MASER CONSULTING

Engineers
Planners
Surveyors
Landscape Architects
Environmental Scientists

Shelbourne at Hunterdon
53 Frontage Road, Suite 110
Hampton, NJ 08827
T: 908.238.0900
F: 908.238.0901
www.maserconsulting.com

December 16, 2020

Keri Green, Borough Liaison
New Jersey Highlands Council
100 North Road (Route 513)
Chester, NJ 07930-2322

Re: Functional Value Assessment and Stream Corridor Plan Sub-Element of the Conservation Plan Element
Borough of Lebanon
Deliverable
MC Project No. LEB-012

Dear Ms. Green:

The Borough of Lebanon has been diligently working to prepare a Functional Value Assessment and Stream Corridor Plan, a Sub-Element of the Conservation Plan Element.

On December 8, 2020 the Planning Board held a hearing and adopted the Functional Value Assessment and Stream Corridor Plan, a Sub-Element of the Conservation Plan Element, dated October 2020.

Enclosed herewith please find the following:

1. Functional Value Assessment and Stream Corridor Plan, a Sub-Element of the Conservation Plan Element, dated October 2020.
2. December 8, 2020 Planning Board Agenda.
3. Planning Board Resolution 2020-10.

If you have any questions or require clarifications regarding the enclosed documents, please do not hesitate to call my office.

Very truly yours,

MASER CONSULTING INC.

Darlene A. Green

Darlene A. Green, P.P., AICP
Borough Planner

DAG:hk
Enclosures

cc: Karen Romano, RMC, CMR (via email clerk@lebanonboro.com)

r:\projects\leb\leb-012\correspondence\out\201216dag_green_deliverable.docx

AMY GREENE ENVIRONMENTAL
a DAVEY company

FUNCTIONAL VALUE ASSESSMENT

and

STREAM CORRIDOR PLAN

A SUB-ELEMENT OF THE CONSERVATION PLAN ELEMENT

FOR:

SOUTH BRANCH ROCKAWAY CREEK TRIBUTARY

BOROUGH OF LEBANON
HUNTERDON COUNTY, NEW JERSEY

October 2020

ADOPTED BY THE PLANNING BOARD: December 8, 2020

PREPARED ON BEHALF OF:
New Jersey Highlands Water Protection and Planning Council
100 North Road (Route 513)
Chester, NJ 07930

PREPARED FOR:
Borough of Lebanon
6 High Street
Lebanon, NJ 08833

PREPARED BY:
Amy Greene Environmental
4 Walter E. Foran Blvd., Suite 209
Flemington, NJ 08822

AGE Project #4562

Table of Contents

List of Tables

Table of Figures

List of Appendices

SECTION 1: PROJECT OVERVIEW AND BACKGROUND

1.1 PROJECT OVERVIEW

Amy Greene Environmental, a Davey Company (AGE) was retained by the Borough of Lebanon to utilize the Functional Value Assessment Methodology (FVAM) to assess the integrity of a South Branch (SB) Rockaway Creek tributary as it flows through the Borough (**Figure 1**). The FVAM consists of two phases, Phase 1: Watershed Assessment and Phase 2: Reach Assessment. The FVAM was completed on two reaches of a South Branch Rockaway Creek tributary that traverses north-south across the northeast and southeast quadrants of the Borough. Results of the FVAM will establish the framework for identifying and developing stream corridor protection and restoration projects that will be summarized in the Stream Corridor Plan (**Section 3.0**) for these portions of the SB Rockaway Creek tributaries in the Borough of Lebanon.

The main objectives of the Phase 1 Assessment were to provide an overview of the general physical characteristics of the watershed, assess the impacts of parameters such as land use, channel modification, floodplain modification, erosion and debris-jam potential on each reach, and to determine which reaches may be in channel adjustment. The primary objective of the Phase 2 Assessment was to provide the Borough with information that can be used for watershed planning and restoration activities.

Data and information for the South Branch Rockaway Creek tributary watershed was obtained from publicly available data and mapping to identify larger natural conditions and human impacts that occur off-site and cannot be easily observed in the field. Existing data sources were accessed from the following data portals:

- NJ Highlands Council Geographic Information System (GIS) Data Downloads
  http://www.highlands.state.nj.us/njhighlands/actmaps/maps/gis_data.html

- NJ Department of Environmental Protection (DEP) GIS Data Downloads
  http://www.state.nj.us/dep/gis/
  http://www.state.nj.us/dep/njgs/geodata/

- NJ Geographic Information Network
  https://njgin.state.nj.us/NJ_NJGINExplorer/index.jsp

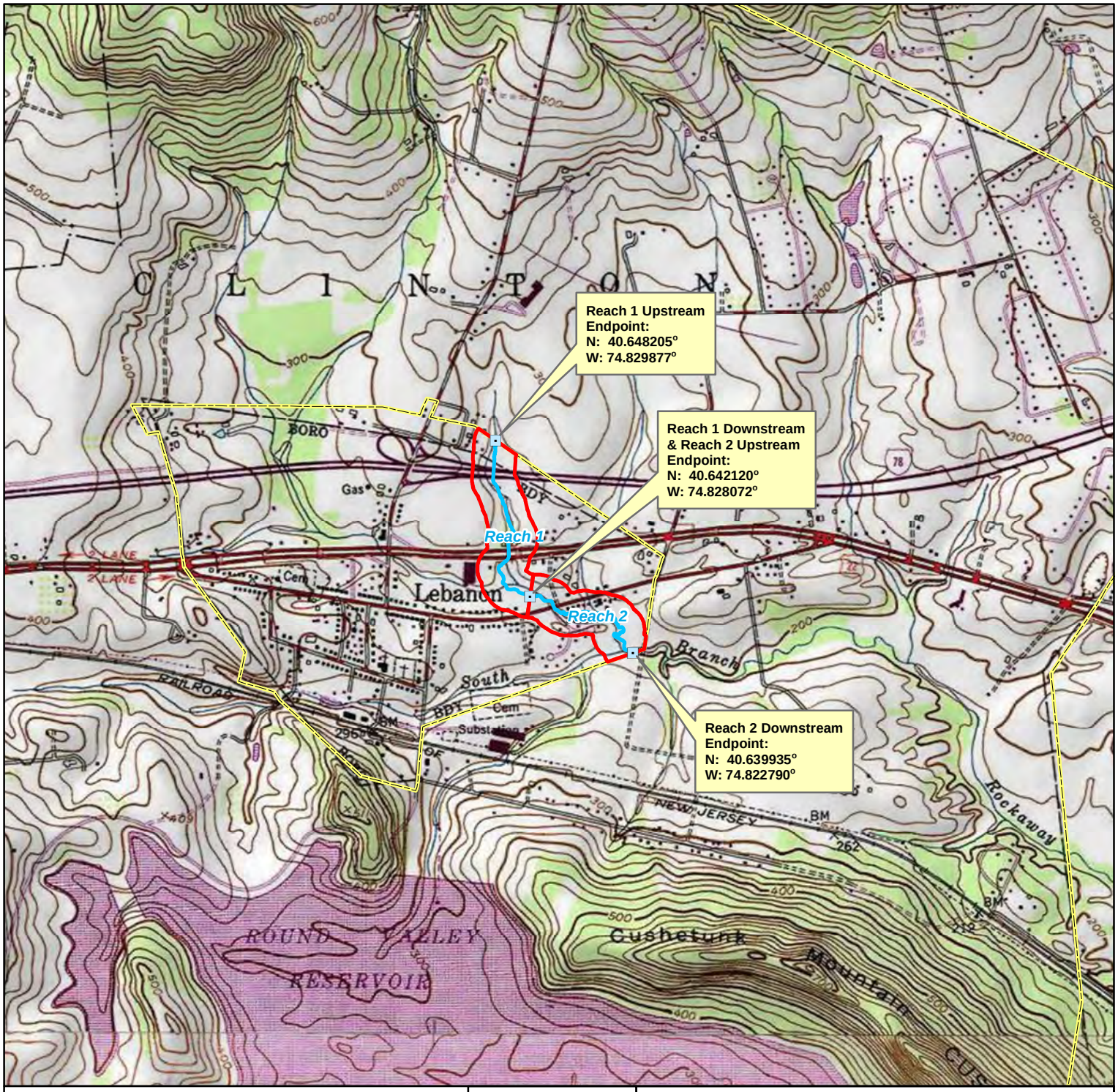
- USDA Natural Resources Conservation Service
  http://datagateway.nrcs.usda.gov/GDGOrder.aspx

John Pabish of AGE conducted much of the Phase 1 Assessment of existing geographic data. Autumn Thomas and David Kunz of AGE conducted the Phase 2 Assessment on May 13, May 19, and May 27, 2020.

1.2 BACKGROUND INFORMATION

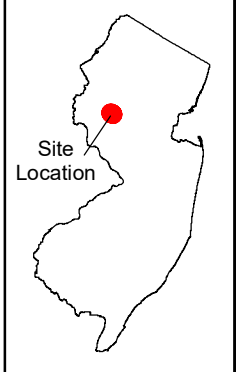
1.2.1 Description of Study Area

The study area covers portions of a first and second order tributary to SB Rockaway Creek, of which there are several that flow through the Borough of Lebanon. Traversing in a north-south fashion within the northeast and southeast quadrants of the municipality the study area starts just above Route 78, traverses between two farm fields, crosses under Route 22, traverses through Borough-owned land,



Legend

- Stream Reach
- Stream Reach Corridor
- Stream Reach Endpoints
- Municipal Boundary



Sources:
National Geographic Society (NGS) USA Topographic Maps, seamless, scanned images of United States Geological Survey (USGS) paper topographic maps, Califon, Flemington, High Bridge, & Pittstown NJ Quadrangles, copyright 2013, distributed as a web mapping service by ESRI® Data & Maps, Redlands, California, 2020.

Figure 1
USGS Topographic Map

South Branch Rockaway Creek Tributary
Stream Corridor Protection & Restoration Plan
Borough of Lebanon
Hunterdon County, New Jersey

AGE Project # 4562

N

2,000
Feet

AMY GREENE ENVIRONMENTAL
a DAVEY company

crosses under Main Street, travels through a residential neighborhood, and then through a vacant parcel before exiting the Borough at the southeast municipal boundary and joining the main stem of the SB Rockaway Creek. The study area was broken into two reaches: Reach-01 starts at the municipal line just east of Presidential Place Apartments and heads south to the north side of Main Street at Sloan Lane where it joins a secondary tributary to SB Rockaway Creek. Reach-02 continues from the junction north of Main Street south and east to just downstream of the Kullman Corporation Campus Drive bridge where it joins the main stem of the SB Rockaway Creek.

The study area is in northwestern New Jersey in Hunterdon County, due north of Round Valley Reservoir and northwest of Cushetunk Mountain. Lebanon Borough is surrounded by Clinton Township which falls within both the Highlands and Piedmont Physiographic regions of New Jersey. Lebanon Borough and the surrounding Clinton Township are in the NJDEP-designated, Upper Raritan Watershed Management Area (WMA 8) with over 60 miles of streams and tributaries that are classified as Category 2 freshwater waterways (FW-2). This requires water quality be maintained in order to continue meeting the State water quality standards.

The study area's mapped bedrock geology is entirely within the Passaic Formation which is a unit of the Newark Supergroup, and is an assemblage of Upper Triassic and Lower Jurassic sedimentary rocks which form outcrops intermittently along the East Coast. The Passaic is defined as a reddish-brown shale, siltstone and mudstone with a few green and brown shale interbeds and red and dark-gray interbedded argillites near the base. In New Jersey, there are conglomerate and sandstone beds within the formation.

The study area watershed is dominated by wetlands. The sub-dominant watershed land cover for the assessment reaches include forest, agriculture, commercial and residential development, and major roadways. Historic photos from the 1930s show that the study area was dominated by agricultural land. Since the 1930s, considerable development has occurred within the watershed. Most of the developed land present today was developed prior to 1997, based on review of aerial photographs.

1.2.2 Flood History

According to Karen Romano (email correspondence), Lebanon Borough Clerk, there were few recorded flood events that have impacted the Borough. One such flood includes Hurricane Bob (1979) in which the intersection of Cokesbury Road and US 22 flooded. Two other floods of record were during Hurricane Irene in 2011 and Hurricane Sandy in 2012 which both flooded residential properties at 2 & 4 Lynwood Drive, adjacent to Reach-02.

Long term data from the U.S. Geological Survey (USGS) gage on the SB Rockaway Creek at Whitehouse Station, NJ (gage # 01399670) was obtained online (USGS 2020). The SB Rockaway Creek gage was selected because it is in the northwestern region of New Jersey and within five miles of the study area. The drainage area at the Whitehouse Station gage is much larger (11.3 square miles) than the study area watershed; however, it provides useful information about when large flood events occurred. This gage has a continuous flow record from 1977 to the present. The long-term record shows that there have been four events where peak discharges were between the 10-year and 25-year recurrence interval. This occurred during water years 1984, 1997, 1999, and 2011. Streamflows exceeded the 25-year recurrence interval in water year 1999 (**Figure 2**).

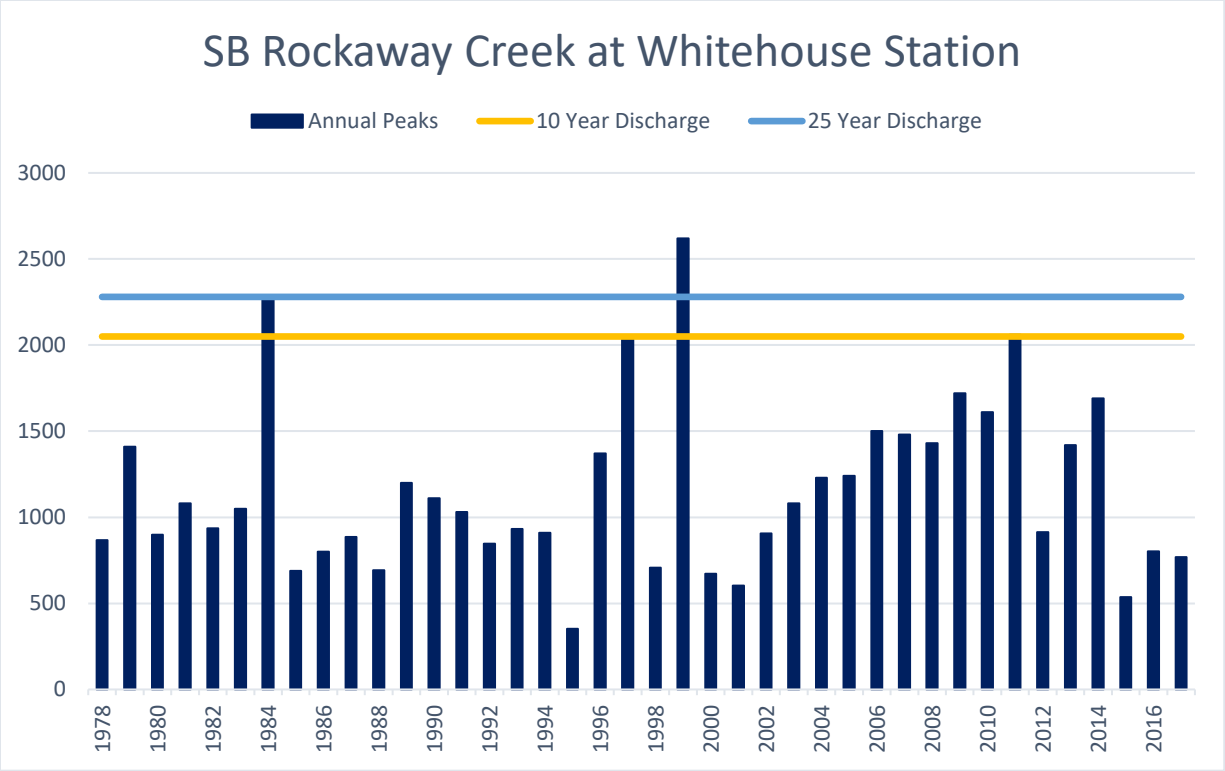


FIGURE 2: Flood Frequency Chart for SB Rockaway Creek at Whitehouse Station, NJ.

SECTION 2: FUNCTIONAL VALUE ASSESSMENT (FVAM)

2.1 PHASE 1 WATERSHED ASSESSMENT

The Phase 1 Watershed Assessment followed procedures specified in the Highlands Council *Stream Corridor Guidance* (Highlands *Guidance*), Part 1: Functional Value Assessment Methodology (FVAM) (New Jersey Highlands Water Protection and Planning Council (WPPC) 2014a). Phase 1 is largely a desktop review exercise utilizing existing geographic data. Data is gathered and clipped down to the Stream Reach including a 300-foot buffer on either side of the creek (known as the Stream Reach Corridor). All assessment data collected in Phase 1 were recorded on the Phase 1 data sheets located in **Appendix A**.

2.1.1 Parameters

During the Phase 1 Assessment, data was collected for each parameter in **Table 1**. The parameters were then rated according to the following menu options: N – NONE, I – INSIGNIFICANT, L – LOW impact, H – HIGH impact, or N/A – not applicable. A zero was scored for N/A options.

Table 1. Parameters Included in Impact Ratings

Step Number	Parameter
1.4	Channel Canopy Cover
1.5	Dams/Weirs
1.5.1	Impoundment Canopy Cover
1.6	Bridges/Culverts
1.7	Channel Straightening
1.8	Channel Migration/Avulsion
1.9	Water Quality Standard
1.10	Surface Water Discharges
1.11	AMNET Reference Sites
1.12	303(d) List
2.4	Valley Slopes
2.5	Soils – Hydrologic Soil Group and Highly Erodible Land
2.6	Land Use/Land Cover and Impervious Cover
2.8	Width of Vegetated Buffer
2.9	Floodplain Constrictions
2.10	Riparian Wildlife Habitat
2.11	Riparian Plant Community
2.12	Public Uses

2.2 PHASE 1 RESULTS

2.2.1 Reach Conditions/Modifications

2.2.1.1 Reach Locations to be Assessed

The SB Rockaway Creek tributary was divided into two reaches for the Phase I Assessment. Reach-01 starts at Latitude 40.648205 N, Longitude 74.829877 W just east of the Presidential Place Apartments at the Borough of Lebanon boundary and ends at Latitude 40.642120N, Longitude 74.828072W where it joins a second SB Rockaway Creek tributary north of Main Street near Sloan Lane. Reach-02 starts at the endpoint of Reach-01 and ends at Latitude 40.639935 N, Longitude 74.822790 W just downstream of the

Kullman Corporation Campus Drive bridge where it joins to the main stem of SB Rockaway Creek. **Figure 1** shows the location of the study reaches used in the Phase 1 and 2 Assessments.

2.2.1.2 Landownership

An online parcel database was consulted to compile a list of private properties within the reach corridor to be assessed. A list of blocks and lots of property ownership is attached in **Appendix B**. No private properties were crossed during the Phase 2 assessment until confirmation from Karen Romano, Borough Clerk, was received that notifications to private property owners had been completed.

2.2.1.3 Define Reference Stream Type

The Highlands *Guidance* defines Reference Stream Types as stream channel forms and processes that would exist in the absence of human-related changes to the channel, floodplain, and/or watershed. Stream and valley characteristics including valley confinement, slope, width, and sinuosity were determined through aerial photograph, Light Detection and Ranging (LiDAR), and topography data. Reference reach typing was based on several combined stream classification systems (Schumm 1977, Rosgen, D.L. 1994, Montgomery and Buffington, 1997) to summarize the physical parameters.

Each stream reach falls within the “C/E” stream type by Rosgen (1994; see key below). These streams have gentle slopes, very broad confinement ratios, and have Pool-Riffle channel bed morphology. The primary morphological features of the "C" stream types are the sinuous, low relief channel; the well-developed floodplains built by the river; and characteristic "point bars" within the active channel. The "E" stream types are slightly entrenched, exhibit very low channel width/depth ratios, and display very high channel sinuosities which result in the highest meander width ratio values of the other stream types. The bedform features of the "E" stream type are predominantly a consistent series of riffle/pool reaches, generating the highest number of pools per unit distance of channel, when compared to other riffle/pool stream types. While the "E" stream types are considered highly stable systems provided the floodplain and the low channel width/depth characteristics are maintained, they are very sensitive to disturbance and can be rapidly adjusted and converted to other stream types in relatively short time periods (EPA 2020). The dominant channel bed morphology determines which scoring sheets are to be used in the Phase 2 Assessment.

Key to Stream Type by Rosgen (1994)			
Valley Slope		**Confinement**	**Reference Stream Type**
< 2.0 %	Moderate – Low	Minimally Confined/Broad/Very Broad	C/E Single Channel
< 4.0 %	High – Low	Minimally Confined/Broad/Very Broad	D Braided Channel
2.0 < 3.0 %	Moderate – High	Minimally Confined/Moderately Confined/Very Confined	B Single Channel
3.0 < 4.0 %	High	Moderately Confined/Very Confined	B Single Channel
4.0 < 6.5 %	Very High	Very Confined	A Single Channel
>/= 6.5 %	Very High	Very Confined	A Single Channel

2.2.1.4 Channel Modifications

Channel modifications may impact a stream reach by affecting the hydraulics and the sediment regime. Historic channel modifications were assessed in this Phase I study by evaluating bridge and culvert impacts, bank armoring, and straightening. The percentage by length of reach impacted by one or more of these channel modifications was estimated and is summarized on the datasheets in **Appendix A**.

Bridges and Culverts

As part of the Phase 1 Assessment, the number of bridges and culverts within the study reach were counted by identifying stream crossings on the topographic map and orthophotos. These stream crossings

were confirmed during the Phase 2 Assessment. The percentage of the reach impacted by stream crossing structures was estimated from orthophotos. Impact ratings for bridge and culverts were evaluated by recording the number of bridge or culvert crossings that occur in the project reach and calculating the number per mile. The impact from bridge and culverts on stream dimension, pattern, or profile was rated 'HIGH' for both reaches.

Channel Straightening

Orthophotos and topographic maps were also reviewed to identify channelized stream sections, which were then confirmed during the Phase 2 Assessments. The percentage of the reach length impacted by channel modification were noted. Categories considered as part of the Step 1.7 (Channel Straightening) included the following parameters:

- HIGH: 20% or more of reach may be straightened / realigned. Impacts are obvious: gross changes in channel characteristics such as pattern, width, substrate, and bank erosion.
- MODERATE: Impacts such as pattern, width, substrate type, bank erosion, pool features, and large wood distribution are local and readily apparent. Less than 20% but more than 5% of reach may be straightened/realigned.
- LOW: Impacts likely affect only a small area (<1%) of channel. Channel impacts are not readily apparent. Channel characteristics such as pattern, width, substrate type, bank erosion, pool features, and large wood distribution are largely unchanged. Less than 5% of reach may be straightened/realigned.
- No Data: Data sources were not available.
- Not Evaluated: Data sources were not evaluated.

Some channel straightening was noted on each stream reach studied. Reach-01 was given an impact rating of 'MODERATE' for channel straightening with 19% of the reach that may have been straightened, while Reach-02 had an impact rating of 'HIGH' noting that approximately 31% of the reach may have been straightened.

Channel Migration/Avulsion

Current and historic aerials were used to identify where channels have migrated, bifurcated, or avulsed[1] over a period of at least two decades. Current aerials from 2015 and historic aerials from 1995 were overlaid to compare the location of the river channel over time. The current and the historic aerials span a range of approximately 20 years. Each of the two reaches were rated 'LOW' having less than 20% of the reach exhibiting channel migration, braiding, or avulsions.

2.2.2 Corridor and Watershed Conditions/Modifications

2.2.2.1 Geology and Soils

The characteristics of the SB Rockaway Creek tributary watershed were determined using a combination of soils data, review of topographic maps, and review of current and historic aerial photography. The Phase 1 datasheets in **Appendix A** provide a summary of the basin characteristics such as grade control structures, geologic materials, valley side slopes, and soil characteristics.
No grade control structures such as ledge and dams were noted during the Phase 1 survey for either reach.

[1] An avulsion is a change in planform resulting from a meander cut-off.

The steepness of the valley side slopes was determined using a combination of a topographic map and the soils layer. The valley side slope steepness was 'LOW' for each reach.

In general, the dominant surficial geology of the watershed consists of alluvium and weathered shale, mudstone, and sandstone. These soils have high runoff potential and have very high erodibility.

2.2.2.2 Land Use / Land Cover

The land use and land cover within the watershed plays a key role in the functional value of receiving channel and riparian corridor. The percentage of urban and cropland development within the watershed are factors which change a watershed's response to precipitation. The most common effects of urban and cropland development on stream corridors are increased volume of storm water runoff, increased exposure to fertilizers and pesticides, and changes in habitat within the stream itself.

As outlined in the Highlands *Guidance*, impact ratings were assigned for watershed land cover/land use and stream corridor land cover/land use as follows:

HIGH: > 25% of corridor / watershed is crop and/or developed.

MODERATE: 10 – 25% of corridor / watershed is crop and/or developed.

LOW: 2 – 10% of corridor / watershed is crop and/or developed.

INSIGNIFICANT: < 2% of corridor / watershed is crop and/or developed.

No Data: Data sources were not available.

As shown on the datasheets in **Appendix A**, the dominant watershed land cover/land use within the SB Rockaway Creek tributary watershed is, urban and forest. The two reaches resulted in a watershed /land use impact rating of 'HIGH'.

Riparian buffers act to intercept sediment, nutrients, pesticides, and other materials in surface runoff and reduce nutrients and other pollutants in shallow subsurface water flow. They also serve to provide habitat and wildlife corridors. They can also be key in reducing erosion by providing stream bank stabilization. Stream reaches that lack a wide, high quality riparian buffer, are at significantly higher risk of lateral erosion. An impact rating of high is assigned when over 20% of the right or left bank has an undisturbed buffer width less than 100 feet. Both assessed reaches received a 'HIGH' impact rating for riparian buffer condition, with both having 50 percent or more of the reach with little or no buffer on one or more banks. This documents poor riparian buffer quality of much of the SB Rockaway Creek tributaries studied.

2.2.2.3 Floodplain Constrictions

In this step of the Phase I assessment, attention is paid to infrastructure and other development which restricts access to the floodplain within the 300-foot corridor on either side of the stream that may result in vertical or lateral confinement of flood flows. The parameters considered in this step include roads, railroads, impervious utility structures, impervious developed areas, and the hardened embankments. The linear distance of the study reach that is paralleled by infrastructure or developed areas within the stream corridor that likely occupy the floodplain is measured and given an impact rating of high if greater than 20% of the right or left floodplain is occupied by infrastructure. Reach-01 was rated 'INSIGNIFICANT' with less than 5% occupied by infrastructure, whereas Reach-02 was rated 'HIGH'.

2.2.3 PHASE 1 DATA COMPILATION

2.2.3.1 Mapping

Multiple corridor/watershed maps were generated to depict bedrock and surficial geology, soil types, land use/land cover, floodplain constrictions, riparian wildlife habitat, riparian plant community, and existing and potential public use locations. These maps are in **Appendix C** along with any supporting data.

2.2.3.2 Impact Ratings

The Phase 1 evaluates parameters to provide the initial characterization of the subject stream channel, corridor, and watershed. Any scores and/or impact ratings tabulated will be used in Phase 2.

2.3 PHASE 2 REACH ASSESSMENT

Phase 2 utilizes information gathered and maps created during Phase 1 to assist in field surveys. Field assessments were conducted in teams of two. Data sheets used to record field observations and final scoring sheets are provided in **Appendix D** and **E**, respectively.

The Phase 2 assessment followed procedures specified in the Highlands *Guidance* and includes six categories of investigation. These categories are as follows:

1. Channel Modifiers
2. Channel Dimensions
3. Channel Features/Condition
4. Stream Banks
5. Riparian Area/Floodplain
6. Public Use Opportunities

The parameters and protocols used for undertaking each of the above steps are outlined in the Highlands *Guidance*. The entire length of each Phase 2 reach was walked to document onsite conditions including bank erosion, grade control structures, bank armoring, debris jams, depositional features, stormwater inputs, head-cuts, and other important features.

2.4 PHASE 2 RESULTS

Phase 2 assessments of two reaches were performed by AGE during May 2020. The Phase 2 Assessment data sheets for each reach are provided in **Appendix D**.

2.4.1 South Branch Rockaway Creek tributary-01

The northern reach of the SB Rockaway Creek tributary studied by AGE scientists begins at the Lebanon Borough municipal line north of I-78 and east of Presidential Place Apartments and continues downstream to the first major tributary, also a SB Rockaway Creek tributary (Reach-02). The total reach length is just over 2,800 feet and drains a watershed area of 165 acres. AGE scientists observed three stormwater inputs during the assessment of this reach. Throughout this reach the riparian buffer averages over 100 feet wide on both sides of the stream.

The most important influence on the geomorphic and habitat condition of this reach is the encroachment of two major highways, agriculture, and commercial development in over 50% of the corridor. The headwaters of this reach north of the municipal boundary is heavily influenced by a large corporate

campus including parking and landscaping. The channel has retained its "C/E" stream type with a weak Pool-Riffle streambed (Photo 1).

Photo 1: Typical cross section across a riffle in Reach-01 looking north and upstream.

2.4.2 South Branch Rockaway Creek tributary-02

The southern reach of the SB Rockaway Creek tributary studied by AGE scientists begins at the junction with Reach-01, north of the Main Street bridge and east of Sloan Lane, and continues downstream to the first major tributary, the main stem of SB Rockaway Creek. The total reach length is just over 2,200 feet and drains a watershed area of 2,455 acres. AGE scientists observed three stormwater inputs during the assessment of this reach. Throughout this reach the riparian buffer averages 70 to 90 feet wide on the right and left banks of the stream.

The most important influence on the geomorphic and habitat condition of this reach is the encroachment of residential development in over 75% of the corridor. Downstream of the junction with SB Rockaway Creek main stem is heavily influenced by agricultural cropland. The channel has retained its "C/E" stream type with a weak Pool-Riffle streambed (Photo 2).

Photo 2. Typical cross section across a riffle in Reach-02 looking west and upstream.

2.4.3 Channel Modifiers

Channel modifiers alter a channel by changing the physical dimensions or materials of its bed or banks, and includes damming, riprapping (or other armoring), widening, deepening, straightening, relocating, lining, and significant removal of bottom or woody rooted vegetation.

2.4.3.1 Dams/Weirs

Dams/weirs are man-made structures that span the channel and raise the upstream water surface, creating a pond, which in turn affects the elevation of the streambed. Generally, dams are higher structures that create falling water over the spillway. Weirs are lower structures that are mostly submerged (NJ Highlands WPPC 2014a). Phase 1 did not identify any dams or weirs on either reach assessed, however during Phase 2 one weir (Photo 3) was observed at the US-22 crossing in Reach-01. It was clogged with trash, large woody debris (LWD), and coarse particulate organic matter (CPOM). Additionally, remnants of a dam or foundation (Photo 4) were observed in Reach-01 between the I-78 crossing and Corporate Drive. No dams/weirs were identified or observed in Reach-02. No beaver dams were observed in either reach assessed.

Photo 3: Weir located on upstream side of the US-22 crossing on Reach-01.

Photo 4: A historic dam observed across the stream bed in Reach-01 south of the I-78 crossing.

2.4.3.2 Bridges/Culverts

Generally speaking, bridges have foundations on either side of the channel and do not have bottoms; culverts are enclosed pipes or concrete boxes. Undersized crossing structures act like dams during high flows, causing unwanted flooding and sediment deposition upstream. Sediment deposition may alter channel morphology and, in severe cases, can lead to major channel adjustments that result in loss or damage of property. The Phase 1 assessment identified three bridges/culverts on Reach-01 (Photo 5) and two bridges/culverts on Reach-02 (Photo 6). During the Phase 2 assessment, one of the bridge/culvert crossing was identified as a weir as discussed above; however, an additional footbridge (Photo 7) was

observed south of the US-22 crossing, therefore the total number of bridges/culverts within Reach-01 remains at three. No additional bridges/culverts were observed on Reach-02 during the Phase 2 assessment.

Upstream and/or downstream scour pools and sediment deposition were observed at all these sites, indicating the impacts of the structures on the stream condition.

Photo 5. View south and downstream at an example of an undersized box culvert on Reach-01. Note CPOM deposited at top of culvert.

Photo 6: View south and downstream at an example of a bridge across Reach-02 at the Main Street crossing.

Photo 7: View north and upstream at a footbridge observed across Reach-01 connecting a mown path through open space to a shopping center.

2.4.3.3 Stormwater Inputs

Increased stormwater runoff is a significant stressor to streams. High rates and volume of stormwater entering channels through pipes, road and agricultural ditches, and roof leaders can cause severe erosion to bed and banks, causing channel degradation or widening and impairing in-stream habitat and aquatic communities (NJ Highlands WPPC 2014a). No surface water discharges were noted during the Phase 1 assessment, however, Phase 2 identified three stormwater pipes on each of Reach-01 and Reach-02. The majority were cement pipes averaging two feet in diameter (Photo 8).

Photo 8: Typical 2-foot diameter cement stormwater pipe observed in both reaches.

2.4.4 Channel Dimensions

This step involved measuring the dimensions of the channel and its sediments to identify existing stream type and determine whether it is consistent with its setting. Measurements were conducted on each reach during the Phase 2 assessment where (1) channel conditions reflect the dominant condition of the study reach and (2) where the thalweg is in the center of the channel or crossing-over from the right to left side of the channel. Representative cross sections for Reach-01 and Reach-02 are located on **Figure 3** and seen in Photos 1 and 2 above.

Measurements taken at these representative cross sections included:

1. Bankfull Width
2. Bankfull Maximum Depth
3. Bankfull Mean Depth
4. Lowest Bank Height
5. Floodprone Width
6. Floodplain Encroachment Height
7. Width-Depth Ratio
8. Entrenchment Ratio
9. Bank Height Ration
10. Floodplain Encroachment Ratio

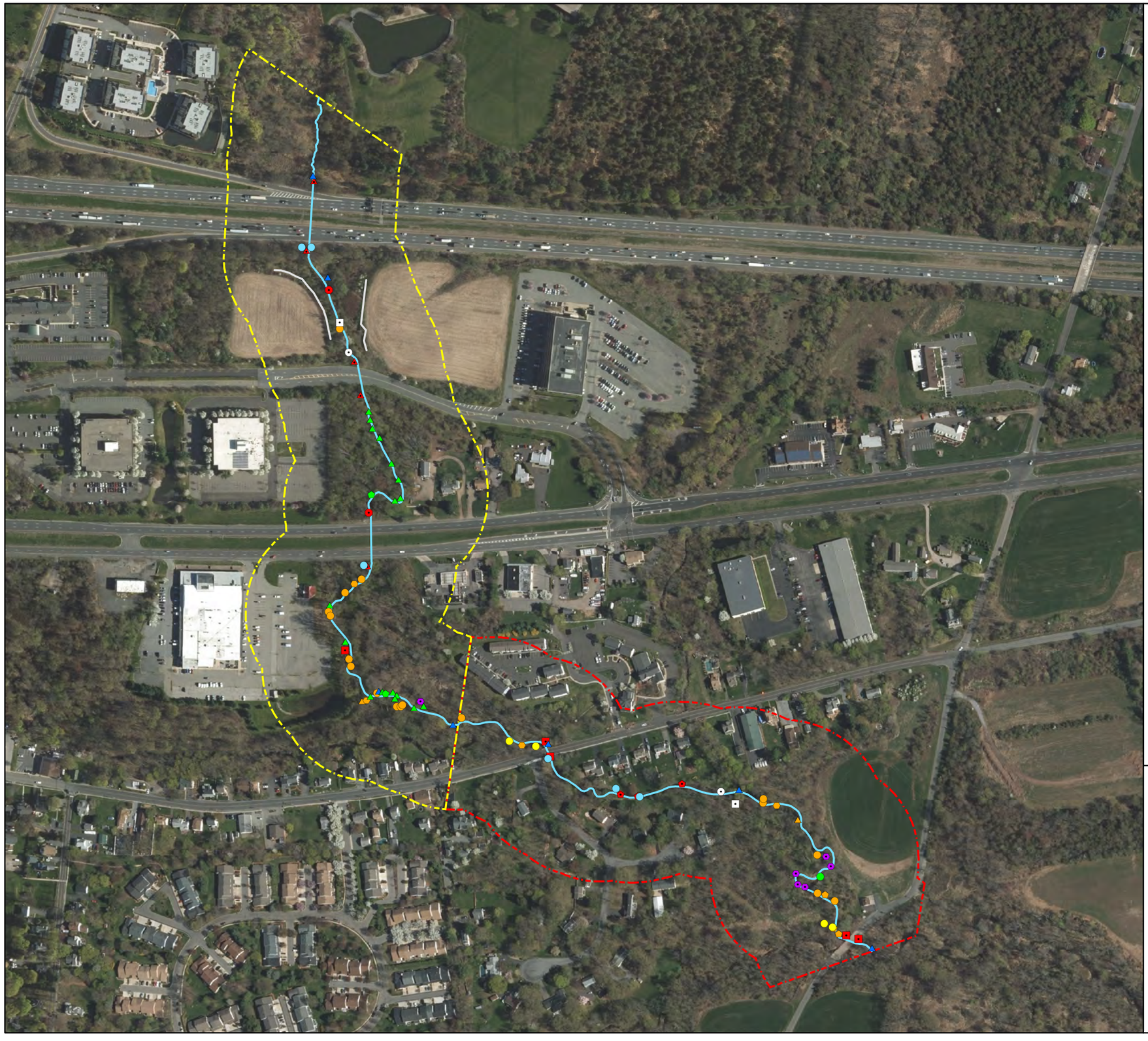
The above gathered calculations and visual observations of the study reach can determine the existing stream type using Rosgen (1994) codes. In addition, combining the dominant particle size class and Rosgen stream type can determine the channel bed morphology per Montgomery and Buffington (1997). Phase 1 and Phase 2 assessments of the stream type and channel bed morphology did not have major differences, therefore, did not indicate impaired conditions.

2.4.5 Channel Features/Condition

This step involved recording and quantifying various features found along the identified study reaches including:

1. Bedrock Grade Controls
2. Head-cuts
3. Riffle or Step Condition
4. Pool Condition
5. Sediment Bars
6. Bed Substrate Composition
7. Vegetative Material

No bedrock outcrops were observed on either reach assessed. No head cuts were observed along Reach-01, however Reach-02 had two headcuts just north of the Main Street bridge, one of which is causing extensive bank erosion leading to the exposure of a sewer man-hole in the streambank (Photo 9). Several complete riffles were identified along both reaches indicating the channels have little aggradation or degradation. Pools greater than 1-foot deep were common and point and lateral sediment bars were the dominant forms along both reaches (Photo 10). Bed substrate composition measurements were taken at the representative cross sections. These measurements are used to characterize the stream's ability to carry different sized sediments. Lastly, numerous debris jams (Photo 11) of vegetative material in the form of large woody debris (LWD) and coarse particulate organic matter (CPOM) were observed along both reaches, which can be indicative of channel instability and excessive erosion.



Legend

- Avulsions
- Stormwater Inputs
- Tributary
- Headcut
- Coarse Particulate Organic Matter
- Coarse Particulate Organic Matter / Debris Jams
- Coarse Particulate Organic Matter / Debris Jams / Tributary
- Large Woody Debris
- Large Woody Debris / Coarse Particulate Organic Matter
- Large Woody Debris / Coarse Particulate Organic Matter / Debris Jams
- Large Woody Debris / Debris Jams
- Bank Armoring
- Bridges
- Culverts
- Weir
- Floristic Inventory Plot Location
- Representive Cross Section
- Walls
- Stream Centerline
- Stream Corridor Reach #1
- Stream Corridor Reach #2

Sources:
Reach Stressor Points and Wall Locations from GPS data taken during Amy Greene Environmental field investigations on May 13, 19, and 27, 2020.

Stream Centerline from NJDEP Surface Water Quality Standards of New Jersey, NJ Department of Environmental Protection (NJDEP), Water Monitoring & Standards (WMS), Bureau of Freshwater and Biological Monitoring (BFBM), Trenton, NJ, December 2010.

This (map/publication/report) was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not State-authorized.

New Jersey 2015 High Resolution Orthophotography, NAD83 NJ State Plane Feet, MrSID Tiles, State of New Jersey - Office of Information Technology (NJOIT), Office of Geographic Information Systems (OGIS), Trenton, NJ, February 2016.

FIGURE 3
Reach Stressor Map

South Branch Rockaway Creek Tributary Stream
Corridor Protection and Restoration Plan
Borough of Lebanon
Hunterdon County, New Jersey

AGE Project #4562

350
Feet

N
W E
S

AMY GREENE ENVIRONMENTAL
a DAVEY company

Photo 9: View south at bank erosion on right bank of Reach-02 exposing sewer manhole.

Photo 10: View east and downstream at example of a gravel point bar on Reach-02.

Photo 11: View south and downstream at example of a debris jam found along Reach-01 including LWD and CPOM.

2.4.6 Stream Banks

For this parameter in the Highlands *Guidance*, the stream bank includes the near bank area within 5-feet from the top of the bank. The following metrics include the primary factors that affect bank erosion rates:

1. Typical Bank Slope
2. Bank Materials
3. Bank Vegetation Coverage
4. Cross Channel Shading
5. Bank Erosion
6. Bank Armoring/Channel Straightening

The first three metrics were assessed at the representative cross sections of each reach while the last three were assessed throughout the entire reach. The bank slopes for both reaches were moderately sloped at 30-50%, 3:1 – 2:1 slopes. The banks are comprised of a silt/clay texture with assumed moderate erodibility based on the mixed particle size and cohesiveness. Areas of slumping banks were rarely (1-2 locations) noted in either reach, but undercut banks were observed in several locations along both Reach-01 and Reach-02, indicating more gradual erosion as opposed to active or episodic erosion. Bank vegetation coverage at the Reach-01 representative cross-section was 100% groundcover, 20% understory, and 10% canopy and cross channel shading was closed. Bank vegetation coverage at the Reach-02 representative cross-section was 80% groundcover and 50% understory and cross channel shading was open. Some bank armoring was observed in a short stretch of Reach-02 (Photo 12).

2.4.7 Riparian Area/Floodplain

This section of the Highlands *Guidance* documents the integrity of the riparian zone along the channel in the reaches studied. Riparian areas are an important component of healthy watersheds and ecological function. To measure this component, the following metrics were documented:

1. Buffer Width
2. Riparian Community – Plant Community Assessment
3. Plant Stewardship Index

4. Adjacent Wetlands
5. Tributaries/Seeps/Springs
6. Floodplain Connectivity
7. Flood Chutes, Meander Cutoffs, Braiding, and Channel Avulsions

The buffer width 'most commonly found' for both the right and left sides along Reach-01 was 'WIDE' at 300 to 150 feet and 'NONE' along Reach-02. Comparatively, the results of Phase 1, Step 2.8 classified both reaches with a 'HIGH' impact rating which indicates > 20% of the reach length has undisturbed buffer widths less than 100 feet along the right or left bank.

Photo 12: Bank armoring observed along the left bank of Reach-02.

2.4.7.1 Riparian Community-Plant Community Assessment

Stream Corridor Evaluation

AGE botanist, David M. Kunz, performed an evaluation of the vegetation present along the full-length of the SB Rockaway Creek tributary reaches on May 13, 19, and 27, 2020. Vegetation occurring on both sides of the channel were identified and recorded. Evidence of anthropogenic disturbance was noted and was evident throughout the corridor by way of trash, scour from stormwater flows emanating from upstream and lateral impervious surfaces, and the presence of non-indigenous invasive plant species.

During the general evaluation, a comprehensive plant species inventory was compiled for Reach-01 and Reach-02 that included 87 individual species, of which 61 (70%) were native species and 26 (30%) were non-native species. Vegetation growing within the survey area of Reach-01 and Reach-02 were not distinguished as they were part of the same continuous riparian plant community.

The Plant Stewardship Index (PSI) was developed by Bowman's Hill Wildflower Preserve based on Swink and Wilhelm's (1994) Floristic Quality Assessment (FQA) Method and is the protocol specified for use in the FVAM to assess vegetative communities. However, since the FVAM was published, PSI analyses have been abandoned and superseded by the Universal Floristic Quality Assessment (FQA) Calculator (Jared Rosenbaum of Wild Ridge Plants, Personal Communication). To meet the requirements of the FVAM, AGE calculated PSI in addition to the Universal FQA. The *Universal FQA Calculator* was

accessed at https://universalfqa.org (Freyman et al. 2016). No guidance exists for interpreting PSI values and very limited information exists on how to interpret FQA calculations (e.g. Total Floristic Quality Index (FQI), Native FQI, Total Mean C, and Native Mean C, etc.). At the time of this report, only the Total FQI had an interpretive scale that had been accepted where the score was correlated to a categorical quality level (**Table 2**). An interpretive scale was available for Native Mean C (**Table 3**) but is still a working draft (Jared Rosenbaum, Personal Communication).

Table 2. Total Floristic Quality Index Thresholds

Total FQI Score	Translative Quality of Natural Area
≥ 30	Exceptional
≥ 20 and ≤ 29.9	High
≥ 10 and ≤ 19.9	Moderate
< 9.9	Low

Source: Jared Rosenbaum, personal communication.

Table 3. DRAFT Native Mean C Thresholds

Native Mean C Score	Translative Quality of Natural Area
≥ 6.0	Exceptional
≥ 5.0 and ≤ 5.9	High
≥ 3.0 and < 4.9	Moderate
< 3	Low

Source: Jared Rosenbaum, personal communication.

For both reaches combined, the total FQI was calculated to be 28.0 and the PSI was calculated to be 15.3. Per **Table 2**, this FQI score suggests that SB Rockaway Creek tributary riparian plant community is of relatively 'High' floristic quality for the New Jersey Highlands region. However, total FQI is biased by sample area size and approaches higher quality calculations the more species observed, which generally increases as the sample area increases regardless of quality (Spyreas 2019). Thus, FQI values for the overall stream corridor evaluation are significantly higher than those calculated for the smaller plot sampling effort (discussed in the next section) and contrast with Native Mean C interpretations. FQI values are more useful in the context of this report when comparing samples of the same area size (e.g. fixed plot sizes) and Mean C values of the overall stream corridor evaluation provide a more stable and consistent assessment of floristic quality. Total Mean C measured 3.0 while Native Mean C measured 4.2. While no reference for interpretation of Total Mean C was available at the time of this report, per **Table 3**, the interpretation of Native Mean C scores suggests that the study area exhibits 'Moderate' floristic quality.

Vegetation Plot Sampling

In lieu of transect sampling, AGE employed the Level 3 Carolina Vegetation Survey (CVS) plot sampling methodology (Pete et al. 1998). Plot sampling is preferred because the sample unit is less likely to cross ecological community boundaries than a linear transect unit that is ten times as expansive. One vegetation plot was sampled in the riparian areas of both Reach-01 and Reach-02 of the survey area. The Level 3 – CVS plot sampling protocol involved placement of a 10 x 10-meter (100 square meters) plot. Plant species within the plot were inventoried and percent cover was estimated using the CVS cover abundance scale. The plot locations for Reach-01 and Reach-02 are found on **Figure 3**.

Reach-01 Plot

Within the plot sampled at Reach-01, Total FQI measured 15.4, suggesting the system was of 'Moderate' quality. Native mean C measured 3.5 at this plot, which also falls within the 'Moderate' quality range per **Table 3**.

Reach-02 Plot

Within the plot sampled at Reach-02, Total FQI measured 13.0 suggesting the system was of 'Moderate' quality. Native mean C measured 3.8 at this plot, which also falls within the 'Moderate' quality range per **Table 3**.

Floristic Quality Assessment Summary

In summary, the floristic quality of SB Rockaway Creek tributary riparian area is estimated to be of 'Moderate' quality according to the thresholds provided in **Table 2** and **Table 3**. While Total FQI of the overall stream corridor evaluation area ranked as 'High' quality, this evaluation method was likely biased by the larger area covered (i.e. 30-40 acres) in contrast to the smaller plots and with the Native Mean C calculation. All field data and Universal FQA Calculator results are provided in **Appendix F**.

2.4.8 Public Use Opportunities

The two reaches of the South Branch Rockaway Creek tributaries currently support little to no public use opportunities. Since the adjacent land ownership is mostly private, very little public use such as hiking, picnicking, wading/swimming, fishing, or hunting is appropriate along either studied reach. The width and depth of the reaches is insufficient for paddling or motor-boating activities.

2.4.9 Additional Considerations

A large corporate campus surrounds the headwaters immediately upstream of Reach-01 which can affect the study reach if poor landscaping practices occur within the campus. Since Reach-01 is immediately upstream of Reach-02, anything affecting Reach-01 will also affect Reach-02. Downstream land use of Reach-02 is predominantly agricultural which would have little effect on the studied reach.

2.4.10 Functional Value Scoring/Rating

The Functional Value Assessment Methodology Scoring forms for Reach-01 and Reach-02 are located in **Appendix E**. There are seven forms, each which assess and score the following for each studied reach:

1. Form 1: Reach ID Form
2. Form 2: Phase I Watershed
3. Form 3: Channel Integrity
4. Form 4: Habitat
5. Form 5: Water Quality
6. Form 6: Temperature Moderation
7. Form 7: Public Use

The forms used for both Reach-01 and Reach-02 were based on the Existing and/or Reference Stream Type established in the Phase 1 and Phase 2 assessments: primarily 'Pool-Riffle' streams and 'C/E channels'.

The scores and ratings which follow in **Table 4** correspond best to conditions observed in the Phase 1 and Phase 2 assessments. Where most observations occur around the same conditions, the numerical score becomes apparent but where there is a wide range of conditions across the parameters, careful judgment was used to weigh the observations and select the numerical score that best reflected the observed conditions.

Table 4: Functional Value Scores and Condition Ratings

Assessment	Reach-01		Reach-02	
	Score	Rating	Score	Rating
Watershed	0.36	FAIR	0.36	FAIR
Channel Integrity	0.57	FAIR	0.57	FAIR
Channel Sensitivity*	--	HIGH	--	VERY HIGH
Habitat	0.56	FAIR	0.54	FAIR
Water Quality	0.45	FAIR	0.41	FAIR
Temperature Moderation	0.54	FAIR	0.46	FAIR
Public Use	0.33	POOR	0.32	POOR

*Channel Sensitivity is based on the Existing Rosgen Stream Type and Channel Integrity Rating and refers to the likelihood of the stream to undergo geomorphic adjustment following human disturbance.

2.4.11 Data Summary

According to the Highlands *Guidance*, the scores and ratings determined in **Table 4** serve as a baseline assessment of existing conditions against with future change can be measured.

Watershed/Corridor

Factors driving down the rating for Reach-01 and Reach-02 included a predominance of unconsolidated glacial till in the native soil, very high soil erodibility, high soil runoff, and high percentages of urban land use and impervious cover.

Channel Integrity

Channel conditions indicative of instability and potential rapid adjustments in Reach-01 and Reach-02 includes undersized bridge crossings, high floodplain encroachment ratios, stormwater headcuts and outfalls perched above the streambed, lack of bedrock grade controls, moderate sediment deposition upstream of bridges/culverts and bridges/culverts partially blocked by sediment, pools filled with sediment finer than the dominant particle sizes, many sediment bars which are composed of sediment finer than dominant particle sizes, moderate erosion at the base of both banks creating unstable overhangs, and the channel is askew to bridge/culvert openings.

Habitat

The conditions manifesting the 'FAIR' habitat ratings in Reach-01 and Reach-02 can be attributed to Fair Channel Integrity, very high Channel Sensitivity, NJ Stream Water Quality Standards, multiple bridges and/or culverts constricting the channels, low number of pools, low number of debris jams for the length of the reach, abundant non-native, invasive plant species, and minimal percentage of adjacent wetlands.

Water Quality

Related parameters contributing to the lower water quality conditions of Reach-01 and Reach-02 include Fair Channel Integrity, high to very high channel sensitivity, NJ Surface Water Quality Standards, few to many eroded banks that are undercut and steep, bank erosion may be contributing to in-stream sediment, minimal wetlands present, and infrequent tributaries/seeps/springs.

Temperature Moderation

The FAIR conditions of this category are manifested by the Fair Channel Integrity, high to very high Channel Sensitivity, contributing stormwater inputs which are predominantly urban, minimal wetland presence, and infrequent tributaries/seeps/springs. In addition, Reach-02 has a minimally shaded channel and a significant amount of riparian buffer in residential areas that does not intercept runoff.

Public Use

Both Reach-01 and Reach-02 scored ‘POOR’ in the Public Use Assessment. This can be attributed to by the Fair ratings achieved in Channel Integrity, Habitat, and Water Quality but also because many public uses are incompatible with the existing adjacent land ownership.

SECTION 3: STREAM CORRIDOR PLAN

It is the understanding that the FVAM was initiated in response to a proposed affordable housing development that may affect the SB Rockaway Creek tributary, identified as Reach-01 in this assessment. The development is proposed on Block 4, Lots 1.03 and 1.04, off of Corporate Drive in the Borough of Lebanon. Therefore, the results of this FVAM will serve as a baseline against which no net loss in functional value to the SB Rockaway Creek tributary will be measured. The baseline FVAM for Reach-01 and Reach-02 is 'FAIR' which indicate the tributaries are in a condition of 'In Adjustment – moderate loss of floodplain function; or moderate to major planform adjustments that could lead to channel avulsions' (FEA 2014). Future management projects considered should focus on mitigation of permanent stressors such as floodplain encroachment from urbanization.

Based on the results of the Phase 1 and Phase 2 FVAM along the limited study area on portions of the SB Rockaway Creek tributaries flowing through the north and south-eastern quadrants of the Borough of Lebanon, Amy Greene Environmental recommends the following for the Borough:

1. Following the implementation of the proposed affordable housing development, repeat the FVAM on Reach-01 during the growing season following construction and restoration activities to monitor any changes to the existing functional values identified, and trigger any remedial actions if necessary.

2. Expand the FVAM across the full length of Reach-02 (starting from the Lebanon Borough Boundary north of Route 78 and east of Spencer Lane, heading south and east through the Borough to the confluence with the main stem of SB Rockaway Creek, just east of Corporate Drive) to better understand the full scope of evolution stage and sensitivity of this tributary. Further, perform the FVAM across all tributaries within the Borough and/or watershed. An expanded study area such as this would create a database to allow for a more comprehensive approach to flood and erosion hazard planning across the Borough and/or adjacent townships, rather than the conventional approach of multiple "spot fixes" with limited knowledge of the stream system as a whole.

3. Conduct a bridge and culvert survey of private and public structures to gather specific information about the impacts of stream crossings and stormwater inputs throughout entire Borough and/or the SB Rockaway Creek watershed. Replace undersized and askew structures when opportunities and/or funding become available. Based on the limited scope of this assessment, these may include but aren't limited to the culverts at Route 78, at Corporate Drive south of Route 78, and at Route 22 along Reach-01; and the bridge at Main Street along Reach-02.

4. The predominant reference stream type for much of the two assessed reaches appears to be "C" (Refer to **Section 2.2.1.3** for definitions). "C" type stream channels are highly dependent upon vegetation for stability. Therefore, the establishment and protection of vegetated buffers should be high priority in any restoration planning and design work. Riparian buffers provide many benefits including protecting and enhancing water quality, providing fish and wildlife habitat, providing streamside shading, and providing root structure to prevent bank erosion (EPA 2020; BCE 2006).

5. Reach-02 particularly has a high floodplain encroachment due to residential yards that are landscaped, mowed, and cleared of vegetation in the floodplain which has led to loss of habitat and geomorphic instability. Consider working with willing residents along this reach to create a 'riparian buffer protection agreement' or similar conservation arrangement. This is a tool to help private landowners and conservation organizations or governments work in

partnership to establish permanent riparian buffers along waterways by planting native trees, shrubs, and other perennial plants within the first 50 feet extending out from the waterway, which the USDA Forestry Service considers the most critical, and should be preserved as near as possible to an undisturbed, natural state (WeConservePA 2009). Actions to recreate a riparian buffer along this reach will deliver a number of benefits including providing shade, creating habitat and corridors for terrestrial species, and providing shelter and food for fish and other aquatic organisms.

6. The uppermost and middle portions of Reach-01 have been minimally impacted by land use as at least one bank is surrounded by relict wetlands. In the uppermost portion, the relict wetland is north of Interstate 78 and along the right bank of Reach-01. In the middle portion, a relict wetland is south of State Route 22 and along the left bank of Reach-01. Conservation and preservation of these wetlands will protect the quality of the tributary.

SECTION 4: REFERENCES

Bear Creek Environmental (BCE). 2006. Phase 1 and 2 Stream Geomorphic Assessments, North Branch of Deerfield River Watershed. Middlesex, Vermont.

Fitzgerald Environmental Associates (FEA), LLC. 2014. Lower Passumpsic River Tributaries River Corridor Plan. Colchester, Vermont.

Freyman, W.A., L.A. Masters, and S. Packard. 2016. The Universal Floristic Quality Assessment (FQA) Calculator: an online tool for ecological assessment and monitoring. Methods in Ecology and Evolution 7(3): 380–383.

New Jersey Highlands Water Protection and Planning Council (NJ Highlands WPPC). 2014a. Stream Corridor Guidance, Part 1: Functional Value Assessment Methodology. www.highlands.state.nj.us

NJ Highlands WPPC. 2014b. Stream Corridor Guidance, Part 2: Part 2: Protection and Restoration Planning. www.highlands.state.nj.us

Peet, R.K., T.R. Wentworth and P.S. White. 1998. A flexible, multipurpose method for recording vegetation composition and structure. Castanea 63:262-274.

Princeton Hydro, LLC. 2002. Clinton Township Natural Resource Inventory. http://www.clintontwpnj.com/modules/showdocument.aspx?documentid=124

Spyreas, G. 2019. Floristic Quality Assessment: a critique, a defense, and a primer. https://doi.org/10.1002/ecs2.2825

Swink, F. and G. Wilhelm. 1994. Floristic Quality Assessment. Pages 11-18 in Plants of the Chicago region. 4th ed. Indiana Academy of Science, Indianapolis.

U.S. Environmental Protection Agency (EPA). 2020. Watershed Academy Web: Fundamentals of Rosgen Stream Classification System. https://cfpub.epa.gov/watertrain/moduleFrame.cfm?parent_object_id=1189

U.S. Fish and Wildlife Service. No date. Floristic Quality Assessment. https://www.fws.gov/midwest/endangered/section7/s7process/plants/FQA.html#:~:text=Utilizing%20this%20method%2C%20a%20Floristic,indicates%20%E2%80%9CNatural%20Area%E2%80%9D%20quality.

U.S. Geological Survey (USGS). 2020. USGS Current Conditions for the Nation, USGS 01399670 South B Rockaway Creek at Whitehouse Station NJ. https://waterdata.usgs.gov/usa/nwis/uv?01399670

Vermont Agency of Natural Resources (VT ANR). 2004. Stream Geomorphic Assessment Protocol Handbook. www.watershedmanagement.vt.gov/rivers.htm

VT ANR. 2005. Vermont Stream Geomorphic Assessment Phase 2 Handbook. Rapid Stream Assessment, Field Protocols. Waterbury, Vermont.

WeConservePA. 2009. ConservationTools.org: Riparian Buffer Protection Agreement. https://conservationtools.org/guides/84-riparian-buffer-protection-agreement.

Wilhelm, G. and L. Rerich. 2017. Flora of the Chicago Region. A Floristic and Ecological Synthesis. Indiana Academy of Science, Indianapolis. 1392 pp.

Personal Communications

Romano, Karen (Borough of Lebanon Clerk). July 9, 2020. Email communication.

Rosenbaum, Jared (Owner of Wild Ridge Plants and former PSI Coordinator at Bowman's Hill Wildflower Preserve). July 19, 2020. Personal communication.

SECTION 5: GLOSSARY

Aggradation: The process of sediment deposition on the channel bed on a reach scale that raises the elevation of the channel bed relative to the banks and floodplain.

Anthropogenic: Referring to environmental change caused or influenced by people, either directly or indirectly.

Avulsion: A process that results in relatively sudden abandonment of a river channel for a new course at a lower level in the floodplain.

Bankfull: The water level, or stage, at which a stream, river or lake is at the top of its banks and any further rise would result in water moving into the floodplain.

Braiding/Braided Channel: A stream reach composed of a complex of multiple, interconnected channels with bed features that form by dynamic erosion and deposition processes.

Channel Avulsion: The process, often occurring suddenly during flood events, in which a new channel is created and the original channel is abandoned.

Channel Canopy Cover: Shading from overhanging bank vegetation that limits direct insolation to the water surface and thereby serves to moderate water temperatures.

Channel Integrity: The quality of a stream channel defined by long-term dynamic stability of dimension, pattern and profile, and at which point, erosion and deposition of sediment are in relative balance.

Channel Migration: The process in which a channel shifts downstream or laterally and can result in greater reach sinuosity.

Channel Sensitivity: The likelihood that a stream will undergo geomorphic adjustment in response to a disturbance.

Channel Straightening: The realignment of a channel creating a straighter and thus steeper reach that is more prone to instability, often done intentionally to accommodate adjacent agriculture, development, roads or railroads.

Dams/Weirs: Structures that span the channel and are designed to raise the water surface elevation to create impoundments for water supply, flood control, recreational, industrial power supply or other uses.

Degradation: The process of erosion of the channel bed that lowers the elevation of the channel bed relative to the tops of banks and floodplain; also referred to as incision, down-cutting or entrenchment.

Entrenched: A river or stream that flows in a narrow trench or valley cut into a plain or relatively level upland.

Flood Chutes: Shallow flow paths on a floodplain that typically form a shorter, more direct path across meander tongues.

Geomorphic: Relating to the form of the landscape and other natural features of the earth's surface.

Geomorphic Change: Changes in channel slope, cross-section or alignment that occur through any of four processes: degradation, aggradation, widening and re-alignment.

Habitat: The space, and its associated biological and physical conditions, in which an organism or population inhabits. Optimal stream habitat is created under equilibrium conditions when sediment, woody material and water flow (depths and velocities) interact to create heterogeneous habitat units for cover, foraging and reproduction.

Head-cut: An erosional feature of some intermittent and perennial streams with an abrupt vertical drop in the streambed. This is also known as a knickpoint.

Headwater: First- through third-order streams (see Stream order); these are the small streams in the upper reaches of a watershed.

Highly Erodible Land (HEL): A soil erodibility factor, which represents both susceptibility of soil to erosion and the rate of runoff.

Hydrologic Soil Hydrologic Groups (HSG): Classes of soils that represent runoff characteristics. High runoff potential may contribute to reduced temperature moderation and degraded water quality and aquatic habitat.

Mainstem: The major reach of a river or stream formed by the smaller tributaries which flow into it.

Meander: One of a series of regular sinuous curves, bends, loops, turns, or windings in the channel of a river, stream, or other watercourse.

Meander Cutoff: The natural form of a cutting or cut in a river which occurs when a pronounced meander (hook) in a river is breached by a flow that connects the two closest parts of the hook to form a new channel, a full loop.

Planform: The contour of an object (such as an airplane) or mass as viewed from above.

Point Bar: A low, curved ridge of sand and gravel along the inner bank of a meandering stream. Point bars form through the slow accumulation of sediment deposited by the stream when its velocity drops along the inner bank.

Pool-Riffle Channel: A stream reach with undulating bed that defines a sequence of riffles, runs, pools, and bars.

Reference Conditions: The highest quality, or optimal condition, of a natural system that is expected to occur in the absence of human disturbance.

Relief: The difference in elevation between any two points.

Riffle: A rocky or shallow part of a stream or river with rough water.

Scour Pool: A deep depression in a stream bed created by the erosional forces of flowing water. These forces can be fully natural in origin or may arise from impact with man-made structures.

Sinuosity: The planform pattern of a river that describes the degree of meandering and is expressed as the ratio of channel length to valley length – straight channels equate to low sinuosity.

Stream Order: A measure of the relative size of a stream. Each increase in stream order is an order of magnitude increase in size. The smallest tributaries are referred to as first-order streams, while the largest river in the world is a twelfth-order waterway.

Thalweg: The deepest part of the channel where velocities are greatest and the majority of flow is concentrated.

Tributary: A stream that flows into, or "feeds," another stream.

Watershed: An area of land that drains into a common reservoir such as a stream, river, lake, or ocean; also referred to as a drainage basin or catchment area.

Water Year: The U.S. Geological Survey term "water year" is defined as the 12-month period beginning on October 1, for any given year through September 30, of the following year. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months. Thus, the year ending September 30, 1999 is called the "1999" water year.

Widening: The process of erosion of both banks that increases the width of the channel.

Weir: A low dam built across a river to raise the level of water upstream or regulate its flow.

Appendix A Phase 1 Data Sheets

Highlands Functional Value Assessment Methodology
Phase 1 Watershed Assessment - Data Sheet

Impact Ratings	
V	Very High
H	High
M	Moderate
L	Low
I/N	Insignificant / None

US = Upstream
DS = Downstream
# = Numerical Value
IR = Impact Rating
T = Text Value
S = Score

Step					
1.1	Define Study Reach				
1.1.1		Stream Name	South Branch Rockaway Creek tributary		
1.1.2		Reach ID	South Branch Rockaway Creek tributary - 01		
1.1.3		Endpoint Descriptions	US: just east of Presidential Place Apartments	DS:	northside Main St @ Sloan Ln
1.1.4		Endpoint Coordinates	US: N: 40.648205 / W: 74.829877	DS:	N: 40.642120 / W: 74.828072
1.1.5		NHD Reach Code(s)	02030105016411, 02030105016412, 02030105016413, 02030105016414, 02030105016415		
1.1.6		HUC 14	02030105050100		
		Town(s)	Borough of Lebanon		
1.1.7		County	Hunterdon		
		USGS Quadrangle	Califon NJ		
1.1.8		Excluded Areas	n/a		
1.2	Landownership				
		Private Properties	see attached list		
1.3	Define Reference Stream Type				
1.3.1		Reach Length (ft)	#: 2849		
1.3.2		Endpoint Elevations (ft)	US: 251	DS:	216
1.3.3		Reach Slope	#: 1.23 %		
1.3.4		Valley Length (ft)	#: 2597		
1.3.5		Valley Slope	#: 1.35%		
1.3.6		Sinuosity	#: Low		
1.3.7		Channel Width (ft)	#: 3.6		
1.3.8		Valley Width (ft)	#: 84.9		
1.3.9		Confinement Ratio	#: 23.6	T:	very broad
1.3.10.1		Rosgen Stream Type	T: C / E Single Channel		
1.3.10.2		Channel Bed Morphology	T: Pool-Riffle		

Highlands Functional Value Assessment Methodology
Phase 1 Watershed Assessment - Data Sheet

			Impact Ratings:	
1.4 Channel Canopy Cover	#: 1	IR:	I (Insignifiant)	H/L/I
1.5 Dams / Weirs	#: 0	IR:	N (none)	H/M/L/N
1.5.1 Impoundment Canopy Cover	#: n/a	IR:	n/a	H/L/I
1.6 Bridges / Culverts	#: 3	IR:	H (high)	H/L/N
1.7 Channel Straightening	#: 19 %	IR:	M (moderate)	H/L/I
1.8 Channel Migration / Avulsion	#: 20 %	IR:	L (low)	H/L/N
1.9 Water Quality Standard	#: FW2-TP-C1	IR:	H (high)	H/L/N
1.10 Surface Water Discharges	#: 0	IR:	L (low)	H/L/N
1.11 AMNET Reference Sites	#: 0	S:	N (none)	H/N
1.12 303(d) List	#: not listed	S:		H/L

2.1 Delineate Corridor Area (acres)	#: 34.33
2.2 Delineate Watershed Area (acres)	#: 165

2.3 Geology

Bedrock	Passaic Formation (36.3 ac / 99.5%) and Passaic Formation Limestone-clast Conglomerate facies (0.2 ac / 0.5%)			
Surficial	Alluvium (7.5 ac / 20.5%) and Weathered Shale, Mudstone, & Sandstone (29 ac / 79.5%)			
2.4 Valley Slopes	#: 6.32 acres / 17.26 %	IR:	L (low)	H/L/I

2.5 Soils

	Area (acres) Corridor/Watershed	Percent Corridor/Watershed	
Hydrologic Group			
A			
B	0.0 / 3195.6	0.0 % / 40.4 %	
C	31.2 / 3999.8	85.5 % / 50.6 %	
D	5.3 / 566.7	14.5 % / 7.2 %	
A/D			
B/D	0.0 / 116.8	0.0 % / 1.5 %	
C/D			
Corridor		IR: H (high)	V/H/M/L
Watershed		IR: H (high)	V/H/M/L
HEL			
Highly Erodible	9.1 / 1895.3	24.9 % / 24.0 %	
Potentially Highly Erodible	15.6 / 5391.8	42.8 % / 68.2 %	
Not Highly Erodible	11.8 / 623.0	32.3 % / 7.8%	
Corridor		IR: H (high)	V/H/M/L
Watershed		IR: V (very high)	V/H/M/L

Highlands Functional Value Assessment Methodology
Phase 1 Watershed Assessment - Data Sheet

2.6 Land Use / Land Cover

	Area (acres) Corridor/Watershed	Percent Corridor/Watershed	
Urban	15.15 / 3057.87	41.5 % / 38.7 %	
Agriculture	4.23 / 1305.24	11.6 % / 16.5 %	
Wetlands	6.25 / 293.55	17.1 % / 3.7 %	
Forest	10.64 / 3180.39	29.2 % / 40.2 %	
Corridor		IR: H (high)	H/M/L/I
Watershed		IR: H (high)	H/M/L/I

Impervious Cover

	Area (acres) Corridor/Watershed	Percent Corridor/Watershed	
%IC	9.79 / 1082.55	26.8 % / 13.7 %	
Corridor		IR: H (high)	H/M/L/I
Watershed		IR: M (moderate)	H/M/L/I

2.7 Pollutant Loading

	Corridor	Watershed
TP	31.42 lbs/year	6310.8 lbs/year
TN	225.73 lbs/year	43,115.8 lbs/year
TSS	16,089.94 lbs/year	3,311,190.7 lbs/year

2.8 Width of Vegetated Buffer (ft)	#: 1637	IR: H (high)	H/L/I
2.9 Floodplain Constrictions	#: 60.7 ft (2.13 %)	IR: I (insignificant)	H/L/I

2.10 Wildlife Habitat - Landscape 3.0

Vernal Pools	#: none			
Stream Rank	#: Rank 1			
Species Patch Rank	5	Area (acres): 0.0	Percent: 0.0 %	
	4	Area (acres): 4.30	Percent: 11.8 %	
	3	Area (acres): 6.76	Percent: 18.5 %	
	2	Area (acres): 2.62	Percent: 7.2 %	
	1	Area (acres): 9.66	Percent: 26.5 %	
	0	Area (acres): 13.16	Percent: 36.0 %	
			S: H (high)	H/M/L
2.11 Riparian Plant Community - PSI			S: M (moderate)	H/M/L
2.12 Public Uses			S: H (high)	H/M/L/N

Highlands Functional Value Assessment Methodology
Phase 1 Watershed Assessment - Data Sheet

Impact Ratings	
V	Very High
H	High
M	Moderate
L	Low
I/N	Insignificant / None

US = Upstream
DS = Downstream
# = Numerical Value
IR = Impact Rating
T = Text Value
S = Score

Step					
1.1	Define Study Reach				
1.1.1		Stream Name	South Branch Rockaway Creek tributary		
1.1.2		Reach ID	South Branch Rockaway Creek tributary - 02		
1.1.3		Endpoint Descriptions	US: northside of Main St at Sloan Ln	DS:	just downstream of Kullman Corp Campus Dr bridge
1.1.4		Endpoint Coordinates	US: N: 40.642120 / W: 74.828072	DS:	N: 40.639935 / W: 74.822790
1.1.5		NHD Reach Code(s)	02030105014870 & 02030105016417		
1.1.6		HUC 14	02030105050100		
		Town(s)	Borough of Lebanon		
1.1.7		County	Hunterdon		
		USGS Quadrangle	Califon NJ		
1.1.8		Excluded Areas	n/a		
1.2	Landownership				
		Private Properties	see attached list		
1.3	Define Reference Stream Type				
1.3.1		Reach Length (ft)	#: 2248		
1.3.2		Endpoint Elevations (ft)	US: 216	DS:	205
1.3.3		Reach Slope	#: 0.48 %		
1.3.4		Valley Length (ft)	#: 1759		
1.3.5		Valley Slope	#: 1.99 %		
1.3.6		Sinuosity	#: Moderate		
1.3.7		Channel Width (ft)	#: 14.1		
1.3.8		Valley Width (ft)	#: 372.2		
1.3.9		Confinement Ratio	#: 26.4	T:	very broad
1.3.10.1		Rosgen Stream Type	T: C / E Single Channel		
1.3.10.2		Channel Bed Morphology	T: Pool-Riffle		

Highlands Functional Value Assessment Methodology
Phase 1 Watershed Assessment - Data Sheet

			Impact Ratings:	
1.4 Channel Canopy Cover	#: 3	IR:	I (Insignificant)	H/L/I
1.5 Dams / Weirs	#: 0	IR:	N (none)	H/M/L/N
1.5.1 Impoundment Canopy Cover	#: n/a	IR:	n/a	H/L/I
1.6 Bridges / Culverts	#: 2	IR:	H (high)	H/L/N
1.7 Channel Straightening	#: 31 %	IR:	H (high)	H/L/I
1.8 Channel Migration / Avulsion	#: 10 %	IR:	L (low)	H/L/N
1.9 Water Quality Standard	#: FW2-TP-C1	IR:	H (high)	H/L/N
1.10 Surface Water Discharges	#: 0	IR:	L (low)	H/L/N
1.11 AMNET Reference Sites	#: 0	S:	N (none)	H/N
1.12 303(d) List	#: not listed	S:		H/L

2.1 Delineate Corridor Area (acres)	#: 26.79
2.2 Delineate Watershed Area (acres)	#: 2,455

2.3 Geology

Bedrock	Passaic Formation (26.8 ac / 100%)		
Surficial	Alluvium (15.2 ac / 56.7%) and Weathered Shale, Mudstone, & Sandstone (11.6 ac / 43.3%)		
2.4 Valley Slopes	#: 1.91 acres / 7.09 %	IR: L (low)	H/L/I

2.5 Soils

	Area (acres) Corridor/Watershed	Percent Corridor/Watershed	
Hydrologic Group A			
B	0.0 / 3195.6	0.0 % / 40.4 %	
C	26.8 / 3999.8	100.0 % / 50.6 %	
D	0.0 / 566.7	0.0 % / 7.2 %	
A/D			
B/D	0.0 / 116.8	0.0 % / 1.5 %	
C/D			
Corridor		IR: H (high)	V/H/M/L
Watershed		IR: H (high)	V/H/M/L
HEL Highly Erodible	0.0 / 1895.3	0.0 % / 24.0 %	
Potentially Highly Erodible	11.3 / 5391.8	42.2 % / 68.2 %	
Not Highly Erodible	15.5 / 623.0	57.8 % / 7.8 %	
Corridor		IR: M (moderate)	V/H/M/L
Watershed		IR: V (very high)	V/H/M/L

Highlands Functional Value Assessment Methodology
Phase 1 Watershed Assessment - Data Sheet

2.6 Land Use / Land Cover

	Area (acres) Corridor/Watershed	Percent Corridor/Watershed	
Urban	13.51 / 3057.87	50.4 % / 38.7 %	
Agriculture	2.20 / 1305.24	8.2 % / 16.5 %	
Wetlands	3.31 / 293.55	12.4 % / 3.7 %	
Forest	7.77 / 3180.39	29.0 % / 40.2 %	
Corridor		IR: H (high)	H/M/L/I
Watershed		IR: H (high)	H/M/L/I

Impervious Cover

	Area (acres) Corridor/Watershed	Percent Corridor/Watershed	
%IC	5.26 / 1082.55	19.6 % / 13.7 %	
Corridor		IR: M (moderate)	H/M/L/I
Watershed		IR: M (moderate)	H/M/L/I

2.7 Pollutant Loading

	Corridor	Watershed
TP	18.06 lbs/year	6310.8 lbs/year
TN	133.88 lbs/year	43,115.8 lbs/year
TSS	7354.12 lbs/year	3,311,190.7 lbs/year

2.8 Width of Vegetated Buffer (ft)	#: 1780	IR: H (high)	H/L/I
2.9 Floodplain Constrictions	#: 738.5 ft (32.8 %)	IR: H (high)	H/L/I

2.10 Wildlife Habitat - Landscape 3.0

Vernal Pools	#: none			
Stream Rank	#: Rank 1			
Species Patch Rank	5	Area (acres): 0.00	Percent: 0.0 %	
	4	Area (acres): 0.64	Percent: 2.4 %	
	3	Area (acres): 12.64	Percent: 47.2 %	
	2	Area (acres): 0.00	Percent: 0.0 %	
	1	Area (acres): 10.84	Percent: 40.4 %	
	0	Area (acres): 2.68	Percent: 10.0 %	
			S: H (high)	H/M/L
2.11 Riparian Plant Community - PSI			S: M (moderate)	H/M/L
2.12 Public Uses			S: H (high)	H/M/L/N

Appendix B Landowner List

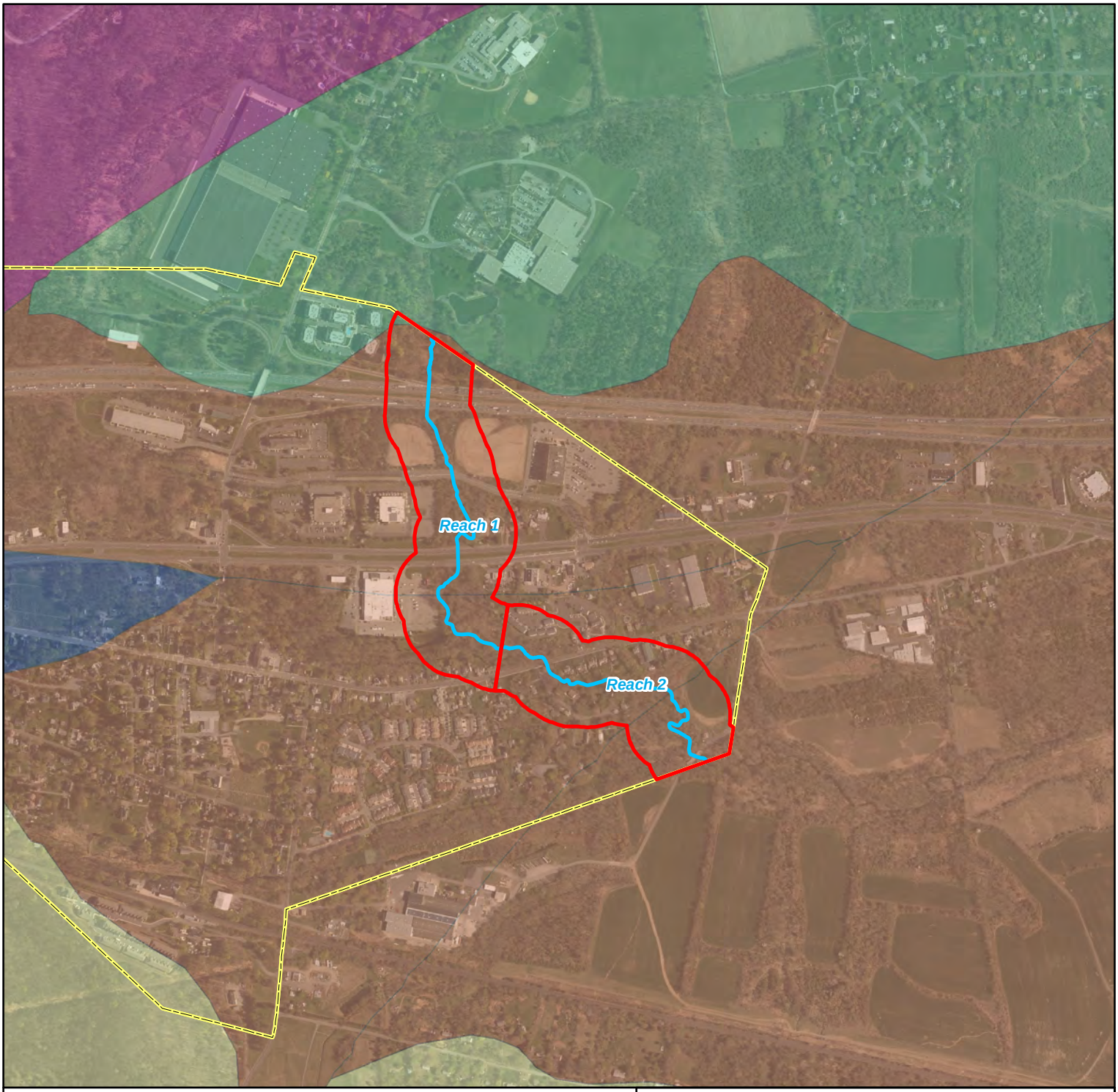
Parcels that intersect with 300ft Stream Reach Corridor

Municipal Code	BLOCK	LOT
1018	1	2
1018	1	3
1018	12	10
1018	12	11
1018	12	12
1018	12	18
1018	12	8
1018	12	8.01
1018	12	9
1018	13	1
1018	13	13
1018	13	2
1018	13	3
1018	13	4
1018	13	5
1018	13	6
1018	13	7
1018	13	7.01
1018	13	8
1018	13.02	10
1018	13.02	11
1018	13.02	12
1018	13.02	22
1018	13.02	25
1018	13.02	26
1018	13.02	33
1018	13.02	34
1018	13.02	35
1018	13.02	36
1018	13.02	37
1018	13.02	38
1018	13.02	39
1018	13.02	40
1018	13.02	41
1018	13.02	42
1018	13.02	43
1018	13.02	44
1018	13.02	45
1018	13.02	46
1018	13.02	47
1018	13.02	48
1018	13.02	49
1018	13.02	50
1018	13.02	52
1018	13.02	9

1018	2	14
1018	2	4.03
1018	2	5
1018	2	6
1018	2	6.01
1018	2	8
1018	2	9
1018	4	1.02
1018	4	1.03
1018	4	1.04
1018	4	7
1018	4	8
1018	5	1
1018	5	10
1018	5	11
1018	5	11.01
1018	5	12
1018	5	13
1018	5	14
1018	5	15
1018	5	16
1018	5	17
1018	5	18
1018	5	19
1018	5	2
1018	5	20
1018	5	21
1018	5	22
1018	5	23
1018	5	24
1018	5	24.01
1018	5	25
1018	5	27
1018	5	28
1018	5	29
1018	5	3
1018	5	35
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01

1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	35.01
1018	5	4
1018	5	5
1018	5	6
1018	5	7
1018	5	8
1018	5	9
1018	6	11
1018	6	18
1018	6	26
1018	6	27
1018	6	28

Appendix C Figures



Legend

- Stream Reach
- Stream Reach Corridor
- Municipal Boundary
- Passaic Formation
- Jurassic Diabase
- Passaic Formation Limestone-clast Conglomerate facies
- Passaic Formation Quatzite-clast Conglomerate facies
- Quartz-Oligoclase Gneiss

Sources: Bedrock and Surficial Geology for New Jersey 1:100,000 Scale, New Jersey Department of Environmental Protection (NJDEP), New Jersey Geological Survey (NJGS), Trenton, NJ, June 1999. Municipal Boundaries for the State of New Jersey, New Jersey State Plane NAD83, NJ Office of Information Technology (NJOIT), Office of Geographic Information Systems (OGIS), vector digital data, Trenton, NJ, July 2016. New Jersey 2015 High Resolution Orthophotography, NAD83 NJ State Plane Feet, MrSID Tiles, State of New Jersey - Office of Information Technology, Office of Geographic Information Systems (OGIS), Trenton, NJ, February 2016.

Bedrock Geology Map

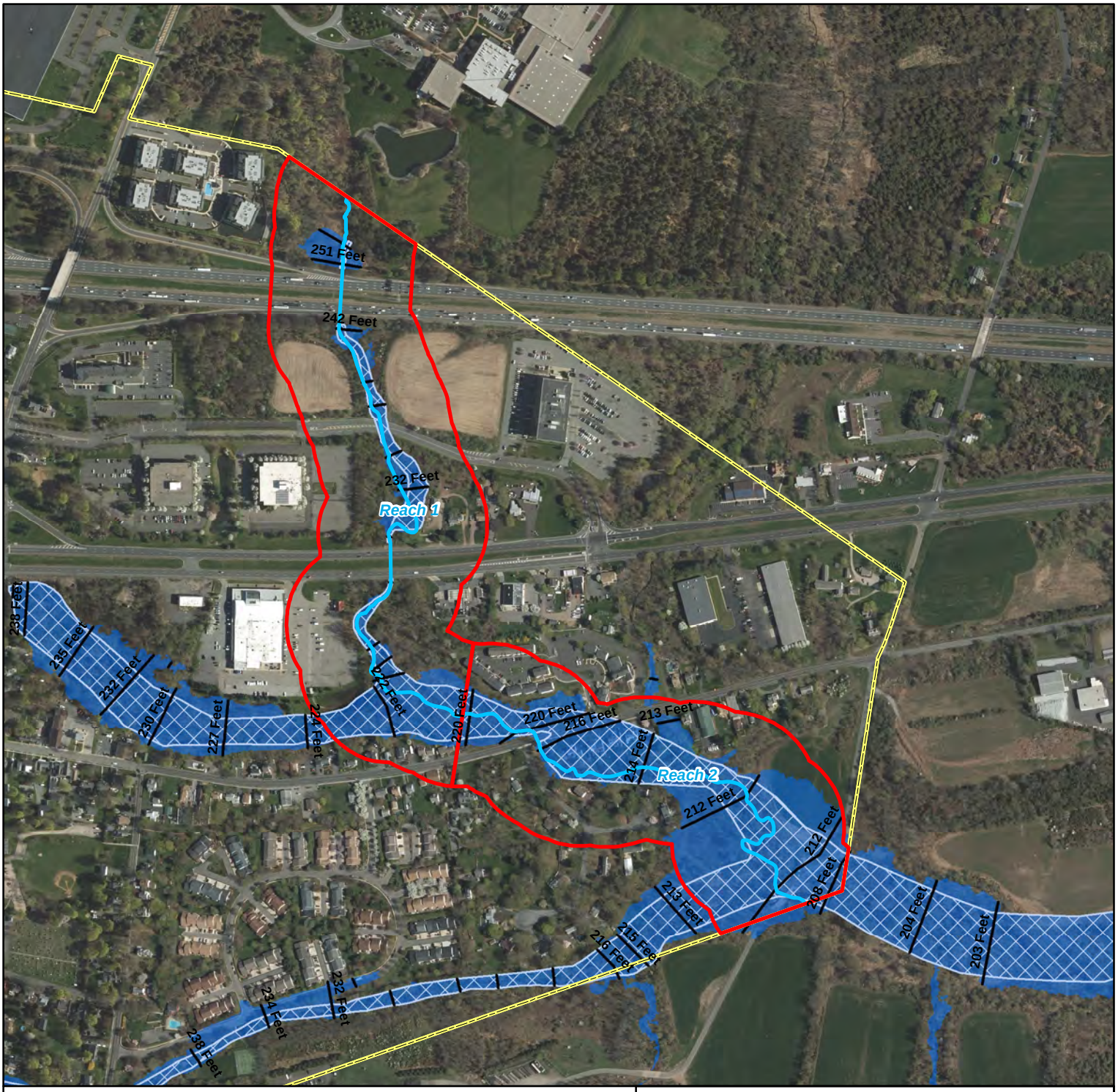
South Branch Rockaway Creek Tributary
Stream Corridor Protection & Restoration Plan
Borough of Lebanon
Hunterdon County, New Jersey

AGE Project # 4562

N

1,000
Feet

AMY GREENE ENVIRONMENTAL
a DAVEY company



Legend

- Stream Reach
- Stream Reach Corridor
- Municipal Boundary
- 100-year FEMA Floodplain
- Floodway
- Base Flood Elevation

Sources:
Federal Emergency Management Agency County Flood Hazard Layer, a compilation of all Digital Flood Insurance Rate Map databases for Hunterdon County, NJ, distributed by FEMA Map Service Center, Washington DC, May 2012. Municipal Boundaries for the State of New Jersey, New Jersey State Plane NAD83, NJ Office of Information Technology (NJOIT), Office of Geographic Information Systems (OGIS), vector digital data, Trenton, NJ, July 2016. New Jersey 2015 High Resolution Orthophotography, NAD83 NJ State Plane Feet, MrSID Tiles, State of New Jersey - Office of Information Technology, Office of Geographic Information Systems (OGIS), Trenton, NJ, February 2016.

Effective FEMA Flood Map

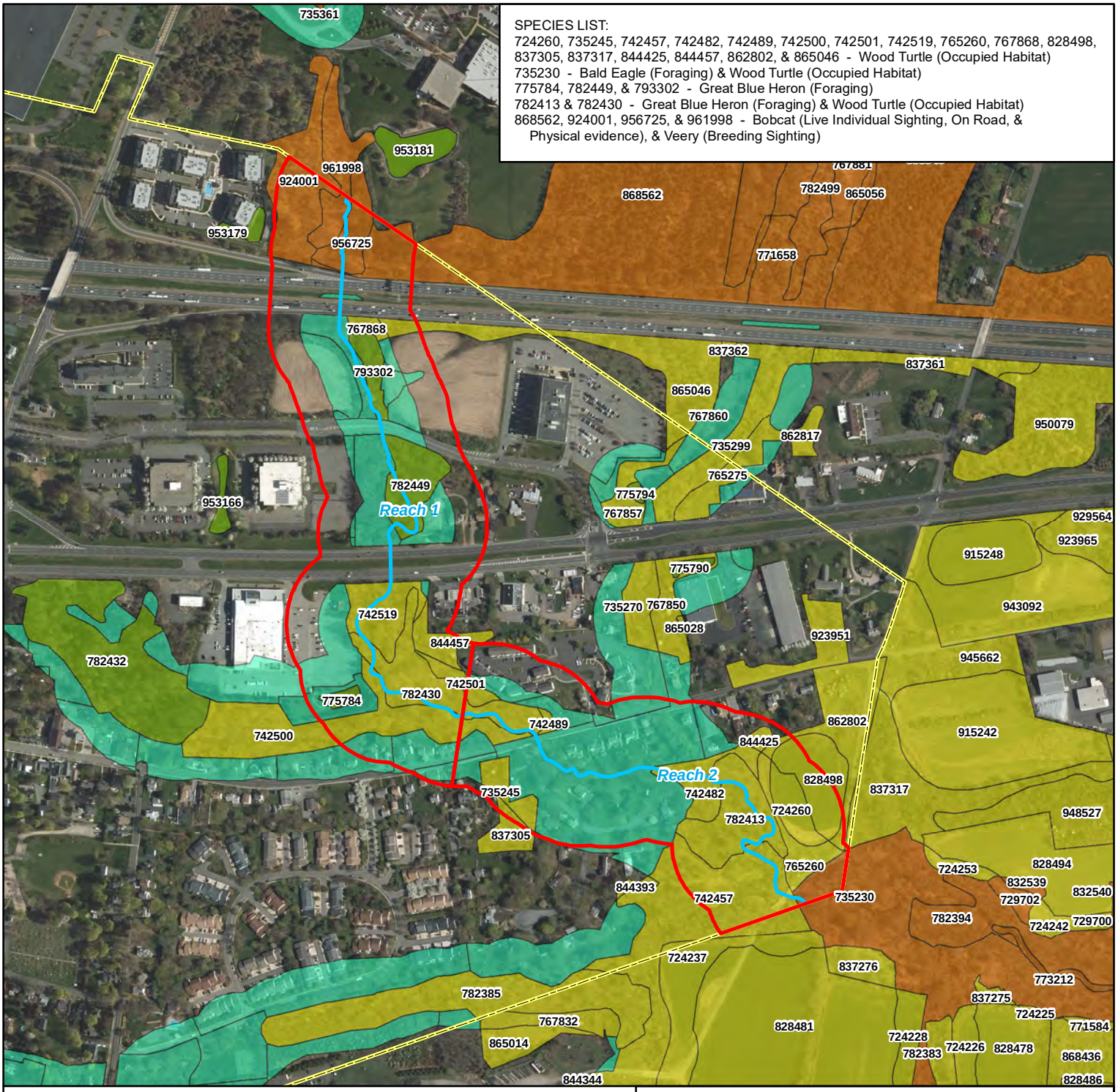
South Branch Rockaway Creek Tributary
Stream Corridor Protection & Restoration Plan
Borough of Lebanon
Hunterdon County, New Jersey

AGE Project # 4562

N

600
Feet

AMY GREENE ENVIRONMENTAL
a DAVEY company



Legend

- Stream Reach
- Stream Reach Corridor
- Municipal Boundary
- Rank 1 Habitat
- Rank 2 Habitat
- Rank 3 Habitat
- Rank 4 Habitat
- Rank 5 Habitat

Sources: NJDEP Species Based Habitat by Landscape Region (Version 3.3), New Jersey Department of Environmental Protection, Division of Fish and Wildlife, Endangered Non-Game Species Program, vector digital data, Division of Information Technology, Bureau of Geographic Information Systems, Trenton, NJ, May 2017. Municipal Boundaries for the State of New Jersey, New Jersey State Plane NAD83, NJ Office of Information Technology (NJOIT), Office of Geographic Information Systems (OGIS), vector digital data, Trenton, NJ, July 2016. New Jersey 2015 High Resolution Orthophotography, NAD83 NJ State Plane Feet, MrSID Tiles, State of New Jersey - Office of Information Technology, Office of Geographic Information Systems (OGIS), Trenton, NJ, February 2016.

NJDEP Landscape Project Map

South Branch Rockaway Creek Tributary
Stream Corridor Protection & Restoration Plan
Borough of Lebanon
Hunterdon County, New Jersey

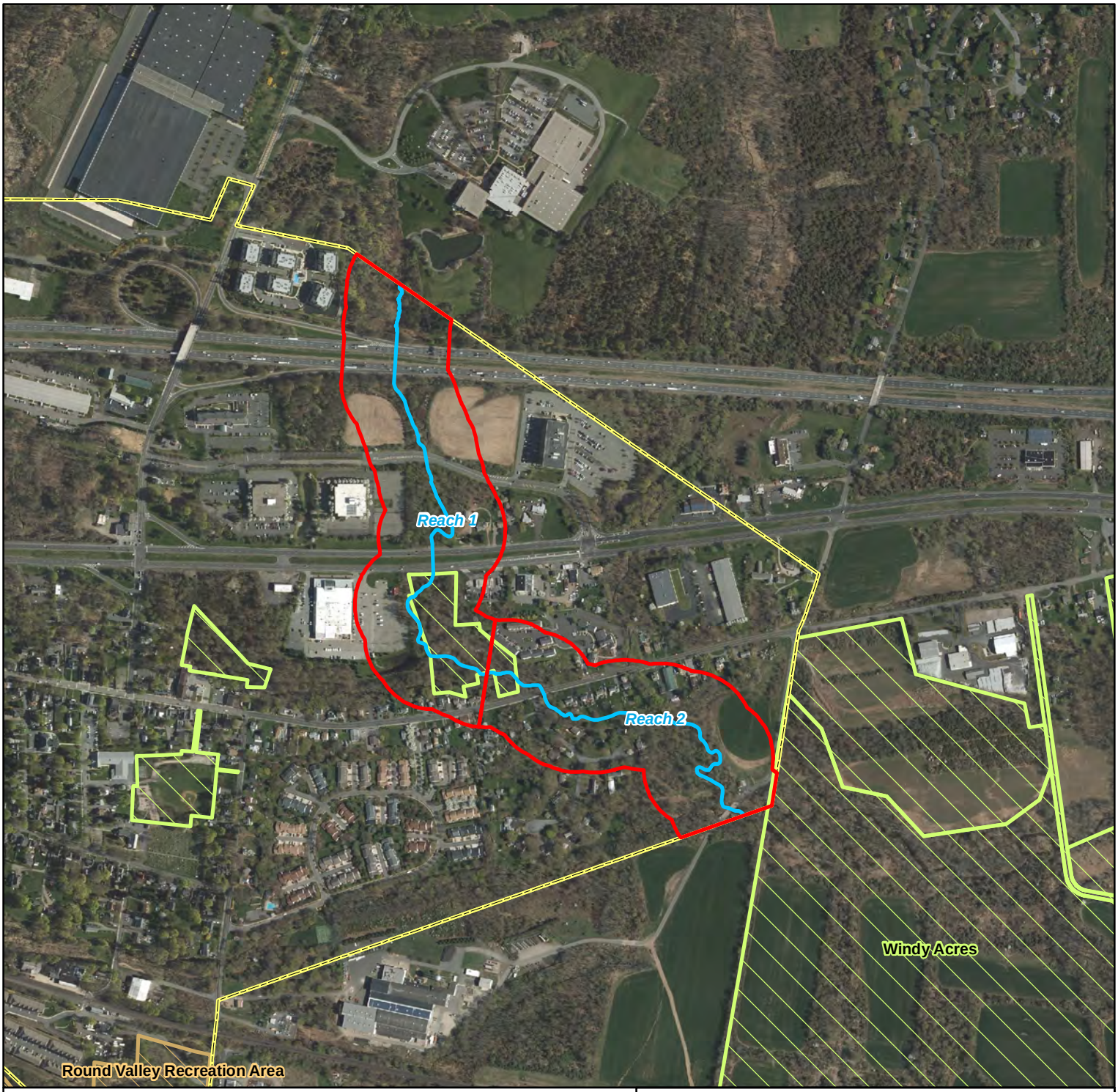
AGE Project # 4562

N

600

Feet

AMY GREENE ENVIRONMENTAL
a DAVEY company



Legend

- Stream Reach
- Stream Reach Corridor
- Municipal Boundary
- Municipal Open Space
- State Open Space

Sources:
State, Local and Nonprofit Open Space of New Jersey, Edition 20190917, NJ Department of Environmental Protection (NJDEP), NJDEP Green Acres Program, New Jersey Office of GIS, Trenton, NJ, September 2019. Municipal Boundaries for the State of New Jersey, New Jersey State Plane NAD83, NJ Office of Information Technology (NJOIT), Office of Geographic Information Systems (OGIS), vector digital data, Trenton, NJ, July 2016. New Jersey 2015 High Resolution Orthophotography, NAD83 NJ State Plane Feet, MrSID Tiles, State of New Jersey - Office of Information Technology, Office of Geographic Information Systems (OGIS), Trenton, NJ, February 2016.

Parks and Open Space Map

South Branch Rockaway Creek Tributary
Stream Corridor Protection & Restoration Plan
Borough of Lebanon
Hunterdon County, New Jersey

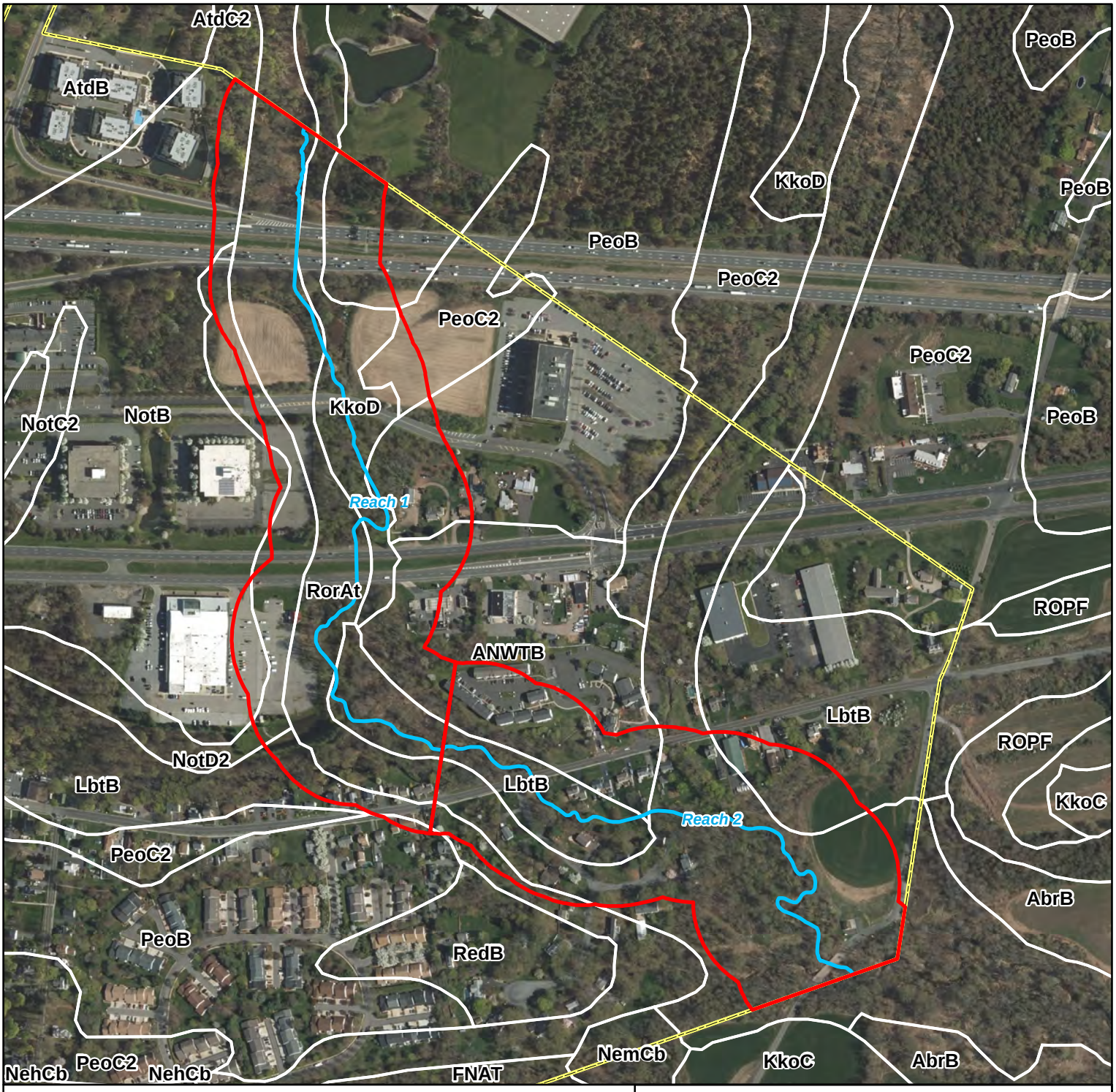
AGE Project # 4562

N

800

Feet

AMY GREENE ENVIRONMENTAL
a DAVEY company



Legend

Stream Reach

Municipal Boundary

Stream Reach Corridor

SOILS LIST:

ANWTB - Annandale and Gladstone gravelly loams, 3 to 8 percent slopes
KkoD - Klinesville channery loam, 12 to 18 percent slopes
LbtB - Lansdowne silt loam, 2 to 6 percent slopes
NotB - Norton loam, 2 to 6 percent slopes
NotD2 - Norton loam, 12 to 18 percent slopes, eroded
PeoB - Penn channery silt loam, 2 to 6 percent slopes
PeoC2 - Penn channery silt loam, 6 to 12 percent slopes, eroded
RorAt - Rowland silt loam, 0 to 2 percent slopes, frequently flooded

Sources: Soil Survey Geographic (SSURGO) Database for Hunterdon County, New Jersey, U.S. Department of Agriculture, Natural Resources Conservation Service, Fort Worth, Texas, January 2014. Municipal Boundaries for the State of New Jersey, New Jersey State Plane NAD83, NJ Office of Information Technology (NJOIT), Office of Geographic Information Systems (OGIS), vector digital data, Trenton, NJ, July 2016. New Jersey 2015 High Resolution Orthophotography, NAD83 NJ State Plane Feet, MrSID Tiles, State of New Jersey - Office of Information Technology, Office of Geographic Information Systems (OGIS), Trenton, NJ, February 2016.

SSURGO Soils Map

South Branch Rockaway Creek Tributary
Stream Corridor Protection & Restoration Plan
Borough of Lebanon
Hunterdon County, New Jersey

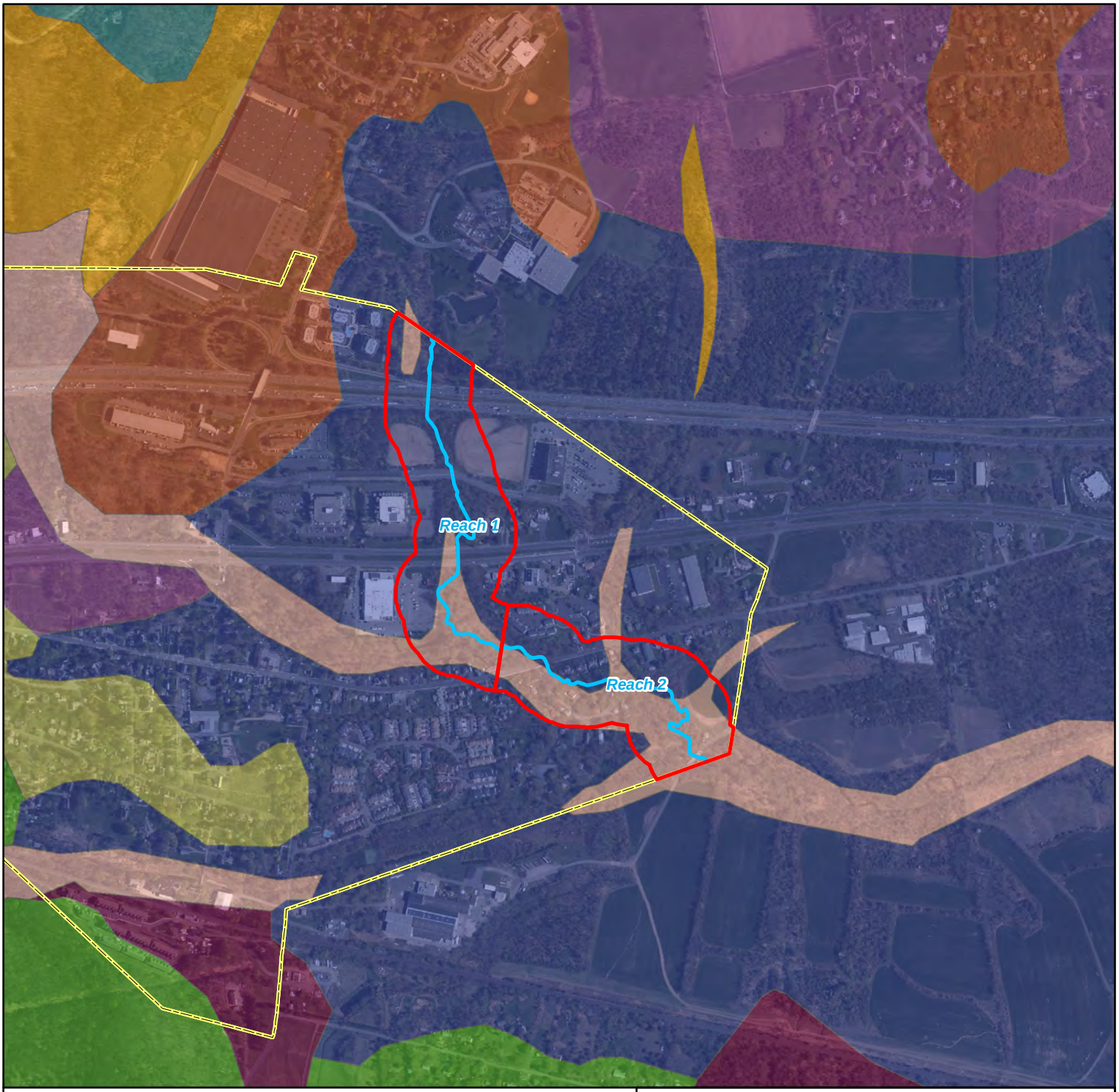
AGE Project # 4562

N

500

Feet

AMY GREENE ENVIRONMENTAL
a DAVEY company



Legend

- Stream Reach
- Stream Reach Corridor
- Municipal Boundary
- Weathered Conglomerate
- Weathered Diabase
- Pre-Illinoian Glaciofluvial Deposits
- Weathered Shale, Mudstone, & Sandstone
- Alluvial Fan Deposits
- Alluvium
- Diabase Colluvium
- Pre-Illinoian Till
- Weathered Gneiss

Sources: Bedrock and Surficial Geology for New Jersey 1:100,000 Scale, New Jersey Department of Environmental Protection (NJDEP), New Jersey Geological Survey (NJGS), Trenton, NJ, June 1999. Municipal Boundaries for the State of New Jersey, New Jersey State Plane NAD83, NJ Office of Information Technology (NJOIT), Office of Geographic Information Systems (OGIS), vector digital data, Trenton, NJ, July 2016. New Jersey 2015 High Resolution Orthophotography, NAD83 NJ State Plane Feet, MrSID Tiles, State of New Jersey - Office of Information Technology, Office of Geographic Information Systems (OGIS), Trenton, NJ, February 2016.

Surficial Geology Map

South Branch Rockaway Creek Tributary
Stream Corridor Protection & Restoration Plan
Borough of Lebanon
Hunterdon County, New Jersey

AGE Project # 4562

N

1,000
Feet

AMY GREENE ENVIRONMENTAL
a DAVEY company

Appendix D Phase 2 Data Sheets

Highlands Functional Value Assessment Methodology

Phase 2 Reach Assessment - Data Sheet

Date: 05/27/2020

Assessors: Autumn Thomas
Dave Kunz

Weather: 64F, cloudy, high 78F

Current Flow Conditions: Base

Recent Precipitation: 1-7 days

Recent Flood Event: 06/18/2019

Step

4.0 Channel Modifiers

4.1 Dams / Weirs

Tally:	1
Height:	10 ft
WSEL Change:	20 ft
Length of Impoundment:	6 ft
Width of Impoundment:	2.5 ft
Width of DS Channel:	15 ft
Active Withdrawal:	No

4.2 Beaver Dams

Tally:	0
Length of Reach Affected:	--
Notes:	--

4.3 Bridges / Culverts

Tally:	4
Signs of Constriction US:	sediment deposition, debris accumulation, scour
Scour DS:	scour pools
Width of Crossing:	1) 3ft, 2) 10ft, 3) 2.5ft, 4) 4.5ft
Width of DS Channel:	1) 25ft, 2) 2ft. 3) 15ft, 4) 4.5ft

4.4 Stormwater Inputs

Type:	stormwater; steel & cement pipes (3)
Pipe Diameter:	1) 3ft, 2) 4 inch, 3) 2ft.

Highlands Functional Value Assessment Methodology

Phase 2 Reach Assessment - Data Sheet

5 Channel Dimensions

5.1	Bankfull Width	10 ft
5.2	Bankfull Max Depth	1.1 ft
5.3	Bankfull Mean Depth	0.9 ft
5.4	Lowest Bank Height	1.4 ft
5.5	Floodprone Width	26 ft
5.6	Floodplain Encroachment Height	3.7 ft
5.7	Width-Depth Ratio	Low - A/B Channels (11)
5.8	Entrenchment Ratio	Minimally entrenched (2.6)
5.9	Bank Height Ratio	Minor Incision, Potentially Unstable
5.10	Floodplain Encroachment Ratio	High Encroachment, Highly Unstable
5.11	Sinuosity	Low
5.12	Existing Stream Type	C/E Single Channel
	Rosgen Stream Type	E Single Channnel
	Dominant Particle Size	4 (gravel)
	Channel Bed Morphology	C4 Pool-Riffle

Highlands Functional Value Assessment Methodology

Phase 2 Reach Assessment - Data Sheet

6 Channel Features / Condition

6.1 Bedrock Grade Controls

Tally:	0
Height:	--
Length:	--

6.2 Head-cuts

Tally:	0
Notes:	--

6.3 Riffle / Step Condition

Tally:	23
Form:	Moderately formed
Complete:	18 Complete, 3 Incomplete
Stablility:	Stable

6.4 Pool Condition

< 1 FT:	9
> 1 FT:	10
< Wbf:	12
= Wbf:	7
Notes:	10 were filled w/sediment finer than dominant particle size. 2 were absent of cover, 3 had cover as LWD, 5 had cover as debris jam, and 9 had cover as overhanging banks.

6.5 Sediment Bars

Point:	7
Lateral:	10
Diagonal:	1
Mid-Channel:	5
Islands:	5
Deltas:	1

6.6 Bed Substrate Composition

Riffle Particle Size	30mm
Embeddedness	46%
Average Largest Particle	346mm
Riffle Stability Index	21%

6.7 Vegetative Material

CPOM:	42 present/abundant, 16 absent
LWD < Wbf:	8
LWD > Wbf:	18
Debris Jams < Wbf:	15
Debris Jams > Wbf:	17

Highlands Functional Value Assessment Methodology

Phase 2 Reach Assessment - Data Sheet

7 Stream Banks		At x-section
7.1 Typical Bank Slope		30-50%, 3:1 - 2:1
7.2 Bank Materials		Silt/clay
	Interpretation	Moderate erodibility
7.3 Bank Vegetation Coverage		At x-section
	Canopy:	10%
	Understory:	20%
	Groundcover:	100%
	Canopy	
	Non-native invasives:	8%
	Coniferous Trees:	0%
	Deciduous Trees:	17%
	Understory	
	Non-native invasives:	8%
	Shrubs:	12%
	Saplings:	4%
	Groundcover	
	Non-native invasives:	8%
	Grasses:	4%
	Forbs:	79%
7.4 Cross Channel Shading		Closed @ x-section
7.5 Bank Erosion		Throughout Reach
	Length:	~95' on LB, ~65' on RB
7.6 Bank Armoring / Channelization		Throughout Reach
	Length:	0
	Type:	N/a

Highlands Functional Value Assessment Methodology

Phase 2 Reach Assessment - Data Sheet

8 Riparian Area / Floodplain — Right Bank

8.1 Buffer Width	
Class:	Wide (300-150')
8.2 Riparian Community - PSI	
Level 1 Score:	Low (53%)
Plant Survey	
Total Species #:	35
Native Species #:	26
Total Mean Coefficient:	2.6
PSI:	13.3
8.3 Adjacent Wetlands	Minimal, >25% of reach
8.4 Tributaries / Seeps / Springs	Infrequent
8.5 Floodplain Connectivity	Extensive
8.6 Flood Chutes, Meander Cutoffs, Braiding and Channel Avulsions	Absent

9 Public Use Opportunities

Public Uses			
Landownership	Compatible with Public Use: (Y/N) No		
	Appropriate for Reach (Y/N)	Currently Supported (Y/N)	Potential to be supported in the future (Y/N)
Walking / Hiking	Yes	No	Yes
Picnicking	No	No	No
Wading / Swimming	No	No	No
Fishing	No	No	No
Hunting	No	No	No
Paddling	No	No	No
Motor-boating	No	No	No
Other	No	No	No
Sum:	1	0	1
% Currently Supported:	0		
% Potentially Supporting:	12		

10 Additional Considerations

Upstream / Downstream	Large corporate campus upstream
Reach / Sub-Reach Division	Reach-01 is a tributary to Reach-02. See Datasheets for Reach-02, South Branch Rockaway Creek tributary.

Highlands Functional Value Assessment Methodology

Phase 2 Reach Assessment - Data Sheet

Date: 05/27/2020

Assessors: Autumn Thomas
Dave Kunz

Weather: 64F, cloudy, high 78F

Current Flow Conditions: Base

Recent Precipitation: 1-7 days

Recent Flood Event: 06/18/2019

Step

4.0 Channel Modifiers

4.1 Dams / Weirs

Tally:	0
Height:	--
WSEL Change:	--
Length of Impoundment:	--
Width of Impoundment:	--
Width of DS Channel:	--
Active Withdrawal:	--

4.2 Beaver Dams

Tally:	0
Length of Reach Affected:	--
Notes:	--

4.3 Bridges / Culverts

Tally:	2
Signs of Constriction US:	heavy scour on right bank approaching bridge
Scour DS:	scour pool, mid-channel sediment deposition
Width of Crossing:	1) 5ft, 2) 3ft.
Width of DS Channel:	1) 25ft, 2) 25ft.

4.4 Stormwater Inputs

Type:	stormwater; PVC (1) & cement pipes (2)
Pipe Diameter:	1) 18inch, 2) 4 inch, 3) 2ft.

Highlands Functional Value Assessment Methodology

Phase 2 Reach Assessment - Data Sheet

5 Channel Dimensions

5.1	Bankfull Width	17 ft
5.2	Bankfull Max Depth	0.3 ft
5.3	Bankfull Mean Depth	0.2 ft
5.4	Lowest Bank Height	0.6 ft
5.5	Floodprone Width	22 ft
5.6	Floodplain Encroachment Height	3 ft
5.7	Width-Depth Ratio	High - C/B Channels (85)
5.8	Entrenchment Ratio	Highly Entrenched (1.3)
5.9	Bank Height Ratio	High Incision, Highly Unstable
5.10	Floodplain Encroachment Ratio	High Encroachment, Highly Unstable
5.11	Sinuosity	Low
5.12	Existing Stream Type	C/E Single Channel
	Rosgen Stream Type	F Single Channnel
	Dominant Particle Size	4 (gravel)
	Channel Bed Morphology	C4 Pool-Riffle

Highlands Functional Value Assessment Methodology

Phase 2 Reach Assessment - Data Sheet

6 Channel Features / Condition

6.1 Bedrock Grade Controls

Tally:	0
Height:	--
Length:	--

6.2 Head-cuts

Tally:	2
Notes:	Exposed sewer manhole north of Main Street bridge crossing.

6.3 Riffle / Step Condition

Tally:	15
Form:	Moderately formed
Complete:	11 Complete, 4 Incomplete
Stablility:	Stable

6.4 Pool Condition

< 1 FT:	0
> 1 FT:	18
< Wbf:	16
= Wbf:	2
Notes:	12 had sediment finer than dominant particle size. 1 was absent of cover, 7 had cover as overhanging vegetation, 7 had cover as LWD, 7 had cover as debris jams, and 9 had cover as overhanging banks.

6.5 Sediment Bars

Point:	4
Lateral:	14
Diagonal:	3
Mid-Channel:	4
Islands:	3
Deltas:	0

6.6 Bed Substrate Composition

Riffle Particle Size	44 mm
Embeddedness	36%
Average Largest Particle	173 mm
Riffle Stability Index	36%

6.7 Vegetative Material

CPOM:	10 present, 10 abundant, 7 absent
LWD < Wbf:	7
LWD > Wbf:	11
Debris Jams < Wbf:	6
Debris Jams > Wbf:	3

Highlands Functional Value Assessment Methodology

Phase 2 Reach Assessment - Data Sheet

7 Stream Banks		At x-section
7.1 Typical Bank Slope		30-50%, 3:1 - 2:1
7.2 Bank Materials		Silt/clay
	Interpretation	Moderate erodibility
7.3 Bank Vegetation Coverage		At x-section
	Canopy:	0%
	Understory:	50%
	Groundcover:	80%
	Canopy	
	Non-native invasives:	--
	Coniferous Trees:	--
	Deciduous Trees:	--
	Understory	
	Non-native invasives:	40%
	Shrubs:	90%
	Saplings:	10%
	Groundcover	
	Non-native invasives:	12.5%
	Grasses:	87.5%
	Forbs:	12.5%
7.4 Cross Channel Shading		Open @ x-section
7.5 Bank Erosion		Throughout Reach
	Length:	~113' on LB, ~114' on RB
7.6 Bank Armoring / Channelization		Throughout Reach
	Length:	~20' on LB
	Type:	rocks

Highlands Functional Value Assessment Methodology

Phase 2 Reach Assessment - Data Sheet

8 Riparian Area / Floodplain — Right Bank

8.1 Buffer Width — Class:	Intermediate (75-150')
8.2 Riparian Community - PSI	
Level 1 Score:	Low (68%)
Plant Survey	
Total Species #:	32
Native Species #:	20
Total Mean Coefficient:	2.3
PSI:	10.3
8.3 Adjacent Wetlands	Minimal, >25% of reach
8.4 Tributaries / Seeps / Springs	Infrequent
8.5 Floodplain Connectivity	Extensive
8.6 Flood Chutes, Meander Cutoffs, Braiding and Channel Avulsions	Present

9 Public Use Opportunities

Public Uses			
Landownership	Compatible with Public Use: (Y/N) No		
	Appropriate for Reach (Y/N)	Currently Supported (Y/N)	Potential to be supported in the future (Y/N)
Walking / Hiking	No	No	No
Picnicking	No	No	No
Wading / Swimming	No	No	No
Fishing	No	No	No
Hunting	No	No	No
Paddling	No	No	No
Motor-boating	No	No	No
Other	No	No	No
Sum:	0	0	0
% Currently Supported:	0		
% Potentially Supporting:	0		

10 Additional Considerations

Upstream / Downstream	Reach-01 is a tributary to Reach-02. See Datasheets for Reach-01, SB Rockaway Ck
Reach / Sub-Reach Division	tributary. Downstream land use is dominated by agricultural fields. Over 50% of reach is through residential yards.

Appendix E Scoring Sheets

Functional Value Assessment Methodology: Reach ID Form **FORM 1-ID**

Stream Name:	South Branch Rockaway Creek tributary	Reach ID:	South Branch Rockaway Creek tributary-01	
Location:	East of Presidential Place apartments at township line south to north side of Main St @ Sloan St	Date:	05/27/2020	
		Town:	Lebanon Borough	
Observers:	Autumn Thomas, Dave Kunz	Elevation:	216-250 ft.	
			Upstream Endpoint	Downstream Endpoint
Organization/Agency:	Lebanon Borough/NJ Highlands Council	Latitude (N/S):	40.648205N	40.642120N
USGS Map Name:	Califon NJ	Longitude (E/W):	74.829877W	74.828072W
Weather:	64F, cloudy, high 78F	Drainage Area:	165 acres	
Rain Storm w/in 7 days:	Yes	Segment Length:	2,849 feet	

Phase 1 Watershed Assessment Scoring Sheet

FORM 2-WA

Stream Name: South Branch Rockaway Creek tributary

Reach ID: South Branch Rockaway Creek tributary-01

Watershed / Corridor Parameter	Condition Category: Optimal	Good	Fair	Poor
Geology	☐ Bedrock has significant stabilizing influence. ☐ Unconsolidated glacial till is minimal or absent.	☐ Bedrock has some stabilizing influence. ☐ Unconsolidated glacial till is present.	☑ Bedrock has minimal influence. ☑ Unconsolidated glacial till is common.	☐ Bedrock has little or no stabilizing influence. ☐ Unconsolidated glacial till predominates.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | **6**	5 | 4 | 3 | 2 | 1
Valley Slopes	☐ Insignificant Steep Slope Impact Rating.	☑ Low Steep Slope Impact Rating.	☐ High Steep Slope Impact Rating.	☐ High Steep Slope Impact Rating.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | **13** | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1
Soil Runoff	☐ Low Soil Runoff Impact Rating.	☐ Moderate Soil Runoff Impact Rating.	☑ High Soil Runoff Impact Rating.	☐ Very High Soil Runoff Impact Rating.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | **8** | 7 | 6	5 | 4 | 3 | 2 | 1
Soil Erodibility	☐ Low Soil Erodibility Impact Rating.	☐ Moderate Soil Erodibility Impact Rating.	☐ High Soil Erodibility Impact Rating.	☑ Very High Soil Erodibility Impact Rating.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | **3** | 2 | 1
Land Use / Land Cover	☐ Insignificant Land Use / Land Cover Impact Rating. ☐ Insignificant Impervious Cover Impact Rating.	☐ Low Land Use / Land Cover Impact Rating. ☐ Low Impervious Cover Impact Rating.	☐ Moderate Land Use / Land Cover Impact Rating. ☑ Moderate Impervious Cover Impact Rating.	☑ High Land Use / Land Cover Impact Rating. ☐ High Impervious Cover Impact Rating.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | **6**	5 | 4 | 3 | 2 | 1

Watershed Score: **0.36**

(Average the scores above; divide by 20)

Condition: **FAIR**

Score	Condition
0.85 - 1.0	Optimal
0.65 - 0.84	Good
0.35 - 0.64	Fair
0.00 - 0.34	Poor

Channel Integrity Assessment for Pool-Riffle Reaches **FORM 3-CH2**

Stream Name: South Branch Rockaway Creek tributary Reach ID: South Branch Rockaway Creek tributary-01

For Reaches in Minimally Confined to Broad Valleys (Valley Confinement Ratio ≥ 4)

Primarily pool-riffle streams; C/E channels; some B channels.

	Condition Category			
Related Parameter	**Optimal**	**Good**	**Fair**	**Poor**
Phase 1 Watershed (From FORM 2-WA)	□ Optimal Score.	□ Good Score.	☑ Fair Score.	□ Poor Score.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1
General Instability				
Dams / Weirs	□ Dams / weirs are absent. □ No evidence of historic dams.	☑ A weir present that creates limited impounded water that is not wider or deeper than the normal channel. ☑ Little evidence of a historic dam.	□ Dam / weirs present. □ Impoundment is wider than the typical channel and contains some sediment. □ Evidence of historic dam that may have created an elevated floodplain.	□ Dam(s) create deep and wide impoundment that traps sediment. □ Impoundment is >2x normal channel width and depth and contains fine sediment. □ Clear evidence of historic dam that has left an elevated floodplain.
Beaver Dams	□ Signs of instability are directly related to Beaver Dams.	□ Signs of instability are related to Beaver Dams.	□ Signs of instability are NOT related to Beaver Dams.	☑ Signs of instability are NOT related to Beaver Dams.
Bridges / Culverts	□ Few or no bridges / culvert crossings [< 2 / mile]. □ Typical crossing width > channel width.	☑ Some bridges / culvert crossings [2 - 3 / mile]. □ Typical crossing width > channel width.	□ Bridges / culvert crossings are common [ave. 4 - 6 / mile]. ☑ Typical crossing width ≤ channel width.	□ Many bridges / culvert crossings [> 6 / mile]. □ Typical crossing width < channel width.
Stormwater Inputs	□ No stormwater inputs observed.	☑ Few stormwater inputs. [< 10 / mile]	□ Some stormwater inputs [10 - 25 / mile].	□ Many stormwater inputs [> 25 / mile].
Floodplain Encroachment Ratio	□ No Floodplain Encroachment concentrating downstream flows. □ 1.0 < Floodplain Encroachment Ratio < 1.2	□ Minor Floodplain Encroachment concentrating downstream flows. □ 1.2 ≤ Floodplain Encroachment Ratio < 1.4	□ Moderate Floodplain Encroachment concentrating downstream flows. □ 1.4 ≤ Floodplain Encroachment Ratio < 2.0	☑ Major Floodplain Encroachment concentrating downstream flows. ☑ Floodplain Encroachment Ratio > 2.0
Bank Erosion	☑ Eroded banks extend < 10% of reach.	□ Eroded banks extend 10% < 25% of reach.	□ Eroded banks extend 25% < 50% of reach.	□ Eroded banks extend ≥ 50% of reach.
Bank Armoring / Channel Straightening	☑ No evidence of bank armoring / channel straightening.	□ Bank armoring extends 10% < 25% of reach. □ Channel straightening < 10% of reach.	□ Bank armoring extends 25% < 50% of reach. □ Channel straightening < 25% of reach.	□ Bank armoring extends ≥ 50% of reach. □ Channel straightening ≥ 25% of reach.
General Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1

Channel Integrity Assessment for Pool-Riffle Reaches — FORM 3-CH2

Stream Name: South Branch Rockaway Creek tributary — Reach ID: South Branch Rockaway Creek tributary-01

Degradation	Optimal	Good	Fair	Poor
Bridges / Culverts	□ No bed and bank erosion associated with bridges/culverts. □ Bridge foundations are not exposed; culverts are not perched.	☑ Adjacent bed and bank erosion are minor and confined to immediately upstream or downstream of crossings. □ Bridge foundations are not exposed; culverts are not perched.	□ Adjacent bed and bank erosion is moderate and typical. ☑ Some bridge foundations are exposed; some culverts are perched.	□ Adjacent bed and bank erosion is severe and extensive. □ Most bridge foundations are exposed or undermined; most culverts are perched.
Stormwater Inputs		□ Stormwater outfalls do not appear to be perched above the streambed.	☑ Stormwater outfalls are perched above the streambed. ☑ Some stormwater ditches have headcuts.	□ Stormwater outfalls are perched above the streambed. □ Headwalls have been undermined and are collapsing into the channel. □ Stormwater ditches have headcuts.
Bank Height Ratio	□ 1.0 ≤ Bank Height Ratio < 1.1 **and** □ Entrenchment Ratio > 2.0	□ 1.1 ≤ Bank Height Ratio < 1.3 **and** □ Entrenchment Ratio > 2.0	☑ 1.3 ≤ Bank Height Ratio < 1.5 **and** ☑ Entrenchment Ratio > 2.0	□ Bank Height Ratio ≥ 1.5 **or** □ Entrenchment Ratio ≤ 2.0
Dominant Particle Size Class	□ Stream substrate is compact and resistant to erosion. □ Dominant particle size class is cobble, boulder or bedrock.	☑ Stream substrate is compact and resistant to erosion. □ Dominant particle size class is cobble, boulder or bedrock.	□ Stream substrate is not compact and prone to erosion. ☑ Dominant particle size class is fine gravel or sand.	□ Stream substrate is not compact and prone to erosion. □ Dominant particle size class is fine gravel or sand.
Bedrock Grade Controls	□ Bedrock grade controls are present, preventing further channel degradation.	□ Bedrock grade controls are present, preventing further channel degradation.	□ Bedrock grade controls are absent, allowing channel degradation.	☑ Bedrock grade controls are absent, allowing channel degradation.
Headcuts	□ No headcuts. ☑ Substrates are compact and stable. ☑ No signs of historic incision.	☑ No headcuts. □ Signs of historic incision: sharp changes of slope / steep riffles.	□ Headcut seen in the main channel and some tributaries. □ Signs of recent incision: sharp changes in slope / steep riffles.	□ Multiple headcuts in the main channel and tributaries. □ Signs of active incision: substrates are loose and actively eroding at headcuts.
Bank Slope	□ Bank slopes are typically low.	☑ Bank slopes are typically moderate.	□ Banks are typically steep or vertical.	□ Banks are typically vertical.
Bank Materials	□ No subsoil layers exposed in the banks.	☑ Few banks with exposed subsoil layers.	□ Subsoil layers clearly exposed in banks.	□ Former streambed materials clearly exposed in banks.
Meander Cutoffs, Channel Avulsions	☑ No evidence of historic or recent meander cutoffs or channel avulsions.	□ Some evidence of historic, not recent, meander cutoffs or channel avulsions.	□ Evidence of recent meander cutoffs or channel avulsions.	□ Evidence of recent and/or impending meander cutoffs or channel avulsions.
Degradation Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1

Channel Integrity Assessment for Pool-Riffle Reaches **FORM 3-CH2**

Stream Name: South Branch Rockaway Creek tributary Reach ID: South Branch Rockaway Creek tributary-01

Aggradation	Optimal	Good	Fair	Poor
Bridges / Culverts	□ No sediment deposition upstream of crossings. ☑ No sediment deposition downstream of crossings. □ Bridge / Culvert openings are not blocked by sediment.	□ Some sediment deposition upstream of crossings. □ Some sediment deposition downstream of crossings. ☑ Bridge / Culvert openings are not blocked by sediment.	☑ Moderate sediment deposition upstream of crossings. □ Moderate sediment deposition downstream of crossings. □ Bridge / Culvert openings are partially blocked by sediment.	□ Significant sediment deposition upstream of crossings. □ Significant sediment deposition downstream of crossings. □ Bridge / Culvert openings are buried in sediment.
Stormwater Inputs	□ No stormwater inputs observed.	☑ Minor sediment deposition at stormwater outfalls.	□ Moderate sediment deposition at stormwater outfalls. □ Multiple stormwater outfalls are partially buried in sediment. □ Multiple stormwater ditches are partially filled with sediment finer than bed.	□ Extensive sediment deposition at stormwater outfalls. □ Stormwater outfalls are partially buried in sediment. □ Stormwater ditches are partially filled with sediment finer than bed.
Channel Dimensions	Low Width-Depth Ratio ☑ ≤ 20 for C or B channels □ ≤ 10 for E channels	Low to Moderate Width-Depth Ratio □ >20 ≤ 30 for C or B channels □ >10 ≤ 12 for E channels	Moderate to High Width-Depth Ratio □ >30 ≤ 40 for C or B channels □ >12 ≤ 20 for E channels	High Width-Depth Ratio □ > 40 for C or B channels □ > 20 for E channels
Pool-Riffle Condition	□ All Pool-Riffles are well formed, complete and stable. □ < 10% pools are < 2 FT deep. □ No pools are filled with sediment.	☑ Pool-Riffles are moderately well formed, complete and stable. 10% < 25% pools are: □ < 2 FT deep. □ filled with sediment finer than dominant particle size.	□ Pool-Riffles are not clearly formed creating plane bed features. 25% < 50% pools are: ☑ < 2 FT deep. □ filled with sediment finer than dominant particle size.	□ Pool-Riffles are not clearly formed creating plane bed features. > 50% pools are: □ < 2 FT deep. ☑ filled with sediment finer than dominant particle size.

Channel Integrity Assessment for Pool-Riffle Reaches **FORM 3-CH2**

Stream Name: South Branch Rockaway Creek tributary Reach ID: South Branch Rockaway Creek tributary-01

Sediment Bars	□ Few or no lateral, diagonal, mid-channel bars. □ Lateral bars and deltas in typical positions. □ Sediment bars less than bankfull height.	□ Some lateral, diagonal, mid-channel bars. ☑ Lateral bars and deltas in typical positions. □ Sediment bars composed of sediment similar to dominant substrate. ☑ Sediment bars at or below bankfull height.	□ Multiple lateral, diagonal, mid-channel bars, or deltas. □ Sediment bars composed of sediment different than dominant substrate. □ Sediment bars are greater than bankfull height and/or longer than a channel width.	☑ Many lateral, diagonal, mid-channel bars, or deltas. ☑ Sediment bars composed of sediment finer than dominant substrate. □ Sediment bars above bankfull elevation and/or multiple channel widths in length. □ Sediment bars split flow in multiple paths.
Embeddedness	□ Coarse gravels, cobbles, boulders are not embedded in finer sediments. □ Embeddedness < 25%.	□ Coarse gravels, cobbles, boulders are not embedded in finer sediments. ☑ 25% < Embeddedness < 50%.	☑ Coarse gravels, cobbles, boulders are embedded in finer sediments. □ 50% ≤ Embeddedness < 75%.	□ Coarse gravels, cobbles, boulders are heavily embedded in finer sediments. □ Embeddedness ≥ 75%.
Braiding	□ No channel braiding.	☑ No channel braiding.	□ Channel braiding present.	□ Channel braiding extensive throughout reach.
Aggradation Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1

Channel Integrity Assessment for Pool-Riffle Reaches **FORM 3-CH2**

Stream Name: South Branch Rockaway Creek tributary Reach ID: South Branch Rockaway Creek tributary-01

Widening	Optimal	Good	Fair	Poor
Stormwater Inputs	□ No stormwater inputs observed.	☑ Stormwater outfalls do not appear to extend out from the banks.	□ Stormwater outfalls are extending out from the banks.	□ Stormwater outfalls are extending out from the banks. □ Headwalls have been undermined and are collapsing into the channel.
Width-Depth Ratio	Low Width-Depth Ratio ☑ < 20 for C or B channels □ < 10 for E channels	Low to Moderate Width-Depth Ratio □ >20 ≤ 30 for C or B channels □ >10 ≤ 12 for E channels	Moderate to High Width-Depth Ratio □ >30 ≤ 40 for C or B channels □ >12 ≤ 20 for E channels	Moderate to High Width-Depth Ratio □ > 40 for C or B channels □ > 20 for E channels
Sediment Bars	□ Few or no lateral, diagonal, mid-channel bars. □ Lateral bars and deltas in typical positions. □ Sediment bars below bankfull height.	□ Some lateral, diagonal, mid-channel bars. ☑ Lateral bars and deltas in typical positions. □ Sediment bars composed of sediment similar to dominant substrate. ☑ Sediment bars at or below bankfull height.	□ Multiple lateral, diagonal, mid-channel bars, or deltas. □ Sediment bars composed of sediment different than dominant substrate. □ Sediment bars are greater than bankfull height and/or longer than a channel width.	☑ Many lateral, diagonal, mid-channel bars, or deltas. ☑ Sediment bars composed of sediment finer than dominant substrate. □ Sediment bars above bankfull elevation and/or multiple channel widths in length. □ Sediment bars split flow in multiple paths.
Bank Materials	□ Bank materials have low or very low erodibility. □ Bank materials are cohesive.	☑ Bank materials have low or moderate erodibility. ☑ Bank materials are cohesive.	□ Bank materials have moderate or high erodibility. □ Bank materials are non-cohesive.	□ Bank materials have high erodibility. □ Bank materials are non-cohesive.
Bank Erosion	□ No erosion on opposing banks; overhanging banks are stable. □ Occasional leaning trees and no recently exposed roots.	□ Minimal erosion at the base of opposing banks; overhanging banks are stable. ☑ Some leaning trees and few recently exposed roots.	☑ Moderate erosion at the base of both banks creating unstable overhangs. □ Many leaning trees, recently exposed roots and/or fracture lines.	□ Continuous, extensive erosion at the base of both banks creating unstable overhangs. □ Continuous leaning trees, recently exposed roots and/or fracture lines.
Widening Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1

Channel Integrity Assessment for Pool-Riffle Reaches

FORM 3-CH2

Stream Name: South Branch Rockaway Creek tributary

Reach ID: South Branch Rockaway Creek tributary-01

Re-alignment	Optimal	Good	Fair	Poor
Bridges / Culverts	□ Channel is aligned with bridge / culvert openings.	□ Channel is aligned with bridge / culvert openings.	☑ Channel is askew to bridge / culvert openings.	□ Channel makes tight meander at bridge / culvert openings.
Sinuosity	□ No change in sinuosity.	☑ May accompany minor change in sinuosity.	□ May accompany moderate change in sinuosity.	□ May accompany major change in sinuosity.
Bank Erosion	□ Typical bank erosion on outside meander bends. □ Overhangs are stable. No slumping. □ Few leaning trees, no recently exposed roots. No fracture lines.	☑ Typical bank erosion on outside meander bends. ☑ Overhangs are stable. Little slumping. ☑ Few leaning trees, recently exposed roots. No fracture lines.	□ Moderate to high bank erosion on many outside meander bends creating unstable overhangs. □ Multiple leaning trees, recently exposed roots and/or fracture lines.	□ Extensive, severe bank erosion on outside meander bends creating unstable overhangs and/or slumping. □ Numerous leaning trees, recently exposed roots and/or fracture
Flood chutes, Meander Cutoffs, Braiding, Channel Avulsions	□ Limited potential for channel avulsions. ☑ No evidence of historic or recent channel avulsions.	☑ Limited potential for channel avulsions. □ 10% < 25% of reach exhibits historic or recent channel avulsions.	□ Flood chutes, meander cutoffs, and braiding potentially leading to channel avulsions. □ 25% < 50% of reach exhibits historic or recent channel	□ Flood chutes, meander cutoffs, braiding causing channel avulsions. □ ≥ 50% of reach exhibits historic or recent channel avulsions.
Re-alignment Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1

Watershed Score: 8

General Instability Score: 11

Degradation Score: 10

Aggradation Score: 13

Widening Score: 13

Re-alignment Score: 14

Score	Condition
0.85 - 1.0	Optimal
0.65 - 0.84	Good
0.35 - 0.64	Fair
0.00 - 0.34	Poor

Channel Integrity Score: 0.57

(Average the scores above; divide by 20)

Channel Integrity Condition: FAIR

Channel Sensitivity: VERY HIGH

(Refer to Item 11.1.4 from Phase 2)

Habitat Assessment for Pool-Riffle Reaches

FORM 4-HA2

Stream Name: South Branch Rockaway Creek tributary

Reach ID: South Branch Rockaway Creek tributary-01

For Reaches in Minimally Confined to Broad Valleys (Valley Confinement Ratio ≥ 4)

Primarily pool-riffle streams; C/E channels; some B channels.

	Condition Category			
Related Parameter	**Optimal**	**Good**	**Fair**	**Poor**
Channel Integrity (From FORM 3-CHx)	□ Optimal Channel Integrity □ Low Channel Sensitivity	□ Good Channel Integrity □ Moderate Channel Sensitivity	☑ Fair Channel Integrity □ High Channel Sensitivity	□ Poor Channel Integrity ☑ Very High Channel Sensitivity
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | **6**	5 | 4 | 3 | 2 | 1
Available Data				
NJ Stream Water Quality Standards	□ Freshwater 1 - Trout Production / Trout Maintenance (FW1-TP/TM)	□ Freshwater 1 - Non-Trout (FW1-NT)	☑ Freshwater 2 - Trout Production / Trout Maintenance (FW2-TP/TM)	□ Freshwater 2 - Non-Trout (FW2-NT)
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	**10** | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1
Channel Modifiers				
Dams / Weirs	□ Dams / weirs are absent. □ No evidence of historic dams.	☑ A weir present that creates limited impounded water that is not wider or deeper than the normal channel. ☑ Little evidence of a historic dam.	□ Dam / weirs present that create impoundment that is wider than the normal channel and retains some sediment. □ Evidence of historic dam.	□ Dam(s) create deep and wide impoundment that traps sediment. □ Clear evidence of historic dam.
Beaver Dams	□ Beaver dam(s) are present.	□ Beaver dam(s) are present.		
Bridges / Culverts	□ Few or no bridges / culvert crossings [< 2 / mile]. □ No bridges / culverts appear to block aquatic organism passage by channel constriction/increased velocity, shallow flow, or perch.	☑ Some bridges / culvert crossings [2 - 4 / mile]. □ No bridges / culverts appear to block aquatic organism passage by channel constriction/increased velocity, shallow flow, or perch.	□ Many bridges / culvert crossings [4 - 6 / mile]. ☑ Multiple bridges / culverts appear to block aquatic organism passage by channel constriction/increased velocity, shallow flow, or perch.	□ Many bridges / culvert crossings [> 6 / mile]. □ Multiple bridges / culverts appear to block aquatic organism passage by channel constriction/increased velocity, shallow flow, or perch.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | **13** | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1

Habitat Assessment for Pool-Riffle Reaches **FORM 4-HA2**

Stream Name: South Branch Rockaway Creek tributary Reach ID: South Branch Rockaway Creek tributary-01

In-Stream Features				
Pool Condition	□ > 40 pools / mile. ☑ > 50% pools are > 2 FT deep. □ > 50% pools span channel width.	□ 40 ≥ pools / mile ≤ 20. □ 50 > 25% pools are > 2 FT deep. ☑ 50 > 25% pools span channel width.	□ 20 > pools / mile < 10. □ 25 > 10% pools are > 2 FT deep. □ 25 > 10% pools span channel width.	☑ ≤ 30 pools / mile. □ ≤ 10% pools are > 2 FT deep. □ ≤ 10% pools span channel width.
Bed Substrate Composition	□ riffle embeddedness < 20%. □ margin embeddedness < 40%. ☑ Riffle Stability Index ≤ 70%.	□ 25 ≤ riffle embeddedness < 40%. □ 40 ≤ margin embeddedness < 60%. □ 70% ≤ RSI < 80%.	☑ 40 ≤ riffle embeddedness < 75%. □ 60 ≤ margin embeddedness < 80%. □ 80% < RSI < 90%.	□ riffle embeddedness ≥ 75%. □ margin embeddedness ≥ 80%. □ Riffle Stability Index ≥ 90%.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1
Vegetative Material	□ > 100 LWD / mile. ☑ > 5 Debris Jams / mile. □ CPOM abundant in margin and center.	□ 100 ≥ LWD / mile > 50. □ 5 ≥ Debris Jams / mile > 3. ☑ CPOM abundant in margins, present in center.	☑ 50 ≥ LWD / mile > 25. □ 3 ≥ Debris Jams / mile > 1. □ CPOM present in margin, absent in center.	□ ≤ 25 LWD / mile. □ Debris Jams absent. □ CPOM absent.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1
Banks				
Bank Slope	□ > 30 stable, undercut banks / mile.	☑ 30 ≥ stable, undercut banks / mile > 15.	□ 15 ≥ stable, undercut banks / mile > 5.	□ < 5 stable, undercut banks / mile.
Bank Vegetation	☑ > 90% coverage in tree, shrub and herb layers. □ Non-native invasives are absent.	□ 90 ≥ coverage > 75% in tree, shrub and herb layers. □ Non-native invasives are minimal.	□ 75 ≥ coverage > 50% in tree, shrub and herb layers. ☑ Non-native invasives are abundant.	□ 50% ≤ coverage in tree, shrub and herb layers. □ Non-native invasives are dominant.
Cross Channel Shading	□ Closed cross-channel canopy.	☑ Cross-channel canopy is mostly closed.	□ Cross-channel canopy is mostly open.	□ Open cross-channel canopy.
Bank Erosion	☑ Eroded banks extend < 10% of reach.	□ Eroded banks extend 10% < 25% of reach.	□ Eroded banks extend 25% < 50% of reach.	□ Eroded banks extend ≥ 50% of reach.
Bank Armoring / Channel Straightening	☑ No evidence of bank armoring / channel straightening.	□ Bank armoring extends 10% < 25% of reach.	□ Bank armoring extends 25% < 50% of reach.	□ Bank armoring extends ≥ 50% of reach.
Buffer Width	☑ Buffer width > 300 FT.	□ Buffer width is 300 - 50 FT.	□ Buffer width is < 50 FT.	□ No buffer.
RB Score:	10 | 9	8 | 7 | 6	5 | 4 | 3	2 | 1
LB Score:	10 | 9	8 | 7 | 6	5 | 4 | 3	2 | 1

Habitat Assessment for Pool-Riffle Reaches

FORM 4-HA2

Stream Name: South Branch Rockaway Creek tributary

Reach ID: South Branch Rockaway Creek tributary-01

Riparian Area				
Riparian Wildlife Habitat (Phase I)	☑ High Score; Reach corridor contains patches rank 3 or higher	□ Moderate Score; Reach corridor contains patches rank 1 or 2.	□ Low Score; Reach corridor contains patches rank 1.	□ Reach corridor contains patches rank 0.
Riparian Plant Community	□ Native Mean C ≥ 4.5	☑ 3.5 ≤ Native Mean C > 4.5	□ 2.5 ≤ Native Mean C > 3.4	□ Low Phase 1 Plant Community Score. □ 0 ≤ Native Mean C > 2.4
Adjacent Wetlands	□ Wetlands are extensive, extend over 75% of reach.	□ Wetlands are present, approximately 50% of reach.	☑ Wetlands are minimal, approximately 25% of reach.	□ Wetlands are altered or absent.
Floodplain Connectivity	☑ Floodplain connectivity is extensive throughout study reach with numerous signs of flooding. □ Little or no encroachment on the	□ Floodplain connectivity is present throughout the study reach with some signs of flooding. ☑ Floodplain encroachment is minimal.	□ Floodplain connectivity is minimal. □ Floodplain connectivity is partially limited by encroachment.	□ No Floodplain connectivity. □ Floodplain connectivity is severely limited by encroachment.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1

Habitat Score: 0.56

(Average the scores above; divide by 20)

Habitat Condition: FAIR

Score	Condition
0.85 - 1.0	Optimal
0.65 - 0.84	Good
0.35 - 0.64	Fair
0.00 - 0.34	Poor

Water Quality Assessment **FORM 5-WQ**

Stream Name: South Branch Rockaway Creek tributary Reach ID: South Branch Rockaway Creek tributary-01

For assessing Functional Values: NonPoint Source Pollution and Water Quality

	Condition Category			
Related Parameters	**Optimal**	**Good**	**Fair**	**Poor**
Phase 1 Watershed (From FORM 2-WA)	□ Optimal Score	□ Good Score	☑ Fair Score	□ Poor Score
Channel Integrity (From FORM 3-CHx)	□ Optimal Channel Integrity □ Low Channel Sensitivity	□ Good Channel Integrity □ Moderate Channel Sensitivity	☑ Fair Channel Integrity ☑ High Channel Sensitivity	□ Poor Channel Integrity □ Very High Channel Sensitivity
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1
Existing Data				
NJ Surface Water Quality Standards	□ Freshwater 1 - Trout Production / Trout Maintenance (FW1-TP/TM)	□ Freshwater 1 - Non-Trout (FW1-NT)	☑ Freshwater 2 - Trout Production / Trout Maintenance (FW2-TP/TM)	□ Freshwater 2 - Non-Trout (FW2-NT)
NJPDES Surface Water Discharges	□ No Discharges	☑ No Discharges	□ One Discharge	□ Multiple Discharges
AMNET Reference Sites	□ One sites	□ One site	☑ No sites	□ No sites
Section 303(d) List	☑ Not listed or Fully Supporting	□ Insufficient information	□ Not Supporting for one use	□ Not supporting for multiple uses
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1
Flow Modifiers				
Dams / Weirs	□ Dams / weirs are absent.	☑ A dam / weir is present that creates limited impounded water that is not wider than the normal channel and does not extend over 20% of the reach.	□ Dam(s) / weir(s) are present that create some impounded water that is not wider than the normal channel but extends over 20% of the reach.	□ Dam(s) / weir(s) create deep impounded water that dominates the reach, is much wider than the normal channel and is exposed to direct sunlight.
Stormwater Inputs	□ No stormwater inputs observed.	☑ Few stormwater inputs. □ Stormwater outfalls contribute little or no urban/crop runoff.	□ Some stormwater inputs. ☑ Stormwater outfalls contribute urban/crop runoff.	□ Many stormwater inputs. □ Stormwater outfalls contribute high quantities of urban/crop runoff relative to study reach.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1
Banks				
Bank Erosion	□ Banks are not eroded and are stable.	☑ Few banks are eroded. □ Most banks are stable and erosion appears natural.	□ Many banks are eroded. ☑ Some banks are undercut or steep. ☑ Bank erosion may be contributing in-stream sediment.	□ Most banks are eroded. □ Most banks are undercut or steep. □ Bank erosion appears to be contributing in-stream sediment.
RB Score:	10 | 9	8 | 7 | 6	5 | 4 | 3	2 | 1
LB Score:	10 | 9	8 | 7 | 6	5 | 4 | 3	2 | 1

Water Quality Assessment **FORM 5-WQ**

Stream Name: South Branch Rockaway Creek tributary Reach ID: South Branch Rockaway Creek tributary-01

Riparian Area

Buffer Width	☑ Buffer width > 300 FT. □ Buffer is wooded; and appears sufficient to intercept, infiltrate and filter surface runoff.	□ Buffer width is 300 - 50 FT. ☑ Buffer appears sufficient to intercept, infiltrate and filter surface runoff.	□ Buffer width is < 50 FT. □ Buffer does not intercept runoff in all locations.	□ No buffer. □ Surface runoff reaches channel directly.
RB Score:	10 | 9	8 | 7 | 6	5 | 4 | 3	2 | 1
LB Score:	10 | 9	8 | 7 | 6	5 | 4 | 3	2 | 1
Wetlands, Tributaries / Seeps / Springs	□ Wetlands are extensive, extend over 75% of reach. □ Tributaries / Seeps / Springs are numerous.	□ Wetlands are present approximately 50% of reach. □ Tributaries / Seeps / Springs are occasional.	☑ Wetlands are minimal, approximately 25% of reach. ☑ Tributaries / Seeps / Springs are infrequent.	□ Wetlands are altered or absent. □ Tributaries / Seeps / Springs are altered or absent.
Floodplain Connectivity	☑ Floodplain connectivity is extensive throughout study reach with numerous signs of flooding. □ Little or no encroachment on the floodplain.	□ Floodplain connectivity is present throughout the study reach with some signs of flooding. ☑ Floodplain encroachment is minimal.	□ Floodplain connectivity is minimal throughout study reach with few signs of flooding. □ Floodplain connectivity is partially limited by	□ Signs of floodplain connectivity are absent. □ Floodplain connectivity is severely limited by encroachment.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1

Water Quality Score:	0.45
(Average the scores above; divide by 20)	
Water Quality Condition:	FAIR

Score	Condition
0.85 - 1.0	Optimal
0.65 - 0.84	Good
0.35 - 0.64	Fair
0.00 - 0.34	Poor

Temperature Moderation Assessment **FORM 6-TM**

Stream Name: South Branch Rockaway Creek tributary Reach ID: South Branch Rockaway Creek tributary-01

	Condition Category			
Related Parameters	**Optimal**	**Good**	**Fair**	**Poor**
Channel Integrity (From FORM 3-CHx)	□ Optimal Channel Integrity □ Low Channel Sensitivity	□ Good Channel Integrity □ Moderate Channel Sensitivity	☑ Fair Channel Integrity ☑ High Channel Sensitivity	□ Poor Channel Integrity □ Very High Channel Sensitivity
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1
Existing Data				
NJPDES Surface Water Discharges	☑ No Discharges	□ No Discharges	□ One Discharge	□ Multiple Discharges
Section 303(d) List	☑ Not listed or Fully Supporting	□ Insufficient information	□ Not Supporting for one use due to Temperature	□ Not Supporting for one use due to Temperature
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1
Flow Modifiers				
Dams / Weirs	□ Dams / weirs are absent.	☑ A dam / weir is present that creates limited impounded water that is not wider than the normal channel and does not extend over 20% of the	□ Dam(s) / weir(s) are present that create some impounded water that is not wider than the normal channel but extends over 20% of the reach.	□ Dam(s) / weir(s) create deep impounded water that dominates the reach, is much wider than the normal channel and is exposed to direct sunlight.
Stormwater Inputs	□ No stormwater inputs observed.	☑ Few stormwater inputs. □ Stormwater outfalls contribute little or no urban/crop runoff.	□ Some stormwater inputs. ☑ Stormwater outfalls contribute urban/crop runoff.	□ Many stormwater inputs. □ Stormwater outfalls contribute high quantities of urban/crop runoff relative to study reach.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1
Banks				
Bank Vegetation	☑ > 90% coverage in tree, shrub and herb layers.	□ 90 ≥ coverage > 75% in tree, shrub and herb layers.	□ 75 ≥ coverage > 50% in tree, shrub and herb layers.	□ 50% ≤ coverage in tree, shrub and herb layers.
Cross Channel Shading	□ Channel is fully shaded. □ For channels wider than 50 FT, banks/channel margins are fully shaded.	☑ Channel is mostly shaded. □ For channels wider than 50 FT, banks/channel margins are mostly shaded.	□ Channel is minimally shaded. □ For channels wider than 50 FT, banks / channel margins are partly shaded.	□ Channel is not shaded. □ For channels wider than 50 FT, banks / channel margins are not shaded.
RB Score:	10 | 9	8 | 7 | 6	5 | 4 | 3	2 | 1
LB Score:	10 | 9	8 | 7 | 6	5 | 4 | 3	2 | 1

Temperature Moderation Assessment

FORM 6-TM

Stream Name: South Branch Rockaway Creek tributary

Reach ID: South Branch Rockaway Creek tributary-01

Riparian Area

Buffer Width	☑ Buffer width > 300 FT. ☐ Buffer is wooded; and appears sufficient to intercept and infiltrate surface runoff.	☐ Buffer width is 300 - 50 FT. ☑ Buffer appears sufficient to intercept and infiltrate surface runoff.	☐ Buffer width is < 50 FT. ☐ Buffer does not intercept runoff in all locations.	☐ No buffer. ☐ Surface runoff reaches channel directly.
RB Score:	10 | 9	8 | 7 | 6	5 | 4 | 3	2 | 1
LB Score:	10 | 9	8 | 7 | 6	5 | 4 | 3	2 | 1
Wetlands, Tributaries / Seeps / Springs	☐ Wetlands are extensive, extend over 75% of reach. ☐ Tributaries / Seeps / Springs are numerous.	☐ Wetlands are present approximately 50% of reach. ☐ Tributaries / Seeps / Springs are occasional.	☑ Wetlands are minimal, approximately 25% of reach. ☑ Tributaries / Seeps / Springs are infrequent.	☐ Wetlands are altered or absent. ☐ Tributaries / Seeps / Springs are altered or absent.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1

Temperature Moderation Score: 0.54

(Average the scores above; divide by 20)

Temp Moderation Condition: FAIR

Score	Condition
0.85 - 1.0	Optimal
0.65 - 0.84	Good
0.35 - 0.64	Fair
0.00 - 0.34	Poor

Public Use Assessment

FORM 7-PU

Stream Name: South Branch Rockaway Creek tributary

Reach ID: South Branch Rockaway Creek tributary-01

	Condition Category			
Related Parameters	**Optimal**	**Good**	**Fair**	**Poor**
Channel Integrity (From FORM 3-CHx)	□ Optimal Channel Integrity □ Low Channel Sensitivity	□ Good Channel Integrity □ Moderate Channel Sensitivity	☑ Fair Channel Integrity ☑ High Channel Sensitivity	□ Poor Channel Integrity □ Very High Channel Sensitivity
Habitat (From FORM 4-HAx)	□ Habitat condition is optimal.	□ Habitat condition is good.	☑ Habitat condition is fair.	□ Habitat condition is poor.
Water Quality (Form FORM 5-WQ)	□ Water quality condition is optimal.	□ Water quality condition is good.	☑ Water quality condition is fair.	□ Water quality condition is poor.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1
Public Use Parameter				
Existing Public Use	□ Land ownership is compatible with public use. □ > 75% of appropriate public uses are currently supported.	□ Land ownership is compatible with public use. □ < 50 - 75% of appropriate public uses are currently supported.	☑ Land ownership may be compatible with public use. □ 25 - 50% of appropriate public uses are currently supported.	□ Land ownership is incompatible with public use. ☑ < 25% of appropriate public uses are currently supported.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1
Potential Public Use	□ > 75% of currently non-supported uses have potential. □ All appropriate public uses are supported.	□ < 50 - 75% of currently non-supported uses have potential.	□ 25 - 50% of currently non-supported uses have potential.	☑ < 25% of currently non-supported uses have potential.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1

Public Use Score:	**0.33**
(Average the scores above; divide by 20)	
Public Use Condition:	**POOR**

Score	Condition
0.85 - 1.0	Optimal
0.65 - 0.84	Good
0.35 - 0.64	Fair
0.00 - 0.34	Poor

Functional Value Assessment Methodology: Reach ID Form **FORM 1-ID**

Stream Name:	South Branch Rockaway Creek tributary	Reach ID:	South Branch Rockaway Creek tributary-02	
Location:	North side of Main St @ Sloan St to just downstream of Kullman Corp Campus Dr bridge.	Date:	05/27/2020	
		Town:	Lebanon Borough	
Observers:	Autumn Thomas, Dave Kunz	Elevation:	205-216 ft.	
			Upstream Endpoint	Downstream Endpoint
Organization/Agency:	Lebanon Borough/NJ Highlands Council	Latitude (N/S):	40.642120N	40.6439935N
USGS Map Name:	Califon NJ	Longitude (E/W):	74.828072W	74.822790W
Weather:	64F, cloudy, high 78F	Drainage Area:	2,455 acres	
Rain Storm w/in 7 days:	Yes	Segment Length:	2,248 feet	

Phase 1 Watershed Assessment Scoring Sheet **FORM 2-WA**

Stream Name: South Branch Rockaway Creek tributary Reach ID: South Branch Rockaway Creek tributary-02

Watershed / Corridor Parameter	Condition Category: Optimal	Good	Fair	Poor
Geology	☐ Bedrock has significant stabilizing influence. ☐ Unconsolidated glacial till is minimal or absent.	☐ Bedrock has some stabilizing influence. ☐ Unconsolidated glacial till is present.	☑ Bedrock has minimal influence. ☑ Unconsolidated glacial till is common.	☐ Bedrock has little or no stabilizing influence. ☐ Unconsolidated glacial till predominates.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | **6**	5 | 4 | 3 | 2 | 1
Valley Slopes	☐ Insignificant Steep Slope Impact Rating.	☑ Low Steep Slope Impact Rating.	☐ High Steep Slope Impact Rating.	☐ High Steep Slope Impact Rating.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | **13** | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1
Soil Runoff	☐ Low Soil Runoff Impact Rating.	☐ Moderate Soil Runoff Impact Rating.	☑ High Soil Runoff Impact Rating.	☐ Very High Soil Runoff Impact Rating.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | **8** | 7 | 6	5 | 4 | 3 | 2 | 1
Soil Erodibility	☐ Low Soil Erodibility Impact Rating.	☐ Moderate Soil Erodibility Impact Rating.	☐ High Soil Erodibility Impact Rating.	☑ Very High Soil Erodibility Impact Rating.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | **3** | 2 | 1
Land Use / Land Cover	☐ Insignificant Land Use / Land Cover Impact Rating. ☐ Insignificant Impervious Cover Impact Rating.	☐ Low Land Use / Land Cover Impact Rating. ☐ Low Impervious Cover Impact Rating.	☐ Moderate Land Use / Land Cover Impact Rating. ☑ Moderate Impervious Cover Impact Rating.	☑ High Land Use / Land Cover Impact Rating. ☐ High Impervious Cover Impact Rating.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | **6**	5 | 4 | 3 | 2 | 1

Watershed Score: **0.36**

(Average the scores above; divide by 20)

Condition: **FAIR**

Score	Condition
0.85 - 1.0	Optimal
0.65 - 0.84	Good
0.35 - 0.64	Fair
0.00 - 0.34	Poor

Channel Integrity Assessment for Pool-Riffle Reaches **FORM 3-CH2**

Stream Name: South Branch Rockaway Creek tributary Reach ID: South Branch Rockaway Creek tributary-02

For Reaches in Minimally Confined to Broad Valleys (Valley Confinement Ratio ≥ 4)

Primarily pool-riffle streams; C/E channels; some B channels.

	Condition Category			
Related Parameter	**Optimal**	**Good**	**Fair**	**Poor**
Phase 1 Watershed (From FORM 2-WA)	□ Optimal Score.	□ Good Score.	☑ Fair Score.	□ Poor Score.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1
General Instability				
Dams / Weirs	☑ Dams / weirs are absent. ☑ No evidence of historic dams.	□ A weir present that creates limited impounded water that is not wider or deeper than the normal channel. □ Little evidence of a historic dam.	□ Dam / weirs present. □ Impoundment is wider than the typical channel and contains some sediment. □ Evidence of historic dam that may have created an elevated floodplain.	□ Dam(s) create deep and wide impoundment that traps sediment. □ Impoundment is >2x normal channel width and depth and contains fine sediment. □ Clear evidence of historic dam that has left an elevated floodplain.
Beaver Dams	□ Signs of instability are directly related to Beaver Dams.	□ Signs of instability are related to Beaver Dams.	□ Signs of instability are NOT related to Beaver Dams.	☑ Signs of instability are NOT related to Beaver Dams.
Bridges / Culverts	□ Few or no bridges / culvert crossings [< 2 / mile]. □ Typical crossing width > channel width.	☑ Some bridges / culvert crossings [2 - 3 / mile]. □ Typical crossing width > channel width.	□ Bridges / culvert crossings are common [ave. 4 - 6 / mile]. ☑ Typical crossing width ≤ channel width.	□ Many bridges / culvert crossings [> 6 / mile]. □ Typical crossing width < channel width.
Stormwater Inputs	□ No stormwater inputs observed.	☑ Few stormwater inputs. [< 10 / mile]	□ Some stormwater inputs [10 - 25 / mile].	□ Many stormwater inputs [> 25 / mile].
Floodplain Encroachment Ratio	□ No Floodplain Encroachment concentrating downstream flows. □ 1.0 < Floodplain Encroachment Ratio < 1.2	□ Minor Floodplain Encroachment concentrating downstream flows. □ 1.2 ≤ Floodplain Encroachment Ratio < 1.4	□ Moderate Floodplain Encroachment concentrating downstream flows. □ 1.4 ≤ Floodplain Encroachment Ratio < 2.0	☑ Major Floodplain Encroachment concentrating downstream flows. ☑ Floodplain Encroachment Ratio > 2.0
Bank Erosion	□ Eroded banks extend < 10% of reach.	☑ Eroded banks extend 10% < 25% of reach.	□ Eroded banks extend 25% < 50% of reach.	□ Eroded banks extend ≥ 50% of reach.
Bank Armoring / Channel Straightening	□ No evidence of bank armoring / channel straightening.	☑ Bank armoring extends 10% < 25% of reach. ☑ Channel straightening < 10% of reach.	□ Bank armoring extends 25% < 50% of reach. □ Channel straightening < 25% of reach.	□ Bank armoring extends ≥ 50% of reach. □ Channel straightening ≥ 25% of reach.
General Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1

Channel Integrity Assessment for Pool-Riffle Reaches

FORM 3-CH2

Stream Name: South Branch Rockaway Creek tributary

Reach ID: South Branch Rockaway Creek tributary-02

Degradation	Optimal	Good	Fair	Poor
Bridges / Culverts	□ No bed and bank erosion associated with bridges/culverts. □ Bridge foundations are not exposed; culverts are not perched.	☑ Adjacent bed and bank erosion are minor and confined to immediately upstream or downstream of crossings. □ Bridge foundations are not exposed; culverts are not perched.	□ Adjacent bed and bank erosion is moderate and typical. ☑ Some bridge foundations are exposed; some culverts are perched.	□ Adjacent bed and bank erosion is severe and extensive. □ Most bridge foundations are exposed or undermined; most culverts are perched.
Stormwater Inputs		□ Stormwater outfalls do not appear to be perched above the streambed.	☑ Stormwater outfalls are perched above the streambed. ☑ Some stormwater ditches have headcuts.	□ Stormwater outfalls are perched above the streambed. □ Headwalls have been undermined and are collapsing into the channel. □ Stormwater ditches have headcuts.
Bank Height Ratio	□ 1.0 ≤ Bank Height Ratio < 1.1 **and** □ Entrenchment Ratio > 2.0	□ 1.1 ≤ Bank Height Ratio < 1.3 **and** □ Entrenchment Ratio > 2.0	□ 1.3 ≤ Bank Height Ratio < 1.5 **and** □ Entrenchment Ratio > 2.0	☑ Bank Height Ratio ≥ 1.5 **or** ☑ Entrenchment Ratio ≤ 2.0
Dominant Particle Size Class	□ Stream substrate is compact and resistant to erosion. □ Dominant particle size class is cobble, boulder or bedrock.	☑ Stream substrate is compact and resistant to erosion. □ Dominant particle size class is cobble, boulder or bedrock.	□ Stream substrate is not compact and prone to erosion. ☑ Dominant particle size class is fine gravel or sand.	□ Stream substrate is not compact and prone to erosion. □ Dominant particle size class is fine gravel or sand.
Bedrock Grade Controls	□ Bedrock grade controls are present, preventing further channel degradation.	□ Bedrock grade controls are present, preventing further channel degradation.	□ Bedrock grade controls are absent, allowing channel degradation.	☑ Bedrock grade controls are absent, allowing channel degradation.
Headcuts	□ No headcuts. ☑ Substrates are compact and stable. ☑ No signs of historic incision.	□ No headcuts. □ Signs of historic incision: sharp changes of slope / steep riffles.	☑ Headcut seen in the main channel and some tributaries. □ Signs of recent incision: sharp changes in slope / steep riffles.	□ Multiple headcuts in the main channel and tributaries. □ Signs of active incision: substrates are loose and actively eroding at headcuts.
Bank Slope	□ Bank slopes are typically low.	☑ Bank slopes are typically moderate.	□ Banks are typically steep or vertical.	□ Banks are typically vertical.
Bank Materials	□ No subsoil layers exposed in the banks.	☑ Few banks with exposed subsoil layers.	□ Subsoil layers clearly exposed in banks.	□ Former streambed materials clearly exposed in banks.
Meander Cutoffs, Channel Avulsions	□ No evidence of historic or recent meander cutoffs or channel avulsions.	☑ Some evidence of historic, not recent, meander cutoffs or channel avulsions.	□ Evidence of recent meander cutoffs or channel avulsions.	□ Evidence of recent and/or impending meander cutoffs or channel avulsions.
Degradation Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1

Channel Integrity Assessment for Pool-Riffle Reaches **FORM 3-CH2**

Stream Name: South Branch Rockaway Creek tributary Reach ID: South Branch Rockaway Creek tributary-02

Aggradation	Optimal	Good	Fair	Poor
Bridges / Culverts	□ No sediment deposition upstream of crossings. □ No sediment deposition downstream of crossings. □ Bridge / Culvert openings are not blocked by sediment.	□ Some sediment deposition upstream of crossings. ☑ Some sediment deposition downstream of crossings. □ Bridge / Culvert openings are not blocked by sediment.	☑ Moderate sediment deposition upstream of crossings. □ Moderate sediment deposition downstream of crossings. ☑ Bridge / Culvert openings are partially blocked by sediment.	□ Significant sediment deposition upstream of crossings. □ Significant sediment deposition downstream of crossings. □ Bridge / Culvert openings are buried in sediment.
Stormwater Inputs	□ No stormwater inputs observed.	☑ Minor sediment deposition at stormwater outfalls.	□ Moderate sediment deposition at stormwater outfalls. □ Multiple stormwater outfalls are partially buried in sediment. □ Multiple stormwater ditches are partially filled with sediment finer than bed.	□ Extensive sediment deposition at stormwater outfalls. □ Stormwater outfalls are partially buried in sediment. □ Stormwater ditches are partially filled with sediment finer than bed.
Channel Dimensions	Low Width-Depth Ratio □ ≤ 20 for C or B channels □ ≤ 10 for E channels	Low to Moderate Width-Depth Ratio □ >20 ≤ 30 for C or B channels □ >10 ≤ 12 for E channels	Moderate to High Width-Depth Ratio □ >30 ≤ 40 for C or B channels □ >12 ≤ 20 for E channels	High Width-Depth Ratio ☑ > 40 for C or B channels □ > 20 for E channels
Pool-Riffle Condition	□ All Pool-Riffles are well formed, complete and stable. □ < 10% pools are < 2 FT deep. □ No pools are filled with sediment.	☑ Pool-Riffles are moderately well formed, complete and stable. 10% < 25% pools are: □ < 2 FT deep. □ filled with sediment finer than dominant particle size.	□ Pool-Riffles are not clearly formed creating plane bed features. 25% < 50% pools are: □ < 2 FT deep. □ filled with sediment finer than dominant particle size.	□ Pool-Riffles are not clearly formed creating plane bed features. > 50% pools are: ☑ < 2 FT deep. ☑ filled with sediment finer than dominant particle size.

Channel Integrity Assessment for Pool-Riffle Reaches **FORM 3-CH2**

Stream Name: South Branch Rockaway Creek tributary Reach ID: South Branch Rockaway Creek tributary-02

Sediment Bars	□ Few or no lateral, diagonal, mid-channel bars. □ Lateral bars and deltas in typical positions. □ Sediment bars less than bankfull height.	□ Some lateral, diagonal, mid-channel bars. ☑ Lateral bars and deltas in typical positions. □ Sediment bars composed of sediment similar to dominant substrate. ☑ Sediment bars at or below bankfull height.	□ Multiple lateral, diagonal, mid-channel bars, or deltas. □ Sediment bars composed of sediment different than dominant substrate. □ Sediment bars are greater than bankfull height and/or longer than a channel width.	☑ Many lateral, diagonal, mid-channel bars, or deltas. ☑ Sediment bars composed of sediment finer than dominant substrate. □ Sediment bars above bankfull elevation and/or multiple channel widths in length. □ Sediment bars split flow in multiple paths.
Embeddedness	□ Coarse gravels, cobbles, boulders are not embedded in finer sediments. □ Embeddedness < 25%.	□ Coarse gravels, cobbles, boulders are not embedded in finer sediments. ☑ 25% < Embeddedness < 50%.	☑ Coarse gravels, cobbles, boulders are embedded in finer sediments. □ 50% ≤ Embeddedness < 75%.	□ Coarse gravels, cobbles, boulders are heavily embedded in finer sediments. □ Embeddedness ≥ 75%.
Braiding	□ No channel braiding.	☑ No channel braiding.	□ Channel braiding present.	□ Channel braiding extensive throughout reach.
Aggradation Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1

Channel Integrity Assessment for Pool-Riffle Reaches **FORM 3-CH2**

Stream Name: South Branch Rockaway Creek tributary Reach ID: South Branch Rockaway Creek tributary-02

Widening	Optimal	Good	Fair	Poor
Stormwater Inputs	□ No stormwater inputs observed.	☑ Stormwater outfalls do not appear to extend out from the banks.	□ Stormwater outfalls are extending out from the banks.	□ Stormwater outfalls are extending out from the banks. □ Headwalls have been undermined and are collapsing into the channel.
Width-Depth Ratio	Low Width-Depth Ratio □ < 20 for C or B channels □ < 10 for E channels	Low to Moderate Width-Depth Ratio □ >20 ≤ 30 for C or B channels □ >10 ≤ 12 for E channels	Moderate to High Width-Depth Ratio □ >30 ≤ 40 for C or B channels □ >12 ≤ 20 for E channels	Moderate to High Width-Depth Ratio ☑ > 40 for C or B channels □ > 20 for E channels
Sediment Bars	□ Few or no lateral, diagonal, mid-channel bars. □ Lateral bars and deltas in typical positions. □ Sediment bars below bankfull height.	□ Some lateral, diagonal, mid-channel bars. ☑ Lateral bars and deltas in typical positions. □ Sediment bars composed of sediment similar to dominant substrate. ☑ Sediment bars at or below bankfull height.	□ Multiple lateral, diagonal, mid-channel bars, or deltas. □ Sediment bars composed of sediment different than dominant substrate. □ Sediment bars are greater than bankfull height and/or longer than a channel width.	☑ Many lateral, diagonal, mid-channel bars, or deltas. ☑ Sediment bars composed of sediment finer than dominant substrate. □ Sediment bars above bankfull elevation and/or multiple channel widths in length. □ Sediment bars split flow in multiple paths.
Bank Materials	□ Bank materials have low or very low erodibility. □ Bank materials are cohesive.	☑ Bank materials have low or moderate erodibility. ☑ Bank materials are cohesive.	□ Bank materials have moderate or high erodibility. □ Bank materials are non-cohesive.	□ Bank materials have high erodibility. □ Bank materials are non-cohesive.
Bank Erosion	□ No erosion on opposing banks; overhanging banks are stable. □ Occasional leaning trees and no recently exposed roots.	□ Minimal erosion at the base of opposing banks; overhanging banks are stable. ☑ Some leaning trees and few recently exposed roots.	☑ Moderate erosion at the base of both banks creating unstable overhangs. □ Many leaning trees, recently exposed roots and/or fracture lines.	□ Continuous, extensive erosion at the base of both banks creating unstable overhangs. □ Continuous leaning trees, recently exposed roots and/or fracture lines.
Widening Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1

Channel Integrity Assessment for Pool-Riffle Reaches

FORM 3-CH2

Stream Name: South Branch Rockaway Creek tributary

Reach ID: South Branch Rockaway Creek tributary-02

Re-alignment	Optimal	Good	Fair	Poor
Bridges / Culverts	□ Channel is aligned with bridge / culvert openings.	□ Channel is aligned with bridge / culvert openings.	☑ Channel is askew to bridge / culvert openings.	□ Channel makes tight meander at bridge / culvert openings.
Sinuosity	□ No change in sinuosity.	☑ May accompany minor change in sinuosity.	□ May accompany moderate change in sinuosity.	□ May accompany major change in sinuosity.
Bank Erosion	□ Typical bank erosion on outside meander bends. □ Overhangs are stable. No slumping. □ Few leaning trees, no recently exposed roots. No fracture lines.	☑ Typical bank erosion on outside meander bends. ☑ Overhangs are stable. Little slumping. ☑ Few leaning trees, recently exposed roots. No fracture lines.	□ Moderate to high bank erosion on many outside meander bends creating unstable overhangs. □ Multiple leaning trees, recently exposed roots and/or fracture lines.	□ Extensive, severe bank erosion on outside meander bends creating unstable overhangs and/or slumping. □ Numerous leaning trees, recently exposed roots and/or fracture
Flood chutes, Meander Cutoffs, Braiding, Channel Avulsions	□ Limited potential for channel avulsions. □ No evidence of historic or recent channel avulsions.	☑ Limited potential for channel avulsions. ☑ 10% < 25% of reach exhibits historic or recent channel avulsions.	□ Flood chutes, meander cutoffs, and braiding potentially leading to channel avulsions. □ 25% < 50% of reach exhibits historic or recent channel	□ Flood chutes, meander cutoffs, braiding causing channel avulsions. □ ≥ 50% of reach exhibits historic or recent channel avulsions.
Re-alignment Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1

Watershed Score: 8

General Instability Score: 12

Degradation Score: 10

Aggradation Score: 12

Widening Score: 12

Re-alignment Score: 14

Score	Condition
0.85 - 1.0	Optimal
0.65 - 0.84	Good
0.35 - 0.64	Fair
0.00 - 0.34	Poor

Channel Integrity Score: 0.57

(Average the scores above; divide by 20)

Channel Integrity Condition: FAIR

Channel Sensitivity: VERY HIGH

(Refer to Item 11.1.4 from Phase 2)

Habitat Assessment for Pool-Riffle Reaches

FORM 4-HA2

Stream Name: South Branch Rockaway Creek tributary

Reach ID: South Branch Rockaway Creek tributary-02

For Reaches in Minimally Confined to Broad Valleys (Valley Confinement Ratio ≥ 4)

Primarily pool-riffle streams; C/E channels; some B channels.

	Condition Category			
Related Parameter	**Optimal**	**Good**	**Fair**	**Poor**
Channel Integrity (From FORM 3-CHx)	☐ Optimal Channel Integrity ☐ Low Channel Sensitivity	☐ Good Channel Integrity ☐ Moderate Channel Sensitivity	☑ Fair Channel Integrity ☐ High Channel Sensitivity	☐ Poor Channel Integrity ☑ Very High Channel Sensitivity
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | **6**	5 | 4 | 3 | 2 | 1
Available Data				
NJ Stream Water Quality Standards	☐ Freshwater 1 - Trout Production / Trout Maintenance (FW1-TP/TM)	☐ Freshwater 1 - Non-Trout (FW1-NT)	☑ Freshwater 2 - Trout Production / Trout Maintenance (FW2-TP/TM)	☐ Freshwater 2 - Non-Trout (FW2-NT)
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	**10** | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1
Channel Modifiers				
Dams / Weirs	☑ Dams / weirs are absent. ☑ No evidence of historic dams.	☐ A weir present that creates limited impounded water that is not wider or deeper than the normal channel. ☐ Little evidence of a historic dam.	☐ Dam / weirs present that create impoundment that is wider than the normal channel and retains some sediment. ☐ Evidence of historic dam.	☐ Dam(s) create deep and wide impoundment that traps sediment. ☐ Clear evidence of historic dam.
Beaver Dams	☐ Beaver dam(s) are present.	☐ Beaver dam(s) are present.		
Bridges / Culverts	☐ Few or no bridges / culvert crossings [< 2 / mile]. ☐ No bridges / culverts appear to block aquatic organism passage by channel constriction/increased velocity, shallow flow, or perch.	☑ Some bridges / culvert crossings [2 - 4 / mile]. ☐ No bridges / culverts appear to block aquatic organism passage by channel constriction/increased velocity, shallow flow, or perch.	☐ Many bridges / culvert crossings [4 - 6 / mile]. ☑ Multiple bridges / culverts appear to block aquatic organism passage by channel constriction/increased velocity, shallow flow, or perch.	☐ Many bridges / culvert crossings [> 6 / mile]. ☐ Multiple bridges / culverts appear to block aquatic organism passage by channel constriction/increased velocity, shallow flow, or perch.
Score:	20 | 19 | 18 | **17** | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1

Habitat Assessment for Pool-Riffle Reaches **FORM 4-HA2**

Stream Name: South Branch Rockaway Creek tributary Reach ID: South Branch Rockaway Creek tributary-02

In-Stream Features				
Pool Condition	□ > 40 pools / mile. ☑ > 50% pools are > 2 FT deep. □ > 50% pools span channel width.	□ 40 ≥ pools / mile ≤ 20. □ 50 > 25% pools are > 2 FT deep. □ 50 > 25% pools span channel width.	□ 20 > pools / mile < 10. □ 25 > 10% pools are > 2 FT deep. ☑ 25 > 10% pools span channel width.	☑ ≤ 30 pools / mile. □ ≤ 10% pools are > 2 FT deep. □ ≤ 10% pools span channel width.
Bed Substrate Composition	□ riffle embeddedness < 20%. □ margin embeddedness < 40%. ☑ Riffle Stability Index ≤ 70%.	□ 25 ≤ riffle embeddedness < 40%. □ 40 ≤ margin embeddedness < 60%. □ 70% ≤ RSI < 80%.	☑ 40 ≤ riffle embeddedness < 75%. □ 60 ≤ margin embeddedness < 80%. □ 80% < RSI < 90%.	□ riffle embeddedness ≥ 75%. □ margin embeddedness ≥ 80%. □ Riffle Stability Index ≥ 90%.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1
Vegetative Material	□ > 100 LWD / mile. ☑ > 5 Debris Jams / mile. □ CPOM abundant in margin and center.	□ 100 ≥ LWD / mile > 50. □ 5 ≥ Debris Jams / mile > 3. ☑ CPOM abundant in margins, present in center.	☑ 50 ≥ LWD / mile > 25. □ 3 ≥ Debris Jams / mile > 1. □ CPOM present in margin, absent in center.	□ ≤ 25 LWD / mile. □ Debris Jams absent. □ CPOM absent.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1
Banks				
Bank Slope	□ > 30 stable, undercut banks / mile.	☑ 30 ≥ stable, undercut banks / mile > 15.	□ 15 ≥ stable, undercut banks / mile > 5.	□ < 5 stable, undercut banks / mile.
Bank Vegetation	☑ > 90% coverage in tree, shrub and herb layers. □ Non-native invasives are absent.	□ 90 ≥ coverage > 75% in tree, shrub and herb layers. □ Non-native invasives are minimal.	□ 75 ≥ coverage > 50% in tree, shrub and herb layers. ☑ Non-native invasives are abundant.	□ 50% ≤ coverage in tree, shrub and herb layers. □ Non-native invasives are dominant.
Cross Channel Shading	□ Closed cross-channel canopy.	□ Cross-channel canopy is mostly closed.	□ Cross-channel canopy is mostly open.	☑ Open cross-channel canopy.
Bank Erosion	□ Eroded banks extend < 10% of reach.	☑ Eroded banks extend 10% < 25% of reach.	□ Eroded banks extend 25% < 50% of reach.	□ Eroded banks extend ≥ 50% of reach.
Bank Armoring / Channel Straightening	□ No evidence of bank armoring / channel straightening.	☑ Bank armoring extends 10% < 25% of reach.	□ Bank armoring extends 25% < 50% of reach.	□ Bank armoring extends ≥ 50% of reach.
Buffer Width	□ Buffer width > 300 FT.	☑ Buffer width is 300 - 50 FT.	□ Buffer width is < 50 FT.	□ No buffer.
RB Score:	10 | 9	8 | 7 | 6	5 | 4 | 3	2 | 1
LB Score:	10 | 9	8 | 7 | 6	5 | 4 | 3	2 | 1

Habitat Assessment for Pool-Riffle Reaches

FORM 4-HA2

Stream Name: South Branch Rockaway Creek tributary

Reach ID: South Branch Rockaway Creek tributary-02

Riparian Area				
Riparian Wildlife Habitat (Phase I)	☑ High Score; Reach corridor contains patches rank 3 or higher	□ Moderate Score; Reach corridor contains patches rank 1 or 2.	□ Low Score; Reach corridor contains patches rank 1.	□ Reach corridor contains patches rank 0.
Riparian Plant Community	□ Native Mean C ≥ 4.5	☑ 3.5 ≤ Native Mean C > 4.5	□ 2.5 ≤ Native Mean C > 3.4	□ Low Phase 1 Plant Community Score. □ 0 ≤ Native Mean C > 2.4
Adjacent Wetlands	□ Wetlands are extensive, extend over 75% of reach.	□ Wetlands are present, approximately 50% of reach.	☑ Wetlands are minimal, approximately 25% of reach.	□ Wetlands are altered or absent.
Floodplain Connectivity	☑ Floodplain connectivity is extensive throughout study reach with numerous signs of flooding. □ Little or no encroachment on the	□ Floodplain connectivity is present throughout the study reach with some signs of flooding. ☑ Floodplain encroachment is minimal.	□ Floodplain connectivity is minimal. □ Floodplain connectivity is partially limited by encroachment.	□ No Floodplain connectivity. □ Floodplain connectivity is severely limited by encroachment.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1

Habitat Score: 0.54

(Average the scores above; divide by 20)

Habitat Condition: FAIR

Score	Condition
0.85 - 1.0	Optimal
0.65 - 0.84	Good
0.35 - 0.64	Fair
0.00 - 0.34	Poor

Water Quality Assessment **FORM 5-WQ**

Stream Name: South Branch Rockaway Creek tributary Reach ID: South Branch Rockaway Creek tributary-02

For assessing Functional Values: NonPoint Source Pollution and Water Quality

	Condition Category			
Related Parameters	**Optimal**	**Good**	**Fair**	**Poor**
Phase 1 Watershed (From FORM 2-WA)	□ Optimal Score	□ Good Score	☑ Fair Score	□ Poor Score
Channel Integrity (From FORM 3-CHx)	□ Optimal Channel Integrity □ Low Channel Sensitivity	□ Good Channel Integrity □ Moderate Channel Sensitivity	☑ Fair Channel Integrity □ High Channel Sensitivity	□ Poor Channel Integrity ☑ Very High Channel Sensitivity
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1
Existing Data				
NJ Surface Water Quality Standards	□ Freshwater 1 - Trout Production / Trout Maintenance (FW1-TP/TM)	□ Freshwater 1 - Non-Trout (FW1-NT)	☑ Freshwater 2 - Trout Production / Trout Maintenance (FW2-TP/TM)	□ Freshwater 2 - Non-Trout (FW2-NT)
NJPDES Surface Water Discharges	□ No Discharges	☑ No Discharges	□ One Discharge	□ Multiple Discharges
AMNET Reference Sites	□ One sites	□ One site	☑ No sites	□ No sites
Section 303(d) List	☑ Not listed or Fully Supporting	□ Insufficient information	□ Not Supporting for one use	□ Not supporting for multiple uses
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1
Flow Modifiers				
Dams / Weirs	☑ Dams / weirs are absent.	□ A dam / weir is present that creates limited impounded water that is not wider than the normal channel and does not extend over 20% of the reach.	□ Dam(s) / weir(s) are present that create some impounded water that is not wider than the normal channel but extends over 20% of the reach.	□ Dam(s) / weir(s) create deep impounded water that dominates the reach, is much wider than the normal channel and is exposed to direct sunlight.
Stormwater Inputs	□ No stormwater inputs observed.	☑ Few stormwater inputs. □ Stormwater outfalls contribute little or no urban/crop runoff.	□ Some stormwater inputs. ☑ Stormwater outfalls contribute urban/crop runoff.	□ Many stormwater inputs. □ Stormwater outfalls contribute high quantities of urban/crop runoff relative to study reach.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1
Banks				
Bank Erosion	□ Banks are not eroded and are stable.	□ Few banks are eroded. □ Most banks are stable and erosion appears natural.	☑ Many banks are eroded. ☑ Some banks are undercut or steep. ☑ Bank erosion may be contributing in-stream sediment.	□ Most banks are eroded. □ Most banks are undercut or steep. □ Bank erosion appears to be contributing in-stream sediment.
RB Score:	10 | 9	8 | 7 | 6	5 | 4 | 3	2 | 1
LB Score:	10 | 9	8 | 7 | 6	5 | 4 | 3	2 | 1

Water Quality Assessment

FORM 5-WQ

Stream Name: South Branch Rockaway Creek tributary

Reach ID: South Branch Rockaway Creek tributary-02

Riparian Area

Buffer Width	☐ Buffer width > 300 FT. ☐ Buffer is wooded; and appears sufficient to intercept, infiltrate and filter surface runoff.	☑ Buffer width is 300 - 50 FT. ☐ Buffer appears sufficient to intercept, infiltrate and filter surface runoff.	☐ Buffer width is < 50 FT. ☑ Buffer does not intercept runoff in all locations.	☐ No buffer. ☐ Surface runoff reaches channel directly.
RB Score:	10 | 9	8 | 7 | 6	5 | 4 | 3	2 | 1
LB Score:	10 | 9	8 | 7 | 6	5 | 4 | 3	2 | 1
Wetlands, Tributaries / Seeps / Springs	☐ Wetlands are extensive, extend over 75% of reach. ☐ Tributaries / Seeps / Springs are numerous.	☐ Wetlands are present approximately 50% of reach. ☐ Tributaries / Seeps / Springs are occasional.	☑ Wetlands are minimal, approximately 25% of reach. ☑ Tributaries / Seeps / Springs are infrequent.	☐ Wetlands are altered or absent. ☐ Tributaries / Seeps / Springs are altered or absent.
Floodplain Connectivity	☑ Floodplain connectivity is extensive throughout study reach with numerous signs of flooding. ☐ Little or no encroachment on the floodplain.	☐ Floodplain connectivity is present throughout the study reach with some signs of flooding. ☑ Floodplain encroachment is minimal.	☐ Floodplain connectivity is minimal throughout study reach with few signs of flooding. ☐ Floodplain connectivity is partially limited by	☐ Signs of floodplain connectivity are absent. ☐ Floodplain connectivity is severely limited by encroachment.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1

Water Quality Score:	0.41
(Average the scores above; divide by 20)	
Water Quality Condition:	FAIR

Score	Condition
0.85 - 1.0	Optimal
0.65 - 0.84	Good
0.35 - 0.64	Fair
0.00 - 0.34	Poor

Temperature Moderation Assessment **FORM 6-TM**

Stream Name: South Branch Rockaway Creek tributary Reach ID: South Branch Rockaway Creek tributary-02

	Condition Category			
Related Parameters	**Optimal**	**Good**	**Fair**	**Poor**
Channel Integrity (From FORM 3-CHx)	□ Optimal Channel Integrity □ Low Channel Sensitivity	□ Good Channel Integrity □ Moderate Channel Sensitivity	☑ Fair Channel Integrity □ High Channel Sensitivity	□ Poor Channel Integrity ☑ Very High Channel Sensitivity
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1
Existing Data				
NJPDES Surface Water Discharges	☑ No Discharges	□ No Discharges	□ One Discharge	□ Multiple Discharges
Section 303(d) List	☑ Not listed or Fully Supporting	□ Insufficient information	□ Not Supporting for one use due to Temperature	□ Not Supporting for one use due to Temperature
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1
Flow Modifiers				
Dams / Weirs	☑ Dams / weirs are absent.	□ A dam / weir is present that creates limited impounded water that is not wider than the normal channel and does not extend over 20% of the	□ Dam(s) / weir(s) are present that create some impounded water that is not wider than the normal channel but extends over 20% of the reach.	□ Dam(s) / weir(s) create deep impounded water that dominates the reach, is much wider than the normal channel and is exposed to direct sunlight.
Stormwater Inputs	□ No stormwater inputs observed.	☑ Few stormwater inputs. □ Stormwater outfalls contribute little or no urban/crop runoff.	□ Some stormwater inputs. ☑ Stormwater outfalls contribute urban/crop runoff.	□ Many stormwater inputs. □ Stormwater outfalls contribute high quantities of urban/crop runoff relative to study reach.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1
Banks				
Bank Vegetation	☑ > 90% coverage in tree, shrub and herb layers.	□ 90 ≥ coverage > 75% in tree, shrub and herb layers.	□ 75 ≥ coverage > 50% in tree, shrub and herb layers.	□ 50% ≤ coverage in tree, shrub and herb layers.
Cross Channel Shading	□ Channel is fully shaded. □ For channels wider than 50 FT, banks/channel margins are fully shaded.	□ Channel is mostly shaded. □ For channels wider than 50 FT, banks/channel margins are mostly shaded.	☑ Channel is minimally shaded. □ For channels wider than 50 FT, banks / channel margins are partly shaded.	□ Channel is not shaded. □ For channels wider than 50 FT, banks / channel margins are not shaded.
RB Score:	10 | 9	8 | 7 | 6	5 | 4 | 3	2 | 1
LB Score:	10 | 9	8 | 7 | 6	5 | 4 | 3	2 | 1

Temperature Moderation Assessment

FORM 6-TM

Stream Name: South Branch Rockaway Creek tributary

Reach ID: South Branch Rockaway Creek tributary-02

Riparian Area

Buffer Width	□ Buffer width > 300 FT. □ Buffer is wooded; and appears sufficient to intercept and infiltrate surface runoff.	☑ Buffer width is 300 - 50 FT. □ Buffer appears sufficient to intercept and infiltrate surface runoff.	□ Buffer width is < 50 FT. ☑ Buffer does not intercept runoff in all locations.	□ No buffer. □ Surface runoff reaches channel directly.
RB Score:	10 | 9	8 | 7 | 6	5 | 4 | 3	2 | 1
LB Score:	10 | 9	8 | 7 | 6	5 | 4 | 3	2 | 1
Wetlands, Tributaries / Seeps / Springs	□ Wetlands are extensive, extend over 75% of reach. □ Tributaries / Seeps / Springs are numerous.	□ Wetlands are present approximately 50% of reach. □ Tributaries / Seeps / Springs are occasional.	☑ Wetlands are minimal, approximately 25% of reach. ☑ Tributaries / Seeps / Springs are infrequent.	□ Wetlands are altered or absent. □ Tributaries / Seeps / Springs are altered or absent.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1

Temperature Moderation Score:	**0.46**
(Average the scores above; divide by 20)	
Temp Moderation Condition:	**FAIR**

Score	Condition
0.85 - 1.0	Optimal
0.65 - 0.84	Good
0.35 - 0.64	Fair
0.00 - 0.34	Poor

Public Use Assessment

FORM 7-PU

Stream Name: South Branch Rockaway Creek tributary

Reach ID: South Branch Rockaway Creek tributary-02

	Condition Category			
Related Parameters	**Optimal**	**Good**	**Fair**	**Poor**
Channel Integrity (From FORM 3-CHx)	□ Optimal Channel Integrity □ Low Channel Sensitivity	□ Good Channel Integrity □ Moderate Channel Sensitivity	☑ Fair Channel Integrity □ High Channel Sensitivity	□ Poor Channel Integrity ☑ Very High Channel Sensitivity
Habitat (From FORM 4-HAx)	□ Habitat condition is optimal.	□ Habitat condition is good.	☑ Habitat condition is fair.	□ Habitat condition is poor.
Water Quality (Form FORM 5-WQ)	□ Water quality condition is optimal.	□ Water quality condition is good.	☑ Water quality condition is fair.	□ Water quality condition is poor.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1
Public Use Parameter				
Existing Public Use	□ Land ownership is compatible with public use. □ > 75% of appropriate public uses are currently supported.	□ Land ownership is compatible with public use. □ < 50 - 75% of appropriate public uses are currently supported.	□ Land ownership may be compatible with public use. □ 25 - 50% of appropriate public uses are currently supported.	☑ Land ownership is incompatible with public use. ☑ < 25% of appropriate public uses are currently supported.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1
Potential Public Use	□ > 75% of currently non-supported uses have potential. □ All appropriate public uses are supported.	□ < 50 - 75% of currently non-supported uses have potential.	□ 25 - 50% of currently non-supported uses have potential.	☑ < 25% of currently non-supported uses have potential.
Score:	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1

Public Use Score:	**0.32**
(Average the scores above; divide by 20)	
Public Use Condition:	**POOR**

Score	Condition
0.85 - 1.0	Optimal
0.65 - 0.84	Good
0.35 - 0.64	Fair
0.00 - 0.34	Poor

Appendix F Universal FQA Reports

Inventory Assessment

Edit This Inventory | Download Report | Done

4562 - Overall Species Inventory

» Date & Location:

2020-05-13
4562 - Overall Sp Inv
Lebanon Borough
Hunterdon, New Jersey, United States

» FQA Database:

Region: **New Jersey**
Year Published: **2019**
Description:
Walz, Kathleen S., Linda Kelly, Karl Anderson, Keith Bowman, Barbara Andreas, Richard Andrus, Scott Schuette, William Schumacher, Sean Robinson, Terry O'Brien, Eric Karlin and Jason Hafstad. 2018. Universal Floristic Quality Assessment Index for Vascular Plants and Mosses of New Jersey: Coefficient of Conservancy (CoC) Values for Species and Genera (Updated November 2019). New Jersey Department of Environmental Protection, New Jersey Forest Service, Office of Natural Lands Management, Trenton, NJ, 08625. Submitted to United States Environmental Protection Agency, Region 2, for State Wetlands Protection Development Grant, Section 104(B)(3); CFDA No. 66.461, CD97225809.

» Details:

Practitioner: **David Kunz**
Latitude:
Longitude:
Weather Notes:
Duration Notes:
Community Type Notes:

Other Notes:
This assessment is **private** (viewable only by you).

» Conservatism-Based Metrics:

Total Mean C: **3**
Native Mean C: **4.2**
Total FQI: **28**
Native FQI: **32.8**
Adjusted FQI: **35.2**
% C value 0: **29.9%**
% C value 1-3: **24.1%**
% C value 4-6: **39.1%**
% C value 7-10: **6.9%**
Native Tree Mean C: **0**
Native Shrub Mean C: **0**
Native Herbaceous Mean C: **0**

» Species Richness:

Total Species: **87**
Native Species: **61 (70.1%)**
Non-native Species: **26 (29.9%)**

» Species Wetness:

Mean Wetness: **n/a**
Native Mean Wetness: **n/a**

» Physiognomy Metrics:

Tree: **n/a**
Shrub: **n/a**
Vine: **n/a**
Forb: **n/a**
Grass: **n/a**
Sedge: **n/a**
Rush: **n/a**
Fern: **n/a**
Bryophyte: **n/a**

» Duration Metrics:

Annual: **n/a**
Perennial: **n/a**
Biennial: **n/a**

Native Annual: **n/a**
Native Perennial: **n/a**
Native Biennial: **n/a**

» Species:

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
Acer negundo	Aceraceae	ACNE2	native	2	n/a	n/a	n/a	box-elder
Acer platanoides	Aceraceae	ACPL	non-native	0	n/a	n/a	n/a	norway maple
Acer saccharinum	Aceraceae	ACSA2	native	5	n/a	n/a	n/a	silver maple
Agrimonia gryposepala	Rosaceae	AGGR2	native	4	n/a	n/a	n/a	tall hairy agrimony
Agrimonia parviflora	Rosaceae	AGPA6	native	3	n/a	n/a	n/a	harvestlice
Alliaria petiolata	Brassicaceae	ALPE4	non-native	0	n/a	n/a	n/a	garlic-mustard
Alnus serrulata	Betulaceae	ALSE2	native	4	n/a	n/a	n/a	smooth alder
Arisaema triphyllum	Araceae	ARTR	native	5	n/a	n/a	n/a	jack-in-the-pulpit
Artemisia vulgaris	Asteraceae	ARVU	non-native	0	n/a	n/a	n/a	common mugwort
Barbarea vulgaris	Brassicaceae	BAVU	non-native	0	n/a	n/a	n/a	common wintercress
Cardamine impatiens	Brassicaceae	CAIM	non-native	0	n/a	n/a	n/a	narrowleaf bitter cress
Carex amphibola; carex amphibola var. amphibola; carex grisea var. amphibola	Cyperaceae	CAAM8	native	9	n/a	n/a	n/a	eastern narrow-leaf sedge
Carex blanda	Cyperaceae	CABL	native	5	n/a	n/a	n/a	woodland sedge
Carex crinita	Cyperaceae	CACR6	native	5	n/a	n/a	n/a	fringed sedge
Carex gracillima	Cyperaceae	CAGR2	native	7	n/a	n/a	n/a	graceful sedge
Carex rosea	Cyperaceae	CARO22	native	4	n/a	n/a	n/a	rose sedge
Carex stricta	Cyperaceae	CAST8	native	5	n/a	n/a	n/a	tussock sedge

Carex vulpinoidea	Cyperaceae	CAVU2	native	3	n/a	n/a	n/a	fox sedge
Carya glabra	Juglandaceae	CAGL8	native	6	n/a	n/a	n/a	pignut hickory
Celastrus orbiculatus	Celastraceae	CEOR7	non-native	0	n/a	n/a	n/a	oriental bittersweet
Celtis occidentalis	Ulmaceae	CEOC	native	5	n/a	n/a	n/a	hackberry
Cicuta maculata	Apiaceae	CIMA2	native	5	n/a	n/a	n/a	spotted water hemlock
Circaea lutetiana	Onagraceae	CILU	native	3	n/a	n/a	n/a	broad-leaf enchanters-nightshade
Cornus amomum	Cornaceae	COAM2	native	5	n/a	n/a	n/a	silky dogwood
Cryptotaenia canadensis	Apiaceae	CRCA9	native	5	n/a	n/a	n/a	honewort
Dryopteris cristata	Dryopteridaceae	DRCR4	native	8	n/a	n/a	n/a	crested shield fern
Equisetum arvense	Equisetaceae	EQAR	native	2	n/a	n/a	n/a	field horsetail
Erigeron philadelphicus	Asteraceae	ERPH	native	2	n/a	n/a	n/a	philadelphia fleabane
Euthamia graminifolia	Asteraceae	EUGR5	native	2	n/a	n/a	n/a	flat-top goldentop
Festuca sp.	Poaceae	FESTU	non-native	0	n/a	n/a	n/a	fescue
Fraxinus americana	Oleaceae	FRAM2	native	5	n/a	n/a	n/a	white ash
Fraxinus pennsylvanica	Oleaceae	FRPE	native	5	n/a	n/a	n/a	green ash
Geum canadense	Rosaceae	GECA7	native	5	n/a	n/a	n/a	white avens
Glechoma hederacea	Lamiaceae	GLHE2	non-native	0	n/a	n/a	n/a	gill-over-the-ground
Glyceria striata	Poaceae	GLST	native	4	n/a	n/a	n/a	fowl manna grass

Hesperis matronalis	Brassicaceae	HEMA3	non-native	0	n/a	n/a	n/a	dames-rocket
Humulus japonicus	Cannabaceae	HUJA	non-native	0	n/a	n/a	n/a	japanese hops
Impatiens capensis	Balsaminaceae	IMCA	native	3	n/a	n/a	n/a	jewelweed
Juglans nigra	Juglandaceae	JUNI	native	3	n/a	n/a	n/a	black walnut
Juncus effusus	Juncaceae	JUEF	native	2	n/a	n/a	n/a	common rush
Juniperus virginiana	Cupressaceae	JUVI	native	2	n/a	n/a	n/a	eastern red-cedar
Ligustrum vulgare	Oleaceae	LIVU	non-native	0	n/a	n/a	n/a	common privet
Lindera benzoin	Lauraceae	LIBE3	native	5	n/a	n/a	n/a	spicebush
Liriodendron tulipifera	Magnoliaceae	LITU	native	5	n/a	n/a	n/a	tuliptree
Lonicera japonica	Caprifoliaceae	LOJA	non-native	0	n/a	n/a	n/a	japanese honeysuckle
Lonicera morrowii	Caprifoliaceae	LOMO2	non-native	0	n/a	n/a	n/a	morrows honeysuckle
Lycopus virginicus	Lamiaceae	LYVI4	native	4	n/a	n/a	n/a	virginia water horehound
Lysimachia nummularia	Primulaceae	LYNU	non-native	0	n/a	n/a	n/a	creeping jenny
Malus toringo	Rosaceae	MATO6	non-native	0	n/a	n/a	n/a	toringo crabapple
Myosotis scorpioides	Boraginaceae	MYSC	non-native	0	n/a	n/a	n/a	garden forget-me-not
Nasturtium officinale; rorippa nasturtium-aquaticum	Brassicaceae	NAOF	non-native	0	n/a	n/a	n/a	watercress
Nyssa sylvatica	Cornaceae	NYSY	native	4	n/a	n/a	n/a	sourgum

Onoclea sensibilis	Dryopteridaceae	ONSE	native	3	n/a	n/a	n/a	sensitive fern
Phalaris arundinacea	Poaceae	PHAR3	native	1	n/a	n/a	n/a	reed canary-grass
Phragmites australis	Poaceae	PHAU7	non-native	0	n/a	n/a	n/a	common reed
Polygonum cuspidatum; fallopia japonica; reynoutria japonica	Polygonaceae	POCU6	non-native	0	n/a	n/a	n/a	japanese knotweed
Polygonum persicaria	Polygonaceae	POPE3	non-native	0	n/a	n/a	n/a	ladys-thumb
Polygonum sagittatum	Polygonaceae	POSA5	native	3	n/a	n/a	n/a	arrow-leaved tearthumb
Polystichum acrostichoides	Dryopteridaceae	POAC4	native	5	n/a	n/a	n/a	christmas fern
Prunus serotina	Rosaceae	PRSE2	native	2	n/a	n/a	n/a	wild black cherry
Quercus palustris	Fagaceae	QUPA2	native	4	n/a	n/a	n/a	pin oak
Ranunculus abortivus	Ranunculaceae	RAAB	native	2	n/a	n/a	n/a	kidney-leaf buttercup
Ranunculus recurvatus	Ranunculaceae	RARE2	native	5	n/a	n/a	n/a	blisterwort
Ranunculus repens	Ranunculaceae	RARE3	non-native	0	n/a	n/a	n/a	creeping buttercup
Ranunculus sceleratus	Ranunculaceae	RASC3	native	5	n/a	n/a	n/a	cursed buttercup
Robinia pseudoacacia	Fabaceae	ROPS	non-native	0	n/a	n/a	n/a	black locust
Rosa multiflora	Rosaceae	ROMU	non-native	0	n/a	n/a	n/a	multiflora rose
Rosa palustris	Rosaceae	ROPA	native	6	n/a	n/a	n/a	swamp rose
Rubus occidentalis	Rosaceae	RUOC	native	3	n/a	n/a	n/a	black-cap raspberry

Rumex obtusifolius	Polygonaceae	RUOB	non-native	0	n/a	n/a	n/a	bitter dock
Salix nigra	Salicaceae	SANI	native	4	n/a	n/a	n/a	black willow
Sambucus nigra subsp. canadensis; sambucus canadensis	Caprifoliaceae	SANIC4	native	4	n/a	n/a	n/a	american black elderberry
Scirpus sp.	Cyperaceae	SCIRP	native	7	n/a	n/a	n/a	bulrush
Solidago gigantea	Asteraceae	SOGI	native	3	n/a	n/a	n/a	giant goldenrod
Stellaria media	Caryophyllaceae	STME2	non-native	0	n/a	n/a	n/a	common chickweed
Symplocarpus foetidus	Araceae	SYFO	native	5	n/a	n/a	n/a	skunk cabbage
Thelypteris noveboracensis	Thelypteridaceae	THNO	native	4	n/a	n/a	n/a	new york fern
Toxicodendron radicans	Anacardiaceae	TORA2	native	1	n/a	n/a	n/a	poison ivy
Typha latifolia	Typhaceae	TYLA	native	3	n/a	n/a	n/a	broadleaf cattail
Urtica sp.	Urticaceae	URTIC	non-native	0	n/a	n/a	n/a	nettle
Veronica anagallis-aquatica; veronica catenata; veronica comosa	Scrophulariaceae	VEAN2	native	7	n/a	n/a	n/a	water speedwell
Viburnum dentatum	Caprifoliaceae	VIDE	native	5	n/a	n/a	n/a	southern arrowwood
Viburnum prunifolium	Caprifoliaceae	VIPR	native	5	n/a	n/a	n/a	black-haw
Viburnum sp.	Caprifoliaceae	VIBUR	native	7	n/a	n/a	n/a	viburnum
Viola cucullata	Violaceae	VICU	native	6	n/a	n/a	n/a	blue marsh violet
Viola sororia	Violaceae	VISO	native	3	n/a	n/a	n/a	common blue violet
Vitis labrusca	Vitaceae	VILA8	native	5	n/a	n/a	n/a	fox grape

Transect/Plot Assessment

Edit This Transect/Plot | Download Report | Done

4562 - Reach 1, Plot 1

» Date & Location:

2020-05-27
4562 - Sp Inv
Lebanon Borough
Hunterdon, New Jersey, United States

» FQA Database:

Region: **New Jersey**
Year Published: **2019**
Description:
Walz, Kathleen S., Linda Kelly, Karl Anderson, Keith Bowman, Barbara Andreas, Richard Andrus, Scott Schuette, William Schumacher, Sean Robinson, Terry O'Brien, Eric Karlin and Jason Hafstad. 2018. Universal Floristic Quality Assessment Index for Vascular Plants and Mosses of New Jersey: Coefficient of Conservancy (CoC) Values for Species and Genera (Updated November 2019). New Jersey Department of Environmental Protection, New Jersey Forest Service, Office of Natural Lands Management, Trenton, NJ, 08625. Submitted to United States Environmental Protection Agency, Region 2, for State Wetlands Protection Development Grant, Section 104(B)(3); CFDA No. 66.461, CD97225809.

» Details:

Practitioner: **David Kunz**
Latitude: 40.646014
Longitude: -74.579675
Community Code:
Community Name:
Community Type Notes: Degraded Floodplain Woodland
Weather Notes:
Duration Notes:
Environmental Description:
Other Notes:
This assessment is **private** (viewable only by you).

» Transect/Plot Design:

Transect or Plot: **Plot**
Plot Size (m^2): 100
Quadrat/Subplot Size (m^2):
Transect Length (m):
Sampling Design Description:
Cover Method: Carolina Vegetation Survey

» Conservatism-Based Metrics:

Total Mean C: **2.6**
Cover-weighted Mean C: **2.3**

Native Mean C: **3.5**
Total FQI: **15.4**
Native FQI: **17.8**
Cover-weighted FQI: **13.6**
Cover-weighted Native FQI: **17.8**
Adjusted FQI: **30.2**
% C value 0: **25.7%**
% C value 1-3: **37.1%**
% C value 4-6: **37.1%**
% C value 7-10: **0%**

» Species Richness:

Total Species: **35**
Native Species: **26 (74.3%)**
Non-native Species: **9 (25.7%)**

» Species Wetness:

Mean Wetness: **n/a**
Native Mean Wetness: **n/a**

» Duration Metrics:

Annual: **n/a**
Perennial: **n/a**
Biennial: **n/a**

Native Annual: **n/a**
Native Perennial: **n/a**
Native Biennial: **n/a**

» Physiognomic Relative Importance Values:

Physiognomy	Frequency	Coverage	Relative Frequency (%)	Relative Coverage (%)	Relative Importance Value
Native tree	n/a	n/a			n/a
Native forb	n/a	n/a			n/a
Non-native forb	n/a	n/a			n/a
Non-native vine	n/a	n/a			n/a
Native vine	n/a	n/a			n/a
Non-native tree	n/a	n/a			n/a
Native shrub	n/a	n/a			n/a
Non-native shrub	n/a	n/a			n/a
Native grass	n/a	n/a			n/a
Non-native grass	n/a	n/a			n/a
Non-native fern	n/a	n/a			n/a
Native bryophyte	n/a	n/a			n/a
Non-native bryophyte	n/a	n/a			n/a
Native fern	n/a	n/a			n/a
Non-native rush	n/a	n/a			n/a
Native sedge	n/a	n/a			n/a
Non-native sedge	n/a	n/a			n/a
Native rush	n/a	n/a			n/a

» Species Relative Importance Values:

Species	Family	Acronym	Nativity	C	W	Physiognomy	Duration	Frequency	Coverage	Relative Frequency (%)	Relative Coverage (%)	Relative Importance Value
Elaeagnus umbellata	Elaeagnaceae	ELUM	non-native	0	n/a	n/a	n/a	1	38	2.9	21.8	12.4
Impatiens capensis	Balsaminaceae	IMCA	native	3	n/a	n/a	n/a	1	18	2.9	10.3	6.6
Solidago altissima; solidago canadensis var. scabra	Asteraceae	SOAL6	native	2	n/a	n/a	n/a	1	18	2.9	10.3	6.6
Cornus amomum	Cornaceae	COAM2	native	5	n/a	n/a	n/a	1	18	2.9	10.3	6.6
Quercus palustris	Fagaceae	QUPA2	native	4	n/a	n/a	n/a	1	8	2.9	4.6	3.8
Onoclea sensibilis	Dryopteridaceae	ONSE	native	3	n/a	n/a	n/a	1	8	2.9	4.6	3.8
Phragmites australis	Poaceae	PHAU7	non-native	0	n/a	n/a	n/a	1	8	2.9	4.6	3.8
Fraxinus americana	Oleaceae	FRAM2	native	5	n/a	n/a	n/a	1	4	2.9	2.3	2.6
Parthenocissus quinquefolia	Vitaceae	PAQU2	native	2	n/a	n/a	n/a	1	4	2.9	2.3	2.6
Solidago gigantea	Asteraceae	SOGI	native	3	n/a	n/a	n/a	1	4	2.9	2.3	2.6
Rubus allegheniensis	Rosaceae	RUAL	native	3	n/a	n/a	n/a	1	4	2.9	2.3	2.6
Lindera benzoin	Lauraceae	LIBE3	native	5	n/a	n/a	n/a	1	4	2.9	2.3	2.6
Viburnum prunifolium	Caprifoliaceae	VIPR	native	5	n/a	n/a	n/a	1	4	2.9	2.3	2.6
Lonicera japonica	Caprifoliaceae	LOJA	non-native	0	n/a	n/a	n/a	1	4	2.9	2.3	2.6
Festuca sp.	Poaceae	FESTU	non-native	0	n/a	n/a	n/a	1	4	2.9	2.3	2.6
Arisaema triphyllum	Araceae	ARTR	native	5	n/a	n/a	n/a	1	4	2.9	2.3	2.6
Cardamine impatiens	Brassicaceae	CAIM	non-native	0	n/a	n/a	n/a	1	4	2.9	2.3	2.6
Glyceria striata	Poaceae	GLST	native	4	n/a	n/a	n/a	1	2	2.9	1.1	2
Circaea lutetiana	Onagraceae	CILU	native	3	n/a	n/a	n/a	1	2	2.9	1.1	2
Eupatorium perfoliatum	Asteraceae	EUPE3	native	4	n/a	n/a	n/a	1	1	2.9	0.6	1.8

Thelypteris palustris	Thelypteridaceae	THPA	native	4	n/a	n/a	n/a	1	1	2.9	0.6	1.8
Carex stipata	Cyperaceae	CAST5	native	2	n/a	n/a	n/a	1	1	2.9	0.6	1.8
Carex lurida	Cyperaceae	CALU5	native	4	n/a	n/a	n/a	1	1	2.9	0.6	1.8
Euthamia graminifolia	Asteraceae	EUGR5	native	2	n/a	n/a	n/a	1	1	2.9	0.6	1.8
Hesperis matronalis	Brassicaceae	HEMA3	non-native	0	n/a	n/a	n/a	1	1	2.9	0.6	1.8
Acer negundo	Aceraceae	ACNE2	native	2	n/a	n/a	n/a	1	1	2.9	0.6	1.8
Galium aparine	Rubiaceae	GAAP2	native	2	n/a	n/a	n/a	1	1	2.9	0.6	1.8
Carex crinita	Cyperaceae	CACR6	native	5	n/a	n/a	n/a	1	1	2.9	0.6	1.8
Toxicodendron radicans	Anacardiaceae	TORA2	native	1	n/a	n/a	n/a	1	1	2.9	0.6	1.8
Geum canadense	Rosaceae	GECA7	native	5	n/a	n/a	n/a	1	1	2.9	0.6	1.8
Celastrus orbiculatus	Celastraceae	CEOR7	non-native	0	n/a	n/a	n/a	1	1	2.9	0.6	1.8
Duchesnea indica	Rosaceae	DUIN	non-native	0	n/a	n/a	n/a	1	1	2.9	0.6	1.8
Barbarea vulgaris	Brassicaceae	BAVU	non-native	0	n/a	n/a	n/a	1	1	2.9	0.6	1.8
Clematis virginiana	Ranunculaceae	CLVI5	native	5	n/a	n/a	n/a	1	0	2.9	0	1.5
Equisetum arvense	Equisetaceae	EQAR	native	2	n/a	n/a	n/a	1	0	2.9	0	1.5

» Quadrat/Subplot Level Metrics:

Quadrat/Subplot	Species Richness	Native Species Richness	Total Mean C	Native Mean C	Total FQI	Native FQI	Cover-weighted FQI	Cover-weighted Native FQI	Adjusted FQI	Mean Wetness	Mean Native Wetness	Latitude	Longitude
FullTransectPlot	35	26	2.6	3.5	15.4	17.8	13.6	17.8	30.2	n/a	n/a	n/a	n/a
Average	35	26	2.6	3.5	15.4	17.8	13.6	17.8	30.2	0	0	n/a	n/a
Standard Deviation	0	0	0	0	0	0	0	0	0	0	0	n/a	n/a

» Quadrat/Subplot FullTransectPlot Species:

Scientific Name	Family	Acronym	% Cover	Cover Range (Midpt)	Nativity	C	W	Physiognomy	Duration	Common Name
Acer negundo	Aceraceae	ACNE2	1	3: 1-2% (1.5)	native	2	n/a	n/a	n/a	box-elder
Arisaema triphyllum	Araceae	ARTR	4	4: 2-5% (3.5)	native	5	n/a	n/a	n/a	jack-in-the-pulpit
Barbarea vulgaris	Brassicaceae	BAVU	1	3: 1-2% (1.5)	non-native	0	n/a	n/a	n/a	common wintercress

Cardamine impatiens	Brassicaceae	CAIM	4	4: 2-5% (3.5)	non-native	0	n/a	n/a	n/a	narrowleaf bitter cress
Carex crinita	Cyperaceae	CACR6	1	3: 1-2% (1.5)	native	5	n/a	n/a	n/a	fringed sedge
Carex lurida	Cyperaceae	CALU5	1	3: 1-2% (1.5)	native	4	n/a	n/a	n/a	sallow sedge
Carex stipata	Cyperaceae	CAST5	1	3: 1-2% (1.5)	native	2	n/a	n/a	n/a	awl-fruited sedge
Celastrus orbiculatus	Celastraceae	CEOR7	1	3: 1-2% (1.5)	non-native	0	n/a	n/a	n/a	oriental bittersweet
Circaea lutetiana	Onagraceae	CILU	2	3: 1-2% (1.5)	native	3	n/a	n/a	n/a	broad-leaf enchanters-nightshade
Clematis virginiana	Ranunculaceae	CLVI5	0	2: 0.1-1% (0.55)	native	5	n/a	n/a	n/a	virgins-bower
Cornus amomum	Cornaceae	COAM2	18	6: 10-25% (17.5)	native	5	n/a	n/a	n/a	silky dogwood
Duchesnea indica	Rosaceae	DUIN	1	3: 1-2% (1.5)	non-native	0	n/a	n/a	n/a	indian strawberry
Elaeagnus umbellata	Elaeagnaceae	ELUM	38	7: 25-50% (37.5)	non-native	0	n/a	n/a	n/a	autumn-olive
Equisetum arvense	Equisetaceae	EQAR	0	2: 0.1-1% (0.55)	native	2	n/a	n/a	n/a	field horsetail
Eupatorium perfoliatum	Asteraceae	EUPE3	1	3: 1-2% (1.5)	native	4	n/a	n/a	n/a	boneset
Euthamia graminifolia	Asteraceae	EUGR5	1	3: 1-2% (1.5)	native	2	n/a	n/a	n/a	flat-top goldentop
Festuca sp.	Poaceae	FESTU	4	4: 2-5% (3.5)	non-native	0	n/a	n/a	n/a	fescue
Fraxinus americana	Oleaceae	FRAM2	4	4: 2-5% (3.5)	native	5	n/a	n/a	n/a	white ash
Galium aparine	Rubiaceae	GAAP2	1	3: 1-2% (1.5)	native	2	n/a	n/a	n/a	stickywilly
Geum canadense	Rosaceae	GECA7	1	3: 1-2% (1.5)	native	5	n/a	n/a	n/a	white avens
Glyceria striata	Poaceae	GLST	2	3: 1-2% (1.5)	native	4	n/a	n/a	n/a	fowl manna grass
Hesperis matronalis	Brassicaceae	HEMA3	1	3: 1-2% (1.5)	non-native	0	n/a	n/a	n/a	dames-rocket
Impatiens capensis	Balsaminaceae	IMCA	18	6: 10-25% (17.5)	native	3	n/a	n/a	n/a	jewelweed
Lindera benzoin	Lauraceae	LIBE3	4	4: 2-5% (3.5)	native	5	n/a	n/a	n/a	spicebush
Lonicera japonica	Caprifoliaceae	LOJA	4	4: 2-5% (3.5)	non-native	0	n/a	n/a	n/a	japanese honeysuckle
Onoclea sensibilis	Dryopteridaceae	ONSE	8	5: 5-10% (7.5)	native	3	n/a	n/a	n/a	sensitive fern
Parthenocissus quinquefolia	Vitaceae	PAQU2	4	4: 2-5% (3.5)	native	2	n/a	n/a	n/a	virginia-creeper
Phragmites australis	Poaceae	PHAU7	8	5: 5-10% (7.5)	non-native	0	n/a	n/a	n/a	common reed

Quercus palustris	Fagaceae	QUPA2	8	5: 5-10% (7.5)	native	4	n/a	n/a	n/a	pin oak
Rubus allegheniensis	Rosaceae	RUAL	4	4: 2-5% (3.5)	native	3	n/a	n/a	n/a	allegheny blackberry
Solidago altissima; solidago canadensis var. scabra	Asteraceae	SOAL6	18	6: 10-25% (17.5)	native	2	n/a	n/a	n/a	canada goldenrod
Solidago gigantea	Asteraceae	SOGI	4	4: 2-5% (3.5)	native	3	n/a	n/a	n/a	giant goldenrod
Thelypteris palustris	Thelypteridaceae	THPA	1	3: 1-2% (1.5)	native	4	n/a	n/a	n/a	eastern marsh fern
Toxicodendron radicans	Anacardiaceae	TORA2	1	3: 1-2% (1.5)	native	1	n/a	n/a	n/a	poison ivy
Viburnum prunifolium	Caprifoliaceae	VIPR	4	4: 2-5% (3.5)	native	5	n/a	n/a	n/a	black-haw

Transect/Plot Assessment

Edit This Transect/Plot | Download Report | Done

4562 - Reach 2, Plot 2

» Date & Location:

2020-05-27
4562 - Sp Inv
Lebanon Borough
Hunterdon, New Jersey, United States

» FQA Database:

Region: **New Jersey**
Year Published: **2019**
Description:
Walz, Kathleen S., Linda Kelly, Karl Anderson, Keith Bowman, Barbara Andreas, Richard Andrus, Scott Schuette, William Schumacher, Sean Robinson, Terry O'Brien, Eric Karlin and Jason Hafstad. 2018. Universal Floristic Quality Assessment Index for Vascular Plants and Mosses of New Jersey: Coefficient of Conservancy (CoC) Values for Species and Genera (Updated November 2019). New Jersey Department of Environmental Protection, New Jersey Forest Service, Office of Natural Lands Management, Trenton, NJ, 08625. Submitted to United States Environmental Protection Agency, Region 2, for State Wetlands Protection Development Grant, Section 104(B)(3); CFDA No. 66.461, CD97225809.

» Details:

Practitioner: **David Kunz**
Latitude: 40.641378
Longitude: -74.824516
Community Code:
Community Name:
Community Type Notes: Degraded Floodplain Woodland
Weather Notes:
Duration Notes:
Environmental Description:
Other Notes:
This assessment is **private** (viewable only by you).

» Transect/Plot Design:

Transect or Plot: **Plot**
Plot Size (m^2): 100
Quadrat/Subplot Size (m^2):
Transect Length (m):
Sampling Design Description:
Cover Method: Carolina Vegetation Survey

» Conservatism-Based Metrics:

Total Mean C: **2.3**
Cover-weighted Mean C: **1.7**
Native Mean C: **3.8**
Total FQI: **13**
Native FQI: **17**
Cover-weighted FQI: **9.6**
Cover-weighted Native FQI: **17.4**
Adjusted FQI: **30**
% C value 0: **37.5%**
% C value 1-3: **28.1%**
% C value 4-6: **31.3%**
% C value 7-10: **3.1%**

» Species Richness:

Total Species: **32**
Native Species: **20 (62.5%)**
Non-native Species: **12 (37.5%)**

» Species Wetness:

Mean Wetness: **n/a**
Native Mean Wetness: **n/a**

» Duration Metrics:

Annual: **n/a**
Perennial: **n/a**
Biennial: **n/a**

Native Annual: **n/a**
Native Perennial: **n/a**
Native Biennial: **n/a**

» Physiognomic Relative Importance Values:

Physiognomy	Frequency	Coverage	Relative Frequency (%)	Relative Coverage (%)	Relative Importance Value
Native tree	n/a	n/a			n/a
Native forb	n/a	n/a			n/a
Non-native forb	n/a	n/a			n/a
Non-native vine	n/a	n/a			n/a
Native vine	n/a	n/a			n/a
Non-native tree	n/a	n/a			n/a
Native shrub	n/a	n/a			n/a
Non-native shrub	n/a	n/a			n/a
Native grass	n/a	n/a			n/a
Non-native grass	n/a	n/a			n/a
Non-native fern	n/a	n/a			n/a
Native bryophyte	n/a	n/a			n/a
Non-native bryophyte	n/a	n/a			n/a
Native fern	n/a	n/a			n/a
Non-native rush	n/a	n/a			n/a
Native sedge	n/a	n/a			n/a

Non-native sedge	n/a	n/a	n/a
Native rush	n/a	n/a	n/a

» Species Relative Importance Values:

Species	Family	Acronym	Nativity	C	W	Physiognomy	Duration	Frequency	Coverage	Relative Frequency (%)	Relative Coverage (%)	Relative Importance Value
Rosa multiflora	Rosaceae	ROMU	non-native	0	n/a	n/a	n/a	1	63	3.1	22	12.6
Impatiens capensis	Balsaminaceae	IMCA	native	3	n/a	n/a	n/a	1	63	3.1	22	12.6
Robinia pseudoacacia	Fabaceae	ROPS	non-native	0	n/a	n/a	n/a	1	38	3.1	13.3	8.2
Glechoma hederacea	Lamiaceae	GLHE2	non-native	0	n/a	n/a	n/a	1	18	3.1	6.3	4.7
Lindera benzoin	Lauraceae	LIBE3	native	5	n/a	n/a	n/a	1	18	3.1	6.3	4.7
Polygonum cuspidatum; fallopia japonica; reynoutria japonica	Polygonaceae	POCU6	non-native	0	n/a	n/a	n/a	1	18	3.1	6.3	4.7
Laportea canadensis	Urticaceae	LACA3	native	6	n/a	n/a	n/a	1	18	3.1	6.3	4.7
Alliaria petiolata	Brassicaceae	ALPE4	non-native	0	n/a	n/a	n/a	1	18	3.1	6.3	4.7
Cryptotaenia canadensis	Apiaceae	CRCA9	native	5	n/a	n/a	n/a	1	8	3.1	2.8	3
Acer negundo	Aceraceae	ACNE2	native	2	n/a	n/a	n/a	1	4	3.1	1.4	2.3
Festuca sp.	Poaceae	FESTU	non-native	0	n/a	n/a	n/a	1	2	3.1	0.7	1.9
Lonicera japonica	Caprifoliaceae	LOJA	non-native	0	n/a	n/a	n/a	1	2	3.1	0.7	1.9
Parthenocissus quinquefolia	Vitaceae	PAQU2	native	2	n/a	n/a	n/a	1	2	3.1	0.7	1.9
Lysimachia nummularia	Primulaceae	LYNU	non-native	0	n/a	n/a	n/a	1	2	3.1	0.7	1.9
Vitis labrusca	Vitaceae	VILA8	native	5	n/a	n/a	n/a	1	1	3.1	0.3	1.7
Toxicodendron radicans	Anacardiaceae	TORA2	native	1	n/a	n/a	n/a	1	1	3.1	0.3	1.7
Duchesnea indica	Rosaceae	DUIN	non-native	0	n/a	n/a	n/a	1	1	3.1	0.3	1.7
Carex rosea	Cyperaceae	CARO22	native	4	n/a	n/a	n/a	1	1	3.1	0.3	1.7
Geum canadense	Rosaceae	GECA7	native	5	n/a	n/a	n/a	1	1	3.1	0.3	1.7

Symplocarpus foetidus	Araceae	SYFO	native	5	n/a	n/a	n/a	1	1	3.1	0.3	1.7
Circaea lutetiana	Onagraceae	CILU	native	3	n/a	n/a	n/a	1	1	3.1	0.3	1.7
Hesperis matronalis	Brassicaceae	HEMA3	non-native	0	n/a	n/a	n/a	1	1	3.1	0.3	1.7
Glyceria striata	Poaceae	GLST	native	4	n/a	n/a	n/a	1	1	3.1	0.3	1.7
Rubus occidentalis	Rosaceae	RUOC	native	3	n/a	n/a	n/a	1	1	3.1	0.3	1.7
Carex amphibola; carex amphibola var. amphibola; carex grisea var. amphibola	Cyperaceae	CAAM8	native	9	n/a	n/a	n/a	1	1	3.1	0.3	1.7
Rubus phoenicolasius	Rosaceae	RUPH	non-native	0	n/a	n/a	n/a	1	1	3.1	0.3	1.7
Geranium maculatum	Geraniaceae	GEMA	native	5	n/a	n/a	n/a	1	0	3.1	0	1.6
Polygonum virginianum	Polygonaceae	POVI2	native	4	n/a	n/a	n/a	1	0	3.1	0	1.6
Hypericum punctatum	Clusiaceae	HYPU	native	1	n/a	n/a	n/a	1	0	3.1	0	1.6
Ligustrum vulgare	Oleaceae	LIVU	non-native	0	n/a	n/a	n/a	1	0	3.1	0	1.6
Phalaris arundinacea	Poaceae	PHAR3	native	1	n/a	n/a	n/a	1	0	3.1	0	1.6
Ranunculus abortivus	Ranunculaceae	RAAB	native	2	n/a	n/a	n/a	1	0	3.1	0	1.6

» Quadrat/Subplot Level Metrics:

Quadrat/Subplot	Species Richness	Native Species Richness	Total Mean C	Native Mean C	Total FQI	Native FQI	Cover-weighted FQI	Cover-weighted Native FQI	Adjusted FQI	Mean Wetness	Mean Native Wetness	Latitude	Longitude
FullTransectPlot	32	20	2.3	3.8	13	17	9.6	17.4	30	n/a	n/a	n/a	n/a
Average	32	20	2.3	3.8	13	17	9.6	17.4	30	0	0	n/a	n/a
Standard Deviation	0	0	0	0	0	0	0	0	0	0	0	n/a	n/a

» Quadrat/Subplot FullTransectPlot Species:

Scientific Name	Family	Acronym	% Cover	Cover Range (Midpt)	Nativity	C	W	Physiognomy	Duration	Common Name

Acer negundo	Aceraceae	ACNE2	4	4: 2-5% (3.5)	native	2	n/a	n/a	n/a	box-elder
Alliaria petiolata	Brassicaceae	ALPE4	18	6: 10-25% (17.5)	non-native	0	n/a	n/a	n/a	garlic-mustard
Carex amphibola; carex amphibola var. amphibola; carex grisea var. amphibola	Cyperaceae	CAAM8	1	3: 1-2% (1.5)	native	9	n/a	n/a	n/a	eastern narrow-leaf sedge
Carex rosea	Cyperaceae	CARO22	1	3: 1-2% (1.5)	native	4	n/a	n/a	n/a	rose sedge
Circaea lutetiana	Onagraceae	CILU	1	3: 1-2% (1.5)	native	3	n/a	n/a	n/a	broad-leaf enchanters-nightshade
Cryptotaenia canadensis	Apiaceae	CRCA9	8	5: 5-10% (7.5)	native	5	n/a	n/a	n/a	honewort
Duchesnea indica	Rosaceae	DUIN	1	3: 1-2% (1.5)	non-native	0	n/a	n/a	n/a	indian strawberry
Festuca sp.	Poaceae	FESTU	2	3: 1-2% (1.5)	non-native	0	n/a	n/a	n/a	fescue
Geranium maculatum	Geraniaceae	GEMA	0	2: 0.1-1% (0.55)	native	5	n/a	n/a	n/a	wood geranium
Geum canadense	Rosaceae	GECA7	1	3: 1-2% (1.5)	native	5	n/a	n/a	n/a	white avens
Glechoma hederacea	Lamiaceae	GLHE2	18	6: 10-25% (17.5)	non-native	0	n/a	n/a	n/a	gill-over-the-ground
Glyceria striata	Poaceae	GLST	1	3: 1-2% (1.5)	native	4	n/a	n/a	n/a	fowl manna grass
Hesperis matronalis	Brassicaceae	HEMA3	1	3: 1-2% (1.5)	non-native	0	n/a	n/a	n/a	dames-rocket
Hypericum punctatum	Clusiaceae	HYPU	0	2: 0.1-1% (0.55)	native	1	n/a	n/a	n/a	spotted st. johns-wort
Impatiens capensis	Balsaminaceae	IMCA	63	8: 50-75% (62.5)	native	3	n/a	n/a	n/a	jewelweed
Laportea canadensis	Urticaceae	LACA3	18	6: 10-25% (17.5)	native	6	n/a	n/a	n/a	wood-nettle
Ligustrum vulgare	Oleaceae	LIVU	0	2: 0.1-1% (0.55)	non-native	0	n/a	n/a	n/a	common privet
Lindera benzoin	Lauraceae	LIBE3	18	6: 10-25% (17.5)	native	5	n/a	n/a	n/a	spicebush
Lonicera japonica	Caprifoliaceae	LOJA	2	3: 1-2% (1.5)	non-native	0	n/a	n/a	n/a	japanese honeysuckle
Lysimachia nummularia	Primulaceae	LYNU	2	3: 1-2% (1.5)	non-native	0	n/a	n/a	n/a	creeping jenny
Parthenocissus quinquefolia	Vitaceae	PAQU2	2	3: 1-2% (1.5)	native	2	n/a	n/a	n/a	virginia-creeper
Phalaris arundinacea	Poaceae	PHAR3	0	2: 0.1-1% (0.55)	native	1	n/a	n/a	n/a	reed canary-grass

Polygonum cuspidatum; fallopia japonica; reynoutria japonica	Polygonaceae	POCU6	18	6: 10-25% (17.5)	non-native	0	n/a	n/a	n/a	japanese knotweed
Polygonum virginianum	Polygonaceae	POVI2	0	2: 0.1-1% (0.55)	native	4	n/a	n/a	n/a	jumpseed
Ranunculus abortivus	Ranunculaceae	RAAB	0	2: 0.1-1% (0.55)	native	2	n/a	n/a	n/a	kidney-leaf buttercup
Robinia pseudoacacia	Fabaceae	ROPS	38	7: 25-50% (37.5)	non-native	0	n/a	n/a	n/a	black locust
Rosa multiflora	Rosaceae	ROMU	63	8: 50-75% (62.5)	non-native	0	n/a	n/a	n/a	multiflora rose
Rubus occidentalis	Rosaceae	RUOC	1	3: 1-2% (1.5)	native	3	n/a	n/a	n/a	black-cap raspberry
Rubus phoenicolasius	Rosaceae	RUPH	1	3: 1-2% (1.5)	non-native	0	n/a	n/a	n/a	wineberry
Symplocarpus foetidus	Araceae	SYFO	1	3: 1-2% (1.5)	native	5	n/a	n/a	n/a	skunk cabbage
Toxicodendron radicans	Anacardiaceae	TORA2	1	3: 1-2% (1.5)	native	1	n/a	n/a	n/a	poison ivy
Vitis labrusca	Vitaceae	VILA8	1	3: 1-2% (1.5)	native	5	n/a	n/a	n/a	fox grape

BOROUGH OF LEBANON
HUNTERDON COUNTY N.J.

LEBANON BOROUGH PLANNING BOARD
BOARD OF ADJUSTMENT

Tuesday, December 8, 2020 7 pm

1. Open Meeting

2. Open Public Meetings Act
   This Meeting has been convened in compliance with the Open Public Meetings Act. Three local newspapers were notified, and a notice has been posted at Borough Hall.

3. Pledge of Allegiance:

4. Moment of Silence

5. Roll Call:

6. Minutes Approval: November 2020

7. Expenditure Approval

8. Master Plan Hearing, Functional Value Assessment and Stream Corridor Plan.
   Sub-element of Conservation Plan Element

9. Resolution Functional Value Assessment and Stream Corridor Plan.

10. Public Hearing on Proposed Non- Condemnation Area in need of Redevelopment study for:

Block 4, Lot 1.01 (100 Corporate Drive);
Block 4, Lot 1.02 (200 Corporate Drive);
Block 4, Lot 1.03 (400 Corporate Drive);
Block 4, Lot 1.04 (500 Corporate Drive);
Block 4, Lot 1.05 (600 Corporate Drive);
Block 4, Lot 2 (19 Cokesbury Road);
Block 4, Lot 5 (11 Cokesbury Road);
Block 4, Lot 7 (1266 Highway 22);
Block 4, Lot 8 (1262-1264 Highway 22); and,
Block 4, Lot 9 (1258-1260 Highway 22).

11. Resolution Public Hearing on Proposed Non- Condemnation Area in need of Redevelopment Study

12. Pellegrino Block 7 Lot 16 Variance for Accessor Structure

13. Discussion: Waving the Variance process for outdoor tents for Restaurants

12. Miscellaneous:

13. Public Comment:

14. Adjournment:

RESOLUTION ADOPTING THE 2020 FUNCTIONAL VALUE ASSESSMENT AND STREAM CORRIDOR PLAN SUB-ELEMENT OF THE CONSERVATION PLAN ELEMENT OF THE BOROUGH OF LEBANON MASTER PLAN

RESOLUTION 2020-10

WHEREAS, upon notice duly provided pursuant to N.J.S.A. 40:55D-13, the Lebanon Borough Planning Board (the "Board") held a public hearing on December 8, 2020 on the adoption of a proposed sub-element of the Conservation Plan Element of the Borough of Lebanon Master Plan, specifically, the 2020 Functional Value Assessment and Stream Corridor Plan Sub-Element of the Conservation Plan Element of the Borough of Lebanon Master Plan; and

WHEREAS, upon the conclusion of the public hearing, the Board determined that the 2020 Functional Value Assessment and Stream Corridor Plan Sub-Element of the Conservation Plan Element was consistent with the goals and objectives of the Conservation Plan Element as well as the other elements of the Master Plan, is consistent with the New Jersey State Highlands Council Regional Master Plan, and will guide the use of lands in the municipality in a manner which protects public health and safety and promotes the general welfare in accordance with N.J.S.A. 40:55D-28;

NOW THEREFORE BE IT RESOLVED, by motion duly made and seconded by the Board on December 8, 2020 that the Board hereby adopts the 2020 Functional Value Assessment and Stream Corridor Plan as a Sub-Element of the Conservation Plan Element of the Borough of Lebanon Master Plan.

BE IT FURTHER RESOLVED that a copy of this resolution, and the 2020 Functional Value Assessment and Stream Corridor Plan Sub-Element of the Conservation Plan Element of the Borough of Lebanon Master Plan shall be submitted by the Planning Board Secretary to: the Mayor and Borough Council via the Lebanon Clerk; the municipal clerks of each and every adjoining municipality; and the Hunterdon County Planning Board; and the New Jersey State Highlands Council not more than 30 days after the date of the adoption of this resolution.

* * *

The above resolution was adopted on December 8, 2020 by the following vote of Board members:

Member	Yes	No	Abstain	Absent
SAHARIC	X			
UCURIN	X			
HOPKINS	X			
ABELES	X			
LAPCYNSKI				X
HAUCK	X			
WISON				X
SKENE	X			
PITTINGER	X			
BERGER	X			

ALEX SAHARIC, Chairperson

ATTEST: KAREN ROMANO, Secretary
DATE ADOPTED: December 8, 2020