

What is the Big Dry Creek Watershed Association?

The Big Dry Creek Watershed Association (BDCWA) is a non-profit corporation consisting of individuals and entities who dedicate time and resources to developing a sound scientific understanding of water quality, flow, aquatic life and habitat conditions in the Big Dry Creek watershed and act to improve these conditions.

The Big Dry Creek Partnership, which included the City and County of Broomfield, the Cities of Northglenn and Westminster, and Rocky Flats Environmental Technology Site (RFETS), founded the BDCWA in 1997. These entities have been heavily involved in monitoring stream conditions for many years. Since 1997, the Association has expanded to include representatives from other cities, counties, farmers, ditch companies, citizens and regulatory and resource agencies. The BDCWA is open to those interested in cooperatively working towards understanding and prioritizing efforts to improve basin conditions.

In 2004, the BDCWA formed a non-profit corporation with a Board of Directors consisting of representatives

of the Cities of Westminster, Thornton and Northglenn, the City and County of Broomfield, Weld County and Adams County. Activities of the BDCWA during the last ten years have been funded through the contributions from these entities, as well as the U.S. Department of Energy, the Woman Creek Reservoir Authority, the Colorado Water Conservation Board, the U.S. Environmental Protection Agency's 319 program (as administered by the Colorado Department of Public Health and Environment) and the Regional Geographic Initiative grant program.

For more information on the Big Dry Creek Watershed Association, please visit The BDCWA's web page at www.bigdrycreek.org or contact Jane Clary, Watershed Coordinator, Wright Water Engineers, Inc., 303-480-1700 or clary@wrightwater.com.



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STATE OF THE WATERSHED

Newsletter of the Big Dry Creek Watershed Association

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Big Dry Creek Watershed Association Celebrates 10 Years of Working Together

In June, the Big Dry Creek Watershed Association Board of Directors celebrated a ten-year milestone with lunch, cake and surprise visits from some of its founding members. Much has changed in the watershed in the past ten years—Rocky Flats was still known as the former nuclear weapons facility on the Superfund List when the group started and now it is a wildlife refuge. The area surrounding the Broomfield Water Treatment Facility was open fields in 1997; now it is a booming residential community.

Amidst these changes, the BDCWA Board has continued to work cooperatively on tough water quality and hydrologic issues that cross jurisdictional boundaries. While some issues are beyond the control of a voluntary organization, BDCWA has worked to increase awareness, further develop scientific data, and facilitate respectful dialogue. A few key accomplishments include:

- Special studies to explore sources of selenium and bacteria in the watershed.
- Completion of a hydrologic study in the lower watershed and integration of findings into regional stormwater planning efforts.
- Long-term monthly water quality monitoring at 11 locations for a broad suite of constituents including metals, bacteria, nutrients and physical parameters.
- Long-term biological monitoring, including fish, benthic macroinvertebrates, artificial substrate sampling, and fish tissue analysis.
- Annual water quality data analysis and data sharing with interested parties, including the Water Quality Control Division.

BDCWA looks forward to many more years of working together and thanks those that have invested in the first 10 years!



Pictured from left to right: Mary Fabisiak, City of Westminster; Robin Byers, Attorney; John Stover (formerly U.S. Department of Energy); Kelly Cline, City of Westminster; David Carter, City of Westminster; Hallie Mahan (formerly City and County of Broomfield); Bob Fiehweg (formerly RMRS/Rocky Flats), Laura Hubbard, City and County of Broomfield; Lesa Julian, City and County of Broomfield; Chris Crowley, City of Thornton; Vic Lucero, City of Thornton; Jane Clary, Wright Water Engineers; Shelley Stanley, City of Northglenn. (Board Members Not Pictured: David Bauer, Weld County and Kelly Hargadin, Adams County).



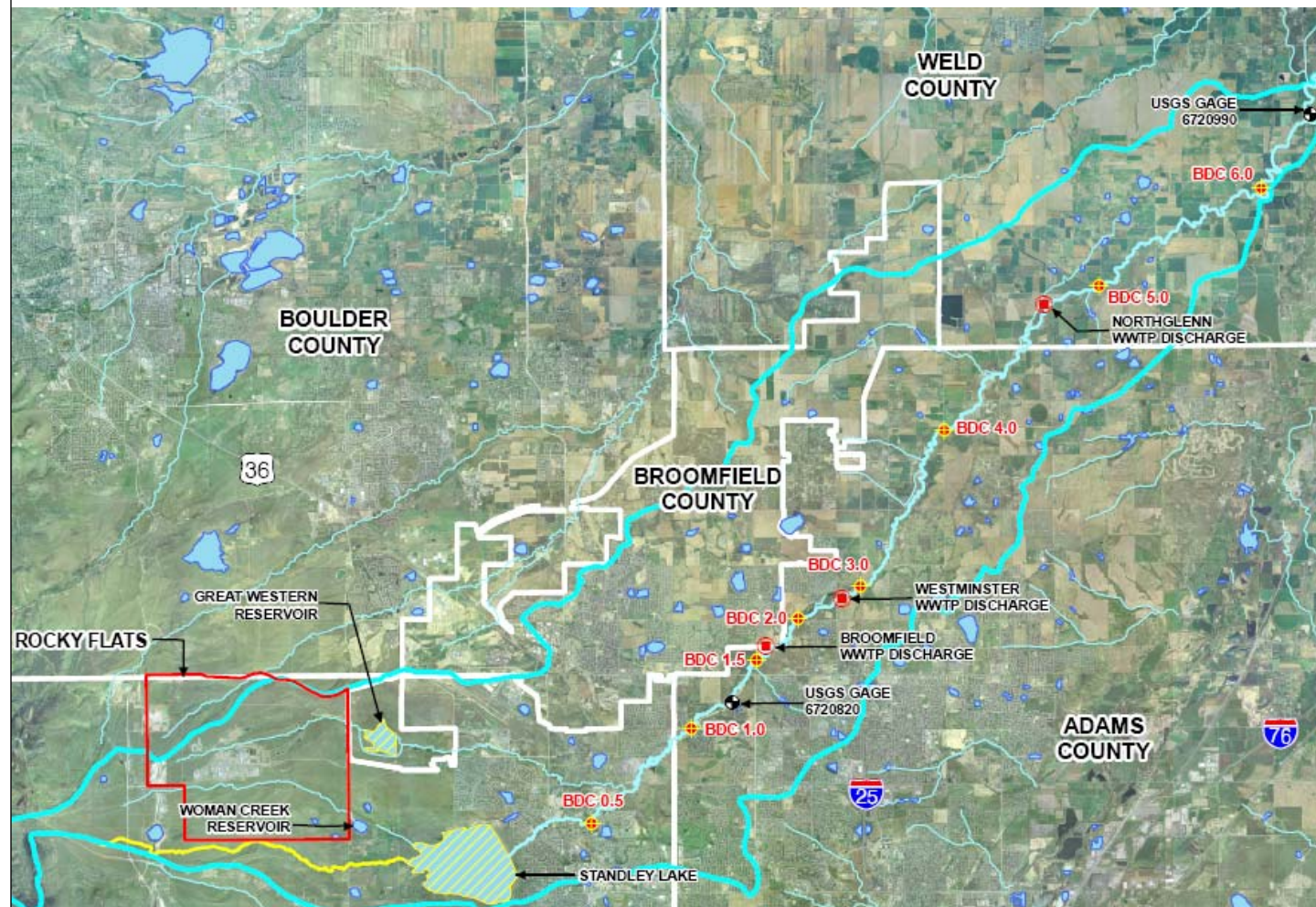
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All Watershed Association general membership meetings are open to the public.

For More Information on the Next Watershed Meeting, contact Jane Clary: 303-480-1700 or visit our website:

www.bigdrycreek.org



The Big Dry Creek Watershed covers 110 square miles from Rocky Flats to its confluence with the South Platte River near Fort Lupton. Monitoring locations are designated as "BDC" on this map.

Big Dry Creek Water Quality Analysis Results for 2006

During 2006, Broomfield, Northglenn, Thornton and Westminister worked together to collect water quality and flow data along the main stem of Big Dry Creek (see map). Water quality samples were analyzed for a variety of constituents, resulting in over 4,800 records being added into the Big Dry Creek Watershed Association (BDCWA) database. Metals were monitored on a quarterly basis with the exceptions of iron and selenium, which were monitored monthly. All other constituents were monitored on a monthly basis. The local governments and BDCWA also helped to fund operation of the U.S. Geological Survey (USGS) gauging station at Westminister behind Front Range Community College.

Attainment of State stream standards is evaluated based on comparison of specific statistical values to chronic stream standards and determining whether acute standards are exceeded in any samples. For most constituents, the relevant statistic for comparison to the chronic standard is the 85th percentile value. Representative exceptions include use of the

50th percentile value for metals with standards in the total recoverable form, the geometric mean for *E. coli*, and the 15th percentile value for dissolved oxygen (DO). From a regulatory perspective, five years of data are used to assess attainment of stream standards.

Segment 1 (the main stem) of Big Dry Creek is listed on the 2006 303(d) List for Colorado for non-attainment of stream standards for fecal coliform, *E. coli* and selenium. The Colorado Water Quality Control Commission (CWQCC) has assigned a temporary modification to the stream standard for each of these constituents. Additionally, a portion of the stream downstream of the Weld County line is listed on the Monitoring and Evaluation (M&E) portion of the 303(d) list for total recoverable iron.

Based on review of the 2006 BDCWA data set, a summary of findings for 2006 includes:

E. coli Work Group Forms

Roughly 25 stream segments throughout Colorado are currently identified as "impaired" by elevated *E. coli* on Colorado's 303(d) list. Watershed groups, local governments, regional planning agencies, and the Water Quality Control Division are working to address this statewide issue. For these entities to successfully work towards restoration and/or realistic goal setting for watersheds designated as "impaired" by elevated *E. coli*, they need to be equipped with a sound understanding of *E. coli* sources, control methods, monitoring approaches to properly identify sources, and factors that affect *E. coli* viability. If these subjects are not properly understood, then effective, practical plans to manage and protect watersheds and address *E. coli* 303(d) listings cannot be developed.

Through the vision of participants in the Water Quality Forum, an *E. coli* Work Group has been formed to work collaboratively on a voluntary basis to address the multi-faceted issues associated with these *E. coli* issues. Jim McCarthy of the City of Arvada is coordinating the statewide work group under the umbrella of the Water Quality Forum. In June, Becky Anthony of the Water Quality Control Division agreed to serve as the Work Group chairperson.

The participants in the Work Group are active in nearly ten different local watershed organizations that are facing *E. coli* 303(d) listings or concerns. Misconceptions regarding *E. coli* sources and control strategies are common. This poses challenges to watershed groups trying to identify and reduce sources of *E. coli* and/or set realistic goals for 303(d) listed

streams. Local government and watershed group resources can be wasted on ineffective monitoring and source reduction strategies.

The *E. coli* Work Group proposes to develop a sound base of technical information regarding *E. coli* and recommend approaches to identify and reduce *E. coli* sources, set realistic *E. coli* reduction (or management) goals, and conduct effective monitoring. The Work Group plans to build on lessons already learned in Colorado, as well as build upon national guidance and experiences, such as those discussed by the Pellston Experts Scientific Work Group sponsored by EPA (www.epa.gov/waterscience/criteria/recreation/).

The Work Group's efforts will benefit locally based watershed groups, while laying a foundation for a consistent statewide approach and/or continued dialogue with those tasked with protecting the State's waters. The Work Group recognizes that it will not be able to address all of the challenging issues associated with elevated *E. coli*; however, it believes that this is a much-needed effort to raise the bar on scientifically based decision-making with regard to *E. coli* in Colorado.

For more information on the work group, see www.cwqf.org/Workgroups/ecoli.asp or contact Coordinator Jim McCarthy (jim-m@arvada.org) to be placed on the Work Group email list.

Biological Monitoring Results to Be Released This Summer

BDCWA initiated a biological monitoring program on Big Dry Creek in 1997 and remains committed to biological monitoring on Big Dry Creek. The program has transitioned from an annual monitoring in the spring and fall to a biannual program. The program was originally supported in large part under grants from EPA and cooperative agreements with the U.S. Department of Energy and has most recently been possible due to support from the Woman Creek Reservoir Authority. The current program includes benthic macroinvertebrates and fish collection at seven monitoring locations corresponding to a subset of the instream water quality sample locations. Additionally, fish tissue sampling and analysis has also been conducted for selenium at certain locations. A habitat assessment is also completed to track changes in habitat conditions along the creek.

Later this summer, Aquatics Associates will be delivering a report that summarizes the 2006 analysis results and compares these to previous years findings. This report will be available in PDF for download from the Big Dry Creek website (www.bigdrycreek.org) in August.



Beaver dam in background on Big Dry Creek in Westminister Open Space. Multiple beaver dams on Big Dry Creek made biological sampling during 2006 challenging.

Regulatory Updates

Federal and state Water Quality Standards continue to evolve, with several changes having potentially significant impacts on wastewater dischargers to Big Dry Creek. Highlights of a few of the regulatory changes in progress follow.

Ammonia

Stream standards for ammonia on Big Dry Creek are undergoing changes. In June 2005, the CWQCC adopted revised ammonia criteria for the Basic Standards based on EPA's 1999 *Update of Ambient Water Quality Criteria for Ammonia*. The new criteria are in the form of total ammonia and are more stringent for warm water streams. During the March 13, 2007 Rulemaking Hearing, the CWQCD proposed temporary modifications to WWTP discharge permits, including those for the Broomfield, Westminster and Northglenn, to remain at the "old" ammonia standard until December 31, 2011. This proposal was based on the CWQCC's acknowledgement that there is substantial uncertainty regarding the appropriateness and cost of compliance with the new criteria. The temporary modification allows time to reassess what standards are appropriate on a site-specific basis and also provides dischargers additional time to address treatment facility modification that may be needed. Dr. Bill Lewis at University of Colorado is conducting a more detailed analysis of the total ammonia standards for the wastewater dischargers on Big Dry Creek.

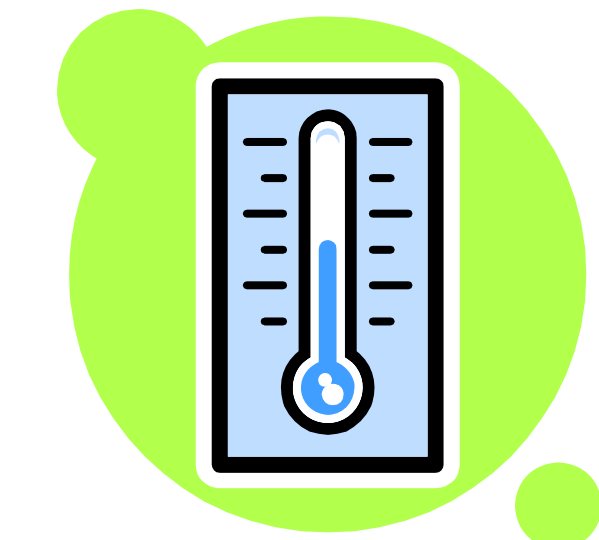
Temperature

At the January 2007 CWQCC Rulemaking Hearing, the CWQCC adopted new temperature standards that took effect on July 1, 2007. Because Big Dry Creek is in the South Platte River Basin in a warm water stream, temporary temperature standards of 30 degrees Celsius will be in place until December 31, 2009; however, much more restrictive standards will potentially apply in the future, with potential implications for WWTP discharges on Big Dry Creek. More detailed analysis of the implications of the temperature standards will be needed in the future due to potentially significant implications to WWTP dischargers on the creek. Additional temperature monitoring will likely be needed in the vicinity of the WWTP discharges on Big Dry Creek, along with an integrated review of fish sampling conducted to date on Big Dry Creek.

The City and County of Broomfield is installing new gaging stations on Big Dry Creek and has offered BDCWA the opportunity to install water quality probes in these stations. BDCWA is considering installing temperature probes to obtain more robust temperature data for the creek.

Nutrient Criteria

In October 1997, a Clean Water Action Plan (CWAP) was initiated by EPA to address nutrient over-enrichment in the



nation's surface waters. The CWAP includes the development of water quality nutrient criteria as one of its components. The CWAP called for the development of region-specific nutrient criteria for different types of water bodies, to account for the wide natural variation in nutrients that is found around the country. As a result, the Colorado CWQCD is working to develop nutrient criteria appropriate for Colorado lakes and streams and released a Nutrient Criteria Development Plan in 2002

(www.cdphe.state.co.us/op/wqcc/Guidance/nutcritplan.pdf).

The CWQCD is currently working on a development approach for nutrient criteria for rivers and streams that seeks to link aquatic life use support with nutrient levels (in terms of nitrogen and phosphorus). This approach differs somewhat from that initially recommended in the 2002 work plan. The indicator of use support that the Division is investigating is the multi-metric index (MMI) for macroinvertebrates, developed by the Refined Aquatic Life Use effort. Investigations will explore the relationship of nitrogen and phosphorus levels (the causal variables) to the MMI score (the response variable). The Division is actively seeking data to support its effort.

The second component of the nutrient criteria effort focuses on lakes and reservoirs. The Water Quality Forum's Nutrient Criteria Work Group is playing a significant role in this effort (www.cwqf.org/Workgroups/Workgroup.htm) and has suggested an alternate approach to developing criteria for lakes and reservoirs that includes special standards for lakes and reservoirs directly used for drinking water supplies. The standard proposed by the work group would be based on chlorophyll-a.

Both the streams/rivers and lakes/reservoirs nutrient criteria continue to evolve and the CWQCD and Water Quality Forum websites listed in this article should be visited to obtain the most current information on these efforts.

- Segment 1 of Big Dry Creek does not attain the currently assigned acute or chronic standards for dissolved selenium at bdc1.5 downstream of Front Range Community College. Although the stream segment as a whole attained the temporarily modified chronic stream standard for dissolved selenium, it did not meet the underlying chronic standard at any monitoring location on the stream except at the upstream-most location (bdc0.5).
- Although the overall stream segment met the temporarily modified fecal coliform and *E. coli* standards, the stream slightly exceeded the underlying (unmodified) *E. coli* standard. The geometric mean concentrations of *E. coli* for the past five years exceeds the underlying stream standard at all locations on the stream except for bdc1.0 and bdc4.0.
- Total recoverable iron met the stream standard at all locations during 2006; however, the five-year 50th percentile value of 1.17 exceeds the stream standard of 1 mg/L at bdc6.0.
- One sample at bdc6.0 in the agricultural area had mercury above the acute standard; however, this site does not have a history of detections of mercury. This site will continue to be observed for trends.
- Due to uncertainty related to the regulatory status of the new total ammonia standard, compliance with this standard was not assessed. The stream continues to comply with the pre-2006 unionized ammonia standard.
- All other constituents attained the stream standards during 2006.

As a general note, the Big Dry Creek monitoring program is an ambient-based program. Nine of the twelve sampling dates occurred during dry weather conditions, with three sampling events within a day following rain or snow in March, May, and October. The July and September sampling events occurred several days after precipitation events and may represent conditions under the descending limb of the hydrograph.

The remainder of this article highlights some of the findings for specific constituents of long-term interest to BDCWA, including selenium, *E. coli*, and total recoverable iron.

Selenium

Dissolved selenium concentrations during 2006 exceeded the underlying chronic stream standard of 4.6 µg/L at all locations on the creek except for bdc0.5 (below Standley Lake), based on comparison of the 85th percentile value at each monitoring location to the stream standard. The 85th percentile value met the temporary modification to this standard of 11 µg/L, which was assigned by the CWQCC in 2004, at all locations except bdc1.5 downstream of Front Range Community College. Two exceedances of the acute dissolved selenium standard also occurred at bdc1.5 during January (21 µg/L) and February (19 µg/L).

During 2003 through 2005, similar trends were present on the

stream. Seasonal variation in selenium concentrations was evident during 2006 with lower concentrations during the irrigation season (May-October) and higher concentrations during the non-irrigation season (November-April).

During 2005-2006, the BDCWA worked to develop a better understanding of selenium sources in the watershed and provided a technical memorandum to the Colorado Water Quality Control Division (CWQCD) regarding study findings in December 2006. BDCWA requested an ambient based standard for selenium based on these study findings. The 2006 sampling results for selenium remain consistent with the technical memorandum provided to CWQCD.

Iron

Total recoverable iron concentrations during 2006 attained the stream standard of 1 mg/L based on the 50th percentile value for the overall stream. Nonetheless, about 20 percent of the samples collected (i.e., 18 out of 96 samples) exceeded the standard, with the elevated concentrations generally corresponding to a precipitation event in March and several days after an event in September. Total recoverable iron and total suspended solids were well correlated to each other, as has been the case in previous years.

As previously noted, the CWQCD placed Segment 1 of Big Dry Creek on the Monitoring and Evaluation List because one location on the stream, bdc6.0, does not meet the stream standard. The 50th percentile value for 2002 through 2006 at bdc6.0 is 1.17 mg/L, exceeding the stream standard. Although the highest concentrations (5-13 mg/L) over the past five years at bdc6.0 occurred during the April to July time period and are believed to be associated with sediment loads associated with summer storm events and irrigation activities, concentrations at this site have historically been elevated above the standard throughout all months of the year, even in the absence of these activities, based on previous analysis. The stream in the lower watershed is actively eroding and has unstable banks in multiple locations based on 2005 field visits. Iron that naturally occurs in the streambank soils is expected to be the probable source of elevated iron in the lower watershed.

Bacteria

Based on review of geometric mean concentrations during the past five years (see graph), the following observations are noteworthy:

- Relative to the overall data set, geometric mean concentrations for *E. coli* are the lowest in grab samples from the Broomfield and Westminster wastewater treatment plant (WWTP) effluent. For the five-year time period, wastewater grab samples were well below the stream standard. For this reason, elevated geometric mean concentrations at in-

(Continued on page 5)

Eagle Scouts Launch Watershed Protection Projects

Over the past year, BDCWA has worked to identify and better understand potential sources of *E. coli* in the Big Dry Creek Watershed. One potential source of *E. coli* that BDCWA has identified is animals: both wildlife living in the open space corridor and domestic animals frequenting the bike path along the creek. In August, Boy Scout Troop 98 of Westminster/Thornton, under the direction of Scout Leader Chris Crowley, plans to spend a day observing and documenting wildlife present along the creek. The scouts will be stationed throughout the Open Space along the bike path between Front Range Community College and I-25 to observe and document wildlife and pets along the creek. The photos and field notes will assist BDCWA in developing a sense of the types and extent of wildlife along the stream. The scouts are also planning to complete a report describing the animals' life cycles/habits, provide their field notes, and map locations of beaver dams and other areas with direct animal contact with the creek. The scouts also envision a tri-fold nature guide to Big Dry Creek.



Troop 98 scouts and parents in the planning stages for the Big Dry Creek projects.

In addition to helping document conditions along Big Dry Creek, Troop 98 will also be proactively helping to educate the public on ways that they can help reduce pollution in Big Dry Creek. The scouts will be installing 35 "Drains to Stream" markers on storm sewer inlets, picking up trash along a section of Big Dry Creek in Thornton, and passing out roughly 500 door knob flyers educating residents on measures that they can take to reduce pollution. The scouts will be working with the City of Thornton's Stormwater Co-

ordinator, Al Quintana, on this project in subdivisions bordering Big Dry Creek.

The two projects planned by Troop 98 are compatible with the Boy Scouts of America's Save Our American Resources ("SOAR") program. BDCWA appreciates the Troop 98's investment in the Big Dry Creek Watershed. If you see the scouts and their parents out on the creek in August, be sure to thank them for their efforts!

It's Official! Rocky Flats is Now a National Wildlife Refuge

On July 12, 2007, the U.S. Fish and Wildlife Service (USFWS) announced the establishment of the Rocky Flats National Wildlife Refuge. Nearly 4,000 acres of the former defense site, located in the headwaters of the Big Dry Creek watershed, was transferred by the U.S. Department of Energy to the USFWS following an extensive process to clean up contamination from nuclear weapons production at the site. Rocky Flats will be administered by the USFWS as a unit of the National Wildlife Refuge System, the nation's premier network of lands and waters managed for the conservation of fish, wildlife, plants and their habitats.

The Rocky Flats National Wildlife Refuge Act of 2001, which was sponsored by Senator Wayne Allard and Representative Mark Udall, designated the future use of the site as a national wildlife refuge. Physical completion of the Rocky Flats cleanup was achieved by Department of Energy in late 2005, and regulatory closure of the cleanup was achieved in September 2006. Earlier this year, the U.S. Environmental Protection Agency, with concurrence from state and local public health agencies, removed Rocky Flats from the national list of "Superfund" sites, thus certifying the cleanup as

complete and paving the way for the transfer of the site from DOE to the USFWS and the establishment of the refuge.

In 2005, the USFWS completed a comprehensive conservation plan and associated environmental impact statement for the refuge that creates a management framework for the next 15 years. The plan, which was developed over a three-year period that included extensive public involvement opportunities, emphasizes wildlife and habitat conservation with a moderate amount of wildlife-dependent public use. Pursuant to the plan, public use will increase gradually over the 15-year life of the plan, as resources become available.

Refuge-wide habitat conservation will include management of xeric tallgrass and native plant communities, as well as weed control, removal and revegetation of unused roads and stream crossings, management of deer and elk populations and black-tailed prairie dog colonies, and protection of habitat for the Preble's meadow jumping mouse, a species listed as threatened under the federal Endangered Species Act.

For more information, go to www.fws.gov.

Water Quality Analysis Results for 2006 (cont.)

(Continued from page 3)

stream locations below the discharges cannot be attributed to WWTP discharges during the vast majority of the sampling events.

- The highest concentrations of *E. coli* are present in the Open Space near 128th Ave. The five year geometric mean exceeds the temporarily modified standard of 401/100 mL at this location, whereas all other locations on the creek meet the modified standard. The underlying standard of 205/100 mL is exceeded by the geometric mean for the five-year period at each site for all locations except bdc4.0.
- During 2006, *E. coli* concentrations were higher than typically observed at upstream open space locations bdc1.0 and bdc1.5. In general, it appears that concentrations at these locations are increasing. An increase in beaver activity and dams has been noted in this area by Westminster Parks staff, Aquatics Associates, and city field staff in this area. In recent guidance from the U.S. Environmental Protection Agency (EPA) and the American Water Works Association (AWWA) (2006), beavers have been identified as a significant source of pathogens.
- Multi-year data plots show that the drought conditions in 2002 continue to show the highest *E. coli* concentrations at each monitoring location.
- Seasonal variation is evident for 2006, which is consistent with previous analyses conducted by BDCWA that

showed elevated *E. coli* in the summer and lower *E. coli* in the winter.

During 2007, BDCWA has embarked on follow-up source identification studies for *E. coli*. This study is being conducted in addition to routine monitoring that will continue.



Becky Sturgeon and Diana Beehler from the City and County of Broomfield and Brian Donahue and Tara Elrod (not pictured) from the City of Westminster have been conducting dry weather outfall screening to determine whether illicit discharges may be present that contribute to elevated *E. coli* in the stream.

Big Dry Creek *E. coli* Geometric Means (2002-2006)

