Gilleland Creek Plan

Storm Water Management Measure — Key Elements

Introduction

This document describes the key elements involved with the implementation of the management measure developed by the Storm Water Work Group[1] to address bacteria loading in the Gilleland Creek Watershed. The following measure is one of the Management Measures proposed for the Gilleland Creek Plan:

- **Determine the effectiveness of retrofitting existing flood control facilities (storm water detention basins) to perform as water quality facilities to reduce bacteria concentrations.**

These key elements for the Storm Water Management Measure will be incorporated into the implementation strategy for the Gilleland Creek Plan. The critical area for the implementation of this management measure is the upper one-third, (Assessment Unit 4) or urbanized area of the 76-square-mile Gilleland Creek Watershed. Specifically, the critical area is defined as the area that was within the City of Austin regulatory jurisdiction when storm water detention facilities were required for new development.

The Gilleland Creek Watershed originates at Hillside Springs, northwest of Pflugerville and drains to the southeast to its confluence with the Colorado River upstream of Webberville (Segment 1428). While pockets of commercial development occur along the western boundary of the watershed, the majority of the urban lands are north of the Dessau Road corridor.

An adaptive management strategy will be used to adjust the plan as needed since its initial implementation will demonstrate which management measures prove most effective given site-specific watershed conditions. The Texas Commission on Environmental Quality (TCEQ) will assess Gilleland Creek every 2 years as part of updating the Texas Water Quality Inventory and 303(d) List. As potential changes are made to the Texas Surface Water Quality Standards criteria for contact recreation and changes in the creek's water quality are observed, modifications to this plan will be made. This adaptive management strategy allows stakeholders to learn and adapt the plan as progress is made. The ultimate goal is for Gilleland Creek's four assessment units to have sufficiently low *E. coli* loading that it meets the criteria for contact recreation.

Key Element #1

This element identifies the causes of the impairment, in this case the sources of bacteria that need to be controlled, by the TMDL and the plan.

[1] Workgroup members include representatives from the Cities of Austin, Pflugerville and Round Rock, University of Texas, LCRA, and TCEQ.

Because no specific sources of the impairment were isolated during Gilleland Creek TMDL monitoring period, this key element summarizes the results of the study in both dry and wet weather conditions to support the broad ranging approach developed for the Gilleland Creek Plan.

Sampling for the Gilleland Creek TMDL occurred between October 2005 and March 2006, and the results of this sampling during dry weather conditions in this period showed that the geometric mean concentration of *E. coli* exceeded the stream criterion of 126 #/100 milliliters at six out of the 10 sampling locations. The average of the exceedance (>126) was 38.5. Some dry weather samples exceeded the single sample criterion of 394 #/100milliliters. During these conditions, effluent from the wastewater treatment facilities makes up the majority (approximately 83 percent) of flow in Gilleland Creek.

In wet weather conditions, E. coli concentrations in all samples taken at the 10 sampling locations exceeded the geometric mean criterion. Using load duration curve analysis, LCRA staff determined that during high flow conditions (greater than 45 ft3 /second) and moderate flow conditions (between 16.5 ft3 /second and 45 ft3 /second), the water quality in the creek exceeded both the geometric mean and single sample criteria. This analysis from the load duration curve showed that in order for the creek to meet the maximum allowable load of bacteria in high and moderate flow conditions, that reductions of 93 percent and 82 percent, respectively, are required. The majority of the E.coli bacteria loading to the watershed occurred during moderate to high flow (stormflow) conditions, which is indicative of nonpoint sources of bacteria.

This plan targets both point sources and nonpoint sources of bacteria contamination. The Storm Water Management Measure will determine the benefit of retrofitting flood control facilities on bacteria concentrations in storm water runoff.

Key Element #2

This element describes the management measure that will be implemented to address bacteria loads to Gilleland Creek from urban nonpoint source runoff

The Storm Water Work Group (formerly named the Structural Best Management Practice (BMP) Work Group) was created to develop strategies to address bacteria loading from urban storm water runoff. Work group members included representatives from the Cities of Pflugerville, Round Rock, Austin, Travis County, TCEQ, LCRA, and the University of Texas. At their first meeting, the work group reviewed the following structural BMP management measures:

1. Construct new water quality management facilities
2. Maintain existing water quality management facilities
3. Retrofit existing storm water detention basins to make them function as water quality management facilities
4. Manage the geomorphic characteristics of Gilleland Creek

In subsequent meetings, because of the enormous costs of constructing water quality control facilities, the work group decided to focus its discussions on the effectiveness of retrofitting existing storm water detention ponds to perform as water quality management facilities. They determined that the first step was to assess the existing storm water detention ponds for feasibility, perform a literature search of best management practices, and prepare conceptual designs to determine the cost and benefits of a retrofit program.

Through its contract with the TCEQ, LCRA assessed existing storm water detention ponds and performed a literature search of best management practices. LCRA documented the results of their work in the following report: *"Gilleland Creek Total Maximum Daily Load for Bacteria Implementation Plan, Water Quality Retrofits Screening Assessment, Can Best Management Practices Manage Bacteria?"* [2]

Through this study, LCRA conducted a field assessment of 19 storm water detention basins and concluded from its research of existing studies to use automated controls to detain storm water runoff for an extended period. Automated controls are mechanisms that rely on valves, timers, depth and rain gage sensors, and a control box to open and close the existing outlet devices to detain runoff for water quality benefits. The automated controls practices cost much less than the constructed retrofits identified in the literature review and minimally impact flood control, recreational uses, utilities, maintenance, and can more readily achieve neighborhood acceptance. Based upon this recommendation, the work group decided on the following as the management measure to address urban nonpoint source runoff for this first phase of the adaptive Gilleland Creek Plan.

Determine the effectiveness of retrofitting existing flood control facilities (storm water detention basins) to water quality facilities to reduce bacteria concentrations through the following:

- *Install automated controls at approximately two flood control (storm water detention) basins and monitor inflow and outflow with and without control.*
- *Monitor existing water quality facilities and/or use existing studies to determine effectiveness of managing bacteria*

As mentioned, the LCRA researched existing studies on storm water BMPs, particularly those focused on conditions in Texas. In 2006, the Center for Research in Water Resources (CRWR) at the University of Texas completed a study measuring the effectiveness of modifying a detention basin with automated controls to provide batch treatment of storm water runoff. The results of their study were published by the Water Environment Research in an article: *"Water Quality Performance of a Batch-Type Storm water Detention Basin."*[3]

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[2] Gilleland Creek Total Maximum Daily Load for Bacteria Implementation Plan, Water Quality Retrofits Screening Assessment, Can Best Management Practices Manage Bacteria? LCRA, with guidance from the Gilleland Creek Stormwater Workgroup, September 2008. See <waterquality.lcra.org/gill/publications>.

[3] Middleton, John; Barrett, Michael; Malina, Joseph, *"Water Quality Performance of a Batch-Type Stormwater Detention Basin*," Center for Research in Water Resources, University of Austin, July 2006.

This recommended management measure to determine the effectiveness of retrofitting existing flood control basins with automated controls is based upon LCRA's Water Quality Retrofits Screening Assessment and the findings of the Middleton and Barrett study. These studies concluded that automated controls removed total suspended solids and other parameters more effectively than conventional extended detention basins. This management measure will determine the effectiveness of automated controls on removing *E.coli* bacteria. This document describes the key elements for implementing automated controls for a set period at two flood control (storm water detention) basins and monitoring inflow and outflow with and without those controls. It should be noted that this retrofit will be designed so as not to adversely impact the original intent of the detention basin and will not be allowed to cause flooding to adjacent lands.

Key Element #3

This element estimates the potential bacteria load reductions that can be achieved by this management measure if implemented in the Gilleland Creek Watershed.

Percent Removal

The ability of extended detention facilities to remove total suspended solids (TSS) and other contaminants from storm water has been demonstrated, with probable TSS removal ranging from 50 to 95 percent (Middleton et. al., 2008). However, the potential ability of these facilities to remove bacteria more clearly defined in another recent study:

> "Swale and detention pond BMPs appear to have low effectiveness in reducing bacteria and in some cases have the potential for exporting bacteria…Due to the wide variability of bacterial data, it is difficult to make accurate estimates of expected pollutant loading and pollutant removal that are transferable from site-to-site with any degree of confidence." In the fecal coliform data presented for detention basins, five of nine showed geometric mean concentrations to be higher in the inflow than the outflow while, conversely, four showed higher concentrations in the outflow. (Clary et. al., 2008).

As this study shows, bacteria removal is more complex than TSS removal as well as more difficult to quantify. For example, the work group noted that bacteria reductions could be offset by waterfowl and wildlife that are drawn to the new habitat created by a BMP.

Evaluating BMP performance

Literature notes that it is not appropriate to quantify the benefit provided by a storm water BMP based entirely on its percent removal of a particular contaminant. Instead, the benefits should be based on the cumulative effects of reducing concentrations, volume, and total load. For example, experts in the work group noted that BMPs such as bioretention, vegetated biofilters, and in some cases, dry-extended detention basins, have the ability to reduce runoff volumes via infiltration and/or evapotranspiration losses. Therefore, in spite of the lack of literature data demonstrating high percent removal of bacteria, these BMPs may have some limited effectiveness in reducing bacteria load into

Gilleland Creek by accounting for a combination of volumetric and total bacteria load reductions. For this reason, further study is warranted on the effectiveness of retrofitting detention facilities to perform as water quality facilities.

Key Element #4

This element identifies technical and financial assistance and the authority needed to implement this management measure.

Technical assistance

The CRWR is a research component of the Bureau of Engineering Research at the University of Texas at Austin. CRWR carries out advanced research, education, design, and planning in water resources and waste management, primarily related to Texas. CRWR staff members are well situated and have the technical resources to conduct this study for the Gilleland Creek Plan and stakeholders.

Financial assistance

To conduct this study over the next 4 years, CRWR has estimated that it would need approximately $216,000 to cover salary, fringe benefits including student tuition reimbursement, equipment, including automated controls and automatic water quality samplers, supplies, transportation, and laboratory analysis costs. To manage storm water monitoring costs, LCRA recommends that the detention ponds selected for the study be located in a centralized location to limit transportation time and expense. Adequate funding is currently available through the TCEQ TMDL team to implement this study.

The stakeholders and CRWR have identified the following specific tasks needed to implement this measure:

- Identify two flood control basins and establish agreements with the appropriate homeowners associations
- Perform design of the inflow and outflow structures
- Prepare monitoring plan and program
- Obtain appropriate local permits from the City of Austin and/or other political jurisdictions
- Secure equipment
- Convert inflow and outflow structures
- Install automated controls and monitoring equipment
- Collect storm samples and send to LCRA’s Environmental Laboratory Services (20 samples, 2 ponds over 10 storm weather events)

- Lab analysis of samples (TSS, *E.coli*, Nitrate, dissolved and total Phosphorus, TKN and other common urban pollutants, such as zinc, copper, lead, and pesticides)
- Analyze data
- Prepare draft and final report of findings
- Review and edit report
- Communicate findings to stakeholders

Key Element #5

This element describes the education component to enhance the public understanding of the Gilleland Creek Plan and to encourage their participation.

For this management measure, the Education and Outreach and Storm water Work Group identified and prioritized education activities and programs that would enhance local developers' understanding of this management measure as well as the public's understanding of storm water management. The following is a summary of the Education and Outreach Work Group recommendations.

Detention Pond Retrofit Workshop – The University of Texas will host an education/demonstration workshop and field tour with stakeholders and developers near the end of the monitoring period to enhance the understanding of retrofitting detention ponds with automated controls to address urban nonpoint source runoff.

Detention Pond Retrofit Final Report – The University of Texas will make available the final report of this study to stakeholders, developers, and the public.

Watershed workshop and tour

The Texas Stream Team [4] will host a watershed workshop and tour to enhance the public and stakeholder understanding of the watershed, to build support for accomplishing the Gilleland Creek Plan and to increase the public's knowledge of pollutant reduction activities. The watershed tour will include stops to illustrate the progress being made toward implementing the plan such as the flood control ponds retrofitted with automated controls, a wastewater treatment facility, natural features, such as riparian areas, an agricultural best management practice, and a water quality monitoring demonstration.

Educational workshops and materials for developers

The Education and Outreach Work Group also identified workshops for developers as a high priority education activity. The purpose of these workshops as well as the educational materials will be to educate developers on the requirements of the Gilleland Creek Watershed Water Quality Ordinance Framework, the use of automated controls in

[4] Texas Stream Team, formerly, the Texas Watch Program, is a statewide water-quality monitoring network of concerned volunteers, partners, and institutions.

flood control facilities and general information on good storm water management practices. The video described below is an example of education materials on storm water management practices that could be used. This workshop is planned to be a collaborative effort between the jurisdictions in the watershed and the City of Round Rock, who has in its Municipal Separate Storm Sewer System (MS4) Storm water Management Program an outreach activity for the development community in Year 3 or 2011.

Educational material on storm water management

The U.S. Environmental Protection Agency (EPA) has made available many resources for education and outreach. In this video, the EPA and the U.S. Botanic Garden produced an online video: <www.epa.gov/nps/lid>, *"Reduce Runoff: Slow It Down, Spread It Out, Soak It In,"* that highlights green techniques such as rain gardens, green roofs, and rain barrels to help manage storm water runoff. The film showcases green techniques that are being used in urban areas to reduce the effects of storm water runoff on the quality of downstream receiving waters. The techniques are innovative storm water management practices that manage urban storm water runoff at its source and are effective at reducing the volume of storm water runoff and capturing harmful pollutants. LCRA will provide a link to this video on it Gilleland Creek TMDL website. Also, LCRA has additional material on its website regarding storm water management and its Highland Lakes Watershed Ordinance.

<www.lcra.org/library/media/public/docs/nps.pdf>
<www.lcra.org/water/quality/watershed/storm water_credits.html>
<www.lcra.org/cleanwater/storm water.html>

Key Element #6

This element provides a schedule with milestones for implementing this management measure.

Table 1. Milestones for Storm Water Management Measure

Year	Milestone
2009	Stakeholders and TCEQ Commissioners approve the Gilleland Creek Watershed Plan TCEQ executes a contract with University of Texas Center for Research in Water Resources
2010	CRWR secures two detention facilities and appropriate permits CRWR designs retrofit and converts structures
2011	CRWR monitors ponds during storm events
2012	CRWR analyzes data and prepares report
2013	Final report published Stakeholders will review final report to assess if this management measure should be implemented throughout the Gilleland Creek Watershed.

Key Element #7

This element highlights the interim, measurable milestones for each measure that will be used to determine its ongoing progress and effectiveness. These milestones are listed in sequential order.

- Two flood control basins are successfully retrofitted with automated controls
- Ten storm events are monitored at each pond
- Data is sufficient to make a determination on the effectiveness of automated controls in reducing TSS and bacteria concentrations

Key Element #8

This element defines the indicators that will be used to document improvements in water quality due to implementation of this management measure.

The indicator used to document water quality improvements is the following: a reduction in *E. coli* concentrations in the outfalls of the two ponds that will be retrofitted with automated controls.

Key Element #9

This element describes the monitoring component of the Plan to determine the attainment of the water quality standards throughout the watershed.

The following summary describes routine water-quality monitoring activities for each of the four assessment units in the Gilleland Creek Watershed. The LCRA currently monitors in Assessment Unit 1 and 2 and proposes to begin monitoring in Assessment Unit 3. The TCEQ currently monitors in Assessment Unit 4. The purpose of this monitoring is to ensure that enough *E.coli* data is collected in each of the four assessment units to determine water quality standards attainment throughout the watershed.

Beginning with the 2010 assessment, TCEQ will require ten sample results over a 7-year period to do a full assessment. If 10 samples are not available, TCEQ will use 10 years to obtain the minimum (10) number of samples. With less that 10 sample results, TCEQ can only identify a water body as a concern and not impaired.

Also included in this element is a summary of the City of Austin's monitoring activities and the Colorado River Watch Network (volunteer water-quality monitoring) program. An attached map illustrates these monitoring programs in the watershed.

Assessment Unit 1 (AU 1): From the Colorado River upstream to Taylor Lane.

Site 17257, Gilleland Creek at FM 969 is downstream of Webberville Road/FM 969, east of Austin. It will be monitored on a bimonthly basis (six times per year). This is a current

and historical site monitored by LCRA and will provide quality assured data for **AU 1**. This site has already compiled enough data for determination of standards attainment.

Assessment Unit 2 (AU 2): From Taylor Lane upstream to Old Highway 20.

Site 12235, Gilleland Creek at FM 973 south of the city of Manor will be monitored on a bimonthly basis (six times per year). This is a current and historical site monitored by LCRA, and will provide quality assured data for **AU 2**. There should be enough data for standards attainment determination for the 2010 assessment.

Assessment Unit 3 (AU 3): From Old Highway 20 to Cameron Road.

Site 12236, Gilleland Creek at US 290 north of Manor has been monitored historically and will potentially be continued by LCRA bimonthly (six times per year) starting in TCEQ's FY 2010. This site should provide quality assured data for **AU 3**. Monitoring at this site should produce enough data to determine standards attainment by the 2014 assessment.

Assessment Unit 4 (AU 4): From Cameron Road to the spring source.

Site 20474, Gilleland Creek at Northeast Metropolitan Park, southeast of Pflugerville (at the low water crossing 1.559 kilometers north, 302 meters west to the intersection of Killingsworth Lane and Cameron Road) is a newly established site which TCEQ began monitoring in 2009. It will be monitored quarterly (four times per year). It will provide quality assured data for **AU 4** and should provide enough data to determine standards attainment by the 2014 assessment.

Other sources of data that may or may not be used in the assessment of Gilleland Creek for 305b/303d purposes include: water quality monitoring by City of Austin and monitoring conducted by Colorado River Watch Network volunteers. The City of Austin may submit monitoring results under the quality assurance of the LCRA Clean Rivers Programs Quality Assurance Project Plan. The City of Austin will discuss this possibility with the LCRA at the 2009 Clean Rivers Program Coordinated Monitoring Meeting. At present, Austin's *E.coli* data is analyzed at an in-house, non-NELAC approved lab, and therefore can not be used for assessment purposes but will be used by the City to calculate their Environmental Integrity Index, which is a tool developed to monitor and assess the ecological integrity of Austin watersheds. Water chemistry data is collected quarterly and biological and habitat surveys are conducted once per year in the summer.

Certified Colorado River Watch Network (CRWN) volunteer water quality monitors will submit to LCRA a minimum of six data points per year from the following sites: Gilleland Creek at Edgemere, Gilleland Creek below Bohl Park (12239), Gilleland Creek at Picadilly Lane (18763), Gilleland Creek at lower end of Gilleland Park at Railroad, and Gilleland Creek at Grand Avenue Parkway. CRWN data is not TCEQ quality assured and will not be used for assessment purposes. Since CRWN volunteer monitoring data provides more frequently collected data from more locations, it might be able to find problem areas that can be addressed by professional monitoring data collection efforts.

Key Element #10

This element provides the following list of entities responsible for implementing the Storm water Management Measure.

University of Texas, Center for Research in Water Resources (CRWR) **–** When funded, manage and implement the work outlined in Key Element #4

City of Austin/ Travis County – Approve permit amendments for the retrofitted flood control ponds

City of Round Rock – Coordinate developer workshop

LCRA – Host annual Clean Rivers Program Steering Committee meetings

TCEQ – Fund and administer CRWR contract

Texas Department of Transportation – As with all TPDES permits in the Gilleland Creek Watershed, the Texas Department of Transportation can not discharge bacteria into the Gilleland Creek Watershed unless their Storm water Management Program through the General Permit for Phase II Municipal Separate Storm Sewer Systems is consistent with the approved TMDL and the implementation plan.

References

Clary, Jane, Jonathan Jones, Ben Urbonas, Marcus Quigley, Eric Strecker, and Todd Wagner. 2008. *Can Storm water BMPs Remove Bacteria? New Findings from the International Storm water BMP Database.*

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