City of Harrisonburg Stormwater Advisory Committee

Agenda

August 3, 2016 5:00 – 7:00 p.m.

5:00 – 5:05	**1. Review and Adopt Minutes**
5:05 – 5:10	**2. Public Comment** (limited to 3 minutes per speaker)
5:10 – 5:15	**3. New Employee Introductions** Erin Yancey, *Public Works Planning Manager* Rebecca Stimson, *Environmental Program Support Specialist*
5:15 – 6:00	**4. Stormwater Improvement Plan Scoping** Timmons Group Presentation Draft RFP Discussion
6:00 – 6:15	**5. Credit Application Update** Application deadline was July 1, 2016 Homeowner BMP Credits through Chesapeake Bay Program
6:15 – 6:50	**6. TMDL Action Plan Update & Stormwater Utility Fee Program Review** Street Sweeping Credits
6:50 – 7:00	**7. Next Steps**

STORMWATER IMPROVEMENT PLAN SCOPING

SCOPING RECOMMENDATIONS REPORT

CITY OF HARRISONBURG, VIRGINIA

JULY 20, 2016

FINAL SUBMITTAL

PREPARED BY:

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Appendix A: Composite Map of Inventoried Stormwater Issues & Supporting Information Table

Stormwater Improvement Plan Scoping Report

The City of Harrisonburg (City) is an independent city located in the Shenandoah Valley of the Commonwealth of Virginia and is surrounded by Rockingham County. The City comprises more than 17 square-miles (over 11,000 acres), is home to nearly 53,875 residents (2015 Weldon Cooper Study), and is located entirely within the Chesapeake Bay watershed.

Based on the US Census in 2000, the City is subject to the General VPDES Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems (MS4). The current permit cycle became effective July 1, 2013 and will expire on June 30, 2018. In response to the requirements of the VPDES permit (Permit #VAR040075) and the costs of operating a stormwater program, the City recently (February 2015) developed a stormwater fund which is collected through a stormwater utility fee. The stormwater utility fee is charged to property owners within the City based on the property's impervious surface coverage. The stormwater fund was developed to be a dedicated source of revenue for stormwater management activities necessary to protect the general health, safety, and welfare of residents of the City and to meet requirements of the City's VPDES MS4 permit and federal and state regulations to address identified water quality and quantity needs (section 6-5 of the City Code). The stormwater fund also provides for the cost of administration of the stormwater program, facility operation and maintenance, and other activities consistent with state/federal regulations or permits governing stormwater management.

AN ESSENTIAL OUTCOME OF THE STORMWATER IMPROVEMENT PLAN IS TO PROVIDE AN ACHIEVABLE PLAN FOR MEETING REGULATORY COMPLIANCE REGARDING THE CHESAPEAKE BAY TMDL AND TO PROVIDE A PLAN FOR THE CITY'S LONG-TERM STORMWATER NEEDS.

With the Stormwater Improvement Plan (SWIP), the City is taking a proactive approach to planning for stormwater management needs within the City and managing the stormwater fund for long-term project and program implementation. An essential outcome of the SWIP is to provide an achievable plan for meeting regulatory compliance regarding the Chesapeake Bay TMDL and to provide a plan for the City's long-term stormwater needs. The SWIP will be used as a tool to assess the long-term budgetary needs of the stormwater program as it relates to primarily water quality improvement projects.

I. Citywide Assessment

The Stormwater Improvement Plan will be a citywide plan for managing the City's stormwater needs. As such, stormwater needs will be evaluated on a citywide basis. Given the size of the City (>17 sq-mi), it is essential that the citywide assessment proceed in a systematic manner and be a multi-faceted approach to accurately assess the stormwater needs for all areas of the City. The efforts of the SWIP will build upon previously completed stormwater studies and incorporate, to the maximum extent possible, other City strategic plans, initiatives, and planning documents.

A. Define Stormwater Improvement Plan Scoping Report Goals

The SWIP is intended to be a long-range visionary plan that incorporates the City's stormwater needs to achieve regulatory compliance. It is important that the plan be developed in such a way that the City's stormwater water quality needs are identified and an achievable plan for implementation is provided. The SWIP will:

1) Develop a plan to assist the City in achieving anticipated pollutant of concern (POC) reduction requirements for the 2028 permit cycle and to protect the City's stormwater infrastructure.
2) Develop a comprehensive list of recommended stormwater quality improvement projects and programs identified within the City.
    a. Prioritize all identified projects and programs using a standardized ranking scheme.
    b. Identify those projects with the ancillary benefits to improve flooding/drainage conditions.
    c. Identify high priority projects and programs based on rankings.
    d. Develop preliminary design and cost estimates for the high priority projects suitable for typical grant applications and develop guidelines for program development.
    e. Provide an implementation schedule for the identified high priority projects and programs.

The SWIP will be a document designed to be actively used by City staff well into the future. As such, it is critical that the plan be established with an adaptive management approach to accommodate changing regulatory and funding dynamics in accordance with the US EPA approach ("A Quick Guide to Developing Watershed Plans to Restore and Protect Our Waters", 2013) illustrated in .

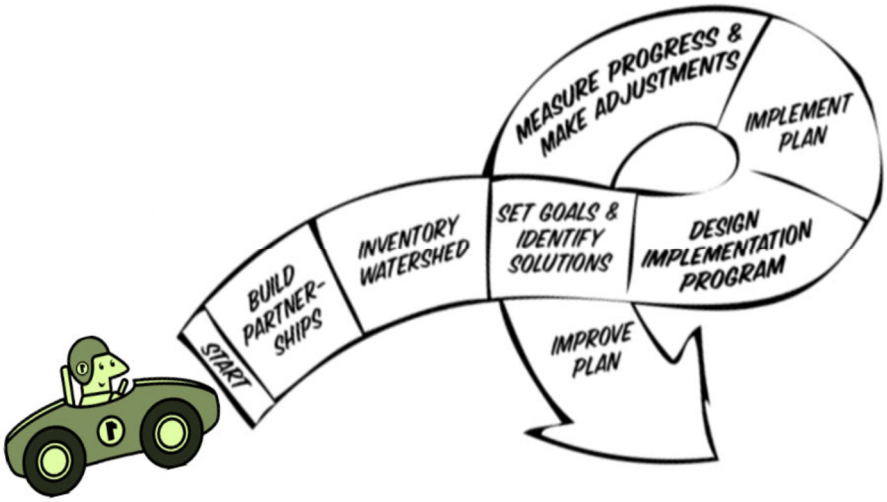
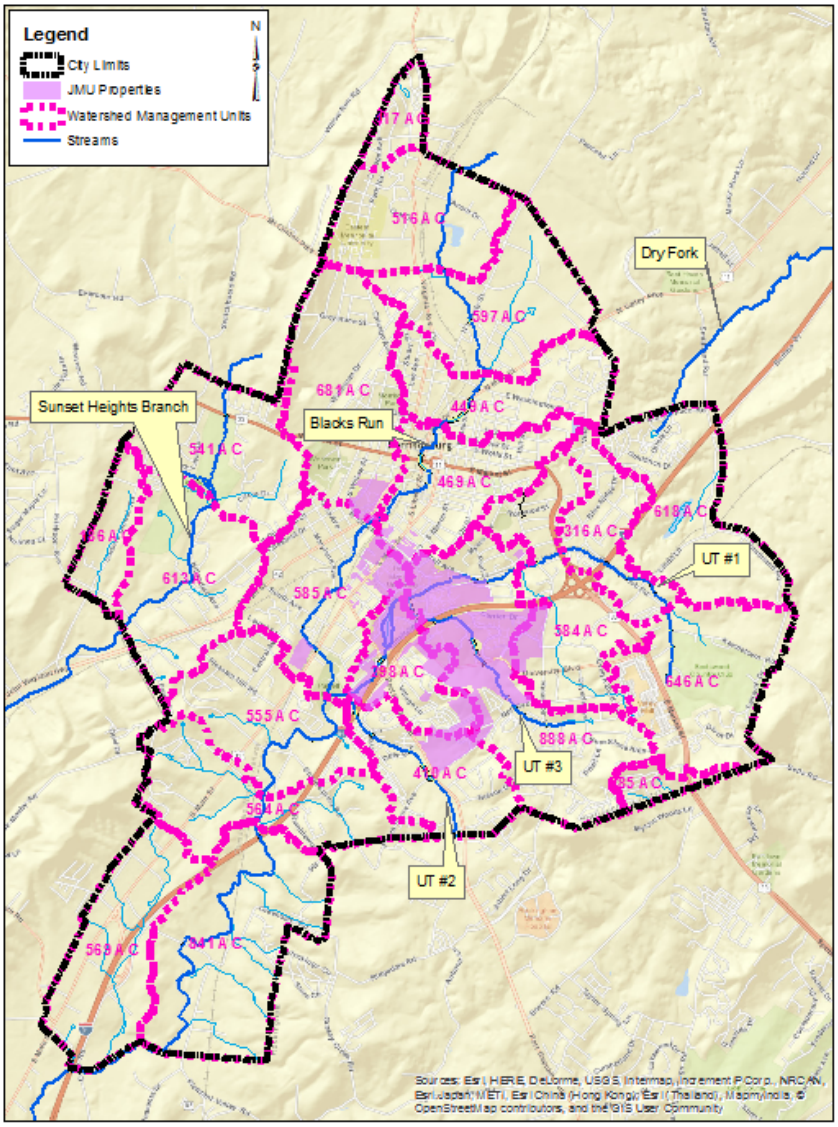


Figure 1. Adaptive Management Approach to Plan Implementation

B. Systematic Watershed Approach

A systematic, watershed-based approach to review of the City's jurisdictional area is recommended during the development of the SWIP. Given the size of the City and the need to thoroughly evaluate all areas of the City for stormwater needs, the City has developed a GIS-based layer depicting sub-basin management units for use during the development of the SWIP. The sub-basin management units are based loosely on sub-drainage area boundaries that are each comprised, on average, of 500 acres. The sub-basin management units are anticipated to assist in managing detailed studies within the management areas and to provide a framework for the systematic study of the entire City.

Figure 2. City of Harrisonburg Stormwater Management Units.



Each watershed within the City will be studied as part of the SWIP. It is recommended that the SWIP studies begin with a single management unit, such as the UT #2 sub-basin (Linville Creek) consisting of 410 acres, to establish a study methodology in conjunction with City staff. With the study methodology in place, it is recommended that the study then progress to a larger watershed study area focusing on the tributaries of Blacks Run, then the sub-basin management units of the main stem of Blacks Run. The detailed study of the City would then finish with the study of the remaining watershed management units (Sunset Heights Branch, Dry Fork, etc.). The proposed plan would allow a systematic and consistent detailed study of the entire City for the SWIP.

C. Public Participation & Stakeholder Involvement

With the recent implementation of the stormwater utility fee, property owners in the City are becoming more aware of the City's stormwater management program and are increasingly more interested and active regarding the City's stormwater quality needs. The City aspires for the SWIP to become a community plan for addressing stormwater needs, particularly water quality needs established by the City's VPDES MS4 permit. The City wants to embrace this enthusiasm and encourage citizen participation in the SWIP process by hosting two public information and input meetings as part of the

SWIP development, outlined below. The public meetings will allow the City to educate citizens about the plan and why a SWIP is needed. The public meetings can also be used to acquire information regarding stormwater runoff issues with in the City and to keep the public abreast of the SWIP progress.

Public Participation Schedule:

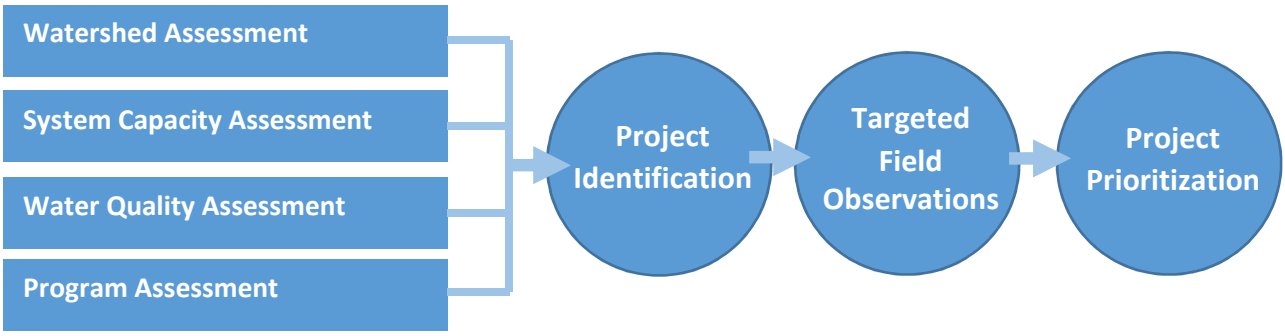
1. Public Input Meeting: Initial input and information gathering from stakeholders about stormwater runoff issues.
2. Draft SWIP Presented to Stormwater Advisory Committee (SWAC)
3. Public Information Meeting: Presentation on draft SWIP and initiation of the formal public comment period.

The SWIP team will prepare maps, handouts, and other appropriate public meeting materials for distribution during the public meetings. It is recommended that the SWIP team work with City staff to identify times and meeting places to facilitate the public meetings that will promote high public attendance.

II. Project Administration

Since a key goal of the SWIP is to develop an actionable plan for permit compliance, it is the City's desire to have the SWIP completed within a 12 month timeframe. The SWIP development process is anticipated to have several tasks that can be completed concurrently, see Figure 3. This will allow the plan to be developed in a time efficient manner.

Figure 3. SWIP Development Process



III. Watershed Assessment

The City has existing data and studies that can be used to support and inform the development of the SWIP. A key step in the SWIP development process will be to review the existing data and plans in order to identify elements from each of the data sources that can be integrated into the SWIP.

A. Review of Existing Plans

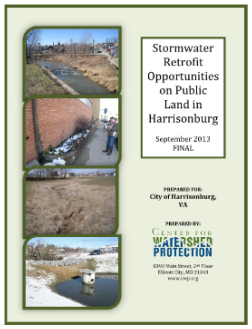
The watershed assessment will provide a systematic review of each study area to include (but not limited to) the following major sources of data.

1. Storm Water Action Plan (1999)

In 1999 a Storm Water Action Plan was developed to identify a comprehensive list of specific projects and programmatic recommendations to improve flooding conditions within the City. Some of the recommendations have been implemented over time. Elements of the 1999 Stormwater Action Plan should be referenced during the SWIP development to identify and carry forward recommendations made that remain consistent with the current vision and goals of the City's Stormwater Program.

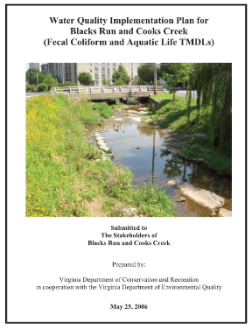
2. Stormwater Retrofit Opportunities on Public Land in Harrisonburg (2013)

This study takes the findings from a larger study of neighboring communities and focuses the findings of the study for the City of Harrisonburg. The study goals were to determine the level to which stormwater retrofit opportunities on publically owned properties can reduce urban nutrients and sediment. An outcome of the study was the development of an inventory of potential retrofit opportunities that quantifies costs of construction and potential pollutant removal for each opportunity. It is anticipated that this report will be valuable resource for reference during the SWIP development process.



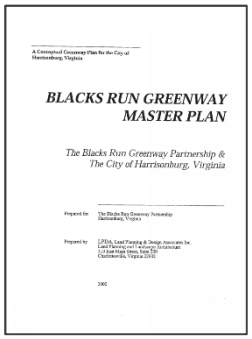
3. Water Quality Implementation Plan for Blacks Run and Cooks Creek (2006)

This plan submitted to the Stakeholders of Blacks Run and Cooks Creek reviews TMDL reduction requirements for fecal coliform and aquatic life and provides an implementation plan improving water quality for Blacks Run and Cooks Creek. Elements of the Water Quality Implementation Plan should be referenced during the SWIP development to identify and carry forward recommendations made that remain consistent with the current vision and goals of the City's Stormwater Program.



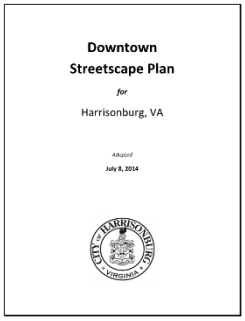
4. Blacks Run Greenway Master Plan (2002)

The Blacks Run Greenway Master Plan was developed in hopes that building a greenway would increase the water quality and aquatic life of Blacks Run and wildlife in areas around Blacks Run. The greenway should also enhance life in the City through outlets for hiking, walking, jogging, biking, improved access to downtown Harrisonburg, and educational opportunities to learn about the City. The Blacks Run Greenway Master Plan is referenced in the City's Comprehensive Plan and is being implemented through projects prioritized in the City's Bicycle and Pedestrian Plan. The Blacks Run Greenway Plan should be



reviewed during the SWIP process to identify how, if any, stormwater initiatives that might be developed as part of the SWIP will complement the Plan.

5. Downtown Streetscape Plan (2014)

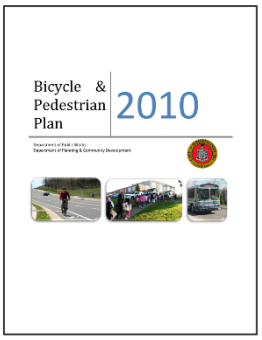


The 2014 Downtown Streetscape Plan, builds upon a previous version of the Plan, with the overall goal of presenting an easily communicable, comprehensive vision for the public streetscape in Downtown Harrisonburg to further develop and sustain a vibrant downtown. The Downtown Streetscape Plan should be reviewed during the SWIP process to identify how, if any, stormwater initiatives that might be developed as part of the SWIP will complement the Plan.

6. Comprehensive Plan (2011)

The City's Comprehensive Plan presents a vision of what kind of community the City would like to be in the future. It identifies the steps required to move toward that vision by providing information about the City's current conditions, long-term goals and objectives, and recommended implementation strategies. The Comprehensive Plan also includes the Street Improvement Plan. There is some GIS data supporting the Comprehensive Plan with the City's geodatabase. The Comprehensive Plan and associated GIS layers should be reviewed during the SWIP process to identify how SWIP stormwater initiatives might complement the Comprehensive Plan.

7. Bicycle & Pedestrian Plan (2010)



The purpose of the Bicycle and Pedestrian Plan (2010) is to provide a framework for developing and implementing bicycle and pedestrian transportation in the City and is an update to the 2005 plan. The Bicycle & Pedestrian Plan should be referenced during the Watershed Assessment task to become familiar with the short and long term goals of the plan and to identify how, if any, stormwater initiatives that might be developed as part of the SWIP will complement the Plan. The City is currently revising the plan for an update in 2016.

B. Existing Maintenance Records

The City is currently implementing CityWorks as a stormwater asset management system. Consequently, a long maintenance history of stormwater assets is not yet available within CityWorks and will not be available during the SWIP process. Prior to implementation of CityWorks, the City tracked chronic maintenance issues using a spreadsheet and hardcopy map (neither integrated with GIS mapped assets). These resources will be critical in evaluating maintenance trends within the City.

1. Current Maintenance Practices

The City currently handles calls reporting stormwater issues on a case-by-case basis. Traditionally, the City has not tracked locations associated with the calls, though a recent effort (early 2016) has begun to track calls by street name in a spreadsheet. The most common types of issues involve debris removal of both natural and manmade materials clogging inlets/pipes.

Figure 4. City of Harrisonburg stormwater maintenance crew.

Backyard flooding is a common complaint voiced in calls. Traditionally, the City has considered backyard flooding issues a private property issue. The focus of the stormwater maintenance program has been on keeping City streets from flooding and making necessary repairs where there are maintenance issues. It is important to note that backyard flooding issues will not be a primary focus of SWIP project/program prioritization.

The City performs routine inspection and maintenance on the stormwater system, taking approximately 1.5 years to cycle through all stormwater assets. Routine maintenance includes pulling ditch lines when needed and removing sediment/debris/trash from inlets and culverts.

2. Routine Maintenance List

In a proactive effort to ready the City for large predicted storms, City maintenance crews frequent a list of locations for maintenance. The list of locations is stored in a spreadsheet, but not referenced to the GIS infrastructure mapping layers. This list should be evaluated during the SWIP development to identify areas of flooding concern.

3. 2013 Drainage Map

In 2011 the City developed a hardcopy map that identified chronic flooding locations within the City. In 2013 the map was updated to reflect changing flooding conditions, removing areas from the map that have been corrected with maintenance and adding additional locations that have been reported.

4. Composite Map and Site Listing

As part of this scoping project, the Timmons Group project team met with City staff and maintenance crew members (Feb 2016) to review the documented flooding locations from the 1999 Stormwater Action Plan and the 2013 Drainage Map. During this meeting City staff reviewed the map to:

1. Identify and discuss documented ongoing flooding issues,
2. Identify issues that have been corrected and should be removed from the list, and

3. Identify known issues that have not been documented on the map.

An outcome of the meeting was to produce a GIS-based map and attribute table documenting current flooding issues within the City, see Appendix A.

C. MS4 Program Plan Review

As part of the City's MS4 permit, the City has developed an MS4 Program Plan. Several resources are included that may be useful during the SWIP development, including the TMDL Action Plan.

1. TMDL Action Plan

VPDES MS4 permit compliance will be a primary driver of the Stormwater Program in the coming 15 years. Reductions of Nitrogen (N), Phosphorous (P), and Total Suspended Solids (TSS) will need to be met for the first, second, and third permit cycles. The SWIP plan will provide an actionable way to meet these reduction requirements.

D. City GIS Geodatabase

The City currently maintains an active GIS geodatabase. The City's geodatabase includes many feature datasets that may be helpful during the SWIP development, see Table 1.

Table 1. Applicable Feature Classes from the City's GIS Geodatabase

City Buildings	City Limits	City Schools	City Streets
Comprehensive Plan layers	City Parks	Contours data (2011)	Downtown layers
ECC Data	Floodplain Data	Historic Data	Sewer Assets
JMU Data	MS4 Data layers	Planning & Zoning	Public Works
Soils	Stormwater Assets	Sanitary Sewer Assets	Water Assets
Survey Support layers	Impervious Area		

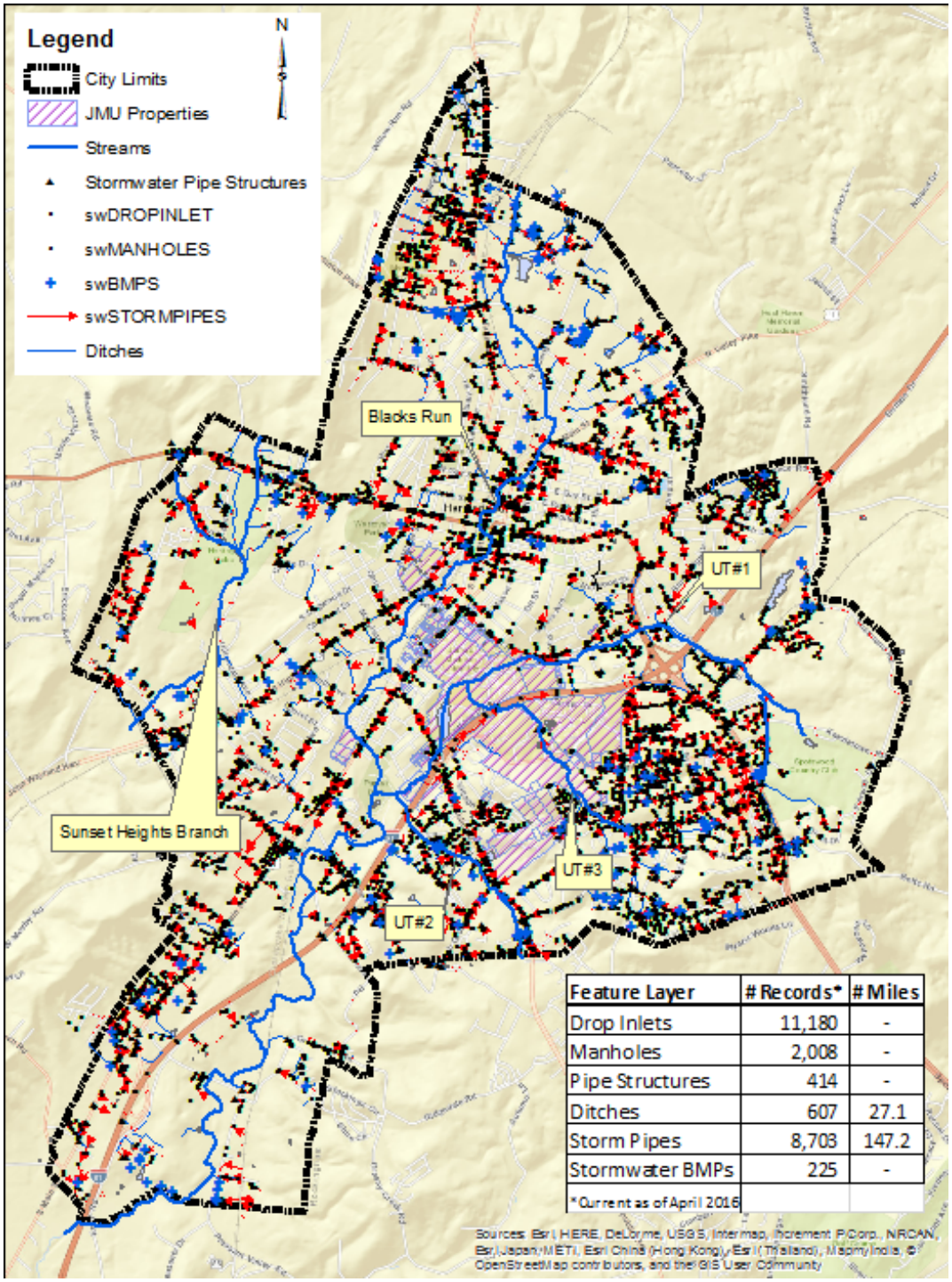
1. Stormwater Assets Mapping

The City actively updates the stormwater system infrastructure mapping, see Figure 5. Data entry for the mapping is hand drawn and based on feature representation on construction plans. The stormwater infrastructure mapping is extensive, but has largely not been field verified or corrected. The feature data tables have many attribute fields, though consistent data entry and the complete attribution of all records remains a goal for the City. Many recent revisions have been made to the feature data set for stormwater infrastructure assets to support the implementation of CityWorks for asset management, including the migration of the dataset into a new data structure with field domains. Migration of attribute field entries to the new domain values is ongoing.

It is anticipated that the stormwater infrastructure mapping will be a key resource of data during the SWIP development. It should be considered approximate in nature and field visits to key locations may be necessary to verify the mapped information during

the SWIP development process. It is anticipated that the SWIP development team will likely want to perform some general quality control review checks (consisting of desktop analysis processes and potentially limited field checks in key locations) to confirm the suitability of the data for analysis.

Figure 5. City of Harrisonburg Stormwater Assets Mapping



Feature Layer	# Records*	# Miles
Drop Inlets	11,180	-
Manholes	2,008	-
Pipe Structures	414	-
Ditches	607	27.1
Storm Pipes	8,703	147.2
Stormwater BMPs	225	-
*Current as of April 2016		

IV. System Capacity Assessment

System capacity assessment is not a primary component of the SWIP and will be considered as an ancillary benefit for any potential projects identified. As such, stormwater system model development will not be a significant task during the SWIP development. There are many existing resources that can inform the system capacity analysis performed during the SWIP, including:

- Routine Maintenance List (Appendix A)
- Composite Map (Appendix A)
    - 2016 GIS-based stormwater issue tracking layer
    - 2013 Drainage Map
    - Stormwater Action Plan (1999)
    - Staff Discussions (Meeting Minutes from 2/3/2016)
- Floodplain Modeling and Mapping

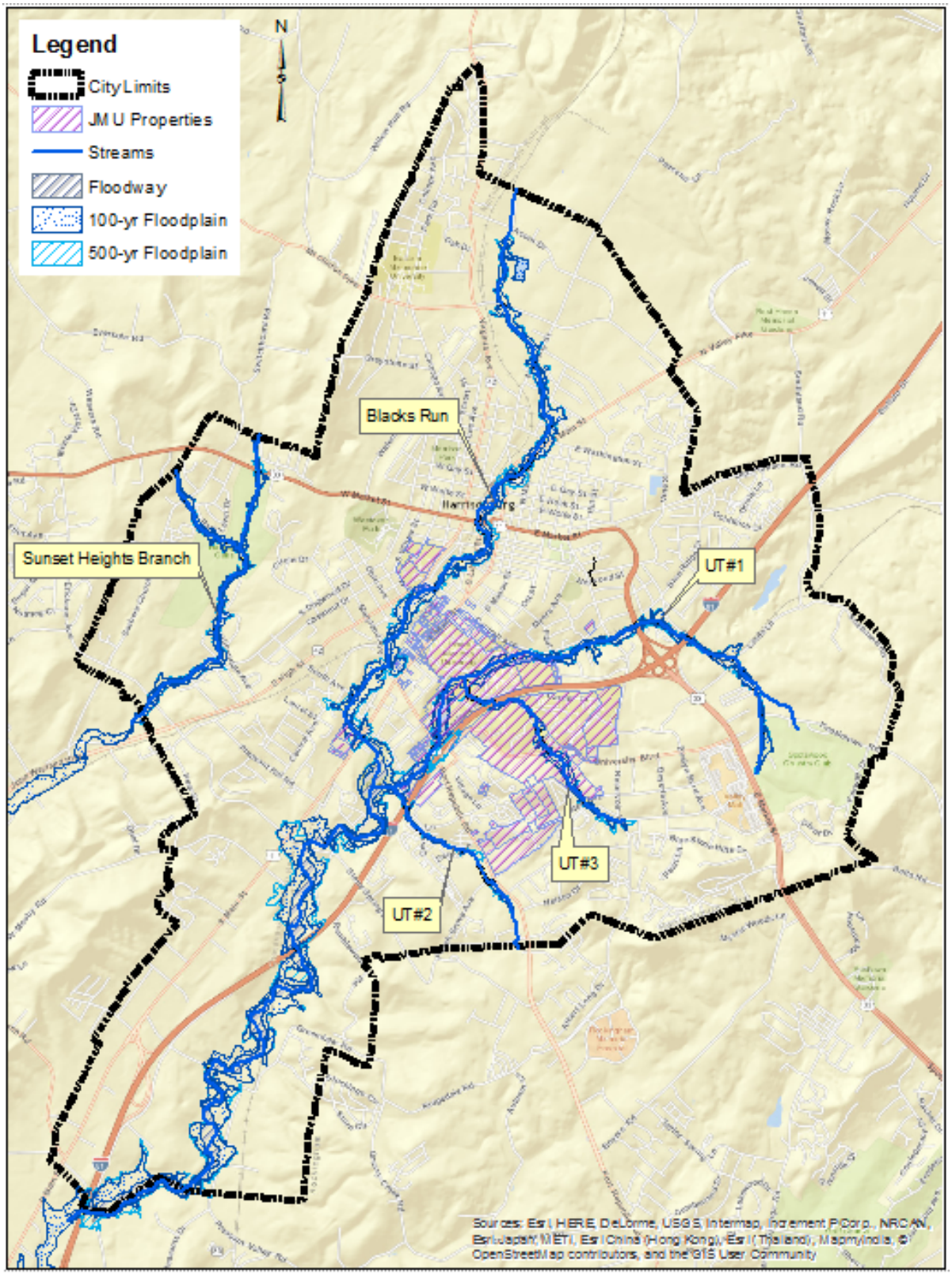
A. Evaluation of Existing Open Channel Modeling

There are several major open channel conveyances within the City for which open channel modeling and floodplain mapping have previously been studied in 2008, see Figure 6. The hydrology supporting the models was also updated (2004) to reflect development conditions at the time of study. The modeling documentation supports the FEMA update of the study reaches. Multiple flow profiles are available within the models to evaluate system performance for a variety of design storms.

The City has access to the hydrology and hydraulic reports that document the floodplain modeling update efforts. Further, the City has access to the HEC-RAS model files supporting the floodplain study for all the modeled reaches and their supporting documentation. Within the "Floodplain" feature dataset in the City's geodatabase, the City has GIS layers representing the following feature classes: Base Flood Elevations (BFE's), cross sections, stream centerlines, model bridge/culvert locations, mapped floodplains (100-year and 500-year), mapped floodway, parcels within the floodplain, and buildings within the floodplain.

It is expected that previously developed modeling will serve as a basis to analyze existing LOS conditions along the studied reaches during the SWIP development process. It is anticipated that the SWIP team will perform limited checks of the modeling data prior to its use during the SWIP development. When applicable, the existing modeling can serve as a tool to evaluate hydraulic benefits of any water quality project identified during the SWIP development.

Figure 6. Existing Floodplain Mapping with the City of Harrisonburg



1. Define LOS goals for Road Crossings/Infrastructure Capacity

One of the first steps in evaluating system capacity performance is to define Level of Service (LOS) goals for road crossings/infrastructure. LOS goals for stormwater system infrastructure are typically evaluated by risk tolerance and defined by design storms. LOS goals will vary across elements of the stormwater infrastructure based on road classification, critical infrastructure and critical routes.

2. Identify Existing LOS Deficits from modeling

Based on the LOS goals identified as a task discussed in paragraph IV.A.1, the SWIP team will analyze the modeling data to identify locations where the functioning LOS of the stormwater system is not meeting the defined goal LOS. It is important that the SWIP team review the results of the modeling with the City staff to verify the reasonableness of the analysis with any anecdotal data and/or local knowledge. City maintenance records (discussed in paragraph III.B) can also be used as anecdotal evidence verifying the model and LOS findings.

Figure 7. News coverage of a flooding on Madison St on September 10, 2015.

B. Evaluation of Other Key Systems

In addition to having a significant amount of open channel infrastructure, the City also has a significant stormwater conveyance system comprised of inlets, manholes, pipes, and stormwater Best Management Practices (BMPs). The GIS data layer currently has over 147 miles of stormwater conveyance piping mapped, ranging in size from 4 inches to multiple barrel box culverts.

Unlike open channel conveyance studies, there has not been a large modeling study completed within the City of the existing stormwater conveyance system capacity. Areas identified for system capacity modeling should be informed from the following sources of information:

- Existing City Maintenance Records, see paragraph III.B
- Review of the GIS based Stormwater Asset Mapping
- Review of findings from field observations
- Review of Open Channel Modeling (to determine areas of high backwater)
- City input

When an identified water quality project might also provide a water quantity benefit, conceptual-level (not design-level analysis) modeling/analysis is anticipated to be sufficient to analyze the potential project benefits. No surveying will be required for this project scope. It is

important to consider in the SWIP development that water quantity improvements are considered an ancillary benefit to identified water quality projects.

V. Water Quality Assessment

The City has identified a primary outcome of the SWIP development to be an actionable plan for achieving required POC reductions for regulatory compliance.

A. TMDL Action Plan Review

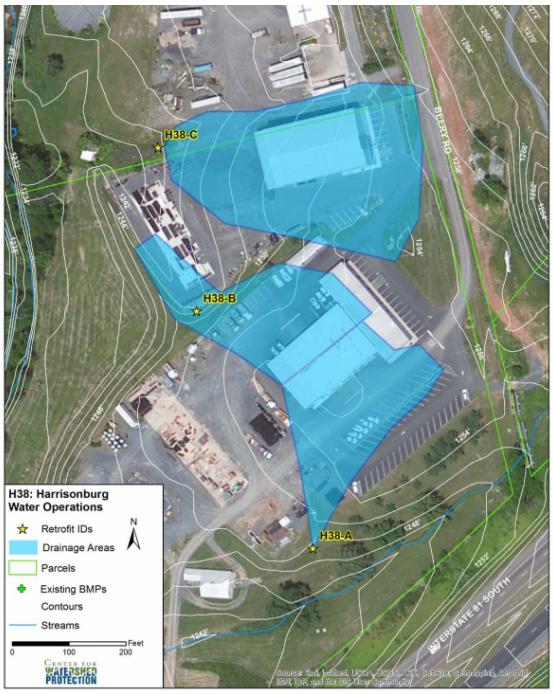
Implementing Chesapeake Bay TMDL POC reductions is the primary focus of the SWIP. The City is actively planning compliance strategies for achieving the anticipated required reductions. In addition to street sweeping, the City is currently considering other practices to achieve POC reductions, including: storm drain cleaning practices, private/public partnerships, capital projects, and purchasing nutrient offsets. A goal of the SWIP project is to identify a plan for efficiently achieving POC reduction credits for permit compliance.

Figure 8. City of Harrisonburg Street Sweeper

B. Evaluate Projects Identified in 2013 Stormwater Retrofit Study

As discussed in paragraph III.A.2 the City partnered with several communities to identify stormwater retrofits on publically owned lands. The findings of this study should be evaluated during the SWIP development to determine which, if any, of the identified projects remain consistent with the City's current goals. Any projects from the 2013 Retrofit Study deemed consistent and applicable to the SWIP project should be carried forward and included in the SWIP. Each of the identified retrofit opportunities should be located with coordinates and key attribute data logged, including: BMP retrofit type, estimated POC removal, and site attributes impacting retrofit implementation noted.

Figure 9. Retrofit recommendation example taken from the 2013 Retrofit Study



It is important to note that the project merits and ranking will likely need to be re-evaluated using the standard developed during the SWIP development process to ensure all projects included in the SWIP are evaluated using consistent definitions. Further, any cost estimates provided by the 2013 report will need to be escalated to dollar values representing the year for the SWIP development.

C. Evaluate Other Retrofit Projects

In addition to the retrofits identified in the 2013 Retrofit Study, it is anticipated that the SWIP team will identify additional sites where retrofit projects could be implemented to achieve water quality reduction. Potential retrofit projects that could be identified include existing stormwater facilities located on public and private properties. It is anticipated a desktop survey of available GIS data will inform the identification of potential retrofit candidate sites. Field visits may be necessary to further screen these locations for applicability.

Each of the identified retrofit opportunities deemed appropriate for including in the SWIP should be located with coordinates and key attribute data logged, including: BMP retrofit type, estimated POC removal, site attributes impacting retrofit feasibility, and parcel ownership.

D. Evaluate Potential for Additional Proposed Projects & Practices

During the development of the SWIP, the SWIP team will endeavor to identify opportunities for water quality improvement projects not previously identified. Potential water quality projects that could be identified include projects located on public and private properties. It is anticipated a desktop survey of available GIS data will inform the identification of potential water quality project candidate sites. Field visits may be necessary to further screen these locations for applicability.

Figure 10. Riparian planting by students along a stream on the City's Parks and Recreation maintenance property (Fall 2006).

Each of the identified water quality project opportunities deemed appropriate for inclusion in the SWIP should be located with coordinates and key attribute data logged, including: BMP retrofit type, estimated POC removal, site attributes impacting retrofit feasibility, and parcel ownership.

VI. Program Assessment

The City's Stormwater Management Program provides for the City's stormwater needs and has a primary goal of protecting water quality in the City's streams. The Stormwater Management Program and its current supporting programs/initiatives is predominately geared for regulatory and MS4 permit compliance and is supported by the recent implementation of a stormwater utility fee.

KEEP IT CLEAN, HARRISONBURG
STOP POLLUTED RUNOFF

It is important to consider that some programmatic components can be used to leverage POC reduction credits. It is recommended that the SWIP team evaluate stormwater-related programs and activities that can be used to achieve cost efficient POC pollutant reductions. Each program or practice identified by the SWIP team should be documented to include the type of program/practice, cost of implementation, costs of maintenance, and guideline for implementation. Programs to consider include: street sweeping, storm drain cleaning,

homeowner residential BMP credits, and a public/private cost-share program alongside the stormwater utility fee credit program.

VII. Field Observations

A. Public Notification and Site Access Procedures

Field observation will be necessary as part of the SWIP development process. Field observations will likely require interaction with the public and/or entry to private property. It is recommended that the City establish a process for handling these issues. It is recommended that this process include:

1) Public notification protocol prior to and during field observations,

2) Instructions to the SWIP team for when/how to enter private property,

3) Public response form for the SWIP team field representatives to provide citizens when the SWIP team is approached, and

4) Coordination of access to City-owned stormwater assets and properties that are secured (by fence, restricted access, etc.).

B. Reference GIS-Based Unique Identification Numbers

Field observations and data collected as part of the SWIP process will assist in informing the recommendations of the SWIP. The SWIP team should collect field data by referencing the unique, GIS-based identification number for the asset on which data is being collected. The GIS data collected during SWIP development should be a deliverable upon project completion so that field verified data can be incorporated into the City's mapping as needed.

C. Windshield Survey to Evaluate Watershed Characteristics

It is anticipated that the SWIP team will need to perform a brief windshield survey of the study area(s) to generally evaluate watershed characteristics. Observations made during this effort could include observations about: stormwater asset condition, abundance (or lack thereof) of stormwater infrastructure, drainage trends, etc.

D. Investigate Known Drainage Problems

During the review of existing maintenance records described in paragraph III.B and supporting GIS data, it is anticipated that the SWIP team will target specific areas documented with drainage issues for further field investigations. It is anticipated that these investigations will review the identified drainage issue, review field conditions, and investigate any other contributing factors to the flooding concern.

E. Natural Conveyance Systems Characterization

Stream restoration has been demonstrated to be a practice that efficiently provides POC removal reductions using the POC reduction crediting implemented in Virginia. The City has a large network of natural conveyance systems on which stream restoration has potential for implementation. It is recommended that the SWIP team strategically identify portions of the City's natural conveyance system for field review. While it is **not** anticipated that a full scientific investigation (BANCS assessment, etc.) be performed for streams targeted as part of these observations, it is recommended that the investigations generally characterize the stability of the field visited natural conveyance systems to be able to gauge a stream's candidacy for restoration. When possible, documentation of this effort should reference the unique GIS ID for the natural conveyance reviewed.

Figure 11. Liberty Park Stream Restoration Project (Blacks Run, 2004)

F. Potential Project Specific Site Visits

During the course of reviewing the City's GIS data, documented maintenance concerns, existing City planning documents, and previously completed studies, it is anticipated that the SWIP team will identify specific potential project locations that will need to be evaluated for feasibility consideration. It is anticipated that during the course of these site visits, the SWIP team will identify the type of potential BMP practice is appropriate for the site, factors affecting implementation, access considerations, utility considerations, and other factors.

VIII. Project Identification

As an outcome from the assessments made as part of work described in paragraphs I, III, IV, V, VI and VII, the SWIP team will be able to identify and inventory potential stormwater improvement projects.

A. Conceptual Project Development

For each location where a potential stormwater improvement project is identified, evaluated and determined to be consistent with the goals of the SWIP development, a potential design concept(s) will be developed. The inventory of conceptual project sites should include **location mapping** and a **collection of project attributes**, agreed upon by the SWIP team and City staff. It is anticipated the tracking attributes for each project could include: 1) the identified issue(s) at the site, 2) proposed improvement solution(s), and 3) project prioritization criteria. A key outcome of this task is for the City to have a **comprehensive list and location** of identified stormwater improvement projects that are consistent with the current goals of the City's Stormwater Program.

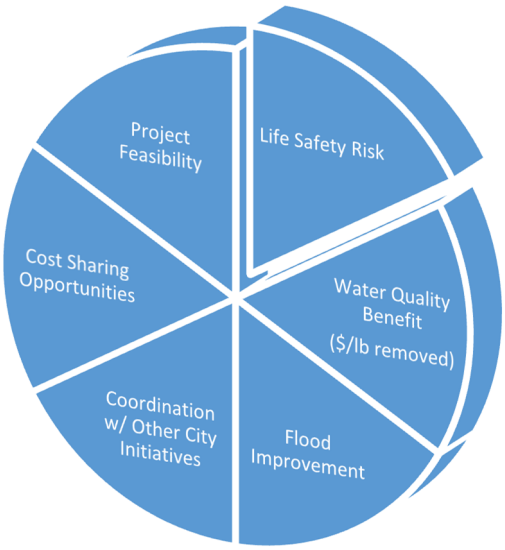
The SWIP team will need to develop, in conjunction with the City, a naming/numbering convention to track the identified projects. It is highly recommended that the location mapping

for the conceptual project sites be GIS-integrated and that the collection of project attributes be maintained in a way that allows the information to be related to the mapping (such as an attribute table to the GIS, as a relate table, etc).

B. Project Prioritization Matrix Development

A key project component will be to prioritize each of the identified projects. The SWIP team will need to coordinate closely with City staff to identify and appropriately weight each identified project. See Figure 12 for potential prioritization criteria.

Figure 12. Potential Prioritization Criteria



It is highly recommended that the prioritization matrix be developed in a spreadsheet format and that the prioritization spreadsheet be a deliverable to the City in its native format. This deliverable will allow the City to manage the spreadsheet moving into the future, accounting for future project implementation and potential changing prioritization dynamics of the City's Stormwater Program.

C. Define High Priority Projects

The project prioritization matrix will rank the identified projects and programs according to the prioritization values developed and assigned by the project team. As a result, the identified projects and programs can be sorted to identify those projects most highly ranked within the matrix. Once the distribution of project rankings is completed, the City will work with the SWIP project team to create a definition of High Priority Projects and High Priority Programs. The City anticipates that the High Priority Projects will be more highly prioritized for implementation.

D. Project Sheet Development for High Priority Projects

A key outcome of the SWIP is that the document provides an achievable plan for meeting regulatory compliance regarding the Chesapeake Bay TMDL and other stormwater program objectives. A key deliverable of this project task is the development of Project Sheets for each of the identified High Priority Projects. It is essential that the project sheets include documentation of the conceptual design layout, provide a conceptual level cost estimate, and list key attributes of the project. The conceptual level cost estimate should include factors such as: engineering costs, right-of-way purchasing costs, and utility concerns. The key attributes should include POC reduction estimates and price per pound for those reductions. It is essential that the Project Sheets contain adequate detail and project attributes for the preparation of grant applications.

IX. Deliverables

Many deliverables are recommended for the SWIP project. Deliverables should be submitted to the City in approved file format. Digital and hardcopy submittals are recommended.

A. Monthly Written Progress Reports

Monthly progress reports are recommended to track progress of the SWIP development. The progress reports should include brief description of work performed, tasks completed, tasks remaining, project budget completed, and project budget remaining.

B. Narrative Report

It is recommended that the SWIP team develop a narrative report summarizing the work performed, findings, and recommendations. It is recommended that City staff be provided with opportunities to review and comment on draft versions (two drafts submittals are anticipated with a subsequent final submittal). The Narrative Report should include maps, prioritization matrix, comprehensive prioritized list of identified projects, and high priority project sheets, and all digital data developed in support of the project. It is recommended that the digital submittal of files be provided in both the file native format and in *.pdf format, as appropriate.

C. Public Outreach Materials

Any handouts, maps, and other material prepared by the SWIP team to facilitate public meetings will be a deliverable to the City. It is recommended the submittal include both hardcopy and digital copy of the finished documents. It is recommended that the digital submittal of files be provided in both the file native format and in *.pdf format, as appropriate.

D. Prioritized Listing of Proposed Projects

It is recommended that the prioritized listing of identified proposed projects be provided in hardcopy and digital format. It is recommended that the digital submittal of files be provided in both the file native format and in *.pdf format, as appropriate. It is highly recommended that the prioritization matrix be developed in a spreadsheet format and that the prioritization spreadsheet be a deliverable to the City in its native format. This deliverable will allow the City to manage the spreadsheet moving into the future, accounting for future project implementation and potential changing prioritization dynamics of the City's Stormwater Program.

E. High Priority Project Sheet Summaries

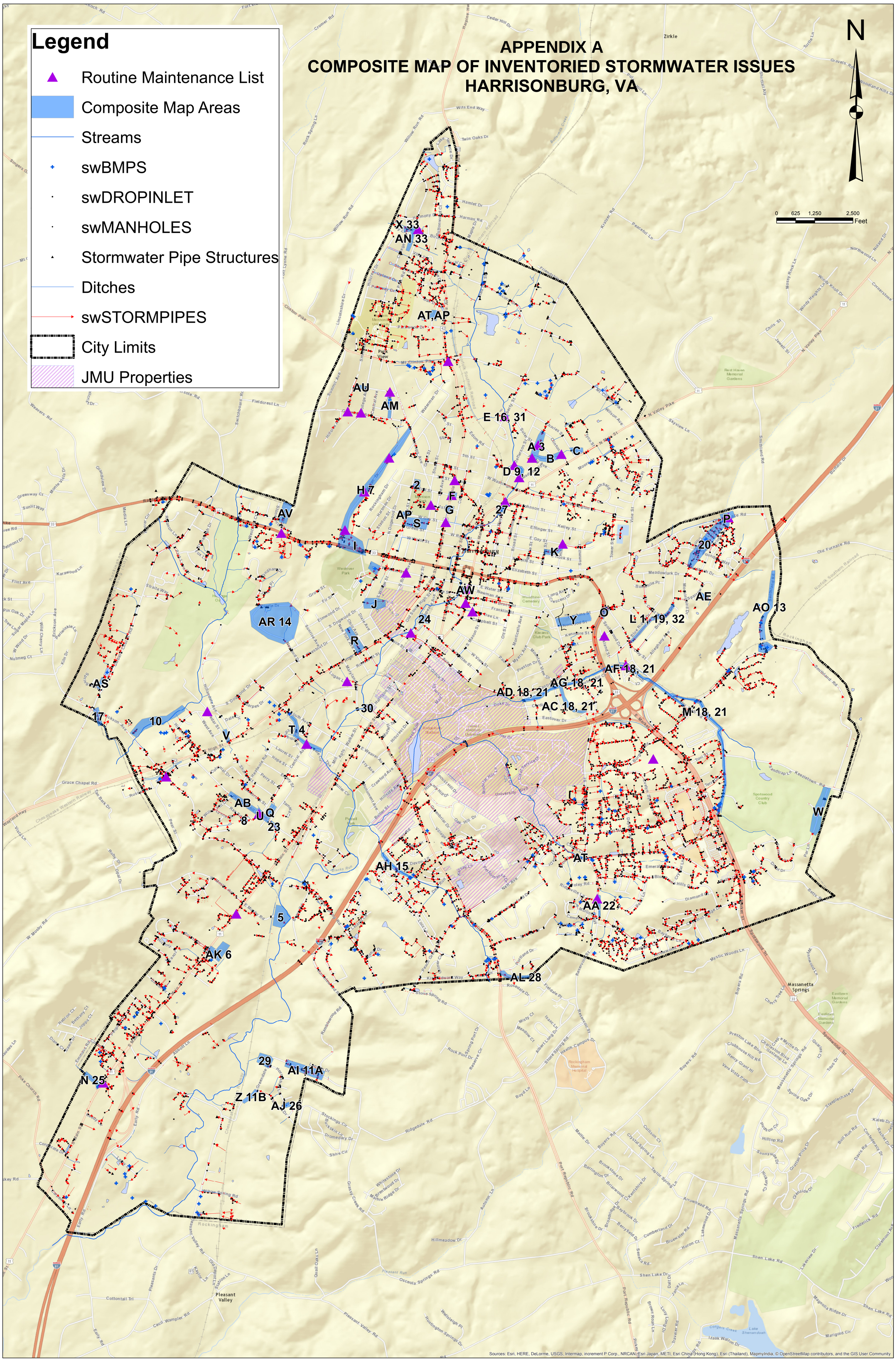
It is recommended that the High Priority Project Sheet Summaries be provided in hardcopy and digital format (*.pdf or other approved format). It is also recommended that the support layers (Example: AutoCAD, GIS, etc) depicting the conceptual project location/layout be submitted.

F. GIS-based Inventory of Proposed Projects & Supporting Data

GIS-based deliverables will be a valuable product for the City and it is highly recommended that the City request a digital data submittal in addition to hardcopy submittal of maps. GIS-based deliverables can include submittals in GIS native format and can also include data tables that reference GIS–based identification numbers in a way that can be used as a relate data to existing GIS-based datasets. GIS-based deliverables for the project should include:

- Location mapping of prioritized projects and associated attribute table,
- Field collected data as described in section VI.
- Any other support data created as a part of this project to support mapping.

APPENDIX A
COMPOSITE MAP OF INVENTORIED STORMWATER ISSUES
HARRISONBURG, VA



COMPOSITE MAP DATA TABLE					
Year	**Project_ID**	**LOCATION**	**DESCRIPTION**	**Ownership**	**CONCEPTUAL_ACTION**
2013	A	Clinton Street to Ashby Avenue	A, B, C, and D are the same vicinity. Residential neighborhood. Natural drainage channel. Homes were constructed in a low area in 1950s. City crews report that one neighbor put 1?x3? boards into drainage channel that is causing water to back up at Sutter Street and flow over top of street. The houses on Clinton Street and Sutter Street that flood are below the top of the drainage channel.	Private	
2013	B	Clinton Street to A	A, B, C, and D are the same vicinity. Residential neighborhood. Natural drainage channel. Homes were constructed in a low area in 1950s. Basements flood, homes with sump pumps. The houses on Clinton Street and Sutter Street that flood are below the top of the drainage channel.	Private	
2013	C	Main Street to Charles Street	A, B, C, and D are the same vicinity.	Private	
2013	D	Ashby Avenue and Jefferson Street to Madison Street	A, B, C, and D are the same vicinity. Residential neighborhood. Natural drainage channel. Homes were constructed in a low area in 1950s. Madison Street bridge is low and waters back up to Jefferson Street.	Private	
2013	E	Liberty Street near Southern States	Blacks Run backs up at Liberty Street and floods the street to the scrap yard to the north. The channel and entrance of Southern States is higher than the street (?). The stream originates from Virginia Avenue where there are two (2) 4?x6? boxes/ culverts and flows to Liberty Street where there are two (2) 24? pipes. Are we prepared to raise Liberty Street? Are upstream improvements better answer? Check out Black Marble Quarry.	Public	
2013	F	Virginia Avenue and 2nd Street	In/Out Pits at this intersection. Without anywhere for water to go, intersection floods.	Public	
2013	G	Virginia Avenue and 1st Street	In/Out Pits at this intersection. Without anywhere for water to go, intersection floods.	Public	
2013	H	Waterman Drive	Waterman Drive has an open drainage system; a ditch along the road. The pipe at the VFW backs up frequently. In private parking lots, water comes up through the grades, e.g. at Finders Keepers. Sediment build up. On the west side of Waterman Drive. There are 12-inch pipes under the (unused?) quarry entrances.	Public	
2013	I	West Market Street east of Waterman Drive	City has an easement that was dedicated when West Market Street was widened in the late 1990s. The easement is to maintain storm pipes. City crews currently check on the storm pipes and clean them out as needed. Lots of sediment build up.	Public	

COMPOSITE MAP DATA TABLE					
Year	**Project_ID**	**LOCATION**	**DESCRIPTION**	**Ownership**	**CONCEPTUAL_ACTION**
2013	J	Dogwood Drive through National Guard Armory	Between Dogwood Drive and Willow Street there is erosion of natural drainage channel between residential homes. Crews said that there is a pipe under the Armory property and used to be a detention pond before James Madison University build there. The outlet of the pipe cannot be found. There was a history of problems before, but the problem has been made worse with development.	Private/ Public	
2013	K	Hill Street to Sterling Street	Residential neighborhood. Naturally low area with drainage problems. Basement flooding.	Private	
2013	L	Starcrest Drive area to Clay Street, parallel to Broadview Drive	Residential neighborhood. Inadequate drainage system causes flooding of houses and basements. New drainage system ties into old system which is undersized. Some neighbors have built fences that blocks natural drainage flow. There is no easement. This was an open ditch at one time. Overtime, the backyards developed gullies and a nuisance pipe was installed that was intended to deal with water from 1-2 inch rainfalls and water was intended to flow over top (of the ground in swale). The pipe was not designed or intended to manage flow. However, new homeowners have different expectations. The streets also flood.	Private	
2013	M	Siebert Creek adjacent to Country Club Road from East Market Street to I-81 bridge	Significant erosion and inadequate drainage capacity to manage flow from upstream. Heavy commercial development upstream. Future Country Club Road improvement projects (not yet scheduled and not yet under design) will need to include road improvements and stormwater management.	Public	
2013	N	South Route 11 Truck Stop	Low area. Sheet flow across truck stop parking lot floods Route 11.	Public	
2013	O	Vine Street and East Market Street	Catches water from Vine Street into a ditch along the north side of Market Street. Raised water encroaches towards a residential home and leaves behind trash and debris in yard.	Public	
2013	P	Old Furnace Road near Oriole Lane	Stormwater from housing development on south side of Old Furnace Road is flowing into field on north side of Old Furnace Road bringing with it trash. Owner of field has blocked up flow with woven wire fence to keep out trash and is creating a problem upstream.	Private	
2013	Q	Between Central Avenue and Emery Street near Pleasant Hill Road	Natural drainage channel behind homes has erosion and remains very wet.	Private	
2013	R	Between New York Avenue and Ohio Avenue west of High Street	Natural drainage channel behind homes has erosion and remains very wet. Water entering basements.	Private	

COMPOSITE MAP DATA TABLE					
Year	**Project_ID**	**LOCATION**	**DESCRIPTION**	**Ownership**	**CONCEPTUAL_ACTION**
2013	S	Between Gay Street and Green Street, and Chicago Avenue and Willow Street	Drainage channel behind homes, sump area. Upstream development and street drainage coverage onto 2nd Street which has an inadequate drainage system. Overtime homeowners have changed the drainage with various disconnected pipes, walls, etc. Homeowners experiencing water entering basements. One homeowner is complaining about neighbors pipe being clogged.	Private	
2013	T	Vale Circle, Southampton Drive area	Natural drainage channel experiencing erosion. Spring fed. Gas line is exposed.	Private	
2013	U	Pleasant Hill Road	? Past city cost share.	Private/ Public	
2013	V	Cedar Street to South High Street	Property owners roof drains, sump pumps creates swampy area. Drainage area filled in with sediment.	Private	
2013	W	Fairway Drive area	? Water backs up and spreads out. City had done some grading to help fix problem, but underground utilities are now exposed. City crews go out to keep pipes open.	Private/ Public	
2013	X	College Avenue & Ivy Lane	Area between Park Road and College Avenue is a sump area. City crews clean out drains regularly.	Public	
2013	Y	Hawkins Street and Norwood Street Area	City crews had dug across Market Street and placed a pipe in ditch to field. Water backs up onto streets.	Private/ Public	
2013	Z	Greendale Road	This issue may have been taken care of when new curb and gutter and new road was constructed. But trash is an issue when water recedes.	Public	
2013	AA	Breckenridge Ct area	Breckenridge HOA is not cleaning detention ponds ?. (what is the problem?)		
2013	AB	Pleasant Hill Road	Pleasant Hill Road between Willow Hills and Central Avenue on north side?.	Public	
2013	AC	Tributary near Eastover Drive	Significant erosion of tributary of Siebert Creek. Upstream drains heavy commercial areas. Erosion has exposed sanitary sewer mains, sanitary sewer laterals, gas lines, and makes electrical transformers vulnerable. Pending grant; Draper Aden may assist with engineering solution.	Private/ Public	
2013	AD	Siebert Creek upstream of Paul Street	Sediment is filling large pipes under Paul Street and sediment is spreading out, filling behind property causing wet basement problems for homeowners.	Private/ Public	
2013	AE	Sparrow Court area	Crews said that DIs were not set correctly when this area was built. City has fixed some DIs. Also sinkhole issues.	Public	
2013	AF	Siebert Creek from I-81 Bridge to East Market Street bridge	Siebert Creek has problems. Sanitary sewer line also runs parallel/ within creek. Public Utilities has plans for a sewer relocation project	Public	
2013	AG	Siebert Creek from East Market Street bridge to AD	Siebert Creek has problems. Sanitary sewer line also runs parallel/ within creek. Public Utilities previously completed sewer relocation project in portions of this area.	Public	
2013	AH	Squire Hill, Devon Lane	Erosion	Private	

COMPOSITE MAP DATA TABLE					
Year	**Project_ID**	**LOCATION**	**DESCRIPTION**	**Ownership**	**CONCEPTUAL_ACTION**
2013	AI	Greendale Road	Flood and capacity issues. People built over drainage ways. This problem may have been resolved with road improvements; have not received phone calls in a while.	Private	
2013	AJ	Harness Lane	Detention pond complaints	Private	
2013	AK	Boxwood Court	Pleckers Trucking filled in drainage way a long time ago.	Private	
2013	AL	Portland Drive area	Development upstream in Rockingham County was not addressed; erosion issues	Private	
2013	AM	Greystone Drive area	Yard and basement flooding. Inadequate drainage facilities.	Private	
2013	AO	Smithland Road	Drains into sinkhole. This is where the new dog park is going. Smithland Road has flooded a few times.	Public	
2013	AP	Woodland Drive		Private	
2013	AR	Circle Drive	Flat, broad, low lying area.	Private	
2013	AS	Springside Drive	Erosion behind Harrisonburg High School. When houses were built, drainage way was filled with loose dirt and rock.	Private	
2013	AT	Woodland Drive area	Perceived issues ? may be taken care of with Reservoir Street project	Private	
2013	AU	Smith Avenue & College Avenue	Previous road construction caused increased flow (date?). Water has always come down, but there are new homeowners Homes are still under construction today. Problem may resolve itself after construction is completed.	Private	
2013	AV	Stonechris Drive and Clara Court	Poorly graded yards	Private	
2013	AW	Public lot at Main Street & Newman Avenue		Public	
1998	1, 19, 32	Starcrest Drive and Broadview Dr. and Blueridge Dr.	Inadequate drainage system causes flooding of houses and basements. The new drainage system ties into the old system which is undersized. Two 48" pipes are connected to a 24" pipe downstream causing overland relief flooding.		Replace existing pipe with a larger pipe, possibly a 48" or 54". If the existing pipe is in good condition and proper hydraulics for a parallel pipe system can be designed, then a parallel replacement pipe might provide cost savings. Pipe sizes and flows should be verified by engineering calculations.
1998	2	2nd St. Properties behind Redfront	The four houses on 2nd St. on the block between North Willow St. and Chicago Ave. are located in a sump area. Upstream development and street drainage converge onto 2nd St. which has an inadequate drainage system. The house on the eastern end (towards Chicago Avenue) appears to have the largest drainage problems. The house on the western end of the block (towards North Willow St) also has a yard lower than 2nd St., but there is an inlet to allow for drainage.		For the eastern house, install a drop inlet in the yard with a pipe running under 2nd St and discharging into playground. For the western house, replace the pipe running under 2nd St. with a 24". Install a grate manhole cover on the other side of 2nd St., so if the system backs up the water enters the park and not the private property. Pipe sizes and flows should be verified by engineering calculations. Additional field verification may be required as storm drain maps show existing piping and inlets.
1998	3	Clinton St., Suter St., and Ashby St.	Houses are flooded due to inadequate capacity of the drainage channel running between them. The elevation of the first floor of the houses on Clinton Street and Suter Street that flood are below the top of the drainage channel.		Flood-proof houses or improve channel and install larger pipes. A field survey and brief study could ascertain the best solution. Pipe sizes and flows should be verified by engineering calculations.

COMPOSITE MAP DATA TABLE					
Year	**Project_ID**	**LOCATION**	**DESCRIPTION**	**Ownership**	**CONCEPTUAL_ACTION**
1998	4	Southampton Dr. and Central Ave.	The drainage channel located in the rear yard of the houses on Southampton Drive shows signs of active erosion in some areas. In one area, towards the middle of the block, property owner(s) have installed a 36" corrugated metal pipe and a drop inlet.		This area should be incorporated into a channel maintenance and management program as described in the feature implementation section of this document.
1998	5	Public Works Shop	The City of Harrisonburg Public Works Facilities is located within the floodplain of Black's Run. It has experienced extensive flooding during large storm events.		Flood- proof the buildings, especially the administration building and the salt storage building. This action will prevent damage to buildings and contents, but not aid in protecting vehicles, access and items outside of the buildings. Other alternatives to be considered will be re-channelization to reduce the width of flooding or relocation of facilities.
1998	6	Boxwood Court	Urban runoff causes flooding at Dr. Adam's office. There is a riprap channel on the north side of the building that carries stormwater from a culvert under Main Street. A detention basin, owned by a private owner upstream of the culvert, has eroded and is currently not functional. Valley Homes, which is to the south of Boxwood Court, has a well-defined riprap drainage channel and detention basin. Water from Valley Home?s drainage channel and the outlet of Valley Home's detention basin flows to the rear of Boxwood Court where there is no defined drainage channel.		Construct a drainage channel behind the parking lot of Boxwood Court across the parking lot and then parallel to the Court to a culvert. If possible, the breach in the berm of the detention basin northwest of the office should be repaired as well as flood-proofing Dr. Adam's office. Flows and channel designs should be verified by engineering calculations.
1998	7	Waterman Drive	Waterman Drive floods because of a lack of an adequate drainage channel. Waterman is a relatively flat road and is at a lower elevation than the land on either side. There are roadside ditches and small culverts present in some areas.		Construct roadside swales and install larger should be verified by engineering calculations.
1998	8	Rex Road	Inadequate conveyance below the detention pond causes house flooding. The detention basin has recently been repaired which has improved the situation. In addition, the homeowner has provided some flood proofing for his basement. This homeowner has observed blockage of the downstream pipe by debris and feels this still contributes to the potential for flooding.		Provide routine maintenance of downstream inlet by removing debris. This area is incorporated into a channel maintenance and management program as described in the Feature implementation section of this document.
1998	9, 12	Jefferson St. and Madison St.	Black's Run is causing flooding of streets and residences. Directly downstream of Jefferson Street there is some channel erosion evident. Upstream of Madison Street large riprap has been installed. The channel downstream of Madison Street is partially filled in with deposited sediment.		The channel is not much lower than the two roads, so in order to increase the flow area, replace existing culverts with box culverts. Improve the downstream channel below Madison Street and remove deposited sediment. Pipe sizes and flows should be verified by engineering calculations.

COMPOSITE MAP DATA TABLE					
Year	**Project_ID**	**LOCATION**	**DESCRIPTION**	**Ownership**	**CONCEPTUAL_ACTION**
1998	11a	Below Greendale Rd. near Ramblewood Rd.	Nuisance flooding below subdivision. Stormwater flows through a 36" culvert under Greendale Rd. into a low area between the road and the railroad tracks. The water exits the lot through a 42" culvert under the railroad tracks. There is no defined channel between the two culverts so the water ponds. In addition, it appears from the contours that high water from Black's Run may be affecting the ability of this area to drain. Currently there are only three small storage buildings in the low lying area.		A flap gate on the downstream side of the railroad culvert should help. If flooding persists, then build a drainage channel between the two culverts. If the channel is improved, engineering calculations should be provided to verify its size. As the City does not have jurisdiction within the railroad right of way, other alternatives may need to be considered.
1998	11b	Below Greendale Rd. near Carriage Dr.	Nuisance flooding below subdivision. Stormwater flows through a 36" culvert under Greendale Rd. into a low area between the road and the railroad tracks. The water exits the lot through a 42" culvert under the railroad tracks. There is no defined channel between the two culverts so the water ponds. In addition, it appears from the contours that high water from Black's Run may be affecting the ability of this area to drain. Currently there are only three small storage buildings in the low lying area.		A flap gate on the downstream side of the railroad culvert should help. If flooding persists, then build a drainage channel between the two culverts. If the channel is improved, engineering calculations should be provided to verify its size. As the City does not have jurisdiction within the railroad right of way, other alternatives may need to be considered.
1998	13	Smithland Road	Smithland Road does not have any drainage facilities, which causes street flooding during heavy rains. The water flows into sink holes located along Smithland Road.		Construct roadside swales and install culverts in order to keep the water off the road. Determine if the water should be directed to the existing sink holes. Pipe sizes and flows should be verified by engineering calculations.
1998	14	Circle Drive	Circle Drive floods because of a lack of an adequate drainage channel. There are roadside ditches and small culverts present in some areas.		Construct roadside swales and install larger culverts. Pipe sizes, channel designs and flows should be verified by engineering calculations.
1998	15	Squire Hill Apartments and Purcel Park	The drainage channel through Squire Hill Apartments has significant erosion. The water in the drainage channel from Squire Hill runs through a culvert under I-81 and into a tributary to Blacks Run. Blacks Run, along with its tributary, has eroded banks in Purcel Park.		Improve the channel through Squire Hill, Blacks Run and its tributary in Purcel Park. The channel should be studied in a manner similar to the channel maintenance and management program as described in the feature implementation section of this document. Types of improvements would be based on the results of the study.
1998	16, 31	Blacks Run at Liberty Street	Liberty Street floods due to inadequate culverts. The channel upstream of Monroe St. and Liberty St. is not well defined and has eroded banks. The water in Black's Run flows through culverts under Monroe Street and then through culverts under Liberty St. The area between the culverts under Monroe St. and Liberty St. has a significant build-up of sediment. One pipe in this area, which carries stormwater away from Liberty St., is partially blocked due to sedimentation. The existing FEMA study indicates that these culverts are inadequate to carry a 10-yr storm event.		An immediate step to improve the channel upstream of the culverts and to clean out the deposited sediments upstream and downstream of Liberty St as well as improve the culvert entrance. In order to alleviate flooding, the existing pipes should be replaced with box culverts and the downstream channel lowered. This assumes that raising the existing roads will not be required. Pipe sizes and flows should be verified by engineering calculations.

COMPOSITE MAP DATA TABLE					
Year	**Project_ID**	**LOCATION**	**DESCRIPTION**	**Ownership**	**CONCEPTUAL_ACTION**
1998	17	Garbers Church Rd. and Erickson Ave.	Undeveloped drainage basin with existing flooding problems. There is concern about flooding of church and school if development occurs upstream. The top of the invert under Erickson Ave. is not much lower than the first flood elevation of the church. The drainage channel around the school is not well-defined and there is not much of an elevation difference between the channel and the first floor elevation of the school.		This area appears to be well suited for the location of a regional detention facility. This region should be given specific attention in a regional hydrologic evaluation. (See Feature Implementation section item "D").
1998	18, 21	Sieberts Creek & Behind Mall Creek	Flooding and major stream erosion. Currently, a paved channel and box culverts are being constructed under Reservoir St. Upstream of 1-81 the area around Sieberts Creek has experienced major flooding. In Mall Creek, there is major deterioration of the channel below a large commercial area		This is an area that requires a more in-depth investigation. The area was previously studied almost ten years ago. However, it would appear that the development in this area has rendered most of the results of the study invalid. An engineering study is recommended to determine the best combination of mitigation alternatives in the area.
1998	20	Reherd New	There is channel deterioration above and below the subdivision detention pond. A farmer downstream of the pond has experienced an increase in stormwater volume and erosion. The detention pond has a breach in the embankment approximately five feet wide. The pond is a wet pond, so the breach greatly reduces its capacity to hold stormwater runoff. The outlet structure is covered by a screen that could easily be clogged with debris.		Maximize basin efficiency by expansion and/or selection of orifice size for optimum use. Fix the breach in the detention pond and remove the screen on the outlet structure. In addition, the channel should be studied in a manner similar to the channel maintenance and management program as described in the feature implementation section of this document. Types of improvements would be based on the results of the study.
1998	22	Reservoir St. at Ridgeville Lane	Upstream development has caused street and private property flooding. As the upstream watershed is mostly undeveloped, the flooding may increase as development occurs. The house to the southeast of the intersection of Reservoir St. and Ridgeville Lane has experienced a substantial increase in stormwater through the backyard due to the development upstream. The property owners have installed an inlet structure and two 15" pipes to route the water around their house. The pipes then empty into the inlet structure on Reservoir St. A court ruling has determined that the upstream detention basin met the criteria at that time.		Install larger pipes through the yard of the house that experiences flooding. To prevent street flooding, replace the pipe paralleling Reservoir Street with a larger diameter pipe or add an additional pipe. The extent and downstream impact of this system enlargement needs additional study. Pipe sizes and flows should be verified by engineering calculations. Additionally, it is recommended that this watershed be included in the regional analysis section.
1998	23	Pleasant Hill Road	Inadequate drainage system causes street flooding. Drainage channel through house's front yard on the corner of Central Ave. and Pleasant Hill Rd. shows signs of minor erosion. The existing double 36" CMP pipes crossing Central Ave. do not appear to be grossly undersized given the sizes of other drainage structures in the area.		Conduct an engineering analysis of the system draining to this point to determine if the existing system is adequately sized. It is quite possible that if the infrastructure is undersized, then more than one pipe crossing may have to be replaced to reduce the frequency of street flooding. Any action taken should not transfer the problem downstream.
1998	24	West Grattan Street	The existing culvert under the railroad tracks to Black's Run is most likely submerged or partially submerged during larger storms. As a result, backwater floods a residence with a walk-out basement.		Flood-proof the affected house.

COMPOSITE MAP DATA TABLE					
Year	**Project_ID**	**LOCATION**	**DESCRIPTION**	**Ownership**	**CONCEPTUAL_ACTION**
1998	25	South Main St. at Truck Sales	Larger storms result in street and commercial property flooding. Flooding of Main Street (Route I I) is of concern because it is heavily traveled. The stormwater enters inlets and flows through a pipe from the northwest side of Main Street (at the Travel Center) under Main St. and H&R Sale's parking lot to a swale behind the parking lot.		The first step is to repair and clear the inlets and outlets to the existing structures. In order to alleviate flooding, the existing pipes should be replaced with larger pipes and/or a parallel pipe crossing main street. This assumes that an acceptable solution can be found without having to raise the elevation of the existing road. The solution should not transfer the existing problem downstream. Pipe sizes and flows should be verified by engineering calculations.
1998	26	Harness Ct. and Bridle Ct.	The drainage channel that flows between Bridle Ct. and Harness Ct. into a detention basin has experienced erosion problems due to upstream development in the County. The residential flooding that has occurred appears to be due to inadequate channelization of the upstream flow, not due to backwater from the detention basin. This does not mean that backwater from the basin will not cause flooding at some future date.		Conduct an engineering study to determine the flows to and capacity of the basin, as well as the potential flooding scenarios to the residence. Assess the channel for restoration.
1998	27	Main St. and Johnson St.	This intersection floods during average rainfalls. The flooding is of concern because Main St. is heavily traveled. Black's Run flows under this intersection through 8-pipe arch culverts. On the upstream end, three of the culverts are obstructed by the edge of the channel rind there is only a 45" x 30" opening to allow water to f1ow to them. Approximately 100 feet downstream of the intersection, the channel is partially obstructed by a rock ledge. Twin 15'x7' arch culverts are in place just downstream of this point. Both the FEMA and SCS study indicate that the eight pipe system will pass a ten year storm without topping the roadway. The causes of flooding could be the system is not working as designed, flows have increased dramatically, or a combination of both.		Further analysis is required to determine the best solution. A more hydraulically efficient opening in the northeast corner of the crossing would help. To achieve significant improvement in this area, either the upstream channel could be opened up by acquiring land and installing box culverts, or the road could be raised and a bridge built over Black's Run.
1998	28	Portland East	The drainage channel below the detention pond has spots where it has been eroded 2 to 4 feet deep. The channel erosion is more severe downstream near the culvert under Portland Drive. Nuisance flooding has also occurred due to upstream development.		Construct improved channel with EC-3 for the first 150 feet upstream of the culvert under Portland Drive. The effectiveness of the existing detention basin should be studied. Possibly the outlet could be further restricted to reduce the volume of flow downstream. The remaining channel should be studied for inclusion in the channel maintenance and management program as described in the feature implementation section of this document. Types of improvements would be based on the results of the studies.
1998	30	Harrison St.	Backwater from Blacks Run causes the culvert under the railroad tracks to back-tip. There is a 30" flap gate in place at the end of the pipe next to Blacks Run that is not operational.		Request that the railroad repair and maintain flap gate. Once the flap gate is working properly, determine if flooding is still a problem

COMPOSITE MAP DATA TABLE					
Year	**Project_ID**	**LOCATION**	**DESCRIPTION**	**Ownership**	**CONCEPTUAL_ACTION**
1998	33	Park Rd. and College Ave.	The area between the two roads is a sump area. Stormwater flows through a drainage channel between a culvert under Park Road to a culvert under College Ave.		Determine if the slope or area can be increased in the drainage channel, or culverts to increase capacity. This could be accomplish with an engineering study.
1998	34	Norwood & Hawkins St's.	Street and residential flooding during more frequent storm events. A new culvert was installed to drain the sink hole yet it did not completely resolve the problem. Pumping is currently required.		Determine where flooding continues and develop alternatives to remedy. This could include flood-proofing of one or more residential structures or a storm server (curb & gutter) system.
1998	35	Watershed-wide	Stream corridors identified as a project area (in- total) due to sections which have bank erosion or where the stream is otherwise iii a degraded condition in need of maintenance. The corridors are identified by stream as follows: Black's Run, Siebert's Creek and Tributaries Sunset Heights Branch, Other Unnamed Tributaries. This program will help address Water Quality Improvements as well as flooding problems.		Determine where the problem areas are located and generate a priority list for restoration. Include as a part of the Maintenance Plan.

Credit Application Information

2016-2017 Billing Cycle

Non-residential Applications

6 non-residential applications were received for the 2016-2017 billing cycle of the Stormwater Utility Fee Credit Program.

Residential Applications

132 residential applications were approved for the 2016-2017 billing cycle. The most common three credits applied for were the Homeowner Nutrient Management and Lawn Care Agreement, Roof Drain Disconnection, and Urban Tree Planting. 108 properties disconnected their downspouts, 113 signed the Homeowner Nutrient Management and Lawn Care Agreement, and 70 properties applied for the Urban Tree Planting Credit.

Credit Type	Amount of Applications	% of Applicant Pool
Homeowner Nutrient Management and Lawn Care Agreement	113	85.06
Roof Drain Disconnection	108	81.82
Urban Tree Planting	70	53
Rain Barrel/Cistern	23	25
Conservation Landscaping	4	3.03
Vegetative Filter Strip	2	1.52
Rain Garden	1	0.75

TMDL Action Plan Update [Item #6]

Street Sweeping Credits (New Methodology)

Storm Drain Cleaning

Approved street sweeping credit calculations in the City of Harrisonburg TMDL Action Plan submittal for 2015-2018.

Calculation of Annual Street Sweeping Pollutant Removal

Annual Billing Statement:

312.55 tons from Sweeper 24 - 7/01/2013-6/30/2014

269.38 tons from Sweeper 25 - 7/01/2013-6/30/2014

Annual Total: 581.93 tons

Total Nitrogen

581.93 x 2,000 = 1,163,860 lbs

1,163,860 lbs x .7 (Dry Weight Factor) = 814,702 lbs

814,702 x .0025 (Pounds of dry weight sweeping solids) = **2,036.755 lbs TN/ year**

Total Phosphorus

581.93 x 2,000 = 1,163,860 lbs

1,163,860 lbs x .7 (Dry Weight Factor) = 814,702 lbs

814,702 x .001 (Pounds of dry weight sweeping solids) = **814.702 lbs TP/ year**

Total Suspended Solids

581.93 x 2,000 = 1,163,860 lbs

1,163,860 lbs x .7 (Dry Weight Factor) = 814,702 lbs

814,702 x .3 (250 Micron Correction) = **244,410.6 lbs TSS/ year**

Proposed new street sweeping credit calculations IF new calculation methodology is adopted by VA DEQ

Street Sweeping Estimates Based On Current (2016) Operations

SCP-1; Downtown Area:	AST – 2 PW	100 Passes/Yr
SCP-3; Areas A,B,C,D:	AST – 1 P2W	25 Passes/Yr
SCP-4; Areas 1,2,3,4:	AST – 1 P4W	10 Passes/Yr

2016 Street Sweeping Credits Based Upon *Expert Panel Report on Street and Storm Drain Cleaning*							
Lane Miles/Acres	Street Cleaning Practice	Removal Rate (%)			Mass Removed (lbs)		
		TSS	TN	TP	TSS	TN	TP
15.62	SCP-1	21	4	10	4,264.26	9.6844	3.014
132.24	SCP-3	11	2	5	18,910.32	40.9944	12.76116
172.80	SCP-4	11	2	5	24,710.4	53.568	16.675
				Total:	**47,884.98**	**104.2464**	**32.45016**

AST = assisted sweeper technology; PW = passes/week; SCP = street cleaning practice

<u>Loading Rate – Using average values from Table 4, Page 17</u>

Downtown (SCP-1)

TSS: 15.62 miles x 1300 lb/ac/yr = 20,306 lb/yr

TN: 15.62 miles x 15.5 lb/ac/yr = 242.11 lb/yr

TP: 15.62 miles x 1.93 lb/ac/yr = 30.14 lb/yr

Areas A-D (SCP-3)

TSS: 132.24 x 1300/lb/ac/yr = 171,912 lb/yr

TN: 132.24 x 15.5 lb/ac/yr = 2,049.72 lb/yr

TP: 132.24 x 1.93 lb/ac/yr = 255.2232 lb/yr

Areas 1-4 (SCP-3)

TSS: 172.80 x 1300 lb/ac/yr = 224,640 lb/yr

TN: 172.80 x 15.5 lb/ac/yr = 2,678.4 lb/yr

TP: 172.80 x 1.93 lb/ac/yr = 333.50 lb/yr

Parking Lots:

SCP-5; 4.53 acres

TSS: 4.53 x 1300/lb/ac/yr = 5,889 lb/yr **- 235.56**

TN: 4.53 x 15.5 lb/ac/yr = 70.215 lb/yr **- .4915**

TP: 4.53 x 1.93 lb/ac/yr = 8.7429 lb/yr **- .174858**

SCP-4; 3.39 acres

TSS: 3.39 x 1300/lb/ac/yr = 4,407 lb/yr **- 264.42**

TN: 3.39 x 15.5 lb/ac/yr = 52.545 lb/yr **- .052545**

TP: 3.39 x 1.93 lb/ac/yr = 6.5427 lb/yr **- .196281**

Grand Totals:

TSS	**TN**	**TP**
48,384.96	104.79	32.82

Proposed Storm Drain Cleaning Credits - not yet submitted as part of TMDL Action Plan

Storm Drain Cleaning Credit Estimates

Wet Sediments - .7 dry weight conversion

June	10.88 tons
May	11.89 tons
April	10.82 tons
March	*Not Collected - Temps Below Freezing*
February	*Not Collected -Temps Below Freezing*
January	13.6 tons
Average:	11.79 tons
Annual Mass (Average at 10mos):	**117.9/235,800**

235,800 x .7 = 165,060 lbs

TN

165,060 x .0027 = **445.662 lbs**

TP

165,060 x .0006 = **99.036 lbs**