CRABTREE GROUP INC.
ENGINEERING SMART GROWTH™

MEMO

To: City of Gunnison Planning Department

From: Tracy Vandaveer

CC: Cody Tusing

Date: December 22, 2020

Re: Gunnison Rising Government Campus Preliminary Plat Comments

---

1. **COMMENT:** *"Does this include the widening of the roadways and sidewalks?"*

   RESPONSE: The Comment is referring to the Impervious areas for the Buildout Runoff Calculations, post developed conditions in Appendix D. The impervious areas shown do reflect the final buildout conditions. However, preliminary calculations assumed 8' wide sidewalks whereas the most recent engineering plans by Williams Engineering show 12' wide sidewalks. Therefor, the Impervious areas have been updated for the Final Drainage Report.

2. **COMMENT:** *"Will alleys be paved and are they bring included?"*

   RESPONSE: There a no alleys within the Government Campus and we assume that the reviewer is referring to the Shared Driveways. The Analysis assumed impervious areas, which would include paved driveways, based on allowed building sizes, as described in section 6.2 of the report.

3. **COMMENT:** *"Shouldn't this be modified as the swales change the flow path and time of concentration?"*

   RESPONSE: The Reviewer is correct that the flow paths are likely to change as sites are developed. However, site development will occur over time and, since the predevelopment flow path is the most direct route, it will result in longer flow paths as development carries drainage on a more circuitous route. Since longer flow paths would lead to lower peak flows, assuming that the flow path remains the same is a more conservative assumption.

PH:719-539-1675
325 D. Street, Salida, CO 81201

DECEMBER 22, 2020

Subdivision Drainage Report

Government Campus Subdivision

GUNNISON, COLORADO

TRACY VANDAVEER
Crabtree Group Inc.
Salida, Colorado

Project No. #20020

719.539.1675
719.221.1799

325 D Street, P.O. Box 924, Salida, CO 81201
918 Cuyama Road Ojai, CA 93023

crabtreegroupinc.com

s:\20020 gunnison rising\analysis and design\drainage\20020-drainage report.docx

Contents

1 Executive Summary 1
2 Location and Description 1
3 Existing Conditions 2
3.1 Topography 2
3.2 Vegetation 2
3.3 Floodplains 3
3.4 Drainage Patterns 3
4 Soils 3
5 Precipitation 4
6 Runoff Analysis 5
6.1 Off-Site Runoff 5
6.2 On-Site Runoff 6
6.3 Stormwater Conveyance 7
7 Stormwater Quality 8
8 Conclusion and Recommendations 8
9 Works Cited 9
Appendix A A-1
Appendix B B-1
Appendix C C-1
Appendix D D-1

1 EXECUTIVE SUMMARY

The Government Campus Subdivision site was analyzed to determine the magnitude off-site stormwater flows that impact the site and the impacts that the development will have on the historic stormwater runoff rates from the site. The Analysis showed that there are stormwater flows that must be accounted for in the subdivision design. However, the proper design will allow these flows to be safely conveyed across the site. The impact of the subdivision to on-site stormwater flows can be mitigated with on-site detention, which will prevent an increase in the historic 100-year stormwater flows from the site.

2 LOCATION AND DESCRIPTION

The Government Campus Subdivision is a proposed subdivision within the City of Gunnison Colorado, consisting of 25.4 acres of currently vacant land. The subdivision proposes to create 7 commercial lots, with sizes ranging from 2.18 acres to 4.79 acres. The property is located immediately south of U.S. Highway 50, as shown in Figure 1 below and is bounded on the north by U.S. Highway 50, and on the south, east, and west by vacant properties. The properties located east and west of the subject parcel are included in the Gunnison Rising P.U.D. and are expected to see future development. The property to the south of the subject parcel is owned by Colorado Parks and Wildlife and is expected to remain in an undeveloped state.

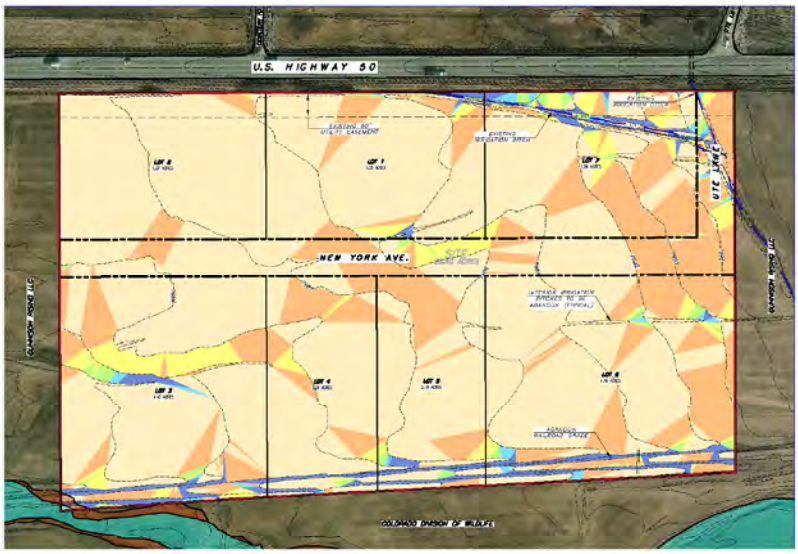
FIGURE 1 - VICINITY MAP

3 EXISTING CONDITIONS

Existing conditions of the subject property were ascertained from aerial photography, topographic surveys, and field reconnaissance of the subject parcel. The site is comprised of irrigated agricultural meadows, with an abandoned railroad grade along the southern boundary.

3.1 TOPOGRAPHY

The site consists of flat meadowland, gently sloping to the southwest. The majority of the site slopes



SLOPES TABLE

NUMBER	MIN. SLOPE	MAX. SLOPE	COLOR
1	0%	1%	
2	1%	2%	
3	2%	3%	
4	3%	4%	
5	4%	5%	
6	5%	600%	

FIGURE 2 - SLOPES MAP

less than 3% in a southwesterly direction, with small areas on the northerly and southerly boundaries exceeding 5%, as shown in Figure 2.

3.2 VEGETATION

The site has historically been irrigated with vegetation consisting of relatively dense meadow grasses, with sparse brush along the northerly and southerly boundaries.

3.3 FLOODPLAINS

The Site is included on FEMA Flood Insurance Rate Map (FIRM) Map no. 08051C1267D, which shows the extreme southwest corner of the site being in the 100-year floodplain. Although the floodplain encroaches onto the site, the portion of the site impacted is within an open space easement and, therefore, will not impact the development.

FIGURE 3 - FLOODPLAIN

3.4 DRAINAGE PATTERNS

Existing drainage patterns on the site generally flow in a southwesterly direction. The abandoned railroad grade along the southern boundary of the site prevents water from exiting along that boundary, channeling the flows in a westerly direction and discharging at the western boundary.

The site is also impacted by off-site stormwater flows at the northeast corner and eastern boundary (see Figure 5 - Off-Site Tributaries). An existing concrete box culvert under U.S. Highway 50 directs flows from north of the site to the northeast corner of the subject site. These flows then spread and flow southeasterly to the adjoining property east of the site. Additionally, similar to the subject site, the abandoned railroad grade channels water onto the southeast corner of the subject site.

4 SOILS

Information for the on-site soils was obtained from the USDA Web Soil Survey (U.S. Department of Agriculture, n.d.). The soils consist primarily of Dewville loam (DeB) with a small area in the northeast corner consisting of Evanston loam (EvB), and the southern boundary being comprised of Irim Loam (IrA). The Dewville series of soils are assigned to Hydraulic Soils Group B, while the Evanston series soils are assigned a Hydraulic rating of C, and Irim Series are assigned B/D. The site Soil information is shown in Figure 4. Soils Map and summarized in Table 1 below, with the USDA Soils report included in Appendix A.

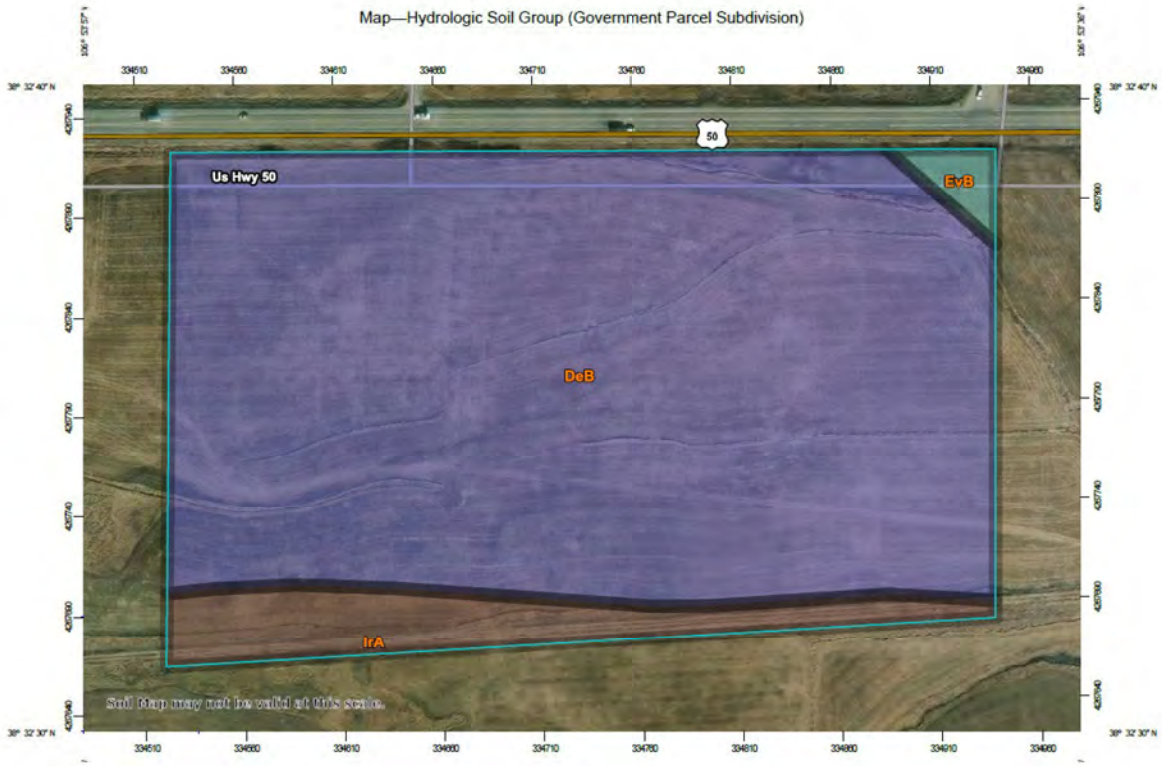


FIGURE 4 – SOILS MAP

TABLE 1 – HYDRAULIC SOILS GROUPS

Saturated Hydraulic Soils Group Table				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
DeB	Dewville loam, 1 to 5 percent slopes	B	22.7	89.2%
EvB	Evanston loam, 1 to 5 percent slopes	C	0.3	1.3%
IrA	Irim loam, 1 to 9 percent slopes	D	2.4	9.5%
Totals for Area of Interest			25.4	100.0%

5 PRECIPITATION

Precipitation amounts for the Design Storms were obtained from the NOAA precipitation frequency estimates (National Weather Service, 2020) for the subject area. The Design Storms utilized in the analysis are summarized in Table 2 below, with the NOAA report included in Appendix C.

TABLE 2 – DESIGN STORMS

	Design Storm				
	2yr-24hr	10yr-24hr	25yr-24hr	50yr-24hr	100yr-24hr
Cumulative Rainfall (in)	1.00	1.41	1.68	1.91	2.14

6 RUNOFF ANALYSIS

The site is impacted by offsite runoff, which must be conveyed through the site, and on-site development, which will increase the amount of stormwater runoff from the site due to the increases in the impermeable area of the site.

6.1 OFF-SITE RUNOFF

The subject parcel is impacted by off-site flows entering the site at the northeast and southeast boundaries, which must be conveyed across the property. Flows entering the site at the northeast corner originate north of U.S. Highway 50 and are conveyed under the highway via a concrete box culvert. Flows entering the site at the southeast corner are channeled onto the site along the abandoned railroad grade.

Off-site flows entering the site were calculated using regression equations developed by the U.S.G.S. for determining peak flows in ungauged basins, as documented in U.S.G.S. Scientific Investigation Report 2009-5136 (Capesius, 2009). This Analysis was completed using U.S.G.S. "StreamStats" software (U.S. Geological Survey, 2020), with the tributary areas for the northeast and southeast corners being 2.13 sq. mi. and 2.16 sq. mi. (includes 2.13sq. mi. north of highway) respectively, and the 100-year peak flows calculated to be 28.5 cfs and 28.8 cfs, respectively.

FIGURE 5 - OFF-SITE TRIBUTARIES

6.2 ON-SITE RUNOFF

The Analysis of the on-site stormwater flows was performed utilizing the methods described in the Soil Conservation Service Technical Release #55 (Soil Conservation Service, 1986), with a Type II storm distribution. The site was analyzed in the pre-construction, Initial Development, and Buildout conditions to determine the impact of the development on stormwater flow in the area. Pre-Construction conditions were ascertained from aerial photography, topographic mapping, and field reconnaissance of the existing site. Initial Development and Buildout conditions were determined from engineering plans and the proposed subdivision plat, with post-development impermeable area assumed to be 1.72 acres of buildings, 0.6 acres of parking, and 1.6 acres of public roadway. The assumptions are based on Appendix G of the development report, as shown in Table 3 and the proposed road design for the subdivision. Calculations for the on-site generated runoff are summarized in Table 4 below and included in Appendix D.

TABLE 3 - DEVELOPMENT REPORT, APPENDIX G

Lot	Building Gross Floor Area (sq. ft.)	Parking Spaces Required	Site Plan Parking Ar (sq. ft.)
Lot 1	8,000	8	2,800
Lot 2	8,000	8	2,800
Lot 3	15,000	15	5,250
Lot 4	12,000	12	4,200
Lot 5	12,000	12	4,200
Lot 6	15,000	15	5,250
Lot 7	5,000	5	1,750

TABLE 4 - ON-SITE RUNOFF TABLE

Development Stage	Design Storms				
	2-yr	10-yr	25-yr	50-yr	100-yr
Pre-Development	0.1	0.5	1.1	2.1	3.3
Buildout	0.1	0.7	1.5	2.7	4.1
Difference	0.1	0.2	0.5	0.6	0.8
Buildout	0.2	1.2	2.8	4.6	6.7
Difference	0.2	0.7	1.8	2.5	3.4

The Analysis showed that development of the site can be expected to increase the amount of stormwater generated on-site. In the initial stages of the of the development, individual lots will remain in a predominately undeveloped condition, with the new roadways comprising the new impervious areas. In this state, the increased runoff will be minimal (0.8 cfs). Under these conditions, a minimum of 6,050 cubic feet is required to maintain the historic runoff rates from the site.

As lots develop, the amount of impervious area will increase, resulting in increased runoff rates. To model this, The impervious areas Appendix G of the development report were used to calculate the stormwater impacts at buildout (shown in Table 4), and the detention volumes required to mitigate this impact. The detention volume required to maintain the pre-development runoff rates for a 100-yr design

storm was calculated to be 12,000 cubic feet. The total detention volume required was proportioned across the lots based on the amount of impermeable area expected on that lot. Detention requirements calculated for each lot are shown in Table 5 below.

TABLE 5 - LOT DETENTION REQUIREMENTS

Lot No.	Bldg. Area (sq. ft.)	Parking Spaces Required	Parking Area (sq. ft.)	Impermeable Area (sq. ft.)	Detention Required
1	8,000	8	2,800	10,800	1,280
2	8,000	8	2,800	10,800	1,280
3	15,000	15	5,250	20,250	2,400
4	12,000	12	4,200	16,200	1,920
5	12,000	12	4,200	16,200	1,920
6	15,000	15	5,250	20,250	2,400
7	5,000	5	1,750	6,750	800
			Totals	**101,250**	**12,000**

Note: Detention volumes shown in Table 5 are based on assumed lot coverages. Actual lot coverage will not be known until specific site plans are developed and may differ from the assumed coverages. Engineered site plans for individual lots should be submitted for review prior to approval of construction on the lot. Lots coverages different from those assumed will require engineered drainage plans and/or revision of this report.

6.3 STORMWATER CONVEYANCE

To maintain conveyance of the offsite flows through the site, channels and culverts must be correctly sized. Although final sizing should be completed by the design engineer, preliminary sizing calculations were completed for the culvert required to convey off-site stormwater across Ute Lane, and for a stormwater channel along the southern boundary to verify subdivision plausibility. Preliminary sizing shows that a 36"

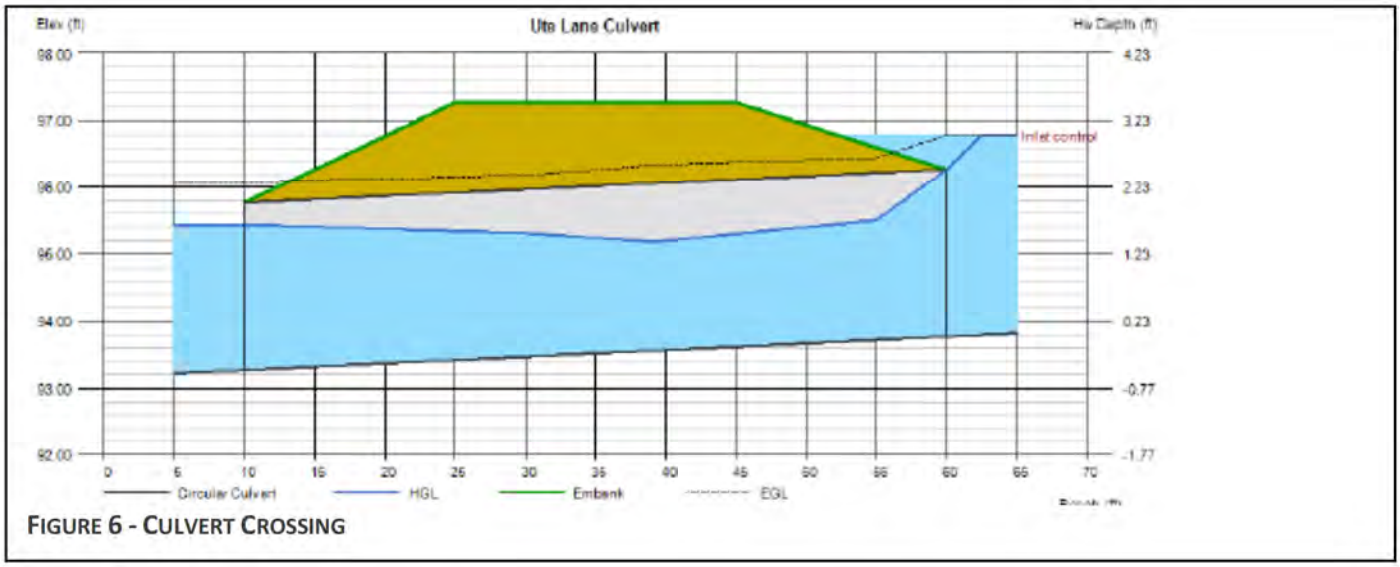


FIGURE 6 - CULVERT CROSSING

diameter culvert is adequate to carry the design flows at the northeast corner. For the channel, a trapezoidal channel with 3' depth, 3:1 side slopes, and 3' bottom is adequate to carry the design flows.

7 Stormwater Quality

Development tends to increase the potential for pollutants, especially during construction. However, without site-specific plans to identify potential pollution sources, an analysis of Best Management Practices (BMPs) is not possible. Future construction should be required to provide stormwater management plans, specific to the lot being developed, that identifies pollution sources and treatment methods that will be utilized to minimize the migration of pollutants from the site, both during and after construction. Priority should be placed on infiltration methods that minimize the opportunity for pollutants to reach the natural drainages.

8 Conclusion and Recommendations

The development within the subdivision must be designed to mitigate stormwater impacts and convey offsite and on-site stormwater where applicable. The following recommendations will ensure that stormwater is safely conveyed through the site and the impacts to historic stormwater runoff rates are mitigated:

- Road design at the northeast corner of the subdivision should allow for a minimum of 29 cfs of stormwater flow to cross the road.
- A 25' wide drainage easement should be provided along the south boundary of the subdivision plat.
- Site grading should allow for conveyance of 36 cfs of stormwater adjacent to the abandoned railroad grade along the southern boundary.
- A minimum of 6,050 cubic feet of stormwater detention is required to mitigate stormwater impacts from the subdivision roadways.
- The site design of each lot should be required to incorporate the minimum on-site detention volume indicated in Table 5 of this report, or an engineered drainage plan showing compliance with the City of Gunnison Drainage standards.
- Site Plans for individual lots should require review for compliance with this report and engineered drainage plans.

9 Works Cited

Capesius, J. a. (2009). *Regional Regression Equations for Estimation of Natural Streamflow Statisics in Colorado.* U.S. Geological Survey; Scientific Investigations Report 2009-5136.

National Weather Service. (2020, August 24). *Precipitation Frequency Data Server*. Retrieved from Hydrometeorological Design Studies Center: https://hdsc.nws.noaa.gov

Soil Conservation Service. (1986). *Urban Hydrology for Small Watersheds.*

U.S. Department of Agriculture. (n.d.). *Web Soil Survey*. Retrieved August 21, 2020, from http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

U.S. Geological Survey. (2020, August 21). *StreamStats*. Retrieved from https://streamstats.usgs.gov/ss/

USDA. (1986). *Urban Hydrology for Small Watersheds.*

Appendix A

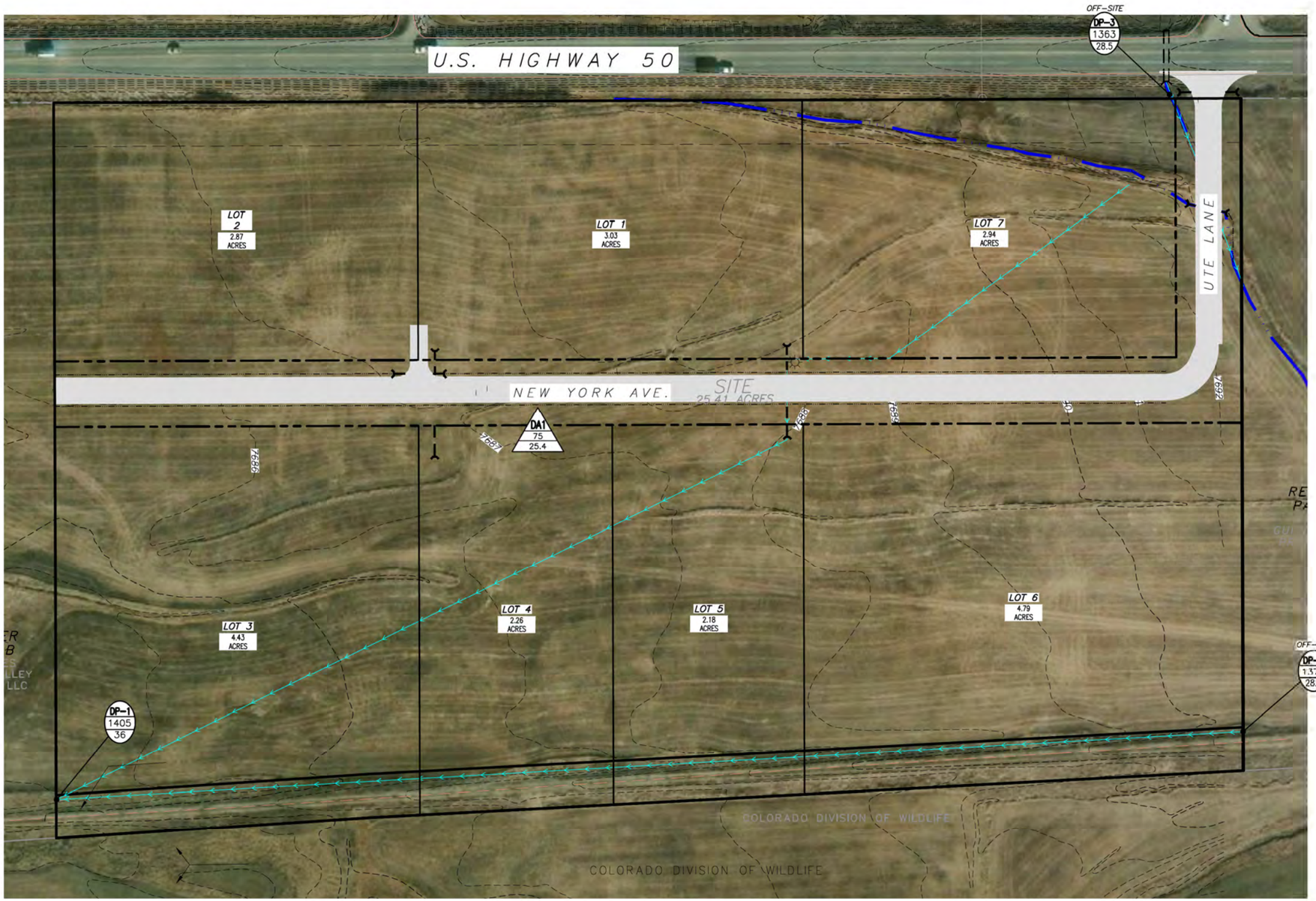
DRAINAGE MAP

GOVERNMENT CAMPUS SUBDIVISION

DRAINAGE MAP

GUNNISON, COLORADO

DECEMBER, 2020



N

GRAPHIC SCALE

60' 0 60' 120' 180'

(CONTOUR INTERVAL = 1 FOOT)

LEGEND

- IRRIGATION DITCH
- EASEMENT LINE
- INDEX CONTOUR
- INTERMEDIATE CONTOUR
- SUBDIVISION BOUNDARY
- SUBDIVISION LOT LINE
- ROAD RIGHT-OF-WAY LINE
- DRAINAGE FLOWPATH

A / B / C

A BASIN DESIGNATION
B COMPOSITE RUNOFF COEFFICIENT
C DRAINAGE BASIN AREA (ACRES)

XX / XXX / XX

D DESIGN POINT DESIGNATION
E DESIGN POINT TRIBUTARY AREA (ACRES)
F DESIGN POINT 100-YR FLOW RATE (CFS)

PREPARED BY:

CRABTREE GROUP INC.
ENGINEERING SMART GROWTH™

SHEET NO. 1 OF 1

GOVERNMENT CAMPUS SUBDIVISION - DRAINAGE MAP

Appendix B

SOILS REPORT

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Gunnison Area, Colorado, Parts of Gunnison, Hinsdale, and Saguache Counties

August 21, 2020

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Preface 2
How Soil Surveys Are Made 5
Soil Map 8
Soil Map (Government Parcel Subdivision) 9
Legend 10
Map Unit Legend (Government Parcel Subdivision) 12
Map Unit Descriptions (Government Parcel Subdivision) 12
Gunnison Area, Colorado, Parts of Gunnison, Hinsdale, and Saguache Counties 14
DeB—Dewville loam, 1 to 5 percent slopes 14
EvB—Evanston loam, 1 to 5 percent slopes 15
IrA—Irim loam, 0 to 1 percent slopes 16
Soil Information for All Uses 18
Soil Properties and Qualities 18
Soil Physical Properties 18
Saturated Hydraulic Conductivity (Ksat), Standard Classes (Government Parcel Subdivision) 18
Soil Qualities and Features 23
Drainage Class (Government Parcel Subdivision) 23
Hydrologic Soil Group (Government Parcel Subdivision) 27
Soil Reports 33
AOI Inventory 33
Map Unit Description (Brief, Generated) (Government Parcel Subdivision) 33
Soil Erosion 36
RUSLE2 Related Attributes (Government Parcel Subdivision) 36
References 38

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

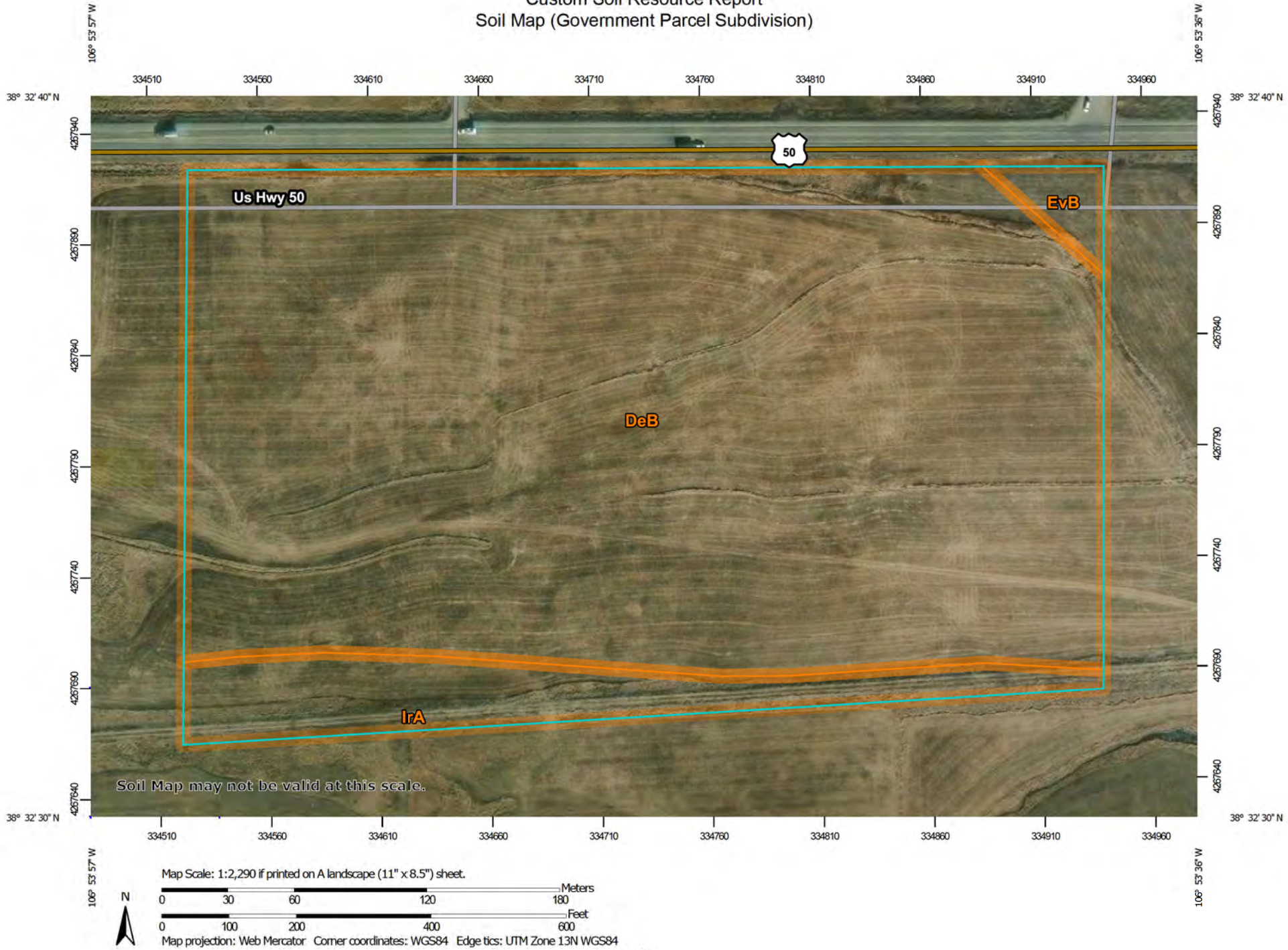
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map (Government Parcel Subdivision)



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
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- 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 13, Jun 9, 2020

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

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend (Government Parcel Subdivision)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
DeB	Dewville loam, 1 to 5 percent slopes	22.7	89.2%
EvB	Evanston loam, 1 to 5 percent slopes	0.3	1.3%
IrA	Irim loam, 0 to 1 percent slopes	2.4	9.5%
Totals for Area of Interest		**25.5**	**100.0%**

Map Unit Descriptions (Government Parcel Subdivision)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

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

DeB—Dewville loam, 1 to 5 percent slopes

Map Unit Setting

National map unit symbol: jqdt
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: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dewville

Setting

Landform: Fans, terraces, valleys
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed, rhyolite alluvium derived from tuff and/or mixed alluvium derived from rhyolite and/or mixed alluvium derived from sandstone

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: 1 to 5 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
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): 5c
Land capability classification (nonirrigated): 6c
Hydrologic Soil Group: B
Ecological site: R048AY281CO - 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

EvB—Evanston loam, 1 to 5 percent slopes

Map Unit Setting

National map unit symbol: jqdz
Elevation: 8,000 to 10,000 feet
Frost-free period: 50 to 70 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Evanston and similar soils: 90 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Evanston

Setting

Landform: Valleys, alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Rhyolitic alluvium derived from tuff and/or alluvium derived from rhyolite and/or alluvium derived from sandstone

Typical profile

H1 - 0 to 6 inches: loam
H2 - 6 to 9 inches: loam
H3 - 9 to 14 inches: clay loam
H4 - 14 to 18 inches: loam
H5 - 18 to 60 inches: loam

Properties and qualities

Slope: 1 to 5 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 (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent

Available water capacity: High (about 9.3 inches)

Interpretive groups

Land capability classification (irrigated): 5c
Land capability classification (nonirrigated): 6c
Hydrologic Soil Group: C
Ecological site: R048AY281CO - Mountain Outwash
Hydric soil rating: No

Minor Components

Wet soils

Percent of map unit: 3 percent
Landform: Depressions
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Dewville

Percent of map unit:
Hydric soil rating: No

Fola

Percent of map unit:
Hydric soil rating: No

Curecanti

Percent of map unit:
Hydric soil rating: No

IrA—Irim loam, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: jqf7
Elevation: 7,800 to 8,500 feet
Frost-free period: 60 to 70 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Irim and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Irim

Setting

Landform: Streams, flood plains, drainageways
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Recent, mixed origin alluvium

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
H1 - 2 to 11 inches: loam
H2 - 11 to 60 inches: very gravelly loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: RareNone
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Low (about 5.9 inches)

Interpretive groups

Land capability classification (irrigated): 5w
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Gas creek

Percent of map unit: 5 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Alluvial land

Percent of map unit: 5 percent
Hydric soil rating: No

Big blue

Percent of map unit: 5 percent
Landform: Depressions
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Physical Properties

Soil Physical Properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Saturated Hydraulic Conductivity (Ksat), Standard Classes (Government Parcel Subdivision)

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity is considered in the design of soil drainage systems and septic tank absorption fields.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

The numeric Ksat values have been grouped according to standard Ksat class limits. The classes are:

Very low: 0.00 to 0.01

Low: 0.01 to 0.1

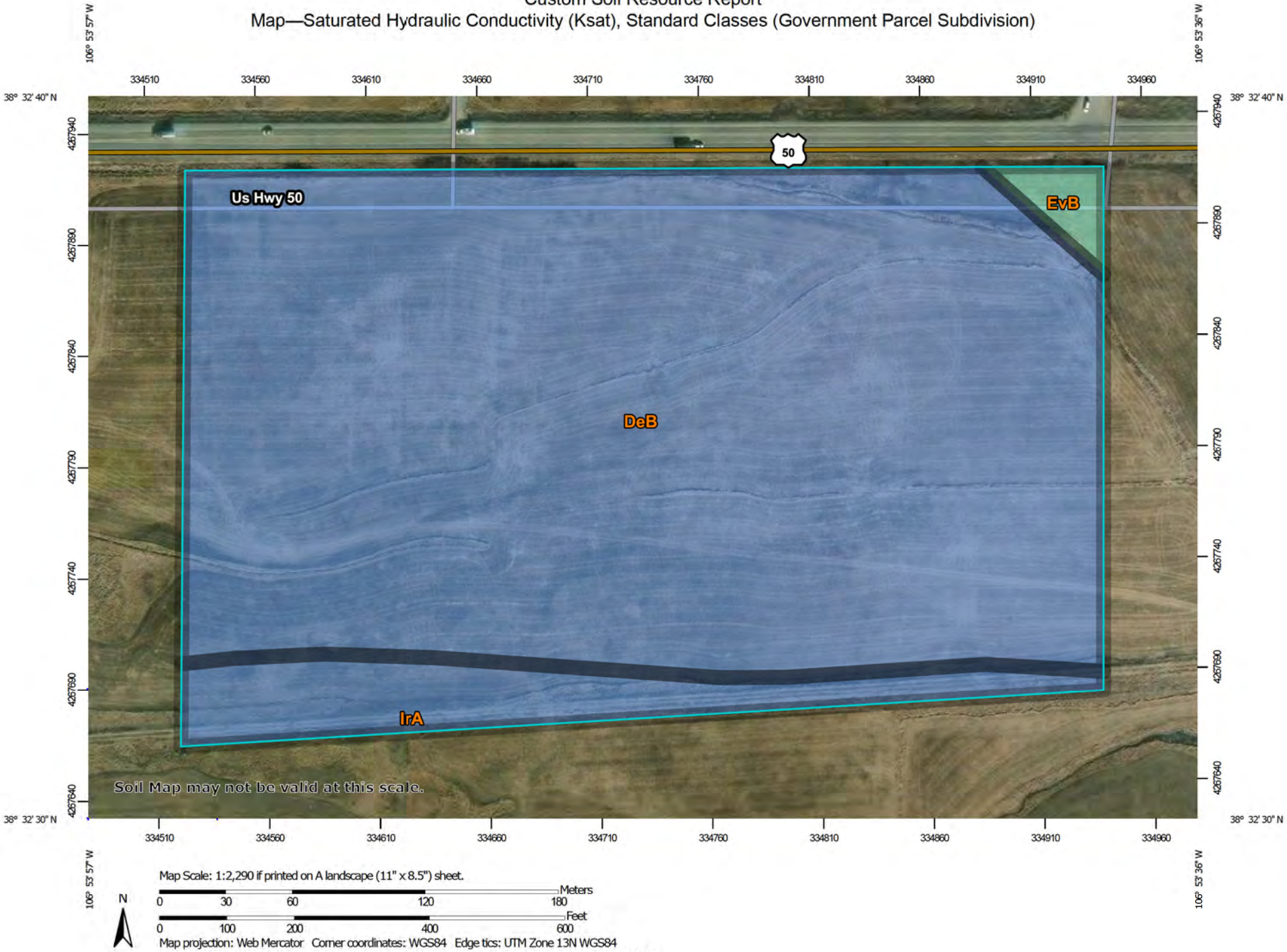
Moderately low: 0.1 to 1.0

Moderately high: 1 to 10

High: 10 to 100

Very high: 100 to 705

Map—Saturated Hydraulic Conductivity (Ksat), Standard Classes (Government Parcel Subdivision)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- Very Low (0.0 - 0.01)
- Low (0.01 - 0.1)
- Moderately Low (0.1 - 1)
- Moderately High (1 - 10)
- High (10 - 100)
- Very High (100 - 705)
- Not rated or not available

Soil Rating Lines
- Very Low (0.0 - 0.01)
- Low (0.01 - 0.1)
- Moderately Low (0.1 - 1)
- Moderately High (1 - 10)
- High (10 - 100)
- Very High (100 - 705)
- Not rated or not available

Soil Rating Points
- Very Low (0.0 - 0.01)
- Low (0.01 - 0.1)
- Moderately Low (0.1 - 1)
- Moderately High (1 - 10)
- High (10 - 100)
- Very High (100 - 705)
- Not rated or not available

Water Features
- 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 13, Jun 9, 2020

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

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Saturated Hydraulic Conductivity (Ksat), Standard Classes (Government Parcel Subdivision)

Map unit symbol	Map unit name	Rating (micrometers per second)	Acres in AOI	Percent of AOI
DeB	Dewville loam, 1 to 5 percent slopes	25.5763	22.7	89.2%
EvB	Evanston loam, 1 to 5 percent slopes	8.6269	0.3	1.3%
IrA	Irim loam, 0 to 1 percent slopes	20.8718	2.4	9.5%
Totals for Area of Interest			**25.5**	**100.0%**

Rating Options—Saturated Hydraulic Conductivity (Ksat), Standard Classes (Government Parcel Subdivision)

Units of Measure: micrometers per second

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Slowest

Interpret Nulls as Zero: No

Layer Options (Horizon Aggregation Method): All Layers (Weighted Average)

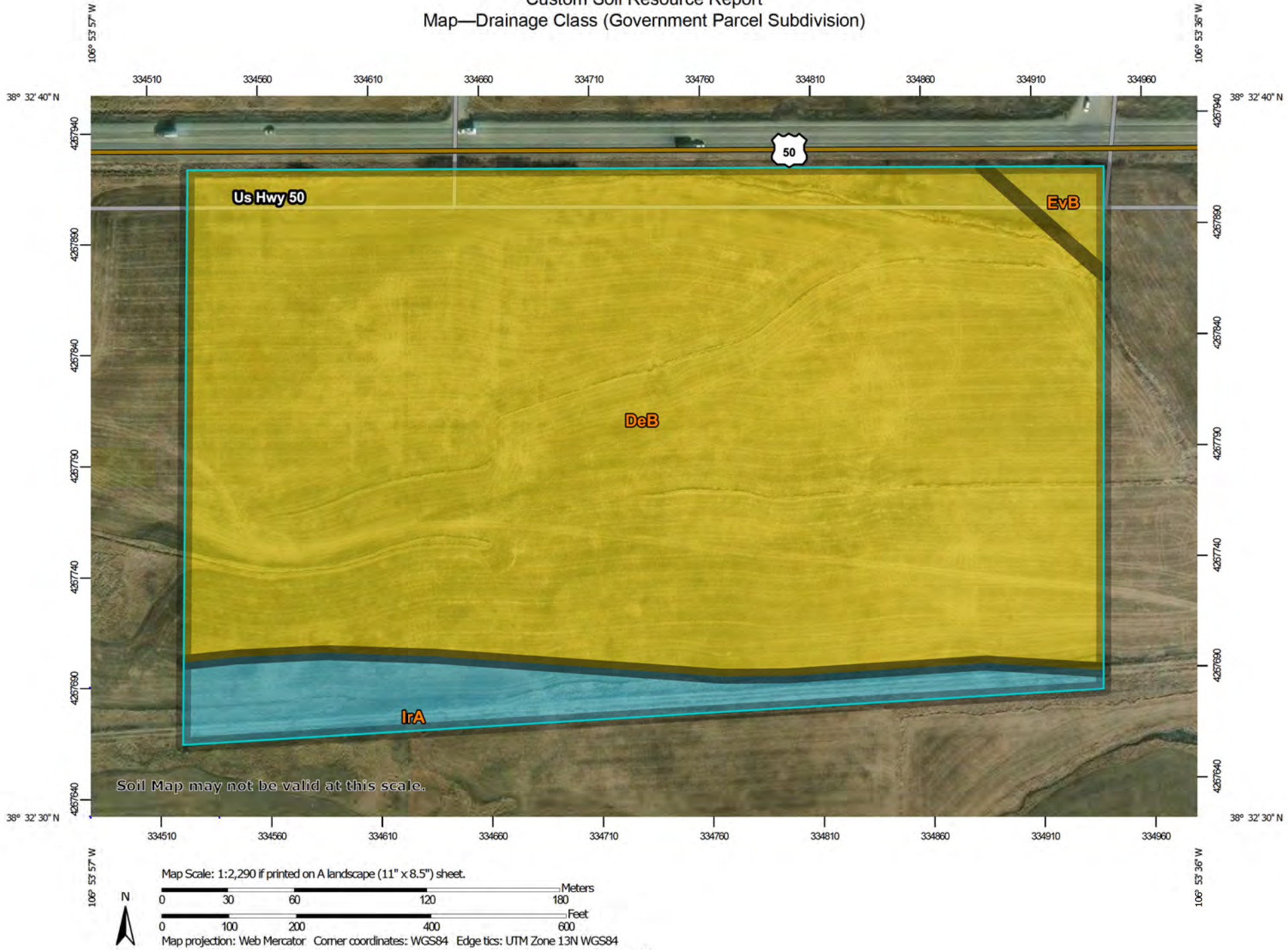
Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Drainage Class (Government Parcel Subdivision)

"Drainage class (natural)" refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized-excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained. These classes are defined in the "Soil Survey Manual."

Custom Soil Resource Report
Map—Drainage Class (Government Parcel Subdivision)



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- Excessively drained
- Somewhat excessively drained
- Well drained
- Moderately well drained
- Somewhat poorly drained
- Poorly drained
- Very poorly drained
- Subaqueous
- Not rated or not available

Soil Rating Lines

- Excessively drained
- Somewhat excessively drained
- Well drained
- Moderately well drained
- Somewhat poorly drained
- Poorly drained
- Very poorly drained
- Subaqueous
- Not rated or not available

Soil Rating Points

- Excessively drained
- Somewhat excessively drained
- Well drained
- Moderately well drained
- Somewhat poorly drained
- Poorly drained
- Very poorly drained
- Subaqueous
- Not rated or not available

Water Features

- 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 13, Jun 9, 2020

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

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Drainage Class (Government Parcel Subdivision)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
DeB	Dewville loam, 1 to 5 percent slopes	Well drained	22.7	89.2%
EvB	Evanston loam, 1 to 5 percent slopes	Well drained	0.3	1.3%
IrA	Irim loam, 0 to 1 percent slopes	Poorly drained	2.4	9.5%
Totals for Area of Interest			**25.5**	**100.0%**

Rating Options—Drainage Class (Government Parcel Subdivision)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Hydrologic Soil Group (Government Parcel Subdivision)

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.

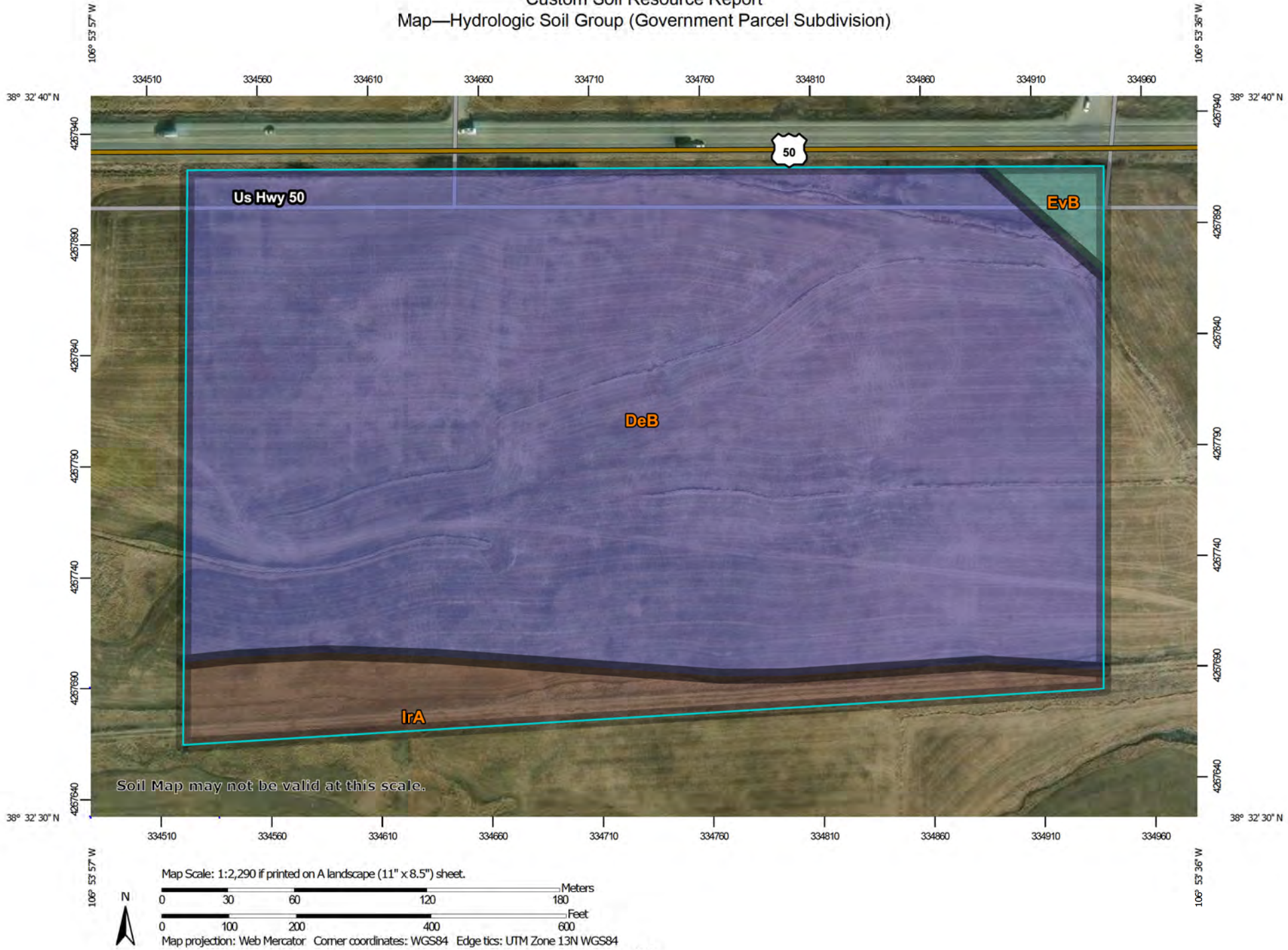
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

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.

Custom Soil Resource Report
Map—Hydrologic Soil Group (Government Parcel Subdivision)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- 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 13, Jun 9, 2020

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

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Hydrologic Soil Group (Government Parcel Subdivision)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
DeB	Dewville loam, 1 to 5 percent slopes	B	22.7	89.2%
EvB	Evanston loam, 1 to 5 percent slopes	C	0.3	1.3%
IrA	Irim loam, 0 to 1 percent slopes	B/D	2.4	9.5%
Totals for Area of Interest			**25.5**	**100.0%**

Rating Options—Hydrologic Soil Group (Government Parcel Subdivision)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

AOI Inventory

This folder contains a collection of tabular reports that present a variety of soil information. Included are various map unit description reports, special soil interpretation reports, and data summary reports.

Map Unit Description (Brief, Generated) (Government Parcel Subdivision)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this report, along with the maps, provide information on the composition of map units and properties of their components.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

The Map Unit Description (Brief, Generated) report displays a generated description of the major soils that occur in a map unit. Descriptions of non-soil (miscellaneous areas) and minor map unit components are not included. This description is generated from the underlying soil attribute data.

Additional information about the map units described in this report is available in other Soil Data Mart reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the Soil Data Mart reports define some of the properties included in the map unit descriptions.

Report—Map Unit Description (Brief, Generated) (Government Parcel Subdivision)

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

Map Unit: DeB—Dewville loam, 1 to 5 percent slopes

Component: Dewville (90%)

The Dewville component makes up 90 percent of the map unit. Slopes are 1 to 5 percent. This component is on older terraces, fill valleys, recent, small fans. The parent material consists of mixed, rhyolite alluvium derived from tuff and/or mixed alluvium derived from rhyolite and/or mixed alluvium derived from sandstone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 85 percent. Below this thin organic horizon the organic matter content is about 1 percent. This component is in the R048AY281CO Mountain Outwash ecological site. Nonirrigated land capability classification is 6c. Irrigated land capability classification is 5c. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 6 percent. There are no saline horizons within 30 inches of the soil surface.

Component: Hopkins (%)

Generated brief soil descriptions are created for major soil components. The Hopkins soil is a minor component.

Component: Corpening (%)

Generated brief soil descriptions are created for major soil components. The Corpening soil is a minor component.

Map Unit: EvB—Evanston loam, 1 to 5 percent slopes

Component: Evanston (90%)

The Evanston component makes up 90 percent of the map unit. Slopes are 1 to 5 percent. This component is on fill valleys, alluvial fans. The parent material consists of rhyolitic alluvium derived from tuff and/or alluvium derived from rhyolite and/or alluvium derived from sandstone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches.

Organic matter content in the surface horizon is about 3 percent. This component is in the R048AY281CO Mountain Outwash ecological site. Nonirrigated land capability classification is 6c. Irrigated land capability classification is 5c. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 10 percent.

Component: Wet soils (3%)

Generated brief soil descriptions are created for major soil components. The Wet soils soil is a minor component.

Component: Fola (%)

Generated brief soil descriptions are created for major soil components. The Fola soil is a minor component.

Component: Dewville (%)

Generated brief soil descriptions are created for major soil components. The Dewville soil is a minor component.

Component: Curecanti (%)

Generated brief soil descriptions are created for major soil components. The Curecanti soil is a minor component.

Map Unit: IrA—Irim loam, 0 to 1 percent slopes

Component: Irim (85%)

The Irim component makes up 85 percent of the map unit. Slopes are 0 to 1 percent. This component is on flood plains, side drainageways, major streams. The parent material consists of recent, mixed origin alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is rarely flooded. It is not ponded. A seasonal zone of water saturation is at 12 inches (depth from the mineral surface is 10 inches) during April, May, June. Organic matter content in the surface horizon is about 85 percent. Below this thin organic horizon the organic matter content is about 3 percent. Nonirrigated land capability classification is 5w. Irrigated land capability classification is 5w. This soil meets hydric criteria. There are no saline horizons within 30 inches of the soil surface.

Component: Gas Creek (5%)

Generated brief soil descriptions are created for major soil components. The Gas Creek soil is a minor component.

Component: Alluvial land (5%)

Generated brief soil descriptions are created for major soil components. The Alluvial land soil is a minor component.

Component: Big Blue (5%)

Generated brief soil descriptions are created for major soil components. The Big Blue soil is a minor component.

Soil Erosion

This folder contains a collection of tabular reports that present soil erosion factors and groupings. The reports (tables) include all selected map units and components for each map unit. Soil erosion factors are soil properties and interpretations used in evaluating the soil for potential erosion. Example soil erosion factors can include K factor for the whole soil or on a rock free basis, T factor, wind erodibility group and wind erodibility index.

RUSLE2 Related Attributes (Government Parcel Subdivision)

This report summarizes those soil attributes used by the Revised Universal Soil Loss Equation Version 2 (RUSLE2) for the map units in the selected area. The report includes the map unit symbol, the component name, and the percent of the component in the map unit. Soil property data for each map unit component include the hydrologic soil group, erosion factor Kf for the surface horizon, erosion factor T, and the representative percentage of sand, silt, and clay in the mineral surface horizon. Missing surface data may indicate the presence of an organic layer.

Report—RUSLE2 Related Attributes (Government Parcel Subdivision)

Soil properties and interpretations for erosion runoff calculations. The surface mineral horizon properties are displayed or the first mineral horizon below an organic surface horizon. Organic horizons are not displayed.

RUSLE2 Related Attributes–Gunnison Area, Colorado, Parts of Gunnison, Hinsdale, and Saguache Counties								
Map symbol and soil name	Pct. of map unit	Slope length (ft)	Hydrologic group	Kf	T factor	Representative value		
						% Sand	% Silt	% Clay
DeB—Dewville loam, 1 to 5 percent slopes								
Dewville	90	—	B	.28	5	42.4	38.1	19.5
EvB—Evanston loam, 1 to 5 percent slopes								
Evanston	90	—	C	.28	5	39.2	37.3	23.5

RUSLE2 Related Attributes–Gunnison Area, Colorado, Parts of Gunnison, Hinsdale, and Saguache Counties								
Map symbol and soil name	Pct. of map unit	Slope length (ft)	Hydrologic group	Kf	T factor	Representative value		
						% Sand	% Silt	% Clay
IrA—Irim loam, 0 to 1 percent slopes								
Irim	85	—	B/D	.32	3	44.3	40.7	15.0

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Appendix C

NOAA Precipitation Estimates

NOAA Atlas 14, Volume 8, Version 2
Location name: Gunnison, Colorado, USA*
Latitude: 38.543°, Longitude: -106.8967°
Elevation: m/ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.108 (0.091-0.127)	0.142 (0.119-0.167)	0.197 (0.165-0.233)	0.242 (0.201-0.288)	0.304 (0.239-0.377)	0.351 (0.268-0.444)	0.398 (0.290-0.519)	0.446 (0.307-0.602)	0.507 (0.332-0.711)	0.554 (0.351-0.793)
10-min	0.158 (0.133-0.186)	0.208 (0.175-0.245)	0.288 (0.241-0.341)	0.355 (0.294-0.422)	0.445 (0.350-0.552)	0.515 (0.393-0.650)	0.583 (0.425-0.760)	0.652 (0.449-0.881)	0.743 (0.486-1.04)	0.811 (0.513-1.16)
15-min	0.193 (0.162-0.227)	0.254 (0.213-0.299)	0.352 (0.294-0.416)	0.433 (0.359-0.515)	0.543 (0.427-0.673)	0.627 (0.479-0.792)	0.711 (0.518-0.927)	0.796 (0.548-1.08)	0.906 (0.592-1.27)	0.989 (0.626-1.42)
30-min	0.260 (0.219-0.306)	0.344 (0.288-0.405)	0.477 (0.399-0.564)	0.585 (0.485-0.696)	0.730 (0.573-0.900)	0.838 (0.639-1.06)	0.943 (0.687-1.23)	1.05 (0.720-1.41)	1.18 (0.771-1.65)	1.28 (0.809-1.83)
60-min	0.335 (0.282-0.394)	0.425 (0.357-0.501)	0.570 (0.476-0.673)	0.687 (0.570-0.817)	0.844 (0.663-1.04)	0.962 (0.734-1.21)	1.08 (0.785-1.40)	1.19 (0.820-1.61)	1.34 (0.874-1.87)	1.45 (0.915-2.07)
2-hr	0.410 (0.347-0.478)	0.506 (0.429-0.592)	0.662 (0.558-0.776)	0.788 (0.659-0.930)	0.959 (0.761-1.17)	1.09 (0.838-1.36)	1.21 (0.892-1.56)	1.34 (0.930-1.79)	1.50 (0.989-2.08)	1.62 (1.03-2.29)
3-hr	0.466 (0.397-0.541)	0.556 (0.473-0.647)	0.702 (0.595-0.820)	0.823 (0.692-0.966)	0.987 (0.790-1.20)	1.11 (0.864-1.38)	1.24 (0.917-1.59)	1.36 (0.955-1.81)	1.53 (1.02-2.11)	1.65 (1.06-2.33)
6-hr	0.578 (0.497-0.667)	0.668 (0.573-0.770)	0.815 (0.696-0.944)	0.939 (0.796-1.09)	1.11 (0.900-1.35)	1.25 (0.979-1.54)	1.38 (1.04-1.76)	1.52 (1.08-2.01)	1.71 (1.15-2.34)	1.85 (1.21-2.59)
12-hr	0.720 (0.624-0.823)	0.823 (0.713-0.943)	0.999 (0.861-1.15)	1.15 (0.983-1.33)	1.37 (1.12-1.65)	1.54 (1.23-1.89)	1.72 (1.31-2.18)	1.91 (1.37-2.51)	2.17 (1.48-2.95)	2.37 (1.56-3.28)
24-hr	0.875 (0.765-0.993)	1.00 (0.874-1.14)	1.22 (1.06-1.39)	1.41 (1.22-1.61)	1.68 (1.40-2.02)	1.91 (1.53-2.33)	2.14 (1.65-2.70)	2.39 (1.74-3.12)	2.73 (1.89-3.69)	3.00 (2.01-4.13)
2-day	1.04 (0.916-1.17)	1.19 (1.05-1.34)	1.44 (1.26-1.63)	1.67 (1.45-1.89)	1.99 (1.66-2.36)	2.25 (1.82-2.72)	2.52 (1.96-3.15)	2.80 (2.07-3.63)	3.20 (2.24-4.28)	3.51 (2.38-4.78)
3-day	1.15 (1.02-1.29)	1.32 (1.17-1.48)	1.59 (1.40-1.79)	1.83 (1.60-2.07)	2.17 (1.82-2.56)	2.44 (1.99-2.93)	2.72 (2.12-3.37)	3.01 (2.23-3.87)	3.41 (2.41-4.54)	3.73 (2.54-5.05)
4-day	1.25 (1.11-1.40)	1.43 (1.27-1.59)	1.71 (1.52-1.92)	1.96 (1.72-2.21)	2.31 (1.95-2.72)	2.59 (2.12-3.10)	2.87 (2.25-3.55)	3.17 (2.36-4.05)	3.57 (2.53-4.72)	3.88 (2.66-5.23)
7-day	1.49 (1.34-1.65)	1.69 (1.51-1.87)	2.01 (1.79-2.24)	2.28 (2.02-2.55)	2.65 (2.25-3.09)	2.95 (2.43-3.49)	3.24 (2.56-3.96)	3.54 (2.66-4.49)	3.94 (2.82-5.17)	4.25 (2.95-5.69)
10-day	1.69 (1.53-1.87)	1.91 (1.71-2.11)	2.25 (2.02-2.50)	2.54 (2.26-2.83)	2.94 (2.51-3.40)	3.25 (2.69-3.82)	3.55 (2.82-4.32)	3.86 (2.92-4.86)	4.28 (3.08-5.58)	4.59 (3.20-6.11)
20-day	2.27 (2.06-2.48)	2.52 (2.29-2.76)	2.93 (2.65-3.22)	3.27 (2.94-3.62)	3.73 (3.21-4.27)	4.08 (3.42-4.76)	4.43 (3.56-5.33)	4.78 (3.65-5.96)	5.24 (3.82-6.76)	5.58 (3.95-7.37)
30-day	2.75 (2.51-2.99)	3.05 (2.79-3.33)	3.54 (3.21-3.87)	3.93 (3.55-4.32)	4.46 (3.85-5.06)	4.85 (4.08-5.61)	5.23 (4.23-6.25)	5.61 (4.31-6.94)	6.10 (4.47-7.81)	6.45 (4.59-8.47)
45-day	3.38 (3.10-3.66)	3.76 (3.45-4.08)	4.36 (3.99-4.75)	4.84 (4.39-5.29)	5.46 (4.74-6.14)	5.91 (5.00-6.79)	6.33 (5.15-7.50)	6.74 (5.21-8.27)	7.24 (5.35-9.21)	7.59 (5.45-9.91)
60-day	3.93 (3.62-4.24)	4.39 (4.04-4.74)	5.11 (4.69-5.54)	5.67 (5.16-6.18)	6.38 (5.55-7.13)	6.88 (5.84-7.85)	7.34 (5.98-8.64)	7.77 (6.02-9.47)	8.27 (6.13-10.4)	8.60 (6.21-11.2)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

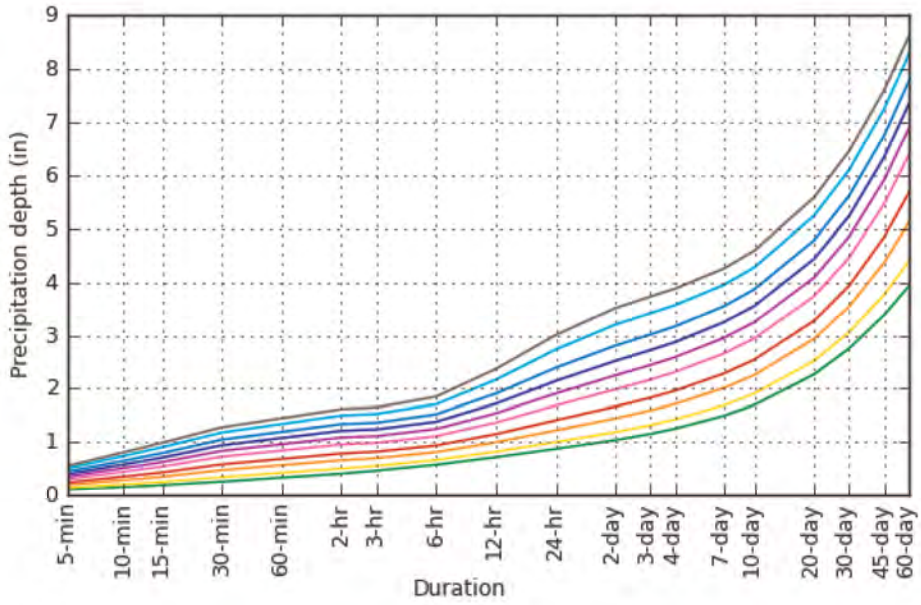
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

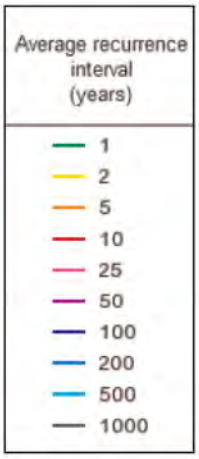
Please refer to NOAA Atlas 14 document for more information.

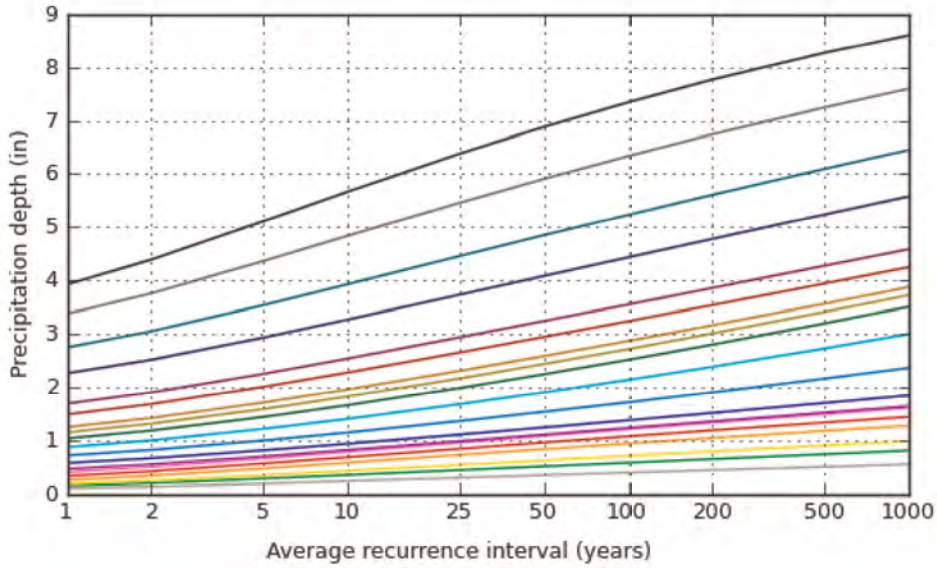
Back to Top

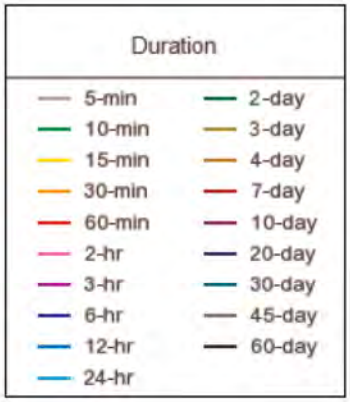
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 38.5430°, Longitude: -106.8967°









NOAA Atlas 14, Volume 8, Version 2

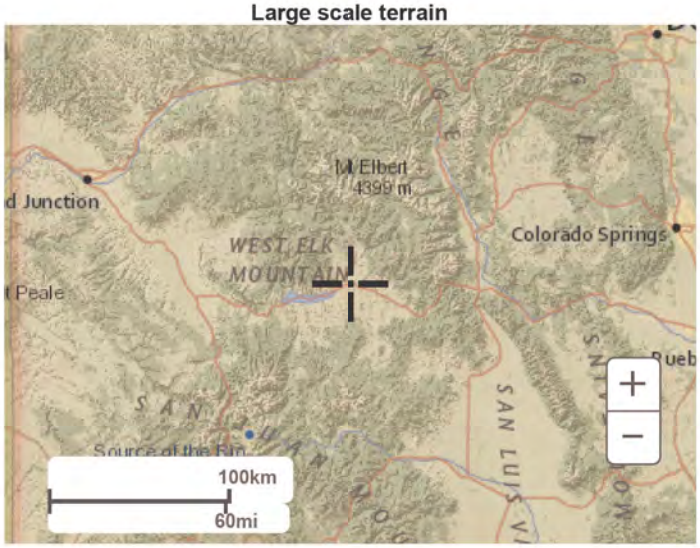
Created (GMT): Mon Aug 24 13:51:12 2020

Back to Top

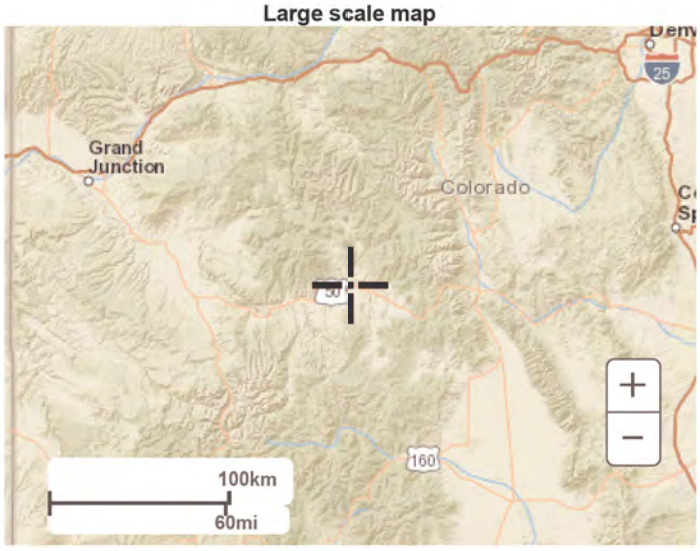
Maps & aerials

Small scale terrain

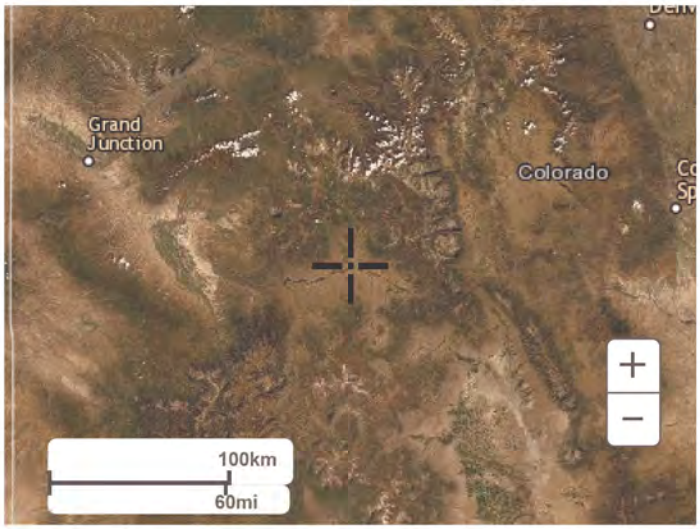
Large scale terrain



Large scale map



Large scale aerial



Back to Top

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

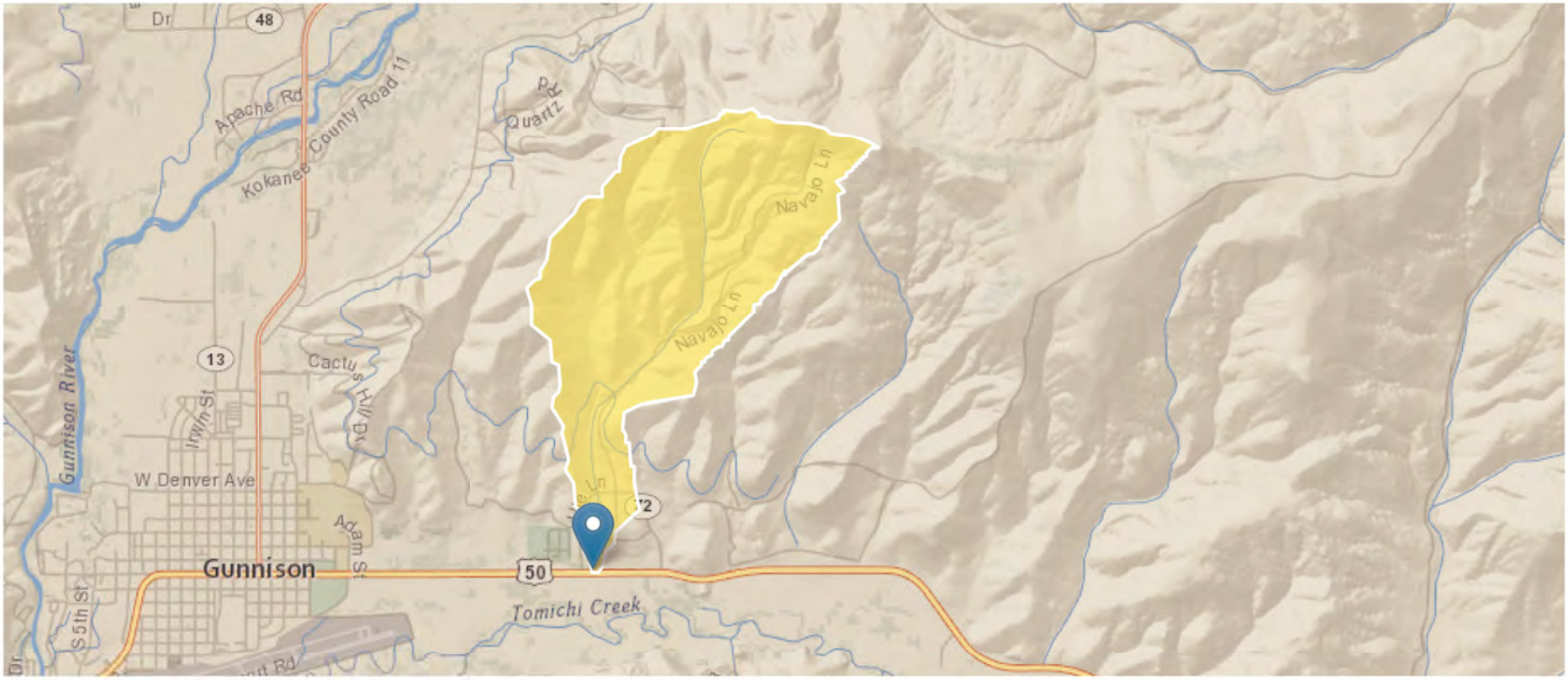
Disclaimer

Appendix D

HYDROLOGIC ANALYSIS

Government Campus Subdivision

Region ID: CO
Workspace ID: CO20200821223824415000
Clicked Point (Latitude, Longitude): 38.54466, -106.89275
Time: 2020-08-21 16:38:41 -0600



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	2.13	square miles
BSLDEM10M	Mean basin slope computed from 10 m DEM	19	percent
PRECIP	Mean Annual Precipitation	12.69	inches

Peak-Flow Statistics Parameters[Mountain Region Peak Flow]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2.13	square miles	1	1060
BSLDEM10M	Mean Basin Slope from 10m DEM	19	percent	7.6	60.2
PRECIP	Mean Annual Precipitation	12.69	inches	18	47

Peak-Flow Statistics Disclaimers[Mountain Region Peak Flow]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors

Peak-Flow Statistics Flow Report[Mountain Region Peak Flow]

Statistic	Value	Unit
2 Year Peak Flood	5.51	ft^3/s
5 Year Peak Flood	9.75	ft^3/s
10 Year Peak Flood	13.1	ft^3/s
25 Year Peak Flood	18.2	ft^3/s
50 Year Peak Flood	23.5	ft^3/s
100 Year Peak Flood	28.5	ft^3/s

Statistic	Value	Unit
200 Year Peak Flood	33.3	ft^3/s
500 Year Peak Flood	42.9	ft^3/s

Peak-Flow Statistics Citations

Capesius, J.P., and Stephens, V. C.,2009, Regional Regression Equations for Estimation of Natural Streamflow Statistics in Colorado: U. S. Geological Survey Scientific Investigations Report 2009-5136, 32 p. (http://pubs.usgs.gov/sir/2009/5136/http://pubs.usgs.gov/sir/2009/5136/)

Application Version: 4.4.0

CRABTREE GROUP INC.
ENGINEERING SMART GROWTH™

325 D Street
Salida, CO 81201
(719) 539-1675
www.crabtreegroup.net

DRAINAGE CALCULATIONS

Project Name: Government Parcel
Project #: 20020
Location: Salida CO

Client Name: Gunnison Rising
Client Address:

Client Phone #:

Prepared By: TLV Date: 8/20/2020
Checked by: Date:

Area Name:

Storm Return Period (yr)		24-hour Rainfall Amount (in.)
2		1
5		1.22
10		1.41
25		1.68
50		1.91
100		2.14

Source:

Rainfall Distribution: II

PRE-DEVELOPMENT RUNOFF CALCULATIONS

Pre-Developed Curve Number

Land Use Description	HSG	Curve No.	Area (acres)	Area (%)
Open space (grass cover 50% to 75%)	B	69	22.70	89%
Open space (grass cover 50% to 75%)	C	79	0.30	1%
Open space (grass cover 50% to 75%)	D	84	2.40	9%
		Totals	**25.40**	**100%**

Weighted Curve Number **71**

Time to Concentration

Sheet Flow

Surface Cover	Length (ft)	Slope ($^{ft}/_{ft}$)	Manning's n	T_t (hrs)
Grass: Dense grasses	100	0.005	0.240	0.741

Shallow Flow

Surface Cover	Length (ft)	Slope ($^{ft}/_{ft}$)	Velocity Coefficient	T_t (hrs)
Unpaved	450	0.005	16.135	0.110

Channel Flow

Length (ft.)	Slope ($^{ft}/_{ft}$)	n-Value	Flow Area (ft^2)	Wetted Perimeter (ft)	Tt (hrs)
1,000	0.05	0.05	8.00	8.00	0.042

Total Travel Time (hrs) **0.892**

Peak Discharge

Storm	2-yr	10-yr	25-yr	50-yr	100-yr
24-hr Precipitation (P)	1	1.41	1.68	1.91	2.14
Initial Abstraction (I_a)	0.817	0.817	0.817	0.817	0.817
I_a/P	0.817	0.579	0.486	0.428	0.382
Unit Peak Discharge (q_u)	169	169	179	226	259
Runoff (Q)	0.01	0.08	0.15	0.23	0.32
Peak Discharge (q_p)	**0.053**	**0.505**	**1.072**	**2.065**	**3.333**

CRABTREE GROUP INC.
ENGINEERING SMART GROWTH™

Government Parcel

INITIAL DEVELOPEMENT RUNOFF CALCULATIONS

Post-Developed Curve Number

Land Use Description	HSG	Curve No.	Area (acres)	Area (%)
Impervious	B	98	1.86	7%
Open space (grass cover 50% to 75%)	B	69	20.84	82%
Open space (grass cover 50% to 75%)	C	79	0.30	1%
Open space (grass cover 50% to 75%)	D	84	2.40	9%
		Totals	**25.40**	**100%**

Weighted Curve Number **73**

Time to Concentration

Sheet Flow

Surface Cover	Length (ft)	Slope ($^{ft}/_{ft}$)	Manning's n	T_t (hrs)
Grass: Dense grasses	100	0.005	0.240	0.741

Shallow Flow

Surface Cover	Length (ft)	Slope ($^{ft}/_{ft}$)	Velocity Coefficient	T_t (hrs)
Unpaved	450	0.005	16.135	0.110

Channel Flow

Length (ft.)	Slope ($^{ft}/_{ft}$)	n-Value	Flow Area (ft^2)	Wetted Perimeter (ft)	Tt (hrs)
1,000	0.005	0.05	8.00	8.00	0.132

Total Travel Time (hrs) **0.982**

Peak Discharge

Storm	2-yr	10-yr	25-yr	50-yr	100-yr
24-hr Precipitation (P)	1	1.41	1.68	1.91	2.14
Initial Abstraction (I_a)	0.740	0.740	0.740	0.740	0.740
I_a/P	0.740	0.525	0.440	0.387	0.346
Unit Peak Discharge (q_u)	161	161	204	241	268
Runoff (Q)	0.02	0.10	0.19	0.28	0.38
Peak Discharge (q_p)	**0.109**	**0.657**	**1.546**	**2.694**	**4.086**

INITIAL DETENTION CALCULATIONS

1. Data:

   Drainage area A_m= 0.0397 $mi.^2$

   Rainfall distribution II

		1st Stage	2nd Stage
2. Frequency	yr	25	100
3. Peak Inflow discharge q_i (from Post-Developed worksheet)	cfs	1.546	4.086
4. Peak outflow discharge q_p (from Pre-Developed worksheet)	cfs	1.072	3.333
5. Compute q_p/q_i		0.69	0.82
6. Vs/Vr ($V_s/V_r=C_0+C_1(q_0/q_i)+C_2(q_0/q_i)^2+C_3(q_0/q_i)^3$)		0.21	0.17
7. Runoff, Q (from Post-Developed worksheet)		0.19	0.38
8. Runoff Vol. V_r ($V_r=QA_m53.33$)	cu-ft	17,571	35,454
9. Storage vol, V_s	cu-ft	3,707	6,042
10. Maximum storage E_{max} (from plot)			

BUILDOUT RUNOFF CALCULATIONS

Post-Developed Curve Number

Land Use Description	HSG	Curve No.	Area (acres)	Area (%)
Impervious (Buildings)	B	98	1.72	7%
Impervious (Parking)	B	98	0.60	2%
Impervious (Roadway)	B	98	1.86	7%
Open space (grass cover 50% to 75%)	B	69	18.60	73%
Open space (grass cover 50% to 75%)	C	79	0.22	1%
Open space (grass cover 50% to 75%)	D	84	2.40	9%
		Totals	**25.40**	**100%**

Weighted Curve Number **75**

Time to Concentration

Sheet Flow

Surface Cover	Length (ft)	Slope ($^{ft}/_{ft}$)	Manning's n	T_t (hrs)
Grass: Dense grasses	100	0.010	0.240	0.561

Shallow Flow

Surface Cover	Length (ft)	Slope ($^{ft}/_{ft}$)	Velocity Coefficient	T_t (hrs)
Paved	400	0.050	20.328	0.024

Channel Flow

Length (ft.)	Slope ($^{ft}/_{ft}$)	n-Value	Flow Area (ft^2)	Wetted Perimeter (ft)	Tt (hrs)
1,000	0.005	0.012	2.00	4.00	0.050

Total Travel Time (hrs) **0.636**

Peak Discharge

Storm	2-yr	10-yr	25-yr	50-yr	100-yr
24-hr Precipitation (P)	1	1.41	1.68	1.91	2.14
Initial Abstraction (I_a)	0.667	0.667	0.667	0.667	0.667
I_a/P	0.667	0.473	0.397	0.349	0.312
Unit Peak Discharge (q_u)	201	228	303	344	373
Runoff (Q)	0.03	0.14	0.24	0.34	0.45
Peak Discharge (q_p)	**0.242**	**1.225**	**2.843**	**4.608**	**6.690**

CRABTREE GROUP INC.
ENGINEERING SMART GROWTH™

Government Parcel

MINIMUM DETENTION CALCULATIONS

1. Data:

   Drainage area A_m= 0.0397 $mi.^2$

   Rainfall distribution II

		1st Stage	2nd Stage
2. Frequency	yr	25	100
3. Peak Inflow discharge q_i (from Post-Developed worksheet)	cfs	2.843	6.690
4. Peak outflow discharge q_p (from Pre-Developed worksheet)	cfs	1.072	3.333
5. Compute q_p/q_i		0.38	0.50

		1st Stage	2nd Stage
6. Vs/Vr ($V_s/V_r=C_0+C_1(q_0/q_i)+C_2(q_0/q_i)^2+C_3(q_0/q_i)^3$)		0.33	0.28
7. Runoff, Q (from Post-Developed worksheet)		0.24	0.45
8. Runoff Vol. V_r ($V_r=QA_m53.33$)	cu-ft	21,780	41,636
9. Storage vol, V_s	cu-ft	7,251	11,543
10. Maximum storage E_{max} (from plot)			