PRELIMINARY DRAINAGE REPORT

for

CHERRY SPRINGS RANCH - FILING NO. 2

Prepared for:

Searle Ranch, Inc.
18911 Cherry Springs Ranch Dr.
Monument, CO 80132

February 18, 2020

Prepared by:

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CHERRY SPRINGS RANCH PUD – FILING NO. 2
PRELIMINARY DRAINAGE REPORT
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DRAINAGE STATEMENT

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 has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for liability caused by negligent acts, errors or omissions on my part in preparing this report.

____

John P. Schwab, P.E. #29891

Developer's Statement:

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

By:

____

Printed Name: Stan Searle Date

Searle Ranch Inc.

18911 Cherry Springs Ranch Drive, Monument, CO 80132

El Paso County's Statement

Filed in accordance with the requirements of the El Paso County Land Development Code, Drainage Criteria Manual, Volumes 1 and 2, and Engineering Criteria Manual as amended.

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Jennifer Irvine, P.E. Date

County Engineer / ECM Administrator

Conditions:

I. GENERAL LOCATION AND DESCRIPTION

A. Background

Cherry Springs Ranch is a residential Planned Unit Development (PUD) consisting of approximately 231-acres located northwest of State Highway 83 (SH83) and Highway 105 in northern El Paso County, Colorado. Cherry Springs Ranch Filing No. 1, comprised of 74.8-acres in the southwest corner of the PUD area, was platted in 2008. The existing Filing No. 1 has been developed with 16 rural residential lots with access along Cherry Springs Ranch Drive. The balance of the Cherry Springs Ranch property consists of approximately 156-acres (El Paso County Assessor's Number 61000-00-498). The approved 2004 Cherry Springs Ranch PUD identifies a maximum of 42 rural residential lots for the subdivision, with 2.5-acre minimum lot sizes. The proposed Cherry Springs Ranch Filing No. 2 consists of 11 rural residential lots on approximately 42.25-acres comprising the southeast part of the property. Access to Filing No. 2 will be provided by the proposed extension of Appaloosa Road on the north side of Highway 105.

B. Scope

This report will provide a summary of site drainage issues impacting the proposed residential development. The report will analyze upstream drainage patterns, site-specific developed drainage patterns, and impacts on downstream facilities. This report is based on the guidelines and criteria presented in the El Paso County Drainage Criteria Manual, and the report is intended to fulfill the requirements for a "Preliminary Drainage Report" in support of the Cherry Springs Ranch PUD Filing 2 Amendment process for this property.

C. Site Location and Description

The Cherry Springs Ranch PUD Filing No. 2 area is located in the South Half of the Southeast Quarter of Section 9, Township 11 South, Range 66 West of the 6th Principal Meridian. The site is currently a vacant meadow tract. The property is zoned PUD, allowing for 2.5–acre minimum lot sizes. A new public road extension of Appaloosa Road will be constructed to serve this subdivision filing. The proposed lots in this subdivision filing will all have driveway access onto Appaloosa Road. Subdivision improvements will include site grading, roadway construction, and utility improvements for the 11 proposed residential lots.

The Cherry Springs Ranch PUD is bordered to the north by vacant ranch property (zoned RR-5) to the northeast, and developed rural residential lots platted as a part of Kings Deer Highlands Subdivision Filing No. 6 (zoned PUD) to northwest. Cherry Springs Ranch is bordered to the east by vacant ranch property (zoned RR-5). Highway 105 adjoins the south boundary of the property, and the existing Canterbury East Subdivision (zoned PUD) is located on the south side of Highway 105. The west boundary of the property adjoins existing rural residential lots platted as Kings Deer Highlands Subdivision Filing No. 6, Hilltop Pines Filing No. 1, and Peaceful Pines Subdivision Filing No. 2 (all Zoned PUD).

Ground elevations within the Filing No. 2 site range from approximately 7,283 to 7,334 feet above mean sea level.

The property is located entirely within the West Cherry Creek Drainage Basin. The proposed residential lots are located on a ridge between the main channel of West Cherry Creek which flows northwesterly across the northeast corner of the site, and a Tributary Channel which flows northeasterly along the west side of the Filing No. 2 site. The terrain is rolling with average grades ranging from 2 to 10 percent. The existing site is vacant range land, with moderate coverage of prairie grass and shrubs.

D. General Soil Conditions

According to the Custom Soil Resource Report for this site provided by the Natural Resources Conservation Service (NRCS), on-site soils in the Filing No. 2 area are comprised of the following soil types (see details in Appendix A):

- Type 1, "Alamosa loam": Hydrologic soils group D (northeast fringe of property)
- Type 28 "Ellicott loamy coarse sand": Hydrologic soils group A (east fringe of property)
- Type 71, "Pring coarse sandy loam": Hydrologic soils group B, (majority of site)
- Type 92, "Tomah-Crowfoot loamy sands": Hydrologic soils group B (northwest fringe of property)
- Type 101, "Ustic Torrifluvents": Hydrologic soils group B (west side property)

The existing drainage swales flowing through the site are generally characterized as stable, grass-lined channels.

E. References

City of Colorado Springs & El Paso County "Drainage Criteria Manual," revised October 12, 1994.

El Paso County "Engineering Criteria Manual," January 9, 2006.

FEMA, Flood Insurance Rate Map (FIRM) Number 08041C0285G, December 7, 2018.

Classic Consulting Engineers & Surveyors, "Final Drainage Report for Cherry Springs Ranch," June, 2007.

Classic Consulting Engineers & Surveyors, "Preliminary / Final Drainage Report for Cherry Springs Ranch," December, 2006.

USDA Natural Resources Conservation Service, "Custom Soil Resource Report, El Paso County, Colorado, CSR-Filing-2," December, 2019.

II. DRAINAGE BASINS AND SUB-BASINS

A. Major Basin Description

The proposed development area lies within the Cherry Creek Drainage Basin as classified by El Paso County. Drainage from the site flows northerly to the existing grass-lined drainage channels adjoining this filing.

B. Floodplain Impacts

The project site is impacted by 100-year floodplain limits along the main channel of West Cherry Creek and the westerly Tributary Channel as delineated by the Federal Emergency Management Agency (FEMA). The floodplain limits in the vicinity of the site are shown in Flood Insurance Rate Map (FIRM) Number 08041C0285G, dated December 7, 2018, as depicted in the enclosed FIRMette exhibit (Appendix D). Drainage easements have been delineated to identify the existing floodplain limits as no-build areas, and the proposed lot layout has been developed to preserve the existing drainage channels and floodplains as greenway areas.

C. Sub-Basin Description

The existing drainage basins lying in and around the proposed development are depicted on the enclosed "Existing Conditions" Drainage Map by CCES (Appendix D). The site is impacted by two tributary channels of West Cherry Creek, which combine in a confluence north of the Filing No. 2 area, and the main channel of West Cherry Creek flows northeasterly through the overall PUD area. The existing on-site topography within the Filing No. 2 area has been delineated as two drainage basins, as shown in Figure EX-2.1 (Appendix D), which sheet flow northerly towards the West Cherry Creek channel.

III. DRAINAGE DESIGN CRITERIA

A. Development Criteria Reference

No Drainage Basin Planning Study (DBPS) has been completed for the Cherry Creek Drainage Basin, and no Master Development Drainage Plans (MDDP's) were found for any adjacent subdivisions.

Detailed drainage planning for the Cherry Springs Ranch PUD was provided in the previously approved "Preliminary / Final Drainage Report for Cherry Springs Ranch" by Classic Consulting Engineers & Surveyors (CCES) dated December, 2006, and the "Final Drainage Report for Cherry Springs Ranch" by CCES dated June, 2007. These reports were reviewed and approved by El Paso County in support of the previous PUD and Filing No. 1 subdivision plat approvals.

B. Hydrologic Criteria

The tributary drainage basins impacting this site are all less than 100 acres, so Rational Method Hydrology procedures were utilized for calculation of peak flows. Rational Method hydrologic calculations were based on the following assumptions:

- Design storm (minor) — 5-year
- Design storm (major) — 100-year
- Time of Concentration – Overland Flow — "Airport" equation (300' max. developed)
- Time of Concentration – Gutter/Ditch Flow — "SCS Upland" equation
- Rainfall Intensities — El Paso County I-D-F Curve
- Hydrologic soil type — B

	C5	C100
• Runoff Coefficients - undeveloped:		
Existing pasture/range areas	0.08	0.35
• Runoff Coefficients - developed:		
Proposed lot areas (2.5-acre lots)	0.154	0.404

(see composite runoff coefficient calculations in Appendix B)

Composite runoff coefficient ("C-values") were calculated for the proposed 2.5-acre rural residential lots based on typical house footprints, typical driveway lengths, and the proposed layout of new public roads within the subdivision. Hydrologic calculations are enclosed in Appendix B, and peak design flows are identified on the drainage plan drawings.

IV. DRAINAGE FACILITY DESIGN

A. General Concept

Development of the proposed Filing No. 2 subdivision will require site grading, roadway construction, and utility improvements serving 11 new rural residential lots, resulting in a marginal increase in impervious areas across the site. The natural drainage patterns will be impacted through development by site grading and concentration of runoff in subdivision streets. Developed runoff will generally continue to follow historic paths. The general concept for management of developed storm runoff is to grade the home sites to provide positive drainage away from the building pads, and divert runoff to the proposed roadside ditches and existing grass-lined drainage swales flowing through the property.

The proposed rural residential subdivision development is an inherently low impact development (LID) approach based on the low densities proposed. Low impact development techniques associated with this subdivision include the following:

- Minimize overlot grading; roadways will be excavated to closely match existing grades, and existing vegetation will generally be preserved unless removal is specifically required for roadways, building pads, utility corridors, cut slopes, etc.
- New public roads will have rural cross-sections with grass-lined ditches to encourage infiltration of stormwater.

B. Specific Details

1. Existing Drainage Conditions

Historic drainage conditions are depicted on the enclosed "Final Drainage Map, Cherry Springs Ranch, Existing Conditions" prepared by CCES. The West Cherry Creek drainage channel flows northwesterly across the northeast corner of the Filing No. 2 site, and a west tributary channel of West Cherry Creek flows northeasterly along the west side of the Filing No. 2 site. According to the 2007 "Final Drainage Report for Cherry Springs Ranch" by CCES, these channels convey off-site drainage from an upstream area of approximately 5 square miles. The HEC-RAS modeling in the CCES report identifies combined peak flows of Q_5 = 931 cfs and Q_{100} = 2,564 cfs at the confluence of these channels on the north side of the Filing No. 2 site.

The existing Filing No. 2 site is currently a vacant range and meadow area. With the exception of the existing West Cherry Creek drainage channels flowing along the edges of site, there are no existing drainage facilities within the Filing No. 2 property. There are no existing irrigation facilities, significant utilities, or other encumbrances impacting the site.

The CCES Existing Conditions Drainage Plan identifies the Filing No. 2 area as being within historic drainage Basins EX-2 and EX-3. Basin EX-2 comprises the eastern part of the site, which sheet flows northeasterly to Design Point #2, with historic peak flows calculated as Q_5 = 22 cfs and Q_{100} = 55 cfs by CCES. Based on current County hydrologic design criteria (revised 5-year runoff coefficients per 2014 DCM), we have calculated historic peak flows at DP-2 as Q_5 = 6.5 cfs and Q_{100} = 47.8 cfs.

Basin EX-3 comprises the western part of the site, which sheet flows northwesterly to Design Point #3, with historic peak flows calculated as Q_5 = 21 cfs and Q_{100} = 51 cfs by CCES. Based on current County hydrologic design criteria, we have calculated historic peak flows at DP-2 as Q_5 = 5.2 cfs and Q_{100} = 38.3 cfs.

2. Developed Drainage Conditions

The developed drainage basins and projected flows are shown on the Developed Drainage Plan (Figure D1.1, Appendix D). Developed Basin P-2A has been delineated as the eastern part of the Filing No. 2 site, which will continue to sheet flow northeasterly to Design Point #2, with developed peak flows calculated as Q_5 = 9.4 cfs and Q_{100} = 52.3 cfs.

Developed Basins P-3A and P-3B have been delineated as the western part of the Filing No. 2 site, which will continue to sheet flow northwesterly to Design Point #3. Basin P-3A will sheet flow northwesterly to a proposed culvert crossing at the low point in the extension of Appaloosa Drive. Developed peak flows at Design Point #3A are calculated as Q_5 = 2.3 cfs and Q_{100} = 10.3 cfs. Channel P-3B will convey the flow from Culvert 3B northwesterly to the existing Tributary Channel at Design Point #3. Basins P-3A and P-3B combine at Design Point #3, with developed peak flows calculated as Q_5 = 9.0 cfs and Q_{100} = 39.6 cfs.

The developed drainage impact at Design Points #2 and #3 is minimal based on the rural residential development plan for the site. In comparison to the flow in the main channel of West Cherry Creek (peak flow of Q_{100} = 2,564 cfs per CCES report), the total on-site flow contribution amounts to less than 4 percent of the flow in the West Cherry Creek Channel downstream of this site. As such, on-site flows from the proposed Filing No. 2 Subdivision are very small in comparison to the total flows in the West Cherry Creek Channel.

As previously noted, the proposed development plan for the site will minimize disturbance of the existing drainage channels along the northeast and west sides of the site.

C. Comparison of Developed to Historic Discharges

Based on the hydrologic calculations in Appendix C, the total developed flow from the site will slightly exceed historic flow from the site. The comparison of developed to historic discharges at key design points is summarized as follows:

Design Point	Historic Flow			Developed Flow			Comparison of Developed to Historic Flow
	Area (ac)	Q_5 (cfs)	Q_{100} (cfs)	Area (ac)	Q_5 (cfs)	Q_{100} (cfs)	
2	32.1	6.5	47.8	32.4	9.4	52.3	+2.9 cfs / +4.5 cfs (increase)
3	26.3	5.2	38.3	21.7	9.0	39.6	+3.8 cfs / +1.3 cfs (increase)

The total increase in developed 100-year peak flow is estimated to be approximately 6.3 percent, and the maximum increase at any design point is less than 5 cfs, which represents a minimal increase. The minor increase in developed flow will be mitigated by proper erosion control measures within the site, including riprap outlet protection downstream of public culverts crossing the subdivision streets.

D. On-Site Drainage Facility Design

Developed sub-basins and proposed drainage improvements are depicted on the enclosed Developed Drainage Plan (Sheet D2.1). In accordance with El Paso County standards, new roadways will be graded with a minimum longitudinal slope of 1.0 percent. The typical rural local road section will consist of a 28-foot asphalt-paved roadway width, with 4:1 ditch foreslopes, and 2.5-foot deep ditches.

On-site drainage facilities will consist of roadside ditches, grass-lined channels, and culverts. Hydraulic calculations for sizing of on-site drainage facilities are enclosed in Appendix C and design criteria are summarized as follows:

1. Culverts

The internal road system will be graded to drain roadside ditches to low points along the road profile, where cross-culverts will convey developed flows into grass-lined channels following historic drainage paths. Culvert pipes will be specified as reinforced concrete pipe (RCP) with a minimum diameter of 18-inches. Preliminary culvert sizes have been tabulated in Appendix C based on a maximum headwater-to-depth ratio (HW/D) of 1.0 for the minor (5-year) design storm, and maximum allowable headwater depths in accordance with County roadway overtopping criteria for the major (100-year) design storm. Final culvert hydraulic calculations will be performed using the FHWA HY-8 software package, providing a detailed headwater depth analysis for each culvert crossing. Riprap outlet protection will be provided at all culverts.

2. Open Channels

Drainage easements have been dedicated along major drainage channels following historic drainage paths through the subdivision. These channels will generally be grass-lined channels designed to convey 100-year flows, with a trapezoidal cross-section, variable bottom width and depth, 4:1 maximum side slopes, 1-foot minimum freeboard, and a minimum slope of 0.5 percent.

The proposed drainage channels will be sized utilizing Manning's equation for open channel flow, assuming a friction factor ("n") of 0.030 for dry-land grass channels. Maximum allowable velocities will be evaluated based on El Paso County drainage criteria, typically allowing for a maximum 100-year velocity of 5 feet per second. The proposed channels will generally be seeded with native grasses for erosion control. Riprap channel lining and/or erosion control mats will be provided where required based on erosive velocities. Ditch flows will be diverted to drainage channels at the nearest practical location to minimize excessive roadside ditch sizes. Primary drainage swales crossing proposed lots have been placed in drainage easements, with variable widths based on the required channel sections.

E. Analysis of Existing and Proposed Downstream Facilities

The proposed subdivision drains to existing natural drainage channels flowing northerly through the site. The existing natural swales downstream of the property appear to be in stable condition. Development of this property as a rural residential subdivision in accordance with its current zoning will have an insignificant impact on downstream drainage facilities.

F. Anticipated Drainage Problems and Solutions

The overall drainage plan for the subdivision includes a system of roadside ditches, channels, and culverts to convey developed flows through the site. The primary drainage problems anticipated within this development will consist of maintenance of these channels and culverts. Care will need to be taken to implement proper erosion control measures in the proposed roadside ditches, channels, and swales. Ditches will be designed to meet allowable velocity criteria. Erosion control mats and/or riprap channel lining will be installed where necessary to minimize erosion concerns. Public road improvements and drainage improvements along the public roads will be dedicated to the County for maintenance upon completion and acceptance by the County. Proposed drainage facilities outside the public right-of-way will be owned and maintained by the individual lot owners, unless otherwise noted.

V. DRAINAGE PLANNING FOUR STEP PROCESS

El Paso County Drainage Criteria require drainage planning to include a Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainageways, and implementing long-term source controls.

As stated in DCM Volume 2, the Four Step Process is applicable to all new and re-development projects with construction activities that disturb 1 acre or greater or that disturb less than 1 acre but are part of a larger common plan of development. The Four Step Process has been implemented as follows in the planning of this project:

Step 1: Employ Runoff Reduction Practices

- Minimize Impacts: The proposed rural residential subdivision is an inherently low impact development. The proposed 2.5-acre minimum lot sizes and rural roads with roadside ditches will minimize drainage impacts in comparison to higher density development alternatives.

Step 2: Stabilize Drainageways

- The existing major drainageways adjacent to this project site are grass-lined channels in stable condition.

Step 3: Provide Water Quality Capture Volume (WQCV)

- Water quality detention is not required based on the rural residential development proposed (2.5-acre minimum lot sizes).

Step 4: Consider Need for Industrial and Commercial BMPs

- No industrial or commercial land uses are proposed as part of this development.

VI. STORMWATER DETENTION AND WATER QUALITY

As stated in the previously approved subdivision drainage report, the proposed development will result in a minimal increase in developed flows based on the rural residential development plan, and there is no requirement for on-site stormwater detention based on the minimal developed drainage impact.

Water quality facilities are not required as this site meets exclusions listed in the revised El Paso County Engineering Criteria Manual (ECM). Section I.7.1.B.11.b of the ECM also identifies residential development sites in "County Growth Areas" as excluded sites under the following definition: "Residential development site or larger common plans of development for which associated construction activities result in a land disturbance of less than or equal to 10 acres and have a proposed density of less than 1,000 people per square mile." The proposed development of Filings No. 3-5 will result in a land disturbance of approximately 6 acres, which is well below the "10-acre" threshold. Assuming 3 people per residential lot, and 11 lots to be developed in Filing No. 2 comprising approximately 42.25 acres, the proposed density will be less than 500 people per square mile, which is substantially lower than the "1,000 people per square mile" limit established under this exclusion.

Based on the rural residential nature of this project and the ECM exclusions described above, Cherry Springs Ranch Filing No. 2 is not required to implement permanent water quality facilities.

VII. EROSION CONTROL / SEDIMENT CONTROL

Best management practices (BMP's) will be implemented for erosion control during and after construction. Erosion control measures will include installation of silt fence at the toe of disturbed slopes, straw bales protecting drainage ditches, vehicle tracking control pads at access points, riprap protection at culvert outlets, and revegetation of disturbed areas. Cut slopes will be stabilized during excavation as necessary and vegetation will be re-established as soon as possible for stabilization of the graded areas.

VIII. COST ESTIMATE AND DRAINAGE FEES

The developer will finance all costs for proposed roadway and drainage improvements, and public facilities will be owned and maintained by El Paso County upon final acceptance.

This property is located entirely in the Cherry Creek Drainage Basin, which is an unstudied basin with no drainage basin fee or bridge fee requirement.

IX. SUMMARY

The Cherry Springs Ranch PUD is a rural residential subdivision consisting of a maximum of 42 lots on a 230-acre parcel. The proposed subdivision of Cherry Springs Ranch Filing No. 2 into 11 rural residential lots with minimum sizes of 2.5-acres per lot is consistent with the surrounding zoning and character of this site.

Development of the proposed subdivision is anticipated to result in a minimal increase in developed runoff from the site, and erosion control best management practices will be implemented to mitigate developed drainage impacts. The proposed drainage patterns will remain consistent with historic conditions, and new drainage facilities will be constructed on-site to El Paso County standards to safely convey runoff to adequate outfalls. Implementation and maintenance of proper erosion control measures will ensure that downstream properties are protected from potential adverse drainage impacts from this development.

APPENDIX A

SOILS INFORMATION

United States Department of Agriculture

NRCS

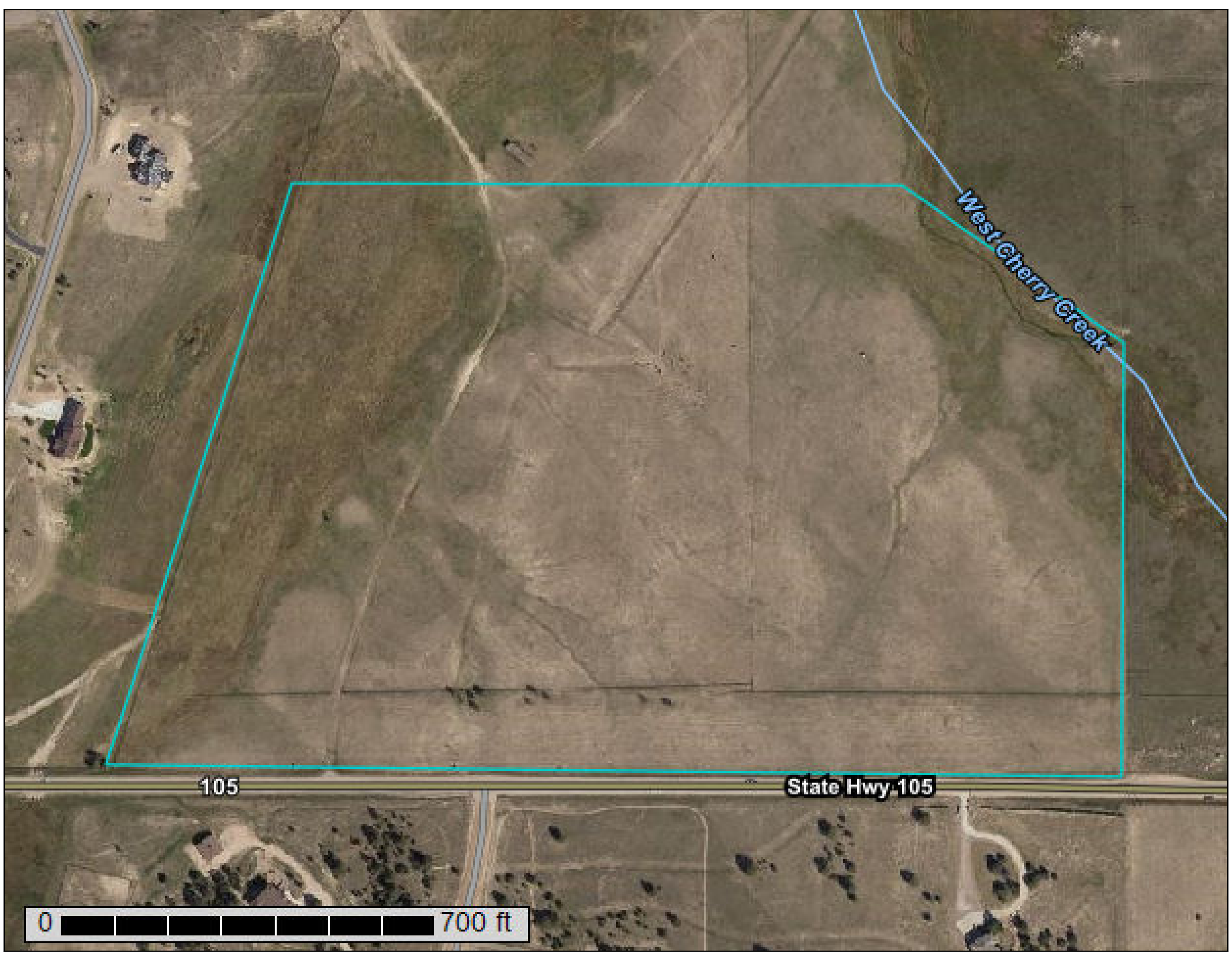
Natural Resources Conservation Service

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

CSR-Filing-2



December 30, 2019

Preface

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

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

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

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

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

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

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Contents

How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

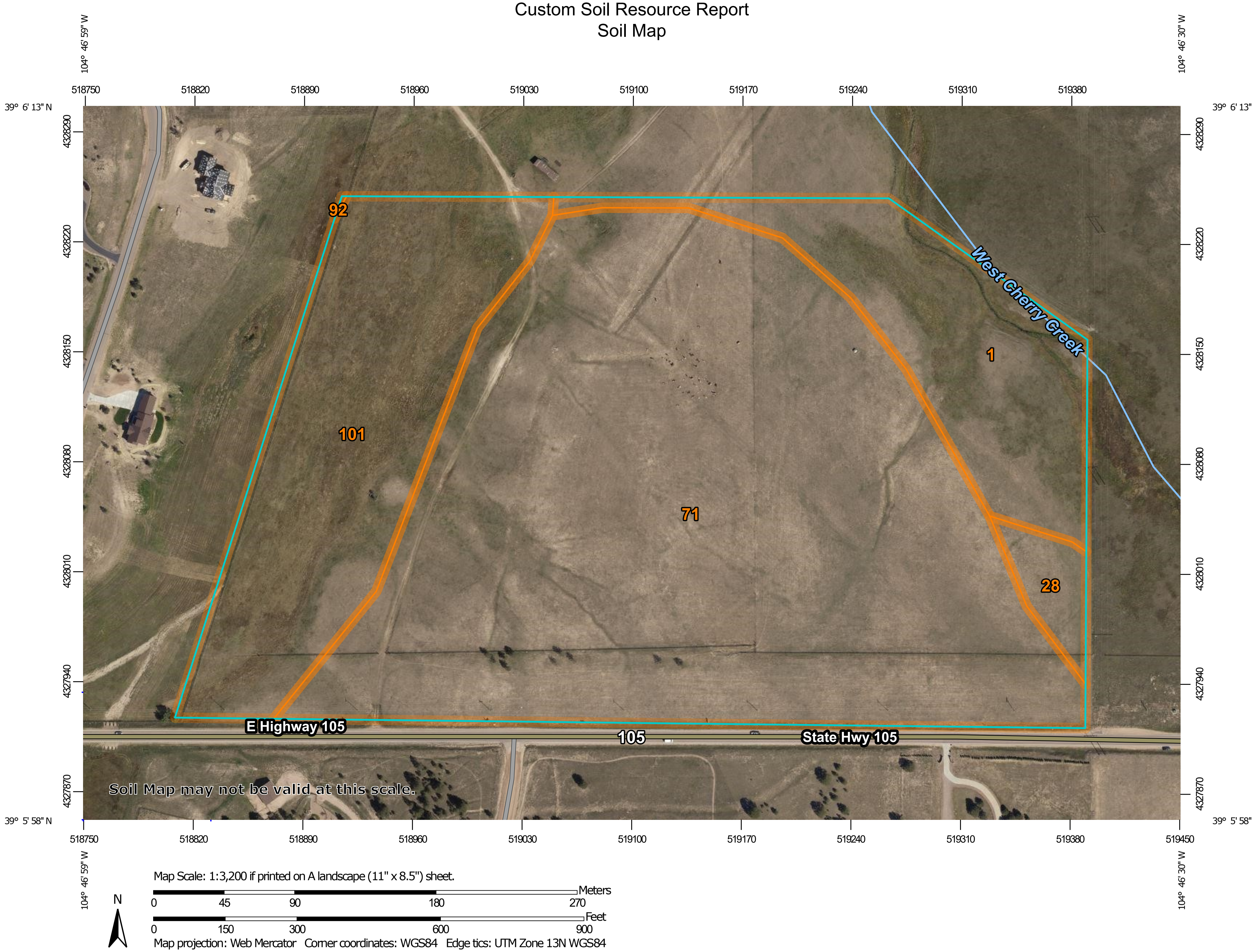
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree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

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

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

Soil Map



Map Scale: 1:3,200 if printed on A landscape (11" x 8.5") sheet.

Meters: 0, 45, 90, 180, 270

Feet: 0, 150, 300, 600, 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

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

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 17, Sep 13, 2019

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

Date(s) aerial images were photographed: Aug 19, 2018—Sep 23, 2018

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1	Alamosa loam, 1 to 3 percent slopes	5.6	13.1%
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	0.8	1.9%
71	Pring coarse sandy loam, 3 to 8 percent slopes	27.3	64.3%
92	Tomah-Crowfoot loamy sands, 3 to 8 percent slopes	0.0	0.0%
101	Ustic Torrifluvents, loamy	8.9	20.8%
Totals for Area of Interest		**42.5**	**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

1—Alamosa loam, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: 3670
Elevation: 7,200 to 7,700 feet
Farmland classification: Prime farmland if irrigated and reclaimed of excess salts and sodium

Map Unit Composition

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

Description of Alamosa

Setting

Landform: Flood plains, fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 6 inches: loam
Bt - 6 to 14 inches: clay loam
Btk - 14 to 33 inches: clay loam
Cg1 - 33 to 53 inches: sandy clay loam
Cg2 - 53 to 60 inches: sandy loam

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 12 to 18 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Very slightly saline to strongly saline (2.0 to 16.0 mmhos/cm)
Available water storage in profile: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: D
Ecological site: Mountain Meadow (R048AY241CO)
Hydric soil rating: Yes

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

28—Ellicott loamy coarse sand, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: 3680
Elevation: 5,500 to 6,500 feet
Mean annual precipitation: 13 to 15 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Ellicott and similar soils: 97 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ellicott

Setting

Landform: Flood plains, stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium

Typical profile

A - 0 to 4 inches: loamy coarse sand
C - 4 to 60 inches: stratified coarse sand to sandy loam

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: A
Ecological site: Sandy Bottomland LRU's A & B (R069XY031CO)
Other vegetative classification: SANDY BOTTOMLAND (069AY031CO)
Hydric soil rating: No

Minor Components

Fluvaquentic haplaquoll

Percent of map unit: 1 percent
Landform: Swales
Hydric soil rating: Yes

Other soils

Percent of map unit: 1 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

71—Pring coarse sandy loam, 3 to 8 percent slopes

Map Unit Setting

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

Map Unit Composition

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

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: 3 to 8 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): 3e
Hydrologic Soil Group: B
Ecological site: Loamy Park (R048AY222CO)
Hydric soil rating: No

Minor Components

Pleasant

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

Other soils

Percent of map unit:
Hydric soil rating: No

92—Tomah-Crowfoot loamy sands, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 36b9
Elevation: 7,300 to 7,600 feet
Farmland classification: Not prime farmland

Map Unit Composition

Tomah and similar soils: 50 percent
Crowfoot and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tomah

Setting

Landform: Hills, alluvial fans
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from arkose and/or residuum weathered from arkose

Typical profile

A - 0 to 10 inches: loamy sand
E - 10 to 22 inches: coarse sand
C - 48 to 60 inches: coarse sand

Properties and qualities

Slope: 3 to 8 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 to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.0 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 Crowfoot

Setting

Landform: Alluvial fans, hills
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 12 inches: loamy sand
E - 12 to 23 inches: sand
Bt - 23 to 36 inches: sandy clay loam
C - 36 to 60 inches: coarse sand

Properties and qualities

Slope: 3 to 8 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 to high (0.60 to 2.00 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 4.7 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

101—Ustic Torrifluvents, loamy

Map Unit Setting

National map unit symbol: 3673
Elevation: 5,500 to 7,000 feet
Mean annual precipitation: 13 to 16 inches
Mean annual air temperature: 47 to 52 degrees F
Frost-free period: 125 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Ustic torrifluvents and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ustic Torrifluvents

Setting

Landform: Flood plains, stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy, clayey, stratified loamy

Typical profile

A - 0 to 6 inches: variable
C - 6 to 60 inches: stratified loamy sand to clay loam

Properties and qualities

Slope: 0 to 3 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 to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Saline Overflow LRU's A & B (R069XY037CO)
Other vegetative classification: OVERFLOW (069BY036CO)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 4 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

References

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

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

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

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

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

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

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

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

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

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

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

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

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

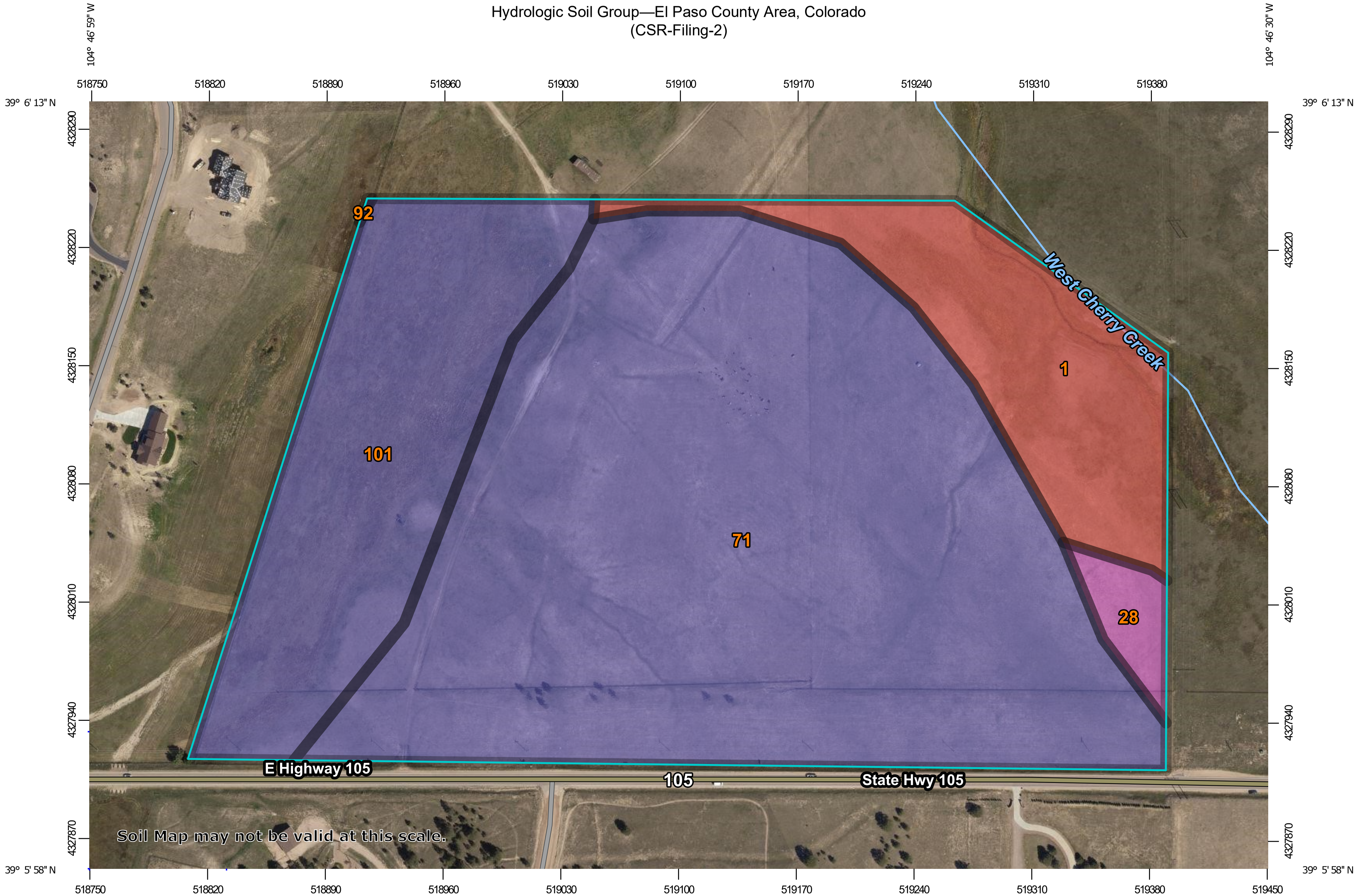
United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

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

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

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

Hydrologic Soil Group—El Paso County Area, Colorado
(CSR-Filing-2)



Map Scale: 1:3,200 if printed on A landscape (11" x 8.5") sheet.

N

0 45 90 180 270 Meters

0 150 300 600 900 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

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

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 17, Sep 13, 2019

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

Date(s) aerial images were photographed: Aug 19, 2018—Sep 23, 2018

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Alamosa loam, 1 to 3 percent slopes	D	5.6	13.1%
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	A	0.8	1.9%
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	27.3	64.3%
92	Tomah-Crowfoot loamy sands, 3 to 8 percent slopes	B	0.0	0.0%
101	Ustic Torrifluvents, loamy	B	8.9	20.8%
Totals for Area of Interest			**42.5**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

APPENDIX B

HYDROLOGIC CALCULATIONS

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

3.2 Time of Concentration

One of the basic assumptions underlying the Rational Method is that runoff is a function of the average rainfall rate during the time required for water to flow from the hydraulically most remote part of the drainage area under consideration to the design point. However, in practice, the time of concentration can be an empirical value that results in reasonable and acceptable peak flow calculations.

For urban areas, the time of concentration (t_c) consists of an initial time or overland flow time (t_i) plus the travel time (t_t) in the storm sewer, paved gutter, roadside drainage ditch, or drainage channel. For non-urban areas, the time of concentration consists of an overland flow time (t_i) plus the time of travel in a concentrated form, such as a swale or drainageway. The travel portion (t_t) of the time of concentration can be estimated from the hydraulic properties of the storm sewer, gutter, swale, ditch, or drainageway. Initial time, on the other hand, will vary with surface slope, depression storage, surface cover, antecedent rainfall, and infiltration capacity of the soil, as well as distance of surface flow. The time of concentration is represented by Equation 6-7 for both urban and non-urban areas.

$$t_c = t_i + t_t \quad \text{(Eq. 6-7)}$$

Where:

t_c = time of concentration (min)

t_i = overland (initial) flow time (min)

t_t = travel time in the ditch, channel, gutter, storm sewer, etc. (min)

3.2.1 Overland (Initial) Flow Time

The overland flow time, t_i, may be calculated using Equation 6-8.

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \quad \text{(Eq. 6-8)}$$

Where:

t_i = overland (initial) flow time (min)
C_5 = runoff coefficient for 5-year frequency (see Table 6-6)
L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)
S = average basin slope (ft/ft)

Note that in some urban watersheds, the overland flow time may be very small because flows quickly concentrate and channelize.

3.2.2 Travel Time

For catchments with overland and channelized flow, the time of concentration needs to be considered in combination with the travel time, t_t, which is calculated using the hydraulic properties of the swale, ditch, or channel. For preliminary work, the overland travel time, t_t, can be estimated with the help of Figure 6-25 or Equation 6-9 (Guo 1999).

$$V = C_v S_w^{0.5} \quad \text{(Eq. 6-9)}$$

Where:

V = velocity (ft/s)

C_v = conveyance coefficient (from Table 6-7)

S_w = watercourse slope (ft/ft)

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.

The travel time is calculated by dividing the flow distance (in feet) by the velocity calculated using Equation 6-9 and converting units to minutes.

The time of concentration (t_c) is then the sum of the overland flow time (t_i) and the travel time (t_t) per Equation 6-7.

3.2.3 First Design Point Time of Concentration in Urban Catchments

Using this procedure, the time of concentration at the first design point (typically the first inlet in the system) in an urbanized catchment should not exceed the time of concentration calculated using Equation 6-10. The first design point is defined as the point where runoff first enters the storm sewer system.

$$t_c = \frac{L}{180} + 10 \qquad \text{(Eq. 6-10)}$$

Where:

t_c = maximum time of concentration at the first design point in an urban watershed (min)

L = waterway length (ft)

Equation 6-10 was developed using the rainfall-runoff data collected in the Denver region and, in essence, represents regional “calibration” of the Rational Method. Normally, Equation 6-10 will result in a lesser time of concentration at the first design point and will govern in an urbanized watershed. For subsequent design points, the time of concentration is calculated by accumulating the travel times in downstream drainageway reaches.

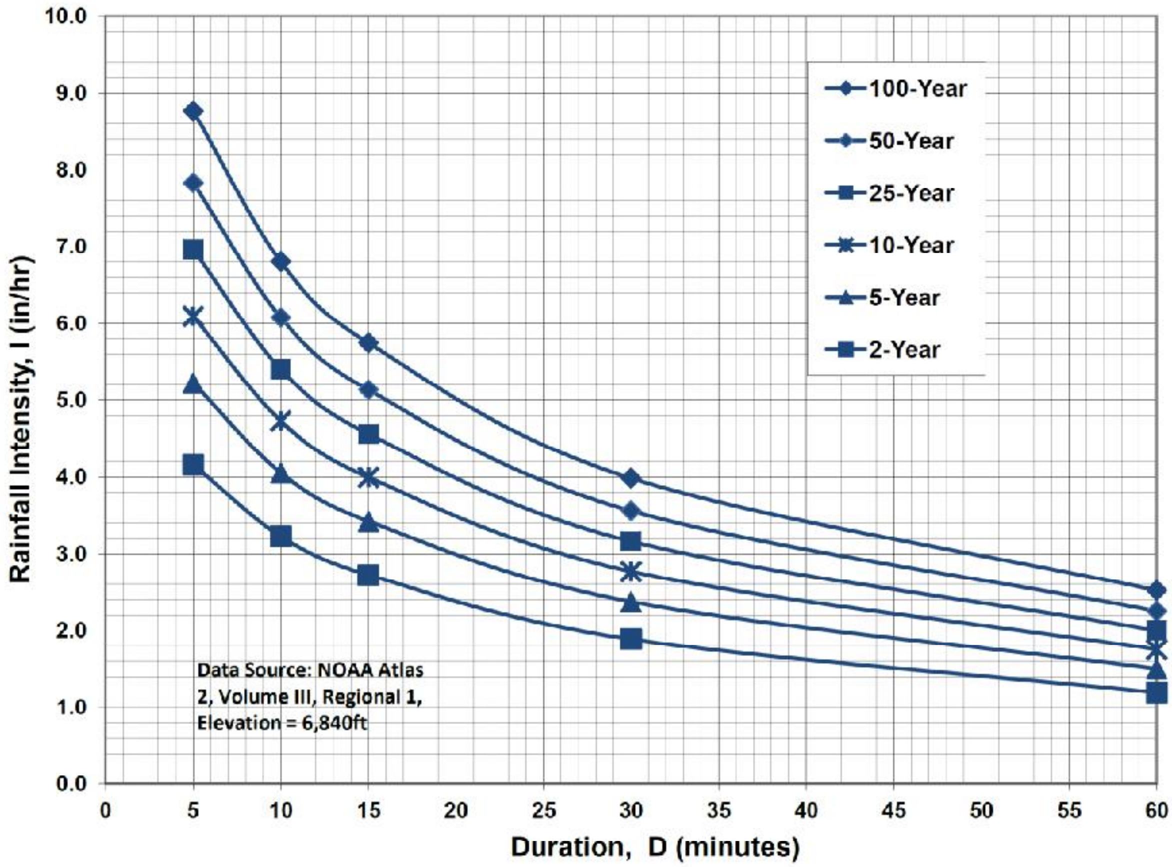
3.2.4 Minimum Time of Concentration

If the calculations result in a t_c of less than 10 minutes for undeveloped conditions, it is recommended that a minimum value of 10 minutes be used. The minimum t_c for urbanized areas is 5 minutes.

3.2.5 Post-Development Time of Concentration

As Equation 6-8 indicates, the time of concentration is a function of the 5-year runoff coefficient for a drainage basin. Typically, higher levels of imperviousness (higher 5-year runoff coefficients) correspond to shorter times of concentration, and lower levels of imperviousness correspond to longer times of

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.

COMPOSITE RUNOFF COEFFICIENTS - TYPICAL 2.5-ACRE DEVELOPED RESIDENTIAL AREA

DEVELOPED CONDITIONS

100-YEAR C VALUES

BASIN	TOTAL AREA (AC)	SOIL TYPE	AREA (%)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (%)	SUB-AREA 2 DEVELOPMENT/ COVER	C	AREA (%)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
2.5-ACRE LOTS	2.50	B	9.00	BLDG/DRIVEWAY	0.9	91.00	LAWN/MEADOW	0.08				0.154

100-YEAR C VALUES

BASIN	TOTAL AREA (AC)	SOIL TYPE	AREA (%)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (%)	SUB-AREA 2 DEVELOPMENT/ COVER	C	AREA (%)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
2.5-ACRE LOTS	2.50	B	9.00	BLDG/DRIVEWAY	0.95	91.00	LAWN/MEADOW	0.35				0.404

IMPERVIOUS AREAS

BASIN	TOTAL AREA (AC)	SOIL TYPE	AREA (%)	SUB-AREA 1 DEVELOPMENT/ COVER	% IMP.	AREA (%)	SUB-AREA 2 DEVELOPMENT/ COVER	% IMP.	AREA (%)	SUB-AREA 3 DEVELOPMENT/ COVER	% IMP.	WEIGHTED % IMP.
2.5-ACRE LOTS	2.50	B	9.00	BLDG/DRIVEWAY	100	91.00	LAWN/MEADOW	0				9.000

CHERRY SPRINGS RANCH - FILING NO. 2
COMPOSITE RUNOFF COEFFICIENTS

5-YEAR C-VALUES

BASIN	TOTAL AREA (AC)	AREA (%)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (%)	SUB-AREA 2 DEVELOPMENT/ COVER	C	AREA (%)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
P-2A	32.41	13.80	2.5-AC LOTS	0.154	18.61	MEADOW	0.08				0.112
P-3A	5.30	5.30	2.5-AC LOTS	0.154							0.154
P-3B	16.42	16.42	2.5-AC LOTS	0.154							0.154
P-3A,P-3B	21.72										0.154

100-YEAR C-VALUES

BASIN	TOTAL AREA (AC)	AREA (%)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (%)	SUB-AREA 2 DEVELOPMENT/ COVER	C	AREA (%)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
P-2A	32.41	13.80	2.5-AC LOTS	0.404	18.61	MEADOW	0.35				0.373
P-3A	5.30	5.30	2.5-AC LOTS	0.404							0.404
P-3B	16.42	16.42	2.5-AC LOTS	0.404							0.404
P-3A,P-3B	21.72										0.404

CHERRY SPRINGS RANCH - FILING NO. 2
RATIONAL METHOD

HISTORIC FLOWS

BASIN	DESIGN POINT	AREA (AC)	C 5-YEAR(7)	C 100-YEAR (7)	Overland Flow LENGTH (FT)	Overland Flow SLOPE (FT/FT)	Overland Flow Tco (1) (MIN)	Channel flow CHANNEL LENGTH (FT)	Channel flow CONVEYANCE COEFFICIENT C	Channel flow SLOPE (FT/FT)	Channel flow SCS (2) VELOCITY (FT/S)	Channel flow Tt (3) (MIN)	TOTAL Tc (4) (MIN)	TOTAL Tc (4) (MIN)	INTENSITY (5) 5-YR (IN/HR)	INTENSITY (5) 100-YR (IN/HR)	PEAK FLOW Q5 (6) (CFS)	PEAK FLOW Q100 (6) (CFS)
EX-2	2	32.10	0.080	0.350	300	0.020	25.7	700	15.00	0.057	3.58	3.3	28.9	28.9	2.54	4.26	6.51	47.81
EX-3	3	26.30	0.080	0.350	300	0.027	23.2	700	15.00	0.013	1.71	6.8	30.1	30.1	2.48	4.16	5.21	38.29

DEVELOPED FLOWS

BASIN	DESIGN POINT	AREA (AC)	C 5-YEAR(7)	C 100-YEAR (7)	Overland Flow LENGTH (FT)	Overland Flow SLOPE (FT/FT)	Overland Flow Tco (1) (MIN)	Channel flow CHANNEL LENGTH (FT)	Channel flow CONVEYANCE COEFFICIENT C	Channel flow SLOPE (FT/FT)	Channel flow SCS (2) VELOCITY (FT/S)	Channel flow Tt (3) (MIN)	TOTAL Tc (4) (MIN)	TOTAL Tc (4) (MIN)	INTENSITY (5) 5-YR (IN/HR)	INTENSITY (5) 100-YR (IN/HR)	PEAK FLOW Q5 (6) (CFS)	PEAK FLOW Q100 (6) (CFS)
P-2A	2	32.41	0.112	0.373	300	0.020	24.9	700	15.00	0.057	3.58	3.3	28.1	28.1	2.58	4.33	9.36	52.30
P-3A	3A	5.30	0.154	0.404	300	0.027	21.5	270	15.00	0.033	2.72	1.7	23.2	23.2	2.87	4.81	2.34	10.30
Channel P3B							0.0	600	15.00	0.050	3.35	3.0	3.0					
P-3B		16.42	0.154	0.404	300	0.030	20.8	550	15.00	0.062	3.73	2.5	23.3	23.3	2.86	4.81	7.24	31.88
P-3A,P-3B	3	21.72	0.154	0.404									26.2	26.2	2.69	4.51	8.98	39.55

1) OVERLAND FLOW Tco = (0.395*(1.1-RUNOFF COEFFICIENT)*(OVERLAND FLOW LENGTH^(0.5)/(SLOPE^(0.333))
2) SCS VELOCITY = C * ((SLOPE(FT/FT)^0.5)
C = 2.5 FOR HEAVY MEADOW
C = 5 FOR TILLAGE/FIELD
C = 7 FOR SHORT PASTURE AND LAWNS
C = 10 FOR NEARLY BARE GROUND
C = 15 FOR GRASSED WATERWAY
C = 20 FOR PAVED AREAS AND SHALLOW PAVED SWALES
3) MANNING'S CHANNEL TRAVEL TIME = L/V (WHEN CHANNEL VELOCITY IS KNOWN)
4) Tc = Tco + Tt
*** IF TOTAL TIME OF CONCENTRATION IS LESS THAN 5 MINUTES, THEN 5 MINUTES IS USED
5) INTENSITY BASED ON I-D-F EQUATIONS IN CITY OF COLORADO SPRINGS DRAINAGE CRITERIA MANUAL
I_5 = -1.5 * ln(Tc) + 7.583
I_{100} = -2.52 * ln(Tc) + 12.735
6) Q = CiA
7) WEIGHTED AVERAGE C VALUES FOR COMBINED BASINS

APPENDIX C

HYDRAULIC CALCULATIONS

TABLE 10-4

MAXIMUM PERMISSIBLE VELOCITIES FOR EARTH CHANNELS WITH VARIED GRASS LININGS AND SLOPES

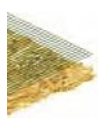
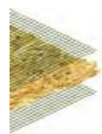
Channel Slope	Lining	Permissible Mean Channel Velocity * (ft/sec)
0 - 5%	Sodded grass	7
	Bermudagrass	6
	Reed canarygrass	5
	Tall fescue	5
	Kentucky bluegrass	5
	Grass-legume mixture	4
	Red fescue	2.5
	Redtop	2.5
	Sericea lespedeza	2.5
	Annual lespedeza	2.5
	Small grains (temporary)	2.5
5 - 10%	Sodded grass	6
	Bermudagrass	5
	Reed canarygrass	4
	Tall fescue	4
	Kentucky bluegrass	4
	Grass-legume mixture	3
Greater than 10%	Sodded grass	5
	Bermudagrass	4
	Reed canarygrass	3
	Tall fescue	3
	Kentucky bluegrass	3

* For highly erodible soils, decrease permissible velocities by 25%.

* Grass lined channels are dependent upon assurances of continuous growth and maintenance of grass.

The complete line of RollMax™ products offers a variety of options for both short-term and permanent erosion control needs. Reference the RollMax Products Chart below to find the right solution for your next project.

RollMax Product Selection Chart

	TEMPORARY						
	ERONET						BIONET
							
	DS75	**DS150**	**S75**	**S150**	**SC150**	**C125**	**S75BN**
Longevity	45 days	60 days	12 mo.	12 mo.	24 mo.	36 mo.	12 mo.
Applications	Low Flow Channels 4:1-3:1 Slopes	Moderate Flow Channels 3:1-2:1 Slopes	Low Flow Channels 4:1-3:1 Slopes	Moderate Flow Channels 3:1-2:1 Slopes	Medium Flow Channels 2:1-1:1 Slopes	High-Flow Channels 1:1 and Greater Slopes	Low Flow Channels 4:1-3:1 Slopes
Design Permissible Shear Stress lbs/ft^2 (Pa)	Unvegetated 1.55 (74)	Unvegetated 1.75 (84)	Unvegetated 1.55 (74)	Unvegetated 1.75 (84)	Unvegetated 2.00 (96)	Unvegetated 2.25 (108)	Unvegetated 1.60 (76)
Design Permissible Velocity ft/s (m/s)	Unvegetated 5.00 (1.52)	Unvegetated 6.00 (1.52)	Unvegetated 5.00 (1.2)	Unvegetated 6.00 (1.83)	Unvegetated 8.00 (2.44)	Unvegetated 10.00 (3.05)	Unvegetated 5.00 (1.52)
Top Net	Lightweight accelerated photodegradable polypropylene 1.50 $lbs/1000\ ft^2$ (0.73 $kg/100\ m^2$) approx wt	Lightweight accelerated photodegradable polypropylene 1.50 $lbs/1000\ ft^2$ (0.73 $kg/100\ m^2$) approx wt	Lightweight photodegradable polypropylene 1.50 $lbs/1000\ ft^2$ (0.73 $kg/100\ m^2$) approx wt	Lightweight photodegradable polypropylene 1.50 $lbs/1000\ ft^2$ (0.73 $kg/100\ m^2$) approx wt	Heavyweight UV-stabilized polypropylene 2.9 $lbs/1000\ ft^2$ (1.47 $kg/100\ m^2$) approx wt	Heavyweight UV-stabilized polypropylene 2.9 $lbs/1000\ ft^2$ (1.47 $kg/100\ m^2$) approx wt	Leno woven. 100% biodegradable jute fiber 9.30 $lbs/1000\ ft^2$ (4.53 $kg/100\ m^2$) approx wt
Center Net	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Fiber Matrix	Straw fiber 0.50 lbs/yd^2 (0.27 kg/m^2)	Straw fiber 0.50 lbs/yd^2 (0.27 kg/m^2)	Straw fiber 0.50 lbs/yd^2 (0.27 kg/m^2)	Straw fiber 0.50 lbs/yd^2 (0.27 kg/m^2)	Straw/coconut matrix 70% Straw 0.35 lbs/yd^2 (0.19 kg/m^2) 30% Coconut 0.15 lbs/yd^2 (0.08 kg/m^2)	Coconut fiber 0.50 lbs/yd^2 (0.27 kg/m^2)	Straw fiber 0.50 lbs/yd^2 (0.27 kg/m^2)
Bottom Net	N/A	Lightweight accelerated photodegradable polypropylene 1.50 $lbs/1000\ ft^2$ (0.73 $kg/100\ m^2$) approx wt	N/A	Lightweight photodegradable polypropylene 1.50 $lbs/1000\ ft^2$ (0.73 $kg/100\ m^2$) approx wt	Lightweight photodegradable polypropylene 1.50 $lbs/1000\ ft^2$ (0.73 $kg/100\ m^2$) approx wt	Heavyweight UV-stabilized polypropylene 2.9 $lbs/1000\ ft^2$ (1.47 $kg/100\ m^2$) approx wt	N/A
Thread	Accelerated degradable	Accelerated degradable	Degradable	Degradable	Degradable	UV-stabilized polypropylene	Biodegradable

APPENDIX D

FIGURES

FINAL DRAINAGE MAP

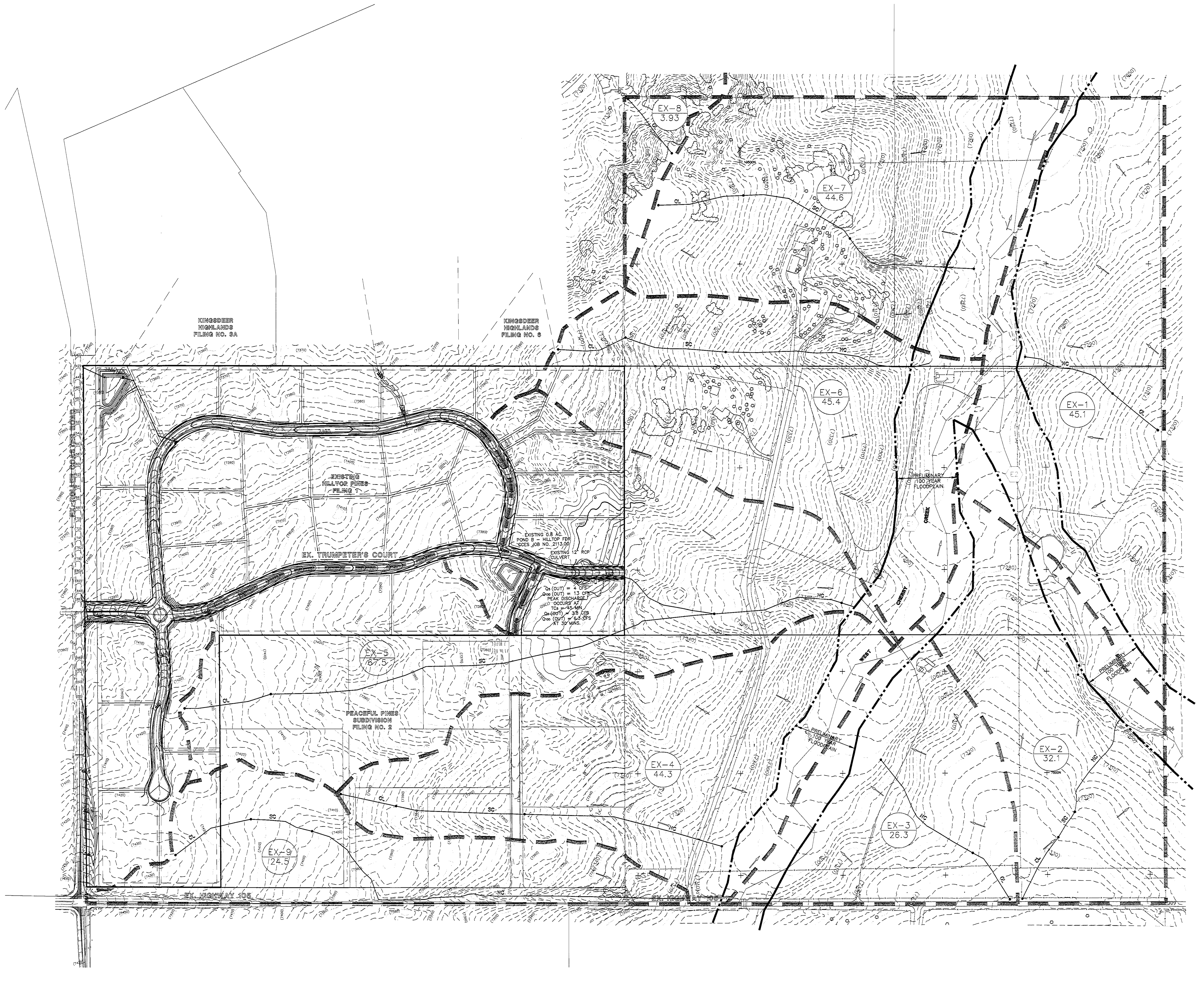
CHERRY SPRINGS RANCH

EXISTING CONDITIONS

N

200 100 0 200 400

SCALE: 1" = 200'



BASIN RUNOFF SUMMARY		
BASIN	Q5 (CFS)	Q100 (CFS)
EX-1	39	96
EX-2	22	55
EX-3	21	51
EX-4	34	83
EX-5	37	93
EX-6	33	81
EX-7	31	78
EX-8	3.6	9
EX-9	17	42
E1	93	226
E2	72	177

LEGEND

EXISTING GROUND INDEX CONTOUR	5910
EXISTING GROUND NOMINAL CONTOUR	
PROPOSED FINISHED INDEX CONTOUR	5910
PROPOSED FINISHED INDEX CONTOUR	
SUBDIVISION BOUNDARY	
LOT LINE	
OVERLAND	OL
SHALLOW CONCENTRATED	SC
NATURAL CHANNEL	NC
PROPOSED BASIN LINE	
PREVIOUS 100 YR FLOODPLAIN PER FEMA MAP NO. 08041C02895F	
TIME OF CONCENTRATION LINE	
DIRECTIONAL FLOW ARROW	
BASIN LABEL	EX-2
BASIN ACREAGE	32.1
DESIGN POINT	

FINAL DRAINAGE MAP
CHERRY SPRINGS RANCH
2113.10
6-27-05
SHEET 1 OF 1

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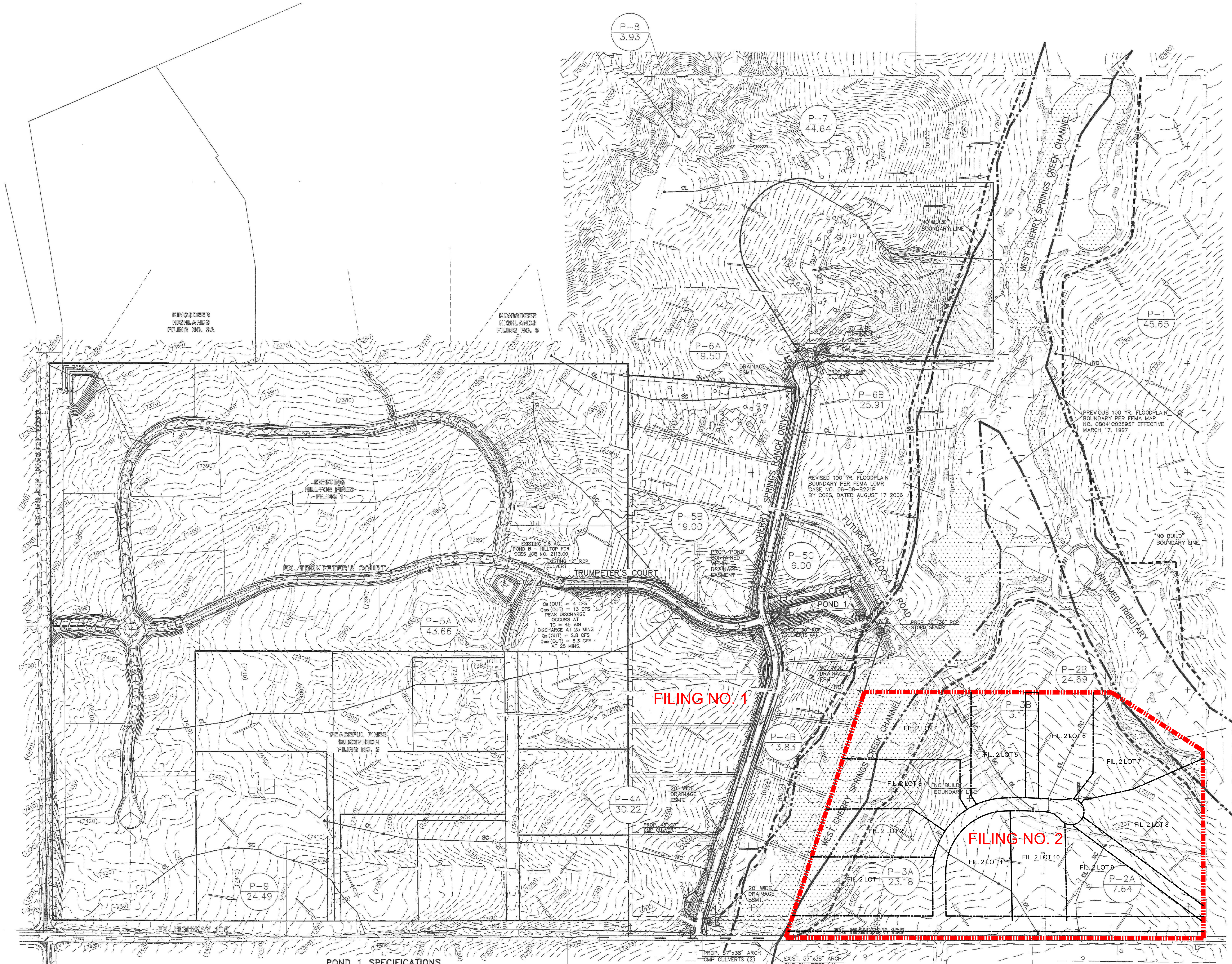
FINAL DRAINAGE MAP

CHERRY SPRINGS RANCH

DEVELOPED CONDITIONS



BASIN RUNOFF SUMMARY		
BASIN	Q5 (CFS)	Q100 (CFS)
P-1	40	100
P-2A	7	16
P-2B	21	50
P-3A	20	48
P-3B	4	8
P-4A	25	61
P-4B	18	42
P-5A	27	65
P-5B	18	44
P-5C	7	16
P-6A	15	37
P-6B	23	56
P-7	32	79
P-8	4	9
P-9	19	45

DESIGN POINT SUMMARY		
DESIGN POINT	Q5 (CFS)	Q100 (CFS)
1	15	37
2	35	85
3	18	44
4	27	65
4A	31	72
5	44	104
5A	48	111
6	25	61
7	19	45
8	69	165
9	24	61
10	24	59
11	23	55
12	37	88
13	76	185
14	20	53
*D-8	46	108

* VALUES FOR D-8 TAKEN FROM DRAINAGE DITCH MAP

LEGEND

- EXISTING GROUND INDEX CONTOUR — 5910
- EXISTING GROUND NOMINAL CONTOUR
- PROPOSED FINISHED INDEX CONTOUR — 5910
- PROPOSED FINISHED INDEX CONTOUR
- SUBDIVISION BOUNDARY
- LOT LINE
- OVERLAND — OL
- SHALLOW CONCENTRATED — SC
- NATURAL CHANNEL — NC
- PROPOSED BASIN LINE
- TIME OF CONCENTRATION LINE
- "NO BUILD" ZONE BOUNDARY LINE
- PREVIOUS 100 YR FLOODPLAIN PER FEMA MAP NO. 08041C02895F
- REVISED 100-YR FEMA FLOODPLAIN PER LOMR CASE NO. 06-08-B221P
- DIRECTIONAL FLOW ARROW
- CHERRY SPRINGS RANCH FILING NO. 1 CURRENT PLATTED AREA
- DESIGN POINT — 10
- BASIN LABEL — EX-2
- BASIN ACREAGE — 32.1

POND 1 SPECIFICATIONS

POND VOLUME: 3.48 AC-FT @ 7299.46
5.62 AC-FT @ 7302.00

POND STORAGE: 100-YR EVENT: 3.90 AC-FT
5-YR EVENT: 1.97 AC-FT

MAX. WSEL: 100-YR EVENT: 7299.46
5-YR EVENT: 7297.21

PEAK INFLOW: Q100 = 111 CFS
Q5 = 48 CFS

TRUNCATED PEAK: Q100 = 88.1 CFS Tc = 54 MINS
Q5 = 36.7 CFS Tc = 45 MINS

PEAK OUTFLOW: ALLOWABLE ACTUAL
Q100 = 51.0 CFS Q100= 48.5 CFS Tc = 75.0 MINS
Q5 = 19.0 CFS Q5 = 18.5 CFS Tc = 76.5 MINS

STORM WATER QUALITY:

SITE % IMPERVIOUS: 10.4%
CONTRIBUTING WS: 68.66AC
WCQV: 0.07 WI
REQ'D VOLUME: 0.476 AC-FT
WCQV ELEVATION: 7293.78
PERM WSE: 7291.63

OUTLET STRUCTURE: 6.5' X 6.5' X 11.73' CONCRETE BOX W/PROJECTING WALLS

TYPE(S): WCQV ORFICE PLATE: 2 COL. 5 ROWS – 13/16" DIA BORES
2.48'H X 1.33'W ~ CONC. RECTANGULAR WEIR @ 7294.50
OUTLET PIPE: 30" RCP W/REST. PLATE @ 6.07%
EFFECT. AREA = 4.00 SQ FT. INV. 7291.50

EMERGENCY SPILLWAY:

TYPE(S): EARTHEN TRAPEZOIDAL WEIR
OVERFLOW CREST ELEVATION: 7299.46
TOP OF EMBANKMENT ELEVATION: 7302.00
EMERGENCY EVENT = 111 CFS
111 CFS @ 25.0' WIDE CREST @ 0.40' DEPTH = 7299.86

N

200' 100' 0 200' 400'

SCALE: 1" = 200'

DEVELOPED CONDITIONS DRAINAGE MAP
CHERRY SPRINGS RANCH
2113.10
11/29/06
SHEET 1 OF 1

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Colorado Springs, Colorado 80919
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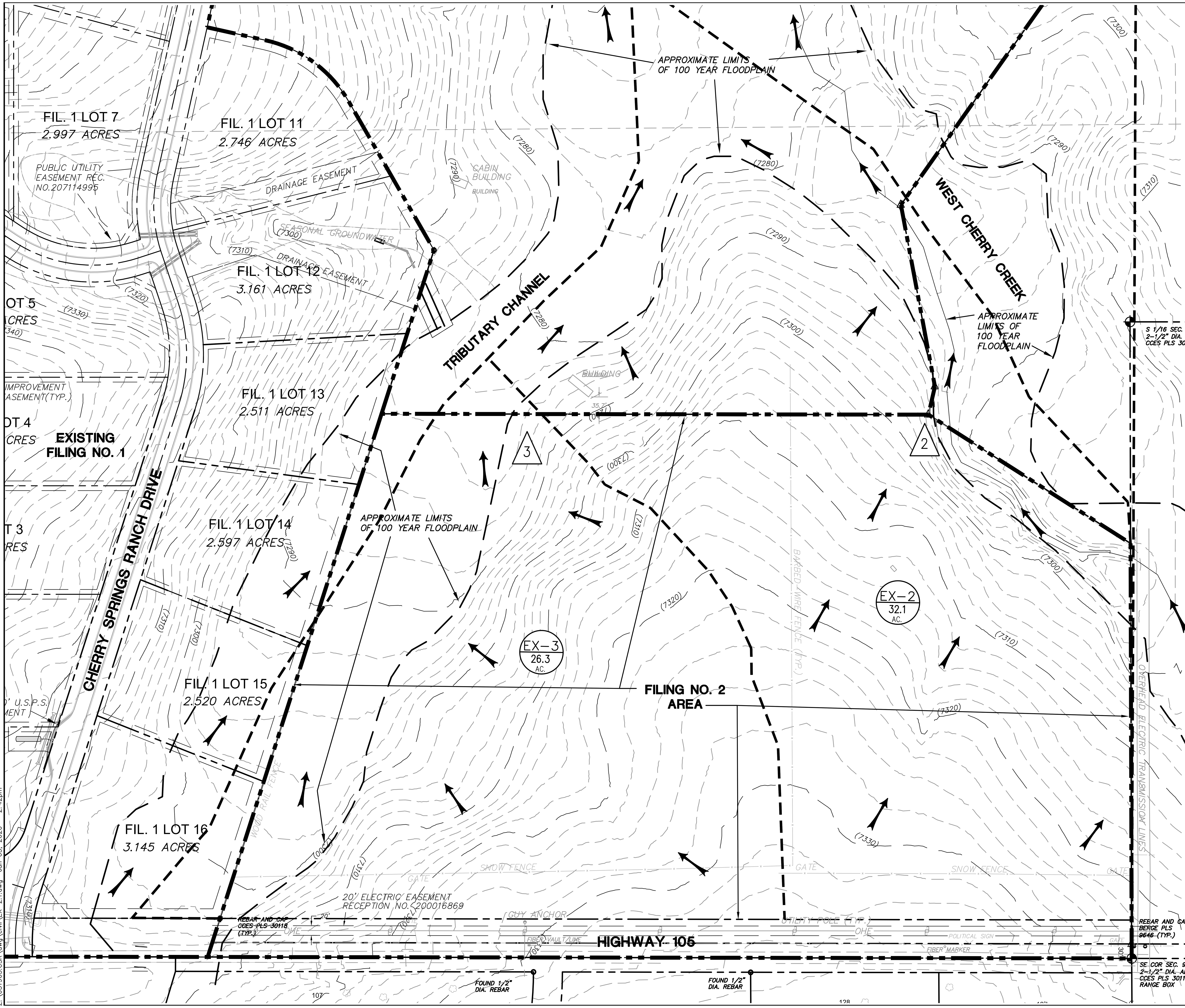

N

Original Scale: 1"=100'
(24"x36" Sheet)
Contour Interval = 2 ft.

LEGEND

- DRAINAGE BASIN BOUNDARY
- 6520 EXISTING CONTOUR
- PROPOSED FLOW DIRECTION ARROW
- DESIGN POINT
- BASIN DESIGNATION
- BASIN AREA (ACRES)

SUMMARY HYDROLOGY TABLE

DESIGN POINT	Q_5 (CFS)	Q_{100} (CFS)
2	6.5	47.8
3	5.2	38.3

CHERRY SPRINGS RANCH - FILING NO. 2

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FAX: 719-471-0766
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CALL UTILITY NOTIFICATION CENTER OF COLORADO
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CALL 2-BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

HISTORIC DRAINAGE PLAN

HORZ. SCALE:	1"=100'	DRAWN:	BJJ
VERT. SCALE:	N/A	DESIGNED:	JPS
SURVEYED:	LWA	CHECKED:	JPS
CREATED:	1/03/20	LAST MODIFIED:	1/03/20
PROJECT NO:	031903	MODIFIED BY:	BJJ

SHEET:
EX2.1

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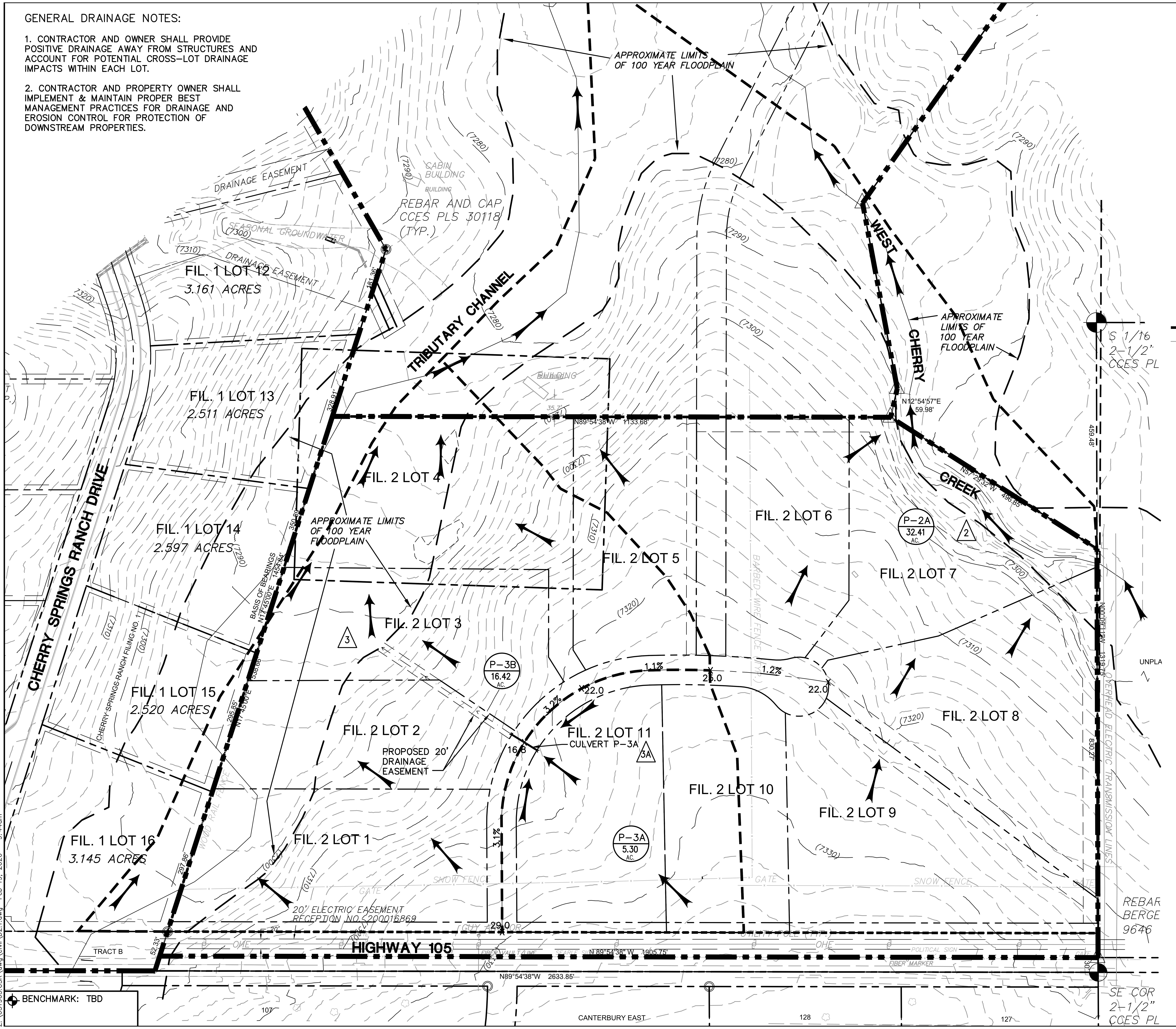
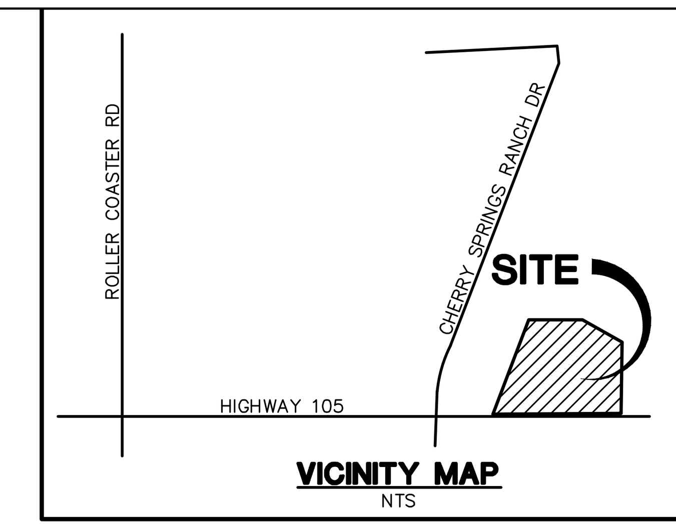
GENERAL DRAINAGE NOTES:

1. CONTRACTOR AND OWNER SHALL PROVIDE POSITIVE DRAINAGE AWAY FROM STRUCTURES AND ACCOUNT FOR POTENTIAL CROSS-LOT DRAINAGE IMPACTS WITHIN EACH LOT.

2. CONTRACTOR AND PROPERTY OWNER SHALL IMPLEMENT & MAINTAIN PROPER BEST MANAGEMENT PRACTICES FOR DRAINAGE AND EROSION CONTROL FOR PROTECTION OF DOWNSTREAM PROPERTIES.





LEGEND

- DRAINAGE BASIN BOUNDARY
- 6520 EXISTING CONTOUR
- PROPOSED FLOW DIRECTION ARROW
- 1 DESIGN POINT
- A BASIN DESIGNATION
- 524 AC. BASIN AREA (ACRES)

SUMMARY HYDROLOGY TABLE

DESIGN POINT	Q_5 (CFS)	Q_{100} (CFS)
2	9.4	52.3
3A	2.3	10.3
3	9.0	39.6

GRAPHIC SCALE

100' 0 50' 100' 200'

(IN FEET) (24"x36" SHEET)
1 inch = 100 ft.
Contour Interval = 2'

N

CHERRY SPRINGS RANCH - FILING NO. 2

DEVELOPED DRAINAGE PLAN

JPS ENGINEERING
19 E. Willamette Ave.
Colorado Springs, CO 80903
PH: 719-477-9429
FAX: 719-471-0766
www.jpsengr.com

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No.	REVISION	BY	DATE

HORZ. SCALE:	1"=100'	DRAWN:	BJJ
VERT. SCALE:	N/A	DESIGNED:	JPS
SURVEYED:	LWA	CHECKED:	JPS
CREATED:	11/29/19	LAST MODIFIED:	2/19/20
PROJECT NO:	031903	MODIFIED BY:	BJJ
SHEET:	D2.1		

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