LONG BRANCH CENTRAL WATERSHED IMPLEMENTATION WORK PLAN



Prepared for:
Fairfax County Department of Public Works and Environmental Services

Prepared by:
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January 2023

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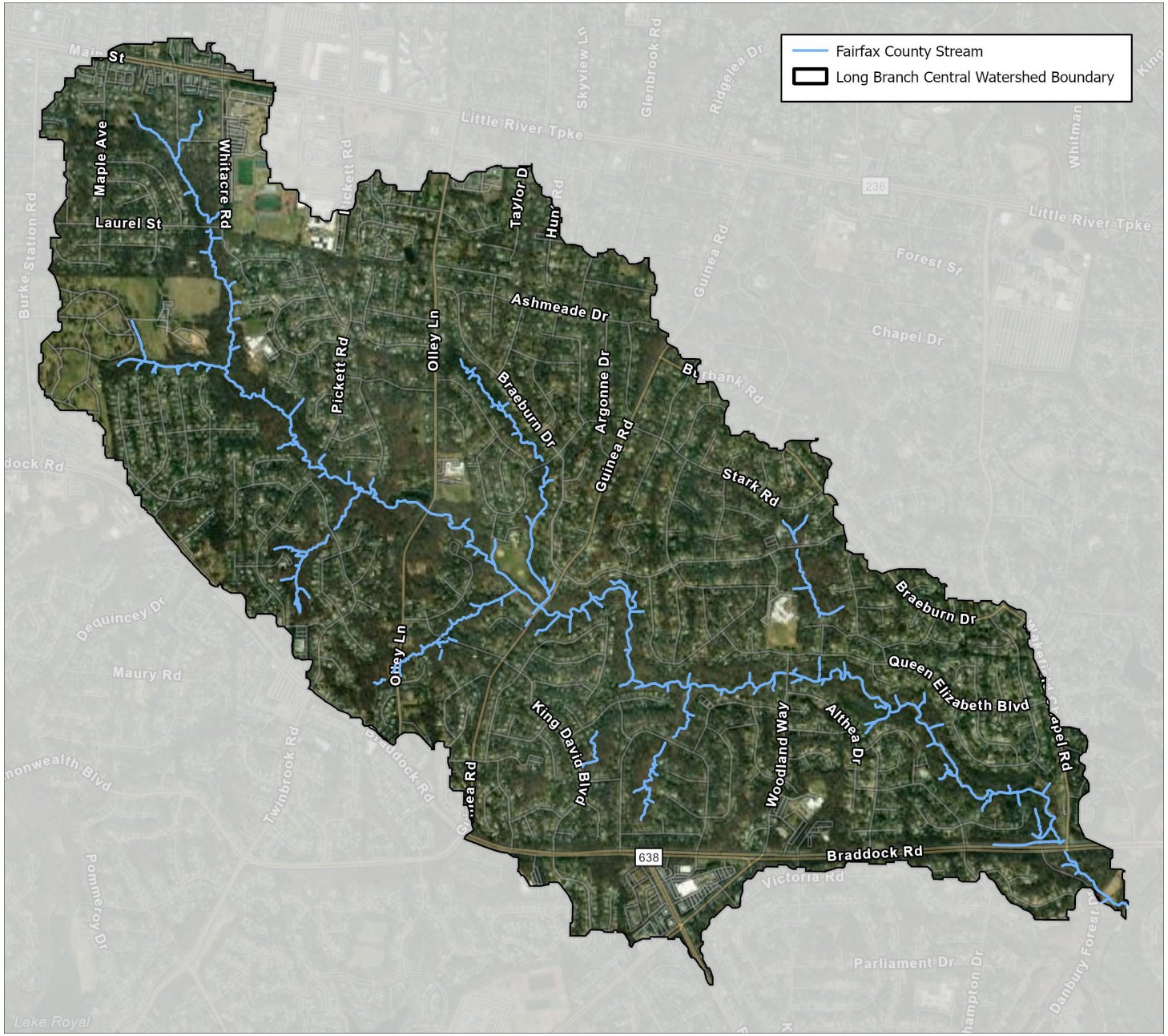
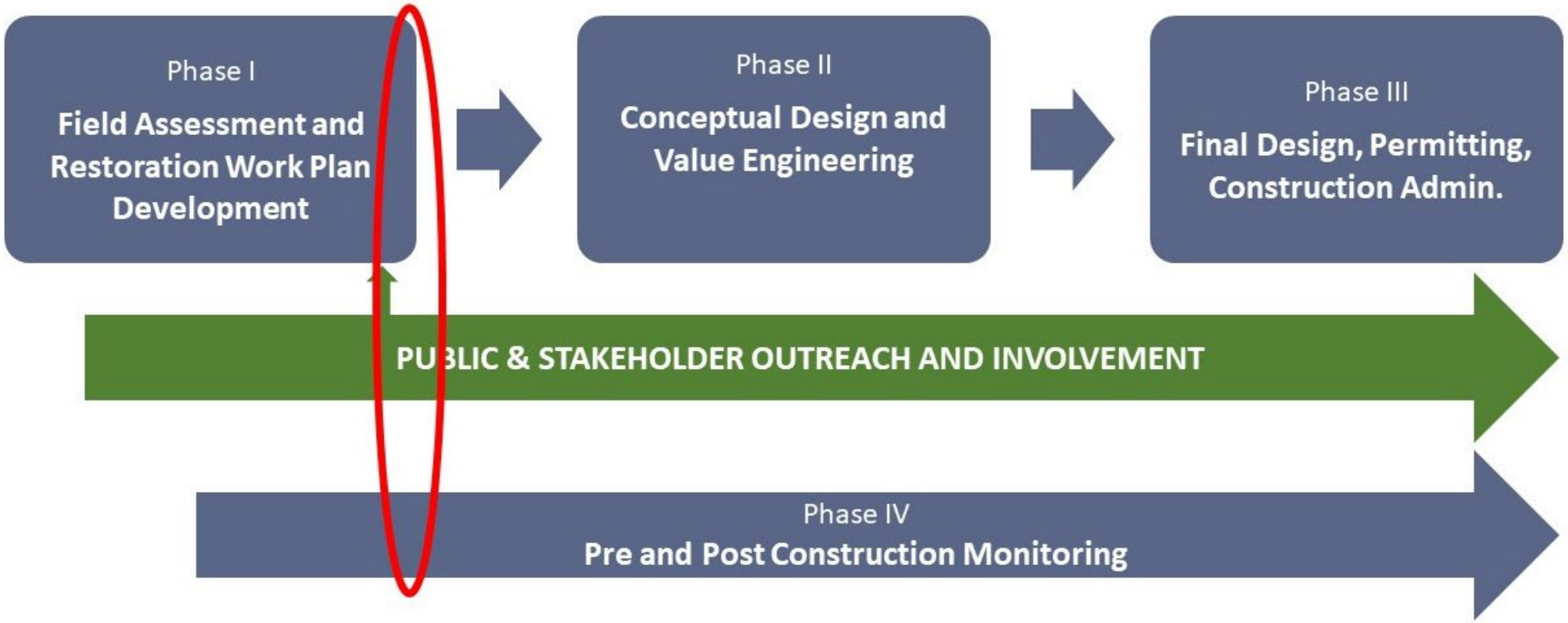


I. WATERSHED ASSESSMENTS AND RESTORATION OPPORTUNITY IDENTIFICATION

The overall approach to restoring Long Branch consists of four phases. Phase I, which is nearing completion, focused on watershed assessments and restoration opportunity identification. Phases II and III, which will begin in 2023, will move selected projects through design and construction. Phase IV is ongoing and includes both watershed and project-specific monitoring. Public outreach is also ongoing.

For more information, see Attachment A: **Response to Long Branch Central Watershed Management Area, Stream & Outfall Design, Construction Admin & As-Built Services RFP, Proposed And Preliminary Scopes Of Work**



Existing Information Review and Field Assessment Work Plan

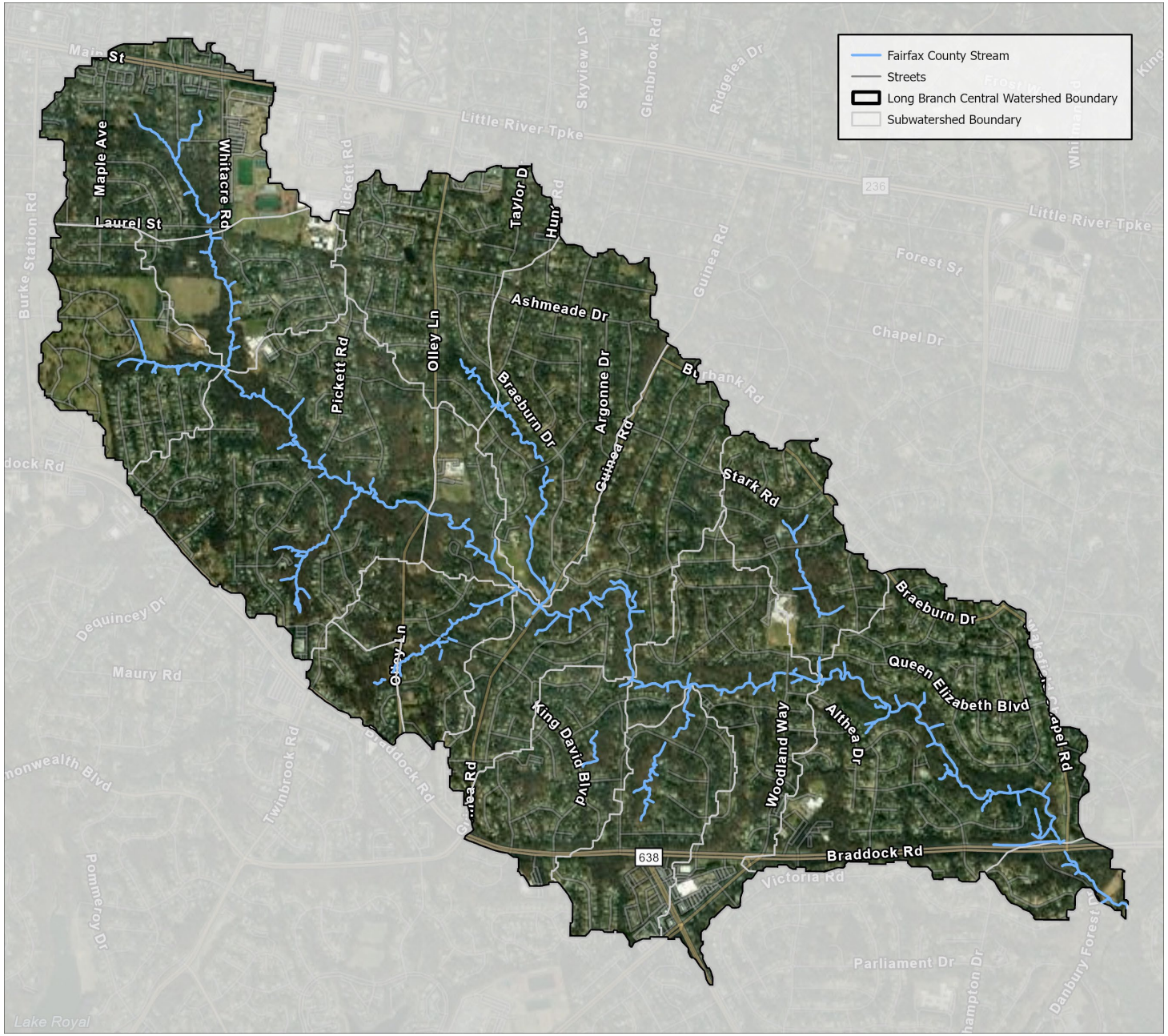
Desktop Assessment

- Reviewed existing watershed information, data and mapping
- Developed public outreach and participation plan
- Developed preliminary restoration goals
- Developed the field assessment plan
- Developed preliminary approach to monitoring

Watershed Profile

- Drainage Area: 3.8 square miles
- Current Imperviousness: 27%
- Stream Length: Approximately 12 miles
- Land Use:
  - Residential (58% of the watershed)
  - Non-Residential (28% of the watershed)
  - Open Space (3% of the watershed)
  - Recreation (11% of the watershed)

For more information, see Attachment B: **Long Branch Central Watershed Management Restoration Framework**



Field Assessment and Restoration Opportunity Identification

Stream Corridor Assessments

Assessed ~12 miles of stream and ~150 outfalls

Assessments conducted:

- Stream Restoration Assessment
- Physical Habitat Assessment
- Floodplain Vegetation Assessment
- BANCS Assessment
- Miscellaneous (resident interactions & points of interest)
- Pipe Crossing
- Outfall: RSC Potential
- Outfall: Repair Needs

County-Maintained Stormwater Facility Assessments

Assessed retrofit potential of 21 existing stormwater management facilities

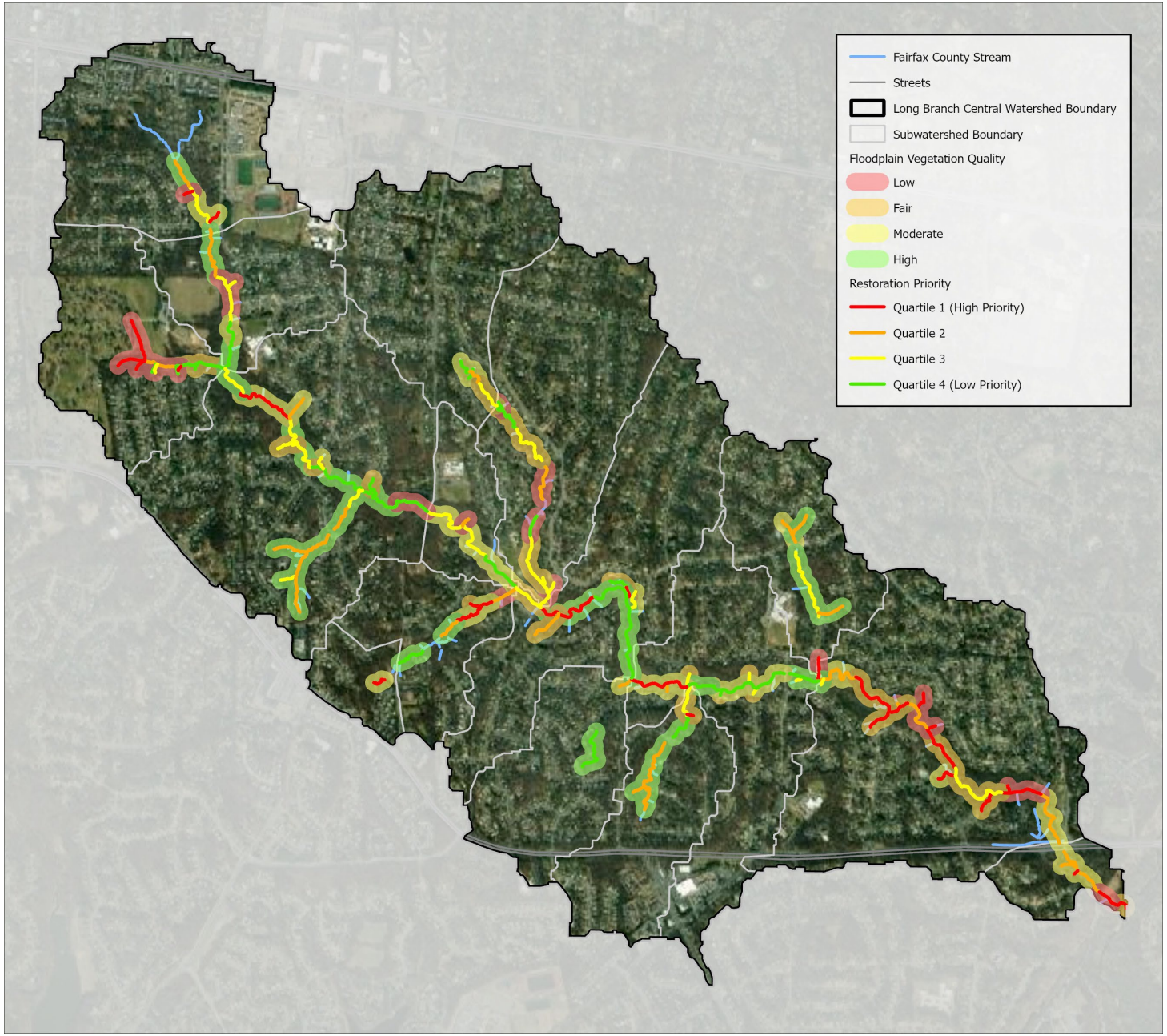
For more information, see Attachment C: **Long Branch Field Assessment Report**

Phase I.B – Field Assessment and Restoration Opportunity Identification

Preliminary Project Identification and Prioritization

- Watershed assessment data used to identify and prioritize potential projects.
- Scoring schemas developed for three project types: stream restoration, RSCs, and stormwater BMP retrofits.
- For stream restoration, prioritization scoring criteria applied on a reach-by-reach basis.
- Each potential project scored within its project type.
- While scoring metrics varied by project type, a similar scoring framework developed and applied across all three project types.
- Scoring metrics organized into three bins:
  - **Ecological benefits**: parameters included sediment load addressed, floodplain vegetation quality, etc.
  - **Ancillary benefits**: parameters included public input obtained via County complaints database, correspondence with County staff, field crew interactions, and the public input map.
  - **Feasibility**: parameters included constraints, property ownership, access, etc.

For more information, see Attachment C: **Long Branch Field Assessment Report**



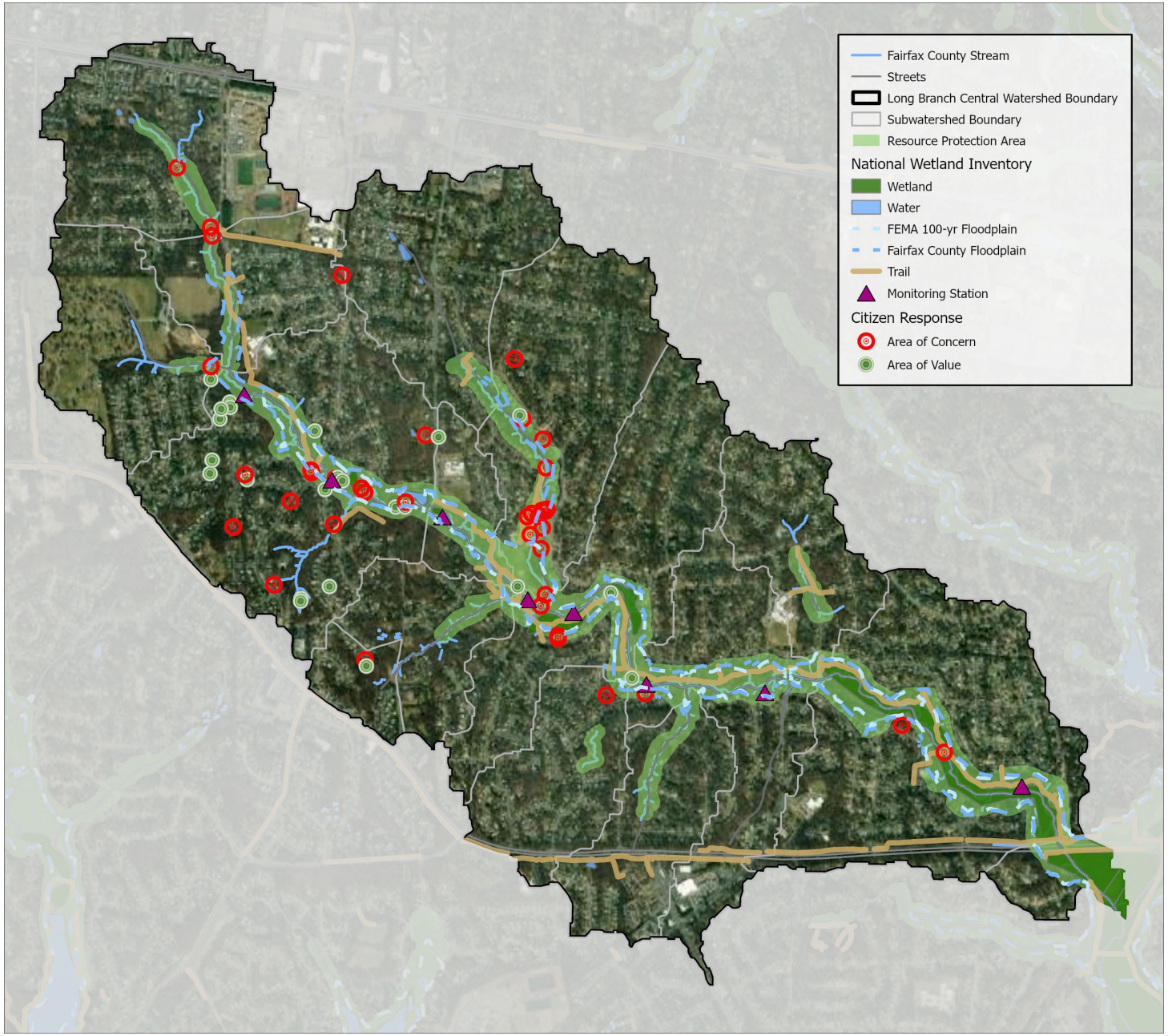
Environmentally Sensitive Areas Mapping

Prepared preliminary watershed-wide mapping of known high quality and environmentally sensitive areas.

- Streams
- Resource Protection Areas
- Wetlands
- FEMA 100-year Floodplain
- Fairfax County Floodplain
- Trails
- Monitoring Stations
- Citizen Responses – Areas of Concern and Areas of Value

Used existing data only, no additional field assessments or surveys conducted.

More detailed field assessments to be conducted prior to design.



II. OVERVIEW OF RECOMMENDED PROJECTS

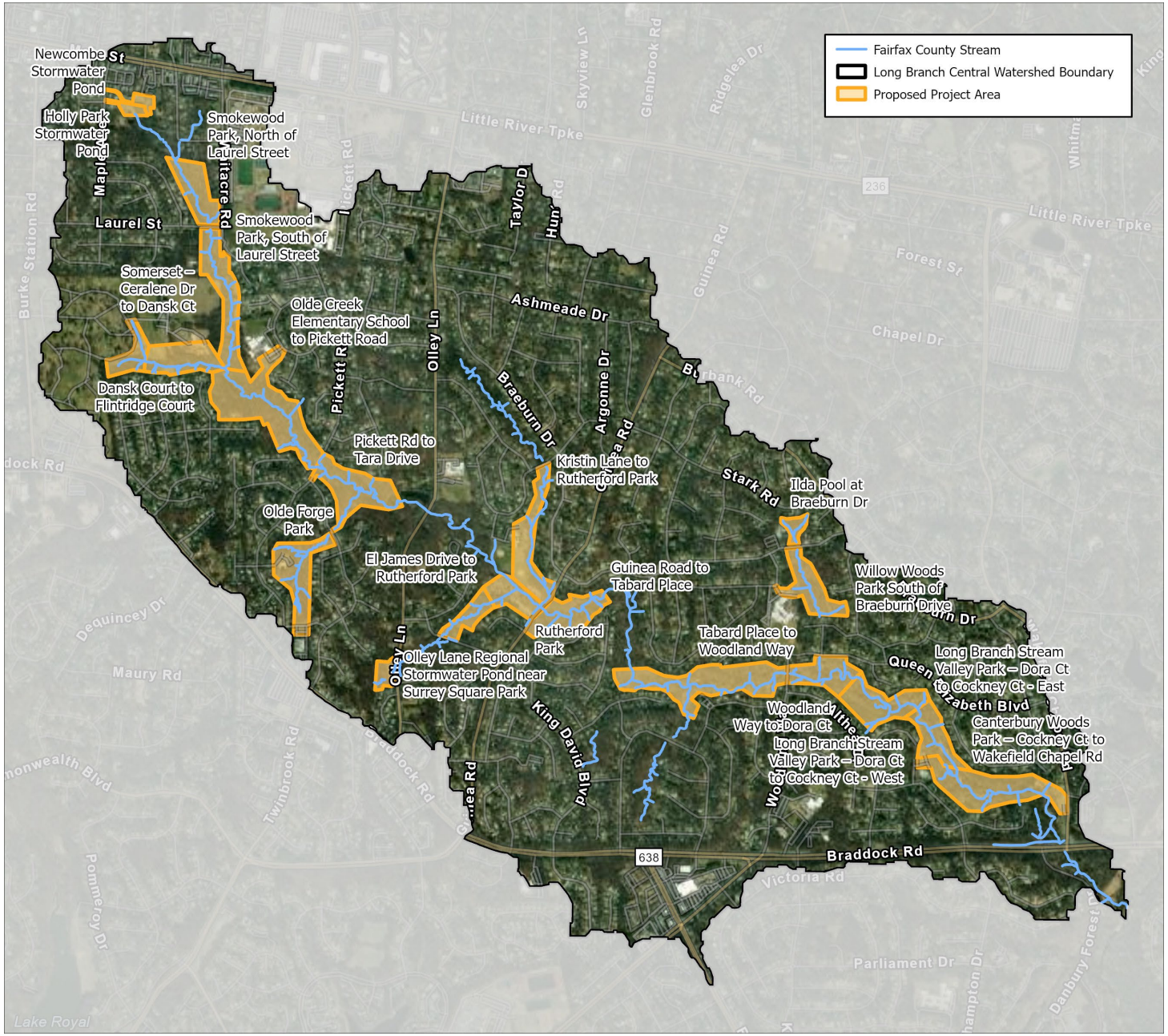
Aggregated the stream reaches and outfalls verified in Phase I.B into project opportunities:

- 15 stream restoration projects
- 2 stream restoration + stormwater retrofit projects
- 3 stormwater retrofit projects

Aggregation driven by proximity, access, and project synergies (e.g., two outfalls that discharge to an adjacent stream reach will be considered one project).

An overview of each project is provided in the following pages.

For more information, see Attachment D: **Long Branch Restoration Opportunity Project Descriptions**



Canterbury Woods Park – Cockney Court to Wakefield Chapel Road

Entrenched, widening channel with low quality floodplain vegetation.

Widening channel with large invasive plant species along left bank.

Entrenched, widening channel with multiple flow paths due to mobile substrate; large streambed material deposit.

Example of a widening outfall channel.

Overview

This potential project in Canterbury Woods Park extends from Cockney Court east to Wakefield Chapel Road. It is largely located on Fairfax County Park Authority property, and potentially includes land owned by the Canterbury Woods Swim Club. The restoration project area includes 2,580 linear feet of stream, regulated floodplains and wetlands, and a forested stream corridor with many intermediate age floodplain trees present. The existing floodplain understory vegetation is of marginal quality with a large presence of invasive plant species. An active sewer line runs along the stream and crosses the stream multiple times; however, no exposed pipes have been identified. A high traffic natural surface trail is located within the project area.

The Long Branch mainstem is a perennial stream that has downcut and widened due to past increases in stormwater runoff from development throughout the contributing drainage area. The banks along the mainstem are three (3) to six (6) feet high with shallow tree root depths and a lack of surface protection exposing the banks to continued erosion. One outfall channel drains from King Richard Drive south to the Long Branch mainstem, while two other outfall channels drain from Canterbury Drive northeast to the Long Branch mainstem. These channels are intermittent and downcut with banks ranging from two (2) to four (4) high.

Restoration Goals and Methods

This project will focus on stabilizing the eroding mainstem and outfall channels to stop current and prevent future channel erosion, improve floodplain function and aquatic habitat, and enhance the health of the riparian forest throughout the stream corridor.

Restoration methods that may be employed:

- Place rock structures within the mainstem to reduce channel erosion, increase channel "roughness", and improve habitat for fish and other aquatic organisms. Structures will be placed in the current channel extents and some grading will occur.
- Stabilize outfall channels using rock and wood structures to reduce channel erosion and improve habitat where possible.
- Large wood may be placed in the mainstem and outfall channels on a limited basis to protect banks and improve habitat for fish and other aquatic organisms.
- Control invasive plant species.
- Conduct restoration planting throughout the floodplain. Note that trees in poor health in the floodplain may be removed to reduce hazard trees, open light gaps to assist in regeneration, and provide large woody debris to improve stream and floodplain stability and habitat and to increase "roughness" to reduce erosion and trap organic debris.

Canterbury Woods Park – Cockney Court to Wakefield Chapel Restoration Opportunity Map

Long Branch Central Watershed

Fairfax County, Virginia

Restoration Opportunity:

Canterbury Woods Park –
Cockney Ct to Wakefield Chapel Rd

December 2022

Existing Conditions

- Stream
- Parcel Boundary
- Fairfax County Floodplain
- FEMA 100-yr Floodplain
- Monitoring Station
- Resource Protection Area

National Wetland Inventory
- Wetland
- Water

Floodplain Vegetation Quality
- Low
- Fair
- Moderate

Restoration Priority
- Quartile 1
- Quartile 2
- Quartile 3

Existing Infrastructure

- Trail
- Storm Drain Node
- Storm Drain
- Sanitary Sewer

Restoration Elements

- Construction Access
- Stockpile
- Channel Realignment
- Channel Modification

Long Branch Stream Valley Park – Dora Court to Cockney Court

Entrenched, widening stream channel impeding on infrastructure; large supply of streambed material.

Stream channel impeding on private property.

Impervious outfall channel with invasive plant species as dominant floodplain vegetation.

Widening outfall channel.

Overview

This restoration project in the Long Branch Stream Valley Park extends from Dora Court to Cockney Court and is located on Fairfax County Park Authority property. It potentially includes land owned by the Canterbury Woods Swim Club. The restoration project area includes 3,250 linear feet of stream, regulated floodplains and wetlands, and a forested stream corridor with many intermediate age floodplain trees present. The existing floodplain understory vegetation is of marginal quality with a large presence of invasive plant species. An active sewer line runs along the stream and crosses the stream multiple times, where an exposed manhole and sewer pipe have been identified. A high traffic natural surface trail is located within the project area.

The Long Branch mainstem is a perennial stream that has downcut and widened due to past increases in stormwater runoff from development throughout the contributing drainage area. The banks along the mainstem are three (3) to seven (7) feet high with shallow tree root depths and a lack of surface protection exposing the banks to continued erosion. The mainstem is threatening existing sewer and trail infrastructure and is disconnected from the floodplain. Three separate outfall channels drain to the Long Branch mainstem from King Richard Drive, Queen Elizabeth Boulevard, and English Drive. These channels are intermittent and downcut with banks ranging from four (4) to six (6) high.

Restoration Goals and Methods

This project will focus on protecting existing infrastructure, stabilizing the eroding mainstem and outfall channels to stop current and prevent future channel erosion, improve floodplain function and aquatic habitat, and enhance the health of the forest throughout the stream corridor.

Restoration methods that may be employed:

- Place rock structures within the mainstem to reduce channel erosion, increase channel "roughness", and improve habitat for fish and other aquatic organisms. Channel extents will be altered to protect private property and existing sewer and trail infrastructure, and some grading will occur.
- Channel restoration of intermittent channels using regenerative stormwater conveyance to capture and infiltrate stormwater, reduce, and prevent channel erosion and elevate and restore ground water elevations which improve channel base flow to better support aquatic organisms.
- Large wood may be placed in the mainstem and outfall channels on a limited basis to protect banks and improve habitat for fish and other aquatic organisms.
- Control invasive plant species.
- Conduct restoration planting throughout the floodplain. Note that trees in poor health in the floodplain may be removed to reduce hazard trees, open light gaps to assist in regeneration, and provide large woody debris to improve stream and floodplain stability and habitat and to increase "roughness" to reduce erosion and trap organic debris.

Long Branch Stream Valley Park – Dora Court to Cockney Court Restoration Opportunity Map

Woodland Way to Dora Court

Widening stream channel; large supply of streambed material.

Potential wetland enhancement area located in the disconnected floodplain.

Debris blockage and exposed sewer manhole.

Concrete outfall channel discharging into widening natural channel.

Overview

The Woodland Way to Dora Court project is located on Fairfax County Park Authority property east of Woodland Way between Queen Elizabeth Boulevard and Althea Drive and is bound by private properties to the north and south. The restoration project area includes 1,780 linear feet of stream, regulated floodplains and wetlands, and a forested stream corridor with many mature trees present. The existing floodplain understory vegetation ranges between poor and optimal quality with some presence of invasive plant species. An active sewer line runs along the stream and crosses the stream multiple times, where an exposed manhole has been identified. A high traffic natural surface trail is located within the project area.

The Long Branch mainstem is a perennial stream that has downcut and widened due to past increases in stormwater runoff from development throughout the contributing drainage area. The banks along the mainstem are three (3) to six (6) feet high with shallow tree root depths and density exposing the banks to continued erosion. One outfall channel drains from Queen Elizabeth Boulevard south to the Long Branch mainstem, while another outfall channel drains from Woodland Way east to the Long Branch mainstem. These channels are intermittent and downcut with banks ranging from three (3) to four (4) feet high. An exposed manhole is located on the outfall channel from Queen Elizabeth Boulevard.

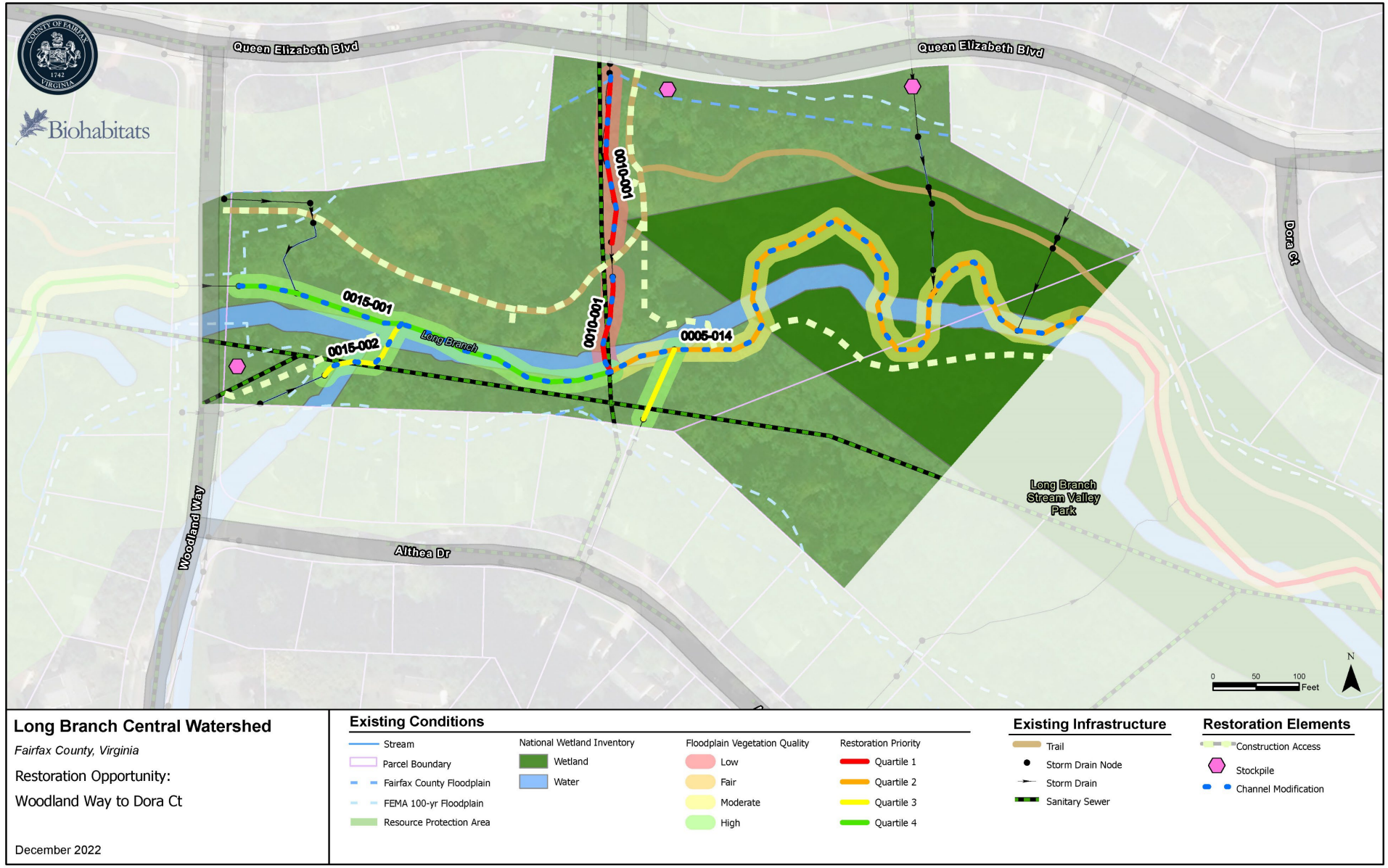
Restoration Goals and Methods

This project will focus on protecting existing infrastructure, stabilizing the eroding mainstem and outfall channels to stop current and prevent future channel erosion, and improve floodplain function and aquatic habitat, while protecting the surrounding good quality forest and enhancing areas where the forested stream corridor are degraded.

Restoration methods that may be employed:

- Place rock structures within the mainstem to reduce channel erosion, increase channel "roughness", and improve habitat for fish and other aquatic organisms. Structures will be placed in the current channel extents and some grading will occur.
- Stabilize outfall channels using rock and wood structures to reduce channel erosion and improve habitat where possible. Outfall channel alignment may be altered to protect existing sewer infrastructure.
- Large wood may be placed in the mainstem and outfall channels on a limited basis to protect banks and improve habitat for fish and other aquatic organisms.
- Control invasive plant species.
- Conduct restoration planting throughout the floodplain. Note that trees in poor health in the floodplain may be removed to reduce hazard trees, open light gaps to assist in regeneration, and provide large woody debris to improve stream and floodplain stability and habitat and to increase "roughness" to reduce erosion and trap organic debris.

Woodland Way to Dora Court Restoration Opportunity Map



Willow Woods Park South of Braeburn Drive

Widening channel with multiple flow paths due to mobile substrate.

Large pedestrian foot bridge spanning stream where elevation and plan form are a constraint.

Incised and widening channel.

Three outfalls at upstream end of reach with failing apron structure.

Overview

The Willow Woods Park project is located on Fairfax County Park Authority property south of Braeburn Drive and west of Ponderosa Drive, and potentially includes land owned by the Canterbury Woods Elementary School. Private properties surround the restoration project area, which includes 1,530 linear feet of stream and forested stream corridor dominated by mature upland mixed hardwood trees. The existing understory vegetation is of good to fair quality with some invasive plant species particularly near the outfall at Braeburn Drive. An active sewer line runs adjacent to the stream and crosses the stream, where an exposed sewer pipe has been identified. High traffic asphalt and natural surface trails with a large pedestrian foot bridge are located within the project area.

The Willow Woods Park stream is a perennial channel that has downcut and widened due to past increases in stormwater runoff from development throughout the contributing drainage area. The banks along the perennial channel are two (2) to ten (10) feet with shallow root depths and a lack of surface protection exposing the bank to continued erosion. These high bank heights combined with the ongoing widening of the channel have disconnected the channel from its floodplain. An intermittent outfall channel enters the Willow Woods Park stream from Ponderosa Drive and has banks ranging from two (2) to five (5) high.

Restoration Goals and Methods

This project will focus on protecting existing trees, infrastructure and private properties; stabilizing the eroding stream and outfall channel to stop current and prevent future channel erosion; improving floodplain function and habitat for fish and other aquatic organisms; and improving the health of the riparian forest throughout the corridor.

Restoration methods that may be employed:

- Place wood and rock structures within stream and outfall channels to reduce channel erosion and migration toward private property, increase channel "roughness", and improve habitat for fish and macroinvertebrates. Channel extents may be altered to protect private property and existing sewer infrastructure, and some grading will occur.
- Work largely within the stream channel to protect surrounding trees and forest community.
- Large wood may be placed in the stream and outfall channel on a limited basis to protect banks and improve habitat for fish and other aquatic organisms.
- Placement of wood to increase channel and floodplain "roughness", improve resiliency, and improve both habitat and biodiversity.
- Control invasive plan species.
- Restoration planting throughout the floodplain. Trees in poor health may be removed to reduce hazard trees, open light gaps to assist in regeneration, and provide large woody debris.

Willow Woods Park South of Braeburn Drive Restoration Opportunity Map

Ilda Pool at Braeburn Drive

Stream segment entering the downstream culvert that passes under Braeburn Drive.

Sewer crossing and invasive plant species.

Trees and invasive plant species in floodplain.

Mature trees along incised channel of stream segment 0010-005.

Overview

The Ilda Pool at Braeburn Drive project is located on land owned by the Ilda Community Recreation Association Inc. north of Braeburn Drive and east of the Ilda community pool. The restoration project area includes 760 linear feet of stream and forested stream corridor dominated by mature upland mixed hardwood trees. The existing understory vegetation is of sub-optimal quality with canopy gaps and invasive plant species. An active sewer line runs adjacent to and crosses the stream, where an exposed sewer pipe has been identified.

The project area includes two perennial channels that are downcut due to past increases in stormwater runoff from development throughout the contributing drainage area. The banks along the channels are three (3) to six (6) feet with shallow to well-established root depths exposing the banks with shallow root depths to continued erosion. The Ilda community pool discharges into the channel near the exposed sewer pipe and has begun undercutting several mature trees. The channel closest to the pool discharges from a large concrete channel which is undercut by erosion.

Restoration Goals and Methods

This project will focus on protecting existing infrastructure; stabilizing the eroding stream channels to stop current and prevent future channel erosion; and improving floodplain function, aquatic habitat, and the health of the riparian forest throughout the corridor.

Restoration methods that may be employed:

- Place wood and rock structures within stream channels to protect existing sewer infrastructure, reduce channel erosion, increase channel "roughness", and improve habitat for fish and macroinvertebrates. Channel extents may be altered to protect existing sewer infrastructure and some grading will occur.
- Large wood may be placed in the streams on a limited basis to protect banks and improve habitat for fish and other aquatic organisms.
- Placement of wood to increase channel and floodplain "roughness", improve resiliency, and improve both habitat and biodiversity.
- Protect older mature trees on east side of channel north of Braeburn Drive.
- Control invasive plant species.
- Restoration planting throughout the floodplain. Trees in poor health may be removed to reduce hazard trees, open light gaps to assist in regeneration, and provide large woody debris.

Ilda Pool at Braeburn Drive Restoration Opportunity Map

Tabard Place to Woodland Way

Widening stream channel with poor alignment into downstream culvert; large supply of sediment and streambed material in front of

Widened stream channel with active bank erosion and an alignment nearing private properties.

Large deposit of streambed material to be harvested.

Widened perennial natural outfall channel.

Overview

This restoration project extends from Tabard Place east to Woodland Way and is located on Fairfax County Park Authority property. The property is bound by private properties to the north and south throughout the project area. The restoration area includes 3,940 linear feet of stream, regulated floodplains and wetlands, and a forested riparian corridor with many mature trees. The existing floodplain understory is minimal and overshadowed by Beech and Tulip Poplars with little presence of invasive plant species. A sewer line runs along the stream and crosses it in multiple locations; however, no exposed pipes have been identified. An asphalt and natural surface trail with a large pedestrian foot bridge is located within the project area.

The western (upstream) stream reaches, and associated outfall channels, have downcut and widened. The stream banks along these segments are three (3) to six (6) feet high with shallow tree root depths and a lack of surface protection exposing the banks to continued erosion. The stream here is disconnected from its floodplain. The eastern (downstream) stream reaches are in good condition with stable stream features and good instream habitat, although there are areas with undermined trees falling into the stream and causing limited erosion. The stream is connected to its floodplain in this area, with erosion on the floodplain due to excessive storm flows which remove leaf litter and organic debris. The floodplain forest has almost no understory or tree recruitment due to excessive browsing by white-tailed deer. Although there are many large trees, the overall forest diversity is low. The farthest downstream part of the project area has a steep stream slope toward Woodland Way. This steep stream reach could become unstable in the future, causing significant erosion and adjustment of the stable portion immediately upstream.

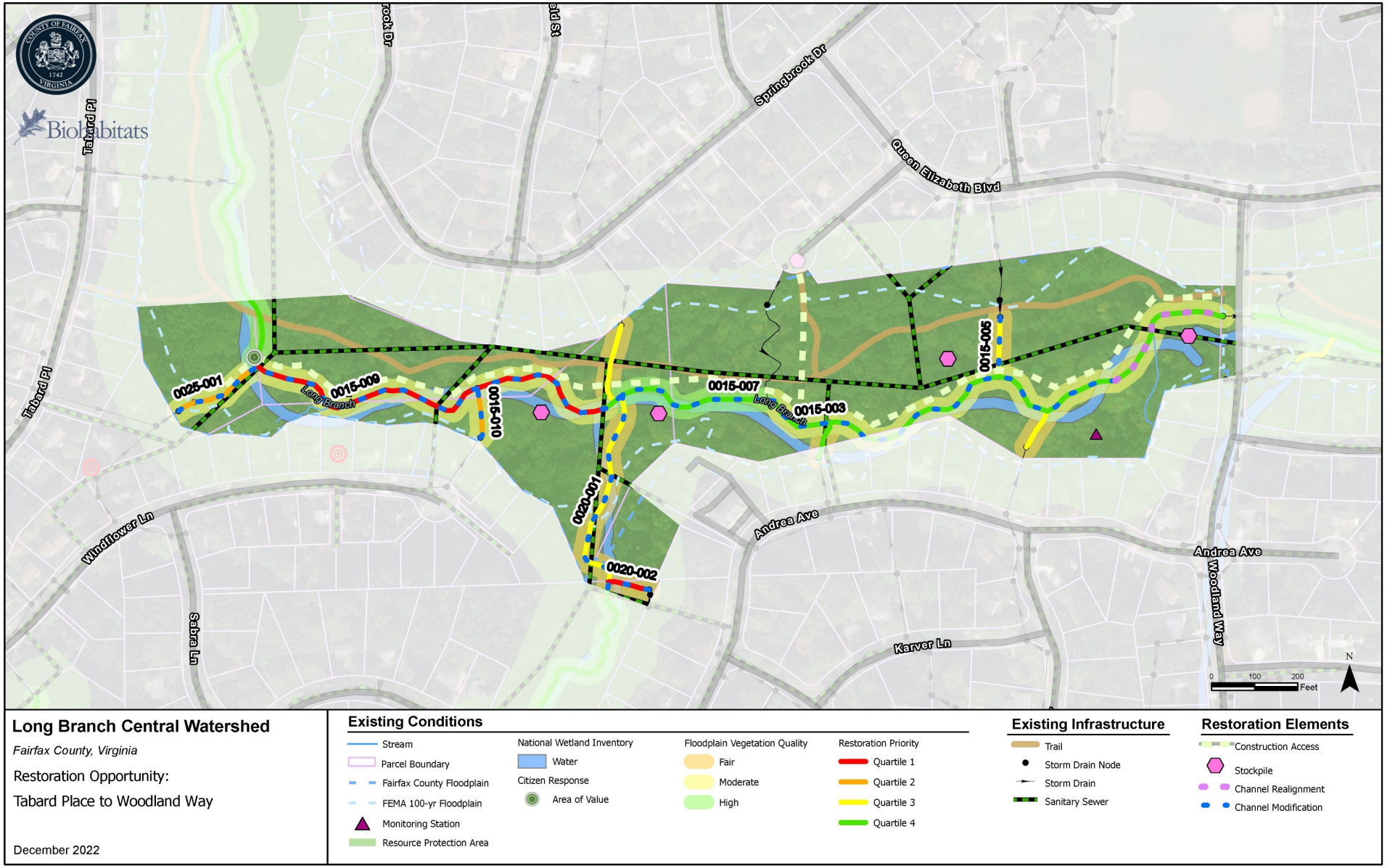
Restoration Goals and Methods

This project will focus on stabilizing the eroding reaches on the upstream portion of the project area, improving aquatic habitat, protecting the stable downstream portion of the project area, preventing stream erosion near Woodland Way, and improving the health of the riparian forest throughout the corridor.

Restoration methods that may be employed:

- Place rock structures within western stream reaches and near Woodland Way to reduce channel erosion and migration, increase channel "roughness", and improve habitat for fish and other aquatic organisms. Structures will be placed in the existing channel extents and some grading will occur.
- Stabilize outfall channels using rock and wood structures to stop erosion and improve habitat.
- Protect the stable eastern stream reaches except in isolated areas where undermined trees may be taken down to prevent them falling in the stream. Large wood may be placed in the channel on a limited basis to protect banks and improve habitat for fish and other aquatic organisms.
- Placement of wood to increase channel and floodplain "roughness", improve resiliency, and improve both habitat and biodiversity.
- Conduct restoration planting throughout the floodplain. Trees in poor health may be removed to reduce hazard trees, open light gaps to assist in regeneration, and provide large woody debris.

Tabard Place to Woodland Way Restoration Opportunity Map



Guinea Road to Tabard Place

Widening stream channel with actively eroding banks and large supply of streambed material.

Channel alignment impeding on existing sewer infrastructure.

Incised outfall channel.

Trail culverts discharging into stream segment.

Overview

The Guinea Road to Tabard Place project is located on Fairfax County Park Authority property east of Guinea Road and Rutherford Park between Braeburn Drive and King Solomon Drive and is bound by private properties to the north, south, and east. The restoration project area includes 1,560 linear feet stream and outfall channel, regulated floodplains and wetlands, and a forested stream corridor with many mature floodplain to mesic trees present. The existing floodplain understory consists of sub-optimal quality vegetation and has a fair amount of invasive plant species present. An active sewer line runs along the stream and crosses the stream once, where an exposed manhole has been identified. A high traffic asphalt and natural surface trail is located within the project area.

The stream is part of the Long Branch mainstem and has downcut and widened due to past increases in stormwater runoff from development throughout the contributing drainage area. The banks along the mainstem are three (3) to six (6) feet high with shallow tree root depths and lack of surface protection exposing the banks to continued erosion. One outfall channel drains from King Solomon Drive northeast to the Long Branch mainstem. The outfall channel is downcut and intermittent with banks ranging from four (4) to six (6) feet high.

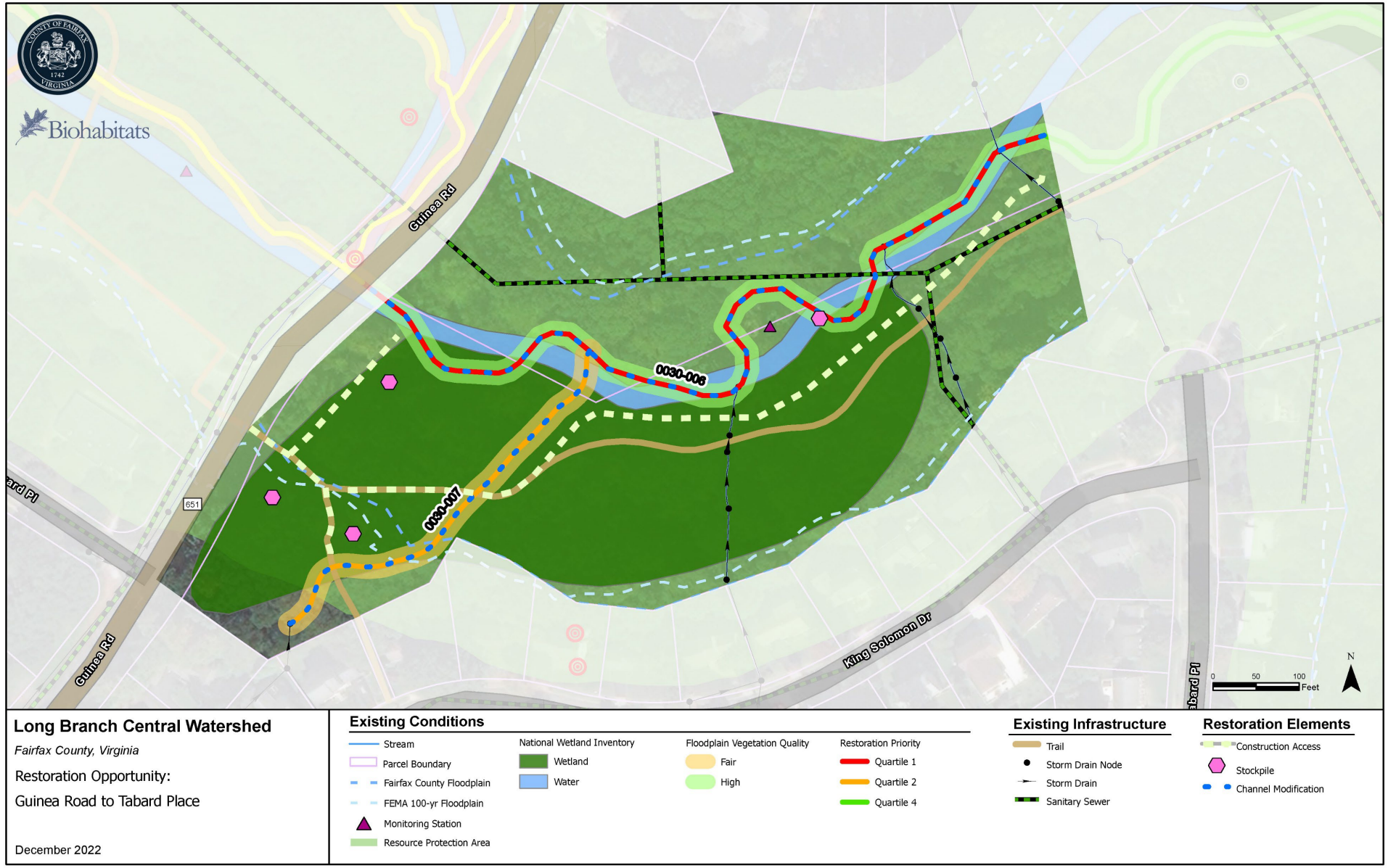
Restoration Goals and Methods

This project will focus on protecting existing infrastructure, stabilizing the eroding mainstem and outfall channels to stop current and prevent future channel erosion, and improve floodplain function and aquatic habitat, while protecting the surrounding sub-optimal quality forest and enhancing areas where the forested stream corridor are degraded.

Restoration methods that may be employed:

- Place rock structures within the mainstem to reduce channel erosion, increase channel "roughness", and improve habitat for fish and other aquatic organisms. Structures will be placed in the current channel extents and some grading will occur. Minor channel alignment modifications will occur to protect existing sewer infrastructure.
- Channel restoration of intermittent outfall channel using regenerative stormwater conveyance to capture and infiltrate stormwater, reduce, and prevent channel erosion and elevate and restore ground water elevations which improve channel base flow to better support aquatic organisms.
- Large wood may be placed in the mainstem and outfall channels on a limited basis to protect banks and improve habitat for fish and other aquatic organisms.
- Control invasive plant species.
- Conduct restoration planting throughout the floodplain. Note that trees in poor health in the floodplain may be removed to reduce hazard trees, open light gaps to assist in regeneration, and provide large woody debris to improve stream and floodplain stability and habitat and to increase "roughness" to reduce erosion and trap organic debris.

Guinea Road to Tabard Place Restoration Opportunity Map



Rutherford Park

Widening channel to be accessed via Rutherford Park.

Widening channel with actively eroding banks and lack of trees.

Widening channel with poor floodplain vegetation quality.

Overhead electric lines and road bridge at end of stream segment 0030-008.

Overview

The Rutherford Park project is located on Fairfax County Park within Rutherford Park. The restoration project area includes 840 linear feet of stream, regulated floodplains, and a forested stream corridor with a few mature floodplain trees. The existing floodplain understory vegetation is of poor quality as much of it is maintained lawn with some invasive plant species present in unmaintained areas. Sewer lines and overhead electric lines are in the project area but are not exposed or being impacted. High traffic paved and natural surface trails are located within the project area as well as one old steel pedestrian bridge across the mainstem of the creek.

The project area consists of two perennial, incised stream channels that have downcut and widened due to past increases in stormwater runoff from development throughout the contributing drainage area. The banks along the mainstem are three (3) to six (6) feet high with shallow tree root depths exposing the banks to continued erosion. Earth Sangha has worked with volunteers for many years to restore vegetation along the southern stream bank between the channel and the parking lot.

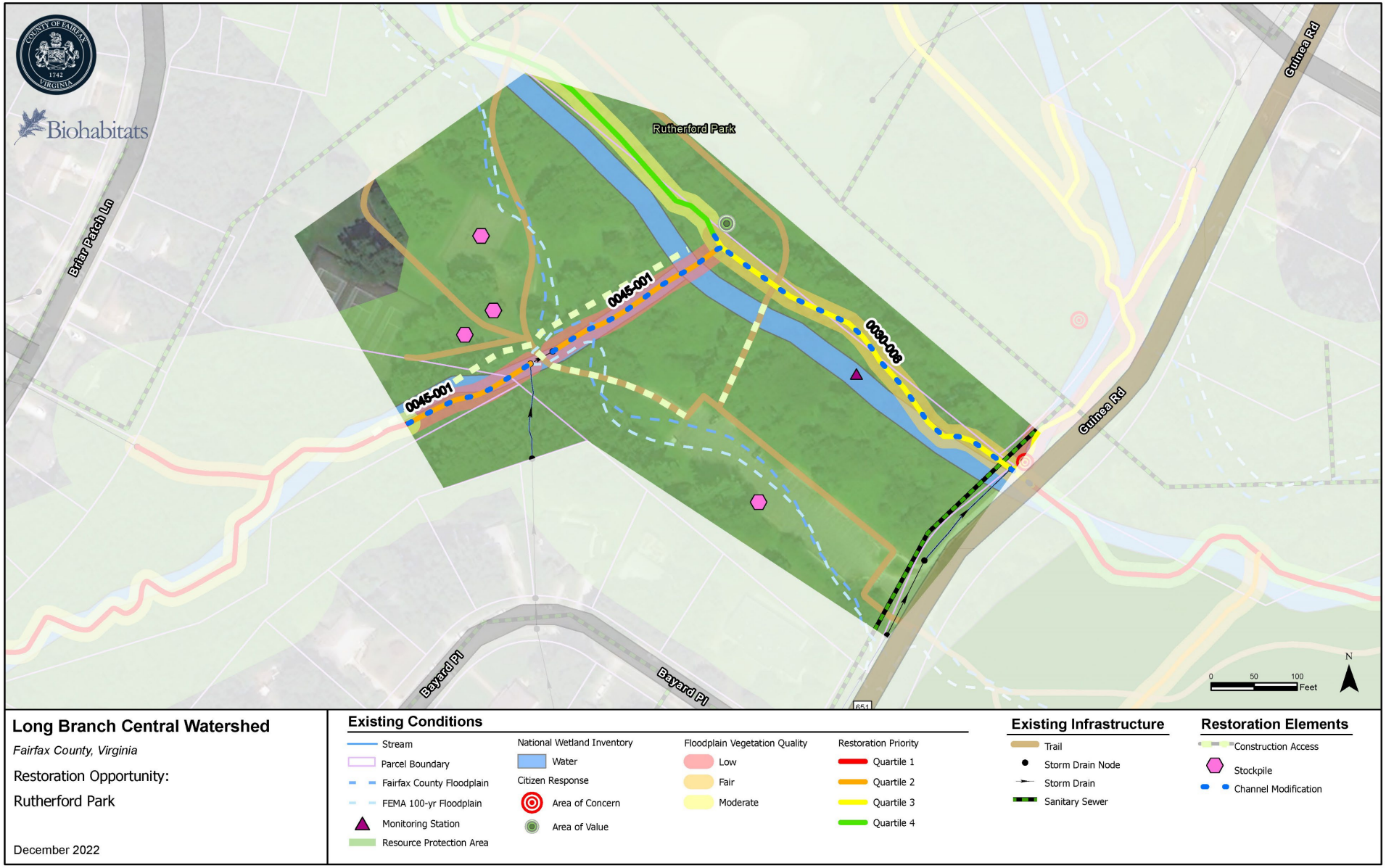
Restoration Goals and Methods

This project will focus on stabilizing the eroding stream channels to stop current and prevent future channel erosion, improving floodplain function and habitat for fish and other aquatic organisms, protecting the previous restoration plantings by Earth Sangha, and enhancing areas where the forested stream corridor is degraded.

Restoration methods that may be employed:

- Place rock structures within the stream channels to reduce channel erosion, increase channel "roughness", and improve habitat for fish and other aquatic organisms. Structures will be placed in the current channel extents and some grading will occur.
- Large wood may be placed in the channels on a limited basis to protect banks and improve habitat for fish and other aquatic organisms.
- Control invasive plant species and conduct restoration planting throughout the floodplain. Note that trees in poor health in the floodplain may be removed to reduce hazard trees, open light gaps to assist in regeneration, and provide large woody debris to improve stream and floodplain stability and habitat and to increase "roughness" to reduce erosion and trap organic debris.

Rutherford Park Restoration Opportunity Map



Kristin Lane to Rutherford Park

Widening channel with large sediment deposition affecting channel planform.

Portion of stream segment 0035-005 located on private property between the homes and fence.

Incised and widening channel lacking near-channel native riparian vegetation communities.

Open space within Rutherford Park, northwest of Guinea Road and southeast of the baseball fields.

Overview

The Kristin Lane to Rutherford Park project is located on Fairfax County Park Authority property within Rutherford Park west of Braeburn Drive and just northeast of the baseball fields and pool. This project area is surrounded by private properties to the west and east with 300 linear feet of stream on private property. The project area includes 2,230 linear feet stream, regulated floodplains, and a narrow forested corridor with scattered mature trees. The existing floodplain understory vegetation is of poor quality with a large presence of invasive plant species. An active sewer line runs adjacent to the stream and crosses the stream once, but no exposures have been identified. A natural surface trail is located within the project area.

The stream is an incised, perennial channel that has downcut and widened due to past increases in stormwater runoff from development throughout the contributing drainage area. The banks along the stream are two (2) to five (5) feet high with root depths extending halfway down the bank, exposing the bottom of the bank to continued erosion. The channel is imposing on private properties, and several homeowners along Braeburn Drive experience regular yard flooding.

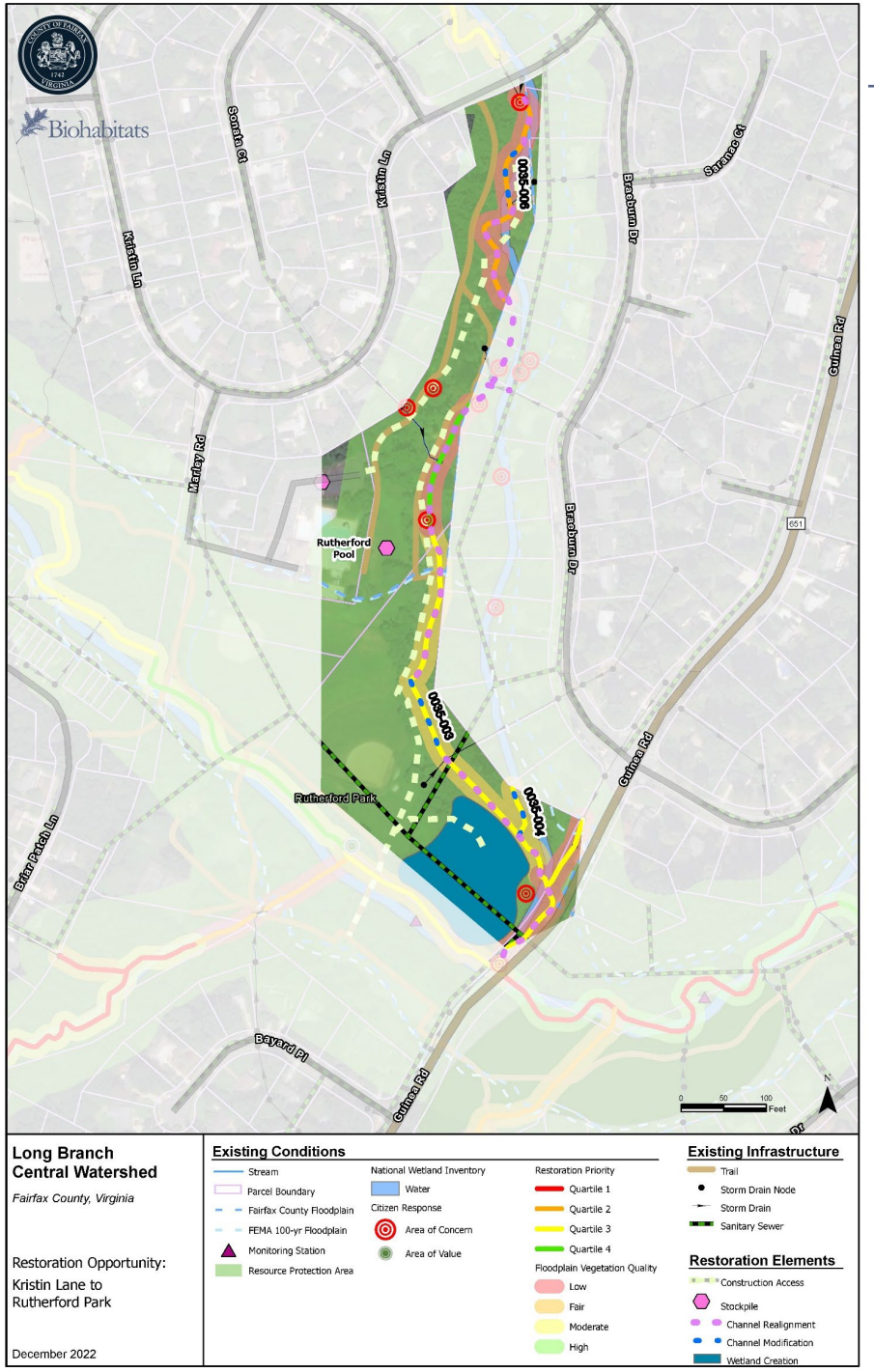
Restoration Goals and Methods

This project will focus on protecting private properties and public infrastructure, channel relocation, and stabilizing the stream to stop current and prevent future erosion. This project will also look to improve floodplain function and habitat for fish and other aquatic organisms, while enhancing the health of the forest stream corridor and controlling invasive species.

Restoration methods that may be employed:

- Channel relocation to move the channel from private properties onto Park Authority property.
- Place wood and rock structures throughout stream extents to reduce erosion, increase channel "roughness", and improve habitat for fish and other aquatic organisms.
- Large wood may be placed in the channel on a limited basis to protect banks and improve habitat for fish and other aquatic organisms.
- Creation of wetlands in open space of Rutherford Park to provide area and volume of water storage.
- Control invasive plant species.
- Conduct restoration planting throughout the floodplain. Note that trees in poor health in the floodplain may be removed to reduce hazard trees, open light gaps to assist in regeneration, and provide large woody debris to improve stream and floodplain stability and habitat and to increase "roughness" to reduce erosion and trap organic debris.
- Create positive drainage from the stormwater outfall pipe that enters the park from Kristen Lane just north of the Rutherford Pool so that stormwater flows freely to the stream channel.

Kristin Lane to Rutherford Park Restoration Opportunity Map



El James Drive to Rutherford Park

Widening channel with actively eroding banks near private properties.

Widening channel with actively eroding banks.

Widening outfall channel.

In-channel access via widening channel.

Overview

The El James Drive to Rutherford Park project is located on Fairfax County Park Authority and potentially on private property west of Rutherford Park and southeast of Briar Patch Lane. This project area is surrounded by private properties to the north, west, and south and includes 1,190 linear feet stream and a forested stream corridor dominated by mature upland mixed hardwood trees. The existing understory vegetation is of poor quality with invasive plant species present.

The project area consists of an incised perennial channel and intermittent outfall channel that have downcut and widened due to past increases in stormwater runoff from development throughout the contributing drainage area. The banks along the perennial channel range from two (2) to seven (7) with shallow root depth and density exposing the banks to continued erosion. The outfall channel has six (6) foot banks that are subject to ongoing erosion due to shallow root depths.

Restoration Goals and Methods

This project will focus on protecting private properties, stabilizing the eroding stream and outfall channel to stop current and prevent future erosion, improving floodplain function, reducing erosive stormwater flows, protecting better quality forest along the south bank behind the homes on Bayard Place and enhancing the poor-quality forest particularly south of the tennis courts, north of the stream and around the outfall from Briar Patch Lane.

Restoration methods that may be employed:

- Place wood and rock structures throughout stream extents to reduce erosion, increase channel "roughness", and improve habitat for fish and other aquatic organisms. Structures will be placed in the current channel extents and some grading will occur.
- Channel restoration of outfall channel using regenerative stormwater conveyance to capture and infiltrate stormwater, reduce and prevent channel erosion, while elevating and restoring ground water elevations which improve channel base flow for aquatic organisms.
- Work within the stream and outfall channel where possible to prevent damage to the mature trees, while removing undermined trees on the channel edge to prevent future bank failure.
- Large wood may be placed in the channel on a limited basis to protect banks and improve habitat for fish and other aquatic organisms.
- Conduct restoration planting to enhance the forest condition and improve biodiversity in sub-optimal quality forest and provide young trees and shrubs.

El James Drive to Rutherford Park Restoration Opportunity Map

Long Branch Central Watershed

Fairfax County, Virginia

Restoration Opportunity:

El James Drive to Rutherford Park

December 2022

Existing Conditions

- Stream
- Parcel Boundary
- Fairfax County Floodplain
- FEMA 100-yr Floodplain
- Resource Protection Area

National Wetland Inventory
- Water

Floodplain Vegetation Quality
- Low
- Fair
- Moderate
- High

Restoration Priority
- Quartile 1
- Quartile 2

Existing Infrastructure

- Trail
- Storm Drain Node
- Storm Drain
- Sanitary Sewer

Restoration Elements

- Construction Access
- Stockpile
- Channel Modification

Olley Lane Regional Stormwater Pond near Surrey Square Park

Backwatered trickle ditch and circular trash rack.

Restored upstream channel.

Maintenance access road and surrounding forest.

Clogged low-flow orifice.

Overview

The Olley Lane Regional Stormwater Pond is located just south of Surrey Square Park and was constructed in the late 1990s. A tributary to Long Branch flows from the northwest through a partially eroded channel into the pond, and then continues downstream of Olley Lane on landed owned by Fairfax County. The restoration project area includes the pond and eroded portion of the stream channel to the north. To the east and west, the pond is surrounded by private property. The existing pond bottom is wet and invasive species including phragmites dominate the groundcover. Some repairs are needed in stream channel, within the pond itself, and at the outfall structure.

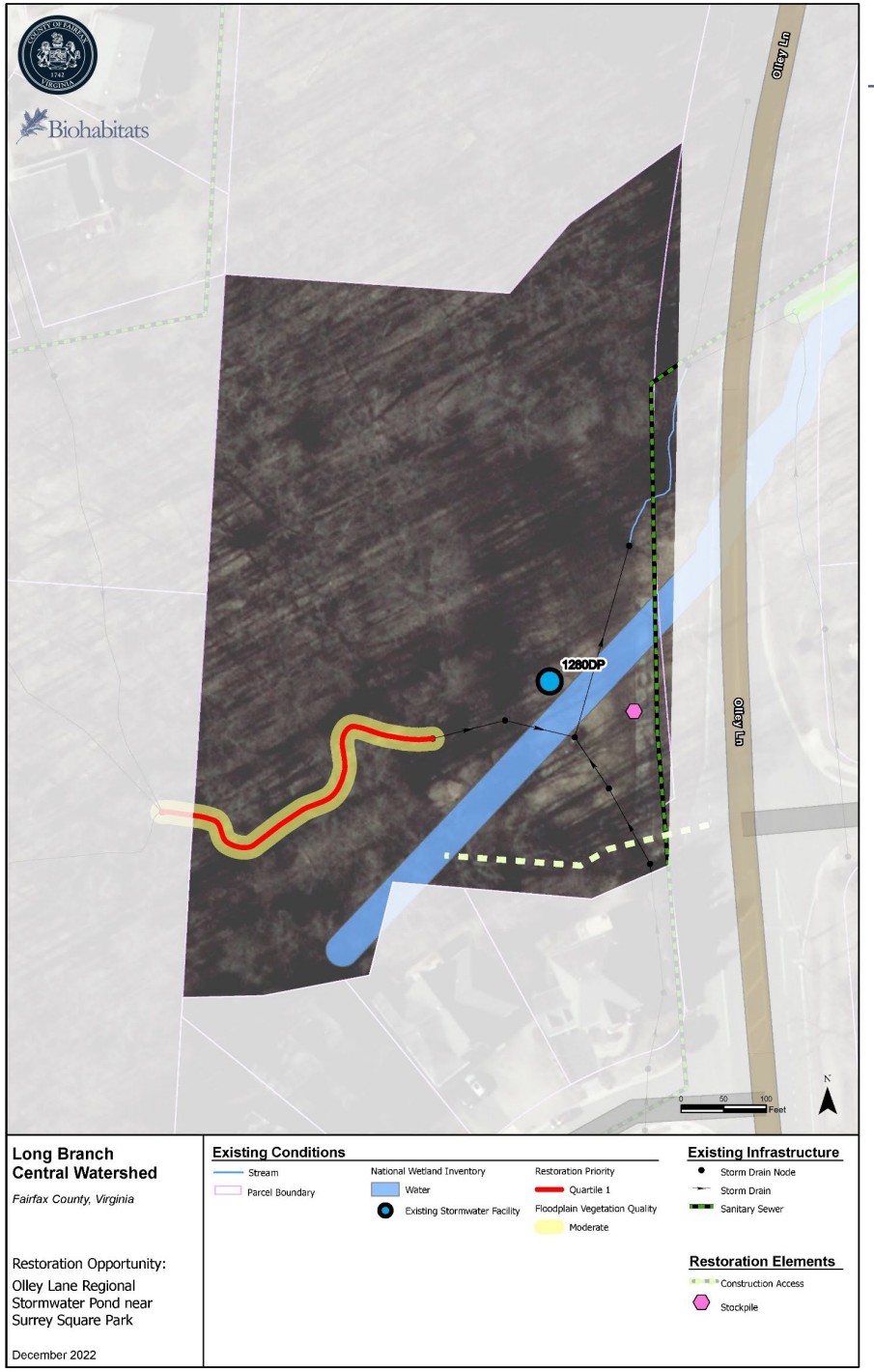
Restoration Goals and Methods

This project could include improvements to the stormwater pond to increase stormwater detention, reduce erosive flows, and provide additional habitat. Restoration of the eroded stream channel upstream of the pond could also be included to stop erosion and the flow of sediment into the pond. All work will be performed on property owned by Fairfax County and will incorporate the protection of the upland forest community along with restoration and wetland plantings to enhance the overall quality of the stream corridor.

Restoration methods that may be employed:

- Potential stormwater pond retrofit to maximize storage, provide water quality using a wetland bottom within the pond, and reduce the intensity of water leaving the pond to reduce the potential for channel erosion downstream.
- Potential channel restoration to reduce erosion and sediment entering the stormwater pond.
- Conduct restoration planting to supplement good quality forest and provide additional young trees, shrubs, and wetland species.

Olley Lane Regional Stormwater Pond near Surrey Square Park Restoration Opportunity Map



Pickett Road to Tara Drive

Widening channel with sediment deposition.

Eroded tributary with existing bench.

Incised and widening channel.

Potential access near Stream segment 0060-005; narrow with electric utility nearby.

Overview

The Pickett Road to Tara Drive project is located on Fairfax County Park Authority with a potential to extend the project onto private property. The project area is bound by private properties to the northwest and southeast and includes 2,560 linear feet of stream, regulated floodplains and wetlands, and a forested stream corridor dominated by mature mesic floodplain tree species. The existing understory vegetation is of optimal quality upstream of the confluence with the stream flowing from Olde Forge Park under Twinbrook Road with few invasive plant species present. The forest condition is more degraded along this stream and along the mainstem downstream of the confluence although there are many mature trees. A high traffic asphalt and natural surface trail along with an existing playground and basketball court is located within the project area.

A portion of the project is located along the Long Branch mainstem, which is a perennial stream that has downcut and widened due to past increases in stormwater runoff from development throughout the contributing drainage area. The banks along the mainstem are three (3) to six (6) feet high with shallow tree root depths and lack of surface protection exposing the banks to continued erosion. The high banks combined with the ongoing widening of the channel have left the channel disconnected from its floodplain. An outfall channel from Twinbrook Road flows northeast toward the mainstem. This is a perennial channel that has downcut and widened due to point source discharges. The banks range from two (2) to six (6) feet high with shallow root depths and little surface protection exposing the banks to erosion.

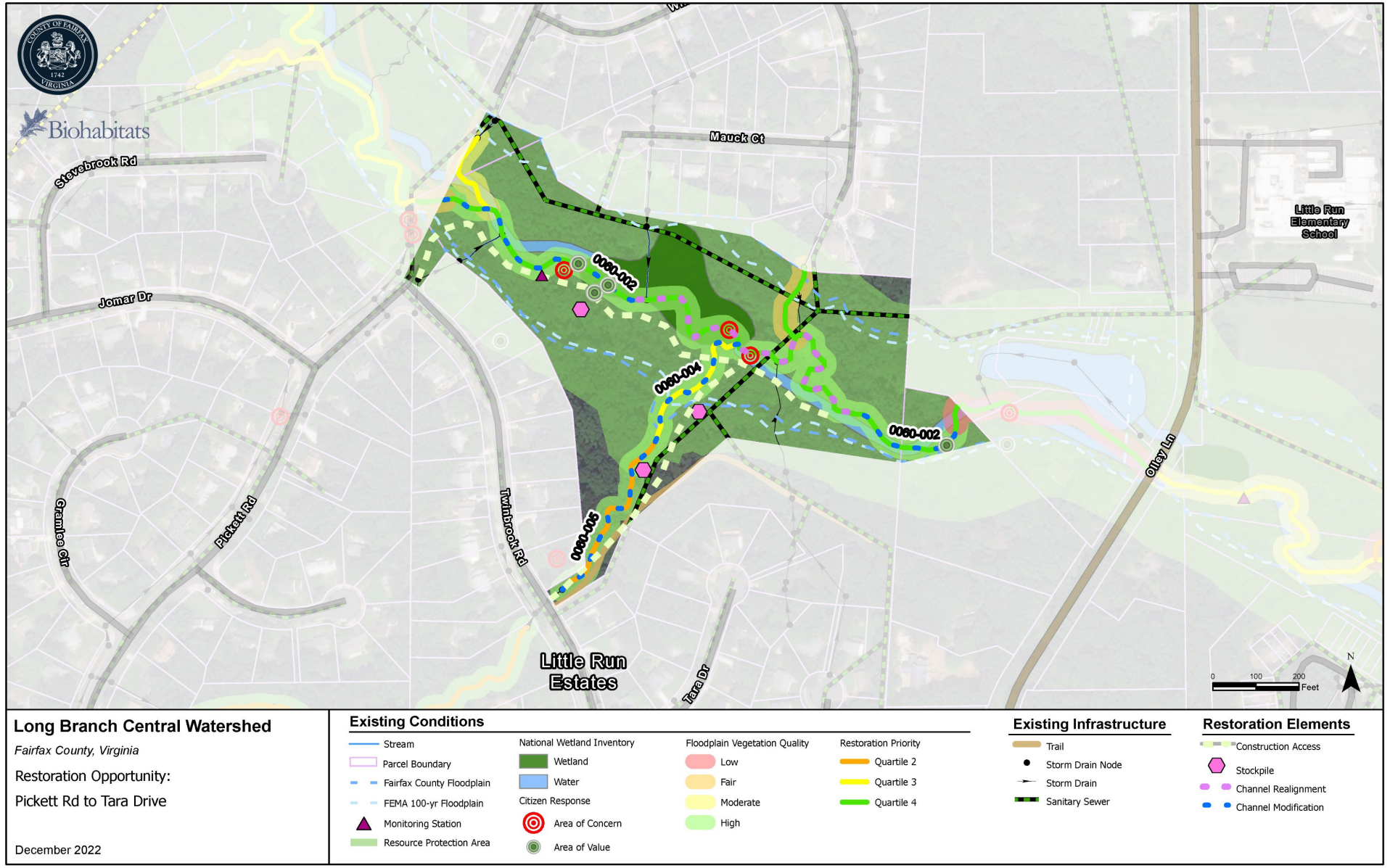
Restoration Goals and Methods

This project will focus on stabilizing the eroding mainstem and outfall channels to stop current and prevent future channel erosion, improving floodplain function and habitat for fish and other aquatic organisms, while protecting the high quality forest along the mainstem upstream of the confluence with the tributary from Twinbrook Road as well as mature trees throughout the project area to the greatest extent possible and enhancing areas where the forested stream corridor is degraded.

Restoration methods that may be employed:

- Place rock structures within the mainstem to reduce channel erosion, increase channel "roughness", and improve habitat for fish and other aquatic organisms. Structures will be placed in the current channel extents and some grading will occur.
- Stabilize outfall channel using wood and rock structures to reduce channel erosion and improve habitat where possible.
- Large wood may be placed in the mainstem and outfall channel on a limited basis to protect banks and improve habitat for fish and other aquatic organisms.
- Conduct restoration planting to supplement optimal quality forest and provide young trees and shrubs.

Pickett Road to Tara Drive Restoration Opportunity Map



Olde Forge Park

Incised, over widened perennial channel.

Incised ephemeral channel.

Headcut on ephemeral channel.

Existing peak shaver dry pond.

Overview

The Olde Forge Park project is located on Fairfax County Park Authority property east of Pickett Road between Nan Mill Lane and Twinbrook Road, and potentially includes land owned by the Korean Presbyterian Church of Washington and the Brandywine Swim Club. The restoration project area includes an existing stormwater pond, several degraded outfalls and 2,180 linear feet of stream channel located within a forested stream corridor dominated by mature mixed hardwood tree species. The existing understory vegetation is of optimal quality with a few invasive plant species present, although the presence of wavy-leaf basket grass was noted. Private properties surround the forested corridor in all directions.

The stream originates at the stormwater pond outfall on the property of the church and continues until discharging into an existing culvert underneath Twinbrook Road. The stream is a downcut ephemeral channel which is actively widening and incising. The stream banks range between one (1) and seven (7) feet with a mix of shallow and well-established tree root depths. The banks are exposed to continued erosion. Two outfall channels drain from Pickett Road. These channels have multiple headcuts along their alignments and are actively widening. There are four (4) concrete lined outfall channels coming from the swim club parking lot. All stream segments within this project are disconnected from the adjacent floodplain.

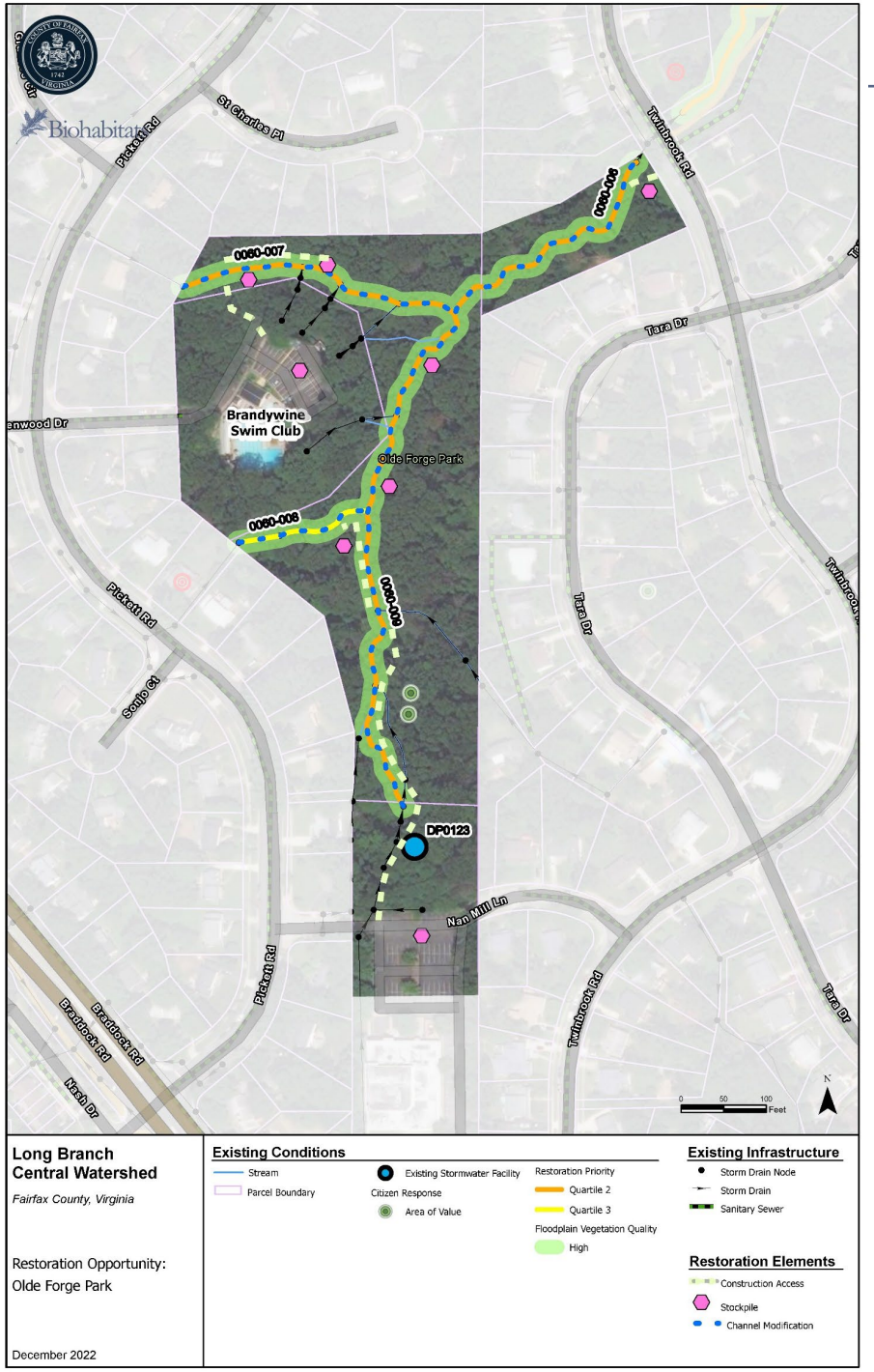
Restoration Goals and Methods

This project could include improvements to the pond and concrete channel outfalls on private property to increase stormwater detention and reduce erosive outfall flows. The project will include restoration of the channels on parkland to capture stormwater flows, stop current and prevent future channel erosion, protection of the surrounding, good quality upland forest, and restoration plantings to enhance areas where the forested riparian corridor are degraded near the church stormwater pond and the swim club outfalls.

Restoration methods that may be employed:

- Potential stormwater pond retrofit on the church property to maximize storage, capture additional flows, provide water quality, and reduce intensity of water leaving the pond to reduce channel erosion.
- Potential outfall improvements from Brandywine Swim Club to reduce channel erosion.
- Channel restoration of intermittent channels in Olde Forge Park using regenerative stormwater conveyance to capture and infiltrate stormwater, reduce and prevent channel erosion, while elevating and restoring ground water elevations which improve channel base flow for aquatic organisms.
- Restoration of perennial portions of the stream to reduce erosion and protect surrounding forests.
- Work within the stream channels to prevent damage to surrounding good quality upland forest, while removing undermined trees on the channel edge to prevent future bank failure.
- Control invasive plant species.
- Conduct restoration planting to supplement good quality forest and provide young trees and shrubs to replace those lost due to excessive deer browse.

Olde Forge Park
Restoration Opportunity Map



Olde Creek Elementary School to Pickett Road

Widening channel with sediment deposition.

Eroded tributary with existing bench.

Incised, headcutting.

Widening channel with sediment deposition.

Overview

The Olde Creek Elementary School to Pickett Road project is located on Park Authority property northwest of Pickett Road, and potentially includes land owned by Fairfax County Public Schools. The project area is bound by private properties to the northeast and southwest and includes 3,050 linear feet of stream, regulated floodplains, and a forested stream corridor dominated by mature mesic mixed hardwood tree species with poor understory vegetation and invasive plant species. A high traffic natural surface trail is located within the restoration project.

A majority of the project occurs along the Long Branch mainstem. The banks along the mainstem area three (3) to fifteen (15) feet high with shallow root depths and a lack of surface protection exposing the banks to continued erosion. These high bank heights combined with channel widening have left the channel entrenched and disconnected from its floodplain.

An outfall channel northeast of Stevebrook Road discharges into the Long Branch mainstem and is an incised, perennial channel. The banks range between three (3) to five (5) feet high with shallow root depths and lack of surface protection exposing the banks to erosion. Another outfall channel enters the mainstem from Barkwood Court. This downcut, ephemeral channel is actively widening due to point source discharges and has banks ranging from almost one (1) to four (4) feet in height. This channel also has a shallow root depth with little surface protection exposing the banks to continued erosion.

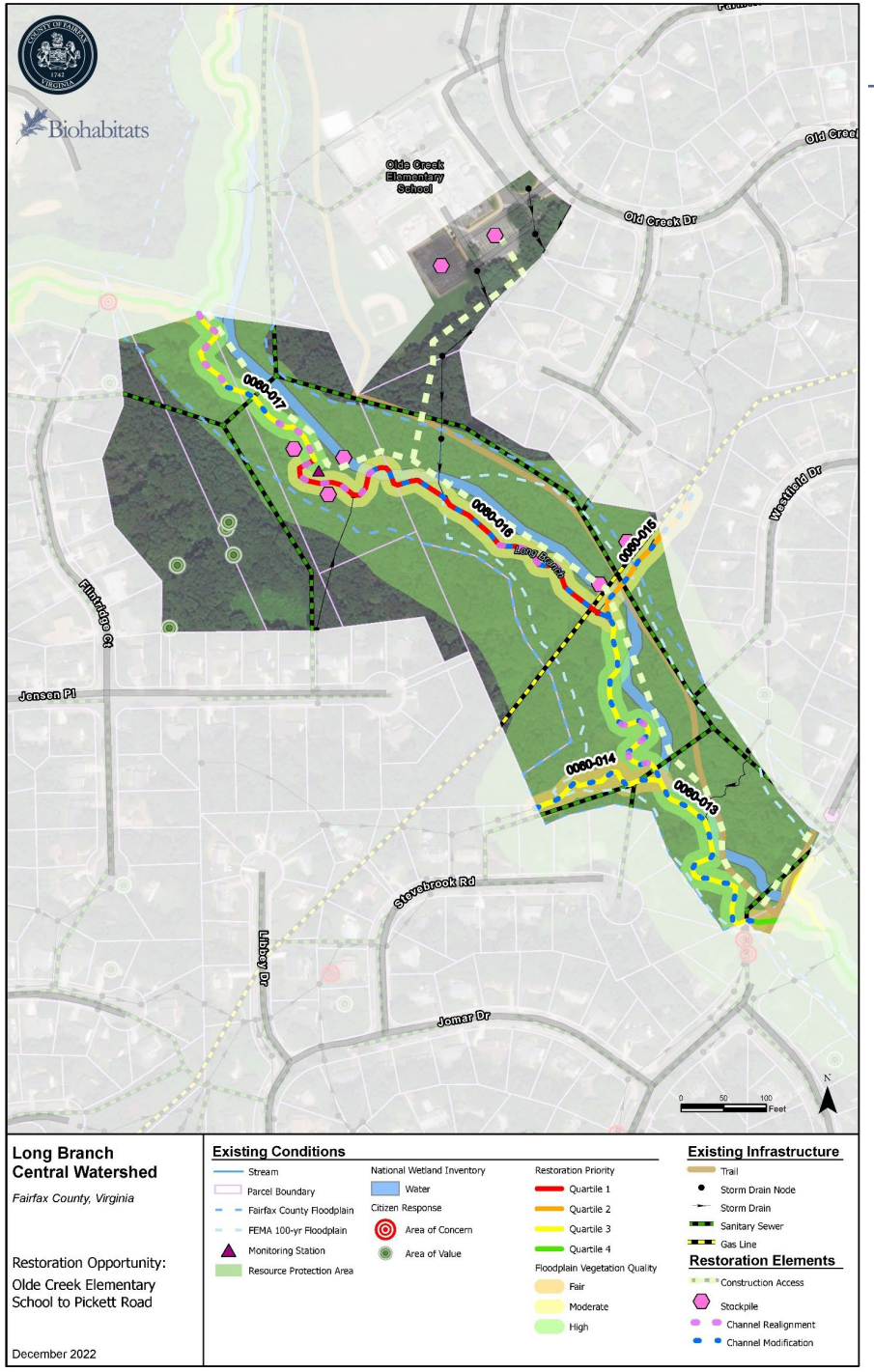
Restoration Goals and Methods

This project will focus on protecting existing infrastructure, stabilizing the eroding mainstem and outfall channels to stop current and prevent future channel erosion, improving floodplain function, habitat for fish and other aquatic organisms, and the health of the riparian forest throughout the stream corridor.

Restoration methods that may be employed:

- Place rock and wood structures within the mainstem and perennial outfall channel to reduce channel erosion, increase channel "roughness", and improve habitat for fish and other aquatic organisms. Structures will be placed in the existing channel extents and some grading will occur.
- Channel restoration of the ephemeral channel using regenerative stormwater conveyance to capture and infiltrate stormwater, reduce and prevent channel erosion, while elevating and restoring ground water elevations which improve channel base flow to better support aquatic organisms.
- Large wood may be placed in the mainstem and outfall channels to increase “roughness”, protect banks, and improve habitat for fish and other aquatic organisms.
- Placement of wood to increase floodplain "roughness", improve resiliency, and improve both habitat and biodiversity throughout the floodplain.
- Control invasive plant species and conduct restoration planting throughout the floodplain. Trees in poor health may be removed to reduce hazard trees, open light gaps to assist in regeneration, and provide large woody debris.

Olde Creek Elementary School to Pickett Road Restoration Opportunity Map



Dansk Court to Flintridge Court

Widening channel with significant invasive species.

Widening outfall channel.

Incised and widening channel.

Headcut at the upstream end of channel.

Overview

The Dansk Court to Flintridge Court project is located on Fairfax County Park Authority property, and potentially includes land owned by Somerset South Homeowner Association and Fairfax Memorial Park. The Somerset South Homeowner Association property is bound by private properties to the south and the Calvary Memorial Park to the north. The restoration project area includes 1,800 linear feet of stream, regulated floodplain, and forested stream corridor with some mature trees present. The existing understory vegetation is of poor quality and is dominated by invasive plant species. There is a natural trail through this restoration project area.

The perennial stream has downcut and widened due to past increases in stormwater runoff from development throughout the contributing drainage area. The banks along the perennial stream area two (2) to six (6) feet high with shallow root depths and a lack of surface protection exposing the bank to continued erosion.

Five incised, ephemeral outfall channels discharges into the stream: one from Flintridge Court, two from Doulton Court, and two from Demby Drive. The banks along the outfall channels are one (1) to four (4) feet steep banks with low root density and depth and very sparse trees along the immediate streambank area.

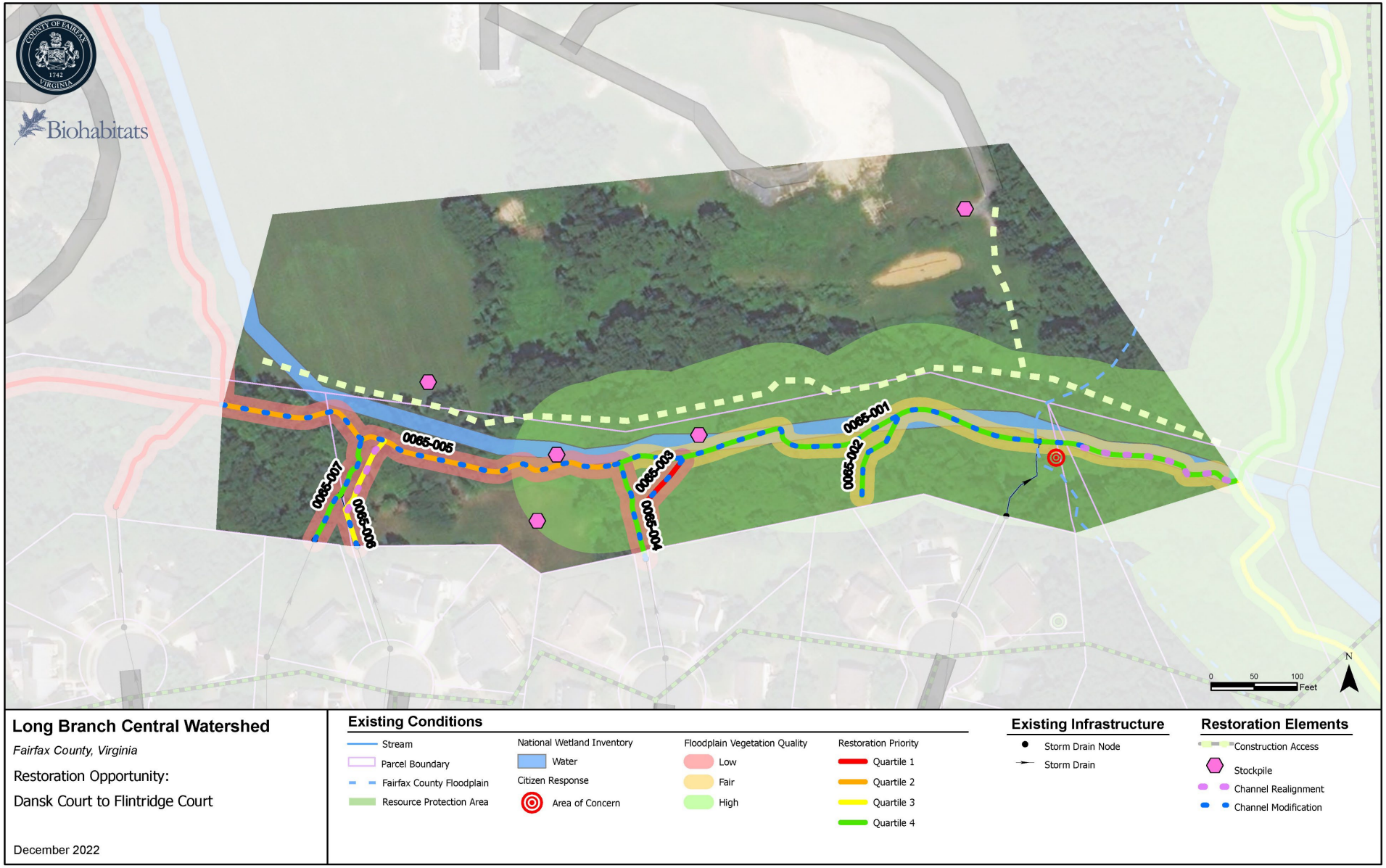
Restoration Goals and Methods

This project will focus on stabilizing the eroding mainstem and outfall channels to stop current and prevent future channel erosion, improve floodplain function and reduce erosive stormwater flows, and controlling invasive plant species while restoring the health of the forest throughout the stream corridor.

Restoration methods that may be employed:

- Place wood structures supplemented with rock structures within the perennial stream to reduce channel erosion, increase channel "roughness", and improve habitat for fish and other aquatic organisms. Structures will be placed within the existing channel extents, and some grading will occur.
- Channel restoration of ephemeral outfall channels using rock and wood structures to reduce and prevent channel erosion and improve habitat where feasible.
- Large wood may be placed in the mainstem and outfall channels to increase “roughness”, protect banks, and improve habitat for fish and other aquatic organisms.
- Placement of wood to increase floodplain “roughness”, improve resiliency, and improve both habitat and biodiversity throughout the floodplain.
- Control invasive plant species.
- Conduct restoration planting throughout the floodplain. Trees in poor health may be removed to reduce hazard trees, open light gaps to assist in regeneration, and provide large woody debris.

Dansk Court to Flintridge Court Restoration Opportunity Map



Somerset – Ceralene Drive to Dansk Court

Incised, widening channel with small forest stand along the bank and maintained lawn.

Incised, widening outfall channel.

Sheet flow off lawn increasing erosion along the left bank of stream segment 0065-009.

BMP-02 outfall and emergency spillway discharges into stream segment 0065-009.

Overview

The Somerset – Ceralene Drive to Dansk Court project is located north of Ceralene Drive, and potentially includes land owned by Somerset South Homeowner Association and Fairfax Memorial Park. The restoration project area includes an existing stormwater pond, a degraded outfall channel and 1,170 linear feet of stream channel located within a forested stream corridor with some mature trees. The existing understory vegetation is of poor quality and is dominated by invasive plant species. Private properties surround the forested stream corridor in all directions. There is a natural surface trail through this restoration project area.

The project area consists of two perennial stream channels that originate from a stormwater pond outfall. The first perennial stream, located north of Ceralene Drive, originates from a county maintained dry stormwater pond outfall on the property of Somerset South Homeowner Association. This perennial channel is actively widening and incising, with banks ranging between three (3) and eight (8) feet high with shallow tree root depths, exposing the banks to continued erosion. A downcut, ephemeral outfall channel drains to the perennial stream from Dansk Court and has three (3) to eight (8) foot high banks. The second perennial stream channel originates at a pond outfall on the Fairfax Memorial Park property and has downcut due to increased stormwater runoff from land use changes throughout the contributing drainage area. This perennial stream has banks ranging between three (3) to eight (8) feet high with shallow root depths and lack of surface protection, exposing the banks to continued erosion.

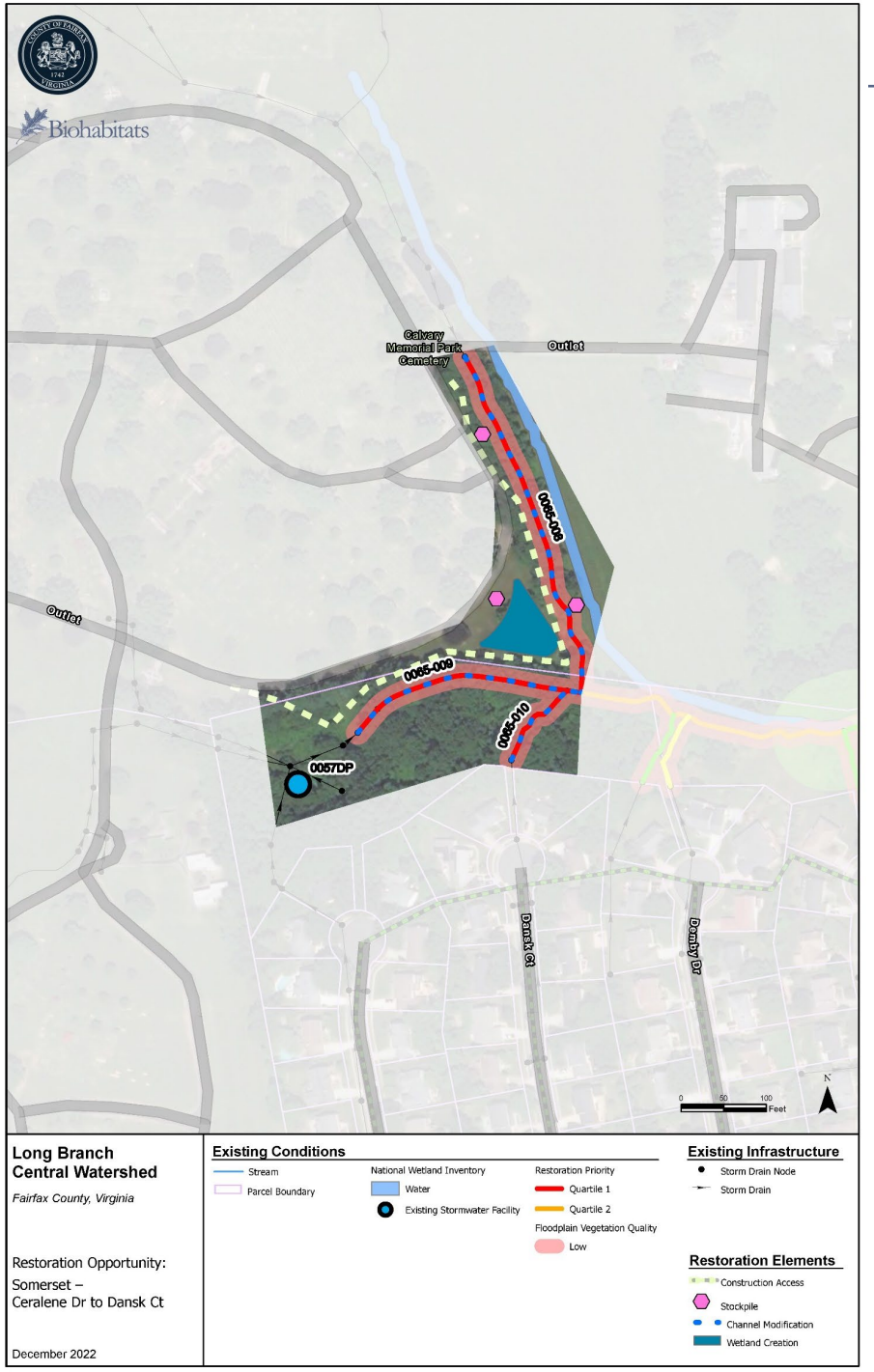
Restoration Goals and Methods

This project could include improvements to the county-maintained stormwater pond on Somerset South Homeowner Association property to increase stormwater detention and reduce erosive outfall flows. The project could also include the restoration of the perennial stream and outfall channels located on private property to capture stormwater flows, stop current and prevent future channel erosion, and conduct restoration plantings to enhance the degraded forested stream corridor.

Restoration methods that may be employed:

- Potential stormwater pond retrofit on the Somerset South Homeowner Association property to maximize storage, provide water quality using a wetland bottom within the pond, and reduce intensity of water leaving the pond to reduce channel erosion.
- Place woody structures within the perennial stream to reduce channel erosion and protect surrounding forests from continued tree loss.
- Control invasive plant species.
- Conduct restoration planting throughout the floodplain. Trees in poor health may be removed to reduce hazard trees, open light gaps to assist in regeneration, and provide large woody debris.

Somerset – Ceralene Drive to Dansk Court Restoration Opportunity Map



Smokewood Park, South of Laurel Street

Exposed sewer encasement.

Paved outfall ditch discharging into stream.

Incised and widening channel beginning to encroach on the sewer.

Asphalt trail to be used as construction access.

Overview

This project in Smokewood Park is located on Fairfax County Park Authority property south of Laurel Street and west of Whitacre Road and Olde Creek Elementary School, and potentially includes land owned by the Fairfax Memorial Park. Private properties surround the restoration project area, which includes 2,400 linear feet of stream, regulated floodplain, and a forested stream corridor dominated by mature floodplain tree species. The existing understory vegetation is of sub-optimal quality with invasive plant species. An active sewer line runs adjacent to the stream and crosses once, where an exposed sewer line has been identified. There is a high traffic asphalt and natural surface trail with three pedestrian foot bridges located in the restoration project area.

The perennial stream has downcut and widened due to past increases in stormwater runoff from development throughout the contributing drainage area. The banks along the channel are three (3) to six (6) feet with root depths extending halfway down the bank exposing the bottom of the bank to further erosion. Two concrete outfall ditches discharge into the perennial channel.

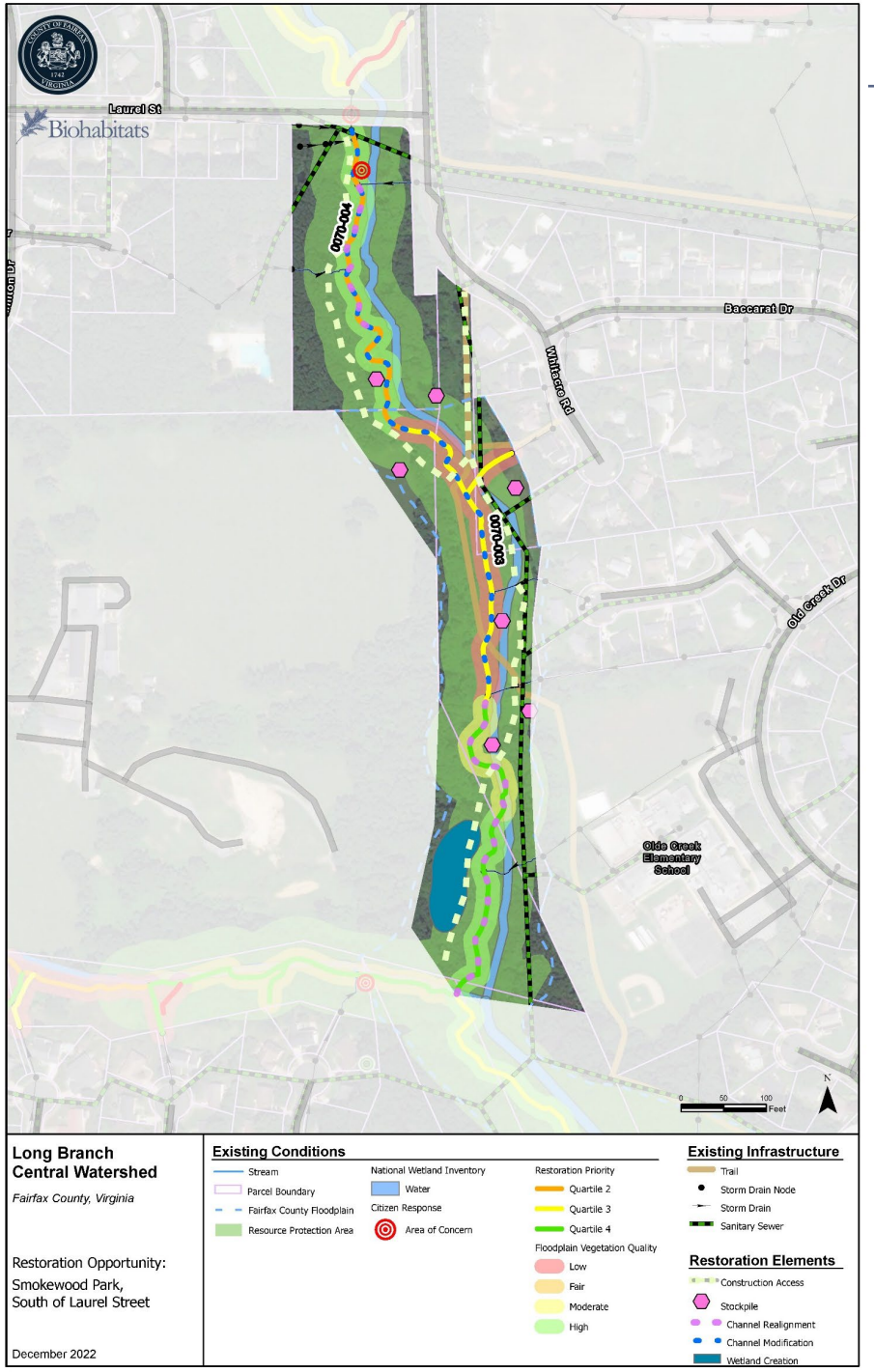
Restoration Goals and Methods

This project will focus on protecting existing infrastructure and private properties, stabilizing the eroding stream channel to stop current and prevent future channel erosion, improving floodplain function, habitat for fish and other aquatic organisms, and the health of the forest throughout the stream corridor.

Restoration methods that may be employed:

- Place wood and supplemental rock structures within stream to reduce channel erosion and migration toward private property, increase channel "roughness", and improve habitat for fish and macroinvertebrates. Channel extents may be altered to protect private property and existing sewer infrastructure, and some grading will occur.
- Large wood may be placed in the stream and floodplain on a limited basis to protect banks, improve habitat for fish and other aquatic and terrestrial organisms, increase “roughness”, and improve biodiversity and resiliency.
- Convert of concrete channels to natural channels.
- Control invasive plan species.
- Restoration planting throughout the floodplain. Trees in poor health may be removed to reduce hazard trees, open light gaps to assist in regeneration, and provide large woody debris.

Smokewood Park, South of Laurel Street Restoration Opportunity Map



Smokewood Park, North of Laurel Street

Widening channel with large deposits of streambed material.

Double culvert at downstream project limits.

Incised and widening outfall channel.

Previously stabilized outfall channel with grade control failure.

Overview

This project in Smokewood Park is located on Fairfax County Park Authority property north of Laurel Street and west of Whitacre Road. Private properties border the restoration project area to the north, west, and east. The restoration project area includes 1,490 linear feet of stream, a regulated floodplain, and a forested stream corridor dominated by mature mesic floodplain tree species. The existing understory vegetation is of sub-optimal quality with a few invasive plant species. An active sewer line runs adjacent to the stream; however, no exposures have been identified.

The stream is an incised, perennial channel that has downcut and widened due to past increases in stormwater runoff from development throughout the contributing drainage area. The banks along the perennial channel are two (2) to six (6) feet high with shall root depths and a lack of surface protection, exposing the bank to continued erosion. There are three outfall channels to the perennial stream. One outfall channel enters the perennial stream from Trapp Road. This outfall is highly degraded with an exposed sewer line and bank heights between four (4) and six (6) feet. Erosion of this channel threatens an adjacent home. Another outfall from Lenox Drive was recently stabilized; however, a small repair near the confluence with the perennial stream needs to be addressed within this restoration project area. The third outfall channel comes from Whitacre Road and is a downcut, perennial channel with bank heights between three (3) and four (4) feet. These banks have low root density and depth with very sparse trees along the immediate streambank exposing the banks to continued erosion.

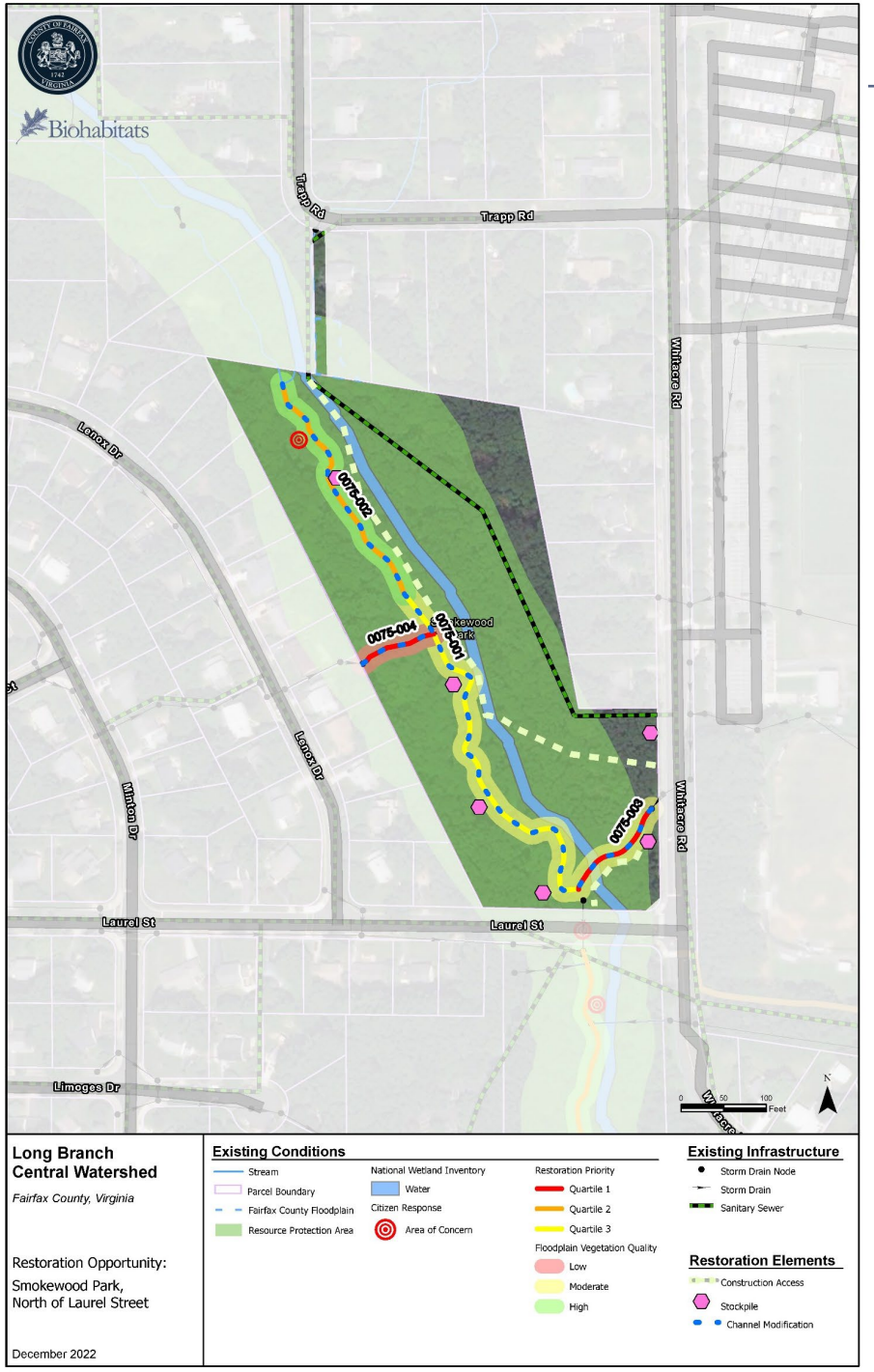
Restoration Goals and Methods

This project will focus on stabilizing the eroding stream and outfall channel to stop current and prevent future channel erosion, improving floodplain function and aquatic habitat, protecting mature trees throughout the riparian corridor to the greatest extent possible, and improving the health of the forest throughout the stream corridor.

Restoration methods that may be employed:

- Place wood and supplemental rock structures within stream to reduce channel erosion and migration toward private property, increase channel "roughness", and improve habitat for fish and macroinvertebrates. Channel extents may be altered to protect private property and existing sewer infrastructure, and some grading will occur.
- Large wood may be placed in the stream and floodplain on a limited basis to protect banks, improve habitat for fish and other aquatic and terrestrial organisms, increase “roughness”, and improve biodiversity and resiliency.
- Access work areas through degraded outfall corridors to the greatest extent possible.
- Restoration planting throughout the floodplain. Trees in poor health may be removed to reduce hazard trees, open light gaps to assist in regeneration, and provide large woody debris.

Smokewood Park, North of Laurel Street Restoration Opportunity Map



Holly Park Stormwater Pond

Channel entering riser, trees on pond embankment and vegetation in basin.

Trees on northern embankment and nearby residential property.

Nearby construction, restriction for expansion or lowering embankment on southern side of pond.

Degraded outfall channel.

Overview

The Holly Park Stormwater Pond is located behind 4029 Maple Avenue and was constructed in the mid-1990s along with the neighborhood on John Robert Way. Stormwater enters the pond from the northwest from one storm drain ditch. The pond is located on property owned by the Fairfax County Board of Supervisors. The existing pond bottom is wet with small trees and undesirable species like phragmites growing within it. The stream corridor downstream of the pond is in poor condition and located within a stormwater easement. Some repairs are needed in within the pond itself and in the stream channel below the outfall structure.

Restoration Goals and Methods

This project could include improvements to the stormwater pond to increase stormwater detention, reduce erosive flows, and provide additional habitat. Restoration of the eroded stream channel downstream of the pond could also be included. All work will be performed within the stormwater easement or on property owned by Fairfax County and will incorporate the protection of the upland forest community along with restoration and wetland plantings to enhance the overall quality of the stream corridor.

Restoration methods that may be employed:

- Potential stormwater pond retrofit to maximize storage, provide water quality using a wetland bottom within the pond, and reduce the intensity of water leaving the pond to reduce the potential for channel erosion downstream.
- Potential channel restoration to reduce erosion and sediment downstream of the stormwater pond.
- Conduct restoration planting to supplement good quality vegetation and provide additional young trees, shrubs, and wetland species.

Holly Park Stormwater Pond Restoration Opportunity Map

Newcombe Stormwater Pond

Pond overview.

Paved maintenance access path from Maple Avenue.

Degraded outfall channel.

Evidence of sedimentation, accumulation of trash and presence of invasive species.

Overview

The Newcombe Stormwater Pond is located within the open space adjacent to 4027 Maple Avenue. It was constructed in the early 2000s along with the four homes along this section of Maple Avenue. Stormwater enters the pond from the north and northwest from two storm drain networks. The pond is located on property owned by the homeowner association and is maintained by Fairfax County through a stormwater easement. The existing pond bottom is wet and invasive species including phragmites dominate the groundcover. The stream corridor downstream of the pond is on property owned by Fairfax County and is in poor condition. Some repairs are needed in within the pond itself and in the stream channel below the outfall structure.

Restoration Goals and Methods

This project could include improvements to the stormwater pond to increase stormwater detention, reduce erosive flows, and provide additional habitat. Restoration of the eroded stream channel downstream of the pond could also be included. All work will be performed within the stormwater easement or on property owned by Fairfax County. The protection of the upland forest community along with restoration and wetland plantings to enhance the overall quality of the stream corridor will be incorporated into the project.

Restoration methods that may be employed:

- Potential stormwater pond retrofit to maximize storage, provide water quality using a wetland bottom within the pond, and reduce the intensity of water leaving the pond to reduce the potential for channel erosion downstream.
- Potential channel restoration to reduce erosion and sediment downstream of the stormwater pond.
- Conduct restoration planting to supplement good quality vegetation and provide additional young trees, shrubs, and wetland species.

Newcombe Stormwater Pond Restoration Opportunity Map

III. PROJECT GROUPING AND PHASING FOR IMPLEMENTATION

Two sets of groupings are recommended – one for design and one for construction and permitting.

Nine **design groupings** bundle adjacent projects so that upstream and downstream influences can be better understood during the design process.

Fifteen **construction groupings** consist primarily of stand-alone projects; some have been bundled to reduce overall disturbance and trail interference.

Design and construction should begin in tributaries and headwaters, and work downstream.

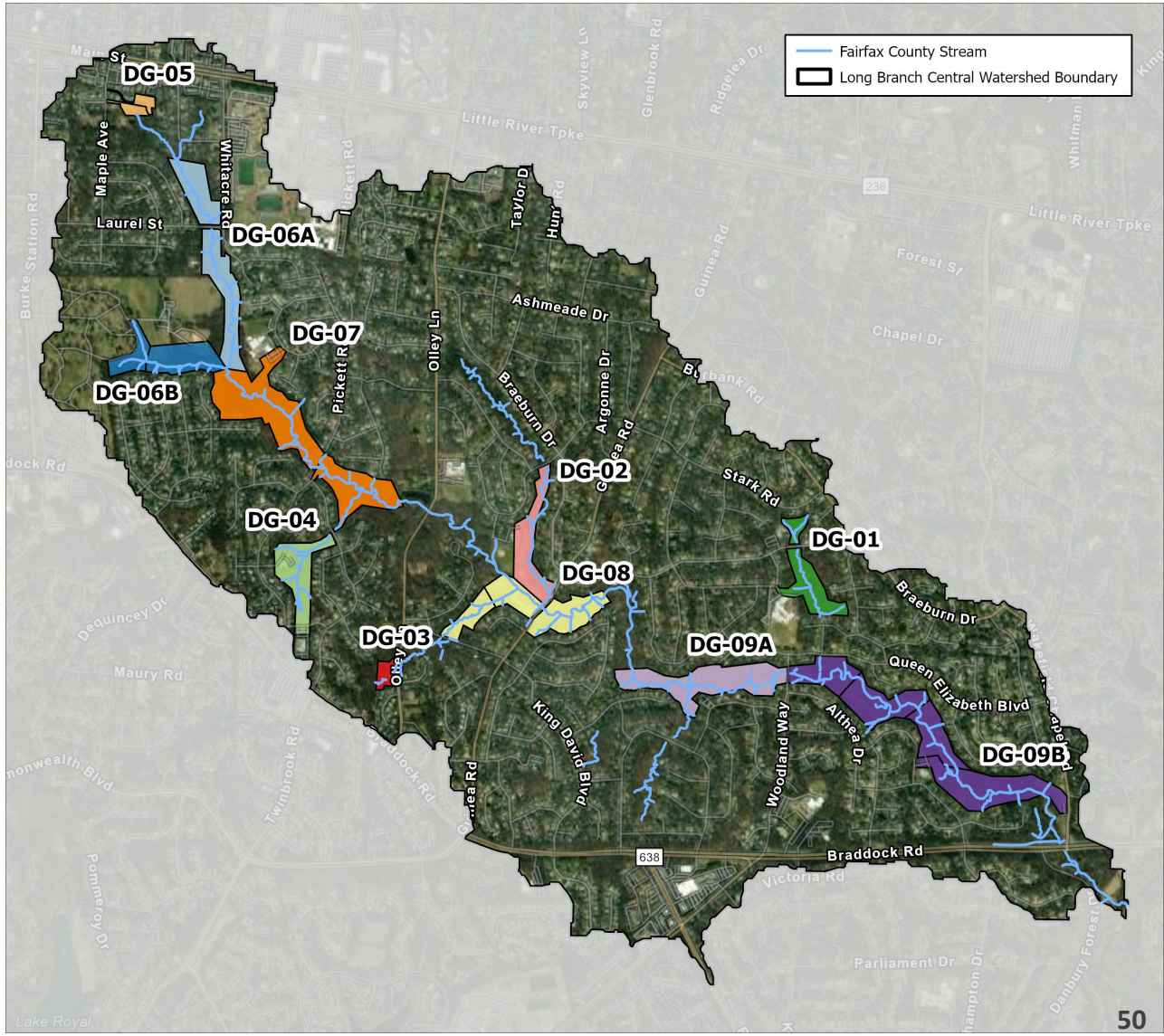
Ponds should be retrofitted prior to downstream reaches being restored.

Length of pre-construction monitoring, design, construction, and post-construction monitoring (in months) has been estimated for each project.

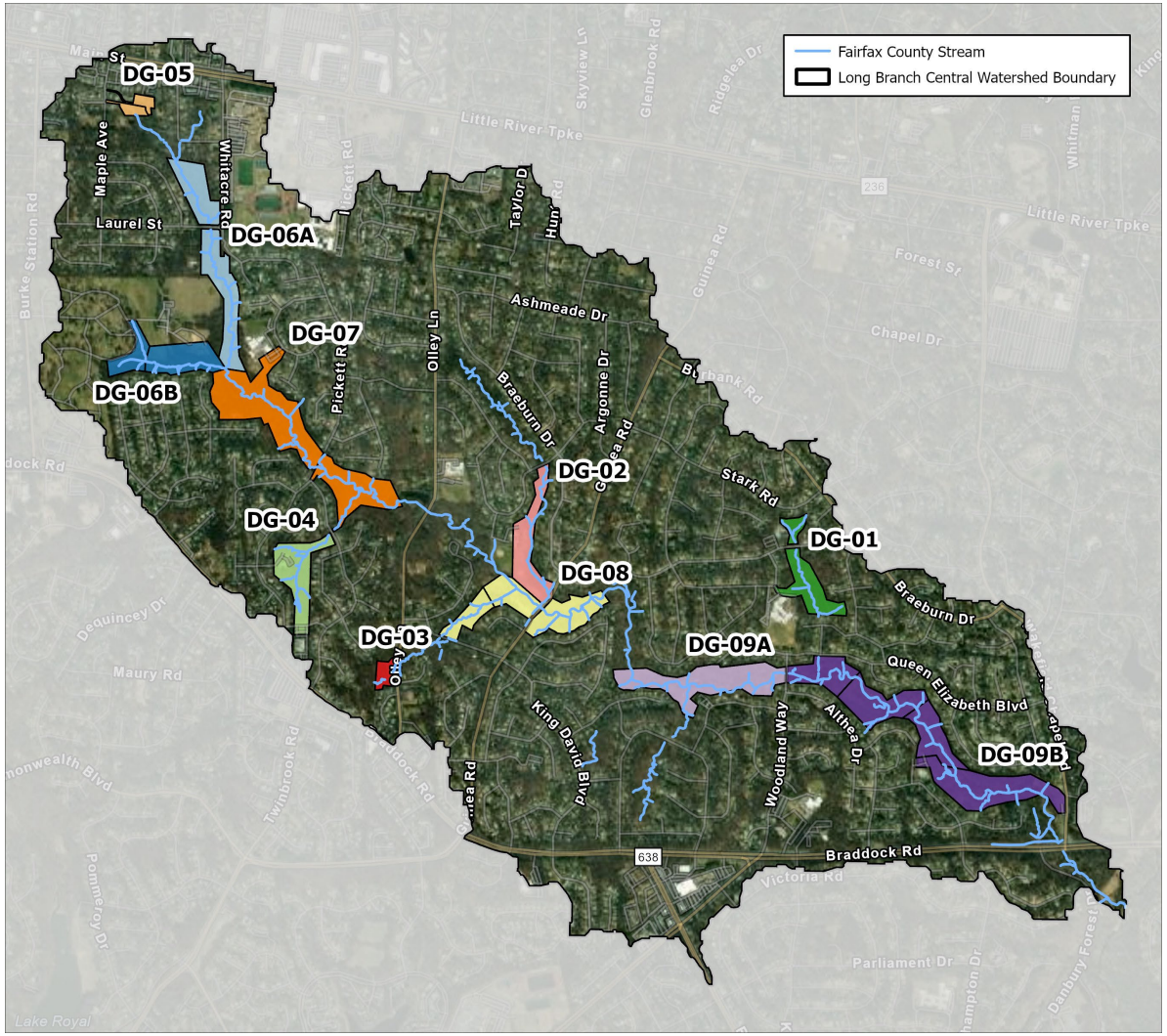
For more information, see Attachment E: **Long Branch Central Watershed Summary of Project Groupings, Costs, Construction Length and Potential Sediment Reduction**

Project Grouping for Design

DG-01	Willow Woods Park South of Braeburn Drive Ilda Pool at Braeburn Drive
DG-02	Kristin Lane to Rutherford Park
DG-03	Olley Lane Regional Stormwater Pond near Surrey Square Park
DG-04	Olde Forge Park
DG-05	Newcombe Stormwater Pond Holly Park Stormwater Pond
DG-06A	Smokewood Park, South of Laurel Street Smokewood Park, North of Laurel Street
DG-06B	Dansk Court to Flintridge Court Somerset – Ceralene Drive to Dansk Court
DG-07	Pickett Road to Tara Drive Olde Creek Elementary School to Pickett Road
DG-08	Guinea Road to Tabard Place Rutherford Park El James Drive to Rutherford Park
DG-09A	Tabard Place to Woodland Way
DG-09B	Canterbury Woods Park – Cockney Court to Wakefield Chapel Road Long Branch Stream Valley Park – Dora Court to Cockney Court Woodland Way to Dora Court



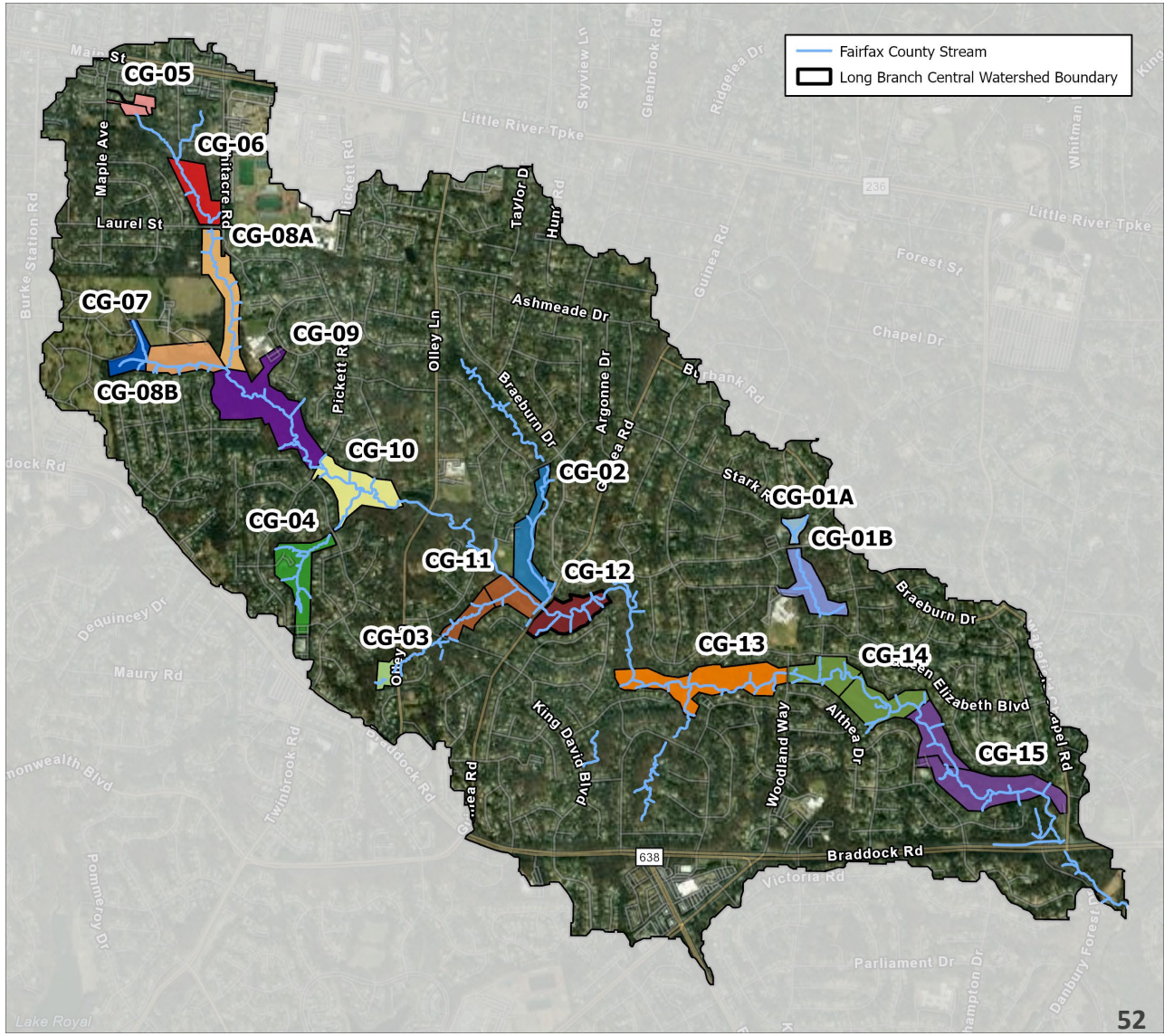
Project Grouping for Design Summary



Grouping	Project Name	Design Services
DG-01	Ilda Pool at Braeburn Drive Willow Woods Park South of Braeburn Drive	$446,000
DG-02	Kristin Lane to Rutherford Park	$441,000
DG-03	Olley Lane Regional Stormwater Pond near Surrey Square Park	$185,000
DG-04	Olde Forge Park	$531,000
DG-05	Newcombe Stormwater Pond Holly Park Stormwater Pond	$370,000
DG-06A	Smokewood Park, North of Laurel Street Smokewood Park, South of Laurel Street	$732,000
DG-06B	Somerset – Ceralene Drive to Dansk Court Dansk Court to Flintridge Court	$662,000
DG-07	Olde Creek Elementary School to Pickett Road Pickett Road to Tara Drive	$1,158,000
DG-08	Guinea Road to Tabard Place Rutherford Park El James Drive to Rutherford Park	$752,000
DG-09A	Tabard Place to Woodland Way	$833,000
DG-09B	Canterbury Woods Park – Cockney Court to Wakefield Chapel Road Long Branch Stream Valley Park – Dora Court to Cockney Court Woodland Way to Dora Court	$1,980,000

Project Grouping for Permitting + Construction

CG-01A	Ilda Pool at Braeburn Drive
CG-01B	Willow Woods Park South of Braeburn Drive
CG-02	Kristin Lane to Rutherford Park
CG-03	Olley Lane Regional Stormwater Pond near Surrey Square Park
CG-04	Olde Forge Park
CG-05	Newcombe Stormwater Pond Holly Park Stormwater Pond
CG-06	Smokewood Park, North of Laurel Street
CG-07	Somerset – Ceralene Drive to Dansk Court
CG-08A	Smokewood Park, South of Laurel Street
CG-08B	Dansk Court to Flintridge Court
CG-09	Olde Creek Elementary School to Pickett Road
CG-10	Pickett Road to Tara Drive
CG-11	Rutherford Park El James Drive to Rutherford Park
CG-12	Guinea Road to Tabard Place
CG-13	Tabard Place to Woodland Way
CG-14	Woodland Way to Dora Court Long Branch Stream Valley Park – Dora Ct to Cockney Ct – West
CG-15	Long Branch Stream Valley Park – Dora Ct to Cockney Ct – East Canterbury Woods Park – Cockney Ct to Wakefield Chapel Rd



Project Grouping for Permitting + Construction – CG-01

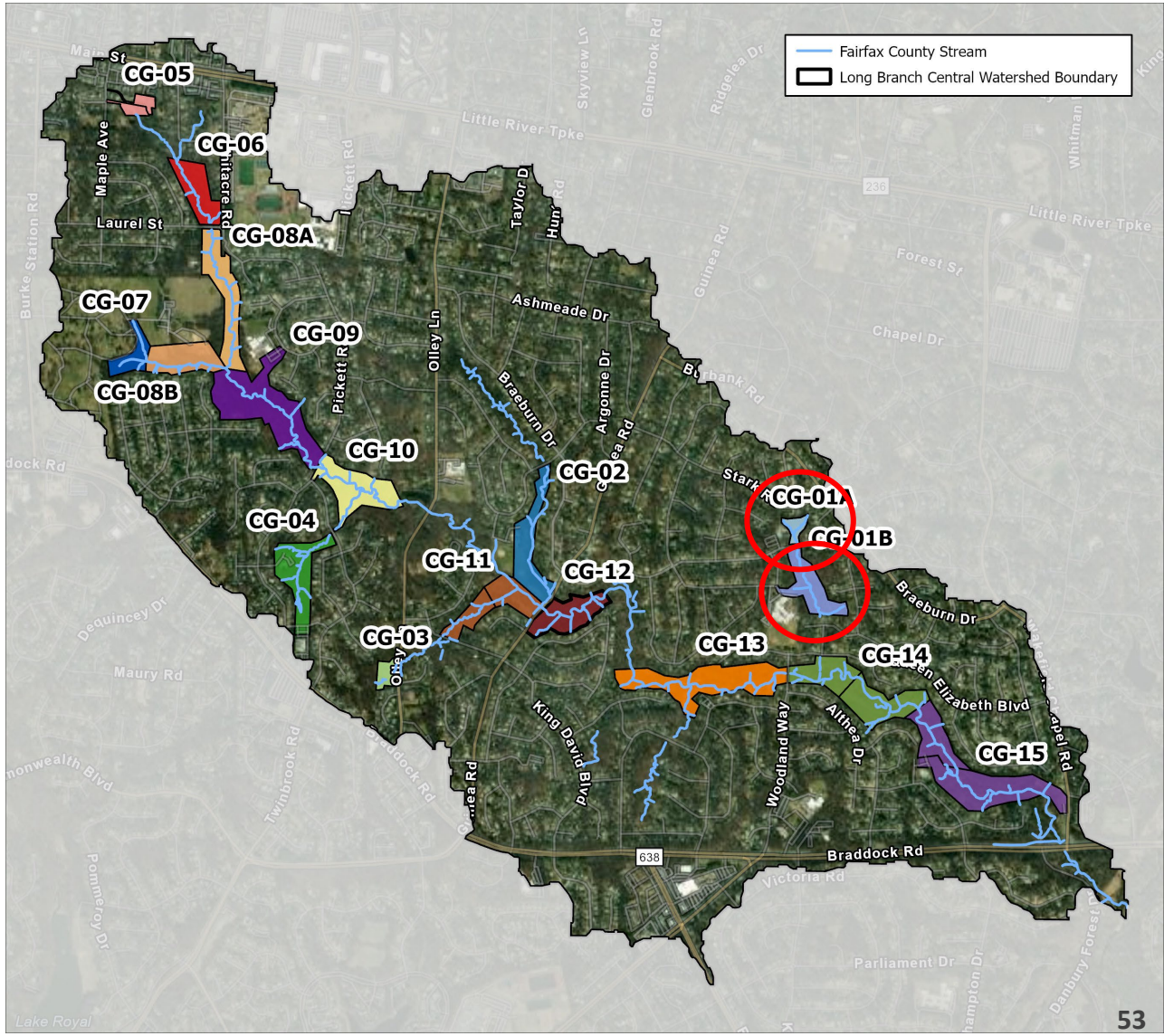
Projects can be grouped or constructed independently

CG-01A Ilda Pool at Braeburn Drive

Metric	Value
Stream Length (LF)	758
CA/CO Services	$38,000
Estimated Cost at Construction Midpoint	$428,000
Construction Cost / LF	$565
Active Construction (months)	1
Total Construction (months)	3
Sediment Reduction Estimate (tons/yr)	14

CG-01B Willow Woods Park South of Braeburn Drive

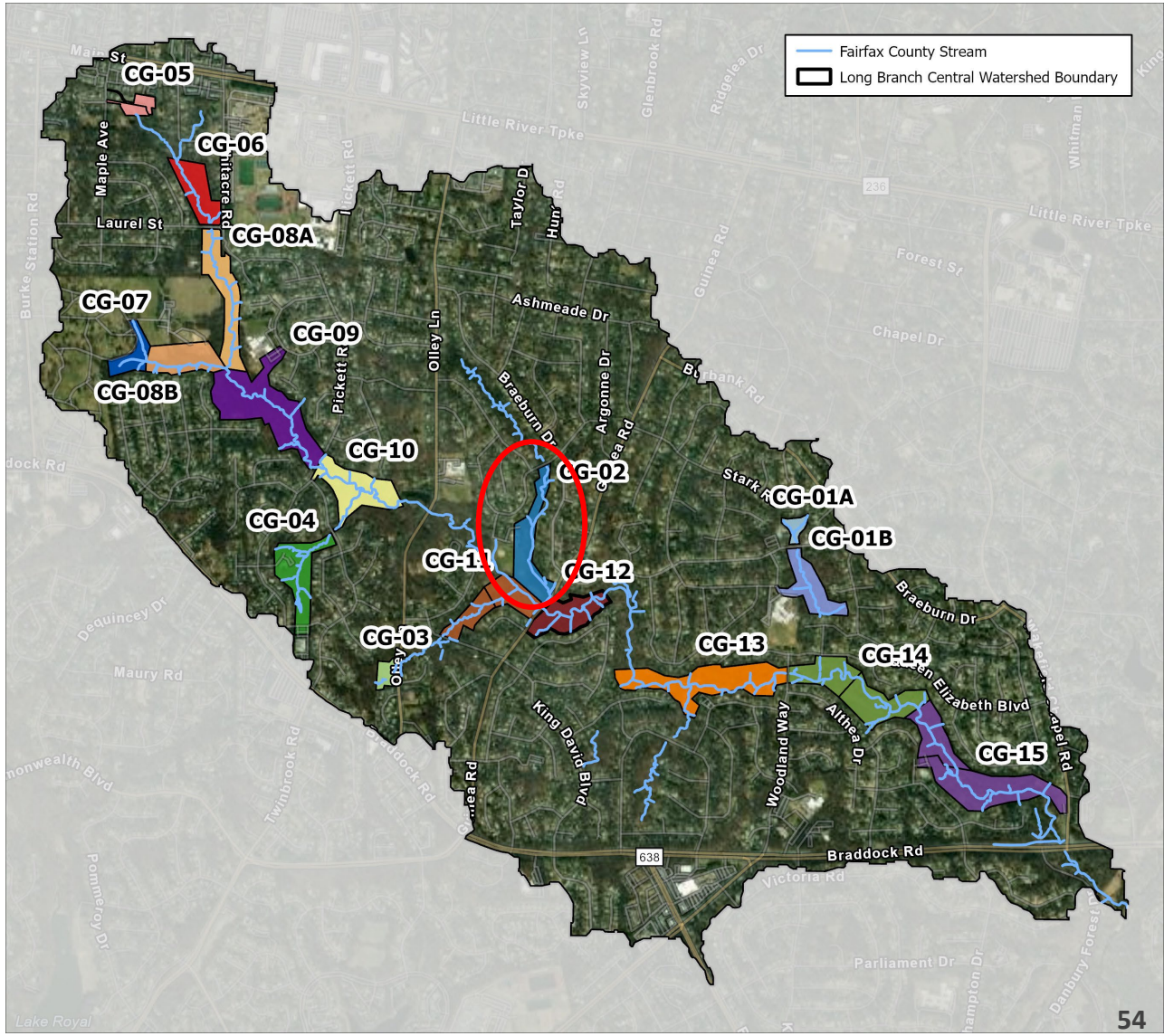
Metric	Value
Stream Length (LF)	1,535
CA/CO Services	$95,000
Estimated Cost at Construction Midpoint	$1,190,000
Construction Cost / LF	$775
Active Construction (months)	3
Total Construction (months)	7
Sediment Reduction Estimate (tons/yr)	41



Project Grouping for Permitting + Construction – CG-02

CG-02 Kristin Lane to Rutherford Park

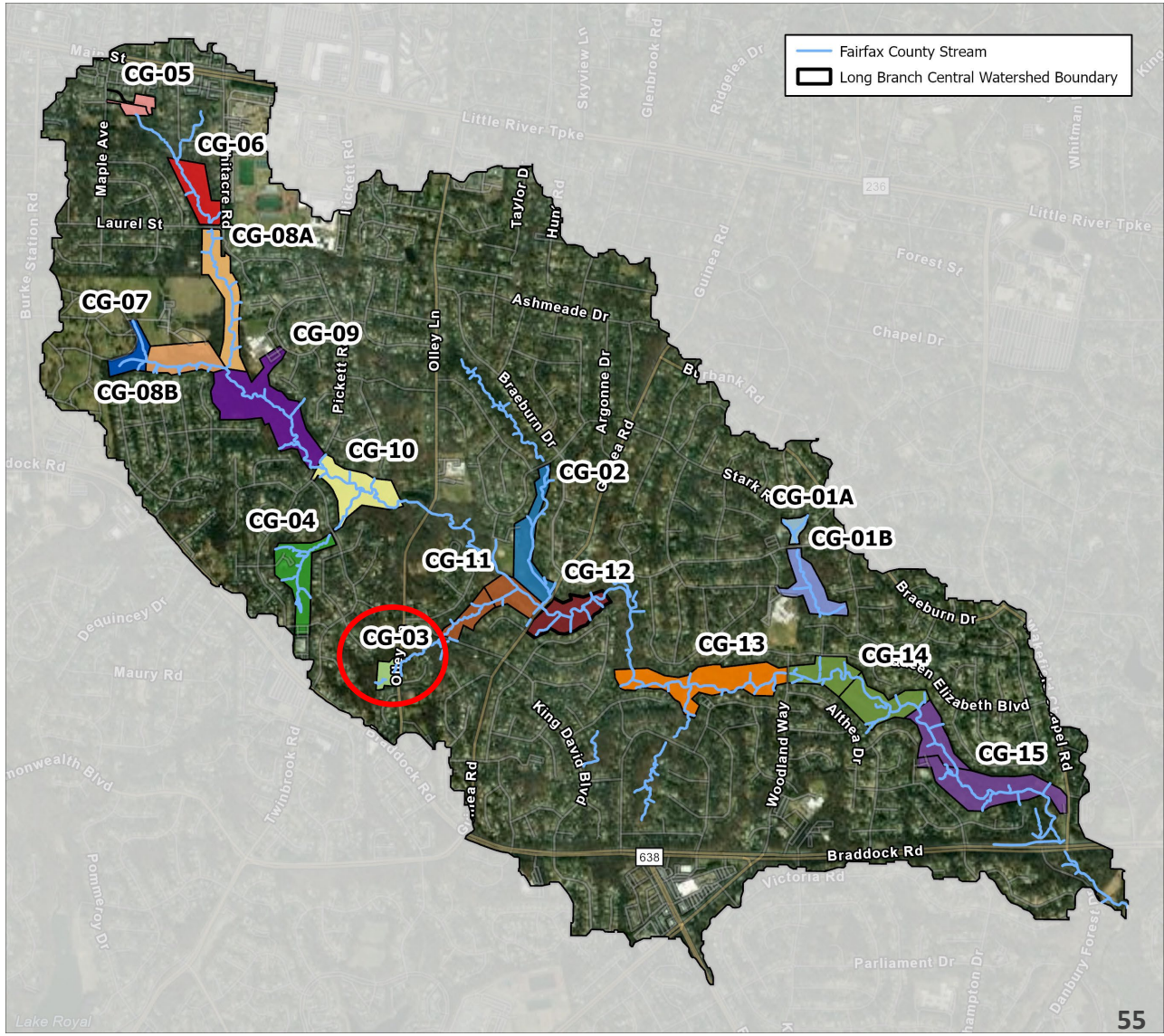
Metric	Value
Stream Length (LF)	2,227
CA/CO Services	$133,000
Estimated Cost at Construction Midpoint	$1,830,000
Construction Cost / LF	$822
Active Construction (months)	4
Total Construction (months)	9
Sediment Reduction Estimate (tons/yr)	24



Project Grouping for Permitting + Construction – CG-03

CG-03 Olley Lane Regional Stormwater Pond near Surrey Square Park

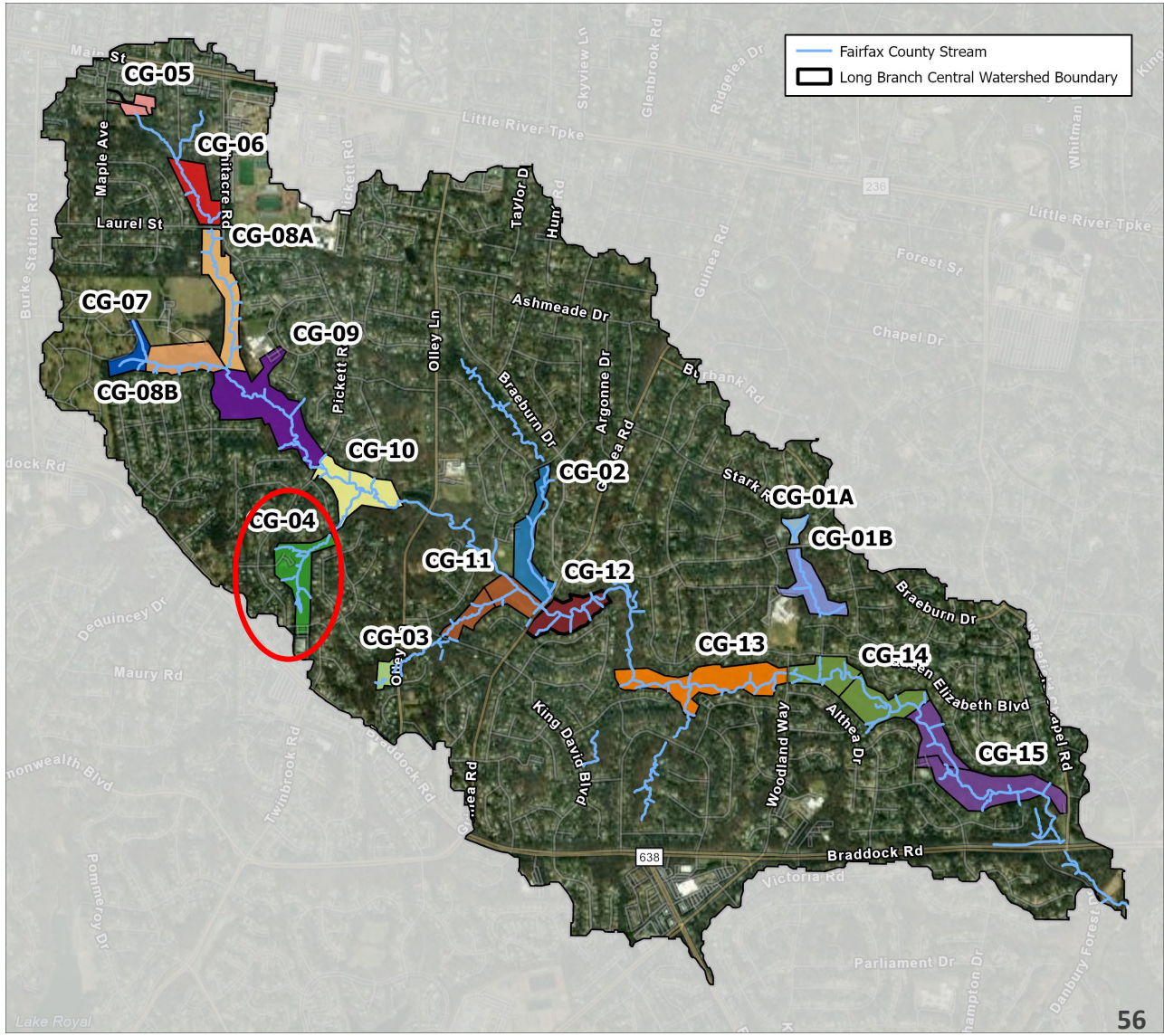
Metric	Value
CA/CO Services	$75,000
Estimated Cost at Construction Midpoint	$429,000
Construction Cost / LF	N/A
Active Construction (months)	2
Total Construction (months)	5



Project Grouping for Permitting + Construction – CG-04

CG-04 Olde Forge Park

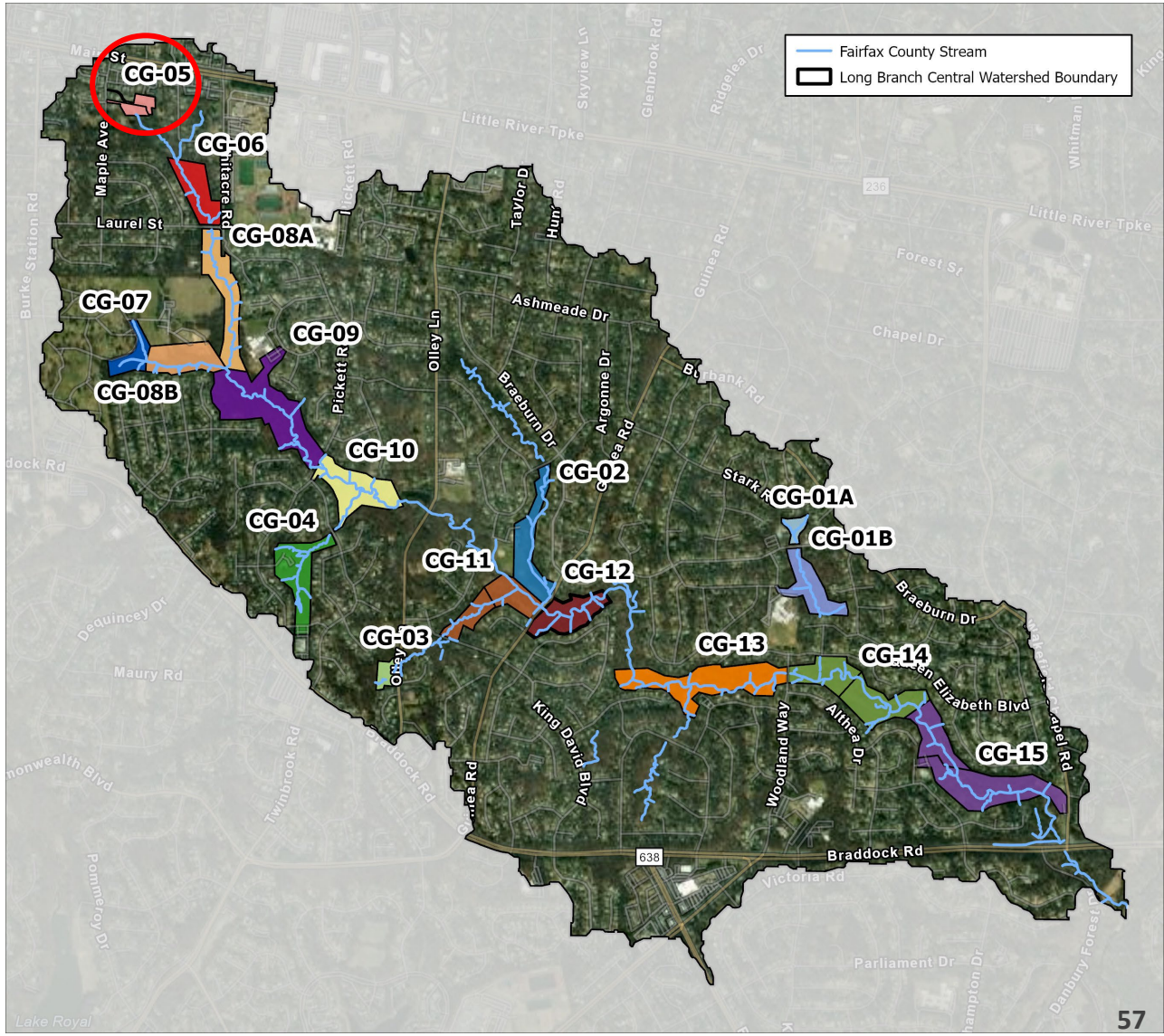
Metric	Value
Stream Length (LF)	2,181
CA/CO Services	$129,000
Estimated Cost at Construction Midpoint	$1,970,000
Construction Cost / LF	$903
Active Construction (months)	4
Total Construction (months)	10
Sediment Reduction Estimate (tons/yr)	46



Project Grouping for Permitting + Construction – CG-05

CG-05 Newcombe Stormwater Pond
Holly Park Stormwater Pond

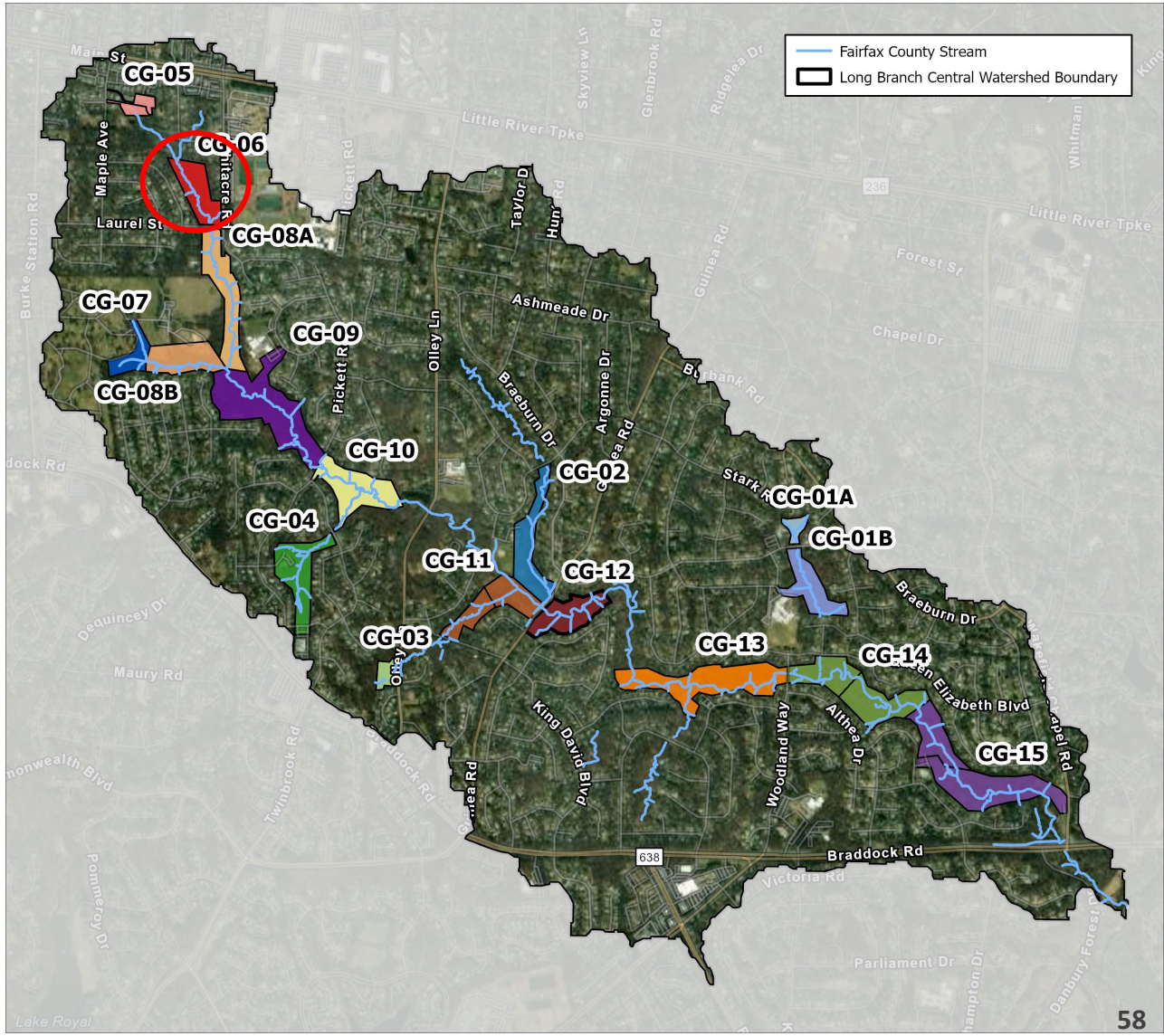
Metric	Value
CA/CO Services	$118,000
Estimated Cost at Construction Midpoint	$528,000
Construction Cost / LF	N/A
Active Construction (months)	3
Total Construction (months)	8



Project Grouping for Permitting + Construction – CG-06

CG-06 Smokewood Park, North of Laurel Street

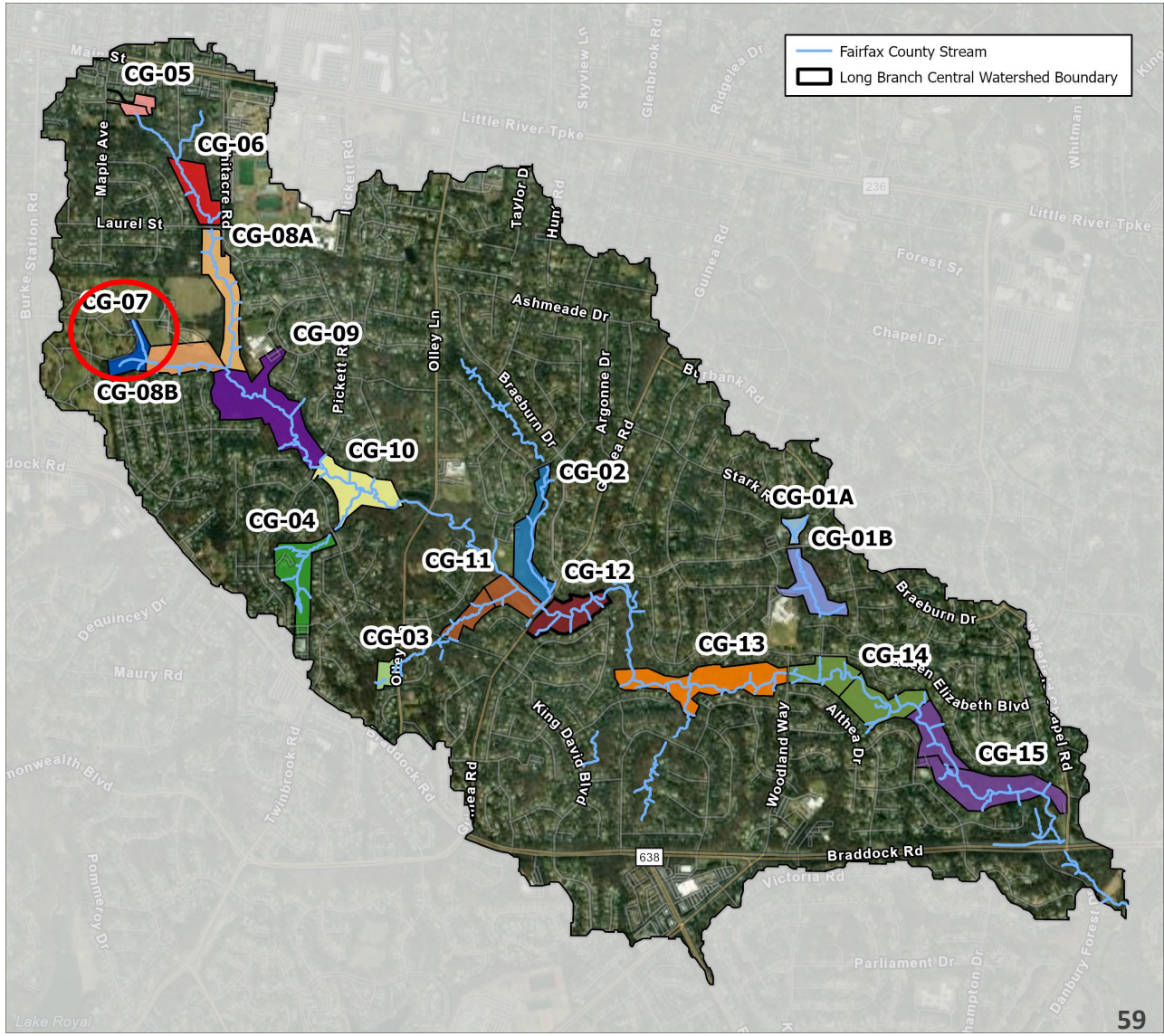
Metric	Value
Stream Length (LF)	1,488
CA/CO Services	$67,000
Estimated Cost at Construction Midpoint	$794,000
Construction Cost / LF	$534
Active Construction (months)	2
Total Construction (months)	5
Sediment Reduction Estimate (tons/yr)	32



Project Grouping for Permitting + Construction – CG-07

CG-07 Somerset – Ceralene Drive to Dansk Court

Metric	Value
Stream Length (LF)	1,170
CA/CO Services	$166,000
Estimated Cost at Construction Midpoint	$1,325,000
Construction Cost / LF	$1,132
Active Construction (months)	5
Total Construction (months)	11
Sediment Reduction Estimate (tons/yr)	21



Project Grouping for Permitting + Construction – CG-08

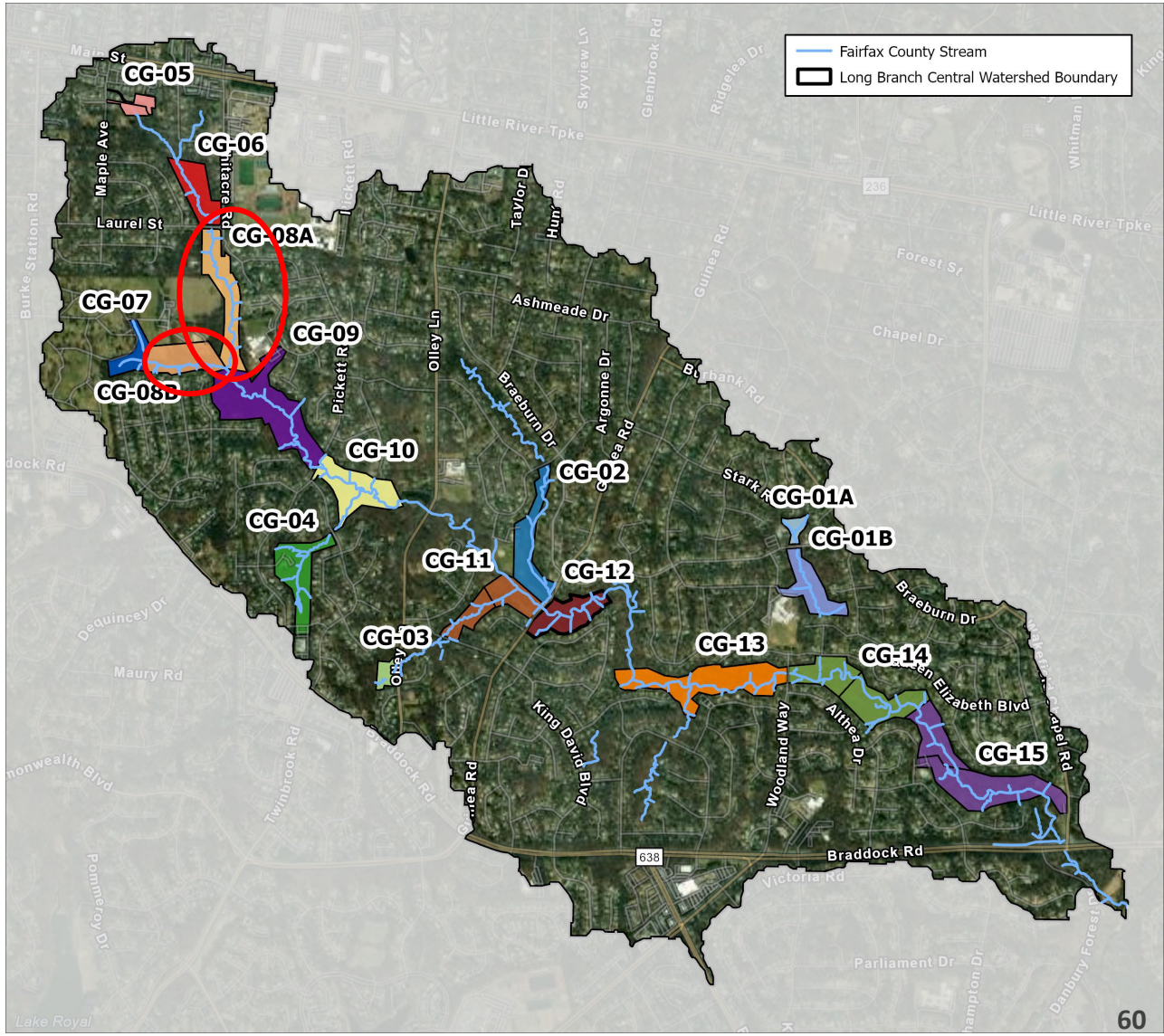
Projects can be grouped or constructed independently

CG-08A Smokewood Park, South of Laurel Street

Metric	Value
Stream Length (LF)	2,401
CA/CO Services	$102,000
Estimated Cost at Construction Midpoint	$1,515,000
Construction Cost / LF	$631
Active Construction (months)	3
Total Construction (months)	8
Sediment Reduction Estimate (tons/yr)	57

CG-08B Dansk Court to Flintridge Court

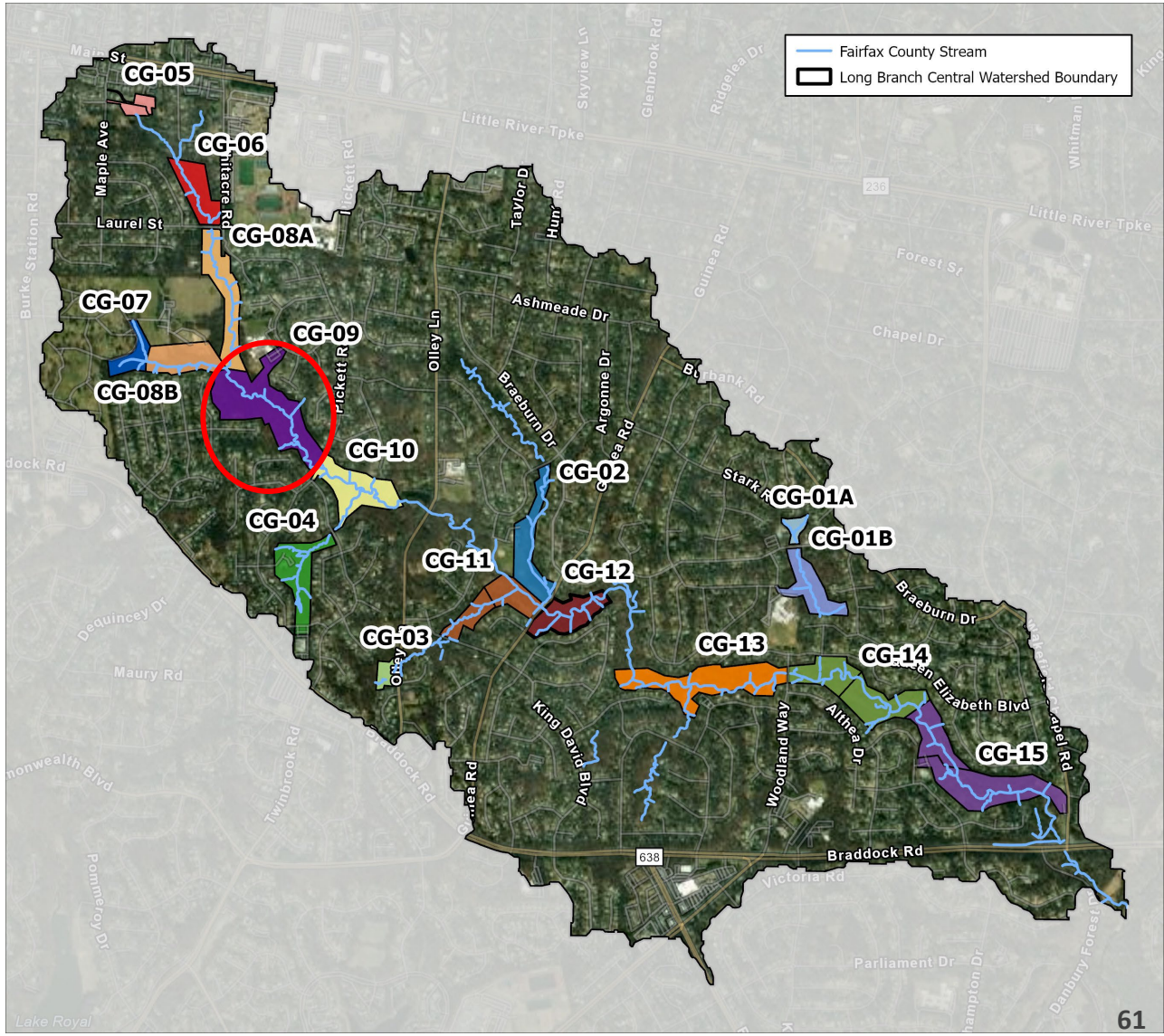
Metric	Value
Stream Length (LF)	1,802
CA/CO Services	$79,000
Estimated Cost at Construction Midpoint	$970,000
Construction Cost / LF	$538
Active Construction (months)	2
Total Construction (months)	6
Sediment Reduction Estimate (tons/yr)	24



Project Grouping for Permitting + Construction – CG-09

CG-09 Olde Creek Elementary School to Pickett Road

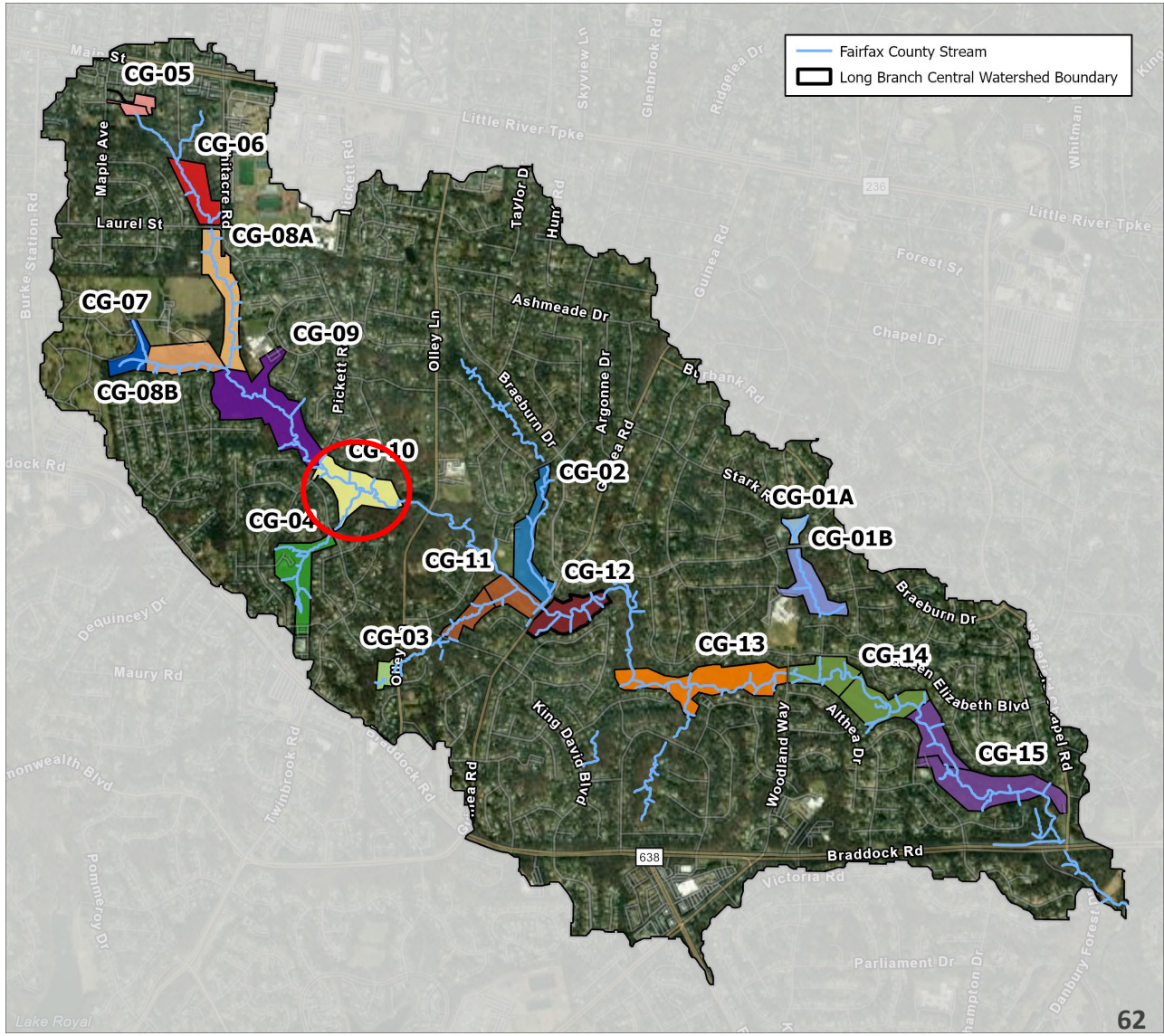
Metric	Value
Stream Length (LF)	3,054
CA/CO Services	$191,000
Estimated Cost at Construction Midpoint	$3,419,000
Construction Cost / LF	$1,120
Active Construction (months)	5
Total Construction (months)	12
Sediment Reduction Estimate (tons/yr)	56



Project Grouping for Permitting + Construction – CG-10

CG-10 Pickett Road to Tara Drive

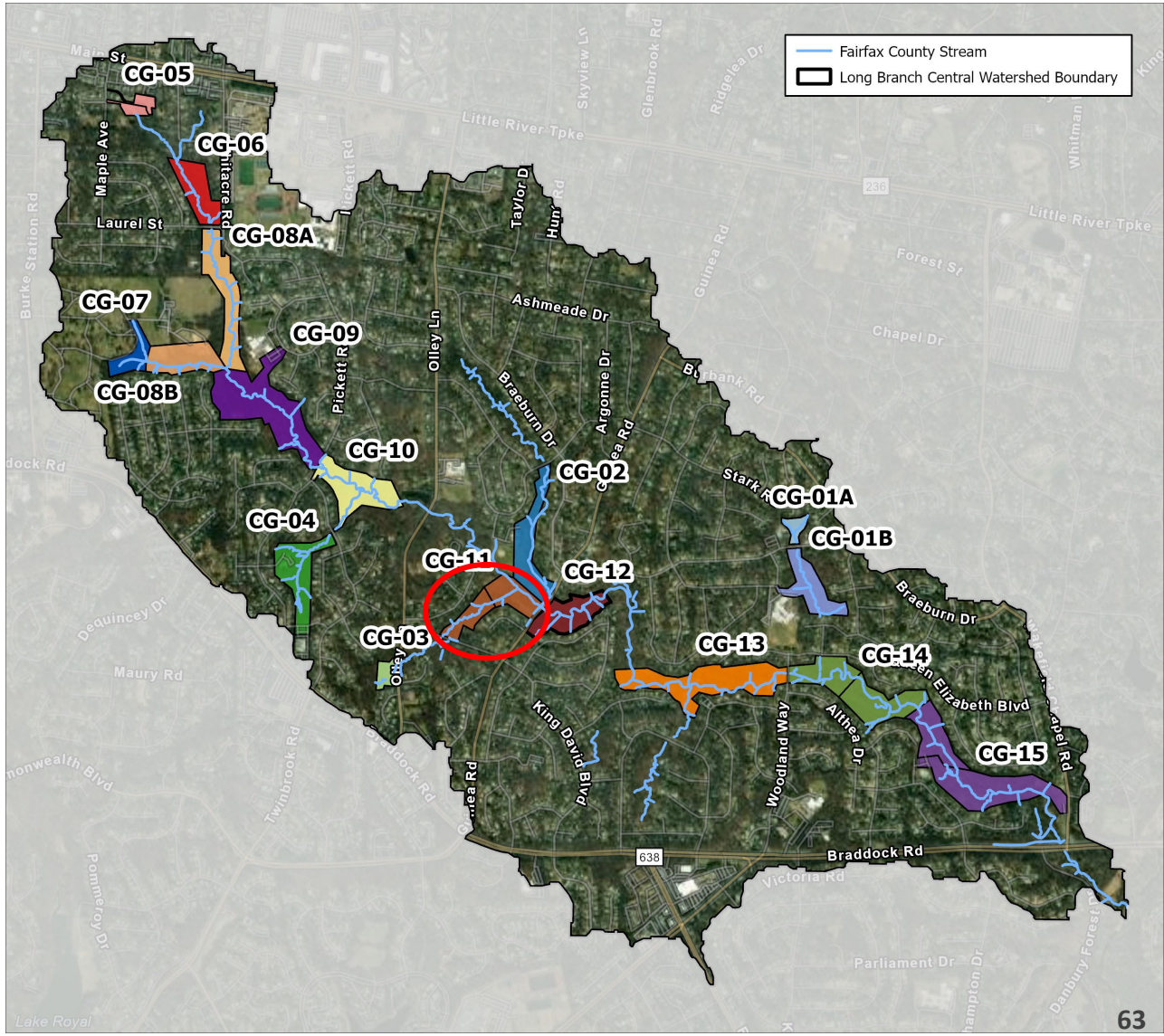
Metric	Value
Stream Length (LF)	2,561
CA/CO Services	$94,000
Estimated Cost at Construction Midpoint	$2,118,000
Construction Cost / LF	$827
Active Construction (months)	2
Total Construction (months)	8
Sediment Reduction Estimate (tons/yr)	33



Project Grouping for Permitting + Construction – CG-11

CG-11 Rutherford Park
El James Drive to Rutherford Park

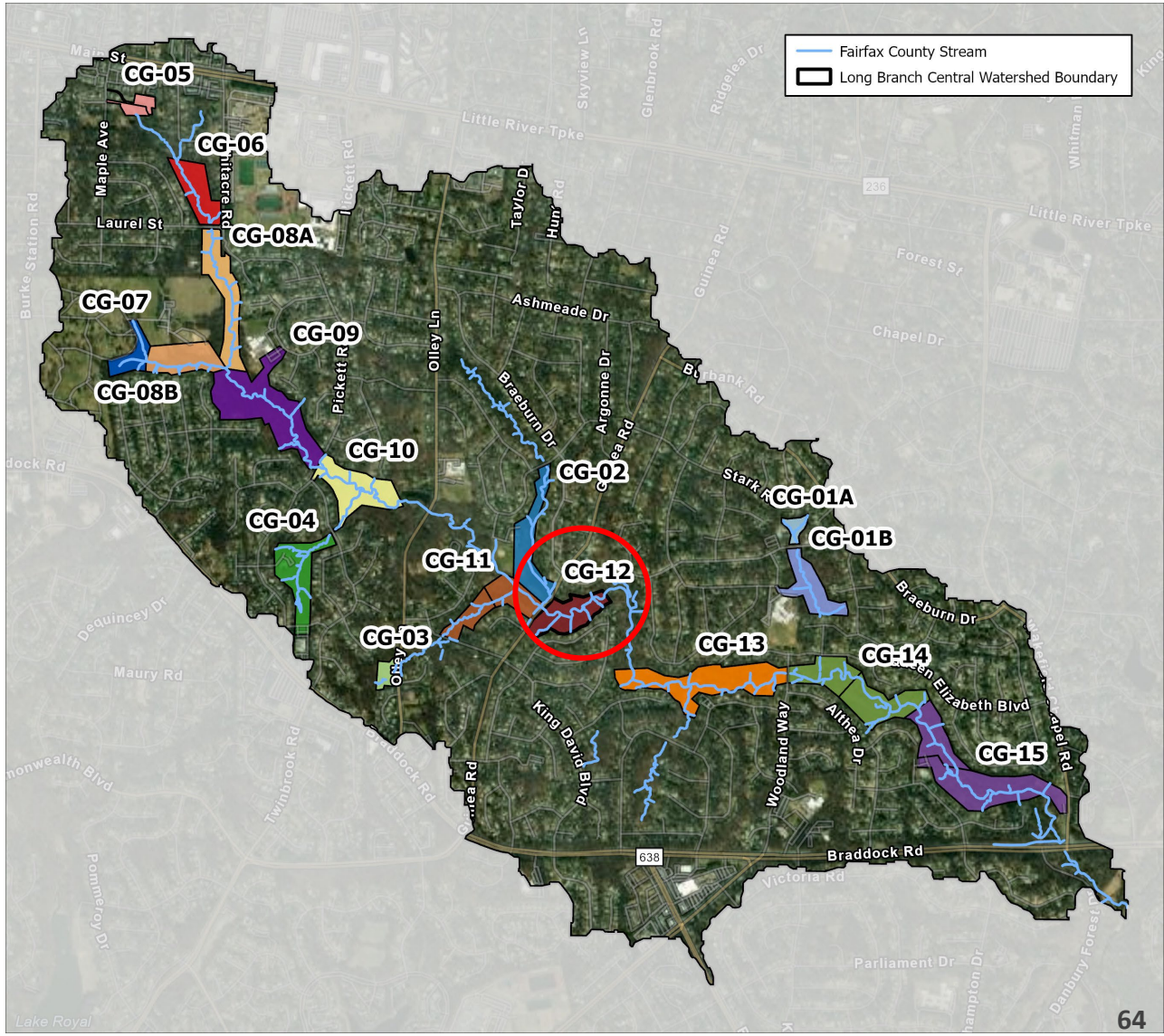
Metric	Value
Stream Length (LF)	2,022
CA/CO Services	$143,000
Estimated Cost at Construction Midpoint	$1,828,000
Construction Cost / LF	$904
Active Construction (months)	4
Total Construction (months)	9
Sediment Reduction Estimate (tons/yr)	48



Project Grouping for Permitting + Construction – CG-12

CG-12 Guinea Road to Tabard Place

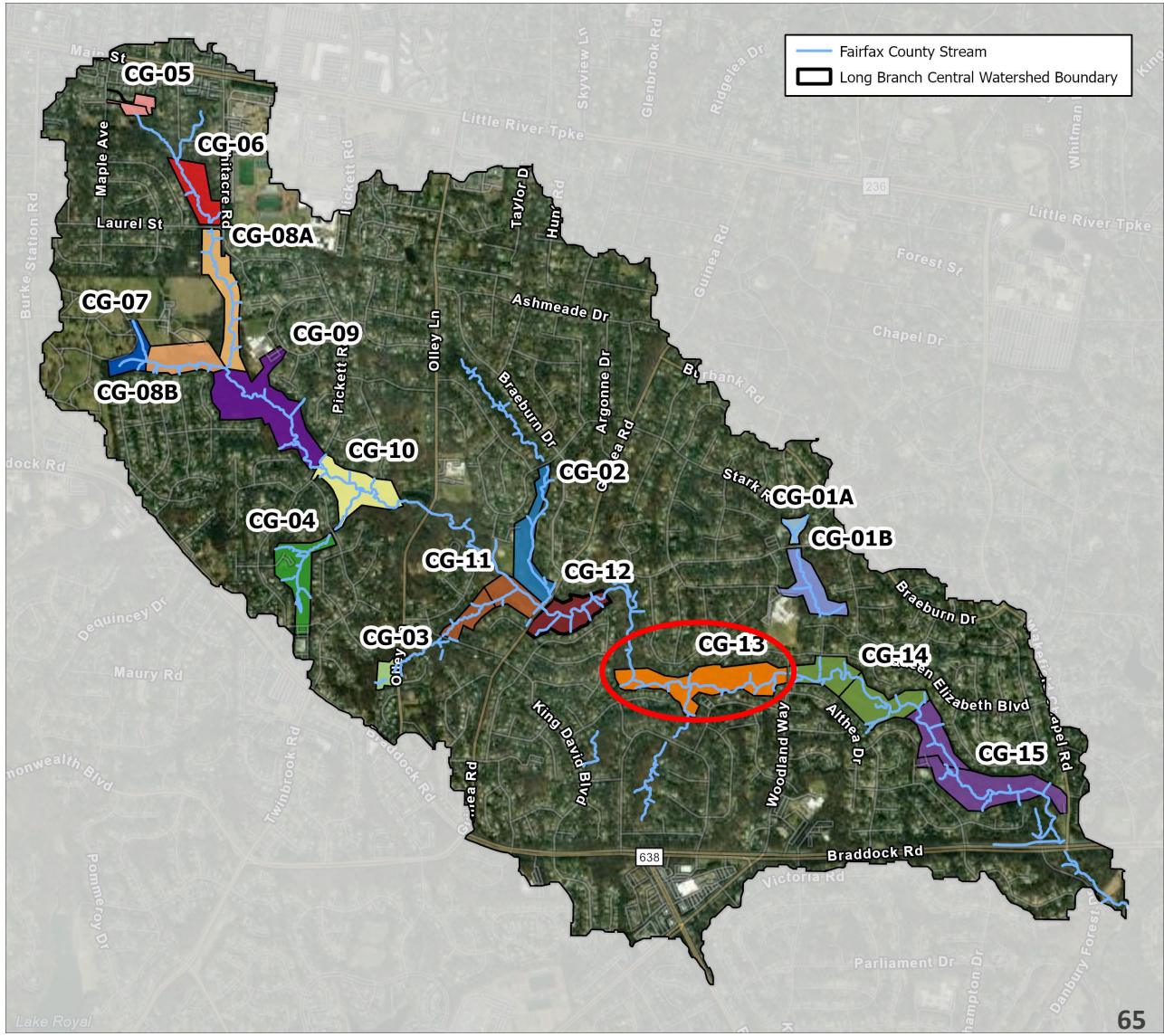
Metric	Value
Stream Length (LF)	1,565
CA/CO Services	$179,000
Estimated Cost at Construction Midpoint	$1,885,000
Construction Cost / LF	$1,204
Active Construction (months)	5
Total Construction (months)	9
Sediment Reduction Estimate (tons/yr)	33



Project Grouping for Permitting + Construction – CG-13

CG-13 Tabard Place to Woodland Way

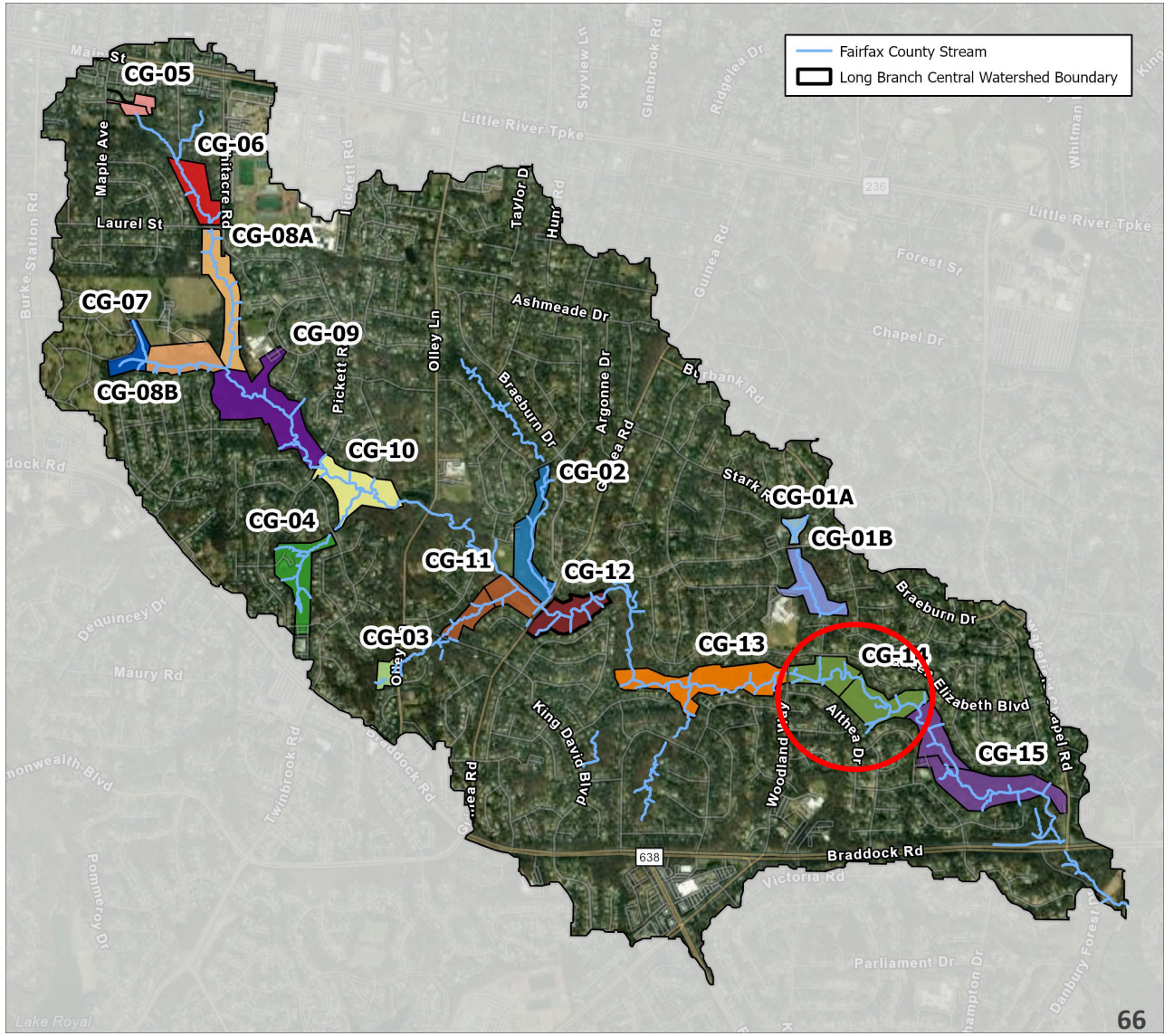
Metric	Value
Stream Length (LF)	3,927
CA/CO Services	$243,000
Estimated Cost at Construction Midpoint	$4,564,000
Construction Cost / LF	$1,162
Active Construction (months)	6
Total Construction (months)	15
Sediment Reduction Estimate (tons/yr)	67



Project Grouping for Permitting + Construction – CG-14

CG-14 Woodland Way to Dora Court
Long Branch Stream Valley Park – Dora Ct to Cockney Ct – West

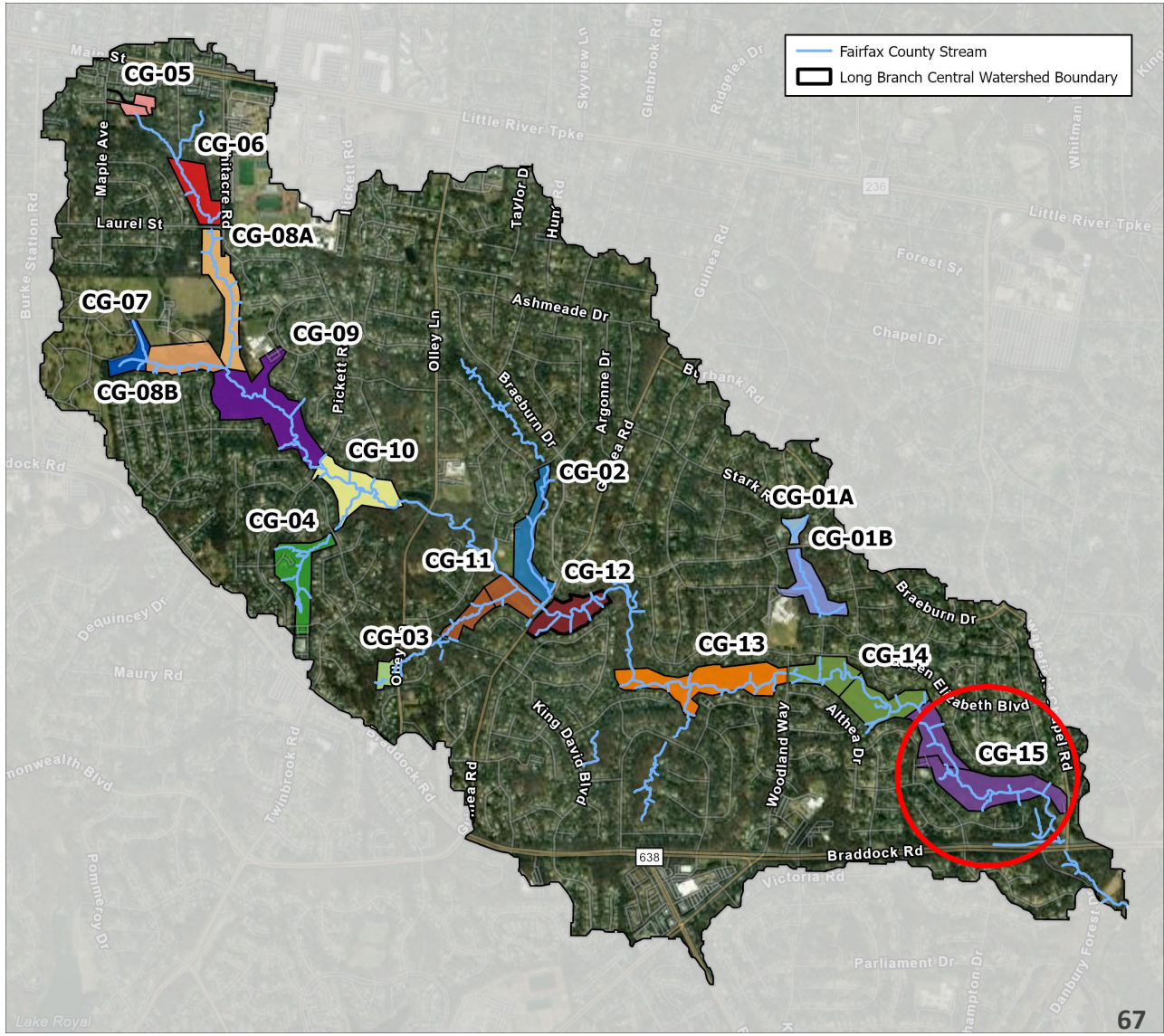
Metric	Value
Stream Length (LF)	3,868
CA/CO Services	$342,000
Estimated Cost at Construction Midpoint	$5,660,000
Construction Cost / LF	$1,463
Active Construction (months)	9
Total Construction (months)	19
Sediment Reduction Estimate (tons/yr)	83



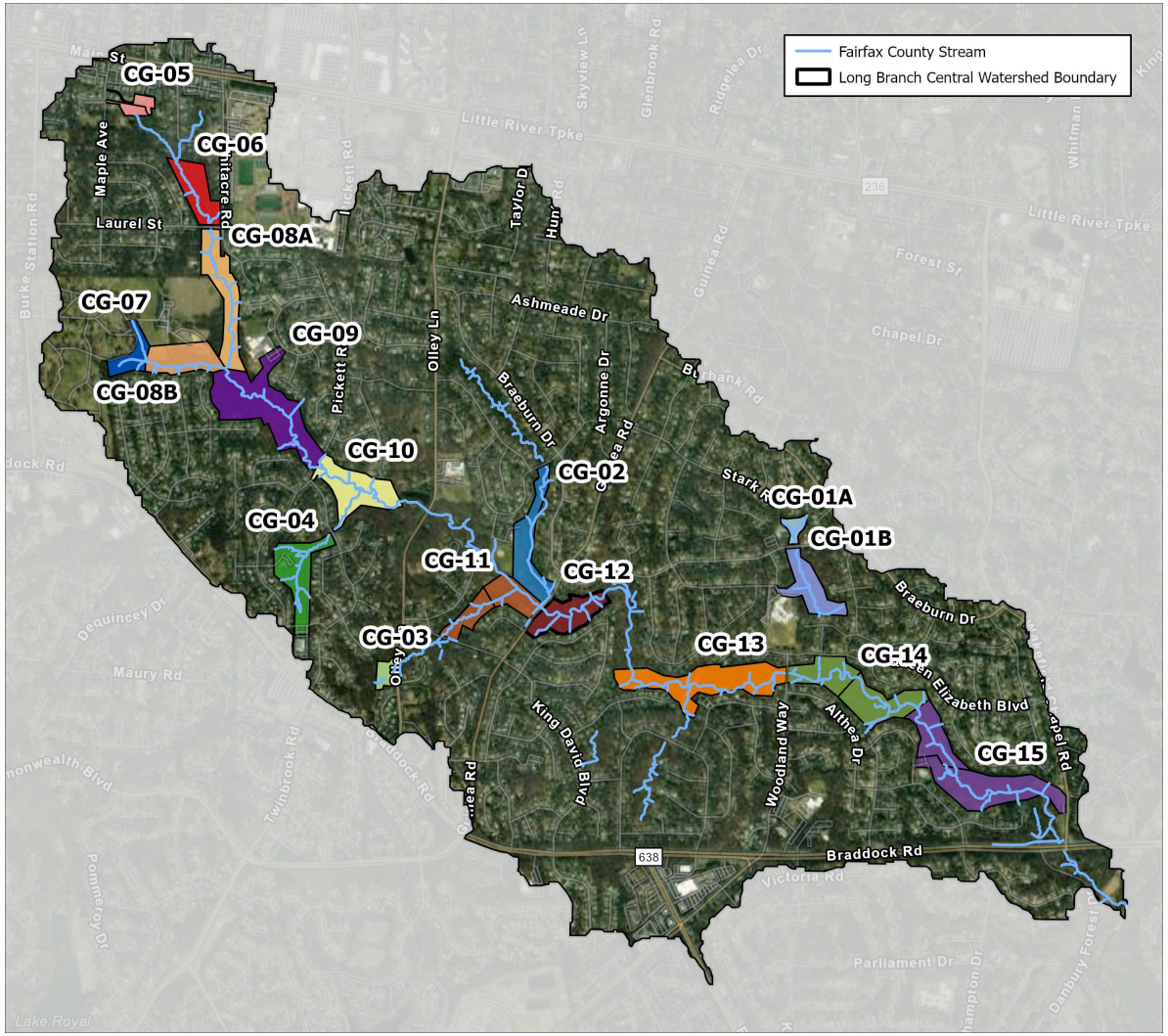
Project Grouping for Permitting + Construction – CG-15

CG-15 Long Branch Stream Valley Park – Dora Ct to Cockney Ct – East Canterbury Woods Park – Cockney Ct to Wakefield Chapel Rd

Metric	Value
Stream Length (LF)	3,733
CA/CO Services	$331,000
Estimated Cost at Construction Midpoint	$5,592,000
Construction Cost / LF	$1,498
Active Construction (months)	9
Total Construction (months)	18
Sediment Reduction Estimate (tons/yr)	79



Project Grouping for Construction Summary



Grouping	Project Name	CA/CO Services	Est. Cost at Midpoint of Construction
CG-01A	Ilda Pool at Braeburn Drive	$38,000	$428,000
CG-01B	Willow Woods Park South of Braeburn Drive	$95,000	$1,190,000
CG-02	Kristin Lane to Rutherford Park	$133,000	$1,830,000
CG-03	Olley Lane Regional Stormwater Pond near Surrey Square Park	$75,000	$429,000
CG-04	Olde Forge Park	$129,000	$1,970,000
CG-05	Newcombe Stormwater Pond Holly Park Stormwater Pond	$118,000	$528,000
CG-06	Smokewood Park, North of Laurel Street	$67,000	$794,000
CG-07	Somerset – Ceralene Drive to Dansk Court	$166,000	$1,325,000
CG-08A	Smokewood Park, South of Laurel Street	$102,000	$1,515,000
CG-08B	Dansk Court to Flintridge Court	$79,000	$970,000
CG-09	Olde Creek Elementary School to Pickett Road	$191,000	$3,419,000
CG-10	Pickett Road to Tara Drive	$94,000	$2,118,000
CG-11	Rutherford Park El James Drive to Rutherford Park	$143,000	$1,828,000
CG-12	Guinea Road to Tabard Place	$179,000	$1,885,000
CG-13	Tabard Place to Woodland Way	$243,000	$4,564,000
CG-14	Woodland Way to Dora Court Long Branch Stream Valley Park – Dora Court to Cockney Court – West	$342,000	$5,660,000
CG-15	Long Branch Stream Valley Park – Dora Court to Cockney Court – East Canterbury Woods Park – Cockney Court to Wakefield Chapel Road	$331,000	$5,592,000

IV. IMPLEMENTATION WORK PLAN SCHEDULE

A schedule was developed for implementation of all projects recommended in this Implementation Work Plan.

This schedule assumes design begins in the Spring of 2023. Construction would then begin in the Fall of 2024.

Active construction will be completed in the Fall of 2031. All construction will be completed in the Spring of 2032.

Post-construction monitoring will extend through early 2037.

Specific assumptions used in developing the implementation schedule include:

- Design duration for the design project groupings ranges from 14.5 to 28 months, depending on length of stream restoration and project complexity. Note that this can change if challenges are encountered due to land acquisition or utility relocations.
- Bidding is assumed to have a three (3) month duration.
- Construction duration ranges from three (3) to 19 months, depending on length of stream restoration and project complexity.
- Active construction duration ranges from one (1) to nine (9) months.
- Pre-construction monitoring has a 24-month duration and is scheduled to finish when construction starts. Note, some early action projects have an 18-month duration.
- Post-construction monitoring has a 60-month duration and is scheduled to start when construction is complete.
- Construction schedules for early action projects on tributaries are driven by design-bid-construction sequencing.
- Construction schedules for projects on the mainstem are driven by construction sequencing that moves from upstream to downstream.

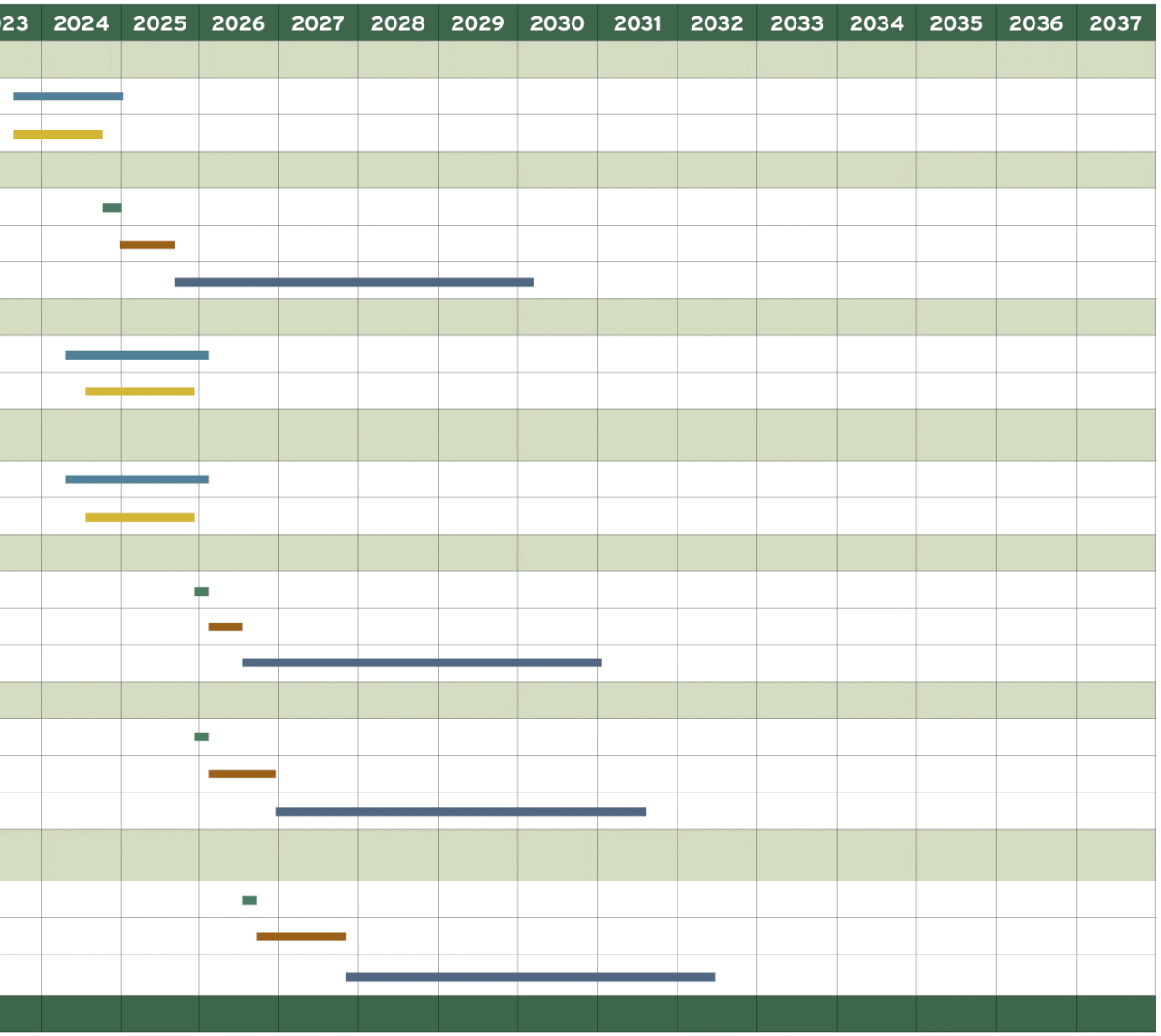
For more information, see Attachment F: **Long Branch Central Watershed Implementation Work Plan Schedule**

Implementation Work Plan Schedule, Early Action Projects

TASK NAME	START	FINISH	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
DG-01 Ilda Pool & Willow Woods	**4/3/23**	**10/28/24**															
Pre-Construction Monitoring	6/12/23	10/28/24															
Design	4/3/23	8/2/24															
CG-01A/B Ilda Pool & Willow Woods	**8/5/24**	**3/8/30**															
Bidding	8/5/24	10/25/24															
Construction	10/28/24	8/1/25															
Post-Construction Monitoring	8/4/25	3/8/30															
DG-02 Kristin Lane to Rutherford Park	**4/3/23**	**3/31/25**															
Pre-Construction Monitoring	5/29/23	3/31/25															
Design	4/3/23	1/3/25															
CG-02 Kristin Lane to Rutherford Park	**1/6/25**	**7/12/30**															
Bidding	1/6/25	3/28/25															
Construction	3/31/25	12/5/25															
Post-Construction Monitoring	12/8/25	7/12/30															
DG-03 Olley Lane Pond	**8/7/23**	**12/23/24**															
Pre-Construction Monitoring	8/7/23	12/23/24															
Design	8/21/23	9/27/24															
CG-03 Olley Lane Pond	**9/30/24**	**12/14/29**															
Bidding	9/30/24	12/20/24															
Construction	12/23/24	5/9/25															
Post-Construction Monitoring	5/12/25	12/14/29															
DG-04 Olde Forge Park	**8/21/23**	**8/18/25**															
Pre-Construction Monitoring	10/16/23	8/18/25															
Design	8/21/23	5/23/25															
CG-04 Olde Forge Park	**5/26/25**	**12/27/30**															
Bidding	5/26/25	8/15/25															
Construction	8/18/25	5/22/26															
Post-Construction Monitoring	5/25/26	12/27/30															

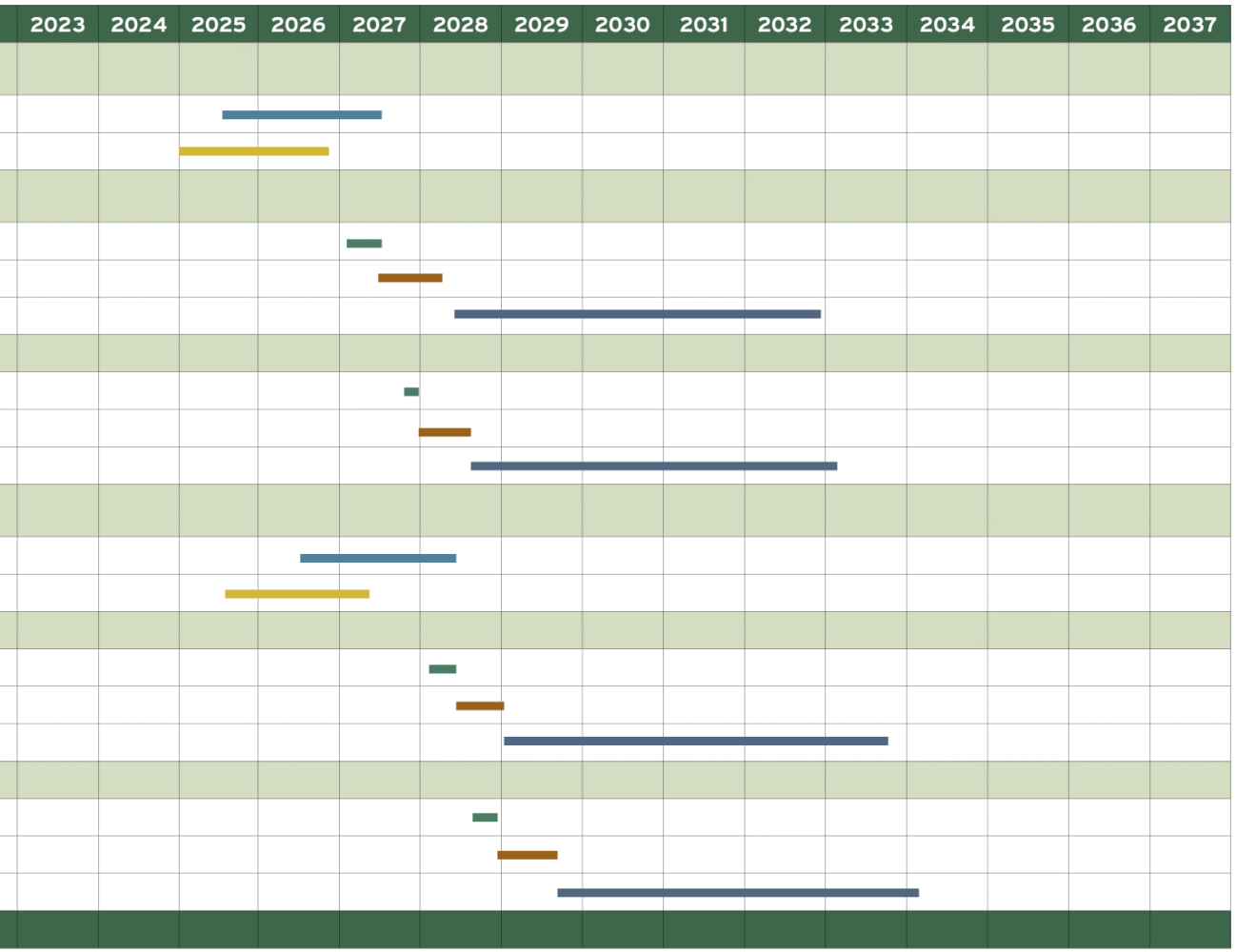
Implementation Work Plan Schedule, Headwaters

TASK NAME	START	FINISH
DG-05 Holly Park & Newcombe Ponds	**8/7/23**	**12/23/24**
Pre-Construction Monitoring	8/7/23	12/23/24
Design	8/21/23	9/27/24
CG-05 Holly Park & Newcombe Ponds	**9/30/24**	**3/8/30**
Bidding	9/30/24	12/20/24
Construction	12/23/24	8/1/25
Post-Construction Monitoring	8/4/25	3/8/30
DG-06A Smokewood Park, North & South	**4/8/24**	**2/9/26**
Pre-Construction Monitoring	4/8/24	2/9/26
Design	7/15/24	11/14/25
DG-06B Somerset & Dansk Court to Flintridge Court	**4/8/24**	**2/9/26**
Pre-Construction Monitoring	4/8/24	2/9/26
Design	7/15/24	11/14/25
CG-06 Smokewood Park, North	**11/17/25**	**1/31/31**
Bidding	11/17/25	2/6/26
Construction	2/9/26	6/26/26
Post-Construction Monitoring	6/29/26	1/31/31
CG-07 Somerset	**11/17/25**	**7/18/31**
Bidding	11/17/25	2/6/26
Construction	2/9/26	12/11/26
Post-Construction Monitoring	12/14/26	7/18/31
CG-08A/B Smokewood Park South & Dansk Court to Flintridge Court	**6/29/26**	**10/15/27**
Bidding	6/29/26	9/21/26
Construction	9/21/26	10/15/27
Post-Construction Monitoring	10/18/27	5/21/32



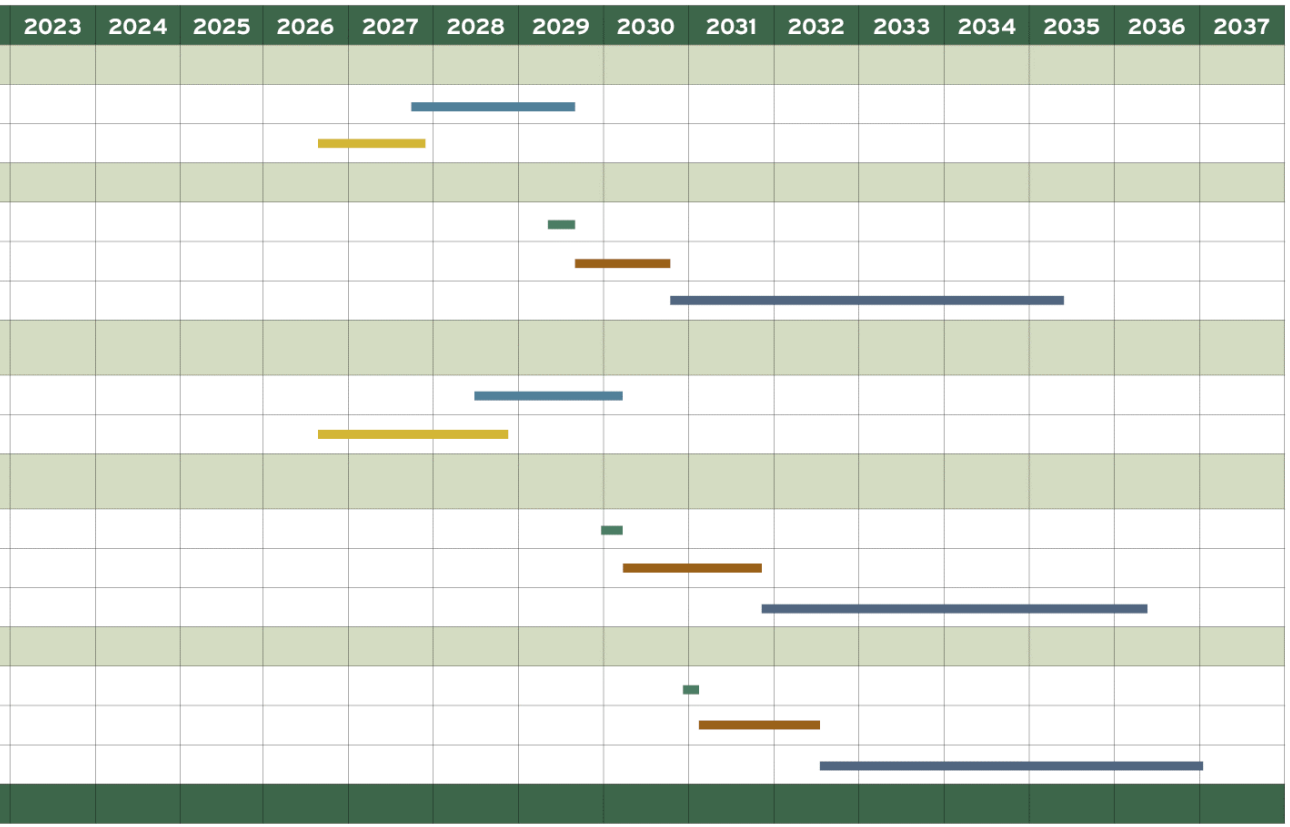
Implementation Work Plan Schedule, Upper Mainstem

TASK NAME	START	FINISH
DG-07 Olde Creek Elem. School to Pickett Road & Pickett Road to Tara Drive	**1/20/25**	**5/3/27**
Pre-Construction Monitoring	6/30/25	5/3/27
Design	1/20/25	10/23/26
CG-09 Olde Creek Elem. School to Pickett Road	**2/8/27**	**11/5/32**
Bidding	2/8/27	5/3/27
Construction	5/3/27	3/31/28
Post-Construction Monitoring	4/3/28	11/5/32
DG-10 Pickett Road to Tara Drive	**9/20/27**	**2/25/33**
Bidding	09/20/27	12/13/27
Construction	12/13/27	7/21/28
Post-Construction Monitoring	7/24/28	2/25/33
DG-08 El James Drive, Rutherford Park & Guinea Road to Tabard Place	**7/21/25**	**5/1/28**
Pre-Construction Monitoring	6/29/26	5/1/28
Design	7/21/25	4/23/27
CG-11 El James Drive & Rutherford Park	**2/7/28**	**8/12/33**
Bidding	2/7/28	5/1/28
Construction	5/1/28	1/5/29
Post-Construction Monitoring	1/8/29	8/12/33
CG-12 Guinea Road to Tabard Place	**8/21/28**	**2/24/34**
Bidding	8/21/28	11/13/28
Construction	11/13/28	7/20/29
Post-Construction Monitoring	7/23/29	2/24/34



Implementation Work Plan Schedule, Lower Mainstem

TASK NAME	START	FINISH
DG-09A Tabard Place to Woodland Way	**7/20/26**	**6/25/29**
Pre-Construction Monitoring	8/23/27	6/25/29
Design	7/20/26	11/19/27
CG-13 Tabard Place to Woodland Way	**4/2/29**	**3/23/35**
Bidding	4/2/29	6/25/29
Construction	6/25/29	8/16/30
Post-Construction Monitoring	8/19/30	3/23/35
DG-09B Woodland Way to Dora Court, LB SVP West & East, & Canterbury Woods	**7/20/26**	**3/4/30**
Pre-Construction Monitoring	5/1/28	3/4/30
Design	7/20/26	9/8/28
CG-14 Woodland Way to Dora Court & LB SVP West	**12/10/29**	**4/18/36**
Bidding	12/10/29	3/4/30
Construction	3/4/30	9/12/31
Post-Construction Monitoring	9/15/31	4/18/36
CG-15 LB SVP East & Canterbury Woods	**11/11/30**	**1/23/37**
Bidding	11/11/30	2/3/31
Construction	2/3/31	6/18/32
Post-Construction Monitoring	6/21/32	1/23/37



Estimated Costs by Fiscal Year

Fiscal Year	Design Services Only	CA/CO Services	Estimated Cost at Midpoint of Construction	Total
2023	$887,000	$0	$0	**$887,000**
2024	$1,086,000	$459,000	$4,405,000	**$5,950,000**
2025	$2,552,000	$362,000	$4,089,000	**$7,003,000**
2026	$752,000	$372,000	$5,904,000	**$7,028,000**
2027	$2,813,000	$237,000	$3,946,000	**$6,996,000**
2028	$0	$422,000	$6,449,000	**$6,871,000**
2029	$0	$342,000	$5,660,000	**$6,002,000**
2030	$0	$331,000	$5,592,000	**$5,923,000**
TOTAL	**$8,090,000**	**$2,525,000**	**$36,045,000**	**$46,660,000**

V. WATERSHED AND PROJECTS MONITORING FRAMEWORK

The monitoring program for the Long Branch watershed includes **watershed-wide monitoring** and **project-specific monitoring**.

Project-specific monitoring will include **pre-construction and post-construction monitoring**.

Watershed-wide monitoring **began in the late Fall of 2021** and is being conducted by **Fairfax County, USGS, and Biohabitats**. Year 1 (2022) of watershed-wide monitoring is complete. Year 2 (2023) is beginning in early 2023.

Project-specific monitoring will **begin in the Spring of 2023**.

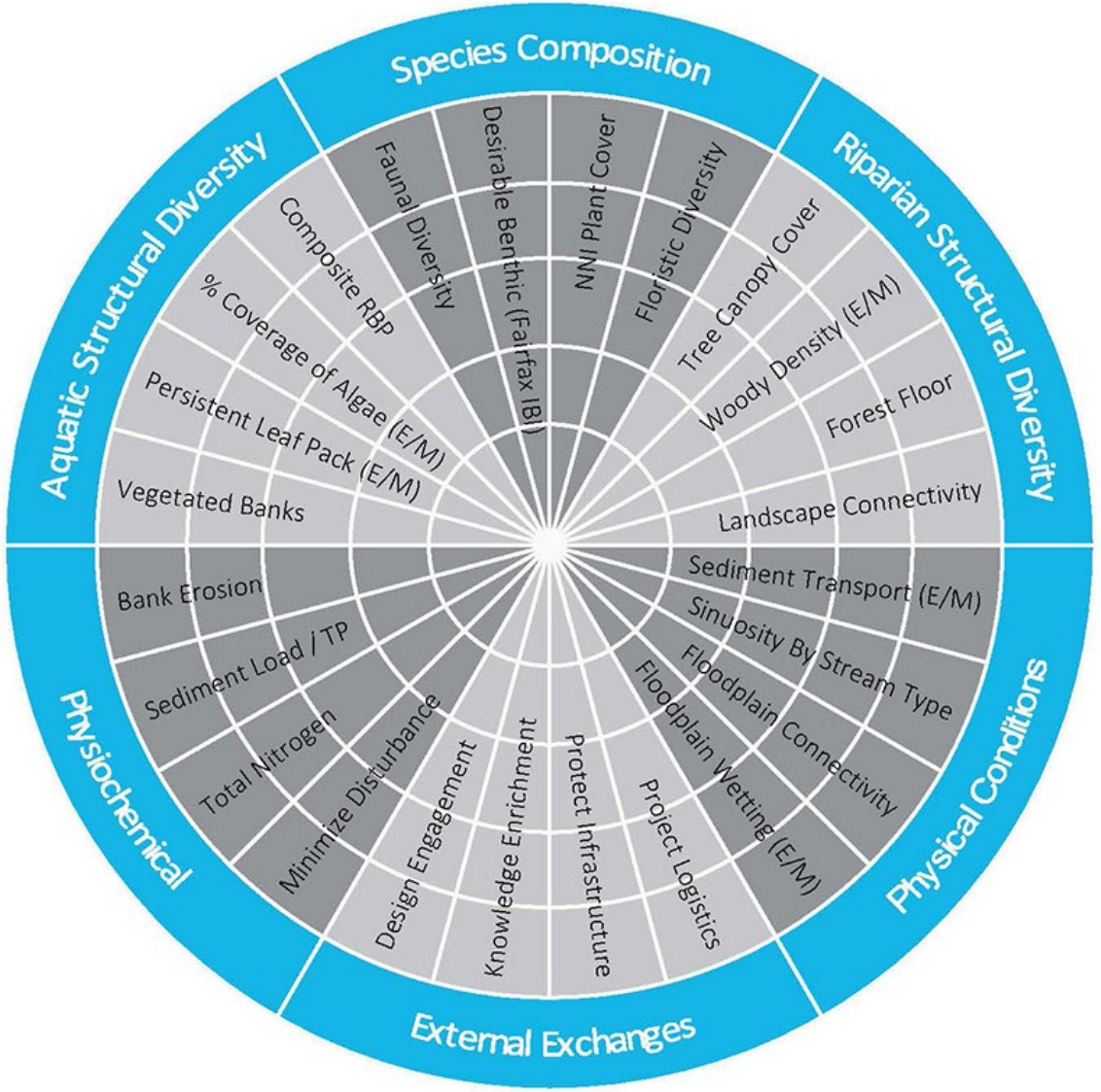
Monitoring parameters and purpose are aligned with the **Fairfax Ecological Recovery Wheel,** the **Stream Functions Pyramid**, and **project goals.**

A **series of potential project goals aligned with the Stream Functions Pyramid** were identified for projects in the Long Branch watershed.

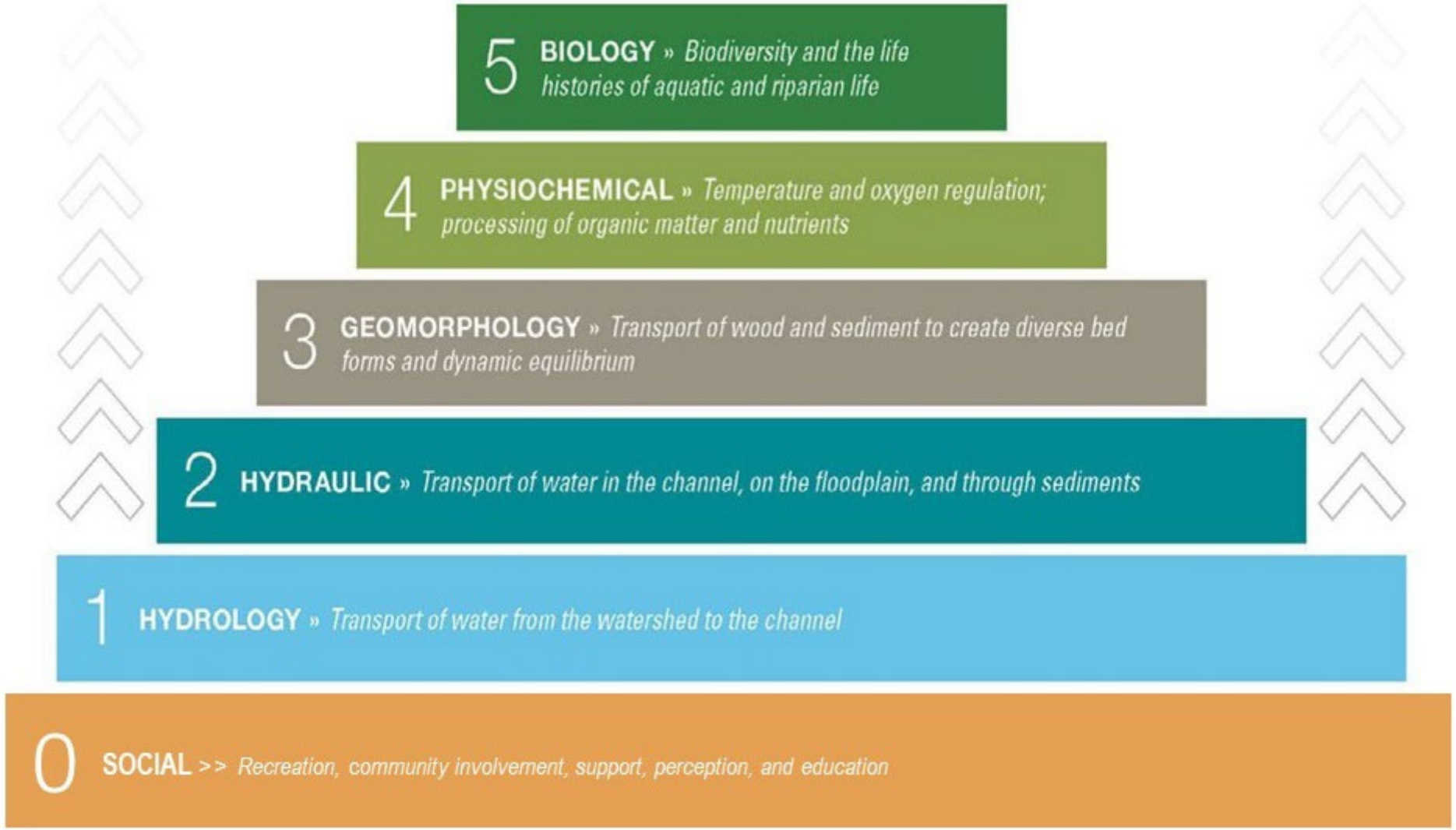
Specific, preliminary project goals were selected for each project (see the project descriptions).

Goals for each project will be refined at the beginning of the design process.

Fairfax Ecological Recovery Wheel



Stream Functions Pyramid



Modified from Harman, 2012

Potential Project Goals Aligned with the Stream Functions Pyramid

Stream Function Principle	Goal
Improve Hydrology	—Attenuate peak discharges (by increasing roughness and storage along watershed flow paths) —Increase watershed time of concentration —Increase the time of concentration at storm drain outfalls —Reduce velocities in the mainstem, in tributaries and at outfalls during runoff events
Improve Hydraulics	—Improve floodplain connectivity and increase frequency of floodplain inundation —Increase floodplain storage and residence time —Reduce downstream flooding
Improve Geomorphology	—Improve lateral stability, thereby reducing bank and bed erosion —Diversify channel bedform —Optimize channel aggradation —Maintain sediment transport —Restore near-channel native riparian vegetation communities

Potential Project Goals Aligned with the Stream Functions Pyramid, Continued

Stream Function Principle	Goal
Improve Physicochemical Processes	—Promote denitrification during base flow (by raising groundwater elevation, thereby increasing hyporheic exchange) —Increase/improve wetlands throughout the riparian corridor —Increase channel roughness, thereby increasing material processing
Improve Biology and Ecology	—Improve wetland hydrology to support wetland species —Improve pool class and increase the area and volume of aquatic habitat, thereby providing greater diversity of habitat —Increase and diversify in-channel habitat structure —Improve coarse particulate organic matter (CPOM) retention —Improve health and structure of the forested riparian corridor —Minimize impacts to existing riparian corridor vegetation —Reduce presence of non-native, invasive plant species
Improve Community	—Protect private property —Protect and minimize conflicts with public infrastructure —Improve natural areas for public use and nature play —Enhance public access to the stream through the elimination of steep, vertical banks —Enhance public access to a diverse assemblage of plant communities

Watershed-Wide Monitoring Framework

Monitoring parameters and purpose are aligned with the Stream Functions Pyramid and the Fairfax Ecological Recovery Wheel.

		Stream Pyramid					Fairfax Ecological Recovery Wheel[1]					
Monitoring Parameter	**Purpose**	Hydrology	Hydraulic	Geomorphology	Physicochemical	Biology	Physiochemical	Aquatic Structural Diversity	Species Composition	Riparain Structural Diversity	External Exchanges	Physical Conditions
Flow Monitoring/Hydrology												
Water level (optional/USGS)	Continuously record stream stage and temperature, to document stream flow and basic physicochemical parameters. Calibrate stream flow to other metrics measured	•	•		•		•					•
Rating curve (USGS)	Calibrate water level monitoring to determine velocity and discharge.		•				•				•	
Groundwater level	Continuous levelogger and setup in a transect perpendicular to the stream channel. Establish baseline water table for comparison after restoration.	•					•			•	•	•
Rain Gauge	Rainfall (by USGS @ Little Run) - to help address rainall-runoff hydrologic relationships; validate rainfall from larger models/sources; infiltration /overbank	•	•				•				•	
Time-lapse photography	Photo document stream conditions during the course of the storm hydrograph. Document rain events that cause overbank flows.	•	•	•			•			•	•	•
Erosion/Sediment												
Bank pins (BH/USGS)	Determine bank erosion rates. 2 of the 3 set co-located with typical riffle and pool cross section locations. Could be correlated to discharge if conducted by USGS.			•			•				•	•
BANCS/BEHI	Qualify severity and extent of bank erosion. Predict rate of erosion. Erosion rate prediction can be calibrated with bank pins.		•	•			•				•	•
Streambank soil sampling	Determine bulk density and nutrient content of stream bank soils to refine loading estimates. Ties in with BANCS and protocol 1 calculations for TMDL load reductions			•	•		•				•	•
Point bar estimated sedment volume	Quantifies stream bed sediment. Meaure of embeddedness.			•		•	•	•	•			
Geomorphology (Sediment)												
Longitudinal profile	Determine slope facets, riffle-pool spacing.			•			•					•
Cross section (BH/USGS)	Determine hydraulic geometry to estimate discharge and track changes in channel form over time.			•			•					•
Planform	Track stream erosion and migration. Field measurement or lidar.			•			•					•
Substrate analysis	Determine substrate size for sediment transport and stability calculations.			•			•	•				•
Water Quality												
Continuous water quality	Follows FFX protocols.				•		•			•		
Monthly grab samples	Follows FFX protocols.				•		•			•		
Chloride	Follows FFX protocols.				•		•				•	
Biology												
FFX Co RBP Assessment	Qualify instream habitat quality					•						
Benthic sampling (County)	Determine the community structure and diversity.					•		•	•	•	•	
eDNA Sampling	Grab sample. Assay for up to four libraries selecting from five options: phytoplankton, salamander/amphibian, macroinvertebrates, fish, or terrestrial vertebrates DNA. Efficient biological sampling method with libraries continually being advanced.					•		•	•		•	
Fish						•			•	•	•	
Leaf pack / CWD quantification (instream)	Qualify instream habitat quality					•	•	•			•	
Photo documentation	Documentation of stream condition annually, QA/QC			•		•	•	•		•	•	
Floodplain Quality [2]												
Riparian plot sampling	Assess riparian community structure and function			•				•	•	•	•	
Floodplain Quality Assessment Index	Quantify potentail floodplain quality resources.			•				•	•	•	•	•

Light yellow shading = Monitoring parameter already measured as part of Assessment and Prioritiziation; or will be measured and project specific reaches
Light orange shading = Monitoring parameter being conducted by others (County/USGS),
Light blue shading = Monitoring metric not assigned in first year plan, but will need to be inclued in additional years
Light green shading = Long-term Monitoring parameter conducted by others (County/USGS) for overall County goals (not necessarily project specific)

1. Will need to develop success criteria/metrics based on project goals. May include elements outside project limits or the scope of this project. Based on Fairfax version of the SER 5-Star Recovery Wheel
2. Vegetation Quality is not a metric on the Stream Pyramid, a forested resource is prioritized as part of geomorphology and the physical structure of trees and roots. This element is treated in a more nuanced approach with the Fairfax Recovery Wheel

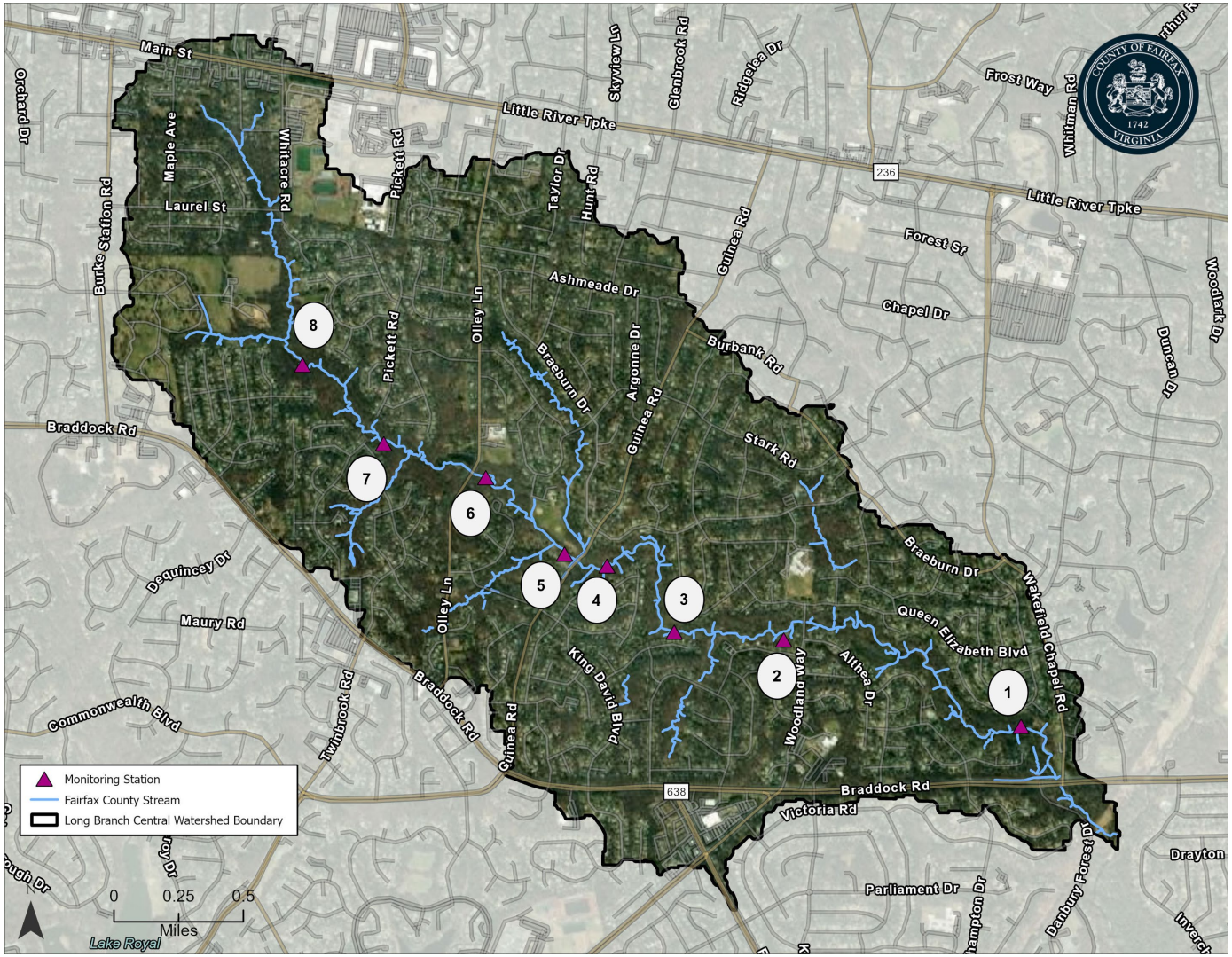
Watershed-Wide Monitoring Progress

Monitoring began in the late Fall, 2021.

Eight monitoring stations were established by Biohabitats.

Year 1 (2022) monitoring includes:

- Flow Monitoring/Hydrology: Groundwater Levels
- Flow Monitoring/Hydrology: Time-Lapse Photography
- Erosion/Sediment: Bank Pins
- Geomorphology: Cross Section Surveys
- Biology: eDNA Sampling
- Biology: Leaf Pack and Coarse Woody Debris



Watershed-Wide Monitoring, Year 1 (2022)
Flow Monitoring/Hydrology: Groundwater Levels

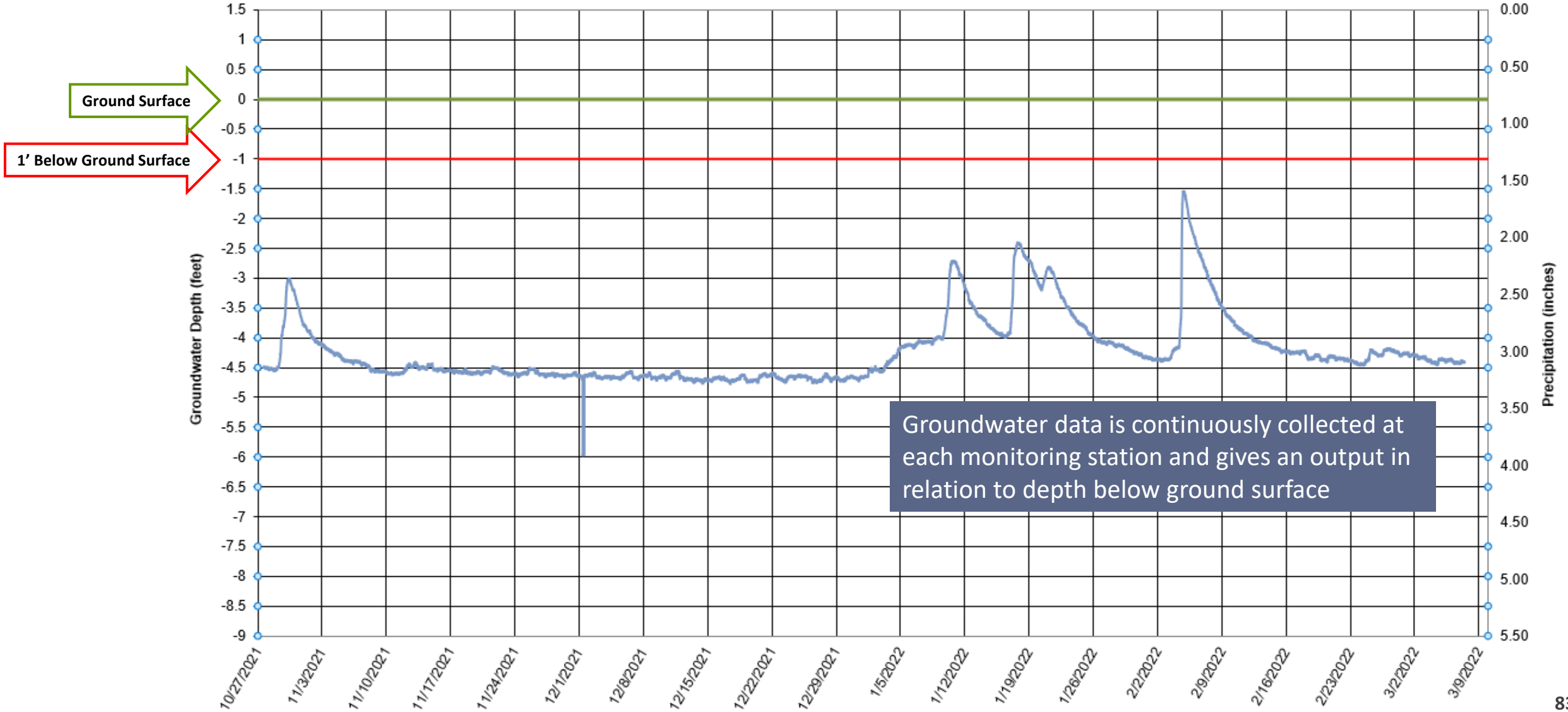
Purpose: The data from the groundwater loggers will be used to establish a baseline groundwater elevation. This will be compared to post-construction groundwater elevations (after the stream has been reconnected to the floodplain) in the future.

Groundwater was monitored continuously at six of the eight monitoring stations using groundwater loggers. Note, groundwater loggers at two of the eight stations were vandalized and taken off-line.

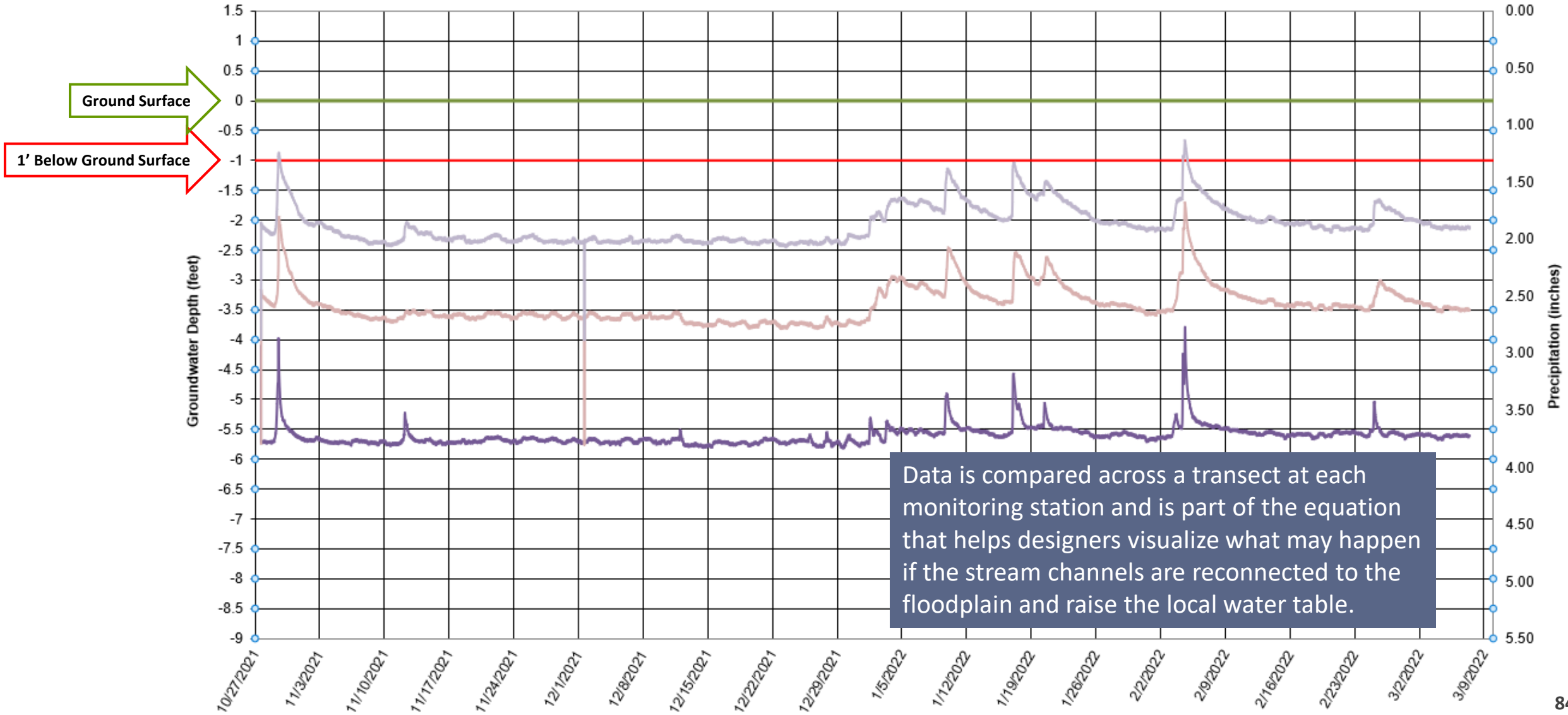
At each monitoring station, three groundwater wells were set up in a transect perpendicular to the stream channel.

Groundwater logger installation.

Watershed-Wide Monitoring, Year 1 (2022)
Flow Monitoring/Hydrology: Groundwater Levels, Example



Watershed-Wide Monitoring, Year 1 (2022)
Flow Monitoring/Hydrology: Groundwater Levels, Example Continued



Data is compared across a transect at each monitoring station and is part of the equation that helps designers visualize what may happen if the stream channels are reconnected to the floodplain and raise the local water table.

Watershed-Wide Monitoring, Year 1 (2022)
Flow Monitoring/Hydrology: Time-Lapse Photography

Purpose: Determine stream conditions throughout a storm length and how storms of varying intensities may impact the stream.

Two locations with three trail cameras each (views of left bank, right bank, and upstream directions).

Locations coordinated with water level stations.

Deployed to capture up to four significant rain events that have a high probability of causing overbank flows.

Since deployment in mid-September 2022, no storms have overtopped the banks, despite some remnants of tropical storms.

Future monitoring may target capturing intense summer storms.

Can correlate images to storm hydrographs and precipitation data whether flow overtops the banks or not.

CAM4 during baseflow conditions.

CAM4 midway through precipitation event on 12/15/22.

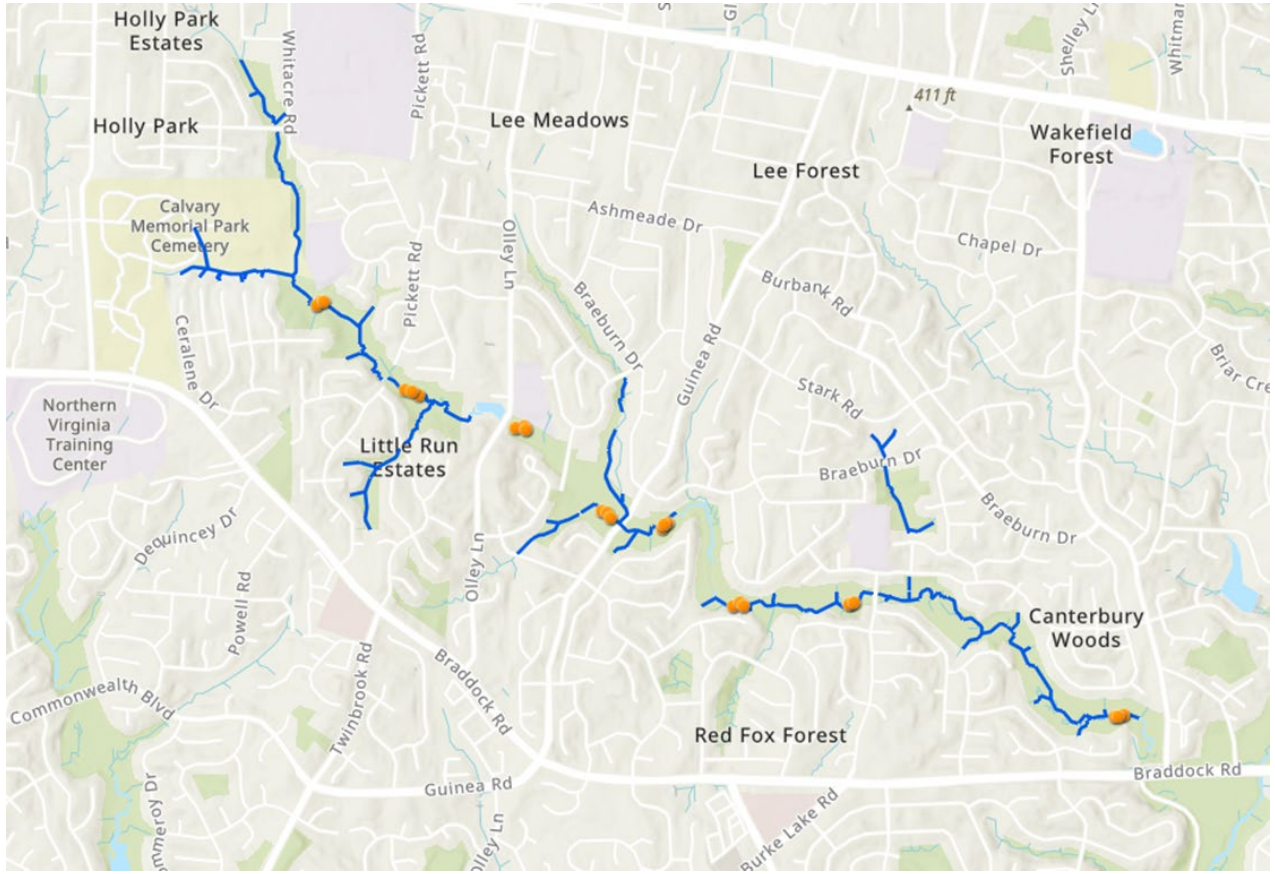
Watershed-Wide Monitoring, Year 1 (2022)
Erosion/Sediment: Bank Pins

Purpose: Measure bank erosion and near bank stress along each reach.

Three sets of bank pins at eight monitoring locations across the watershed; two sets are co-located with cross sections.

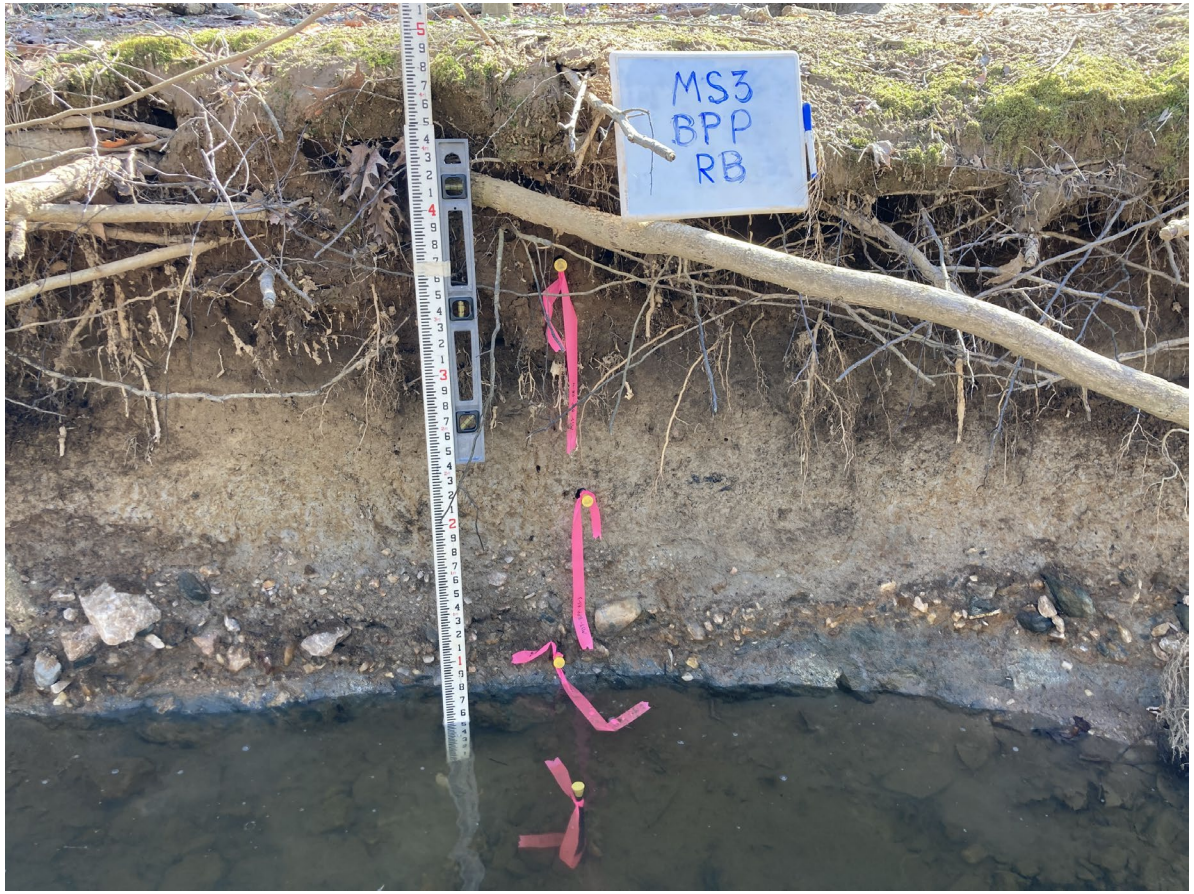
Bank pins consist of three or four rebar rods set horizontally into the bank (approximately 0.5 to 1 foot apart) including one vertical toe pin.

Measure pin protrusion quarterly. Change (increased protrusion) indicates erosion.

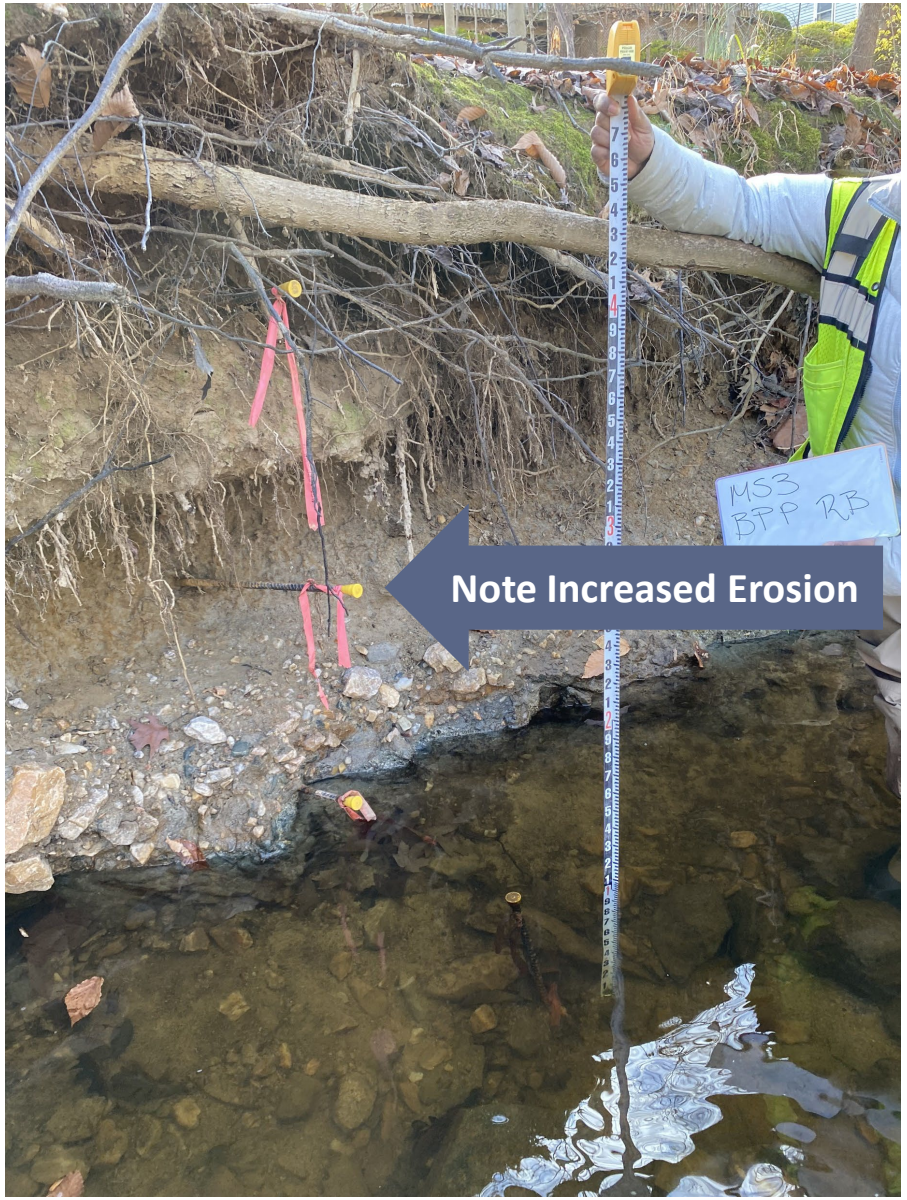


Bank pin locations indicated by orange dots.

Watershed-Wide Monitoring, Year 1 (2022)
Erosion/Sediment: Bank Pins, Example



Bank Pin Measurement in March 2022 (initial installation)



Bank Pin Measurement in December 2022

Watershed-Wide Monitoring, Year 1 (2022)
Geomorphology: Cross Section Surveys

Purpose: Track changes in channel form over time; determine hydraulic geometry to estimate discharge.

One riffle and one pool surveyed at all eight monitoring stations (16 cross sections total).

Centered on channel and extends five channel widths in length.

Surveyed one time per year during leaf off conditions (late winter/early spring).

Year 1 pre-construction cross sections were measured in February and March 2022.

Cross sections will be resurveyed in 2023.

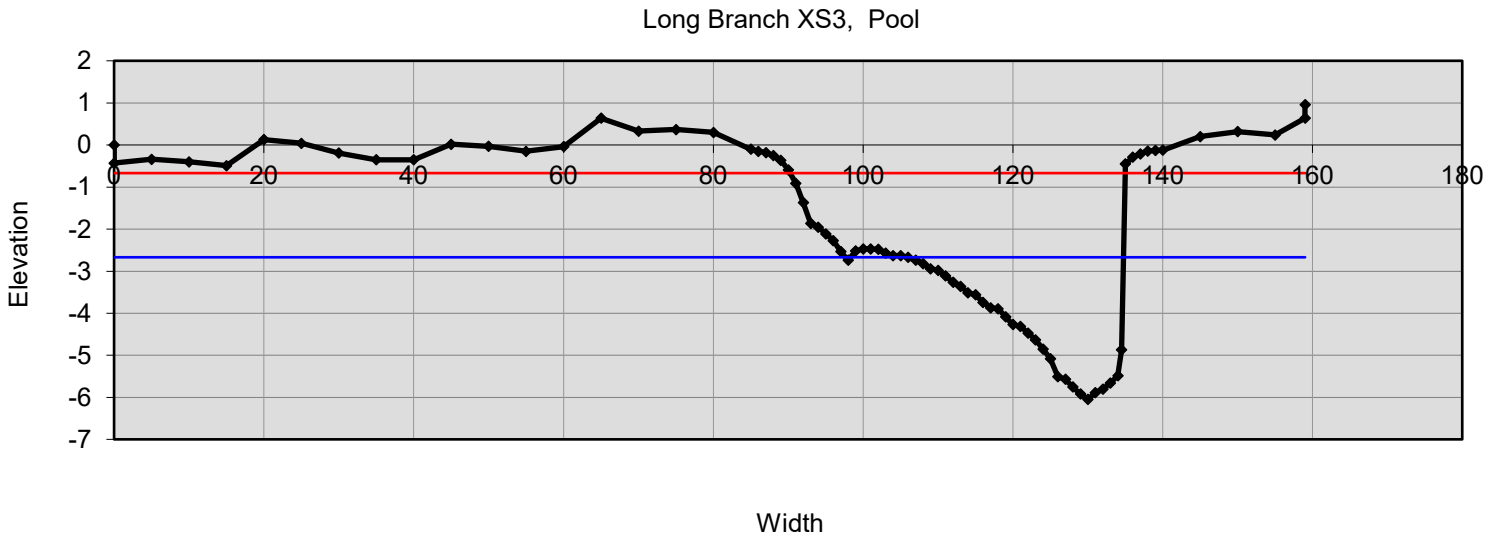
Profiles can be graphically overlayed to visualize changes over time.

Cross section survey in progress.

Watershed-Wide Monitoring, Year 1 (2022)
Geomorphology: Cross Section Surveys, Example

Displayed below is an example cross section near Tabard Place at Monitoring Station 4.

Notice the steep right bank and bed deposition on the left bank under the current conditions (facing downstream).



Watershed-Wide Monitoring, Year 1 (2022)
Biology: eDNA Sampling

Purpose: This data will be used to identify macroinvertebrates, amphibians, fish, and other vertebrates (mammals and birds) present within the watershed and stream.

Water samples were collected at two monitoring stations in April and August 2022. Next Generation Sequencing tests were run for fish, amphibians, vertebrates, and macroinvertebrates.

Samples were analyzed with PCR testing and compared to samples within a database to identify different species within the watershed.

TestId	sequence	Kingdom	Phylum	Class	Order	Family	Genus	Species	% match	# species
MiFishU	CACCGCGGTTATACGAAAGGCCCTAGT	Eukaryota	Chordata	Actinopteri	Siluriformes	Ictaluridae	Ameiurus	Ameiurus natalis (Yellow Bullhead)	99.4	1
MiFishU	CACCGCGGTTATACGAGGGGCTCAAAT	Eukaryota	Chordata	Actinopteri	Anguilliformes	Anguillidae	Anguilla	Anguilla rostrata (American eel)	99.4	1
MiFishU	CACCGCGGTTATACGAGAGGCCCTAGT	Eukaryota	Chordata	Actinopteri	Cypriniformes	Catostomidae	Catostomus	Catostomus commersonii (White sucker)	100	1

A snapshot of the fish eDNA test results.

Watershed-Wide Monitoring, Year 1 (2022)
Biology: Leaf Pack and Coarse Woody Debris

Purpose: Document particular aquatic habitat conditions to establish a baseline measure of stream health, inform restoration design objectives, and track the recovery trajectory.

Document coarse woody debris, rootwads, leaf packs, debris jams, benthic macroinvertebrate habitats, bank height ratios, canopy closure, wetted width, forest community association and riparian buffer characterization.

Conducted assessment in April 2022 at four monitoring stations (1, 3, 6, and 7).

Comparing the stability and types of habitats across the landscape helps identify where improvements are needed to increase species diversity.

Coarse woody debris, debris jams, and leaf packs at two locations in the watershed.

Watershed-Wide Monitoring, Year 2 (2023) and Year 3 (2024)

Continued Watershed-Wide Monitoring will be expanded to include:

Hydrology

- Groundwater – All 8 monitoring stations; reestablish at 7 and 8
- Time-Lapse Photography – at 2 monitoring stations

Erosion/Sediment

- Bank Pins – Bank profile 1x year and measurements 2x year; All 8 monitoring stations; reset as needed

Geomorphology

- Cross Section – All 8 monitoring stations
- RBP Habitat Assessment – Fairfax County's protocol that was last performed in 2020; growing season; all 8 monitoring stations

Biology

- Leaf Pack and Coarse Woody Debris Quantification – All 8 monitoring stations

Riparian Vegetation

- Vegetation Community Mapping – Fairfax County's Protocol; growing season; only at monitoring station 6 where no restoration projects are proposed as a control site

Project-Specific Monitoring Framework

A project monitoring framework has been developed, aligning project goals with the Stream Functions Pyramid and the Fairfax Ecological Recovery Wheel (see excerpt below). A project-specific monitoring plan will be development for each project.

For more information, see Attachment G: **Long Branch Project Monitoring Framework Matrix**

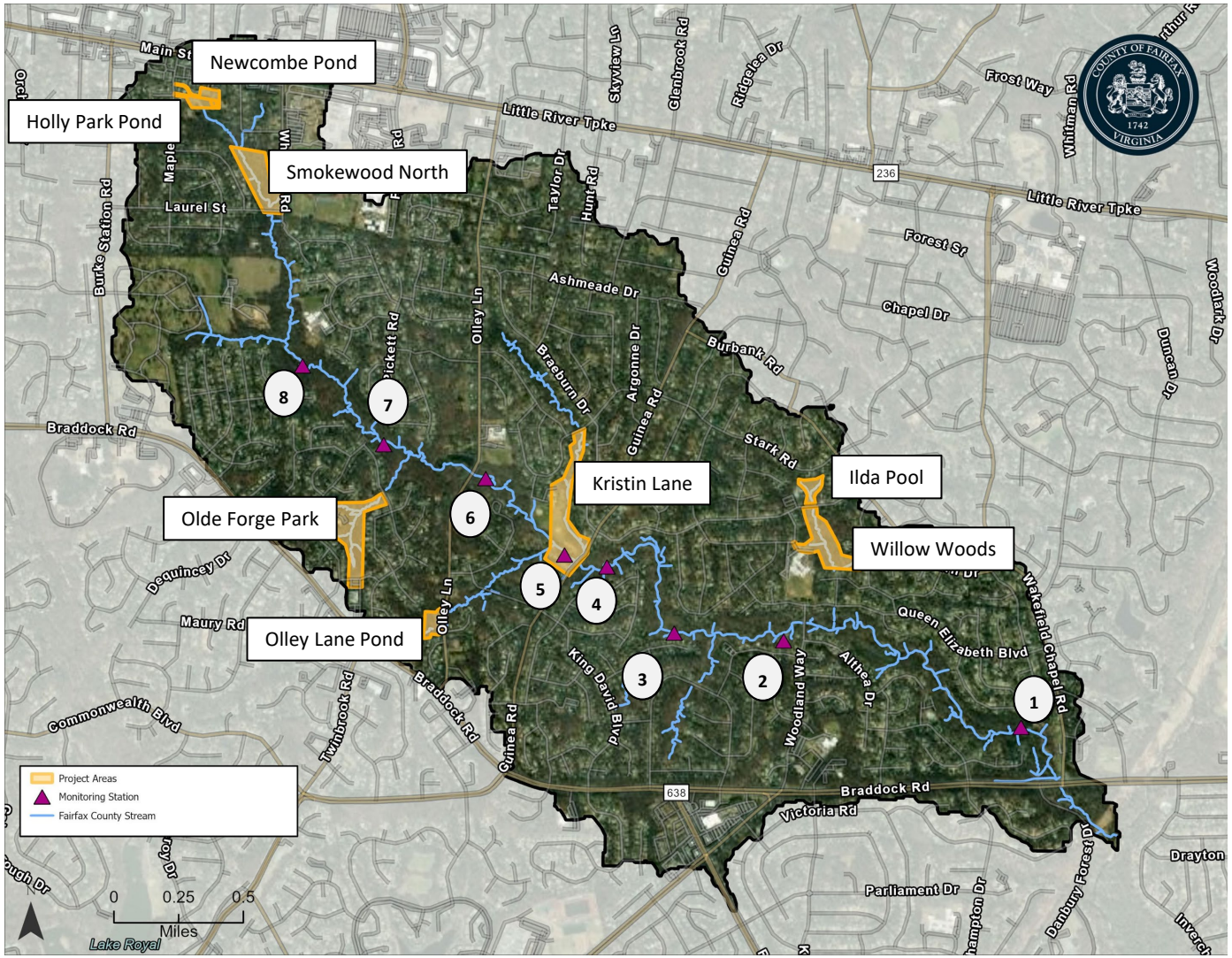
		MONITORING PARAMETER AND DESCRIPTIONS					
		Flow Monitoring/Hydrology					
		Water Level	Rating Curve	Groundwater Level	Rain Gauge	Time-Lapse Photography / USGS HIVIS	Watershed Modeling
		Continuously record stream stage and temperature to document stream flow and basic physicochemical parameters.	Calibrate water level monitoring to determine velocity and discharge.	Continuous levelogger and setup in a transect perpendicular to the stream channel. Establish baseline water table for comparison after restoration.	Measure rainfall to help establish rainfall-runoff hydrologic relationships and to support other monitoring efforts.	Photo document stream conditions during storms and correlate to the hydrograph. Document rain events that cause overbank flows.	Use a two-dimensional, watershed-wide hydraulic model to evaluate likely project impacts on stream hydraulics.
FUNCTION	**PROJECT GOAL**						
Improve Hydrology	Attenuate peak discharges (by increasing roughness and storage along watershed flow paths)	●	●		●		●
	Increase watershed time of concentration	●	●	●	●		●
	Increase the time of concentration at storm drain outfalls	●			●		●
	Reduce velocities in the mainstem, in tributaries and at outfalls during runoff events	●			●		●
Improve Hydraulics	Improve floodplain connectivity and increase frequency of floodplain inundation (by altering channel dimension and maintaining vertical stability)	●	●	●	●	●	●
	Increase floodplain storage and residence time	●	●	●	●	●	●
	Reduce downstream flooding	●	●	●	●		●

Project-Specific Monitoring Planned, Year 2 (2023) and Year 3 (2024)

Project-specific pre-construction monitoring will begin for eight projects.

Monitoring will include:

- Hydrology
  - Groundwater Level
- Erosion/Sediment
  - Bank Pins
- Geomorphology
  - Fairfax County RBP Habitat Assessment
- Biology
  - Leaf Pack and Coarse Woody Debris Quantification
  - Photo Documentation
  - Benthic Sampling
- Riparian Vegetation
  - Vegetation Community Mapping



Project-Specific Monitoring, Year 2 (2023) and Year 3 (2024)

Willow Woods
- Bank Pins
- Fairfax County RBP
- Benthic Monitoring
- Leaf Pack and CWD Quantification
- Photo Documentation
- Vegetation Community Mapping

Ilda Pool
- Bank Pins
- Photo Documentation
- Vegetation Community Mapping

Kristin Lane
- Groundwater Level
- Bank Pins
- Fairfax County RBP
- Benthic Monitoring
- Leaf Pack and CWD Quantification
- Photo Documentation
- Vegetation Community Mapping

Olde Forge Park
- Groundwater Level
- Bank Pins
- Fairfax County RBP
- Benthic Monitoring
- Leaf Pack and CWD Quantification
- Photo Documentation
- Vegetation Community Mapping

Newcombe Pond
- Bank Pins
- Photo Documentation

Holly Park Pond
- Bank Pins
- Photo Documentation

Olley Lane Pond
- Photo Documentation

Smokewood North
- Benthic Monitoring

V. RESTORATION TECHNIQUES

Restoration techniques that may be applied throughout the Long Branch corridor include:

- Engineered Log Jams
- Constructed Riffles
- Floodplain Log Sills
- Regenerative Stormwater Conveyance (RSC)
- Bank Protection
- Floodplain Bench
- Large Woody Debris
- Wetland Complex

Restoration Technique – Engineered Log Jam

An engineered log jam is a wood structure that is designed to prevent channel degradation and promote the development of a specific hydraulic criteria and tie into the stream riparian corridor with minimal disturbance.

Bacon Ridge
Anne Arundel County, MD

Restoration Technique – Constructed Riffle

Constructed riffles are composed of a mix of gravel and cobble sized material. These structures are proposed to ensure floodplain connection is maintained and are typically located downstream of concentrated flow inputs and where in-stream stormflow velocities and shear stress are predicted to be the greatest.

Breewood
Montgomery County, MD

Restoration Technique – Floodplain Log Sill

Log sills provide protection of the reconnected floodplain laterally past the armored instream structure width during larger flood flows will be primarily provided by maintaining the existing floodplain vegetation with small, low ground pressure equipment and minimizing areas of disturbance. Permanent seeding is proposed in all disturbed floodplain areas to re-establish herbaceous plants intended to develop thick root densities, good ground cover, and protect slopes from soil erosion during out of bank flow events.

Bacon Ridge at Elks Camp
Anne Arundel County, MD

Restoration Technique – Regenerative Stormwater Conveyance (RSC)

The regenerative stormwater conveyance (RSC) approach is to stabilize outfall channel bed and banks, attenuate stormflow peaks and filter stormwater, and reduce the sediment and nutrient loading to downstream waterways generated from channel enlargement. An RSC system uses a series of in-stream constructed riffles and cascades to form a series of aquatic pools to help maintain the channel bed at a higher elevation, while providing energy dissipation and stormflow conveyance from the outfall to the receiving channel.

Carriage Hills
Anne Arundel County, MD

Restoration Technique – Bank Protection

Bank protection is one method to reduce erosive impacts on a stream bank. Boulders and/or tree rootwads can be positioned along the toe of an eroded bank and back filled with soil to create a new stable bank. Boulders provide a higher degree of stability for higher flows whereas rootwads provide increased habitat in addition to protection for moderate to low flows.

River Valley Ranch
Baltimore County, MD

Restoration Technique – Floodplain Bench

Floodplain benches are implemented on either side of a pilot channel with natural geometry that handles typical baseflows. The bench provides a larger cross section with handles flows above baseflow, reducing flow velocity through surface roughness and protecting the stream bank. Floodplain benches can be used within over widened channels or areas in which the stream invert cannot be raised.

Brentwood Manor
Howard County, MD

Restoration Technique – Large Woody Debris

Large woody debris are added to provide increase roughness, promote flow diversity, bank protection, and add habitat complexity to stream systems, most typically in constructed pools. Large woody debris can be added along a bank for bank protection or in the center of a pool for added roughness and habitat.

Breewood
Montgomery County, MD

Restoration Technique – Stage 0 / Wetland Complex

Where site conditions allow, the Stage 0 restoration approach is proposed to restore the physical, chemical, and biological processes of a healthy, resilient stream ecosystem. Stage 0 refers to a pre-channelization phase in which a stream valley is occupied by a forested wetland complex with many anabranching (interweaving) flowpaths and no defined single threaded channel exists. This approach would be utilized coming off small tributaries before reaching the mainstem.

Bacon Ridge at Elks Camp
Anne Arundel County, MD