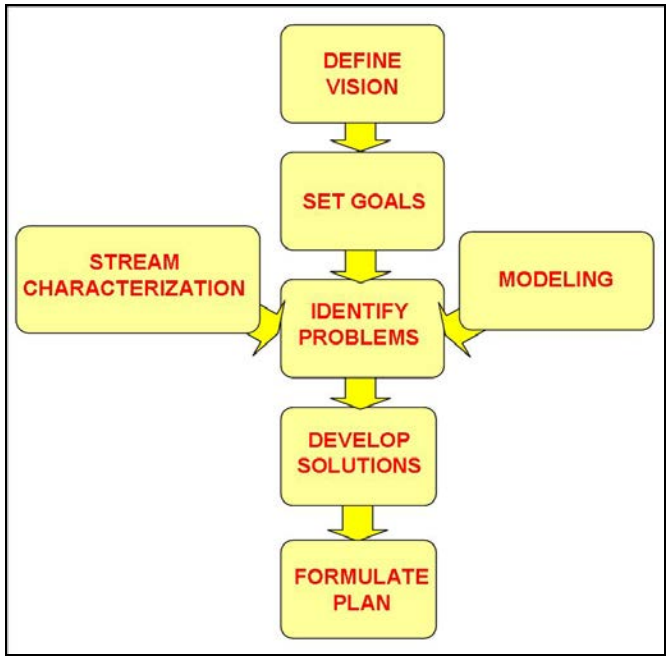
Chapter 5
Development of the Watershed Plan

Development of this management plan for the Cameron Run watershed was a coordinated process involving Fairfax County's Stormwater Planning Division; Versar, Inc., as the consultant; the Advisory Committee of watershed stakeholders (see the Acknowledgments); and the public. At times the process was decidedly iterative; in general, however, the process followed the diagram below:



The vision and goals that guided the development process are presented with the plan in Chapter 6. The results of stream characterizations, modeling, and public meetings that contributed to the assessment of problems throughout the watershed are presented in Chapter 4. This chapter describes the range of solutions considered and the method for selecting specific projects to be included in the plan.

5.1 FINAL LIST OF PROBLEMS

As described earlier, the stream characterization, modeling, and public involvement components of the process produced the following final list of problems to be addressed in the watershed plan:

Ultimate Sources of Stream Problems

- loss of forest cover
- increase in impervious surfaces
- rapid stormwater delivery system
- sources of point and nonpoint pollution

Proximal Stressors Causing Stream Degradation

- lack of riparian buffers
- loss of instream habitat
- bank erosion and sedimentation
- irregular flows
- channel alteration
- pollution
- bacteria
- flooding
- trash

5.2 POTENTIAL SOLUTIONS

Given this list of watershed problems, the Project Team identified two classes of solutions, physical and programmatic:

Physical Solutions

- decrease impervious surfaces
- restore culverts and eroded channels to natural shapes
- preserve or add trees and open space
- sweep streets
- capture storm flows and sediment

Programmatic Solutions

- decrease trash and pollution
- enact new regulations and policies
- tighten enforcement
- increase public awareness and transparency of government projects

Among the physical solutions, four categories of actions were identified:

New or Retrofit Structural Stormwater Controls

- dry pond
- wet pond
- manufactured devices to improve water quality
- sediment forebays and multiple cells
- redesigned control structures

Low Impact Development

- bioretention (e.g., rain gardens)
- grass swale
- green roofs
- cisterns and rain barrels
- porous pavement
- tree box filters
- better site design

Stream and Wetland Restoration

- bank stabilization
- natural channel design
- daylighting piped streams
- wetland restoration and creation
- riparian planting and reforestation

Pollution Reduction

- street sweeping
- trash cleanup
- recycling and dumping facilities
- education in pollution prevention

5.3 FINAL LIST OF SOLUTIONS

The Project Team and Advisory Committee discussed different strategies for managing the watershed management and selecting projects. Overall the group agreed that a balance of preserving the best remaining places, protecting the most vulnerable, restoring degraded places to acceptable condition, and reducing the influence of the worst streams on downstream areas (e.g., via loadings to the Chesapeake Bay) was the best approach.

In addition to developing a diverse list of programmatic ("policy") recommendations, the process focused on the following five categories of physical solutions that address site-specific conditions:

- <u>LID</u> – any of a number of innovative practices integrated into single projects, such as bioretention at the edges of large parking lots, off-line bioretention from stormwater discharge outfalls, or distributed LID techniques (e.g., rain barrels/cisterns) in neighborhoods

- <u>New Ponds or Small Detention Areas</u> – new stormwater management facilities or smaller extended-detention dry ponds in headwaters (streams draining 10 to 50 acres) created by constructing a control structure at the upstream end of a road culvert and excavating a micropool

- <u>Retrofit Existing Ponds</u> – retrofitting existing, dry detention ponds by adding storage (deeper, higher, or smaller outlet) or increasing the flowpath (baffles, earthen berms, microtopography) or incorporating infiltration trenches

- <u>Stream Restoration</u> – physically restoring natural stream morphology and habitat where the stream is stable (i.e., CEM score of 4 or 5) and habitat is degraded (i.e., a low habitat score)

- <u>Riparian Planting and Reforestation</u> – riparian planting will be undertaken as a countywide program

5.4 PROJECT SELECTION APPROACH

Developing the content of the plan involved selecting specific projects from this final list of solutions and designing them to meet the plan's goals and objectives. Selecting projects required choosing actions that will address the goals effectively (e.g., reducing high flows of stormwater) and finding locations where it is practical to implement those actions.

In the urbanized Cameron Run watershed, controlling stormwater flows (and their constituent pollutants) is the primary goal. Reductions in water quantity (peak flow velocities) and improvements of water quality (reductions in pollutant loadings) of 10% were determined to be reasonable goals for the plan. It was also determined that physical stream restoration should be conducted where the likelihood of success is the greatest (i.e., where streams are degraded but are physically stable or stabilizing). This recognizes that attempting to restore stream morphology without controlling hydrology will not succeed.

The number of projects allocated to each subwatershed was based on the amount of uncontrolled impervious surface in the subwatershed. The amount of impervious surface area without storm-water controls (e.g., existing dry or wet ponds) was used to allocate the percentage of all projects that ideally would be selected for each subwatershed. This ideal allocation ranged from 6% to 27% of all projects as follows:

Tripps Run	15
Upper Holmes Run	19
Lower Holmes Run	14
Turkeycock Run	6
Indian Run	5
Backlick Run	27
Tributaries to Cameron Run	8
Pike Branch	6
	100%

It is not feasible to implement actions for every opportunity to improve stormwater management in an older, urbanized watershed like Cameron Run. Therefore, the following three-step process was used to identify, screen, and rank projects according to priority in this watershed plan. Candidate projects were (1) identified by reviewing maps of the watershed, (2) screened to identify an initial list of high-value projects, and (3) ranked to develop a list of projects that offer the best opportunities for implementation via avenues available to the county. This plan identifies projects in three tiers:

- **Tier 1 –** Projects with the highest priority scores that represent the best opportunities for the county's efforts, are located on public land, and were ranked using the Stormwater Management Division's framework for defining priorities in rough proportion to the relative amount of uncontrolled impervious surface within the subwatershed
- **Tier 2 –** Sites with slightly lower priority scores that represent projects on public land or sites on private lands, present good opportunities, and have received various levels of support from members of the Advisory Committee or the public at large
- **Tier 3 –** The rest of the approximately 650 sites identified during the initial map review and public involvement process

The following sections describe the site identification and prioritization process.

5.4.1 Identifying Candidate Projects

The first step in selecting projects was to identify the problem stream segments (i.e., those with degraded conditions determined by stream characterization, modeling results, and local knowledge). In this step, the integrated habitat score from the SPA was mapped and used to identify degraded segments. Additional maps were produced with scores for variables diagnostic of the problems of concern, such as bank instability and erosion. Detailed topographic and aerial maps were then reviewed for the specific cause of these problems, primarily upstream impervious surface (e.g., large parking lots). This process identified hundreds of degraded stream segments and their contributing causes.

The next step in selecting projects was to identify opportunities for addressing these widespread problems. Because stormwater contributes to many discrete problems in Cameron Run watershed, as well as to overall degradation, selecting projects required reviewing maps in detail to search for appropriate locations for the types of solutions planned: LID, new ponds, retrofits of existing ponds and small detention areas, and stream restoration. The key to this step was reviewing the topography and land cover near each stream to find (1) impervious areas in the headwaters of degraded streams and (2) available land (or infrastructure such as culverts) suitable for stormwater-control facilities and LID. Existing ponds were obvious opportunities for retrofits to increase stormwater detention or pollutant removal. Open public lands, such as parks, schools, and Chapter-2 roads, are most suitable for new stormwater facilities. Chapter-2 roads are county-owned rights-of-way that were never developed. In general, constructing new facilities on wooded land is not desirable. This process yielded 647 candidate projects (Figure 5-1).

5.4.2 Screening Projects for Feasibility

After defining candidates, projects were screened to identify those that the county would most likely be able to implement. Projects were grouped by land ownership, with publicly owned land in one group of sites, and privately owned land and area-wide/neighborhood projects in the second group. In most cases, the first group of sites presented the best opportunity for implementing projects and improving water quality and flow conditions expediently. Public ownership avoids costly land acquisition, allowing more resources to be directed toward actual improvements. Through the public involvement and review process, several sites from the second group were moved to the first group because of strong public support and substantial opportunity for improvement. Stream restoration sites were also included in the first group of sites. Stream restoration sites were identified using information about stream condition (e.g., erosion, exposed pipe, riparian buffer width) and stream stability (e.g., a CEM score of 4 [stabilizing] or 5 [stable]). This first group of most feasible sites contained 235 sites.

The remaining 412 projects in the second group (i.e., privately owned land) were not evaluated further and were assigned to Tier 3. Many of the projects in this group represent good opportunities for improving watershed conditions, but their location on private property raises major hurdles for implementation via avenues available to the county. Other avenues of implementation (e.g., non-profit groups, county-funded grant programs) may be more effective and efficient for working with volunteer landowners to implement Tier 3 projects.

5.4.3 Ranking Projects into Tiers

Additional analysis was conducted on the first group of sites to rank them according to the best opportunities for implementation via avenues available to the county, to help refine the conceptual restoration plan, and to estimate cost for each site.

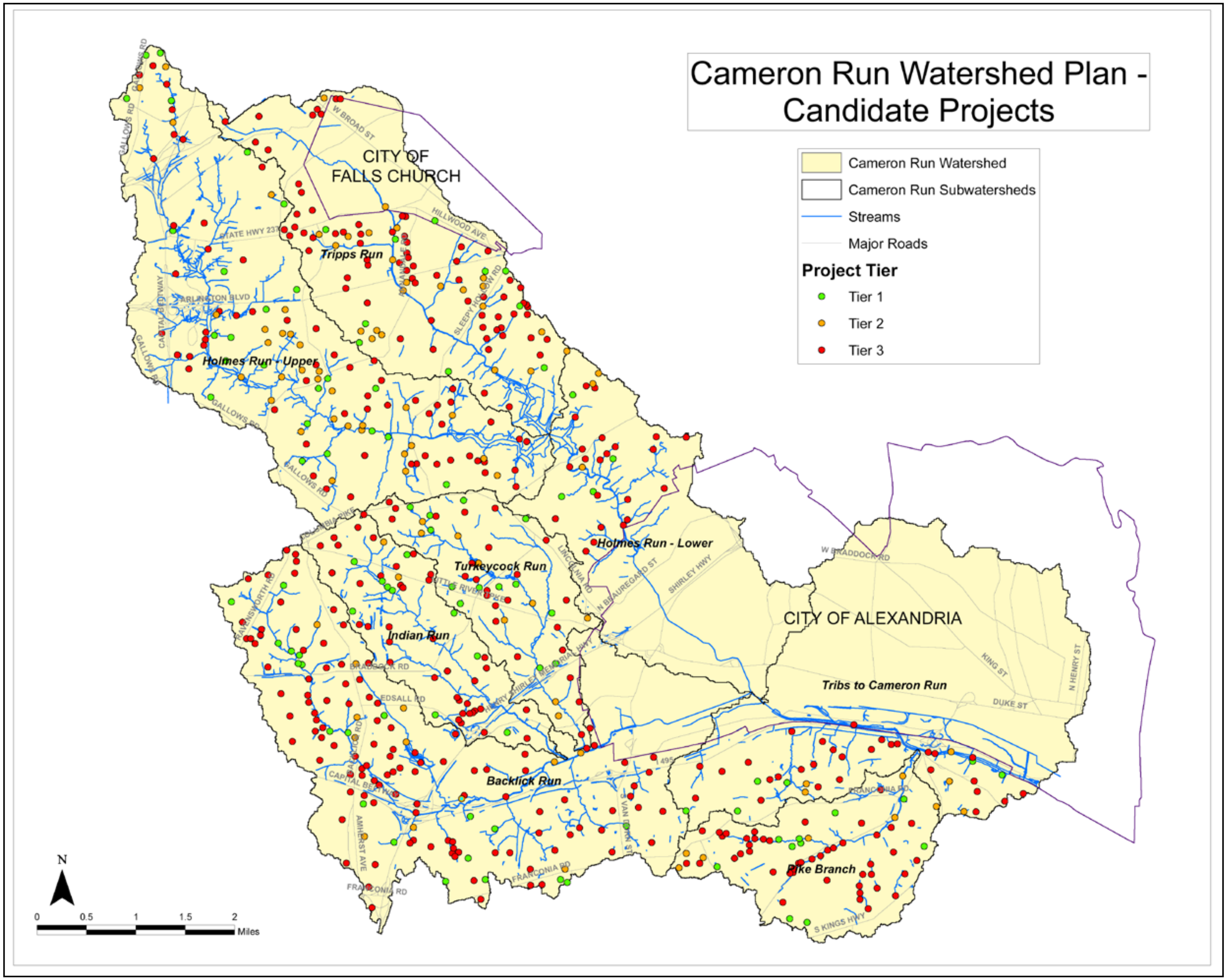


Figure 5-1. Candidate watershed restoration projects identified in Cameron Run

During the fall of 2005, Versar's field crews visited candidate project sites in Cameron Run watershed to visually assess and photograph opportunities for improving stormwater controls. Field crews observed drainage pathways, available space, uses of the site, land cover, and potential constraints (e.g., location of utilities, new buildings) that were not evident on maps and aerial photographs to develop site-specific restoration plans. Approximately 40 sites were found to be unsuitable and were dropped from further consideration. Data on drainage areas and appropriate solutions for specific locations were mapped in GIS for subsequent analysis and presentation.

Versar used guidance developed by Fairfax County's Stormwater Planning Division for the Pope's Head Creek Watershed Plan to rank candidate projects in tiers according to priority for implementation. The procedure scores candidate projects on a scale of 1 (worst) to 5 (best) for each of five criteria. The criteria are weighted to reflect their relative importance to the county. The weighted scores are summed to obtain a total score for each project; higher scores represent better opportunities. The criteria and their weights are as follows:

1. Board-adopted Stormwater Control Project Prioritization Categories (40%)
   - Projects that are mandated by state or federal regulations for immediate implementation and projects that address critical/emergency dam safety issues.
   - Projects that protect structures from damage by flood waters or from being undermined by severe erosion.
   - Projects that achieve stormwater quality improvement in specific conformance with the county's obligation under the Chesapeake Bay initiatives and/or the VPDES permit for storm-sewer discharges.
   - Projects that alleviate severe erosion of streambanks and channels.
   - Projects that alleviate moderate and minor erosion of streambanks and channels.
   - Projects that alleviate yard flooding.
   - Projects that alleviate road flooding.

2. Direct Regulatory Contribution (10%)
   - Hybrid projects that accomplish multiple objectives.
   - Projects that contribute directly to complying with the county's Municipal Stormwater Permit (MS4) and Virginia Tributary Strategies.
   - Projects that contribute to complying only with TMDLs.
   - Projects that have indirect water quality benefits.
   - Projects that mitigate flooding.

3. Public Support (10%)
   - Citizen's Advisory Committee support.
   - Support for projects by affected residents.

4. Effectiveness/Location (25%)
   - Quantity control projects are more desirable in "headwaters" areas that lack stormwater management controls.
   - Quality control projects are desirable in areas that previously lacked controls.
   - An indication of relative costs and benefits of a project, such as pollutant reduction or efficiency, increased retrofit area, etc.

5. Ease of Implementation (15%)
   - Simple projects will be easier to implement than more complex projects.
   - Projects that do not require purchasing land will be easier to implement.

To further define and help rank the candidate projects, Versar worked with the county's staff to perform a cost-benefit analysis to identify projects that would provide the most environmental benefit for the least cost. To accomplish this, costs were normalized per acre, and the following formula was applied:

$$\text{Cost-Benefit} = \frac{\text{Estimated Cost from Draft Report}}{\text{Drainage Area Treated}} \div \text{Total Score for SWPD Prioritization}$$

Because stream restoration projects cannot be considered to treat a particular drainage area, we replaced Drainage Area Treated in this formula with Project-site Footprint (acres), calculated from

$$\text{Project Site Footprint (acres)} = \text{Stream Project Length (feet)} \times 200 \text{ feet} \div 43{,}560 \text{ square feet/acre}$$

to determine the cost-benefit ratio for candidate restoration projects. The project-site footprint assumes that projects will improve conditions within a 100-foot buffer along both sides of the stream. Results from this analysis were ranked in ascending order by subwatershed, noting that a smaller cost-benefit ratio is more desirable than a higher ratio.

The top-ranked sites in each subwatershed became Tier 1. The remaining sites became Tier 2. The final allocation of sites in Tier 1 is as follows:

Watershed-wide	3
Tripps Run	10
Upper Holmes Run	24
Lower Holmes Run	4
Turkeycock Run	13
Indian Run	10
Backlick Run	20
Tributaries to Cameron Run	6
Pike Branch	10
	100

This project selection approach produced 100 Tier 1 projects, 92 Tier 2 projects, and 407 Tier 3 projects, totaling 599 projects in the Cameron Run Watershed Plan (Figure 5-1).