THE CITY OF KNOXVILLE
TENNESSEE

NPDES Permit Annual Report

CITY OF KNOXVILLE
BILL HASLAM, MAYOR

National Pollutant Discharge Elimination System
Stormwater Discharge Permit TNS068055
July 1, 2006 - June 30, 2007

CITY OF KNOXVILLE
BILL HASLAM, MAYOR

Engineering Division
Stephen J. King, P.E.
Director

December 24, 2007

Ms. Pamela Myers
Tennessee Department of Environmental and Conservation
Division of Water Pollution Control
Attention: Compliance Review
401 Church Street
L & C Annex, 6th Floor
Nashville, TN 37243-1534

RE: City of Knoxville, NPDES MS4 Permit # TNS068055
2006 – 2007 Annual Report

Dear Ms. Myers:

The City of Knoxville is pleased to submit the third annual report for the NPDES permit issued July 1, 2004. This annual report summarizes the NPDES activities during the twelve-month period of July 1, 2006 through June 30, 2007. The annual report was coordinated and prepared by the Engineering Division in conformance with the reporting requirements in the City's NPDES Permit Part VI.

If you have any questions or wish to discuss any of the NPDES Permit programs, please contact me by email at dhagerman@cityofknoxville.org or by phone at (865) 215-3251.

Sincerely,

David Hagerman, P.E., Stormwater Management

CITY COUNTY BUILDING • SUITE 480 • 400 MAIN STREET • P.O. BOX 1631 • KNOXVILLE, TENNESSEE 37901
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CITY OF KNOXVILLE
BILL HASLAM, MAYOR

Engineering Division
Stephen J. King, P.E.
Director

December 24, 2007

Ms. Natalie Ransone Harris
Tennessee Department of Environmental and Conservation
Division of Water Pollution Control
3711 Middlebrook Pike
Knoxville, TN 37921

RE: City of Knoxville, NPDES MS4 Permit # TNS068055
2006 – 2007 Annual Report

Dear Ms. Harris:

The City of Knoxville is pleased to submit the third annual report for the NPDES permit issued July 1, 2004. This annual report summarizes the NPDES activities during the twelve-month period of July 1, 2006 through June 30, 2007. The annual report was coordinated and prepared by the Engineering Division in conformance with the reporting requirements in the City's NPDES Permit Part VI.

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Signature and Certification

NPDES STORMWATER PERMIT TNS068055
2006/2007 MUNICIPAL ANNUAL REPORT

FOR: City of Knoxville, Tennessee

Federal regulations, 40 CFR 122.22 (a) (3) and 122.22 (d), require the application and reports for the NPDES permit to be signed and certified as follows:

> *For a municipality, State, Federal, or other public facility, by either a principal executive officer or ranking elected official.*
>
> *"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."*

Bill Haslam
Mayor

12.21.07
Date

Stephen J. King, P.E.
Public Works Director

12-21-2007
Date

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1.0 INTRODUCTION

The Tennessee Department of Environment and Conservation, Division of Water Pollution Control issued the City of Knoxville a National Pollutant Discharge Elimination System (NPDES) Permit (TNS068055) for the discharge of stormwater from the municipal separate storm drain system (MS4). Stormwater from the City of Knoxville discharges directly to the Tennessee River and to major creeks that drain to the Tennessee River. Only a small portion of the MS4 runoff will drain to sinkholes, ponds, and lakes throughout the area. The City's first NPDES Permit was issued on July 1, 1996 and expired on June 28, 2001. In December 2000, the City submitted a reapplication as part of the Year Four annual report. The current permit was approved and made effective July 1, 2004. The City will reapply in the report to be submitted in December 2008.

The NPDES Permit requires an annual progress report for the Stormwater Management Program outlined in the Part I and Part II applications. This annual report was completed in accordance with the reporting requirements of Part VI of the permit and will complete the requirements for the permit year from July 1, 2006 through June 30, 2007.

The Stormwater Quality Section of the City of Knoxville Engineering Division coordinated preparation and submittal of the system-wide annual report. Information for the annual report has been provided by the Engineering Division, Public Service Division, Solid Waste Management office, and Knoxville/Knox County Emergency Management Agency (KEMA). The Engineering Division has compiled the available information into the format outlined in Part VI of the current NPDES Permit.

2.0 CONTACTS LIST

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Stephen J. King, P.E., Director
Department of Public Works (865) 215-6100 sking@cityofknoxville.org

Mailing Address: City of Knoxville
P.O. Box 1631, Suite 480
400 Main Street
Knoxville, TN 37901

3.0 STORMWATER MANAGEMENT PROGRAM (SWMP) EVALUATION

The objective of the City of Knoxville's SWMP is to protect the taxpayer's health, safety, and welfare through an economically viable comprehensive stormwater quality and quantity program. Although it would be impossible to list all of the City's water quality related accomplishments in this report, the City is proud to report some of the major accomplishments related to the SWMP that occurred during the third year of the new NPDES permit term.

- The City initiated a major improvement project on Third Creek that restored over 7,600 feet of degraded and channelized stream. The Tennessee Stream Mitigation Program (TSMP) provided the primary funds and administration for the project. The City provided land, coordination, access, easements, and $100,000 for matching funds. The City met with each of the private land-owners several times to explain the project and to obtain permanent conservation easements.

The primary goals of the project are to reduce sediment, invasive vegetation, and the existing hydromodification of the creek while improving habitat, riparian zones and water quality. A secondary goal is to reduce flooding by restoring the creek's access to the floodplain with a high-flow over bank.

Buck Engineering substantially completed the design plans in year two. Construction began in the fall of 2006. The initial focus was to meander the channelized section of stream downstream of Sutherland Avenue (see photo). The section of creek was apparently straightened in the past, which has caused slow widening of the channel and a steady loss of trees. Soil was removed from the floodplain to provide some additional storage and reduce erosive flows. The areas around the creek were stripped of all invasive species of vegetation and replanted with native trees and shrubs. Volunteers from the community and property owners will be involved with maintenance and monitoring in the future. More information on the project and plans is available at www.tsmp.us.

- The City of Knoxville continued to expand the greenways/buffers zones along the major waterways. The City currently maintains over 40 miles of trail distributed over 31 greenways. These linear parks help protect the adjacent waterways with natural buffers and provide opportunities for stream enhancements.

- A total of 5,216.38 tons of recyclables was collected at the City's eleven solid waste drop-off recycling centers in 2006. This is a 334-ton increase over the previous year. One of the temporary recycling drop-off centers was relocated this year to a permanent facility at Park Village Road near Cross Park Drive. The City maintains updated information on the web at http://www.cityofknoxville.org/solidwaste/recycle.asp.

- The City's Solid Waste office was part of a citywide steering committee that developed Earthfest 2006, which celebrated the 34th anniversary of Earth Day at Worlds Fair Park. Over 9,000 people attended the event, which had over 100 exhibitors from the environmental community.

- The year 2007 was the 18th year for the River Rescue, which is coordinated by Ijams Nature Center and the Water Quality Forum partners. The spring 2007 River Rescue attracted 750 volunteers who collected 14 tons of trash and 25 tires from the shores of the Tennessee River.

- During year three, the City partnered with Knox County to develop a pilot Masterplan and Model for First and Whites Creek. After careful review by the consultant, the City and County chose the MIKE URBAN SWMM model to for this work. The initial focus is to resolve significant flooding problems in the watershed but this model allows the water quality components to be developed later. If successful, this work will be expanded to other watersheds as funds become available.

Since the stormwater quality program officially started in 1996, the City has defined a baseline to compare future surface water improvements and/or degradations. Although the continuing improvements are incremental and difficult to measure quantitatively, many programs initiated since the inception of this program have undeniably improved quality of surface waters throughout the city. The long-term results should become apparent in future years. The City implemented many of the SWMP tasks beyond the minimum permit requirements and will continue to advance the water quality programs beyond the minimum requirements as economically feasible.

4.0 STORMWATER MANAGEMENT PROGRAM SUMMARY TABLE

SWMP activity summary tables for the last year of the NPDES permit program were compiled in accordance with the reporting requirements specified in Part VI(A)(2)(c) of the permit and included on the next few pages. Although the summary tables concisely document many program activities, some activities could not be quantified and have therefore been omitted.

4.0 Stormwater Management Program Summary Table

MONITORING TASKS WET/DRY WEATHER	SCHEDULE OF ACTIVITIES	SCHEDULE FOLLOWED	ACTIVITIES ACCOMPLISHED	COMMENTS
Repeat High Parameter Sites	20 Outfalls repeated from year six	Yes	25	Each outfall tested at least four times this year
Field Screening Industrial Outfalls	Visits to Industrial outfalls	Yes	52	Continued retesting outfalls from Industrial areas (four times)
Total Field Screening Outfalls	High Parameter repeats + 30 to 40	Yes	161	All field data sheets available for inspection. Outfalls tested four times this year.
Full Suite Stormwater Analysis (one station per year)	One Station pr year	Yes	1 sample	Full Suite sample obtained at Acker Place Monitoring Station.
Storms Sampled at 5 monitoring stations	1 storm / quarter / 5 sites	Yes	20 storms	Summer: 5 storms, Fall: 5 storms, Winter: 5 storms, Spring: 5 storms
Ambient Samples at 5 monitoring stations	1 sample / quarter / 5 sites	Yes	20 samples	Summer: 5 samples, Fall: 5 samples, Winter: 5 samples, Spring: 5 samples
Storm Drain Televised	As Needed	Yes	3,974 feet	Pipes are defined as sections between inlets, catch basins, junction boxes, or outlets.

STORMWATER MANAGEMENT & INDUSTRIAL PROGRAM TASKS	SCHEDULE OF ACTIVITIES	SCHEDULE FOLLOWED	ACTIVITIES ACCOMPLISHED	COMMENTS
Stormwater Quantity Requests for Service (Received / Resolved)	As Needed	Yes	650/795	Complaints are investigated as received and resolved as solutions or resources are available
Stormwater Quality Requests for Service (Received / Resolved)	As Needed	Yes	208/257	Complaints are investigated as received and resolved as solutions or resources are available
Site Development Workshops	Annually	Yes	92	Included Engineers, contractors, developers, & surveyors involved in land disturbing activities.
Stormwater GIS Field Investigations for Annexations	As Required	Yes	9	Newly annexed areas are investigated within 60 days for all storm drain features and possible pollution sources.

4.0 Stormwater Management Program Summary Table

STRUCTURAL CONTROLS	SCHEDULE OF ACTIVITIES	SCHEDULE FOLLOWED	ACTIVITIES ACCOMPLISHED	COMMENTS
Street Cleaning	Daily/Bi-Weekly	Yes	32,512 Miles	Daily for downtown streets. Frequency varies for other streets.
Litter Pick-up, Hand	As Needed	Yes	54,544 Bags	Routine Schedule
Catch Basin Cleaning and Repair	As Needed	Yes	9,322 Jobs	Per work order and requests
Ditching: Hand, Truck, & Track/Gradall	As Needed	Yes	13,014 Feet	Per work order and requests
Storm Drain Installation & Repair	As Needed	Yes	92 Jobs	Per work order and requests
Brush & Leaf Pick-up	Bi-Weekly	Yes	13,799 Loads	Bi-Weekly curb pick-up
Seed/Sod, ROW	As Needed	Yes	61 Jobs	Per work order and requests
Storm Drain Cleaning	As Needed	Yes	25,561 Feet	Per work order and requests
Grate Replacement	As Needed	Yes	47 Jobs	As Needed
Field Inventory & Inspection of On-Site Detention Facilities	Within 60 Months	Yes	As needed	All new facilities are mapped after construction is complete. Existing facility's inventory is complete.
Creek Cleaning by Creek Restoration Crew	As Needed	Yes	83 Jobs	Creeks are inspected and cleaned on a routine schedule
Tree and Plant Planting	When Applicable	Yes	398 trees	Trees were planted by the City's Service Department
Total Waste Recycled	As Brought In	Yes	32,794 tons	5,466 tons of paper, metal, plastic, glass, etc. and over 33,085 tons of yard wastes

4.0 Stormwater Management Program Summary Table

EDUCATIONAL PROGRAM TASKS	SCHEDULE OF ACTIVITIES	SCHEDULE FOLLOWED	ACTIVITIES ACCOMPLISHED	COMMENTS
Water Quality Hotline	Within 24 Months	Yes	Undetermined	Hotline number has been published in phone book, on road signs, pamphlets, magnets, radio PSA's, etc.
River Rescue	Annual Event	Yes	1 day event	14 tons of trash and 25 tires removed by 750 volunteers from 30 sites.
Water Quality Forum	Meets Monthly and Quarterly	Yes	Undetermined	Three committees meet monthly to plan projects focused on urban water quality.
Storm Drain Marking	As Needed or by volunteers	Yes	Approx.	Catch Basins marked with decals labeled "Dump No Waste-Drains to Waterway"
Volunteer Creek Cleanups	Volunteers	Yes	Several sites on several creeks	A citizen based program that periodically hosts several creek cleanups in the spring and fall
Waterfest	Annual Event	Yes	1 Day Educational Event	A unique community event dedicated to educating citizens about water quality. Over 900 youths, 175 teachers & parents, and 100 volunteers participated.
Pooper Scoopers	As Needed or by volunteers	Yes	~7,700	Disposable dog waste containers were distributed to 9 different pooper scooper stations.

NEW DEVELOPMENT PROGRAM TASKS	SCHEDULE OF ACTIVITIES	SCHEDULE FOLLOWED	ACTIVITIES ACCOMPLISHED	COMMENTS
Residential/Commercial Inspections	As Required	Yes	576	As Required
Final Inspections	As Required	Yes	226	As Required
Site Development Permits Reviewed	As Required	Yes	1567	As Required
Right of Way Permits Issued	As Required	Yes	98	As Required
As-Built Certificications Reviewed	As Required	Yes	148	As Required

5.0 NARRATIVE REPORT

The following narrative report is divided into the five main programs of the SWMP plus an additional section for specific TMDL activities. The SWMP is described in the program element schedules listed in Part II of the permit application and Part III of the permit. The main programs are listed as follows:

5.1 Residential and Commercial Program (RC).
5.2 Illicit Discharges and Improper Disposal Program (ILL).
5.3 Industrial and Related Facilities Program (IN).
5.4 Construction Site Runoff Program (CS).
5.5 Comprehensive Monitoring Program (MN).
5.6 TMDL Implementation and Activities.

Each of the above programs are further divided into separate program elements and related tasks that correspond to the Implementation Schedules listed in Part IV of the Permit and to the requirements listed in 40 CFR 122.26(d)(2)(iv). Each specific task is briefly discussed in accordance with the reporting guidelines outlined in Part VI of the NPDES Permit. Some sections of this report may be an abbreviated version of earlier reports when the particular task elements are ongoing. Changes for the new permit cycle are discussed where applicable.

5.1 RESIDENTIAL AND COMMERCIAL PROGRAM (RC)

Program of Structural and Source Controls for Reducing Pollutants to the Municipal Separate Storm Sewer System, 40 CFR 122.26(d)(2)(iv)(A).

RC-1 Maintenance Activities for Structural Controls

SWMP Task: Continue Existing Maintenance Activities from Part 2 application, pp. 5-5 to 5-9.
Status: Ongoing

The City's Public Service Department (PSD) currently performs maintenance of the municipal stormwater system. The PSD has developed and maintained an extensive database to track work tasks performed during the year. The database not only tracks labor category (e.g., Equipment Operator) and labor hours devoted to each task, but also includes equipment type and costs. The PSD database produces summary reports for monthly and annual work production and costs. The database includes more than 80 task activities of which 18 were identified as relating directly or indirectly to stormwater management. Only a small portion of the stormwater conveyance system is located on public rights-of-way and city-held easements. The City generally assumes no responsibility for maintenance or improvements on private property even though crews may work in some of those areas to remove blockages, spills, and trash with permission or in emergencies.

Maintenance by the City within rights-of-way and easements is normally performed on an as-needed basis by the PSD. Approximately 75 percent of the storm drainage system maintenance work performed by the PSD is in response to direct calls from property owners and requests from the Engineering division. The remainder of the storm drainage system maintenance work is in response

to maintenance needs detected by the PSD, such as repairing collapsed pipes. Under normal conditions, the PSD can respond to all complaints that are the responsibility of the City as defined by the City's stormwater policy.

Under the current system, the PSD has divided the City into six geographic maintenance zones, for routine work. Duties performed in each zone relating to stormwater are brush collection, leaf collection, street sweeping, and the cleaning of curb inlets. Catch basins are inspected annually. Cleaning and maintenance of catch basins are performed "as-needed". Most drainage facility maintenance is performed in response to complaints or known problems. The PSD logs all complaints by address and by category into the computerized database. The Construction Division of the PSD performs non-routine storm drain maintenance and installation.

The City has three 7-person multipurpose construction crews that perform storm drain installation. One of their primary responsibilities includes installing various sizes of corrugated metal pipe and reinforced concrete pipe, major repair to existing storm drains, and building catch basins. Each of the crews has seven employees, a backhoe, two single-axle dump trucks, and one 3/4-ton pickup truck. A 12-ton tool truck services all crews. These crews also provide emergency response in the event of flooding. The Storm Drain Maintenance Crew has five employees. They perform such tasks as: clearing culverts of debris, flushing storm drains, hand and mechanical ditching, and performing minor catch basin repair. A Storm Drain Vacuum Machine, a ditching machine, and a 3/4-ton pickup truck with a small crane are used to perform these tasks.

SWMP Task: Develop Improved Stream Restoration and Channel Maintenance Program.

Status: Complete

Stream restoration and channel maintenance were addressed with two new programs during the first permit cycle. These programs included stream bank stabilization projects to reduce erosion and sediment and a creek restoration crew to remove litter, debris, and flow blockages. The City has improved this program by providing an annual grant to the Tennessee Izaak Walton League for removing debris and blockages on the major urban creeks. The summary report for the TN IWL's efforts are included in appendix of this report. Removal of the dams helps prevent streambank erosion and reduce large destructive pools of silt and trash. The IWL primarily used chain saws and hand tools to restore flow and remove the unnatural dams. Large or heavy objects require assistance by heavy equipment. The City properly disposes all of the trash and debris.

With the addition of the Izaak Walton League's work in the creeks, the 4-person Creek Restoration Crew that was added to the Public Service Department in 1996 will now be able to focus their attention on the maintaining the stormdrain system as the Stormwater Maintenance Crew. Obviously, the crew will still respond on a work order basis for work in the creek when needed. This new division of responsibilities has proven to be an improvement over the initial program that was created in the first permit term. The crew still has access to a knuckle boom and a single-axle dump truck for performing their work. The crew has been trained and is used to assist with illicit discharge investigations in the MS4.

Since the City's NPDES permit program began in 1996, several bank stabilization projects have been completed with the help of TDEC, TVA, USCOE, UTK, and CAC Americorps along urban creeks throughout the city. The first demonstration project was completed Fall 1997 at Inskip Ball Field by using natural fiber coconut rolls and jute fiber mats and a synthetic mattress to protect the grass and live stakes during high water. Similar projects have been completed on Goose Creek,

First Creek, Love Creek, and along Second Creek above the Worlds Fair Park.

Since sediment, hydromodification, and habitat alteration are the most common impairments in our urban creeks, the City will continue to focus on stream restoration projects where possible. Although these projects will certainly vary in scope, biostabilization techniques will be used instead of concrete or riprap. Whenever possible, the adjacent riparian zone will be enhanced with trees and native vegetation to provide cooling effects and help restore habitat. The City will work with TDEC to obtain the appropriate ARAP permits before work begins.

SWMP Task: Implement Improved Stream Restoration and Channel Maintenance Program.

Status: Ongoing

The City has completed some initial flood control projects in the upper portion of First Creek. These projects focus on improving flow capacity but include the benefit of stabilized creek banks and improved high-flow bench. The design for the lower sections of the First Creek project will include the same concept for stabilizing the low-flow channel and creating access to the floodplain. Stream improvements and watershed modeling in First Creek will continue to be a priority in the next year. The 2007/2008 budget includes $1,200,000 to continue improvements in First Creek.

The 2003 ordinance revisions added a significant improvement to the stream restoration program. The City began requiring private development to stabilize eroding creek banks on their project sites before completing their development. The ordinance specifically prohibits the use of hard armor unless no better alternative exists. TDEC can exempt the work if they determine that stabilization efforts would do more harm than good.

The City initiated a major improvement project on Third Creek in 2005 to restore over 7,600 feet of degraded and channelized stream. The goals of the restoration project are to reduce sediment, hydromodification and flooding while improving habitat, riparian zones and water quality. Projects of this magnitude should help comply with the TMDLs for sediment and habitat alteration.

The proposal for the restoration project was presented to the Tennessee Stream Mitigation Program (TSMP) in year one and was approved. In year two, City Council approved $100,000 of matching funds for the restoration project, which was estimated at over $1,000,000.

The City obtained letters of commitment from each the private landowners and later obtained signed Land Preservation Agreements (LPA) for the areas adjacent to the project site. The City owns the largest portion of property to be impacted by the restoration project and signed the LPA for the construction area in 2006. The preservation areas are approximately 100' wide in most areas.

Buck Engineering completed the design of the project in the summer of 2006 and construction started in the Fall of 2006. More information about this project can be obtained at www.tsmp.us. The first section of creek below Sutherland Avenue was significantly improved by restoring the original meanders. The 90-degree bend was smoothed out and the entire reach stabilized. Invasive species plants were removed and native species were planted in year three.

Opportunities to implement large-scale restoration projects such as the First Creek and Third Creek projects may not be feasible every year. However, the City will continue to focus when feasible on large projects, which may produce significant and measurable impacts.

SWMP Task: Implement Structural Controls To Prevent Floating Discharges To The TN River.

Status: Ongoing

Since the summer of 1999, the City has coordinated with TVA, UTK, TDEC, USACOE, the Isaac Walton League (IWL), Keep America Beautiful and area businesses to reduce the amount of floating pollution entering the river from the urban creeks. The City has studied and identified several possible solutions. Short-term solutions have included increasing the frequency of the maintenance at the mouths of the major creeks, adding more trash receptacles at bus stops, increasing public awareness, installing temporary skimmers, etc.

During the first permit term, the City donated a new boat and hundreds of feet of trash skimmers to help the IWL collect litter and debris along the riverfront in the downtown area. The City will continue to fund replacement of the skimmers (left) as long as they remain effective. The City has contracted with the IWL to maintain a "Litter Free Zone" from the South Knoxville Bridge to the Alcoa Highway Bridge. Although the focus of this initiative has largely been to reduce unsightly trash from entering the river, the floating trash skimmers at the mouths of the creeks have also effectively detained oil spills until remediation personnel could respond. According to the IWL, the booms have successfully prevented tons of floating material that would otherwise have been discharged from the creeks into the river. All of the trash skimmers have been purchased with penalty funds collected from polluters. Due to the age of the skimmers, the City will likely replace major portions in the future.

SWMP Task: Require Standard Maintenance Agreement for On-site Facilities.

Status: Ongoing

Since 1997, permanent maintenance agreements and/or covenants have been required for all new stormwater detention facilities and special pollution abatement devices (i.e. oil/water separators, catch basin inserts, etc.). To speed up the permit review process the original "Agreement" referred to in the Part II application and Part IV of the permit has been replaced with a "Covenants", which does not require the Mayor's signature or council approval. The end result for water quality protection and flood control is the same. The Stormwater and Street Ordinance section 22.5-34 now requires the owner of the property to execute a legal document entitled "Covenants for Permanent Maintenance of Stormwater Facilities" and record it in the office of the Knox County Register of Deeds before a site development permit is issued.

In the case of a lessee, the Stormwater and Street Ordinance Section 22.5-5 allows the City to require a Performance and Indemnity Agreement along with a surety bond or letter of credit to assure the stormwater facilities will be maintained and removed, if necessary, at the end of the lease. This is a new provision to allow some property owners the ability to share the responsibility of maintenance with the lessee who will use the land and create the need for the stormwater facility. The lessee must also pay the City no less than $5,000 to compensate for any perpetual maintenance that may be required after the expiration of their lease.

The City will retain the right to inspect to insure that the stormwater facilities are properly maintained, however, the responsibility for the maintenance of stormwater facilities will remain with the property owner unless legally transferred to another person or entity by a properly recorded legal agreement. If the property owner does not maintain the facility properly, the City

may authorize the maintenance to be completed and place a lien against the property for double the cost. To ensure access to the facility, a traversable access easement is recorded on the plat.

SWMP Task: Require Routine / major maintenance of BMP facilities. Status: Ongoing

All stormwater facilities constructed since 1997 are required to be maintained according to the detailed agreement or covenant, which was recorded before the site development permit was issued. These agreements and covenants are discussed in the previous section above and also in the Stormwater and Street Ordinance sections 22.5-5 and 22.5-34. At a minimum, woody vegetation must be cut annually and sediment must be removed as necessary from detention ponds to maintain proper function of the facility. The standard maintenance requirements for large underground facilities (i.e. detention or oil/water separators) include a minimum of quarterly visual inspections and annual maintenance. Smaller BMPs, such as catch basin inserts, must be inspected at least monthly and maintained quarterly.

Sediment from the maintenance of detention/water quality ponds, treatment devices, or from stream restoration activities must be removed from the stormwater facility and disposed properly in a landfill classified for such material or used as fill outside the stormwater drainage system. The City does not propose to duplicate TDEC's efforts to regulate contaminated sediments from any stormwater management sources.

RC-2 Planning for New Development

SWMP Task: Review Stormwater & Streets Ordinance to evaluate possible improvements to existing water quality and quantity requirements for new development. Status: Complete

The City of Knoxville revised the Stormwater and Street Ordinance in 2005. The ordinance may be accessed on the Internet at www.cityofknoxville.org/engineering/stormwater. A brief summary of the current development requirements for stormwater detention and water quality control is included in the following paragraphs.

Stormwater detention is required for the following categories of development:

(1) All road construction exceeding one-half (1/2) acre of impervious area;

(2) All commercial, industrial, educational, institutional and recreational developments of one (1) acre or more of disturbed area;

(3) Large single-family or duplex residential developments of five (5) acres or more of disturbed area or five (5) lots or more;

(4) Any site development which contains one-half (1/2) acre or more of additional impervious area.

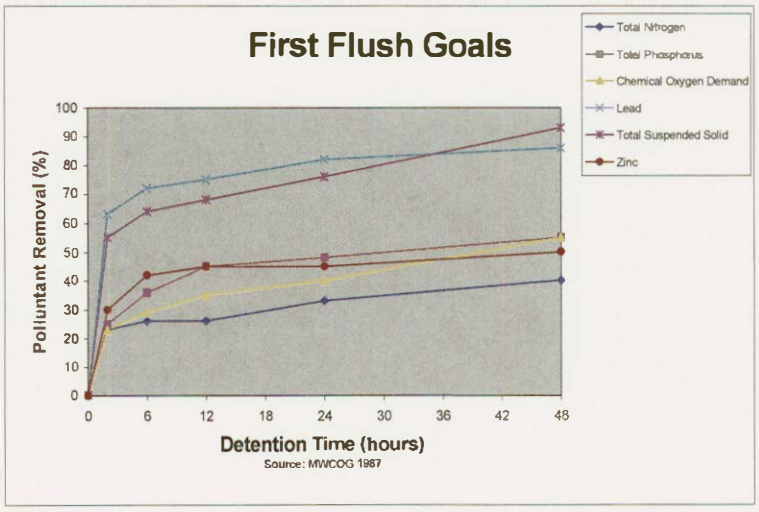
(5) Any redevelopment that meets any of the four criteria above.

When a stormwater quantity detention pond is required, the engineer must design the pond to control the runoff from the 1-year, 2-year, 5-year, 10-year, 25-year and 100-year return frequency 24-hour storm events. The design Engineer must submit calculations to show that the detention facility will control the post development as required and that the downstream system is adequate to convey the flow from a 10-year storm. Detention may be waived for some developments

discharging directly into a main stream (i.e. TN River) or if the developer submits supporting hydrologic and hydraulic computations to show that detention is unnecessary. For areas of redevelopment, detention requirements may be waived if the downstream stormwater system is adequate to convey the 2-year and 10-year 24-hour storms. The ordinance clearly states that a waiver of detention requirements "does not exempt the developer from providing the first flush and/or water quality requirements."

The standard management method for water quality control from new development and redevelopment includes first flush control outlets in the quantity pond or in a separate quality pond. The quality pond must be designed to collect the first one-half inch of direct runoff from the contributing drainage basin or the first 4500 cubic feet of stormwater runoff, whichever is greater, and attenuate that runoff for a minimum 24-hour period. Alternate treatment methods are accepted if they provide equivalent or better pollutant removal efficiencies than the standard first flush detention ponds.

The target removal efficiencies for the first flush treatment were estimated from the research and chart provided by the Metropolitan Washington Council of Governments' 1987 report titled "Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs." The target removal efficiencies for a 24-hour detention are estimated as follows: Total Suspended Solids – 76%, Lead – 81%, Zinc – 47%, Total Phosphorus – 44%, COD – 40%, and Total Nitrogen – 33%. The City chose 24-hour attenuation of the first flush since the pollutant removal rates for detention longer than 24 hours did not increase significantly. This may be reevaluated before the next ordinance update.



In addition to first flush treatment, Section 22.5-37 of the ordinance requires a Special Pollution Abatement Permit (SPAP) for certain land uses that are known to either contribute a disproportionate amount of stormwater pollution (a.k.a. hotspots) or contribute pollutants which would not be effectively removed by the standard first flush control. The SPAP requires the operator to submit the management and structural controls necessary to address the expected pollutants and sources of pollution from the site after development. The typical special pollution abatement requirement has been a minimum of an oil/water separator for large parking lots of 400 spaces or 120,000 square feet of area along with a management plan to keep the site free of illicit discharges and pollution sources. Other special land uses that need a SPAP include any type of vehicle maintenance, fueling, washing, and storage areas; scrap and recycling facilities; restaurants; grocery stores; animal housing facilities; and other areas with concentrated bacteria sources. Most of these land uses are expected to have a much higher potential for either floatable pollutants (e.g. oil, grease, hydrocarbons, trash) or soluble pollutants (e.g. bacteria, nutrients) that will not be collected in a standard first flush pond.

After implementing the illicit discharge program for a few years, some of these land uses

were added in the 2003 ordinance update when they proved to be common hotspots for pollution. The pollution is typically caused by illicit dumping/discharges from employees and contractors or from an increased volume of vehicle traffic. The SPAP program has effectively reduced pollution in our waterways by requiring planning and education to prevent pollution before it occurs from these new sources. This is more economical for the operator and the City since it reduces the need for enforcement, penalties, structural retrofits, and downstream remediation. Some businesses have reported that the pollution control requirements have paid for themselves by reducing other normal costs.

As the City implements the requirements of the NPDES permit and as other TMDLs are issued, other land uses may be added to the SPAP program to control specific pollutants.

The ordinance also requires protective streamside buffer zone along blue-line creeks. The three-tier restricted buffer zone requirement varies from 100', to 70' to 30', centered on the centerline of the low-flow channel of the creek. The width required for the buffer depends on whether the creek is a FEMA studied named creek, unstudied named creek, or unnamed tributary respectively. The natural streamside buffer zone must be shown on the plat and maintained in a stable condition for the life of the development. The ordinance does not allow any vertical or actively eroding creek banks to remain after development is complete. This may require the stream bank to be stabilized as part of the construction project. If stabilization is necessary, hard armor may only be used when bioengineering alternatives are not technologically feasible.

SWMP Task: Require "No Dumping" message cast into all curb irons and solid stormwater catch basin covers installed on new developments. Status: Complete

In January 2000, the City set a new standard to require a "No Dumping" message to be cast in all new curb irons and solid stormwater catch basin covers. The following year, the City included covers for stormwater treatment devices in this requirement. The message is an attempt to educate the public that our stormdrain system is not a sewer for their waste. When polluters are caught discharging or dumping pollutants into the stormdrain, they often plead ignorance to the fact that the stormdrain is directly connected to the creeks. After using stencils and plastic curb markers for years, the City decided to halt the growing number of curb irons that needed the temporary markers by requiring the permanently cast message.

Before setting the standard, the City contacted the major foundries to be sure they could manufacture the new irons and remain competitive in Knoxville. East Jordon Iron Works, NEENAH, John Bouchard & Sons, Acheson, and Deeter are the primary foundries that provide irons in Tennessee. Each of the foundries could provide the new pattern without any additional cost to the development community. Since there was no additional cost for the messages and the message will never need to be replaced unlike the plastic markers or stencils, this new standard may be the most cost effective educational program in the City.

SWMP Task: Plan and site location for regional BMP facilities for areas of new development.
Status: Ongoing

During the term of the permit, the City will target large development projects or strategically located smaller developments that are suitable for siting regional BMPs. Regional BMPs would serve multiple upstream developments and typically have drainage areas ranging

from 50 acres to several hundred acres. Since most development activity within the City is primarily "infill" that occurs on the limited number of remaining vacant parcels, there are limited opportunities for siting regional BMPs without impacting existing developments.

The City only owns and maintains three regional detention facilities. Those facilities include the detention pond at the Acker Place development, the detention pond located at the Northwest Crossing shopping center on Clinton Highway, and the retention pond at Victor Ashe Park. However, private developers continue to build regional ponds for developments that have drainage areas over 50 acres.

Last year, the City partnered with Knox County to hire a consultant to review the stormwater ordinances for each agency and to develop a master plan and SWMM model for First and Whites Creek. Although the initial project focused on flooding, it creates a base model that can be expanded in the future to include water quality parameters and analysis for the watershed. One benefit of the watershed model will be to help identify beneficial locations for regional detention. The full report will be completed in year four but the executive summary did list three locations of regional detention that were evaluated. One is an existing on line pond South of Adair Drive on a tributary to First Creek that might be improved. The other two locations are located on White's Creek immediately upstream of I-640 and at McCampbell Road. The exact advantages are unknown at this time but may be known before next year's annual report is submitted. If successful, the City may replicate the model in other watersheds.

SWMP Task: Review, update, and maintain guidance criteria for BMPs on City web page (www.cityofknoxville.org/engineering). Status: Ongoing

The City has successfully completed a comprehensive BMP manual during the first permit term. The manual may be accessed at www.cityofknoxville.org/engineering on the Engineering Division's web page. The guidance criteria describe acceptable types of BMPs, design standards, and maintenance requirements for BMPs to be used throughout the City to meet the requirements of the new Stormwater and Street Ordinance. The guidance criteria will be kept on file in the Engineering Division and distributed to developers as the official reference to ensure proper selection, design and maintenance criteria for BMPs.

Because maintenance of BMPs is critical to their long-term effectiveness in reducing pollutant loading from stormwater, the guidance criteria incorporates maintenance considerations with the design criteria to ensure that effective and maintainable BMPs are constructed in the City. The guidance criteria addresses the goals of the NPDES stormwater program by only allowing BMPs which are effective in reducing pollutants targeted by the NPDES stormwater regulations.

This manual is intended to be a live document that changes as new technology or future needs develop. Therefore, the website version is the preferred method of free distribution while CDs and paper copies may be made available for a fee at a local copy center. Free CD versions are typically distributed during the new development seminars each spring. The website and BMP content will continue to be updated at least annually as needed.

TDEC and the UT Water Resources Research Center have adopted the BMP manual as a basic model for use by Phase II NPDES communities. The City provided an electronic copy and has authorized modifications by the State for this purpose. Several other municipalities have obtained electronic copies of the Knoxville BMP manual for edit and adoption in their

community. The City intends to continue providing the editable version of the BMP manual to other MS4s to help develop some consistency in the region.

RC-3 Maintenance Activities for Public Streets, Roads, and Highways

SWMP Task: Continue street maintenance activities outlined in Part 2 application, p. 5-8.
Status: Ongoing

Street cleaning is performed daily for the downtown streets and less frequently for all other streets throughout the City. Large Vac-All trucks are used in most service areas while smaller Tymco vacuum sweepers are used in the downtown areas where maneuverability is key. The Vac-All trucks are also used to vacuum debris from catch basins and remove leaves in the fall. Mowing in City rights of way is typically performed on a two to four week schedule between the months of April and September.

SWMP Task: Evaluate current deicing program and study alternatives and improvements.
Status: Complete

Snow removal, anti-icing, and de-icing of roadways are performed by the PSD and are essential programs to ensure public safety. Sodium chloride, stored undercover at the Loraine Street facility, mixed with liquid calcium chloride is applied to highways and streets by spreaders as necessary. Application of de-icing/anti-icing materials targets highways and major arteries first, and residential streets next. Priorities follow the adopted Major Roads Plan of the City of Knoxville. Because of the importance of maintaining public safety and public commerce, the City aggressively pursues its road clearing operations.

The Public Service Division evaluated the snow removal activities and materials and revises the Snow Removal Plan on an annual basis. The City has been able to significantly reduce the quantity of deicing materials used by improved equipment, improved forecasting, chemicals, and operator training. The City will continue to look for opportunities to minimize the use of deicing materials to reduce costs and protect the environment.

RC-4 Evaluation of Flood Management Projects

SWMP Task: Evaluate regional BMP facilities for water quality retrofit. Status: Ongoing

The City only owns and maintains three regional detention facilities. Those facilities include the detention pond adjacent to Middlebrook Pike and Weisgarber Road at the Acker Place development, the detention pond located at the Northwest Crossing shopping center on Clinton Highway, and the regional retention pond at Victor Ashe Park. Although the regional basins were designed for flood control, the City found that it was possible to retrofit the sites to achieve additional water quality benefits as well. All ponds built since 1997 were required to comply with the water quality requirements for new development.

The City has assumed the responsibility of continued maintenance and water quality improvements at the large regional pond (Acker Place) in the Fourth Creek Watershed. The City restored a large section of Fourth Creek downstream of the pond in the first year of the permit.

In order to reduce the vast amount of sediment in the stormwater effluent and to prevent future accumulation of sediment downstream, two rock check dams and an 18-inch weir plate were placed in the pond's low flow channel. These velocity dissipaters allow the sediment time to settle out of the stormwater while still in the pond. The sediment is removed to prevent migration into Fourth Creek. In the first permit term, volunteers replanted riparian zone vegetation in the pond including red osier, silky dogwood, black willow, and willow oak in addition to the existing species of white pine, cedar, and red oak trees. Since this pond is a site of one of the permanent stormwater monitoring stations, the City will continue to monitor the water quality enhancements and improve the pond as needed in the future. The City is currently evaluating further water quality retrofits to this regional pond through a partnership with an adjacent property development. If this project is beneficial, it will be reported next year.

The regional pond at Northwest Crossing on Clinton Highway serves the Wal-Mart, Lowe's, and surrounding area. The City accepted the maintenance of this pond and immediately designed a water quality retrofit to reduce the pollution in the stormwater runoff. Three large Crystal Stream stormwater treatment devices (www.crystalstream.com) were installed. The units have effectively removed large amounts of trash, sediment, hydrocarbons and organic material from the runoff and prevented the discharge of those pollutants into the receiving stream.

The retention pond at Victor Ashe Park was designed and built with water quality in mind. Three Crystal Stream stormwater treatment vaults were installed to improve the quality of the stormwater runoff from the contributing parking lots, park, and subdivisions. Maintenance and inspection of the Crystal Stream units has been contracted out to Crystal Stream's service company to ensure proper function at both regional ponds.

SWMP Task: Maintain existing GIS inventory of on-site BMP facilities. Status: Ongoing

When the NPDES permit program first started, the City implemented a systematic method of inventorying the existing detention ponds by using a GIS grid of the city. Field crews inspected drainage features in each map grid and recorded the detention facilities in the GIS with a circled D. Since all new development must be certified to confirm that constructed facilities were built as planned, all new stormwater facilities will be properly recorded in the GIS after construction. During the year three reorganization of the stormwater section, the City dedicated one technician position to mapping and maintenance inspections. Due to staffing turnover, this position was not filled until year four.

Engineering staff will continue to maintain and update the existing inventory of ponds, pipes, water quality facilities and other drainage features as part of an ongoing GIS maintenance program. A GIS analyst inspects newly annexed areas in the field to verify the accuracy of the GIS stormwater features and edits the stormwater layers as necessary.

RC-5 Monitoring of Solid Waste Facilities

This program is described in the management section IN-3 for industrial facilities.

RC-6 Management Program for Pesticides, Herbicides, and Fertilizer

SWMP Task: Evaluate possible improvements to existing public education program as part of the illicit connection and improper disposal program. Educate City staff, public, etc.

Status: Ongoing

Public education programs for pesticides, herbicides, and fertilizer use have already been implemented in conjunction with City public education programs for collection and recycling of household hazardous waste. In addition to the solid waste and household hazardous waste informational programs, the City has developed a stormwater pollution program that includes helpful information regarding pesticide and fertilizer use. The City's online Best Management Practices manual located at www.cityofknoxville.org/engineering/bmp_manual/ offers two BMPs for proper pesticide, herbicide, and fertilizer use and disposal. The BMP AM-13 is targeted towards institutional and commercial applications while the BMP RH-05 is directed towards residential and homeowner uses.

The HHW collection program, which includes collection of pesticide, herbicide, and fertilizer waste material, was officially implemented when the facility opened on April 22, 1997. More information about the HHW facility is included in the Illicit Discharges and Improper Disposal Program section ILL-6.

SWMP Task: Reevaluate effect of fertilizers as part of the City's ongoing monitoring program.

Status: Ongoing

Pesticides, herbicides, and fertilizer used by the City are stored in a building at the Loraine Street Operations Center. This building is in compliance with all regulations regarding the storage of hazardous materials. The Horticulture and Grounds Maintenance section of the PSD is responsible for the application of pesticides, herbicides, and fertilizer. The herbicide "Roundup" is applied annually to City parks and rights-of-way to control unwanted weed growth. PSD personnel, who have been trained to apply the herbicide as needed. Fertilizer is only used for minor landscaping projects and stormwater runoff from these projects is not considered a threat to receiving water quality.

The City does not currently require registration by commercial applicators; however, commercial applicators must be licensed under State and Federal Regulations. There are no regulations restricting the use of these substances by individual landowners; however, a household hazardous waste collection facility has been opened to collect all types of hazardous wastes including pesticides, herbicides, and fertilizer.

For pesticide, herbicide, and fertilizer pollutants, the control program is difficult to define since the presence of pesticides, herbicides, and fertilizers in urban runoff is not always evident. Current problems with pesticide, herbicide, and fertilizer pollutants are not believed to be significant. As part of the ongoing stormwater-monitoring program, the City will continue to

monitor the significance of these pollutants. Pesticides, PCBs, and nutrients are tested as part of the ongoing monitoring program described in Sections 5.5 and 6.0 of this report. To date, no significant traces of pesticides have been detected in the annual full-suite grab sample.

5.2 ILLICIT DISCHARGES AND IMPROPER DISPOSAL PROGRAM

Program to Detect and Remove Illicit and Improper Discharges to the Municipal Storm Sewer System, 40 CFR 122.26(d)(2)(iv)(B).

ILL-1 Ordinances.

SWMP Task: Evaluate the prohibitions and exemptions of non-stormwater discharges in the original Stormwater & Streets Ordinance. Maintain authority for $5,000 penalties.

Status: Complete

This task was completed in 1997. See description below.

SWMP Task: Implement any new revisions to the Stormwater and Street ordinance.

Status: Complete

The Stormwater and Street Ordinance was developed to specifically prohibit non-stormwater discharges, increase penalties for illegal discharges, and to provide water quality regulations for new development. The first ordinance was effective June 20, 1997. The ordinance has been updated several times since then. The revised ordinance is available on the Internet at www.cityofknoxville.org/engineering/stormwater.

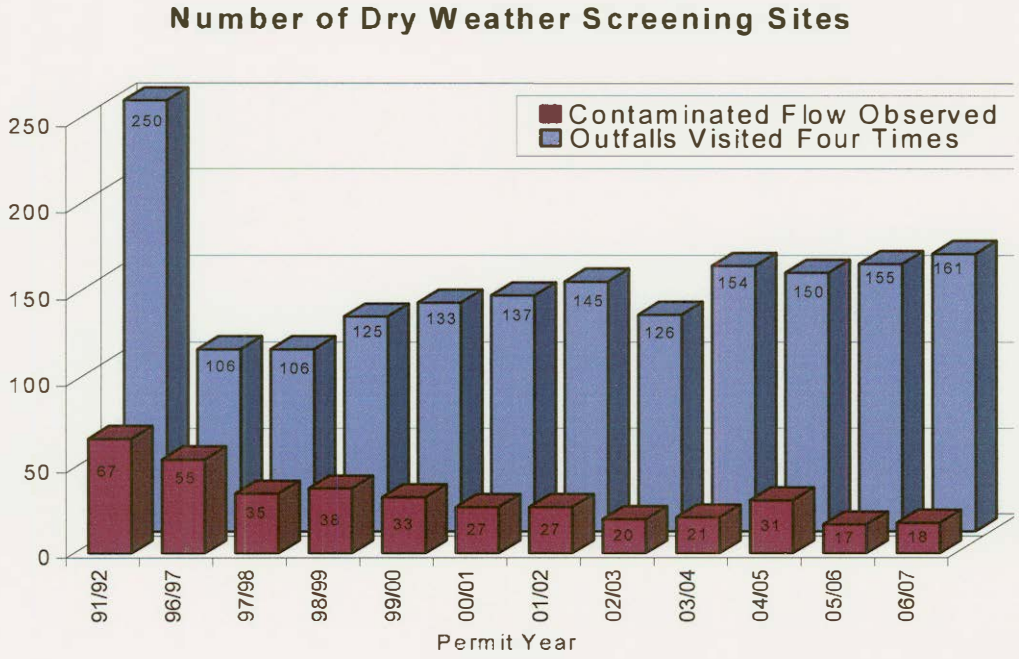
The ordinance section 22.5-52 specifically prohibits illicit discharges and illegal dumping to any portion of the MS4 or any area draining to the MS4. Illicit discharges were defined consistent with 40 CFR 122.26(b)(2) as any non-stormwater discharge to the MS4, which is not specifically exempted in the ordinance. This definition, along with the $5,000 penalty for violations, has formed the cornerstone of our successful enforcement program and will remain in place during this permit term.

Exemptions to the non-stormwater prohibition are listed in the ordinance in accordance with the list in 40 CFR 122.26(d)(2)(iv)(B)(1). The City added language to the exemption for individual car washing on residential property to include fund-raising washes by non-profit organizations for no more than two consecutive days in duration. The City has reevaluated these exemptions allowed in the CFR but did not make any changes to the current list in the ordinance.

ILL-2 Field Screening

SWMP Task: Perform follow-up analysis at all high-risk screening sites. Status: Ongoing

The Dry-Weather Screening Program was developed and implemented during the first permit term to evaluate both randomly chosen outfalls and high-risk outfalls, which were tested during the previous year. Each high-risk stormwater outfall was checked for flow after a period of dry weather. If flow was present, the discharge was tested with a Chemetrics colorimetric field test kit (shown) for the following parameters: phenols, ammonia, detergents, copper, chlorine, pH, turbidity, color, temperature, and flow rate. If ammonia is greater than one part per million, then a fecal coliform and E-coli sample is collected for laboratory testing. The outfall test was repeated again between four and forty-eight hours after the first test. After one month, this process was repeated for each outfall to complete a total of four tests each year.



Since this program has successfully identified many illegal dumps and illicit discharges during the first permit term, the City will continue to annually retest all sites that have high parameters or signs of illegal dumping until the outfall is clean during all four annual visits. Once the outfall has tested clean or dry during four site visits in a single year, it will only be retested if randomly selected from the list of inventoried outfalls.

As illustrated by the bar graph, the percentage of high-risk outfalls decreased each year since 1991 except for 2004/2005. The number of high-risk outfalls that need to be retested each year will obviously vary depending on the tested results of the previous year.

As required by Part VI (A)(2)(f)(ii) of the NPDES permit, the results of the dry-weather screening are included in the appendix of this report. Since the beginning of the program, 6505 outfall-screening visits have been conducted. The results from each of those visits are tabulated in the database by outfall identification number, testing date, and visit number. The testing results from the outfall screenings that occurred during the last permit year are included in the appendix of this report.

SWMP Task: Investigate 150 field-screening sites four times per year. Status: Ongoing

To insure that all outfalls are eventually tested each permit cycle, the City will continue to monitor a minimum of 150 outfalls each year throughout the new permit term. Last year the City visited 161 outfalls four times each and one additional outfall was visited twice. The monitored outfalls consisted of the previous year's 17 high-risk outfall sites plus 144 randomly selected outfalls from the general outfall inventory. The randomly selected sites were selected from areas of primarily industrial use and from areas that had not been previously tested. The City also selected outfalls throughout the city with some preference given to the highly developed areas.

The Engineering Division has developed an outfall database to maintain the testing data and site information for each outfall in the inventory. This outfall database is linked to the GIS to allow data access geographically for a single point or by report/query functions for many outfalls at a time. By maintaining a history of each outfall, illicit discharge trends may become apparent and therefore may be resolved with education or enforcement.

The dry-weather-screening program has been one of the most successful programs during the last permit term and will continue to be a high priority throughout this permit cycle.

ILL-3 Investigation of the Storm Drain System

SWMP Task: Implement procedures for mapping, field surveys and upstream source identification. Status: Ongoing

The procedures for mapping, field surveys and upstream source identification were developed and included in the Part II Application section 5.3.5. These procedures were adopted as policy and successfully implemented during the first permit term. The City will continue to utilize these procedures to maintain the effectiveness of the Illicit Discharge and Illegal Dumping Program. These updated procedures were included for the Division's review in monitoring section 6.1.3 of the first annual report in 1997. Last year there were no updates to report for this procedure. If the procedure is updated, it will be included in the following annual report.

SWMP Task: Evaluate and update enforcement procedures, policies, monitoring and inspections. Status: Complete

The schedule for this task appropriately coincided with the schedule for ordinance updates. The existing enforcement procedures and policies have been effective and were not amended when the ordinance was updated in 2005.

Depending on the violation, a first-time offender is usually educated and asked to remediate the damage or correct the violation if possible. This is usually followed up with a letter to inform the violator of the City's expectations and to provide helpful BMPs to prevent future problems. More severe or repeated violations will merit a Notice of Violation (NOV), which is issued in the field directly to the violator if available on site. Copies of the NOV are distributed to the property owner or developer by certified mail, the City Law Department, and the Engineering Division's file. The NOV may order specific remedies and require the violator to submit reports and/or pollution prevention plans. Penalties, if any, are only issued after the NOV expires so the violation and remedies may be fully evaluated.

In the event that a penalty is assessed, a violator may appeal the penalty before a five-member Environmental Appeals Board. The five volunteer members of the Environmental Appeals Board are appointed by the Mayor and consists of individuals with an expertise as follows:

1) One licensed professional engineer with three (3) years of engineering experience as a Professional Engineer;
2) One architect, engineer, landscape architect or surveyor with three (3) years of experience;
3) One representative of the development or industrial community;
4) One neighborhood representative;
5) One member at large.

In addition to the above qualifications, one of the five members must have at least three years of civil engineering experience and a second member must have at least three years of civil or environmental engineering experience. Board members serve a 5-year term and may be re-appointed at the end of their term.

Some research has already begun to determine appropriate penalties for discharges that cannot be recovered but do not cause a fish kill or other quantifiable immediate damage. The City's current evaluation method does not account for incremental contributions to the overall pollutant loading or degradation of the waterway.

To help identify repeat violators, the City maintains an updated record of every NOV issued and a database for stormwater complaints. Follow-up monitoring and inspections will be a combination of City and self-inspections by industries. Enforcement actions resulting from the dry-weather screening program will be followed as defined within that program as a minimum. Any outfall that is tested for high parameters or identified as an illicit connection/ illegal dump source, will be tested four times a year, every year, until the outfall is dry or clean on all four visits. Sources of pollution identified by other means will be monitored as needed or specified for the individual situation. The ordinance Section 22.5-53 requires immediate reporting of spills and illicit discharges and Section 22.5-54 allows the City to require additional monitoring.

SWMP Task: Inspect stormdrain system and update features on GIS. Status: Ongoing

The City is dedicated to updating and maintaining reliable stormdrain data on the GIS. This task is implemented by a concerted effort within the Engineering Division. All employees are instructed to submit their completed stormwater work orders to a designated GIS analyst for the purpose of updating the GIS stormwater layer. That same analyst personally inspects all new annexations to insure that all existing stormdrain features are added to the system shortly after the parcel becomes part of the city. All new developments require a development certification submitted by a design professional upon completion. The analyst in the stormwater quality group records the stormdrain features from the development certifications into the GIS. Field personnel are instructed to log and report any discrepancies that are found between the maps and actual system in the field. The GIS analyst is responsible for completing the proper updates.

During the first permit term, the GIS analyst and two engineering interns began to systematically inspect the entire stormdrain system by grid to find and correct the parts of the stormwater GIS layer that may be in error. Now that much of this work has been verified and the procedures for maintaining accurate data are in place, the grid-by-grid investigations will be

conducted as needed or as part of specific updates for areas of significant development. Because maintaining the integrity of the GIS via field verification is extremely time-consuming, it is reasonable to believe this will be an ongoing task. The Stormwater program reorganized staff in year three to assign watersheds to specific technicians. A Stormwater Technician position was dedicated to inspections for mapping accuracy and maintenance needs. However, the position remained vacant until year four due to unusual staffing turnover.

ILL-4 Spill Response Program

SWMP Task: Coordinate with Knoxville Emergency Response Team (KERT) and TDEC.

Status: Ongoing

The City of Knoxville Stormwater Quality Section of the Engineering Division continued to coordinate with both the KERT and TDEC during emergency situations. Each agency has specific roles to play during an emergency event. When discharges enter the MS4, the City's Stormwater Quality Section assists with information gathering, investigations, GIS support, containment, remediation, follow-up monitoring, and enforcement when necessary.

The Knoxville- Knox County Emergency Management Agency (KEMA) and Knoxville Fire Department (KFD) coordinate most major spills when they are called in to 911. KEMA also coordinates routine training and simulations for various situations throughout the year. Workshops are provided to simulate real scenarios and allow coordination of the field teams and the Emergency Operations Center (EOC). Engineering Division staff participates in the EOC while the KEMA, KFD, Police Department, and Rural Metro units perform the field exercises.

The KFD and Engineering Division coordinate to respond to small spills and possible hazards as they are reported. The two groups will continue to work closely together to contain and remediate discharges in the street, stormdrain system, creeks or wherever necessary. The KFD maintains a fireboat downtown on the waterfront and a Hazardous Materials truck in one fire hall to assist with spills and signification discharges into the river, creeks or stormdrains.

When a responsible party is identified for a spill or hazardous discharge, the Engineering Division staff will follow normal investigation and enforcement procedures to order the containment and remediation at the violator's expense. The HAZMAT team will work to contain the spill until the responsible party takes over. The City's HAZMAT team will then report back to the station to be ready for the next emergency while the Stormwater Section personnel monitor the remediation of site until the stormdrain and creek are restored.

Last year, the Stormwater staff responded to assist the Fire Department with a variety of spills including traffic accidents that lost fuel, illegal dumping, and discharges from permanent facilities. The small releases from accidents and illegal dumping were contained by the Fire Department and Stormwater management staff. Stormwater staff and/or Public Service Division will remove and dispose of the materials from the small spills. Larger spills are typically referred to a private remediation company.

Engineering staff will continue to closely coordinate with other emergency personnel by attending the monthly Local Emergency Planning Committee meetings and by maintaining a staff member on call after hours and on weekends to help respond to water quality emergencies.

ILL-5 Reporting of Illicit Discharges

SWMP Task: Maintain and monitor the "Water Quality Hotline" for public reporting.

Status: Ongoing

The Water Quality Hotline for public reporting of water quality concerns was established as planned during year one of the first permit term. The hotline was operational in November of 1996 but did not receive mass publicity until December 1996. The hotline phone number is a local Greater Knoxville Area number listed in the blue pages as follows:

WATER QUALITY HOTLINE-
To Report Illegal Dumping Into Ditches
Creeks Or Catch Basins 24-Hours/Day.....[865] 215-4147

The hotline has received a variety of calls including: industrial discharges, gray water discharges, broken laterals, commercial washing, and neighbors dumping, etc. The hotline has been a popular and convenient method for callers to anonymously report problems that they have witnessed or created. Common calls are from neighbors or dissatisfied employees of polluters. This program has been very successful and will be continued throughout the permit term.

The Water Quality Hotline is a dedicated phone line attached to a phone in the Stormwater Quality Section of the Engineering Division. Employees in the section also have the hotline linked as a second line on their individual office phones so anyone may answer the phone during the day. After hours and on weekends, the messages are recorded and routinely retrieved by the on-call supervisor. If the water quality concern is within the City limits, the Engineering Division investigates the problem. Otherwise, the problem is referred to the Knox County Health Department, TDEC Environmental Assistance Center, or other appropriate agency.

The objective of this task is to increase the public awareness of the City's role in water quality issues and to create a quick and anonymous method for citizens to report water quality concerns. The publicity of the hotline has already provided a consistent and convenient resource for concerned citizens.

The City includes the hotline number in thousands of mass produced stormwater pollution prevention educational handouts such as magnets, brochures, presentations, business cards, and routine correspondence with residents. The hotline is prominently displayed at the bottom of the Second Creek watershed boundary road signs to let travelers know where they may report water quality concerns.

Recently, the Hotline was advertised by placing the number on the plastic stormdrain markers, which are placed on curb iron inlets. Although the curb iron markers have been used for years, this custom design helps identify the markers specifically for Knoxville. The City will continue to seek out and develop innovative methods to advertise this successful program as a method for citizens to anonymously report complaints. Future opportunities to advertise may include: utility bills, public access TV, radio PSAs, signs on city buses, refrigerator magnets, pamphlets, brochures, BMP manual CDs, permits, etc. The innovative methods of publicity will vary each year as opportunities are developed.

SWMP Task: Maintain public education program. Status: Ongoing

River Rescue

The year 2007 was the 18th year for the River Rescue. The spring 2007 River Rescue attracted 750 volunteers who collected 14 tons of trash and 25 tires from the shores of the Tennessee River. This annual event is coordinated through Ijams Nature Center in cooperation with the City of Knoxville and Sea Ray Boats and more than 20 other partners, including members of the business community, government agencies, private organizations, and individuals. There are over 30 sites or "zones" that stretch from the forks of the river above Knoxville to Fort Loudoun Dam. River Rescue is also held in partnership with Lake User groups on Watts Bar Lake, Melton Hill Lake, and the Clinch River. Ijams Water Quality Specialists plan for this event throughout the year by recruiting volunteers, surveying riverbank conditions, securing additional sponsors, and pinpointing areas in need of cleanup.

Operation Storm Drain Status: Ongoing

The Blue Thumb Coalition started this ongoing program in 1994 in an effort to educate the public that there is a difference between the stormdrain system and the sanitary sewer. Operation Storm Drain attempts to reduce the amount of pollutants dumped into our waterways through education instead of enforcement.

The message "DUMP NO WASTE, DRAINS TO STREAM" was stenciled on over ten thousand storm drains earlier in the permit term. In the last few years, the City replaced the stenciling program with DAS curb markers. These brightly colored plastic disks are affixed to the curb irons and carry the message "Dump no Wastes, Drains to Stream". Although the curb markers are a temporary retrofit for the existing storm drains, they are more economical and environmentally friendly since they do not wear off as quickly as the painted stencils. When the disks were first introduced, volunteers and City staff placed several thousands of markers on storm drains in the city. Currently, several hundred of the informational disks are purchased and distributed to volunteers each year to attach to curb irons. During year one the disks were revised to include the Water Quality Hotline phone number and some Spanish text.

In the City's new permit application, a permanent version of this educational program was proposed. The City has already adopted a new development standard for all new curb irons and solid stormwater manhole covers. The new standard requires the iron to be cast with the educational message included on top of all new curb irons and solid manhole lids. In an effort to make the curb irons more eye-catching, several foundries have cast into the iron a graphic of a fish in addition to the environmental message. The foundries offer these designs to the surrounding communities to simplify their stock requirements. This program should offer long-term educational benefits as citizens become familiar with the message and it's meaning.

Water Quality Forum — Status: Ongoing

The WQF is a consortium of agencies, organizations, academic institutions, public utilities, and interested citizens working to protect and restore the waterways in Knox and the eight surrounding counties. It was initiated by the City of Knoxville in 1990. Currently it has twelve dues paying Partners; the City, TVA, Ijams Nature Center, Knox County, UTK-WRRC, the Town of Farragut, KGIS, the Knox County Soil Conservation District, KUB, the Sevier County Water Board, The League of Women Voters, and the Hallsdale –Powell Utility District. There are numerous other stakeholders, who attend the quarterly meetings ranging from concerned individuals to agencies from other counties seeking information and guidance. To learn more about the WQF, go to www.waterqualityforum.org.

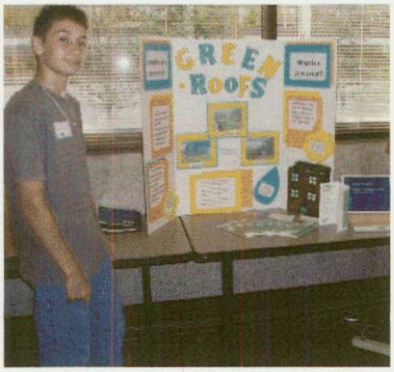
Adopt-a-Watershed — Status: Ongoing

Currently, fifteen area high schools and middle schools are participating in the program. The Americorp volunteers coordinate the program with the individual schools. This program has helped implement the goals of the NPDES program and increased public awareness of water quality issues. The primary goals of the Adopt-a-Watershed program include:

- Characterizing the school's watershed using, at minimum, two AAW characterization tools (e.g., watershed inventory, watershed mapping, windshield survey, stream walk).
- Monitor the school's watershed stream(s), conducting, at minimum, chemical testing twice and a biological (i.e. macroinvertebrate and/or fish) assessment once.
- Conduct at least one water quality improvement activity (e.g., tree planting, storm drain stenciling, stream cleanup, stream bank restoration, presentations to school groups/community organizations on the "state of the watershed" as determined by the students' characterization/monitoring efforts).

The City will continue working with the schools and provide support such as information, solid waste support for cleanups, GIS maps, stencils, testing supplies, training, and grants.

This spring, South Doyle Middle School teacher Dave Gorman's seventh grade science classes learned about low impact development (LID) practices as a part of the Adopt-A-Watershed Program. LIDs are alternatives to conventional development practices. Each of his five classes became experts on one of the following LID practices:



Green Roofs: Vegetated rooftops that provide both aesthetic and environmental benefits such as reducing and filtering stormwater runoff

Rain Barrels: Containers that are used to collect and store stormwater from roof tops for later use such as irrigation

Grassy Swales: Grass lined channels that slow stormwater runoff and promote infiltration, trap sediment and help treat pollutants

Rain Gardens: Visually appealing gardens that are located in depressions catch and hold runoff to promote infiltration

Pervious Paving: An alternative to standard asphalt or concrete that allows stormwater to infiltrate, thereby reducing runoff and promoting groundwater recharge

The students enthusiastically put together projects that included models, posters, brochures, and PowerPoints to educate the public about their LID. On Monday, May 7, 2007 the students presented their projects at the City County Building to educate the public on their LID practices. Two students from each class introduced their LIDs to fellow classmates, parents and city officials in brief presentations. After the introductions, the students answered questions as people walked around to look at the models and posters on display. While some students answered questions, others took tours of the City County Building where representatives from the Fire Prevention, City Stormwater Engineering, and South Waterfront Development departments spoke with the students. A rain barrel that had been donated by Fort Loudoun Lake Association (FLLA) and had been assembled by the students under the guidance of FLLA was raffled off at the end of the day.

In the afternoon the students participated in activities run by community partners at Volunteer Landing. Ed Scott from the Tennessee Valley Authority ran an ecology lesson, Parci Gibson and Jake Hudson from the FLLA helped the students build booms and AmeriCorps WQT members helped the students do water chemistry and an artistic reflection activity. The field trip was deemed a success by all! The students learned an amazing amount about LID and did a fantastic job in conveying their newfound knowledge to the community.

Adopt-A-Stream — Status: Ongoing

The City of Knoxville, in conjunction with Knox County and The Town of Farragut is in the sixth year of administering the Adopt-A-Stream program. The program now has over 15 miles adopted by over 30 groups. The City has provided the supervision and training in addition to gloves, trash bags, pitchforks, wheelbarrows, waders, and other tools for these activities. The Rotary Club of West Knoxville (photo at right) adopted a portion of Fourth Creek.

Stock Creek Watershed Initiative — Status: Ongoing

The Stock Creek Watershed Initiative (SCWI) was established in 2002 under the direction of the Water Quality Forum to assess Stock Creek conditions, prioritize problems, educate and involve residents, and implement solutions.

The following agencies have made significant contributions to Stock Creek Watershed protection projects and will continue to do so during the implementation of this project: City of Knoxville, Knox County Soil Conservation District, Knox County, Knox-Chapman Utility

District, KGIS, MPC, Little River Water Quality Forum, Little River Watershed Association, NRSC, TDEC, EAC, TVA, USGS and UT.
The 21 square mile Stock Creek Watershed, a sub basin of the Little River Watershed, is located in the southern part of Knox County with a small portion in Blount County. Stock Creek is experiencing degradation related to development and land use. Significant progress has been made in the areas of building partnerships, educating citizens, assessing conditions and identifying pollution sources over the last three years. Last year the partners in the WQF received a 319(h) grant for the watershed.

Clean, Protect and Restore (CPR) Status: Ongoing

This annual project coordinated by the Americorps Volunteers with the assistance of the Water Quality Forum, coordinates creek cleanups at seven sites throughout the City of Knoxville in October.

During this fiscal year, the CPR efforts were concentrated in the Williams Creek watershed. Over 30 volunteers filled two roll-off dumpers full of trash and collected approximately 160 tires.

Public Displays And Presentations Status: Ongoing

In cooperation with the COK Solid Waste Office staff presented displays and informational materials at several public events including the Dogwood Arts Festival, Home Show, and Earth Day Celebration.

Various environmental presentations were also made to citizens through groups such as the Fulton High School, Saint Luke's Episcopal Church, and University of Tennessee classes.

City Employee Training Status: Ongoing

The City purchased a stormwater pollution prevention video from Excal Visual to train City employees. The eighteen-minute long video outlines BMP's for stormwater pollution prevention and has been shown to Knox County Schools Maintenance Division and various other businesses. To learn more about the video, go to www.excalvisual.com.

WaterFest — Status: Ongoing

WaterFest is an annual festival designed to educate youth about the many values of water. It was initiated in 1995 by the Water Quality Forum (WQF) and has grown into an event with hundreds of elementary and middle school children attending from across Knox County. Ijams Nature Center hosts and coordinates this springtime event that is planned by forum partners throughout the year. It is designed to be fast-paced, engaging, educational, entertaining and just plain fun for the students.

On the day of this event, WQF partners come together to make WaterFest happen. The CAC AmeriCorps Team takes the lead in conducting games, arts and crafts and model-building activities with the students. Storytellers and musicians engage students in audience participation performances and forum partners run informational/demonstration booths. Local high school and university students provide great volunteer support.

Warning Signs — Status: Ongoing

In compliance with the new bacteria TMDL, the city installed three improved warning signs along the creeks, which are on the 303(d) list for bacteria. The locations for the placement of the new signs will focus on public parks, greenways, schools, and other places with easy public access. The warning signs include the prominent warning, a list of possible sources, and a phone number to report problems or obtain more information.

Waterworks

In 2005, the City partnered with other local municipalities and participated in the Waterworks clean water campaign. The television and radio announcements concentrated on stormwater pollution activities and featured the City's Water Quality Hotline number. To learn more about the Waterworks program, go to www.tennesseewaterworks.com.

ILL-6 Used Oil & Toxic Materials Program

SWMP Task: Continue coordination of Recycling Program. — Status: Ongoing

The Solid Waste Division manages the City of Knoxville's recycling program. The entire annual report of these programs is included in the appendix of this report.

SWMP Task: Maintain and Operate Household Hazardous Waste Facility. Status: Ongoing

The City continues to operate the Household Hazardous Waste (HHW) Collection Center, which first opened on April 22, 1997. When first opened, the City of Knoxville HHW Facility was the first permanent HHW Collection Center in the State of Tennessee. The HHW Facility is open five days a week. The center accepts HHW from both Knoxville and Knox County residents. Knox County shares the annual costs of operation. The capital expenditures associated with construction of this facility were paid for through a $500,000 grant from the State of Tennessee. Activities at the center include:

- Diverting reusable products;
- Collecting, reusing and solidifying latex paint;
- Collecting car batteries, oil and antifreeze;
- Diverting selected acid and bases to waste water treatment;
- Bulking flammable materials; and
- Packing miscellaneous HHW materials for safe shipment and disposal.

Upon entering the HHW Collection Center, customers pull into a covered drive-through unloading area, where technicians remove HHW from vehicles. Material that is collected and is still "good" is separated and made available for pickup by the public free of charge in a "reuse area". "Good" material includes containers that have never been opened or materials that have not yet exceeded their useful shelf life. The staff then processes materials that are not reusable. Diverting selected acids and bases to the wastewater treatment facility, bulking flammable materials, lab packing, and solidifying latex paint. Some limited amounts of latex paint are reconditioned at the facility and used by the City in its facility services operation. After materials are processed, they are packed into 55-gallon drums, which are placed in one of two prefabricated storage units. Each of these units has a special fire suppression system, and drainage/spill containment systems. The hazardous materials are then stored in the units and held until sufficient quantities are collected. The HHW is operated by two technicians trained to the 40-hour OSHA site worker level and managed by an on site foreman and manager.

5.3 THE INDUSTRIAL AND RELATED FACILITIES PROGRAM (IN).

Program to Monitor and Control Runoff from TSD and Industrial Facilities Subject to SARA Title III, Section 313, requirements, 40 CFR 122.26(d)(2)(iv)(C).

IN-1 Ordinances

SWMP Task: Evaluate and implement revisions to the prohibitions and exemptions of non-stormwater discharges in the existing Stormwater & Streets Ordinance. Status: Complete

The Stormwater and Street Ordinance was developed in 1996 to specifically prohibit non-stormwater discharges, increase penalties for illegal discharges, and to provide water quality regulations for new and redevelopment. The ordinance was updated in 2005 but the non-stormwater discharge prohibition was not altered. The current Stormwater and Street Ordinance was included in the report for 2005/2006 and may be accessed on the Engineering Division's

web page at www.cityofknoxville.org/engineering/stormwater.

The ordinance section 22.5-52 specifically prohibits illicit discharges and illegal dumping to any portion of the MS4 or any area draining to the MS4. Illicit discharges were defined according to 40 CFR 122.26(b)(2) as any non-stormwater discharge to the MS4 except those discharges pursuant to a valid NPDES permit, firefighting, or specifically exempted in the ordinance. The exemptions were copied directly from the list of possible exemptions in the CFR with the addition of charitable car washes for no longer than two days duration. This definition, along with the $5,000 penalty for violations, has formed the cornerstone of our successful enforcement program and will remain in place throughout the permit term.

IN-2 Inspection Element

SWMP Task: Develop inspection program for non-permitted commercial facilities (i.e. car lots, restaurants, service stations, grocery stores, etc.). Status: Complete

Over the course of the first permit term, the City has identified many common discharges from facilities that were not required to be permitted under the TDEC multi-sector general stormwater permit or individual NPDES permit program. Rather than spend limited resources attempting to duplicate the efforts of TDEC and EPA by monitoring existing permitted facilities, the City added a Special Pollution Abatement Permit (SPAP) program for those specific land-uses that have proven to cause polluted runoff problems. This program has been developed to fill in the gaps in the existing permit programs of those agencies with a local inspection program for otherwise non-permitted facilities.

In March 2005 the City added a new Stormwater Technician position to perform additional education and inspections for industry and certain commercial areas. The technician performs most of the industrial and commercial facility inspections on sites that currently have a Special Pollution Abatement Permit (SPAP). Other technicians also perform inspections as needed. A complete list of the SPAP facilities that were inspected during this permit year can be found in the appendix.

Each of the SPAP facilities is required to have some type of structural stormwater treatment device (i.e. oil/water separators, catch basin insets, sand filters, grass swales, etc.) in addition to their pollution prevention management controls. During the SPAP inspection, the City normally reviews the facilities maintenance records, provides technical advice on proper maintenance scheduling, records the devices GPS coordinates if needed, and updates the City's industrial and commercial facilities database. Inspection of the SPAP permitted facilities will occur systematically to insure that the structural controls are maintained and the management controls are being followed.

In addition to inspections of sites that have SPAPs, the City will select for inspection some existing sites that were built before the SPAP program was implemented. These sites will be targeted for education rather than enforcement to bring the sites into compliance using proper BMPs from the City's manual. Other commercial site inspections will need to be performed in direct response to specific complaints from citizens or tips from the water quality hotline. The City will decide on a case-by-case basis whether this group of inspections will use education or enforcement to correct any problems found. In some cases, the old facility may be required to

apply for a SPAP to correct violations.

The inspection program will focus on performing routine and/or random inspections on a variety of commercial sectors. The inspectors can work with the business to develop site-specific pollution prevention plans, employee training and structural modifications, if needed. The City's BMP manual has a wide assortment of information for a variety of businesses. Since these businesses are not regulated in a permit program now, many of the operators are not focused on how their actions impact water quality in the area streams.

Section 22.5-37 of the ordinance requires a Special Pollution Abatement Permit (SPAP) for certain land uses and Section RC-2 of this report provides more details on this program.

SWMP Task: Collect and analyze NOIs from Industrial Permit applicants. Status: Ongoing

When the NOIs are received from TDEC or directly from the private industry, the City reviews and evaluates the information for potential impacts to the municipal storm drain system. In the past, the NOIs have been instrumental in locating and removing discharges from local industries. During inspections or enforcement actions with an industry, the City may verify that an NOI has been filed. If an NOI has not been filed, the City will coordinate with TDEC to obtain the NOI. Future NOIs may be obtained annually from TDEC in bulk or electronically.

SWMP Task: Identify potential industrial discharges through Illicit Connection and Improper Disposal Program. (Both stormwater & non-stormwater discharges). Status: Ongoing

The illicit connection and improper disposal program defined in the City's Part II NPDES stormwater permit application and in the previous section of this report, primarily addresses runoff from industrial facilities. The majority of dry weather screening occurs from areas of industrial use or outfalls indicated by a "300" in the identification number. Illicit connections or improper disposal from industrial facilities that are discovered while inspecting the storm drain system under this program are recorded in the facilities' file in the database. The City contacts the industrial facility directly, along with TDEC if necessary, to identify the problem and work on an appropriate solution. If enforcement action is necessary, the City will track the situation until the illicit connection is corrected, the illegal dumping stopped, or until the facility receives a valid NPDES permit for the discharge.

SWMP Task: Review and update inspection program as part of Pollution Prevention Plans for Municipal Industrial Facilities. Conduct annual inspections at MIFs. Status: Ongoing

During the first permit term, the City developed an inspection and pollution prevention program for municipal industrial facilities. Currently only four municipal industrial facilities are operated in the City. These facilities include:

- the Solid Waste Management Facility (SWMF) on Elm Street,
- the fleet truck & heavy equipment garage on Loraine Street,
- the fleet and police garage at Prosser Road, and
- the Knoxville Area Transit (KAT bus station) on Magnolia Avenue.

Each facility has been evaluated and inspected regularly by Engineering personnel during the first permit term and will continue to be inspected at least annually in the future. Since the bus

terminal is owned by the City but managed by KAT, they developed their own PPP, which was submitted in the first annual report in 1997.

Some structural pollution control measures have been implemented at several MIF sites. The KAT bus station installed two large Stormceptor stormwater treatment devices in November 1999. The total project cost was nearly $300,000. A strip of the concrete parking lot along First Creek was removed and replaced with a new slope directed away from the creek. The reversed slope and a large curb prevent the runoff from entering First creek directly. The runoff is now routed through the two oil/water separators before being discharged. Other measures at KAT include their commitment for ongoing upgrades to their fleet and fuels to produce less air and water pollution.

The SWMF has installed some above ground filters and catch basin inserts to mitigate potential pollution. The entire transfer facility is covered and the drain in the loading dock for the transfer trucks is routed to the sanitary sewer system. At the end of year two, the City's inspection of the SWMF identified several areas for improvement and began working on a plan. A draft Stormwater Pollution Prevention Plan was included in last year's report and has been implemented in year three. The SWPPP includes provisions for structural controls, retrofits, employee training, routine maintenance, inspections, and monitoring.

Soon after work began on the new SWPPP, the City started closing the SWMF on Wednesday afternoons to allow complete site maintenance, inspection, and employee training. City Council approved funds in year three for structural improvements in 2007/2008 budget. The stormwater improvements that were funded include:

1. Six catch basin inserts with bacteria killing filters for the six inlets that drain to the detention pond, and
2. A single treatment vault with gross pollutant screens and bacteria reducing filters for the remaining lot that bypasses the detention pond, and
3. Retrofit (to be determined) for the vacuum truck unloading area.

Both maintenance garages have adopted spill protection policies and all mechanical work is done inside. A hydrocarbon absorbent boom is maintained in a trench drain at the police garage as a secondary control for emergency spills.

The TDEC inspection of the Loraine Street facility revealed two areas of concern. The large parking lot where all of the heavy equipment, truck, and trailers are parked receives a concentrated amount of oil/grease drippings and debris, which may be washed into the storm drain system during rain events. The car wash facility did not seem long enough to adequately handle the longest truck/trailer combinations in the City fleet.

To improve the quality of stormwater runoff from the entire facility, a stormwater system retrofit project was designed to add two underground stormwater treatment structures at the outfall from the Loraine Street facility. Construction was completed in the summer of 2006. The retrofit successfully updated the facility to comply with the new ordinance requirements for vehicle storage and maintenance facilities. The two stormwater treatment units were installed in parallel to allow the City to perform full-scale performance study on more than one type of stormwater treatment BMP. Both units appear to be functioning properly. Monitoring started in year three but the severe drought limited the amount of data this year. Future results will be reported as they become available.

The extension project for the vehicle wash facility was completed last year. The roof over the wash bays was extended a total of twenty feet (ten foot on either side of the existing

building). The trench drains inside the drip edge of the new roof are routed to a grit chamber before discharging to the sanitary sewer.

IN-3 Monitoring Element

SWMP Task: Collect monitoring data from industrial stormwater dischargers and/or from TDEC. Assess impacts to the storm drain system. Status: Ongoing

As part of the NPDES Permit for stormwater discharges associated with industrial activity, applicants are required to monitor, at least bi-annually, representative stormwater outfalls identified on the facilities' Pollution Prevention Plans. Applicants must monitor in accordance with TDEC Rule 1200-4-10-.04. The City currently receives copies of the results of the industrial outfall self-monitoring from some of the regulated industries. The City will continue to work with TDEC or directly with the industrial discharger to obtain copies of the information, as it becomes available. The City will maintain this information in the City's industrial files, and will assess the impact of the monitored discharges on the water quality of the storm drain system as the City receives the data.

If the City determines that additional data needs to be provided in the monitoring program for an industry (reports on additional parameters, etc.), requirements for an expanded program for subsequent monitoring events will be coordinated with TDEC and/or the industrial discharger.

The Stormwater and Street Ordinance authorizes the City to require additional monitoring from industries not covered under the TDEC programs whenever necessary. This will usually be required in conjunction with some enforcement action after a problem has been observed.

SWMP Task: Develop ongoing monitoring program at non-permitted commercial facilities using guidelines pursuant to 40 CFR 122.26(d)(2)(iv)(c)(2). Identify pollutants/sources as applicable. Status: Complete

In the first permit cycle, the City's Ongoing Monitoring Program, defined in the Part 2 NPDES stormwater permit application, included the monitoring of stormwater runoff from two areas of industrial facilities (e.g. industrial parks). Stormwater samples were collected, analyzed, and recorded for 12 to 15 storms per year per site using flow weighted composites from ISCO monitoring stations. Each of the monitoring locations received runoff from small watersheds approximately 1/4 square mile with several different industries included. Therefore specific pollutants were not easily traced back to a specific industry but the general data did allow implementation of industry wide BMPs requirements through the SPAP program.

In addition to the stormwater sampling above, all outfalls from industrial areas have been tested as part of the dry weather field-screening program to identify potential specific sources of the pollutants. Each year the City will continue to choose random outfalls from industrial areas as the primary dry weather screening locations. These outfalls are tested with field screening kits with additional laboratory tests as necessary.

Additional monitoring and reports from TSDs and industrial facilities subject to SARA Title III, Section 313 may be required when a problem has occurred, when the City has reason to believe a pollution problem exists, when TDEC or EPA do not already require sufficient testing,

or if the City is mandated to test and report those facilities. The Stormwater & Streets ordinance Section 22.5-54 states, *"The Engineering Director may require any person engaging in any activity or owning any property, building or facility (including but not limited to a site of industrial activity) to undertake such reasonable monitoring of any discharge(s) to the stormwater system operated by the City and to furnish periodic reports of such discharges."* The City will maintain this legal authority to require monitoring from all facilities necessary as the Stormwater & Streets ordinance is updated throughout the permit term.

To replace the monitoring by the City on specific permitted industries or industrial homogeneous land uses, the City continued to sample commercial sites that do not require TDEC or EPA permits. The land-uses that require a City of Knoxville Special Pollution Abatement Permit (see section RC-2) are targeted for this sampling program. The standard operating procedures for the City's wet-weather sampling program are used except for the automatic sampler stations. The City has used both passive samplers and grab samples.

A wide range of pollutants will be sampled initially from the hotspot land uses until a standard set of expected pollutants can be identified. These pollutants should vary from one land use to the other. For example, restaurants and grocery stores will likely have runoff containing a higher nutrient load from their dumpster/grease bin area than a new auto dealership. Both will likely have oil/grease, sediments, and metals from the vehicle traffic. This monitoring data may play an important role in determining the future direction of the SPAP program and to verify the suitability and effectiveness of the SPAP runoff controls.

SWMP Task: Implement the ongoing monitoring program at non-permitted commercial facilities and analyze the results from ongoing commercial monitoring program.

Schedule: Begin Year Two.

Beginning in year two, the City initiated an annual sampling program at the storage and maintenance areas at the City's Loraine Street facility, Solid Waste Management Facility, and the KAT bus station. Samples are also collected at non-permitted commercial facilities such as Restaurants, gas stations, car lots, grocery stores and other known hotspots. The sampling locations will change each year to ensure a wide variety of sites within each commercial group.

SWMP Task: Maintain adequate legal authority to require monitoring and reports from TSDs and Industrial facilities subject to SARA Title III, Section 313. Schedule: Ongoing

The Stormwater & Streets ordinance Section 22A-54 states, *"The Director of Engineering may require any person engaging in any activity or owning any property, building or facility (including but not limited to a site of industrial activity) to undertake such reasonable monitoring of any discharge(s) to the stormwater system operated by the City and to furnish periodic reports of such discharges."* The City will maintain this legal authority to require monitoring from all facilities necessary if the Stormwater & Streets ordinance is updated in the next permit term. Additional monitoring may be required when a problem has occurred or still exists, when the City has reason to believe a pollution problem exists, when TDEC or EPA do not already require sufficient testing, or if the City is mandated to test and report those facilities.

SWMP Task: Evaluate and update the monitoring program for Municipal Industrial Facilities.
Status: Ongoing

The City has implemented limited testing at these facilities including ambient monitoring, dry-weather screening, and industrial stormwater inspections conducted by the Engineering Division. Initial monitoring inspections resulted in some of the structural modifications mentioned above in section IN-2 as well as some management policies and procedures. The City evaluated the current monitoring at MIFs and updated the plan to include some laboratory analysis to help evaluate the effectiveness of the installed structural controls. For example, the large Stormceptors that were installed at the bus terminal may be monitored with a before and after treatment sample to determine the removal efficiency of that BMP.

The Loraine Street facility is the site for a full-scale side-by-side BMP investigation project. Inflow and effluent samples are collected from each of the structural devices to determine the efficiency of each unit. The City completed installation of the test site in year two and started sampling in year three.

Stormwater runoff from the SWMF is sampled annually as described in MN-2. BMP monitoring will begin after the structural retrofits are completed.

The dry-weather screening program will continue to monitor the outfalls from all MIFs to insure that management controls are sufficient.

SWMP Task: Manage and Conduct Monitoring Program at MIFs. Status: Ongoing

The monitoring program for the municipal industrial facilities was developed during the first permit term and included in the first annual report. The program specified that the only municipal industries included in the City's monitoring program will be limited to the Knoxville Area Transit station, the Prosser Road fleet and passenger vehicle garage, and the Loraine Street maintenance and storage facility. However, the City added additional monitoring and testing of the parking lot runoff from the Solid Waste Management Facility (SWMF) on Elm Street during the first permit term. This monitoring program was developed as a Best Management Practices test site to evaluate the usefulness and effectiveness of catch basin filters on ultra-urban land uses. The City partnered with the University of Tennessee Civil & Environmental Engineering Department and with Aqua Shield to put two catch basin filters in place. One filter was installed at the SWMF and one was located on Phillip Fulmer Way outside Neyland Stadium.

A BMP sampling project began in 2007 at the Loraine Street as described earlier. Two vault type stormwater treatment units were installed side-by-side at the Loraine Street facility in 2006. Funds are available to begin improvements and BMP testing at the SWMF in year four.

Each year, the MIF outfalls are inspected at least once for non-stormwater flow in dry weather. If flow is observed, the normal dry weather screening parameters are analyzed, recorded, and investigated. In addition to the dry-weather screening, grab samples are collected from storage/maintenance areas at the City's Loraine Street facility, the Solid Waste Management Facility and the KAT bus station.

5.4 CONSTRUCTION SITE RUNOFF PROGRAM (CS).

Program to Implement and Maintain BMP Plans to Reduce Construction Site Runoff to the Municipal Storm Sewer System, 40 CFR 122.26(d)(2)(iv)(D).

CS-1 Site Planning

SWMP Task: Review & update the Stormwater & Streets Ordinance which requires construction sites greater than 10,000 sq. ft. to submit Erosion and Sediment (E&S) Control Plans.

Status: Complete

The original Stormwater and Street Ordinance was passed in 1997 and specifically required construction sites greater than 10,000 square feet to provide erosion and sediment control plans. The ordinance was revised in 2005 but the requirement for erosion control plans was not removed. The current ordinance may be reviewed or downloaded on the Internet at www.cityofknoxville.org/engineering/stormwater. This requirement is satisfied in Section 22.5-27(j)(1) of the ordinance.

SWMP Task: Require Site Plans Submittals per the City of Knoxville BMP Manual.

Status: Complete

The Stormwater and Street Ordinance requires all erosion and sediment control plan submittals and all site development work to comply with the Erosion and Sediment Control Handbook produced by TDEC, dated March 2002, or as amended by TDEC or its successor, or the City of Knoxville's Best Management Practices Manual, whichever is more restrictive.

SWMP Task: Review and update minimum criteria for plan review and checklists.

Status: Complete

Although the TDEC Erosion and Sediment Control Handbook does provide a checklist for review of Erosion and Sediment Control Plans, the City developed a list of minimum criteria to supplement the State checklist for various categories of site plans (residential, commercial, etc.). The City plans review staff uses the minimum criteria and checklists to insure consistency in the plan review process. The checklist is available on the Stormwater section's web page at www.cityofknoxville.org/engineering/ldmanual as part of the Land Development manual.

SWMP Task: Continue Pre-construction Assistance Meetings with Developers and Contractors.

Status: Ongoing

Since 1999, the City of Knoxville requires a Pre-construction Assistance Meeting with the Developer, contractors, design Engineers, and the City staff before a Site Development Permit is issued. A pre-construction meeting is required for all bonded projects or for projects that are identified as a priority or may be on a problematic site. This meeting is scheduled after

the Site Development plans are ready for approval but before construction begins. The meeting insures that all parties involved with the construction project are equally aware of the City's expectations. Topics covered in the meeting may include:

- The Development Inspection Checklists,
- The Stormwater & Streets Ordinance,
- The Engineering Department Enforcement Policy,
- Construction Best Management Practices,
- Inspection Schedules,
- State of Tennessee Erosion & Sediment Control Handbook,
- The City of Knoxville BMP manual,
- TDEC's SWPPP and ARAP,
- Special notes and considerations for the particular site,
- Other important information relevant to the project, and
- The City inspector, which is assigned to the project.

The Pre-construction Assistance Meeting format will continue to be reviewed and updated throughout the permit term as new policies, procedures, BMPs, and other regulations necessitate. Since the assistance meetings have been successful at increasing compliance and reducing enforcement, they will be continued throughout the permit term.

CS-2 BMP Requirements

SWMP Task: Require Construction BMPs from the City BMP manual or equivalent.
Status: Complete

As outlined in the new Stormwater and Street Ordinance section 22.5-27, all erosion and sediment control plans must comply with either the Erosion and Sediment Control Handbook produced by TDEC, dated March 2002, or as amended by TDEC or its successor, or the City of Knoxville's Best Management Practices Manual, whichever is more restrictive. The requirement to use BMPs from the BMP manual or TDEC manual applies to Utility, Single Family Residential (>10,000 s.f), Large Residential and Commercial Developments.

SWMP Task: Evaluate additional BMP requirements and design modifications. Maintain the updated BMP requirements on the City's web page. Status: Ongoing

The Stormwater and Street Ordinance section 22.5-22 authorizes the Engineering Division to compose a development design manual as the standard for which the ordinance requirements will be met. The BMP manual may be accessed on the Stormwater Section's web site at www.cityofknoxville.org/engineering/stormwater.

The guidance criteria in the new manual describe acceptable types of BMPs, design standards, and maintenance requirements for BMPs to be used throughout the City to meet the requirements of the new Stormwater and Street Ordinance. The guidance criteria are maintained on the Internet and distributed to developers as the official reference to ensure proper selection, design and maintenance criteria for BMPs. To ensure that effective post-development BMPs are constructed and maintained in the City, a standard maintenance covenant is executed before site

development plans are permitted. The guidance criteria address the goals of the NPDES stormwater program by allowing only BMPs, which are effective in reducing the targeted pollutants.

The BMP manual was intended to be a live manual with updates to add additional BMPs as necessary and to remove ineffective BMPs when appropriate. Maintaining the manual on the web is the easiest method to keep the manual current and available to the public.

SWMP Task: Continue to require construction site Good Housekeeping practices.

Status: Ongoing

To ensure that construction sites are kept clean and orderly, and to minimize pollutants in stormwater runoff as a result of other construction activities, the City will continue to require good housekeeping measures on all active construction sites. The good housekeeping regulations included in the new BMP manual address the following considerations:

- Designated areas for construction equipment maintenance and repair,
- Prohibition of discharges of oil and grease into the MS4 or receiving waters,
- Designated areas for construction equipment washing to ensure washwater is discharged to a maintained temporary holding basin or sediment trapping device,
- Designated construction site entrances, exits, and staging areas for all site traffic,
- Provision of storage areas for construction materials and receptacles for liquids (solvents, paints, acids) and solids in accordance with manufacturers recommendations,
- Provision of adequate waste storage areas and ensuring that the locations for collection of waste materials do not receive concentrated runoff, and
- Provision of adequate sanitary facilities on construction sites in accordance with Health Department Regulations.

Good Housekeeping issues are reviewed with the contractor, engineer, and developer during the pre-construction assistance meeting.

CS-3 Inspection / Enforcement

SWMP Task: Continue expanded inspections to include smaller construction sites (single family). Status: Ongoing.

In the first permit term, the City of Knoxville expanded new development construction inspections to include single-family residential sites. At the beginning of year three, the City hired two additional construction inspectors. One of the inspectors is dedicated to inspecting single-family residential projects consistent with the City's ongoing inspections on the larger sites. The Engineering Division also created a new triage plans review position by reorganizing resources. This reviewer will focus primarily on small projects that require less intensive review.

SWMP Task: Implement routine site inspections on commercial and large residential developments (e.g. rough grading, E&S control installation, final grading, and final stabilization.)
Status: Ongoing

The Engineering Division continues to implement site inspections for large residential and commercial developments. These inspections are not a new program and have been occurring since at least 1994. Inspections are performed during rough grading, final grading, and at various other times during the construction process. Although the site inspections are not always scheduled with the contractor or developer, the City staff may visit the construction sites approximately every three weeks or sooner if necessary. The time frame for some project inspections will vary due to the specific project.

These inspections are performed to insure compliance with the approved erosion and sediment control plan, good housekeeping measures, and the design plan.

A significant improvement in this process was implemented after the 2003 ordinance revision. The developer is now given a letter, which authorizes the installation of erosion and sediment controls after the submitted site development plan is approvable but before the permit is issued. After the e/s controls are in place, a licensed professional must certify that the installation has been completed according to the e/s control plan. The site development permit is issued after the Engineering Division receives the certification.

During the permit year, some concerned citizens asked that the City review and clarify the policy for inspections and enforcement on newly annexed areas that are developing under plans previously approved by Knox County government. The City began implementing the following procedures in year three for County permitted annexed areas:

1. The City will conduct routine inspections for erosion and sediment control.
2. Inspections will not verify compliance with County-approved plans but will determine if sediment is adequately controlled on site.
3. If sediment is not controlled on site, the City will coordinate with Knox County to conduct a joint compliance inspection.
4. If the County declines to inspect the site for any reason, fail to take action, or if their enforcement is ineffective to control sediment from the site, then the City will proceed with standard enforcement procedures consistent with all other sites within the city limits.

Any changes to this policy will be reported as they occur.

SWMP Task: Continue to require post-construction Development Certifications from licensed professional Engineers, and/or the appropriate design professionals before bond release to insure the stormwater facilities are built as planned. Status: Ongoing

Since 1999, the City required all developments with a bond to submit to a post-construction Development Certification before the bond is released. A licensed professional Engineer and land surveyor must certify that the roads and stormwater features (quality & quantity) will function as intended. Some deviation from the permitted plan may be allowed during construction as long as the final project still meets the City's minimum requirements. If the final certified project does not meet the minimum requirements, further adjustments must be

made before the entire bond is released to the developer. This program does require a second plan review by the Engineering Department after construction has finished to insure proper results in the field.

The Development Certification requires the following components when applicable:

- As-built drawings
- Complete detention calculations
- Roadway inspection reports
- Final site inspection in accordance with checklist
- Verification that all stormwater quantity and quality facilities are covered by a Covenants for Permanent Maintenance of Stormwater Facilities
- Engineering certification or soil retaining calculations for slopes or retaining walls steeper than 2:1.

This program has been successful and will be continued throughout the permit term.

SWMP Task: Maintain enforcement procedures, policies, and follow-up monitoring/ inspections.

Status: Ongoing

The schedule for this task appropriately coincided with the schedule for ordinance updates. The existing enforcement procedures and policies have been effective and were not amended when the ordinance was updated in 2005. During year three, 392 NOVs were written for construction site runoff violations, 8 of those resulted in civil penalties totaling $32,975.

Depending on the violation, a first-time offender is usually educated and asked to remediate the damage or correct the violation if possible. This is usually followed up with a letter to inform the violator of the City's expectations and to provide helpful BMPs to prevent future problems. More severe or repeated violations will merit a Notice of Violation (NOV), which is issued in the field directly to the violator if available on site. Copies of the NOV are distributed to the property owner or developer by certified mail, the City Law Department, and the Engineering Division's file. The NOV may order specific remedies and require the violator to submit reports and/or pollution prevention plans. Penalties, if any, are only issued after the NOV expires so the violation and remedies may be fully evaluated.

In the event that a penalty is assessed, a violator may appeal the penalty before a five-member Environmental Appeals Board. The five volunteer members of the Environmental Appeals Board are appointed by the Mayor and consists of individuals with an expertise as follows:

1. One licensed professional engineer with three (3) years of engineering experience as a Professional Engineer;
2. One architect, engineer, landscape architect or surveyor with three (3) years of experience;
3. One representative of the development or industrial community;
4. One neighborhood representative;
5. One member at large.

In addition to the above qualifications, one of the five members must have at least three years of civil engineering experience and a second member must have at least three years of civil or environmental engineering experience. Board members serve a 5-year term and may be re-appointed at the end of their term.

Some research has already begun to determine appropriate penalties for discharges that cannot be recovered but do not cause a fish kill or other quantifiable immediate damage. The City's current evaluation method does not account for incremental contributions to the overall pollutant loading or degradation of the waterway. The City is developing standard penalties for construction violations to be more consistent with TDEC's expedited enforcement procedures.

To help identify repeat violators, the City maintains an updated record of every NOV issued and a database for stormwater complaints.

CS-4 Training Programs

SWMP Task: Co-Sponsor E&S Control Practice Seminars for all participants.

Status: Annually

The City and other Water Quality Forum members developed and presented free erosion and sediment control workshops throughout the first five years of the first permit term. To maximize participation, the workshops were typically presented in the early spring or late fall while construction activities are least intense. The workshops were very successful.

Beginning in year six, the City assisted UT and TDEC with promotion and presentation of the new TDEC erosion control certification program. This new certification program effectively duplicates the information the City had been providing in our annual seminars. To reduce the amount of competition for the two programs, the City will continue to promote and support the TDEC certification program in place of a separate competing erosion control workshop. Each year, the City will send inspectors and supervisors to the training program as needed. Last year, all the new inspectors received this training and some inspectors were retrained.

SWMP Task: Provide training for City plans review staff. Status: Ongoing

In an effort to fully train the Stormwater Management staff, the City has participated in several stormwater seminars around the region. Most staff members at the Engineer level will attend at least one, but typically more, seminars or training workshops annually. Typical seminars attended each year include: stormwater modeling, NAFSMA conference, regulatory updates, erosion control certification, NPDES updates, ASCE seminars, software workshops, and others. All licensed engineers must complete at least twelve hours of professional development each year. In addition to the stormwater management seminars attended, the Engineering staff have sponsored, planned, and presented a series of annual workshops/seminars to better educate the staff and development community about the development and plans review processes. Some of the topics of the City sponsored development process training sessions include:

- ***Technical Requirements of the Stormwater & Streets Ordinance***
- ***Construction Site Erosion and Sediment Control design and implementation***
- ***Site Development Permit Review***
- ***Special Pollution Abatement Permit program***
- ***Performance and Indemnity Agreements, Permanent Maintenance Covenants for***

Stormwater Facilities

- ***Plat Review Process and Procedures***
- ***Development Certifications***

The City will continue to provide training to the Engineering staff by participating in seminars locally and outside the city; in-house training by professional engineers; tuition reimbursement for university engineering classes; cooperating with TDOT, TDEC, TVA, UTK, and other agencies to provide professional training for the staff. Training of the plans review and inspections staff is an ongoing program within the Engineering Division.

5.5 COMPREHENSIVE MONITORING PROGRAM (MN).

Program to Collect Quantitative Data to Determine the Impacts of Urban Stormwater on the Natural Environment, pursuant to 40 CFR 122.26(d)(2)(iii)(A).

MN-1 Seasonal Storm Event Monitoring

SWMP Task: Review and update the Standard Operating Procedures (SOP) for the seasonal sampling program. Status: Complete

The original SOP was developed and submitted with the first annual report during the first permit cycle. Over time the SOP had become outdated and some parts obsolete. The City revised the SOP to make it current and valid for the equipment, software, site locations, and procedures that are currently used.

SWMP Task: Maintain at least five (5) automatic monitoring stations. Status: Ongoing

The City moved two of the five ISCO automatic monitoring stations in 2005. The new locations have not changed since they were reported that year. The specific locations are noted on the large inventory map in the appendix of this report. The five monitoring stations are currently located First Creek, Love Creek, Williams Creek, Fourth Creek and at the outlet of the regional pond at Acker Place (headwater of Fourth Creek). Next year a new station may be sited on Third Creek just downstream of the confluence with East Fork. Once it is operational, the new station may replace one of the other five or remain as a sixth station.

Each monitoring station consists of a tipping bucket rain gage, an automatic sampler with 24 individual bottles or bags, and a flow meter/data logger. The intake line and flow sensors are installed in the low flow path for constant monitoring. Modems and cell phones were initially installed to allow City staff to remotely monitor the conditions and station activity. Unfortunately, remote monitoring has not been available via phone since the City upgraded to Windows XP. The ISCO representative is working with the City to restore this capability.

After each rain event, a technician will interrogate the sampler in the field via laptop computer and calculate the appropriate flow-weighted composite sample. The information is then used to prepare the actual sample from the individual bottles. The composite sample is prepared; it is immediately transported to the laboratory for analysis.

SWMP Task: Collect twenty (20) - thirty (30) flow-weighted composite storm samples annually. Schedule: Annually

Each year, the automatic sampling stations should collect at least twenty (20) flow-weighted composite storm samples. Each of the five monitoring stations should collect four (4) to six (6) storm samples each year with at least one storm sample per quarter to help distribute the sampling events seasonally. During dry weather, the stations may also collect ambient samples as described below in section MN-3 unless grab samples are taken manually.

Each of the flow-weighted storm samples will be analyzed for thirteen (13) routine parameters. Only pH will be recorded in the field. The remaining routine parameters will be analyzed and recorded in the laboratory in accordance with 40 CFR part 122.26 and 40 CFR part 136. The routine parameters to be tested in the laboratory are listed in the table below:

Routine Parameters for Laboratory Analysis		
Total Suspended Solids (TSS)	Nitrate + Nitrite Nitrogen (as N)	Total Recoverable Lead
Total Dissolved Solids (TDS)	Total Nitrogen	Total Recoverable Zinc
Total Ammonia Nitrogen (as N)	Biochemical Oxygen Demand (BOD_5)	Dissolved Phosphorus
Total Ammonia + Organic Nitrogen	Chemical Oxygen Demand (COD)	Total Phosphorus

SWMP Task: Collect five (5) wet weather bacteria samples. Schedule: Annually

Five bacteria samples will be collected each year. One grab sample will be collected manually at each monitoring station during a qualified storm event. Since the TMDL includes both fecal coliform and e-coli standards, both parameters will be analyzed in the laboratory.

SWMP Task: Collect five (5) full-suite grab samples (one/station/permit). Schedule: Ongoing

Each year, one monitoring station will be selected for a full-suite grab sample. The five stations will be rotated throughout the permit term to allow one sample from each location.

In addition to the 13 routine parameters, the full-suite grab sample includes analysis for oil & grease and all the pollutants listed in Tables II & III of 40 CFR Part 122 Appendix D including: volatiles, pesticides, acids, base/neutrals, toxic metals, total phenol, and cyanide.

SWMP Task: Analyze Results from Ongoing Monitoring Program. Schedule: Year 5

Sampling data will continue to be collected, evaluated, and analyzed by City staff as part of the ongoing seasonal monitoring program. The updated seasonal pollutant loading and event mean concentration for the major watersheds within the MS4 may be estimated from the City monitoring data and/or from other regional data, which may include:

- NURP study,
- USGS Open-File Report 94-68 titled "Rainfall, Streamflow, and Water-Quality Data for Five Small Watersheds, Nashville, Tennessee, 1990-1992",
- USGS Water-Resources Investigations Report 95-4140,
- USGS Open-File Report 93-xxx titled "Stormwater Data for Knoxville, TN '91-'92.
- Any available data from TVA, EPA, and the State of Tennessee.

The estimates of the seasonal loading and event mean concentrations will be included in the fifth annual report. An estimate of the total annual runoff from each of the major watersheds within the City will be provided in each annual report (see Section 6.2.4 in this report). Due to ongoing annexations, watersheds or portions of watersheds may be added to this estimate as needed.

MN-2 Dry Weather Screening & Industrial/Commercial Site Monitoring

SWMP Task: Dry Weather Screening as described in ILL-2. Status: Ongoing

SWMP Task: Implement Commercial/Industrial Monitoring in IN-3. Status: Ongoing

This year the City began sampling runoff from commercial sites such as restaurants, car lots and large parking lots. The purpose of this sampling is to determine the magnitude and variety of pollutants discharging from sites that have been targeted as pollution hotspots. The City began regulating some hotspots in 1997 through the Special Pollution Abatement Permit (SPAP) program. The list of SPAP land uses was expanded in the 2003 ordinance revision. The current sampling program will help refine the SPAP requirements to better regulate the hotspots.

MN-3 Ambient & Biological Monitoring

SWMP Task: Implement ongoing Ambient sampling program. Schedule: Quarterly.

At least twenty (20) ambient samples will be collected each year at a rate of one sample per quarter from each of the five monitoring station locations (detailed by map in section 8.0 and on the inventory map attached). The City had already implemented a quarterly ambient sampling program during the first permit term.

The samples may be collected either by a single grab sample or by using the automatic samplers for a timed composite. Each ambient sample collected was analyzed for the 13 routine parameters listed in MN-1. This program was first implemented after the monitoring stations were moved to locations that have base flow in dry weather. Since all of the locations have some flow in ambient conditions, the samples can be retrieved at the same location as the storm event samples. This is an added convenience for direct comparison of storm event and ambient samples as well as allowing more options for collecting samples automatically.

SWMP Task: Develop/Implement a Biological-monitoring program to supplement the program previously administered by TVA. Status: Ongoing

For the last few years, the Tennessee Izaak Walton League (IWL) has been contracted to continue their study of the biological health of urban streams. During the 2006/2007 permit year, the Fort Loudon Lake Association (FLLA) took over the contract for this work as the two organizations split. The FLLA conducted studies at locations on Baker Creek, First Creek, Third

Creek and Fourth Creek. They collected the field data and determined an Index of Biotic Integrity (IBI) for multiple locations. The results of this year's IBI studies are included in the appendix. The actual sampling occurred in between May and June 2007.

Whenever possible the City will partner with TVA and TDEC to perform further IBIs in the urban streams to help identify improvements.

SWMP Task: Develop/Implement a Bacteriological-monitoring program. Status: Ongoing

To insure that adequate bacteriological data is collected throughout the City, a five-part monitoring program has been developed for implementation. Since the bacteria TMDL includes both e-coli and fecal coliform, the City has started requesting both analysis from the laboratory. The five-part program includes bacteria sampling during dry-weather screening (ILL-2), storm event sampling grab samples (MN-1), ambient monitoring (MN-3), TMDL specific studies (6.0), and on demand samples due to specific citizen requests.

The last part of the program involves acquiring data collected from other agencies. Specifically, the City will seek data collected from creek monitoring by sewer utilities. As part of their current Consent Decree, the Knoxville Utilities Board is required to have a bacteriological-monitoring program. The TDEC approved program is located in all of the City's 303(d) listed streams. Copies of the annual water quality report can be obtained at www.kub.org. The City will obtain copies of this data each year and may supplement additional sampling as requested by concerned citizens.

A comprehensive TMDL Monitoring Plan has been included as a draft in this report for TDEC's approval.

MN-4 Training Programs

SWMP Task: Develop and Implement Monitoring Training Program for staff and/or volunteers. Status: Ongoing

During the first permit term, the City partnered with volunteers for dry-weather screening, ambient sampling, and biological monitoring. Last year, no volunteers were used for any monitoring activities. If volunteers are used in the future, the City will hold a training session to insure that proper sampling protocols are used. The City does hold training sessions for the adopt-a-stream volunteers before they begin their activities on their own.

City staff has continued to improve their skills and abilities by assisting other agencies in the field with IBIs, Stream Assessments, and stormwater monitoring. All new employees will be cross-trained on monitoring and stream assessments. Most of the stormwater staff attended a Streamwalk training course at Ijams Nature Center on September 4 and 5 of 2007.

5.6 TMDL IMPLEMENTATION AND ACTIVITIES

A TMDL Implementation Plan was approved by EPA on January 15, 2003 for the Fort Loudoun Lake Watershed (HUC 06010201) for the following creek systems: First Creek, Second Creek, Third Creek, Fourth Creek, and Goose Creek.

The City of Knoxville addressed the following bacteria sources and activities as required by the TMDL and permit.

Farm Animals — Schedule: Complete by Year Five

At the end of year two, the City contracted the CAC Americorps Water Quality Team (AWQT) to begin a study of the potential bacteria impact of farm animals on the 303(d) streams in Knoxville. Using agricultural zoning maps and GIS, the AWQT started to field verify potential livestock sites. During year two and three, they checked each site for signs of livestock access and runoff to the creek as well as erosion caused by access. Five properties in the Third Creek watershed contained a total of 94 head of livestock, including horses and cattle. Grab samples were collected from upstream and downstream of the study sites and delivered to the State of Tennessee's Laboratory for bacteria analysis. The data was compiled and analyzed during year three but did not indicate that the livestock create a significant impact on the bacteria in the stream. In fact, two of the sampled sites showed a decrease in both fecal coliform and E. coli from the upstream sample to the downstream sample. A third property was sampled on three different dates with upstream and downstream samples. Only one of the downstream samples showed an increase in bacteria levels. The City may reevaluate the effect of livestock on urban streams in the future but at this time there is no evidence to indicate that livestock are a significant source of bacteria in Knoxville's streams. Due to codes and zoning, the properties that do contain livestock should shrink or be eliminated in the future.

Wild Birds — Schedule: Complete by Year Five

During year one, the CAC Americorps Water Quality Team (AWQT) volunteered to study the biological impact that waterfowl populations have on our local waterways. The City identified 56 possible waterfowl locations that could be either a source or sink for bacteria. The AWQT visited those locations in the fall and spring, counted the number of birds, and selectively sampled for ammonia. Six sites that had a large number of waterfowl or high concentrations ammonia were analyzed for fecal Coliform and E. coli. Four sites were considered to be sources of bacterial pollution since they discharged to creeks and two were considered sinks since they had no outlet to waters. The results of the initial investigation were reported in year one.

The initial investigation reduced the original 56 possible locations down to only four sites that need to be analyzed for structural retrofit or some management control to reduce the bacteria levels entering the stream or river. Since two of those sites enter the Tennessee River directly, the City will concentrate on analyzing, designing and implementing some mitigation measure for the remaining two sites, which discharge directly into 303(d) streams listed in the bacteria TMDLs. The City has met with the property owners, a stormwater treatment unit manufacturer,

and the Fort Loudon Lake Association to discuss retrofitting the outlet of the large duck pond on First Creek with a device to reduce bacteria. At TDEC's request, the project was put on hold until toxicity data could be collected on the media filter. Any future progress on the analysis or mitigation measures will be reported in the future annual reports.

Outside dumping of animal wastes — Status: Ongoing

In year one, the City investigated possible bacterial pollution sources from the Knoxville/Knox County Animal shelter. The City helped the shelter personnel setup a maintenance schedule for quarterly inspections and annual cleanout of their Nutrient Baffle Box.

Domestic Pets — Status: Ongoing

The City partnered with the Izaak Walton League and Prestige Cleaners to encourage the use of pooper-scoopers in City parks and the Central Business Improvement District. Four dispensers are located downtown and four are located in two City parks. Approximately 500 pooper-scoopers bags are restocked bi-weekly at the dispenser on Gay and Summit, which indicates a successful start to our pet waste challenge downtown. Additional dispensers may be added in other parks in the future. The City has distributed pooper-scoopers to vet clinics, pet stores, and during public functions such as Bark-in-the-Park and Earth Fest. An attention-grabbing poster was placed on display at these functions to help educate the pet owners of their responsibility to manage their pet's waste. In March 2003, the City passed a pet waste ordinance (O-98-03) to require the owner or custodian of any pet to collect and remove all solid pet wastes from all areas within the CBID.

Fish/Bait Shops — Status: Ongoing

The City inspected Rea Springs Live Bait, Seymour Bait & Tackle, and Conservation Fisheries Inc. as possible sources of bacterial pollution. The effluent from Seymour Bait & Tackle and Conservation Fisheries Inc. discharged directly to a KUB sewer line. The effluent from Rea Springs Live Bait shop discharges to a constructed wetland and then into First Creek. Results of the bacterial sampling of the effluent entering First Creek were well below the threshold for human contact. TDEC was notified of the sampling and results.

Private Leaking Laterals — Status: Ongoing

The City has continued to coordinate with KUB to identify and correct sanitary sewer discharges as necessary. A standard procedure has been developed to insure that each possible contamination source is investigated after a problem is identified during dry weather screening. When high ammonia or fecal coliform levels are detected in the MS4, KUB and City personnel cooperate to identify the contamination source through dye testing or manhole by manhole testing. Once a source has been identified, KUB will be responsible for correcting problems in the main sanitary sewer system while the City will work with KUB and the private property owners to correct problems on private property. These coordinated inspections have identified private residences, industries, and businesses with plumbing or floor drains connected to the

MS4 instead of the sanitary sewer system. This type of close coordination with all sewer utilities is essential for solving illicit discharges to the MS4 and will likely continue throughout the new permit term.

A Memorandum of Understanding has clarified the cooperative roles and responsibilities of both the City and KUB with respect to the City's stormwater management program and compliance with the MS4 NPDES permit. A copy of the MOU was included in the appendix of the 2003/2004 annual report.

Human wastes (Outdoor Elimination by Humans) Schedule: Completed

In year two, the City implemented a survey and inventory of homeless populations in Knoxville. The Engineering Division was able to add a few questions to the survey to determine how transients use the creeks while living outdoors. The results of the survey indicate that there is likely some impact on stream water quality by homeless people.

Dr. Nooe issued the following statement regarding his homeless study for the City of Knoxville: *"In the February, 2006, survey of homelessness, we had planned to examine use of creeks and streams by those persons living in outside locations. However, finding a limited number of persons in the six camps visited, the data are incomplete. There are several observations based on visits to camps and conversations with outreach workers that I can share. Homeless camps are scattered throughout the county. Many are located in or near center city, but others can be found in various sections such as west in the Cedar Bluff and Lovell Road area. There appear to be approximately 18-20 camps along creeks and streams, with an average of 4-6 persons staying in each camp. Occasionally, someone will use the water for bathing, but the most frequent use seems to be cooling food and beverages (tying the food in a plastic bag and suspending it in the water). We did not observe directly using the water for disposal of waste, but the proximity suggests possible runoff."*

Illicit connections to storm drain system Status: Ongoing

The Illicit Connections and Illegal Dumping Program (ILL) is an ongoing program reported in section 5.2 of this report.

6.0 MONITORING REPORTS SUMMARY

6.1 Dry-Weather Screening Program - New Outfall Inventory.

During the past permit year, no outfalls were removed from the City's outfall inventory and 132 outfalls were added. Outfalls are typically added as a result of re-development or annexations and removed as a result of drainage alterations.

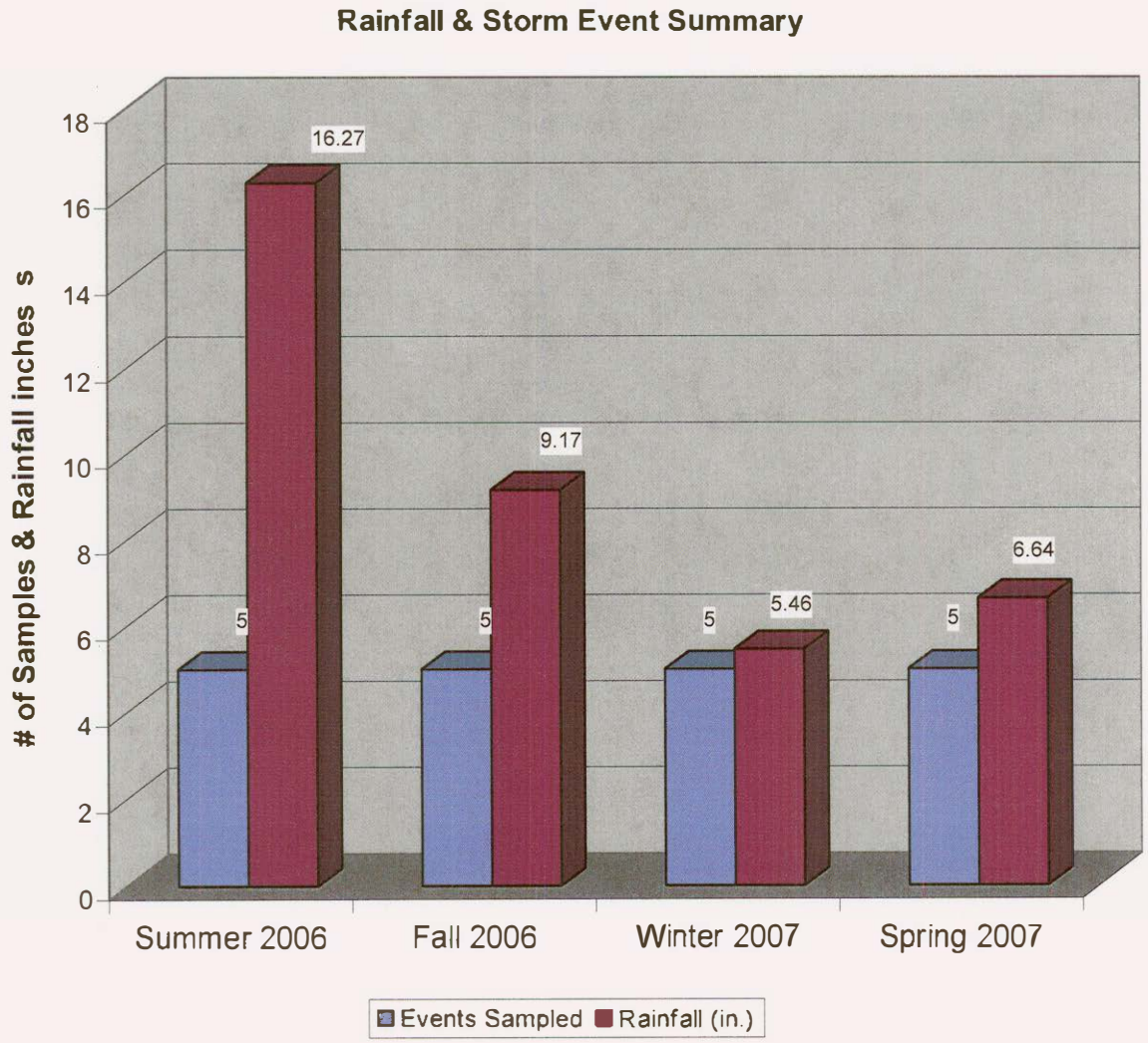
All updated outfalls are clearly marked on the inventory map located in the appendix but attached separately. The outfalls added to the inventory this year are listed below:

02-300-0171	04-400-0271	06-100-0146	12-400-0094
02-300-0172	04-500-0272	09-400-0015	12-200-0095
02-400-0173	04-400-0273	09-500-0020	12-300-0096
02-300-0174	04-400-0274	09-400-0025	12-300-0097
02-300-0176	04-500-0276	10-400-0365	12-100-0098
02-300-0177	04-400-0286	10-300-0424	12-300-0099
02-300-0178	04-300-0291	10-100-0440	12-500-0100
02-300-0179	04-400-0292	10-400-0442	12-200-0101
02-300-0181	04-400-0293	10-300-0443	12-400-0553
02-400-0194	04-400-0324	10-300-0445	12-400-0554
03-200-0436	04-400-0336	10-300-0450	12-400-0557
03-400-0552	04-400-0350	10-400-0510	12-400-0558
03-100-0553	04-300-0355	10-400-0515	12-300-0563
03-400-0576	04-300-0378	10-400-0520	13-400-0179
03-400-0578	06-400-0096	10-400-0525	18-100-0701
03-200-0579	06-400-0105	10-100-0530	31-300-0505
03-300-0629	06-400-0110	10-200-0535	31-400-0507
03-300-0631	06-400-0115	10-500-0550	31-500-0510
04-500-0017	06-100-0116	10-400-0553	31-300-0515
04-400-0037	06-200-0118	10-400-0558	31-300-0520
04-400-0254	06-400-0121	10-400-0559	53-400-0205
04-400-0256	06-400-0124	10-100-0562	53-400-0215
04-400-0257	06-400-0127	10-100-0564	55-200-0151
04-400-0258	06-100-0128	10-500-0566	56-400-0218
04-400-0259	06-400-0132	11-200-0592	70-400-0598
04-400-0261	06-100-0133	12-300-0064	70-400-0599
04-400-0262	06-400-0134	12-200-0066	70-400-0610
04-400-0263	06-400-0136	12-400-0067	70-300-0615
04-300-0264	06-400-0137	12-100-0073	79-500-0339
04-400-0266	06-400-0138	12-500-0090	79-200-0341
04-300-0267	06-200-0139	12-200-0091	79-500-0343
04-400-0268	06-400-0141	12-400-0092	79-200-0344
04-400-0269	06-400-0142	12-300-0093	79-300-0376

6.2 Ongoing Stormwater Monitoring Program.

6.2.1 Area Rainfall Data & Storm Event Summary.

During the July 1, 2006 to June 30, 2007 monitoring period, an average of 37.54 inches of rainfall was recorded and 20 storm events were sampled from the City's five ISCO monitoring stations. Section V of the current NPDES Permit requires a sampling frequency for routine wet-weather samples of one storm event per season per station. This requirement was met. The graph below shows the relationship between the amounts of rainfall received and the number of storm events sampled per season. Monitoring data summaries for each of the sampling locations are included for TDEC's review on the following pages.



6.2.2 Laboratory Analysis Summary

Laboratory Analysis Summary - Seasonal Storm Sampling Program

July 1, 2006 thru June 30, 2007

Site	Quarter	pH	Average Sampled Volume	Rainfall per Event	BOD	COD	Suspended Residue	Dissolved Residue	Nitrate+ Nitrite nitrogen	Ammonia nitrogen	Total Kjeldahl nitrogen	Total organic nitrogen	Lead	Zinc	Total Phosphorus	Ortho Phosphate
Units			cu-ft	inches	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Acker Place Fourth Creek	Sum. '06	7.0	-	1.19	BDL	BDL	120	40	0.25	0.26	0.50	BDL	0.0110	0.220	BDL	BDL
	Fall'06	7.0	216	0.10	BDL	23.0	20	130	0.49	0.12	0.58	BDL	BDL	0.250	BDL	0.160
	Wtr. '07	7.0	204,381	1.09	BDL	30.0	32	70	1.10	BDL	1.10	1.10	0.0084	0086	BDL	BDL
	Spr. '07	7.0	424,877	0.82	BDL	31.0	98	72	0.44	BDL	0.78	0.78	0.0073	0.170	BDL	0.005
Average:		**7.0**	**209,825**	**0.80**	**BDL**	**28.0**	**67.5**	**78.0**	**0.6**	**0.2**	**0.7**	**0.9**	**0.0**	**0.2**	**BDL**	**0.1**
KAT First Creek	Sum. '06	7.0	8,506,769	1.39	12.0	26.0	380	70	0.69	0.22	1.80	1.60	0.0470	0.290	0.54	0.031
	Fall'06	7.0	5,353,028	0.97	5.1	BDL	140	200	1.10	BDL	0.59	0.59	0.0250	0.057	0.23	0.160
	Wtr. '07	7.0	1,161,165	0.17	BDL	BDL	23	210	1.00	BDL	BDL	BDL	0.0130	0.040	BDL	0.046
	Spr. '07	7.0	3,896,489	0.81	5.1	27.0	210	180	0.66	BDL	1.60	1.60	0.0270	0.130	0.34	BDL
Average:		**7.0**	**4,729,363**	**0.84**	**7.4**	**26.5**	**188.3**	**165.0**	**0.9**	**0.2**	**1.3**	**1.3**	**0.0**	**0.1**	**0.4**	**0.1**
Love Creek	Sum. '06	7.0	208,600	0.91	6.4	31.0	110	150	0.82	0.18	0.61	BDL	0.0120	0.062	BDL	0.048
	Fall '06	7.0	1,135,247	0.97	BDL	BDL	76	140	0.51	BDL	BDL	BDL	0.0130	0.039	0.13	0.073
	Wtr. '07	7.0	102,928	0.18	BDL	BDL	10	250	1.10	BDL	0.56	0.56	0.0052	0.170	BDL	0.035
	Spr. '07	7.0	1,147,536	0.74	BDL	28.0	73	180	0.88	BDL	1.10	1.10	0.0084	0.055	0.12	0.034
Average:		**7.0**	**648,578**	**0.70**	**6.4**	**29.5**	**67.3**	**180.0**	**0.8**	**0.2**	**0.8**	**0.8**	**0.0**	**0.1**	**0.1**	**0.0**
Walden Drive Fourth Creek	Sum. '06	7.0	2,818,117	2.43	8.0	63.0	430	110	0.45	BDL	1.90	1.90	0.0270	0.210	0.22	BDL
	Fall '06	7.0	485,585	0.94	BDL	27.0	150	130	0.35	0.31	0.80	BDL	BDL	0.230	0.22	BDL
	Wtr. '07	7.5	292,407	0.22	BDL	29.0	52	140	BDL	BDL	0.64	0.64	BDL	0.190	BDL	0.081
	Spr. '07	7.0	1,210,363	0.72	BDL	23.0	200	100	0.48	BDL	0.97	0.97	0.0190	0.120	0.25	BDL
Average:		**7.1**	**1,201,618**	**1.1**	**8.0**	**35.5**	**208.0**	**120.0**	**0.4**	**0.3**	**1.1**	**1.2**	**0.0**	**0.2**	**0.2**	**0.1**
Williams Creek	Sum. '06	8.0	21,963	0.95	9.0	43.0	22	150	0.88	BDL	BDL	BDL	0.0057	0.038	BDL	0.038
	Fall '06	7.0	24,420	1.36	BDL	25.0	21	140	0.49	BDL	0.82	0.82	BDL	BDL	BDL	0.051
	Wtr. '07	7.5	8,813	0.20	8.6	31.0	37	150	0.84	BDL	0.59	0.59	0.0064	0.042	BDL	0.090
	Spr. '07	7.0	1,100,815	0.73	7.6	34.0	67	130	0.60	BDL	1.40	1.40	0.0160	0.069	0.25	0.041
Average:		**7.4**	**289,003**	**0.8**	**8.4**	**33.3**	**36.8**	**142.5**	**0.7**	**BDL**	**0.9**	**0.9**	**0.0**	**0.0**	**0.3**	**0.1**
National NURP Study Average					11.9	90.8	na	na	na	*****	2.35	3.31	0.18	0.176	0.16	
Characteristics of Urban Stormwater Range					1 - 700	5 - 3,100	2 - 11,300	200 - 14,600	na	0.1 - 2.5	0.01 - 4.5	na	0.0 - 1.9	na	0.1 - 125	

-The above chart is comprised of seasonal averages from the data collected from each individual storm event.

-Winter (Jan., Feb., and March); Spring (April, May, and June); Summer (July, Aug., and Sept.); Fall (Oct., Nov., and Dec.)

-The Characteristics of Urban Stormwater and National NURP Study Average data was taken from tables 4-1 and 4-2 of the Stormwater Management for Maine: BMPS

6.2.2 Laboratory Analysis Summary

Fourth Creek Monitoring Station (Acker Place)

Quarter	Date	Type	pH	Flow	Rainfall amount	BOD	COD	Suspended Residue	Dissolved Residue	Nitrate + Nitrite nitrogen	Ammonia	Total Kjeldahl Nitrogen	Total Organic Nitrogen	Lead	Zinc	Total Phosphorus	Ortho Phosphate
Units				cu-ft	inches	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
SUMMER 2006	31-Aug	Full Suite	7.0	/	1.19	BDL	BDL	120	40	0.25	0.26	0.50	BDL	0.0110	0.220	BDL	BDL
FALL 2006	12-Oct	Comp	7.0	216	0.10	BDL	23.0	20	130	0.49	0.12	0.58	BDL	BDL	0.250	BDL	0.160
WINTER 2007	16-Mar	Comp	7.0	204,381	1.09	BDL	30.0	32	70	1.10	BDL	1.10	1.10	0.0084	0.086	BDL	BDL
SPRING 2007	11-Apr	Comp	7.0	424,877	0.82	BDL	31.0	98	72	0.44	BDL	0.78	0.78	0.0073	0.170	BDL	0.048
Sample Average			7.0	209,824.7	0.80	BDL	28.0	68	78	0.57	0.19	0.74	0.94	0.0089	0.182	BDL	0.104

***National NURP Study Average**	11.9	90.8	na	na	na	*****	2.35	3.31	0.18	0.176	0.16
***Characteristics of Urban Stormwater Range**	1 - 700	5 - 3,100	2 - 11,300	200 - 14,600	na	0.1 - 2.5	0.01 - 4.5	na	0.0 - 1.9	na	0.1 - 10

* Data was taken from tables 4-1 and 4-2 of the Stormwater Management for Maine: BMPS.

6.2.2 Laboratory Analysis Summary

First Creek Monitoring Station (KAT)

Quarter	Date	Type	pH	Flow	Rainfall amount	BOD	COD	Suspended Residue	Dissolved Residue	Nitrate + Nitrite nitrogen	Ammonia	Total Kjeldahl Nitrogen	Total Organic Nitrogen	Lead	Zinc	Total Phosphorus	Ortho Phosphate
Units				cu-ft	inches	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
SUMMER 2006	11-Aug	Comp	7.0	8,506,769	1.39	12.0	26.0	380	70	0.69	0.22	1.80	1.60	0.047	0.290	0.54	0.031
FALL 2006	2-Nov	Comp	7.0	5,353,028	0.97	5.1	BDL	140	200	1.10	BDL	0.59	0.59	0.025	0.057	0.23	0.160
WINTER 2007	13-Feb	Comp	7.0	1,161,165	0.17	BDL	BDL	23	210	1.00	BDL	BDL	BDL	0.013	0.040	BDL	0.046
SPRING 2007	11-Apr	Comp	7.0	3,896,489	0.81	5.1	27.0	210	180	0.66	BDL	1.60	1.60	0.027	0.130	0.34	BDL
Sample Average			7.0	4,729,362.8	0.84	7.4	26.5	188	165	0.86	0.22	1.33	1.26	0.028	0.129	0.37	0.079

***National NURP Study Average**	11.9	90.8	na	na	na	*****	2.35	3.31	0.18	0.176	0.16
***Characteristics of Urban Stormwater Range**	1 - 700	5 - 3,100	2 - 11,300	200 - 14,600	na	0.1 - 2.5	0.01 - 4.5	na	0.0 - 1.9	na	0.1 - 10

* Data was taken from tables 4-1 and 4-2 of the Stormwater Management for Maine: BMPS.

6.2.2 Laboratory Analysis Summary

Love Creek Monitoring Station

Quarter	Date	Type	pH	Flow	Rainfall amount	BOD	COD	Suspended Residue	Dissolved Residue	Nitrate + Nitrite nitrogen	Ammonia	Total Kjeldahl Nitrogen	Total Organic Nitrogen	Lead	Zinc	Total Phosphorus	Ortho Phosphate
Units				cu-ft	inches	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
SUMMER 2006	6-Jul	Comp	7.0	208,600	0.91	6.4	31.0	110	150	0.82	0.18	0.61	BDL	0.0120	0.062	BDL	0.048
FALL 2006	2-Nov	Comp	7.0	1,135,247	0.97	BDL	BDL	76	140	0.51	BDL	BDL	BDL	0.0130	0.039	0.13	0.073
WINTER 2007	5-Jan	Comp	7.0	102,928	0.18	BDL	BDL	10	250	1.10	BDL	0.56	0.56	0.0052	0.170	BDL	0.035
SPRING 2007	11-Apr	Comp	7.0	1,147,536	0.74	BDL	28.0	73	180	0.88	BDL	1.10	1.10	0.0084	0.055	0.12	0.034
Sample Average			7.0	648,577.8	0.70	6.4	29.5	67	180	0.83	0.18	0.76	0.83	0.0097	0.082	0.13	0.048

***National NURP Study Average**						11.9	90.8	na	na	na	*****	2.35	3.31	0.18	0.176	0.16	
***Characteristics of Urban Stormwater Range**						1 - 700	5 - 3,100	2 - 11,300	200 - 14,600	na	0.1 - 2.5	0.01 - 4.5	na	0.0 - 1.9	na	0.1 - 10	

* Data was taken from tables 4-1 and 4-2 of the Stormwater Management for Maine: BMPS.

6.2.2 Laboratory Analysis Summary

Walden Drive Monitoring Station

Quarter	Date	Type	pH	Flow	Rainfall amount	BOD	COD	Suspended Residue	Dissolved Residue	Nitrate + Nitrite nitrogen	Ammonia	Total Kjeldahl Nitrogen	Total Organic Nitrogen	Lead	Zinc	Total Phosphorus	Ortho Phosphate
Units				cu-ft	inches	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
SUMMER 2006	6-Jul	Comp	7.0	2,818,117	2.43	8.0	63.0	430	110	0.45	BDL	1.90	1.90	0.027	0.210	0.22	BDL
FALL 2006	8-Nov	Comp	7.0	485,585	0.94	BDL	27.0	150	130	0.35	0.31	0.80	BDL	BDL	0.230	0.22	BDL
WINTER 2007	5-Jan	Comp	7.5	292,407	0.22	BDL	29.0	52	140	BDL	BDL	0.64	0.64	BDL	0.190	BDL	0.081
SPRING 2007	11-Apr	Comp	7.0	1,210,363	0.72	BDL	23.0	200	100	0.48	BDL	0.97	0.97	0.019	0.120	0.25	BDL
Sample Average			7.1	1,201,618.0	1.08	8.0	35.5	208	120	0.43	0.31	1.08	1.17	0.023	0.188	0.23	0.081

***National NURP Study Average**	11.9	90.8	na	na	na	*****	2.35	3.31	0.18	0.176	0.16
***Characteristics of Urban Stormwater Range**	1 - 700	5 - 3,100	2 - 11,300	200 - 14,600	na	0.1 - 2.5	0.01 - 4.5	na	0.0 - 1.9	na	0.1 - 10

* Data was taken from tables 4-1 and 4-2 of the Stormwater Management for Maine: BMPS.

6.2.2 Laboratory Analysis Summary

Williams Creek Monitoring Station

Quarter	Date	Type	pH	Flow	Rainfall amount	BOD	COD	Suspended Residue	Dissolved Residue	Nitrate + Nitrite nitrogen	Ammonia	Total Kjeldahl Nitrogen	Total Organic Nitrogen	Lead	Zinc	Total Phosphorus	Ortho Phosphate
Units				cu-ft	inches	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
SUMMER 2006	6-Jul	Comp	8.0	21,963	0.95	9.0	43.0	22	150	0.88	BDL	BDL	BDL	0.0057	0.038	BDL	0.038
FALL 2006	8-Nov	Comp	7.0	24420	1.36	BDL	25.0	21	140	0.49	BDL	0.82	0.82	BDL	BDL	BDL	0.051
WINTER 2007	5-Jan	Comp	7.5	8,813	0.20	8.6	31.0	37	150	0.84	BDL	0.59	0.59	0.0064	0.042	BDL	0.090
SPRING 2007	11-Apr	Comp	7.0	1,100,815	0.73	7.6	34.0	67	130	0.60	BDL	1.40	1.40	0.0160	0.069	0.25	0.041
Sample Average			7.4	289,002.8	0.81	8.4	33.3	37	143	0.70	BDL	0.94	0.94	0.0094	0.050	0.25	0.055

***National NURP Study Average**	11.9	90.8	na	na	na	*****	2.35	3.31	0.18	0.176	0.16
***Characteristics of Urban Stormwater Range**	1 - 700	5 - 3,100	2 - 11,300	200 - 14,600	na	0.1 - 2.5	0.01 - 4.5	na	0.0 - 1.9	na	0.1 - 10

* Data was taken from tables 4-1 and 4-2 of the Stormwater Management for Maine: BMPS.

6.2.2 Laboratory Analysis Summary

Seasonal Ambient Grab Samples 2006-2007

Summer 2006	Date	pH	BOD	COD	Suspended Residue	Dissolved Residue	Nitrate + Nitrite Nitrogen	Ammonia Nitrogen	Total Kjeldahl Nitrogen	Total Organic Nitrogen	Lead	Zinc	Total Phosphorus	Ortho Phosphate	E. Coli	Fecal Colif.
Acker Place	9/8/06	7.0	BDL	BDL	1.9	270	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	231	348
First Creek	9/8/06	7.5	BDL	BDL	2.8	240	1.7	0.17	BDL	BDL	BDL	BDL	BDL	0.030	921	1420
Loves Creek	9/8/06	7.0	BDL	BDL	5.8	320	1.2	BDL	0.58	0.58	BDL	BDL	BDL	0.028	313	580
Walden Drive	9/8/06	7.5	55	BDL	9.2	250	1.2	BDL	0.70	0.70	BDL	BDL	BDL	0.031	816	570
Williams Creek	9/8/06	7.0	BDL	BDL	2.4	280	1.1	BDL	0.87	0.87	BDL	BDL	BDL	0.040	2419	5570
Average		**7.2**	**BDL**	**BDL**	**4.4**	**272.0**	**1.3**	**BDL**	**0.72**	**0.72**	**BDL**	**BDL**	**BDL**	**0.032**	**1117**	**2035**

Fall 2006	Date	pH	BOD	COD	Suspended Residue	Dissolved Residue	Nitrate + Nitrite Nitrogen	Ammonia Nitrogen	Total Kjeldahl Nitrogen	Total Organic Nitrogen	Lead	Zinc	Total Phosphorus	Ortho Phosphate	E. Coli	Fecal Colif.
Acker Place	12/6/06	8.0	BDL	BDL	1.2	230	BDL	BDL	BDL	BDL	BDL	0.098	BDL	BDL	248	120
First Creek	12/6/06	8.0	BDL	BDL	1.8	240	1.3	BDL	0.55	0.55	BDL	BDL	BDL	BDL	122	70
Loves Creek	12/6/06	8.0	BDL	BDL	2.2	280	1.5	1.4	0.72	BDL	BDL	BDL	BDL	BDL	179	180
Walden Drive	12/6/06	8.0	16	BDL	1.0	270	1.8	BDL	BDL	BDL	0.0051	BDL	BDL	BDL	461	300
Williams Creek	12/6/06	8.0	BDL	BDL	2.5	240	1.2	BDL	BDL	BDL	0.0059	BDL	BDL	BDL	57	50
Average		**8.0**	**BDL**	**BDL**	**1.7**	**252**	**1.5**	**BDL**	**BDL**	**BDL**	**BDL**	**BDL**	**BDL**	**BDL**	**213**	**144**

Winter 2007	Date	pH	BOD	COD	Suspended Residue	Dissolved Residue	Nitrate + Nitrite Nitrogen	Ammonia Nitrogen	Total Kjeldahl Nitrogen	Total Organic Nitrogen	Lead	Zinc	Total Phosphorus	Ortho Phosphate	E. Coli	Fecal Colif.
Acker Place	1/4/07	7.0	BDL	BDL	3.8	190	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	37	38
First Creek	1/4/07	7.5	BDL	35	1.0	230	1.1	BDL	1.0	1.0	BDL	BDL	BDL	BDL	248	590
Loves Creek	1/4/07	7.5	BDL	BDL	2.4	280	1.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	133	130
Walden Drive	1/4/07	7.5	BDL	BDL	1.6	240	1.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	111	130
Williams Creek	1/4/07	8.0	BDL	BDL	2.6	250	1.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	144	280
Average		**7.5**	**BDL**	**BDL**	**2.3**	**238.0**	**1.3**	**BDL**	**BDL**	**BDL**	**BDL**	**BDL**	**BDL**	**BDL**	**135**	**234**

Spring 2007	Date	pH	BOD	COD	Suspended Solids	Dissolved Solids	Nitrate + Nitrite Nitrogen	Ammonia Nitrogen	Total Kjeldahl Nitrogen	Total Organic Nitrogen	Lead	Zinc	Total Phosphorus	Ortho Phosphate	E. Coli	Fecal Colif.
Acker Place	4/23/07	7.5	BDL	BDL	1.7	210	BDL	0.21	BDL	BDL	BDL	BDL	BDL	BDL	1	BDL
First Creek	4/23/07	8.0	BDL	BDL	4.7	240	1.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	173	220
Loves Creek	4/23/07	8.0	BDL	BDL	1.6	280	1.5	0.23	0.56	BDL	BDL	BDL	BDL	BDL	153	280
Walden Drive	4/23/07	8.0	BDL	BDL	2.6	260	1.2	0.13	BDL	BDL	BDL	BDL	BDL	BDL	387	180
Williams Creek	4/23/07	8.0	BDL	BDL	16	320	1.7	0.21	0.60	BDL	BDL	BDL	BDL	BDL	218	220
Average		**7.9**	**BDL**	**BDL**	**5.3**	**262**	**1.40**	**0.19**	**0.60**	**BDL**	**BDL**	**BDL**	**BDL**	**BDL**	**186**	**225**

U = Analyte requested but not detected

BDL = Below Detection Limit

6.2.2 Laboratory Analysis Summary

Municipal Wet Weather Sampling Results

Point Source Sample Site	Date	Type	pH	BOD	COD	Suspended Residue	Dissolved Residue	Nitrate + Nitrite nitrogen	Ammonia	Total Kjeldahl Nitrogen	Total Organic Nitrogen	Lead	Zinc	Total Phosphorus	Ortho Phosphate	Oil/ Grease	E. Coli	Fecal Coliform
Units				mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	CFU/100ml	
KAT Oil/Water Sep	26-Apr	Grab	6.0	64.0	190	38	140	0.41	0.33	2.60	2.30	0.006	0.14	0.41	0.140	3	-	-
Loraine St. Combined	26-Apr	Grab	6.0	49	220	130	200	0.85	0.40	4.10	3.70	0.018	0.42	0.79	0.220	7	-	-
Loraine St. East Unit	26-Apr	Grab	6.0	18	93	68	100	0.22	BDL	1.80	1.80	0.016	0.20	0.29	0.082	4	-	-
Loraine St. West Unit	26-Apr	Grab	6.0	26	140	92	140	0.28	0.42	2.80	2.40	0.024	0.31	0.37	0.120	5	-	-
Transfer Station 1	16-May	Grab	6.5	1100	3900	4200	4100	5.00	7.60	98.00	90.00	1.300	8.70	15.00	2.200	25	241,920	800,000
Average			6.1	251.4	908.6	905.6	936.0	1.35	2.19	21.9	20.0	0.273	1.95	3.37	0.552	8.8		
*National NURP Study Average				11.9	90.8	na	na	na	*****	2.35	3.31	0.18	0.176	0.16				
*Characteristics of Urban Stormwater Range				1 - 700	5 - 3,100	2 - 11,300	200 - 14,600	na	0.1 - 2.5	0.01 - 4.5	na	0.0 - 1.9	na	0.1 - 10				

* Data was taken from tables 4-1 and 4-2 of the Stormwater Management for Maine: BMPS.

6.2.2 Laboratory Analysis Summary

Commercial Facilities Wet Weather Sampling Results

Point Source Sample Site	Date	Type	pH	BOD	COD	Suspended Residue	Dissolved Residue	Nitrate + Nitrite nitrogen	Ammonia	Total Kjeldahl Nitrogen	Total Organic Nitrogen	Lead	Zinc	Total Phosphorus	Ortho Phosphate	Oil/ Grease
Units				mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
International	16-May	Grab	6.5	150.0	450.0	290	500	2.80	0.70	9.2	8.50	0.030	0.71	1.40	0.99	3.0
Pilot Service Sta	3-Jun	Grab	6.0	150.0	740.0	86	600	1.60	1.90	8.2	6.30	0.014	1.50	0.72	0.44	BDL
Best One Tire	16-May	Grab	6.0	230.0	990.0	620	1600	3.60	2.20	14.0	12.00	0.200	2.30	1.50	0.38	BDL
BP Ken Jo Market	16-May	Grab	6.0	29.0	160.0	230	100	0.85	0.34	3.5	3.20	0.037	0.45	0.49	0.09	BDL
Napa/Ryder	3-Jun	Grab	6.0	51.0	290.0	24	260	1.20	1.70	6.2	4.50	BDL	1.90	0.68	0.51	BDL
Shell Service Sta.	16-May	Grab	7.0	51.0	470.0	110	270	1.70	1.60	8.1	6.50	0.016	0.89	1.40	1.60	3.0
Express Auto	16-May	Grab	7.0	96.0	460.0	210	290	2.20	1.20	7.8	6.60	0.028	0.64	0.88	0.04	BDL
KAT Parking Lot	26-Apr	Grab	6.0	17.0	130.0	56	88	0.23	BDL	2.3	2.30	0.016	0.22	0.34	0.13	9.0
Average			6.3	96.8	461.3	203.3	463.5	1.77	1.38	7.4	6.24	0.049	1.08	0.93	0.52	5.0
*National NURP Study Average				11.9	90.8	na	na	na	*****	2.35	3.31	0.18	0.176	0.16		
*Characteristics of Urban Stormwater Range				1 - 700	5 - 3,100	2 - 11,300	200 - 14,600	na	0.1 - 2.5	0.01 - 4.5	na	0.0 - 1.9	na	0.1 - 10		

* Data was taken from tables 4-1 and 4-2 of the Stormwater Management for Maine: BMPS.

6.2.3 Noncompliance.

The City of Knoxville has complied with all permit requirements.

6.2.4 Estimated Runoff from Major Watersheds within the MS4 Area.

Part VI (A)(2)(e)(i)(3) of the NPDES permit requires an estimate of the total volume of urban runoff discharged by the City of Knoxville for the year. This estimate is to be based on total rainfall for the year and the estimated imperviousness of different land uses. The total rainfall for the year was determined to be an average of the annual rainfall recorded during the year from the City's five stormwater monitoring stations located throughout the city and the National Weather Service's rain gage at the McGhee Tyson Airport. The average recorded annual rainfall amount was 37.54 inches.

To estimate the total runoff volume, the City utilized the GIS to determine approximate areas for each watershed within the city limits along with the corresponding land uses. Each land use is assigned an approximated impervious percentage according to the Camp Dresser and McKee Watershed Management Model described in the Part 2 application, pages 4-14 to 4-18.

It was assumed for each watershed that 95 percent of the rainfall from the impervious fraction, and 15 percent of the rainfall from the pervious fraction of each land use was converted to runoff. Therefore the impervious runoff coefficient and the pervious runoff coefficient were assumed to be 0.95 and 0.15, respectively. For example, based upon an average annual rainfall volume of 42.99 inches/year, the average annual runoff from a single-family residential land use (25% impervious) is 15.05 in/yr (42.99*[(0.15*0.75)+(0.95*0.25)]). The runoff coefficient for a single land use is the sum of the impervious percentage multiplied times the impervious runoff coefficient plus the pervious percentage multiplied by the pervious runoff coefficient. For the previous example, the average runoff coefficient for the single-family residential land use is 0.35 ([0.15*0.75]+[0.95*0.25]). For a watershed, the average runoff coefficient is an area weighted average of each land use runoff coefficients times the percentage of the area of each land use.

The runoff from the major watersheds within the MS4 area was estimated by a formula in Camp Dresser & Mckee's Watershed Management Module shown below:

$$Qi = P \times Ci \times Ai$$

Where,

P = total precipitation (inches/year)

C = land use area weighted runoff coefficient = 0.15*Pervious% + 0.95*Impervious%

A = drainage area (acres) = acres x (43,560 ft2/acre) = ft2

Q = ΣQi = total runoff rate / 1,000,000 = Mgal

$Q_{tot\ 06/07}$ = 28,399 Million Gallons

Please find the analysis for the each watershed and for the entire city in table 6.2.4 on the following page.

6.2.4 ESTIMATED RUNOFF FROM MAJOR WATERSHEDS WITHIN THE MS4

July 1, 2006 - June 30, 2007

Watershed	Agricul./ Forest/ Vacant, Public Parks	Vacant (>10)	Rural Res.	Single Family Res.	Private Rec., Public Land	Multi-Family Res., Church	Insti-tutional	Mining, Office/ Service	Manu-facturing/ Whole-sale	Commer., Trans./ Utility/ Commun.	Major Roads/ Hwys/ ROWs	Under Const	Not Loaded	Total Acres in Watershed	Acres in the City Limits	Est. % Imperv-ious	C Value	Total Rainfall during 06/07 (in./yr)	Total Runoff for 06/07 (Mgal/yr)
Baker Cr.	412	2	107	640	90	77	32	1	1	3	269	13	27	1,674	1,674	32	0.41	37.54	696
East Fork	313	0	10	475	302	78	73	31	195	235	584	33	180	2,509	2,509	53	0.57	37.54	1,465
First Cr.	724	0	300	3,152	544	501	110	157	127	556	1,412	51	116	7,750	7,750	44	0.50	37.54	3,943
Fourth Cr.	965	57	423	2,026	468	406	93	206	201	568	881	61	414	6,769	5,920	41	0.48	37.54	2,881
Goose Cr.	639	40	126	669	213	67	8	21	77	131	327	34	29	2,381	1,755	35	0.43	37.54	765
Grassy Cr.	2,230	176	561	610	215	24	0	14	31	95	211	39	95	4,301	433	17	0.29	37.54	126
Holston R.	2,362	69	371	1,222	417	45	5	2	219	33	805	32	50	5,632	2,455	28	0.37	37.54	929
Inman Br.	563	33	214	138	4	12	0	0	0	0	145	0	34	1,143	99	21	0.31	37.54	32
Knob Cr.	1,719	195	481	843	125	84	1	19	1	29	296	4	169	3,966	989	19	0.30	37.54	307
Knob Fork	1,659	26	398	675	182	56	5	93	6	124	257	19	252	3,752	823	22	0.33	37.54	275
Love Cr.	1,735	102	505	1,625	311	212	51	94	178	408	1,038	46	103	6,408	5,090	36	0.44	37.54	2,288
Second Cr.	443	0	90	1,281	346	247	29	107	140	542	1,161	35	82	4,503	4,498	53	0.57	37.54	2,618
Sinking Cr.	1,614	146	459	1,266	284	90	17	33	31	267	881	12	347	5,447	2,434	33	0.41	37.54	1,029
Swanpond C	3,892	303	833	604	121	36	4	79	240	232	457	65	285	7,151	499	19	0.30	37.54	155
Ten Mile Cr.	1,879	0	638	3,421	165	895	55	115	58	615	1,500	24	641	10,006	3,921	38	0.45	37.54	1,801
Third Cr.	1,757	79	436	3,003	406	512	184	124	225	443	1,252	98	220	8,739	8,417	37	0.45	37.54	3,833
TN River	7,197	503	2,269	4,681	2,910	403	187	72	170	238	990	121	1,113	20,854	8,232	22	0.33	37.54	2,747
Toll Cr.	535	69	154	222	42	26	1	0	37	4	93	42	4	1,229	767	22	0.32	37.54	252
Turkey Cr.	3,353	235	603	2,693	264	343	121	104	91	442	1,161	68	738	10,216	1,677	29	0.38	37.54	657
Whites Cr.	2,733	154	782	1,298	575	59	31	11	49	126	608	51	578	7,055	1,634	23	0.34	37.54	561
Williams Cr.	358	11	47	561	46	96	125	17	10	61	276	3	30	1,641	1,605	37	0.45	37.54	736
Woods Cr.	1,220	106	281	371	0	26	0	2	140	43	261	1	157	2,608	143	23	0.33	37.54	49
Sink-East	1,226	0		728	9	17	0	17	3	27	0	0	0	2,027	91	12	0.24	37.54	23
Beaver Cr	21,174	0	0	21,230	1,292	845	4	259	283	712	0	160	0	45,959	162	16	0.28	37.54	46
Tuckahoe	4,293	0	0	1,829	18	14	0	8	2	1	0	4	0	6,169	229	8	0.22	37.54	51
Fr.Broad riv	8,954	0	0	2,744	73	40	24	24	497	117	0	166	0	12,639	551	11	0.24	37.54	134
COK Total	73,949	2,306	10,088	58,007	9,422	5,211	1,160	1,610	3,012	6,052	14,865	1,182	5,664	192,528	64,357				**28,399**

The runoff from the major watersheds within the MS4 area was estimated by a formula in Camp Dresser & Mckee's Watershed Management Module. Q = P x C x A

where, P = total precipitation (inches/year) = 37.54 in./yr. = 3.13 ft./yr.

C = land use area weighted runoff coefficient = 0.15*Pervious% + 0.95*Impervious%

A = drainage area (acres) = acres in watershed x (4.35E4 ft2/acre) = Ai ft2

Q = total runoff rate = sum of each watershed's Qi.

Total estimated runoff for Year One = 28,399 Mgal

Approximate area and land use for each watershed was determined through the City's GIS. Total yearly rainfall amount was determined by averaging the amount of rain collected from the City's five monitoring stations located throughout the city (refer to map in appendix). Runoff coefficient (C) was calculated by adding 15 % of the pervious fraction to 95% of the impervious fraction in each watershed. This assumes that the fraction of rainfall producing runoff is 15% and 95% from pervious and impervious surfaces respectively. The summary of the runoff calculations are provided in the table above. Calculations for some of the watersheds were left out due to the insignificant amount of runoff that would be produced.

7.0 ASSESSMENT OF CONTROLS: ESTIMATED POLLUTANT LOADING REDUCTIONS FROM THE MS4.

Since the NPDES permit was first issued in 1996, the City of Knoxville has developed and implemented all of the scheduled programs. The ongoing monitoring program and the dry weather-screening program were started in during the 1996-1997 permit year. Each program has been implemented annually since that time. Data has been collected, analyzed, and archived for future reference.

Quantitative estimates of pollutant loads and event mean concentrations were reported as required in the fifth annual report. In the fifth year of the new permit term, the pollutant loads and event mean concentrations will be calculated again and compared to the previous results. Any quantitative reductions or groundwater impacts from the MS4 may become evident at that time and will be reported. However, as described in the dry weather-screening program (ILL-2), noticeable reductions in contaminated outfalls have been observed since the program began.

Although testing data may not be available to substantiate all of the illicit discharges and illegal dumping problems, which have been resolved, the qualitative effect on water quality within the MS4 and waters-of-the State is irrefutable. Many industries have removed illicit discharges, homeowners and utilities have replaced sections of leaking or broken sanitary sewers, the last known sections of the combined sewers were separated, unknown combined sewer systems have been located and planned for repair, creek restoration and cleanup activities have begun, and many educational and volunteer programs have been sponsored, conducted, and/or coordinated to reduce dumping.

Structural controls for water quality control include stormwater treatment facilities on most new development and significant redevelopment throughout the city since 1997. Covenants are in place to require that these water quality facilities are maintained and/or replaced as needed. The City has also installed oil/water separators or stormwater treatment devices at the following locations: the KAT bus facility on First Creek, Victor Ashe Park, Northwest Crossing regional detention pond, the Prosser Road garage, the Loraine Street facility, and the Solid Waste Transfer facility. The City is planning new structural controls at the Solid Waste Transfer Station during this permit term. Floating trash skimmers were installed near the mouth of some major creeks to prevent floating pollutants from discharging to the river. The Izaak Walton League has been contracted to maintain and replace the skimmers as needed.

All of the programs implemented to improve water quality in the creeks and river throughout the city should provide some quantitative evidence of improvement in future years. This data will be reported, as it becomes apparent.

8.0 SUMMARY OF MODIFICATIONS TO THE SWMP.

As expected, the new permit created several modifications to the existing SWMP in year one. However, the City did not make any modifications last year. We do anticipate adding one wet-weather monitoring station on Third Creek. After it is up and running we may wish to abandon one of the existing stations. The current locations for all of the monitoring stations are shown on detailed maps in the appendix. Future locations will be reported in each annual report.

9.0 FISCAL ANALYSIS

The Fiscal Analysis for this annual report will list the permit year budget sources and amounts along with estimates for the following permit year. Sources of funds are listed for each major program. Due to complexity, all of the support activities such as purchasing, payroll, legal support, information systems, fleet management, and human resources are not reflected in the table. Future funding sources may change if a stormwater utility fee is implemented.

Program Description	Fund Source	Actual FY 06/07	Est. FY 07/08
Solid Waste Recycling (includes: composting, education, staff, etc.)	Fund 230	$1,781,280	$1,781,280
Household Hazardous Waste Facility	Fund 230	$141,4983	$170,000
Stormwater Mgmt Operating expenses	Fund 220	$1,548,685	$1,817,960
Public Service operating/maintenance (brush/leaf/litter pickup; street cleaning; curb/gutter repair; stormdrain/catch basin cleaning, repair, & installation; ditching; seed/sod in R.O.W.; grate replacement; water pumping; tree trimming, removal, and planting.)	General Fund 100	$2,835,260	$2,911,190
First Creek Restoration/Improvements First Creek Masterplan	Fund 401 Grwth Bndry	$47,850 $298,331	$1,200,000 $77,958
Papermill Road Culverts @ 4th Creek	Fund 401	$ 29,950	$12,325
Baker Creek Restoration	Fund 220	$7,590	$65,000
Emily Avenue Sinkhole Project Emily Avenue Sinkhole Reclamation	Fund 401	$0 $0	$231,432 $112,750
Solid Waste Transfer Station – SWPPP	Fund 401	$0	$154,000
Loraine St.- Stormwater Improvements	Fund 401	$100,094	$0
Cross Park Dr. Drainage Improvement	Fund 401	$66,638	$200,000
Third Creek Restoration Project	Fund 401	$100,000	$0
Neighborhood Drainage Projects	Fund 401	$250,000	$250,000
Total Estimated Stormwater Program Costs		$8,480,661	$8,983,895

APPENDIX A

City of Knoxville Solid Waste Office 2006 Annual Report

Solid Waste Section
2006 Annual Report

CITY OF KNOXVILLE
BILL HASLAM, MAYOR

Department of Community & Neighborhood Services
Sam Anderson, Director

Public Service Division
Bob Whetsel, Director

INTRODUCTION

In 2006, we continued to show positive progress in the development of our solid waste programs. This is the fifth year of our on-site paint recycling program at the Solid Waste Management Facility. We continued active enforcement of the solid waste ordinances and completed our ninth full year of operations at the Household Hazardous Waste Collection Center. The Public Service Division is in its fifth year of garbage collection service and recycling in the Central Business District at a cost savings of $30,000 per year. All of these programs have been successful and reflect the continued interest in and growth of our comprehensive solid waste management program.

The following pages summarize our activities for the calendar year 2006.

The last page is a residential waste stream analysis of data such as:

* The total waste stream decreased by 3584.64 tons from 2005
* The diversion rate increased to 56.12% from 55.25% in 2005
* The recycling rate increased to 28.77% from 27.61% in 2005

The total waste stream shows a decrease for the second time in two years. This decrease is attributed to decreased use of the Solid Waste Management Facility (Transfer Station) by large business customers who took their material to the Waste Connections Transfer Station. Diversion and recycling rates have remained level over the last five years, varying a few points up or down each year.

I. RECYCLING

A total of 5,216.38 tons of recyclables was collected at the City's eleven drop-off recycling centers in 2006. This number is level with recyclables from 2004 to 2005, up by 334 tons. The increase is believed to come from the extended operation at the Lowe store on North Peters Rd. All commodities showed an increased while mixed paper showed just a slight decrease.

Goodwill Industries is in the fifth year of a 5-year contract to assist in on-site operation of the recycling centers. The contract that was negotiated with SP Recycling to haul newspaper paid the City current market value for material collected in the amount of $70,240.67. This, and the contract with Waste Management for the other materials, combined to save the City $123,351.60 in operational costs. Final 1 year extension contract options were approved with both companies.

In 2006, the City started a pilot project to collect cardboard brought to the Market Street Garage by downtown businesses. A local recycling non profit organization was asked to assist in collection, processing and weighting and of the material. During the first two months of the pilot 3 tons of material was collected and showing an increase in volume. The City hopes to expand the project to aluminum cans and complete a yearly contract for collection.

II. MUNICIPAL SOLID WASTE (MSW)

A total of 50,097.85 tons of garbage was collected from Knoxville homes in 2006 as part of the

weekly garbage collection service the City offers via its contractor, Waste Connections. This number reflects a less than 1% decrease from the previous year. The City has currently renegotiated a five year contract with Waste Connections that expires in 2011. Current collection costs per this contract are:

. Curbside Collection	$6.18 / house/month	41,462 residents
. Backdoor Collection	$7.73 / house/month	14,407 residents

All garbage is disposed of at the Chestnut Ridge Landfill operated by Waste Management of Knoxville. The City is currently in a 10 year contract with Waste Management that expires in 2010. Disposal costs for 2006 were as follows:

. Jan. - Jun.	$25.71 / ton
. Jul. - Dec.	$25.86 / ton

III. COMPOSTING

A total of 32,794.74 tons of yard waste was collected by City crews in 2006. This number is up by 382.82 tons from last year. The Solid Waste Department sees this increase based on weather conditions for leaves in the fall of 2006. All yard waste is taken to Shamrock Organic Products where it is turned into mulch products. The City is currently in a 5 year contract with Shamrock that expires in 2011. Costs for disposal in 2006 at Shamrock were:

. Jan. - Dec.	$31.50 / ton

IV. SOLID WASTE MANAGEMENT FACILITY

Transfer Station

The design of the Transfer Station encourages separation of Construction and Demolition waste (C&D) from Municipal Solid Waste. This allows us to save money by sending C&D waste to a Class III landfill and also enable us to comply with the State mandate calling for a reduction in the volume of waste placed in Class I landfills. In 2006, we diverted 25,279 tons of C&D waste to a Class III landfill. This was 67% of the waste received at the Transfer Station. The total number of vehicles using the facility in 2006 was just over 57,000 up 3,300 from 2005 including City of Knoxville vehicles. Total revenue from charge and cash customers was $587,831.66 up $68,521.55 from 2005

Household Hazardous Waste (HHW) Collection Center

Staffed by City Solid Waste personnel, the HHW Facility is operated jointly by the City and County for all residents. Based on approximately 50/50 usage by City and County residents, the County contributes 50% of the operating and disposal cost. In 2006, this facility was visited by 4,859 vehicles, slightly down by 229 from 2005, and processed 167 tons of HHW, 52% of which was latex paint.

Rather than pay the City's contracted hazardous materials hauler to dispose of the latex paint, we have developed an in-house paint re-manufacturing facility. Last year we produced 892 gallons of high quality paint of which 962 gallons were sold to businesses for an income of $2,406.70 gallons collected in 2005 were sold in 2006.

V. EDUCATION

The Solid Waste Office engaged in many activities and special programs throughout 2006 to educate Knoxvillians about waste reduction, recycling, composting, and other solid waste issues.

America Recycles Day - The City of Knoxville, along with several other local organizations, participated in the tenth annual America Recycles Day, a national education campaign aimed at increasing citizens' commitment to recycling and buying recycled goods.

Telephone Book Recycling - Once again this year the Solid Waste Office coordinated the Knoxville/Knox County schools telephone book recycling program. Forty three Knox County schools competed for cash prizes donated by the City and County. Over 156 tons of old phone books were collected from the schools and from eight City of Knoxville drop-off centers.

Earth Day - The Solid Waste Office was a part of a city-wide steering committee that developed EarthFest 2006 which celebrated the 34th anniversary of Earth Day at Worlds Fair Park. Over 9,000 people attended the event which had 100 + exhibitors from the environmental community.

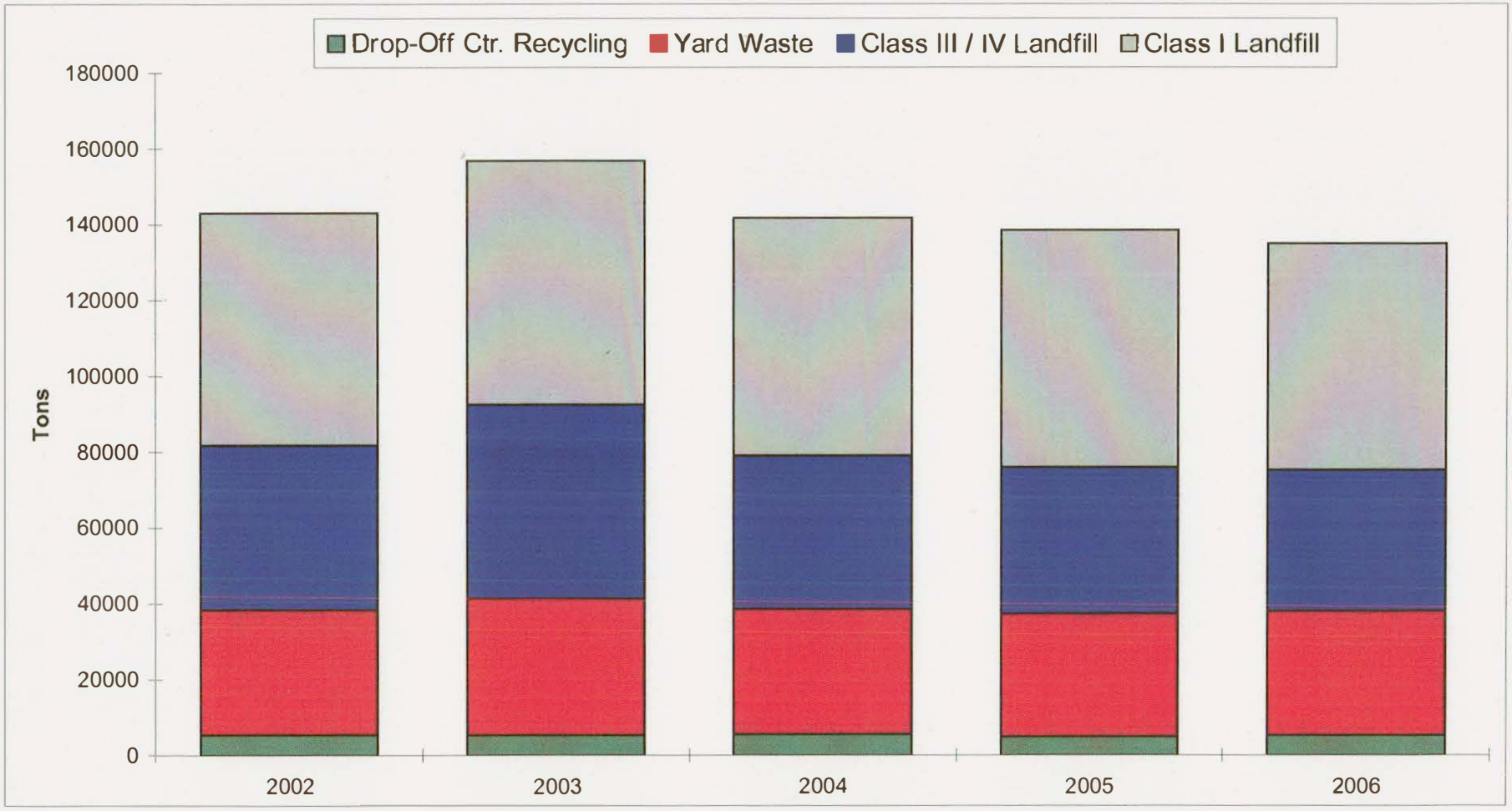
One-Day Computer Collection Events - One-day computer collection events were held in January with ten sponsors contributing to the success of the event. Approximately 600 residents participated in the events with just over 27 tons of electronic materials collected. The material was recycled at 5R Processors in Clinton, TN.

Used Residential Thermometer Exchange - The Solid Waste Office started an ongoing mercury thermometer exchange program. The exchanges, conducted in cooperation with the Tennessee Department of Environment and Conservation, the City of Knoxville Public Service Division, and the Safe Kids Coalition of the Greater Knox Area, collected over 650 mercury thermometers from City and County residents, containing a total of close a pound of mercury. New digital thermometers were given out for each used mercury thermometer that was turned in.

Curbside Recycling – The City's contractor for the collection of residential solid waste, Waste Connections, began a subscription curbside recycling program in the city. The program started in November of 2004 and Waste Connections provided statistics on participation rates to the Solid Waste Office throughout 2006. City of Knoxville residents can call Waste Connections to request the service. Materials collected for recycling are cardboard, glass, aluminum, newspaper, and plastics. 200 tons was collected from 2000 residents signed up for the service in 2006.

Other - In 2006, the Solid Waste Office continued to produce and distribute educational brochures and promotional items. Staff of the Solid Waste Office participated in several educational events in 2006 using our exhibit booth display at events including the Dogwood Arts' House and Garden Show and America Recycles Day Events. Over 200 school children toured the SWMF and listened to a presentation at the HHW facility.

Destination of Knoxville's Residential Waste Stream, 2002 - 2006



	2002	2003	2004	2005	2006
Diversion Rate	**54.81%**	**54.46%**	**59.26%**	**56.25%**	**56.12%**
Recycling Rate	**27.95%**	**27.16%**	**28.02%**	**27.61%**	**28.77%**

Annual Report 2006 Drop Off Centers	Kroger 5003 N. Broadway	Goodwill Magnolia & Alice	Kroger 5425 Clinton Hwy	Kroger 4818 Kingston Pk.	Kroger 2217 N. Broadway	Goodwill 225 Moody Av.	Kroger 4440 Western Av.	Lowes 210 N. Peters	K-Mart 7428 Kingston Pk.	Food City 5941 Kingston Pk	Food City 2939 Alcoa Hwy.	Totals
Aluminum	9602 lbs	3107 lbs	9346 lbs	15981 lbs	8791 lbs	11014 lbs	6624 lbs	23225 lbs	8073 lbs	3127 lbs	5261 lbs	52.08 tons
Steel	19700 lbs	6624 lbs	19532 lbs	29839 lbs	17130 lbs	21171 lbs	12877 lbs	47969 lbs	15913 lbs	524 lbs	524 lbs	95.90 tons
Plastics	70464 lbs	31453 lbs	62851 lbs	102895 lbs	35227 lbs	63488 lbs	30893 lbs	123208 lbs	33493 lbs	6443 lbs	10973 lbs	285.69 tons
Clear Glass	60413 lbs	20945 lbs	25488 lbs	101503 lbs	47800 lbs	55593 lbs	27164 lbs	127554 lbs	45032 lbs	0 lbs	0 lbs	255.75 tons
Brown Glass	46062 lbs	15820 lbs	19446 lbs	84099 lbs	39373 lbs	42247 lbs	20714 lbs	97161 lbs	33605 lbs	0 lbs	0 lbs	199.26 tons
Green Glass	37345 lbs	12985 lbs	15805 lbs	68328 lbs	32171 lbs	34430 lbs	16832 lbs	79005 lbs	26487 lbs	0 lbs	0 lbs	161.69 tons
Newspaper	512860 lbs	167080 lbs	444920 lbs	560076 lbs	271340 lbs	341760 lbs	180567 lbs	712840 lbs	255680 lbs	66498 lbs	54074 lbs	1,783.85 tons
Mixed Paper	473616 lbs	160740 lbs	290340 lbs	723890 lbs	254720 lbs	323170 lbs	172670 lbs	789560 lbs	261980 lbs	22000 lbs	45500 lbs	1,759.09 tons
Cardboard	148460 lbs	47480 lbs	127140 lbs	199040 lbs	114640 lbs	102860 lbs	65900 lbs	336350 lbs	71300 lbs	16480 lbs	16480 lbs	623.07 tons
Drop Off Center Totals	689.26 tons	233.12 tons	507.43 tons	942.83 tons	410.60 tons	497.87 tons	267.12 tons	1,168.44 tons	375.78 tons	57.54 tons	66.41 tons	5,216.38 tons

KPD / Lovain St. Cardboard / Paper	20.46 tons
Phone Books	250.14 tons

	Leaves	Brush	Total
Mulching Site	8,291.69 tons	24,503.05 tons	32,794.74 tons

	Scrap Metal	Rec. Tir. / Backing	HHW REC.	HHW Divert.
Transfer Station	696.18 tons	0.65 tons	53.00 tons	27.33 tons

	C&D	Compacted	Computers	Tires	Total
Transfer Station Cont.	29,848.00 tons	9,282.87 tons	43.03 tons	141.84 tons	40,092.90 tons
				13508	

	Household Trash	Misc. Trash	Total
Landfill Class I	50,097.85 tons	393.88 tons	50,491.73 tons

	Transfer Station	Construction	Codes	Total
Landfill Class III	21,530.66 tons	7,018.00 tons	8,680.00 tons	37,228.66 tons

Total Waste Recycled	39,195.96 tons
Total Waste Diverted, Class III & Rec.	76,451.95 tons
Total Waste Landfilled, Class I	59,774.60 tons
Total Wastestream	136,226.55 tons

Recycling	28.77%
Diversion	56.12%
	6.19%
* Yard Waste Not Included w/ just residential trash	9.43%

APPENDIX B

Dry Weather Screening Results Summary

1. List of outfalls tested during the permit year with status (6 pages)
2. Table of testing results for outfalls with dry-weather flow (3 pages)

Dry Weather Screening - Sample Events for 2007

Outfall	Outfall Status	Visit #1	Visit #2	Visit #3	Visit #4
00-400-0050	DRY	08/08/2006	08/08/2006	09/12/2006	09/12/2006
00-400-0065	DRY	11/06/2006	11/06/2006	12/11/2006	12/11/2006
00-400-0070	DRY	11/06/2006	11/06/2006	12/11/2006	12/11/2006
00-400-0072	DRY	08/08/2006	08/08/2006	09/12/2006	09/12/2006
00-400-0080	DRY	08/08/2006	08/08/2006	09/12/2006	09/12/2006
00-400-0085	DRY	11/06/2006	11/06/2006	12/11/2006	12/11/2006
00-400-0090	DRY	11/06/2006	11/06/2006	12/11/2006	12/11/2006
00-400-0095	WET	11/06/2006	11/06/2006	12/11/2006	12/11/2006
00-500-0100	DRY	08/08/2006	08/08/2006	09/12/2006	09/12/2006
00-400-0105	DRY	11/28/2006	11/28/2006	12/27/2006	12/27/2006
00-500-0110	DRY	11/28/2006	11/28/2006	12/27/2006	12/27/2006
00-100-0115	DRY	11/28/2006	11/28/2006	12/27/2006	12/27/2006
00-400-0120	DRY	11/28/2006	11/28/2006	12/27/2006	12/27/2006
00-400-0125	ILLICIT DUMP	08/08/2006	08/08/2006	09/12/2006	09/12/2006
00-400-0130	DRY	08/08/2006	08/08/2006	09/12/2006	09/12/2006
00-400-0132	DRY	08/08/2006	08/08/2006	09/12/2006	09/12/2006
00-100-0140	DRY	08/08/2006	08/08/2006	09/12/2006	09/12/2006
00-500-0160	DRY	08/09/2006	08/09/2006	09/12/2006	09/12/2006
00-400-0170	DRY	08/09/2006	08/09/2006	09/18/2006	09/18/2006
00-200-0175	DRY	08/09/2006	08/09/2006	09/18/2006	09/18/2006
00-100-0180	DRY	08/09/2006	08/09/2006	09/18/2006	09/18/2006
00-100-0185	DRY	08/09/2006	08/09/2006	09/18/2006	09/18/2006
00-400-0192	DRY	08/09/2006	08/09/2006	09/18/2006	09/18/2006
00-400-0210	ILLICIT CONNECTION	08/09/2006	08/09/2006	09/18/2006	09/18/2006
00-400-0215	ILLICIT CONNECTION	08/09/2006	08/09/2006	09/18/2006	09/18/2006

Outfall	Outfall Status	Visit #1	Visit #2	Visit #3	Visit #4
00-100-0300	ILLICIT CONNECTION	08/14/2006	08/14/2006	09/21/2006	09/21/2006
00-400-0390	ILLICIT CONNECTION	08/14/2006	08/14/2006	09/21/2006	09/21/2006
01-300-0143	DRY	07/20/2006	07/20/2006	08/24/2006	08/24/2006
01-300-0147	DRY	12/12/2006	12/12/2006	01/11/2007	01/11/2007
01-300-0149	DRY	07/20/2006	07/20/2006	08/24/2006	08/24/2006
01-300-0150	WET	12/12/2006	12/12/2006	01/11/2007	01/11/2007
01-300-0160	ILLICIT CONNECTION	08/01/2006	08/01/2006	09/11/2006	09/11/2006
01-300-0350	DRY	12/12/2006	12/12/2006	01/18/2007	01/18/2007
01-300-0520	DRY	12/12/2006	12/12/2006	01/18/2007	01/18/2007
02-400-0045	ILLICIT CONNECTION	08/02/2006	08/03/2006	09/11/2006	09/11/2006
02-400-0050	ILLICIT CONNECTION	08/02/2006	08/03/2006	09/11/2006	09/11/2006
02-100-0097	DRY	12/06/2006	12/06/2006	01/11/2007	01/11/2007
02-100-0098	DRY	12/06/2006	12/06/2006	01/07/2007	01/11/2007
02-100-0099	DRY	12/06/2006	12/06/2006	01/11/2007	01/11/2007
02-100-0100	DRY	12/06/2006	12/06/2006	01/11/2007	01/11/2007
02-100-0102	DRY	12/06/2006	12/06/2006	01/11/2007	01/11/2007
02-100-0103	DRY	08/02/2006	08/03/2006	09/11/2006	09/11/2006
02-100-0105	DRY	12/06/2006	12/06/2006	01/11/2007	01/11/2007
02-400-0168	DRY	12/06/2006	12/06/2006	01/11/2007	01/11/2007
02-300-0175	WET	12/06/2006	12/06/2006	01/11/2007	01/11/2007
02-300-0190	DRY	12/12/2006	12/12/2006	01/18/2007	01/18/2007
02-400-0195	DRY	12/12/2006	12/12/2006	01/18/2007	01/18/2007
02-100-0210	DRY	07/18/2006	07/19/2006	08/17/2006	08/17/2006
02-300-0230	ILLICIT CONNECTION	02/06/2007	02/06/2007	03/08/2007	03/08/2007
02-300-0245	WET	12/15/2006	12/15/2006	01/18/2007	01/18/2007
02-400-0285	DRY	12/15/2006	12/15/2006	01/18/2007	01/18/2007
02-400-0290	WET	12/15/2006	12/15/2006	01/18/2007	01/18/2007

Outfall	Outfall Status	Visit #1	Visit #2	Visit #3	Visit #4
02-300-0295	DRY	12/15/2006	12/15/2006	01/18/2007	01/18/2007
02-100-0380	DRY	02/06/2007	02/06/2007	03/08/2007	03/08/2007
02-100-0395	WET	02/06/2007	02/06/2007	03/08/2007	03/08/2007
02-100-0500	ILLICIT CONNECTION	02/06/2007	02/06/2007	03/08/2007	03/08/2007
03-300-0005	ILLICIT CONNECTION	07/25/2006	07/25/2006	08/28/2006	08/28/2006
03-300-0010	DRY	11/13/2006	11/13/2006	12/27/2006	12/27/2006
03-300-0015	DRY	02/06/2007	02/06/2007	03/08/2007	03/08/2007
03-300-0035	DRY	11/13/2006	11/13/2006	12/27/2006	12/27/2006
03-100-0045	ILLICIT CONNECTION	11/13/2006	11/13/2006	03/08/2007	03/08/2007
03-400-0050	DRY	11/13/2006	11/13/2006	12/27/2006	12/27/2006
03-300-0075	DRY	01/04/2007	01/04/2007	02/22/2007	02/22/2007
03-400-0110	DRY	11/27/2006	11/27/2006	12/27/2006	12/27/2006
03-300-0115	DRY	11/27/2006	11/27/2006	12/27/2006	12/27/2006
03-300-0370	DRY	11/27/2006	11/27/2006	12/27/2006	12/27/2006
03-100-0380	WET	11/27/2006	11/27/2006	12/28/2006	12/28/2006
03-300-0385	DRY	11/27/2006	11/27/2006	12/27/2006	12/27/2006
03-300-0400	WET	12/28/2006	12/28/2006	03/07/2007	03/07/2007
03-300-0430	WET	11/27/2006	11/27/2006	02/22/2007	02/22/2007
03-100-0435	WET	11/27/2006	11/27/2006	02/22/2007	02/22/2007
03-400-0440	DRY	11/27/2006	11/27/2006	02/22/2007	02/22/2007
03-100-0445	DRY	11/28/2006	11/28/2006	02/22/2007	02/22/2007
03-100-0475	DRY	12/28/2006	12/28/2006	03/07/2007	03/07/2007
03-300-0480	WET	12/28/2006	12/28/2006	03/07/2007	03/07/2007
03-300-0550	WET	01/04/2007	01/04/2007	03/07/2007	03/07/2007
03-300-0615	DRY	08/02/2006	08/03/2006	12/11/2006	12/11/2006
03-300-0625	DRY	01/04/2007	01/04/2007	02/12/2007	02/12/2007
03-300-0630	DRY	01/04/2007	01/04/2007	02/12/2007	02/12/2007

Outfall	Outfall Status	Visit #1	Visit #2	Visit #3	Visit #4
03-300-0640	DRY	01/04/2007	01/04/2007	02/12/2007	02/12/2007
03-300-0645	WET	01/30/2007	01/30/2007	03/07/2007	03/07/2007
03-300-0655	DRY	01/04/2007	01/04/2007	02/12/2007	02/12/2007
03-300-0675	WET	01/04/2007	01/04/2007	03/07/2007	03/07/2007
04-100-0010	DRY	03/23/2007	03/23/2007	04/23/2007	04/23/2007
04-100-0015	DRY	03/23/2007	03/23/2007	04/23/2007	04/23/2007
04-400-0330	DRY	12/07/2006	12/07/2006	02/12/2007	02/12/2007
04-400-0335	DRY	12/07/2006	12/07/2006	02/12/2007	02/12/2007
04-400-0336	DRY	12/07/2006	12/07/2006	02/12/2007	02/12/2007
04-300-0337	DRY	12/07/2006	12/07/2006	02/12/2007	02/12/2007
04-400-0340	DRY	12/07/2006	12/07/2006	02/12/2007	02/12/2007
04-300-0345	DRY	12/07/2006	12/07/2006	02/12/2007	02/12/2007
04-400-0350	DRY	12/07/2006	12/07/2006	02/12/2007	02/12/2007
04-300-0355	DRY	12/07/2006	12/07/2006	02/12/2007	02/12/2007
04-400-0360	DRY	12/07/2006	12/07/2006	02/12/2007	02/12/2007
04-400-0365	DRY	12/07/2006	12/07/2006	02/12/2007	02/12/2007
05-100-0165	WET	12/19/2006	12/19/2006	02/19/2007	02/19/2007
05-500-0190	WET	12/19/2006	12/19/2006	02/19/2007	02/19/2007
05-300-0240	WET	12/19/2006	12/19/2006	02/19/2007	02/19/2007
06-100-0005	DRY	12/19/2006	12/19/2006	02/19/2007	02/19/2007
06-100-0060	DRY	12/19/2006	12/19/2006	02/19/2007	02/19/2007
06-400-0075	DRY	12/19/2006	12/19/2006	02/19/2007	02/19/2007
06-400-0135	DRY	01/30/2007	01/30/2007	03/05/2007	03/05/2007
06-200-0160	DRY	01/30/2007	01/30/2007	03/05/2007	03/05/2007
06-100-0200	DRY	01/30/2007	01/30/2007	03/05/2007	03/05/2007
07-400-0075	DRY	01/23/2007	01/23/2007	03/05/2007	03/05/2007
07-100-0130	DRY	01/23/2007	01/23/2007	03/05/2007	03/05/2007

Outfall	Outfall Status	Visit #1	Visit #2	Visit #3	Visit #4
07-100-0205	WET	01/23/2007	01/23/2007	03/05/2007	03/05/2007
08-200-0005	DRY	01/23/2007	01/23/2007	03/05/2007	03/05/2007
08-200-0010	DRY	01/23/2007	01/23/2007	03/05/2007	03/05/2007
08-200-0030	DRY	01/23/2007	01/23/2007	03/05/2007	03/05/2007
09-400-0005	DRY	01/23/2007	01/23/2007	03/05/2007	03/05/2007
09-400-0010	DRY	01/23/2007	01/23/2007	03/05/2007	03/05/2007
10-200-0470	DRY	03/23/2007	03/23/2007	04/23/2007	04/23/2007
11-300-0602	DRY	01/26/2007	01/26/2007	03/13/2007	03/13/2007
11-300-0610	DRY	01/26/2007	01/26/2007	03/13/2007	03/13/2007
11-300-0611	WET	01/26/2007	01/26/2007	03/13/2007	03/13/2007
11-300-0612	DRY	01/26/2007	01/26/2007	03/13/2007	03/13/2007
11-300-0613	DRY	01/26/2007	01/26/2007	03/13/2007	03/13/2007
11-300-0614	WET	01/26/2007	01/26/2007	03/13/2007	03/01/2007
11-300-0615	WET	01/26/2007	01/26/2007	03/13/2007	03/13/2007
12-400-0705	WET	03/27/2007	03/27/2007	04/30/2007	04/30/2007
13-300-0135	ILLICIT CONNECTION	07/25/2006	07/25/2006	08/28/2006	08/28/2006
13-300-0140	ILLICIT CONNECTION	07/25/2006	07/25/2006	08/28/2006	08/28/2006
13-300-0181	DRY	07/18/2006	07/19/2006	08/17/2006	08/17/2006
13-300-0182	DRY	07/18/2006	07/19/2006	08/17/2006	08/17/2006
13-300-0184	DRY	07/18/2006	07/19/2006	08/17/2006	08/17/2006
13-300-0185	ILLICIT CONNECTION	02/06/2007	02/06/2007	03/26/2007	03/26/2007
13-300-0226	DRY	07/20/2006	07/20/2006	08/24/2006	08/24/2006
13-300-0227	DRY	07/20/2006	07/20/2006	08/24/2006	08/24/2006
13-300-0228	ILLICIT DUMP	07/20/2006	07/20/2006	08/24/2006	08/24/2006
18-200-0005	DRY	11/29/2006	11/29/2006	02/28/2007	02/28/2007
18-500-0010	DRY	11/29/2006	11/29/2006	02/28/2007	02/28/2007
18-400-0020	DRY	11/29/2006	11/29/2006	02/28/2007	02/28/2007

Outfall	Outfall Status	Visit #1	Visit #2	Visit #3	Visit #4
18-400-0025	DRY	11/29/2006	11/29/2006	02/28/2007	02/28/2007
18-400-0030	DRY	11/29/2006	11/29/2006	02/28/2007	02/28/2007
18-100-0690	DRY	12/15/2006	12/15/2006	02/28/2007	02/28/2007
18-100-0700	DRY	12/15/2006	12/15/2006	02/28/2007	02/28/2007
31-100-0500	ILLICIT CONNECTION	01/23/2007	01/23/2007	05/01/2007	05/01/2007
51-100-0900	WET	12/04/2006	12/04/2006	03/23/2007	03/23/2007
53-100-0030	DRY	12/04/2006	12/04/2006	01/03/2007	01/03/2007
53-400-0035	DRY	12/04/2006	12/04/2006	01/03/2007	01/03/2007
53-100-0045	WET	01/03/2007	01/03/2007	03/12/2007	03/12/2007
53-100-0065	DRY	12/04/2006	12/04/2006	01/03/2007	01/03/2007
53-100-0085	WET	03/26/2007	03/26/2007	04/30/2007	04/30/2007
53-200-0125	DRY	01/02/2007	01/02/2007	03/12/2007	03/12/2007
53-200-0132	DRY	01/02/2007	01/02/2007	03/12/2007	03/12/2007
53-100-0133	DRY	01/02/2007	01/02/2007	03/12/2007	03/12/2007
53-200-0175	DRY	01/03/2007	01/03/2007	03/26/2007	03/26/2007
53-200-0200	WET	01/02/2007	01/02/2007	03/26/2007	03/26/2007
55-100-0150	DRY	03/23/2007	03/23/2007	04/23/2007	04/23/2007
56-400-0150	DRY	01/02/2007	01/02/2007	03/12/2007	03/12/2007
56-400-0170	DRY	01/02/2007	01/02/2007	03/12/2007	03/12/2007
56-100-0230	WET	03/23/2007	03/23/2007	04/23/2007	04/23/2007
70-400-0605	WET	01/03/2007	01/03/2007	02/26/2007	02/26/2007
79-200-0045	WET	12/18/2006	12/18/2006	02/26/2007	02/26/2007
79-400-0340	ILLICIT CONNECTION	07/25/2006	07/25/2006	08/28/2006	08/28/2006
79-200-0345	WET	12/18/2006	12/18/2006	02/26/2007	02/26/2007
79-100-0365	WET	12/18/2006	12/18/2006	02/26/2007	02/26/2007
79-100-0400	WET	12/18/2006	12/18/2006	02/26/2007	02/26/2007

Dry Weather Screening Data

Outfall / Permit Year	Date	Visit #	Flow ?	Flow Rate (gpm)	pH (su)	Chlorine (ppm)	Copper (ppm)	Phenol (ppm)	Detergents (ppm)	Ammonia (ppm)	Fecal Sample (mpn/100ml)	Turbidity (ntu)	Color	Odor?	Surface Scum	Oil Sheen
00-100-0300																
2007	8/14/06	1	Yes	32	7.00	0.40	0	0	0	0	No	0	0	0	No	No
	8/14/06	2	Yes	32	7.00	0.40	0	0	0	0	No	0	0	0	No	No
	9/21/06	4	Yes	3	6.00	0.40	0	0	0	0	No	0	0	0	No	No
00-400-0095																
2007	11/6/06	1	Yes	0.16	5.00	0.40	0	0	0	0.10	No	0	0	0	No	No
	11/6/06	2	Yes	0.16	5.00	0.40	0	0	0	0.10	No	0			No	No
00-400-0210																
2007	8/9/06	2	Yes	1	7.00	0.60	0	0	0	0	No	0	0	0	No	No
00-400-0215																
2007	8/9/06	1	Yes	2	7.00	0	0	0.30	0.50	2.00	Yes 151,000	50	80	80	MULCH	No
	9/18/06	3	Yes	0.48	6.00	0.10	0	0	0.25	2.00	No	0	0	0	No	No
	9/18/06	4	Yes	0.80	7.00	0.10	0	0	0.25	2.00	Yes	0	0	0	No	No
00-400-0390																
2007	8/14/06	1	Yes	14	6.00	2.00	0	0	0	0	No	0	0	0	No	No
	8/14/06	2	Yes	14	6.00	2.00	0	0	0	0	No	0	0	0	No	No
	9/21/06	3	Yes	5	6.00	1.00	0	0	0	0	No	0	0	0	No	No
	9/21/06	4	Yes	6	6.00	1.00	0	0	0	0	No	0	0	0	No	No
01-300-0160																
2007	8/1/06	1	Yes	4	6.00	0.60	0	0	0	0.80	No	0	30	30	No	No
	8/1/06	2	Yes	4	7.00	0.60	0	0	0	0.40	No	0	20	20	No	No
	9/11/06	3	Yes	4	7.00	0.40	0	0	0	0.40	No	0	0	0	No	No
	9/11/06	4	Yes	4	7.00	0.40	0	0	0	2.00	Yes <2	0	0	0	No	No
02-100-0500																
2007	3/8/07	3	Yes	10	8.00	0.40					No				No	No
02-300-0230																
2007	2/6/07	2	Yes	30	7.00	0.25					No				No	No
	3/8/07	3	Yes	19	6.50	0.40					No				No	No
	3/8/07	4	Yes	19	7.50	0.30					No				No	No
02-400-0045																
2007	8/3/06	2	Yes	11	7.00	0.20	0.20	0	0	0	No	0	0	0	No	No
	9/11/06	3	Yes	16	7.00	0.30	0	0	0	0	No	0	0	0	No	No
	9/11/06	4	Yes	2	7.00	0.30	0	0	0	0	No	0	0	0	No	No

Dry Weather Screening Data

Outfall / Permit Year	Date	Visit #	Flow ?	Flow Rate (gpm)	pH (su)	Chlorine (ppm)	Copper (ppm)	Phenol (ppm)	Detergents (ppm)	Ammonia (ppm)	Fecal Sample (mpn/100ml)	Turbidity (ntu)	Color	Odor?	Surface Scum	Oil Sheen
02-400-0050																
2007	8/2/06	1	Yes	2	7.00	0.60	0	0	0	0	No	0	0	0	No	No
	8/3/06	2	Yes	2	7.00	0.80	0	0	0	0	No	0	0	0	No	No
	9/11/06	3	Yes	2	7.00	2.00	0	0	0	0	No	0	0	0	No	No
	9/11/06	4	Yes	2	7.00	2.00	0	0	0	0	No		0	0	No	No
03-100-0045																
2007	11/13/06	1	Yes	19	5.00	1.00	0	0	0	0	No	0	0	0	No	No
	11/13/06	2	Yes	19	5.00	1.00	0	0	0	0	No	0	0	0	No	No
	3/8/07	3	Yes	5	6.50	1.50					No				CHLORINE	No
	3/8/07	4	Yes	5	6.50	2.00					No				No	No
03-300-0005																
2007	7/25/06	1	Yes	19	7.00	0.80	0	0	0	0	No	0	0	0	No	No
	7/25/06	2	Yes	19	7.00	1.00	0	0	0	0.20	No	0	0	0	No	No
	8/28/06	3	Yes	38	7.00	0.30	0	0	0.75	0	No	0	0	0	No	No
	8/28/06	4	Yes	38	7.00	0.40	0	0	0	0	No	0	0	0	No	No
03-300-0400																
2007	3/7/07	3	Yes	3	7.00					10.00	No				DECAY	No
03-300-0430																
2007	11/27/06	1	Yes	0.33	6.00	0	0	0	0	1.00	No	0	0	0	No	No
	11/27/06	2	Yes	0.33	6.00	0	0	0	0	1.00	No	0	0	0	No	No
11-300-0614																
2007	1/26/07	2	Yes	1	7.00	0.25					No				No	No
13-300-0135																
2007	7/25/06	1	Yes	MODERATE	7.00	0.30	0	0	0.10	4.00	No	0	0	0	No	No
	7/25/06	2	Yes	MODERATE	7.00	0.20	0	0	0	4.00	No	0	0	0	No	No
	8/28/06	3	Yes	MODERATE	6.00	0	0	0	0	4.00	No	0	40	40	No	No
	8/28/06	4	Yes	MODERATE	6.00	0.30	0	0	0	4.00	No	0	0	0	No	No
13-300-0140																
2007	7/25/06	1	Yes	19	6.00	0.30	0	0	0	0	No	0	0	0	No	No
	7/25/06	2	Yes	19	7.00	0.60	0	0	0	0	No	0	0	0	No	No
	8/28/06	3	Yes	76	7.00	0.60	0	0	0	0	No	0	0	0	No	No
	8/28/06	4	Yes	76	7.00	0.40	0	0	0	0	No	0	0	0	No	No

Dry Weather Screening Data

Outfall / Permit Year	Date	Visit #	Flow ?	Flow Rate (gpm)	pH (su)	Chlorine (ppm)	Copper (ppm)	Phenol (ppm)	Detergents (ppm)	Ammonia (ppm)	Fecal Sample (mpn/100ml)	Turbidity (ntu)	Color	Odor?	Surface Scum	Oil Sheen
13-300-0185																
2007	2/6/07	1	Yes	5	8.00					1.00	No				ROTTEN	No
	2/6/07	2	Yes	5	8.00					1.00	No				ROTTEN	No
	3/26/07	4	Yes	4	8.00	0.80				1.00	No				No	No
13-300-0228																
2007	7/20/06	1	Yes	LOW	7.00	0.60	0	0	0	0	No	0	0	0	No	No
	7/20/06	2	Yes	VERY LOW	7.00	0.60	0	0	0	0.30	No	0	0	0	No	No
	8/24/06	3	Yes	0.50	7.00	0.20	0.20	0	> 3	0.60	No	50	20	20	No	No
	8/24/06	4	Yes	0.30	7.00	0.30	0	0	> 3	0.60	No	0	20	20	No	No
31-100-0500																
2007	5/1/07	3	Yes	35	8.00	0.40					No				CHLORINE	
79-200-0345																
2007	12/18/06	1	Yes	0.25	8.00					1.00	No				No	No
	12/18/06	2	Yes	0.25	8.00					1.00	No				No	No
	2/26/07	3	Yes	0.75	8.00					3.00	No				No	No
	2/26/07	4	Yes	0.75	8.00					3.00	No				No	No
79-400-0340																
2007	7/25/06	1	Yes	0.06	5.00	0.60	10.00	10.00	0.50	10.00	No	0	0	0	No	No
	7/25/06	2	Yes	0.06	5.00	0.80	10.00	10.00	0.25	10.00	No	0	0	0	No	No
	8/28/06	3	Yes	5	5.50	0.10	0.40	0	0.25	> 10.00	No	0	0	0	No	No
	8/28/06	4	Yes	5	5.50	0.10	0.40	0	0	> 10.00	No	0	0	0	No	No

Record Selection Criteria: SELECT * FROM Dry_Samples WHERE ((pH < 6.5 and pH > 9) or (Chlorine > .2) or (Detergents > .25) or (FecalCount >= 200) or (Ammonia >= 1)) or (Phenol >= .1) or (Copper >= .1)) and (PermitYear = '2007'

Elevated readings are in red.

Below is a listing of sample parameters and their elevated reading criteria:

pH	<= 6 or >8 su
Chlorine	>=0.3 ppm
Copper	>=0.1 ppm
Phenol	>=0.1 ppm
Detergents	>=0.25 ppm
Ammonia	>=1 ppm
Fecal Sample	>=200 mpn/100 ml

APPENDIX C

IBI Studies Summary for permit year

INDEX OF BIOTIC INTEGRITY ON FOUR CREEKS IN THE CITY OF KNOXVILLE MAY-JUNE 2007

INTRODUCTION

This document represents data collected from four streams located in Knoxville, TN by the Fort Loudoun Lake Association (FLLA) for the City of Knoxville. Fourth Creek, Third Creek, Baker Creek and First Creek were the four streams surveyed for Index of Biological Integrity (IBI) in May-June, 2007. In this document we will state our plan, describe the study areas, explain methodology, and discuss results.

OBJECTIVES

1. Perform backpack electro-shocking, and macro-invertebrate study.
2. Perform a water quality test.
3. Score IBI and deliver write-up to the city of Knoxville.

STUDY AREAS

FLLA assessed two sites along each of the four creeks for this IBI. A down stream site and an up stream site were located based upon guidance from the City of Knoxville.

METHODS

FLLA used the protocols adapted by the Tennessee Department of Environment and Conservation from the creator of the IBI assessment, James Karr. The biotic condition of the stream was assessed by examining the fishes present and by examining the benthic macroinvertebrates present in each of the selected sites. The index of biotic integrity (IBI) for fish communities is an assessment of environmental quality at a stream site through application of ecologically based metrics to fish community data collected from the site (Karr,1981). Twelve metrics address species richness and composition, trophic structure, fish abundance, and fish condition. Each metric reflects the condition of one aspect of the fish community and is scored against expectations under reference conditions. Potential scores are 1-poor, 3-intermediate, or 5-the best to be expected. Scores for the 12 metrics are summed to produce the IBI for the site. The IBI is then classified using the system developed by Karr et al. (1986) rating the site from "Very poor" to "Excellent". Data was collected at a given sampling site and compared to what might be expected in an undisturbed system. Two sites were selected to provide a representative example of the condition of the stream as a whole. Site selection was based upon representative habitat types, available topography and ease of access to the stream.

The index of biotic integrity (IBI) for a macroinvertebrate community is an assessment of environmental quality at a stream site through application of ecologically based metrics to the benthic macroinvertebrate community data collected from the site. Laboratory sample analysis was conducted from raw benthic data and a numerical value was generated based upon the Ephemeroptera, Plecoptera, and Trichoptera (EPT) richness. A

qualitative, family level EPT survey was used to examine the benthic macroinvertebrate populations of mayflies (Ephemeroptera), stoneflies (Plecoptera), and caddisflies (Tricoptera). A thorough search for benthic macroinvertebrates was conducted in fast and slow riffle habitats. All of the organisms were collected and identified to the family level. The EPT score is a sum of the total number of families of EPT organisms represented in a sample. Scores of 0-5 are considered poor, 7-11 fair, and >13 good.
Four kicks (two in slow riffle habitats and two in fast riffle habitats) were conducted at each of the two selected sites to provide a representative sample of the condition of the stream as a whole. Site selection was based upon location of fish IBIs.

Fish Sampling Methods

Tools used to conduct the IBI included a backpack shocker, one twenty-foot seine, collection nets and a bucket. Two techniques were used to collect the fish, seine hauling and backpack shocking into the seine. Seine hauling was used to sample shallow pool and run habitats that were relatively free of boulders, snags or other obstacles. Backpack shocking into the seine was used in riffle, run and pool habitats. Positioning the seine perpendicular to the stream flow and shocking a predefined area of approximately 300 ft^2 downstream to the seine accomplished this. Sampling protocol required sampling of dominant habitats, usually riffle, run and pool. Each of the habitats was sampled until three consecutive units of sampling effort produced no additional species for that habitat. After each sampling effort, fish collected were identified to species, examined for anomalies and then released. FLLA followed Tennessee's Biological Standard Operating Procedures Manual: Volume II-Fish Communities from March 1996.

Benthic Macroinvertebrate Sampling Methods

The sampling protocol used for the following macroinvertebrate surveys is borrowed from the document *Division of Water Pollution Control Quality Standard Operating Procedures for Macroinvertebrate Stream Surveys (TDEC, 2006).* The streams in Knox County are all high gradient streams and the corresponding high gradient Habitat Assessment forms were used at each site. The stream parameters measured included pH, dissolved oxygen (mg/L), conductivity (ppt) and temperature (°C). The YSI 60 PH3 instrument was used to measure temperature and pH and the YSI 85 was used to verify temperature and measure dissolved oxygen (DO) and conductivity. The technique used to collect samples was the Semi-Quantitative Riffle Kick (SQKICK). A one square meter kick net with a 500-micron mesh was used to sample riffles; two fast current velocity and two slower current velocity riffles. Sampling was conducted from downstream riffles to upstream riffles to avoid collecting debris from a previous kick. The four kicks were combined in a 500-micron sieve bucket and then stored in containers with 70% isopropyl alcohol. Invertebrates were later picked out of debris and identified to the family level taxon where possible.

Water Quality

Tests were conducted using YSI meters. The parameters tested were dissolved oxygen, pH, temperature, and conductivity.

Habitat Assessment

A habitat assessment is conducted anytime a biological sample is collected. Habitat data sheets, as finalized in *Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers* (Barbour et. al., 1999) were used to evaluate the integrity of the habitat at each site. Two investigators collaborated on the habitat assessment to reduce the potential for individual bias. The following ten habitat parameters were evaluated:

- Epifaunal substrate/available cover
- Embeddedness
- Velocity/depth regime
- Sediment deposition
- Channel flow status
- Channel alteration
- Frequency of riffles (or bends)
- Bank stability (score for each bank)
- Vegetative protective (score for each bank)
- Riparian vegetative zone width (score for each bank)

Scores were based on a scale of 0 to 20 for each parameter, with 20 being the highest attainable score. Scores were divided into four categories (optimal, suboptimal, marginal and poor) with a range of five scores possible in each category. The ten parameters were totaled and the score compared with the Habitat Assessment Guidelines for ecoregion 67f as printed in Table 1 of Tennessee's Department of Environment and Conservation Quality System Standard Operating Procedure for Macroinverebrate Stream Surveys revised October 2006 to determine if the habitat is capable of supporting a healthy macroinvertebrate community. Scoring for the Habitat Assessment is as follows:

- Scores greater than or equal to 130 indicate the habitat is not impaired
- Scores between 103-129 indicate the habitat is moderately impaired
- Scores less than or equal to 102 indicate the habitat is severely impaired

Summary Table of Results for Fish IBI

Sample Sites	Survey Date	IBI Score
Fourth Creek at Kingston Pike and Northshore Dr.	May 24, 2007	28=Poor
Fourth Creek near 1122 Old Weisgarber Road	May 24, 2007	36=Poor
Third Creek at Cox St. and Sutherland Ave.	May 31, 2007	24=Very Poor
Third Creek at Middlebrook Pk and Lonas Rd	May 31, 2007	24=Very Poor
Baker Creek at Mary James Park	June 13, 2007	28=Very Poor
Baker Creek at Rock City Park	June 13, 2007	34=Poor
First Creek at Cottage Place and 6th Ave	June 21, 2007	35=Poor
First Creek at Woodland Ave and Broadway	June 21, 2007	34=Poor

IBI Range: 0 = No fish; 12-22 = Very poor; 28-34 = Poor; 40-44 = Fair; 48-52 = Good; 59-60 = Excellent

Summary Table of Results for Macroinvertebrate IBI

Sample Sites	Survey Date	EPT Score
Fourth Creek at Kingston Pike and Northshore Dr.	May 24, 2007	2 = Poor
Fourth Creek near 1122 Old Weisgarber Road	May 24, 2007	8 = Fair
Third Creek at Cox St. and Sutherland Ave.	May 31, 2007	2 = Poor
Third Creek at Middlebrook Pk and Lonas Rd	May 31, 2007	2 = Poor
Baker Creek at Mary James Park	June 13, 2007	2 = Poor
Baker Creek at Rock City Park	June 13, 2007	3 = Poor *
First Creek at Cottage Place and 6th Ave	June 21, 2007	4 = Poor
First Creek at Woodland Ave and Broadway	June 21, 2007	4 = Poor

* *using a different metric might change the score to Poor/Fair*

KEY	EPT Families
Good	13 or more
Fair/Good	12
Fair	7-11
Poor/Fair	5-6
Poor	4 and less

INDEX OF BIOTIC INTEGRITY
FOURTH CREEK

STUDY AREAS

FLLA assessed two sites along Fourth Creek for this IBI. The down stream site was located near the intersection of Kingston Pike and Northshore Dr. (see Figure 1). This survey site was conducted at approximately 1.75 miles up stream from the confluence with Fort Loudoun Lake. The upstream site was located near 1122 Old Weisgarber Rd. (see Figure 2). This survey was conducted at approximately 4 miles up stream from the confluence with Fort Loudoun Lake. The site near Kingston Pike and Northshore Dr. has an approximate drainage area of 6 square miles and the site on Old Weisgarber has an approximate drainage area of 5 square miles.

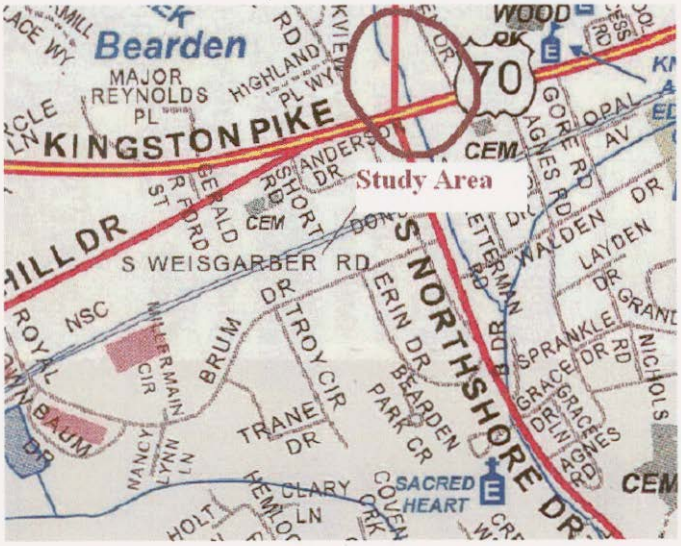


Figure 1: down stream survey site at Kingston Pike and Northshore Dr.

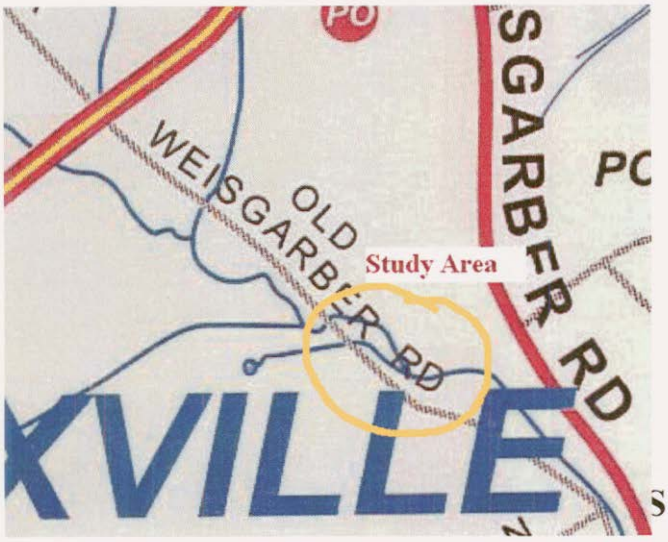


Figure 2: up stream survey site near 1122 Old Weisgarber Dr.

Index of Biotic Integrity
Fourth Creek at Kingston Pike and Northshore Dr. May 24, 2007
Ecoregion: Central Appalachian Ridges and Valleys (67f)
Approximate Drainage Area: 6 sq. miles

Fish

Fish sampling on May 24, 2007 yielded an IBI score of **28** that equates to poor.

Metric Description	Scoring Criteria			Observed	Score
	1	3	5		
Total number of native fish species	<5	(5-10)	>10	4	1
Number of darter species	<1.5	(1.5-2.5)	>2.5	0	1
Number of sunfish species, less *Micropterus*	<1.5	(1.5-2.5)	>5	1	1
Number of sucker species	<0.5	(0.5-1)	>1	1	3
Number of intolerant species	<1	(1-2.5)	>2.5	0	1
Percent of individuals as tolerant species	>40%	20%-40%	<20	31%	3
Percent of individuals as omnivores and stoneroller species	>50%	25%-50%	<25	10%	5
Percent of individuals as specialized insectivores	<10%	10%-20%	>20%	0%	1
Percent of individuals as piscivores	<2%	2%-4%	>4%	0%	1
Catch rate (average number of fish per 300 sq. ft. sampling unit)	<22	22-43.8	>43.8	173	5
Percent of individuals as hybrids	<1%	TR-1%	0%	0%	5
Percent of individuals with diseases, tumors, fin damage, and other anomalies	>5%	2%-5%	<2%	7%	1
			IBI		28
			IBI Classification		Poor

IBI Range: 0 = No fish; 12-22 = Very poor; 28-34 = Poor; 40-44 = Fair; 48-52 = Good; 59-60 = Excellent

Common names of fish species present:

- Blacknose Dace: 307 (black spots on some fish)
- Central Stoneroller: 50 (black spots on some fish)
- Creek Chub: 158 (black spots on some fish)
- Green Sunfish: 4

Benthic

Macroinvertabrate sampling on May 24, 2007 yielded an IBI score of **2** that equates to Poor.

Comments:

This reach of Fourth Creek is wide with low velocity and heavy siltation. The reach is impacted by large impervious surfaces (parking lots and a five-lane road) plus development. The riparian area is non-existent save for a few shrubby trees next to Northshore Drive. The macroinvertabrate assemblage is missing EPT taxa found in the upstream site at Old Weisgarber Road and received a 'Poor' rating. Crayfish were plentiful in all sizes and several salamanders were also present and released. Midges were the most numerous invertebrate in the sample. The presence of a large density of midges combined with the presence of isopods, amphipods and oligochaetes generally denotes poor water quality.

Taxa	Density
OLIGOCHAETA (aquatic worms)	~ 19
EPHEMEROPTERA (Mayflies)	2
Siphlonuridae	
Ameletus sp.	37
PLECOPTERA (Stoneflies)	0
TRICHOPTERA (Caddisflies)	
Hydropsychidae	172
MEGALOPTERA	
Sialidae	1
COLEOPTERA (beetles)	
Elmidae (3 larvae/4 adults)	7
DIPTERA (flies)	7
Chironomidae	1000+
Simulidae	158
Tipulidae	66
Atherixidae	1
GASTROPODA (snails)	
Ancylidae (limpet)	1
Physidae	1
Pleuroceridae	4
POLECYPODA (mussels)	
Corbibulidae	
Corbicula fluminea	1
ARACHNOIDEA (water mites)	
Hydracarina	2
CRUSTACEA	
Amphipod (scuds)	2
Isopoda (sow bugs)	309
Decapoda (crayfish)	6

Scores of 0-5 are considered poor, 7-11 fair, and >13 good

Ephemeroptera	1
Plecoptera	0
Trichoptera	1
	2 Poor

Water Quality

Water tests on May 24, 2007 yielded the following results:

Dissolved Oxygen: 6.82 mg/L
Conductivity: 0.2 ppT
Temperature: 20°C
pH: 7.66

Habitat Assessment

This section of the creek received a score of 35. A score of 35 indicates that the habitat in the observed area is severely impaired for ecoregion 67f. Of the ten metrics used to assess habitat, this section did not meet expectations for individual habitat parameters in the following categories:

- Epifaunal Substrate/Available Cover
- Embeddeness
- Velocity/Depth regime
- Sediment Deposition
- Channel Alteration
- Frequency of Riffles
- Bank Stability
- Vegetative Protective
- Riparian Vegetative Zone Width

RESULTS

Index of Biotic Integrity
Fourth Creek near 1122 Old Weisgarber Rd May 24, 2007
Ecoregion: Central Appalachian Ridges and Valleys (67f)
Approximate Drainage Area: 5 sq. miles

Fish

Fish sampling on May 24, 2007 yielded an IBI score of **36** that equates to poor.

Metric Description	Scoring Criteria			Observed	Score
	1	3	5		
Total number of native fish species	<5	(5-10)	>10	4	1
Number of darter species	<1.5	(1.5-2.5)	>2.5	0	1
Number of sunfish species, less *Micropterus*	<1.5	(1.5-2.5)	>5	0	1
Number of sucker species	<0.5	(0.5-1)	>1	1	3
Number of intolerant species	<1	(1-2.5)	>2.5	0	3
Percent of individuals as tolerant species	>40%	20%-40%	<20	10%	5
Percent of individuals as omnivores and stoneroller species	>50%	25%-50%	<25	5.6%	5
Percent of individuals as specialized insectivores	<10%	10%-20%	>20%	0%	1
Percent of individuals as piscivores	<2%	2%-4%	>4%	0%	1
Catch rate (average number of fish per 300 sq. ft. sampling unit)	<22	22-43.8	>43.8	83	5
Percent of individuals as hybrids	<1%	TR-1%	0%	0%	5
Percent of individuals with diseases, tumors, fin damage, and other anomalies	>5%	2%-5%	<2%	0%	5
			IBI		36
			IBI Classification		Poor

IBI Range: 0 = No fish; 12-22 = Very poor; 28-34 = Poor; 40-44 = Fair; 48-52 = Good; 59-60 = Excellent

Common name of fish species present:

- Blacknose Dace: 203
- Central Stoneroller: 14
- Creek Chub: 25
- Banded Sculpin: 8

Benthic

Macroinvertabrate sampling on May 24, 2007 yielded an IBI score of **8** that equates to Fair

Comments:

Fourth Creek is about 3 to 4 meters wide and is impacted by a culvert and storm water drainage from Middlebrook Pike and Old Weisgarber Road. The riparian area is largely intact giving the stream plenty of shade and some protection from siltation and stormwater flow. The macroinvertebate assemblage here lacked odonates (dragonflies and damselflies) but had an aquatic moth in the sample. Numerous salamanders were present and released at the sight.

Taxa	Density
OLIGOCHAETA (aquatic worms)	3
EPHEMEROPTERA (Mayflies)	14
Baetidae	3
Ephemerellidae	1
Siphlonuridae	
Ameletus sp.	15
PLECOPTERA (Stoneflies)	
Chloroperlidae	1
Nemouridae	1
Taeniopterygidae	1
TRICHOPTERA (Caddisflies)	
Hydropsychidae	334
Rhyacophilidae	1
LEPIDOPTERA (moths)	
Pyralidae	1
COLEOPTERA (beetles)	
Elmidae (larvae only)	9
Gyrinidae	1
DIPTERA (flies)	
Chironomidae	188
Simulidae	158
Tipulidae	18
Antocha	92
GASTROPODA (snails)	
Pleuroceridae	37
Physidae	1
POLECYPODA (mussels)	
Corbibulidae	
Corbicula fluminea	1
ARACHNOIDEA (water mites)	
Hydracarina	3
CRUSTACEA	
Isopoda (sow bugs)	168
Decapoda (crayfish)	2

Scores of 0-5 are considered poor, 7-11 fair, and >13 good

Ephemeroptera	3
Plecoptera	3
Trichoptera	2
	8
	Fair

Water Quality

Water tests on May 24, 2007 yielded the following results:

Dissolved Oxygen: 5.70 mg/L
Conductivity: 0.1 ppT
Temperature: 18.4°C
pH: 7.84

Habitat Assessment

This section of the creek received a score of 110. A score of 110 indicates that the habitat in the observed area is moderately impaired for ecoregion 67f. Of the ten metrics used to assess habitat, this section did not meet expectations for individual habitat parameters in the following categories:

- Velocity/Depth Regime
- Sediment Deposition
- Channel Flow Status
- Bank Stability
- Vegetative Protective
- Riparian Vegetative Zone Width

DISCUSSION

Fourth Creek is registered in the final version of the 2006, 303d list for the state of Tennessee because of physical substrate habitat alterations and Escherichia coli due to discharges from MS4 area and channelization.(p. 92) Both sites received an overall score of poor for the Index of Biotic Integrity (I.B.I.). The scores reflect a low number of intolerant species, and a high number of tolerant species. Water quality of Fourth Creek showed to have adequate pH and temperature. The Habitat Assessment shows that habitat impairment varies along the stream. Sediment deposition, bank stability and poor riparian zone width and cover appear to be adding to habitat degradation at the study sites.

INDEX OF BIOTIC INTEGRITY
THIRD CREEK

STUDY AREAS

FLLA assessed two sites along Third Creek for this IBI. The down stream site was located near the intersection of Cox St. and Sutherland Ave. at the Tennessee Stream Mitigation Project (see Figure 1). This survey site was conducted at approximately 3 miles up stream from the confluence with Fort Loudoun Lake. The upstream site was located at the intersection of Middlebrook Pike and Lonas Rd. (see Figure 2). This survey was conducted at approximately 4.75 miles up stream from the confluence with Fort Loudoun Lake. The site near Cox St. and Sutherland Ave. has an approximate drainage area of 10 square miles and the site near Middlebrook Pike and Lonas Rd has an approximate drainage area of 3 square miles.

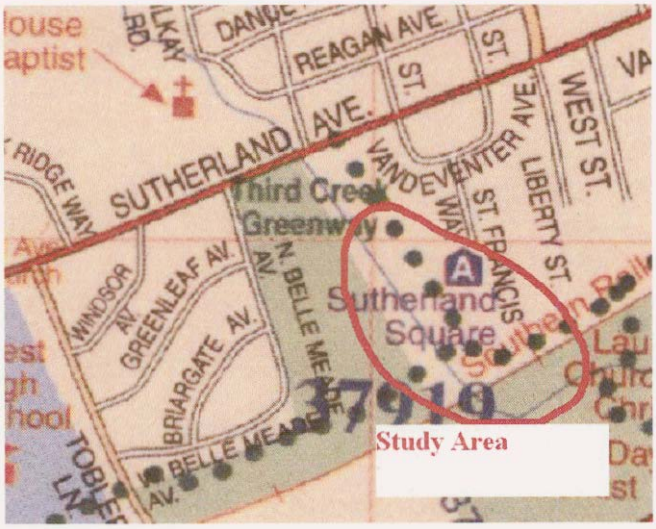


Figure 1: down stream survey site at Cox St and Sutherland.

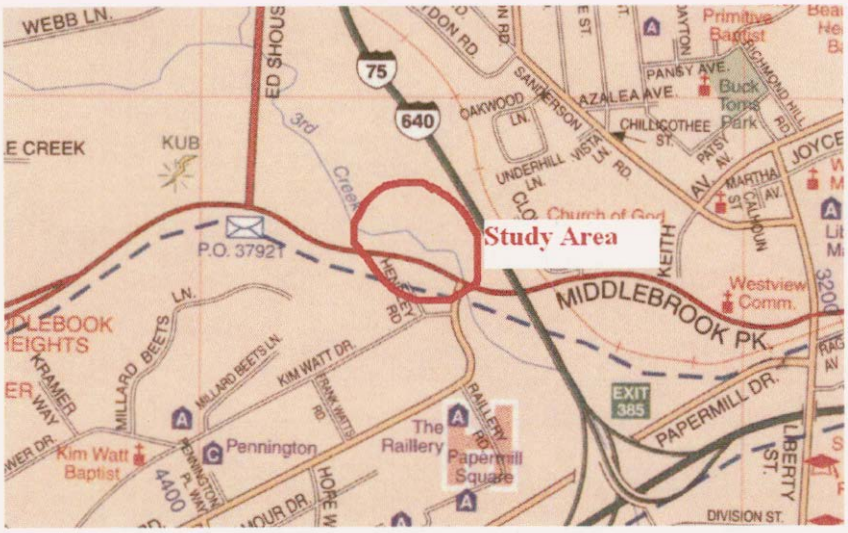


Figure 2: up stream survey site near Middlebrook Pike and Lonas Road.

RESULTS

Index of Biotic Integrity
Third Creek at Cox St. and Sutherland Ave. May 31, 2007
Ecoregion: Central Appalachian Ridges and Valleys (67f)
Approximate Drainage Area: 10 sq. miles

Fish

Fish sampling on May 31, 2007 yielded an IBI score of **24** that equates to Very Poor.

Metric Description	Scoring Criteria			Observed	Score
	1	3	5		
Total number of native fish species	<8	(8-15)	>16	7	1
Number of darter species	<2	(2-3)	>3	1	1
Number of sunfish species, less *Micropterus*	<2	2	>2	1	1
Number of sucker species	<2	2	>2	2	3
Number of intolerant species	<2	2	>2	0	1
Percent of individuals as tolerant species	>36%	20%-36%	<20	78%	1
Percent of individuals as omnivores and stoneroller species	>45%	25%-45%	<25	11%	5
Percent of individuals as specialized insectivores	<15%	15%-30%	>30%	4%	1
Percent of individuals as piscivores	<2%	2%-4%	>4%	0%	1
Catch rate (average number of fish per 300 sq. ft. sampling unit)	<22	22-43.8	>43.8	43	3
Percent of individuals as hybrids	<1%	TR-1%	0%	0%	5
Percent of individuals with diseases, tumors, fin damage, and other anomalies	>5%	2%-5%	<2%	10%	1
			IBI		24
			IBI Classification		Very Poor

IBI Range: 0 = No fish; 12-22 = Very poor; 28-34 = Poor; 40-44 = Fair; 48-52 = Good; 59-60 = Excellent

Common names of fish species present:

- Northern Hog Sucker: 6
- Stone Roller: 27 (black spot and fin rot)
- Creek Chub: 286 (black spot)
- Snub Nose Darter: 16 (black spot)

Blue Gill: 10
Black Nose Dace: 24 (black spot)
White Sucker: 15

Benthic:
Macroinvertabrate sampling on May 31, 2007 yielded an IBI score of **2** that equates to Poor.

Comments:
The Third Creek Greenway reach has been re-meandered and restructured to have a more natural fauna and flow regime. The riparian zone plantings have not yet grown to provide shade and bank stability. The macroinvertebrate fauna is sparse and has not been re-established since the stream restoration construction. This reach is devoid of crayfish but on the other hand it had two taxa of salamanders, which is encouraging. Two damselfly nymphs (Odonata) were collected and that order was not seen at the upper site on Middlebrook Pike and Lonas Drive. Midges were the most abundant invertebrate in the sample but that does not appear unusual considering the scarcity of invertebrates and the transitional state of the riparian zone.

Taxa	Density
OLIGOCHAETA (aquatic worms)	~4
EPHEMEROPTERA (Mayflies)	27
Siphlonuridae	
Ameletus sp.	81
PLECOPTERA (Stoneflies)	0
TRICHOPTERA (Caddisflies)	
Hydropsychidae	233
COLEOPTERA (beetles)	
Elmidae (1 larvae/2 adult)	3
HEMIPTERA (water striders)	
Veliidae	1
DIPTERA (flies)	1
Chironomidae	~ 1000
Simulidae	73
Tipulidae	14
CRUSTACEA	
Isopoda (sow bugs)	86
Decapoda (crayfish)	0

Scores of 0-5 are considered poor, 7-11 fair, and >13 good

Ephemeroptera	1
Plecoptera	0
Trichoptera	1
	2 Poor

Water Quality
Water tests on May 31, 2007 yielded the following results:

Dissolved Oxygen: 7.27 mg/L
Conductivity: 0.2 ppT
Temperature: 18.9°C
pH: 7.8

Habitat Assessment

This section of the creek received a score of 91. A score of 91 indicates that the habitat in the observed area is severely impaired for ecoregion 67f. Of the ten metrics used to assess habitat, this section did not meet expectations for individual habitat parameters in the following categories:

- Epifaunal Substrate/Available Cover
- Embeddeness
- Sediment Deposition
- Channel Flow Status
- Frequency of Riffles
- Bank Stability
- Vegetative Protective

RESULTS

Index of Biotic Integrity
Third Creek at Middlebrook Pike and Lonas Rd May 31, 2007
Ecoregion: Central Appalachian Ridges and Valleys (67f)
Approximate Drainage Area: 3 sq. miles

Fish

Fish sampling on May 31, 2007 yielded an IBI score of **24** that equates to Very Poor.

Metric Description	Scoring Criteria			Observed	Score
	1	3	5		
Total number of native fish species	<8	(8-15)	>16	6	1
Number of darter species	<2	(2-3)	>3	1	1
Number of sunfish species, less *Micropterus*	<2	2	>2	0	1
Number of sucker species	<2	2	>2	1	1
Number of intolerant species	<2	2	>2	0	1
Percent of individuals as tolerant species	>36%	20%-36%	<20	18%	5
Percent of individuals as omnivores and stoneroller species	>45%	25%-45%	<25	40%	3
Percent of individuals as specialized insectivores	<15%	15%-30%	>30%	7%	1
Percent of individuals as piscivores	<2%	2%-4%	>4%	0%	1
Catch rate (average number of fish per 300 sq. ft. sampling unit)	<22	22-43.8	>43.8	35	3
Percent of individuals as hybrids	<1%	TR-1%	0%	0%	5
Percent of individuals with diseases, tumors, fin damage, and other anomalies	>5%	2%-5%	<2%	62%	1
			IBI		24
			IBI Classification		Very Poor

IBI Range: 0 = No fish; 12-22 = Very poor; 28-34 = Poor; 40-44 = Fair; 48-52 = Good; 59-60 = Excellent

Common name of fish species present:

- Black Nose Dace: 124 (black spot and fin rot)
- Snubnose Darter: 22
- Creek Chub: 44 (black spot)
- Stone Roller: 112 (black spot and lesions)
- White Sucker: 14 (black spot and lesions)

Benthic

Macroinvertabrate sampling on May 31, 2007 yielded an IBI score of **2** that equates to Poor.

Comments:

Third Creek along this reach has no riparian zone. The grass is mowed right down to the edge of the water. Only a few trees grow along the edge of the banks and there is heavy bank erosion. The macroinvertebrate community is dominated by isopods and free-living caddisflies from the tolerant Hydropsychidae family group. There are at least a thousand hydropsychids in the sample ranging from unusually large to very small in size. We collected a few hundred tiny, newly hatched mayflies that appear to be *Ameletus sp.* Many are without gills and have tiny mouthparts so identification is problematic. They are all about the same size and have similar morphology. Aquatic beetles were present however all these elmids were larvae save one adult. Crayfish of all sizes were present and small salamanders, which were released. There was a leech in this sample, which along with the hydropsychids and isopods suggests poor water quality.

Taxa	Density
OLIGOCHAETA (aquatic worms)	~ 19
Nemouridae (leeches)	1
EPHEMEROPTERA (Mayflies)	~ 200
Siphlonuridae	
Ameletus sp.	12
PLECOPTERA (Stoneflies)	0
TRICHOPTERA (Caddisflies)	
Hydropsychidae	2000+
COLEOPTERA (beetles)	
Elmidae (308 larvae/1 adult)	309
HEMIPTERA (water striders)	
Gerridae	1
Veliidae	2
DIPTERA (flies)	1
Chironomidae	215
Simulidae	54
Tipulidae	34
GASTROPODA (snails)	
Ancylidae (limpet)	4
Pleuroceridae	49
CRUSTACEA	
Isopoda (sow bugs)	2000+
Decapoda (crayfish)	7

Scores of 0-5 are considered poor, 7-11 fair, and >13 good

Ephemeroptera	1
Plecoptera	0
Trichoptera	1
	2 Poor

Water Quality

Water tests on May 31, 2007 yielded the following results:

Dissolved Oxygen: 6.72 mg/L
Conductivity: 0.1 ppT
Temperature: 18.1°C
pH: 7.92

Habitat Assessment

This section of the creek received a score of 92. A score of 92 indicates that the habitat in the observed area is severely impaired for ecoregion 67f. Of the ten metrics used to assess habitat, this section did not meet expectations for individual habitat parameters in the following categories:

- Epifaunal Substrate/Available Cover
- Embeddedness
- Channel Alteration
- Bank Stability
- Vegetative Protective
- Riparian Vegetative Zone Width

DISCUSSION

Third Creek is registered in the final version of the 2006, 303d list for the state of Tennessee because of nitrates, loss of biogical integrity due to siltation, other anthropogenic habitat alterations and Escherichia coli due to discharges from MS4 area, being in an urbanized high density area, land development and collection system failure.(p. 90) Both sites received an overall score of very poor for the Index of Biotic Integrity (I.B.I.). The scores reflect a low number of intolerant species, and a high number of tolerant species. Water quality of Third Creek showed to have adequate pH and temperature. The Habitat Assessment shows that there is severe impairment in both study areas and at different locations along the creek. Sediment deposition, bank stability and poor riparian zone width and cover appear to be adding to habitat degradation at the study sites.

INDEX OF BIOTIC INTEGRITY
BAKER CREEK

STUDY AREAS

FLLA assessed two sites along Baker Creek for this IBI. One stream site was located on a tributary to Baker Creek at Mary James Park on South Haven Drive. (see Figure 1). This survey site was conducted at approximately 1 mile up stream from the confluence with Fort Loudoun Lake. The second site was located on Baker Creek at Rock City Park at the intersection near Moody Ave and Sevier Ave. (see Figure 2). This survey was conducted at approximately 1.25 miles up stream from the confluence with Fort Loudoun Lake. The Mary James Park site on the tributary of Baker Creek has an approximate drainage area of 2 square miles and the Rock City Park site has a drainage area of approximately 4 square miles.

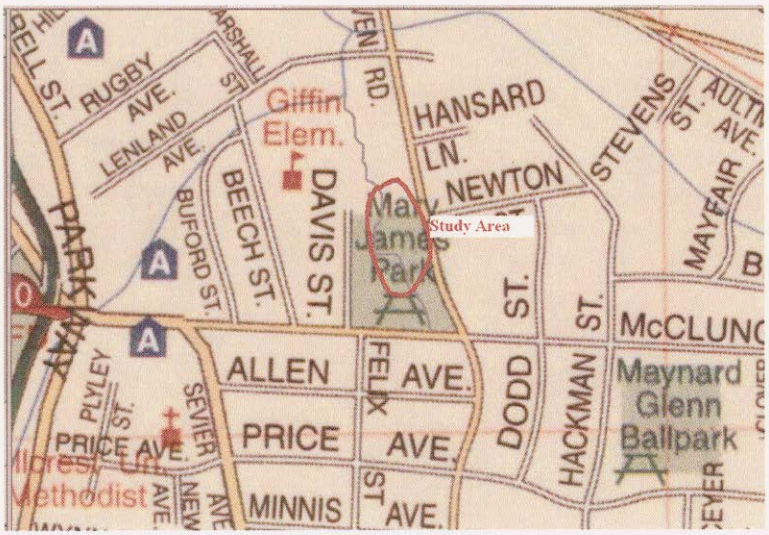


Figure 1: Tributary of Baker Creek at Mary James Park on South Haven Dr.

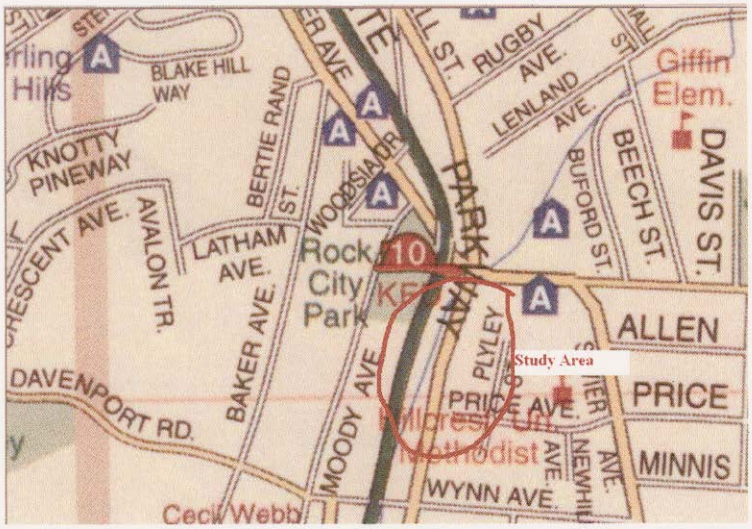


Figure 2: Baker Creek at Rock City Park near the intersection of Baker Ave and Latham Ave.

RESULTS

Index of Biotic Integrity
Baker Creek at Mary James Park June 13, 2007
Ecoregion: Central Appalachian Ridges and Valleys (67f)
Approximate Drainage Area: 2 sq. miles

Fish

Fish sampling on June 13, 2007 yielded an IBI score of **28** that equates to poor.

Metric Description	Scoring Criteria			Observed	Score
	1	3	5		
Total number of native fish species	<5	(5-10)	>10	1	1
Number of darter species	<1.5	(1.5-2)	>2	0	1
Number of sunfish species, less *Micropterus*	<2	(2-6)	>6	0	1
Number of sucker species				0	1
Number of intolerant species	<2	2	>2	0	1
Percent of individuals as tolerant species	>36%	20%-36%	<20	0%	5
Percent of individuals as omnivores and stoneroller species	>45%	25%-45%	<25	0%	5
Percent of individuals as specialized insectivores	<15%	15%-30%	>30%	0%	1
Percent of individuals as piscivores	<2%	2%-4%	>4%	0%	1
Catch rate (average number of fish per 300 sq. ft. sampling unit)	<22	22-43.8	>43.8	15	1
Percent of individuals as hybrids	<1%	TR-1%	0%	0%	5
Percent of individuals with diseases, tumors, fin damage, and other anomalies	>5%	2%-5%	<2%	0%	5
			IBI		28
			IBI Classification		Poor

IBI Range: 0 = No fish; 12-22 = Very poor; 28-34 = Poor; 40-44 = Fair; 48-52 = Good; 59-60 = Excellent

Common names of fish species present:
Blacknose Dace: 46

Benthic

Macroinvertabrate sampling on June 13, 2007 yielded an IBI score of **2** that equates to Poor.

Comments:

This reach was very narrow, less than one meter across. The protocol recommends using a smaller kicknet and doing four riffle kicks. We did not have the smaller net with us so we used the one meter net and rolled the sides to make it a little smaller. This site received a 'poor' rating. The macroinvertebrate fauna would have had an EPT of 1 except for one small mayfly, which allotted it an EPT of 2. The fauna was not very populous, leaving midges as the most common invertebrate. There were no crayfish seen at this site but there was one in the sample. Salamanders were present and released at the stream. Overall the rating of 'poor' is appropriate for this reach. The lawn goes down to the water line. The stream is impacted by fertilizers/mowing, heavy stormwater flow and impervious surfaces. Bank erosion and siltation were elevated. The velocity of the stormwater is slowed by a newly constructed rock garden which helps. Restoration of the riparian area would improve in-stream habitat and help absorb more stormwater.

Taxa	Density
OLIGOCHAETA (aquatic worms)	~ 7
EPHEMEROPTERA (Mayflies)	1
PLECOPTERA (Stoneflies)	0
TRICHOPTERA (Caddisflies)	
Hydropsychidae	83
COLEOPTERA (beetles)	
Elmidae (18 larvae/3 adults)	21
DIPTERA (flies)	
Chironomidae	231
Simulidae	61
Tipulidae	28
GASTROPODA (snails)	
Pleuroceridae	24
POLECYPODA (mussels)	
Corbibulidae	
Corbicula fluminea	1
CRUSTACEA	
Amphipod (scuds)	1
Decapoda (crayfish)	1

Ephemeroptera	1
Plecoptera	0
Trichoptera	1
	2 Poor

Water Quality

Water tests on June 13, 2007 yielded the following results:

Dissolved Oxygen: 6.43 mg/L
Conductivity: 0.2 ppT
Temperature: 17°C
pH: 7.42

Habitat Assessment

This section of the creek received a score of 51. A score of 51 indicates that the habitat in the observed area is severely impaired for ecoregion 67f. Of the ten metrics used to assess habitat, this section did not meet any of the expectations for individual habitat parameters.

RESULTS

Index of Biotic Integrity
Baker Creek at Rock City Park June 13, 2007
Ecoregion: Central Appalachian Ridges and Valleys (67f)
Approximate Drainage Area: 4 sq. miles

Fish

Fish sampling on June 13, 2007 yielded an IBI score of **34** that equates to poor.

Metric Description	Scoring Criteria			Observed	Score
	1	3	5		
Total number of native fish species	<5	(5-10)	>10	7	3
Number of darter species	<1.5	(1.5-2)	>2	1	1
Number of sunfish species, less *Micropterus*	<2	(2-6)	>6	1	1
Number of sucker species	100-90	89-70	<70	100%	1
Number of intolerant species	<2	2	>2	0	1
Percent of individuals as tolerant species	>36%	20%-36%	<20	7%	5
Percent of individuals as omnivores and stoneroller species	>45%	25%-45%	<25	2%	5
Percent of individuals as specialized insectivores	<15%	15%-30%	>30%	2%	1
Percent of individuals as piscivores	<2%	2%-4%	>4%	0%	1
Catch rate (average number of fish per 300 sq. ft. sampling unit)	<22	22-43.8	>43.8	50	5
Percent of individuals as hybrids	<1%	TR-1%	0%	0%	5
Percent of individuals with diseases, tumors, fin damage, and other anomalies	>5%	2%-5%	<2%	0%	5
			IBI		34
			IBI Classification		Poor

IBI Range: 0 = No fish; 12-22 = Very poor; 28-34 = Poor; 40-44 = Fair; 48-52 = Good; 59-60 = Excellent

Common name of fish species present:
Blacknose Dace: 53
Snubnose Darter: 11
Creek Chub: 30
White Sucker: 11
Central Stoneroller: 2
Banded Sculpin: 1
Bluegill: 2

Benthic

Macroinvertabrate sampling on June 13, 2007 yielded an IBI score of32 that equates to Poor

Comments:

The stream behind Rock City Park has a fair riparian area and plenty of habitat for aquatic insects including rootwads, leaf packs and detritus. The stream is impacted by a road crossing and culvert, stormwater drainage and the fire department lawn and parking lot. The macroinvertebrate fauna received a score of 'poor' however please note that three odonates were found in our sample plus there were very low numbers of diptera (chironomids, simulids, tipulids), isopods and oligochaetes. Elmid beetles and beetle larvae were the dominate invertebrate and hydropsychid caddisflies are close behind in numbers. Salamanders and crayfish were common at the site. Considering all the additional factors, using a different metric than EPT families for scoring this site would be recommended

Taxa	Density
OLIGOCHAETA (aquatic worms)	~ 10
EPHEMEROPTERA (Mayflies)	
Heptageniidae	12
Siphlonuridae	
Ameletus sp.	5
PLECOPTERA (Stoneflies)	0
TRICHOPTERA (Caddisflies)	
Hydropsychidae	947
MEGALOPTERA (dobsonflies)	
Sialidae	7
ODONATA (dragonflies/damselflies)	
Aeshnidae *(dragonfly)*	3
Calopterygidae *(damselfly)*	2
Gomphidae *(dragonfly)*	1
COLEOPTERA (beetles)	1
Elmidae (766 larvae/ 464 adults)	1230
HEMIPTERA (water striders)	
Veliidae	4
DIPTERA (flies)	
Chironomidae	190
Simulidae	52
Tipulidae	23
GASTROPODA (snails)	
Pleuroceridae	29
Physidae	3
ARACHNOIDEA (water mites)	
Hydracarina	1
CRUSTACEA	
Isopoda (sow bugs)	20
Decapoda (crayfish)	* 5

** released*

Scores of 0-5 are considered poor, 7-11 fair, and >13 good

Ephemeroptera	2
Plecoptera	0
Trichoptera	1
	3 Poor

Water Quality

Water tests on June 13, 2007 yielded the following results:

Dissolved Oxygen: 6.11 mg/L
Conductivity: 0.0 ppT
Temperature: 17.5°C
pH: 7.78

Habitat Assessment

This section of the creek received a score of 88. A score of 88 indicates that the habitat is severely impaired for ecoregion 67f. Of the ten metrics used to assess habitat, this section did not meet the following expectations for individual habitat parameters in the following categories:

- Embeddedness
- Velocity/Depth Regime
- Sediment Deposition
- Channel Flow Status
- Channel Alteration
- Bank Stability
- Vegetative Protective
- Riparian Vegetative Zone Width

DISCUSSION

Baker Creek is registered in the final version of the 2006, 303d list for the state of Tennessee because of nitrates, other anthropogenic habitat alterations and Escherichia coli due to discharges from MS4 area and collection system failure.(p. 92) Both sites received an overall score of poor for the Index of Biotic Integrity (I.B.I.). The scores reflect a low number of intolerant species, and a high number of tolerant species. Water quality of Baker Creek showed to have adequate pH and temperature. The Habitat Assessment shows that there is severe impairment in both study areas and at different locations along the creek. Sediment deposition, bank stability and poor riparian zone width and cover appear to be adding to habitat degradation at the study sites.

INDEX OF BIOTIC INTEGRITY
FIRST CREEK

STUDY AREAS

FLLA assessed two sites along First Creek for this IBI. The down stream site was located at Cottage Place and 6th Avenue (see Figure 1). This survey site was conducted at approximately 2.75 miles up stream from the confluence with Fort Loudoun Lake. The upstream site was located at Woodland Avenue and Broadway (see Figure 2). This survey was conducted at approximately 3.75 miles up stream from the confluence with Fort Loudoun Lake. The up stream site on First Creek has an approximate drainage area of 17 square miles and the down stream site has a drainage area of approximately 18 square miles.

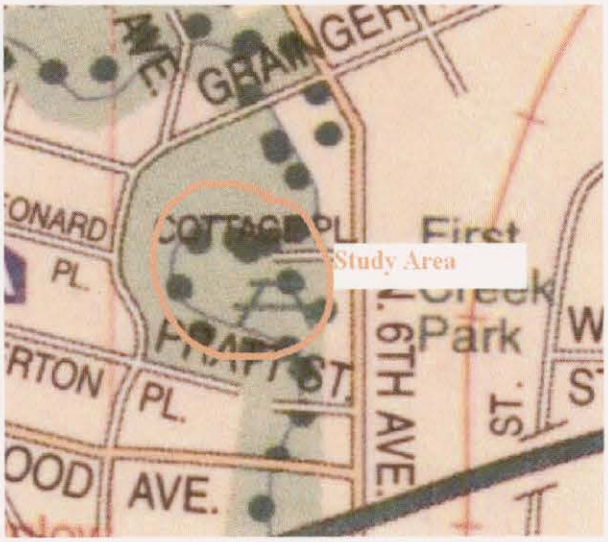


Figure 1: down stream survey site at Cottage Place and 6th Avenue

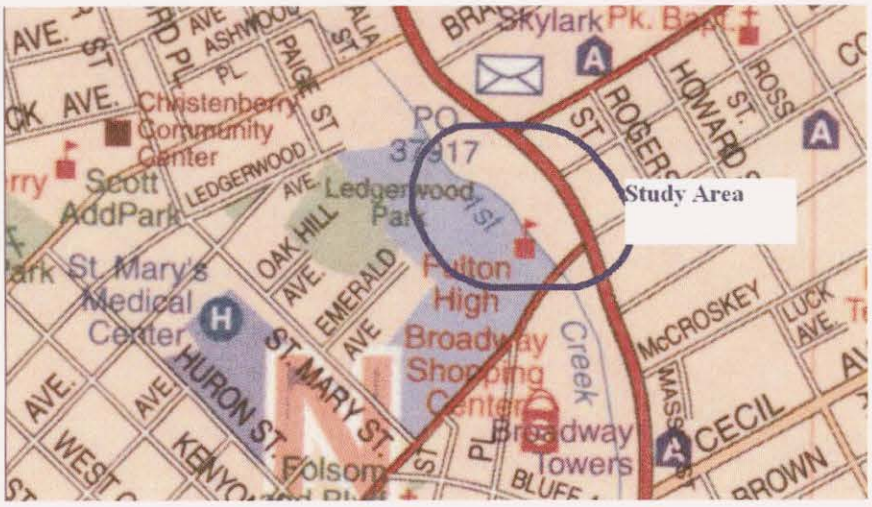


Figure 2: up stream survey site at Woodland Ave and Broadway

RESULTS

Index of Biotic Integrity
First Creek at Cottage Place and 6th Ave June 21, 2007
Ecoregion: Central Appalachian Ridges and Valleys (67f)
Approximate Drainage Area: 18 sq. miles

Fish

Fish sampling on June 21, 2007 yielded an IBI score of **35** that equates to poor.

Metric Description	Scoring Criteria			Observed	Score
	1	3	5		
Total number of native fish species	<10	(10-20)	>20	8	1
Number of darter species	<2	(2-4)	>4	1	1
Number of sunfish species, less *Micropterus*	<2	(2-4)	>4	1	1
Number of sucker species	<1	(1-2)	>2	2	3
Number of intolerant species	<1.5	(1.5-3.5)	>3.5	1	1
Percent of individuals as tolerant species	>35%	18%-35%	<18	65%	1
Percent of individuals as omnivores and stoneroller species	>40%	20%-40%	<20	8%	5
Percent of individuals as specialized insectivores	<16%	16%-35%	>35%	16%	3
Percent of individuals as piscivores	<2.2%	2.2%-4%	>4%	12%	5
Catch rate (average number of fish per 300 sq. ft. sampling unit)	<15	15-30	>30	26	3
Percent of individuals as hybrids	<1%	TR-1%	0%	0%	5
Percent of individuals with diseases, tumors, fin damage, and other anomalies	>5%	2%-5%	<2%	0%	5
	77		IBI		35
			IBI Classification		Poor

IBI Range: 0 = No fish; 12-22 = Very poor; 28-34 = Poor; 40-44 = Fair; 48-52 = Good; 59-60 = Excellent

Common names of fish species present:

Northern Hog Sucker: 6
Rock Bass: 8
White Sucker: 6
Snubnose Darter: 10
Smallmouth Bass: 1
Bluegill: 1
Creek Chub: 42
Blacknose Dace: 2

Benthic

Macroinvertabrate sampling on June 21, 2007 yielded an IBI score of **4** that equates to Poor.

Comments:

The riparian area on this reach provides shade and in-stream habitat. Bank erosion and siltation were present. In addition, broken glass and other trash were frequently removed from the net. There were almost no crayfish and the salamanders were very small. The most common macroinvertebrates were the elmid beetles and the hydropsychid caddisflies. However, three Ephemeroptera families were represented in the sample. The dipteran were present but in low numbers, as were the aquatic worms. Isopods were completely absent. The sample reach received a score of 'poor' but was borderline and needed only one more EPT family to be 'poor/fair'.

Taxa	Density
OLIGOCHAETA (aquatic worms)	~ 3
EPHEMEROPTERA (Mayflies)	10
Baetidae	39
Heptageniidae	1
Siphlonuridae	
Ameletus sp.	1
PLECOPTERA (Stoneflies)	
TRICHOPTERA (Caddisflies)	
Hydropsychidae	215
COLEOPTERA (beetles)	
Elmidae (254 larvae/38 adults)	292
HEMIPTERA	
Veliidae	1
DIPTERA (flies)	
Chironomidae	42
Simulidae	3
Tipulidae	4
Atherixidae	1
GASTROPODA (snails)	
Pleuroceridae	95
POLECYPODA (mussels)	4
CRUSTACEA	
Decapoda (crayfish)	2

Scores of 0-5 are considered poor, 7-11 fair, and >13 good

Ephemeroptera	**3**
Plecoptera	**0**
Trichoptera	**1**
	4 Poor

Water Quality

Water tests on June 21, 2007 yielded the following results:

Dissolved Oxygen: 5.93 mg/L
Conductivity: 0.2 ppT
Temperature: 19.9°C
pH: 7.81

Habitat Assessment

This section of the creek received a score of 113. A score of 113 indicates that the habitat in the observed area is moderately impaired for ecoregion 67f. Of the ten metrics used to assess habitat, this section did not meet expectations for individual habitat parameters in the following categories:

- Epifaunal substrate/Available Cover
- Embeddeness
- Sediment Deposition
- Bank Stability
- Vegetative Protective
- Riparian Vegetative Zone Width

RESULTS

Index of Biotic Integrity
First Creek at Woodland Ave and Broadway June 21, 2007
Ecoregion: Central Appalachian Ridges and Valleys (67f)
Approximate Drainage Area: 17 sq. miles

Fish

Fish sampling on June 21, 2007 yielded an IBI score of **34** that equates to poor.

Metric Description	Scoring Criteria			Observed	Score
	1	3	5		
Total number of native fish species	<10	(10-20)	>20	8	1
Number of darter species	<2	(2-4)	>4	1	1
Number of sunfish species, less *Micropterus*	<2	(2-4)	>4	0	1
Number of sucker species	<1	(1-2)	>2	2	3
Number of intolerant species	<1.5	(1.5-3.5)	>3.5	1	1
Percent of individuals as tolerant species	>35%	18%-35%	<18	53%	1
Percent of individuals as omnivores and stoneroller species	>40%	20%-40%	<20	17%	5
Percent of individuals as specialized insectivores	<16%	16%-35%	>35%	12%	1
Percent of individuals as piscivores	<2.2%	2.2%-4%	>4%	8%	5
Catch rate (average number of fish per 300 sq. ft. sampling unit)	<15	15-30	>30	35	5
Percent of individuals as hybrids	<1%	TR-1%	0%	0%	5
Percent of individuals with diseases, tumors, fin damage, and other anomalies	>5%	2%-5%	<2%	0%	5
	105		IBI		34
			IBI Classification		Poor

IBI Range: 0 = No fish; 12-22 = Very poor; 28-34 = Poor; 40-44 = Fair; 48-52 = Good; 59-60 = Excellent

Common name of fish species present:
Blacknose Dace: 13
Snubnose Darter: 13
Northern Hog Sucker: 6 (some with lesions)
White Sucker: 17
Rock Bass: 1
Smallmouth Bass: 6
Creek Chub: 39

Benthic

Macroinvertabrate sampling on June 21, 2007 yielded an IBI score of **4** that equates to Poor.

Comments:

This reach has a different look; the streambed is almost entirely bedrock. The tolerant snail, Pleuroceridae, lines the streambed and are positioned about two centimeters from each other. Silt covers the bottom and sometimes the tops of the snails. *Justicia* (water willow) beds occur above each riffle and make excellent habitat for damselfly nymphs. The riparian zone is present but narrow. The creek is next to parking lots and a heavily traveled three-lane road. The major impacts are stormwater run-off and pollutants washed from the road. A wider riparian zone would absorb more pollutants and silt. The macroinvertebrate assemblage included a higher density of mayflies than the 6th and Cottage Place reach. A damselfly was caught near a water willow bed and released. Several small crayfish and salamanders were collected. Larger crayfish were not present. There were very low numbers of dipterans and oligochaetes. Hydropsychids were the dominant invertebrate after the snails. Elmid beetles were also fairly abundant. And only one isopod was collected.

Taxa	Density
OLIGOCHAETA (aquatic worms)	2
EPHEMEROPTERA (Mayflies)	10
Baetidae	69
Heptageniidae	15
Siphlonuridae	21
PLECOPTERA (Stoneflies)	0
TRICHOPTERA (Caddisflies)	
Hydropsychidae	416
ODONATA (dragonflies/damselflies)	
Coenagrionidae	1
COLEOPTERA (beetles)	
Elmidae (93 larvae/ 26 adults)	119
Psephenidae (water penny)	1
DIPTERA (flies)	
Chironomidae	26
Simulidae	5
Tipulidae	4
GASTROPODA (snails)	
Pleuroceridae	800+
POLECYPODA (mussels)	5
CRUSTACEA	
Isopoda (sow bugs)	1
Decapoda (crayfish)	8

Scores of 0-5 are considered poor, 7-11 fair, and >13 good

Ephemeroptera	3
Plecoptera	0
Trichoptera	1
	4 Poor

Water Quality

Water tests on June 21, 2007 yielded the following results:

Dissolved Oxygen: 5.24 mg/L
Conductivity: 0.2 ppT
Temperature: 20.9°C
pH: 7.91

Habitat Assessment

This section of the creek received a score of 67. A score of 67 indicates that the habitat is severely impaired for ecoregion 67f. Of the ten metrics used to assess habitat, this section did not meet expectations for individual habitat parameters in any of the categories.

DISCUSSION

First Creek is registered in the final version of the 2006, 303d list for the state of Tennessee because of nitrates, loss of biological integrity due to siltation, other anthropogenic habitat alterations and Escherichia coli due to discharges from MS4 area, being located in an urbanized high density area and collection system failure.(p. 90) Both sites received an overall score of poor for the Index of Biotic Integrity (I.B.I.). The scores reflect a low number of intolerant species, and a high number of tolerant species. Water quality of First Creek showed to have adequate pH and temperature. The Habitat Assessment shows that habitat impairment varies along the stream. Sediment deposition, bank stability and poor riparian zone width and cover appear to be adding to habitat degradation at the study sites.

APPENDIX D

Stream Assessment Summary Report for permit year

City of Knoxville

Department of Engineering, Stormwater Division

Creek and Stream Assessments

2nd Creek—June 2007

Josh Gresham and Kim Seal

The 2nd Creek assessment was divided into 13 reaches, spanning from mouth of 2nd Creek at the Tennessee River along Neyland Drive until intersection of 2nd Creek and Merchants Drive. The assessed portions of the stream covered a length of 4.8 miles, the majority of which ran through the urbanized Knoxville area. Many large sections of the stream are culverted, and the majority is channelized. The geographical locality of the stream makes for a short Riparian Zone, which impact the bacteriological factors and stability of the stream.

The protocol used to assess 4th Creek was created by the EPA for use in wadeable streams and rivers. There were 12 parameters used to assess the quality of the stream. The parameters and averages for the 13 reaches are shown in Table 1. These parameters were assessed on a quantitative basis, using a scale of 0-20, according to EPA standards. Additional macro observations were also made, such as pollution levels, by recording the amount of trash, livestock, waterfowl, and homeless camps located near the streams. Using these factors, 7 sites were recommended for cleanup.

Table 1. Averages of habitat parameters for 2nd Creek, Knoxville, TN

Habitat Parameter	Weighted Average
Epifaunal Substrate	11.1
Pool Substrate	10.8
Pool Variability	9.4
Sediment Deposition	8.4
Channel Flow	9.0
Channel Alteration	3.0
Channel Sinuosity	1.4
Nutrient Enrichment	9.3
Barriers to Fish	6.7
Bank Stability L	11.6
Bank Stability R	11.8
Vegetation Protection L	8.5
Vegetation Protection R	6.4
Riparian Zone Width L	3.5
Riparian Zone Width R	3.2

Outfall inventory was also taken, recording descriptive factors such as type, dimension, location along stream, odor, and discharge. A total of 65 new outfalls and 66 previously recorded outfalls were located along the creek for a sum of 131 outfalls. Of the 131 outfalls, 12 of these had discharge including 6 which had not been previously recorded.

City of Knoxville

Department of Engineering, Stormwater Division

Outfall Inventory

2nd Creek-July 2007

Josh Gresham and Kim Seal

Inventory ID #	Pic #	GPS Reading	Type of Outfall	Outfall Size	Outfall Type	Location	Odor	Discharge
		Sheet 1						
02-400-0010	278	N 35, 57.353; W 83, 55.331	Commercial	18"	RC	R bank	N	N
02-400-0015	279	N 35, 57.369; W 83, 55.336	Commercial	18"	CM	L bank	N	N
N	280	N 35, 57.353; W 83, 57.331	Commercial	30"	CM	L bank	N	N
N	280	N 35, 57.353; W 83, 57.331	Commercial	6"	PL	L bank	N	N
N	281	N 35, 57.394; W 83, 55.370	Commercial	10"	PL	R bank	N	N
N	282	N 35, 57.421; W 83, 55.362	Commercial	18"	RC	R bank	N	N
02-400-0050	302		Commercial	24"	RC	R bank	N	Y
02-400-0045	303		Commercial	18"	RC	L bank	N	Y
02-400-0055	304		Commercial	24"	RC	R bank	N	Y
N	305		Commercial	36"	RC	L bank	N	N
		Sheet 2						
02-100-0099	284	N 35, 57.843; W 83, 55.545	Commercial	36"	RC	L bank	N	N
N	285	N 35, 57.853; W 83, 55.554	Commercial	15"	RC	L bank	N	N
02-100-0097	286	N 35, 57.864; W 83, 55.560	Commercial	48"	RC	R bank	N	N
02-100-0100	287	N 35, 57.864; W 83, 55.560	Commercial	18"	RC	L bank	N	N
02-100-0103	288	N 35, 57.900; W 83, 55.603	Commercial	18"	CM	R bank	N	Y
N	289	N 35, 57.901; W 83, 55.616	Commercial	8"	RC	L bank	N	N
N	289	N 35, 57.901; W 83, 55.616	Commercial	6"	St	L bank	N	N
N	290	N 35, 57.901; W 83, 55.616	Commercial	6"	PL	R bank	N	N
N	291	N 35, 57.909; W 83, 55.621	Commercial	12"	RC	L bank	N	N
N	292	N 35, 57.919; W 83, 55.630	Commercial	42"	RC	R bank	N	N
N	306	N 35, 57.919; W 83, 55.630	Commercial	18"	RC	R bank	N	N
N	293	N 35, 57.919; W 83, 55.630	Commercial	48"	RC	L bank	N	N
02-100-0105	294	N 35, 57.931; W 83, 55.640	Commercial	48"	CM	L bank	N	N
N	295		Commercial	8"	PL	L bank	N	N
02-400-0120	296		Commercial	12"	RC	R bank	N	Y
N	297		Commercial	10"	RC	R bank	N	N
02-400-0125	298		Commercial	42"	RC	R bank	N	N
N	299		Commercial	30"	RC	L bank	N	N
02-100-0130	300		Commercial	10"	RC	L bank	N	N
N	301		Commercial	24"	RC	R bank	N	N
		Sheet 3						
02-400-0150	1	N 35, 58.184; W 83, 55.633	Commercial	12"	RC	L bank	N	N
N	2	N 35, 58.189; W 83, 55.631	Commercial	12"	RC	L bank	N	N
N	3	N 35, 58.211; W 83, 55.633	Commercial	30"	RC	L bank	N	N
N	4	N 35, 58.218; W 83, 55.618	Commercial	6"	PL	L bank	N	N
N	5	N 35, 58.249; W 83, 55.626	Commercial	4"	PL	L bank	N	N

N	6 N 35, 58.255; W 83, 55.628 Commercial	6"	M	L bank	N	N
N	7 N 35, 58.255; W 83, 55.628 Commercial	1"	M	L bank	N	N
N	7 N 35, 58.255; W 83, 55.628 Commercial	2"	M	L bank	N	N
N	8 N 35, 58.255; W 83, 55.628 Commercial	8"	RC	L bank	N	N
N	9 N 35, 58.263; W 83, 55.631 Commercial	4"	M	L bank	N	N
N	10 N 35, 58.263; W 83, 55.631 Commercial	4"	PL	L bank	N	Y
N	11 N 35, 58.267; W 83, 55.632 Commercial	4"	M	L bank	N	N
02-400-0155	12 N 35, 58.270; W 83, 55.654 Commercial	15"	RC	L bank	N	Y
N	13 N 35, 58.298; W 83, 55.648 Commercial	24"	RC	L bank	N	N
N	14 N 35, 58.302; W 83, 55.647 Commercial	24"	CM	R bank	N	N
N	15 N 35, 58.303; W 83, 55.651 Commercial	12"	RC	L bank	N	N
02-300-0165	16 N 35, 58.389; W 83, 55.710 Commercial	4X4	CM	R bank	N	N
N	17 N 35, 58.409; W 83, 55.750 Commercial	12"	M	L bank	N	submerged
N	18 N 35, 58.445; W 83, 55.785 Commercial	6"	M	R bank	N	N
N	365 N 35, 58.468; W 83, 55.819 Commercial	24"	RC	R bank	N	Y
N	365 N 35, 58.468; W 83, 55.819 Commercial	8"	M	R bank	N	N
N	19 N 35, 58.740; W 83, 55.820 Commercial	15"	RC	L bank	N	N
N	21 N 35, 58.479; W 83 55.835 Commercial	18"	RC	L bank	N	N
N	22 N 35, 58.478; W 83, 55.832 Commercial	4"	RC	L bank	N	N
N	23 N 35, 58.491; W 83, 55.841 Commercial	6"	RC	L bank	N	N
02-400-0169	24 N 35, 58.497; W 83, 55.849 Commercial	15"	RC	R bank	N	Y
02-400-0170	25 N 35, 58.497; W 83, 55.849 Commercial	30"	RC	L bank	N	N
N	26 N 35, 58.516; W 83, 55.853 Commercial	8"	St	R bank	N	N
02-300-0172	27 N 35, 58.522; W 83, 55.863 Commercial	15"	St	R bank	N	N
02-400-0173	28 N 35, 58.522; W 83, 55.863 Commercial	10"	PL	R bank	N	N
02-300-0171	29 N 35, 58.522; W 83, 55.863 Commercial	18"	CM	L bank	N	N
02-300-0174	30 N 35, 58.545; W 83, 55.892 Commercial	12"	CM	R bank	N	N
02-300-0177	31 N 35, 58.545; W 83, 55.892 Commercial	12"	PL	R bank	N	N
N	32 N 35, 58.556; W 83, 55.873 Commercial	12"	CM	R bank	N	N
02-300-0179	33 N 35, 58.560; W 83, 55.880 Commercial	18"	CM	R bank	N	N
N	34 N 35, 58.582; W 83, 55.880 Commercial	30"	RC	L bank	N	N
N	35 N 35, 58.604; W 83, 55.886 Commercial	18"	CM	R bank	N	N
02-300-0176	36 N 35, 58.604; W 83, 55.886 Commercial	18"	CM	L bank	N	N
N	37 N 35, 58.669; W 83, 55.934 Commercial	8"	PL	L bank	N	N
N	38 N 35, 58.669; W 83, 55.934 Commercial	6"	RC	L bank	N	N
N	39 N 35, 58.401; W 83, 55.564 Commercial	8"	RC	L bank	N	N

Sheet 4

N	414 N 35, 58.690; W 83, 55.963 Commercial	12"	RC	R bank	N	N
N	415 N 35, 58.690; W 83, 55.963 Commercial	8"	RC	R bank	N	N
N	416 N 35, 58.690; W 83, 55.963 Commercial	15"	RC	L bank	N	N
N	417 N 35, 58.727; W 83, 55.983 Commercial	1"	St	R bank	N	N
N	418 N 35, 58.727; W 83, 55.983 Commercial	12"	RC	L bank	N	N
02-400-0185	419 N 35, 58.778; W 83, 56.020 Commercial	30"	RC	L bank	N	N
02-400-0185	419 N 35, 58.778; W 83, 56.020Commercial	30"	RC	L bank	N	N
N	420 N 35, 58.817; W 83, 56.035 Commercial	15"	RC	L bank	N	N
02-400-0194	421 N 35, 58.804; W 83, 56.004 Commercial	24"	RC	R bank	N	N
02-400-0195	422 N 35, 58.813; W 83, 56.001 Commercial	18"	RC	R bank	N	Y

N	423 N 35, 58.861; W 83, 56.032	Commercial	18"	RC	R bank	N	Y
N	424 N 35, 58.924; W 83, 56.090	Commercial	6"	C	R bank	N	N
02-200-0205	425 N 35, 58.936; W 83, 56.148	Commercial	54"	CM	R bank	N	N
02-400-0215	426 N 35, 58.936; W 83, 56.148	Commercial	12"	C	R bank	N	N
N	427 N 35, 58.936; W 83, 56.148	Commercial	4"	PL	R bank	N	N
N	427 N 35, 58.936; W 83, 56.148	Commercial	12"	PL	R bank	N	N
02-100-0210	428 N 35, 58.936; W 83, 56.148	Commercial	4'X4'	C	L bank	N	N
	Sheet 5						
N	366 N 35, 58.975; W 83, 56.177	Commercial	4"	St	L bank	N	N
02-400-0215	367 N 35, 58.977; W 83, 56.177	Commercial	18"	RC	R bank	N	N
N	368	Commercial	36"	RC	L bank	N	N
N	369	Commercial	24"	RC	L bank	N	Y
N	370	Commercial	6"	St	L bank	N	N
N	371	Commercial	24"	RC	R bank	N	Y
N	372	Commercial	18"	RC	R bank	N	N
N	373 N 35, 59.077; W 83, 56.439	Commercial	2"	PL	L bank	N	N
N	373 N 35, 59.077; W 83, 56.439	Commercial	2"	PL	L bank	N	N
N	374 N 35, 59.077; W 83, 56.439	Commercial	18"	St	R bank	N	N
	Sheet 6						
N	328 N 35, 59.084; W 83, 56.916	Commercial	18"	RC	L bank	N	N
N	329 N 35, 59.098; W 83, 56.914	Commercial	16"	RC	L bank	N	N
N	330	Commercial	1"	M	L bank	N	N
N	331 N 35, 59.325; W 83, 57.055	Commercial	36"	RC	R bank	N	Y
	Sheet 7						
02-500-0275	333 N 35, 59.366; W 83, 57.037	Commercial	42"	RC	L bank	N	N
N	334 CULVERT	Commercial	18"	RC	R bank	N	N
N	335 CULVERT	Commercial	4"	PL	R bank	N	N
02-400-0280	336 N 35, 59.474; W 83, 57.060	Commercial	18"	RC	L bank	N	N
02-400-0285	337 N 35, 59.527; W 83, 57.056	Commercial	24"	RC	R bank	N	N
02-300-0295	338 N 35. 59.533; W 83, 57.083	Commercial	48"	RC	R bank	N	Y
02-400-0290	339 N 35. 59.533; W 83, 57.083	Commercial	24"	RC	L bank	N	N
02-400-0305	340 N 35, 59.630; W 83, 57.108	Commercial	24"	RC	L bank	N	Y
N	341 N 35, 59.645; W 83, 57.139	Commercial	8"	RC	L bank	N	N
02-400-0310	342 N 35, 59.668; W 83, 57.133	Commercial	18"	RC	R bank	N	N
02-400-0315	343 N 35, 59.681; W 83, 57.150	Commercial	15"	RC	R bank	N	N
	Sheet 8_CULVERT						
	Sheet 9						
02-100-0390	N 36, 01.866; W 83, 57.834	Commercial	48"/36"	RC	R bank	N	N
	Sheet 10						
02-400-0430	430 N 36, 00.159; W 83, 57.706	Commercial	24"	RC	R bank	N	N
02-400-0435	431 N 36, 00.160; W 83, 57.713	Commercial	30"	RC	R bank	N	N
N	432 N 36, 00.192; W 83, 57.743	Commercial	24"	RC	R bank	N	N
N	433 N 36, 00.241; W 83, 57.807	Commercial	24"	RC	R bank	N	N
02-100-0465	434 N 36, 00.312; W 83, 57.904	Commercial	60"	RC	R bank	N	N
02-400-0475	435 N 36, 00.334; W 83, 57.935	Commercial	18"	RC	R bank	N	N
02-100-0480	436 N 36, 00.334; W 83, 57.935	Commercial	8" box	RC box	R bank	N	N

02-400-0470	437 N 36, 00.340; W 83, 57.996	Commercial	24"	CM	L bank	N	N
N	438 N 36, 00.362; W 83, 58.082	Residential	4"	PL	R bank	N	N
N	439 N 36, 00.355; W 83, 58.085	Commercial	8"	C	L bank	N	N
N	440 N 36 00.371; W 83, 58.098	Commercial	18"	C	L bank	N	N
	Sheet 11						
N	441 N 35, 00.386; W 83, 58.138	Commercial	24"	RC	L bank	N	N
N	441 N 35, 00.386; W 83, 58.138	Commercial	24"	RC	L bank	N	N
02-200-0490	442 N 36, 00.398; W 83, 58.140	Commercial	12"	CM	L bank	N	N
N	443 N 36, 00.525; W 83, 58.341	Commercial	12"	CM	R bank	N	Y
02-400-0510	444 N 36, 00.559; W 83, 58.417	Commercial	36"	CM	L bank	N	Y

City of Knoxville

Department of Engineering, Stormwater Division

Creek and Stream Assessments

4th Creek—June 2007

Josh Gresham and Kim Seal

The 4th Creek assessment was divided into 31 reaches, spanning from the bridge at the intersection of 4th Creek with Northshore until the intersection of Middlebrook and Old Wiesgarber. The streams and tributaries combined for a length of 8.03 miles. The main stream was easily accessible and located in a moderately urbanized area while the tributaries reached into sections that were largely inaccessible.

The protocol used to assess 4th Creek was created by the EPA for use in wadeable streams and rivers. There were 12 parameters used to assess the quality of the stream. The parameters and averages for the 31 reaches are shown in Table 1. These parameters were assessed on a quantitative basis, using a scale of 0-20, according to EPA standards. Additional macro observations were also made, such as pollution levels, by recording the amount of trash, livestock, waterfowl, and homeless camps located near the streams. Using these factors, 18 sites were recommended for trash cleanup.

Table 1. Averages of habitat parameters for 4th Creek, Knoxville, TN.

Habitat Parameter	Weighted Average
Epifaunal Substrate	14.9
Pool Substrate	12.6
Pool Variability	12.1
Sediment Deposition	6.5
Channel Flow	8.0
Channel Alteration	10.0
Channel Sinuosity	8.4
Nutrient Enrichment	11.4
Barriers to Fish	7.3
Bank Stability L	9.2
Bank Stability R	8.8
Vegetation Protection L	10.6
Vegetation Protection R	10.2
Riparian Zone Width L	12.4
Riparian Zone Width R	12.3

Outfall inventory was also taken, recording descriptive factors such as type, dimension, location along stream, odor, and discharge. A total of 106 new outfalls and 36 previously recorded outfalls were located along the creek for a sum of 142 outfalls. Of the 142 outfalls, 39 of these had discharge including 16 which had not been previously recorded.

City of Knoxville

Department of Engineering, Stormwater Division

Outfall Inventory

4th Creek-June 2007

Josh Gresham and Kim Seal

Inventory ID #	Pic #	GPS Reading	Type of Outfall	Outfall Size	Outfall Type	Location	Odor	Discharge
Sheet 2								
N	1	N 35, 54.764; W 83, 59.221	Residential	12"	Plastic	R bank	N	Y
N	2	N 35, 54.764; W 83, 59.221	Residential	2"	Metal	L bank	N	Y
N	3	N 35, 54.764; W 83, 59.222	Residential	6"	Plastic	R bank	N	Y
Sheet 3								
04-400-0030	6	N 35, 55.172; W 83, 59.817	Commercial	24"	RC	R bank	N	Y
N		N 35, 55.196; W 83, 59.817	Residential	16"	RC	R bank	N	N
Sheet 4								
N	2	N 35, 55.234; W 59.959	Residential	4"	Plastic	R bank	N	N
N	4	N 35, 55.275; W 83, 59.853	Residential	2"	Metal	L bank	N	intake
N	5		Residential	6"	Plastic	R bank	N	submerged
N	6	N 35, 55.298; W 83, 59.826	Residential	4"	Plastic	R bank	N	N
N	7	N 35, 55.326; W 83, 59.805	Residential	4"	Rubber	L bank	N	submerged
N	8	N 35, 55.303; W 83, 59.798	Residential	6"	Plastic	R bank	N	submerged
N		N 35, 55.447; W 83, 59.848	Residential	2"	Metal	L bank	N	Y
04-400-0180		N 35, 55.470; W 83, 59.859	Commercial	24"	RC	R bank	N	N
N		N 35, 55.450; W 83, 59.859	Residential	8"	Plastic	L bank	N	N
N	13	N 35, 55.507; W 83, 59.903	Commercial	18"	CM	L bank	N	N
N	14	N 35, 55.537; W 83, 59.944	Commercial	24"	CM	L bank	N	N
04-400-0195	15	N 35, 55.539; W 83, 59.942	Commercial	24"	RC	R bank	N	N
04-400-0200	17	N 35, 55.569; W 83, 59.978	Commercial	18"	CM	R bank	N	Y
N	17	N 35, 55.569; W 83, 59.978	Commercial	18"	Plastic	R bank	N	N
N	25		Residential	30"	RC	R bank	N	N
N	26		Residential	4"	Plastic	R bank	N	N
N	29	N 35, 55.247; W 83, 59.968	Residential	2"	Plastic	L bank	N	intake
04-400-0035	30	N 35, 55.234; W 83, 59.958	Residential	30"	CM	L bank	N	submerged
N	30	N 35, 55.234; W 83, 59.958	Residential	6"	Plastic	L bank	N	N
N	30	N 35, 55.234; W 83, 59.958	Residential	4"	Plastic	L bank	N	N
N	31	N 35, 55.231; W 83, 59.956	Residential	3"	Plastic	L bank	N	N
N	31	N 35, 55.231; W 83, 59.956	Residential	4"	Plastic	L bank	N	N
N	31	N 35, 55.231; W 83, 59.956	Residential	4"	Plastic	L bank	N	N
N	32		Residential	2"	Rubber	L bank	N	N
04-400-0060	34	N 35, 55.322; W 83, 59.951	Commercial	13"	Plastic	L bank	N	Y
N	35	N 35, 55.325; W 83, 59.954	Residential	4"	Metal	L bank	N	N
N	36	N 35, 55.387; W 83, 59.968	Residential	4"	Plastic	R bank	N	N
N	37	N 35, 55.355; W 84, 00.000	Residential	8"	RC	L bank	N	N
04-400-0070	39	N 35, 55.411; W 84, 00.063	Residential	16"	CM	L bank	N	Y
Sheet 5								
N	130	N 35, 55.484; W 84, 00.218	Residential	1"	Metal	R bank	N	N

N	131	N 35, 55.948; W 84, 00.252	Residential	1"	Metal	R bank	N	N
N	132	N 35, 55.498; W 84, 00.252	Commercial	12"	CM	R bank	N	N
N	133	N 35, 55.522; W 84, 00.396	Commercial	16"	CM	L bank	N	N
N	134	N 35, 55.519; W 84, 00.430	Residential	4"	RC	L bank	N	N
04-400-0080	135	N 35, 55.519; W 84, 00.522	Commercial	24"	CM	R bank	N	N
N	136	N 35, 55.486; W 84, 00.655	Commercial	12"	CM	R bank	N	N
N	137	N 32, 55.479; W 84, 00.661	Commercial	24"	RC	R bank	N	Y
Sheet 6 and 7								
N	2	N 35, 55.515; W 84, 00.746	Commercial	12"	CM	R bank	N	N
N	4	N 35, 55.456; W 84, 00.746	Commercial	8"	Metal	L bank	N	N
04-400-0105	5	N 35, 55.418; W 84, 00.930	Commercial	18"	CM	R bank	N	N
N	11	N 35, 55.359; W 84, 01.022	Residential	4"	Plastic	R bank	N	N
Sheet 8								
N	1	N 35, 55.283; W 84, 01.097	Residential	1"	Rubber	L bank	N	N
N	2	N 35, 55.269; W 84, 81.152	Residential	1"	Plastic	R bank	N	N
N	5	N 35, 55.269; W 84, 01.152	Residential	1"	Rubber	R bank	N	intake
N	6		Residential	24"	CM	L bank	N	N
N	7	N 25, 55.169; W 84, 01.342	Residential	1"	Plastic	L bank	N	intake
N	8	N 25, 55.169; W 84, 01.342	Residential	4"	Plastic	R bank	N	N
N	9	N 35, 55.117; W 84, 01.444	Residential	36"	CM	L bank	sewage	N
N	10	N 35, 55.084; W 84, 01.195	Residential	4"	Plastic	L bank	N	N
N	12	N 35, 55.084; W 84, 01.195	Residential	4"	Plastic	L bank	N	N
N	14	N 35, 55.031; W 84, 01.565	Residential	4"	Plastic	R bank	N	N
N	14	N 35, 55.031; W 84, 01.565	Residential	4"	Plastic	R bank	N	N
N	15	N 35, 55.055; W 84, 01.600	Residential	4"	Plastic	R bank	N	N
04-400-0132	16	N 35, 55.042; W 84, 1.772	Commercial	12"	RC	R bank	N	N
04-400-0133	17	N 35, 55.042; W 84, 1.772	Commercial	52"	CM	L bank	N	Y
Sheet 9								
04-400-0210	50 & 51	N 35, 55.589; W 84, 59.984	Commercial	24"	RC	L bank	sewage	N
N	52	N 35, 55.784; W 84, 00.024	Commercial	18"	CM	L bank	N	Y
N	53		Commercial	8"	Plastic	L bank	N	N
04-100-0250	54		Commercial	42"	RC	L bank	N	N
04-400-0252	55		Commercial	12"	RC	R bank	N	N
N	55		Commercial	6"	RC	R bank	N	N
N	56		Commercial	8"	Plastic	R bank	N	N
N	57		Commercial	12"	Plastic	L bank	N	N
N	58	N 35, 55.864; W 84, 00.065	Commercial	4"	Plastic	R bank	N	N
N	58	N 35, 55.864; W 84, 00.065	Commercial	4"	Plastic	R bank	N	N
N	59		Commercial	12"	CM	L bank	N	N
N	60	N 35, 55.906; W 84, 00.068	Commercial	6"	RC	L bank	N	N
N	61	N 35, 55.906; W 84, 00.068	Commercial	24"	CM	R bank	N	N
04-400-0255	62	N 35, 55.912; W 84, 59.076	Commercial	24"	CM	L bank	N	Y
04-400-0256	64	N 35, 55.919; W 84, 00.081	Commercial	8"	CM	R bank	N	Y
	65	N 35, 55.923; W 84, 00.084	Commercial	4"	RC	L bank	N	N
	66	N 35, 55.945; W 84, 00.098	Commercial	24"	RC	L bank	N	Y
	67	N 35, 55.948; W 84, 00.098	Commercial	8"	CM	R bank	N	Y
	68	N 35, 55.960; W 84, 00.082	Commercial	6"	RC	R bank	N	N
	69	N 35, 55.960; W 84, 00.082	Commercial	4"	RC	L bank	N	N
	70	N 35, 55.959; W 84, 00.099	Commercial	8"	CM	R bank	N	Y

	71	N 35, 55.959; W 84, 00.099	Commercial	2"	Metal	R bank	N	N
	72	N 35, 55.961; W 84, 00.101	Commercial	2"	Metal	R bank	N	N
	73	N 35, 55.961; W 84, 00.102	Commercial	4"	RC	L bank	N	N
	74	N 35, 55.961; W 84, 00.102	Commercial	2"	Metal	R bank	N	N
	75	N 35, 55.971; W 84, 00.108	Commercial	15"	CM	R bank	N	Y
N	76	N 35, 55.817; W 83, 59.956	Commercial	6"	Plastic	R bank	N	N
N	79	N 35, 55.835; W 83, 59.947	Commercial	15"	RC	L bank	N	N
04-400-0215	80	N 35, 55.859; W 83, 59.921	Commercial	24"	RC	R bank	N	N
N	81	N 35, 55.885; W 83, 59.872	Residential	1"	Plastic	L bank	N	N
N	82	N 35, 55.893; W 83, 59.870	Commercial	4"	Plastic	L bank	N	N
N	82	N 35, 55.893; W 83, 59.870	Commercial	4"	Plastic	L bank	N	N
04-400-0225	83	N 35, 55.897; W 83, 59.865	Commercial	24"	RC	R bank	N	N
04-400-0220	84	N 35, 55.897; W 83, 59.865	Commercial	12"	RC	L bank	N	N
Sheet 10								
N	85	N 35, 55.956; W 83, 59.727	Commercial	4"	Plastic	R bank	N	Y
N	86	N 35, 55.966; W 83, 59.694	Commercial	18"	CM	R bank	N	N
N	87	N 35, 55.972; W 83, 59.685	Commercial	4"	Plastic	R bank	N	N
N	88	N 35, 55.977; W 83, 59.663	Commercial	4"	Plastic	R bank	N	N
N	89	N 35. 55.987; W 83, 59.657	Commercial	2"	RC	L bank	N	N
N	90	N 35, 55.993; W 83, 59.656	Commercial	15"	CM	R bank	N	N
N	91	N 35, 56.010; W 83, 59.606	Commercial	4"	Plastic	R bank	N	N
N	92	N 35, 56.017; W 83, 59.591	Commercial	4"	O	R bank	N	N
	94	N 35, 56.083; W 83, 59.565	Commercial	2"	Metal	R bank	N	N
	95	N 35, 56.103; W 83, 59.579	Commercial	4"	Plastic	R bank	N	N
14-400-0235	96	N 35, 56.051; W 83, 59.565	Commercial	6"	Plastic	R bank	N	N
N	97	N 35, 56.061; W 83, 59.495	Commercial	6"	Metal	L bank	N	N
N	98	N 35, 56.063; W 83, 59.488	Commercial	16"	CM	R bank	N	N
N	99	N 35, 56.062; W 83, 59.489	Commercial	4"	Plastic	L bank	N	N
04-400-0243	100	N 35, 56.088; W 83, 59.415	Commercial	16"	Plastic	R bank	N	Y
04-400-0242	101	N 35, 56.088; W 83, 59.415	Commercial	18"	CM	R bank	N	Y
	102	N 35, 56.116; W 83, 59.433	Commercial	2"	Plastic	R bank	N	N
Sheet 12								
N	1	N 35, 55.979; W 84, 00.114	Commercial	24"	RC	R bank	N	Y
N	2	N 35, 55.998; W 84, 00.111	Commercial	16"	RC	R bank	N	N
04-400-0264	3	N 35, 56.006; W 84, 00.128	Commercial	15"	CM	R bank	N	Y
04-400-0266	4	N 35, 56.022; W 84. 00.134	Commercial	12"	RC	R bank	N	N
04-400-0267	5	N 35, 56.030; W 84, 00.136	Commercial	3"	RC	R bank	N	N
04-400-0268	6	N 35, 56.038; W 84, 00.134	Commercial	24"	CM	R bank	N	N
04-400-0269	7	N 35, 56.053; W 84, 00.170	Commercial	15"	Plastic	L bank	N	N
04-400-0271	8	N 35, 56.053; W 84, 00.170	Commercial	18"	CM	L bank	N	N
04-400-0260	11	N 35, 56.175; W 84, 00.176	Commercial	30"	RC	R bank	N	N
04-400-0265	12	N 35, 56.175; W 84, 00.176	Commercial	24"	RC	R bank	N	N
N	15	N 35, 26.193; W 84, 00.180	Commercial	6"	CM	R bank	N	N
04-400-0275	20	N 35, 56.225; W 84, 00.269	Commercial	18"	RC	R bank	N	N
N	21	N 35, 56.212; W 84, 00.293	Commercial	18"	RC	R bank	N	N
04-400-0285	23	N 35, 56.204; W 84, 00.319	Commercial	18"	RC	R bank	N	N
04-400-0286	26	N 35, 56.195; W 84, 00.339	Commercial	8"	Plastic	R bank	N	N
N	27	N 35, 56.182; W 84, 00.515	Commercial	24"	RC	R bank	sewage	Y
N	29	N 35, 56.180; W 84, 00.531	Commercial	4"	Plastic	R bank	N	N

Sheet 13								
N	182	N 35, 56.166; W 84, 00.596	Commercial	8"	Plastic	R bank	N	N
N	183	N 35, 56.158; W 84, 00.624	Commercial	8"	RC	R bank	N	N
N	184	N 35, 56.132; W 84, 00.669	Commercial	24"	RC	L bank	N	Y
N	185	N 35, 56.132; W 84, 00.669	Commercial	15"	RC	L bank	N	N
N	186	N 35, 56.174; W 84, 00.706	Commercial	44"	RC	R bank	N	N
04-400-0305	188	N 35, 56.229; W 94, 00.573	Commercial	18"	RC	L bank	N	N
04-400-0300	190	N 35, 56.229; W 94, 00.573	Commercial	18"	RC	R bank	N	N
N	191	N 35, 56.319; W 84, 00.583	Commercial	36"	RC	R bank	N	N
04-400-0317	193	N 35, 56.349; W 84, 00.610	Commercial	24"	RC	R bank	N	N
N	194	N 35, 56.373; W 84, 00.630	Commercial	12"	RC	L bank	N	N
N	195	N 35, 56.373; W 84, 00.630	Commercial	12"	Plastic	L bank	N	Y
04-400-0320	196	N 35, 56.403; W 84, 00.685	Commercial	18"	RC	L bank	N	Y
Sheet 14								
N	197	N 35, 56.494; W 84, 00.668	Commercial	6"	Plastic	R bank	N	N
N	198	N 35, 56.519; W 84, 00.669	Commercial	18"	RC	L bank	N	N

City of Knoxville

Department of Engineering, Stormwater Division

Creek and Stream Assessments

Goose Creek—August 2007

Josh Gresham and Kim Seal

The Goose Creek assessment was divided into 12 reaches, spanning from the mouth of Goose Creek flowing into the Tennessee until the creek passes Mount Olive Rd. at the Knoxville City limit. The streams and tributaries combined for a length of 4.6 miles. The majority of the creek flowed through suburban areas although there were portions that were not assessed due to Super Fund boundaries. Additionally, 1.4 miles of Goose Creek were not assessed because of seasonal drought.

The protocol used to assess Goose Creek was created by the EPA for use in wadeable streams and rivers. There were 12 parameters used to assess the quality of the stream. The parameters and averages for the 12 reaches are shown in Table 1. These parameters were assessed on a quantitative basis, using a scale of 0-20, according to EPA standards. Additional macro observations were also made, such as pollution levels, by recording the amount of trash, livestock, waterfowl, and homeless camps located near the streams. Using these factors, 9 sites were recommended for trash cleanup.

Table 1. Averages of habitat parameters for Goose Creek, Knoxville, TN.

Habitat Parameter	Weighted Average
Epifaunal Substrate	12.00873
Pool Substrate	10.90926
Pool Variability	7.046563
Sediment Deposition	9.537197
Channel Flow	8.485553
Channel Alteration	11.11159
Channel Sinuosity	9.578005
Nutrient Enrichment	11.99081
Barriers to Fish	7.654313
Bank Stability L	10.81544
Bank Stability R	11.03472
Vegetation Protection L	10.47511
Vegetation Protection R	10.47511
Riparian Zone Width L	5.592917
Riparian Zone Width R	5.253497

Outfall inventory was also taken, recording descriptive factors such as type, dimension, location along stream, odor, and discharge. A total of 23 new outfalls and 17 previously recorded outfalls were located along the creek for a sum of 40 outfalls. Of the 40 outfalls, 9 of these had discharge including 5 of which had not been previously recorded.

City of Knoxville

Department of Engineering, Stormwater Division

Outfall Inventory

Goose Creek-August 2007

Josh Gresham and Kim Seal

Inventory ID #	Pic #	GPS Reading	Type of Outfall	Outfall Size	Outfall Type	Location	Odor	Discharge
Sheet 1								
N	441	N 35, 56.278; W 83, 54.599	Residential	12"	RC	R bank	N	N
Sheet 2								
05-500-0020	451	N 35, 56.294; W 84, 54.918	Residential	24"	C	L bank	N	N
N	456	N 35, 56.209; W 83, 54.918	Commercial	12"	CM	L bank	N	N
05-400-0025	457	N 35, 56.210; W 83, 54.909	Commercial	24"	RC	L bank	N	N
05-400-0030	458	N 35, 56.211; W 83, 54.931	Commercial	18"	CM	L bank	N	N
05-400-0040	459	N 35, 56.211; W 83, 54.931	Commercial	18"	CM	R bank	N	N
Sheet 3								
05-400-0035	460	N 35, 56.207; W 83, 54.899	Commercial	60"	CM	L bank	sewage	Y
N	461	N 35, 56.201; W 83, 54.897	Commercial	6"	CM	L bank	N	N
N	462	N 35, 56.197; W 83, 54.895	Commercial	12"	CM	L bank	N	N
N	463	N 35, 56.189; W 83, 54.891	Commercial	12"	CM	L bank	N	Y
N	465/466	N 35. 56.118; W 83, 54.891	Commercial	24"	CM	L bank	N	N
05-400-0060	471	N 35, 56.115; W 83, 54.476	Commercial	15"	CM	R bank	N	N
N	473	N 35, 56.569; W 83, 54.451	Commercial	12"	C	R bank	N	N
05-400-0045	475	N 35, 56.085; W 83, 54.903	Commercial	15"	C	R bank	N	N
N	476	N 35, 55.995; W 83, 54.990	Commercial	15"	C	R bank	N	N
N	477	N 35, 55.995; W 83, 54.990	Commercial	8"	P	R bank	N	N
N	479	N 35, 55.931; W 83, 54.853	Residential	4"	P	R bank	N	N
N	480	N 35, 55.883; W 83, 54.799	Residential	4"	C	L bank	N	N
N	492	N 35, 56.154; W 83, 55.648	Commercial	15"	CM	R bank	N	N
N	493	N 35, 56.130; W 83, 58.759	Commercial	15"	CM	R bank	N	N
N	494	N 35, 55.551; W 83, 55.126	Commercial	12"	CM	R bank	N	N
05-300-0210	495	N 35, 55.558; W 83, 55.127	Commercial	42"	RC	R bank	N	Y
Sheet 4								
N	489	N 35, 55.560; W 83, 54.260	Commercial	6"	P	L bank	N	N
05-400-0085	490	N 35, 55.570; W 83, 54.260	Commercial	54"	RC	L bank	N	N
Sheet 5_CULVERT								
Sheet 6								
05-400-0135	481	N 35, 55.758; W 83, 54.667	Commercial	15"	RC	R bank	N	N
05-400-0140	482	N 35, 55.776; W 83, 54. 652	Commercial	15"	RC	L bank	N	N
05-500-0145	483	N 35, 55.759; W 83, 54.643	Residential	18"	CM	L bank	N	N
05-100-0165	484	N 35, 55.561; W 83, 54.576	Residential	24"	CM	L bank	N	N
Sheet 7								
N	486	N 35, 55.377; W 83, 54.247	Commercial	12"	C	L bank	N	N

N	486	N 35, 55.379; W 83, 54.247	Commercial	18"	C	L bank	N	N
Sheet 8								
05-400-0230	500	N 35, 55.615; W 83, 55.376	Commercial	30"	CM	R bank	N	Y
05-400-0230	500	N 35, 55.615; W 83, 55.376	Commercial	18"	RC	R bank	N	Y
05-400-0230	500	N 35, 55.615; W 83, 55.376	Commercial	18"	RC	R bank	N	Y
05-400-0230	500	N 35, 55.615; W 83, 55.376	Commercial	18"	RC	R bank	N	Y
Sheet 9								
N	796	N 35, 55.022; W 83, 55.257	Commercial	12"	C	L bank	N	Y
05-400-0250	798	N 35, 55.478; W 83, 55.235	Commercial	24"	RC	R bank	N	N
05-400-0255	799	N 35, 55.366; W 83, 55.143	Commercial	18"	CM	L bank	N	N

APPENDIX E

Stream Restoration/Weir Removal Contract Report

Weir Removal Program

Work Conducted by:
Jake Hudson, Mark Campen, Amy Mann and Scott Wilson

Fort Loudoun Lake Association
956 Volunteer Landing Lane Box 12
Knoxville, TN 37915

Weir Survey and Removal

Abstract:

The Weir survey and removal program has been very successful to date. The program entailed a ground survey of urban creeks throughout Knoxville where-in weirs were located, documented, and assessed as to whether they were necessary for removal. Project plans were then composed and the weirs removed.

Weirs Removed:

Turkey Creek Weir - 01

N 35°54.234'
W 084°08.051'

Staff members Mark Campen and Jake Hudson removed this weir January 30, 2007. The weir was made up of several logs and consolidated debris that extended from bank to bank. Trash was accumulating upstream in the pool trapped by the weir.
Using a chain saw, an axe and a mattock, the logs were cut into manageable sized pieces and hauled above the flood stage shelf. The accumulated trash was bagged and removed. The sediment bar that had formed upstream of the weir, was dug out and a new channel created to restore the natural flow.

Turkey Creek Weir - 02

N 35°54.234'
W 084°08.033'

Staff members Mark Campen and Jake Hudson removed this weir January 30, 2007. The weir was made up of several logs and consolidated debris resting on and upstream of a concrete structure and extending from bank to bank. The largest log was two and one-half feet in diameter and had trapped several other logs. Trash had accumulated upstream in the pool trapped by the weir.

Using a chain saw, an axe and a mattock, the logs were cut into manageable sized pieces and hauled above the flood stage shelf. The accumulated trash was bagged and removed. Removal of these logs allowed the flow to resume around the concrete structure.

Turkey Creek Weir - 03

N 35°54.234'
W 084°08.028'

Staff members Mark Campen and Jake Hudson removed this weir January 30, 2007. The weir was made up of several logs and consolidated debris including a portable swimming pool, several sections of corrugated PVC pipe and two tires, and it extended from bank to bank. The largest log was two feet in diameter and was on top of several other logs and the majority of the debris. Sediment and trash had accumulated upstream in the pool trapped by the weir.

Using a chain saw, an axe, a mattock and a come along, the logs were cut into manageable sized pieces and hauled above the flood stage shelf. The accumulated trash was bagged and removed.

After removal of these logs, a new channel was excavated to allow the flow to resume.

Turkey Creek Weir - 04

N 35°54.224'
W 084°08.053'

Staff members Mark Campen and Jake Hudson removed this weir March 8, 2007. The weir was made up of consolidated debris and trash trapped between two trees growing in the channel. Sediment and trash had accumulated upstream in the pool trapped by the weir.

Using a mattock, rake and shovel, the debris was removed and hauled above the flood stage shelf. The accumulated trash was bagged and removed.

After removal of the debris, a new channel was excavated to allow the flow to resume.

First Creek Weir - 01

N 36°00.910'
W 083°55.324'

Staff members Mark Campen and Jake Hudson removed this weir January 16, 2007. The weir was made up of a 25' long willow tree with 4 major branches that stretched from bank to bank, and assorted sedimentation, trash, and woody debris. Trash was accumulating upstream in the pool trapped by the main trunk.

Using a chain saw, an axe and a bow saw under water, the tree was cut into manageable sized logs and they were hauled above the flood stage shelf. The accumulated trash was bagged and removed.

The sediment bars that had formed upstream of the weir, were left in place for the creek to move naturally.

First Creek Weir - 02

N 36°01.895'
W 083°55.974'

This weir was removed August 13, 2007 by staff members Jake Hudson and Scott Wilson. The weir was made up of a 2' wide wooden form that stretched from bank to bank, two shopping carts that were partially buried by sedimentation, trash, and woody debris. Deep pooling had formed on the downstream side of the blockage and the flow had been diverted to the west bank.

Using a come along we removed the two shopping carts. Then we dug out around the wooden form, wrapped the cable from the come along around one end and pulled the form from the creek bed.

Sediment bars had formed upstream of the weir. We used a mattock, rake and shovel to dredge out areas in the sediment bar to restore flow.

The wooden form, shopping carts and one bag of trash was collected and removed from site.

Fourth Creek Weir

N 35°56.719'
W 083°00.927

This weir was removed by staff member Scott Wilson on May 30th 2007.The weir consisted of several large logs intertwined with smaller woody debris and trash. Approximately 70% of the creek was blocked. The flow was being diverted to the north bank and a deep pool had formed on the south bank. The blockage was removed using a mattock, rake, and handsaw. One bag of trash was collected and removed.

The following weirs were removed June 26, 2007 by Fort Loudoun Lake Association staff members Jake Hudson and Scott Wilson. A shovel, rake, and mattock were used to remove the blockages.

Baker Creek Weir – 01

N 35°57.072'
W 083°53.701'


This weir appeared to have been caused by beavers and stretched from bank to bank. This resulted in 100% blockage and deep pooling upstream of the dam.

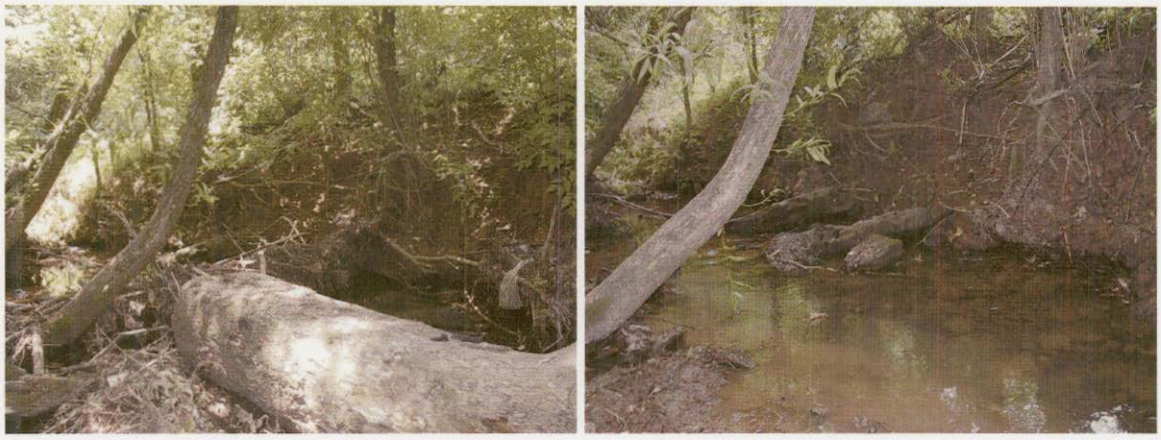
Baker Creek Weir – 02

N 35°57.114'
W 083°53.643'


This weir, although smaller than the previous still stretched from bank to bank. The weir was newer and less settled than weir #1. Pooling had started upstream of the dam, but had not gotten as deep as the previous.

Baker Creek Weir – 03

N 35°57.078'
W 083°53.699'



You can see in the photo that this weir had a large fallen tree through the center. Smaller woody debris built up against the trunk of the fallen tree and the standing tree to the left of the photo. Once again the blockage stretched from bank to bank. First the fallen tree was cut up and removed. Then the smaller woody debris and trash was removed.

The following weirs were located on a small tributary of Williams Creek. Staff members Jake Hudson and Scott Wilson removed the blockages on July 5th, 2007. A mattock, rake, shovel, and trash grabber were used to complete the task.

Cavalier Avenue Weir – 01

N 35°58.792'
W 083°53.400'

This weir stretched across the entire stream. Deep pooling had begun on the downstream side of the dam. One bag of trash was collected and removed from site. Debris was removed and normal flow restored.

Cavalier Avenue Weir – 02

N 35°58.795'
W 083°53.413'


This weir consisted of woody debris and trash. The culvert was full of trash and there was only a trickle of water coming through. Debris was removed and two bags of trash were collected from both the blockage and the culvert. The silt that had built up on the upstream side of the dam was dredged and removed. The after photo shows a heavier flow through the culvert.

The following weirs were removed July 6th, 2007 by staff members Jake Hudson and Scott Wilson. A shovel, rake, axe, and mattocks were used.

Williams Creek Weir – 01

N 35°58.816'
W 083°53.231'


This weir consisted of a large limb that stretched across the creek, a lot of woody debris pinned against the rocks and trash. Using an axe, limbs and roots were cleared. The debris was broken up with a mattock and rake. A bag of trash was collected and removed from the site.

Williams Creek Weir – 02

N 35°59.935'
W 083°53.264'


Woody debris and trash pinned against this guy-wire to create a weir that blocked approximately 70% of the creek, diverting flow to the west bank and creating heavy erosion. Debris was removed and one bag of trash was collected and removed from site.

Williams Creek Weir - 03

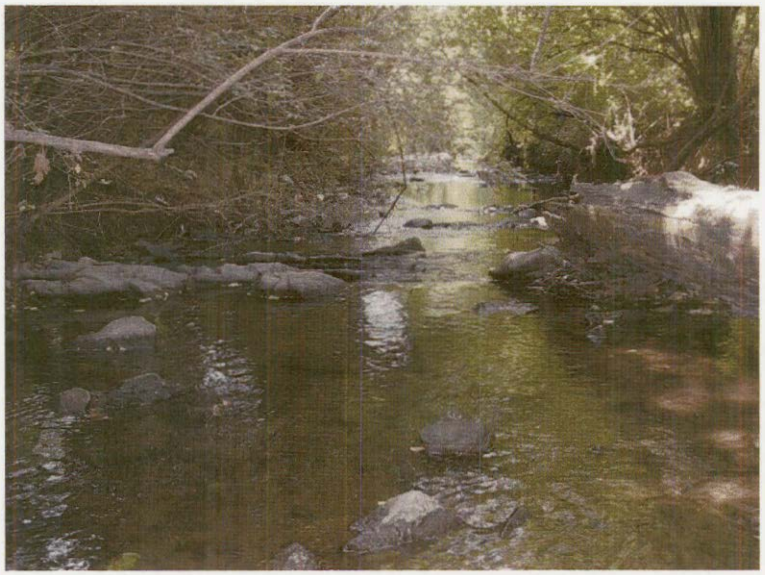
N 35°58.922'
W 083°53.255'


This weir consisted of a galvanized fence post with a roll of chain link fence and concrete footer still attached, Steel framework, mesh wire, woody debris and trash. Approximately 80% of the creek was blocked and stream flow was diverted to the west bank. The fence post was removed. The mesh wire and framework was dug out and removed using a mattock. Debris was removed and one bag of trash was collected and removed. Using shovels silt was dredged and natural flow restored.

The following weirs were removed June 20th, 2007 by staff member Amy Mann and volunteer crews, during a large scale creek cleans up. Unfortunately there was no camera available for the before pictures.

Williams Creek Weir – 04

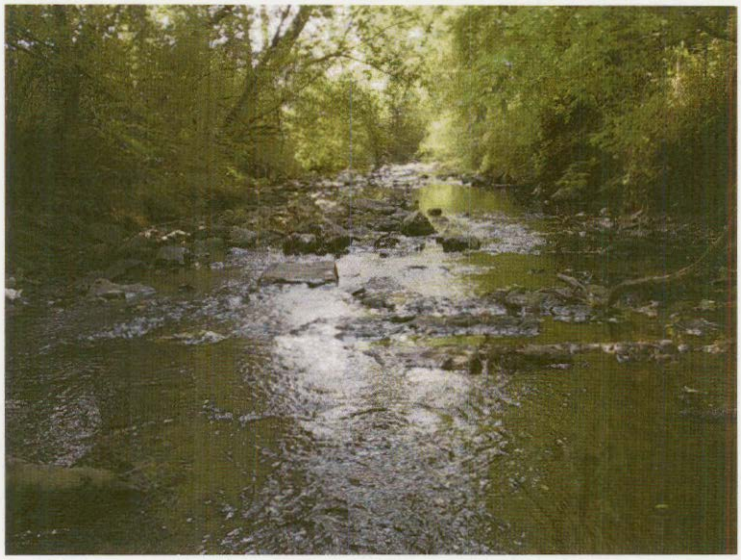
N 35°58.475'
W 083°53.169'



This weir consisted of woody debris and trash. Debris had pinned against rocks and the large tree to the left of the photo. The crew removed debris and on bag of trash was collected and removed from site. Staff members Jake Hudson and Scott Wilson later returned with timberjacks and moved the tree further out of the way.

Williams Creek Weir – 05

N 35°58.473'
W 083°53.170'



This weir consisted of woody debris and trash. About 60% of the creek was blocked. Debris was broken up and removed. One bag of trash was collected and removed from site.

The following weirs were located on the headwaters of Third Creek. Only a few feet separated each weir. The blockages were removed August 9, 2007 by staff members Jake Hudson and Scott Wilson. A mattock, rake, timber jack, come along and chainsaw were used in the removal.

Third Creek Weir – 01

N 35°59.973'
W 083°59.481'

This weir consisted of a 2' diameter concrete culvert, several bricks, and woody debris. The culvert was removed using a come along and timber jack. Then the bricks and debris were removed.

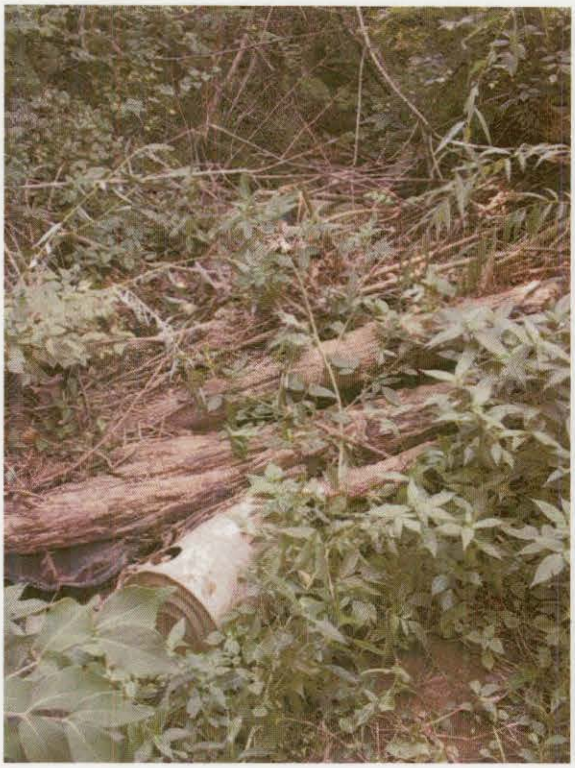
Third Creek Weir – 02

N 35°59.973'
W 083°59.480'

This blockage was made up of woody debris, bricks, trash, and a 4'x 8' metal sign. The debris was removed. The trash and metal sign were collected and removed from site.

Third Creek Weir – 03

N 35°59.920'
W 083°59.481'



This weir was a combination of large logs, trash and clippings. It seemed as though this blockage had been in place for a long time. The water was forced underground and resurfaced again just past the weir. All of the logs and debris were removed. The threat of flooding was reduced, and with the aid of rain, the flow should be restored.

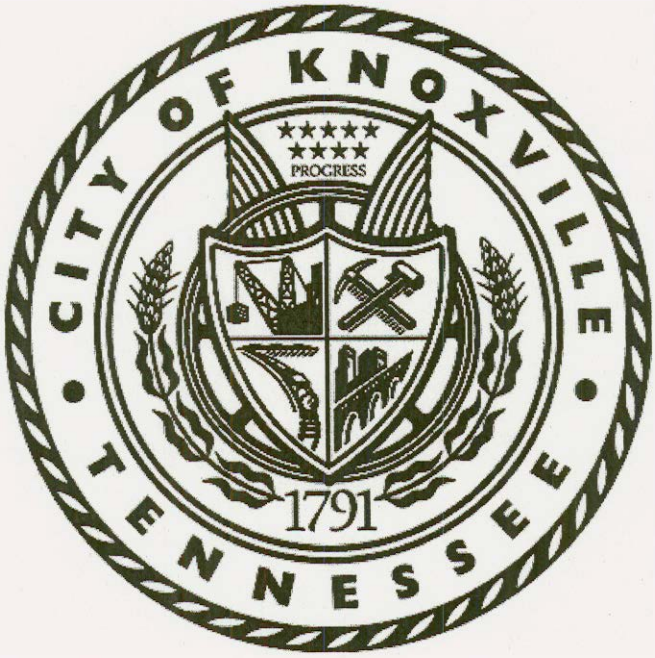
Conclusion:

As urban runoff has increased within watersheds in the Knoxville area, stream bank scouring and stream widening has increased the frequency of weirs in surrounding urban creeks. Said weirs are a problem in that they can create additional stream bank scouring/erosion, trash and debris buildup, urban flooding, stream-bed sedimentation, Oxygen depletion, biota passage obstruction, mosquito and other pest breeding, and can be a human safety issue causing underpinning and drowning if a person is caught in the stream during a high water event. The removal of these obstructions can help further degradation to the creek, both visually and biologically.

APPENDIX F

TMDL Monitoring Plan and Stream Assessment Protocol

Proposed TMDL Monitoring Plan



September, 2007

Prepared by:

City of Knoxville
Stormwater Engineering
400 Main Street, Rm 480
Knoxville, TN 37902

Overview

The Fort Loudon Lake Watershed Siltation and Habitat Alteration TMDL was approved by EPA on January 26, 2006. The Tennessee Department of Environment and Conservation Division of Water Pollution Control requires small MS4s to submit a TMDL monitoring plan within one year of the TMDL. Although the City is not required to submit a monitoring plan under the current conditions of the TMDL, this document outlines our current monitoring programs associated with our Phase 1 NPDES permit.

Table of Contents

Watersheds

The City of Knoxville currently has 11 streams on the Tennessee Department of Environment and Conservation's 303(d) list, which drain into the Ft. Loudon Lake Watershed (Table 1). The majority of these streams are located in 4 primary and 2 secondary subwatersheds.

Table 1. City of Knoxville's Sediment TMDLs for Subwatersheds with Waterbodies Impaired for Siltation/Habitat Alteration

HUC-12 Subwatershed (06010201___)[a]	Waterbody ID	Creek Name	Existing Sediment Load (lbs/ac/yr)[b]	Target Load (lbs/ac/yr)[b]	TMDL required load reduction (%)
0201	060102011697_1000	Fourth	1,149	397.1	65.5
	060102011719_1000	Williams			
	060102011721_1000	Baker			
	060102011723_1000	Goose			
0202	06010201080_0100	Whites	1,178		66.3
	06010201080_1000	First			
0203	06010201097_1000	Second	1,604		75.2
0204	06010201067_1000	Third	1,209		67.2
0208	060102011330_2000	Sinking	987		59.8
0209	06010201037_1000	~~L. Turkey~~[c]	759		47.7
	06010201340_1000	Turkey			

[a] 6 HUCs

- 4 primary (201-204) First, Second, Third, Fourth, Baker, Williams, Goose, Whites
- 2 secondary (208-209) Sinking, Turkey

[b] Data taken from TDEC's TMDL for Siltation and Habitat Alteration in the Ft. Loudoun Lake Watershed.

[c] Little Turkey Creek has insufficient amount of area within the City to warrant sampling.

Chemical Analysis

The City of Knoxville currently operates five monitoring stations located on four streams. The existing monitoring stations are located on Fourth Creek (two sites), First Creek, Williams Creek, and Love Creek, which is currently not on the 303(d) list. The City will add another monitoring station on Third Creek during the 07-08-permit year. The stations are sampled quarterly for both ambient and storm events. The chemical parameters that are routinely sampled include: pH, BOD, COD, ammonia-nitrogen, nitrate-nitrite, organic-nitrogen, Kjeldahl-nitrogen, ortho-phosphate, total phosphorus, dissolved and suspended solids, lead, and zinc. In addition, annually one storm event grab sample is tested for the full suite of parameters including: the parameters mentioned above, plus volatile organics, pesticides, and PCB's. All samples are collected using Standard Methods approved by the EPA and sent to Environmental Science Corporation for analysis.

Biological Monitoring

Currently, the City of Knoxville is conducting IBIs via a contract with the Fort Loudon Lake Association (FLLA). Two sites on two-303(d) streams are sampled. The sampling locations will rotate around all the streams on the 303(d) list in the City.

Starting in 07-08-permit year, the City will contact with the FLLA to perform a Rapid Bioassessment Protocol (RBPs) program. The program will include performing RBP's on two streams, one test area per stream, and have 2 sites per test area. The streams will be located in different HUCs and rotate on a five-year permit cycle. The EPA RBP III protocols will be used for this program.

Bacteria

The City of Knoxville currently collects fecal coliform and E. coli data through the following programs:

- Dry weather screening (when ammonia over 1 ppm or as indicated by odor or visual inspection),
- Storm Event Monitoring (Every station/ each year),
- Ambient monitoring (Every station/ each year),
- Special Projects and Investigations (varies depending on project),
- Hotspots (described below)
- Coordination with KUB Consent Decree Requirements for Creek Monitoring (Data is reported quarterly to TDEC and posted on web).

All samples are collected using Standard Methods and sent to the State of Tennessee's Environmental Laboratories or Environmental Sciences Corporation.

Visual Stream Assessments

The City recently started to conduct visual stream assessments using the EPA's RBP III protocols. Some additional parameters were added from other acceptable assessments to help identify future stream improvement projects. The field data sheet can be found beginning on page eight. The City's Adopt-A-Stream program also uses volunteers for stream assessment. Furthermore, the City gains valuable knowledge through its dry weather screening program, quality and quantity stormwater investigations, and new & redevelopment projects.

Dry Weather Screening

One full time Stormwater Engineering technician visits at a minimum 150 outfalls each year. The outfalls are sampled four times per year and only collected after a minimum of 36 hours with no precipitation. All of the outfalls are continuously updated and mapped using KGIS software. The chemical analyses are tested using a Chemetrics colorimetric kit. The typical parameters that are tested include; flow (ml/sec), color, turbidity, pH, total chlorine, total copper, total phenol, detergents, and ammonia. If a high ammonia reading is detected a bacteria sample is sent to the lab. In addition, the presence of odor, oily sheen, and surface scum are also noted on the field sheet.

Hotspots

Starting in the 05-06-permit year the City started collecting storm event samples from commercial hotspots listed in the Stormwater Ordinance (Restaurants, Gas Stations, Animal Facilities, Grocery Stores, Repair Shops, etc.). In year one (05-06), the City focused on sampling runoff from restaurants. The focus changed to gas stations and repair shops in year two (06-07), and this year the focus is on grocery stores. At a minimum, eight sites are sampled every year. All hotspot samples are analyzed for: pH, BOD, COD, ammonia-nitrogen, nitrate-nitrite, organic-nitrogen, Kjeldahl-nitrogen, ortho-phosphate, total phosphorus, dissolved and suspended solids, lead, and zinc. In addition, bacteria samples are collected from grocery stores, restaurants, and animal facilities, and oil & grease at gas stations, repair shops, and large parking lots.

BMP Effectiveness

The City of Knoxville currently performs pre- and/or post- BMP monitoring at municipal facilities. The City performs laboratory analysis of BMP efficiency at selected public facilities. Current installations at public facilities include but are not limited to: the KAT bus station, Loraine Street garage, Liberty Street Animal Shelter, Acker Place regional pond, Northwest Crossing regional pond, etc. Funds have been requested and approved to retrofit the Solid Waste Transfer Station. The Transfer Station will have a combination of catch basin inserts and an vault separator treatment device. All locations may not be tested every year.

CITY OF KNOXVILLE
BILL HASLAM, MAYOR

Stream Assessment Protocol

Storm water MATTERS!

Evaluator's Name:_____ **Date:**_____ **Time:**_____

Stream Name:_____ **Reach Location:**_____

_____

Starting Reach Lat _____ **Long** _____ **Ending Reach Lat** _____ **Long**_____

Total Length Assessed: _____ **ft Channel Width:** _____ **ft Top of Bank Width:** _____ **ft**

Weather Conditions-today _____ **Past 2-5 days**_____

Water Odors: [ ] Normal/None [ ] Petroleum [ ] Sewage [ ] Chemical [ ] Other_____

Turbidity: [ ] Clear [ ] Slightly turbid [ ] Turbid [ ] Opaque [ ] Stained [ ] Other_____

Habitat Assessment

Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover: mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominate; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep, very few shallow.	Shallow pools much more prevalent that deep pools.	Majority of pools small-shallow or pools absent.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr), may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Nutrient Enrichment	Clear water along entire reach; diverse aquatic plant community includes low quantities of many species of macrophytes; little algal growth present	Fairly clear or slightly greenish water along entire reach; moderate algal growth in stream substrates.	Greenish water along entire reach; overabundance of lush green macrophytes; abundant algal growth, especially during warmer months.	Pea green, gray, or brown water along entire reach; dense stands of macrophytes clog stream; severe algal blooms create thick mats in stream
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
9. Barriers to Fish Movement	No barriers	Seasonal water withdrawals inhibit movement within the reach	Drop structures, culverts, dams, or diversions (<1 foot drop) within the reach	Drop structures, culverts, dams, or diversions (>1 foot drop) within the reach
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
10. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; 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; obvious bank sloughing; 60-100% of bank has erosion scars.

	Left Bank 10 9 Right Bank 10 9	8 7 6 8 7 6	5 4 3 5 4 3	2 1 0 2 1 0
11. Vegetation Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
	Left Bank 10 9 Right Bank 10 9	8 7 6 8 7 6	5 4 3 5 4 3	2 1 0 2 1 0
12. Riparian Vegetation Zone Width	Width of riparian zone > 54 feet; human activities (i.e. parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 36-54 feet; human activities have impacted zone only minimally.	Width of riparian zone 18-36 feet; human activities have impacted zone a great deal.	Width of riparian zone <18 feet; little or no riparian vegetation due to human activities.
	Left Bank 10 9 Right Bank 10 9	8 7 6 8 7 6	5 4 3 5 4 3	2 1 0 2 1 0

Trash Dumping

Type of trash: Commercial, Residential, Industrial, Yard Waste, Floatable, Tires, Construction, Other:_____

Amount of trash: _____ pick-up truckloads **Is trash confined to?** Single site, Entire reach

Possible cleanup site for volunteers? Yes No

Bacteria Source Information

Are livestock present? Yes No **Type:** Cattle, Horses, Pigs, Other:_____

Are waterfowl present? Yes No **Type:** Ducks, Geese, Other:_____

Are homeless camps present? Yes No **Estimated number present:**_____

Exposed Pipe

Pipe is: Exposed across bottom of stream, exposed along stream bank, exposed manhole, above stream, other:_____

Type of pipe: Concrete, Smooth Metal, Corrugated Metal, Plastic, Terra Cotta, Other:_____

Pipe Diameter: _____ in. **Length exposed:** _____ ft.

Purpose of Pipe: Sewage, Water Supply, Unknown, Other: _____

Evidence of Discharge? Yes No

Color: Clear, medium brown, dark brown, green brown, yellow brown, green, other:_____

Odor: Sewage, oily, musky, fishy, rotten eggs, chlorine, none, other:_____

Pipe Inventory Table

Inventory ID #	**GPS Reading**	**Type of Outfall;** Commercial, Industrial, Residential, or Unknown	**Outfall Size;** Inside Diameter: in.	**Outfall Type;** Corrugated Metal, Reinforced Concrete, Plastic, Clay, Other	**Location (facing downstream);** Left Bank, Right Bank, Head of Stream, Other	**Odor:** Sewage, Rotten Eggs, Musky, Fishy, Chlorine, None	**Evidence of Discharge;** Yes or No

Additional Comments

City of Knoxville
Stormwater Outfall Inspection Checklist

Date	Time	Permit Yr
Last Rain	Outfall ID	Inspector
N	W	Photo

	Time	Time
Flow ml/sec		
Color color units		
Odor	Yes No	Yes No
Turbidity NTU		
Oil Sheen	Yes No	Yes No
Surface Scum	Yes No	Yes No
pH		
Total Chlorine ppm		
Total Copper ppm		
Total Phenol ppm		
Detergents ppm		
Ammonia		

Outfall Description

Notes

Field Investigator_____
Date_____

APPENDIX G

Table of SPAP Facility Inspections

Commerical and Industrial Facilities Inspected During 2006-2007

Permit Number	Project Name	Address	Street Name	Inspection Date	Inspector	Water Quality Device
00-004	SuperTarget and Retail Center	11020	Parkside Dr	06/28/2007	J. Shubzda	Stormceptor STC 7200
00-005	Pilot Food Mart	1826	Western Ave	08/15/2006	J. Shubzda	grass swale
01-001	Lakeside Center	2016	Lakeside Center Way, Suit	04/03/2007	J. Shubzda	Aqua-Swirl
01-005	Pilot Food Mart	4603	Chapman Hwy.	08/15/2006	J. Shubzda	catch basin inserts
01-010	Pilot Food Mart	405	Lovell Rd	08/15/2006	J. Shubzda	Fossil Filter Flo Guard
02-004	CarMax	11225	Parkside Dr	08/11/2006	R. Jones/Shu	Aqua-Swirl AS-9
02-007	Lakeside Center III	2016	Lakeside Center Way	04/03/2007	J. Shubzda	ADS unit
03-001	Park West Church of God	7635	Middlebrook Pk	06/15/2007	J. Shubzda	First flush filter and skimmer plate
03-012	Earthfare and Shops	10921	Parkside Dr	06/28/2007	J. Shubzda	3 Catch basin inserts
04-004	Pilot Food Mart	100	Merchant Drive	08/15/2006	J. Shubzda	3 Catch basin inserts
04-007	Kitt's Café	4620	Greenway Drive	08/14/2006	J. Shubzda	2 catch basin inserts
04-011	Connor Seafood	10915	Turkey Drive	06/28/2007	J. Shubzda	Catch Basin Inserts
04-014	Colonial Pinnacle-Phase I	11240	Parkside Drive	08/10/2006	J. Shubzda	Oil water separators
04-015	Medic Regional Blood Center-Vehicl	1705	Ailor Avenue	12/18/2006	Greg Shaw	Aquasheild Catch Basin Insert
04-016	Essen Motor Company	8837	Kingston Pike	02/16/2007	J. Shubzda	AquaShield Catch Basin Insert
04-022	Food City	4805	N. Broadway	08/14/2006	J. Shubzda	3 Hancor Flow-Guard Plus catch basin inserts
04-028	Zaxby's Restaurant	607	East Emory Road	03/29/2007	J. Shubzda	4 Suntree Catch Basin & 2 Grease Guards
05-002	West Side Motor Company	8835	Kingston Pike	06/28/2007	J. Shubzda	Grass Swale
05-005	Burlington Save-A-Lot	3840	Holston Drive	04/02/2007	J. Shubzda	catch basin inserts
05-007	Krystal	8901	Kingston Pike	06/27/2007	J. Shubzda	2 Suntree Catch Basin Inserts
05-012	Reily Foods/JFG Coffee	3434	Mynatt Avenue	11/17/2006	Jeff Gamble	grass swale
05-017	McDonalds	7030	Kingston Pike	12/29/2006	J. Shubzda	catch basin inserts
05-020	Pilot Food Mart #217	4800	N. Broadway & Adair Drie	08/14/2006	J. Shubzda	media filtration inserts
05-029	Panera Bread Broadway	4867	N. Broadway	08/14/2006	J. Shubzda	Downstream Defender
06-025	Long John Silvers	2816	E. Magnolia Ave	06/20/2007	J. Shubzda	Enviropod
06-031	Harvest Park Shopping Center	5515	Washington Pike	06/28/2007	Storm Systen	Suntree Vault

APPENDIX H

NPDES Permit Program Inventory Map

(Attached separately)

The entire inventory map is not reproduced as part of the online version of the Year 11 Annual Report. The entire map is approximately 66 inches by 32 inches (covering an area of approximately 33 miles by 16 miles) at a scale of 1-inch equals one-half mile.

To view the entire map, please contact the Stormwater Engineering Division at (865) 215-2148.