MASTER DRAINAGE STUDY
FOR
GUNNISON RISING
GUNNISON, COLORADO

December 5, 2012
January 30, 2013
April 4, 2013

Prepared for:

Gunnison Valley Properties, L.L.C.
234 North Main Street, Suite 3A
Gunnison, CO 81230
Phone: 970.986.3400

Prepared by:

CLC Associates, Inc.
8480 E. Orchard Road, Ste. 2000
Greenwood Village, CO 80111
Phone: 303.770.5600

CLC Job No. 12.0156

ENGINEER'S STATEMENT

This Master Drainage Study for the final design of Gunnison Rising was prepared by me or under my direct supervision in accordance with the provisions of the City of Gunnison Stormwater Management Manual. I understand that the City of Gunnison and its designated City authority do not and will not assume liability for drainage facilities designed by others.

COLORADO LICENSED
GINA BERNIECE GRAVES
39761
PROFESSIONAL ENGINEER

Gina B. Graves
P.E. # 39761
State of Colorado

Date April 4, 2013

TABLE OF CONTENTS

GENERAL LOCATION AND DESCRIPTION 1
Site Location 1
Description of Property 1

DRAINAGE BASINS AND SUB-BASINS 2
Major Drainage Basins 2
Minor Drainage Basins 3

DRAINAGE DESIGN CRITERIA 4
Regulations 4
Drainage Studies, Outfall Systems Plans, Site Constraints 4
Hydrology 4
Detention 5
Water Quality Enhancement 5

STORMWATER MANAGEMENT FACILITY DESIGN 5
Stormwater Conveyance Facilities 5
Stormwater Storage Facilities 6
Water Quality Enhancement Best Management Practices 6
Floodplain 7
Groundwater 7
Irrigation System 7
Geologic Hazards 7
Additional Permitting Requirements 7

CONCLUSIONS 8
Compliance with Standards 8
Variances 8
Drainage Concept 8
Sediment and Erosion Control Concept 8

REFERENCES 9

Index of Figures

All figures are presented in the appendices

Appendix A

Vicinity Map
PUD Land Use Map
Flood Insurance Rate Maps
NRCS Soils Survey
Table 3-1 Rainfall Depth-Duration-Frequency – 1-hour Rainfall
Tables RO-3 and RO-5 – Runoff Coefficients (c) for Rational Method
Table RO-13 Velocity Chart

Appendix B

Weighted C Coefficient
CUHP Worksheets
SF-2 Time of Concentration
SF-3 Storm Drainage Design
Summary of Allowable Release Rates
Detention Pond Sizing 10-YR, 100-YR
Summary of Detention Pond Volumes
Existing Outfall Capacities

Appendix C

Gunnison Airport Drainage Map
Colorado Geological Survey Letter
FEMA LOMR
Existing Drainage Map
Proposed Drainage Map

GENERAL LOCATION AND DESCRIPTION

This report presents the Gunnison Rising Master Drainage Study. The design and analysis of this site has been performed in accordance with the City of Gunnison Stormwater Management Manual, Draft August 2012 edition (STANDARDS) and Urban Drainage and Flood Control District, Urban Storm Drainage Criteria Manual, Volumes 1, 2, & 3, June 2001. Drawings, tables, and design calculations are included in the appendix of this report.

Site Location

The site is located east of the City of Gunnison, Colorado. The site spans Highway 50 and is located on both the south and north sides of the highway. On the north side of the highway is where the majority of the project is located with the western edge of the project abutting Western State Colorado University, the east side of the project abuts the Cemetery, Tomichi Heights subdivision, a residential development and the south side is bounded by Highway 50. The south portion of the project is bounded by Highway 50 to the north, the airport to the west and bounded to the south by Colorado Parks and Wildlife property and Tomichi Creek. A Vicinity map is located in the Appendix.

Description of Property

The site is approximately 633 acres in size. The topography for the site generally slopes southerly at slopes ranging from 1% to 40%. The soils within the site are sandy loam in nature and fall into Hydrologic Soil Groups A, B and C per mapping information from the Natural Resources Conservation Service (NRCS). The Duffson-Spring Creek (DsE) stony loams with 5% to 40% slopes, is classified by the City of Gunnison as Hydrologic Soil Group D. To meet City requirements for design of storm drainage facilities, the DsE soils within design basins are considered to be Hydrologic Group D soils. Therefore, the majority of the soils are made of Type C & D soils. The vegetation is native grasses and weeds. The site is broken into three sections; section one is from the Cemetery irrigation ditch to the north property line, section two is from the irrigation ditch south to Highway 50 and section three is from Highway 50 south to Tomichi Creek.

The site north of Highway 50 is located in a portion of Sections 30 and 31, Township 50 North, Range 1 East. The site south of Highway 50 is located in a portion of Sections 5 and 6, Township 49 North, Range 1 East and Section 1, Township 49 North, Range 1 West. The majority of the site is located outside the 100yr floodplain as indicated on the Flood Insurance Rate Map Community-Panel Numbers 0800780755 B and 0800780615 B, dated September 29, 1989, for Gunnison County, Colorado (see Appendix for FIRM maps). These maps will be replaced on May 16, 2013 with the following New City FIRM Panel Numbers: 1262 of 1975, 1264 of 1975, 1266-1268 of 1975; and the new *Flood Insurance Study Gunnison County, Colorado and Incorporated Areas* will be released on May 16, 2013.

On the north portion of the site is "The Gunnison and Tomichi Valleys Ditch Association's Irrigating and Supply Ditch", otherwise known as the Cemetery Ditch. This ditch runs west to east through the property. It is unclear if the ditch historically outfalls south of the highway and at what location. A portion of the ditch, or a lateral turns south through the cemetery. Tomichi Creek runs parallel to the southern parcel on the south side of the project.

The project consists of multiple land uses as shown in the PUD Zoning Plan Map, see appendix. The majority of the site, 234 acres, consists of R-2 residential (1-3 dwelling units per acre) which is the most northern portion of the site; north of the Cemetery Ditch. The other land uses consist of, R-1 residential, 16.29 acres (0.26 dwelling units per acre), R-2M residential, 72.74 acres (5-

12 dwelling units per acre), C, 5.02 acres (commercial), C/WP, 15.65 acres (commercial/western pavilion), CM, 48.10 acres (modified commercial/mixed use), CRV, 63.74 acres (commercial recreational resort), IM, 36.95 acres (modified industrial), GOV, 17.01 acres (government), O, 62.36 acres (open space) and O/E, 52.47 acres (open space-equestrian).

The property south of Highway 50 may have the potential to have high ground water due to the proximity of the wetlands and Tomichi Creek.

The irrigation for the site will be controlled and any runoff will be conveyed to the water quality/detention facilities as each site is developed.

DRAINAGE BASINS AND SUB-BASINS

Major Drainage Basins

The property north of the highway contributes considerable storm runoff during storm events. These existing basins are significant in area and topography. The existing drainage basins on the north side of the highway are separated into six existing sub-basins. Sub-basins E1 and E5 outfall across the highway at the 6'x6' box culvert along the western border of the property. Sub-basins E2-E4 and E6 outfall across the highway via an existing 42" CMP culvert. The Cemetery Ditch is a privately owned irrigation ditch which dissects the northern property from west to east. The existing condition is such that the runoff from the basins north of the ditch outfalls into the ditch until its capacity is met at which point the ditch is overtopped and the runoff sheet flows across the existing ground towards the lowpoint at the 42" CMP culvert. The existing contours demonstrate that the overtopping occurs over wide expanses of the ditch and not at any particular localized area. During major storm events it is surmised that ponding occurs on the north side of the highway until the 42" pipe drains the stormwater runoff.

The proposed northern basins were delineated as close to the existing basin delineation as possible to provide a balanced comparison. Proposed sub-basins were delineated in more detail in order to account for existing off-site flow from proposed development flow within a major basin grouping. The proposed land uses determined the overall basin percent impervious for master study purposes as demonstrated with the spreadsheet "Weighted Runoff Coefficients" provided within Appendix B. It is proposed that each sub-basin within Basins A-D north of the Cemetery Ditch will provide a water quality/detention facility and sub-basins F1-F3, south of the ditch and north of the highway, will provide a water quality/detention facility.

The proposed property south of the highway is represented by sub-basins G-L. The basins were delineated based upon proposed land uses. The proposed concept is that each of these basins will provide their own water quality/detention facilities as required by the City and UDFCD criteria. Each development must address groundwater, soils and determine adequate water quality treatments relevant to their parcel and land use. Open space and low density residential will allow for low-impact drainage design. Industrial, RV parks, government zones and commercial uses will be required to use standard water quality treatments and detention ponds. As each parcel develops a Drainage Study and Stormwater Management Plan will be required to demonstrate that proposed construction will use typical Best Management Standards as approved by the City. The ultimate downstream outfall for the entire proposed development is Tomichi Creek, including a Colorado State Wildlife area.

There are two off-site basins on the north side of the highway. Basin OS-1 is along the western boundary, mostly developed and historically outfalls to the existing 6'x6' box culvert. Basin OS-2 is a portion of the cemetery along the eastern project boundary.

The 6'x6' box culvert has been identified in the City Trails Master Plan as a future pedestrian underpass. The developer will be required to install a low-flow pipe capable of conveying

nuisance flows as well as the minor storm without disturbing the pedestrian access. It is understood however, during major storm events, (10-yr and above) that the culvert's use would revert to its original purpose of storm conveyance.

This report establishes the parameters for the overall development from a stormwater perspective. It shall be understood that adjacent properties may/will be required to accommodate upstream conveyance to the ultimate downstream outfall. The method of conveyance as well as any associated agreements/easement must be designed and submitted for approval by the City of Gunnison.

Minor Drainage Basins

The proposed sub-basins were analyzed based upon their proposed land uses as provided in the PUD and outlined in the following table:

BASIN	LAND USE
A1	Residential
A2	Undeveloped Historical
A3	Undeveloped Historical
A4	Undeveloped Historical
B1	Residential
B2	Residential
B3	Undeveloped Historical
B4	Undeveloped Historical
B5	Undeveloped Historical
C1	Residential
C2	Undeveloped Historical
C3	Undeveloped Historical
C4	Undeveloped Historical
D1	Residential
D2	Undeveloped Historical
F1	Commercial
F2	Residential
F3	Residential
G	Industrial
H1	Equestrian (Greenbelt)
H2	Western Pavilion (Greenbelt)
J	Government (Commercial)
K	Residential
L	Residential

The percent impervious values and the corresponding runoff coefficients are given in the Weighted C Coefficient Table, Appendix B.

DRAINAGE DESIGN CRITERIA

Regulations

City of Gunnison Stormwater Management Manual (STANDARDS), and the Urban Drainage and Flood Control District (UDFCD) "Urban Storm Drainage Criteria Manual" were used for the storm drainage system design.

Drainage Studies, Outfall Systems Plans, Site Constraints

There are two existing studies that were considered as a part of this study. Both are related to the Gunnison-Crested Butte Airport. The Drainage Report by Knight Piesold was relied upon to determine possible stormwater outfall locations. This existing report will be utilized by each adjacent development in order to ensure that proposed flow rates do not exceed the historic flow rate.

The proposed sub-basins will restrict releases based upon the historic storm of the same periodic reoccurrence. Restricting flows to historic rates ensures that existing storm conditions are not surpassed. The storm hydrograph for the creek will not be altered with the development of this project.

Hydrology

Basins E1-E6 were analyzed under existing conditions using the Colorado Urban Hydrograph Program, CUHP, (for use with basin over 90 acres). The proposed sub-basins were analyzed with the rational method. The proposed basins, with the exception of Sub-basin B5 and C4 (which were analyzed with CUHP due to their basin size), were analyzed using the Rational Method.

The following criteria were utilized in developing the proposed drainage system.

- The proposed drainage system concept is designed to match, as best as possible, the historic drainage patterns occurring at the site.
- The proposed drainage system concept attempts to limit the diversion of storm runoff from one basin to another (basin transfer).
- Runoff generated from drainage sub-basins is conveyed either directly or via storm sewer systems or channels to outfall locations into a conceptual regional detention pond where water quality facilities are located. (As each basin develops additional detention ponds may be designed.)

Design Rainfall: local point rainfall data is used to determine peak runoff values. The 5-year and 100-year frequency storms are used as the initial and major design storms respectively.

Runoff Calculation: Peak storm runoff is determined using the rational formula,

$Q = CIA$:
Q = storm runoff in CFS;
C = runoff coefficient based on surface impermeability;
I = rainfall intensity in inches per hour; and
A = drainage basin area in acres.

UDFCD Imperviousness Values (Table RO-3, page RO-9, Chapter 5, Volume 1) and Runoff Coefficients (Table RO-5, page RO-11, Chapter 5, Volume 1) are used to develop basin runoff

coefficients. The runoff coefficients are weighted for each applicable sub-basin to more accurately reflect the runoff characteristics of the site.

Time of Concentration is determined using the criteria in Section 2.4, (Chapter 5, Volume 1) of the UDFCD Criteria Manual.

Rainfall intensities are determined using STANDARDS Point Rainfall data and Intensity-Duration curves.

The recurrence intervals used for this study were based on a commercial land use. The minor drainage system is designed for a 5-year recurrence interval, the minor storage system is designed for a 10-year recurrence interval and the major drainage system is designed for a 100-year recurrence interval.

Detention

Detention Facilities for each sub-basin were sized using the City's Rational Volume Method. The outlet structures are to be three-stage systems for the water quality capture volume (WQCV), the 10-year (minor) storm and the 100-year (major) storm (STANDARDS). The outlet structure should incorporate an inclusive micro-pool and trash rack. The allowable release rates for the outlet structures during the 10-year and 100-year storms are area-weighted. The area-weighted rate is determined by design return period and NRCS Hydrologic Soil Group. The release rate is quantified by multiplying the area-weighted multiplier by the basin area, in acres (UDFCD, Volume II, Storage, 3.2.1).

Water Quality Enhancement

Stormwater quality is to be appropriated with the design of stormwater quality best management practices (BMPs) that start with the pre-construction stage and continue through the post-construction stage. Criteria presented in Volume 3 of the UDFCD criteria shall govern unless specifically modified by STANDARDS. Each developed parcel will be required to submit Stormwater Management Plans and Report to the proper local and state agencies.

STORMWATER MANAGEMENT FACILITY DESIGN

Stormwater Conveyance Facilities

The purpose of this study is to discuss general design concepts and to introduce initial constraints for future development. As each parcel (basin) is developed a City approved drainage report as well as construction documentation will be required. Each development is required to address all stormwater quality standards by providing the appropriate temporary and permanent BMPs. Each development will be required to provide a stormwater quality/detention facility with allowable release rates not to exceed the historic flow rates.

The proposed land uses for each sub-basin determined the overall basin percent impervious for master study purposes. This study proposes that each proposed parcel will provide a water quality/detention facility. The undeveloped sub-basins, at the northern most boundary, will not be disturbed and as such the stormwater runoff associated with the basins will be routed through the proposed site to outfall historically. Any undeveloped flows that are routed through water quality/detention facilities will be by-passed undetained and will not be subject to any detention or release rate restrictions.

There is one off-site basin, Sub-Basin OS-1 on the north side of the highway along the western boundary. This area is mostly developed and historically outfalls to the existing 6'x6' box culvert. Sub-Basin OS-2 is a small basin on the eastern project boundary that includes runoff from the adjacent cemetery and outfalls at the 42-inch CMP.

Any proposed storm sewer system design for future developed sub-basins will be determined based upon future approved site plans. Proposed storm sewer systems will consist of storm inlets, storm sewer piping, storm manholes, energy dissipation devices, water quality BMPs, water quality/detention facilities and outlet structures. All of the proposed detention ponds will have restricted release rates that will be determined based upon the historic flow rates per UDFCD.

Each proposed project will be required to design within the PUD and City of Gunnison standards. Easements and maintenance agreements may be required by the City.

Stormwater Storage Facilities

Each water quality/detention pond will be designed based upon the Rational Volume Method per the STANDARDS and UDFCD. The outlet structures are to be three-stage systems for the water quality capture volume (WQCV), the 10-year (minor) storm and the 100-year (major) storm. The outlet structure should incorporate an inclusive micro-pool and trash rack.

Detention pond volumes and release rates have been calculated based on the basin parameters of this report (Appendix B). These volumes are subject to change based upon individual and specific site plans as each parcel develops.

The existing culverts at Highway 50 are estimated to convey a maximum flow and this was calculated based upon a 2-percent slope resulting in full flow capacity of the 6'x6' box culvert as 923 CFS and the 42" CMP as 77.07 CFS.

All water quality/detention ponds are to be privately owned and maintained. Each developing parcel will be required to submit to the City a Stormwater Maintenance & Operations Manual for each proposed facility. This manual will outline scheduled maintenance of the facility, assigned parties responsible for maintenance, dedicated funding source provisions and legal organizational structure. Refer to the *City of Gunnison Municipal Code*, Title 10, Special Improvement Districts.

Water Quality Enhancement Best Management Practices

The extended detention basins will provide water quality. This report requires that each developed sub-basin will have a stormwater quality/detention pond. There is room within this model to allow sub-basins to incorporate regional ponds or multiple ponds based upon final site plans and grading configurations. The ponds are required to be multi-stage structures to provide water-quality and flood detention. Trash racks and micropools are to be incorporated within the outlet structure. Forebays are to be incorporated with pipe outfalls into ponds. Low flow channels shall be designed for capacity for the minor storms and as energy dissipation. Proper landscaping shall be considered that will enhance water quality as well as aesthetics. Ponds shall be designed with appropriate maintenance considerations.

Grass-lined swales should be incorporated where possible to route stormwater to and from extended detention basins or prior to entering stormwater inlets. Swales shall be designed and landscaped per the STANDARDS.

Porous landscape detention systems may be utilized in future developments and shall be designed per the STANDARDS.

Channel design shall incorporate energy dissipation devices to minimize the effects of supercritical flow to include scour and streambed degradation. Channels shall be designed per the UDFCD criteria.

Floodplain

The property north of Highway 50 is outside of any designated floodplain. There may be portions of the sub-basins south of Highway 50 that lie within the 500-year floodplain, the 100-year floodplain or the 100-year floodway. This information is based on the LOMR of May 2010.

Groundwater

Groundwater information is typically included within the Geotechnical report. Each development is required to analyze the groundwater impact.

Irrigation System

On the north portion of the site is "The Gunnison and Tomichi Valleys Ditch Association's Irrigating and Supply Ditch", otherwise known as the Cemetery Ditch. This ditch runs west to east through the property. Currently under existing conditions the sub-basins north of the Cemetery Ditch outfall into the existing ditch. There is sufficient visual evidence based on contouring that the ditch overtops and the excess runoff sheetflows to the 42" CMP culvert that crosses Highway 50. This ditch is an active irrigation ditch with decreed water rights. No proposed stormwater facilities shall release any stormwater runoff into the ditch. Development north of the ditch will require stormwater runoff to be routed around or under ditch without compromise of the irrigation ditch. Any proposed development will be required to perpetuate the irrigation ditch through the site.

Geologic Hazards

Each development is required to perform a Geologic and Geotechnical Analysis of all affected real property pursuant to Section 2.7.6, of the *Gunnison Rising PUD Development Standards*.

Additional Permitting Requirements

There are two isolated wetlands areas shown in Appendix H of the Gunnison Rising PUD, Section 14.3.4 of the PUD exempts these two areas from the 100' buffer requirement but requires a Section 404 Permit if any dredging or filling activity occur in the wetland.

U.S. Fish and Wildlife Service may list the Gunnison Sage Grouse as either Threatened or Endangered by the Fall of 2013. Site specific development applications may be required to address new requirements or regulations promulgated by the U.S. Fish and Wildlife Service.

CONCLUSIONS

Compliance with Standards

It is understood that the purpose of this study is to provide general stormwater practices based on a general land use concept. As each land use is developed a detailed drainage report will be required in order to show minimal compliance with the overall drainage concept. The master drainage system for Gunnison Rising was designed to meet the City of Gunnison's drainage criteria. The site does include a portion of F.E.M.A. mapped floodplains. The existing Flood Insurance Rate Map (Panels 1266D and 1267D) shows a portion of the site south of Highway 50 to be within a floodplain. The adopted floodplain maps and the *Flood Insurance Study Gunnison County Colorado and Incorporated Areas* (May 16, 2013) are available in the City of Gunnison Community Development Department office.

Variances

No known variances have been requested at this time.

Drainage Concept

The drainage system for Gunnison Rising was designed to allow storm water to be safely conveyed through and away from the site without negatively impacting downstream or upstream properties (regionally) beyond that imposed by the historic condition. The drainage concepts proposed for this site are in accordance with those presented in previous reports. All drainage facilities proposed with this development are private facilities and will be privately maintained.

Sediment and Erosion Control Concept

Construction BMP's proposed for this site will follow the requirements of the City of Gunnison and recommendations by UDFCD. Attention to proper installation and maintenance are essential for the sediment and erosion control practices to function properly.

REFERENCES

1. City of Gunnison, Colorado, *Stormwater Management Manual*, August 2012 (Draft).

2. *Gunnison-Crested Butte Regional Airport Master Plan Update*, by The Barnard Dunkelberg & Company Team.

3. Gunnison County Airport Schedule II: Site Preparation for Runway and Taxiway Shift Regrade Runway Safety Area AIP Projects No. 3-08-0030-27 Final Design Report, by Knight Piesold and Company, dated January, 2002.

4. *Gunnison Rising Drainage Report* prepared by Del-Mont Consultants, Inc., May 2008.

5. Urban Drainage and Flood Control District, Denver, Colorado, *Urban Storm Drainage Criteria Manual, Volumes 1, 2 & 3*, June 2001.

6. Letter of Map Revision, Federal Emergency Management Agency, May 2010.

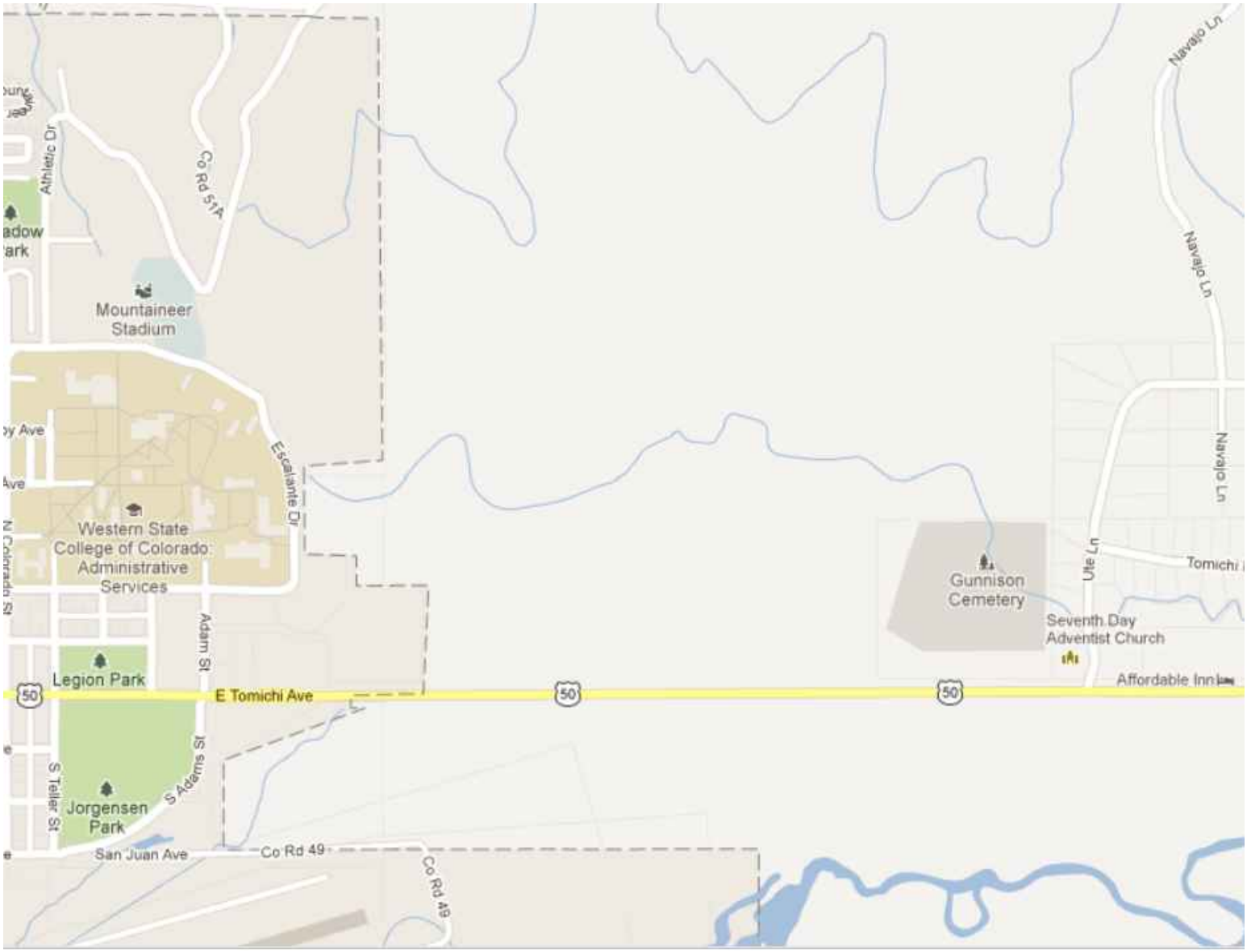
7. *Geologic Hazards Evaluation Gunnison Rising, Gunnison County, Colorado*, prepared by CTL Thomson, dated June 10, 2008.

8. Letter from the Colorado Geolgoical Survey dated December 21, 2007.

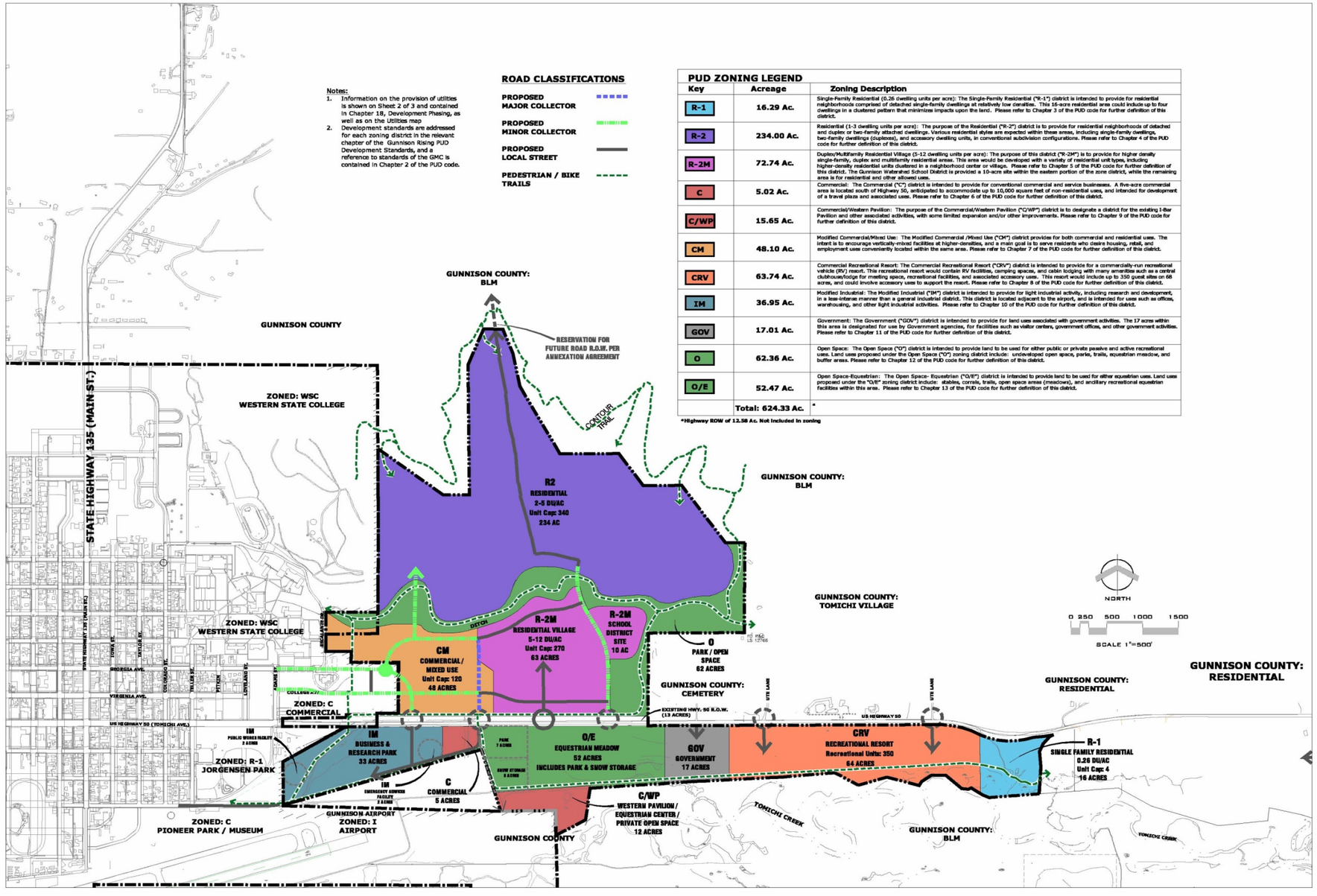
9. *Gunnison Rising PUD Development Standards*, Amended December 2010.

APPENDIX A

- VICINITY MAP
- PUD LAND USE MAP
- FLOOD INSURANCE RATE MAPS
- NRCS SOIL SURVEY
- RAINFALL DEPTH-DURATION-FREQUENCY–2 AND 100-YEAR, 1-HOUR RAINFALL
- TABLE 3-1 RAINFALL DEPTH-DURATION-FREQUENCY–2 AND 100-YEAR, 1-HOUR RAINFALL
- TABLES RO-3 AND RO-5 – RUNOFF COEFFICIENTS (C) FOR RATIONAL METHOD
- TABLE RO-13 VELOCITY CHART



VICINITY MAP



PUD ZONING LEGEND

Key	Acreage	Zoning Description
R-1	16.29 Ac.	Single-Family Residential (0.26 dwelling units per acre): The Single-Family Residential ("R-1") district is intended to provide for residential neighborhoods comprised of detached single-family dwellings at relatively low densities. This 16-acre residential area could include up to four dwellings in a clustered pattern that minimizes impacts upon the land. Please refer to Chapter 3 of the PUD code for further definition of this district.
R-2	234.00 Ac.	Residential (1-3 dwelling units per acre): The purpose of the Residential ("R-2") district is to provide for residential neighborhoods of detached and duplex or two-family attached dwellings. Various residential styles are expected within these areas, including single-family dwellings, two-family dwellings (duplexes), and accessory dwelling units, in conventional subdivision configurations. Please refer to Chapter 4 of the PUD code for further definition of this district.
R-2M	72.74 Ac.	Duplex/Multifamily Residential Village (5-12 dwelling units per acre): The purpose of this district ("R-2M") is to provide for higher density single-family, duplex and multifamily residential areas. This area would be developed with a variety of residential unit types, including higher-density residential units clustered in a neighborhood center or village. Please refer to Chapter 5 of the PUD code for further definition of this district. The Gunnison Watershed School District is provided a 10-acre site within the eastern portion of the zone district, while the remaining area is for residential and other allowed uses.
C	5.02 Ac.	Commercial: The Commercial ("C") district is intended to provide for conventional commercial and service businesses. A five-acre commercial area is located south of Highway 50, anticipated to accommodate up to 10,000 square feet of non-residential uses, and intended for development of a travel plaza and associated uses. Please refer to Chapter 6 of the PUD code for further definition of this district.
C/WP	15.65 Ac.	Commercial/Western Pavilion: The purpose of the Commercial/Western Pavilion ("C/WP") district is to designate a district for the existing I-Bar Pavilion and other associated activities, with some limited expansion and/or other improvements. Please refer to Chapter 9 of the PUD code for further definition of this district.
CM	48.10 Ac.	Modified Commercial/Mixed Use: The Modified Commercial /Mixed Use ("CM") district provides for both commercial and residential uses. The intent is to encourage vertically-mixed facilities at higher-densities, and a main goal is to serve residents who desire housing, retail, and employment uses conveniently located within the same area. Please refer to Chapter 7 of the PUD code for further definition of this district.
CRV	63.74 Ac.	Commercial Recreational Resort: The Commercial Recreational Resort ("CRV") district is intended to provide for a commercially-run recreational vehicle (RV) resort. This recreational resort would contain RV facilities, camping spaces, and cabin lodging with many amenities such as a central clubhouse/lodge for meeting space, recreational facilities, and associated accessory uses. This resort would include up to 350 guest sites on 68 acres, and could involve accessory uses to support the resort. Please refer to Chapter 8 of the PUD code for further definition of this district.
IM	36.95 Ac.	Modified Industrial: The Modified Industrial ("IM") district is intended to provide for light industrial activity, including research and development, in a less-intense manner than a general industrial district. This district is located adjacent to the airport, and is intended for uses such as offices, warehousing, and other light industrial activities. Please refer to Chapter 10 of the PUD code for further definition of this district.
GOV	17.01 Ac.	Government: The Government ("GOV") district is intended to provide for land uses associated with government activities. The 17 acres within this area is designated for use by Government agencies, for facilities such as visitor centers, government offices, and other government activities. Please refer to Chapter 11 of the PUD code for further definition of this district.
O	62.36 Ac.	Open Space: The Open Space ("O") district is intended to provide land to be used for either public or private passive and active recreational uses. Land uses proposed under the Open Space ("O") zoning district include: undeveloped open space, parks, trails, equestrian meadow, and buffer areas. Please refer to Chapter 12 of the PUD code for further definition of this district.
O/E	52.47 Ac.	Open Space-Equestrian: The Open Space- Equestrian ("O/E") district is intended to provide land to be used for either equestrian uses. Land uses proposed under the "O/E" zoning district include: stables, corrals, trails, open space areas (meadows), and ancillary recreational equestrian facilities within this area. Please refer to Chapter 13 of the PUD code for further definition of this district.
	Total: 624.33 Ac.	*

*Highway ROW of 12.58 Ac. Not included in zoning

URBAN DESIGN LAND PLANNING & LANDSCAPE ARCHITECTURE
NES
DMC DEL-MONT CONSULTANTS, INC

PUD ZONING PLAN MAP
GUNNISON, COLORADO

GUNNISON RISING
Authentically Colorado

DATE: NOV 18, 2009
DRAWN: DOD
APPROVED: TWB

REVISIONS:
DATE: BY: COMMENTS:

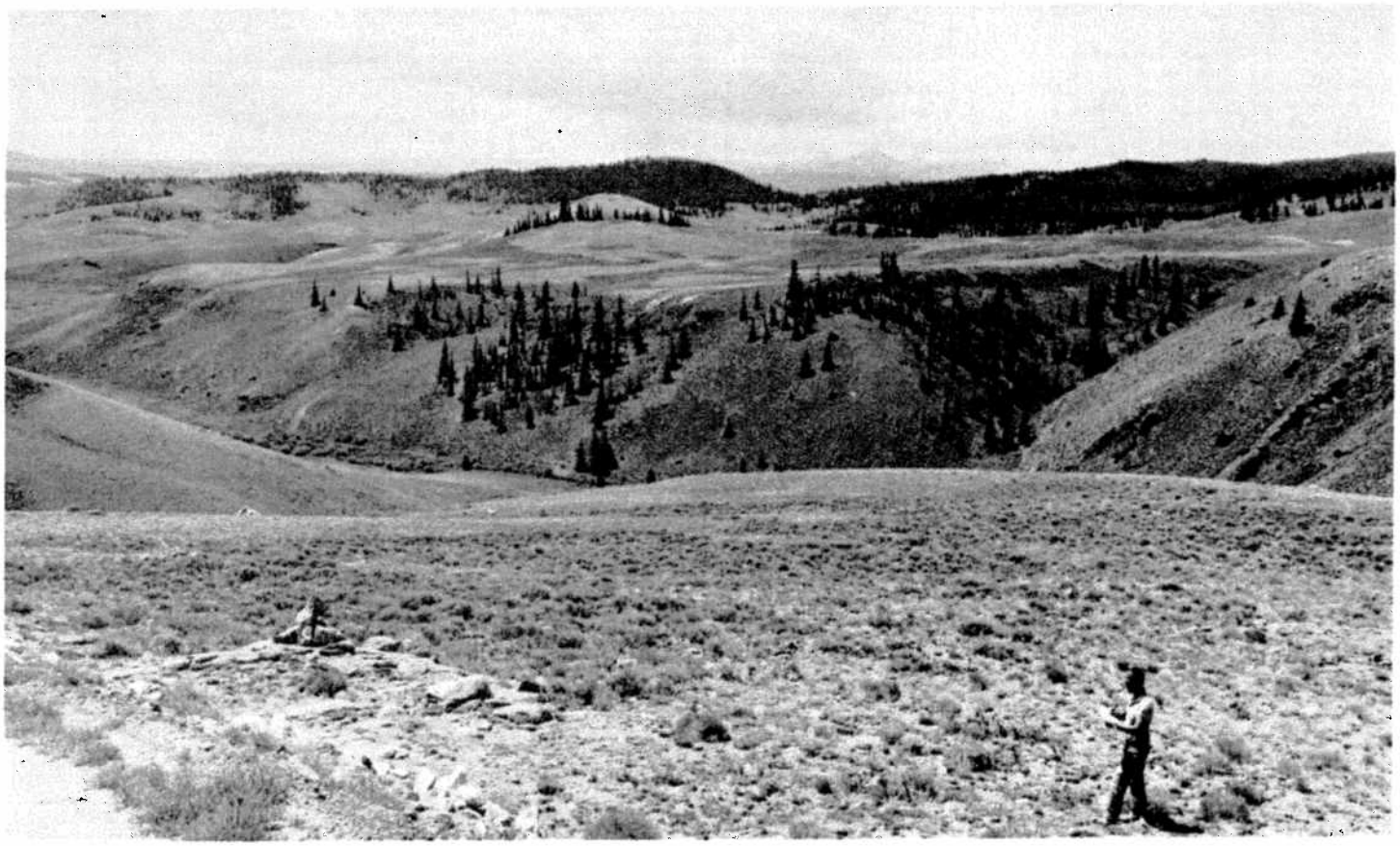
ZONING MAP
FIGURE 2.17

SHEET NO.
OF MAPS

SOIL SURVEY OF

Gunnison Area, Colorado

Parts of Gunnison, Hinsdale, and Saguache Counties



United States Department of Agriculture
Soil Conservation Service
In cooperation with
Colorado Agricultural Experiment Station

mat of partly decomposed plant material on the surface. The surface layer is very stony loam. The subsoil is very stony silt loam. The substratum is very stony silt loam several feet thick.

Rockslides consists of loose, angular stone fragments that range in size from gravel to boulders many feet in diameter. It is commonly on very steep upland slopes below Rock outcrop and rimland.

This association is used mostly for grazing sheep. The grazing season is short, commonly no longer than 2 months. The native vegetation is low-growing sedges, alpine bluegrass, moss campion, silver cinquefoil, and alpine willow. Rockslides provides water for lower areas. Winter snow accumulates in crevices between the stones and is slower to melt during spring thaw. Slower melting allows a more even distribution of water to springs and streams.

This association has good potential as habitat for elk, black bear, mountain sheep, ptarmigan, and snowshoe hare. It has good potential as cover for deer and mourning dove, but only fair potential for food.

Descriptions of the Soils

This section describes the soil series and mapping units in the Gunnison Area. Each soil series is described in considerable detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile; that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second, detailed and in technical terms, is for scientists, engineers, and others who need to make thorough and precise studies of soils. Unless it is otherwise stated, the colors given in the descriptions are those of a dry soil.

As mentioned in the section How This Survey Was Made, not all mapping units are of a soil series. Rock outcrop, for example, does not belong to a soil series, but nevertheless, is listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit, range site, or woodland group to which the mapping unit has been assigned. The page for the description of each capability unit and range site can be found by referring to the Guide to Mapping Units at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*4*).[1]

Alluvial Land

Alluvial land (Ad) is in narrow, winding valleys and on small fans and mountain toe slopes. It consists of an accumulation of valley-fill sediment that was derived from many kinds of rocks and upland soils. Some sediment has been carried for only short distances and has been sorted only slightly. Other sediment has been carried for considerable distances and has been well sorted and stratified. This land is subject to flooding and deposition of new sediment. Slopes are dominantly 0 to 5 percent, but they range to 15 percent.

Little or no soil formation has occurred in most areas. In some areas a thin, dark-colored, generally loamy surface layer has formed. The underlying material is highly stratified. Drainageways that are not protected by adequate plant cover are subject to entrenchment and headcutting. The water table in most areas has been lowered by the entrenchment of drainageways.

Alluvial land is used mainly for range, wildlife, and recreation. The vegetation is commonly grass and mixed stands of big sagebrush and grass. Areas above an elevation of 9,000 feet are forested. Capability unit VIw-3 nonirrigated; Mountain Swale range site.

Alluvial Land, Occasionally Flooded

Alluvial land, occasionally flooded (Ao) is on flood plains along streams and side drainageways. It consists of material recently deposited by streams. It varies widely in texture and commonly has very cobbly or stony areas interspersed throughout. It is subject to erosion from floods and changes in stream channels. Slopes are 0 to 5 percent.

Alluvial land, occasionally flooded, is suited to limited grazing and to wildlife and recreation. In most areas the vegetation is narrowleaf cottonwood, willows, grasses, sedges, and rushes. Small areas are flooded annually and support little or no vegetation. Capability unit VIIw-4 nonirrigated.

Alluvial Land, Wet

Alluvial land, wet (Aw) is commonly on flood plains and in narrow, winding valleys. It consists of deep, very poorly drained, dark-colored, stratified sandy loam to clay loam that was derived from mixed alluvium. Slopes are 0 to 5 percent.

This land receives water from springs and streams. The water table is at the surface or within a depth of 1 foot during most of the year. Organic-matter content is high. Buried surface layers, mottling, and gleying are common in most areas. Numerous stones and cobblestones are on the surface and throughout the soil material.

Alluvial land, wet, is used for range and wildlife. It can be irrigated and used for pasture. It has good plant cover and supports meadow vegetation, willows, and

[1] Italic numbers in parentheses refer to Literature Cited, p. 83.

Permeability is moderate. The root zone is 20 to 40 inches deep. Available water capacity is low.

Bogan soils are important for range, and they provide habitat for wildlife.

Representative profile of Bogan silt loam, 5 to 30 percent slopes, three-fourths of a mile east of Baldwin; NE1/4 sec. 7, T. 15 S., R. 86 W., Gunnison County:

A1—0 to 8 inches, dark-brown (10YR 3/3) silt loam, very dark brown (10YR 2/3) moist; weak, very fine, granular structure; soft, very friable; pH 6.6; clear, smooth boundary.

B1—8 to 16 inches, brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; moderate, medium, subangular blocky structure; hard, firm; thin continuous clay films on ped faces; pH 7.0; clear, smooth boundary.

B2t—16 to 24 inches, pale-brown (10YR 6/3) light silty clay loam, dark grayish brown (10 YR 4/2) moist; moderate and strong, fine, subangular blocky structure; hard, firm; moderate continuous clay films on ped faces; pH 6.7; clear, smooth boundary.

R—24 inches +, yellowish-brown shale interbedded with fine-grained sandstone.

The A1 horizon is dominantly silt loam, but ranges to fine sandy loam and loam. It ranges from dark brown to brown. The B2t horizon is typically light silty clay loam, but in places is clay loam. It ranges from 6 to 12 inches in thickness. Sandstone or interbedded sandstone and sandy shale is at a depth of 20 to 40 inches. Bogan soils are commonly noncalcareous, but limy horizons occur in places.

Bogan silt loam, 5 to 30 percent slopes (BoE).—This soil is on uplands in the northern part of the survey area along Ohio Creek and its tributaries and near Crested Butte.

Included with this soil in mapping are areas of Cochetopa and Tongue River soils and small areas, commonly near Crested Butte, of soils that are only 10 to 20 inches deep over shale, but are otherwise similar to Bogan soils. Included soils make up 15 percent of the total acreage.

Almost all the acreage is in native vegetation and is used for grazing, wildlife, and recreation. Small, less sloping areas below irrigation ditches are irrigated to produce hay and pasture. Runoff is medium. Slight to moderate erosion is common. The erosion hazard is moderate. Capability units VIe-1 irrigated, VIe-4 nonirrigated; Subalpine Loam range site.

Bosler Series

The Bosler series consists of deep, well-drained soils on terraces and alluvial fans. Slopes are 1 to 8 percent. These soils formed in mixed alluvium, sand, and gravel.

In a representative profile the surface layer is brown sandy loam about 10 inches thick. The subsoil is brown sandy loam and brown and grayish-brown gravelly sandy clay loam about 22 inches thick. It is calcareous in the lower part. The substratum to a depth of 72 inches is calcareous, white very cobbly loamy sand and cobbly sand.

Bosler soils are at elevations of 7,800 to 8,500 feet. The average annual soil temperature is 41° F. The average annual precipitation is approximately 11 inches. The native vegetation is commonly Arizona fescue, squirreltail, and big sagebrush.

Permeability is moderate. Roots can penetrate to a depth of 60 inches or more, but available water capacity is low.

If irrigated, these are important soils for hay and pasture.

Representative profile of Bosler sandy loam, 1 to 8 percent slopes, one-fourth mile north of Gunnison; NW1/4 sec. 36, T. 50 N., R. 1 W., Gunnison County:

A1—0 to 10 inches, brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; weak, fine, granular structure; slightly hard, very friable; about 5 percent gravel; pH 7.2; clear, smooth boundary.

B1—10 to 22 inches, brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; weak, coarse, subangular blocky structure; slightly hard, very friable; about 5 percent gravel; pH 7.4; clear, wavy boundary.

B2t—22 to 26 inches, brown (7.5YR 5/3) gravelly sandy clay loam, dark brown (7.5YR 4/3) moist; moderate, medium, subangular blocky structure; hard, friable; thin continuous clay films on ped faces; about 40 percent gravel and cobblestones; clear, irregular boundary.

B3ca—26 to 32 inches, grayish-brown (10YR 5/2) gravelly sandy clay loam, dark grayish brown (10 YR 4/2) moist; weak, medium, subangular blocky structure; hard, very friable; thin patchy clay films; about 40 percent gravel and cobblestones; strongly calcareous; pH 7.6; gradual, wavy boundary.

IIC1ca—32 to 48 inches, white (10YR 8/2) very cobbly loamy sand, very pale brown (10YR 7/3) moist; massive; hard, very friable; strongly calcareous; pH 8.0; clear, wavy boundary.

IIC2—48 to 72 inches, cobbly sand.

The A horizon is typically sandy loam, but in places is loam. The B2t horizon is 35 to 65 percent gravel and cobblestones. It ranges from 4 to 12 inches in thickness. Reaction is neutral to moderately alkaline.

Bosler sandy loam, 1 to 8 percent slopes (BsB).—This soil is on terraces and alluvial fans along major streams and side drainageways. Terraces are normally 30 to 60 feet above streams.

Included with this soil in mapping are areas of Curecanti and Fola soils in narrow bands along terrace edges and areas of Evanston and Dewville soils on small fans. Steep, cobbly terrace edges are common. Included soils make up about 15 percent of the total acreage.

About three-fourths of the acreage is used for irrigated hay and pasture. The rest is native range. Runoff is slow, and the erosion hazard is slight. Capability units Vc-1 irrigated, VIe-2 nonirrigated; Mountain Outwash range site.

Carbol Series

The Carbol series consists of shallow, well-drained soils on hillsides and mountainsides. Slopes are 15 to 60 percent. These soils formed in material derived in place from granite.

In a representative profile the surface layer is very dark grayish-brown gravelly sandy loam about 8 inches thick. The subsoil is dark-brown gravelly sandy clay loam about 8 inches thick. Unweathered granite is at a depth of 16 inches.

Carbol soils are at elevations of about 9,000 to 10,000 feet. The average annual soil temperature is 38° F., and the average annual precipitation is about 17 inches. The vegetation is commonly thin stands of ponderosa pine and Douglas-fir and an understory of big sagebrush, Arizona fescue, pine dropseed, and Indian ricegrass.

Included soils make up about 10 percent of the total acreage.

Nearly all the acreage is native range and is used for grazing in summer and fall. Runoff is medium to rapid, depending on slope. The erosion hazard is moderate. Capability units VIe-1 irrigated, VIe-4 nonirrigated; Subalpine Loam range site.

Corpening Series

The Corpening series consists of shallow, well-drained soils on upland hills, ridges, and benches. Slopes are 5 to 40 percent. These soils formed in material derived in place from calcareous sandstone or limestone.

In a representative profile the surface layer is brown fine sandy loam about 7 inches thick. Below this is about 7 inches of calcareous, pink gravelly sandy loam. Calcareous sandstone is at a depth of 14 inches.

Corpening soils are at an elevation of about 8,400 feet. The average annual soil temperature is 42° F., and the annual precipitation is 14 inches. The native vegetation is commonly fringed sage, cactus, winterfat, blue grama, and big sagebrush.

Permeability is moderately rapid. Roots can penetrate to a depth of only about 14 inches, and available water capacity is low.

These soils are used for range and provide habitat for wildlife.

Representative profile of Corpening fine sandy loam, 5 to 40 percent slopes; sec. 26, T. 48 N., R. 2 E., Saguache County:

A1—0 to 7 inches, brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 3/2) moist; weak, medium, platy structure parting to moderate, medium, granular; soft, very friable; 1 percent angular coarse fragments; pH 7.8; clear, smooth boundary.

Cca—7 to 14 inches, pink (7.5YR 7/4) gravelly sandy loam, light brown (7.5YR 6/4) moist; massive; slightly hard, very friable; calcareous; pH 8.0; 20 percent angular coarse fragments; clear, wavy boundary.

R—14 inches, slightly weathered, calcareous sandstone.

The A horizon is fine sandy loam, loam, or sandy loam that commonly is up to 20 percent coarse fragments. It ranges from dark grayish brown to brown. The depth to partly weathered calcareous sandstone or limestone ranges from 10 to 20 inches.

The Corpening soils in the survey area contain less clay than is typical for the Corpening soils mapped in other parts of Colorado. Use and management of the soils, however, are similar.

Corpening fine sandy loam, 5 to 40 percent slopes (CrE).—This soil is south of Powderhorn in the vicinity of Iron Hill.

Included with this soil in mapping are small eroded areas of Corpening fine sandy loam and small areas of Rock outcrop, Alluvial land, and Alluvial land, wet. Included soils make up about 10 percent of the total acreage.

This soil is best suited to range and wildlife. Runoff is medium to rapid, and the erosion hazard is moderate. Capability unit VIIs-1 nonirrigated; Dry Mountain Loam range site.

Curecanti Series

The Curecanti series consists of deep, well-drained soils on alluvial fans. These soils formed in cobbly loamy alluvium. Slopes are 1 to 8 percent.

In a representative profile the surface layer is brown gravelly loam about 7 inches thick. The subsoil is brown very cobbly sandy clay loam about 12 inches thick. The substratum to a depth of 60 inches is light-brown very cobbly loam.

Curecanti soils are at elevations of 7,700 to 8,500 feet. They receive about 18 inches of annual precipitation. The average annual soil temperature is about 42° F. The native vegetation is commonly black sagebrush, winterfat, phlox, squirreltail, and blue grama.

Permeability is moderate. Roots can penetrate to a depth of 60 inches or more, but available water capacity is low.

Curecanti soils are used for range and hay and provide habitat for wildlife.

Representative profile of Curecanti gravelly loam, 1 to 8 percent slopes; NE1/4 sec. 20, T. 48 N., R. 4 E., Saguache County:

A1—0 to 7 inches, brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; weak, fine, granular structure; slightly hard, very friable; about 15 percent gravel; pH 7.0; clear, smooth boundary.

B2t—7 to 14 inches, brown (7.5YR 5/3) very cobbly sandy clay loam, dark brown (7.5YR 4/3) moist; weak, medium, subangular blocky structure; hard, firm; clay films on ped faces; about 50 percent gravel and cobblestones; pH 6.8; clear, smooth boundary.

B3t—14 to 19 inches, brown (7.5YR 5/3) very cobbly sandy clay loam, dark brown (7.5YR 4/3) moist; weak, coarse to medium, subangular blocky structure; hard, firm; very few patchy clay films on ped faces; about 60 percent gravel and cobblestones; gradual boundary.

C—19 to 60 inches +, light-brown (7.5YR 6/3) very cobbly sandy loam, brown (7.5YR 4.5/3) moist; massive; very hard, friable; 60 percent cobblestones and gravel; pH 7.0.

The A horizon is typically gravelly loam, but in places is cobbly loam and gravelly sandy loam. It is 6 to 10 inches thick and is brown to dark brown. The content of cobblestones and gravel in the A horizon ranges from 15 to 40 percent. The B horizon is 8 to 14 inches thick. The Bt horizon is dominantly very cobbly sandy clay loam. The content of gravel and cobblestones in the B2t horizon ranges from 35 to 70 percent.

Curecanti gravelly loam, 1 to 8 percent slopes (CuB).—This soil is on terraces and outwash fans along major streams and side drainageways throughout the survey area. In many irrigated areas, it has a 1- to 2-inch organic mat.

Included with this soil in mapping in irrigated areas are patches of Evanston soils. Also included are small areas of Fola soils on terrace edges and steep terrace faces. Included soils make up less than 10 percent of the total acreage.

About half the acreage is used for irrigated hay and pasture. The rest is used for range. Runoff is medium, and the erosion hazard is slight. Capability units VIs-1 irrigated, VIe-2 nonirrigated; Mountain Outwash range site.

Dewville Series

The Dewville series consists of deep, well-drained soils on recent alluvial fans and valley-fill slopes. Slopes are 1 to 15 percent. These soils formed in mixed alluvium that was derived from sandstone, rhyolite, and rhyolitic tuff.

In a representative profile the surface layer is grayish-brown loam 10 inches thick. The subsoil is brown sandy clay loam about 12 inches thick. The substratum to a depth of 60 inches is grayish-brown and very pale brown sandy loam. It is calcareous below a depth of 22 inches.

Dewville soils are at elevations of about 9,000 to 10,000 feet. The average annual soil temperature is 40° F. The average annual precipitation is 15 inches. The native vegetation is commonly big sagebrush, needle-and-thread, Arizona fescue, and Indian ricegrass.

Permeability is moderate. Roots can penetrate to a depth of 60 inches or more. Available water capacity is moderate.

These soils are used mostly for irrigated hay and pasture.

Representative profile of Dewville loam, 5 to 15 percent slopes, 1½ miles west of Parlin; sec. 15, T. 49 N., R. 2 E., Gunnison County:

O1—1 inch to 0, partly decomposed organic material.

A1—0 to 10 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate, medium and fine, granular structure; slightly hard, very friable; pH 6.8; clear, wavy boundary.

B2—10 to 22 inches, brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; moderate, medium and fine, subangular blocky structure; slightly hard, friable; 5 percent angular gravel; pH 7.2; gradual, smooth boundary.

C1ca—22 to 45 inches, grayish-brown (10YR 5/2) sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable; 5 percent rock fragments; calcareous; pH 8.2; clear, wavy boundary.

C2ca—45 to 60 inches, very pale brown (10YR 7/4) sandy loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, very friable; 5 percent rock fragments; calcareous; pH 8.2; gradual, wavy boundary.

The A horizon is typically loam, but in places is sandy loam, gravelly loam, and gravelly sandy loam. It is 7 to 12 inches thick and is grayish brown to dark brown. The amount of stratification varies within the profile. The content of rock fragments, mainly gravel, ranges from 0 to 15 percent throughout the profile.

Dewville loam, 1 to 5 percent slopes (DeB).—This soil occurs throughout the survey area on recent small fans and valley-fill slopes and in places on older terraces. Areas are irregular and in many places roughly triangular. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Corpening and Hopkins soils and areas of Curecanti and Bosler soils along the edges of old terraces and steep cobbly terraces. Also included, near the confluence of Gold Basin Creek and Tomichi Creek, is a strongly alkaline Dewville soil that is stratified below a depth of 22 inches. Included soils make up less than 10 percent of the total acreage.

Most of the acreage is used for irrigated hay and pasture. The rest is used for range and wildlife. Runoff is slow to medium. The erosion hazard is slight in areas under permanent vegetation. It is moderate during snowmelt. Capability units Vc-1 irrigated, VIe-2 nonirrigated; Mountain Outwash range site.

Dewville loam, 5 to 15 percent slopes (DeC).—This soil is on fans and valley-fill slopes. It is at higher elevations than Dewville loam, 1 to 5 percent slopes.

Included with this soil in mapping are areas of Corpening and Hopkins soils and Rock outcrop. Also included are wet areas and saline spots, which are identified by spot symbols on the soil map. Included soils make up less than 10 percent of the total acreage.

Most of the acreage is used for irrigated hay and pasture. Small areas are used for range. Runoff is medium to rapid, and the erosion hazard is moderate. Shallow gullies are common. Capability units VIe-1 irrigated, VIe-2 nonirrigated; Mountain Outwash range site.

Dollard Series

The Dollard series consists of moderately deep, well-drained soils on upland hills and ridges. Slopes are 5 to 30 percent. These soils formed in material derived in place from calcareous silty shale.

In a representative profile the surface layer is light olive-brown, calcareous silty clay loam about 6 inches thick. The next layer is light olive-brown, moderately calcareous silty clay about 4 inches thick. The underlying material is light yellowish-brown, strongly calcareous silty clay. Calcareous silty shale is at a depth of 20 to 40 inches.

Dollard soils are at an elevation of about 8,600 feet. The average annual soil temperature is 45° F. The average annual precipitation is about 16 inches. The native vegetation is chiefly western wheatgrass, muttongrass, and needlegrass. Big sagebrush is the principal shrub.

Permeability is slow. The root zone is only 20 to 40 inches deep, and available water capacity is low.

These soils are used mainly for grazing. Small acreages are used for irrigated hay and pasture.

Representative profile of Dollard silty clay loam, 5 to 30 percent slopes; sec. 14, T. 51 N., R. 1 W., Gunnison County:

A1—0 to 6 inches, light olive-brown (2.5YR 5/3) silty clay loam, olive brown (2.5Y 4/3) moist; weak, medium, platy structure parting to moderate, fine, granular; soft, firm; calcareous; pH 8.2; clear, smooth boundary.

AC—6 to 10 inches, light olive-brown (2.5Y 5/3) silty clay, olive brown (2.5Y 4/4) moist; weak, coarse, subangular blocky structure; hard, firm; numerous shiny pressure faces; few shale fragments; moderately calcareous; pH 8.4; gradual, wavy boundary.

Cca—10 to 25 inches, light yellowish-brown (2.5Y 6/4) silty clay, light olive brown (2.5Y 5/4) moist; massive; very hard, extremely firm; few shale fragments; strongly calcareous; many, medium to coarse, white (5Y 8/2) soft lime masses; pH 8.4; clear, wavy boundary.

R—25 inches, silty calcareous shale.

The A horizon is typically silty clay loam, but in places is silt brown and silty clay. It ranges from light olive brown to brown. Depth to calcareous shale ranges from 20 to 40 inches.

Dollard silty clay loam, 5 to 30 percent slopes (DoE).—This soil is mainly in the areas drained by Ohio and Razor Creeks. This soil has the profile described as representative of the series, but in small eroded areas the surface layer is thinner and lighter colored. Gullies have formed in the steeper areas.

Included with this soil in mapping are areas of Rock outcrop and areas where slopes are more than 30 per-

cent. Leaps and Morop soils make up about 10 percent of some mapped areas.

This soil is used mostly for grazing. Small areas are used for irrigated hay and pasture. Runoff is medium to rapid, and the erosion hazard is slight to moderate. Capability units VIe-1 irrigated, VIIe-1 nonirrigated; Deep Clay Loam range site.

Duffson Series

The Duffson series consists of moderately deep, well-drained, calcareous soils on hills, ridges, and benches. Slopes are 5 to 40 percent. These soils formed in locally transported alluvium that was derived from calcareous, interbedded sandstone and shale.

In a representative profile the surface layer is grayish-brown loam about 5 inches thick. The subsoil is brown and light yellowish-brown loam and clay loam about 15 inches thick. It is calcareous in the lower part. The substratum is about 10 inches of strongly calcareous, white loam. Below this is sandstone bedrock.

Duffson soils are at elevations of 7,500 to 9,500 feet. The average annual soil temperature is 45° F. The average soil temperature in summer is 62°. The average annual precipitation is 17 inches. The vegetation is commonly big sagebrush, Arizona fescue, wheatgrass, and native bluegrass.

Permeability is moderately slow. The root zone is only 20 to 40 inches deep, and available water capacity is low.

Most of the acreage is used for grazing.

The Duffson soils in the Gunnison Area are mapped only with Corpening and Spring Creek soils.

Representative profile of Duffson loam, 5 to 35 percent slopes; NW1/4 sec. 35, T. 48 N., R. 2 E., Saguache County:

A1—0 to 5 inches, grayish-brown (10YR 5/2) light loam, very dark grayish brown (10YR 3/2) moist; moderate, very fine, granular structure; soft, very friable; 10 percent fine sandstone gravel; pH 6.8; clear, smooth boundary.

B1t—5 to 8 inches, brown (7.5YR 5/3) clay loam, dark brown (7.5YR 3/3) moist; weak, medium, subangular blocky structure parting to moderate, very fine, subangular blocky; slightly hard, very friable; thin patchy clay films on ped faces; about 10 percent fine sandstone gravel; pH 6.8; clear, smooth boundary.

B2t—8 to 16 inches, brown (7.5YR 5/3) clay loam, dark brown (7.5YR 4/3) moist; weak, medium, prismatic structure parting to moderate, medium, subangular blocky; hard, friable; thin nearly continuous clay films on ped faces; about 10 percent angular sandstone gravel; pH 7.0; clear, wavy boundary.

B3tca—16 to 20 inches, light yellowish-brown (10YR 6/4) heavy loam, yellowish brown (10YR 5/4) moist; weak, medium, subangular blocky structure; hard, friable; few, thin, patchy clay films on ped faces; 10 percent angular sandstone gravel; lime in fine seams and small concretions; pH 8.0; gradual, wavy boundary.

Cca—20 to 30 inches, white (10YR 8/2) loam, light gray (10YR 7/2) moist; massive; hard, friable; about 10 percent sandstone gravel; calcareous; marl-like lime coatings on stone fragments; pH 8.2; clear, smooth boundary.

R—30 inches, sandstone.

The A horizon is typically loam, but in places is fine sandy loam. It is 4 to 9 inches thick and is grayish brown or brown. Depth to bedrock ranges from 20 to 40 inches. The content of gravel ranges from 5 to 15 percent.

Duffson-Corpening loams, 5 to 35 percent slopes (DrE).—This mapping unit is mainly in the central part of the survey area. The largest acreage is between Razor and Cochetopa Creeks. The unit is about 50 percent Duffson loam and 30 percent Corpening loam. The Duffson soil is generally on northern and eastern exposures. The Corpening soil is commonly on windswept, southern and western exposures. In some eroded areas of these soils, the surface layer is thinner and stonier than that in the profiles described as representative of the series.

Included with these soils in mapping are small areas of Lucky and Parlin soils, areas of severely eroded Duffson and Corpening soils, and areas of Rock outcrop and Stony rock land. Also included are areas of Alluvial land and Alluvial land, wet, commonly along small drainageways and toe slopes. Included soils make up less than 20 percent of the total acreage.

This unit is almost entirely in range. Runoff is medium. The erosion hazard is moderate unless a good plant cover is maintained. Capability unit VIe-5 nonirrigated; Duffson soil in Mountain Loam range site, Corpening soil in Dry Mountain Loam range site.

Duffson-Spring Creek stony loams, 5 to 40 percent slopes (DsE).—This mapping unit is mainly in the north-central part of the survey area. It is about 65 percent Duffson stony loam and 20 percent Spring Creek stony loam. The Duffson soil is mainly on northern exposures. At the higher elevations it has a surface layer 10 to 20 inches thick. The Spring Creek soil is on windswept, southern and western exposures. It has the profile described as representative of the Spring Creek series. Slopes are complex.

Included with these soils in mapping are small areas of Mord and Parlin soils and areas of Alluvial land and Alluvial land, wet, along minor drainageways in narrow, winding valleys. Also included are areas of Rock outcrop and Stony rock land on the steeper slopes and a few small sandy areas of wind-deposited material on north-facing slopes near Gunnison. Included soils make up 15 percent of the total acreage.

Nearly all the acreage is in native vegetation and is used for range, recreation, and wildlife. Runoff is medium to rapid, and the erosion hazard is moderate to high. About half the acreage, particularly where vegetation is sparse, has been eroded by wind and water. In these areas the surface layer is thinner and stonier than is typical. In some areas up to 3 acres in size, the Spring Creek soil has been so severely eroded that bedrock is exposed. Capability unit VIIs-1 nonirrigated; Duffson soil in Mountain Loam range site, Spring Creek soil in Dry Mountain Loam range site.

Evanston Series

The Evanston series consists of deep, well-drained soils on alluvial fans and valley-fill slopes. Slopes are 1 to 20 percent. These soils formed in alluvium that was derived from sandstone, rhyolite, and tuff.

In a representative profile the surface layer is dark-brown loam about 6 inches thick. The subsoil is brown clay loam and loam about 12 inches thick. It is calcare-

Representative profile of Hopkins channery loam, 5 to 45 percent slopes; SE1/4 sec. 27, T. 49 N., R. 2 E., Gunnison County:

A1—0 to 12 inches, dark grayish-brown (10YR 4/2) channery loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, granular structure parting to moderate, fine, granular; soft, very friable; about 20 percent channery fragments; pH 7.6; gradual, wavy boundary.

C1—12 to 16 inches, light brownish-gray (10YR 6/2) channery loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable; about 20 percent coarse channery fragments; calcareous; pH 8.2; gradual, wavy boundary.

IIC2—16 to 60 inches, overlapping rhyolite flagstone, separated by unfilled, ½- to 4-inch voids.

The A horizon is typically channery loam, but in places is channery sandy loam. It ranges from 5 to 15 inches in thickness and from dark grayish brown to grayish brown in color. The C horizon is typically calcareous, but in places is free of lime. The content of channery material in the A and C horizons ranges from 10 to 35 percent. Depth to the open-lattice flagstone is 8 to 20 inches.

Irim Series

The Irim series consists of deep, poorly drained soils on flood plains. Slopes are 0 to 5 percent. These soils formed in recent alluvium of mixed origin.

Typically, these soils have a 2-inch mat of partly decomposed organic material. In a representative profile the surface layer is dark-gray loam about 11 inches thick. The subsoil extends to a depth of 60 inches. It is mottled grayish-brown very gravelly loam.

Irim soils are at elevations of about 7,800 to 8,500 feet. The climate is cold in winter and cool in summer. The average annual soil temperature is 42°F. The average annual precipitation is about 15 inches. The vegetation is commonly timothy, redtop, tufted hairgrass, slender wheatgrass, rushes, and sedges.

These soils have a water table within 36 inches of the surface during much of the growing season. Permeability is moderate. Roots can penetrate to a depth of 60 inches or more, but available water capacity is low.

These soils are important for production of native hay and pasture.

Representative profile of Irim loam, 0 to 1 percent slopes, 1 mile west of Doyleville along Tomichi Creek; SW1/4 sec. 34, T. 49 N., R. 3 E., Gunnison County:

O1—2 inches to 0, organic mat of roots.

A1g—0 to 11 inches, dark-gray (10YR 4/1) loam, black (10YR 2/1) moist; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; hard, friable; about 10 percent gravel; pH 7.0; gradual, wavy boundary.

B21g—11 to 22 inches, grayish-brown (10YR 5/2) very gravelly loam, dark grayish brown (10YR 4/2) moist; common, medium, prominent, light olive-brown (2.5Y 5/6) mottles; massive; hard, friable; 50 percent gravel; pH 7.0; clear, wavy boundary.

B22g—22 to 60 inches, grayish-brown (10YR 5/2) very gravelly loam, dark grayish brown (10YR 4/2) moist; common, medium, prominent, light olive-brown (2.5Y 5/6) mottles; massive; soft, very friable; pH 7.0.

The O1 horizon is typically 2 inches thick, but ranges from 1 to 4 inches. The A horizon is typically loam, but in places is heavy sandy loam and light clay loam. Below a depth of about 10 inches, this soil is 50 to 70 percent gravel and cobblestones.

Irim loam, 0 to 1 percent slopes (IrA).—This soil is on flood plains adjacent to major streams and side drainageways. It has the profile described as representative of the series. It has a fluctuating water table, the level of which depends on the water level in adjacent streams. In spring the water table is at or near the surface. Late in summer it drops to a depth of about 2 feet. Overflow and the deposition of silt, sand, or gravel are common. Water from overflow or irrigation is ponded in small depressions.

Included with this soil in mapping are small areas of Gas Creek and Big Blue soils and Alluvial land, occasionally flooded. Also included near Crested Butte are areas of peat and muck. Excessively wet areas are indicated by spot symbols on the soil map. Included soils make up about 15 percent of the total acreage.

All the acreage is irrigated and is used for hay. Runoff is very slow or ponded, and the erosion hazard is slight. Capability unit Vw-1 irrigated.

Irim loam, 1 to 5 percent slopes (IrB).—This soil is on flood plains along major streams. It is ordinarily farther from the main stream channels than Irim loam, 0 to 1 percent slopes. It has a water table that fluctuates from near the surface for short periods to a depth of about 3 feet. It is subject to occasional overflow.

Included with this soil in mapping are small areas of Big Blue and Gas Creek soils and areas of peat and muck near Crested Butte. Included soils make up about 10 percent of the total acreage.

All the acreage is irrigated and produces moderate to good yields of native hay. Runoff is slow, and the erosion hazard is slight to moderate. Capability unit Vw-2 irrigated.

Jerry Series

The Jerry series consists of deep, well-drained soils on upland hills, ridges, and valley sides. Slopes are 5 to 30 percent. These soils formed in locally transported alluvium that was derived from sandstone and sandy shale.

In a representative profile the surface layer is dark-gray loam about 6 inches thick. The subsoil is gravelly heavy clay loam about 39 inches thick. It is dark grayish brown, brown, light brown, and pale brown. The substratum to a depth of 60 inches is pale-brown stony loam.

Jerry soils are at elevations of 8,900 to 10,000 feet. The average annual precipitation is about 20 inches, and the average annual soil temperature is about 38°F. The native vegetation is commonly big sagebrush, snowberry, Thurber fescue, Arizona fescue, nodding brome, native bluegrass, and scattered groves of aspen.

Permeability is slow, and available water capacity is moderate. Roots can penetrate to a depth of 60 inches or more.

These soils are used mainly for grazing and wildlife.

Representative profile of Jerry loam, 5 to 30 percent slopes, near the center of sec. 36, T. 15 S., R. 85 W., Gunnison County:

A1—0 to 6 inches, dark-gray (10YR 4/1) loam, black (10YR 2/1) moist; weak, thin, platy structure parting to moderate, medium, granular; soft, very friable; 10

slopes; SE1/4 sec. 36, T. 47 N., R. 5 W., Gunnison County:

O1—4 inches to 1 inch, organic material consisting of bark, twigs, leaves, and needles.

O2—1 inch to 0, partly decomposed organic material.

A2—0 to 8 inches, pinkish-gray (7.5YR 7/2) loam, brown (7.5YR 5/2) moist; weak, medium, subangular blocky structure parting to moderate, fine, granular; weak platy structure in places; soft, very friable; 5 percent gravel and stones; pH 7.0; clear, smooth boundary.

A&B—8 to 16 inches, mixed-colored, including pinkish-gray (7.5YR 7/2) and brown (7.5YR 5/3), heavy loam, brown (7.5YR 5/2) and dark brown (7.5YR 4/3) moist; moderate, medium, subangular blocky structure parting to moderate, fine, granular; slightly hard, very friable; seams and nodules of B2t material imbedded in A2 matrix; 10 percent stones and gravel; pH 6.8; gradual, irregular boundary.

B2t—16 to 34 inches, reddish-brown (5YR 5/3) clay loam, reddish brown (5YR 4/3) moist; moderate, medium, subangular blocky structure; hard, friable; thin nearly continuous clay films on ped faces; 10 percent rhyolite rock, stones, and gravel; pH 6.6; clear, wavy boundary.

R—34 to 60 inches, rhyolite.

The A horizon is typically loam, but in places is gravelly and stony loam. The A2 horizon ranges from 6 to 12 inches in thickness and from pinkish gray to pink or light gray to very pale brown in color. The B2t horizon ranges from reddish brown to light reddish brown. The soil is slightly acid or neutral. The content of angular gravel and stones ranges from 5 to 35 percent. Depth to bedrock ranges from 20 to 40 inches.

Shule and Sapinero loams, 10 to 50 percent slopes (SsF). —This mapping unit is mainly in the Blue Mesa and Pine Creek parts of the survey area. It is about 65 percent Shule loam and 20 percent Sapinero loam. Each soil has the profile described as typical of its series. The moderately sloping Shule soil is mostly on mountainsides. The Sapinero soil is mostly on ridges.

Included with these soils in mapping are areas of Youman and Sunshine soils in small parks and clearings and small areas of Vulcan soils on the east side of Pine Creek. These inclusions make up less than 15 percent of the total acreage.

This unit is almost entirely forested, mainly Engelmann spruce and subalpine fir. Areas where forest fire and logging have been extensive are dominantly in stands of aspen and scattered conifers.

In this unit runoff is medium to rapid, and the erosion hazard is moderate to high. Use and management are about the same for both soils. Capability unit VIIe-2 nonirrigated; woodland group 4.

Spring Creek Series

The Spring Creek series consists of shallow, well-drained soils on upland ridges and mountainsides. Slopes are 5 to 40 percent. These soils formed in locally transported stony material that was derived from rhyolitic tuff and breccia.

In a representative profile the surface layer is dark grayish-brown stony loam 9 inches thick. Below this is pale-brown, calcareous gravelly and very gravelly loam about 10 inches thick. Rhyolitic tuff is at a depth of 19 inches.

Spring Creek soils receive from 11 to 14 inches of precipitation. The average annual soil temperature is 42° F. The average soil temperature in summer is about 62°. The native vegetation is commonly fringed sage, winterfat, phlox, western wheatgrass, squirreltail, dryland sedge, and slimstem muhly.

Permeability is moderately rapid. Roots can penetrate to a depth of only about 20 inches, and available water capacity is low.

Most of the acreage is in native vegetation and is used as range and wildlife habitat.

The Spring Creek soils in this survey area are mapped only with Duffson soils.

Representative profile of Spring Creek stony loam in native vegetation; NW1/4 sec. 3, T. 49 N., R. 1 W., Gunnison County:

A1—0 to 9 inches, dark grayish-brown (10YR 4/2) stony loam, very dark grayish brown (10YR 3/2) moist; weak, fine, subangular blocky structure; soft, friable; 10 percent angular stones and gravel; pH 6.8; clear, smooth boundary.

C1ca—9 to 15 inches, pale-brown (10YR 6/3) gravelly loam, dark brown (10YR 4/3) moist; weak, fine, subangular blocky structure; slightly hard, friable; 40 percent angular gravel; calcareous; thin white (10YR 8/2) lime coats on the base of gravel; pH 8.0; clear, smooth boundary.

C2ca—15 to 19 inches, pale-brown (10YR 6/3) very gravelly loam, brown (10YR 5/3) moist; massive; soft, very friable; 80 percent gravel, cobblestones, and stones; calcareous; pH 8.2; clear, smooth boundary.

R—19 inches, rhyolitic tuff.

The A horizon is typically stony loam, but in places is loam and channery loam. It is 4 to 10 inches thick. The content of coarse fragments ranges from 35 to 60 percent. Depth to bedrock is 10 to 20 inches.

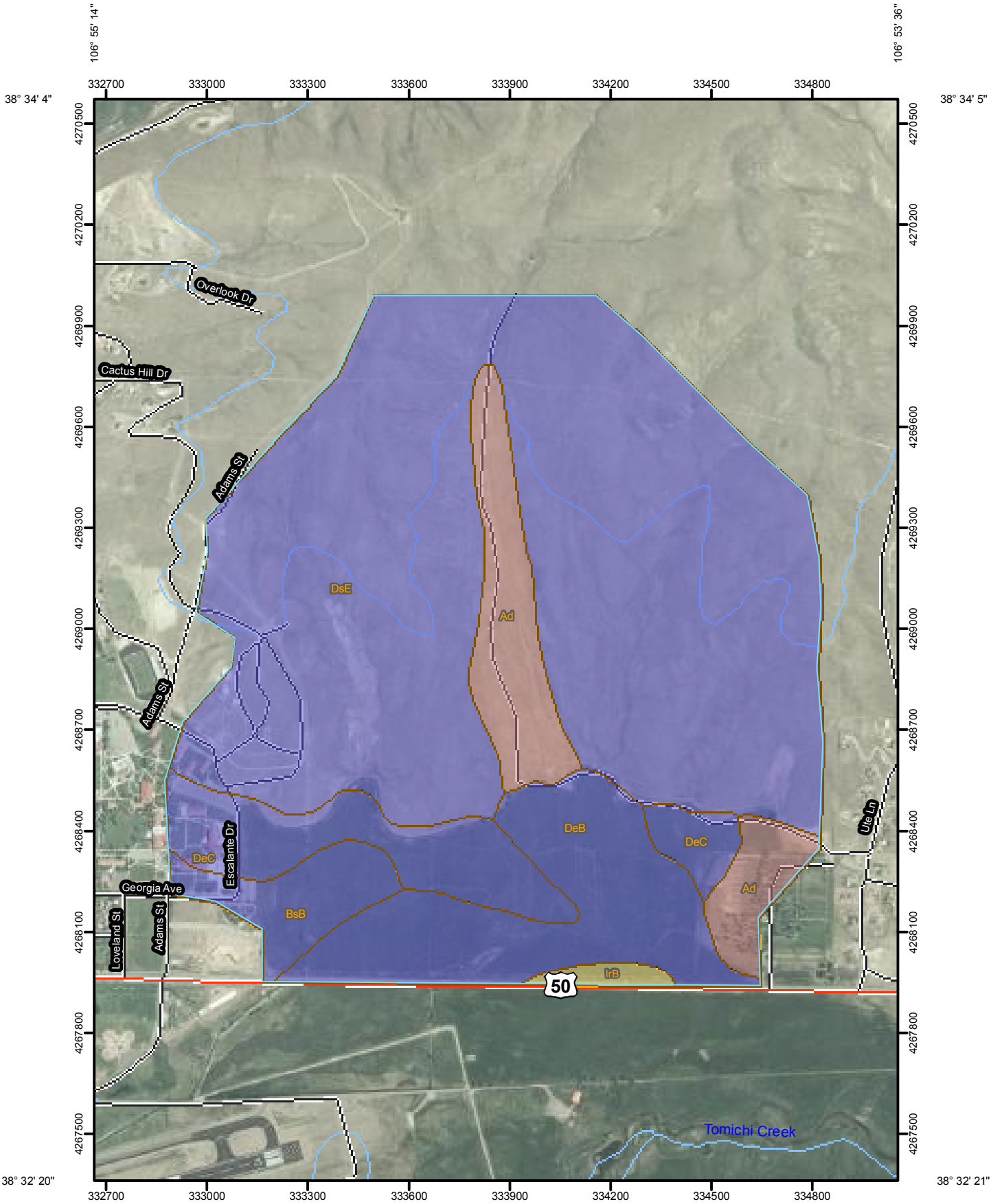
Stony Rock Land

Stony rock land (St) consists mostly of exposed bedrock, loose stones, boulders, and soils that are very shallow over bedrock. Exposed bedrock and stones cover 25 to 90 percent of the surface area. Common rock types are rhyolite, tuff, quartz latite, sandstone, granite, breccia, gneiss, and schist and small outcrops of silty shale. Slopes range from 10 to 80 percent. Included in mapping are small areas of soils that are up to 40 inches deep.

Generally the largest areas of exposed bedrock are on southerly exposures. The very shallow soil between rocks has a very high content of loose stones. Less bedrock is exposed on northerly exposures, and areas of very shallow soils are larger. Northerly exposures commonly support more dense vegetation than southerly exposures.

Stony rock land is somewhat intermittent throughout the survey area. It is commonly on steeper terrain. The vegetation varies widely, depending on moisture, elevation, and exposure. Sparse stands of climatically adapted grasses, shrubs, and forbs are dominant at lower elevations. Open stands of conifers and aspen are common where moisture is in excess of 18 inches or elevations are more than 8,000 feet.

Stony rock land provides concealment and escape for wildlife. Deer and elk often graze the sunny slopes in winter. Capability unit VIIIs-3.


106° 55' 14"
106° 53' 36"
38° 34' 4"
38° 34' 5"
332700
333000
333300
333600
333900
334200
334500
334800
4270500
4270200
4269900
4269600
4269300
4269000
4268700
4268400
4268100
4267800
4267500
Overlook Dr
Cactus Hill Dr
Adams St
Adams St
Escalante Dr
Georgia Ave
Loveland St
Adams St
Ute Ln
DsE
Ad
DeB
DeC
DeC
Ad
BsB
IrB
50
Tomichi Creek
38° 32' 20"
38° 32' 21"
106° 55' 11"
106° 53' 33"
N
Map Scale: 1:15,300 if printed on A size (8.5" x 11") sheet.
Meters
0 100 200 400 600
Feet
0 500 1,000 2,000 3,000

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Units

Soil Ratings

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Political Features

Cities

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

MAP INFORMATION

Map Scale: 1:15,300 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 13N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Gunnison Area, Colorado, Parts of Gunnison, Hinsdale, and Saguache Counties
Survey Area Data: Version 6, Feb 1, 2008

Date(s) aerial images were photographed: 7/2/2005

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Gunnison Area, Colorado, Parts of Gunnison, Hinsdale, and Saguache Counties (CO662)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
Ad	Alluvial land	A	69.4	8.5%
BsB	Bosler sandy loam, 1 to 8 percent slopes	B	30.8	3.8%
DeB	Dewville loam, 1 to 5 percent slopes	B	101.9	12.5%
DeC	Dewville loam, 5 to 15 percent slopes	B	69.2	8.5%
DsE	Duffson-Spring creek stony loams, 5 to 40 percent slopes	B	535.7	65.9%
IrB	Irim loam, 1 to 5 percent slopes	C	5.7	0.7%
Totals for Area of Interest			**812.7**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

of Gunnison can be derived according to the location (N106^0 55' 36" Latitude W38^0 32' 39" longitude) and elevation (7,700 feet). IDF data for events less than one hour are established using ratio data found in *Short Duration Rainfall Relations of the Western United States* (Arkell R.E., F. Richards, 1986, AMS Conference on Climate and Water Management).

TABLE 3-1 POINT RAINFALL, DEPTH, DURATION, FREQUENCY IN GUNNISON, COLORADO

	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	24-hr
2-yr	0.13	0.20	0.26	0.36	0.45	0.54	0.59	0.70	1.00
5-yr	0.20	0.31	0.39	0.54	0.68	0.79	0.86	1.00	1.40
10-yr	0.25	0.38	0.48	0.67	0.85	0.97	1.05	1.20	1.60
25-yr	0.32	0.50	0.63	0.87	1.10	1.20	1.27	1.40	2.00
50-yr	0.40	0.62	0.79	1.09	1.38	1.46	1.51	1.60	2.20
100-yr	0.48	0.76	0.94	1.22	1.51	1.61	1.69	1.80	2.40

TABLE 3-2 RAINFALL INTENSITY DURATION-FREQUENCY IN GUNNISON, COLORADO (INTENSITY IN INCHES/HR)

	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	24-hr
2-yr	1.57	1.22	1.03	0.71	0.45	0.27	0.20	0.12	0.04
5-yr	2.37	1.84	1.55	1.07	0.68	0.39	0.29	0.17	0.06
10-yr	2.96	2.30	1.94	1.34	0.85	0.48	0.35	0.20	0.07
25-yr	3.38	2.97	2.51	1.74	1.10	0.60	0.42	0.23	0.08
50-yr	4.80	3.73	3.15	2.18	1.38	0.73	0.50	0.27	0.09
100-yr	5.80	4.53	3.74	2.45	1.51	0.80	0.56	0.30	0.10

The following equation can be used to determine intensities not shown in the IDF table or curve. The equation is used with the *Rational Method* by setting T_d equal to the time of concentration of the watershed.

EQUATION 3-1 RAINFALL INTENSITY DURATION-FREQUENCY (INCHES/HR)

$$I = \frac{29P_1}{(10 + T_d)^{0.789}}$$

Where I = rainfall intensity (inch/hr),
P_1 = 1hour rainfall depth (inches), and
T_d = duration or time of concentration (minutes)

II. Recommended Runoff Coefficients

Land Use or Surface Characteristics	Percent imper-viousness
Business:	
Commercial areas	95
Neighborhood areas	85
Residential:	
Single-family	*
Multiunit (detached)	60
Multiunit (attached)	75
Half-acre lot or larger	*
Apartments	80
Industrial:	
Light areas	80
Heavy areas	90
Parks, cemeteries:	5
Playgrounds:	10
Schools:	50
Railroad yard areas:	15
Undeveloped areas:	
Historical Flow Analysis	2
Greenbelts, agricultural Off-site flow analysis (when land use not defined)	45
Streets:	
Paved	100
Gravel (packed)	40
Driveways and sidewalks:	90
Roofs:	90
Lawns, sandy soil	0
Lawns, clayey soil	0

*Refer to Figures RO-3 through RO-5 in Runoff Chapter of USDCM.

Runoff Coefficient vs. Watershed Imperviousness

Based on Runoff Coefficient estimating equation published by Urbonas, et.al. (1990) & WEF (1998)

Basic equation for NRCS Soil Types C & D:

$$C_{CD} = K_{CD} + (0.858*i^3 - 0.786*i^2 + 0.774*i + 0.04)$$

Basic equation for NRCS Soil Type A:

$$C_A = K_A + (1.31*i^3 - 1.44*i^2 + 1.135*i - 0.12) \quad \text{in which use values for } C_A > 0$$

in which: i = I_a/100, imperviousness ratio

I_a = watershed imperviousness in percent

C_A = Runoff Coefficient for NRCS Soil Type A

K_A = Correction factor for C_A when the storm return period is greater than 2-years

C_{CD} = Runoff Coefficient for NRCS Soil Types C and D

K_{CD} = Correction factor for C_{CD} when the storm return period is greater than 2-years

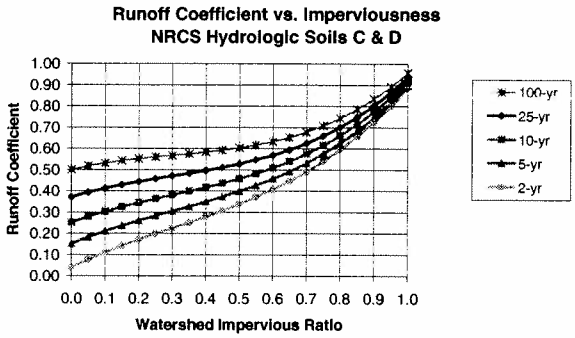
NRCS Soil Types	Values of Correction Factors K_{CD} & K_A					
	Storm Return Period					
	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
C & D	0.00	[-0.10*i+0.11]	[-0.18*i+0.21]	[-0.28*i+0.33]	[-0.33*i+0.40]	[-0.39*i+0.46]
A	0.00	[-0.08*i+0.09]	[-0.14*i+0.17]	[-0.19*i+0.24]	[-0.22*i+0.28]	[-0.25*i+0.32]

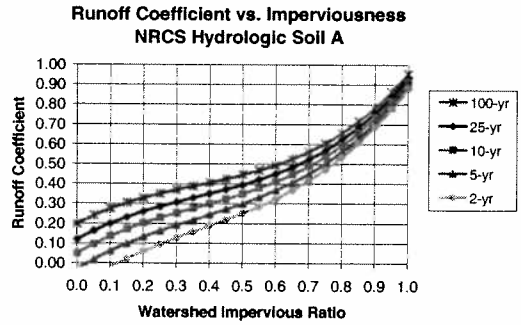
Imperv. Ratio (i)	Values of Runoff Coefficient C_{CD}						Values of Runoff Coefficient C_A					
	Type C and D NRCS Hydrologic Soil Groups						Type A NRCS Hydrologic Soils Group					
	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
0.00	0.04	0.15	0.25	0.37	0.44	0.50	-0.12	-0.03	0.05	0.12	0.16	0.20
0.05	0.08	0.18	0.28	0.39	0.46	0.52	-0.07	0.02	0.10	0.16	0.20	0.24
0.10	0.11	0.21	0.30	0.41	0.48	0.53	-0.02	0.06	0.14	0.20	0.24	0.28
0.15	0.14	0.24	0.32	0.43	0.49	0.54	0.02	0.10	0.17	0.23	0.27	0.30
0.20	0.17	0.26	0.34	0.44	0.50	0.55	0.06	0.13	0.20	0.26	0.30	0.33
0.25	0.20	0.28	0.36	0.46	0.52	0.56	0.09	0.16	0.23	0.29	0.32	0.35
0.30	0.22	0.30	0.38	0.47	0.53	0.57	0.13	0.19	0.25	0.31	0.34	0.37
0.35	0.25	0.33	0.40	0.48	0.54	0.57	0.16	0.22	0.28	0.33	0.36	0.39
0.40	0.28	0.35	0.42	0.50	0.55	0.58	0.19	0.25	0.30	0.35	0.38	0.41
0.45	0.31	0.37	0.44	0.51	0.56	0.59	0.22	0.27	0.33	0.37	0.40	0.43
0.50	0.34	0.40	0.46	0.53	0.57	0.60	0.25	0.30	0.35	0.40	0.42	0.45
0.55	0.37	0.43	0.48	0.55	0.59	0.62	0.29	0.33	0.38	0.42	0.45	0.47
0.60	0.41	0.46	0.51	0.57	0.61	0.63	0.33	0.37	0.41	0.45	0.47	0.50
0.65	0.45	0.49	0.54	0.59	0.63	0.65	0.37	0.41	0.45	0.49	0.51	0.53
0.70	0.49	0.53	0.57	0.62	0.66	0.68	0.42	0.45	0.49	0.53	0.54	0.56
0.75	0.54	0.58	0.62	0.66	0.69	0.71	0.47	0.50	0.54	0.57	0.59	0.61
0.80	0.60	0.63	0.66	0.70	0.73	0.74	0.54	0.56	0.60	0.63	0.64	0.66
0.85	0.66	0.68	0.71	0.75	0.78	0.79	0.61	0.63	0.66	0.69	0.70	0.72
0.90	0.73	0.75	0.77	0.80	0.83	0.83	0.69	0.71	0.73	0.76	0.77	0.79
0.95	0.80	0.82	0.84	0.87	0.89	0.89	0.78	0.80	0.82	0.84	0.85	0.86
1.00	0.89	0.90	0.92	0.94	0.96	0.96	0.89	0.90	0.92	0.94	0.95	0.96

Notes: For Type B Soils, use the average of coefficients C_{CD} and C_A.

When the Runoff Coefficient in above table is < 0, use 0.

When compositing the Runoff Coefficient for different soil types, use the table values above regardless if they are < 0.





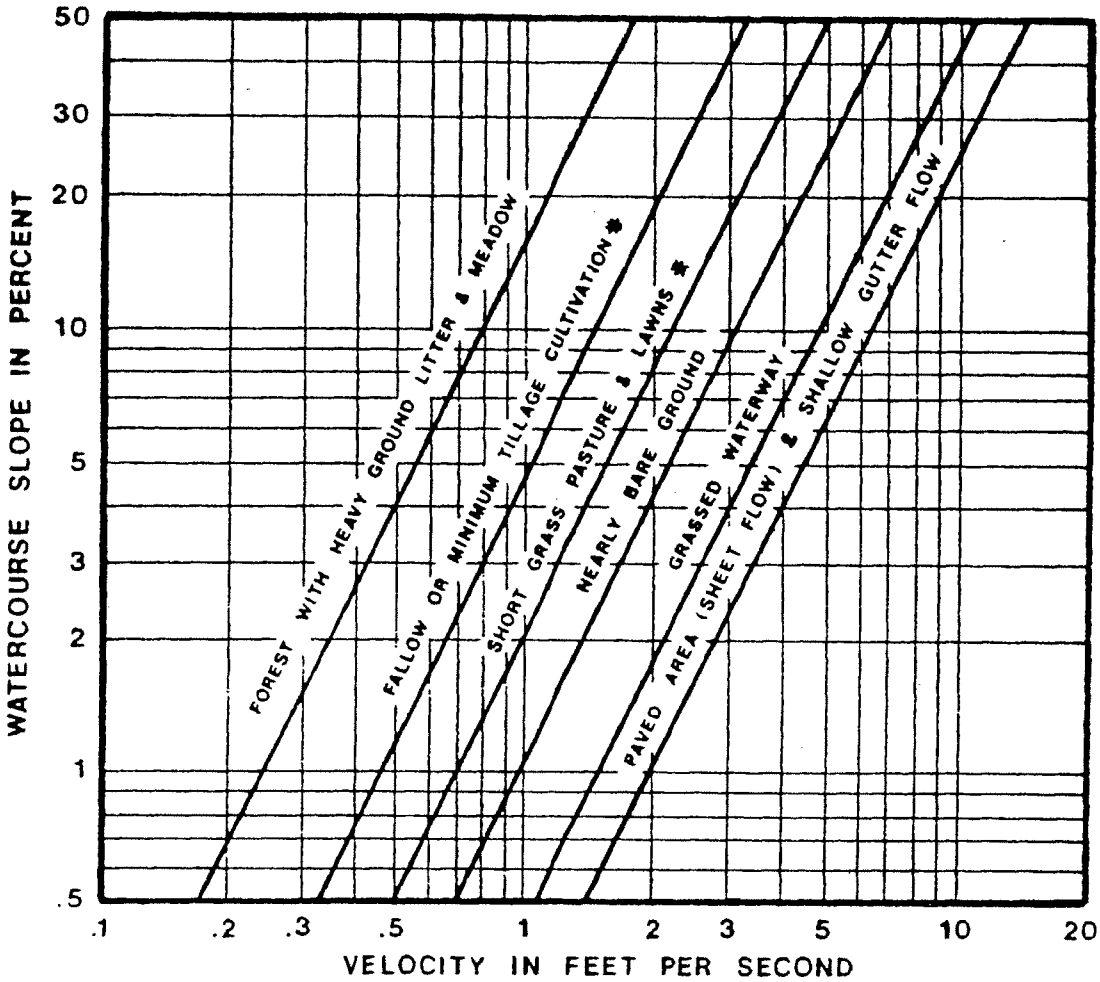


FIGURE RO-1

Estimate of Average Overland Flow Velocity for Use With the Rational Formula

APPENDIX B

- WEIGHTED C COEFFICIENT
- CUHP WORKSHEETS
- SF-2 TIME OF CONCENTRATION
- SF-3 STORM DRAINAGE DESIGN
- SUMMARY OF RELEASE RATES
- DETENTION POND SIZING 10-YR, 100-YR
- SUMMARY OF DETENTION VOLUMES
- EXISTING OUTFALL CAPACITIES

Weighted Runoff Coefficients
GUNNISON RISING
Job Number: 12-0156

Calculated By: GBG
Checked By: MJ
Date: 1/15/2013

Proposed/ Existing	IMP%
Undeveloped Historical	2
Greenbelt	45
Residential	60
Multiunit Residential	75
Commercial	90
Industrial	80
School	50

Soil Types: Nunn-Urban, 0-2 %
Nunn-Urban, 2-5 %

Hydrologic Grouping: Type B

Runoff Coefficients: C = Kc + (.858i^3-.786i^2+.774i+.04)
Kc(2year) = 0
Kc(5year) = -.10i+.11
Kc(10year) = -.18i+.21
Kc(100year) = -.39i+.46

Historic Basins (existing conditions.) — Land Use (Acres) — Weighted Runoff Coefficient

Basin	Total Area	Undeveloped Historical	Greenbelt	Residential	Multiunit Residential	Commercial	Industrial	C2	C5	C10	C100	%Imp
E1	131.95	131.95	0.00	0.00	0.00	0.00	0.00	0.06	0.16	0.26	0.51	2.0
E2	305.38	305.38	0.00	0.00	0.00	0.00	0.00	0.06	0.16	0.26	0.51	2.0
E3	179.83	179.83	0.00	0.00	0.00	0.00	0.00	0.06	0.16	0.26	0.51	2.0
E4	95.90	95.90	0.00	0.00	0.00	0.00	0.00	0.06	0.16	0.26	0.51	2.0
E5	88.06	0.00	0.00	0.00	88.06	0.00	0.00	0.54	0.58	0.62	0.71	75.0
E6	152.07	152.07	0.00	0.00	0.00	0.00	0.00	0.06	0.16	0.26	0.51	2.0

TOTAL AREA: 953.19 ACRES
TOTAL IMPERVIOUS: 8.74

Proposed Basins (proposed conditions.) — Land Use (Acres) — Weighted Runoff Coefficient

Basin	Total Area	Greenbelt	Residential	Multiunit Residential	Commercial	Industrial	Undeveloped Historical	C2	C5	C10	C100	%Imp
A1	52.49	3.46	0.00	49.04	0.00	0.00	0.00	0.52	0.56	0.60	0.70	73.0
A2	25.22	1.07	0.00	0.00	0.00	0.00	24.15	0.07	0.17	0.27	0.51	3.8
A3	17.33	0.00	0.00	0.00	0.00	0.00	17.34	0.06	0.16	0.26	0.51	2.0
A4	36.90	0.00	0.00	0.00	0.00	0.00	36.90	0.06	0.16	0.26	0.51	2.0
B1	31.26	8.29	0.00	22.97	0.00	0.00	0.00	0.46	0.51	0.55	0.66	67.0
B2	72.05	5.95	0.00	66.10	0.00	0.00	0.00	0.52	0.55	0.59	0.69	72.5
B3	65.79	0.00	0.00	0.00	0.00	0.00	65.79	0.06	0.16	0.26	0.51	2.0
B4	19.30	0.00	0.00	0.00	0.00	0.00	19.30	0.06	0.16	0.26	0.51	2.0
B5	117.00	0.00	0.00	0.00	0.00	0.00	117.00	0.06	0.16	0.26	0.51	2.0
C1	44.13	14.07	0.00	30.05	0.00	0.00	0.00	0.45	0.49	0.54	0.66	65.4
C2	23.48	0.00	0.00	0.00	0.00	0.00	23.48	0.06	0.16	0.26	0.51	2.0
C3	5.71	0.00	0.00	0.00	0.00	0.00	5.71	0.06	0.16	0.26	0.51	2.0
C4	106.51	0.00	0.00	0.00	0.00	0.00	106.51	0.06	0.16	0.26	0.51	2.0
D1	63.62	6.92	0.00	56.71	0.00	0.00	0.00	0.51	0.55	0.59	0.69	71.7
D2	32.28	0.00	0.00	0.00	0.00	0.00	32.28	0.06	0.16	0.26	0.51	2.0
F1	55.47	8.87	0.00	0.00	46.60	0.00	0.00	0.63	0.66	0.69	0.77	82.8
F2	32.79	1.43	0.00	31.36	0.00	0.00	0.00	0.53	0.56	0.60	0.70	73.7
F3	70.00	22.97	0.00	47.03	0.00	0.00	0.00	0.45	0.49	0.54	0.65	65.2
G	42.00	0.00	0.00	0.00	0.00	42.00	0.00	0.60	0.63	0.66	0.74	80.0
H1	52.42	52.42	0.00	0.00	0.00	0.00	0.00	0.31	0.37	0.44	0.59	45.0
H2	11.75	11.75	0.00	0.00	0.00	0.00	0.00	0.31	0.37	0.44	0.59	45.0
J	17.04	0.00	0.00	0.00	17.04	0.00	0.00	0.73	0.75	0.77	0.83	90.0
K	65.37	0.00	65.37	0.00	0.00	0.00	0.00	0.41	0.46	0.51	0.63	60.0
L	16.13	0.00	16.13	0.00	0.00	0.00	0.00	0.41	0.46	0.51	0.63	60.0
OS1	57.62	0.00	0.00	39.39	0.00	0.00	18.22	0.35	0.41	0.47	0.61	51.9
OS2	24.25	24.25	0.00	0.00	0.00	0.00	0.00	0.31	0.37	0.44	0.59	45.0

TOTAL AREA: 1157.91 ACRES
TOTAL IMPERVIOUS: 41.35

CUHP 2005 Project Summary

CUHP Version:	CUHP 2005 1.3.3 rel. 2/8/2010
System Information	OS: Windows (32-bit) NT 6.01, Excel Version: 11.0
Project Title:	12-0056 GUNNISON RISING
Project Comment:	5-YR
Run Date:	11/8/2012 15:01
Input Workbook:	F:\2012\12-0156 Gunnison Rising\4.0 Construction Documents\civil\Drainage\CUHP\Existing CUHP\12-0156 Cuhp_5YR STORM.xls
Output Database:	F:\2012\12-0156 Gunnison Rising\4.0 Construction Documents\civil\Drainage\CUHP\Existing CUHP\CUHP_Out\12-0156 5YR OUT.mdb
Output Workbook:	F:\2012\12-0156 Gunnison Rising\4.0 Construction Documents\civil\Drainage\CUHP\Existing CUHP\CUHP_Out\12-0156 5YR OUT.xls
SWMM File:	F:\2012\12-0156 Gunnison Rising\4.0 Construction Documents\civil\Drainage\CUHP\Existing CUHP\CUHP_Out\12-0156 5YR SWMM.txt
SWMM Start Time:	<Not Specified> assumed 1/1/2005 12:00 AM

Printouts for User Selected Storm Hydrographs

flow in cfs

	time in minutes	E1	E2	E3	E4	E5	E6
1/1/2005 0:05	5	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 0:10	10	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 0:15	15	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 0:20	20	0.01	0.01	0.01	0.01	30.09	14.09
1/1/2005 0:25	25	0.04	0.02	0.02	0.03	76.90	45.60
1/1/2005 0:30	30	0.19	0.12	0.12	0.16	79.89	61.45
1/1/2005 0:35	35	0.33	0.28	0.25	0.27	53.56	53.15
1/1/2005 0:40	40	0.36	0.41	0.33	0.28	32.77	40.98
1/1/2005 0:45	45	0.31	0.48	0.35	0.23	21.55	31.78
1/1/2005 0:50	50	0.26	0.49	0.33	0.19	17.65	25.57
1/1/2005 0:55	55	0.22	0.47	0.29	0.16	15.64	20.14
1/1/2005 1:00	60	0.19	0.42	0.26	0.14	14.39	15.84
1/1/2005 1:05	65	0.17	0.38	0.23	0.12	14.02	14.11
1/1/2005 1:10	70	0.14	0.35	0.20	0.10	13.89	13.50
1/1/2005 1:15	75	0.12	0.32	0.19	0.08	12.88	12.77
1/1/2005 1:20	80	0.10	0.29	0.17	0.07	11.39	11.64
1/1/2005 1:25	85	0.09	0.27	0.16	0.06	10.55	10.72
1/1/2005 1:30	90	0.08	0.25	0.14	0.05	10.25	10.21
1/1/2005 1:35	95	0.07	0.23	0.13	0.05	10.18	9.90
1/1/2005 1:40	100	0.06	0.22	0.11	0.04	8.78	9.06
1/1/2005 1:45	105	0.05	0.20	0.10	0.03	7.53	7.92
1/1/2005 1:50	110	0.04	0.18	0.09	0.02	7.10	7.31
1/1/2005 1:55	115	0.03	0.16	0.08	0.02	6.94	6.94
1/1/2005 2:00	120	0.02	0.14	0.08	0.01	6.54	6.55
1/1/2005 2:05	125	0.02	0.13	0.07	0.01	3.58	4.90
1/1/2005 2:10	130	0.01	0.12	0.06	0.01	1.14	2.75
1/1/2005 2:15	135	0.01	0.11	0.06	0.01	0.29	1.57
1/1/2005 2:20	140	0.01	0.10	0.05	0.00	0.00	0.82
1/1/2005 2:25	145	0.01	0.10	0.04	0.00	0.00	0.40
1/1/2005 2:30	150	0.00	0.09	0.03	0.00	0.00	0.13
1/1/2005 2:35	155	0.00	0.08	0.03	0.00	0.00	0.00
1/1/2005 2:40	160	0.00	0.07	0.02	0.00	0.00	0.00
1/1/2005 2:45	165	0.00	0.06	0.02	0.00	0.00	0.00
1/1/2005 2:50	170	0.00	0.06	0.01	0.00	0.00	0.00
1/1/2005 2:55	175	0.00	0.05	0.01	0.00	0.00	0.00
1/1/2005 3:00	180	0.00	0.04	0.00	0.00	0.00	0.00
1/1/2005 3:05	185	0.00	0.03	0.00	0.00	0.00	0.00
1/1/2005 3:10	190	0.00	0.03	0.00	0.00	0.00	0.00
1/1/2005 3:15	195	0.00	0.02	0.00	0.00	0.00	0.00
1/1/2005 3:20	200	0.00	0.01	0.00	0.00	0.00	0.00
1/1/2005 3:25	205	0.00	0.01	0.00	0.00	0.00	0.00
1/1/2005 3:30	210	0.00	0.01	0.00	0.00	0.00	0.00
1/1/2005 3:35	215	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 3:40	220	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 3:45	225	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 3:50	230	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 3:55	235	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 4:00	240	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 4:05	245	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 4:10	250	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 4:15	255	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 4:20	260	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 4:25	265	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 4:30	270	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 4:35	275	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 4:40	280	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 4:45	285	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 4:50	290	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 4:55	295	0.00	0.00	0.00	0.00	0.00	0.00

Printouts for User Selected Unit Hydrographs

flow in cfs

time in minutes	E1	E2	E3	E4	E5	E6
5	133.92	70.36	73.53	116.85	445.42	391.83
10	233.69	186.87	170.79	186.43	395.59	614.69
15	228.66	267.33	215.32	172.00	136.71	344.38
20	179.70	301.03	213.97	133.09	49.62	219.33
25	150.69	297.33	195.02	109.07	0.00	122.49
30	121.99	277.60	162.09	88.76		81.76
35	104.91	242.56	144.71	75.38		41.03
40	88.96	213.71	127.34	62.00		0.30
45	73.00	193.87	109.96	48.61		0.00
50	57.05	174.03	99.80	36.66		
55	45.55	154.19	90.11	32.20		
60	40.24	141.77	80.41	27.74		
65	34.92	130.75	70.72	23.28		
70	29.60	119.73	61.02	18.82		
75	24.28	108.71	51.33	14.36		
80	18.97	97.69	42.92	9.89		
85	13.65	86.68	39.69	5.43		
90	8.33	75.66	36.46	0.97		
95	3.01	64.64	33.23	0.00		
100	0.00	58.15	29.99			
105		54.48	26.76			
110		50.80	23.53			
115		47.13	20.30			
120		43.46	17.07			
125		39.78	13.84			
130		36.11	10.60			
135		32.44	7.37			
140		28.77	4.14			
145		25.09	0.91			
150		21.42	0.00			
155		17.75				
160		14.07				
165		10.40				
170		6.73				
175		3.05				
180		0.00				

Summary of CUHP Input Parameters (Version 1.3.3)

							Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			
Catchment Name/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	Percent Eff. Imperv.
E1	5YR_GAGE	0.206	0.323	0.646	0.073	2.0	0.40	0.10	4.50	0.60	0.0018	0.00	0.04	0.02	1.06
E2	5YR_GAGE	0.477	0.643	1.263	0.041	2.0	0.40	0.10	4.50	0.60	0.0018	0.00	0.04	0.02	1.06
E3	5YR_GAGE	0.281	0.576	0.964	0.062	2.0	0.40	0.10	4.50	0.60	0.0018	0.00	0.04	0.02	1.06
E4	5YR_GAGE	0.150	0.241	0.507	0.062	2.0	0.40	0.10	4.50	0.60	0.0018	0.00	0.04	0.02	1.06
E5	5YR_GAGE	0.138	0.280	0.458	0.061	75.0	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	72.11
E6	5YR_GAGE	0.238	0.261	0.576	0.021	45.0	0.40	0.10	4.50	0.60	0.0018	0.00	0.83	0.22	40.67

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 1.3.3)

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph		
Catchment Name/ID	User Comment for Catchment	Ct	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)
E1	BASIN E1	0.169	0.270	25.9	6.86	13.5	4.85	11.4	239	478,579	0.00	887	40.0	0.36	885
E2	BASIN E2	0.159	0.306	47.4	12.63	24.6	8.93	21.1	302	1,108,166	0.00	2,054	50.0	0.49	2,054
E3	BASIN E3	0.159	0.283	38.7	9.90	20.1	7.00	16.5	218	652,819	0.00	1,210	45.0	0.35	1,208
E4	BASIN E4	0.186	0.257	24.1	6.26	12.5	4.42	10.4	187	348,480	0.00	646	40.0	0.28	646
E5	BASIN E5	0.095	0.569	5.7	2.00	3.0	1.34	6.7	723	320,602	0.46	145,894	30.0	80	140,252
E6	BASIN E6	0.094	0.427	10.6	3.70	5.5	2.47	8.3	676	552,922	0.24	133,924	30.0	61	131,944

Printouts for User Selected Unit Hydrographs

flow in cfs

time in minutes	E1	E2	E3	E4	E5	E6
5	135.10	71.24	74.39	117.75	451.37	397.22
10	233.99	188.59	171.85	186.36	394.97	635.39
15	227.99	268.56	215.48	171.45	136.14	348.49
20	178.98	301.01	213.45	132.80	46.73	211.71
25	150.39	296.58	194.31	108.87	0.00	119.78
30	121.80	276.58	161.70	88.65		74.19
35	104.80	241.49	144.40	75.31		28.60
40	88.89	213.19	127.09	61.97		0.00
45	72.98	193.43	109.79	48.63		
50	57.08	173.68	99.68	36.65		
55	45.54	153.92	90.02	32.20		
60	40.24	141.58	80.35	27.75		
65	34.94	130.60	70.69	23.31		
70	29.64	119.61	61.02	18.86		
75	24.34	108.63	51.35	14.41		
80	19.04	97.64	42.91	9.96		
85	13.73	86.66	39.68	5.52		
90	8.43	75.67	36.46	1.07		
95	3.13	64.69	33.24	0.00		
100	0.00	58.13	30.02			
105		54.47	26.80			
110		50.81	23.58			
115		47.15	20.35			
120		43.48	17.13			
125		39.82	13.91			
130		36.16	10.69			
135		32.50	7.47			
140		28.84	4.24			
145		25.18	1.02			
150		21.51	0.00			
155		17.85				
160		14.19				
165		10.53				
170		6.87				
175		3.21				
180		0.00				

CUHP 2005 Project Summary

CUHP Version:	CUHP 2005 1.3.3 rel. 2/8/2010
System Information	OS: Windows (32-bit) NT 6.01, Excel Version: 11.0
Project Title:	12-0156 GUNNISON RISING
Project Comment:	<Not Specified>
Run Date:	11/8/2012 15:21
Input Workbook:	F:\2012\12-0156 Gunnison Rising\4.0 Construction Documents\civil\Drainage\CUHP\Existing CUHP\12-0156 Cuhp133_1.xls
Output Database:	F:\2012\12-0156 Gunnison Rising\4.0 Construction Documents\civil\Drainage\CUHP\Existing CUHP\CUHP_Out\12-0156 GunnisonR.mdb
Output Workbook:	F:\2012\12-0156 Gunnison Rising\4.0 Construction Documents\civil\Drainage\CUHP\Existing CUHP\CUHP_Out\12-0156 100YR OUT.xls
SWMM File:	F:\2012\12-0156 Gunnison Rising\4.0 Construction Documents\civil\Drainage\CUHP\Existing CUHP\CUHP_Out\12-0156 100YR SWMM.txt
SWMM Start Time:	<Not Specified> assumed 1/1/2005 12:00 AM

Printouts for User Selected Storm Hydrographs

flow in cfs

	time in minutes	E1	E2	E3	E4	E5	E6
1/1/2005 0:05	5	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 0:10	10	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 0:15	15	0.00	0.00	0.00	0.00	8.93	4.18
1/1/2005 0:20	20	0.02	0.01	0.01	0.02	43.94	23.61
1/1/2005 0:25	25	0.21	0.12	0.12	0.18	97.54	60.36
1/1/2005 0:30	30	10.16	5.46	5.66	8.83	203.01	151.94
1/1/2005 0:35	35	37.91	24.95	24.13	31.72	226.76	245.17
1/1/2005 0:40	40	61.37	53.38	47.05	48.80	168.13	243.43
1/1/2005 0:45	45	68.94	78.58	63.00	53.06	114.77	199.71
1/1/2005 0:50	50	66.34	95.01	69.97	50.12	79.98	157.76
1/1/2005 0:55	55	60.20	101.87	69.46	44.71	59.26	120.41
1/1/2005 1:00	60	52.99	101.19	64.72	39.06	50.14	90.56
1/1/2005 1:05	65	47.43	95.90	60.12	34.65	47.47	71.47
1/1/2005 1:10	70	41.38	89.36	54.79	29.55	35.33	54.06
1/1/2005 1:15	75	34.50	82.30	49.04	23.93	25.26	37.35
1/1/2005 1:20	80	27.99	74.65	43.98	19.15	18.18	26.97
1/1/2005 1:25	85	22.95	67.33	39.26	15.86	13.82	19.51
1/1/2005 1:30	90	19.28	61.16	34.88	13.23	12.73	15.57
1/1/2005 1:35	95	16.34	55.67	30.85	11.02	12.36	13.14
1/1/2005 1:40	100	13.77	50.74	26.91	9.01	12.36	12.04
1/1/2005 1:45	105	11.41	46.14	23.15	7.10	12.36	11.72
1/1/2005 1:50	110	9.16	41.65	20.03	5.28	12.36	11.60
1/1/2005 1:55	115	7.02	37.25	17.80	3.55	12.36	11.60
1/1/2005 2:00	120	4.95	32.95	15.96	2.06	12.36	11.60
1/1/2005 2:05	125	3.04	29.00	14.37	1.17	6.94	9.06
1/1/2005 2:10	130	1.70	25.93	12.92	0.66	2.20	5.00
1/1/2005 2:15	135	0.97	23.59	11.53	0.36	0.56	2.78
1/1/2005 2:20	140	0.54	21.63	10.21	0.19	0.00	1.42
1/1/2005 2:25	145	0.29	19.89	8.95	0.08	0.00	0.66
1/1/2005 2:30	150	0.14	18.27	7.69	0.02	0.00	0.18
1/1/2005 2:35	155	0.04	16.72	6.43	0.00	0.00	0.00
1/1/2005 2:40	160	0.01	15.26	5.17	0.00	0.00	0.00
1/1/2005 2:45	165	0.00	13.83	3.92	0.00	0.00	0.00
1/1/2005 2:50	170	0.00	12.40	2.66	0.00	0.00	0.00
1/1/2005 2:55	175	0.00	10.97	1.57	0.00	0.00	0.00
1/1/2005 3:00	180	0.00	9.54	0.88	0.00	0.00	0.00
1/1/2005 3:05	185	0.00	8.11	0.50	0.00	0.00	0.00
1/1/2005 3:10	190	0.00	6.68	0.27	0.00	0.00	0.00
1/1/2005 3:15	195	0.00	5.25	0.15	0.00	0.00	0.00
1/1/2005 3:20	200	0.00	3.82	0.06	0.00	0.00	0.00
1/1/2005 3:25	205	0.00	2.43	0.02	0.00	0.00	0.00
1/1/2005 3:30	210	0.00	1.34	0.00	0.00	0.00	0.00
1/1/2005 3:35	215	0.00	0.77	0.00	0.00	0.00	0.00
1/1/2005 3:40	220	0.00	0.43	0.00	0.00	0.00	0.00
1/1/2005 3:45	225	0.00	0.23	0.00	0.00	0.00	0.00
1/1/2005 3:50	230	0.00	0.12	0.00	0.00	0.00	0.00
1/1/2005 3:55	235	0.00	0.04	0.00	0.00	0.00	0.00
1/1/2005 4:00	240	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 4:05	245	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 4:10	250	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 4:15	255	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 4:20	260	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 4:25	265	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 4:30	270	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 4:35	275	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 4:40	280	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 4:45	285	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 4:50	290	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2005 4:55	295	0.00	0.00	0.00	0.00	0.00	0.00

Summary of CUHP Input Parameters (Version 1.3.3)

							Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			
Catchment Name/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	Percent Eff. Imperv.
E1	100YR_GAGE	0.206	0.323	0.646	0.073	2.0	0.40	0.10	4.50	0.60	0.0018	0.00	0.04	0.02	1.50
E2	100YR_GAGE	0.477	0.643	1.263	0.041	2.0	0.40	0.10	4.50	0.60	0.0018	0.00	0.04	0.02	1.50
E3	100YR_GAGE	0.281	0.576	0.964	0.062	2.0	0.40	0.10	4.50	0.60	0.0018	0.00	0.04	0.02	1.50
E4	100YR_GAGE	0.150	0.241	0.507	0.062	2.0	0.40	0.10	4.50	0.60	0.0018	0.00	0.04	0.02	1.50
E5	100YR_GAGE	0.138	0.280	0.458	0.061	75.0	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	73.42
E6	100YR_GAGE	0.238	0.261	0.576	0.021	45.0	0.40	0.10	4.50	0.60	0.0018	0.00	0.83	0.22	42.62

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 1.3.3)

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph		
Catchment Name/ID	User Comment for Catchment	Ct	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)
E1	BASIN E1	0.167	0.267	25.9	6.81	13.5	4.81	11.3	239	478,579	0.39	186,805	45.0	69	186,310
E2	BASIN E2	0.157	0.303	47.4	12.52	24.7	8.85	20.9	302	1,108,166	0.39	432,553	55.0	102	432,571
E3	BASIN E3	0.157	0.279	38.7	9.82	20.1	6.94	16.4	218	652,819	0.39	254,816	50.0	70	254,465
E4	BASIN E4	0.184	0.254	24.1	6.21	12.5	4.39	10.3	187	348,480	0.39	136,023	45.0	53	136,015
E5	BASIN E5	0.095	0.574	5.7	1.98	2.9	1.32	6.6	733	320,602	1.25	401,561	35.0	227	386,729
E6	BASIN E6	0.093	0.445	10.0	3.51	5.2	2.35	8.2	711	552,922	0.89	491,246	35.0	245	483,865

CUHP 2005 Project Summary

CUHP Version:	CUHP 2005 1.3.3 rel. 2/8/2010
System Information	OS: Windows (32-bit) NT 6.01, Excel Version: 11.0
Project Title:	12-0156 GUNNISON RISING
Project Comment:	<Not Specified>
Run Date:	12/4/2012 12:58
Input Workbook:	F:\2012\12-0156 Gunnison Rising\4.0 Construction Documents\civil\Drainage\CUHP\CUHP B5 C4\12-015
Output Database:	F:\2012\12-0156 Gunnison Rising\4.0 Construction Documents\civil\Drainage\CUHP\CUHP B5 C4\CUHP
Output Workbook:	F:\2012\12-0156 Gunnison Rising\4.0 Construction Documents\civil\Drainage\CUHP\CUHP B5 C4\CUHP
SWMM File:	F:\2012\12-0156 Gunnison Rising\4.0 Construction Documents\civil\Drainage\CUHP\CUHP B5 C4\CUHP
SWMM Start Time:	5/1/2012

Printouts for User Selected Storm Hydrographs

flow in cfs

	time in minutes	B5	C4
5/1/2012 9:05	5	0.00	0.00
5/1/2012 9:10	10	0.00	0.00
5/1/2012 9:15	15	0.00	0.00
5/1/2012 9:20	20	0.02	0.02
5/1/2012 9:25	25	0.06	0.05
5/1/2012 9:30	30	0.33	0.26
5/1/2012 9:35	35	0.47	0.38
5/1/2012 9:40	40	0.39	0.34
5/1/2012 9:45	45	0.30	0.27
5/1/2012 9:50	50	0.23	0.22
5/1/2012 9:55	55	0.18	0.17
5/1/2012 10:00	60	0.13	0.14
5/1/2012 10:05	65	0.11	0.11
5/1/2012 10:10	70	0.09	0.09
5/1/2012 10:15	75	0.07	0.08
5/1/2012 10:20	80	0.05	0.06
5/1/2012 10:25	85	0.03	0.05
5/1/2012 10:30	90	0.02	0.03
5/1/2012 10:35	95	0.02	0.02
5/1/2012 10:40	100	0.02	0.02
5/1/2012 10:45	105	0.01	0.01
5/1/2012 10:50	110	0.01	0.01
5/1/2012 10:55	115	0.01	0.01
5/1/2012 11:00	120	0.01	0.01
5/1/2012 11:05	125	0.01	0.01
5/1/2012 11:10	130	0.01	0.01
5/1/2012 11:15	135	0.00	0.01
5/1/2012 11:20	140	0.00	0.00
5/1/2012 11:25	145	0.00	0.00
5/1/2012 11:30	150	0.00	0.00
5/1/2012 11:35	155	0.00	0.00
5/1/2012 11:40	160	0.00	0.00
5/1/2012 11:45	165	0.00	0.00
5/1/2012 11:50	170	0.00	0.00
5/1/2012 11:55	175	0.00	0.00
5/1/2012 12:00	180	0.00	0.00
5/1/2012 12:05	185	0.00	0.00
5/1/2012 12:10	190	0.00	0.00

Printouts for User Selected Unit Hydrographs

flow in cfs

time in minutes	B5	C4
5	261.53	198.31
10	319.25	263.74
15	226.40	198.01
20	164.10	153.27
25	129.55	119.61
30	95.00	94.92
35	64.13	70.22
40	52.61	50.72
45	41.09	42.48
50	29.58	34.25
55	18.06	26.02
60	6.54	17.79
65	0.00	9.56
70		1.33
75		0.00

Summary of CUHP Input Parameters (Version 1.3.3)

							Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			
Catchment Name/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	Percent Eff. Imperv.
B5	5YR_GAGE	0.183	0.310	0.660	0.556	2.0	0.40	0.10	4.50	0.60	0.0018	0.00	0.04	0.02	1.06
C4	5YR_GAGE	0.166	0.373	0.629	0.534	2.0	0.40	0.10	4.50	0.60	0.0018	0.00	0.04	0.02	1.06

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 1.3.3)

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph		
Catchment Name/ID	User Comment for Catchment	Ct	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)
B5		0.175	0.265	16.6	4.88	8.6	3.45	8.1	330	424,681	0.00	787	35.0	0.47	783
C4		0.180	0.261	18.7	5.26	9.7	3.72	8.8	267	386,580	0.00	716	35.0	0.38	712

CUHP 2005 Project Summary

CUHP Version:	CUHP 2005 1.3.3 rel. 2/8/2010
System Information	OS: Windows (32-bit) NT 6.01, Excel Version: 11.0
Project Title:	12-0156 GUNNISON RISING
Project Comment:	<Not Specified>
Run Date:	12/4/2012 13:01
Input Workbook:	F:\2012\12-0156 Gunnison Rising\4.0 Construction Documents\civil\Drainage\CUHP\CUHP B5 C4\12-0156 PROP 100YR Cuhp.›
Output Database:	F:\2012\12-0156 Gunnison Rising\4.0 Construction Documents\civil\Drainage\CUHP\CUHP B5 C4\CUHP Out\12-0156 P100 Gun
Output Workbook:	F:\2012\12-0156 Gunnison Rising\4.0 Construction Documents\civil\Drainage\CUHP\CUHP B5 C4\CUHP Out\12-0156 P100 Gun
SWMM File:	F:\2012\12-0156 Gunnison Rising\4.0 Construction Documents\civil\Drainage\CUHP\CUHP B5 C4\CUHP Out\12-0156 P100 Gun
SWMM Start Time:	5/1/2012

Printouts for User Selected Storm Hydrographs

flow in cfs

	time in minutes	B5	C4
5/1/2012 9:05	5	0.00	0.00
5/1/2012 9:10	10	0.00	0.00
5/1/2012 9:15	15	0.01	0.00
5/1/2012 9:20	20	0.03	0.02
5/1/2012 9:25	25	0.39	0.30
5/1/2012 9:30	30	19.55	14.86
5/1/2012 9:35	35	63.48	49.76
5/1/2012 9:40	40	82.47	67.80
5/1/2012 9:45	45	78.31	66.93
5/1/2012 9:50	50	68.94	60.86
5/1/2012 9:55	55	57.29	51.89
5/1/2012 10:00	60	46.07	43.45
5/1/2012 10:05	65	37.83	36.37
5/1/2012 10:10	70	29.97	28.91
5/1/2012 10:15	75	22.53	22.66
5/1/2012 10:20	80	16.55	17.76
5/1/2012 10:25	85	11.36	13.64
5/1/2012 10:30	90	6.77	9.96
5/1/2012 10:35	95	3.65	6.47
5/1/2012 10:40	100	2.08	3.64
5/1/2012 10:45	105	1.15	2.07
5/1/2012 10:50	110	0.62	1.17
5/1/2012 10:55	115	0.30	0.64
5/1/2012 11:00	120	0.10	0.34
5/1/2012 11:05	125	0.02	0.14
5/1/2012 11:10	130	0.01	0.03
5/1/2012 11:15	135	0.01	0.01
5/1/2012 11:20	140	0.01	0.01
5/1/2012 11:25	145	0.00	0.00
5/1/2012 11:30	150	0.00	0.00
5/1/2012 11:35	155	0.00	0.00
5/1/2012 11:40	160	0.00	0.00
5/1/2012 11:45	165	0.00	0.00
5/1/2012 11:50	170	0.00	0.00
5/1/2012 11:55	175	0.00	0.00
5/1/2012 12:00	180	0.00	0.00
5/1/2012 12:05	185	0.00	0.00
5/1/2012 12:10	190	0.00	0.00

Printouts for User Selected Unit Hydrographs

flow in cfs

time in minutes	B5	C4
5	262.77	199.29
10	318.36	263.17
15	225.91	197.55
20	163.89	153.00
25	129.44	119.48
30	95.00	94.86
35	64.11	70.24
40	52.63	50.70
45	41.15	42.50
50	29.66	34.29
55	18.18	26.08
60	6.70	17.88
65	0.00	9.67
70		1.46
75		0.00

Summary of CUHP Input Parameters (Version 1.3.3)

							Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			
Catchment Name/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	Percent Eff. Imperv.
B5	100YR_GAGE	0.183	0.310	0.660	0.556	2.0	0.40	0.10	4.50	0.60	0.0018	0.00	0.04	0.02	1.50
C4	100YR_GAGE	0.166	0.373	0.629	0.534	2.0	0.40	0.10	4.50	0.60	0.0018	0.00	0.04	0.02	1.50

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 1.3.3)

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph		
Catchment Name/ID	User Comment for Catchment	Ct	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)
B5		0.173	0.262	16.6	4.85	8.7	3.43	8.1	329	424,681	0.39	165,767	40.0	82	164,853
C4		0.178	0.258	18.8	5.22	9.8	3.69	8.7	266	386,580	0.39	150,895	40.0	68	149,910

STANDARD FORM SF-2
TIME OF CONCENTRATION
SUBDIVISION: GUNNISON RISING
CALCULATED BY: GBG DATE: 11/06/2012

SUB-BASIN DATA			INITIAL/OVERLAND TIME (t_i)			TRAVEL TIME (t_t)				t_c CHECK (URBANIZED BASINS)			FINAL t_c	REMARKS
DESIG: (1)	C_5 (2)	AREA Ac (3)	LENGTH Ft (4)	SLOPE % (5)	t_i Min (6)	LENGTH Ft (7)	SLOPE % (8)	VEL. FPS (9)	t_t Min (10)	COMP. t_c (11)	TOT. LENGTH Ft (12)	tc=(L/180)+10 Min (13)	Min (14)	
A1	0.56	52.49	615	16.3	9.5	1072	4.7	3.5	5.1	14.6	1687	19.4	14.6	
A2	0.17	25.22	870	16.1	19.6	0								
A3	0.16	17.33	1090	15.6	22.4	0								
A4	0.16	36.9	1168	14.6	23.7	0								
B1	0.51	31.26	997	9.0	16.1	550	2	2.5	3.7	19.8	1547	18.6	18.6	
B2	0.55	72.05	1121	10.7	15.0	138	2.7	2.5	0.9	16.0	1259	17.0	16.0	
B3	0.16	65.79	1478	14.9	26.4	0								
B4	0.16	19.3	1129	19.5	21.1	0								
C1	0.49	44.13	751	13.3	12.7	1112	3.9	3	6.2	18.9	1863	20.4	18.9	
C2	0.16	23.48	969	18.6	19.9	830	8.4	4.2	3.3	23.2	1799	20.0	20.0	
C3	0.16	5.71	671	17.9	16.8									
D1	0.55	63.62	600	12.6	10.4	1454	4.8	3.5	6.9	17.3	2054	21.4	17.3	
D2	0.16	32.28	781	16.6	18.5	726	8.3	4.2	2.9	21.4	1507	18.4	18.4	
F1	0.66	55.47	50	2.0	4.4	1375	2.0	2.8	8.2	12.6	1425	17.9	12.6	
F2	0.56	32.79	50	2.0	5.5	1370	2.0	2.8	8.2	13.6	1420	17.9	13.6	
F3	0.49	70.00	50	2.0	6.2	1580	2.0	2.8	9.4	15.6	1630	19.1	15.6	
G	0.63	42.00	50	2.0	4.7	2200	2.0	2.8	13.1	17.8	2250	22.5	17.8	
H1	0.37	52.42	50	2.0	7.4	1700	2.0	2.8	10.1	17.5	1750	19.7	17.5	
H2	0.37	11.75	50	2.0	7.4	1100	2.0	2.8	6.5	13.9	1150	16.4	13.9	
J	0.75	17.04	50	2.0	3.5	1000	2.0	2.8	6.0	9.5	1050	15.8	9.5	
K	0.46	65.37	50	2.0	6.5	900	2.0	2.8	5.4	11.8	950	15.3	11.8	
L	0.46	16.13	50	2.0	6.5	900	2.0	2.8	5.4	11.8	950	15.3	11.8	
OS1	0.41	57.62	1329	14.3	18.7	1709	3.5	3.7	7.7	26.4	3038	26.9	26.4	
OS2	0.37	24.25	1046	5.7	23.8	679	5.8	3.5	3.2	27.0	1725	19.6	19.6	

CALCULATED BY : GBG
DATE: 11/06/2012
CHECKED BY: MJ

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

JOB NO: 12-0156
PROJECT: GUNNISON RISING
DESIGN STORM: 5-YEAR HISTORIC
0.68

BASIN	DESIGN POINT	DIRECT RUNOFF: AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A (AC)	I IN/HR	Q (CFS)	TOTAL RUNOFF: t_c (MIN)	Σ (C * A) (AC)	I (IN/HR)	Q (CFS)	STREET: SLOPE (%)	STREET FLOW (CFS)	PIPE: DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	TRAVEL TIME: LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	REMARKS
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
A1			52.49	0.16	14.6	8.4	1.58	13.2					X X	X X	X X	X X	X X	X X	X X	X X	XXXXX
A2			25.22	0.16	19.6	4.04	1.36	5.5													
A3			17.33	0.16	22.4	2.77	1.27	3.5													
A4			36.90	0.16	23.7	5.9	1.23	7.3													
B1			31.26	0.16	18.6	5	1.4	7.0													
B2			72.05	0.16	16.0	11.5	1.51	17.4													
B3			65.79	0.16	26.4	10.5	1.16	12.2													
B4			19.30	0.16	21.1	3.09	1.31	4.0													
C1			44.13	0.16	18.9	7.06	1.39	9.8													
C2			23.48	0.16	20.0	3.76	1.35	5.1													
C3			5.71	0.16	16.8	0.91	1.47	1.3													
D1			63.62	0.16	17.3	10.2	1.45	14.8													
D2			32.28	0.16	18.4	5.16	1.41	7.3													
	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	

5-YEAR HISTORIC

CALCULATED BY : GBG
DATE: 11/06/2012
CHECKED BY: MJ

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

JOB NO: 12-0156
PROJECT: GUNNISON RISING
DESIGN STORM: 5-YEAR HISTORIC

BASIN	DESIGN POINT	DIRECT RUNOFF: AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A (AC)	I IN/HR	Q (CFS)	TOTAL RUNOFF: t_c (MIN)	Σ (C * A) (AC)	I (IN/HR)	Q (CFS)	STREET: SLOPE (%)	STREET FLOW (CFS)	PIPE: DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	TRAVEL TIME: LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	REMARKS
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
F1			55.47	0.16	12.6	8.88	1.68	15.0					X X	X X	X X	X X	X X	X X	X X	X X	XXXXX
F2			32.79	0.16	13.6	5.25	1.63	8.5													
F3			70.00	0.16	15.6	11.2	1.53	17.1													
G			42.00	0.16	17.8	6.72	1.43	9.6													
H1			52.42	0.16	17.5	8.39	1.44	12.1													
H2			11.75	0.16	13.9	1.88	1.61	3.0													
J			17.04	0.16	9.5	2.73	1.89	5.2													
K			65.37	0.16	11.8	10.5	1.73	18.1													
L			16.13	0.16	11.8	2.58	1.73	4.5													
OS1			57.62	0.41	26.4	23.6	1.16	27.3													
OS2			24.25	0.37	19.6	8.97	1.36	12.2													
	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X									

5-YEAR HISTORIC

CALCULATED BY : GBG
DATE: 11/06/2012
CHECKED BY: MJ

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

JOB NO: 12-0156
PROJECT: GUNNISON RISING
DESIGN STORM: 5-YEAR
0.68

BASIN	DESIGN POINT	DIRECT RUNOFF: AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A (AC)	I IN/HR	Q (CFS)	TOTAL RUNOFF: t_c (MIN)	Σ (C * A) (AC)	I (IN/HR)	Q (CFS)	STREET: SLOPE (%)	STREET FLOW (CFS)	PIPE: DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	TRAVEL TIME: LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	REMARKS
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
A1			52.49	0.56	14.6	29.4	1.58	46.3					X X	X X	X X	X X	X X	X X	X X	X X	XXXXX
A2			25.22	0.17	19.6	4.29	1.36	5.8													
A3			17.33	0.16	22.4	2.77	1.27	3.5													
A4			36.90	0.16	23.7	5.9	1.23	7.3													
B1			31.26	0.51	18.6	15.9	1.4	22.3													
B2			72.05	0.55	16.0	39.6	1.51	59.8													
B3			65.79	0.16	26.4	10.5	1.16	12.2													
B4			19.30	0.16	21.1	3.09	1.31	4.0													
C1			44.13	0.49	18.9	21.6	1.39	30.0													
C2			23.48	0.16	20.0	3.76	1.35	5.1													
C3			5.71	0.16	16.8	0.91	1.47	1.3													
D1			63.62	0.55	17.3	35	1.45	50.8													
D2			32.28	0.16	18.4	5.16	1.41	7.3													
	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X									

5-YEAR PROPOSED

CALCULATED BY : GBG
DATE: 11/06/2012
CHECKED BY: MJ

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

JOB NO: 12-0156
PROJECT: GUNNISON RISING
DESIGN STORM: 5-YEAR

BASIN	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A (AC)	I IN/HR	Q (CFS)	t_c (MIN)	Σ (C * A) (AC)	I (IN/HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
F1			55.47	0.66	12.6	36.6	1.68	61.7					X X	X X	X X	X X	X X	X X	X X	X X	XXXXX
F2			32.79	0.56	13.6	18.4	1.63	29.9													
F3			70.00	0.49	15.6	34.3	1.53	52.4													
G			42.00	0.63	17.8	26.5	1.43	37.9													
H1			52.42	0.37	17.5	19.4	1.44	28.0													
H2			11.75	0.63	13.9	7.4	1.61	11.9													
J			17.04	0.75	9.5	12.8	1.89	24.2													
K			65.37	0.46	11.8	30.1	1.73	52.1													
L			16.13	0.46	11.8	7.42	1.73	12.9													
OS1			57.62	0.41	26.4	23.6	1.16	27.3													
OS2			24.25	0.37	19.6	8.97	1.36	12.2													
	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X									

5-YEAR PROPOSED

CALCULATED BY : GBG
DATE: 11/06/2012
CHECKED BY: MJ

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

JOB NO: 12-0156
PROJECT: GUNNISON RISING
DESIGN STORM: 10-YEAR HISTORIC
0.85

BASIN	DESIGN POINT	DIRECT RUNOFF: AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A (AC)	I IN/HR	Q (CFS)	TOTAL RUNOFF: t_c (MIN)	Σ (C * A) (AC)	I (IN/HR)	Q (CFS)	STREET: SLOPE (%)	STREET FLOW (CFS)	PIPE: DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	TRAVEL TIME: LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	REMARKS
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
A1			52.49	0.26	14.6	13.6	1.97	26.9					X X	X X	X X	X X	X X	X X	X X	X X	XXXXX
A2			25.22	0.26	19.6	6.56	1.7	11.2													
A3			17.33	0.26	22.4	4.51	1.58	7.1													
A4			36.90	0.26	23.7	9.59	1.54	14.7													
B1			31.26	0.26	18.6	8.13	1.75	14.2													
B2			72.05	0.26	16.0	18.7	1.89	35.3													
B3			65.79	0.26	26.4	17.1	1.45	24.7													
B4			19.30	0.26	21.1	5.02	1.64	8.2													
C1			44.13	0.26	18.9	11.5	1.73	19.9													
C2			23.48	0.26	20.0	6.1	1.68	10.3													
C3			5.71	0.26	16.8	1.48	1.84	2.7													
D1			63.62	0.26	17.3	16.5	1.81	30.0													
D2			32.28	0.26	18.4	8.39	1.76	14.8													
	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X									

10-YEAR HISTORIC

CALCULATED BY : GBG
DATE: 11/06/2012
CHECKED BY: MJ

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

JOB NO: 12-0156
PROJECT: GUNNISON RISING
DESIGN STORM: 10-YEAR HISTORIC

BASIN	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A (AC)	I IN/HR	Q (CFS)	t_c (MIN)	Σ (C * A) (AC)	I (IN/HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
F1			55.47	0.26	12.6	14.4	2.11	30.4					X X	X X	X X	X X	X X	X X	X X	X X	XXXXX
F2			32.79	0.26	13.6	8.53	2.04	17.4													
F3			70.00	0.26	15.6	18.2	1.91	34.7													
G			42.00	0.26	17.8	10.9	1.79	19.5													
H1			52.42	0.26	17.5	13.6	1.8	24.6													
H2			11.75	0.26	13.9	3.06	2.01	6.2													
J			17.04	0.26	9.5	4.43	2.37	10.5													
K			65.37	0.26	11.8	17	2.17	36.8													
L			16.13	0.26	11.8	4.19	2.17	9.1													
OS1			57.62	0.62	26.4	35.7	1.45	51.7													
OS2			24.25	0.44	19.6	10.7	1.7	18.2													
	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X									

10-YEAR HISTORIC

CALCULATED BY : GBG
DATE: 11/06/2012
CHECKED BY: MJ

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

JOB NO: 12-0156
PROJECT: GUNNISON RISING
DESIGN STORM: 10-YEAR
0.85

BASIN	DESIGN POINT	DIRECT RUNOFF: AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A (AC)	I IN/HR	Q (CFS)	TOTAL RUNOFF: t_c (MIN)	Σ (C * A) (AC)	I (IN/HR)	Q (CFS)	STREET: SLOPE (%)	STREET FLOW (CFS)	PIPE: DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	TRAVEL TIME: LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	REMARKS
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
A1			52.49	0.60	14.6	31.5	1.97	62.0					X X	X X	X X	X X	X X	X X	X X	X X	XXXXX
A2			25.22	0.27	19.6	6.81	1.7	11.6													
A3			17.33	0.26	22.4	4.51	1.58	7.1													
A4			36.90	0.26	23.7	9.59	1.54	14.7													
B1			31.26	0.55	18.6	17.2	1.75	30.1													
B2			72.05	0.59	16.0	42.5	1.89	80.1													
B3			65.79	0.26	26.4	17.1	1.45	24.7													
B4			19.30	0.26	21.1	5.02	1.64	8.2													
C1			44.13	0.54	18.9	23.8	1.73	41.3													
C2			23.48	0.26	20.0	6.1	1.68	10.3													
C3			5.71	0.26	16.8	1.48	1.84	2.7													
D1			63.62	0.59	17.3	37.5	1.81	68.1													
D2			32.28	0.26	18.4	8.39	1.76	14.8													
	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X									

10-YEAR PROPOSED

CALCULATED BY : GBG
DATE: 11/06/2012
CHECKED BY: MJ

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

JOB NO: 12-0156
PROJECT: GUNNISON RISING
DESIGN STORM: 10-YEAR

BASIN	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A (AC)	I IN/HR	Q (CFS)	t_c (MIN)	Σ (C * A) (AC)	I (IN/HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
F1			55.47	0.69	12.6	38.3	2.11	80.6					X X	X X	X X	X X	X X	X X	X X	X X	XXXXX
F2			32.79	0.60	13.6	19.7	2.04	40.0													
F3			70.00	0.54	15.6	37.8	1.91	72.1													
G			42.00	0.66	17.8	27.7	1.79	49.6													
H1			52.42	0.44	17.5	23.1	1.8	41.6													
H2			11.75	0.44	13.9	5.17	2.01	10.4													
J			17.04	0.77	9.5	13.1	2.37	31.0													
K			65.37	0.51	11.8	33.3	2.17	72.2													
L			16.13	0.51	11.8	8.23	2.17	17.8													
OS1			57.62	0.47	26.4	27.1	1.45	39.2													
OS2			24.25	0.44	19.6	10.7	1.7	18.2													
	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X									

10-YEAR PROPOSED

CALCULATED BY : GBG
DATE: 11/06/2012
CHECKED BY: MJ

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

JOB NO: 12-0156
PROJECT: GUNNISON RISING
DESIGN STORM: 100-YEAR HISTORIC

1.51

BASIN	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A (AC)	I IN/HR	Q (CFS)	t_c (MIN)	Σ (C * A) (AC)	I (IN/HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
A1			52.49	0.51	14.6	26.8	3.5	93.7					X X	X X	X X	X X	X X	X X	X X	X X	XXXXX
A2			25.22	0.51	19.6	12.9	3.02	38.9													
A3			17.33	0.51	22.4	8.84	2.82	24.9													
A4			36.90	0.51	23.7	18.8	2.73	51.4													
B1			31.26	0.51	18.6	15.9	3.11	49.5													
B2			72.05	0.51	16.0	36.7	3.35	123.1													
B3			65.79	0.51	26.4	33.6	2.57	86.2													
B4			19.30	0.51	21.1	9.84	2.91	28.6													
C1			44.13	0.51	18.9	22.5	3.08	69.3													
C2			23.48	0.51	20.0	12	2.99	35.8													
C3			5.71	0.51	16.8	2.91	3.27	9.5													
D1			63.62	0.51	17.3	32.4	3.22	104.6													
D2			32.28	0.51	18.4	16.5	3.12	51.4													
	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X									

100-YEAR HISTORIC

CALCULATED BY : GBG
DATE: 11/06/2012
CHECKED BY: MJ

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

JOB NO: 12-0156
PROJECT: GUNNISON RISING
DESIGN STORM: 100-YEAR HISTORIC

BASIN	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A (AC)	I IN/HR	Q (CFS)	t_c (MIN)	Σ (C * A) (AC)	I (IN/HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
F1			55.47	0.51	12.6	28.3	3.74	105.8					X X	X X	X X	X X	X X	X X	X X	X X	XXXXX
F2			32.79	0.51	13.6	16.7	3.62	60.5													
F3			70.00	0.51	15.6	35.7	3.39	121.0													
G			42.00	0.51	17.8	21.4	3.18	68.1													
H1			52.42	0.51	17.5	26.7	3.2	85.7													
H2			11.75	0.51	13.9	5.99	3.58	21.4													
J			17.04	0.51	9.5	8.69	4.2	36.5													
K			65.37	0.51	11.8	33.3	3.85	128.3													
L			16.13	0.51	11.8	8.23	3.85	31.7													
OS1			57.62	0.61	26.4	35.1	2.57	90.3													
OS2			24.25	0.59	19.6	14.3	3.02	43.3													
	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X									

CALCULATED BY : GBG
DATE: 11/06/2012
CHECKED BY: MJ

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

JOB NO: 12-0156
PROJECT: GUNNISON RISING
DESIGN STORM: 100-YEAR

1.51

BASIN	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A (AC)	I IN/HR	Q (CFS)	t_c (MIN)	Σ (C * A) (AC)	I (IN/HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
A1			52.49	0.70	14.6	36.7	3.5	128.6					X X	X X	X X	X X	X X	X X	X X	X X	XXXXX
A2			25.22	0.51	19.6	12.9	3.02	38.9													
A3			17.33	0.51	22.4	8.84	2.82	24.9													
A4			36.90	0.51	23.7	18.8	2.73	51.4													
B1			31.26	0.66	18.6	20.6	3.11	64.1													
B2			72.05	0.69	16.0	49.7	3.35	166.5													
B3			65.79	0.51	26.4	33.6	2.57	86.2													
B4			19.30	0.51	21.1	9.84	2.91	28.6													
C1			44.13	0.66	18.9	29.1	3.08	89.7													
C2			23.48	0.51	20.0	12	2.99	35.8													
C3			5.71	0.51	16.8	2.91	3.27	9.5													
D1			63.62	0.69	17.3	43.9	3.22	141.5													
D2			32.28	0.51	18.4	16.5	3.12	51.4													
	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X									

100-YEAR PROPOSED

CALCULATED BY : GBG
DATE: 11/06/2012
CHECKED BY: MJ

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

JOB NO: 12-0156
PROJECT: GUNNISON RISING
DESIGN STORM: 100-YEAR

BASIN	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A (AC)	I IN/HR	Q (CFS)	t_c (MIN)	Σ (C * A) (AC)	I (IN/HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
F1			55.47	0.77	12.6	42.7	3.74	159.8					X X	X X	X X	X X	X X	X X	X X	X X	XXXXX
F2			32.79	0.70	13.6	23	3.62	83.0													
F3			70.00	0.65	15.6	45.5	3.39	154.3													
G			42.00	0.74	17.8	31.1	3.18	98.7													
H1			52.42	0.59	17.5	30.9	3.2	99.1													
H2			11.75	0.59	13.9	6.93	3.58	24.8													
J			17.04	0.83	9.5	14.1	4.2	59.4													
K			65.37	0.63	11.8	41.2	3.85	158.5													
L			16.13	0.63	11.8	10.2	3.85	39.1													
OS1			57.62	0.61	26.4	35.1	2.57	90.3													
OS2			24.25	0.59	19.6	14.3	3.02	43.3													
	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X									

100-YEAR PROPOSED

PROJECT: GUNNISON RISING
PROJ. NO. 12-0156
DESIGN BY: GB GRAVES
REV. BY: M JOHNSON
AGENCY: CITY OF GUNNISON
DATE: 12.03.2012
REV. DATE: 01.17.2013

DETENTION POND RELEASE RATES BASED UPON HISTORIC RELEASE RATES

BASIN	SOILS	AREA (AC)	10 YR	100 YR
A1	D	52.49	26.90	93.70
B1	D	31.26	14.20	49.50
B2	D	72.05	35.30	123.10
C1	D	44.13	19.90	69.30
D1	D	63.62	30.00	104.60
F1	B	55.47	30.40	105.80
F2	B	32.79	17.40	60.50
F3	B	70.00	34.70	121.00
G	C	42.00	19.50	68.10
H1	C	52.42	24.60	85.70
H2	C	11.75	6.20	21.40
J	C	17.04	10.50	36.50
K	C	65.37	36.80	128.30
L	C	16.13	9.10	31.70

PROJECT: GUNNISON RISING
PROJ. NO. 12-0156
DESIGN BY: GB GRAVES
REV. BY: M JOHNSON
DATE: 12.3.2012

BASIN	**A1**		
AREA =	**52.49**	P1=	0.85 INCHES
C=	**0.60**	Tc =	14.6 MIN
RELEASE RATE =	**26.90**		

MASS DIAGRAM

DURATION		CA	INTENSITY	INFLOW	OUTFALL	STORAGE
MIN.	SEC.		IN/HR	VOLUME	VOLUME	VOLUME
0						
5	300	31.49	2.91	27723	15817	11905
10	600	31.49	2.32	44186	19852	24334
15	900	31.49	1.94	55580	23887	31693
20	1200	31.49	1.68	64177	27922	36255
25	1500	31.49	1.49	71035	31957	39077
30	1800	31.49	1.34	76718	35992	40726
35	2100	31.49	1.22	81561	40027	41534
40	2400	31.49	1.13	85777	44062	41715
45	2700	31.49	1.04	89509	48097	41412
50	3000	31.49	0.97	92856	52132	40724
55	3300	31.49	0.92	95890	56167	39723
60	3600	31.49	0.86	98666	60202	38464
65	3900	31.49	0.82	101226	64237	36988
70	4200	31.49	0.78	103600	68272	35328
75	4500	31.49	0.74	105816	72307	33508
80	4800	31.49	0.71	107893	76342	31551
85	5100	31.49	0.68	109849	80377	29472
90	5400	31.49	0.65	111697	84412	27285
95	5700	31.49	0.63	113450	88447	25003
100	6000	31.49	0.60	115117	92482	22635

REQUIRED STORAGE = **41715 CUBIC FEET**
0.96 ACRE-FT

PROJECT: GUNNISON RISING
PROJ. NO. 12-0156
DESIGN BY: GB GRAVES
REV. BY: M JOHNSON
DATE: 12.03.2012

BASIN	**A1**			
AREA =	**52.49**	P1=	1.5	INCHES
C=	**0.70**	Tc =	14.6	MIN
RELEASE RATE =	**93.70**			

MASS DIAGRAM

DURATION		CA	INTENSITY	INFLOW	OUTFALL	STORAGE
MIN.	SEC.		IN/HR	VOLUME	VOLUME	VOLUME
0						
5	300	36.74	5.17	57456	55096	2361
10	600	36.74	4.12	91578	69151	22428
15	900	36.74	3.45	115192	83206	31986
20	1200	36.74	2.99	133011	97261	35750
25	1500	36.74	2.65	147223	111316	35907
30	1800	36.74	2.38	159001	125371	33631
35	2100	36.74	2.17	169040	139426	29614
40	2400	36.74	2.00	177778	153481	24297
45	2700	36.74	1.85	185512	167536	17976
50	3000	36.74	1.73	192448	181591	10857
55	3300	36.74	1.63	198737	195646	3092
60	3600	36.74	1.53	204491	209701	-5210
65	3900	36.74	1.45	209795	223756	-13961
70	4200	36.74	1.38	214716	237811	-23094
75	4500	36.74	1.32	219308	251866	-32558
80	4800	36.74	1.26	223613	265921	-42307
85	5100	36.74	1.20	227667	279976	-52309
90	5400	36.74	1.16	231498	294031	-62532
95	5700	36.74	1.11	235131	308086	-72954
100	6000	36.74	1.07	238587	322141	-83554

REQUIRED STORAGE = **35907 CUBIC FEET**
0.82 ACRE-FT

PROJECT: GUNNISON RISING
PROJ. NO. 12-0156
DESIGN BY: GB GRAVES
REV. BY: M JOHNSON
DATE: 12.03.2012

BASIN	**B1**		
AREA =	**31.26**	P1=	0.85 INCHES
C=	**0.55**	Tc =	18.6 MIN
RELEASE RATE =	**14.20**		

MASS DIAGRAM

DURATION		CA	INTENSITY	INFLOW	OUTFALL	STORAGE
MIN.	SEC.		IN/HR	VOLUME	VOLUME	VOLUME
0						
5	300	17.19	2.91	15134	10054	5081
10	600	17.19	2.32	24122	12184	11938
15	900	17.19	1.94	30342	14314	16028
20	1200	17.19	1.68	35035	16444	18592
25	1500	17.19	1.49	38779	18574	20205
30	1800	17.19	1.34	41881	20704	21178
35	2100	17.19	1.22	44525	22834	21692
40	2400	17.19	1.13	46827	24964	21863
45	2700	17.19	1.04	48864	27094	21771
50	3000	17.19	0.97	50691	29224	21468
55	3300	17.19	0.92	52348	31354	20994
60	3600	17.19	0.86	53863	33484	20380
65	3900	17.19	0.82	55260	35614	19647
70	4200	17.19	0.78	56557	37744	18813
75	4500	17.19	0.74	57766	39874	17893
80	4800	17.19	0.71	58900	42004	16897
85	5100	17.19	0.68	59968	44134	15834
90	5400	17.19	0.65	60977	46264	14713
95	5700	17.19	0.63	61934	48394	13540
100	6000	17.19	0.60	62844	50524	12321

REQUIRED STORAGE = **21863 CUBIC FEET**
0.50 ACRE-FT

PROJECT: GUNNISON RISING
PROJ. NO. 12-0156
DESIGN BY: GB GRAVES
REV. BY: M JOHNSON
DATE: 12.03.2012

BASIN	**B1**			
AREA =	**31.26**	P1=	1.5	INCHES
C=	**0.66**	Tc =	18.6	MIN
RELEASE RATE =	**53.20**			

MASS DIAGRAM

DURATION		CA	INTENSITY	INFLOW	OUTFALL	STORAGE
MIN.	SEC.		IN/HR	VOLUME	VOLUME	VOLUME
0						
5	300	20.63	5.17	32262	37666	-5403
10	600	20.63	4.12	51422	45646	5777
15	900	20.63	3.45	64681	53626	11056
20	1200	20.63	2.99	74687	61606	13081
25	1500	20.63	2.65	82667	69586	13082
30	1800	20.63	2.38	89281	77566	11715
35	2100	20.63	2.17	94918	85546	9372
40	2400	20.63	2.00	99824	93526	6299
45	2700	20.63	1.85	104167	101506	2661
50	3000	20.63	1.73	108062	109486	-1424
55	3300	20.63	1.63	111593	117466	-5873
60	3600	20.63	1.53	114824	125446	-10622
65	3900	20.63	1.45	117802	133426	-15623
70	4200	20.63	1.38	120566	141406	-20840
75	4500	20.63	1.32	123144	149386	-26242
80	4800	20.63	1.26	125561	157366	-31804
85	5100	20.63	1.20	127837	165346	-37508
90	5400	20.63	1.16	129989	173326	-43337
95	5700	20.63	1.11	132029	181306	-49277
100	6000	20.63	1.07	133969	189286	-55317

REQUIRED STORAGE = **13082 CUBIC FEET**
0.30 ACRE-FT

PROJECT: GUNNISON RISING
PROJ. NO. 12-0156
DESIGN BY: GB GRAVES
REV. BY: M JOHNSON
DATE: 12.03.2012

BASIN	**B2**		
AREA =	**72.05**	P1=	0.85 INCHES
C=	**0.59**	Tc =	16.0 MIN
RELEASE RATE =	**35.30**		

MASS DIAGRAM

DURATION		CA	INTENSITY	INFLOW	OUTFALL	STORAGE
MIN.	SEC.		IN/HR	VOLUME	VOLUME	VOLUME
0						
5	300	42.51	2.91	37419	22239	15180
10	600	42.51	2.32	59641	27534	32107
15	900	42.51	1.94	75020	32829	42191
20	1200	42.51	1.68	86624	38124	48500
25	1500	42.51	1.49	95880	43419	52461
30	1800	42.51	1.34	103551	48714	54837
35	2100	42.51	1.22	110088	54009	56079
40	2400	42.51	1.13	115779	59304	56475
45	2700	42.51	1.04	120816	64599	56217
50	3000	42.51	0.97	125333	69894	55439
55	3300	42.51	0.92	129429	75189	54240
60	3600	42.51	0.86	133176	80484	52692
65	3900	42.51	0.82	136631	85779	50852
70	4200	42.51	0.78	139836	91074	48762
75	4500	42.51	0.74	142826	96369	46457
80	4800	42.51	0.71	145630	101664	43966
85	5100	42.51	0.68	148270	106959	41311
90	5400	42.51	0.65	150765	112254	38511
95	5700	42.51	0.63	153131	117549	35582
100	6000	42.51	0.60	155382	122844	32538

REQUIRED STORAGE = **56475 CUBIC FEET**
1.30 ACRE-FT

PROJECT: GUNNISON RISING
PROJ. NO. 12-0156
DESIGN BY: GB GRAVES
REV. BY: M JOHNSON
DATE: 12.03.2012

BASIN	**B2**			
AREA =	**72.05**	P1=	1.5	INCHES
C=	**0.69**	Tc =	16.0	MIN
RELEASE RATE =	**123.10**			

MASS DIAGRAM

DURATION		CA	INTENSITY	INFLOW	OUTFALL	STORAGE
MIN.	SEC.		IN/HR	VOLUME	VOLUME	VOLUME
0						
5	300	49.71	5.17	77741	77553	188
10	600	49.71	4.12	123908	96018	27890
15	900	49.71	3.45	155858	114483	41375
20	1200	49.71	2.99	179968	132948	47020
25	1500	49.71	2.65	199197	151413	47784
30	1800	49.71	2.38	215134	169878	45256
35	2100	49.71	2.17	228716	188343	40373
40	2400	49.71	2.00	240539	206808	33731
45	2700	49.71	1.85	251003	225273	25730
50	3000	49.71	1.73	260389	243738	16651
55	3300	49.71	1.63	268898	262203	6695
60	3600	49.71	1.53	276683	280668	-3985
65	3900	49.71	1.45	283859	299133	-15274
70	4200	49.71	1.38	290518	317598	-27080
75	4500	49.71	1.32	296731	336063	-39332
80	4800	49.71	1.26	302556	354528	-51972
85	5100	49.71	1.20	308041	372993	-64952
90	5400	49.71	1.16	313225	391458	-78233
95	5700	49.71	1.11	318140	409923	-91783
100	6000	49.71	1.07	322816	428388	-105572

REQUIRED STORAGE = **47784 CUBIC FEET**
1.10 ACRE-FT

PROJECT: GUNNISON RISING
PROJ. NO. 12-0156
DESIGN BY: GB GRAVES
REV. BY: M JOHNSON
DATE: 12.03.2012

BASIN	**C1**		
AREA =	**44.13**	P1=	0.85 INCHES
C=	**0.54**	Tc =	18.9 MIN
RELEASE RATE =	**19.90**		

MASS DIAGRAM

DURATION		CA	INTENSITY	INFLOW	OUTFALL	STORAGE
MIN.	SEC.		IN/HR	VOLUME	VOLUME	VOLUME
0						
5	300	23.83	2.91	20977	14268	6708
10	600	23.83	2.32	33434	17253	16181
15	900	23.83	1.94	42055	20238	21817
20	1200	23.83	1.68	48560	23223	25337
25	1500	23.83	1.49	53749	26208	27541
30	1800	23.83	1.34	58049	29193	28856
35	2100	23.83	1.22	61714	32178	29536
40	2400	23.83	1.13	64904	35163	29741
45	2700	23.83	1.04	67728	38148	29579
50	3000	23.83	0.97	70260	41133	29127
55	3300	23.83	0.92	72556	44118	28438
60	3600	23.83	0.86	74657	47103	27553
65	3900	23.83	0.82	76593	50088	26505
70	4200	23.83	0.78	78390	53073	25317
75	4500	23.83	0.74	80066	56058	24008
80	4800	23.83	0.71	81638	59043	22595
85	5100	23.83	0.68	83118	62028	21090
90	5400	23.83	0.65	84517	65013	19503
95	5700	23.83	0.63	85843	67998	17845
100	6000	23.83	0.60	87105	70983	16121

REQUIRED STORAGE = **29741 CUBIC FEET**
0.68 ACRE-FT

PROJECT: GUNNISON RISING
PROJ. NO. 12-0156
DESIGN BY: GB GRAVES
REV. BY: M JOHNSON
DATE: 12.03.2012

BASIN	**C1**			
AREA =	**44.13**	P1=	1.5	INCHES
C=	**0.66**	Tc =	18.9	MIN
RELEASE RATE =	**69.30**			

MASS DIAGRAM

DURATION		CA	INTENSITY	INFLOW	OUTFALL	STORAGE
MIN.	SEC.		IN/HR	VOLUME	VOLUME	VOLUME
0						
5	300	29.13	5.17	45545	49688	-4143
10	600	29.13	4.12	72593	60083	12510
15	900	29.13	3.45	91311	70478	20833
20	1200	29.13	2.99	105436	80873	24563
25	1500	29.13	2.65	116702	91268	25434
30	1800	29.13	2.38	126039	101663	24376
35	2100	29.13	2.17	133996	112058	21938
40	2400	29.13	2.00	140923	122453	18470
45	2700	29.13	1.85	147053	132848	14205
50	3000	29.13	1.73	152552	143243	9309
55	3300	29.13	1.63	157537	153638	3899
60	3600	29.13	1.53	162098	164033	-1935
65	3900	29.13	1.45	166302	174428	-8126
70	4200	29.13	1.38	170203	184823	-14620
75	4500	29.13	1.32	173843	195218	-21375
80	4800	29.13	1.26	177256	205613	-28357
85	5100	29.13	1.20	180469	216008	-35539
90	5400	29.13	1.16	183506	226403	-42897
95	5700	29.13	1.11	186386	236798	-50412
100	6000	29.13	1.07	189125	247193	-58068

REQUIRED STORAGE = **25434 CUBIC FEET**
0.58 ACRE-FT

PROJECT: GUNNISON RISING
PROJ. NO. 12-0156
DESIGN BY: GB GRAVES
REV. BY: M JOHNSON
DATE: 12.03.2012

BASIN	**D1**		
AREA =	**63.62**	P1=	0.85 INCHES
C=	**0.59**	Tc =	17.3 MIN
RELEASE RATE =	**30.00**		

MASS DIAGRAM

DURATION		CA	INTENSITY	INFLOW	OUTFALL	STORAGE
MIN.	SEC.		IN/HR	VOLUME	VOLUME	VOLUME
0						
5	300	37.54	2.91	33041	20070	12971
10	600	37.54	2.32	52663	24570	28093
15	900	37.54	1.94	66242	29070	37172
20	1200	37.54	1.68	76489	33570	42919
25	1500	37.54	1.49	84662	38070	46592
30	1800	37.54	1.34	91435	42570	48865
35	2100	37.54	1.22	97208	47070	50138
40	2400	37.54	1.13	102233	51570	50663
45	2700	37.54	1.04	106680	56070	50610
50	3000	37.54	0.97	110669	60570	50099
55	3300	37.54	0.92	114286	65070	49216
60	3600	37.54	0.86	117594	69570	48024
65	3900	37.54	0.82	120645	74070	46575
70	4200	37.54	0.78	123475	78570	44905
75	4500	37.54	0.74	126115	83070	43045
80	4800	37.54	0.71	128591	87570	41021
85	5100	37.54	0.68	130922	92070	38852
90	5400	37.54	0.65	133125	96570	36555
95	5700	37.54	0.63	135214	101070	34144
100	6000	37.54	0.60	137202	105570	31632

REQUIRED STORAGE = **50663 CUBIC FEET**
1.16 ACRE-FT

PROJECT: GUNNISON RISING
PROJ. NO. 12-0156
DESIGN BY: GB GRAVES
REV. BY: M JOHNSON
DATE: 12.03.2012

BASIN	**D1**			
AREA =	**63.62**	P1=	1.5	INCHES
C=	**0.69**	Tc =	17.3	MIN
RELEASE RATE =	**104.60**			

MASS DIAGRAM

DURATION		CA	INTENSITY	INFLOW	OUTFALL	STORAGE
MIN.	SEC.		IN/HR	VOLUME	VOLUME	VOLUME
0						
5	300	43.90	5.17	68645	69977	-1333
10	600	43.90	4.12	109411	85667	23743
15	900	43.90	3.45	137623	101357	36265
20	1200	43.90	2.99	158911	117047	41864
25	1500	43.90	2.65	175891	132737	43154
30	1800	43.90	2.38	189963	148427	41536
35	2100	43.90	2.17	201956	164117	37838
40	2400	43.90	2.00	212396	179807	32588
45	2700	43.90	1.85	221636	195497	26138
50	3000	43.90	1.73	229923	211187	18735
55	3300	43.90	1.63	237436	226877	10559
60	3600	43.90	1.53	244310	242567	1743
65	3900	43.90	1.45	250647	258257	-7610
70	4200	43.90	1.38	256527	273947	-17420
75	4500	43.90	1.32	262013	289637	-27624
80	4800	43.90	1.26	267156	305327	-38171
85	5100	43.90	1.20	271999	321017	-49018
90	5400	43.90	1.16	276577	336707	-60131
95	5700	43.90	1.11	280917	352397	-71480
100	6000	43.90	1.07	285046	368087	-83042

REQUIRED STORAGE = **43154 CUBIC FEET**
0.99 ACRE-FT

PROJECT: GUNNISON RISING
PROJ. NO. 12-0156
DESIGN BY: GB GRAVES
REV. BY: M JOHNSON
DATE: 11.01.2012

BASIN	**F1**		
AREA =	**55.47**	P1=	0.85 INCHES
C=	**0.69**	Tc =	12.6 MIN
RELEASE RATE =	**30.40**		

MASS DIAGRAM

DURATION		CA	INTENSITY	INFLOW	OUTFALL	STORAGE
MIN.	SEC.		IN/HR	VOLUME	VOLUME	VOLUME
0						
5	300	38.27	2.91	33691	16051	17640
10	600	38.27	2.32	53699	20611	33088
15	900	38.27	1.94	67545	25171	42374
20	1200	38.27	1.68	77994	29731	48263
25	1500	38.27	1.49	86328	34291	52036
30	1800	38.27	1.34	93234	38851	54383
35	2100	38.27	1.22	99120	43411	55709
40	2400	38.27	1.13	104244	47971	56273
45	2700	38.27	1.04	108779	52531	56248
50	3000	38.27	0.97	112847	57091	55755
55	3300	38.27	0.92	116534	61651	54883
60	3600	38.27	0.86	119908	66211	53697
65	3900	38.27	0.82	123018	70771	52247
70	4200	38.27	0.78	125904	75331	50573
75	4500	38.27	0.74	128597	79891	48705
80	4800	38.27	0.71	131121	84451	46670
85	5100	38.27	0.68	133498	89011	44487
90	5400	38.27	0.65	135744	93571	42173
95	5700	38.27	0.63	137875	98131	39744
100	6000	38.27	0.60	139901	102691	37210

REQUIRED STORAGE = **56273 CUBIC FEET**
1.29 ACRE-FT

PROJECT: GUNNISON RISING
PROJ. NO. 12-0156
DESIGN BY: GB GRAVES
REV. BY: M JOHNSON
DATE: 11.01.2012

BASIN	**F1**			
AREA =	**55.47**	P1=	1.5	INCHES
C=	**0.77**	Tc =	12.6	MIN
RELEASE RATE =	**105.80**			

MASS DIAGRAM

DURATION		CA	INTENSITY	INFLOW	OUTFALL	STORAGE
MIN.	SEC.		IN/HR	VOLUME	VOLUME	VOLUME
0						
5	300	42.71	5.17	66790	55862	10928
10	600	42.71	4.12	106455	71732	34723
15	900	42.71	3.45	133905	87602	46302
20	1200	42.71	2.99	154618	103472	51146
25	1500	42.71	2.65	171139	119342	51797
30	1800	42.71	2.38	184831	135212	49619
35	2100	42.71	2.17	196500	151082	45418
40	2400	42.71	2.00	206658	166952	39705
45	2700	42.71	1.85	215648	182822	32826
50	3000	42.71	1.73	223711	198692	25019
55	3300	42.71	1.63	231022	214562	16460
60	3600	42.71	1.53	237710	230432	7278
65	3900	42.71	1.45	243876	246302	-2426
70	4200	42.71	1.38	249597	262172	-12575
75	4500	42.71	1.32	254935	278042	-23108
80	4800	42.71	1.26	259939	293912	-33973
85	5100	42.71	1.20	264651	309782	-45131
90	5400	42.71	1.16	269105	325652	-56547
95	5700	42.71	1.11	273328	341522	-68194
100	6000	42.71	1.07	277345	357392	-80047

REQUIRED STORAGE = **51797 CUBIC FEET**
1.19 ACRE-FT

PROJECT: GUNNISON RISING
PROJ. NO. 12-0156
DESIGN BY: GB GRAVES
REV. BY: M JOHNSON
DATE: 11.01.2012

BASIN	**F2**		
AREA =	**32.79**	P1=	0.85 INCHES
C=	**0.60**	Tc =	13.6 MIN
RELEASE RATE =	**17.40**		

MASS DIAGRAM

DURATION		CA	INTENSITY	INFLOW	OUTFALL	STORAGE
MIN.	SEC.		IN/HR	VOLUME	VOLUME	VOLUME
0						
5	300	19.67	2.91	17318	9709	7609
10	600	19.67	2.32	27603	12319	15284
15	900	19.67	1.94	34720	14929	19791
20	1200	19.67	1.68	40091	17539	22552
25	1500	19.67	1.49	44375	20149	24225
30	1800	19.67	1.34	47925	22759	25166
35	2100	19.67	1.22	50950	25369	25581
40	2400	19.67	1.13	53584	27979	25605
45	2700	19.67	1.04	55915	30589	25326
50	3000	19.67	0.97	58006	33199	24807
55	3300	19.67	0.92	59902	35809	24092
60	3600	19.67	0.86	61636	38419	23217
65	3900	19.67	0.82	63235	41029	22205
70	4200	19.67	0.78	64718	43639	21079
75	4500	19.67	0.74	66102	46249	19853
80	4800	19.67	0.71	67400	48859	18540
85	5100	19.67	0.68	68621	51469	17152
90	5400	19.67	0.65	69776	54079	15697
95	5700	19.67	0.63	70871	56689	14182
100	6000	19.67	0.60	71913	59299	12614

REQUIRED STORAGE = **25605 CUBIC FEET**
0.59 ACRE-FT

PROJECT: GUNNISON RISING
PROJ. NO. 12-0156
DESIGN BY: GB GRAVES
REV. BY: M JOHNSON
DATE: 11.01.2012

BASIN	**F2**			
AREA =	**32.79**	P1=	1.5	INCHES
C=	**0.70**	Tc =	13.6	MIN
RELEASE RATE =	**60.50**			

MASS DIAGRAM

DURATION		CA	INTENSITY	INFLOW	OUTFALL	STORAGE
MIN.	SEC.		IN/HR	VOLUME	VOLUME	VOLUME
0						
5	300	22.95	5.17	35893	33759	2134
10	600	22.95	4.12	57208	42834	14374
15	900	22.95	3.45	71959	51909	20050
20	1200	22.95	2.99	83090	60984	22106
25	1500	22.95	2.65	91969	70059	21910
30	1800	22.95	2.38	99327	79134	20193
35	2100	22.95	2.17	105597	88209	17388
40	2400	22.95	2.00	111056	97284	13772
45	2700	22.95	1.85	115887	106359	9528
50	3000	22.95	1.73	120220	115434	4786
55	3300	22.95	1.63	124149	124509	-360
60	3600	22.95	1.53	127743	133584	-5841
65	3900	22.95	1.45	131057	142659	-11602
70	4200	22.95	1.38	134131	151734	-17603
75	4500	22.95	1.32	137000	160809	-23809
80	4800	22.95	1.26	139689	169884	-30195
85	5100	22.95	1.20	142221	178959	-36738
90	5400	22.95	1.16	144615	188034	-43419
95	5700	22.95	1.11	146884	197109	-50225
100	6000	22.95	1.07	149043	206184	-57141

REQUIRED STORAGE = **22106 CUBIC FEET**
0.51 ACRE-FT

PROJECT: GUNNISON RISING
PROJ. NO. 12-0156
DESIGN BY: GB GRAVES
REV. BY: M JOHNSON
DATE: 11.01.2012

BASIN	**F3**		
AREA =	**70.00**	P1=	0.85 INCHES
C=	**0.54**	Tc =	15.6 MIN
RELEASE RATE =	**34.70**		

MASS DIAGRAM

DURATION		CA	INTENSITY	INFLOW	OUTFALL	STORAGE
MIN.	SEC.		IN/HR	VOLUME	VOLUME	VOLUME
0						
5	300	37.80	2.91	33273	21445	11829
10	600	37.80	2.32	53034	26650	26384
15	900	37.80	1.94	66708	31855	34854
20	1200	37.80	1.68	77027	37060	39968
25	1500	37.80	1.49	85258	42265	42993
30	1800	37.80	1.34	92079	47470	44609
35	2100	37.80	1.22	97892	52675	45217
40	2400	37.80	1.13	102952	57880	45073
45	2700	37.80	1.04	107431	63085	44347
50	3000	37.80	0.97	111448	68290	43159
55	3300	37.80	0.92	115090	73495	41596
60	3600	37.80	0.86	118422	78700	39723
65	3900	37.80	0.82	121494	83905	37589
70	4200	37.80	0.78	124344	89110	35234
75	4500	37.80	0.74	127003	94315	32688
80	4800	37.80	0.71	129496	99520	29977
85	5100	37.80	0.68	131844	104725	27119
90	5400	37.80	0.65	134062	109930	24133
95	5700	37.80	0.63	136166	115135	21032
100	6000	37.80	0.60	138167	120340	17828

REQUIRED STORAGE = **45217 CUBIC FEET**
1.04 ACRE-FT

PROJECT: GUNNISON RISING
PROJ. NO. 12-0156
DESIGN BY: GB GRAVES
REV. BY: M JOHNSON
DATE: 11.01.2012

BASIN	**F3**			
AREA =	**70.00**	P1=	1.5	INCHES
C=	**0.65**	Tc =	15.6	MIN
RELEASE RATE =	**121.00**			

MASS DIAGRAM

DURATION		CA	INTENSITY	INFLOW	OUTFALL	STORAGE
MIN.	SEC.		IN/HR	VOLUME	VOLUME	VOLUME
0						
5	300	45.50	5.17	71150	74778	-3628
10	600	45.50	4.12	113404	92928	20476
15	900	45.50	3.45	142646	111078	31568
20	1200	45.50	2.99	164711	129228	35483
25	1500	45.50	2.65	182311	147378	34933
30	1800	45.50	2.38	196896	165528	31368
35	2100	45.50	2.17	209327	183678	25649
40	2400	45.50	2.00	220148	201828	18320
45	2700	45.50	1.85	229725	219978	9747
50	3000	45.50	1.73	238314	238128	186
55	3300	45.50	1.63	246102	256278	-10176
60	3600	45.50	1.53	253227	274428	-21201
65	3900	45.50	1.45	259796	292578	-32782
70	4200	45.50	1.38	265890	310728	-44838
75	4500	45.50	1.32	271576	328878	-57302
80	4800	45.50	1.26	276907	347028	-70121
85	5100	45.50	1.20	281927	365178	-83251
90	5400	45.50	1.16	286671	383328	-96657
95	5700	45.50	1.11	291170	401478	-110308
100	6000	45.50	1.07	295449	419628	-124179

REQUIRED STORAGE = **35483 CUBIC FEET**
0.81 ACRE-FT

PROJECT: GUNNISON RISING
PROJ. NO. 12-0156
DESIGN BY: GB GRAVES
REV. BY: M JOHNSON
DATE: 11.01.2012

BASIN	**G**		
AREA =	**42.00**	P1=	0.85 INCHES
C=	**0.66**	Tc =	17.8 MIN
RELEASE RATE =	**19.50**		

MASS DIAGRAM

DURATION		CA	INTENSITY	INFLOW	OUTFALL	STORAGE
MIN.	SEC.		IN/HR	VOLUME	VOLUME	VOLUME
0						
5	300	27.72	2.91	24401	13338	11063
10	600	27.72	2.32	38891	16263	22628
15	900	27.72	1.94	48920	19188	29732
20	1200	27.72	1.68	56487	22113	34374
25	1500	27.72	1.49	62522	25038	37484
30	1800	27.72	1.34	67525	27963	39562
35	2100	27.72	1.22	71788	30888	40900
40	2400	27.72	1.13	75498	33813	41685
45	2700	27.72	1.04	78783	36738	42045
50	3000	27.72	0.97	81729	39663	42066
55	3300	27.72	0.92	84399	42588	41811
60	3600	27.72	0.86	86843	45513	41330
65	3900	27.72	0.82	89095	48438	40657
70	4200	27.72	0.78	91185	51363	39822
75	4500	27.72	0.74	93136	54288	38848
80	4800	27.72	0.71	94964	57213	37751
85	5100	27.72	0.68	96685	60138	36547
90	5400	27.72	0.65	98312	63063	35249
95	5700	27.72	0.63	99855	65988	33867
100	6000	27.72	0.60	101323	68913	32410

REQUIRED STORAGE = **42066 CUBIC FEET**
0.97 ACRE-FT

PROJECT: GUNNISON RISING
PROJ. NO. 12-0156
DESIGN BY: GB GRAVES
REV. BY: M JOHNSON
DATE: 11.01.2012

BASIN	**G**			
AREA =	**42.00**	P1=	1.5	INCHES
C=	**0.74**	Tc =	17.8	MIN
RELEASE RATE =	**68.10**			

MASS DIAGRAM

DURATION		CA	INTENSITY	INFLOW	OUTFALL	STORAGE
MIN.	SEC.		IN/HR	VOLUME	VOLUME	VOLUME
0						
5	300	31.08	5.17	48601	46580	2021
10	600	31.08	4.12	77464	56795	20668
15	900	31.08	3.45	97438	67010	30428
20	1200	31.08	2.99	112510	77225	35285
25	1500	31.08	2.65	124532	87440	37092
30	1800	31.08	2.38	134495	97655	36840
35	2100	31.08	2.17	142986	107870	35116
40	2400	31.08	2.00	150378	118085	32292
45	2700	31.08	1.85	156920	128300	28619
50	3000	31.08	1.73	162787	138515	24272
55	3300	31.08	1.63	168107	148730	19376
60	3600	31.08	1.53	172974	158945	14028
65	3900	31.08	1.45	177460	169160	8300
70	4200	31.08	1.38	181623	179375	2248
75	4500	31.08	1.32	185507	189590	-4083
80	4800	31.08	1.26	189149	199805	-10656
85	5100	31.08	1.20	192578	210020	-17443
90	5400	31.08	1.16	195819	220235	-24417
95	5700	31.08	1.11	198892	230450	-31559
100	6000	31.08	1.07	201815	240665	-38851

REQUIRED STORAGE = **37092 CUBIC FEET**
0.85 ACRE-FT

PROJECT: GUNNISON RISING
PROJ. NO. 12-0156
DESIGN BY: GB GRAVES
REV. BY: M JOHNSON
DATE: 11.01.2012

BASIN	**H1**		
AREA =	**52.42**	P1=	0.85 INCHES
C=	**0.44**	Tc =	17.5 MIN
RELEASE RATE =	**24.60**		

MASS DIAGRAM

DURATION		CA	INTENSITY	INFLOW	OUTFALL	STORAGE
MIN.	SEC.		IN/HR	VOLUME	VOLUME	VOLUME
0						
5	300	23.06	2.91	20303	16605	3698
10	600	23.06	2.32	32360	20295	12065
15	900	23.06	1.94	40704	23985	16719
20	1200	23.06	1.68	47001	27675	19326
25	1500	23.06	1.49	52023	31365	20658
30	1800	23.06	1.34	56185	35055	21130
35	2100	23.06	1.22	59732	38745	20987
40	2400	23.06	1.13	62820	42435	20385
45	2700	23.06	1.04	65552	46125	19427
50	3000	23.06	0.97	68003	49815	18188
55	3300	23.06	0.92	70226	53505	16721
60	3600	23.06	0.86	72259	57195	15064
65	3900	23.06	0.82	74133	60885	13248
70	4200	23.06	0.78	75872	64575	11297
75	4500	23.06	0.74	77495	68265	9230
80	4800	23.06	0.71	79016	71955	7061
85	5100	23.06	0.68	80448	75645	4803
90	5400	23.06	0.65	81802	79335	2467
95	5700	23.06	0.63	83086	83025	61
100	6000	23.06	0.60	84307	86715	-2408

REQUIRED STORAGE = **21130 CUBIC FEET**
0.49 ACRE-FT

PROJECT: GUNNISON RISING
PROJ. NO. 12-0156
DESIGN BY: GB GRAVES
REV. BY: M JOHNSON
DATE: 11.01.2012

BASIN	**H1**			
AREA =	**52.42**	P1=	1.5	INCHES
C=	**0.59**	Tc =	17.5	MIN
RELEASE RATE =	**85.70**			

MASS DIAGRAM

DURATION		CA	INTENSITY	INFLOW	OUTFALL	STORAGE
MIN.	SEC.		IN/HR	VOLUME	VOLUME	VOLUME
0						
5	300	30.93	5.17	48363	57848	-9484
10	600	30.93	4.12	77084	70703	6382
15	900	30.93	3.45	96961	83558	13403
20	1200	30.93	2.99	111959	96413	15547
25	1500	30.93	2.65	123922	109268	14655
30	1800	30.93	2.38	133837	122123	11714
35	2100	30.93	2.17	142286	134978	7309
40	2400	30.93	2.00	149641	147833	1809
45	2700	30.93	1.85	156151	160688	-4536
50	3000	30.93	1.73	161990	173543	-11553
55	3300	30.93	1.63	167284	186398	-19114
60	3600	30.93	1.53	172127	199253	-27126
65	3900	30.93	1.45	176591	212108	-35516
70	4200	30.93	1.38	180734	224963	-44229
75	4500	30.93	1.32	184599	237818	-53219
80	4800	30.93	1.26	188223	250673	-62450
85	5100	30.93	1.20	191635	263528	-71893
90	5400	30.93	1.16	194860	276383	-81523
95	5700	30.93	1.11	197918	289238	-91320
100	6000	30.93	1.07	200826	302093	-101266

REQUIRED STORAGE = **15547 CUBIC FEET**
0.36 ACRE-FT

PROJECT: GUNNISON RISING
PROJ. NO. 12-0156
DESIGN BY: GB GRAVES
REV. BY: M JOHNSON
DATE: 11.01.2012

BASIN	**H2**		
AREA =	**11.75**	P1=	0.85 INCHES
C=	**0.44**	Tc =	13.9 MIN
RELEASE RATE =	**6.20**		

MASS DIAGRAM

DURATION		CA	INTENSITY	INFLOW	OUTFALL	STORAGE
MIN.	SEC.		IN/HR	VOLUME	VOLUME	VOLUME
0						
5	300	5.17	2.91	4551	3515	1035
10	600	5.17	2.32	7254	4445	2808
15	900	5.17	1.94	9124	5375	3748
20	1200	5.17	1.68	10535	6305	4230
25	1500	5.17	1.49	11661	7235	4426
30	1800	5.17	1.34	12594	8165	4428
35	2100	5.17	1.22	13389	9095	4294
40	2400	5.17	1.13	14081	10025	4056
45	2700	5.17	1.04	14694	10955	3738
50	3000	5.17	0.97	15243	11885	3358
55	3300	5.17	0.92	15741	12815	2926
60	3600	5.17	0.86	16197	13745	2451
65	3900	5.17	0.82	16617	14675	1942
70	4200	5.17	0.78	17007	15605	1401
75	4500	5.17	0.74	17371	16535	835
80	4800	5.17	0.71	17712	17465	246
85	5100	5.17	0.68	18033	18395	-363
90	5400	5.17	0.65	18336	19325	-989
95	5700	5.17	0.63	18624	20255	-1632
100	6000	5.17	0.60	18897	21185	-2288

REQUIRED STORAGE = **4428 CUBIC FEET**
0.10 ACRE-FT

PROJECT: GUNNISON RISING
PROJ. NO. 12-0156
DESIGN BY: GB GRAVES
REV. BY: M JOHNSON
DATE: 11.01.2012

BASIN	**H2**			
AREA =	**11.75**	P1=	1.5	INCHES
C=	**0.59**	Tc =	13.9	MIN
RELEASE RATE =	**21.40**			

MASS DIAGRAM

DURATION		CA	INTENSITY	INFLOW	OUTFALL	STORAGE
MIN.	SEC.		IN/HR	VOLUME	VOLUME	VOLUME
0						
5	300	6.93	5.17	10841	12134	-1293
10	600	6.93	4.12	17279	15344	1935
15	900	6.93	3.45	21734	18554	3180
20	1200	6.93	2.99	25096	21764	3332
25	1500	6.93	2.65	27777	24974	2804
30	1800	6.93	2.38	30000	28184	1816
35	2100	6.93	2.17	31894	31394	500
40	2400	6.93	2.00	33542	34604	-1061
45	2700	6.93	1.85	35001	37814	-2812
50	3000	6.93	1.73	36310	41024	-4714
55	3300	6.93	1.63	37497	44234	-6737
60	3600	6.93	1.53	38582	47444	-8861
65	3900	6.93	1.45	39583	50654	-11071
70	4200	6.93	1.38	40512	53864	-13352
75	4500	6.93	1.32	41378	57074	-15696
80	4800	6.93	1.26	42190	60284	-18093
85	5100	6.93	1.20	42955	63494	-20539
90	5400	6.93	1.16	43678	66704	-23026
95	5700	6.93	1.11	44363	69914	-25550
100	6000	6.93	1.07	45015	73124	-28108

REQUIRED STORAGE = **3332 CUBIC FEET**
0.08 ACRE-FT

PROJECT: GUNNISON RISING
PROJ. NO. 12-0156
DESIGN BY: GB GRAVES
REV. BY: M JOHNSON
DATE: 11.01.2012

BASIN	**J**		
AREA =	**17.04**	P1=	0.85 INCHES
C=	**0.77**	Tc =	9.5 MIN
RELEASE RATE =	**10.50**		

MASS DIAGRAM

DURATION		CA	INTENSITY	INFLOW	OUTFALL	STORAGE
MIN.	SEC.		IN/HR	VOLUME	VOLUME	VOLUME
0						
5	300	13.12	2.91	11550	4568	6982
10	600	13.12	2.32	18409	6143	12266
15	900	13.12	1.94	23155	7718	15438
20	1200	13.12	1.68	26737	9293	17445
25	1500	13.12	1.49	29594	10868	18726
30	1800	13.12	1.34	31962	12443	19519
35	2100	13.12	1.22	33979	14018	19962
40	2400	13.12	1.13	35736	15593	20143
45	2700	13.12	1.04	37291	17168	20123
50	3000	13.12	0.97	38685	18743	19942
55	3300	13.12	0.92	39949	20318	19632
60	3600	13.12	0.86	41106	21893	19213
65	3900	13.12	0.82	42172	23468	18704
70	4200	13.12	0.78	43161	25043	18119
75	4500	13.12	0.74	44084	26618	17467
80	4800	13.12	0.71	44950	28193	16757
85	5100	13.12	0.68	45764	29768	15997
90	5400	13.12	0.65	46535	31343	15192
95	5700	13.12	0.63	47265	32918	14347
100	6000	13.12	0.60	47959	34493	13467

REQUIRED STORAGE = **20143 CUBIC FEET**
0.46 ACRE-FT

PROJECT: GUNNISON RISING
PROJ. NO. 12-0156
DESIGN BY: GB GRAVES
REV. BY: M JOHNSON
DATE: 11.01.2012

BASIN	**J**		
AREA =	**17.04**	P1=	1.5 INCHES
C=	**0.83**	Tc =	9.5 MIN
RELEASE RATE =	**36.50**		

MASS DIAGRAM

DURATION		CA	INTENSITY	INFLOW	OUTFALL	STORAGE
MIN.	SEC.		IN/HR	VOLUME	VOLUME	VOLUME
0						
5	300	14.14	5.17	22116	15878	6239
10	600	14.14	4.12	35251	21353	13898
15	900	14.14	3.45	44340	26828	17512
20	1200	14.14	2.99	51199	32303	18896
25	1500	14.14	2.65	56669	37778	18892
30	1800	14.14	2.38	61203	43253	17951
35	2100	14.14	2.17	65067	48728	16340
40	2400	14.14	2.00	68431	54203	14228
45	2700	14.14	1.85	71408	59678	11730
50	3000	14.14	1.73	74078	65153	8925
55	3300	14.14	1.63	76498	70628	5871
60	3600	14.14	1.53	78713	76103	2611
65	3900	14.14	1.45	80755	81578	-823
70	4200	14.14	1.38	82649	87053	-4403
75	4500	14.14	1.32	84417	92528	-8111
80	4800	14.14	1.26	86074	98003	-11929
85	5100	14.14	1.20	87634	103478	-15843
90	5400	14.14	1.16	89109	108953	-19844
95	5700	14.14	1.11	90507	114428	-23920
100	6000	14.14	1.07	91837	119903	-28065

REQUIRED STORAGE = **18896 CUBIC FEET**
0.43 ACRE-FT

PROJECT: GUNNISON RISING
PROJ. NO. 12-0156
DESIGN BY: GB GRAVES
REV. BY: M JOHNSON
DATE: 11.01.2012

BASIN	**K**		
AREA =	**65.37**	P1=	0.85 INCHES
C=	**0.51**	Tc =	11.8 MIN
RELEASE RATE =	**36.80**		

MASS DIAGRAM

DURATION		CA	INTENSITY	INFLOW	OUTFALL	STORAGE
MIN.	SEC.		IN/HR	VOLUME	VOLUME	VOLUME
0						
5	300	33.34	2.91	29346	18547	10799
10	600	33.34	2.32	46774	24067	22707
15	900	33.34	1.94	58835	29587	29248
20	1200	33.34	1.68	67936	35107	32829
25	1500	33.34	1.49	75195	40627	34568
30	1800	33.34	1.34	81211	46147	35064
35	2100	33.34	1.22	86338	51667	34671
40	2400	33.34	1.13	90802	57187	33614
45	2700	33.34	1.04	94752	62707	32045
50	3000	33.34	0.97	98295	68227	30067
55	3300	33.34	0.92	101507	73747	27760
60	3600	33.34	0.86	104446	79267	25178
65	3900	33.34	0.82	107155	84787	22367
70	4200	33.34	0.78	109668	90307	19361
75	4500	33.34	0.74	112014	95827	16186
80	4800	33.34	0.71	114212	101347	12865
85	5100	33.34	0.68	116283	106867	9416
90	5400	33.34	0.65	118240	112387	5853
95	5700	33.34	0.63	120095	117907	2188
100	6000	33.34	0.60	121860	123427	-1567

REQUIRED STORAGE = **35064 CUBIC FEET**
0.80 ACRE-FT

PROJECT: GUNNISON RISING
PROJ. NO. 12-0156
DESIGN BY: GB GRAVES
REV. BY: M JOHNSON
DATE: 11.01.2012

BASIN	**K**			
AREA =	**65.37**	P1=	1.5	INCHES
C=	**0.63**	Tc =	11.8	MIN
RELEASE RATE =	**128.30**			

MASS DIAGRAM

DURATION		CA	INTENSITY	INFLOW	OUTFALL	STORAGE
MIN.	SEC.		IN/HR	VOLUME	VOLUME	VOLUME
0						
5	300	41.18	5.17	64400	64663	-264
10	600	41.18	4.12	102645	83908	18737
15	900	41.18	3.45	129112	103153	25959
20	1200	41.18	2.99	149084	122398	26686
25	1500	41.18	2.65	165014	141643	23370
30	1800	41.18	2.38	178215	160888	17327
35	2100	41.18	2.17	189467	180133	9333
40	2400	41.18	2.00	199261	199378	-117
45	2700	41.18	1.85	207929	218623	-10694
50	3000	41.18	1.73	215704	237868	-22164
55	3300	41.18	1.63	222753	257113	-34360
60	3600	41.18	1.53	229202	276358	-47156
65	3900	41.18	1.45	235147	295603	-60456
70	4200	41.18	1.38	240663	314848	-74185
75	4500	41.18	1.32	245810	334093	-88283
80	4800	41.18	1.26	250635	353338	-102703
85	5100	41.18	1.20	255179	372583	-117405
90	5400	41.18	1.16	259473	391828	-132355
95	5700	41.18	1.11	263545	411073	-147528
100	6000	41.18	1.07	267418	430318	-162900

REQUIRED STORAGE = **26686 CUBIC FEET**
0.61 ACRE-FT

PROJECT: GUNNISON RISING
PROJ. NO. 12-0156
DESIGN BY: GB GRAVES
REV. BY: M JOHNSON
DATE: 11.01.2012

BASIN	**L**		
AREA =	**16.13**	P1=	0.85 INCHES
C=	**0.51**	Tc =	11.8 MIN
RELEASE RATE =	**9.10**		

MASS DIAGRAM

DURATION		CA	INTENSITY	INFLOW	OUTFALL	STORAGE
MIN.	SEC.		IN/HR	VOLUME	VOLUME	VOLUME
0						
5	300	8.23	2.91	7241	4586	2655
10	600	8.23	2.32	11542	5951	5590
15	900	8.23	1.94	14518	7316	7201
20	1200	8.23	1.68	16763	8681	8082
25	1500	8.23	1.49	18554	10046	8508
30	1800	8.23	1.34	20039	11411	8627
35	2100	8.23	1.22	21304	12776	8528
40	2400	8.23	1.13	22405	14141	8264
45	2700	8.23	1.04	23380	15506	7874
50	3000	8.23	0.97	24254	16871	7383
55	3300	8.23	0.92	25047	18236	6810
60	3600	8.23	0.86	25772	19601	6170
65	3900	8.23	0.82	26440	20966	5474
70	4200	8.23	0.78	27061	22331	4729
75	4500	8.23	0.74	27639	23696	3943
80	4800	8.23	0.71	28182	25061	3120
85	5100	8.23	0.68	28693	26426	2266
90	5400	8.23	0.65	29176	27791	1384
95	5700	8.23	0.63	29633	29156	477
100	6000	8.23	0.60	30069	30521	-452

REQUIRED STORAGE = **8627 CUBIC FEET**
0.20 ACRE-FT

PROJECT: GUNNISON RISING
PROJ. NO. 12-0156
DESIGN BY: GB GRAVES
REV. BY: M JOHNSON
DATE: 11.01.2012

BASIN	**L**			
AREA =	**16.13**	P1=	1.5	INCHES
C=	**0.63**	Tc =	11.8	MIN
RELEASE RATE =	**31.70**			

MASS DIAGRAM

DURATION		CA	INTENSITY	INFLOW	OUTFALL	STORAGE
MIN.	SEC.		IN/HR	VOLUME	VOLUME	VOLUME
0						
5	300	10.16	5.17	15891	15977	-86
10	600	10.16	4.12	25328	20732	4596
15	900	10.16	3.45	31858	25487	6371
20	1200	10.16	2.99	36786	30242	6545
25	1500	10.16	2.65	40717	34997	5720
30	1800	10.16	2.38	43975	39752	4223
35	2100	10.16	2.17	46751	44507	2244
40	2400	10.16	2.00	49167	49262	-94
45	2700	10.16	1.85	51306	54017	-2710
50	3000	10.16	1.73	53225	58772	-5547
55	3300	10.16	1.63	54964	63527	-8563
60	3600	10.16	1.53	56555	68282	-11726
65	3900	10.16	1.45	58022	73037	-15014
70	4200	10.16	1.38	59383	77792	-18408
75	4500	10.16	1.32	60653	82547	-21893
80	4800	10.16	1.26	61844	87302	-25458
85	5100	10.16	1.20	62965	92057	-29092
90	5400	10.16	1.16	64025	96812	-32787
95	5700	10.16	1.11	65030	101567	-36537
100	6000	10.16	1.07	65985	106322	-40337

REQUIRED STORAGE = **6545 CUBIC FEET**
0.15 ACRE-FT

PROJECT: GUNNISON RISING
PROJ. NO. 12-0156
DESIGN BY: GB GRAVES
REV. BY: M JOHNSON
AGENCY: CITY OF GUNNISON
DATE: 12.03.2012

REQUIRED DETENTION BASIN VOLUMES

RATIONAL METHOD

			STAGE STORAGE	
BASIN	**AREA (AC)**	**% IMP.**	**10-YR.**	**100-YR.**
A1	52.49	73	0.96	0.82
B1	31.26	67	0.50	0.30
B2	72.05	72.5	1.30	1.10
C1	44.13	65.4	0.68	0.58
D1	63.62	71.7	1.16	0.99
F1	55.47	82.80	1.29	1.19
F2	32.79	73.70	0.59	0.51
F3	70.00	65.20	1.04	0.81
G	42.00	80.00	0.97	0.85
H1	52.42	45.00	0.49	0.36
H2	11.75	45.00	0.10	0.08
J	17.04	90.00	0.46	0.43
K	65.37	60.00	0.80	0.61
L	16.13	60.00	0.20	0.15

VOLUMES ARE IN ACRE-FT

EXISTING 42" CMP Outfall
Worksheet for Circular Channel

Project Description	
Project File	untitled.fm2
Worksheet	culvert capacity
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

Input Data		
Mannings Coefficient	0.024	
Channel Slope	0.020000	ft/ft
Diameter	42.00	in

Results		
Depth	3.50	ft
Discharge	77.07	cfs
Flow Area	9.62	ft^2
Wetted Perimeter	11.00	ft
Top Width	0.00	ft
Critical Depth	2.75	ft
Percent Full	100.00	
Critical Slope	0.021770	ft/ft
Velocity	8.01	ft/s
Velocity Head	1.00	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	82.90	cfs
Full Flow Capacity	77.07	cfs
Full Flow Slope	0.020000	ft/ft

EXISTING 6'x6' Box Culvert Full Flow Capacity Worksheet for Rectangular Channel

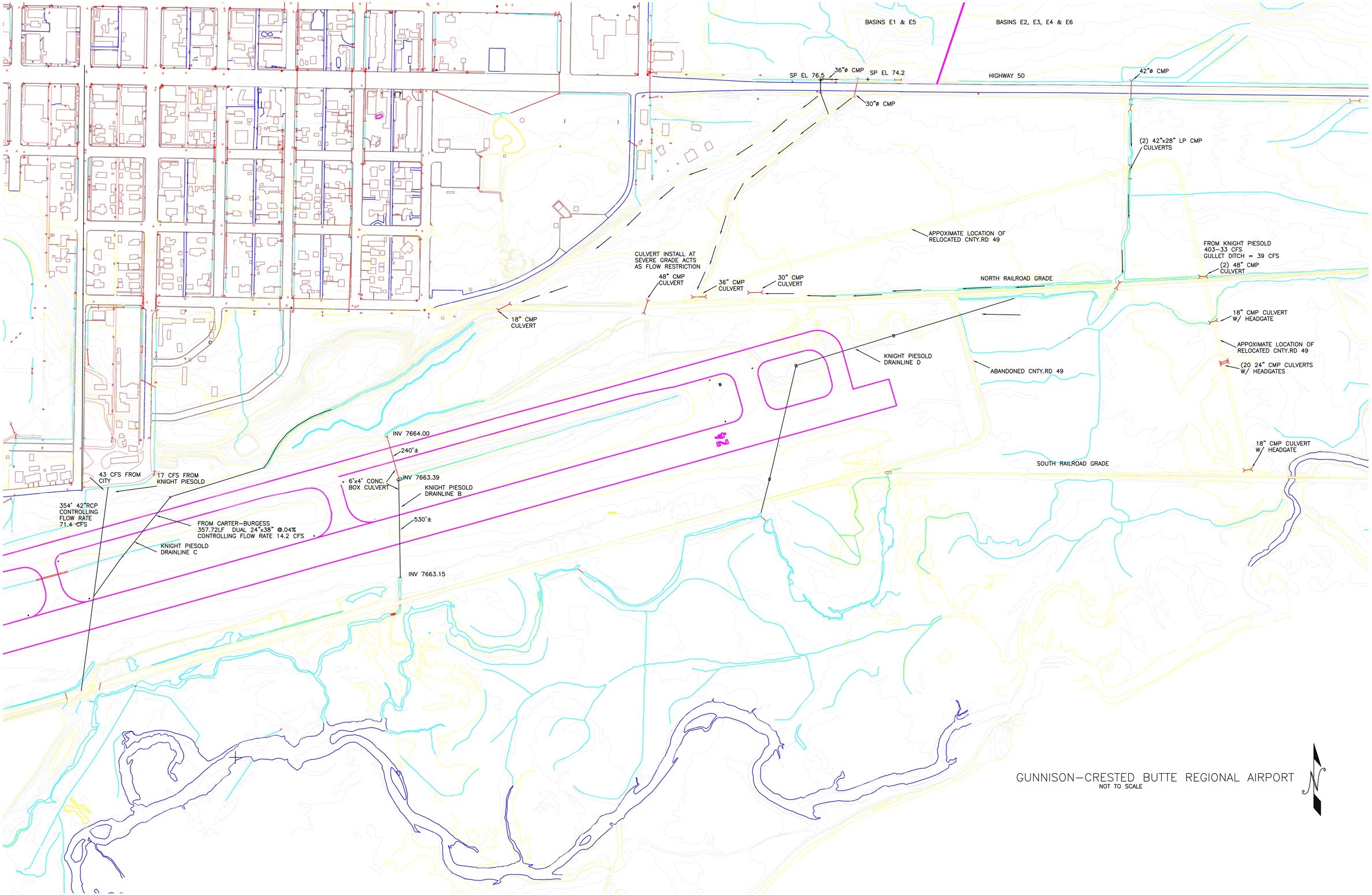
Project Description	
Project File	untitled.fm2
Worksheet	Box Culvert Capacity
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.020000	ft/ft
Depth	6.00	ft
Bottom Width	6.00	ft

Results		
Discharge	923.75	cfs
Flow Area	36.00	ft^2
Wetted Perimeter	18.00	ft
Top Width	6.00	ft
Critical Depth	9.03	ft
Critical Slope	0.007535	ft/ft
Velocity	25.66	ft/s
Velocity Head	10.23	ft
Specific Energy	16.23	ft
Froude Number	1.85	
Flow is supercritical.		

APPENDIX C

- GUNNISON AIRPORT DRAINAGE MAP
- CO GEOLOGICAL SURVEY LETTER
- FEMA LOMR
- EXISTING DRAINAGE MAP
- PROPOSED DRAINAGE MAP


BASINS E1 & E5
BASINS E2, E3, E4 & E6
SP EL 76.5
36"ø CMP
SP EL 74.2
HIGHWAY 50
42"ø CMP
30"ø CMP
(2) 42"x28" LP CMP
CULVERTS
APPOXIMATE LOCATION OF
RELOCATED CNTY.RD 49
FROM KNIGHT PIESOLD
403-33 CFS
GULLET DITCH = 39 CFS
(2) 48" CMP
CULVERT
CULVERT INSTALL AT
SEVERE GRADE ACTS
AS FLOW RESTRICTION
48" CMP
CULVERT
36" CMP
CULVERT
30" CMP
CULVERT
NORTH RAILROAD GRADE
18" CMP
CULVERT
18" CMP CULVERT
W/ HEADGATE
APPOXIMATE LOCATION OF
RELOCATED CNTY.RD 49
KNIGHT PIESOLD
DRAINLINE D
ABANDONED CNTY.RD 49
(20 24" CMP CULVERTS
W/ HEADGATES
INV 7664.00
240'±
SOUTH RAILROAD GRADE
18" CMP CULVERT
W/ HEADGATE
43 CFS FROM
CITY
17 CFS FROM
KNIGHT PIESOLD
6'x4' CONC.
BOX CULVERT
INV 7663.39
KNIGHT PIESOLD
DRAINLINE B
354' 42"RCP
CONTROLLING
FLOW RATE
71.4 CFS
FROM CARTER-BURGESS
357.72LF DUAL 24"x38" @.04%
CONTROLLING FLOW RATE 14.2 CFS
530'±
KNIGHT PIESOLD
DRAINLINE C
INV 7663.15
24
GUNNISON-CRESTED BUTTE REGIONAL AIRPORT
NOT TO SCALE
N

STATE OF COLORADO

COLORADO GEOLOGICAL SURVEY

Department of Natural Resources
1313 Sherman Street, Room 715
Denver, CO 80203
Phone: (303) 866-2611
Fax: (303) 866-2461

COLORADO
DEPARTMENT OF NATURAL RESOURCES

Bill Ritter
Governor

Harris D. Sherman
Executive Director

Vincent Matthews
Division Director and
State Geologist

December 21, 2007

Mr. Steven Westbay
Planning Director
City of Gunnison
P.O. Box 239201
Gunnison, CO 81230

Re: Gunnison Rising, Tomichi Creek Corridor Annexation, GU070007_2

Dear Mr. Westbay:

On February 17, 2007, the Colorado Geological Survey (CGS) reviewed the above referenced annexation proposal. The proposal was revised and resubmitted. The primary purpose of this review is to evaluate whether the comments and concerns raised in the previous letter have been adequately addressed.

As outlined previously, a key concern is development in steep areas prone to slope instability. The revised plans show that development will not occur north of the contour trail. This greatly limits development occurring in areas prone to landslides and rockfall. However, Phases II, III and IV contain some areas with steep slopes. As develop proceeds, additional analysis and investigation will be needed to prevent construction-related slope instability.

As previously noted by CGS and the applicant's geotechnical consultant, CTL Thompson, parts of Phases II, III, and IV have been mapped as containing alluvial fan and/or debris flow deposits. According to CTL Thompson, due to agricultural uses, they could not determine the extent of debris flow deposits.

Structures and improvements, such as roads, located near the apex of fans and the mouth of drainages would have the highest risk of damages from alluvial fan flooding or debris flows. The application includes the delineation of floodplain of Tomichi Creek and a discussion of how storm water generated from the development will be handled. However, the initial application and the revised submittal do not address how flows from drainages, tributary to Tomichi Creek, will be handled.

For example, preliminary plans for Phase III, show homes and roads located within or near the junction of a drainage with a valley or where the slope gradient of the drainage abruptly decreases. This area would have the greatest risk of alluvial fan flooding or debris flows. CTL Thompson describes these drainages as "relatively minor". In some cases this is true, in others; the drainages have a tributary area of over 1000 acres. In Phase III, plans show homes will be located in a drainage with a tributary area of approximately 300 acres. Significant flows, sediment, and debris could be generated.

Detailed design of how drainage will be routed through a subdivision is normally done during a later design stage. However, the applicant's reports do not adequately address debris flow and alluvial fan hazards. If hazard avoidance will be used as mitigation or if it is important to develop each phase with a specific number of lots, it would be prudent to better define potential risks before zoning.

The CTL Thompson report notes that the site contains soil that is susceptible to erosion. This is common to the area and is evidenced by steep, incised drainages. The report suggests that erosion should be handled by silt fencing or other techniques. Due to the proposed densities, it is likely that some areas, especially those with steeper slopes, will require extensive overlot grading. Sediment control measures, like silt fence, are designed to be used on short slope lengths with a small tributary area.

Controlling or preventing erosion from a large graded area takes an integrated storm-water management plan that relies more on erosion control, like limiting the amount of disturbance, and less on sediment control measures such as silt fence. To be effective, storm water management for such areas should be done early in the planning process.

Please contact me if you have any questions or concerns. I can be reached at 303.866.2018 or by email at karen.berry@state.co.us.

Sincerely,

Karen A. Berry
Geological Engineer, PG, AICP, CPESC-SWQ

Federal Emergency Management Agency

Washington, D.C. 20472

May 28, 2010

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable Paula Swenson
Chairperson, Gunnison County
Board of Commissioners
200 East Virginia Avenue, Suite 104
Gunnison, CO 81230

IN REPLY REFER TO:

Case No.:	09-08-0466P
Community Name:	Gunnison County, CO
Community No.:	080078
Effective Date of This Revision:	**October 15, 2010**

Dear Ms. Swenson:

The Flood Insurance Study report and Flood Insurance Rate Map for your community have been revised by this Letter of Map Revision (LOMR). Please use the enclosed annotated map panels revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals issued in your community.

Additional documents are enclosed which provide information regarding this LOMR. Please see the List of Enclosures below to determine which documents are included. Other attachments specific to this request may be included as referenced in the Determination Document. If you have any questions regarding floodplain management regulations for your community or the National Flood Insurance Program (NFIP) in general, please contact the Consultation Coordination Officer (CCO) for your community. If you have any technical questions regarding this LOMR, please contact the Director, Mitigation Division of the Department of Homeland Security's Federal Emergency Management Agency (FEMA) in Denver, Colorado, at (303) 235-4830, or the FEMA Map Information eXchange (FMIX), toll free, at 1-877-336-2627 (1-877-FEMA MAP). Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Sincerely,

David N. Bascom

David N. Bascom, CFM, Program Specialist
Engineering Management Branch
Mitigation Directorate

For: Kevin C. Long, Acting Chief
Engineering Management Branch
Mitigation Directorate

List of Enclosures:

- Letter of Map Revision Determination Document
- Annotated Flood Insurance Rate Map
- Annotated Flood Insurance Study Report

Courtesy copy list-Gunnison County, CO

The Honorable Stu Ferguson
Mayor, City of Gunnison

Mr. Neal Starkebaum
Assistant Director
Gunnison County Planning Department

Mr. James R. Roberts, P.E.
Del-Mont Consultants, Inc.

Mr. Dennis Minchow
Gunnison Valley Partners, LLC

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT

COMMUNITY AND REVISION INFORMATION		PROJECT DESCRIPTION	BASIS OF REQUEST
COMMUNITY	Gunnison County Colorado (Unincorporated Areas)	NO PROJECT	HYDRAULIC ANALYSIS HYDROLOGIC ANALYSIS NEW TOPOGRAPHIC DATA FLOODWAY
	COMMUNITY NO.: 080078		
IDENTIFIER	DMC Project 0643-Gunnison Rising	APPROXIMATE LATITUDE & LONGITUDE: 38.540, -106.870 SOURCE: FIRM Panel DATUM: NAD 27	

ANNOTATED MAPPING ENCLOSURES			ANNOTATED STUDY ENCLOSURES
TYPE: FIRM*	NO.: 0800780755 B	DATE: September 29, 1989	DATE OF EFFECTIVE FLOOD INSURANCE STUDY: September 29, 1989
TYPE: FIRM*	NO.: 0800780775 B	DATE: September 29, 1989	PROFILE(S): 16P, 17P, 18P, 19P FLOODWAY DATA TABLE: 2 SUMMARY OF DISCHARGES TABLE: 1

Enclosures reflect changes to flooding sources affected by this revision.
* FIRM - Flood Insurance Rate Map; ** FBFM - Flood Boundary and Floodway Map; *** FHBM - Flood Hazard Boundary Map

FLOODING SOURCE(S) & REVISED REACH(ES)

Tomichi Creek - from approximately 3,290 feet downstream of Railroad Bridge A to approximately 4,380 feet upstream of Railroad Bridge B

SUMMARY OF REVISIONS

Flooding Source	Effective Flooding	Revised Flooding	Increases	Decreases
Tomichi Creek	Zone A	Zone AE	YES	YES
	No BFEs*	BFEs	YES	NONE
	No Floodway	Floodway	YES	NONE

* BFEs - Base Flood Elevations

DETERMINATION

This document provides the determination from the Department of Homeland Security's Federal Emergency Management Agency (FEMA) regarding a request for a Letter of Map Revision (LOMR) for the area described above. Using the information submitted, we have determined that a revision to the flood hazards depicted in the Flood Insurance Study (FIS) report and/or National Flood Insurance Program (NFIP) map is warranted. This document revises the effective NFIP map, as indicated in the attached documentation. Please use the enclosed annotated map panels revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals in your community.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 6730 Santa Barbara Court, Elkridge, MD 21075. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

David N. Bascom, CFM, Program Specialist
Engineering Management Branch
Mitigation Directorate

112553 10.3.1.09080466 102-I-A-C

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

OTHER COMMUNITIES AFFECTED BY THIS REVISION

CID Number: 080080 **Name:** City of Gunnison, Colorado

AFFECTED MAP PANELS	AFFECTED PORTIONS OF THE FLOOD INSURANCE STUDY REPORT
TYPE: FIRM* NO.: 0800800001 B DATE: April 18, 1983 TYPE: FBFM** NO.: 0800800003 DATE: April 18, 1983	DATE OF EFFECTIVE FLOOD INSURANCE STUDY: September 29, 1989 PROFILE(S): 5P FLOODWAY DATA TABLE: 1 SUMMARY OF DISCHARGES TABLE: 1

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 6730 Santa Barbara Court, Elkridge, MD 21075. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

David N. Bascom, CFM, Program Specialist
Engineering Management Branch
Mitigation Directorate

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

COMMUNITY INFORMATION

APPLICABLE NFIP REGULATIONS/COMMUNITY OBLIGATION

We have made this determination pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (P.L. 93-234) and in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, P.L. 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. Pursuant to Section 1361 of the National Flood Insurance Act of 1968, as amended, communities participating in the NFIP are required to adopt and enforce floodplain management regulations that meet or exceed NFIP criteria. These criteria, including adoption of the FIS report and FIRM, and the modifications made by this LOMR, are the minimum requirements for continued NFIP participation and do not supersede more stringent State or local requirements to which the regulations apply.

We provide the floodway designation to your community as a tool to regulate floodplain development. Therefore, the floodway revision we have described in this letter, while acceptable to us, must also be acceptable to your community and adopted by appropriate community action, as specified in Paragraph 60.3(d) of the NFIP regulations.

COMMUNITY REMINDERS

We based this determination on the base (1-percent-annual-chance) flood discharges computed in the submitted hydrologic analysis. Future development of projects upstream could cause increased discharges, which could cause increased flood hazards. A comprehensive restudy of your community's flood hazards would consider the cumulative effects of development on discharges and could, therefore, indicate that greater flood hazards exist in this area.

Your community must regulate all proposed floodplain development and ensure that permits required by Federal and/or State law have been obtained. State or community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction or may limit development in floodplain areas. If your State or community has adopted more restrictive or comprehensive floodplain management criteria, those criteria take precedence over the minimum NFIP requirements.

We will not print and distribute this LOMR to primary users, such as local insurance agents or mortgage lenders; instead, the community will serve as a repository for the new data. We encourage you to disseminate the information in this LOMR by preparing a news release for publication in your community's newspaper that describes the revision and explains how your community will provide the data and help interpret the NFIP maps. In that way, interested persons, such as property owners, insurance agents, and mortgage lenders, can benefit from the information.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 6730 Santa Barbara Court, Elkridge, MD 21075. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

David N. Bascom, CFM, Program Specialist
Engineering Management Branch
Mitigation Directorate

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

We have designated a Consultation Coordination Officer (CCO) to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Ms. Jeanine D. Petterson
Director, Mitigation Division
Federal Emergency Management Agency, Region VIII
Denver Federal Center, Building 710
Post Office Box 25267
Denver, CO 80225-0267
(303) 235-4830

STATUS OF THE COMMUNITY NFIP MAPS

We are preparing a revised FIRM and FIS report for Gunnison County in our countywide format; therefore, we will not physically revise and republish the FIRM and FIS report for your community to incorporate the modifications made by this LOMR at this time. Preliminary copies of the countywide FIRM and FIS report, which will present information from the effective FIRMs and FIS reports for your community and other incorporated communities in Gunnison County, will be distributed for review in approximately 2 months. We will incorporate the modifications made by this LOMR into the Preliminary countywide FIRM before it is distributed, and the modifications will be included when the countywide FIRM becomes effective.

Although the project area is shown on the above-referenced FIRM panels as within the unincorporated areas of Gunnison County, the City of Gunnison has annexed portions of this area. We have not reflected these corporate limits changes in this LOMR.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 6730 Santa Barbara Court, Elkridge, MD 21075. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

David N. Bascom, CFM, Program Specialist
Engineering Management Branch
Mitigation Directorate

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

PUBLIC NOTIFICATION OF REVISION

PUBLIC NOTIFICATION

FLOODING SOURCE	LOCATION OF REFERENCED ELEVATION	BFE (FEET NGVD 29)		MAP PANEL NUMBER(S)
		EFFECTIVE	REVISED	
Tomichi Creek	Approximately 2,990 feet downstream of Railroad Bridge A	NONE	7,668	0800780755 B
	Approximately 1,080 feet upstream of Railroad Bridge B	NONE	7,715	0800780775 B

Within 90 days of the second publication in the local newspaper, a citizen may request that we reconsider this determination. Any request for reconsideration must be based on scientific or technical data. Therefore, this letter will be effective only after the 90-day appeal period has elapsed and we have resolved any appeals that we receive during this appeal period. Until this LOMR is effective, the revised BFEs presented in this LOMR may be changed.

A notice of changes will be published in the Federal Register. A short notice also will be published in your local newspaper on or about the dates listed below. Please refer to FEMA's website at https://www.floodmaps.fema.gov/fhm/Scripts/bfe_main.asp for a more detailed description of proposed BFE changes, which will be posted within a week of the date of this letter.

LOCAL NEWSPAPER Name: *Gunnison Country Times*
Dates: June 10, 2010 and June 17, 2010

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 6730 Santa Barbara Court, Elkridge, MD 21075. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

David N. Bascom, CFM, Program Specialist
Engineering Management Branch
Mitigation Directorate

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
TOMICHI CREEK								
AA	27,346	80	430	5.9	7,669.0	7,669.0	7,669.5	0.5
AB	28,903	65[2]	309	8.2	7,674.8	7,674.8	7,675.1	0.3
AC	32,838	996	1,701	1.5	7,682.4	7,682.4	7,683.2	0.8
AD	37,729	290	900	2.8	7,693.5	7,693.5	7,694.2	0.7
AE	43,065	174	500	5.1	7,701.4	7,701.4	7,702.3	0.9
AF	45,941	318	869	2.9	7,708.1	7,708.1	7,709.0	0.9
AG	48,495	218	1,015	2.5	7,714.7	7,714.7	7,715.5	0.8

[1]Stream distance in feet above the confluence with the Gunnison River

[2]Width within Gunnison City Limits

REVISED TO
REFLECT LOMR
EFFECTIVE: October 15, 2010

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

GUNNISON COUNTY, CO
(UNINCORPORATED AREAS)

FLOODWAY DATA

TOMICHI CREEK

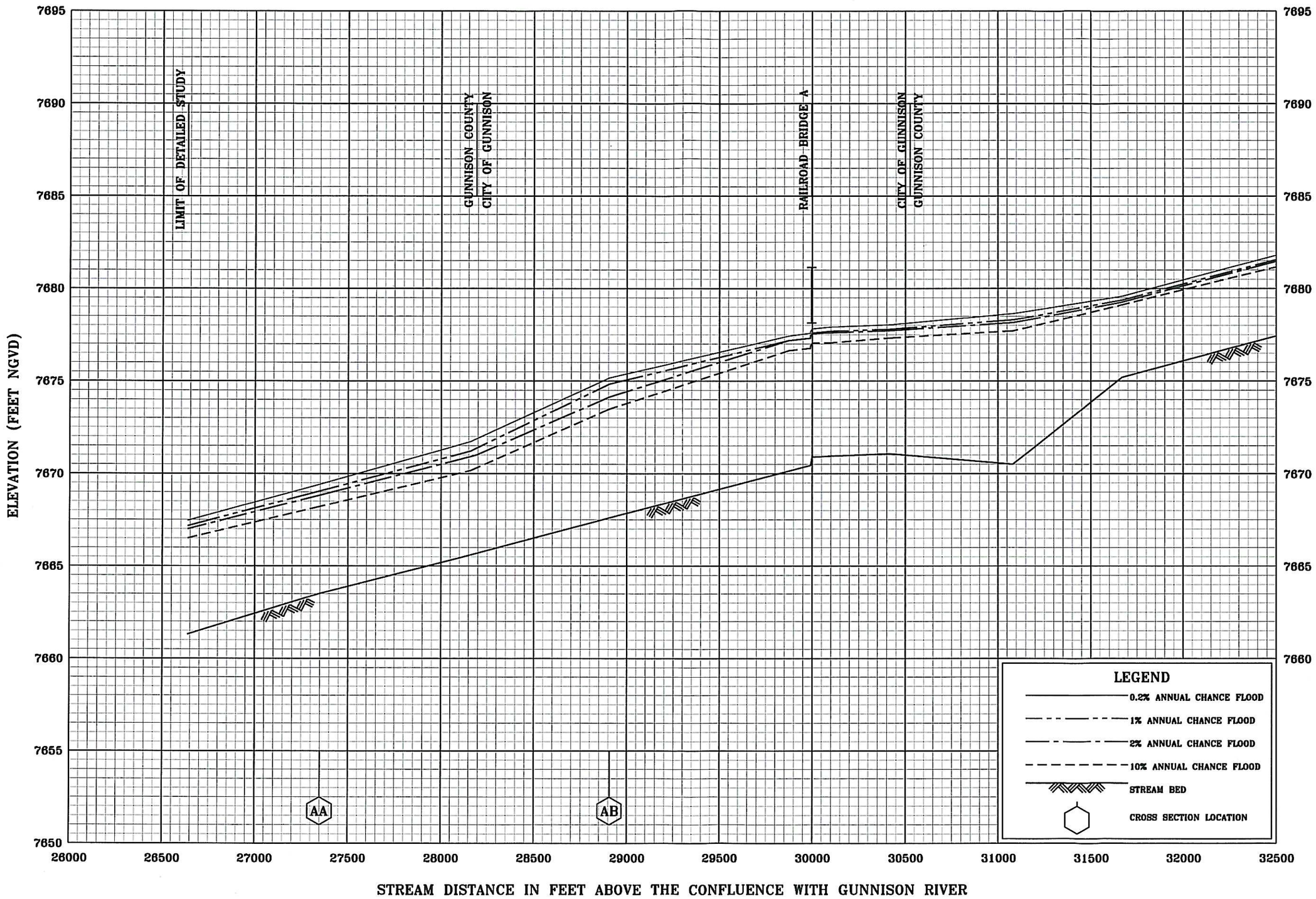
Table 1. Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (Cubic Feet Per Second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual Chance
Tomichi Creek					
At Gunnison (Hydrologic Unit 14020003)	1,061.0	1,501	1,904	2,050	2,340
At Gunnison Airport	1,061.0	1,524	2,227	2,534	3,264
At Parlin	427.0	716	874	924	1,017
Gunnsion River					
Near Gunnison (Hydrologic Unit 14020002)	1,012.0	5,762	7,967	8,930	11,256
Near Somerset (Hydrologic Unit 14020004)	531.0	5,600	8,000	9,200	11,300

Revised Data

REVISED TO
REFLECT LOMR
EFFECTIVE: October 15, 2010

[1] Data Not Available



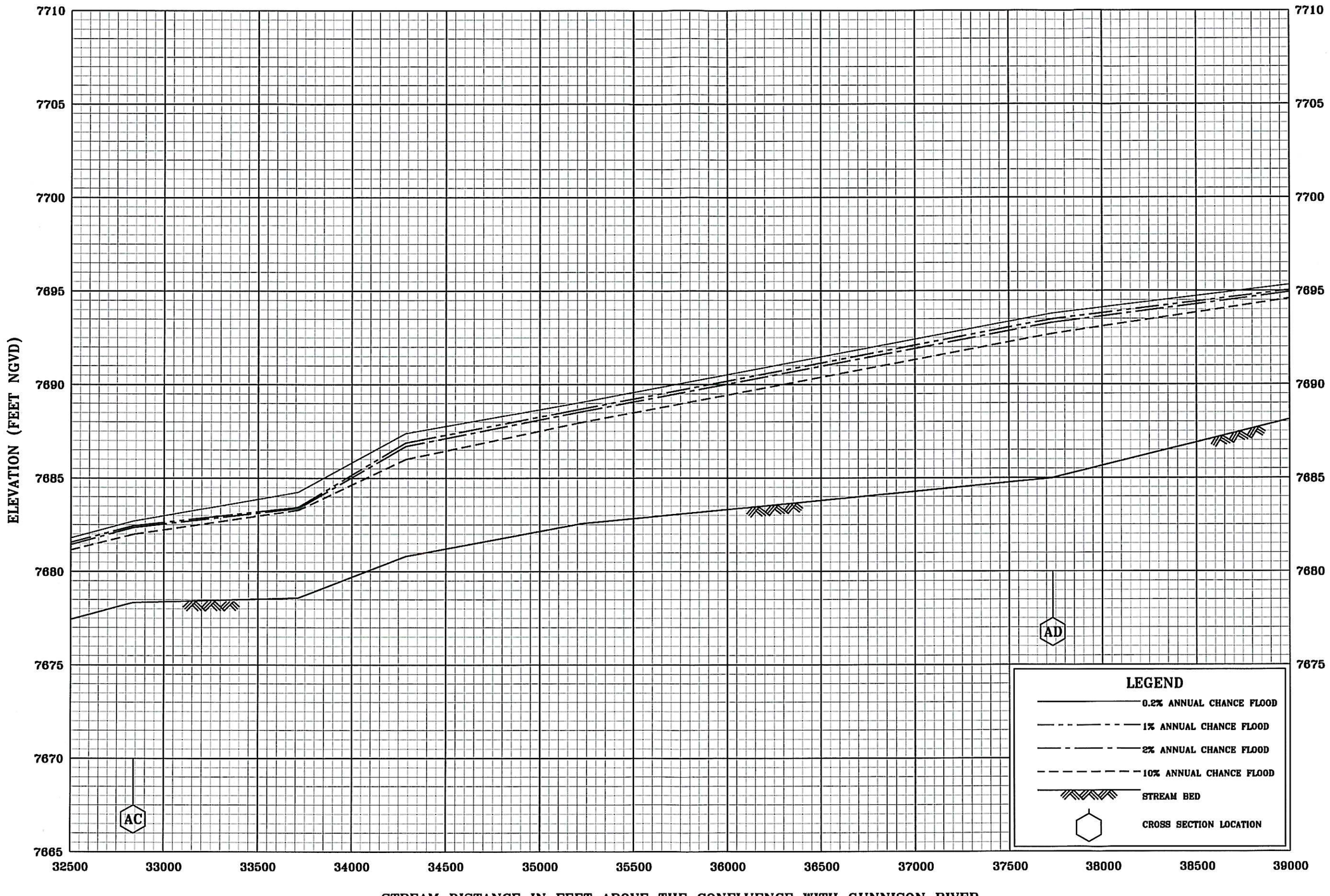
FLOOD PROFILES

TOMICHI CREEK

REVISED TO REFLECT LOMR EFFECTIVE: October 15, 2010

FEDERAL EMERGENCY MANAGEMENT AGENCY

GUNNISON COUNTY, CO
(UNINCORPORATED AREAS)



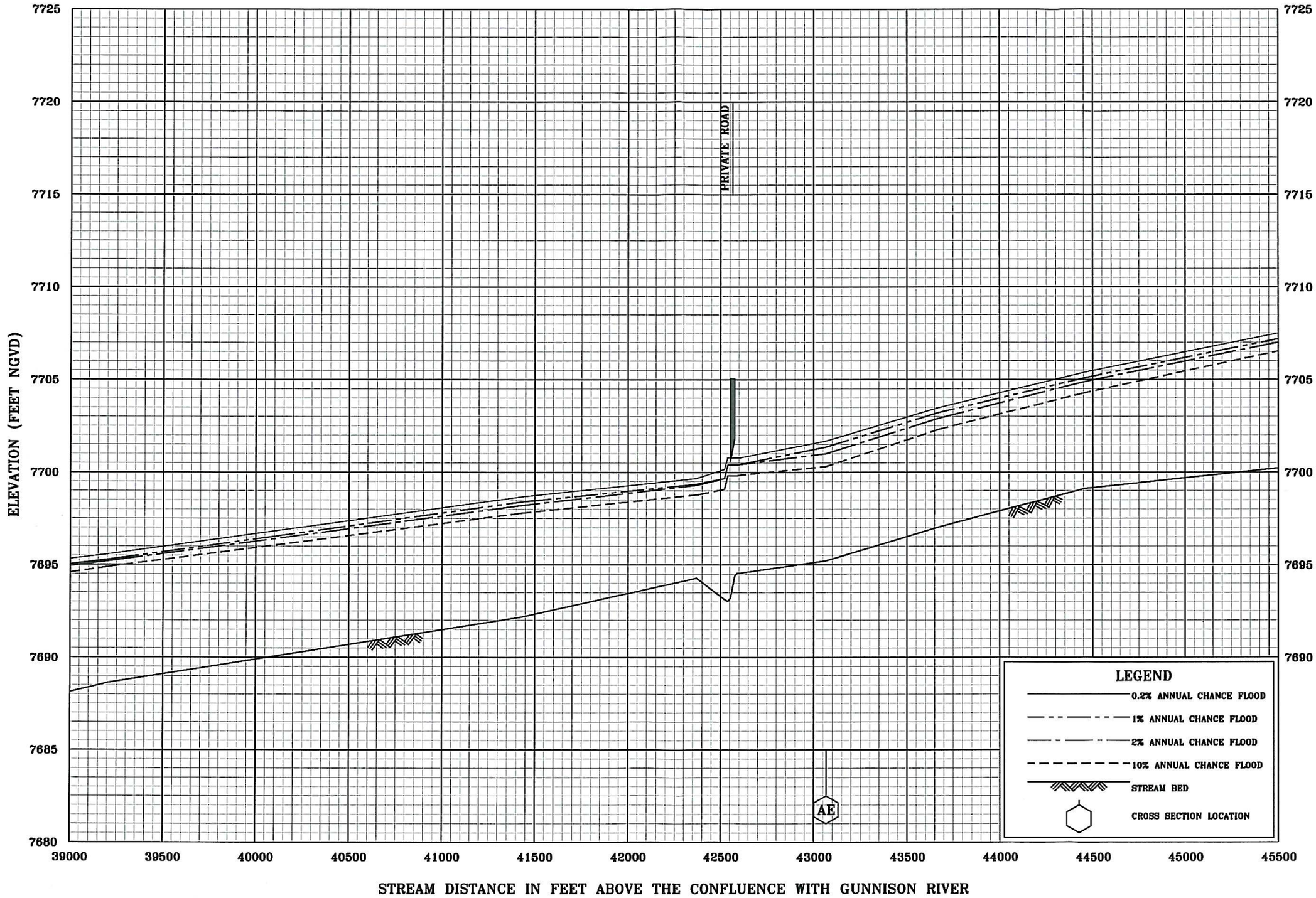
FLOOD PROFILES

TOMICHI CREEK

REVISED TO
REFLECT LOMR
EFFECTIVE: October 15, 2010

FEDERAL EMERGENCY MANAGEMENT AGENCY

GUNNISON COUNTY, CO
(UNINCORPORATED AREAS)



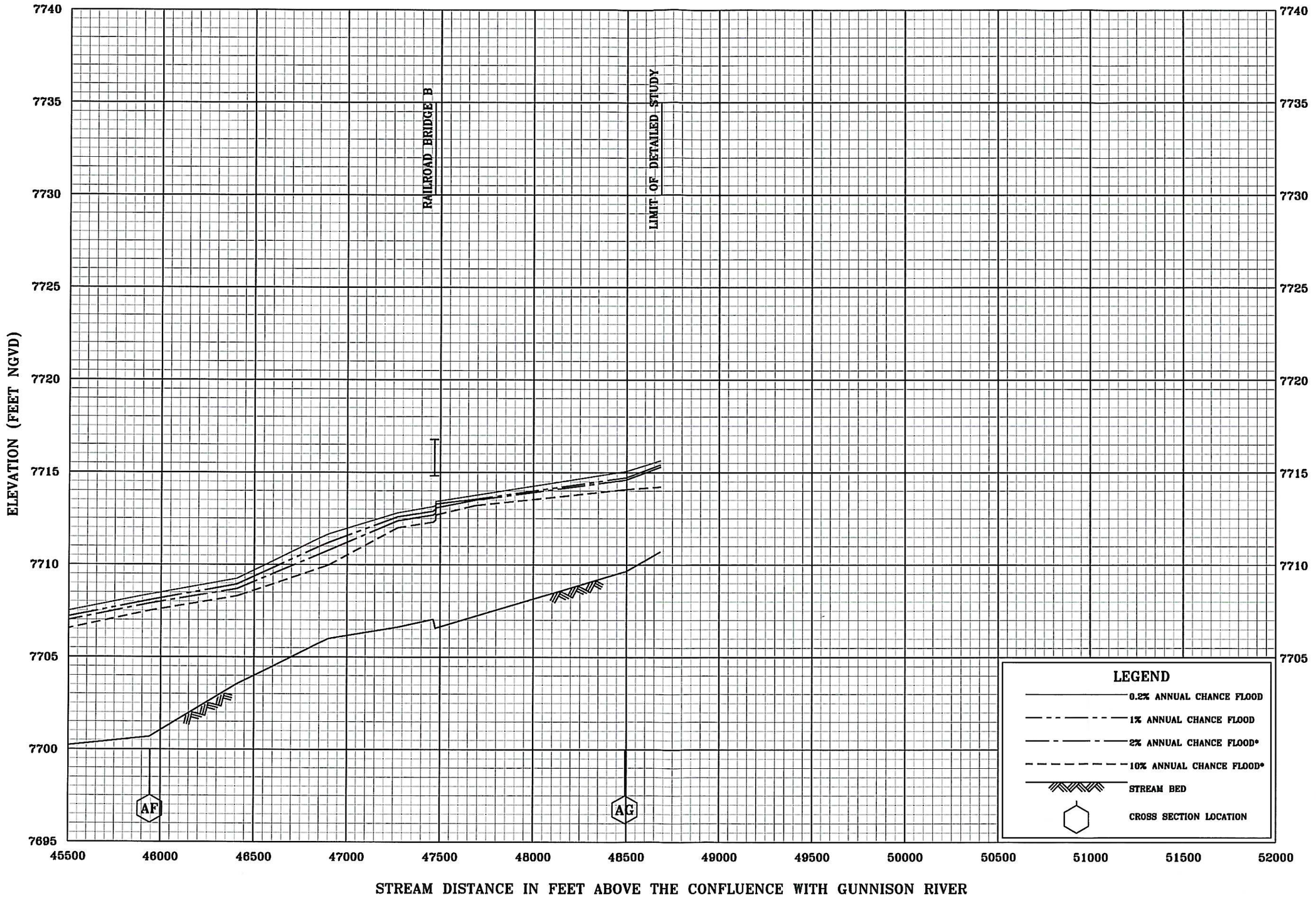
FLOOD PROFILES

TOMICHI CREEK

REVISED TO REFLECT LOMR EFFECTIVE: October 15, 2010

FEDERAL EMERGENCY MANAGEMENT AGENCY

GUNNISON COUNTY, CO
(UNINCORPORATED AREAS)



FLOOD PROFILES

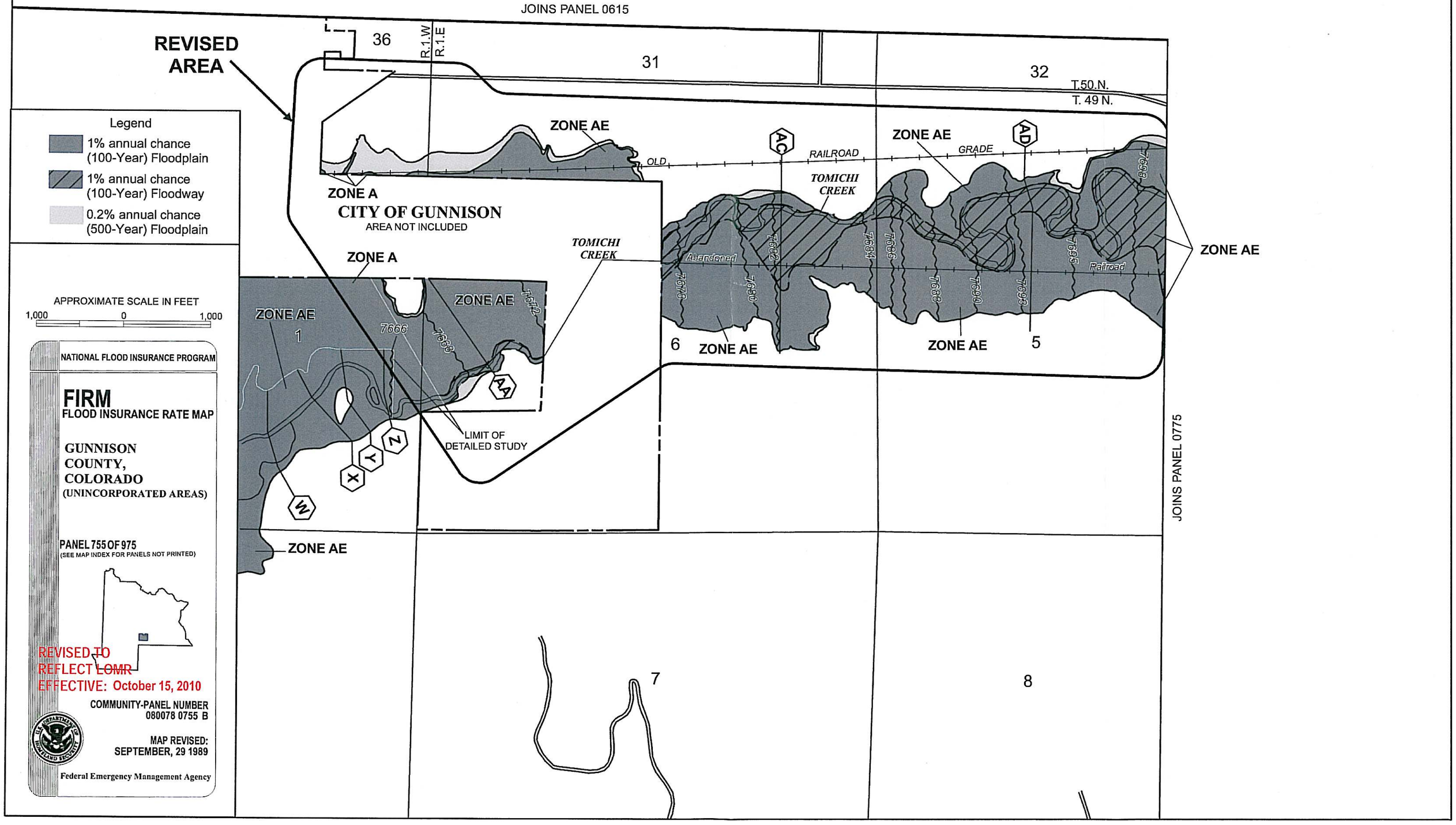
TOMICHI CREEK

REVISED TO REFLECT LOMR EFFECTIVE: October 15, 2010

FEDERAL EMERGENCY MANAGEMENT AGENCY

GUNNISON COUNTY, CO
(UNINCORPORATED AREAS)

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 49 NORTH, RANGE 1 WEST, AND TOWNSHIP 50 NORTH, RANGE 1 EAST.



Legend

- 1% annual chance (100-Year) Floodplain
- 1% annual chance (100-Year) Floodway
- 0.2% annual chance (500-Year) Floodplain

APPROXIMATE SCALE IN FEET

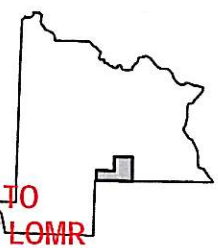
2,000 0 2,000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

GUNNISON COUNTY, COLORADO
(UNINCORPORATED AREAS)

PANEL 775 OF 975
(SEE MAP INDEX FOR PANELS NOT PRINTED)



REVISED TO REFLECT LOMR
EFFECTIVE: October 15, 2010

COMMUNITY-PANEL NUMBER
080078 0775 B

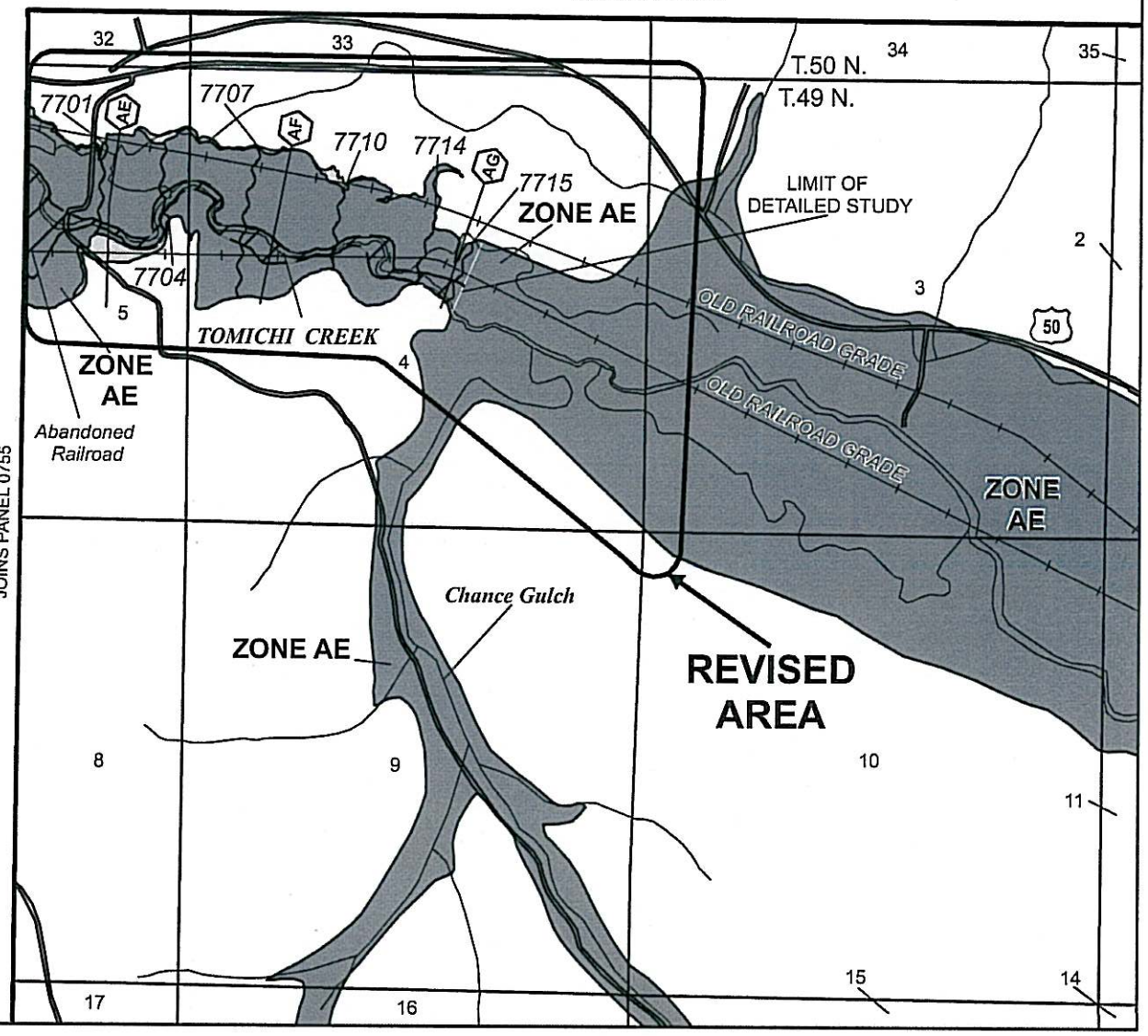
MAP REVISED:
SEPTEMBER, 29 1989

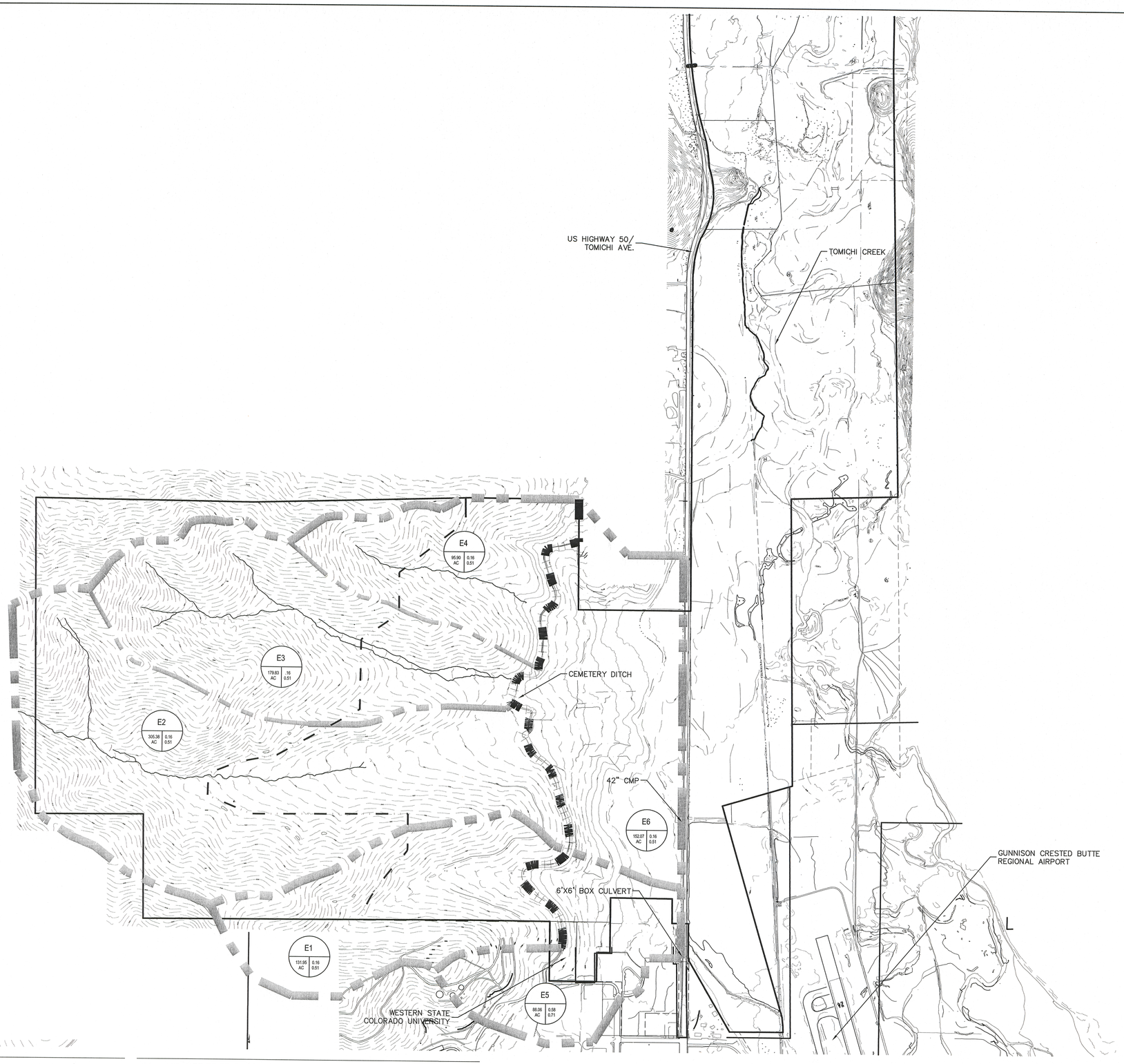
Federal Emergency Management Agency

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 49 NORTH, RANGE 1 WEST, AND TOWNSHIP 50 NORTH, RANGE 1 EAST.

JOINS PANEL 0625

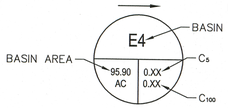
JOINS PANEL 0755





LEGEND

- PROPOSED LOT LINE
- CEMETERY DITCH
- BASIN BOUNDARY
- SUB-BASIN BOUNDARY
- NORTHERN ANNEXATION BOUNDARY
- DIRECTION OF FLOW



CUHP FLOWS

BASIN	Q5	Q100
E1	.36	69
E2	.49	102
E3	.35	70
E4	.28	53
E5	80	227
E6	61	245

CALL UTILITY NOTIFICATION CENTER OF COLORADO
1-800-922-1987
CALL 2-BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

CAUTION: NOTICE TO CONTRACTOR

THE CONTRACTOR IS SPECIFICALLY CAUTIONED THAT THE LOCATION AND/OR ELEVATION OF EXISTING UTILITIES AS SHOWN ON THESE PLANS IS BASED ON RECORDS OF THE VARIOUS UTILITY COMPANIES AND, WHERE POSSIBLE, MEASUREMENTS TAKEN IN THE FIELD. THE INFORMATION IS NOT TO BE RELIED ON AS BEING EXACT OR COMPLETE. THE CONTRACTOR MUST CALL THE LOCAL UTILITY LOCATION CENTER AT LEAST 48 HOURS BEFORE ANY EXCAVATION TO REQUEST EXACT FIELD LOCATIONS OF THE UTILITIES. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL EXISTING UTILITIES WHICH CONFLICT WITH THE PROPOSED IMPROVEMENTS SHOWN ON THE PLANS.

NORTH 600 0 300 600
SCALE: 1" = 600'

CLC ASSOCIATES
8480 E. ORCHARD RD.
SUITE 2000
GREENWOOD VILLAGE
COLORADO 80111
P 303 770 5600
F 303 770 2349
CLCASSOC.COM

ARCHITECTURE
ENGINEERING PLANNING
LANDSCAPE ARCHITECTURE
LAND SURVEYING

MASTER DRAINAGE STUDY
GUNNISON RISING
GUNNISON, COLORADO

COLORADO LICENSED PROFESSIONAL ENGINEER
NO. 39761
4/4/13

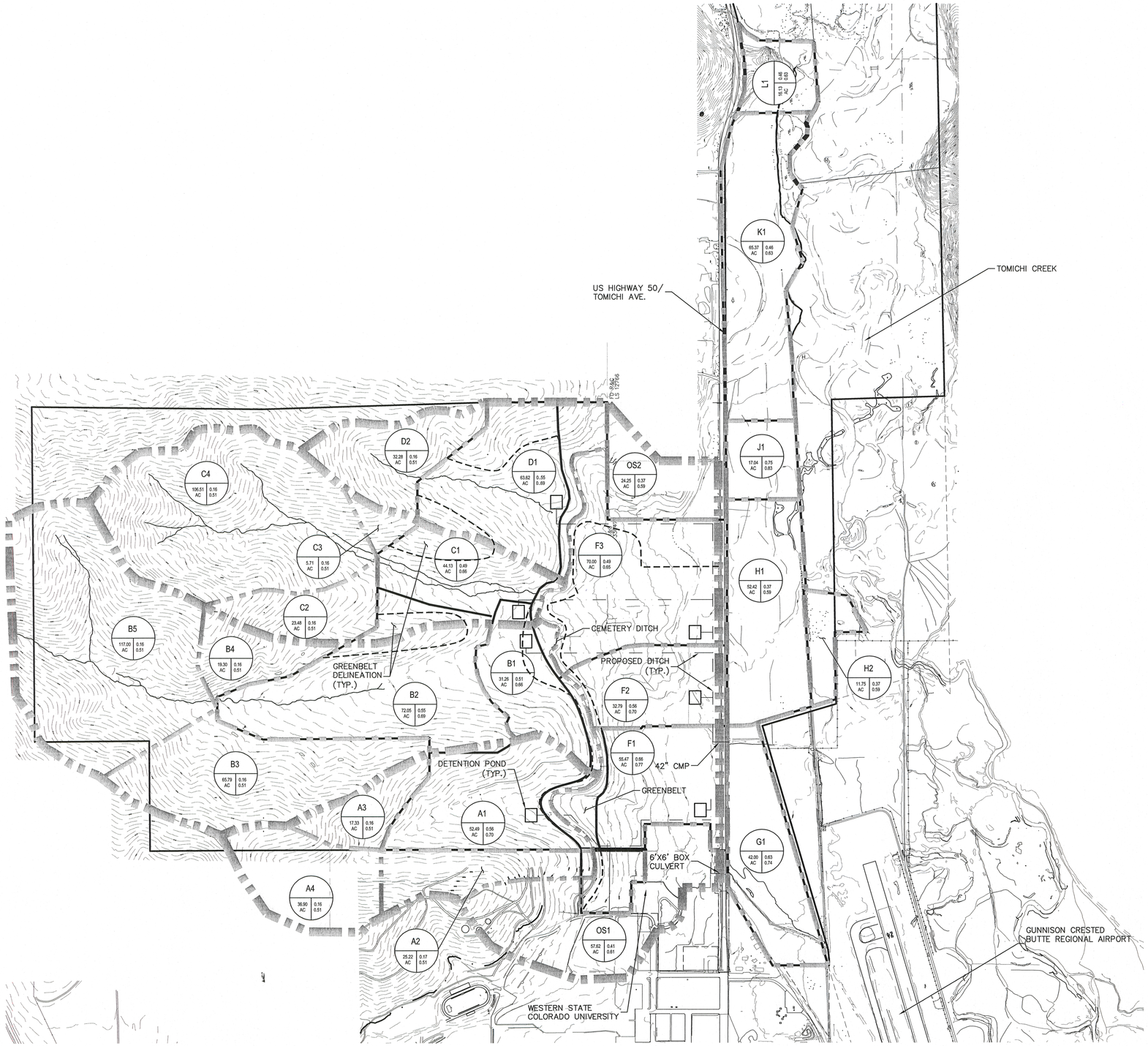
PREPARED UNDER THE DIRECT SUPERVISION OF GINA B. GRAVES COLORADO REGISTRATION NO. 39761 FOR AND ON BEHALF OF CLC ASSOCIATES

DATE	DESCRIPTION
11.02.12	FIRST CITY SUBMITTAL
01.30.13	SECOND CITY SUBMITTAL
04.04.13	APPROVED CITY SUBMITTAL

HISTORIC DRAINAGE PLAN

PROJECT #: 12-0156
DRAWN BY: GBG
DESIGNED BY: GBG
CHECKED BY: TDW

D-1



LEGEND

- PROPOSED LOT LINE
- BASIN BOUNDARY
- SUB-BASIN BOUNDARY
- PHASING LINE
- GREENBELT DELINEATION
- DIRECTION OF FLOW
- BASIN NAME
- BASIN AREA
- C_5
- C_{100}
- PROPOSED DETENTION POND
- PROPOSED DITCH DELINEATION

GENERAL NOTES

1. THE PROPOSED DETENTION PONDS AS SHOWN HERE ARE CONCEPTUAL IN BOTH SIZE AND LOCATION.
2. THE PROPOSED DITCH THAT ROUTES STORM RUNOFF FROM PROPOSED DETENTION PONDS TO OUTFALL IS CONCEPTUAL IN LOCATION.
3. ADJACENT PROPOSED PARCELS, SUB-BASINS, AND/OR DEVELOPMENTS WILL PROVIDE ANY EASEMENTS OR RIGHT-OF-WAYS NECESSARY TO ROUTE STORMWATER.

CUHP PEAK FLOWS

BASIN	Q5	Q100
B5	0.47	82
C4	0.38	68

RATIONAL FLOWS

	HISTORIC			PROPOSED		
BASIN	Q5	Q10	Q100	Q5	Q10	Q100
A1	13.2	26.9	93.7	46.3	62.0	128.6
A2	5.5	11.2	38.9	5.8	11.6	38.9
A3	3.5	7.1	24.9	3.5	7.1	24.9
A4	7.3	14.7	51.4	7.3	14.7	51.4
B1	7.0	14.2	49.5	22.3	30.1	64.1
B2	17.4	35.3	123.1	59.8	80.1	166.5
B3	12.2	24.7	86.2	12.2	24.7	86.2
B4	4.0	8.2	28.6	4.0	8.2	28.6
C1	9.8	19.9	69.3	30.0	41.3	89.7
C2	5.1	10.3	35.8	5.1	10.3	35.8
C3	1.3	2.7	9.5	1.3	2.7	9.5
D1	14.8	30.0	104.6	50.8	68.10	141.5
D2	7.3	14.8	51.4	7.3	14.8	51.4
F1	15.0	30.4	105.8	61.7	80.6	159.8
F2	8.5	17.4	60.5	29.9	40.0	83.0
F3	17.1	34.7	121.0	52.4	72.1	154.3
G	9.6	19.5	68.1	37.9	49.6	98.7
H1	12.1	24.6	85.7	28.0	41.6	99.1
H2	3.0	6.2	21.4	11.9	10.4	24.8
J	5.2	10.5	36.5	24.2	31.0	59.4
K	18.1	36.8	128.3	52.1	72.2	158.5
L	4.5	9.1	31.7	12.9	17.8	39.1
OS1	27.3	51.7	90.3	27.3	39.2	90.3
OS2	12.2	18.2	43.3	12.2	18.2	43.3

CALL UTILITY NOTIFICATION CENTER OF COLORADO
1-800-922-1987
CALL 2-BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

CAUTION: NOTICE TO CONTRACTOR

THE CONTRACTOR IS SPECIFICALLY CAUTIONED THAT THE LOCATION AND/OR ELEVATION OF EXISTING UTILITIES AS SHOWN ON THESE PLANS IS BASED ON RECORDS OF THE VARIOUS UTILITY COMPANIES AND, WHERE POSSIBLE, MEASUREMENTS TAKEN IN THE FIELD. THE INFORMATION IS NOT TO BE RELIED ON AS BEING EXACT OR COMPLETE. THE CONTRACTOR MUST CALL THE LOCAL UTILITY LOCATION CENTER AT LEAST 48 HOURS BEFORE ANY EXCAVATION TO REQUEST EXACT FIELD LOCATIONS OF THE UTILITIES. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL EXISTING UTILITIES WHICH CONFLICT WITH THE PROPOSED IMPROVEMENTS SHOWN ON THE PLANS.

NORTH 600 0 300 600
SCALE: 1" = 600'

CLC ASSOCIATES
8480 E. ORCHARD RD.
SUITE 2000
GREENWOOD VILLAGE
COLORADO 80111
P 303 770 5600
F 303 770 2349
CLCASSOC.COM

ARCHITECTURE
ENGINEERING PLANNING
LANDSCAPE ARCHITECTURE
LAND SURVEYING

MASTER DRAINAGE STUDY
GUNNISON RISING
GUNNISON, COLORADO

COLORADO LICENSED
GINA B. GRAVES
39761
4/4/13
PROFESSIONAL ENGINEER

PREPARED UNDER THE DIRECT SUPERVISION OF GINA B. GRAVES COLORADO REGISTRATION NO. 39761 FOR AND ON BEHALF OF CLC ASSOCIATES

DATE	DESCRIPTION
11.02.12	FIRST CITY SUBMITTAL
01.30.13	SECOND CITY SUBMITTAL
04.04.13	APPROVED CITY SUBMITTAL

PROPOSED DRAINAGE PLAN

PROJECT #: 12-0156
DRAWN BY: GBG
DESIGNED BY: GBG
CHECKED BY: TDW

D-2