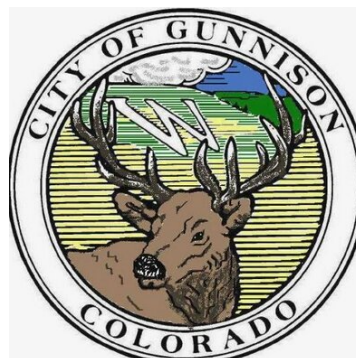


Drainage Report  
City of Gunnison  
North Substation Expansion

**Prepared For:**  
City of Gunnison

**Prepared By:**  
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February 2022



## Signature

The technical material and data contained in this document were prepared under the supervision and direction of the undersigned, whose seal, as a professional engineer licensed to practice as such, is affixed below.

*Sara J. Bergstrom*

Prepared by Sara Bergstrom, EIT



Approved by Cody Tusing, P.E.

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# 1 General Location and Description

The site is 39,271 SF and is preliminarily platted as Lot 2 of the Gunnison Substation Subdivision. There is an existing substation on the south side of Clark Blvd near the northern edge of the City of Gunnison as seen on the Site Vicinity Map.

Plans are to expand the substation to the south and install foundations and poles to support the generation, transmission, and distribution of electric power.

The North Substation is located on the south side of Clark Blvd with homes to the north, vacant property to the west, south and east, and a storage facility beyond the vacant land to the south. The site has existing trails on the vacant land and an irrigation ditch along the east side of the substation site. The vacant land where the substation will be expanded to the south, is vegetated mostly with native grasses and a few cottonwood trees. The site generally slopes from the north east to the south west and is relatively flat, with an overall average slope of 3.5%.

Concrete pads will be added to support the new equipment. The rest of the site will be covered in 6" of base course material and 4" of top rock ( 1 ½" to 2" D50 crushed aggregate).



Figure 1 Site Vicinity Map

## 1.1 Soils

The expansion area property consists of one soil group. However just to the east of the site, another soil type is identified and included in this report. The site specific soil type is identified as Bosler sandy loam (BsB). Adjacent to the site to the east the soil is Dewville loam (DeC). Both soil types are classified as a Soil Group “B” soil.

The USDA hydrologic soil classification of Group B soils are identified as 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

The soil map and soil descriptions are attached in Appendix A.

There are no major or minor drainage ways on the site. There are a few drainage “laterals” which will be filled in with the proposed construction. These are not connected to any primary drainage features.

The site is not located within a 100-year floodplain. A copy of the floodplain map for this property is provided in Appendix B.

No delineated geological hazards or significant geological features are shown for this property.

## 2 Drainage Basins and Subbasins

### 2.1 Major Drainage Basins

For this study, major drainage basin descriptions have been excluded as offsite basins are not included in this analysis.

### 2.2 Minor Drainage Basins

The site will be considered a minor drainage basin.

From the USDA web soil survey, the soil classification is Group B. Group B classified soils shall be used in the drainage calculations contained in this report.

Consistent with Minor Drainage basin requirements the basin will be developed using Low Impact development (LID) practices. The Stormwater management plan is for bio-retention of all developed runoff. Drainage will be directed to one retention basin located on the very south side and perimeter of the parcel. With full retention there are no offsite impacts.



### 3 Drainage Design Criteria

The Stormwater Management Plan was designed in accordance with the City of Gunnison Stormwater Management Manual.

There are no known drainage or master plans for the site. With the LID concepts used there is no influence on adjacent sites.

#### 3.1 Hydrology

- The Rational Method was used for runoff calculations.
- Time of concentration was computed by the FAA method.
- Detention volume was determined using the Detention Volume Rational Volume Method.
- No release rate was calculated as the intent is full retention, capture for storage and release through infiltrative soils.
- With this design concept Hydraulics and water Quality Enhancement do not apply.
- Full drainage calculations are shown in Appendix 3.
- Only 1.5% of the site includes impermeable material (concrete). The rest of the site is base course and top rock. This material exhibits some permeability. Typical C values for gravel or crushed aggregate pavements range between 0.30 to 0.70 based on the degree of compaction. Without a permeability test available for these materials, a C value of 0.57 (100 year) has been assumed for the rock materials.

#### 3.2 Stormwater Management Facility Design

The design concept of bio-retention will be utilized for this site. The proposed grading is uniform across the site and drains from the north to the south. The simplest way to capture the required storage volumes is to install a depressed trench along the southern edge of the site. This location will be out of the way of daily patterns at the facility- maintenance and equipment operations. Designing facilities which can recharge our ground water table is a good practice, especially in arid regions like Gunnison County.

Refer to the attached Drainage Plan to review drainage routing and storage area location.

## 4 Conclusions

Bio-retention has been prescribed for this site. The property is relatively flat and simple, localized drainage patterns will allow for the developed flows to be distributed and absorbed on the site.

The bio-retention area account for the required volumes to store a 1-hour rainfall event for a 100-year storm. The storm water captured shall naturally infiltrate through the existing soils to recharge the groundwater table.

# Appendix 1

## Soil Properties



Soil Map—Gunnison Area, Colorado, Parts of Gunnison, Hinsdale, and Saguache Counties



Soil Map may not be valid at this scale.

Map Scale: 1:830 if printed on A landscape (11" x 8.5") sheet.



## MAP LEGEND

- Area of Interest (AOI)
- Area of Interest (AOI)
- Soils**
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points
- Special Point Features**
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Streams and Canals
- Transportation**
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads
- Background**
- Aerial Photography

## MAP INFORMATION

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

**Warning:** Soil Map may not be valid at this scale.  
 Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

Source of Map: Natural Resources Conservation Service  
 Web Soil Survey URL:  
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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 14, Sep 2, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 31, 2009—Jun 17, 2017

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.

## **Gunnison Area, Colorado, Parts of Gunnison, Hinsdale, and Saguache Counties**

### **BsB—Bosler sandy loam, 1 to 8 percent slopes**

#### **Map Unit Setting**

*National map unit symbol:* jqdm

*Elevation:* 7,800 to 8,500 feet

*Frost-free period:* 50 to 70 days

*Farmland classification:* Farmland of statewide importance

#### **Map Unit Composition**

*Bosler and similar soils:* 85 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### **Description of Bosler**

##### **Setting**

*Landform:* Stream terraces, alluvial fans, streams, drainageways

*Landform position (three-dimensional):* Tread

*Down-slope shape:* Linear

*Across-slope shape:* Linear

*Parent material:* Mixed sandy and gravelly alluvium

##### **Typical profile**

*H1 - 0 to 10 inches:* sandy loam

*H2 - 10 to 22 inches:* sandy loam

*H3 - 22 to 26 inches:* very gravelly sandy clay loam

*H4 - 26 to 32 inches:* very gravelly sandy clay loam

*H5 - 32 to 48 inches:* very cobbly loamy sand

*H6 - 48 to 72 inches:* cobbly sand

##### **Properties and qualities**

*Slope:* 1 to 8 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Well drained

*Runoff class:* Low

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately high to high (0.20 to 2.00 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Calcium carbonate, maximum content:* 10 percent

*Available water supply, 0 to 60 inches:* Low (about 4.4 inches)

##### **Interpretive groups**

*Land capability classification (irrigated):* 6s

*Land capability classification (nonirrigated):* 6c

*Hydrologic Soil Group:* B

*Ecological site:* R048AY311CO - Mountain Outwash

*Hydric soil rating:* No

### **Minor Components**

#### **Curecanti**

*Percent of map unit:*

*Hydric soil rating:* No

#### **Fola**

*Percent of map unit:*

*Hydric soil rating:* No

## **Data Source Information**

Soil Survey Area: Gunnison Area, Colorado, Parts of Gunnison, Hinsdale, and  
Saguache Counties

Survey Area Data: Version 14, Sep 2, 2021

## Gunnison Area, Colorado, Parts of Gunnison, Hinsdale, and Saguache Counties

### DeC—Dewville loam, 5 to 15 percent slopes

#### Map Unit Setting

*National map unit symbol:* jqdv

*Elevation:* 9,000 to 10,000 feet

*Frost-free period:* 50 to 70 days

*Farmland classification:* Farmland of statewide importance

#### Map Unit Composition

*Dewville and similar soils:* 85 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Dewville

##### Setting

*Landform:* Fans, valleys

*Down-slope shape:* Linear

*Across-slope shape:* Linear

*Parent material:* Mixed alluvium derived from sandstone and/or mixed alluvium derived from rhyolite and/or mixed, rhyolite alluvium derived from tuff

##### Typical profile

*Oe - 0 to 1 inches:* moderately decomposed plant material

*H1 - 1 to 10 inches:* loam

*H2 - 10 to 22 inches:* sandy clay loam

*H3 - 22 to 60 inches:* sandy loam

##### Properties and qualities

*Slope:* 5 to 15 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Well drained

*Runoff class:* Medium

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately high to high (0.20 to 2.00 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Calcium carbonate, maximum content:* 10 percent

*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

*Available water supply, 0 to 60 inches:* Moderate (about 7.6 inches)

##### Interpretive groups

*Land capability classification (irrigated):* 6e

*Land capability classification (nonirrigated):* 6c

*Hydrologic Soil Group:* B

*Ecological site:* R048AY311CO - Mountain Outwash  
*Hydric soil rating:* No

**Minor Components**

**Corpening**

*Percent of map unit:*  
*Hydric soil rating:* No

**Hopkins**

*Percent of map unit:*  
*Hydric soil rating:* No

**Rock outcrop**

*Percent of map unit:*  
*Hydric soil rating:* No

**Data Source Information**

Soil Survey Area: Gunnison Area, Colorado, Parts of Gunnison, Hinsdale, and Saguache Counties  
Survey Area Data: Version 14, Sep 2, 2021

## Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BsB	Bosler sandy loam, 1 to 8 percent slopes	2.3	80.7%
DeC	Dewville loam, 5 to 15 percent slopes	0.6	19.3%
<b>Totals for Area of Interest</b>		<b>2.9</b>	<b>100.0%</b>



# Appendix 2

## Floodplain Map

# National Flood Hazard Layer FIRMette

106°55'48"W 38°33'50"N



## Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

**SPECIAL FLOOD HAZARD AREAS**



0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*



**OTHER AREAS OF FLOOD HAZARD**

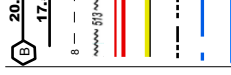
**OTHER AREAS**



**GENERAL STRUCTURES**



**OTHER FEATURES**



**MAP PANELS**



The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on **2/4/2022 at 7:07 PM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.



# Appendix 3

## Hydrologic Calculations

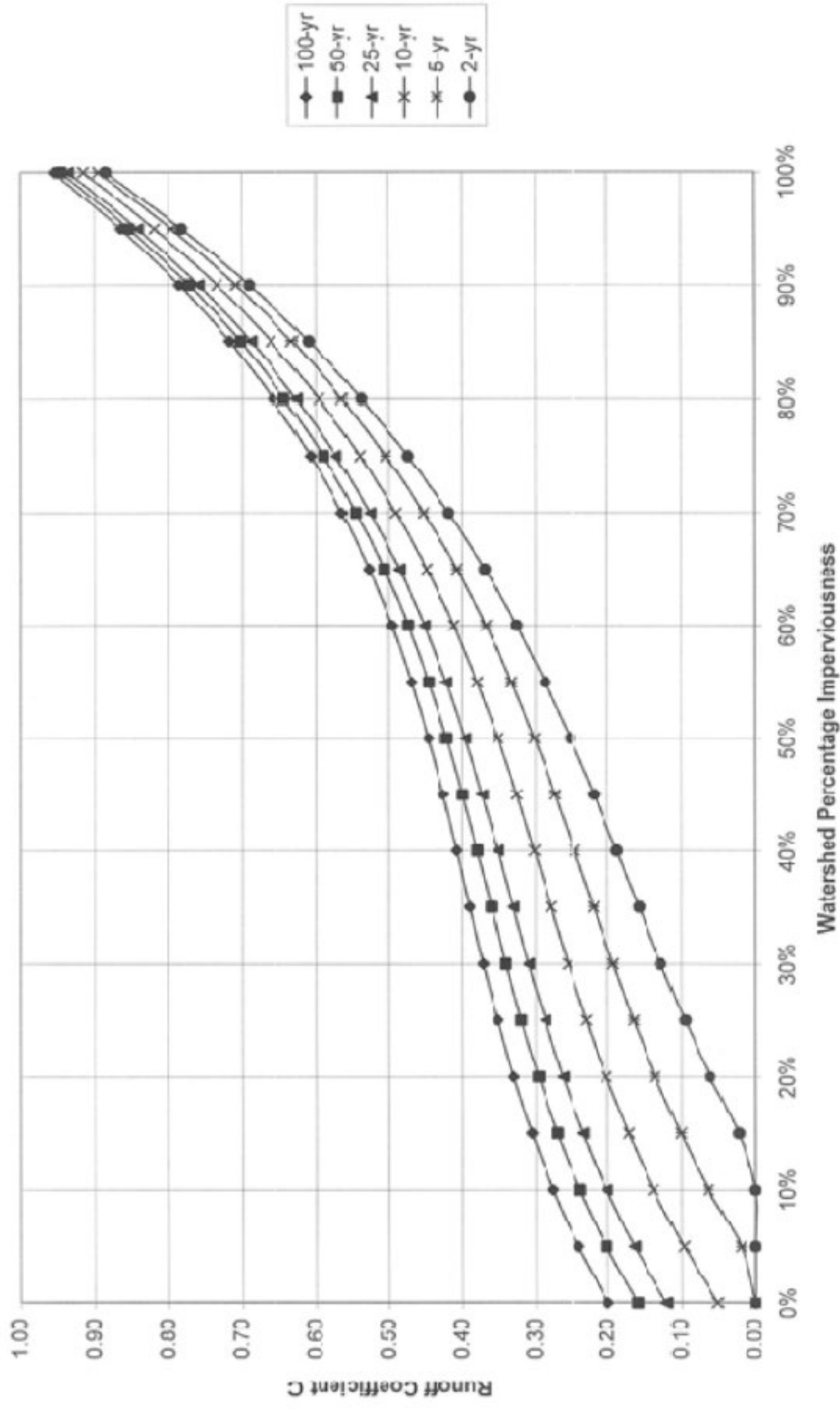




	LOT ID	AREA IN SF	Area in acres	Lo (ft)	To	Tc=Td	I	Q in CFS	runoff volume in CF	Td	C	Vi	Vo	Vd (CF)
Maximum Lot Impervious area														
C runoff Coefficient	A	39271	0.902	50	10	10	4.119668574	2.117002	0.064662821	10	0.57	0.029403	1270.2	-1270.17
P100 year 1 hr rainfall event														
So lot slope														
Lo Overland Flow distance														
To Overland Flow Time														
I= rainfall intensity in inches/hr.														
Vd = Retention Volume required (storage)														

required retention volume





**FIGURE 6 RUNOFF COEFFICIENTS FOR NRCS HYDROLOGIC SOIL GROUP B**



# IDF Rainfall for Gunnison, Colorado

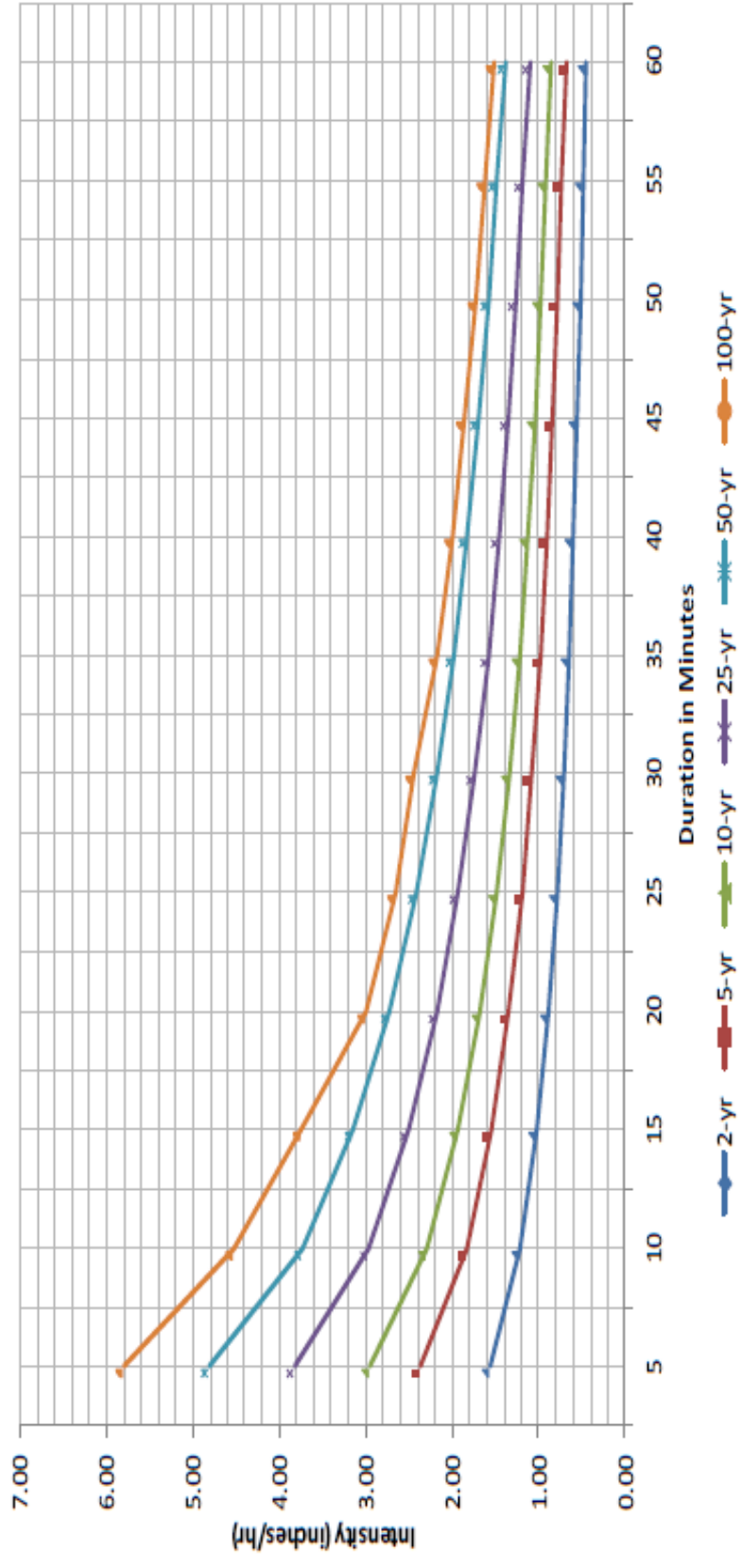


FIGURE 3 RAINFALL IDF FOR GUNNISON, CO

# Appendix 4

## Drainage Plan

