabilization

Stabilization Type: Step Pool Stormwater Conveyance

Ownership: County Owned
Single Owner

Existing Conditions:

The existing site is a severely eroded channel originating from a HDPE stormdrain pipe with no stormwater management behind a residential property. The channel erosion starts immediately downstream of the outfall and extends approximately 100 ft. Site access is easy from the adjacent properties off Millers Way Drive.



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-SR-F613D-PO001
Site Name: Millers Way B
Contractor: KCI
Watershed: Patapsco Lower North

View of outfall pipe structure.

View of erosion facing downstream from outfall.

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-SR-F613D-PO001
Site Name: Millers Way B
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:
Constraints are minimal and include minor impact to trees.

Concept Description:
The proposed stabilization BMP is a Step Pool Storm Conveyance system (SPSC) with 2 cascades, 4 pools, and 4 riffles. The SPSC will be 8 ft. wide and span the full 120 ft. of erosion starting from the outfall structure. Since this outfall is downstream of a wet pond, the water quality treatment provided is in addition to what the wet pond provides.

Nearby Opportunities:
LNB-TP-F604, LNB-SR-F613C-PO001, LNB-SR-F613D-PO002, LNB-SR-F613D-PO003,

Proposed Project Credit	
Drainage Area (ac.):	19.44
Impervious Area within Drainage (ac.):	5.65
Impervious Area Treated (ac.):	4.79
Impervious Area Treated Credit (ac.):	4.79

Water Quality Volume	
WQVolume Target (cf.):	21,987
Max Treated (cf.):	8,674
Percent Treated:	39%
Rainfall Depth Treated (in.):	0.39

Costs

Estimated Design Cost:	$200,000
Estimated Construction Cost:	$138,000
30 % Contingency:	$101,400
Estimated Total Cost:	$439,400
Cost per Impervious Credit Acre:	$91,733

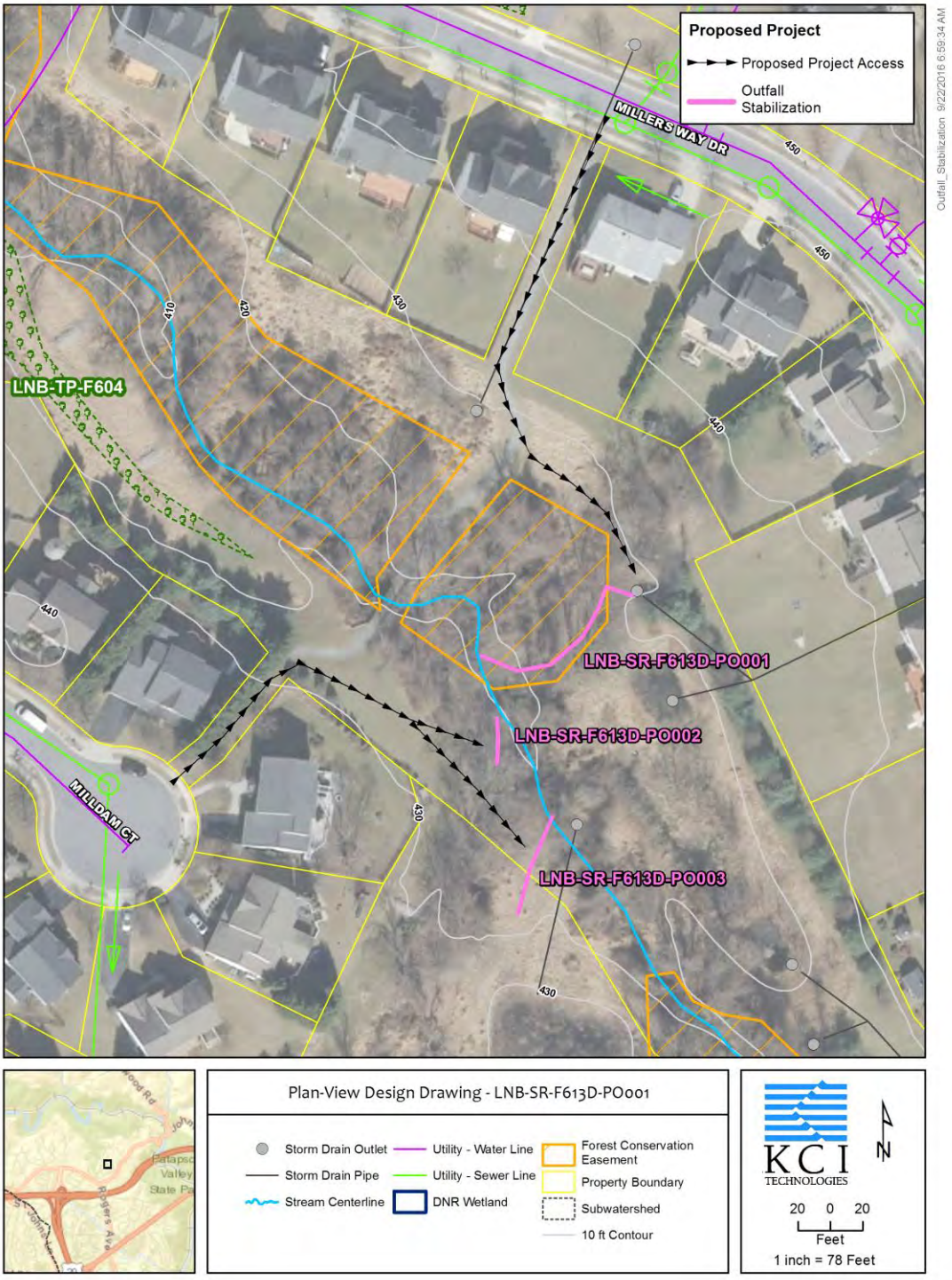
Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-SR-F613D-PO001

Site Name: Millers Way B

Contractor: KCI

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-SR-F613D-PO002

Site Name: Milldam Ct

Contractor: KCI

Watershed: Patapsco Lower North

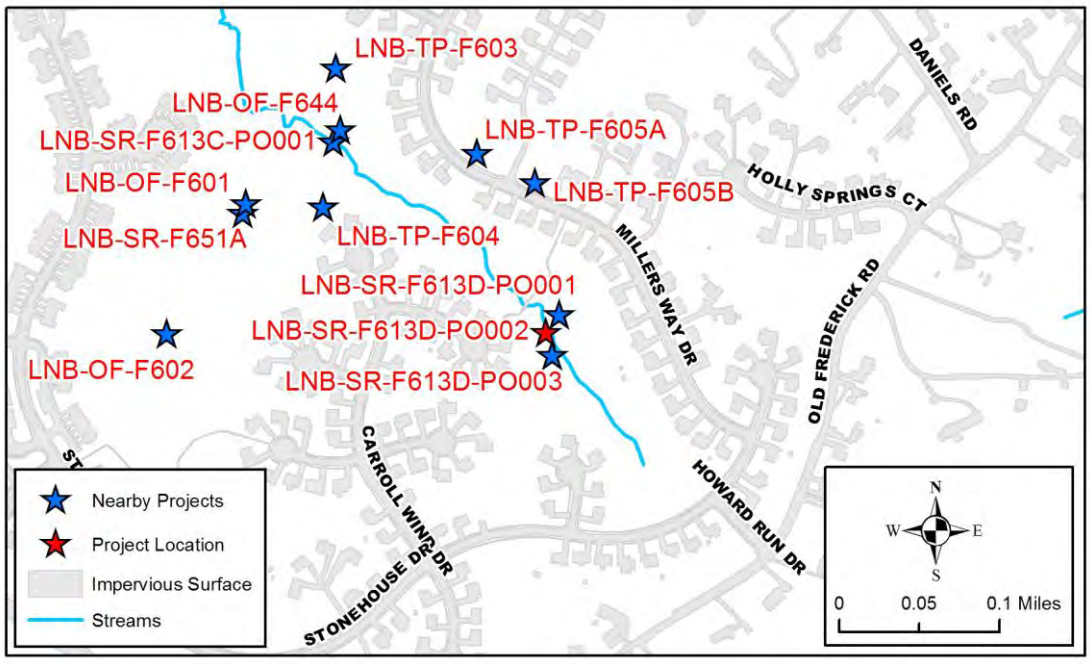
Proposed BMP Type: Outfall Stabilization

Stabilization Type: Step Pool Stormwater Conveyance

Ownership: County Owned
Single Owner

Existing Conditions:

The proposed outfall stabilization is a stormwater pond outfall channel that drains to an unnamed tributary to the Patapsco River. The channel erosion begins approximately 30 ft. downstream from a gabion basket weir of the pond. The first 20 ft. of erosion is minor downcutting of the channel. The channel then splits into two, each with 5 ft. headcuts to meet the stream elevation. Total length of erosion is approximately 60 ft.



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-SR-F613D-PO002
Site Name: Milldam Ct
Contractor: KCI
Watershed: Patapsco Lower North

View facing upstream at top of eroded portion of outfall channel.

View facing downstream of headcut in eroded outfall channel.

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-SR-F613D-PO002
Site Name: Milldam Ct
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:
Constraints include only moderate impact to trees.

Concept Description:
The proposed stabilization BMP is a Step Pool Storm Conveyance system (SPSC) with 2 pools, and 2 riffles. The SPSC will be 10 ft. wide and span the full 60 ft. of erosion starting from the pond outfall. Since this outfall is downstream of a wet pond, the water quality treatment provided is in addition to what the wet pond provides.

Nearby Opportunities:
LNB-SR-F613D-PO003, LNB-SR-F613D-PO001, LNB-TP-F604

Proposed Project Credit

Drainage Area (ac.):	6.17
Impervious Area within Drainage (ac.):	1.56
Impervious Area Treated (ac.):	1.56
Impervious Area Treated Credit (ac.):	1.56

Water Quality Volume

WQVolume Target (cf.):	6,216
Max Treated (cf.):	6,137
Percent Treated:	99%
Rainfall Depth Treated (in.):	0.99

Costs

Estimated Design Cost:	$100,000
Estimated Construction Cost:	$78,000
30 % Contingency:	$53,400
Estimated Total Cost:	$231,400
Cost per Impervious Credit Acre:	$148,333

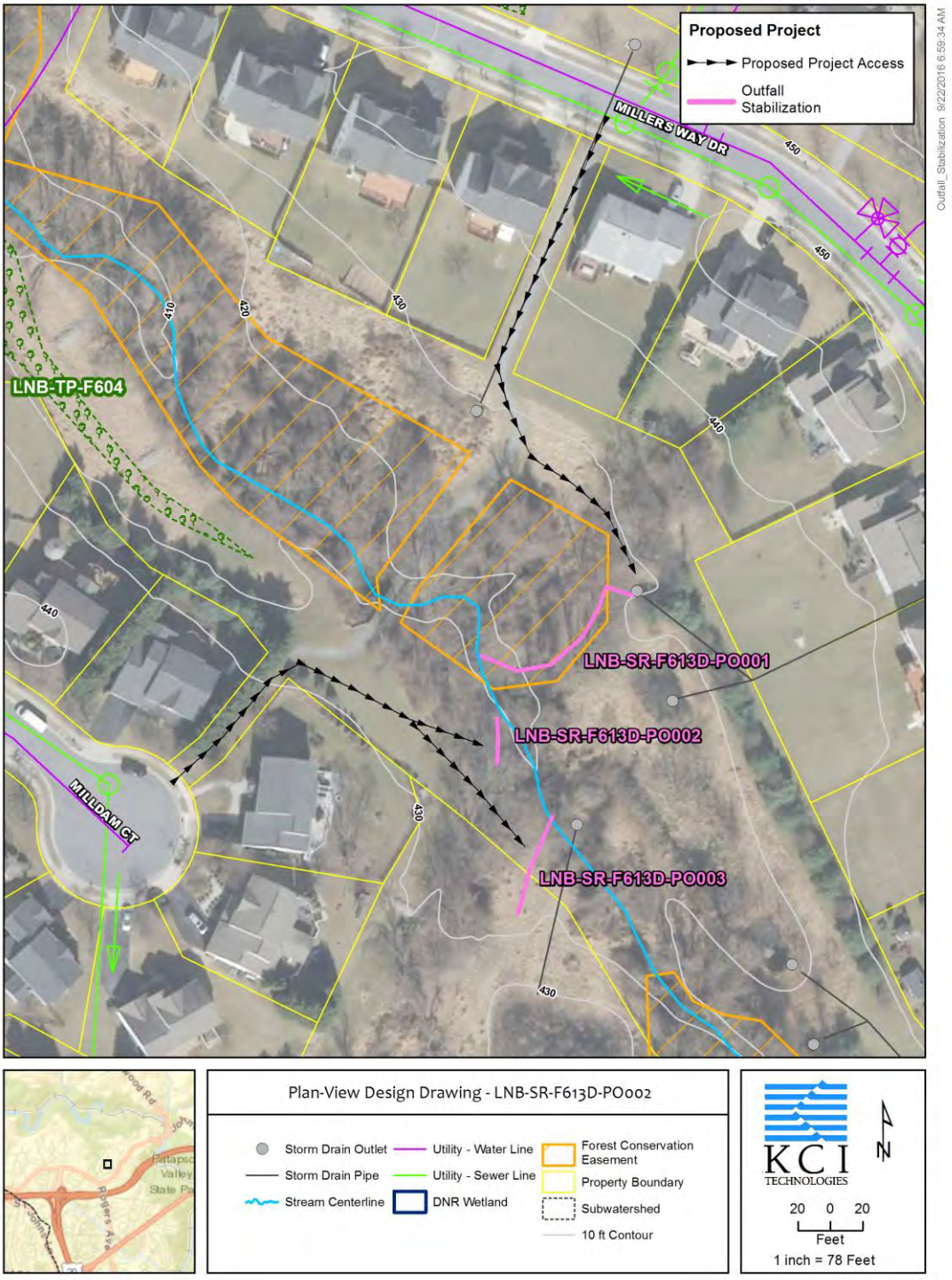
Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-SR-F613D-PO002

Site Name: Milldam Ct

Contractor: KCI

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-SR-F613D-PO003

Site Name: Stone Hollow Ct

Contractor: KCI

Watershed: Patapsco Lower North

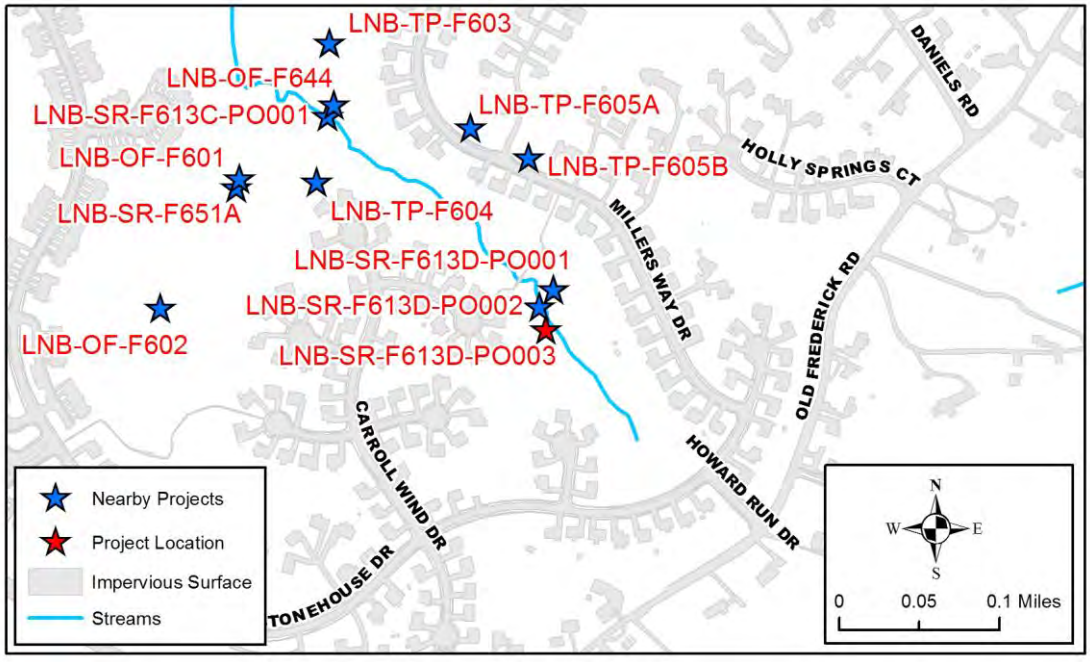
Proposed BMP Type: Outfall Stabilization

Stabilization Type: Step Pool Stormwater Conveyance

Ownership: County Owned
Single Owner

Existing Conditions:

The proposed outfall stabilization is an eroded channel originating from the spillway of a stormwater management pond north of Stone Hollow Court. The channel erosion starts immediately downstream of the spillway with minor erosion for 25 ft. and then a 2 ft. headcut and insized channel for 20 ft., until it meets the Patapsco River. Site access is easy from the adjacent properties off Stone Hollow Court.



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-SR-F613D-PO003
Site Name: Stone Hollow Ct
Contractor: KCI
Watershed: Patapsco Lower North

View of spillway with erosion facing south.

View of erosion looking upstream.

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-SR-F613D-PO003
Site Name: Stone Hollow Ct
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:
Constraints are minimal and include minor impact to trees.

Concept Description:
The proposed stabilization BMP is a Step Pool Storm Conveyance system (SPSC) with 1 cascade, 4 pools, and 4 riffles. The SPSC will be 8 ft. wide and span 100 ft. including the 60 ft. of erosion starting from the spillway. Since this channel is downstream of a wet pond, the water quality treatment provided is in addition to what the wet pond provides.

Nearby Opportunities:
LNB-TP-F604, LNB-SR-F613C-PO001, LNB-SR-F613D-PO001, LNB-SR-F613D-PO002,

Proposed Project Credit	
Drainage Area (ac.):	8.88
Impervious Area within Drainage (ac.):	2.43
Impervious Area Treated (ac.):	2.32
Impervious Area Treated Credit (ac.):	2.32

Water Quality Volume	
WQVolume Target (cf.):	9,551
Max Treated (cf.):	7,856
Percent Treated:	82%
Rainfall Depth Treated (in.):	0.82

Costs

Estimated Design Cost:	$200,000
Estimated Construction Cost:	$118,000
30 % Contingency:	$95,400
Estimated Total Cost:	$413,400
Cost per Impervious Credit Acre:	$178,190

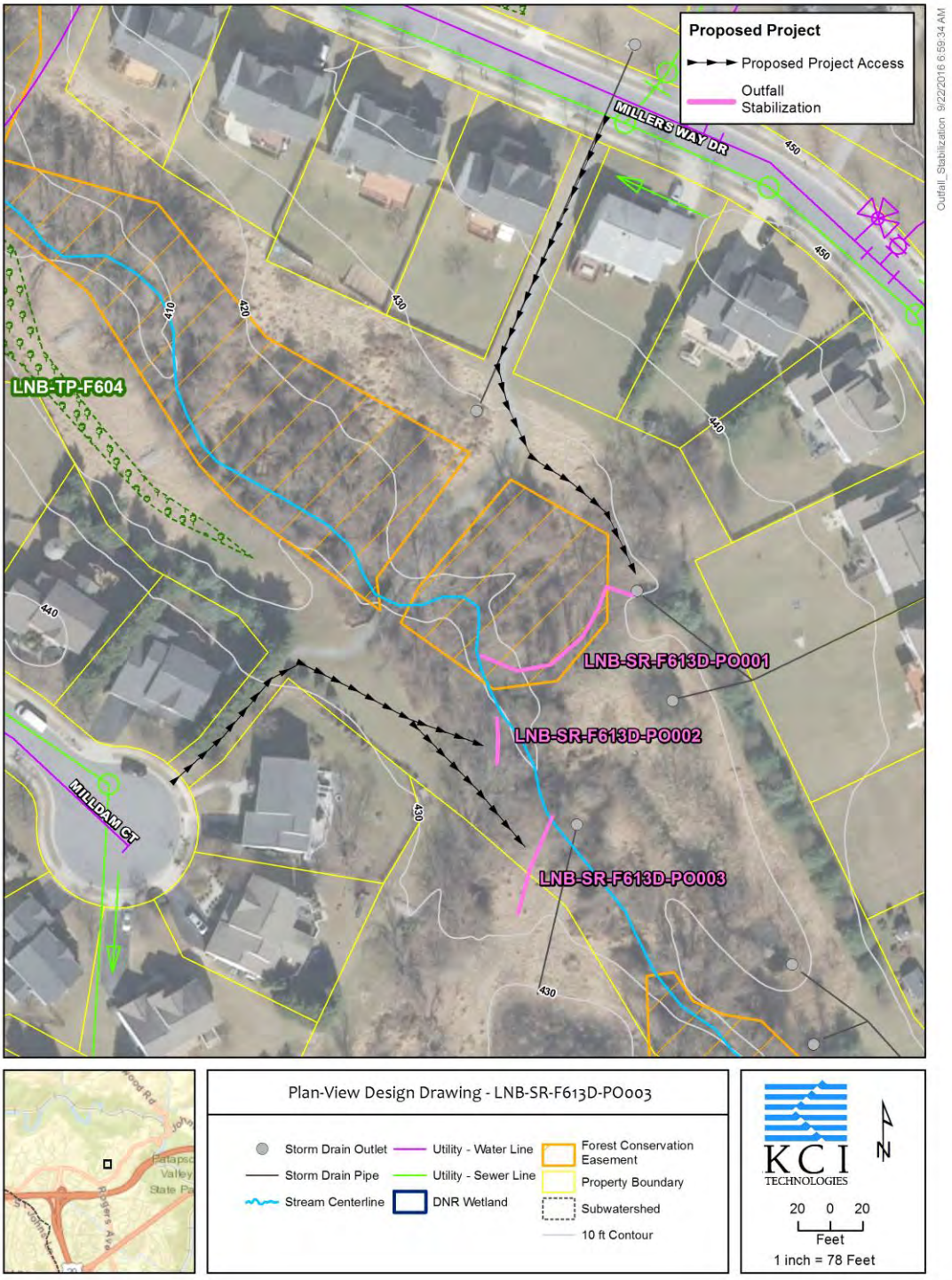
Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-SR-F613D-PO003

Site Name: Stone Hollow Ct

Contractor: KCI

Watershed: Patapsco Lower North



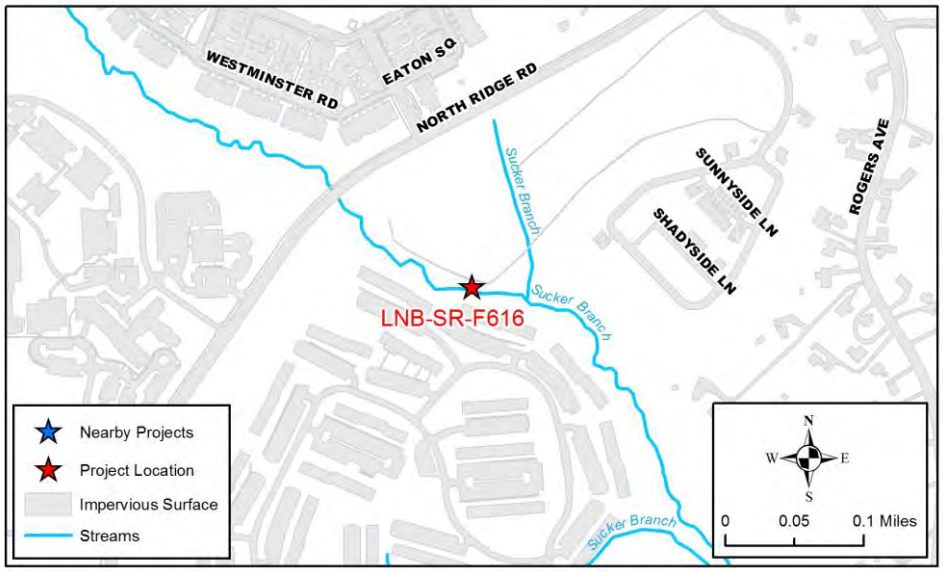
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F616
Site Name: North Ridge Road
Contractor: KCI
Watershed: Patapsco Lower North

Ownership: County Owned
Multiple Owners

Existing Conditions:

This site includes a portion of Sucker Branch and tributaries to Sucker Branch. The site is located on land owned by Howard County and Home Properties, Howard Crossing. The stream in this location has downcut and eroded laterally, resulting in many areas of bank erosion. A headcut is located on a short section of this project near the center of the apartment complex. The eroded banks along this reach are near vertical and have an average height of 5 ft. The banks are primarily composed of silt and have very low root density and very shallow root depth. Stream habitat is poor at this site, lacking both suitable cover for fish and stable substrates for stream insects. Habitat diversity is low, with the majority of the available habitat consisting of shallow pools with intermittent short, shallow riffles. The habitat is also impaired by a moderate amount of fine material covering the stream bed. The stream substrate is comprised mostly of sand, gravel, and cobble.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F616
Site Name: North Ridge Road
Contractor: KCI
Watershed: Patapsco Lower North

Typical erosion along the left bank

Typical erosion along the right bank

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F616
Site Name: North Ridge Road
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

Ownership will be a constraint at this site because a significant portion of the site is owned by an apartment complex. A portion of the site is located in a forest, requiring the removal of many trees for access and construction. Field crews noted specimen trees near the stream which may be impacted by construction. A sewer line parallels the stream for much of the length of this project and crosses the stream eight times.

Concept Description:

The proposed stream restoration design will focus on stabilizing eroding banks and reconnecting the stream to its floodplain. Banks will be graded to create a new lower elevation floodplain and to allow the stream access to its historical floodplain during high-flow events. The bed elevation may need to be raised in the area of the headcut to bring the stream bed up to an appropriate elevation. Bank protection will include natural channel design and bioengineering techniques, but may need stone treatments in some areas especially where the stream is crossed by the sanitary sewer line. Existing rootwads will be retained when possible to provide habitat and overhead cover for fish and benthic macroinvertebrates. A sanitary sewer line parallels the stream and crosses the stream channel in eight locations. Consideration will be given to protecting the existing infrastructure in the proposed design. A planting plan will be developed for the site to revegetate the stream banks and areas disturbed during construction using native plant species.

Nearby Opportunities:

LNB-SR-F617C, LNB-SR-F616A-PO002

Proposed Project Credit		Costs	
Length Restored (ft):	3,365	Estimated Design Cost:	$300,000.00
Impervious Area Treated Credit (ac.):	33.65	Estimated Construction Cost:	$1,514,250.00
Cost per Impervious Credit Acre:	$70,090	30% Contingency:	$544,275.00
		Estimated Total Cost:	$2,358,525.00

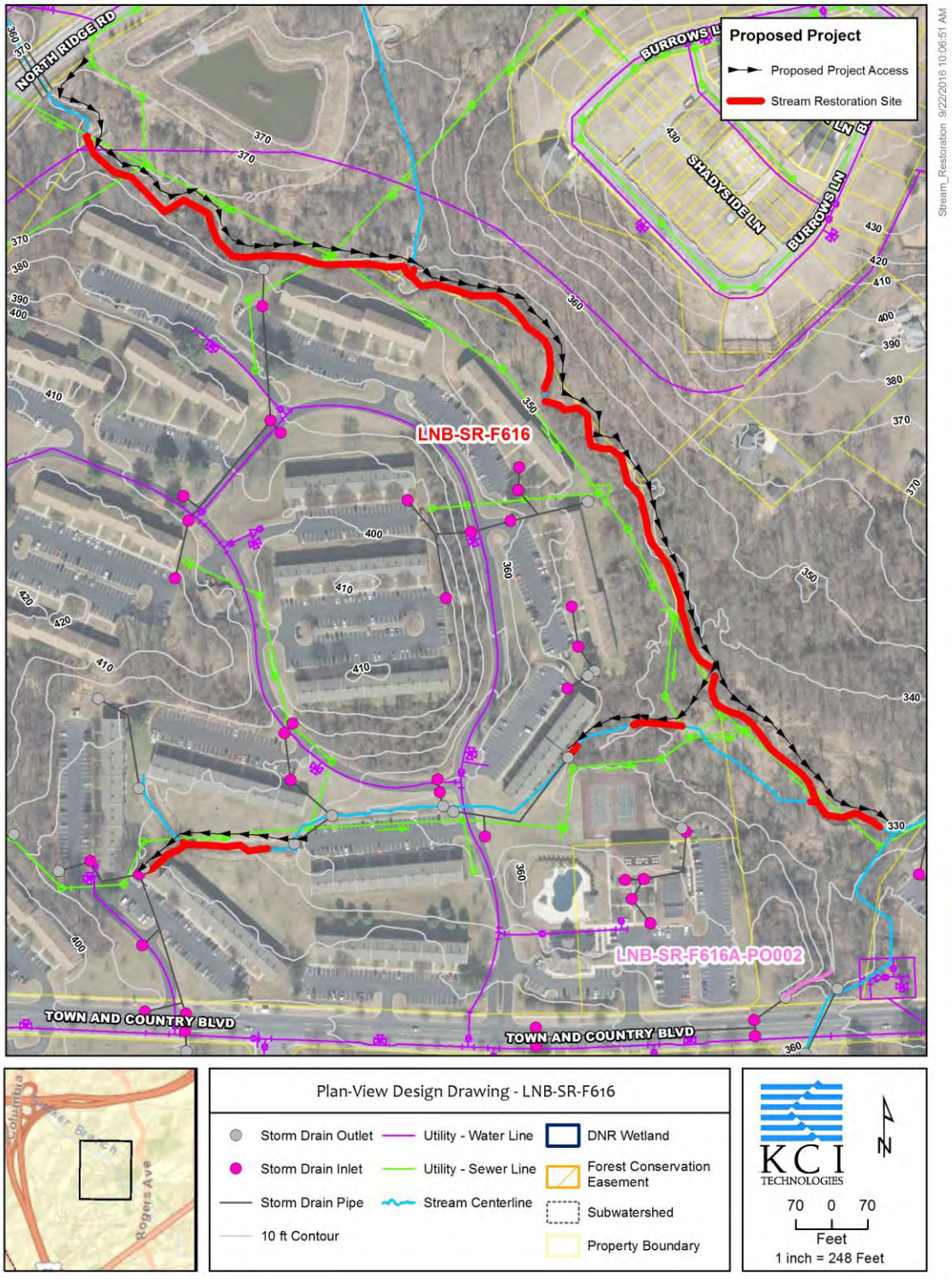
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F616

Site Name: North Ridge Road

Contractor: KCI

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-SR-F616A-PO002

Site Name: Town and Country

Contractor: KCI

Watershed: Patapsco Lower North

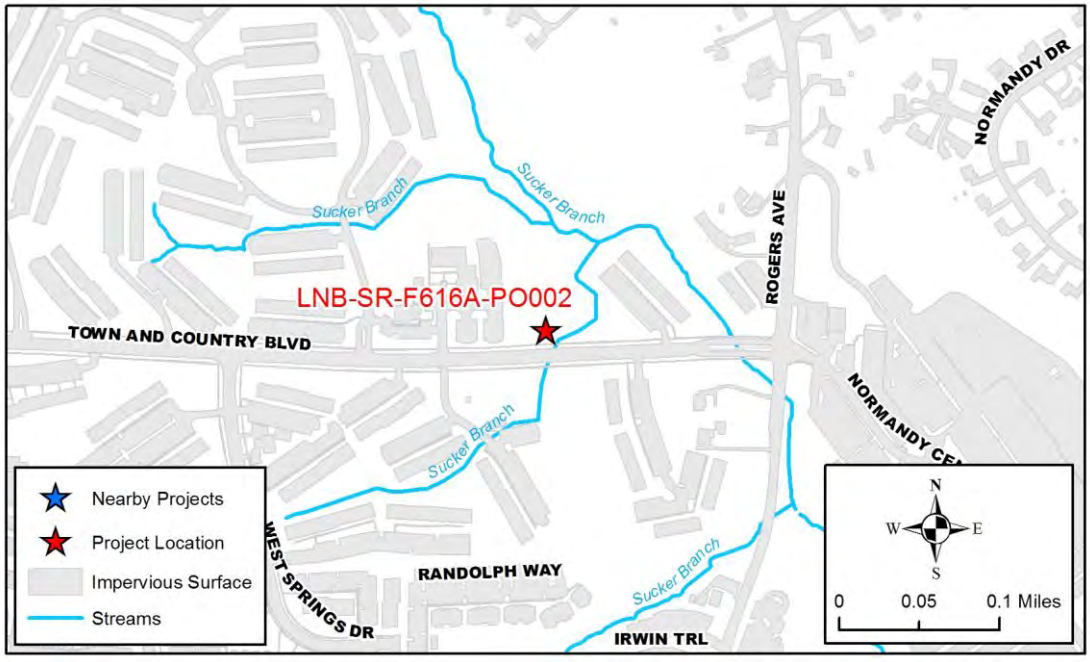
Proposed BMP Type: Outfall Stabilization

Stabilization Type: Step Pool Stormwater Conveyance

Ownership: County Owned
Single Owner

Existing Conditions:

The proposed outfall stabilization is an outfall originating at a 24 in. concrete storm drain pipe draining Town and Country Boulevard. The eroded channel has 15 ft. high eroded banks and extends for 110 ft. until it meets Sucker Branch. The site is located immediately adjacent to a parking lot off Town and Country Boulevard, therefore access is easy and there will be minimal impact to trees.



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-SR-F616A-PO002
Site Name: Town and Country
Contractor: KCI
Watershed: Patapsco Lower North

View facing upstream eroded outfall channel.

View facing left bank of eroded outfall channel.

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-SR-F616A-PO002
Site Name: Town and Country
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:
Aside from minimal impact to trees, there are no constraints associated with this project.

Concept Description:
The proposed stabilization BMP is a Step Pool Storm Conveyance system (SPSC) with 3 cascades, 4 pools, and 4 riffles. The SPSC will be 8 ft. wide and span the full 110 ft. of erosion starting from the outfall structure.

Nearby Opportunities:
LNB-SR-F616

Proposed Project Credit	
Drainage Area (ac.):	2.22
Impervious Area within Drainage (ac.):	1.16
Impervious Area Treated (ac.):	1.35
Impervious Area Treated Credit (ac.):	1.35

Water Quality Volume	
WQVolume Target (cf.):	4,193
Max Treated (cf.):	6,956
Percent Treated:	166%
Rainfall Depth Treated (in.):	1.66

Costs

Estimated Design Cost:	$200,000
Estimated Construction Cost:	$128,000
30 % Contingency:	$98,400
Estimated Total Cost:	$426,400
Cost per Impervious Credit Acre:	$315,852

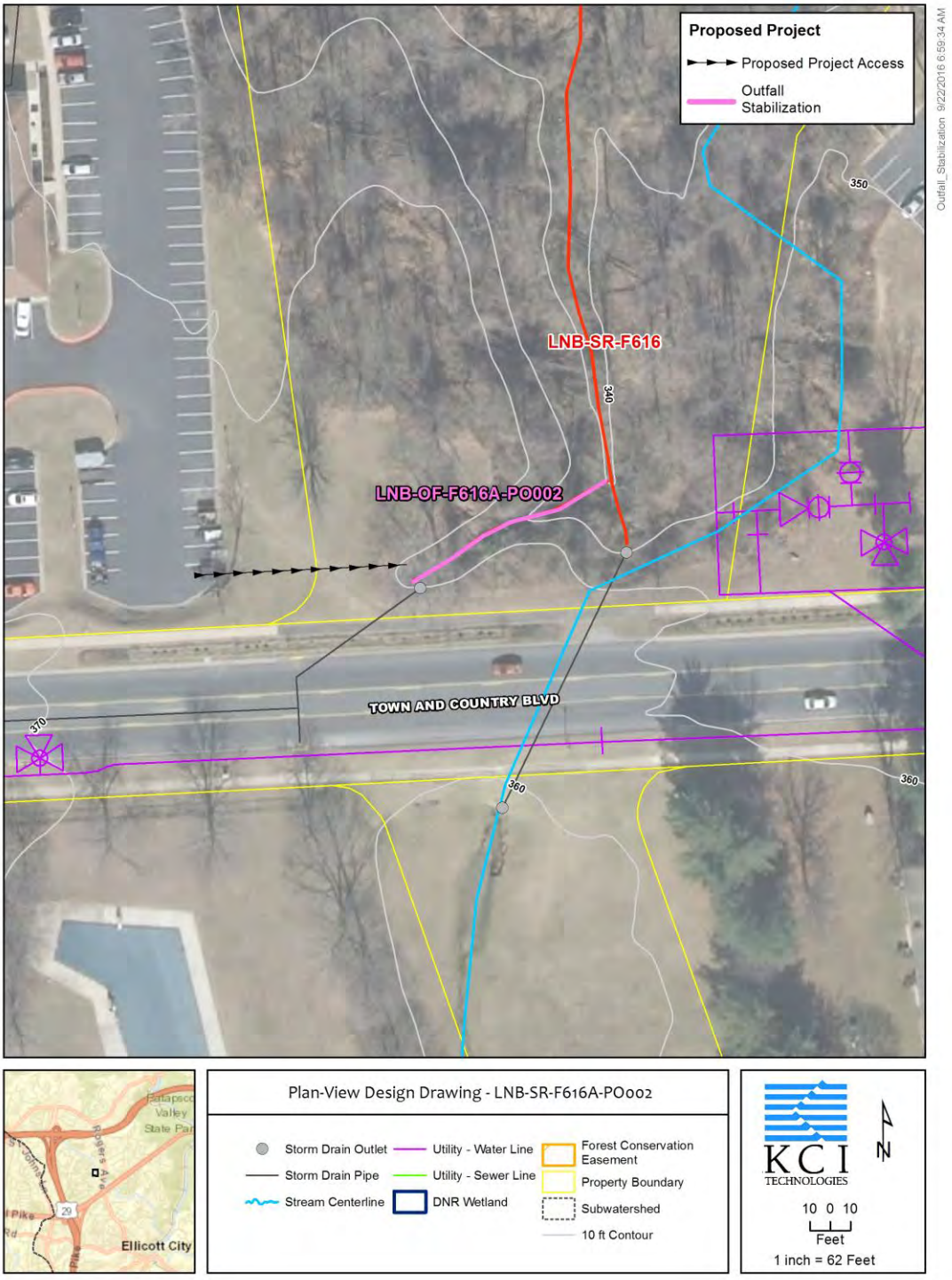
Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-SR-F616A-PO002

Site Name: Town and Country

Contractor: KCI

Watershed: Patapsco Lower North



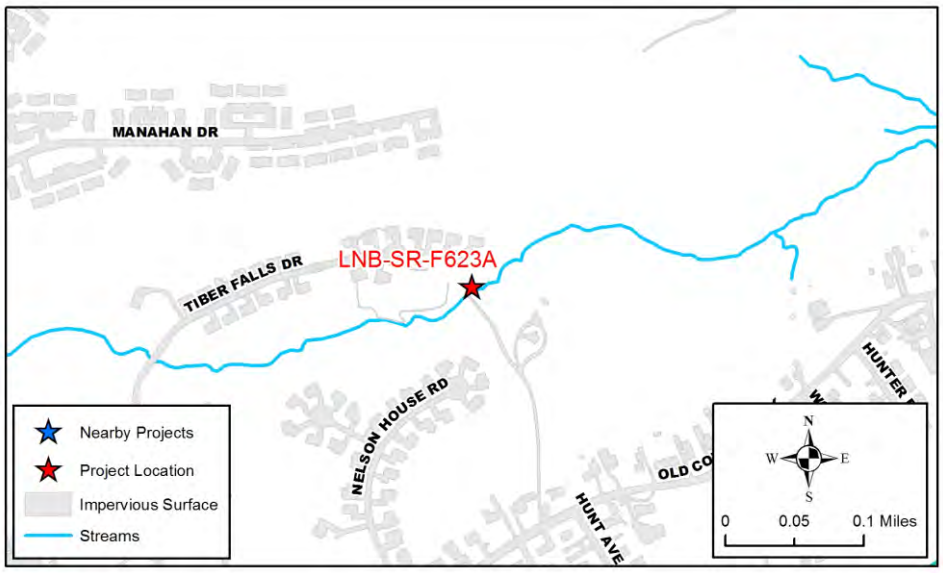
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F623A
Site Name: Tiber Falls Drive
Contractor: KCI
Watershed: Patapsco Lower North

Ownership: County Owned
Multiple Owners

Existing Conditions:

This site is located on a tributary to Tiber Branch. The site is located on land owned by Howard County and a private landowner. The stream in this location has eroded laterally, resulting in many areas of bank erosion. The eroded banks along this reach are near vertical and have an average height of 3 ft. The banks are primarily composed of silt and have very low root density and very shallow root depth. Stream habitat is poor at this site, lacking both suitable cover for fish and stable substrates for stream insects. Habitat diversity is low, with the majority of the available habitat consisting of shallow pools with intermittent short, shallow riffles. The habitat is also impaired by a moderate amount of fine material covering the stream bed. The stream substrate is comprised mostly of sand and gravel with some cobble present.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F623A
Site Name: Tiber Falls Drive
Contractor: KCI
Watershed: Patapsco Lower North

Typical stream bank erosion on the left bank

Stream bank erosion on the right bank and debris jam

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F623A
Site Name: Tiber Falls Drive
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

Ownership may be a constraint at this site because the lowest portion of the site is on private property. The surrounding area is forested, and would require the removal of trees for access and construction. A sanitary sewer line parallels the site for the entire length and crosses the stream channel at one location.

Concept Description:

The proposed stream restoration design will focus on stabilizing eroding banks and reconnecting the stream to its floodplain. Banks will be graded to create a new lower elevation floodplain and to allow the stream access to its historical floodplain during high-flow events. Bank protection will include natural channel design and bioengineering techniques, but may need stone treatments in some areas especially where the stream is crossed by the sanitary sewer line. Cobble brought in from off-site will be added to the existing sand and gravel substrates in constructed riffles to increase velocity and habitat diversity. Existing rootwads will be retained when possible to provide habitat and overhead cover for fish and benthic macroinvertebrates. A sanitary sewer line parallels the stream and crosses the stream channel in one location. Consideration will be given to protecting the existing infrastructure in the proposed design. A planting plan will be developed for the site to revegetate the stream banks and areas disturbed during construction using native plant species.

Nearby Opportunities:

None recommended

Proposed Project Credit		Costs	
Length Restored (ft):	550	Estimated Design Cost:	$200,000.00
Impervious Area Treated Credit (ac.):	5.5	Estimated Construction Cost:	$247,500.00
Cost per Impervious Credit Acre:	$105,773	30% Contingency:	$134,250.00
		Estimated Total Cost:	$581,750.00

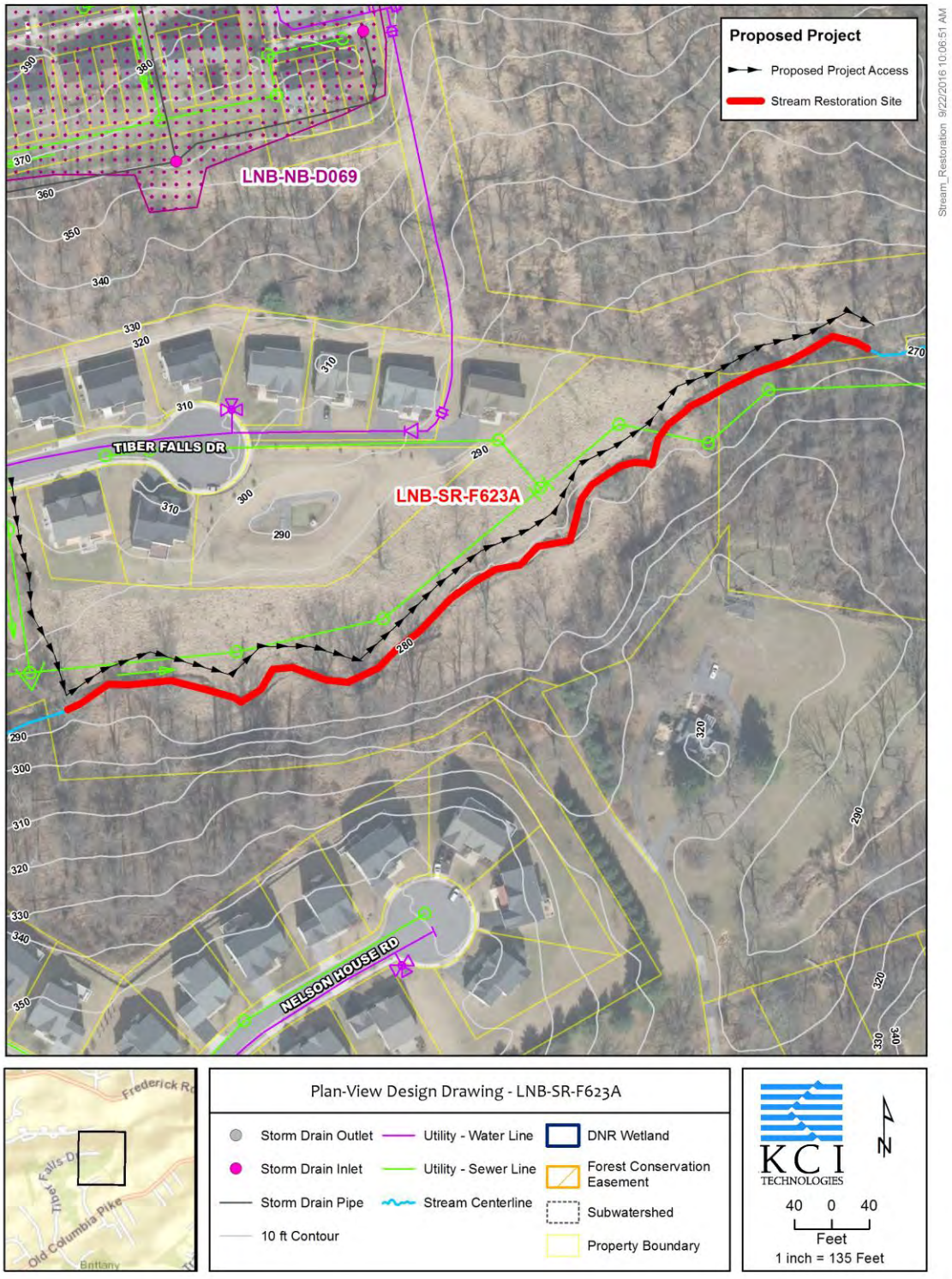
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F623A

Site Name: Tiber Falls Drive

Contractor: KCI

Watershed: Patapsco Lower North



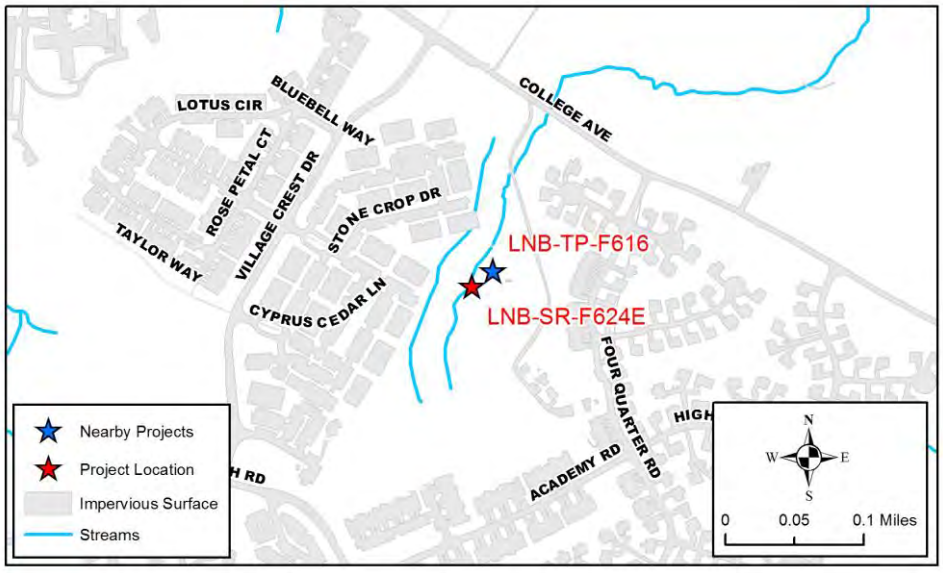
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F624E
Site Name: Taylor Family Association
Contractor: KCI
Watershed: Patapsco Lower North

Ownership: Private- Mixed Use
Multiple Owners

Existing Conditions:

The site is located on property owned by a community association and on property owned by a private landowner. The stream in this location has downcut and eroded laterally, resulting in many areas of bank erosion. The eroded banks along this reach are near vertical and have an average height of 2 ft. in the lower half of the site and 5 ft. in the upper half of the site. The banks are primarily composed of silt and have low root density and very shallow root depth. A 4.5 ft. headcut is present within the reach and is threatening to undermine the outfall of an upstream stormwater management pond. Stream habitat is poor at this site, lacking both suitable cover for fish and stable substrates for stream insects. Habitat diversity is low, with the majority of the available habitat consisting of shallow pools with intermittent short, shallow riffles. The habitat is also impaired by a high amount of fine material covering the stream bed. The stream substrate is comprised mostly of sand and gravel with some cobble present. There is evidence that the channel was straightened in the past, and an old failing culvert is located in the lower third of the site. A new 3 in. pvc pipe and an old metal pipe were exposed in the upper third of the site.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F624E
Site Name: Taylor Family Association
Contractor: KCI
Watershed: Patapsco Lower North

Upper portion of headcut threatening SWM pond outfall

Typical stream bank erosion in upstream portion of site

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F624E
Site Name: Taylor Family Association
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

Land ownership may be a constraint at this site; a portion of the site is on property which appears to be owned by a family entity or trust. No other constraints were identified by the field crew.

Concept Description:

The proposed stream restoration design will focus on stabilizing eroding banks, addressing the headcut, and reconnecting the stream to its floodplain. Banks will be graded to create a new lower elevation floodplain and to allow the stream access to its historical floodplain during high-flow events. The bed elevation will need to be raised in the area downstream of the headcut to bring the stream back to its original elevation and to stop the headcut from continuing upstream and undermining the stormwater management pond outfall. Bank protection will include natural channel design and bioengineering techniques, but may need stone treatments in some areas. Additional cobble brought in from off-site will be added to the existing substrates in constructed riffles to increase velocity and habitat diversity. Existing rootwads will be retained when possible to provide habitat and overhead cover for fish and benthic macroinvertebrates. A planting plan will be developed for the site to revegetate the stream banks and areas disturbed during construction using native plant species. This planting plan may be developed in concert with the tree planting project LNB-TP-F616.

Nearby Opportunities:

LNB-TP-F616

Proposed Project Credit		Costs	
Length Restored (ft):	950	Estimated Design Cost:	$200,000.00
Impervious Area Treated Credit (ac.):	9.5	Estimated Construction Cost:	$427,500.00
Cost per Impervious Credit Acre:	$85,868	30% Contingency:	$188,250.00
		Estimated Total Cost:	$815,750.00

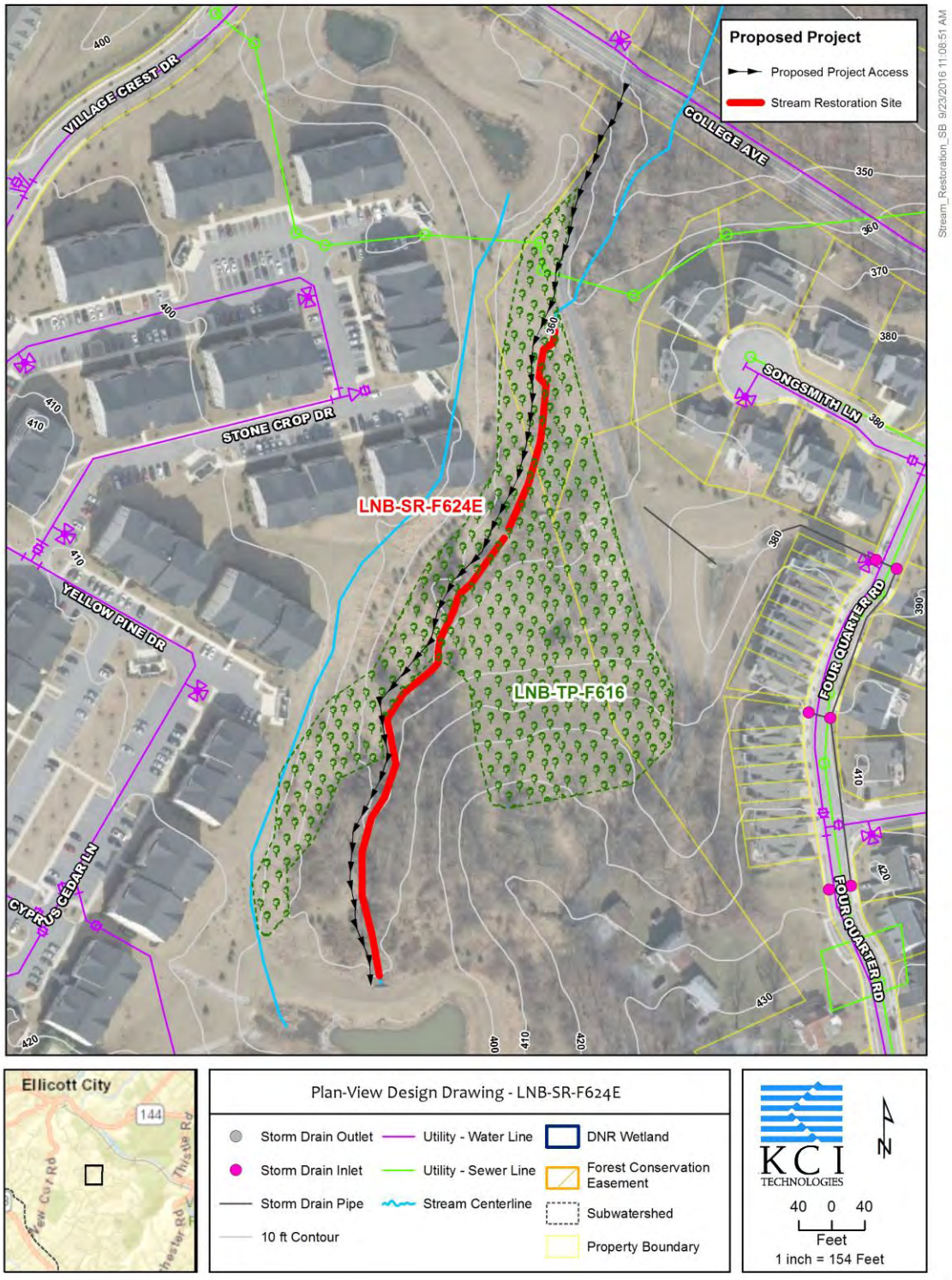
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F624E

Site Name: Taylor Family Association

Contractor: KCI

Watershed: Patapsco Lower North



Plan-View Design Drawing - LNB-SR-F624E

- Storm Drain Outlet
- Storm Drain Inlet
- Storm Drain Pipe
- 10 ft Contour
- Utility - Water Line
- Utility - Sewer Line
- Stream Centerline
- DNR Wetland
- Forest Conservation Easement
- Subwatershed
- Property Boundary

KCI TECHNOLOGIES

40 0 40

Feet

1 inch = 154 Feet

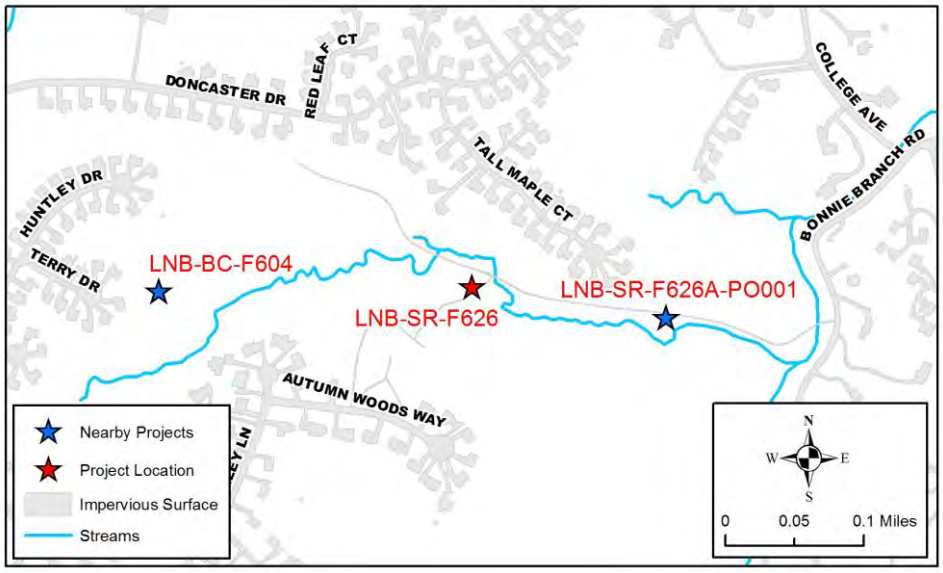
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F626
Site Name: Bonnie Branch Tributary
Contractor: KCI
Watershed: Patapsco Lower North

Ownership: County Park
Single Owner

Existing Conditions:

The site is located on property owned by Howard County Department of Parks and Recreation. The stream in this location has downcut and eroded laterally, resulting in many areas of bank erosion. The eroded banks along this reach are near vertical and have an average height of 5 ft. in the lower half of the site and 2.5 ft. in the upper half of the site. The banks are primarily composed of silt and have low root density and very shallow root depth. Stream habitat is poor at this site, lacking both suitable cover for fish and stable substrates for stream insects. Habitat diversity is low, with the majority of the available habitat consisting of shallow pools with some shallow riffles. The habitat is also impaired by a high amount of fine material filling the interstitial spaces of the stream bed. The stream substrate is comprised mostly of sand, gravel, and cobble. An old concrete structure, possibly from a milldam, was found along both banks at about the midpoint of the site. Near the top of the site an old damaged culvert was found in the stream and along the left bank.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F626
Site Name: Bonnie Branch Tributary
Contractor: KCI
Watershed: Patapsco Lower North

Typical stream bank erosion along the lower portion of the site

Typical stream bank erosion along the upper portion of the site

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F626
Site Name: Bonnie Branch Tributary
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

Access will be a constraint at this site, as it is located in a wooded area some distance away from the nearest road. There will be a significant impact to trees because of the forested nature of the site. Specimen trees were noted as being close to the site and could be impacted by construction. A sewer line parallels the stream for the length of the project and crosses the stream in two locations.

Concept Description:

The proposed stream restoration design will focus on stabilizing eroding banks and reconnecting the stream to its floodplain. Banks will be graded to create a new lower elevation floodplain and to allow the stream access to its historical floodplain during high-flow events. Bank protection will include natural channel design and bioengineering techniques, but may need stone treatments in some areas especially where the stream is close to the adjacent sanitary sewer line. Riffle length and frequency will be increased to add additional available habitat to the site. Cobble brought in from off-site will be added to the existing sand and gravel substrates in constructed riffles to increase velocity and habitat diversity. Existing rootwads will be retained when possible to provide habitat and overhead cover for fish and benthic macroinvertebrates. A sanitary sewer line parallels the stream and crosses the stream channel in two locations. Consideration will be given to protecting the existing infrastructure in the proposed design. An old concrete structure near the midpoint of the site should be removed. A planting plan will be developed for the site to revegetate the stream banks and areas disturbed during construction using native plant species.

Nearby Opportunities:

LNB-SR-F626A-PO001

Proposed Project Credit		Costs	
Length Restored (ft):	1,410	Estimated Design Cost:	$300,000.00
Impervious Area Treated Credit (ac.):	14.1	Estimated Construction Cost:	$634,500.00
Cost per Impervious Credit Acre:	$86,160	30% Contingency:	$280,350.00
		Estimated Total Cost:	$1,214,850.00

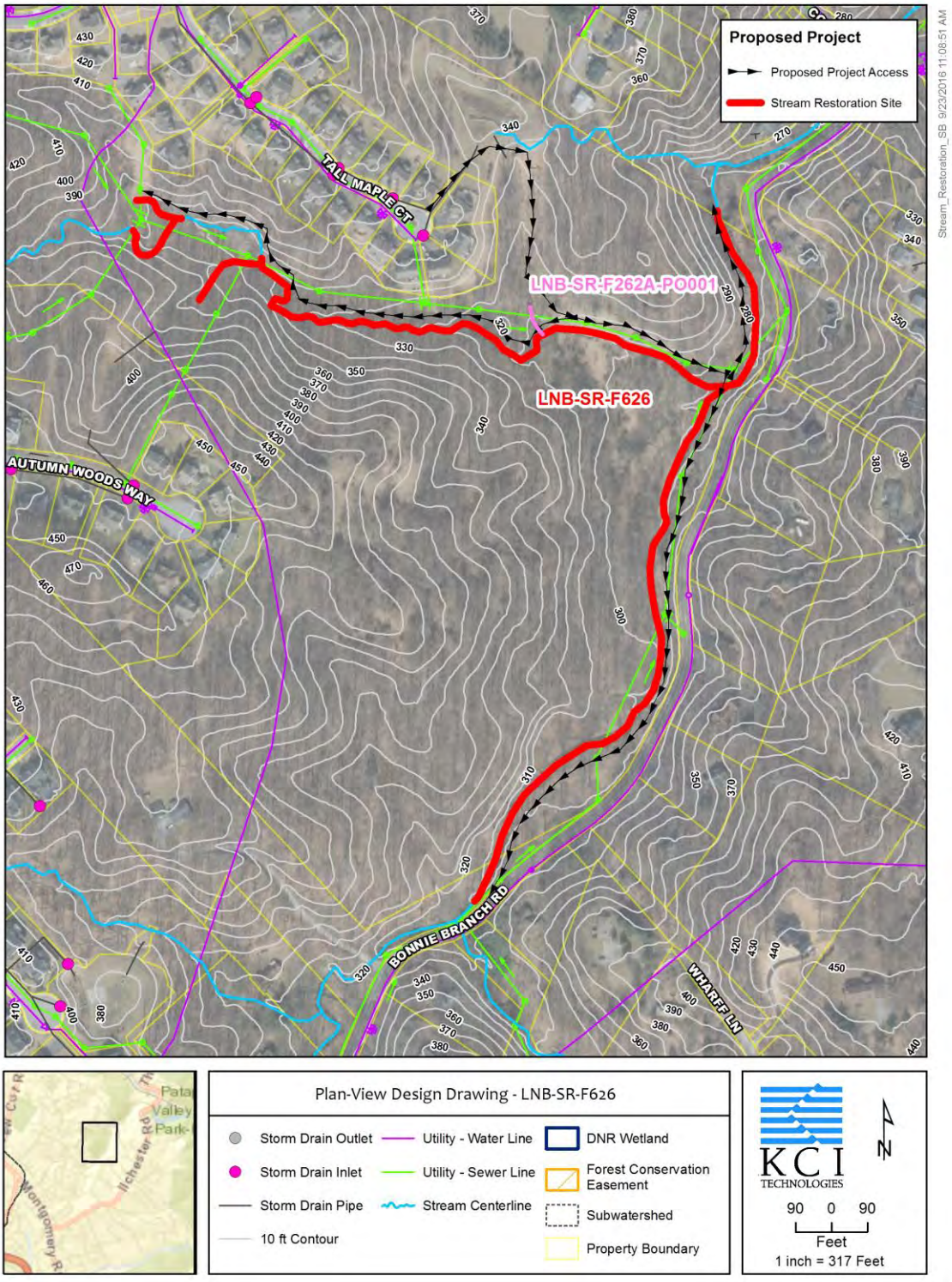
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F626

Site Name: Bonnie Branch Tributary

Contractor: KCI

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-SR-F626A-PO001

Site Name: Bonnie Branch Tributary

Contractor: KCI

Watershed: Patapsco Lower North

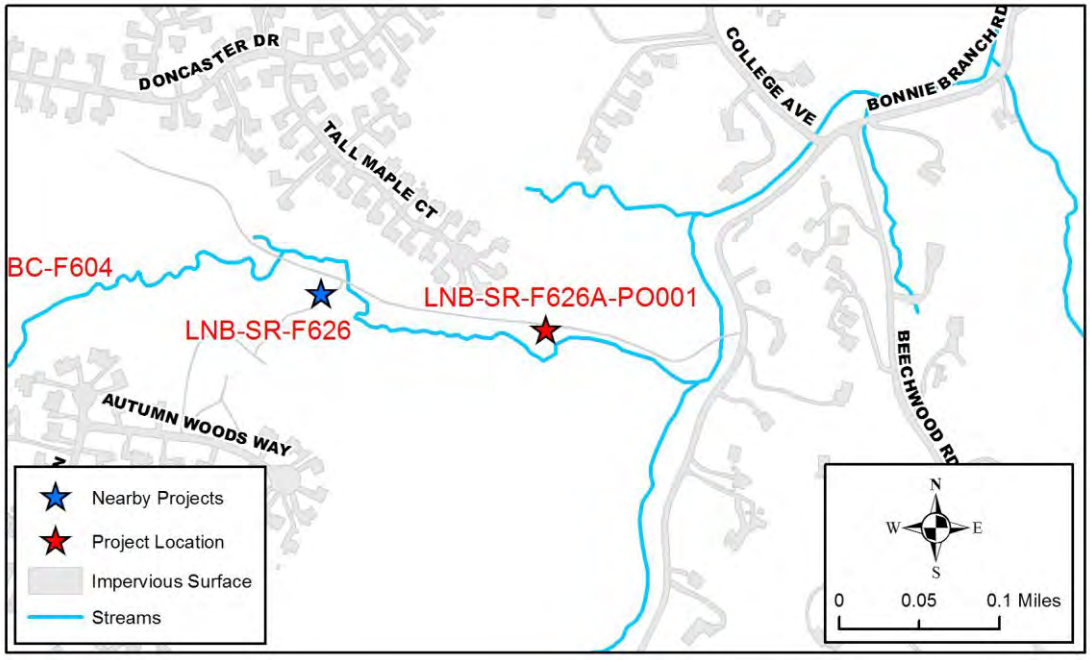
Proposed BMP Type: Outfall Stabilization

Stabilization Type: Step Pool Stormwater Conveyance

Ownership: County Owned
Single Owner

Existing Conditions:

The proposed outfall stabilization is for the outfall channel of a 24 in. corrugated metal culvert in a sanitary sewer easement. The channel downstream of the culvert is eroding and has undermined the end of the culvert. Evidence of past stabilization attempts with rip rap appear to have failed as the eroded area is wider than the area where rip rap was placed. The outfall channel is eroded for approximately 77 ft. and drains to an unnamed tributary to the Patapsco River.



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-SR-F626A-PO001
Site Name: Bonnie Branch Tributary
Contractor: KCI
Watershed: Patapsco Lower North

View facing upstream pipe outfall.

View facing downstream eroded outfall channel.

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-SR-F626A-PO001
Site Name: Bonnie Branch Tributary
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:
The sanitary sewer easement may be used as an access route. Impacts to trees would be minimal.

Concept Description:
The proposed stabilization BMP is a Step Pool Storm Conveyance system (SPSC) with 1 cascade, 3 pools, and 3 riffles. The SPSC will be 15 ft. wide and span the full 77 ft. of erosion starting from the outfall structure.

Nearby Opportunities:
LNB-SR-F626

Proposed Project Credit

Drainage Area (ac.):	15.52
Impervious Area within Drainage (ac.):	2.41
Impervious Area Treated (ac.):	2.42
Impervious Area Treated Credit (ac.):	2.42

Water Quality Volume

WQVolume Target (cf.):	10,690
Max Treated (cf.):	10,848
Percent Treated:	101%
Rainfall Depth Treated (in.):	1.01

Costs

Estimated Design Cost:	$100,000
Estimated Construction Cost:	$95,000
30 % Contingency:	$58,500
Estimated Total Cost:	$253,500
Cost per Impervious Credit Acre:	$104,752

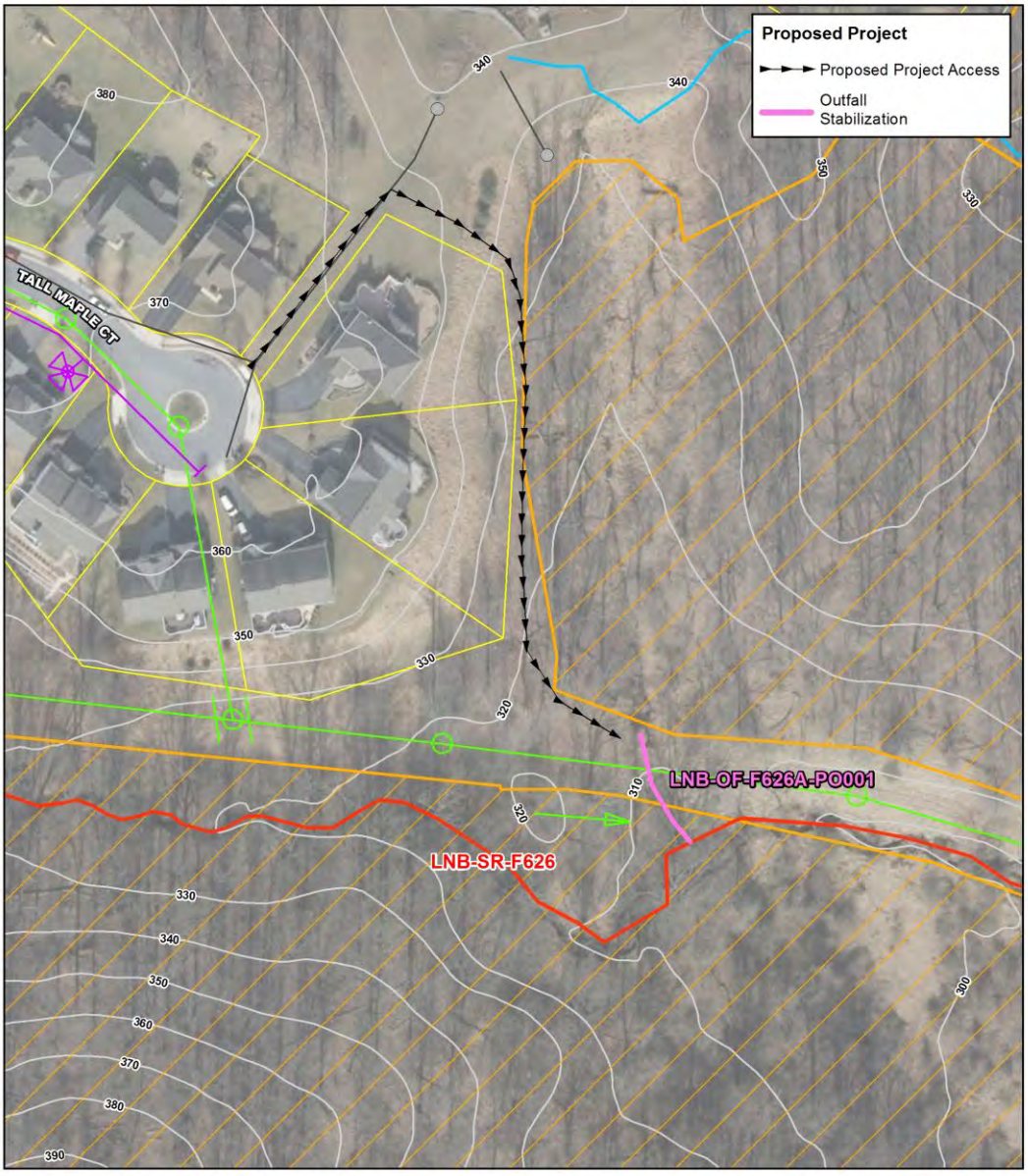
Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-SR-F626A-PO001

Site Name: Bonnie Branch Tributary

Contractor: KCI

Watershed: Patapsco Lower North



Plan-View Design Drawing - LNB-SR-F626A-PO001

- Storm Drain Outlet
- Storm Drain Pipe
- Stream Centerline
- Utility - Water Line
- Utility - Sewer Line
- DNR Wetland
- Forest Conservation Easement
- Property Boundary
- Subwatershed
- 10 ft Contour

KCI TECHNOLOGIES

20 0 20
Feet
1 inch = 90 Feet

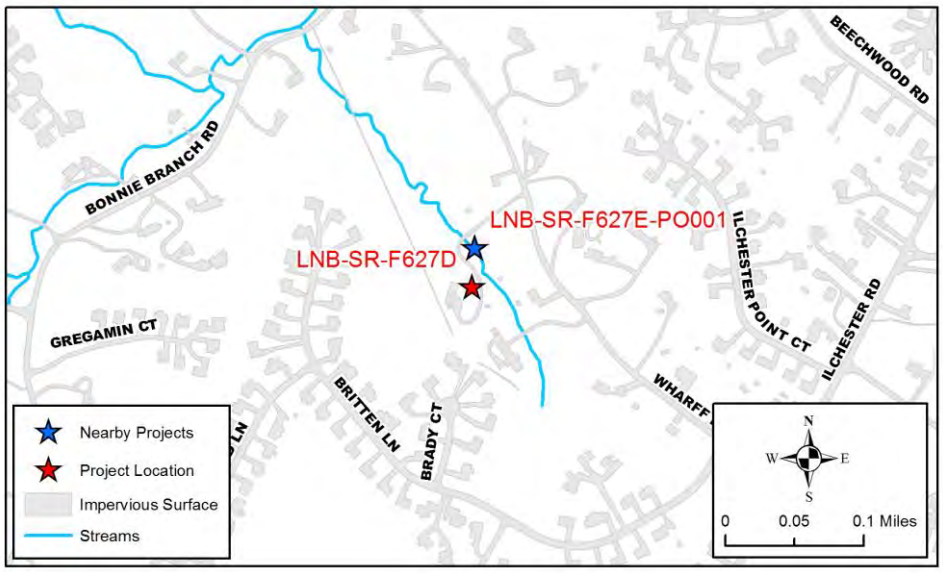
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F627D
Site Name: Wharff Lane
Contractor: KCI
Watershed: Patapsco Lower North

Ownership: Private- Residential
Multiple Owners

Existing Conditions:

This site is located on an unnamed tributary to the Patapsco River. The site is located on property owned by multiple private landowners. The stream in this location has downcut and eroded laterally, resulting in many areas of bank erosion. The eroded banks along this reach are near vertical and have an average height of 7 ft. in the lower half of the site and 3.5 ft. in the upper half of the site. The banks are primarily composed of silt and have low root density and shallow root depth. Stream habitat is poor at this site, lacking both suitable cover for fish and stable substrates for stream insects. Habitat diversity is low, with the majority of the available habitat consisting of shallow pools with short, shallow riffles. The habitat is also impaired by a large amount of fine material filling the interstitial spaces of the stream bed. The stream substrate is comprised mostly of sand, gravel, and cobble.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F627D
Site Name: Wharff Lane
Contractor: KCI
Watershed: Patapsco Lower North

Typical stream erosion on the left bank in the lower portion of the site

Typical stream bank erosion in the upper portion of the site

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F627D
Site Name: Wharff Lane
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

Ownership will be a constraint for this project; the site is located on properties owned by at least seven different private landowners. Private driveways and bridges will be constraints for this project. At least two private driveways cross the stream in this project area. A large portion of the site is forested and will require the removal of many trees for access and for construction. A sewer line crosses the stream in one location.

Concept Description:

The proposed stream restoration design will focus on stabilizing eroding banks and reconnecting the stream to its floodplain. Banks will be graded to create a new lower elevation floodplain and to allow the stream access to its historical floodplain during high-flow events. Bank protection will include natural channel design and bioengineering techniques, but may need stone treatments in some areas especially where the stream is threatening private driveway crossings. Additional riffles will be constructed in this project reach to increase the available habitat. Cobble brought in from off-site will be added to the existing sand and gravel substrates in constructed riffles to increase velocity and habitat diversity. Existing rootwads will be retained when possible to provide habitat and overhead cover for fish and benthic macroinvertebrates. A sanitary sewer line crosses the stream channel in one location. Consideration will be given to protecting the existing infrastructure in the proposed design. A planting plan will be developed for the site to revegetate the stream banks and areas disturbed during construction using native plant species.

Nearby Opportunities:

LNB-SR-F627E-PO001

Proposed Project Credit		Costs	
Length Restored (ft):	1,530	Estimated Design Cost:	$300,000.00
Impervious Area Treated Credit (ac.):	15.3	Estimated Construction Cost:	$688,500.00
Cost per Impervious Credit Acre:	$83,990	30% Contingency:	$296,550.00
		Estimated Total Cost:	$1,285,050.00

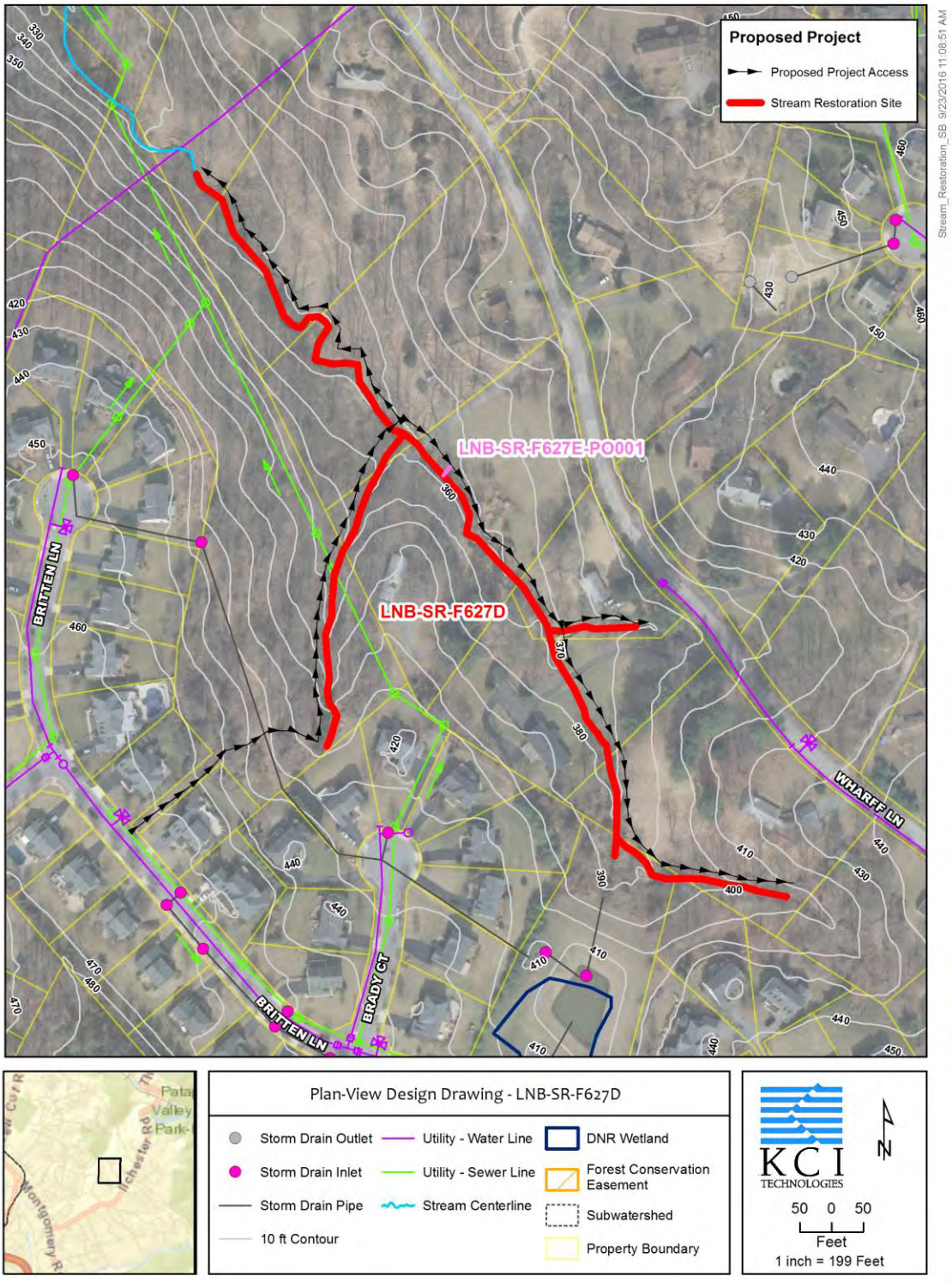
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F627D

Site Name: Wharff Lane

Contractor: KCI

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-SR-F627E-PO001

Site Name: Bonnie Branch

Contractor: KCI

Watershed: Patapsco Lower North

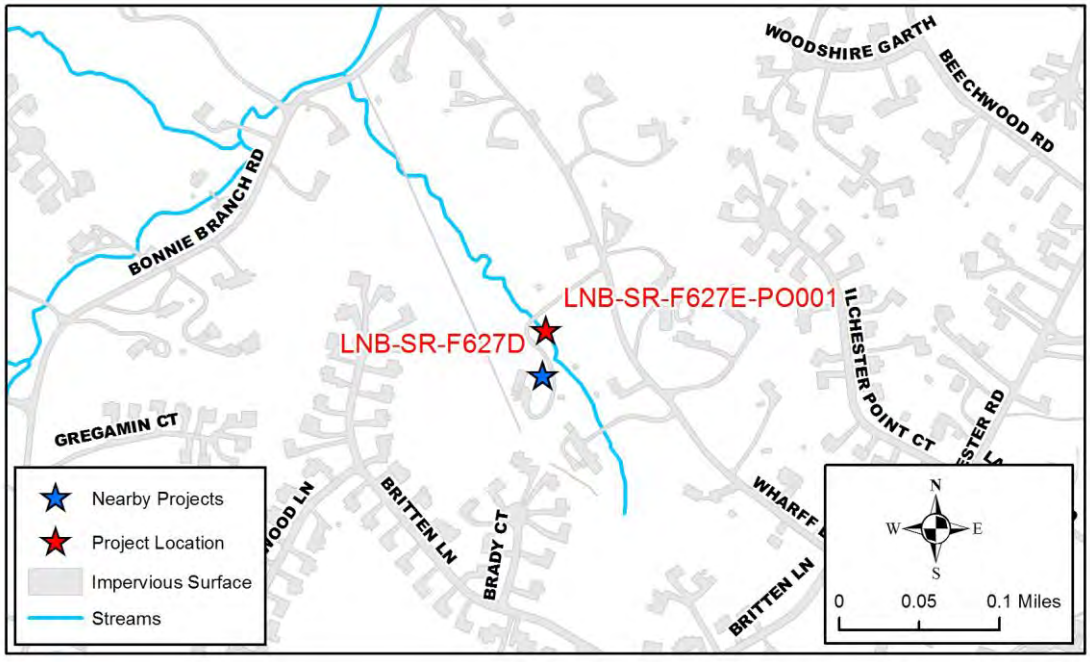
Proposed BMP Type: Outfall Stabilization

Stabilization Type: Step Pool Stormwater Conveyance

Ownership: Private- Residential
Single Owner

Existing Conditions:

The proposed outfall stabilization is for a short, eroded outfall channel originating at a 18 in. corrugated HDPE pipe draining private property. The pipe is approximately 4 ft. above the outfall channel and much of the HDPE pipe is exposed. The channel is eroded for approximately 17 ft. until it meets an unnamed tributary to the Patapsco River. The site is on private property, but access is easy and the surrounding area is open.



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-SR-F627E-PO001
Site Name: Bonnie Branch
Contractor: KCI
Watershed: Patapsco Lower North

View facing upstream of exposed outfall pipe and eroded channel.

View facing downstream of exposed outfall pipe and eroded channel.

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-SR-F627E-PO001
Site Name: Bonnie Branch
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:
The private ownership of the project area could be a constraint.

Concept Description:
The proposed stabilization BMP is a Step Pool Storm Conveyance system (SPSC) with 1 cascade, 2 pools, and 2 riffles. The SPSC will be 15 ft. wide and span the 17 ft. of erosion plus 33 extra ft. starting in the neighboring field. The existing 18 in. HPPE pipe would need to be cut to move the outfall location upstream. The system is proposed to extend into the nearby field to increase water quality treatment benefits, not to address erosion. Since the proposed system would extend into the field, this project may be restricted by property ownership.

Nearby Opportunities:
LNB-SR-F627

Proposed Project Credit	
Drainage Area (ac.):	12.05
Impervious Area within Drainage (ac.):	2.06
Impervious Area Treated (ac.):	1.94
Impervious Area Treated Credit (ac.):	1.94

Water Quality Volume	
WQVolume Target (cf.):	8,917
Max Treated (cf.):	6,904
Percent Treated:	77%
Rainfall Depth Treated (in.):	0.77

Costs

Estimated Design Cost:	$100,000
Estimated Construction Cost:	$68,000
30 % Contingency:	$50,400
Estimated Total Cost:	$218,400
Cost per Impervious Credit Acre:	$112,577

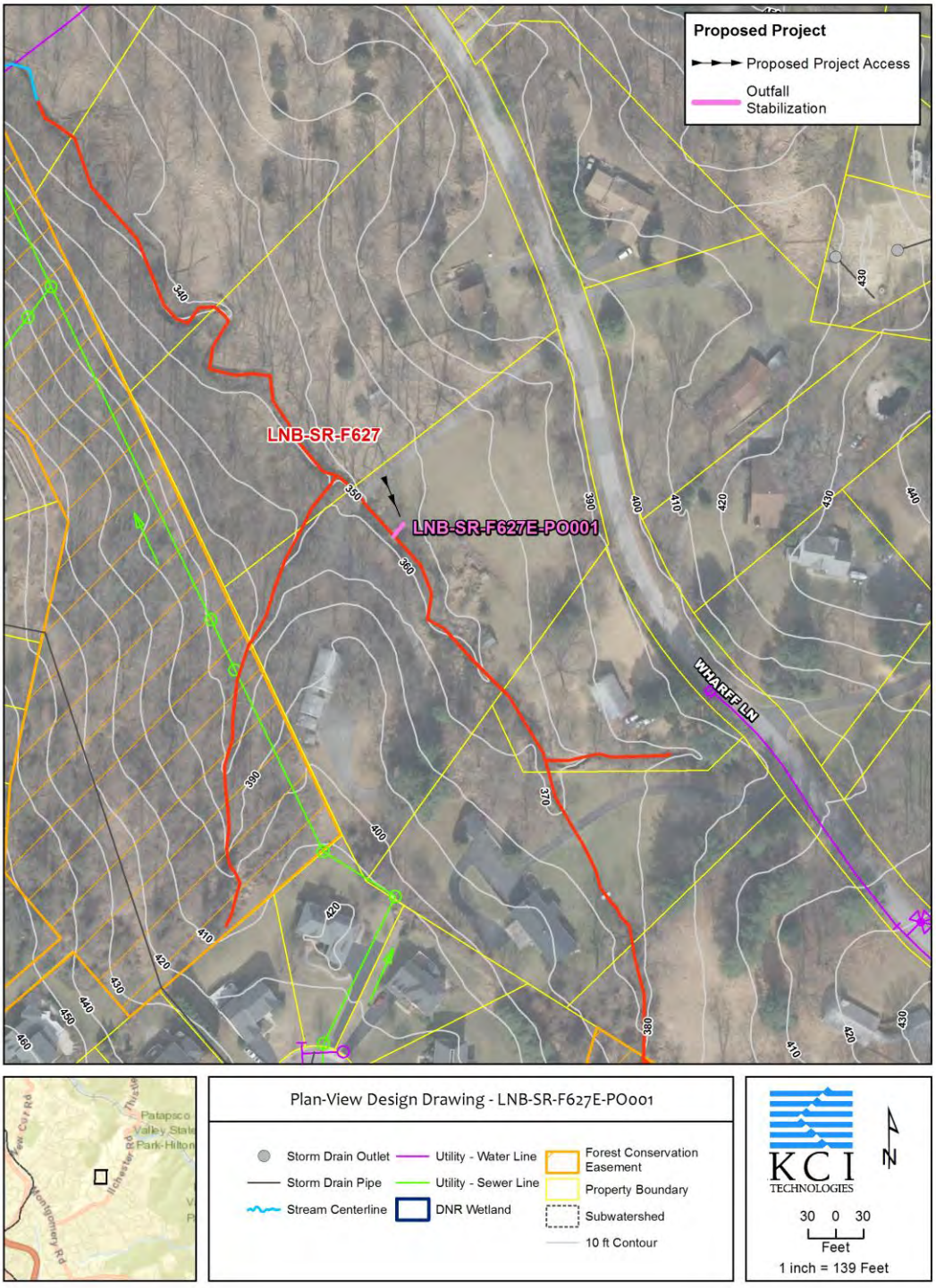
Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-SR-F627E-PO001

Site Name: Bonnie Branch

Contractor: KCI

Watershed: Patapsco Lower North



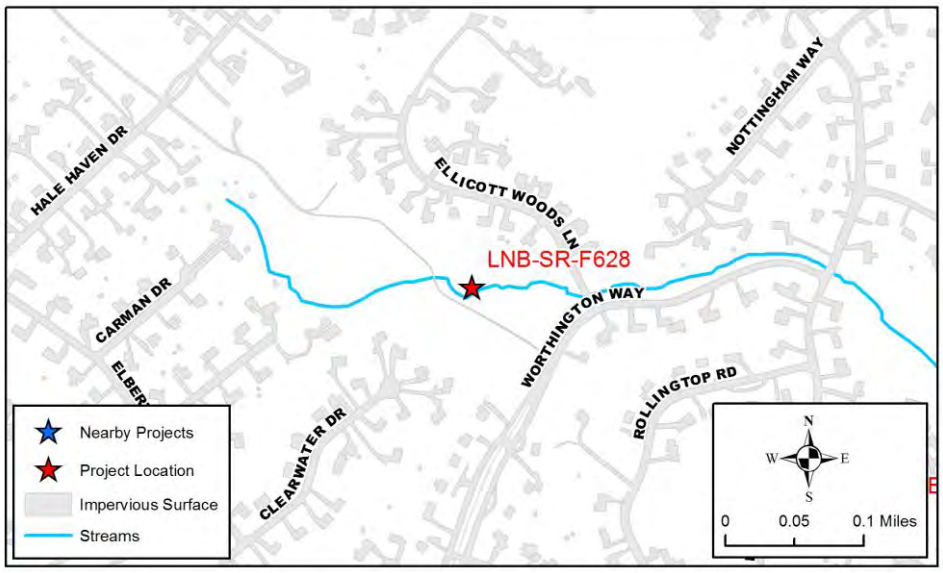
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F628
Site Name: Worthington Way
Contractor: KCI
Watershed: Patapsco Lower North

Ownership: Private- Mixed Use
Multiple Owners

Existing Conditions:

This site is located on an unnamed tributary to the Patapsco River. The site is located on property owned by BG&E and multiple private landowners. The stream in this location has downcut and eroded laterally, resulting in many areas of bank erosion. The eroded banks along this reach are near vertical and have an average height of 3 ft. throughout the site. The banks are primarily composed of silt and have low root density and shallow root depth. Stream habitat is fair and poor at this site, lacking both suitable cover for fish and stable substrates for stream insects. Habitat diversity is low, with the majority of the available habitat consisting of shallow pools with short, shallow riffles. The habitat is also impaired by a large amount of fine material filling the interstitial spaces of the stream bed. The stream substrate is comprised mostly of sand, gravel, and cobble.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F628
Site Name: Worthington Way
Contractor: KCI
Watershed: Patapsco Lower North

Typical stream bank erosion in the lower portion of the site

Typical stream bank erosion in the middle portion of the site

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F628
Site Name: Worthington Way
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

Ownership will be a constraint at this site; the properties along this site are owned by BG&E and multiple private landowners. Worthington Way parallels the lower portion of the site and is an average of 30 ft. from the stream. A sewer line parallels the lower portion of the site and crosses the stream in at least five locations.

Concept Description:

The proposed stream restoration design will focus on stabilizing eroding banks, and reconnecting the stream to its floodplain. Banks will be graded to create a new lower elevation floodplain to decrease velocity during high-flow events. Bank protection will include natural channel design and bioengineering techniques, but may need stone treatments in some areas especially where the stream is threatening infrastructure and where it is close to Worthington Way. Additional cobble brought in from off-site will be added to the existing sand and gravel substrates in constructed riffles to increase velocity and habitat diversity. Existing rootwads will be retained when possible to provide habitat and overhead cover for fish and benthic macroinvertebrates. A sanitary sewer line parallels the stream in the lower portion of the site and crosses the stream channel in five locations. Consideration will be given to protecting the existing infrastructure in the proposed design. A planting plan will be developed for the site to revegetate the stream banks and areas disturbed during construction using native plant species.

Nearby Opportunities:

None recommended

Proposed Project Credit		Costs	
Length Restored (ft):	2,165	Estimated Design Cost:	$300,000.00
Impervious Area Treated Credit (ac.):	21.65	Estimated Construction Cost:	$974,250.00
Cost per Impervious Credit Acre:	$76,514	30% Contingency:	$382,275.00
		Estimated Total Cost:	$1,656,525.00

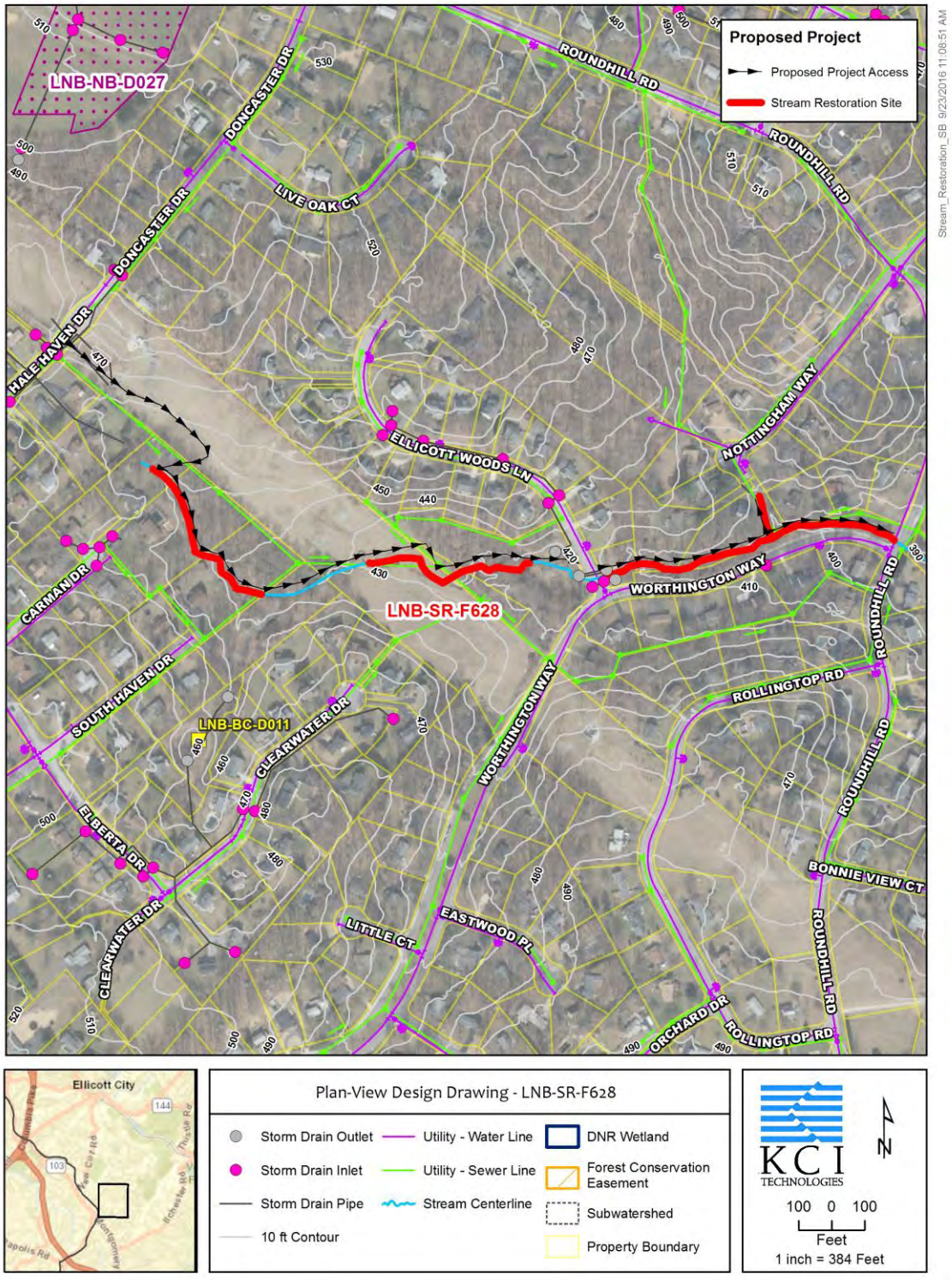
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F628

Site Name: Worthington Way

Contractor: KCI

Watershed: Patapsco Lower North



Plan-View Design Drawing - LNB-SR-F628

- Storm Drain Outlet
- Storm Drain Inlet
- Storm Drain Pipe
- 10 ft Contour
- Utility - Water Line
- Utility - Sewer Line
- Stream Centerline
- DNR Wetland
- Forest Conservation Easement
- Subwatershed
- Property Boundary

KCI TECHNOLOGIES

N

100 0 100

Feet

1 inch = 384 Feet

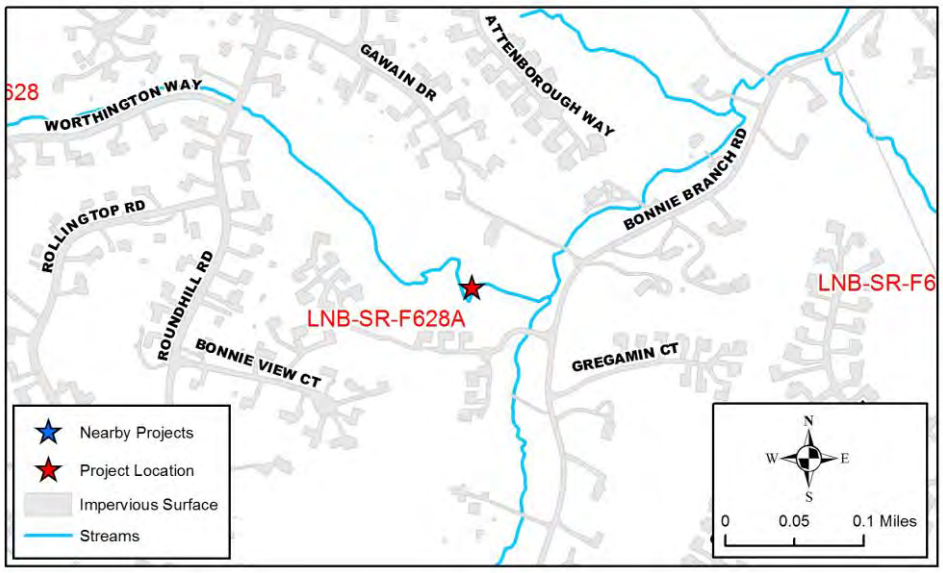
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F628A
Site Name: Twin Stream Drive
Contractor: KCI
Watershed: Patapsco Lower North

Ownership: County Owned
Single Owner

Existing Conditions:

This site is located on an unnamed tributary to the Patapsco River. The site is owned by Howard County Department of Parks and Recreation. Widening has occurred at this location exposing a sewer line. Near the upper end of the site a concrete casement for the sewer line crossing of the stream is also exposed. The eroded banks along this reach are near vertical and have an average height of 3.5 ft. throughout the site. The banks are primarily composed of silt and have low root density and moderate root depth. Stream habitat is poor to fair at this site, lacking both suitable cover for fish and stable substrates for stream insects. The habitat is impaired by a moderate amount of fine material filling the interstitial spaces of the stream bed. The stream substrate is comprised mostly of sand, gravel, and cobble.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F628A
Site Name: Twin Stream Drive
Contractor: KCI
Watershed: Patapsco Lower North

Facing upstream at the sewer crossing showing boulders placed to protect the sewer line

Exposed sewer line in the channel bed

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F628A
Site Name: Twin Stream Drive
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

A sewer line parallels the site and crosses the site at one location. The sewer line is exposed by stream erosion in two places.

Concept Description:

The proposed stream restoration design will focus on stabilizing eroding banks, and reconnecting the stream to its floodplain. A sanitary sewer line parallels the stream and crosses the stream channel in one location. Consideration will be given to protecting the existing infrastructure in the proposed design. Banks will be graded to create a new lower elevation floodplain and to allow the stream access to its historical floodplain during high-flow events. Bank protection will include natural channel design and bioengineering techniques, but may need stone treatments in some areas especially where the stream is threatening the integrity of the sanitary sewer line. The channel will be realigned to move the stream away from the unprotected sanitary sewer in the lower portion of the site. Additional cobble brought in from off-site will be added to the existing sand and gravel substrates in constructed riffles to increase velocity and habitat diversity. Existing rootwads will be retained when possible to provide habitat and overhead cover for fish and benthic macroinvertebrates. A planting plan will be developed for the site to revegetate the stream banks and areas disturbed during construction using native plant species.

Nearby Opportunities:

None recommended

Proposed Project Credit		Costs	
Length Restored (ft):	245	Estimated Design Cost:	$200,000.00
Impervious Area Treated Credit (ac.):	2.45	Estimated Construction Cost:	$110,250.00
Cost per Impervious Credit Acre:	$164,622	30% Contingency:	$93,075.00
		Estimated Total Cost:	$403,325.00

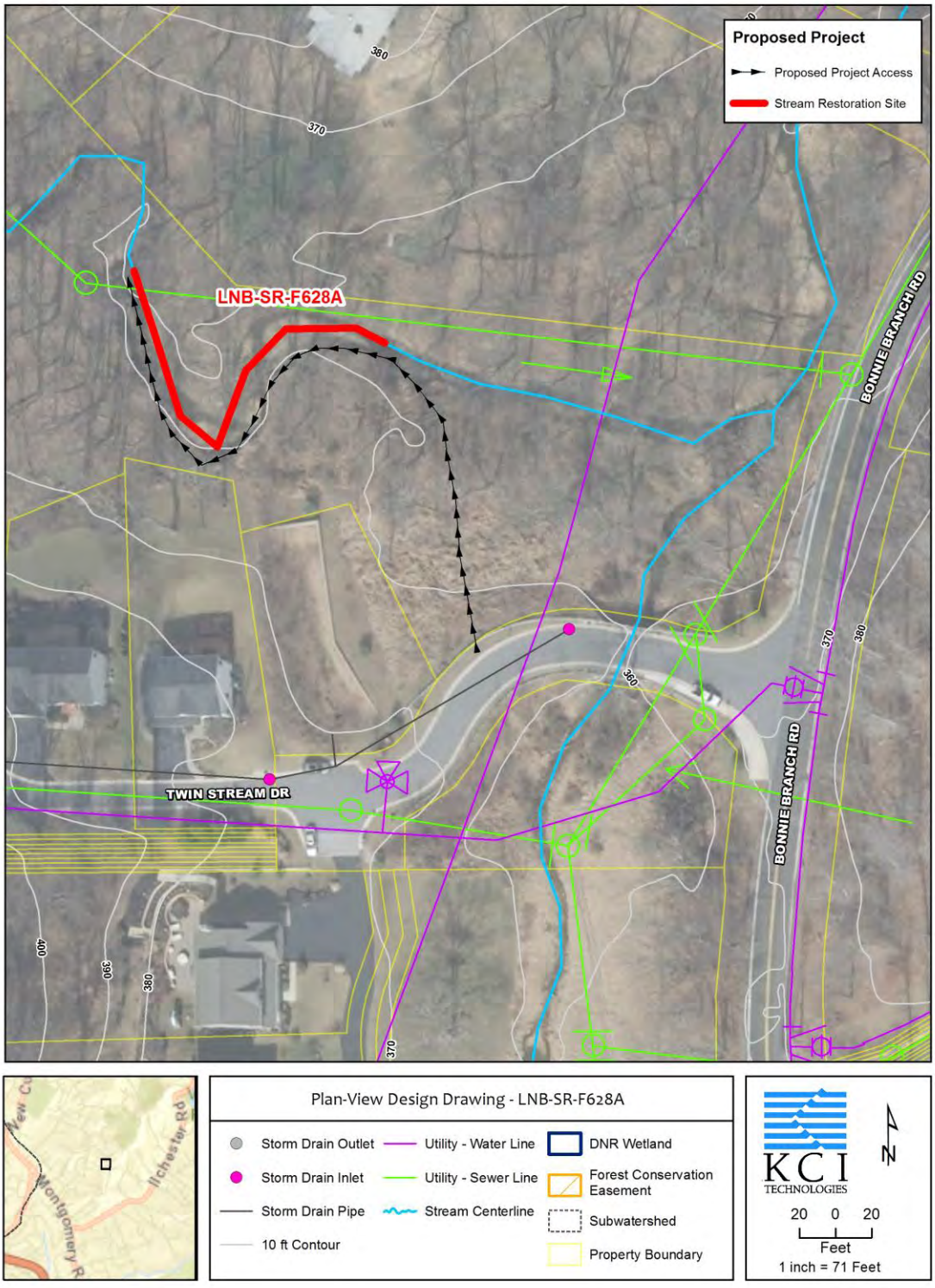
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F628A

Site Name: Twin Stream Drive

Contractor: KCI

Watershed: Patapsco Lower North



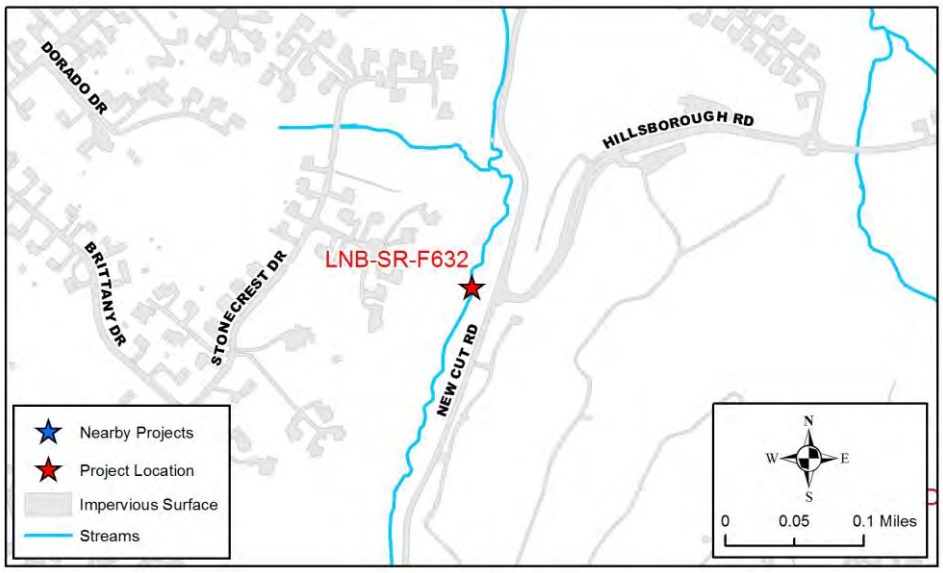
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F632
Site Name: New Cut Road
Contractor: KCI
Watershed: Patapsco Lower North

Ownership: County Owned
Single Owner

Existing Conditions:

The site is located on an unnamed tributary to the Patapsco River and is owned by Howard County. Downcutting and widening have occurred throughout this reach resulting in eroding banks and is threatening to undermine an old stone wall protecting New Cut Road. Erosion primarily occurs on the outside of meander bends and where the stream is confined against the steep valley wall by New Cut Road. Eroded bank heights average 3 ft. in the upper portion of the site and average 5 ft. in the lower portion. The banks are primarily composed of silt and have low root density and shallow root depth. Stream habitat is poor throughout this site, lacking both suitable cover for fish and stable substrates for stream insects. The habitat is impaired by a high amount of fine material filling the interstitial spaces of the stream bed. The stream substrate is comprised mostly of sand and gravel.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F632
Site Name: New Cut Road
Contractor: KCI
Watershed: Patapsco Lower North

Facing upstream in the lower portion of the site showing vertical banks and the old stone wall along New Cut Road

Typical stream bank erosion along the outside of a meander bend

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F632
Site Name: New Cut Road
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

Portions of this project are located in a forested area and will require removing many trees for access and construction. Field crews noted specimen trees may be impacted throughout the project area. A sewer line parallels the stream for the entire length of the site and crosses the stream in at least one location. New Cut Road parallels the stream for the length of the site and will limit the area available to modify the stream's sinuosity. The upstream most portion of the site crosses an AT&T right-of-way, and at this crossing there is an exposed fiber optic cable.

Concept Description:

The proposed stream restoration design will focus on stabilizing eroding banks, relieving the compressed meanders, and reconnecting the stream to its floodplain. Banks will be graded to create a new lower elevation floodplain and to allow the stream access to its historical floodplain during high-flow events. Bank protection will include natural channel design and bioengineering techniques, but may need stone treatments in some areas especially where the stream is threatening New Cut Road. Cobble brought in from off-site will be added to the existing sand and gravel substrates in constructed riffles to increase velocity and habitat diversity. Existing rootwads will be retained when possible to provide habitat and overhead cover for fish and benthic macroinvertebrates. A sanitary sewer line parallels the stream and crosses the stream channel in one location and a fiber optic cable crosses the channel at another location. Consideration will be given to protecting the existing infrastructure in the proposed design. A planting plan will be developed for the site to revegetate the stream banks and areas disturbed during construction using native plant species.

Nearby Opportunities:

None recommended

Proposed Project Credit		Costs	
Length Restored (ft):	1,550	Estimated Design Cost:	$300,000.00
Impervious Area Treated Credit (ac.):	15.5	Estimated Construction Cost:	$697,500.00
Cost per Impervious Credit Acre:	$83,661	30% Contingency:	$299,250.00
		Estimated Total Cost:	$1,296,750.00

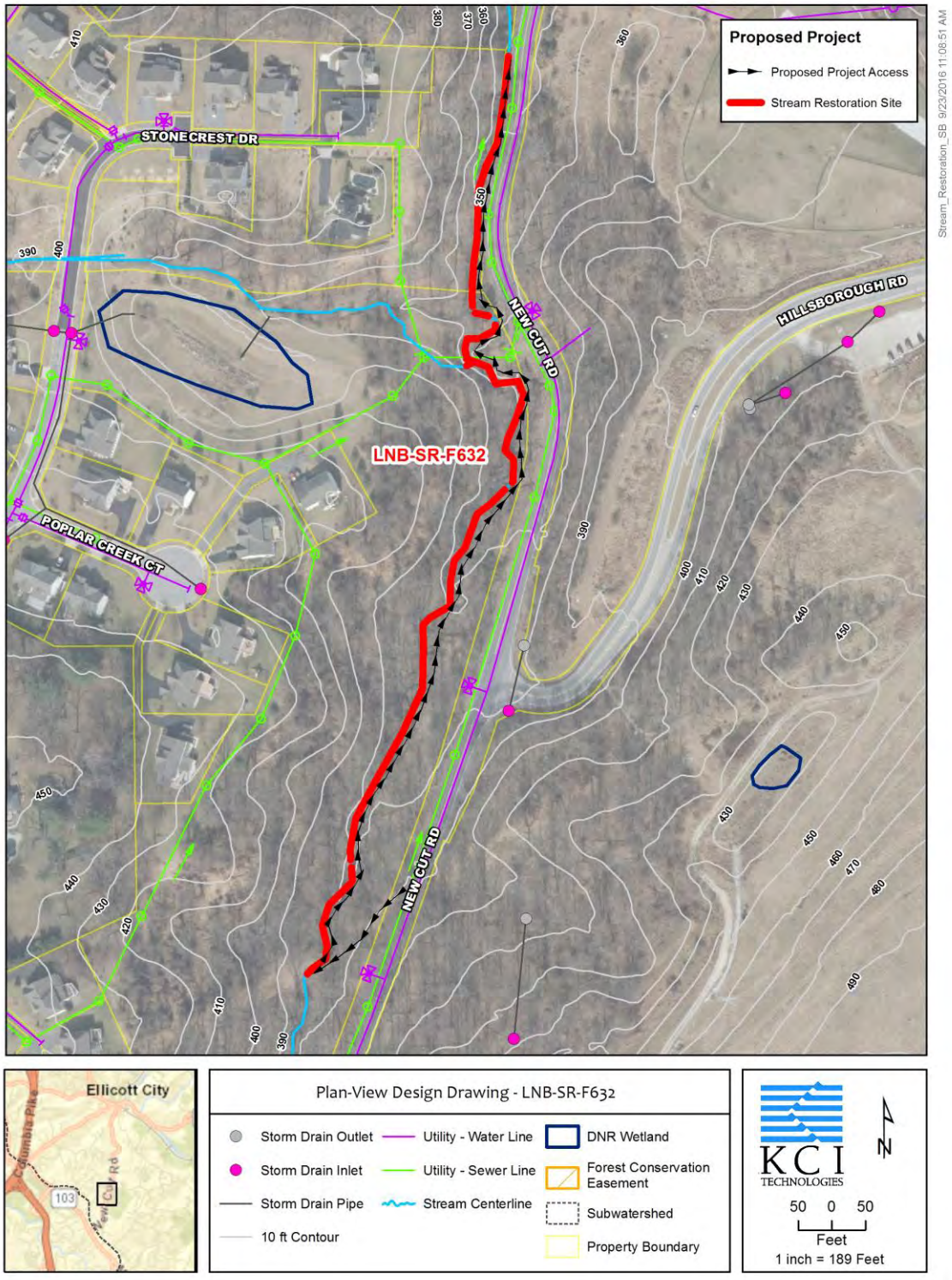
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F632

Site Name: New Cut Road

Contractor: KCI

Watershed: Patapsco Lower North



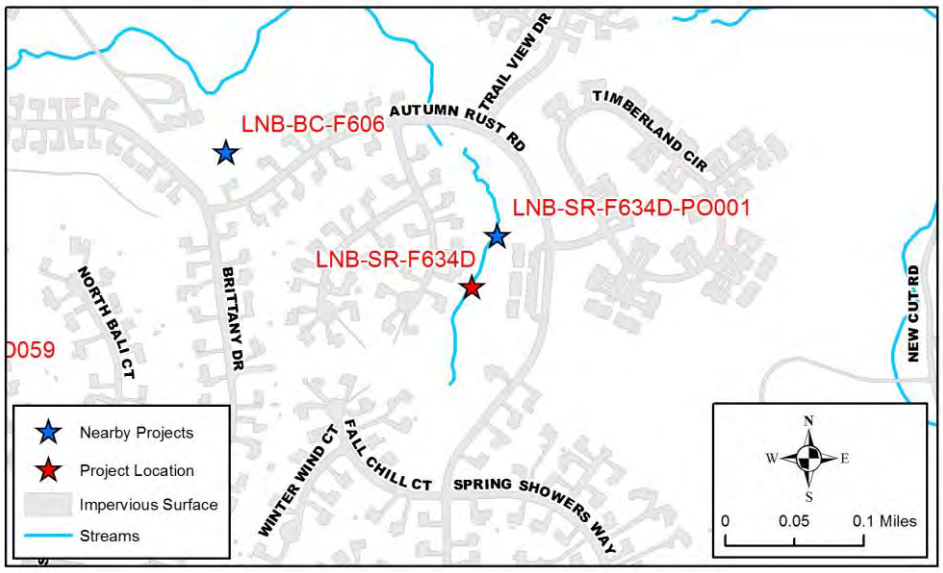
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F634D
Site Name: Autumn Rust Road
Contractor: KCI
Watershed: Patapsco Lower North

Ownership: County Park
Single Owner

Existing Conditions:

This site is located on an unnamed tributary to Tiber Branch. The property along the site is owned by Howard County Department of Parks and Recreation. Downcutting and widening have occurred throughout this reach resulting in eroding banks throughout much of the site. Downcutting has exposed an area of bedrock which has resulted in a 4 ft. high cascade. Eroded bank heights average 4 ft. along both banks. The banks are primarily composed of silt and have very low root density and very shallow root depth. Stream habitat is poor throughout this site, lacking both suitable cover for fish and stable substrates for stream insects. The habitat is impaired by a moderate amount of fine material filling the interstitial spaces of the stream bed. The stream substrate is comprised mostly of sand, gravel, and cobble.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F634D
Site Name: Autumn Rust Road
Contractor: KCI
Watershed: Patapsco Lower North

Typical stream bank erosion at this site

Facing upstream a cascade over bedrock near the downstream end of the site

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F634D
Site Name: Autumn Rust Road
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

The site is located in a forested area and will require the removal of many trees for access and construction.

Concept Description:

The proposed stream restoration design will focus on stabilizing eroding banks and reconnecting the stream to its floodplain. Banks will be graded to create a new lower elevation floodplain and where possible to allow the stream access to its historical floodplain during high-flow events. The stream bed in the lower portion of the site may need to be elevated to reduce or eliminate the drop at the bedrock cascade. Bank protection will include natural channel design and bioengineering techniques, but may need stone treatments in some areas especially where the stream is close to private property. Cobble brought in from off-site will be added to the existing sand, gravel, and cobble substrates in constructed riffles to increase velocity and habitat diversity. Existing rootwads will be retained when possible to provide habitat and overhead cover for fish and benthic macroinvertebrates. A planting plan will be developed for the site to revegetate the stream banks and areas disturbed during construction using native plant species.

Nearby Opportunities:

LNB-SR-F634D-PO001

Proposed Project Credit		Costs	
Length Restored (ft):	615	Estimated Design Cost:	$200,000.00
Impervious Area Treated Credit (ac.):	6.15	Estimated Construction Cost:	$276,750.00
Cost per Impervious Credit Acre:	$100,776	30% Contingency:	$143,025.00
		Estimated Total Cost:	$619,775.00

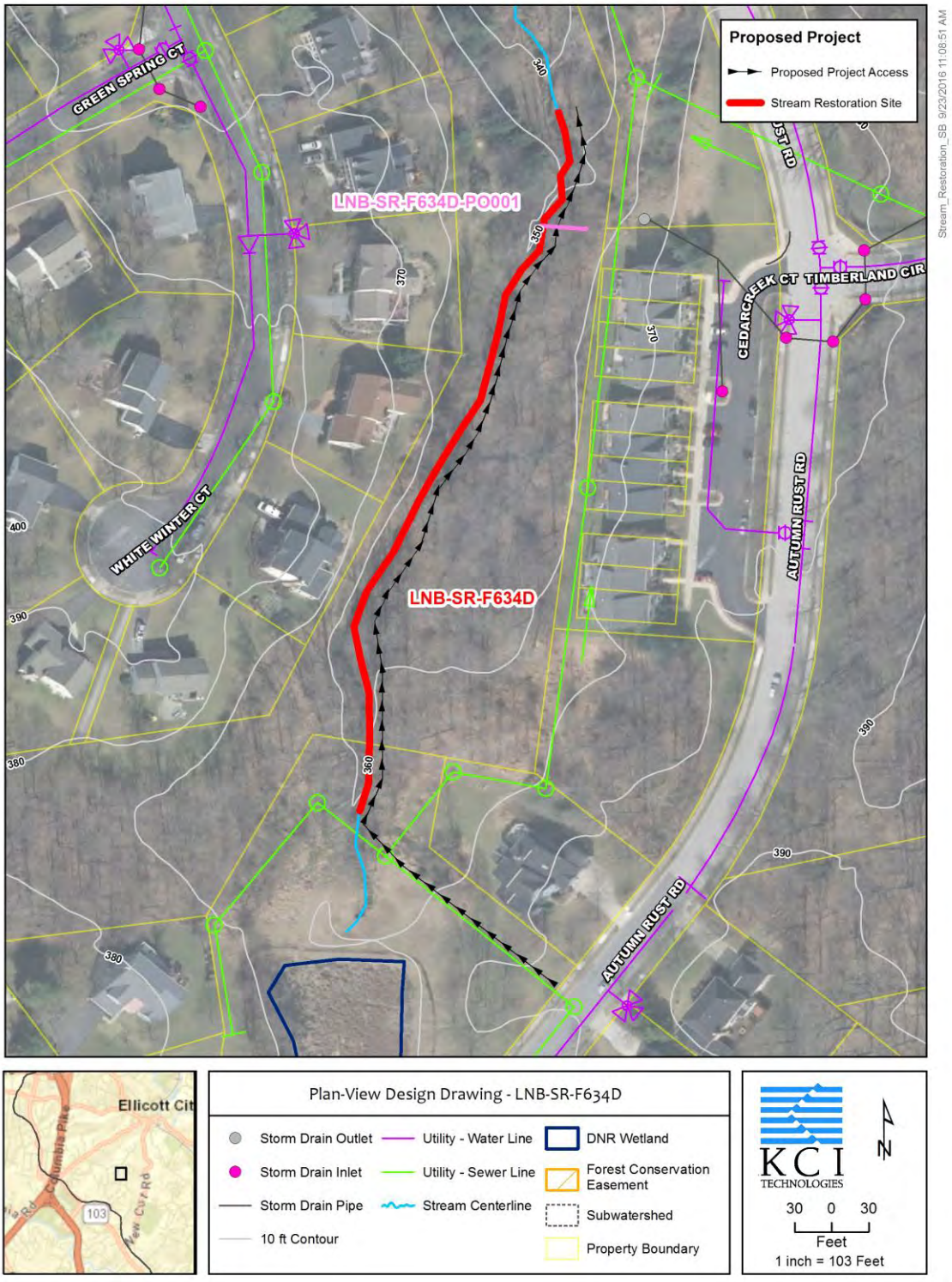
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F634D

Site Name: Autumn Rust Road

Contractor: KCI

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-SR-F634D-PO001

Site Name: Cedar Creek Ct

Contractor: KCI

Watershed: Patapsco Lower North

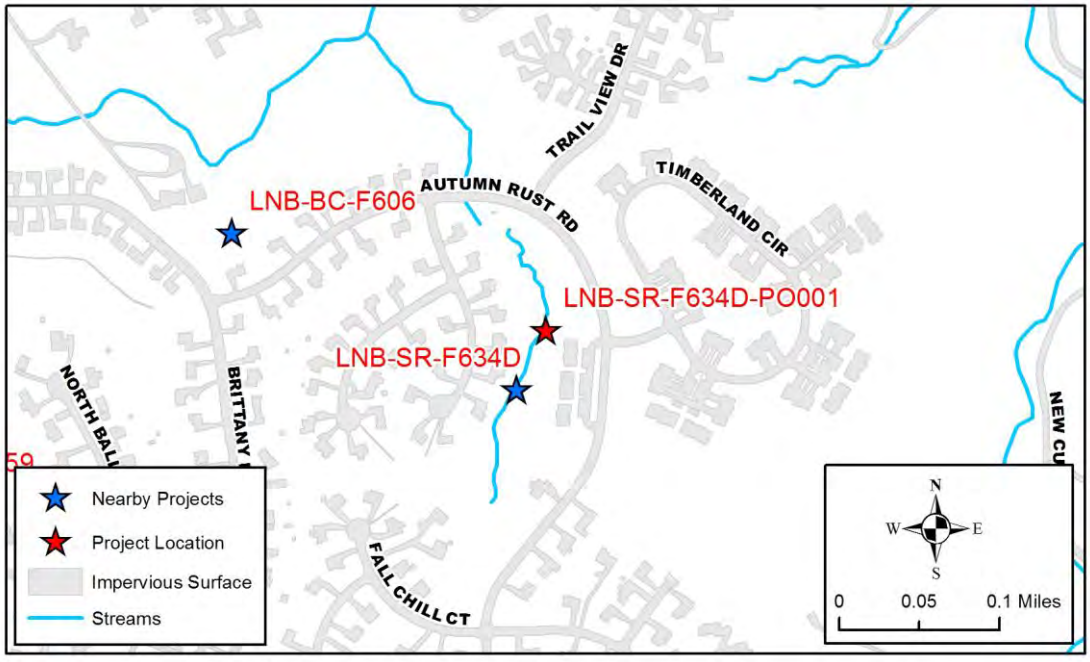
Proposed BMP Type: Outfall Stabilization

Stabilization Type: Step Pool Stormwater Conveyance

Ownership: County Owned
Single Owner

Existing Conditions:

The proposed outfall stabilization is for a short, eroded outfall channel originating at a 18 in. corrugated metal pipe draining nearby residential parking and roads. The pipe is approximately 10 ft. above the eroded outfall channel. The channel is eroded for approximately 40 ft. until it meets an unnamed tributary to the Patapsco River. The site is immediately adjacent to Autumn Rust Road and Cedar Creek Court, so access is easy.



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-SR-F634D-PO001
Site Name: Cedar Creek Ct
Contractor: KCI
Watershed: Patapsco Lower North

View facing upstream at pipe outfall and eroded outfall channel.

View facing downstream of eroded outfall channel.

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-SR-F634D-PO001
Site Name: Cedar Creek Ct
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:
Aside from minimal impact to trees, there are no constraints associated with this project.

Concept Description:
The proposed stabilization BMP is a Step Pool Storm Conveyance system (SPSC) with 1 cascade, 3 pools and 3 riffles. The SPSC will be 12 ft. wide and span 80 ft. including the full 40 ft. of erosion starting from the outfall structure. Since the channel is eroded 10 ft. vertically, cascading structures may be necessary which do not provide water quality credit.

Nearby Opportunities:
LNB-SR-F634

Proposed Project Credit	
Drainage Area (ac.):	7.22
Impervious Area within Drainage (ac.):	2.54
Impervious Area Treated (ac.):	2.52
Impervious Area Treated Credit (ac.):	2.52

Water Quality Volume	
WQVolume Target (cf.):	9,609
Max Treated (cf.):	9,329
Percent Treated:	99%
Rainfall Depth Treated (in.):	0.99

Costs

Estimated Design Cost:	$100,000
Estimated Construction Cost:	$98,000
30 % Contingency:	$59,400
Estimated Total Cost:	$257,400
Cost per Impervious Credit Acre:	$102,143

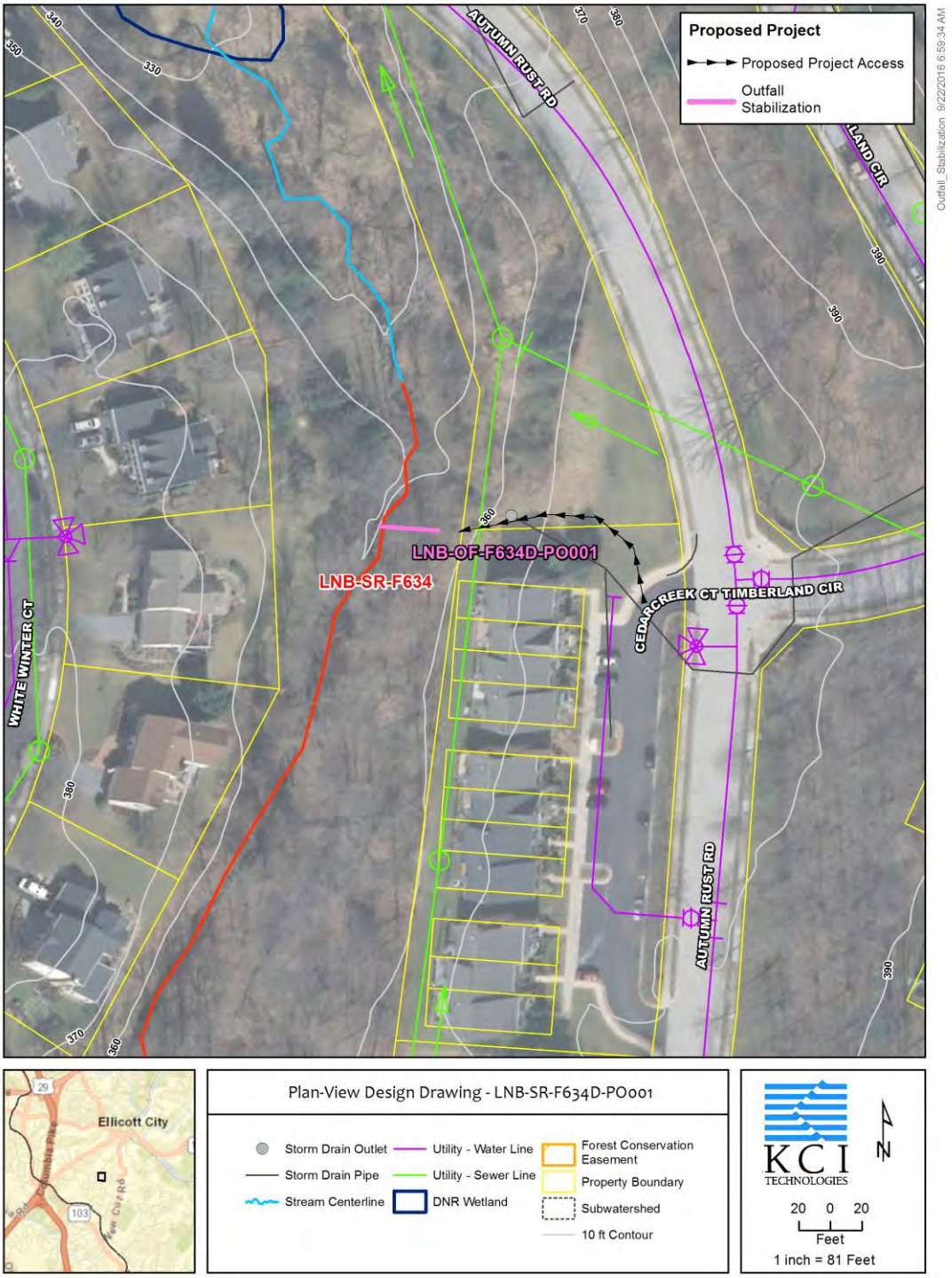
Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: LNB-SR-F634D-PO001

Site Name: Cedar Creek Ct

Contractor: KCI

Watershed: Patapsco Lower North



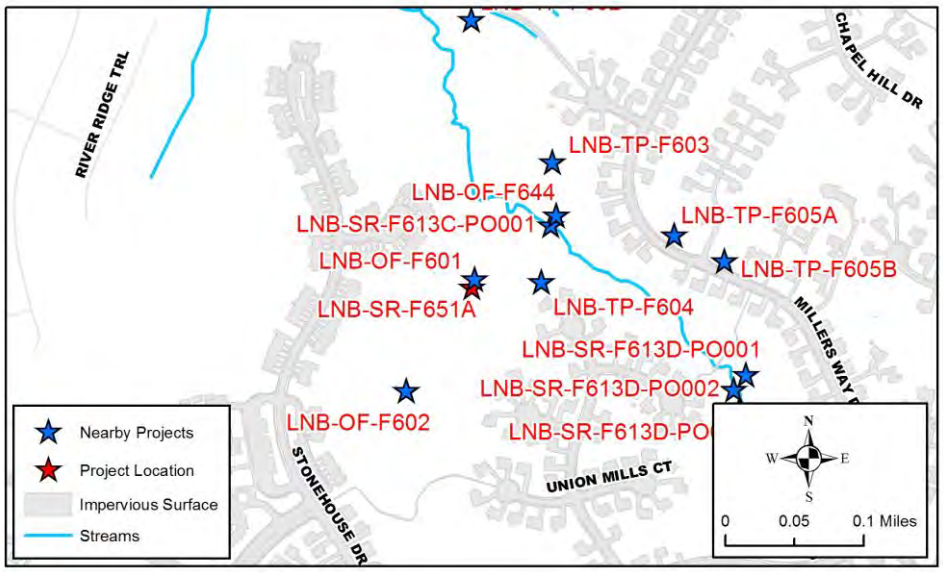
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F651A
Site Name: Millers Way
Contractor: KCI
Watershed: Patapsco Lower North

Ownership: County Owned
Single Owner

Existing Conditions:

This site is located on an unnamed tributary to the Patapsco River and is owned by Howard County. Widening has occurred in this reach resulting in eroding banks throughout much of the site. The stream has eroded bank heights averaging 6 ft. along both banks. Sinuosity has increased, resulting in compressed meanders. The stream bank erosion is threatening an adjacent stormwater management pond. The banks are primarily composed of silt and have extremely low root density and extremely shallow root depth. Stream habitat is very poor throughout this site, lacking both suitable cover for fish and stable substrates for stream insects. The habitat is impaired by a high amount of fine material filling the interstitial spaces of the stream bed. Sand, gravel, and cobble comprised most of the stream substrate.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F651A
Site Name: Millers Way
Contractor: KCI
Watershed: Patapsco Lower North

Typical stream bank erosion along the right bank

Typical stream bank erosion along the left bank

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F651A
Site Name: Millers Way
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

Adjacent storm water management pond may be a constraint at this site.

Concept Description:

The proposed stream restoration design will focus on stabilizing eroding banks, relieving the compressed meanders, and reconnecting the stream to its floodplain. Banks will be graded to create a new lower elevation floodplain and to allow the stream access to its historical floodplain during high-flow events. Bank protection will include natural channel design and bioengineering techniques, but may need stone treatments in some areas especially where the stream is threatening the integrity of the stormwater management pond. The channel will be realigned to reduce the compressed meanders and to move the stream away from the adjacent stormwater management pond. Cobble brought in from off-site will be added to the existing sand and gravel substrates in constructed riffles to increase velocity and habitat diversity. Existing rootwads will be retained when possible to provide habitat and overhead cover for fish and benthic macroinvertebrates. A planting plan will be developed for the site to revegetate the stream banks and areas disturbed during construction using native plant species.

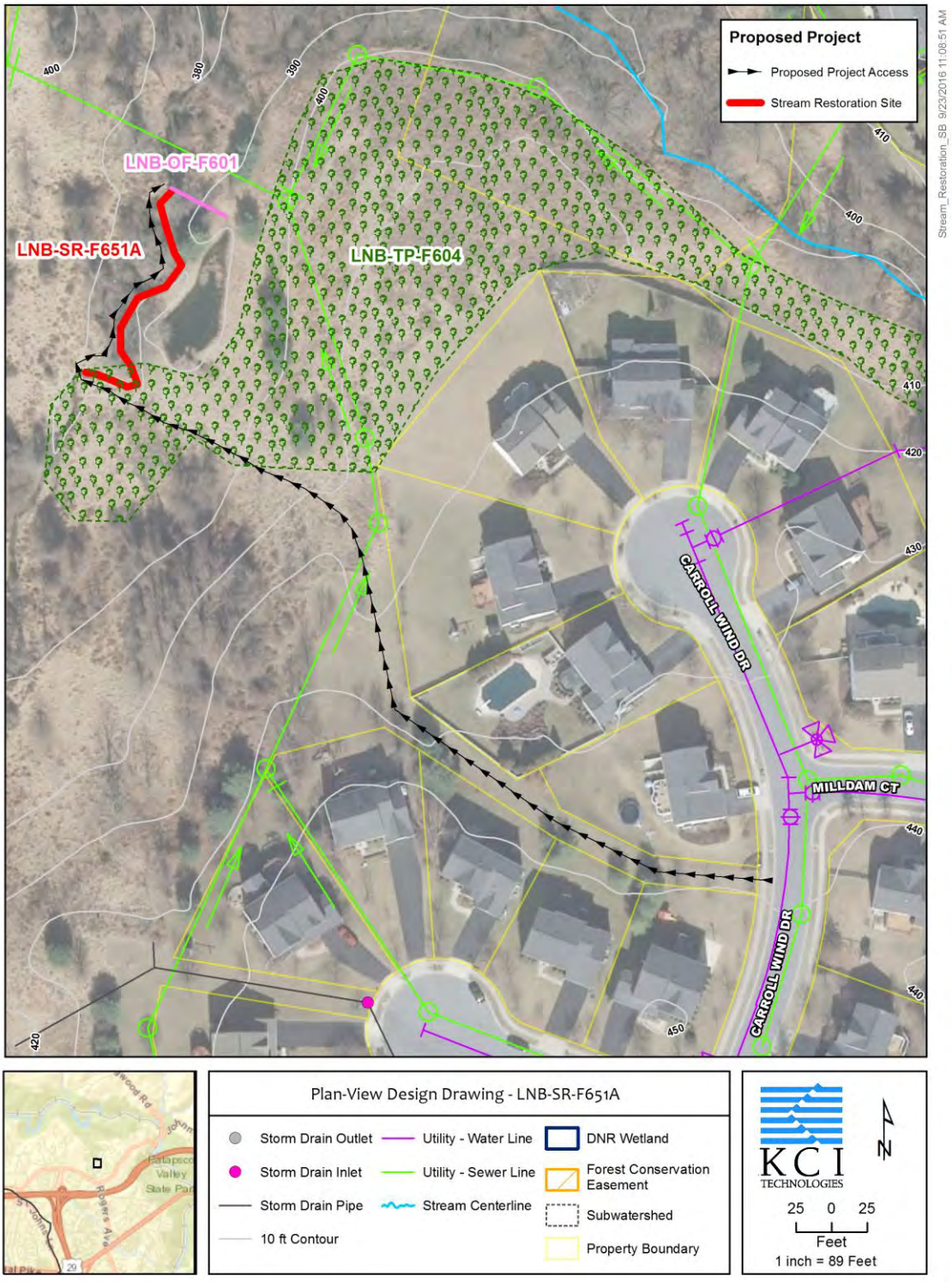
Nearby Opportunities:

LNB-TP-F603, LNB-TP-F604, LNB-OF-F601, LNB-OF-F602, LNB-OF-F644, LNB-SR-F613C-PO001,

Proposed Project Credit		Costs	
Length Restored (ft):	115	Estimated Design Cost:	$100,000.00
Impervious Area Treated Credit (ac.):	1.15	Estimated Construction Cost:	$51,750.00
Cost per Impervious Credit Acre:	$171,543	30% Contingency:	$45,525.00
		Estimated Total Cost:	$197,275.00

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F651A
Site Name: Millers Way
Contractor: KCI
Watershed: Patapsco Lower North



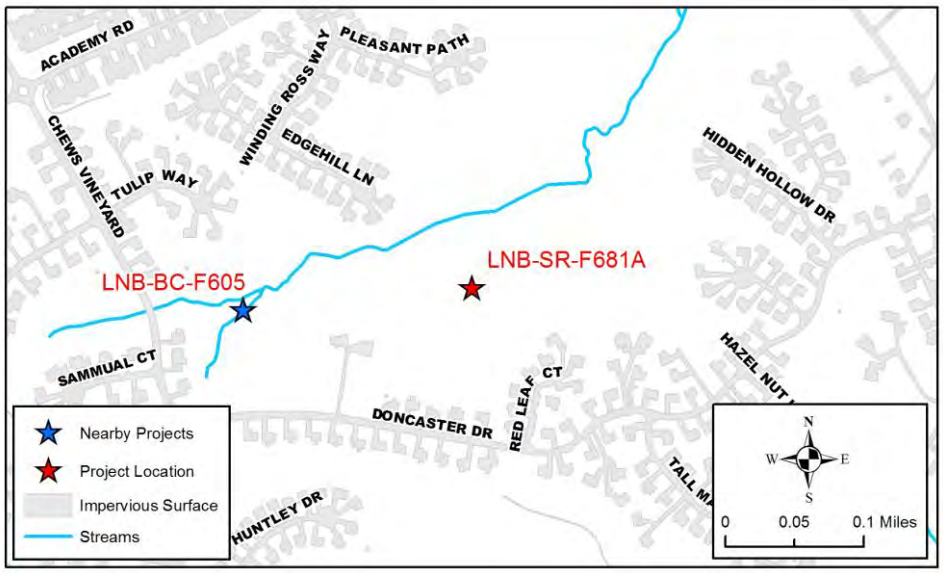
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F681A
Site Name: Doncaster Drive
Contractor: KCI
Watershed: Patapsco Lower North

Ownership: County Park
Single Owner

Existing Conditions:

This site is located downstream of an outfall of a stormwater management pond on an unnamed tributary to the Patapsco River. The site is owned by Howard County Department of Parks and Recreation. Downcutting and widening has occurred at this location, and a headcut is progressing upstream near the midpoint of the site. Throughout this site the eroded banks average 4 ft. in height. The channel downstream of the headcut averages 5 ft. wide and upstream of the headcut the channel averages 3 ft. wide.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F681A
Site Name: Doncaster Drive
Contractor: KCI
Watershed: Patapsco Lower North

Facing upstream headcut near midpoint of site

Typical downcutting and bank erosion facing downstream from upstream extent of site

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F681A
Site Name: Doncaster Drive
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

Access may be a constraint for this site. Most of the site is located in forest and will require removing many trees for access and construction. The field crew identified potential impacts to wetlands in the site.

Concept Description:

The proposed stream restoration design will focus on stabilizing eroding banks and reconnecting the stream to its floodplain. The bed elevation may be raised to reconnect the stream to its previous floodplain and to address the headcuts. Bank protection will include natural channel design and bioengineering techniques, but may need stone treatments in some areas. Existing rootwads will be retained when possible to provide habitat and overhead cover for fish and benthic macroinvertebrates. A planting plan will be developed for the site to revegetate the stream banks and areas disturbed during construction using native plant species.

Nearby Opportunities:

None recommended

Proposed Project Credit		Costs	
Length Restored (ft):	570	Estimated Design Cost:	$200,000.00
Impervious Area Treated Credit (ac.):	5.7	Estimated Construction Cost:	$256,500.00
Cost per Impervious Credit Acre:	$104,114	30% Contingency:	$136,950.00
		Estimated Total Cost:	$593,450.00

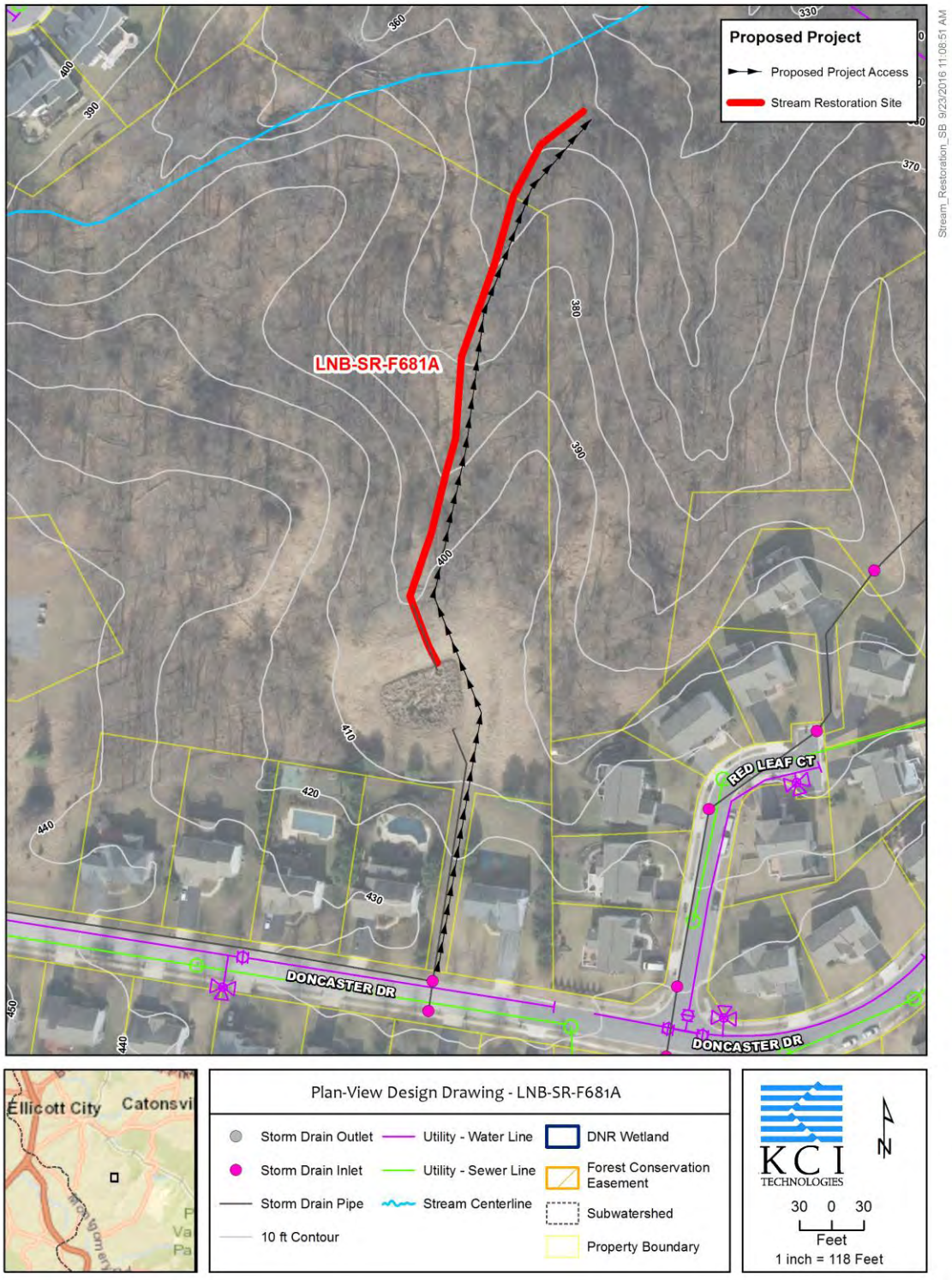
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: LNB-SR-F681A

Site Name: Doncaster Drive

Contractor: KCI

Watershed: Patapsco Lower North



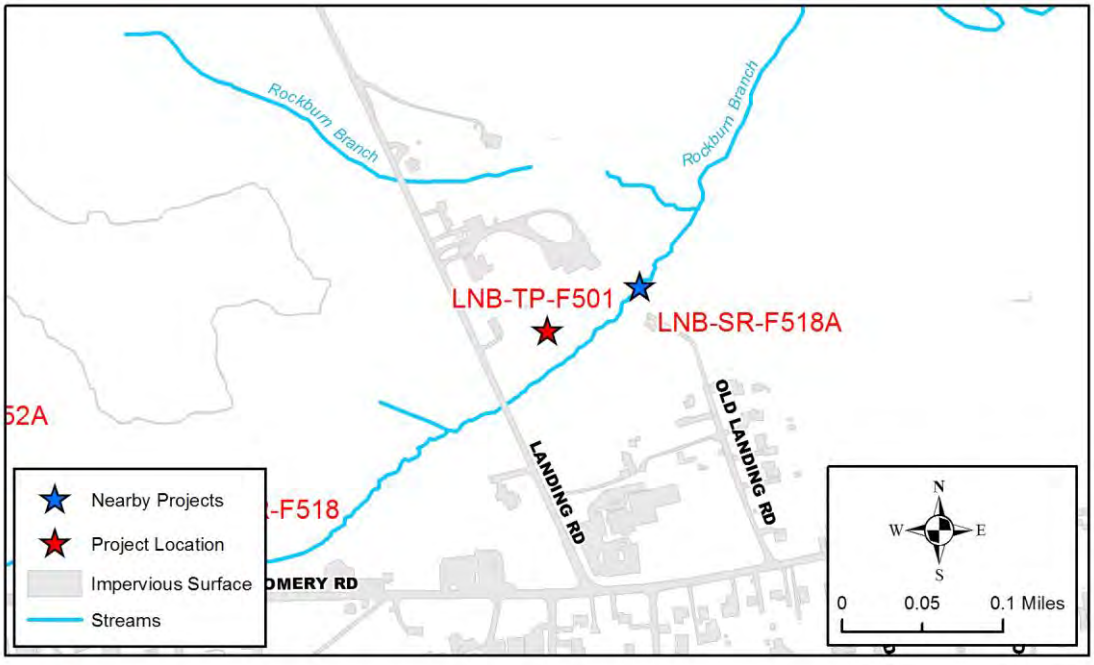
Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F501
Site Name: Landing Road
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Project Type: Tree Planting
Ownership: County Owned
Single Owner

Existing Conditions:

The proposed tree planting site is located approximately 800 ft. north of the Landing Road/Montgomery Road intersection in Elkridge, MD. The property associated with the planting area is county owned and is within an existing forest conservation easement. The project site is also within the riparian buffer zone of LNB-SR-F518. The site has some floodplain connection with LNB-SR-F518, however this connection does not likely extend into the proposed planting area. The proposed planting area currently receives full sunlight and is primarily comprised of herbaceous cover (95%). Dominant tree species observed in adjacent areas include tulip poplar (*Liriodendron tulipifera*) and red maple (*Acer rubrum*). Approximately 15% of the proposed planting area has invasive species coverage. Dominant invasive species include multiflora rose (*Rosa multiflora*) and autumn olive (*Elaeagnus umbellata*). Soils within the project are primarily loam and are not compacted. Water sources other than rainfall include runoff from surrounding landuse. Wetlands are located within adjacent areas of the stream and planting site.



Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F501
Site Name: Landing Road
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed tree planting site LNB-TP-F501 facing east.

Proposed tree planting site LNB-TP-F501 facing west.

Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F501
Site Name: Landing Road
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints within the project site include heavy deer browse, adjacent wetlands, and presence of overhead and underground utilities adjacent to the planting area.

Concept Description:

Approximately 0.47 ac. of planting area can be planted at the site with suitable tree species. It is recommended that American sycamore (*Platanus occidentalis*) be included as a suitable tree species since it is typically more resistant to deer browse. No previous plantings have occurred on this property. Selection of other suitable tree species will be determined in a planting plan if the project is selected for planting. Access to the site is generally easy with foot and vehicle traffic from Landing Road. However, it could be somewhat difficult for larger heavy equipment due to a 15 ft. overhead utility line that runs parallel with Landing Road that could constrain access. Space for temporary storage and onsite material delivery is available adjacent to the planting site. Volunteer parking and facilities are not available.

Nearby Opportunities:

LNB-SR-F518A

Proposed Project Credit	
Planting Acres:	0.5
Impervious Area Treated Credit (ac.):	0.18
Cost per Impervious Credit Acre:	$180,844

Costs	
Estimated Design Cost:	$10,000
Estimated Construction Cost:	$15,040
30% Contingency:	$7,512
Estimated Total Cost:	$32,552

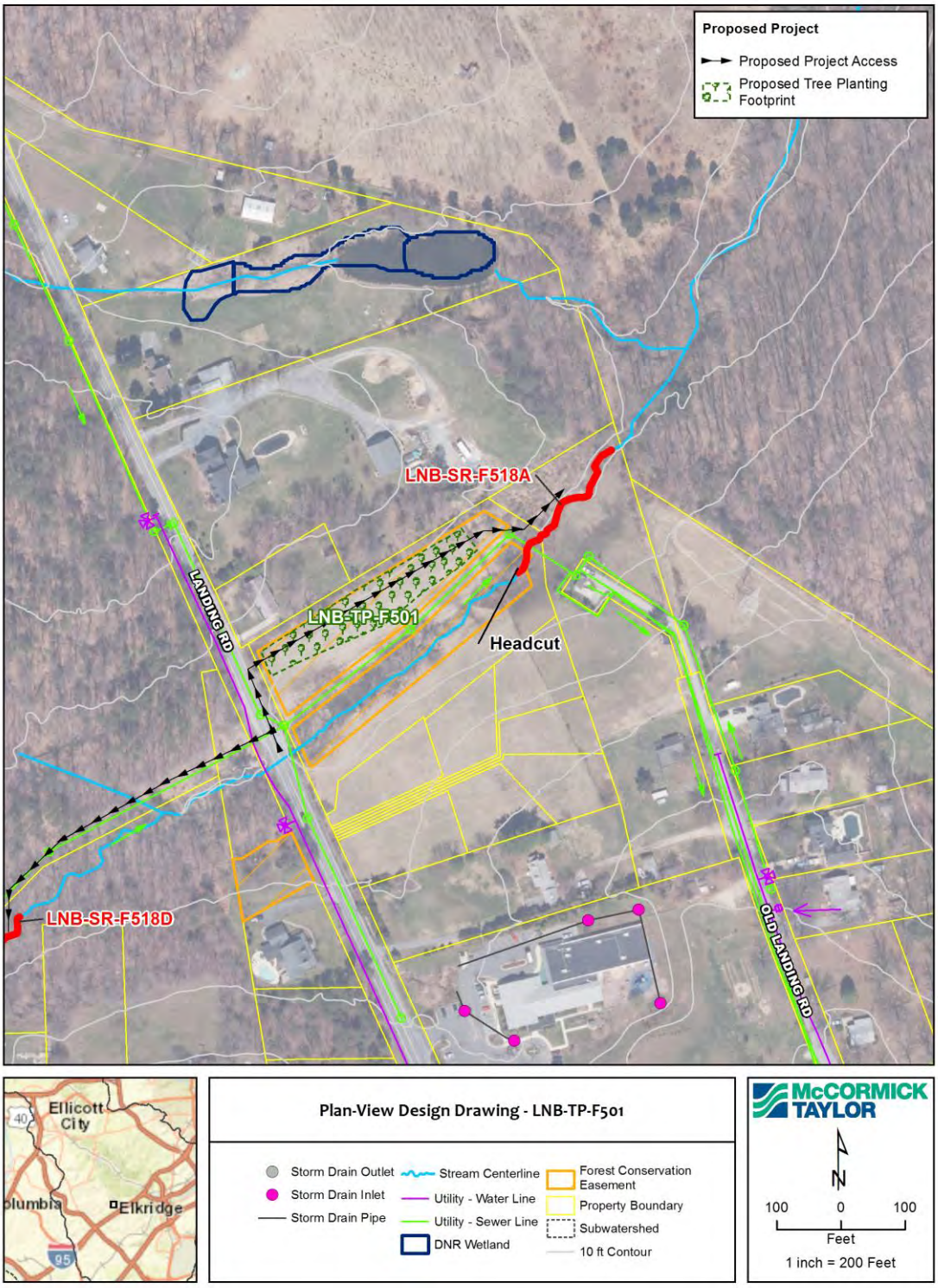
Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F501

Site Name: Landing Road

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



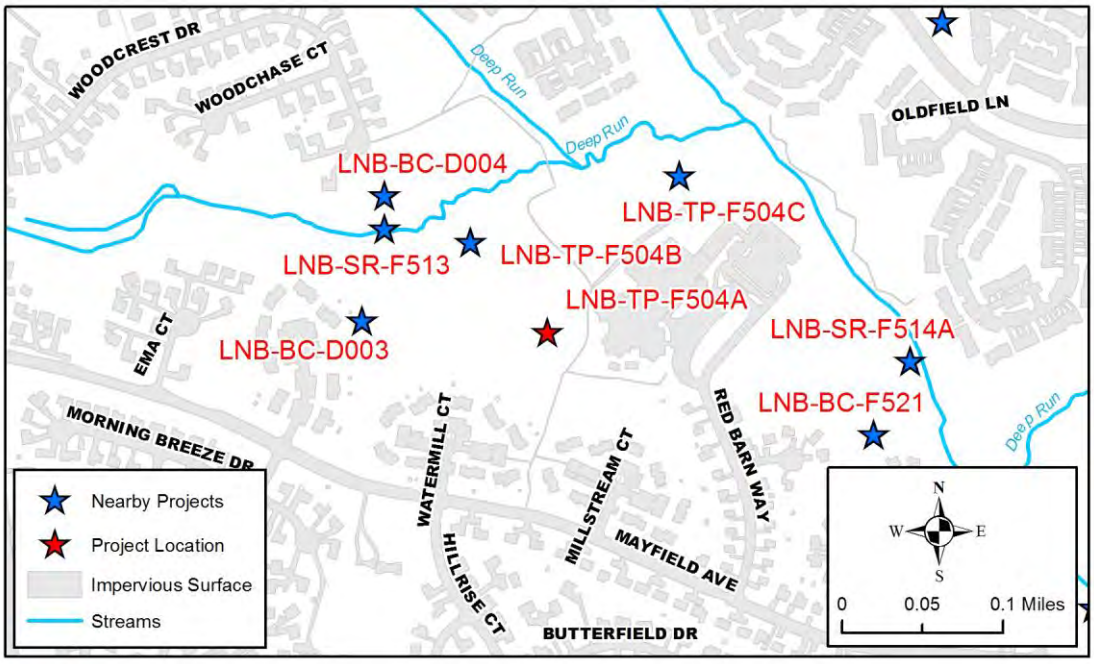
Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F504
Site Name: Mayfield Woods Oaks
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Project Type: Tree Planting
Ownership: County School
Single Owner

Existing Conditions:

Three tree planting areas (LNB-TP-F504a, LNB-TP-F504b, LNB-TP-F504c) are proposed within the fields behind Mayfield Woods Middle School in Elkridge, MD. The proposed planting area currently receives full sunlight and is completely comprised of mowed turf. Dominant tree species observed in adjacent areas include tulip poplar (*Liriodendron tulipifera*) and red maple (*Acer rubrum*). Approximately 15% of the adjacent area contains Japanese honeysuckle (*Lonicera japonica*). Soils within the project are primarily loam and moderately compacted. Water sources other than rainfall include surface runoff from local drainage areas.



Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F504
Site Name: Mayfield Woods Oaks
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed tree planting site LNB-TP-F504 facing north.

Proposed tree planting site LNB-TP-F504 facing northeast.

Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F504
Site Name: Mayfield Woods Oaks
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

The northeastern planting area contains a drainage swale that will need to be excluded from planting.

Concept Description:

Approximately 1.46 ac. of planting area can be planted at the site with suitable tree species. The areas of recommendation were approved by Greg Connor from Howard County Public Schools Grounds Services at a meeting during the site investigation. No previous plantings have occurred on this property. Selection of other suitable tree species will be determined in a planting plan if the project is selected for planting. Access to the site is generally easy, with foot and vehicle traffic able to enter the school property off of Red Barn Way. Temporary storage for material is possible using existing parking lots. Heavy equipment traffic and onsite material delivery is available to the planting area. Volunteer parking and facilities are also available.

Nearby Opportunities:

LNB-SR-F513, LNB-SR-F514A

Proposed Project Credit	
Planting Acres:	1.5
Impervious Area Treated Credit (ac.):	0.55
Cost per Impervious Credit Acre:	$134,065

Costs	
Estimated Design Cost:	$10,000
Estimated Construction Cost:	$46,720
30% Contingency:	$17,016
Estimated Total Cost:	$73,736

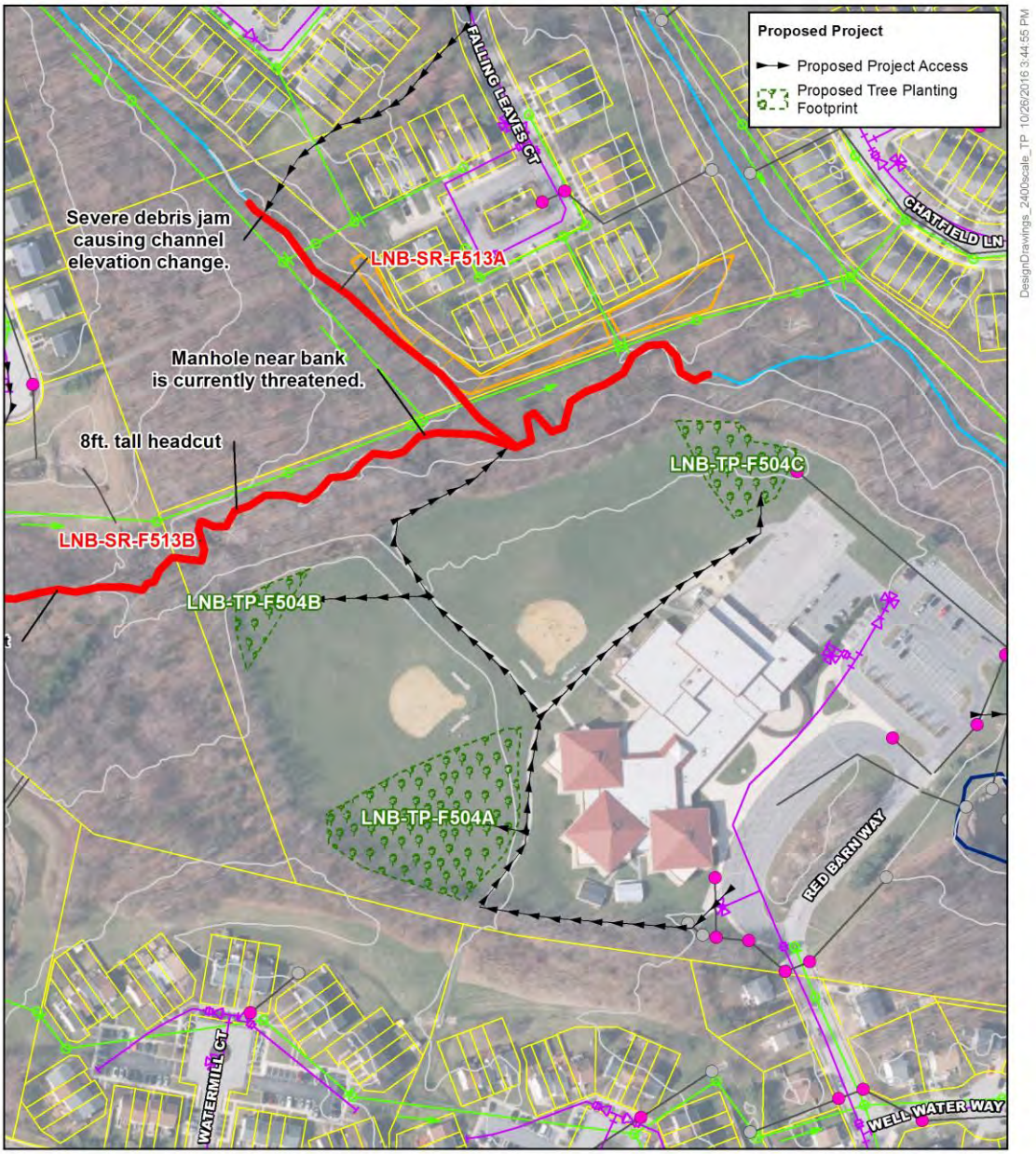
Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F504

Site Name: Mayfield Woods Oaks

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



Plan-View Design Drawing - LNB-TP-F504

- Storm Drain Outlet
- Storm Drain Inlet
- Storm Drain Pipe
- Stream Centerline
- Utility - Water Line
- Utility - Sewer Line
- DNR Wetland
- Forest Conservation Easement
- Property Boundary
- Subwatershed
- 10 ft Contour

McCORMICK TAYLOR

N

100 0 100

Feet

1 inch = 200 Feet

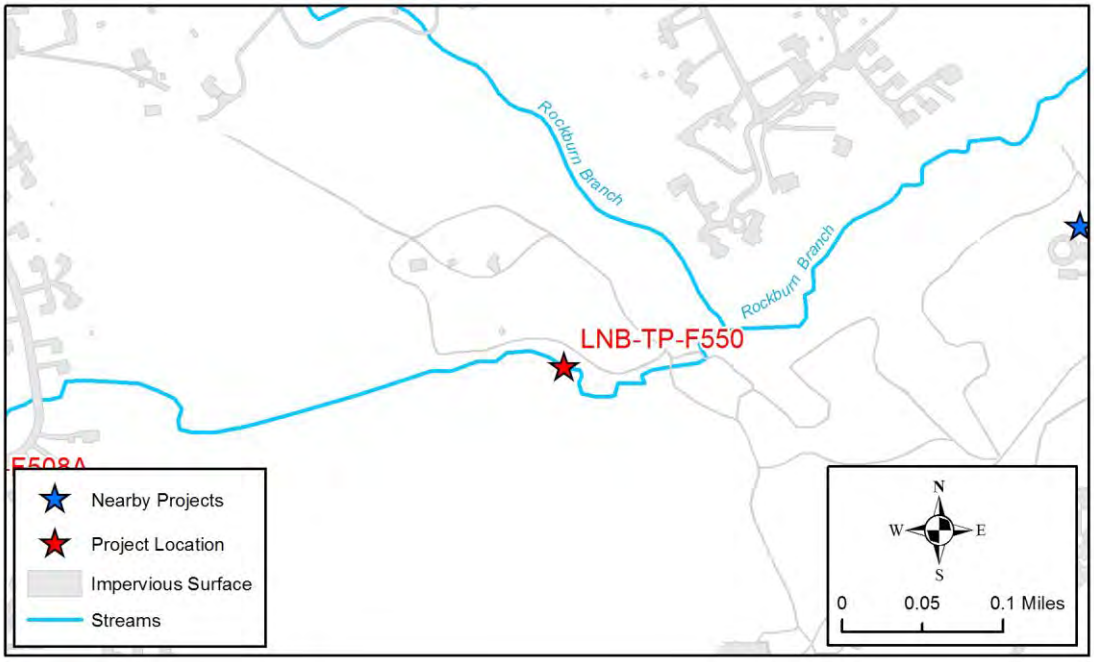
Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F550
Site Name: Rockburn Park Disc Golf
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Project Type: Tree Planting
Ownership: County Park
Single Owner

Existing Conditions:

The proposed tree planting site is located within the Rockburn Branch Park Disc Golf Course in Elkridge, MD. The property associated with the planting area is a County owned park. The project site is also within the riparian buffer zone of LNB-SR-F510. The site has some floodplain connection with LNB-SR-F510, which has bank heights between 3-5 ft. The proposed planting area currently receives full sunlight and is primarily comprised of mowed turf (80%). Dominant tree species observed in adjacent areas include tulip poplar (*Liriodendron tulipifera*) and red maple (*Acer rubrum*). Approximately 60% of the proposed planting area has invasive species coverage. Dominant invasive species include multiflora rose (*Rosa multiflora*), Japanese stilt grass (*Microstegium vimineum*), and Japanese wineberry (*Rubus phoenicolasius*). Soils within the project are primarily loam and are not compacted. Water sources other than rainfall include surface runoff from local drainage areas.



Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F550

Site Name: Rockburn Park Disc Golf

Contractor: McCormick Taylor

Watershed: Patapsco Lower North

Proposed tree planting site LNB-TP-F550 facing west along LNB-SR-F510.

Proposed tree planting site LNB-TP-F550 facing west along park trail.

Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F550
Site Name: Rockburn Park Disc Golf
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

The only constraint identified within the project site was regular mowing of the area.

Concept Description:

Approximately 0.92 ac. of riparian buffer can be planted with suitable tree species. No previous plantings appear to have occurred on this property. Coordination with County Parks and Recreation is recommended so that tree plantings do not interfere with the existing disc golf course. Selection of other suitable tree species will be determined in a planting plan if the project is selected for planting. Access to the site is generally easy, with foot, vehicle, and heavy equipment traffic able to enter the County property by a park trail that is located north of the Disc Golf Course Parking lot. Space for temporary storage and onsite material delivery is available. Volunteer parking and facilities are also available at Rockburn Branch Park.

Nearby Opportunities:

LNB-SR-F510

Proposed Project Credit	
Planting Acres:	0.9
Impervious Area Treated Credit (ac.):	0.35
Cost per Impervious Credit Acre:	$146,491

Costs	
Estimated Design Cost:	$10,000
Estimated Construction Cost:	$29,440
30% Contingency:	$11,832
Estimated Total Cost:	$51,272

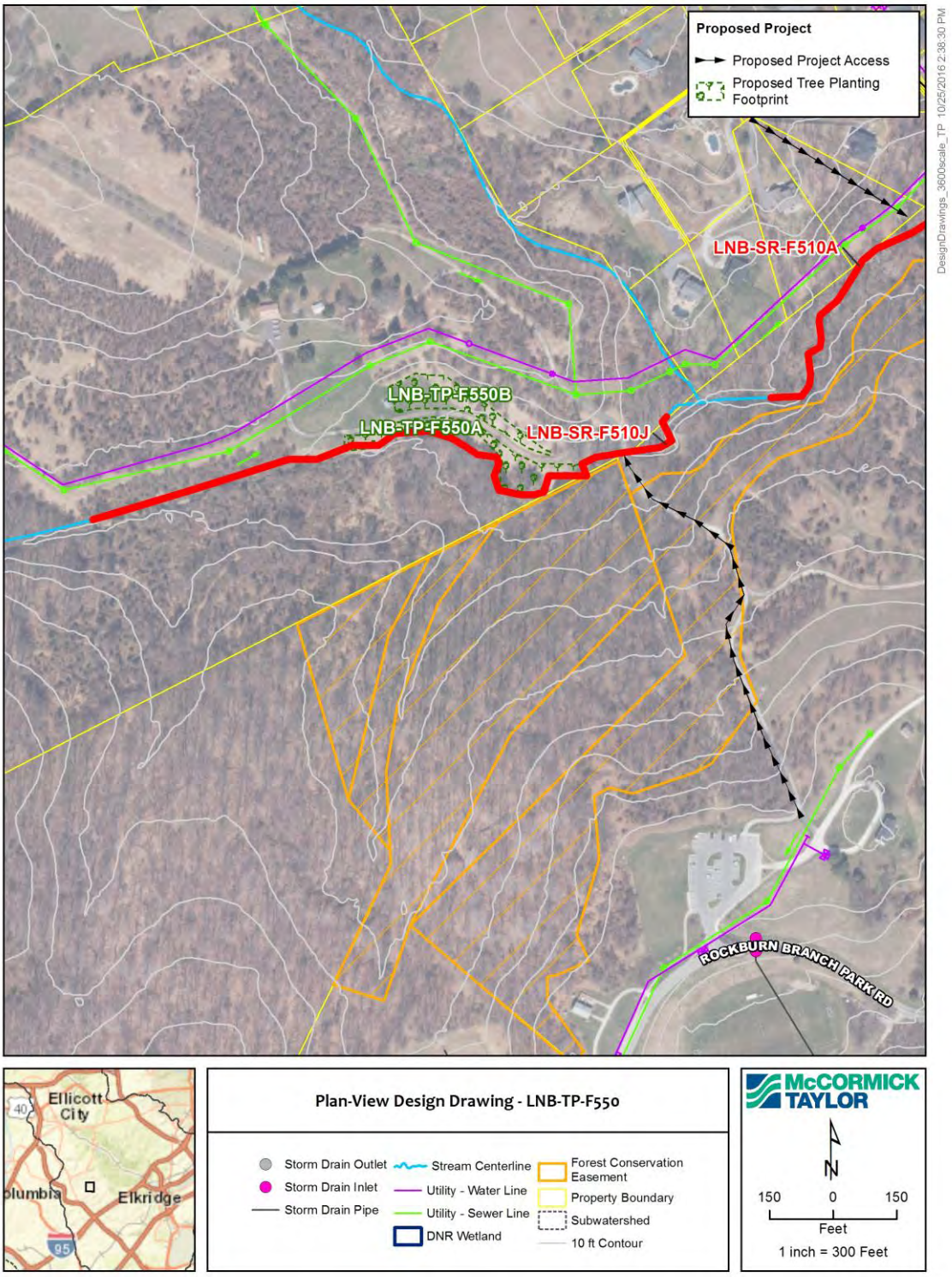
Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F550

Site Name: Rockburn Park Disc Golf

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



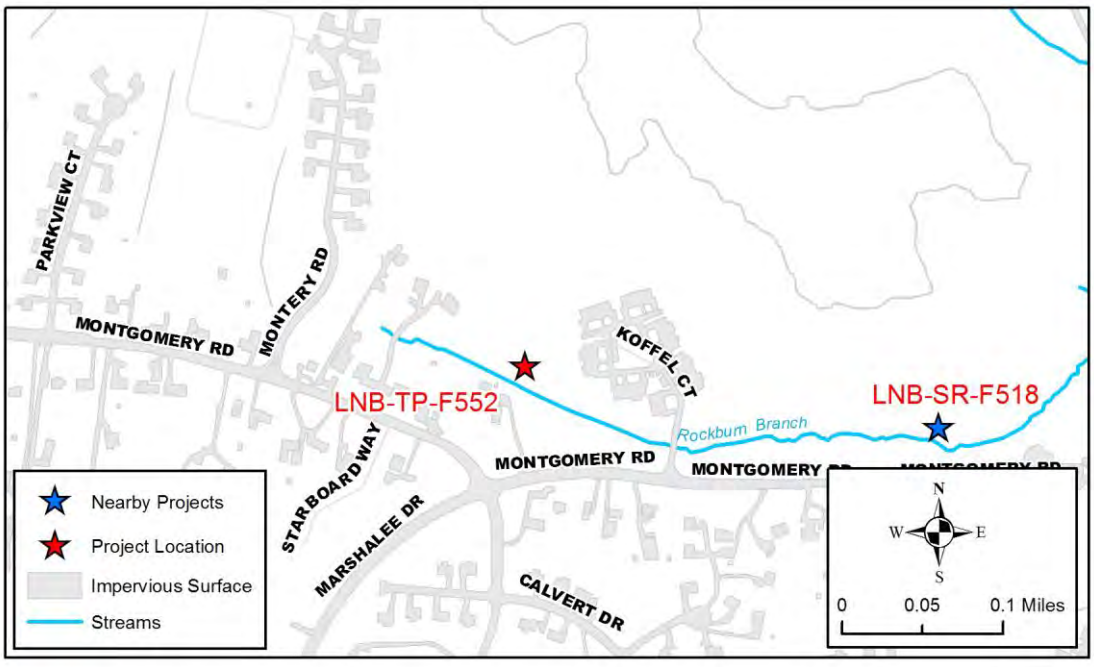
Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F552
Site Name: Landing Road
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Project Type: Tree Planting
Ownership: County Owned
Single Owner

Existing Conditions:

This proposed tree planting consists of two field assessment sites (LNB-TP-F552A and LNB-TP-F552B) on either side of a utility right-of-way. The proposed planting site is located approximately 100 ft. west of a residential development at Koffel Court in Elkridge, MD. The property associated with the planting area is county owned. The project site is also partially within the riparian buffer zone of LNB-SR-F518. The site has some floodplain connection with LNB-SR-F518. The proposed planting area currently receives full sunlight and is primarily comprised of herbaceous cover (85%). Dominant tree species observed in adjacent areas include tulip poplar (*Liriodendron tulipifera*) and red maple (*Acer rubrum*). Approximately 5% of the proposed planting area is comprised of Japanese honeysuckle (*Lonicera japonica*). The adjacent forest area also contains invasive species, including Japanese honeysuckle and multiflora rose (*Rosa multiflora*). Soils within the project are primarily loam and moderately compacted. Water sources other than rainfall include surface runoff from local drainage areas. There is evidence of heavy deer browse within the project area.



Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F552
Site Name: Landing Road
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Proposed tree planting site LNB-TP-F552 facing north.

Proposed tree planting site LNB-TP-F552 facing west towards Koffel Court.

Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F552
Site Name: Landing Road
Contractor: McCormick Taylor
Watershed: Patapsco Lower North

Constraints/Utilities:

Constraints within the project include heavy deer browse and an existing sewerline utility that is located in between the proposed planting areas.

Concept Description:

Approximately 0.71 ac. of planting area can be planted at the site with suitable tree species. It is recommended that American sycamore (*Platanus occidentalis*) be included as a suitable tree species since it is typically more resistant to deer browse. Selection of other suitable tree species will be determined in a planting plan if the project is selected for planting. Foot, vehicle, and heavy equipment traffic can access the site using the sewerline easement that is adjacent to Koffel Court. Access to the project will require coordination with private property owner from Koffel Court. Space for temporary storage and onsite material delivery is available. Volunteer parking and facilities are not available.

Nearby Opportunities:

LNB-SR-F518

Proposed Project Credit	
Planting Acres:	0.7
Impervious Area Treated Credit (ac.):	0.27
Cost per Impervious Credit Acre:	$157,541

Costs	
Estimated Design Cost:	$10,000
Estimated Construction Cost:	$22,720
30% Contingency:	$9,816
Estimated Total Cost:	$42,536

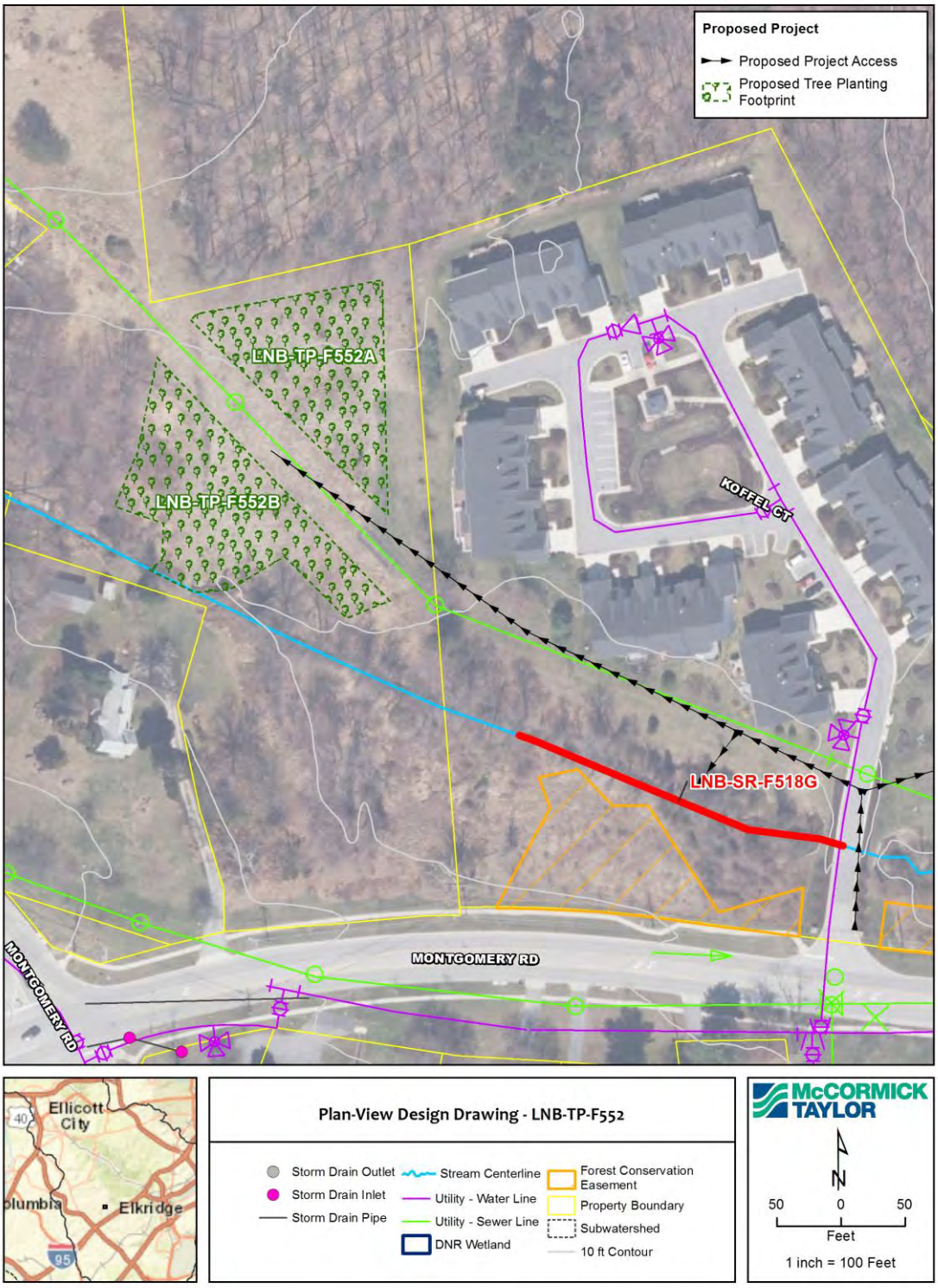
Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F552

Site Name: Landing Road

Contractor: McCormick Taylor

Watershed: Patapsco Lower North



Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F602

Site Name: Old Frederick Road Pumping Station

Contractor: KCI

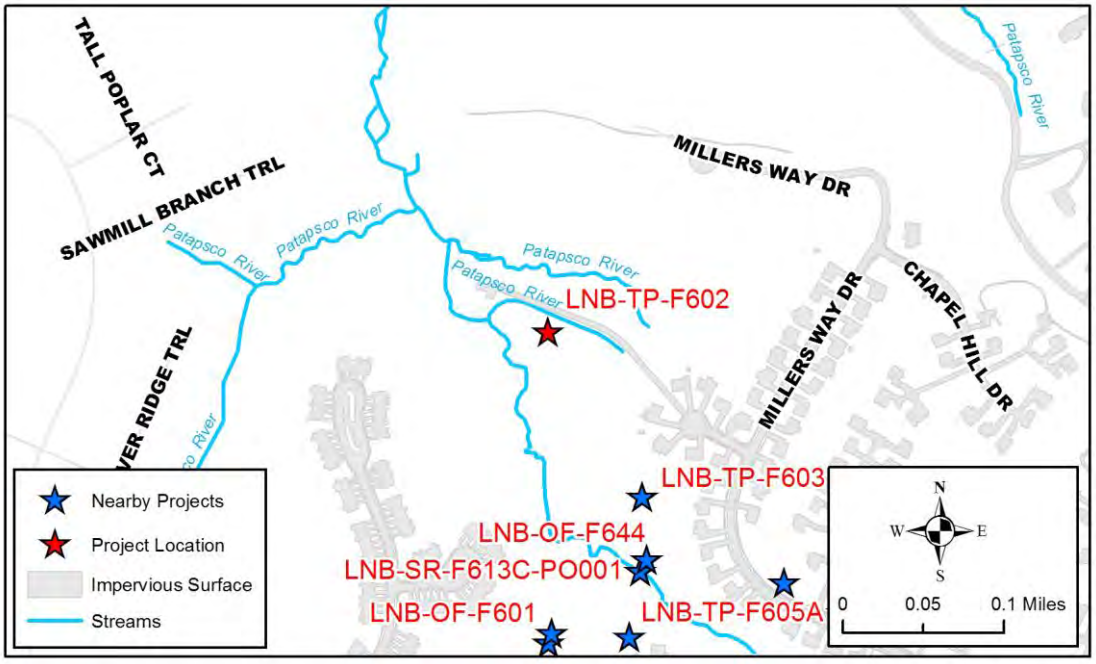
Watershed: Patapsco Lower North

Project Type: Tree Planting

Ownership: County Owned
Single Owner

Existing Conditions:

The proposed planting area is located on the southern side of the Old Frederick Road pumping station access road off the end of Dorsey Spring Court on Howard County property. This upland site is currently open turf that receives part to full sun. Approximately 30% of the site is covered in invasive species, including multiflora rose, Japanese honeysuckle, and Japanese barberry.



Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F602

Site Name: Old Frederick Road Pumping Station

Contractor: KCI

Watershed: Patapsco Lower North

View facing east of open planting area next to access road off Dorsey Spring Court.

View facing west and downslope of open planting area and pumping station.

Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F602

Site Name: Old Frederick Road Pumping Station

Contractor: KCI

Watershed: Patapsco Lower North

Constraints/Utilities:

A low amount of site preparation will be required and includes the removal of multiflora rose, Japanese honeysuckle, and Japanese barberry and mowing of the site. No utilities have been found to conflict with the planting of this site and site access is easy.

Concept Description:

Invasive species removal and tree planting is proposed on a 0.51 ac. area. The multiflora rose, Japanese honeysuckle, and Japanese barberry should be removed prior to planting and the entire site will require mowing in preparation for the tree planting. A variety of native trees should be planted. Tree shelters should be installed to protect the trees from deer damage. Tree maintenance and inspections should be performed yearly, and should include the removal of invasive species and repair of tree shelters and stakes. The site can easily be accessed from the adjacent access road.

Nearby Opportunities:

LNB-TP-F603, LNB-TP-F604, LNB-TP-F605

Proposed Project Credit	
Planting Acres:	0.5
Impervious Area Treated Credit (ac.):	0.19
Cost per Impervious Credit Acre:	$180,084

Costs	
Estimated Design Cost:	$10,000
Estimated Construction Cost:	$16,320
30% Contingency:	$7,896
Estimated Total Cost:	$34,216

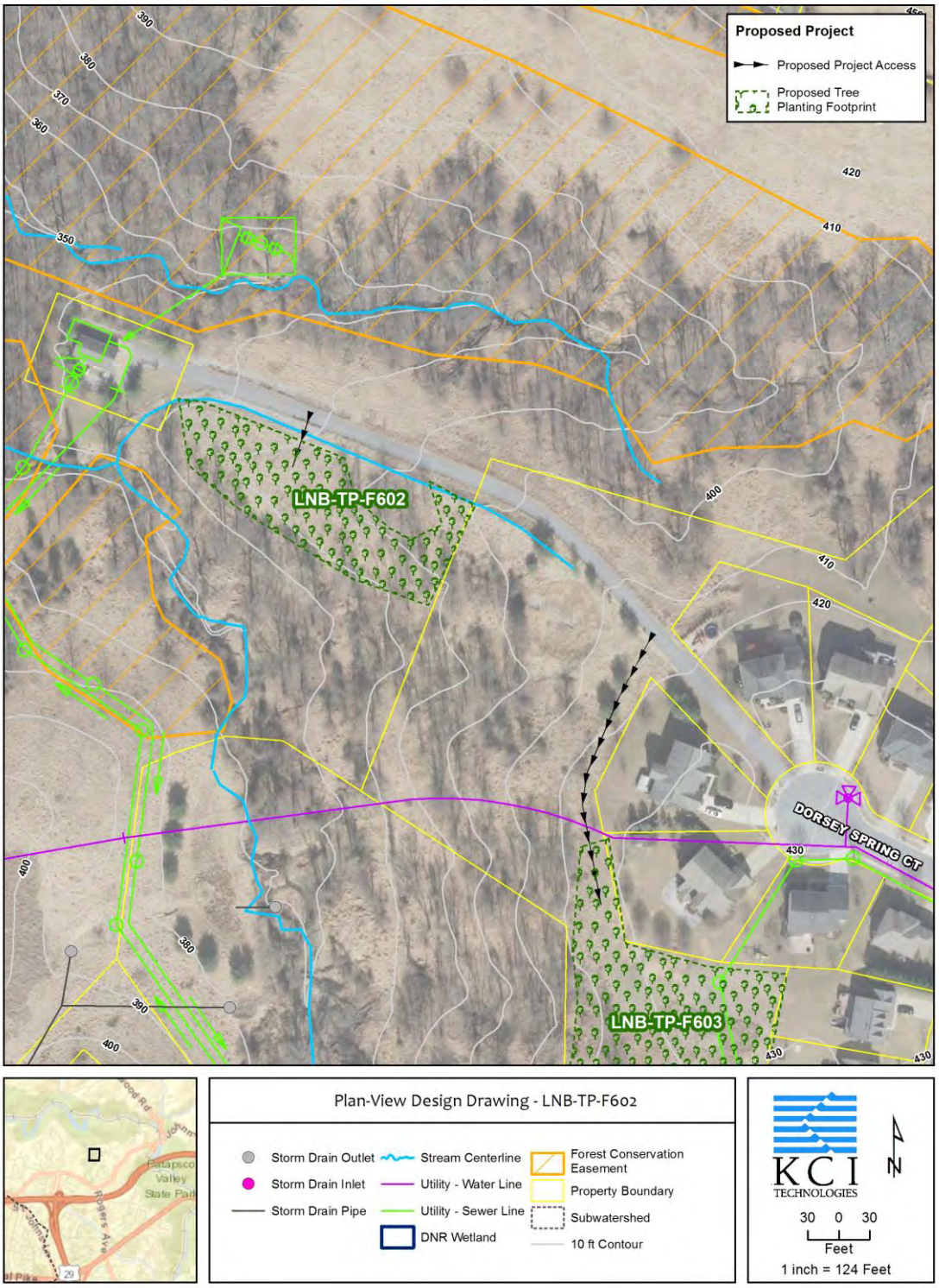
Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F602

Site Name: Old Frederick Road Pumping Station

Contractor: KCI

Watershed: Patapsco Lower North



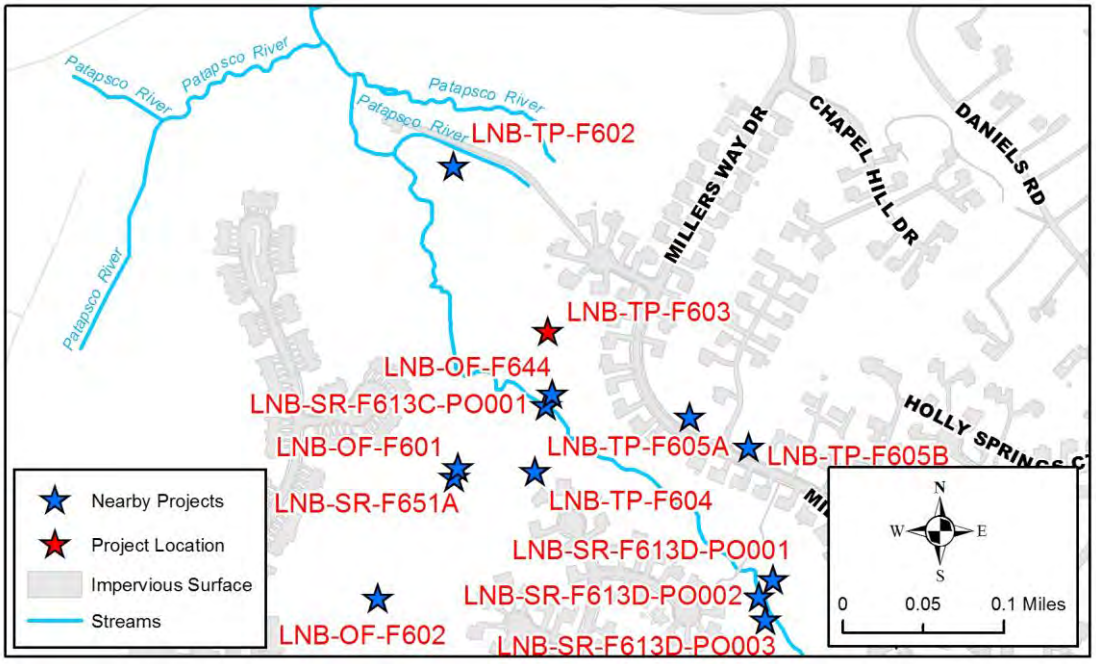
Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F603
Site Name: Dorsey Spring Court
Contractor: KCI
Watershed: Patapsco Lower North

Project Type: Tree Planting
Ownership: County Owned
Single Owner

Existing Conditions:

The proposed planting area is located on Howard County property south of Dorsey Spring Court and west of Millers Way Drive behind residential properties. This upland site is currently open turf that receives full sun. Only approximately 5% coverage of invasive oriental bittersweet and multiflora rose was found in the proposed planting area. A stormwater management facility is located southeast of the proposed planting area.



Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F603

Site Name: Dorsey Spring Court

Contractor: KCI

Watershed: Patapsco Lower North

View facing north of open planting area behind residential properties on Dorsey Spring Court.

View facing south of open planting area and adjacent wooded areas.

Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F603
Site Name: Dorsey Spring Court
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

A low amount of site preparation will be required and includes the removal of multiflora rose and oriental bittersweet and mowing of the site. A sewer line transects the eastern side of the proposed planting area and planting over this line will be avoided; however, this would not likely impact the quantity of trees planted. No other utilities have been found to conflict with the planting of this site. Site access is moderately difficult from the pumping station access road off Dorsey Spring Court due to the distance between the road and proposed planting area.

Concept Description:

Invasive species removal and tree planting is proposed on a 1.18 ac. open area. The invasive oriental bittersweet and multiflora rose should be removed prior to planting and the entire site will require mowing in preparation for the tree planting. A variety of native trees should be planted. Tree shelters should be installed to protect the trees from deer damage. Tree maintenance and inspections should be performed yearly, and should include the removal of invasive species and repair of tree shelters and stakes. The site can be accessed from the pumping station access road off Dorsey Spring Court.

Nearby Opportunities:

LNB-TP-F602, LNB-TP-F604, LNB-TP-F605, LNB-SR-F613C-PO001, LNB-OF-F644

Proposed Project Credit	
Planting Acres:	1.2
Impervious Area Treated Credit (ac.):	0.45
Cost per Impervious Credit Acre:	$137,973

Costs	
Estimated Design Cost:	$10,000
Estimated Construction Cost:	$37,760
30% Contingency:	$14,328
Estimated Total Cost:	$62,088

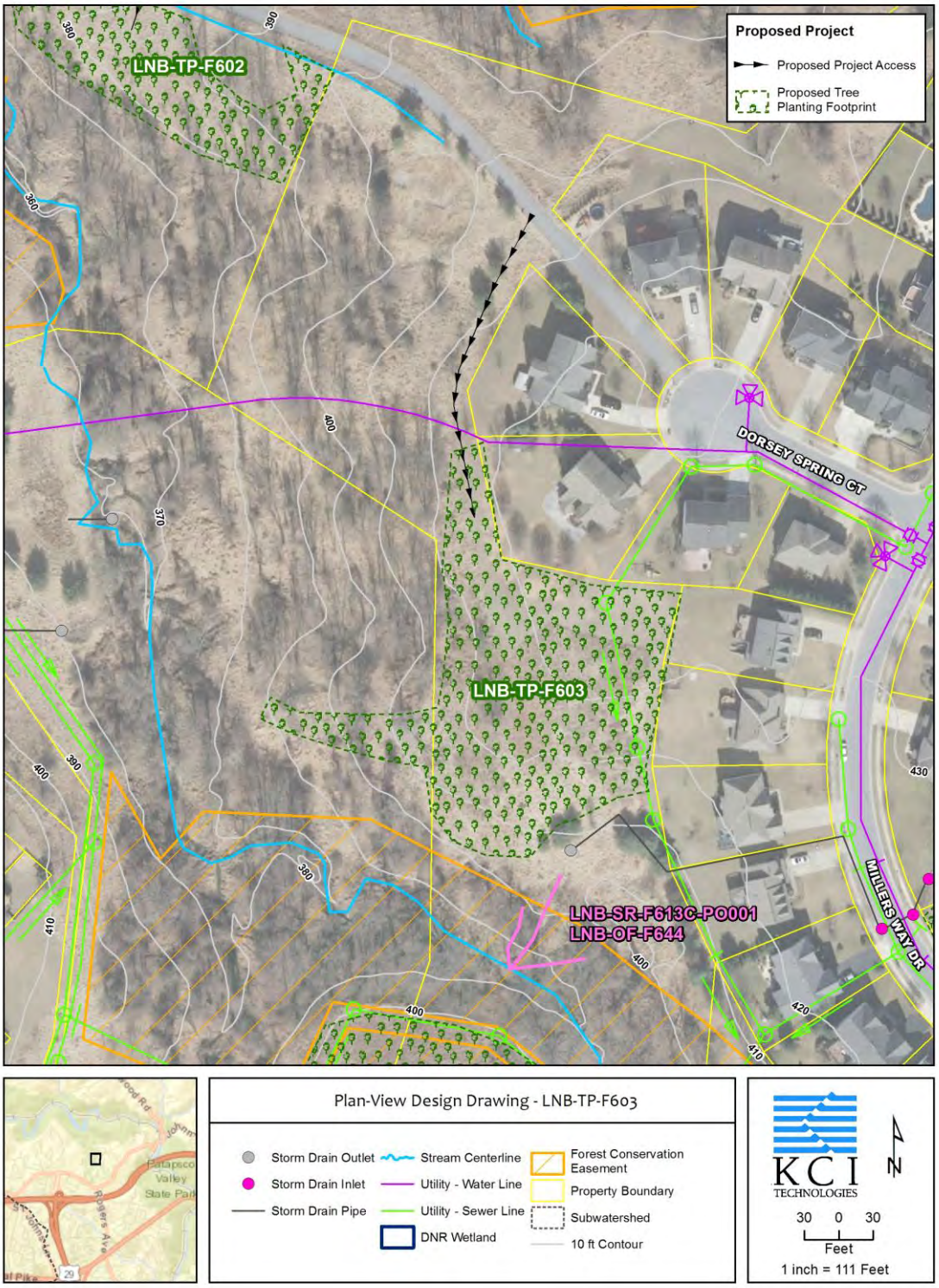
Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F603

Site Name: Dorsey Spring Court

Contractor: KCI

Watershed: Patapsco Lower North



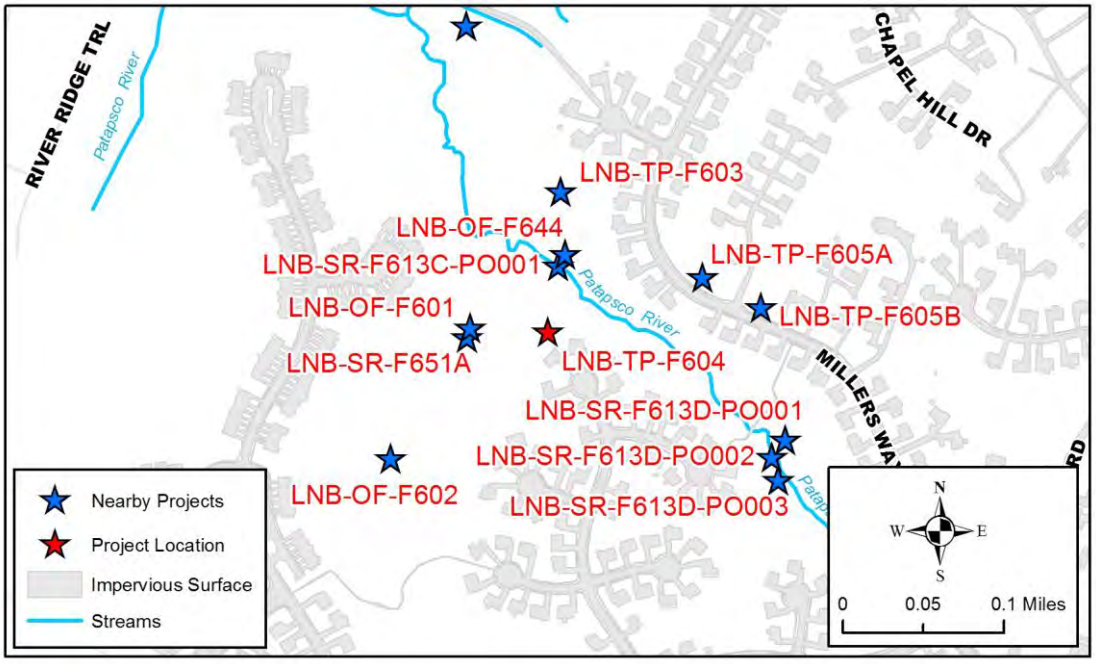
Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F604
Site Name: Carroll Wind Drive
Contractor: KCI
Watershed: Patapsco Lower North

Project Type: Tree Planting
Ownership: County Owned
Single Owner

Existing Conditions:

The proposed planting area is located on Howard County property north of Carroll Wind Drive behind residential properties. This upland and riparian site is currently open turf that receives full sun. This site had previously been planted, however the success rate was poor and there are many empty tree tubes remaining. Approximately 30% of the site is covered in invasive species, including garlic mustard, oriental bittersweet, Japanese honeysuckle, and thistle.



Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F604

Site Name: Carroll Wind Drive

Contractor: KCI

Watershed: Patapsco Lower North

View facing north of open planting area adjacent to residential properties.

View facing north of previous unsuccessful planting at northern edge of proposed planting area.

Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F604
Site Name: Carroll Wind Drive
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

A low amount of site preparation will be required and includes the removal of invasive species and mowing of the site. Sewer and water lines transect the site in many areas and planting over these lines will be avoided. Site access is easy from the public easement between residential properties on Milldam Court at the eastern side of the planting area.

Concept Description:

Invasive species removal and tree planting is proposed on this 1.94 ac. site. Garlic mustard, oriental bittersweet, Japanese honeysuckle, and thistle should be removed prior to planting and the entire site will require mowing in preparation for the tree planting. A variety of native trees should be planted. Tree shelters should be installed to protect the trees from deer damage. Tree maintenance and inspections should be performed yearly, and should include the removal of invasive species and repair of tree shelters and stakes. The site can be accessed from the easement in between residential properties on Milldam Court at the eastern side of the planting area.

Nearby Opportunities:

LNB-TP-F602, LNB-TP-F603, LNB-TP-F605, LNB-SR-F613C-PO001, LNB-OF-F644, LNB-OF-F601, LNB-SR-F651

Proposed Project Credit		Costs	
Planting Acres:	1.9	Estimated Design Cost:	$10,000
Impervious Area Treated Credit (ac.):	0.74	Estimated Construction Cost:	$62,080
		30% Contingency:	$21,624
Cost per Impervious Credit Acre:	$126,627	Estimated Total Cost:	$93,704

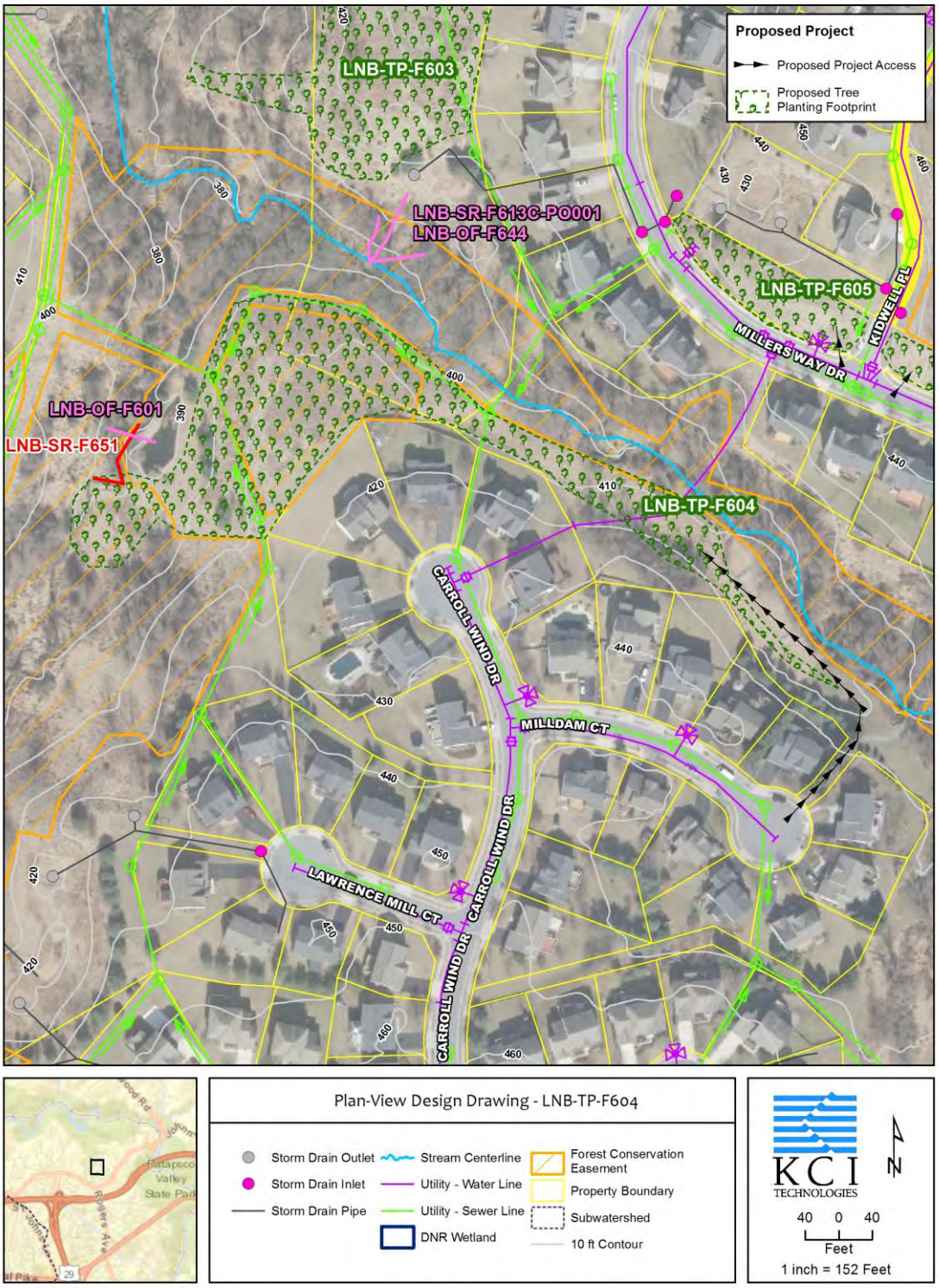
Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F604

Site Name: Carroll Wind Drive

Contractor: KCI

Watershed: Patapsco Lower North



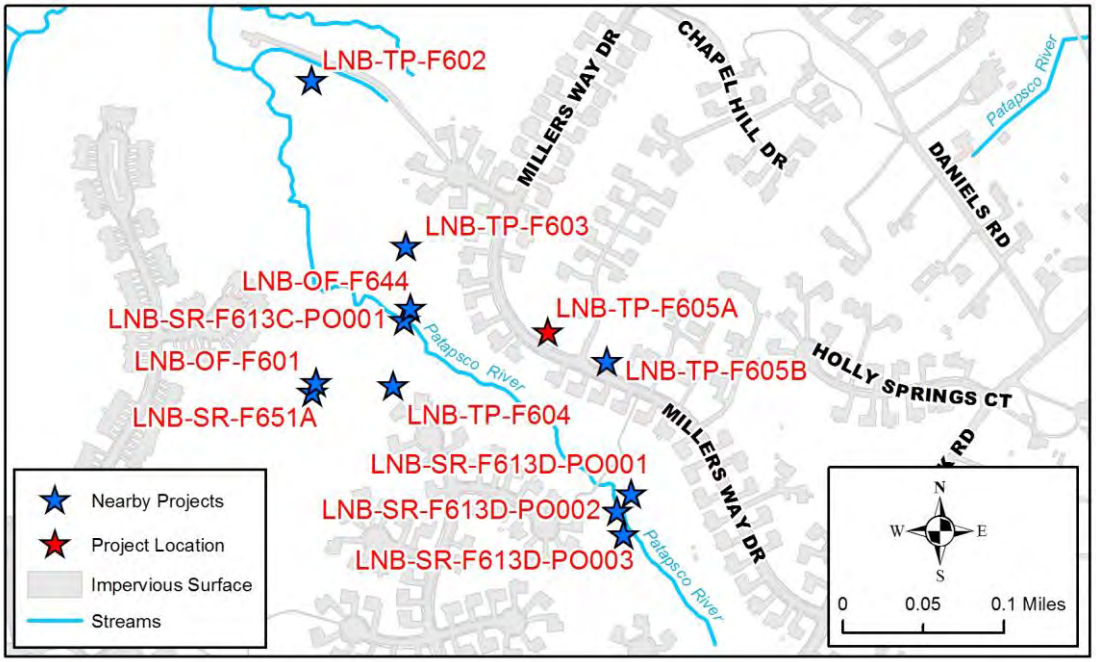
Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F605
Site Name: Kidwell Place
Contractor: KCI
Watershed: Patapsco Lower North

Project Type: Tree Planting
Ownership: County Owned
Single Owner

Existing Conditions:

The proposed planting area is located north of Millers Way Drive at the intersection of Kidwell Place on Howard County property. The site is located on a slope adjacent to the sidewalk along Millers Way Drive. It is currently open turf that receives full sun. Approximately 10% of the site is covered in invasive species, including multiflora rose and Chinese lespedeza. The site is within a housing development and soil compaction is assumed to be moderate.



Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F605

Site Name: Kidwell Place

Contractor: KCI

Watershed: Patapsco Lower North

View facing north of western planting area on slope adjacent to Millers Way Drive.

View facing east of eastern planting area on slope adjacent to Millers Way Drive and Kidwell Place intersection.

Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F605
Site Name: Kidwell Place
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

A low amount of site preparation will be required and includes the removal of invasive species and mowing of the site. Due to the proximity of this planting site to a road intersection, care should be taken to keep the planted trees a reasonable distance from the road/sidewalk as to not restrict visibility of traffic and pedestrians. No utilities have been found to conflict with the planting of this site and site access is easy.

Concept Description:

Invasive species removal and tree planting is proposed on the 0.43 ac. area. The invasive multiflora rose should be removed prior to planting and the entire site will require mowing in preparation for the tree planting. A variety of native trees should be planted. Tree shelters should be installed to protect the trees from deer damage. Tree maintenance and inspections should be performed yearly, and should include the removal of invasive species and repair of tree shelters and stakes. A fire hydrant is located adjacent to the planting area which may be used for watering the trees. Access is easy since the site is immediately next to Millers Way Drive.

Nearby Opportunities:

LNB-TP-F602, LNB-TP-F603, LNB-TP-F604

Proposed Project Credit		Costs	
Planting Acres:	0.4	Estimated Design Cost:	$10,000
Impervious Area Treated Credit (ac.):	0.16	Estimated Construction Cost:	$13,760
		30% Contingency:	$7,128
Cost per Impervious Credit Acre:	$193,050	Estimated Total Cost:	$30,888

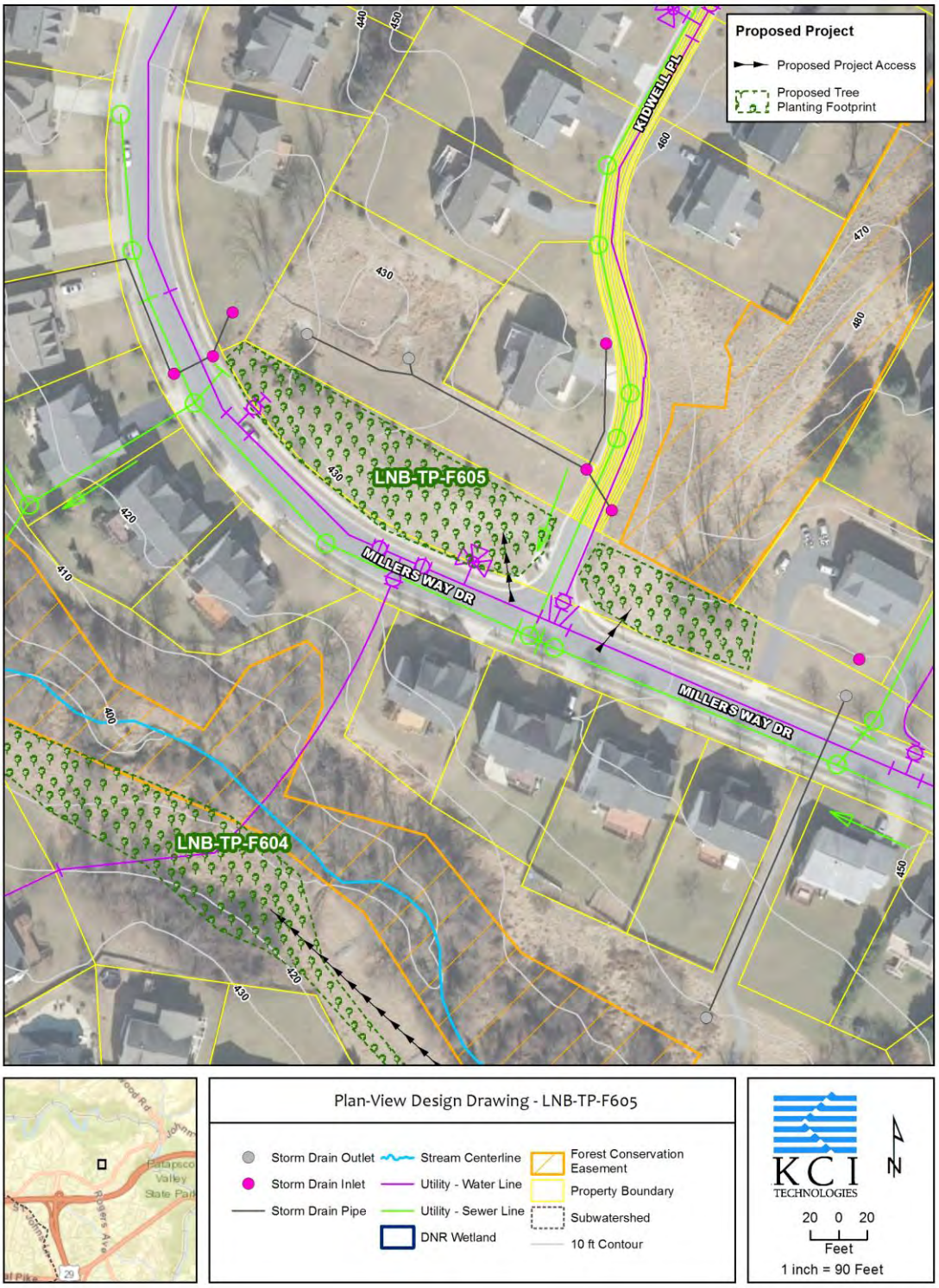
Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F605

Site Name: Kidwell Place

Contractor: KCI

Watershed: Patapsco Lower North



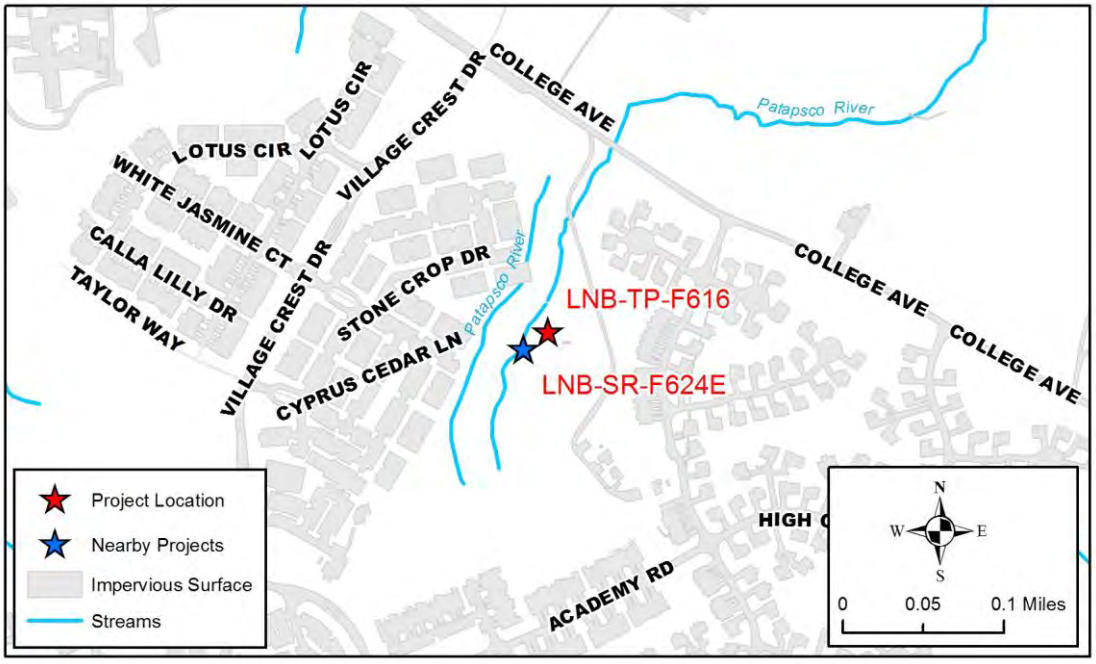
Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F616
Site Name: College Ave
Contractor: KCI
Watershed: Patapsco Lower North

Project Type: Tree Planting
Ownership: Private- Residential
Multiple Owners

Existing Conditions:

The proposed planting area is located south of College Ave in between residential properties on Village Crest Drive and Four Quarter Road. This riparian planting area has been planted in the past, but could benefit from supplemental planting to increase density of trees. The proposed planting area is currently low turf that receives full to part sun. Approximately 10% of the site is covered in invasive species, including multiflora rose, autumn olive, and wineberry. The site is adjacent to a housing development and soil compaction is assumed to be moderate in the higher elevation areas closer to the residential properties.



Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F616
Site Name: College Ave
Contractor: KCI
Watershed: Patapsco Lower North

View facing south from center of proposed planting area, note open space in between trees from previous planting.

View facing east of open riparian planting area.

Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F616
Site Name: College Ave
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

Private ownership of the site is a constraint. A low amount of site preparation will be required and includes the removal of invasive species and mowing of the site. A water line crosses the site at the northern extent of the site and planting over these lines will be avoided. No other utilities have been found to conflict with the planting of this site and site access is easy.

Concept Description:

Invasive species removal and tree planting is proposed on this 3.14 ac. tract. The invasive multiflora rose, autumn olive, and wineberry should be removed prior to planting and the entire site will require mowing in preparation for the tree planting. A variety of native trees should be planted. Tree shelters should be installed to protect the trees from deer damage. Tree maintenance and inspections should be performed yearly, and should include the removal of invasive species and repair of tree shelters and stakes. The site can easily be accessed from several roads in the condominium complex off Village Crest Drive.

Nearby Opportunities:

LNB-SR-F624E

Proposed Project Credit		Costs	
Planting Acres:	3.1	Estimated Design Cost:	$10,000
Impervious Area Treated Credit (ac.):	1.19	Estimated Construction Cost:	$100,480
		30% Contingency:	$33,144
Cost per Impervious Credit Acre:	$120,692	Estimated Total Cost:	$143,624

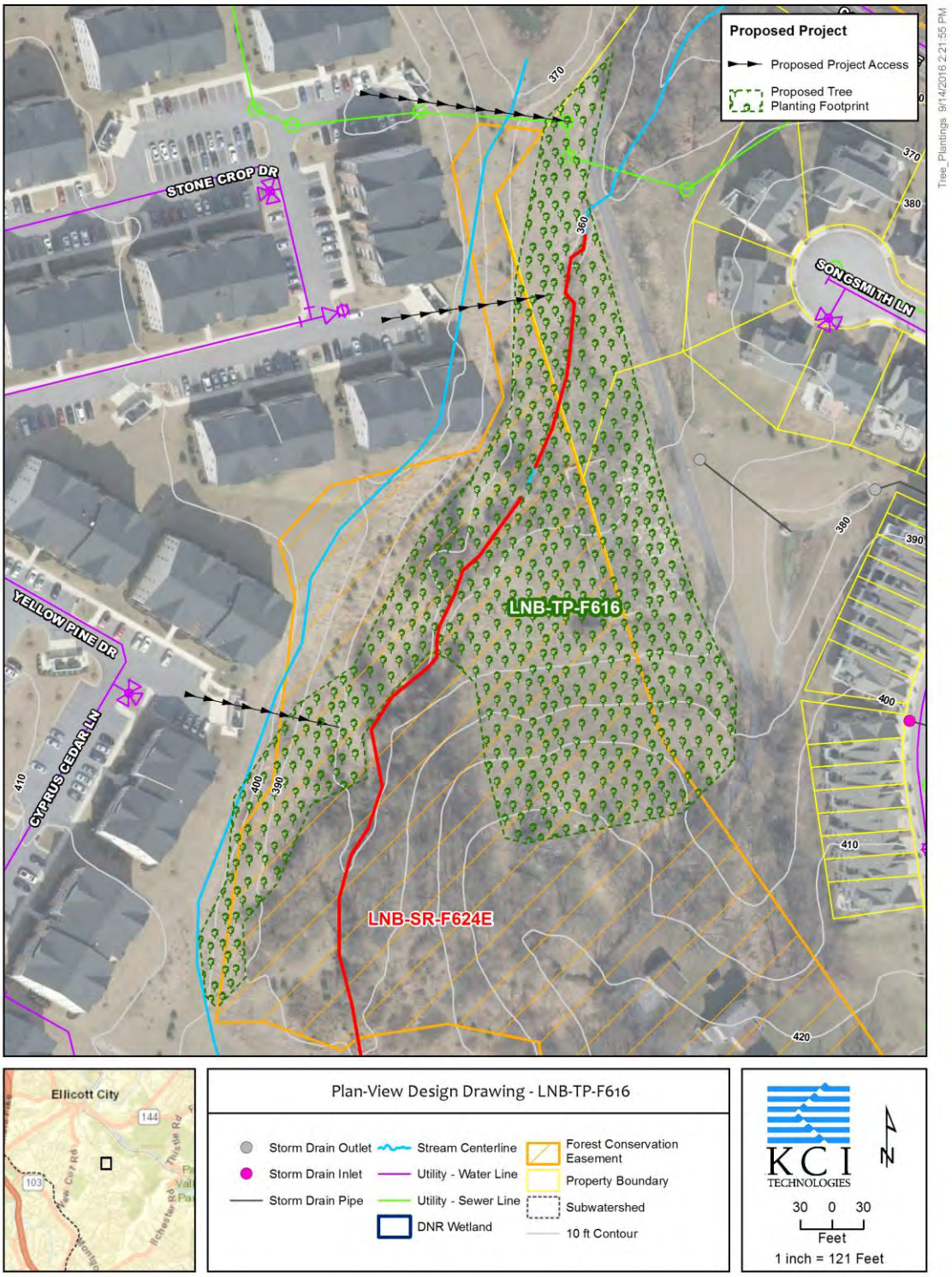
Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F616

Site Name: College Ave

Contractor: KCI

Watershed: Patapsco Lower North



Plan-View Design Drawing - LNB-TP-F616

- Storm Drain Outlet
- Storm Drain Inlet
- Storm Drain Pipe
- Stream Centerline
- Utility - Water Line
- Utility - Sewer Line
- DNR Wetland
- Forest Conservation Easement
- Property Boundary
- Subwatershed
- 10 ft Contour

KCI TECHNOLOGIES

N

30 0 30

Feet

1 inch = 121 Feet

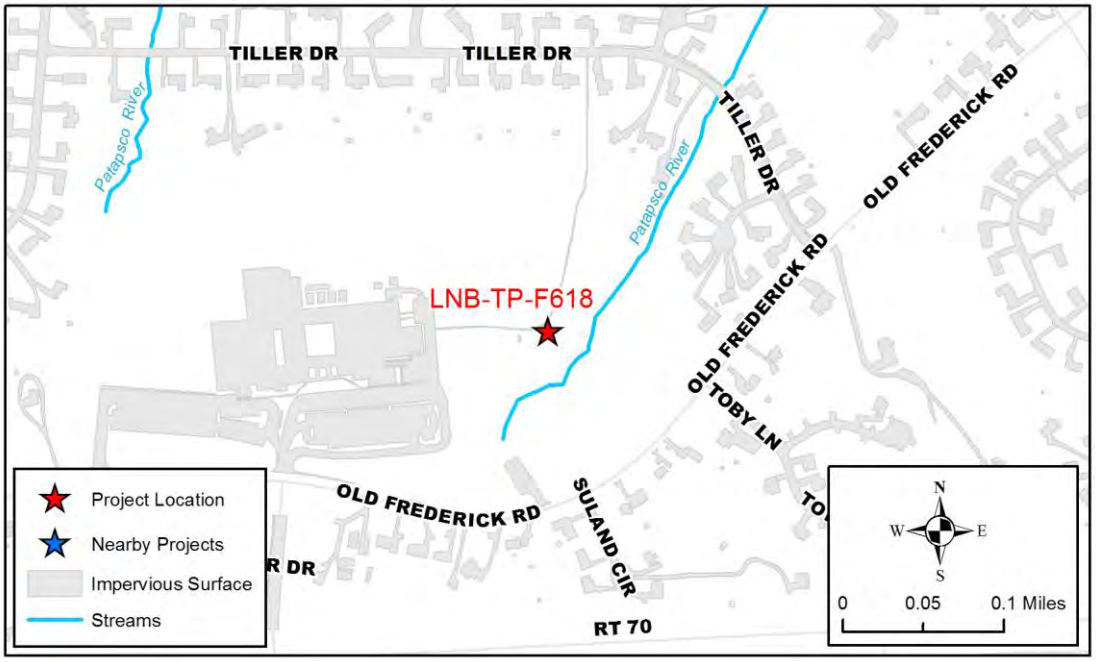
Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F618
Site Name: Mt Hebron High School
Contractor: KCI
Watershed: Patapsco Lower North

Project Type: Tree Planting
Ownership: County School
Single Owner

Existing Conditions:

The proposed planting area is located on the eastern side of Mt. Hebron High School property. The proposed planting area is currently majority mowed turf that receives part sun. Approximately 10% of the site is covered in invasive species, including garlic mustard. During the field investigations, Greg Connor from Howard County Public Schools Grounds Services and the field crew walked the assessment area and determined areas suitable for planting that would not interfere with school activities. Before planting, additional coordination would be required to determine if a running/walking path is required; however leaving a small path would not significantly reduce the number of trees planted. A small portion of the proposed planting area at the southern end is within a wetland; however the majority of the site is upland.



Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F618

Site Name: Mt Hebron High School

Contractor: KCI

Watershed: Patapsco Lower North

View facing south from northern portion of proposed planting, site is currently open maintained turf.

View facing south from southern portion of proposed planting area of open and mowed planting area.

Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F618
Site Name: Mt Hebron High School
Contractor: KCI
Watershed: Patapsco Lower North

Constraints/Utilities:

A low amount of site preparation will be required and includes the removal of invasive species and mowing of the site. No other utilities have been found to conflict with the planting of this site and site access is easy. Before planting, additional coordination with the school would be required to determine if a running/walking path is required through the planting area.

Concept Description:

Invasive species removal and tree planting is proposed on 1.92 ac. at the perimeter of the Mt. Hebron High School property . The garlic mustard should be removed prior to planting and the entire site will require mowing in preparation for the tree planting. A variety of native trees should be planted. Tree shelters should be installed to protect the trees from deer damage. Tree maintenance and inspections should be performed yearly, and should include the removal of invasive species and repair of tree shelters and stakes. The site can easily be accessed from the front parking lot of Mt. Hebron High School.

Nearby Opportunities:

None

Proposed Project Credit	
Planting Acres:	1.9
Impervious Area Treated Credit (ac.):	0.73
Cost per Impervious Credit Acre:	$127,222

Costs	
Estimated Design Cost:	$10,000
Estimated Construction Cost:	$61,440
30% Contingency:	$21,432
Estimated Total Cost:	$92,872

Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: LNB-TP-F618

Site Name: Mt Hebron High School

Contractor: KCI

Watershed: Patapsco Lower North

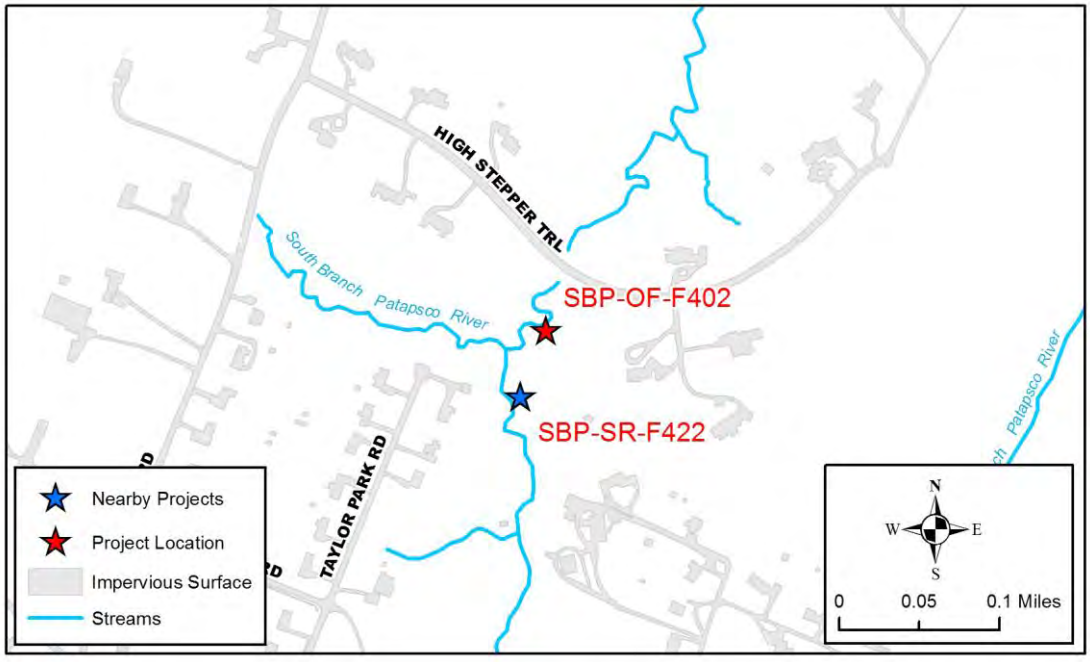
Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: SBP-OF-F402
Site Name: High Stepper Trail
Contractor: Biohabitats
Watershed: South Branch Patapsco

Proposed BMP Type: Outfall Stabilization
Stabilization Type: Step Pool Stormwater Conveyance
Ownership: Private- Residential Single Owner

Existing Conditions:

This outfall stabilization site is on the same property that stream restoration site SBP-SR-F422 is located. The pond is fed by stormwater collected on High Stepper Trail. The pond overflows over land towards the stream to the west. A 7 ft. headcut formed at the confluence of the overland flow path and the stream, it has moved 40 ft. upstream towards the pond forming a new channel. The headcut is not endangering the berm structure.



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: SBP-OF-F402
Site Name: High Stepper Trail
Contractor: Biohabitats
Watershed: South Branch Patapsco

Facing upstream, the pond and point of overflow.

Facing upstream, a 7 ft. headcut moving from the stream to the pond.

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: SBP-OF-F402
Site Name: High Stepper Trail
Contractor: Biohabitats
Watershed: South Branch Patapsco

Constraints/Utilities:
This outfall stabilization project is located on a single residential private property. Some trees may be at risk of removal to realign the SPSC. There are stormwater pipes and a guardrail that may impact construction.

Concept Description:
The objective for this project is to stabilize a headcut formed by a pond overflow. This will be accomplished by constructing a step pool storm conveyance (SPSC) connecting the pond to the stream. Realignment of the headcut channel will be necessary to ensure a smooth connection between the SPSC and the stream. This stabilization has the potential to reduce the amount of sediment supplied by the expanding headcut. The stabilization will also prevent further erosion and potentially a pond failure. This project should be done in conjunction with stream restoration project SBP-SR-F422. The SPSC would likely not be able to gain additional WQv credit due to it being in line with a storm water pond.

Nearby Opportunities:
SBP-SR-F422

Proposed Project Credit	
Drainage Area (ac.):	2.08
Impervious Area within Drainage (ac.):	0.24
Impervious Area Treated (ac.):	0.29
Impervious Area Treated Credit (ac.):	1.1

Water Quality Volume	
WQVolume Target (cf.):	1,508
Max Treated (cf.):	1,824
Percent Treated:	121%
Rainfall Depth Treated (in.):	1.21

Costs

Estimated Design Cost:	$200,000
Estimated Construction Cost:	$110,000
30 % Contingency:	$93,000
Estimated Total Cost:	$403,000
Cost per Impervious Credit Acre:	$366,364

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: SBP-OF-F402

Site Name: High Stepper Trail

Contractor: Biohabitats

Watershed: South Branch Patapsco

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: SBP-OF-F408
Site Name: Hoods Mill 1

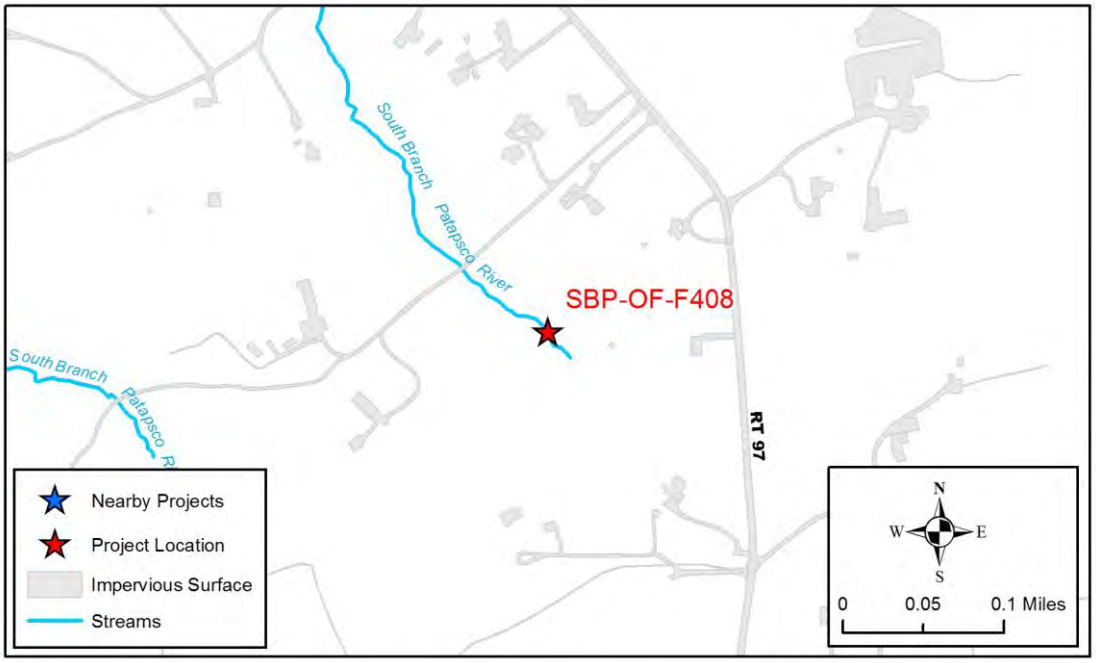
Contractor: Biohabitats
Watershed: South Branch Patapsco

Proposed BMP Type: Outfall Stabilization
Stabilization Type: Other

Ownership: Private- Residential
Single Owner

Existing Conditions:

The project site is located at the outfall of a private farm pond at the headwaters of the tributary. Baseflow was observed during the assessment date. The outfall barrel is a 12 in. CMP with considerable corrosion, and joint separation. Piping below the barrel is probable, and currently the barrel is propped up with branches and make shift straps to prevent further collapse. The channel is eroded 3 ft. below the barrel with active headcutting back into the pond embankment.



Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: SBP-OF-F408
Site Name: Hoods Mill 1

Contractor: Biohabitats
Watershed: South Branch Patapsco

Upstream view of 12 in. CMP outfall barrel.

Downstream view of the channel from the outfall.

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: SBP-OF-F408
Site Name: Hoods Mill 1
Contractor: Biohabitats
Watershed: South Branch Patapsco

Constraints/Utilities:
No utility constraints were observed. Access is limited to private property with moderate difficulty accessing the outfall channel through trees and brush.

Concept Description:
The proposed 110 ft. channel stabilization design is a staggered rock cascade for velocity control to reduce further channel erosion. Large rocks will be placed below and around the outfall barrel to provide a stable plunge pool, and address headcutting upstream into the embankment.

Nearby Opportunities:
None recommended

Proposed Project Credit	
Length Restored (ft):	110
Impervious Area Treated Credit (ac.):	1.1
Cost Per Impervious Credit Acre:	$150,682

Costs	
Estimated Design Cost:	$100,000
Estimated Construction Cost:	$27,500
30% Contingency:	$38,250
Estimated Total Cost:	$165,750

Howard County Watershed Assessment Concept Plan: Outfall Stabilization

Site ID: SBP-OF-F408

Site Name: Hoods Mill 1

Contractor: Biohabitats

Watershed: South Branch Patapsco

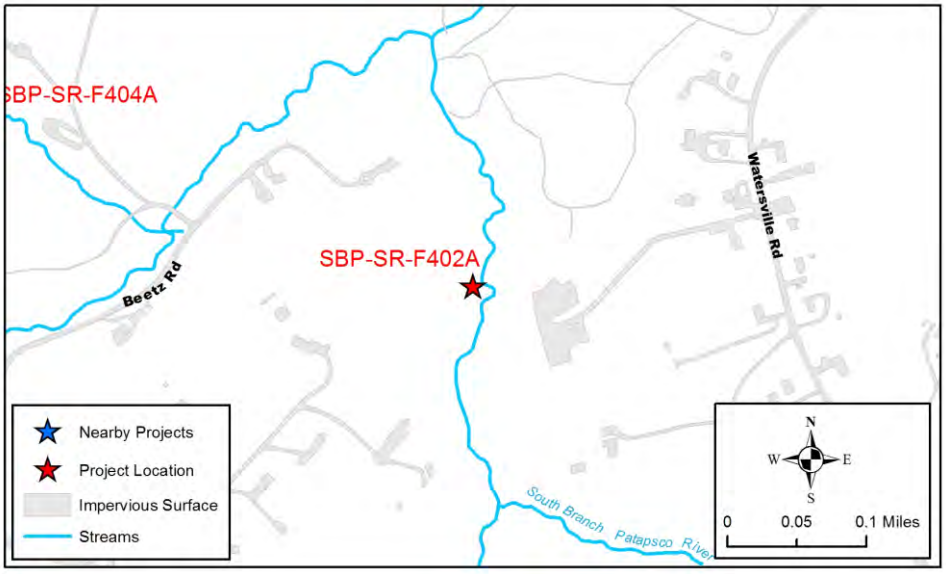
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F402A
Site Name: Elm Forest
Contractor: Biohabitats
Watershed: South Branch Patapsco

Ownership: Private- Residential
Multiple Owners

Existing Conditions:

The site is located in Mt Airy, MD in between Beetz Rd and Watersville Rd with the upstream limits of the stream beginning at Old Frederick Rd. The assessed stream is surrounded by five separate private residential properties. The stream is located within a steep valley surrounded by a mature forest. During the site assessment, over 2,000 lf. of the stream was evaluated, but the only 1,600 lf. was recommended for potential restoration. The stream channel has incised down to a resistant bedrock layer and has begun to widen. Even though the stream is currently widening, it has not begun to form a floodplain bench within its banks in many locations. Mature forest along the valley bottom provides localized bank stability and limits the amount of bank erosion and widening within the reach. In addition, resistant and weathered bedrock in the stream banks are providing localized stability. Minor erosion or areas of erosion that have healed over were observed in the upstream limits of the reach. The extent and severity of erosion increases moving downstream with alternating stretches of erosion on both left and right banks exceeding 100 lf. in length. In between these long stretches of alternating bank erosion are stream banks with minimal bank erosion similar to the upstream stream banks. One section within the assessed stream the right bank cuts into the valley wall creating an eroded right bank height of 14 ft. that is approximately 65 ft. long; however, bedrock along the toe of the bank is helping provide bank protection during storm events. Several wetland seeps discharge along the stream as well as a couple of tributaries. One tributary to the stream, believed to be a drainage ditch from the private residential home upstream, showed evidence of unstable erosion and could be included within the project, but no assessment was completed here. The instream habitat within the existing channel scored in the suboptimal range. Moderate sediment deposition throughout the channel is evident based on recent bank failure which is creating alternating bars along the toe of the banks. Riparian vegetative zone for both the upstream and downstream limits of the stream are optimal. Shading along the existing channel is optimal (80%).



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F402A
Site Name: Elm Forest
Contractor: Biohabitats
Watershed: South Branch Patapsco

Photo facing upstream at 14 ft. high right bank with bedrock toe protection/stabilization.

Photo facing upstream showing bank erosion along the left bank and showing the mature forest and wetland species that are currently stabilizing the banks.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F402A
Site Name: Elm Forest
Contractor: Biohabitats
Watershed: South Branch Patapsco

Constraints/Utilities:

Access to this stream is one of the biggest constraints on this site. Because the site is surrounded by private property, access will need to be granted by the private property owners. Even if access is granted by these properties, steep valley walls and mature forest along the entire stream length limit access. In the tight valley, clearing for a mulch access road and staging areas could remove trees that are currently stabilizing the stream banks.

Concept Description:

The objective for this project is to reduce bank erosion. This project proposes the restoration of 1,600 lf. of bank stabilization/channel restoration. During the site reconnaissance for the concept development, the stream banks showed evidence of minor bank erosion throughout the stream length; however, this bank erosion was spotty and inconsistent. Because of this inconsistency, the proposed in stream work would consist of spot repairs of eroded banks and possibly the addition of some instream structures (riffles, vanes or rock/log spurs) in key locations to direct the flows of the bank. The addition of a continuous floodplain or hyporheic bench through the reach would be beneficial, but the benefit would need to be weighed against the potential tree loss associated with the grading. Due to the current condition of the stream, the proposed in stream work may not result in a net benefit to the stream condition. In order to access and construct along the stream, multiple mature trees would be lost. In addition, the surrounding wetlands could be impacted. Due to the patchy and minor nature of problems within the reach, this is not a priority project for channel restoration; however, this assessment is based on the current stream condition relative to the watershed's rural character. Should additional development occur in the watershed, the stream conditions may change and increase the priority for restoration.

Nearby Opportunities:

None recommended

Proposed Project Credit		Costs	
Length Restored (ft):	1,600	Estimated Design Cost:	$300,000
Impervious Area Treated Credit (ac.):	16	Estimated Construction Cost:	$720,000
Cost per Impervious Credit Acre:	$82,875	30% Contingency:	$306,000
		Estimated Total Cost:	$1,326,000

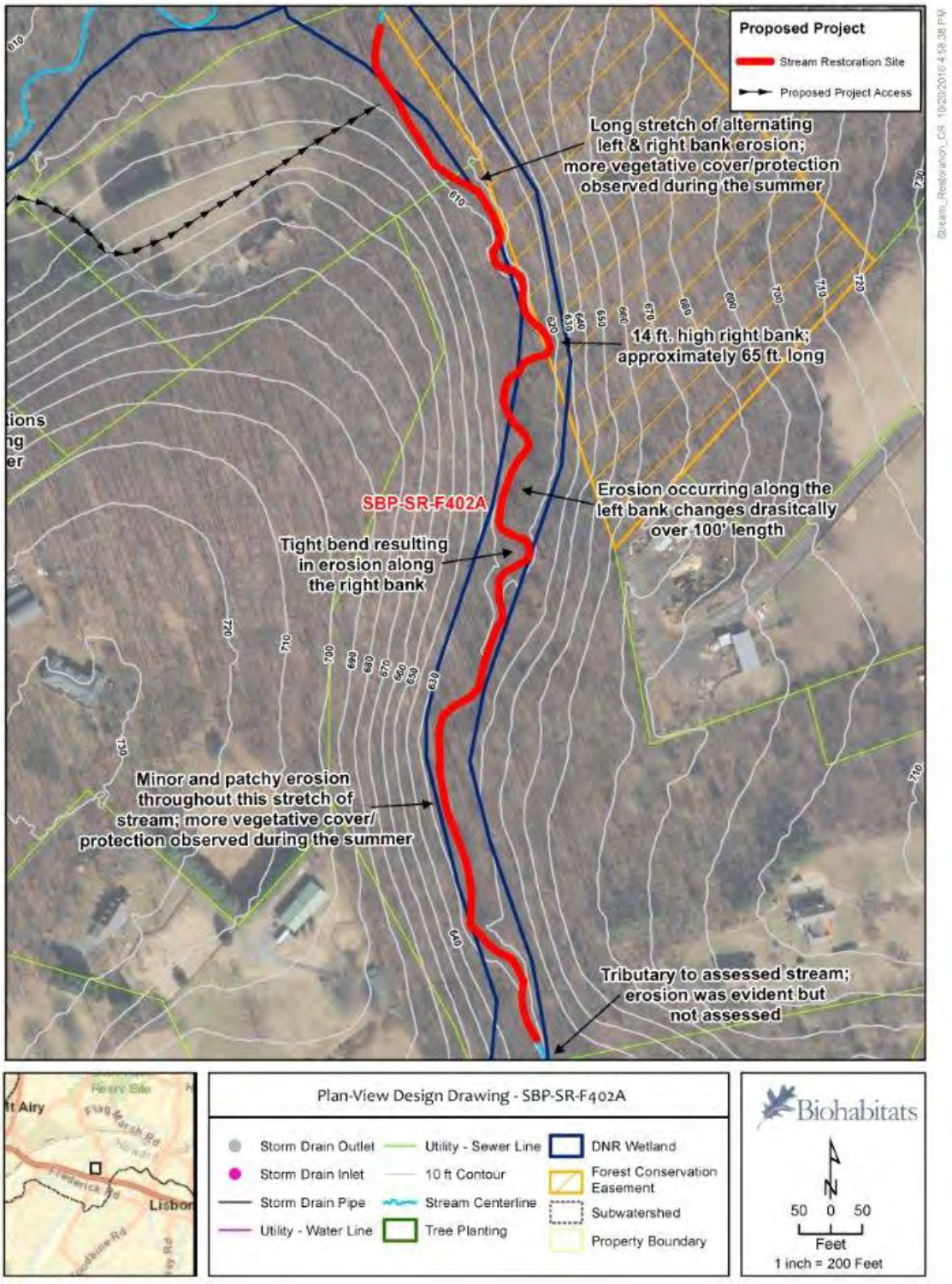
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F402A

Site Name: Elm Forest

Contractor: Biohabitats

Watershed: South Branch Patapsco



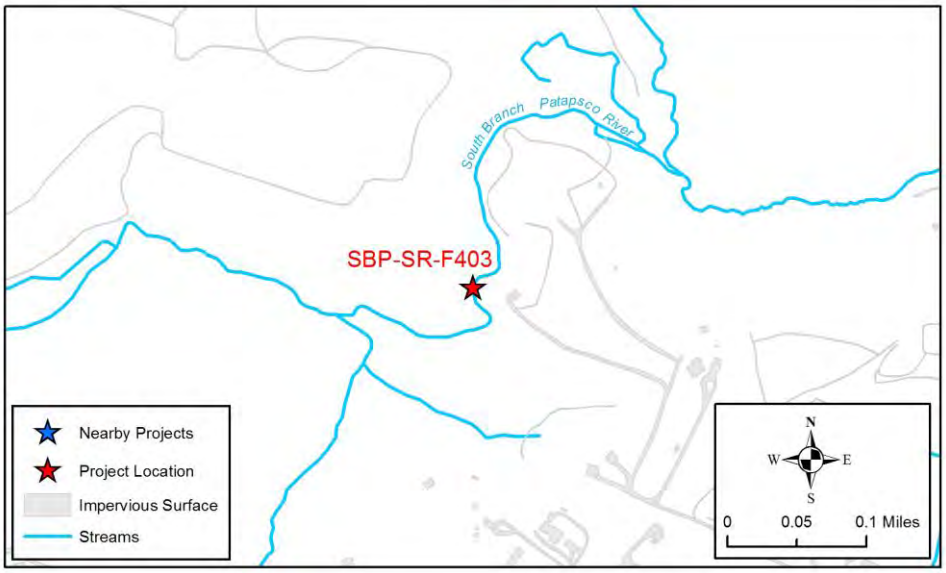
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F403
Site Name: Camalo
Contractor: Biohabitats
Watershed: South Branch Patapsco

Ownership: Private- Residential
Multiple Owners

Existing Conditions:

The project site is a 1,900 ft. reach segment along Hay Meadow Branch, a tributary to South Branch Patapsco River. The project concept includes two stream assessment sites: SBP-SR-F403A and SBP-SR-F403B. Multiple property owners bound this segment of stream, and the entire length of the project reach is within a DNR wetland, and Howard County Environmental Preservation Easement. Moderate to severe bank erosion was observed during the assessment with bank heights greater than 6 ft. Channel widening, undercut banks, and areas of extreme near bank stress were primary indicators of instream degradation. Some areas of deposition and bar formation have reduced the channel flow status. Overall the stream rates high in epifaunal substrate and available cover. In stream habitat is well suited for full colonization. At certain tight meander locations, large woody debris has been pushed into the stream by the property owner in an attempt to reduce erosion, only to create very local stability, and divert erosive forces elsewhere. The general condition of the stream is an entrenched reach without floodplain connectivity. Since stormflows are contained within the channel banks and not dispersed over the floodplain, erosive velocities are forcing channel widening and lateral migration. These conditions are resulting in the loss of once stable tree root mass and causing sharp meanders and extreme near bank stress scenarios. There are numerous downed trees, and compromised trees along the edge of stream.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F403
Site Name: Camalo
Contractor: Biohabitats
Watershed: South Branch Patapsco

Typical tight meander bend with undercut bank facing downstream from midpoint of SBP-SR-F403A

Upstream view from top portion of SPB-SR-F403A towards SBP-SR-F403B

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F403
Site Name: Camalo
Contractor: Biohabitats
Watershed: South Branch Patapsco

Constraints/Utilities:

No utility constraints were observed. Access permission from private property owners may be a constraint, and will require diligent communication. The stream valley can be difficult to access from the upstream portion, but open areas are present at the downstream end.

Concept Description:

The objective of restoring this segment of Hay Meadow Branch is to reduce bank erosion and improve instream habitat for aquatic organisms. The proposed project encompasses approximately 1,900 lf. of stream restoration beginning where stream impairments were observed due to moderate bank erosion, approximately 2,800 lf. upstream of the confluence with South Branch Patapsco, and ending where stream banks and bed have stabilized approximately 900 lf. upstream of the South Branch Patapsco confluence. Since the stream valley is forested and contains wetlands, the grading footprint should be minimized. This may be accomplished by work occuring predominately on the existing channel; however, some minor realignment may be necessary at tight meander bends. Where possible, the channel invert could be raised to provide floodplain connection, wetland enhancement, and reduce downstream erosive velocities. In areas where floodplain connection is not possible, grading banks back to a stable angle and stabilizing them with boulder, large woody debris, and integrated native vegetation to stabilize soil. Adding instream structures such as woody debris, cobble riffles, pools, and other nature mimicking structures will reinforce and stabilize the channel bed and banks. Restoration will improve flow diversity, structural complexity of the stream bed, and provide ecological uplift. Recently fallen trees will be reused for structures and/or bank protection. An attempt to save compromised edge of stream trees and rootwads for bank stability and habitat structure should made at every opportunity. Restoration of this reach has significant potential to reduce sediment and nutrient transport.

Nearby Opportunities:

SBP-SR-F405X and SBP-SR-F405Z

Proposed Project Credit		Costs	
Length Restored (ft):	1,900	Estimated Design Cost:	$300,000
Impervious Area Treated Credit (ac.):	19	Estimated Construction Cost:	$855,000
Cost per Impervious Credit Acre:	$79,026	30% Contingency:	$346,500
		Estimated Total Cost:	$1,501,500

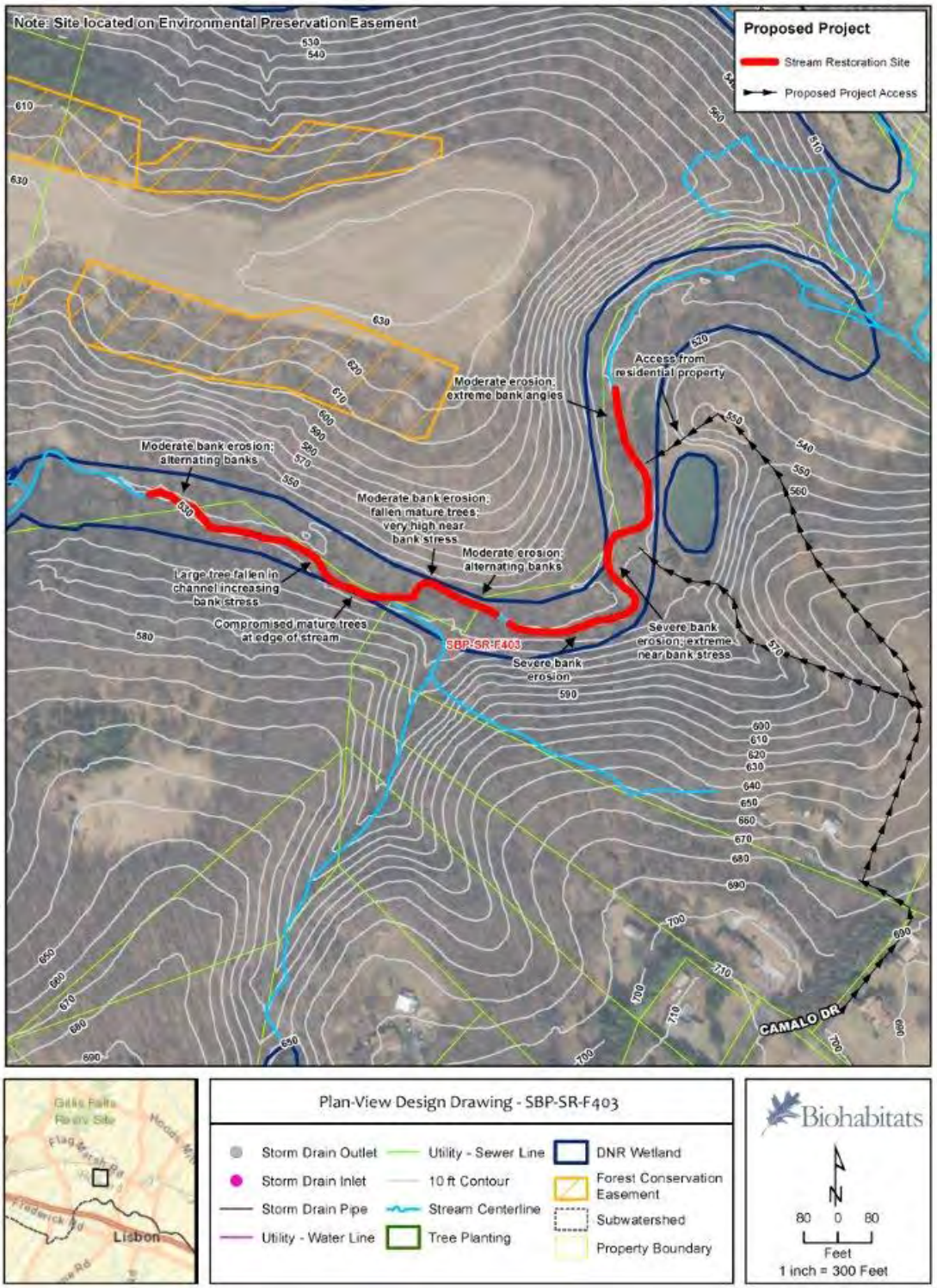
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F403

Site Name: Camalo

Contractor: Biohabitats

Watershed: South Branch Patapsco



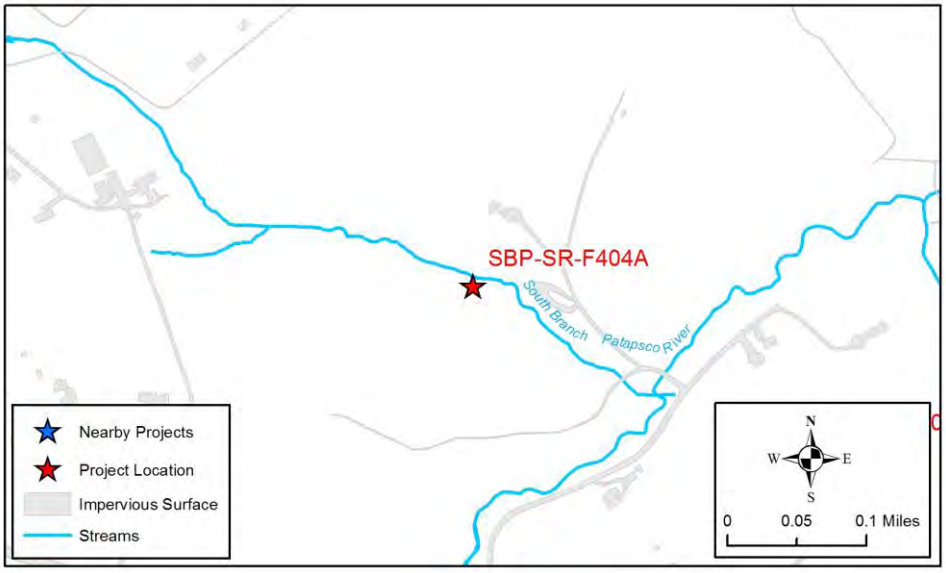
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F404A
Site Name: Hay Meadow Branch
Contractor: Biohabitats
Watershed: South Branch Patapsco

Ownership: Private- Commerical/Industrial
Single Owner

Existing Conditions:

The site is located in Mt Airy, MD along Beetz Rd and is located on private property. At the downstream limits, the assessed stream confluences with Hay Meadow Branch before it discharges into the South Branch Patapsco River. Hay Meadow Branch was not assessed, but evidence of erosion and alignment issues were observed near the tributary's confluence and may need to be assessed in the future. Heading upstream along the assessed reach, moderate erosion can be seen along the right bank until the private road crossing approximately 100 lf. upstream. The road crossing consists of three culverts capped with concrete and is in poor condition. The road crossing is currently the local base level control for the upstream reach, which is generally stable, but slightly aggraded. If the road crossing fails or is replaced in a different condition it could destabilize the upstream reach. Minor patchy erosion was observed on both banks moving upstream. A large manure dumping site was located at the top of the valley wall along the left bank. An abandoned road crossing and culvert were observed approximately 700 lf. upstream from the beginning of the stream. Upstream from this abandoned road crossing and culvert, the stream channel changes, becoming a very narrow stream with shallow left and right banks. Throughout the remaining limits of the assessed stream, minor erosion was discovered before the stream runs through several DNR wetlands, finally ending at a road culvert. The instream habitat within the existing channel scored in the suboptimal range. Riparian vegetative zone for the downstream limits of the stream are optimal where the forested riparian zone is larger; however, the upstream limits of the stream are poor, with horse pastures, roads, and buildings in close proximity to the stream. Shading along the existing channel is suboptimal (60%), with more shading in the downstream limits and less shading in the upstream limits.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F404A
Site Name: Hay Meadow Branch
Contractor: Biohabitats
Watershed: South Branch Patapsco

Photo facing downstream at left bank showing minor bank erosion with trees and vegetation helping stabilize.

Photo facing downstream at left bank showing moderate erosion with no riparian forest buffer.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F404A
Site Name: Hay Meadow Branch
Contractor: Biohabitats
Watershed: South Branch Patapsco

Constraints/Utilities:

Access to this stream is one of the biggest constraints on this site. Because the site is surrounded by private property, access will need to be granted by the private property owner. The private property is currently a business that trains horses and subsequently has several horse pastures surrounding the stream. If access is granted by the property owner, construction would need to be completed downstream to upstream. A mature forest surrounds part of the stream; therefore, clearing for a mulch access road and staging areas could remove trees that are currently stabilizing the stream banks. DNR wetlands are located at the upstream limits of the stream, but are not a part of the construction area; however, other potential wetlands were observed within the construction limits that could also be impacted.

Concept Description:

The objective for this project is to reduce bank erosion and enhance and establish riparian forest buffers. This project proposes the restoration of 700 lf. of bank stabilization and 1,000 lf. of forest buffer establishment. During the site reconnaissance for the concept development, the stream banks showed evidence of minor bank erosion throughout the stream length; however, this bank erosion was spotty and inconsistent. Because of this inconsistency, the proposed in stream work would consist of spot repairs of eroded banks and the addition of some grade controls in key locations such as the failing private drive. Due to the current condition of the stream, the proposed in stream work may not result in a net benefit to the stream condition. In order to access and construct along the stream, multiple mature trees would be lost. In addition, the surrounding wetlands could be impacted. The site is located on private property that currently trains horses. Coordination with the owner would be crucial in order to assure the safety of the horses and the construction crew. Due to the patchy and minor nature of problems within the reach, this is not a priority project for in channel restoration. Riparian enhancements would consist of tree plantings and localized areas of bioengineering where light and soil moisture conditions are conducive to plant establishment.

Nearby Opportunities:

None recommended

Proposed Project Credit		Costs	
Length Restored (ft):	700	Estimated Design Cost:	$200,000
Impervious Area Treated Credit (ac.):	7	Estimated Construction Cost:	$315,000
Cost per Impervious Credit Acre:	$95,643	30% Contingency:	$154,500
		Estimated Total Cost:	$669,500

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F404A

Site Name: Hay Meadow Branch

Contractor: Biohabitats

Watershed: South Branch Patapsco

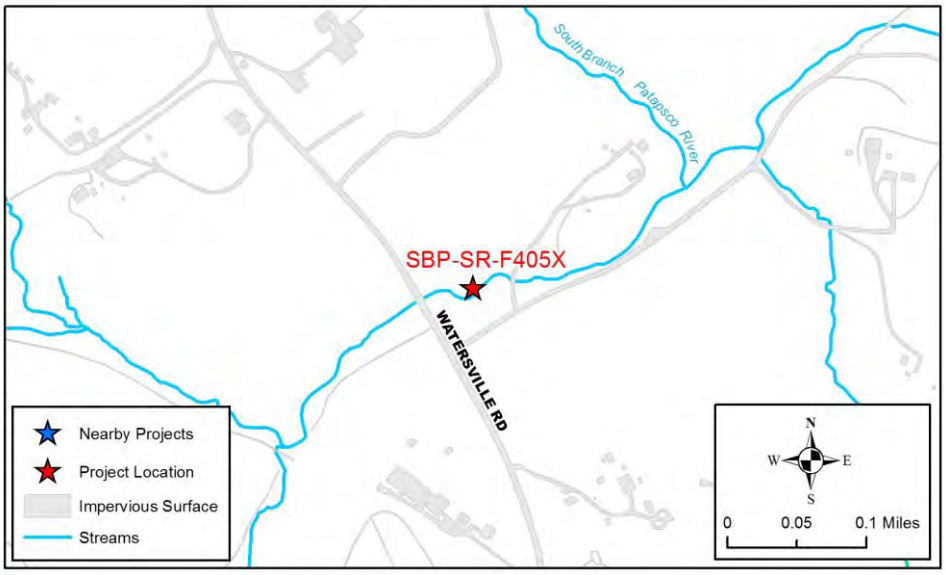
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F405X
Site Name: Blooms Lane - A
Contractor: Biohabitats
Watershed: South Branch Patapsco

Ownership: Private- Residential
Multiple Owners

Existing Conditions:

The project site is an approximately 1,550 lf. reach segment along Hay Meadow Branch, a tributary to South Branch Patapsco River. The project concept includes two stream assessment sites: SBP-SR-F405C and SBP-SR-F405D. Multiple property owners bound this segment of stream, and a small portion of the stream flows through a forest conservation easement. Extensive moderate bank erosion was observed during the assessment with bank heights greater than 5 ft. Channel widening, vertical banks, and areas of high near bank stress were primary indicators of instream degradation. Some areas of deposition and bar formation have reduced the channel flow status. Overall the stream rates high in epifaunal substrate and available cover. In stream habitat is well suited for full colonization. Segments of the stream lack sufficient shading. The general condition of the stream is an entrenched reach without floodplain connectivity. Erosive velocities are forcing channel widening and lateral migration. At one section, channel migration threatened to undermine an adjacent roadway; riprap armoring has been installed to stabilize the right bank. Spot armoring of the bank with riprap only provides localized stabilization, diverting erosive forces elsewhere. The overall condition of the stream bed is good and stable.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F405X
Site Name: Blooms Lane - A
Contractor: Biohabitats
Watershed: South Branch Patapsco

Facing upstream at riprap armored bank.

Facing downstream from upstream segment of SBP-SR-F405C.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F405X
Site Name: Blooms Lane - A
Contractor: Biohabitats
Watershed: South Branch Patapsco

Constraints/Utilities:

Few constraints exist; no utility obstructions observed. There are multiple access points with minimal constraints. Access through private property will require permission from multiple landowners. Blooms Lane runs parallel to majority of the stream and provides easy access points.

Concept Description:

The objective of restoring this segment of Hay Meadow Branch is to reduce bank erosion and improve instream habitat for aquatic organisms. This project proposes approximately 1,550 lf. of restoration starting at Watersville Road and extending downstream to the point where the stream has better floodplain connection and bank erosion is less severe. There is a section of the stream reach, approximately 150 lf., with ideal streambed form and stable banks that is not included in the proposed restoration length. This 150 foot reference area extends just beyond the driveway culvert from Blooms Lane. The restoration may be accomplished by grading banks back to a stable angle and stabilizing them with boulder, large woody debris, and integrated native vegetation to stabilize soil. Where possible, a hyporheic bench should be added to buttress high stream banks, provide enhanced nutrient processing and instream habitat. Adding additional instream structures such as woody debris, cobble riffles, pools, and other nature mimicking structures will reinforce and stabilize the channel bed and banks at key locations. Restoration will improve flow diversity, structural complexity of the stream bed, and provide ecological uplift. An essential part of enhancing the biological function of the stream, and providing long term bank stability should include the addition of a forested buffer where needed. The proposed channel restoration work will occur predominately on the existing channel; however, some minor realignment may be necessary at tight meander bends. Pushing the stream away from valley walls, or edge of road, and providing a hyporheic bench along the eroded banks will provide relief and reduce bank erosion. Recently fallen trees will be reused for structures and/or bank protection. An attempt to save compromised edge of stream trees and rootwads for bank stability and habitat structure will made where feasible. Raising the channel invert will not be needed. This reach has stable bed formation, with some sections in ideal condition. Extending the restoration area approximately 200 ft. upstream of SBP-SR-F405C should be considered to reduce bank angles and provide stability between restoration areas. Restoration of this reach has significant potential to reduce transport of sediment and nutrients, and provide enhanced biological function.

Nearby Opportunities:

SBP-SR-405Z and SBP-SR-F403

Proposed Project Credit		Costs	
Length Restored (ft):	1,550	Estimated Design Cost:	$300,000
Impervious Area Treated Credit (ac.):	15.5	Estimated Construction Cost:	$697,500
Cost per Impervious Credit Acre:	$83,661	30% Contingency:	$299,250
		Estimated Total Cost:	$1,296,750

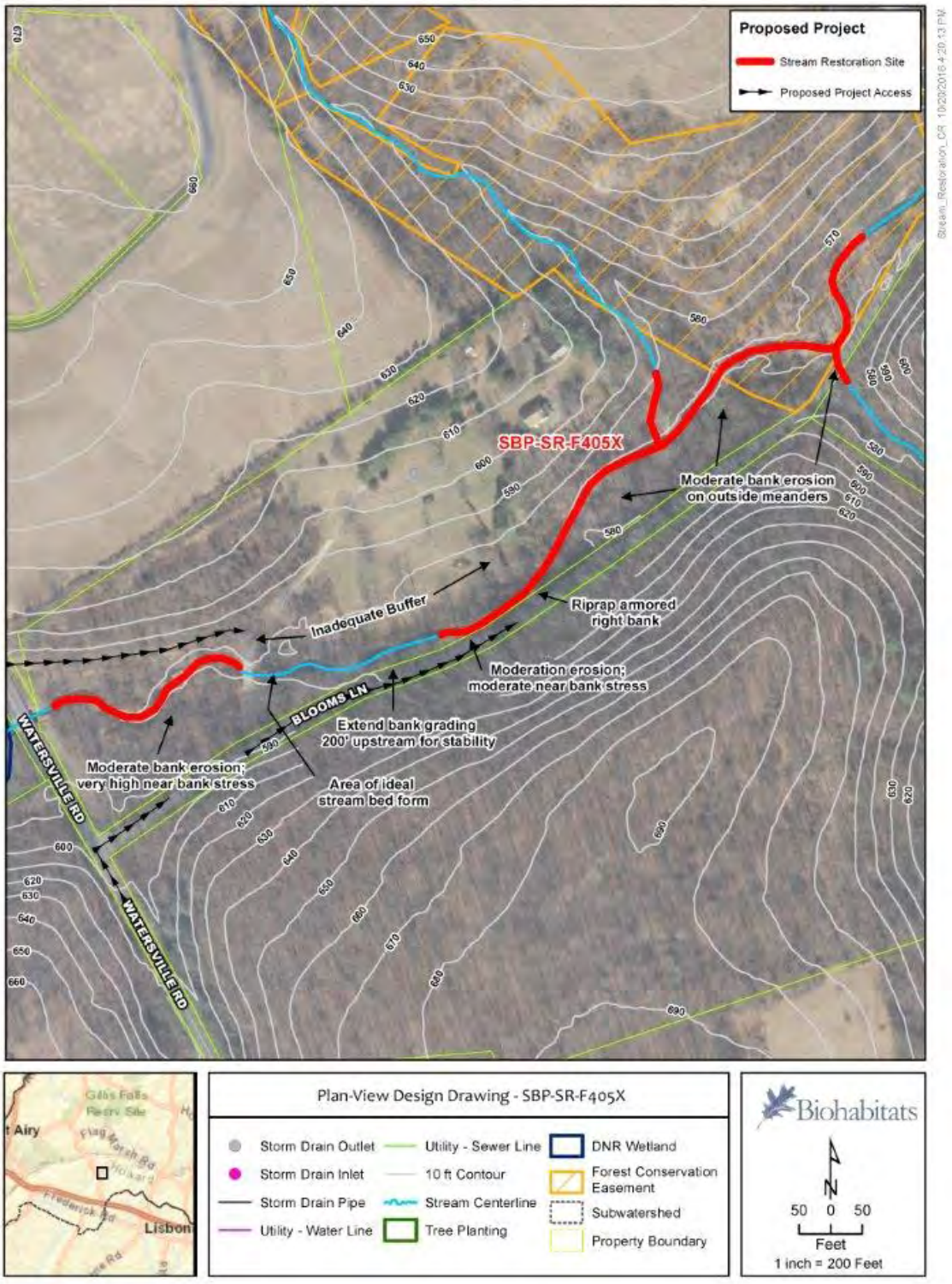
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F405X

Site Name: Blooms Lane - A

Contractor: Biohabitats

Watershed: South Branch Patapsco



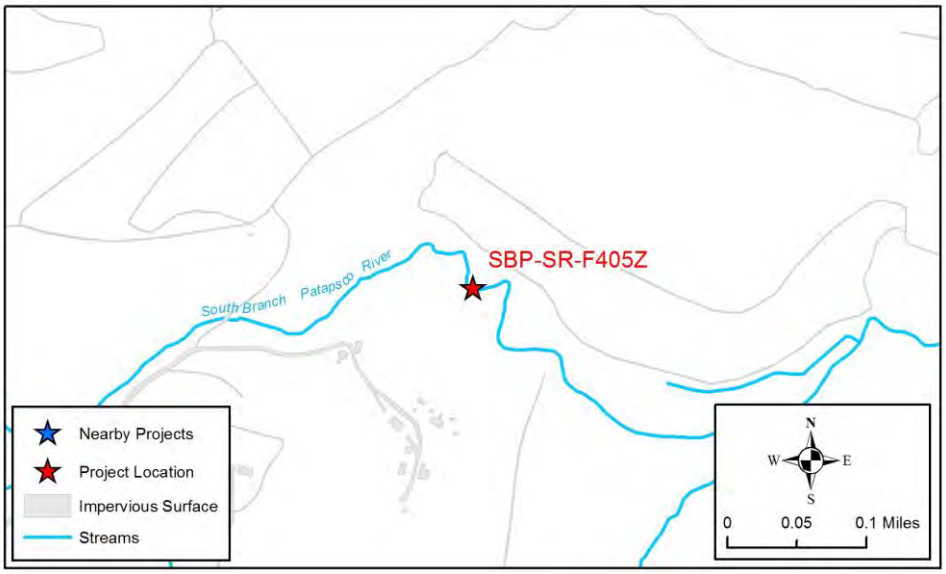
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F405Z
Site Name: Blooms Lane - B
Contractor: Biohabitats
Watershed: South Branch Patapsco

Ownership: Private- Residential
Multiple Owners

Existing Conditions:

The project site is an approximately 1,800 lf. reach segment along Hay Meadow Branch, a tributary to South Branch Patapsco River. The project concept includes two stream assessment sites: SBP-SR-F405A and SBP-SR-F405B. Multiple property owners bound this segment of stream, and a portion of the stream flows through a forest conservation easement, and DNR wetland. Moderate to severe bank erosion was observed during the assessment with bank heights greater than 6 ft. Channel widening, vertical banks, and areas of high near bank stress were primary indicators of instream degradation. Some areas of deposition and bar formation have reduced the channel flow status. Overall the stream rates high in epifaunal substrate and available cover. In stream habitat would be well suited for full colonization except for inadequate shading. Large stretches of the stream lack a sufficient forested buffer. The general condition of the stream is an entrenched reach without floodplain connectivity. Erosive velocities are forcing channel widening and lateral migration and in some location the stream is eroding into the valley walls. At the upstream edge of the restoration project the stream channel is attempting to migrate around the road culvert. The erosion at the culvert is minor, but has the potential to jeopardize the culvert if debris jams were neglected. The overall condition of the stream bed is good and stable.



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F405Z
Site Name: Blooms Lane - B
Contractor: Biohabitats
Watershed: South Branch Patapsco

Facing upstream from downstream segment of SBP-SR-F405A

Facing downstream from midpoint of SBP-SR-F405B

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F405Z
Site Name: Blooms Lane - B
Contractor: Biohabitats
Watershed: South Branch Patapsco

Constraints/Utilities:

Few constraints exist; no utility obstruction observed. There are multiple access points and open areas with minimal constraints. Site access through private property will require permission from multiple landowners. A portion of the stream passes approximately 50 feet from the toe of slope of a pond embankment.

Concept Description:

The objective of restoring this segment of Hay Meadow Branch is to reduce bank erosion and improve instream habitat for aquatic organisms. This project proposes approximately 1,800 lf. of restoration starting near the end of Blooms Lane and extending downstream to the point where the stream has better floodplain connection and bank erosion is less severe. This may be accomplished by grading banks back to a stable angle and stabilizing them with boulder, large woody debris, and integrated native vegetation to stabilize soil. Adding instream structures such as woody debris, cobble riffles, pools, and other nature mimicking structures will reinforce and stabilize the channel bed and banks. Restoration will improve flow diversity, structural complexity of the stream bed, and provide ecological uplift. An essential part of enhancing the biological function of the stream, and providing long term bank stability should include the addition of a forested buffer where needed. The proposed channel restoration work will occur predominately on the existing channel; however, some minor realignment may be necessary at tight meander bends and to pull the channel off of the valley wall. Pushing the stream away from valley walls, and providing a hyporheic bench along the eroded banks will provide relief and reduce bank erosion. Recently fallen trees will be reused for structures and/or bank protection. An attempt to save compromised edge of stream trees and rootwads for bank stability and habitat structure will made where feasible. The channel becomes more incised downstream. Raising the channel invert in the downstream portion of the project area may be needed to provide floodplain connectivity, and restore hydrology to the wetland. Excavated materials from bank grading can be used to create the hyporheic benches and raise the channel invert and excess material could be spoiled in the turf areas with landowner approval. Restoration of this reach has significant potential to reduce transport of sediment and nutrients, and provide enhanced biological function. Combining this project with PRU-SR-F405X could provide considerable cost savings if excavated materials could be spoiled onsite.

Nearby Opportunities:

SBP-SR-F405X and SBP-SR-F403

Proposed Project Credit		Costs	
Length Restored (ft):	1,800	Estimated Design Cost:	$300,000
Impervious Area Treated Credit (ac.):	18	Estimated Construction Cost:	$810,000
Cost per Impervious Credit Acre:	$80,167	30% Contingency:	$333,000
		Estimated Total Cost:	$1,443,000

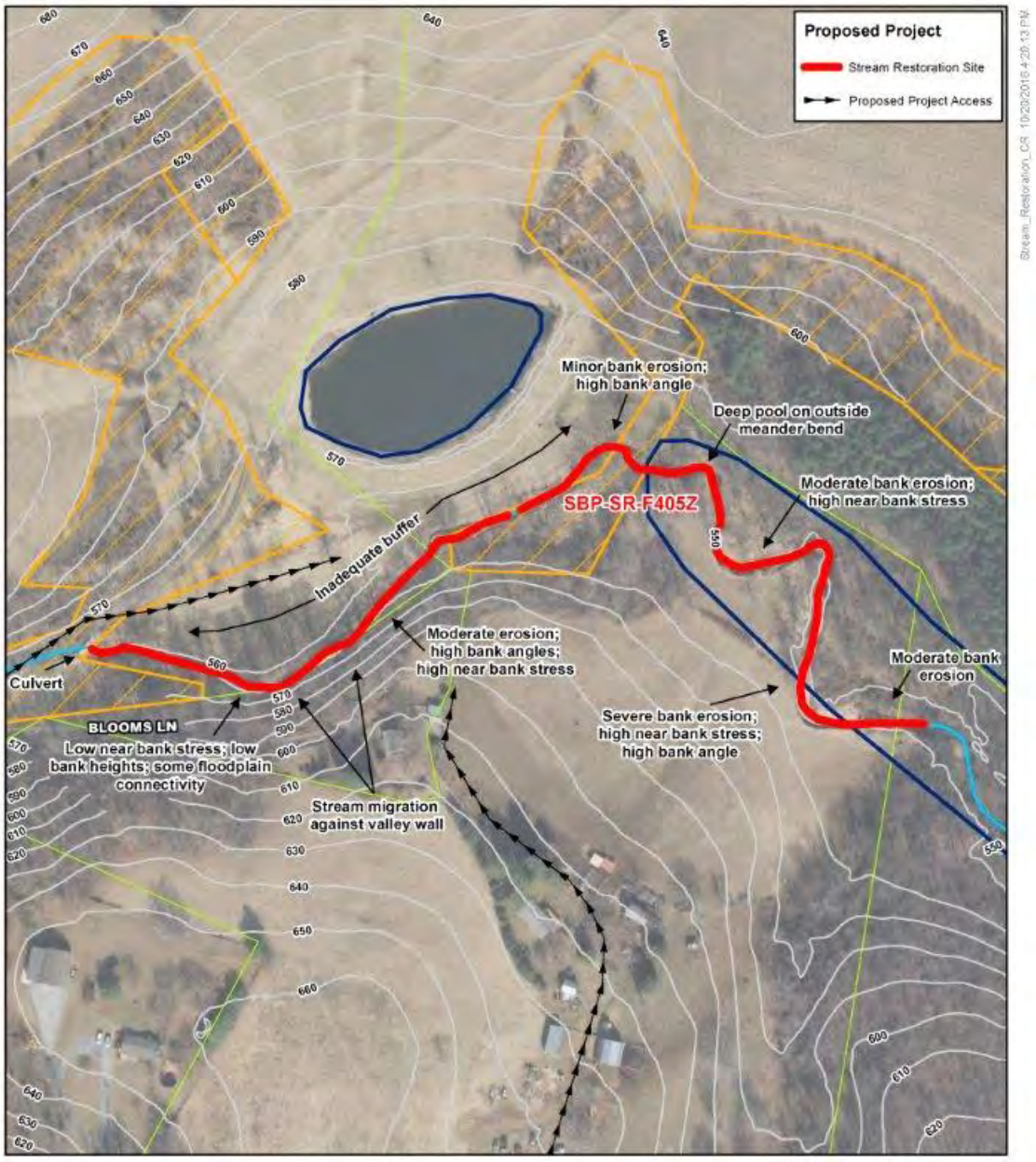
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F405Z

Site Name: Blooms Lane - B

Contractor: Biohabitats

Watershed: South Branch Patapsco



Plan-View Design Drawing - SBP-SR-F405Z

- Storm Drain Outlet
- Storm Drain Inlet
- Storm Drain Pipe
- Utility - Water Line
- Utility - Sewer Line
- 10 ft Contour
- Stream Centerline
- Tree Planting
- DNR Wetland
- Forest Conservation Easement
- Subwatershed
- Property Boundary

Biohabitats

N

50 0 50

Feet

1 inch = 200 Feet

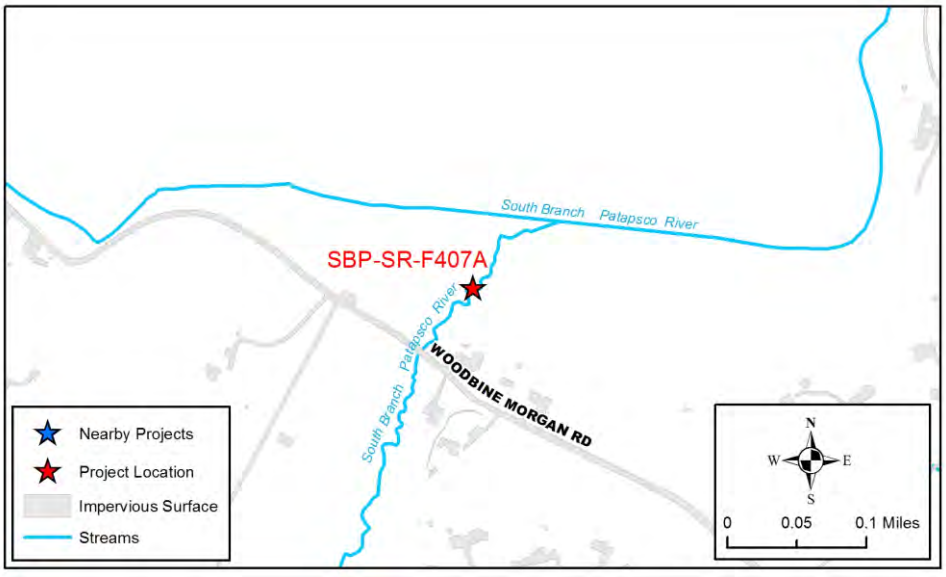
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F407A
Site Name: Woodbine Morgan
Contractor: Biohabitats
Watershed: South Branch Patapsco

Ownership: County Park
Single Owner

Existing Conditions:

This site consists of one stream assessment SBP-SR-F407A. The channel runs through a single park property located on Woodbine Morgan Rd, Woodbine, MD. There is a gate off of Woodbine Morgan Rd onto the property with a small clearing for access to half of the site. Bank erosion is moderate with a lack of adequate vegetation along stream banks. The existing channel currently exhibits moderate erosion averaging 3.5 ft that is most severe on tight outer meanders. The instream habitat within the existing channel scored in the suboptimal range. The epifaunal substrates is suboptimal with less than 40 - 70% stable habitat that is well suited for colonization with marginal embeddedness (50-75%), due to high quantities of sand, making these substrates marginal for colonization. The velocity/depth regime of the channel is marginal with only two of the four depth/velocity regimes. Significant sediment deposition throughout the channel is evident based on frequent point bar formations throughout the channel. The channel flow status is marginal with water filling more than 25 - 75% channel and with the substrate mostly exposed. Both stream banks are moderately unstable and eroding with limited vegetation. Both banks have 70% of their surface covered by vegetation due to continued erosion. Shading along the existing channel is very good (90%).



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F407A
Site Name: Woodbine Morgan
Contractor: Biohabitats
Watershed: South Branch Patapsco

Facing upstream, showing erosion with some slumping visible.

Facing downstream, showing erosion along an outside meander.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F407A
Site Name: Woodbine Morgan
Contractor: Biohabitats
Watershed: South Branch Patapsco

Constraints/Utilities:

This site is located on a single property that is owned by the Howard County Department of Parks and Recreation. There is a fence off of the right bank at a variable distance along the stream. Mature trees are in close proximity to the stream which may need to be cleared to accomplish the restoration. An existing a grass walking path could provide access for small construction equipment.

Concept Description:

The objective for this project is to reduce bank erosion and improve the instream habitat for aquatic organisms. This project proposes approximately 707 lf. of restoration starting at Woodbine Morgan Road and extending to the channel confluence with the South Branch Patapsco River. Since much of the erosion on the site is associated with the channel's tight meander geometry, some channel realignment will be necessary and efforts will need to made to ensure that the stream length is not reduced as a result of the realignment. In addition, the stream valley is forested and contains wetlands so the grading footprint should be minimized to preserve these resources. To keep the project footprint to a minimum, the channel invert should be raised to keep excavations shallow in realigned sections, provide floodplain connection, wetland enhancement, and reduce downstream erosive velocities. In areas where floodplain connection is not possible, grading banks back to a stable angle and stabilizing them with boulder, large woody debris, and integrated native vegetation to stabilize soil. Adding instream structures such as woody debris, cobble riffles, pools, and other nature mimicking structures will reinforce and stabilize the channel bed and banks. Restoration will improve flow diversity, structural complexity of the stream bed, and provide ecological uplift. This channel restoration has the potential to reduce the sediment supply, improve habitat and provide opportunities for nutrient uptake. The site can be accessed from Woodbine Morgan Rd.

Nearby Opportunities:

None recommended

Proposed Project Credit		Costs	
Length Restored (ft):	707	Estimated Design Cost:	$200,000
Impervious Area Treated Credit (ac.):	7.07	Estimated Construction Cost:	$318,150
Cost per Impervious Credit Acre:	$95,275	30% Contingency:	$155,445
		Estimated Total Cost:	$673,595

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F407A
Site Name: Woodbine Morgan
Contractor: Biohabitats
Watershed: South Branch Patapsco

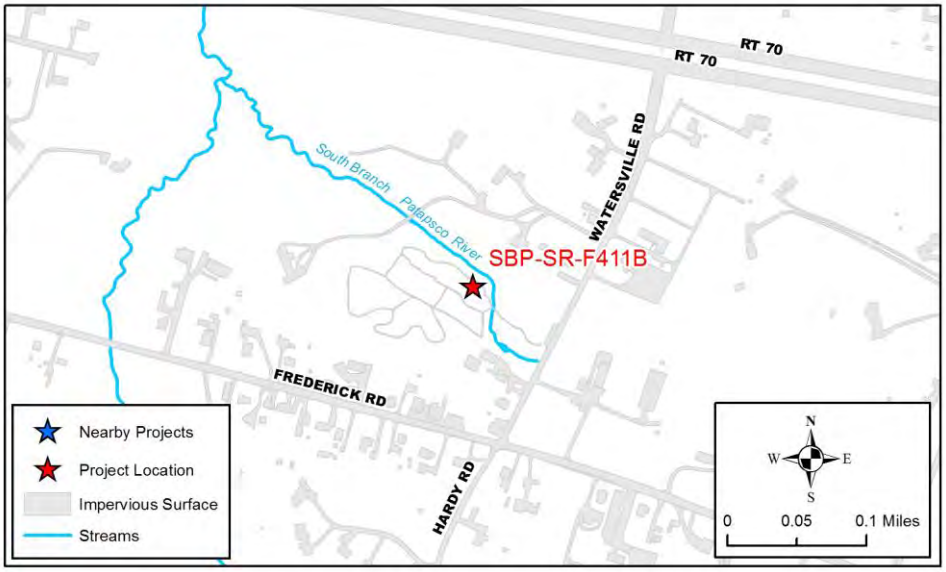
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F411B
Site Name: Poplar Spring Park
Contractor: Biohabitats
Watershed: South Branch Patapsco

Ownership: County Owned
Single Owner

Existing Conditions:

The site is located within Poplar Springs Park, which is a Howard County property in Mt Airy, MD. The stream is located within a low density residential area and surrounded by local protected lands and a forest conservation easement. The existing channel is fed by a pond outfall and has more bank erosion near the upstream end of its extents. A 3.5 ft. headcut was identified approximately 80 ft. downstream of the outfall. The channel below the head cut is entrenched with erosion occurring along the left and right bank (left bank erosion is worse). A walking bridge crosses the stream and is causing erosion to occur upstream and downstream of its location. As the stream moves downstream past the bridge, it becomes less entrenched and has minor bank erosion until it reaches a road crossing. On the opposite side of the road crossing, the stream enters private property and becomes channelized. The channelized stream is approximately 250 ft. long and its surrounding floodplain is a lawn that is mowed up to the edges of the stream. As the stream leaves the mowed lawn and enters the forest, it is still within private property and becomes a meandering stream. As the stream continues through the forest, minor bank erosion was observed, but wetlands and trees along the stream bank helped stabilize. The stream discharges into a larger stream at the downstream extents of the assessment. The instream habitat within the existing channel scored in the suboptimal range. The epifaunal substrates consists of 40% stable habitat well suited for full colonization and adequate habitat with some embeddedness (25%-50%) throughout the stream limits. Moderate sediment deposition throughout the channel is evident based on recent bank failure which is creating alternating bars along the toe of the banks. Riparian vegetative zone for the stream are optimal, with human activities (homes and roads) only being an impact within the middle of the stream. Shading along the existing channel is optimal (80%).



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F411B
Site Name: Poplar Spring Park
Contractor: Biohabitats
Watershed: South Branch Patapsco

Photo facing upstream at 3.5' headcut showing the left bank erosion as a result of the headcut.

Photo facing upstream at left bank erosion associated with the bridge crossing. Stable restoration tie in point would be downstream of this location.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F411B
Site Name: Poplar Spring Park
Contractor: Biohabitats
Watershed: South Branch Patapsco

Constraints/Utilities:

The stream is located within a Forest Conservation Easement and Local Protected Area and has a thriving forest with wetlands and wetland seeps surrounding it, which could be impacted during construction. No water or sewer lines are present within the project limits. The site is in a remote location. The project length itself is short with minor erosion, but the headcut at the upstream limits poses an issue that could cause more erosion to occur downstream in the future.

Concept Description:

The objective for this project is to reduce bank erosion and improve instream habitat for aquatic organisms. This project would include the stabilization of a 3.5 ft. headcut and 500 ft. of stream channel before tying into a stable location just upstream of the private driveway. Downstream of the road crossing is relatively stable despite the absence of a forested buffer; therefor, was not included in this narrative. The stream length to be restored was adjusted from ~700 lf. to roughly 500 lf. following a site reconnaissance in support of the concept development. Overall the bank erosion became less severe and stream conditions improved in the lower 200 ft. of the identified project. Consequently, restoration of this lower section is not recommended at this time, but this reach should be re-evaluated once the project moves to the design. Within the proposed project limits, the primary work efforts include stabilizing the headcut and raising the stream invert back up to grade and safely conveying the stream downstream through a series of grade controls throughout the 500 lf. extent. The headcut occurs downstream of the outfall approximately 80 ft. The outfall is currently stable. Adding woody debris, cobble riffles, pools, and other nature-like habitat structures will reinforce the stream bed and banks, improve the flow diversity and structural complexity of the stream bed, and uplift the instream habitat throughout the stream. The proposed channel restoration work would occur predominately on the existing channel alignment; however, some minor realignment may be necessary at the tight meander bends. The proposed channel restoration work would tie-in to the existing downstream limits before the road crossing at a stable location. This channel restoration has the potential to reduce sediment supply, improve habitat and provide opportunities for nutrient uptake. The site can be accessed from the park entrance off Watersville Road. There are no nearby project recommendations for concurrent implementation.

Nearby Opportunities:

None recommended

Proposed Project Credit		Costs	
Length Restored (ft):	500	Estimated Design Cost:	$200,000
Impervious Area Treated Credit (ac.):	5	Estimated Construction Cost:	$225,000
Cost per Impervious Credit Acre:	$110,500	30% Contingency:	$127,500
		Estimated Total Cost:	$552,500

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F411B

Site Name: Poplar Spring Park

Contractor: Biohabitats

Watershed: South Branch Patapsco

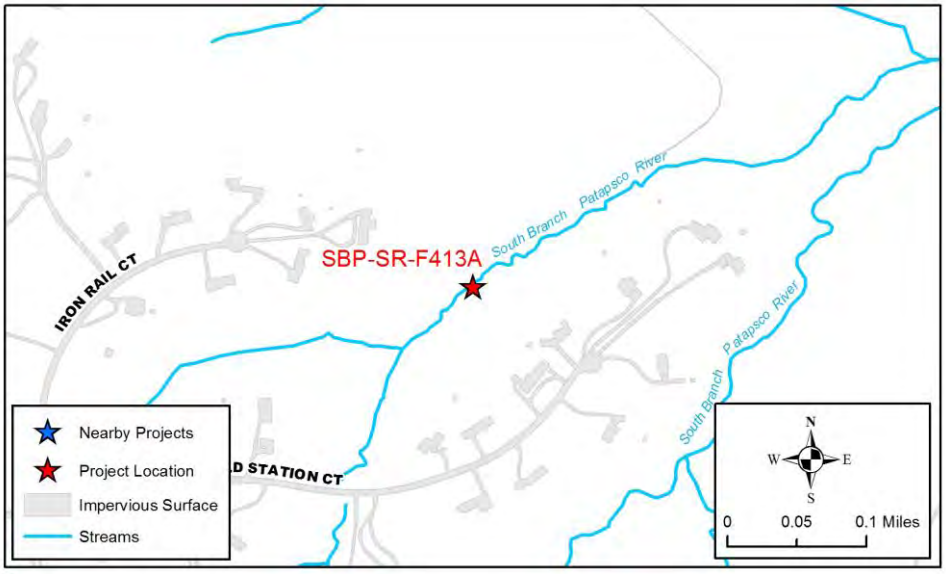
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F413A
Site Name: The Old Station Court
Contractor: Biohabitats
Watershed: South Branch Patapsco

Ownership: Private- Residential
Multiple Owners

Existing Conditions:

This site consists of one stream assessment, SBP-SR-F413A. The channel runs through several residential private properties located on The Old Station Ct, Woodbine, MD. Bank erosion is moderate due to open stream access caused by mowing to the stream edge and a lack of adequate vegetation along stream banks. The existing channel currently exhibits moderate erosion averaging 4.25 ft. The instream habitat within the existing channel scored in the marginal range. The epifaunal substrates is poor with less than 20% stable habitat that is poorly suited for colonization with significant embeddedness (50-75%) making these substrates marginal for colonization. The velocity/depth regime of the channel is poor with a single shallow fast velocity. Moderate sediment deposition throughout the channel is evident based on frequent point bar formations throughout the channel. The channel flow status is suboptimal with water filling more than 75% channel and with less than 25% of the substrate exposed. Both stream banks are moderately unstable and eroding with limited vegetation. Along both banks active erosion has prevented vegetation to establish 50% to 70% of the bank surface. Shading along the existing channel is poor (30%).



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F413A
Site Name: The Old Station Court
Contractor: Biohabitats
Watershed: South Branch Patapsco

Facing upstream, displaying outside meander erosion and open floodplain with insufficent planting along the stream banks.

Facing the right bank, significant erosion cutting into a bank along an outside meander, showing tree roots are not fully capable of stabilizing the banks.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F413A
Site Name: The Old Station Court
Contractor: Biohabitats
Watershed: South Branch Patapsco

Constraints/Utilities:

The site is located across multiple privately owned properties. There is also a sparse canopy of trees that could generally be avoided during construction. Access is off the culvert at the end of The Old Station Ct through a private residential property.

Concept Description:

The objective for this project is to reduce bank erosion and improve the instream habitat for aquatic organisms. This project proposes approximately 802 lf. of restoration starting at the downstream bridge and extending upstream to the point where the a tributary splits off of the left bank. This will be accomplished by grading the banks along the outside meanders back to a stable angle, and planting them with native vegetation to stabilize the soil. Adding woody debris, cobble riffles, pools, and other nature-like habitat structures in key locations will reinforce the stream bed and banks, improve the flow diversity and structural complexity of the stream bed, and uplift the instream habitat. The proposed channel restoration work would occur predominately in the existing channel alignment; however, some minor realignment may be necessary at the tight meander bends. The proposed work could potentially impact trees that are adjacent to the stream; however, the tree density is fairly low and it is possible to work around critical trees in the design. This channel restoration has the potential to reduce the sediment supply, improve habitat and provide opportunities for nutrient uptake. In addition to the in-channel restoration, the riparian buffer should be established and/or enhanced throughout the project reach and along the site access to provide shading, stability and organic material (litter, woody debris, etc.) to improve both the physical habitat enhance nutrient processing. The site can be accessed from The Old Station Ct.

Nearby Opportunities:

None recommended

Proposed Project Credit		Costs	
Length Restored (ft):	802	Estimated Design Cost:	$200,000
Impervious Area Treated Credit (ac.):	8.02	Estimated Construction Cost:	$360,900
Cost per Impervious Credit Acre:	$90,919	30% Contingency:	$168,270
		Estimated Total Cost:	$729,170

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F413A

Site Name: The Old Station Court

Contractor: Biohabitats

Watershed: South Branch Patapsco

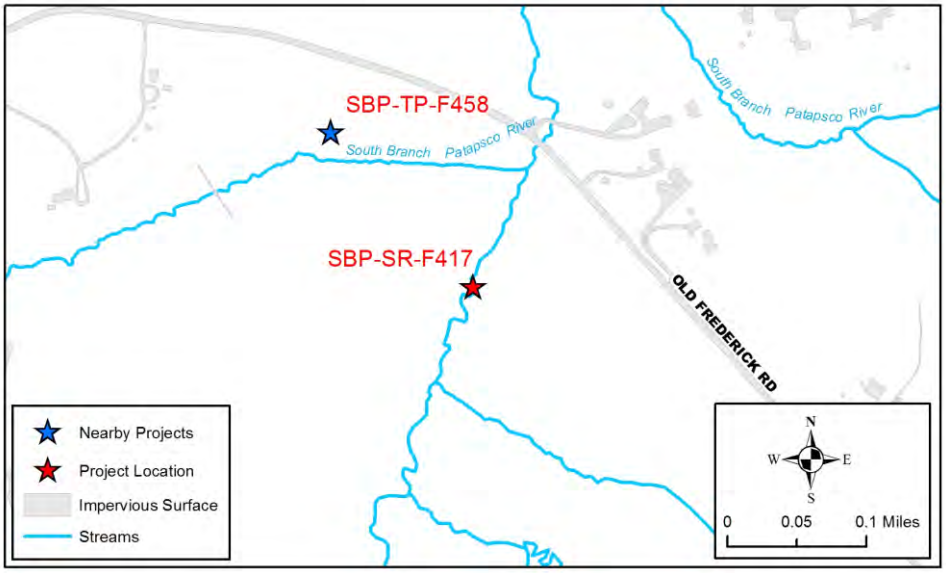
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F417
Site Name: Old Frederick Road Tributary 1
Contractor: Biohabitats
Watershed: South Branch Patapsco

Ownership: Private- Mixed Use
Single Owner

Existing Conditions:

This site consists of two separate stream assessments: SBP-SR-F417A and SBP-SR-F417B. The channel runs through a private property located at 14175 Old Frederick Rd, Sykesville, MD. The private property owned by the Oakland Farms Associates II Limited Partnership and is listed as agricultural. On the left bank there has been a recent tree planting site and a fence to exclude livestock offset between 100 and 200 ft. from the left bank. While the livestock exclusion and tree plantings have likely benefitted the stream health, the stream is still entrenched and has not fully recovered from the past land use. Bank erosion is moderate due to lack of adequate vegetation along both stream banks. Presently, the planted trees have not established the root systems necessary to improve bank stability. The existing channel currently exhibits moderate erosion with 3-5 ft. eroding banks and tight bends with recent bank erosion and deposition evident. The instream habitat within the existing channel scored in the suboptimal range. The epifaunal substrates consists of 40% - 70% stable habitat well suited for full colonization and adequate habitat with moderate embeddedness (25-50%) making these substrates moderate for colonization. The velocity/depth regime of the channel is suboptimal with all velocities present except fast-deep. Moderate sediment deposition throughout the channel is evident based on point bar formations throughout the portions of the channel. The channel flow status is suboptimal with water filling 75% of the channel and some riffle substrates exposed. Both stream banks are moderately unstable and eroding with limited vegetation. Both banks have 50% of their surface covered by vegetation due to continued erosion. Shading along the existing channel is poor (35%).



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F417

Site Name: Old Frederick Road Tributary 1

Contractor: Biohabitats

Watershed: South Branch Patapsco

Facing upstream, displaying the poor bank protection and erosion.

Facing downstream, at a tight bend, displaying the poor bank protection, erosion, and insufficient buffer.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F417
Site Name: Old Frederick Road Tributary 1
Contractor: Biohabitats
Watershed: South Branch Patapsco

Constraints/Utilities:

The stream is located on private property that uses the land as a pasture and for agriculture. Stream restoration on this site will require landowner permission to perform more active restoration of the stream. Minimal impact to trees is expected due to the low density of trees along the left bank. No utilities were observed.

Concept Description:

The objective for this project is to reduce bank erosion and improve the instream habitat for aquatic organisms. This project proposes approximately 1,536 lf. of restoration starting where the stream enters a heavily wooded area upstream of the pastures and extending downstream to the point where the stream intersects a tributary on the left bank. This will be accomplished by excavating a narrow floodplain with a hyporheic bench, grading banks back to a stable angle and stabilizing them with native vegetation to hold soil in place. Adding woody debris, cobble riffles, pools, and other nature-like habitat structures will reinforce the stream bed and banks, improve the flow diversity and structural complexity of the stream bed, and uplift the instream habitat. The proposed channel restoration work would occur predominately in the existing channel alignment; however, some minor realignment may be necessary at the tight meander bends. This work should not impact the existing fence to exclude animal grazing. With landowner approval, excavated material could be spoiled in open areas outside of the floodplain and replanted with native trees. This channel restoration has the potential to reduce the sediment supply, improve habitat and provide opportunities for nutrient uptake. The site can be accessed from Old Frederick Rd. There is fencing and a guard rail that would need to be temporarily taken down or moved for access. There is also a stream (SBP-SR-F416) that would need to be crossed in order to avoid tree removal along the right bank.

Nearby Opportunities:

None recommended

Proposed Project Credit		Costs	
Length Restored (ft):	1,536	Estimated Design Cost:	$300,000
Impervious Area Treated Credit (ac.):	15.4	Estimated Construction Cost:	$691,200
Cost per Impervious Credit Acre:	$83,891	30% Contingency:	$297,360
		Estimated Total Cost:	$1,288,560

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F417

Site Name: Old Frederick Road Tributary 1

Contractor: Biohabitats

Watershed: South Branch Patapsco

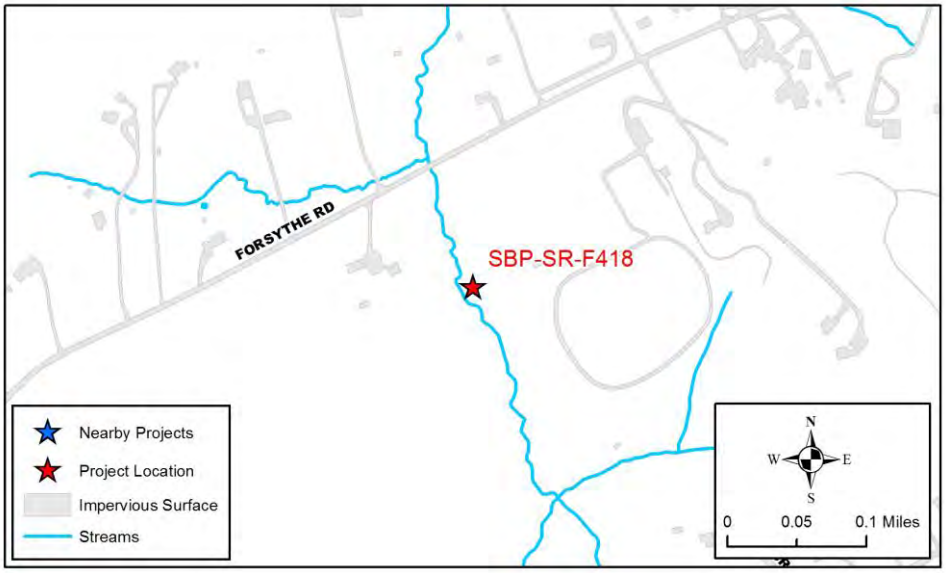
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F418
Site Name: Forsythe Road
Contractor: Biohabitats
Watershed: South Branch Patapsco

Ownership: Private- Residential
Multiple Owners

Existing Conditions:

This site consists of four separate stream assessments: SBP-SR-F418A, SBP-SR-F418B, SBP-SR-F418C, and SBP-SR-F415A. The channel runs through private properties located on Forsythe Rd, Old Frederick Rd, and Hewitt Dr in Sykesville, MD. The properties have three different uses; agricultural, residential, and a small park property. The agricultural properties appear to be horse pastures along multiple sections of streams. There is a fence along 1,250 ft. of stream to exclude horses from the stream. At 14010 Forsythe Rd the fence is in danger of failure due to bank erosion along the property. Bank erosion is severe due to lack of adequate vegetation along alternating stream banks. The existing channel currently exhibits moderate erosion averaging 4 ft., with a section of erosion reaching 9 ft. in height. The erosion is the result of the channel's entrenchment where stormflow is contained within the channel banks producing erosive velocities and shear stress instead of dissipating over a broad floodplain. The instream habitat within the existing channel scored in the suboptimal range. The epifaunal substrates consists of greater than 70% stable habitat well suited for full colonization and habitat with moderate embeddedness (25-50%) making these substrates moderate for colonization. The velocity/depth regime of the channel is suboptimal with all velocities present except fast-deep. Minimal sediment deposition throughout the channel is evident based on infrequent point bar formations throughout the channel. The channel flow status is suboptimal with water filling the entire channel and with minimal substrates exposed. Both stream banks are moderately unstable and eroding with limited vegetation. Both banks have 50 - 70% of their surface covered by vegetation due to continued erosion. Shading along the existing channel is moderate (45%).



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F418
Site Name: Forsythe Road
Contractor: Biohabitats
Watershed: South Branch Patapsco

Facing the left bank, pasture fencing on the 14010 Forsythe Rd property at risk from erosion.

Facing upstream, moderate to severe erosion, 4.5 ft in height with little vegetative cover.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F418
Site Name: Forsythe Road
Contractor: Biohabitats
Watershed: South Branch Patapsco

Constraints/Utilities:

The site is located across multiple privately owned properties. There are fences along 1,250 ft. of stream on one or both sides primarily along the downstream half of the reach. Some portions of the stream have trees in close proximity which would need to be avoided or removed. Access to the site from Forsythe Rd will also require the removal of wooden fences and possibly a guardrail. There are pastures along the stream for the majority of its length, and the upstream half of the project area is within a DNR wetland of poor quality.

Concept Description:

The objective for this project is to reduce bank erosion and improve the instream habitat for aquatic organisms. This project proposes 3,635 lf. of stream restoration, of which 2,150 lf. is upstream of Forsythe Rd, 1,260 lf. is downstream of Forsythe Rd and 225 lf. is along an unnamed tributary paralleling Forsythe Rd (site SBP-SR-F415A) and confluencing with the mainstem downstream of the road culvert. The project could be constructed as a single project or in phases with Forsythe Rd as the dividing point between phases. The restoration will be accomplished by fencing off the stream and an adequate riparian buffer from livestock and excavating a narrow floodplain/hyporheic bench along both banks and grading banks back to a stable angle where possible and stabilizing them with native vegetation to hold soil in place. The proposed channel restoration work would occur predominately in the existing channel alignment; however, some minor realignment may be necessary at the tight meander bends. In some locations the stream invert could be raised to minimize excavation and restore a hydrological connection to the mapped DNR wetlands. Where grading is not possible, root wads or stone will be used to harden the banks to prevent further erosion. Excluding livestock from the stream will also improve habitat and reduce nutrient inputs. Adding woody debris, cobble riffles, pools, and other nature-like habitat structures will reinforce the stream bed and banks, improve the flow diversity and structural complexity of the stream bed, and uplift the instream habitat. This channel restoration has the potential to reduce the sediment supply, improve habitat and provide opportunities for nutrient uptake. The site can be accessed from Forsythe Rd. There is fencing and a guard rail that would need to be temporarily taken down or moved for access. The proposed work will impact existing fence lines and property owner coordination and education will be critical to the project success.

Nearby Opportunities:

SBP-SR-F415A

Proposed Project Credit		Costs	
Length Restored (ft):	3,635	Estimated Design Cost:	$300,000
Impervious Area Treated Credit (ac.):	31.4	Estimated Construction Cost:	$1,635,750
Cost per Impervious Credit Acre:	$80,194	30% Contingency:	$580,725
		Estimated Total Cost:	$2,516,475

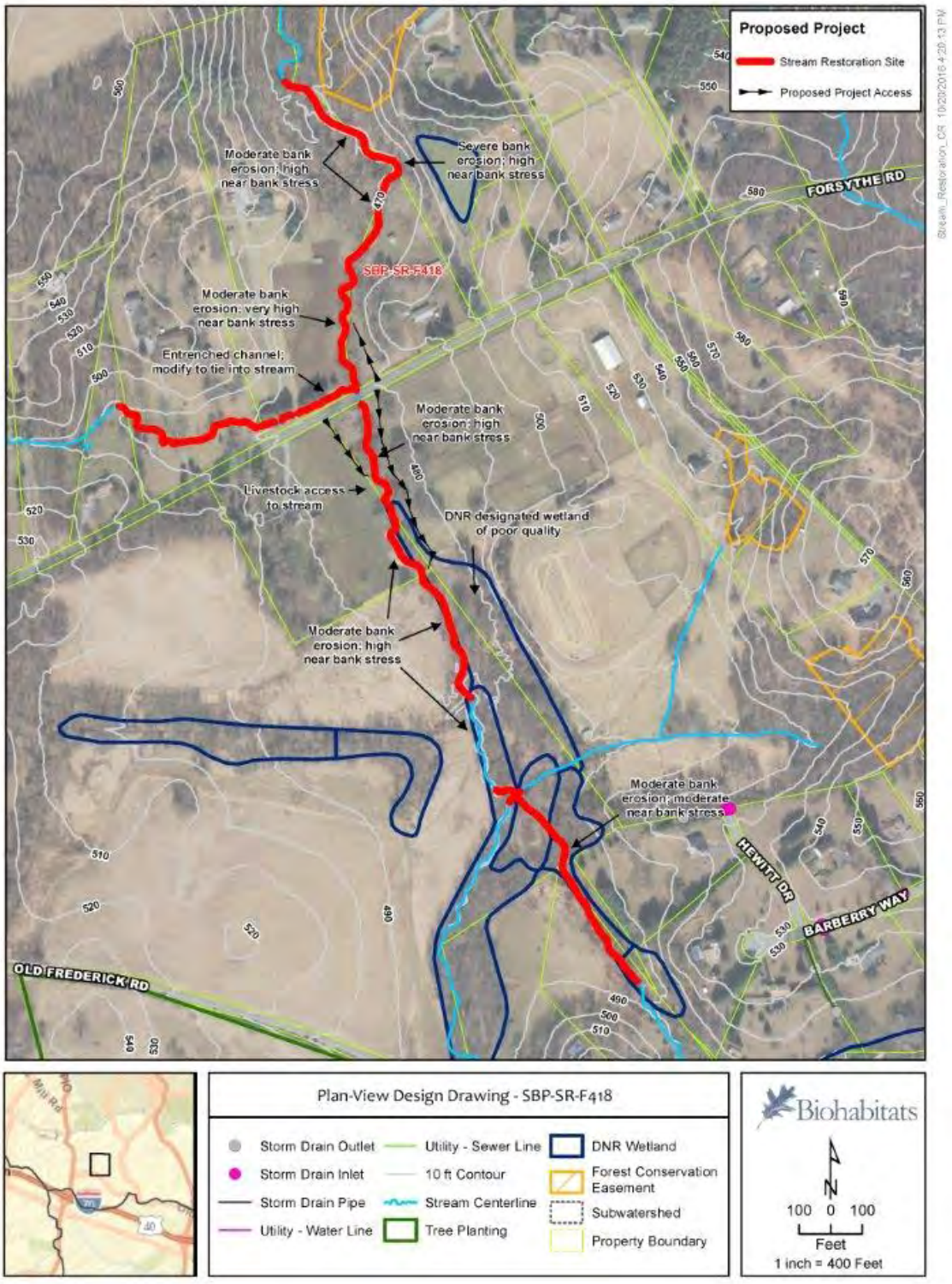
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F418

Site Name: Forsythe Road

Contractor: Biohabitats

Watershed: South Branch Patapsco



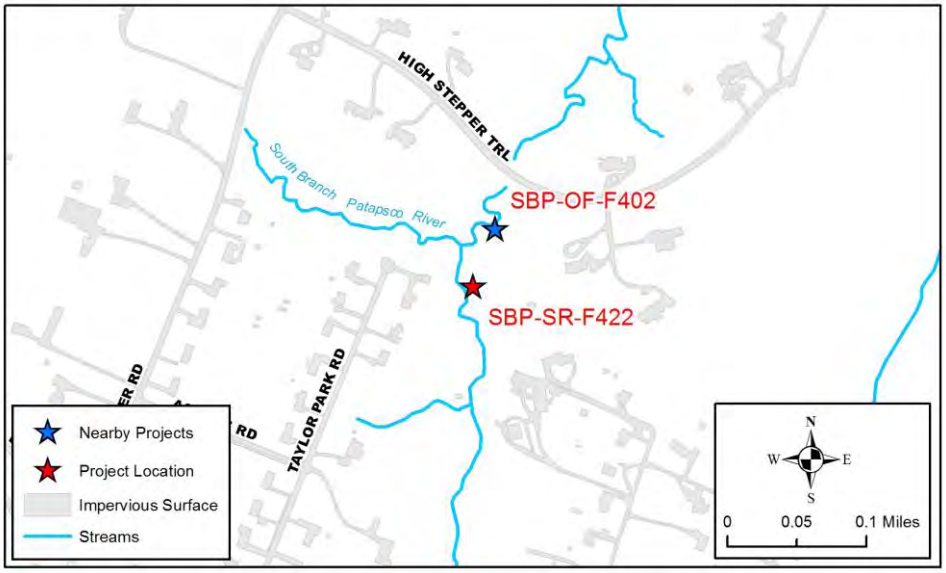
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F422
Site Name: High Stepper Trail
Contractor: Biohabitats
Watershed: South Branch Patapsco

Ownership: Private- Residential
Multiple Owners

Existing Conditions:

This site consists of two separate stream assessments: SBP-SR-F422A and SBP-SR-F422B. This project can be done in conjunction with an outfall stabilization project site SBP-OF-F402. The channel runs through several private properties off of High Stepper Trail, Taylor Park Rd, and Howard Lodge Dr in Sykesville, MD. The stream corridor and properties containing the stream are mostly forested with mature trees. On the upstream end of the site there is a large stand of bamboo that should be removed to return the forest to a natural canopy and understory. Bank erosion varies between moderate (3 ft. to 4 ft.) and severe (4 ft. to 6 ft.) for most of the reach, with the exception of one patch of minor erosion. Overall the channel exhibits varying degrees of widening, lateral migration and restabilization. The instream habitat within the existing channel scored in the upper end of the suboptimal range. The epifaunal substrates consists of greater than 70% stable habitat well suited for full colonization and stable habitat with minor embeddedness (0-25%) making these substrates favorable for colonization. The velocity/depth regime of the channel is suboptimal with all velocities present except fast-deep. Moderate sediment deposition throughout the channel is evident based on point bar formations throughout the portions of the channel. The channel flow status is marginal with water filling 25 - 75% of the channel and most of the riffle substrate is exposed. Both stream banks are moderately unstable and eroding with limited vegetation. Both banks have 50% of their surface covered by vegetation due to continued erosion. Shading along the existing channel is moderate (70%).



Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F422

Site Name: High Stepper Trail

Contractor: Biohabitats

Watershed: South Branch Patapsco

Facing upstream, moderate erosion with view of invasive bamboo stand.

Facing downstream, significant erosion on the outside meander.

Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F422
Site Name: High Stepper Trail
Contractor: Biohabitats
Watershed: South Branch Patapsco

Constraints/Utilities:

The stream is located on multiple residential private properties. Stream restoration on this site will require landowner permission to perform restoration of the stream. There are possible significant impacts to mature trees along the stream, particularly in the upstream portion of the stream with a bamboo stand. No utilities were observed.

Concept Description:

The objective for this project is to reduce bank erosion and improve the instream habitat for aquatic organisms. This project proposes 2,240 lf. of stream restoration, of which 1,115 lf. is upstream of High Stepper Trail and 1,125 lf. is downstream of High Stepper Trail. The project could be constructed as a single project or in phases with High Stepper Trail as the dividing point between phases. The restoration will be accomplished by a combination of grading banks back to a stable angle and stabilizing them with native vegetation to hold soil in place as well as raising the stream invert downstream of significant sections of erosion to minimize the amount of grading required. A second option downstream of the culvert is to completely realign the stream off the valley wall and to re-establish the connection with the floodplain to improve or create nearby wetlands. Adding woody debris, cobble riffles, pools, and other nature-like habitat structures will reinforce the stream bed and banks, improve the flow diversity and structural complexity of the stream bed, and uplift the instream habitat. The proposed channel restoration work would occur predominately in the existing channel alignment; however, some realignment will be necessary at the tight meander bends. Realignment will be constrained by tree impacts and preserving the stream length. This channel restoration has the potential to reduce the sediment supply, improve habitat and provide opportunities for nutrient uptake. The site can be accessed from High Stepper Trail. There is a guard rail that would need to be temporarily taken down or moved for access.

Nearby Opportunities:

SBP-OF-F402

Proposed Project Credit		Costs	
Length Restored (ft):	2,273	Estimated Design Cost:	$300,000
Impervious Area Treated Credit (ac.):	22.7	Estimated Construction Cost:	$1,022,850
Cost per Impervious Credit Acre:	$75,658	30% Contingency:	$396,855
		Estimated Total Cost:	$1,719,705

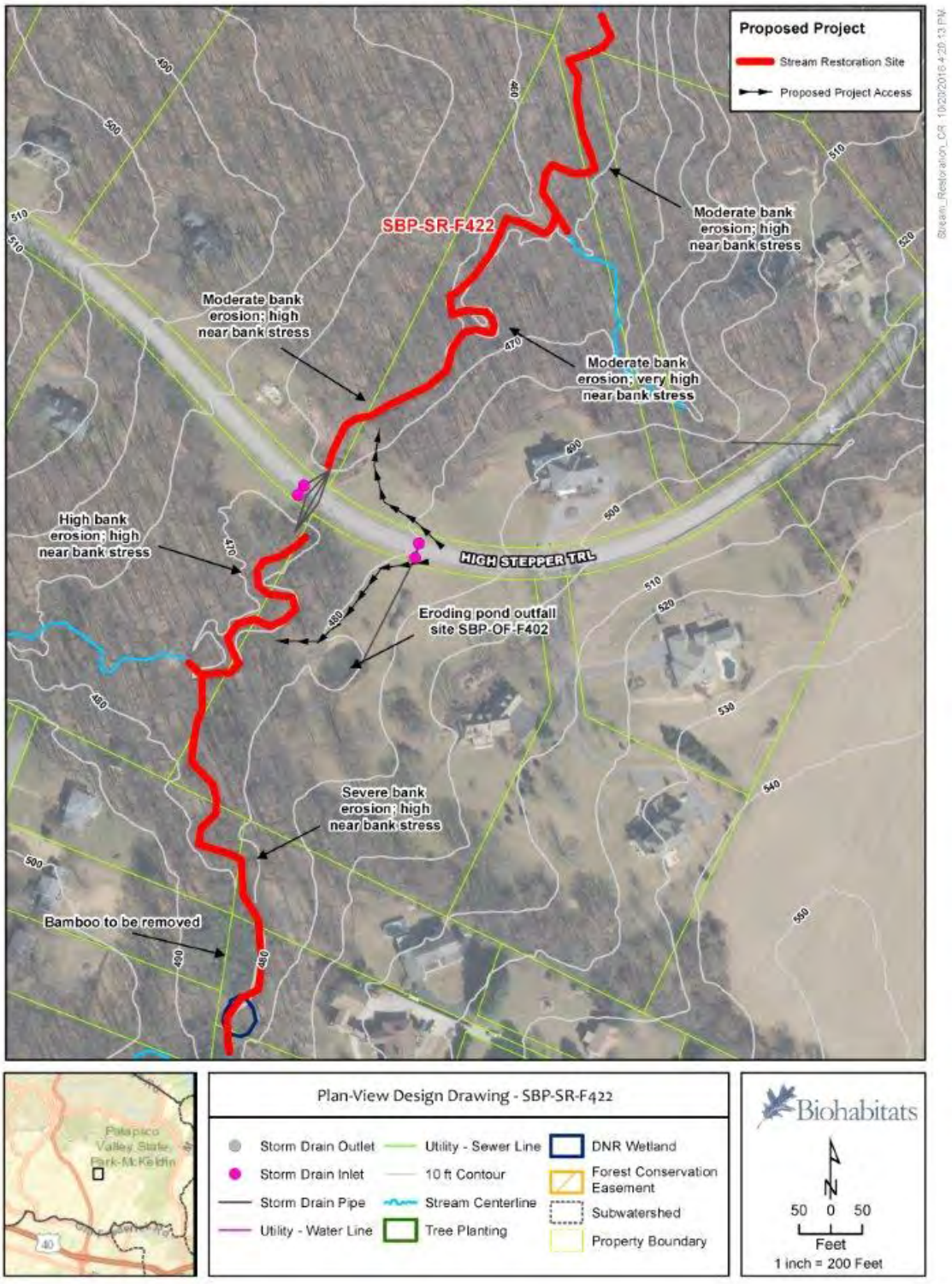
Howard County Watershed Assessment Concept Plan: Stream Restoration

Site ID: SBP-SR-F422

Site Name: High Stepper Trail

Contractor: Biohabitats

Watershed: South Branch Patapsco



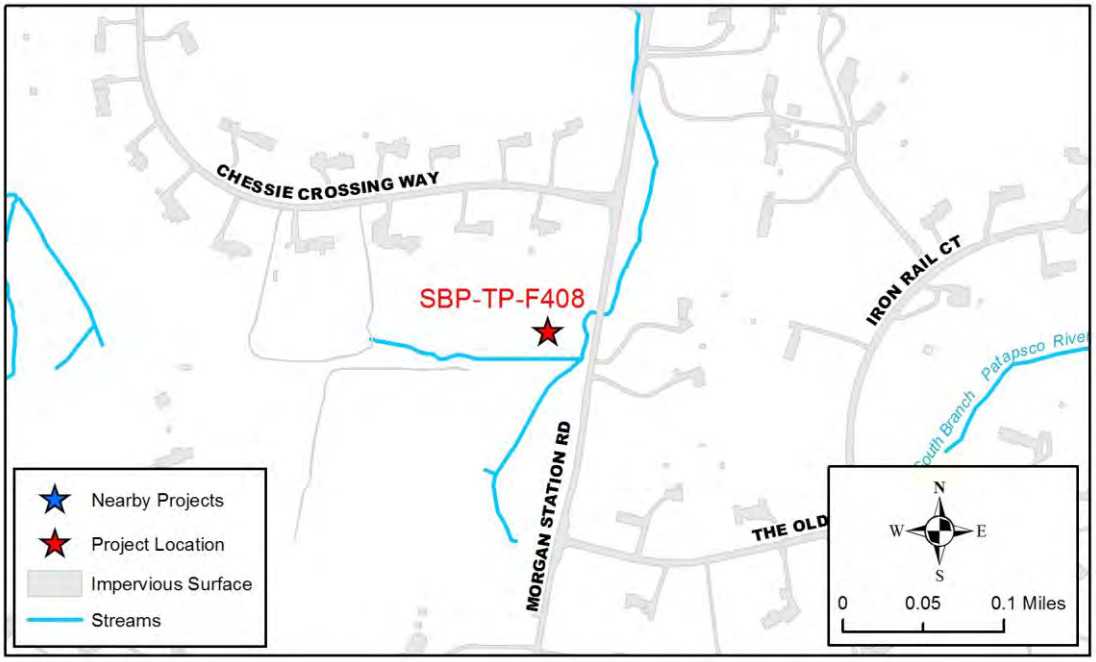
Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: SBP-TP-F408
Site Name: Morgan Station
Contractor: Biohabitats
Watershed: South Branch Patapsco

Project Type: Tree Planting
Ownership: Private- Residential
Multiple Owners

Existing Conditions:

This site spans multiple private properties. The current vegetation is 80% mowed turf, 15% trees and shrubs, and 5% other herbaceous plants. The trees are located primarily along the edge of the stream, providing a minimal riparian buffer of 5 to 15 ft. on either side of the stream. Existing tree species include black walnut (*Juglans nigra*), tulip poplar (*Liriodendron tulipifera*), black cherry (*Prunus serotina*), black willow (*Salix nigra*), and arrowwood (*Viburnum dentata*). Invasive species cover approximately 10% of the non-turf area, consisting of multiflora rose (*Rosa multiflora*), bradford pears (*Pyrus calleryana*), and autumn olive (*Elaeagnus umbellata*). Portions of this site are located in low lying areas adjacent to the stream channel with wetland hydrology indicators, and the southern section of the planting area is within a designated DNR Wetland. The stream channel has low banks with good floodplain connection. The soil is moderately compacted and has a loamy texture.



Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: SBP-TP-F408

Site Name: Morgan Station

Contractor: Biohabitats

Watershed: South Branch Patapsco

Tree planting area facing west along Chessie Crossing Way.

Tree planting area facing south along Morgan Station Road.

Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: SBP-TP-F408
Site Name: Morgan Station
Contractor: Biohabitats
Watershed: South Branch Patapsco

Constraints/Utilities:

Constraints at the site include current mowing practices, multiple property ownerships and a DNR wetland at the southern edge of the planting area. A natural gas line is in proximity to the planting area; signs were observed along the edge of Morgan Station Road. No other utility constraints were observed and access should not be a limiting factor as there appears to be multiple points of entry across the entire project area. Avoidance of wildlife impacts should be considered to ensure planting success.

Concept Description:

The proposed project consists of one 13.24 acre tree planting area that runs parallel to the stream channel. The planting area is on the east side of Morgan Station Road and crosses over a culvert to the west side of the road. Portions of the planting area extend along the southern property edge of private residences along Chessie Crossing Way. This is a highly visible site that presents an opportunity for volunteer involvement.The proposed planting area receives mostly full sun. Microclimates and steep slopes (greater than 15%) are absent. The planting area contains low lying areas with wetland conditions, resulting in a high potential for wetland enhancement. Facultative or facultative wet species will need to be considered in low lying areas adjacent to the stream channel. Other portions of the planting area have gentle slopes where upland species will thrive. There is no evidence of erosion, contamination, or debris on site. It is predominantly residential turf with a few gardens and ornamental trees.

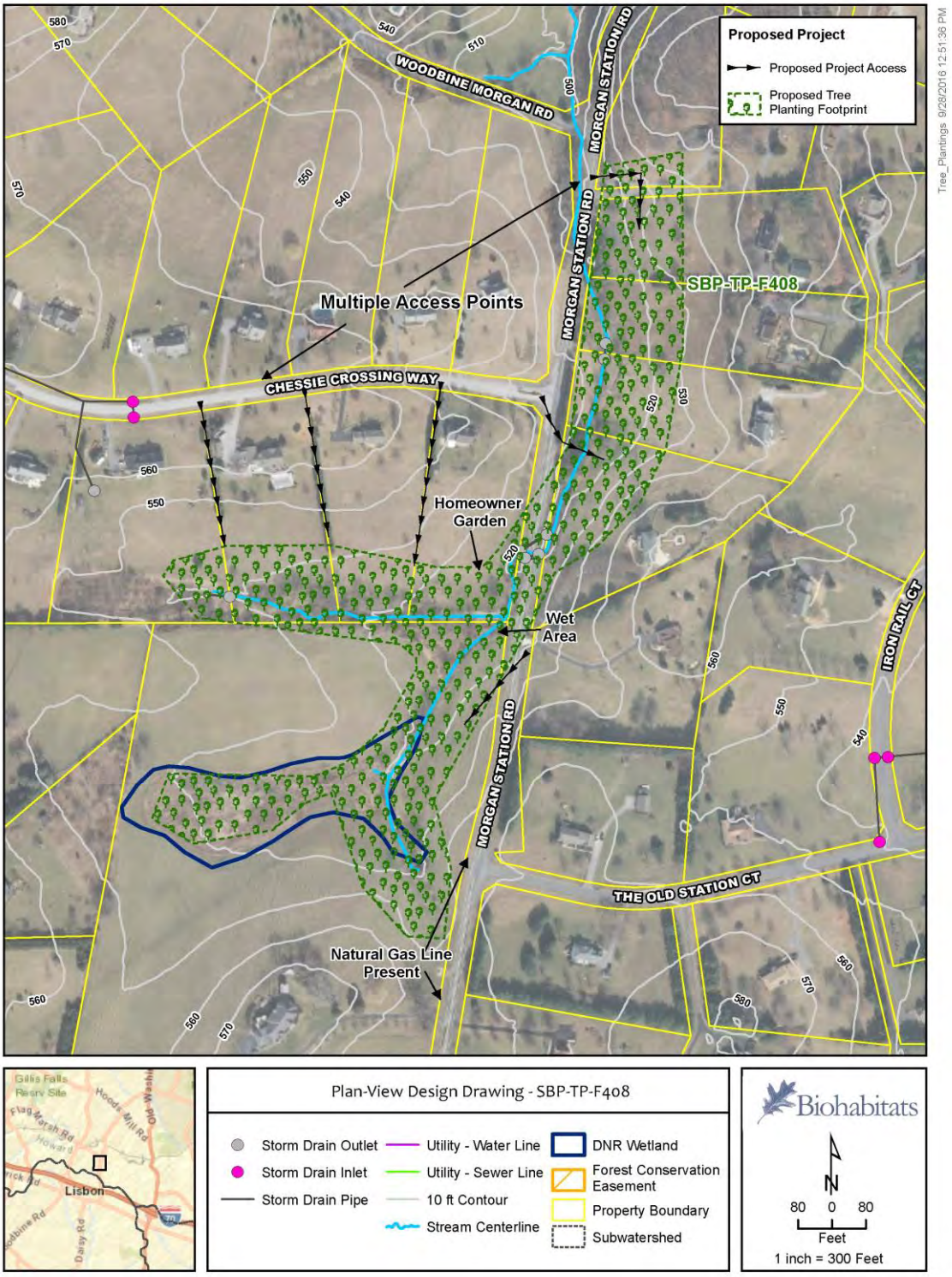
Nearby Opportunities:

None recommended

Proposed Project Credit		Costs	
Planting Acres:	13	Estimated Design Cost:	$10,000
Impervious Area Treated Credit (ac.):	5.03	Estimated Construction Cost:	$423,680
		30% Contingency:	$130,104
Cost per Impervious Credit Acre:	$112,058	Estimated Total Cost:	$563,784

Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: SBP-TP-F408
Site Name: Morgan Station
Contractor: Biohabitats
Watershed: South Branch Patapsco



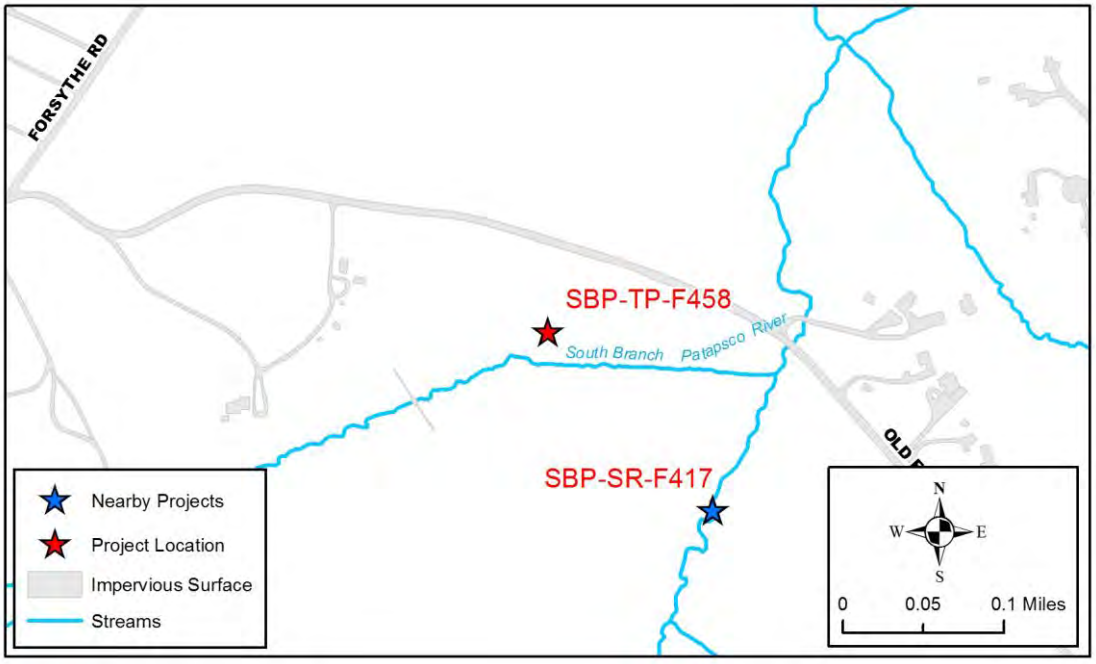
Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: SBP-TP-F458
Site Name: 14006 Old Frederick Road A
Contractor: Biohabitats
Watershed: South Branch Patapsco

Project Type: Tree Planting
Ownership: Private- Residential
Multiple Owners

Existing Conditions:

The planting site is within a single private property along the southern edge of Old Frederick Road. The current vegetation is 65% mowed turf, 15% trees and shrubs, 15% other herbaceous plants, and 5% bare soil. The site contains evidence of a partially successful tree planting. Existing tree species include green ash (*Fraxinus pennsylvanica*), sycamore (*Platanus occidentalis*), and bald cypress (*Taxodium distichum*). Invasive species cover approximately 5% of the non-turf area, consisting primarily of multiflora rose (*Rosa multiflora*). Portions of this site are located in low lying areas adjacent to the stream channel with wetland hydrology indicators, and a swath of area along the stream channel is within a designated DNR Wetland. The stream channel has low banks with good floodplain connection. The soil is moderately compacted and has a loamy texture.



Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: SBP-TP-F458

Site Name: 14006 Old Frederick Road A

Contractor: Biohabitats

Watershed: South Branch Patapsco

Tree planting area facing west at downstream end.

Tree planting area facing east from upstream end.

Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: SBP-TP-F458
Site Name: 14006 Old Frederick Road A
Contractor: Biohabitats
Watershed: South Branch Patapsco

Constraints/Utilities:

No utility constraints were observed and access should not be a limiting factor as there appears to be multiple points of access along the entire northern edge of the project area from Old Frederick Rd. Avoidance of wildlife impacts should be considered to ensure planting success. The site contains low lying areas adjacent to the stream that are wet, and portions of the planting site are within DNR Wetland boundaries. Current mowing practices and land owner consent may be potential constraints.

Concept Description:

The proposed project consists of one tree planting area that is 14.01 acres along the stream channel that runs nearly parallel to Old Frederick Rd. The eastern edge of the planting area is bound by the confluence of stream recommendation site SBP-SR-F417. The site is moderately visible from passing traffic and has low education or volunteer potential, but has high reforestation potential with beneficial water quality impact. The proposed planting area receives mostly full sun. Microclimates and steep slopes (greater than 15%) are absent. The planting site contains low lying areas with wetland conditions and has a high potential for wetland enhancement. Facultative or facultative wet species will need to be considered in low lying areas adjacent to the stream channel. Other portions of the planting area have gentle slopes where upland species will thrive. There is no evidence of erosion, contamination, or debris on site. It is predominantly open field with surviving remnants of a partially successful previous tree planting.

Nearby Opportunities:

SBP-SR-417

Proposed Project Credit	
Planting Acres:	14
Impervious Area Treated Credit (ac.):	5.32
Cost per Impervious Credit Acre:	$111,916

Costs	
Estimated Design Cost:	$10,000
Estimated Construction Cost:	$448,320
30% Contingency:	$137,496
Estimated Total Cost:	$595,816

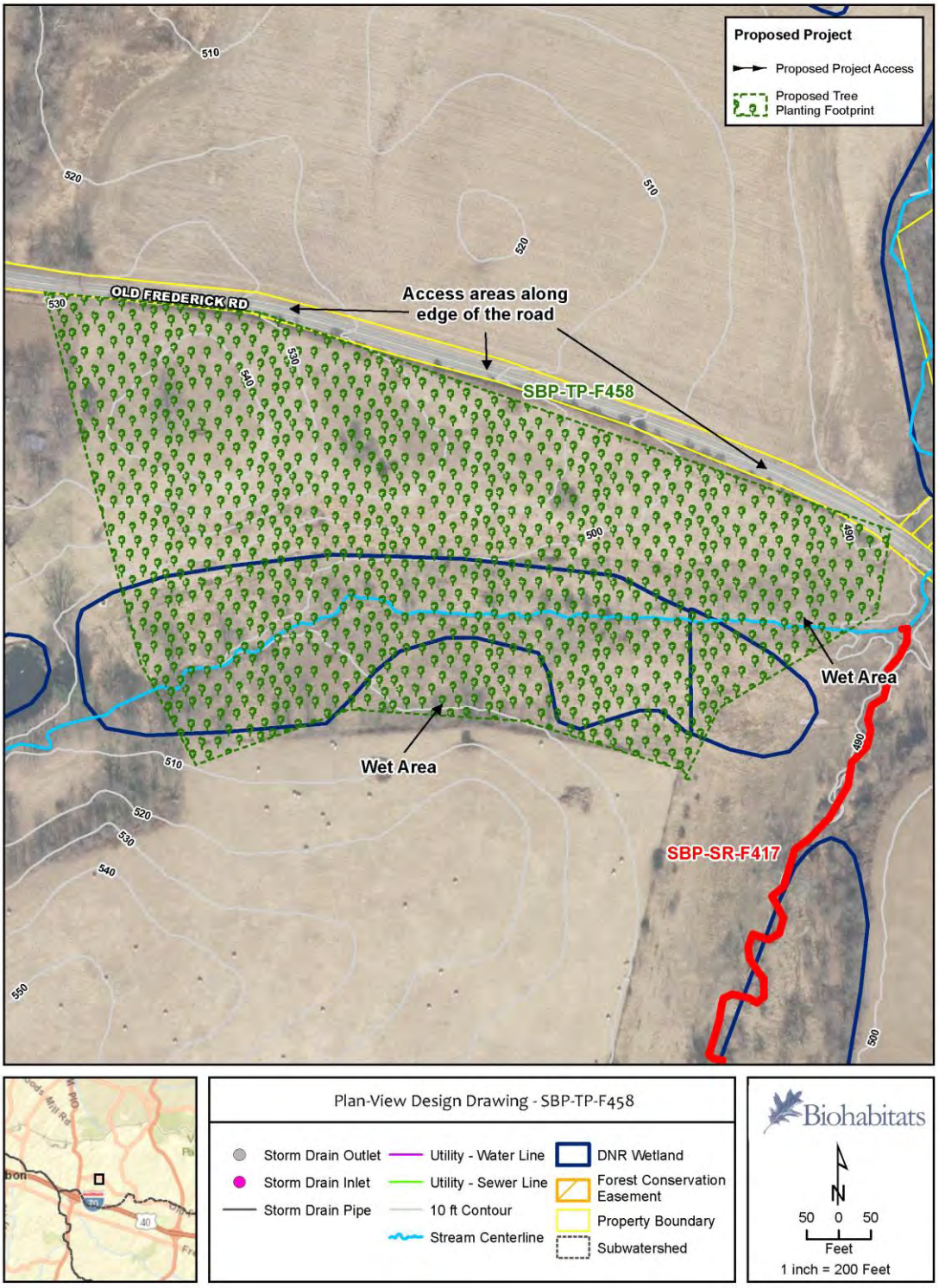
Howard County Watershed Assessment Concept Plan: Tree Planting

Site ID: SBP-TP-F458

Site Name: 14006 Old Frederick Road A

Contractor: Biohabitats

Watershed: South Branch Patapsco



APPENDIX H: POLLUTANT LOAD REDUCTION CALCULATIONS FOR CONCEPT PLAN SITES

Appendix H- Pollutant Load Reduction Calculations for Concept Plan Sites

South Branch Patapsco

Site ID	Site Name	Proposed BMP Type	Land Use (Urban)		Length (ft)	Existing Load (EOS lbs)			Removal Rate (% and lbs/LF)			Load Reduction (EOS lbs)			Impervious Credit	Estimated Total Cost
			Pervious (ac)	Impervious (ac)		TN	TP	TSS	TN	TP	TSS	TN	TP	TSS		
SBP-OF-F408	Hoods Mill 1	Outfall Stabilization			110	0.0	0.0	0.0	n/a	n/a	n/a	n/a	n/a	n/a	1.1	$165,750
SBP-OF-F402	High Stepper Trail	Step Pool Storm Conveyance	1.8	0.2	110	24.9	0.9	1,063.3	0.37	0.58	0.73	9.1	0.5	778.2	1.1	$403,000
SBP-SR-F402A	Elm Forest	Stream Restoration			1,600	0.0	0.0	0.0	0.075	0.068	45.0	120.0	108.8	72,000.0	16.0	$1,326,000
SBP-SR-F403	Camalo	Stream Restoration			1,900	0.0	0.0	0.0	0.075	0.068	45.0	142.5	129.2	85,500.0	19.0	$1,501,500
SBP-SR-F404A	Hay Meadow Branch	Stream Restoration			700	0.0	0.0	0.0	0.075	0.068	45.0	52.5	47.6	31,500.0	7.0	$669,500
SBP-SR-F405X	Blooms Lane - A	Stream Restoration			1,550	0.0	0.0	0.0	0.075	0.068	45.0	116.3	105.4	69,750.0	15.5	$1,296,750
SBP-SR-F405Z	Blooms Lane - B	Stream Restoration			1,800	0.0	0.0	0.0	0.075	0.068	45.0	135.0	122.4	81,000.0	18.0	$1,443,000
SBP-SR-F407A	Woodbine Morgan	Stream Restoration			707	0.0	0.0	0.0	0.075	0.068	45.0	53.0	48.1	31,815.0	7.1	$673,595
SBP-SR-F411B	Poplar Spring Park	Stream Restoration			500	0.0	0.0	0.0	0.075	0.068	45.0	37.5	34.0	22,500.0	5.0	$552,500
SBP-SR-F413A	The Old Station Court	Stream Restoration			802	0.0	0.0	0.0	0.075	0.068	45.0	60.2	54.5	36,090.0	8.0	$729,170
SBP-SR-F417	Old Frederick Road Tributary 1	Stream Restoration			1,536	0.0	0.0	0.0	0.075	0.068	45.0	115.2	104.4	69,120.0	15.4	$1,288,560
SBP-SR-F418	Forsythe Road	Stream Restoration			3,635	0.0	0.0	0.0	0.075	0.068	45.0	272.6	247.2	163,575.0	31.4	$2,516,475
SBP-SR-F422	High Stepper Trail	Stream Restoration			2,273	0.0	0.0	0.0	0.075	0.068	45.0	170.5	154.6	102,285.0	22.7	$1,719,705
SBP-TP-F408	Morgan Station	Tree Planting	13.2			149.9	3.6	4,007.0	0.66	0.77	0.57	98.9	2.8	2,284.0	5.0	$563,784
SBP-TP-F458	14006 Old Frederick Road A	Tree Planting	14.0			158.6	3.8	4,240.0	0.66	0.77	0.57	104.7	2.9	2,416.8	5.3	$595,816
		TOTAL	29.1	0.2	17,223	333.4	8.3	9,310.3				1,487.9	1,162.4	770,614.0	177.6	$15,445,105

Patapsco Lower North Branch

Site	Descriptive Name	Proposed BMP Type	Land Use (Urban)		Length (ft)	Existing Load (EOS lbs)			Removal Rate (% and lbs/LF)			Load Reduction (EOS lbs)			Impervious Credit	Estimated Total Cost
			Pervious (ac)	Impervious (ac)		TN	TP	TSS	TN	TP	TSS	TN	TP	TSS		
LNB-BC-D002	Waterloo Road	Extended Detention Pond - Wetland	15.6	15.5		269.4	27.5	33,639.4	0.35	0.55	0.70	94.9	15.2	23,702.2	15.5	$869,050
LNB-BC-D003	Green Tree Court	Micropool Extended Detention Pond	16.7	7.3		194.3	15.3	18,439.8	0.35	0.55	0.70	68.3	8.4	12,958.9	7.3	$567,748
LNB-BC-D004	Woodcrest Drive	Micropool Extended Detention Pond	6.6	4.2		89.7	8.0	9,701.6	0.35	0.55	0.70	31.4	4.4	6,799.9	4.2	$798,637
LNB-BC-D005	Karas Walk	Micropool Extended Detention Pond	20.6	4.4		192.9	11.9	14,019.9	0.35	0.56	0.71	68.3	6.6	9,928.0	4.4	$769,552
LNB-BC-D007	Fetlock Court	Micropool Extended Detention Pond	14.8	4.4		151.8	10.5	12,484.2	0.35	0.55	0.70	53.3	5.8	8,773.5	4.4	$696,508
LNB-BC-D008	Hunting Horn Dr	Micropool Extended Detention Pond	3.0	0.9		30.8	2.1	2,540.3	0.39	0.61	0.77	11.9	1.3	1,958.0	1.0	$505,480
LNB-BC-D009	Debbie Court	Micropool Extended Detention Pond	10.0	3.4		106.2	7.7	9,191.8	0.35	0.56	0.71	37.6	4.3	6,509.1	3.4	$566,488
LNB-BC-D010	East Glen Road	Infiltration Basin	6.7	2.1		69.4	4.9	5,847.9	0.65	0.76	0.81	44.9	3.7	4,747.4	2.3	$784,371
LNB-BC-D012	Kesting Court	Extended Detention Pond - Wetland	12.4	4.0		129.8	9.2	10,974.2	0.36	0.57	0.72	47.0	5.2	7,943.6	4.0	$600,717
LNB-BC-D013	Thornbrook Road	Extended Detention Structure, Wet	13.6	6.0		159.1	12.6	15,160.5	0.35	0.55	0.70	55.8	6.9	10,626.1	6.0	$603,990
LNB-BC-F501	Britt Ct (Deep Run)	Retention Pond (Wet Pond)	116.9	52.7		1,377.5	110.0	132,305.5	0.35	0.55	0.70	482.7	60.6	92,733.6	52.8	$1,784,514
LNB-BC-F502	Troy Hill 2	Retention Pond (Wet Pond)	12.2	21.9		309.0	36.3	44,783.8	0.39	0.61	0.77	119.4	22.0	34,606.3	25.9	$1,464,843
LNB-BC-F504	Quail Ridge	Extended Detention Structure, Wet	18.3	10.3		236.7	20.4	24,642.8	0.35	0.55	0.70	83.0	11.2	17,272.3	10.3	$731,340
LNB-BC-F505	Bonnie Branch Middle School	Extended Detention Structure, Wet	20.1	7.3		219.4	16.3	19,441.9	0.35	0.55	0.70	76.7	9.0	13,589.9	7.3	$1,194,718
LNB-BC-F506	Latchlift Ct	Extended Detention Structure, Wet	21.6	5.6		212.3	14.0	16,553.1	0.35	0.55	0.70	74.4	7.7	11,602.1	5.6	$666,159
LNB-BC-F507	Radel Court	Extended Detention Structure, Wet	18.9	4.9		186.5	12.3	14,592.9	0.35	0.55	0.70	65.2	6.8	10,200.4	4.9	$545,582
LNB-BC-F508	Greenmount Drive	Retention Pond (Wet Pond)	16.2	6.1		178.6	13.4	16,020.8	0.35	0.56	0.71	63.2	7.5	11,345.0	6.2	$540,261
LNB-BC-F509	Baltimore Washington Commerce Park	Extended Detention Structure, Wet	5.8	15.8		200.9	25.4	31,411.0	0.35	0.55	0.70	70.2	13.9	21,956.3	15.8	$694,610
LNB-BC-F510	Briarstone Court	Retention Pond (Wet Pond)	17.1	4.2		166.5	10.8	12,801.9	0.38	0.59	0.75	62.5	6.4	9,616.7	4.7	$515,808
LNB-BC-F511	Orchard Club	Extended Detention Structure, Wet	9.9	7.9		151.3	14.5	17,680.7	0.35	0.55	0.70	52.9	8.0	12,358.8	7.9	$1,070,727
LNB-BC-F513	Merle Way	Retention Pond (Wet Pond)	10.7	3.5		113.1	8.1	9,653.4	0.64	1.03	1.30	72.9	8.3	12,538.2	5.7	$568,997
LNB-BC-F514	Business Parkway 1	Retention Pond (Wet Pond)	34.8	58.2		837.9	96.9	119,491.0	0.38	0.60	0.76	318.5	57.9	90,836.3	65.4	$1,882,485
LNB-BC-F515	Manchester Way	Extended Detention Structure, Wet	8.4	3.9		99.8	8.1	9,690.3	0.36	0.56	0.71	35.7	4.5	6,926.6	4.0	$587,667
LNB-BC-F516	Santa Barbara Rd	Retention Pond (Wet Pond)	3.8	8.3		111.1	13.5	16,687.7	0.37	0.58	0.74	41.2	7.9	12,370.0	8.9	$730,546
LNB-BC-F517	Gatepost Way	Retention Pond (Wet Pond)	7.9	3.6		93.1	7.5	8,981.3	0.36	0.56	0.72	33.3	4.2	6,434.1	3.7	$717,623
LNB-BC-F518	Troy Hill 3	Retention Pond (Wet Pond)	3.8	7.5		103.3	12.3	15,249.2	0.20	0.32	0.41	21.1	4.0	6,242.4	2.6	$613,531
LNB-BC-F519	Ruxton Drive	Retention Pond (Wet Pond)	9.1	2.2		87.7	5.7	6,679.2	0.41	0.65	0.83	36.2	3.7	5,537.6	3.2	$443,840
LNB-BC-F520	Troy Hill 1	Retention Pond (Wet Pond)	5.4	4.8		87.0	8.6	10,476.6	0.35	0.56	0.71	30.9	4.8	7,436.9	4.8	$477,484
LNB-BC-F521	Milk Shed Place	Retention Pond (Wet Pond)	7.2	2.9		81.2	6.2	7,443.8	0.39	0.61	0.77	31.4	3.8	5,755.6	3.4	$732,485
LNB-BC-F522	Business Parkway 2	Retention Pond (Wet Pond)	4.5	5.4		87.1	9.3	11,465.1	0.34	0.54	0.68	29.7	5.0	7,821.6	5.0	$622,514

Patapsco Lower North Branch

Site	Descriptive Name	Proposed BMP Type	Land Use (Urban)		Length (ft)	Existing Load (EOS lbs)			Removal Rate (% and lbs/LF)			Load Reduction (EOS lbs)			Impervious Credit	Estimated Total Cost
			Pervious (ac)	Impervious (ac)		TN	TP	TSS	TN	TP	TSS	TN	TP	TSS		
LNB-BC-F523	Huntshire Drive	Retention Pond (Wet Pond)	5.4	3.8		77.2	7.1	8,618.5	0.36	0.56	0.72	27.7	4.0	6,174.2	3.9	$611,449
LNB-BC-F524	Windsor	Retention Pond (Wet Pond)	30.7	16.7		390.3	33.2	40,082.5	0.23	0.36	0.46	90.5	12.1	18,594.8	6.9	$1,080,010
LNB-BC-F601	Tiber Ridge Ct Pond	Retention Pond (Wet Pond)	26.0	7.3		261.5	17.8	21,049.1	0.35	0.56	0.71	92.8	9.9	14,941.8	7.4	$481,535
LNB-BC-F602	Glenmar Road Pond	Shallow Marsh	18.6	5.2		186.7	12.6	14,974.3	0.36	0.57	0.73	68.1	7.2	10,920.8	5.4	$249,600
LNB-BC-F603	Pasture Court pond	Infiltration Basin	10.6	3.4		111.3	7.9	9,463.2	0.58	0.68	0.73	64.9	5.4	6,918.3	3.4	$423,932
LNB-BC-F604	Terry Drive Pond	Wet Pond	7.9	3.5		92.6	7.4	8,857.7	0.87	1.38	1.75	80.6	10.2	15,526.4	4.9	$225,723
LNB-BC-F605	Chews Vineyard Pond	Step Pool Conveyance System	22.1	8.3		243.0	18.2	21,810.6	0.34	0.54	0.69	83.4	9.8	14,976.9	8.2	$426,400
LNB-BC-F606	Autumn Rust Road Pond	Created Wetland	11.6	2.9		112.9	7.4	8,717.9	0.36	0.57	0.73	41.2	4.2	6,358.0	3.0	$415,122
LNB-BC-F607	Governor Thomas Pond	Wet Pond or Infiltration Basin	8.6	3.0		92.4	6.8	8,055.3	0.39	0.62	0.78	36.2	4.2	6,314.8	3.9	$242,516
LNB-BC-F608	Old Mill Road Pond	Wet Pond	8.5	3.6		97.9	7.7	9,225.4	0.38	0.60	0.76	37.2	4.6	7,013.1	4.1	$226,490
LNB-BC-F610	Roberts Road Pond	Wet Pond	9.0	3.1		95.7	6.9	8,272.4	0.36	0.56	0.72	34.3	3.9	5,926.2	3.1	$227,508
LNB-NB-D026	Worthington Elementary	Underground Filter	0.7	0.9		14.3	1.6	1,944.6	0.35	0.55	0.70	5.0	0.9	1,366.6	0.9	$269,508
LNB-NB-D027	Worthington Elementary	Underground Sand Filter	4.2	0.8		38.3	2.3	2,638.3	0.35	0.55	0.70	13.4	1.3	1,849.2	0.8	$272,103
LNB-NB-D030	Patapsco Middle School	Bio-Swale	0.3	0.2		4.1	0.3	413.3	0.61	0.71	0.76	2.5	0.2	313.7	0.2	$245,421
LNB-NB-D072	George Howard Building Parking Lot	Bioretention	1.3	1.5		24.1	2.6	3,160.6	0.67	0.79	0.85	16.2	2.0	2,674.4	2.0	$489,385
LNB-NB-F501	Elite Spice	Bio-Swale	0.1	0.7		7.3	1.0	1,282.9	0.57	0.66	0.71	4.2	0.7	914.1	0.7	$238,329
LNB-NB-F502	Levering Ave	Infiltration Trench, Underground Filter	0.5	3.4		37.7	5.2	6,499.9	0.58	0.68	0.73	22.0	3.5	4,751.9	3.1	$586,937
LNB-NB-F503	Race Road	Infiltration Trench	1.3	1.1		20.5	2.0	2,426.2	0.60	0.70	0.75	12.3	1.4	1,822.4	1.1	$465,836
LNB-NB-F504	Furnace Ave	Underground Filter	0.0	1.1		11.2	1.7	2,063.5	0.35	0.55	0.70	3.9	0.9	1,442.4	1.1	$446,284
LNB-NB-F505	The Woodlands	Wet Pond - Wetland	2.0	1.1		25.6	2.2	2,607.0	0.38	0.60	0.76	9.8	1.3	1,987.4	1.2	$451,003
LNB-NB-F607	Rockburn Park 1	Bioswale and Bioretention	2.6	1.0		28.0	2.1	2,508.1	0.68	0.79	0.85	19.1	1.7	2,144.3	1.3	$482,846
LNB-NB-F608	Elkridge Elementary	Bioretention and Impervious Surface Removal	0.1	0.7		8.4	1.2	1,431.7	0.66	0.77	0.82	5.5	0.9	1,180.3	0.9	$240,526
LNB-NB-F609	Rockburn Park 2	Step Pool Storm Conveyance(SPSC), Bioretention, and Bioswale	5.7	1.1		52.2	3.1	3,612.4	0.68	0.79	0.85	35.7	2.5	3,088.4	1.5	$497,738
LNB-OF-D032	Worthington Elementary	Step Pool Storm Conveyance	0.1	1.7	524	17.3	2.5	3,139.0	0.32	0.50	0.64	5.5	1.3	2,003.8	1.3	$520,000
LNB-OF-F509	Coca Cola Drive Pond	Step Pool Storm Conveyance	4.3	4.5	104	75.8	7.8	9,593.3	0.06	0.09	0.12	4.4	0.7	1,123.9	0.3	$395,200
LNB-OF-F515	Deer Path Road	Outfall Stabilization			11	0.0	0.0	0.0	n/a	n/a	n/a	n/a	n/a	n/a	0.1	$133,575
LNB-OF-F516	Tyson Place	Outfall Stabilization			58	0.0	0.0	0.0	n/a	n/a	n/a	n/a	n/a	n/a	0.6	$149,500
LNB-OF-F555	Mayfield Woods	Step Pool Storm Conveyance	2.5	2.0	88	38.2	3.7	4,473.6	0.13	0.20	0.26	5.0	0.8	1,165.1	0.4	$244,400
LNB-OF-F557	Ducketts Lane Gabion South	Outfall Stabilization			46	0.0	0.0	0.0	n/a	n/a	n/a	n/a	n/a	n/a	0.5	$144,950
LNB-OF-F558	Ducketts Lane Gabion North	Outfall Stabilization			38	0.0	0.0	0.0	n/a	n/a	n/a	n/a	n/a	n/a	0.4	$142,350
LNB-OF-F561	Rowanberry Drive Outfall	Outfall Stabilization			29	0.0	0.0	0.0	n/a	n/a	n/a	n/a	n/a	n/a	0.3	$148,525
LNB-OF-F562	Capitol Mobile Outfall	Outfall Stabilization			17	0.0	0.0	0.0	n/a	n/a	n/a	n/a	n/a	n/a	0.2	$142,025
LNB-OF-F601	Carroll Wind Drive	Step Pool Storm Conveyance	3.4	1.6	43	40.5	3.2	3,902.8	0.24	0.38	0.48	9.7	1.2	1,865.6	1.3	$209,300
LNB-OF-F602	Stonehouse Drive B	Step Pool Storm Conveyance	4.9	4.9	200	84.5	8.6	10,530.2	0.36	0.56	0.72	30.3	4.9	7,560.0	5.0	$543,400
LNB-OF-F615	Thornbrook Road	Step Pool Storm Conveyance	17.0	5.9	43	182.4	13.3	15,855.4	0.10	0.16	0.20	18.2	2.1	3,160.3	4.6	$209,300
LNB-OF-F617	Courthouse Parking Lot A	Step Pool Storm Conveyance	0.2	0.6	250	7.8	1.0	1,260.1	0.40	0.62	0.79	3.1	0.6	999.2	0.9	$608,400
LNB-OF-F635	Normandy Woods	Step Pool Storm Conveyance	14.2	13.4	217	238.0	24.0	29,326.2	0.25	0.39	0.49	58.5	9.3	14,413.6	11.6	$565,500
LNB-OF-F644	Millers Way A	Step Pool Storm Conveyance	8.0	3.2	210	89.8	6.9	8,226.0	0.37	0.58	0.74	33.2	4.0	6,088.6	3.4	$556,400
LNB-OF-F680	Courthouse Parking B	Step Pool Storm Conveyance	0.1	0.3	166	3.5	0.4	540.0	0.40	0.62	0.79	1.4	0.2	428.2	0.4	$499,200
LNB-SR-F613D-PO001	Millers Way B	Step Pool Storm Conveyance	13.8	5.7	120	156.7	12.1	14,529.6	0.22	0.35	0.45	35.2	4.3	6,526.3	4.8	$439,400
LNB-SR-F613D-PO002	Milldam Ct	Step Pool Storm Conveyance	4.6	1.6	60	49.1	3.6	4,237.4	0.35	0.55	0.70	17.1	2.0	2,953.7	1.6	$231,400
LNB-SR-F613D-PO003	Stone Hollow Ct	Step Pool Storm Conveyance	6.5	2.4	100	71.2	5.3	6,395.0	0.33	0.52	0.66	23.4	2.7	4,199.3	2.3	$413,400
LNB-SR-F616A-PO002	Town and Country	Step Pool Storm Conveyance	1.1	1.2	110	19.4	2.0	2,485.1	0.39	0.61	0.77	7.5	1.2	1,914.2	1.4	$426,400
LNB-SR-F626A-PO001	Bonnie Branch Tributary	Step Pool Storm Conveyance	13.1	2.4	77	119.2	7.0	8,229.9	0.35	0.55	0.70	41.8	3.9	5,768.4	2.4	$253,500
LNB-SR-F627E-PO001	Bonnie Branch	Step Pool Storm Conveyance	10.0	2.1	50	93.1	5.7	6,692.7	0.32	0.50	0.64	29.9	2.9	4,293.8	1.9	$218,400
LNB-SR-F634D-PO001	Cedar Creek Ct	Step Pool Storm Conveyance	4.7	2.5	80	59.5	5.1	6,104.7	0.35	0.55	0.70	20.7	2.8	4,255.3	2.5	$257,400
LNB-SR-D046	Tiber Branch Concept A	Stream Restoration			2,129	0.0	0.0	0.0	0.075	0.068	45.0	159.7	144.8	95,805.0	21.3	$1,635,465
LNB-SR-D048	Sucker Branch Concept B	Stream Restoration			823	0.0	0.0	0.0	0.075	0.068	45.0	61.7	56.0	37,035.0	8.2	$741,455
LNB-SR-D053	Sucker Branch Concept E	Stream Restoration			415	0.0	0.0	0.0	0.075	0.068	45.0	31.1	28.2	18,675.0	4.2	$502,775
LNB-SR-F501A	Elibank Drive A	Stream Restoration			1,010	0.0	0.0	0.0	0.075	0.068	45.0	75.8	68.7	45,450.0	10.1	$850,850
LNB-SR-F501B	Elibank Drive B	Stream Restoration			1,247	0.0	0.0	0.0	0.075	0.068	45.0	93.5	84.8	56,115.0	12.5	$1,119,495
LNB-SR-F501D	Elibank Drive D	Stream Restoration			607	0.0	0.0	0.0	0.075	0.068	45.0	45.5	41.3	27,315.0	6.1	$615,095
LNB-SR-F504A	Smith Avenue	Stream Restoration			1,541	0.0	0.0	0.0	0.075	0.068	45.0	115.6	104.8	69,345.0	15.4	$1,291,485
LNB-SR-F505A	Montevideo Road	Stream Restoration			953	0.0	0.0	0.0	0.075	0.068	45.0	71.5	64.8	42,885.0	9.5	$817,505
LNB-SR-F505D	Montevideo Road North	Stream Restoration			616	0.0	0.0	0.0	0.075	0.068	45.0	46.2	41.9	27,720.0	6.2	$620,360
LNB-SR-F506	Coca Cola Drive	Stream Restoration			2,865	0.0	0.0	0.0	0.075	0.068	45.0	214.9	194.8	128,925.0	28.7	$2,066,025
LNB-SR-F507A	Montgomery Run Road	Stream Restoration			1,065	0.0	0.0	0.0	0.075	0.068	45.0	79.9	72.4	47,925.0	10.7	$883,025
LNB-SR-F508A	Sunny Field Court A	Stream Restoration			1,061	0.0	0.0	0.0	0.075	0.068	45.0	79.6	72.1	47,745.0	10.6	$880,685
LNB-SR-F508B	Sunny Field Court B	Stream Restoration			945	0.0	0.0	0.0	0.075	0.068	45.0	70.9	64.3	42,525.0	9.5	$812,825

Patapsco Lower North Branch

Site	Descriptive Name	Proposed BMP Type	Land Use (Urban)		Length (ft)	Existing Load (EOS lbs)			Removal Rate (% and lbs/LF)			Load Reduction (EOS lbs)			Impervious Credit	Estimated Total Cost
			Pervious (ac)	Impervious (ac)		TN	TP	TSS	TN	TP	TSS	TN	TP	TSS		
LNB-SR-F510	Rockburn Park	Stream Restoration			6,892	0.0	0.0	0.0	0.075	0.068	45.0	516.9	468.7	310,140.0	68.9	$4,421,820
LNB-SR-F511	Rockburn Branch/Landing Road	Stream Restoration			2,471	0.0	0.0	0.0	0.075	0.068	45.0	185.3	168.0	111,195.0	24.7	$1,835,535
LNB-SR-F512A	Timbers of Troy Golf Course	Stream Restoration			1,564	0.0	0.0	0.0	0.075	0.068	45.0	117.3	106.4	70,380.0	15.6	$1,304,940
LNB-SR-F513	Woodcrest Drive	Stream Restoration			1,980	0.0	0.0	0.0	0.075	0.068	45.0	148.5	134.6	89,100.0	19.8	$1,548,300
LNB-SR-F514A	Mayfield Woods	Stream Restoration			1,418	0.0	0.0	0.0	0.075	0.068	45.0	106.4	96.4	63,810.0	14.2	$1,219,530
LNB-SR-F515B	Troy Hill Drive	Stream Restoration			2,321	0.0	0.0	0.0	0.075	0.068	45.0	174.1	157.8	104,445.0	23.2	$1,747,785
LNB-SR-F516	Capitol Mobile	Stream Restoration			1,676	0.0	0.0	0.0	0.075	0.068	45.0	125.7	114.0	75,420.0	16.8	$1,370,460
LNB-SR-F517	Rowanberry Drive	Stream Restoration			4,201	0.0	0.0	0.0	0.075	0.068	45.0	315.1	285.7	189,045.0	42.0	$2,847,585
LNB-SR-F518	Koffel Court	Stream Restoration			1,512	0.0	0.0	0.0	0.075	0.068	45.0	113.4	102.8	68,040.0	15.1	$1,274,520
LNB-SR-F518A	Landing Road	Stream Restoration			271	0.0	0.0	0.0	0.075	0.068	45.0	20.3	18.4	12,195.0	2.7	$418,535
LNB-SR-F519X	Brandons Way	Stream Restoration			1,041	0.0	0.0	0.0	0.075	0.068	45.0	78.1	70.8	46,845.0	10.4	$868,985
LNB-SR-F519Z	Gardenview Drive	Stream Restoration			2,074	0.0	0.0	0.0	0.075	0.068	45.0	155.6	141.0	93,330.0	20.7	$1,603,290
LNB-SR-F522B	Kit Kat Road	Stream Restoration			2,629	0.0	0.0	0.0	0.075	0.068	45.0	197.2	178.8	118,305.0	26.3	$1,927,965
LNB-SR-F523	Wesley Lane	Stream Restoration			2,659	0.0	0.0	0.0	0.075	0.068	45.0	199.4	180.8	119,655.0	26.6	$1,945,515
LNB-SR-F552A	Ducketts Lane	Stream Restoration			3,324	0.0	0.0	0.0	0.075	0.068	45.0	249.3	226.0	149,580.0	33.2	$2,334,540
LNB-SR-F554	Summer Home Terrace	Stream Restoration			893	0.0	0.0	0.0	0.075	0.068	45.0	67.0	60.7	40,185.0	8.9	$782,405
LNB-SR-F604A	Taylor Farm	Stream Restoration			1,260	0.0	0.0	0.0	0.075	0.068	45.0	94.5	85.7	56,700.0	12.6	$1,127,100
LNB-SR-F605B	Dorchester Way	Stream Restoration			640	0.0	0.0	0.0	0.075	0.068	45.0	48.0	43.5	28,800.0	6.4	$634,400
LNB-SR-F607	Gudel Drive	Stream Restoration			3,565	0.0	0.0	0.0	0.075	0.068	45.0	267.4	242.4	160,425.0	35.7	$2,475,525
LNB-SR-F610C	Carrie Way	Stream Restoration			320	0.0	0.0	0.0	0.075	0.068	45.0	24.0	21.8	14,400.0	3.2	$447,200
LNB-SR-F616	North Ridge Road	Stream Restoration			3,365	0.0	0.0	0.0	0.075	0.068	45.0	252.4	228.8	151,425.0	33.7	$2,358,525
LNB-SR-F623A	Tiber Falls Drive	Stream Restoration			550	0.0	0.0	0.0	0.075	0.068	45.0	41.3	37.4	24,750.0	5.5	$581,750
LNB-SR-F624E	Taylor Family Association	Stream Restoration			950	0.0	0.0	0.0	0.075	0.068	45.0	71.3	64.6	42,750.0	9.5	$815,750
LNB-SR-F626	Bonnie Branch Tributary	Stream Restoration			1,410	0.0	0.0	0.0	0.075	0.068	45.0	105.8	95.9	63,450.0	14.1	$1,214,850
LNB-SR-F627D	Wharff Lane	Stream Restoration			1,530	0.0	0.0	0.0	0.075	0.068	45.0	114.8	104.0	68,850.0	15.3	$1,285,050
LNB-SR-F628	Worthington Way	Stream Restoration			2,165	0.0	0.0	0.0	0.075	0.068	45.0	162.4	147.2	97,425.0	21.7	$1,656,525
LNB-SR-F628A	Twin Stream Drive	Stream Restoration			245	0.0	0.0	0.0	0.075	0.068	45.0	18.4	16.7	11,025.0	2.5	$403,325
LNB-SR-F632	New Cut Road	Stream Restoration			1,550	0.0	0.0	0.0	0.075	0.068	45.0	116.3	105.4	69,750.0	15.5	$1,296,750
LNB-SR-F634D	Autumn Rust Road	Stream Restoration			615	0.0	0.0	0.0	0.075	0.068	45.0	46.1	41.8	27,675.0	6.2	$619,775
LNB-SR-F651A	Millers Way	Stream Restoration			115	0.0	0.0	0.0	0.075	0.068	45.0	8.6	7.8	5,175.0	1.2	$197,275
LNB-SR-F681A	Doncaster Drive	Stream Restoration			570	0.0	0.0	0.0	0.075	0.068	45.0	42.8	38.8	25,650.0	5.7	$593,450
LNB-TP-F501	Landing Road	Tree Planting	0.5			3.4	0.1	132.1	0.66	0.77	0.57	2.2	0.1	75.3	0.2	$32,552
LNB-TP-F504	Mayfield Woods Oaks	Tree Planting	1.5			10.6	0.4	410.5	0.66	0.77	0.57	7.0	0.3	234.0	0.6	$73,736
LNB-TP-F550	Rockburn Park Disc Golf	Tree Planting	0.9			6.7	0.2	258.7	0.66	0.77	0.57	4.4	0.2	147.5	0.4	$51,272
LNB-TP-F552	Landing Road	Tree Planting	0.7			5.1	0.2	199.6	0.66	0.77	0.57	3.4	0.2	113.8	0.3	$42,536
LNB-TP-F602	Old Frederick Road Pumping Station	Tree Planting	0.5			3.7	0.1	143.4	0.66	0.77	0.57	2.4	0.1	81.7	0.2	$34,216
LNB-TP-F603	Dorsey Spring Court	Tree Planting	1.2			8.5	0.3	331.8	0.66	0.77	0.57	5.6	0.2	189.1	0.5	$62,088
LNB-TP-F604	Carroll Wind Drive	Tree Planting	1.9			14.0	0.5	545.5	0.66	0.77	0.57	9.2	0.4	310.9	0.7	$93,704
LNB-TP-F605	Kidwell Place	Tree Planting	0.4			3.1	0.1	120.9	0.66	0.77	0.57	2.0	0.1	68.9	0.2	$30,888
LNB-TP-F616	College Ave	Tree Planting	3.1			22.7	0.8	882.9	0.66	0.77	0.57	15.0	0.6	503.3	1.2	$143,624
LNB-TP-F618	Mt Hebron High School	Tree Planting	1.9			13.9	0.5	539.8	0.66	0.77	0.57	9.2	0.4	307.7	0.7	$92,872
		TOTAL	771.4	419.0	73,694	9,804.3	833.0	1,006,853.2				8,855.3	5,290.9	3,896,464.3	1,132.9	$96,749,890

Appendix H- Pollutant Load Reduction Calculations for Concept Plan Sites

Patapsco Lower North Branch- Bacteria

Site ID	Site Name	Proposed BMP Type	Land Use (Urban)		Length (ft)	Bacteria			Impervious Credit
			Pervious (ac)	Impervious (ac)		Existing Load (MPN/100mL/yr)	Removal Rate (%)	Load Reduction (MPN/100mL/yr)	
LNB-BC-D002	Waterloo Road	Extended Detention Pond - Wetland	15.64	15.51		149.8	0.6	89.9	15.51
LNB-BC-D003	Green Tree Court	Micropool Extended Detention Pond	16.7	7.29		115.4	0.6	69.2	7.29
LNB-BC-D004	Woodcrest Drive	Micropool Extended Detention Pond	6.61	4.16		51.8	0.6	31.1	4.16
LNB-BC-D005	Karas Walk	Micropool Extended Detention Pond	20.56	4.37		119.9	0.6	71.9	4.37
LNB-BC-D007	Fetlock Court	Micropool Extended Detention Pond	14.83	4.41		92.5	0.6	55.5	4.41
LNB-BC-D009	Debbie Court	Micropool Extended Detention Pond	9.96	3.39		64.2	0.6	38.5	3.39
LNB-BC-D010	East Glen Road	Infiltration Basin	6.65	2.11		42.1	0.9	37.9	2.32
LNB-BC-F501	Britt Ct (Deep Run)	Retention Pond (Wet Pond)	116.91	52.74		816	0.95	775.2	52.84
LNB-BC-F502	Troy Hill 2	Retention Pond (Wet Pond)	12.16	21.94		164	0.95	155.8	25.86
LNB-BC-F504	Quail Ridge	Extended Detention Structure, Wet	18.31	10.34		137.8	0.6	82.7	10.34
LNB-BC-F508	Greenmount Drive	Retention Pond (Wet Pond)	16.21	6.08		107.2	0.95	101.8	6.15
LNB-BC-F509	Baltimore Washington Commerce Park	Extended Detention Structure, Wet	5.77	15.8		103.8	0.6	62.3	15.8
LNB-BC-F511	Orchard Club	Extended Detention Structure, Wet	9.91	7.9		85.7	0.6	51.4	7.9
LNB-BC-F513	Merle Way	Retention Pond (Wet Pond)	10.73	3.52		68.5	0.95	65.1	5.73
LNB-BC-F514	Business Parkway 1	Retention Pond (Wet Pond)	34.79	58.19		447.2	0.95	424.8	65.44
LNB-BC-F515	Manchester Way	Extended Detention Structure, Wet	8.38	3.89		59	0.6	35.4	3.98
LNB-BC-F516	Santa Barbara Rd	Retention Pond (Wet Pond)	3.83	8.28		58.2	0.95	55.3	8.87
LNB-BC-F517	Gatepost Way	Retention Pond (Wet Pond)	7.87	3.59		55.1	0.95	52.3	3.68
LNB-BC-F518	Troy Hill 3	Retention Pond (Wet Pond)	3.81	7.52		54.5	0.95	51.8	2.57
LNB-BC-F519	Ruxton Drive	Retention Pond (Wet Pond)	9.07	2.19		54.2	0.95	51.5	3.21
LNB-BC-F520	Troy Hill 1	Retention Pond (Wet Pond)	5.41	4.75		48.9	0.95	46.5	4.82
LNB-BC-F521	Milk Shed Place	Retention Pond (Wet Pond)	7.23	2.87		48.6	0.95	46.2	3.38
LNB-BC-F522	Business Parkway 2	Retention Pond (Wet Pond)	4.5	5.41		47.7	0.95	45.3	4.98
LNB-BC-F523	Huntshire Drive	Retention Pond (Wet Pond)	5.44	3.76		44.3	0.95	42.1	3.85
LNB-BC-F524	Windsor	Retention Pond (Wet Pond)	30.71	16.68		227.9	0.95	216.5	6.9
LNB-BC-F602	Glenmar Road Pond	Shallow Marsh	18.59	5.17		114.3	0.95	108.6	5.42
LNB-NB-F501	Elite Spice	Bio-Swale	0.07	0.67		3.6	-0.05	-0.2	0.67
LNB-NB-F503	Race Road	Infiltration Trench	1.32	1.09		11.6	0.9	10.4	1.09
LNB-NB-F504	Furnace Ave	Underground Filter	0.03	1.09		5.4	0.6	3.2	1.09
LNB-NB-F505	The Woodlands	Wet Pond - Wetland	2.03	1.08		15	0.95	14.3	1.22
LNB-NB-F608	Elkridge Elementary	Bioretention and Impervious Surface Removal	0.13	0.74		4.2	0.7	2.9	0.86
LNB-OF-F509	Coca Cola Drive Pond	Step Pool Storm Conveyance	4.28	4.45	104	42	0	0	0.34
LNB-OF-F515	Deer Path Road	Outfall Stabilization			11	0	0	0	0.11
LNB-OF-F516	Tyson Place	Outfall Stabilization			58	0	0	0	0.58
LNB-OF-F555	Mayfield Woods	Step Pool Storm Conveyance	2.5	2	88	21.6	0	0	0.37
LNB-OF-F557	Ducketts Lane Gabion South	Outfall Stabilization			46	0	0	0	0.46
LNB-OF-F558	Ducketts Lane Gabion North	Outfall Stabilization			38	0	0	0	0.38
LNB-OF-F561	Rowanberry Drive Outfall	Outfall Stabilization			29	0	0	0	0.29
LNB-OF-F562	Capitol Mobile Outfall	Outfall Stabilization			17	0	0	0	0.17
LNB-SR-F504A	Smith Avenue	Stream Restoration			1541	0	0	0	15.41
LNB-SR-F505A	Montevideo Road	Stream Restoration			953	0	0	0	9.53
LNB-SR-F505D	Montevideo Road North	Stream Restoration			616	0	0	0	6.16
LNB-SR-F506	Coca Cola Drive	Stream Restoration			2865	0	0	0	28.65
LNB-SR-F507A	Montgomery Run Road	Stream Restoration			1065	0	0	0	10.65
LNB-SR-F512A	Timbers of Troy Golf Course	Stream Restoration			1564	0	0	0	15.64
LNB-SR-F513	Woodcrest Drive	Stream Restoration			1980	0	0	0	19.8
LNB-SR-F514A	Mayfield Woods	Stream Restoration			1418	0	0	0	14.18
LNB-SR-F515B	Troy Hill Drive	Stream Restoration			2321	0	0	0	23.21
LNB-SR-F516	Capitol Mobile	Stream Restoration			1676	0	0	0	16.76
LNB-SR-F517	Rowanberry Drive	Stream Restoration			4201	0	0	0	42.01
LNB-SR-F519X	Brandons Way	Stream Restoration			1041	0	0	0	10.41
LNB-SR-F519Z	Gardenview Drive	Stream Restoration			2074	0	0	0	20.74
LNB-SR-F522B	Kit Kat Road	Stream Restoration			2629	0	0	0	26.29
LNB-SR-F523	Wesley Lane	Stream Restoration			2659	0	0	0	26.59
LNB-SR-F552A	Ducketts Lane	Stream Restoration			3324	0	0	0	33.24
LNB-TP-F504	Mayfield Woods Oaks	Tree Planting	1.46			7	0	0	0.55
		TOTAL	432.4	292.98	32318	3489	24.25	2895.2	610.62