



City of  
Golden

# Stormwater Standards Manual

December 2019

Public Works Department  
Engineering Division  
Environmental Services Division

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# City of Golden

## Stormwater Standards Manual

### SUMMARY OF REVISIONS

The April 2019 City of Golden Stormwater Standards Manual (COGSSM) revision reflects the following minor updates:

- Inclusion by reference of the Ultra Urban Green Infrastructure Guidelines, CCD and UDFCD
- Post-construction submittal requirement indicating treated area
- Revised Stormwater Quality Permit Application Packet, Appendix D
- Minor update to Revegetation Requirements 3.1(A) Limits of Exposure, Appendix E
- Minor editorial revisions, throughout

A December 2019 revision adds the following new requirements:

- During construction and final inspections of permanent stormwater control measures
- Material verification requirements

## ACRONYMS AND ABBREVIATIONS

<	Less than
>	Greater than
BMP	Best Management Practice
EMC	Event Mean Concentration
EURV	Excess Urban Runoff Volume
LID	Low Impact Development
mg/L	Milligrams per Liter
MDCIA	Minimize Directly Connected Impervious Areas
MS4	Municipal Separate Storm Sewer System
SWMP	Stormwater Management Plan
TSS	Total Suspended Solids
USDCM	Urban Storm Drainage Criteria Manual
WQCD	Water Quality Control Division
WQCV	Water Quality Capture Volume

## I. INTRODUCTION

### A. STORMWATER MANAGEMENT

Urbanization and development affect both the quantity and the quality of stormwater discharged to receiving waters. Land disturbing activities, such as construction, expose soil and result in increased erosion and sediment transport. Effects are mitigated by proper planning, limiting exposure and use of sediment and erosion control methods. Once construction is complete, rooftops and parking lots increase impervious area and reduce the ability of stormwater to infiltrate into the ground. The result is increased flow velocity, flood risk and pollutant transport. Effects are mitigated by integrative site design strategies, property management practices and use of stormwater control measures to attenuate flows and treat expected pollutants.

### B. USE OF MANUAL

The intent of the Stormwater Standards Manual (Manual) is to present design standards for the implementation of Stormwater Control Measures, also referred to here as Best Management Practices (BMPs), to manage stormwater for the purposes of water quality and flood control. The Manual outlines required submittals and will be used by city staff when reviewing flood control and stormwater management practices. Individual methods shall be selected and implemented to best fit the conditions of each site.

The Public Works Director, or designee, shall be authorized to make periodic updates and technical amendments from time to time. Major revisions will be presented to City Council.

### C. REFERENCES

This Manual outlines methods for the control of stormwater for development and redevelopment. The reader is referred to specific design criteria presented in the Urban Storm Drainage Criteria Manual (USDCM) as amended. Where more specific criteria are warranted, it is noted in Appendix A. The reader is referred to general concepts presented in the Ultra-Urban Green Infrastructure Guidelines, City and County of Denver and Urban Drainage and Flood Control District, where redevelopment of constrained sites presents challenges to integrating stormwater control measures into site design.

## II. STORMWATER MANAGEMENT: FLOOD CONTROL AND STORMWATER QUALITY

### A. INTRODUCTION

Impervious areas associated with urbanization increase the volume of runoff which leads to increased severity of flooding and degradation of water quality. A coordinated approach to managing increased runoff volumes associated with development and redevelopment is critical to ensuring the safety of citizens and the health of our receiving waterways. The intent of this manual is to provide standards for the responsible management of stormwater runoff.

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#### 1. FLOOD CONTROL

All development that results in a net increase of greater than or equal to 10,000 square feet of impervious area shall provide flood control for the increased impervious area runoff. Runoff rates in the developed condition shall be attenuated and released at historic rates.

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#### 2. STORMWATER QUALITY

Stormwater control measures are required for any activity resulting in, or contributing to, a total disturbed area greater than one half ( $\frac{1}{2}$ ) acre and areas less than one half ( $\frac{1}{2}$ ) acre that are part of a larger common plan of development or sale. A common plan of development or sale means a contiguous area where multiple separate and distinct construction activities may be taking place at different times, on different schedules, but remain related by a common contract or plan. Contiguous means construction activities located in close proximity to each other (within  $\frac{1}{4}$  mile).

## B. GENERAL REQUIREMENTS

**Table 1 Applicability of Requirements: Flood Control and Stormwater Quality**

<b>Impervious Area/Disturbed Area</b>		<b>Requirements</b>
Net increase of greater than or equal to 10,000 square feet impervious area		Flood attenuation required
Disturb >½ acre, or <½ acre if part of a larger common plan of development		Stormwater quality required, per below
<b>Total Disturbed Area includes larger common plan of development</b>	<b>Treatment Type</b>	
<½ acre	None required Source Control, Runoff Reduction and Conveyance based BMPs are encouraged	
½ acre – 1 acre	Source Control, Runoff Reduction and Conveyance based BMPs required	
>1 acre	Storage based BMPs providing WQCV or EURV in accordance with Design Standards required (refer to <a href="#">Section II.C.</a> )	
where flood attenuation is required	Full Spectrum Detention is required	
<b>Treatment Type</b>	<b>BMPs</b>	
Source Control	Outdoor storage, Equipment maintenance, Vehicles, Deicing and snow storage, Waste disposal, Landscape maintenance <b>Consider Source Control early in the site design process for every project</b>	
Runoff Reduction (MDCIA)	Route runoff from impervious surfaces over pervious areas to decrease velocity and promote infiltration	
Conveyance based	Grass Swales, Grass Buffers, Constructed Wetland Channels, Storage based BMPs where less than 100% WQCV is provided	
Storage based	Bioretention, Extended Detention Basin, Sand Filter, Constructed Wetland Pond, Retention Pond, Permeable Pavement, Green Roof	

## C. STORMWATER QUALITY DESIGN STANDARDS

Evaluation of suitability of stormwater control measures is based on pollutant removal, flood attenuation and long-term maintenance considerations appropriate for the site conditions and proposed land use. Stormwater control measures must be designed in accordance with the most current version of [USDCM Volume 3, Chapter 4 “Treatment BMPs”](#) and meet the Design Standards outlined below. Refer to Appendix B for additional limitations and submittal checklists. Conformance to the following standards will be evaluated in accordance with the MS4 Permit.

Where redevelopment presents challenges to integrating stormwater control measures, refer to the general design concepts presented in the [Ultra-Urban Green Infrastructure Guidelines](#), authored by the City and County of Denver and Urban Drainage and Flood Control District. Any concepts derived from the Ultra-Urban Green Infrastructure Guidelines, proposed for use as a stormwater control measure, must meet the requirements set forth in this Manual.

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### 1. BASE DESIGN STANDARDS

Base Design Standards may be used in combination, as necessary, to meet the requirements while considering site constraints and site design goals. Additional design methods may be considered if they comply with the MS4 Permit. WQCV indicates a minimum standard. Where appropriate, EURV should be incorporated to reduce flooding and stream degradation impacts in addition to providing water quality.

#### a. WQCV STANDARD

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Control measure(s) must be designed to provide treatment and/or infiltration of the WQCV for 100% of the site.

#### b. POLLUTANT REMOVAL STANDARD

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Control measure(s) must be designed to provide treatment of the 80<sup>th</sup> percentile storm event. The control measure(s) shall be designed to treat stormwater runoff in a manner expected to reduce the event mean concentration of total suspended solids (TSS) to a median value of 30mg/L or less for 100% of the site.

#### c. RUNOFF REDUCTION STANDARD

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Control measure(s) must be designed to infiltrate, evaporate or evapotranspire a quantity of water equal to 60% of what the calculated WQCV would be if all impervious area discharged without infiltration. This Standard can be met through practices such as Green Infrastructure and Low Impact Development practices.

#### d. REGIONAL WQCV CONTROL MEASURE

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Control Measure(s) must be designed to accept the drainage from the applicable development site. Stormwater from the site must not discharge to a water of the state before being discharged to the Regional WQCV Control Measure. The Regional WQCV Control Measure must be designed to provide treatment and/or infiltration of the WQCV for 100% of the applicable development site.

e. **REGIONAL WQCV FACILITY**

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Control Measure(s) must be designed to accept drainage from the applicable development site. Stormwater from the site may discharge to a water of the state before being discharged to the Regional WQCV facility. Before discharging to a water of the state, at least 20 percent of the upstream imperviousness of the site must be disconnected from the storm drainage system and drain through a pervious area control measure comprising of at least 10 percent of the upstream disconnected impervious area of the applicable development site. In addition, the stream channel between the discharge point of the applicable development site and the Regional WQCV facility must be stabilized.

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2. **CONSTRAINED SITE STANDARD**

Constrained Redevelopment Sites are sites where the existing condition is >35% imperviousness and the proposed redevelopment will result in >75% imperviousness. If the proposed redevelopment will result in >75% imperviousness, but the existing condition is <35% imperviousness, the Constrained Site Standard cannot be used and [Base Design Standards](#) must be followed. The Constrained Site Standard can only be used if it is determined that it is not practicable to meet any of the Base Design Standards. It is incumbent on the design engineer to demonstrate adherence to Base Design Standards has been thoroughly evaluated and found to be infeasible before a Constrained Site Standard is proposed.

The minimum treatment levels are included below and treatment should be maximized to the extent feasible under constrained site conditions.

a. **CONSTRAINED WQCV**

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Control measure(s) must be designed to provide treatment and/or infiltration of the WQCV for 50% or more of the impervious area of the site, or

b. **CONSTRAINED POLLUTANT REMOVAL**

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Control measure(s) must be designed to provide treatment of the 80th percentile storm event. The control measure(s) shall be designed to treat stormwater runoff in a manner expected to reduce the event mean concentration of total suspended solids (TSS) to a median value of 30mg/L or less for 50% of the impervious area of the site, or

c. **CONSTRAINED RUNOFF REDUCTION**

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Control measure(s) must be designed to infiltrate, evaporate or evapotranspire a quantity of water equal to 30% of what the calculated WQCV would be if all impervious area discharged without infiltration. This Standard can be met through practices such as Green Infrastructure and Low Impact Development practices.

## D. DRAINAGE DESIGN STANDARDS

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### 1. RIPARIAN SETBACKS

No new development shall be permitted to construct structures or impervious surfaces within 50' of a channel designated as a major drainageway as measured from the top of bank. City of Golden Engineering Division will determine top of bank location when not readily apparent.

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### 2. FLOODPLAIN

The City of Golden adopted floodplain standards are provided in the [City of Golden Municipal Code, Section 15.60](#). All development within a FEMA designated floodplain shall adhere to all State, Federal, and City of Golden standards.

In addition to the requirements set forth in The City of Golden Municipal Code, the City shall require the following additional requirements of all development within any FEMA designated Floodplain or any flood study or FHAD adopted by the City:

- a. The design flood elevation for all new development shall be the Base Flood Elevation plus one (1) additional foot of freeboard.
- b. Physical map revisions in the City of Golden in which a floodway is delineated shall adhere to a half (1/2) foot rise criteria.
- c. Stream alteration activities shall not be constructed unless the project proponent demonstrates through a floodway analysis and report, sealed by a Colorado Registered Professional Engineer, that there are no adverse floodway impacts resulting from the project. This requirement only applies on stream reaches with Base Flood Elevations established. It is the responsibility of the applicant to obtain any State or Federal permits required for work (e.g., USACE 404 Permit). Review by Urban Drainage and Flood Control District will be required.
- d. Flood attenuation is not permitted within the 100-year floodplain.

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### 3. STANDARD DETAILS

With the exception of the details provided in Appendix A, the City has adopted the standard details applicable to drainage found in the latest version of the Colorado Department of Transportation M&S standards and the details provided in the most current version of the USDCM. In the event that a detail for a type of facility is provided in both documents, the City of Golden Engineering Division will decide which standard detail is applicable.

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### 4. LONG-TERM MAINTENANCE

- a. Maintenance Access  
Provide necessary access to stormwater control measures for long-term maintenance purposes. Larger basins may require vehicle access to the bottom of the basin. Grades and material must conform to the most current version of [USDCM Volume 3](#).

b. Retaining Walls

Retaining walls around stormwater control measures shall not be located in such a manner as to restrict inspection and maintenance access. Retaining walls shall not exceed 50% of the perimeter of any extended detention basin or retention pond/constructed wetland.

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5. COMPLIANCE WITH OTHER STANDARDS

All work performed under this section must comply with all applicable local, State, and Federal Regulations. In situations where these standards contradict, the most restrictive requirement must be used.

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6. RUNOFF CALCULATION

Both the Colorado Urban Hydrograph Procedure (CUHP) and the Rational Method are allowable methods for runoff calculation within the watershed size limitations shown in Table 2.

**Table 2 Runoff Method Based on Watershed Size**

<b><i>Applicability of Hydrologic Methods Watershed Size (acres)</i></b>	<b><i>Is the Rational Method Applicable?</i></b>	<b><i>Is CUHP Applicable?</i></b>
0 to 5	Yes	Yes (1)
6 to 90	Yes	Yes (1)
91 to 160	Yes	Yes
161 to 3,000	No	Yes (2)
Greater than 3,000	No	Yes if subdivided into smaller catchments(2)

(1) *If one-minute unit hydrograph is used*

2) *Subdividing into smaller sub-catchments and routing the resultant hydrographs using SWMM may be needed to accurately model a catchment with areas of different soil types or percentages of imperviousness*

Detailed information on both the Rational Method and the Colorado Urban Hydrograph Procedure can be found in the most current version of [USDCM Volume 1](#).

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7. CONVEYANCE

Streets are an integral part of the urban drainage system and may be used for transporting storm runoff up to design limits. The design engineer should recognize that the primary purpose of streets is for traffic, and therefore the use of streets for storm runoff must be restricted. The policy of the City is to allow the use of streets for drainage within the limitations described in the [City of Golden Street, Drainage and Sidewalk Specifications](#).

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## 8. EASEMENTS

The easements required to provide adequate inspection, operation and/or maintenance access are as follows:

**Table 3 Easement Minimums**

<b>Facility Type</b>	<b>Minimum Easement Width</b>
Single pipe	20' minimum width. Pipe centered in easement. An additional 2' width for every 1' of depth over 5' as measured from invert.
Multiple pipes	10' minimum on either side from outside edge of pipe(s). Additional 1' of width on either side of pipe(s) for every 1' of depth over 5' as measured from invert.
Open channels & swales	Q100 < 20 cfs: 20' Q100 < 100cfs: 25' Q100 > 101cfs: see USDCM vol.1
Stormwater Control Measures	Sufficient to contain storage, freeboard, release structures, and associated facilities, plus no less than 10' for inspection and maintenance access around the entire perimeter. For multiple lots, a dedicated tract of land is required.

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## 9. STORM SEWERS

Storm sewers are a part of the drainage system and are required when the other parts of the system no longer have capacity for additional runoff. Except as modified herein, the design of storm sewers shall be in accordance with the most current version of [USDCM Volume 2 Chapter 7, "Streets, Inlets, and Storm Drains"](#).

All new or reconstructed storm sewers shall be sized to convey the major event (100 year) flows in excess of the allowable street conveyance capacity.

All direction changes, both horizontal and vertical, shall be achieved through a manhole. Bends, longitudinal bending and joint deflection are prohibited.

Contractor shall submit to the City, for approval, shop drawings for all pipe and fittings.

Polyvinyl Chloride (PVC), High Density Polyethylene (HDPE) and Reinforced Concrete Pipe (RCP) are the only permissible pipe materials for stormwater sewer installations in the City of Golden. All pipes shall meet the material and handling specifications set forth by the Urban Drainage and Flood Control District. Refer to [UDFCD Specifications Division 33: Utilities](#).

## E. SUBMITTALS

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### 1. PRE-CONSTRUCTION SUBMITTALS

The following submittals are required for review for permit issuance. Refer to Appendix B for specific Pre-construction submittal requirements and associated documents.

#### a. STORMWATER CONTROL MEASURE DESIGN STANDARDS SUBMITTALS

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Design Standards submittals shall be provided for all projects that require stormwater control measures in accordance with [Table 1 Applicability of Requirements](#) of this document. Complete a Design Standards Project Sheet along with the corresponding Design Standards Checklist(s) from Appendix B for each Control Measure identified in the Drainage Report. Specific limitations and information required for submittal is included with the corresponding checklist.

When the Constrained Site Standard is applied, it must be accompanied by a written evaluation for review and approval that it is not practicable to meet any of the Base Design Standards.

#### b. DRAINAGE REPORT

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Drainage Reports shall be provided for all projects that meet the trigger levels summarized in [Table 1 Applicability of Requirements](#) of this document. The Drainage Report shall be a stand-alone document signed and sealed by a Professional Engineer, licensed in the State of Colorado.

When references are made or assumptions are based on previously approved submitted reports, the Drainage Report must include the appropriate excerpts, pages, tables, and maps containing the reference information. Assumptions made in previous reports must be verified and substantiated. All submitted reports should be clearly and cleanly reproduced and legible.

Drainage Reports shall follow the layout provided in Appendix B. Drainage Reports may be separated into two submittals, the Preliminary Drainage Report and Final Drainage Report. Preliminary Drainage Reports shall provide a proof of concept and may exclude information specific to construction. Final Drainage Reports shall include all information shown in Appendix B. Preliminary Drainage Reports may be used for preliminary submittal. Final Drainage Reports will be required for building permit.

#### c. DRAINAGE PLAN

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The Drainage Plan drawings shall be included as an appendix to the Drainage Report. Applicable drawings may be required by the construction drawings and SWMP as well. Requirement for the Drainage Plan drawings are provided in Appendix B. Drainage Plans may be separated into Preliminary and Final Drainage Plans. Preliminary Drainage Plans, like Preliminary Drainage Reports may be used for proof of concept for planning purposes. Preliminary Drainage Plans may exclude information such as orifice plate details, profiles for storm sewers, etc. Final Drainage Plans will be required for building permit issuance.

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## 2. FINAL/POST-CONSTRUCTION SUBMITTALS

After construction of stormwater collection, conveyance and stormwater control measures is complete and prior to final inspection by the City, the design engineer (or a Professional Engineer registered in the state of Colorado) shall provide to the City of Golden Public Works Department, Engineering Division the submittals summarized below. Refer to Appendix C for specific submittal requirements and associated documents.

### a. STORMWATER INFRASTRUCTURE CERTIFICATION

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A completed, signed, and sealed Stormwater Infrastructure Certification. The Certification form can be found in Appendix C.

### b. AS-BUILTS

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As-builts showing any deviations from the approved plans. Include the following in a PDF submittal: pipe length, pipe material, pipe size(s); manhole depth, rim elevation, diameter; inlet depth, deck elevation, inlet type; manhole and inlet pipe inverts.

### c. VIDEO INSPECTION

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A video inspection of all installed pipes in MPEG or mp4 format.

### d. STATE WATER RIGHTS REPORTING

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Compliance with Colorado Revised Statute (CRS) §37-92-602 (8) Water Rights reporting for Stormwater Detention and Infiltration Facilities is the responsibility of the Design Engineer. The compliance portal can be found at

<https://maperture.digitaldataservices.com/gvh/?viewer=cswdif>.

### e. OPERATION AND MAINTENANCE PLAN

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All sites requiring stormwater control measures must submit an Operations and Maintenance Plan describing long-term operation and maintenance procedures. The Plan will be used to ensure site specific inspection and maintenance criteria are followed for the long term. The Operations and Maintenance Plan should contain all information outlined in Appendix C. An example Plan is provided.

### f. TREATED AREA

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Upon completion of the project, as-built treated area for each individual stormwater control measure implemented at the site shall be provided to the City. Information should be provided via Esri shape file or geodatabase format to enable the City to bring the data into its GIS and Asset Management Systems.

Information may also be provided in an AutoCAD file with the treated area of each stormwater control measure shaded. If treated area is provided in AutoCAD all elements should be referenced to the Colorado State Plane Coordinate System NAD83 US survey feet. The vertical datum is North American Vertical Datum of 1988 (NAVD 88). Ground to grid scaling factor is

necessary for deliverables. Collection in a “modified” coordinate system is acceptable, but deliverables must be in the above coordinate system settings. In addition to drawing files, survey deliverables will include Tabular data in a spreadsheet format, including survey point descriptions, Northing & Easting Coordinates, and descriptive fields.

Digital files must match hard copy as-built drawings also submitted in PDF format. All mapped object types must be in separate layers with clear, descriptive names for each layer’s content. Line work must be continuous polylines.

## F. INSPECTIONS

Inspections are an important element of proper construction and oversight of stormwater control measures. Inspections are performed by the City, and must also be performed by the design engineer at significant milestones during construction, and upon construction completion.

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### 1. INSPECTIONS DURING CONSTRUCTION

All elements of control measures that will be installed below grade and won’t be visible for inspection at construction completion require an inspection by the City following installation. Examples include underdrains, clean-outs, filter media, etc. Delivery tickets and sieve analyses for filter media must be provided prior to installation and inspection to demonstrate materials comply with design drawings and specifications. This documentation must also be included in post-construction submittals discussed in Section II.E. and Appendix C. Original copies, photocopies or electronic copies are acceptable.

### 2. FINAL INSPECTION

Upon completion of construction, a Public Works-Engineering final inspection of control measures will be performed. Before this inspection is requested, all post-construction submittals discussed in Section II.E. and Appendix C must be provided to the City.

### 3. LONG-TERM MAINTENANCE INSPECTIONS

Performing routine maintenance of stormwater control facilities is key to ensuring they will function as designed for the long term. Inspections are regularly performed by the City, and must also be performed by the property owner or designated agent as described in the Operation and Maintenance Plan, discussed in Section II.E. and Appendix C.

## III. STORMWATER MANAGEMENT: DURING CONSTRUCTION

### A. INTRODUCTION

Effective management of stormwater runoff during construction is important for the protection of water quality. Effective erosion and sediment controls, along with material and site management, are necessary to minimize pollutants generated by construction sites and transported in stormwater.

### B. GENERAL REQUIREMENTS

A Stormwater Quality Permit is required for any activity resulting in, or contributing to, a total disturbed area greater than one half (½) acre and areas less than one half (½) acre which are a part of a Common Plan of Development or Sale. Refer to the Permit Application Packet included in Appendix D.

A State Permit for *Stormwater Discharges Associated with Construction Activities* is required only if more than five acres will be disturbed. The City is a designated Qualifying Local Program by the Colorado Department of Public Health and Environment Water Quality Control Division. Construction sites less than five (5) acres are automatically covered under the State's Stormwater Permit for Construction Activities with a City permit. Sites greater than five (5) acres require a State Stormwater Construction Permit in addition to the City permit. Contact CDPHE at <https://www.colorado.gov/pacific/cdphe/wq-construction-permits> or 303-692-3517 for more information.

### C. SUBMITTALS

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#### 1. STORMWATER QUALITY PERMIT APPLICATION

A Permittee must be designated on the permit. The Permittee must be an individual person who will be the responsible party for the project.

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#### 2. STORMWATER MANAGEMENT PLAN

Please refer to the SWMP Fact Sheet in Appendix D for Plan requirements.

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#### 3. PERFORMANCE SECURITY

The Performance Security must be a check or an irrevocable letter of credit. The amount is based on the cost of material and installation of all BMPs identified on the SWMP, plus the amount to stabilize the entire proposed disturbed area (seed and mulch).

The Performance Security will only be used in the event that the City has to take corrective action. Such action will follow a written request to the Permittee. If the city is required to call upon the escrow or letter of credit the permittee shall be required to pay the city a 15% administrative fee. If the City does not draw from the Performance Security it will be returned upon final stabilization, plus interest at the rate currently earned by the City. It is the responsibility of the Permittee to request the release of the Performance Security.

## D. STORMWATER CONTROL MEASURES (BMPS) FOR CONSTRUCTION

BMPs are evaluated for appropriateness to effectively control erosion, sediment and waste based upon site conditions and the type of construction. For specific design criteria and construction details, refer to the most current version of [USDCM Volume 3, Chapter 7, "Construction BMPs"](#).

Effective stormwater management during construction is dependent upon utilizing practices from each category below:

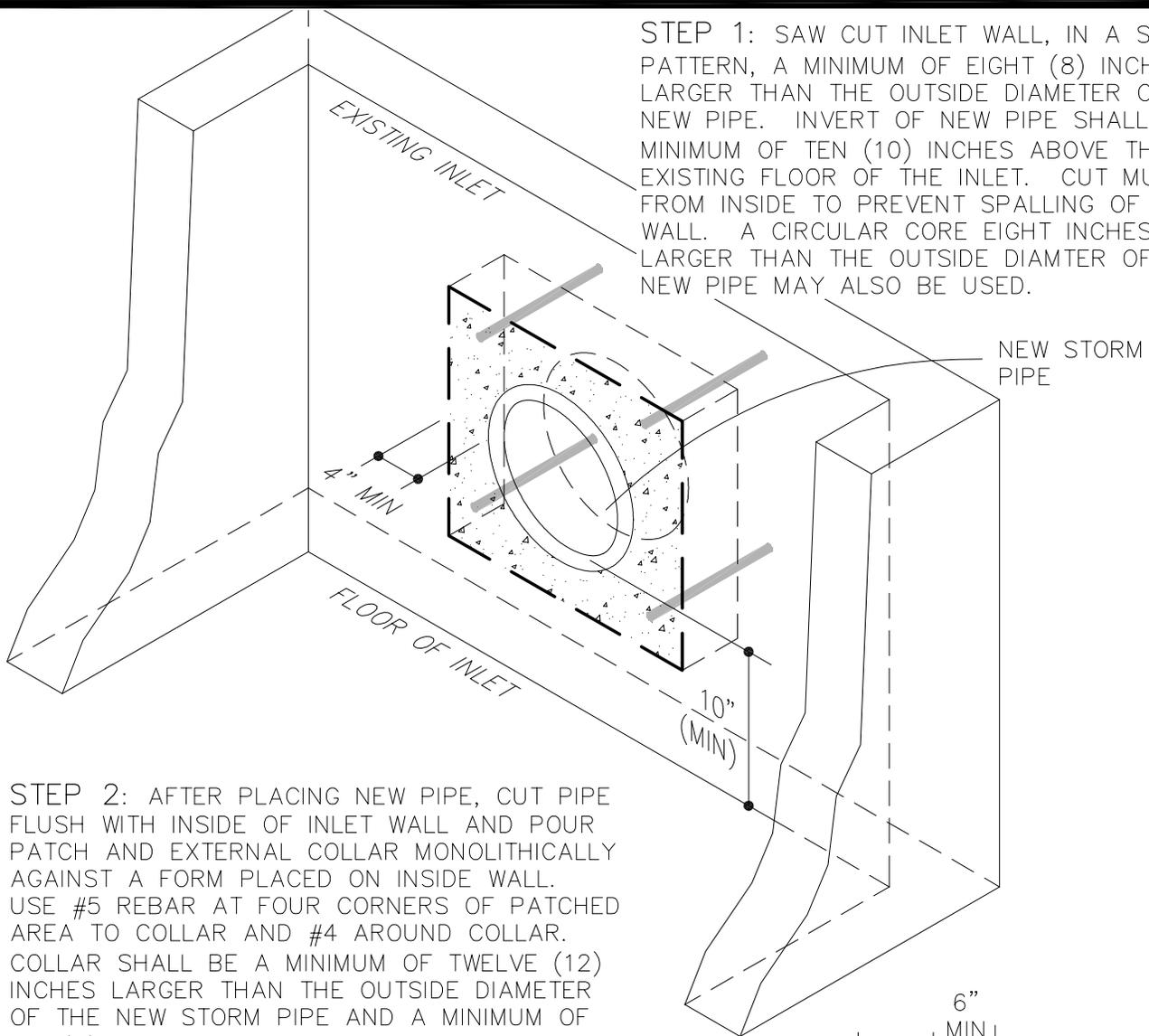
**Table 4 Control Measures for Construction**

<p><b>Erosion Control</b></p> <ul style="list-style-type: none"> <li>▪ Surface Roughening</li> <li>▪ Temporary/Permanent Seeding</li> <li>▪ Soil Binders</li> <li>▪ Mulching</li> <li>▪ Compost Blanket/Berm</li> <li>▪ Rolled Erosion Control Products</li> <li>▪ Temporary Slope Drain</li> <li>▪ Temporary Outlet Protection</li> <li>▪ Rough Cut Street Control</li> <li>▪ Earth Dikes/Drainage Swales</li> <li>▪ Terracing</li> <li>▪ Check Dams</li> <li>▪ Streambank Stabilization</li> </ul>	<p><b>Site Management</b></p> <ul style="list-style-type: none"> <li>▪ Construction Sequencing/Phasing</li> <li>▪ Protection of Existing Vegetation</li> <li>▪ Construction Fence</li> <li>▪ Vehicle Tracking Control</li> <li>▪ Stabilized Construction Roadway</li> <li>▪ Stabilized Staging Area</li> <li>▪ Street Sweeping/Vacuumping</li> <li>▪ Temporary Diversion Channel</li> <li>▪ Dewatering Operations</li> <li>▪ Temporary Stream Crossing</li> <li>▪ Temporary Batch Plant</li> <li>▪ Paving and Grinding Operations</li> </ul>
<p><b>Sediment Control</b></p> <ul style="list-style-type: none"> <li>▪ Silt Fence</li> <li>▪ Sediment Control Log</li> <li>▪ Straw Bale Barrier</li> <li>▪ Rock Sock</li> <li>▪ Inlet Protection</li> <li>▪ Sediment Basin</li> <li>▪ Sediment Trap</li> <li>▪ Vegetative Buffer</li> </ul>	<p><b>Materials Management</b></p> <ul style="list-style-type: none"> <li>▪ Concrete Washout</li> <li>▪ Stockpile Management</li> <li>▪ Good Housekeeping</li> </ul>

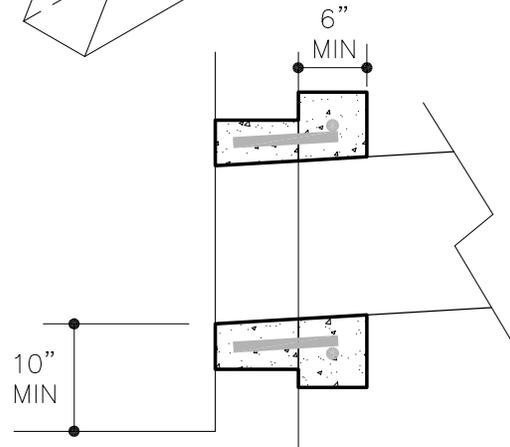
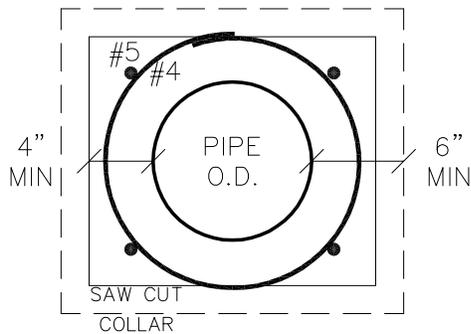
## APPENDIX A STANDARD DETAILS

- Storm Inlet Tie-in
- City Storm Manhole Lids
- Sediment Barrier in Sediment Basin
- Cut Back Curb

STEP 1: SAW CUT INLET WALL, IN A SQUARE PATTERN, A MINIMUM OF EIGHT (8) INCHES LARGER THAN THE OUTSIDE DIAMETER OF THE NEW PIPE. INVERT OF NEW PIPE SHALL BE A MINIMUM OF TEN (10) INCHES ABOVE THE EXISTING FLOOR OF THE INLET. CUT MUST BE FROM INSIDE TO PREVENT SPALLING OF INLET WALL. A CIRCULAR CORE EIGHT INCHES LARGER THAN THE OUTSIDE DIAMETER OF THE NEW PIPE MAY ALSO BE USED.



STEP 2: AFTER PLACING NEW PIPE, CUT PIPE FLUSH WITH INSIDE OF INLET WALL AND POUR PATCH AND EXTERNAL COLLAR MONOLITHICALLY AGAINST A FORM PLACED ON INSIDE WALL. USE #5 REBAR AT FOUR CORNERS OF PATCHED AREA TO COLLAR AND #4 AROUND COLLAR. COLLAR SHALL BE A MINIMUM OF TWELVE (12) INCHES LARGER THAN THE OUTSIDE DIAMETER OF THE NEW STORM PIPE AND A MINIMUM OF SIX (6) INCHES THICK.



STEP 3: REPAIR ANY IRREGULARITIES ON INSIDE OF INLET WALL WITH NON-SHRINK GROUT.

APPROVED

*Dan Kent*

DIRECTOR OF PUBLIC WORKS

CITY OF GOLDEN



DEPARTMENT OF PUBLIC WORKS

TIE INTO EXISTING INLET WITH NEW STORM PIPE

APPROVED

*Vince Anzures*

CITY ENGINEER

SCALE: NTS

DETAIL NO.

DATE: FEB 2007

X

**EAST JORDAN  
IRON WORKS, INC.**  
P.O. BOX 439  
EAST JORDAN, MI. 49727  
1-800-874-4100  
FAX 231-536-4458

DRAWN SMH	DATE 12/03/01
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APPROVED	DATE
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## 2405A COVER

PRODUCT NO.

**00240574**

CATALOG NO.

**2405A**

REF. PRODUCT DRAWING

00240573

EST. WT.

COVER: 135 LBS 61kg

OPEN AREA

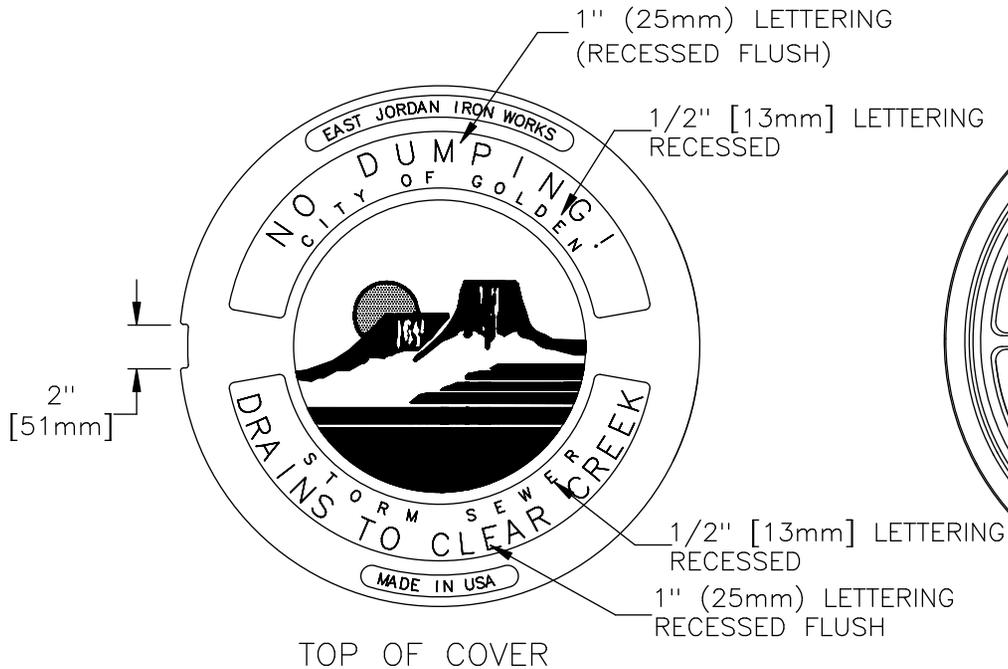
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MAT'L SPEC.

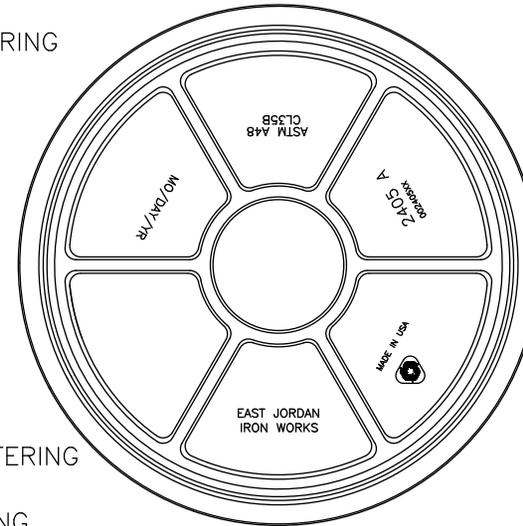
COVER - GRAY IRON  
ASTM A48 CL35

LOAD RATING

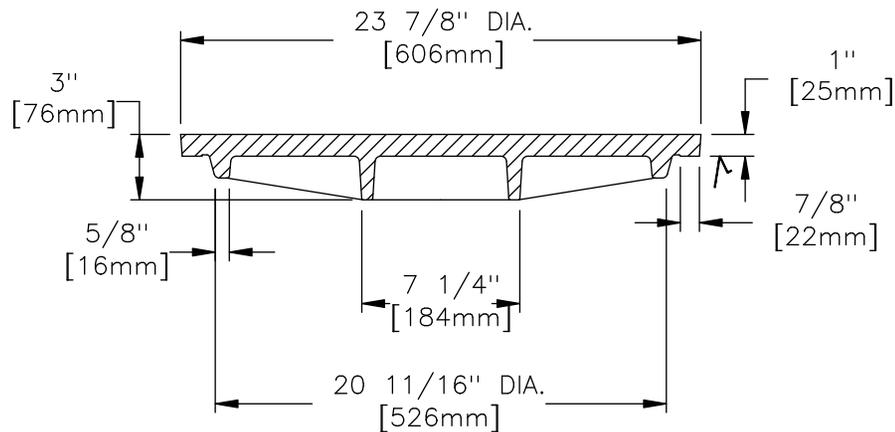
**HEAVY DUTY**



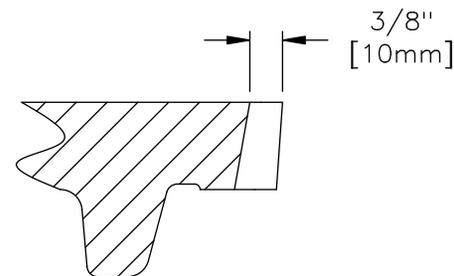
TOP OF COVER



BOTTOM OF COVER

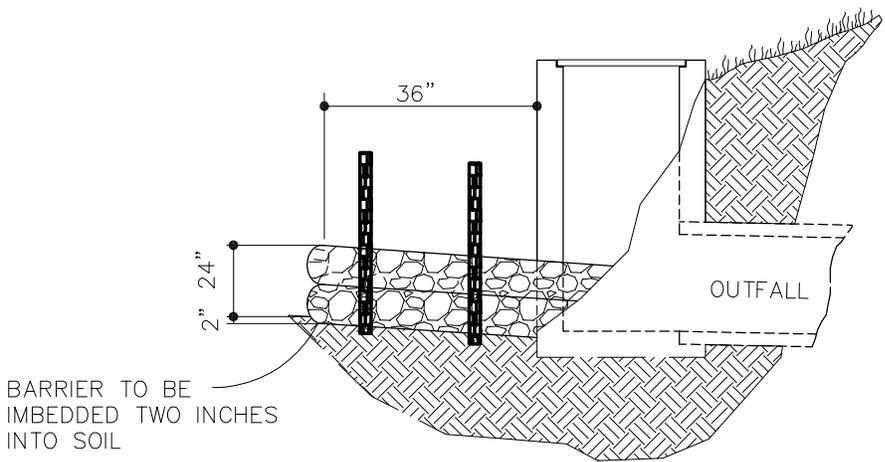
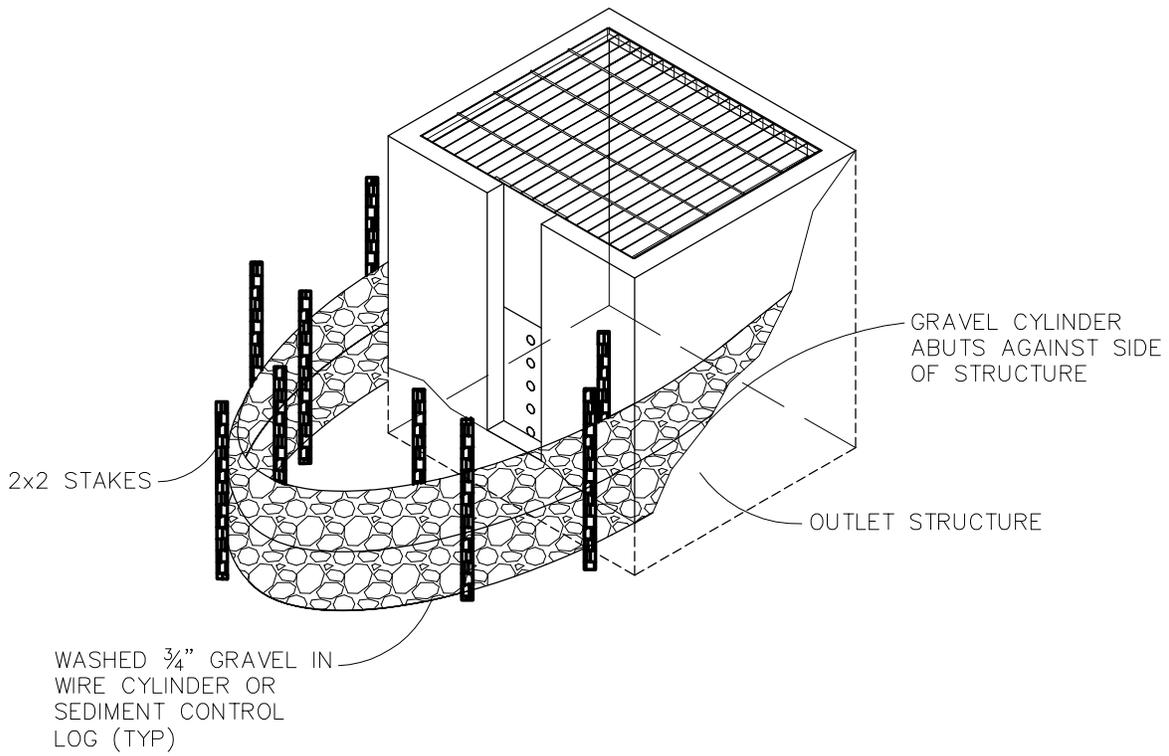


SECTION OF COVER



PICKSLOT DETAIL

√ MACHINED SURFACE



# SEDIMENT BARRIER FOR OUTLET STRUCTURE

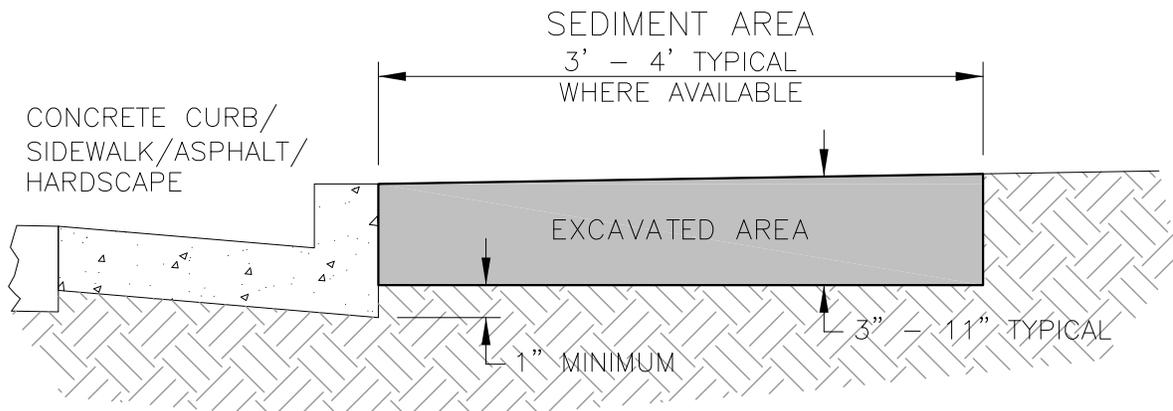
	<p>CITY OF GOLDEN</p>  <p>DEPARTMENT OF PUBLIC WORKS</p>	<p>SEDIMENT BARRIER</p>	
		<p>SCALE: NTS</p>	<p>DETAIL NO.</p>
		<p>DATE: JUNE 2006</p>	<p><i>IP</i></p>

**CUT BACK CURB:** TEMPORARY SEDIMENT CONTROL THAT UTILIZES CONTAINMENT PROVIDED BY EXISTING HARDSCAPE SUCH AS CURB, SIDEWALK, AND ASPHALT.

**APPROPRIATE USES:** CUT BACK CURB IS TYPICALLY USED FOR SHORT-TERM SEDIMENT CONTAINMENT OF SMALL AREAS WITH MINIMAL AREA AND SLOPE.

**PLACEMENT:** THE EXCAVATED AREA IS IMMEDIATELY UPHILL FROM HARDSCAPE WITH A MINIMUM DEPTH OF THREE INCHES (3") AND A MAXIMUM DEPTH OF ONE INCH (1") LESS THAN THE TOTAL DEPTH OF THE HARDSCAPE. ANY FURTHER EXCAVATION COULD UNDERCUT THE HARDSCAPE.

**INSPECTION AND MAINTENANCE:** INSPECT ROUTINELY AND MAINTAIN REGULARLY TO ENSURE THE ORIGINAL DIMENSIONS OF THE SEDIMENT AREA.



CITY OF GOLDEN



DEPARTMENT OF PUBLIC WORKS

CUT BACK CURB

SCALE: NTS

DATE: MAR 2016

DETAIL NO.

**CBC**

## APPENDIX B PRE-CONSTRUCTION SUBMITTALS

- Stormwater Quality Design Standards
  - Project Sheet, Base Design Standard
    - WQCV Standard Checklist
    - Pollutant Removal Standard Checklist
    - Runoff Reduction Standard Checklist
    - WQCV Control Measure Standard Checklist
    - WQCV Facility Standard Checklist
  - Project Sheet, Constrained Site Standard
    - Constrained WQCV Standard Checklist
    - Constrained Pollutant Removal Standard Checklist
    - Constrained Runoff Reduction Standard Checklist
- Drainage Report
- Drainage Plan

# PROJECT SHEET *BASE DESIGN STANDARDS*

Complete one Project Sheet for each project that includes Stormwater Quality BMPs.

## SITE INFORMATION

Project Name:			
Project Location:			
Submitted Date:		Submitted By:	
Acreage Disturbed:			
Existing Impervious:		New Net Impervious:	
Review Date:		Reviewed By:	
✓ Preparer	✓ COG	Requirements	
		Design Details are included for all BMPs	
		List or include a description of any Source Control BMPs (refer to Table 1) or other non-structural BMPs:	
		Does project overlap multiple MS4 Jurisdictions?	Yes      No
		If project overlaps jurisdictions, provide written agreement designating responsibility for BMP requirements, review, inspections	

## DESIGN STANDARDS

Design Standards may be used in combination, as necessary, to meet the requirements. Additional design methods may be considered if they comply with the MS4 Permit. Evaluation of suitability of Stormwater Control Measures (BMPs) is based on pollutant removal, flood attenuation and long-term maintenance. BMPs must be designed in accordance with the most current version of [USDCM vol. 3, Chapter 4 "Treatment BMPs"](#) and meet the specific requirements for each Design Standard used.

1. Indicate below, which Design Standards will be used for the project, and
2. Complete a separate, corresponding Design Standards checklist for each BMP (e.g., WQCV, etc.)

<i>Design Standard</i>	<i># BMPs</i>	<i>Location/Identifying information</i>
WQCV		
Pollutant Removal		
Runoff Reduction		
Regional WQCV Control Measure		
Regional WQCV Facility		

# CHECKLIST WQCV Standard

## WQCV STANDARD Criteria

Control measure(s) must be designed to provide treatment and/or infiltration of the WQCV for 100% of the site.

*Complete checklist if using the WQCV Standard to meet Design Standard requirements.*

Project Name:		
Preparer	COG	Requirements
		Control measure(s) provide treatment and/or infiltration of the WQCV for 100% of the site
		% of site treated:
		BMP type: <span style="float: right;">BMP ID/location:</span>
		See Drainage Report section:

*If less than 100% of the site is treated, complete the following:*

Preparer	COG	Requirements
		% of site not treated by control measures (not to exceed 20% or 1 acre):
		% <span style="float: right;">size (acres)</span>
		Provide explanation that the excluded area is impractical to treat:
		Provide explanation that another BMP is not practicable for the untreated area:

# CHECKLIST Pollutant Removal Standard

## POLLUTANT REMOVAL STANDARD Criteria

Control measure(s) must be designed to provide treatment of the 80th percentile storm event. The control measure(s) shall be designed to treat stormwater runoff in a manner expected to reduce the event mean concentration of total suspended solids (TSS), at a minimum, to a median value of 30mg/L or less for 100% of the site. Substantiating data must meet criteria in USDCM vol.3, T-11 and be included in the submittal.

*Complete checklist if using the Pollutant Removal Standard to meet Design Standard requirements.*

Project Name:		
Preparer	COG	Requirements
		Control measure(s) provide treatment of the 80th percentile storm event. The control measure(s) treat stormwater runoff in a manner expected to reduce the event mean concentration of total suspended solids (TSS) to a median value of 30mg/L or less for 100% of the site.
		BMP type: <input type="text"/> BMP ID/location: <input type="text"/>
		Storm event: <input type="text"/>
		TSS mg/L reduction: <input type="text"/>
		% of site treated: <input type="text"/>
		See Drainage Report section: <input type="text"/>

*If less than 100% of the site is treated, complete the following:*

Preparer	COG	Requirements		
		% of site not treated by control measures (not to exceed 20% or 1 acre):		
		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">%</td> <td style="width: 50%; text-align: center;">size (acres)</td> </tr> </table>	%	size (acres)
%	size (acres)			
		Provide explanation that the excluded area is impractical to treat:		
		Provide explanation that another BMP is not practicable for the untreated area:		

# CHECKLIST Runoff Reduction Standard

## RUNOFF REDUCTION STANDARD Criteria

Control measure(s) must be designed to infiltrate, evaporate or evapotranspire, at a minimum, a quantity of water equal to 60% of what the calculated WQCV would be if all impervious area discharged without infiltration. This Standard can be met through practices such as Green Infrastructure and Low Impact Development practices.

*Complete checklist if using the Runoff Reduction Standard to meet Design Standard requirements.*

Project Name:		
Preparer	COG	Requirements
		Control measure infiltrates, evaporates or evapotranspires at least 60% of WQCV
		% treated through runoff reduction:
		BMP type:
		BMP ID/location:
		See Drainage Report section:

# CHECKLIST Regional WQCV Control Measure Standard

## REGIONAL WQCV CONTROL MEASURE STANDARD Criteria

Control Measure(s) must be designed to accept the drainage from the applicable development site. Stormwater from the site must not discharge to a water of the state before being discharged to the Regional WQCV Control Measure. The Regional WQCV Control Measure must be designed to provide treatment and/or infiltration of the WQCV for 100% of the applicable development site.

*Complete checklist if using the Regional WQCV Control Measure Standard to meet Design Standard requirements.*

Project Name:		
Preparer	COG	Requirements
		Control Measure(s) are designed to accept the drainage from the site
		Stormwater from the site must not discharge to a water of the state before being discharged to the Regional WQCV Control Measure
		The Regional WQCV Control Measure is designed to provide treatment and/or infiltration of the WQCV for 100% of the site
		BMP ID/location:
		See Drainage Report section:

*If less than 100% of the site is treated, complete the following:*

Preparer	COG	Requirements		
		% of site not treated by control measures (not to exceed 20% or 1 acre):		
		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">%</td> <td style="width: 50%; text-align: center;">size (acres)</td> </tr> </table>	%	size (acres)
%	size (acres)			
		Provide explanation that the excluded area is impractical to treat:		
		Provide explanation that another BMP is not practicable for the untreated area:		

# CHECKLIST Regional WQCV Facility Standard

## REGIONAL WQCV FACILITY STANDARD Criteria

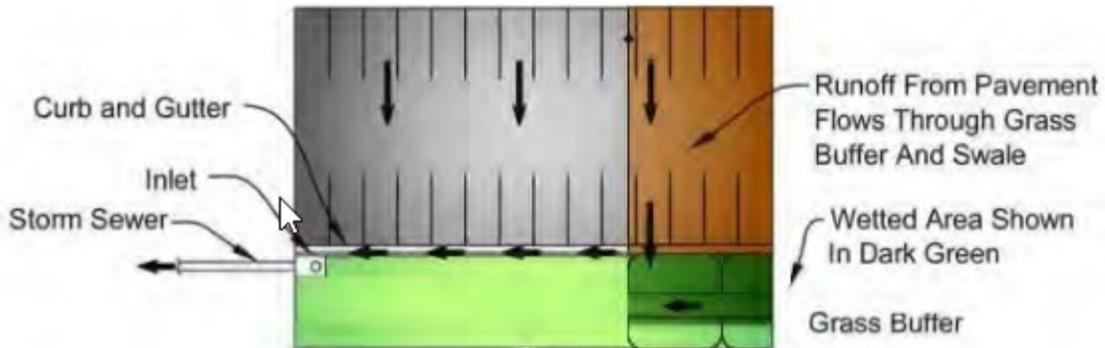
Control Measure(s) must be designed to accept drainage from the applicable development site. Stormwater from the site may discharge to a water of the state before being discharged to the Regional WQCV facility. Before discharging to a water of the state, at least 20 percent of the upstream imperviousness of the site must be disconnected from the storm drainage system and drain through a receiving pervious area control measure comprising a footprint of at least 10 percent of the upstream disconnected impervious area of the applicable development site. In addition, the stream channel between the discharge point of the applicable development site and the Regional WQCV facility must be stabilized.

*Complete checklist if using the Regional WQCV Facility Standard to meet Design Standard requirements.*

Project Name:			
Preparer	COG	Requirements	
		The Regional WQCV Facility is implemented, functional, and maintained following good engineering, hydrologic and pollution control practices.	
		The Regional WQCV Facility is designed and operating in accordance with the original design and/or USDCM vol.3.	
		The Regional WQCV Facility is designed and operating to provide 100% WQCV for its entire drainage area.	
		The Regional WQCV Facility has capacity to accommodate the drainage from the site.	
		The Regional WQCV Facility is designed and built to comply with all assumptions for the development planned within the drainage area and site.	
		Evaluation of the minimum drain time is based on the pollutant removal mechanism and functionality of the facility.	
		The Regional WQCV Facility is designed and constructed with flood control and water quality as the primary use. Recreational ponds and reservoirs or Classified State Waters cannot be used as Regional WQCV Facilities.	
		% of site treated in facility:	
		% of unconnected imperviousness area (prior to facility):	
		% of receiving pervious area (prior to facility):	
		Stream channel stabilized (include documentation)	
		Stream reach:	Method of stabilization:
		Date completed:	Included in project scope:
		BMP type:	BMP ID/location:
		See Drainage Report section:	

# Regional WQCV Facility Standard example

## Example Water Quality Enhancements for Site Tributary to Regional Facility



### LEGEND

-  Directly Connected Impervious Area
-  Unconnected Impervious Area (Equal to 20% of the Total impervious area)
-  Receiving Pervious Area (Equal to 10% of the unconnected impervious area)
-  Separate Pervious Area

Graphic courtesy of SEMSWA  
Criteria Regarding Onsite Treatment in a Regional System  
2014

# PROJECT SHEET *CONSTRAINED SITE STANDARD*

Complete one Project Sheet for each project that is Constrained and includes Stormwater Quality BMPs.

## CONSTRAINED REDEVELOPMENT SITES

Constrained Redevelopment Sites are sites where the existing condition is >35% imperviousness and the proposed redevelopment will result in >75% imperviousness. If the proposed redevelopment will result in >75% imperviousness, but the existing condition is <35% imperviousness, the Constrained Site Standard cannot be used and Base Design Standards must be followed. **The Constrained Site Standard can only be used if it is determined that it is not practicable to meet any of the Base Design Standards.** It is incumbent on the design engineer to demonstrate adherence to Base Design Standards has been thoroughly evaluated and found to be infeasible before a Constrained Site Standard is proposed.

## SITE INFORMATION

Project Name:				
Project Location:				
Submitted Date:			Submitted By:	
Acreage Disturbed:				
Existing Impervious:			New Net Impervious:	
Review Date:			Reviewed By:	
✓ Preparer	✓ COG	Requirements		
		Design Details are included for all BMPs		
		List or include a description of any Source Control BMPs (refer to Table 1) or other non-structural BMPs:		
		Does project overlap multiple MS4 Jurisdictions?	Yes	No
		If project overlaps jurisdictions, provide written agreement designating responsibility for BMP requirements, review, inspections		

## DESIGN STANDARDS

Design Standards may be used in combination, as necessary, to meet the requirements. Additional design methods may be considered if they comply with the MS4 Permit. Evaluation of suitability of Stormwater Control Measures (BMPs) is based on pollutant removal, flood attenuation and long-term maintenance. BMPs must be designed in accordance with the most current version of [USDCM vol. 3, Chapter 4 "Treatment BMPs"](#) and meet the specific requirements for each Design Standard used.

1. Indicate below, which Design Standards will be used for the project, and
2. Complete a separate, corresponding Design Standards checklist for each BMP (e.g., WQCV, etc.)

Design Standard	# BMPs	Location/Identifying information
WQCV		
Pollutant Removal		
Runoff Reduction		

# CHECKLIST Constrained WQCV Standard

## APPLICABILITY

Constrained Redevelopment Sites are sites where the existing condition is >35% imperviousness and the proposed redevelopment will result in >75% imperviousness. If the proposed redevelopment will result in >75% imperviousness, but the existing condition is <35% imperviousness, the Constrained Site Standard cannot be used and Base Design Standards must be followed. **The Constrained Site Standard can only be used if it is determined that it is not practicable to meet any of the Base Design Standards.** It is incumbent on the design engineer to demonstrate adherence to Base Design Standards has been thoroughly evaluated and found to be infeasible before a Constrained Site Standard is proposed.

The minimum treatment levels are included below and treatment should be maximized to the extent feasible under constrained site conditions.

---

## CONSTRAINED WQCV STANDARD Criteria

Control measure(s) must be designed to provide, at a minimum, treatment and/or infiltration of the WQCV for 50% of the site.

*Complete checklist if using the Constrained WQCV Standard to meet Design Standard requirements.*

Project Name:		
Preparer	COG	Requirements
		Control measure(s) provide treatment and/or infiltration of the WQCV for 50% of the site
		% of site treated:
		BMP type:
		BMP ID/location:
		See Drainage Report section:
		Provide an evaluation of the infeasibility of Base Design Standards and justification for use of Constrained Site Standard:

# CHECKLIST Constrained Pollutant Removal Standard

## APPLICABILITY

Constrained Redevelopment Sites are sites where the existing condition is >35% imperviousness and the proposed redevelopment will result in >75% imperviousness. If the proposed redevelopment will result in >75% imperviousness, but the existing condition is <35% imperviousness, the Constrained Site Standard cannot be used and Base Design Standards must be followed. **The Constrained Site Standard can only be used if it is determined that it is not practicable to meet any of the Base Design Standards.** It is incumbent on the design engineer to demonstrate adherence to Base Design Standards has been thoroughly evaluated and found to be infeasible before a Constrained Site Standard is proposed.

The minimum treatment levels are included below and treatment should be maximized to the extent feasible under constrained site conditions.

---

## CONSTRAINED POLLUTANT REMOVAL STANDARD Criteria

Control measure(s) must be designed to provide treatment of the 80th percentile storm event. The control measure(s) shall be designed to treat stormwater runoff in a manner expected to reduce the event mean concentration of total suspended solids (TSS), at a minimum, to a median value of 30mg/L or less for 50% of the site. Substantiating data must meet criteria in USDCM vol.3, T-11 and be included in the submittal.

*Complete checklist if using the Constrained Pollutant Removal Standard to meet Design Standard requirements.*

Project Name:		
Preparer	COG	Requirements
		Control measure(s) provide treatment of the 80th percentile storm event. The control measure(s) shall be designed to treat stormwater runoff in a manner expected to reduce the event mean concentration of total suspended solids (TSS) to a median value of 30mg/L or less for 100% of the site.
		BMP type: <span style="float: right;">BMP ID/location:</span>
		Storm event:
		TSS mg/L reduction:
		% of site treated:
		See Drainage Report section:
		Provide an evaluation of the infeasibility of Base Design Standards and justification for use of Constrained Site Standard:

# CHECKLIST Constrained Runoff Reduction Standard

## APPLICABILITY

Constrained Redevelopment Sites are sites where the existing condition is >35% imperviousness and the proposed redevelopment will result in >75% imperviousness. If the proposed redevelopment will result in >75% imperviousness, but the existing condition is <35% imperviousness, the Constrained Site Standard cannot be used and Base Design Standards must be followed. **The Constrained Site Standard can only be used if it is determined that it is not practicable to meet any of the Base Design Standards.** It is incumbent on the design engineer to demonstrate adherence to Base Design Standards has been thoroughly evaluated and found to be infeasible before a Constrained Site Standard is proposed.

The minimum treatment levels are included below and treatment should be maximized to the extent feasible under constrained site conditions.

---

## CONSTRAINED RUNOFF REDUCTION STANDARD Criteria

Control measure(s) must be designed to infiltrate, evaporate or evapotranspire, at a minimum, a quantity of water equal to 30% of what the calculated WQCV would be if all impervious area discharged without infiltration. This Standard can be met through practices such as Green Infrastructure and Low Impact Development practices.

*Complete checklist if using the Constrained Runoff Reduction Standard to meet Design Standard requirements.*

Project Name:		
Preparer	COG	Requirements
		Control measure infiltrates, evaporates or evapotranspires at least 30% of WQCV
		% treated through runoff reduction:
		BMP type:
		BMP ID/location:
		See Drainage Report section:
		Provide an evaluation of the infeasibility of Base Design Standards and justification for use of Constrained Site Standard:

# DRAINAGE REPORT LAYOUT AND CONTENTS

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## I. CERTIFICATION STATEMENT

This report for the drainage design of (Name of Development) was prepared by me (or under my supervision) in accordance with the provisions of City of Golden Storm Drainage Design and Technical Criteria, and was designed to comply with the provisions thereof. I understand that the City of Golden does not, and will not, assume liability for drainage facilities designed by others.

By: \_\_\_\_\_

Licensed Professional Engineer

State of Colorado

No. \_\_\_\_\_

Affix Seal

---

## II. GENERAL LOCATION AND DESCRIPTION

### A. Location

- a. Vicinity Map: A map showing the project location within the City. The project area shall be shaded; major arterial streets labeled; and major water courses and water bodies shall be labeled. The map shall be a minimum of 6" x 6", with a scale ranging from 1" = 1000' to 1" = 3000'.
- b. Township, range, section, ¼ section
- c. Local streets within and adjacent to the subdivision with ROW width shown
- d. Major drainageways, facilities, and easements within or adjacent to the site

### B. Description of Property

- a. General project description, including proposed land use
  - b. Area in acres
  - c. Existing ground cover (type of trees, shrubs, vegetation, general soil conditions, topography, and slope)
  - d. Impervious area and area of disturbance, including weighted and non-weighted (total square feet of concrete surfaces, asphalt surfaces, roofs, etc.) pre- and post-construction impervious area, and anticipated area of disturbance in acres
  - e. Major drainageways and drainage facilities
  - f. Irrigation facilities
  - g. Easements within and adjacent to the site
- 

## III. MAJOR DRAINAGE BASINS AND SUB-BASINS

### A. Major Basin Description

- a. Reference to major drainageway planning studies such as flood hazard delineation reports, major drainageway planning reports, and flood insurance rate maps

- b. Major basin drainage characteristics, existing and planned land uses within the basin.
- c. Identification of all irrigation facilities within the basin, which will influence or be influenced by the local drainage design
- B. Sub-Basin Description
  - a. Discussion of historic and proposed drainage patterns of the property
  - b. Discussion of offsite drainage flow patterns and impact on development under existing and fully developed basin conditions

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#### IV. DRAINAGE DESIGN CRITERIA

- A. Regulations: Discussion of the optional provisions selected or the deviation from the criteria, if any, and its justification
- B. Discussion on implementation of the "Four Step Process" including Runoff Reduction Practices, Water Quality Capture Volume, Stabilizing Drainageways and Source Control BMPs
- C. Development Criteria Reference and Constraints
  - a. Discussion of previous drainage studies (i.e., project master plans) for the site that influence or are influenced by the drainage design and how the plan will affect drainage design for the site
  - b. Discussion of the relationship to and effects of adjacent drainage studies
  - c. Discussion of the drainage impact of site constraints such as streets, utilities, rapid transit, existing structures, and development or site plan
- D. Hydrological Criteria
  - a. Identify design rainfall.
  - b. Hydrologic soil group.
  - c. Identify runoff calculation method
  - d. Identify detention discharge and storage calculation method
  - e. Identify design storm recurrence intervals
  - f. Discussion and justification of other assumptions or calculation methods used that are not referenced by the criteria
- E. Hydraulic Criteria
  - a. Identify various capacity references
  - b. Discussion of other drainage facility design criteria used that are not referenced in the criteria
  - c. If there are proposed modifications to areas within the 100-year floodplain or floodway, a "Floodplain Modeling Report" must be submitted
  - d. If there are proposed modifications to a natural drainageway where a 100-year floodplain has not been designated, a "Floodplain Modeling Study" must be submitted
- F. Water Quality
  - a. Include applicable Stormwater Quality Design Standards Checklist(s) for all stormwater control measures (BMPs) included in the design. See Appendix B for checklist(s).
- G. Modifications of Criteria
  - a. Identify provisions by section number for which a modification is requested
  - b. Provide justification for each modification requested

---

## V. DRAINAGE FACILITY DESIGN

### A. General Concept

- a. Discussion of concept and typical drainage patterns
- b. Discussion of compliance with off-site runoff considerations
- c. Discussion of anticipated and proposed drainage patterns
- d. Discussion of the content of tables, charts, figures, plates, or drawings presented in the report

### B. Specific Details

- a. Discussion of drainage problems encountered and solutions at specific design points
- b. Discussion of detention storage and outlet design
- c. Discussion of measures implemented to treat the WQCV
- d. Structural and non-structural control measures (BMPs) that will be part of the stormwater management design.
- e. A summary table for each detention storage pond on the site to include:
  - i. Stage-Storage Curve
  - ii. Stage-Discharge Curve
  - iii. Detention Pond Volume Required
  - iv. Detention Pond Volume Provided
  - v. Water Quality Capture Volume (WQCV)
  - vi. Water Quality Elevation
  - vii. Spillway Elevation
  - viii. Pond Freeboard
  - ix. Outlet(s) size(s)
- f. Discussion of maintenance access and maintenance responsibility
- g. Discussion of easements and tracts for drainage purposes, including the conditions and limitations for use
- h. Discussion of the facilities needed offsite for the conveyance of minor and major flows to the major drainageway

---

## VI. CONCLUSIONS

### A. Compliance with Standards

- a. Compliance with City of Golden Stormwater Standards Manual
- b. Compliance with any existing Master Drainage Plans
- c. Compliance with the City's floodplain regulations
- d. Compliance with applicable State and Federal regulations

### B. Drainage Concept

- a. Effectiveness of drainage design to control damage from storm runoff
- b. Influence of proposed development on the Master Drainage Plan recommendation(s)

---

## VII. REFERENCES

Reference all criteria and technical information used

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## VIII. APPENDICES

- A. Vicinity Map
- B. Hydrologic Computations
  - a. Land use assumptions regarding adjacent properties
  - b. Initial and major storm runoff at specific design points
  - c. Historic and fully developed runoff computations at specific design points
  - d. Hydrographs at critical design points
  - e. Time of concentration and runoff coefficients for each basin
- C. Hydraulic Computations
  - a. Culvert capacities
  - b. Storm sewer capacity. Allowable models include StormCAD, UDSewer, FlowMaster, and Extran. Other models will be accepted on a case by case basis upon prior approval from the City
  - c. Street flow calculations for the 2-year and 100-year events regarding street encroachment, theoretical capacity, and allowable gutter flow
  - d. Storm inlet capacity including inlet control rating at connection(s) to storm sewer system
  - e. Open channel design
  - f. Check dam and/or channel drop design
  - g. Detention facility design including area/volume capacity, outlet capacity, soil analysis, and ground water table elevations
  - h. Downstream/outfall system capacity to the major drainageway system
  - i. Design of erosion protection measures for culverts, and storm sewer outlets
- D. Letters of intent to acquire all necessary off-site easements
- E. Water quality design calculations
- F. Printed copies of input and output files for all computer models used in the analysis and design
- G. Digital copies of input and output files for all computer models used in the analysis and design
- H. Drainage Plan (Overall Drainage Plan, Detailed Drainage Plans)

# DRAINAGE PLAN CONTENTS

All final drainage plan drawings shall be 24" X 36" in size and signed and sealed by a professional engineer, registered in the State of Colorado. All drawings should include title block, project name, project address, date of preparation, and north arrow, legend to define map symbols and scale as applicable. An overall drainage plan and detailed drainage plan should be provided with the information provided below. Some information may be repeated on several plans but should be repeated as necessary.

---

## I. OVERALL DRAINAGE PLAN

- A. Boundaries of entire development or project
- B. Limits of all major basins, including offsite basins.
- C. General drainage patterns and flow paths, including those entering and leaving the site.
- D. Any existing or proposed major stormwater management facilities, upstream, downstream, or within the site.

---

## II. DETAILED DRAINAGE PLAN

- A. Scale of 1"=20' to 1"=100'
- B. The boundary lines of the subdivision or project, right-of-way lines of streets, easements and other rights of way with purposes noted, irrigation ditches, detention ponds, watercourses, and lot lines, with accurate bearings and distances.
- C. Designations of all streets and other rights of way, including dimensions and names of such streets.
- D. Floodplain boundary based on the most current information.
- E. The location, size, and type of all existing utilities.
- F. The location, size, and type of all storm sewers.
- G. The location, size, and type of all culverts, including box culverts.
- H. The location, size, and type of all open channels, including irrigation ditches with profile views where applicable.
- I. The location, size, and type of all inlets, cross pans, manholes, and other storm sewer appurtenances.
- J. Major basin and sub-basin boundaries.
- K. Drainage sub-basin boundaries and concentration points for the developed site clearly delineated and labeled
- L. Any offsite feature or basin influencing development.
- M. Show the lowest floor elevation (the basement floor elevation or the bottom of the crawl space) and grade at foundation elevations of all buildings.
- N. Street slope and flow direction and cross-pan.
- O. Existing (dashed or screened) and proposed (solid) contours (use NAVD 88 Datum) with a 2-foot maximum interval. The contours must extend a minimum of 100 feet beyond property lines.

- P. Spot elevations or one foot contours where two foot contours do not show on the property or where needed to depict the grading. Spot elevations may be needed in critical areas, especially adjacent to existing developed property.
- Q. Spot elevations critical to describe drainage features and their function (e.g., inlets, cross pans, spillways, inlets/outlets of manholes, culverts, and storm sewers).
- R. A summary table of site hydrology, including offsite flows entering the site for the 10-year and 100-year design storms, basin numbers, basin areas, runoff coefficients, and onsite flows for the 10-year and 100-year design storms at the concentration points
- S. Cross-sectional views of all open channels, including irrigation ditches, trickle channels, spillway structures, etc. These views must include applicable easement/right-of-way boundaries and water surface elevations such as the 100-year storm depth, 2-year storm depth, major storm freeboard, and operating irrigation level
- T. Capacity, discharge, outlet structure, spillways, permanent pool water level (if any), and 100-year high water level for all detention ponds, including both the water quality and water quantity elevations. Cross-hatching of the area inundated by the 100-year water surface elevation is recommended
- U. If SWMM modeling is used, a sub-basin map and a SWMM schematic diagram are required to depict the sub-basins and conveyance elements represented in the model
- V. All existing and proposed drainage facilities (e.g., detention facilities, storm sewers, swales, riprap, outlet structures, irrigation ditches, culverts, cross pans and other appurtenances, including riprap protection).
- W. Water surface profiles for all major open channels, or as required
- X. Proposed outfalls or exit points for runoff from the developed area and facilities to convey flows to the final outfall point without damage to downstream properties.
- Y. Proposed stormwater control measure grading and outlet schematic, include overflow directions and amount and emergency spillway.
- Z. Runoff summary table.
- AA. Stormwater control measure summary table.
- BB. Location and footprints of stormwater control measure.
- CC. Include benchmark.
- DD. Stormwater control measure schematic.
- EE. Construction details for stormwater control measure including, but not limited to, outlet structures, trickle channels, and forebays.
- FF. Profile views of all subsurface drainage facilities showing their size, slope, lengths, design storm hydraulic grade lines (2-year and 100-year), cover, details of structures or City of Golden Standard Details, and relationship with existing utilities.
- GG. General notes relating to the design of the drainage features of the development are required on the utility plan cover sheet. (Additional notes are required by other departments, such as Engineering and Water/Wastewater.) The required drainage notes are as follows:
  - a. All street, sanitary sewer, storm sewer and water construction shall conform to City Standards and Specifications current at date of execution of the Development Agreement pertaining to this development. Any construction occurring three years after the execution of the development agreement shall require re-examination of the plans by the Director who may require that they be made to conform to standards and specifications current at that time.
  - b. The type, size, location, and number of all known underground utilities are approximate as shown on the drawings. It shall be the responsibility of the

contractor to verify the existence and location of all underground utilities along the route of the work. Before commencing new construction, the contractor shall be responsible for locating unknown underground utilities.

- c. These plans have been reviewed by the City for concept only. The review does not imply responsibility by the reviewing department, the City Engineer, or the City for accuracy or correctness of the calculations. Furthermore, the review does not imply that the quantities of the items on the plans are the final quantities required. The review shall not be construed in any reason as acceptance of financial responsibility by the City for additional quantities of items shown that may be required during the construction phase.
- d. Maintenance of onsite stormwater facilities shall be the responsibility of the property owners, the maintenance procedures of any permitted proprietary stormwater control measure must meet the requirements of City of Golden Engineering Division.
- e. If fill or dredged material is discharged into waters of the United States, a USACE 404 permit is required.
- f. If construction affects any Colorado Highway, a Colorado Department of Transportation Right-of-Way permit is required.

## APPENDIX C FINAL/POST-CONSTRUCTION SUBMITTALS

- Stormwater Infrastructure Certification form
- Operation and Maintenance Plan guidelines
- Operation and Maintenance Plan example
- Operation and Maintenance Acknowledgement Form

# Stormwater Infrastructure Certification

TO BE COMPLETED BY DESIGN ENGINEER AND RETURNED PRIOR TO ISSUANCE OF CERTIFICATE OF OCCUPANCY

Property Location		
Address:	Permit Number:	
Location Description:	Parcel Size (acre):	
Contact Information		
Owner		
Name	Company	
Address	City, State, Zip	
Phone	Email	
Design Engineer		
Name	Company	
Address	City, State, Zip	
Phone	Email	
Requirements for Approval		✓ completed
State Water Rights Reporting documentation provided to Public Works		
As-Built Drawings provided to Public Works		
Delivery tickets and sieve analyses of filter media, if applicable		
Treated area of stormwater control measure(s)		
Video Inspection of all installed pipes performed, provided to Public Works		
Operation and Maintenance Plan provided to Public Works		
Operation and Maintenance Acknowledgement Form provided to Public Works		
<p>I hereby certify that the stormwater and drainage facilities for the above referenced project have been constructed and operate in conformance with the approved design. Further I certify that any deviation from the design has been documented and approved, in writing, by the City of Golden and that said documentation has been provided to the City of Golden.</p> <p>Signature: _____ Date: _____</p>		Affix Professional Engineer Seal

<b>Stormwater Quality Design Standard</b> (check all that apply)		
WQCV	Pollutant Removal	Runoff Reduction
Regional WQCV Control Measure	Regional WQCV Facility	Constrained Site
<b>Stormwater Control Measure Type</b> (check all that apply)		
Extended Detention Basin	Sand Filter	
Bioretention	Constructed Wetland Pond	
Retention Pond	Constructed Wetland Channel	
Grass Buffer	Green Roof	
Grass Swale	Underground	

<b>Stormwater Collection System</b> (if additional space is needed complete additional form and attach)			
Pipe System			
Size (in):	Length (ft):	Invert Depth (ft):	Material:
Size (in):	Length (ft):	Invert Depth (ft):	Material:
Size (in):	Length (ft):	Invert Depth (ft):	Material:
Surface System (gutters, pans, channels, chases, etc.)			
Width(ft):	Depth(ft):	Max. Longitudinal Slope (%):	Material:
Width(ft):	Depth(ft):	Max. Longitudinal Slope (%):	Material:

<b>Flood Control</b>	As Designed / As Constructed
100 Year Volume (CF):	
100 Year WSEL:	
10 Year Volume (CF):	
10 Year WSEL:	

<b>Water Quality</b>	As Designed / As Constructed
WQCV (CF):	
WQCV WSEL:	
EURV (CF):	
EURV WSEL:	

<b>Stormwater Facility</b>	As Designed / As Constructed
10 Year Orifice Elevation:	
Top of Pond Outlet Elevation:	
100 Year Restriction Plate Orientation:	
Total Pond Volume (CF):	
Overflow Elevation Width:	
Overflow Elevation Depth:	
Trickle Channel Longitudinal Slope (%):	
Trickle Channel Cross Sectional Area (ft <sup>2</sup> ):	

# Operation and Maintenance Plan

## OVERVIEW

The City of Golden requires that an Operation and Maintenance Plan (O&M Plan) be submitted for all projects requiring construction of stormwater control measures (BMPs). The O&M Plan shall consist of a single plan sheet, sized 24 inches by 36 inches, that includes all the necessary information for long-term maintenance of the site and shall generally conform to the guidelines that follow and the provided plan example. Graphical elements included on the plan sheet are to reflect As-built Record Drawing information associated with the completed project.

## CONTENTS OF OPERATION AND MAINTENANCE SITE PLAN

The following outline shall be used to guide the development of the O&M Plan. Some items may not apply to all projects, and any unique features may warrant inclusion of additional information if pertinent to the anticipated maintenance of the site.

---

### Section 1 - Project Information

Information can be listed in drawing title, as shown in example

#### *1.0 General Information*

- A. Property Owner - Including contact information (address, phone, email)
- B. Design Engineer - Including contact information (address, phone, email)
- C. Project Completion Date
- D. Golden Approval Block

#### *1.1 Hydraulic Information*

- A. Flow Rates- All applicable flow rates should be listed, e.g. base flow, design flow, any storm flows that were evaluated, etc. Detention facilities should include inflow and outflow rates.
- B. Facility Description- Include additional design information for the facility, including volumes, water surface elevations, and surface types for forebays and micropools.
- C. Outlet Type
- D. WQCV Drain Time

#### *1.2 Miscellaneous Information*

- A. Project Survey Information- Include survey control information and at least one on-site "Maintenance Control Point" established during construction for use during maintenance activities.
- B. Seed Mix
- C. Mow Area- Include area in acres and description of mow limits.
- D. Long Term Monitoring Requirements- If applicable, list monitoring requirements such as 404 Permit Reports or any other required monitoring.

---

## Section 2 - Project Notes

### 2.0 General Facility Description

Include function, flow source, flow pattern through project, any special features, and any additional information that may be helpful in understanding the basic workings of the facility.

### 2.1 Maintenance Notes

- A. Maintenance Frequency
- C. Equipment and Special Tools Required
- D. Location and description of maintenance access

### 2.2 Maintenance Procedure

- A. Dewatering
- B. Sediment Removal
- C. Debris Removal
- D. Site Inspection - List all general features and equipment that should be inspected to ascertain additional maintenance needs.
- F. Post-Maintenance Considerations - Any additional maintenance-related tasks should be listed here. These may include restoring flow patterns, or additional cleanup requirements.

---

## Section 3 – Site Plan

### 3.0 Vicinity Map

3.1 Plan View- All major features of the facility should be labeled, including the following:

- Inflow
- Forebay, include the longest reach distance required from access road
- Trickle channel
- Micropool, include the longest reach distance required from access road
- Outlet Structure
- Emergency spillway
- Maintenance access
- On-site storm conveyances including channels and storm sewers

In addition, special maintenance-related information should be identified:

- Maintenance Control Point location and elevation
- Maintenance access (entrance, access road, gates, turnarounds, etc.). Include applicable information such as road material, width, maximum grade, etc.
- Power source
- Weight-restricted areas
- Wetland or natural areas to avoid

### 3.2 Hydraulic Profile

- Major features
- Permanent pool elevations
- Other applicable water surface elevations
- Flow direction
- Shading identifying forebay and micropool sediment removal zones

## Section 4 – Details

Information relevant to the facility on site: Bioretention, EDB, Sand Filter Basin, etc.

- 4.0 *Inlet Structure(s)*
- 4.1 *Forebay Release Structure*
- 4.2 *Trickle Channel Section*
- 4.3 *Outlet Structure*
- 4.5 *Maintenance Road/Access*

### SUBMITTAL REQUIREMENTS

The Engineer shall submit electronically, one O&M Plan with the project's as-built Record Drawings for review. Any comments shall be addressed by the Engineer until approval has been granted by the City. Once approval has been granted, a final submittal shall be made.

**PROJECT INFORMATION**

**1.0 GENERAL INFORMATION**

A. UDFCD DRAINAGEWAY #XXX, [NAME OF CREEK/TRIBUTARY]

B. PROPERTY OWNER: PHONE: \_\_\_\_\_

C. DESIGN ENGINEER: PHONE: \_\_\_\_\_

**1.1 HYDRAULIC INFORMATION**

A. ONLINE OR OFFLINE FACILITY? ONLINE

B. FLOW RATES	INFLOW	OUTFLOW
10-YEAR	406 CFS	53 CFS
100-YEAR	758 CFS	177 CFS

C. POND DESCRIPTION	VOLUME	WSEL	DEPTH	INVERT	SURFACE TYPE
MICROPOOL	0.26 AF (420 CY)	5739.5	3.5 FT.	5736.0	EARTH
FOREBAY	0.28 AF (450 CY)	5742.0	1.5 FT.	5740.5	CONCRETE
WQCV	4.8 AF	5745.0			
10-YEAR	12.2 AF	5749.5			
TOTAL CAPACITY	22.0 AF	5754.0	(100-YR WS)		

D. OUTLET TYPES  
 10-YR - DROP BOX OUTLET STRUCTURE  
 100-YR - OFFLINE RECTANGULAR OUTLET STRUCTURE

E. WQCV DRAIN TIME: 40 HOURS

**1.2 MISCELLANEOUS INFORMATION**

A. PROJECT SURVEY:  
 HORIZONTAL CONTROL IS BASED ON NORTHING AND EASTING FROM SURVEY PROVIDED BY ARROW CIVIL ENGINEERS, INC.

SITE BENCHMARK: NE CORNER NW 1/4, SECTION 34, T5S, R67W, 3" BRASS CAP "PUBLIC SERVICE OF COLORADO, PLS 19607", ELEV. = 5869.90, ARAPAHOE COUNTY DATUM.

B. SEED MIX:

SEED SPECIES AND VARIETY	PERCENTAGE OF MIX BY WEIGHT
WESTERN WHEATGRASS "ARRIBA"	25%
SIDEOATS GRAMA "VAUGHN"	10%
BLUE GRAMA "LOVINGTON"	20%
NEEDLE AND THREAD	10%
STREAMBANK WHEATGRASS "SODAR"	15%
INDIAN RICEGRASS "PALOMA"	5%
BUFFALOGRASS (NATIVE)	100%

C. MOW AREA: X X AC  
 THE MOW AREA IS GENERALLY DESCRIBED AS THE INTERIOR SIDES AND BOTTOM OF THE ENTIRE POND UP TO THE APPROXIMATE ELEVATION OF 5750. NATIVE GRASSES SHOULD BE MOWED TO A HEIGHT OF NO LESS THAN 6 INCHES.

**PROJECT NOTES**

**2.0 GENERAL FACILITY DESCRIPTION**

THIS FACILITY IS A REGIONAL DETENTION POND THAT HAS BEEN IMPROVED TO PROVIDE WQCV, REDUCE THE 100-YR DISCHARGE, AND PREVENT SMALL EVENTS FROM BYPASSING. THE POND INFLOWS ARE GENERATED THROUGH SURFACE RUNOFF FROM THE BUSINESS PARK AND ENTER THE POND FROM THE NORTHEAST. THE POND RELEASES INTO AN EAST TRIBUTARY OF WILLOW CREEK.

**2.1 MAINTENANCE NOTES**

A. MAINTENANCE FREQUENCY  
 ROUTINE MAINTENANCE TASKS, INCLUDING MOWING AND DEBRIS REMOVAL, SHOULD BE PERFORMED ON AN AS-NEEDED BASIS. DEBRIS REMOVAL SHOULD BE DONE PRIOR TO THE SUMMER STORM SEASON AND FOLLOWING SIGNIFICANT RAINFALL EVENTS. IN ADDITION, THE PROPERTY OWNER SHOULD PERFORM A SITE INSPECTION ON AN ANNUAL BASIS TO EVALUATE THE NEED FOR ADDITIONAL MAINTENANCE, INCLUDING SEDIMENT REMOVAL, EROSION CONTROL, REVEGETATION, AND STRUCTURAL REPAIRS.

B. EQUIPMENT AND SPECIAL TOOLS REQUIRED  
 SUBMERSIBLE PUMP / GENERATOR  
 LONG-REACH RAKE OR BROOM (7 FT)  
 LONG-REACH TRACK EXCAVATOR  
 SKID STEER  
 DUMP TRUCK

C. MAINTENANCE ACCESS  
 [LOCATION & DESCRIPTION]

**2.2 MAINTENANCE PROCEDURE**

A. DEWATERING  
 THIS POND HAS NO NATURAL BASEFLOW BUT WILL RECEIVE STORM AND IRRIGATION RUNOFF ON A FREQUENT BASIS. PERMANENT POOLS FORM IN THE MICROPOOL AND FOREBAY. THESE TWO AREAS MUST BE PUMPED TO DEWATER. IF PUMP DOES NOT HAVE FINE SCREENING AT THE INTAKE, ALTERNATELY PUMP FROM ONE POOL TO THE OTHER TO PREVENT SEDIMENT-LADEN DISCHARGE.

B. SEDIMENT REMOVAL  
 SEDIMENT MUST BE REMOVED FROM THE FOREBAY ANNUALLY AND FROM THE MICROPOOL WHEN AT 3/4 CAPACITY OR WHEN THE DEPTH OF POOL IS REDUCED TO 18 INCHES. THE CONCRETE-LINED FOREBAY IS ACCESSED FROM A MAINTENANCE RAMP OFF THE MAINTENANCE ROAD, AND CAN BE CLEANED WITH A SKID-STEER OR LOADER. HAND REMOVAL MAY BE NECESSARY ADJACENT TO THE VERTICAL WALLS. THE MICROPOOL CAN BE CLEANED WITH A LONG-REACH EXCAVATOR OR BACKHOE FROM THE MAINTENANCE ROAD. PROPERLY DISPOSE OF ALL REMOVED SEDIMENT AND DO NOT PLACE ELSEWHERE WITHIN FACILITY.

C. DEBRIS REMOVAL  
 DEBRIS BUILDUP IS EXPECTED AT THE 10-YR OUTLET STRUCTURE TRASH RACK AND WATER QUALITY SCREEN, AT THE 100-YR OUTLET STRUCTURE TRASH RACK, AND AT THE ENERGY DISSIPATOR UPSTREAM OF THE FOREBAY ENTRANCE STRUCTURE. ALL DEBRIS SHOULD BE COLLECTED AND DISPOSED OFFSITE. ACCESS TO THE WATER QUALITY SCREEN IN THE 10-YR STRUCTURE IS PROVIDED BY A TRAP DOOR ABOVE THE TRASH RACK. A LONG-REACH BROOM OR RAKE WILL BE NECESSARY TO CLEAN THE SCREEN.

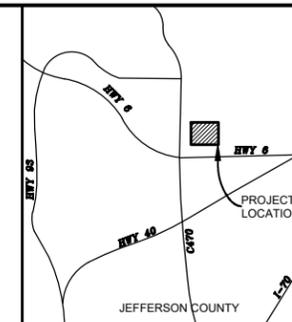
D. SITE INSPECTION  
 THE FOLLOWING ITEMS SHOULD BE INSPECTED A MINIMUM OF ONCE PER YEAR AND MAINTAINED AS NEEDED:

- GENERAL:  
 RIPRAP TRICKLE CHANNEL  
 MAINTENANCE ROAD  
 EROSION  
 VEGETATION
- EQUIPMENT AND STRUCTURES  
 FOREBAY ENTRANCE STRUCTURE AND CONCRETE-LINED FOREBAY  
 CONCRETE ENTRANCE STRUCTURE  
 ENERGY DISSIPATOR  
 24" REINFORCED CONCRETE PIPE  
 CONCRETE SLAB AND VERTICAL WALLS  
 10-YR OUTLET STRUCTURE  
 CONCRETE STRUCTURE  
 OVERFLOW GRATE  
 TRASH RACK  
 WATER QUALITY SCREEN  
 FLOW CONTROL PLATE  
 24" REINFORCED CONCRETE PIPE  
 100-YR OUTLET STRUCTURE  
 CONCRETE STRUCTURE  
 INTERCEPTOR GRATE  
 42" REINFORCED CONCRETE PIPE  
 HANDRAIL  
 SLOPING GROUDED BOULDERS AT MICROPOOL

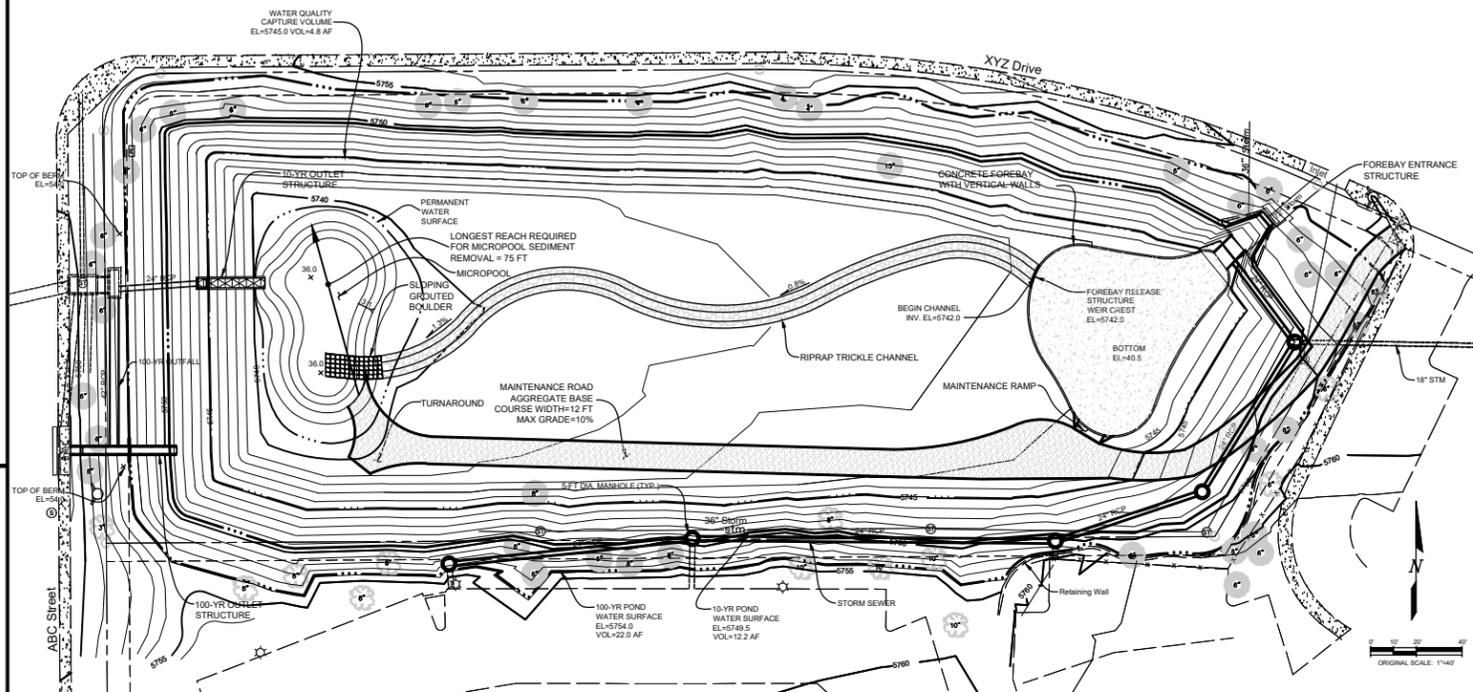
- E. POST-MAINTENANCE CONSIDERATIONS  
 FOLLOWING COMPLETION OF MAINTENANCE ACTIVITIES, ALL DEBRIS, TRASH, AND EXCAVATED SEDIMENT MUST BE REMOVED OFFSITE. IF NECESSARY, XYZ DRIVE MUST BE SWEEPED CLEAN.

[EXAMPLE PLAN]

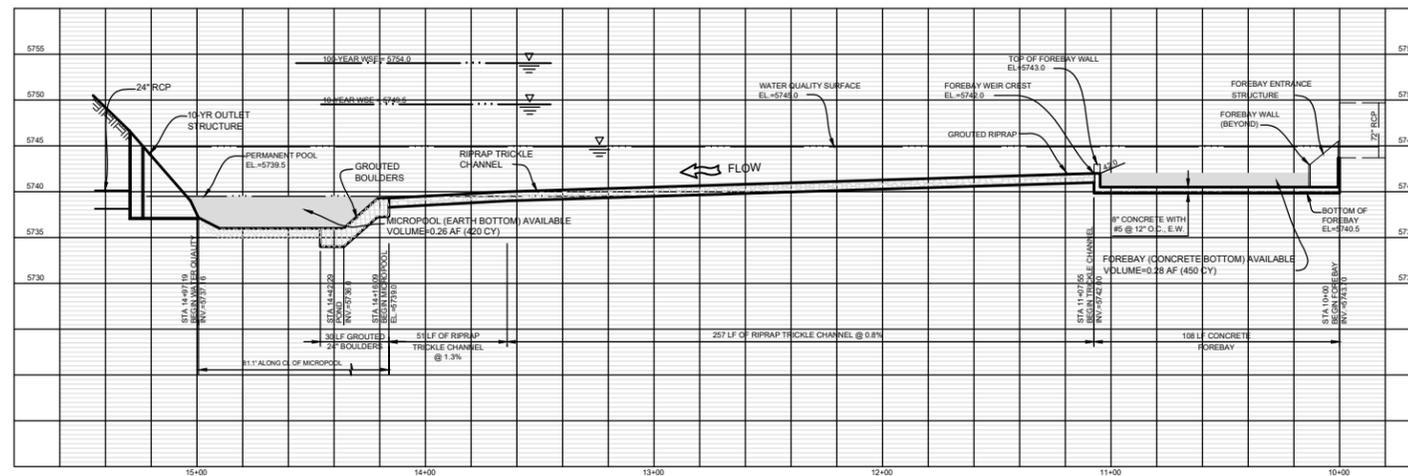
**XYZ PARK REGIONAL  
 WATER QUALITY DETENTION POND  
 MAINTENANCE SITE PLAN  
 FEBRUARY, 2018  
 (PROJECT COMPLETED APRIL, 2018)**



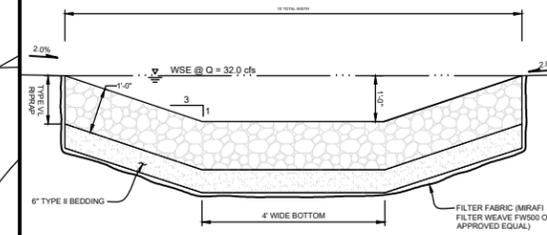
LOCATION MAP  
 SCALE: 1" = 200'



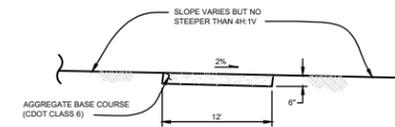
HYDRAULIC PROFILE  
 SCALE: 1" = 40' HORIZ.  
 1" = 10' VERT.



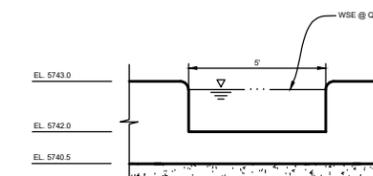
**PROJECT DETAILS**



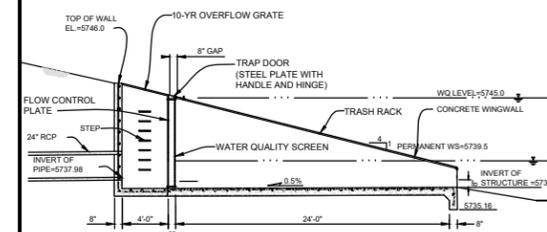
TRICKLE CHANNEL SECTION  
 SCALE: 1/2" = 1'-0"



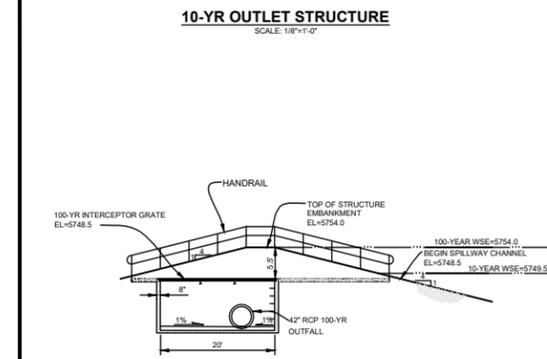
MAINTENANCE ROAD  
 NOT TO SCALE



FOREBAY RELEASE STRUCTURE  
 NOT TO SCALE



10-YR OUTLET STRUCTURE  
 SCALE: 1/8" = 1'-0"



100-YR OUTLET STRUCTURE  
 SCALE: 1/16" = 1'-0"



PLOTTED: 7/2/2018 9:48:03 AM  
 NAME: P:\2018 PROJECTS\18-034-01 WATER QUALITY MAINTENANCE EXAMPLE PLAN - GOLDEN\CADD\DRAWINGS\18-GOLDEN MAINTENANCE EXAMPLE.DWG

## STORMWATER FACILITIES

### OPERATION AND MAINTENANCE ACKNOWLEDGEMENT

#### *Purpose*

Performing routine maintenance of stormwater facilities is key to ensuring they will function as designed for the long term. Regular maintenance will help avoid nuisance conditions such as poor drainage resulting in mosquitos or flooding. Additionally, costly rehabilitation can result when regular maintenance is deferred. Perpetual maintenance is required by Municipal Code 13.30.110.

#### *Background*

The stormwater facility is an investment in clean water and improves the safety of downstream properties. It is designed to slowly release stormwater to prevent flooding and filter pollutants commonly transported in stormwater.

#### *Operation and Maintenance Plan*

An Operation and Maintenance Plan was developed by the design engineer for the property and identifies the features of, and maintenance specific to, the stormwater facility. Since it is an engineered facility, it is important that those performing maintenance are familiar with the information included in the Plan. Please keep, and refer to the Plan for inspection and maintenance criteria.

#### *Access*

Access is required by Municipal Code and is identified in the Operation and Maintenance Plan. Inspection access allows the city to inspect the stormwater facilities to ensure they are operating as intended. Maintenance access is identified in the Plan to indicate the best access location and to minimize possible damage to the facility.

#### *Acknowledgement*

I acknowledge that I have received an Operation and Maintenance Plan prepared for the stormwater facility at the location indicated above. I understand it is my responsibility to perform maintenance and to maintain the facility as defined in the Plan.

Signature: \_\_\_\_\_

Name (print): \_\_\_\_\_

Date: \_\_\_\_\_

*Property information*

Project Name	
Project/facility address/location	Permit #

Owner contact	
Name	Company
Address	City, State, Zip
Phone	Email

Plan Preparer contact	
Name	Company
Address	City, State, Zip
Phone	Email

Responsible Party for Maintenance (check one)	
Property Owner	Tenant
Homeowners Association	Property Management Company

Responsible Party contact	
Name	Company
Address	City, State, Zip
Phone	Email

## APPENDIX D STORMWATER QUALITY PERMIT APPLICATION PACKET

- Permit Fact Sheet
- Fee Schedule
- Permit Application
- SWMP Fact Sheet
- Inspection Report



## Stormwater Quality Permit Fact Sheet

### Why is a Stormwater Quality Permit Required?

The stormwater program is mandated under the National Pollutant Discharge Elimination System (NPDES), a component of the Clean Water Act. The requirement is intended to reduce the amount of pollutants entering streams, rivers, lakes, and wetlands as a result of runoff from residential, commercial and industrial areas. Large construction sites have been under a requirement to obtain permit coverage since 1992 (Phase I of the program). Small construction sites have been under a requirement to obtain permit coverage since July 1, 2002.

### When is a Stormwater Quality Permit Required from the City?

A Stormwater Quality Permit is required if you will disturb one half acre or more ( $\geq 1/2$ ) OR if you will disturb less than one half acre that is part of a larger common plan of development or sale. A “common plan of development or sale” is a contiguous area where multiple separate and distinct construction activities may be taking place at different times, on different schedules, but remain related by a common contract or plan. Contiguous means construction activities located in close proximity to each other (within  $1/4$  mile).

### When is a Stormwater Permit Required from the State?

The City is a designated Qualifying Local Program by the Colorado Department of Public Health and Environment Water Quality Control Division (CDPHE-WQCD). Construction sites less than five acres are automatically covered under the State’s Stormwater General Permit for Construction Activities with a City permit. Sites greater than five acres require a State Stormwater Construction Permit in addition to the City permit. Contact CDPHE-WQCD at <https://www.colorado.gov/pacific/cdphe/wq-construction-permits> or 303-692-3517 for more information.

### What is Required to Obtain a Stormwater Quality Permit?

- Permit application**
  - A **Permittee** must be designated on the permit. The Permittee must be an individual person who will be the responsible party for the project.
- Stormwater Management Plan (SWMP)** Please refer to the SWMP Fact Sheet for plan requirements.
- Performance Security** Must be a check or an irrevocable letter of credit. The Performance Security is based on the cost of material and installation of all BMPs called for on the SWMP. The Performance Security will only be used in the event that the City has to take corrective action. Such action will follow a written request to the Permittee. When the City must utilize the Performance Security a 15% administrative cost will be assessed and drawn from the Performance Security. If the City does not draw from the Performance Security it will be returned upon final stabilization, plus interest at the rate currently earned by the City. It is the responsibility of the Permittee to request the release of the Performance Security.



City of  
Golden

**PUBLIC WORKS DEPARTMENT**  
ENVIRONMENTAL SERVICES DIVISION

1445 10<sup>TH</sup> ST. GOLDEN, CO 80401  
TEL: 303-384-8151  
TEL: 303-384-8188  
[WWW.CITYOFGOLDEN.NET](http://WWW.CITYOFGOLDEN.NET)

## **Stormwater Quality Permit**

### Fee Schedule

Effective January 1, 2010, per City of Golden Resolution 1997, the following fees will be assessed:

- Stormwater Quality Permit \$350 for initial permit and SWMP review
- Stormwater Quality Permit renewal - \$125 for annual renewal
- Stormwater Quality Permit reinspection fee - \$40

The Performance Security is a separate requirement. Please see the Permit Application.



City of  
Golden

PUBLIC WORKS DEPARTMENT  
ENVIRONMENTAL SERVICES DIVISION

1445 10<sup>TH</sup> ST. GOLDEN, CO 80401  
TEL: 303-384-8151  
TEL: 303-384-8188  
WWW.CITYOFGOLDEN.NET

## Stormwater Quality Permit Application

*A Permit is required for all land disturbances equal to or greater than ½ acre OR if you will disturb less than one half acre that is part of a larger common plan of development or sale.*

### Project Information

Project Name:

Address/Location:

### Owner

Name:

Contact Person:

Street Address:

City, State, Zip:

Email:

Phone:

Mobile:

### Contractor

Name:

Contact Person:

Street Address:

City, State, Zip:

Email:

Phone:

Mobile:

### Other

Name:

Contact Person:

Street Address:

City, State, Zip:

Email:

Phone:

Mobile:

**Designate a permittee from the above list:**

*The Permittee must be an individual person who will be the responsible party for the project*

**Project Information**

Project Size including all off-site staging/storage areas (acres):

Brief Description of Project:

**Project Schedule**

Expected work start date:

Expected work completion date:

**Performance Security**

Stormwater Quality Control Measures: (must include stabilization for entire disturbed area)

Item description	Quantity	Unit	\$/Unit	Total
<b>Total Performance Security \$</b>				

As a condition for the issuance of a Stormwater Quality Permit, applicants shall be required to provide security in the form of cash escrow or an irrevocable letter of credit. The amount of the security shall be based upon the cost of the work required to ensure compliance with the permit's terms and conditions. The security, with interest at the rate currently earned by the city, less any deductions, shall be released upon the city's determination that the Permittee has successfully completed all work required by the permit. If the Permittee does not successfully complete all required work or violates any requirement of the permit, the city may take corrective measures and charge the cost of such to the Permittee. Such costs shall include the actual cost of any work deemed necessary by the city plus administrative and inspection costs and penalties pursuant to the city's stormwater quality enforcement policy. In determining the cost of work, a 15% administrative fee shall be assessed. If the total of such costs exceeds the security, the Permittee shall be responsible for payment of the remaining balance within thirty calendar days of receipt of an accounting of such from the city. It is the Permittee's responsibility to request a release of the Performance Security. Please note that eligibility for a full release is determined by adequate permanent stormwater quality control features, including established vegetation. In most cases, a minimum of one year from the date of seeding is necessary to determine vegetation establishment.

**FOR OFFICE USE**

Application received:

Stormwater Quality Management Plan received:

Total Performance Security collected: \$

Payer:

Date paid:

Method of Payment:



# Stormwater Management Plan Fact Sheet

## GENERAL REQUIREMENTS

A Stormwater Management Plan (SWMP) is required for a City of Golden Stormwater Quality Permit. A SWMP must include a description of all stormwater management control measures (also referred to as Best Management Practices or BMPs) that will be implemented to control pollutants in stormwater discharges during construction. The SWMP shall be prepared in accordance with good engineering, hydrologic and pollution control practices. The SWMP does not need to be prepared by a registered engineer. Consult the City of Golden Stormwater Standards Manual for approved practices and details. The Manual can be found at <https://www.cityofgolden.net/government/departments-divisions/water/stormwater/>.

The SWMP submittal is comprised of the information outlined below and is reviewed for completeness. The submittal includes plans, standard details and specifications, as well as a narrative description of the construction activity, pollutant sources and control measures.

## STORMWATER MANAGEMENT PLAN CONTENTS

Each item below must be addressed in the SWMP, or referenced in the SWMP if another plan or document containing the information will be used.

### PROJECT:

--

### 1. DESIGNATE AN AUTHORIZED AGENT

Include the name and title of individual(s) with knowledge of the principles and practices of erosion and sediment control and pollution prevention. The Authorized Agent(s) must perform site inspections and therefore, possess skills to assess conditions that could impact stormwater quality and the effectiveness of stormwater controls used to comply with the permit.

<i>completed</i>	
<i>✓ or n/a</i>	
Preparer	COG

### 2. SITE DESCRIPTION

***Include a narrative with the following information, at a minimum:***

		Preparer	COG
a.	A description of the construction activity.		
b.	A proposed construction schedule.		
c.	Total area of the site, and total disturbed area, including offsite staging/storage areas.		
d.	A description of the soil or soil erosion potential.		
e.	A description of the existing vegetation, including percent coverage and the method for determining the percentage.		
f.	A description of any non-stormwater discharges such as uncontaminated springs and landscape irrigation or those discharged in accordance with CDPHE Water Quality Control Division Low Risk Discharge Guidance. Construction dewatering cannot be discharged to surface waters or to the storm sewer system without separate CDPS permit coverage.		
g.	The name of the receiving water(s) or if the discharge is to a municipal separate storm sewer, the location of the storm sewer discharge, and the ultimate receiving water(s).		

h.	A list of potential pollution sources. At a minimum, each of the following sources must be evaluated and included in the SWMP if determined to be a potential pollution source:		
	i. Disturbed and stockpiled soil, including dust and contaminated soil;		
	ii. Vehicle tracking;		
	iii. Materials handling and material storage, including loading and unloading;		
	iv. Equipment maintenance and fueling;		
	v. Waste management including portable toilets, trash, sawcut waste, concrete washout and masonry mixing stations;		
	vi. Asphalt or concrete batch plants.		
i.	Include a spill prevention and response plan.		

### 3. SITE MAP

**Include a plan sheet(s) with the following information, at a minimum:**

		Preparer	COG
a.	Construction site boundaries indicating grading, cut, fill and stockpile locations.		
b.	Arrows depicting stormwater flow directions.		
c.	Locations of springs, streams, wetlands and State Waters.		
d.	Stream crossings.		
e.	Areas within 50' of a receiving water where pre-existing vegetation will be preserved. If determined infeasible, provide a statement.		
f.	The Plan must indicate locations of control measures that will be used. The plan should clearly describe the implementation of control measures relevant to each phase of site development:		
	i. Before clearing and grading begins;		
	ii. During all phases of construction (temporary construction and waste control BMPs);		
	iii. Post-construction/final stabilization (permanent BMPs).		
g.	Identify staging areas, materials handling and material storage control measures (site management and waste control BMPs).		
h.	Approved details must be included for each BMP indicated.		

### 4. INSPECTION PROCEDURES

**The plan must include inspection procedures to ensure BMPs are effective and in good operating condition. The following are required minimum procedures:**

		Preparer	COG
a.	Begin inspections within 7 days of commencement of site work.		
b.	Inspections must be performed by the designated Authorized Agent(s).		
c.	Perform inspections throughout construction in accordance with one of the following schedules: <ul style="list-style-type: none"> <li>i. every 14 days, and within 24 hours of a storm event that causes erosion <ul style="list-style-type: none"> <li>a. a post-event inspection can fulfill a 14 day inspection;</li> <li>b. a post-event inspection can be performed within 72 hours of a storm event if there is no site activity during the 72 hours;</li> </ul> </li> <li>ii. every 7 days.</li> </ul>		
d.	Perform inspections once every 30 days at sites where construction is complete, but final stabilization is pending.		
e.	During each inspection, observe disturbed areas, the site perimeter, material storage areas, and BMPs.		

## 5. MAINTENANCE PROCEDURES

**The plan must include maintenance procedures to ensure BMPs are effective and in good operating condition. The following are required minimum procedures:**

		Preparer	COG
a.	Perform maintenance and repairs immediately on items or areas identified in the inspection report. Most repairs should be completed within 24 to 48 hours. Until the items are completed, the site is in non-compliance.		
b.	Perform maintenance as indicated in the City of Golden Stormwater Standards Manual, per manufacturer's specifications, or other sources determined to be acceptable.		

## 6. RECORDKEEPING REQUIREMENTS

**The plan must include the following recordkeeping procedures. The following are required minimum procedures:**

SWMP		Preparer	COG
a.	Retain a copy of the SWMP onsite when construction activities are occurring unless another location is specified.		
b.	The SWMP must be made available to EPA, State and local inspectors for review.		
c.	Throughout construction, the SWMP must be regularly updated and reflect site conditions at all times.		
d.	Possible updates may include modifying, replacing, or adding BMPs and identifying additional potential sources of pollution.		
e.	Hand-written notations, including the date, description and location of the change, are adequate for most plan updates.		
f.	When deviations from the specific requirements listed below occur, the Permittee must take all necessary steps to prevent the discharge of pollutants and document the following information: <ul style="list-style-type: none"> <li>i. When it is infeasible to immediately take corrective actions to install or replace a control measure:               <ul style="list-style-type: none"> <li>a. why the installation or repair of a deficient BMP cannot begin immediately;</li> <li>b. provide a schedule for the installation or repair of the deficient BMP to restore function as soon as possible.</li> </ul> </li> <li>ii. When it is infeasible to install temporary stabilization BMPs within 14 days:               <ul style="list-style-type: none"> <li>a. the constraints necessitating an alternative schedule;</li> <li>b. the alternate stabilization schedule; and</li> <li>c. all locations to which the alternative schedule is applicable.</li> </ul> </li> </ul>		
g.	Changes involving design, site hydrology, project scope or additional disturbed area must be submitted for review prior to making such changes		
Inspection Reports		Preparer	COG
h.	Complete an inspection report for each inspection performed.		
i.	Keep inspection reports, maintenance records, spill response, etc. on-site as part of the SWMP.		
j.	Use of the city's inspection form (March 2019) is not required, however, the report must include all information on the city's form.		
k.	The designated Authorized Agent(s) is required to sign all inspection reports with the following statement: <i>"I verify that, to the best of my knowledge and belief, all corrective action and maintenance items identified during the inspection are complete, and the site is currently in compliance with the permit."</i>		

\* Retain copies of all documentation for at least three years from the date the permit is terminated.



City of  
Golden

PUBLIC WORKS DEPARTMENT  
ENVIRONMENTAL SERVICES DIVISION

1445 10<sup>TH</sup> ST. GOLDEN, CO 80401  
TEL: 303-384-8151  
TEL: 303-384-8188  
WWW.CITYOFGOLDEN.NET

## Stormwater Inspection Report

Project and Inspection Information					
Project:			Inspector Name/Title:		
Date:	Time:	Weather: Sun Wind Rain Snow Temp:			
Construction phase/activities:		Grading	Utilities	Structural	Paving Landscaping
Routine Inspection			Post-event Inspection		Revegetation Inspection
<input type="checkbox"/> routine 14 day + post-event <input type="checkbox"/> routine 7 day			<input type="checkbox"/> 24 hour <input type="checkbox"/> 72 hour		<input type="checkbox"/> 30 day
Storm event date/time:					
New Pollutant Sources/ Discharge Points					
Site Assessment			If yes, note location and corrective action; update map		
Increase in disturbed area? Y / N			If yes, estimated increase:		
New pollutant sources? Y / N					
Area requiring stabilization(inactive > 14 days)? Y/N					
Discharge beyond site boundary? Y / N					
Discharge to storm sewer or State Waters? Y / N					

Control Measure Assessment						
<i>Routine: A control measure requiring expected maintenance in accordance with COGSSM or approved standard detail</i>						
<i>Inadequate: A control measure that is not constructed in accordance with COGSSM or approved standard detail</i>						
<i>Failure to Implement: A Control Measure is not constructed; A pollutant source is not controlled</i>						
Erosion control/stabilization			Corrective Action required note location			Correction log
CM	Control Measure	Good Condition	Routine Maintenance	Inadequate	Failure to Implement	Date completed
PS	Permanent seed					
TS	Temporary seed					
MU	Mulch					
SB	Soil Binder/Tackifier					
RECP (ECB)	Rolled Erosion Control Product (Erosion Blanket)					
TSD	Temporary Slope Drain					
TOP	Temporary Outlet Protection					
RCS	Rough Cut Street Control					
ED/DS	Earth Dike/Drainage Swale					
SR	Surface Roughening					
CD	Check Dam					
DC	Dust Control					
Permanent Water Quality Measures			Corrective Action required note location			Correction log
Control Measure	Good Condition	Routine Maintenance	Inadequate	Failure to Implement	Date completed	
Extended Detention Basin						
Bioretention						
Sand Filter						





## CITY OF GOLDEN REVEGETATION REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 Description.

- A. This section covers soil preparation, fertilizing, seeding, mulching, installation of erosion control fabrics, watering and initial care, final inspection and approval, and the guarantee period for temporarily and permanently revegetated areas.
- B. This section addresses work within the limits of disturbance as shown on the Drawings. However, if disturbance does occur outside of this designated area, this section will also pertain to those areas which have been disturbed.

### PART 2 - MATERIALS

#### 2.1 Quality.

All materials used for revegetation shall be new and without flaws or defects of any type, and shall be the best of their class and kind.

#### 2.2 Handling and Storage.

Protect all materials used for revegetation from damage, deterioration, or loss of any kind while in transit, storage and during installation.

#### 2.3 Fertilizer.

Commercial product of uniform composition, free flowing and conforming to applicable State and Federal laws. Deliver in original, unopened containers. Application rates shall be based upon recommendations of soils laboratory and shall be reviewed by the CITY. Biosol organic fertilizer is preferred to synthetic fertilizer.

#### 2.4 Herbicide.

Where site conditions warrant or is determined by the CITY, use "Roundup" herbicide as a one percent (1%) application solution or other approved equal that is recommended and legally approved.

#### 2.5 Soil Conditioners.

Where topsoil has been stripped or is absent from the soil horizon, soils conditioners may be required by the CITY. Acceptable organic soil amendment may include mycorrhizal inoculums, humate conditioners or certified Class II compost product produced on a site compliant with and in accordance with current Colorado Department of Health and Environment (CDPHE) regulations pertaining to Solid Waste Composting. Compost shall be a totally organic product that has been aerobically and naturally processed without the addition of coarse wood chips. Organic material shall be tilled to a minimum depth of eight inches (8") or per manufacturer's specification. The application of granular humate is acceptable.

2.6 Temporary Revegetation Seed.

Furnish in bags or containers clearly labeled to show the name and address of the supplier, the seed name, the lot number, net weight, percent of weed seed content and the guaranteed percent of purity and germination. All seed shall be free from noxious weeds as listed in the Colorado Noxious Weed Act; seed shall be fresh, clean, new crop seed. Do not use seed which has become wet, moldy or otherwise damaged in transit or storage.

No.	Species	Growth Season	Pounds of Live Seed/acre	Planting Depth (in)
1.	Oats	Cool	35 - 50	1 - 2
2.	Spring Wheat	Cool	25 - 35	1 - 2
3.	Spring Barley	Cool	25 - 35	1 - 2
4.	<del>Annual Ryegrass</del>	<del>Cool</del>	<del>10 - 15</del>	<del>½</del>
5.	Millet	Warm	3 - 15	½ - ¾
6.	Sudangrass	Warm	5 - 10	½ - ¾
7.	Sorghum	Warm	5 - 10	½ - ¾
8.	Winter Wheat	Cool	20 - 35	1 - 2
9.	Winter Barley	Cool	20 - 35	1 - 2
10.	Winter Rye	Cool	20 - 35	1 - 2
11.	Triticale	Cool	25 - 40	1 - 2

Adapted from Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual Volume 3 - Best Management Practices

Successful seeding of annual grass resulting in adequate plant growth will usually produce enough dead plant material residue to provide protection from wind and water erosion for an additional year. This assumes that the cover is not disturbed or mowed closer than 8 inches.

Hydraulic seeding may be substituted for drilling only where slopes are steeper than 3:1 or where access limitations exist.

Seeding rates should be doubled if seed is broadcast; or increased by 50 percent if done by a Brillion drill or by hydraulic seeding.

2.7 Permanent Revegetation Seed.

- A. Furnish in bags or containers clearly labeled to show the name and address of the supplier, the seed name, the lot number, net weight, percent of weed seed content and the guaranteed percent of purity and germination.
- B. All seed shall be free from noxious weeds as listed in the Colorado Noxious Weed Act; seed shall be fresh, clean, new crop seed. Do not use seed which has become wet, moldy or otherwise damaged in transit or storage.
- C. The seed shall be mixed in proportions, generally matching the following recommended mix designs of the indicated manufacturer's (or approved equals), as indicated and as necessary to obtain the application rate specified.
- D. The following mixes are preferred. The City will review alternatives for approval.

1. Rocky Mountain Native Mix from Arkansas Valley Seeds

Common Name	Variety	Percent	Lbs/Acre
Slender Wheatgrass	Revenue	25	
Mountain Brome	Bromar	20	
Blue Grama	Hachita	20	
Idaho Fescue	Winchester	15	
Buffalograss	Bison	10	
Green Needlegrass	Lodorm	5	
Indian Ricegrass	Paloma	5	
	Total	100%	<b>20</b>

Hydraulic seeding may be substituted for drilling only where slopes are steeper than 3:1 or where access limitations exist.

Seeding rates should be doubled if seed is broadcast; or increased by 50 percent if done by a Brillion drill or by hydraulic seeding.

2. Foothills Native Mix from Pawnee Buttes Seed

Common Name	Variety	Percent	Lbs/Acre
Indian Ricegrass	Paloma	10	
Little Bluestem	Camper	10	
Blue Grama	Hachita	10	
Indiangrass	Cheyenne	10	
Sandberg Bluegrass	High Plains	10	
Rocky Mountain Fescue	Native	10	
Sideoats Gramma	Butte	10	
Green Needlegrass	Lodorm	10	
Big Bluestem	Roundtree	8	
Sand Dropseed	Reliable	2	
Western Wheatgrass	Arriba	10	
	Total	100%	<b>25</b>

3. Short Grass Prairie Mix from Western Native Seed

Common Name	Variety	Percent	Lbs/Acre
Buffalograss	Bison	40	
Western Wheatgrass	Arriba	30	
Blue Grama	Hachita	24	
Galleta Grass	Viva	3	
Sand Dropseed	Reliable	1.5	
Needle & Thread	Native	1.5	
	Total	100%	<b>20</b>

4. Mix for Detention Ponds.

Common Name	Variety	Percent	Lbs/Acre
Buffalograss	Texoka	4	9.0
Blue Grama	Hachita	39	6.0
Switchgrass	Blackwell	18	6.0
Western Wheatgrass	Barton	4	5.0
Sand Dropseed	Reliable	14	1.0
Inland Saltgrass	Native	14	3.0
Prairie Cordgrass	Native	7	5.0
	Total	100%	35.0

Where there is persistent water, add the following:

Common Name	Variety	Percent	Ozs/Acre
Wooly Sedge	Native	1.4	4.0
Nebraska Sedge	Native	2.3	4.0
Baltic Rush	Native	53.1	4.0
Louisiana Sage	Artemisia ludoviciana	19.4	1.0
Aster	Native	5.2	3.0
Showy Milkweed	Asclepias speciosa	0.3	2.0
Swamp Milkweed	Asclepias incarnata	0.3	2.0
Wild Bergamot	Monarda fistulosa	6.0	3.0
Yarrow	Achillea millefolium	12.0	1.0
	Total	100%	24.0

5. Invasive, Exotic Grasses to AVOID for Revegetation

Common Name	Species	Comments
Canada Bluegrass	Poa compressa	
Creeping Bentgrass	Agrostis stolonifera	Extensively rhizomatous, highly competitive with native species
Crested Wheatgrass	Agropyron deserforum	Forms monoculture
Hard or Sheep Fescue	Festuca ovina	
Intermediate Wheatgrass	Agropyron intermedium	Outcompetes native species
Kentucky Bluegrass	Poa pratensis	
Meadow Fescue	Festuca pratensis	
Meadow Foxtail	Alopecurus pratensis	
Orchardgrass	Dactylis glomerata	
Quackgrass	Agropyron repens	Very aggressive, highly competitive with native species
Reed Canary Grass	Phalaris arundinacea	Replaces native species in riparian areas
Ryegrass: Italian, annual ryegrass, common rye	Loluim perenne	
Smooth Brome	Bromopsis inermis	Outcompetes native species
Tall Fescue	Festuca arundinacea	
Timothy	Phleum pratense	

Adapted from the Colorado Native Plant Society, 2002

The plants listed above are invasive, exotic species which threaten or potentially threaten natural areas, agricultural lands, and gardens. While there are thousands of introduced plants which pose no threat, there are some that become invasive, displacing and outcompeting native vegetation.

2.8 Mulch.

- A. Mulch shall be clean, weed-and seed-free, long stemmed grass hay (preferred) or cereal grain straw. Mulch should be applied evenly at a rate of two tons per acre. At least fifty percent (50%) of the mulch, by weight, should be ten inches or more in length. For steep slopes (slopes steeper than 3:1), drainage swales, in areas of anticipated heavy runoff, and other special situations, blankets anchored with staples, are required instead of mulch.
- B. Hydromulch: Degradable green dyed virgin wood cellulose fiber, free from weeds or other foreign matter toxic to seed germination. Apply product according to

manufacturer's specifications at a minimum rate of two thousand (2,000) pounds/acre.

- C. Compost Blanket: The use of a Class I Compost Blanket is an acceptable alternative to crimped mulch for stabilizing exposed soils, but shall not be used in drainageways or concentrated flow areas.

#### 2.9 Organic Tackifier/Binder.

- A. All mulched areas shall receive an application of an organic mulch tackifier/binder. Use a non-toxic, non-corrosive, all organic powder which forms a firm resilient, re-wettable membrane.
- B. Manufacturers:
  - a. Regular application: Nilex Plantango Insul-ari, or approved equal, at two hundred (200) pounds per acre.
  - b. Steep (3:1 or greater) slopes or unstable soil: Rantec Guardian Tackifier, or approved equal, at one-hundred twenty (120) pounds per acre.

#### 2.10 Erosion Control Blanket.

- A. An erosion control blanket shall be used on slopes equal to or steeper than three to one (3:1) and in swale bottoms or in areas of concentrated flows (i.e. detention pond low flow areas, inlets, and outlets), except where sod is used. Biodegradable netting must be used.
- B. Manufacturers:
  - 1. Slope Application: Type SC 150 BN, North American Green, or approved equal.
  - 2. Areas receiving flows: Type C 125 BN, North American Green, or approved equal.

#### 2.11 Water.

The CONTRACTOR will be required to provide all water necessary for hydraulic spray applications. The City bulk water sales station is located on the north end of Golden at 1151 Catamount Drive, adjacent to the City of Golden maintenance shops. This station provides bulk water to contractors without the need for the customer to rent a hydrant meter. A standard 2.5" male fire hose connection is installed on the station. The discharge from the station is currently set at approximately 250 gpm. Contractors will be required to set up a **prepaid** account with the City of Golden. Accounts may be opened at the City of Golden Public Works office located at 1445 10th Street. Be prepared to provide company and truck information, including license plate numbers and truck capacity.

PART 3 - EXECUTION

3.1 Limits of Exposure.

- A. After construction begins, soil surface stabilization shall be applied to all disturbed areas that may or may not be at final grade but will remain undisturbed for periods longer than fourteen (14) calendar days or for an indeterminate length of time. The maximum time limit of land exposure for the following erosion control measures is shown by the following table:

<b>Erosion Control Method</b>	<b>Maximum Allowable Period of Exposure (months)</b>
Surface Roughening	1
Mulching	12
Temporary Revegetation	6 - 12
Permanent Revegetation	12 or more
Soil Stockpile Revegetation	2
Early Application of Road Base	1

Modified from Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual Volume 3 - Best Management Practices

3.2 Site Preparation.

- A. Clearing and Grubbing: All damaged native shrubbery and trees adjacent to the disturbed areas must be correctively pruned or removed. All large rocks, boulders, and construction debris must be removed from the site by the CONTRACTOR.
- B. Grading: The disturbed area must be fine graded to allow for tractor-driven mowing machinery. Transition from the disturbed areas to the original grade must have an even, natural, and maintainable appearance.

3.3 Soil Preparation.

- A. If needed prior to seeding, spray all areas that are to be seeded with "Roundup" herbicide or approved equal using a one percent (1%) solution as directed on packaging. Do not contaminate surface waters during application(s) and leave adequate residual time for the chemicals prior to seeding.
- B. Thoroughly till all areas which are to be seeded and are 3:1 or flatter; areas that previously supported vehicular traffic shall be tilled to a depth of twelve (12) inches, till all remaining areas to a depth of four (4) inches. Slopes which are steeper than 3:1 shall be raked so that the top one-quarter (¼) inches of soil are loose and friable before seeding. Work the soil only when moisture conditions are suitable. Remove rocks and other objects two (2) inches or greater in any dimension.

- C. Where required, apply soils conditioners immediately after fine grading.
- D. Spread fertilizer and other soil amendments, when necessary, over all areas to be seeded by broadcast or drill seeding methods. Mix amendments into the top two (2) inches of soil by use of a harrow or rake until a uniform mixture is obtained with no pockets of soil or amendments remaining.
- E. Correct irregularities in the ground surface resulting from soil preparation operations and slope to drain. Confirm that all work is returned to final grade, per construction plans, prior to seeding.

#### 3.4 Seeding.

- A. Seed all areas which have been disturbed as a result of construction operations.
- B. Seed all areas which are flatter than 3:1 with a mechanical power-drawn drill when possible. When access is not possible, broadcast seeding is allowable. All broadcast seeding must be raked in prior to mulching.
- C. Areas which are equal to or steeper than 3:1 shall:
  - 1. Include the use of erosion control blankets.
  - 2. Hydroseeding/mulching shall be used only in areas that are not accessible by other equipment/methods.
- D. Seeding shall occur immediately after soil preparation and prior to erosion control blanket installation.
- E. Do not seed during windy weather or when the ground is frozen, muddy or untillable.
- F. Seed at the rates specified in "PART 2 - MATERIALS."
- G. Drill seeding: Set depth bands to a depth of three and one-half inches (3 ½"). Set to space rows not more than seven inches (7") apart. Sow seeds of different sizes from at least two (2) separate hoppers adjusted to provide the proper coverage. The drill must have the capacity to handle fluffy seeds adequately.
- H. Broadcast seeding: Do not broadcast seed except in small areas which are not accessible by machine methods. Distribute seed as evenly as possible. Rake in or otherwise cover seed with soil to a depth of one eighth inch (1/8") to one quarter inch (1/4").
- I. Hydraulic seeding: Apply seed and fertilizer at the recommended rates. Perform hydraulic spray applications in such a manner that the liquid carrier will uniformly distribute the material over the entire area to be seeded at rates not less than indicated herein. Equipment used for hydraulic seeding must meet the following criteria:
  - 1. Equipment shall include a pump capable of being operated at one hundred (100) gallons per minute, at one hundred (100) psi.

2. Equipment shall have an acceptable gauge and a nozzle adaptable to hydraulic seeding requirements.
3. Storage tanks shall have a means of agitation and a means of estimation of the volume used or remaining in the tank.

### 3.5 Mulch Application.

- A. Mulch will be required for all seeded areas. Mulch should be applied immediately following seeding operations.
- B. Crimped Hay: Mulch areas with two (2) tons/acre grass hay or cereal grain straw. Spread uniformly by hand or mechanically. Immediately following application, stabilize mulch by means of crimping such that mulch is anchored at least two inches (2") into the soil.. Follow with application of tackifier.
- C. Hydromulch with tackifier: Mulch with hydromulch and tackifier. After seeding, apply mulch in a *separate* hydraulic spray application. Combine mulch with water to create a slurry and apply according to manufacturer's specifications at a minimum rate of two thousand (2,000) pounds/acre. Perform hydraulic application of mulch in such a manner that the liquid carrier will uniformly distribute the material over the entire seeded area at rates not less than described herein. Do not perform hydraulic spray applications during windy weather.

### 3.6 Erosion Control Blanket.

- A. After seeding, an approved erosion control blanket must be placed vertically on the slope. Bury upslope end in a narrow trench six inches (6") deep and tamp trench firmly closed. Adjacent rolls should have a four inch (4") overlap. Staple edges and centers at two foot (2') intervals. Slope shall be prepared to maximize contact with blanket. Correction of gaps and separation due to rocks or other debris will be required.
- B. All drainage swales shall be covered by erosion control blankets

### 3.7 Protection of Seeded Areas.

Protect seeded areas from unnecessary pedestrian or vehicular traffic until well established through the use of fences, barricades and signage. Provide any additional erosion control measures which are necessary for the successful establishment of vegetation.

### 3.8 Re-seeding and Repair.

Reseed and mulch areas where there is not a satisfactory stand of grass immediately following the CITY's evaluation. The CONTRACTOR, at his discretion, may repair any areas at any time prior to a CITY evaluation.

### 3.9 Maintenance and Acceptance.

Care for seeded areas, including weed control and watering until Final Acceptance by the CITY. Seeded areas shall monitored monthly and be evaluated after one (1) full growing season. Acceptance depends on evidence of a satisfactory stand of grass and weed control.

A satisfactory stand of grass is defined as where a minimum of seventy percent (70%) of a planted area has an evenly distributed grass cover and a minimum of three (3) to four (4) desirable plants per square foot with limited occurrence of State listed Noxious Weed species.

3.10 Roads and Soil Stockpiles.

All non-paved portions of road cut, fill, and parking lot areas should be seeded and mulched as soon as possible after final grading has occurred, but in no case later than fourteen (14) days after the grading has been completed.

If stockpiles are located within close proximity to a drainageway (i.e., 100 feet) additional sediment control measures, such as a temporary diversion dike or silt fence, shall be provided.

END OF SECTION