Cherry Creek Watershed 'Smart Growth for Clean Water' Report

December 2003

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Sue Barton, Senior Planner, Arapahoe County Planning; primary technical editor.
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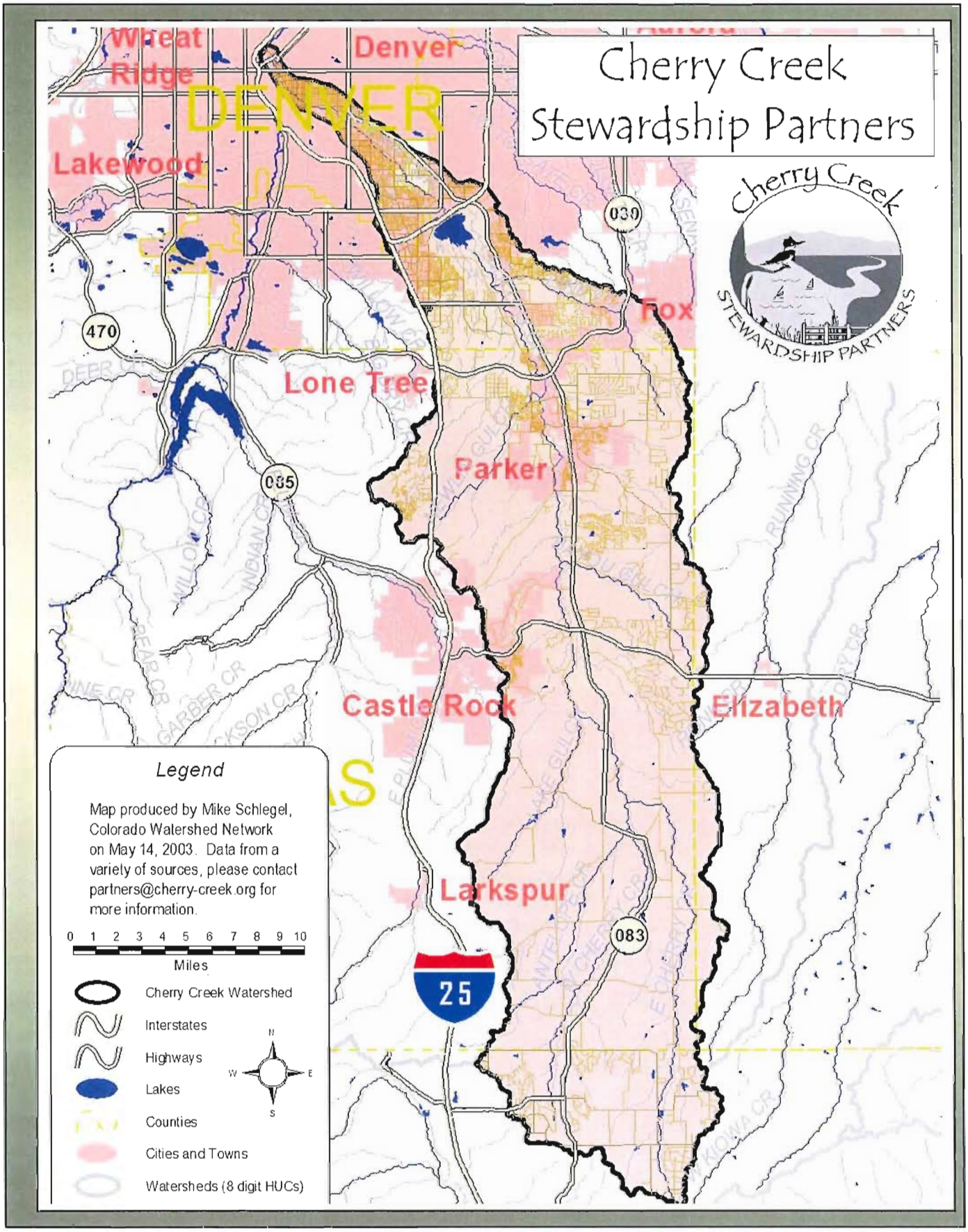
Bob Toll, Park Ranger, Cherry Creek State Park; technical review.


Cherry Creek Stewardship Partners
Wheat Ridge
Denver
DENVER
Lakewood
Aurora
039
470
Fox
Lone Tree
Parker
085
Castle Rock
Elizabeth
Larkspur
083
25
Legend
Map produced by Mike Schlegel, Colorado Watershed Network on May 14, 2003. Data from a variety of sources, please contact partners@cherry-creek.org for more information.
0 1 2 3 4 5 6 7 8 9 10
Miles
Cherry Creek Watershed
Interstates
Highways
Lakes
Counties
Cities and Towns
Watersheds (8 digit HUCs)
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W
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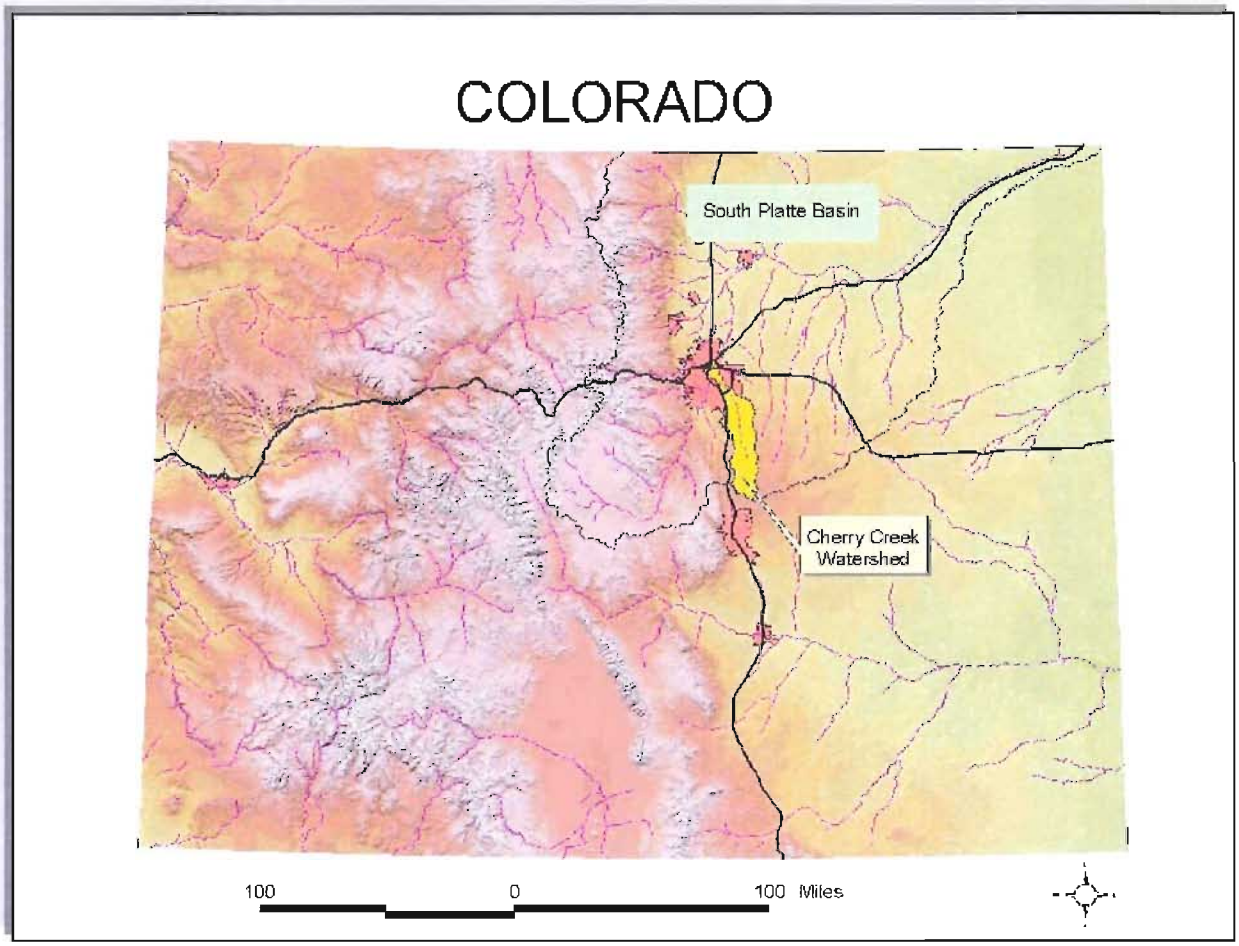
S
Cherry Creek
STEWARDSHIP PARTNERS



Located in the southeast portion of the Denver metropolitan area, the Cherry Creek Reservoir watershed consists 386 square miles of some of the fastest growing portions of Arapahoe and Douglas counties. The 600 miles of riparian-vegetated stream corridor, the alluvial aquifer that provides water supplies to many water users, and the Cherry Creek Reservoir, including its recreational amenities and fishery, provide a highly valued resource to the residents of Colorado (*Watershed Plan 2003*, prepared for the Cherry Creek Basin Water Quality Authority by URS Corporation, August 2003).

1.0 EXECUTIVE SUMMARY

During the *Cherry Creek Stewardship Partners* (*Partners*) 3-year long participation in the ***Smart Growth for Clean Water - Cherry Creek Watershed Partnership*** project, five broad categories of findings were identified:

1) The practice of **engaging** the development community, local land use agencies, and citizens **in the watershed planning** process is a key component of making smart growth techniques viable in a watershed. Public understanding helps lead to public acceptance and leadership for projects.

2) There are **excellent sources of information about the watershed**, including substantial scientific analysis of the soil and water quality, an extensive compilation of watershed conditions, including the vulnerability of the sub-watersheds, and numerous master plans that provide a sound basis for applying watershed smart growth strategies in the region;

3) We can go **beyond** the level of water quality enhancement mandated by **existing regulations** and substantially further reduce runoff volumes and pollutant loading to streams and the Cherry Creek Reservoir to as close to pre-development conditions as possible;

4) There are **available solutions** that can be implemented **to minimize or remove the barriers** that block implementation of these watershed smart growth water quality practices within the development community and within local government planning agencies; and

5) There are **funding and marketing options** available to local governments, special districts, the development community, and special interest groups, such as watershed networks that can provide economic incentives for innovative site and planning design, and help fund watershed projects.

The goal of the ***Smart Growth for Clean Water*** partnership project was not only to connect growth decisions to water quality, but to meet the watershed's existing water quality mandate with innovative strategies that pushed beyond compliance with regulations to identifying enhancement opportunities. The following are the key findings of this partnership project:

There is a competitive advantage to 'smart growth for clean water' practices: watershed smart growth "pays its way".

Quality of life and profitable development do not have to be disparate concepts. Many watershed smart growth practices produce market advantages that improve sales and property values. The open spaces and greenscapes associated with innovative stormwater management plans are attractive to consumers and often command premium prices and enhanced property values. Some examples of the economic benefits to the developer utilizing 'smart growth for clean water' tools include the following:

Executive Summary

Removing regulatory barriers, involving the community, going beyond minimal regulations and identifying funding sources are all key tasks that can be accomplished in the Cherry Creek watershed.

Incentives for developers, as well as the monetary benefits of lot premiums near open space, give watershed smart growth strategies a competitive advantage.

Executive Summary

- Negotiated settlements or concessions in the planning process, such as reducing the overall number of units to facilitate platting and zoning approvals, can lead to increased open space and may become the specific enhancement feature that attracts buyers. The monetary loss resulting from a reduction in the number of units available for development can be more than offset by the optimization of lot premiums near undeveloped open space. This increase in open space can have significant monetary value in an urban environment.
- The incentive of density credits given to cluster development has the economic benefit of potentially lowering the infrastructure costs as well as increasing the amount of connected open space. The increase in density due to clustering is an economic benefit in itself with additional units to sell, and the reduced cost of condensed site preparation, the increase in development flexibility for the site design, and the conservation of resources can be additional economic benefits to the developer.
- The increased open space has the added effect of providing a highly prized, desirable 'rural character' in an urban setting that can enhance the attractiveness of a community.

Density reductions and clustering can provide for more open space, which can be beneficial for both the development's bottom line and for the environment, while at the same time adding to the value of a community.

There are environmental benefits to utilizing watershed smart growth strategies.

'Smart growth for clean water' practices protect not only water quality, but also wildlife habitat, riparian corridor, open space, and the natural areas. Local identity is closely linked to the wide-open spaces along the creeks in the Cherry Creek watershed. Some environmental benefits to the watershed using 'smart growth for clean water' techniques include:

- For source water that has a particular environmental problem, such as the phosphorous standard for Cherry Creek and the Reservoir, wetlands are the most valuable, yet undervalued, landscape. Wetlands provide water storage during times of stormwater runoff, slowing the velocity of the floodwaters. Wetlands provide an excellent area for groundwater recharge, and they filter pollutants as they attenuate the floodwaters.
- Wetlands, associated riparian zones, and land conservation/setback efforts are critical to maintaining the wildlife "health" of an urban setting by serving as diverse natural corridors used by wildlife for reproduction, shelter and food.
- Enhanced stormwater Best Management Practices (BMPs), such as grass swales and porous landscape detention, control the quality of runoff and reduce the loads of contaminants reaching the creek and the Reservoir.

The environmental benefits of 'smart growth for clean water' practices can be seen in the increased riparian habitat, flood control, and storage, as well as the water quality benefits inherent in increased wetlands and open space.

Local and regional land use planning entities will require educational opportunities to feel comfortable applying or even be able to apply 'smart growth for clean water' practices applicable to the watershed.

Enhanced water quality is a worthy and important goal. However, it does not necessarily follow that the processes to meet that goal are immediately

accessible within the development planning and engineering divisions in the land use agencies. Minimizing the impervious surfaces to reduce runoff through the use of narrower streets with adjacent grass-lined swales may make sense from a watershed management perspective, but the current roadway standards may not allow streets other than standard width with curb and gutter in a developable area. Other findings that will require additional efforts to incorporate smart growth water quality practices so that they are not deterrents from planning approvals include:

- The local governmental planning effort in terms of current building, zoning, and other regulations may not be integrated sufficiently to successfully deal with the issues of stormwater and non-point source reductions, in addition to water quality and low impact development strategies.
- Watershed smart growth practices, if new to the land use planners, such as minimizing directly connected impervious surfaces, can impact the anticipated schedule of planning approvals. These approvals are crucial to getting a project financed, so training in these strategies is essential.

There is a need identified in the Cherry Creek watershed for a phosphorous reduction/watershed smart growth advocate to provide assistance to developers and land use agencies.

In order to facilitate the best use of technology and the best fiscally sound development practices that can be utilized in the watershed, a special ombudsman or "phosphorous facilitator" must be identified to assist development in the watershed. Some of the characteristics of this person would be as follows:

- Knowledge of where and how pollutants are entering the surface water and groundwater. This understanding would provide the basis for applying 'smart growth for clean water' strategies to development projects throughout the watershed.
- Ability to provide training sessions with local land use staff on applicable strategies for the watershed. From a development standpoint, higher development costs result when there is a disconnect between best available technology and planning agency knowledge and procedures. Without predictability in the timetable for the planning process, there may be delays that produce higher capital and interest costs for funding. Additionally, this can lead to a longer learning curve for the developer and the land use staff during the development planning approval process.
- Oversight, monitoring, and reporting of the reductions in phosphorous loads from non-point sources in the watershed. In order to reach the standard and goal in the Cherry Creek Reservoir Control Regulation for the phosphorous load, there needs to be an accounting and tracking of the phosphorous coming into the system from all non-point sources.

A key to integrating watershed smart growth practices into the development process is to educate local governments about the tools, rationales, and benefits so that practices can eventually become a part of the local planning process.

A Phosphorous Facilitator position is critical to the watershed; the *Partners* have lobbied for an advocate that assists and supports developers and local planning staff in going beyond minimal regulations.

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The *Partners* have completed the process of securing an MOU among the local governments in the Cherry Creek watershed under a grant from the Governor's Office of Smart Growth.

Enhanced erosion controls and stormwater BMPs can be implemented in the watershed with just a little extra effort in the planning stage of a development.

Local governments can promote 'smart growth for clean water' activities by participating in watershed management as a key stakeholder and as a champion for creating a long-term strategy for development and growth impacts on the watershed.

The nature of intergovernmental agreements, memorandums of understanding, and statement of purpose documents is such that they require an extensive commitment in time and energy during discussion, preparations and implementation. The result is an extremely valuable document that captures the intent of the parties in writing, and provides a baseline with which to document and monitor the progress and ensure the long-term adherence to the agreement. In addition, the agreements can document that the development remains true to 'smart growth for clean water' practices, and required monitoring and maintenance programs. The *Partners* are excited about putting this finding into action with the signing of the Cherry Creek Regional Memorandum of Understanding Agreement by the majority of entities within the Cherry Creek watershed in the spring of 2003.

The goal in the Cherry Creek watershed should be to encourage practices that go beyond the baseline BMPs, so that watershed smart growth practices mean implementation of enhanced erosion control and stormwater BMPs.

The Cherry Creek Basin Water Quality Authority has adopted a long-range plan to manage stormwater in the basin using BMPs as described in the Urban Drainage and Flood Control District's (UDFCD) Volume 3 to reduce phosphorous and other pollutant loads to the stream system and ultimately to the Reservoir. The goal for all new development is to implement minimum BMPs, as specified in the Control Regulation. The *Partners* has identified that there are smart growth water quality strategies that can go beyond minimum measures and is suggesting that the goal be reducing stormwater runoff and phosphorous loads from development to levels similar to pre-development conditions. Findings from the ***Smart Growth for Clean Water*** partnership project suggest the following:

- For a development with enhanced BMPs including alternative street configurations, upstream storage, filtration, and stormwater recharge, stormwater runoff and phosphorous loads would be reduced to near pre-development conditions.
- The use of maximized areas of constructed wetlands in riparian zones and optimized infiltration practices, in conjunction with clustering of residences, can reduce the annual average stormwater phosphorous load from the parcel to approximate the pre-development conditions, even though additional units were added to the development utilizing density credits.
- Erosion control for stream reaches can go beyond conventional drop structure and bank stabilization of the channel and instead focus on establishing wide, shallow flow conditions, resulting in wetlands and enhancement of water quality and riparian habitat.

Funding Options for land conservation and water quality enhancements are available.

One of the goals of the *Partners* in this report is to provide a listing of funding resources that are available. This review of funding options identified over 50 grant opportunities from federal agencies, state agencies, as well as several private foundations and corporate entities, that can provide funding resources for planning, design, coordination, restoration, protection, infrastructure, corridor enhancements and technical assistance for the watershed. While external funding sources are available, it takes a serious investment to identify and pursue those available resources. Some of the agencies listed that have demonstrated interest in *Partners* projects in the watershed include:

- U.S. Army Corps of Engineers
- Colorado Wetlands Program
- Colorado Water Pollution Control Revolving Fund
- North American Wetlands Conservation Act
- U.S. Environmental Protection Agency
- Colorado Department of Public Health and Environment
- Colorado Department of Transportation

A funding matrix has been developed to provide all stakeholders with the opportunity to access additional funding sources for development, retrofitting, and restoration.

Citizen participation is a key component in maximizing opportunities for watershed enhancements.

In many instances, a public involvement stakeholder process is required by state and local statutes and land use agency comprehensive plans. In other cases, public participation may be a necessary part of securing funding for a watershed project. In all cases, citizens and grassroots organizations want significant opportunities to interact with watershed groups, land use planning agencies and regulators, in order to communicate their vision for how they want their watershed to mature. The *Partners* have identified several key components to public involvement in the watershed:

- Providing a public forum, such as the annual *Partners* conference, is a valuable way to gather a network of interested community members in order to build coalitions across the jurisdictional boundaries.
- Homeowner Associations (HOAs) can provide a key role in all aspects of a watershed planning effort, in that they not only inform local decision makers about what is going on in their neighborhood and their needs, but also serve to disseminate information back to the community. In addition, HOAs are often responsible for the operation and maintenance of private BMPs, and may be in need of ongoing education forums and training opportunities.
- Encouraging quasi-governmental agencies, such as the Authority, to take a lead role in promoting education and information sharing serves to expand the sphere of public participation.

The *Partners* public education forums include the Annual Conference, quarterly meetings, and periodic forums of topics of interest, such as the "Water Quality Concepts Tour" held in May 2003.

Executive Summary

The time is now to push forward the 'smart growth for clean water' initiatives that have been identified over the last 3 years by the *Partners.*

A broad coalition of resource agencies, local governments, and stakeholders, multi-objective watershed projects that provide benefits to various user groups, innovative master plan reports and 'greenprints', and a "regional mindset" all go a long way towards providing the foundation for successful implementation of watershed smart growth practices. Some of the 'foundation' activities that will keep the smart growth water quality strategies moving forward include:

- The Trust for Public Land Legacy Planning grant project presented a 'greenprint' that highlighted significant opportunities to preserve land, develop parks and trails, protect and improve water quality, restore degraded areas, and conserve cultural and historical resources.
- UDFCD's master planning effort for the Cherry Creek corridor is a groundbreaking plan that will identify not only water quantity and quality controls, but also identify reclamation opportunities for the stream corridors and provide for the integration of recreational and open space components.
- The Authority's Watershed Plan 2003 provides an analysis of the watershed in terms of a road map to implementation of restoration, reclamation, and protection strategies on a sub-watershed basis so that each land use entity can identify the strategy required for each sub-watershed. This effort will provide a 5-year approach to water quality improvement.

The *Partners* will build on the efforts ongoing in the watershed that have provided a strong foundation for meeting the water quality mandate with watershed smart growth strategies.

The documents highlighted here, including the "Greenprint", the Cherry Creek Corridor Master Plan, and the Watershed Plan 2003 provide the foundation for continuing stewardship of the watershed.

The baseline assumptions behind the estimates shown in **Figure 1** are provided in **Appendix A**, located at the end of this section.

Figure 1 shows that as imperviousness increases with urbanization, stormwater runoff volume and total phosphorus loading increases, while groundwater recharge and evapotranspiration decreases (Figure 1 does not reflect base flow volumes). It is the increase in stormwater runoff volume that leads to the greatest impact on the natural stream system of a watershed. As discussed in the TPL Legacy Greenprint, the natural drainageways of the Front Range are generally not able to withstand the increased frequency, rate, and volume of runoff resulting from urbanization. Streams respond by degrading to a flatter slope, leading to cycles of bed and bank erosion. Such erosion removes natural streambank vegetation, impairs habitat, and degrades water quality. Stream degradation adds to watershed nutrient loading by incorporating phosphorus-entrained sediments into the water column. Thus, urbanization often leads to negative impacts on the stream environment and on water quality.

Urbanization also brings about a significant demand for irrigation. The quantity of water typically used to irrigate the lawns of single-family residential development is usually greater than the annual precipitation falling on the same land.

Water resource impacts and phosphorus loading from a given area of development in the Cherry Creek watershed can be estimated by reading values from **Figure 1** at the appropriate impervious percentage, then prorating up or down based on the ratio of actual area to one square mile. For instance, irrigation requirements for a 320-acre single family residential development with an imperviousness of 30% may be about 450 acre-feet per year (320 ac/640 ac * 900 = 450 ac-ft/yr).

Benefits of Land Conservation

Water quality benefits associated with land conservation are shown in **Figure 2**. Acquiring a parcel or dedicating open space that otherwise would develop mitigates increases in runoff volume, degradation, and phosphorus loading. With stabilization improvements to arrest any naturally occurring stream erosion or erosion caused by other developing areas further upstream, a significant amount of phosphorus loading can be prevented (this is in addition to other benefits associated with open space conservation addressed later).

The phosphorus reduction amounts shown in **Figure 2** assume that the developing area would have partially mitigated its increased phosphorus loading through permanent BMPs, such as extended detention basins. Providing these BMPs is a standard requirement for new development in the Cherry Creek watershed.

Figure 2 can be used to estimate potential, future phosphorus loading that may be reduced through land conservation. The phosphorus savings can be estimated by reading values at the potential impervious percentage of the tract if it were developed, then pro-rating up or down based on the ratio of tract area to one square mile. For instance, the phosphorus reduction associated with conserving what would have been a 1,000-acre mixed-urban development area (48% imperviousness) would be almost 690 pounds/year (1000 ac/640 ac*440 lbs/yr).

TPL Legacy "Greenprint"

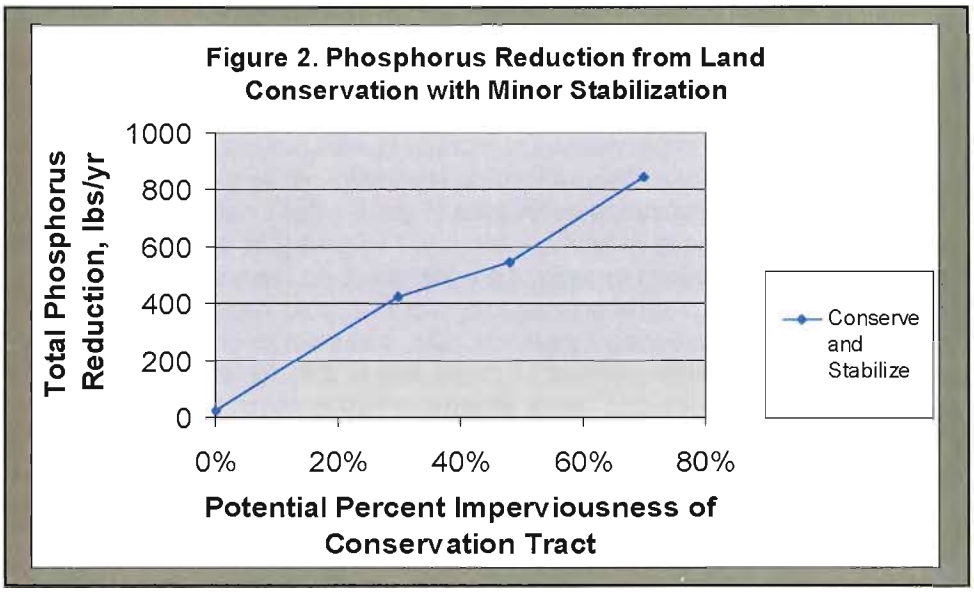
Acquiring a parcel or dedicating an area for open space that would otherwise develop mitigates increases in runoff volume, degradation, and phosphorous loads.

The phosphorous reduction associated with conserving a 1,000-acre mixed urban development area (48% impervious) would be about 690 pounds per year.

TPL Legacy "Greenprint"

The Shop Creek system has been immobilizing over 50% of its inflowing phosphorous load over the last 8 years.

Figure 3 illustrates the affect of one mile of stream length, reclaimed and configured for water quality enhancement assumed to provide a 5% reduction in upstream phosphorous loading.



It follows from **Figure 2** and its underlying assumptions that the greatest amount of phosphorus reduction from land conservation will accrue from larger parcels that could develop at a relatively high density, which can include a substantial stream network where degradation can be reduced. Thus, it is important to consider the strategic acquisition of open space parcels that hold the greatest potential for water quality degradation. This strategy does not preclude development, just seeks to optimize it in less sensitive areas.

Water Quality Benefits of Stream Reclamation


Shop Creek Reclamation Project

Significant phosphorus reduction can accrue if tracts located along reaches of major stream corridors are set aside for open space conservation. Such parcels are especially valuable for preserving the habitat, recreation, and water quality functions of natural stream corridors. Monitoring of the Shop Creek reclamation project in Cherry Creek State Park shows that stream channels can be constructed as linear water quality treatment facilities, providing reduction of phosphorus loads from upstream developing watersheds. The Shop Creek system, consisting of a water quality pond and ½-mile of wetland channel, has been immobilizing over 50-percent of its inflowing phosphorus load over the last 8 years, according to Authority data (Chadwick, 2003).

The phosphorous reduction that may be provided by a reclaimed stream will vary based on the nature of the improvements, the length of the reach, and the loading conditions upstream. For illustration purposes, **Figure 3** indicates the potential phosphorous reduction associated with a one-mile reach of stream reclamation, which is assumed to provide a 5% reduction in upstream phosphorous loading. A 5% reduction in this loading for the length of the reclaimed stream appears to be achievable based on evaluation of Cottonwood Creek and Shop Creek projects.

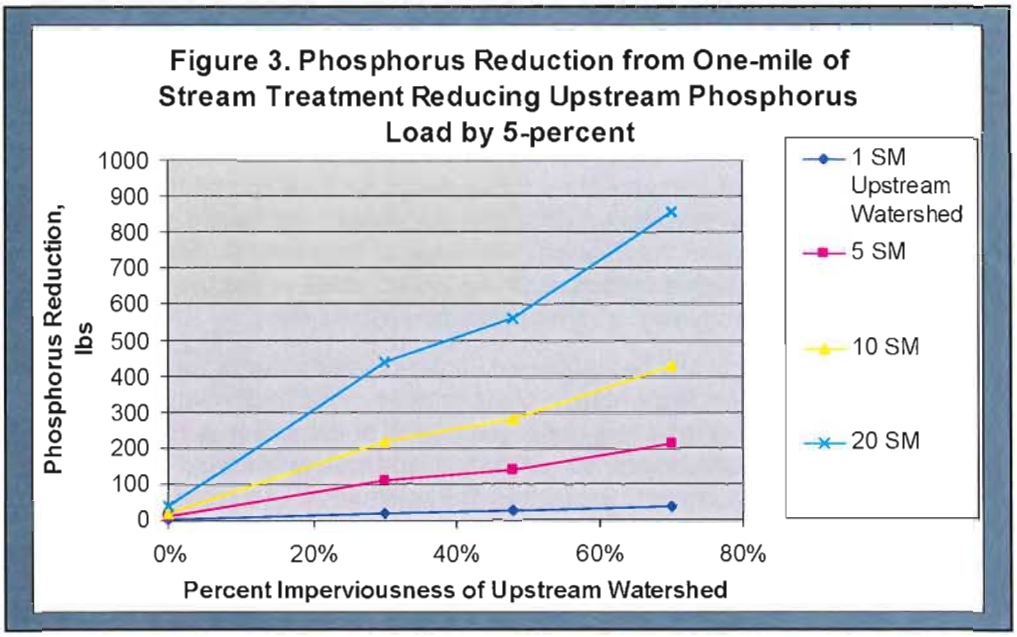


Figure 3 indicates that one mile of stream reclamation treating at the 5% level may reduce phosphorus loading from a 20-square mile upstream area, with an average imperviousness of 30-percent by over 450 pounds annually. Longer reaches of reclaimed stream are believed to have increased phosphorus reduction benefits, but generally at a rate lower than indicated for the first mile. It is suggested that a second mile of stream reclamation be allotted with half the phosphorus reduction of the first mile, and that a third mile be allotted with half the reduction of the second mile, and so on. This will produce an upper estimate of phosphorus reduction about twice the assumed one-mile level of phosphorous reduction (10-percent for **Figure 3**). For reclaimed stream reaches less than one mile, it is suggested that the phosphorus reduction shown in **Figure 3** be prorated to reflect the actual reach length. For instance, if the reclaimed stream length from the example above is 2500 lineal feet, **Figure 3** would indicate just over 200 pounds of phosphorus reduction.

Stormwater Volume Control

Another watershed smart growth practice, stormwater volume control, is aimed at reducing the increase in pollutant loading from stream degradation and watershed runoff that is normally associated with urbanization. Stormwater volume control seeks to reduce and disconnect urban impervious areas like streets, sidewalks, parking lots, and roof areas, and encourage runoff to infiltrate into the soil. The "stretch goal" for stormwater volume control is to come as close as possible to matching pre-development quantities of runoff and pollutant loads. Theoretically, if this goal is reached, a development project may have little additional impact on downstream receiving waters compared to pre-development conditions.

If a site applies stormwater volume control to the extent that pre-development quantities of runoff and pollutant loads are approximated, **Figure 2** can be used to approximate the level of phosphorus reduction that would be attained as compared to conventional development. It stands to reason that if a lesser level of volume control is applied, some portion of the phosphorus reduction shown in **Figure 2** can still be attributed to the practice.

TPL Legacy "Greenprint"

A significant length of stream restoration might reduce the in-flowing phosphorous loads by as much as 10%, according to existing data.

Stormwater volume control seeks to reduce and disconnect urban impervious areas like streets, sidewalks, parking lots, and roof areas, and encourage infiltration.

TPL Legacy "Greenprint"

Generally, implementing stream reclamation for water quality enhancement is cost effective as compared to other regional water quality facilities.

Habitat, recreation, and resource values of open space can help tip the scales toward acquiring parcels for conservation.

Cost Effectiveness of 'Smart Growth for Clean Water' Practices

As discussed herein, the 'smart growth for clean water' practices of land conservation, stream reclamation, and stormwater volume control each provide significant benefits in terms of reducing urban impacts to receiving waters. Expressing the cost of implementing these practices as a unit cost per quantity of runoff or pollutant that is reduced (for instance, dollars per pound of phosphorus), provides one measure of the cost effectiveness of the practice. Another, and perhaps a more applicable measure, is the added value to the land associated with open space, greenways, and recreational opportunities.

Although experience is still being gained in stormwater volume control, some studies indicate that implementation costs may be close to conventional development. This implies a low dollar per pound of phosphorus reduced and a high level of cost effectiveness. When added land values are also considered, there can be strong economic incentives to implement these practices.

Generally, implementing stream reclamation for water quality enhancement is cost effective (on the basis of dollars per pound of phosphorus reduced) compared to other regional water quality facilities. Stream reclamation costs will vary according to the magnitude of the design flow rate, condition of the stream, and nature of the improvements. Construction costs of many stream improvement projects on the front range of Colorado are in the range of $100 to $500 per lineal foot. A project reclaiming a two-mile reach of Cottonwood Creek upstream of Cherry Creek Reservoir is estimated to immobilize hundreds of pounds of phosphorus at a unit rate of $300 to $600 per pound.

The cost effectiveness of land conservation in dollars per pound varies according to the actual land costs involved. If "top dollar" goes toward acquiring a parcel of land for open space, and if water quality is the only focus, the transaction may not yield the lowest cost per pound of phosphorus reduced compared to other possible projects. However, if the open space conservation achieves other benefits, such as habitat, recreation, and resource value, phosphorus reduction can "tip the scales" more favorably toward acquiring parcels for conservation.

Conclusions

The effort to mitigate urban impacts on receiving waters is focusing increased attention on watershed smart growth practices such as land conservation, stream reclamation, and stormwater volume reduction. This section offers a screening method to quantify the water quality benefits of open space conservation and other related smart growth techniques. Although the method is approximate, and more detailed analyses and data collection are recommended to estimate any site or project-specific impacts or benefits, the figures provide a tool to illustrate general, long-term average effects on water quality due to various land practices.

References

Chadwick Ecological Consultants (2003). "Draft Cherry Creek Reservoir 2002 Annual Aquatic Biological and Nutrient Monitoring Study."

The Trust for Public Land (2002). "Cherry Creek Basin Open Space Conservation and Stewardship Plan".

Urban Drainage and Flood Control District (1999). Urban Storm Drainage Criteria Manual, Volume 3 - Best Management Practices.

Urban Drainage and Flood Control District (2001). Urban Storm Drainage Criteria Manual, Volume 1.

Appendix A

Assumptions for Figure 1

1. Annual precipitation equals 15 inches.
2. Effective precipitation equals 70% of total precipitation for developed conditions (deleted first 0.1 inch of precipitation from each event as non-runoff producing) and 40% for undeveloped conditions (deleted first 0.4 inch).
3. Annual storm runoff equals the product of effective precipitation and the 2-year runoff coefficient shown in Figure RO-8 in the Urban Drainage and Flood Control District's Volume 1 Drainage Criteria Manual (UDFCD, 2001).
4. Does not include base flow runoff volumes.
5. Pervious area evapotranspiration equals 90% of total precipitation, based on water balance assumptions in The Trust for Public Land's ***Cherry Creek Basin Open Space Conservation and Stewardship Plan***.
6. Groundwater recharge equals total precipitation less runoff and evapotranspiration.
7. Annual irrigation water needs are assumed to equal 30-inches over 80% of the pervious portion of the developed area.
8. Total phosphorus loading is made up of contributions from watershed loading and stream erosion. Watershed phosphorus loading is estimated as the product of storm runoff volume and representative concentrations of phosphorus in runoff (0.4 mg/l for undeveloped conditions and 0.65 mg/l for developed conditions (UDFCD, 1999)). Phosphorus contribution from stream erosion is based on the quantity of eroded sediment times a phosphorus content of 1.6 pounds per cubic yard, based on monitoring data in the Cherry Creek watershed. Stream bed erosion is assumed to progress downward at a rate of 2-inches per year over a degraded width of 25% of the total stream bottom width over a representative major drainageway length of 2.4 miles for one square mile of watershed area. Twenty-five percent of the estimated stream erosion phosphorus load is assumed to be already reflected in the watershed phosphorus load, thus seventy-five percent of the stream erosion load is added to the watershed load to obtain the total phosphorus load shown in Figure 1.
9. Values shown in Figure 1 apply at the downstream limit of an arbitrary watershed area of one square-mile and do not reflect any increases or reductions that may occur in downstream stream corridors. Because of the current infiltration and absorption effects of the Cherry Creek corridor, values reflected in Figure 1 are generally greater than the direct effects on Cherry Creek Reservoir.

TPL Legacy "Greenprint"

Apendix B

TPL Legacy Greenprint Water Quality Goals and Recommendations (from the ***Cherry Creek Basin Open Space Conservation and Stewardship Plan*** *(TPL, 2002))*

Goal 2.1 Encourage development practices that minimize increases in runoff volume and pollutant loading over predevelopment conditions.

Planning for increased runoff

Recommendation 2.1a *Work with one or more developers to implement runoff control demonstration projects to advance the technical approaches involved and showcase the approaches to local governments and other developers.*

Recommendation 2.1b *Create incentives for developers to incorporate runoff control practices into new projects.*

Recommendation 2.1c *Remove local government barriers to implementing innovative runoff controls.*

Goal 2.2 Adopt "water quality friendly" stream stabilization practices.

Recommendation 2.2a *Encourage natural stream restoration, maintaining shallow, stable base flow channels with wide, vegetated floodplains, as opposed to stabilizing eroded channels in place.*

Recommendation 2.2b *Promote design criteria for stream stabilization projects that focus on water quality enhancement, considering width to depth ratios and design roughness values and velocities for a range of flow conditions.*

Recommendation 2.2c *Stabilize tributaries to Cherry Creek to control the delivery of high sediment loads to mainstream Cherry Creek, reducing loading to the reservoir and impairment of the creek and creating healthy, natural stream environments within the watershed.*

Recommendation 2.2d *Develop and implement a stabilization plan for mainstream Cherry Creek that mitigates the impacts of increased runoff, is natural in appearance and function, and preserves and enhances the corridor's inherent ability to improve water quality.*

Goal 2.3 Formulate an implementation strategy to fund and construct stream and tributary improvements proactively, in advance of increased runoff from development and degradation of the stream system.

Recommendation 2.3a *Supplement or replace the current practice of having developers implement stream stabilization measures on the portions of streams within or adjacent to their development site with local-government-initiated projects, because the timing and location of development projects seldom provides continuous stream protection in advance of increased runoff and degradation caused by upstream urbanization.*

Recommendation 2.3b *Create a regional fee system to fund stabilization improvements on mainstream Cherry Creek and, perhaps, on major tributary streams.*

Incised channel from upstream development

Recommendation 2.3c *Improve the current practice of identifying and prioritizing stream stabilization projects after (in response to) the onset of severe erosion with a focus on identifying the stream reaches that are about to degrade due to upstream development and proactively stabilizing before impairment occurs.*

Recommendation 2.3d *Acquire construction and maintenance easements along the mainstream corridor to enable improvements to be constructed and/or limit disturbance.*

TPL Legacy "Greenprint"

Goal 2.4 Adopt "water quality friendly" floodplain management policies.

Recommendation 2.4a *Increase freeboard requirements above the 100-year water surface from one foot to three feet or more so that as riparian vegetation increases in the stream corridor and watershed sediments are deposited, protection of new developments from flooding is maintained. Recreational facilities are exempted.*

Recommendation 2.4b *Protect the floodplain of Cherry Creek and tributary streams from undue encroachment and adopt buffer criteria (similar to Town of Parker's Streamside Overlay Zone) to provide for development setbacks where floodplain widths are narrow.*

Protected floodplain at Arapahoe County's 17-Mile House property

4.0 CASE STUDIES

The case studies profiled here highlight four approaches to integrating water quality goals with planned development within the watershed via 'smart growth for clean water' strategies:

- ***Site design to maximize stormwater infiltration and achieve pre-development hydrology conditions***: The V.C. Multi-Family Community Development
- ***Site design to maximize wetland vegetative areas and provide natural areas conservation***: The Canyons Development
- ***Utilization of a Stormwater Quality Management Intergovernmental Agreement***: The Grant Ranch Agreement
- ***Land Acquisition as a strategy for stormwater quality management***: The "Bow Tie" Property Acquisition

Three of the case studies are occurring within the watershed, and one case study is in a neighboring watershed within the South Denver Metro area. The case study highlights all follow a similar format to assist the reader, as follows:

- ***Description of Case Study***: the who, what, where, why, and how of the study and anything that makes this unique to Cherry Creek.
- ***Watershed Smart Growth Concept and/or Strategy***: an explanation of the particular 'smart growth for clean water' tool(s) used to enhance water quality efforts.
- ***Stormwater BMPs***: a description of baseline BMPs that are required in the basin as part of the Control Regulation and local land use jurisdiction criteria manuals, as well as the "enhanced" BMPs which take the water quality efforts one step more.
- ***Realized Benefits of 'Smart Growth for Clean Water' Strategy***: discussion of both the environmental/economical benefits identified.
- ***Strategies for Implementation***: the steps taken to put the strategy in place or to justify the benefits that made the strategy viable, as well as barriers and tips on implementation.
- ***Conclusions***: a recap of the study in terms of its benefits, as well as some next steps to either keep the study going or to start the process in a like-situation, in order to keep the 'smart growth for clean water' effort going beyond this report.

This report started out defining the concept of 'smart growth' as it is commonly used and works to further define the concept from a watershed perspective, with the emphasis on water quality. These four case studies serve to illustrate the varied strategies that could be used for development within a watershed. Since the term 'smart growth' has overlying implications associated with pro/anti-growth issues and private property rights, an attempt was made to define another all inclusive term for the efforts of this report. However, no one phrase was found to better encompass the different strategies used than 'smart growth for clean water'. The following case studies are illustrative of an attempt to accommodate growth and development in a better, smarter, thoughtful way, by tying it to water quality enhancements in the context of a watershed.

Case Studies

Watershed smart growth strategies discussed in the case studies include maximizing infiltration and vegetative areas, intergovernmental agreements, and land conservation and acquisition.

"Smart Growth" in this report is from a watershed perspective, accommodating growth and development in a better, smarter way in the context of a watersheds water quality.

Case Studies: "Green" Development

"GREEN" DEVELOPMENT CONCEPT FOR V.C. MULTI-FAMILY COMMUNITY: THE USE OF SMART GROWTH SITE PRACTICES TO MAXIMIZE INFILTRATION AND MINIMIZE STORMWATER RUNOFF AND ACHIEVE PRE-DEVELOPMENT HYDROLOGY

Description of Case Study

The proposed V.C. Multi-Family Community is a development of 5th generation farmland located directly adjacent to Cherry Creek. The parcel is approximately 35 acres in size with approximately 25 acres of developable land. The developers would like to provide upscale mixed residential units, including 4, 6, and 8-plexes, as well as detached single-family residences. It is anticipated in this early planning stage that there will be a total of 240 units in the development.

'Smart Growth for Clean Water' Concepts/Strategies

The V.C. Multi-family Community development is a case study in a "green" development concept using 'smart growth for clean water' best site design practices for a development with direct runoff potential into Cherry Creek. The concept aims to reduce stormwater runoff and phosphorus loads from the development to levels similar to pre-development hydrologic conditions.

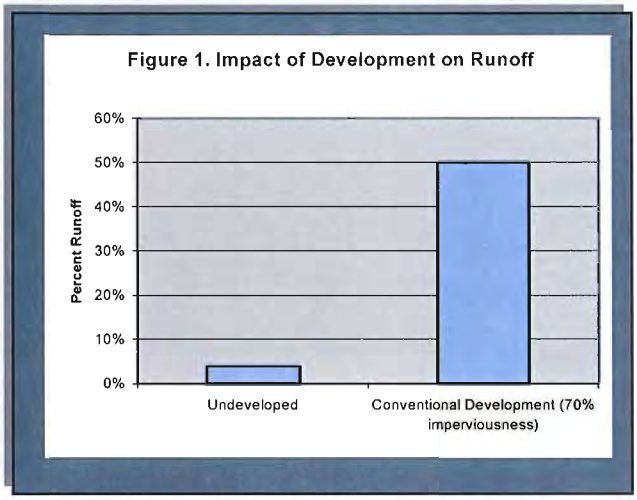
The V.C. Multi-Family development has direct runoff potential to Cherry Creek, so the goal is to reduce runoff to pre-development hydrology conditions.

In the absence of significant bedrock outcroppings, the vegetation and underlying soil of undeveloped areas in the front range of Colorado (or anywhere) tend to absorb most of the rain falling on it in any given year. A small amount of runoff may occur, particularly during intense storm events, but the majority of the rainfall is captured, either evaporating directly into the atmosphere or infiltrating into the soil for plant transpiration and groundwater recharge. Quantities of runoff and phosphorus generated from undisturbed parcels and delivered to downstream receiving waters are typically low relative to developed parcels.

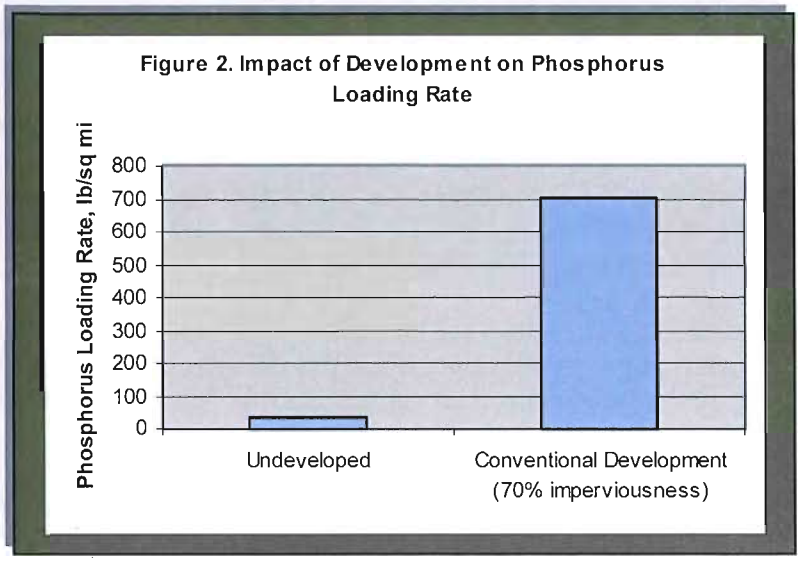
Development changes the historic rainfall/runoff process. Roofs of buildings, streets, driveways, sidewalks, and parking lots hinder the infiltration of rainfall. In conventional developments, street curbs and gutters, and storm sewer inlets and pipelines, typically convey runoff from a site quickly and efficiently. The result is significantly higher runoff peaks and volumes, compared to pre-development conditions. Detention facilities are often required to reduce peak rates of runoff, but generally do not function to reduce runoff volume. Runoff and phosphorus loads to downstream receiving waters from developed parcels can be significantly greater than for pre-development conditions.

Estimated runoff volume increases significantly for development as compared to historic, pre-development conditions.

Figures 1 and 2 show a comparison of runoff volume and phosphorus loads estimated for a 25-acre portion of the V.C. Multi-Family parcel for two conditions. The first represents historic, pre-development conditions and the second represents a conventional multi-family development with an impervious percentage of approximately 70 percent. **Figure 1** shows how the estimated runoff volume is estimated to increase by a factor of 2200 percent compared to pre-development conditions. **Figure 2** shows how the phosphorus load is estimated to increase 3600 percent.



Increased runoff volume from development can produce a secondary impact that affects water quality; increased runoff, together with increased peak flow rates for small, frequent events (not always controlled by detention) often leads to stream degradation in downstream reaches, with associated bed and bank erosion and conveyance of particulate-bound phosphorus.



In the Cherry Creek watershed, and in other sensitive areas, water quality impacts associated with the increased runoff and phosphorus loads from convention development are intended to be mitigated through a number of BMPs.

Stormwater Best Management Practices

UDFCD has published a series of criteria manuals to guide stormwater management practices. Volume 3 of these criteria manuals describes a series of stormwater quality BMPs intended to reduce sediment, phosphorus, and other pollutant loads to downstream receiving waters. Baseline BMPs utilized in this case study include grass swales, porous landscape detention, and an extended detention pond.

The techniques described herein for the "green" development concept are based, in large part, on the approaches described in the Volume 3 Drainage Criteria Manual. However, the water quality objective of the "green" concept goes well beyond the minimum baseline BMP criteria of Volume 3 and adopts the goal of reducing stormwater runoff and phosphorus loads from the development to levels similar to pre-development conditions.

Case Studies: "Green" Development

Upstream reaches with stream degradation and associated bed and bank erosion impact the water quality in the Reservoir.

The "green" development scenario goes beyond the criteria in Volume 3 with the goal of "pre-development" hydrology.

Case Studies: "Green" Development

Grass swales are an integral part of the "minimized directly connected impervious areas" (MDCIA) development concept and are densely vegetated drainageways with shallow side slopes that collect and slowly convey runoff, facilitating sedimentation and limiting erosion. These will be used in the V.C. Multi-family development as an alternative to a curb and gutter system. Porous landscape detention will utilize low-lying vegetated areas underlain by a sand bed and an underdrain pipe system. During runoff events the accumulated flows will gradually infiltrate into the underlying sand beds. Excess flows will collect in the V.C. development extended detention pond for settling.

Enhanced BMP Opportunities

The proposed concept to reduce stormwater runoff and phosphorus loads from the development consists of these three main components:

1. Alternative Street Configuration (grass swales instead of curb and gutter)
2. Upstream Storage and Filtration (porous landscape detention)
3. Two-year Extended Detention and Storm Recharge (a pumping system in the detention pond will redistribute the collected stormwater runoff back to landscape areas following the storm)

This enhanced BMP system will be utilized to reduce phosphorous loading via sand filtration in the swales, ponding in the detention basin, and soil filtration from the storm recharge system. The components for reducing stormwater runoff and phosphorous loads are described in the following sections.

Alternative Street Configuration. An alternative street configuration is proposed that is narrower than a conventional street and features a detached walk and grass swale in lieu of curb and gutter, storm sewer and attached sidewalk. The alternative street configuration will generate less runoff and will slow down and attenuate runoff that does occur. The street configuration will implement the principle of MDCIA recommended in UDFCD's Volume 3 Criteria Manual. The grass swale will incorporate sand bedding and an underdrain, similar to Volume 3's porous landscape detention practice, to promote infiltration of runoff into the soil.

Upstream Storage and Filtration. The grass swale described above, plus similar porous landscape detention areas located adjacent to buildings, alleys, and driveways, will provide for temporary storage and filtration of runoff. To eliminate the need for large conveyance channels or storm sewers, it is proposed that the porous landscape detention areas be sized and shaped to provide temporary storage sufficient for a 100-year storm. Subsurface storage volume in the pore spaces on the sand bedding is proposed to store the runoff expected from a 2-year storm, and the balance of the 100-year storage is to be provided on the surface.

An alternative street configuration is narrower than conventional streets, with a detached sidewalk & grass swales instead of curb & gutter, storm sewer and attached sidewalk.

Temporary storage, sized appropriately, and infiltration of runoff can eliminate the need for a large conveyance facilities in this case study.

Some of the runoff captured in the porous landscape detention areas will infiltrate into the subsoil. The amount will depend on the infiltration capacity of the underlying soils. An underdrain system within the sand bedding will convey much of the runoff to a collection system that will flow downstream through the development to the extended detention basin, a central low point. At that point, the runoff is proposed to be redistributed via the storm recharge system.

Extended Detention and Storm Recharge. The extended detention basin is proposed to be sized to fully capture runoff from a 2-year storm. A pump at the detention basin outlet is proposed to redistribute the runoff through the development's irrigation system. It is anticipated that the pump will be controlled by float switches to start automatically at the outset of a runoff event and turn off when the runoff is fully drained and redistributed. The runoff will be applied to landscape areas over a period of 40-hours at a low enough rate to promote infiltration of the majority of the runoff. Stormwater quality treatment will be provided through the adsorption of soluble phosphorus onto silt and clay particles in the soil.

Storm runoff will be applied to the landscape at low rates to promote infiltration of the majority of runoff as part of the enhanced BMPs.

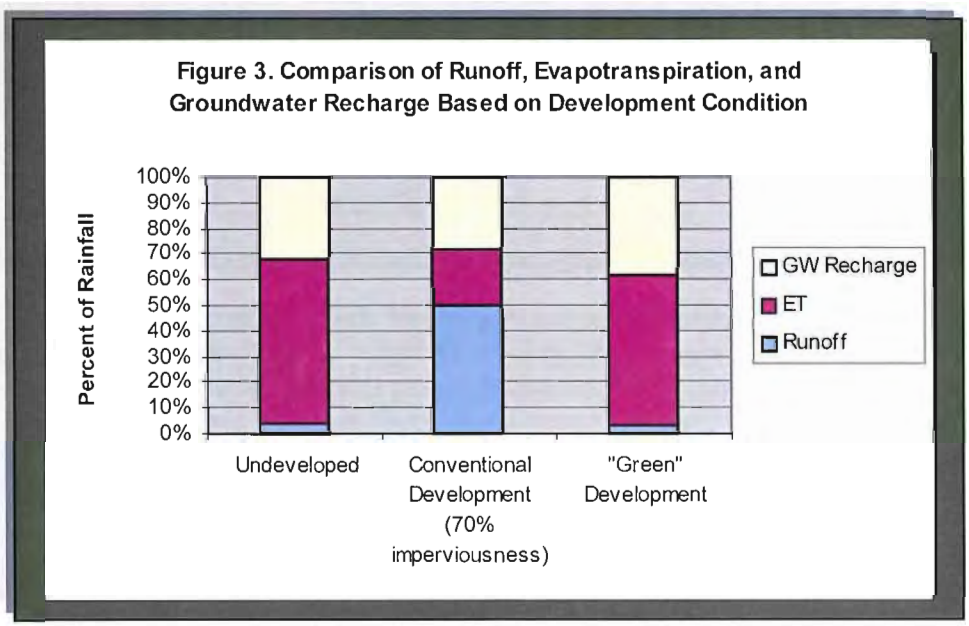
Realized Benefits of 'Smart Growth for Clean Water' Strategy

Conventional development practices have been shown to significantly increase stormwater runoff volume and phosphorus loading over undeveloped conditions. A "green" development concept, described herein, shows promise for reducing runoff volumes and phosphorus loading rates to levels expected from undeveloped areas.

Environmental Benefits

An analysis was undertaken to compare the proposed "green" alternative to conventional development and undeveloped conditions in terms of stormwater runoff, evapotranspiration, and infiltration. The results are summarized in **Figure 3**, which shows that that the proposed concept is anticipated to maintain runoff, evapotranspiration, and groundwater recharge at levels approximating undeveloped conditions. Approximating the hydrology of pre-development

Figure 3. Comparison of Runoff, Evapotranspiration, and Groundwater Recharge Based on Development Condition



Reduction in runoff volumes and phosphorous loading rates is a key goal in accommodating development within the Cherry Creek watershed.

Case Studies: "Green" Development

conditions is important from a water use and water rights standpoint. As recommended by State Engineer's staff during initial communication regarding the concept, the system is intended to avoid increases in evapotranspiration and to reduce changes in the rate and timing of flows leaving a site as compared to pre-development conditions.

Figure 4 depicts percent runoff for conventional medium density (40 percent imperviousness) and high density (70 percent imperviousness) development, and for undeveloped conditions for a range of storm probabilities. Runoff is based on Figure RO-8 of UDFCD's Volume 1 Drainage Criteria Manual (for Type C and D soils). As indicated by the two lowest curves, retaining runoff (detaining over a period of 40-hours) from the 2-year storm event maintains runoff volumes to levels approximating undeveloped conditions for all storms up to and including the 100-year event. This is why the extended detention basin proposed for the V.C. development is to be sized to capture the runoff expected from a 2-year event.

Extended detention and recharge of runoff from the 2-year storm event maintains runoff volumes to levels similar to undeveloped conditions for all storms up to the 100-year event.

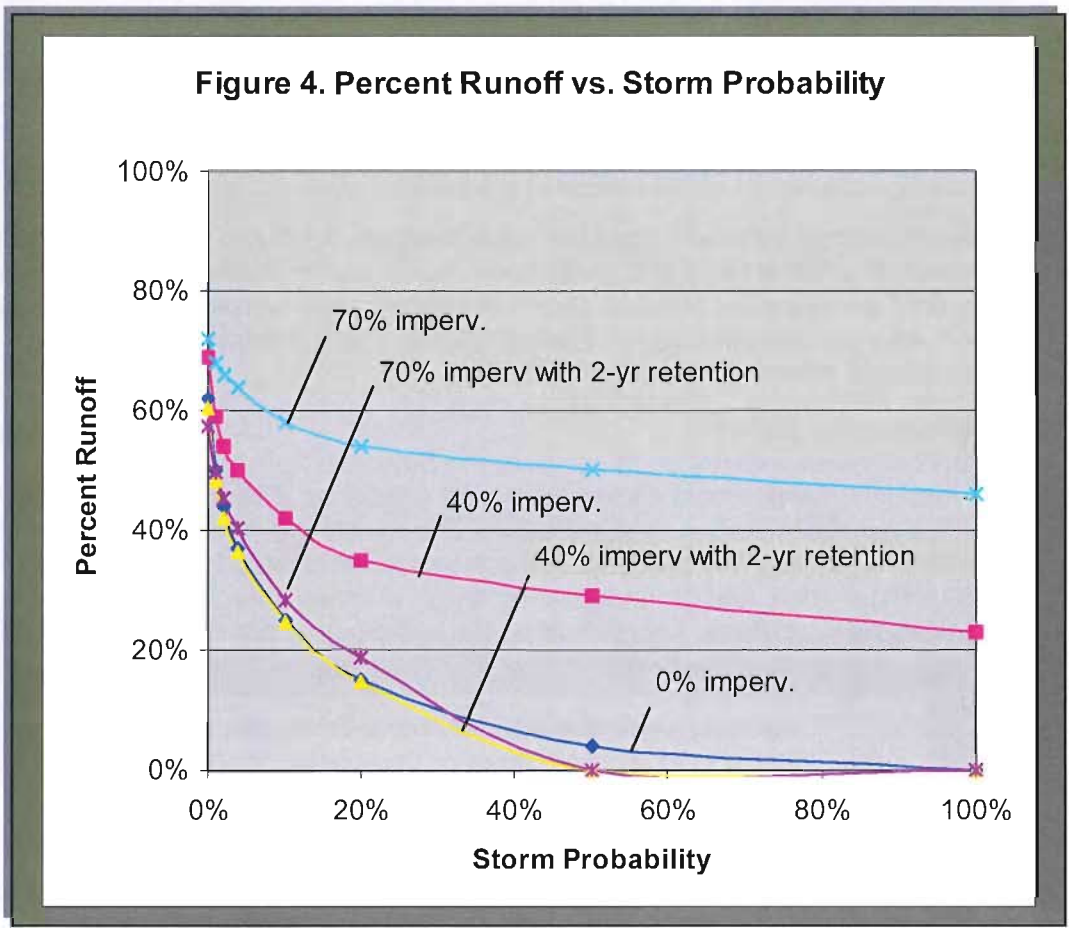
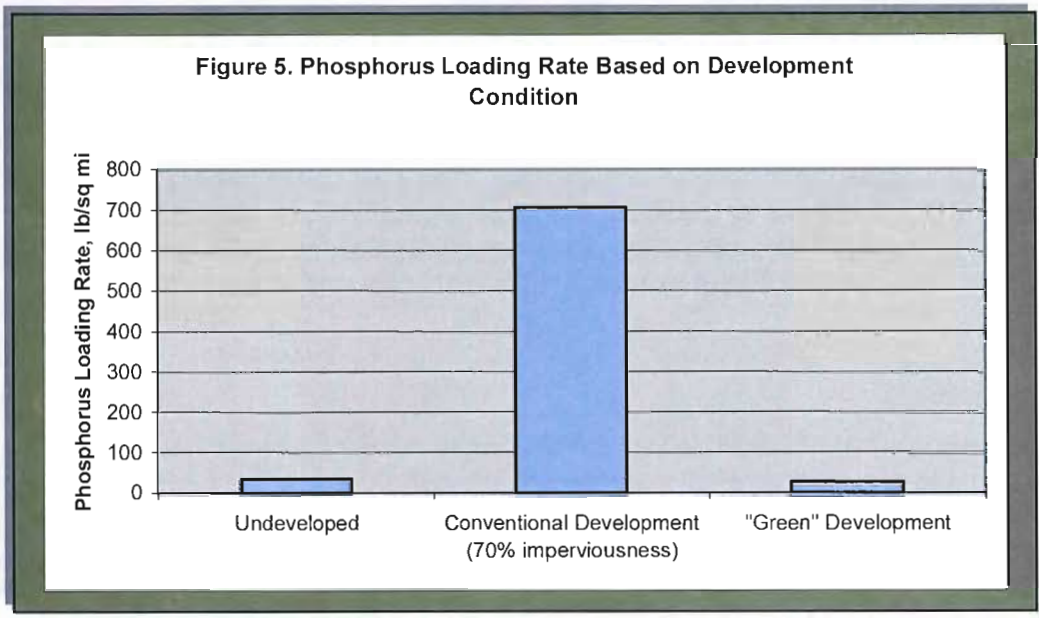


Figure 5 summarizes the impact of the "green" development concept on phosphorus loading rates. The "green" alternative will reduce phosphorus loading via sand filtration in the street swales, ponding in the detention basin, and soil filtration via storm recharge. Adsorption onto silt and clay particles in the soil has been shown to immobilize even soluble forms of phosphorus. For storms at least up to the 2-year event, the "green" alternative is anticipated to reduce phosphorus loading to levels similar to undeveloped conditions.

Phosphorous loading will be reduced via sand infiltration in the street swales, ponding in the detention basin, and soil infiltration during storm recharge.

Case Studies: "Green" Development

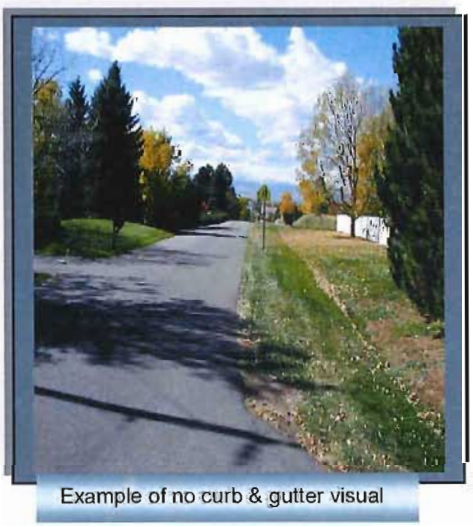


Costs of the "green" development scenario were found to be comparable to conventional development costs.

Economic Benefits

Costs associated with the "green" concept were found to be comparable with costs associated with conventional development. The proposed concept had higher costs for infiltration facilities, driveway culverts, landscaping a larger portion of the site, and pump facilities. However, these costs were offset by lower costs for narrower streets and the elimination of curb and gutter, storm inlets, and storm sewer pipelines, and reduced requirements for downstream drainageway stabilization.

Strategies for Implementation



Example of no curb & gutter visual

The V.C. Multi-Family development parcel was identified early in it's planning process for potential "green" development by a *Partners* member. An initial meeting was held with the developer and several *Partners* members who were familiar with the Cherry Creek Control Regulation BMPs for development and ways to enhance the BMPs for better control of runoff and phosphorous loads. At the initial meeting, the developer was intrigued by the idea of a more rural streetscape than the accepted standard curb and gutter approach to roadways that would enhance the rustic country-wooded appeal of the topography.

The developer was intrigued by the idea of a more rural streetscape with the grass swales instead of curb & gutter.

Case Studies: "Green" Development

The developer had a concern about the impact of the enhanced BMPS on the predictability of the planning process and approvals.

Next steps could include attending meetings at local land use agency on behalf of the developer and monitoring of the enhanced BMPs.

The developer was also interested in the re-application of storm runoff on landscape areas, rather than a conveying the water downstream, as an amenity in the design. A total of 3 office meetings and one field meeting were held to discuss the enhanced BMPs with the developer.

One difficulty with the enhanced BMP proposal was the developer's concern that the local land use planning agency would not be familiar with the 'smart growth for clean water' strategies being proposed that were not "business as usual", and this would in turn restrict his options, lengthen the approval process and affect the overall predictability of the planning process. The *Partners* members volunteered to assist the developer by providing technical information and justification to the local planning staff regarding alternate street configurations, upstream storage and filtration, and the 2-year extended detention basin and storm recharge system.

Conclusions

The enhanced BMPs identified for the V.C. Multi-Family development appear to be capable of reducing runoff volumes and phosphorous loading rates to levels similar to undeveloped conditions, at costs comparable to conventional development scenarios and with tremendous environmental benefits. The challenges associated with implementing the concept include a possible lack of knowledge at the local land use agency planning level about the proposed enhanced BMPs and the need for an effective long-term maintenance program to keep the system fully operational.

The next steps in this case study would be to assist the developer with the planning process at the local land use agency. A meeting with the planning and engineering personnel would be held in conjunction with the Preliminary Development Plan pre-submittal meeting for the development site. Additional "next steps" could include:

- Assisting the developer's engineer with presenting the enhanced BMP scenario to the planning personnel and Planning Commission
- Determine a monitoring scenario to confirm runoff benefits and phosphorous loading reductions
- Observe implementation of the enhanced BMPs
- Conduct monitoring of the site design
- Report monitoring results

Case Studies:
The Canyons

THE CANYONS DEVELOPMENT: THE USE OF DEDICATED OPEN SPACE AND WETLANDS CONSTRUCTION TO REDUCE PHOSPHOROUS LOADS

Description of Case Study

The Canyons development (The Canyons) is located in Douglas County immediately east of I-25 and north of Castle Rock, encompassing the Newlin Gulch, Lemon Gulch, Scott Gulch and McMurdo Gulch drainageways, tributary to Cherry Creek. The 2,501 living units are placed in clusters within a 5,576-acre development site. Of the total acreage, 60% is dedicated open space. The clustering of the development areas has provided opportunities to enhance property values through dedicated open space with constructed wetlands. The constructed wetlands will enhance wildlife habitat and improve the opportunities for recreation along a trail system that parallels the constructed wetlands. The wetlands will provide the additional environmental benefit of reducing stormwater phosphorous loads in addition to those that will be achieved by the baseline BMPs that are also included in the development plan.

The cluster plan with the large open space and constructed wetlands became a condition of approval from the local planning agency, and helped to overcome objections to a development plan that had been rejected several times over a 15 year period, and helped to provide a basis for the award of density bonuses to the development.

Of the total acreage of The Canyons, over 5,500 acres, 60 % is dedicated open space.

'Smart Growth for Clean Water' Concepts/Strategies

The Canyons development is an example of a site design that is incorporating large amounts of open space land set aside for conservation and the use of large areas of constructed wetlands as effective enhanced BMP stormwater treatment. In this case study, cluster zoning and transferable development rights were utilized in order to get project approval; the developer was able to get a density bonus, while at the same time, large areas of open space were preserved using conservation easements. Cluster zoning maintains high levels of development by clustering buildings and infrastructure on a concentrated area of the development instead of spreading development evenly over the site. This site design produces open space parcels that are more contiguous and larger, and makes more efficient use of the infrastructure.

Transferable development rights separates the value of potential development of land from the current use of that parcel and "transfers" that development value to another site. Generally, the transfer is from a less desirable area for development, such as open space and floodplain, to one where density is desirable. Conservation easements allow the landowner to obtain tax benefits for the difference between the land's value for development and for an open space use. In addition to these land use planning 'smart growth for clean water' strategies, The Canyons development utilizes enhanced BMP stormwater treatment via constructed wetlands.

Clustering, transferable development rights and conservation easements were all strategies for development of The Canyons.

Case Studies: *The Canyons*

Baseline BMPs at The Canyons will include construction BMPs (erosion control) and permanent BMPs (post construction).

Riparian wetlands will provide enhanced BMP water quality benefits as well as improve habitat and recreational amenities.

Stormwater Best Management Practices

The goal of the water quality mandate for the Cherry Creek watershed is to limit the quantity of pollutants that enter the Reservoir and to maintain watershed "health" through controls on external loads to the Reservoir (non-point sediment source control) and wasteloads (point source control). Management of external loads in the watershed will be achieved by implementing stormwater management controls including baseline BMPs to control erosion and phosphorous discharges, and constructing facilities, specifically Pollutant Reduction Facilities (PRFs) that provide removal beyond baseline stormwater BMPs.

Baseline BMPs

At The Canyons, baseline stormwater BMPs for construction and post-construction include the following:

- *Construction BMPS:* Control of construction erosion and sedimentation is the first level of non-point source protection in the watershed. This will be achieved at The Canyons through a combination of minimizing exposure of disturbed land surfaces, minimizing sediment transport with grass swales or terraces, and treating the runoff with sediment ponds.
- *Permanent BMPs:* This second level of non-point source protection addresses pollutant reduction after development is complete, either minimizing it at the source or retaining it on site. Permanent BMPS to be employed at the The Canyons will include flattened slopes for channels, check structures to control channel grade, and extended detention facilities to minimize post-developed peak flow rates. Additional enhanced BMP stormwater control practices will also include constructed wetland basins.

Enhanced BMP Opportunities

In addition to the baseline BMPs, The Canyons will construct approximately 40 acres of planned Riparian Wetland areas to act as a PRF. These riparian wetland areas will act as the third level for non-point source protection, beyond BMPs, and will be located to take advantage of opportunities to enhance water quality in the watershed. These riparian wetlands are also designed to enhance riparian corridor and improve its value for wildlife habitat, and provide a recreation amenity for the residents of the development.

The riparian wetland areas, made feasible by increased stormwater runoff and irrigation return flows from development clusters, have been identified as follows:

-	Newlin Gulch wetlands	5.2 Ac
-	South Newlin Gulch wetlands	9.9 Ac
-	Lemon Gulch wetlands	14.1 Ac
-	Scott Gulch wetlands	6.0 Ac
-	McMurdo Gulch wetlands	4.4 Ac
	Total	39.6 Ac

The constructed wetlands will occur in approximately 14,000 linear feet of riparian corridor with an average width of 120 feet. This configuration will enhance the riparian wildlife habitat and will also enhance the passive recreation opportunities for the linear trail system planned for the riparian corridor.

Realized Benefits of Smart Growth Strategy

Once the developers began working with the site plan, they discovered extensive potential for those open space preservation and conservation areas in terms of water quality, wildlife corridors, recreation areas, and overall preservation of naturally vegetated areas. They were able to realize an even more marketable product, as the clustered lots were optimized to take advantage of the open space. In addition, this was an excellent opportunity to generate real reductions in phosphorous loads to the Cherry Creek watershed.

Environmental Benefits

The potential total phosphorus reduction in watershed as a result of the 40 acres of constructed flow-through wetlands downstream of stormwater detention ponds is estimated to be 4.8 pounds per acre per year.

An analysis of an incentive example (see **Strategies for Implementation** section for complete description of the example) indicated that just 5-acres of wetlands for a 100-acre development site with 321 dwelling units could significantly reduce the annual phosphorous discharge levels to closer to pre-development conditions.

Economic Benefits

The size of the development, its location in a semi-rural portion of Douglas County and the potential adverse impacts on wildlife habitat were major concerns in the development review process. The clustering of the development parcels and the preservation of large parcels of open space made the proposal acceptable to the local communities and the Planning Commission. The use of constructed wetlands to further enhance the open space by providing excellent wildlife habitat was viewed as a major benefit of the development plan.

The "greening" of the riparian corridors using additional stormwater runoff produced by the development clusters will also provide additional stormwater treatment, improve neighboring property values and enhance the recreational experience for the users of an extensive network of trails along riparian corridors. In short, an apparent problem (increased stormwater runoff) had become an asset that, when properly managed, resulted in an overall improvement for the development proposal. All of these factors helped in the development review process so that there became additional security in the predictability of the planning and approval processes, which in turn assisted the developer in their financial operations.

Case Studies:
The Canyons

The clustered lots were optimized to take advantage of the open space they created.

For The Canyons development, an apparent problem, increased stormwater runoff, has become an asset that will result in a better site design.

Case Studies: *The Canyons*

Transfer of development rights and density bonuses could be used in other locations to encourage wetland creation.

Pre-development loads for a 100 acre parcel are about 5 pounds of phosphorous discharge per year.

Strategies for Implementation

The following is a preliminary outline of a potential water quality-based incentive program for developers based on The Canyons development concept. It illustrates how transfers of development credits and/or density bonuses could be used as incentives for developers to construct wetlands in riparian areas to enhance water quality in the Cherry Creek watershed. Issuing transfers of development rights or density bonuses could be used to encourage the development community to construct wetlands to improve water quality while improving their own bottom line.

Three conditions are compared in this example:

I. 100-acre parcel prior to residential development (produces an annual total phosphorus load of 5.0 lbs of total phosphorus discharge per year)

II. 300 residential units on the same 100-acre parcel using traditional residential development techniques with the mandatory stormwater BMPs (the annual stormwater phosphorus load from this parcel to 28.5 lbs of total phosphorus per year in spite of the inclusion of the mandatory BMPs in the plan)

III. 321 residential units on the same 100-acre parcel including a 21 residential unit density credit with mandatory stormwater BMPs supplemented by 5 acres of constructed wetlands in a riparian area (reduces the average annual stormwater phosphorous load to closer to predevelopment conditions even though an additional 21 units were added to the development)

The following illustrates these incentive examples. All of these examples use the conversion as follows:

43,560 ft^3/acre-ft x 2.205 x 10^{-6} lbs/mg x 28.32 l/ft^3 = 2.72 lbs/(af-mg/l)

I. Pre-developed Condition
(100-acres, 0% impervious, 0.55 inches stormwater runoff per year, 5.0 lbs total phosphorus discharge per year)

Annual Stormwater Discharge
100 acres x 0.55 in/yr x 1 ft/12 in x 0.40 mg/L total P x 2.72 **5.0 lbs P/yr**

Net Discharge to Watershed **5.0 lbs P/yr**

II. Traditional Residential Development
(100-ACRES, 300 RESIDENTIAL UNITS, 40% IMPERVIOUS, 3.86 INCHES STORMWATER RUNOFF PER YEAR, 28.5 LBS TOTAL PHOSPHORUS DISCHARGE PER YEAR)

Stormwater Discharges	
100 acres x 3.86 in/yr x 1 ft/12 in x 0.65 mg/L total P x 2.72=	56.9 lbs P/yr
Mandatory BMP Reductions (50% effective)	
50% x 56.9 lbs/yr =	(28.4 lbs P/yr)
Net Discharge to Watershed	**28.5 lbs P/yr**

III. Residential Development with Water Quality Incentives
(100 ACRES, 321 RESIDENTIAL UNITS ON 95 ACRES, 46% IMPERVIOUS, 4.28 INCHES STORMWATER RUNOFF PER YEAR FROM 95 ACRES, 6.0 LBS TOTAL PHOSPHORUS DISCHARGE PER YEAR)

Stormwater Discharges	
95 acres x 4.28in/yr x 1 ft/12 in x 0.65 mg/L total P x 2.72	59.9 lbs P/yr
Mandatory BMP Reductions (50% effective)	
50% x 59.9 lbs/yr =	(29.9 lbs P/yr)
Constructed Wetlands P Removals (4.8 lbs P /acre-yr)	
4.8 lbs P/acre-yr x 5 acres	(24.0 lbs P/yr)
Net Discharge to Watershed	**6.0 lbs P/yr**

The bottom line is that 5-acres of wetlands could reduce the annual phosphorus discharge to levels close to predevelopment conditions. This requires a strategic placement of the wetlands in the watershed and a proper design to accommodate the expected stormwater flow patterns from the development. Sites downstream of the detention pond BMPs are typically ideal for this purpose.

The reader is cautioned that these calculations represent best professional judgment and expected long-term performance, not actual measurements. Yearly results will likely vary considerably about the long-term averages.

Baseline BMPs used for a developed parcel still see an increase in phosphorous loads over pre-development conditions.

Wetlands need to be strategically placed in a development to accommodate the expected stormwater flow patterns from the development.

Case Studies:
The Canyons

Both economic and environmental benefits were achieved with the clustering and wetlands construction.

Next steps include presenting to the land use agency, observing implementation, and institute monitoring.

Conclusions

Transfer of development rights, cluster zoning, and density bonuses were the key components to getting The Canyons off paper and into construction. Transfer of development rights to maximize desirable land for development, cluster zoning to concentrate development on a smaller parcel in a specific portion of the property, and density credits that allowed higher densities in that clustered area provided economic and environmental benefits to all stakeholders.

Some benefits were both economic and environmental: less grading, infrastructure and site preparation is less costly to the developer and lessens the impact of erosion. An extremely big component of phosphorous loading to the watershed and Reservoir is the toll that disturbed lands take on sediment transport. In addition, there are other benefits of clustering in that it reduces energy costs, conserves resources, and allows for a greater amount of community interaction than a typical semi-rural single lot parcels of 1-acre or more.

The *Partners* goal of enhanced BMPs to reduce pollutant loading to approximate pre-development scenarios was achieved with The Canyons development plan in a way that served the interests of the developer and the future residents of this and neighboring communities.

The next steps in this case study would be to continue to assist the developer with the planning process at the local land use agency level. A meeting with the planning personnel would be held in conjunction with the Preliminary Development Plan pre-submittal meeting for the development site(s). Additional "next steps" could include:

- Assisting the developer's engineer with presenting the enhanced BMP scenario to the planning personnel and Planning Commission
- Determine a monitoring scenario to confirm benefits from wetlands construction by quantifying the phosphorous loading reductions
- Observe implementation of the enhanced BMPs
- Conduct monitoring of the site design
- Report monitoring results

GRANT RANCH STORMWATER QUALITY MANAGEMENT PLAN: THE USE OF A STORMWATER QUALITY MANAGEMENT AGREEMENT TO MAINTAIN AND ENHANCE WATER QUALITY, AND PROTECT THE DOWNSTREAM USES

Case Studies: Grant Ranch Agreement

Description of Case Study

Grant Ranch is an existing residential community located in the South Denver Metro area in the South Platte watershed, immediately west of the Cherry Creek watershed. Grant Ranch was developed by Simeon Residential Properties. Immediately downgradient from a portion of Grant Ranch is Bow Mar Lake, which is owned and operated by the Bow Mar Homeowner's Association (Bow Mar HOA). The lake has been used for many years by Bow Mar residents for swimming, fishing and other forms of active and passive recreation.

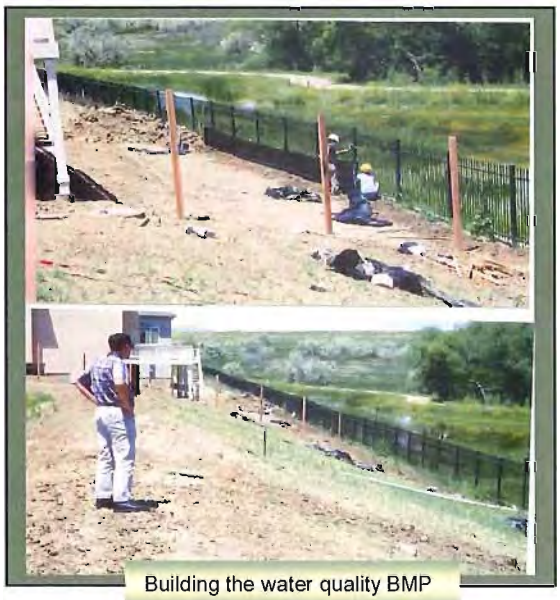
'Smart Growth for Clean Water' Concepts/Strategies

To ensure that Bow Mar Lake would not be adversely impacted by stormwater runoff from the proposed residential development, the Bow Mar HOA entered into a long-term Stormwater Quality Management Agreement with the developer and the Bowles Metropolitan District (Metro District). The Agreement was signed in 1997, and has been followed since then. Although this Grant Ranch case study is not in the Cherry Creek watershed, the principles of negotiation and implementation for such an agreement is applicable to all watersheds.

The Grant Ranch Agreement, between the HOA, the Metro District, and the developer, was signed in 1997.

Stormwater Best Management Practices

The cornerstones of the 1997 Agreement are the commitments of the developer and the Metro District to design and construct advanced stormwater BMPs and to regularly monitor their performance, in accordance with certain numeric thresholds, to assure that Bow Mar Lake is being adequately protected.



Building the water quality BMP

A combination of non-structural (source controls) and structural BMPs were utilized. The significance of the Agreement is that it requires monitoring to determine whether the standards are being met, as the measure of compliance. If the standards are not met, the mere fact that the BMPs exist will not be a sufficient defense to justify non-compliance. Instead, the Metro District will have to come up with some remedial measures that will meet the standard, failing which, the Bow Mar community will have the power to develop such measures at the Metro District's expense.

A combination of structural and non-structural BMPs were used to provide the enhanced water quality for the Bow Mar Lake.

Case Studies: *Grant Ranch Agreement*

The structural BMPs include three large extended dry detention ponds, followed by a combination wetland/water quality pond. All of these facilities were designed in accordance with Volume 3 of the UDFCD Criteria Manual. The design is highly conservative, in that the upstream extended dry ponds release the "water quality capture volume" over 40 hours, and this water is then subjected to an additional 24-hours of residence time in the water quality/wetland pond. These two large BMPs, in series, provide 64-hours of residence time for the water quality capture volume. In addition to these structural BMPs, Bow Mar HOA covenants were enacted to stress the importance of water quality protection in the everyday activities of residents. The Metro District has distributed newsletters and flyers in Grant Ranch that describe good residential water management practices.

The key to any stormwater BMP program is regular monitoring, followed by maintenance and program adjustments as required. The water quality monitoring at Grant Ranch is comprehensive. Specifically, four "dry weather" and four "wet weather" events are monitored each year at five automated monitoring stations. Constituents monitored in some or all of these events include:

- Total phosphorus
- Total nitrogen
- Total suspended solids
- Chemical oxygen demand
- Metals (cadmium, chromium,
- Copper, lead, zinc, manganese)
- Pesticides (glyphosate, malathion)
- Fecal coliform
- Volatile Organic Compounds (ethyl benzene, toluene)
- Oil/Grease

Grant Ranch water quality pond

Analytical results are compared against water quality "thresholds" which were agreed to by parties that signed the Agreement. These thresholds were established via extensive research and experience of consultants for the developer, Metro District, and the Bow Mar HOA. Many negotiation meetings were held to arrive at thresholds that were suitably protective of Bow Mar Lake, while at the same time recognizing the unknowns and uncertainties associated with enhanced BMPs, and the limitations of current BMP monitoring data.

The combination structural BMPs used at Grant Ranch will provide 64 hours of residence time for water quality treatment.

Realized Benefits of 'Smart Growth for Clean Water' Strategy

Cooperative planning efforts incorporating intergovernmental agreements have been identified as critical tools for achieving "smart growth." What was required in this Grant Ranch case study was a shift in attitude on the part of the stakeholders to realize that this was an opportunity to develop a common vision that would provide a protected Bow Mar Lake for the Metro District and the residents, as well as an opportunity for the developer to make a positive impact on the surrounding area with enhanced BMPs. This required a willingness to recognize the interdependencies of each stakeholder on the impact of each person's action. It also took a willingness to commit to a process that was time consuming and sometimes difficult as each stakeholder bought in to the vision, and shifted their previously held attitudes. Both environmental and economic benefits were realized from this project.

Cooperative planning efforts and participation in a key water quality agreement is one of the watershed smart growth practices at Grant Ranch.

Case Studies:
Grant Ranch Agreement

Economic Benefits

The developer, Simeon Residential Properties, was required to reach a stormwater quality agreement with the Bow Mar HOA in order to move ahead with the development of the relevant filings in Grant Ranch. The Bow Mar residents were concerned that excessive pollutant inputs from Grant Ranch runoff would cause water quality problems in Bow Mar Lake, which would be costly to address. As a result of the Agreement and the construction of the water quality BMPs, enhanced recreational benefits are being realized as a result of clean water and reduced eutrification that may have otherwise resulted from impacts from the adjacent development. Lot premiums were charged for home lots immediately adjacent to the water quality ponds/constructed wetlands. Bow Mar Lake is a Recreation Class 1 State Water that is currently being used by many of the nearby residents. The lake and surrounding areas are nestled in a pristine setting located in southwest Denver. The water quality BMPs which were installed as a condition of the planned development not only protect the lake from increased degradation, but add value by providing open space and a natural areas buffer.

Environmental Benefits

The immediate and most critical environmental benefit was to Bow Mar Lake and the surrounding area. In addition, the combination wetland/water quality pond provided additional open space, natural areas, and increased habitat for wildlife. In addition to the structural BMPs required of the developer to protect the environment, homeowner covenants were enacted to stress the importance of watershed protection in the daily activities of the residents of Grant Ranch. The Metro District has distributed newsletters and flyers that described good residential water management practices. This education outreach program has had a very positive effect on highlighting the connection between homeowner activities and the environment.

Strategies for Implementation

The negotiated stakeholder process that led to the execution of the 1997 Agreement included in excess of 15 meetings. Typically, 8-10 people attended the water quality negotiation meetings, including Simeon Communities and Simeon's engineering and legal consultants. There were also numerous separate technical meetings that were extremely valuable in addressing the technical aspects of the project.

The most important lesson learned is that several interests can be served by establishing a facilitated process. The lake is being protected for all existing uses, the pristine nature of the lake and surrounding natural areas is preserved and enhanced, and the demand for additional housing in a well planned residential community were allowed to move forward. Firm commitments by all parties in the form of the Grant Ranch Agreement are the only way that the lake and adjacent large-scale development could coexist.

In the Agreement process, many stakeholders needed to be involved so that diversity of interests are represented, including engineering staff, regulating agencies, legal representatives, the Bow Mar HOA, the developer staff, and the local jurisdictional agency, as well as many others. There were far too many people involved with the development and execution of the 1997 Agreement to list them here. However, it is important to note here, that there needs to be various disciplines involved to carry this process to successful conclusion.

Lot premiums were charged for lots directly adjacent to the water quality features constructed as part of the enhanced BMPs.

HOA covenants were enacted to stress the importance of residential activities on the water quality, part of the non-structural BMP strategies.

Case Studies: *Grant Ranch Agreement*

Many diverse stakeholders may need to be involved in a successful agreement process, including engineers and attorneys.

Monitoring data indicate that the BMP performance is excellent, with an average percent removal of 59% to 94% of the analyzed constituents.

Conclusions

The monitoring data demonstrated that the Grant Ranch BMPs have performed effectively in protecting the lake from degradation both during and after construction. [It is important to note however that the lake receives inflows from other sources, not only from the Grant Ranch development.] The water quality capture volume concept was utilized in designing these BMPs. However, the actual performance of these BMPs during the first three years of operation would lend consideration to a removal efficiency or performance guarantee approach as an alternate design basis.

There remains a strong commitment from all parties to the 1997 Agreement to assure that the stormwater management system continues to function as designed, and that the water quality in Bow Mar Lake is protected. The next steps in this case study are to continue to collect monitoring data, review the maintenance program and address any issues, and continue to update the HOA on the continued successful implementation of the Agreement.

SUMMARY OF GRANT RANCH BMP PERFORMANCE DATA FOR THE 2002 SAMPLING SEASON OBTAINED BY THE BOWLES METROPOLITAN DISTRICT

(Note: BMOI independently collects laboratory data, which do not appear in Tables)

Dry Weather Sampling Events - Water Quality Wetland Outfall

	Concentration Standards		Results[1]				
			Sample Date				
Analyte/Units	Average Threshold (Baseflow)	Maximum Allowable	04/16/2002	05/30/2002	06/26/2003	7/24/02	Average
Total Phosphorus (mg/L)	0.2	0.7	0.40	0.1	0.00	0.12	0.16
Dissolved Phosphorus (mg/L)	-	-	0.0	0.05	0	0.07	0.03
Total Nitrogen (mg/L)	4.0	4.2	1.10	1.6	2.5	1.4	1.65
Fecal Coliform (#/100mL)[2]	-	-	0.0	0	-	210	70
Nitrate/Nitrite (mg/L)	-	-	0.52	0.3	1.75	2.63	1.30
Glyphosate (mg/L)	0.7	-	N/A	N/A	0.0	0.0	0.0
Malathion (µg/L)	0.1	-	N/A	N/A	0.0	0.0	0.0

N/A = not sampled

1/Non-detectable concentrations reported as 0 (per Stormwater Agreement)

2/Fecal Coliform analysis not required for dry weather sampling (per Stormwater Agreement)

Wet Weather Sampling Events - Water Quality Wetland Outfall

	Performance Standards[2]		Results				
			Sample Date				
Analyte	Average Threshold (Stormflow)[3]	Maximum Allowable Concentration	05/13/2002	06/04/2002	06/17/2002	Average Discharge Concentration[3]	Average Percent Removal[4]
Total Phosphorus (mg/L)	0.2	0.7	0.075	0.132	0.12	0.10	-
Dissolved Phosphorus (mg/L)	-	-	0.059	0.15	0.06	-	-
Total Nitrogen (mg/L)	4	4.2	1.3	1.6	1.4	1.40	-
Fecal Coliform (#/100mL)[7]	-	-	230	2300	310	-	92%
Nitrate/Nitrite (mg/L)	-	-	2.24	0.81	1.4	-	-
Chloride (mg/L)	230	-	42	53	-	39	-
Chemical Oxygen Demand (mg/L)	50%[5]	80	67	33	38	-	67%
Total Suspended Solids (mg/L)	75%	200	9	9	3	-	97%
Cadmium (µg/L)	-	See Footnote 6	0	0	-	-	-
Chromium (µg/L)	-	See Footnote 6	0	0	-	-	-
Copper (µg/L)	55%	30	8	11	-	-	58%
Lead (µg/L)	60%	80	0	0	-	-	67%
Manganese (µg/L)	50%	-	see Footnote 6	see Footnote 6	-	-	53%
Zinc (µg/L)	55%	140	5	8.4	-	-	87%
Ethyl benzene (mg/L)	0.68	32	-	0	-	0	-
Toluene (mg/L)	1	17.5	-	0	-	0	-
Glyphosate (mg/L)	0.7	-	-	0	-	0	-
Malathion (µg/L)	0.0	-	-	0	-	0	-
Oil and Grease (mg/L)	15	-	0	0	-	0	-

ND = non-detectable concentration

1/ Non-detecabli concentrations reported as 0 (per Stormwater Agreement).
2/ Concentration standards were established in the 1997 Stormwater Agreement.
3/ Percent removal or concentration. Calculated as the running average of the four most recent samples (flow-weighted).
4/ Calculated average for comparison to average threshold standard.
5/ Percent removal calculations are based on analyses of inflows to tributary dry ponds (not reported herein).
6/ Mn not analyzed due to an error in the analytical suite applies by Metro Wastewater Reclamation District Laboratories.
7/ This is a performance goal. A performance threshold has not been set.

Case Studies: "Bow Tie" Land Acquisition

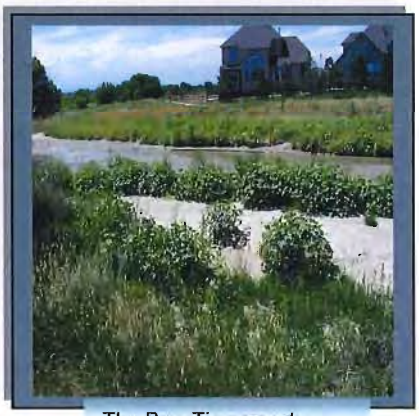
THE DENVER WHOLESALE FLORIST PARCEL ACQUISITION: THE USE OF LAND ACQUISITION IN A WATERSHED TO PROTECT AND ENHANCE WATER QUALITY

Description of Case Study

A partnership between TPL, City of Centennial, State Parks, Arapahoe County, UDFCD, and the Authority contributed funds to purchase property adjacent to Cherry Creek State Park along a major tributary to Cherry Creek called Piney Creek. The property was owned by Denver Wholesale Florists Company. There are two parcels that make up the property: the "Bow Tie" and "Southern" parcels. The "Bow Tie" is approximately 21.5-acres, with 16.2-acres in the floodplain, and 5.3-acres of upland that contain two functional greenhouses. The riparian areas are undisturbed, and the Piney Creek trail connections to the Cherry Creek State Park trail (to the north into the Park) and the Cherry Creek Regional Trail (to the south towards Castlewood Canyon State Park) run through this parcel. The "Southern" parcel is approximately 9-acres in size, with 2-acres in the floodplain and 7-acres of upland. The "Southern" parcel is mostly developed, and has been purchased by the neighboring landowner.

The "Bow Tie" parcel is named for its shape, and encompasses both Cherry Creek and its floodplain as well as Piney Creek and its floodplain at their confluence.

'Smart Growth for Clean Water' Concepts/Strategies



The Bow Tie property

Land acquisition for the purpose of watershed conservation is an identified 'smart growth for clean water' tool because of the strong interrelationship between land use and water resources. The "Bow Tie" property is an especially good example of this interrelationship. Watershed land is the catch basin that collects, directs, and naturally filters our water. This particular property has tremendous natural value in buffering, storing, filtering, and recharging surface water flows. These values need to be factored in the Cherry Creek watershed land acquisition strategy.

The Denver Wholesale Florists property land acquisition project would not only preserve the land as open space, but there is an excellent opportunity with the "Bow Tie" property for enhanced BMP implementation by constructing a water quality feature, likely stream stabilization that will provide wetlands, and possibly a sedimentation basin.

Although this parcel is not large, watershed protection in the form of land acquisition may be the most economic and best way to guarantee both the quantity (safeguard recharge areas) and quality (channel stabilization, likely to result in filtrating wetlands) of water in the Cherry Creek watershed.

Land acquisition is an economic way to safeguard recharge areas and filter the sediment containing phosphorous within the Cherry Creek watershed.

Case Studies: "Bow Tie" Land Acquisition

Besides the watershed smart growth strategy of land acquisition, enhanced BMPs for the "Bow Tie" property include and extended detention basin – sediment facility and constructed wetlands.

Incorporating the trail system into the PRF design in the form of a trail berm is an excellent example of multi-objective thinking in watershed smart growth strategies.

Stormwater Best Management Practices

The "Bow Tie" property is envisioned to be modified to create a "pollution reduction facility" (PRF) that will reduce phosphorus loads into the Reservoir, and will be constructed in phases. The PRF would consist of an extended detention basin-sediment facility (utilizing an enlarged detention pond area) and channel stabilization, which would likely result in wetlands, as well as a trail and facilities to stabilize Cherry Creek. The "Bow Tie" property is also adjacent to land owned by State Parks, which includes a detention pond that can be utilized in the design.

Baseline BMPs

An extended detention pond BMP, as described in UDFCD Volume 3, is a sedimentation basin designed to totally drain sometime after runoff ends. The extended drain time for a detention basin of this type allows the removal of a significant portion of the fine particulate pollutants found in urban stormwater runoff, as well as the phosphorous-laden sediments in the base flow. The basin is designed to be dry, to not have a significant pool of water remaining between storm runoff events. This allows for the removal of sediments during routine maintenance activities, thus reducing phosphorous loads to the Reservoir. (Refer to the UDFCD Volume 3 for additional design criteria and a complete discussion of the advantages and disadvantages of an extended detention –sediment facility). In addition to the extended detention basin-sediment facility, the "Bow Tie" property water quality design will also utilize wetlands, for an enhanced BMP opportunity.

Enhanced BMP Opportunities

The analysis for the "Bow Tie" property enhanced BMP design was divided into the following parts:

- Sizing required facilities to capture sediment and phosphorus (i.e.: sediment basin and constructed wetlands)
- Estimating phosphorus loads to the sediment basin and wetlands
- Estimating reduction in phosphorus loads to the Reservoir due to the sediment basin and wetlands, and
- Estimating costs for the facilities.

PRF Description and Sizing

A schematic of the proposed facilities is presented on **Figure 1** and includes the following:

- Relocated trail berm (top width is12-feet, 8' wide concrete path, 4:1 side slopes, maximum height of 6'). The trail would include 10 each, 4'x12' culverts to pass the 2-year flood (2,400 cfs) without overtopping the trail. The combination of trail and culverts would "divert" minor Piney Creek

floods into the sediment basin. The culverts would be spaced throughout the length of berm to distribute sediment in the basin. Approximately 300 feet of the berm would be reinforced with riprap and designed to pass residual flood flows up to the 10-year event (5,300 cfs) without significantly damaging the trail. It was assumed that the trail would be damaged at least once during the 35-year economic analysis, and require capital replacement.

- The property to the north, including the existing detention pond, would be graded to create a 6–acre sediment basin with an effective volume of 15-acre feet (i.e.: depth of 2.5 to 3-feet). The material excavated for the sediment pond would be used in the construction of the trail.

- Three grade control structures would be constructed across the alluvium (6-foot deep) varying in lengths from 300 to 700 feet. Each structure would be "notched" at several locations to pass the 2-year flood and to distribute the flow. These structures, in combination with the sediment basin, would stabilize Cherry Creek and promote wetland vegetation growth in a 28-acre area in the west portion of the "Bow Tie" property.

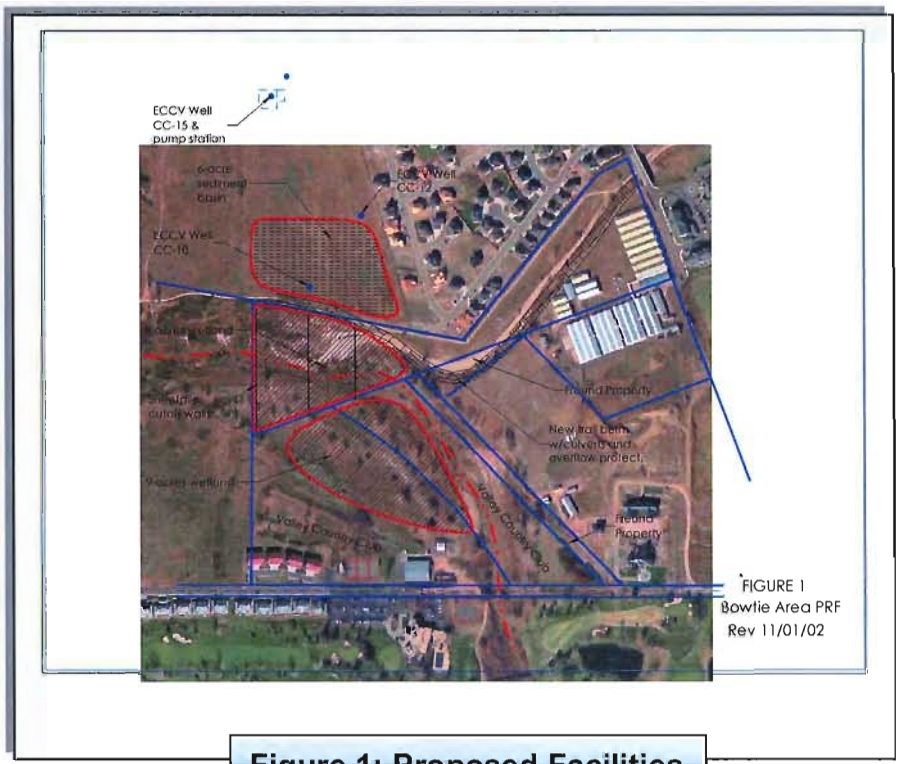


Figure 1: Proposed Facilities

Case Studies: "Bow Tie" Land Acquisition

The sediment basin is anticipated to be the second phase of the PRF project, after grade control stabilization features are constructed.

It is anticipated that the shallow grade control structures will provide base flows for wetland vegetative growth.

Case Studies: "Bow Tie" Land Acquisition

The phosphorous loads into the sediment basin based on the 2-year flood event is about 122 pounds on an annual basis.

The sediment basin would trap 85 tons of sediment, which translates into 85 pounds of phosphorous.

Phosphorus Load Estimates

1. Sediment Basin. The phosphorus loads into the sediment basin were estimated based on a 2-year flood that conveys the dominant sediment loads. Piney Creek 2-year flood runoff was estimated to be around 300-acre feet with a sediment load of 122 tons that would be discharged to the sediment basin. It was assumed that base flows would not deposit substantial amounts in the basin, since base flows (e.g.: 400 cfs) would continue in the existing alignment of Piney Creek. These sediment volumes were estimated using the following:

- Piney Creek watershed of 22 square miles
- 2-year storm event of 1.0 inches of rainfall
- Type C soil, CN of 88 resulting in 0.25 inches of runoff or about 300 acre feet.
- Runoff sediment concentration of 300 mg/l or about 122 tons of sediment.

Based on Cherry Creek bed-sediment, phosphorus concentration measurements by Halepaska (2000), a value of 500 ppm was used to estimate phosphorus in sediment. Therefore, 122 tons of sediment contain 122 lbs of phosphorus (i.e.: 122-tons x 500 ppm x 2000 lbs/ton).

2. Wetlands. The phosphorus load estimate for evaluating the wetlands assumed an average concentration in Cherry Creek base flow of 0.35 mg/l.

Phosphorus Load Reduction

1. Sediment Basin. The trap efficiency of a sediment basin is dependent on the basin volume (i.e.: 15–af) divided by the runoff volume (i.e.: 300-af), which is 0.05. Based on curves developed by the U.S. Bureau of Reclamation, this size basin would trap approximately 70% of the sediment load or 85 tons of sediment (i.e.: 122 tons x 0.70 = 85 tons).

Based on Cherry Creek bed-sediment, phosphorus concentration measurements by Halepaska (2000), a value of 500 ppm was used to estimate reduction in total phosphorus loads. Therefore, the 85-tons sediment trapped in the pond includes 85 pounds of phosphorus (i.e.: 85-tons x 500 ppm x 2000 lbs/ton).

2. Wetlands. The ability of wetlands (28-acres) to trap phosphorus was based on performance of the Cottonwood Wetlands, previous estimates made for the Cherry Creek State Park Wetlands, and subsequent calculations using equations suggested by Kadlec and Knight (*Treatment Wetlands*).

The equations suggest that the influent phosphorus concentration (i.e. 0.35 mg/l) can be reduced to about 0.12 mg/l, or about 65% reduction, which is similar to the performance of the Cottonwood Perimeter Road Wetlands. This performance (i.e.: 65% removal) is also based on a hydraulic loading rate (HLR) of 0.6 cfs over 10-acres (e.g.: 3.7 cm/day for equation). For a 210-day growth cycle at 0.6 cfs and an influent concentration of 0.35 mg/l, the wetlands would immobilize 15-lbs of phosphorus per acre or 150 pounds of P.

2.0 INTRODUCTION

"Smart Growth" is a commonly used phrase for improving the quality of life when addressing the challenge of growth on critical resources in a watershed. Growth will occur where economic opportunities and quality of life exist. Balancing economic growth with truly livable communities has generated a multitude of smart growth principles that encourage business leaders to pursue profitable development, but at the same time enhance the quality of life in their development and surrounding areas. Over time, the smart growth movement has grown to encompass strategies, tools, practices, and partnerships.

For the purposes of the Cherry Creek watershed, the discussion of smart growth strategies is conditioned not on a community's concerns of sprawl and traffic jams, but on the impacts of growth on the available water resources. Smart growth concepts on a watershed basis are about promoting the wise use of our watershed resources, protecting the quality of the environment, optimizing regional opportunities, encouraging collaborative efforts, utilizing development incentives instead of private property controls, using enhanced BMPs, and finally, about sharing the findings of this report with others so that the pursuit of enhanced water quality is a shared vision in the watershed.

The focus of this report is on "smart growth for clean water" strategies that can be used to support the wise use of water resources, specifically stormwater as it relates to non-point source controls by managing the runoff flows to facilitate infiltration, protecting threatened water bodies, preserving open space, encouraging recreational opportunities, and optimizing wetland vegetation. Keeping runoff to near pre-development levels is a key goal of the *Partners* watershed smart growth efforts for improving water quality.

'Smart Growth for Clean Water' is a set of water quality strategies or practices that can be implemented in a watershed to address the impacts of growth and development.

Background

The unprecedented growth in the Cherry Creek watershed, which includes the nationally-recognized growth in Arapahoe and Douglas counties, has prompted wide-spread focus on local water quality and quantity management strategies for the watershed. Out of this concern, interested parties have proposed a regional management strategy for the watershed, where the "health" of the region is in terms of both the economy and the environment. In this strategy, development is economically viable and takes into account the environmental components of open space, natural resources and sustainable habitats.

Watershed smart growth efforts make no judgement on growth itself, but concentrates on implementing strategies that limit stormwater runoff to levels similar to pre-development conditions.

In response to the need to bring this management strategy to the forefront, the *Cherry Creek Stewardship Partners* collaboration group was formed in 1999. The *Partners* mission is the promotion of stewardship of the watershed so that the resources of the basin and the environmental opportunities (i.e. water quality improvement, flood control, recreational possibilities, trail connectivity, and

Introduction

habitat restoration and preservation) are taken into consideration as the watershed experiences rapid growth. The *Partners* has sought to include all parties in the basin, including regulators and regulated industries, local government planning personnel, elected officials, the development community, environmental groups, and private property owners. The *Partners* are committed to optimizing opportunities by emphasizing collaborative efforts, incentives over controls, and providing tools to local planning agencies that take watershed development decisions beyond 'business as usual' to 'watershed health'.

The *Partners* organization was approached in late 2000 about possible interest in participating in the ***Smart Growth for Clean Water*** project sponsored by the U.S. Environmental Protection Agency (EPA), Trust for Public Land, and the National Association of Local Government Environmental Professionals (NALGEP). The ***Smart Growth for Clean Water*** project's goal is to promote the use of smart growth tools as strategies for improving water quality, and to provide technical expertise at a national level on water quality issues impacted by rapid growth, such as that now occurring in the Cherry Creek watershed.

The *Smart Growth for Clean Water - Cherry Creek Watershed Partnership* is one of 5 national projects that will study, present, and promote watershed smart growth strategies.

The Water Quality Committee of the *Partners* consists of volunteers from land use agencies, regulatory agencies, local watershed groups and the business community. Its mission is to investigate water quality enhancements and benefits from 'smart growth for clean water' principles in response to the ***Smart Growth for Clean Water*** project goals, including innovative streamside and on-site enhancement projects to protect and improve the water quality of Cherry Creek and the Cherry Creek Reservoir.

Presently, the Cherry Creek watershed and the Reservoir are managed by the Cherry Creek Basin Water Quality Authority (the Authority) under a legislative mandate for water quality control, and as such, the regulatory water quality component is in place. The Control Regulation for the Cherry Creek Reservoir prescribes the BMPs that are to be used in the Cherry Creek watershed to reduce phosphorous loads to the streams and the Reservoir.

The *Partners* are suggesting enhanced BMPs be utilized in the watershed to reduce phosphorous loadings to levels similar to pre-development conditions.

The implementation of BMPs to meet the Cherry Creek Reservoir Control Regulation for chlorophyll-a and phosphorous is accomplished at the local government level. These BMPs are based on the Urban Drainage and Flood Control District's (UDFCD's) Volume 3 Criteria Manual, and are expected to provide a range of about 45% to 55% reduction in annual loading of total phosphorous. While these BMPs provide for structural and non-structural 'control' of the effects of growth in the basin on stormwater runoff quantity and quality, the *Partners* is suggesting that watershed smart growth goes beyond these required BMPs to enhanced practices that actually reduce phosphorous loading from development sites to levels representative of undeveloped conditions. Although phosphorous is the driving element behind the Control Regulation, these BMPs mitigate for other pollutants as well, including sediment, nitrogen, and metals. The smart growth water quality strategies investigated in this report will have applicability to other impacts to the water quality in the watershed.

Introduction

The Smart Growth for Clean Water Report

In this report, the *Partners* will identify how 'smart growth for clean water' tools, such as limited impact "green" development, riparian land conservation, constructed wetlands, and water quality management plans can fulfill the Cherry Creek Reservoir Control Regulation's requirements for approved BMPs, floodplain preservation and conservation easements as strategies for water pollution control. The ***Smart Growth for Clean Water – Cherry Creek Watershed Partnership*** project's participation by the *Partners* not only meets the watershed's water quality mandate with any and all available strategies, but integrates local government planning efforts and the development community's economic goals into a set of tools recognized as critical to improving water quality in the watershed. Specifically, this report documents a 3-year long effort by the *Partners* and other stakeholders to broaden the available knowledge about the relationship of land use decisions on water quality and quantity, and hopefully give legitimacy to these watershed smart growth strategies as tools to be used in the Cherry Creek watershed.

Section 1 of this report highlights the key findings that emerged from the Case Studies described in a later section, as well as the numerous watershed activities that have been undertaken by the *Partners* during the ***Cherry Creek Watershed Partnership***. These findings summarized in the **Executive Summary,** led to the recommendations contained at the end of this report.

Sections 3, 4 and 5 highlight the major watershed activities conducted during the ***Cherry Creek Watershed Partnership*** project, and include the following:

The TPL Legacy Greenprint: The Authority provided extensive scientific analysis of water quality in the upper basin with their Watershed Plan 2000 (Brown and Caldwell, 2000), highlighting the results of substantial computer modeling and analysis of phosphorous loads. As a complement to this technical plan, the Trust for Public Land (TPL), through a Great Outdoors Colorado (GOCO) Legacy Planning grant, published a stewardship plan or a "greenprint" that looked at the watershed from the resource side, and over a 15-month process developed guidelines for the protection of key riparian, aquatic, and upland zones in support of improving the water quality in the watershed. **Section 3** of this report contains an analysis of the Legacy planning study in terms of quantifying the actual water quality benefits of watershed smart growth strategies, and provides a link between the valuable technical analysis by the Authority and the watershed opportunities now, and in the future.

Case Studies: Through case studies, the *Partners* hope to illustrate potential practices that can benefit and enhance the water quality in the Cherry Creek watershed. **Section 4** presents four approaches to integrating water quality goals with planned development within the watershed via these watershed smart growth strategies, including the following: site design to maximize stormwater infiltration; site design to maximize wetland vegetative areas and natural areas conservation; utilization of a stormwater quality management agreement; and land acquisition.

Since the year 2000, the *Partners* has been attempting to broaden the available knowledge about the relationship of land use decisions to water quality and the role of watershed smart growth strategies.

Four Case Studies in the watershed have been instrumental in advancing the understanding of just what a difference it makes looking at development from a 'smart growth for clean water' viewpoint.

Introduction

The Water Quality Concepts Tour was a very successful effort at challenging the "business-as-usual" approach to stormwater runoff controls.

Based on the key findings highlighted in the Executive Summary section, the *Partners* developed short-term and long-term recommendations to continue addressing water quality in the Cherry Creek watershed.

***Cherry Creek Watershed Partnership* Outreach Efforts:** Several watershed projects came about as a direct result of the exploration by the *Partners* into 'smart growth for clean water' strategies that could work in the basin. **Section 5** highlights three of these efforts:

One of the first outreach efforts has been the development of a process and the creation of a **Regional "Memorandum of Understanding" Agreement** that formalizes the cooperative efforts that would be needed to move forward on some of the goals and objectives for the watershed. Early on in the partnership project, the goal of a regional agreement among all the jurisdictions in the watershed was expressed. This stated goal also came out of the TPL Legacy Planning grant efforts as they identified cross-jurisdictional projects that would need regional cooperation.

Another project the *Partners* took on was the creation of a special ombudsman or "**Phosphorus Facilitator**" position within the Authority organizational structure. This position will provide the Authority, local land use agencies, and developers with assistance in the use of innovative non-point source and stormwater runoff controls as a tool for achieving water quality standards and other stated goals in the watershed. Some of these non-point source/stormwater runoff controls include watershed smart growth strategies, and would further legitimize, through actual demonstration projects, the value of these enhanced approaches to site development.

Finally, the *Partners* organized and conducted a **Water Quality Concepts Tour** to highlight several 'smart growth for clean water' strategies that are being used in the region now, so that land use planners, developers and resource agency personnel could see the actual practices in action.

Tour Highlight: Inverted Curb & Gutter

Section 6 outlines concepts related to funding of Cherry Creek watershed projects from external sources, and the importance of local financial support. One of the goals of the *Partners* was to research and compile a dynamic listing of sources for funds to accomplish watershed smart growth practices within the Cherry Creek corridor. It also includes recommendations related to project financing, and a demonstration scenario for the impact of leveraging loans and grants. The funding options table is a valuable resource to any entity attempting to find funding for a watershed project.

Section 7 contains short term and long-term recommendations. Each project undertaken by the *Partners* generated extensive discussion about the next steps, revised goals, more projects, and a call to action. It will be the job of the *Partners* to prioritize the efforts, implement the recommendations, and make sure that the innovative work done on behalf of the watershed in response to water quality concerns continues long after the ***Smart Growth for Clean Water – Cherry Creek Watershed Partnership*** is over.

3.0 LEGACY PLANNING GRANT "GREENPRINT"

The Cherry Creek watershed presents one of the most significant opportunities to conserve natural and agricultural lands, create community separators, develop parks and trails, protect and improve water quality, restore degraded areas, and conserve cultural and historic resources. Both the inherent natural resource value and recreational potential of the watershed are significant, as are the pressures of growth and development. This combination of natural resources and recreational potential has created an opportunity to develop an integrated resource protection system to both complement and mitigate the effects of rapid development – a "Greenprint for Growth" to help define and prioritize efforts in the watershed.

The purpose of the greenprinting effort has been to establish a cross-jurisdictional relationship among the various local jurisdictions in the watershed. Throughout this effort, a plan was developed to guide the creation of an inter-connected open space system aimed at protecting key riparian, upland and aquatic zones. This plan is the ***Cherry Creek Basin Open Space Conservation and Stewardship Plan*** (Trust for Public Land, 2002), and is designed as a strategic implementation tool for each jurisdiction.

The ***Cherry Creek Basin Open Space Conservation and Stewardship Plan*** is the direct result of a Legacy Planning Grant awarded to the Trust for Public Land (TPL) by the Great Outdoors Colorado (GOCO) Trust Fund, in cooperation with the City and County of Denver, Arapahoe County, Douglas County, and other municipal, agency and public partners. Over the course of 15 months, the Cherry Creek Basin Steering Committee met almost monthly to develop the greenprint. Throughout the 15 months, the greenprinting effort became known as the "Legacy Grant planning effort" throughout the watershed, and for this reason it will be referred to in this report as the "TPL Legacy Greenprint" to pay respect to the sponsors, the source of the funds for the effort, and the many people who contributed so many months on the greenprinting effort.

The TPL Legacy Greenprint is a culmination of numerous studies, public forums, and resource inventories. In addition, this greenprinting effort has taken significant steps towards understanding of the water quality of Cherry Creek and the relationship of land conservation to water quality. TPL, with the assistance of local consultants, was able to provide information to help local governments, state, and federal resource agencies, and other stakeholders plan and implement effective resource protection measures in the watershed. The water quality Goals and Recommendations that came out of this study are presented in **Appendix B** at the end of this section.

The TPL Legacy Planning project is complementary to the Smarth Growth for Clean Water partnership project. While the focus of each is slightly different, land conservation as one key 'smart growth for clean water' strategy represents a common link in the goal of watershed water quality enhancement. In addition, there is strong consistency in the goals and recommendations from one project to the other. The following sections offer an attempt at quantifying the qater quality benefits of open space conservation and other related watershed smart growth techniques.

TPL Legacy "Greenprint"

A "greenprint" is an integrated resource protection system to both complement and mitigate rapid development.

Over the course of 15 months, the Cherry Creek Basin Steering Committee met almost monthly to develop the "greenprint".

TPL Legacy "Greenprint"

Projected growth in the watershed will lead to increased levels of stormwater runoff and total phosphorous, and decreased stream infiltration.

The TPL effort offers a method to quantify the water quality benefits of open space conservation and other watershed smart growth strategies.

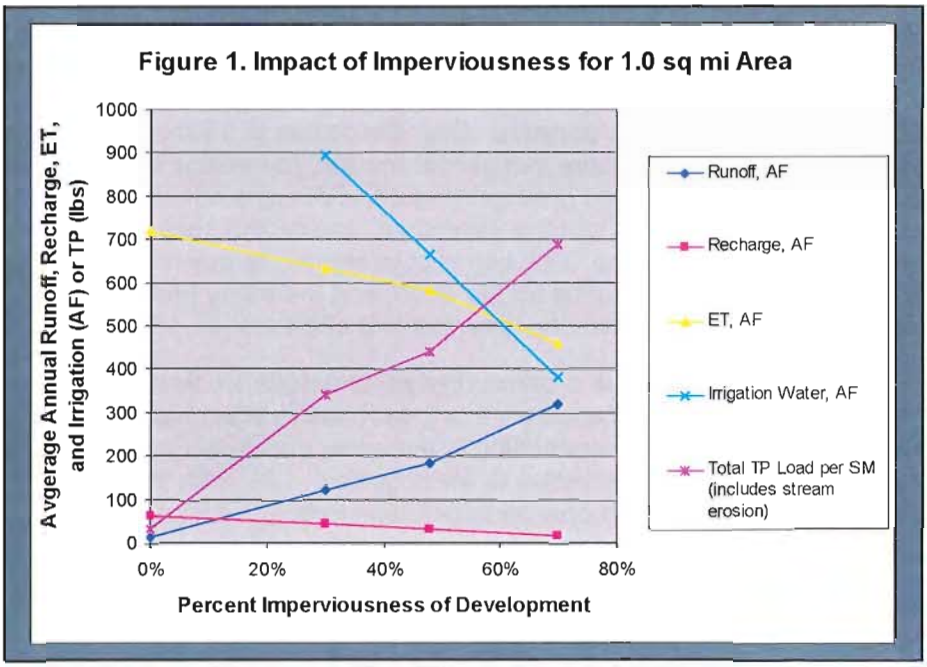
Water Resources and Water Quality

Protecting water resources and water quality is one of the most important steps local municipalities and jurisdictions can take to ensure the long-term environmental health and sustainability of the Cherry Creek watershed. Projected future growth in the watershed is anticipated to lead to increased levels of stormwater runoff, total phosphorus loading, and stream erosion, along with decreased absorption of phosphorous (through infiltration and vegetative filtering) in degraded stream corridors. Understanding potential impacts to lakes and stream corridors and encouraging effective land conservation and stewardship to eliminate or mitigate these impacts is critical if 'beneficial uses' of state waters are to be protected. The following section offers a method to quantify[1] the water quality benefits of open space conservation and other related techniques.

Impacts of Urbanization

Figure 1 illustrates typical impacts of urbanization on the following water resource parameters:

. Stormwater Runoff Volume (Runoff)
. Groundwater Recharge (Recharge)
. Total Phosphorus Loading (TP Load/Square Mile)
. Evapotransipration (ET)
. Irrigation Water



Approximate long-term average annual values of these parameters were estimated for four impervious values representing these types of land uses:

0%	Undeveloped Conditions
30%	Typical Single-family Residential
48%	Mixed Urban (SF Residential plus Multi-family and Commercial)
70%	Multi-family and Commercial

[1] The quantification of urban impacts and open space conservation shown herein is approximate and is intended to illustrate general, long-term average effects on water quality due to various land use practices. Actual impacts will vary from the information presented. More detailed analyses and data collection are recommended to estimate any site-specific or project-specific impacts or benefits.

The total annual phosphorus load reduction to the Reservoir (e.g.: long term projections, since sediment basin based on 2-year flood) is then 85 + 150 = 235 pounds of phosphorus.

Cost Estimates

The PRF cost includes land acquisition, construction, annual O&M, and capital replacement, and are summarized in the table below.

Realized Benefits of Smart Growth Strategy

Land acquisition, as a 'smart growth for clean water' strategy has several tangible and intangible benefits associated with its implementation. Watershed development may divert critical groundwater recharge even as it increases the demand on the aquifers. Watershed development may affect the quality of the surface and groundwater resources as well as the quantity of the water resource in volume and velocity. The value of an undeveloped piece of land's ability to store, buffer, filter and recharge may outweigh the development value. Additionally, there is a tangible environmental benefit in the pounds of phosphorous removed from the watershed. On the intangible side, the benefits to the watershed are in terms of buffer, riparian habitat, and wildlife corridors, as well as the benefit of working together to enhance the watershed resources.

Environmental Benefits

The "Bow Tie" property PRF (see **Figure 1**) is estimated to reduce the long-term annual phosphorus load to the Reservoir by 235-pounds through the construction of a sediment basin, channel stabilization and wetlands. Capital costs (with

CHERRY CREEK BASIN WATER QUALITY AUTHORITY
BOW TIE PROPERTY PRF CONCEPTUAL COST ESTIMATE

ITEM	ITEM DESCRIPTION	QUAN.	UNIT	UNIT COST	ITEM COST	SUB-TOTAL	COMMENTS
1	Trail					$ 277,680	
	a. Earthwork	3650	cy	$ 12.00	$ 43,800		12 wide, 4:1 ss, avg 5 feet high, L = 600
	b. 8 foot concrete walk	4800	sf	$ 0.60	$ 2,880		8' x 600 feet
	c. Culverts,	600	lf	$ 220.00	$ 132,000		10 ea, 4' x 12' x 60 feet
	d. Riprap overflow protection	1980	cy	$ 50.00	$ 99,000		6 cy rock per lf, 330 ft of overflow
2	Wetlands	10	acres	$ 15,000.00	$ 150,000	$ 150,000	
3	Stream Stabilization					$ 162,500	
	a. Sheet piling	9000	sf	$ 15.00	$ 135,000		6' high, 1500 lineal feet
	b. Concrete cap	55	cy	$ 500.00	$ 27,500		1 cf/lf
	Sub-Total					$ 590,180	
	25% contingency	0.25				$ 147,500	
	15% Engineering/Admin	0.15				$ 88,500	
	Total Capital Cost					$ 826,180	
4	Land Acquisition					$ 300,000	
	Annualized Capital & Land Costs at 7% for 35-years					$ 86,700	CRF @7%, 35yr = 0.077
5	Operations/Maintenance					$ 6,350	
	a. Routine at 0.5% capital	0.005			$ 4,100		
	b. Sediment removal	90	cy	$ 25.00	$ 2,250		85 tons at 70 pcf
6	Capital Replacement	0.077		$ 23,000.00	$ 1,800	$ 1,800	replace 50% of trail = $23,000
	Total Annual Costs =					*$ 94,850*	
	Annual phosphorus reduction (lbs) =					*235*	
	Annual Cost per Pound of Phosphorus					*$ 400*	

Case Studies: "Bow Tie" Land Acquisition

Constructed wetlands, as an enhanced BMP, have been shown to have a phosphorous concentration removal of about 65% within the watershed.

Maintenance and water rights are two important factors when considering implementation of 'smart growth for clean water' strategies highlighted here.

Case Studies: "Bow Tie" Land Acquisition

The price per pound of phosphorous removed appears to be in the range of $300 -$400 per pound on an annual basis, making this a viable PRF.

If you add in the increased riparian vegetation and improved habitat,, and the additional open space in an urban environment, this is an excellent type of project for the watershed.

contingencies) are estimated to be $826,200 (see **Table 1**) and the assumed land acquisition costs (in partnership with other watershed stakeholders) are $300,000. Annual operations/maintenance costs are estimated to be $6,400. These costs do not include water augmentation, but gross estimates of annual water consumption by the wetlands indicate that acquisition of the water rights and well on the property would meet the project's water requirements, assuming a worst-case scenario. The natural vegetation and exposed water surfaces already consume water, but the 28-acres constructed wetlands may consume an additional 10- to 30-acre feet per year, which appears to be covered in the purchase.

The total annualized cost of the PRF is $94,850, which results in a cost of $400 per pound of phosphorus immobilized. This performance is comparable, and in some instances, higher per pound of phosphorus removed when compared to the other BMP and PRF projects recommended for the Cherry Creek watershed. The "Bow Tie" property PRF is also similar to an Advanced Water Treatment Plant PRF in cost per pound.

The phosphorus cost per pound for the "Bow Tie" property PRF could be reduced as sediment loads are increased. Information provided by local experts suggests that sediment loads could be substantially higher from Piney Creek than used for this analysis. Therefore, as sediment loads increase, the amount of phosphorus trapped is increased and annual maintenance costs are increased. It is estimated that annual phosphorus costs could be around $300 per pound if sediment loads are higher. In addition, the project could be expanded to include an additional 20- to 30-acres of constructed wetlands on property between the "Bow Tie" and other potentially available properties on the west side of Cherry Creek.

Other intangible benefits of the "Bow Tie" PRF include:

- The property provides additional buffer land around the State Park.
- This could be a demonstration project to illustrate benefits of created wetlands along the Cherry Creek corridor.
- The project enhances wildlife habitat
- The project could improve the trail in an enhanced riparian corridor.
- The project could lead to enhanced collaborative efforts among watershed stakeholders: the costs for construction of the PRF could be reduced via storm water demonstration grants from state and federal regulatory agencies or construction/maintenance funds from the local district/local government partners.

Economic Benefits

The primary economic benefit to this land acquisition watershed smart growth strategy is apparent when reviewing the costs per pound of phosphorous removed for BMP and PRF strategies within the watershed that have been defined previously by the Authority in their Watershed 2000 Plan. The range of costs per pound of phosphorous removed by project varies from $10 to $1,658, assuming cost sharing is available from the local land use planning agencies. If sharing is not an option, those costs go up considerably per pound. The economic value of a PRF that is estimated to be around $300 per pound of phosphorous removed, when coupled with increased riparian and wildlife habitat, and additional open space in an urban environment, makes this a very viable PRF for the watershed.

Case Studies: "Bow Tie" Land Acquisition

Strategies for Implementation

TPL, whose mission is to conserve land for people to improve the quality of life in communities and to protect natural and historic resources for future generations, took the lead in the real estate due diligence and negotiations for the land acquisition. This actual piece of property had been on the radar screen of the Cherry Creek State Park staff for several years, who brought it to the attention of the local government, Arapahoe County. The emergence of the interest in the property as a site for a potential BMP or PRF site by the Authority was probably the single most important catalyst for bringing the land acquisition into the realm of possibility.

The original concept regarding wetlands planting was reevaluated. It was previously estimated that wetlands planting would be required at a cost of $150,000, plus contingencies. Upon further consideration, it is likely that stabilizing the Piney Creek and Cherry Creek confluence with partial cutoff walls would result in increased natural wetland vegetation, which would reduce capital costs for the project. Whereas there is still uncertainty on the need for augmentation water, the opinion at this time is the wetlands are incidental to the project (e.g.: stabilization), which helped control overall project costs.

For scheduling purposes, the "Bow Tie" PRF concept was divided into two phases. The first phase would construct the channel stabilization at the confluence and allow the wetlands to occur naturally. The second phase would add the sediment basin, which requires construction of the trail/berm across Piney Creek.

Costs and phosphorus reduction benefits for Phase I were evaluated. Capital costs (with contingencies) were estimated to be $227,500 and the assumed land costs are $300,000 for the Authority. Annual operations and maintenance costs are estimated to be $1,140. The total annualized cost of the PRF is $41,760, which results in a cost of $278 per pound of phosphorus immobilized. Therefore, phasing of the "Bow Tie" PRF would provide similar, if not more economical long-term performance in immobilization of phosphorus as the original concept.

Phase I of the "Bow Tie" PRF project would include the construction of channel stabilization at the confluence, allowing the wetland to occur naturally.

Conclusions

The "Bow Tie" property acquisition was completed in spring 2003. This case study is an ongoing regional, collaborative project that is attempting to bring the multi-objective nature of the acquisition into reality with the construction of enhanced BMPs and continued stewardship of the floodplain.

The TPL Cherry Creek Legacy project identified and prioritized strategic parcels of land deemed to be significant in terms of water quality and quantity protection and enhancement. This initial foray into identifying a parcel of land for acquisition by a watershed stakeholder partnership, firming up the monetary commitments, and initiating design for a BMP or PRF facility has been a success. Through the Denver Wholesale Florist's property acquisition case study, the process, pitfalls, and promise of this smart growth tool as a viable strategy in the basin will lead the way for the future opportunities that will be identified through the Legacy Project.

The GIS work done for the TPL Legacy Grant Greenprint has identified additional "Bow Tie" opportunities in the watershed.

Case Studies: *"Bow Tie" Land Acquisition*

TRUST FOR PUBLIC LAND

"BOW TIE" PARCEL:
PROPERTY DESCRIPTION

PARCEL NO.: 2073-19-1-00-013

SIZE: 21.49-acres

DEVELOPABLE AREA: 5.2-acres above 100-year floodplain

ZONING: Agriculture

LOCATION: City of Centennial, Arapahoe County

ASSESSOR'S VALUE: $276,421

APPRAISED FAIR MARKET VALUE: $740,000

IMPROVEMENTS:

Greenhouses and pads to be removed

CONDITION OF SITE: Riparian areas are undisturbed. Piney Creek Trail runs through this parcel. Frequent flooding leaves the trail covered with sediment, requiring extensive maintenance; relocating or restructuring of trail may be required.

ENCUMBRANCES: The US Army Corps of Engineers holds a flowage easement on the western-most 8 or 9-acre portion of the property, to allow for flows relating to the reservoir downstream.

PARTNERS:

PRIVATE CONSERVATION BUYER
CHERRY CREEK BASIN WATER QUALITY AUTHORITY
CITY OF CENTENNIAL
ARAPAHOE COUNTY
STATE PARKS
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
ORCHARD VALLEY @ CHERRY CREEK STATE PARK HOA

References:

John C. Halapaska and Associates, Inc. (2000). "200 Annual Monitoring Report – Baseline Water Quality Data Collection Study for the Upper Cherry Creek Basin."

Robert H. Kadlec and Robert L. Knight (1996). "Treatment Wetlands."

Urban Drainage and Flood Control District (1999). "Urban Storm Drainage Criteria Manual, Volume 3 - Best Management Practices. "

5.0 OUTREACH EFFORTS

Several watershed projects came about as a direct result of the exploration by the *Partners* into 'smart growth for clean water' strategies that could work in the basin. **Section 5** highlights three of these efforts.


Signature Page – Cherry Creek Regional Memorandum of Understanding

Debra Vickrey, Chair
Arapahoe County Board of County Commissioners — Date 5/29/03

Wellington Webb, Mayor
City and County of Denver — Date

Walter M. Maxwell, Chair
Douglas County Board of County Commissioners — Date 5.21.03

Catherine Dempsey, Mayor Pro Tem
City of Glendale — Date 5.20.03

David W. Pfaffer, Mayor
City of Greenwood Village — Date 5/27/03

Gary Lasater, Mayor
Town of Parker — Date 5-23-03

Randy Pye, Mayor
City of Centennial — Date 7/17/03

Regional MOU Agreement Signature Page

One of the first outreach efforts has been the development of a process and the creation of a **Regional "Memorandum of Understanding" Agreement** that formalizes the cooperative efforts that would be needed to move forward on some of the goals and objectives for the watershed. Early on in the ***Smart Growth for Clean Water Partnership*** project, the goal of a regional agreement among all the jurisdictions in the watershed was expressed. This goal also came out of the TPL Legacy Planning grant efforts as they identified cross-jurisdictional projects that would need regional cooperation.

Another project the *Partners* took on was the creation of a special ombudsman or "**Phosphorus Facilitator**" position within the Authority organizational structure. This position will assist the Authority, local land use agencies, and developers in the use of innovative non-point source controls as a tool for achieving water quality standards and other goals in the watershed. Some of these non-point source controls would include watershed smart growth strategies, and would further legitimize, through actual demonstration projects, the value of these enhanced approaches to site development.

The Authority believes that stormwater quality in the Cherry Creek Reservoir Basin can be improved by developing land-use plans for new development that extend beyond minimum requirements for immobilization of phosphorus. The goal is to accomplish this through a more comprehensive working relationship between land-use agencies and developers, including their planners and engineers. The intent is to identify water quality opportunities within a parcel of land before a developer selects his land-use plan and encourages the developer to implement the enhanced water quality plan.

The proposed *Partner* effort would include working with the Phosphorous Facilitator in accomplishing the goals of the project, including assisting in the outreach to identify those that should be involved in the process and assist with technical issues through consultation with the *Partners* Water Quality Committee. The *Partners* would also work to promote the results of the effort to other land-use agencies and developers.

Outreach Efforts

Three outreach efforts have been accomplished in 2003: the MOU Agreement, the Phosphorous Facilitator position, and the Water Quality Tour.

The *Partners* will try to assist the Authority's Phosphorous Facilitator in outreach efforts and brainstorming 'smart growth for clean water' strategies that can be used in the basin.

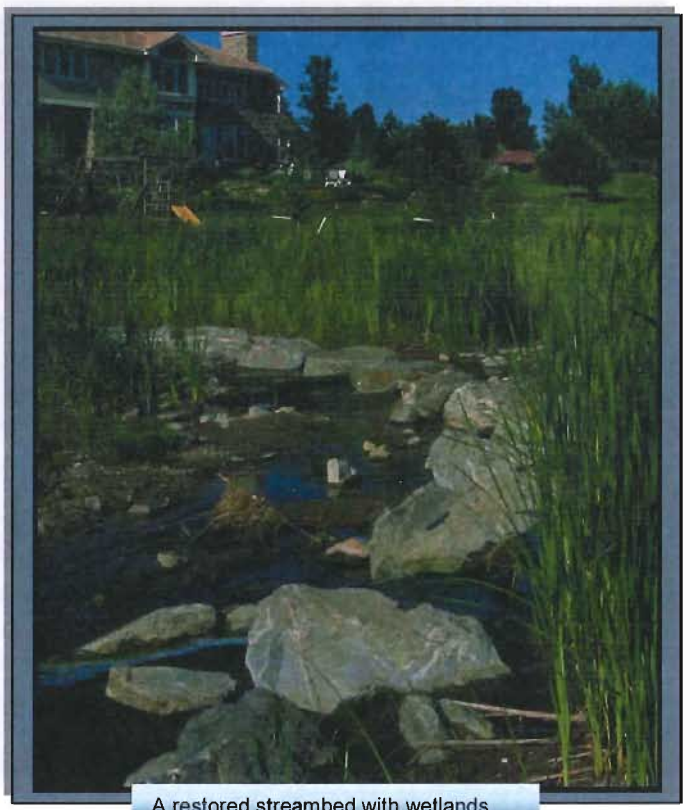
Outreach Efforts

The Water Quality Tour included 7 stops to illustrate water quality concepts that can be put into action now.

Finally, the *Partners* organized and conducted a **Water Quality Concepts Tour** to highlight several 'smart growth for clean water' strategies that are being used in the watershed now, so that land use planners, elected officials, developers and resource agency personnel could see the actual practices in action.

Some 'smart growth for clean water' strategies that were discussed as part of the tour include the following:

- Enhanced site design to maximize stormwater infiltration
- Enhanced site design through natural landscaping
- Enhanced site design to maximize wetland vegetative areas and provide natural areas conservation
- Utilization of stormwater irrigation to augment limited groundwater supplies
- Restoration of streambeds to improve water quality beyond channel stabilization
- Enhanced site design to facilitate stormwater attenuation, storage and infiltration



A restored streambed with wetlands

5.1 REGIONAL MOU AGREEMENT

One of the action items that emerged from the work done in conjunction with the ***Smart Growth for Clean Water - Cherry Creek Watershed Partnership*** project was the pursuit of a regional understanding among all the land use entities in the watershed about the value of the Cherry Creek mainstem, it's tributaries, the Reservoir, and all the associated upland, riparian and wetland areas.

Background

As described earlier in this report, the *Partners* has operated successfully for years as an informal coalition of interests from throughout the watershed. The work of the *Partners* was focused on formalizing this intent in 2002 with the TPL Legacy Plan completion, and the ***Smart Growth for Clean Water Partnership*** work. These projects engaged a broad cross-section of interests within the watershed and laid out, for the first time, specific goals and objectives for integrating land protection with water quality goals in the Cherry Creek watershed.

As the TPL Legacy Planning and ***Smart Growth for Clean Water Partnership*** efforts wrapped up, and the *Partners* began to consider a variety of possible cooperative regional projects, interest increased in the development of a more formal regional agreement to facilitate that work. In the summer of 2002, the Partner received and grant form the Governor's Office of Smart Growth, Department of Local Affairs (DOLA), to hire a consultant who could facilitate the creation and signing of a regional agreement. The development of a regional agreement to formalize what had previously been a successful informal process, was pursued for several reasons, as follows:

Engaging Elected and Appointed Officials: Staff from various jurisdictions who had been working with the *Partners* to develop regional goals felt that it was time to get official buy-in from their governing bodies. Asking these bodies to sign a regional agreement would require that they both understood the work that led up to it, and a willingness to formally endorse the goals that resulted. Once local governing bodies had officially agreed to support these goals, it would be much more effective for staff to pursue them.

Regional Fundraising Potential: While there are a multitude of potential funders for watershed-based water quality projects, most of them prefer to fund more effective regional efforts rather than specific local projects. Many also require specific proof of regional "intent to cooperate" in the form of an Memorandum of Understanding (MOU) or Intergovernmental Agreement (IGA) between the participating entities. This agreement, then, would provide documentation of regional intent to cooperate within the Cherry Creek watershed.

Shared Resources and Technology Transfer: A third motivator for local governments to participate in a more formal regional cooperative agreement is the advent of new water quality control regulations (e.g. NPDES Phase II Stormwater Permits). These un-funded mandates require local governments of cities under a

Outreach Efforts
Regional MOU Agreement

The development of a regional agreement formalized what has been an informal process within the *Partners* organization.

The Cherry Creek Regional MOU Agreement provides documentation of regional intent to cooperate in the watershed.

Outreach Efforts
Regional MOU Agreement

This agreement provides the impetus for local governments to share NPDES efforts, realize significant economies of scale and learn from each other.

An effort was made to try and engage all the local governments in the main part of the watershed for the agreement.

certain size (and counties managing unincorporated land) to meet the six minimum measures defined in these new permits, including education and outreach efforts. Rather than reinventing the required materials and programs in each local area, there is strong potential for local governments to share these efforts and realize significant economies of scale (as well as to learn from each other in the process of implementing them).

Formation of the Agreement

Once the decision had been made to pursue a regional agreement, several more detailed questions arose. The discussion surrounding these questions helped form the intent and structure of the eventual agreement.

- ***Who to engage?***

  There was considerable discussion about who should be a signatory to the agreement. Among those considered were local, state and federal government agencies and interests, local water and sanitation districts, non-profit partners and regional entities such as the Authority.

  In order to make a determination, the *Partners* considered their target audience – who would be able to drive activities to realize the goals described in the ***Smart Growth for Clean Water Partnership*** project and TPL Legacy Plans? Who had direct control over land use and development activities in their areas? How could we use this agreement to engage those who needed to be at the table in order to make a difference? At the same time, how could we define a group small enough to be manageable, both in the agreement process and afterwards?

  Balancing these considerations, a decision was made to engage all local governments in the main part of the watershed in the agreement – including Arapahoe, Denver and Douglas counties (the original signatories and contractual parties to the DOLA grant), as well as all local municipalities (including Parker, Glendale, Greenwood Village, Centennial and Aurora). Of these entities, Aurora chose not to participate at this particular time, citing their small amount of area within the watershed and their unfamiliarity with the *Partners* and watershed smart growth tools being proposed.

  At the request of the Greenwood Village City Council, the Centennial Airport Authority (an independent, board-governed agency that is a major landowner in the basin), has been added to the wish list of signatories. In addition, the Town of Castle Rock, in the southern portion of the basin, and the City of Lone Tree at the far west edge of the watershed, have expressed an interest in joining this effort, and the City of Aurora has indicated that they would like to revisit this effort after reviewing the types of 'smart growth for clean water' efforts that the signatories are suggesting in the Regional MOU Agreement. These additional entities and others that are identified will be part of a subsequent phase of the MOU, when additional funds are secured for another round of presentations.

- ***What type of agreement?***

  There was additional discussion among the *Partners* about the goals for the agreement – what is it intended to accomplish? It was decided that this agreement was meant to increase understanding of the work being done by the *Partners* in the watershed by decision-makers, and to make it easier to move forward on projects of mutual interest; it was not to require funding (difficult in this economic climate) or to impact their control in any way or to indicate specific endorsement for any project or cause. These were identified as being inappropriate to the role and function of the *Partners*.

  For these reasons, it was decided that the agreement should take the form of the less formal MOU rather than the more formal and legally binding IGA. For purposes of stating the assumptions behind the agreement and summarizing its intent, the *Partners* adopted a resolution format for the agreement, to be signed by one person representing the will of each jurisdiction.

The Regional Agreement as a Reality

As the development of the Regional MOU Agreement was intended to educate as well as engage the decision-makers in local governments, presentations were made to each council and board of county commissioners. A brief Power Point™ presentation was presented on the agreement for their consideration. Staff from each jurisdiction helped to tailor the presentation for their governing group, based on particular issues and concerns in each jurisdiction. Eight presentations were made over the course of three months, to both governing bodies, planning groups and senior management staff. Presentations lasted between 30-45 minutes, on average, including discussion time. In every case, there was extensive questioning and discussion following the presentation, which led ultimately to a resolution to sign the agreement. In all cases, the presentations and discussion resulted in the placement of the agreement as a consent agenda item for formal adoption and was adopted without issue.

A brief analysis of questions and concerns raised during the course of these presentations may be instructional for future outreach or for projects that seek to replicate this process. Major concerns included:

Confusion regarding the purpose of the Agreement and its Legal Status: Several jurisdictions (and their legal staff) questioned the development of the agreement as an MOU in the form of a resolution. Concerns included a lack of substance/ legally binding content in the agreement (if it's not substantive, why sign it?) as well as a concern that there might be hidden terms in the agreement that they would have to face later. Staff and consultants reinforced the value of a less formal type of agreement as a means to facilitate regional cooperation and fundraising.

Funding and Local Control: While the informal and non-binding nature of this agreement was emphasized, concerns remained that this agreement would somehow "tie the hands" of local government or actually create new water quality regulatory requirements for them to fulfill. Through further discussion and analysis of the agreement, these fears were resolved.

Outreach Efforts
Regional MOU Agreement

It would have been difficult, if not impossible, to secure the support of governing bodies without the strong interest by their respective staffs.

The informal MOU form of agreement was used so as not to raise issues of local control that might have been present in a more formal IGA.

Getting their Share: Some groups expressed concern that they would not be included in the process to develop cooperative projects, or would not have access to regional funding sought by others. With this signed agreement all entities will be ensured equal consideration. State sponsorship of the regional effort (through the DOLA Smart Growth grant) adds support in seeking federal dollars for future cooperative efforts for any given entity to provide leadership in the watershed or to champion a watershed-level project.

Lessons Learned

The only real challenge in developing a regional agreement was establishing the right contacts and support in two local jurisdictions. In the first case, contacts were eventually established through persistent contacts and referrals, and they were eventually engaged in the agreement. The second case involved a single jurisdiction that had not typically been involved in the work of the *Partners*, and that had only a small segment of watershed lands within its city boundary. After many attempts to contact different staff, it was agreed that the Agreement would proceed without their participation, but with the possibility of engaging them at a later date if and when regional projects might be of mutual interest.

The success when pursuing any type of regional initiative is very site specific, but it was clear that such an initiative in the Cherry Creek watershed had a greater chance of success due to several factors, including the following:

- Staff interest, investment and support for the agreement: without strong support for the benefits of the Agreement, and investment in its successful execution, it would have been difficult if not impossible to secure the support of governing bodies.
- Balancing politics across jurisdictions: consideration was given to the sensitivities and unique political circumstances of the potential signatories in the development of the agreement itself, as well as the adoption process. This helped to form the type of the agreement (an informal MOU describing voluntary actions, and unlikely to raise issues of local control), it's timing (majority before June to avoid the delay likely from a large-scale turnover of term-limited council members and mayor at that time), and its presentation approach.
- The existence, longevity and stability of the Cherry Creek Stewardship Partners organization: this undoubtedly contributed to the willingness of jurisdictions to participate in this agreement. The track record established by the *Partners* for collaborative work, for sharing its results and for developing a constructive relationship with both the State Park and the Authority contributed to acceptance of a regional agreement to further the work of the *Partners*.

Outcome and Next Steps: Making the MOU a Living Document

In order for the Cherry Creek Regional MOU Agreement to accomplish its stated goals, it needs to be actively used as a basis for regional cooperation. Recommendations for next steps to continue this regional cooperation include the following:

- Develop contact list for all Regional MOU Agreement signatory governments for all future communications and update quarterly. This list needs to identify the person(s) who can facilitate future projects based on the agreement for each government.
- The *Partners* should provide regular news/ updates regarding their activities, including new or upcoming opportunities for cooperative work (possibly consider forming a *Partners* special group to consider/compile these and to produce a quarterly newsletter). Ensure that these are distributed to both active and inactive participants in the regional agreement.
- Showcase the agreement and its future accomplishments locally and nationally/ internationally to ensure that local governments get the recognition they need to ensure the political viability of cooperative projects.
- Develop and agree upon a protocol for initiating and pursuing cooperative projects (ensure equal access to information, opportunities). How will cooperative fundraising and projects be started? How will participants in the MOU Agreement have an opportunity to participate? What happens if projects are in competition with one another for funding or participants? All of these things should be considered, agreed upon and made clear to ensure future success.
- Continue to hold quarterly meetings of the *Partners* group and develop a plan to conduct outreach and engage more decision-makers and senior staff from signatory governments in these meetings.
- Develop "short and sweet" version of presentation for "road shows" in various communities, to allow individual jurisdictions to "get credit" for their participation in the agreement, and to build their investment in the success of the agreement at meeting its stated goals.
- Ensure commitments (in-kind, cash or other) from participating governments to support the *Partners* annual conference, which extends beyond current administrations into long-term stewardship.
- Leverage funds, where appropriate, to finance larger projects that would otherwise individually not be possible.

To be successful, the Cherry Creek Regional MOU Agreement needs to be actively used as a basis for regional cooperation.

Some next steps include engaging signatory agencies in watershed meetings and build their interest in the MOU Agreement.

Outreach Efforts
Regional MOU Agreement

CHERRY CREEK WATERSHED
WATER QUALITY AND RESOURCE STEWARDSHIP
REGIONAL MEMORANDUM OF UNDERSTANDING

WHEREAS, Water Quality is an issue for all governmental jurisdictions within the Cherry Creek watershed.

WHEREAS, Unprecedented growth throughout the region has had a significant impact on water quality, natural resource health, and recreational opportunities.

WHEREAS, New mandated water quality regulations may impact both public and private economic interests throughout region.

WHEREAS, The protection of natural resources and sustainability of healthy ecosystems is a recognized priority within the watershed.

WHEREAS, There are nationally recognized correlations between open space preservation, natural resource protection, recreational opportunities and property values.

WHEREAS, The issues and opportunities are regional in nature and can most efficiently and effectively be addressed through regional solutions – resulting in a need for continuing coordination and cooperation among basin jurisdictions.

WHEREAS, The Cherry Creek Stewardship Partners group (CCSP) was formed by representatives of three counties and a diverse range of stakeholder constituencies over four years ago as a regional forum.

WHEREAS, With private, local, state and national funding, the CCSP, with support from the Trust for Public Land and the Smart Growth for Clean Water Partnership, engaged in public process to develop a series of stewardship guidelines to address growth impacts and related water quality issues in the Cherry Creek watershed.

WHEREAS, These plans, now complete, form a blueprint for further action by jurisdictions within the watershed.

WE THEREFORE RESOLVE TO:

Adopt the goals developed through extensive public process:

1. *Support smart growth practices to mitigate development-induced water quality impacts.*
2. *Foster multi-jurisdictional relationships among local governments, state and federal agencies, and local citizens.*
3. *Protect and enhance high quality wildlife habitat and recognize the importance of wildlife corridors.*
4. *Help meet open space and recreation needs of the region's growing population.*
5. *Protect important cultural and historic features.*
6. *Provide environmental education and interpretive opportunities.*
7. *Provide buffers to development and community separators.*
8. *Provide recommendations on urban design to protect Cherry Creek as a natural amenity.*
9. *Help establish trail connectivity between Cherry Creek and adjoining neighborhoods.*

Support regional approaches to water quality improvement in the Cherry Creek basin, throughout Douglas and Arapahoe Counties and the City and County of Denver.

Consider and where possible apply a variety of tools available to accomplish water quality goals, including (but not limited to) land conservation and stewardship, public policy and public outreach and education.

Commit staff and, where approved, financial resources to regional cooperation for improved water quality.

Coordinate activities with key stakeholders including the Urban Drainage and Flood Control District, Cherry Creek Basin Water Quality Authority, and a variety of local governments throughout the watershed.

Meet semi-annually to review and advance cooperative efforts and coordinate funding activities toward these ends.

Support increased regional coordination and communication through the work of the Cherry Creek Stewardship Partners.

Cooperate to pursue grants and other funding sources toward common regional water quality goals.

Support a comprehensive and integrated approach to land conservation, water quality protection, public education and recreation in the watershed.

2.

Outreach Efforts
Regional MOU Agreement

Signature Page – Cherry Creek Regional Memorandum of Understanding

Debra A. Vickrey — 5/27/03

Debra Vickrey, Chair
Arapahoe County Board of County Commissioners — **Date**

Wellington Webb, Mayor
City and County of Denver — **Date**

Walter M Maxwell — 5-21-03

Walter M. Maxwell, Chair — **Date**
Douglas County Board of County Commissioners

Catherine Dempsey — 5.20.03

Catherine Dempsey, Mayor Pro Tem — **Date**
City of Glendale

5/27/03

David W. Phifer, Mayor — **Date**
City of Greenwood Village

5-23-03

Gary Lasater, Mayor — **Date**
Town of Parker

7/17/03

Randy Pye, Mayor — **Date**
City of Centennial

5.2 PHOSPHOROUS FACILITATOR

Out of the discussion on how to use and implement the watershed smart growth tools documented in the case studies, the *Partners* developed a concept for a Phosphorous Facilitator position to assist development with these 'smart growth for clean water' strategies. This special ombudsman position would be housed within the Authority organizational structure to assist the Authority, local land use agencies, and developers in the use of innovative non-point source controls and site designs to maintain pre-development hydrologic conditions as strategies for achieving water quality standards and other goals in the watershed, collectively termed 'watershed smart growth strategies'. This position would facilitate the best use of technology and competitive development tools that can be utilized in the watershed.

The Phosphorus Facilitator would become actively involved in the development of a planning process long before a specific proposal is completed by the developer and submitted to the review agencies. The Phosphorus Facilitator would actively encourage the developer to consider innovative watershed smart growth practices and would work with the review agencies to recognize those practices that could produce the greatest benefit for the region.

The goals of this interactive process would be to produce a plan that is cost effective, enhances property values, can be approved in a timely manner, and will achieve regional watershed goals that may not be apparent when consideration is limited to the development requirements that would apply only to the parcel in question. Such a planning process could create opportunities to obtain open space, improve recreational opportunities, construct enhanced BMPs, achieve pre-development hydrology conditions, and allow for density transfers or bonuses for the development parcel. Each case study highlighted in this report would benefit greatly from the Phosphorous Facilitator position, and the goal of the *Partners* is to see that future development and development decisions include the use of this expert.

The Phosphorous Facilitator Position

As a result of the ***Smart Growth for Clean Water*** project work, the *Partners* identified a need for a special position within the Authority organizational structure to assist the Authority, local land use agencies, and developers in the development process. The standard development review process is usually reactionary in nature. The developer typically prepares and submits a plan for a specific land parcel. Such plans are very site specific and do not include special consideration for more watershed-wide issues such as regional open space goals, the availability of off-site parcels to implement enhanced BMPs, etc. The development proposal is then reviewed by the local government agency in the context of the minimum applicable requirements for that specific land parcel. In this process, there are only limited opportunities to consider water quality, open space, riparian habitat enhancement, and other watershed goals.

Outreach Efforts
Phosphorous Facilitator

The ombudsman position would be housed within the Authority organizational structure to assist developers and local governments on watershed smart growth strategies.

Standard development plans are very site specific and do not include consideration for watershed issues.

Outreach Efforts
Phosphorous Facilitator

The preparation of a development proposal would be an interactive exercise between the developer, the Facilitator and the review agencies.

Within the Cherry Creek watershed it is imperative that the strategies go beyond the status quo if we are to meet the standards for the Reservoir.

Figure 1 illustrates an alternative, more interactive, process that would be enhanced by the active presence of the Phosphorus Facilitator. The preparation of the development proposal would be an interactive exercise between the developer, the Phosphorus Facilitator, and the review agencies. Proposals would be discussed, refined, and improved upon based on the input from all three parties.

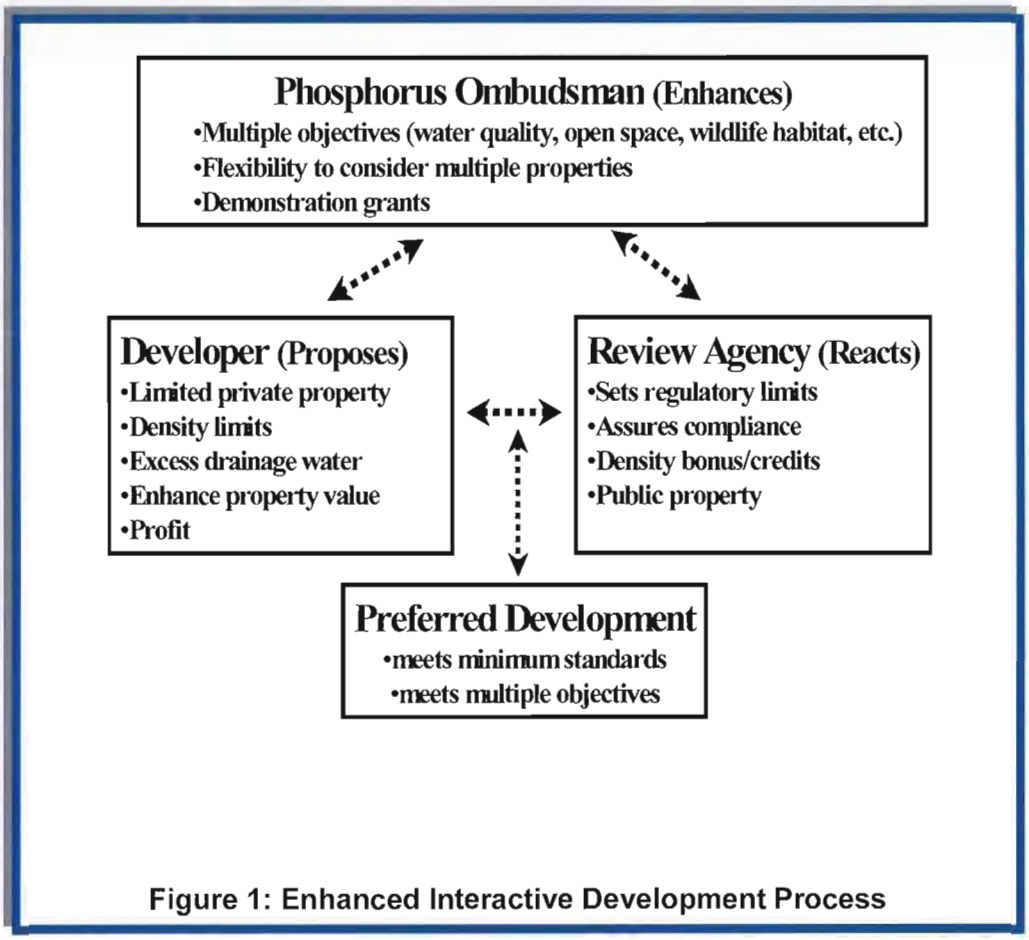


Figure 1: Enhanced Interactive Development Process

Opportunities Realized with the Phosphorous Facilitator Position

Within the Cherry Creek basin, it is imperative that water quality strategies go beyond the status quo and reach into the realm of reducing runoff volumes and subsequent pollutant loads similar to pre-development conditions. The Phosphorus Facilitator advocate would be in a key position to identify low impact development techniques, encourage developers to adopt these approaches, facilitate their approval in the regulatory process, coordinate outreach and education on the benefits of these approaches, and provide wider implementation of these practices. The following are some thoughts on the identified opportunities and how progress can specifically be achieved through the efforts of the Phosphorus Facilitator position.

Outreach Efforts
Phosphorous Facilitator

1. Promotion of 'smart growth for clean water' strategy information to make informed decisions: Most local government staff and the development community remain unaware of the economic and environmental costs of business-as-usual development, as well as the benefits and cost-effectiveness of watershed smart growth strategies. The Phosphorus Facilitator's ability to provide training sessions with local land use staff, as well as developers, on applying these strategies for the watershed is a key. From a development standpoint, higher development costs can accrue whenever the local planning agency does not understand the benefits of an innovative proposal and the approval of the innovative plan is delayed.

Some of the specific things that can be done by this Phosphorous Facilitator position include:

- Organize and facilitate face to face meetings between the developer and review agency staffs to discuss and explore smart growth development techniques that will provide watershed benefits beyond those which will accrue as a result of meeting minimum regulatory requirements.
- Work with the development community to encourage it to adopt proven smart growth development techniques that are cost effective and responsive to those concerned with preserving open space.
- Conduct information-sharing sessions with elected and appointed officials so that 'smart growth for clean water' opportunities can be fully supported at all decision-making levels to avoid any unnecessary delays.

The Phosphorous Facilitator's ability to provide training for local land use staff and developers on 'smart growth for clean water' strategies is a key factor.

2. Establishment of policies that complement watershed smart growth within the planning agencies, and obtain certainty in the review and approval process: The practice of actually going beyond the regulatory requirements, towards enhancement efforts, is typically not encouraged in the development planning and engineering process. For example, the runoff volumes can be minimized through the use of narrower streets with adjacent grass-lined swales. This approach may make sense from a 'smart growth for clean water' perspective, but local roadway standards may not allow streets other than standard width with curb and gutter in a developable area. So mere education is a great start, but education alone may not achieve the intended result. There may be a need to institutionalize watershed smart growth practices that make sense for the Cherry Creek basin. In addition, the local government requirements in the form of building, zoning, and other regulations may not be integrated sufficiently to successfully deal with the integrated issues of development design and stormwater quality management.

There is a need to institutionalize watershed smart growth strategies that make sense for the Cherry Creek watershed.

Watershed smart growth practices, if new to the review agencies, can slow the schedule for planning approvals. Without predictability in the timetable for the planning and approval process, funding sources may require higher lending rates to make up for any uncertainty and schedule lapses. Additionally, this can lead to a longer learning curve during the development planning approval process. The Phosphorous Facilitator advocate position would provide a go-between with local review agencies to obtain certainties, incentives, and timely approvals from local development review authorities.

Outreach Efforts
Phosphorous Facilitator

The goal of the interaction of the advocate is to increase the certainty and predictability on the planning and approval process for these innovative strategies.

The Phosphorous Facilitator can be the champion for creating a long term strategy for development impacts on the watershed.

The Phosphorous Facilitator could enhance this process through the following:

- Identification of approximately 5 specific development parcels where 'smart growth for clean water' practices could be implemented in the short run (2 to 5 years).
- Evaluation of local review processes to see where reviews and approvals may be accelerated following the inclusion of these watershed smart growth practices.
- Facilitation of the creation of incentives like density credits, transfer of development credits, faster permit approval, services based on site area, not just developed areas, and/or reduced building fees to direct development where it is desired. Compile list of incentives developers have found to be advantageous in the planning process.
- Facilitation of the goal of an increase in certainty and predictability in the planning, approval, and permitting process.
- Submission of recommendations to the Authority and local land use agencies on the institutionalizing of these incentives over time.

3. Promotion of cooperative planning and collaborative efforts: Local governments can promote watershed smart growth activities by participating in the watershed management as a key stakeholder and a champion for creating a long-term strategy for the development impacts on the watershed.

HOAs and other community groups can play a key role in shaping local plans by providing information about the concerns of their constituents, disseminating development information back to the community, and facilitating the eventual implementation of the strategy or plan.

In many instances, public involvement is required by state and local statutes and comprehensive plans. In other cases, public participation may be a necessary part of securing funding for a watershed enhancement. In all cases, citizens and grassroots organizations want significant opportunities to interact with watershed groups, land use planning agencies, developers and regulators in order to communicate their vision for how they want their watershed to mature, and see it formalized in planning documents.

The *Partners* organization has made great strides to fill this need for communication and collaboration. Greater strides can be made with an active and knowledgeable Phosphorous Facilitator. This position can do the following to facilitate the collaborative process as follows:

- Identify common ground between the planner, the engineer, the developer, the financial backer, the environmentalist, and the public that allows each entity to realize its goals.

- Create new partnerships where the developer is assisted in viewing land development sites that have a difficult time making it through the regulatory process in the broader context of regional goals, such as open space set-asides and wetland construction, such that approvals are forthcoming because the development met the regional watershed water quality goals.
- Create new partnerships where the environmentalist and the public are conversant about the efficient use of capital such that they work better and smarter with the development community to meld all of their respective needs.

Phosphorus Facilitator Objectives And Responsibilities

The Phosphorous Facilitator will require skills and experience in areas such as mediation, watershed protection, BMPs, hydrology, watershed smart growth tools, development economics, and public communication to fulfill the following objectives:

- ***Identify Beyond Compliance Practices*** – The Phosphorous Facilitator will identify a set of low impact development practices that have proven effective at phosphorus reduction and removal, with a focus on constructed wetlands, riparian buffers, and on-site stormwater retention techniques. The advocate position will assemble a clearinghouse of information and resources on these techniques, including information on the economic advantages of these techniques for the private sector.

- ***Gain Support of Development Review Authorities*** – The Phosphorous Facilitator will conduct an effort to educate development and planning review staff and officials on the water quality and economic benefits of these low impact development techniques. Efforts will be focused in Douglas County, Arapahoe County, the City of Centennial, and the Town of Parker. The Phosphorous Facilitator will seek support from these development authorities for regulatory incentives for these techniques, including streamlined approvals, development rights transfers, and development density bonuses.

- ***Facilitate Adoption by Developers*** – The Phosphorous Facilitator will approach developers proposing subdivisions of significant size to encourage the developers to adopt proven low impact development techniques, identify the economic benefits of these approaches, and facilitate their acceptance in the regulatory process.

- ***Promote Institutionalization*** – The Phosphorus Facilitator will make recommendations to the Authority and local governments on the institutionalization of these techniques over time through regulatory or voluntary programs. The Phosphorus Facilitator will also identify how the advocate position can be sustained through the sponsorship of local and state entities, development fees, and/or the economic value created by the implementation of these practices.

Outreach Efforts
Phosphorous Facilitator

Facilitator skills required include watershed protection, mediation, BMPs, hydrology, watershed smart growth tools, development economies, and communication skills.

The Phosphorous Facilitator will make recommendations to the Authority and local governments on the institutionalization of 'smart growth for clean water' techniques over time.

Outreach Efforts
Phosphorous Facilitator

The sum of $40,000 has been approved by the Authority, and a local government has approved another $20,000 to retain a Phosphorous Facilitator for the watershed.

The Authority Technical Advisory Committee has selected the Phosphorous Facilitator, with the cope of work to be completed by June 2004.

Establishing The Position

The Phosphorous Facilitator position is estimated to require a full time employee funded by the Authority, local governments and the development community. Until the details of the position are fully defined, the position will be effectively filled through a consultant or a team of consultants that have expertise currently present in the basin, based on a 'Request for Proposal' process. At this point in time, the Authority has set aside $40,000 in their 2003 budget for this function, and the Town of Parker has authorized an additional $20,000 for this position to work with developers in Parker. The Authority Technical Advisory Committee (TAC) has issued a Request for Proposal to obtain this consultant or team of consultants, with additional steps as follows:

- The Authority's TAC will review the proposals to be performed by the Phosphorous Facilitator position and finalize a list of consultants or consultant teams for the interview process.
- The TAC will interview 3 to 5 consultants (or teams) for the position.
- The TAC will present the final selection of the consultant (or team) to the Authority Board for consideration, discussion and approval.
- A contract will be negotiated with the selected consultant (or team).
- The selected consultant (or team) will report to the TAC once a month at the TAC regularly scheduled monthly meeting with a status update and to receive additional instruction.
- The TAC will work closely with the *Partners* in integrating the Phosphorous Facilitator position in the *Partners* planning, education, and project activities.

Four consulting teams responded to the request for proposals. The TAC reviewed the proposals and interviewed each of the teams. A consultant was selected consisting of a consulting engineering firm, an urban planning firm, and an environmental consulting firm specializing in wetlands and riparian corridor habitat. The initial scope is expected to be completed by June 2004, and the program will be modified for continuation based on this initial experience.

The Phosphorous Facilitator 'Request for Proposal' document follows.

CHERRY CREEK BASIN WATER QUALITY AUTHORITY

June 12, 2003

To Qualified Consultant

From: Jim Worley, Manager, CCBWQA

Re: Request for Proposal to Perform the Role of **Cherry Creek Reservoir Watershed Phosphorus Facilitator**

The Cherry Creek Basin Water Quality Authority (Authority) requests a proposal to perform the role of **Cherry Creek Reservoir Watershed Phosphorus Facilitator** on behalf of the Authority.

PROJECT DESCRIPTION

The Authority believes that stormwater quality in the Cherry Creek Reservoir Basin (Basin) can be improved by developing land-use plans for new development that go beyond minimum requirements[1] for immobilization of phosphorus. This goal would be accomplished through a more comprehensive working relationship between the Land Use Agency (LUA) and developers, including their planners and engineers (collectively called "development group"). The intent is to identify water quality opportunities within a parcel of land before a developer selects his land-use plan, and to encourage the developer to implement the enhanced water quality plan. The Authority believes this goal can be achieved through the "planned development" process that emphasizes stormwater quality.

The Authority will retain a consultant to work with the Authority, developer(s), developer's engineer(s), and the Town of Parker Planning and Engineering (and one additional LUA to be identified at a later date) to develop demonstration project(s) that could be used as model(s) for other developments throughout the Basin. The additional demonstration project(s) for another LUA would be identified following a search effort by the Technical Advisory Committee (TAC) of the Authority and the Consultant.

The Authority will select a consultant or a specialized team of qualified individuals/consultants (called Phosphorus Facilitator) to facilitate the planned development process in a development area in Parker and one other area within the Cherry Creek Basin. The selection process consists of a 5-page proposal, a short-list of 3- to 5-consultants and a 45-minute informal proposal.

The Authority has prepared a draft of the possible work tasks for the Phosphorus Facilitator to assist the Consultant in developing the proposed Work Tasks to accomplish the stated goals (see Scope of Services).

[1] Cherry Creek Basin Water Quality Authority February 16, 2000. *Cherry Creek Reservoir Watershed Stormwater Quality Requirements.*

3. CONSULTANT QUALIFICATIONS

The Phosphorus Facilitator shall demonstrate the following qualifications:

- Have a history of successful land development projects and a good working relationship with one or more developers in the Metropolitan area, preferably within the Cherry Creek watershed, including knowledge of development cost and benefit scenarios.
- Have an understanding of the development process and a good working relationship with the planning and engineering staff of local land-use agencies in the Cherry Creek Basin, including the use of incentives and other innovative approaches to gaining timely approvals.
- Have an understanding of the principles behind the various storm water quality measures identified in UDFCD's Volume 32, and have designed and supervised construction of these type of facilities for new development.
- Have the ability to facilitate discussions between parties with competing interests to develop workable solutions.
- Have an understanding of the principles of "sustainable" development and/or low impact development concepts as they relate to water quality.
- Have a working knowledge of maintenance requirements for the various BMP.
- Have a working knowledge of suitability of various landscaping materials to address aesthetic requirements of BMP.
- Have an understanding of water rights issues related to BMPs in urban areas.

PROPOSAL REQUIREMENTS

Interest consultants should submit a proposal to perform the services in accordance with the attached Scope of Services for Cherry Creek Reservoir Watershed Phosphorus Facilitator. Any questions regarding the scope, proposal requirements or selection process must be submitted by email to jim.worley@cliftoncpa.com. Responses to email submitted questions will be sent to all consultants on the Authority's proposal list.

We request that you review these documents and submit a proposal to perform the services. Proposals should include include the following information.

1.0 Your general comments regarding the ability of the scope to meet project objectives and your understanding of same;

2.0 A discussion of specific scope items

[2] Urban Drainage & Flood Control District September 1999, *Urban Storm Drainage Criteria Manual Volume 3 Best Management Practices.*

3.0 An organization chart with key roles and individuals and sub-consultants identified and why the individuals and sub-consultants are appropriate for the role. Provide resumes for the project manager, and project engineer or project scientist, only, however proposals shall include a one paragraph summary with similar work experience for all team members.

4.0 The proposed budget for the project which is $55,000. Provide a discussion of the adequacy or not of the proposed budget and suggestions to alter or limit the scope if the budget is considered inadequate. *Include the proposed fees for the project and the applicable rates in a separate electronic file transmitted to the Authority.*

PROJECT SCHEDULE

- Proposals are due by close of business on Friday July 18, 2003
- The Technical Advisory Committee (TAC) of the Authority will review the proposals and prepare a short list of up to 4 consultants by July 25, 2003. The TAC will use the evaluation criteria attached to this RFP.
- Interviews will be conducted on the hour with the short-listed consultants beginning at a date, time and location to be announced. Each consultant will have 45 minutes for presentations and Q&A.
- The TAC will make a recommendation to the Board to enter into negotiations with the selected consultant on August 21, 2003. Therefore, we anticipate negotiating the final contract in September 2003 and providing a notice-to-proceed in September 2003, so take this schedule into consideration in your proposal.

Please limit your responses to no more than ten (5) pages, excluding resumes. Your submittal shall be made by email in either Word for pdf format. *The consultant is responsible to confirm successful receipt of the email by the Authority by contacting Jim Worley at 303.779.4525.*

We look forward to hearing from you. Should you have any questions about the proposal requirements, please do not hesitate to call.

Sincerely,

Jim Worley
Manager

Enclosure: Scope of Services
Evaluation Criteria

Outreach Efforts
Phosphorous Facilitator

Proposed Work Plan/Scope of Services

The following work plan is provided as a guide to the Consultant to demonstrate the Authority's approach. The Consultant shall propose their own work plan, subject to review by the TAC and approval by the Authority Board. It is also anticipated that the work plan may need to be adjusted during the process to improve the results.

1.0 Meet with the Town of Parker (and one additional LUA) planners and engineers to identify constraints to a more comprehensive, water quality approach to development. Identify those constraints that will require a variance process and those that require changes to land development and subdivision codes and standards. Document findings in a memorandum to the Authority.

2.0 Meet with the appropriate developer(s) to identify constraints to implementation of a more comprehensive, water quality approach to development. The Town (and the additional LUA) will identify developer(s) for consideration. Document findings in a memorandum to the Authority.

3.0 Arrange for and conduct a working-session between the Town of Parker (and one additional LUA) development group and the selected developers to:

- a Identify a single land use plan (called "enhanced stormwater quality plan") with development requirements that would exceed minimum Authority requirements for immobilization of phosphorus from the development.
- b Identify those measures that will enhance storm water quality from the proposed land use plan, such as:
  - i Minimization of directly connected impervious surfaces (DCIA) and low-impact development (LID) techniques.
  - ii Measures to reduce storm runoff volume
  - iii Larger, more comprehensive Best Management Practices (BMPs) that exceed the performance of the Extended Detention Basin (EDB).
  - iv Stream/drainageway "reclamation" measures that go beyond stabilization.
  - v Reduction in development density
  - vi Increase in passive open space
  - vii Preservation of natural resources
  - viii Density trading within the overall development
  - ix Land conservation easements and riparian buffers
  - x Implementation of stream reclamation measures prior to development or downstream of development.
  - xi Other measures
- c Identify those measures that require approval by Council/Commission members to implement the enhanced stormwater quality plan, including those that will require variances of changes to codes or standards.

4.0 Estimate, with assistance from the Authority, the "additional" loads of phosphorus immobilized by the enhanced stormwater quality plan. Document the estimates in a technical memorandum and include the methodology and assumptions used to estimate performance.

5.0 Identify and quantify, where applicable, costs and benefits associated with the enhanced stormwater quality plan, such as:

- a Reduced and/or increased land-development costs, both direct and indirect.
- b Increased lot-premiums for lots adjacent to open space and water features.
- c Intangible benefits, such as coordinated promotional efforts with LUA or "built-green" advertisement
- d Increased LUA staff time and resources to facilitate variances or code/standard changes
- e Others costs and benefits, both tangible and intangible.

6.0 Prepare a written report identifying the process, results, and recommendations for continuation (or termination) of the phosphorus facilitator program.

7.0 Present results to the TAC and the Authority Board of Directors, including summary documents and graphics, as appropriate.

5.3 WATER QUALITY CONCEPTS TOUR

As part of the ***Smart Growth for Clean Water - Cherry Creek Watershed Partnership*** project, the *Partners* presented several of the strategies for minimizing runoff and maximizing infiltration of stormwater at the Partners 2002 Annual Conference, " Celebrating Stewardship through Collaborative Efforts". In response to these presentations, several attendees requested that the *Partners* organize a tour of sites in the watershed that were utilizing the 'smart growth for clean water' practices so that the concepts would have a visual legacy. Out of that request emerged the "**Water Quality Concepts Tour 2003"** held on May 21, 2003 that highlighted more than 7 sites in the Cherry Creek watershed that were putting 'smart growth for clean water' practices to work.

The *Partners* took developers, planning staff, resource agencies, and other interested parties on a tour of sites that illustrate water quality improvement techniques that can be put into action now. The *Partners* have been actively pursuing strategies that promote the use of innovative non-point source (stormwater runoff) controls as a tool for achieving water quality standards, habitat enhancement and profitable development in the watershed. Within the Cherry Creek basin, it is imperative that water quality strategies go beyond the status quo and make progress towards the goal of reducing runoff volumes and associated pollutant loads to levels approximating pre-development conditions. Highlights of the Tour included:

- An example of a landscape infiltration basin at the Cherry Creek State Park East Boat Ramp parking area
- Functioning 15-year old roadside swales
- Constructed wetlands that became the 'signature' of an up-scale development in Greenwood Village, Colorado
- Inverted curb & gutter to facilitate runoff infiltration

The following sections contain the fact sheets that were provided to the Tour participants to highlight the 'smart growth for clean water' strategy being emphasized at that site. Based on the success of this first Water Quality Concepts Tour, additional tours will be held in other parts of the basin to highlight pro-active approaches to stormwater quality and runoff controls in those areas. Some suggestions have been to concentrate the next tour on 'smart growth for clean water' examples in higher density residential settings, followed by a tour on strategies for commercial and industrial sites. The success of this first tour has established a water quality educational strategy that will be repeated on an annual basis, and the practice of holding an annual water quality tour will be formalized as one of the components of the *Partners* strategic action plan.

Outreach Efforts
Water Quality Tour

The *Partners* "Water Quality Concepts Tour" was conducted on May 21, 2003, and included 55 local government staff, agency personnel and basin-wide developers.

The tour was such a success, that this will be at least an annual activity by the *Partners*, and possibly 2 times a year, one upper basin and one lower basin.

Partners Water Quality Concepts Tour 2003

"Challenging the Business-as-Usual Approach to Development"

PURPOSE:

The purpose of the tour is to encourage new "smart growth for clean water" approaches to stormwater management to reduce urban impacts to streams and lakes, achieve mandated water quality goals, and enhance the urban environment.

How will this be achieved?

By alerting tour participants to smart growth approaches that can be used during development planning and by discussing how these can be an asset to the development in the form of open space, lot premiums and potential incentives during the planning and permitting process.

By also providing an opportunity for "two-way" communication, we hope to identify and overcome some barriers to 'smart growth for clean water' implementation.

An additional smart growth concept to ponder:

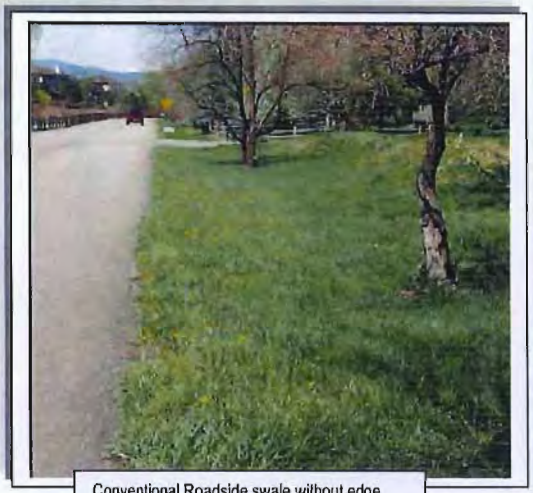
The Cherry Creek Basin Water Quality Authority is taking a lead role in "advocating" smart growth opportunities through the Phosphorous Facilitator position. The Facilitator would encourage communication between the development community and the review agencies earlier in the planning process to identify economical stormwater management opportunities to achieve phosphorous reductions beyond those already required for baseline BMPS. Such practices will ultimately protect the water quality in Cherry Creek Reservoir and enhance the open space, greenspace, wildlife habitat, and recreational goals in the watershed. For more information about the Phosphorous Facilitator position, contact the Authority.

Partners Water Quality Concepts Tour 2003
May 21, 2003

Tour Stop #: 1

Location: Estates at Fox Trail: Jackson Street, N of Orchard Road, in Greenwood Village

Contact: Bob McGregor, P.E., Water & Waste Engineering, 303-292-3503



Conventional Roadside swale without edge

Roadside Swale w/ non-traditional Inverted Curb & Gutter

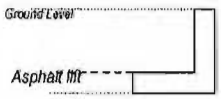
Smart Growth Strategy:

Enhanced site design to maximize stormwater infiltration: The use of Inverted Curb & Gutter to provide structural integrity to the road when utilizing roadside swales to manage stormwater quality

Discussion:

One of the challenges associated with roadside swales is the integrity of the asphalt pavement edge. Conventional curb & gutter provides a uniform edge for snow plowing, street cleaning, and lateral structural support to prevent edge cracking and sliding. In order to meet the need for this definitive edge, Greenwood Village has developed a specification for an *inverted curb and gutter* treatment and included this in their development standards.

An inverted curb & gutter is exactly what it sounds like; instead of the curb rising up from the ground, the curb is reversed into the ground, so that it gives a hard, protective edge to the asphalt at ground level.



Conventional concrete curb & gutter

Non-traditional inverted concrete curb & asphalt lift

This hard edge meets street edge structural requirements, but allows stormwater runoff to flow off the road into the roadside swale, and reap the benefits of runoff attenuation, increased infiltration and improved water quality.

***Partners* Water Quality Concepts Tour 2003**
May 21, 2003

Tour Stop #: 2

Location: Koebel Library on the SW Corner of Orchard Road & Holly Street

Contact: Jim Wulliman, P.E., Muller Engineering, 303-988-4939

Smart Growth Strategy:

Enhanced Site Design Through Natural Landscaping: Incorporating natural grasses and plantings into stormwater quality basins and swales improves treatment effectiveness, reduces maintenance requirements, conserves irrigation water, and enhances site aesthetics.

Discussion:

Like many other communities, Greenwood Village requires newly developing areas to construct detention facilities to reduce post-developed peak flow rates and provide settling for improved water quality. Depending on how these facilities are designed, detention basins can either become eyesores and maintenance headaches or features that enhance the value of the site. Koebel Library's landscaped native species and constructed wetlands function better within the site's two extended detention basins than irrigated bluegrass, and provide ancillary benefits such as enhanced wildlife habitat, reduced maintenance, improved water quality treatment, and reduced irrigation needs. An effort was made to utilize these detention basins for parking lot runoff via the curb cuts along the perimeter of the parking lot area.

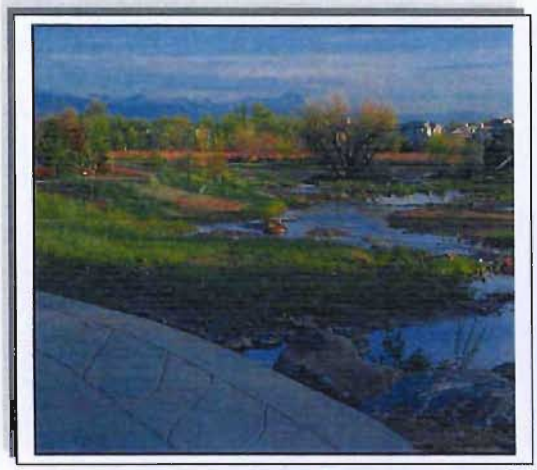
The natural areas within the site's stormwater detention basins are an example of a Smart Growth "win-win" – a practice that improves water quality while reducing construction and maintenance costs and enhancing the site aesthetics.

***Partners* Water Quality Concepts Tour 2003**
May 21, 2003

Tour Stop #: 3A

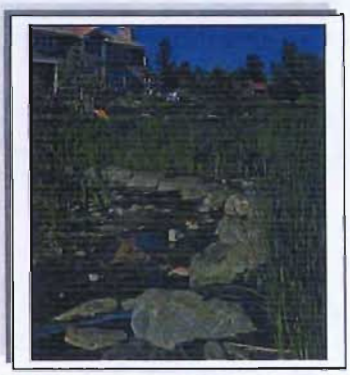
Location: The Preserve in Greenwood Village @ Orchard Road & Holly Street

Contact: Bob McGregor, P.E., Water & Waste Engineering, Inc., 303-292-3503



Smart Growth Strategy:

Site design to maximize wetland vegetative areas and provide natural areas conservation: Utilizing riparian zone enhancements for erosion control, water quality Improvement, and to provide increases in greenscape, wildlife habitat and recreational opportunities.



Discussion:

Improving the channel with constructed wetlands definitely enhanced wildlife habitat and improved the opportunities for recreation by residents of the Village along a public trail system that parallels these constructed wetlands. In addition, the wetlands, as a filtering and treatment mechanism, provide the additional environmental benefit of reducing stormwater nutrient loads beyond that achieved by baseline BMPs. The erosion control for this reach of Greenwood Gulch constructed by UDFCD also went beyond the conventional check grade structure and utilized shallow drop structures the full width of the floodplain to make use of the entire channel for enhancement of water quality and riparian habitat.

For this development, an apparent problem (increased stormwater runoff from developing upstream areas) has become an asset that, when properly managed, results in an overall improvement of the channel.

Partners Water Quality Concepts Tour 2003
May 21, 2003

Tour Stop #: 3B

Location: Greenwood Hills in Greenwood Village @ Orchard Road & Holly Street

Contact: Bob McGregor, P.E., Water & Waste Engineering, Inc., 303-292-3503

Greenwood Gulch BEFORE

Greenwood Gulch AFTER

Smart Growth Strategy:

Site design to maximize stormwater infiltration: Erosion control in narrow channels using landscaped drop structures rather than large diameter storm sewers for enhanced water quality and property values

Discussion:

Development changes the historic rainfall/runoff process. Roofs of buildings, streets, driveways, sidewalks, and parking lots hinder the infiltration of rainfall. In conventional developments, street curbs & gutters, storm sewer inlets and pipelines typically convey runoff off a site quickly and efficiently. The result is significantly higher runoff peaks, volumes, and pollutant loads compared to pre-development conditions. Increased runoff volume from development can produce a secondary impact that affects water quality; increased runoff volume, together with increased peak flow rates for small, frequent events (not always controlled by detention) often leads to stream degradation in downstream reaches, with associated bed and bank erosion and conveyance of particulate-bound nutrients like phosphorous in the Cherry Creek watershed.

This tour stop illustrates that even narrow channels can be effectively stabilized with shorter drop structures placed closer together, constructed of large, aesthetic boulders, rather than using a large diameter storm sewer pipe. While check structures to control channel grade are considered to be a first order BMP, the more frequent, shallower drop structures allow for additional stormwater attenuation and infiltration, as well as provide a beautiful natural area that increase property values in the neighborhood.

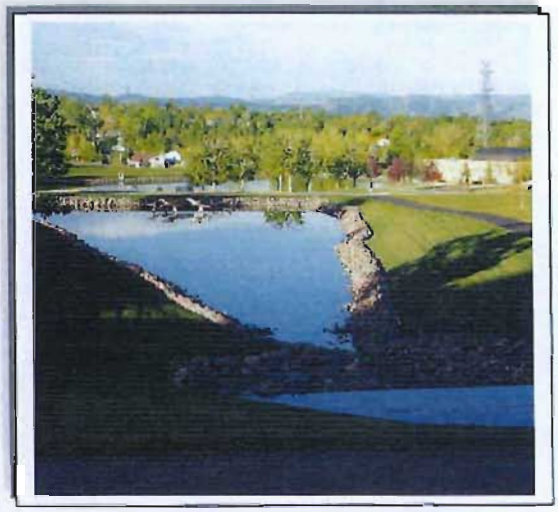
Partners Water Quality Concepts Tour 2003
May 21, 2003

Tour Stop #: 4

Location: Westland Park, NW corner of Orchard Road & Quebec Street

Contact: Bob McGregor, P.E., Water & Waste Engineering, Inc., 303-292-3503

Lower pond, looking north from Orchard Dr.



Upper ponds, looking south from Park

Smart Growth Strategy:

Utilization of Storm Irrigation: Using stormwater runoff for non-potable irrigation to augment limited groundwater supplies

Discussion:

In the 1970's, the Greenwood Plaza Metropolitan Water District constructed retention ponds at this location to augment their non tributary Denver Basin water supply by using non-potable water for the irrigation of parks and greenspace. The runoff is collected in the 3 ponds and is then pumped through a separate non-potable irrigation system. The storm runoff is applied to irrigated landscaped areas at a low enough rate to promote infiltration of the majority of the runoff. Stormwater quality treatment is provided through the adsorption of soluble nutrients onto silt and clay particles in the soil at the development. In later years, the ponds were incorporated into the beautiful park that exists today.

Partners Water Quality Concepts Tour 2003
May 21, 2003

Tour Stop #: 5

Location: Cherry Creek State Park, East Boat Ramp Area

Contact: Jim Wulliman, P.E., Muller Engineering, 303-988-4939

Smart Growth Strategy:

Site design to maximize stormwater infiltration: Utilizing landscaped low areas for parking lot runoff

Discussion:

As noted previously, roofs of buildings, streets, driveways, sidewalks, and parking lots hinder the infiltration of rainfall. The result is significantly higher runoff volumes and pollutant loads that, in this instance, could go directly from the parking lot into the Cherry Creek Reservoir. The East Boat Ramp parking lot uses a smart growth best site design practices of landscaped infiltration basins to minimize the load of pollutants with direct runoff potential into the Reservoir. Porous landscape detention basins utilize low-lying vegetated areas, where during runoff events the accumulated flows will enter the landscaped basin directly off the parking lot and provide for temporary storage and filtration of runoff.

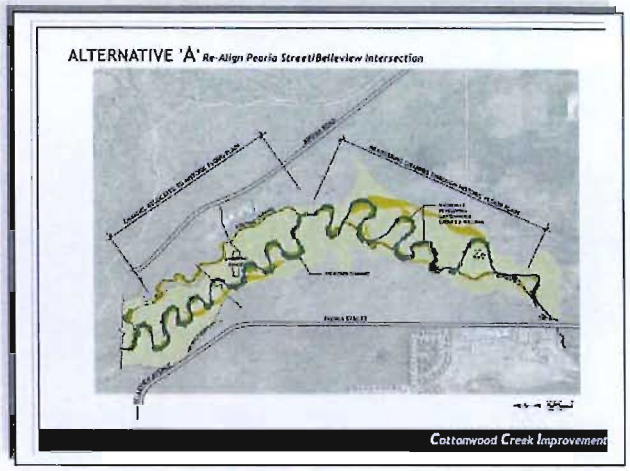
The amount of infiltration will depend on the infiltration capacity of the underlying soils and the capacity of the basin to absorb additional runoff. Adsorption onto silt and clay particles in the soil has been shown to immobilize even soluble forms of phosphorus. These landscaped detention basins also provide an enhanced aesthetic for the park user in providing an oasis of green in the monotonous parking lot environment.

Partners Water Quality Concepts Tour 2003
May 21, 2003

Tour Stop #: 6

Location: Lower Cottonwood Creek within the Cherry Creek State Park

Contact: Jim Wulliman, P.E., Muller Engineering, Inc., 303-988-4939



Smart Growth Strategy:

Restoration of Streambeds: Using an enhanced BMP approach to Channel Stabilization along Cottonwood Creek in the Cherry Creek Watershed

Discussion:

Cottonwood Creek today is a deep, narrow slot eroded into the adjacent prairie landscape. Other than several cottonwood trees and some willow growth, the corridor is largely devoid of riparian vegetation as the rapidly eroding channel prevents the establishment of plants on the banks. The beauty of this project is that it will go beyond just stabilization of the channel is place, to re-creating a natural, well-vegetated stream corridor that provides additional water quality, habitat and aesthetic benefits. Returning Cottonwood Creek to a shallow prairie stream, so that floods can spread out with non-erosive velocities even during flood stages, promotes wide flood banks for vegetation and cottonwoods and willow shrubs, which would then protect the banks from future erosion.

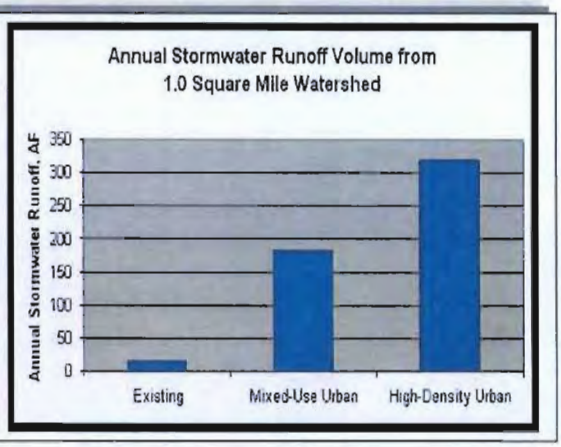
All efforts are being made to consider the short term and long term impacts of channel and bank disturbance, fitting the improvements into their regional context of rolling prairie and meandering streams, making the creek an amenity for both humans and wildlife, and most importantly, to take advantage of opportunities to improve water quality beyond channel stabilization.

Partners Water Quality Concepts Tour 2003
May 21, 2003

Tour Stop #: NA

Location: Fox Hollow Estates on Christianson Lane off Platte Canyon Road

Contact: Jim Wulliman, P.E., Muller Engineering, 303-988-4939



Smart Growth Strategy:

Enhanced site design to facilitate stormwater attenuation, storage & infiltration: Using an alternate street configuration of roadside swales to provide treatment of runoff, conserve irrigation water and enhance site aesthetics.

Discussion:

As stated previously, development changes the historic rainfall/runoff process. Roofs of buildings, streets, driveways, sidewalks, and parking lots hinder the infiltration of rainfall (see Figure above). In conventional developments, street curbs and gutters, storm sewer inlets and pipelines typically convey runoff off a site quickly and efficiently. The result is significantly higher runoff peaks, volumes, and pollutant loads compared to pre-development conditions.

An alternative street configuration is narrower than a conventional street and features a roadside swales and surface drainage channels in lieu of curb, gutter, inlets and storm sewer. The alternative street configuration generates less runoff and will slow down and attenuate runoff that does occur, as well as facilitate infiltration and provide a positive affect on water quality and groundwater recharge. The street configuration and surface channels implement the principle of "minimizing directly connected impervious areas" (MDCIA) recommended in UDFCD's Volume 3 Criteria Manual. The approach requires careful consideration of design, inspection, enforcement and maintenance issues.

6.0 FUNDING STRATEGIES

Once a community has gone through the process to understand, identify and prioritize 'smart growth for clean water' projects, the critical next step is raising the necessary funds to implement that project. Funding and implementing any project can be one of the greatest hurdles because it takes time and resources to educate stakeholders and generate enthusiasm. The *Partners* recognize it is not enough to propose sustainable, cost-effective approaches to 'smart growth for clean water' projects, but that it is also important to provide the partnerships, expertise, and the resources that can be used to implement those approaches. While external funding sources are available, it takes a serious investment to identify and pursue those available resources. Local participation and investment in projects is essential to successfully accessing external funding sources.

This section contains a discussion of key items to consider when anticipating funding for a project, a demonstration example of a 'leveraging' scenario, highlights of some key funders within the Cherry Creek watershed that have either been utilized successfully before or have programs that fit especially well in the Cherry Creek watershed. In addition, a Funding Table is provided as a reference for over 50 groups or programs that can assist in funding watershed projects, as well as some funding web sites that can provide additional information.

An investment in identifying the financial resources is essential to successful, measurable environmental improvement in the Cherry Creek watershed. Success will be achieved when jurisdictions, public agencies, communities and non-profits work together to leverage limited resources to implement practical, on-the-ground measures to improve water quality, wildlife habitat and land protection. A creative and collaborative approach also helps identify important stakeholders, decision makers and resources. Three essential ingredients to successful projects include local participation and financial support, leveraging, and building relationships.

Local Participation and Financial Support. Local participation and local financial support are the two essential ingredients for successful financing. External funders want to see that local stakeholders and the community are supportive of projects. Local contributions to project planning or construction, both cash and "in-kind" matches, show commitment and sensitivity to local concerns. The local financing may come from contributions of land or easement value, planning commitments, staff time, as well as direct cash contributions.

Leveraging. Leveraging, or matching of local financing with other external sources, will maximize effectiveness of the local commitment. There is a large and complex array of funding sources available to support land conservation, restoration, and water quality improvement projects. Multi-objective projects (e.g., water quality, habitat restoration, and recreation) present an opportunity to utilize more sources of funds, and effectively increase leveraging.

Building Relationships. Ongoing communication with potential funders is another ingredient to success. This includes building relationships with future funders, making them aware of successful Cherry Creek efforts in utilizing multiple sources of funds, and the types of future projects that may be a high priority for their source of funds. At the time of project financing, a strategy of bringing multiple funders together should be considered.

Funding Strategies

Funding Resource Table

Potential sources of funds for future anticipated projects in Cherry Creek are listed in the table at the end of this section (**Table 1**). Existing sources have been tabulated to create the table based on the experience of various stakeholders, and many of these sources have been previously utilized in the Cherry Creek watershed. Some existing sources were not listed because the likelihood of obtaining funds from that source for Cherry Creek watershed projects was limited or nonexistent.

The sources in **Table 1** are listed by project type, and include the funding agency, eligibility requirements, a brief description of purpose for funding, amounts available and contacts for more information. Ideally this list will be adapted to highlight new funding sources, offer unique opportunities to combine multiple funding sources, and possibly even generate a new approach to a project based on availability of funds.

Loan Programs

In addition to grants, public loan funds for environmental restoration are available. They are available at excellent interest rates with no down payment and no local match, and clearly increase immediate capability to finance projects. It has been difficult for local entities to commit to loans for environmental improvements. This tendency may be countered by recent studies by consultants in the Cherry Creek watershed, who have found that *it is much less expensive (by an order of magnitude) to perform stream restoration and stabilization prior to degradation (which is expected to be a result of future growth), than it is to restore streams after degradation.*

In addition to grants, public loan funds for environmental restoration are viable sources of supplemental funds.

There are three loan programs that are outlined in greater detail in this chapter: the Colorado Water Pollution Control Revolving Fund (CWPCRF), and both EPA's and Colorado's Brownfields Revolving Loan Funds. All three should be considered to increase leveraging. The CWPCRF is particularly suited to the types of projects envisioned in Cherry Creek watershed.

Leveraging

External grant sources typically require a certain percentage of matching funds. Percentage levels vary by source. A very successful strategy is to combine multiple external sources for project support. This can result in a "multiplier" effect, as the different sources can be matches for each other. External sources view this strategy favorably, as it enhances their "leveraging" capabilities by getting more for their money. Multiple objective projects are particularly suited to this practice. Funds should be selected based on project objective (e.g. wetland creation, education, stream stabilization), compatible with other objectives, thus increasing potential sources of funds. There are local examples of this approach, with the Denver Northside Treatment Plant project being one worthy of further examination.

It is much less expensive, by an order of magnitude, to perform stream restoration and stabilization prior to degradation, than it is to restore after the damage is done.

For the purposes of this report, an example of a project funding scenario is provided, as follows.

Demonstration Scenario:
Project for stream restoration with erosion control and wetlands creation and restoration.

Funding opportunities:

1. $3M CWPCRF loan at 4% requires $270,000 payment per year for 20 years with no down payment.

2. $3M is split into 3 increments

    - $1M to match a $2M Army Corps of Engineers Restoration grant = $3M
    - $1M to match a $2M Urban Drainage and Flood Control District project = $3M
    - $1M to match a $2M Colorado Wetlands Program grant = $3M

A $3 million loan can be leveraged into $9 million in watershed projects.

This scenario is over simplified and hypothetical, but illustrates how a $3M loan can be leveraged into $9M for watershed projects. Integration of other objectives or funding sources into this scenario could increase leveraging further. One limiting condition is that federal sources typically do not allow other federal sources to be used as match, so this must be taken into consideration when attempting to leverage funds for watershed projects.

Land Ownership Considerations

Most of the external funding sources cited in this section are intended for support of public projects on publicly owned land. The following conditions bear mentioning for possible projects on privately-owned land:

- The Colorado Wetlands Program, highlighted later in the section, is one source that accesses funds applicable to both public and private lands.
- In the development of private projects, there are three common scenarios, which result in transfer of land from private to public ownership. All three scenarios may provide opportunities for financing of restoration or environmental improvement projects.
    1) Private land can be donated to a public entity to be held as open space;
    2) A public entity, such as a Metropolitan District, can be created as part of a development to manage facilities, or open space; and
    3) Lands can be placed under conservation easement and be protected. The conservation easement can be held by a public entity or a non-profit organization working in land conservation.

There are three ways that private land can revert to the public domain so that public funds can be used for watershed improvements.

Funding Strategies

Table 1 is a compilation of the various sources of funding for watershed projects that have been identified so far.

The Army Corps of Engineers have several funding opportunities available, including their 1135 and 206 programs and their General Investigative program.

Specific Funding Sources

The funding sources highlighted in this section are selected as ones that deserve a focus in development of any watershed wide funding strategy, such as is recommended for Cherry Creek projects. These sources are generally relevant to the types of project needs as exist in the Cherry Creek watershed, offer generally large amounts of funds, and are appropriate for pursuit by watershed scale partnerships.

US Army Corps of Engineers

The Army Corps of Engineers (Corps) is a source of funds for large watershed scale, or specific projects. The Corps operates the Cherry Creek Reservoir dam, and owns the Cherry Creek State Park property. There is an awareness of Cherry Creek watershed issues and needs within both the local Corps office as well as the Regional Office in Omaha. In addition, the Corps is now financing a Preliminary Reconnaissance Report for a stretch of Piney Creek, a major tributary to Cherry Creek. The Corps-financed Denver South Platte project is a local example of large-scale multi-objective restoration that could be used as a model for Cherry Creek. Corps grants programs are shown below by the authorizing section of the Water Resources Development Act. Restoration projects are generally initiated by a request for a Corps Reconnaissance study, following the Preliminary Reconnaissance Report.

Contact: Sandy Rayl, Colorado Field Office (303) 232-3403

Project Types: Environmental Restoration, Watershed Planning

Specific Continuing Authorities Programs:

1135 Program: Restoration Projects on Corps property, or where Corps projects have contributed to environmental impact. Requires a 25% local, non-federal match. Maximum federal contribution is $5,000,000 per project.

206 Program: Ecosystem Restoration on non-Corps property. Funds projects to restore or protect the aquatic ecosystem for the purpose of improving environmental quality. Requires 35% local, non-federal match.

General Investigation Program:

Generally for larger projects, they require a specific Congressional authorization that outlines the local sponsor, the restoration project, local and Corps financing, and other commitments. The General Investigation consists of two phases: 1) Reconnaissance and Analysis that is funded 100% by the Corps; and 2) Feasibility phase that is funded 50% by the Corps.

Colorado Wetlands Program

Coordination with this program can be very beneficial to support future Cherry Creek wetland needs. The Colorado Wetlands Program is an outstanding example of a partnership that has assisted many local entities throughout the State with their wetlands enhancement and restoration needs. Over 100,000 acres of Colorado wetlands have been protected by this program over the last five years. Wetlands under both public and private ownership have received support under this program. There is a funding process as part of a Wetlands Initiative group that allows access to funds from many sources. Upon submitted application, the Wetlands Initiative group will search for funds to support projects and has been successful in assisting many projects over the past several years.

There is also opportunity for numerous entities to cooperate with Division of Wildlife (DOW) and the other partners and each other on wetlands protection efforts on a project-by-project basis or a long-term basis.

There is also assistance on strategy development, which provides the opportunity for communities that request it to receive information and assistance in planning wetlands protection and developing a wetlands strategy. Focus areas have been created throughout the state to support local efforts.

Suggested activities include:

* Summary of Cherry Creek Watershed wetland project needs (Upper and Lower Watershed);
* Contact with Wetlands Program Partners, the South Platte or Front Range Focus Group, and a meeting or field trip;
* Identification of local project contributions and leveraging ability;
* Development of initial project application.

Web-site: http://www.wildlife.state.co.us/habitat/wetlands/default.asp

Administered by: Colorado Division of Wildlife, in partnership with Ducks Unlimited, Great Outdoors Colorado, The Nature Conservancy, US Fish and Wildlife Service (Partners for Fish and Wildlife), CO State Parks and others

Project Types: Wetlands protection strategy development and implementation Financing to create, enhance and restore wetlands

Dollar Range and match: varies dependent on project and funding partners. The process has resulted in over $20 million of wetlands project support.

Over 100,000 acres of Colorado wetlands have been protected by this program over the last 5 years.

Colorado Water Pollution Control Revolving Fund

Sources of repayments for a State Revolving Fund loan can be from several types of revenue, including dedicated portion of local or county taxes or fees, recreational fees, stormwater management fees, and wastewater user charges. The source of repayment does not have to come from the project itself. The source of security for a WPCRF loan is revenue or general obligation bonds

The Revolving Fund is a loan whose amount depends on the dedicated resources of the applicant.

Funding Strategies

issued by a local government. The loan term cannot exceed 20 years. Early repayment is possible.

The Colorado Department of Public Health and Environment (CDPHE) works with local governments to complete necessary planning and design requirements (if applicable), and manages the project through completion.

The Colorado Water Resources and Power Development Authority is the lending agency. The Department of Local Affairs, Division of Local Government, conducts an analysis of the financial capability of the loan applicant to repay the loan.

Administered by:
CDPHE;
Colorado Water Resources and Power Development Authority; and
Colorado Department of Local Affairs

Project Types:
Publicly-owned wastewater treatment works and non-point source projects.

Low-interest loans (between 0% and market rate; typically 4%) to local governments for the construction of wastewater treatment works (section 212 of the Clean Water Act) and implementation of Colorado's non-point source management plan. The latter could include a wide range of water quality projects, including protection of wetlands, land acquisition, and conservation easements.

Low interest loans from the Colorado non-point source management plan includes protection of wetlands, land acquisition, and conservation easements.

Dollar Range and match:
Historically, the Colorado WPCRF has funded projects ranging from $70,000 to $25 million. The WPCRF can fund 100% of eligible project costs. No match is necessary for applicants seeking financial assistance. Due dates for inclusion on the WPCRF Workplan (Intended Use Plan or "IUP") are August of each year. The IUP is effective during the calendar year.

Benefits:
Significant dollar amounts are available. Fewer federal requirements are attached to an SRF loan than other federal grant programs.

The WPRCF can fund 100% of eligible project costs, unlike many other grant sources that require a matching amount, sometimes up to 50%.

North American Wetlands Conservation Act (NAWCA) Grants Program

This source is specifically focused on maintaining quality wetland and wetland-associated uplands resources for wildlife habitat. If vital wetlands habitat is identified and there is a link to defined waterfowl and fishery objectives or identified priority species, this funding source is worth pursuing. Significant resources are available.

NAWCA Cost Principles identify wetlands acquisition, restoration, enhancement, and constructed wetlands as primary purposes. Identified wetlands tracts for acquisition must be consistent with the National Wetlands Priority Conservation Plan by being listed in a Service Regional Wetlands Concept Plan or must

meet specific additional criteria. Wildlife and fisheries value is the focus, however, the focus may be complemented by water quality, flood protection or erosion control values. Technical Assessment Questions in the application emphasize waterfowl habitat, wetland-associated migratory birds, the North American Waterfowl Management Plan, priority wetlands types, long-term conservation benefits, and endangered bird and fish species. Priority species lists are provided. Administrative costs are discouraged but are reviewed on a case-by-case basis.

Administered by:
US Fish and Wildlife Service

Project Types:
Protect, restore, and/or enhance critical wetlands and wetlands-associated upland habitats for waterfowl and fisheries.

Standard Grants Program:
Grant requests for $50K to $1M. Standard grants are for 4-year plans of action to conserve wetlands and wetlands dependent fish and wildlife. Up to $50M in annual funding is available.

Small Grants Program:
Support long term wetlands acquisition, restoration, and/or enhancement projects that are less complex than those encountered in the Standard Grants Program. Requests may not exceed $50K. Priority is given to projects that have a grantee or partners that have not participated in a NAWCA supported project before. Other criteria are the same as those for the Standard Grants program. Small grants pool for 2002 was $2M.

Dollar Range and match:
$1M limit for Standard and $50K for Small. 1:1 non-federal match is required for both. Application due dates for Standard grants are March and July. Deadline for Small Grants is December. Funds should be spent within a two-year period.

Match is eligible up to two years prior to proposal submission. Property and easement acquisition, monitoring and evaluation, and stewardship costs are eligible to count towards match amount. A 2:1 match receives maximum points in application scoring.

NACWA has both standard grants ($50k - $1M) and smaller grants (<$50,000) for wildlife and fisheries focused activities.

EPA and CDPHE Brownfields Cleanup Grants

Brownfields are real properties, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant or contaminant. EPA and CDPHE Brownfields Programs offer grants, loans and other funding and technical assistance to promote the cleanup and reuse of brownfields, to provide financial assistance for brownfields revitalization.

Brownfield grants can be utilized for riparian property contamination assessment and cleanup.

These sources are pertinent to riparian property contaminant assessment and cleanup. There are both EPA and state grants and loans available. Recent

Funding Strategies

legislative change has provided ability to fund cleanups and additional cleanup loan funds. Recent policy changes have provided additional emphases on open space as appropriate property "reuse".

Contact CDPHE (Dan Scheppers 303 692 3398) / USEPA Region 8 (303 312 6312).

Recommendations

Again, it is critical that the time and the resources are invested to promote the cooperation and the increased investment in the Cherry Creek watershed. To that end, the following represent critical steps for local jurisdictions, public agencies, non-profits and citizens alike.

1. Build awareness and relationships among major potential external funding sources of Cherry Creek watershed.
2. Incorporate leveraging concepts of borrowing and combining of multiple funding sources, whenever feasible and appropriate.
3. When projects are in their final planning stages and construction is anticipated, but not yet scheduled, it is time to review potential funding sources, and prioritize sources according to project objectives, availability, and timing. At the time of final design and imminent construction, contact the highest priority funders directly.
4. Coordination among various funders. Keep funders informed as to progress and accomplishments.
5. Maintain an up-to-date resource list and solicit comments from recipients of various funding scenarios to provide practical information to users.

Funding Key Strategy: Incorporate leveraging and combining fund sources where feasible.

Funding Key Strategy: Maintain up-to-date listing of resources and practical information that grant writers can access.

Table 1: Potential Sources of Funding for Water Quality Projects

Funding Source	Eligibility		Funding Areas	Funding Specifics	Contact/Web Site
	Public Agency	Non-Profit			
EPA Brownfields Cleanup Grants - new in fall 2002	X	X	Competitive grants for cleaning up Brownfields sites owned by the grant recipient and purchasing insurance related to cleanup	Up to $200,000/site, 20% match (hardship waiver); 10% of grant may be used by local governments to monitor health of populations exposed to Brownfields and enforce institutional controls	Kathie Atencio 303 312-6803 atencio.kathie@epa.gov
EPA Brownfields Revolving Loan Fund	X		Competitive grants for capitalizing a revolving loan fund to make loans and grants for cleaning up Brownfields sites	Up to 1 million, 20% match (hardship waiver)	Kathie Atencio 303 312-6803 atencio.kathie@epa.gov
EPA Brownfields Job Training Grants	X	X	Competitive grants to train disadvantaged population living near Brownfields sites in environmental jobs		Kathie Atencio 303 312-6803 atencio.kathie@epa.gov
EPA Brownfields Site Assessment Grants	X		Competitive grants to inventory, characterize, assess, and develop cleanup and reuse plans for Brownfields sites	Up to $200,000 per site for hazardous substance, pollutant, or contaminant and up to $200,000 for pure petroleum sites; potential waiver up to $350,000 per site	Kathie Atencio 303 312-6803 atencio.kathie@epa.gov
EPA Brownfields Targeted Brownfields Assessments	X	X	EPA uses in-house contractors to inventory, characterize, assess, and develop cleanup and reuse plans for Brownfields sites	Funding determined by EPA Region depending upon need, applicant meeting requirements, and Regional funding available	Kathie Atencio 303 312-6803 atencio.kathie@epa.gov

Table 1: Potential Sources of Funding for Water Quality Projects

Funding Source	Eligibility		Funding Areas	Funding Specifics	Contact/Web Site
	Public Agency	Non-Profit			
Land and Water Conservation Fund - Stateside Funding, Colorado State Parks	x		Open Space, Farmland Preservation: Planning, Acquisition, Construction	$2 million annually	U.S. Department of the Interior, www.ncrs.nps.gov/lwcf, e-mail: wayne_sturm@nps.gov
CDPHE: Nonpoint Source Implementation Grants/Section 319	x		Water Quality: Nonpoint Source, Open Space, Land Acquisition, Easements, Stormwater Collection and Treatment	$2 million per year. Requires 40% match	Dick Parachini 303-692-3516 www.cdphe.state.co.us
USDA: Farmland Protection Program	x		Easements on farms, ranches		Gary Finstad 720-544-2820 email: Gary.Finstad@co.usda.gov
CDOT: Transportation Enhancements Grants	x		Land Acquisition and landscaping connected to vehicle corridor enhancements		Myron Swisher 303-757-9866 Karen Sullivan 303-757-9502 http://www.dot.state.co.us/DesignSupport/
Great Outdoors Colorado	x	x	Conservation Easements, Fee Title Acquisition, Recreation Water Leases	Multiple grant programs at various levels. Will provide up to 80% of funding	Janis Whisman, 303-863-7522, jwhisman@goco.org, www.goco.org
CONSTRUCTION/RESTORATION					
Five-Star Restoration Challenge Grants: EPA, National Fish and Wildlife Found., NACO, Wildlife Habitat Council	x		Support community-based wetland, and riparian habitat restorations with diverse partnerships that foster local natural resource stewardship	Grant range is $5,000 to $20,000; $10,000 average grant	EPA contact: John Pai 202-260-8076 http://nfwf.org/programs/5star-rfp.htm
EPA Brownfields Cleanup Grants	x		Grants for property cleanup to facilitate redevelopment (new program in development)	$200,000 with 20% match (new program under development)	Kathie Atencio 303-312-6803 atencio.kathie@epa.gov
Colorado CDPHE Brownfields Cleanup Funds	x		Grants for property cleanup to facilitate redevelopment		Dan Scheppers 303-692-3398 daniel.scheppers@state.co.us

Table 1: Potential Sources of Funding for Water Quality Projects

Funding Source	Eligibility		Funding Areas	Funding Specifics	Contact/Web Site
	Public Agency	Non-Profit			
EPA Brownfields Revolving Loan Fund	x		Loans for assessment or cleanup	Up to $1M loans	Kathie Atencio 303-312-6803 atencio.kathie@epa.gov
Colorado (CDPHE) Brownfields Revolving Loan Fund	x		Loans for assessment or cleanup	Up to $1M Loans with flexible terms	Dan Scheppers 303-692-3398 daniel.scheppers@state.co.us
Division of Plant Industry Colorado Noxious Weed Management Fund	x		Stimulate new management efforts, add management capacity and leverage resources to initiate working partnerships, demonstrate successful collaborative development of permanent funding for long-term weed management	Up to $25,000 2:1 Match (1:1 ideal)	Eric Lane 303-239-4182 http://www.ag.state.co.us/DPI/weeds/Weed.html
USDA, USFS: Urban Parks Restoration and Recovery	x		Urban park improvements and restoration		Susan Ford, Regional Office in charge of Urban Forestry 303-275-5742
DNR: Colorado Water Conservation Board Planning Grants	x		Planning and Financial Assistance, construction loan program		Brian Hyde 303-866-3441 e-mail: brian.hyde@state.co.us www.cwcb.state.co.us
Army Corps or Engineers:Sections 1135 - Environmental Improvements at Existing Corps Projects	x	x	Modifications to an existing Corps project to create environmental restoration or improvements. An 1135 project can modify either the existing project's structure or its operation. Restoration may be done at a degraded site rather than at the Corps project if the degradation has occurred because of a Corps project.	Total project costs are shared 75% Federal and 25% non-Federal. Total project costs include the studies, designs, construction, monitoring, and lands.	Sandy Rayl 303-232-3403 www.cwcb.state.co.us

Table 1: Potential Sources of Funding for Water Quality Projects

Funding Source	Eligibility		Funding Areas	Funding Specifics	Contact/Web Site
	Public Agency	Non-Profit			
Army Corps of Engineers: Flood Damage Reduction (Section 205)	x		Planning and Construction Assistance		Sandy Rayl 303-232-3403 www.cwcb.state.co.us
Army Corps of Engineers: Emergency Bank Stabilization (Section 14)	x		Planning and Construction Assistance		Sandy Rayl 303-232-3403 www.cwcb.state.co.us
Army Corps or Engineers: Section 206 - Aquatic Habitat Improvements at any Location	x	x	Restoration of aquatic ecosystems any location. Section 206 projects do not need to be associated with an existing Corps project. The non-Federal sponsor provides any lands which may be credited towards a sponsor's share of project costs.	Total project costs are shared 65% Federal and 35% non-Federal. Total project costs include the studies, designs, construction, monitoring, and lands.	Sandy Rayl 303-232-3403 www.cwcb.state.co.us
North American Wetlands Conservation Act	x	x	Provides matching grants to private and public groups or to individuals who have developed partnerships to carry out wetlands conservation in the United States, Canada and Mexico.	Project must meet certain biological criteria, and grant requests are limited to $1 million. Partners must match the grant request at a 1-to-1 ratio (minimum).	http://birdhabitat.fws.gov/NAWCA/grants.htm
WATER QUALITY					
Regional Geographic Initiative	x		Yearly grant program for restoration or protection of impacted watersheds or ecosystems, and water quality improvement	Maximum of $30,000 w/ 5 % match	Pam Dougherty 303 312 6012 dougherty.pam@epa.gov http://www.epa.gov/Region8/community_resources/ecoprotection/ecogrant/newgrant/newgrant.html

Table 1: Potential Sources of Funding for Water Quality Projects

Funding Source	Eligibility		Funding Areas	Funding Specifics	Contact/Web Site
	Public Agency	Non-Profit			
EPA Region 8: Ecosystem Protection Program	x		Water Quality: Protection, Coordination		See Regional, Wetlands, Water Quality and TMDL
TMDL Program	x		Yearly grant or contract support to address high-priority non-point source TMDLs		Kathy Hernandez 303-312-6101 hernandez.kathryn@epa.gov Dick Parachini CDPHE 303 692 3516
Water Quality Project Grant Criteria	x		Yearly grant program to support innovative efforts to address water quality impacts from point or non point sources	Grants range from $8000 to $100,000 with no required match. Average grant approx $35K	Jennifer Harris 303 312 6254 harris.jennifer@epa.gov
USDA: Water Quality Special Research Grants Program	x		Water Quality: Agricultural Degradation		Polly Hays, Water Program Manager 303-275-5096 e-mail: pehays@fs.fed.us
USDA: Wetlands Reserve Program	x		Water Quality: Protection		Polly Hays, Water Program Manager 303-275-5096 e-mail: pehays@fs.fed.us
Army Corps of Engineers Flood Hazard Mitigation and Riverine Ecosystem Restoration Program	x		Water Quality: Characterization, Design, Partnerships		Sandy Rayl 303-232-3403 www.cwcb.state.co.us
PLANNING/SUPPORT					
Wetlands Protection Project Grants	x		Yearly grant program to develop state, tribal and local wetlands protection programs and strategies	Grants range from $9,000 to $100,00 in FY 2002; 25% match	Ed Stearns 303-312-6946 stearns.edward@epa.gov

Table 1: Potential Sources of Funding for Water Quality Projects

Funding Source	Eligibility		Funding Areas	Funding Specifics	Contact/Web Site
	Public Agency	Non-Profit			
EPA Brownfields Assessment Pilot Grants	x		Grant for planning and assessment of contaminated property to facilitate redevelopment	Yearly grant cycle: $200,000 with possible $50,000 open space add-on	Kathie Atencio 303 312 6803 atencio.kathie@epa.gov
EPA Targeted Brownfields Assessments	x		Site assessments for specific brownfields properties	Performed under contract	Kathie Atencio 303 312 6803 atencio.kathie@epa.gov
CDPHE Targeted Brownfields Assessments	x		Site assessments for specific brownfields properties	Performed under contract or by staff	Dan Scheppers 303 692 3398 daniel.scheppers@state.co.us
EPA Brownfields Job Training Grants	x		Grants to train disadvantaged populations in environmental jobs	up to $200,000 grants	Karen Reed 303 312 6019 reed.karen@epa.gov
Eastman Kodak American Greenways Awards and Grants		x	Greenway planning and design, specifically focused on linkages to natural areas, historic sites, parks and open spaces.	$500 - $2,500	Leigh Anne McDonald, American Greenways Coordinator, 703.525.6300, lmcdonald@conservationfund.org, www.comservationfund.org - click on Awards
River Network Partner Grants		x	Water Quality: Capacity Building		www.rivernetwork.org/howwecanhelp/howwag.cfm
River Network: Watershed Assistance Grants		x	Grants available to local watershed partnerships to support their organizational development and long-term effectiveness	Mini-grants (under $4K) and project grants up to $30,000. Funded by EPA, no program for 2002	www.rivernetwork.org/howwecanhelp/howwag.cfm, wag@rivernetowrk.org
Turner Foundation: Water Protection and Conservation Grants		x	Strengthen advocacy, outreach and technical capabilities of organizations addressing the protection of water systems	$20,000 - $50,000	www.turnerfoundation.org

Table 1: Potential Sources of Funding for Water Quality Projects

Funding Source	Eligibility		Funding Areas	Funding Specifics	Contact/Web Site
	Public Agency	Non-Profit			
National Fish and Wildlife Foundation		x	Federal matching funds toward formal & informal watershed education program for youth, teacher, & other community members	Unknown, Up to $1 million invested since 1990	Kathleen Pickering, 202.857.0166, www.nfwf.org
USDA Natural Resources Conservation Service: Environmental Quality Incentives Program	x		Technical, training, and financial assistance		Tom Weber 720-544-2818 e-mail:tom.weber@co.usda.gov www.co.nrcs.usda.gov
USDA Natural Resources Conservation Service: Public Law 566 Small Watershed Program	x		Technical, training, and financial assistance		Dennis Alexander 720-544-2805 or Tony Puga 720-544-2821 email: Dennis.Alexander@co.usda.gov or Anthony.Puga@co.usda.gov
USDA Natural Resources Conservation Service: Conservation Technical Assistance	x		Technical, training, and financial assistance		Dennis Alexander 720-544-2805 or Tony Puga 720-544-2821 email: Dennis.Alexander@co.usda.gov or Anthony.Puga@co.usda.gov
USDA Natural Resources Conservation Service: Rural Conservation and Development	x		Technical, training, and financial assistance		Dennis Alexander 720-544-2805 or Tony Puga 720-544-2821 email: Dennis.Alexander@co.usda.gov or Anthony.Puga@co.usda.gov
USDA Natural Resources Conservation Service: Wetlands Restoration Program	x		Technical, training, and financial assistance		Dennis Alexander 720-544-2805 or Tony Puga 720-544-2821 email: Dennis.Alexander@co.usda.gov or Anthony.Puga@co.usda.gov

Table 1: Potential Sources of Funding for Water Quality Projects

Funding Source	Eligibility		Funding Areas	Funding Specifics	Contact/Web Site
	Public Agency	Non-Profit			
DOLA: Colorado Heritage Planning Grant Program	x		Land Use Planning; Creative solutions to address unique public impacts caused by growth: Technical and Financial Assistance	Up to $100,000 - Must be submitted by two local governments	Lillie Fuller, 303.866.3296
LOCAL FUNDING SOURCES					
Cherry Creek Basin Water Quality Authority	X		Water Quality: Pollution Reduction Facilities		Jim Worley 303-779-4525 jim.worley@cliftoncpa.com
Division of Wildlife - Wetland Focus Groups	x	x	Habitat Conservation: Land Acquisition		Alex Chappel
Urban Drainage and Flood Control	x		Water Quality: Restoration, BMP's, Flood plain mngmt.		Ben Urbonas
Colorado State Parks	x		Water Quality: Acquisition, Restoration, PRF's, Buffers		Bob Toll 303-699-3860 ext.725
Denver Water Department	x		Proposed; no information at this time		Andrew Wallach

Watershed Funding opportunities
State and Federal Funding sources
River Rally
Marc Alston, EPA Region 8
May 13th, 2003

PLEASE NOTE: WHERE SPACES MAY APPEAR IN WEB SITE ADDRESS IT DENOTES AN UNDERSCORE_

Federal

NRCS:

www.nacdnet.org/govtaff/FB/FB-SxS.htm
www.nrcs.usda.gov/programs/farmbill/2002/
www.usda.gov/farmbill/

EPA:

Updated Catalog of Federal Funding for Watershed Protection now online.
http://www.epa.gov/watershedfunding.

Non Point Source

www.epa.gov/owow/nps/index.html
www.epa.gov/owow/nps/319hfunds.html

State Revolving Funds

www.epa.gov/owm/cwfinance/cwsrf/index.html

EPA Smart Growth

http://www.epa.gov/smartgrowth/topics/water_quality_funding.html
http://www.epa.gov/smarthgrowth/topics/other_funding.html
http://www.smarthgrowth.org/pdf/funding_resources.pdf

Watershed Initiative

http://www.epa.gov/owow/watershed/initiative/

5 Star Restoration Program (joint with NOAA)

http://www.epa.gov/owow/wetlands/restore/5star/
http://www.epa.gov/owow/waterhed/funding/awpd_rfip_fy2003.html

Assessment and Watershed Protection Program

http://www.epa.gov/owow/watershed/funding/awpd_rfip_fy2003.html

Department of Interior

Fish and Wildlife Service; North American Wetlands Conservation Grants.
http://northamerican.fws.gov/NAWCA/grants.html

National Park Service; Rivers, Trails and Conservation Assistance program (RTCA)
http://www.nps.gov/rtca

National Park Service; Land and Water Conservation Fund
http://www.nps.gov/ncrc/programs/1wcf

NOAA:

http://www.nmfs.noaa.gov/habitat/restoration/funding.html

Office of Surface Mining
Appalachian Clean Streams Program
www.osmre.gov/acsi.funding

Army Corps of Engineers
Colorado Corps page: (with nationwide funding info)
http://cwcb.state.co.us/flood_watch/USACE

National:
http://www.hq.usace.army.mil
http://www.usace.army.mil/where.html#Divisions
(For organizational / contact information)

States:
http://www.tgci.com/funding/states.asp
Montana:
http://www.montanatu.org/article/issues

Washington
Infrastructure Funding Database
http://www.infrafunding.wa.gov
Washington Community Economic Revitalization Team
http://www.oted.wa.gov/ed/wacert/home.asp
Water Quality Funding
http://www.ecy.wa.gov/programs/wq/funding
Dan Filip (360-407-6509)

Oregon
Watershed Enhancement Board (503) 986 0187
Oregon Watershed Enhancement Board
Funding Directory
http://www.oweb.state.or.us/directory/
fundingintro.html

Colorado Non Point Source
http://www.cdphe.state.co.us/wq/nps/npshom.asp

Great Outdoors Colorado www.goco.org

Local Affairs Grant and Loan Directory
http://www.dola.state.co.us/fs/grants.html

Miscellaneous:

Information on Federal sources
http://firstgov./Topics/Nonprofit.shtml#fundraising

Boise State University Environmental Finance Ctr.
http://ssrc.boisestate.edu. 866 627 9847
(Directory of Watershed Resources)

Sonoran Institute www.sonoran.org

River Network
www.rivernetwork.org 503 241 3506

7.0 RECOMMENDATIONS

The *Partners* has found that active, committed leadership in the local governments, state and federal resource agencies, special interest groups, and the business community is critical to address the challenges of growth and water quality in the Cherry Creek watershed. To this end, the *Partners* has compiled a list of recommendations to make sure the ***Smart Growth for Clean Water – Cherry Creek Watershed Partnership*** continues to make a difference. Each recommendation noted has several components that have been identified as short-term or long-term strategies. The *Partners* recommends the following:

1. Work with the developers to build communities and neighborhoods that complement 'smart growth for clean water' practices.

- Use development incentives rather than regulatory mechanisms to influence where growth should not occur
- Promote incentives like density credits, transfer of development rights, faster permit approval, services based on site area, not just developed areas, and/or reduced building fees to direct development where it is desired
- Challenge the development community to find solutions that will be economically beneficial and also responsive to those concerned with preserving open space

Short Term:

- Compile a list of incentives developers have found to be advantageous in the planning process
- Convene a working group of interested parties made up of local land use jurisdictions, the development community, regulators, the Authority and *Partners* members, and interested parties to discuss the use of incentives to direct development as appropriate
- Establish a subcommittee of the *Partners* to interact with the national ***Smart Growth for Clean Water*** project participants in order to research innovative development designs across the nation that could be applied

Long Term:

- Conduct regularly scheduled ½ day forums for developers to acquaint them with watershed smart growth practices being used or promoted
- Establish and present a "Developer Cherry Creek Stewardship Award" to be awarded at the *Partners* Annual Conference that recognizes a developer for contributions to watershed smart growth practices
- Develop a design competition for developers utilizing 'smart growth for clean water' practices within the watershed

2. Work with the local land use agencies to set up planning tools to incorporate watershed smart growth strategies in the planning process and approvals process in the local land use agencies

- Research innovative development designs, like the pre-development hydrology development concepts described herein or building homes on piles to allow existing topography to run underneath and leave the watershed undisturbed, and incorporate where applicable.

Recommendations

- Influence where growth occurs by assigning desirability to specific areas away from environmentally sensitive areas (i.e. recharge zones)
- Review processes to see where review and approvals may be able to be speeded up and where watershed smart growth practices may be implemented
- Create incentives like density credits, faster permit approval, services based on site area, not just developed areas, and/or reduced building fees to direct development where it is desired
- Make the goal to be an increase in certainty and predictability in the planning, approval, and permitting process
- Leverage the development communities desire for certainty and lower project costs with 'smart growth for clean water' practices and considerations

Short Term:

- Compile a list of watershed smart growth practices and innovative designs that can be utilized, as well as a list of incentives that other jurisdictions in Colorado and elsewhere are successfully utilizing
- Establish a subcommittee of the *Partners* that are land use agency staff to review processes and approval timetables to see if there are any planning components that could be improved to enhance the use of 'smart growth for clean water' practices

Long Term:

- Conduct several ½ day technical forums or brown bags for planning and engineering staff to acquaint them with 'smart growth for clean water' practices being used or promoted in the watershed
- Present an award at the *Partners* Annual conference to recognize a local planning agency's stewardship of the Cherry Creek watershed via promotion of watershed smart growth practices

Continue to host forums to introduce and reinforce watershed smart growth practices to developers and planners.

3. Establish a monitoring program to measure the quantitative benefits of watershed smart growth strategies as discussed in the case studies

- Monitor the four case studies presented herein for both environmental and economic benefits to document the phosphorous reductions and the incentives provided to developers
- Publish the results in an annual report that documents the 'smart growth for clean water' practices utilized in the watershed

Short Term:

- Gather information about the monitoring programs and data on going in the Cherry Creek watershed
- Compile applicable monitoring criteria from UDFCD and create a monitoring process, program and methodology for appropriate comparison of data across the watershed
- Compile any monitoring data for the four case studies reported herein

Make strides to quantitatively measure the water quality benefits of 'smart growth for clean water' strategies described in the case studies.

Long Term:

- Prepare and report quantitative data to document benefits from 'smart growth for clean water' strategies in use in the watershed
- Develop quantitative BMP phosphorous reduction values for watershed smart growth enhanced BMPs
- Prepare an annual report summarizing monitoring data and the benefits from these practices in the watershed

4. Take advantage of the advocacy for water quality and watershed smart growth that resides in HOAs and other local community groups.

- HOAs and community groups can play a key triple role in shaping local plans as they both provide information about their constituents and are able to then disseminate the information back to the community, as well as facilitate the eventual implementation of the strategy or plan.

Short Term:

- Compile a list of HOAs and community groups in the Cherry Creek watershed and keep a database of key officers and area of influence
- Send literature about activities in the watershed to all HOAs and groups
- Make contact with HOA officers and members and invite them to the *Partners* quarterly meetings

Long Term:

- Prepare a newsletter about the activities and 'smart growth for clean water' practices in the watershed and distribute to HOAs and community groups
- Create an HOA Cherry Creek Stewardship Award to be awarded at the *Partners* Annual Conference in November

5. Establish a network of knowledgeable funding and grant resources within each of the identified funding sources, and request the local watershed group to become the clearinghouse for this important information.

- In the Cherry Creek watershed, the *Partners* could function as this clearinghouse and provide assistance to grant-seekers
- The funding options identified in this report (**Section 6**) could be used as the initial attempt to access funding opportunities

Short Term:

- Convene a subcommittee of the *Partners* to become the funding and grant experts for funds available in the watershed for 'smart growth for clean water' practices
- Take the Funding Table contained in **Section 6** and identify 5 programs that have the highest potential for funding projects in the watershed; complete the due diligence necessary to qualify the grant opportunity as viable.

Utilize HOA and other citizen groups to verify assumptions and disseminate information about what works in the watershed.

Become a champion for funding opportunities so that the successes in the watershed can be the foundation for additional 'smart growth for clean water' strategies.

Recommendations

Build on the signed Cherry Creek Regional MOU Agreement by preparing a specific "Course of Action" outline for future cooperative efforts.

Pursue the long-term goals of the Regional MOU Agreement, including meetings, outreach, and action.

Long Term:

- Publish a newsletter of grant opportunities and highlight existing or new funding sources
- Provide standard text, support letters, and graphics for potential grant writers to facilitate the grant solicitation process

6. Produce a document that states the areas of agreement and lays out a course of action for integrating watershed smart growth practices with water quality objectives between adjoining jurisdictions.

- A collaborative effort will clarify any conflicts among the jurisdictions that may impede efforts to come to an agreement
- At a minimum, parties to the agreement should include the local land use agencies, regulatory agency, the development community, the Authority, the *Partners*, and local community groups.

Short Term:

- Convene a working group of interested parties made up of local land use jurisdictions, the development community, regulators, the Authority and *Partners* members, and interested parties to discuss the use of an agreement to lay out a course of action in the watershed
- Establish a subcommittee of the *Partners* to interact with the national ***Smart Growth for Clean Water*** project participants in order to research agreements utilized across the nation that could be applied here in the watershed
- Research agreements utilized in the front range to build a library of applicable language regarding laying a course of action for a watershed
- Create an agreement among the stakeholder regarding the vision for the watershed and compile signatures of all stakeholders on the document **(completed; see "Outreach Efforts: Regional MOU Agreement")**

Long Term:

- Using the Regional MOU agreement among the jurisdictions, formalize a "course of action" to be implemented over the life of the vision agreement
- Develop contact list for all Regional Agreement signatory governments for all future communications and update quarterly
- Provide regular news/ updates regarding *Partners* activities, including new or upcoming opportunities for cooperative work
- Develop and agree upon a protocol for initiating and pursuing cooperative projects
- Continue to hold quarterly meetings of the *Partners* group and develop a plan to conduct outreach and engage more decision-makers and senior staff from signatory governments in these meetings
- Develop a "short and sweet" version of the MOU presentation for "road shows" in various communities, to allow individual jurisdictions to "get credit" for their participation in the MOU Agreement, and to build their investment in the success of the Agreement in meeting its stated goal.

7. Establish a watershed advocate for overseeing the reductions of phosphorous loads from non-point sources for the watershed

- Although the technologies are available and cost-effective, 'smart growth for clean water' approaches are not being used because they are not business-as-usual practices (i.e. practices that require minimal regulatory review and are the lowest cost practices)
- The advocate would be in a position to show developers that they can save and make money by adopting beyond-compliance pollution control practices and achieving pre-development hydrology conditions
- The advocate would provide a "go-between" with local planning and regulatory agencies and developers in order to obtain certainties, incentives and timely approvals from local development review authorities for innovative and better development practices
- The advocate would be in a key position to identify low impact development techniques, encourage developers to adopt these approaches, facilitate their approval in the regulatory process, coordinate outreach and education on the benefits of these approaches, and provide wider implementation

Short Term:

- Research the applicability of an Intergovernmental Personnel Assignment (IPA) position with shared funding by the U.S Environmental Protection Agency and the Authority
- Identify a set of watershed smart growth practices that have proven effective at phosphorous reduction and removal
- Assemble a clearing house of information and resources on watershed smart growth techniques in other areas, including information on the economic advantages to the developer
- Prepare a Scope of Services and initiate a Request for Proposal for the position (**completed; see Section 5.2**); fill the position and monitor the effectiveness for an initial period.

Long Term:

- Prepare and conduct forums for education of planning agency officials and staff on the water quality and economic benefits of the watershed smart growth development techniques, and seek support from these agencies for regulatory incentives for these techniques, including streamlined approvals, phosphorous trading credits, and development density bonuses
- Work with the development community to encourage them to adopt proven watershed smart growth development techniques, identify the economic benefits of these, and facilitate their acceptance in the regulatory process
- Coordinate public outreach and education on the benefits of these approaches, in coordination with the Authority and the *Partners*
- Make recommendations to the Authority and local land use agencies on the institutionalizing of these techniques over time through voluntary programs
- Identify how the facilitator position can be sustained beyond the initial consultant assignment through the sponsorship of local and state entities, grants, development fees, and/or the economic value created by the implementation of these practices

Utilize the Phosphorous Facilitator position to go between developers and land use agencies to identify opportunities and facilitate approvals.

Monitor the advocacy benefits of the Phosphorous Facilitator and plan a course of action to make the position sustainable.

Recommendations

Identify the next "Bow Tie" parcel that could be a collaborative acquisition effort in the watershed.

Highlight long term operation and maintenance efforts that will be required with implementation of these 'smart growth for clean water' strategies.

8. Identify parcels in the Cherry Creek watershed that are critical to the mission of the *Partnership*

- Use the Legacy Plan as a framework for identifying potential land use acquisition opportunities that would be key to the vision of the smart growth partnership

Short Term:

- Form a land acquisition strategy subcommittee from the *Partners* made up of local land use jurisdictions and interested parties to prioritize land conservation opportunities
- Use the "Bow Tie" property acquisition to outline a process for initial inquiries up to final acquisition

Long Term:

- Work with TPL and other conservation groups to secure funds and community support for specific land acquisition projects

9. Work with the Authority and NPDES Phase I and II cities and counties within the watershed and bring the importance of the maintenance aspect to these 'smart growth for clean water' practices to the forefront.

- Too often new and innovative practices are recommended for their obvious water quality benefit without a thorough understanding of the requirements for maintenance of the strategy

Short Term:

- Identify maintenance requirements and responsibilities that are inherent in the watershed smart growth strategies put forth in the case studies as potential water quality solutions

Long Term:

- Prepare a maintenance sheet or O&M Manual for the prominent enhanced BMPs that are being highlighted for use in the watershed
- Identify maintenance requirements and responsibilities for other watershed smart growth strategies that may be used in the watershed
- Conduct a ½ day forum on operation and maintenance requirement for watershed smart growth strategies being highlighted in the watershed

In summary, the Cherry Creek Watershed 'Smart Growth for Clean Water' Report is the culmination of the first phase of an extended effort to integrate innovative stormwater volume controls into the land development process in a win-win environment, going beyond a regulatory approach in dealing with stormwater runoff. The findings and recommendations in this report provide a wide range of goals as a basis for future collaborative activities that will serve multiple objectives within the Cherry Creek watershed and beyond.