Maintenance Program Activities

by
Mark R. Hunter, P.E., Chief, Maintenance Program

Routine Maintenance
Through the routine maintenance program $687,600 was spent in 2001 for mowing and debris pickups. This work was done on approximately 240 different sections of urban drainageways within the District boundaries. This equates to a total of over 100 miles of drainageways in the Denver area on which we performed scheduled mowing and debris pickup maintenance.

Many of the more urban drainageways now receive four or five mowings and seven or eight debris pickups per year. In the early 1980s the sole purpose of the routine program was to pick up large debris that could otherwise contribute to blockages and flooding problems. These days urban drainageway corridors are prized as neighborhood amenities. Along with that outlook comes the community desire for a level of drainageway maintenance that goes beyond our original flood control debris pickups. Three or four debris pickups per year is now inadequate on the more urban drainageways that we maintain.

All of our routine work is done on structured schedules by private contractors. We are not set up to carry out landscape maintenance, on-call work, or emergency services. In the past we have participated with other agencies by splitting maintenance duties along drainageways through improved parks. We have seldom been pleased with our performance in these areas. Recognizing this, we will resume our initial policy of not providing mowing and debris pickup on irrigated drainageway corridors.

For the year 2001 we awarded eight separate contracts for routine work. All eight contracts were awarded through a direct competitive bid process. This was the first year all routine contracts were competitively bid. Over the last four years we have been transitioning away from awarding routine contracts based on an internal review of contractor proposals and toward awarding them based on the competitive bid process. For the year 2002 we will add a provision to the routine contracts that will allow us to negotiate contract renewals for 2003 if we are satisfied with the contractor's work.

Restoration Maintenance
In 2001 the restoration program completed $1,887,000 of work. Restoration projects typically address isolated drainage problems where the solution involves small-scale construction. Eighty-seven individual activities were completed during the year. A major advantage of the restoration program is the ability to use it to react quickly to local drainage needs.

The topography in the Denver area is generally steep enough that stream erosion is a rapid and visible element of the hydrologic cycle. When development occurs streams are often confined to inflexible corridors. If the stream corridor is narrow little room is available for the common episodes of erosion. A frequent method of controlling vertical stream erosion is to install drop structures to dissipate the energy. A drop structure must be stout in order to withstand the erosive power of a stream.

To borrow a football cliché, only three things can happen to a drop structure and two of them are bad. In the first case, drops can fail when water flows through, under, or around them due to an inadequate cutoff wall. In the second case, they can be damaged when the structure itself is not robust enough to withstand and dissipate the stream's energy. Only if all goes well with the design and construction will the drop structure provide years of stable and durable grade control.

Our restoration program repaired several drop structures that suffered the first type of failure. The drop structures on **Greenwood Gulch** in Greenwood Village were built in 1998, but three of them were showing signs of water flowing around the sides of the structures. These were originally built as low-flow drops with grouted boulders as the cutoff wall. We repaired them by driving a ten-foot deep sheet pile wall on their upstream edge and grouting the connection from the sheet pile to the existing boulders.

A drop structure of concrete rubble and grout had been in place for years on **Harvard Gulch** just upstream of Madison Street in Denver. This facility had no cutoff wall and had been undermined by the stream. Our approach was to trench and pour a concrete wall for the cutoff and to use grouted boulders for the sloping face of the structure.

It is common to have utility lines cross streams. Many of them end up with concrete encasements to protect the utility from the stream. On **Massey Draw, North Tributary** in Jefferson County the stream eroded both under and around one end of a sewer line encasement. With the financial assistance of the sewer district we poured a concrete cutoff wall and placed grouted boulders for the drop structure face.

We also repaired several facilities that suffered from the second type of drop structure damage. A Capital Program project from the 1970s on **Sanderson Gulch** in west Denver included drop structures made of gabion baskets. The high bed load of sediment and vandalism combined to limit the service life of the gabions. The gabion drop on the east side of Federal Boulevard had been repaired in the past with sprayed-on concrete, but that was now deteriorating. We replaced that structure with a trenched and poured concrete cutoff wall with grouted boulders for the sloping face. We will continue replacing the old drop structures on Sanderson Gulch as funds are available.

Just south of C-470 in Douglas County **Willow Creek** flows through an undeveloped area. Similarly, in

Brighton, **Line A,** also called **North Urban Channel**, discharges to the South Platte River after flowing through a rural area. The structures on both these creeks shared a similar history in that they suffered from increased flows due to upstream development and the downstream channel was degrading resulting in undermining of the facilities. For both these structures we drove sheet pile to establish the cutoff wall and installed grouted boulders to create the face of the drop. We realize that since there is no grade control downstream of these structures they will still be vulnerable to vertical erosion in the downstream channel.

Stream-rounded boulders were used over the years by the City of Boulder to establish a dozen drop structures on **Boulder Creek**. These drops are two to three feet tall and have no concrete and no cutoff wall. The original boulders were locked into an arch shape through careful placement, but, eventually, in the cobble-bedded stream some of the rounded boulders became displaced. We imported some angular boulders and re-established an arched grade wall bedded in the cobbles. The rounded boulders were then placed downstream of the grade wall to give a sloping face to the structure.

Rehabilitation Maintenance

Twenty-four projects were at various stages of design or construction during 2001. Those projects are listed in the accompanying table titled "STATUS OF MAINTENANCE REHABILITATION PROJECTS". Rehabilitation projects usually take the form of consultant-designed repairs that are intended to address severe problems that have occurred on a previously improved urban drainageway. By the end of 2001 the District will have spent about $2,559,300 on rehabilitative design and construction for the year. A few of the unique projects are discussed below.

We are always doing something on **Cherry Creek.** In southeast Denver where the Highline Canal crosses the creek there is a massive 12 foot tall drop structure composed of dumped concrete rubble. As the creek bed downstream has degraded the structure has evolved into a drop that protects the Highline Canal siphon that crosses under Cherry Creek. Erosion has now exposed the siphon and the rubble appears inadequate to resist a major flood event. Several regional and local governments are participating with us in rebuilding this substantial structure including trail and park improvements for the large open space area.

Niver detention pond is a large regional facility located west of I-25 at 88th Avenue. **Tributary M to Niver Creek** joins Niver Creek just upstream of the dam. The dam provides some grade **(Continued on page 23)**

STATUS OF MAINTENANCE REHABILITATION PROJECTS

Project	Jurisdiction		Cost	Status
ADAMS COUNTY				
Clear Creek – S. Platte R. to York St.	Adams County	Design	$72,700	25%
Build drops to control grade.		Const.	0	0%
Little Dry Ck., Shaw Heights. – South	Westminster	Design	65,000	100%
of 80th. Repair bank erosion, partic.		Const.	600,000	100%
Niver Ck, Trib M – N.E. of Huron St. &	Thornton	Design	43,600	100%
88th Ave. Drops & repair bank erosion.		Const.	263,400	5%
ARAPAHOE COUNTY				
Big Dry Creek – East of University Blvd	Arapahoe County	Design	83,950	100%
Repair to channel and trails		Const.	296,850	100%
East Toll Gate Trb. – Along Uravan Av	Aurora	Design	104,064	100%
Drops and channel repair		Const.	152,208	5%
Lee Gulch – West of Prince Street.	Littleton	Design	By others	100%
Remove sediment from lake, partic.		Const.	10,000	25%
Little Dry Ck – Quincy to Belleview Av	Cherry Hills Village	Design	By others	100%
Grade control at sewer crossings partic.		Const.	100,000	100%
S.J.C.D. North – East of Sheridan Bvd.	Arapahoe County	Design	68,857	100%
Repair low flow channel and drops.		Const.	354,206	100%
BOULDER COUNTY				
No Changes in 2001				
DENVER COUNTY				
Cherry Creek – Highline canal crossing.	Denver	Design	Included	100%
Repair drop structure, participation		Const	437,550	0%
Goldsmith Gulch, - North of Hampden	Denver	Design	54,000	0%
Channel and bank repair.		Const.	Next year	0%
Harvard Gulch – Through DeBoer Park	Denver	Design	77,683	100%
Rebuild trickle channel		Const	278,526	100%
Lakewood Gulch – Federal to Knox	Denver	Design	86,185	100%
Channel erosion repair		Const.	420,393	100%
South Platte River, West Side Trib. -	Denver	Design	85,779	100%
N.E. of 6th and I-25. Concrete channel.		Const.	379,423	100%
DOUGLAS COUNTY				
Big Dry Creek – In Heritage Park	Douglas County	Design	By others	100%
Drops and repair steep banks, partic.		Const.	100,000	0%
Big Dry Creek – Crest Hill Tributary	Douglas County	Design	By others	100%
Drops and repair steep banks, partic.		Const.	100,000	100%
Sulphur Gulch – W. of Hwy #83.	Parker	Design	77,940	100%
Rebuild drop structure		Const.	291,307	100%
JEFFERSON COUNTY				
Bear Creek – Through Morrison	Morrison	Design	By others	100%
Access trail, participation.		Const.	50,000	100%
Coon Creek – West of Sheridan Blvd	Jefferson County	Design	30,200	20%
Drops and repair eroding channel.		Const.	Next year	0%
Dutch Ck – NE. of Pierce & Coal Mine	Jefferson County	Design	76,558	100%
Repair eroding channel.		Const.	464,702	100%
Lena Gulch – Colfax at Heritage Road	Golden	Design	20,000	10%
Drops and repair channel, participation.		Const.	Next year	0%
Lilley Gulch – Wadsworth to Estes	Jefferson County	Design	62,515	100%
Repair channel and trail.		Const.	268,762	0%
McIntyre Gulch – West of Holland St.	Lakewood	Design	Included	100%
Repair channel banks, participation.		Const.	265,000	0%
McIntyre Gulch – Union at Alameda Pk	Lakewood	Design	63,910	100%
Repair erosion and drops, participation		Const.	300,000	100%
S.J.C.D. North – West of Sheridan Blvd	Jefferson County	Design	11,134	70%
Floodplain determination.		Const.	No const.	0%

Ken A. MacKenzie, Project Engineer, Design and Construction Program
*Presenter at the 12th annual conference of the Colorado Association of Stormwater and Floodplain Managers (CASFM).
*Presenter at *Urban Storm Drainage Criteria Manual Volumes 1 and 2* Update Seminar.
*Developed spreadsheet-based design aid software with Dr. James C.Y. Guo, department of Civil Engineering, University of Colorado at Denver, and Wright Water Engineers.
*Developed AutoCAD™ details for the *Urban Storm Drainage Criteria Manual Volumes 1 and 2*.

Bryan Kohlenberg, Project Engineer, South Platte River Program
*Co-authored, with David Lloyd, Bill DeGroot, and Mark Hunter, "Mitigating Stream Erosion in the Denver Metropolitan Area."
*Continued as NSPE's scoring coordinator for the Jefferson Chapter and Colorado State MATHCOUNTS competitions for 7th and 8th graders.

Paul Hindman, Project Engineer, Design and Construction Program
*Member of site selection committee for APWA's 2008 Congress and Exposition.

John Doerfer, Project Hydrologist, Master Planning Program
*Chairman of Awards Committee, Colorado Association of Stormwater and Floodplain Managers, 2001 Annual Conference.
*Chairman of Municipal Workgroup, Colorado Stormwater Task Force.
*Speaker on construction-site sediment control measures and enforcement procedures at International Erosion Control Association Mini-Conference, June 5-6, in Denver.
*Co-authored paper with Ben Urbonas, "Testing of an Underground Stormwater Treatment Vault in Denver, Colorado, USA," NOVATECH 2001conference, June 25-27, in Lyon, France.
*Co-authored article with Matt Gavin, Wright Water Engineers, "Retrofit of an Extended Detention Basin in Denver, Colorado," Water Resources IMPACT, Journal of American Water Resources Association, Vol. 3, No. 6, November.

Mark Hunter, Chief, Maintenance Program
*Committee member for the IECA-Mountain States Chapter.
*Member of IECA Technical Review Committee and Awards Committee.
*Co-authored, with David Lloyd, Bill DeGroot, and Bryan Kohlenberg, "Mitigating Stream Erosion in the Denver Metropolitan Area."

David Bennetts, Project Engineer, Maintenance Program
*Guided a field trip on riparian zone plant species, with Deb Kemmerer at the 12th Annual CASFM Conference in Steamboat Springs in September.

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control, but by the time Tributary M reaches Huron Street the erosion is severe with 12 to 15 foot tall vertical banks and a headcut undermining the Huron Street culvert. Our project will include five drop structures and extensive bank reshaping.

One of this year's projects includes the elimination of an 18-inch diameter trickle flow/underdrain pipe. The **East Toll Gate Tributary** in Aurora has several grouted rock drop structures with deep stilling basins that drain into the 18-inch trickle flow pipe. The pipe is damaged or plugged in several areas. The drops are deteriorated and have become a safety problem because of the deep stilling basins. Rebuilding the drop structures and regrading the channel will allow all runoff to flow on the surface through the improved corridor. Aurora plans to upgrade the site to an irrigated bluegrass park.

The City of Denver also had a channel with a troublesome underdrain pipe. **Harvard Gulch** flows through DeBoer Park in south Denver. The underdrain was connected to multiple surface inlets with the intent of keeping the area dry during low flow periods. The thin slope-paved concrete of the trickle channel through the park had become displaced and broken-up to the extent that the trickle flows went under or around the inlets and never made it to the underdrain pipe. With the coordination of Denver Parks the five-foot wide concrete trickle channel was replaced with a boulder-edged low flow channel that varies from 10 to 15 feet wide.

With the acquisition, by Foothills Park District, of a parcel of land west of Wadsworth Boulevard a final link was made in the **Lilley Gulch** corridor in Jefferson County. The additional public land allowed us to incorporate a re-aligned trail, streambank protection, and several areas of wetlands. Four drop structures will also be built to control the grade through this new open space park.

DeBoer Park low flow channel before and after.