Lytle Creek Watershed-Based Plan
Tennessee Environmental Council
11/16/2015
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The Tennessee Environmental Council (Council) is a 501 (c) 3 conservation organization whose mission is to educate and advocate for the conservation and improvement of Tennessee's environment, communities and public health. The Council has been for the past four years working in Rutherford County with Murfreesboro's Stormwater department, MTSU and the Stones River Watershed Association in Garrison Creek, implementing best management practices.

The Lytle Creek Watershed Based plan (WBP) is being re developed based on the 2009 Civil and Environmental Consultants Inc. and Stones River Watershed Association's 2009 WBP. The CEC plan is being updated and refined to focus on restoration opportunities. The 2015 WBP is to be implemented by the Council with support from Murfreesboro Stormwater, local organizations and the Cumberland River Compact.

The CEC plan sought to:

- Identify the sources of sediment and E. coli loading.
- Develop a plan to fully restore the stream to support designated uses
- Focus on BMPs implementation such as streambank stabilization, riparian buffer restoration and septic system maintenance.
- Identify key property owners, developers and other stakeholders to educate them on the existing impairments and restoration plan.
- Garner support for the restoration of Lytle Creek (CEC, 2009).

The purpose of the WBP is to provide an overview of the water quality problems and way forward actions necessary to de list Lytle Creek. While the plan goals are similar to the 2009 goals, there will be less emphasis on monitoring and more emphasis on BMP implementation. The Council working with TDEC, MTSU and local schools will carry out some monitoring, but it will be limited to finding specific problems, that can then be addressed through the implementation of BMPs or regulatory means. Lytle Creek is located almost exclusively in Rutherford County and is a part of the Stones River watershed. The plan includes the following sections:

- Identification of causes and sources (or groups of causes/sources)
- Load Reduction Estimates
- Description of Non-point Source Management Measures (BMPs)
- Cost Estimates
- Information/education
- Schedule for implementation
- Watershed Restoration Milestones
- Criteria to determine if load reductions are being met
- Measures of success (are loading reduction estimates being met?)

1) Identification of causes and sources (or groups of causes/sources)

The Tennessee Department of Environment and Conservation (TDEC) 2014 303 (d) list identifies the cause of degradation in the Lytle Creek watershed generally as siltation, loss of Biological integrity due to siltation, alteration of stream side or littoral vegetation, and *E. coli (TDEC 2014)*. Pollutant sources include land development, discharges from municipal separate storm sewer system (MS4), land development and pasture grazing (Table 1).

Table 1 (TDEC, 2014)

Waterbody ID	Stream Name	Length impacted	Cause	Source
TN05130203022 –0100	Town Creek (Formerly NT to Lytle Ck.	0.13	Low DO, *E. coli*	Unknown
TN05130203022 –1000	Lytle Ck.	8.9	Alteration in stream-side or littoral vegetative cover; Loss of biological integrity due to siltation; *E. coli*	Discharges from MS4 area
TN05130203022 –2000	Lytle Ck.	10.1	Alteration in stream-side or littoral vegetative cover; Loss of biological integrity due to siltation; *E. coli*	Pasture Grazing Land Development

2) Load Reduction Estimates

Load reduction and cost estimates can be found in Table 2 and are based on the best available data for the management practice and its ability to reduce pollutant loads according to Tennessee Department of Agriculture's Non-Point Source Division. The two core practices to address the cause (siltation) identified are riparian restoration and stream bank stabilization in both rural and urban areas. In a suburban - urban environment these practices would generally include riparian re vegetation and stream bank stabilization through cedar revetment installation, jetties, and/or bank re vegetation. In some cases the practice may include the creation of recreational greenway trails. In some urban and suburban areas as well as areas developing into urban/suburban water and sediment control basins may be installed if land area and/or developments can accommodate these practices. In more rural areas, and in addition to the above mentioned practices livestock exclusion, providing for alternative water supply or limited stream access watering points maybe necessary to restore riparian zones.

3) Description of Non-point Source Management Measures (BMPs)

The primary non-point source management measures necessary to abate the pollutant sources and causes associated with the State's 303 (d) listing of Lytle Creek in

the Stones River watershed are riparian restoration and stream bank stabilization. While the load reduction tables do indicate the greatest reductions from water and sediment control basins, the application of these is limited primarily to developing areas, with some implementation in previously developed areas.

3.1) Riparian restoration consists of two basic activities including 1) removal of the cause of degradation and 2) restoration of the vegetative community. In addition, some hydrologic conditions may need to be restored. Removal of the cause of degradation includes livestock exclusion and provision for alternative water supply. Livestock exclusion will be accomplished by fencing riparian zones. Alternative water supply may be provided by one of two mechanisms, placement of trough or tank outside the livestock exclusion zone or a limited stable access point allowing livestock to enter the creek. Based on conversations with district conservationists water supply should be provided every 2000 feet. Once livestock are excluded from the riparian zone and alternative water supply provided riparian (buffer) restoration can occur.

The Natural Resources Conservation Service (NRCS) guidance calls for a minimum of 35 foot wide buffer along rivers and streams, however other sources call for up to 100 foot buffer (Wenger, 1999). The Council will promote as wide a buffer as seemingly possible, based on land condition, landowner concerns and other factors that may apply. In an effort to leverage additional (NRCS) funds buffers need to be a minimum of 35 feet wide. However, because TDEC biologist (per. comm James R. Smith) and others have observed improvements in water quality associated with one row of trees along creek banks, and because land owner objections often have to do with loss of land to graze, crop etc. the Council will advocate for as wide as possible, but in some cases will work to reestablish minimal riparian zones (i.e. one row of trees/5ft width). Re vegetation may occur by two methods, including active planting and/or natural "volunteer" re vegetation. While the latter is more cost-effective, it may not provide as desirable a mix of biodiversity or as quick a return on investment in pollutant reduction.

Finally, in some cases it may be necessary to restore natural hydrology to the riparian zone in cases where aquatic systems are severely down cut or where channels have formed through riparian zones. This would in effect bypass sheet flow and thus pollutant load reductions associated with storm water filtration / infiltration capacity of the riparian zone.

3.2) Stream bank stabilization will be carried out along roughly 35 % of stream banks. Stream bank erosion is a significant problem in Lytle Creek and thus treating all stream banks is not cost-effective or practical. Stabilization projects will be prioritized based on protecting specific ecologic assets and treating the most significant problem areas. For example, streams with one row of or scattered trees on a highly erosive stream bank would be treated in an effort to protect and save those trees (ecological asset) providing shade and detrital material (habitat and food) to the system. Secondly, long, highly erosive segments may be treated. This should provide for the greatest load reductions at the least cost.

Table 2 – Pollutant Load Reduction and Cost Estimates

Water Body ID - TN05130203022 –2000, Lytle Creek

Practice	Code	Total Miles impacted	Miles treated (projected)	Feet treated	Sed. reduction factor (tons/ft/yr) ****	tons/yr	Costs ($/ft)	Total Cost
Riparian Forest Buffer*	391	10.1	7.575	39,996.00	0.002	79.99	$8.00	$319,968.00
Streambank/Shoreline protection**	580	10.1	5.05	26,664.00	0.047	1,253.21	$45.00	$1,199,880.00
Water and Sediment control Basin***	638	10.1	0.505	2,666.40	6.109	16,289.04	$205.00	$546,612.00
Critical Area planting	342	10.1	5.05	26,664.00	0.055	1,466.52	$33.00	$879,912.00
Total Sediment reduction in tons per year/total cost						**19,088.76**		**$2,946,372.00**

Water Body ID - TN05130203022 –1000, Lytle Creek

Practice	Code	Total Miles impacted	Amount (treated miles)	Ft treated	Sed. reduction factor (tons/ft/yr)	tons/yr	Costs ($/ft)	Total Cost
Riparian Forest Buffer*	391	8.9	4.45	23,496.00	0.002	46.99	$8.00	$187,968.00
Streambank/Shoreline protection**	580	8.9	2.225	11,748.00	0.047	552.16	$45.00	$528,660.00
Water and Sediment control Basin***	638	8.9	0.445	2,349.60	6.109	14,353.71	$205.00	$481,668.00
Critical Area planting	342	8.9	4.45	23,496.00	0.055	1,292.28	$33.00	$775,368.00
Total Sediment reduction in tons per year/total cost						**16,245.13**		**$1,973,664.00**

* Assumes 35' width both sides bank

** Assumes bank failure rate of 25%

***Treating 0.5 miles of impaired waters located in urban/suburban areas of watershed

****Estimate based on TDA NPS projected

The primary method utilized to treat eroding stream banks will be placement of cedar revetments, possibly with reshaping of banks, back fill and re vegetation. Council staff and others (i.e. Obed Community Watershed Association) have utilized cedar revetments to treat banks as high as 12 foot and generally found them effective in reducing stream bank erosion. Staffs utilize a technique developed by Jen-Hill construction for cedar revetments. The process is the same as that recommended by the Natural Resources Conservation Service, except cedar trees are bundled in coir matting, prior to being attached to the stream bank. The coir matting helps capture additional sediment by allowing cedar branches to be denser. In addition the revetment can be backfilled and re vegetated immediately following installation.

4) Cost Estimates

4.1) Technical and financial resource estimates

Rutherford County and Murfreesboro Stormwater, NRCS and the Council's technical advisors will work with individual landowners to develop site-specific plans for stream restoration projects. Best management practice (BMP) cost estimates are generally based on past experience and directly relate to stream miles impaired, causes and sources associated with the TDEC 303 (d) listing. Thus, BMP cost estimates are for the entire sub watershed impaired and presented in Table 2 along with load reduction estimates.

The Council will work with local officials on the implementation of an erosion control for developers. The majority of the erosion and sediment control program will be funded thru participating municipalities.

4.2) Sources of technical and financial resources

The Council will seek funds from multiple sources. Sources include State/EPA 319 grants, NRCS farm conservation programs such as Environmental Quality Incentives program (EQIP), private foundations such as the Fish and Wildlife Foundation, Maddox Charitable Trust ($20,000 committed), private business, and individual donors, including individual landowners. Council staff have been successful in incorporating NRCS farm programs into agricultural BMP implementation costs and has seen as much as 75% of costs covered by those programs. However, limitations exist for these programs, mainly limited funding and NRCS ability to deliver the programs in a timely manner. Thus, while this is an excellent source of cost share dollars, its limitations must be considered. Most if not all site-specific BMP implementation will require a diverse source of funding. In the suburban – urban environments NRCS funds will not be available and thus other sources of financial resources must be sought. .

4.3) Authorities who will implement the plan

The Tennessee Environmental Council's Watershed Support Center in partnership with local governments (e.g. Rutherford County, Murfreesboro), MTSU and the Natural Resources Conservation Service will be the primary agency's responsible for the implementation of the plan. In addition, the Council will work with any other agency or individuals identified with potential to impact Lytle Creek watershed restoration.

Established in 2007, the Watershed Support Center is a science and technically based watershed conservation project that has historically focused on protecting and restoring the ecological health of the respective river systems. Work has focused on river

restoration, education and outreach that focus on proactive, cooperative efforts to improve long-term conservation of Tennessee's vast water resources. Our work leverages scientific and technical experience of staff and advisors in additon to efforts of a diverse corps of volunteers who represent a crucial link in every aspect of the Watershed Support Center's work.

Some accomplishments include work funded by multiple 319 grants to focus on reduction in non-point source pollution. One project lead by McFadden for HRWA Visual Stream Assessment (VSA) in which 25 volunteers, logged over 550 hours, surveying 217 sites on 303(d) segments in the watershed. Data, including 800 photographs, included in an Access database and report produced, which is now used by staff to drive restoration program.

With a second 319 grant in 2002, DROP, in cooperation with HRWA launched the Volunteer River Restoration Corps, an ongoing effort to engage citizens, schools, municipalities, farmers and others to improve long-term water quality of Grassy Branch in the Duck River watershed by improving stream and riaprian habitat on a site by site basis. DROP/HRWA completed over twenty stream and riparian restoration projects, planting over 25,000 seedlings, and stablizing close to 1700' (+/-) of stream bank. This could not have been accomplished without volunteers. The 2002 319 grant also included gathering citizen based field data, something DROP had been doing since 1999 to assess the effectiveness of restoration efforts.

Watershed Support Center is currently working with a group of citizens in Grassy branch and the City of Spriong Hill to implement a stakeholder based restoration plan as a part of the current 319 project. The Watershed Support Center also, working under an EPA Urban Small Streams grant developed the TN Citizens Action Guide (CAG) to Watershed Assessment and Restoration and has trained over 50 citizens, stormwater directors, and educators in the basicss associated with assessment and restoration. The Council's TN Tree Project launched the 50K Tree day in 2015, planting 52000 trees in 93 TN counties with over 2600 volunteers.

5) Information/education

The Council in conjunction with NRCS, local municipalities and other partners may carry out field days for agricultural and development operators, and will work to have participating farmers/contractors present to and help recruit other farmers into the program for conservation. In addition, the Council will continue to work with youth and other groups utilizing the CAG in an effort to 1) add to information provided by TDEC and others and 2) get students involved in identifying and implementing restoration projects. The core of the educational programs will be related to getting locals to speak on behalf of restoration of the watershed and developing volunteers to help implement BMP's.

Secondly, and perhaps most importantly, the Council will work with local officials, and staff to determine the best ways to meet water quality load reductions called for above and in the sediment TMDL (EPA, 2002) on the Stones River. Our approach will be to utilize the basics of watershed science to help local officials and staffs develop effective short and long-term programs that protect watershed and water quality. One example might be to utilize the watershed treatment model (Center for Watershed Protection, 2013) to help engineering staff understand the importance of maintaining less

than 10 % imperviousness within a sub watershed or increasing the use of a practice on developments to decrease sediment loss and resulting siltation.

5.1) Erosion and Sediment Control Program

The Erosion and Sediment control program is primarily a function of local municipalities. However, given a lack of MS4 status in the upper Lytle Creek sub watershed the Council will focus its attention on the more rural residents in an effort to educate landowners about the need for an riparian BMPs and effective erosion and sediment controls. In addition, the Council will continue working with Murfreesboro and others on implementation of short and long term practices to control sediment.

6) Schedule for implementation - Total implementation time is estimated to be 20 years.

Activity	Year(s)
1) Identify and meet with project partners, landowners, Homeowners associations	1 - 10
2) Identify willing landowners, homeowners assoc., developers, etc	1 - 18
3) Develop outreach information in conjunction w/ MTSU and Water City USA	1 - 3
4) Work with city and county to implement CAG and work within the systems (i.e. local MS4s) protocol to educate developers and disseminate CAG information	1 - 3
5) Identify and train willing youth groups, scouts, schools etc	1 - 20
6) Carry out pre BMP information collection	1, 3, 5, 7, 9, 11, 13, as needed.
7) Develop site specific BMP implementation plans	2 - 18
8) Implementation of BMPs	2 – 20
9) Carry out post BMP information collection / assessment	4, 6, 8, 10, 12, 14, 16, 18, 20
10) Final report	19, 20

7) Watershed Restoration Milestones

Milestones	Year(s)
1) Site specific BMP plan development	2-18
2) Youth groups collecting information in the watershed	1 - 20
3) One community meeting per year, articles to local media	1-20
4) Develop outreach information in conjunction w/ MTSU/Water City USA	1 - 3
5) Work with city and county to develop protocol to education protocol (i.e. use of CAG)	1 - 3
6) Collect information prior to BMP implementation	1, 3, 5, 7, 9, 11, 13, as needed.
7) Site specific BMP implementation	2 – 20
8) BMP implementation assessment / analysis (survival, structure integrity)	4, 6, 8, 10, 12, 14, 16, 18, 20
9) Final report and public meeting	19, 20

8) Measures of success (are loading reduction estimates being met?)

The long-term success of the program will be measured utilizing TDEC watershed data. TDEC is in the watershed every five years collecting data through their watershed cycle. Data include benthic macroinvertebrate (BMI), habitat and physical/chemical measures. Ecological health is defined / operationalized as the inclusion of benthic macroinvertebrates communities that are deemed by TDEC as fully supporting the fish and aquatic life use of waters of the state as compared to the appropriate ecoregional reference site. Council staff will utilize TDEC data in addition to other data collected by professional and volunteers to determine if the plan and/or the TMDL need revising. The main criteria will be BMI collections as many organizations, including TDEC and U.S. EPA consider this the primary characteristic of healthy aquatic systems. However, based on individual sampling plan data (i.e. TSS) associated with localized site work, it maybe determined that a specific practice, in a specific application situation is not functioning as predicted. The practice may then be modified and/or excluded from the suite of practices being recommended. The Council may utilize the Watershed Treatment Model to access the basic watershed load reduction predictions (above) and the Georgia tool, developed by AMEC environmental (currently being adapted for Middle Tennessee) to make site level predictions as allowed. If predictions are not verified, then the plan (or TMDL) will be revised to increase the effectiveness of load reductions.

9) Monitoring component to evaluate effectiveness

Three basic monitoring components will be utilized, including 1) benthic macroinvertebrate (BMI) data collected on the five year cycle by TDEC (sentinel data) and possibly collected by Council (staff and volunteers) (site-specific) 2) physical habitat data collected on specific sites and 3) practice implementation data, such as stream miles fenced off from livestock, trees planted/survival rates, and stream bank stabilized.

Literature Cited

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