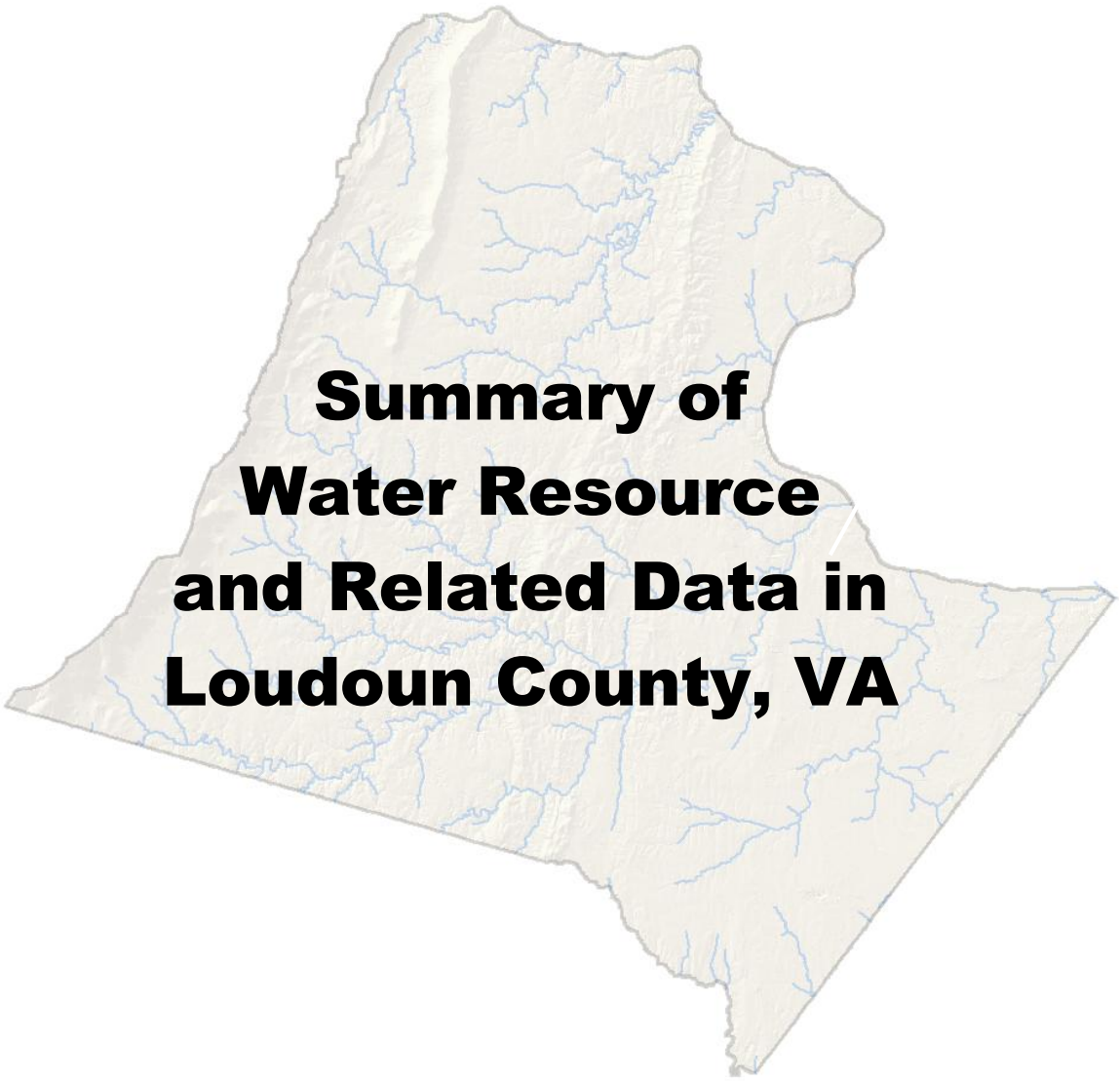

Summary of Water Resource and Related Data in Loudoun County, VA

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Loudoun County - Water Resources Data Summary

This data summary highlights those data most pertinent to overall water resource monitoring and hydrological analysis. The discussions include a brief description of the data source, a summary of the data contents and relevant notes regarding the data compilation and status.

1 Groundwater Data

1.1 Loudoun County Groundwater, Well, and Pollution Sources

Well construction and groundwater information in database (MS Access) with locations in GIS maintained by B&D and Health Department. Source of most data from paper files generated during Health Department well permitting process (e.g., GW2 well construction form). Subset of the WellPoll database, which includes well data and pollution sources data. Data on ~18,500 wells dating from 1930 to present, with information of varying quality and completeness including: location (VA state plane coordinates), surface elevation (62% complete), well depth (70%), casing depth (65%), static water level (53%) {suspect accuracy}, total yield (60%), depth of primary yield zone (60%), and transmissivity (~250 values).

Also includes groundwater quality data. Water quality data for a limited number of parameters are entered in the database for some wells (~2,100) constructed and tested prior to 2002. Water quality data provided digitally to B&D by National Testing Labs started in 2002 and is available for approximately 2,250 wells. These data are considered level A quality and typically consist of 100 physical/chemical water quality parameters per well for a total of more than 200,000 individual analyses. NTL data linked to the groundwater database by Health Department Permit No.

Also includes data on potential pollution sources – primarily on-site sewage disposal systems (e.g., drain fields) but also other sites such as cemeteries, landfills, chemical storage sites, etc. Currently there are approximately 14,000 records with site ID numbers and corresponding points in GIS. Data in some of the old records may be obsolete. Currently, data are obtained primarily from the Health Department sewage disposal system permitting process.

1.2 USGS Groundwater Wells

The USGS operates three real-time water level measurement wells within Loudoun County or contributing watersheds. One well is located on the ridge of Short Hill north of Hillsboro (1963 to present), one is located east of Leesburg (1977 to present), and the third is in Prince William County, just south of the Loudoun County line in the Bull Run watershed (1968 to present). Data is added to B&D databases through automated web queries.

1.3 County Hydrogeologic Studies

These reports are valuable sources of high-quality groundwater data, including level data, geologic logs and aquifer testing data. The reports are required for most large subdivisions, as well as other developments with anticipated usage greater than 10,000 gallons per day. The County has ~ 165 reports on file. Well construction and aquifer testing data from these reports are electronically stored in County databases. Over 1,950 wells have been drilled and tested through this process.

1.4 USGS NAWQA Wells

As part of the USGS National Water-Quality Assessment Program (NAWQA) program, fourteen wells in Loudoun County were sampled between 1994 and 2004 for a broad range of chemicals. Data are compiled in a personal geodatabase format with related time series table. As many as 140 analyses per sample were analyzed including pesticides, radionuclides and volatile organic compounds. Two well sites in Purcellville were sampled in 2003 and 2004 with over 500 analyses each and showed little change over time. The total number of water quality analyses reported exceeds 3,000.

1.5 WRMP Monitoring Wells

B&D started monitoring groundwater levels in the county in 2003 and, with two wells added in December 2006, currently monitors ten wells (with the goal of establishing 17-20 wells by 2009). Water levels recorded by automatic data loggers several times per day and manually downloaded. Records are incomplete for some wells. (Water quality sampling from many of these wells may begin by late 2008.)

1.6 Water Quality Data from LCSA and VADH Public Water Supplies

These data are collected by state and local agencies to monitor public water supply wells. The only data obtained is from the annually published Consumer Confident Reports (CCR).

1.7 Luck Stone Special Exception Water Quality Reports

As part of the County regulatory process, Luck Stone Quarries supply B&D with quarterly groundwater quality and level data from their Bull Run facility.

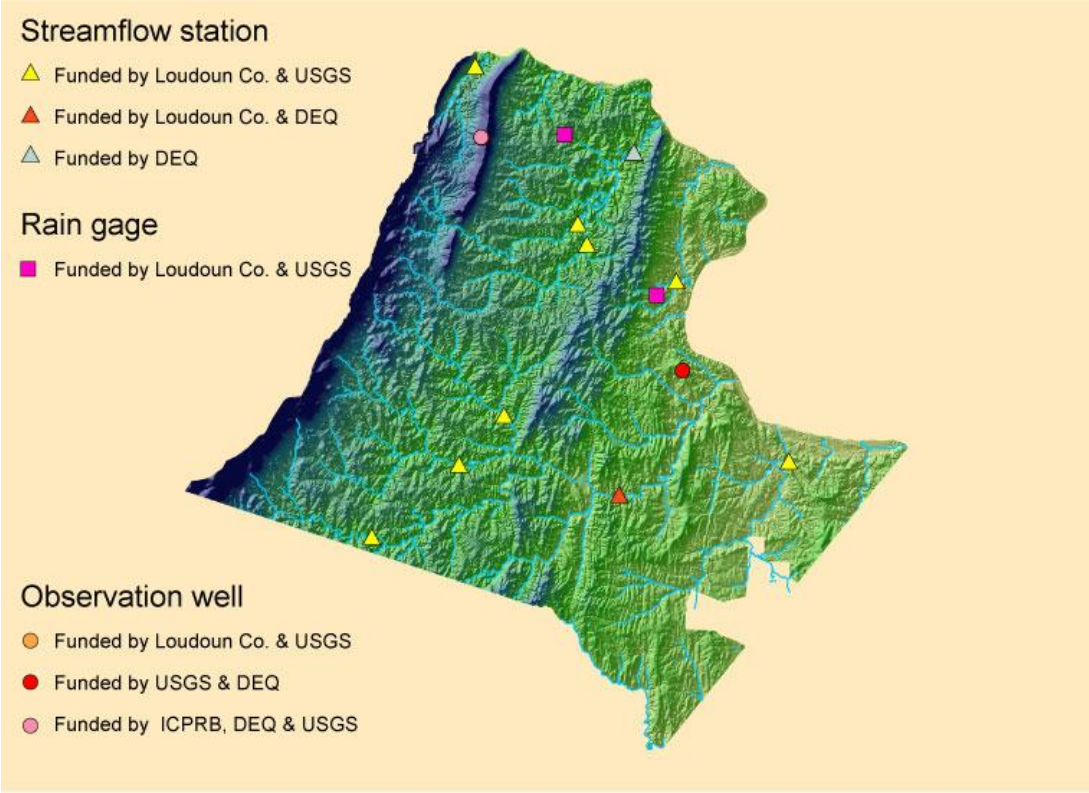
1.8 EPA Safe Drinking Water Information System (SDWIS)

Water Quality Data from Public water supply wells in Loudoun County. These data are routinely updated by EPA.

2 Government Hydrologic-related data:

2.1 Stream Stage & Discharge – USGS (and DEQ)

Ten stream gaging sites in Loudoun County (see map for locations) established by USGS and currently operated by USGS (8 sites) and DEQ (2 sites). Data include daily stage (ft) and discharge (cfs). Site locations and POR are: Broad Run at Rt. 7 (10/01-present), Limestone Branch at Rt. 15 (9/01-present), Goose Creek near Rt. 621 (1/30-present), Catoctin Creek at Taylorstown (11/70-present), S.F. Catoctin Creek at Rt. 698 (7/01-present), N.F. Catoctin Creek at Rt. 681 (8/01-present), N.F. Goose Creek at Rt. 734/Lincoln (8/01-present), Beaverdam Creek at Rt. 734/Mountvail (8/01-present), Goose Creek nr Middleburg (10/65-12/96 | 6/01-present), Piney Run at Rt. 671 (10/01-present). POR data and some statistics for these sites available on USGS web page. Since December 2006, the 15-minute "real-time" data available for only the last 30 days have been recorded as monthly snapshots, providing stage/discharge of provisional values for more detailed hydrographs. The Instantaneous Data Archive contained over 2.3 million records of 15-minute data since 1990.



Locations of stream gages, wells, and rainfall monitoring sites managed by, or in cooperation with, USGS.

2.2 Precipitation Data – National Weather Service / National Climatic Data Center

Daily precipitation (rain and frozen) collected as part of the National Weather Service Cooperative Station Network and purchased from NCDC. (These data sets are for distribution only by NCDC.) Five stations with relatively long and complete data sets in Loudoun County and vicinity currently purchased by B&D: Lincoln (1/30-7/06), Mt. Weather (8/48-7/06), Sterling RCS (9/77-7/06), Dulles Airport (3/63-7/06), and The Plains in Fauquier County (4/54-7/06). (See map for station locations.) Data sets have been converted from text files into Excel spreadsheets, missing records identified, and have monthly and annual totals calculated. **{Commercial data - restricted distribution}**

2.3 Precipitation Data – USGS

Two automated rain gauges (not heated to melt frozen precipitation) installed and activated for Loudoun County by the USGS in early 2003 (see map for locations). One station located in Lovettsville and one at Plains of Raspberry golf course. Stations equipped with telemetry devices for near-real time data posting to USGS web site. Equipment and reporting malfunctions resulted in impaired record quality to date.

2.4 USGS National Hydrology Data (NHD)

The NHD file, mapped at a 1:24,000 scale, provides a functional geometric network of all perennial and some intermittent streams. Stream locations are sometimes not consistent with recently developed suburban areas in eastern Loudoun. The geodatabase includes stream and water body naming consistent with GNIS.

2.5 USGS Elevation (NED)

The National Elevation Data available as a seamless download replaces the former DEM (Digital Elevation Model) tiles. Posting is 30 meters. Raster files are downloaded, converted to HARN and scaled from meter to feet.

2.6 National Wetlands Inventory (NWI)

The NWI inventory polygon file from the US Fish & Wildlife Service has been downloaded, merged and dissolved. In Loudoun the images dates are 1981 to 1994. Data are used for comparison with County wetlands models for eastern and western Loudoun.

2.7 Watershed Boundaries

There are several sources for watershed boundaries at different scales by several agencies.

Loudoun County watershed boundaries (aka "majsheds"), are mapped at 1:2,400 scale. There are 161 polygons, limited to Loudoun County. These are legacy, developed several years ago. Data is generally still current, though not necessarily completely consistent with the current "topo" layer. The mapping is to the 7th level. Naming is not consistent with federal efforts; however, naming is included for each level. Metadata is incomplete.

VA DCR: This includes 5th and 6th order of hydrologic units, mapped at 1:24,000 scale. The 6th order corresponds to the 12 digit HUC (12 digits - i.e. 020700040101). The 5th order corresponds to 10-digit HUC. Data is limited to state of Virginia.

NRCS USDA: Currently all of Virginia is "certified". This includes 5th and 6th order (10 and 12-digit HUC). Data extends into MD. The naming is generally consistent with DCR, however they are not identical. The packaging of DCR and NRCS differs in that NRCS stores both 10 and 12-digit numbering in one file, but requires 6 files for County. DCR files require that table names be joined and there are separate files for the 10 and 12-digit layers. Note that there are no data available for WV at this time.

USGS National Hydrology Data (NHD): The boundaries are mapped at 1:100,000 scale. This extends beyond the County boundary and contains 2 polygons nominally. This comes in two resolutions, medium and high. The USGS only maps down to the 4th level or 8-digit HUC.

3 Government Environmental Studies:

3.1 Geology – USGS/Loudoun County

Surficial and bedrock geology GIS layers and printed maps developed through mapping efforts by USGS with assistance from Loudoun County's former Department of Natural Resources. Bedrock map data updated by USGS in 1999. Following minor corrections with data labeling after consulting with USGS, layers incorporated into Loudoun County GIS in 2003.

3.2 VA DEQ Water Quality (Trend and Ambient Stream Monitoring)

The Dept of Environmental Quality (DEQ) operates numerous stream monitoring sites, often coincident with USGS stream flow gages. Water chemistry data includes basic cations and anions as well as pH, temperature, fecal/E.Coli. Trend stations are long-term sites and ambient stations are used on a rotating basis. Data are

obtained from DEQ web site. There is a total of 57 monitoring sites in Loudoun County. Only nine of these are designated as "trend" sites. There are 98,000 water measurements on file.
VA DEQ monitors for benthic macroinvertibrate as part of their stream assessment. The benthic database "EDAS" is available online and requires a password to access. There are 75 values for Loudoun County starting in 1994 with as many as 18 measurements at CAXO04.57 (Taylorstown). Data metrics include EPA RBP and SCI.

3.3 VA DEQ 2006 Water Quality Assessment

The Dept of Environmental Quality (DEQ) publishes water quality impairments as part of the Water Quality Assessment Integrated Reporting of 305(b)/303(d) listings within the TMDL program. Stream reaches are assessed for exceedance of water quality standards for a particular use. Data are in GIS format for all of the stream reaches, not just the impaired sections. Most impairments are bacteria, though there are several benthic impairments, probably caused by excess sediments. The 2008 WQA is currently under review and not available in digital GIS format.

3.4 Broad Run Water Quality Monitoring Program (OWML)

Since 1990, a station on Broad Run, upstream of the LCSA plant now under construction has been monitored for water chemistry and flow. Only an approximate site location is known. Over 430 sampling events have been recorded every two weeks with approximately 20 to 50 analyses per sample. In general the recent stream flow data were found to be consistent with the new USGS station on Broad Run. Review of the fecal concentration display the expected positive correlation with increased stream flow. Comparisons with DEQ data have not been examined. Data are available in raw Excel format only.

3.5 Fairfax County – SPS

In 1998, Fairfax County conducted stream monitoring for their Stream Protection Strategy. In 2002, a CD of the data was published that includes 2 sites in Loudoun County. Data also includes three sites upstream in Sugarland Run that flow into Loudoun County. Monitoring data is primarily related to macroinvertebrates using Rapid Bioassessment Protocol at over 120 sites. Other data include fish and habitat assessments. A GIS monitoring station file was received in 2003. The biological data reside in MS Application. Additionally the Fairfax Health Department provides data on fecal coliform, temperature, pH, DO, P and N from 1989 to 2002.

3.6 USGS NAWQA Surface Water

As part of the USGS National Water-Quality Assessment Program (NAWQA) program, five surface water samples were collected between 1992 and 2003 and analyzed for a broad range of chemicals. Data are compiled in a personal geodatabase format with a related time series table. As many as 80 analyses per sample were analyzed including pesticides and volatile organic compounds. At the Catoctin Creek -Taylorstown site, extensive sediment and analyses for PCBs were performed. The total number of water quality analyses reported exceeds 1,500 values.

3.7 Loudoun Soil & Water Conservation District Stream Monitoring

Since 1999, the LSWCD has monitored 14 stations in the Piney Run, Catoctin Creek, Little River, North Fork Goose Creek, and Beaver Dam watersheds for fecal coliform. This effort is related to the potential development of fecal coliform Total Maximum Daily Loads (TMDL) for these waterways, and was expanded to include E-Coli in 2003. Some water chemistry and macroinvertebrate data are also available. Data are periodically posted to the LSWCD web site (http://loudoun.vaswcd.org/).

3.8 Fairfax County - Cub Run and Bull Run Watershed

In Fairfax County, watershed planning efforts extends into Loudoun in the Cub Run and Bull Run watershed. The watershed management plan includes maps of habitat assessment, stream obstructions, head cuts, utility crossings and dump sites. No tabular or GIS files have been requested. Identification of structural restoration projects (riparian buffer planting, pond retrofit, dump site removal, etc.) are limited to Fairfax County.

3.9 Occoquan Source Water Assessment and TMDL

The Occoquan River has headwaters in southeast Loudoun County. In the TMDL for bacteria, approximately 11 percent is attributed to Loudoun County. Modeling using HSPF indicates that a 90% reduction in Loudoun is needed to achieve TMDL goals. Modeling also addresses MS4 (storm water) loads from Loudoun County (42.3 ton/yr of sediments). No TMDL-specific field data was collected in Loudoun County. Note that recently, DEQ added a segment of Bull Run along the County border to the 2006 Category 5A listing as being impaired for bacteria.

3.10 Tributary Strategies

The EPA Tributary Strategies program in conjunction with Chesapeake Bay waste loading modeling has resulting in the preparation of "input decks". Waste loadings are categorized and estimate loads computed. The Potomac watershed loads were then used to estimate the portion contributed by Loudoun County. These pollutant loadings are first order approximations only.

3.11 Wellhead Protection Plans

Well head protection plans prepared for several towns and community water systems within the past few years have been obtained for: Round Hill, Raspberry Falls, Lenah Run, and Beacon Hill. Plans for other communities are currently in development and will be obtained for Selma, Rokeby and Elysian Heights.

3.12 Town of Purcellville Water Supply Plan

In 2007, CH2M Hill and GeoTrans were contracted to conduct a water resources study for the town. Alternative water supply considerations included additional groundwater wells, reservoirs and surface water from the Potomac and Shenandoah Rivers.

3.13 Natural Resource and Conservation Service – Fish Survey

The Natural Resource and Conservation Service Fish Survey (Teels and Danielson, 2001, USDA) reported IBI score at 42 sites in Goose Creek, many of which rank as poor or very poor.
http://www.wli.nrcs.usda.gov/products/ibi.pdf

As a follow-up study, the 2005 USDA report evaluates the effectiveness of CREP restoration on stream biological integrity. Annual IBI and SVAP measurements from 2000 to 2003 are evaluated. Six Loudoun sites include: Hungry Run/632, Little River/632, Plum Run/50, Pantherskin Run, North Fork Goose Creek/782, North Fork Catotin/287. http://directives.nrcs.usda.gov/media/pdf/tn_b_58_a.pdf

4 Non-Government Environmental Studies:

4.1 Rapid Stream Assessment Technique (RSAT) Survey by Council of Governments (COG)

Since 1997, five reports have been prepared by Metropolitan Washington Council of Governments COG providing assessments of the stream health in Loudoun County. The purpose is to document the baseline conditions for possible future watershed protection, restoration, monitoring and resource management initiatives and action. The RSAT technique provides a systematic evaluation of the physical, chemical and biological stream quality conditions. The six RSAT categories include: stream bank stability, channel scouring/sediment deposition, physical aquatic habitat, water quality, riparian habitat conditions and biological indicators (macroinvertebrates).

RSAT of Sugarland Run Watershed - Phase I: Mainstem (1997). Prepared for Virginia Environmental Endowment. The survey included 10.4 stream miles.

RSAT of Sugarland Run Watershed - Phase II: Tributaries (1999). Prepared for Virginia Environmental Endowment.

Talbot Farm Tributary RSAT Survey (1998). Prepared for the Virginia Department of Forestry, Loudoun Soil and Water Conservation District and Natural Resources Conservation Services. The Talbot Farm tributary is a third-order stream in the Catoctin watershed, near Waterford. The 3.7 square mile watershed is primarily cow pasture.

Loudoun County Baseline Biological Monitoring Survey (2000-2002) - Phase I: Broad Run, Goose Creek, Limestone Branch, Catoctin Creek, Dutchman Creek and Piney Run Mainstem Conditions (2003). Prepared for the National Fish and Wildlife Foundation. Streams were monitored at 26 stations and conditions were assessed for each of the six watersheds. To address channel morphology, a limited number of modified Rosgen Level I stream morphology analyses were performed and several one-time fecal coliform grab samples were performed.

Loudoun County Baseline Biological Monitoring Survey (2004-2005), Phase II: Clark's Run, Catoctin Creek, Quarter Branch, Dutchmen Creek and Piney Run. Prepared for the National Fish and Wildlife Foundation. In northern Loudoun, 16 stations were surveyed. Additional analysis included existing riparian buffer. Over 25 miles of stream do not meet the 35-foot riparian buffer. Over 270 potential reforestation sites were mapped and GIS coordinates available. Summary RSAT scores have been input into GIS format.

4.2 Goose Creek Demonstration Watershed Vulnerability Analysis

In 2003, PEC and the Goose Creek Association in consultation with the Center for Watershed Protection, reported on subwatershed plans. Report includes a summary table for 40 subwatersheds. The underlying GIS data (land use, imperviousness, etc.) are not readily available. Data is available from printed report only.

4.3 LCSA Goose Creek Source Water Protection

In 2003, LCSA (now Loudoun Water) developed a comprehensive source water assessment of their water intake in Goose Creek. The plan focuses on pollutant source, primarily within a 5-mile radius of the intake. Analysis includes waste loading calculating using PLOAD for suspended solids, nitrogen and phosphorous. In addition to a review of existing watershed characteristics, the study included 45 stream miles (10%) of assessments. Using EPA's Rapid Bioassessment Protocol, 68 reaches were characterized. Stream Walk Assessment contract was completed by Michael Baker Corporation. The site investigations predate though are similar to USA & USSR techniques developed by Center for Watershed Protection (CWP). Data is available from the printed report and primary stream assessment data has been input into GIS.

4.4 Goose Creek Vulnerability Analysis

In 2002 and 2003, PEC and the Goose Creek Association in consultation with the Center for Watershed Protection, completed its study of the Goose Creek watershed, covering both Loudoun and Fauquier counties. The project assessed the current and future health of the watershed on a subwatershed basis, with a field-verified, in-depth analysis of three subwatersheds and recommendations to improve or maintain their health. Data is available from printed report only.

4.5 Tuscorora Creek Field Work and Baseline Assessment

In 2007, PEC contracted the Center for Watershed Protection to perform field studies within the watersheds of the Town of Leesburg. Stream surveys and environmental assessments were documented along with sensitive areas inventory and recommendations for environmental improvement. Funded by Piedmont Environmental Council (PEC), the USSR and USA techniques were applied and over 80 recommendations for restoration, revision or retrofits identified.

4.6 Virginia Commonwealth University - INSTAR

Developed by Virginia Commonwealth University, INSTAR is a combined stream and watershed integrity assessment approach of Virtual Stream Assessment (VSA) metric and modified Index of Biotic Integrity (mIBI). The technique alleges to eliminate limitations inherent with RBP and IBI. There are 35 sites classified in Loudoun County. It is unlikely that other groups or agencies will use this protocol.
http://instar.vcu.edu/stream_watershed.html

4.7 Dawson's Coner and Seven Hills –USM

As part of legislative application, Greenvest contracted with Virginia Waters and Wetlands, Inc. to conduct stream and habitat assessments at five sites in southeast portion of the County. Data was collected in August 2007 and May 2008. Methodology is Unified Stream Methodology (USM). Note that the habitat assessment metrics reported do not provide an interpretive scale. The benthic macroinvertebrate were sampling using EPA's RBP approach. Benthic scores of Order Richness and Percent EPT are provided. The benthic macroinvertebrate assessment metrics reported do not provide an interpretive scale.

5 TMDL Studies:

The five TMDL reports include: Catoctin Creek Bacteria (2002), Goose Creek Watershed Bacteria (2003), Limestone Branch Bacteria (2004), Piney Run Bacteria (2004), and Goose Creek and Little River Benthic (2004).

Each report is highly detailed and includes waste load modeling using a deterministic stream flow and waste load model or a statistical analysis of water quality data. In some TMDL reports, additional field work and stream monitoring data are included. All reports are available in Adobe format, though no data tables or GIS files have been received or recreated at this time.

TMDL Project	Watershed ID	Pollutant(s)	Comment document	Final report	EPA approval date
Catoctin Creek Watershed	A02R	Fecal Coliform	Comment document	Final report Addendum	05/31/2002 EPA rationale
Goose Creek and Little River Watersheds	A08R	Sediment	Comment document	Final report	04/26/2004 EPA rationale
Goose Creek Watershed	A04R, A05R, A06R, A07R, A08R	Fecal Coliform	Comment document	Final report Modification	05/01/2003 EPA rationale
Limestone Branch Watershed	A03R	E. Coli	-	Final report	07/06/2004 EPA rationale
Piney Run Watershed	A01R	E. Coli	-	Final report	07/06/2004 EPA rationale

The Catoctin Creek TMDL study was followed with an Implementation Plan (IP). The creek was first listed as impaired in 1996. The final TMDL was published in 2002. The Catoctin Creek IP includes implementation of the agricultural component of the Catoctin Creek TMDL Implementation Plan and is being funded annually with 319 Grant funds from DCR to LSWCD to work specifically with landowners in the Catoctin Creek watershed. Landowners in this watershed are provided financial and technical assistance for the installation of targeted agricultural bmps, and education programs that encourage landowners to exclude livestock access to Catoctin Creek and its tributaries. The LSWCD is now entering their second five-year grant with DCR to continue these efforts. To date, approximately $79,000 of cost share money has been used on 22 properties within the watershed.

Grant funding is available for the correction of fecal coliform contributions from both livestock and failing onsite wastewater treatment systems. The U.S. Environmental Protection Agency (EPA) with the Virginia Department of Conservation and Recreation (DCR) provides grant money to homeowners to pay for a percent of repairs and upgrades to existing individual wastewater systems, the program is administered locally by the Loudoun County Department of Health. A total of 20 systems have been repaired or upgraded in the watershed to date using approximately $165,000 in grant monies.

6 Citizen Stream Monitoring:

6.1 Loudoun Wildlife Conservancy (LWC) and Loudoun Watershed Watch (LWW)

The Loudoun Wildlife Conservancy (LWC) and has been collecting macroinvertebrate samples at 16 stations since the late 1990's. The LWC and data from other groups were compiled by Loudoun Watershed Watch (LWW) in the 2002 and 2005 State of the Streams Reports. The other groups include Loudoun Soil & Water Conservation District, North Fork Goose Creek Watershed Project, Audubon Naturalist and others. Data are available in report format and summary scoring has been input into GIS. Multiple measurements are available for most sites. Data include 249 benthic macroinvertebrate and 217 habitat assessments using the Audubon Naturalist protocols. Starting in 2008, LWC changed to using the VA SOS protocol.

6.2 Goose Creek Association (GCA)

The volunteers of Goose Creek Association conduct stream assessment using VA SOS methodology at 20 locations, mostly in Fauquier County, although some are in Loudoun County.

6.3 Catoctin Watershed Project (CWP)

In support of the Catoctin Creek TMDL Implementation, the Loudoun Wildlife Conservancy (LWC) volunteers have collected over 700 E. Coli samples at 14 stations in the Catoctin watershed between Lovettsville and Purcellville. Data are posted on web at Loudoun Watershed Watch (LWW) and used to constructed GIS layer with over 50 measurements per station.

6.4 Ashburn Pond (Student)

Several ponds in Ashburn have been monitored at fourteen locations for basic water parameters on a monthly basis since 2004. Measurements are in-field (LaMotte) and stored as Excel tables. Site locations coordinates are available.

6.5 EarthForce

In conjunction with several High Schools, Earth Force has collected about a dozen samples throughout the County in the fall 2005 and fall 2006. Water analysis includes: pH, turbidity, nitrate, phosphate, suspended solids, and E. Coli. Lab work was performed by Fairfax Water Authority. This data has not yet been compared with DEQ station data.

7 Basemap:

7.1 Loudoun Drains and Water

At a scale of 1:2,400, the creek, stream ponds and drainage swales are mapped in GIS. Data has been updated using 2005 in western Loudoun and 2004 in eastern Loudoun. The drainage network is generally cartographically correct, though not ready for construction of a geometric network. All streams greater than 10 feet wide are mapped as polygons with stream centerlines arcs. Over 3,200 farm ponds with areas greater than 1/10 acre are mapped. Data is current as of 2005/2004 in western/eastern Loudoun.

7.2 Loudoun 3D Drains

In addition to drains, three-dimensional GIS shapefiles of the "drains" include the Z or elevation at all vertexes in the polyline layer. Elevation values are generally accurate to +/- 0.1 feet.

7.3 Loudoun Historic Drains

The historic or preconstruction drainage GIS layer, mapped similar to "drains". The reaches are assigned a hydrologic attribute of alluvium, perennial, intermittent and not classified. This is not a complete drainage network and drains occasionally cross. The layer is maintained to be consistent with the "soils" layer. This data is helpful in understanding post construction wet basement problems.

7.4 Loudoun Topography

At 1:2,400 scale, 5-foot topography contours are mapped with null sections for buildings and roads. Data is current as of 2005/2004 in western/eastern Loudoun. There is no equivalent DEM or DTM, though these formats are anticipated later in 2008.

7.5 Loudoun Stormwater Infrastructure

A field survey of the stormwater infrastructure includes 46,000 inlets and pipe outfalls. There are over 600 miles of pipe and culvert. In support of maintenance, the GIS data include detailed specifications such as material type, size, flow direction and maintenance condition. The outfalls are snapped to the "drain" GIS layer. The inventory is supported by several photo libraries.

7.6 Loudoun Soil and Water Conservation District Agricultural BMPs

During the past 20 years, the LSWCD has worked with landowners to install agricultural best management practices (BMP stream fencing, alternate water systems, cover crops hardened crossings, etc.) to minimize non-point source pollution from agricultural sources in Loudoun County. Technical and financial assistance is available to landowners from the Virginia Agricultural BMP Cost-Share & Tax Credit Program and the USDA-Conservation Reserve Enhancement Program (CREP). Data though 2005 has been obtained through VA DOF. Data for Ag BMP in Catoctin watershed 2005-2008 have been obtained. In the Catoctin Watershed, data on the

corrective actions performed by the Health Dept on private sewage disposal system has been obtained (2006-2008).

7.7 Loudoun County Sanitation Authority

The LCSA maps the water and sanitary in GIS. Data is primarily in eastern Loudoun and includes 50,000 water connection nodes, 17,000 sanitary sewer nodes, 650 miles of water lines and 838 miles of water lines. Tables include basic structural information. The geodatabase was restructured in 2007 and last updated in June 2007.

7.8 DC WASA

The Potomac Interceptor sanitary sewer line runs form Dulles airport north to the Potomac and also along Surgarland Run, eventually to the Blue Plains wastewater treatment plant in Washington DC. There are approximately 16 miles of pipe in GIS format. **{Restricted data}**

7.9 Virginia Conservation Lands Needs Assessment (VCLNA)

A statewide land use classification files have been obtained.

7.10 Virginia Department of Forestry Conservation Lands and Easements

The VFOD maps conservation easements and riparian buffer projects files have been obtained.

7.11 Orthoimagery

Loudoun County has numerous orthoimagery available for use in the GIS.
These include:

Digital Orthoimage 2007 B&W
Digital Orthoimage 2005 B&W
Digital Orthoimage 2004 B&W (Partial – eastern Loudoun)
Digital Orthoimage 2002 Color (VGIN)
Digital Orthoimage 2003 Color Infrared (CIR - Partial)
Digital Orthoimage 1957 B&W Soils
Digital Orthoimage 2006 Color UDSA/NRCS NAIP (partial, lower quality)
Digital Orthoimage 2005 Color leaf-on Aerial Express (not on-line, requires 9.2)
Digital Orthoimage 1937 B&W (In preparation as of Sept 2008)

7.12 DCR Land Use/Land Cover

The Dept Recreation and Conservation map land use. GIS files have been obtained.

7.13 USGS NLCD Land Use/Land Cover

The US Geological Survey offer land use classification. At present only eastern Loudoun County has been produced with the remainder soon to be posted on-line. Available files have been obtained.

7.14 Regulatory Stream Designations

Loudoun County has two scenic rivers, Catoctin and Goose Creek. These are mapped using arcs at several scales by Dept Recreation and Conservation (DCR) and by Loudoun County Office of Mapping. The arcs are buffered by 300 feet for zoning overlay analysis.

7.15 DCR Natural Heritage Screening

DCR maintains a natural heritage GIS layer, available though on-line web mapping via a subscription service. Loudoun County also received these data, subject to restrictions. "Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, rare or state significant natural communities or geologic sites, and similar features of scientific interest. DCR maintains a data system that is the most comprehensive and up-to-date repository of natural heritage resource information available. Information on potential impacts to natural heritage resources is crucial to a comprehensive environmental assessment of proposed developments or activities. "

8 GIS Zoning Overlays, Analysis and Models

8.1 Floodplain Overlay

The floodplain boundary includes the digital floodplain map of FEMA (DFIRM), as approved in July 2001. Additional to the floodplain layer include recent flood studies and floodplain alterations and do not necessarily edge match to the DFIRM.

The regulatory floodplain boundary reflects the limits of flooding resulting from a storm having an occurrence probability of 1%, identified as the 100 year storm. The floodplain boundary was recompiled from the listed sources onto the County's 1:2400 scale maps with five-foot interval topography.

Floodplain data is used to establish a Floodplain Overlay District (FOD) as defined in the Zoning Ordinance of Loudoun County, which restricts the allowable uses within the regulatory floodplain. Data is used to establish flood risk factors and eligibility to participate in the National Flood Insurance Program. Floodplain data are also used in land use planning and for taxation of land.

8.2 Mountainside Overlay

The Mountainside Development Overlay District is a zoning overlay district administered by the Department of Building and Development. Mountainside classifications are based upon the following criteria: critical elevation, soils, slope, and forest values. Critical elevation areas are determined from the County's digital topography, soil and slope values are based upon data the County's soil layer and digital forest data. For more information consult the metadata for those layers.

8.3 Limestone Overlay

The limestone overlay is an area represented by the Limestone Conglomerate Overlay District (LOD) is generally east from the Catoctin Mountain Range to the Potomac River (excludes Lost Corner), and from Leesburg north to Point of Rocks, MD. The LOD is a zoning overlay district administered by the Loudoun County Department of Building and Development. The Department is responsible for all development approvals, review procedures, modifications and density calculations in the LOD as governed by Article VI, "Development Process and Administration", of the Revised 1993 Zoning Ordinance, and procedures in Chapter 8 of the Facilities Standards manual.

The LOD is comprised of all or portions of the following geologic formations: Cf-Frederick Limestone, Ct-Tomstown Dolomite, JTRc-Catharpin Creek Formation, JTRcg-Catharpin Creek Formation Goose Creek Member, TRbl-Balls Bluff Siltstone Leesburg Member, and TRbs-Balls Bluff Siltstone Fluvial and Deltaic Sandstone Member.

NOTE: The Circuit Court of Loudoun County issued an opinion dated March 30, 2004 ruling that the Limestone Conglomerate Overlay District (LCOD) is void. The March 30, 2004 decision may be the subject of an appeal.

Purpose: The land area delineated by the boundaries of the LOD is comprised of limestone and "Karst terrain" areas. The terrain is also characterized by the presence of certain natural features, such as sinkholes and rock outcrops. Thus, development on Karst terrain has a direct correlation to the potential for collapse and ground slippage and the susceptibility of groundwater and surface water pollution, and spring contamination, posing serious risks to public health, safety and welfare. The provisions of Section 4-1900 of the Revised 1993 Zoning Ordinance are intended to regulate land use and development in areas underlain by limestone and in areas with Karst features and terrain as shown on the official Limestone Conglomerate Overlay District Map of Loudoun County.

8.4 Steep Slopes Overlay

The Steep Slope layer identifies areas with a slope greater than 15% in Loudoun County. Steep Slope assists in identifying steep slope areas. Improper uses and disturbances in steep slope areas cause erosion, result in structural failure of structures and roads, and lead to downstream flooding and other hazards.

8.5 River and Stream Corridor Overlay

The Circuit Court of Loudoun County issued an opinion dated March 30, 2004 ruling that the River and Stream Corridor Overlay District (RSCOD) is void. The Floodplain Overlay District (FOD) and the Scenic Creek Valley Buffer regulations in effect prior to adoption of the RSCOD on January 6, 2003, will apply in the administration of zoning regulations. The March 30, 2004 decision may be the subject of an appeal.

The River and Stream Corridor Overlay District (RSCOD) was created in the 2001 Comprehensive Plan. It was created to protect corridor resources, including water quality, aquatic and wildlife habit, and scenic value.

RSCOD is composed of:

a. Rivers and streams draining 100 acres or more

b. 100-year floodplains (includes major and minor)

c. adjacent steep slopes (25% or greater), starting within 50 feet of streams and floodplains but extending no further than 100 feet beyond

d. 50-foot management buffer around steep slopes and floodplain

e. 100-foot buffer measured from the scar line on both sides of streams that drain 100 acres or more

f. 300-foot buffers around state designated scenic rivers (Goose Creek, Bull Run, Catoctin Creek from the bridge at Route 698 at Waterford to the Potomac River); the Potomac River, and County reservoirs (Beaverdam and Goose Creek) the originating stream or floodplain

8.6 Wetlands Model(s)

Loudoun County has developed models to predict wetlands, under a grant from the United States Environmental Protection Agency. The model incorporates several sources of information and data available to the County to produce a weighted estimation of the presence of actual wetlands. Data inputs to the model include hydric soils, drainage, points for wet spots, marshes and springs, water bodies, slopes and National Wetlands Inventory. There are separate Wetlands model for the eastern and western Loudoun.

8.7 Impervious Surface Analysis

Using the basemap layers of roads and building, a composite feature class of "impervious surface" has been developed based on March 2005 conditions. Future refinements may include use of data for sidewalks and other impervious features not currently included.

8.8 Alternate Wastewater Disposal Potential Analysis

Using the soils classification table, areas favorable and unfavorable for alternate wastewater disposal sites are identified. The soils have been classified according to their soil mapping unit into the categories of no potential, spray irrigation, shallow-placed drip / alternative drain fields or conventional gravity and low pressure systems. This classification is an interpretation based on the soil mapping unit and its' basic characteristics.

8.9 Groundwater Recharge Analysis

Using the soils classification table, areas of groundwater recharge are mapped. Soil polygons are classified as being discharge areas, or having moderate to high or low to moderate recharge potential. This classification is an interpretation based on the soil mapping unit and its' basic characteristics.

8.10 LID Infiltration Potential Analysis

Using the soils classification table, areas of favorable low impact development (LID) infiltration are mapped. Classifications for infiltration potential include good, fair, poor, very poor, no potential or water. This classification is an interpretation based on the soil mapping unit and its' basic characteristics.

8.11 Open Space

The open space feature class contains permanent open space easements for Loudoun County. The open space feature class is utilized for taxation, planning and in the Purchase of Development Rights (PDR) Program (no longer in existence).

8.12 Planned Land Use

The planned land use feature class is a general reference relating to authorized land use. The data is used extensively by the Planning and Building and Development departments. The data layer is administered by the Planning and Development office.

8.13 Agricultural Districts

This data set identifies properties that participate in and are part of Agricultural overlay districts according to State enabling legislation per the Virginia State Code, Chapter 43, Section 15.2, Agricultural Districts. Economic Development administers the County's Agricultural District program. A parcel is not the smallest unit within an Agricultural District. A portion of any parcel can be in or out of a district, through appropriate reviews, without an official subdivision. This layer identifies properties within each of the Agricultural Districts, which are used by participants to preserve farmland and open space through parcel subdivision restrictions. Each Agricultural District has unique terms and subdivision restrictions.