Final Drainage Report

Prairie Ridge Subdivision

August 2020

PCD File No SF2010

Prepared for:

Justin Ensor
Sonship Properties, LLC
P.O Box 511
Rocky Ford, Colorado 81067

Prepared by:

Kenneth C. Harrison, P.E.
KCH Engineering Solutions
5228 Cracker Barrel Circle
Colorado Springs, Colorado 80917
719-246-4471
ksharrison5228@msn.com

Job No: 2019-104

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APPENDIX

Certifications and Approvals

Engineer's Statement

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report had been prepared according to the criteria established by El Paso County for drainage reports and said drainage report is in conformity with the master plan of the drainage basin, I accept responsibility for any liability caused by any negligent acts, errors or omission on my part in preparation this report

Signature _____
(Kenneth C. Harrison, P.E.)

Registered Professional Engineer State of Colorado No. _____

Seal

Owner's Statement

I, the Owner, Justin Ensor, have read and will comply with all of the requirements specified in this drainage report and plan.

_____
(Print Entity Name)

By: _____
Title: _____

Address: _____

_____
_____

Review 1 comment: Please revise to the following: Filed in accordance with the requirement of the Drainage Criteria Manual Volumes 1 and 2, El Paso County Engineering Criteria Manual and Land Development Code as amended.
Review 2: Unresolved. Please include the El Paso County Engineering Criteria Manual in the statement.

El Paso County

Filed in accordance with the requirements of the Drainage Criteria Manual and Land Development Code as amended.

El Paso County Engineer/ ECM Administrator

Jennifer Irvine, P.E. _____
(Print name) *(Signature)*

Date: _____

I. REPORT PURPOSE

The purpose of this study is to evaluate the drainage characteristics for both the existing and developed conditions of the Prairie Ridge Subdivision in accordance the current El Paso County Drainage Criteria. A drainage study and report were previously prepared by Troy Kent of Land Development Consultants (LDC), submitted and approved by El Paso County on May 28, 2008. Subsequent to the report approval the plat was never recorded and the project remained dormant until recently. An Early Assistance Meeting was held on August 28, 2018 to review current requirements for reconsidering the plat. According to the Meeting Minutes, the existing drainage study needed to be amended to address current drainage criteria. El Paso County amended it criteria on January 27, 2015. At this meeting El Paso County adopted the adopted Chapter 6 (Hydrology) and Section 3.2.1 of Chapter 13 (Full Spectrum Detention) of the May 2014 City of Colorado Springs Drainage Criteria Manual Volume 1 (DCMV1). The criteria changes that impact this report are:

- Design storm for the minor event was changed from the 10 year to the 5-year storm
- The Curve Numbers (CN) used in the NRCS method were amended to more accurately reflect the runoff for both the existing and developed conditions. However, the Curve Numbers presented in the User's Manual for the TR55 Method (see Appendix, Exhibit 5), were used since the results closely correlate to the results obtained from the Rational Method (see Appendix, Exhibit 4). These results are shown on the two (2) Drainage Plans included in the map pocket.
- Additional detail describing the components of this study was required to meet requirements.

It was decided to use the sections of the existing report where no changes were required. Sections of the narrative were updated where required. Hydrologic calculations were modified to reflect the new Curve Numbers. The drainage maps prepared for the existing and developed conditions are basically the same with only minimal modifications.

II. GENERAL DESCRIPTION

The property is approximately located in the SE ¼ of the SE ¼ of Section 12, Township 11 South, Range 66 West of the 6th P.M., El Paso County, Colorado. The property is comprised of 40.7 +/- acres and is more particularly located on the south and east sides of Brown Road approximately 0.5 miles north of the intersection of Brown Road and Walker Road (*Appendix, Exhibit 1*).

The project is currently undeveloped agricultural ground and has been used for pasture and grazing land. There are no buildings or irrigation ditches located on the property, however there are observable natural drainage corridors on the site. One of the natural drainage corridors bisects the site north to south, while the other runs west to east along the southerly boundary. The site is to be divided

into 7 single-family lots with a minimum size of 5 acres.

Offsite improvements include the leveling and the placement of Class 6 road base at the northeast and northwest corners of the property. Roadway improvements to Brown Road, at the northwest corner of the site include increasing the existing turning radius of Brown Road on the east side from a 30' radius to a 100' radius. This widens the road approximately 15' at the corner. At the northeast corner of the property a 60' radius emergency turnaround will be constructed. This will be accomplished by widening the road to the south approximately 75' from its existing edge. Roadside ditch restoration at both locations will be provided to continue to direct runoff along the edge of Brown Road.

The Soil, Geology, Geologic Hazard, and Wastewater Study, dated May 31, 2007, by Entech Engineering, Inc., addresses the general soil conditions and erosion potential of the site. The soils on the subject property have been generally classified as sandy clay and sandy clay-silt.

The existing channel along the southerly portion of the site is fairly well vegetated, and is in good condition, however, since it is subject to seasonal flooding and further erosion, this region of the development is being preserved. Some ponding of water exists on the site within the southerly drainage corridor, where water has been impounded behind an earthen dam east of the site for a stock pond. This portion of the site, in addition to the lesser drainage way running from north to south has been identified as a no-build area, and has been included within a proposed drainage easement.

The Entech report states that "the soil types observed on the site are mildly to highly susceptible to wind erosion, and moderately to highly susceptible to water erosion". This is in reference to areas that are to be disturbed during the construction. Since no site grading is proposed, the erodible soils will not be exposed to weathering, therefore no on-site erosion control measures have been presented. Brown Road improvements, where significant grading is proposed (northwest and northeast corners of the site), have been provided with stone check dams (*Appendix, Exhibit 7*) and silt fence. As individual lots are developed, erosion control measures are to be installed, according to the specific needs of each parcel, consistent with the recommendations of Entech's report.

Undeveloped and unplatted parcels, ranging in size from 4.67 to 97-acres surround the site, along with an existing MVEA overhead power lines along the southerly and easterly side of Brown Road.

III. DESIGN CRITERIA AND METHODOLOGY

The existing and proposed runoff patterns, runoff estimates, and proposed drainage improvements were evaluated based on the criteria and procedures outlined in the El Paso County Drainage Criteria Manual.

- ***Design Manuals***
  - ***City of Colorado Springs Criteria Manual, Volume I.***
    The charts and graphs used from this manual are reproduced within the pertinent sections of the Appendix.

  - **Soil Survey of El Paso County Area, Colorado United States Department of Agriculture, Soil Conservation Service**
    (*Appendix, Exhibit 3*)

  - ***Flood Insurance Rate Map, Federal Emergency Management Agency***
    (Appendix, Exhibit 2)

  - ***Urban Storm Drainage Criteria Manual, Urban Storm & Flood Control District, Copyright 2005 updated January 2016***

  - ***Soil, Geology, Geologic Hazard, and Wastewater Study – Prairie Ridge, El Paso County, Colorado, Entech Engineering, Inc., dated May 31, 2007***
    Not duplicated in the Appendix of the report. The report is available upon request.

- **Design storms**
  - Minor storm: 5-year
  - Major storm: 100-year

- **Drainage Areas**
  - Areas for the offsite and onsite sub basins were obtained from the May 28, 2008 drainage report that was previously approved by El Paso County

- **Runoff Methods**
  - ***Rational Method***
    This method was used to determine runoff quantities for sub basins with less than 130 acres. Intensity-Duration-Frequency (IDF) curves were obtained from the Colorado Springs Drainage Criteria Manual (DCM) (*Appendix, Exhibit 4*). This method was used to estimate existing from offsite basins at design points 2, 3, and 5. Runoff from sub basins A, B, C D, and E were used to verify the stability of the existing swales that drain these sub basins. Based visual observation and existing vegetative conditions, it is expected that these swales safely convey the runoff from both the minor and major to the site's outfall point at Design Point 6.

- ***National Resources Conservation Service (NRCS) (TR 55)***
  This method was used for the entire drainage area that impacts the subdivision which has an area of 296.3 acres. The runoff values that were determined for the areas less than 130 acres were compared to those determined with the Rational Method. The values obtained from the SCS TR55 method were used since the overall drainage area was in excess of 130 acres.

- **Culverts**

  Sizing
  - The 5-year storm was used to size the culvert under Brown Road located at the southwesterly corner of the site. Assumptions were necessary due to the limited field data.
  - The 100-year storm was used to evaluate the over topping conditions anticipated at the existing culvert under Brown Road.

  Culvert Velocities
  - Maximum velocity = 18 fps
  - Minimum velocity = 3 fps when the pipe is 50% full

- **Drainage Swale and Borrow Ditch Sizing**

  Sizing
  - Estimated runoff from the design the design storms were used to verify the stability of the existing onsite swales as well as the borrow ditch along Brown Road.
  - The 100-year storm event was used to evaluate roadway overtopping conditions along the borrow ditches.

  Velocity
  - Less than the erosive velocities typical for the existing soils.

  Freeboard Requirements
  - 12" for the minor storm and no roadway overtopping for the 100 year.

  Flow Regime
  - Drainage improvements are not recommended for swales that are characterized by a subcritical flow regime. This occurs when the Froude No. is less than 1.0
  - Erosion control improvements are recommended for swales where the runoff is characterized by a supercritical flow regime. This regime is characterized by high velocities and erratic, erosive, and unpredictable flows. This occurs when the Froude No. is 1.0 or greater

Please indicate ECM Appendix I.7.1.B.5 instead of the page #.

- **Detention/ Water Quality Pond**

Basis of evaluation:

- El Paso County Engineering Criteria Manual, Appendix 1, Page 1-18-19 According to El Paso County criteria a Water Quality Capture Volume (WQCV) pond is not required for lots 2.5 acres or larger. Also, since the area of disturbance is less than 1- acre a WQCV pond is not required.

Detention has not been addressed. Your previous submittal indicated why detention was not required. Please also provide that explanation in this section.

IV. EXISTING REPORTS, MAPPING AND INFORMATION

The project lies within the East Cherry Creek Drainage Basin. There are drainage fees associated with this basin.

No drainage reports have been prepared for any of the tracts that surround the site.

Please identify the acreage of the proposed land disturbance to include any improvements to the roadway. Per ECM Appendix I these improvements may also be excluded from water quality (see I.7.B.2). Should these improvements be excluded please also state the above exclusion in your narrative. Also, please be aware that land disturbance is defined in appendix I as any activity that results in a change in the existing land surface (both vegetative and non-vegetative). Although permanent water quality may not be required due to exclusions, an ESQCP as well as SWMP may be required if the disturbance is 1 acre or greater.

V. FEMA FLOODPLAIN

The project is within Zone X (other) as shown on the Flood Insurance Rate Map (FIRM) for El Paso County, Colorado and Incorporated Areas, Panel 325 of 1300, Map Number 08041C0305 G, Effective Date December 7, 2018 (Appendix, Exhibit 2).

VI. HYDROLOGIC SOILS INFORMATION

The hydrologic soils groups were obtained from the United States Department of Agriculture Natural Resources Conservation Service website for soils type for El Paso County, Colorado Eastern Part *(Appendix, Exhibit 3).* The soils are identified as follows:

- Brusset Loam 3-5% (SCS No. 15)
- Peyton-Pring Complex 8-15% (SCS No. 69).

The soils and their characteristic are described in the soils report included in the Appendix, Exhibit 3. All of the soils in the project area are classified within the B hydrologic group.

VII. DOWNSTREAM DRAINAGE CONDITIONS

There is a stock pond located immediately downstream of the subdivision at Design Point 6. A total of approximately 295 acres drain through the pond. According to the drainage plan offsite sub basins OS1, OS2 and OS3 drain through the project site. The total area for the offsite basins is 255 acres which represents 86% of the total area draining to the pond. Onsite sub basins consist of area A, B, C, D, and E with a total area of 40.3 acres. This represents 14% of the total area.

All of the offsite and onsite basins are carried to the stock pond via a natural grassed swale located along the southerly boundary of the project site. Based on visual observations, the swale is stable with only a minimal amount of erosion. The condition of the swale as it enters the pond is also stable with negligible signs of erosion. Based on visual observations of the upstream and downstream swale of the pond, and the relatively small percentage that the project site is

compared to the total drainage area, it is reasonable to assume that the pond is adequate to accommodate the minor increase in flows as a result of development.

A detailed analysis of the hydraulic and structural characteristics of the pond is outside the scope of this report.

VIII. HISTORIC OFFSITE CONDITIONS

- **Basin OS-1 (based on 2% Impervious)**
  Sub basin OS-1 is approximately 211.8-acres, and extends from the westerly boundary of the site to the top of the watershed at Spruce Hill to the west. The topography within the basin ranges from 9.9% near Spruce Hill to 2.9% near the site boundary. Runoff from this basin flows easterly to the southwest corner of the site, crossing Brown Road via an existing 24-inch CMP at an assumed slope of 2.0%. This culvert is in good condition. This basin comprises the primary source of flow in the existing channel. A stock pond exists within this channel, immediately upstream from the site (Design Point 1) on the westerly side of Brown Road. At the southwest corner of the site, flows from this basin are evaluated at Design Point 1 (DP1).

  Since this sub basin is greater than 130 acres, the **NRCS-TR55** method was utilized. Values were obtained from the **TR-55** User Guide.

  - Area = 211.8 acres
  - Curve Numbers = 69 (*Appendix, Exhibit 5*). These values presented in this table were used instead of the ones published in the DCMV1 since they are specific to the TR55 method and the runoff produced are comparable to those of the Rational Method.
  - Time of Concentration = 33.4 minutes
  - Estimated Runoff (TR 55)
    Minor storm (5 year) = 69.6 cfs
    Major Storm (100 year) = 279.5 cfs

- **Basin OS-2 (based on 2% Impervious)**
  Basin OS-2 is approximately 31.8-acres, and drains most of the region south of the site. The topography within this basin ranges from 6.5% at the top to 5.1% near the existing channel. Runoff from this basin flows to the northeast, and intersects the existing channel south of the site boundary. For this reason, flow from this basin is extended via the channel to the site boundary. At this point, flows are evaluated at Design Point 3 (DP3), where runoff from Basin OS-1 and Basin A combines with that from Basin OS-2.

  Since this sub basin is less than 130 acres, the Rational Method was utilized

with the following hydrologic parameters and characteristics.

- Area = 31.8 acre
- Runoff Coefficients
  Minor (5 year) storm = 0.08
  Major (100 year) storm = 0.35
- Time of Concentration: 26.7 minutes
- Estimated Runoff (UDFC Rational): (*Appendix, Exhibit 4*)
  Minor storm (5 year) = 6.4 cfs
  Major Storm (100 year) = 47.1 cfs
- Estimated Runoff (TR55): (*Appendix, Exhibit 5*)
  Minor storm (5 year) = 17.4 cfs
  Major Storm (100 year) = 65.5 cfs

Comments
The discharge estimated using the Rational Method will be used since this adheres to the current criteria.

- **Basin OS-3 and sub basin D (based on 2% Impervious)**
  Sub basins OS3 and D were combined since sub basin D is relatively small in comparison to OS-3. It is also expected, due to the location of the Sub Basin D in the "watershed" that no development will occur. Basin OS-3 and D is approximately 13.6 acres, and drains the region south of the site and east of Basin OS-2. The topography within this basin ranges from 4.5% at the top to 5.9% near the sites southeast corner. Runoff from this basin flows to the northeast, and intersects the site near its southeast corner. At this point, flows are evaluated at Design Point 5 (DP5).

  Since this sub basin is less than 130 acres, the Rational Method was utilized with the following hydrologic parameters and characteristics. They were compared with those determined by the TR55 Method.

  - Area 13.6 acres
  - Runoff Coefficients
    Minor (5 year) storm = 0.08
    Major (100 year) storm = 0.35
  - Time of Concentration: 31.6 minutes
  - Estimated Runoff (UDFC Rational Method) (Appendix, Exhibit 4):
    Minor storm (5 year) = 0.4 cfs

based on 2% impervious and table 6-6 the runofff coefficient values for the 5yr/100yr storms would be .09 and .36. The values used appear to be for 0%impervious. Revise accordingly throughout the report

Major Storm (100 year) = 22.7 cfs

- Estimated Runoff (TR55) (Appendix, Exhibit 5):
  Runoff from OS3 was not determined using the TR55 program. The runoff from OS3 was included with the runoff from sub basin D for the developed conditions. It is anticipated that the developed runoff from sub basins OS3 and D will be the same as for the historic conditions since there is not a suitable building site for a residence in sub basin D

IX. HISTORIC ONSITE DRAINAGE CONDITIONS

- **General**

The site is bounded to the north and west by Brown Road and to the south and east by undeveloped agricultural land. A defined drainage channel runs along the southerly boundary of the site, which is tributary to East Cherry Creek. The site drains primarily to the south and east, where this drainage channel intercepts it. Stock ponds exist immediately upstream and downstream from the site. The subject property consists of approximately 40.7-acres, and is divided into five (5) historic basins, identified as Basins A through E. Approximately 255.5-acres of off-site area tributary to the site is divided into three (3) basins, labeled OS-1 through OS-3. The hydrologic characteristics of these offsite sub-basins are described in the previous section. The historic hydrologic conditions of the onsite basins are described in more detail below. The TR55 program was used to compare the flows obtained using the Rational Method. The results are shown below. The TR20 data is shown for information purposes only. The flows obtained from the Rational Method were used in order to adhere to the El Paso County drainage criteria.

- **Sub-basin A (historic) (based on 2% Impervious)**

Sub-basin A is approximately 10.7 acres, and drains the westerly portion of the site, along Brown Road. The topography within this basin ranges between 2.2% and 6.5%. Runoff from this basin flows to the south and intersects the existing channel at the southerly boundary approximately 250-feet east of Brown Road. At this point, flows are evaluated at Design Point 2 (DP2), where runoff from Basin OS-1 combines with that from Basin A.

Since this sub basin is less than 130 acres, the Rational Method was utilized with the following hydrologic parameters and characteristics. They were compared with those determined by the TR55 Method.

- Area 10.7 acres
- Runoff Coefficients
  Minor storm (5 year): 0.08
  Major Storm (100 year): 0.35
- Time of Concentration: 26.7 minutes
- Estimated Runoff (UDFC Rational Method) (*Appendix, Exhibit 4*)
  Minor storm (5 year): 6.4 cfs
  Major Storm (100 year): 47.1 cfs
- Estimated Runoff (TR55) (*Appendix, Exhibit 5)*

Is this correct?

Minor storm (5 year): 5.8 cfs
Major Storm (100 year): 22.0 cfs

The estimated runoff utilizing the Rational Method was used to evaluate the hydraulic characteristics of the existing swale that drains the sub basin.

- **Sub-basin B (historic) (based on 2% Impervious)**
  Sub-basin B is approximately 19.6-acres, and drains the central portion of the site. The topography within this basin ranges between 2.1% and 10.4%. Runoff from this basin flows to the southeast, and intersects the existing channel near the southeast corner of the site. At this point, flows were evaluated at Design Point 4 (DP4), where runoff from Basins OS-1, OS-2, and Basin A combine with runoff from Basin B.

  Since this sub basin is less than 130 acres, the Rational Method was utilized with the following hydrologic parameters and characteristics. They were compared with those determined by the TR55 Method.

  - Area 19.6 acres

  - Runoff Coefficients
    Minor storm (5 year): 0.08
    Major Storm (100 year): 0.35

  - Time of Concentration: 26.1 minutes

  - Estimated Runoff (UDFC Rational Method) (*Appendix, Exhibit 4)*
    Minor storm (5 year): 4.0 cfs
    Major Storm (100 year): 29.4 cfs

  - Estimated Runoff (TR55) (*Appendix, Exhibit 5)*
    Minor storm (5 year): 10.4 cfs
    Major Storm (100 year): 39.4 cfs

  The estimated runoff utilizing the Rational Method was used to evaluate the hydraulic characteristics of the existing swale that drains the sub basin

- **Sub-basin C (historic) (based on 2% Impervious)**
  Sub-basin C is approximately 5.3-acres, and drains most of the easterly portion of the site. The topography within this basin ranges from 2.0% to 15.7%. Runoff from this basin flows to the southeast, and intersects the existing channel near the southeast corner of the site, approximately 130-feet downstream from DP4. At this point, flows are evaluated at Design Point 6 (DP6), where runoff from Basins OS-1, OS-2, OS-3, A, B, and D combines with Basin C.

Since this sub basin is less than 130 acres, the Rational Method was utilized with the following hydrologic parameters and characteristics. They were compared with those determined by the TR55 Method.

- Area = 5.3 acres

- Runoff Coefficients
  Minor storm (5 year): 0.08
  Major Storm (100 year): 0.35

- Time of Concentration: 22.6 minutes

- Estimated Runoff (UDFC Rational Method) (*Appendix, Exhibit 4)*
  Minor storm (5 year): 1.2 cfs
  Major Storm (100 year): 8.6 cfs

- Estimated Runoff Estimated Runoff (TR55) (*Appendix, Exhibit 5)*
  Minor storm (5 year): 3.5 cfs
  Major Storm (100 year): 12.6 cfs

The estimated runoff utilizing the Rational Method was used to evaluate the hydraulic characteristics of the existing swale that drains the sub basin

- **Sub-basin OS-3 and D (historic) (based on 2% Impervious)**
  These two sub-basins were combined since the runoff from OS-3 flows into sub-basin D. Sub-basin OS-3 is 12.1 acres and Sub-basin D is approximately 1.5 acres. The sub basins drain to the southeasterly corner of the site. The topography within this basin slopes at approximately 12.5%. Runoff from this basin flows to the northwest from the southerly side of the existing channel, and intersects it near the southeast corner of the site, approximately 130-feet downstream from DP4. At this point, flows are evaluated at Design Point 6 (DP6), where runoff from Basins OS-1, OS-2, OS-3, A, B, and C combine with Basin D.

  Since this sub basin is less than 130 acres, the Rational Method was utilized with the following hydrologic parameters and characteristics. They were compared with those determined by the TR55 Method.

  - Area = 13.6 areas

  - Runoff Coefficients
    Minor storm (5 year): 0.08
    Major Storm (100 year): 0.35

  - Time of Concentration: 31.6 minutes

- Estimated Runoff (UDFC Rational Method) (*Appendix, Exhibit 4*)
  Minor storm (5 year): 2.5 cfs
  Major Storm (100 year): 18.2 cfs

- Estimated Runoff (TR55) (*Appendix, Exhibit 5)*
  Minor storm (5 year): 7.0 cfs
  Major Storm (100 year): 26.7 cfs

The estimated runoff utilizing the Rational Method was used to evaluate the hydraulic characteristics of the existing swale that drains the sub basin

- **Sub-basin E (historic) (based on 2% Impervious)**
  Sub-basin E is approximately 3.7-acres, and drains the northeast corner of the site. The topography within this basin ranges from 2.4% to 7.7%. Runoff from this basin flows to the southeast, and exits the site at the eastern boundary, approximately 700-feet south of the north boundary. At this point, flows are evaluated at Design Point 7 (DP7).

  Since this sub basin is less than 130 acres, the Rational Method was utilized with the following hydrologic parameters and characteristics;

  - Area = 3.7 acres

  - Runoff Coefficients
    Minor storm (5 year): 0.08
    Major Storm (100 year): 0.35

  - Time of Concentration: 22.3 minutes

  - Estimated Runoff (UDFC Rational Method) (*Appendix, Exhibit 4*)
    Minor storm (5 year): 0.8 cfs
    Major Storm (100 year): 6.1 cfs

  - Estimated Runoff (TR55) (*Appendix, Exhibit 5*)
    Minor storm (5 year): 1.9 cfs
    Major Storm (100 year): 7.2 cfs

  The estimated runoff was used to evaluate the hydraulic characteristics of the existing swale that drains the sub basin

- **All Offsite and Onsite Sub-basins (historic) (based on 2% Impervious)**
  All runoff from the sub-basins described above ultimately leaves the site at Design Point 6 which is located at the southeast corner of the site. The runoff historically enters an existing stock pond. The physical and hydraulic characteristics of this pond are outside the scope of this report since there is only negligible increase in runoff for both the minor (5 year) and major (100

year) storm events.

Since the total drainage area is greater than 130 acres, the NRCS TR55 method was utilized to determine the following hydrologic characteristics:

- Drainage area = 296.3 acres
- Curve Number = 69 (based on an imperviousness of 2%) (see Appendix, Exhibit 5)
- Estimated Runoff
  Minor storm (5 year) = 85.7 cfs
  Major Storm (100 year) = 356 cfs

X. EXISTING DRAINAGE FACILITIES

The only drainage facility on this site is a 24-inch corrugated metal pipe located under Brown Road at the southwest corner of the site (DP 1). This DP is located on the westerly side of the project. The stormwater runoff at this location was estimated to be:

- Location: Brown Road
- Contributing sub basin: OS1
- Contributing Drainage area: 211.6
- Method: TR 55
- Minor storm (5 yr.) = 69.6 cfs
- Major storm (100 yr.) = 279.5 cfs

The hydraulic characteristics of the existing 24-inch culvert were determined by assuming the inverts and the length of the culvert since field data was not obtained. This is a safe assumption since the outfall "swale" is broad and is expected to have minimal depth that would create an "outlet control condition". Based on the limitations described, the hydraulic conditions were determined to be as follows (*Appendix, Exhibit 6*)

- The culvert has a capacity of 20.5 cfs (*Appendix, Exhibit 6*). This is based on a headwater to depth ratio of 1.5. This provides an upstream depth of 3.1 feet.
- The culvert is operating under inlet control since the downstream depth is expected to be negligible.
- The velocity in the culvert was not determined since data regarding the pipe slope was not obtained.

Conclusions

- The existing culvert is undersized to safely accommodate the runoff from the 5-year storm event
- The runoff from the 100-year event is expected to overtop the existing roadway and therefore has the potential of damaging the existing roadway cross section.

It is recommended to replace the existing culvert. Since the culvert only accommodates runoff from offsite sources, the culvert is to be replaced by other parties and not as part of the subdivision improvements.

XI. DEVELOPED DRAINAGE CONDITIONS

- **Offsite Sub-basin Characteristics for Developed Conditions**
  There are no plans to develop the tracts located upstream of the project site. Therefore, the hydrologic conditions for the offsite sub basins will remain the same, as described Section VIII of this report, under the developed conditions.

- **Onsite Sub-basin Characteristics for Developed Conditions**
  Since the development of this site consists of 5-acre parcels, the majority of the hydrologic parameters for onsite sub-basins, presented in Section IX, remain the same. The only change is in the determination of the Runoff Coefficient. The following is a summary of how the runoff coefficients for the developed conditions were calculated (*Appendix, Exhibit 4*):

  - Drainage Sub Basins identification is the same as existing conditions

  - Developed Lot Characteristics
    - Typical total lot area = 217,800 square feet (lot size of 5 acres)
    - Average house footprint = 4,000 square feet
    - Average area for driveways, patios, walk ways = 2,500 square feet
    -- Average area for driveways, patios, walk ways = 1,200 square feet
    - Average area to remain in its existing condition = 210,100 square feet

  - Runoff Coefficients (Rational Method "C" coefficient) (Table 6-6, CSDCM) (*Appendix, Exhibit 4*) and TR55 Method "CN" Curve Numbers (Tables 2-2a- 2d) (*Appendix, Exhibit 5)*
    Typically, published design tables for use with the Rational Method and the NCRS Method do not provide runoff coefficients for 5-acre developments. It only provides values for 2.5 acres and smaller. As a result, the composite coefficients (Table 6-6) and curve number (Table 2-2a- 2d) for each developed lot were determined as follows:

    - Average **roof** size = 4,000 square feet
      - % Impervious: 90%
      - Rational Method: Minor storm (5 year) runoff coefficient: 0.73
      - Rational Method: Major storm (100 year) runoff coefficient: 0.81
      - NCRS Curve Number = 98

    - Average area for **driveways, patios, and walk ways** = 2,500 square feet
      - % Impervious: 100% (This is a conservative assumption. It assumes a paved driveway as opposed to a typical gravel one)
      - Rational Method: Minor storm (5 year) runoff coefficient: 0.73

This should be 0.90 per table 6-6 and 100% impervious. Please revise. If a gravel driveway is proposed then 80% impervious may be used for the driveway. Concrete walkways and patios would still be considered 100% impervious.

should be 0.96 per table 6-6 and 100%impervious. Revise accordingly.

- Rational Method: Major storm (100 year) runoff coefficient: 0.81
- NCRS Curve Number = 98

- Average area for "grassed" **lawn** = 1,200 square feet
  - % Impervious: 0%
  - Rational Method: Minor storm (5 year) runoff coefficient: 0.08
  - Rational Method: Major storm (100 year) runoff coefficient: 0.35
  - NCRS Curve Number = 69 (fair condition)

- Average area in **existing condition** (Pasture/Meadow) = 210,100 square feet
  - Rational Method Impervious: 0%
  - Rational Method: Minor storm (5 year) runoff coefficient: 0.08
  - Rational Method: Major storm (100 year) runoff coefficient: 0.35
  - NCRS Curve Number = 69

  The value from Table 6-9 ARC I, instead of Table 6-10 ARC II, was used since the "undeveloped" area of the lot will not be disturbed and will remain "un-watered/ irrigated".

- Composite Runoff Coefficients and Curve Numbers for **developed conditions** (*Appendix, Exhibit 4 and 5)*
  Exhibit 4 in the Appendix includes the tables used for the Rational Method. Exhibit 5 in the Appendix includes the tables used for the NCRS method. Based on the above assumptions the following **composite runoff coefficients** were determined as follows:

  Developed Conditions: the following is for **developed** lots only and not for offsite areas.
  - % Impervious = 2.8%
  - Rational Method: Minor storm (5 year) runoff coefficient: 0.10 (developed conditions)
  - Rational Method: Major storm (100 year) runoff coefficient: 0.37 (developed conditions)
  - NCRS Curve Number = 70

Please see previous comment

- Existing Conditions (for comparison purposes)
  - % Impervious = 2%
  - Rational Method: Minor storm (5 year) runoff coefficient: 0.08 (existing conditions)
  - Rational Method: Major storm (100 year) runoff coefficient: 0.35 (existing conditions)
  - NCRS Curve Number = 69

- Time of Concentration
  The time of concentration for each sub-basin remains the same.

- Rainfall Intensity
  The rainfall intensity for each sub-basin remains the same since the time of concentration remains the same.

- Estimated Runoff
  Based on the above assumptions, runoff for the minor (5 year) and major (100 year) storms were estimated for each sub-basin

- **Sub-basin A (developed)**
  - Design point = 2
  - Drainage Area = 10.7 acres
  - Runoff Coefficients
    - % Impervious = 2.8
    - Rational Method: Minor storm (5 year): 0.10
    - Rational Method: Major Storm (100 year): 0.37
    - NCRS Curve #: 70
  - Estimated Runoff
    - Rational Method: Minor storm (5 year): 2.7 cfs (see Appendix, Exhibit 4)
    - Rational Method: Major Storm (100 year): 16.7 cfs (see Appendix, Exhibit 4)
    - NCRS: Not Applicable

Please explain how/why the developed runoff from Basin A is much less than the historic runoff (47 cfs) indicated in page 12 of 28. Revise accordingly.

- **Sub-basin B (developed)**
  - Design Point = 4
  - Drainage Area = 19.6 acres
  - Runoff Coefficients
    - % Impervious = 2.8
    - Rational Method: Minor storm (5 year): 0.10
    - Rational Method: Major Storm (100 year): 0.37
    - NCRS Curve #: 70 (see Appendix, Exhibit 5)
  - Estimated Runoff
    - Minor storm (5 year): 5.0 cfs
    - Major Storm (100 year): 31.1 cfs
    - NCRS: Not Applicable

- **Sub-basin C (developed)**
  - Design Point = 6

- Drainage Area = 5.3 acres

- Runoff Coefficients
  - % Impervious = 2.8
  - Rational Method: Minor storm (5 year): 0.10
  - Rational Method: Major Storm (100 year): 0.37
  - NCRS Curve #: 70

- Estimated Runoff
  - Rational Method: Minor storm (5 year): 1.5 cfs
  - Rational Method: Major Storm (100 year): 9.1 cfs
  - NCRS: Not Applicable

Developed drainage plan indicates 13.6 acres. Revise accordingly.

- **Sub-basin OS-3 and D (developed)**
  - Design Point = 4

  - Drainage Area = 16.6 acres

  - Runoff Coefficients
    - % Impervious = 2.0
    - Rational Method: Minor storm (5 year): .08
    - Rational Method: Major Storm (100 year): 0.35
    - NCRS Curve #: 69

  - Estimated Runoff
    - Rational Method: Minor storm (5 year): 2.5 cfs
    - Rational Method: Major Storm (100 year): 18.2 cfs
    - NCRS: Not Applicable

- **Sub-basin E (developed)**
  - Design Point = 7

  - Drainage Area = 3.7 acres

  - Runoff Coefficients
    - % Impervious = 2.8
    - Rational Method: Minor storm (5 year): 0.10
    - Rational Method: Major Storm (100 year): 0.37
    - NCRS Curve #: 70

  - Estimated Runoff
    - Rational Method: Minor storm (5 year):1.0 cfs
    - Major Storm (100 year): 6.4 cfs
    - NCRS: Not Applicable

- **All Sub-basins (developed) (NCRS Method) (*Appendix, Exhibit 5)***
  - Design Point = 6
  - Drainage Area = 296.3 acres
  - Runoff Coefficients
    - % Impervious = 2.1
    - Rational Method: Minor storm (5 year): Not Applicable
    - Rational Method: Major Storm (100 year): Not Applicable
    - NCRS Curve #: 70 (+-)
  - Estimated Runoff (Developed)
    - Rational Method: Minor storm (5 year): Not Applicable
    - Rational Method: Major Storm (100 year): Not Applicable
    - NCRS: 5 year = 86.7 cfs
    - NCRS: 100 year = 360.8 cfs
  - Estimated Runoff (Historic)
    - Rational Method: Minor storm (5 year): Not Applicable
    - Rational Method: Major Storm (100 year): Not Applicable
    - NCRS: 5 year = 85.7 cfs
    - NCRS: 100 year = 356.0 cfs
  - Conclusions
    The increase in runoff is negligible for both the minor and major storm events as a result of development

XII. PROPOSED IMPROVEMENTS

Please consider revising this to indicate "recommended" instead of "proposed" as the applicant is not proposing to install this culvert.

- **Culvert Improvements**
  The existing culvert (24" CMP) was evaluated in Section X of this report. It was determined that the existing 24" culvert had a capacity to pass 20.5 cfs based on a headwater to depth ratio of 1.5. This is substantially less than the discharge for the 5-year storm event which is 69.6 cfs. This was determined based on the assumptions described in Report Section X.

  It is recommended to replace the existing culvert. The proposed culvert described below was sized only for the 5-year storm since data regarding the existing and/or proposed roadway at the culvert crossing was not available. The final design of the culvert will require field data to obtain inverts, roadway cross section, and inlet and outlet topography. The design and construction of this culvert is not part of this subdivision since the stormwater runoff from the subdivision does not impact the facility.

The following recommendation is based on the size culvert required to pass the 5-year flow with a limiting headwater to depth ratio of 1.5 (*Appendix, Exhibit 6);*

- **Criteria**
  - Minor storm (5 yr.): Headwater to Depth ratio = 1.5 limit with no roadway overtopping.
  - Major Storm (100 yr.): not used in the following concept design.

- **Recommended culvert**
  - Size: 42" RCP Culvert
  - Headwater to depth ratio: 1.5
  - Culvert Capacity = 80 cfs
  - % slope = 1.0 %
  - Headwater to depth = 1.5
  - Culvert Velocity = 7.8 fps
  - Culvert Depth of Flow = 2.2
  - End treatments: Flared end sections
  - Riprap protection at the outfall: 12" D50, 30 feet long by 12 feet wide
  - Concrete low water crossing

- **Borrow Ditches and Onsite Swales (*Appendix, Exhibit 8*)**
  - West Property Line, East borrow ditch
    - Runoff Areas: Sub basins E and C
    - Design Discharge
      5 yr. = 2.5 cfs
      100 yr. = 15.5)
    - Estimated Slope = 6.4%
    - Estimated Side slope = 3:1
    - Manning's Coef. = .035
    - Depth:
      5 year: 0.3 ft
      100 Year: 0.7 ft
    - Velocity =
      5 year: 5.0 fps
      100 Year: 8.0 fps
    - Froude No.
      5 year: 1.97 (supercritical)
      100 Year: 2.23 (supercritical)

Sub basins E and C are on the northeast property line. Sub basin A is on the west property line. Please revise accordingly as it is not clear which ditch this is referring to.

Recommended Improvements = stone check dams at 50-foot intervals

  - North Property Line, South borrow ditch

- Runoff Areas, only ½ of the existing road in sub basin B drains into the roadside ditch. = 0.2 acres
- Runoff Coefficient:
  5 yr. = 0.59
  100 yr. = 0.71
- Time of Concentration: 5 minutes (minimal allowed)
- Rainfall Intensity:
  5 yr. = 4.1
  100 yr. = 8.8
- Design Discharge
  5 yr. = 0.5 cfs
  100 yr. = 1.9
- Estimated Slope = 6.4%
- Estimated Side slope = 3:1
- Manning's Coef. = .035
- Depth:
  5 year: 0.2 ft
  100 Year: 0.3 ft
- Velocity =
  5 year: 2.5 fps
  100 Year: 3.6 fps
- Froude No.
  5 year: 1.28 (supercritical)
  100 Year: 1.41 (supercritical)

Recommended Improvements = stone check dams at 50-foot intervals

- Onsite Swale Design Point 1 to Design Point 6 (developed)
  A range for the 5 yr. and 100 yr. storms is represented below since the flows are subcritical and therefore no improvements are recommended.

5 Year storm Event

- Discharge
  5 yr.= 86.7cfs
- Slope = 2.5% to 6%
- Side slope = 0.5 to 0.5
- Manning's Coef. = 0.12 for range grass
- Velocity range = 2.2 fps to 4.9 fps
- Depth range = 1.3 ft to 2.4 ft
- Froude No. range == 0.34 to 0.56, subcritical flow
- Recommended Improvements = none since flow is subcritical.

100 Year storm Event

- 100 yr. = 360.8 cfs
- Slope = 2.5% to 6%
- Side slope = 0.5 to 0.5

- Manning's Coef. = 0.12 for range grass
- Velocity range = 3.7 fps to 4.9 fps
- Depth range = 2.4 ft to 3.4 ft
- Froude No. range = 0.38 to 0.57, sub critical flow

Please remove this section as this does not provide any relevant information pertaining to the drainage of the site. Additionally, if there is any changes to the Broad Road evaluation report this will have to be continually updated.

No improvements are required for the onsite swales since all velocities are less that the erosive velocities and are sub critical in the flow regime (Appendix, Exhibits 4, 5, and 8)

XIII. BROWN ROAD COST SHARING

The following was taken from Section XI of the Brown Road Evaluation Report prepared by KCH Engineering Solutions, LLC, dated August 2020.

The current improvements along the entire length of Brown Road currently do not meet El Paso County standards for a rural gravel road. Due to the cost required to bring the road to current standards, equitable cost sharing for the individual parcels sharing access to this road, was discussed in a 2008. Attached is a letter from El Paso County, dated May 19, 2008 and corrected October 1, 2008 (Appendix, Exhibit 9 (Brown Road Evaluation Report)). This letter outlines the "Conditions for Approval" for the Prairie Ridge plat in 2008. An inflation rate of 21.1% was used in the calculation of the various numbers used in the Development Services letter. This rate was determined from a table produced by the ***Department of Labor and Statistics*** *for the average inflation rate for the period between 2008 and 2020 is included as Exhibit 10 in the Appendix (Brown Road Evaluation Report) of this report.*

It is recommended that the May 19, 2008 (corrected October 1, 2008) letter from El Paso County Development Services be revised to include the following amended amounts for the Brown Road improvements:

Preliminary Plan Conditions of Approval (Appendix, Exhibit 9)
All conditions are to remain the same except for the changes described below.

Conditions of Approval, Item 9.1 (adjusted for 2020) revised as follows (changes are shown in bold type):
Applicant's total fair share, equitable, and reasonably proportional contribution to the Brown Road Improvements shall be ***$13,325*** *per lot for a total of* ***$93,275*** *structured as follows:*

Conditions of Approval, Item 9.1.A (adjusted for 2020) revised as follows (changes are shown in bold type):
Prior to recording the final plat, Applicant shall deposit the sum of ***$60,550*** *with the El Paso County Treasurer, which funds the County shall maintain and deposit in a separate, interest bearing account not part of the County's operating budget.*

Conditions of Approval, Item 9.1.B (adjusted for 2020) revised as follows (changes are shown in bold type):

At the time of closing each lot the remaining ***$32,725*** *balance of the contribution, or* ***$4,675*** *per lot, ...*

Conditions of Approval, Item 9.2
No changes

Conditions of Approval, Item 9.3

No changes

Conditions of Approval, Item 9.4

No changes but repeated as follows:

Should the County not use the funds on or before the expiration date the County shall return the funds to the Applicant, their heirs, successors and assigns (excluding individual lot owner successors), together with accrued interest.

Conditions of Approval, Item 10

No changes

Final Plat Conditions of Approval

All conditions are to remain the same except for the changes described below.

Conditions of Approval, Item 14.1 (adjusted for 2020) (changes are shown in bold type):

Applicant's total fair share, equitable, and reasonably proportional contribution to the Brown Road Improvements shall be ***$13,325*** *per lot for a total of $93,275 structured as follows:*

Conditions of Approval, Item 14.1.A (adjusted for 2020) (changes are shown in bold type):

Prior to recording the final plat, Applicant shall deposit the sum of ***$60,550*** *with the El Paso County Treasurer, which funds the County shall maintain and deposit in a separate, interest bearing account not part of the County's operating budget.*

Conditions of Approval, Item 14.1.B (adjusted for 2020) revised as follows (changes are shown in bold type):

At the time of closing each lot the remaining ***$32,725*** *balance of the contribution, or* ***$4,675*** *per lot, ...*

Conditions of Approval, Item 14.2

No changes

Conditions of Approval, Item 14.3

a. *No changes*

Conditions of Approval, Item 14.4

b. *No changes and repeated as follows:*

Should the County not use the funds on or before the expiration date the County shall return the funds to the Applicant, their heirs, successors and assigns (excluding individual lot owner successors), together with accrued interest.

Conditions of Approval, Item 15

No changes

Please see comments above regarding detention and water quality and revise accordingly.

XIV. DETENTION AND WATER QUALITY

Criteria

El Paso County Engineering Criteria Manual, Appendix 1, Page 1.18-19
According to El Paso County criteria a Water Quality Capture Volume (WQCV) pond is not required for lots 2.5 acres or larger. Also, since the area of disturbance is less than 1- acre a WQCV pond is not required.

Hydrologic for Existing and Developed Conditions) (see Report Section XI)

- Estimated Runoff (Historic)
  - Rational Method: Minor storm (5 year): Not Applicable
  - Rational Method: Major Storm (100 year): Not Applicable
  - NCRS: 5 year = 85.7 cfs
  - NCRS: 100 year = 356.0 cfs

- Estimated Runoff (Developed)
  - Rational Method: Minor storm (5 year): Not Applicable
  - Rational Method: Major Storm (100 year): Not Applicable
  - NCRS: 5 year = 86.7 cfs
  - NCRS: 100 year = 360.8 cfs

XV. EROSION CONTROL

The following erosion control measures are recommended. Exhibits for all of the erosion control facilities recommended below are included in the *Appendix, Exhibit 7.*

- Stone check dams in the roadside swales under supercritical conditions
- Riprap outlet aprons (by others) at locations where the storm sewer exit velocity is great enough to cause excessive erosion
- Silt fences are recommended along the lower edge of grading activity

XVI. SUMMARY

This report provides a thorough analysis of the historic and developed drainage conditions for the proposed Prairie Ridge Subdivision. The property is comprised of 40.7 +/- acres and is located on the south and east sides of Brown Road approximately 0.5 miles north of the intersection of Brown Road and Walker Road. The subdivision is to be subdivided into seven (7) consisting of areas 5-acres or greater.

The vegetation consists of primarily prairie grass with no trees. There is a main natural drainage way that is located along the southerly side of the boundary. It has been demonstrated that there is only a negligible increase in runoff as a result of development. Also, based on the present engineering criteria for El Paso County a water quality/ detention pond is not required.

Please state whether or not this development will have an adverse affect to the downstream or surrounding properties.

Erosion control facilities include staked hay bales, erosion control check dams, and stone check dams. The location and details for these are included on the Storm Water Management Plan.

Included in the map pocket are drainage maps for the Historic Drainage Conditions and the Developed Drainage Conditions. No storm water structures are proposed for this subdivision.

APPENDIX

Exhibit 1
General Location Map

Vicinity Map

Exhibit 2
FEMA FIRM Map

FEMA

(//www.fema.gov/)

FEMA Flood Map Service Center: Search By Address

Navigation

Search

Languages

MSC Home (/portal/)

MSC Search by Address (/portal/search)

MSC Search All Products (/portal/advanceSearch)

MSC Products and Tools (/portal/resources/productsandtoc

Hazus (/portal/resources/hazus)

LOMC Batch Files (/portal/resources/lomc)

Product Availability (/portal/productAvailability)

MSC Frequently Asked Questions (FAQs) (/portal/resources/faq)

Enter an address, place, or coordinates:

El Paso County Colorado

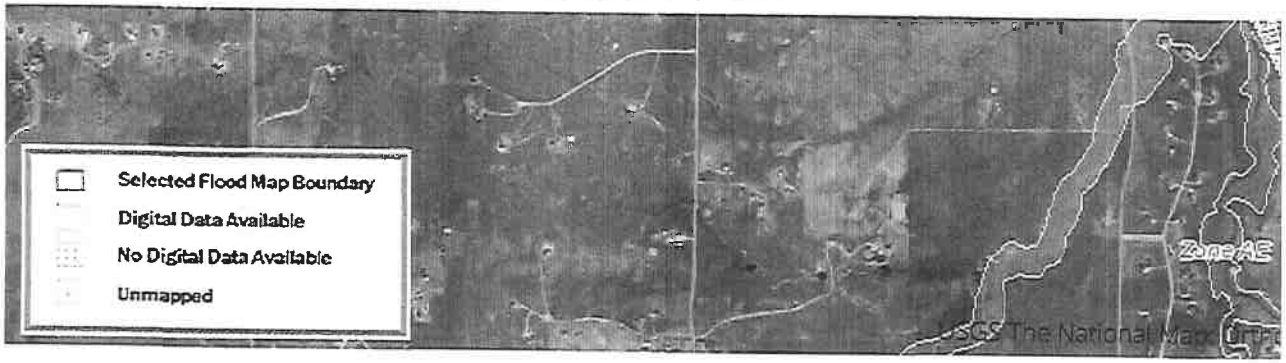
Search

Whether you are in a high risk zone or not, you may need flood insurance (https://www.fema.gov/national-flood-insurance-program) because most homeowners insurance doesn't cover flood damage. If you live in an area with low or moderate flood risk, you are 5 times more likely to experience flood than a fire in your home over the next 30 years. For many, a National Flood Insurance Program's flood insurance policy could cost less than $400 per year. Call your insurance agent today and protect what you've built.

Learn more about steps you can take (https://www.fema.gov/what-mitigation) to reduce flood risk damage.

MSC Email Subscriptions (/portal/subscriptionHome)

Contact MSC Help (/portal/resources/contact)



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(https://www.oig.dhs.gov/hotline)

Official website of the Department of Homeland Security

Exhibit 3
SCS Soils Map and Data

United States Department of Agriculture

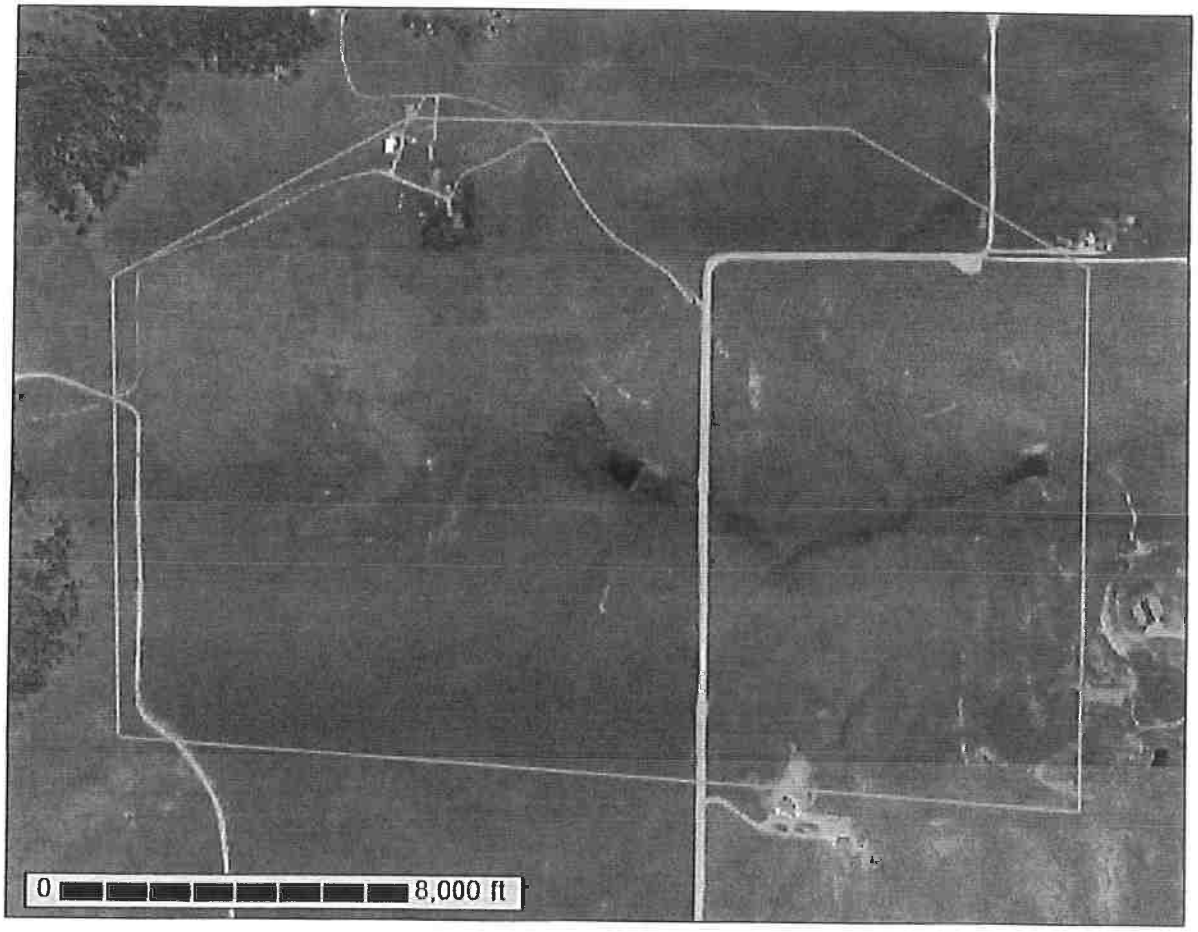
NRCS

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 El Paso County Area, Colorado

Prairie Ridge Subdivision

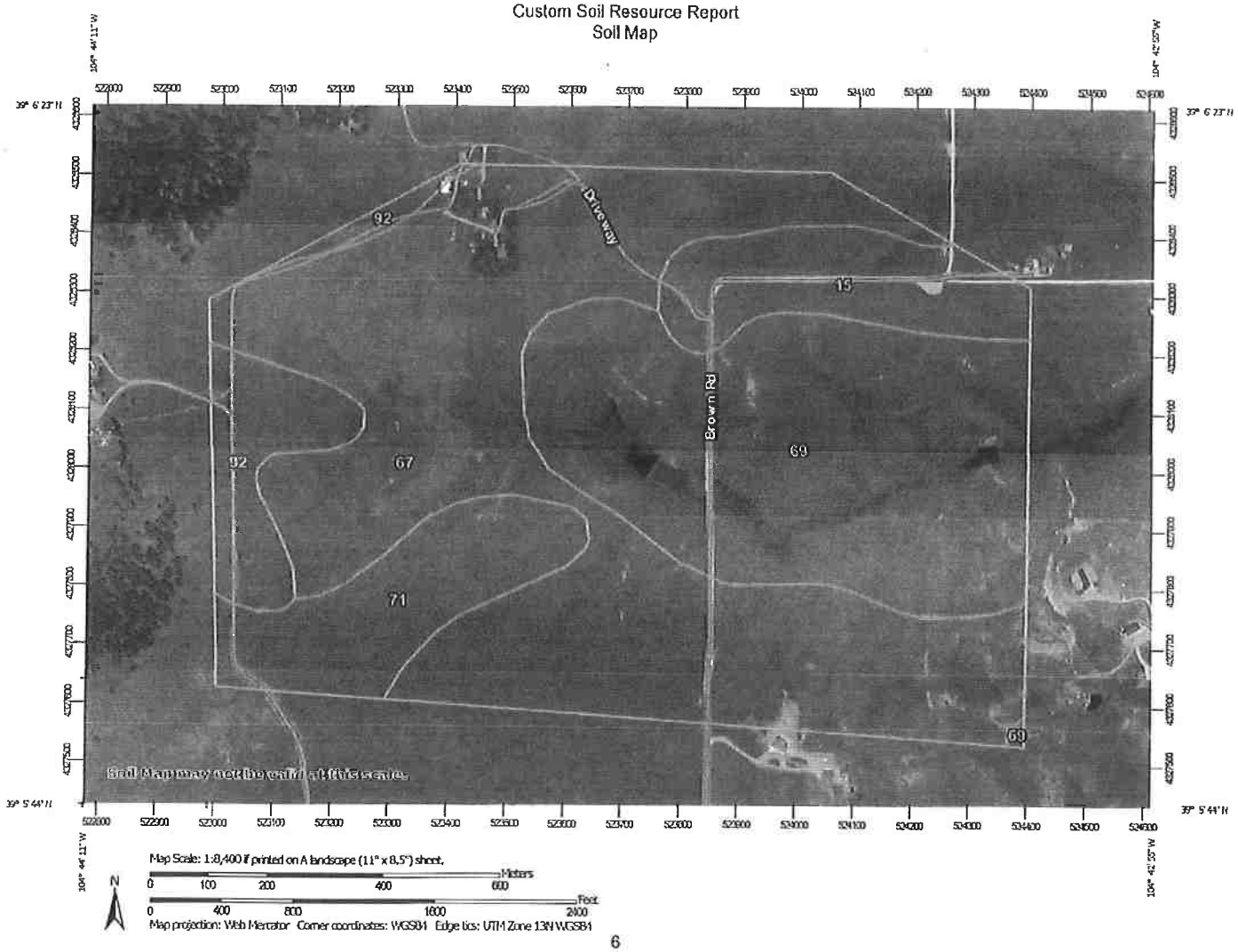


March 25, 2019

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



Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
15	Brussett loam, 3 to 5 percent slopes	23.9	7.8%
67	Peyton sandy loam, 5 to 9 percent slopes	147.0	47.9%
69	Peyton-Pring complex, 8 to 15 percent slopes	90.5	29.5%
71	Pring coarse sandy loam, 3 to 8 percent slopes	26.8	8.7%
92	Tomah-Crowfoot loamy sands, 3 to 8 percent slopes	18.4	6.0%
Totals for Area of Interest		306.6	100.0%

Map Unit Descriptions

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.

El Paso County Area, Colorado

15—Brussett loam, 3 to 5 percent slopes

Map Unit Setting

National map unit symbol: 367k
Elevation: 7,200 to 7,500 feet
Frost-free period: 115 to 125 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Brussett and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Brussett

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian deposits

Typical profile

A - 0 to 8 inches: loam
BA - 8 to 12 inches: loam
Bt - 12 to 26 inches: clay loam
Bk - 26 to 60 inches: silt loam

Properties and qualities

Slope: 3 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
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 in profile: 5 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 9.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Loamy Park (R048AY222CO)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

67—Peyton sandy loam, 5 to 9 percent slopes

Map Unit Setting

National map unit symbol: 369d
Elevation: 6,800 to 7,600 feet
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 115 to 125 days
Farmland classification: Not prime farmland

Map Unit Composition

Peyton and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Peyton

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Arkosic alluvium derived from sedimentary rock and/or arkosic residuum weathered from sedimentary rock

Typical profile

A - 0 to 12 inches: sandy loam
Bt - 12 to 25 inches: sandy clay loam
BC - 25 to 35 inches: sandy loam
C - 35 to 60 inches: sandy loam

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural 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
Available water storage in profile: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Sandy Divide (R049BY216CO)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

69—Peyton-Pring complex, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 369g
Elevation: 6,800 to 7,600 feet
Farmland classification: Not prime farmland

Map Unit Composition

Peyton and similar soils: 40 percent
Pring and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Peyton

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Arkosic alluvium derived from sedimentary rock and/or arkosic residuum weathered from sedimentary rock

Typical profile

A - 0 to 12 inches: sandy loam
Bt - 12 to 25 inches: sandy clay loam
BC - 25 to 35 inches: sandy clay loam
C - 35 to 60 inches: sandy loam

Properties and qualities

Slope: 8 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural 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
Available water storage in profile: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Sandy Divide (R049BY216CO)
Hydric soil rating: No

Description of Pring

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Arkosic alluvium derived from sedimentary rock

Typical profile

A - 0 to 14 inches: coarse sandy loam
C - 14 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Loamy Park (R049BY222CO)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

Exhibit 4
Rational Method Exhibits

Stormwater Runoff Summary

Historic Conditions

Prairie Ridge

Jul-20

			TR55				Rational				
Design Point	Sub Basib I.D.	Area (acres)	Time of Concentration (min)	Curve #	5 year (cfs)	100 year (cfs)	Time of Concentration (min)	C5 Table	C100 table	5 year (cfs)	100 year (cfs)
1	OS-1	211.6	33.4	69	69.6	279.5					
3	OS-2	31.8	14.6	69	17.4	65.5	26.7	0.08	0.35	6.4	47.1
5	OS-3 and D	13.6	16.4	69	7.0	26.7	31.6	0.08	0.35	0.4	22.7
2	A	10.7	14.6	69	5.8	22.0	26.7	0.08	0.35	6.4	47.1
4	B	19.6	15.5	69	10.4	39.4	26.1	0.08	0.35	4	29.4
6	C	5.3	8	69	3.5	12.6	22.6	0.08	0.35	1.2	8.6
7	E	3.7	16.8	69	1.9	7.2	22.3	0.08	0.35	10.9	7.2
6	All Sub basins	296.3			85.7	356.0					

Stormwater Runoff Summary

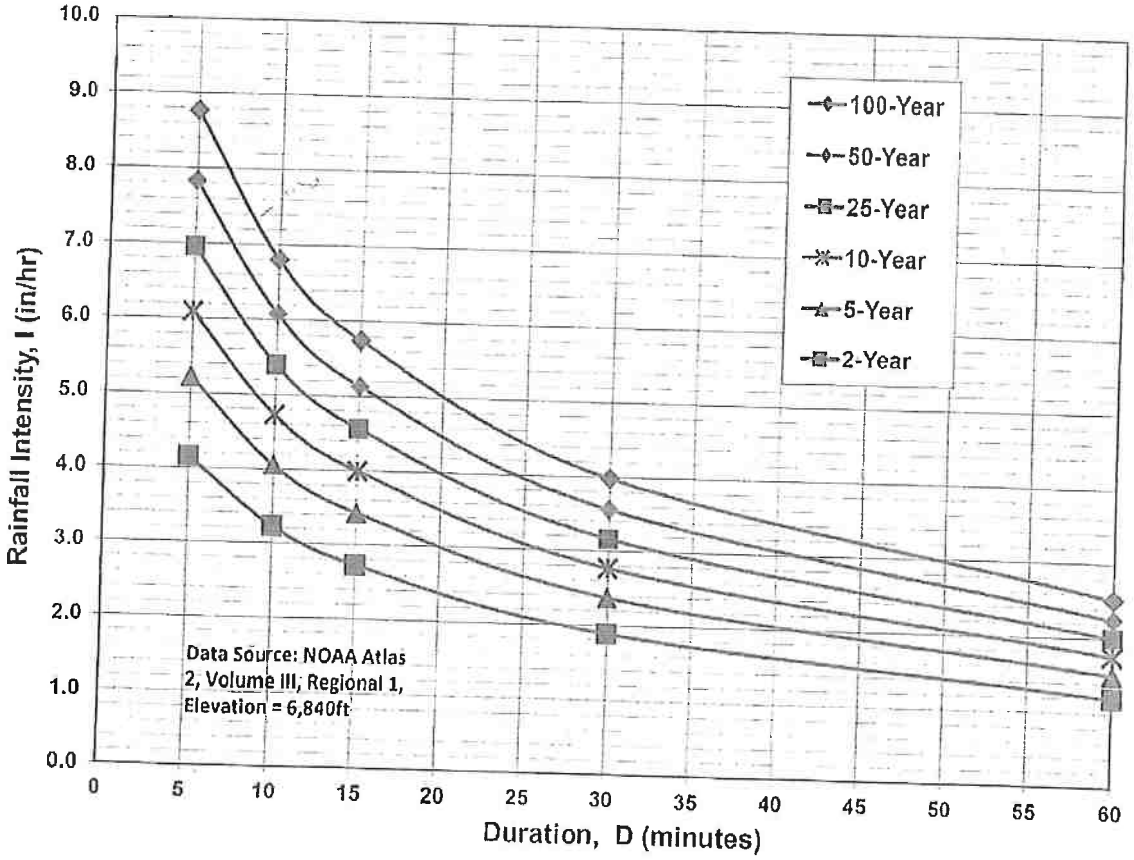
Developed Conditions

Prairie Ridge

Jul-20

			TR55				Rational				
Design Point	Sub Basib I.D.	Area (acres)	Time of Concentration (min)	Curve #	5 year (cfs)	100 year (cfs)	Time of Concentration (min)	C5 Table	C100 table	5 year (cfs)	100 year (cfs)
1	OS-1	211.6	33.4	69	69.6	279.5					
3	OS-2	31.8	14.6	69	17.4	65.5	26.7	0.08	0.35	1.0	58.6
5	OS-3 and D	13.6	16.4	69	7.0	26.7	31.6	0.08	0.35	0.4	22.7
2	A	10.7	14.6	70	7.7	23.1	26.7	0.10	0.37	2.7	16.7
4	B	19.6	15.5	70	13.8	41.3	26.1	0.10	0.37	5.0	31.1
6	C	5.3	8	70	3.9	11.6	22.6	0.10	0.37	1.5	9.1
7	E	3.7	16.8	70	2.5	7.6	22.3	0.10	0.37	1.0	6.4
6	All Sub basins	296.3			86.7	360.8					

Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency



IDF Equations

$I_{100} = -2.52 \ln(D) + 12.735$

$I_{50} = -2.25 \ln(D) + 11.375$

$I_{25} = -2.00 \ln(D) + 10.111$

$I_{10} = -1.75 \ln(D) + 8.847$

$I_{5} = -1.50 \ln(D) + 7.583$

$I_{2} = -1.19 \ln(D) + 6.035$

Note: Values calculated by equations may not precisely duplicate values read from figure.

July 2020

Table 6-7. Conveyance Coefficient, C_v

Type of Land Surface	C_v
Heavy meadow	2.5
Tillage/field	5
Riprap (not buried)*	6.5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

* For buried riprap, select C_v value based on type of vegetative cover.

July Submittal

Table 6-6. Runoff Coefficients for Rational Method
(Source: UDFCD 2001)

Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients											
		2-year		5-year		10-year		25-year		50-year		100-year	
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D
Business													
Commercial Areas	95	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.87	0.87	0.88	0.88	0.89
Neighborhood Areas	70	0.45	0.49	0.49	0.53	0.53	0.57	0.58	0.62	0.60	0.65	0.62	0.68
Residential													
1/8 Acre or less	65	0.41	0.45	0.45	0.49	0.49	0.54	0.54	0.59	0.57	0.62	0.59	0.65
1/4 Acre	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
1/3 Acre	30	0.18	0.22	0.25	0.30	0.32	0.38	0.39	0.47	0.43	0.52	0.47	0.57
1/2 Acre	25	0.15	0.20	0.22	0.28	0.30	0.36	0.37	0.46	0.41	0.51	0.46	0.56
1 Acre	20	0.12	0.17	0.20	0.26	0.27	0.34	0.35	0.44	0.40	0.50	0.44	0.55
Industrial													
Light Areas	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Heavy Areas	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Parks and Cemeteries	7	0.05	0.09	0.12	0.19	0.20	0.29	0.30	0.40	0.34	0.46	0.39	0.52
Playgrounds	13	0.07	0.13	0.16	0.23	0.24	0.31	0.32	0.42	0.37	0.48	0.41	0.54
Railroad Yard Areas	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
Undeveloped Areas													
Historic Flow Analysis-- Greenbelts, Agriculture	2	0.03	0.05	0.09	0.16	0.17	0.26	0.26	0.38	0.31	0.45	0.36	0.51
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Forest	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Exposed Rock	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Offsite Flow Analysis (when landuse is undefined)	45	0.26	0.31	0.32	0.37	0.38	0.44	0.44	0.51	0.48	0.55	0.51	0.59
Streets													
Paved	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Gravel	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Drive and Walks	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Roofs	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Lawns	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50

4E

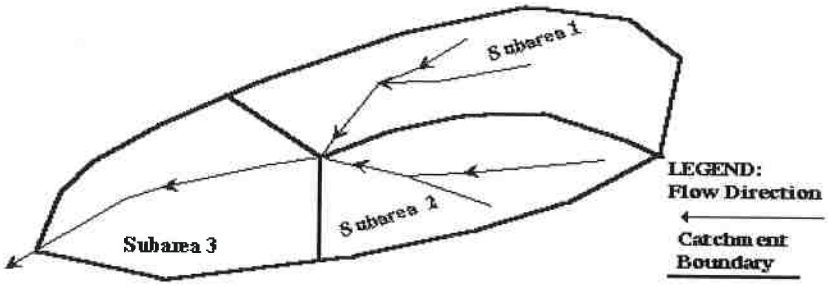
July Submittal

Developed Lots

Area-Weighted Runoff Coefficient Calculations

Version 2.00 released May 2017

Designer: Ken Harrison
Company: KCH Engineering Solutions
Date: 6/26/2020
Project: Prairie Ridge Historic Conditions
Location: El Paso County



Subcatchment Name
Typ 5 acre lot

Cells of this color are for required user-input
Cells of this color are for optional override values
Cells of this color are for calculated results based on overrides

See sheet "Design Info" for imperviousness-based runoff coefficient values.

Sub-Area ID	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C						
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
Roof	0.0918	B	90.0	0.74	0.76	0.78	0.81	0.83	0.84	0.87
				0.71	0.73	0.75	0.78	0.80	0.81	
Patio, walks, drives	0.0574	B	100.0	0.84	0.86	0.86	0.88	0.89	0.89	0.90
				0.89	0.90	0.92	0.94	0.95	0.96	
Lawn	0.0275	B	0.0	0.00	0.00	0.06	0.25	0.33	0.43	0.54
				0.02	0.08	0.15	0.25	0.30	0.35	
Natural	4.8233	B	0.0	0.00	0.00	0.06	0.25	0.33	0.43	0.54
				0.02	0.08	0.15	0.25	0.30	0.35	
Total Area (ac)	5.0000		Area-Weighted C	0.02	0.02	0.08	0.27	0.34	0.44	0.55
			Area-Weighted Override C	0.04	0.10	0.17	0.27	0.32	0.37	0.55

Calculation of Peak Runo

Designer: Ken Harrison
Company: KCH Engineering Solutions
Date: 7/23/2020
Project: Prairie Ridge Historic Conditions
Location: El Paso County

Version 2.00 released May 2017

Cells of this color are for required user-input
Cells of this color are for optional override values
Cells of this color are for calculated results based on overrides

$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_i^{0.33}}$

$t_t = \frac{L_t}{60K\sqrt{S_t}} = \frac{L_t}{60V_t}$

Computed $t_c = t_i + t_t$

Regional $t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$

$t_{minimum} = 5$
$t_{minimum} = 1($

Selected t_c =

Subcatchment Name	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C							Overland (Initial) Flow Time					Channel		
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	Overland Flow Length L_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)	Overland Flow Time t_i (min)	Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)
OS2	31.60	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.54	100.00	7540.00	7500.00	0.050	11.55	1700.00	7500.00	7420.00
				0.02	0.08	0.15	0.25	0.30	0.35						10.83			
A	10.70	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.54	100.00	7510.00	7490.00	0.033	13.25	1500.00	7490.00	7430.00
				0.02	0.08	0.15	0.25	0.30	0.35						12.42			
B	19.60	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.54	100.00	7510.00	7490.00	0.033	13.25	1500.00	7490.00	7430.00
				0.02	0.08	0.15	0.25	0.30	0.35						12.42			
C	5.30	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.54	100.00	7490.00	7480.00	0.033	13.25	1100.00	7480.00	7410.00
				0.02	0.08	0.15	0.25	0.30	0.35						12.42			
OS3 and D	13.60	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.54	100.00	7510.00	7490.00	0.064	10.64	1600.00	7490.00	7410.00
				0.02	0.08	0.15	0.25	0.30	0.35						9.98			
E	3.70	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.54	100.00	7490.00	7480.00	0.017	16.49	700.00	7480.00	7460.00
				0.02	0.08	0.15	0.25	0.30	0.35						15.46			
OS3	12.10	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.54	100.00	7510.00	7500.00	0.100	9.19	922.00	7500.00	7440.00
				0.02	0.08	0.15	0.25	0.30	0.35						8.61			

Please update the runoff coefficient values so that it matches the 2% impervious indicated in table 6-6.

Exhibit 4
Historic
1 of 2

July Report

ff using Rational Method

(urban)
0 (non-urban)

$\max\{t_{minimum}, \min(\text{Computed } t_c, \text{Regional } t_c)\}$

Select UDFCD location for NOAA Atlas 14 Rainfall Depths from the pulldown list OR enter your own depths obtained from the NOAA website (click this link)

	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
1-hour rainfall depth, P1 (in) =	1.19	1.50	1.75	2.00	2.25	2.52	

	a	b	c
Rainfall Intensity Equation Coefficients =	28.50	10.00	0.786

$I(in/hr) = \frac{a * P_1}{(b + t_c)^c}$

$Q(cfs) = CIA$

ized (Travel) Flow Time				Time of Concentration			Rainfall Intensity, I (in/hr)							Peak Flow, Q (cfs)						
Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Velocity V_t (ft/sec)	Channelized Flow Time t_t (min)	Computed t_c (min)	Regional t_c (min)	Selected t_c (min)	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
0.071	7	1.87	15.19	26.74	37.12	26.74	2.00	2.52	2.94	3.35	3.77	4.23		0.55	0.97	6.83	27.91	40.71	58.52	
				26.02										1.27	6.40	14.00	26.67	36.01	47.05	
0.070	7	1.85	13.50	26.74	35.84	26.74	2.00	2.52	2.94	3.35	3.77	4.23		0.18	0.33	2.30	9.39	13.70	19.69	
				25.92										0.43	2.15	4.71	8.97	12.11	15.83	
0.077	7	1.94	12.87	26.12	35.37	26.12	2.02	2.55	2.98	3.40	3.83	4.28		0.34	0.61	4.27	17.43	25.43	36.55	
				25.29										0.79	4.00	8.75	16.66	22.49	29.39	
0.078	7	1.95	9.38	22.62	32.73	22.62	2.19	2.76	3.22	3.68	4.14	4.64		0.10	0.18	1.25	5.11	7.45	10.71	
				21.80										0.23	1.17	2.56	4.88	6.59	8.61	
0.033	7	1.27	20.97	31.62	41.48	31.62	1.81	2.28	2.66	3.04	3.42	3.83		0.21	0.38	2.65	10.82	15.78	22.69	
				30.95										0.49	2.48	5.43	10.34	13.96	18.24	
0.082	7	2.00	5.82	22.31	30.05	22.31	2.21	2.78	3.25	3.71	4.18	4.68		0.07	0.13	0.88	3.59	5.24	7.53	
				21.28										0.16	0.82	1.80	3.43	4.63	6.06	
0.065	7	1.79	8.61	17.79	32.15	17.79	2.49	3.13	3.66	4.18	4.70	5.26		0.26	0.46	3.24	13.22	19.29	27.73	
				17.22										0.60	3.03	6.63	12.64	17.06	22.29	

Exhibit 4
History
2 of 2

July Report

Calculation of Peak Runoff

Designer: Ken Harrison
Company: KCH Engineering Solutions
Date: 7/23/2020
Project: Prairie Ridge Develped Conditions
Location: El Paso County

Version 2.00 released May 2017

Cells of this color are for required user-input
Cells of this color are for optional override values
Cells of this color are for calculated results based on overrides

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_i^{0.33}}$$

$$t_t = \frac{L_t}{60K\sqrt{S_t}} = \frac{L_t}{60V_t}$$

Computed $t_c = t_i + t_t$

Regional $t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$

$t_{minimum} = 5$
$t_{minimum} = 10$

Selected t_c =

Subcatchment Name	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C							Overland (Initial) Flow Time					Channel		
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	Overland Flow Length L_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)	Overland Flow Time t_i (min)	Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)
OS2	31.80	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.54	100.00	7540.00	7500.00	0.050	11.55	1700.00	7500.00	7420.00
				0.02	0.08	0.15	0.25	0.30	0.35						10.83			
A	10.70	B	2.8	0.01	0.02	0.08	0.27	0.34	0.44	0.55	100.00	7510.00	7490.00	0.033	13.18	1500.00	7490.00	7430.00
				0.04	0.10	0.17	0.27	0.32	0.37	0.55					12.18			
B	19.60	B	2.8	0.01	0.02	0.08	0.27	0.34	0.44	0.55	100.00	7510.00	7490.00	0.033	13.18	1500.00	7490.00	7430.00
				0.04	0.10	0.17	0.27	0.32	0.37	0.55					12.18			
C	5.30	B	2.8	0.01	0.02	0.08	0.27	0.34	0.44	0.55	100.00	7490.00	7480.00	0.033	13.18	1100.00	7480.00	7410.00
				0.04	0.10	0.17	0.27	0.32	0.37	0.55					12.18			
OS3 and D	13.60	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.54	100.00	7510.00	7490.00	0.064	10.64	1600.00	7490.00	7410.00
				0.02	0.08	0.15	0.25	0.30	0.35						9.98			
E	3.70	B	2.8	0.01	0.02	0.08	0.27	0.34	0.44	0.55	100.00	7490.00	7480.00	0.017	16.40	700.00	7480.00	7460.00
				0.04	0.10	0.17	0.27	0.32	0.37	0.55					15.15			
OS3	12.10	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.54	100.00	7510.00	7500.00	0.100	9.19	922.00	7500.00	7440.00
				0.02	0.08	0.15	0.25	0.30	0.35						8.61			

Please update the runoff coefficient values so that it matches the 2% impervious indicated in table 6-6.

Exhibit 4
Developed
1 of 2

Tab, Pro

ff using Rational Method

(urban)
0 (non-urban)

$\max\{t_{minimum}, \min(\text{Computed } t_c, \text{Regional } t_c)\}$

Select UDFCD location for NOAA Atlas 14 Rainfall Depths from the pulldown list OR enter your own depths obtained from the NOAA website (click this link)

	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
1-hour rainfall depth, P1 (in) =	1.19	1.50	1.75	2.00	2.25	2.52	

	a	b	c
Rainfall Intensity Equation Coefficients =	28.50	10.00	0.786

$I(in/hr) = \frac{a * P_1}{(b + t_c)^c}$

$Q(cfs) = CIA$

ized (Travel) Flow Time				Time of Concentration			Rainfall Intensity, I (in/hr)							Peak Flow, Q (cfs)						
Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Velocity V_t (ft/sec)	Channelized Flow Time t_t (min)	Computed t_c (min)	Regional t_c (min)	Selected t_c (min)	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
0.071	7	1.87	15.19	26.74	37.12	26.74	2.00	2.52	2.94	3.35	3.77	4.23		0.55	0.97	6.83	27.91	40.71	58.52	
				26.02										1.27	6.40	14.00	26.67	36.01	47.05	
0.070	7	1.85	13.50	26.68	35.58	26.68	2.00	2.52	2.94	3.36	3.78	4.23		0.27	0.47	2.50	9.58	13.90	19.88	
				25.67										0.86	2.70	5.35	9.70	12.94	16.76	
0.077	7	1.94	12.87	26.05	35.12	26.05	2.03	2.55	2.98	3.41	3.83	4.29		0.51	0.88	4.65	17.79	25.80	36.92	
				25.05										1.59	5.01	9.93	18.02	24.03	31.12	
0.078	7	1.95	9.38	22.56	32.51	22.56	2.20	2.77	3.23	3.69	4.15	4.65		0.15	0.26	1.36	5.21	7.56	10.82	
				21.55										0.47	1.47	2.91	5.28	7.04	9.12	
0.033	7	1.27	20.97	31.62	41.48	31.62	1.81	2.28	2.66	3.04	3.42	3.83		0.21	0.38	2.65	10.82	15.78	22.69	
				30.95										0.49	2.46	5.43	10.34	13.96	18.24	
0.082	7	2.00	5.82	22.23	29.86	22.23	2.21	2.79	3.25	3.72	4.18	4.69		0.10	0.18	0.96	3.67	5.32	7.61	
				20.98										0.33	1.03	2.05	3.72	4.95	6.42	
0.065	7	1.79	8.61	17.79	32.15	17.79	2.49	3.13	3.66	4.18	4.70	5.26		0.26	0.46	3.24	13.22	19.29	27.73	
				17.22										0.60	3.03	6.63	12.64	17.06	22.29	

Exhibit 4
Declared
2-8-2

Exhibit 5
SCS TR55 Method Exhibits

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Table 2-2a Runoff curve numbers for urban areas [1]

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area [2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

[1] Average runoff condition, and $I_a = 0.2S$.

[2] The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

[3] CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

[4] Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

[5] Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

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Table 2-2b Runoff curve numbers for cultivated agricultural lands [1]

Cover description			Curve numbers for hydrologic soil group			
Cover type	Treatment [2]	Hydrologic condition [3]	A	B	C	D
Fallow	Bare soil	—	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
	C&T+ CR	Poor	65	73	79	81
		Good	61	70	77	80
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
	C&T+ CR	Poor	60	71	78	81
		Good	58	69	77	80
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

[1] Average runoff condition, and I_a=0.2S

[2] Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.

[3] Hydraulic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good ≥ 20%), and (e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.

Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

5A (2084)

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Table 2-2c Runoff curve numbers for other agricultural lands [1]

Cover description			Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. [2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. [3]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 [4]	48	65	73
Woods—grass combination (orchard or tree farm). [5]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. [6]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 [4]	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

1 Average runoff condition, and $I_a = 0.2S$.

2 *Poor:* <50%) ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: > 75% ground cover and lightly or only occasionally grazed.

3 *Poor:* <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.

4 Actual curve number is less than 30; use CN = 30 for runoff computations.

5 CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.

6 *Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

5A (3084)

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Table 2-2d Runoff curve numbers for arid and semiarid rangelands [1]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition [2]	A [3]	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

1 Average runoff condition, and I_a = 0.2S. For range in humid regions, use table 2-2c.
2 Poor: <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: > 70% ground cover.
3 Curve numbers for group A have been developed only for desert shrub.

5A (4084)

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Table 6-9. NRCS Curve Numbers for Pre-Development Thunderstorms Conditions (ARC I)

Fully Developed Urban Areas (vegetation established)[1]	Treatment	Hydrologic Condition	%I	Pre-Development CN			
				HSG A	HSG B	HSG C	HSG D
Open space (lawns, parks, golf courses, cemeteries, etc.):							
Poor condition (grass cover < 50%)	-----	-----	---	47	61	72	77
Fair condition (grass cover 50% to 75%)	-----	-----	---	29	48	61	69
Good condition (grass cover > 75%)	-----	-----	---	21	40	54	63
Impervious areas:							
Paved parking lots, roofs, driveways, etc. (excluding right-of-way	-----	-----	---	95	95	95	95
Streets and roads:							
Paved; curbs and storm sewers (excluding right-of-way)	-----	-----	---	95	95	95	95
Paved; open ditches (including right-of-way)	-----	-----	---	67	77	83	85
Gravel (including right-of-way)	-----	-----	---	57	70	77	81
Dirt (including right-of-way)	-----	-----	---	52	66	74	77
Western desert urban areas:							
Natural desert landscaping (pervious areas only)	-----	-----	---	42	58	70	75
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)	-----	-----	---	91	91	91	91
Developing Urban Areas[1]	**Treatment[2]**	**Hydrologic Condition[3]**	**%I**	**HSG A**	**HSG B**	**HSG C**	**HSG D**
Newly graded areas (pervious areas only, no vegetation)	-----	-----	---	58	72	81	87
Cultivated Agricultural Lands[1]	**Treatment**	**Hydrologic Condition**	**%I**	**HSG A**	**HSG B**	**HSG C**	**HSG D**
Fallow	Bare soil	-----	---	58	72	81	87
	Crop residue cover (CR)	Poor	---	57	70	79	85
		Good	---	54	67	75	79
Row crops	Straight row (SR)	Poor	---	52	64	75	81
		Good	---	46	60	70	77
	SR + CR	Poor	---	51	63	74	79
		Good	---	43	56	66	70
	Contoured (C)	Poor	---	49	61	69	75
		Good	---	44	56	66	72
	C + CR	Poor	---	48	60	67	74
		Good	---	43	54	64	70
	Contoured & terraced (C&T)	Poor	---	45	54	63	66
		Good	---	41	51	60	64
	C&T+ CR	Poor	---	44	53	61	64
		Good	---	40	49	58	63
Small grain	SR	Poor	---	44	57	69	75
		Good	---	42	56	67	74
	SR + CR	Poor	---	43	56	67	72
		Good	---	39	52	63	69
	C	Poor	---	42	54	66	70
		Good	---	40	53	64	69
	C + CR Poor	Poor	---	41	53	64	69
		Good	---	39	52	63	67
	C&T	Poor	---	40	52	61	66
		Good	---	38	49	60	64
	C&T+ CR	Poor	---	39	51	60	64
		Good	---	37	48	58	63
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	---	45	58	70	77
		Good	---	37	52	64	70
	C	Poor	---	43	56	67	70
		Good	---	34	48	60	67
	C&T	Poor	---	42	53	63	67
		Good	---	30	46	57	63

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Table 6-9. (continued)

Other Agricultural Lands[1]	Treatment	Hydrologic Condition	%I	HSG A	HSG B	HSG C	HSG D
Pasture, grassland, or range—continuous forage for grazing[4]	-----	Poor	---	47	61	72	77
	-----	Fair	---	29	48	61	69
	-----	Good	---	21	40	54	63
Meadow—continuous grass, protected from grazing and generally mowed for hay	-----	-----	---	15	37	51	60
Brush—brush-weed-grass mixture with brush the major element[5]	-----	Poor	---	28	46	58	67
	-----	Fair	---	18	35	49	58
	-----	Good	---	15	28	44	53
Woods—grass combination (orchard or tree farm)[6]	-----	Poor	---	36	53	66	72
	-----	Fair	---	24	44	57	66
	-----	Good	---	17	37	52	61
Woods[7]	-----	Poor	---	26	45	58	67
	-----	Fair	---	19	39	53	61
	-----	Good	---	15	34	49	58
Farmsteads—buildings, lanes, driveways, and surrounding lots	-----	-----	---	38	54	66	72
Arid and Semi-arid Rangelands[1]	**Treatment**	**Hydrologic Condition[8]**	**%I**	**HSG A**	**HSG B**	**HSG C**	**HSG D**
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element	-----	Poor	---	-----	63	74	85
	-----	Fair	---	-----	51	64	77
	-----	Good	---	-----	41	54	70
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush	-----	Poor	---	-----	45	54	61
	-----	Fair	---	-----	28	36	42
	-----	Good	---	-----	15	23	28
Pinyon-juniper—pinyon, juniper, or both; grass understory	-----	Poor	---	-----	56	70	77
	-----	Fair	---	-----	37	53	63
	-----	Good	---	-----	23	40	51
Sagebrush with grass understory	-----	Poor	---	-----	46	63	70
	-----	Fair	---	-----	30	42	49
	-----	Good	---	-----	18	27	34
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus	-----	Poor	---	42	58	70	75
	-----	Fair	---	34	52	64	72
	-----	Good	---	29	47	61	69

[1] Average runoff condition, and Ia = 0.1S.

[2] Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.

[3] Hydraulic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good ≥ 20%), and (e) degree of surface roughness. Poor: Factors impair infiltration and tend to increase runoff. Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

[4] Poor: <50%) ground cover or heavily grazed with no mulch. Fair: 50 to 75% ground cover and not heavily grazed. Good: > 75% ground cover and lightly or only occasionally grazed.

[5] Poor: <50% ground cover. Fair: 50 to 75% ground cover. Good: >75% ground cover.

[6] CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.

[7] Poor: Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning. Fair: Woods are grazed but not burned, and some forest litter covers the soil. Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

[8] Poor: <30% ground cover (litter, grass, and brush overstory). Fair: 30 to 70% ground cover. Good: > 70% ground cover.

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Table 6-10. NRCS Curve Numbers for Frontal Storms & Thunderstorms for Developed Conditions (ARCII)

Fully Developed Urban Areas (vegetation established)[1]	Treatment	Hydrologic Condition	%I	Pre-Development CN			
				HSG A	HSG B	HSG C	HSG D
Open space (lawns, parks, golf courses, cemeteries, etc.):							
Poor condition (grass cover < 50%)	-----	-----	---	68	79	86	89
Fair condition (grass cover 50% to 75%)	-----	-----	---	49	69	79	84
Good condition (grass cover > 75%)	-----	-----	---	39	61	74	80
Impervious areas:							
Paved parking lots, roofs, driveways, etc. (excluding right-of-way	-----	-----	---	98	98	98	98
Streets and roads:							
Paved; curbs and storm sewers (excluding right-of-way)	-----	-----	---	98	98	98	98
Paved; open ditches (including right-of-way)	-----	-----	---	83	89	92	93
Gravel (including right-of-way)	-----	-----	---	76	85	89	91
Dirt (including right-of-way)	-----	-----	---	72	82	87	89
Western desert urban areas:							
Natural desert landscaping (pervious areas only)	-----	-----	---	63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)	-----	-----	---	96	96	96	96
Urban districts:							
Commercial and business	-----	-----	85	89	92	94	95
Industrial	-----	-----	72	81	88	91	93
Residential districts by average lot size:							
1/8 acre or less (town houses)	-----	-----	65	77	85	90	92
1/4 acre	-----	-----	38	61	75	83	87
1/3 acre	-----	-----	30	57	72	81	86
1/2 acre	-----	-----	25	54	70	80	85
1 acre	-----	-----	20	51	68	79	84
2 acres	-----	-----	12	46	65	77	82
Developing Urban Areas[1]	**Treatment[2]**	**Hydrologic Condition[3]**	**%I**	**HSG A**	**HSG B**	**HSG C**	**HSG D**
Newly graded areas (pervious areas only, no vegetation)	-----	-----	---	77	86	91	94
Cultivated Agricultural Lands[1]	**Treatment**	**Hydrologic Condition**	**%I**	**HSG A**	**HSG B**	**HSG C**	**HSG D**
Fallow	Bare soil	-----	---	77	86	91	94
	Crop residue cover (CR)	Poor	---	76	85	90	93
		Good	---	74	83	88	90
Row crops	Straight row (SR)	Poor	---	72	81	88	91
		Good	---	67	78	85	89
	SR + CR	Poor	---	71	80	87	90
		Good	---	64	75	82	85
	Contoured (C)	Poor	---	70	79	84	88
		Good	---	65	75	82	86
	C + CR	Poor	---	69	78	83	87
		Good	---	64	74	81	85
	Contoured & terraced (C&T)	Poor	---	66	74	80	82
		Good	---	62	71	78	81
	C&T+ CR	Poor	---	65	73	79	81
		Good	---	61	70	77	80
Small grain	SR	Poor	---	65	76	84	88
		Good	---	63	75	83	87
	SR + CR	Poor	---	64	75	83	86
		Good	---	60	72	80	84
	C	Poor	---	63	74	82	85
		Good	---	61	73	81	84
	C+ CR Poor	Poor	---	62	73	81	84
		Good	---	60	72	80	83
	C&T	Poor	---	61	72	79	82
		Good	---	59	70	78	81
	C&T+ CR	Poor	---	60	71	78	81
		Good	---	58	69	77	80

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Table 6-10. (continued)

Other Agricultural Lands[1]	Treatment	Hydrologic Condition	%I	HSG A	HSG B	HSG C	HSG D
Pasture, grassland, or range—continuous forage for grazing[4]	-----	Poor	---	68	79	86	89
	-----	Fair	---	49	69	79	84
	-----	Good	---	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay	-----	-----	---	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element[5]	-----	Poor	---	48	67	77	83
	-----	Fair	---	35	56	70	77
	-----	Good	---	30	48	65	73
Woods—grass combination (orchard or tree farm)[6]	-----	Poor	---	57	73	82	86
	-----	Fair	---	43	65	76	82
	-----	Good	---	32	58	72	79
Woods[7]	-----	Poor	---	45	66	77	83
	-----	Fair	---	36	60	73	79
	-----	Good	---	30	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots	-----	-----	---	59	74	82	86
Arid and Semi-arid Rangelands[1]	**Treatment**	**Hydrologic Condition[8]**	**%I**	**HSG A**	**HSG B**	**HSG C**	**HSG D**
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element	-----	Poor	---	-----	80	87	93
	-----	Fair	---	-----	71	81	89
	-----	Good	---	-----	62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush	-----	Poor	---	-----	66	74	79
	-----	Fair	---	-----	48	57	63
	-----	Good	---	-----	30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory	-----	Poor	---	-----	75	85	89
	-----	Fair	---	-----	58	73	80
	-----	Good	---	-----	41	61	71
Sagebrush with grass understory	-----	Poor	---	-----	67	80	85
	-----	Fair	---	-----	51	63	70
	-----	Good	---	-----	35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus	-----	Poor	---	63	77	85	88
	-----	Fair	---	55	72	81	86
	-----	Good	---	49	68	79	84

: $I_a = 0.1\ S$

[2] Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.

[3] Hydraulic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good ≥ 20%), and (e) degree of surface roughness. Poor: Factors impair infiltration and tend to increase runoff. Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

[4] Poor: <50%) ground cover or heavily grazed with no mulch. Fair: 50 to 75% ground cover and not heavily grazed. Good: > 75% ground cover and lightly or only occasional

[5] Poor: <50% ground cover. Fair: 50 to 75% ground cover. Good: >75% ground cover.

[6] CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods

[7] Poor: Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning. Fair: Woods are grazed but not burned, and some forest litter covers the soil. Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

[8] Poor: <30% ground cover (litter, grass, and brush overstory). Fair: 30 to 70% ground cover. Good: > 70% ground cover.

4.6 Lag Time

While the NRCS curve numbers are used to calculate the volume of runoff and magnitude of losses, to transform the volume of runoff into a hydrograph using the NRCS dimensionless unit hydrograph, the lag time must be specified. The lag time is defined as the time from the centroid of the rainfall distribution of a storm to the peak discharge produced by the watershed. For this Manual, the lag time is defined as a fraction of the time of concentration (t_c) as shown in Equation 6-13.

$$t_{lag} = 0.6 \cdot t_c \qquad \text{(Eq. 6-13)}$$

July 2020 Deposit

Table 6-11. Roughness Coefficients (Manning's n) for NRCS Overland Flow

Surface description	n[1]
Smooth surfaces (concrete, asphalt, gravel, bare soil, etc.)	0.011
Fallow (no residue)	0.05
Cultivated Soils:	
Residue cover ≤20%	0.06
Residue cover >20%	0.17
Grass:	
Short grass prairie	0.15
Dense grasses [2]	0.24
Bermuda grass	0.41
Range (natural)	0.13
Woods [3]	
Light underbrush	0.40
Dense underbrush	0.80

4. [1]The values are a composite of information compiled by Engman (1986).

5. [2]Includes species such as weeping lovegrass, bluegrass, buffalograss, blue gramma grass, native grass mixtures.

6. [3]When selecting n, consider cover to a height of about 0.1 feet. This is the only part of the plant cover that will obstruct sheet flow.

KCH Engineering Solutions
5228 Cracker Barrel Circle
Colorado Springs, CO 80917
(719) 246-4471

July 2020 Report

JOB Prairie Ridge
SHEET NO. ____ OF ____
CALCULATED BY K. Harrison DATE 6/30/20
CHECKED BY ____ DATE ____
SCALE ____

Curve No for Typical 5 Acre Lot

Historic Condition
from Table 6-9 Predevelopement Condition ARC I
Past, Grassland, Rang, continuous forage from grazing

Assume Fair condition CN = 69

Developed Condition from TR-55 5 Acres = 217,800 ft²

Rooftops (4000 SF) CN = 98
Patios, Walkways, Drives (2500 s.f.) CN = 98
Lawn, fair condition (1200 S.F.) CN = 69
Natural, undisturbed, Not watered CN = 69
Remaining Natural Area
217,800 - 4000 - 2500 - 1200 = 210,100 S.F

Weighted Impervious

[4000(98) + 2500(98) + 1200(69) + 210,100(69)] / 217,800

CN = 69.9 use 70 for Composite

KCH Engineering Solutions
5228 Cracker Barrel Circle
Colorado Springs, CO 80917
(719) 246-4471

July Report

JOB Ridge Ridge

SHEET NO. _____ OF _____

CALCULATED BY K. Harrison DATE 6/30/26

CHECKED BY _____ DATE _____

SCALE _____

% Impervious for Drainage Area

A. Area for 2.0%

OS1	=	211.6
OS2	=	31.8
OS3+D	=	13.6
		257.0 Acres

B Area for 2.8%

A=	10.7
B=	19.6
C=	5.3
D=	(included w/ OS basins)
E=	3.7
	39.3

C. Total Area = 296.3

D. Composite %

$[257(0.02) + 39.3(0.028)] / 296.3 = 0.021 = 2.1\%$

Prairie Ridge TR 1

Time of Concentration

Subbasin OS-1

Sheet Flow

Length = ~~300ft~~ 100ft property limits

Slope = 10%

Surface = Bluegrass Grazing

Shallow Concentrated

Length = ~~3500ft~~ 3,700ft

Slope = (7520-7450)/3500 = 2%

Surface = Same

Channel

Length = 0

Slope = ([illegible] 7[illegible]) [illegible] 7%

n =

Bottom Width = [illegible]

Side Slope [illegible]

Discharge [illegible]

Prairie Ridge

Time of Concentration

Subbasin OS-2

Sheet Flow

Length = 300' 100

Slope = 15/300 = 5% use 5%

Surface grass = Field - grazing

Shallow Concentrated

Length = 1400'

Slope = (7520 - 7420)/1400 = 7.14%

Surface = grass, grazing

Channel

Length = 0

Slope = 1%

n =

Side Slope =

Discharge =

Prairie Ridge TR-3

Time of Concentration

Subbasin D-3 and D

Sheet Flow

Length = ~~300'~~ 100'

Slope = (7610 - 7600)/300 = 3.3% ok to use w/ 100'

Land Use = grass, grazing

Shallow Concentrate

Length 1400

Slope = (7500 - 7440)/1400 = 6.43%

No Concentrated Channel Flow

Sub-basin A

Sheet Flow

Length = ~~300~~ use 100 ∴ program limit

Slope = (7520 - 7510)/300 = 3.3%

Land Use = grass, grazing

Shallow Channel

Length = 1000 ft

Slope = (7510 - 7440)/1000 = 7%

No Concentrated Channel Flow

Prairie Ridge
Time of Concentration

Sub-basin B

Sheet Flow

Length = ~~300ft~~ use 100

Slope = (7520-7510)/300 = 3.3% ~~db to~~ up

Land Use = grass, grazing

Shallow Concentrated

Length = 1300ft

Slope = (7510 - 7410)/1300 = 7.69%

Channel - No channel flow

Sub-basin C

Sheet Flow

Length = ~~300ft~~ 100ft property upper limit

Slope = (7490 - 7480)/300 = 3.33% ob to us

Land Use = grass, grazing

Shallow concentrated

Length = 900ft

Slope = (7480-7410)/900 = 7.8%

Land Use = grass, grazing

Concentrated Channel - None

TR 5

Prairie Ridge

Time of Concentration

Sub-basin E

Sheet Flow

Length = ~~300~~ use 100 ft for upper limit of program

Slope = (7490 - 7485)/300 = 1.67%

Land Use = grass, grazing

Shallow concentrated

Length = 850 ft

Slope = (7485 - 7415)/850 = 8.24%

Concentrated Channel - None

Prairie Ridge

Reach Data

TR-6

Reach 1 to Reach 2

Length = 600'

Mannings 'n' = grassy swale

Friction Slope (7450 - 7430)/600 = 3.33%

Bottom Width = 30'

Side Slopes = 0.1 ft per ft

Reach 2 to Reach 3

Length = 300ft

Mannings "n" = grassy swale

Friction Slope = (7440 - 7430)/300 = 1.67%

Bottom Width = 30'

Side Slope = 0.1 ft per 1 ft

Reach 3 - Reach 4

Length = 300ft

Mannings = grassy swale

Slope = (7420 - 7415)/300 = 1.67%

Side Slopes = 0.1 ft per ft

Reach 4

Length = 200 ft

Mannings = grassy swale

Slope (7415 - 7410)/200 = 2.5%

Side Slopes = 0.1 to 1

Prairie Ridge

Structure Data

Existing Structure

- There are 4 small stock ponds that will have little impact on the runoff
- There is a relatively large pond at the outlet of the subdivision. Evaluating this is beyond the scope of this report

Prairie Ridge TR-7

Storm Data (Windows)

Rainfall Distribution - Type II

Use Colorado Springs Table for the Return Period & the 24-hour rainfall amount

Dimensionless Hydrograph

Use the one included in the program. This one cannot be changed

Historic

Harrison

Prairie Ridge
Existing Conditions
El Paso County, Colorado

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 5-Yr (cfs)	100-Yr (cfs)
SUBAREAS		
OS-1	69.61	279.49
OS-2	17.37	65.45
OS-3 and D	7.02	26.69
A	5.84	22.02
B	10.42	39.39
C	3.50	12.60
E	1.88	7.19
REACHES		
Reach 1	72.17	289.29
Down	72.08	289.06
Reach 2	72.08	289.06
Down	72.00	288.70
Reach 3	77.98	314.96
Down	77.88	314.74
Reach 4	84.31	348.68
Down	84.28	348.66
OUTLET	85.73	356.00

Historic

WinTR-55 Current Data Description

--- Identification Data ---

User: Harrison
Project: Prairie Ridge
SubTitle: Existing Conditions
State: Colorado
County: El Paso
Filename: C:\Users\Ken\Documents\Business-Consulting\Prairie Ridge\TR 55 existing conditions.w55

Date: 3/31/2019
Units: English
Areal Units: Acres

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
OS-1		Reach 1	211.6	69	.556
OS-2		Reach 3	31.8	69	.243
OS-3 and D		Reach 4	13.6	69	.274
A		Reach 1	10.7	69	.243
B		Reach 4	19.6	69	.258
C		Outlet	5.3	69	.134
E		Outlet	3.7	69	0.280

Total area: 296.30 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
2.1	2.7	3.2	3.6	4.2	4.6	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type II
Dimensionless Unit Hydrograph: <standard>

Historic

Harrison

Prairie Ridge
Existing Conditions
El Paso County, Colorado

Storm Data

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
2.1	2.7	3.2	3.6	4.2	4.6	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type II
Dimensionless Unit Hydrograph: <standard>

Historic

Harrison

Prairie Ridge
Existing Conditions
El Paso County, Colorado

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period 5-Yr (cfs) (hr)	100-Yr (cfs) (hr)
SUBAREAS		
OS-1	69.61 12.29	279.49 12.22
OS-2	17.37 12.07	65.45 12.04
OS-3 and D	7.02 12.09	26.69 12.07
A	5.84 12.07	22.02 12.04
B	10.42 12.08	39.39 12.05
C	3.50 12.02	12.60 11.97
E	1.88 12.10	7.19 12.08
REACHES		
Reach 1	72.17 12.25	289.29 12.23
Down	72.08 12.31	289.06 12.24
Reach 2	72.08 12.31	289.06 12.24
Down	72.00 12.35	288.70 12.26
Reach 3	77.98 12.33	314.96 12.24
Down	77.88 12.36	314.74 12.26
Reach 4	84.31 12.35	348.68 12.21
Down	84.28 12.36	348.66 12.21
OUTLET	85.73	356.00

HISTORIC

Prairie Ridge
Existing Conditions
El Paso County, Colorado

Sub-Area Summary Table

Sub-Area Identifier	Drainage Area (ac)	Time of Concentration (hr)	Curve Number	Receiving Reach	Sub-Area Description
OS-1	211.60	0.556	69	Reach 1	
OS-2	31.80	0.243	69	Reach 3	
OS-3 and D	13.60	0.274	69	Reach 4	
A	10.70	0.243	69	Reach 1	
B	19.60	0.258	69	Reach 4	
C	5.30	0.134	69	Outlet	
E	3.70	0.280	69	Outlet	

Total Area: 296.30 (ac)

Historic

Prairie Ridge
Existing Conditions
El Paso County, Colorado

Reach Summary Table

Reach Identifier	Receiving Reach Identifier	Reach Length (ft)	Routing Method
Reach 1	Reach 2	600	CHANNEL
Reach 2	Reach 3	300	CHANNEL
Reach 3	Reach 4	300	CHANNEL
Reach 4	Outlet	200	CHANNEL

Historic

Harrison

Prairie Ridge
Existing Conditions
El Paso County, Colorado

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
OS-1							
SHEET	100	0.1000	0.150				0.106
SHALLOW	3700	0.0200	0.050				0.450
					Time of Concentration		.556
OS-2							
SHEET	100	0.0500	0.150				0.140
SHALLOW	1600	0.0714	0.050				0.103
					Time of Concentration		.243
OS-3 and D							
SHEET	100	0.0330	0.150				0.165
SHALLOW	1600	0.0643	0.050				0.109
					Time of Concentration		.274
A							
SHEET	100	0.0330	0.150				0.165
SHALLOW	1200	0.0700	0.050				0.078
					Time of Concentration		.243
B							
SHEET	100	0.0330	0.150				0.165
SHALLOW	1500	0.0769	0.050				0.093
					Time of Concentration		.258
C							
SHEET	100	0.3300	0.150				0.066
SHALLOW	1100	0.0780	0.050				0.068
					Time of Concentration		.134
E							
SHEET	100	0.0167	0.150				0.217
SHALLOW	1050	0.0824	0.050				0.063
					Time of Concentration		0.280

Historic

Prairie Ridge
Existing Conditions
El Paso County, Colorado

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
OS-1	CN directly entered by user	-	211.6	69
	Total Area / Weighted Curve Number		211.6	69
OS-2	CN directly entered by user	-	31.8	69
	Total Area / Weighted Curve Number		31.8	69
OS-3 and DCN	directly entered by user	-	13.6	69
	Total Area / Weighted Curve Number		13.6	69
A	CN directly entered by user	-	10.7	69
	Total Area / Weighted Curve Number		10.7	69
B	CN directly entered by user	-	19.6	69
	Total Area / Weighted Curve Number		19.6	69
C	CN directly entered by user	-	5.3	69
	Total Area / Weighted Curve Number		5.3	69
E	CN directly entered by user	-	3.7	69
	Total Area / Weighted Curve Number		3.7	69

Historic

Harrison

Prairie Ridge
Existing Conditions
El Paso County, Colorado

Reach Channel Rating Details

Reach Identifier	Reach Length (ft)	Reach Manning's n	Friction Slope (ft/ft)	Bottom Width (ft)	Side Slope
Reach 1	600	0.13	0.0333	30	.1 :1
Reach 2	300	0.13	0.0167	30	.1 :1
Reach 3	300	0.13	0.0167	30	.1 :1
Reach 4	200	0.13	0.025	30	.1 :1

Reach Identifier	Stage (ft)	Flow (cfs)	End Area (sq ft)	Top Width (ft)	Friction Slope (ft/ft)
Reach 1	0.0	0.000	0	30	0.0333
	0.5	19.336	15	30.1	
	1.0	60.263	30.1	30.2	
	2.0	184.730	60.4	30.4	
	5.0	775.675	152.5	31	
	10.0	2179.432	310	32	
	20.0	5826.058	640	34	
Reach 2	0.0	0.000	0	30	0.0167
	0.5	13.693	15	30.1	
	1.0	42.676	30.1	30.2	
	2.0	130.820	60.4	30.4	
	5.0	549.308	152.5	31	
	10.0	1543.403	310	32	
	20.0	4125.826	640	34	
Reach 3	0.0	0.000	0	30	0.0167
	0.5	13.693	15	30.1	
	1.0	42.676	30.1	30.2	
	2.0	130.820	60.4	30.4	
	5.0	549.308	152.5	31	
	10.0	1543.403	310	32	
	20.0	4125.826	640	34	
Reach 4	0.0	0.000	0	30	0.025
	0.5	16.754	15	30.1	
	1.0	52.215	30.1	30.2	
	2.0	160.061	60.4	30.4	
	5.0	672.090	152.5	31	
	10.0	1888.388	310	32	
	20.0	5048.039	640	34	

Developed

Harrison

Prairie Ridge
Developed conditions
El Paso County, Colorado

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 5-Yr (cfs)	100-Yr (cfs)
SUBAREAS		
OS-1	69.61	279.49
OS-2	17.37	65.45
OS-3 and D	7.02	26.69
A	6.45	23.11
B	11.51	41.30
C	3.26	11.61
E	2.08	7.55
REACHES		
Reach 1	72.41	289.73
Down	72.30	289.42
Reach 2	72.30	289.42
Down	72.22	289.15
Reach 3	78.22	315.47
Down	78.12	315.25
Reach 4	84.88	350.33
Down	84.84	350.32
OUTLET	86.66	360.77

Developed

WinTR-55 Current Data Description

--- Identification Data ---

User: Harrison
Project: Prairie Ridge
SubTitle: Developed conditions
State: Colorado
County: El Paso
Filename: C:\Users\Ken\Documents\Business-Consulting\Prairie Ridge\TR 55 developed conditions.w55

Date: 3/31/2019
Units: English
Areal Units: Acres

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
OS-1		Reach 1	211.6	69	.556
OS-2		Reach 3	31.8	69	.243
OS-3 and D		Reach 4	13.6	69	.274
A		Reach 1	10.7	70	.243
B		Reach 4	19.6	70	.258
C		Outlet	5.3	70	.233
E		Outlet	3.7	70	0.280

Total area: 296.30 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
2.1	2.7	3.2	3.6	4.2	4.6	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type II
Dimensionless Unit Hydrograph: <standard>

Developed

Prairie Ridge
Developed conditions
El Paso County, Colorado

Storm Data

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
2.1	2.7	3.2	3.6	4.2	4.6	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type II
Dimensionless Unit Hydrograph: <standard>

Developed

Prairie Ridge
Developed conditions
El Paso County, Colorado

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period 5-Yr (cfs) (hr)	100-Yr (cfs) (hr)
SUBAREAS		
OS-1	69.61 12.29	279.49 12.22
OS-2	17.37 12.07	65.45 12.04
OS-3 and D	7.02 12.09	26.69 12.07
A	6.45 12.07	23.11 12.05
B	11.51 12.08	41.30 12.07
C	3.26 12.06	11.61 12.04
E	2.08 12.08	7.55 12.07
REACHES		
Reach 1	72.41 12.25	289.73 12.22
Down	72.30 12.31	289.42 12.25
Reach 2	72.30 12.31	289.42 12.25
Down	72.22 12.34	289.15 12.26
Reach 3	78.22 12.33	315.47 12.25
Down	78.12 12.36	315.25 12.26
Reach 4	84.88 12.33	350.33 12.20
Down	84.84 12.34	350.32 12.22
OUTLET	86.66	360.77

Developed

Prairie Ridge
Developed conditions
El Paso County, Colorado

Sub-Area Summary Table

Sub-Area Identifier	Drainage Area (ac)	Time of Concentration (hr)	Curve Number	Receiving Reach	Sub-Area Description
OS-1	211.60	0.556	69	Reach 1	
OS-2	31.80	0.243	69	Reach 3	
OS-3 and D	13.60	0.274	69	Reach 4	
A	10.70	0.243	70	Reach 1	
B	19.60	0.258	70	Reach 4	
C	5.30	0.233	70	Outlet	
E	3.70	0.280	70	Outlet	

Total Area: 296.30 (ac)

Developed

Prairie Ridge
Developed conditions
El Paso County, Colorado

Reach Summary Table

Reach Identifier	Receiving Reach Identifier	Reach Length (ft)	Routing Method
Reach 1	Reach 2	600	CHANNEL
Reach 2	Reach 3	300	CHANNEL
Reach 3	Reach 4	300	CHANNEL
Reach 4	Outlet	200	CHANNEL

Developed

Harrison

Prairie Ridge
Developed conditions
El Paso County, Colorado

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
OS-1							
SHEET	100	0.1000	0.150				0.106
SHALLOW	3700	0.0200	0.050				0.450
					Time of Concentration		.556
OS-2							
SHEET	100	0.0500	0.150				0.140
SHALLOW	1600	0.0714	0.050				0.103
					Time of Concentration		.243
OS-3 and D							
SHEET	100	0.0330	0.150				0.165
SHALLOW	1600	0.0643	0.050				0.109
					Time of Concentration		.274
A							
SHEET	100	0.0330	0.150				0.165
SHALLOW	1200	0.0700	0.050				0.078
					Time of Concentration		.243
B							
SHEET	100	0.0330	0.150				0.165
SHALLOW	1500	0.0769	0.050				0.093
					Time of Concentration		.258
C							
SHEET	100	0.0330	0.150				0.165
SHALLOW	1100	0.0780	0.050				0.068
					Time of Concentration		.233
E							
SHEET	100	0.0167	0.150				0.217
SHALLOW	1050	0.0824	0.050				0.063
					Time of Concentration		0.280

Developed

Prairie Ridge
Developed conditions
El Paso County, Colorado

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
OS-1	Cover Description	?	0	0
	Cover Description	?	0	0
	Total Area / Weighted Curve Number		211.6	69
OS-2	CN directly entered by user	-	31.8	69
	Total Area / Weighted Curve Number		31.8	69
OS-3 and DCN	directly entered by user	-	13.6	69
	Total Area / Weighted Curve Number		13.6	69
A	CN directly entered by user	-	10.7	70
	Total Area / Weighted Curve Number		10.7	70
B	CN directly entered by user	-	19.6	70
	Total Area / Weighted Curve Number		19.6	70
C	CN directly entered by user	-	5.3	70
	Total Area / Weighted Curve Number		5.3	70
E	CN directly entered by user	-	3.7	70
	Total Area / Weighted Curve Number		3.7	70

Developed

Prairie Ridge
Developed conditions
El Paso County, Colorado

Reach Channel Rating Details

Reach Identifier	Reach Length (ft)	Reach Manning's n	Friction Slope (ft/ft)	Bottom Width (ft)	Side Slope
Reach 1	600	0.13	0.0333	30	.1 :1
Reach 2	300	0.13	0.0167	30	.1 :1
Reach 3	300	0.13	0.0167	30	.1 :1
Reach 4	200	0.13	0.025	30	.1 :1

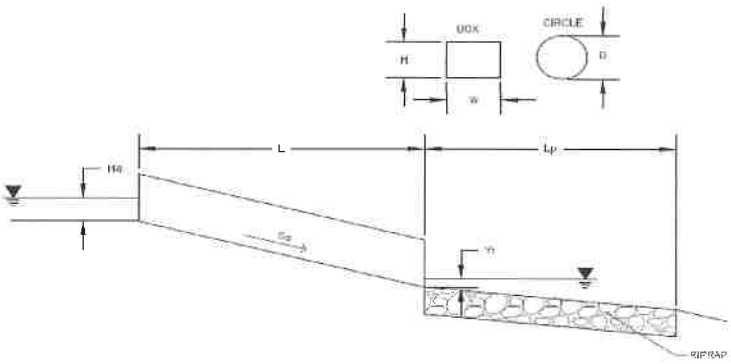
Reach Identifier	Stage (ft)	Flow (cfs)	End Area (sq ft)	Top Width (ft)	Friction Slope (ft/ft)
Reach 1	0.0	0.000	0	30	0.0333
	0.5	19.336	15	30.1	
	1.0	60.263	30.1	30.2	
	2.0	184.730	60.4	30.4	
	5.0	775.675	152.5	31	
	10.0	2179.432	310	32	
	20.0	5826.058	640	34	
Reach 2	0.0	0.000	0	30	0.0167
	0.5	13.693	15	30.1	
	1.0	42.676	30.1	30.2	
	2.0	130.820	60.4	30.4	
	5.0	549.308	152.5	31	
	10.0	1543.403	310	32	
	20.0	4125.826	640	34	
Reach 3	0.0	0.000	0	30	0.0167
	0.5	13.693	15	30.1	
	1.0	42.676	30.1	30.2	
	2.0	130.820	60.4	30.4	
	5.0	549.308	152.5	31	
	10.0	1543.403	310	32	
	20.0	4125.826	640	34	
Reach 4	0.0	0.000	0	30	0.025
	0.5	16.754	15	30.1	
	1.0	52.215	30.1	30.2	
	2.0	160.061	60.4	30.4	
	5.0	672.090	152.5	31	
	10.0	1888.388	310	32	
	20.0	5048.039	640	34	

Exhibit 6
Culvert Capacity Exhibits

July 2020

Determination of Culvert Headwater and Outlet Protection

Project: Prairie Ridge: Existing culvert capacity
Basin ID: OS1



Soil Type:
Choose One:
(•) Sandy
( ) Non-Sandy

Design Information (Input):

Design Discharge	Q =	20	cfs
Circular Culvert:			
Barrel Diameter in Inches	D =	24	inches
Inlet Edge Type (Choose from pull-down list)	Square End Projection		
Box Culvert:	**OR**		
Barrel Height (Rise) in Feet	Height (Rise) =		ft
Barrel Width (Span) in Feet	Width (Span) =		ft
Inlet Edge Type (Choose from pull-down list)			
Number of Barrels	No =	1	
Inlet Elevation	Elev IN =	5100	ft
Outlet Elevation **OR** Slope	So =	0.01	ft/ft
Culvert Length	L =	60	ft
Manning's Roughness	n =	0.022	
Bend Loss Coefficient	k_b =	0	
Exit Loss Coefficient	k_x =	1	
Tailwater Surface Elevation	Elev Y_t =	5099.8	ft
Max Allowable Channel Velocity	V =	18	ft/s

Required Protection (Output):

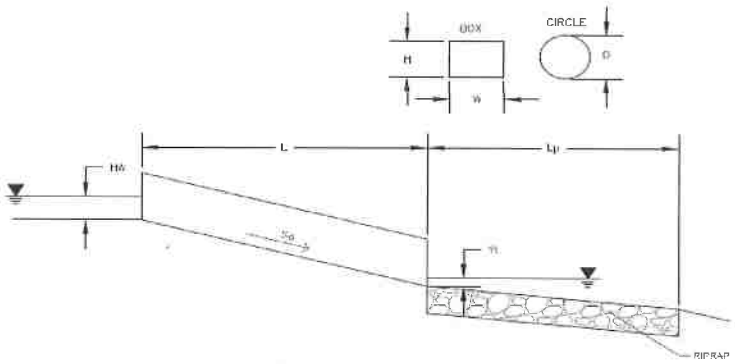
Tailwater Surface Height	Y_t =	0.40	ft
Flow Area at Max Channel Velocity	A_t =	4.44	ft^2
Culvert Cross Sectional Area Available	A =	9.62	ft^2
Entrance Loss Coefficient	k_e =	0.50	
Friction Loss Coefficient	k_f =	1.01	
Sum of All Losses Coefficients	k_s =	2.51	ft
Culvert Normal Depth	Y_n =	2.08	ft
Culvert Critical Depth	Y_c =	2.79	ft
Tailwater Depth for Design	d =	3.15	ft
Adjusted Diameter **OR** Adjusted Rise	D_a =	-	ft
Expansion Factor	1/(2*tan(Θ)) =	0.77	
Flow/Diameter$^{2.5}$ **OR** Flow/(Span * Rise$^{1.5}$)	Q/D^2.5 =	3.49	$ft^{0.5}/s$
Froude Number	Fr =	-	Pressure flow!
Tailwater/Adjusted Diameter **OR** Tailwater/Adjusted Rise	Yt/D =	0.11	
Inlet Control Headwater	HW_i =	5.14	ft
Outlet Control Headwater	HW_o =	5.24	
Design Headwater Elevation	**HW =**	**5,105.24**	**ft**
Headwater/Diameter OR Headwater/Rise Ratio	**HW/D =**	**1.50**	
Minimum Theoretical Riprap Size	d_{50} =	46	in
Nominal Riprap Size	d_{50} =	-	in
UDFCD Riprap Type	**Type =**	**Very Big**	
Length of Protection	**L_p =**	**11**	**ft**
Width of Protection	**T =**	**18**	**ft**

July 2020

Consider revising this to state recommended instead of proposed.

Determination of Culvert Headwater and Outlet Protection

Project: Prairie Ridge: proposed culvert at DP2 designed for 5yr storm
Basin ID: OS1



Soil Type:
Choose One:
(●) Sandy
( ) Non-Sandy

Design Information (Input):

Design Discharge	Q =	80	cfs
Circular Culvert:			
Barrel Diameter in Inches	D =	42	inches
Inlet Edge Type (Choose from pull-down list)	Square End Projection		
Box Culvert:		**OR**	
Barrel Height (Rise) in Feet	Height (Rise) =		ft
Barrel Width (Span) in Feet	Width (Span) =		ft
Inlet Edge Type (Choose from pull-down list)			
Number of Barrels	No =	1	
Inlet Elevation	Elev IN =	5100	ft
Outlet Elevation **OR** Slope	So =	0.01	ft/ft
Culvert Length	L =	60	ft
Manning's Roughness	n =	0.022	
Bend Loss Coefficient	k_b =	0	
Exit Loss Coefficient	k_y =	1	
Tailwater Surface Elevation	Elev Y_t =	5099.8	ft
Max Allowable Channel Velocity	V =	18	ft/s

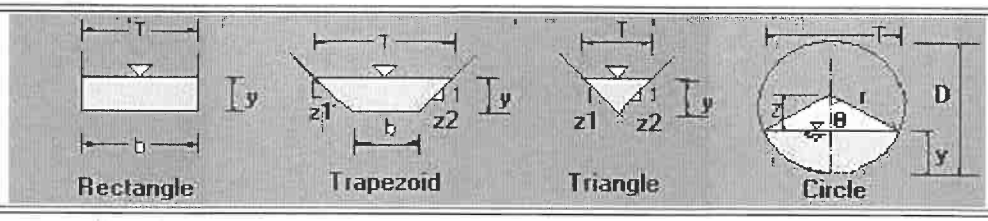
Required Protection (Output):

Tailwater Surface Height	Y_t =	0.40	ft
Flow Area at Max Channel Velocity	A_t =	4.44	ft^2
Culvert Cross Sectional Area Available	A =	9.62	ft^2
Entrance Loss Coefficient	k_e =	0.50	
Friction Loss Coefficient	k_f =	1.01	
Sum of All Losses Coefficients	k_s =	2.51	ft
Culvert Normal Depth	Y_n =	2.08	ft
Culvert Critical Depth	Y_c =	2.79	ft
Tailwater Depth for Design	d =	3.15	ft
Adjusted Diameter **OR** Adjusted Rise	D_a =	-	ft
Expansion Factor	1/(2*tan(Θ)) =	0.77	
Flow/Diameter$^{2.5}$ **OR** Flow/(Span * Rise$^{1.5}$)	Q/D^2.5 =	3.49	$ft^{0.5}/s$
Froude Number	Fr =	-	Pressure flow!
Tailwater/Adjusted Diameter **OR** Tailwater/Adjusted Rise	Yt/D =	0.11	
Inlet Control Headwater	HW_I =	5.14	ft
Outlet Control Headwater	HW_O =	5.24	
Design Headwater Elevation	**HW =**	**5,105.24**	**ft**
Headwater/Diameter OR Headwater/Rise Ratio	**HW/D =**	**1.50**	
Minimum Theoretical Riprap Size	d_{50} =	46	in
Nominal Riprap Size	d_{50} =	-	in
UDFCD Riprap Type	**Type =**	**Very Big**	
Length of Protection	**L_p =**	**11**	**ft**
Width of Protection	**T =**	**18**	**ft**

July 2020

The open channel flow calculator

Select Channel Type: Circle



Depth from Q

Select unit system: Feet(ft)

Channel slope: .01 ft/ft	Water depth(y): 2.19 ft	Radius (r) 3.5 ft
Flow velocity 7.79 ft/s	LeftSlope (Z1): to 1 (H:V)	RightSlope (Z2): to 1 (H:V)
Flow discharge 80 ft^3/s	Input n value 0.022 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 8.31 ft	Flow area 10.29 ft^2	Top width(T) 6.49 ft
Specific energy 3.13 ft	Froude number 1.09	Flow status Supercritical flow
Critical depth 2.29 ft	Critical slope 0.0084 ft/ft	Velocity head 0.94 ft

July 2020

Exhibit 7
Stone Check Dams

Send to Stan

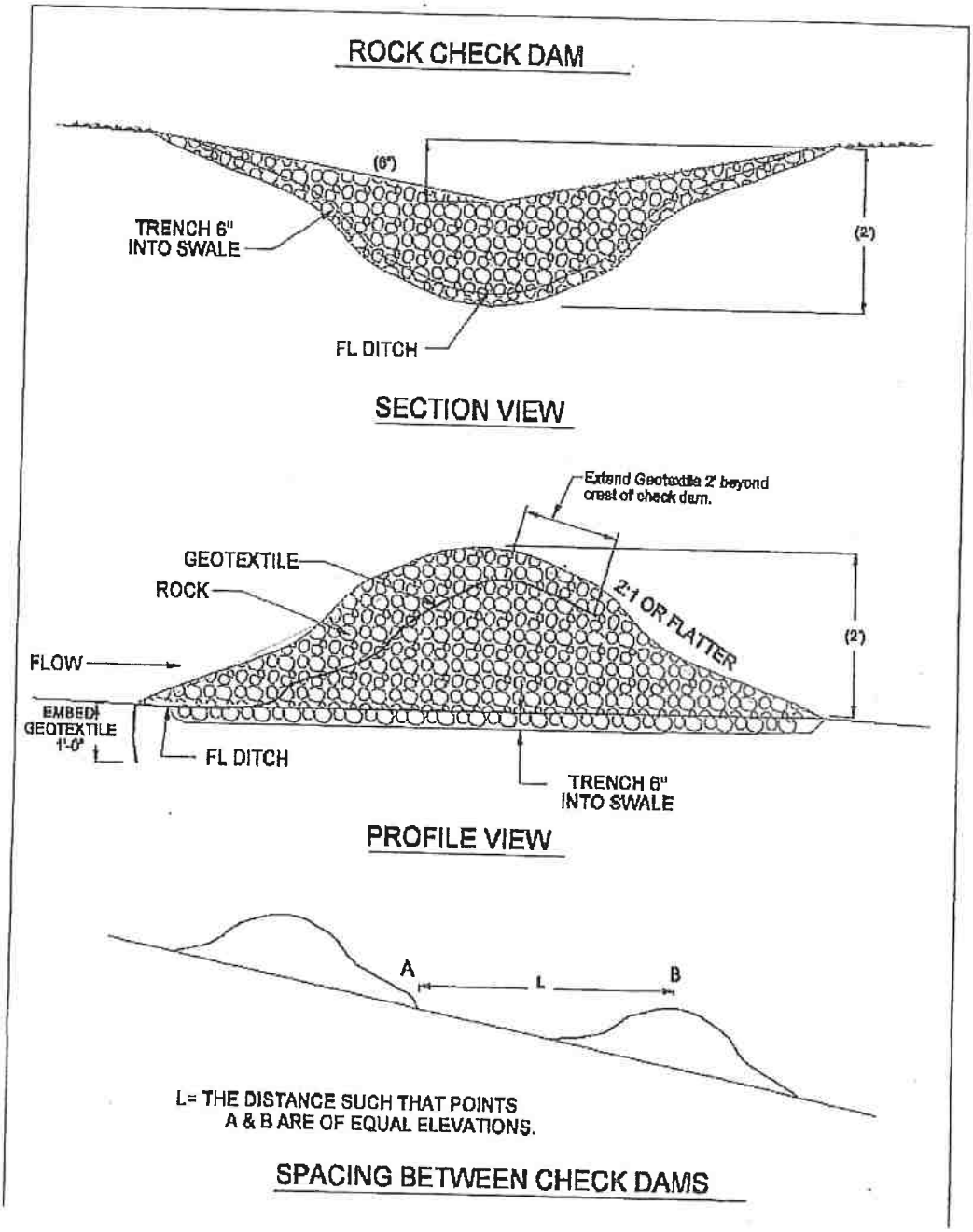


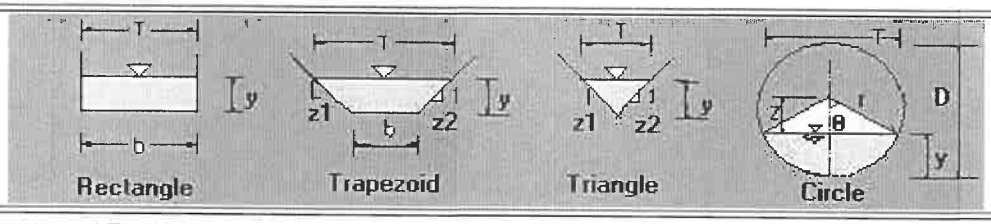
TABLE EC 9.1
Check Dam Spacing

Slope	2 percent	3 percent	4 percent	5 percent	6 percent
Spacing (ft)	100	67	50	40	33

Exhibit 8
Borrow Ditch Calculations

The open channel flow calculator

Select Channel Type: Trapezoid



Depth from Q | Select unit system: Feet(ft)

Channel slope: .025 ft/ft	Water depth(y): 1.31 ft	Bottom width(b) 30 ft
Flow velocity 2.209 ft/s	LeftSlope (Z1): 0..5 to 1 (H:V)	RightSlope (Z2): 0...5 to 1 (H:V)
Flow discharge 86.7 ft^3/s	Input n value 0.12 or select n very poor natural channels:0.060	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 32.62 ft	Flow area 39.25 ft^2	Top width(T) 30 ft
Specific energy 1.38 ft	Froude number 0.34	Flow status Subcritical flow
Critical depth 0.64 ft	Critical slope 0.2524 ft/ft	Velocity head 0.08 ft

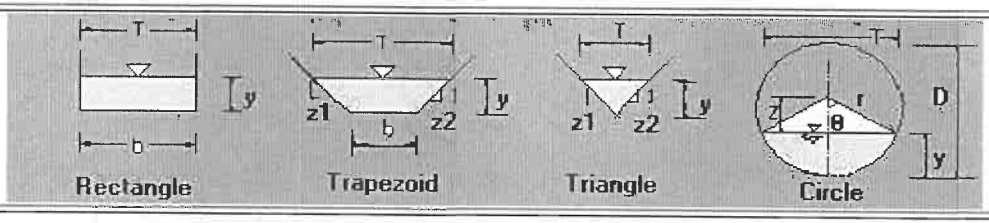
Please provide additional description as to where this swale is on the drainage map. Per the flow indicated above this appears to be at DP6.

Onsite Swale
Slope 2.5%

July Report

The open channel flow calculator

Select Channel Type: Trapezoid



Depth from Q

Select unit system: Feet(ft)

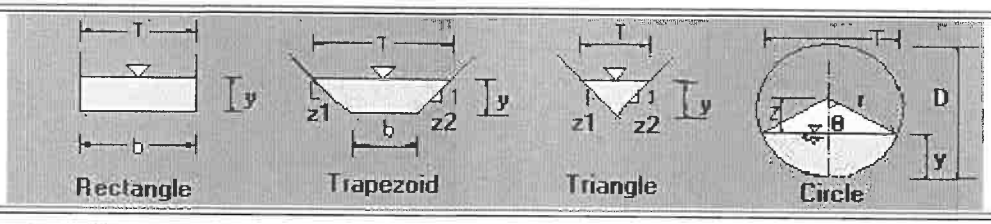
Channel slope: .06 ft/ft	Water depth(y): 2.43 ft	Bottom width(b) 30 ft
Flow velocity 4.947 ft/s	LeftSlope (Z1): 0..5 to 1 (H:V)	RightSlope (Z2): 0...5 to 1 (H:V)
Flow discharge 360 ft^3/s	Input n value 0.12 or select n very poor natural channels:0.060	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 34.85 ft	Flow area 72.76 ft^2	Top width(T) 30 ft
Specific energy 2.81 ft	Froude number 0.56	Flow status Subcritical flow
Critical depth 1.65 ft	Critical slope 0.2028 ft/ft	Velocity head 0.38 ft

Please provide additional description as to where this swale is on the drainage map

Onsite Swales
Slope: 6.0%

The open channel flow calculator

Select Channel Type: Trapezoid



Depth from Q

Select unit system: Feet(ft)

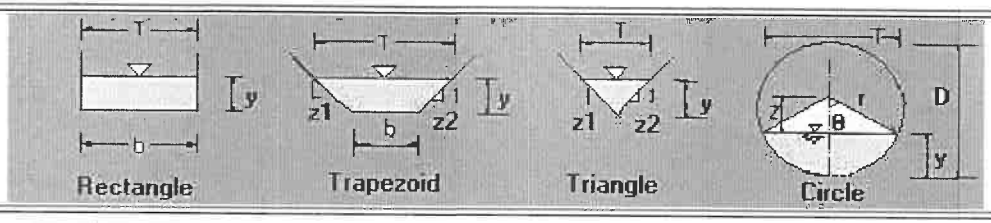
Channel slope: 0.025 ft/ft	Water depth(y): 3.14 ft	Bottom width(b) 30 ft
Flow velocity 3.729 ft/s	LeftSlope (Z1): 0..5 to 1 (H:V)	RightSlope (Z2): 0.5 to 1 (H:V)
Flow discharge 360 ft^3/s	Input n value .12 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 36.64 ft	Flow area 96.54 ft^2	Top width(T) 31.57 ft
Specific energy 3.35 ft	Froude number 0.38	Flow status Subcritical flow
Critical depth 1.64 ft	Critical slope 0.1991 ft/ft	Velocity head 0.22 ft

Please provide additional description as to where this swale is on the drainage map

Interval (onsite)
5 scales
10
Slope = 2.5%
100 yr

The open channel flow calculator

Select Channel Type: Trapezoid



Depth from Q

Select unit system: Feet(ft)

Channel slope: 0.06 ft/ft	Water depth(y): 2.38 ft	Bottom width(b) 30 ft
Flow velocity 4.941 ft/s	LeftSlope (Z1): 0..5 to 1 (H:V)	RightSlope (Z2): 0.5 to 1 (H:V)
Flow discharge 360 ft^3/s	Input n value .12 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 35.04 ft	Flow area 72.86 ft^2	Top width(T) 31.19 ft
Specific energy 2.76 ft	Froude number 0.57	Flow status Subcritical flow
Critical depth 1.64 ft	Critical slope 0.1991 ft/ft	Velocity head 0.38 ft

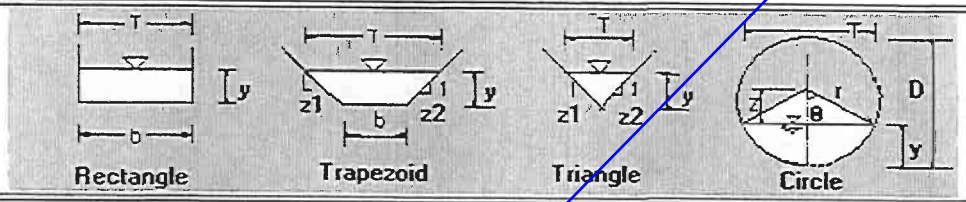
Internal (onsite)
Swales
Slope = 6%
100 YT

T:0.2% Roads

Existing Swale: Design Point 1 to 6 (Lower Slope)

The open channel flow calculator

Select Channel Type: Trapezoid



Depth from Q | Select unit system: Feet(ft)

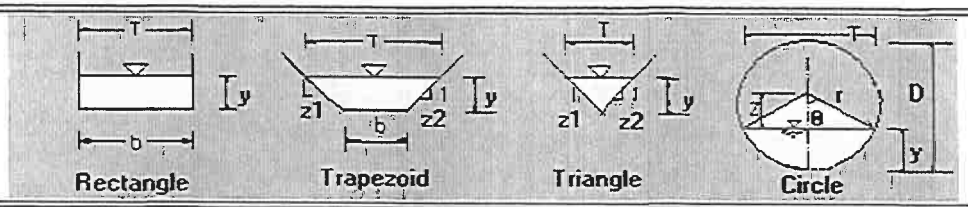
Channel slope: .025 ft/ft	Water depth(y): 1.31 ft	Bottom W(b) 100 ft
Flow velocity 2.29 ft/s	LeftSlope (Z1): 0.1 to 1 (H:V)	RightSlope (Z2): 0.1 to 1 (H:V)
Flow discharge 300 ft^3/s	Input n value .12 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 102.63 ft	Flow area 131 ft^2	Top width(T) 100.26 ft
Specific energy 1.39 ft	Froude number 0.35	Flow status Subcritical flow
Critical depth 0.66 ft	Critical slope 0.2422 ft/ft	Velocity head 0.08 ft

Is this the analysis of the southern swale between DP1 and DP2? Please be more specific as to where this existing swale is at. This comment also applies to the next calculation.

Existing Drainage Swale: Design Pt 1 to 6

The open channel flow calculator (Higher Slope)

Select Channel Type: Trapezoid

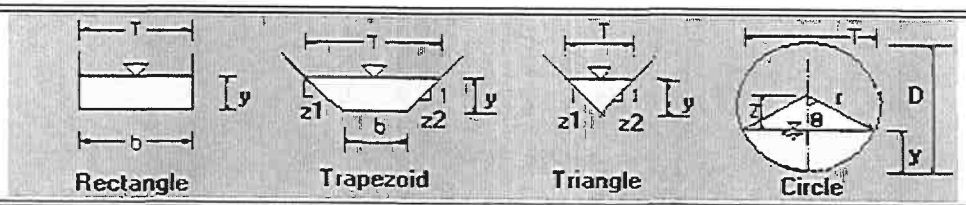


Depth from Q | Select unit system: Feet(ft)

Channel slope: .06 ft/ft	Water depth(y): 1 ft	Bottom W(b) 100 ft
Flow velocity 2.984 ft/s	LeftSlope (Z1): 0.1 to 1 (H:V)	RightSlope (Z2): 0.1 to 1 (H:V)
Flow discharge 300 ft^3/s	Input n value .12 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 102.02 ft	Flow area 100.55 ft^2	Top width(T) 100.2 ft
Specific energy 1.14 ft	Froude number 0.52	Flow status Subcritical flow
Critical depth 0.66 ft	Critical slope 0.2422 ft/ft	Velocity head 0.14 ft

The open channel flow calculator

Select Channel Type: Trapezoid



Depth from Q

Select unit system: Feet(ft)

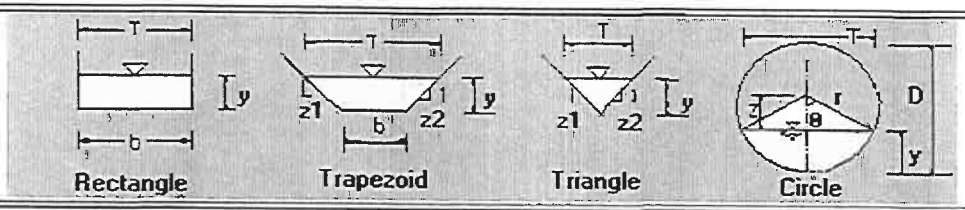
Channel slope: .02 ft/ft	Water depth(y): 0.49 ft	Bottom width(b) 10 ft
Flow velocity 1.015433 ft/s	LeftSlope (Z1): .1 to 1 (H:V)	RightSlope (Z2): .1 to 1 (H:V)
Flow discharge 5 ft^3/s	Input n value .12 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 10.98 ft	Flow area 4.92 ft^2	Top width(T) 10.1 ft
Specific energy 0.51 ft	Froude number 0.26	Flow status Subcritical flow
Critical depth 0.2 ft	Critical slope 0.3595 ft/ft	Velocity head 0.02 ft

Sub basin Swales - 2% slope

Please provide more description of which swale from the drainage plan you are calculating.

The open channel flow calculator

Select Channel Type: Trapezoid



Depth from Q

Select unit system: Feet(ft)

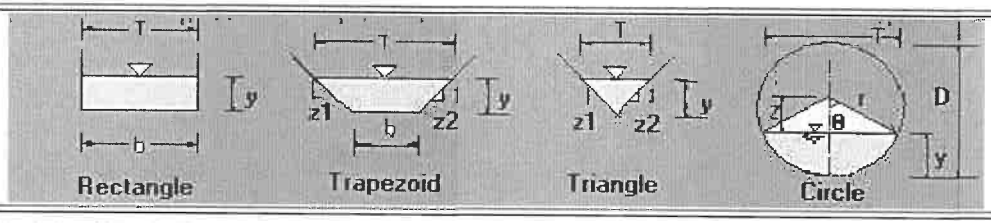
Channel slope: .10 ft/ft	Water depth(y): 0.3 ft	Bottom width(b) 10 ft
Flow velocity 1.667815 ft/s	LeftSlope (Z1): .1 to 1 (H:V)	RightSlope (Z2): .1 to 1 (H:V)
Flow discharge 5 ft^3/s	Input n value .12 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 10.6 ft	Flow area 3 ft^2	Top width(T) 10.06 ft
Specific energy 0.34 ft	Froude number 0.54	Flow status Subcritical flow
Critical depth 0.2 ft	Critical slope 0.3595 ft/ft	Velocity head 0.04 ft

Sub-basin - 10% slope

Please provide more description of which swale from the drainage plan you are calculating.

The open channel flow calculator

Select Channel Type: Trapezoid



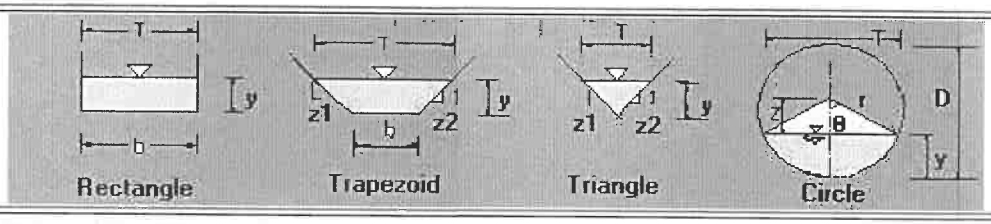
Depth from Q | Select unit system: Feet(ft)

Channel slope: .067 ft/ft	Water depth(y): 0.33 ft	Bottom width(b) 0.5 ft
Flow velocity 5.003335 ft/s	LeftSlope (Z1): 3 to 1 (H:V)	RightSlope (Z2): 3 to 1 (H:V)
Flow discharge 2.5 ft^3/s	Input n value 0.025 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 2.61 ft	Flow area 0.5 ft^2	Top width(T) 2.5 ft
Specific energy 0.72 ft	Froude number 1.97	Flow status Supercritical flow
Critical depth 0.46 ft	Critical slope 0.0146 ft/ft	Velocity head 0.39 ft

Please provide further description. It appears this may be on the west property line as indicated on pg 23 of 28 of your report. Please update the description accordingly.

The open channel flow calculator

Select Channel Type: Trapezoid



Depth from Q

Select unit system: Feet(ft)

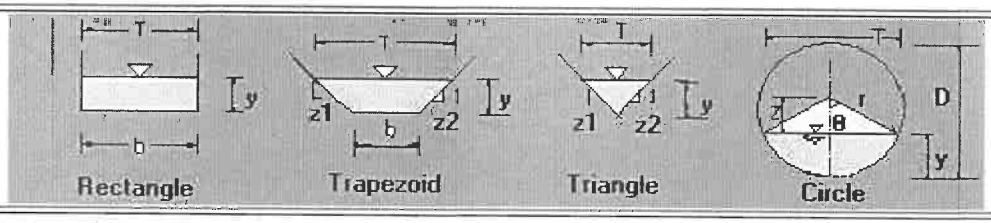
Channel slope: .067 ft/ft	Water depth(y): 0.73 ft	Bottom width(b) 0.5 ft
Flow velocity 7.988 ft/s	LeftSlope (Z1): 3 to 1 (H:V)	RightSlope (Z2): 3 to 1 (H:V)
Flow discharge 15.5 ft^3/s	Input n value 0.025 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 5.09 ft	Flow area 1.94 ft^2	Top width(T) 4.85 ft
Specific energy 1.72 ft	Froude number 2.23	Flow status Supercritical flow
Critical depth 1.03 ft	Critical slope 0.0117 ft/ft	Velocity head 0.99 ft

Front Side of Brown 100 year 2862

Tuby Report

The open channel flow calculator

Select Channel Type: Trapezoid



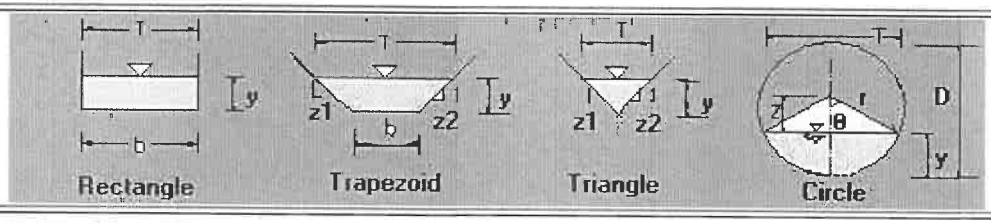
Depth from Q | Select unit system: Feet(ft)

Channel slope: 0.064 ft/ft	Water depth(y): 0.19 ft	Bottom width(b) 0.5 ft
Flow velocity 2.536638 ft/s	LeftSlope (Z1): 3 to 1 (H:V)	RightSlope (Z2): 3 to 1 (H:V)
Flow discharge 0.5 ft^3/s	Input n value 0.035 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 1.68 ft	Flow area 0.2 ft^2	Top width(T) 1.62 ft
Specific energy 0.29 ft	Froude number 1.28	Flow status Supercritical flow
Critical depth 0.22 ft	Critical slope 0.0335 ft/ft	Velocity head 0.1 ft

North Prop Line
South Prop Line

The open channel flow calculator

Select Channel Type: Trapezoid



Depth from Q

Select unit system: Feet(ft)

Channel slope: 0.064 ft/ft	Water depth(y): 0.34 ft	Bottom width(b) 0.5 ft
Flow velocity 3.622864 ft/s	LeftSlope (Z1): 3 to 1 (H:V)	RightSlope (Z2): 3 to 1 (H:V)
Flow discharge 1.9 ft^3/s	Input n value 0.035 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 2.67 ft	Flow area 0.52 ft^2	Top width(T) 2.56 ft
Specific energy 0.55 ft	Froude number 1.41	Flow status Supercritical flow
Critical depth 0.41 ft	Critical slope 0.0294 ft/ft	Velocity head 0.2 ft

North red line
South Bottom
100 ft

Tuby Report

Exhibit 9
Historical Inflation Rate Table

Table of Historical Inflation Rates in Percent

The table of **historical inflation rates** displays annual rates from 1914 to 2020. Rates of inflation are calculated using the current Consumer Price Index published monthly by the Bureau of Labor Statistics (BLS). BLS data was last updated on August 12, 2020 and covers up to July 2020. The next inflation update is set to happen on September 11, 2020. It will provide historical inflation rates through to August 2020.

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVE
2008	4.3	4	4	3.9	4.2	5	5.6	5.4	4.9	3.7	1.1	0.1	3.8
2009	0	0.2	-0.4	-0.7	-1.3	-1.4	-2.1	-1.5	-1.3	-0.2	1.8	2.7	-0.4
2010	2.6	2.1	2.3	2.2	2	1.1	1.2	1.1	1.1	1.2	1.1	1.5	1.6
2011	1.6	2.1	2.7	3.2	3.6	3.6	3.6	3.8	3.9	3.5	3.4	3	3.2
2012	2.9	2.9	2.7	2.3	1.7	1.7	1.4	1.7	2	2.2	1.8	1.7	2.1
2013	1.6	2	1.5	1.1	1.4	1.8	2	1.5	1.2	1	1.2	1.5	1.5
2014	1.6	1.1	1.5	2	2.1	2.1	2	1.7	1.7	1.7	1.3	0.8	1.6
2015	-0.1	0	-0.1	-0.2	0	0.1	0.2	0.2	0	0.2	0.5	0.7	0.1
2016	1.4	1	0.9	1.1	1	1	0.8	1.1	1.5	1.6	1.7	2.1	1.3
2017	2.5	2.7	2.4	2.2	1.9	1.6	1.7	1.9	2.2	2	2.2	2.1	2.1
2018	2.1	2.2	2.4	2.5	2.8	2.9	2.9	2.7	2.3	2.5	2.2	1.9	2.4
2019	1.6	1.5	1.9	2	1.8	1.6	1.8	1.7	1.7	1.8	2.1	2.3	1.8
2020	2.5	2.3	1.5	0.3	0.1	0.6	1						
											Total		21.1

Exhibit 10
Drainage Map for Historic Conditions
(Inside map pocket)

Stormwater Runoff Summary

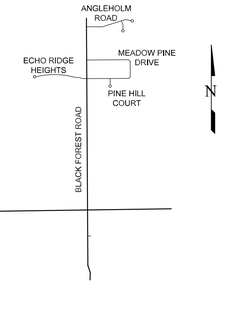
Historic Conditions

Design Point	Sub Basin I.D.	Area (acres)	Time of Concentration (min)	C5 Table	C100 table	5 year (cfs)	100 year (cfs)
1	OS-1	211.6					
3	OS-2	31.8	26.7	0.08	0.35	6.4	47.1
5	OS-3 and D	13.6	31.6	0.08	0.35	0.4	22.7
2	A	10.7	26.7	0.08	0.35	6.4	47.1
4	B	19.6	26.1	0.08	0.35	4	29.4
6	C	5.3	22.6	0.08	0.35	1.2	8.6
7	E	3.7	22.3	0.08	0.35	10.9	7.2
6	All Sub basins	296.3					

Please provide the 5yr/100yr flows at design points 1 and 6.

See comment in the narrative and revise accordingly.

The narrative and runoff calculations indicate 0.8cfs/6.1cfs for basin E. Please verify the values shown in the table and make sure they are consistent with the narrative and calculations.



VICINITY MAP
N.T.S

LEGAL:

SOUTHEAST ONE QUARTER OF THE SOUTHEAST ONE QUARTER OF SECTION 12, TOWNSHIP 11 SOUTH, RANGE 66 WEST OF THE 6TH P.M., COUNTY OF EL PASO, STATE OF COLORADO.

OWNER:

JUSTIN ENSOR
SONSHIP PROPERTIES
P.O. BOX 511
ROCKY FORD, COLORADO 81067

NOT FOR CONSTRUCTION:

THESE PLANS ARE INTENDED FOR SUBMITTAL, REVIEW AND APPROVAL BY CITY/COUNTY PLANNING DEPARTMENTS AND SHALL NOT BE USED ON SITE FOR CONSTRUCTION OR LAYOUT.

REVISIONS

No.	Description	By	Date

H Scale: 1"=200'
V Scale:
Designed By: SLG
Drawn By:
Checked By: KH
Date: 05/03/19

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2850 Serendipity Circle West · Colorado Springs, CO 80917

HISTORIC DRAINAGE PRAIRIE RIDGE

EL PASO COUNTY, COLORADO

Project Number: 07051

Sheet: 1 of 2

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Exhibit 11
Drainage Map for Developed Conditions
(Inside map pocket)

Please update accordingly per previous comments provided in the narrative. The developed flows are shown less than the historic for this basin.

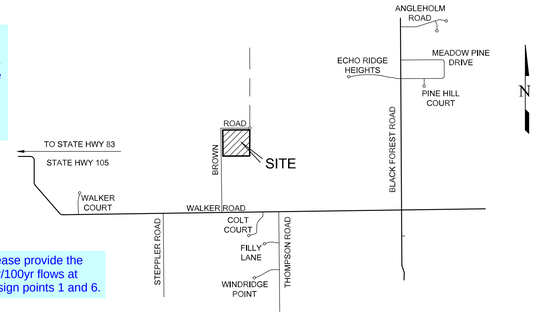
The table should provide the cumulative flows at these design points not just the flows for each of the basins. Please provide another table or update this table so that the cumulative flows at each of the design points is also shown.

There is no development proposed in OS-2. As stated in the narrative this flows should match the historic conditions. Please revise.

Please provide the 5yr/100yr flows at design points 1 and 6.

Developed Conditions

Design Point	Sub Basin I.D.	Area (acres)	Time of Concentration (min)	C5 Table	C100 table	5 year (cfs)	100 year (cfs)
1	OS-1	211.6					
3	OS-2	31.8	26.7	0.08	0.35	1.0	58.6
5	OS-3 and D	13.6	31.6	0.08	0.35	0.4	22.7
2	A	10.7	26.7	0.10	0.37	2.7	16.7
4	B	19.6	26.1	0.10	0.37	5.0	31.1
6	C	5.3	22.6	0.10	0.37	1.5	9.1
7	E	3.7	22.3	0.10	0.37	1.0	6.4
6	All Sub Basins	296.3					



VICINITY MAP
N.T.S

NOTE:
ALL DRIVEWAY CULVERTS ALONG BROWN ROAD ARE TO BE 18" RCP AT A MIN SLOPE OF 2%

Please identify where these will be installed in a GEC plan or Constructions documents

Review 1 comment: The narrative indicates a 42" RCP culvert to replace the existing culvert. Revise accordingly.
Review 2: The drainage plan show conflicting information as it still indicates that a 36" RCP is proposed. Please revise accordingly and i suggest to indicate "recommended" instead of proposed.

It appears that this may be for the ditches along Brown Rd. Please relocate this text to the appropriate location.

Please provide the cumulative flows at the various design points shown on the drainage plan (DP 1 through DP6).

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DEVELOPED DRAINAGE PRAIRIE RIDGE

EL PASO COUNTY, COLORADO

Project Number: 07051

Sheet: 2 of 2

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