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Welcome

Bill DeGroot, P.E.
Manager, Floodplain Management Program

Philosophy

Preserving the natural and beneficial values of floodplains

Regulatory

404 permitting
UDFCD maintenance eligibility
Land Development and Floodplain Approvals

Good Examples

Projects that exemplify holistic planning, good design, and offer amenities for livable communities

Business Cases

Projects illustrating social, economic, and environmental benefits

Library Links

Resources and Acknowledgements

Dear Reader

Shortly after I came to the Urban Drainage and Flood Control District in 1974, my wife and I took a walking tour of lower downtown Denver, long before it became an historic district and the place to be. We were admiring the rows of brick warehouses and old hotels when we came to a warehouse that was being converted into shops and lofts. The developer happened to be there. A member of our tour group asked him what had moved him to preserve and reuse this historic warehouse. He replied: "To make money." That answer was a valuable lesson to me, as I will explain below.

Most of the District's resources go to the planning, design, construction and maintenance of remedial projects to fix past mistakes of development in the floodplains. The District's Floodplain Management Program was established in 1974 to prevent new flood damage potential from being constructed in the floodplains. The traditional way to do that has been to map the 100-year floodplains, with the help of the Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA); and then work with our local government partners to utilize floodplain regulations and other land use regulations to require developments that are "safe" from the 100-year flood.

Too often developers and their consultants have looked at these requirements as just one more hurdle to overcome at the least possible cost; resulting in the construction of straight, narrow channels, fill in the floodplain to the maximum extent allowed by the regulations, or even underground conduits. While allowed, these approaches were doing significant damage to the limited natural and beneficial values of the drainageways in the Denver area.

Land developers are in the business to make money. There's nothing wrong with that. One of the approaches we have been trying over the last several years is to work with developers and local governments to show them how the developer can make money ***and*** preserve the natural and beneficial values of the drainageways. This is the lesson I learned as described in the first paragraph.

For this CD we have put together a number of case studies of developments that made money and preserved the natural and beneficial values of the floodplains. We have also assembled a number of photographs of what we consider to be good projects, and links to a number of other resources.

Please browse through this CD and learn more about this approach to floodplain management.

Sincerely,

Bill DeGroot

Bill DeGroot, PE
Manager, Floodplain Management Program

Acknowledgements

Michelle Leach (now with Matrix Design Group) originally pitched the idea for the brochure development to Bill DeGroot, UDFCD in June 2006. The project was contracted in two phases and David Mallory, UDFCD was assigned to work on both phases together with Bill and Michelle. The project began in the fall of 2006 with community surveys and format development. Oblique aerial photography was conducted throughout the spring and summer of 2007. The text and good examples were assembled and released in draft form in February 2008. Final brochure production was completed in April. The text, photography and brochure contents are entirely the work of the three authors. Several photographs were supplied from UDFCD archives. While this document is public and not protected by copyright, the District should be notified of any use of the material outside of the original format.

The authors wish to acknowledge the support of the District's Board of Directors and Executive Director, David W. Lloyd. The authors wish to acknowledge the many helpful comments and resource links received in response to the draft release.

During the development of this document we conducted a survey with numerous local governments and agencies interviewing key staff and elected officials. We wanted to solicit input to create the conceptual framework and willingness to distribute this document to the development and engineering community.

Adams County: Beshara Najjar, Rob Coney
Adams County is experiencing rapid growth of new residential developments (greenfields). There is a desire for new commercial development in older industrial areas (brownfields). The County recognizes the amenity and financial benefit to creating a more natural approach to channel enhancement.

Aurora: Verne Adam, Robert Watkins, Kevin Murphy
The city covers 145 square miles, of which sixty-five square miles it already developed. Eighty square miles are to be developed which illustrates the largest urban growth boundary in the region. They have been working on evaluating density transfer; and supporting the philosophy of smart growth and new urbanism, so more open space could be achieved in these multi-use developments. They require the floodway tract be dedicated to open space and collect a per acre development fee.

Arapahoe County: City of Centennial: Steve Gardner/ Sue Wesburg
Arapahoe County is updating their criteria manual. The growth in the county has been both residential and commercial development projects that are greenfields. Arapahoe's open space program supports regional trail system links.

Brighton: Shawnee Klein
Both brownfield and greenfield development is occurring in this city. The stormwater utililities in the city core are extremely old and undersized. Brighton wishes to execute many new regional improvements but funding has been a critical barrier. Brighton has been reviewing their criteria manual and seeking to improve the integration of drainage structures (depth and shape) within open space and on a development property. They recently have considered open space credit for water quality volumes. They encourage land dedication from developers for drainage facilities (open space credit).

Broomfield: Nancy Arthur, Terry Ware

Acknowledgements

Boulder: Christina Martinez, Karen Medde
Boulder prides itself on being proactive and pursuing the implementation of amenities for their community. Boulder has limited growth and the only parcels left are those for re-development with very challenging barriers. Boulder contributes a 50% capital match on conveyance capacity to upgrade improvements. For maintenance there is no match. Their wetland ordinance requires a 2:1 mitigation ration. They currently are doing a study on the regulation of buffer zones that equate value (width and species diversity). Additionally maintenance paths are being studied to see the impact on terrestrial habitat when next to a riparian area. Boulder has been instrumental in the region for developing a noxious weed management program. Critical to their oversight on projects is the sequence of development to implement the masterplan and not impact upstream or downstream properties.

Denver: Dave Ridenour

Golden: Dan Hartman, Steve Glueck
Golden has very few greenfield developable acreage. Brownfield infill redevelopment projects are more likely. In town the drainage is mostly conveyed through pipes. Other open channels built several decades ago with higher valley slopes are concrete lined. If channel improvements were to happen they desire the treatment to be more natural but it depends on the development project location, use and criteria. A recent public survey was conducted and an overwhelming response for more trails and parks was noted. They are in the process of updating their masterplan for open space. There is concern of transporting sedimentation downstream if development is to occur at the headwaters.

Greenwood Village: Mark Wesburg
In general, most parcels have been developed so public works focus is on maintenance. They look to UDFCD masterplan for improvements required.

Erie: Wendy Palmer, Debbie Pearson
The town of Erie's historical land use was predominantly agricultural and a small downtown with commercial properties. Over the past decade Greenfield parcels have been developed as residential communities. Drainage basins that were once ephemeral now have perennial flows. Erie is highly concerned with water quality and prefers native species to establish grass areas recognizing the need for water conservation as well. Irrigation is required for establishment. Additionally they have developed a west nile spray and pellets program to meet the concern of their community. They have instituted a weed control management plan. They are not responsive to engineered shapes for drainage facilities and encourage developers to create a more integrated structure described in their design manual that could also receive open space credit.

Lakewood: Anne Heine, Mark Doring
Opportunities in Lakewood are small infill development parcels. The city has been designated class 6 for CRS. Their pre-planning process identifies main issues and how the project will be developed. Engineering and planning review type of improvements before the formal application to avoid 'what is not successful'. The city contains channels that have a formal urban character and also more natural organic character. Redevelopment opportunities will occur around proposed light rail stations. They desire more pedestrian linkages through the corridor and ultimately to connect to Denver trails. Lakewood wants to enforce floodway preservation, especially significant riparian areas, in floodway corridors.

Acknowledgements

Littleton:
The city is comprised of mostly residential and commercial (retail and office). Greenfield development opportunities are rare. Their opinion is smaller developers have the most impact.

Lone tree: John Cotton, John Johnson
The city sees intrinsic value as the result of the enhancements in the floodplain that will benefit the adjacent communities. They collectively establish drainage criteria jointly with Arapahoe and Douglas County. Their comprehensive masterplan, planning and open space guideline documents support enhancements for floodways and drainage features.

Parker: Tom Williams, Garner Stoll
They have recommended to developers that drainageways must be amenities. They have established ordinances right up front. Their required set backs go beyond the 100-year floodplain boundaries. Open space requirements integrate ordinances. Their guidelines emphasize riparian enhancement for vegetation communities.

Thornton: David Kighswonger, Mike Boden

Westminster: David Shinneman, David Downing
Good set of guidelines in place for floodway enhancements. Very proactive from an open space land acquisition stand point – part of branding of the city. They wish more smaller unprogressive engineering consultants would attend the District's annual seminar to learn what is valuable.

Mayors: Nancy McNally, City of Westminster
Karen Stuart, City of Broomfield

Philosophy behind this document

Urban stream corridors provide many critical functions in the life of a community. During storm events, they function as conveyance systems for storm runoff. Floodplain managers have a keen interest in making this function as reliable and safe as possible. But, urban stream corridors are much more. Their linear nature is well suited to trails and a variety of recreational activities. Human beings are naturally drawn to water and the natural environment. More over, Coloradoans seek an active outdoor lifestyle and value natural areas for beauty and the appreciation of wildlife. Urban drainageways also provide an immense ecological resource and are central to the natural processes that support the environment. Thus, thoughtful treatment of these natural systems creates community assets that are important to local governments and developers as they plan new projects and especially to the future residents. Therefore, floodplain, wetland, and riparian preservation are critical community values.

For many years, the District has advocated floodplain preservation. We believe there is a universal benefit in preserving natural floodplain functions. Channelizing major drainageways produces single purpose projects, namely flood conveyance, and contributes to the decline of stream corridors. We believe the first choice should be multi-purpose preservation and restoration projects that enhance stream corridor function. However, many development proposals reviewed by District staff over recent years lacked imagination and acknowledgement of the natural and beneficial values of floodplains, while still meeting minimum design criteria. Communities were missing the opportunity for public amenities, livability, and sustainability and developers were missing significant marketing opportunities. The intent of this brochure is to influence the land development process at the earliest stage before land use decisions have been made and concepts have become fixed plans.

Essential to the beginning of each new project is conducting the due diligence to assess the benefits, constraints and cost. Each project also must look at potential regulatory requirements. Depending on project improvements, it can include a Section 404 Permit through the Corps of Engineers (COE), Letter of Map Revision through the Federal Emergency Management Agency (FEMA), State of Colorado water and air quality permits, and planning permits required by the entitlement process through the individual community. The recent trend is for communities to encourage green or sustainability principles and many have refined their guidelines to attain benefits for the environment, employers, residents, and visitors.

Historically, development has encroached into the floodplain, constricted the low flow channel and floodway, impacted the ecological integrity, and removed any natural character of the riparian corridor. In recent years, enlightened developers have recognized the value of preserving the floodplain, wetland, and riparian areas. This offers the opportunity to set the character of the new development and offer amenities that are components of livable communities and healthy economies. We therefore, advocate the following approach:

- Preserve floodplain and riparian systems to the greatest extent possible,
- Mitigate the effects of watershed urbanization with stream stability techniques, and
- Restore degraded and damaged stream systems.

Why is floodplain preservation important?

Flood damages are the most costly natural disasters that we face as a nation. From Gilbert F. White, the father of modern floodplain management, we know that "Floods area an act of God, but flood losses are largely an act of man" (*Human Adjustments to Floods, 1945*). Dr. White argued that over reliance on structural flood protection measures (dams and levees for example) has increased the potential for flood damage. Where feasible, adaption to the flood hazard is a sounder public policy. The National Flood Insurance Program (NFIP) spends enormous sums each year in flood disaster mitigation and floodplain mapping. Yet, flood damages continue to rise. The Association of State Floodplain Managers (ASFPM) has advocated a stronger approach. "No Adverse Impact (NAI) in floodplain management ensures that the actions of one property owner does not adversely impact the rights of other property owners, in terms of increased flood risk and loss of development potential. Floodplain preservation actually promotes property values and land development activities, while enhancing the natural and beneficial functions of floodplains.

What are the natural and beneficial functions of floodplains?

The low banks adjacent to streams are infrequently occupied by floodwaters. During a flood event, these overbank areas serve an important function in moderating peak discharges and velocities, and filtering out sediment and debris. The natural and beneficial functions of floodplains can be summarized as follows:

- Floodplains have the capacity to store and convey floodwaters, thus diminishing floodwater velocities and reducing flood damages and erosion.
- Soil fertility is increased as floodplains naturally replenish the nutrients of the surrounding soils during periodic inundation.
- Floodplains improve water quality and quantity by providing areas of groundwater recharge, while also filtering impurities and nutrients.
- Floodplains enhance biodiversity, providing breeding and feeding grounds for fish and a wide variety of wildlife including endangered species.

What is the stream ecology issue?

Stream corridors and adjacent riparian zones are not geographically large; however, their environmental importance is immense. "Riparian areas comprise less than one percent of the land area in most western States, yet up to 80 percent if all wildlife species in this region of the country are dependent upon riparian areas for at least part of their life cycles." (*Congressional Testimony of Robert Wayland, EPA, June 26, 1997*). Riparian areas are often called "ribbons of green", reflecting the contrast with the otherwise dry landscape of the arid west. Agricultural and land development activities have resulted in loss or significant degradation of 75 to 95 percent of this invaluable habitat. Development projects have the opportunity to preserve, protect, and utilize stream corridors and adjacent riparian areas. In fact, increased urban runoff often results in sustained base flows in streams that were ephemeral in the pre-development condition.

How does this relate to the District's Maintenance Eligibility Program?

The District's boundaries encompass approximately 1600 square miles of the Denver Metropolitan area. In addition to basin master planning, floodplain management and capital improvement activities, the District works with each of our 40 units of local government on drainageway maintenance for development projects that meet the Districts critieria. Ongoing maintenance of major drainageway corridors is essential to long-term stream vitality. The Maintenance Eligibility Program was launched in March of 1983 and has always encouraged floodplain preservation and thoughtful development.

Is floodplain and stream preservation compatible with Section 404 Permit requirements?

Absolutely! The District has worked with the COE to make our programs complimentary. We encourage early consultation with the COE Tri-Lakes office, local government, and the District in order to plan the best way forward. Development projects that require an individual permit must demonstrate preservation of the natural and beneficial floodplain functions. The COE issues a guidance letter on June 16, 2006 that articulated an interest in floodplain preservation. Since that time, we have worked with project proponents to utilize the natural resources present on the site. The COE role is to permit the least damaging project alternative that does not significantly degrade the nation's waters.

How about the FEMA Letter of Map Change process?

A conditional letter of map revision (CLOMR) is often a prerequisite to land development activity. Floodplain preservation results in lower flood risk and a streamlined approval process. The CLOMR is also FEMA's commitment to accept the revised floodplains when the final letter of map revision (LOMR) is issued. FEMA will look to the local government for maintenance of the altered floodplain. The District's Maintenance Eligibility Program offers an additional revenue stream for meeting the community's maintenance responsibility.

The NFIP offers flood insurance premium discounts through the Community Rating System (CRS) in communities that pursue flood risk reduction activities including:

- Outreach and public education projects that promote the natural and beneficial floodplain functions.
- Open space preservation that replicates the natural and pre-development condition and have demonstrated habitat value.
- Higher regulatory standards that protect natural areas.
- Stormwater management that addresses erosion and sediment control.
- Floodplain management planning coordinated with a communities Habitat Conservation Plan.

What are the sustainable development issues?

Low Impact Development (LID) is an ecologically friendly approach to site development and stormwater management that aims to mitigate development impacts to land, water, and air. The approach emphasizes the integration of site design and planning techniques that conserve natural systems and hydrologic functions on a site. By incorporating these sustainable principles early in the process land development approvals can be achieved timely through the entitlement process. Municipalities gain community amenities and preserve valuable natural areas while the developer benefits from lower site infrastructure costs and increase their project's marketability.

Although infill development and new development projects have different issues, the incorporation of sustainable methods in planning and construction can add value to both ventures. LID uses decentralized, or source, controls to replicate pre-development hydrology (stormwater) conditions. This approach can be used as an alternative or enhancement for conventional end-of-pipe stormwater pond technology. This alternative tool is important because of the potential to lessen the energy impacts of large concentrated volumes of runoff from conventional end-of-pipe approaches on receiving waters as well as reducing the development footprint and long-term maintenance considerations for end-of-pipe facilities.

What are the advantages to developers?

We recognize that development is essential to community building. Good environmental stewardship cannot exist in the absence of a good business process. When the approach to stream corridors turns from overcoming a problem to embracing a resource, the following positive outcomes emerge:

- Lower capital costs
- Lower operation and maintenance costs
- Open space credits
- Multi-use opportunities, including parks and recreation
- Increased marketing potential
- Lot premiums adjacent to stream corridors
- Community character and identification
- Neighborhood ownership of the stream corridor

We have included a number of good examples and business cases to demonstrate the above points.

What are the advantages to communities?

There are tremendous advantages to communities that encourage a thoughtful approach t development adjacent to natural streams.

- Community identification
- A sense of community that encourages volunteerism
- District assistance in meeting NFIP maintenance responsibilities
- CRS credits for floodplain preservation
- Linear recreation corridors

A resource driven approach to land development activities results in a positive nexus in regulatory programs, floodplain management, community building, and sound business principles. Stewardship of our natural resources is a basic decision that we make as a society. “Civilizations rise and fall as they manage natural resources” (*Collapse: How Societies Choose to Fall or Succeed,* Jared Diamond, 2006).

Business Cases

Click a link below to be taken to that section

Stapleton Redevelopment

Developer: Forest City Stapleton

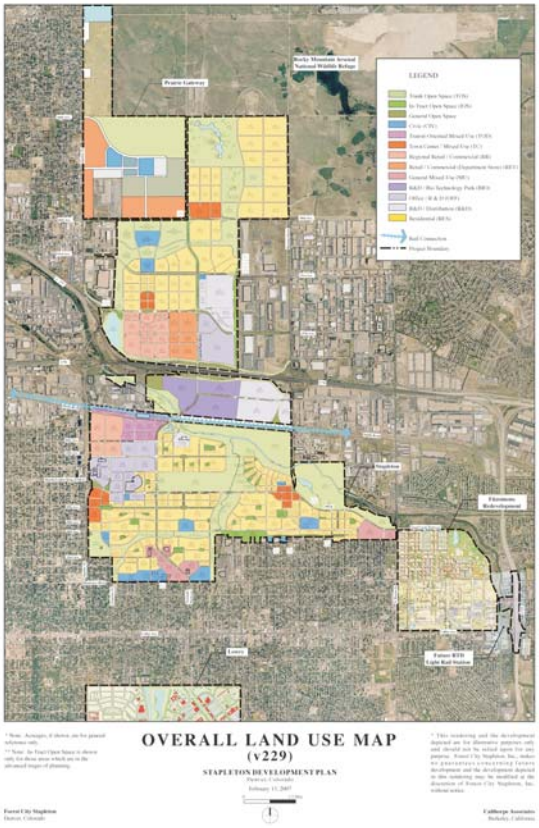
Year Started: 1999

Year to be completed: 2015

History: The guiding principles for Stapleton are embodied in the “Green Book” adopted by the Denver City Council in 1995. The reference book gives guidance to the physical, social, environmental, economic and regulatory framework for the transformation of the former airport site.

Key Facts:

- 4700 acres will be developed within a period of 15-20 years
- 1,116 acres are dedicated open space increasing the size of the Denver Park system by more than 25%
- Its trails connect to the regional trail system



View along 29th Street Linear Greenway towards Westerly Creek

Town Green Park

View of meandering creek, trails, drop structure, detention and water quality ponds at Westerly Creek

Philosophy: Developer sees amenities as a way to get a sale premium on residential lots and commercial parcels

Awards:

- Stapleton received the 2006 Urban Land Institute Awards in Excellence that acknowledge contributions to the community, innovations, public/private partnerships, environmental protection and enhancement, response to social needs, and financial success.
- In 2004, Stapleton was awarded the Best in American Living for Smart Growth which highlights the project's commitment to protect and provide access to the natural environment, incorporates a mix of land use, land use in an efficient and innovative manner, encourages multiple transportation options, provide housing choices, respects local tradition and takes advantage of infill opportunities.
- In 2002, Stapleton received the prestigious Stockholm Partnerships for Sustainable Cities Award in recognition of the project's commitment to sustainable development, community-building and environmental stewardship.
- Stapleton Development Plan was saluted as a "model" at the United Nations Conference on Sustainable Development.

Trails at Greewnway Park

Water feature at Town Green Park

View of trails and open space at Westerly Creek

Westerly Creek

Highlighted Project: Restoration of Westerly Creek

History: Before the expansion of Denver's Stapleton International Airport took place during the 1960's, Westerly Creek flowed northward through an open area of the airport. The creek in this former state performed an important ecological function of absorbing occasional runoff from the watershed. As the Stapleton airport developed, Westerly Creek became confined and piped under the runways. After the airport was decommissioned in 1998, Forest City Enterprises designed and built a 4700 acre mixed-use community in its place called Stapleton Redevelopment. Through this project the opportunity emerged to reconstruct Westerly Creek. This rehabilitation was compatible with the projects goal of providing open space, sustainable stormwater management, broad floodplain for ecological productivity, flood control and riparian habitat.

Parcel Size: 72 acres

Design Consultant: Matrix Design Group

Project Approach: Land was dedicated to create a broad floodplain area. This would accommodate the meandering channel alignment, softer minimal overbank slopes for bank stabilization, provide different experiential areas in the park for visitors, set aside areas for wildlife, and create an expansive visual view for residents to front upon.

Key Features:

- Manage flood events up to a projected 100-year flood of 6,200 cfs
- Build a meandering 5,700 linear feet riparian channel to improve water quality
- Build detention facility forebays that incorporate function for performance and sculpture for aesthetics
- Restore prairie and riparian habitat
- Offer opportunities for interpretive education
- Construct an attractive trail system for bicycling, walking, birding, and horseback riding

Process: To achieve these independent objectives, Matrix Design Group developed an innovative master plan, conferred with multiple entities and governmental authorities systematically, and implemented a cost effective plan.

Budget: $13,000,000

Completed: 2003

View of signature pedestrian bridge upstream of a specialty drop structure

View of low flow channel stabilized with bio-logs and wetland sod

Outdoor interpretive education station adjacent to water quality

Low flow channel with riffles of shale stone

Low flow channel with riparian habitat

Sculptural detention facility forebay

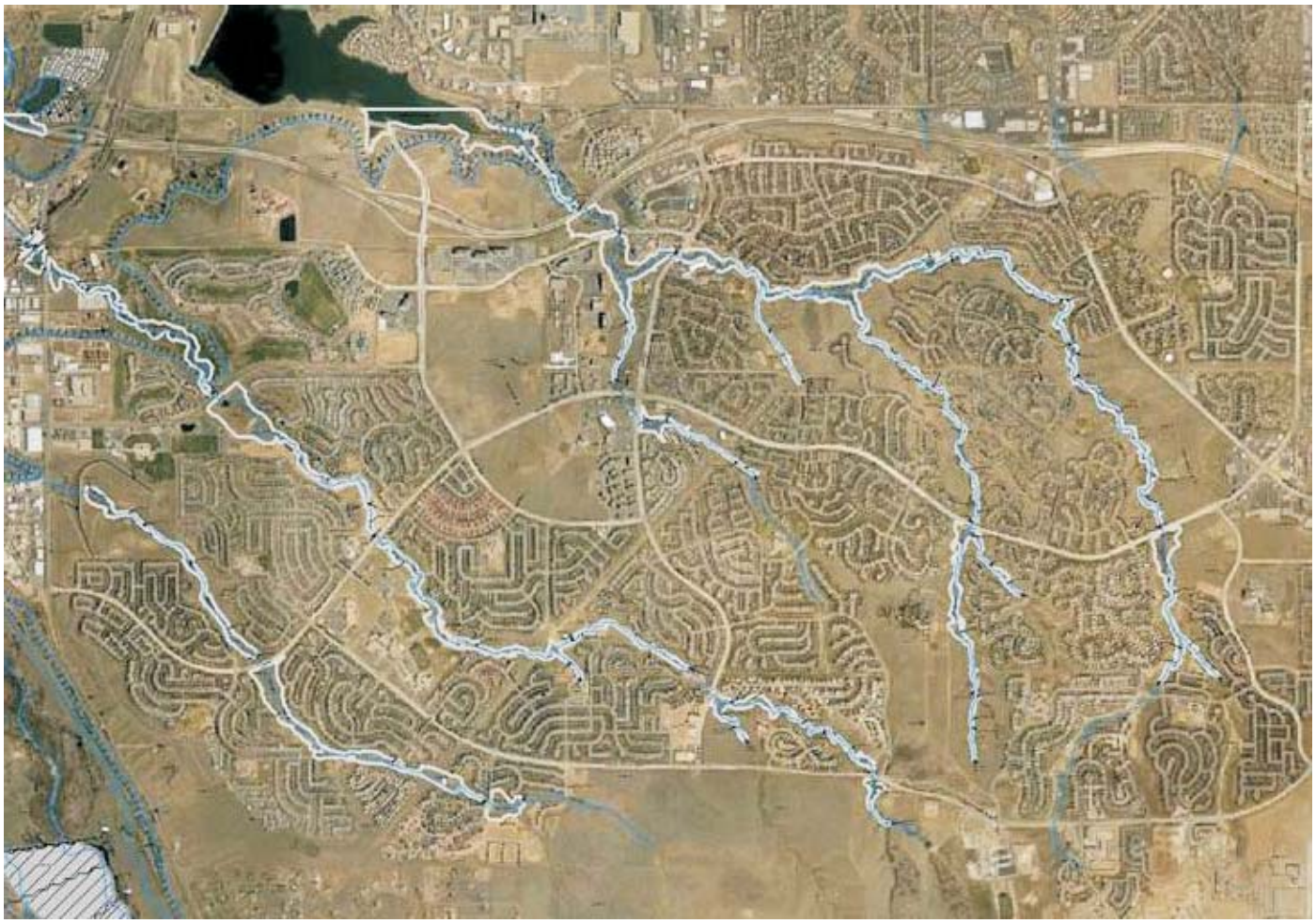
Water quality ponds planted extensively with wetland species

Highlands Ranch

Developer:	Mission Viejo / Shea Homes
Year Started:	1981
Progress completion 2007:	85-90% residential build out, 30-40% commercial build out
History:	Mission Viejo realized the value of open space. The total Metro District area comprises 22, 600 acres. Of this total, 8,200 acres is dedicated conservation area, 4,000 acres are committed for open space functions such as parks and drainageways, and 10,400 acres serve development.

Key Facts:

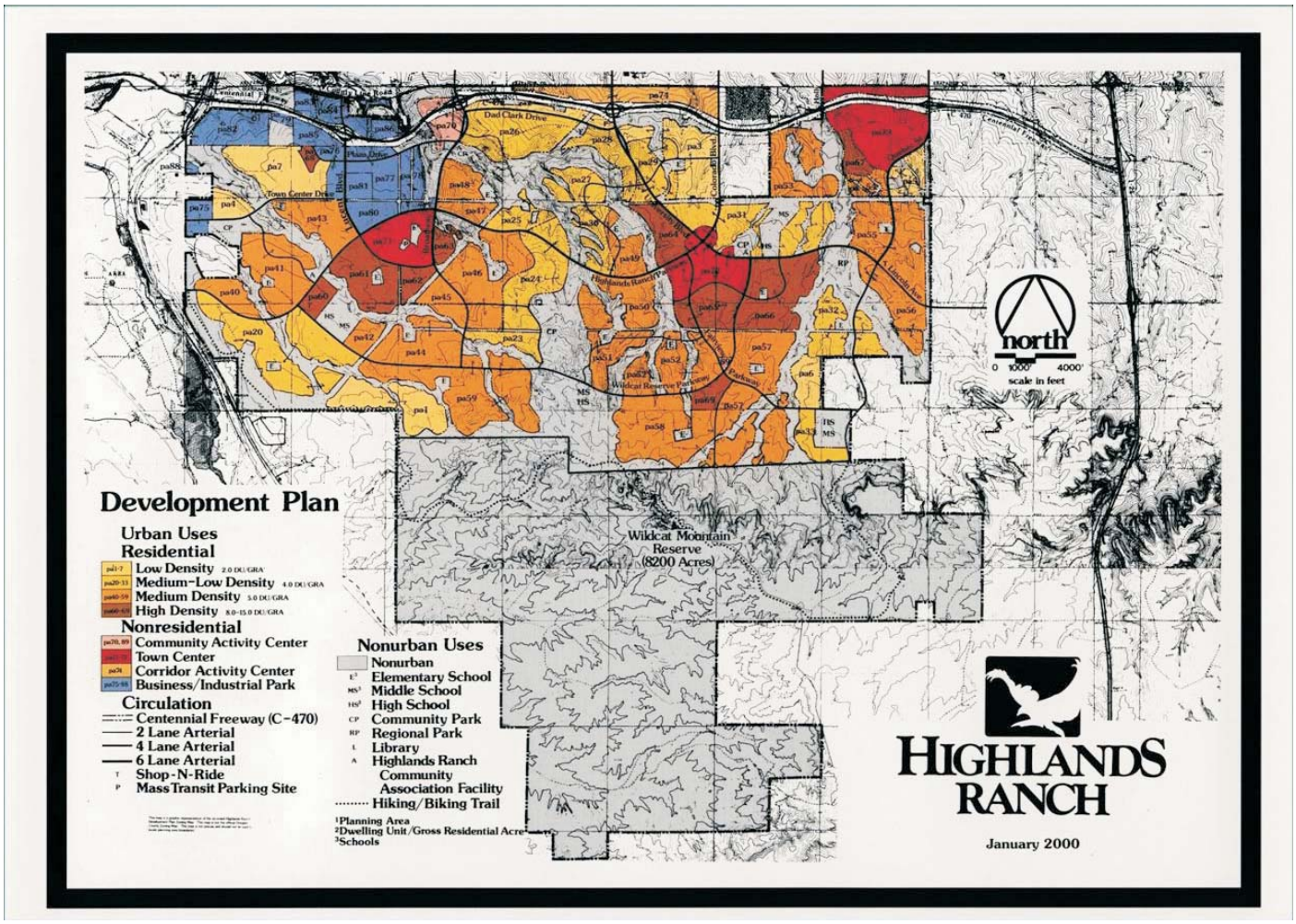
- Reduced infrastructure cost for stormwater utilities and earthwork by leaving expansive areas for surface drainage (wide drainage corridor with large building setbacks)
- During the market slump in the mid to late 80's Highland Ranch was able to capture 25% of home sales within the Denver Metropolitan area because these associated amenities made it a more desirable place to live.
- Community demographics are changing from younger families to empty nesters who find walking trails critical to their active lifestyle
- Average tax for enhancements (impact fee) $450 annually



Substantial tracts of open space preserved adjacent to drainageways

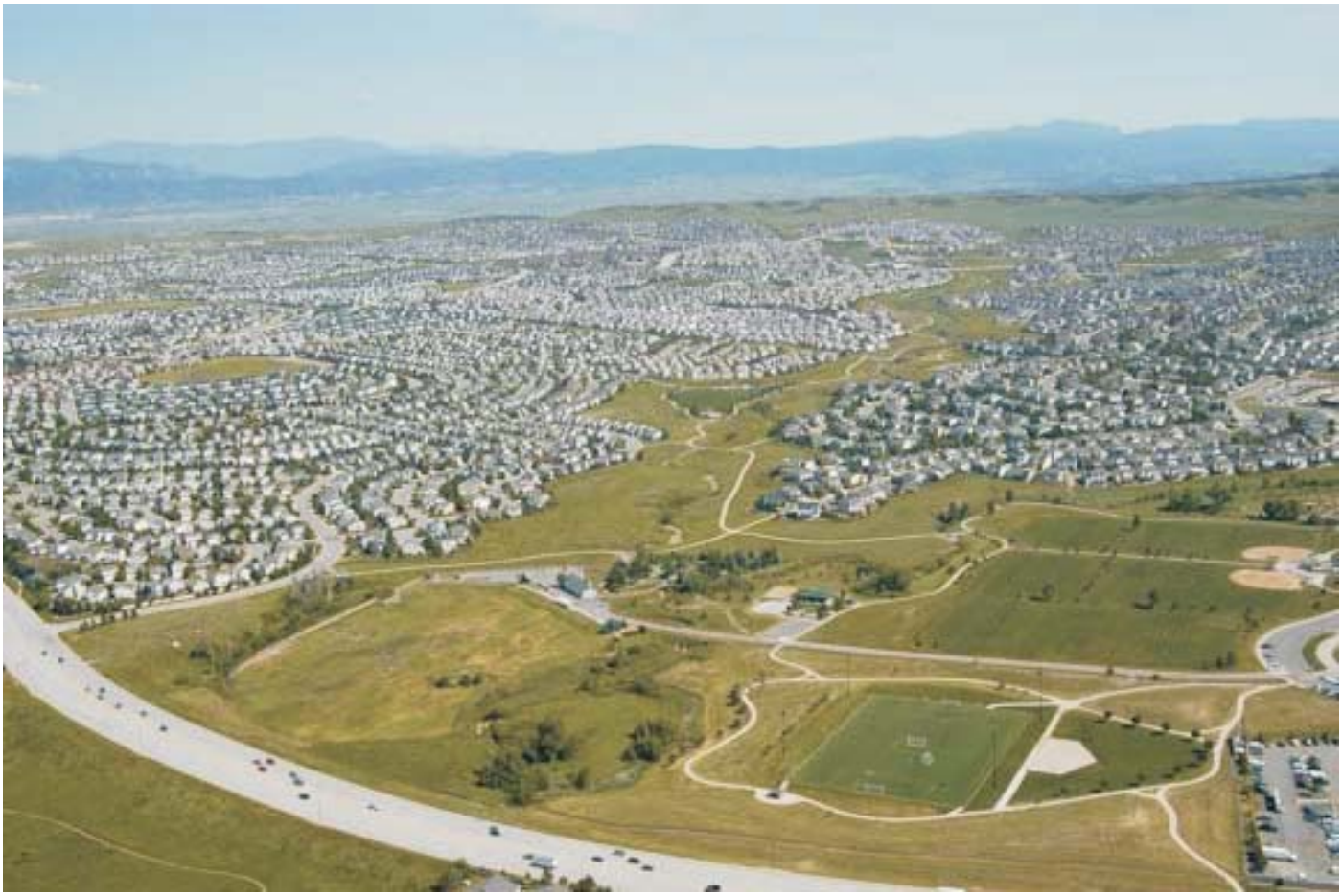
Key Features:

- Trail system comprising over 50 miles is used extensively and are located outside of the 100-year floodplain
- The trail system provides a walking network for children to go to school
- 22 parks
- Major utilitiy infrastructure and arterials were built before all the residential and commercial parcels were completed
- Dedication of a huge volunteer community to plant vegetation species along drainageways and parks (church and civil groups)



Reason why model works:

- Marketing as a community asset
- Reduced infrastructure cost
- Character of community is defined by the substantial area of open space (20-30%)
- Community pride
- Less cost for operations and maintenance
- Metro district model superior to HOA
- Lot premiums (25% adjacent to open space)



Large setbacks between residential units and open space / drainageways

Project Approach:

- Land was dedicated to create a broad floodplain area
- Adapting improvements to surroundings

Open Space Features:

- Manages flood events up to a projected 100-year flood
- Built a meandering riparian channel to improve water quality
- Restored prairie and riparian habitat
- Offers opportunity for interpretive education
- Constructed an attractive trail system for bicycling and walking
- Located recreational facilities adjacent to the creek as an extension of the park
- Trail crossings were incorporated into drainage improvements

Budget:

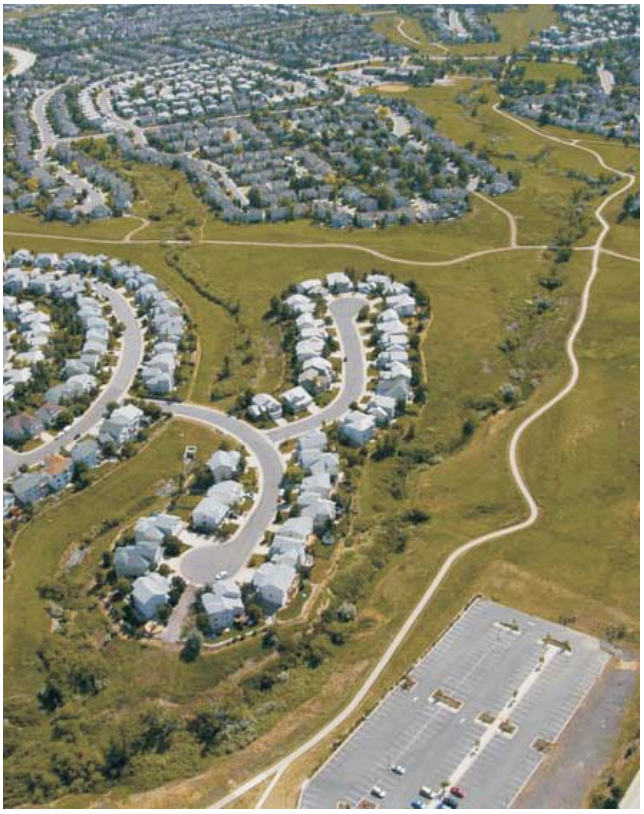
Project costs varied from:

- $250 per linear foot for major enhancements
- $50 per linear foot for bio-engineering

Highlighted Projects: Metro District / UDFCD

Design Consultant: Muller Engineering

Project Attributes:



Large setbacks between residential units and open space / drainageways

Marcy Gulch

- Phases 1 and 2
  3 mile reach
  18 drop structures, 3500 lf of bank protection
  6 trail crossings
  $3,700,000 ($325 lf)

Marcy Gulch

- Phase 3
  2,500 lf reach
  Boulder drops, grass plugs
  $700,000 ($140 lf)

Filing 103

- 1,000 lf reach
  Vegetative methods for stabilization
  $152,000 ($148 lf)versus conventional approach at $300 lf

Upper Big Dry Creek

- 1,100 lf reach
  Vegetative methods for stabilization (grass plugs)
  $20,000 ($20 lf)

Upper Dad Clark Creek

- 1,300 lf reach
  Several utilities, hidden erosion
  Boulder drops, low flow rock lining
  $150,000 ($118 lf)

Broad floodplain illustrates it can accomodate large storm events without compromising residential units

Wide continuous buffer and ribbon of riparian vegetation community that provides bank stabilization and wildlife habitat

Trail system adjacent to housing and crosses drainageway areas within the open space

Sculpted concrete drop structure

Soil cement drop structure

Neighborhood park adjacent to creek

Westminster Promenade

Developer: Excel Legacy Corporation and Entertainment Properties Trust

Year Started: 1998

Year to be completed: 2008

View of open space and trails adjacent to the hotel and commercial/retail complex of Westminster Promenade

History: Public parks, a recreation center and segments of trails were initially located near existing residential units.

Philosophy: Create a mixed-sue project with intentions to provide opportunities to live, work and play. The open space, creek system, and trails were critical elements to support this vision.

Project Approach: The developer specifically sited the development project near the existing park open space which lay adjacent to the creek understanding it was an amenity to complement the project.

Parcel Size: 42 acres

Budget: $50 million

Key Facts:

1st phase:

- The City of Westminster built a conference center on their land adjacent to the Westin hotel. The conference center is available for rent that generates revenue for the city.
- Transportation links and pedestrian connections were essential to make regional connections.
- Providing recreational, retail, hospitality, office space and restaurant serves as a local and regional destination was a key focus for the project. The hotel, restaurants, specialty retail and entertainment retail space anchored by an exisiting 24-screen AMC theater comprises 325,000 sqft.

2nd phase:

- Valuing the idea of wellness and the development of a senior population, Deepak Chopra (the best selling author and speaker on wellness and sprituality) plans to open a spa that would anchor a new seven-story, $40 million condominium and retail development next to the Westin Hotel and Conference Center. The 60 condominium units in the building will range in price from the $200,000s to more than $1 million. Construction is to be completed by Spring 2008.

View of the Hotel and Conference Center adjacent to the Sun Microsystems Ice Center.

Big Dry Creek meandering through the City of Westminster open space park system with trails

Preserve at Weaver Creek

Developer: Fairfield Homes

Location: City of Lakewood, Jefferson County

Size: 15 acres, 164 residential condominium units

Consultant: David Evans Associates

Key Facts:

- Infill project, in that development and roads already surround the site
- Weaver Creek runs through the site from south to north with a continuous base flow
- Developer mapped wetlands and erected stone walls at the edge to create the large building footprints
- The floodplain was contained within the walls. A CLOMR and LOMR were prepared. The LOMR became effective on 5/13/04.
- UDFCD approved the plans 5/13/02. The City of Lakewood approved 5/21/02. Construction was completed 9/25/03.

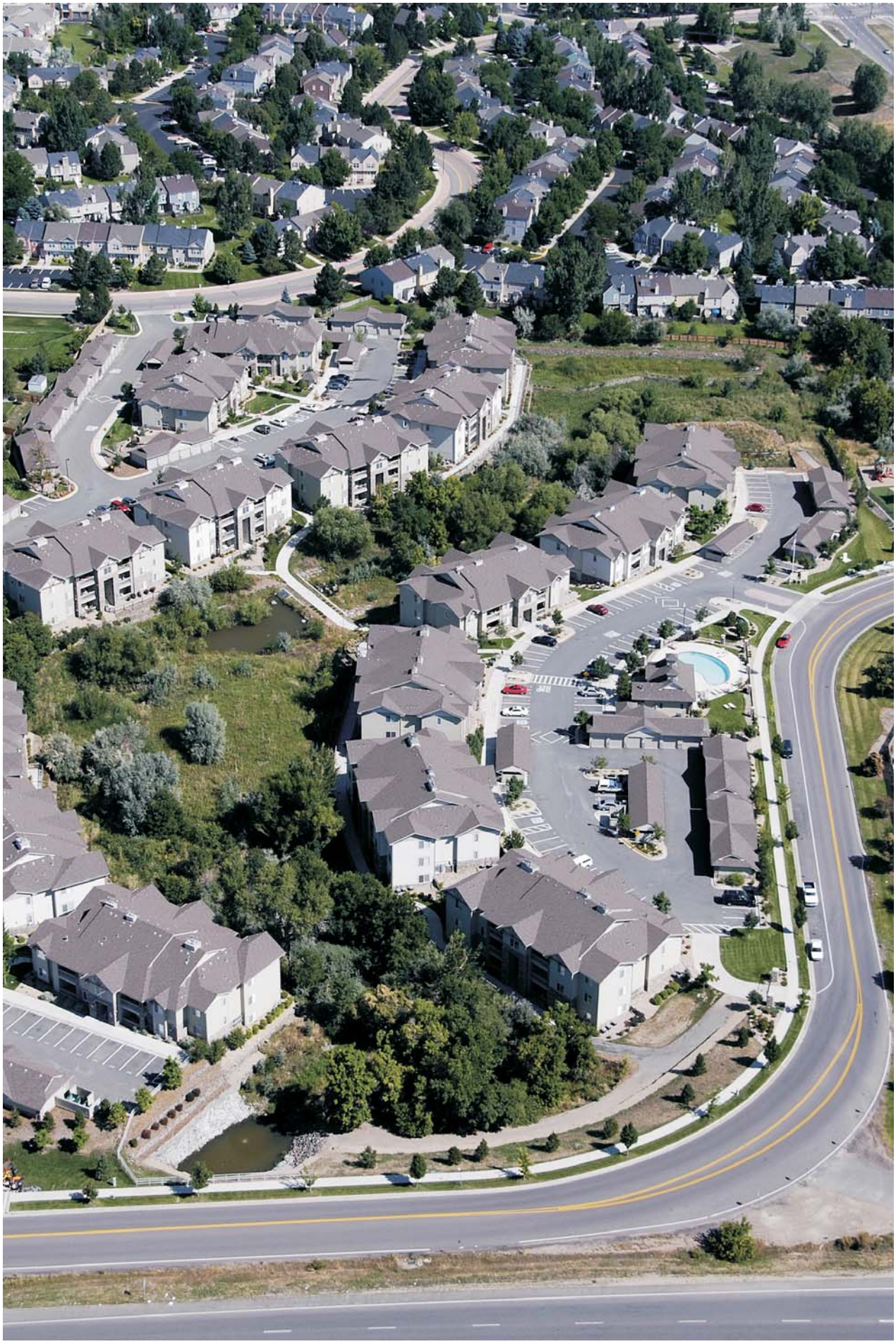
Key features:

- Provided trails, maintenance access and one stream crossing with low flow culverts and pond. Otherwise the riparian and wetland habitat was preserved.

Benefits:

The developer charged a unit premium for the creek side units, $5,000, $7,000, and $10,000 for the first, second, and third floors respectively. The premiums offset the cost of drainageway improvements (walls, trails, crossing and pond, stream stabilization and extra land given over to habitat preservation). The added bonus was all units were presold.

View of preserved wetlands



View of residential condominium units adjacent to preserved wetlands

View to trail and low flow of Weaver Creek adjacent to residential condominium units

View to low flow of Weaver Creek

View to preserved wetlands

View to preserved creekside riparian habitat

Good Examples

Orange dot indicates link to photo

Projects	Cultural Preservation	Regional Detention	Drop & Grade Control Structure	Floodplain Preservation	Golf Course	Infill Development	Low Flow Channel	Open Space	Riparian Preservation	Trails / Recreation	Wetlands / Water Quality
Baldwin Gulch at Parker Auto Plaza			● sd					●		○ ts	
Bear Creek				○	○			●	○	●	
Big Dry Creek at Westminster City Park				●				●	●	○	
Big Dry Creek at Highlands Ranch		●	○ sd	●	●			●	●	●	●
Brantner Gulch		○ jd	●	○			○	●	●	●	● wp
Brantner Gulch at Eastlake Village		○						●		●	
Cherry Creek Denver			○				●	●		○	
Cherry Creek at Stroh Road			○ sd	●			●	●	●	●	● wp
Cherry Creek Stream Stabilization	○		○ sd	●			●	●	●	●	● wp
City Park Drainage						○	○			●	
Coon Creek at Dancing Willows		●	●	○				●	●	●	●
First Creek at Green Valley Ranch		●	○	●	○			●	○	●	○ wp
Goldsmith Gulch at George Wallace Park		●	○ sd				●	○		●	
Goldsmith Gulch at Hutchinson Park			○ sd	●				●	○	○	● wp
Grange Hall Creek Tributary #5			● sd				●	●	●	○	
Happy Canyon Creek at Compark			●	○				●	●	○ ts	○ wp
Heritage Todd Creek		○ jd	●	●	●			●	●	●	○ wp
High Plains Country Club		●	●	●	○			●	●	●	●
Irondale Gulch at Gateway Park		○						●		●	●
Irondale Gulch at Parkfield		●						●		○	○
Lakewood Gulch							○	●		●	● wp
Lena Gulch			○ sd				●	●	●	●	
Massey Draw			○ sd				●	●	●		● wp
Murphy Creek Golf Course	○		●	●	○			●	○		
North Dry Gulch at Vance Street Center			●			○	●				
Pinery West Pradera Golf Course		○	●	●	○			●		●	●
Piney Creek at the Farm at Araphahoe County			●	●			○	●	●	●	
Prairie Gateway	●	○				●		●		●	○
Preble Creek at Larkridge		●	○ sd				●	●		●	●
Preserve at Weaver Creek				●		○		●	○	●	● wp
Rock Creek at Flatirons Mall			● sd	○				○	●	● ts	
Rock Creek Open Space			○ sd	●			●	●	●	●	● wp
Rock Creek Ranch		●	●	●			●	●	○	●	○
Saddle Rock Ranches Gulch at Eagle Bend				●	○			●	●	●	
Sanderson Gulch at White Fence Farm	○	●	●			○	●	○		●	● wp
SJCD (S) at Meadows Sanctuary			●	●				○		●	●
Sulphur Gulch			○ sd	●			●	●	●	●	● wp
Sulphur Gulch at Villages of Parker			●	○				○	○	●	
Tallman Gulch at Hidden River				●				○	○	●	
Tallman Gulch at Reata North			○	●			●	●	●	●	
Tallman Gulch at Rowley Downs			○ sd	●				●		●	● wp
Westerly Creek at Stapleton		●	○ sd	●		●	○	●		○	○ wp

Orange dot indicates link to photo

jd = jurisdictional dam
sd = specialty drop
ts = trail grade separation that works
wp = wetlands permitting coordination with COE

Murphy Creek Golf Course

City of Aurora public golf course built in cooperation with the surrounding residential development. Historic and cultural sites were preserved along with the riparian habitat.

Cultural Preservation
Drop Structure
Floodplain Preservation
Golf Course
Open Space
Riparian Preservation

Sanderson Gulch at White Fence Farm

Located along Jewel Avenue, west of Sheridan Boulevard in the City of Lakewood, this residential development surrounds the historic White Fence Farm Restaurant. Careful treatment of Sanderson Gulch and North Sanderson Gulch resulted in a community asset for both the restaurant and the neighborhood.

Cultural Preservation
Drop Structure
Regional Detention
Infill Development
Low Flow Channel
Open Space
Trails / Recreation
Wetlands / Water Quality

Cherry Creek Stream Stabilization

The preservation of the 17 Mile House is located along the Cherry Creek Corridor in Arapahoe County. It serves as a wildlife corridor for deer, coyote, and raptors. This property adds more than 160 acres of buffer space along Parker Road and Cherry Creek and can be accessed by a regional trail. This historic structure is one of the three remaining “mile houses” along the Cherokee/Smokey Hill Trail, a mid-19th century route that connected Bent’s Fort and other settlements along the Arkansas River and Palmer Divide to the gold camps and settlements along the Front Range. Collaboration and funding for this project was provided by UDFCD, Arapahoe County, Douglas County, the Town of Parker, Great Outdoors Colorado, the Gates Family Foundation, The Colorado State Historical Fund, the City of Aurora and the Trust for Public Land.

Cultural Preservation
Drop Structure
Floodplain Preservation
Low Flow Channel
Open Space
Riparian Preservation
Trails / Recreation
Wetlands / Water Quality

End of Section

Irondale Gulch at Gateway Park

Located in the City and County of Denver, this multi-family development incorporated a significant water feature that doubles as dedicated flood storage.

Regional Detention
Open Space
Trails / Recreation
Wetlands / Water Quality

Prairie Gateway

Located in the City of Commerce City, the Prairie Gateway is the new home for the Colorado Rapids Soccer stadium, new Civic Center and infill commercial and retail development. The retention pond, located in the conservation area, receives all the stormwater from the adjacent development. Wetlands were created to address water quality.

Cultural Preservation
Regional Detention
Open Space
Trails / Recreation
Wetlands / Water Quality
Infill Development

Brantner Gulch

Over a dozen development projects have recently come on line within the Brantner Gulch watershed in the City of Thornton. This view is of Marshal Lake, a jurisdictional dam and recreation feature.

Regional Detention
Drop Structure
Floodplain Preservation
Low Flow Channel
Open Space
Trails / Recreation
Wetlands / Water Quality
Riparian Preservation

Pinery West Pradera Golf Course

This Douglas County development is located south of the Town of Parker along Scott Gulch, which passes through the irrigation reservoir.

Regional Detention
Drop Structure
Floodplain Preservation
Golf Course
Open Space
Trails / Recreation
Wetlands / Water Quality

Brantner Gulch at Eastlake Village

Cooperation with the City of Thornton to convert a former irrigation reservoir into a regional detention pond with a significant open space component and riparian preservation.

Regional Detention
Open Space
Trails / Recreation

Heritage Todd Creek

This project included a jurisdictional dam, Smith Reservoir. A variety of vegetative methods were used to stabilize drainageways that integrated well into the golf course and residential community.

Regional Detention
Drop Structures
Floodplain Preservation
Golf Course
Open Space
Riparian Preservation
Trails / Recreation
Wetlands / Water Quality

End of Section

Cherry Creek at Denver

One of the grouted sloping boulder drop structures along Cherry Creek in Denver.

Drop Structure
Low Flow Channel
Open Space
Trails / Recreation

Goldsmith Gulch at Hutchinson Park

UDFCD project that exemplifies sculpted concrete drop structure placement along Goldsmith Gulch in a Denver Park.

Drop Structure
Floodplain Preservation
Open Space
Riparian Preservation
Trails / Recreation
Wetlands / Water Quality

Lena Gulch

This UDFCD project located downstream of Maple Grove Reservoir in Wheat Ridge and Lakewood mitigated stream degradation and protected residential property that is listed in the National Backyard Wildlife Registry.

Drop Structure
Low Flow Channel
Open Space
Riparian Preservation
Trails / Recreation

Drop & Grade Control Structures

Massey Draw

An example of a sculpted drop structure. Vegetation has grown in around the structure creating habitat, erosion control and also softening the hardness of the structure.

Drop Structure
Low Flow Channel
Open Space
Riparian Preservation
Wetlands / Water Quality

Drop & Grade Control Structures

Rock Creek Open Space

An example of a sculpted drop structure. Efforts were made to undulate the structures outside edges and steps to emulate natural rock outcrops.

Drop Structure
Low Flow Channel
Floodplain Preservation
Open Space
Riparian Preservation
Trails / Recreation
Wetlands / Water Quality

Tallman Gulch at Reata North

Grade control structure used in an open floodplain in Douglas County. Notice how little of this structure is visible.

Grade Control Structure
Low Flow Channel
Floodplain Preservation
Open Space
Riparian Preservation
Trails / Recreation

Drop & Grade Control Structures

Highlands Ranch Filing 122

The shotcrete style sculpted drop structure doubles as an outlet structure for a stock pond that was incorporated into the development.

Regional Detention
Drop Structure
FloodPlain Preservation
Golf Course
Open Space
Riparian Preservation
Trails / Recreation
Wetlands / Water Quality

Cherry Creek at Stroh Road

Sculpted concrete drops were used to stabilize the Cherry Creek low flow channel for this UDFCD project in the Town of Parker.

Drop Structure
Low Flow Channel
Floodplain Preservation
Open Space
Riparian Preservation
Trails / Recreation
Wetlands / Water Quality

Drop & Grade Control Structures

Cherry Creek Stream Stabilization

This Colorado Association of Stormwater and Floodplain Managers (CASFM) award winning UDFCD project in Arapahoe County included riffle drops, very low head and mild sloped riprap structures. The project was done in conjunction with the aquisition and preservation of the historic 17-Mile House.

Cultural Preservation
Drop Structure
Low Flow Channel
Floodplain Preservation
Open Space
Riparian Preservation
Trails / Recreation
Wetlands / Water Quality

Drop & Grade Control Structures

Westerly Creek at Stapleton

This Colorado Association of Stormwater and Floodplain Managers (CASFM) award winning project in Stapleton incorporated circular cast in place concrete drop structures to create an artful contrast with the park preserve because it was in a more urban setting.

Regional Detention
Drop Structure
Low Flow Channel
Floodplain Preservation
Infill Development
Open Space
Trails / Recreation
Wetlands / Water Quality

Drop & Grade Control Structures

Preble Creek at Larkridge

For cost effective measures this drop structure incorporated natural boulders in the stilling pool and pre-cast blocks for easy placement on site while creating interesting sculpture elements.

Regional Detention
Drop Structure
Low Flow Channel
Infill Development
Open Space
Trails / Recreation
Wetlands / Water Quality

Tallman Gulch at Rowley Downs

This is the confluence of Tallman Gulch and Tallman Gulch Tributary in the Rowley Downs development in the Town of Parker. UDFCD installed a series of sculpted concrete drop structures along the entire Gulch to set a theme.

Drop Structure
Floodplain Preservation
Open Space
Trails / Recreation
Wetlands / Water Quality

Drop & Grade Control Structures

Sulphur Gulch

UDFCD project using a series of sculpted concrete drop structures to stabilize severe erosion and headcutting along Sulphur Gulch.The project was considered so successful that the Town of Parker adopted this treatment for all similar projects within the town.

Drop Structure
Low Flow Channel
Floodplain Preservation
Open Space
Riparian Preservation
Trails / Recreation
Wetlands / Water Quality

Drop & Grade Control Structures

Goldsmith Gulch at George Wallace Park

A large open space set a side in the Denver Tech Center Development for flow conveyence and regional detention. Even though it is a formalized park it still provides a wide buffer between two different land uses. Unique concrete baffle drop structures were created to enhance the urban design quality of the park.

Regional Detention
Drop Structure
Low Flow Channel
Floodplain Preservation
Open Space
Trails / Recreation

First Creek at Green Valley Ranch

Golf course development with extensive COE consultation which included a regional peak shaving detention pond, floodplain and riparian preservation, trails, low flow controls for First Creek and Tributary T.

Regional Detention
Drop Structure
Golf Course
Floodplain Preservation
Open Space
Riparian Preservation
Trails / Recreation
Wetlands / Water Quality

End of Section

Bear Creek

The Bear Creek corridor in the western metro Denver area is a great recreation resource and natural habitat. Notice the mixed uses, residential development, open space/natural habitat, and golf course.

Floodplain Preservation
Golf Course
Open Space
Riparian Preservation
Trails / Recreation

Floodplain Preservation

Brantner Gulch

Brantner Gulch and Lakewiew Tributary in the City of Thornton run through several development projects. Floodplains and riparian habitat have been preserved, providing a great asset to the community.

Regional Detention
Drop Structure
Floodplain Preservation
Low Flow Channel
Open Space
Riparian Preservation
Trails / Recreation
Wetland / Water Quality

Coon Creek at Dancing Willows

This project rebuilt an existing irrigation reservoir into a regional water quality and flood routing pond. The project approach was handled in a more natural manner by utilizing vegetative methods for stream stabilization, minimal structures for grade control, and creating meandering recreational trails.

Regional Detention
Grade Control Structures
Floodplain Preservation
Open Space
Riparian Preservation
Trails / Recreation
Wetland / Water Quality

Happy Canyon Creek at Compark

Extensive coordination with COE to obtain an individual permit, which resulted in a unique treatment of preserved vertical banks with toe protection, riparian habitat. During the monitoring period the outside bends have remained stable showing no surface evidence of rip rap even though very high flows have been experienced.

Drop Structure
Floodplain Preservation
Open Space
Riparian Preservation
Trails / Recreation
Wetland / Water Quality

Rock Creek at Flatirons Mall

Unique grouted boulder drop structures were created to route irrigation flows for a continuous water effect. The project contains a lot of sheet piling and revetment for stabilization but none of these materials are visually apparent except for this drop structure. This is a city park in Broomfield adjacent to the Mall.

Drop Structure
Floodplain Preservation
Open Space
Riparian Preservation
Trails / Recreation

Sulphur Gulch at Villages of Parker

Open Space areas were left natural. Large setbacks were created from the open space for the residential units. A network of trails connects to the Cherry Creek regional trail.

Drop & Grade Control Structures
Floodplain Preservation
Open Space
Riparian Preservation
Trails / Recreation

End of Section

Bear Creek

Golf course and recreational development along the Bear Creek corridor in Lakewood.

Floodplain Preservation
Golf Course
Open Space
Riparian Preservation
Trails / Recreation

Pinery West Pradera Golf Course

View along drainageways and fairways in rural high-end Douglas County development.

Regional Detention
Drop Structure
Floodplain Preservation
Golf Course
Open Space
Trails / Recreation
Wetlands / Water Quality

Murphy Creek Golf Course

View along Murphy Creek tributary showing the golf course and residential development land uses.

Cultural Preservation
Drop Structure
Floodplain Preservation
Golf Course
Open Space
Riparian Preservation

First Creek at Green Valley Ranch

Golf course development with extensive COE consultation which included a regional peak shaving detention pond, floodplain and riparian preservation, trails, low flow controls for First Creek and Tributary T.

Regional Detention
Drop Structure
Golf Course
Floodplain Preservation
Open Space
Riparian Preservation
Trails / Recreation
Wetlands / Water Quality

High Plains Country Club

This project involved an adjacent golf course development with selected stabilizing controls which included grade control, low flow and grouted sloping boulder drops. The floodplain preservation supported the protection of riparian remnants.

Regional Detention
Drop & Grade Control Structures
Floodplain Preservation
Golf Course
Open Space
Riparian Preservation
Trails / Recreation
Wetlands / Water Quality

Saddle Rock Ranches Gulch at Eagle Bend

Floodplain preservation provided the protection of riparian remnants. The open space and golf course activity were good uses to integrate with stream functions and provide a buffer to the residential community. Drop structures were built for stream stabilization.

Drop Structures
Floodplain Preservation
Golf Course
Open Space
Riparian Preservation
Trails / Recreation

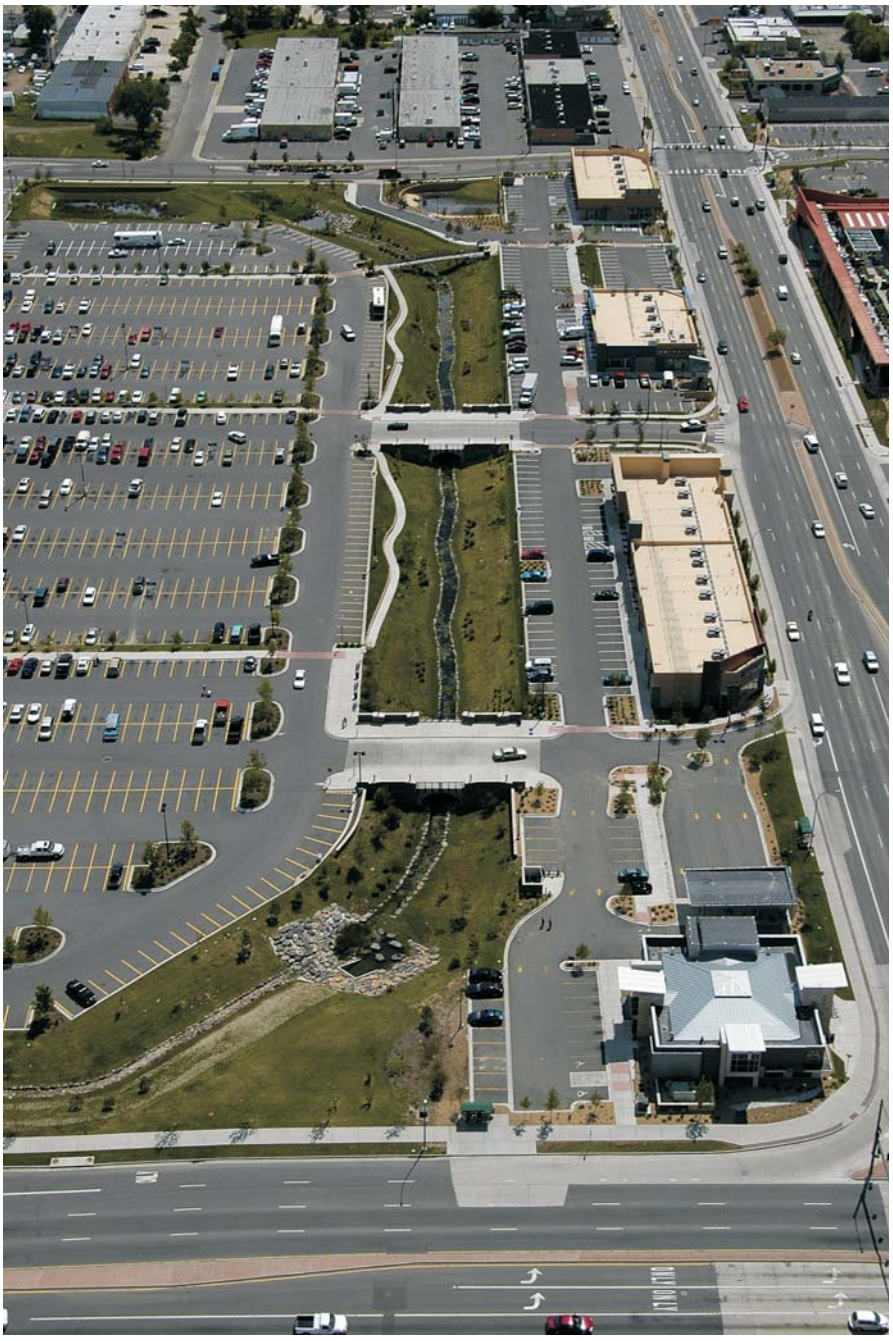
End of Section

Infill Development

City Park Drainage

A series of commercial and mixed-use developments are lined up along City Park Drainageway at 120th Avenue in the Cities of Broomfield and Westminster. UDFCD persuaded three developers to cooperate on their various LOMRs. Part of Broomfields's municipal campus is visible in the lower photo.

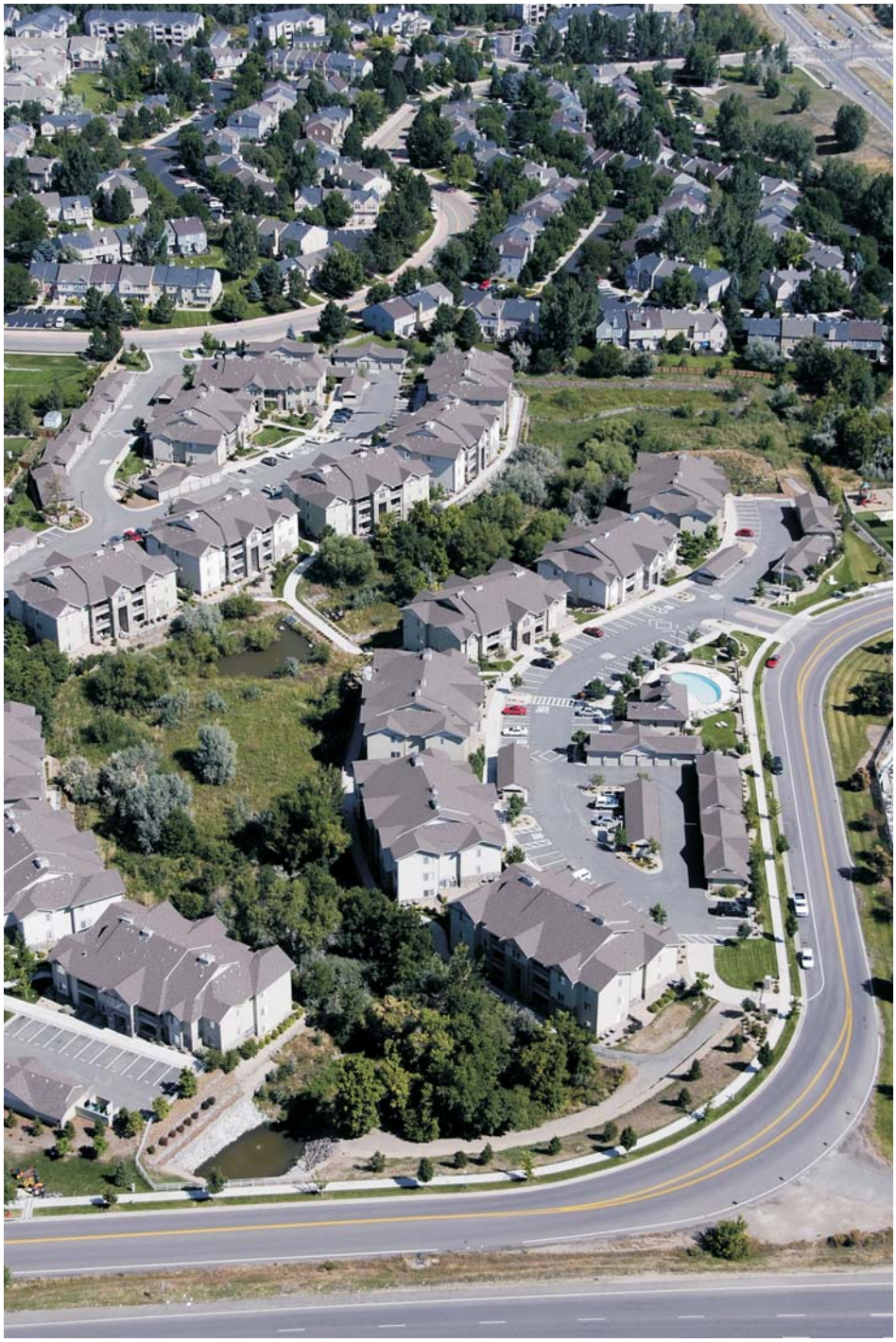
Infill Development
Low Flow Channel
Trails / Recreation



North Dry Gulch at Vance Street Center

This infill commercial project rehabilatated a drainageway that was ephemeral. The drainageway was created between the pad sites and the development storefronts adjacent to Colfax Avenue. This improvement was created to be self supporting and provide storage on site as a historic drainage control. A cobble low flow created a channelized drainageway.

Drop Structures
Infill Development
Low Flow Channel



Preserve at Weaver Creek

Residential units were built around the wetlands and Weaver Creek to preserve the habitat and create a community and aesthetic asset.

Floodplain Preservation
Infill Development
Open Space
Riparian Preservation
Trails / Recreation
Wetlands / Water Quality

Sanderson Gulch at White Fence Farm

Located along Jewel Avenue, west of Sheridan Boulevard in the City of Lakewood, this residential development surrounds the historic White Fence Farm Restaurant. Careful treatment of Sanderson Gulch and North Sanderson Gulch resulted in a community asset for both the restaurant and the neighborhood. The open field in the photo center is an undeveloped Lakewood park site.

Cultural Preservation
Drop Structure
Regional Detention
Infill Development
Low Flow Channel
Open Space
Trails / Recreation
Wetlands / Water Quality

End of Section

Brantner Gulch

Grade control structures used along Brantner Gulch reversed accelerated stream degradation.

Regional Detention
Grade Control Structures
Floodplain Preservation
Low Flow Channel
Open Space
Riparian Preservation
Trails / Recreation
Wetlands / Water Quality

City Park Draiange

This is City Park drainageway in Broomfield. The low flow channel has a concrete mowing strip and wetland bench protected from erosion by a row of boulders.

Infill Development
Low Flow Channel
Trails / Recreation

Low Flow Channel

Low Flow Channel
Open Space
Trails / Recreation
Wetlands

Lakewood Gulch

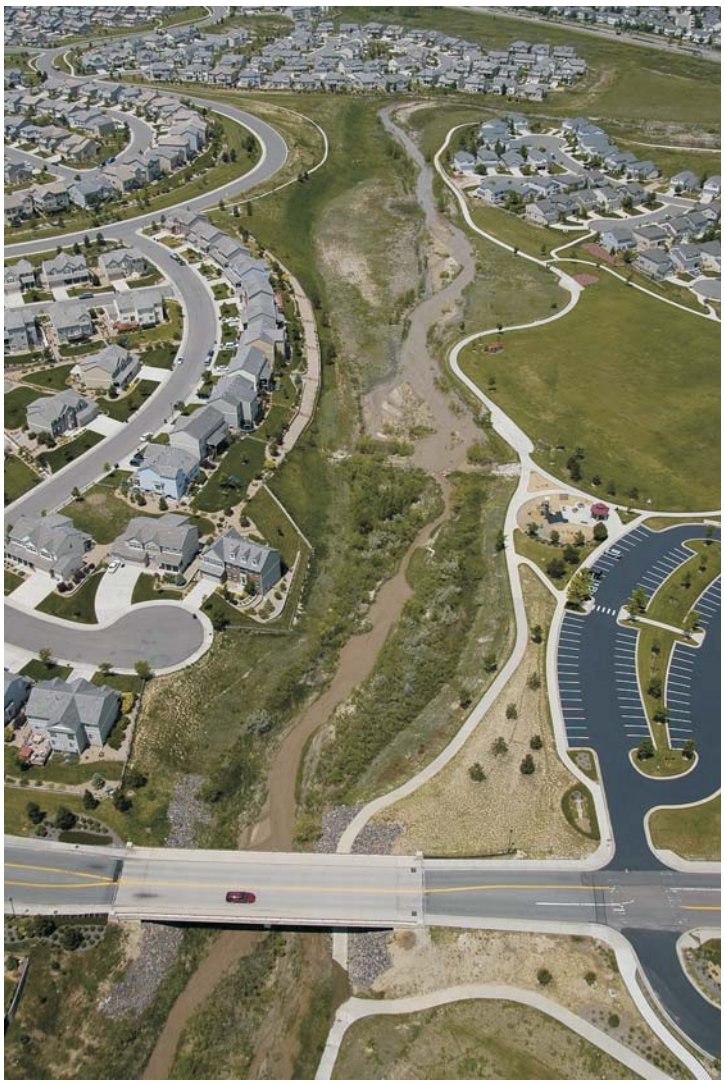
The upper photo is of Lakewood Gulch in Denver showing a boulder lined low flow channel. The lower photo is also Lakewood Gulch in Denver showing a grade control structure and low flow drop structure.

Low Flow Channel

Westerly Creek at Stapleton

Bioengineering methods were used to stabilize the reconstruction of this drainageway. Biologs were used to stabilize the toe of the slope on outside bends and wetland sod was used on the gradual slope of the inside bend. Along tighter bends rock veins were used to secure the upper banks.

Regional Detention
Drop Structures
Floodplain Preservation
Low Flow Channel
Open Space
Trails / Recreation
Wetlands / Water Quality



Piney Creek at the Farm at Arapahoe County

Tower Road Bridge at Piney Creek. Notice the stream form for this reach located between two drop structures along an otherwise very dynamic Piney Creek. Riparian habitat has developed from the drop structure down stream of Tower Road. Drop structure use results in milder stream gradients, lowering velocities for robust vegetation growth.

Drop Structure
Floodplain Preservation
Low Flow Channel
Open Space
Riparian Preservation
Trails / Recreation

End of Section

Sanderson Gulch at White Fence Farm

Located along Jewel Avenue, west of Sheridan Boulevard in the City of Lakewood, this residential development surrounds the historic White Fence Farm Restaurant. Careful treatment of Sanderson Gulch and North Sanderson Gulch resulted in a community asset for both the restaurant and the neighborhood.

Cultural Preservation
Drop Structure
Regional Detention
Infill Development
Low Flow Channel
Open Space
Trails / Recreation
Wetlands / Water Quality

Tallman Gulch at Hidden River

Trails, open space, and pocket park uses characterize Tallman Gulch in this Town of Parker development.

Floodplain Preservation
Open Space
Riparian Preservation
Trails / Recreation

Goldsmith Gulch at George Wallace Park

A large open space set a side in the Denver Tech Center Development for flow conveyance and regional detention. This reach does a successful job of riparian preservation within a linear corridor of open space.

Regional Detention
Drop Structure
Low Flow Channel
Floodplain Preservation
Open Space
Trails / Recreation

Rock Creek at Flatirons Mall

Unique grouted boulder drop structures were created to route irrigation flows for a continuous water effect. The project contains a lot of sheet piling and revetment for stabilization but none of these materials are visually apparent except for this drop structure. This is a city park in Broomfield adjacent to the Mall.

Drop Structure
Floodplain Preservation
Open Space
Riparian Preservation
Trails / Recreation

SJCD (S) at Meadows Sanctuary

Several unique grouted boulder drop structures were used to create flat reaches that promote stability and provide a generous open space set aside.

Drop Structure
Floodplain Preservation
Open Space
Trails / Recreation
Wetlands / Water Quality

Sulphur Gulch at Villages of Parker

The most important feature of this large scale Town of Parker development is Sulphur Gulch. Development avoided any contact with the floodplain, riparian corridor and wetland areas of this valuable community resource.

Drop Structure
Floodplain Preservation
Open Space
Riparian Preservation
Trails / Recreation

End of Section

Sulphur Gulch at Villages of Parker

Open Space areas were left natural. Large setbacks were created from the open space for the residential units. A network of trails connects to the Cherry Creek regional trail.

Drop Structure
Floodplain Preservation
Open Space
Riparian Preservation
Trails / Recreation

Bear Creek

Land use decisions along the Bear Creek corridor have favored floodplain preservation. Development interests, communities, residents, and the natural environment have all benefitted as discussed in the philosophy section.

Floodplain Preservation
Golf Course
Open Space
Riparian Preservation
Trails / Recreation

First Creek at Green Valley Ranch

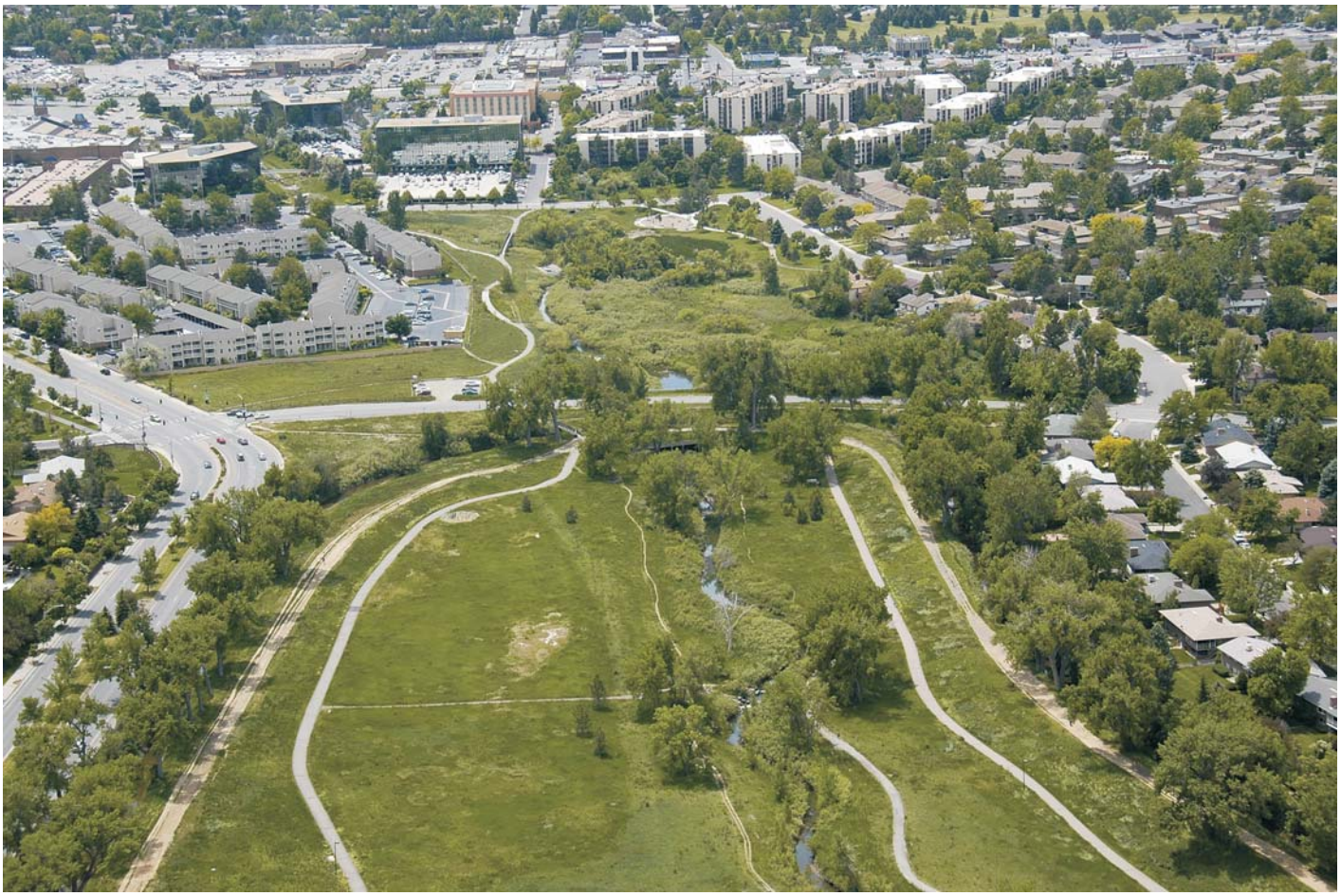
Golf course development with extensive COE consultation which included a regional peak shaving detention pond, floodplain and riparian preservation, trails, low flow controls for First Creek and Tributary T.

Regional Detention
Drop Structure
Golf Course
Floodplain Preservation
Open Space
Riparian Preservation
Trails / Recreation
Wetlands / Water Quality

Murphy Creek Golf Course

View along Murphy Creek tributary showing the integration of the golf course and riparian preservation.

Cultural Preservation
Drop Structure
Floodplain Preservation
Golf Course
Open Space
Riparian Preservation



Goldsmith Gulch at Hutchinson Park

This Denver park contains a large wetland area, riparian remnants adjacent to a meandering creek, as well as an innovative and attractive recreation/maintenance trail.

Drop Structure
Floodplain Preservation
Open Space
Riparian Preservation
Trails / Recreation
Wetlands / Water Quality

Tallman Gulch at Hidden River

Remnants of riparian vegetation are integrated with the park and trails.

Floodplain Preservation
Open Space
Riparian Preservation
Trails / Recreation

Riparian Preservation

Preserve at Weaver Creek

Residential units were built around the existing riparian corridor and wetlands to preserve the habitat and create a community and aesthetic asset.

Floodplain Preservation
Infill Development
Open Space
Riparian Preservation
Trails / Recreation
Wetlands / Water Quality

Rock Creek Ranch

This view includes residential and commercial development, a water quality pond (foreground), pocket park, ballfields, and trails adjacent to the preserved and enhanced Rock Creek corridor in the Rock Creek Ranch development in the Town of Superior.

Regional Detention
Drop Structure
Floodplain Preservation
Low Flow Channel
Open Space
Riparian Preservation
Trails / Recreation
Wetlands / Water Quality

End of Section

Irondale Gulch at Parkfield

This view includes Parkfield Lake, a City and County of Denver regional park, Montbello Recreation Center (right background) and Gateway Elementary School (right foreground). Parkfield Lake is an important flood control facility within the Irondale Gulch watershed. The outlet works are visible between the recreation center and the school.

Regional Detention
Open Space
Trails / Recreation
Wetlands / Water Quality

Goldsmith Gulch at Hutchinson Park

This Denver park contains a large wetland area as well as an innovative and attractive recreation/maintenance trail.

Drop Structure
Riparian Preservation
Open Space
Trails / Recreation
Wetlands / Water Quality

Cherry Creek at Denver

Low flow grade control structure and recreation/maintenance trail crossing on Cherry Creek in Denver.

Drop Structure
Low Flow Channel
Open Space
Trails / Recreation

Big Dry Creek at Westminster City Park

The natural stream system is visible adjacent to the City of Westminster's regional park campus.

Floodplain Preservation
Open Space
Riparian Preservation
Trails / Recreation

Westerly Creek at Stapleton

The trail system is graded into the undulating landscape which meanders against the overbank areas adjacent to the creek and the upper terraces. The trail system was separated from the migration corridor in order to not fragment wildlife habitat.

Regional Detention
Drop Structure
Low Flow Channel
Floodplain Preservation
Infill Development
Open Space
Trails / Recreation
Wetlands / Water Quality

Grange Hall Creek Tributary 5

This is a sculpted drop structure and recreation/maintenance trail crossing in Northglenn.

Drop Structure
Low Flow Channel
Open Space
Riparian Preservation
Trails / Recreation

Baldwin Gulch at Parker Auto Plaza

This was the first development project that utilized a sculpted concrete drop structure. Grade separated crossings were handled well and small riparian remnants were preserved. This crossing accommodated both the flow of the creek and the traveling pedestrian either on bicycle or foot.

Drop Structure
Open Space
Trails / Recreation

Happy Canyon Creek at Compark

Single Span bridges are an effective way to handle trail grade separations. This structure accommodates the trail and the creek. It allows more opening for the flow to pass through. The structure is more minimal than a box culvert resulting in a much more open and light filled environment for the safety of pedestrians.

Drop Structure
Floodplain Preservation
Open Space
Riparian Preservation
Trails / Recreation
Wetland / Water Quality

End of Section

Prairie Gateway

These upper water quality ponds are located on the Prairie Gateway in City of Commerce City. They collect stormwater from the adjacent urban infill development thereby maximizing land economically and providing water to the conservation area. Extensive consideration was given to the design of these water quality ponds because of its sensitive adjacent location to the Rocky Mountain Arsenal National Wildlife Refuge. These ponds are in the migration corridor for significant wildlife. They are extensively planted with wetland species to increase bio-filtering. Additionally the tail is extended to promote efficient infiltration for improved water quality. These water quality ponds daylight to a large retention pond in the conservation area.

Cultural Preservation
Regional Detention
Open Space
Trails / Recreation
Wetlands / Water Quality
Infill Development

Irondale Gulch at Parkfield

This view is looking east along 56th Avenue. Parkfield II Water Quality Pond is located on Rocky Mountain Arsnenal National Wildlife Refuge. Designed and built by the Parkfield developer on federal property in cooperation with the US Fish and Wildlife Service, this very successful project will become a Denver community asset when the perimeter fence is relocated. The outlet channel is visible in the right of the photo, the overflow weir is visible in the foreground and wetland growth is visible everywhere.

Regional Detention
Open Space
Trails / Recreation
Wetlands / Water Quality

Westerly Creek at Stapleton

This view shows the broad floodplain that incorporates a meandering low flow, expansive open space that weaves through the different residential filings, drop structures, trails, bridges, riparian plant communities and a water quality structure with tiered water quality ponds. All man made structures were created to be formal in geometry to show the contrast to the natural preserve area that supports wildlife habitat. The water quality pond was composed of three tiered ponds to enhance infiltration and provide different ecological aspects for wildlife habitat (open water, nesting areas, and food source). Wetlands were extensively planted to create littoral zones and improve biofiltering for enhanced water quality. The outfall structure was designed as a staging place for outdoor interpretive education.

Regional Detention
Drop Structure
Low Flow Channel
Floodplain Preservation
Open Space
Infill Development
Riparian Preservation
Trails / Recreation
Wetlands / Water Quality

Rock Creek Ranch

This view includes residential and commercial development, a water quality pond (foreground), pocket park, ballfields, and trails adjacent to the preserved and enhanced Rock Creek corridor in the Rock Creek Ranch development in the Town of Superior.

Regional Detention
Drop Structure
Floodplain Preservation
Low Flow Channel
Open Space
Riparian Preservation
Trails / Recreation
Wetlands / Water Quality

Heritage Todd Creek

This project included a jurisdictional dam, Smith Reservoir. A variety of vegetative methods were used to stabilize drainageways that integrated well into the golf course and residential community.

Regional Detention
Drop Structures
Floodplain Preservation
Golf Course
Open Space
Riparian Preservation
Trails / Recreation
Wetlands / Water Quality

First Creek at Green Valley Ranch

Golf course development with extensive COE consultation which included a regional peak shaving detention pond, floodplain and riparian preservation, trails, low flow controls for First Creek and Tributary T.

Regional Detention
Drop Structure
Golf Course
Floodplain Preservation
Open Space
Riparian Preservation
Trails / Recreation
Wetlands / Water Quality

Happy Canyon Creek at Compark

Extensive coordination with COE to obtain an individual permit, which resulted in a unique treatment of preserved vertical banks with toe protection, riparian habitat. During the monitoring period the outside bends have remained stable showing no surface evidence of riprap even though very high flows have been experienced.

Drop Structure
Floodplain Preservation
Open Space
Riparian Preservation
Trails / Recreation
Wetland / Water Quality

End of Section

Library Links

Counties
Adams County
Arapahoe County
Boulder County
City & County of Broomfield
City & County of Denver
Douglas County
Jefferson County

Incorporated Cities and Towns
Arvada
Aurora
Boulder
Brighton
Centennial
Erie
Golden
Greenwood Village
Lakewood
Lakewood Floodplain Management
Lakewood Review Process
Lakewood Site Development Standards
Littleton
Lone Tree
Parker
Thornton
Westminster

Federal Agencies
Environmental Protection Agency
Federal Emergency Management Agency
US Fish & Wildlife Service

Professional Organizations
Association of State Floodplain Managers
Association of State Wetland Managers
Colorado Association of Stormwater & Floodplain Managers
National Association of Flood & Stormwater Management Agencies

State and Regional Resources
Colorado Department of Public Health and Environment
Colorado Water Conservation Board
Foothills Park and Recreation District
Highlands Ranch Metro Districts
South Suburban Parks and Recreation District
Southeast Metro Stormwater Authority (SEMSWA)
Urban Drainage and Flood Control District

Other Resources
Addressing Water and Natural Resource Edition
Center for Watershed Protection
Colorado Natural Heritage Program
Colorado Riparian Association
ERO Resources Corp. (404 permitting)
Low Impact Development Center
Trust for Public Land
Urban Watersheds Research Institute
The Nature Conservancy