Catoctin Watershed Project

Stewardship for the Catoctin Creek Watershed

Catoctin TMDL -- Citizen Outreach and Monitoring Results 2005-2007

Loudoun Watershed Watch

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A. INTRODUCTION

Loudoun Watershed Watch (LWW) prepared this report for the February 27, 2008 re-convening of the Catoctin TMDL Implementation Steering Committee by the Virginia Department of Conservation and Recreation (DCR) and the Loudoun Soil and Water Conservation District LSWCD). The purpose of the Steering Committee meeting is to review progress towards implementing the Catoctin Creek bacteria TMDL. DCR and LSWCD also seek input on how to correct additional bacteria source problems in the watershed.

The Catoctin Creek Bacteria TMDL Implementation Plan (TMDL IP) seeks to improve water quality and remove Catoctin Creek from the state list of impaired waters. Catoctin Creek does not meet the state water quality standards for recreational use due to fecal pollution from non-point sources (NPS). DEQ conducted a "total maximum daily load" study (TMDL) that identified the various fecal pollution sources and load contributions. The study found that the principle sources of NPS are from livestock wastes being discharged into the creek, from wildlife, and from failing septic systems. The report recommended that livestock be excluded from streams in the Catoctin Creek watershed, and failing septic systems be upgraded.

Starting in the Summer of 2005, LSWCD began targeting farmers with livestock to accept Federal cost-sharing funds to install fencing to exclude livestock from streams in the Catoctin watershed. Cost share funds also covered alternative water supply systems and harden crossing, where applicable. Concurrently, the Loudoun County Health Department (LCHD) began identifying homes adjacent to streams in the watershed with inadequate onsite waste disposal systems. The LCHD worked with these homeowners to upgrade their systems to meet state standards.

Citizen Role in Catoctin TMDL Implementation Plan – The Catoctin TMDL IP includes two activities for local environmental organizations in Loudoun County to support the TMDL IP.

- **Community Outreach and Public Education** – Loudoun Watershed Watch (LWW) is to organize Catoctin watershed events, and provide educational materials and displays.
- **Citizen Monitoring** – LWW is to provide complementary monitoring to better define implementation progress.

LWW's Catoctin Watershed Project -- LWW has worked in partnership with the Loudoun Wildlife Conservancy (LWC) and other groups since 2005 to provide the citizen support. The "Catoctin Watershed Project" was organized in 2005 to help meet the stream monitoring and community outreach goals under the TMDL IP. Grant funding to support the CWP was obtained from:

- Canaan Valley Institute;
- DEQ;
- Chesapeake Bay Restoration Fund;
- Loudoun Wildlife Conservancy; and
- Citizen donations.

B. PROGRESS REPORT – COMMUNITY OUTREACH AND EDUCATION

Community Outreach Projects – LWW and its supporting partners helped organized several community outreach projects. The purpose of the projects are to increase public awareness of the water quality problems and needs in the Catoctin Watershed, and to promote community stewardship and appreciation of the importance of Catoctin Creek as a valuable natural resource. These projects are:

- **2005 Riparian Tree Planting Day** – Watertown area with 50 participants and 500 trees planted
- **2005 Catoctin Creek Clean-up Day** – Taylorstown area with 60 participants

- **2006 Riparian Tree Planting Day** – Hamilton area with 65 participants and 300 trees planted
- **2008 Riparian Tree Planting Day** – Waterford area with 50 participants and 100 trees and shrubs planted
- **Taylorstown Stream Days** – Annual event organized by the Taylorstown Citizen Association

Community Outreach Educational Materials – LWW has produced several educational materials, and provides a website with educational materials.

- **Pamphlets –**
  Citizen's Guide – Starting a Local Watershed Group
  Catoctin Creek – A Community Treasure
  Catoctin Creek – Water Quality Report Card
  Benefits of Clean Water Fecal Bacteria in Stream Water: Public Health Considerations
- **Website** – Educational materials and monitoring data are provided on-line at www.loudounwatershedwatch.org.
- **Logo –** The CWP has a distinctive logo that is placed on educational materials and T-shirts.
- **Display –** There are Catoctin Watershed Project banners and a display used at community events.

Citizen Volunteer Stakeholder Overall Contributions – 2005-2007 -- Citizen volunteer organizations have made a substantial contribution to the TMDL IP. The volunteer time devoted to the TMDL IP are estimated as follows:

- **Community Outreach and Education** – publications, website, meetings, etc. = 1000 hrs volunteer time
- **Riparian Tree Planting and Stream Clean-up Projects =** 1000 hrs volunteer time
- **Stream Monitoring –** 61 sampling days, 700 samples, 1300 lab analyses = 1200 hrs volunteer time
- **Recognition** -- LWW received the 2007 Outstanding Organization Award from Virginia Citizens for Water Quality

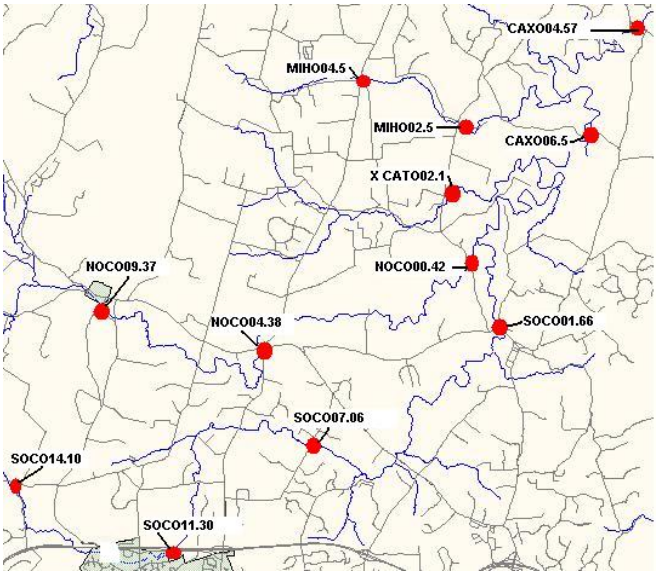
C. PROGRESS REPORT – STREAM MONITORING BASELINE DATA

Protocol and Sampling Stations -- LWW began monitoring in June 2005 at 12 stations, twice monthly. Sampling stations are shown in **Map 1**. Samples are analyzed to enumerate *E. coli* using the Coliscan Easygel protocol. Training was obtained from DEQ. Analyses are performed at the Leesburg STP laboratory. Since monitoring began in 2005, over 700 samples have been collected and analyzed. A one-year data analytical status report was prepared in 2006. The data and status report are available on LWW website.

LWW Data Uses -- Coliscan data is not official data that can be used by DEQ to classify state waters. However, Coliscan data can be used to suggest water quality patterns for DEQ to consider. Coliscan data can also be used to indicate progress being made to improve water quality, and to identify stream segments impacted by NPS pollution.

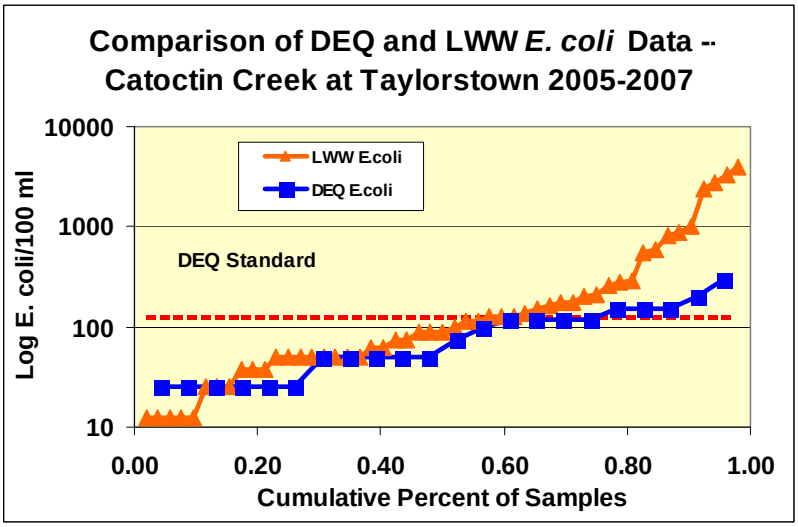
Comparison of LWW and DEQ Data – DEQ has one trend monitoring station at the Taylorstown Bridge in the Catoctin Creek watershed that is sampled approximately 10 times yearly. *E. coli* data are available since 2002. LWW also samples at this station using the Coliscan Easygel protocol. These overlapping stations allow a comparison to be made between the official DEQ *E. coli* data and the LWW unofficial data.

Map 1. Loudoun Watershed Watch Stream Monitoring Stations for the Catoctin Watershed Project.



The DEQ and LWW data are sorted by *E. coli* value, and plotted on a log scale against a cumulative percentile. This provides a straight line data plot, and allows a comparison to be made of the *E. coli* values at a particular cumulative percentile. These data are shown in **Graph 1.** Generally, DEQ and LWW data are well correlated except at higher *E. coli* levels where LWW data are more elevated.

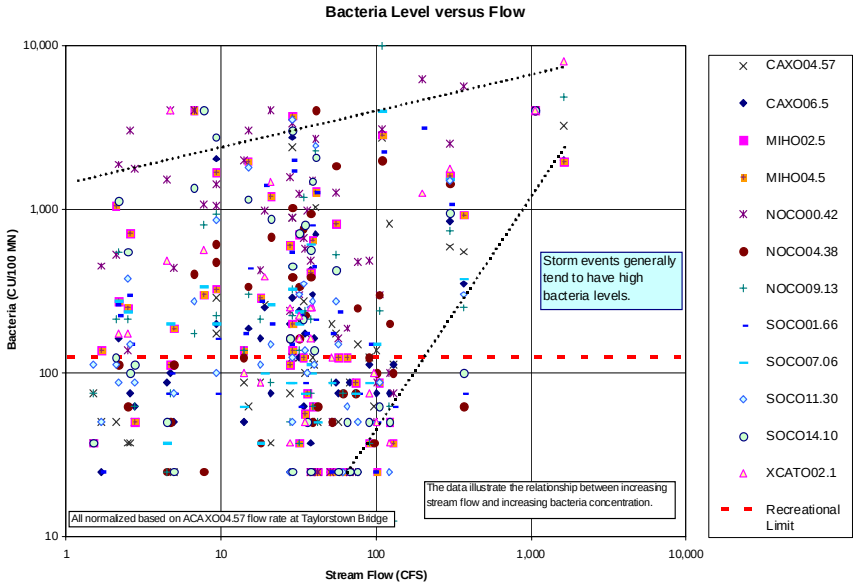
Graph 1.



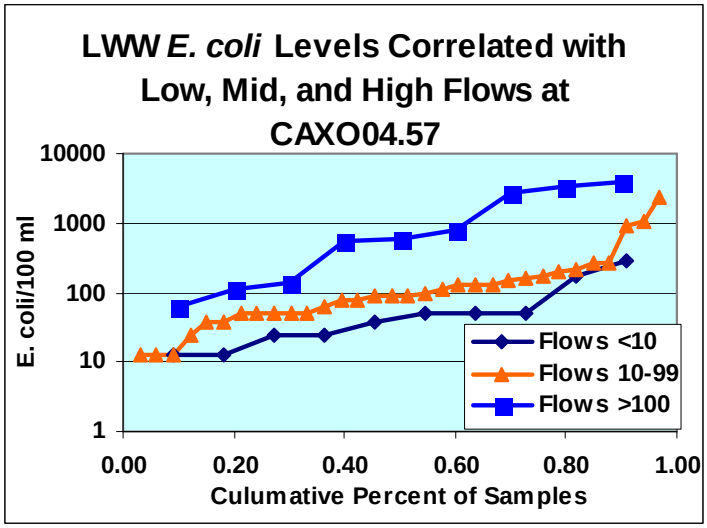
Correlation Between Stream Flow and *E. coli* Levels – The effects of stream flow on *E. coli* concentrations or loads is often considered an important factor in water quality trend analyses. A possible correlations was investigated in the DEQ TMDL study of Catoctin Creek, but no conclusion could be reached because the study was able to include only one high flow event. The TMDL report recommended additional high flow data be collected so a possible correlation could be assessed.

LWW investigate the effect of stream flow on *E. coli* using two approaches. **Graph 2** provides a scatter plot with *E. coli* levels on the y-axis and stream flow on the x-axis. This plot shows a positive correlation between *E. coli* levels and stream flow at the higher flow levels (>100 cfs). A correlation at the low (<10 cfs) and mid flows (10-100 cfs) is weak. In **Graph 3** the *E. coli* data are sorted by flow and plotted on a log-cumulative percentile graph, and the correlation between *E. coli* and flow levels appears stronger.

Graph 2. Correlation Between LWW *E. coli* Data and Stream Flow – All Data

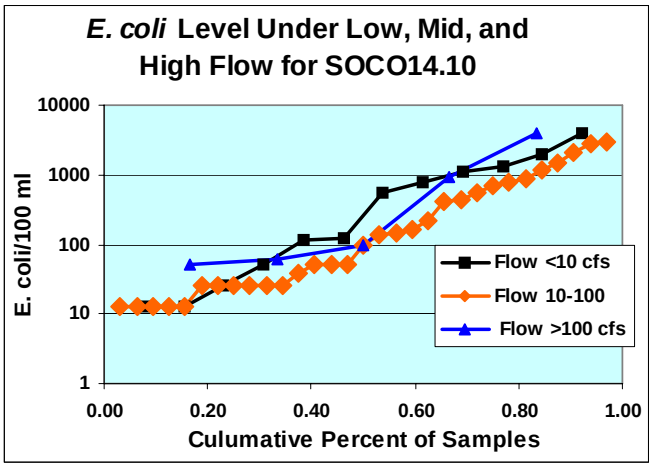


Graph 3.



The stronger correlation that shows at Taylorstown near the mouth of Catoctin Creek is not consistent throughout the watershed as shown in **Graph 4**. There appears to be a weak reverse correlation in the upper portion of the South Fork Catoctin Creek. Therefore, correlations between *E. coli* levels and flows vary by station.

Graph 4.



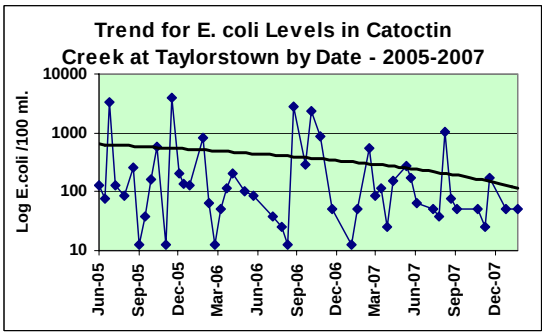
Representativeness of LWW Data – If there is a correlation between *E. coli* and flow levels, it is important that monitoring data be representative of different flow levels. The LWW data were analyzed to determine the degree to which samples taken represent the frequency of the different flow regimes. The analysis is shown in **Table 1**. The sample frequency for the LWW data corresponded closely with the frequency of the different flow regimes.

Table 1. **Sample Distribution by Flow 2005-2007**

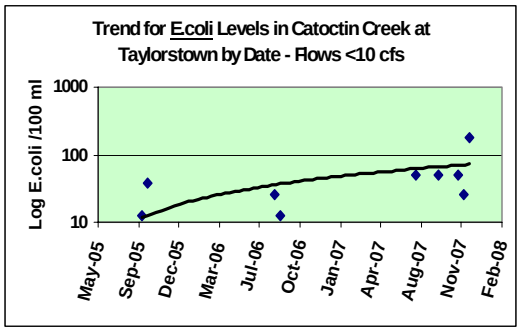
Flow	LWW Sample Frequency	Flow Frequency
<10 cfs	25%	24%
10-100 cfs	55%	60%
>100 cfs	20%	16%

Impact of 2007 Drought on Data Trends – Drought conditions existed in the Catoctin Creek watershed for an extended period in 2007 (>nine months). The LWW data from the Taylorstown station near the mouth of the watershed were analyzed to determine whether these drought conditions affected data trends. **Graph 5** shows a graph of the Taylorstown data that includes a trend line. It appears that there has been a substantial improvement in water quality over time. **Graphs 6-8** show these data plotted by different flow regimes. The trend lines for these data show that there is improved water quality only under the high flow regime, and there are few samples taken under high flow conditions in 2006 and 2007.

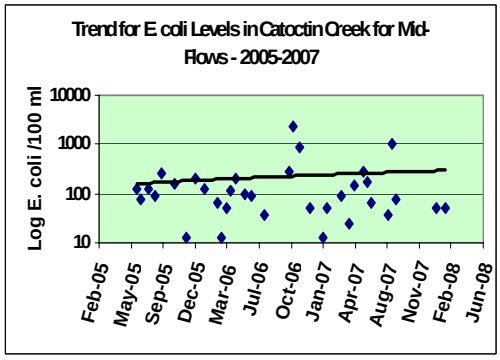
Graph 5. Trend for All Data.



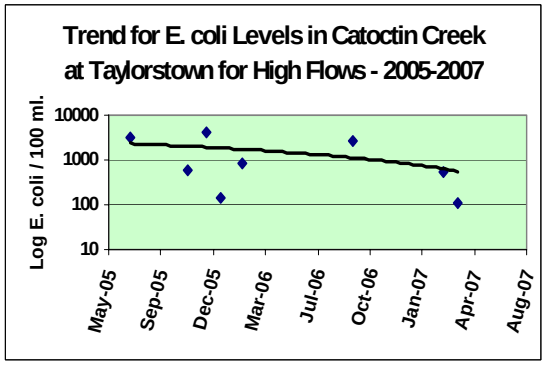
Graph 6. Trend for Low Flow Data.



Graph 7. Trend for Mid-Flow Data.



Graph 8. Trend for High Flow Data.



D. PROGRESS REPORT – NON-POINT SOURCE POLLUTION CONTROL

Agriculture BMP Goals and Accomplishments – The TMDL study found that approximately 87% of the nonpoint pollution load is coming from livestock that have direct access to the streams. Pollution loads from land runoff of manure from livestock excluded from the streams is insignificant compared to the instream pollutions loads. This pollution load can be eliminated if approximately 81 miles of streamside fencing are installed by landowners with livestock It is estimated that 83 full livestock exclusion systems, 43 horse exclusion systems, and 76 hardened crossings are need to meet this goal.

DCR and LSWCD rely on several Federal supported, cost-sharing programs to encourage landowners with livestock to voluntarily install the needed livestock and horse exclusion systems to keep livestock out of the streamrms. State funding to hire an Agricultural Specialist is to last five years. The target accomplishment rate is 20% per year, and efforts are to be directed towards "hot spots" in order to get the greatest return for the support dollar.

A summary of the amount of fencing and livestock excluded from the streams that has been voluntarily installed by landowners in the first four years of the five year project is provided in **Table 2**. Todate, approximately 11% of the targetted fencing has been installed, and another 12% is contracted for future installation.

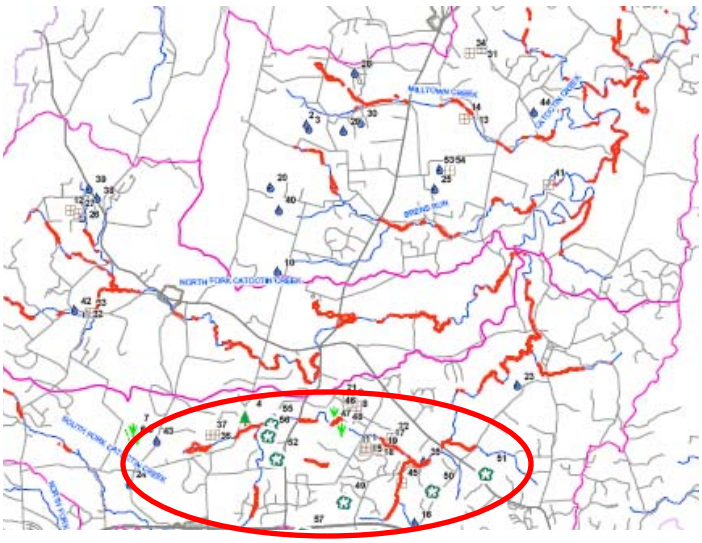
Table 2. Agriculture Fencing Achievement Based on 80% Performance Target

Sub-watershed	Fencing Installed (ft)	Number of Livestock Excluded	TMDL Target-Fencing (ft)	% Achieved	Fencing Contracted (ft)	Number of Livestock to be Excluded	Total % Fencing Achieved
Catoctin Main Stem	3380	49	52,000	0.07	8440	86	0.23
South Fork Catoctin	8223	60	36,000	0.23	3825	45	0.33
NF Catoctin	3467	241	45,600	0.08	4490	117	0.17
Totals	**15070**		**133,600**	**0.11**	**16755**	**248**	**0.24**

Targeted Method to Improve Water Quality – The DCR guidelines for TMDL implementation provides for the use of a "targeted method" to improve water quality. This method calls for the use of "stream walks, watershed inventory, analyze of land use, stream network GIS layers, monitoring results and BMP survey responses" be used to determine the critical areas to be targeted. The needed data to apply the targeted method have not been compiled by DCR. Instead, LSWCD considers the critical areas to be the largest farms with the most livestock that have access to the streams. Unfortunately, these landowners have been the least receptive to the cost-sharing incentives offered under the TMDL IP.

Map 2 showed the stream segments targeted for fencing (red highlighted sections), and the locations where fencing has been installed (small dark markers). The highlighted area around Purcellville seems to show some correlation between hot spots and fencing installations.

Map 2. Projected Stream Segments for Target Fencing (highlighted in red).



Waste Disposal System Accomplishments – The Loudoun County Health Department has been highly successful addressing the residential waste disposal component portion of the TMDL implementation plan. There is a high level of

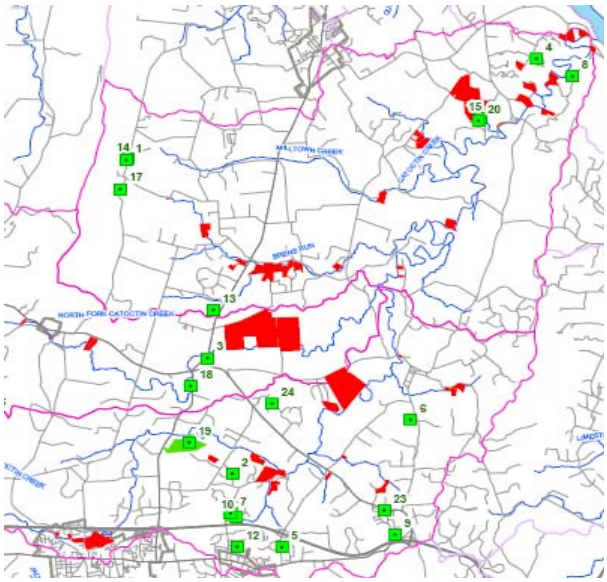
community awareness of the significance of improperly treated human wastes on water quality. Community response to outreach and education programs has been high, and the resulting number of corrections of inadequately operating systems also high as shown in **Table 3**.

Table 3. Septic System Upgrades Based on 80% Performance Target

	Units Installed	TMDL Target	% Achieved
Main Stem	8	6	133%
Lower SF Catoctin	11	10	110%
NF Cactoctin	2	4	50%
Other	3		
Totals	24	20	120%

Targeted Residential Waste Disposal Systems – A variety of methods were used in the TMDL report to identify areas in the watershed where residential waste disposal systems were most likely to be malfunctioning. These areas are highlighted in red on **Map 3**. The disposal systems that have been improved through the Health Department TMDL IP efforts are shown on Map 2 with green markers. In general there is little correlation between the two. The Health Department reports that additional water quality testing is needed at these target areas to determine whether unidentified disposal problems exist.

Map 3. Correlation Between Waste Disposal Target Areas (red area) and Residential Improvements (green markers).



E. PROGRSS REPORT – WATER QUALITY TRENDS

Water Quality Trend Analyses – An important purpose of the citizen monitoring is to assess whether progress is being made to restore good water quality in the Catoctin watershed. Based on the TMDL study model, water quality should improve as cattle are excluded from the streams throughout the watershed. Two accepted means of tracking progress are used:

- **Moving Geometric mean –** The DEQ state water quality standard of 126 *E. coli*/100 ml is based on the geometric mean of the sampling results if sampling is done at least monthly. The geometric mean:
  - Transforms data to log values, and calculates averages of last 12 sample results; and
  - Reduces influence of very high numbers on the data set
- ***E. coli* Load Rates –** The TMDL purpose is to reduce the load of fecal contamination in the stream. The load rate is:
  - A product of *E. coli* monitoring value and flow; and
  - An estimate of the bacteria load in the water.

Assessing water quality trends proves to be difficult, however, because water quality seems to be influenced by stream flow at some stations, as discussed in an earlier section of this report. Higher stream flows seem to be related to higher fecal loads, and stream flow has been substantially reduced in 2007. Thus, it is difficult to determine to what extent any improvements in water quality are related to the modest level of success in excluding livestock from the stream and/or the lower flows. Water quality trends also vary at different monitoring station. This is expected since water qualities are affected by small, local, and intermittent nonpoint sources of pollution.

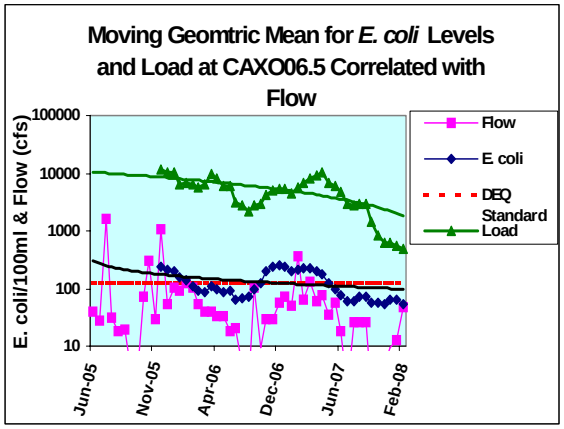
Ag BMP's in Catoctin Main Stem –

There are several stream segments in the mainstem of Catoctin Creek that are projected as target livestock elimination areas as shown in Map 2. **Map 3** shows that there have only been two fencing installation projects in this portion of the watershed. It is unlikely that these two projects would improve water quality at the two monitoring stations shown as red marks on Map 3.

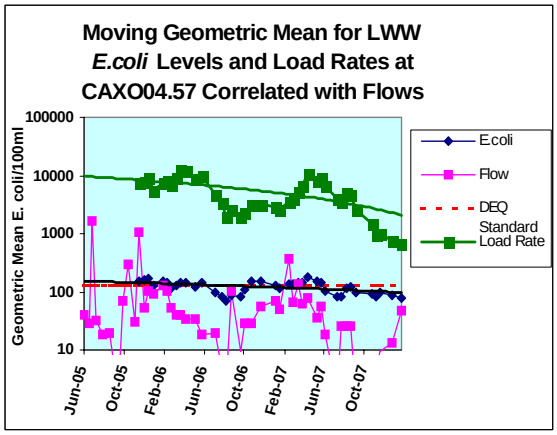
Map 3. Agricultural BMP Installations in the Catoctin Creek Mainstem Section.

Water Quality Trend – Catoctin Mainstem – The stream monitoring results for the two stations in the mainstem of Catoctin Creek are shown in **Graphs 9 and 10**. The graphs include the *E. coli* load levels in green and the moving geometric mean in blue. A trend line is provided for each trend indicator. Stream flow at the time of sampling is indicated in pink. The trend line for the moving geometric mean for the upstream station at mile point 6.5 (Featherbed Road) suggests there is a small improvement in water quality since 2005. The trend line for the downstream station at mile point 4.57 (Taylorstown Rd.) shows little change. The trend lines for the load rates show how *E. coli* loads vary with stream flows. Load rates have decreased as stream flows have decreased.

Graph 9. Mile Point 6.5



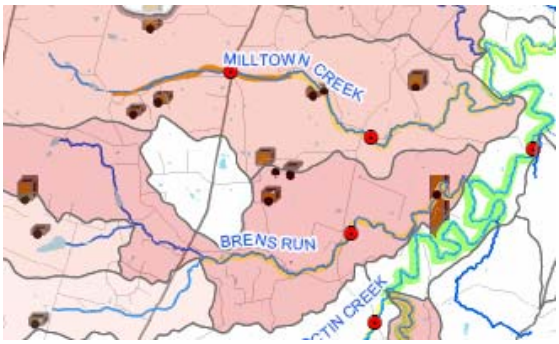
Graph 10. Mile Point 4.57.



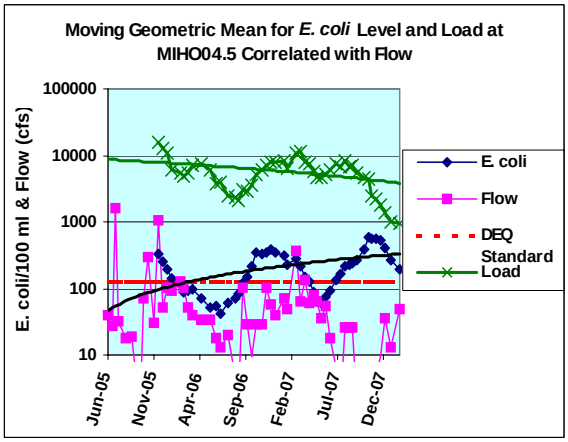
Water Quality Trends in Milltown Creek, Brens Run, North Fork Catoctin Creek, and South Fork Catoctin Creek – The agricultural BMP installations and water quality trends for the other ten stations in the Catoctin Watershed are shown in the following graphs. The colored lines and trend lines are the same as the lines for mainstem Catoctin Creek data discussed in the preceding section.

- **Ag BMP's and Water Quality Trend in Milltown Creek and Brens Run** -- The new BMP's in the Milltown Creek subwatershed and in Bren's Run are shown in **Graph 11**. *E. coli* levels in the headwaters of Milltown Creek are elevated including during the drought, and slightly elevated in the mid-section. *E. coli* load rates have decreased during the drought as shown in **Graph 12-13**. In Brens Run water quality has slightly improved while load rates have substantially decreased during the drought as shown in **Graph 14**.

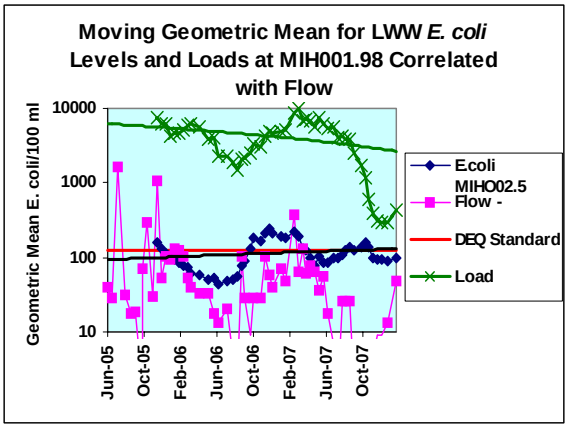
Graph 11. Agricultural BMP's in the Milltown Creek and Brens Run Watersheds.



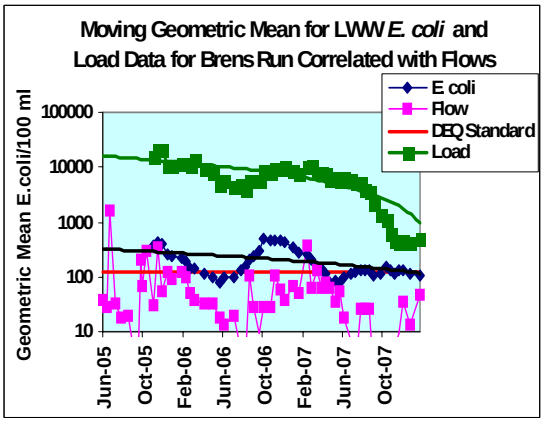
Graph 12. Water Quality Trends in Milltown Creek at Mile Point 0.46.



Graph 13. Water Quality Trend in Milltown Creek at Mile Point 1.98.



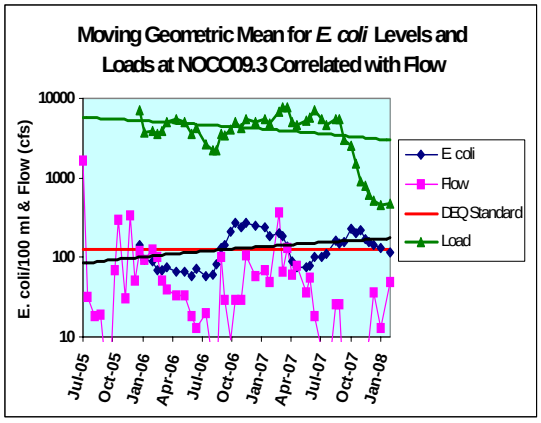
Graph 14. Water Quality in Brens Run.



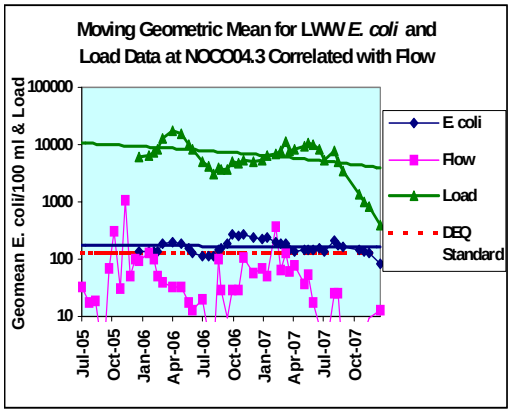
- **Ag BMP's and Water Quality Trend in North Fork Catoctin --** There are several new BMP's in the headwaters of the North Fork Catoctin Creek above Hillsboro, but no new BMP's in the middle and lower sections as shown in **Graph 15**. Generally the water quality in the upper reaches is slightly degraded and *E. coli* levels remain elevated during the drought period although load rates decreased as shown in **Graphs 16 - 18**. At the mouth of the North Fork, the water quality is slightly degraded over time and remains elevated during drought period. *E. coli* levels are the highest in the watershed which suggest local NPS pollution. However, the priority for targeted implementation for this portion of the Catoctin Watershed is ranking moderately low – 12 of 16.

Graph 15. Ag BMP's in the North Fork Catoctin Creek.

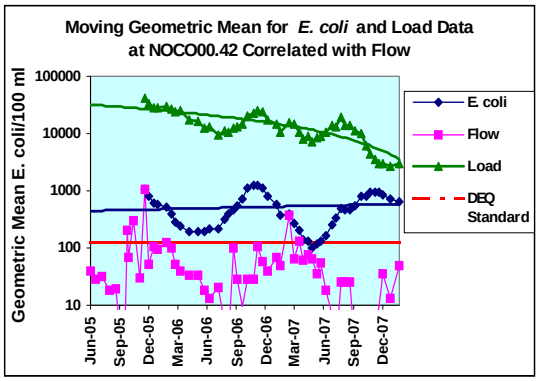
Graph 16. Water Quality Trends in NF Catoctin Creek at Mile Point 9.3.



Graph 17. Water Quality Trends in NF Catoctin Creek at Mile Point 4.3.

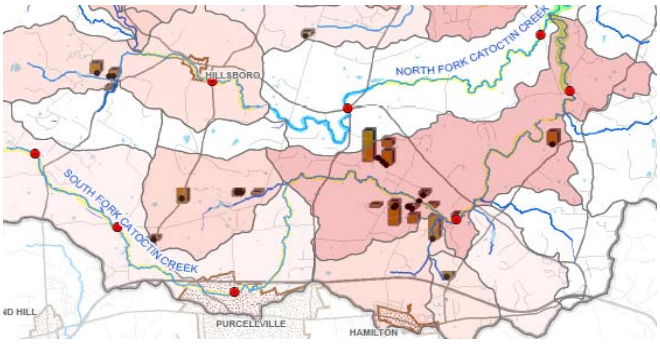


Graph 18.Water Quality Trends in NF Catoctin Creek at Mile Point 0.4.

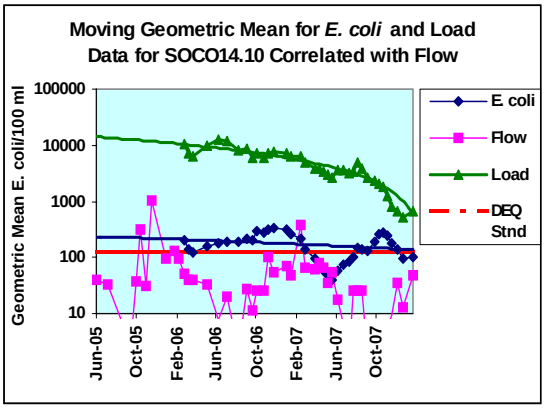


- **Ag BMPs and Water Quality Trends in South Fork Catoctin –** There has been some success with the installation of new BMP's downstream of Purcellville as shown in **Graph 19**. The water quality in the upstream section varies, while the load rate consistently decreased during the drought period as shown in **Graphs 20 - 21**. Generally water quality in the middle portion of the watershed does not show improvements from BMP installation as shown in **Graph 22**. However, improved water quality is suggested at mile 1.66 with the load rate sharply dropping during the drought period as shown in **Graph 23**.

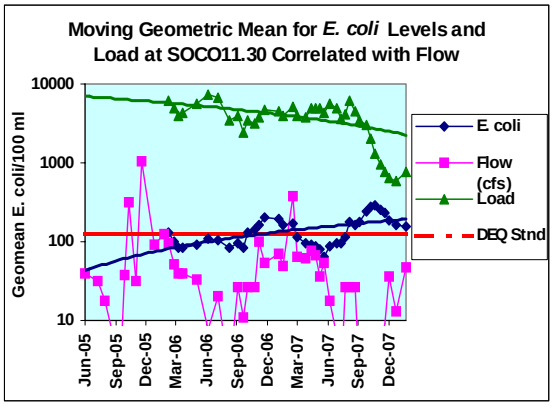
Graph 19. Ag BMP's in the South Fork Catoctin Watershed.



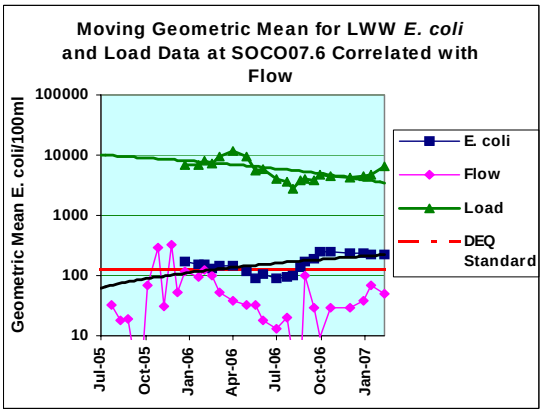
Graph 20. Water Quality Trends in SF Catoctin Creek at Mile Point 14.1.



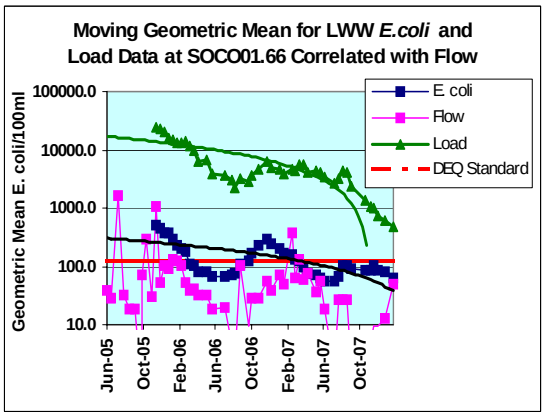
Graph 21. Water Quality Trends in SF Catoctin Creek at Mile Point 11.8.



Graph 22. Water Quality Trends s in SF Catoctin Creek at Mile Point 7.6.



Graph 23. Water Quality Trends s in SF Catoctin Creek at Mile Point 1.66.



F. LESSONS LEARNED – CITIZENS IN A SUPPORTIVE ROLE

Lessons Learned Regarding Outreach and Education --

- Citizen groups can successfully accomplished community outreach projects as shown in 2005 and 2006.
- However, it is difficult for a single volunteer group to organize outreach activities without other stakeholder support:
  - Need non-profit organization for grants
  - Need larger number of experienced volunteers
  - Need collaboration with many organizations
- LWW sought to address these difficulties by developing a collaborative agreement and support from LSWCD in 2007. However, LSWCD declined to collaborate since community outreach and education is not their responsibility under the TMDL IP. Consequently, LWW's community outreach program is currently inactive.

Lessons Learned Regarding Stream Monitoring –

- Volunteer citizen group can organize stream monitoring for a TMDL IP.
- Monitoring data can assess trends, and the influence of flows and droughts on water quality.
- A monitoring program based on Coliscan Easygel costs about $1200/year, and grant funds are available.

Reasonable Assurance of Success – The DCR Guidelines for TMDL Implementation provides that there should be a "reasonable assurance" that:

- Implemntation activities will occur,
- BMPs will be implemented, and
- TMDLs will be allocated and met.

At the same time, DCR is relying upon cost-sharing incentives that have been available to landowners for years before the TMDL initiative to provide this assurance of success. These programs only had a modest level of acceptance before the TMDL, and continue to have a modest level of success under the TMDL IP. This suggests that successful implementation of BMPs and the successful restoration of water quality will not likely occur if implementation continues to rely only upon these traditional incentive programs.

G. RECOMMENDATIONS – A MORE REASONABLE ASSURANCE OF SUCCESS

Where to Go From Here? -- After 3 ½ years of implementation, citizens have learned that:

- Additional initiatives are needed to supplement the traditional TMDL implementation strategies; and
- Additional organizational involvement and collaborative mechanisms are needed to provide complimentary initiatives.

Additional Stakeholder "Buy-In" -- More Catoctin watershed stakeholders need to be engaged in the TMDL project.

- The Loudoun Watershed Management Stakeholder Steering Committee should be invited to help.
- The Catoctin TMDL could become a pilot for future, widespread watershed restoration projects in the County.
- An updated Catoctin TMDL IP could be used to test new collaborative approaches between stakeholder groups, the County, and state agencies.

New Initiative for Community Outreach and Education -- The community outreach and education efforts started by Loudoun Watershed Watch that target stakeholders in the Catoctin watershed should be continued and expanded.

- Grant funds could be sought to hire a community outreach educator/specialist.
- The "Education" and "Funding" subcommittees of the Watershed Management Stakeholders Steering Committee could be asked to help.

New Initiative for Grant Funds for BMP Installation -- New incentive grants and cost-share funds should be sought to supplement the current Federal cost-share programs.

- Funds for alternative fencing systems; and
- Funds for flood damage repair.

The "Funding" subcommittees of the Watershed Management Stakeholders Steering Committee could be asked to help. Funding for Catoctin TMDL could be a pilot for future, County-wide, stream restoration funding.

Possible Strategies for Grant Fund Administration –

- The Stakeholder Steering Committee could obtained the grant funds by using the County as the grantee; or
- A nonprofit Steering Committee member could obtain the grant funds in partnership with the Steering Committee.

The Steering Committee could become a partner with a limited role if the grant funds obtained were passed through and administered by Loudoun Soil and Water Conservation District to:

- Hire a needed community education specialist; and
- Provide "extra" grant and cost-share funds as appropriate to willing landowners.

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