ACCOTINK CREEK STREAM STABILITY ASSESSMENT AND PRIORITIZATION PLAN

SUPPLEMENTAL REPORT FOR DANIELS RUN

City of Fairfax, Virginia

October 14, 2008

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

APPENDICES

I. EXECUTIVE SUMMARY

RK&K conducted a stream assessment of the Accotink Creek stream system within the City of Fairfax in the spring of 2007 to capture the scale and extent of stream bank erosion in the Accotink Creek watershed as well as develop a prioritization plan for future restoration activities based upon observed conditions. In summer 2008, RK&K conducted a stream assessment of Daniels Run to supplement the original prioritization scheme formulated in 2007. The ultimate goal of the study was to provide a five-year plan and associated budget to maximize near future restoration efforts. This report represents the new findings on Daniels Run and the incorporation of this new information into the prioritization scheme created from the 2007 report on Accotink Creek. This report should be used in parallel with the 2007 *Accotink Creek Stream Stability Assessment and Prioritization Plan Final Report.*

Background investigation was initiated including a review of past studies focusing on the City's streams and their stability and health. Field assessments were then performed on reaches in the study area. During field investigations, the streams in the study area were divided into reaches of similar geomorphic and hydraulic characteristics. In the 2007 study, a total of 31 reaches resulted with an average length of 1200 LF. In the 2008 supplemental study, a total of 30 reaches resulted with an average length of 443 LF. Assessments were conducted using the Bank Erodibility Hazard Index (BEHI) method to quantify the stream bank scour potential. Also, visual assessments of stream accessibility, impacted properties, natural resources, and nearby utilities were made and documented. This report only includes those results for Daniels Run.

Once all reaches were assessed, BEHI scores were totaled and reach locations were mapped. It was found that over 85% of studied stream reach length on Daniels Run had at least a high potential for stream bank degradation and over 40% of all stream reaches on Daniels Run were found to be at very high or extreme risk for stream bank degradation. It is evident from these results that stream bank erosion is a major impact on the stability and overall health of the City's streams.

The results of the BEHI assessment for Daniels Run were analyzed along with data on the feasibility of construction and public sentiment for all the studied reaches. A prioritization analysis on all stream reaches on Accotink Creek and Daniels Run was performed using this data producing 12 reaches of high priority. Previously restored reaches in need of repairs due to recent storm damages were also included in this priority listing to produce a total of 15 priority reaches: four from the South Reach, two from the North Reach, one from the Dale Lestina tributary, one from the Main Stem, and seven from Daniels Run.

Three levels of restoration were assumed for a cost analysis: light, moderate, and full. A range of costs were associated with each level of effort. Light restoration involves restoring short reaches of stream using low-cost efforts targeted at protecting nearby properties, resources, or utilities. Full restoration includes activities such as grading back banks, using in-stream structures to control lateral and vertical migration, and producing comprehensive planting plans. Moderate restoration incorporates aspects of light and full restoration.

Once the priority reaches were identified and restoration efforts spelled out, two five-year budgetary scenarios were developed using two funding levels: $200,000 per year and $500,000 per year. The cost assumed for restoration at each reach was estimated by incorporating the severity of bank erosion along with feasibility of the site. Areas impacting citizens were first targeted with funds. Previously restored reaches that had been damaged were then targeted, and finally all other areas identified by bank severity were included. The results were broken down by budget scenario. While the smaller funding scenario effectively covered areas impacting citizens, the higher funding provided for a more comprehensive restoration plan. With the higher funding scenario, an additional 89% of bank length can be restored, while also allowing for some full restoration opportunities.

Other related topics, including stormwater management retrofit, stream monitoring, and outside funding sources are discussed at the end of this report.

II. INTRODUCTION

Since 1994, the City of Fairfax has completed full restoration projects on approximately 2.2 miles of stream and has stabilized approximately 3.8 miles of stream, accounting for 68% of stream within the City boundary. In late June/early July 2006, significant rain events led to severe erosion of stream bed and bank in several locations, including in areas previously restored by the City. Study and possible restoration of these damaged areas is necessary to stabilize the stream and address effects to water quality, aquatic life, forest, and private property.

RK&K has been selected by the City to provide design services for stream bank restoration along Accotink Creek and its tributaries. This report represents the supplemental stream ranking portion of RK&K's efforts for Daniels Run, as well as a prioritization scheme for the streams in Fairfax, including both Daniels Run and Accotink Creek. Assessment methods used to rank the stream reaches include a visual assessment of the stream bed and banks, photographic documentation, Bank Erosion Hazard Index (BEHI) assessment, review of past watershed and stream studies, and a decision matrix that includes economic, social, and ecological factors.

III. GOALS

The primary goals of the stream assessment and prioritization report of Accotink Creek, inclusive of Daniels Run and other tributaries, are to assess the current condition of stream bank stability and to prioritize stream reaches for restoration. Prioritization is influenced by the following factors: stream degradation, public/private easements, access, ancillary effects to trees and other resources, aesthetic concerns, cost/benefit assessment, and public/private sentiment.

IV. BACKGROUND

The City of Fairfax is mostly located in the Accotink Creek Watershed, within the larger Potomac-Shenandoah watershed. Approximately ten miles of stream channel exist within the city, with Accotink Creek serving as the major drainage body. The South Reach of Accotink originates in the southwest and flows in a northeast direction. The North Reach originates in the northern section of the city and flows in an easterly direction, where it meets Dale Lestina tributary before joining the South Reach of Accotink Creek. Draper Drive tributary begins in the northern section of the city, flowing south until its confluence with the Main Stem just before flowing under Lee Highway. Daniels Run begins in the southern section of the city and flows northeast until its confluence with the Main Stem. Accotink Creek then flows under Pickett Road and leaves the City of Fairfax. The location of these streams within the City of Fairfax is shown in Figure 1.

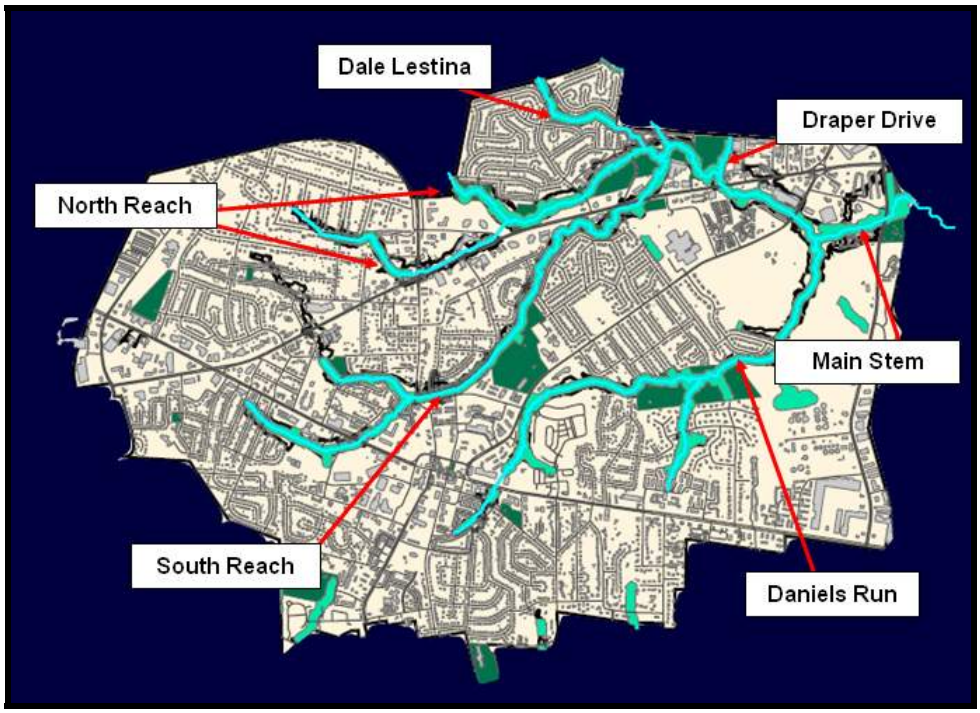

Figure 1: Accotink Creek's Tributaries

IV.A. Biological and Physical Assessment

A stream survey was conducted by the Louis Berger Group, Inc. and Gannett Fleming, Inc. for the City of Fairfax in October 2002 to assess the physical and biological health of streams located in the City of Fairfax, including both Accotink Creek and its tributaries and Daniels Run. The Stream Visual Assessment Protocol developed by the USDA was utilized to evaluate and quantify biological conditions in the stream system. Physical conditions include channel condition, hydrologic alteration, riparian zone vegetation, vegetative protection, and bank stability. Biological and habitat conditions include sediment deposition, water appearance, nutrient enrichment, barriers to fish movement, instream fish cover, pools, insect/invertebrate habitat, canopy cover, riffle embeddedness, and macroinvertebrates observed.

According to the Lois Berger report, the City of Fairfax has restored 68% of its streams. Even after this amount of restoration, only 1% of the reaches examined remained in excellent physical condition, while 26% had a score of good, 9% a score of fair, and 65% a score of poor. It should be noted that most stream reaches with a good physical score were in areas where Fairfax had recently completed restoration projects. The worst conditions were located on the lower Main Stem, Daniels Run, and the lower South Reach. The North Reach, especially near the confluence of the North Reach with the South Reach, was in the best condition.

Though physical conditions of the streams were found to be improving, the biological conditions were not restored yet. No stream reaches were given a score of excellent or good, with 20% receiving a score of fair and 80% receiving a score of poor. The South Reach and Main Stem seemed to be in the worst condition, as affirmed in the previous paragraph.

Overall stream health also was calculated in the report using the aforementioned physical, biological, and habitat assessments. In the study, no stream reaches were given an overall stream health score of excellent, 3% of the streams were given an overall score of good, 20% received a score of fair, and 77% were given a score of poor. The South Reach and lower Main Stem of Accotink Creek were in the worst condition, followed by Daniels Run. The Overall result scores are seen in Figure 2.

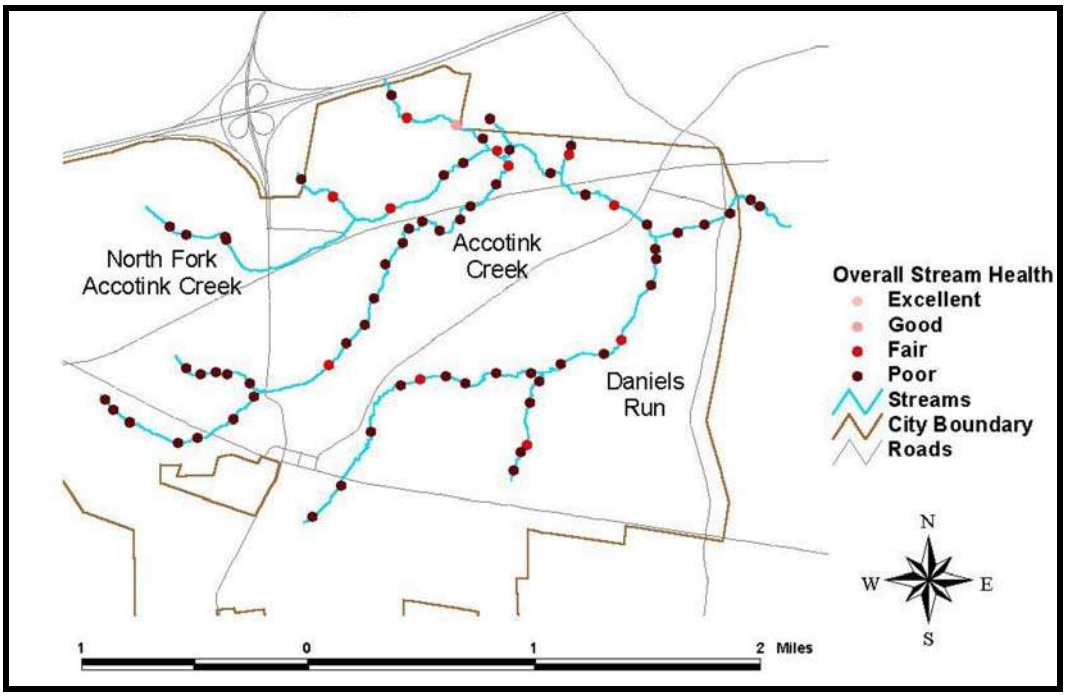

Figure 2: Overall Stream Health in the City of Fairfax *(Adapted from City of Fairfax 2002)*

V. METHODS

An assessment of present and potential erosion in the Accotink Stream system was conducted in the early spring of 2007 with an analysis of Accotink Creek's North Fork, South Fork, and Main Stem. These results are located in the 2007 *Accotink Creeek Stream Stability Assessment and Prioritization Plan Final Report*, though mapping is also located in Appendix E. Reaches were also identified in summer of 2008 for an analysis of Daniels Run, which is the main focus of this report. Reaches were identified based on channel features and assessed using visual observations and the Bank Erodability Hazard Index (BEHI).

V.A. Reach Identification

To describe and assess the stream system, it was necessary to divide the streams into reaches. Reach limits were set based upon changes in channel size and shape, slope, and vegetative patterns. Often, divisions were made at road crossings based on the influence that these crossings have on stream systems. In 2007, a total of 31 reaches were identified with an average length of 1200 LF. In 2008, a total of 30 reaches were identified with an average length of 443 LF.

In this study, reaches are identified by their tributary; "SR" designates the reaches in the South Reach, "NR" designates the reach in the North Reach; "MS" designates the Main Stem; "DDT" designates reaches in the Draper Drive tributary; "DLT" designates reaches in the Dale Lestina tributary; and "D" designated reaches in Daniels Run. The number immediately following the tributary (i.e., SR**1**) designates each branch within the tributary network, and the three-digit number following the tributary identification (i.e., SR1-**001**) designates the specific reach within each tributary branch.

V.B. Visual Assessment

Visual assessment and photographic documentation of the stream system was conducted to record the current conditions of the stream and to substantiate the BEHI scores given to a particular reach. Photographs taken include both upstream and downstream views, bank erosion conditions, riparian vegetation, and the condition of

previous restoration efforts. At least two pictures were taken in each reach, with extra pictures denoting areas of significance. Appendix A contains photographs of each reach. Other site-specific features were noted, such as the adequacy of access to the reach, mature tree population, debris in the stream (natural or manmade), direct impacts to property, and nearby utilities that could potentially affect stream improvement work done on the reach.

V.C. Bank Erosion Hazard Index (BEHI)

BEHI assessments were conducted on Accotink Creek on January 16-19, 2007 and on Daniels Run on August 4-7, 2008. The field effort was intended to be quick so that the entire system could be assessed in a short period of time. This allows comprehensive "calibration" so the assessor's scoring is as objective as possible. BEHI scores characterize the reaches rather than using a more in-depth study of individual banks that would be delineated and characterized for more precise erosional rate predictions. This study was intended to be expanded to include more precise assessment once potential restoration reaches were selected. Summary score sheets and result mapping for Daniels Run are included in Appendices B and C; Accotink Creek results are located in the 2007 *Accotink Creeek Stream Stability Assessment and Prioritization Plan Final Report*, though mapping is also located in Appendix E.

VI. RESULTS OF ASSESSMENT

VI.A. Bank Erosion Hazard Index

BEHI scores were determined, with results reflecting the initial observations of excessive stream bank erosion. In Daniels Run, no reaches were found to have low bank erosion potential and only six reaches were found to have moderate potential. The remaining 24 reaches (80% of the total reaches observed) have high, very high, or extreme bank erosion potential. A more descriptive measure of the extent of bank erosion in the study area is the amount of total stream length in each category. Table 1 illustrates the distribution of bank erosion severity by stream length in Daniels Run.

Table 1: BEHI-rated Stream Reach Lengths in Daniels Run

BEHI Rating	*Stream Length (LF)*	*% of Total Stream Length*
Low	0	0.0%
Moderate	1,567	11.8%
High	5,740	43.2%
Very High	3,791	28.5%
Extreme	2,201	16.6%
	Total = 13,299	

BEHI ratings of very high and extreme are considered critically unstable. Table 1 shows over 40% of the stream length assessed in 2008 falls into this category. This result illustrates that stream bank erosion is a major concern for Daniels Run. Even when the system reaches a point of dynamic equilibrium, the rate of lateral migration may continue to erode stream banks at a high rate. High bank erosion can lead to further downstream sedimentation problems at culverts and bridge crossings. Also, pollutants such as phosphorus, nitrogen and heavy metals may adsorb on to sediment particles that are flushed out to downstream water bodies, such as the Potomac River and Chesapeake Bay.

The distribution of BEHI scores for Daniels Run is shown in Figure 3. Summary sheets of the reaches are included in Appendix D.

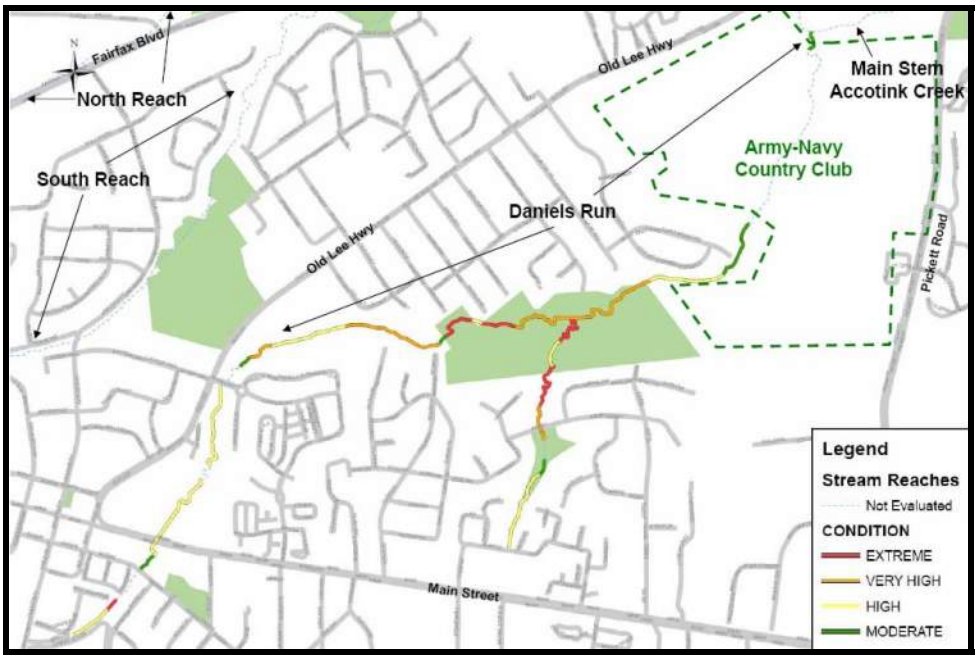

Figure 3: BEHI Score Distribution

VII. REACH PRIORITIZATION FACTORS

VII.A. Feasibility Inventory

In this study, feasibility is a combination of both ease of access to the stream corridor as well as site specific constraints on construction work, such as utilities that are near or that cross the stream. Construction access is a key factor when planning stream stabilization or restoration efforts. Having locations with wide and flat areas for proper construction equipment ingress and egress can greatly reduce construction costs. In the same way, a stream corridor that is impinged upon by sanitary sewer crossings and manholes and other utilities is constrictive and difficult to work within. More constraints in, and near, a stream lead to less freedom in design and may limit the space required to adequately construct the appropriate stream stabilization measures.

VII.B. Citizen Concerns

Another factor considered was public sentiment for stream improvements. A number of reaches are degraded to the point where citizens have become directly impacted. Concerns commonly associated with stream impacts include tree loss, severe bank erosion, flooding, and debris in the stream. RKK and has no knowledge of any citizen concerns on Daniels Run. However, public concerns have been raised about the removal of trees in Daniels Run Park. Instead of being considered a citizen concern, this information was incorporated into the feasibility of a project, since not removing any trees will impede access to the stream corridor. Identified citizen concerns from the Accotink Creek analysis is reflected in the mapping provided in Appendix E.

VII.C. Costs

Costs for design and construction services were estimated for all reaches. These costs were generalized based upon the severity of erosion and other site-specific constraints, such as access, that were observed in the field.

For the purposes of this analysis, costs were broken into three ranges based upon the level of restoration required:

- **Full Restoration:** **$450-$600 per LF**
- **Moderate Restoration:** **$250-$450 per LF**
- **Light Restoration:** **$50-$250 per LF**

Full stream restoration includes activities such as:

- **Laying back the stream banks** to reduce near-bank shear stress over long, continuous reaches
- **Installing instream structures** (ie. cross-vanes, imbricated walls) to control vertical and lateral migration
- **Adjusting planform configuration of stream**
- **Planting native, non-invasive vegetation** to enhance aesthetics and reinforce bank stability

Moderate restoration includes many aspects of full restoration; however this work would be less intensive. Fewer in-stream structures would be used and the extent of laying back banks would be reduced. Also, this work would most likely not include alteration of the planform configuration.

Light restoration emphasizes vegetative solutions and would focus structural controls in portions of the stream that are directly impacting nearby homeowners or citizens, such as armoring an outside bend of badly eroded stream bank. It should be noted that these are generalized estimates to be used for planning and budgeting purposes only.

VIII. FUTURE PLAN

VIII.A. Prioritization Ranking

Due to the large number of severely impacted stream reaches relative to funding that is available to address stream erosion problems in the City, it is necessary to maximize the impact of available funds. The best way to maximize the impact of funding is by developing a priority ranking of stream projects based upon key factors. In the analysis of Daniels Run, the key factors are: BEHI ranking (stream bank erosion severity) and Feasibility (access, utilities, easements). These factors take several viewpoints into account: objective and scientific (BEHI) and practical and constructible (feasibility). No citizen concerns were known for Daniels Run, so it was not a factor in prioritization.

Finding restoration projects that intersect the optimal values for each factor will provide the top priority projects. Ideally, these top priority projects will be reaches that are the most severely impacted, are the most feasible, and cost the least. In reality, however, projects that are the most impacted require the most restoration effort, and therefore, cost the most. Table 2 shows a layout of the key factors in prioritization for Daniels Run.

Light Yellow: Daniels Run priority areas- "Very High" or above BEHI rating, "High" or above feasibility
Light Orange: Daniels Run- second-tier priority areas: "High" or above feasibility and BEHI rating
Gray: Reaches that would be considered, but certain circumstances eliminate them from consideration.

Table 2: Reach Prioritization Scheme – Daniels Run

Reach ID	Location	Feasibility	BEHI Rating
D1-001	Courthouse Drive	High	High
D1-002	Breckinridge Lane	High	Extreme
D1-003	South Sager and Main	High	Moderate
D1-004	North Sager and Main	High	High
D1-005	West of Farr Homeplace	Very Low	High
D1-006	Lewiston Place	Fair	High
D1-007	North of Farrcroft Pond	High	Moderate
D1-008	First Church of Christ	High	Very High

Table 2: Reach Prioritization Scheme – Daniels Run			
Reach ID	**Location**	**Feasibility**	**BEHI Rating**
D1-009	Daniels Run Elementary	Very High	High
D1-010		Very High	High
D1-011	Old Post Estates	High	Very High
D1-012		High	Very High
D1-013		High	Very High
D1-014	West of Heritage Lane	High	Moderate
D1-015	Daniels Run Park	Low	Extreme
D1-016		Low	High
D1-017		Low	Extreme
D1-018		Low	Very High
D1-019	Cornell Road	Very Low	High
D1-020		Very Low	High
D1-021	Army-Navy Country Club	Very Low	Moderate
D1-022		Fair	Moderate
D2-001	Fairfax Square	High	High
D2-002		High	High
D2-003	South of Ashby Pond	Fair	Moderate
D2-004	North of Ashby Pond	Very High	Very High
D2-005	Haynesworth Street	Very Low	Very High
D2-006		Very Low	Extreme
D2-007	South Daniels Run Park	Low	High
D2-008		Low	Extreme

An initial analysis of factors highlights eleven reaches on Daniels Run that have high feasibility and are considered to be critically unstable. The five orange highlighted reaches (D1-001, D1-004, D1-009, and D1-010) have a BEHI score of high and the four yellow highlighted reaches (D1-002, D1-008, D1-011, D1-012, and D1-013) have a BEHI score of very high or extreme. The reaches in gray (D2-001, D2-002, and D2-004) are part of a tributary off of the main stem of Daniels Run that will be affected in the near future by the rehabilitation of Ashby Pond. Since this rehabilitation will change the flow regime of the tributary, restoration or stabilization of these stream reaches at this time is not recommended.

The five yellow highlighted reaches (D1-002, D1-008, D1-011, D1-012, and D1-013) should be considered the top priority reaches on Daniels Run. We recommend that work performed in D1-002 be treated as spot remediation since the area is only 100 FL and the problems seem to be associated with the presence of a culvert. D1-008, D1-011, D1-012, and D1-013 include moderate to full restoration due to the extensive nature of the impacts on the stream. The accessibility of the project area coupled with the facts that the upstream reaches have been previously restored and the area is publicly accessible make this area a very good candidate for restoration. The lower reach (D1-013, approximately 150 LF) is the most impacted, so it is recommended that full restoration be concentrated around the pedestrian bridge located in this area. D1-011 is a lengthy (881 LF) reach between Colony Road and Anne Place. Again, this area is accessible and close to public facilities, which makes it another candidate for moderate to full restoration. D1-012 and D1-008 are the least impacted of the five reaches, but still require moderate to full restoration, focusing on a deep channelized feature at the north end of D1-012 and severely eroded banks and exposed pipes in D1-008. The orange colored reaches should be considered as alternative sites.

Though no citizen concerns were identified along the stream, there was public concern raised about Daniels Run Park due to the relative maturity of the trees in this area. Therefore, public sentiment against tree removal in this

area has reduced the feasibility of access, and thus the priority, for restoration of reaches D1-015 to -018 and D2-007 and -008, even though these areas have above "High" BEHI ratings.

VIII.B. Comprehensive Analysis of Accotink Creek and Daniels Run

Table 3 shows how the scores from Daniels Run compare to those of the Main Stem of Accotink Creek. Overall, the priority restoration reaches on Daniels Run fall within the same scoring range as those for Accotink Creek.

Dark Yellow: Accotink Creek priority areas- "High" or above feasibility and BEHI rating, public concern
Light Yellow: Daniels Run priority areas- "Very High" or above BEHI rating, "High" or above feasibility
Dark Orange: Accotink Creek second-tier priority areas: "High" or above BEHI rating, public concern
Light Orange: Daniels Run- second-tier priority areas: "High" or above feasibility and BEHI rating
Gray: Reaches that would be considered, but certain circumstances eliminate them from consideration.

Table 3: Reach Prioritization Scheme – Accotink Creek and Daniels Run

Reach ID	*Location*	*Feasibility*	*Citizen Concerns*	*BEHI Total*	*BEHI Rating*
SR3-002	Jean St.	High	Yes	59.6	Extreme
NR1-002	Howerton & Orchard	High	No	58.3	Extreme
SR1-004	Main Street Green Condos	Very Low	No	58.1	Extreme
SR1-005	Railroad Avenue	Very Low	No	57.9	Extreme
SR1-008	Autumn Woods	High	No	56.4	Extreme
SR1-007	Fairfax Nursing Center	Fair	No	54.7	Extreme
MS1-001	Draper Dr. Park	Very High	No	52.1	Extreme
MS1-005	Old Pickett Dr.	High	Yes	51.2	Extreme
SR1-003	Main Street Green Condos	Low	No	50.9	Extreme
D1-002	Breckinridge Lane	High		50.3	Extreme
NR2-002	Mosby Woods	High	Yes	49.9	Extreme
MS1-004	Old Pickett Dr.	High	Yes	49.6	Extreme
D2-008	South Daniels Run Park	Low		48.5	Extreme
D1-017	Daniels Run Park	Low		48.2	Extreme
D2-006	Haynesworth Street	Very Low		47.0	Extreme
D1-015	Daniels Run Park	Low		46.8	Extreme
SR2-002	Springmann Dr.	Low	Yes	46.6	Extreme
D1-013	Old Post Estates	High		44.8	Very High
D1-018	Daniels Run Park	Low		44.6	Very High
SR3-004	Spring Lake Terr.	Very Low	Yes	43.6	Very High
SR2-003	North of Tusico Ct.	Fair	No	43.1	Very High
SR1-006	Stafford Dr.	Fair	No	43.0	Very High
DDT1-001	Draper Dr.	High	No	42.6	Very High
SR3-003	Spring Lake Terr.	Very Low	Yes	42.1	Very High
DLT1-001	Dale Lestina Park	Low	Yes	41.6	Very High
D2-004	North of Ashby Pond	Very High		41.4	Very High
D1-011	Old Post Estates	High		41.1	Very High
D1-012	Old Post Estates	High		40.9	Very High
D2-005	Haynesworth Street	Very Low		40.9	Very High
D1-008	First Church of Christ	Very High		40.7	Very High

Table 3: Reach Prioritization Scheme – Accotink Creek and Daniels Run					
Reach ID	***Location***	***Feasibility***	***Citizen Concerns***	***BEHI Total***	***BEHI Rating***
SR1-010	Autumn Woods	Very High	No	40.6	Very High
NR2-001	Ranger Rd.	High	No	39.6	High
D2-007	South Daniels Run Park	Low		39.5	High
MS1-003	Fairfax Blvd/Old Lee Hwy	High	No	39.0	High
D1-004	North Sager and Main	High		38.4	High
SR2-001	Keith Ave. Park	High	No	38.0	High
SR3-007	S. Ranger Rd. Park	Fair	No	36.4	High
NR2-003	N. Ranger Rd. Park	High	Yes	36.1	High
D2-002	Fairfax Square	High		35.8	High
D1-020	Cornell Road	Very Low		35.6	High
D1-001	Courthouse Drive	High		33.2	High
D1-005	West of Farr Homeplace	Very Low		33.2	High
D1-019	Cornell Road	Very Low		33.1	High
SR3-006	Stafford Dr.	Fair	No	32.8	High
D1-009	Daniels Run Elementary	Very High		32.7	High
D1-016	Daniels Run Park	Low		32.5	High
D2-001	Fairfax Square	High		32.2	High
D1-010	Daniels Run Elementary	Very High		31.9	High
SR3-005	Lower Spring Lake Terr.	Fair	No	31.0	High
D1-006	Lewiston Place	Fair		30.3	High
SR1-001	Rust Hill Pl.	High	No	30.3	High
D1-022	Army-Navy Country Club	Fair		29.4	Moderate
D1-014	West of Heritage Lane	High		29.2	Moderate
D1-021	Army-Navy Country Club	Very Low		28.2	Moderate
D1-003	South Sager and Main	High		28.0	Moderate
D2-003	South of Ashby Pond	Fair		28.0	Moderate
NR1-001	Howerton Ave.	Fair	No	27.9	Moderate
SR1-002	Meadow Bridge Ln.	High	No	27.4	Moderate
D1-007	North of Farrcroft Pond	High		27.2	Moderate
SR3-001	Kenmore Dr.	Very High	No	21.8	Moderate
SR1-009	Autumn Woods	Fair	No	18.6	Low

These results are also similar to those found in the Louis Berger report. According to the report, the "poor" sections of stream in the City of Fairfax are the South Fork of Accotink Creek, most notably the headwaters and near its confluence with the Main Stem of Accotink Creek, Daniels Run, most notably the headwaters, at the confluence of Daniels run with a tributary, and at the confluence of Daniels Run with the Main Stem of Accotink Creek, and the Main stem east of Pickett Road. RKK also found the headwaters of the North Fork of Accotink Creek, the confluence of Daniels Run with a tributary, and the Main Stem of Accotink Creek east of Pickett Road to be in poor condition- very high to extreme bank stability. The largest discrepancies in condition between the Louis Berger report and RKK's analysis are the headwaters of Daniels Run and the South Fork of Accotink Creek near the confluence with the Main Stem. This is mainly due to restoration efforts that have taken place between these two reports, resulting in a higher current score.

VIII.C. Repair Recommendations

In addition to erosion severity, feasibility, public sentiment, and cost in prioritization of projects, the maintenance of previously restored areas has been considered important. The City has been involved with stream restoration and stabilization since the mid-1990's. Reaches previously restored are shown in Figure 4. These restored areas have been observed by City officials over the last decade. Through this observation, several reaches have been identified as having continuing stream stability problems. Since these areas were previously restored, only light restoration and maintenance is required on most instances to allow these restored reaches to perform as originally designed.

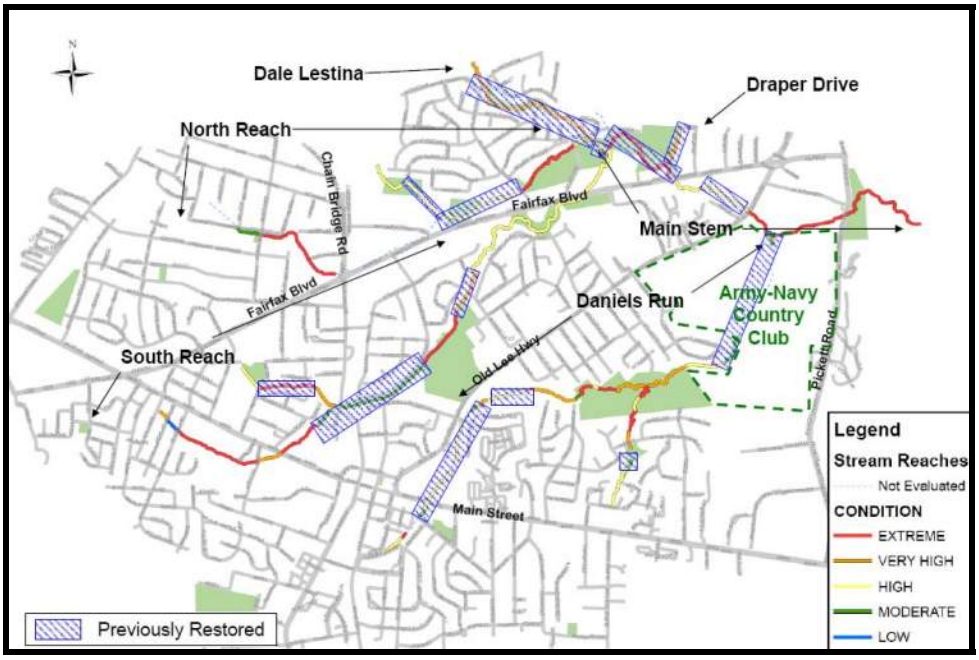

Figure 4: Previously Restored Areas in the City of Fairfax

The previously restored sections of Daniels Run near Daniels Run Elementary School were impacted during the June 26, 2006 storm event. The three reaches were previously stabilized using primarily Filtrexx socks, which are 12"-18" diameter tubes of filter fabric filled with compost, straw, or other suitable material. These tubes are normally placed parallel to the stream at key locations in the stream, such as the toe. These measures provide short-term stream bank protection. Normally, plantings are placed directly into the tubes, which should provide long-term stability for the stream bank after the filter fabric biodegrades. Figure 5 shows an example of this application at the Daniels Run site.

As Figure 5 illustrates, plantings have not become fully established, although many of the tubes are still stable and in place. This area (D1-009 and D1-010) can be stabilized by identifying areas of local destabilization and a comprehensive planting plan to reinforce the Filtrexx systems already in place. This area requires light restoration. Portions of D1-010 have been previously stabilized (near a pedestrian bridge). This reach is experiencing severe bank erosion, as is evident in the near-vertical 5-6 foot high banks, and will require a greater effort than D1-009. Moderate restoration should be assumed for this area. Any work done in these reaches should incorporate public educational components and be integrated into the restoration work performed previously on school grounds.

Figure 5: Filtrexx Socks at Daniels Run

Another area known to be impacted is MS1-003, which is located between Fairfax Boulevard and Old Lee Highway. This 1900 LF reach was previously restored; however, it was severely impacted by the June, 2006 storm event. This stream is accessible and design services would be minimal. Construction efforts would be considered light restoration and be focused on fixing previously-installed in-stream structures and addressing other areas of local erosion problems, as noted in the design documents. This area, as well as the Daniels Run Elementary site, should be included on the list for priority reaches for restoration.

In summation, priority should be given to restoring/stabilizing the following reaches:

- SR3-002 (Jean Street)
- NR2-002 (Mosby Woods)
- NR2-003 (North Ranger Road Park)
- SR3-003 and 004 (Spring Lake Terrace)
- DLT1-001 (Dale Lestina Park)
- SR2-002 (Springmann Drive)
- MS1-003 (Fairfax Boulevard/Old Lee Highway)
- D1-008 (First Church of Christ)
- D1-0009 to 010 (Daniels Run Elementary)
- D1-002 (Breckinridge Lane)
- D1-011 to D1-013 (Old Post Estates)

The locations for these reaches are shown in Figure 6.

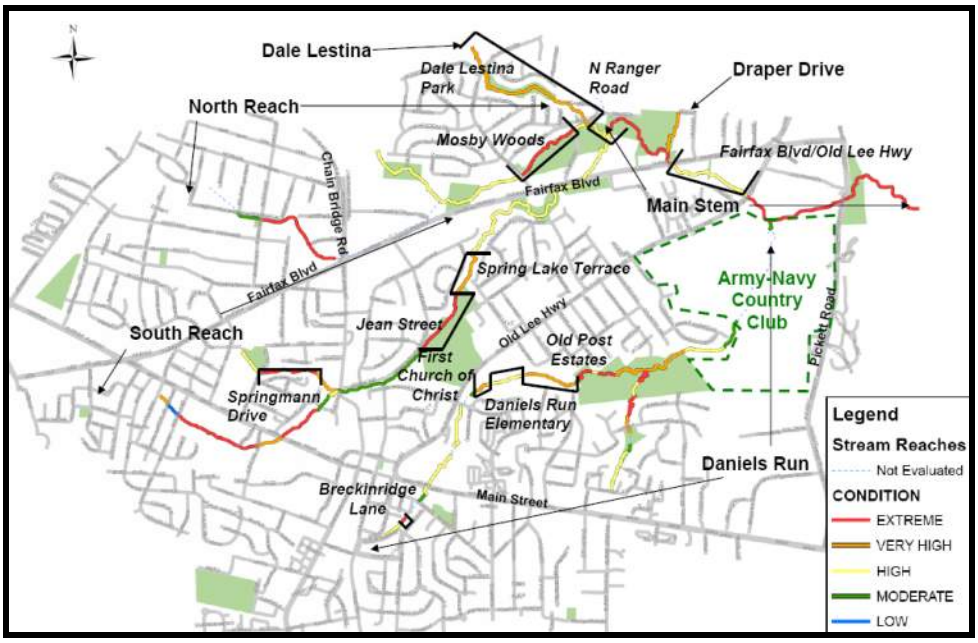

Figure 6: Priority Reaches in the City of Fairfax

VIII.D. Budget Recommendations over 5 years

The priority reaches on both Accotink Creek and Daniels Run have been identified, but a systematic plan to address each reach is required to determine future budgetary requirements. The goal of this analysis is to maximize the amount of restoration with assumed funding quantities. This analysis assumes two scenarios over a 5-year window: an annual available budget of $200,000 and an annual available budget of $500,000. Larger projects are more cost-effective since a significant portion of construction costs are associated with mobilization efforts; however, limited budgets inhibit large construction projects.

$200,000 Annual Budget

Light restoration is emphasized in this scenario to perform restoration at more locations, which allows more flexibility on addressing citizen concerns. Also, sites with access problems were not included. Table 4 shows the details for this budget scenario. Due to the cost of some of the restoration, some years may be over budget and some may be under budget. The total cost over the five-year window, however, is below $1,000,000. The locations of restoration for this scenario are shown in Figure 7.

Table 4: 5-Year Plan and $200,000 Budget

Year	*Reach ID*	*Location*	*Restoration*	*Cost ($/LF)*	*Length (LF)*	*Total Cost*	*Subtotal*
Year 1	SR3-002	Lower Jean Street	Moderate	$250	600	$150K	$185K
	D1-002	Breckinridge Lane	Moderate	$250	140	$35K	
Year 2	DLT-001	Dale Lestina Park	Light	$150	300	$45K	$190K
	NR2-003	N. Ranger Road Park	Light	$150	300	$45K	
	NR2-002	Mosby Woods	Moderate	$250	400	$100K	
Year 3	MS1-003	Fairfax Blvd/Old Lee Hwy	Light	$150	1300	$195K	$195K
Year 4	D1-008	First Church of Christ	Moderate	$250	310	$77.5K	$77.5K
Year 5	D1-011 to 013	Old Post Estates	Moderate	$250	1350	$337.5K	$337.5K

The $200,000 budget scenario allows for 4,700 LF of total restoration over five years at the following intensities:

- 1,900 LF of light restoration
- 2,800 LF of moderate restoration

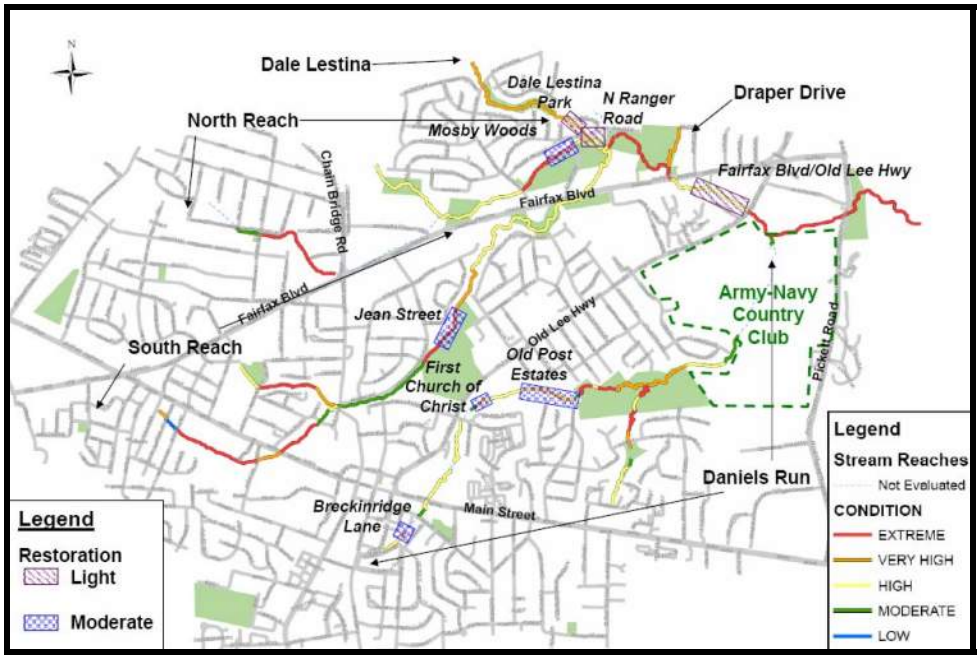

Figure 7: Restoration Efforts under $200,000 per Year Budget over 5 Years

$500,000 Annual Budget

In addition to addressing citizen concerns, the larger budget emphasizes full and moderate restoration efforts as well. Table 4 shows the details for this budget scenario. With access issues at Spring Lake Terrace, Springmann drive, and Dale Lestina, restoration was kept moderate. As mentioned before, due to the cost of some of the restoration, some years may be over budget and some may be under budget. The total cost over the five-year window, however, is below $2,500,000. The locations of restoration for this scenario are shown in Figure 8.

Table 5: 5-Year Plan and $500,000 Budget

Year	*Reach ID*	*Location*	*Restoration*	*Cost ($/LF)*	*Length (LF)*	*Total Cost*	*Subtotal*
Year 1	SR3-002	Lower Jean St.	Moderate	$400	600	$240K	$480K
	MS1-003	Fairfax Blvd/Old Lee Hwy	Light	$150	1300	$195K	
	NR2-003	N. Ranger Road Park	Light	$150	300	$45K	
Year 2	NR2-002	Mosby Woods	Full	$450	1100	$495K	$495K
Year 3	SR2-002	Springmann Drive	Moderate	$250	1000	$250K	$500K
	SR3-003/4	Spring Lake Terrace	Moderate	$250	1000	$250K	
Year 4	SR3-002	Upper Jean Street	Full	$450	650	$292.5K	$507K
	DLT1-001	Dale Lestina Park	Moderate	$250	300	$75K	
	D1-008	First Church of Christ	Full	$450	310	$139.5K	
Year 5	D1-009/010	Daniels Run Elementary	Light	$150	850	$127.5K	$500K
	D1-001 to 013	Old Post Estates	Moderate	$250	1350	$337.5K	
	D1-002	Breckinridge Lane	Moderate	$250	140	$35K	

The $500,000 budget scenario allows for 8,900 LF of total restoration over five years at the following intensities:

- 2,450 LF of light restoration
- 4,390 LF of moderate restoration
- 2,060 LF of full restoration

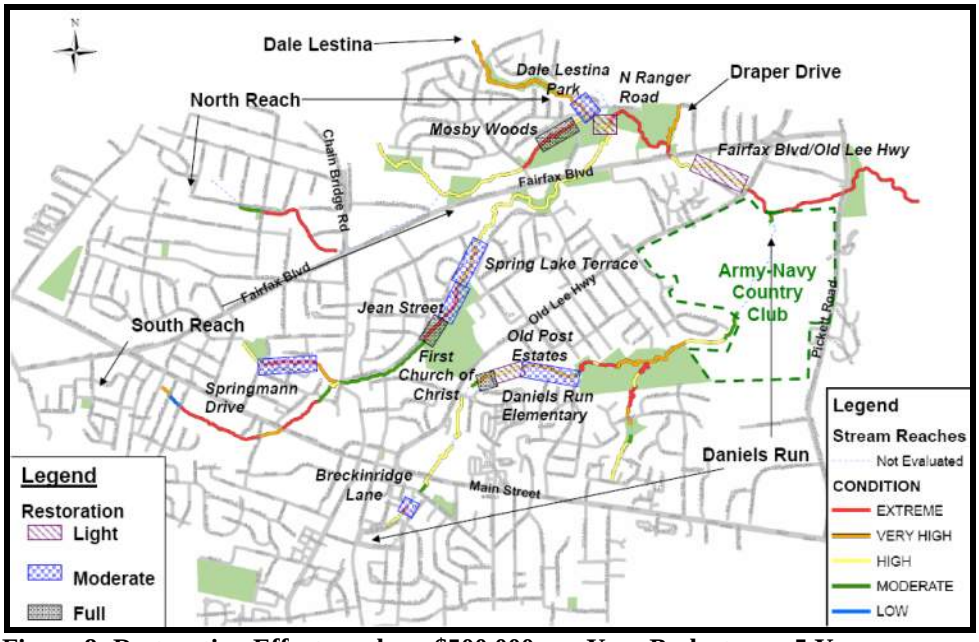

Figure 8: Restoration Efforts under a $500,000 per Year Budget over 5 Years

A comparison of the amount of restoration and the distribution of the level of restoration shows the differences between the two scenarios. Over 80% more restoration by length is provided in the higher funding scenario. Also, only the higher funding scenario includes full restoration for some reaches. Citizen concerns, however, are addressed in both scenarios.

IX. OTHER CONSIDERATIONS

Other actions can be taken concurrently with stream restoration to complement these projects. These include a stormwater retrofit program, stream monitoring program, and outside funding sources to offset costs or provide additional funding for restoration efforts.

IX.A. Stormwater Retrofit Program

Current stormwater regulations provide not only for water quantity control, but also for water quality treatment and stream protection. However, much of the City's growth occurred in the 1960's and 70's, when the stormwater philosophy stressed flood control. Therefore, a significant number of stormwater facilities in the City did not provide controls beyond water quantity management. Other municipalities in the Northern Virginia region with similar problems have initiated retrofit programs in order to repair aging stormwater ponds and provide or enhance water quality treatment and stream protection by re-grading pond footprints, adding water quality features (micropools, wetland plantings, etc.) and new control structures aimed at improving pond performance. A program of this nature would protect restored sections of streams as well as provide enhanced water quality benefit, which could possibly provide credit in the City's MS4 permit.

IX.B. Stream Monitoring Program

The City has already invested significantly in stream restoration efforts. As the City prepares to restore more streams, a comprehensive monitoring plan targeted at past and future restoration efforts could provide quantifiable evidence on the benefits of these efforts towards stream stability and functionality. Monitoring can provide insight

on more successful design measures and construction techniques, as well as allowing the City to be proactive in repairing any damaged reaches to minimize impacts on public safety and stream functionality. Such a monitoring plan can reflect City priorities and include any required metrics called out in permitting documents (VPDES, etc.).

IX.C. Outside Funding

Outside funding sources, such as grants and cost-sharing with neighboring communities, should be considered when developing budgets for restoration efforts. These grants include the Virginia Water Quality Improvement Fund, the U.S. Fish and Wildlife Service Small Watershed Grants Program, and other similar programs. Also, stream mitigation has recently surfaced in Virginia as an alternative method for municipalities to perform restoration. This is a relatively new approach, so further analysis would be required in order to fully understand the dynamics of stream mitigation banking.

X. SOURCES

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APPENDIX A

REACH PHOTOS FROM DANIELS RUN

001_D2-004_pond

002_D2-004

003_D2-004_culvert

004_D2-005_ponded

005_D2-005

006_D2-005

007_D2-005

008_D2-006

009_D2-006

010_D2-006

011_D2-006

012_D2-006

013_D2-007

014_D2-007

015_D2-008

016_D2-008

017_D2-008

018_D2-008_confluence

019_D1-021

020_D1-021

021_D1-021

022_D1-021

023_D1-021_trib

024_D1-020

025_D1-020_trib

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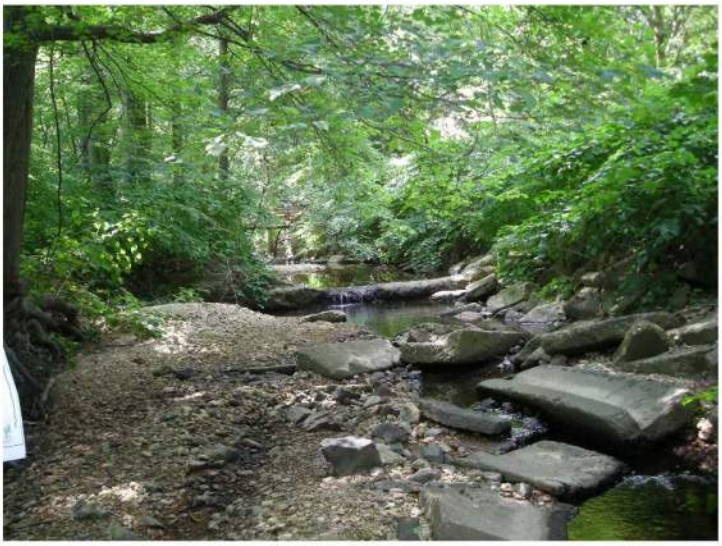
028_D1-020

029_D1-020

030_D1-019



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033_D1-019

034_D1-018

035_D1-018

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038_D1-018

039_D1-018

040_D1-018

041_D2-001_culvert

042_D2-001

043_D2-003_pond

044_D2-003

045_D2-003

046_D2-002

047_D2-002

048_D2-002

049_D2-002

050_D2-002_culvert

051_D2-002_culvert

052_D2-001

053_D2-001

054_D2-001

055_D2-001

056_D1-022

057_D1-022

058_D1-022

059_D1-022

060_D1-022

061_D1-022

062_D1-018

063_D1-018

064_D1-018

065_D1-018

066_D1-018_trib

067_D1-017

068_D1-017

069_D1-017

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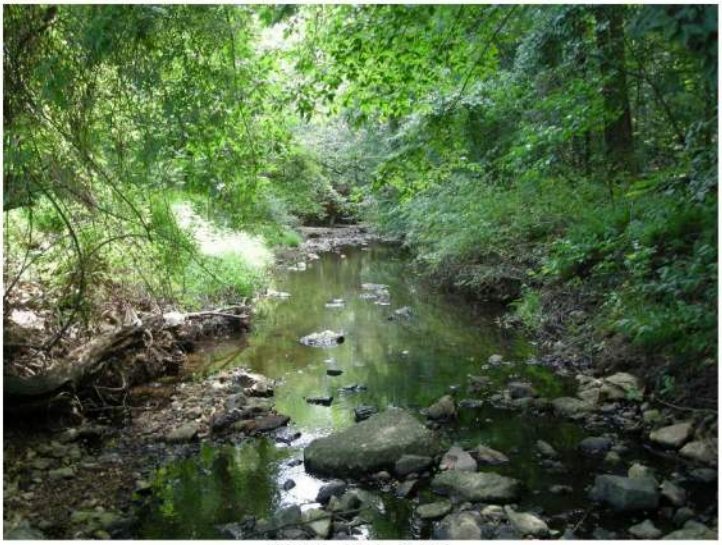
076_D1-015



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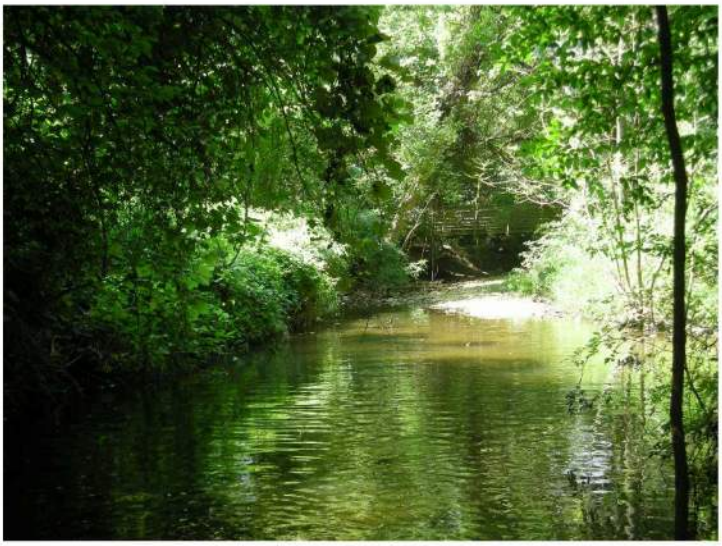
080_D1-015

081_D1-015_trib

082_D1-015

083_D1-014

084_D1-014



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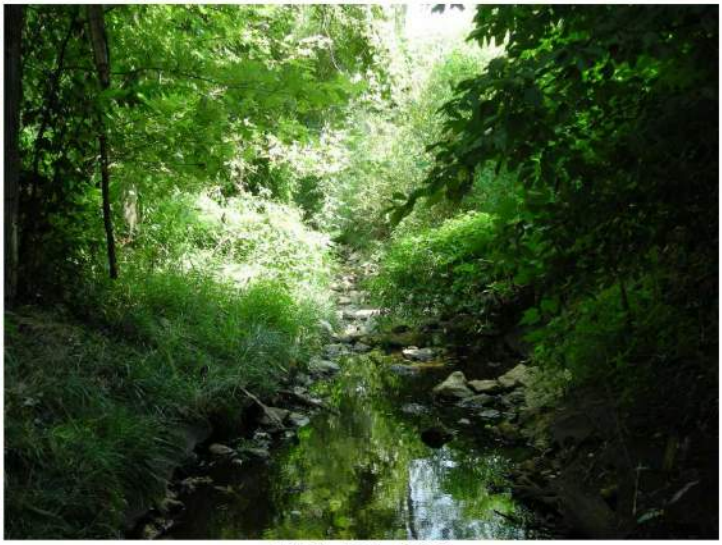
106_D1-010

107_D1-009



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116_D1-008

117_D1-008

118_D1-008

119_D1-007

120_D1-007

121_D1-007_snake

122_D1-007_pond

123_D1-006

124_D1-006

125_D1-006

126_D1-006

127_D1-006

128_D1-006

129_D1-006

130_D1-006

131_D1-006

132_D1-006

133_D1-006

134_D1-006

135_D1-006_pond

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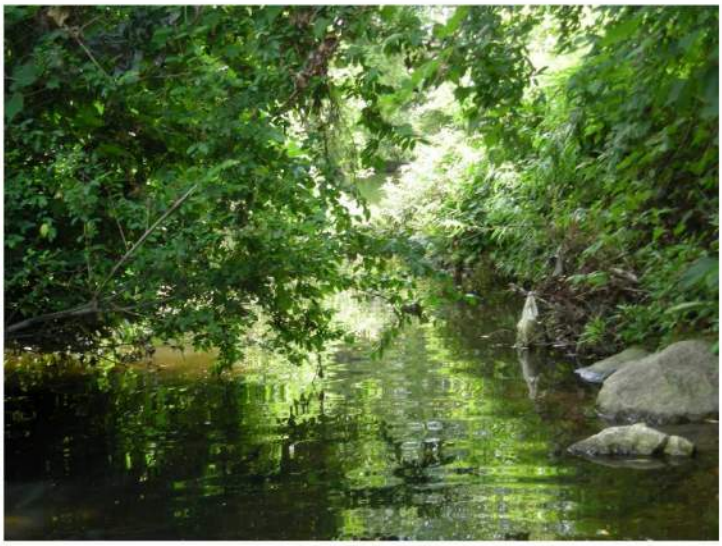
138_D1-006_trib

139_D1-006_trib



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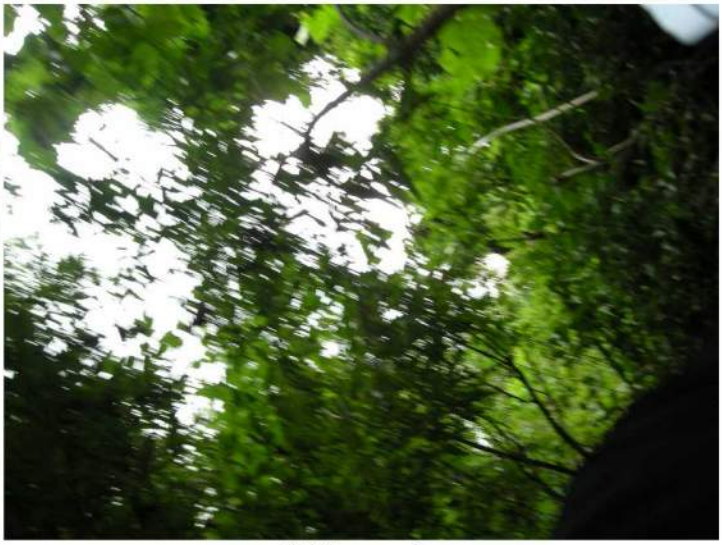

144_waste

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153_D1-005

154_D1-004

155_D1-004

156_D1-004

157_D1-003

158_D1-003

159_D1-003

160_D1-002

161_D1-002

162_D1-002

163_D1-001

164_D1-001

165_D1-001

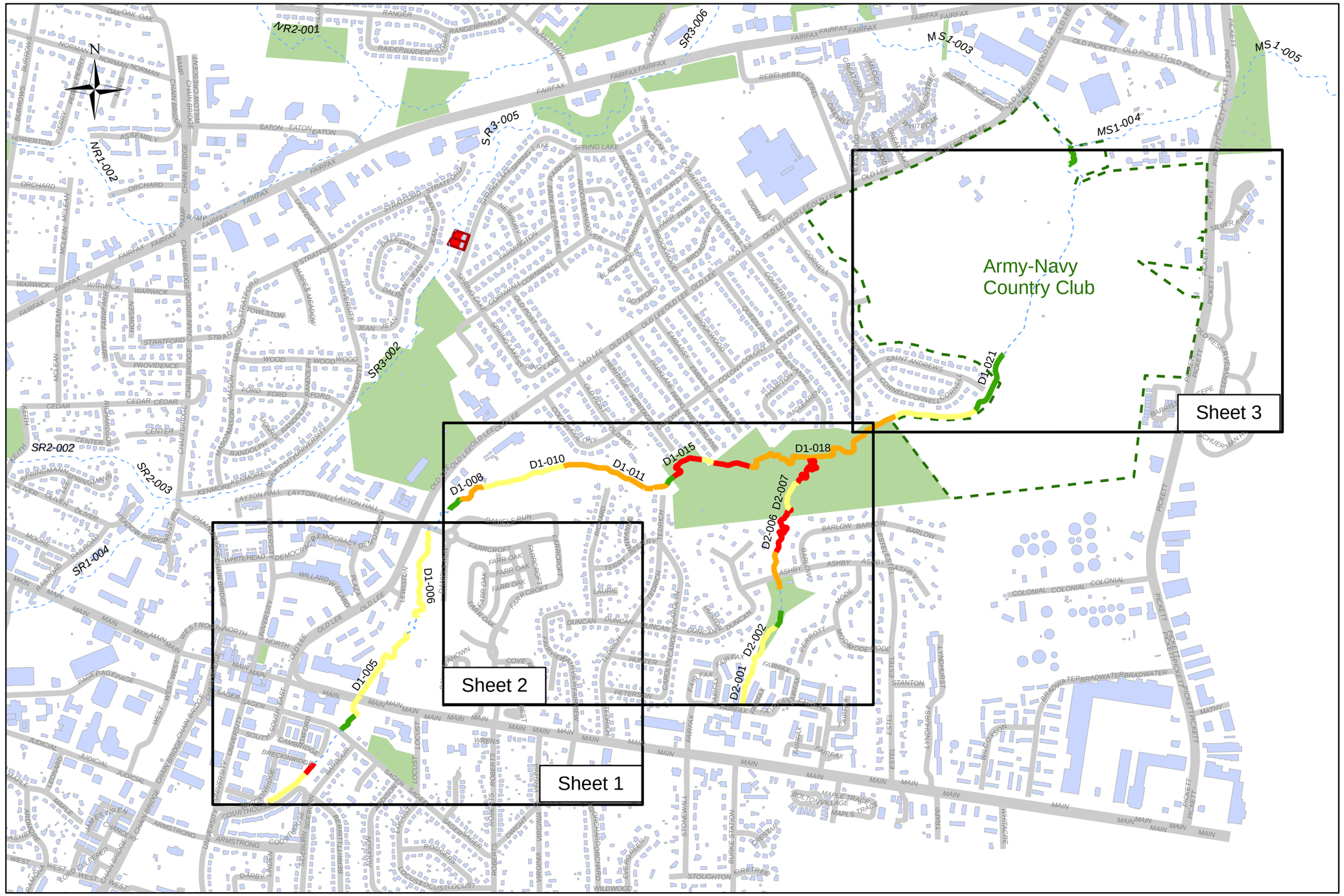
166_D1-001

167_D1-001

168_D1-001

APPENDIX B

STREAM ASSESSMENT & BEHI RESULTS MAPPING FOR DANIELS RUN



Key Sheet
Sclae: 1' = 1000'

RK&K

RUMMEL, KLEPPER & KAHL, LLP
81 Mosher St., Baltimore, Maryland 21217
(410)728-2900 FAX (410)728-29927
http://www.rkk.com

CITY OF FAIRFAX, VIRGINIA
ACCOTINK CREEK STREAM STABILITY
ASSESSMENT AND PRIORITIZATION PLAN
SUPPLEMENT

STREAM ASSESSMENT AND BEHI RESULTS

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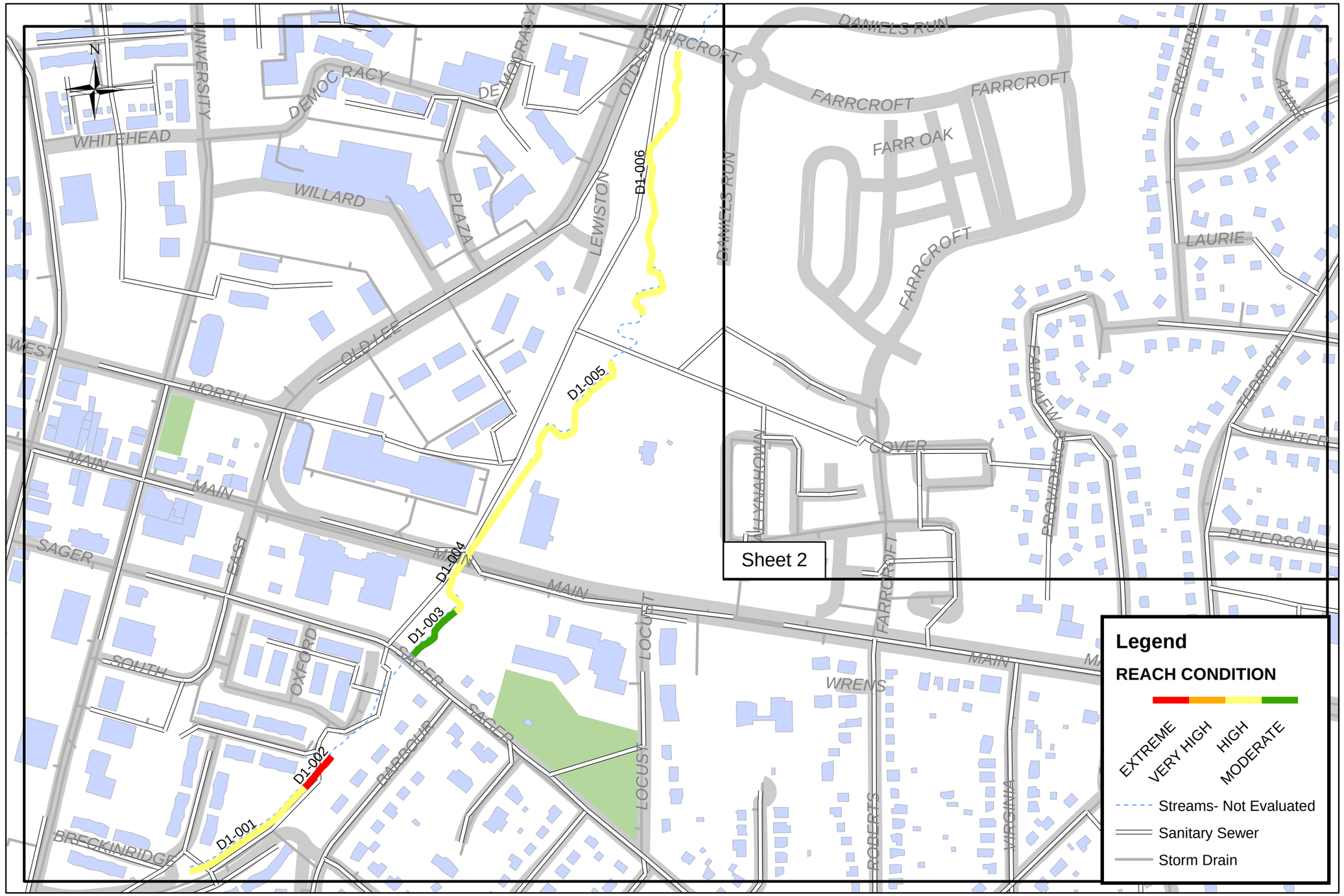
COUNTOUR: N/A
DATE: October 3, 2008
DESIGNED: DWB
DRAFTED: SPB
CHECKED: DWB

PROJECT #: 406-150-4

SHEET: Key Sheet



Sheet 1

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ASSESSMENT AND PRIORITIZATION PLAN
SUPPLEMENT

STREAM ASSESSMENT AND BEHI RESULTS

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DRAFTED: SPB
CHECKED: DWB

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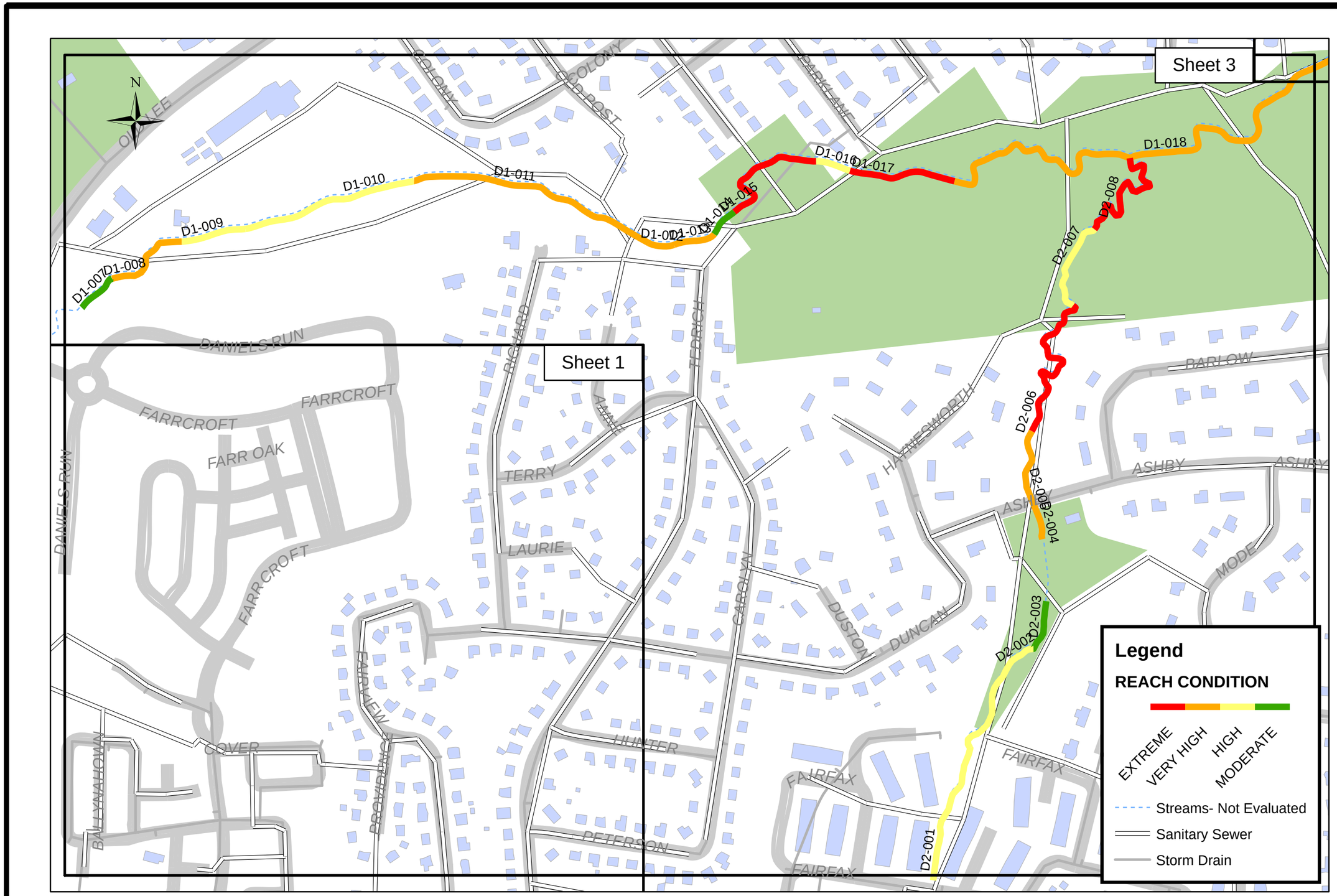

Sheet 2

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CITY OF FAIRFAX, VIRGINIA
ACCOTINK CREEK STREAM STABILITY
ASSESSMENT AND PRIORITIZATION PLAN
SUPPLEMENT

STREAM ASSESSMENT AND BEHI RESULTS

H SCALE:	1" = 330'
V SCALE:	N/A
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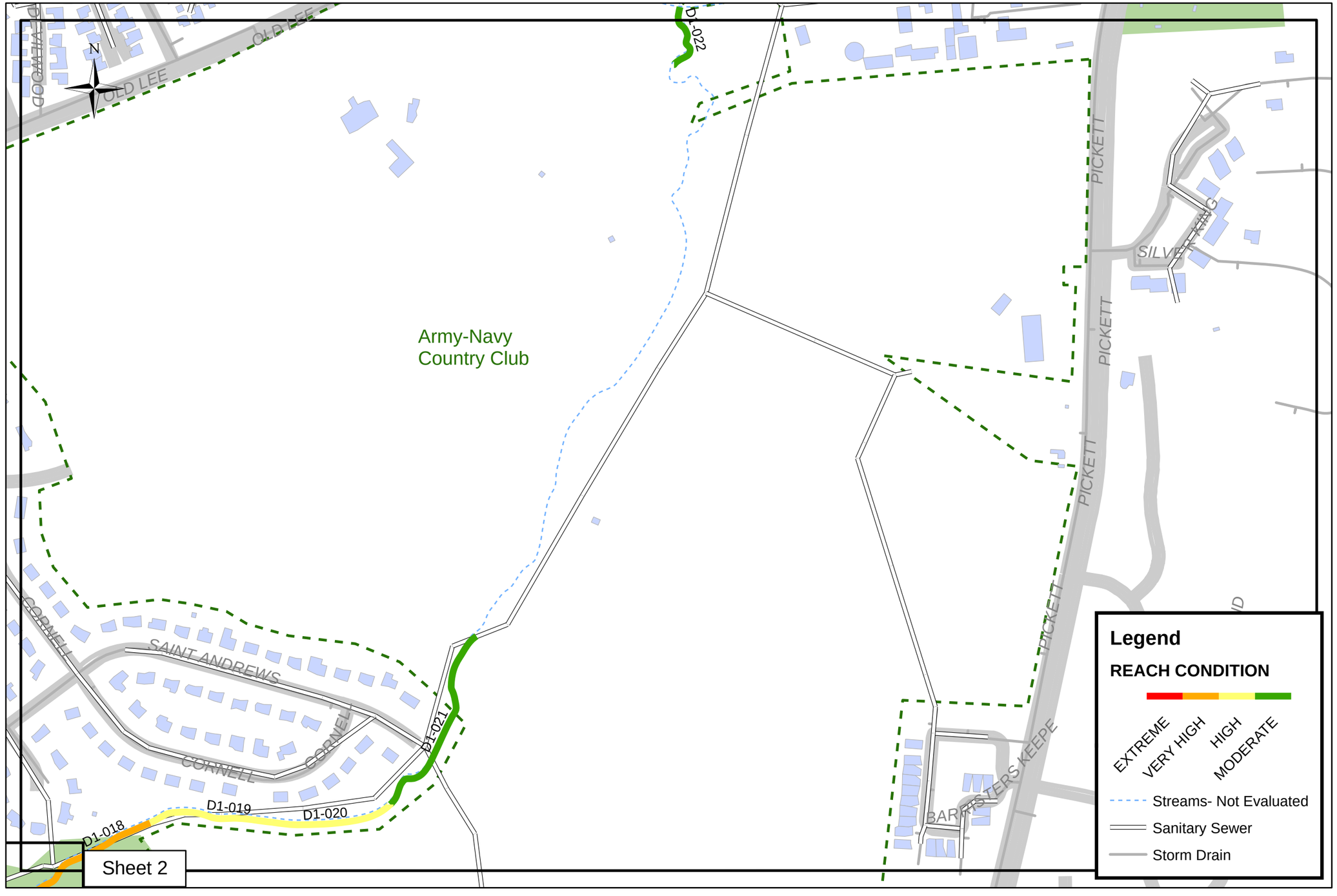

Sheet 3

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ACCOTINK CREEK STREAM STABILITY
ASSESSMENT AND PRIORITIZATION PLAN
SUPPLEMENT

STREAM ASSESSMENT AND BEHI RESULTS

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V SCALE: N/A
COUNTOUR: N/A
DATE: Oct 02, 2008
DESIGNED: DWB
DRAFTED: SPB
CHECKED: DWB

PROJECT #: 406-150-4

SHEET: 3

APPENDIX C

SUMMARY TABLE OF BEHI SCORING RESULTS

Reach ID	Bank H/ Bankfull H	Index	Root D/ Bank H	Index	Weighted Root D	Index	Bank Angle	Index	Surface Protection	Index	Materials	Strat	Total	Condition
D1-001	3.00	10.0	0.333	5.6	14.985	7.9	75	5.4	50	4.3	0.000	0.000	33.200	High
D1-002	8.00	10.0	0.063	8.9	3.750	10.0	90	7.9	60	3.5	5.000	5.000	50.300	Extreme
D1-003	3.00	10.0	0.667	3.1	53.333	4.1	60	3.9	80	1.9	5.000	0.000	28.000	Moderate
D1-004	3.33	10.0	0.300	5.9	12.000	9.7	75	5.4	75	2.4	5.000	0.000	38.370	High
D1-005	3.00	10.0	0.333	5.6	28.305	6.2	45	3.2	95	1.2	7.000	0.000	33.200	High
D1-006	2.00	7.9	0.333	5.6	26.664	6.4	60	3.9	90	1.5	5.000	0.000	30.300	High
D1-007	7.00	10.0	0.286	6.1	27.142	6.4	55	3.7	100	1.0	0.000	0.000	27.200	Moderate
D1-008	3.33	10.0	0.200	7.2	10.000	8.8	80	5.9	70	2.8	6.000	0.000	40.700	Very High
D1-009	5.00	10.0	0.300	5.9	15.000	7.9	75	5.4	60	3.5	0.000	0.000	32.700	High
D1-010	4.33	10.0	0.231	6.8	13.848	8.2	75	5.4	90	1.5	0.000	0.000	31.900	High
D1-011	5.00	10.0	0.300	5.9	12.000	9.7	85	7.0	60	3.5	5.000	0.000	41.100	Very High
D1-012	2.67	8.8	0.250	6.6	20.000	7.3	85	7.0	95	1.2	5.000	5.000	40.900	Very High
D1-013	8.00	10.0	0.250	6.6	13.128	8.2	90	7.9	40	5.1	7.000	0.000	44.800	Very High
D1-014	5.00	10.0	0.400	4.9	18.000	7.5	40	2.9	55	3.9	0.000	0.000	29.200	Moderate
D1-015	3.00	10.0	0.222	6.9	4.400	10.0	85	7.0	30	5.9	0.000	7.000	46.800	Extreme
D1-016	2.67	8.8	0.250	6.6	10.000	10.0	45	3.2	55	3.9	0.000	0.000	32.500	High
D1-017	2.33	8.2	0.200	7.2	1.000	10.0	90	7.9	10	9.9	5.000	0.000	48.200	Extreme
D1-018	5.50	10.0	0.273	6.2	4.090	10.0	90	7.9	35	5.5	5.000	0.000	44.600	Very High
D1-019	10.00	10.0	0.200	7.2	12.000	9.7	50	3.4	70	2.8	0.000	0.000	33.100	High
D1-020	8.00	10.0	0.250	6.6	16.250	5.5	85	7.0	90	1.5	5.000	0.000	35.600	High
D1-021	4.00	10.0	0.250	6.6	20.000	7.3	35	2.7	90	1.6	0.000	0.000	28.200	Moderate
D1-022	7.00	10.0	0.143	8.0	11.429	8.3	20	1.9	95	1.2	0.000	0.000	29.400	Moderate
D2-001	2.00	7.9	0.100	8.5	1.000	10.0	60	3.9	80	1.9	0.000	0.000	32.200	High
D2-002	1.75	7.1	0.286	6.1	11.429	8.3	75	5.4	55	3.9	5.000	0.000	35.800	High
D2-003	1.00	1.0	0.500	3.9	7.500	9.4	10	1.4	20	7.3	5.000	0.000	28.000	Moderate
D2-004	8.00	10.0	0.125	8.2	5.000	9.9	60	3.9	50	4.4	5.000	0.000	41.400	Very High
D2-005	2.00	7.9	0.167	7.7	3.330	10.0	55	3.7	25	6.6	5.000	0.000	40.900	Very High
D2-006	3.50	10.0	0.286	6.1	4.275	10.0	80	5.9	5	10.0	5.000	0.000	47.000	Extreme
D2-007	2.00	7.9	0.500	3.9	7.500	9.4	50	3.4	10	9.9	5.000	0.000	39.500	High
D2-008	4.00	10.0	0.250	6.6	3.750	10.0	85	7.0	10	9.9	5.000	0.000	48.500	Extreme

APPENDIX D

SUMMARY SHEETS OF DANIELS RUN BEHI RATINGS

Site No.:	D1-001
Site Score:	33.2 – High
Location:	Courthouse Drive; from Courthouse Dr. & Ratcliff Rd. to south of Breckinridge Ln.

Site Description:	Reach Length = 484 LF Located between two residential developments (townhouses). Slightly armored. Where rip rap is in place, stream is fine. Where rip rap is absent, banks eroded and beginning to undercut. Banks steep and vegetated.
Citizen Comments:	N/A
Access:	Access is good. Stream is less than 50 feet from the closest residence and 25 feet from parking lot. There are open green areas near the northern extent of the reach, which can be utilized for access. The banks are steep and vegetated.

Site No.:	D1-002
Site Score:	50.3 – Extreme
Location:	Breckinridge Lane; from 130 feet south of Breckinridge Ln. to Breckinridge Ln.

Site Description:	Reach Length = 139 LF Reach begins near Breckinridge Road. This is 130 feet of wide and high banks before becoming channelized in Reach DM 21. Highly eroded, extreme bank angle, and some vegetation.
Citizen Comments:	N/A
Access:	Access is good. Stream is less than 50 feet from road and residences. There are open green areas near the southern extent of the reach, which can be utilized for access. The banks are steep and high.

Site No.:	D1-003
Site Score:	28.0 – Moderate
Location:	South Sager and Main; upstream of Sager Ave to approximately 100 ft south of Main St.

Site Description:	Reach Length = 210 F Slightly eroded, but smaller bank height and less steep slopes than DM-18. Good amount of vegetation, but mostly vines and trees.
Citizen Comments:	N/A
Access:	Access is good. Though commercial properties are over 150 feet away, the area is forested.

Site No.:	D1-004
Site Score:	39.5 – High
Location:	North Sager and Main; from 100 ft. south of Main St. to Main St.

Site Description:	Reach Length = 252 LF The area is just south of Main St. and is highly eroded. The banks are steep and high, though vegetated. No evidence of armoring and trees falling into the stream.
Citizen Comments:	N/A
Access:	Access is good. Right near Main Street and commercial properties are over 150 feet away, however the area is forested.

Site No.:	D1-005
Site Score:	33.2 – High
Location:	West of Farr Homeplace; from Main St. Shopping Center to the pond near Lewiston Rd.

Site Description:	Reach Length = 888 LF Reach primarily seems to be in park area, with a pedestrian path approximately 80 feet away. Completely overgrown, but similar to DM-16. Banks 45 degree angle and 3 feet high. Armoring present; when missing, the banks are eroded.
Citizen Comments:	N/A
Access:	Access is extremely difficult given the completely overgrown nature of this reach.

Site No.:	D1-006
Site Score:	30.3 – High
Location:	Lewiston Road; from the pond near Lewiston Rd. to Farrcroft Dr.

Site Description:	Reach Length = 1033 LF Just downstream of pond above Farrcroft Dr. Completely armored and replanted section of stream. One or two eroded banks where there is no rip rap, but mostly in good condition. Lots of pool features created. 45 degree banks that are 3 feet tall.
Citizen Comments:	N/A
Access:	Access is okay. Closest house is 60 feet away, trail only 20 ft away. Designed before, but a new development has gone in since (Lewistown Rd.). Pretty vegetated.

Site No.:	D1-007
Site Score:	27.2 – Moderate
Location:	North of Farrcroft Drive; from the pond at Farrcroft Dr. to approximately 100 ft northeast

Site Description:	Reach Length = 149 LF Open area right before stream feeds into pond; two reaches separated by fallen trees. Lots of vegetation, rip rap present.
Citizen Comments:	N/A
Access:	Access good due to the proximity to the pond. Pedestrian path to the southeast of the stream less than 40 feet away.

Site No.:	D1-008
Site Score:	40.7 – Very High
Location:	First Church of Christ; from near the pond at Farrcroft Dr. to south of Daniels Run Elementary

Site Description:	Reach Length = 311 LF Steep eroded area upstream of Daniels Run Elementary School. Trees fallen in and undercut banks. Stream has more vegetation than DM-13, but steeper and more eroded.
Citizen Comments:	N/A
Access:	Access is easy assuming access onto the First Church of Christ's property is okay. Right upstream from stormwater management pond. One house approximately 70 ft. from stream's edge, the rest of the area is open and forested.

Site No.:	D1-009
Site Score:	32.7 – High
Location:	Daniels Run Elementary; from the western edge of the Daniels Run Elementary property to 100 ft upstream of the bridge to Daniels Run Elementary

Site Description:	Reach Length = 229 LF Similar to DM 12, but revetment did not take as well. Slope less steep (40%). Matting holding back trees and only about 50% successful reseeding.
Citizen Comments:	N/A
Access:	Access is easy assuming access onto Daniels Run Elementary's property is okay. This stream segment is surrounded by open recreational fields.

Site No.:	D1-010
Site Score:	31.9 – High
Location:	Daniels Run Elementary; from upstream of the bridge to Daniels Run Elementary to 200 ft. upstream of the bridge between Colony Rd. and Daniels Run Elementary

Site Description:	Reach Length = 619 LF Highly vegetated banks, ranging from 60 to 90 degrees. Little bit of erosion. Matting visible, but doing well. Trees pushing at some matting/some trees falling into streambed.
Citizen Comments:	N/A
Access:	Access is easy assuming access onto Daniels Run Elementary's property is okay. This stream segment is surrounded by open recreational fields.

Site No.:	D1-011
Site Score:	41.1 – Very High
Location:	Old Post Estates; from upstream of bridge between Colony Rd. and Daniels Run Elementary to Anne Pl.

Site Description:	Reach Length = 881 LF Lots of crawling vines; few trees. Steep, muddy banks. Minor armoring visible, but stream condition poor. Lots of erosion underneath vines.
Citizen Comments:	N/A
Access:	Access is good. From northeast, there is a community pool and facilities that may make access easy. The stream is abutted by a walkway and houses to the south.

Site No.:	D1-012
Site Score:	40.9 – Very High
Location:	Old Post Estates; from Anne Pl. to Tedrich Blvd.

Site Description:	Reach Length = 92 LF Deep channelized feature at north end of reach, then transitions to shallower. Very shrubby, densely vegetated area. High, steep banks. Slightly eroded banks.
Citizen Comments:	N/A
Access:	Access is good considering behind community center and near paths for walking and bridge.

Site No.:	D1-013
Site Score:	44.8 – Very High
Location:	Old Post Estates; around the bridge at Tedrich Blvd.

Site Description:	Reach Length = 881 LF Area around bridge highly eroded and in poor shape.
Citizen Comments:	N/A
Access:	Access is good considering behind community center and near paths for walking and bridge.

Site No.:	D1-014
Site Score:	29.2 – Moderate
Location:	West of Heritage Lane; from near the bridge at Tedrich Blvd. to 150 ft. upstream of Heritage Ln. Bridge

Site Description:	Reach Length = 107 LF Nice shrubby area. Little bit of erosion, but not much. Small, shallow banks and 3 ft deep pool area.
Citizen Comments:	N/A
Access:	Access is good considering behind community center, half in Daniels Run Park, and near paths for walking and bridge.

Site No.:	D1-015
Site Score:	46.8 – Extreme
Location:	Daniels Run Park; from 150 ft. upstream of Heritage Ln. bridge to 150 ft. upstream of Parklane Rd. bridge

Site Description:	Reach Length = 465 LF Eroded banks; more like DM 5. Tall, steep banks, lots of exposed roots.
Citizen Comments:	N/A
Access:	Access is good considering in Daniels Run Park and near paths for walking and bridge. However, forest would need to be cut to get equipment in, which could cause public outcry.

Site No.:	D1-016
Site Score:	32.5 – High
Location:	Daniels Run Park; from 150 ft. upstream of Parklane Rd. bridge to Parklane Rd.

Site Description:	Reach Length = 123 LF Shallow slopes, lots of cobble. Some exposed saprolite. Lots of vegetation, but all herby/shrubby- very few trees. Some armored slopes, but not common.
Citizen Comments:	N/A
Access:	Access is good considering in Daniels Run Park and near paths for walking and bridge. However, forest would need to be cut to get equipment in, which could cause public outcry.

Site No.:	D1-017
Site Score:	48.2 – Extreme
Location:	Daniels Run Park; from Parklane Rd. to 50 ft. upstream of Embassy Ln.

Site Description:	Reach Length = 377 LF Lots of fallen trees and erosion. Poor condition, but wider, less sinuous, and smaller banks than DM 4.
Citizen Comments:	N/A
Access:	Access is good considering in Daniels Run Park and near paths for walking and bridge. However, forest would need to be cut to get equipment in, which could cause public outcry.

Site No.:	D1-018
Site Score:	44.6 – Very High
Location:	Daniels Run Park; from 50 ft. upstream of Embassy Ln. to the end of Daniels Run Park

Site Description:	Reach Length = 1958 LF 100 feet upstream of bridge at edge of Daniels Run Park, obvious stabilization ends. Lots of fallen trees, mostly steep banks. Small cobble.
Citizen Comments:	N/A
Access:	Access is good considering in Daniels Run Park and near paths for walking and bridges. However, forest would need to be cut to get equipment in, which could cause public outcry.

Site No.:	D1-019
Site Score:	33.1 – High
Location:	Cornell Road; from the end of Daniels Run Park to 100 ft above a break in houses on Cornell Rd.

Site Description:	Reach Length = 423 LF Previously restored area. Lots of concrete in the channel, non-armored side eroded.
Citizen Comments:	N/A
Access:	Access is difficult due to proximity of residences and Army-Navy County Club (both less than 50 ft off the stream).

Site No.:	D1-020
Site Score:	35.6 – High
Location:	Cornell Road; from 100 ft above a break in houses on Cornell Rd. to 200 ft. upstream of St. Andrews Dr.

Site Description:	Reach Length = 415 LF Erosion and scour downstream of St. Andrews Dr. Some right bank erosion, a lot of vegetation. Tight channel.
Citizen Comments:	N/A
Access:	Access is difficult due to proximity of residences and Army-Navy County Club (both less than 50 ft off the stream).

Site No.:	D1-021
Site Score:	28.2 – Moderate
Location:	Army-Navy Country Club; from 200 ft. upstream of St. Andrews Dr. to Army-Navy Country Club

Site Description:	Reach Length = 685 LF Excellent condition. Wide, lots of cobble in stream. Some erosion, but not much. Little riprap, big cobble, some fines.
Citizen Comments:	N/A
Access:	Access is difficult due to proximity of residences and Army-Navy County Club (both less than 50 ft off the stream).

Site No.:	D1-022
Site Score:	29.4 – Moderate
Location:	Army-Navy Country Club; downstream of Army-Navy Country Club to confluence with Accotink Creek

Site Description:	Reach Length = 239 LF Excellent condition. Relatively wide, lots of cobble in stream. Designed and stabilized recently. Lots of vegetation.
Citizen Comments:	N/A
Access:	Access is fair due to proximity to commercial areas, but most likely considered to be part of Army-Navy property.

Site No.:	D2-001
Site Score:	32.2 – High
Location:	Fairfax Square; within Fairfax Square properties



Site Description:	Reach Length = 491 LF Stream channel filled with boulders and cobble. Timber used to protect some banks. Two sections show evidence of erosion- one looks like the timber was removed and vegetation is reestablishing.
Citizen Comments:	N/A
Access:	Access is good. Large, open area within Fairfax Squares- closest property approximately 50 ft at end southern end of reach, approximately 150 ft at northern extent.

Site No.:	D2-002
Site Score:	35.8 – High
Location:	Fairfax Square; from Fairfax Square Properties to the southern side of the corner on Duncan St.

Site Description:	Reach Length = 453 LF Banks become defined from area D-1; wide channel more erosion and fallen trees. Only left downstream bank eroded; right bank a gradual slope.
Citizen Comments:	N/A
Access:	Access is good. Large, upstream end near open area within Fairfax Squares; within a small park area.

Site No.:	D2-003
Site Score:	28.0 – Moderate
Location:	South of Ashby Pond; from the southern side of the corner on Duncan St. to a pond near Ashby Rd.

Site Description:	Reach Length = 178 LF Low-lying floodplain area- transition from pond to defined stream banks. Very muddy and wide.
Citizen Comments:	N/A
Access:	Access is fair. In park area, but very muddy and wide- width extends out close to property lines

Site No.:	D2-004
Site Score:	41.4 – Very High
Location:	North of Ashby Pond; from a pond near Ashby Rd. to south of Ashby Rd.

Site Description:	Reach Length = 107 LF Section of stream between two culverts, one under Ashby Rd. and the other to the pond. Ivy with some shrubs, lots of concrete debris and rebar. Fallen trees and some steep, exposed banks.
Citizen Comments:	N/A
Access:	Access is easy. Right beside Ashby Road and within a small park area. Steep banks may cause a problem.

Site No.:	D2-005
Site Score:	40.9 – Very High
Location:	Haynesworth Street; from north of Ashby Rd. to 375 ft. north

Site Description:	Reach Length = 293 LF Armored ponded area right after culvert from Ashby Rd. Stream with slightly eroded banks. Bank angle 10 degrees on inside bend and 60 degrees on outside bend- slightly cut banks alongside deposits. One bad area found, but not typical. Some fallen trees.
Citizen Comments:	N/A
Access:	Access would be difficult. Lots of “no trespassing” signs between Daniels Run Park and Ashby Rd. Some fence goes all the way to the stream bank. Closest residence is over 100 ft. away.

Site No.:	D2-006
Site Score:	47.0 – Extreme
Location:	Haynesworth Street; from 375 ft. north of Ashby Rd. to 100 ft. within Daniels Run Park at pedestrian bridge

Site Description:	Reach Length = 653 LF Sinuous area with severely eroded outside bends; some sediment deposition on inside bends. Mostly steep or undercut banks with trees falling in. Coarse gravel, cobble. Fallen trees.
Citizen Comments:	N/A
Access:	Access would be difficult. Lots of “no trespassing” signs between Daniels Run Park and Ashby Rd. Some fence goes all the way to the stream bank. Closest residence about 100 ft. away.

Site No.:	D2-007
Site Score:	39.5 – High
Location:	South Daniels Run Park; from pedestrian bridge in Daniels Run Park to 250 ft. upstream

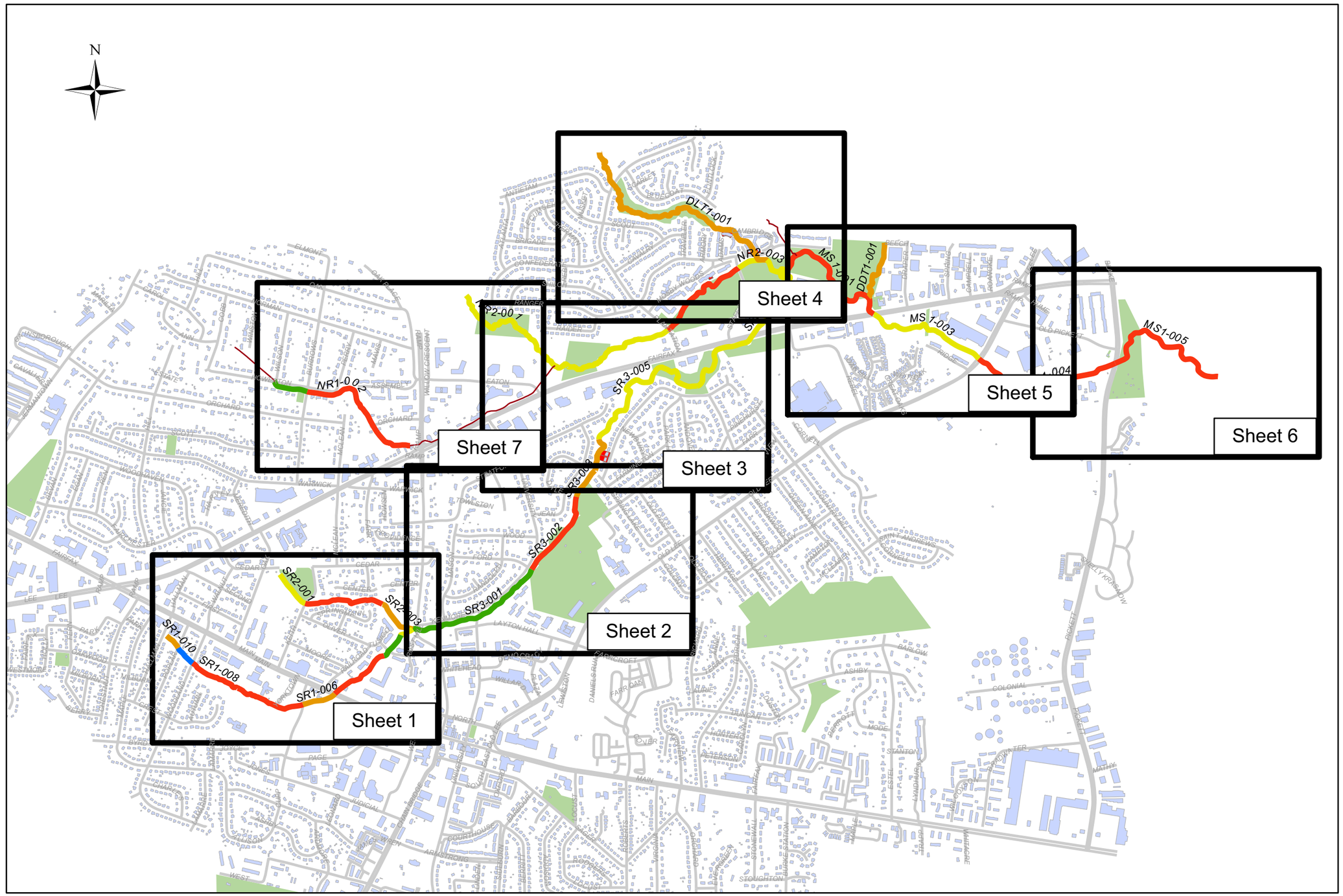
Site Description:	Reach Length = 331 LF Less curvy section between two sinuous sections of stream. Banks shallower and less eroded. Mossy area, not much groundcover other than trees.
Citizen Comments:	N/A
Access:	Access is good. Within Daniels Run Park and trees spread out. However, forest would need to be cut to get equipment in, which could cause public outcry.

Site No.:	D2-008
Site Score:	48.5 – Extreme
Location:	South Daniels Run Park; from 250 ft. upstream of pedestrian bridge in Daniels Run Park to confluence with the main stem of Daniels Run

Site Description:	Reach Length = 569 LF Extremely sinuous section of stream. Lots of fallen debris and eroded areas. Banks tall and steep, confluence incised. Lots of cobble.
Citizen Comments:	N/A
Access:	Access is good. Within Daniels Run Park and trees spread out. However, channel incised and sinuous and forest would need to be cut to get equipment in, which could cause public outcry.

APPENDIX E

STREAM ASSESSMENT & BEHI RESULTS MAPPING FOR ACCOTINK CREEK



500 250 0 500 1,000 1,500 2,000 2,500 3,000
Feet

Key Sheet
Scale: 1"=1500'

RK&K

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CITY OF FAIRFAX, VIRGINIA
STREAM ASSESSMENT AND INVENTORY
STREAM RESTORATION DESIGN SERVICES
ACCOTINK CREEK

STREAM ASSESSMENT AND BEHI RESULTS

H SCALE: 1" = 1500'
V SCALE: N/A
COUNTOUR: N/A
DATE: May 22, 2007
DESIGNED: DWB
DRAFTED: SPB
CHECKED: DWB

PROJECT #: 406-150-1

SHEET: Key Sheet

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CITY OF FAIRFAX, VIRGINIA
STREAM ASSESSMENT AND INVENTORY
STREAM RESTORATION DESIGN SERVICES
ACCOTINK CREEK

STREAM ASSESSMENT AND BEHI RESULTS

Sheet 1

H SCALE: 1" = 300'
V SCALE: N/A
COUNTOUR: N/A
DATE: Jun 06, 2007
DESIGNED: DWB
DRAFTED: SPB
CHECKED: DWB

PROJECT #: 406-150-1

SHEET: 1 of 7

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CITY OF FAIRFAX, VIRGINIA
STREAM ASSESSMENT AND INVENTORY

STREAM RESTORATION DESIGN SERVICES
ACCOTINK CREEK

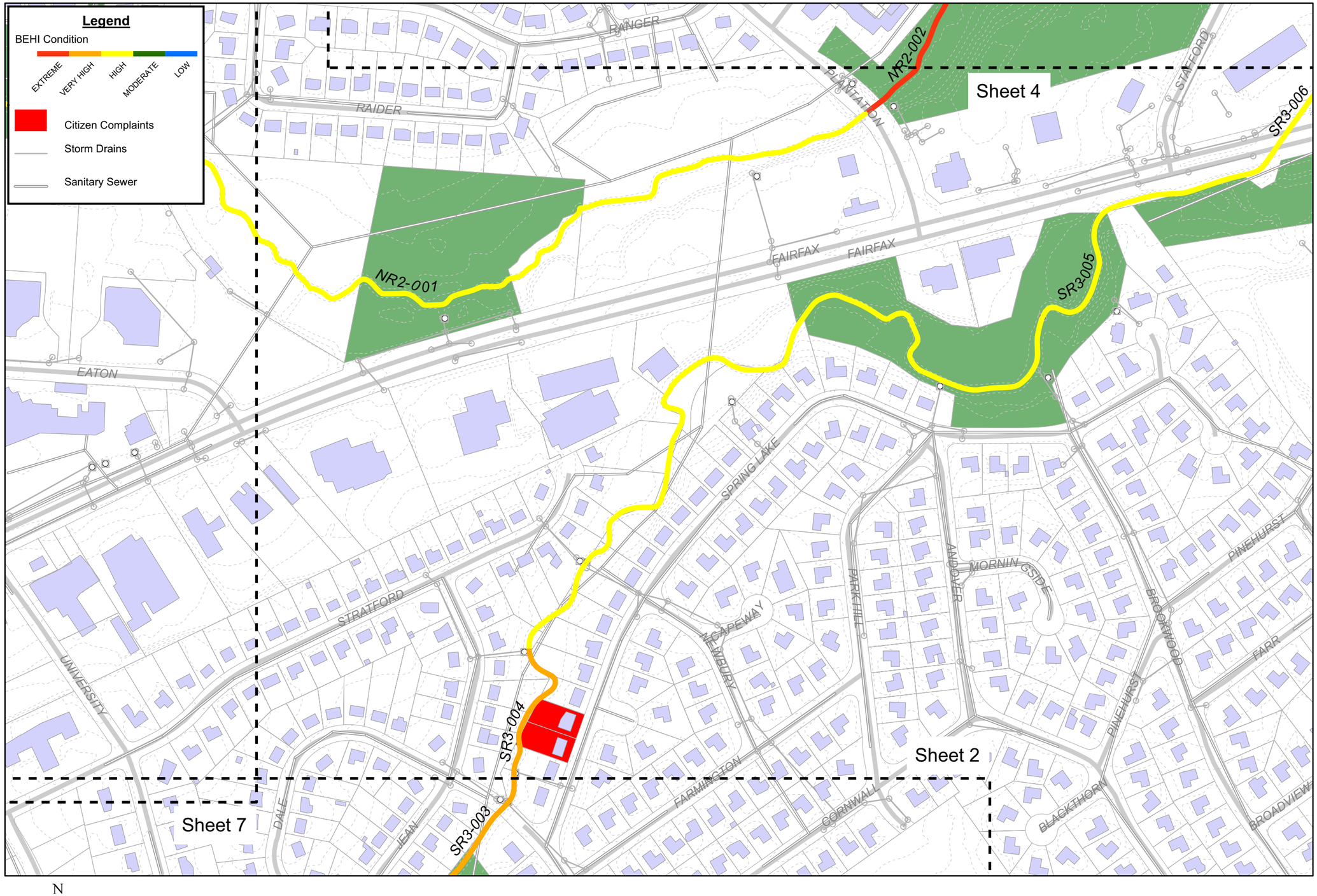
STREAM ASSESSMENT AND BEHI RESULTS

Sheet 2

H SCALE: 1" = 300'
V SCALE: N/A
COUNTOUR: N/A
DATE: Jun 06, 2007
DESIGNED: DWB
DRAFTED: SPB
CHECKED: DWB

PROJECT #: 406-150-1

SHEET: 2 of 7



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CITY OF FAIRFAX, VIRGINIA
STREAM ASSESSMENT AND INVENTORY
STREAM RESTORATION DESIGN SERVICES
ACCOTINK CREEK

STREAM ASSESSMENT AND BEHI RESULTS
Sheet 3

H SCALE: 1" = 300'
V SCALE: N/A
COUNTOUR: N/A
DATE: Jun 06, 2007
DESIGNED: DWB
DRAFTED: SPB
CHECKED: DWB

PROJECT #: 406-150-1

SHEET: 3 of 7

Legend

BEHI Condition

EXTREME | VERY HIGH | HIGH | MODERATE | LOW

Citizen Complaints

Storm Drains

Sanitary Sewer

PLANTATION
JESSIE
SINGLETON
FLINTLOCK
SCARLET
BLUE COAT
MUSKET
SCOUT
SABER
TRAVELER
ARMORY
ADAMS
DUNSTER
CAMBRIDGE
RANGER
SHERMAN
CAVALRY
CONFEDERATE
SHILOH
MOSBY WOODS
STAFFORD

DLT 1-001
MS1-001
NR2-003
NR2-002
SR3-007
SR3-006

Sheet 5
Sheet 3

N

300 150 0 300 600 900 1,200
Feet

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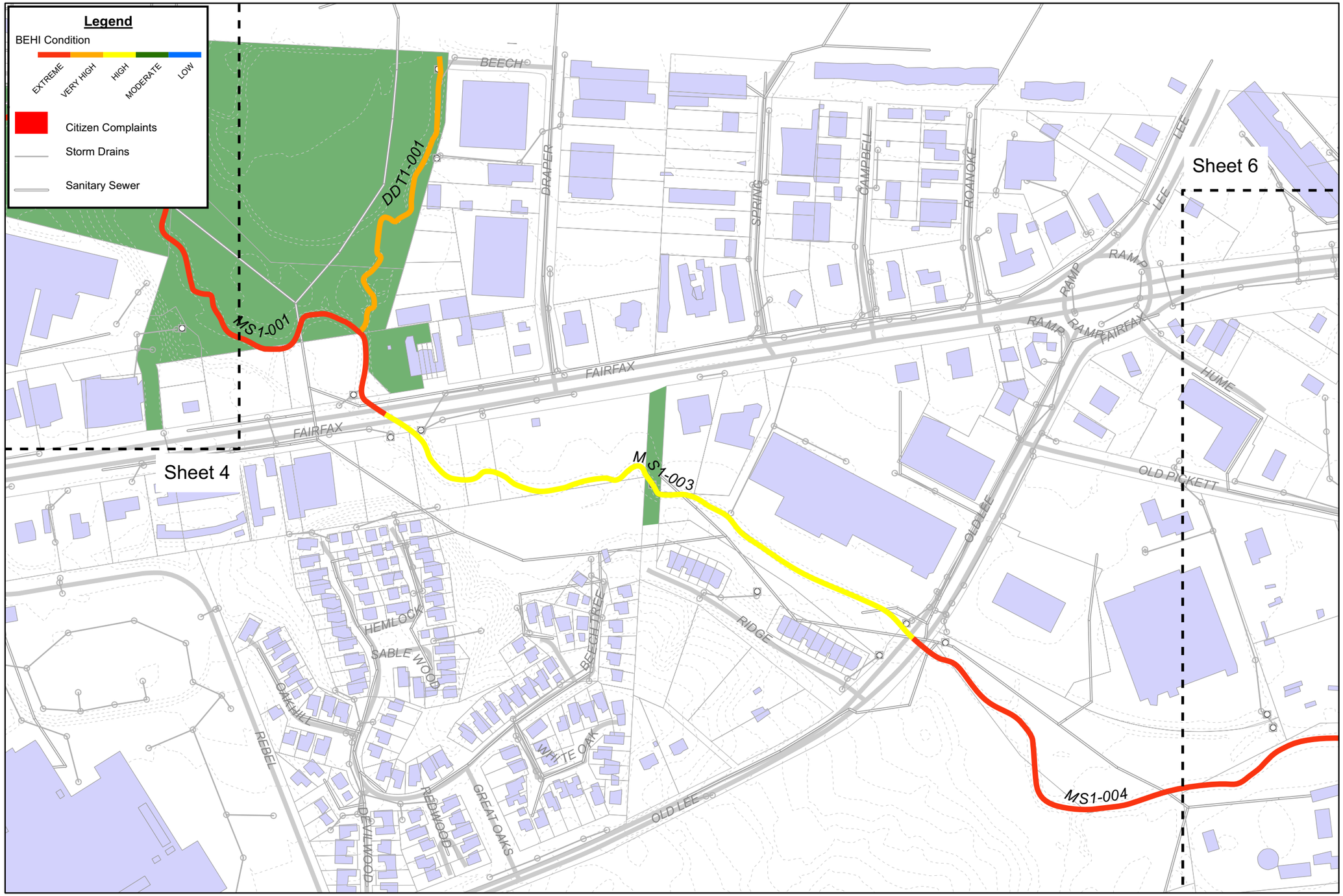
STREAM ASSESSMENT AND INVENTORY
STREAM RESTORATION DESIGN SERVICES
ACCOTINK CREEK

STREAM ASSESSMENT AND BEHI RESULTS
Sheet 4

H SCALE: 1" = 300'
V SCALE: N/A
COUNTOUR: N/A
DATE: Jun 06, 2007
DESIGNED: DWB
DRAFTED: SPB
CHECKED: DWB

PROJECT #: 406-150-1

SHEET: 4 of 7



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CITY OF FAIRFAX, VIRGINIA
STREAM ASSESSMENT AND INVENTORY
STREAM RESTORATION DESIGN SERVICES
ACCOTINK CREEK

STREAM ASSESSMENT AND BEHI RESULTS

Sheet 5

H SCALE: 1" = 300'
V SCALE: N/A
COUNTOUR: N/A
DATE: Jun 06, 2007
DESIGNED: DWB
DRAFTED: SPB
CHECKED: DWB

PROJECT #: 406-150-1

SHEET: 5 of 7

N

300 150 0 300 600 900 1,200

Feet

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CITY OF FAIRFAX, VIRGINIA
STREAM ASSESSMENT AND INVENTORY
STREAM RESTORATION DESIGN SERVICES
ACCOTINK CREEK

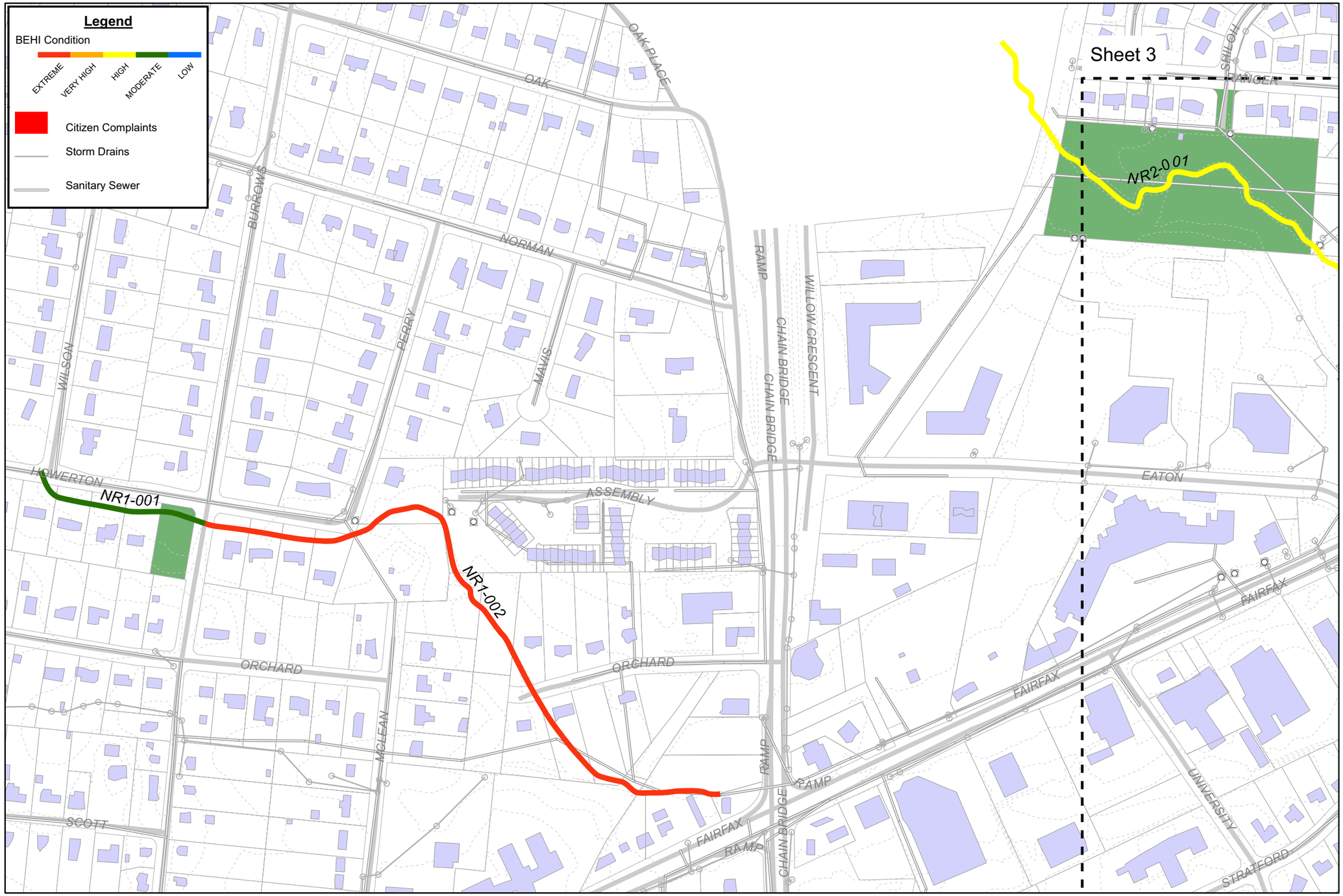
STREAM ASSESSMENT AND BEHI RESULTS

Sheet 6

H SCALE: 1" = 300'
V SCALE: N/A
COUNTOUR: N/A
DATE: Jun 06, 2007
DESIGNED: DWB
DRAFTED: SPB
CHECKED: DWB

PROJECT #: 406-150-1

SHEET: 6 of 7



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CITY OF FAIRFAX, VIRGINIA
STREAM ASSESSMENT AND INVENTORY
STREAM RESTORATION DESIGN SERVICES
ACCOTINK CREEK

STREAM ASSESSMENT AND BEHI RESULTS

Sheet 7

H SCALE: 1" = 300'
V SCALE: N/A
COUNTOUR: N/A
DATE: Jun 06, 2007
DESIGNED: DWB
DRAFTED: SPB
CHECKED: DWB

PROJECT #: 406-150-1

SHEET: 7 of 7