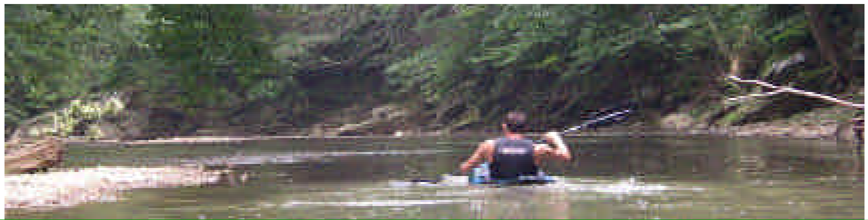


Loudoun Watershed Watch

Protecting the Water Resources of Loudoun County

Catoctin TMDL Validation Monitoring Plan
Citizen Monitoring Component

Submitted by:

Loudoun Watershed Watch

Introduction

Stream monitoring is an important component of Total Maximum Daily Load (TMDL) Implementation Plans. Traditionally, Virginia has relied upon the Virginia Department of Environmental Quality (DEQ) to provide stream monitoring data to validate the TMDL model and assess the effectiveness of the Implementation Plan. DEQ also has a continuing responsibility to assess water quality and to identify impaired stream segments. They use citizen monitoring data to help identify areas with observed effects that merit DEQ follow-up.

In addition to DEQ, there are two active citizen stream monitoring organizations and an umbrella Loudoun Watershed Watch organization in Loudoun County that can provide monitoring data. These citizen groups seek to be part of the TMDL Implementation Plan (IP) monitoring program by providing additional validation assessment monitoring data that will help assess the effectiveness of the TMDL Implementation Plan in accomplishing its goals. This Citizen Monitoring Component prepared by Loudoun Watershed Watch (LWW) outlines the role that citizen monitors are prepared to play in validation assessment.[1]

There are four important needs that citizen stream monitoring organizations can meet to help assure the success of the Catoctin watershed TMDL Implementation Plan.

[1] Originally LWW sought to establish a collaborative relationship with the Loudoun County Soil and Water Conservation District to implement a stream monitoring validation assessment program. However, at their 5/5/04 Board Meeting, LCSWCD decided to focus their resources on Best Management Practices (BMP) installation efforts and not stream monitoring.

- **Critical Pollution Areas –** Detailed water quality data are needed to confirm and document hot spots and areas most heavily impacted by pollution in order to develop a staged implementation approach that will result in the greatest return in water quality improvement. This is consistent with findings in DEQ's TMDL report that additional monitoring that targets restoration projects "is critical to implementation development."[2] DEQ relies upon local citizen monitoring to collect these data.

- **Monitor Adequacy of Water Pollution Load Model –** Load requirement for nonpoint pollution are based upon models and not comprehensive field studies. Sufficient tend monitoring data are needed to assess the adequacy of the model assumptions and parameters. If field data show the implemented management controls based on the model are not effective, recommendations on redesigning the management controls will be considered by DCR.

- **Track Improvements in Water Quality Throughout Watershed –** DEQ/DCR guidelines recognize that it is important to consider future TMDL needs for a watershed when establishing a monitoring plan. Citizen assessment monitoring data can help identify threatened areas in portions of the watershed not monitored by DEQ for appropriate follow-up by DEQ. Trend monitoring will track progress in these areas.

- **Provide Avenue for Citizen Involvement in TMDL Implementation Process –** Traditionally, citizen monitoring groups have taken on the role of citizen watch-dog rather than citizen collaborator. However, a properly supported and funded citizen monitoring program in Catoctin will help place local citizens and local environmental stewardship organizations in a collaborative role in the TMDL Implementation Plan process. Trend data can be used to track progress and keep the public informed.

Legal Requirements

EPA provides grant funds to states under Section 319 of the Clean Water Act to control nonpoint pollution sources. EPA guidelines[3] to award these grants require that TMDL Implementation Plans include a monitoring component to validate the effectiveness of the implementation efforts. A validation assessment is designed to document the effectiveness of the best management practices (BMPs) that have been installed to control nonpoint pollution and improve water quality. Virginia DEQ has responsibility to assess TMDL implementation, and will do this when remedial controls have been installed.

[2] DEQ, "Fecal Coliform TMDL Development for Four Catoctin Creek Impairments, Virginia," March 2002, p. xv.
[3] EPA, "Supplemental Guidelines for the Award of Section 319 Nonpoint Source Grants to States and Territories in FY 2003."

TMDL Water Quality Monitoring Guidelines

Guidelines for the water quality validation assessment component of TMDL Implementation Plans are provided by DEQ and DCR[4]. These guidelines require that progress toward end goals be assessed during the implementation process through continued water quality monitoring. The guidelines address: (1) a schedule for monitoring, (2) location of monitoring stations, (3) organizations responsible for monitoring, and (4) monitoring procedures.

Under these guidelines, DCR has set rules that delineate the scope of monitoring that they will support.

- Monitoring under the TMDL IP will be limited to the impairments approved at the time the TMDL was finalized.
    - The benthic impairment in the South Fork Catoctin and the segments in the mainstem, North Fork Catoctin, and Milltown Creek with observed benthic effects are not part of the fecal TMDL and not within the scope of the Catoctin TMDL IP.
    - The water quality in the other 77% of the Catoctin watershed not assessed by DEQ is outside the scope of the TMDL IP monitoring plan and is not relevant to the IP.
- Any future impairment that impact stream segments in the same watershed but in different portions from the impairments in the original TMDL are to be addressed under separate TMDL's and IP’s at a future date.

The rules that DCR has established are based on four assumptions:

- The TMDL model has adequately characterized the water quality in the portion of the watershed impacting on the impaired segments;
- The TMDL model has adequately characterized the nonpoint pollution loads that are responsible for the degraded water quality and additional BST monitoring is not necessary;
- The TMDL model database provides sufficient information to identify pollution hot spots that can be used to establish a staged implementation plan; and
- Monitoring at the five existing DEQ stations in the impaired segments in the watershed will provide sufficient data to validate the TMDL model and assess the effectiveness of the TMDL IP.

Scope of Citizen Monitoring

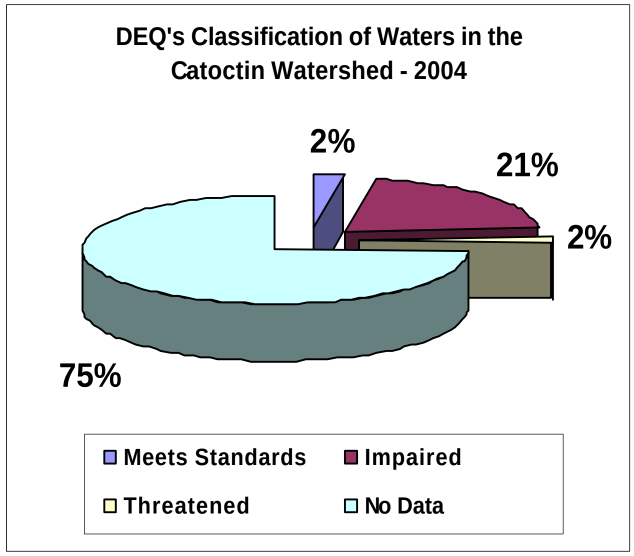
The DCR/DEQ guidelines and the rules regarding the scope of monitoring are necessary to help DCR and DEQ comply with a court ordered timetable for completing over 1000 TMDLs in the state by 2010. New impairments established after the 1998 court order will be addressed after the original impairments. Regrettably, this may require DEQ and DCR to return to a watershed a second time to develop another TMDL and another

[4] VADEQ and VADCR, “Guidance Manual for Total Maximum Daily Load Implementation Plans,” July 2003.

TMDL IP. An example is the benthic impairment established by DEQ in 2004 on the South Fork Catoctin Creek.

LWW believes that every effort should be made to address all known problems in the Catoctin Watershed at one time. Implementation of one TMDL may take up to 10 years, and two TMDL IP's would likely take twice that period. Therefore, LWW is willing to provide two types of monitoring data:

- Data within the scope of the current TMDL IP and supported by DCR; and
- Data outside the scope of the DCR guidelines that will be supported by other grant funds that LWW will seek to obtain.



LWW believes it is important to provide data outside the scope of the current impairments in the Catoctin watershed because most of the watershed has not been assessed by DEQ. There are five impairments that vary in length from 2.45 river-miles to 13.91 river-miles (entire length of the South Fork Catoctin Creek). These impairments represent 21% of the total river-miles in the watershed. Two percent of the waters meet standards, and 77% of the watershed has not been assessed by DEQ because they have no data. In addition, there is a known benthic impairment and other areas with observed effects that require DEQ follow-up assessments.

These data outside the scope of the TMDL IP will be used by LWW to identify any problem areas in unassessed portions of the watershed, and to test the assumptions upon which the DCR approved IP monitoring plan are based. Any data on problem areas will be referred to DEQ for assessment. LWW will then work with DEQ and DCR to determine whether remedial actions can be taken under the current TMDL IP to address any new impairments.

Types of Monitoring Data

The implementation of BMPs to reduce nonpoint pollution impacts and restore water quality will be accomplished in stages using the **targeted method**. Targeting the areas in the watershed with the greatest pollution loads will allow the greatest improvement in water quality to be achieved in the shortest amount of time. Stream monitoring data needed to support the targeted method are as follows.

1. **Field Survey** -- A Field Survey or stream walk conducted as part of a watershed survey is a starting point in the development of TMDL Implementation Plans because it provides basic information on the watershed that can be used to help determine

which areas or issues need to receive attention. The information can be used to establish monitoring priorities that most efficiently use monitoring resources, and identify stream segments where best management practices will address the most critical needs. The results can also be used to develop community education and awareness programs and materials.

Field surveys are needed as part of the Catoctin TMDL IP because the original bacterial source tracking (BST) done by MapTech, Inc. during the TMDL study was very limited. The TMDL report concluded that it was sufficient only to "provide insight into the likely sources of fecal contamination," and to "aid in distributing fecal loads from different sources during model calibration." The MapTech, Inc. data will not be sufficient for identifying hot spots because of the short time-frame of the MapTech, Inc. BST study and the subsequent small number of observations taken.

A Field Survey will be conducted on as much of impacted streams as possible. Considerations for determining which stream segments should receive the highest priority for Field Surveys includes:

- Stream segments that contain known problem areas that might be a high priority for some corrective action;
- Stream segments that contain special resource areas such as parks and public access; and
- Stream segments that contain threats to human and aquatic life uses of the water.

The activities associated with a Field Survey are summarized in **Table 1**. A Field Survey Form is provided in **Attachment A**.

Table 1. Summary of Parameters for Conducting a Field Survey.

Field Survey Activities	Parameters and Methods Applied
Survey the stream, riparian, and watershed characteristics and conditions including: • Habitat assessment • NPS and erosion assessment • Stream channel cross section	Preferred protocols include: • Visual assessment based upon EPA RBP • Watershed Field Inventory (Adopt-A-Stream) • EPA BioRecon • COG RSAT* • CWP Riparian Improvement Tracking (RIP)**

*Galli, J. 1996. Final Technical Memorandum: Rapid Stream Assessment Technique (RSAT) Field Methods. Washington Metropolitan Council of Governments (COG).
**Center for Watershed Protection (CWP). 1998. "Rapid Watershed Planning Handbook." Ellicott City: Center for Watershed Protection.

2. **Spatial Monitoring –** Data collected from a spatially distributed monitoring network along a single segment of a stream are needed to confirm and document critical areas and hot spots with heavy pollution loads, and to help target implementation strategies. This type of monitoring will be conducted during stream walks to help identify agricultural, stormwater, and septic tank hot spots. Citizen monitoring groups on an as needed basis will conduct special follow-up studies designed with the help of DEQ.

3. **Temporal Monitoring** – Stream monitoring will be used to document progress toward achieving the goals and for evaluating the effectiveness of the implementation actions. DEQ has one trend station in the Catoctin watershed that will be sampled on a regular basis. Five additional AW stations will be sampled at six-year intervals with twelve samples collected over a two-year period. This level of monitoring will not be sufficient to track progress in restoring water quality in the impairments. Supplemental trend data is needed at DEQ sites, especially during the off year periods. Data collected at stations within the impaired watershed on a fixed-frequency basis will improve the overall picture of the impairment and help track progress on restoring water quality.

    - **Unapproved Data --** Citizen monitoring to identify hot spots and track progress do not necessarily need to meet DEQ requirements for “approved data” regarding collection, analytical, and QA/QC protocols since they will not be used to establish or delist impairments.

    - **DEQ Validation Monitoring Data** – DEQ guidelines[5] provide that an impairment can be remove when one or two years of data from the same monitoring station that caused the original impairment and subsequent impairments show that water quality standards are being met. The impairments in the Catoctin watershed listed in 2002 were based upon data from five monitoring stations – one in Catoctin Creek, two in North Fork Catoctin Creek, and two in South Fork Catoctin Creek. In 2004 two additional impairments, one in North Fork and one in South Fork Catoctin, were added. Data for delisting these impaired stream segments will be collected by DEQ and will meet their collection, analytical, and QA/QC protocols. Final validation data collection by DEQ is not part of this plan.

Siting of Citizen Monitoring Stations

Loudoun Wildlife Conservancy (LWC) and North Fork Goose Creek Watershed Association (NFGC) will conduct the citizen monitoring. The monitoring stations are as follows.

Spatial Monitoring Stations – The spatial monitoring stations needed to confirm and document targeted implementation goals will be established by LWW during their field surveys. Any follow-up special studies will be designed with the help of DEQ.

Temporal Monitoring Stations -- The designated temporal monitoring stations for the TMDL Implementation Plan are listed in **Table 2.** DEQ has six monitoring stations in the watershed that will be used by DEQ to assess TMDL implementation. One is a trend station that is sampled monthly. The other five stations are for ambient watershed monitoring (AW) and will only be sampled on 12 occasions over a six-year period. The next sampling in Catoctin will likely occur “in the fiscal year following the actual

[5] DEQ, “Water Quality Assessment Guidance Manual for Y2004 305(b)/303(d) Integrated Water Quality Report,” November 3, 2003.

installation of BMPs or a similar event-triggering target set by DEQ and DCR TMDL staff."[6] Therefore, citizen monitoring data are needed at these stations to monitor progress on a more continuous basis. Additional monitoring stations are needed in the Purcellville portion of the South Fork Catoctin Creek in order to better assess the impacts of stormwater from the town and agricultural activities upstream of the town.

- **Benthic Monitoring Stations --** The benthic impairment on the South Fork Catoctin Creek in Purcellville will be monitored by citizen groups outside the scope of the TMDL IP monitoring plan to assess the impact that the fecal TMDL IP has on restoring stream health for aquatic life. In addition, benthic monitoring by DEQ, LWC, and NFGC will continue at several other locations in the watershed in order to document aquatic life conditions throughout the watershed.
- **Monitoring Stations in Unimpaired Segments –** There are two tributaries to Catoctin Creek that do not have impairments: Milltown Creek and an unnamed tributary a short distance downstream from Milltown Creek. DEQ has established new ambient monitoring stations near the mouth of each tributary. These stations will also be monitored by citizen groups outside the scope of the TMDL IP monitoring plan in order to track any contribution of these waters to the downstream impairment in the Catoctin mainstem.

Table 2. List of TMDL Implementation Plan Temporal Monitoring Stations for the Catoctin Watershed -- 2004.

Stream Name	Cause	Boundaries of Impaired Segment	Monitoring Station[1]
Catoctin Creek Mainstem	FC	7.2 mile segment from its mouth at the Potomac River upstream to the confluence with Milltown Creek	1. **DEQ** – Maintain trend site 1ACAX004.57 at Rt. 668
North Fork Catoctin Creek	FC	4.1 mile segment from the confluence with Catoctin Creek upstream to a point 0.2 miles downstream of the Rt. 287 bridge	2. **Local/DEQ -** Provide continuous sampling at DEQ's AW 1ANCO00.42 site at Rt. 681.
North Fork Catoctin Creek	FC	North Fork Catoctin Creek from the impaired segment starting at stream mile 4.1 to its headwaters	3. **Local/DEQ –** Provide continuous sampling at AW site 1ANOC009.37 at Rt. 718.
South Fork Catoctin	FC	17.3 miles from the mouth at Catoctin Creek upstream to the headwaters	4. **Local/DEQ -** Provide continuous sampling at DEQ's AW 1ASOC001.66 at Rt. 698. 5. **Local/DEQ** – Provide continuous sampling at DEQ's AW site 1ASOC007.06 at Rt. 738. 6. **Local** – Establish trend station at Hirst Rd crossing below Purcellville 7. **Local** – Provide continuous sampling at DEQ's AW site 1ASOC012.38 at Rt. 690.

[1] AW = Ambient Watershed station; Local = to be sampled by local citizen group

[6] DEQ, "Water Quality Assessment Guidance Manual for Y2004 305(b)/303(d) Integrated Water Quality Report," November 3, 2003, p. 47.

Parameters

Bacteria – All but one impairment in the Catoctin watershed are based upon fecal pollution. Monitoring for *E. coli* organisms is to be used to assess the success of the fecal TMDL implementation. Water quality restoration will require improved Best Management Practices (BMPs) in (1) riparian buffers in order to keep livestock out of streams and (2) residential areas to better control failing septic systems and straight pipes. These controls should decreased bacteriological levels in the streams. In addition, standard physical, chemical, and nutrient parameters will be tested to provide sufficient meta data for proper interpretation of sample results. The parameters are listed in **Table 3**.

- **DEQ –** DEQ samples will be analyzed at state laboratories using the membrane filter technique for *E. coli* bacteria.
- **Local –** Samples collected by citizen monitoring groups will be analyzed by LWC for *E. coli* using the Coliscan Easygel methodology.

Table 3. Sampling Parameters for Trend Sampling Stations.

Parameter	Sampling Protocol	Analytical Protocol	Frequency
Water Temperature	Thermometer		Biweekly
pH	LaMotte Kit	LaMotte Kit	Biweekly
DO	LaMotte Kit	LaMotte Kit	Biweekly
Turbidity	LaMotte Kit	LaMotte Kit	Biweekly
Nitrates	LaMotte Kit	LaMotte Kit	Biweekly
Phosphates	LaMotte Kit	LaMotte Kit	Biweekly
E. coli Bacteria	Coliscan	Coliscan	Biweekly

Frequency

Field Survey and Spatial Data – Field survey and spatial data is to be collected during the first 12 months. Follow-up surveys and special study sampling will be conducted on an as needed basis.

Trend Data -- Trend assessments require that samples be collected under as many different conditions as resources allow. An important consideration is providing enough samples to understanding variability. The TMDL model indicates that periods of low flow in the summer-fall months are the most unfavorable conditions for bacteriological water quality. In order to produce the needed information, trend stations should be sampled for a minimum of five years.

- DEQ's recommended frequency for sampling trend stations is biweekly(24 times per year) for chemical and bacteriological parameters.
- In addition, bacteriological samples will be taken under unfavorable, storm event conditions.

Data Analysis

Trend data used to validate TMDL Implementation will allow a broad range of statistical analyses. They include:

- Averages to show values typical of the data set;
- Correlations to show the degree of differences between data sets; and
- Comparisons with various reference conditions including water quality standards, informal guidelines established by federal or state authorities, and actual results from county or regional reference sites.

Quality Assurance/Quality Control (QA/QC)

Quality assurance measures need to be compatible with the capabilities of citizen watershed organizations. QA/QC parameters will include the following:

- Written, detailed protocol comparable with DEQ guidelines;
- Training for monitors;
- Data quality objectives as provided in **Table 4;**
- Equipment inspection and maintenance;
- 10% level of field equipment blanks for bacteriological water samples; and
- 100% level of field duplicate samples for bacteriological water samples analyzed by citizens using Coliscan Easygel.

Table 4. Quality Objectives for TMDL Implementation Monitoring in Catoctin Creek.

Monitoring Parameter	Quality Objectives
Chemical and Physical	90% completeness on data collection sheet
Bacteriological	90% completeness on data collection sheet
Other parameters and meta data	90% completeness on data sheet

Projected Costs Associated With a Citizen Monitoring and Educational Program

Funding is needed for a citizen's monitoring program if the Catoctin TMDL IP is to be successful implemented. LWW is the only county citizen-based organization prepared and motivated to provide a monitoring program to support the TMDL IP. The program will need to include a part-time position to provide coordination, technical support, and field collection of data because of the needed scope of the program. **Table 5** provides a summary of projected costs. Under this approach, all bacteriological samples will be collected and analyzed by citizens. This will substantially reduce the projected costs compared to paying a consulting firm or hiring government employees.

Table 5. Projected Costs for Monitoring Program Provided by Loudoun Watershed Watch.

Year	Number Samples [1] Spat/Trnd/SpSt	Equipment/ Materials	Data/ Progress Reports	Program Coordination/ Technical Assistant	Annual Cost
1	50/150/0	$1400	$250	$25,000	$26,650
2	0/150/50	$1100	$250	$12,500	$13,850
3	0/150/50	$1100	$250	$12,500	$13,850
4	0/150/50	$1100	$250	$12,500	$13,850
5	0/150/50	$1100	$250	$12,500	$13,850
Total	**50/750 / 200**	**$5800**	**$1250**	**$75,000**	**$82,050**

(1) Spat = spatial sampling; Trnd = trend sampling; and SpSt = Special Studies.

Cost Basis:

- **Number of Samples: 1st Year:** Conduct spatial sampling, and trend sampling at 6 *E. coli* bacteriological stations biweekly; **2nd-5th Years**: Sample at 6 stations 25 times/year, and conduct special studies.
- **Equipment/Materials**: Includes chemical test kits, bacteriological sampling equipment, and materials including a used incubator during the first year.
    - **Bacteriological Tests**: Based upon using Coliscan Easygel procedure @ $3/sample (including QA duplicate test) (200 samples/yr @ $3/sample).
    - **Chemical and Nutrient Tests**: Based on using LaMotte Chemical test kits ($500).
    - **Used Incubator**: $300
- **Data and Progress Reports**: Cost for color-printing a yearly progress report to stakeholders and for educational purposes.
- **Technical Support/Coordination**: 1st Year: Based upon $25/hour, 20 hours/week, 50 weeks/year (1/2 FTE) for field survey, spatial monitoring, and trend monitoring; **2nd –5th year**: Based upon $25/hour, 10 hours/week, 50 weeks/year (1/2 FTE) for special studies and trend monitoring.

ATTACHMENT A.

LOUDOUN STREAM MONITORING PROGRAM

STREAM BIO-RECON FIELD DATA FORM

Project:______________________________

Date:_______________ **Time:**_________

Watershed: _______________________ Stream: _____________________________ Specific Location: ____

Data Collectors' Names: ____

WEATHER CONDITIONS

Rain Conditions Past 48 Hours: ☐ Little/None ☐ Light ☐ Moderate ☐ Heavy # Days since heavy rain: ______________

Stream Flow Conditions: ☐ High ☐ Medium ☐ Low ☐ Drought Air Temperature ____ ^{0}F _____ ^{0}C Water Temperature _____ ^{0}F ____ ^{0}C

pH _______ Turbidity: ______ NTU's **or** ☐ High ☐ Medium ☐ Low ☐ Clear

WATERSHED LAND FEATURES AND NONPOINT POLLUTION

Estimate **watershed features** and identify **NPS impacts** in watershed within ¼ mile upstream and adjacent to the site. For "Land Use Profile," record information as a percent. For "NPS Impacts," **check each parameter** with "**1**" if not present or little impact, "**2**" if moderate impact, and "**3**" if any parameter has potential high impact on the stream and/or monitoring site.

WATERSHED FEATURES:					
%	Forested Uplands	%	Pasture/crops/open lands	%	Wetlands
%	Commercial/Industrial	%	Low intensity residential	%	High intensity residential
NONPOINT POLLUTION SOURCE IMPACTS:					
Nonpoint Pollution: No evidence Some potential sources Obvious sources					
1 2 3	**Residential/Commercial** Single-family housing	**1 2 3**	Multifamily housing	**1 2 3**	Commercial/institutional
	Roads -- Paved roads or bridges		Unpaved roads		Cleared right-of-ways
	Construction underway on: Housing development		Commercial development		Road or bridge construction/repair
	Agricultural – Active cropland		Grazing land or animal holding areas		Other:
	Recreational -- Golfing		Camping		Other:
	Other -- Trash dumping		Landfills/wetland encroachment		Storm drains/storm water runoff
Local Watershed Erosion: None Moderate Heavy					

STREAMBED COMPOSITION OF RIFFLE

% Silt (mud)	% Sand	%Gravel (1/4-2")	%Cobble (2-10")	% Boulders (>10")

ORGANIC SUBSTRATE COMPOSITION OF POOL/RUN

% Detritus	% Muck-Mud	% Root Masses

STREAM HABITAT ASSESSMENT DATA

Estimated **average** stream width ______ ft. Estimated stream depth in riffle #1 ______ ft. & riffle #2 ______ft. Estimated stream depth in pool or run _____ ft.

Habitat Parameter/Score	**Optimal** **20 – 19 – 18 – 1 7- 16**	**Good** **15 – 14 – 13 – 12 - 11**	**Marginal** **10 – 9 – 8 – 7 - 6**	**Poor** **5 – 4 – 3 – 2 – 1 - 0**
Epifaunal Substrate/ Available Cover Score	>70% of substrate favorable for insect communities; mix of snags, submerged logs, undercut banks, cobble or other stable habitat to allow full colonization potential.	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat to maintain populations; additional substrate in form of newfall.	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	<20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
Embeddedness Score	Fine sediment surrounds and fills 0-25% of living spaces around gravel, cobble, & boulders. Plume of sediment almost nonexistent. Rocks look as if placed on streambed.	Find sediment fills in 25-50% of living spaces around gravel, cobble, & boulders. Sides of rocks have partial “cemented in” look. Plume is small to moderate.	Find sediment surrounds and fills in 50-75% of living spaces around and between gravel, cobble, & boulders. Sides of rocks have a “cemented in” look. Plume is moderate to extensive.	Find sediment surrounds and fills in >75% of living spaces around and between gravel, cobble, & boulders. Sides of rocks have a “cemented in” look. Sediment plume is extensive.
Velocity/Depth Regime Score	All four velocity/depth regimes present – slow-deep, slow-shallow, fast-deep, fast-shallow – and slow is <0.3 m/s and deep is >o.5 m/s	Only 3 of 4 regimes present (if fast-shallow is missing, score lower than if mission other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
Sediment Deposition Score	Less than 5% of bottom affected by scouring and/or deposition; islands and point bars not enlarging	5-30% of bottom affected; scour at constrictions and where grades steepen; slight deposition in pools and/or bars	30-50% of bottom affected; deposits and/or scour at obstructions, constrictions, and bends; moderate deposition of pools and new bars prevalent	>50% of bottom affected; pools almost absent due to deposition; heavy deposition of fine material; new bars developing

Channel Flow Score	Water reaches base of both lower banks; and minimal amount of channel substrate is exposed.	Water fills >75% of available channel; or <25% of channel substrate exposed.	Water fills 25-75% of available channel; and/or riffle substrates mostly exposed.	Very little water in channel, and mostly present as standing pools.
Channel Alteration Score	Minimal impact from stream straightening, artificial embankments, dams, bridge abutments.	Some stream straightening, artificial embankments, dams usually in areas of bridges. No evidence of recent channel alteration.	Artificial embankments extensive and present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Bank shored with gabion or cement; over 80% of the stream site straightened and disrupted. Habitat greatly altered or removed.
Frequency of Riffles (or bends) Score	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of stream <7:1 (generally 5-7); variety of habitat is good.	Occurrence of riffles infrequent; distance between riffles divided by stream width is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by stream width is between 15-25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by stream width is a ratio of >25.
Left and Right Orientation – Face upstream				
Parameter/Score L Bank R Bank	**Optimal 10 – 9**	**Good 8 – 7 – 6**	**Marginal 5 – 4 – 3**	**Poor 2 – 1 – 0**
Bank Stability	Banks stable; minimal evidence of erosion or bank failure; little potential for future problems; <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; “raw” areas frequent along straight sections and bends; bank sloughing; >60% with bank scars.
Bank Vegetation Protection	>90% of bank surfaces and immediate riparian zone covered by naturally growing trees, shrubs, and perennial plants; vegetation not disturbed	70-90% of bank surfaces covered by natural vegetation; some disruption evident; >1/2 of natural plant height remaining	50-70% of bank covered by vegetation; disruption obvious; patches of bare soil or low cut vegetation; <1/2 of natural plant height remaining.	<50% of bank surfaces covered by vegetation; high level of disruption evident; bare soil or low cut vegetation extensive
Riparian Zone	Width of riparian zone > 54 feet; human activity has not impacted zone	Width of zone between 36-54’; minimal human impact on zone	Width of zone between 18-36’; considerable human impact on zone	Width of zone <18’; little or no riparian zone due to human activity/alterations
Score	**Habitat Assessment Score: (Sum of Individual Scores) ______ %** (>90% = Excellent; 75-89% = Good; 60-74% = Marginal; <60% = Poor)			

STREAM PROFILE

Bank Height: Left _____ Right _____ **Bank Angle**: Left ____ Right ____ **Top Stream Bank Width**: ______ **Stream Bottom Width**: _____ **Bank Flood Height**: _____ **Stream Depth**:______ ___________________

STREAM PROFILE SKETCH – Include measurements

STREAM CORRIDOR PROBLEM IDENTIFICATION

Map Location: ____ **Picture No.** _____
Dominant Vegetation Adjacent to Stream _____________________________
Concern: Inadequate Buffer (IB) / Severe Erosion (ER) / Cattle Access (CA) / Horse Access (HA) / Pipe/Outfall (PO) / Sewer / Debris Dam / Trash
Severity (10 high – 1):____________ **Mitigation Potential**: Yes / No **Reasonable Access**: Yes / No
Ownership: Public/ Private / Park
Inadequate Buffer: Buffer width: Left _____ Right ____ **Length or Extent of IB** __________ **Length or Extent of CA or HA** _______________
Severe Erosion: Bank Height: Right _____ Left ____ Bank Flood Height ____ Bank Angle Left _____ Right ______ Bottom Stream Width _______
Pipe/Outfall: Diameter _________ Flow: Yes / No **Crossing or Outfall Type:** Sewer / Agriculture Drainage / Stormwater / Unknown / Other
Retrofit Potential: Yes / No / NA **Adjacent Land Use**: Residential (high / medium / low) / Forest / Pasture / Crop / Commercial / Industrial / Other

Notes: