

This City of Annapolis Stormwater Management Inventory and Watershed Improvement Plan Interim Submittal (Scope Tasks 2, 3, and 6) summarizes the initial evaluation and selection of potential Best Management Practices (BMPs) for continued evaluation. The BMPs will help the City to meet the water quality and load reduction requirements of the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit and the Chesapeake Bay Total Maximum Daily Load (TMDL). The primary goal of these tasks is to perform preliminary analyses to identify potential new and retrofit BMPs for further analyses.

Desktop Analysis (Scope Task 2): AECOM staff reviewed data provided by City of Annapolis prior to the field assessment. This data included Geographic Information System (GIS) data, such as stormwater systems, sanitary sewer lines, water lines, City-owned property, park locations, and 2-foot contour data. Additional GIS information such as impervious cover and sub-watershed boundaries were downloaded from Anne Arundel County's website. The existing stormwater management facilities that were digitized as a part of Task 1 were also used for the desktop analysis.

A desktop analysis was conducted to identify potential new and retrofit opportunities for stormwater management facilities. The City also requested that AECOM evaluate three sites that reported drainage problems and are being considered for acquisition by the City.

Sixty-five sites, including the City requested sites, were selected for field assessment:

- 20 existing stormwater management facilities
- 45 potential new stormwater management facility sites

AECOM further evaluated these sites in the field to assess the feasibility for potential improvements.

Field Reconnaissance and Identification of Stormwater Management Opportunities (Scope Task 3): AECOM staff investigated 65 locations in the City to assess stormwater management and identify potential solutions. This information was documented on field data sheets. Copies of the field data sheets will be provided as part of the final submittal. Photographs from the site visit are provided digitally as Appendix A. Figure 1 provides an overview of site locations.

AECOM accessed 62 of the 65 sites. Three sites were inaccessible because of existing grading, fencing, or other site constraints. Therefore, these sites were not considered feasible locations for potential stormwater management projects.

AECOM assessed 62 sites and collected the following information for each site:

- Location
- Ownership
- Land-use type of the surrounding drainage area
- Access constraints
- Utilities present
- Potential permits / regulatory approvals required

- Site visibility to public
- Flooding concerns
- Recommendations for the site
- Sketch of site and potential improvement measure

Appendix B provides a table summarizing the data from the site assessment. Based on the field investigation, 45 sites have the potential for stormwater management improvements. The remaining 17 accessible sites are not considered appropriate for potential improvements because of significant site constraints (e.g., utilities, major accessibility concerns, small drainage areas) where the cost of implementation will outweigh the project benefits. Reforestation or stream restoration are recommended for some sites as alternatives to stormwater management. Multiple potential facilities were proposed at 4 sites, resulting in 52 total potential facilities.

At the City request, AECOM investigated flooding problems west of McKendree Avenue and at Harness Creek View Court. Stormwater management alternatives that improve water quality and may improve flooding were identified during the inspection of the existing Harness Creek View Court wet pond. The drainage recommendations for these sites will be discussed in detail in the final report.

The City also requested that AECOM evaluate a property offered to the City as a donation north of Lincoln Drive (owned by the Baldwin Family) and another potential donation near the intersection of Ridgewood Street and Brewer Avenue (owned by the Schubert Family). The potential water quality benefits for accepting the donation of each site were evaluated.

In addition to the potential stormwater management opportunities identified as a part of this study, several restoration projects are currently planned within the City to be implemented to improve natural resources. The City requested that AECOM avoid investigating sites where restoration projects are planned. Five projects are currently underway or planned by the Spa Creek Conservancy:

1. Street Ends Project, throughout the Spa Creek watershed (including restoring one ravine using step pool technology; installing three street-end park biocells; one DPW Stormwater Retrofit-Fuel Station Canopy, one pocket park, and stormwater retrofits at two business locations);
2. Headwaters of Spa Creek Stream Restoration, a 5,000 linear foot stream restoration from the headwaters of Spa Creek from the Chinquapin Round Road industrial park to the Chesapeake Children's Museum;
3. Hawkins Cove Restoration Project, an assessment of the City of Annapolis Housing Authority on Madison Street, and surrounding neighborhoods bordering Truxtun Park;
4. Hawkins Cove Restoration Biocell Showcase – Conservation Landscaping, at the City of Annapolis Housing Authority on Madison Street; and,

5. Hawkins Cove Reforestation, an ongoing project with community youth and young adults to plant trees, install stormwater planters, and implement downspout diversion to native plantings.

The public housing adjacent to Madison Street is included as part of the three Hawkins Cove projects; therefore, no recommendations for this area were included as part of this study.

Two projects are planned by South River Federation:

1. Bywater Stream and Wetland Restoration project at Kingsport City Park, and
2. Allen Apartments Branch Project (Church Creek Phase III), a 1,400 linear foot urban outfall stabilization project, which is a portion of a multi-pronged effort to improve urban habitat in southwest Annapolis' Church Creek.

Recommendations for Kingsport City Park were not included as part of the field reconnaissance due to the planned South River Federation projects.

Development of Priority Ranking Matrix (Scope Task 3 and 6): The potential BMPs were prioritized using weighted numeric criteria to identify the highest ranked projects. The details of the evaluation criteria are provided in Appendix C. The 52 potential improvements were ranked as part of this analysis.

Of the highly ranked potential BMPs, concept designs and feasibility assessments will be developed as a part of Task 5 for the 20 highest ranked restoration measures, as selected by the City.

The City requested that the projects be divided into four groups for ranking based on their location in the watershed. The City of Annapolis includes the Severn River and South River watersheds, which are subdivided into 12 sub-watersheds. Spa Creek and Back Creek are the largest sub-watersheds and the remaining 10 sub-watersheds were grouped into two groups based on their location in Severn River or South River watershed. These grouping are provided in Table 1, and include:

- Spa Creek;
- Back Creek;
- Severn River Sub-watersheds; and,
- South River Sub-watersheds.

Figures 2-5 provide potential site locations in each of the four watersheds.

Table 1: Prioritization Grouping

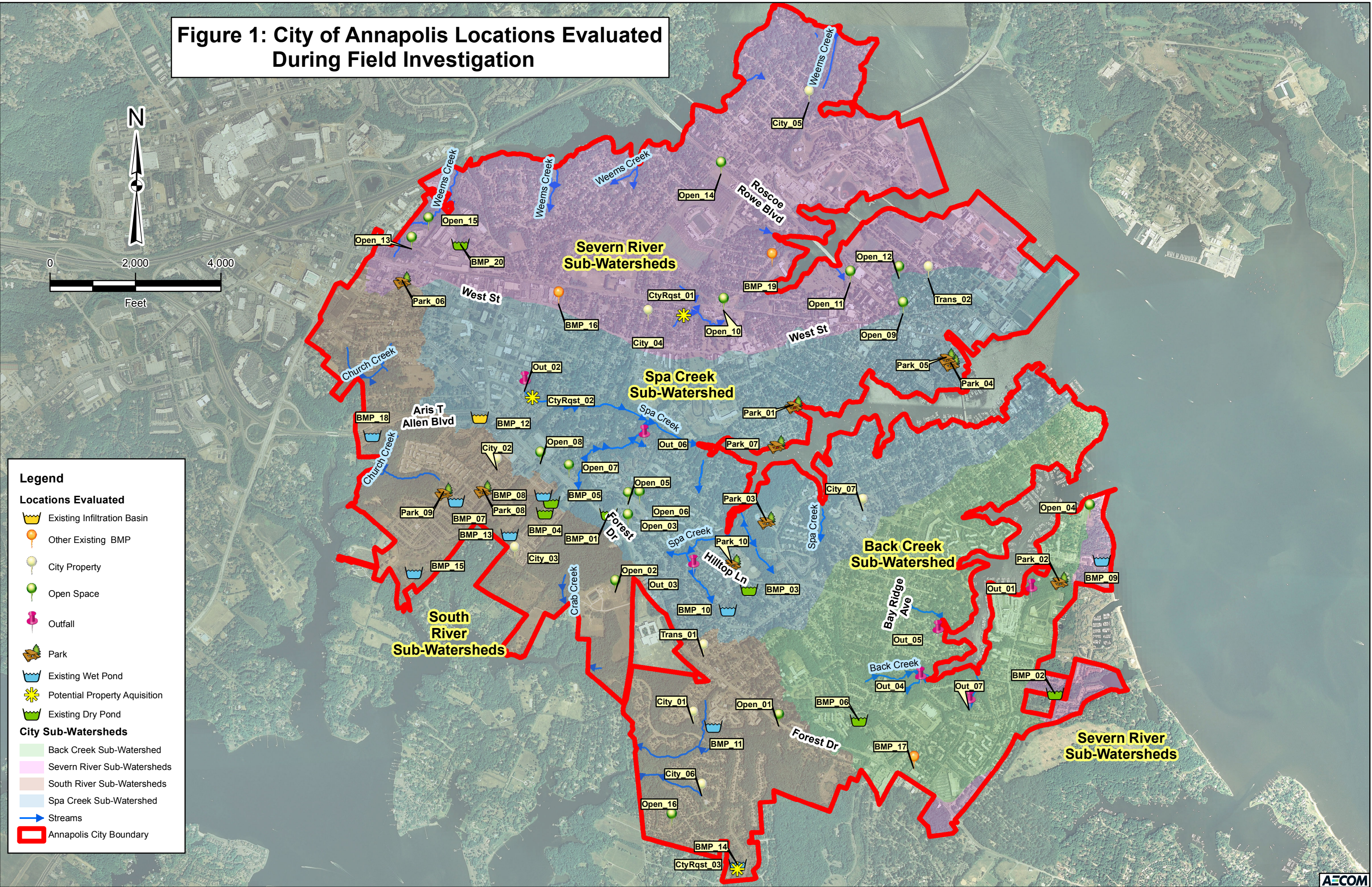
Group Number	Watershed Name	Sub-watersheds Included
1	Spa Creek Sub-Watershed	Spa Creek
2	Back Creek Sub-Watershed	Back Creek
3	Severn River Sub-Watersheds	College Creek, Weems Creek, Chase Pond, Lake Ogleton, Severn River Tidal
4	South River Sub-Watersheds	Church Creek, Crab Creek, Aberdeen Creek, Duvall Creek, Harness Creek

The priority ranking matrix with the score for each criterion is provided in Appendix D. The appendix is divided into four priority ranking tables (for each Watershed Group) arranged by rank.

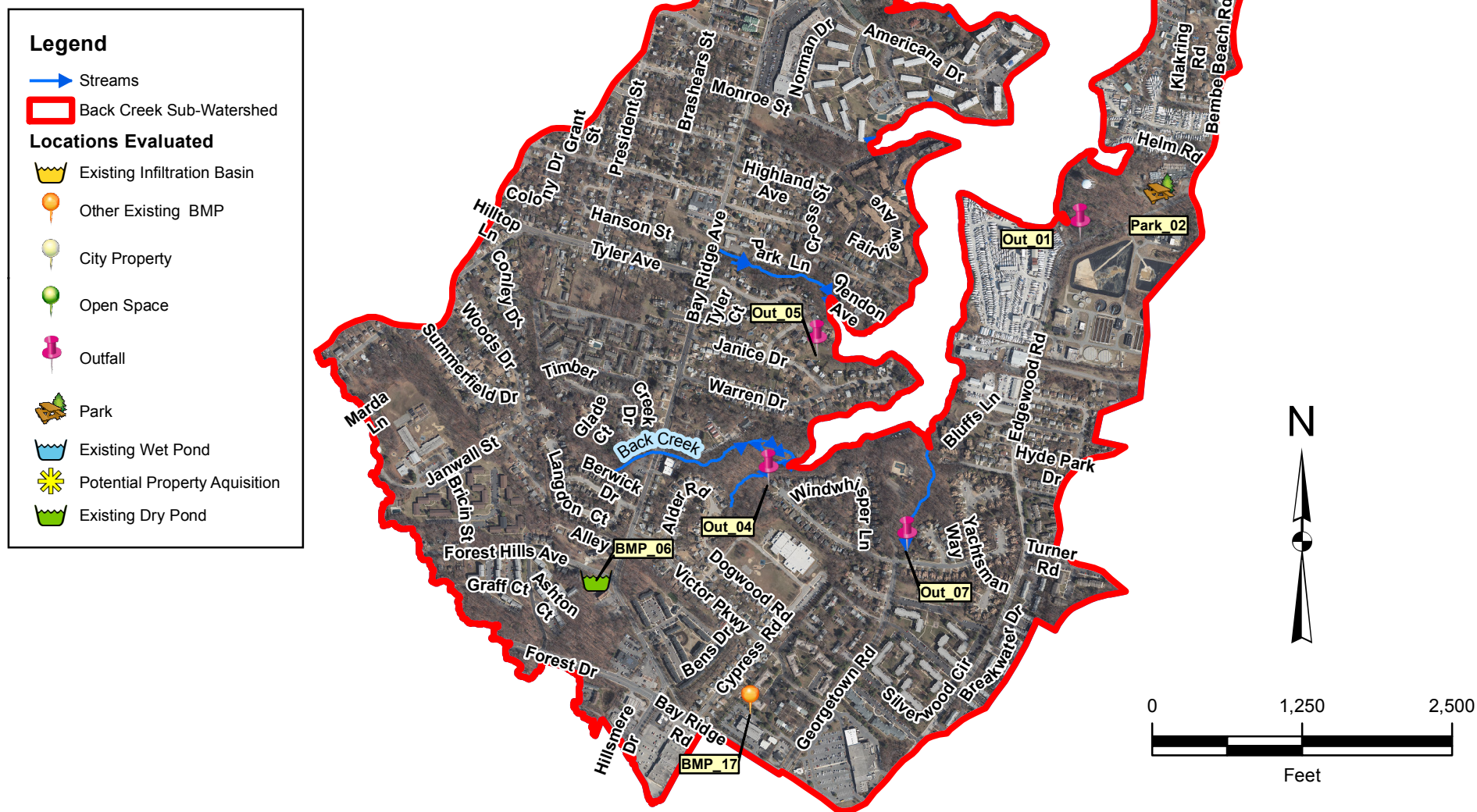
Evaluation of Potential Improvements (Task 3): AECOM developed an evaluation of potential improvements for the field-assessed sites. The summary table shown in Appendix B includes existing site summary information, proposed restoration measures, and a feasibility assessment. This evaluation table will also be included as a part of the final report. As part of Task 6, the ranking for the 20 solutions recommended for concept designs will be reevaluated based on concept level costs, treatment areas, and nutrient removal rates.

Next Steps: This interim submittal will assist the City in selecting 20 sites to develop conceptual designs. These designs will include detailed layout of the proposed BMP, water quality benefits, and cost estimates. The 20 sites selected for concept design will be ranked with updated prioritization criteria using detailed information provided with the designs.

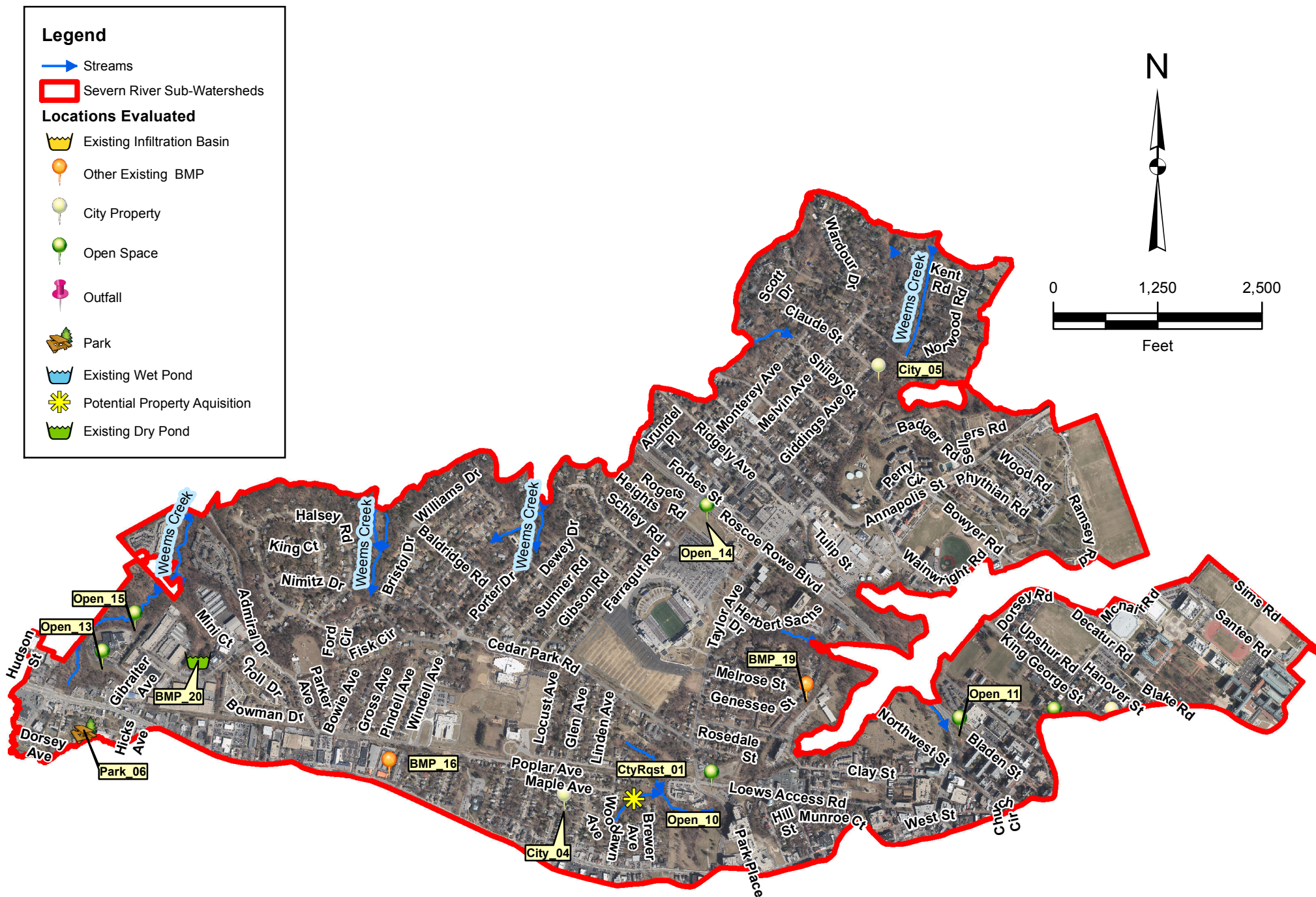
Figure 1: City of Annapolis Locations Evaluated During Field Investigation



**Figure 2: City of Annapolis Back Creek Sub-Watershed
Locations Evaluated During Field Investigation**



**Figure 3: City of Annapolis Severn River Sub-Watersheds (North)
Locations Evaluated During Field Investigation**



**Figure 4: City of Annapolis Severn River Sub-Watersheds (South)
Locations Evaluated During Field Investigation**



**Figure 5: City of Annapolis South River Sub-Watersheds
Locations Evaluated During Field Investigation**

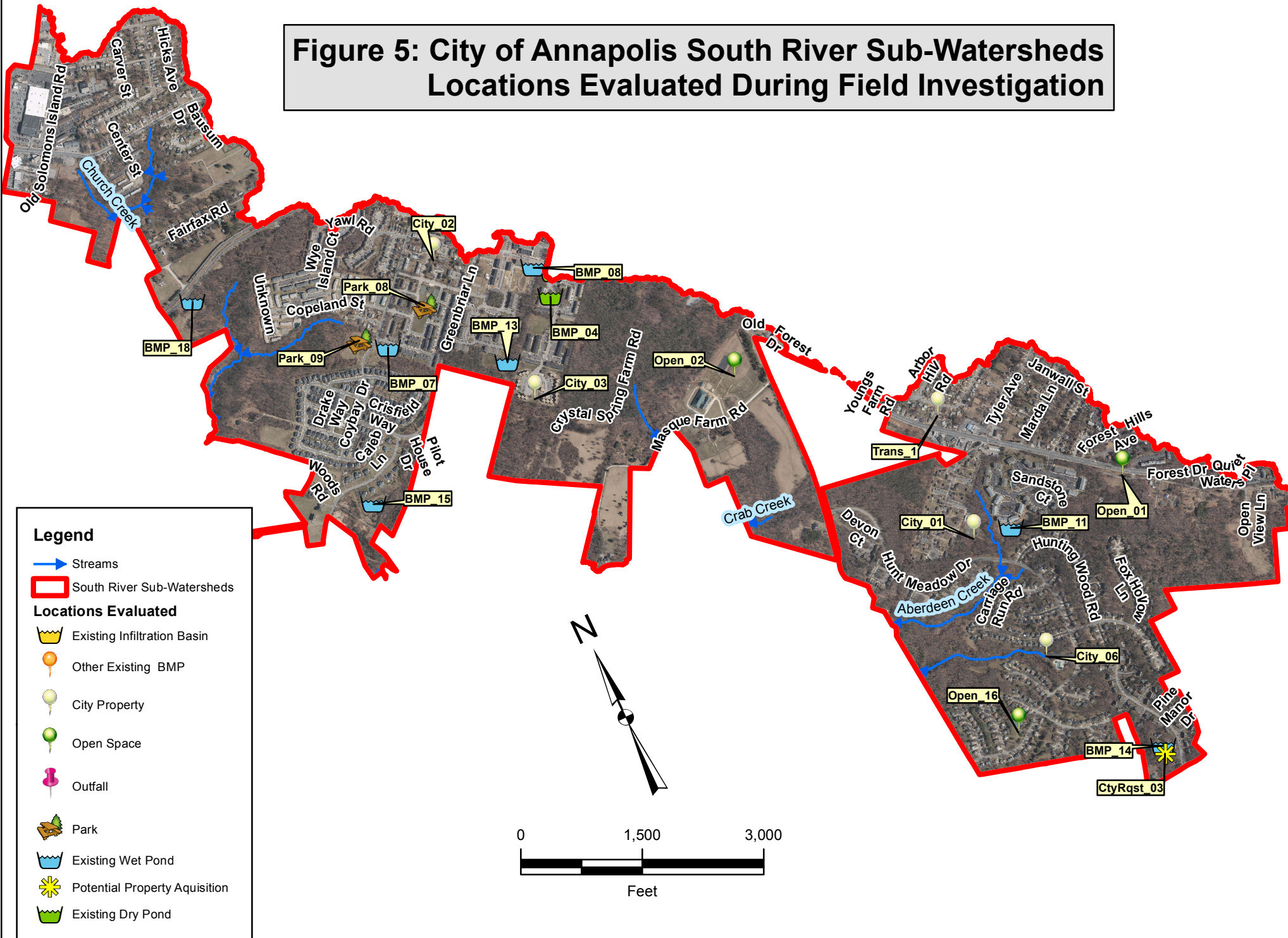


Figure 6: City of Annapolis Spa Creek Sub-Watershed Locations Evaluated During Field Investigation

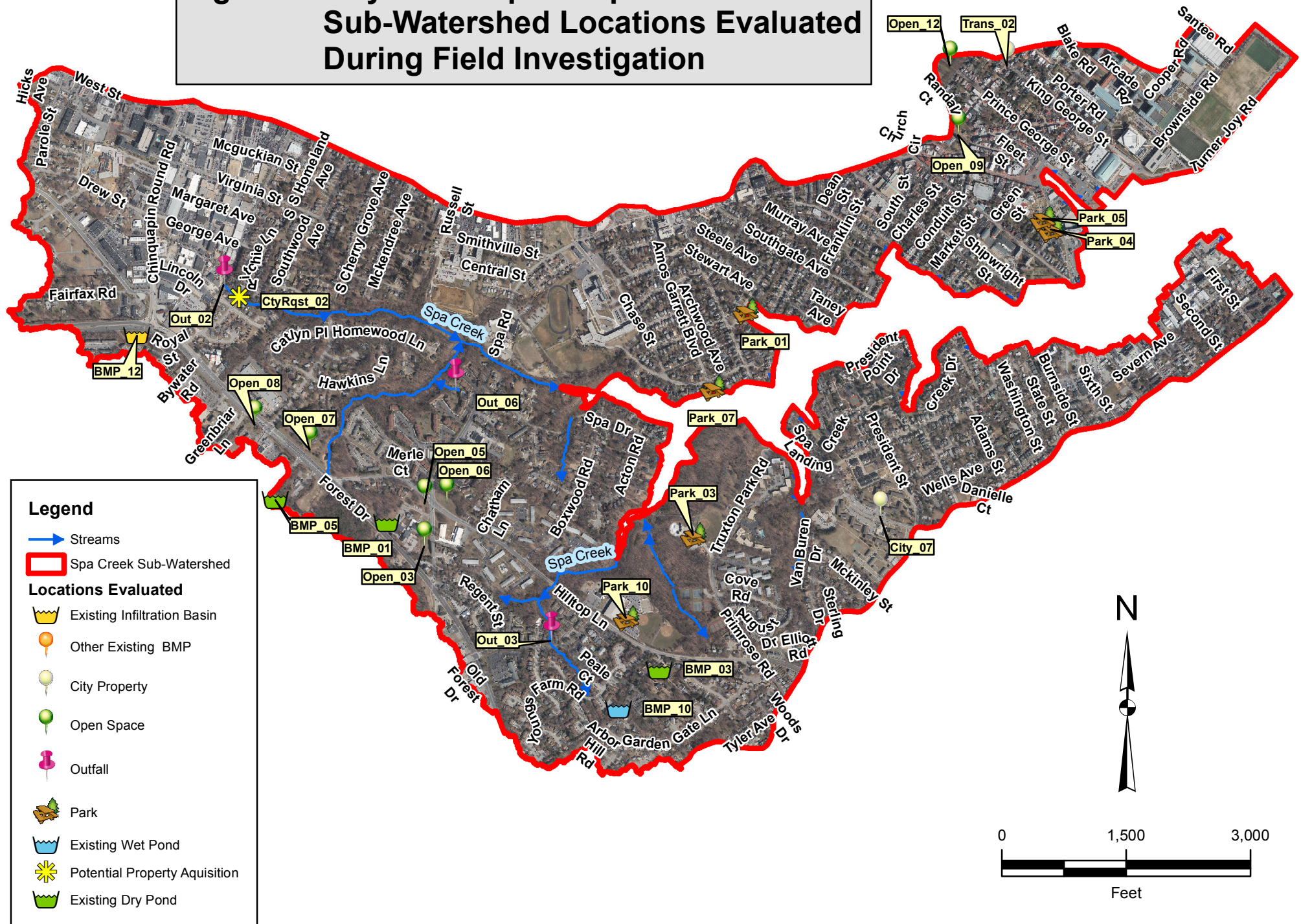


Table B-1: Back Creek Sub-Watershed Field Investigation Summary

Project ID	Location	Existing Site Conditions	Potential Improvement Project Type	Project Description	Owner	Approximate Drainage Area (Acres)	Approximate Impervious Area (Acres)
BMP_06	Mt. Moriah Church (2204 Bay Ridge Ave)	The church addition and dry pond designed in 1999 were never constructed. A grass area adjacent to the south entrance of the church that currently receiving runoff from a roof drain. No utilities were observed in this grass area.	Rain Garden	Potential improvements at this site include converting the grass area into a rain garden to treat roof runoff. This Environmental Site Design (ESD) practice would reduce runoff while creating an aesthetically pleasing garden that could provide an educational opportunity.	Community (Church, Mosque, etc.)	0.1	0.1
BMP_17	914 Bay Ridge Road (Georgetown Plaza)	This site is an existing infiltration area (riprap area) at the northwest corner of the Georgetown Plaza. Runoff enters the facility from an inlet that captures runoff from a catch basin at the corner of the parking lot. The parking lot is sloped toward the catch basin, and a concrete channel conveys runoff from the east side of an existing mulch island to the west. No utilities were observed in the infiltration area, although one tree was observed southeast of the facility. The infiltration area is surrounded by fence on the east and west sides and a trash enclosure on south. The site is not easily visible from the parking area.	Infiltration Basin Retrofit	Retrofit alternatives at this site include upgrading the existing infiltration area to either an infiltration trench or infiltration basin. A stilling basin would need to be constructed near the inlet, possibly using existing riprap. The majority of the riprap will need to be removed from the infiltration area, although it could be used to stabilize the slope. Several parking spaces could be used as construction staging areas. The tree adjacent to the existing practice would most likely need to be removed.	Private	0.9	0.6
Out_01	North of Edgewood Road (Osprey Nature Center).	This site is at the outfall on the Osprey Nature Center property, adjacent to the Bert Jabin Yacht Yard. A 36-inch elliptical pipe that conveys runoff from the Annapolis Water Reclamation Facility, and a 24-28-inch elliptical pipe outfall are at this location. Only the larger pipe was identified in the City GIS data. A concrete block and riprap strip are downstream of the larger outfall pipe, and a footbridge is downstream of both outfalls. Approximately 10 trees are in proximity to the stream, and wetland areas may be upstream of the confluence with Back Creek. There is approximately a 4-foot of drop between the outfall and the confluence with Back Creek.	Step Pool Conveyance System	Potential improvements include implementing a step pool conveyance system at this outfall. The existing bridge would need to be temporarily removed during construction, and up to 10 trees could be impacted.	City	33.4	12.2
Out_04	Northwest of Windwhisper Lane	The site is at the northern end of Windwhisper Lane. Due to the existing fencing, steep slopes, and thick vegetation the outfall was inaccessible.	None - Inaccessible	The site was inaccessible; no potential improvements are provided at this site.	Private	Not Applicable	Not Applicable

Table B-1: Back Creek Sub-Watershed Field Investigation Summary

Project ID	Location	Existing Site Conditions	Potential Improvement Project Type	Project Description	Owner	Approximate Drainage Area (Acres)	Approximate Impervious Area (Acres)
Out_05A	Northeast of Tyler Avenue and Janice Drive	The site is in the recreation area of Greenacres north of Janice Drive and leads to an existing dock. Runoff from Janice Drive and nearby properties flow to an 18-inch storm drain pipe under the recreation area that outfalls to Back Creek. There is an existing storm drain manhole in the recreation area, and the open space is bounded to the north and south by residential structures. The entire space has a mild slope, and parts are within 100 feet of the Bay. It appears that vehicles occasionally drive to the existing dock from Janice Drive.	Bioretention	Potential improvements include implementing a bioretention along the southern boundary of the open space by diverting a portion of the flow from the existing storm drain pipe. A flow splitter could be installed at the manholes, and there appears to be approximately 50 linear feet available with an approximate width of 20 feet to implement a bioretention cell. Excavation would be required to set the practice below existing grade, and low vegetation would be recommended to avoid impacting the view from properties to the south. The elevations of the existing manhole and pipe are not available at this time, and the proposed design may not be possible if the invert elevation of the manhole is more than 2 feet below ground surface elevation without additional expense.	Home Owners Association (HOA)	2	0.7
Out_05B	Northeast of Tylder Avenue and Janice Drive	The site is in the recreation area of Greenacres north of Janice Drive that leads to an existing dock. Runoff from Janice Drive flows into an existing inlet, that enters an 18-inch storm drain pipe that outfalls to Back Creek. There is a mulch area with several plants that is surrounded by grass areas near the existing inlet, with a utility pole and a tree nearby. It appears that vehicles occasionally drive to the existing dock from Janice Drive.	Micro-Bioretention	Potential improvements include implementing a micro-bioretention in the existing mulch area and nearby grass areas. A curb cut could be installed adjacent to the existing inlet on Janice Drive, and a weir could be placed at the existing inlet to promote flow into the curb cut. The curb cut would cross under the existing sidewalk allow runoff to enter the micro-bioretention facility. The soils in the area are hydrologic group C so an underdrain may be required that connects to the existing storm drain system. The elevations of the existing manhole and pipe are not available at this time, and the proposed design may not be possible if the invert elevation of the manhole is less than 2 feet below the ground surface elevation.	HOA	0.3	0.3
Out_07	Windwhisper Lane and Georgetown Road	The site is northeast of the intersection of Windwhisper Lane and Georgetown Road at the outfall of a 48-inch RCP pipe. Runoff from nearby residential structures and roadways drain from the outfall to a tributary of Back Creek. A scour pool has developed downstream of the outfall. Gabion baskets are placed along the edges of the stream, with gabion baskets in the stream functioning like a weir. Several trees are in the area, although the stream is wide near the outfall. According to the National Hydrography Dataset (NHD) this stream is not Perennial. The outfall is approximately 500 feet upstream of the existing FEMA 100 year floodplain.	Step Pool Conveyance System	Potential improvements include implementing a step pool conveyance system at this outfall. Approximately 20 to 30 trees could be impacted and sediment and debris would need to be removed from the channel bottom. Permitting for stream and/or wetland impacts would be required.	Private	50	26.7

Table B-1: Back Creek Sub-Watershed Field Investigation Summary

Project ID	Location	Existing Site Conditions	Potential Improvement Project Type	Project Description	Owner	Approximate Drainage Area (Acres)	Approximate Impervious Area (Acres)
Park_02	Ellen O. Moyer Nature Park at Back Creek (Bembe Beach Road and Edgwood Road)	The site is northwest of the intersection of Edgewood Road and Bembe Beach Road in the grass island in the visitor parking lot. The parking area drains to the grass island, and a grass swale flows to an 18-inch culvert that leads to another swale that eventually flows into Back Creek. The existing culvert is covered with riprap, most likely impeding flow. A sewer line crosses the grass island towards the northeast, and a single tree is in the island.	Dry Swale Retrofit to Bioswale	Potential stormwater improvements at this site include upgrading the existing swale to a bioswale to meet current MDE standards or implementing a linear micro-bioretenention cell. Curb cuts with pea gravel flow dissipaters would be provided as needed. One tree may need to be removed to construct the facility.	City	0.6	0.3

Table B-2: Severn River Sub-Watersheds Field Investigation Summary

Project ID	Location	Existing Site Conditions	Potential Improvement Project Type	Project Description	Owner	Approximate Drainage Area (Acres)	Approximate Impervious Area (Acres)
BMP_02	1013-1075 Blackwell Road	This site is at an existing extended detention dry pond at the end of Blackwell Road. According to the site plans the pond collects runoff from Blackwell Road and adjacent houses via a curb cut and storm drain pipe. The pond has significant vegetation growth, including several trees, and is surrounded by a fence. No utilities were observed in the pond, and hydrologic group C soils are in the area. It had rained the day before the field work and there was no evidence of ponding water; therefore, the infiltration rate of the pond may be higher than is typical for hydrologic group C soils.	Dry Pond Retrofit to Infiltration Basin	Retrofit alternatives at this site include implementing an infiltration basin if soil tests provide evidence that the soil is permeable enough for infiltration practices. A berm is proposed near the inlet to create a sediment forebay, and the entire pond area would need to be cleared of vegetation. The riser would need to be modified to treat the water quality volume.	Home Owners Association (HOA)	4.4	2.0
BMP_09	7101 Bay Front Drive (BayWoods of Annapolis)	This site is at an existing wet pond north of the BayWoods of Annapolis Commons and Service building. The wet pond collects runoff from the BayWoods buildings and parking areas from a 21-inch Acrylonitrile Butadiene Styrene (ABS) pipe that enters the pond from the South. Runoff leaves the pond via a low flow pipe to the north and during high flows from an overflow weir with gabions downstream. The pond is surrounded by ornamental plants and is well maintained. There is a foot bridge crossing the pond, a fountain toward the north, and an aerator to the south. This pond is highly visible to the BayWoods community.	Wet Pond Retrofit	Retrofit alternatives at this site include upgrading the existing pond to meet current MDE standards. A berm or wall would be required to create a sediment forebay. The structure may need to be modified slightly to treat the water quality volume. The aesthetics of this pond would have to be maintained, possibly by placing the forebay divider under the existing bridge. The bridge would most likely need to be temporarily moved during construction, and the existing aerator may need to be moved.	Community (Private Cooperative)	12.4	2.5
BMP_16	Northwest of Legion Avenue and West Street (Public Storage West Street)	The site is between a Public Storage facility and an office complex north west of Legion Avenue and West Street. An existing infiltration trench is behind the offices that collects rooftop runoff from the offices. The runoff from Public Storage facility appears to connect directly to the existing storm drain system.	Infiltration Trench	Retrofit alternatives at this site include implementing an infiltration trench upstream of the existing facility to capture runoff from the Public Storage facility. The existing infiltration trench could be upgraded to meet current standards during construction of the proposed new facility. Rooftop disconnects are another alternative at this site.	Private	1.4	1.2
BMP_19	Northwest of Adams Park Road	The site is an existing swale northwest of Adams Park Road, between a school parking lot and residences. The residential property lines are unclear, and homeowners are using the swale area for storage, a treehouse, a chicken coop, etc.	Dry Swale Retrofit	Retrofit alternatives at this site include upgrading the existing swale to a bioswale or infiltration trench. Several trees may be impacted by construction, and the stored items would likely need to be removed.	Private (Multiple Properties)	2.1	1.0
BMP_20	Northwest of Moreland Parkway	The site is an existing wet pond adjacent to a parking lot northwest of Moreland Parkway. The facility collects runoff from the office/industrial complex and has a 60-inch pipe inflow. Water outfalls through large gabion weir without a riser.	Wet Pond Retrofit	Retrofit alternatives at this site include upgrading the existing wet pond to meet current MDE standards. The footprint of the pond would need to be increased substantially, and a berm would be required to create a sediment forebay at the inflow pipe. A riser structure would be required to provide treatment for the water quality volume. Up to 50 trees may be impacted by construction. Wetland permitting would most likely be required at this site, although the site also has potential for constructed wetlands.	Unknown Ownership	54.0	38.0

Table B-2: Severn River Sub-Watersheds Field Investigation Summary

Project ID	Location	Existing Site Conditions	Potential Improvement Project Type	Project Description	Owner	Approximate Drainage Area (Acres)	Approximate Impervious Area (Acres)
City_04	Glen Avenue (Municipal Other)	The site is an open grass area between two residences at Glen Avenue and Beech Street. A 60-inch pipe runs through the site, and there is a manhole located within the grass area.	None - No Feasible	No feasible stormwater management alternatives at this location.	City	Not Applicable	Not Applicable
City_05	Southeast of Claude Street and Giddings Avenue (Municipal Public Work Property)	The site is at an existing outfall in a public works right-of-way southeast of Claude Street and Giddings Avenue. The site is adjacent to Naval Academy housing. The existing outfall is an approximately 48-inch end section. Downstream from the end section there is a scour hole and 3-to-5-foot eroded banks extending 75 feet downstream.	Step Pool Conveyance System	Potential improvements include a step pool conveyance system to improve the outfall channel. Limited space, steep slopes, and heavy brush surrounding the site may cause access and construction issues. Up to 10 trees would be impacted by construction at this location.	City	32.0	12.7
CtyRqst_01	Ridgewood Street and Brewer Avenue	The site is on Ridgewood and Brewer Avenue. The site is the Schubert property and a potential donation. There is an outfall with a scour hole and channel with minor erosion along the banks for approximately 100 feet downstream of the outfall.	Step Pool Conveyance System	Potential improvements include creating a step pool conveyance system in the channel, or stream restoration. Both practices would improve the water quality of College Creek.	Schubert Family, Possible Donation	48.0	21.0
Open_04	South of Bay Front Drive and Bembe Beach Rd	There is an open grass area adjacent to Bembe Beach Road. The grade of Bembe Beach Road does not promote drainage to the open area.	None - Reforestation	This is a potential reforestation area, but will not be considered for conceptual design.	Private	Not Applicable	Not Applicable
Open_10	East of Lowes Access Road and Taylor Avenue	The site is in an open area east of Lowes Access Road and Taylor Road. A catch basin is in the center of the grass area that collects runoff from adjacent building. Fiber optic utility wires were observed on site.	Bioretention	Potential improvements at this site include implementing a filtration practice. The area would need to be re-graded and reconnected to upstream and downstream pipes.	Private (Trust)	3.5	1.6
Open_11	North of Calvert Street and Roscoe Rowe Boulevard	The site is at a Fire/Rescue memorial near the intersection of Calvert Street and Roscoe Rowe Boulevard. One inlet in a grass area collects runoff from the memorial area and some runoff from Roscoe Rowe Boulevard. The memorial is primarily composed of brick walking areas surrounded by grass areas.	Micro-Bioretention	Potential improvements include a micro-bioretention southwest of the existing brick area. The soils are hydrologic group B so an underdrain likely would not be required, and the practice and the existing yard inlet could be used as a riser structure.	State	0.1	0.1
Open_13	Southwest of Capital Drive	The site is southwest of Capital Drive adjacent to the Capital newspaper office parking lot. The site is an open grassy area about 500 feet long and 75 feet wide. A forested area is adjacent to the open area.	None - Reforestation	This is a potential reforestation area, but will not be considered for conceptual design.	Private (LLC)	Not Applicable	Not Applicable
Open_14	Southeast of Farragut Road and Roscoe Rowe Boulevard	The site is an open field next to Anne Arundel County District Courts building on the corner of Roscoe Rowe Boulevard and Farragut Road. An existing storm drain system is in the area. Inlets on walkways at the court building flow downhill to connect to inlets from the court building parking lot, connecting to the storm drain system in the Navy Stadium parking lot.	Bioretention	The site is very large and could accommodate either a large reforestation project or a stormwater management facility in addition to reforestation. An aesthetically-pleasing filtering practice (e.g., a bioretention) or a pond could be implemented in the area. The practice would receive drainage from the inlets along the court building walkway. The outlet would tie-in to the downstream storm drain at the parking lot area.	State	2.9	0.7

Table B-2: Severn River Sub-Watersheds Field Investigation Summary

Project ID	Location	Existing Site Conditions	Potential Improvement Project Type	Project Description	Owner	Approximate Drainage Area (Acres)	Approximate Impervious Area (Acres)
Open_15	Northeast of Capital Drive	This site is adjacent to The Capital building. A large grassy embankment is along the rear parking lot. Downstream there is an inlet and outfall and a stream channel that is a tributary of Weems Creek.	None - Reforestation	This is a potential reforestation area, but will not be considered for conceptual design.	Private	Not Applicable	Not Applicable
Park_06	Chambers Park (North of Dorsey Avenue)	The site is at a City park north of Dorsey Ave. The park contains playgrounds, a basketball court, and multiple educational displays for rain barrels and rain gardens.	Bioswale	There may be room for a small bioswale at the south side of the park between the fence and basketball courts. There is an existing inlet at the corner of the basketball court that bioswale could convey flow to. Two recently planted trees are in this area that may be impacted. A bioswale could provide an educational opportunity, but would reduce open space within the park.	City	0.7	0.5

Table B-3: South River Sub-Watersheds Field Investigation Summary

Project ID	Location	Existing Site Conditions	Potential Improvement Project Type	Project Description	Owner	Approximate Drainage Area (Acres)	Approximate Impervious Area (Acres)
BMP_04	Juliana Circle West and Newtowne Drive (Riders Glen)	This site is at an existing dry pond at the intersection of Juliana Circle and Newtown Drive, in a parking lot for adjacent townhomes. The existing facility collects runoff from the parking lot. Several small trees are in or adjacent to the existing facility.	Dry Pond Retrofit to Pocket Wet Pond or Infiltration Basin	Retrofit alternatives at this site include upgrading the existing pond into a pocket pond or infiltration basin depending on the soil type and water table elevation. A berm would be required to create a stilling basin at the inlet pipe. The entire pond area would need to be cleared of vegetation, and it appears that a riser structure would need to be installed to manage the water quality volume.	Home Owners Association (HOA)	1.6	1.0
BMP_07	Southeast of Coybay Drive and Annapolitan Lane (Annapolis Walk)	The site is at an existing wet pond southeast of Coybay Drive and Annapolitan Lane. The pond receives runoff from the adjacent neighborhood. The water surface is covered with algae, and the riser structure appears to be in good condition.	Wet Pond Retrofit	Retrofit alternatives at this site include upgrading the existing wet pond to meet current Maryland Department of the Environment (MDE) standards. A berm would be required to create a sediment basin at the inlet pipe. Minimal changes would be required to the low flow or high flow structures.	HOA	19.7	6.6
BMP_08	5 Cherry Grove Avenue (The Village Greens)	The site is at an existing wet pond along Cherry Grove Avenue, across from the Village Greens shopping center. The pond was upgraded in 2001 from a dry pond. A new townhome development is under construction on the other side of the pond, including stormwater management ponds. The drainage area to this facility may be reduced due to new construction; however, the drainage area is still expected to include over 2 impervious acres. The facility is surrounded by trees and is covered with vegetation.	Wet Pond Retrofit	Retrofit alternatives at this site include upgrading the existing wet pond to meet current MDE standards. A berm would be required to create a sediment basin at the inlet pipe. The structure may need to be modified to treat the water quality volume.	Private	10.4	7.0
BMP_11	Cobblestone Drive (Annapolis Overlook Parking Lot)	The site is at an existing wet pond on Cobblestone Drive behind the Annapolis Overlook apartment complex. The pond collects runoff from the adjacent parking roof areas. The low flow orifice of the riser is blocked, although the riser appears to be in good condition. A retaining wall is on pond embankment along the apartment buildings.	Wet Pond Retrofit	Retrofit alternatives at this site include upgrading the existing wet pond to meet current MDE standards. A berm would be required to create a sediment basin at the inlet pipe. The structure may need to be modified slightly to treat the water quality volume. Dam permitting will most likely be required based on the size of the facility.	Private	32.8	18.2
BMP_13	South Cherry Grove Avenue (Village Green)	The site is southwest of South Cherry Grove Avenue. The site could not be accessed during the field investigation.	None - Inaccessible	The site was inaccessible; no potential improvements are provided at this site.	Private	Not Applicable	Not Applicable
BMP_14	Harness Creek View Court	The site is an existing wet pond at Harness Creek View Court. The pond receives runoff from the nearby residential area along Harness View Creek Court up to Potters Lane. The outfall is a large riprap lined ditch that extends approximately 200 feet downstream. A large vegetated mound is in the center of the pond. A fence circles the pond and several trees are on the embankment. The City indicated that there are flooding concerns at this location.	Wet Pond Retrofit	Retrofit alternatives at this site include upgrading the existing wet pond to meet current MDE standards. A berm would be required to create a sediment forebay toward the eastern end of the pond. Minimal changes would be required to the low flow or high flow structures. Up to 20 trees may be impacted by construction, including several growing on the pond embankment. The volume of the pond could be increased to reduce flooding, and catch basins or swales could be implemented in areas where localized flooding is occurring.	HOA	25.3	16.5

Table B-3: South River Sub-Watersheds Field Investigation Summary

Project ID	Location	Existing Site Conditions	Potential Improvement Project Type	Project Description	Owner	Approximate Drainage Area (Acres)	Approximate Impervious Area (Acres)
BMP_15	Southwest of Child's Point Road and Woods Road	The site is an existing wet pond in a residential area southwest of Childs Point Road and Woods Road. According to City GIS, the pond is owned by the City; however, this site may be HOA owned. The pond has some algae on the water surface. The riser structure appears to be in good condition. The inflow is mostly submerged.	Wet Pond Retrofit	Retrofit alternatives at this site include upgrading the existing wet pond to meet current MDE standards. A berm would be required to create a sediment basin at the inlet pipe. The structure may need to be modified to manage the water quality volume and to prevent the inflow pipe from being submerged during normal conditions.	City	49.0	23.3
BMP_18	South of Aris T Allen Boulevard and Vineyard Road	This site is an existing wet pond on Vineyard Road and Aris T. Allen Boulevard. This site is most likely owned by SHA, although the City GIS listed the parcel owner as "Unknown" at this location, and plans were not available for this site. The site is heavily overgrown, and inflows were not found in the field, although a storm drain pipe is located along Aris T. Allen Boulevard. The pond is covered by a thick layer of green algae.	Wet Pond Retrofit	Retrofit alternatives at this site include upgrading the existing wet pond to meet current MDE standards. A berm would be required to create a sediment forebay at the inflow pipe. Based on the existing conditions of the pond substantial changes to the riser structure are expected. Up to 10 trees may be impacted by construction, including several growing on the pond embankment.	SHA	5.0	1.3
City_01	Forest Drive (Municipal Housing Authority)	The site is on Tyler Avenue adjacent to a housing development on Forest Drive. Currently, the site is an open area with a storm drain pipe crossing an open field and flowing to a ditch behind the development beyond the utility easement.	Sand Filter	Potential improvements include a wet pond in the empty space between the stream and the basketball courts. The outfall from pond would be at existing storm drain outfall, and the downstream channel would need to be repaired. This channel is behind three layers of fencing. The soils in the area appear to be hydrologic group D and the drainage area appears to be over 10 acres so infiltration and filtration practices were not considered.	City	17.8	6.9
City_02	Belle Court (Parks and Recreation)	The site is on Belle Court in an open area behind townhomes and parking lot. Yard inlets are in the open space, and they appear to only collect roof drainage.	Bioretention	Potential improvements include a bioretention that could be placed in the open area to collect roof runoff. The existing yard inlet could be retrofit to provide an overflow to the existing storm drain system.	City	0.7	0.3
City_03	Betsy Court (Municipal Housing Authority)	The site is on the Besty Court municipal housing property. Currently, a storm drain pipe end section outfalls to a riprap channel. The channel and end section are almost completely filled in with sediment. A large earthen berm is downstream from the outfall.	Infiltration Basin	Potential improvement includes removing the riprap channel and replacing it with an infiltration basin or filtering practice. There is a relatively large grass area where a practice could be installed. The soils in the area appear to be hydrologic group C, so further soil investigation would be required to verify the suitability of an infiltration practice.	City	1.9	1.2
City_06	Hunt Meadows Drive (Municipal Other)	The site is at an outfall of a 42-inch pipe to Aberdeen Creek behind a pool parking lot on Hunt Meadows Drive. Erosion along the banks and sedimentation downstream were observed. A trail and several footbridges are along the channel, and trees and brush are along the banks of the stream channel.	Wet Pond	Potential improvements include installing a wet pond at the outfall. This could be done without impacting the trail but would cause impacts to trees. A step pool conveyance is another potential retrofit at this location. Stream and/or wetland permits would likely be required for any projects in this area, and up to 50 trees would be impacted.	City	27.0	9.7
CtyRqst_03	Harness Creek View Court	This site is at Harness Creek View Court. See BMP 14.	None - Stream Restoration	See Discussion for BMP 14. No additional stormwater management projects are recommended at this location.	HOA	Not Applicable	Not Applicable

Table B-3: South River Sub-Watersheds Field Investigation Summary

Project ID	Location	Existing Site Conditions	Potential Improvement Project Type	Project Description	Owner	Approximate Drainage Area (Acres)	Approximate Impervious Area (Acres)
Open_01	Southwest of Forest Drive and Martha Court	The site is on a roadside easement along Forest Drive across from a cemetery. A steep vegetated slope is between the roadway and the site, and overhead utility lines run over the site. A sewer line and structure/vent are also in the proposed Best Management Practice (BMP) site.	Micro-Bioretention	There are many utility conflicts in this area but a small micro-bioretention may be feasible depending on the exact locations of the utilities. The facility would receive road runoff and outlet to a downstream drainage ditch.	City	0.2	0.2
Open_02	North of Masque Farm Road	The site could not be accessed during the field investigation.	None - Inaccessible	The site was inaccessible; no potential improvements are provided at this site.	Private (Horse Farm)	Not Applicable	Not Applicable
Open_16	Northeast of Centerfield Road and Hunt Meadow Drive	This site is northeast of Centerfield Road and Hunt Meadows Drive in an open space adjacent to community tennis courts. A storm drain system is along Hunt Meadows Drive, and a manhole is in the roadway that is adjacent to the site.	Bioretention	Runoff could be rerouted from the storm drain to a filtering practice such as a bioretention. A flow diverter could be installed at the northern inlet to split the water quality volume to the bioretention. Several trees are between the manholes on Hunt Meadows Drive and the open space and may be impacted. The outlet for the BMP would tie back into existing storm drain along Canterfield Road or Hunt Meadow Drive.	HOA	2.0	0.9
Park_08	Annapolis Walk Park (Annapolis Walk Drive)	This site is at an open area in Annapolis Walk Park, on Annapolis Walk Drive. Two grass ditches convey drainage to a yard inlet between playground and tennis courts	Dry Swale to Bioswale Retrofit	Potential improvements include retrofitting the existing swales to bioswales. Safety fencing would be required.	City	0.7	0.4
Park_09	Kingsport City Park (West of Bywater Road)	This site is west of Bywater road at an existing 54 inch pipe outfall in a wooded area adjacent to Kingsport City Park. The downstream channel is eroded and there is evidence of previous outfall stabilization. The outfall is surrounded by large trees. It appears that this site will be included in the Bywater Stream and Wetland Restoration performed by the South River Federation.	CIP	This is the location of a future stormwater management project, so no additional stormwater management projects are required at this site. Prior to the field investigation there was some uncertainty as to the exact locations of the proposed projects, but the location was verified following the field investigation.	City	Not Applicable	Not Applicable
Trans_01	Rosecrest and Arborhill Road	This site is on Rosecrest Drive and Arborhill Road, and is the median of Rosecrest Road. Currently, the median is curbed. Stormwater is conveyed down Rosecrest Drive and towards Forest Drive. The median has three trees.	None - No Feasible	No feasible stormwater management alternatives at this location.	City	Not Applicable	Not Applicable

Table B-4: Spa Creek Sub-Watershed Field Investigation Summary

Project ID	Location	Existing Site Conditions	Potential Improvement Project Type	Project Description	Owner	Approximate Drainage Area (Acres)	Approximate Impervious Area (Acres)
BMP_01	1120 Spa Road (St. Martins Lutheran Church)	This site is at an existing dry pond northwest of St. Martins Lutheran Church. The pond collects runoff from the roof of nearby church buildings and has a single inlet. The outlet structure includes a low flow pipe and a concrete riser with a grate inlet that drains to a stormdrain pipe under Forest Drive. No utilities were observed in the pond, and there are two small ornamental trees.	Bioretention	Retrofit alternatives at this site include implementing a bioretention facility in the existing pond footprint. A berm is proposed near the inlet to create a sediment forebay. The low flow pipe of the existing riser would need to be blocked, but the grate inlet could remain to provide overflow control for the bioretention. The soils in the area are hydrologic group C, so an underdrain would most likely be required.	Community (Church, Mosque, etc.)	1.1	0.3
BMP_03	Milkshake Lane	The site is east of Milkshake Lane near the intersection with Hilltop Lane. According to the site plans, the pond collects runoff from properties to the south via a swale, with overflow flowing north out of a 4-inch polyvinyl chloride (PVC) pipe. The pond has significant vegetation growth including several trees. No utilities were observed in the pond, and hydrologic group C soils are in the area; however, infiltration practices are located nearby indicating that the soils may be suitable for infiltration.	Infiltration Basin Retrofit	Retrofit alternatives at this site include implementing an infiltration basin if soil tests provide evidence that the soil is permeable enough for infiltration practices. The existing swale may need to be re-graded, and a berm is proposed near the entrance to the pond to create a stilling basin. The entire pond area would need to be cleared of vegetation, and it appears that a riser structure would need to be installed for volume control.	Private	1.7	0.2
BMP_05	Northeast of Juliana Circle East and Newtowne Drive (Riders Glen)	This site is at an existing dry pond at the intersection Juliana Circle East and Newtowne Drive, in a parking lot for adjacent townhomes. No storm drain is shown on the City’s GIS data, but storm drain pipe was found in the field and site plans. The entire pond is covered in light vegetation, although there are no trees.	Dry Pond Retrofit to Sand Filter	Retrofit alternatives at this site include upgrading the existing pond into a sand filter or wet pond. A berm would be required to create a sediment basin at the inlet pipe. The entire pond area would need to be cleared of vegetation, and a riser structure would need to be installed to treat the water quality volume.	Home Owners Association (HOA)	7.5	4.8
BMP_10	Meridian Nursing Center (Milkshake Ln and Hilltop Ln)	The site is at an existing wet pond west of Meridian Nursing Center. The wet pond collects runoff from the Meridian Nursing Center building and parking from a 27-inch reinforced concrete pipe (RCP) pipe at the eastern end of the pond. A chain link fence, brush, and large trees surround the pond. A walking path is along the south of the pond, and the existing riser does not appear to require repairs. No utilities were observed in the pond, and the pond is not visible to the public.	Wet Pond Retrofit	Retrofit alternatives at this site include upgrading the existing wet pond to meet current MDE standards. A berm would be required to create a sediment forebay toward the eastern end of the pond. The structure may need to be modified slightly to treat the water quality volume. Up to 20 trees may be impacted by construction, including several growing on the pond embankment.	Private	5.0	2.2

Table B-4: Spa Creek Sub-Watershed Field Investigation Summary

Project ID	Location	Existing Site Conditions	Potential Improvement Project Type	Project Description	Owner	Approximate Drainage Area (Acres)	Approximate Impervious Area (Acres)
BMP_12	Tuckahoe Creek Court (Oxford Landing Section III)	This site is at an existing infiltration basin adjacent to Forest Drive northeast of Tuckahoe Creek Court. The basin collects runoff from the Oxford landing residential area to the south from two 15-inch RCP pipes that enter the basin from the southwest and southeast. The infiltration basin is on a State Highway Administration (SHA) stormwater easement, and was observed to have standing water. The pond is surrounded by dense vegetation including several large trees, and was difficult to access. The riser structure could not be observed in the field but was identified from aerial imagery. No utilities were observed in the basin, and the basin is not visible to the public.	Infiltration Basin Retrofit	Retrofit alternatives at this site include upgrading the existing infiltration basin to meet current MDE standards. Two berms would be required to create two stilling basins at each inlet pipe. The structure may need to be modified to treat the water quality volume. Up to 36 trees may be impacted by construction, and the entire pond area would most likely need to be excavated to remove fine sediments. Soil tests will be required to verify that an infiltration basin is appropriate: if it is not, a wet pond could be constructed (possibly with some infiltration capacity). The sewer easement south of the pond could be used as a staging area, although the area is partially vegetated. Due to the size of the facility and proximity to Forest Drive and nearby properties, dam safety issues will need to be considered.	SHA	10.9	7.0
City_07	Madison Street (Municipal Housing Authority)	This site is the location of several future Capital Improvement Projects. As a result, this site was not considered as part of this study.	CIP	This site is the location of several future Capital Improvement Projects. As a result, this site was not considered as part of this study.	City	Not Applicable	Not Applicable
CtyRqst_02	North of Lincoln Drive	The City requested that this site be considered. The Spa Creek Conservancy will perform a stream restoration in the area, and the Baldwin family would like to donate the property to the City. During the AECOM field investigation, it was observed that the channel is full of thick vegetation, and the channel thickness varies from 2- to 10-feet wide. Both these factors are likely impeding flow. The slope of the stream is relatively flat in this area. Several residential structures are adjacent to the stream.	None - Stream Restoration	The City has indicated that there are some flooding issues upstream of this stream, and based on preliminary field investigation, it was observed that lack of maintenance of the existing channel could be exacerbating the problem. Stream restoration could be the best option for receiving impervious area credit at this outfall due to the existing grading, and the proximity to adjacent residential structures.	Baldwin Family	Not Applicable	Not Applicable
Open_03	Northwest of the intersection of Forest Drive and Spa Road (Saint Martin’s Lutheran Church)	The site is northwest of the intersection of Forest Drive and Spa Road. There is a fenced-in open grass area that is entirely made up of sports fields.	None - No Feasible	No feasible stormwater management alternatives at this location.	Community (Church, Mosque, etc.)	Not Applicable	Not Applicable
Open_05	West of Hilltop Lane and Spa Road	This site is southwest of the intersection of Hilltop Lane and Spa Road. A rain garden is adjacent to the St. Martins Lutheran Church driveway.	None - Reforestation	This is a potential reforestation area and will not be considered for conceptual design.	Community (Church, Mosque, etc.)	Not Applicable	Not Applicable

Table B-4: Spa Creek Sub-Watershed Field Investigation Summary

Project ID	Location	Existing Site Conditions	Potential Improvement Project Type	Project Description	Owner	Approximate Drainage Area (Acres)	Approximate Impervious Area (Acres)
Open_06A	East of Hilltop Lane and Spa Road	This site is northeast of the intersection of Hilltop Lane and Spa Road. An existing inlet on Hilltop Lane intercepts runoff from the road. No utilities were observed in the grass area, and this area has high visibility from Hilltop Lane and Spa Road.	Micro-Bioretenction	Potential improvements at this site include installing a micro-bioretenction facility in the grass open space. This would require curb cuts upstream and downstream of the existing inlet and partially blocking the existing inlet using a weir. The soils in the area are hydrologic group C so an underdrain would most likely be required. Aesthetically pleasing plantings are recommended due to the visibility of this site, although trees should be avoided to prevent impacting visibility.	Community (Church, Mosque, etc.)	0.3	0.3
Open_06B	East of Hilltop Lane and Spa Road	This site is northeast of the intersection of Hilltop Lane and Spa Road. No storm drain inlets are along Spa Road at the intersection, so runoff travels toward the intersection. A water line is observed at this location, but it can easily be avoided. This area has high visibility from Hilltop Lane and Spa Road.	Micro-Bioretenction	Potential improvements at this site include installing a micro-bioretenction facility in the grass open space. This would require several curb cuts upstream and downstream of the existing inlet. The soils in the area are hydrologic group D, so an underdrain would be required. Aesthetically pleasing plantings are recommended due to the visibility of this site, although trees should be avoided to prevent negatively impacting visibility. This practice could be constructed entirely in the road right-of-way.	City	0.5	0.5
Open_07	North of Forest Drive and Newtowne Drive	This site is southeast of the Heritage Baptist Church. There are several grass areas with intermittent trees, as well as what appears to be a micro-bioretenction. It appears that runoff from a portion of the church and the parking area enters the facility from a curb cut. Plans for the facility could not be located.	None - Reforestation	This is a potential reforestation area and will not be considered for conceptual design.	Community (Church, Mosque, etc.)	Not Applicable	Not Applicable
Open_08	Northwest of Forest Drive and South Cherry Grove Avenue	The site is an existing infiltration trench southwest of the intersection of Forest Drive and Greenbriar Lane. Runoff from Greenbriar Lane and a portion of the adjacent parking lot enters the facility from an 18-inch pipe. The trench includes a concrete overflow structure and geotextile over a gravel layer. An electric pole is adjacent to the facility. The site is in the road right-of-way, and the practice is visible to the public. It appears that the facility may be over hydrologic group D soils, although soil tests would be required to verify.	Infiltration Trench Retrofit	Potential alternatives at this site include upgrading the existing infiltration trench to meet current MDE standards. A berm is proposed near the inlet to create a stilling basin, providing pretreatment for the runoff.	City	0.25	0.25
Open_09	Center of State Circle	The site is a mulch area adjacent to the northeastern corner of the Maryland State House (near the intersection of North Street and State Circle). An existing roof drain connects directly to a metal pipe that appears to be directed to an existing storm drain system (data was unavailable at this location). The existing mulch area has several bushes and ornamental plants.	Rain Garden	Potential improvements at this site include disconnecting the existing roof drain and converting the mulch area into a rain garden to treat roof runoff. This ESD practice would reduce runoff while creating an aesthetically pleasing garden. This is in a highly visible area with high foot traffic, so an educational sign explaining the reasons for a rain garden and its benefits would be beneficial.	State	0.05	0.05

Table B-4: Spa Creek Sub-Watershed Field Investigation Summary

Project ID	Location	Existing Site Conditions	Potential Improvement Project Type	Project Description	Owner	Approximate Drainage Area (Acres)	Approximate Impervious Area (Acres)
Open_12A	Saint John's Campus: Pinkney Hall	The site is a mulch area adjacent to the northeastern face of Pinkney Hall, at the southeastern corner of the building. The existing roof drain conveys runoff to a splash block that directs flow onto the mulch. There was some evidence of erosion in the mulch area.	Rain Garden	Potential improvements at this site include converting a portion of the mulch area into a rain garden to treat roof runoff. This ESD practice would reduce runoff while creating an aesthetically pleasing garden that could provide an educational opportunity.	Community (Private School)	0.05	0.05
Open_12B	Saint John's Campus: Pinkney Hall	The site is a mulch area adjacent to the northeastern face of Pinkney Hall between the two entrances to the building. Two roof drains are in this area; one conveys runoff to a splash block, the other to a rain barrel. The rain barrel was not connected to the roof drain, so runoff drains directly to the mulch. The reason the rain barrel was disconnected was not clear at the time of the field investigation.	Rain Garden	Potential improvements at this site include converting a portion of the mulch area into rain gardens to treat runoff from each roof drain. This ESD practice would reduce runoff while creating an aesthetically pleasing garden that could provide an educational opportunity. The rain barrel should be reconnected with the adjacent roof drain, although an overflow hose could be provided to direct runoff to the proposed rain garden.	Community (Private School)	0.1	0.1
Open_12C	Saint John's Campus: Pinkney Hall	This site is a grass area adjacent to the northeastern face of Pinkney Hall, to the north of the northernmost entrance of the building. The existing roof drain conveys runoff to a splash block that directs flow onto the grass area.	Rain Garden	Potential improvements at this site include converting a portion of the grass area into a rain garden to treat roof runoff. This ESD practice would reduce runoff while creating an aesthetically pleasing garden that could provide an educational opportunity.	Community (Private School)	0.05	0.05
Open_12D	Saint John's Campus: Chase-Stone House	This site is a vegetated mulch area at the northwestern corner of the Chase-Stone House. An existing roof drain connects directly to a metal pipe that is directed to an existing storm drain system (according to 2011 site plan for Hudson Hall). The mulch area is surrounded by brick.	Rain Garden	Potential improvements at this site include disconnecting the existing roof drain and converting the mulch area into a rain garden to treat roof runoff. This ESD practice would reduce runoff while creating an aesthetically pleasing garden that could provide an educational opportunity. The size of the rain garden would be limited to the existing footprint to avoid impacting the existing brick walkways.	Community (Private School)	0.05	0.05
Open_12E	Saint John's Campus: Harrison Health Center	This site is a vegetated mulch semicircular area at the northeastern corner of the Harrison Health Center. The area is bounded by a walkway and a brick swale that drains to a yard inlet. Runoff from the brick walkway and a portion of the building roof drains to this inlet. An existing tree and smaller plants are in the mulch area. The site is over hydrologic group B soils.	Rain Garden	Potential improvements include converting the mulch area to a micro-bioretention or a rain garden. Approximately 2 feet would need to be excavated from the mulch area. A curb cut would be provided at the existing brick swale, as well as a weir structure to promote flow into the proposed facility. The overflow weir would be installed to provide overflow conveyance to the existing yard inlet. Approximately 6 inches of pea gravel slopes are recommended along the walkway to drain runoff from the walkway directly to the rain garden without causing erosion. The proposed facility would not require an underdrain due to the hydrologic group B soils.	Community (Private School)	0.5	0.5
Out_02	North of Lincoln Drive	This site overlaps with City Request 2. See CtyRqst_02 for site description.	None - Stream Restoration	No feasible stormwater management project at this site, although it may be a good candidate for stream restoration.	Private (Baldwin Family)	Not Applicable	Not Applicable

Table B-4: Spa Creek Sub-Watershed Field Investigation Summary

Project ID	Location	Existing Site Conditions	Potential Improvement Project Type	Project Description	Owner	Approximate Drainage Area (Acres)	Approximate Impervious Area (Acres)
Out_03	Northeast of Stonecreek Road and Gemini Drive	The site is northeast of the intersection of Stonecreek Road and Gemini Drive at the outfall of a 48-inch RCP pipe to a tributary of Spa Creek. The existing channel is narrow with incised banks and has significant meanders. The channel is within 50 feet of residential structures on both the east and west banks.	None - No Feasible	No feasible stormwater management project at this site, although it may be a good candidate for stream restoration.	Unknown Site Ownership.	Not Applicable	Not Applicable
Out_06	West of Spa Road and Silopanna Road	The site is at the Bayshore Landing Apartments at the existing grass swale downstream of a 27-inch storm drain pipe. The grass swale intercepts runoff from the Bayshore Landing Apartments and adjacent roadways. An existing scour pool is downstream of the outfall pipe, as well as a pilot channel that appears to have been created by erosive velocities. The existing swale crosses a sewer line, and electric lines are nearby.	Dry Swale Retrofit	Retrofit alternatives at this site include upgrading the existing swale to meet current MDE standards. An armored sedimentation basin with a level spreader would provide pretreatment. Upgrading the swale from the pipe outfall to the existing bridge would treat approximately 10% of the drainage area. The bottom of the swale may need to be excavated and replaced with permeable soils.	Private (LLC)	1.1	0.6
Park_01	LaFayette Avenue and Spa Creek (Lafayette Park)	This site is at LaFayette Park near the intersection of Lafayette Avenue and Spa Creek. The park is composed of a small grass area and is within 25 feet of the Bay.	None - No Feasible	No feasible stormwater management alternatives at this location.	City	Not Applicable	Not Applicable
Park_03	Truxtun Park (North) near Pump House Road	The site is in the parking lot adjacent to Pump House Road at Truxtun Park. Runoff from the parking lot drains to catch basin that conveys runoff to the Bay without treatment. A grass area is to the north of the parking lot with a walking path separating it from the existing pool area. No utilities were observed in the parking lot. Sedimentation was observed in the parking lot at relative low points that suggest occasional flooding.	Bioretention	Potential improvements at this site include converting a portion of the grass area and an unused portion of the parking lot into a bioretention to treat roof runoff. A flow splitter would be required at the existing catch basin to send the water quality volume to the treatment facility. Two additional catch basins are recommended to the east and west of the existing catch basin to intercept flow from the entire parking lot. An overflow yard inlet would be provided to convey overflow to the existing storm drain system. The soils in the area are hydrologic group C so an underdrain would most likely be required.	City	0.9	0.8
Park_04A	Rec Center (Compromise Street and Newman Street)	The site is near Newman Street at the corner of the Recreation Center Building. A roof drain drains to a mulch area, with a diverting hose that appears to be able to connect to a nearby rain barrel (it was not connected at the time of the field investigation).	Rain Garden	Potential improvements at this site include converting the mulch area into a rain garden to treat roof runoff. This ESD practice would reduce runoff while creating an aesthetically pleasing garden that could provide an educational opportunity. Flow from the roof drain can still be diverted to the rain barrel, and an overflow hose can be provided from the rain barrel to a rain garden.	City	0.03	0.03
Park_04B	Rec Center (Compromise Street and Saint Mary's Street)	The site is near Saint Mary's Street at the corner of the Recreation Center Building. A roof drain drains to a mulch area with two small trees.	Rain Garden	Potential improvements at this site include converting the mulch area into a rain garden to treat roof runoff. This ESD practice would reduce runoff while creating an aesthetically pleasing garden that could provide an educational opportunity.	City	0.03	0.03
Park_05	Newman Street Playground	An existing rain garden appears to be treating the majority of the park impervious area.	None - No Feasible	No feasible stormwater management projects are proposed at this location.	City	Not Applicable	Not Applicable

Table B-4: Spa Creek Sub-Watershed Field Investigation Summary

Project ID	Location	Existing Site Conditions	Potential Improvement Project Type	Project Description	Owner	Approximate Drainage Area (Acres)	Approximate Impervious Area (Acres)
Park_07	Amos Garrett Park (Amos Garrett Boulevard)	The site is south of the intersection of Amos Garrett Boulevard and Spaview Avenue at Amos Garrett Park. The park is composed of a walkway the leads from Spaview Avenue to Spa Creek surrounded by grass areas, trees, and bushes. There is a relative low area toward the end of the path near the Bay.	Rain Garden	Potential improvements at this site include implementing a rain garden to treat runoff from the walkway. This ESD practice would reduce runoff while creating an aesthetically pleasing garden that could provide an educational opportunity. The proposed project is within 25 feet of the Bay.	City	0.003	0.003
Park_10	Truxtun Park (South) near the Pip Moyer Recreation Center	The site is at the Pip Moyer Recreation Center at Truxtun Park. Most of the impervious area at this site is treated by bioretentions, micro-bioretention, or what appears to be a wet-swale.	None - No Feasible	No additional stormwater management projects are required at this site.	City	Not Applicable	Not Applicable
Trans_02	Maryland Avenue from King George Street to State Circle	The site is along Maryland Avenue from King George Street south to State Circle. The road is made of bricks, and a parking lot is along the east side of the street. A brick gutter is adjacent to the curb on the east side of the street. Water lines, sewer lines, and possibly gas lines are under Maryland Avenue.	Permeable Pavement	Potential improvements at this site include implementing permeable pavements over the existing parking areas. The sewer lines will need to be avoided, and the water lines may need to be encased.	City	1.5	0.49

Scoring Criteria for the Development of Preliminary Priority Ranking Matrix

Preliminary prioritization criteria were developed to provide a framework to select storm water management projects for conceptual design. The scoring criteria are summarized in the table below. A maximum of 100 points is possible. A high score represents a good storm water management opportunity or Best Management Practice (BMP), while a low score represents a less favorable opportunity. The maximum points possible for each category can be updated based on recommendations by the City.

Storm Water Management Prioritization Criteria

Criterion	Max Possible Score
A. Impervious Drainage Area.....	25
B. Site Ownership.....	10
C. Site Access	5
D. Utility Conflicts	10
E. Environmental Impacts of Proposed Solution	10
F. Regulatory Approval.....	10
G. Flooding and Erosion Concerns.....	10
H. Anticipated Project Cost per Acre Treated	10
I. Public Visibility	5
J. Anticipated Annual Maintenance Cost	5
TOTAL.....	100

The details of each criterion are discussed in Sections A to J below, and an overall summary table is provided in Section K. The proposed ranking criteria is a tool to assist the City to select the 20 high priority projects (Task 3); however, the City may select any projects it believes are most appropriate based on engineering judgment.

AECOM will prepare conceptual designs as part of Task 5 for 20 high priority projects selected by the City. The concept designs will include detailed information for each project (e.g., detailed drainage areas, nutrient removal estimates, and cost estimates). The ranking criteria will then be updated accordingly to consider the detailed information when ranking the proposed conceptual design projects as part of Task 6.

A. Impervious Drainage Area 25

This criterion is based on the number of impervious acres draining to each facility. A site has greater potential when it drains larger impervious areas when compared to a site that drains smaller impervious areas. The impervious cover was calculated based on site plans for existing BMPs. The impervious cover was estimated for all other proposed BMPs using geographic information system (GIS) data and field estimates. The pollutant removal benefits are assumed to be proportional to the impervious drainage area for preliminary ranking.

Impervious Area (Acres)	Points
Less than 0.5 Acres	0
Between 0.5 and 2 Acres	12.5
Greater than 2 Acres	25

B. Site Ownership 10

This criterion evaluates the impact of property ownership for the proposed project site. Public sites are owned by the City of Annapolis and are typically easier to implement projects when compared to privately owned sites. For sites on private property, county property, or state highway property, it may not be feasible or cost effective to acquire the necessary property or obtain required easements to construct the BMP. Agreements between the City and private sites owned by Home Owners Associations or Institutions (e.g., Colleges) are considered more feasible than other private sites.

Property Description	Points
Private/County/Maryland State Highway	0
Home Owners Association or Institution	5
City	10

C. Site Access 5

Site access was scored for each project based on whether poor, fair, or good construction access was available. Sites requiring demolition of structures, road construction, easements on private property, or clearing and grubbing of trees were considered less desirable. Sites that are relatively easy to access with equipment, but have limited space for staging without compromising existing land use (e.g., parking), are considered to have fair construction access.

Access	Points
Poor	0
Fair	2.5
Good	5

D. Utility Conflicts 10

Utility impacts were estimated from field visits. The scoring is based on the typical impacts existing utilities may cause during construction. Major impacts include relocating utilities, and minor impacts include raising manhole rims. Unknown impacts are for sites with the potential for utility conflicts but available data is insufficient to determine the nature of the conflict, if any.

Utility Impacts	Points
Major	0
Minor or Unknown	5
None	10

E. Environmental Impacts of Proposed Solution 10

Potential proposed impacts to trees, streams and wetlands were assigned a ranking as described in the table below. Trees, natural streams, and natural wetlands provide environmental benefits that are difficult to reproduce once impacted. A lower score was assigned to projects that would impact trees, wetland, and trees.

Types of Tree Loss	Points
Construction in wetlands or streams, or involves removal of more than 10 trees	0
Construction on edge of wetlands or streams, or removal of 1 to 9 trees	5
No impact to wetlands or trees	10

F. Regulatory Approval 10

Potential regulatory approval was assigned in the table below. In addition to environmental impacts, regulatory approvals for wetland, critical area, and floodplain impacts can be time consuming and expensive. A lower score was assigned to projects that would impact wetlands, floodplains, or dam safety.

Utility Impacts	Points
Regulatory approvals required	0
Regulatory approvals are <u>not</u> required	10

G. Flooding and Erosion Concerns 10

Flooding and erosion concerns was scored for each project based on whether there was evidence of flooding or erosion at each site. The City identified several locations with existing flooding concerns, and AECOM looked for evidence of flooding and erosion at field sites.

Utility Impacts	Points
No flooding or erosion concerns at site	0
Evidence of erosion at site	5
Flooding concerns at site	10

H. Anticipated Project Cost per Acre Treated 10

The evaluation of cost was a quantitative comparison of costs for a new or retrofit project based on the type of proposed storm water management facility. Relative capital costs per impervious acre treated were adapted from the University of Maryland's document *Costs of Stormwater Management Practices in Maryland Counties* (2011) along with engineering judgment. The costs from the University of Maryland document have been observed typically to be an under estimate of the actual implementation costs; however, they were used for this planning level analysis for comparative purposes only. The anticipated project cost per impervious acre treated was scored for each project based on whether costs were expected to be greater than \$100,000 per impervious acre treated, between \$40,000 and \$100,000 per impervious acre treated, or less than \$40,000 per impervious acre treated.

Storm water management practices that treat large drainage areas are generally more expensive than those that treat less; however, the anticipated cost per impervious acre treated may decrease for practices that treat large drainage areas. This criterion will be recalculated when ranking the conceptual designs as part of Task 6 using the estimated project cost and the calculated impervious drainage area.

Anticipated Projects Cost / Impervious Acre	Points
Greater than \$100,000	0
\$40,000 to \$100,000	5
Less than \$40,000	10

I. Public Visibility 5

Public acceptance of storm water treatment practices is often related to whether practices are aesthetically pleasing. Practices that will be aesthetically pleasing when implemented in public areas are given a high score (e.g., rain gardens, micro-bioretentions, and bioretentions), while those that are in public and would not be aesthetically pleasing (e.g., sand filters and infiltration basins) are given low a low score. Practices that are

aesthetically acceptable (e.g., ponds, swales, porous pavement, and infiltration trenches) or practices that are not aesthetically pleasing but are out of public view are given medium scores.

Utility Impacts	Points
In public view and not aesthetically acceptable	0
Aesthetically acceptable and/or not in public view	2.5
Aesthetically pleasing	5

J. Anticipated Annual Maintenance Cost 5

The evaluation of maintenance burden was a quantitative comparison of required maintenance for a site based on the type of proposed storm water management facility. The relative maintenance burden was adapted from the average annual maintenance costs from the University of Maryland's document *Costs of Stormwater Management Practices in Maryland Counties* (2011) along with engineering judgment. Anticipated annual maintenance cost was scored for each project based on whether costs per impervious acre are expected to be greater than \$2,000 per year, between \$1,000 and \$2,000 per year, or less than \$1,000 per year.

Anticipated Annual Maintenance Cost	Points
Greater than \$2,000	0
\$1,000 to \$2,000	5
Less than \$1,000	10

K. Ranking Criteria Summary Table

100

A table summarizing the ranking criteria is provided below. The impervious drainage area criterion will include the estimated total nitrogen removal, total phosphorus removal, and total suspended solids removal, during final ranking and evaluation of the conceptual designs as part of Task 6. The anticipated project cost will also be reevaluated when ranking the concept designs as part of Task 6.

<i>Prioritization Category</i>	<i>Max Score</i>	<i>Description</i>	<i>Score</i>
Impervious Drainage Area	25	Less than 0.5 acre	0
		Between 0.5 and 2 acres	12.5
		Greater than 2 acres	25
Site Ownership	10	Private/County/Maryland State Highway	0
		Home Owners Association or Institution	5
		City	10
Site Access	5	Poor	0
		Fair	2.5
		Good	5
Utility Conflicts	10	Major	0
		Minor or Unknown	5
		None	10
Environmental Impact of Proposed Solution	10	Construction in wetlands or streams, or involves removal of more than 10 trees	0
		Construction on edge of wetlands or streams, or removal of 1 to 9 trees	5
		No impact to wetlands or trees	10
Regulatory Approval	10	Regulatory approvals required	0
		Regulatory approvals are not required	10
Flooding Concerns	10	No flooding or erosion concerns at site	0
		Evidence of erosion at site	5
		Flooding concerns at site	10
Anticipated Project Cost / Impervious Acre ¹	10	Greater than \$100,000	0
		\$40,000 to \$100,000	5
		Less than \$40,000	10
Public Visibility ¹	5	In public view and not aesthetically acceptable	0
		Aesthetically acceptable and/or not in public view	2.5
		Aesthetically pleasing	5
Maintenance Burden ¹	5	Greater than \$2,000	0
		\$1,000 to \$2,000	2.5
		Less than \$1,000	5

¹ Base on BMP type

Table D-1: Back Creek Sub-Watershed Priority Ranking Table

Project ID	Location	Project Type	Impervious Drainage Area (0-25)	Ownership (0-10)	Access (0-5)	Utility Impacts (0-10)	Environmental Impact of Proposed Solution (0-10)	Regulatory Approval (0-10)	Flooding and Erosion Concerns (0-10)	Anticipated Project Cost / Impervious Acre (0-10)	Public Visibility (0-5)	Maintenanc e Burden (0-5)	Total Score (0-100)	Rank
Park_02	Ellen O. Moyer Nature Park at Back Creek (Bembe Beach Road and Edgwood Road)	Dry Swale Retrofit to Bioswale	0	10	5	10	5	10	10	10	2.5	2.5	65	1
Out_01	North of Edgewood Road (Osprey Nature Center).	Step Pool Conveyance System	25	10	0	10	0	0	5	5	2.5	5	62.5	2
BMP_06	Mt. Moriah Church (2204 Bay Ridge Ave)	Rain Garden	0	5	5	10	10	10	0	10	5	5	60	3
BMP_17	914 Bay Ridge Road (Georgetown Plaza)	Infiltration Basin Retrofit	12.5	0	5	10	5	10	0	5	2.5	5	55	4
Out_07	Windwhisper Lane and Georgetown Road	Step Pool Conveyance System	25	0	0	10	0	0	5	5	2.5	5	52.5	5
Out_05B	Northeast of Tylder Avenue and Janice Drive	Micro- Bioretention	0	5	5	10	10	10	0	5	5	2.5	52.5	5
Out_05A	Northeast of Tyler Avenue and Janice Drive	Bioretention	12.5	5	5	5	10	0	0	5	5	2.5	50	7

Table D-2: Severn River Sub-Watersheds Priority Ranking Table

Project ID	Location	Project Type	Impervious Drainage Area (0-25)	Ownership (0-10)	Access (0-5)	Utility Impacts (0-10)	Environmental Impact of Proposed Solution (0-10)	Regulatory Approval (0-10)	Flooding and Erosion Concerns (0-10)	Anticipated Project Cost / Impervious Acre (0-10)	Public Visibility (0-5)	Maintenance Burden (0-5)	Total Score (0-100)	Rank
BMP_02	1013-1075 Blackwell Road	Dry Pond Retrofit to Infiltration Basin	25	5	5	10	5	10	0	5	2.5	5	72.5	1
BMP_09	7101 Bay Front Drive (BayWoods of Annapolis)	Wet Pond Retrofit	25	5	2.5	5	10	10	0	5	2.5	5	70	2
Open_14	Southeast of Farragut Road and Roscoe Rowe Boulevard	Bioretention	12.5	0	5	10	10	10	0	5	5	2.5	60	3
BMP_19	Northwest of Adams Park Road	Dry Swale Retrofit	12.5	0	2.5	10	5	10	0	10	2.5	5	57.5	4
City_05	Southeast of Claude Street and Giddings Avenue (Municipal Public Work Property)	Step Pool Conveyance System	25	10	0	10	0	0	0	5	2.5	5	57.5	4
CtyRqst_01	Ridgewood Street and Brewer Avenue	Step Pool Conveyance System	25	0	0	10	5	0	5	5	2.5	5	57.5	4
Park_06	Chambers Park (North of Dorsey Avenue)	Bioswale	0	10	2.5	10	10	10	0	5	2.5	5	55	7
BMP_20	Northwest of Moreland Parkway	Wet Pond Retrofit	25	0	5	10	0	0	0	5	2.5	5	52.5	8
BMP_16	Northwest of Legion Avenue and West Street (Public Storage West Street)	Infiltration Trench	12.5	0	5	0	10	10	0	5	2.5	5	50	9
Open_11	North of Calvert Street and Roscoe Rowe Boulevard	Micro- Bioretention	0	0	5	10	10	10	0	5	5	2.5	47.5	10
Open_10	East of Lowes Access Road and Taylor Avenue	Bioretention	12.5	0	5	0	5	10	0	5	5	2.5	45	11

Table D-3: South River Sub-Watersheds Priority Ranking Table

Project ID	Location	Project Type	Impervious Drainage Area (0-25)	Ownership (0-10)	Access (0-5)	Utility Impacts (0-10)	Environmental Impact of Proposed Solution (0-10)	Regulatory Approval (0-10)	Flooding and Erosion Concerns (0-10)	Anticipated Project Cost / Impervious Acre (0-10)	Public Visibility (0-5)	Maintenance Burden (0-5)	Total Score (0-100)	Rank
BMP_15	Southwest of Child's Point Road and Woods Road	Wet Pond Retrofit	25	10	5	10	10	10	0	5	2.5	5	82.5	1
BMP_14	Harness Creek View Court	Wet Pond Retrofit	25	5	5	10	0	10	10	5	2.5	5	77.5	2
BMP_07	Southeast of Coybay Drive and Annapolitan Lane (Annapolis Walk)	Wet Pond Retrofit	25	5	5	10	10	0	0	5	2.5	5	67.5	3
BMP_08	5 Cherry Grove Avenue (The Village Greens)	Wet Pond Retrofit	25	0	2.5	10	5	10	0	5	2.5	5	65	4
City_03	Betsy Court (Municipal Housing Authority)	Infiltration Basin	12.5	10	2.5	10	10	10	0	5	2.5	2.5	65	4
City_01	Forest Drive (Municipal Housing Authority)	Sand Filter	25	10	0	0	5	10	0	5	2.5	2.5	60	6
City_06	Hunt Meadows Drive (Municipal Other)	Wet Pond	25	10	0	10	0	0	5	5	2.5	2.5	60	6
Open_16	Northeast of Centerfield Road and Hunt Meadow Drive	Bioretention	12.5	5	5	10	5	10	0	5	5	2.5	60	6
BMP_11	Cobblestone Drive (Annapolis Overlook Parking Lot)	Wet Pond Retrofit	25	0	0	10	10	0	0	5	2.5	5	57.5	9
City_02	Belle Court (Parks and Recreation)	Bioretention	0	10	5	10	10	10	0	5	5	2.5	57.5	9
Park_08	Annapolis Walk Park (Annapolis Walk Drive)	Dry Swale to Bioswale Retrofit	0	10	2.5	10	10	10	0	5	2.5	5	55	11
BMP_04	Juliana Circle West and Newtowne Drive (Riders Glen)	Dry Pond Retrofit to Pocket Wet Pond or Infiltration Basin	12.5	5	5	10	0	0	0	0	2.5	5	40	12
BMP_18	South of Aris T Allen Boulevard and Vineyard Road	Wet Pond Retrofit	12.5	0	0	10	0	10	0	0	2.5	5	40	12
Open_01	Southwest of Forest Drive and Martha Court	Micro-Bioretention	0	10	0	0	5	10	0	5	5	2.5	37.5	14

Table D-4: Spa Creek Sub-Watershed Priority Ranking Table

Project ID	Location	Project Type	Impervious Drainage Area (0-25)	Ownership (0-10)	Access (0-5)	Utility Impacts (0-10)	Environmental Impact of Proposed Solution (0-10)	Regulatory Approval (0-10)	Flooding and Erosion Concerns (0-10)	Anticipated Project Cost / Impervious Acre (0-10)	Public Visibility (0-5)	Maintenance Burden (0-5)	Total Score (0-100)	Rank
Park_03	Truxtun Park (North) near Pump House Road	Bioretention	12.5	10	5	10	10	10	10	5	5	2.5	80	1
BMP_05	Northeast of Juliana Circle East and Newtowne Drive (Riders Glen)	Dry Pond Retrofit to Sand Filter	25	5	5	10	10	10	0	5	0	2.5	72.5	2
Open_06B	East of Hilltop Lane and Spa Road	Micro-Bioretention	12.5	10	5	10	10	10	0	5	5	2.5	70	3
Open_12E	Saint John's Campus: Harrison Health Center	Rain Garden	12.5	5	5	10	10	10	0	5	5	2.5	65	4
Park_04A	Rec Center (Compromise Street and Newman Street)	Rain Garden	0	10	5	10	10	10	0	10	5	5	65	4
Open_12A	Saint John's Campus: Pinkney Hall	Rain Garden	0	5	5	10	10	10	5	10	5	2.5	62.5	6
Park_04B	Rec Center (Compromise Street and Saint Mary's Street)	Rain Garden	0	10	5	10	5	10	0	10	5	5	60	7
BMP_10	Meridian Nursing Center (Milkshake Ln and Hilltop Ln)	Wet Pond Retrofit	25	0	0	10	0	10	0	5	2.5	5	57.5	8
Open_12B	Saint John's Campus: Pinkney Hall	Rain Garden	0	5	5	10	10	10	0	10	5	2.5	57.5	8
Open_12C	Saint John's Campus: Pinkney Hall	Rain Garden	0	5	5	10	10	10	0	10	5	2.5	57.5	8
Open_12D	Saint John's Campus: Chase-Stone House	Rain Garden	0	5	5	10	10	10	0	10	5	2.5	57.5	8
Out_06	West of Spa Road and Silopanna Road	Dry Swale Retrofit	12.5	0	5	5	10	10	5	5	0	5	57.5	8
Open_06A	East of Hilltop Lane and Spa Road	Micro-Bioretention	0	5	5	10	10	10	0	5	5	2.5	52.5	13
Open_08	Northwest of Forest Drive and South Cherry Grove Avenue	Infiltration Trench Retrofit	0	10	5	5	10	10	0	5	2.5	5	52.5	13
Open_09	Center of State Circle	Rain Garden	0	0	5	10	10	10	0	10	5	2.5	52.5	13
Park_07	Amos Garrett Park (Amos Garrett Boulevard)	Rain Garden	0	10	2.5	10	10	0	0	10	5	5	52.5	13
BMP_01	1120 Spa Road (St. Martins Lutheran Church)	Bioretention	0	5	5	10	5	10	0	5	5	2.5	47.5	17

Project ID	Location	Project Type	Impervious Drainage Area (0-25)	Ownership (0-10)	Access (0-5)	Utility Impacts (0-10)	Environmental Impact of Proposed Solution (0-10)	Regulatory Approval (0-10)	Flooding and Erosion Concerns (0-10)	Anticipated Project Cost / Impervious Acre (0-10)	Public Visibility (0-5)	Maintenance Burden (0-5)	Total Score (0-100)	Rank
BMP_12	Tuckahoe Creek Court (Oxford_Landing_Section_III)	Infiltration Basin Retrofit	25	0	0	10	0	0	0	5	2.5	5	47.5	17
Trans_02	Maryland Avenue from King George Street to State Circle	Permeable Pavement	0	10	5	0	0	10	0	0	2.5	0	27.5	19
BMP_03	Milkshake Lane	Infiltration Basin Retrofit	0	0	2.5	5	0	10	0	0	2.5	5	25	20