STATE OF THE WATERSHED

Annual Newsletter of the Big Dry Creek Watershed Association

December 2017 Volume 19

Big Dry Creek 2016 Water Quality and Biological Monitoring Review

A key focus of the Big Dry Creek Watershed Association (BDCWA) is annual assessment of water quality conditions in Big Dry Creek. In the spring of each year, BDCWA uploads the results of the instream water quality monitoring program into a long-term water quality database and compares the results to applicable water quality standards for Big Dry Creek. Findings are documented in an annual water quality report that is presented and discussed at the March BDCWA public meeting and then posted to the BDCWA website.

Biennially, biological monitoring is also conducted at a subset of the water quality monitoring sites. The most recent round of biological monitoring, which was conducted by Aquatics Associates, occurred during October 2016.

This brief article highlights some of the key findings of the 2016 water quality analysis and biological monitoring program, based on analysis of the data completed during 2017.

In 2016, water quality samples were collected and analyzed for a variety of constituents. Metals were monitored on a quarterly basis. All other constituents were monitored on a monthly basis. BDCWA communities also fund operation of the U.S. Geological Survey (USGS) gauging station at Westminster behind Front Range Community College.

Key findings and recommendations regarding Big Dry Creek water quality and aquatic life conditions based on analysis of the 2016 data set include:

- Water quality in Big Dry Creek attained currently applicable stream standards, with the exception of *E.*

(Continued on page 2)

Big Dry Creek downstream of I-25 in October 2016.

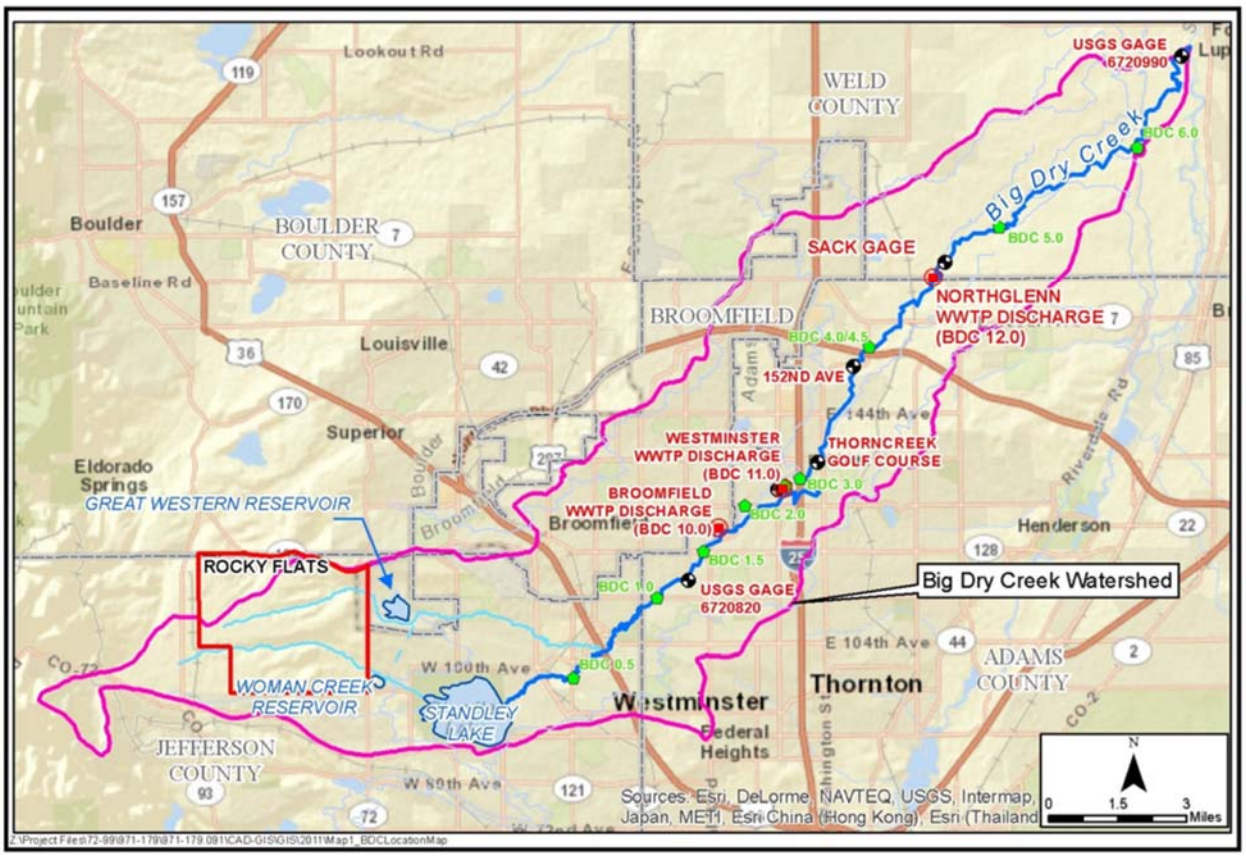
Inside this issue:

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

Meetings are generally held on a quarterly basis in March, June, September and December.

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 Association is a 501(c)(3) corporation.



(Big Dry Creek 2016 Water Quality Review, Continued from page 1)

coli for the entire stream and iron for the reach below Weld County Road 8.

- *E. coli* concentrations are elevated at multiple instream locations, with the highest concentrations present at bdc3.0 at I-25 and at bdc6.0 in the lower agricultural area. *E. coli* concentrations in the WWTP discharges are very low and meet stream standards.
- Big Dry Creek below Weld County Road 8 is listed as impaired on the 2016 303(d) List for elevated iron concentrations, which are expected to be due to stream bank and soil erosion in the lower watershed.
- For the most recent five-year analysis period (2012-2016), Big Dry Creek attained its site-specific selenium standard. In 2016, the stream was removed from the 303(d) List of impaired waters.
- Big Dry Creek does not attain the warm water instream nitrogen and phosphorus "interim values" below WWTP discharges (from the Broomfield WWTP to the South Platte River). Although these values are not expected to be adopted as stream standards on the main stem of Big Dry Creek below WWTP discharges prior to 2027, addressing nutrient sources on Big Dry Creek should be an increasing area of focus for BDCWA. Phosphorus concentrations and loads to Big Dry Creek have decreased over time as a result of WWTP upgrades at the Broomfield and Westminster WWTPs, along with reuse programs that continue to be implemented at these WWTPs.
- Big Dry Creek does not show impairment of aquatic life uses, based on calculation of Multi-metric Index (MMI) scores in accordance with the Commission's Aquatic Life Use Attainment Policy 10-1. Scores were calculated at six biological monitoring locations for fall monitoring conducted during 2008, 2010, 2012, 2014 and 2016. MMI scores vary substantially, both temporally and spatially.

For a copy of the 2016 Annual Report, please visit http://www.bigdrycreek.org/.

Colorado's 10-year Water Quality Road Map and Incentive Program

At the October 2017 Water Quality Control Commission Rulemaking Hearing related to nutrients, the Water Quality Control Division presented its 10-year water quality roadmap for pollutants including total nitrogen (TN), total phosphorus (TP), cadmium, ammonia, selenium, arsenic and temperature. As a result of this hearing, phased adoption of instream TN and TP standards was extended to 2027. As part of this decision, a new Commission policy, Policy 17-1 Voluntary Incentive Program for Early Nutrient Reductions, was adopted. The Roadmap and Incentives Policy was a result of extensive stakeholder meetings and dialogue through the Water Quality Forum.

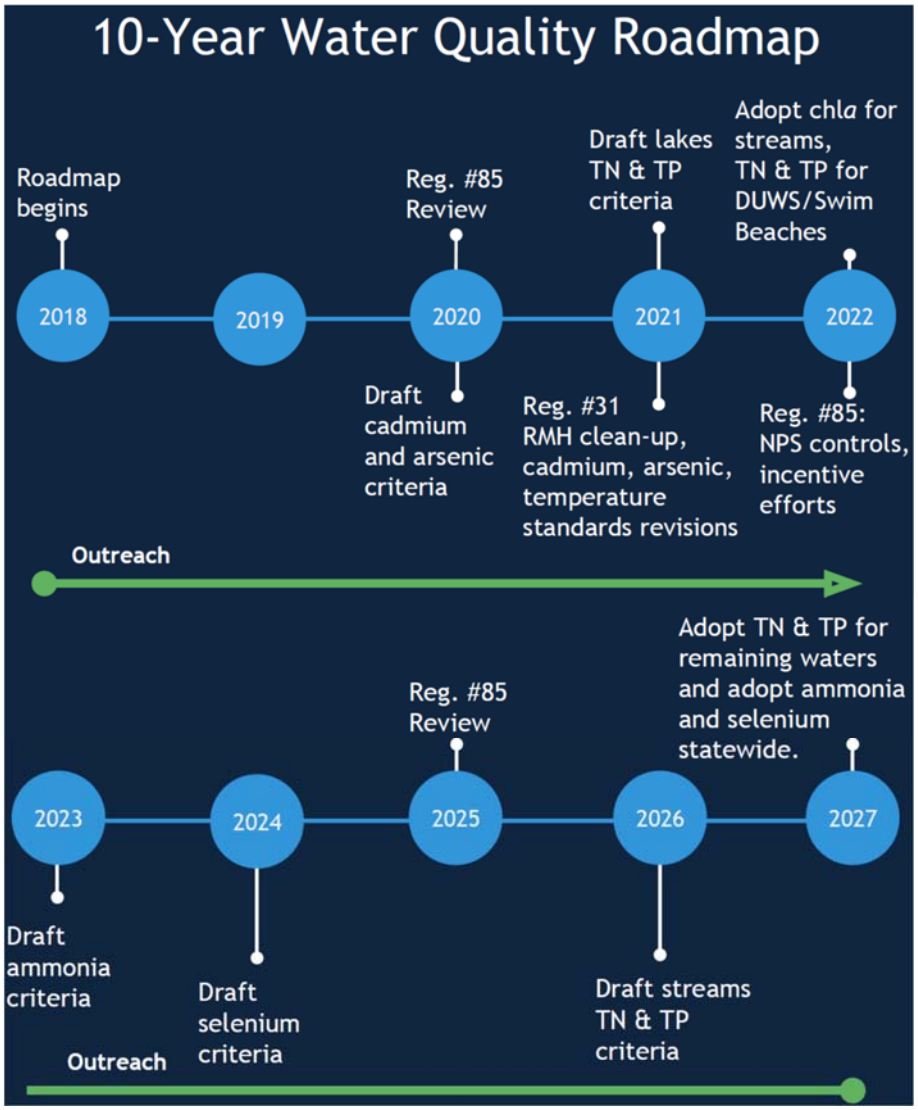
The Incentive Program will encourage facilities to make voluntary reductions of nutrients, and in exchange the facility will receive an extended compliance schedule as well as certainty about the year in which the facility will need to meet water quality based effluent limits. An extended compliance schedule means the facility will be given additional time to comply with effluent limits that would be based on water quality standards or variances adopted in 2027 or nutrient-related waste load allocations.

The intent of this policy is for Colorado to continue to make progress toward further reducing TP and TN in state waters, while providing facilities that go above and beyond the current regulatory requirements a meaningful incentive and certainty.

The Commission determined that the best way to make progress during the next 10 years is to continue within the technology-based framework. The next step of nutrient reductions in Colorado is for existing facilities to achieve the levels of nutrients reductions that can be realized through enhanced biological nutrient removal (BNR) or other operational changes.

Additionally, the Incentive Program will allow a WWTP to accrue time under a post-2027 compliance schedule through trading or watershed nutrient reductions as part of its nutrient reduction plan. Both the 2004 Colorado Pollutant Trading Policy and the trading provisions in Regulation 85 provide guidance on trade credits generated by nutrient load reductions.

For more information on Policy 17-1 Voluntary Incentive Program for Early Nutrient Reductions, see https://www.colorado.gov/pacific/sites/default/files/Policy17-1.pdf.



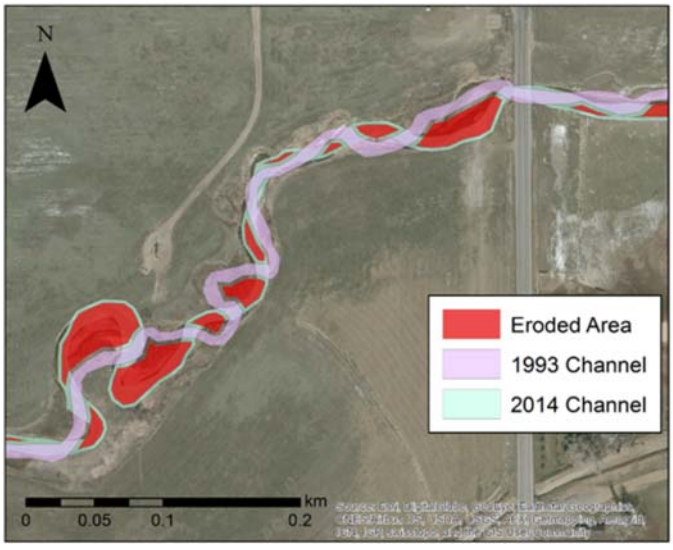
Graphic Source: Water Quality Control Division.

The CLEAN Center
Center for Comprehensive, OptimaL and Effective Abatement of Nutrients
Colorado State University

Erosion Potential and Water Quality Impacts: Big Dry Creek, CO

In 2017, Colorado State University researchers Rod Lammers and Dr. Brian Bledsoe completed the study "Erosion Potential and Water Quality Impacts: Big Dry Creek, CO" and presented study findings at the September 2017 BDCWA meeting. BDCWA and Urban Drainage and Flood Control District supported the study. Big Dry Creek is experiencing channel instability, caused primarily by alteration to the watershed's hydrology and sediment dynamics. Using field and GIS-based analyses, Lammers and Bledsoe summarized the current geomorphic status of Big Dry Creek, identified areas prone to future erosion, and provided some recommendations to reduce channel instability and improve stream health, in terms of both aquatic habitat and water quality.

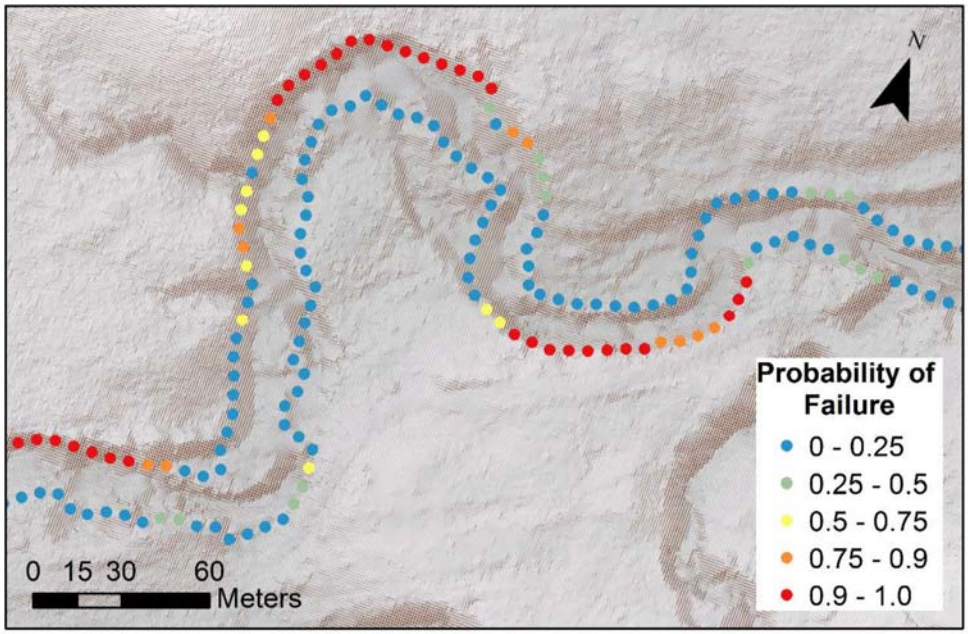
The field reconnaissance and GIS analysis enabled some general conclusions about the current state of Big Dry Creek and potential trajectories of channel change. The entire length of the channel has incised, although the magnitude of incision tends to decrease moving downstream. Many of the upper reaches have a relatively stable bed and do not appear prone to significant future incision. The lower watershed has incised less, and in many places the channel has encountered a stiff clay layer which is resistant to erosion and should slow further bed degradation. The channel here may be considered in a state of "arrested incision" where bank heights have not increased enough to become widely unstable. Despite the relative stability of the channel bed, Big Dry Creek is still laterally unstable and is prone to meander bend migration. This is supported by a measured increase in sinuosity from 1993 to 2014 and the fact that most unstable banks are located on the outside of bends. This lateral migration is relatively consistent throughout the watershed; however, bank heights are generally higher in the upper watershed because this area has experienced more incision. These banks are more susceptible to failure and will contribute larger volumes of sediment and phosphorus to the channel than the smaller banks in the lower watershed.



Example of the satellite imagery analysis showing the channel location in 1993 and 2014 as well as the area of eroded channel over this time period.

Based on field observations and the data analysis in this report, Lammers and Bledsoe made some general recommendations for mitigating further channel instability in Big Dry Creek:

- **Flow management**: New and upgraded stormwater controls can mitigate the erosive power of high flows. This approach, however, shouldn't solely prioritize reducing peak flows. It is important to address both flow magnitude and duration to reduce cumulative stream power over time. Requiring full spectrum detention for new development will prevent further flow alteration and reduce the chance of additional channel erosion. Stormwater retrofits to existing development could also reduce erosion potential across the full range of flow events and further contribute to channel stability. Future work could more clearly define bank erosion thresholds (e.g. a maximum allowable discharge) that could be used as design criteria for stormwater controls. In addition, irrigation releases from Standley Lake could potentially be managed to release the



Example map showing the probability of bank failure calculated from logistic regression equation. High resolution DEM is shown in the background. Flow direction is left to right. Source: Lammers and Bledsoe, 2017.

same volume of water over a longer time span, reducing flow peaks and flashiness; however, changing release patterns and/or timing is of course constrained by water rights administration and downstream uses.

- **Floodplain reconnection**: Reconnecting the stream to its floodplain can involve raising the channel bed or creating inset floodplains within the existing incised channel. This allows high flows to dissipate energy on the floodplain, reducing their erosive power. In some areas, riparian vegetation is suffering because the channel is incised, lowering groundwater tables and reducing water availability for these plants. Floodplain reconnection will raise groundwater tables and improve riparian health. Much of the upper portion of Big Dry Creek flows through publicly-owned open space which makes this intensive restoration approach more feasible.

- **Grade control**: Although much of the channel appears relatively vertically stable, there is the potential for continued incision. This is primarily a concern in the lower portion of the watershed where there are fewer grade controls. While some reaches have hardpan clay on the bed, it is unclear how thick these layers are and how long they will remain. Additionally, many areas show significant sand deposition, but these reaches may become erosion-dominated if sand supply from upstream decreases. Some preemptive grade control may be warranted in these areas to protect the channel against potential incision. Overlaying the bank stability and stream power data identified two sites with high transport capacity and banks near stability thresholds: just downstream from CR 21 and just downstream from CR 8. Grade control structures in these areas can prevent further incision and could be designed to encourage sediment deposition, raising the channel bed and stabilizing the banks.

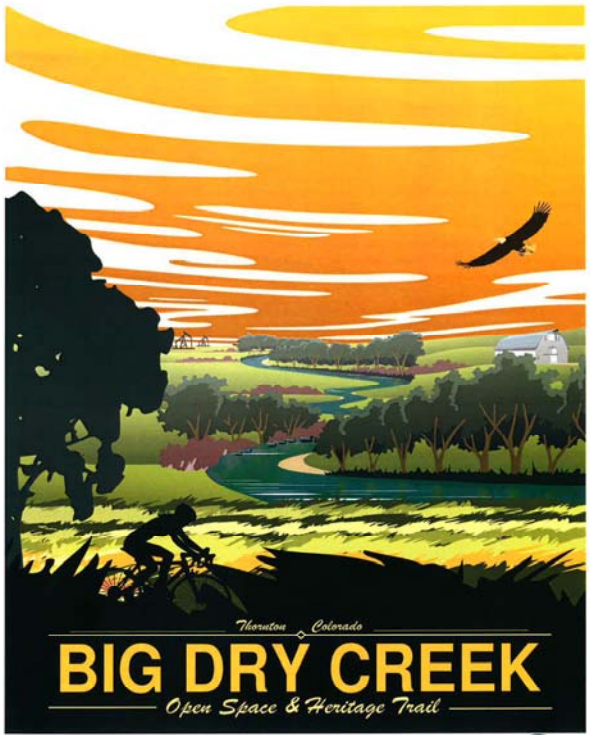
- **Bank stabilization/revegetation**: The GIS bank stability analysis identified unstable banks. These data can be used to locate high-priority restoration areas (e.g., unstable sections near trails, roads, or other infrastructure) which may benefit from bank stabilization. Stabilization may entail grading banks to gentler slopes but should incorporate toe protection to avoid bank undercutting and failure. Additionally revegetation and other bioengineering techniques should be considered. The effectiveness of vegetation in preventing bank erosion was clearly seen during the field campaign.

- **Monitoring and future analysis**: Lammers and Bledsoe recommended monitoring channel stability into the future to identify potential channel changes.

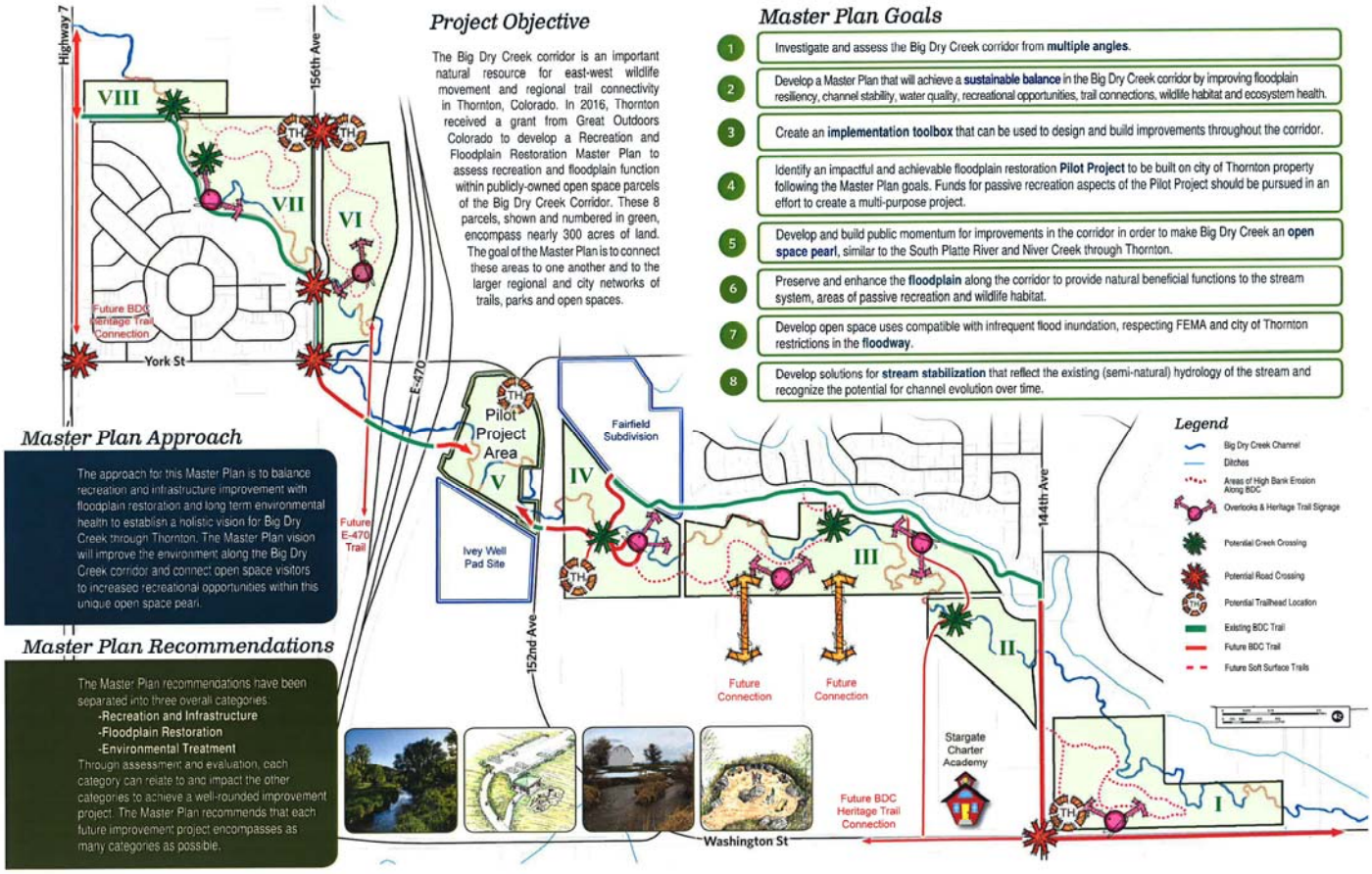
Article adapted from final report prepared by Rod Lammers and Dr. Brian Bledsoe.

Thornton and Adams County Complete Open Space Master Plan

In 2017, the City of Thornton and Adams County completed an Open Space Master Plan and Floodplain Restoration toolbox for publicly-owned open space in the Big Dry Creek corridor between Interstate 25 and 160th Avenue. Water quality, biological and stream channel work by BDCWA was referenced in the Master Plan. The Master Plan included an assessment and evaluation of the biological, hydraulic, geomorphic, and open space resource values of Big Dry Creek to provide recreation and conservation opportunities, with a prioritized plan of action for restoration of the creek corridor through Thornton and unincorporated Adams County. Almost 300 acres of open land in the corridor have been preserved by Thornton and Adams County, providing continuity with the upstream Westminster Open Space along the Big Dry Creek Corridor.



The Floodplain Restoration Toolbox provides a framework that may also be useful for other projects along the stream corridor. A floodplain restoration Pilot Project was also identified during the master planning process. For more information contact Paula Schulte at Paula.Schulte@cityofthornton.net.

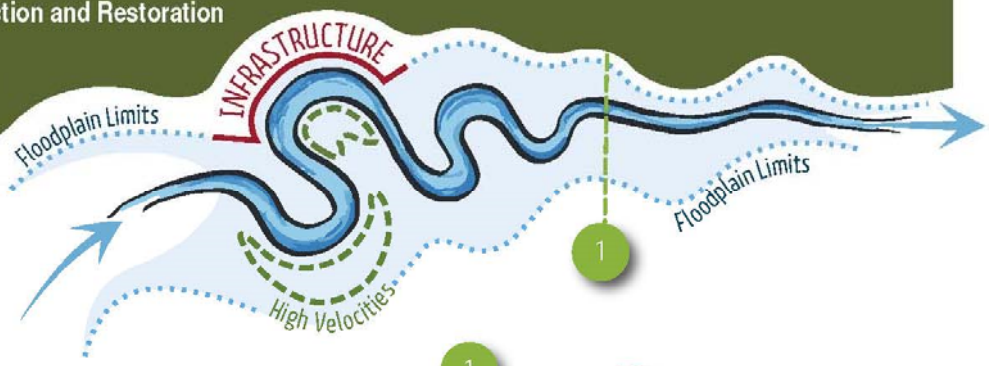


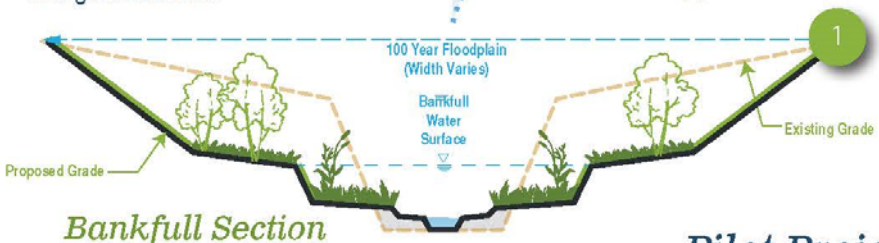
Floodplain Restoration Toolbox

A 'toolbox' approach was taken for the Master Plan to identify general strategies and techniques for the restoration and management of Big Dry Creek. The Toolbox enables the users of the Master Plan to develop a conceptual restoration approach for a variety of potential deficiencies along Big Dry Creek and adapt each technique to the individual conditions of a specific project. The Toolbox was separated into the following categories to address any issue that may be encountered on Big Dry Creek:

1. **Floodplain Reconnection and Restoration**
2. **Bank Stabilization**
3. **Channel Complexity**
4. **Grade Control**

The restored creek channel will vary in function, form and ecology based on the site specific issues which exist at a given location.

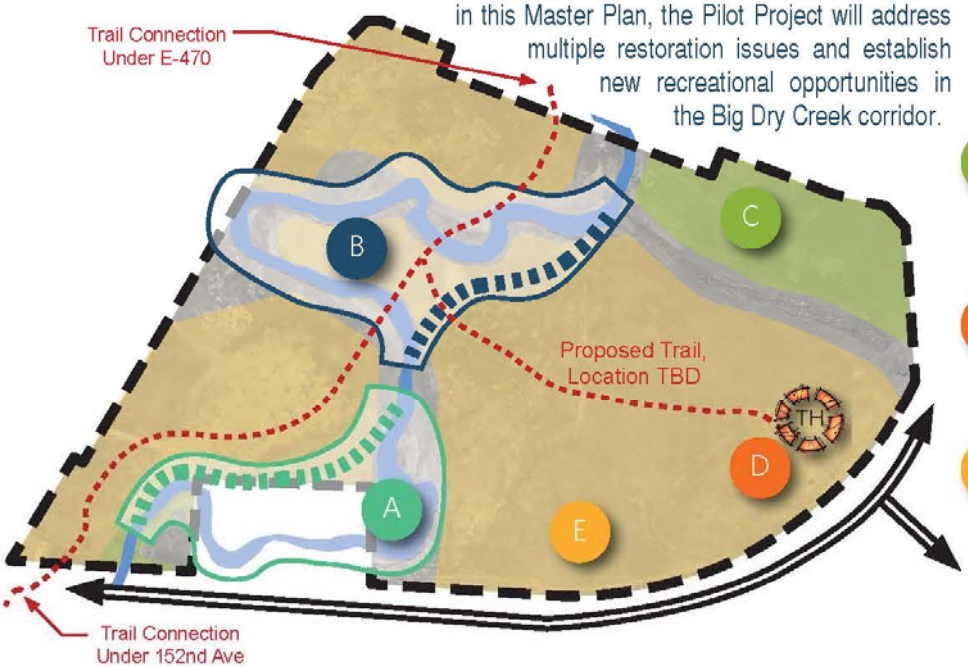




Bankfull Section

Pilot Project

The Big Dry Creek Pilot Project will set the example of restoration in the corridor. By using the Toolbox strategies developed in this Master Plan, the Pilot Project will address multiple restoration issues and establish new recreational opportunities in the Big Dry Creek corridor.



A
Issues
- Lateral Migration
- Erosion
- Habitat degradation

Improvement Strategies
- Off channel wetlands
- Bank stabilizations
- Grade Control
- Revegetation

B
Issues
- Lateral Migration
- Erosion

Improvement Strategies
- Channel Realignment
- Bank Stabilization
- Grade Control
- Revegetation

C
Invasive Weeds including:
- Curly Dock
- Russian Olive
- Musk Thistle
- Kochia

Weed management and revegetation

D
Potential Trailhead Location:
- Paved/unpaved parking
- 36,000 SF Max

E
Heavily populated Prairie Dog habitat with short low grasses throughout

Opportunity to increase vegetation and biodiversity

Next Steps

The next step in the Big Dry Creek Recreation & Floodplain Restoration Master Plan will be to design and construct the Pilot Project. This project will help build momentum for future projects in the corridor and help the city of Thornton apply for grants to help fund future projects.

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 currently consisting of representatives of the Cities of Westminster and Northglenn, the City and County of Broomfield, Weld County and Adams County. Activities of the BDCWA during the last twenty years have been funded through the contributions from these entities, as well as the City of Thornton, 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.

BIG DRY CREEK

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