

# THE BEAVER CREEK WATERSHED

## Knox County, Tennessee

The Beaver Creek Watershed is located in the 630 square mile Lower Clinch Basin. Its 86 square miles lies entirely within the northern portion of Knox County. The 44 miles of main stem plus seven main tributaries wind through five different communities before emptying into the Clinch River. Beaver Creek is a rapidly urbanizing watershed with approximately 80,000 residents. Two communities in the watershed, Gibbs and Karns, have been identified by the Metropolitan Planning Commission as the fastest growing areas in Knox County. The creek is on the State of Tennessee’s 303(d) list of impaired streams. The primary impacts to Beaver Creek include sediment; nutrients and pathogens from agricultural and urban runoff; nutrients and pathogens from municipal point sources; and habitat alteration due primarily to land development. A Total Maximum Daily Load requirement has been developed by the Tennessee Department of Environment and Conservation for sediment and pathogens in Beaver Creek.

### **Background**

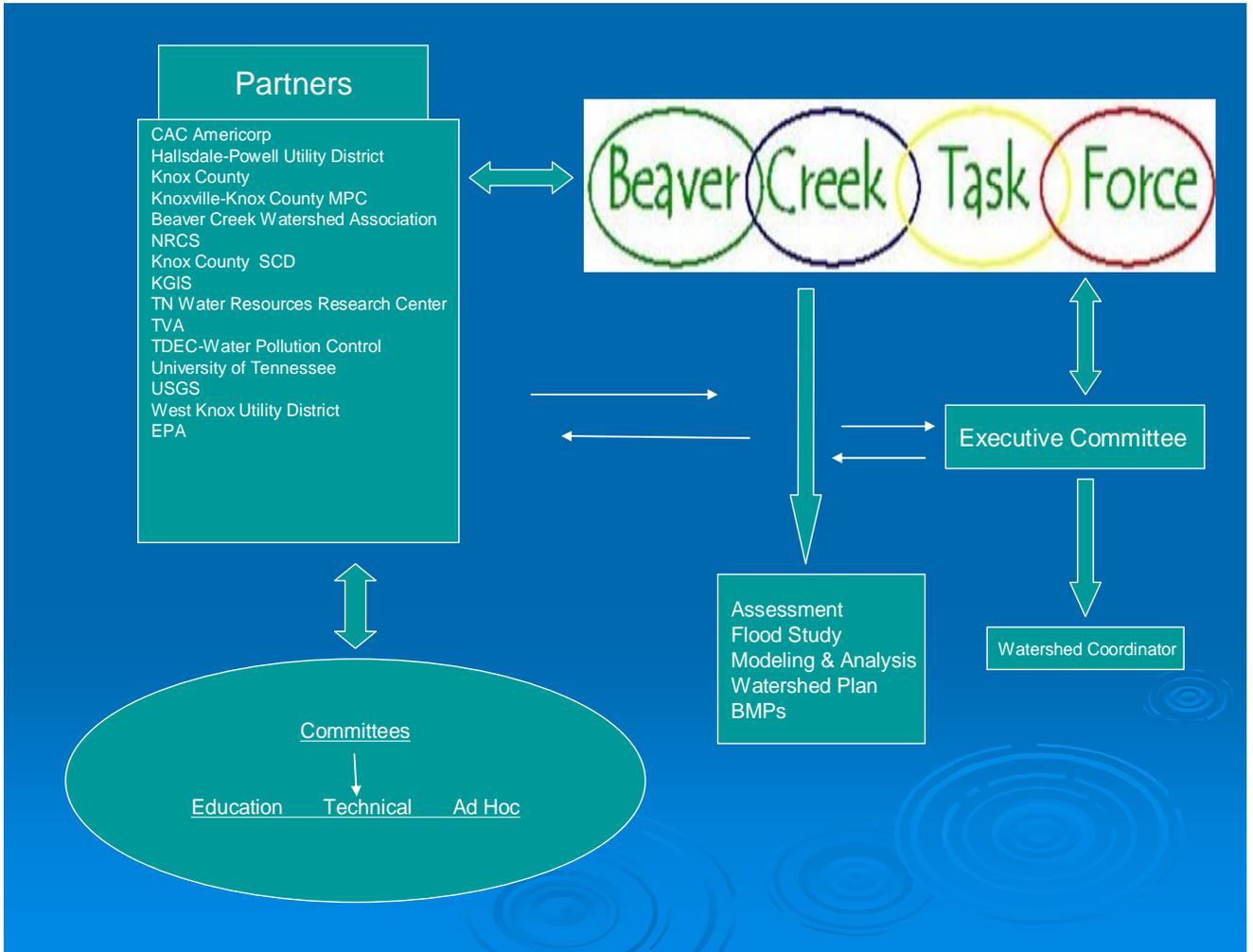
In 1998 Knox County Stormwater and its partners in the Water Quality Forum formed the Beaver Creek Task Force (BCTF), a consortium of agencies, institutions, utilities, and non-profits. The partnership was formed to determine how to address impacts to an impaired stream in a rapidly urbanizing watershed. The partnership over the years has included:

<ul style="list-style-type: none"> <li>• Beaver Creek Watershed Association</li> <li>• CAC AmeriCorps</li> <li>• City of Knoxville</li> <li>• Environmental Protection Agency, Region IV</li> <li>• Hallsdale-Powell Utility District</li> <li>• Knox County Engineering and Public Works Stormwater Management Division</li> <li>• Knox County Health Department</li> <li>• Knox County Parks and Recreation</li> <li>• Knox County Soil Conservation District</li> <li>• Knoxville-Knox County Metropolitan Planning Commission</li> <li>• Tennessee Department of Agriculture</li> </ul>	<ul style="list-style-type: none"> <li>• Knoxville/Knox County/Knoxville Utility Board GIS</li> <li>• Legacy Parks Foundation</li> <li>• Tennessee Department of Environment and Conservation</li> <li>• Tennessee Department of Transportation</li> <li>• Tennessee Valley Authority</li> <li>• Tennessee Water Resources Research Center, University of Tennessee</li> <li>• USDA Natural Resources Conservation District</li> <li>• United States Geological Survey</li> <li>• Water Quality Forum</li> <li>• West Knox Utility District</li> </ul>
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To enhance the effectiveness of the partnership, the BCTF is structured for maximum efficiency. The task force is divided in to three primary committees; an executive committee consisting of five members tasked with oversight of the day to day activities of the task force; a technical committee responsible for sample analysis, modeling, assessments, etc; and an education/outreach committee tasked with developing and implementing a communication plan. Ad hoc committees are formed for special projects.

Committees meet monthly and the task force as a whole meets quarterly. Roy Arthur, Knox County Watershed Coordinator, facilitates the BCTF.

The BCTF has operated under this same structure for the past 13 years. It has proven to be effective through the assessment, planning and now restoration phases. An organizational chart showing the interactions between committees and the task force as a whole is shown below.



**Timeline**

During the past 18 years, member organizations of the BCTF have made significant contributions toward the assessment, understanding, and restoration of the impacts to the Beaver Creek

Watershed. Hundreds of hours of staff time and over 2 million dollars have been spent in this effort to date. A timeline includes:

- 1998: Beaver Creek Task Force Formed
- 1998: Updated FEMA Flood Study
- 2000: Floodplain no fill line expanded
- 2002: Initial BCW Assessment complete
- 2002: Tennessee Growth Readiness
- 2002: Site Planning Roundtable convened
- 2003: BC Watershed Association formed
- 2003: Part time Watershed Coordinator hired
- 2003: Intensive Watershed Education initiated
- 2004: USA/USSR assessments for 23 sub basins
- 2004: Water Quality sampling & analysis
- 2004: Green Infrastructure plan completed
- 2005: GIS Land Use Map update
- 2005: Awarded 604(b) Watershed Planning Grant
- 2005: BMP projects initiated
- 2005: Water quality models developed
- 2005: Watershed Plan process initiated
- 2005: Stakeholder Advisory Council convened
- 2006: Awarded an EPA Cooperative Agreement Grant to create and test a Pilot Ecological Credit Trading Market
- 2006: Models calibrated
  - HSPF for sediment and nutrients
  - AnnAGNPS for sediment
- 2006: Watershed Plan Complete
- 2007: 319 Grant awarded (\$919,385.00)
- 2008: Implementation Plan for 319 grant complete
- 2009: Restoration begins
- 2012: Cox Creek Tributary Delisted
- 2014: 319 Grant awarded (\$167,160)

## **Major Projects**

Since its inception, the BCTF has been undertaken a number of major projects. A brief description of some of these projects follows:

*Flood study:* From 1998-2000, Knox County updated the FEMA flood study for Beaver Creek in response to extreme development pressure and related stormwater/flooding issues. Using data and findings from the flood study, a Beaver Creek Watershed Stormwater Master Plan was written to determine a regulatory mechanism that could address future flooding and environmental issues. This plan considered future build-out conditions in the watershed in order to allow Knox County to enact current regulations to mitigate future damages in the watershed caused by the anticipated level and pattern of development. The "no fill line" policy which

expanded the preserved floodplain area well beyond FEMA minimums followed this study as a key management measure for new construction.

*Watershed inventory:* From 1998 – 2002, Task force members identified future development patterns and road construction projects, environmentally sensitive areas, potential greenway routes, flood hazards and storage areas, and cultural and historic sites. A report titled the “The Beaver Creek Assessment” summarized the results of this project. Areas with multiple benefits were designated priority areas.

*Outreach and education:* In 1999, a telephone survey by the University of Tennessee provided valuable information about the knowledge and attitudes of watershed residents about water quality issues. Results of the telephone survey indicate that an outreach/education campaign was needed for watershed stakeholders to be effective in participating in the development of a watershed plan. An Outreach Committee was formed to educate stakeholders about basic water quality problems, inform them about the watershed initiative and encouraged them to get involved.

From 2000- the present the BCTF Outreach Committee has developed an ongoing communication plan and oversee its implementation. The communication plan developed includes: a defined target audience, clear and consistent messages and a timetable and methods of delivery.

BCTF Outreach Committee activities include: over 100 articles in local newspapers, presentations to community groups, a 16 page Beaver Creek supplement to the local newspaper, the Adopt-A-Watershed program in middle and high schools, an Environmental Learning Center targeting elementary school students, the Adopt-A-Stream a program, demonstrations and promotion of improved stormwater treatment, sediment and erosion control training, public meetings and a wetland and riparian buffer educational campaign.

In recent years the BCTF Outreach Committee has developed outdoor classroom space for Gibbs, Halls, Karns, and Powell High Schools and Brickey Elementary.

*Tennessee Growth Readiness Initiative:* The Tennessee Growth Readiness Initiative (TGRI) is an educational program developed by TVA and BCTF partners to educate the public, local officials, and other decision makers about the sources and impacts of nonpoint source pollution, how different land uses effect water quality, and what communities can do to protect water quality. In the spring of 2002 Knox County served as the pilot area for TGRI.

*Site Planning Roundtable:* In the fall of 2002 Several BCTF partners assisted in convening the Knox County Site Planning Roundtable, a diverse committee that included representatives of county, city and state government agencies, environmentalists, lawyers, bankers, developers, builders and homeowners. Roundtable committees reviewed current planning and zoning ordinances and compared them to "model development ordinances." In 2005 the Roundtable reached consensus on recommended changes to development rules and processes. 21 of these recommendations have been incorporated into the new Knox County Stormwater Regulations.

The Roundtable also recommended that Low Impact Development demonstration sites be developed in the Beaver Creek Watershed. A pervious concrete parking lot has been completed at the new Powell Library; construction has begun on a low impact Town Center development

named Bell Meadow in Powell next to the new library; and construction is set to begin on a low impact design for the new Hallsdale Powell Utility District headquarters.

*Beaver Creek Watershed Association (BCWA):* In 2003 the BCTF provided funding and support for the formation of the Beaver Creek Watershed Association. The BCWA is a non-profit (501c3) organization for stakeholders in the Beaver Creek Watershed. The BCWA now boasts over 250 members and is involved in a number of education and restoration initiatives in the watershed. The BCTF took the lead in developing a wetland Education project in the Halls community. Also, in 2003, the BCTF provided funding for a part time Watershed Coordinator for Knox County.

*Beaver Creek Assessment:* The first task for the BCTF was to conduct a comprehensive assessment of the Beaver Creek Watershed. The assessment included gathering all available historical agency data, a visual assessment, and suggestions for next steps. This study culminated with the publication of the “*Beaver Creek Assessment*” in 2003.

*Water Resource Assessment and modeling:* Funding through a TDEC TMDL Support Grant enabled Department of Civil and Environmental Engineering at The University of Tennessee to collect 12 sampling runs over a period of one year at 13 sites in the Beaver Creek watershed and to develop a sediment load model. Water quality parameters include those necessary to generate models for sediment, phosphorus, nitrate, and pathogens. Two water quality models subsequently have been developed for sediment and nutrients. Samples were collected in 2004 and models were completed in 2006.

*Green Infrastructure:* In 2004 a Green Infrastructure Plan was created by the BCTF and the UT Department of Architecture, Green Studio, for the Beaver Creek Watershed. Green infrastructure is the supporting systems the landscape provides for a community; an interconnected system of natural areas and other open spaces managed for the benefits to both people and the environment.

The plan identifies ways to connect communities and natural areas; develop a program for individual conservation easements; identify conservation buffer areas, lands for greenway development, and lands with significant historic, recreational, or visual value; and recommended implementation strategies.

A report titled “*The Beaver Creek Green Infrastructure Plan*” has been published and is being used to help identify areas in the Beaver Creek Watershed that are best suited for development and the areas that are best suited for conservation.

*Watershed Action Plan:* In 2005 the Tennessee Department of Environment and Conservation awarded the BCTF a \$54,000 grant to develop a Watershed Action Plan (WAP) for the Beaver Creek Watershed. The “*Beaver Creek Watershed Restoration Plan*” was completed in November of 2006 and was published in early 2007. An important part of the development of the Beaver Creek WAP was done by a Stakeholder Advisory Council composed of developers, farmers, residents, and public officials.

*Ecological Credit Trading:* In 2006 the Environmental Protection Agency awarded Knox County Engineering and the BCTF a \$353,000 grant to develop and pilot test a water pollution credit trading program. This 3 year study developed a market based credit trading program for sediment and nutrients that, if implemented, will accelerate the restoration of the Beaver Creek Watershed to a healthy ecosystem. A final report “*Ecological Credit Trading Pilot Study for the Beaver*

*Creek Watershed*” was published in 2009. TNWRRC/UT provided project management for the study.

*TDA 319(h) Grant:* The BCTF submitted a proposal to the Tennessee Department of Agriculture for funds to implement the first phase of restoration as outlined in the WAP. In 2007 TDA awarded the Task Force \$919,385.00.

*Restoration Implementation Plan:* The majority of 2008 was spent preparing a detailed implementation plan for execution of the 319 grant. Major components of the implementation plan include: Agricultural improvements that include pasture renovation and cattle exclusion fencing, Stormwater retrofits to address water quality and water quantity on public and private property using bioengineered solutions, acquiring easements on and donations of floodplain property in partnership with the Legacy Parks Foundation, and other best management practices such as wetland restoration and stream bank stabilization.

A comprehensive monitoring protocol has been initiated. The monitoring program is a partnership between the University of Tennessee, Knox County, Hallsdale-Powell Utility District, West Knox Utility District, USGS, TDEC, and TVA. The data collected in the first year provided a baseline against which the BCTF can track progress.

*Restoration:* Restoration began in 2009 and is being led by Knox County Stormwater and The Tennessee Water Resources Research Center at the University of Tennessee (TNWRRC/UT). By 2012 the BCTF expects to have a minimum of 25 agricultural projects completed, to have bioengineered solutions to at least 20 stormwater problems on public and private property and to have protected and restored at least 200 acres of floodplain.

#### *2009 Projects*

- Agricultural BMP projects
  - 1 – complete
  - Marketing plan developed
- Streambank Rehabilitation
  - 3,500 on Hines Branch by Hallsdale Powell Utility District (HPUD) complete

#### *2010 Projects*

- Agricultural BMP projects
  - 6 – complete
- Streambank Rehabilitation
  - 3 – Approximately 3,000 feet by Hallsdale Powell Utility in conjunction with new interceptor construction
- Retrofit projects
  - 3 – rain gardens complete
- Other
  - Green Roof installed on building in Gibbs Outdoor Classroom
  - 3 acre wetland enhancement project in Halls complete

### *2011 Projects*

- Agricultural BMP Projects
  - 4 – complete
- Retrofit projects
  - 6 – rain gardens complete
  - Stormwater wetland at Brickey Elementary Completed by Hallsdale Powell Utility

### *2012 Projects*

- Ag BMP Projects
  - 6 - Complete
- Retrofits
  - 1 - Rain Garden
- Streambank Restoration
  - 900 feet - Halls Community Park
  - 1,400 feet - Mill Run Subdivision
- Community Engagement
  - 3 - Educational Kiosks in Parks

### *2013 Projects*

- Ag BMP Projects
  - 7 - Complete
- Retrofits
  - 1 - Rain Garden
  - 1- 1550 gallon cistern
  - 1 - Divert acre foot of stormwater in a 1' rain through 2 newly constructed stormwater ponds

### *2014 Projects*

- Ag BMP Projects
  - 4 - Complete
- Retrofits
  - 100 Trees - Harrell Rd. Riparian Planting
  - 1 - Canoe/Kayak Ramp installed at Harrell Rd.
- Community Engagement
  - 1 - Kiosk installed at Harrell Rd.

### *2015 Projects*

- Ag BMP Projects
  - 2 – Complete
- Retrofits
  - 100' streambank restored
  - 2 – rain gardens

### *2016 Projects*

- Ag BMP Projects
  - 3 – complete
- Retrofits
  - 5,100 square foot bio-retention basin
  - 300' pervious concrete sidewalk
  - Pervious Paver Parking Lot
- Kiosk installed at Harrell Rd. Park
- Beaver Creek Kayak Club established with 500 members by the end of the year.

### *2017 Projects thru June 30*

- Ag BMP Projects
  - 2 – complete
- Retrofits
  - 2 Bio-swales installed
- 6 BMP signs installed at Harrell Rd. Park
- Harrell Rd. Stormwater BMP Demonstration Park officially opened
- Beaver Creek Water Trail opened in Karns
- Second Phase of Water Trail in Powell under development
- 6 Environmental Stewardship projects complete

### *Prior Accomplishments*

- 2017: Harrell Rd. Stormwater BMP Demonstration Park Opened
- 2017: Karns Water Trail Opened
- 2014: Kayak launch and water trail in Karns
- 2012: Cox Creek Tributary removed from the 303(d) list of impaired streams
- 2009: Baseline monitoring complete
- 2008: 52 acres of land protected through easement, purchase, or donation in partnership with the Legacy Parks Foundation
- 2007: 150 feet of eroding ditch in Powell Station Park converted to grassy swale and planted with native grasses, trees, shrubs, and flowers.
- 2006: Beaver Creek Watershed Restoration Plan published
- 2005: Pervious Parking lot with underground detention built in new Powell Branch Library
- 2005: Three agricultural BMP projects completed
- 2004: Beaver Creek Green Infrastructure Plan published
- 2004: 1,500 feet of riparian planting in partnership with NRCS in the Halls Community Park
- 2003: Beaver Creek Assessment published
- 2003: Beaver Creek Watershed Association formed

*Environmental Stewardship Program (ESP)*

ESP is a 60-40 cost share program that originated through the Water Quality Forum and is currently run by Knox County Stormwater. The program is designed to provide environmentally friendly solutions to landowners with drainage problems on privately owned property. By the end of 2016, The ESP program had completed 54 projects in the Beaver Creek Watershed. The ESP program is currently promoting rain gardens and has installed approximately 15 in the Beaver Creek Watershed through 2016. In addition the program has restored over 500 feet of streambank and converted approximately 3,000 feet of eroding ditch lines to grass swales.