SECTION 400 - STORM DRAINAGE DESIGN, GRADING, AND WATER QUALITY TECHNICAL CRITERIA

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SECTION 400 - STORM DRAINAGE DESIGN, GRADING, AND WATER QUALITY TECHNICAL CRITERIA

401 GENERAL PROVISIONS

401.1 Purpose

A. These standards are promulgated by the Public Works Director of the City in accordance with the authority contained in the City Code. Improvements shall also be in conformance with all applicable provisions of the City Code. B. This section presents the minimum design and technical criteria for the analysis and design of storm drainage facilities located within the City. All subdivisions or any other proposed construction, which increase drainage from historic levels or otherwise alters storm runoff shall be subject to these Standards and Specifications. The primary resource for stormwater drainage policy and design is the Urban Drainage and Flood Control District's (UDFCD) Urban Storm Drainage Criteria Manual (UDFCD Manual). The purpose of these Standards and Specifications is to further define the guidelines and/or to identify variations.

C. In addition to the above, these regulations are to establish minimum design criteria for water quality control, flood control, and site grading, which are all closely related to stormwater management.

1. Design Criteria

Storm drainage system analysis and design shall meet or exceed these Standards and Specifications which were developed to support and supplement the policies and standards set forth by the UDFCD. Policies and technical criteria not specifically addressed in this document shall follow the provisions of the UDFCD Manual. The Responsible Party is also referred to the Colorado Department of Transportation's Standard Plans ("M-Standards") for additional design details not covered in these Standards and Specifications or the UDFCD Manual.

2. Review and Approval

a. The Development Engineering Manager shall review submittals as necessary for general compliance with these Standards and Specifications. An approval by the Development Engineering Manager does not relieve the Responsible Party from the responsibility of ensuring that the calculations, plans, specifications, construction, and record drawings are in compliance with these Standards and Specifications.

b. The UDFCD shall approve reports and construction plans for regional detention ponds or Masterplan drainageway improvements as required by this Section or the UDFCD Manual. Where floodplain delineation is involved, UDFCD and FEMA approval is required. All submittals to either UDFCD or FEMA shall be made to the City, who will coordinate the submittal and approval.

402 STORM DRAINAGE DESIGN CRITERIA

402.1 Rainfall

1. Introduction

A. Colorado Urban Hydrograph Procedure (CUHP) or an equivalent method shall be used to generate an inflow hydrographs from watersheds unless a variance is approved by the Development Engineering Manager.

B. Design Storm Distribution

The one (1) hour design point rainfall values obtained from the NOAA Atlas for Thornton are as follows:

TABLE 400-1

ONE (1) HOUR POINT RAINFALL (IN.)

2-YEAR	5-YEAR	100-YEAR
.97	1.38	2.69

402.2 Runoff

A. Introduction

This subsection presents the criteria and methodology for approximating the storm runoff design peaks and volumes to be used in the City in the preparation of storm drainage studies, plans, and facility design.

The details of the rainfall/runoff models are presented in the UDFCD Manual. The specific input data requirements and modifications to the procedures are presented in this subsection.

B. CUHP

The CUHP method or equivalent UDFCD method shall be used to determine stormwater runoff calculations. The procedures for the CUHP, as explained in the Manual, Volume-1 "Runoff," shall be followed in the preparation of drainage reports or plans and storm drainage facility designs in the City.

402.3 Overlot Grading

For residential application (single family detached and duplex), the grading shall be designed so that no more than one lot shall drain through another lot.

402.4 Street Drainage

A. Introduction

The Responsible Party is directed to utilize the UDFCD Manual for allowable use of streets for storm runoff, with the exception that the allowable depth of water at the gutter flowline shall be 12 inches on local and collector roadways and streets shall be designed so that the runoff does not encroach onto residential lots.

402.5 Curb and Gutter

A. The minimum longitudinal slope of a gutter shall be 0.75%.

B. The minimum cross slope of two (2)% for pavement drainage.

C. Concrete cross pans may be used to convey runoff across intersections. However, cross pans will only be permitted at locations where traffic is controlled by a stop sign. The minimum longitudinal slope for cross pans is 0.75%.

402.6 Roadside Ditches

A. Roadside ditches shall not be permitted in lieu of curb and gutter for public right-of-way except in instances where the Responsible Party is only required to construct curb and gutter for one (1) side of the roadway, then roadside ditches are permitted and shall be designed to adequately carry the street runoff caused by the minor storm.

B. Freeboard of six (6) inches is required on all roadside ditches.

C. Roadside ditches shall be designed with maximum side slopes of 4:1 and maximum velocities during the minor storm of five (5) feet per second.

D. Where the requirements of this section cannot be met, curb and gutter and/or storm sewer shall be required.

E. Roadside ditches are not permitted in or adjacent to developed property. Are allowed only on a temporary basis and must be approved by the Development Engineering Manager. The primary function is to convey right-of-way drainage to an approved drainage system or approved drainageway.

402.7 Storm Sewers

A. Introduction

1. Storm sewers must be designed to convey the minor storm without surcharging the pipe. The CUHP method is required to determine the peak flows that the storm sewers must be able to covey. Modeling shall be done using StormCAD or approved equal.

2. All storm sewer infrastructure in public right-of-ways shall be designed for the ultimate cross section of the roadway.

3. The minimum allowable pipe size for all public storm sewer shall be 18 inches.

4. Private owned and maintained detention pond outlet pipes which do not discharge to public right-of-way may be smaller than 18 inches.

B. Vertical Alignment

1. The storm sewer grade shall be such that a minimum cover is maintained to withstand AASHTO HS-20 loading on the pipe. The minimum cover depends upon the pipe size, type and class, and soil bedding condition, but shall be not less than 18 inches for Reinforced Concrete Pipe (RCP) and 24 inches for High Density Polyethylene (HDPE) at any point along the pipe.

2. Refer to Section 200 and 300 for clearance requirements.

3. Uniform slopes shall be maintained between manholes.

C. Horizontal Alignment

The minimum horizontal separation between storm sewers and water mains shall be 10 feet measured from edge of pipe to edge of pipe.

D. Material

Storm sewers within the City shall be constructed using the following material and meet the applicable standard as presented below:

TABLE 400-2

STORM SEWER STANDARDS

Pipe Material	Standard	Application
Reinforced Concrete (ClassIII)	ASTM C-76/C-506/C-507/C-789/C-850 or AASHTO M-170/M-206/M-207/M-259/M-273	Permitted for all public and private storm sewer
High Density Polyethylene Polyvinyl Chloride Pipe	AASHTO M-294/M-252 or ASTM F-667ASTM F-679/F-794/F-1803/D-3212/F-477 or AASHTO M-304	Permitted for all private storm sewer

1. High Density Polyethylene Polyvinyl Chloride Pipe (HDPE)

i. The maximum pipe size for High Density Polyethylene is 48 inch diameter.

ii. The minimum allowable pipe size for all public storm sewer, with the exception of detention pond outlets shall be 18 inches.

iii. The Responsible Party's shall provide calculations for all concrete head and end walls required due to the buoyancy of HDPE.

E. Storm Sewer Hydraulics

All storm sewers shall be designed for the buildout condition of the street as depicted in the current Transportation Plan, and include the five (5) and 100 year HGL. The five (5) year HGL should be completely contained within the pipe and the 100 year HGL must be contained within the overall drainage system but cannot encroach onto any lots.

402.8 Inlets

1. All inlets in sump conditions must provide an emergency overflow that does not encroach upon residential lots. All emergency overflows shall be designed for a major storm and the assumption that the storm sewer system is plugged. In addition, the 100 year ponding shall be shown on grading plans.

2. Care should be taken to not place inlets within areas which will be shadowed during the winter months by structures, landscaping, or fencing along the south side of east-west roadways. This may require additional inlets along north-south roadways to minimize flows to the south side of an east-west street.

A. Types of Inlets

Grate and slotted inlets and are not permitted.

402.9 Manholes

A. Manholes shall be required whenever there is a change in size, direction, elevation, grade, or where there is a junction of two (2) or more pipes.

B. Manhole covers are not permitted within concrete areas (i.e. gutter, sidewalks, crosspans, etc.).

C. Grate or slotted manhole lids are not permitted.

D. A locking ring and cover shall be installed on manholes located below the HGL of the major (100 year) storm. See Section 404 for requirements.

TABLE 400-3

REQUIRED MANHOLE SIZES:

SEWER DIAMETER	MANHOLE DIAMETER
18"	4'
21" to 42"	5'
48" to 54"	6'
60" and larger	CDOT Std. M-604-20 and M-604-21

MAXIMUM SPACING:

VERTICAL DIMENSION OF PIPE (INCHES)	MAXIMUM ALLOWABLE DISTANCE (FEET)
18” to 36”	400’
42” and larger	500’

B. Larger manhole diameters or a junction structure may be required when sewer alignments are not straight through or more than two (2) storm sewers enter the manhole.

D. A locking ring and cover shall be installed on manholes located in open fields. The locking lids shall have McGard Intimidator man locks installed two (2) per manhole, model No. 117011 or approved equal.

402.10 Hyrdaulic Structures

A. Seepage Analysis

Seepage analyses shall be performed on all hydraulic structures (i.e. irrigation ditches, ponds, etc) both existing and proposed which may impact the development. Linings, cut off walls and/or underdrains may be required if seepage is found.

B. Culvert or Storm Sewer Outlet Structures

1. Rip rap or approved equivalent is required at all culvert and storm sewer outfalls as depicted in Detail 400-4. These structures must be designed to minimize or eliminate standing water.

2. Impact Stilling Basins

Reinforced concrete stilling basins are not allowed at culvert outlets unless they are located within a major drainageway which will be maintained by UDFCD. All stilling basins shall be designed to minimize or eliminate standing water.

C. Breach Analysis

A breach analysis is required for all hydraulic structures.

402.11 Post Construction Stormwater Quality

A. Permanent water quality best management practices (BMPs) are required for new or redevelopment projects that disturb greater than or equal to one acre, including projects less than one acre that are part of a larger common plan of development or sale. If water quality detention is required, full spectrum detention pond sizing method shall be utilized per the UDFCD Manual.

B. Acceptable stormwater management practices include those found in the UDFCD Manuals Volume 3 – Water Quality Capture Volume.

C. Consideration for selecting and using stormwater management BMPs for a specific development will include, but not limited to: site applicability, public safety, spatial requirements, soil characteristics, hydrologic benefits, slope, existing land use conditions, maintenance requirements, location within the watershed, buffer requirements, tree protection, and easements. In addition to the items listed above, it is the City's goal to make stormwater features amenities and assets to the overall aesthetics of the City.

402.12 Detention Pond Design

A. Introduction

Detention ponds are used for stormwater runoff quantity control to mitigate the effects of excess runoff due to development. Parking lot and underground detention shall not be permitted in residential subdivisions.

B. Detention Sizing Procedures

1. The method for determining runoff magnitude will be by the CUHP or equivalent methodology. An inflow hydrograph is required for sizing of detention facilities.

2. The Rational Method shall only be used for sites less than 1 acre.

3. Detention ponds that accept stormwater runoff from public right-of-ways shall be designed for the ultimate cross section of the roadway.

4. Water quality detention is required for all development and adjacent rights-of-way if it is not included in the Excess Urban Runoff Volume (EURV) provided by Full Spectrum Detention design method. This is designated as the two (2) year frequency event.

Storage volumes must be calculated using the Full Spectrum Detention Pond sizing method; therefore, the empirical equations and the Modified FAA Procedure may not be used except for preliminary estimating purposes. The 100 year water surface elevation shall be less than residential lots.

C. Forebays

Concrete forebays are not allowed unless it is a regional facility. However, outlet protection to control outfall velocities is required.

D. Outlet Configuration

See Details 400-5A and 400-5B for detention pond outlet structure requirements. Micropools are not allowed except within the outlet structure.

E. Grading Requirements

Side slopes for detention ponds shall not be steeper than four (4) horizontal to one (1) vertical. The minimum bottom slope from storm sewer pipe to outlet box shall be two (2)% measured perpendicular to the trickle channel. In addition, the bottom of the pond shall slope at a minimum of four (4)%. Access is required to all detention ponds, and shall be a minimum of 10 feet wide and a maximum slope of seven (7)%.

F. Trickle Channel or Low flow Channel

Detention ponds may include a low flow trickle channel to convey storm drainage from the culvert outlets to the outlet structure. The trickle channel shall be a "u-style" channel terminating prior to the outlet structure to allow for vegetation to capture sediment and oil.

G. Emergency Overflow Spillways

1. Emergency overflow spillways shall be designed to pass twice the 100 year storm and have one (1) foot of freeboard.

2. The emergency overflow spillway shall be designed to have an overland flow path to convey flows to a designated drainageway or right-of-way, without encroaching onto residential lots.

Emergency overflow spillways shall be constructed of grouted rip-rap buried a minimum of 12 inches.

402.13 Minor and Major Drainage System

Subdivisions shall include the planning, designing, and implementation for both the minor and major drainage systems. The five (5) and 100 year respectively.

A. Downstream Effects

1. The downstream conveyance system shall be evaluated to ensure that it has sufficient capacity to accept design discharges without adverse backwater or downstream impacts such as flooding, erosion, and sediment deposition. Each design must take into consideration travel path to the nearest designated major drainage facility (i.e. creek, river, etc…)

2. Drainage easements may be required from all downstream property owners through which developed stormwater flows are conveyed between the proposed development and an approved drainageway.

3. Runoff from private property should be directed to approved drainageways or public right-of-way. Adverse impacts on adjacent property due to storm or irrigation runoff should be avoided whenever possible. Special procedures such as drainage swales or grading restrictions may be required to minimize impacts.

4. Easement Requirements

The City requires dedicated drainage easements whenever surface or subsurface drainage from public property drains across private property, for detention ponds and for property within the floodplain.

a) Storm sewer shall be installed in dedicated right-of-way or drainage easements, as determined by the Development Engineering Manager. The minimum width requirements for drainage easements are 20 feet or twice the depth of the pipe, whichever is greater. The pipeline shall be centered in the easement and offset a minimum of five (5) feet from any property line. In the event that two (2) or more utilities share the same easement, the minimum width for the easement shall be 30 feet, and for three (3) public utilities, the width shall be 40 feet, etc.

b) Detention ponds both public and private shall be encompassed within a tract with a drainage easement granted over the tract.

c) Floodplains shall be encompassed within a tract with a drainage easement granted over the tract.

403 CONSTRUCTION SPECIFCATIONS

403.1 Pipe Material

A. Storm sewers within the City shall be constructed using the following material and meet the applicable standard as presented below:

TABLE 400-4

STORM SEWER STANDARDS

Pipe Material	Standard
Reinforced Concrete (Class III)	ASTM C-76/C-506/C-507/C-789/C-850 or AASHTO M-170/M-206/M-207/M-259/M-273
High Density Polyethylene Polyvinyl Chloride Pipe	AASHTO M-294/M-252 or ASTM F-667ASTM F-679/F-794/F-1803/D-3212/F-477 or AASHTO M-304

B. Manholes;

1. As depicted on detail 400-3.

2. A locking ring and cover shall be installed on manholes located below the HGL of the major storm.

a. Manholes located outside of the roadway section shall have McGard Fibershield locking lids or approved equal.

b. For manholes located in the roadway section, the locking lids shall have McGard Intimidator man locks installed two (2) per manhole, model No. 11701, or approved equal.

403.2 Pipe Installation

A. Refer to Detail 400-2 for pipe bedding requirements.

D. High Density Polyethylene Pipe (HDPE)

The Responsible Party's shall provide calculations for all concrete head and end walls required due to the buoyancy of HDPE.

403.3 As-Built Certification

The Responsible Party shall provide a final detention pond volume certification, as constructed topographic map of the detention pond, and the final release rates in accordance to drainage criteria.

404 UNDERDRAINS

A. Mains

1. Underdrains are required to be installed in all residential subdivisions. The underdrain main shall connect to the foundation drain system of every residence.

2. Underdrains shall be installed for commercial and industrial subdivisions where they are recommended by the Geotechnical Engineer.

3 The underdrain main shall be the responsibility of the Homeowners' Association or the Business Owners' Association and will not be owned or maintained by the City.

4. Underdrain main shall be installed in accordance with the approved construction plans, prepared under the direction of a registered professional engineer.

5, Underdrain main shall be a minimum of six (6) inches, and constructed of black HDPE.

6. Underdrain pipes shall be placed in a trench approximately one (1) to one and one-half (1-1/2) feet below sanitary sewer main.

7. Underdrain main shall be provided with a minimum of 6 inch clean-outs.. Underdrain cleanouts will not be permitted in public storm or sanitary sewer manholes.

8. If groundwater is present, underdrain pipe may be perforated in the lower quadrants and shall be contained within a geotextile fabric.

9. The underdrain system shall discharge directly to the detention pond, and shall not discharge into any part of the storm or sanitary sewer system.

B. Services

1. A minimum of four (4) inch HDPE pipe is required for underdrain services. Underdrain services shall be black HDPE pipe, with cleanouts as appropriate,

2. Underdrain services shall be the responsibility of the Owner.

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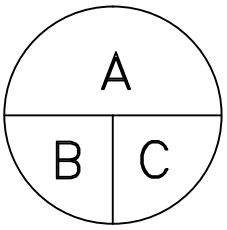
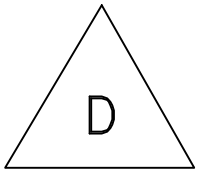


A=BASIN DESIGNATION

B=AREA IN ACRES

C=COMPOSITE RUNOFF COEFFICIENTS



D=DESIGN POINT DESIGNATION

SUMMARY RUNOFF TABLE
(TO BE PLACED ON DRAINAGE PLAN)

DESIGN POINT	CONTRIBUTING AREA (ACRES)	RUNOFF 5YR (CFS)	PEAK 100YR (CFS)
XX	XX.XX	XX.X	XX.X

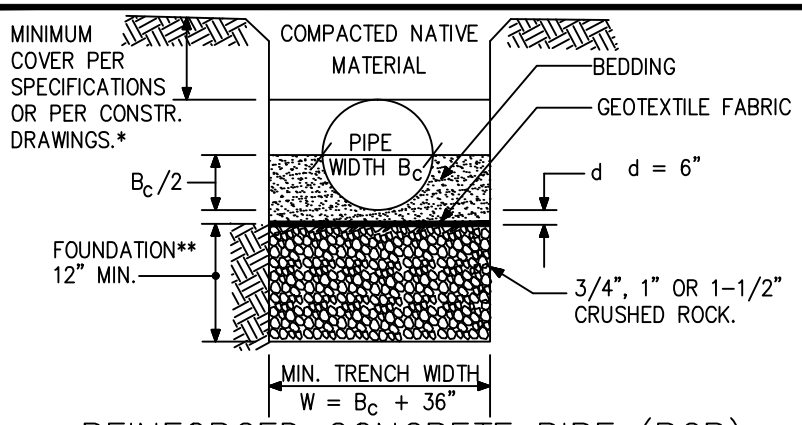
N.T.S.

CITY OF THORNTON, COLORADO
STANDARDS & SPECIFICATIONS

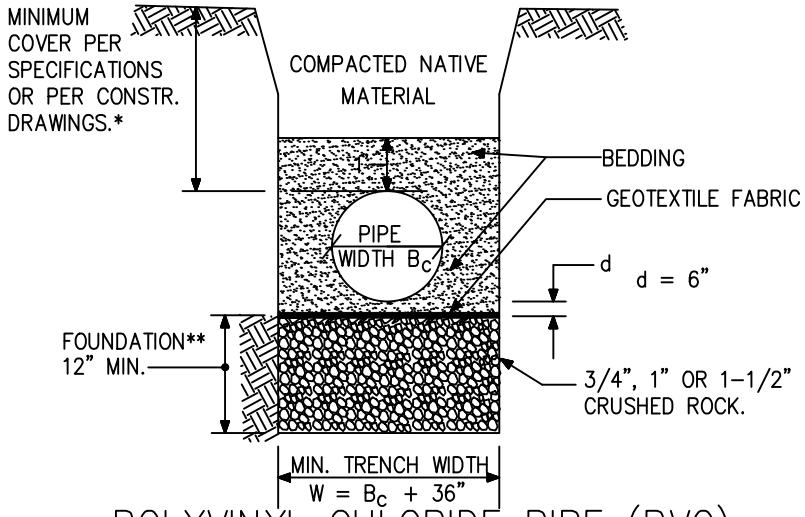
DRAWING SYMBOL CRITERIA & HYDROLOGY REVIEW TABLE

ISSUED:
APRIL 1993
REVISED:
APRIL 2010

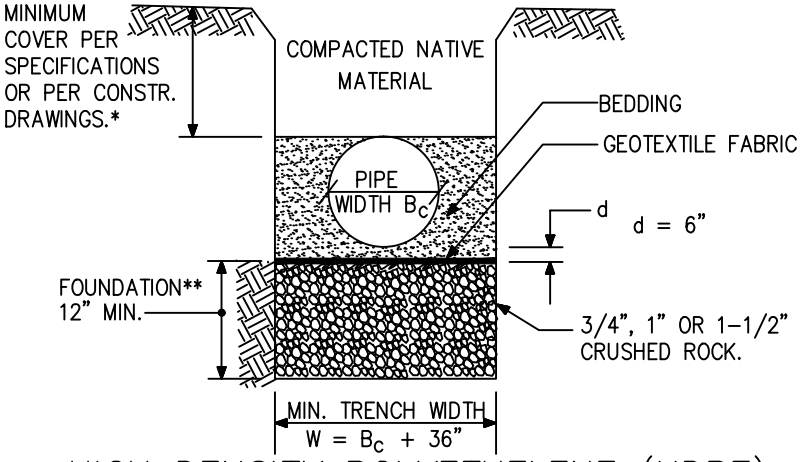
DRAWING NO.
400-1



REINFORCED CONCRETE PIPE (RCP)



POLYVINYL CHLORIDE PIPE (PVC)



HIGH DENSITY POLYETHELENE (HDPE)

NATIVE SOIL:	BEDDING:
COARSE GRAINED SAND AND GRAVEL (50% OR MORE BY WEIGHT RETAINED ON # 40 SIEVE)	CDOT CLASS A FILTER MATERIAL (SECTION 703.0q)
FINE GRAINED SOIL (LESS THAN 50% RETAINED ON # 40 SIEVE)	UDFCD TYPE 1 FILTER MATERIAL, CDOT FINE AGGREGATE FOR CONCRETE AASHTO M6 (SECTION 703.01)

* MINIMUM COVER SHALL NOT INCLUDE PAVEMENT.

** MAY BE REQUIRED IN AREAS WITH HIGH GROUNDWATER TABLE OR UNSUITABLE SUB-GRADE.

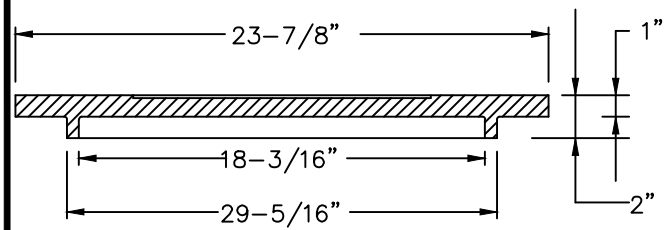
N.T.S.

CITY OF THORNTON, COLORADO
STANDARDS & SPECIFICATIONS

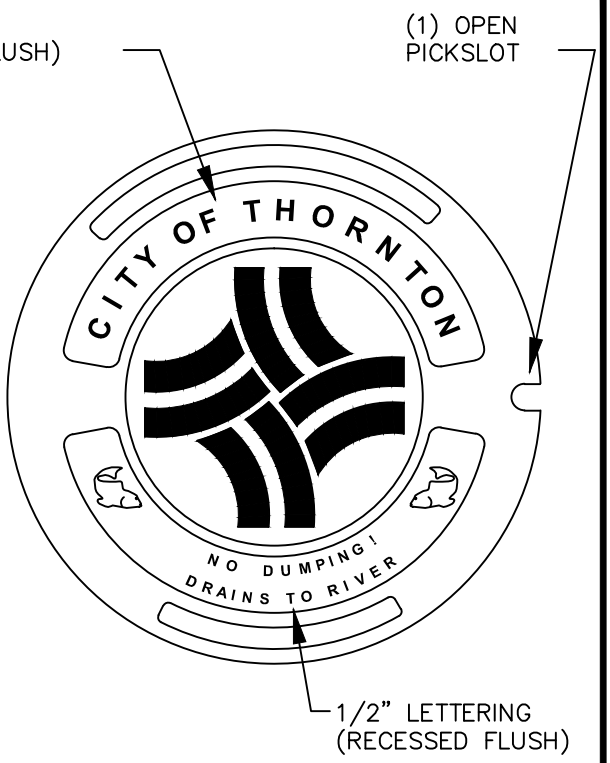
STORM DRAINAGE PIPE BEDDING DETAILS

ISSUED:
DECEMBER 2002
REVISED:
APRIL 2010

DRAWING NO.
400-2



COVER SECTION



TOP VIEW

NOTES:

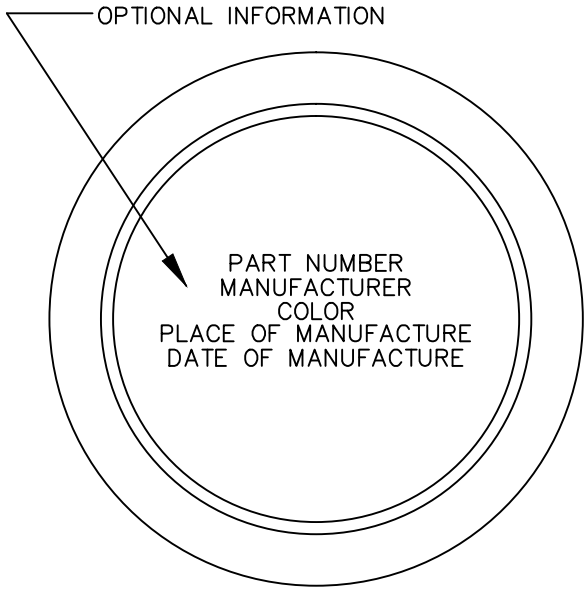
EST. WT = 112 LBS.

COVER – GRAY IRON ASTM A48 CL35B

HEAVY DUTY LOAD RATING.

MANHOLE TO BE EAST JORDAN IRON WORKS, INC.

CATALOG NO. 2408A OR APPROVED EQUAL.



BOTTOM VIEW

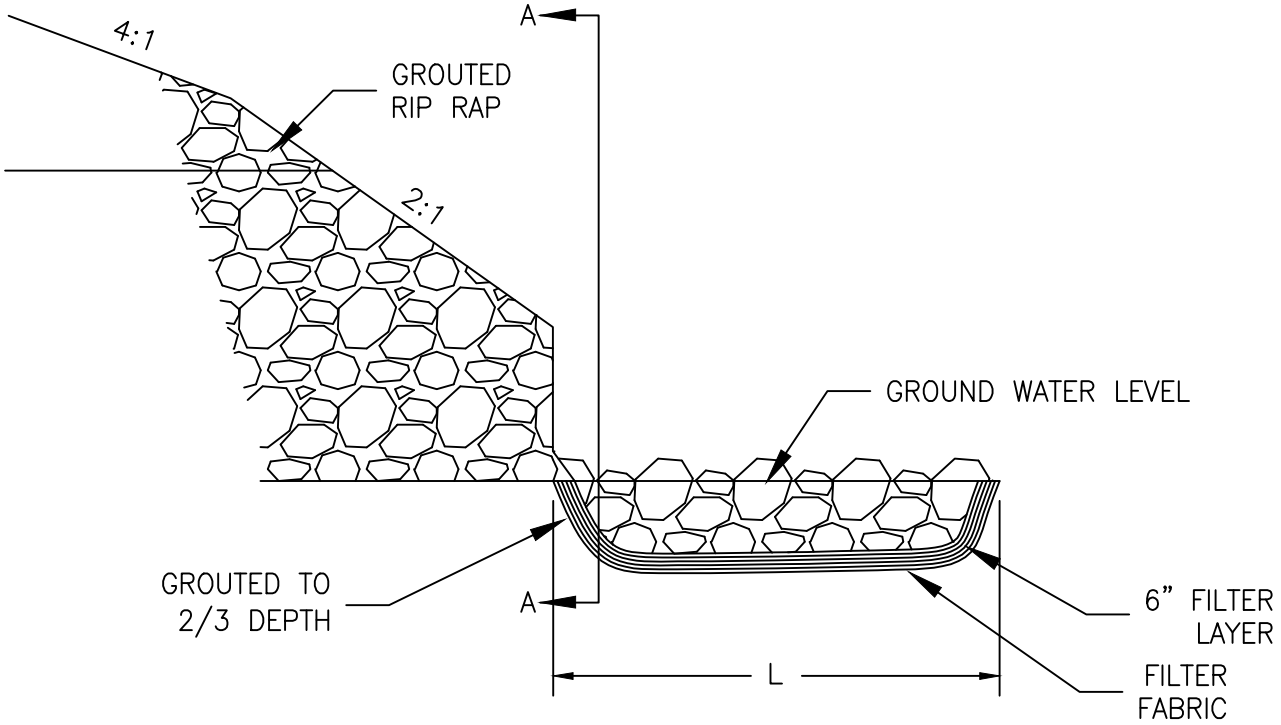
N.T.S.

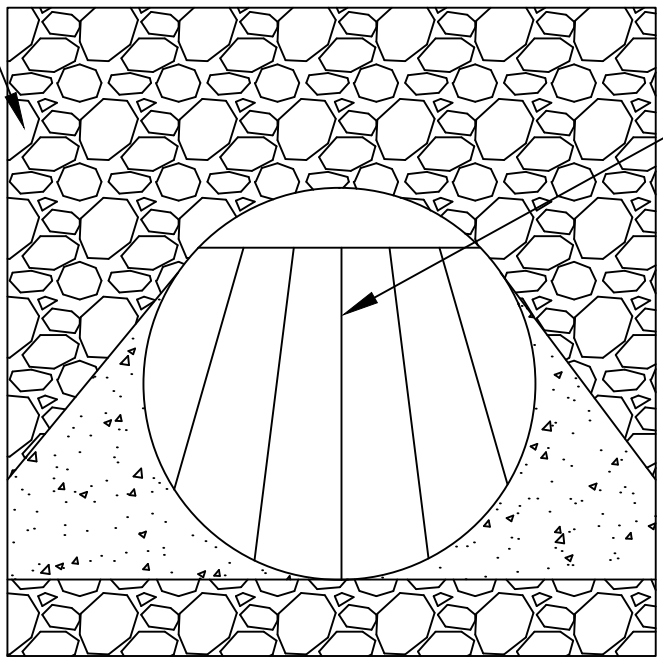
CITY OF THORNTON, COLORADO
STANDARDS & SPECIFICATIONS

STORM MANHOLE COVER

ISSUED:
NOVEMBER 2005
REVISED:
APRIL 2010

DRAWING NO.
400–3





NOTES:
1. L, D, AND W DIMENSIONS TO BE PROVIDED BY THE ENGINEER OF RECORD
2. RIP RAP SHALL BE HAND PLACED
3. SEE SPECIFICATIONS FOR MATERIALS
4. FILTER LATER AND FABRIC ARE INCIDENTAL TO RIP RAP
5. ADD RIP RAP OVER TOP OF PIPE
6. PIPE SHALL BE RCP TO FIRST STRUCTURE

SECTION A–A

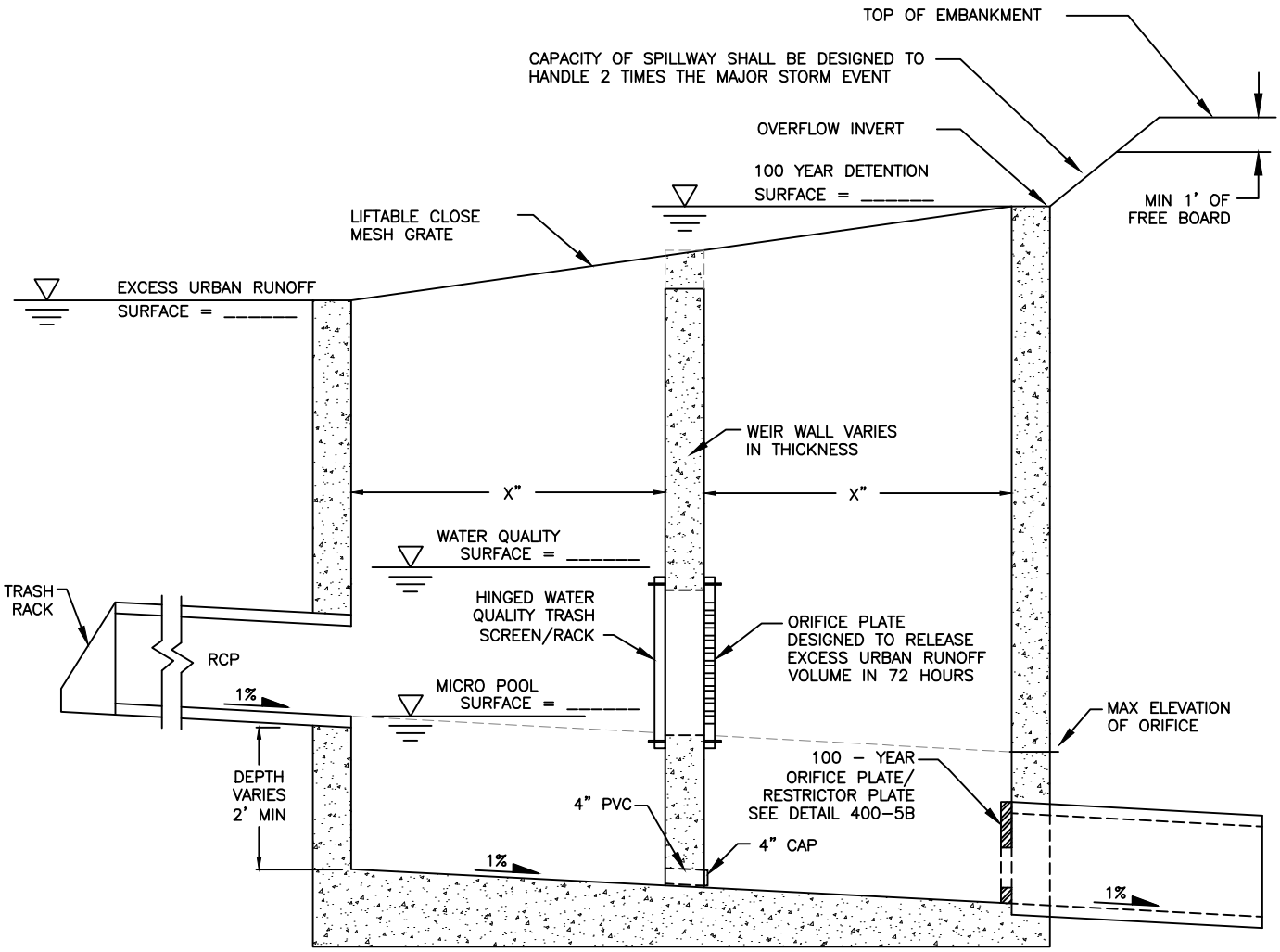
N.T.S.

CITY OF THORNTON, COLORADO
STANDARDS & SPECIFICATIONS

RIP RAP AT CULVERT OUTLET DETAIL

ISSUED:
APRIL 1995
REVISED:
APRIL 2010

DRAWING NO.
400–4



NOTE:
THE ENGINEER OF RECORD MUST PROVIDE THE REBAR SPECIFICATIONS (DESIGN)

N.T.S.

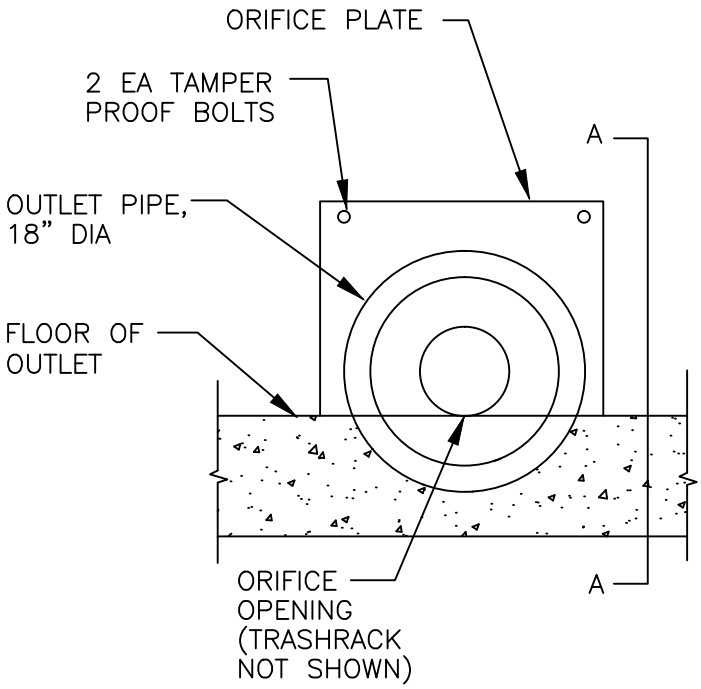
CITY OF THORNTON, COLORADO
STANDARDS & SPECIFICATIONS

DETENTION POND OUTLET CONFIGURATION DETAIL

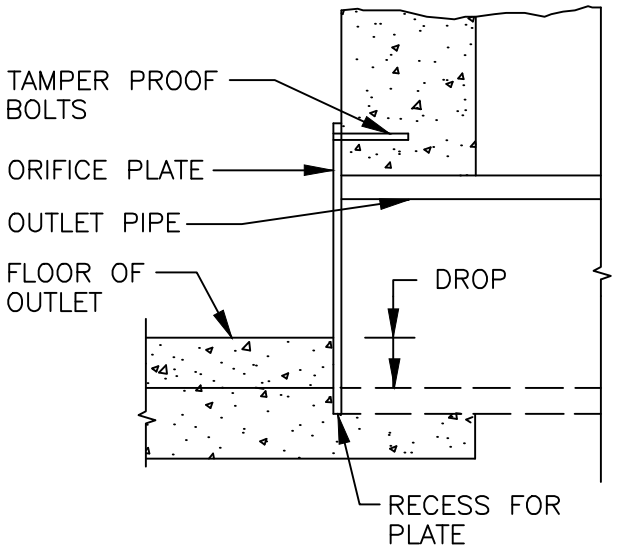
ISSUED:
APRIL 2010
REVISED:

DRAWING NO.
400-5A

ORIFICE PLATE DETAILS



ELEVATION



SECTION A–A

NOTE: TRASHRACK CAPACITY TO BE 10 TIMES ORIFICE CAPACITY.

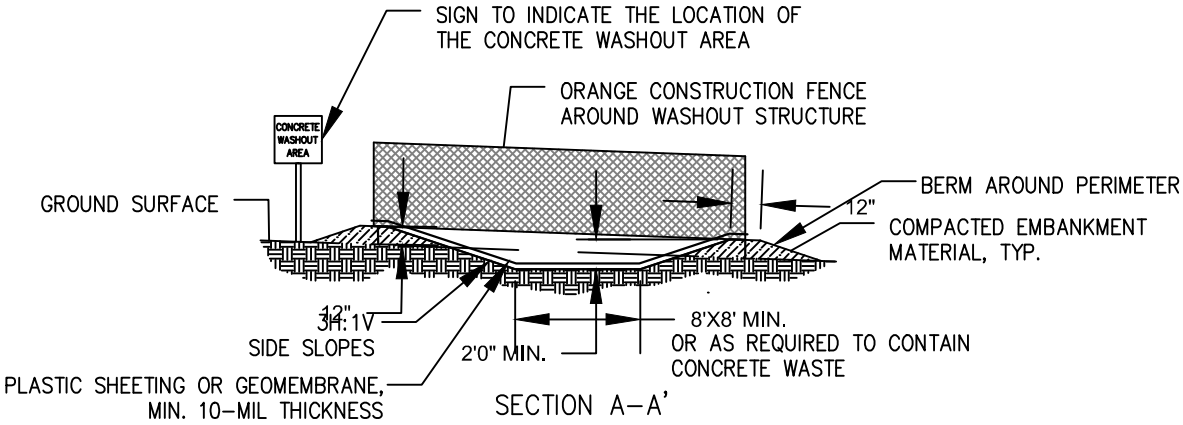
N.T.S.

CITY OF THORNTON, COLORADO
STANDARDS & SPECIFICATIONS

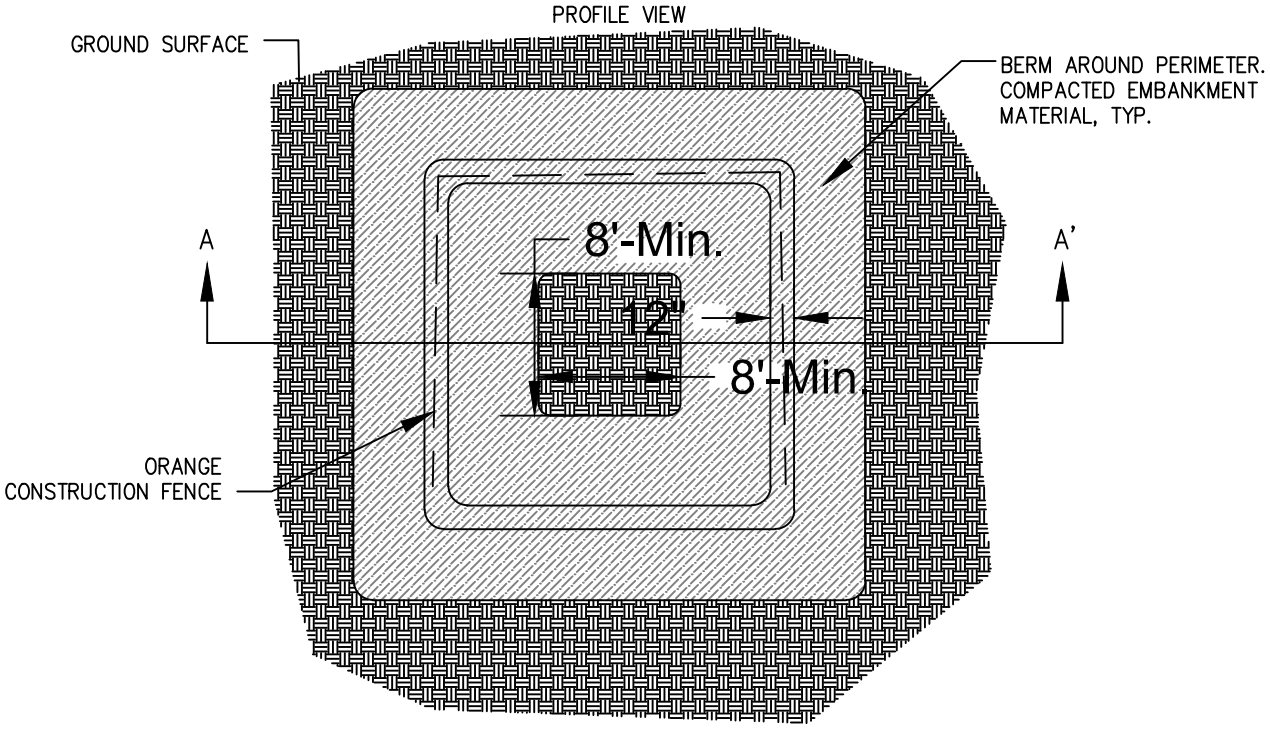
DETENTION POND DETAILS

ISSUED:
APRIL 1992
REVISED:
APRIL 2010

DRAWING NO.
400–5B



SECTION A–A'



PLAN VIEW

NOTES:

1. CONCRETE WASHOUT AREA SHALL BE INSTALLED PRIOR TO ANY CONCRETE PLACEMENT ON SITE; PLACED A MINIMUM 50' FROM STATE WATERS.
2. VEHICLE TRACKING CONTROL IS REQUIRED AT CONCRETE WASHOUT ENTRANCE IF ACCESS TO CONCRETE WASHOUT AREA IS OFF PAVEMENT.
3. A PLASTIC SHEETING OR GEOMEMBRANE LINER SHALL BE PLACED. MINIMUM 10–MIL THICKNESS..
4. THE CONCRETE WASHOUT AREA SHALL BE REPAIRED AND/OR ENLARGED AS NECESSARY TO MAINTAIN CAPACITY FOR WASTE CONCRETE.
5. WASTE MATERIAL FROM CONCRETE WASHOUT OPERATIONS MUST BE REMOVED AND LEGALLY DISPOSED OF WHEN IT HAS ACCUMULATED TWO–THIRDS OF THE WET STORAGE CAPACITY OF THE STRUCTURE AND AT THE END OF CONSTRUCTION.
6. WHEN THE CONCRETE WASHOUT AREA IS REMOVED, THE DISTURBED AREA SHALL BE SEEDED AND MULCHED OR OTHERWISE STABILIZED IN A MANNER ACCEPTED BY THE CITY.
7. NO STORMWATER RUN–OFF SHALL DRAIN INTO CONCRETE WASHOUT AREA.

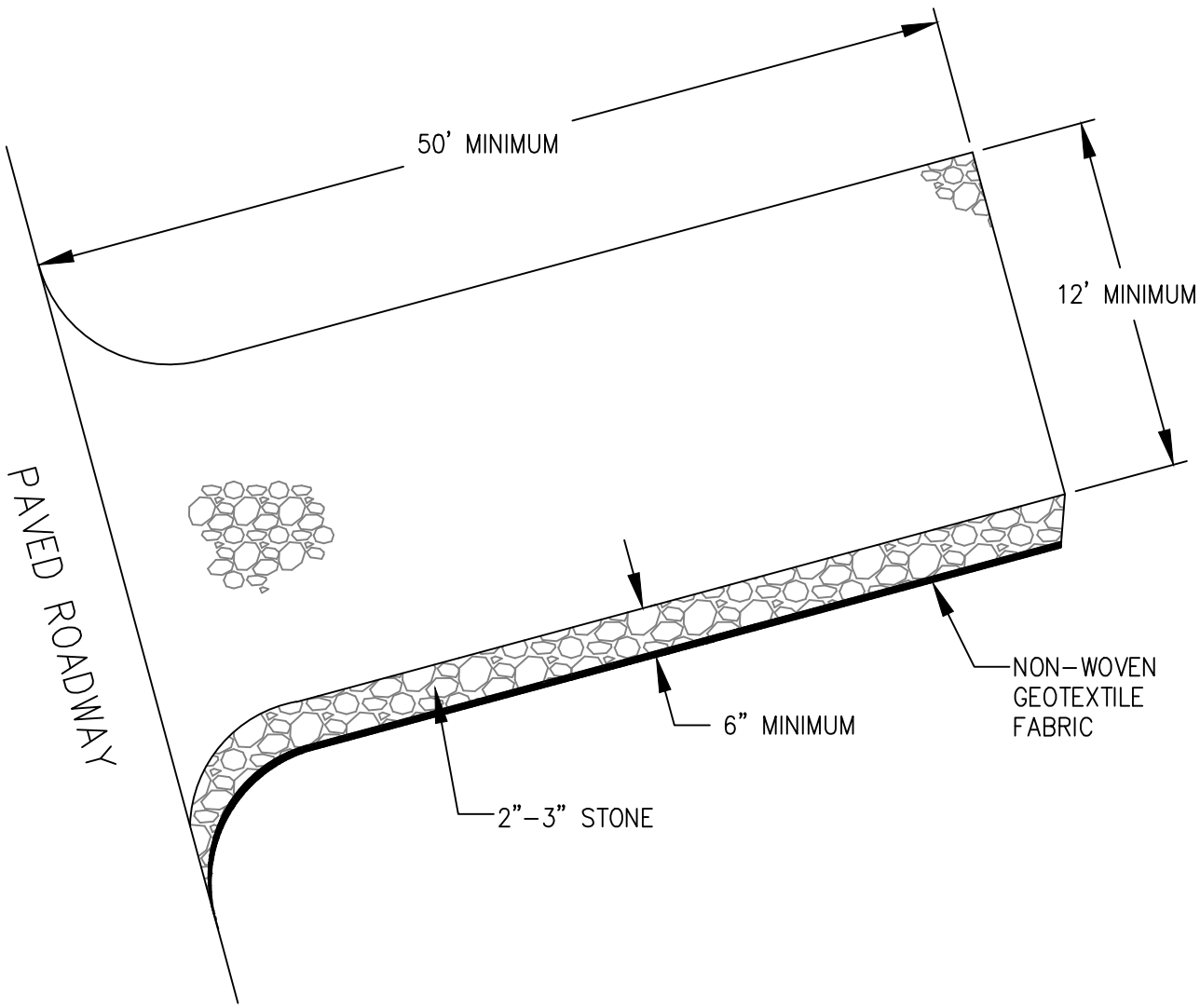
N.T.S.

CITY OF THORNTON, COLORADO
STANDARDS & SPECIFICATIONS

CONCRETE WASHOUT AREA DETAIL

ISSUED:
MARCH 2005
REVISED:
NOV 08

DRAWING NO.
400–6



NOTES:

1. PAVED ROADWAY TO BE KEPT CLEAN OF MUD, DIRT, ROCKS, AND DEBRIS AT ALL TIMES.
2. GEOTEXTILE FABRIC SHALL COMPLY WITH CDOT 712.08b.
3. 2"-3" STONE SHALL CONTAIN LESS THAN 10% FINES.
4. CONSTRUCTION EXIT SHALL BE MAINTAINED AT ALL TIMES. STONE SHOULD BE BLADED AND/OR ADDITIONAL 2"-3" STONE SHOULD BE PLACED IF VOIDS BEGIN FILLING WITH DEBRIS.
5. IF A DRAINAGE DITCH EXISTS NEXT TO ROADWAY, INSTALL TEMPORARY CULVERT UNDERNEATH STONE CONSTRUCTION EXIT TO CONVEY FLOW.
6. PROVIDE INLET PROTECTION FOR ANY INLETS LOCATED IMMEDIATELY ADJACENT TO THE CONSTRUCTION EXIT.
7. IF TRACKOUT DOES OCCUR, ROADWAY SHOULD BE SWEPT IMMEDIATELY.
8. RECYCLED CONCRETE OR RECYCLED ASPHALT SHALL NOT BE USED.

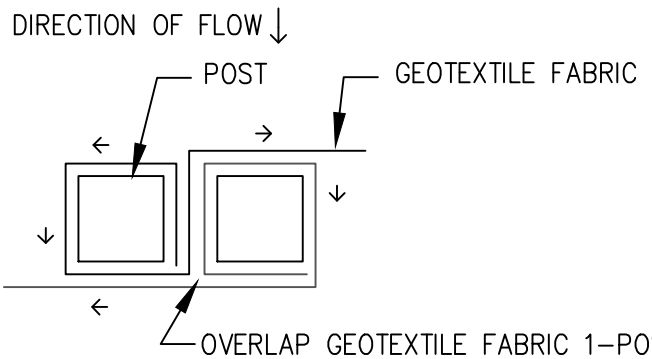
N.T.S.

CITY OF THORNTON, COLORADO
STANDARDS & SPECIFICATIONS

VEHICLE TRACKING PAD

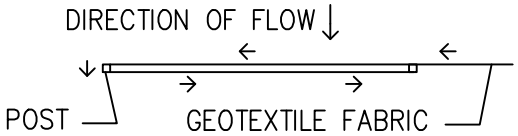
ISSUED:
NOV 08
REVISED:

DRAWING NO.
400-7

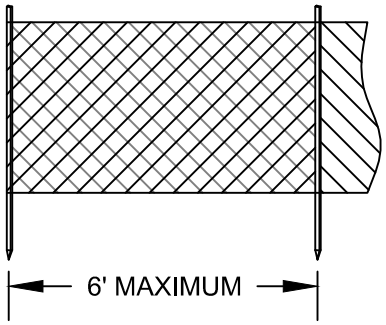


PLAN VIEW

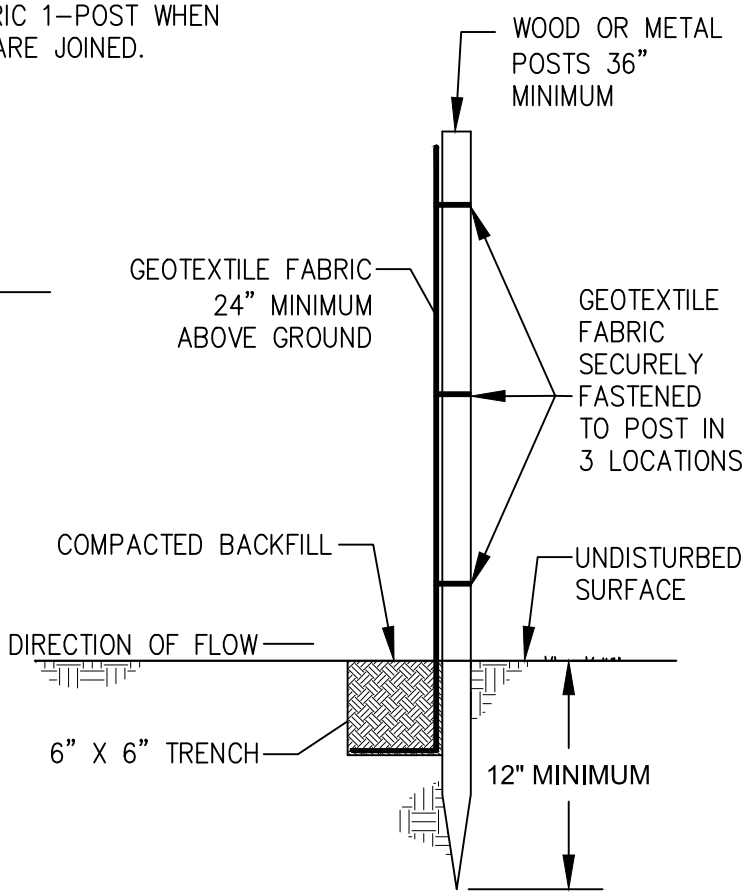
TRANSITION DETAIL
N.T.S.



PLAN VIEW



END DETAIL
N.T.S.



NOTES:

1. WOOD POSTS SHALL HAVE A MINIMUM DIAMETER OR CROSS–SECTION OF 2 INCHES. METAL POSTS SHALL BE STUDDED "T" OR "U" TYPE.
2. GEOTEXTILE FABRIC SHALL COMPLY WITH CDOT 712.08b.
3. GEOTEXTILE FABRIC SHALL EXTEND A MINIMUM OF 6" BELOW GRADE AND ANOTHER 6" HORIZONTALLY IN A "L" SHAPE BEFORE BACKFILLING AND COMPACTING THE TRENCH. (SLICING METHOD IS ALSO ACCEPTED)
4. SILT FENCE SHALL NOT BE USED IN CONCENTRATED FLOWS.
5. SILT FENCE SHALL ONLY BE PLACED PARALLEL TO SURFACE CONTOURS.
6. CLEAN AND REMOVE SILT WHEN THE SILT REACHES ½ THE HEIGHT OF THE GEOTEXTILE FABRIC.
7. UPON PERMANENT STABILIZATION OF AREAS UPSLOPE OF THE SILT FENCE, THE SILT FENCE SHALL BE REMOVED AND DISTURBED AREAS PERMANENTLY STABILIZED.

N.T.S.

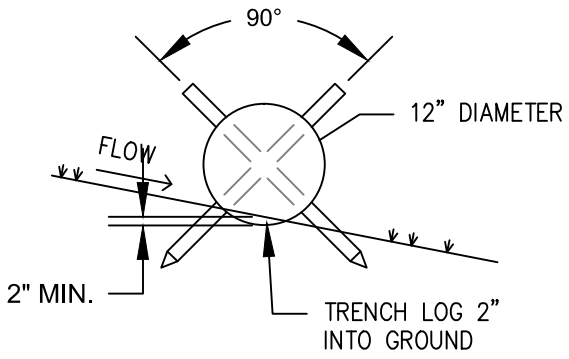
CITY OF THORNTON, COLORADO
STANDARDS & SPECIFICATIONS

SILT FENCE

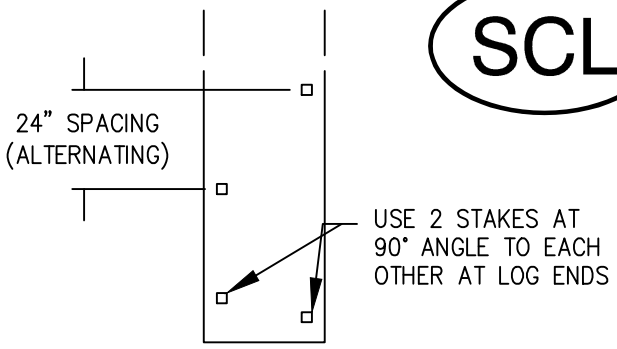
ISSUED:
NOV 08
REVISED:

DRAWING NO.
400–08

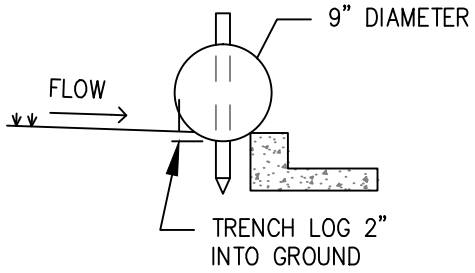
SCL



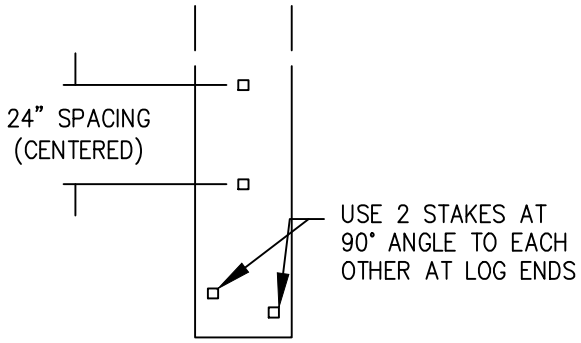
PROFILE VIEW



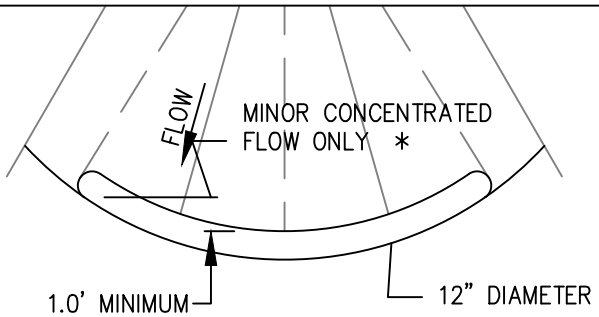
PLAN VIEW



PROFILE VIEW

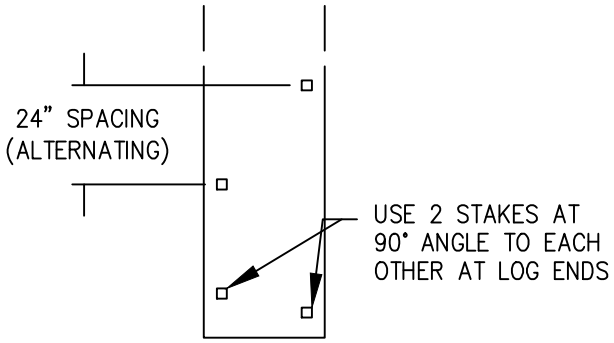


PLAN VIEW



PROFILE VIEW

* FOR MAJOR CONCENTRATED FLOWS, USE A ROCK CHECK DAM



PLAN VIEW

NOTES:

1. STAKES SHALL BE 1–1/2" x 1–1/2" x 24" MINIMUM AND EMBEDDED INTO GROUND A MINIMUM OF 12".
2. SEDIMENT CONTROL LOG SHALL BE TRENCHED 2" INTO GROUND.
3. FOR CONTINUOUS CONTROL, ADJACENT SEDIMENT CONTROL LOGS SHALL BE PLACED FIRMLY TOGETHER WITH NO GAPS.
4. SEDIMENT SHALL BE CLEANED/ REMOVED WHEN SEDIMENT DEPTH IS 1/2 THE HEIGHT OF THE SEDIMENT CONTROL LOG.

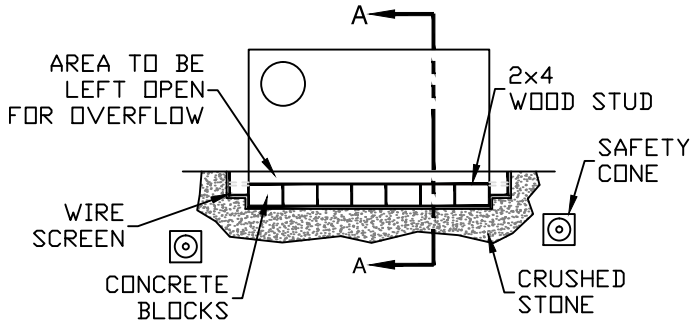
N.T.S.

CITY OF THORNTON, COLORADO
STANDARDS & SPECIFICATIONS

SEDIMENT CONTROL LOG

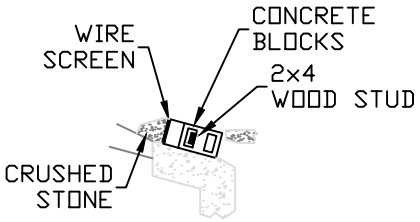
ISSUED:
NOV 08
REVISED:

DRAWING NO.
400–9

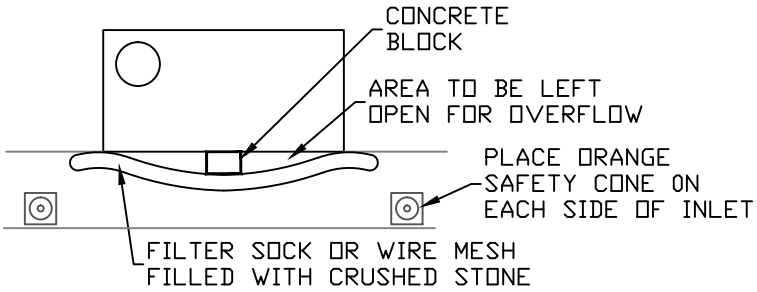


TYPE I - PLAN VIEW

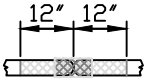
* ONLY TO BE USED IF STREET IS CLOSED TO THE PUBLIC



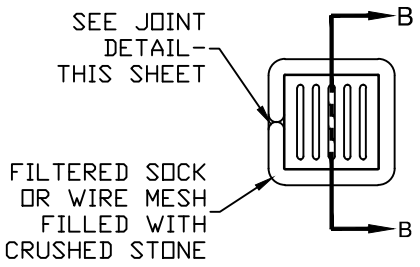
TYPE I - SECTION A-A



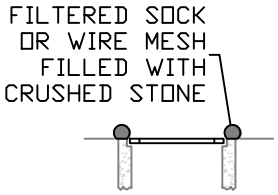
TYPE II - PLAN VIEW



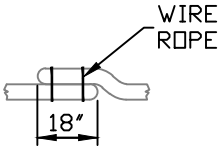
FOR WIRE MESH LOG, FILL GAPS IN JOINT WITH ADDITIONAL CRUSHED STONE AND WRAP WITH WIRE MESH



TYPE III - PLAN VIEW



TYPE III - SECTION B-B



FOR FILTER SOCK, OVERLAP JOINT BY 18" AND SECURE WITH 2 WIRE ROPES

JOINT DETAIL

NOTES:

1. CRUSHED STONE SHALL BE NO. 4 STONE WITH 0% PASSING THE 3/4" SIEVE.
2. SEDIMENT SHALL BE REMOVED WHEN SEDIMENT ACCUMULATION REACHES 1/2 THE INLET PROTECTION HEIGHT.
3. INLET PROTECTION SHALL BE PLACED IN A MANNER NOT TO CAUSE SIGNIFICANT FLOODING IN PUBLIC STREETS OR AREAS.
4. INSET FILTER BAGS WITH OVERFLOW PORTS MAY BE USED IN HIGH TRAFFIC AREAS AS A SUBSTITUTE.
5. IF LARGE DEPOSITS OF SEDIMENT ENTERS THE STORM SEWER, THE CONTRACTOR SHALL CLEAN THE STORM SEWER TO THE SATISFACTION OF THE CITY.

N.T.S.

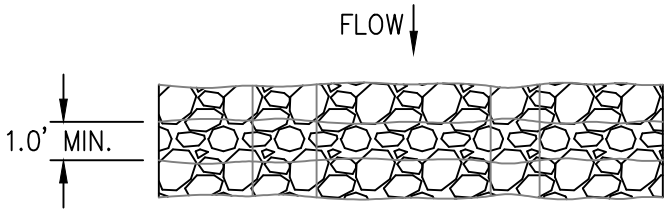
CITY OF THORNTON, COLORADO
STANDARDS & SPECIFICATIONS

INLET PROTECTION

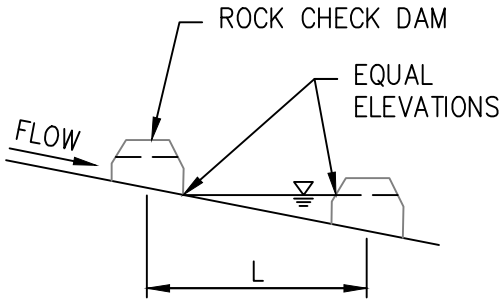
ISSUED: NOV 08
REVISED:

DRAWING NO. 400-10

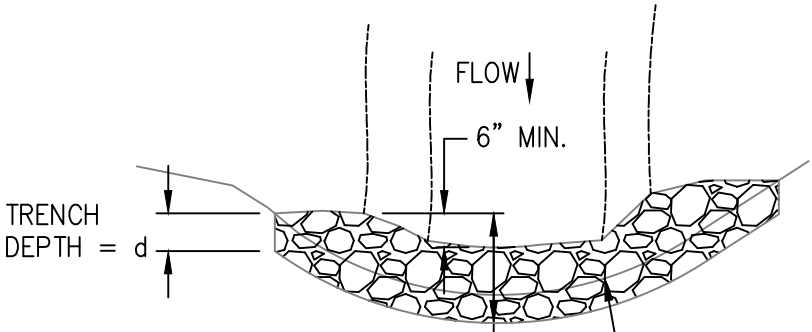
SCL



PLAN VIEW



SPACING (L)



d=d50 in inches, min
(for example: d50=6"
d=6" trench depth)

PROFILE VIEW

NOTES:

1. CHECK DAMS SHALL BE INSTALLED PRIOR TO UPSTREAM EARTH DISTURBING ACTIVITIES.
2. STONE SHALL HAVE < 10% FINES.
3. EACH END OF CHECK DAM SHALL BE 6" MINIMUM HIGHER THAN CENTER.
4. SEDIMENT SHALL BE REMOVED FROM THE CHECK DAM WHEN THE SEDIMENT DEPTH REACHES 1/2. THE HEIGHT OF THE CENTER.
5. CHECK DAM SHALL BE REMOVED ONCE ALL UPSTREAM DISTURBED AREAS HAVE BEEN STABILIZED.
6. UPON REMOVAL OF CHECK DAM, EXCAVATIONS SHALL BE FILLED WITH SUITABLE COMPACTED FILL, SEEDED AND COVERED WITH AN EROSION CONTROL BLANKET ADEQUATE FOR EXPECTED CHANNEL VELOCITY.

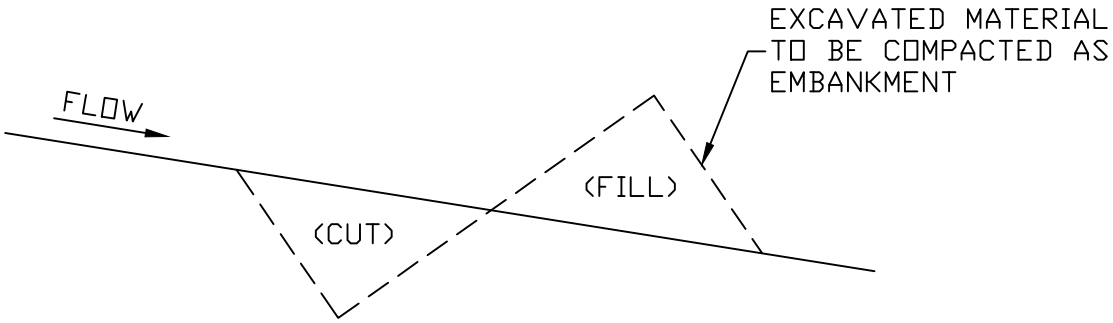
N.T.S.

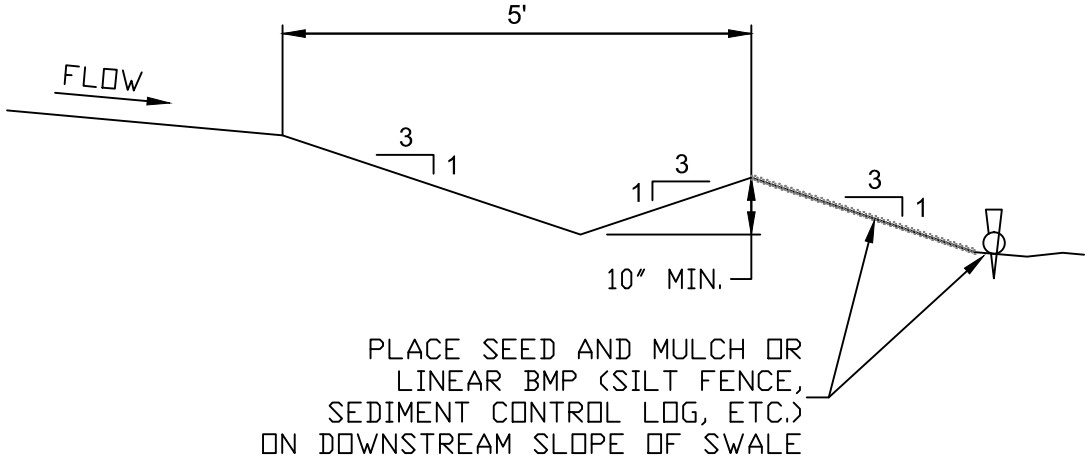
CITY OF THORNTON, COLORADO
STANDARDS & SPECIFICATIONS

CHECK DAM

ISSUED:
NOV 08
REVISED:

DRAWING NO.
400–11





NOTES:

1. CHECK DAMS OR EROSION CONTROL BLANKETS MAY BE REQUIRED IF VELOCITY BEGINS TO ERODE DITCH/ SWALE.

2. DIVERSION DITCHES/ SWALES SHALL BE DISCHARGED TO SEDIMENT TRAPS OR BASINS WHICH HAVE BEEN SIZED APPROPRIATELY.

3. IF SEDIMENT BEGINS TO COLLECT IN THE SWALE, THE SEDIMENT SHALL BE REMOVED WHEN IT REACHES 1/3 THE HEIGHT OF THE SWALE.

N.T.S.

CITY OF THORNTON, COLORADO
STANDARDS & SPECIFICATIONS

DIVERSION DITCH / SWALE

ISSUED:
NOV 08
REVISED:

DRAWING NO.
400–12