CITY OF GOLDEN

STORMWATER DRAINAGE MAINTENANCE PLAN

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I. OVERVIEW

Responsibility

Maintaining an adequate stormwater quality and stormwater conveyance system is a combined and cooperative effort between the Stormwater, Engineering and Environmental Services Divisions of the Public Works Department. This system is also referred to as a "municipal separate storm sewer system" (MS4).

1. *Engineering* is instrumental in the initial design and acceptance of new drainage systems to see that they meet current standards and practices. Engineering also works closely with the Urban Drainage and Flood Control District which provides Master Drainageway Planning and Maintenance assistance.
2. *Environmental Services* provides information pertaining to activities affecting stormwater quality and compliance with the City of Golden's MS4 Permit requirements.
3. *Stormwater* performs inspections and ensures maintenance of the components that make up the drainage system.

Climate

The climate in the Golden area, classified in the Koppen system as "mid-latitude dry steppe", is characterized by cold winters and warm summers. Average annual snowfall is 67". Mean monthly temperatures range from 31.9°F in January to 73.1°F in July, with an average annual temperature of 51.1°F. The average annual precipitation (water equivalent) is 15.1 inches falling mainly from April to August. The heaviest recorded rainfalls have come in late May and early June, when the temperature contrast between warm surface air and cool upper air is greatest.

The Golden area, with an average elevation of 6,000 feet, is also subject to a meteorological phenomenon known as cloudbursts. They are confined chiefly to the eastern foothills regions below an elevation of 7,500 feet and extend eastward toward the plains for approximately 50 miles. Cloudbursts develop when there is a marked temperature range within a relatively small area and occur in the afternoon or early evening of an unusually warm day. Cloudbursts are characterized by intense rainfall of short duration that is confined to a very small area. These storms have rarely occurred where precipitation could be measured at a weather station. In the Golden area, the peak discharge experienced in channels from a cloudburst is greater than that caused by a period of high runoff related to snowmelt during severe winters.

II. DRAINAGE SYSTEM COMPONENTS

The City's drainage system is comprised of two basic components:

- Subsurface System – Inlets, Manholes, and Pipes
- Surface System – Drainage channels and Permanent BMPs including Detention Ponds

The Subsurface System

Inlets

There are currently **965 inlets** that are maintained by the City. Stormwater is conveyed to most of these inlets from drainage of street and gutter sections of the paved roadways. Inlets within the City are generally categorized as follows:

1. The "catch basin" or "Type R":
   a concrete box that receives stormwater through an open section of the curb face in the gutter section of the street;

2. The "grate type drop box":
   receives stormwater directly from the gutter section; and

3. The combination "open curb face with grate":
   these are few in number and are being replaced over time with the catch basin type.

Manholes

There are **499 manholes** that serve as junction points for various sizes of stormwater pipes. Manholes are most commonly made of precast concrete.

Pipes

There are over **24.5 miles** of pipe that range in sizes from 6" to 96" in diameter. Pipes are made of concrete, corrugated metal, and high density polyethelene (HDPE).

The Surface System

Channels

The stream network in Golden is comprised of Clear Creek, which flows from west to east, and its tributaries.

Clear Creek

Clear Creek has its source in the Rocky Mountains at the Continental Divide. After flowing easterly through the mountains, Clear Creek enters the high plains at Golden and flows northeasterly to Commerce City, where it joins the South Platte River. The 400-square mile drainage area of Clear Creek above Golden is characterized by steep slopes, rugged terrain, and forests. Within Golden, the Clear Creek flood plain contains heavily developed areas as well as parks, campgrounds, and municipal buildings.

There are **11 ½ miles** of tributaries within Golden that flow into Clear Creek. Tucker Gulch, Magpie Gulch and Arapahoe Gulch are left-bank tributaries, providing drainage for areas north of Clear Creek. Kenney's Run and Lena Gulch are right-bank tributaries, providing drainage for areas south of Clear Creek. The confluences of Tucker Gulch and Kenney's Run with Clear Creek occur within the City of Golden. The confluence of Lena Gulch with Clear Creek occurs downstream of the city. The City also maintains stormwater facilities tributary to the Pleasant View Area Watershed and Fairmount Area Outfall system.

Tucker Gulch

Tucker Gulch begins in the foothills northwest of Golden and winds its way through Golden Gate Canyon before flowing into Clear Creek in Golden. Tucker Gulch drains an area of 11.22 square miles above Clear Creek.

Cressman's Gulch

Cressman's Gulch is a left-bank tributary to Tucker Gulch whose 1.48-square mile drainage area covers the foothills and valley area west of North Table Mountain. The drainage areas in the upper portions of these stream basins have steep slopes and cover complexes that vary from forested areas to rangeland with rock outcroppings, to new residential and commercial subdivisions.

Magpie Gulch

Magpie and Arapahoe Gulches are located in portions of Sections 20, 21, 28, 29, 30, and 33, Township 3 South, Range 70 West. Approximately one-half of the area lies within the City of Golden with the remaining area located in unincorporated Jefferson County. Within the city limits of Golden, Ford Street forms the northeast boundary and Clear Creek the southern boundary. The lower portion of Magpie Gulch drains through various structures to an outfall to Church Ditch and Clear Creek.

Throughout the upper watershed, Magpie Gulch drains primarily through one well-defined drainageway. The Hall Dam and Reservoir is located in Magpie Gulch approximately 1600 feet upstream of S.H. 93. Through review of information from the State Engineer's Office (SEO) it appears that the dam was constructed in the early 1970's. The dam is a compacted earth structure with rock protection at the upstream face and downstream toe. The dam has a reported design capacity of 6 acre-feet with a 3.5-foot freeboard based on SEO records and the water storage right granted to Hall Reservoir in Case No. W-7606-74. Due to various inadequacies, the dam is currently restricted to a maximum water level of 10 feet below the crest of the dam.

Arapahoe Gulch

In the upper Arapahoe Gulch watershed, runoff concentrates in several natural channels. Prior to the development of areas west of S.H. 93, these channels would have discharged to the roadside ditch along the west side of the highway. The residential development west of S.H. 93 includes drainage systems to intercept 100-year flows for subsequent routing through detention ponds with ultimate discharge to the Arapahoe Gulch channel downstream of 2nd Street.

East of S.H. 93, runoff from areas north of 2nd Street concentrates at the Arapahoe Gulch channel at 2nd Street.

Between 2nd Street and Clear Creek, Arapahoe Gulch includes various reaches of open channel and pipe culverts of various materials, and a few larger box culverts. A 2004 study performed by Wright Water Engineers indicated that the channel

and culverts are below 100-year capacity along most of the reach between 2nd Street and Clear Creek, and extensive flooding of properties would occur during major storm events. Arapahoe Gulch is piped across the Church Ditch and the ditch does not intercept runoff from the gulch itself.

Kenney's Run (East and West Forks)

The West Fork of Kenney's Run and its tributaries drain a 3.43-square mile basin that starts on the eastern face of Lookout Mountain and extends across the plains southwest of Golden. The plains portion of the West Fork Kenney's Run basin is primarily hilly rangeland, with heavy urban development beginning north of 24th Street.

The East Fork of Kenney's Run drains a 1.78-square mile basin that starts on the western face of South Table Mountain and extends across the plains southeast of Golden. The plains portion of the East Fork Kenney's Run basin has the same hilly topography as the West Fork Kenney's Run basin, but overall it has been more heavily developed.

The upper portions of both these basins have steep slopes and rugged terrain.

The forks join at 20th Street to form Kenney's Run, which flows northeasterly through a buried 8-foot diameter corrugated metal pipe culvert to its confluence with Clear Creek. The intervening 1-square mile basin between the confluence of East and West Forks Kenney's Run and the mouth of Kenney's Run is a heavily urbanized area lying in the valley between Lookout and South Table Mountains.

Lena Gulch / Apex Gulch

Lena Gulch has its source on Lookout Mountain and flows northeasterly, where it joins Clear Creek in Wheat Ridge. Apex and Jackson Gulches drain the foothill area south of Lookout Mountain before joining below Heritage Square at the base of the foothills to form Lena Gulch. Lena Gulch then flows parallel to the north side of U.S. Highway 40 through Golden. This reach also receives runoff from the northwestern slope of Green Mountain. The total drainage area of Lena Gulch affecting Golden, 3.68 square miles, is characterized by steep slopes, bedrock outcrops, and some forested areas in the foothills, and by heavily developed flood plain areas in Golden. At several locations along Lena Gulch, the natural channel has been diverted and partially filled.

Detention Ponds/Permanent BMPs

Detention ponds are fed by surface or subsurface systems and are a vital part of the City's flood control and water quality. These ponds are designed to include an overflow system of a box, outlet or spillway that carries water downstream in the event of excessive runoff conditions. There are a few detention "basins" in asphalt parking lots of commercial areas that also serve the purpose of detaining water.

There are a total of **283 detention ponds** within City of Golden. Of these, there are 18 that are on the City-owned golf course (Fossil Trace) and maintained in cooperation with the Golf Division.

Most of the detention ponds constructed in the City were designed as extended dry detention facilities to extend the emptying time of frequently occurring runoff events, and to facilitate pollutant removal.

Outfalls
There are a total of **420** City-owned outfalls within Golden, all maintained by the Stormwater Division.

Sediment Traps
There are a total of **26** City-owned sediment basins within Golden, all maintained by the Stormwater Division.

Drainage Chases
There are a total of 102 City-owned chases within Golden, all maintained by the Stormwater Division. These include sidewalk chases and curb chases connecting inlets.

III. INSPECTION AND MAINTENANCE ACCESS

The City's Stormwater Supervisor oversees the inspection and maintenance of all City-owned and privately-owned storm systems within the City. The Stormwater Division has the right of entry on any property within the City to perform inspections per the Golden Municipal Code 13.30.130.

IV. OPERATIONS POLICY—INSPECTIONS & MAINTENANCE

Inspections
The following minimum inspection frequencies have been established by the Stormwater Division:

Subsurface System

Inlets: 1 inspection per year of privately owned inlets and twice yearly on city-owned.

Manholes: 1 inspection per year

Pipes: video inspection will be performed on pipes that lie beneath streets that are on the annual street paving program, otherwise pipes will be video inspected once every 5 years.

Inspection of subsurface system will determine what repair or maintenance is needed. Inspection and cleaning will typically be performed at the same time. The condition of city-owned structures will be evaluated and the information will be reported to the City Engineer. Repairs or replacement will be coordinated between the Stormwater and Engineering Divisions.

Surface System

Channels: 1 inspection per year, and an inspection after major storm events.

Detention Ponds/Permanent BMPs: 1 inspection per year, generally in the Spring.

Inspection of the surface system will include functional and aesthetic needs. Functional maintenance is important for performance and safety reasons and aesthetic is important primarily for public acceptance of stormwater facilities. The removal of debris, sediment, overgrown or weedy vegetation will be prioritized based upon the inspection results. All maintenance work that needs to be completed on these ponds will be performed before summer thunderstorm season. Major capital replacements (reconstruction of a pond or replacement of outlet structure, grates, culverts, etc.) will be prioritized based upon the inspections and are subject to budget constraints and capital improvement programming.
At this point the Public Works Department is moving toward an annual stormwater facility replacement program, similar to its annual curb/gutter/sidewalk and street replacement programs. After the stormwater utility's debt is retired, funding will be available for this annual replacement program, and the inspection frequencies established in this plan will aid in prioritizing the improvements.

Outfalls: 1 inspection per year, generally in the Spring.

Sediment Traps: 1 inspection per year, generally in the Spring, and after major storm and runoff events.

Chases: 1 inspection per year.

Problem Sites

The Stormwater Division has identified drainage system components that are "choke points,", flow obstructions, or sites prone to erosion or sedimentation. These sites, described below, are inspected and maintained differently or more frequently than other parts of the system. In addition to the inspection frequency listed below, all problem sites will be inspected by the Stormwater Division after major storms and runoff events.

Site	Inspection frequency	Specific site issues
Arapahoe Gulch		
-inlet upstream of 5th St.	Min. 2X per year	Debris accumulation
-channel upstream of 8th St.	Min. 2X per year	Debris accumulation
-sed. Basin at Clear Creek	Min. 2X per year	Debris accumulation
W. Fork Kenney Run		
-pond upstream of US 6	Min. 2X per year	Sediment accumulation
-ped bridge downstream US 6	Min. 2X per year	Sediment accumulation
-bypass inlet and ditch along Illinois at Golf Course	Min. 2X per year	Sediment accumulation
Tucker Gulch		
-from Cressman Gulch Confluence to Garden Glen Court	Min. 2X per year	Sediment accumulation, some grass clipping and tree branch dumping

Maintenance

Vehicles/Equipment

City-owned vehicles and equipment used for Stormwater maintenance include:

- 1 ton dump trucks
- 5 ton and larger dump trucks
- backhoe
- loader
- skid steer
- DR-mower
- 2 mechanical sweepers
- Vac-Con jet truck
- Wood chipper
- Chainsaws
- Miscellaneous hand tools
- All-terrain vehicle

The Stormwater Division may also use private contractors and/or lease equipment not owned by the City to perform the required maintenance.

Preventive Maintenance—Street Sweeping Program

Preventive maintenance of all drainage systems begins with an aggressive street sweeping program of all paved roadways. Our goal is to collect miscellaneous debris, sand, and leaves before it enters the system. This is done with the use of two street sweepers per the policies described in the City's *Street Sweeping Plan*.

Subsurface System

Maintenance of inlets, manholes, and pipes will be performed during the inspection process. Maintenance typically requires the use of the vacuum truck and a 2-person crew. Silt and miscellaneous debris will be hauled offsite as it is removed from the structures and disposed of at the dump station at the City's Catamount Shops complex (operation of the dump station is covered in a separate standard operating procedure). Debris will not be stored on site.

The "older grate" type structures are typically shallow and can usually be cleaned with the use of a shovel and a 1 ton dump truck. The top (grate portion) of these older inlets are cleaned of leaves and miscellaneous debris after heavy rains. This allows the water to enter the system without any obstructions and prevents pollutants from entering the storm sewer system.

Surface System

Routine maintenance of the surface channel system consists of trash and debris pickup. In addition, the removal of vegetation such as shrubs and trees will be selectively performed to ensure that runoff will flow freely and with little or no obstruction. Thinning of shrubs and trees will also be performed with care to ensure that soil stabilization is minimally affected.

All dead trees and trees in the flow line of a structure such as a bridge or culvert restricting flow will be removed. This work will usually be performed with hand tools such as clippers and chainsaws.

Removal of sediment will be performed with the use of the skid steer, backhoe, and front end loader. The materials are hauled to an acceptable landfill site as they are generated with the use of dump trucks. Materials will not be stored on site.

Restoration work such as side slope reconstruction, rip rap installation, and general improvements to enhance their stability and maintainability will also be performed with the use of heavy equipment. The use of a contractor may be required for this type of work.

Routine maintenance for permanent BMPs including **detention ponds** includes trash and debris removal. Mowing of both native and turf grass, and thinning or removal of willows, shrubs, and trees are also included. This is typically hand work. Maintenance for overflow boxes, grates, filtration systems, trash racks, spillways, and inlet and outlet pipes will be performed as the inspection process as noted.

The following is a more detailed guideline for detention pond maintenance considerations:

Action	Maintenance Objective	Frequency of Action
Lawn mowing and lawn care	Occasional mowing to limit unwanted vegetation. Maintain irrigated turf grass as 2 to 4 inches tall and non-irrigated native grasses at 4 to 6 inches.	Routine – Depending on aesthetic requirements
Debris and litter removal	Remove debris and litter from the entire pond to minimize outlet clogging and improve aesthetics.	Routine – Including annual, pre-storm season (April and May) and following significant rainfall events.
Erosion and sediment control	Repair and revegetate eroded areas in the basin and channels.	Non-routine – Periodic and repair as necessary based on inspection.
Structural	Repair pond inlets, outlets, forebays, low flow channel liners, and energy dissipaters as needed.	Non-routine – Repair as needed based on regular inspections.
Inspections	Inspect basins to insure that the basin continues to function as initially intended. Examine the outlet for clogging, erosion, slumping, excessive sedimentation levels, overgrowth, embankment and spillway integrity, and damage to any structural element.	Routine – Annual inspection of hydraulic and structural facilities. Also check for obvious problems during routine maintenance visits, especially for plugging of outlets.
Nuisance control	Address odor, insects, and overgrowth issues associated with stagnant or standing water in the bottom zone.	Non-routine – Handle as necessary per inspection or complaints.
Sediment removal	Remove accumulated sediment from the forebay and the bottom of the basin.	Non-routine – Performed when sediment accumulation occupies 20 percent of the WQCV. This may vary considerably, but expect to do this as necessary per inspection. The forebay will require more frequent cleanout than other areas of the pond.

<u>Special Maintenance--Contaminants</u>

Inspections should be performed in conjunction with routine storm sewer system maintenance. City staff should pay particular attention to identify contaminated stormwater, such as the presence of floating and suspended materials, oil and grease, discoloration, turbidity, odor, foam, or unusual vegetative growth.

If contents are discovered in any portion of the storm sewer system that look or smell suspicious like gas or oil, chemical-smelling sludges, etc., the following steps should be taken:

1. Keep the contents isolated and do not allow it to mix with “clean” debris that has been removed from other locations.
2. Call Environmental Services 303-384-8181 or 303-384-8136 with location, characteristics (smell, appearance) for further investigation.

3. Environmental Services will assist in sampling, analysis and proper disposal protocol once the substance is determined.
4. All confined space rules will apply.

V. PRIVATELY OWNED SYSTEMS

Annually, the Stormwater Division will ensure that the privately- owned storm systems within the city receive routine maintenance and cleaning . Owners of private facilities are required to clean and perform necessary repairs to inlets, manholes, underground pipe, channels and permanent BMPs including detention ponds on their property. After work is complete, facilities will be inspected by the City's Stormwater Supervisor for compliance.

Currently, there are 1,598 inlets, 428 manholes, 169 detention ponds, 738 outfalls and 38 miles of underground pipe maintained by private owners.

VI. APPLICABLE ORDINANCES

Water Supply Ditch

Golden Municipal Code, Section 5.01.070 (d):

> *It is unlawful and constitutes a nuisance for any person to own or operate a water supply ditch where the condition of the ditch is such that it creates a health, sanitation or safety hazard upon any property within the City.*

Maintenance Requirements

Golden Municipal Code, Section 13.30.110:

> *The property owner shall be responsible for the maintenance of all permanent stormwater quality measures enacted pursuant to this chapter. All temporary stormwater quality control measures shall be removed after work on the site has been completed and measures are no longer needed. Should any property owner fail to adequately maintain the permanent stormwater quality control measures or remove the temporary measures, the City may, after notifying the owner of the required maintenance and/or removal and the owner failing to perform such maintenance and/or removal, enter the affected property and perform or cause to be performed the required work and assess the charge for such work against the property owner, in accordance with the procedure set forth in Section 13.30.095. (Ord. 1498 §1, 2000; Ord. 1235 §2, 1994).*

Right of Entry

Golden Municipal Code, Section 13.30.130:

> *The city engineer and/or the city inspector may, where reasonable cause exists, with or without a warrant issued by a court of competent jurisdiction, including the city's municipal court, enter upon any property for examination of the same to ascertain whether a violation of the requirements of this chapter exists and shall be exempt from any legal action or liability on account thereof. (Ord. 1498 §1, 2000; Ord. 1235 §2, 1994).*

Nuisance Provision – Non-Stormwater Discharges

Golden Municipal Code, Section 13.30.140:

> *It is unlawful and constitutes a nuisance for any person to discharge or cause to be discharged or spilled any substance other than naturally occurring stormwater runoff into the city's storm drainage system, except for: landscape irrigation, lawn watering, diverted stream flows, irrigation return flow, rising ground waters, uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20)), uncontaminated pumped ground water, springs, flows from riparian habitats and wetlands, water line flushing, discharges from potable water sources, foundation drains, air conditioning condensation, water from crawl space pumps, footing drains, individual residential car washing, dechlorinated swimming pool discharges, and water incidental to street sweeping (including associated sidewalks and medians) and that is not associated with construction, discharges resulting from emergency fire fighting activities, discharges specifically authorized by a separate CDPS permit, and other waters determined by the city's environmental services division to be non-contaminated and acceptable for return to the storm drainage system and receiving waters. Nothing contained herein shall be construed to relieve any person discharging or causing to be discharged water into the storm drainage system from any liability for damage caused by the volume or quality of water discharged. (Ord. 1904, §1, 2011; Ord. 1498 §1, 2000).*

VII. MOSQUITO CONTROL

Beginning in 1999, the City has used a larvicide to control mosquito populations as needed. In May of 2003, in response to West Nile Virus, the City began using this larvicide in all potential mosquito breeding sites city wide. Each year, the larvicide is distributed in the first week of the month from approximately May through September. It is important to use it throughout the entire mosquito season. All areas of standing water where Bti (Bacillus thuringiensis israelensis) larvicide has been dispensed in the City since May 2003 have been given a GPS location number and are mapped for future reference. This is updated as needed.

The Bti bacteria, which specifically attack the larval stage of mosquitoes and black flies, are distributed to standing water bodies once every thirty days. It is a non-restricted use pesticide. Due to its ease of use and because Bti has no effect on other animals or the physical environment in which it is used, it is currently the best method available to kill mosquitoes before they have a chance to reproduce. Bti is approved by the Colorado Department of Public Health and Environment and is currently being used throughout Jefferson County and the State. The product has a life span of up to two years, becomes active upon contact with water and is effective for 30 days in water. If the water is transient and the product dries up, it is still effective when rewetted.