

**Regional General Permit (RGP)**

**Channel Maintenance and Construction on Tributaries to the South Platte River**  
**Under Authority of Urban Drainage and Flood Control District**

**Permittee:** Urban Drainage and Flood Control District (UDFCD)

**Permit No.:** NWO-2006-186-DEN

**Permit Expires:** December 31, 2016

**Issuing Office:** Omaha District, US Army Corps of Engineers (Corps)

**Location:** All waters of the US in the State of Colorado within the Boundaries of UDFCD, except the South Platte River

**Authorization:** UDFCD is authorized to perform work in accordance with the terms and conditions specified herein.

**Table of Contents**

**Section 1. Introduction**

- 1.1. Permit Overview
- 1.2. General Definitions for purposes of this RGP
- 1.3. General Limitations

**Section 2. Description of Authorized Work**

- 2.1. Grade control/drop structures
- 2.2. Bank stabilization controls
- 2.3. Channel bottom linings
- 2.4. Realignment and reshaping of a channel
- 2.5. Culverts and bridges
- 2.6. Storm sewer outfalls
- 2.7. Channel rundowns
- 2.8. Stormwater treatment detention and management facilities

**Section 3. Application Procedure**

**Section 4. Compensatory Mitigation Requirements and Guidelines**

- 4.1. Mitigation Requirement
- 4.2. Design of Mitigation Sites
- 4.3. Mitigation Success
- 4.4. Mitigation Monitoring
- 4.5. Mitigation Protection
- 4.6. Unsuccessful Mitigation

**Section 5. Permit Conditions**

**Section 6. Further Information**

**Section 7: Location Map and Figures**

## Section 1. Introduction

### 1.1. Permit Overview

With this Regional General Permit (RGP) the District Engineer for the Omaha District US Army Corps of Engineers (Corps) authorizes certain channel erosion and protection projects, flood-related fill or excavation activities, other work associated with drainage and flood protection, and repair work for flood-damaged areas performed in waters of the US within the jurisdiction of the Urban Drainage and Flood Control District (UDFCD) in Colorado. These activities have only minimal adverse impacts on the aquatic environment when performed separately or on a cumulative basis. This RGP pertains to the construction, repair, rehabilitation, and improvement of the following eight categories of facilities in developed and undeveloped areas:

1. **Grade control/drop structures**
2. **Bank stabilization controls**
3. **Channel bottom linings**
4. **Realignment and reshaping of a channel**
5. **Culverts and bridges**
6. **Storm sewer outfalls**
7. **Channel rundowns**
8. **Stormwater treatment detention and management facilities**

### 1.2. General Definitions for purposes of this RGP

**Ordinary High Water Mark:** That line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.

**Single and Complete Project:** The total project proposed or accomplished by one owner/developer or partnership or other association of owners/developers and which would be constructed absent the construction of other projects in the project area.

**Sinuosity:** The ratio of stream length to project reach length or valley length.

**Waters of the US:** Those waters under Corps Section 404 jurisdiction, including jurisdictional rivers, lakes, ponds, creeks, gulches and wetlands.

**Riparian Area:** The area next to streams or drainages, normally 50 feet wide on each side of the stream, and usually containing native riparian vegetation.

**Stream channelization:** The manipulation of a stream's course, condition, capacity, or location that causes more than minimal interruption of normal stream processes.

**Developed Areas:** Areas where most surrounding land currently has residential or commercial developments. Drainage projects in developed areas will normally be undertaken to correct problems (such as erosion or flooding) associated with increased surface flows from *post*-development conditions.

**Undeveloped Areas:** Areas where most surrounding land currently does not have residential or commercial developments. Drainage projects in undeveloped areas will normally be undertaken to correct problems associated with increased surface flows *anticipated to occur* under developed conditions.

### **Permanent Modifications:**

- Permanent modifications to waters of the US include the filled area and other waters below the ordinary high water mark, including wetlands, that are permanently adversely affected by filling, flooding, excavation, or drainage as a result of the regulated activity. These include permanent above-grade, at-grade, or below-grade fills that change an aquatic area to dry land, increase the bottom elevation of a waterbody, or change the use of a waterbody.
- For purposes of this permit, examples of permanent modifications include placement of rock, grouted rock or concrete below the ordinary high water mark.

### **Temporary Modifications:**

- Temporary modifications to waters of the US, including wetlands, are those modifications that temporarily affect waters during construction by filling, flooding, excavation, or drainage, where the project area is restored to preconstruction contours, elevations, and wetland or riparian characteristics. These temporary modifications are not included in the calculation of permanent modifications to waters of the US.
- If the project area, where temporary modifications are involved, is not restored to preconstruction contours, elevations, and wetland or riparian characteristics within one year, the modifications will be considered permanent and must be mitigated immediately adjacent to the project or as part of a nearby larger mitigation area within UDFCD jurisdiction.
- For purposes of this permit, examples of temporary modifications include, but are not limited to, construction staging areas and use of temporary construction materials (e.g., timber, steel, geotextile used during construction and removed upon completion of the work).

## **1.3. General Limitations**

- The total combined aerial footprint of permanent modifications to waters of the U.S for a single and complete project will not exceed one (1) acre.
- The total combined aerial footprint of permanent modifications, including those from all structures and treatments, for a single and complete project will not exceed 1,000 continuous linear feet.
- All permanent modifications to waters of the US associated with the structure must be mitigated on or immediately adjacent to the project site or as part of a nearby larger mitigation area within UDFCD jurisdiction at a compensatory mitigation ratio of 1:1 in accordance with Section 3.
- All disturbed upland areas and adjacent riparian areas will be replanted with grasses, shrubs and trees according to UDFCD Criteria Manual Revegetation Guidelines and at a 1:1 basis.
- Removal of sediment, trash or brush near a structure under UDFCD jurisdiction is acceptable if the sediment, trash or brush is adversely affecting the hydraulic function or capacity of the affected structure. All material removed from facilities must be placed out of the natural drainage way and outside of all waters of the US.
- Typical structures shown in the attached figures are for general clarification only. Specific dimensions will vary with each project.
- No projects, where filling of an existing 100-year floodplain is proposed in order to increase developable land, are authorized by this permit.
- Projects in undeveloped areas, and where possible in developed areas, must retain an undeveloped riparian area along the entire project reach within at least 50 feet landward of both channel banks.

## Section 2. Description of Authorized Work

### 2.1. Grade Control/Drop Structures

#### Definitions

A *grade control or drop structure* is defined as any structure that modifies the centerline slope of a natural drainageway in such a way as to resolve erosion and sediment transport problems. Grade control or drop structures authorized by this RGP will be boulder, grouted boulder, riffle-drop, narrow sheet metal piling or concrete drops, soil cement, or sculpted concrete structures. Example designs are shown in Figs. 1-1 through 1-4.

#### Limits

- Permanent modifications cannot exceed 0.1 acres of waters of the US per structure.
- Permanent modifications cannot exceed 100 linear feet of stream bed per structure.
- The structure must have an inclined surface sufficient to allow movement and survival of water-dwelling organisms.
- Where possible, grouting of rock must be avoided. If grouting is used, the grouting must be the minimum necessary to stabilize the rock, thereby allowing sediment to accumulate in voids between the boulders.
- The number of structures constructed in a given reach will be optimized to provide for the movement of aquatic organisms. Thus, more smaller structures rather than a few large structures, with subsequent greater total footprint, may be the best option to provide for the movement of aquatic organisms.

### 2.2. Bank Stabilization Controls

#### Definitions

*Bank stabilization controls* include, but are not limited to, riprap or soil cement toe and bank protection, boulder edging, geotextile installations, modular blocks, and bioengineering techniques. Bank stabilization is done to repair or protect banks that have been eroded, or are beginning to erode. Example designs are shown in Figs. 2-1 through 2-4.

#### Limits

- The activity will not exceed an average of two (2) cubic yards per running foot placed along the bank below the plane of the ordinary high water mark.
- Boulder edging will generally be used only on inner and outer creek bends at areas of high erosion potential. Continuous boulder edging will be allowed only where unusual bank stability and conditions require. Where possible, boulder edging will have a grass/shrub border planted landward of the boulders, so that the grasses/shrubs eventually hang channel-ward over the boulders providing cover and habitat.
- No bank stabilization material will impair surface water flow into or out of any wetland area.
- Unless otherwise approved by the Corps, all riprap will be buried with soil (soil riprap) as specified in the UDFCD's Urban Storm Drainage Criteria Manual.
- Vegetated bank areas will not be manicured/landscaped in a manner that would diminish wildlife habitat.

### 2.3. Channel Bottom Lining

#### Definitions

*Channel bottom lining* includes, but is not limited to, riprap, soil riprap, boulders and geotextile/erosion control blankets. The purpose of channel bottom lining is to protect the channel invert from erosion and degradation, to maintain flow conveyance capacity and for energy dissipation. Example designs are shown in Fig. 3-1.

#### Limits

- Concrete or grouted channel bottom lining will only be placed where significant protection is necessary along a stream bottom and no greater than 100 feet in length.

## 2.4. Realignment and Reshaping of a Channel

### Definitions

**Realignment** is moving the centerline of the channel horizontally in either direction. **Reshaping** is changing the cross sectional configuration of the drainageway. These activities are often conducted with another activity such as construction of a grade control structure, or bank stabilization measures. Occasionally, the purpose is to restore the capacity or the alignment of the drainageway to historic conditions. Example designs are shown in Figs. 4-1 and 4-2.

### Limits

- Total post-construction linear channel length and sinuosity will equal or exceed pre-construction conditions.
- This permit does not authorize stream channelization or stream relocation projects.
- No projects, where realignment of an existing drainage is proposed in order to increase developable land, are authorized by this permit.

## 2.5. Culverts and Bridges

### Definitions

A **culvert or bridge** is defined as any hydraulic structure that enables vehicular or pedestrian traffic to cross a natural drainageway above the elevation of the normal base flow. Culverts are typically circular or box sections. Associated structures include wingwalls, flared end sections, trash racks, and energy dissipaters. A bridge structure can include piles and/or abutments. Example designs are shown in Fig. 5-1.

### Limits

- Work must be accomplished within 100 feet upstream or downstream of culverts or bridges.
- This permit cannot be used to authorize work on culverts or bridges associated with buildings, parking lots or other non-linear structures.
- Culverts and bridges must be designed with the bottom of the structure positioned to smoothly transition flows into and out of the structure.

## 2.6. Storm Sewer Outfalls

### Definitions

A **storm sewer outfall** is defined as a hydraulic structure that serves as a point discharge for a storm sewer system. Storm sewer outfalls are typically circular pipe or box outlet sections. Associated structures are wing walls or flared end sections, trash racks, energy dissipaters, and grouted riprap/boulder rundowns. Example designs are shown in Figs. 6-1 and 6-2.

### Limits

Work must be accomplished within 100 feet upstream or downstream of storm sewer outfalls.

## 2.7. Channel Rundowns

### Definitions

A **channel rundown** is defined as a structure that carries water from the top of the drainageway bank to the bottom of the bank, and usually below the water surface. The rundown can be constructed with, but is not limited to, concrete, grouted riprap or boulders, soil riprap, geotextiles/erosion control blankets, and other bio-engineering materials. The

purpose of the rundown is to convey concentrated urban stormwater runoff down the bank without eroding the bank. Example designs are shown in Fig. 7-1.

#### **Limits**

- Channel rundown structures can not exceed 20 feet in width.
- Where adequate land is available, channel rundowns require a water quality improvement facility (detention, wetlands, etc.) at its upstream end.

## **2.8. Stormwater Treatment, Detention and Management Facilities**

#### **Definitions**

*Stormwater treatment, detention and management facilities* include stormwater ponds/ facilities, detention basins and retention basins, water quality control structures and facilities, and the associated inlet and outlet structures and emergency spillways. Example designs are shown in Figs. 8-1 and 8-2.

#### **Limits**

- No stormwater treatment, detention and management facility will store water on a permanent basis.
- If the facility is to be located on a perennial stream, UDFCD will specifically demonstrate that the structure will only minimally impact aquatic habitat and organisms.
- Stormwater treatment, detention and management facilities, with exception of sediment forebays, micro pools and trickle channels, can not be lined with impermeable material such as clay, concrete or grout.
- Wetlands within stormwater treatment, detention and management facilities, that form after construction of the facility and are included in areas designated for routine improvement or maintenance, are authorized to be excavated without need for compensatory mitigation, provided these wetlands were not created as areas of compensatory mitigation.
- If wetland compensatory mitigation is proposed in areas of stormwater treatment, detention and management facilities, a forebay will be constructed on the upstream end of the facility designated for sediment capture. Wetlands growing in the forebay are authorized to be excavated without need for compensatory mitigation.

### 3. Application Procedure

**The following information is required, for each facility considered under this RGP, in order to process a permit application.**

- 3.1. Completed Application Form 4345
- 3.2. Project manager at UDFCD, and the name, address and telephone number of the owner of the affected land.
- 3.3. Wetland and stream delineations.
- 3.4. Maps showing general location, permanent and temporary modifications to waters of the US, and mitigation areas and specifications.
- 3.5. Representative pre-project photos of the project reach.
- 3.6. Drawings/sketches, on 8.5x11-inch sheets, showing details of the proposed work, including plan views, cross sectional views showing elevations and dimensions and standard detail.
- 3.7. A compensatory mitigation plan for permanent impacts to waters of the US, if applicable.
- 3.8. Endangered species and cultural assessments/surveys, if applicable.

## 4. Compensatory Mitigation Requirements and Guidelines

### 4.1. Mitigation Requirement

- All permanent modifications to waters of the US associated with the structure must be mitigated on or immediately adjacent to the project site or as part of a nearby larger mitigation area within UDFCD jurisdiction at an aerial or functional compensatory mitigation ratio of no less than 1:1, as determined by the Corps. Only native vegetation is authorized in mitigation areas.
- All disturbed upland areas and adjacent riparian areas will be replanted with grasses, shrubs and trees according to UDFCD Criteria Manual Revegetation Guidelines at a 1:1 aerial or plant-for-plant basis.
- All mitigation will be constructed concurrently with impacts where possible, but no longer than one year after impacts to waters of the US, disturbed upland areas and adjacent riparian areas are incurred.

### 4.2. Design of Mitigation Sites

Maps and specifications for mitigation areas will be submitted with Form 4345. Mitigation sites will use guidance specified in the following documents and other documents as specified by the Corps:

- Corps' RGL 2-02, 24-Dec-02 (<http://www.usace.army.mil/inet/functions/cw/cecwo/reg/rgls/RGL2-02.pdf>).
- UDFCD Criteria Manual, 1999 and 2001 ([http://www.udfcd.org/downloads/down\\_critmanual.htm](http://www.udfcd.org/downloads/down_critmanual.htm)).
- 33CFR Parts 325 and 332, Compensatory Mitigation for Losses of Aquatic Resources, April 10, 2008

### 4.3. Mitigation Success

Riparian mitigation and wetland mitigation will be considered successful and self-sustaining when the following conditions have been met without intervention in the form of irrigation, removal of undesirable vegetation or replanting of desirable vegetation for a three (3) consecutive year period or other time period determined by the Corps:

- At least 80 % of the mitigation site is vegetated, in wetlands at least 50 % of species will consist of species rated as facultative or wetter.
- Trees and shrubs, to include volunteer specimens, will have a survival rate of at least 85%. Species composition shall be representative of species planted.
- Those species shown on the Colorado Noxious Weed Inventory list-A shall be 100% eradicated. Those species shown on list-B shall be no more than 10% or less of the total cover in the mitigation area. The lists can be found at <http://www.ag.state.co.us/CSD/weeds/statutes/weedrules.pdf>.

### 4.4. Mitigation Monitoring

**Table of all projects authorized under this RGP.** Each year before December 31, UDFCD will submit to the Corps a running updated table of all projects authorized under this RGP. The table will include the following columns:

- Project name.
- Corps file number.
- Project location (individual columns with drainage name, county, latitude and longitude).
- Date project and mitigation began.
- Date project and mitigation complete.
- Impacts to waters of the US (individual columns with acres and stream length).
- Successful mitigation of waters of the US (individual columns with acres and stream length).
- Date mitigation determined successful by the Corps.

**Monitoring Report of Each Project.** UDFCD will annually monitor the work and mitigation of each project.

Reports describing the monitoring will be submitted each year to the Corps before December 31 beginning during the calendar year the project and mitigation are completed. For each project, the following information will be included in the report:

- Project name.



- Corps file number.
- Project location (drainage name, county, latitude and longitude).
- Date project and mitigation began.
- Date project and mitigation complete.
- Impacts to waters of the US (in both acres and stream length).
- Successful mitigation of waters of the US (in both acres and stream length).
- Summary of the mitigation plan and standards of success, discussion of success or failure of mitigation, and potential remedial actions proposed to meet standards.
- Short statement and dates of any recent corrective or maintenance activities conducted since the previous report.
- Conclusion summarizing project success, mitigation success, and recommendations.
- Maps and drawings of the project and mitigation areas.
- Photos of the project and mitigation areas, including areas of restored temporary impacts.

#### **4.5. Mitigation Protection**

UDFCD agrees that once the mitigation areas have been constructed and planted, proper precautions will be taken to prevent domestic animals and human activity from adversely affecting them, and there will be no mowing, or other detrimental effects to the mitigation areas.

#### **4.6. Unsuccessful Mitigation**

If, during the *first two years* after initial implementation of mitigation, the site conditions indicate that the success criteria are not likely to be achieved, UDFCD agrees that remedial efforts will be undertaken after consultation between the Corps and UDFCD.

## 5. Permit Conditions

1. This RGP expires on **December 31, 2016**.
2. The information submitted in the application must clearly describe the project so that the Corps can determine whether or not the work complies with the terms, conditions, and limitations of this RGP. The project may not proceed until notification approval has been received from the Corps that the proposed work meets the RGP criteria.
3. UDFCD must maintain the activity authorized by this permit in good condition and in conformance with the terms and conditions of this permit. If UDFCD relinquishes responsibility for construction or maintenance of a project authorized under this RGP, UDFCD must obtain the signature of the new construction/maintenance party, together with that party's assurance of maintenance, and forward the information to the Corps. The Corps must approve the transfer of the responsible party.
4. This RGP may be subject to reevaluation at the discretion of the Corps or UDFCD at any time, but will be reevaluated at least every five (5) years.
5. The Corps has the discretion to require an individual permit on a case-by-case basis. For any activity that the Corps determines to have more than minimal adverse environmental effects, individually or cumulatively, or may be contrary to the public interest, an individual permit may be required.
6. This permit authorizes only projects managed or constructed by UDFCD.
7. The project will not adversely affect hydraulic characteristics of the drainage upstream or downstream of the project.
8. All disturbances associated with the activity will be only the minimal necessary for the completion of the activity.
9. Prior to disturbing an area, at least the upper 6 inches of soil must be salvaged and stockpiled for potential placement at the surface of restored or temporary impact areas, unless the salvaged soil hosts unacceptable weeds.
10. Construction and post-construction BMPs indicated in the UDFCD Criteria Manual will be used on all projects.
11. UDFCD must allow representatives from the Corps to inspect the authorized activity at any time deemed necessary to ensure that it is being or has been accomplished in accordance with the terms and conditions of the permit.
12. No activity is authorized under this permit which is likely to jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Endangered Species Act, or which is likely to destroy or adversely modify the critical habitat of such species, including potential impacts to listed species and critical habitat on the Platte River in Nebraska that may result from depletions associated with these activities. When appropriate, the Corps will consult with the U.S. Fish and Wildlife Service (USFWS) on specific requests to perform work under this RGP when a project may affect a threatened or endangered species.
13. The Colorado Parks and Wildlife (CDPW) has indicated that populations of Northern redbelly dace, common shiner, and Iowa darter can be found on Plum Creek and its tributaries, and should be protected. No work is authorized under this permit on Plum Creek and its tributaries without written clearance from the CDPW stating that the project will not harm these species. CDPW also indicated that Chatfield and Cherry Creek Reservoirs, which are premier walleye fishing lakes and sources of walleye eggs for the state hatchery system, should be protected. No work is authorized under this permit at Chatfield and Cherry Creek Reservoirs without written clearance from the CDPW stating that the project will not harm fish or hatchery systems in the reservoirs.

14. UDFCD agrees to contact the U. S. Fish and Wildlife Service, Office of Migratory Birds, at (303) 236-8171, for permitting requirements prior to the removal or destruction of any bird nest.
15. An activity which may affect historic properties listed, or eligible for listing, in the National Register of Historic Places is not authorized by this RGP until the Corps has complied with the provisions of the April 25, 2005 Revised Interim Guidance for Implementing Appendix C of 33 CFR Part 325 (or until Appendix C of 33 CFR Part 325 is replaced). The applicant must notify the Corps if the activity may affect any historic properties listed, determined to be eligible for listing, or which the applicant has reason to believe may be eligible for listing in the National Register of Historic Places, and will not begin the activity until notified by the Corps that the requirements of the National Historic Preservation Act have been satisfied and that the activity is authorized. In the event that subsurface archaeological resources are encountered during ground disturbing activities, the work will be halted until such resources can be evaluated in consultation with the State Historic Preservation Officer.
16. All imported fill material will be obtained from a non-wetland source.
17. Equipment for handling and conveying materials during construction will be operated to prevent dumping or spilling the materials into the water except as approved herein. Construction equipment will not be operated in flowing water to the maximum extent practicable.
18. All excavated materials, with the exception of that authorized herein, will be placed on an upland site above the ordinary high water line in a confined area, not classified as a wetland, to prevent the return of such materials to the waterway.
19. Concrete trucks will be washed at a site and in such a manner that washwater cannot enter a waterway or wetland.
20. During construction, petroleum products, chemicals, or other deleterious materials will not be allowed to enter or be deposited, in waters of the United States. Precautions will be taken to prevent entry of these materials into waters of the United States.
21. All work in the waterway and on the banks will be performed in such a manner so as to minimize increases in suspended solids and turbidity which may degrade water quality and damage aquatic life outside the immediate area of operation.
22. If and when the Corps has been notified that a permitted activity is adversely affecting fish or wildlife resources or the harvest thereof and the Corps subsequently directs remedial measures, UDFCD will comply with such directions to suspend or modify the activity to the extent necessary to mitigate or eliminate the adverse effect as required.
23. If the Corps is notified that work being performed does not comply with or fall within the scope of this RGP, the responsible party will take immediate steps, as directed by the Corps, to bring the work into compliance with this permit.
24. The Corps may require that additional special conditions be included in any authorization issued under this RGP to avoid, minimize or compensate for adverse environmental impacts.

## 6. Further Information

**1. Congressional Authorities:** UDFCD has been authorized to undertake the activity described above pursuant to Section 404 of the Clean Water Act (33 U.S.C. 1344).

**2. Limits of this authorization.**

- a. This permit does not obviate the need to obtain other Federal, state, or local authorizations required by law.
- b. This permit does not grant any property rights or exclusive privileges.
- c. This permit does not authorize any injury to the property or rights of others.
- d. This permit does not authorize interference with any existing or proposed Federal project.

**3. Limits of Federal Liability.** In issuing this permit, the Federal Government does not assume any liability for the following:

- a. Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes.
- b. Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.
- c. Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.
- d. Design or construction deficiencies associated with the permitted work.
- e. Damage claims associated with any future modification, suspension, or revocation of this permit.

**4. Reliance on Applicant's Data:** The determination of the Corps that issuance of this permit is not contrary to the public interest was made in reliance on the information UDFCD provided.

**5. Reevaluation of Permit Decision.** The Corps may reevaluate its decision on this permit at any time the circumstances warrant. Circumstances that could require a reevaluation include, but are not limited to, the following:

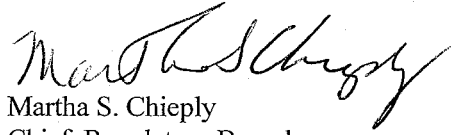
- a. UDFCD fails to comply with the terms and conditions of this permit.
- b. The information provided by UDFCD in support of the permit application proves to have been false, incomplete, or inaccurate (See 4 above).
- c. Significant new information surfaces which the Corps did not consider in reaching the original public interest decision.

Such a reevaluation may result in a determination that it is appropriate to use the suspension, modification, and revocation procedures contained in 33 CFR 325.7 or enforcement procedures such as those contained in 33 CFR 326.4 and 326.5. The referenced enforcement procedures provide for the issuance of an administrative order requiring UDFCD to comply with the terms and conditions of the permit and for the initiation of legal action where appropriate. UDFCD will be required to pay for any corrective measures ordered by the Corps, and if UDFCD fails to comply with such directive, the Corps may in certain situations (such as those specified in 33 CFR 209.170) accomplish the corrective measures by contract or otherwise and bill UDFCD for the cost.

**6. Extensions.** Permit Condition No. 1 establishes a time limit for the application of the activities authorized by this permit. Unless there are circumstances requiring either a prompt completion of the authorized activity or a reevaluation of the public interest decision, the Corps will normally give favorable consideration to a request for an extension of this time limit.

This permit becomes effective when the Federal official, designated to act for the Secretary of the Army, has signed below.

Issued for and in behalf of Colonel Robert J. Ruch, Omaha District Commander





Martha S. Chieply  
Chief, Regulatory Branch  
Operations Division  
Omaha District

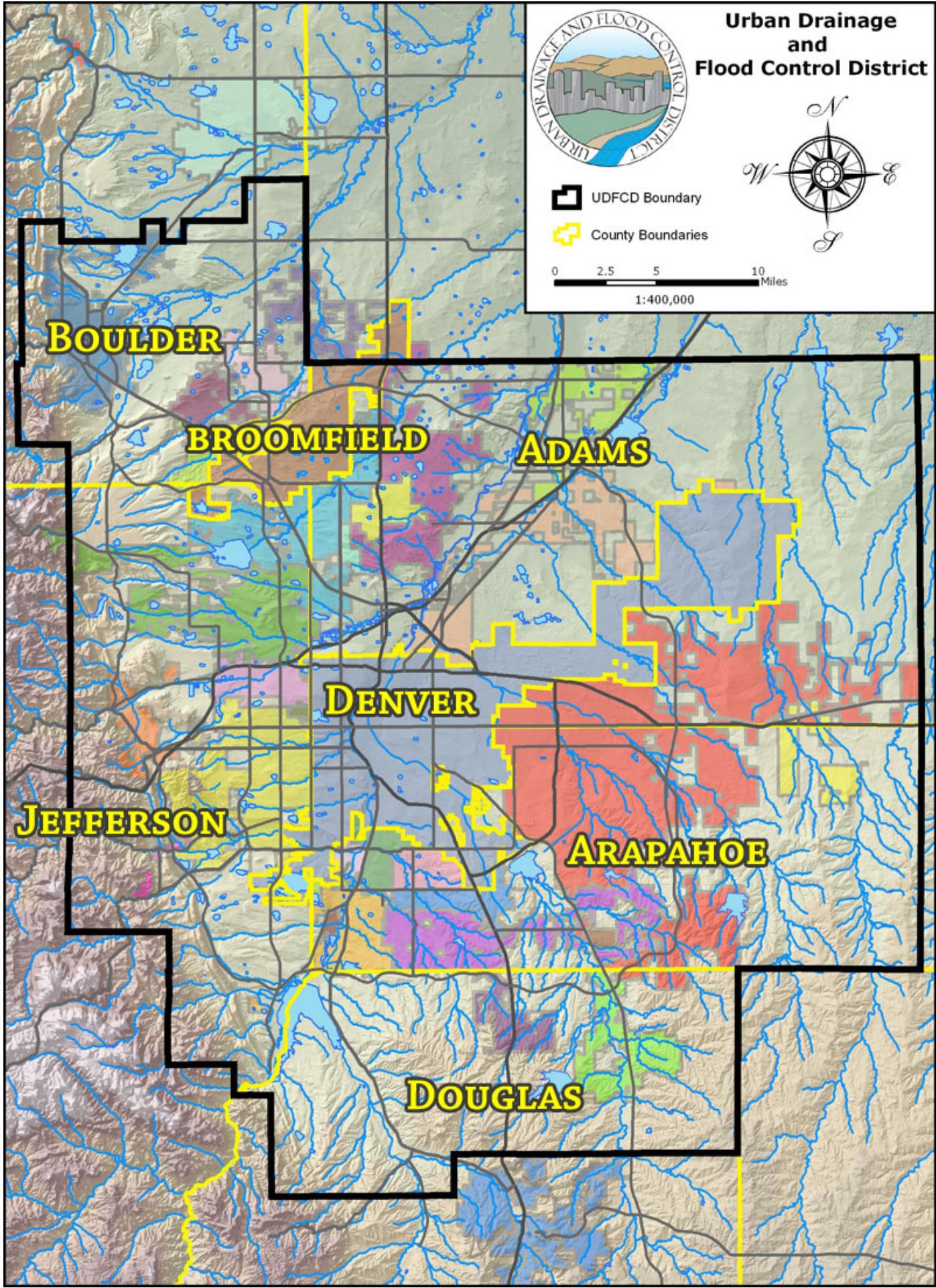
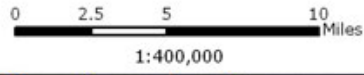
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# Urban Drainage and Flood Control District



-  UDFCD Boundary
-  County Boundaries



**BOULDER**

**BROOMFIELD**

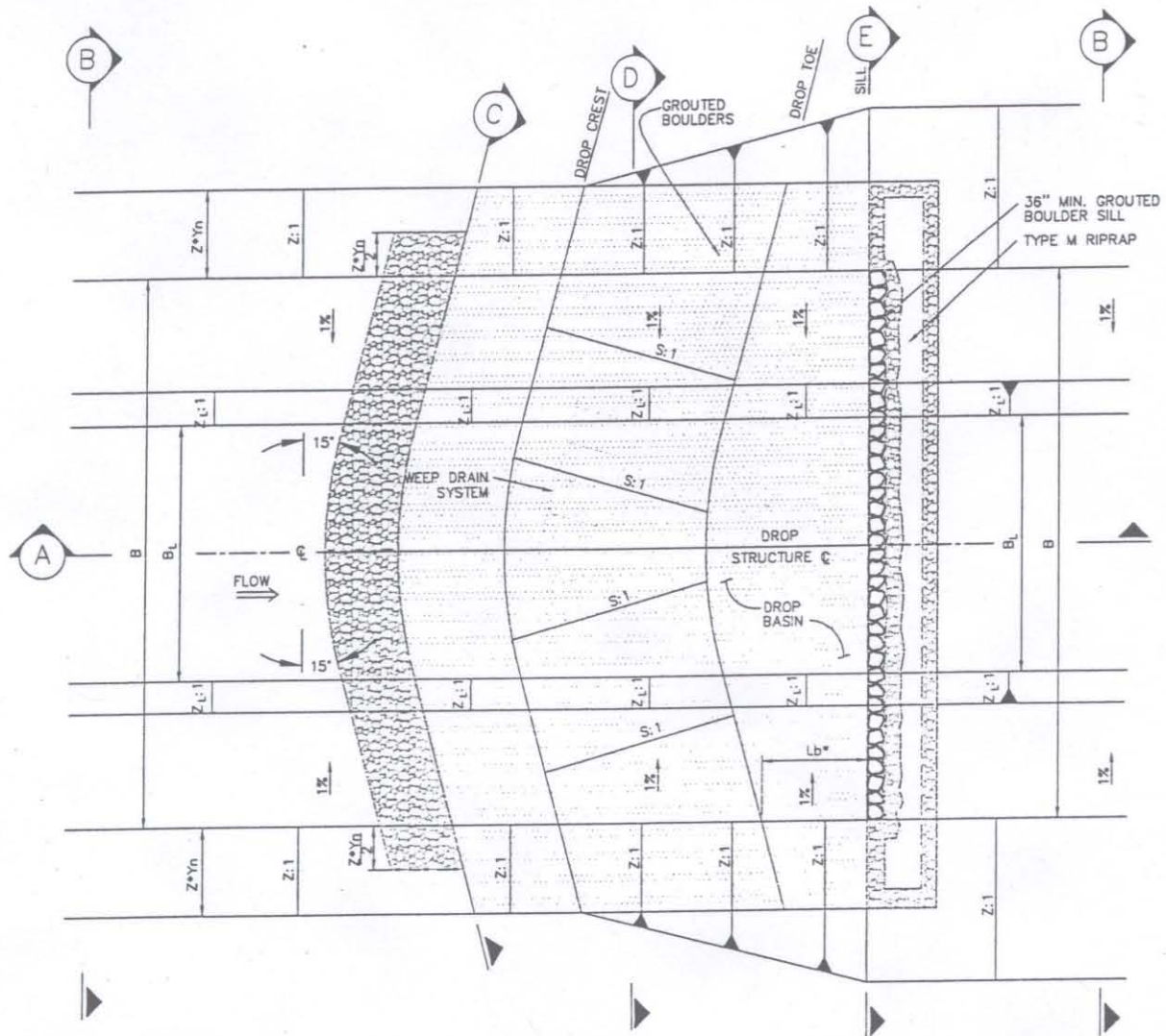
**ADAMS**

**DENVER**

**JEFFERSON**

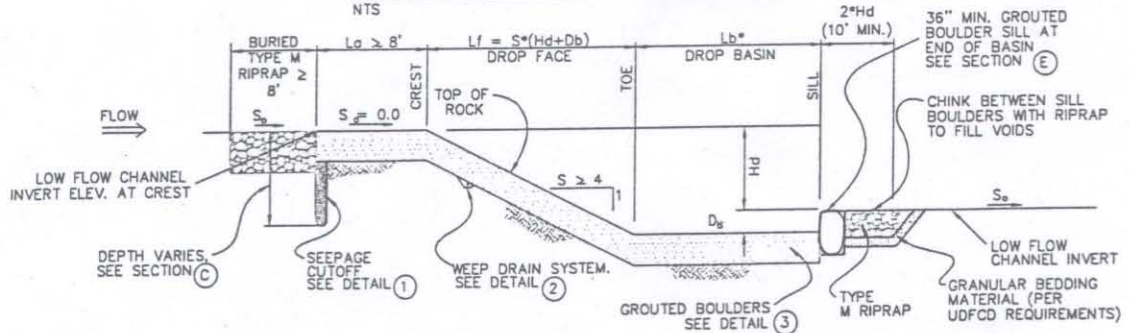
**ARAPAHOE**

**DOUGLAS**



**DROP STRUCTURE PLAN**  
NTS

\*  $L_b = 20'$  FOR ERODIBLE SOILS  
 $L_b = 15'$  FOR NON-ERODIBLE SOILS



**DROP STRUCTURE PROFILE**  
NTS

**Proposed Regional General Permit**  
 For Channel Maintenance and Construction on  
 Tributaries to the South Platte River  
**Grade Control and Drop Structures**  
**Fig. 1-1A**

**GRADE CONTROL STRUCTURES**  
**EXAMPLE: GROUDED SLOPING BOULDER DROP**

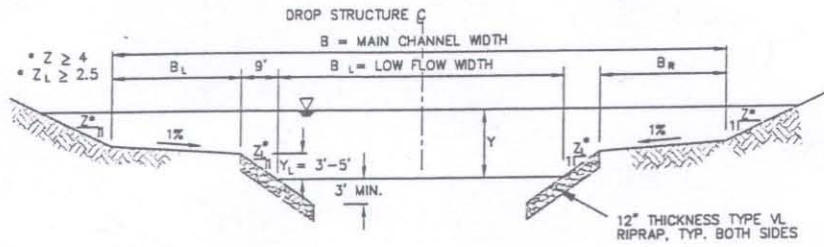
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

DATE: 2/3/03

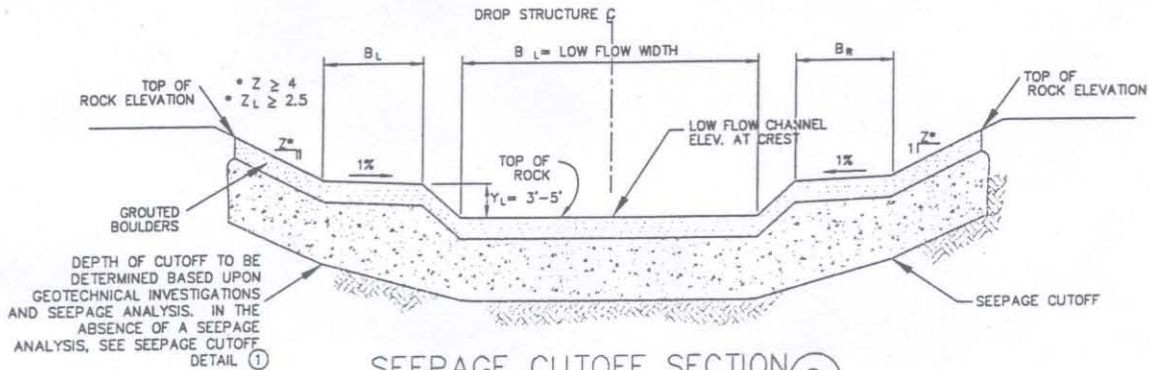
DRAWN: SAM

FIGURE: N/A

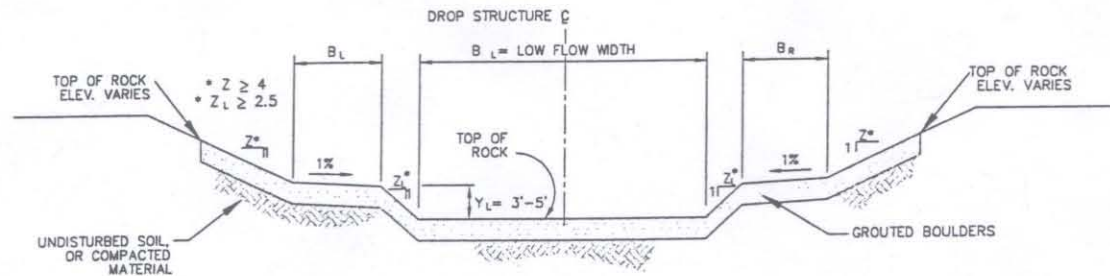




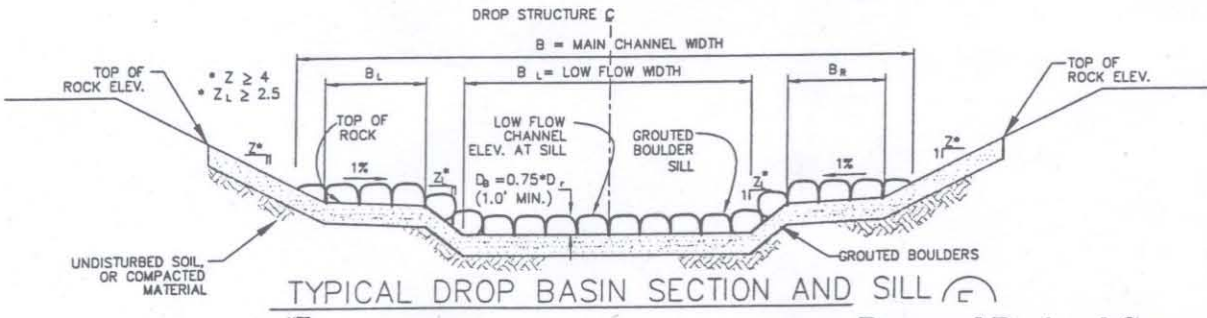
TYPICAL CHANNEL SECTION (UPSTREAM AND DOWNSTREAM OF DROP) (B)  
 NTS



SEEPAGE CUTOFF SECTION (C)  
 NTS



TYPICAL DROP FACE SECTION (D)  
 NTS



TYPICAL DROP BASIN SECTION AND SILL (E)  
 NTS

Proposed Regional General Permit  
 For Channel Maintenance and Construction on  
 Tributaries to the South Platte River  
 Grade Control and Drop Structures  
 Fig. 1-1B

NAME: P:\01-009\15101-009.15-ACT1.dwg p5 DATE: MAR 21, 2003 TIME: 3:18 PM

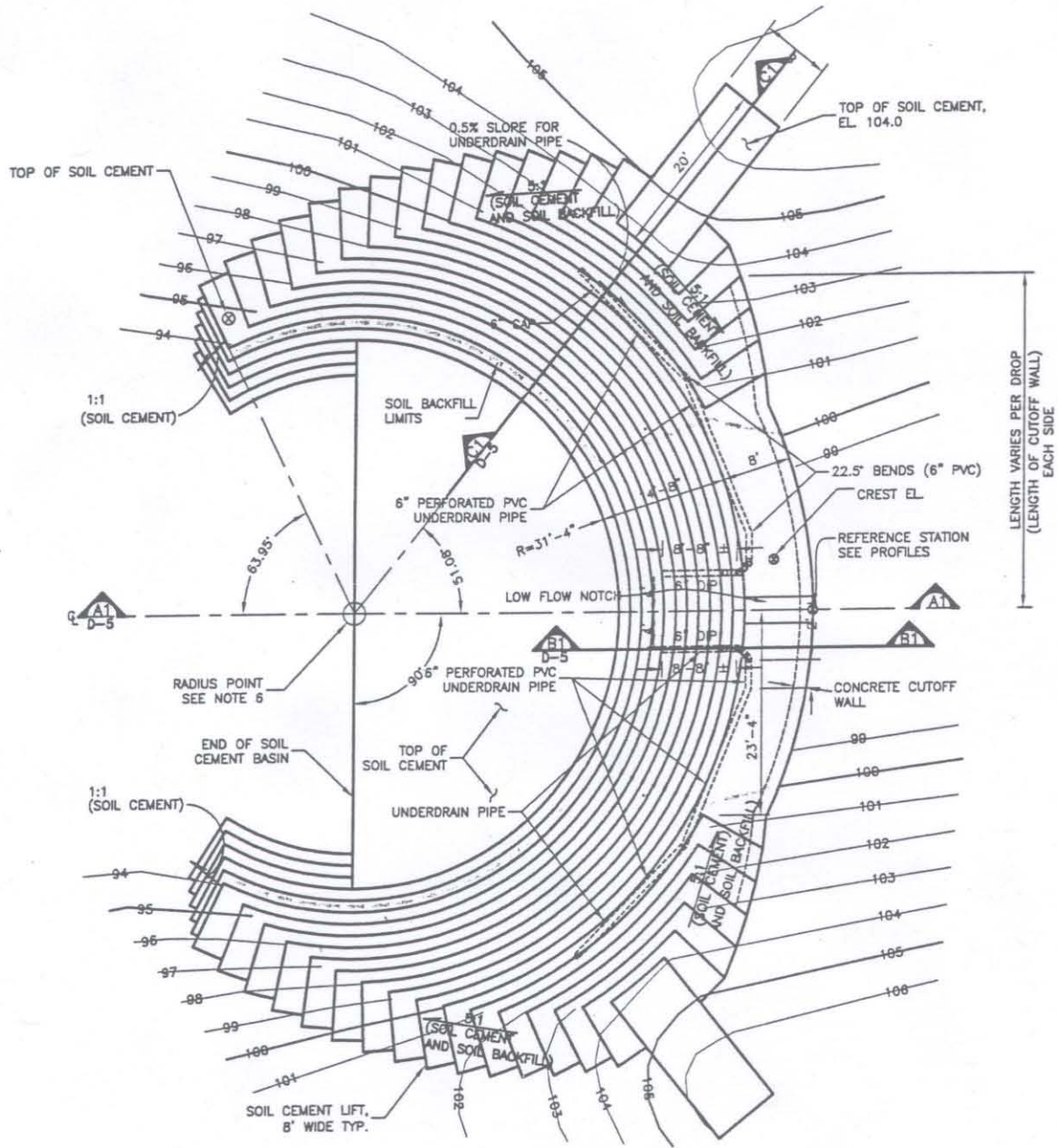


GRADE CONTROL STRUCTURES  
 EXAMPLE: GROUDED SLOPING BOULDER DROP

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

DATE:	2/3/03
DRAWN:	SAM
FIGURE:	N/A





**DROP STRUCTURE PLAN**  
ORIGINAL SCALE 1"=10'

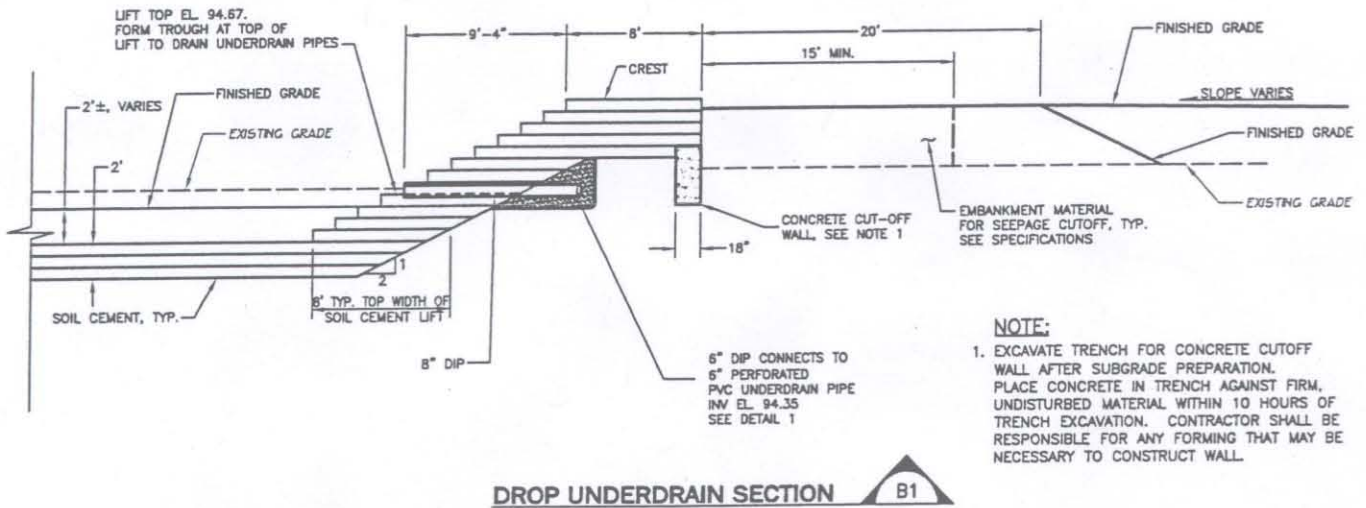
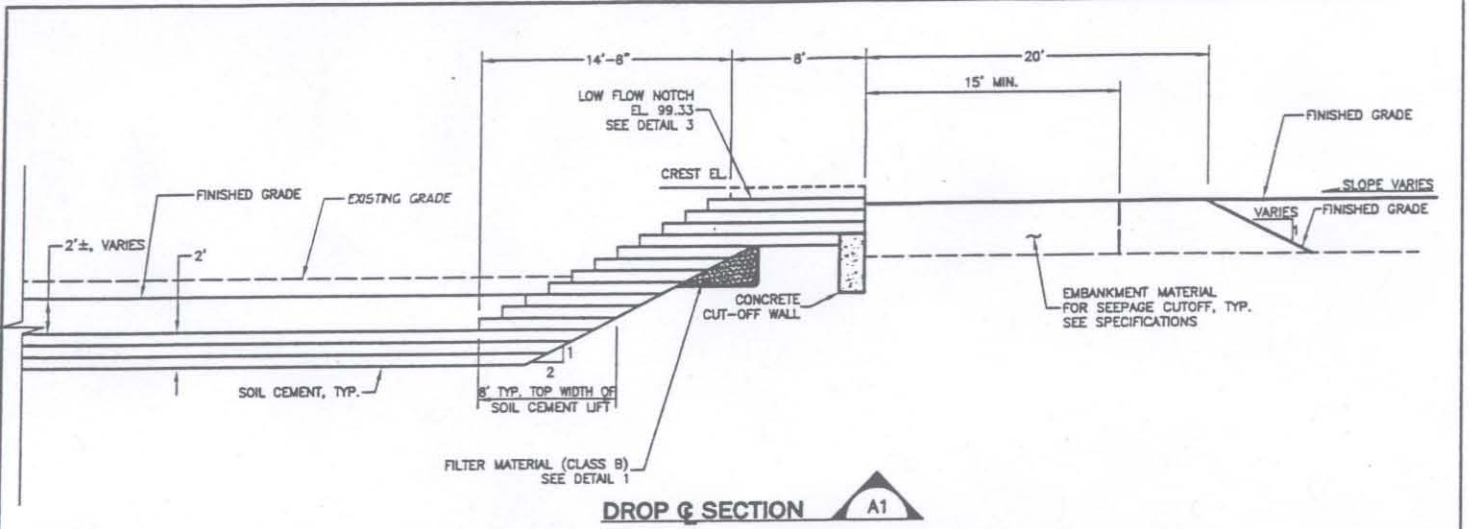
**Proposed Regional General Permit**  
For Channel Maintenance and Construction on  
Tributaries to the South Platte River  
**Grade Control and Drop Structures**  
**Fig. 1-2A**

**GRADE CONTROL STRUCTURES**  
**EXAMPLE: SOIL CEMENT DROP**

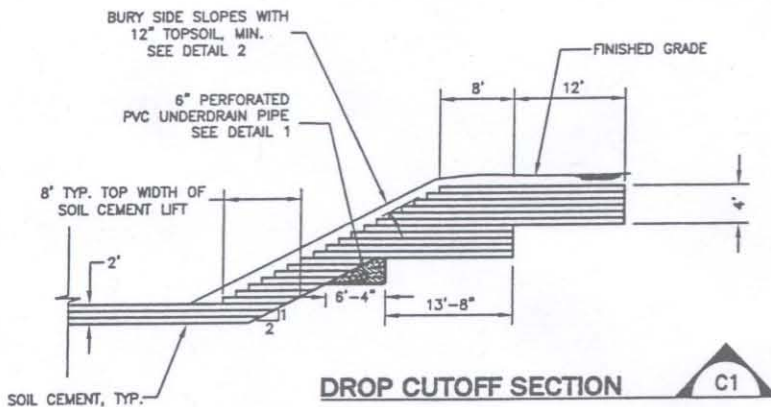
**URBAN DRAINAGE AND FLOOD CONTROL DISTRICT**



SCALE:	N.T.S.
DATE:	3/21/03
DRAWN:	CLW
FIGURE:	N/A



**NOTE:**  
 1. EXCAVATE TRENCH FOR CONCRETE CUTOFF WALL AFTER SUBGRADE PREPARATION. PLACE CONCRETE IN TRENCH AGAINST FIRM, UNDISTURBED MATERIAL WITHIN 10 HOURS OF TRENCH EXCAVATION. CONTRACTOR SHALL BE RESPONSIBLE FOR ANY FORMING THAT MAY BE NECESSARY TO CONSTRUCT WALL.



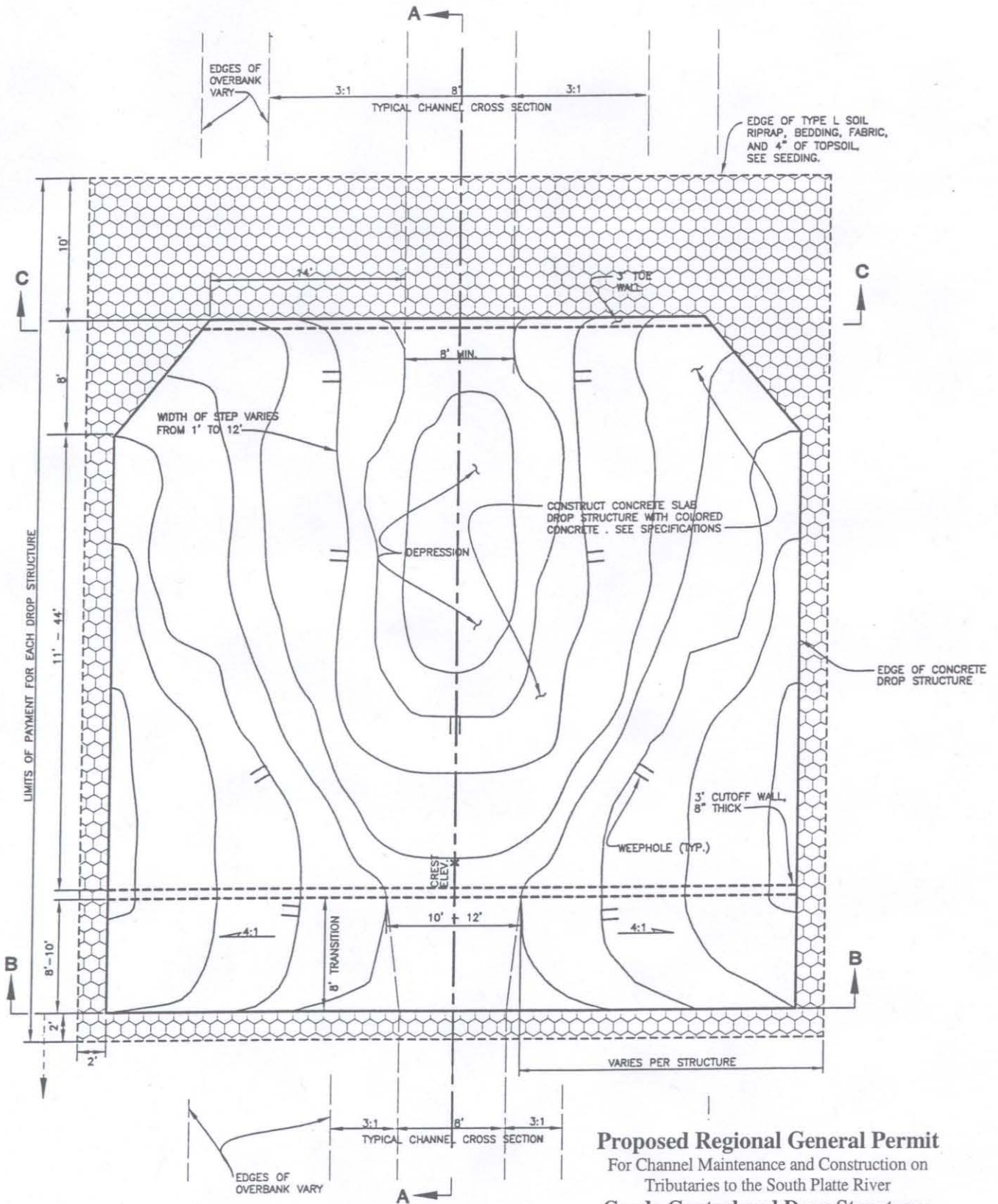
**Proposed Regional General Permit**  
 For Channel Maintenance and Construction on  
 Tributaries to the South Platte River  
**Grade Control and Drop Structures**  
**Fig. 1-2B**

**GRADE CONTROL STRUCTURES**  
**EXAMPLE: SOIL CEMENT DROP**

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

DATE:	3/21/03
DRAWN:	CLJ
FIGURE:	N/A





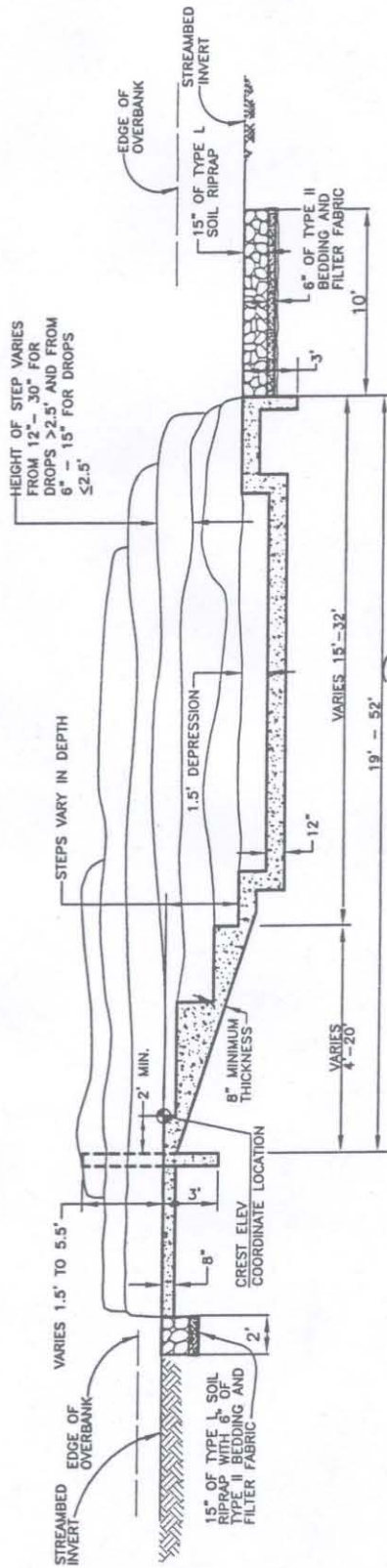
**Proposed Regional General Permit**  
 For Channel Maintenance and Construction on  
 Tributaries to the South Platte River  
**Grade Control and Drop Structures**  
**Fig. 1-3A**

**GRADE CONTROL STRUCTURES**  
**EXAMPLE: SCULPTED CONCRETE SLAB**  
**STRUCTURE PLAN VIEW**

SCALE:	N.T.S.
DATE:	2/3/03
DRAWN:	SAM
FIGURE:	N/A

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT





SECTION A-A  
SCALE 1"=10'  
Note this would exceed the 50' limit

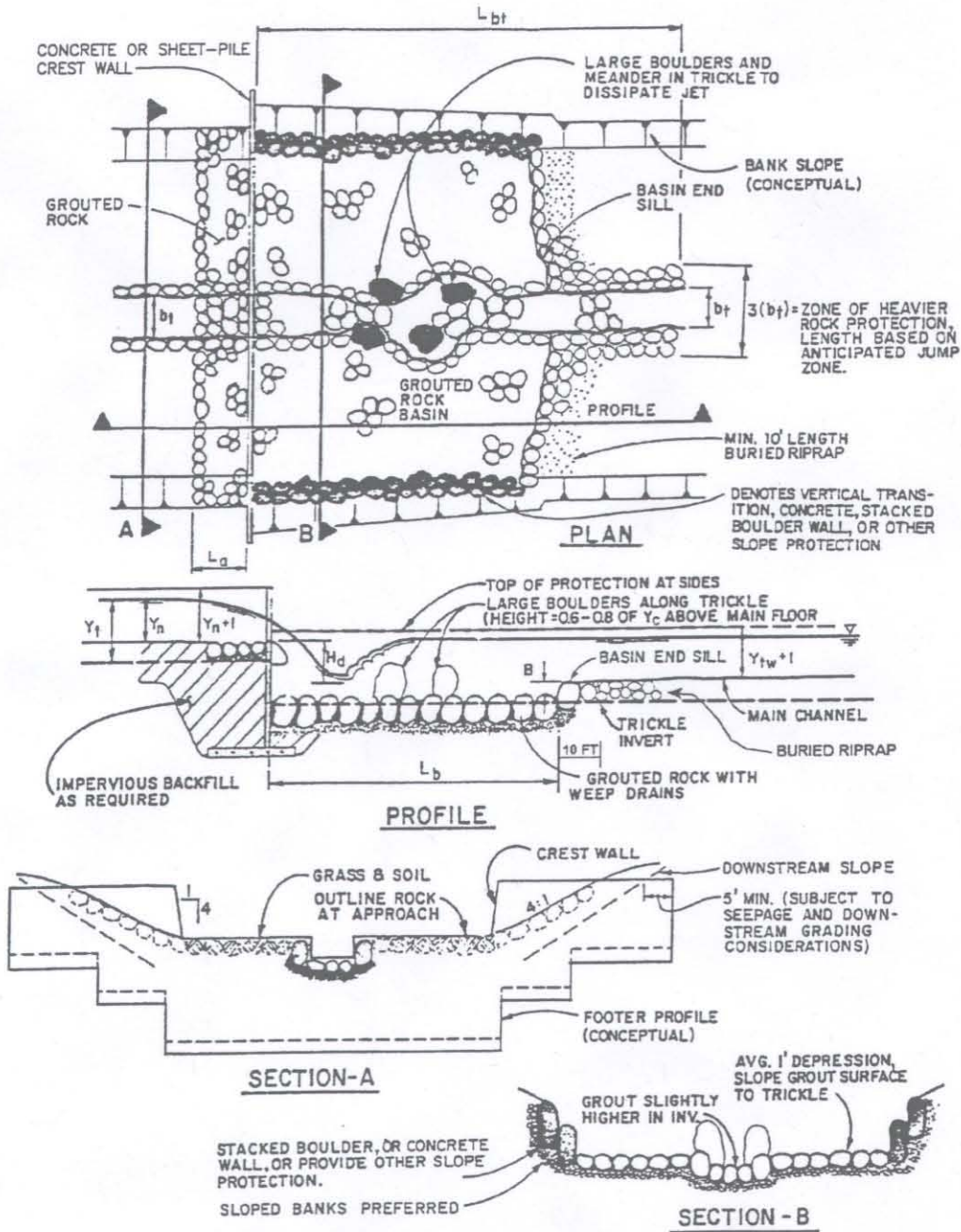
**Proposed Regional General Permit**  
For Channel Maintenance and Construction on  
Tributaries to the South Platte River  
**Grade Control and Drop Structures**  
**Fig. 1-3B**



**GRADE CONTROL STRUCTURES**  
**EXAMPLE: SCULPTED CONCRETE SLAB DROP**  
**STRUCTURE PLAN VIEW**

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

SCALE:	N.T.S.
DATE:	2/3/03
DRAWN:	SAM
FIGURE:	N/A



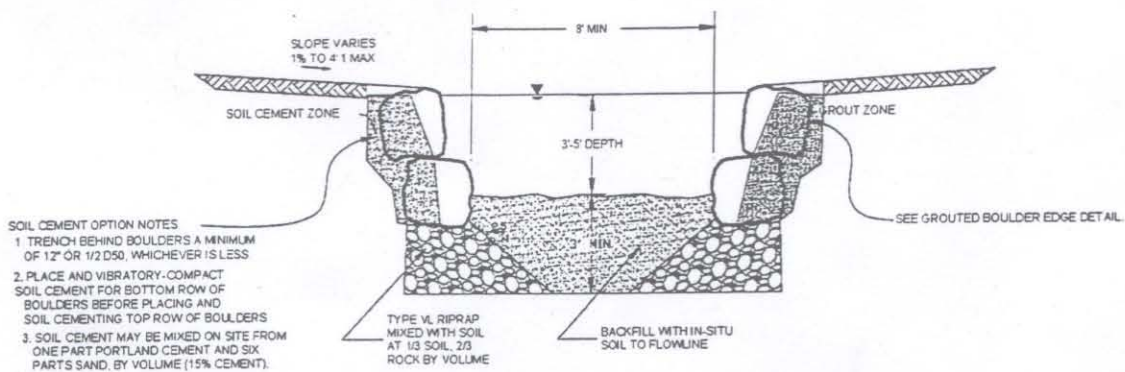
**Proposed Regional General Permit**  
 For Channel Maintenance and Construction on  
 Tributaries to the South Platte River  
**Grade Control and Drop Structures**  
**Fig. 1-4**



**GRADE CONTROL STRUCTURES**  
**EXAMPLE: VERTICAL HARD BASIN DROP**  
**CONCRETE OR SHEET PILE CREST WALL**

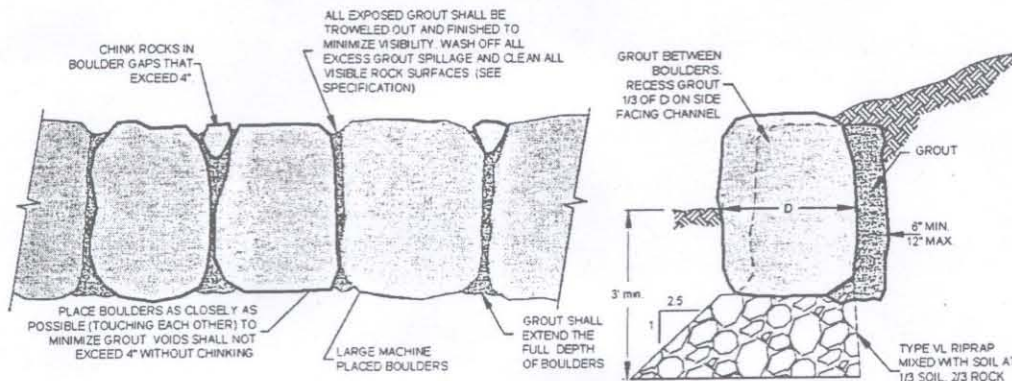
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

SCALE:	N.T.S.
DATE:	2/3/03
DRAWN:	SAM
FIGURE:	N/A



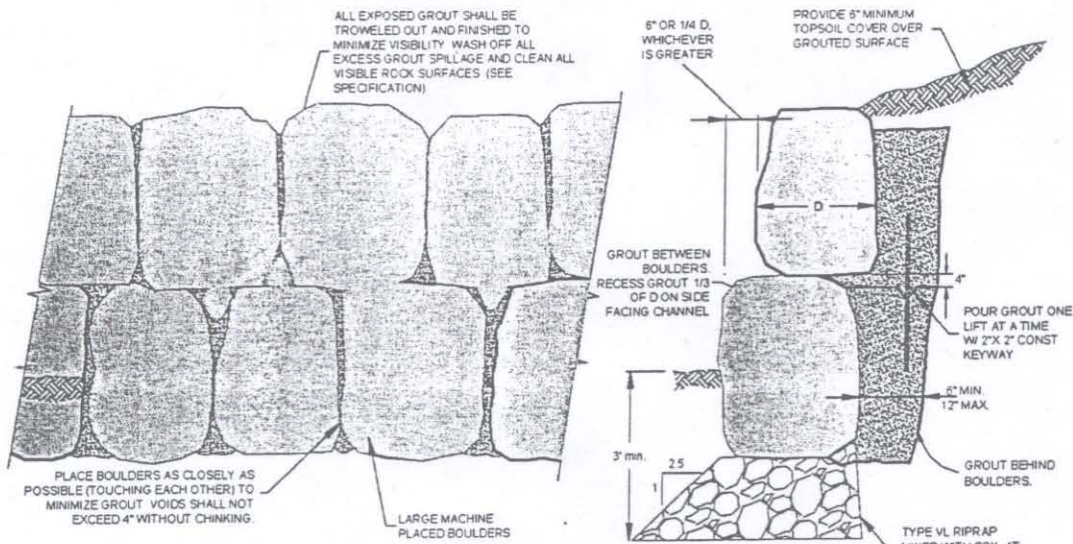
- SOIL CEMENT OPTION NOTES**
1. TRENCH BEHIND BOULDERS A MINIMUM OF 12" OR 1/2 D50, WHICHEVER IS LESS
  2. PLACE AND VIBRATORY-COMPACT SOIL CEMENT FOR BOTTOM ROW OF BOULDERS BEFORE PLACING AND SOIL CEMENTING TOP ROW OF BOULDERS
  3. SOIL CEMENT MAY BE MIXED ON SITE FROM ONE PART PORTLAND CEMENT AND SIX PARTS SAND, BY VOLUME (15% CEMENT).

**BOULDER EDGED LOW FLOW CHANNEL**  
NOT TO SCALE



**ELEVATION SECTION**  
**GROUTED BOULDER EDGE DETAIL**

NOT TO SCALE



**ELEVATION SECTION**  
**GROUTED BOULDER STACKED WALL**

NOT TO SCALE

**Proposed Regional General Permit**  
For Channel Maintenance and Construction on  
Tributaries to the South Platte River  
**Bank Stabilization Controls**

**Fig. 2-1**

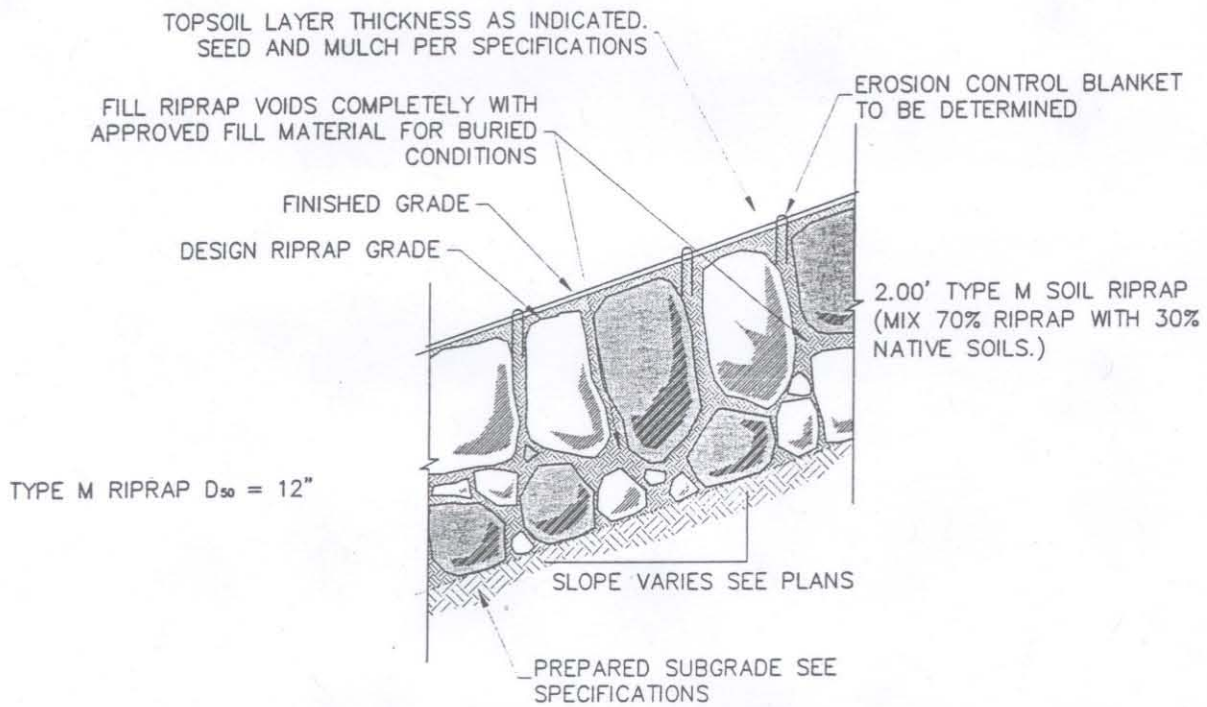
**BANK STABILIZATION**  
**EXAMPLE: BOULDER TOE PROTECTION**  
**DETAILS**

DRAWN:

FIGURE: N/A



L:\CAD LIBRARY\GOVERNMENT ENTITIES\SPECIAL DISTRICTS\UDFCD\UPDATED DETAILS\SOIL-M-RR-FCB.DWG



NOTES:

1. SOIL RIPRAP DETAILS ARE APPLICABLE TO FLAT OR SLOPED AREAS. REFER TO THE SITE PLAN FOR ACTUAL LOCATION AND LIMITS.
2. GENERAL PLACEMENT TECHNIQUES SHOULD RESULT IN LARGER ROCK AT THE SURFACE WITH ROCK SECURELY INTERLOCKED AT THE DESIGN THICKNESS AND GRADE. COMPACTION AND LEVELING SHOULD RESULT IN MINIMAL VOIDS AND PROJECTIONS ABOVE GRADE.
3. RIPRAP SHALL BE MIXED WITH ON-SITE SOIL TO PROVIDE A MIXTURE OF 30% SOIL AND 70% RIPRAP PRIOR TO INSTALLATION.

**Proposed Regional General Permit**  
 For Channel Maintenance and Construction on  
 Tributaries to the South Platte River  
**Bank Stabilization Controls**  
**Fig. 2-2**



**BANK STABILIZATION CONTROLS**  
**EXAMPLE: SOIL RIPRAP WITH**  
**EROSION CONTROL FABRIC**

**URBAN DRAINAGE AND FLOOD CONTROL DISTRICT**

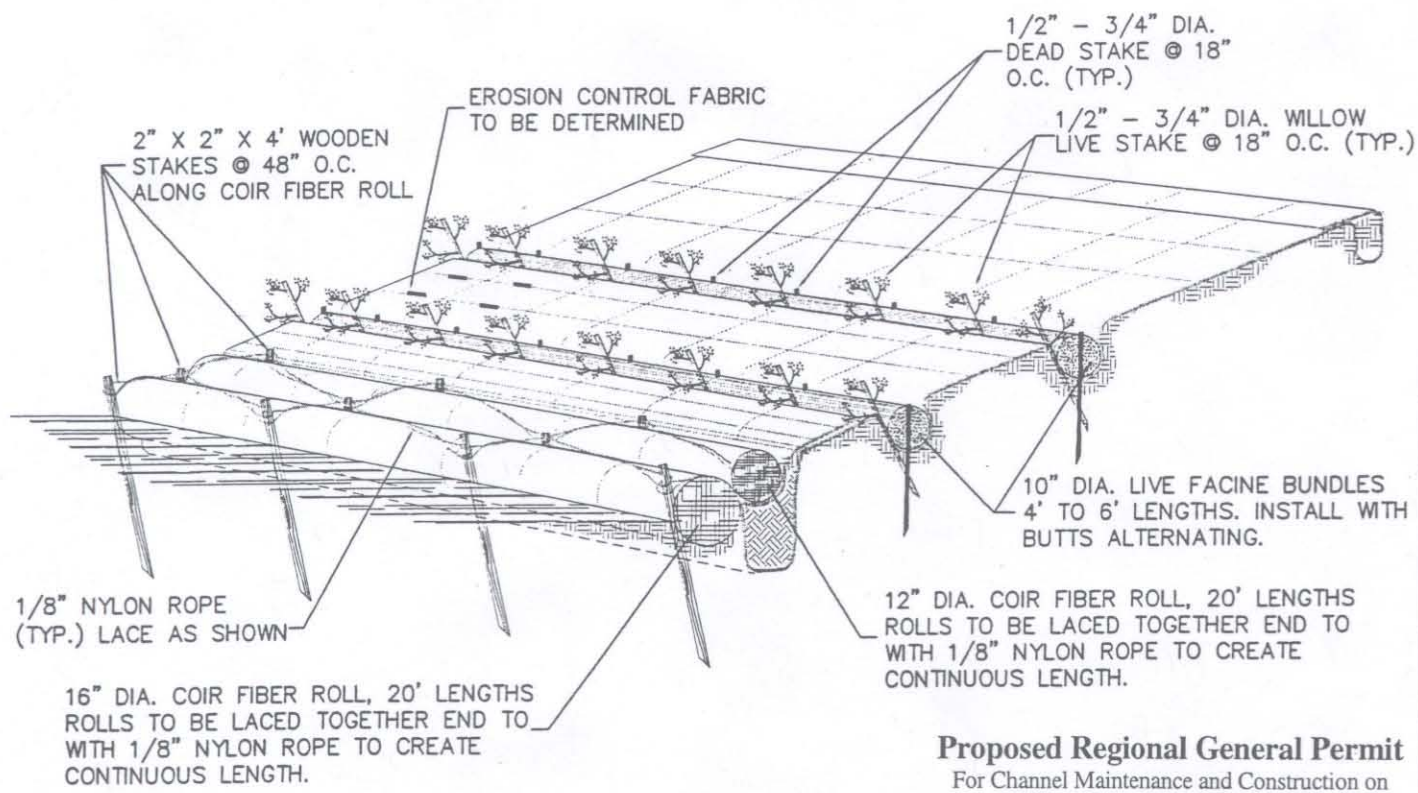
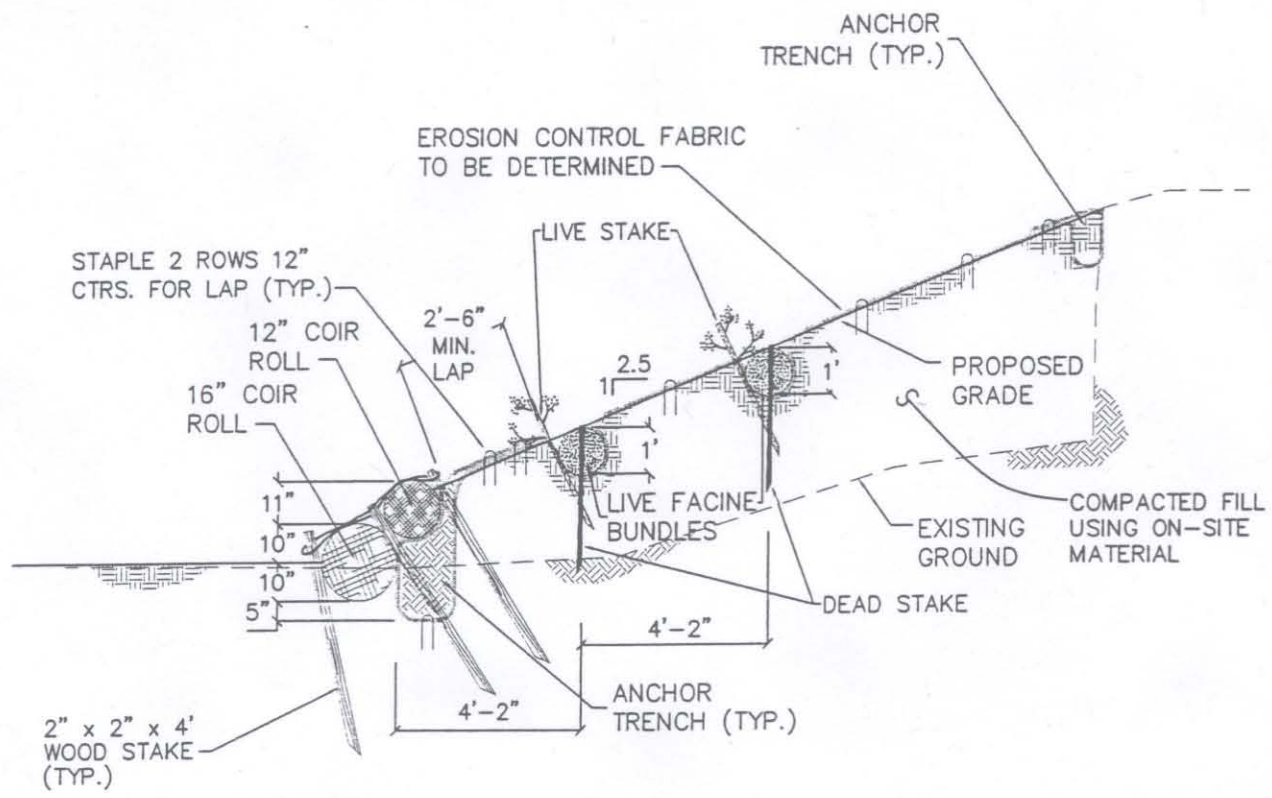
SCALE: N/A

DATE: 10.16.2002

DRAWN: DDB

FIGURE: N/A

L:\CAD LIBRARY\GOVERNMENT ENTITIES\SPECIAL DISTRICTS\UDFCD\UPDATED DETAILS\EC-MAT-2.DWG



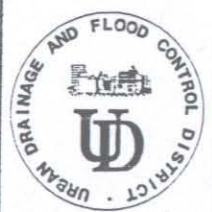
**Proposed Regional General Permit**  
 For Channel Maintenance and Construction on  
 Tributaries to the South Platte River  
**Bank Stabilization Controls**

**Fig. 2-3**

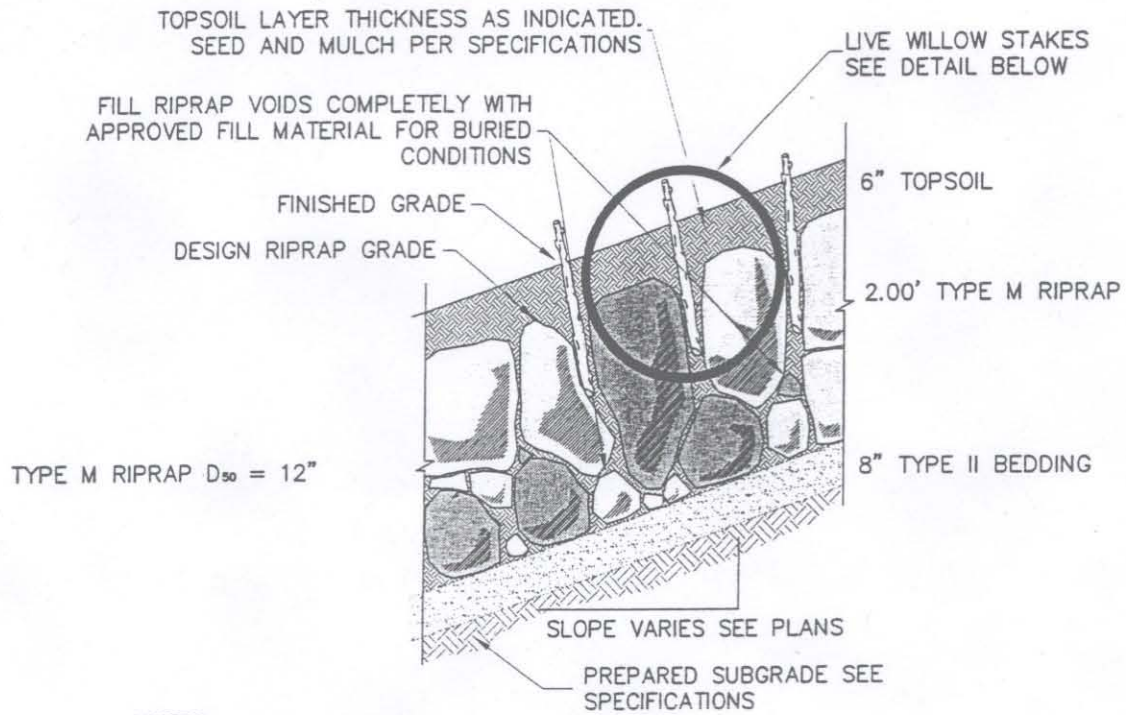
**BANK STABILIZATION CONTROLS**  
**EXAMPLE: BIOENGINEERING BANK STABILIZATION**

**URBAN DRAINAGE AND FLOOD CONTROL DISTRICT**

DATE: 10.16.2002
DRAWN: DDB
FIGURE: N/A

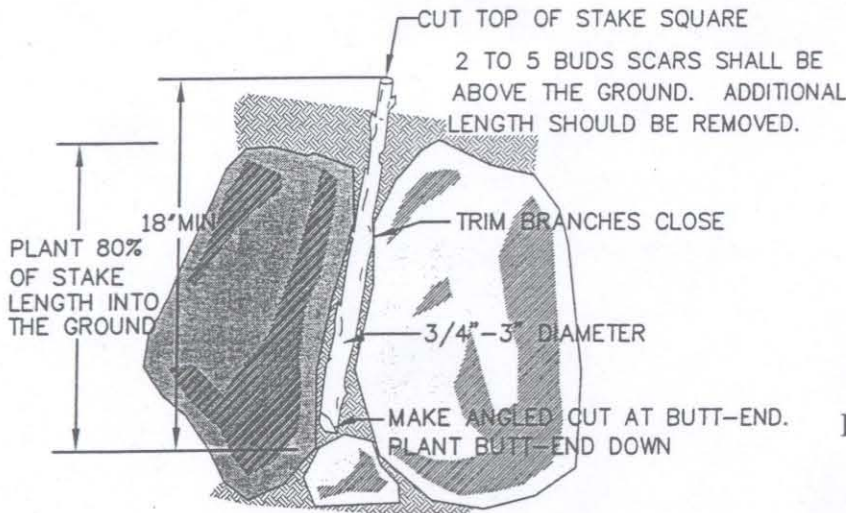






**NOTES:**

1. BURIED RIPRAP DETAILS ARE APPLICABLE TO FLAT OR SLOPED AREAS. REFER TO THE SITE PLAN FOR ACTUAL LOCATION AND LIMITS.
2. GENERAL PLACEMENT TECHNIQUES SHOULD RESULT IN LARGER ROCK AT THE SURFACE WITH ROCK SECURELY INTERLOCKED AT THE DESIGN THICKNESS AND GRADE. COMPACTION AND LEVELING SHOULD RESULT IN MINIMAL VOIDS AND PROJECTIONS ABOVE GRADE.



**LIVE WILLOW STAKE DETAIL**

**Proposed Regional General Permit**  
 For Channel Maintenance and Construction on  
 Tributaries to the South Platte River  
**Bank Stabilization Controls**  
**Fig. 2-4**

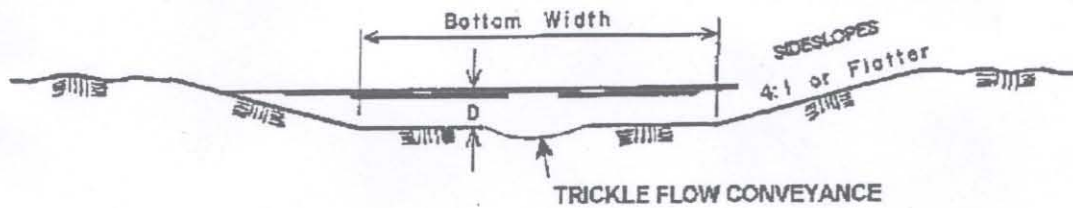
**BANK STABILIZATION CONTROLS  
 EXAMPLE: BURIED RIPRAP  
 WITH LIVE WILLOW STAKES**

**URBAN DRAINAGE AND FLOOD CONTROL DISTRICT**

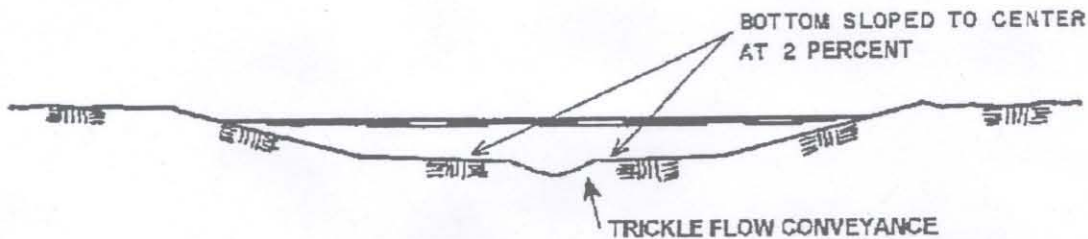


SCALE: N/A
DATE: 10.16.2002
DRAWN: DDB
FIGURE: N/A

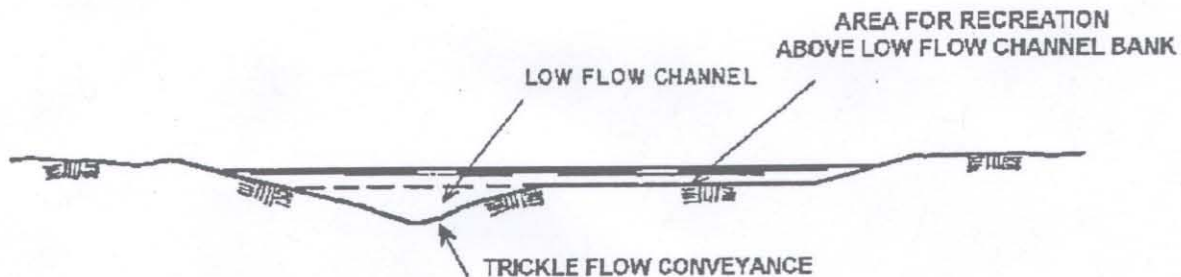
L:\CAD LIBRARY\GOVERNMENT ENTITIES\SPECIAL DISTRICTS\UIDECD\UPDATED DETAIL 5 BUR-M-RR-WS.DWG



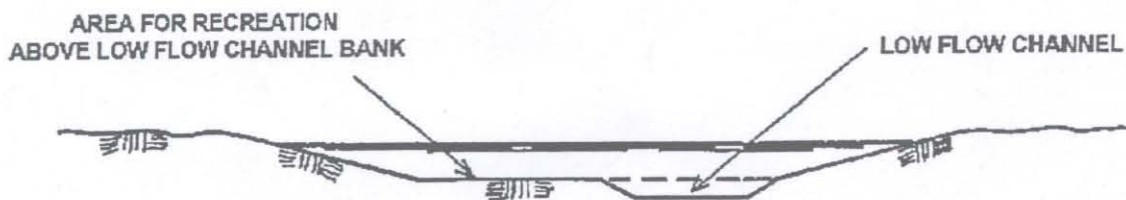
CROSS SECTION WITH OVAL OR SLOPED BOTTOM WITH TRICKLE CHANNEL



CROSS SECTION WITH OVAL OR SLOPED BOTTOM WITH TRICKLE CHANNEL



CROSS SECTION WITH LOW FLOW CHANNEL WITH TRICKLE CHANNEL  
AREA FOR MAJOR DRAINAGE RUNOFF



CROSS SECTION WITH LOW FLOW CHANNEL WITH  
OVERFLOW AREA FOR MAJOR DRAINAGE RUNOFF

**Proposed Regional General Permit**  
For Channel Maintenance and Construction on  
Tributaries to the South Platte River  
**Channel Bottom Linings**

**Fig. 3-1**

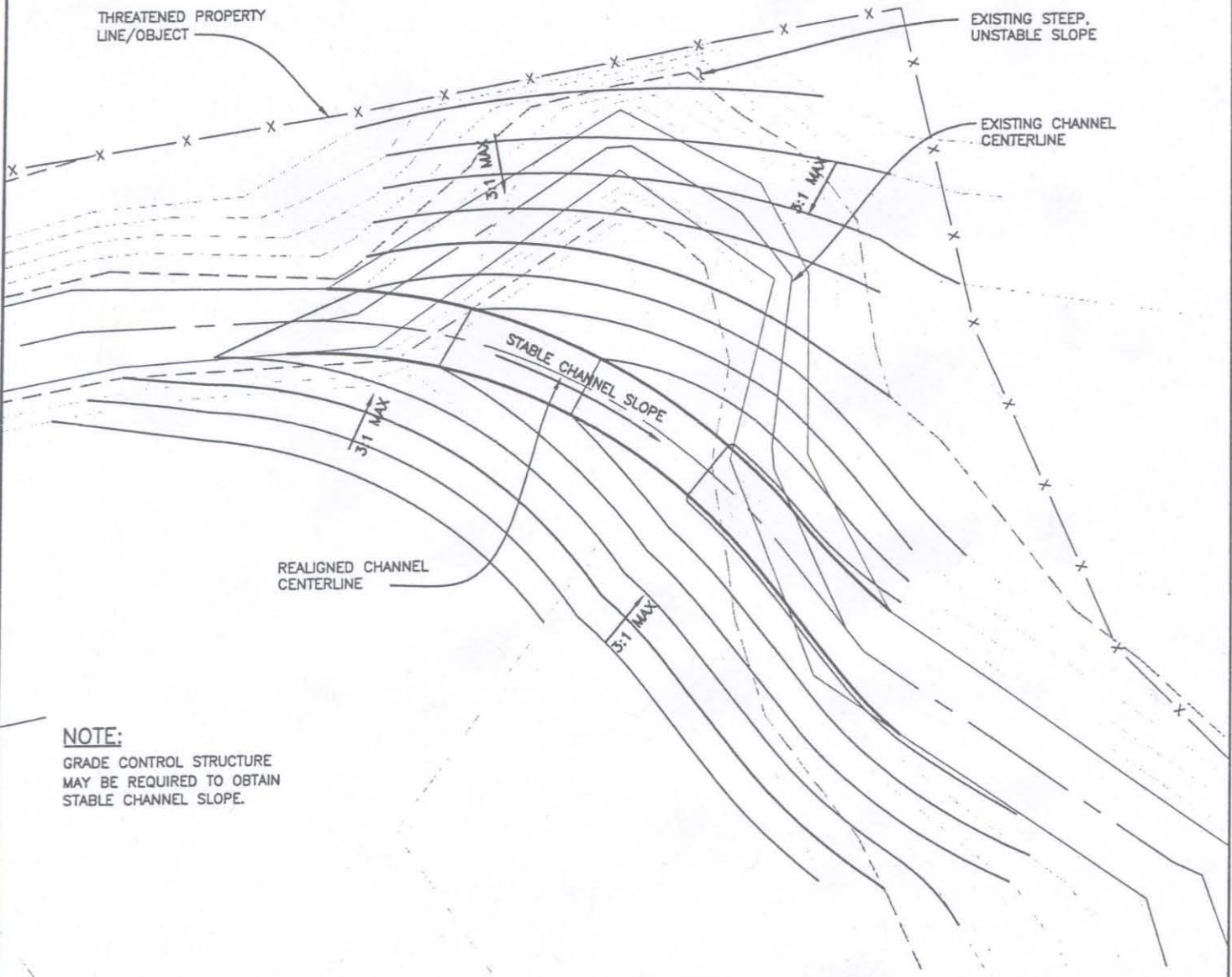
NAME: P:\01-000\15101-009-ACT3.dwg DATE: MAR 21, 2003 TIME: 11:16 AM P1



**CHANNEL BOTTOM LININGS  
EXAMPLE: TYPICAL GRASSED CHANNELS**

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

SCALE:	N.T.S.
DATE:	3/21/03
DRAWN:	CLJ
FIGURE:	N/A



**NOTE:**  
 GRADE CONTROL STRUCTURE  
 MAY BE REQUIRED TO OBTAIN  
 STABLE CHANNEL SLOPE.

**Proposed Regional General Permit**  
 For Channel Maintenance and Construction on  
 Tributaries to the South Platte River  
**Channel Realignment and Reshaping**  
**Fig. 4-1**

NAME: P:\01-009\15\01-009-ACT4.dwg DATE: MAR 24, 2003 TIME: 9:46 AM



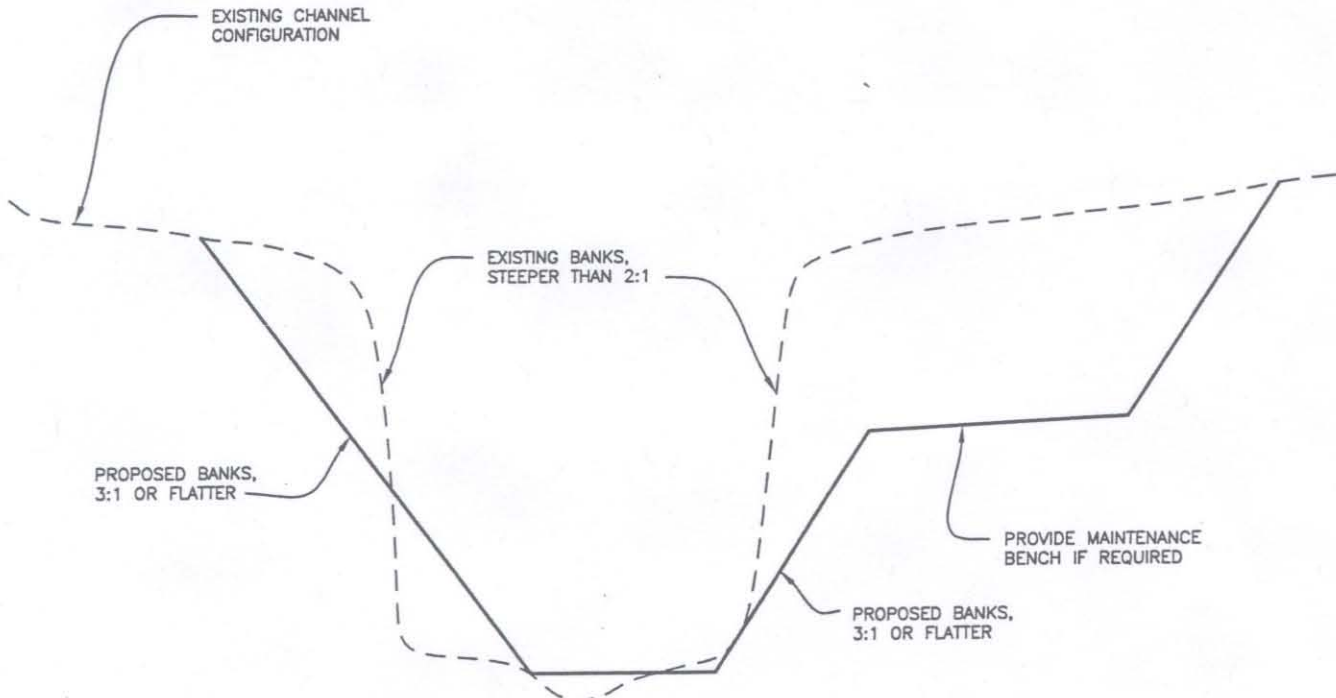
**REALIGNMENT AND RESHAPING  
 OF A CHANNEL  
 EXAMPLE: REALIGN CHANNEL CENTERLINE**

**URBAN DRAINAGE AND FLOOD CONTROL DISTRICT**

SCALE:	N.T.S.
DATE:	03/21/03
DRAWN:	MAM
FIGURE:	N/A

DATE: MAR 25, 2003 TIME: 1:05 PM

NAME: P:\01-000\15101-000-AC1.dwg



**NOTE:**  
 RESHAPE CHANNEL TO MINIMIZE  
 EARTHWORK AND FLOODPLAIN  
 IMPACTS.

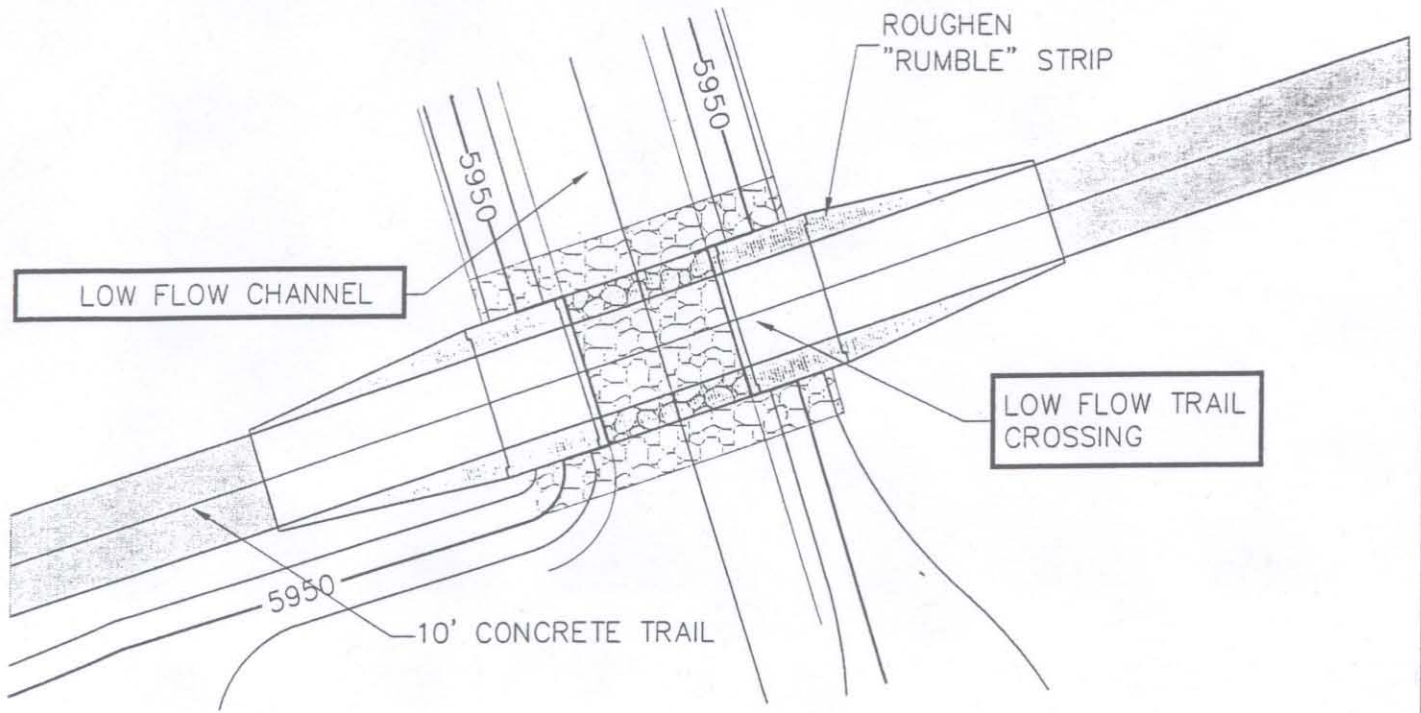
**Proposed Regional General Permit**  
 For Channel Maintenance and Construction on  
 Tributaries to the South Platte River  
**Channel Realignment and Reshaping**  
**Fig. 4-2**



**REALIGNMENT AND RESHAPING  
 OF A CHANNEL  
 EXAMPLE: ADJUST CHANNEL CROSS SECTION**

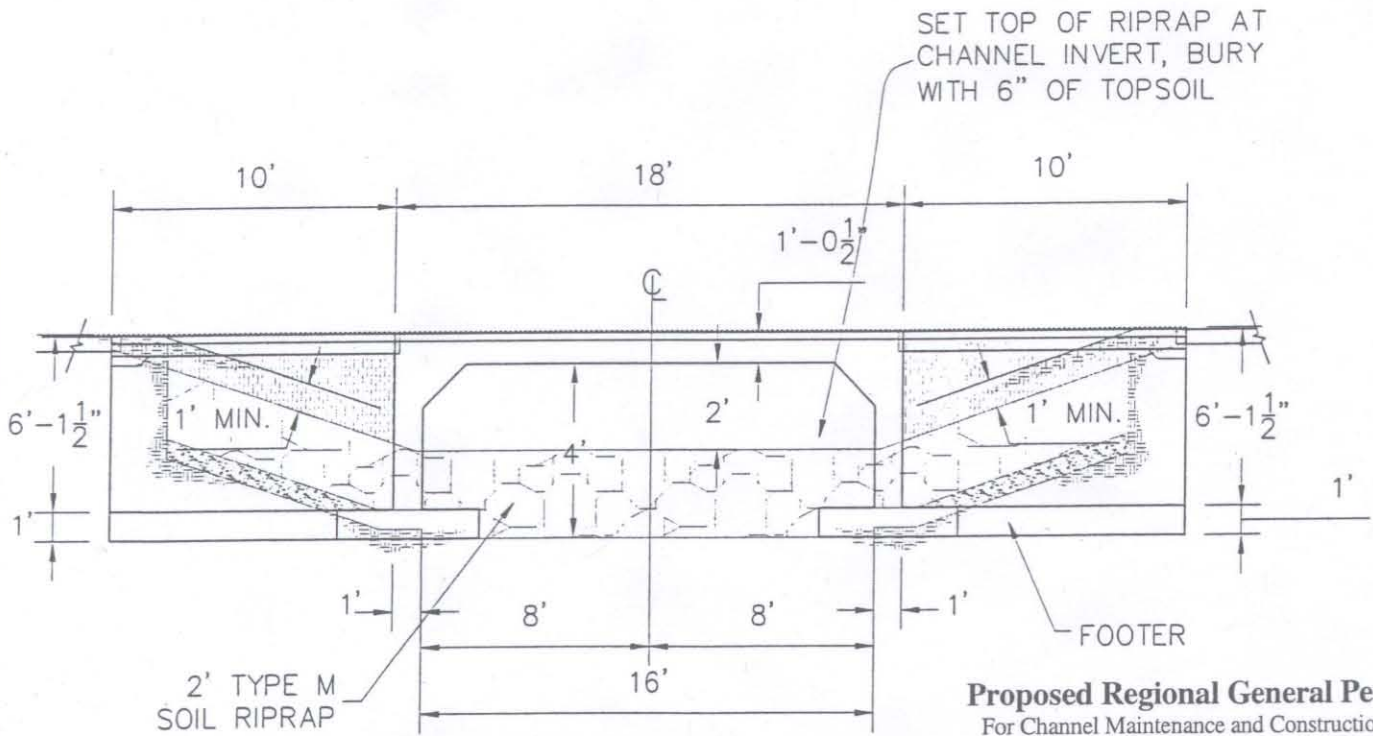
**URBAN DRAINAGE AND FLOOD CONTROL DISTRICT**

SCALE:	N.T.S.
DATE:	03/21/03
DRAWN:	MAM
FIGURE:	N/A



**PLAN VIEW**

N.T.S.



**ELEVATION**

N.T.S.

**Proposed Regional General Permit**  
 For Channel Maintenance and Construction on  
 Tributaries to the South Platte River  
**Culverts and Bridges**

**Fig. 5-1**

3-SIDED-LOWFLOW.COM



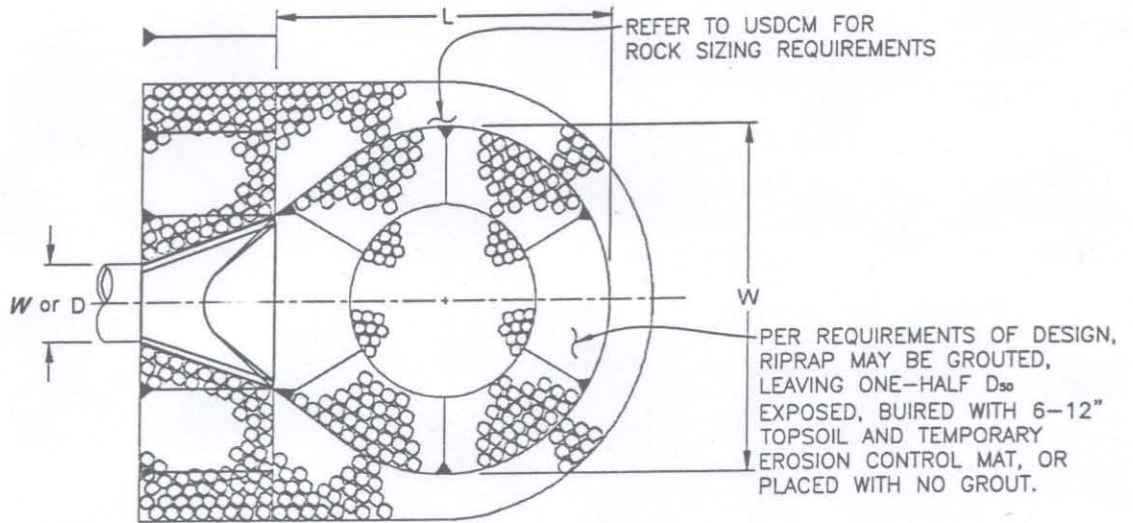
**URBAN DRAINAGE AND FLOOD CONTROL DISTRICT**

SCALE: N/A

DATE: MAR 2003

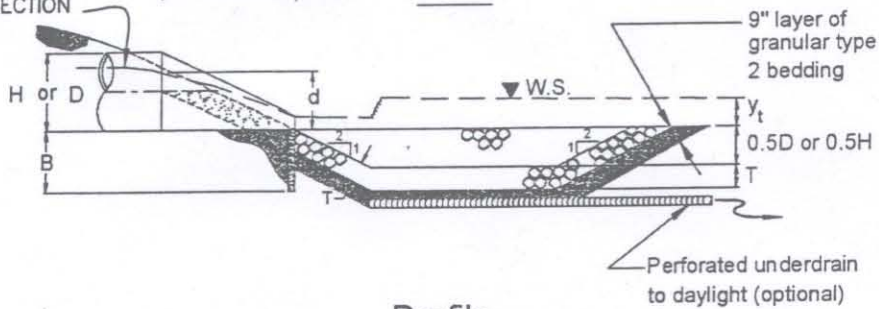
DRAWN: DDB

FIGURE: N/A



Plan

PIPE OUTLET WITH \*  
FLARED END SECTION



Profile

\* Note: For rectangular conduits use a standard design for a headwall with wingwalls, paved bottom between the wingwalls, with an end cutoff wall extending to a minimum depth equal to B

**Proposed Regional General Permit**  
For Channel Maintenance and Construction on  
Tributaries to the South Platte River  
**Pipe Outfalls**  
**Fig. 6-1**

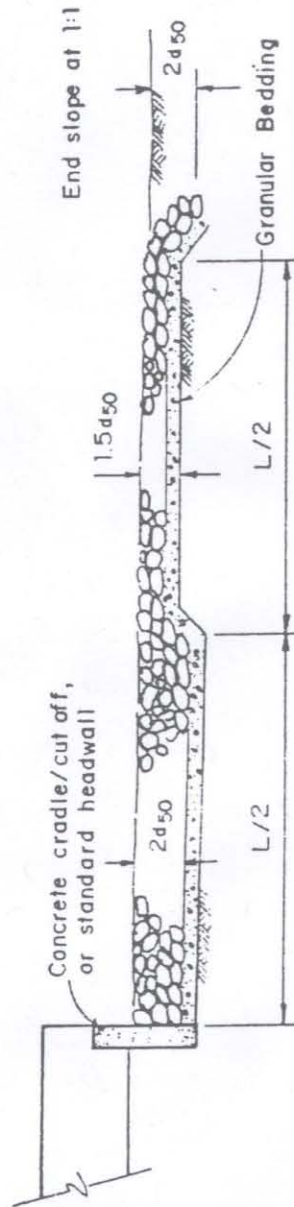
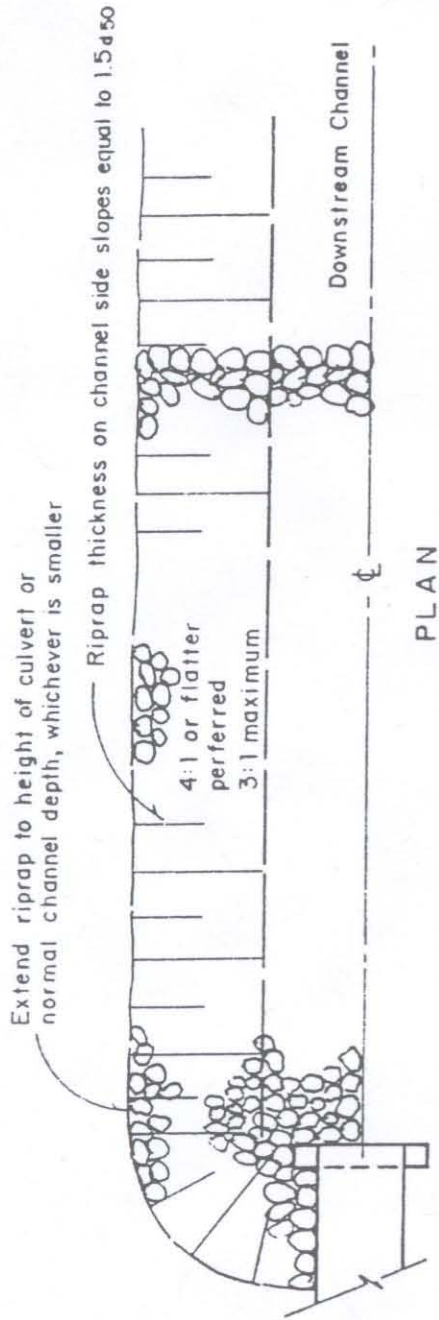
NAME: P:\01-009\15\01-009.15-DET1.dwg p11 DATE: MAR 18, 2003 TIME: 9:15 AM



**PIPE OUTFALLS**  
**EXAMPLE: PIPE OUTLET AND LOW TAILWATER BASIN**

**URBAN DRAINAGE AND FLOOD CONTROL DISTRICT**

SCALE: NTS
DATE: 02/03/03
DRAWN:
FIGURE: N/A



**NOTE:**  
REFER TO USDCM  
FOR RIPRAP D50  
SIZING AND L

FIGURE 5-6. CONDUIT OUTLET EROSION PROTECTION

**Proposed Regional General Permit**  
For Channel Maintenance and Construction on  
Tributaries to the South Platte River  
**Pipe Outfalls**  
**Fig. 6-2**

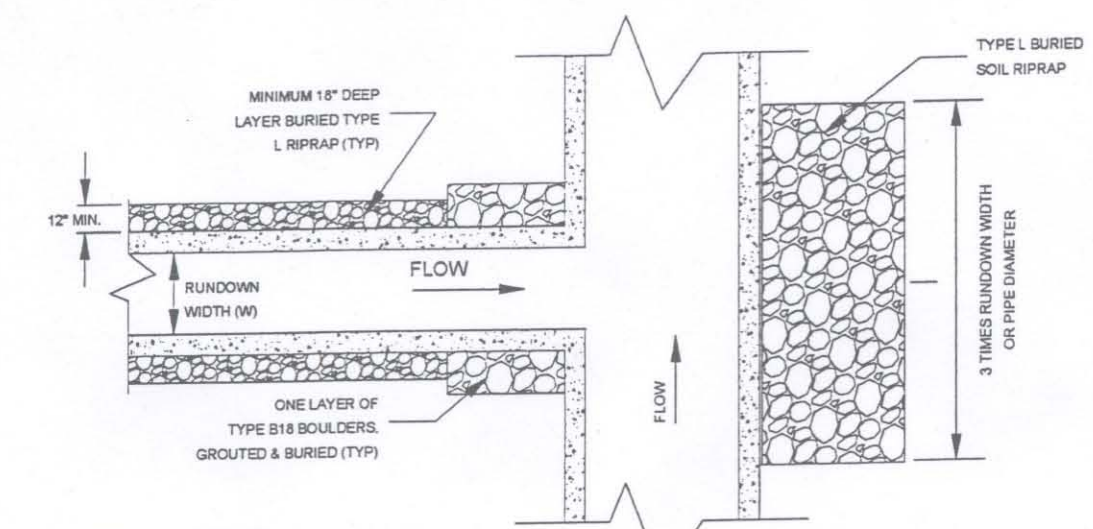


**PIPE OUTFALLS**

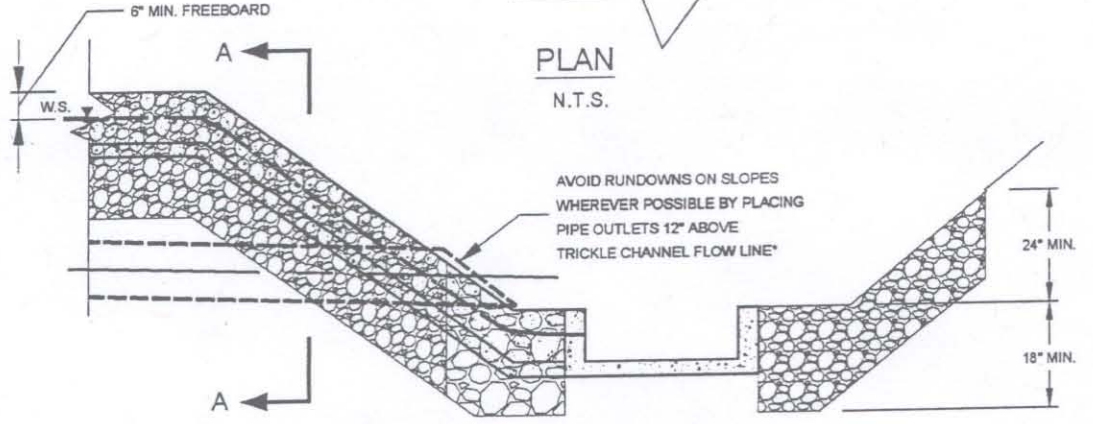
**EXAMPLE: PIPE OUTLET EROSION PROTECTION**

**URBAN DRAINAGE AND FLOOD CONTROL DISTRICT**

SCALE:	N.T.S.
DATE:	03/21/03
DRAWN:	SAM
FIGURE:	N/A



**PLAN**  
N.T.S.



**PROFILE**  
N.T.S.

\* PROVIDE A LOW TAILWATER ENERGY DISSIPATING BASIN AT PIPE OUTLET BEFORE DISCHARGING TO TRICKLE OR LOW FLOW CHANNEL SECTION (SEE STRUCTURES CHAPTER).



**CHANNEL RUNDOWN DETAILS**  
N.T.S.

DETAILS BASED ON THOSE PROVIDED TO DISTRICT BY CITY OF THORNTON, COLORADO

**Proposed Regional General Permit**  
For Channel Maintenance and Construction on  
Tributaries to the South Platte River  
**Channel Rundowns**  
**Fig. 7-1**

\* Provide a low tailwater energy dissipating basin at end of pipe before discharging to

NAME: P:\01-009\15\01-009.15-DET1.dwg p12 DATE: MAR 18, 2003 TIME: 8:42 AM

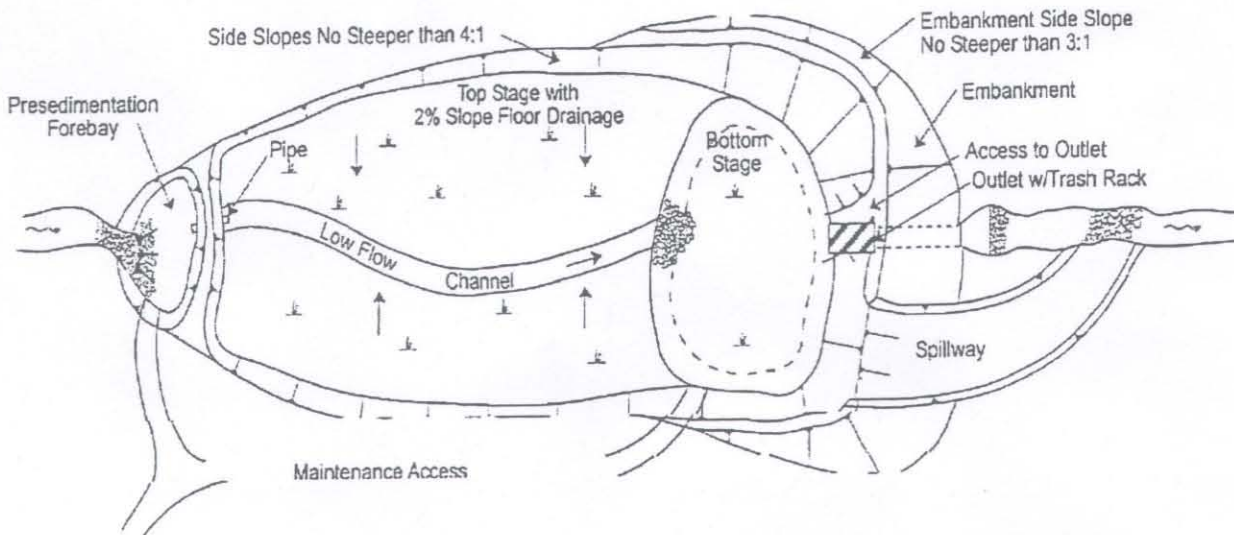


**CHANNEL RUNDOWNS**  
**EXAMPLE: CONCRETE OR BOULDER EDGE**

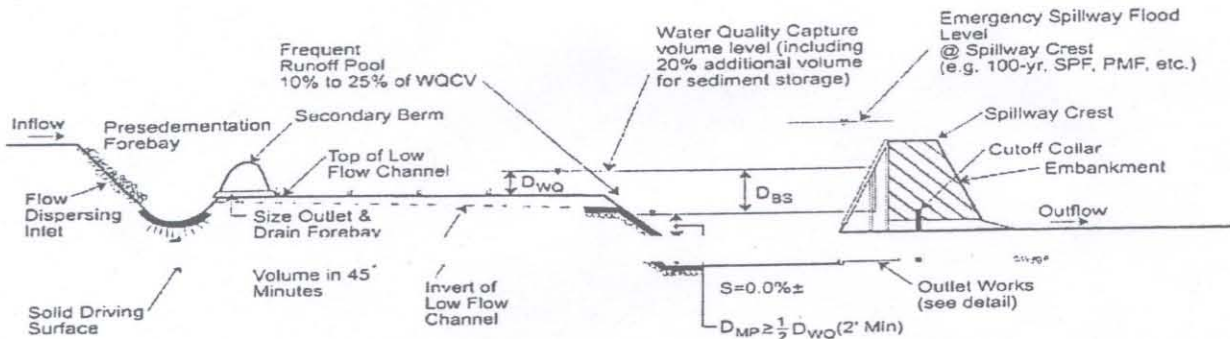
**URBAN DRAINAGE AND FLOOD CONTROL DISTRICT**

SCALE: NTS
DATE: 02/03/03
DRAWN:
FIGURE: N/A





PLAN



SECTION  
NOT TO SCALE

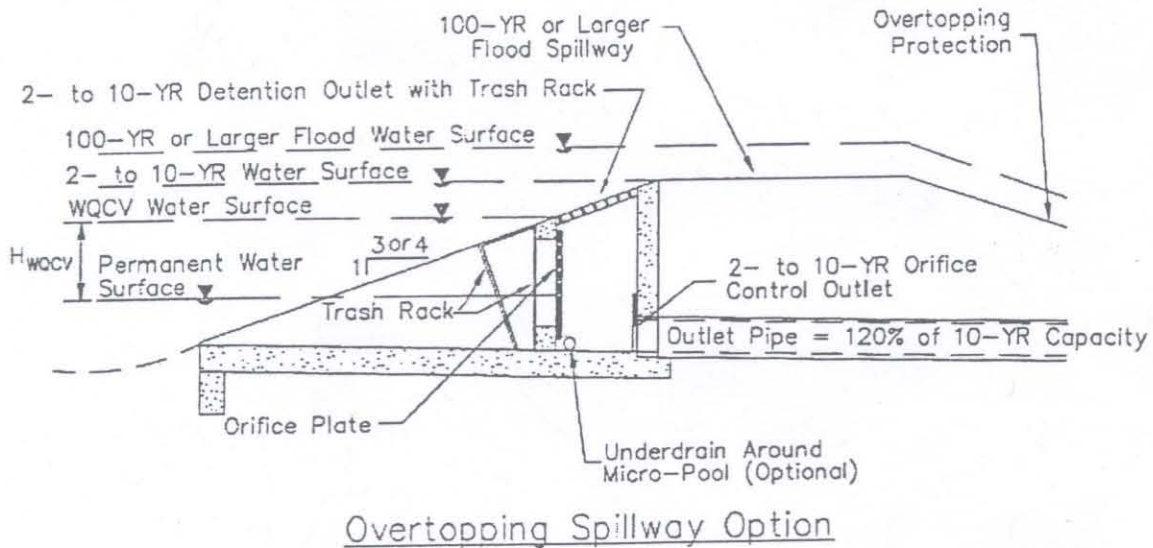
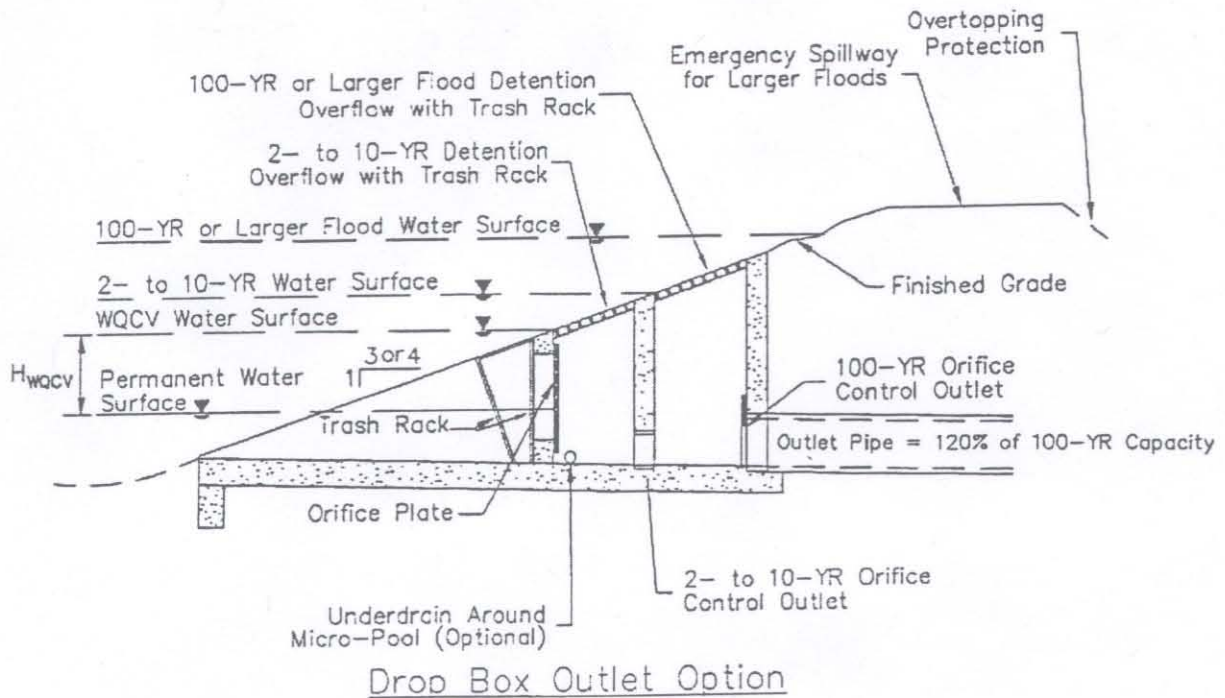
**Proposed Regional General Permit**  
For Channel Maintenance and Construction on  
Tributaries to the South Platte River  
**Stormwater Detention Facilities**  
**Fig. 8-1**

**STORM WATER/ MANAGEMENT FACILITIES**  
**EXAMPLE: FLOOD CONTROL/ DETENTION BASIN**

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

SCALE:	N.T.S.
DATE:	3/21/03
DRAWN:	CLJ
FIGURE:	N/A





**Proposed Regional General Permit**  
 For Channel Maintenance and Construction on  
 Tributaries to the South Platte River  
**Stormwater Detention Facilities**  
**Fig. 8-2**



**STORM WATER/ MANAGEMENT FACILITIES**  
**EXAMPLE: TYPICAL OUTLET STRUCTURE PROFILES**

**URBAN DRAINAGE AND FLOOD CONTROL DISTRICT**

SCALE:	N.T.S.
DATE:	3/21/03
DRAWN:	CLJ
FIGURE:	N/A