EAGLE RISING, FILING NO. 1

El Paso County, Colorado

FINAL DRAINAGE REPORT

AUGUST 2015

Prepared for:

My Pad, Inc.
P.O. Box 2076
Colorado Springs, CO 80901
Stephen Jacobs

FILE COPY

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Prepared by:

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Project# 43-043

SF-18-029

EAGLE RISING, FILING NO.1

FINAL DRAINAGE REPORT

DRAINAGE PLAN STATEMENTS

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 acceptable to the City of Colorado Springs. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

____

Virgil A. Sanchez, P.E. #37160
For and on Behalf of M & S Civil Consultants, Inc.

DEVELOPER'S STATEMENT

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

BY: ______________________________ DATE: _______________

TITLE: President

ADDRESS: My Pad, Inc.
P.O Box 2076
Colorado Springs, CO 80901

EL PASO COUNTY STATEMENT

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

BY: ______________________________ DATE: _______________

Andre Brackin, P.E.
County Engineer/ECM Administrator Jennifer Irvine, P.E.

CONDITIONS:

EAGLE RISING, FILING NO.1

FINAL DRAINAGE REPORT

TABLE OF CONTENTS

PURPOSE 4

GENERAL LOCATION AND DESCRIPTION 4

SOILS 4

CLIMATE 4

Add section: "Four Step Process"

FLOODPLAIN STATEMENT 4

DRAINAGE CRITERIA 5

EXISTING DRAINAGE CONDIDONS 5

PROPOSED DRAINAGE CHARACTERISTICS 7

DBPS RECOMMENDATIONS & ALTERNATIVE 12

HEC-RAS MODELING 13

PRUDENT LINE ESTABLISHMENT 14

DRAINAGE FEES 16

SUMMARY 16

REFERENCES 17

APPENDIX 1

Vicinity Map Soils
Map
FEMA Floodplain Maps
Hydrologic Calculations
Hydraulic Calculations - Culverts and Drainageways
Channel Pictures
HECRAS Model Data - Select Output Results
Prudent Line Calculations
DBPS Excerpts
Map -Hydrology (On-site Existing) Map -
Hydrology (On-site Proposed) Map-
Hydrology (Off-site)
Plan & Profile - Future Briargate Parkway Concept

APPENDIX 2

HECRAS Model Data- Complete Input and Output Report

The HECRAS is not included?

EAGLE RISING FILING NO.1

FINAL DRAINAGE REPORT

PURPOSE

This document is the Final Drainage Report for Eagle Rising, Filing No. 1. The purpose of this report is to identify existing and proposed runoff patterns and peak flow rates, to determine the safe setback distance from Cottonwood Creek for future and proposed development using the Prudent Line Concept, and to ensure that proposed drainage improvements serve to route stormwater to outfall facilities without adverse affect to surrounding or downstream properties and in a manner that satisfies requirements set forth by current City & County Drainage Criteria.

GENERAL LOCATION AND DESCRIPTION

Eagle Rising is located in Section 29 Township 12 South, Range 65 West of the 6th P.M. in El Paso County, Colorado. The site is bounded on the north by the Park Forest Estates Subdivision, on the east by the Poco Subdivision and unplatted land, on the south by the Highland Park Subdivisions Filing Nos. 1 and 2, and on the west by the Eagle Wing Subdivision. The site lies within the Cottonwood Creek Drainage Basin.

The property is occupied by an existing house with detached garage and a large barn. Existing site terrain generally slopes from the northwest to the southeast at grades that vary between 2% and 12%. Runoff conveys across the site in natural drainage swales and discharges into to the Cottonwood Creek channel. Vegetation consists of native grasses, shrubs and trees.

The proposed site consists of approximately 70 acres. Improvements proposed as part of Filing 1 include street, sanitary sewer, water, and drainage improvements to serve 8 single family residential lots. Two of the proposed eight lots will contain the existing structures.

SOILS

Site soils are described by the National Cooperative Soil Survey (Natural Resources Conservation Service-Web Soil Survey) as Kettle gravelly loam Sand and Pring course sandy loam. The predominant hydrologic soil type is "B", and is comprised primarily of #40 Kettle, & #71 Pring. Permeability of these soils is generally rapid.

CLIMATE

This area of El Paso County can be described as the foothills, with total precipitation amounts typical of a semi-arid region. Winters are generally cold and dry, and summers relatively warm and dry. Precipitation ranges from 12 to 14 inches per year, with the majority of this moisture occurring in the spring and summer in the form of rainfall. Thunderstorms are common during the summer months.

FLOODPLAIN STATEMENT

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panel No's. 08041C0530F & 08041C0535F, both effective March 17, 1997 and revised to reflect LOMR

527G

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Verify
12/7/2018

Revise

dated May 24, 2001, portions of the site of the site are impacted by a Special Flood Hazard Area(SFHA) Zone A. A SFHA Zone A is defined as an area that is impacted by a 100-year event, for which no detailed study has been completed and for which no Base Flood Elevations have been determined. Refer to the FIRMETTE included in Appendix 1.

DRAINAGE CRITERIA

Add section: "Four Step Process"

The drainage analysis has been prepared in accordance with the current City of Colorado Springs/El Paso County Drainage Criteria Manual and El Paso County Engineering Criteria Manual. Calculations were performed to determine runoff quantities during the 5- year and 100-year frequency storms for developed conditions using the Rational Method.

Revise for Filing 1 and Filing 2. Explain the subdividing of the 70.9 acres

EXISTING DRAINAGE CONDITIONS

The Eagle Rising Development is approximately 70 acres in size. The site primarily consists of grass land with slopes ranging from 4% to 12% and greater adjacent to Cottonwood Creek. The Cottonwood Creek main stem and several tributary branches are located within the site boundary. In addition, there are two on- line ponds along the main stem. These two man-made ponds along the channel reach which were believed to be constructed around the 50's. The purpose for their construction is unknown due to lack of history but is speculated to be for livestock use. There is one residence with ancillary buildings present. Existing gravel roadways provide access. There is no evidence of severe erosion or degradation of existing channel. However, it has been mentioned by the previous owner that the existing ponds did overflow at the existing locations, into the downstream channel. Also, there is no evidence of large sediment transfer deposits in the channel way or in the existing ponds.

The existing upstream land is currently 80% developed into 2.5 acre lots or larger, as planned in the Cottonwood Creek DBPS. Therefore, the planned developed flows per the DBPS are closely matched to the current flows routed through the site. A brief description of each existing drainage basin including runoff rates, and drainage patterns for each basin is provided in this section of the report. A summary of peak developed runoff for the basins and designated design points are depicted on the Hydrologic Map - On-site Existing in the appendix. The site has been divided into eight existing drainage basins described as follows:

Design Point E1 (DP E1) flows (Q5=307cfs, Q100=547cfs) are generated from off-site basins A1, A2, A3, A4, A5, A8, A9 & A13. These basins were delineated in the 1994 Cottonwood Creek DBPS. These basins are located at the top of the Cottonwood Creek watershed and consist of large lot subdivisions, open space, fields and pastures. DPE1 is located on the main stem of Cottonwood Creek at the site northern boundary as creek flow enters the Eagle Rising development.

Design Point E2 (DP E2) flows (Q5=24cfs, Q100=57cfs) are generated from off-site basin OS-B1A. This basin is a sub-basin of DBPS basin B1 and has been created to determine the flow at the entry point into the site along a tributary branch of the main stem. This basin consists of large lot subdivisions, open space, fields and pastures.

Design Point E3 (DP E3) flows (Q5=42cfs, Q100=98cfs) are generated from off-site basin OS-B1B. This basin is a sub-basin of DBPS basin B1 and has been created to determine the flow at the entry point into the site along a tributary branch of the main stem. This basin consists of large lot subdivisions, open space, fields and pastures.

Design Point E4 (DP E4) flows (Q5=76cfs, Q100=136cfs) are generated from off-site basins A6, A7 and

A10. These basins were delineated in the 1994 Cottonwood Creek DBPS. These basins consist of large lot subdivisions, open space, fields and pastures. DP E4 is located along a tributary reach off the main stem of Cottonwood Creek as flow enters the Eagle Rising development.

Design Point E5 (DP E5) flows (Q5=408cfs, Q100=728cfs) are generated from DP E1, DP E4 on-site basin EX-A and off-site basin A11. On-site basin EX-A consists of open space as well as a small portion of the creek itself. Off-site basin A11 consists of large lot subdivisions, open space, fields and pastures. These basins were delineated in the 1994 Cottonwood Creek DBPS. DPE5 is located on the main stem of Cottonwood Creek.

Design Point E6 (DP E6) flows (Q5=484cfs, Q100=884cfs) are generated from DP E2, DP E3, DP E5, on- site basin EX-B and off-site basin A12. On-site basin EX-B consists of large lot (2.5ac +/-) existing development as well as a small portion of the creek itself. Off-site basin Al2 consists of large lot subdivisions, open space, fields and pastures. This basin was delineated in the 1994 Cottonwood Creek

Design Point E7 (DP E7) flows (Q5=1.7cfs, Q100=4.0cfs) are generated from off-site basin OS-B1C. Off-site basin OS-B1C consists of large lot subdivisions, open space, fields and pastures.

Design Point E8 (DP E8) flows (Q5=6cfs, Q100=14cfs) are generated from off-site basin OS-B1D. Off-site basin OS-B1D consists of large lot sub visions, open space, fields and pastures.

Design Point E9 (DJ7·E9) flows (Q5=485cfs, Q100=893cfs) are generated from DP E6, D, DP E8, and on-site basin EX-C, EX-D, and off-site basin OS-B4A. Off-site basin OS-B4A is a sub-basin of DBPS basin B4 and has been created to determine the flow at the entry point into the site as sheet flow into the main stem. Off-site basin OS-B4A consists of large lot subdivisions, open space, fields and pastures. On- site basins EX-C and EX-D consist of large lot (~2.5ac +/-) existing development. There are two existing ancillary structures present within the basins.

Design Point E10 (DP E10) flows (Q5=10cfs, Q100=24cfs) are generated from off-site basin OS-B1E. Off-site basin OS-B1E consists of large lot subdivisions, open space, fields and pastures.

Design Point E11 (DP E11) flows (Q5=9cfs, Q100=2lcfs) are generated from off-site basin OS-B3A. Off-site basin OS-B3A consists of large lot subdivisions, open space, fields and pastures.

Design Point E12 (DP E12) flows (Q5=499cfs, Q100=926cfs) are generated from DP E9, DP E1, DP ,E11, on-site basins EX-E, EX-F, and off-site basin OS-B4B. Off-site basin OS-B4B is a sub-basin of DBPS basin B4 and has been created to determine the flow at the entry point into the site as sheet flow into the main stem. Off-site basin OS-B4A consists of large lot subdivisions, open space, fields and pastures. On- site basins EX-E and EX-F consist of pasture.

Design Point E13 (DP E13) flows (Q5=2.1cfs, Q100=5.lcfs) are generated from off-site basin OS-B3B. Off-site basin OS-B3A consists of large lot subdivisions, open space, fields and pastures.

Design Point E14 (DP E14) flows (Q5=496cfs, Q100=925cfs) are generated from DP E12, DP E13, on-site basins EX-G and EX-H, and off-site basin OS-B4C. Off-site basin OS-B4C consists of large lot subdivisions, open space, fields and pastures. This basin is a sub-basin of DBPS basin B4 and has been created to determine the flow at the entry point into the site at the southern pond along the main stem as primarily sheet flow. DP14 is located on the main stem of Cottonwood Creek. On-site basins EX-G and EX-H consist of pasture.

Design Point E15 (DP E15) flows (Q5=6.5cfs, Q100=14.8cfs) are generated from off-site basin OS-B3C. This basin is a sub-basin of DBPS basin B3 and has been created to determine the flow at the entry point to the site. This calculated flow for information only since it does not mix with on-site flow. This basin consists of large lot subdivisions, open space, fields and pastures within the Eagle Wing subdivision.

Design Point E16 (DP E16) flows (Q5=4.9cfs, Q100=11.6cfs) are generated from off-site basin OS-B3C, and basin EX-H. DP E16 is a summation of the off-site basin and future onsite developed basin. DP E16 can be compared to DP16 in the next section for the total flows exiting the site.

Design Point E17 (DP E17) flows (Q5=64cfs, Q100=152cfs) are generated from off-site basins OS-B1A and OS-B1B (DP E2 & DP E3). The summations of these flows at DP E17 are combined in an existing small local depression area. The depression appears to be man-made, possibly for livestock watering. The current condition of the depression appears to hold some water at certain times of year but not continually. The downstream end of the depression area is a small bank to trap the water in the existing natural swale. The depression area is proposed to be left intact, non disturbed, and is within a no build area.

Design Point E18 (DP E18) flows (Q5=4.2cfs, Q100=10cfs) are generated from off-site basin OS-B1C (DP-E7) and basin EX-C1. Basin EX-C1 was created by the construction of the existing Barn Building. The Barn construction has redirected the historic flows to the east and into the Cottonwood channel.

Design Point E19 (DP E19) flows (Q5=64cfs, Q100=151cfs) are generated from the summation of DP E18, basin EX-B, and DP E17. The summations of these historic flows enter the Cottonwood Creek channel and combine with flows from DP E5.

Design Point E20 (DP E20) flows (Q5=9.7cfs, Q100=23cfs) are generated from off-site basin OS-B1D (DP E8) and basin EX-D. Basin EX-D was created by the construction of the existing Barn Building and riding arena. This construction created a flat graded area and man-made pond. The pond overflow continues in the historic drainage swale to DP E20.

Design Point E21 (DP E21) flows (Q5=18cfs, Q100=43cfs) are generated from off-site basin OS-B1E (DP E10), OS-B3A (DP Ell) and basin EX-F. Basin EX-F is an undisturbed historic drainage area. The summation of flows at DP E21 discharges into the existing south pond area and combine with flows from upstream DP E9.

And the proposed roadway area will need SWQCV Treatment.

PROPOSED DRAINAGE CHARACTERISTICS

The proposed drainage facilities for the development of Eagle Rising are minimal. The proposed use of the land being 2.5 acre lots does not lead to the necessity of onsite drainage facilities, other than culverts to convey the existing flows under the proposed roadways and driveways. As mentioned above, the existing channel is currently witnessing close to the ultimate flows from the existing upstream developed property. And per the Prudent Line Concept, its full intention and definition, the application of this method for the channel to be left in a natural condition for its aesthetic value, better water quality conditions, for both engineering and economic considerations is proposed.

A brief description of each developed drainage basin including developed runoff rates, drainage patterns and proposed drainage facilities for each basin is provided in this section of the report. A summary of peak developed runoff for the basins and designated design points are depicted on the Hydrologic Map in the appendix. The site has been divided into twelve developed drainage basins described as follows:

Design Point 1 (DP1) flows (Q5=307cfs, Q100=547cfs) are generated from off-site basins A1, A2, A3, A4, AS, A8, A9 & A13. These basins were delineated in the 1994 Cottonwood Creek DBPS. These basins are located at the top of the Cottonwood Creek watershed and consist of large lot subdivisions, open space; fields and pastures. DP1 is located on the main stem of Cottonwood Creek at the site northern boundary as creek flow enters the Eagle Rising development.

Design Point 2 (DP2) flows (Q5=76cfs, Q100=136cfs) are generated from off-site basins A6, A7 and A10. These basins were delineated in the 1994 Cottonwood Creek DBPS. This basin consists of large lot subdivisions, open space, fields and pastures. DP2 is located along a tributary reach off the main stem of Cottonwood Creek as flow enters the Eagle Rising development.

Design Point 3 (DP3) flows (Q5=408cfs, Q100=728cfs) are generated from DP1, DP2, on-site basin A1 and off-site basin A11. On-site basin A1 consists of large lot (~2.5ac +/-) proposed development as well as a small portion of the creek itself. Off-site basin A11 consists of large lot subdivisions, open space, fields and pastures. These basins were delineated in the 1994 Cottonwood Creek DBPS. DP3 is located on the main stem of Cottonwood Creek.

Design Point 4 (DP4) flows (Q5=24cfs, Q100=57cfs) are generated from off-site basin OS-B1A. This basin is a sub-basin of DBPS basin B1 and has been created to determine the flow at the entry point into the site along a tributary branch of the main stem. This basin consists of large lot subdivisions, open space, fields and pastures. This flow is contained within a drainageway (Drainageway 1) that runs through a future tract. The slope of the drainageway is approximately 3.6% and has velocities of 3.8fps and 4.7fps, depths of 0.8' and 1.1' during the 5 yr and 100 yr storms respectively, at the steepest and most defined a point along the reach. A threshold of 5fps has been utilized for all natural drainageways within the project site due to the presence of well established vegetation in the bottom and along the side slopes. Refer to the hydraulic calculations in appendix 1 for additional information for all drainageways.

Design Point 5 (DP5) flows (Q5=42cfs, Q100=98cfs) are generated from off-site basin OS-B1B. This basin is a sub-basin of DBPS basin B1and has been created to determine the flow at the entry point into the site along a tributary branch of the main stem. This basin consists of large lot subdivisions, open space, fields and pastures. This flow is contained within a drainageway (drainageway 2) that also runs through a future tract. The slope of the drainageway is approximately 3.7% and has velocities of 3.8fps and 4.7fps, depths of 0.8' and 1.1' during the 5yr and 100yr storms respectively, at the steepest and most defined a point along the reach.

Design Point 6 (DP6) flows (Q5=68cfs, Q100=160cfs) are generated from DP4 and DP5 and on site basins B and C. On-site basins B & C consist of large lot (~2.5ac +/-) proposed development. Drainageways 1 and 2 combine at this location. Immediately downstream of this outfall, there is an existing depression area which appears to be man-made.

Design Point 6A (DP 6A) flows (Q5=4.2cfs, Q100=10cfs) are generated from off-site basin OS-B1C (DP E7) and basin E1. Basin E1 was created by the construction of the existing Barn Building and the proposed development of large lots. On-site basins E1 consist of large lot (~2.5ac +/-) proposed development.

Design Point 6B (DP 6B) flows (Q5=65cfs, Q100=155cfs) are generated from the summation of DP 6A, and basin D. The summations of these flows will enter the Cottonwood Creek channel and combine with flows from DP 3.

Design Point 7 (DP7) flows (Q5=488cfs, Q100=892cfs) are generated from DP3, DP6, on-site basin D and off-site basin A12. On-site basin D consists of large lot (~2.5ac +/-) proposed development as well as a small portion of the creek itself. Off-site basin A12 consists of large lot subdivisions, open space, fields and pastures. This basin was delineated in the 1994 Cottonwood Creek DBPS. Flow is contained within a drainageway (Drainageway 3) that runs through Lots 1 & 2 (see map). A conservative 5yr and 100yr flow calculated along this reach is approximately 80cfs and 197cfs (DP6 and basin D direct runoff) respectively. The slope of the drainageway is approximately 4.0% and has velocities of 6.1fps and 7.7fps, depths of 1.5' and 2.1' during the 5yr and 100yr storms respectively at the steepest and most defined a point along the reach. These velocity values are above the threshold chosen for the project (5fps) and are therefore considered erosive in nature. However, this drainageway is located along the rear lot lines of the lots noted and is not felt to be a threat to proposed structures. Therefore, no improvements are proposed at this time, thereby preserving the natural drainageway characteristics. DP7 is located on the main stem of Cottonwood Creek.

Design Point 8 (DP8) flows (Q5=490cfs, Q100=898cfs) are generated from DP7, on-site basin E2 and off- site basin OS-B1C. Off-site basin OS-B1C is a sub-basin of DBPS basin B1 and has been created to determine the flow at the entry point into the site along a tributary branch of the main stem. This basin consists of large lot subdivisions, open space, fields and pastures. On-site basin E2 consists of large lot (~2.5ac +/-) proposed development. There is an existing residence and ancillary structures present within the basin. Flow is contained within a drainageway (Drainageway 4) that runs through future lots & future tract. A conservative 5 yr and 100 yr flow calculated along this reach is approximately 11 cfs and 26 cfs (DP6 and basin E2 direct runoff) respectively. The slope of the drainageway is approximately 4.0% and has velocities of 2.9fps and 3.6fps, depths of 0.5' and 0.7' during the 5yr and 100yr storms respectively, at the steepest and most defined a: point along the reach. These velocity values are below the threshold chosen for the project (5fps) and are therefore considered non-erosive in nature. Therefore, no improvements are proposed DP8 is located on the main stem of Cottonwood Creek.

Design Point 8A (DP 8A) flows (Q5=8.2cfs, Q100=20cfs) are generated from off-site basin OS-B1D (DP E8) and approximately half of basin F. The purpose of the computation of DP 8A is to understand the proposed flows in the roadside ditch and to size the driveway culverts to access proposed and future lots. At this time the exact location of the driveway culvert is unknown. However, a 30" CMP or RCP culvert should be installed under the driveway to adequately convey the flows in a roadside ditch downstream.

Design Point 8B (DP 8B) flows (Q5=9.7cfs, Q100=23cfs) are generated from off-site basin OS-B1D (DP E8) and all of basin F. Flows from DP 8B are calculated to design Drainageway 6 that runs through an easement. Drainageway 6 is proposed within a 50' wide drainage easement. A proposed swale in the drainage easement will convey the flows into the Cottonwood Creek Channel. The swale shall be constructed with temporary and permanent BMP's. At the base of the proposed swale, a permanent sediment basin shall be constructed to prevent sediment transfer into the channel. A conservative 100 yr flow calculated at this location is approximately 23 cfs (basin F and OS-B1D direct runoff - DP 8B). To convey this flow a 36" RCP with flared end sections at each end are proposed. The proposed slope of the culvert is 5.5%, with an outflow velocity of 18.5fps. A riprap plunge pool will be located at the downstream end to dissipate energy. Downstream from the aforementioned culvert, flow is contained within a proposed drainageway (Drainageway 6) that runs through Tract E in Filing No. 1. The slope of the drainageway is approximately 6.4% and has velocities of 5.4fps and 6.4fps, depths of 0.9' and 1.2' during the 5yr and 100yr storms respectively, at the steepest and most defined a point along the reach. These velocity values are above the threshold chosen for the project (5fps) and are therefore considered erosive in nature. However, this drainageway is located along the side lot lines of the lots noted and is not felt to be a threat to proposed structures. Therefore, no improvements are proposed. At the downstream end of the drainageway, flows reach the main stem. Since the drainageway outfall is immediately adjacent to the creek, short in nature, and within the prudent line setback, no proposed improvements are recommended. DP9 is located on the main stem of Cottonwood Creek.

Channel improvements need to match County criteria for the proposed velocities

Design Point 9 (DP9) flows (Q5=490cfs, Q100=903cfs) are generated from DP8, on-site basin F and off-site basins OS-B1D and OS-B4A. Off-site basin OS-B1D is a sub-basin of DBPS basin B1 and has been created to determine the flow at the entry point into the site. Off-site basin OS-B4A is a sub-basin of DBPS basin B4 and has been created to determine the flow at the entry point into the site as sheet flow into the main stem. Off-site basins OS B1D and OS-B4A consists of large lot subdivisions, open space, fields and pastures. On-site basins F consists of large lot (~2.5ac +/-) proposed development. There is an existing ancillary structure present within the basin.

Design Point 10 (DP10) flows (Q5=490cfs, Q100=904cfs) are generated from DP9 and on-site basin G. On-site basin G consists of large lot (2.5ac +/-)proposed development as well as a small portion of the creek itself. Flow from basin G is contained within a broad swale that runs through Tract E in Filing No. 1. At the downstream end of the swale, flow concentrates into a drainageway prior to reaching the main stem. Since the drainageway is immediately adjacent to the creek, short in nature, and within the prudent line setback, no proposed improvements are recommended. DP10 is located on the main stem of Cottonwood Creek.

Design Point 11 (DP11) flows (Q5=24cfs, Q100=58cfs) are generated from on-site basins Hand I and off- site basins OS-B1E and OS-B3A. Off-site basin OS-B1E is a sub-basin of DBPS basin B1 and has been created to determine the flow at the entry point into the site. Off-site basin OS-B3A is a sub-basin of DBPS basin B3 and has been created to determine the flow at the entry point into the site. Off-site basins OS-B1E and OS-B3A consist of large lot subdivisions, open space, fields and pastures. On-site basins H and I consist of large lot (~2.5ac +/-) proposed development and future tracts. Flow from off-site basin OS-B1E and on-site basin H is contained within a drainageway (Drainageway 7) that runs through future tract & onsite lot adjacent to Eagle Wing Drive. The slope of the drainageway is approximately 4.8% and has velocities of 2.6fps and 3.2fps, depths of 0.3' and 0.5' during the 5yr and 100yr storms respectively. Drainageway 7 and flow from basin OS-B3A and basin I combine at the location of proposed Eagle Wing Drive. To convey this flow, dual 36" RCPs with flared end sections at each end are proposed. The proposed slope of the culvert is approximately 3.5%, with an outflow velocity of 11.6 fps. A riprap plunge pool will be located at the downstream end to dissipate energy.

Design Point 11A (DP11A) flows (Q5=27cfs, Q100=64cfs) are generated from DP 11, and basin J. The combination of these flows are conveyed in Drainageway 5, and into the existing pond area. Flow is contained within a drainageway (Drainageway 5) that runs through future tracts. A conservative 5 yr and 100 yr flow calculated along this reach is approximately 27 cfs and 64 cfs (DP11A). The slope of the drainageway is approximately 5.1% and has velocities of 4.2fps and 5.2fps, depths of 0.7' and 1.0' during the 5yr and 100 yr storms respectively, at the steepest and most defined a point along the reach. These velocity values are right at the threshold chosen for the project (5fps). However, this drainageway is located along the open space tract and is not felt to be a threat to proposed structures. Therefore, no improvements are proposed at this time, other than the upstream sediment control basin at the end of the culvert, thereby preserving the natural drainageway characteristics.

Design Point 12 (DP12) flows (Q5=501cfs, Q100=930cfs) are generated from DP10, DP11, DP11A and on-site basin J. On-site basin J consists of large lot (~2.5ac +/-)proposed development as well as a small portion of the creek itself as well as an open space drainage tract designated to convey from upstream. DP12 is located on the main stem of Cottonwood Creek.

Design Point 13 (DP13) flows (Q5=504cfs, Q100=937cfs) are generated from DP12, and off-site basin OS-B4B. Off-site basin OS-B4B consists of large lot subdivisions, open space, fields and pastures. This basin is a sub-basin of DBPS basin B4 and has been created to determine the flow at the entry point into the site at the southern pond along the main stem as sheet flow. DP13 is located on the main stem of Cottonwood Creek.

Design Point 14 (DP14) flows (Q5=507cfs, Q100=943cfs) are generated from DP13, and off-site basin OS-B4C. Off-site basin OS-B4C consists of large lot subdivisions, open space, fields and pastures. This basin is a sub-basin of DBPS basin B4 and has been created to determine the flow at the entry point into the site at the southern pond along the main stem as primarily sheet flow. DP14 is located on the main stem of Cottonwood Creek. This design point was set at this location for sizing the future crossing for Briargate Parkway which will be determined at the time of the those improvements with a separate study (DBPS recommends a 12'x9' CBC). This design point corresponds with design point E14. Design point E14 has existing flow values of 496cfs and 925cfs for the 5yr and 100yr storms respectively. This is an increase in developed flows of 13cfs and 18cfs for the 5yr and 100yr storms respectively. These are negligible increases and are so close to the existing conditions due to the proposed development being large lot development and relatively small (70 acres) compared to the entire tributary watershed.

Design Point 15 (DP15) flows (Q5=2.lcfs, Q100=5.lcfs) are generated from off-site basin OS-B3B. This basin is a sub-basin of DBPS basin B3 and has been created to determine the flow at the entry point into the site. This basin consists of large lot subdivisions, open space, fields and pastures. This flow is contained within a broad swale that runs through Lot 12, Filing No. 1. The 100 yr flow calculated at this location is approximately 5.1 cfs. To convey this flow an existing 24" RCP with flared end sections at each end is already installed under the existing driveway. The existing slope of the culvert is ~1.1%, with an outflow velocity of 8.0fps. A riprap plunge pool will be located at the downstream end to dissipate energy.

Design Point 16 (DP16) flows (Q5=7cfs, Ql00=16cfs) are generated from DP15 and on-site basin L. On-site basin L consists of large lot (~2.5ac +/-) proposed development. Flow from DP15, downstream from the aforementioned culvert, is contained within a broad swale that runs through Lot 6. Due to the minimal amount of calculated flow within this swale, no calculations have been performed to determine erosiveness. Therefore, no improvements are proposed. DP16 is located along the northern ROW of future Briargate Parkway. This design point was located to size the diversion drainageway (Drainageway 8). The drainageway has been created to ensure site flow does not enter the Briargate Parkway ROW. A conservative 5 yr and 100 yr flow calculated along this reach is approximately 7cfs and 16cfs (DP15 and basin L direct runoff) respectively. The slope of the drainageway is approximately 1.4% and has velocities of 2.6fps and 3.2fps, depths of 1.0' and 1.3' during the 5yr and 100yr storms respectively. These velocity values are below the threshold chosen for the project (5fps) and are therefore considered non-erosive.

It is anticipated that with the future construction of the roadway, an area inlet be located within a roadside drainageway, thus picking up the flows and routing them to the southern side of the roadway directly downstream of proposed main stem crossing structure. Until such time as this occurs, flow will be shallow unconcentrated sheet flow routing directly into the main stem below the southern pond.

Design Point 17 (DP17) flows (Q5=6.5cfs, Q100=14.8cfs) are generated from off-site basin OS-B3C. This basin is a sub-basin of DBPS basin B3 and has been created to determine the flow at the entry point adjacent to the site. This calculated flow for information only since it does not mix with on-site flow. This basin consists of large lot subdivisions, open space, fields and pastures within the Eagle Wing subdivision. Flows from the Eagle Wing development were calculated to be 17cfs and 36cfs for the 5yr and 100yr storms respectively. The flows are therefore almost double of that which was calculated in this report. Upon construction and analysis of the Briargate Parkway improvements and storm system sizing, this difference needs to be taken into consideration.

Proposed Residence and Ancillary Structure Protection

At this time, proposed home pads and ancillary structures (sheds, animal corals, etc.) locations are not known. It shall be the responsibility of the home builder and subsequently the homeowner to ensure flows from stormwater are appropriately routed around said structures to prevent flooding and damage to property. This can be accomplished by the use of broad swales as opposed to ditches which tend to concentrate flows and are therefore more susceptible to erosion. Swales shall be protected from erosion until such time that vegetation is established. A civil engineer may be necessary to aid in determination of swale placement and erosion control measures to be used.

Pond Embankment Improvements

The slopes located on the downstream ends of the aforementioned ponds need improvements to ensure safety. The downstream pond slopes are proposed to be regarded to a 2.5:1 slopes, maximum. The downstream slopes should be cleaned of organics and have soft areas re-compacted. The fill should be benched into the existing compacted slopes and the toes keyed into the existing ground. It is also proposed that a maintenance access road 24' wide be constructed along the embankment of the south pond. No other improvements to the pond embankments or overflow structures are proposed at this time. The increase of developed flows versus the historic flows are negligible; (13cfs and 18cfs for the 5yr and 100yr storms respectively). Therefore, construction of drainage improvements is unnecessary.

DBPS RECOMMENDATIONS & ALTERNATIVES

Per the Cottonwood Drainage Basin Planning Study prepared by URS Consultants, June 9, 1994, the area of Eagle Rising was outside of the study area. The detailed limits of the DBPS study was approximately Powers Boulevard (See Map 10 of 11 - DBPS). However, the *"study recommends six detention ponds to be constructed as a part of the overall basin improvements. The ponds were sized to reduce the overall peak flow rates in the main channel of Cottonwood Creek to the capacities which the current facilities can handle." DBPS "Table 2 presents the design information for the detention ponds."*

It is also shown in the DBPS that *"the detention ponds are located on tributaries of the basin in order to keep their size to a minimum with the limits of using regional type detention ponds."* However, a pond is shown on the overall DBPS map within the property of Eagle Rising on the main stem of Cottonwood Creek (Pond at 5). The detention pond characteristics in the DBPS are; HEC-1 inflow is 870cfs (compared to 892cfs per this study), HEC-1 release of 90cfs, 52 ac-ft detention, 23.5' total depth, and 8.9 acres right-of-way area (See Appendix). The Briargate Parkway culvert recommendation per the DBPS is a 12' x 9' concrete box culvert, with passing 851 cfs HEC-1 flow w/det. and 160 linear foot length (See Appendix).

An alternative to the DBPS recommendation allows for consideration of the Prudent Line concept for the Cottonwood Creek Channel. Therefore, the Prudent Line concept is proposed for Eagle Rising from the findings of this study. (See section regarding Prudent Line Establishment). The findings and physical nature of the Cottonwood Creek drainage channel through this development possess characteristics to value the use of its natural state to convey storm water. The Prudent Line concept allows for potential lateral movement of the channel conveyance without endangering the proposed habitable structures adjacent to the channel. The setbacks from the channel to the buildable areas vary from 50 feet to 230 feet. The lesser setback is adjacent to the channel with steep banks and where the vertical separation from a habitable structure is greater than 10 vertical feet from the studied 100 year floodplain, or adjacent to the existing ponds where the flood velocities are minimal. The larger setback is adjacent to the channel where the slopes are flatter, and have a greater potential for lateral movement. The larger setback still has more than 10 feet of vertical separation from the studied 100 year floodplain to a habitable structure.

Currently, the physical characteristics of the channel show no signs of erosion or lateral movement. The channel is heavily vegetated and is stable. The upstream runoff to cottonwood creek north of Eagle Rising is mostly developed "Black Forest property" as large lot, 2.5 acre (or greater) residential subdivisions. Therefore, the existing hydrology passing through Eagle Rising is near the fully developed condition. (If a substantial change to the upstream land use is proposed, a downstream analysis should be preformed.)

Channel improvements (grade control structures, channel armoring, etc...) as proposed by the DBPS for the channel are not necessary with the development of Eagle Rising. The current status of the channel and the development of Eagle Rising with the prudent line concept is a valid and economical approach to subdividing the land, and controlling the storm water. The future owners of lots adjacent to the channel, or properties within the channel and/or whomever is responsible for the maintenance of the channel in the future, shall monitor the erosion and lateral movement of the channel. A maintenance and operation manual filed with El Paso County should track the effects of any potential needs for maintenance or total channel repair. If significant erosion or relocation of the channel becomes apparent, and before habitable structures are within harms way, a hydrologic and hydraulic analysis of the channel should commence.

If significant repairs to the channel are necessary, access thru tract and the drainage easements adjacent to the channel, shall be utilized for channel repairs, and or construction of a detention pond as shown in the DBPS.

HEC-RAS MODELING

The United States Army Corp of Engineers (USACOE) - Hydrologic Engineering Center River Analysis System (HEC-RAS) version 4.1.0, January 2010 computer model was used to perform the hydraulic analysis for the main stem of Cottonwood Creek thru the site.

<u>Input</u>

The primary input data is composed of topographical cross section data, roughness coefficients, and contributing watershed flow. Cross section data was based on aerial topography. The geometric input was gathered from two sources, AutoCAD Land Development Desktop and by manually "cutting" sections with the use of an engineering scale. The roughness coefficient (Manning's "N" value) used (0.060) was derived from review of the City/County Drainage Criteria Manual (DCM) Vol. 1 table 10-2 (see appendix) and by using prudent engineering judgment based on field observation. This value coincides with that which was used in the downstream model performed for the Highland Park Filing No. 2 development to the south. Contributing watershed flow values at various locations along the channel were taken from the hydrologic calculations as contained in this report. The 100 yr storm event flows were used, as this is the standard practice and is mandated in the DCM.

The ponds along the main stem (described in the Existing Drainage Characteristics narrative) were treated as wide channels due to their limited capacity for storage. Utilizing this approach is conservative in nature because the model assumes no storage; therefore yielding a certain amount of velocity thru the pond reach, albeit minor. Upon field investigation, an outlet structure and pipe was discovered. This was not taken into consideration in the model since the size (12") is not large enough to convey a significant amount of flow and is thought to be used as an overflow structure during minor storm events only. A "mixed" flow regime approach was used in the model. This approach is typically used for reaches of channels when you have a "mixture" of subcritical and supercritical flow regimes as was evident from review of the model's output data.

<u>Output</u>

The primary use of this HEC-RAS model was to establish 100 yr storm water surface elevations and flow velocities. Water surface elevations were established along the entire channel reach and have been shown on the maps in the appendix. Resultant velocity output data is included in appendix 1 in tabular form. This data has been generated to determine the erosiveness of the channel during the 100 yr storm event and to provide solutions to ensure adequate stability of the channel if such an event occurs. This is of key interest since Cottonwood Creek main stem runs thru the Eagle Rising development which proposes adjacent development. There are certain velocity constraints as contained within the DCM, table 10-4 based on the existing slopes and vegetation characteristics present in the channel (see appendix 1). For the purposes of this analysis; a maximum permissible velocity of five feet per second was used. This is felt to be a conservative value since the channel is very well established as can be seen in the pictures (see appendix 1) and upon field investigation. In summary, of the thirty-eight sections modeled approximately one third have velocities in excess of this threshold. Some are above the threshold by a small amount and some much higher. Those much higher are isolated to those areas where the pond embankment overflow spillways are located within the reach. With the exception of the spillway areas, the channel is relatively non-erosive. However, as has been mentioned; there are reaches which do have erosive tendencies during a 100 yr storm event. This has been addressed in the Prudent Line Establishment narrative of the report to follow.

PRUDENT LINE ESTABLISHMENT

As mentioned previously, the owner proposes to leave the channel in a natural state to preserve the channel and ponds as site amenities. In addition, from an environmental standpoint; it clearly stands to reason that wetlands and the accompanying natural ecosystems present need to be preserved to the maximum extent possible. The addition of channel improvements; bank linings, sloping drops, or any method that would modify the existing hydraulic dynamics of the existing channel would cause downstream unwanted changes, like severe sediment transfer to fill the existing ponds or bury existing vegetation. fu order to accomplish this goal, the "Prudent Line" approach is proposed in lieu of constructed channel stabilization techniques being used (e.g.- riprap lining, reconstruction of the channel, drop structure placement). This approach is applicable because this reach of Cottonwood Creek falls within selection criteria described in the "Prudent Line Addendum For Unincorporated El Paso County Only", dated June 21, 2001, prepared by Ayres Associates and SEC Olsson Associates.

Per the Prudent Line Addendum (PLA), the channel must meet certain criteria for use of the concept (refer to Table 1 in the PLA.

Applicability
1. *Does basin have a DBPS?*
Yes, Cottonwood Creek Drainage Basin Planning Study, 1994 however the study limits do not extend this far upstream. Therefore, discussions with the County must be conducted to determine if the prudent line approach is acceptable.

2. *Has a County discussion taken place with regards to PLA applicability?*
Yes, with various members of County engineering staff.

3. *Is the development density greater than 1 unit per acre? (If yes, a PLA is not applicable)*
No, existing and proposed land use density in the watershed is less than 1 unit per acre.

4. *Is the channel capacity greater than or equal to the 5 yr storm flow? (If no, a PLA is not applicable)*
Yes, the channel has adequate capacity for the 5 yr storm as well as the 100 yr storm.

5. *Is the watershed imperviousness value in less than 15%? (If no, a PLA must be discussed with County engineering staff regarding transition issues)*

The existing and future contributing basin imperviousness value is less than 15% (refer to DBPS).

Transition Issues

Case 1 - Transition between an improved channel reach and a prudent line reach, or vice versa.

This case is not applicable for this site as there is no proposed improved channel reaches upstream or downstream of the limits of this study. If at such a time in the future upstream development requires improvements along their reach; consideration shall be given that this project is being developed with the prudent line concept.

Case 2 - Transition that is necessary at road crossings on a prudent line reach.

As stated in the PLA, considerations must be given to situations where road crossings occur. Future Briargate Parkway will require careful consideration when designed and subsequently constructed so as to not create a situation where sediment deposition will occur. Although this does not affect the Eagle Rising site because it is upstream, it is noteworthy nonetheless to protect the downstream PLA that was implemented and discussed in the Highland Park Filing No. 2 report.

Defining the Prudent Line

The prudent line for the Eagle Rising development was defined considering the 100 yr floodplain boundary, the erosion during a 100 yr event, and the long-term anticipated erosion over a 30 year period.

Sta 1+00 - 4+00	N/A-100 yr Flood Plain under Future Bridge
Sta 4+00 -10+00	Adjacent to Pond. - Low Potential Erosion- 50' setback from 100 year F.P.
Sta 10+00 - 20+00	5:1 Bank- Moderate Erosion Potential-Est. Annual Potential Migration * 30
Sta 20+00 - 27+00	Sharp Curve in Channel - High Erosion Potential - Est. Annual Potential Migration * 30
Sta 27+00 - 33+50	Adjacent to Pond- Low Potential Erosion- 50' setback from 100 year F.P.
Sta 33+50- 37+00	Steep/High Bank- Average Annual Migration = 1.0' * 30 = 30' - Use 50' setback from 100 year F.P.

Maintenance Line

A maintenance line is a way of monitoring the amount of lateral migration from erosion a streambed has incurred. If a channel begins to encroach on the maintenance line from significant hydrologic events or from long-term erosion, corrective measures should be evaluated and designed to ensure the prudent line as proposed in this study is still valid. Such measures include riprap, regrading, revegetation, or other channel stability remedial approaches. The prudent line addendum does not provide a basis for establishing a maintenance line with regards to the prudent line setback. However, it is the recommendation of this study that the line be located at the top of bank where the main channel is basically defined.

Maintenance Access

The PLA requires that maintenance access be· provided at locations along the channel not to exceed on- quarter mile for lot sizes less than or equal to 2.5 acres. The Eagle Rising lots are 2.5 acres in size. Although criteria suggests providing access through each lot in excess of 2.5 acres, no maintenance access provisions are necessary due to the private obligation of maintenance on the developer and/or lot owner. The maintenance provisions for the channel will be addressed in the HOA documents, or by separate document agreement with the land owner/developer.

Calculating the Prudent Line

The prudent line calculations performed as a part of this analysis was based on the "Sandy Soil" methodology. This approach was used in defining the prudent line for the Highland Park Filing no. 2 analysis as well. A prudent line was developed from the calculations found in appendix 1 and is shown on the drainage map. Note: a prudent line setback distance was not calculated at certain sections because of the sinuous geometry of the channel, which creates an overlap (e.g. - 29+00 thru 31+00).

Residence and Ancillary Structure Positioning

At this time, proposed home pads and ancillary structures (sheds, animal corals, etc.) locations are not known as mentioned prior. It shall be the responsibility of the home builder and subsequently the home owner to ensure such structures are not located within the prudent line setback to prevent property damage and more importantly loss of life. A land surveyor may be necessary to aid in determination of the prudent line setback as defined in this report.

DRAINAGE FEES

The drainage fees will be calculated based upon the DCM, Prudent Line Addendum for Unincorporated El Paso County Only, 3.10.3a, Fee Reductions for Land Required to be Dedicated for the Prudent Line, Example4.

SUMMARY

Eagle Rising contains 70 acres within the Cottonwood Creek Drainage Basin. A total of 8 single family 2.5 acres lots will be constructed with associated roadways. The development of the site will not require elaborate drainage and water quality facilities to accommodate developed flows and meet City/El Paso County Drainage Criteria and El Paso county Engineering Criteria Manual. Use of the Prudent Line concept to establish drainage setbacks from the channel and to allow for erosion and channel migration will provide sufficient flood protection to adjacent habitable structures. Proposed drainage facilities will adequately convey, and route runoff from the site to Cottonwood Creek within the confines of their respective drainage easements. The development of Eagle Rising will not adversely impact downstream or surrounding developments.

The drainage analysis has been prepared in accordance with the current City of Colorado Springs/El Paso County Drainage Criteria Manual and El Paso County Engineering Criteria Manual. Supporting information and calculations are included in the Appendix.

REFERENCES

The sources of information used in the development of this study are listed below:

1. City of Colorado Springs and El Paso County "Drainage Criteria Manual", 1990 revised 1994

2. Soil Survey for El Paso County, Colorado, U.S. Department of Agriculture, Soil Conservation Service, June 1980.

3. Cottonwood Creek Drainage Basin Planning Study, URS Consultants, 1994

4. Final Drainage Report for Eagle Wing Estates, JPS Engineering, December 16, 2003

5. Final Drainage Report for Eagle Wing Estates Addendum No. 1, JPS Engineering, April 21, 2004

6. Final Drainage Report for Eagle Wing Estates Addendum No. 2, JPS Engineering, April 30, 2004

7. Preliminary/Final Drainage Report for Highland Park Filing No. 2, Law and Mariotti Consultants, Inc., June 2002

8. Preliminary/Final Drainage Report for Highland Park Filing No. 3, Law and Mariotti Consultants, Inc., September 2009

9. Prudent Line Addendum for Unincorporated El Paso County Only, City of Colorado Springs and El Paso County Drainage Criteria Manual, Ayres and SEC Olsson Associates, June 21, 2001

APPENDIX 1

VICINITY MAP

VICINITY MAP

SOILS MAP

Soil Map—El Paso County Area, Colorado
(Eagle Rising - Steve Jacobs)

Map Scale: 1:5,760 if printed on B size (11" x 17") sheet.

Meters: 0 40 80 160 240

Feet: 0 150 300 600 900

Map Unit Legend

El Paso County Area, Colorado (CO625)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	27.6	6.4%
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	49.7	11.5%
40 *	Kettle gravelly loamy sand, 3 to 8 percent slopes	20.0	4.6%
41	Kettle gravelly loamy sand, 8 to 40 percent slopes	38.5	8.9%
71 *	Pring coarse sandy loam, 3 to 8 percent slopes	288.4	66.7%
96	Truckton sandy loam, 0 to 3 percent slopes	1.4	0.3%
111	Water	6.8	1.6%
Totals for Area of Interest		432.4	100.0%

MAP LEGEND

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

Soils
- Soil Map Units

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
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Streams and Canals

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

MAP INFORMATION

Map Scale: 1:5,760 if printed on B size (11" × 17") sheet.

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 accurate map measurements.

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

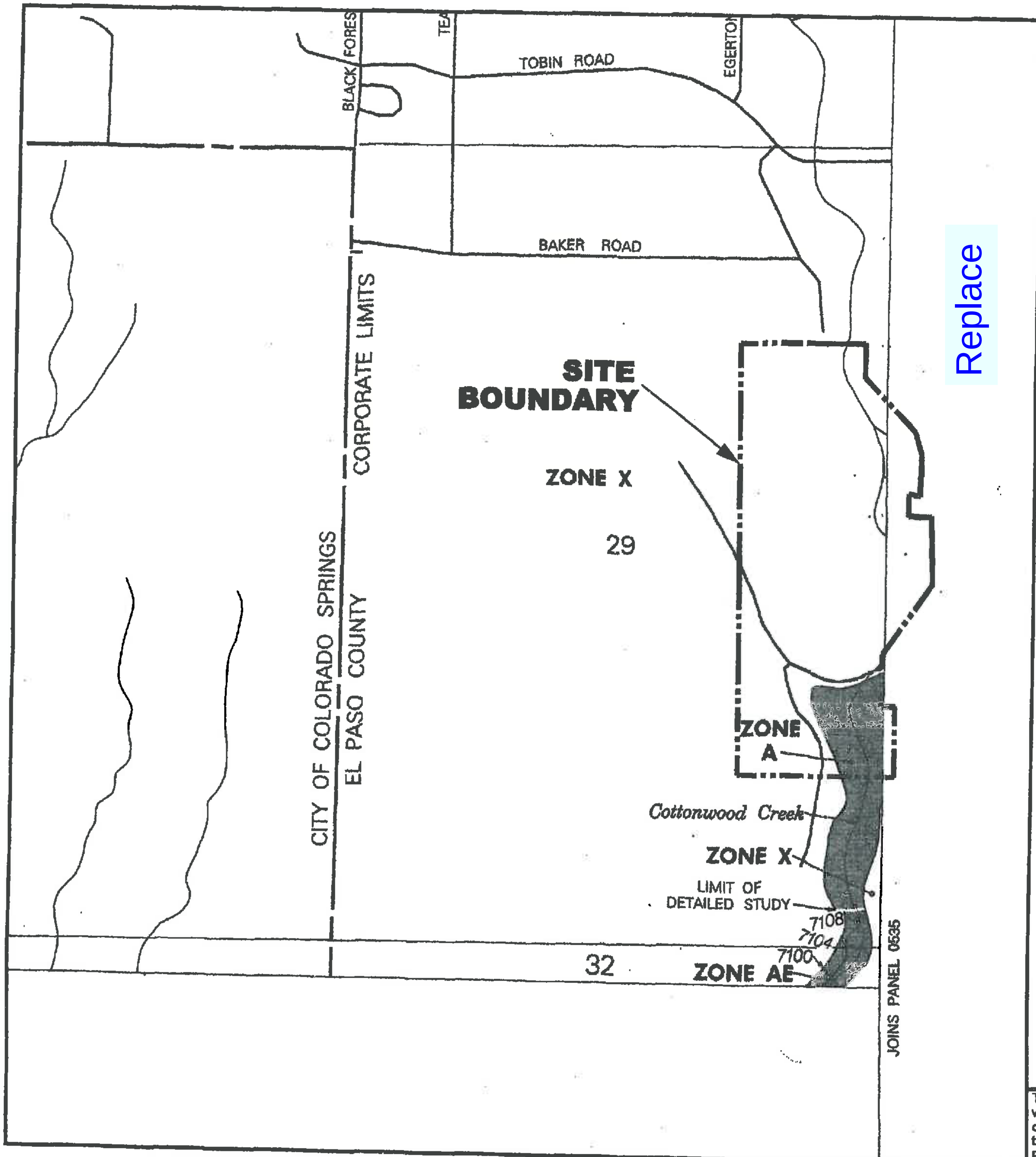
This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 8, Apr 6, 2011

Date(s) aerial images were photographed: 7/30/2005

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

FEMA FLOODPLAIN MAPS



APPROXIMATE SCALE IN FEET

1000 0 1000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 530 OF 1300

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

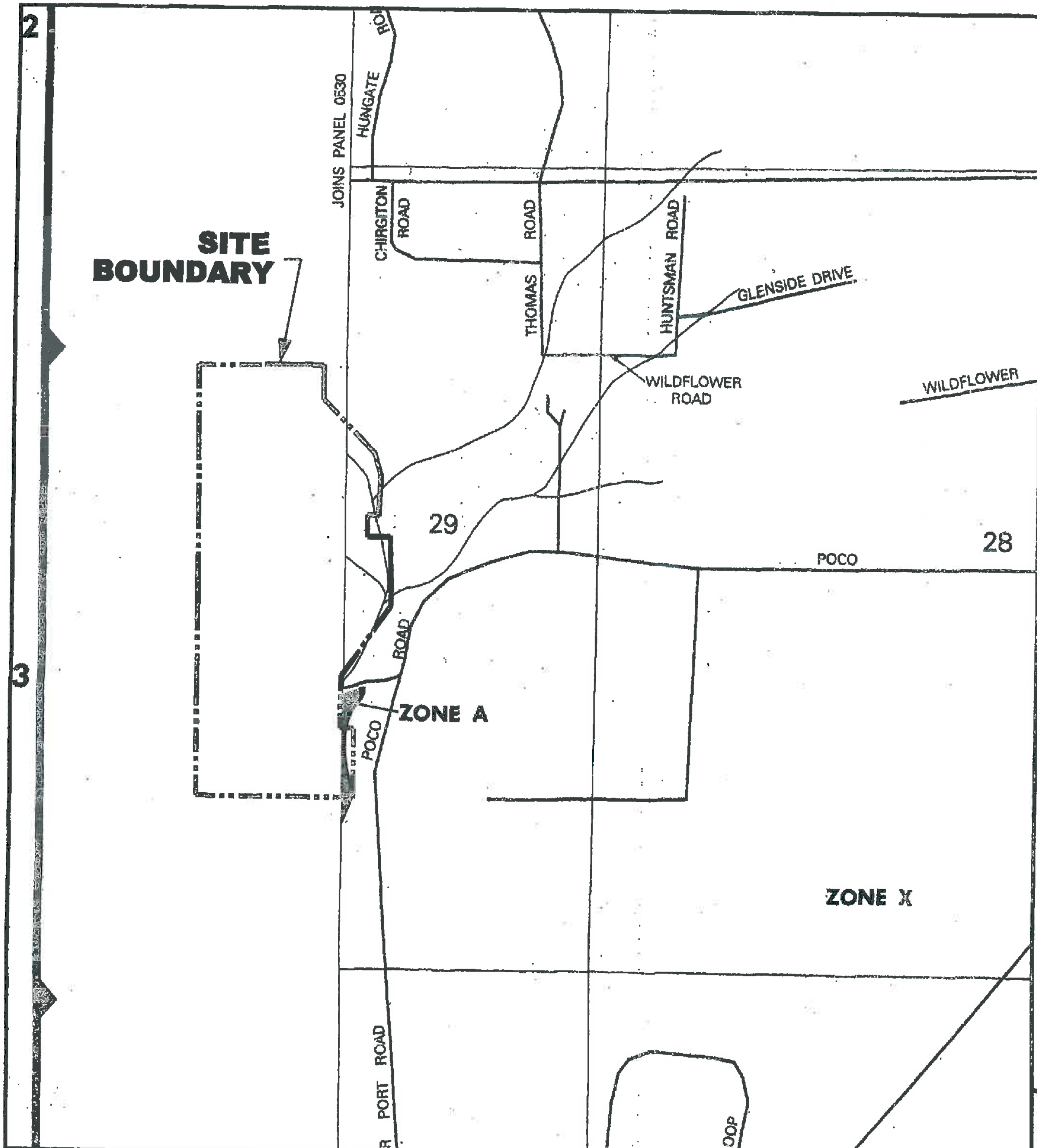
COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0530	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0530	F

MAP NUMBER 08041C0530 F

EFFECTIVE DATE: MARCH 17, 1997

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 535 OF 1300

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0535	F

MAP NUMBER 08041C0535 F

EFFECTIVE DATE: MARCH 17, 1997

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

Hydrologic Calculations

EAGLE RISING
FINAL DRAINAGE REPORT

BASIN			TOTAL AREA (Acres)
A1			4.9
A2			1.6
B			3.1
C			1.2
D			10.7
E1			3.8
E2			7.5
F			8.8
G			2.6
H			4.1
I			1.6
J			2.7
K			2.8
L			5.3
EX-A1			4.9
EX-A2			1.6
EX-B			13.1
EX-C1			3.8
EX-C2			7.5
EX-D			9.0
EX-E			2.6
EX-F			7.5
EX-G			2.8
EX-H			5.3
OS-B1A			24.9
OS-B1B			41.0
OS-B1C			1.8
OS-B1D			6.0
OS-B1E			10.1
OS-B3A			9.1
OS-B3B			2.3
OS-B3C			5.7
OS-B4A			5.2
OS-B4B			8.1
OS-B4C			13.4

EAGLE RISING
FINAL DRAINAGE REPORT
(Area Drainage Summary)

				OVERLAND				STREET / CHANNEL FLOW				Time of Travel (T_c)	INTENSITY *		TOTAL FLOWS	
BASIN	AREA TOTAL (Acres)	C_5	C_{100}	C_5	Length (ft)	Height (ft)	T_C (min)	Length (ft)	Slope (%)	Velocity (fps)	T_t (min)	TOTAL (min)	I_5 (in/hr)	I_{100} (in/hr)	Q_5 (c.f.s.)	Q_{100} (c.f.s.)
A1 (Onsite)	4.9	0.30	0.40	0.25	220	24	10.7	0	0.0%	0.0	0.0	10.7	4.0	7.1	***5.9***	***13.9***
A2 (Onsite)	1.6	0.30	0.40	0.25	220	24	10.7	0	0.0%	0.1	0.0	10.7	4.0	7.1	***1.9***	***4.5***
B	3.1	0.30	0.40	0.25	290	26	13.1	160	5.0%	7.8	0.3	13.5	3.6	6.5	***3.4***	***8.0***
C	1.2	0.30	0.40	0.25	160	13	10.1	70	1.2%	3.8	0.3	10.4	4.0	7.2	***1.5***	***3.5***
D	10.7	0.30	0.40	0.25	235	20	12.0	720	3.5%	6.5	1.8	13.9	3.6	6.4	***11.5***	***27.3***
E1	3.8	0.30	0.40	0.25	100	10	7.4	800	4.0%	7.0	1.9	9.3	4.2	7.5	***4.8***	***11.4***
E2	7.5	0.30	0.40	0.25	250	6	18.8	400	4.0%	7.0	1.0	19.8	3.0	5.4	***6.8***	***16.2***
F	8.8	0.30	0.40	0.25	300	11	17.9	600	3.7%	6.7	1.5	19.4	3.1	5.4	***8.1***	***19.2***
G	2.6	0.30	0.40	0.25	135	10	9.5	190	6.3%	8.8	0.4	9.9	4.1	7.3	***3.2***	***7.6***
H	4.1	0.30	0.40	0.25	300	22	14.3	160	3.8%	6.8	0.4	14.7	3.5	6.2	***4.3***	***10.2***
I	1.6	0.30	0.40	0.25	125	12	8.4	115	5.2%	8.0	0.2	8.7	4.3	7.7	***2.1***	***4.9***
J	2.7	0.30	0.40	0.25	210	16	11.8	185	6.5%	8.9	0.3	12.1	3.8	6.8	***3.1***	***7.3***

				OVERLAND				STREET / CHANNEL FLOW				Time of Travel (T_c)	INTENSITY *		TOTAL FLOWS	
BASIN	AREA TOTAL (Acres)	C_5	C_{100}	C_5	Length (ft)	Height (ft)	T_C (min)	Length (ft)	Slope (%)	Velocity (fps)	T_t (min)	TOTAL (min)	I_5 (in/hr)	I_{100} (in/hr)	Q_5 (c.f.s.)	Q_{100} (c.f.s.)
K	2.8	0.90	0.95	0.25	80	12	5.8	0	0.0%	0.0	0.0	5.8	4.9	8.7	***12.4***	***23.2***
L	5.3	0.30	0.40	0.25	300	14	16.6	500	2.4%	5.4	1.5	18.1	3.2	5.6	***5.1***	***12.0***
EX-A1	4.9	0.30	0.40	0.25	220	24	10.7	0	0.0%	0.1	0.0	10.7	4.0	7.1	***5.9***	***13.9***
EX-A2	1.6	0.30	0.40	0.25	220	24	10.7	0	0.0%	0.1	0.0	10.7	4.0	7.1	***1.9***	***4.6***
EX-B	13.1	0.30	0.40	0.25	235	20	12.0	720	3.5%	6.5	1.8	13.9	3.6	6.4	***14.1***	***33.5***
EX-C1	3.8	0.30	0.40	0.25	100	10	7.4	800	4.0%	7.0	1.9	9.3	4.2	7.5	***4.8***	***11.4***
EX-C2	7.5	0.30	0.40	0.25	250	6	18.8	400	4.0%	7.0	1.0	19.8	3.0	5.4	***6.8***	***16.2***
EX-D	9.0	0.30	0.40	0.25	300	9	19.2	745	5.4%	8.1	1.5	20.7	3.0	5.3	***8.0***	***19.0***
EX-E	2.6	0.30	0.40	0.25	135	10	9.5	190	6.3%	8.8	0.4	9.9	4.1	7.3	***3.2***	***7.6***
EX-F	7.5	0.30	0.40	0.25	300	14	16.6	185	6.5%	8.9	0.3	16.9	3.3	5.8	***7.4***	***17.5***
EX-G	2.8	0.90	0.95	0.25	80	12	5.8	0	0.0%	0.1	0.0	5.8	4.9	8.7	***12.4***	***23.2***
EX-H	5.3	0.30	0.40	0.25	300	14	16.6	500	2.4%	5.4	1.5	18.1	3.2	5.6	***5.0***	***12.0***
OS-B1A	24.9	0.30	0.40	0.25	300	18	15.2	940	4.8%	7.7	2.0	17.3	3.2	5.8	***24.2***	***57.4***
OS-B1B	41.0	0.30	0.40	0.25	300	32	12.6	1560	5.1%	7.9	3.3	15.9	3.4	6.0	***41.5***	***98.4***
OS-B1C	1.8	0.30	0.40	0.25	300	10	18.5	115	3.5%	6.5	0.3	18.8	3.1	5.5	***1.7***	***4.0***

				OVERLAND				STREET / CHANNEL FLOW				Time of Travel (T_c)	INTENSITY *		TOTAL FLOWS	
BASIN	AREA TOTAL (Acres)	C_5	C_{100}	C_5	Length (ft)	Height (ft)	Tc (min)	Length (ft)	Slope (%)	Velocity (fps)	T_c (min)	TOTAL (min)	I_5 (in/hr)	I_{100} (in/hr)	Q_5 (c.f.s.)	Q_{100} (c.f.s.)
OS-B1D	6.0	0.30	0.40	0.25	300	20	14.7	575	3.5%	6.5	1.5	16.2	3.3	5.9	***6.0***	***14.3***
OS-B1E	10.1	0.30	0.40	0.25	300	22	14.3	810	3.6%	6.6	2.0	16.3	3.3	5.9	***10.1***	***24.0***
OS-B3A	9.1	0.30	0.40	0.25	300	15	16.2	400	4.7%	7.6	0.9	17.1	3.3	5.8	***8.9***	***21.1***
OS-B3B	2.3	0.30	0.40	0.25	300	10	18.5	180	2.9%	6.0	0.5	19.0	3.1	5.5	***2.1***	***5.1***
OS-B3C	5.7	0.35	0.45	0.25	300	14	16.6	310	4.7%	7.6	0.7	17.2	3.2	5.8	***6.5***	***14.8***
OS-B4A	5.2	0.30	0.40	0.25	300	38	11.9	160	13.5%	12.9	0.2	12.1	3.8	6.8	***5.9***	***14.1***
OS-B4B	8.1	0.30	0.40	0.25	300	42	11.5	220	15.0%	13.6	0.3	11.8	3.8	6.8	***9.3***	***22.2***
OS-B4C	13.4	0.30	0.40	0.25	300	14	16.6	1010	7.6%	9.6	1.7	18.3	3.2	5.6	***12.7***	***30.1***
A1 (Offsite)	120.6	0.20	0.20	Tc per DBPS								45.6	1.9	3.4	***45.5***	***81.0***
A2 (Offsite)	134.2	0.20	0.20	Tc per DBPS								39.2	2.1	3.7	***55.5***	***98.9***
A3	103.9	0.20	0.20	Tc per DBPS								40.3	2.0	3.6	***42.3***	***75.3***
A4	162.4	0.20	0.20	Tc per DBPS								35.0	2.2	3.9	***71.9***	***128.1***
A5	134.2	0.20	0.20	Tc per DBPS								38.2	2.1	3.7	***56.4***	***100.4***
A6	90.0	0.20	0.20	Tc per DBPS								37.3	2.1	3.8	***38.4***	***68.3***

				OVERLAND				STREET / CHANNEL FLOW				Time of Travel (T_c)	INTENSITY *		TOTAL FLOWS	
BASIN	AREA TOTAL (Acres)	C_5	C_{100}	C_5	Length (ft)	Height (ft)	Tc (min)	Length (ft)	Slope (%)	Velocity (fps)	T_c (min)	TOTAL (min)	I_5 (in/hr)	I_{100} (in/hr)	Q_5 (c.f.s.)	Q_{100} (c.f.s.)
A7	87.4	0.20	0.20	Tc per DBPS								39.3	2.1	3.7	***36.1***	***64.3***
A8	153.3	0.20	0.20	Tc per DBPS								42.6	2.0	3.5	***60.3***	***107.4***
A9	126.0	0.20	0.20	Tc per DBPS								36.2	2.2	3.9	***54.7***	***97.4***
A10	108.2	0.20	0.20	Tc per DBPS								40.4	2.0	3.6	***44.0***	***78.3***
A11	76.1	0.20	0.20	Tc per DBPS								31.7	2.3	4.2	***35.7***	***63.6***
A12	76.2	0.40	0.40	Tc per DBPS								31.7	2.3	4.2	***71.5***	***127.3***
A13	102.9	0.20	0.20	Tc per DBPS								39.2	2.1	3.7	***42.6***	***75.8***

* Intensity equations assume a minimum travel time of 5 minutes.

Calculated by: VAS
Date: 2/7/2013

EAGLE RISING
FINAL DRAINAGE REPORT
(Surface Routing Summary - Existing)

Design Point(s)	*Contributing Basins/Design Points*	*Equivalent CA_5*	*Equivalent CA_{100}*	*Maximum T_C*	*Intensity* I_5	*Intensity* I_{100}	*Flow* Q_5	*Flow* Q_{100}	*Comments*
E1	A1,A2,A3,A4,A5,A8,A9,A13 (Offsite)	207.50	207.50	66.4	1.5	2.6	***307.4***	***547.1***	***Inflow Point to Site along main stem***
E2	OS-B1A	7.47	9.96	17.3	3.2	5.8	***24.2***	***57.4***	
E3	OS-B1B	12.30	16.40	15.9	3.4	6.0	***41.5***	***98.4***	
E4	A6, A7, & A10	57.12	57.12	77.7	1.3	2.4	***76.2***	***135.6***	
E5	E1+E4+EX-A1+A11	281.31	281.80	68.5	1.5	2.6	***408.2***	***727.9***	
E6	E5+E2+E3+EX-B+A12+EX-A2+EX-C1	337.12	346.05	69.6	1.4	2.6	***483.9***	***884.2***	***DBPS DP5=870, w/in accept. range***
E7	OS-B1C	0.54	0.72	18.8	3.1	5.5	***1.7***	***4.0***	
E8	OS-B1D	1.80	2.40	16.2	3.3	5.9	***6.0***	***14.3***	
E9	E6+E7+E8+EX-C2+EX-D+OS-B4A	344.86	356.37	71.7	1.4	2.5	***485.4***	***892.9***	
E10	OS-B1E	3.03	4.04	16.3	3.3	5.9	***10.1***	***24.0***	
E11	OS-B3A	2.73	3.64	17.1	3.3	5.8	***8.9***	***21.1***	
E12	E9+EX-E+EX-F+E10+OS-B4B+E11	356.08	371.33	72.2	1.4	2.5	***498.9***	***926.1***	
E13	OS-B3B	0.69	0.92	19.0	3.1	5.5	***2.1***	***5.1***	
E14	E12+EX-G+E13+EX-H+OS-B4C	364.90	382.39	75.6	1.4	2.4	***495.8***	***924.8***	***Future Briargate Pkwy Crossing***
E15	OS-B3C	2.00	2.57	17.2	3.2	5.8	***6.5***	***14.8***	
E16	E13+EXH	2.23	3.04	37.1	2.1	3.8	***4.9***	***11.6***	
E17	E2+E3	19.77	26.36	17.3	3.2	5.8	***64.0***	***152.0***	
E18	E7+EXC1	1.68	2.24	28.1	2.5	4.5	***4.2***	***10.0***	
E19	E17+EX-B+E18	25.33	33.84	28.1	2.5	4.5	***63.7***	***151.3***	
E20	E8+EX-D	4.50	6.00	36.9	2.1	3.8	***9.7***	***22.9***	
E21	E10+E11+EX-F	8.01	10.68	34.0	2.3	4.0	***18.1***	***42.9***	

Calculated by: VAS
Date: 6/4/2013

EAGLE RISING
FINAL DRAINAGE REPORT
(Surface Routing Summary - Proposed)

Design Point(s)	Contributing Basins/Design Points	Equivalent CA_5	Equivalent CA_{100}	Maximum T_C	Intensity I_5	Intensity I_{100}	Flow Q_5	Flow Q_{100}	Comments
1	A1,A2,A3,A4,A5,A8,A9,A13 (Offsite)	207.50	207.50	66.4	1.5	2.6	307.4	547.1	Inflow Point to Site along main stem
2	A6, A7, A10 (Offsite)	57.12	57.12	77.7	1.3	2.4	76.2	135.6	
3	DP1,DP2,A1(Onsite),A11	281.31	281.80	68.5	1.5	2.6	408.2	727.9	
4	OS-B1A	7.47	9.96	17.3	3.2	5.8	24.2	57.4	
5	OS-B1B	12.30	16.40	15.9	3.4	6.0	41.5	98.4	
6	DP4,DP5,B,C	21.06	28.08	17.7	3.2	5.7	67.5	160.1	
6A	E7, E1	1.68	2.24	28.1	2.5	4.5	4.2	10.0	
6B	DP6, D, DP6A	25.95	34.60	28.1	2.5	4.5	65.2	154.7	
7	DP3,DP6B,A12,A2(Onsite)	338.22	347.52	69.1	1.4	2.6	487.9	892.4	DBPS DP5=870, w/in accept. range
8	DP7,E2	340.47	350.52	69.3	1.4	2.6	490.3	898.4	
8A	OS-B1D, 1/2 F	3.12	4.16	25.9	2.6	4.7	8.2	19.5	
8B	OS-B1D, F	4.44	5.92	35.6	2.2	3.9	9.7	23.1	50' Wide Drainage Swale
9	DP8,OS-B1D,F,OS-B4A	346.47	358.52	71.2	1.4	2.5	490.0	902.5	
10	DP9,G	347.25	359.56	71.4	1.4	2.5	490.2	903.5	
11	OS-B1E,H,OS-B3A,I	7.47	9.96	17.1	3.3	5.8	24.3	57.8	36" Culvert
11A	DP11, J	8.28	11.04	17.3	3.2	5.8	26.8	63.6	Outfall into Pond
12	DP10,DP11,J	355.53	370.60	71.5	1.4	2.5	501.4	930.3	
13	DP12,OS-B4B	357.96	373.84	71.7	1.4	2.5	503.9	936.7	
14	DP13,K,OS-B4C	362.48	379.07	72.5	1.4	2.5	506.5	942.8	Future Briargate Pkwy Crossing
15	OS-B3B	0.69	0.92	19.0	3.1	5.5	2.1	5.1	Ex. 24" Culvert
16	DP15,L	2.29	3.06	20.9	2.9	5.2	6.8	16.0	Diversion Swale
17	OS-B3C	2.00	2.57	17.2	3.2	5.8	6.5	14.8	Off-Site Flow

Calculated by: VAS

Date: 6/4/2013

Hydraulic Calculations – Culverts & Drainageways

LOCH LINNEH PLACE

Road 2 Culvert1.txt

Road2 Culvert

Culvert Calculator

Entered Data:

```
     Shape ............................ Circular
     Number of Barrels ................ 1
     Solving for ...................... Headwater
     Chart Number ..................... 3
     Scale Number ..................... 1
     Chart Description ................ CONCRETE PIPE CULVERT; BEVELED RING ENTRANCE
     Scale Decsription ................ (A) SMALL BEVEL = 0.042D
     Overtopping ...................... Off
     Flowrate ......................... 15.0000 cfs
     Manning's n ...................... 0.0130
     Roadway Elevation ................ 7137.5000 ft
     Inlet Elevation .................. 7134.5000 ft
     Outlet Elevation ................. 7134.0000 ft
     Diameter ......................... 2.0000 ft
     Length ........................... 45.0000 ft
     Entrance Loss .................... 0.0000
     Tailwater ........................ 1.0000 ft
```

Computed Results:

```
     Headwater ........................ 7136.5980 ft Inlet Control
     Slope ............................ 0.0111 ft/ft
     Velocity ......................... 8.0220 fps
```

DIS-CHARGE Flow cfs	HEAD-WATER ELEV. ft	INLET CONTROL DEPTH ft	OUTLET CONTROL DEPTH ft	FLOW TYPE	NORMAL DEPTH ft	CRITICAL DEPTH ft	OUTLET VEL. fps	OUTLET DEPTH ft	TAILWATER VEL. fps	TAILWATER DEPTH ft
3.00	7135.31	0.81	0.00	NA	0.48	0.60	5.19	0.48	0.00	1.00
6.00	7135.69	1.19	0.00	NA	0.68	0.87	6.32	0.68	0.00	1.00
9.00	7136.01	1.51	0.00	NA	0.85	1.07	7.06	0.85	0.00	1.00
12.00	7136.31	1.81	0.00	NA	1.00	1.24	7.60	1.00	0.00	1.00
15.00	7136.60	2.10	0.00	NA	1.15	1.40	8.02	1.15	0.00	1.00
18.00	7136.95	2.45	0.00	NA	1.30	1.53	8.34	1.30	0.00	1.00
21.00	7137.31	2.81	0.00	NA	1.46	1.64	8.57	1.46	0.00	1.00

EAGLE WING ROAD

Road 3 Culvert1.txt

Road 3 CUlvert 1

Culvert Calculator

Entered Data:

Shape	Circular
Number of Barrels	1
Solving for	Headwater
Chart Number	3
Scale Number	1
Chart Description	CONCRETE PIPE CULVERT; BEVELED RING ENTRANCE
Scale Decsription	(A) SMALL BEVEL = 0.042D
Overtopping	Off
Flowrate	56.0000 cfs
Manning's n	0.0130
Roadway Elevation	7138.2000 ft
Inlet Elevation	7133.0000 ft
Outlet Elevation	7130.0000 ft
Diameter	3.0000 ft
Length	75.0000 ft
Entrance Loss	0.0000
Tailwater	1.0000 ft

Computed Results:

Headwater	7137.0429 ft Inlet Control
Slope	0.0400 ft/ft
Velocity	18.0564 fps

DIS-CHARGE Flow cfs	HEAD-WATER ELEV. ft	INLET CONTROL DEPTH ft	OUTLET CONTROL DEPTH ft	FLOW TYPE	NORMAL DEPTH ft	CRITICAL DEPTH ft	OUTLET VEL. fps	OUTLET DEPTH ft	TAILWATER VEL. fps	TAILWATER DEPTH ft
4.40	7133.81	0.81	0.00	NA	0.37	0.66	8.69	0.37	0.00	1.00
8.80	7134.20	1.20	0.00	NA	0.52	0.94	10.68	0.52	0.00	1.00
13.20	7134.52	1.52	0.00	NA	0.64	1.16	12.04	0.64	0.00	1.00
17.60	7134.80	1.80	0.00	NA	0.74	1.34	13.09	0.74	0.00	1.00
22.00	7135.05	2.05	0.00	NA	0.82	1.51	13.95	0.82	0.00	1.00
26.40	7135.30	2.30	0.00	NA	0.90	1.66	14.70	0.90	0.00	1.00
30.80	7135.53	2.53	0.00	NA	0.98	1.80	15.35	0.98	0.00	1.00
35.20	7135.77	2.77	0.00	NA	1.05	1.93	15.93	1.05	0.00	1.00
39.60	7136.00	3.00	0.00	NA	1.12	2.05	16.46	1.12	0.00	1.00
44.00	7136.29	3.29	0.00	NA	1.19	2.16	16.94	1.19	0.00	1.00
48.40	7136.57	3.57	0.00	NA	1.25	2.27	17.37	1.25	0.00	1.00
52.80	7136.82	3.82	0.00	NA	1.31	2.36	17.78	1.31	0.00	1.00
57.20	7137.11	4.11	0.00	NA	1.37	2.45	18.16	1.37	0.00	1.00
61.60	7137.42	4.42	0.00	NA	1.43	2.53	18.51	1.43	0.00	1.00

EAGLE WING ROAD - DRIVEWAY

Drive 4 Culvert 1

Culvert Calculator

Entered Data:

Shape	Circular
Number of Barrels	1
Solving for	Headwater
Chart Number	3
Scale Number	1
Chart Description	CONCRETE PIPE CULVERT; BEVELED RING ENTRANCE
Scale Decsription	(A) SMALL BEVEL = 0.042D
Overtopping	Off
Flowrate	40.0000 cfs
Manning's n	0.0130
Roadway Elevation	7150.4000 ft
Inlet Elevation	7146.7500 ft
Outlet Elevation	7144.0000 ft
Diameter	3.0000 ft
Length	50.0000 ft
Entrance Loss	0.0000
Tailwater	1.0000 ft

Computed Results:

Headwater	7149.7604 ft Inlet Control
Slope	0.0550 ft/ft
Velocity	18.5198 fps

DIS-CHARGE Flow cfs	HEAD-WATER ELEV. ft	INLET CONTROL DEPTH ft	OUTLET CONTROL DEPTH ft	FLOW TYPE	NORMAL DEPTH ft	CRITICAL DEPTH ft	OUTLET VEL. fps	OUTLET DEPTH ft	TAILWATER VEL. fps	TAILWATER DEPTH ft
4.40	7147.55	0.80	0.00	NA	0.35	0.66	9.71	0.35	0.00	1.00
8.80	7147.95	1.20	0.00	NA	0.48	0.94	11.95	0.48	0.00	1.00
13.20	7148.26	1.51	0.00	NA	0.59	1.16	13.47	0.59	0.00	1.00
17.60	7148.54	1.79	0.00	NA	0.68	1.34	14.65	0.68	0.00	1.00
22.00	7148.79	2.04	0.00	NA	0.76	1.51	15.63	0.76	0.00	1.00
26.40	7149.04	2.29	0.00	NA	0.83	1.66	16.47	0.83	0.00	1.00
30.80	7149.27	2.52	0.00	NA	0.90	1.80	17.21	0.90	0.00	1.00
35.20	7149.51	2.76	0.00	NA	0.97	1.93	17.87	0.97	0.00	1.00
39.60	7149.74	2.99	0.00	NA	1.03	2.05	18.47	1.03	0.00	1.00
44.00	7150.03	3.28	0.00	NA	1.09	2.16	19.01	1.09	0.00	1.00
48.40	7150.31	3.56	0.00	NA	1.15	2.27	19.52	1.15	0.00	1.00

Ditch 1 5yr

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	24.2000 cfs
Slope	0.0360 ft/ft
Manning's n	0.0400
Height	4.0000 ft
Bottom width	0.0000 ft
Left slope	0.1000 ft/ft (V/H)
Right slope	0.1000 ft/ft (V/H)

Computed Results:

Depth	0.7974 ft
Velocity	3.8058 fps
Full Flowrate	1784.3344 cfs
Flow area	6.3588 ft2
Flow perimeter	16.0279 ft
Hydraulic radius	0.3967 ft
Top width	15.9484 ft
Area	160.0000 ft2
Perimeter	80.3990 ft
Percent full	19.9355 %

Ditch 1 100yr

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	57.4000 cfs
Slope	0.0360 ft/ft
Manning's n	0.0400
Height	4.0000 ft
Bottom width	0.0000 ft
Left slope	0.1000 ft/ft (V/H)
Right slope	0.1000 ft/ft (V/H)

Computed Results:

Depth	1.1024 ft
Velocity	4.7230 fps
Full Flowrate	1784.3344 cfs
Flow area	12.1534 ft2
Flow perimeter	22.1584 ft
Hydraulic radius	0.5485 ft
Top width	22.0485 ft
Area	160.0000 ft2
Perimeter	80.3990 ft
Percent full	27.5606 %

Ditch 2 5yr

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	41.5000 cfs
Slope	0.0370 ft/ft
Manning's n	0.0400
Height	4.0000 ft
Bottom width	0.0000 ft
Left slope	0.0900 ft/ft (V/H)
Right slope	0.0380 ft/ft (V/H)

Computed Results:

Depth	0.7672 ft
Velocity	3.7682 fps
Full Flowrate	3392.5501 cfs
Flow area	11.0132 ft2
Flow perimeter	28.7611 ft
Hydraulic radius	0.3829 ft
Top width	28.7121 ft
Area	299.4152 ft2
Perimeter	149.9632 ft
Percent full	19.1788 %

Ditch 2 100yr

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	98.4000 cfs
Slope	0.0370 ft/ft
Manning's n	0.0400
Height	4.0000 ft
Bottom width	0.0000 ft
Left slope	0.0900 ft/ft (V/H)
Right slope	0.0380 ft/ft (V/H)

Computed Results:

Depth	1.0604 ft
Velocity	4.6759 fps
Full Flowrate	3392.5501 cfs
Flow area	21.0439 ft2
Flow perimeter	39.7567 ft
Hydraulic radius	0.5293 ft
Top width	39.6890 ft
Area	299.4152 ft2
Perimeter	149.9632 ft
Percent full	26.5110 %

Ditch 3 5yr

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	80.0000 cfs
Slope	0.0400 ft/ft
Manning's n	0.0400
Height	4.0000 ft
Bottom width	0.0000 ft
Left slope	0.1500 ft/ft (V/H)
Right slope	0.2100 ft/ft (V/H)

Computed Results:

Depth	1.5140 ft
Velocity	6.1079 fps
Full Flowrate	1067.2632 cfs
Flow area	13.0977 ft2
Flow perimeter	17.5727 ft
Hydraulic radius	0.7453 ft
Top width	17.3025 ft
Area	91.4286 ft2
Perimeter	46.4281 ft
Percent full	37.8492 %

Ditch 3 100 yr

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	197.0000 cfs
Slope	0.0400 ft/ft
Manning's n	0.0400
Height	4.0000 ft
Bottom width	0.0000 ft
Left slope	0.1500 ft/ft (V/H)
Right slope	0.2100 ft/ft (V/H)

Computed Results:

Depth	2.1227 ft
Velocity	7.6514 fps
Full Flowrate	1067.2632 cfs
Flow area	25.7471 ft2
Flow perimeter	24.6379 ft
Hydraulic radius	1.0450 ft
Top width	24.2591 ft
Area	91.4286 ft2
Perimeter	46.4281 ft
Percent full	53.0668 %

Ditch 4 5 yr

Channel Calculator

Given Input Data:

```
Shape ..........................  Trapezoidal
Solving for ....................  Depth of Flow
Flowrate .......................  11.0000 cfs
Slope ..........................  0.0400 ft/ft
Manning's n ....................  0.0400
Height .........................  2.0000 ft
Bottom width ...................  0.0000 ft
Left slope .....................  0.0500 ft/ft (V/H)
Right slope ....................  0.0800 ft/ft (V/H)
```

Computed Results:

```
Depth ..........................  0.4845 ft
Velocity .......................  2.8836 fps
Full Flowrate ..................  482.3079 cfs
Flow area ......................  3.8147 ft2
Flow perimeter .................  15.7781 ft
Hydraulic radius ...............  0.2418 ft
Top width ......................  15.7467 ft
Area ...........................  65.0000 ft2
Perimeter ......................  65.1298 ft
Percent full ...................  24.2257 %
```

Ditch 4 100yr

Channel Calculator

```
Given Input Data:
     Shape ...........................  Trapezoidal
     Solving for .....................  Depth of Flow
     Flowrate ........................  26.0000 cfs
     Slope ...........................  0.0400 ft/ft
     Manning's n .....................  0.0400
     Height ..........................  2.0000 ft
     Bottom width ....................  0.0000 ft
     Left slope ......................  0.0500 ft/ft (V/H)
     Right slope .....................  0.0800 ft/ft (V/H)

Computed Results:
     Depth ...........................  0.6690 ft
     Velocity ........................  3.5754 fps
     Full Flowrate ...................  482.3079 cfs
     Flow area .......................  7.2719 ft2
     Flow perimeter ..................  21.7845 ft
     Hydraulic radius ................  0.3338 ft
     Top width .......................  21.7411 ft
     Area ............................  65.0000 ft2
     Perimeter .......................  65.1298 ft
     Percent full ....................  33.4479 %
```

Ditch 5 5yr

Channel Calculator

Given Input Data:

```
     Shape ...........................  Trapezoidal
     Solving for .....................  Depth of Flow
     Flowrate ........................  9.0000 cfs
     Slope ...........................  0.0450 ft/ft
     Manning's n .....................  0.0400
     Height ..........................  4.0000 ft
     Bottom width ....................  0.0000 ft
     Left slope ......................  0.1200 ft/ft (V/H)
     Right slope .....................  0.1100 ft/ft (V/H)
```

Computed Results:

```
     Depth ...........................  0.5560 ft
     Velocity ........................  3.3421 fps
     Full Flowrate ...................  1736.1901 cfs
     Flow area .......................  2.6929 ft2
     Flow perimeter ..................  9.7511 ft
     Hydraulic radius ................  0.2762 ft
     Top width .......................  9.6874 ft
     Area ............................  139.3939 ft2
     Perimeter .......................  70.1555 ft
     Percent full ....................  13.8993 %
```

Ditch 5 100yr

Channel Calculator

Given Input Data:

```
     Shape ........................... Trapezoidal
     Solving for ..................... Depth of Flow
     Flowrate ........................ 21.0000 cfs
     Slope ........................... 0.0450 ft/ft
     Manning's n ..................... 0.0400
     Height .......................... 4.0000 ft
     Bottom width .................... 0.0000 ft
     Left slope ...................... 0.1200 ft/ft (V/H)
     Right slope ..................... 0.1100 ft/ft (V/H)
```

Computed Results:

```
     Depth ........................... 0.7639 ft
     Velocity ........................ 4.1306 fps
     Full Flowrate ................... 1736.1901 cfs
     Flow area ....................... 5.0841 ft2
     Flow perimeter .................. 13.3981 ft
     Hydraulic radius ................ 0.3795 ft
     Top width ....................... 13.3106 ft
     Area ............................ 139.3939 ft2
     Perimeter ....................... 70.1555 ft
     Percent full .................... 19.0978 %
```

DITCH 6 5 YR

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	20.0000 cfs
Slope	0.0640 ft/ft
Manning's n	0.0400
Height	4.0000 ft
Bottom width	0.0000 ft
Left slope	0.2000 ft/ft (V/H)
Right slope	0.2300 ft/ft (V/H)

Computed Results:

Depth	0.8904 ft
Velocity	5.3979 fps
Full Flowrate	1099.0739 cfs
Flow area	3.7051 ft2
Flow perimeter	8.5121 ft
Hydraulic radius	0.4353 ft
Top width	8.3228 ft
Area	74.7826 ft2
Perimeter	38.2415 ft
Percent full	22.2588 %

DITCH 6 100 YR

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	40.0000 cfs
Slope	0.0640 ft/ft
Manning's n	0.0400
Height	4.0000 ft
Bottom width	0.0000 ft
Left slope	0.2000 ft/ft (V/H)
Right slope	0.2300 ft/ft (V/H)

Computed Results:

Depth	1.1546 ft
Velocity	6.4193 fps
Full Flowrate	1099.0739 cfs
Flow area	6.2313 ft2
Flow perimeter	11.0388 ft
Hydraulic radius	0.5645 ft
Top width	10.7934 ft
Area	74.7826 ft2
Perimeter	38.2415 ft
Percent full	28.8661 %

DITCH 7 5 YR

Channel Calculator

Given Input Data:

```
     Shape ..........................  Trapezoidal
     Solving for ....................  Depth of Flow
     Flowrate .......................  4.3000 cfs
     Slope ..........................  0.0480 ft/ft
     Manning's n ....................  0.0400
     Height .........................  2.0000 ft
     Bottom width ...................  0.0000 ft
     Left slope .....................  0.0500 ft/ft (V/H)
     Right slope ....................  0.2000 ft/ft (V/H)
```

Computed Results:

```
     Depth ..........................  0.3635 ft
     Velocity .......................  2.6031 fps
     Full Flowrate ..................  405.6177 cfs
     Flow area ......................  1.6519 ft2
     Flow perimeter .................  9.1333 ft
     Hydraulic radius ...............  0.1809 ft
     Top width ......................  9.0882 ft
     Area ...........................  50.0000 ft2
     Perimeter ......................  50.2480 ft
     Percent full ...................  18.1764 %
```

DITCH 7 100 YR

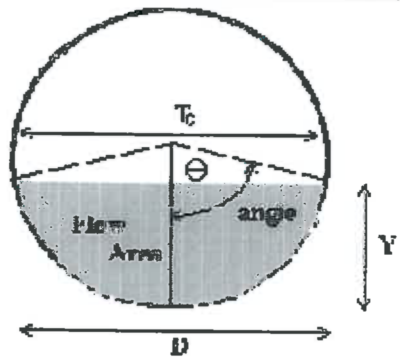
Channel Calculator

```
Given Input Data:
     Shape ..........................  Trapezoidal
     Solving for ....................  Depth of Flow
     Flowrate .......................  10.2000 cfs
     Slope ..........................  0.0480 ft/ft
     Manning's n ....................  0.0400
     Height .........................  2.0000 ft
     Bottom width ...................  0.0000 ft
     Left slope .....................  0.0500 ft/ft (V/H)
     Right slope ....................  0.2000 ft/ft (V/H)

Computed Results:
     Depth ..........................  0.5026 ft
     Velocity .......................  3.2305 fps
     Full Flowrate ..................  405.6177 cfs
     Flow area ......................  3.1574 ft2
     Flow perimeter .................  12.6270 ft
     Hydraulic radius ...............  0.2501 ft
     Top width ......................  12.5647 ft
     Area ...........................  50.0000 ft2
     Perimeter ......................  50.2480 ft
     Percent full ...................  25.1293 %
```

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

Project: Eagle Rising - Filing No. 1
Pipe ID: Culvert Crossing @ DP 11



Design Information (Input)			
Pipe Invert Slope	So =	0.0350	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	24.00	inches
Design discharge	**Q =**	**29.00**	**cfs**
Full-flow Capacity (Calculated)			
Full-flow area	Af =	3.14	sq ft
Full-flow wetted perimeter	Pf =	6.28	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	32.08	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	2.08	radians
Flow area	An =	2.51	sq ft
Top width	Tn =	1.74	ft
Wetted perimeter	Pn =	4.16	ft
Flow depth	Yn =	1.49	ft
Flow velocity	Vn =	11.56	fps
Discharge	Qn =	29.00	cfs
Percent Full Flow	Flow =	90.4%	of full flow
Normal Depth Froude Number	Fr_n =	1.70	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.58	radians
Critical flow area	Ac =	3.03	sq ft
Critical top width	Tc =	1.07	ft
Critical flow depth	Yc =	1.85	ft
Critical flow velocity	Vc =	9.57	fps
Critical Depth Froude Number	Fr_c =	1.00	

DITCH 8 5 YR

Channel Calculator

Given Input Data:

```
     Shape ............................  Trapezoidal
     Solving for ......................  Depth of Flow
     Flowrate .........................  7.2000 cfs
     Slope ............................  0.0140 ft/ft
     Manning's n ......................  0.0400
     Height ...........................  4.0000 ft
     Bottom width .....................  0.0000 ft
     Left slope .......................  0.3330 ft/ft (V/H)
     Right slope ......................  0.3330 ft/ft (V/H)
```

Computed Results:

```
     Depth ............................  0.9600 ft
     Velocity .........................  2.6018 fps
     Full Flowrate ....................  323.7142 cfs
     Flow area ........................  2.7673 ft2
     Flow perimeter ...................  6.0767 ft
     Hydraulic radius .................  0.4554 ft
     Top width ........................  5.7655 ft
     Area .............................  48.0480 ft2
     Perimeter ........................  25.3210 ft
     Percent full .....................  23.9988 %
```

DITCH 8 100 YR

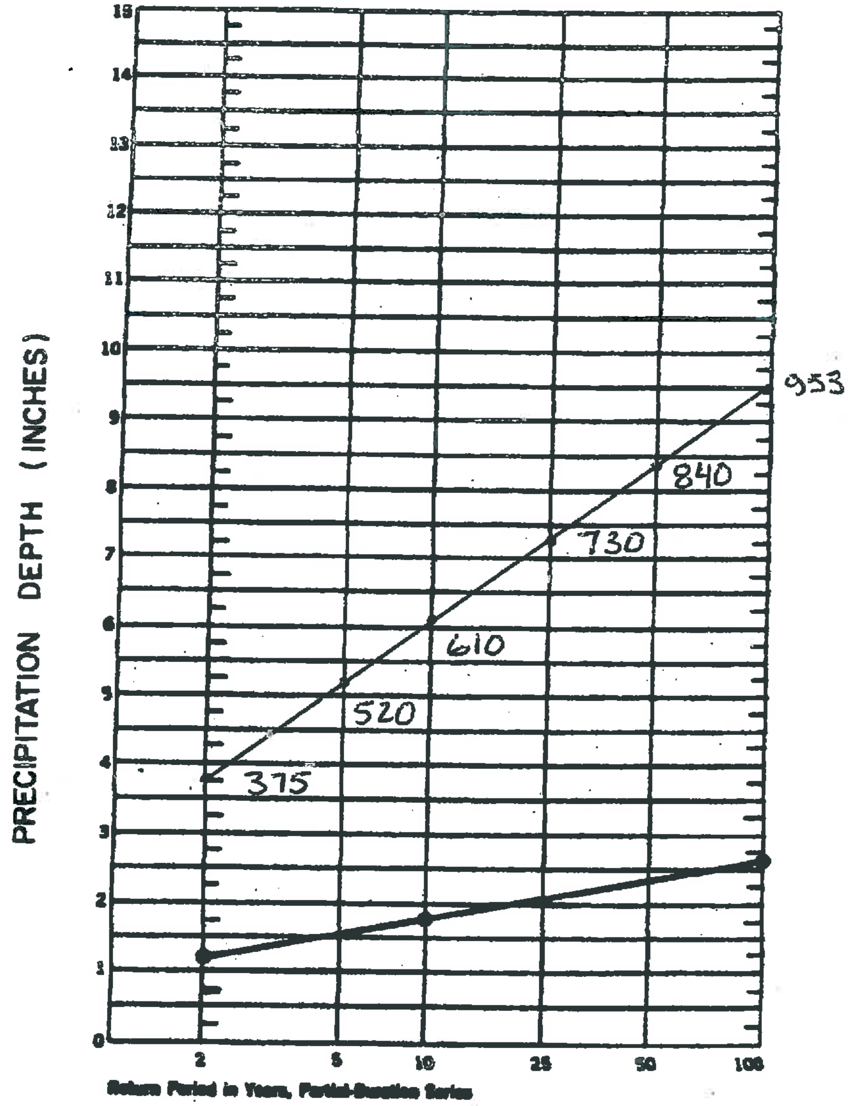
Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	17.1000 cfs
Slope	0.0140 ft/ft
Manning's n	0.0400
Height	4.0000 ft
Bottom width	0.0000 ft
Left slope	0.3330 ft/ft (V/H)
Right slope	0.3330 ft/ft (V/H)

Computed Results:

Depth	1.3278 ft
Velocity	3.2299 fps
Full Flowrate	323.7142 cfs
Flow area	5.2942 ft2
Flow perimeter	8.4051 ft
Hydraulic radius	0.6299 ft
Top width	7.9746 ft
Area	48.0480 ft2
Perimeter	25.3210 ft
Percent full	33.1943 %



EXAMPLE

2 yr. 1 hr rainfall (calculated) = 1.19"
100 yr. 1 hr rainfall (calculated) = 2.64"
10 yr. 1 hr rainfall (interpolated) = 1.78"

REFERENCE : NOAA Atlas 2, Volume 3 - Colorado

<u>NOTE</u>: This example is for Colorado Springs as indicated on the isopluvials.

RAINFALL DEPTH-DURATION RELATIONSHIP

PRUDENT LINE - 10 YR FLOW VALUE INTERPOLATION

	River	Reach	RS	100yr PF 1	10 yr PF2
1	?IVER-1	?each-1	38	547	350
2	?IVER-1	?each-1	27	724	463
3	?IVER-1	?each-1	20	881	564
4	?IVER-1	?each-1	17	890	570
5	?IVER-1	?each-1	12	897	574
6	?IVER-1	?each-1	10	898	575
7	?IVER-1	?each-1	6	931	596
8	?IVER-1	?each-1	1	953	610

Note: Use 0.64 adjustment factor to obtain 10 yr flow value.

TABLE 10-2 (Continued)

TYPICAL ROUGHNESS COEFFICIENTS FOR OPEN CHANNELS

Type of Channel and Description	Minimum	Normal	Maximum
NATURAL STREAMS			
Minor streams (top width at flood stage 100 ft)			
a. Streams on plain			
1. Clean, straight, full stage, no rifts or deep pools	0.025	0.030	0.033
2. Same as above, but more stones and weeds	0.030	0.035	0.040
3. Clean, winding, some pools and shoals	0.033	0.040	0.045
4. Same as above, but some weeds and stones	0.035	0.045	0.050
5. Same as above, lower stages, more ineffective slopes and sections	0.040	0.048	0.055
6. Same as 4, but more stones	0.045	0.050	0.060
7. Sluggish reaches, weedy, deep pools	0.050	0.070	0.080
8. Very weedy reaches, deep pools, or floodways with heavy stand of timber and underbrush	0.075	0.100	0.150
LINED OR BUILT-UP CHANNELS			
a. Corrugated Metal	0.021	0.025	0.030
b. Concrete			
1. Trowel finish	0.011	0.013	0.015
2. Float finish	0.013	0.015	0.016
3. Finished, with gravel on bottom	0.015	0.017	0.020
4. Unfinished	0.014	0.017	0.020
5. Gunite, good section	0.016	0.019	0.023
6. Gunite, wavy section	0.018	0.022	0.025
7. On good excavated rock	0.017	0.020	
8. On irregular excavated rock	0.022	0.027	

TABLE 10-2 (Continued)

TYPICAL ROUGHNESS COEFFICIENTS FOR OPEN CHANNELS

Type of Channel and Description	Minimum	Normal	Maximum
c. Concrete bottom float finished with sides of			
1. Dressed stone in mortar	0.015	0.017	0.020
2. Random stone in mortar	0.017	0.020	0.024
3. Cement rubble masonry, plastered	0.016	0.020	0.024
4. Cement rubble masonry	0.020	0.025	0.030
5. Dry rubble or riprap	0.020	0.030	0.035
d. Gravel bottom with sides of			
1. Formed concrete	0.017	0.020	0.025
2. Random stone in mortar	0.020	0.023	0.026
3. Dry rubble or riprap	0.023	0.033	0.036
e. Asphalt			
1. Smooth		0.013	
2. Rough		0.016	
f. Grassed	0.030	0.040	0.050

TABLE 10-3

MAXIMUM PERMISSIBLE DESIGN OPEN CHANNEL FLOW VELOCITIES IN EARTH*

Soil Types	Permissible Mean Channel Velocity (ft/sec)
Fine Sand (noncolloidal)	2.0
Coarse Sand (noncolloidal)	4.0
Sandy Loam (noncolloidal)	2.5
Silt Loam (noncolloidal)	3.0
Ordinary Firm Loam	3.5
Silty Clay	3.5
Fine Gravel	5.0
Stiff Clay (very colloidal)	5.0
Graded, Loam to Cobbles (noncolloidal)	5.0
Graded, Silt to Cobbles (colloidal)	5.5
Alluvial Silts (noncolloidal)	3.5
Alluvial Silts (colloidal)	5.0
Coarse Gravel (noncolloidal)	6.0
Cobbles and Shingles	5.5
Hard Shales and Hard Pans	6.0
Soft Shales	3.5
Soft Sandstone	8.0
Sound rock (usu. igneous or hard metamorphic)	20.0

* These velocities shall be used in conjunction with scour calculations and as approved by City/County.

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.

EAGLE RISING
HYDROLOGY MAP
EXISTING
(ON-SITE)

1" = 100'

0 50 100 200
Scale in Feet

BASIN SUMMARY			
BASIN	AREA (ACRES)	Q5 (CFS)	Q100 (CFS)
EX-A1	4.9	5.9	13.9
EX-A2	1.6	1.9	4.6
EX-B	13.1	14.1	33.5
EX-C1	3.8	4.8	11.4
EX-C2	7.5	6.8	16.2
EX-D	9.0	8.0	19.0
EX-E	2.6	3.2	7.6
EX-F	7.5	7.4	17.5
EX-G	2.8	12.4	23.2
EX-H	5.3	5.0	12.0

BASIN SUMMARY			
BASIN	AREA (ACRES)	Q5 (CFS)	Q100 (CFS)
OS-B1A	24.9	24.2	57.4
OS-B1B	41.0	41.5	98.4
OS-B1C	1.8	1.7	4.0
OS-B1D	6.0	6.0	14.3
OS-B1E	10.1	10.1	24.0
OS-B3A	9.1	8.9	21.1
OS-B3B	2.3	2.1	5.1
OS-B3C	5.7	6.5	14.8
OS-B4A	5.2	5.9	14.1
OS-B4B	8.1	9.3	22.2
OS-B4C	13.4	12.7	30.1

BASIN SUMMARY			
BASIN	AREA (ACRES)	Q5 (CFS)	Q100 (CFS)
A1	120.6	45.5	81.0
A2	134.2	55.5	98.9
A3	103.9	42.3	75.3
A4	162.4	71.9	128.1
A5	134.2	56.4	100.4
A6	90.0	38.4	68.3
A7	87.4	36.1	64.3
A8	153.3	60.3	107.4
A9	126.0	54.7	97.4
A10	108.2	44.0	78.3
A11	76.1	35.7	63.6
A12	76.2	71.5	127.3
A13	102.9	42.6	75.8

DESIGN POINT SUMMARY		
DESIGN POINT	Q5 (CFS)	Q100 (CFS)
E1	307.4	547.1
E2	24.2	57.4
E3	41.5	98.4
E4	76.2	135.6
E5	408.2	727.9
E6	483.9	884.2
E7	1.7	4.0
E8	6.0	14.3
E9	485.4	892.9
E10	10.1	24.0
E11	8.9	21.1
E12	498.9	926.1
E13	2.1	5.1

DESIGN POINT SUMMARY		
DESIGN POINT	Q5 (CFS)	Q100 (CFS)
E14	495.8	924.8
E15	6.5	14.8
E16	4.9	11.6
E17	64.0	152.0
E18	4.2	10.0
E19	63.7	151.3
E20	9.7	22.9
E21	18.1	42.9

LEGEND

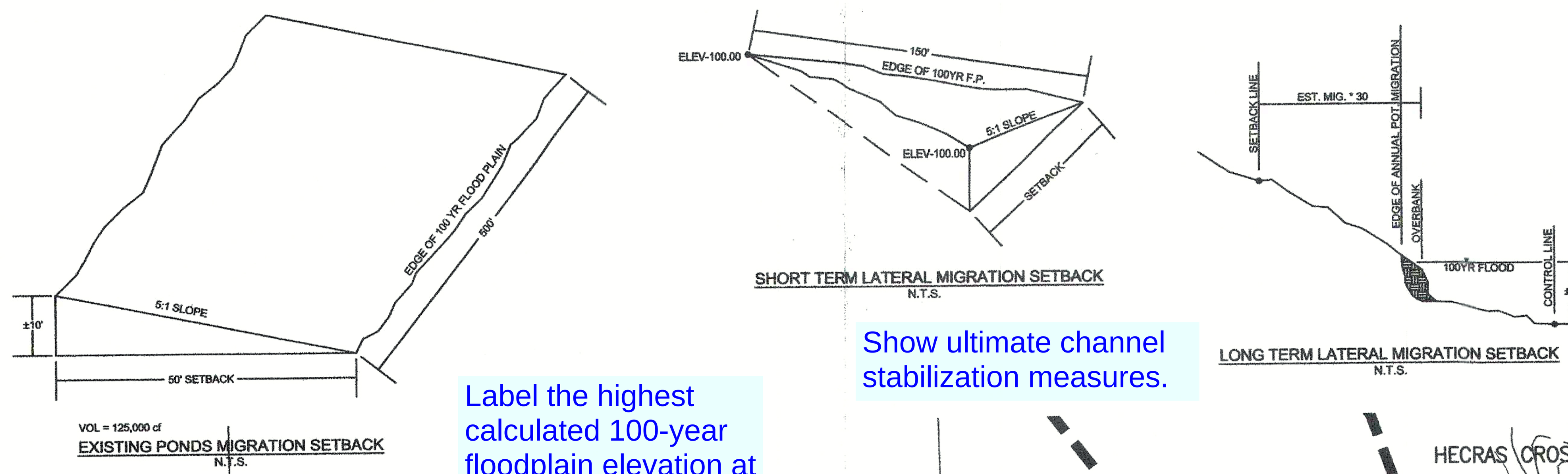
EX-A — ON-SITE BASIN IDENTIFIER
E1 — DESIGN POINT
FLOW ARROW
FEMA 100-YR FLOODPLAIN (ZONE A)
M&S CIVIL 100-YR FLOODPLAIN BOUNDARY

M&S CIVIL CONSULTANTS, INC.
102 E PIKES PEAK AVENUE, SUITE 306
COLORADO SPRINGS, COLORADO 80903
v 719.955.5485
f 719.444.8427

DATE: 2/7/2013
REV DATE: 7/12/2014

SHEET 1 OF 3

EAGLE RISING
HYDROLOGY MAP
PROPOSED
(ON-SITE)



PLAT NOTE: DRAINAGE EASEMENTS

FOR FILING NO. 1 LOTS ~~1, 3, 4, 5, 7 AND 12, AND FILING NO. 2 LOT 2~~, THE FINAL LOCATION OF DRAINAGE EASEMENTS THROUGH AND ACROSS THE LOT SHALL BE DETERMINED AND GRANTED PRIOR TO BUILDING PERMIT AUTHORIZATION WITH AN ENGINEERED SITE PLAN. THE ENGINEERED SITE PLAN SHALL DESIGN AND LOCATE DRAINAGE EASEMENTS IN COORDINATION WITH THE PROPOSED LOT DEVELOPMENT, MUST BE CONSISTENT WITH THE APPROVED DRAINAGE REPORT, AND MUST PROVIDE A CONTINUOUS PATH FOR DRAINAGE BETWEEN ADJACENT LOTS. IF AN ADDITIONAL DRAINAGE EASEMENT IS NECESSARY, IT SHALL BE SUBMITTED FOR REVIEW WITH THE ENGINEERED SITE PLAN AND SHALL BE RECORDED WITH THE EL PASO COUNTY CLERK AND RECORDER'S OFFICE PRIOR TO BUILDING PERMIT AUTHORIZATION. RECORDING FEES SHALL BE PAID AT THE TIME OF SITE PLAN APPLICATION.

PRUDENT LINE SETBACKS

STA 1+00 - 4+00 N/A 100YR FP - UNDER FUT. BRIDGE
STA 4+00 - 10+00 ADJ. TO POND - LOW POTENTIAL EROSION - 50' FROM 100YR F.P.
STA 10+00 - 20+00 5:1 BANK, MODERATE EROSION POTENTIAL - EST. POTENTIAL MIGRATION * 30
STA 20+00 - 27+00 SHARP CURVE IN CHANNEL -HIGH POTENTIAL EROSION - EST. POTENTIAL MIGRATION * 30
STA 27+00 - 33+50 ADJ. TO POND - LOW POTENTIAL EROSION - 50' FROM 100 YR F.P.
STA 33+50 - 37+00 STEEP BANK - AVG. ANNUAL MIGRATION = 1.0' *30 = 30' - USE 50' FROM F.P.

1" = 100'
0 50 100 200
Scale in Feet

Label the highest calculated 100-year floodplain elevation at each relevant lot line.

Show ultimate channel stabilization measures.

Show cul-de-sac and drainage.

Lots are labeled differently on the Plat?

Drainage from the road will require SWCV. per our criteria and the county's MS4 permit.

Please darken the line for the area to be platted.

BASIN SUMMARY			
BASIN	AREA (ACRES)	Q5 (CFS)	Q100 (CFS)
A1	4.9	5.9	13.9
A2	1.6	1.9	4.5
B	3.1	3.4	8.0
C	1.2	1.5	3.5
D	10.7	11.5	27.3
E1	3.8	4.8	11.4
E2	7.5	6.8	16.2
F	8.8	8.1	19.2
G	2.6	3.2	7.6
H	4.1	4.3	10.2
I	1.6	2.1	4.9
J	2.7	3.1	7.3
K	2.8	12.4	23.2
L	5.3	5.1	12.0

BASIN SUMMARY			
BASIN	AREA (ACRES)	Q5 (CFS)	Q100 (CFS)
OS-B1A	24.9	24.2	57.4
OS-B1B	41.0	41.5	98.4
OS-B1C	1.8	1.7	4.0
OS-B1D	6.0	6.0	14.3
OS-B1E	10.1	10.1	24.0
OS-B3A	9.1	8.9	21.1
OS-B3B	2.3	2.1	5.1
OS-B3C	5.7	6.5	14.8
OS-B4A	5.2	5.9	14.1
OS-B4B	8.1	9.3	22.2
OS-B4C	13.4	12.7	30.1

BASIN SUMMARY			
BASIN	AREA (ACRES)	Q5 (CFS)	Q100 (CFS)
A1	120.6	45.5	81.0
A2	134.2	55.5	98.9
A3	103.9	42.3	75.3
A4	162.4	71.9	128.1
A5	134.2	56.4	100.4
A6	90.0	38.4	68.3
A7	87.4	36.1	64.3
A8	153.3	60.3	107.4
A9	126.0	54.7	97.4
A10	108.2	44.0	78.3
A11	76.1	35.7	63.6
A12	76.2	71.5	127.3
A13	102.9	42.6	75.8

DESIGN POINT SUMMARY		
DESIGN POINT	Q5 (CFS)	Q100 (CFS)
E1	307.4	547.1
E2	24.2	57.4
E3	41.5	98.4
E4	76.2	135.6
E5	408.2	727.9
E6	483.9	884.2
E7	1.7	4.0
E8	6.0	14.3
E9	485.4	892.9
E10	10.1	24.0
E11	8.9	21.1
E12	498.9	926.1
E13	2.1	5.1

DESIGN POINT SUMMARY		
DESIGN POINT	Q5 (CFS)	Q100 (CFS)
E14	495.8	924.8
E15	6.5	14.8
E16	4.9	11.6
E17	64.0	152.0
E18	4.2	10.0
E19	63.7	151.3
E20	9.7	22.9
E21	18.1	42.9

DESIGN POINT SUMMARY		
DESIGN POINT	Q5 (CFS)	Q100 (CFS)
1	307.4	547.1
2	76.2	135.6
3	408.2	727.9
4	24.2	57.4
5	41.5	98.4
6	67.5	160.1
6A	4.2	10.0
6B	65.2	154.7
7	487.9	892.4
8	490.3	898.4
8A	8.2	19.5
8B	9.7	23.1
9	490.0	902.5
10	490.2	903.5

DESIGN POINT SUMMARY		
DESIGN POINT	Q5 (CFS)	Q100 (CFS)
11	24.3	57.8
11A	26.8	63.6
12	501.4	930.3
13	503.9	936.7
14	506.5	942.8
15	2.1	5.1
16	6.8	16.0
17	6.5	14.8

NOTES:
1) NO DRAW DOWN EFFECT CONSIDERED FOR PONDS SINCE THEY DO NOT DETAIN RUNOFF ABOVE F.P.
2) AVERAGE WATER DEPTH IN CHANNEL = ±4 FEET
3) AVERAGE HEIGHT AT SETBACK ABOVE F.P. = 9.5 FEET, MIN. 3.07', MAX 15.31'
4) OVERFLOW ELEVATION OVER POND EMBANKMENTS - SOUTH POND=7118, NORTH POND=7152
5) REFER TO CONSTRUCTION PLANS PREPARED BY M&S CIVIL FOR GRADING & CULVERT DETAILED DESIGN.
6) REFER TO CONSTRUCTION PLANS PREPARED BY M&S CIVIL FOR ROADWAY DESIGN.
7) REFER TO REPORT FOR BASIN SUMMARY AND DESIGN POINT SUMMARY INFORMATION.
8) REFER TO REPORT FOR PRUDENT LINE SETBACK REQUIREMENTS.
9) REFER TO SHEET 3 OF 3 FOR OFF-SITE HYDROLOGY MAP.

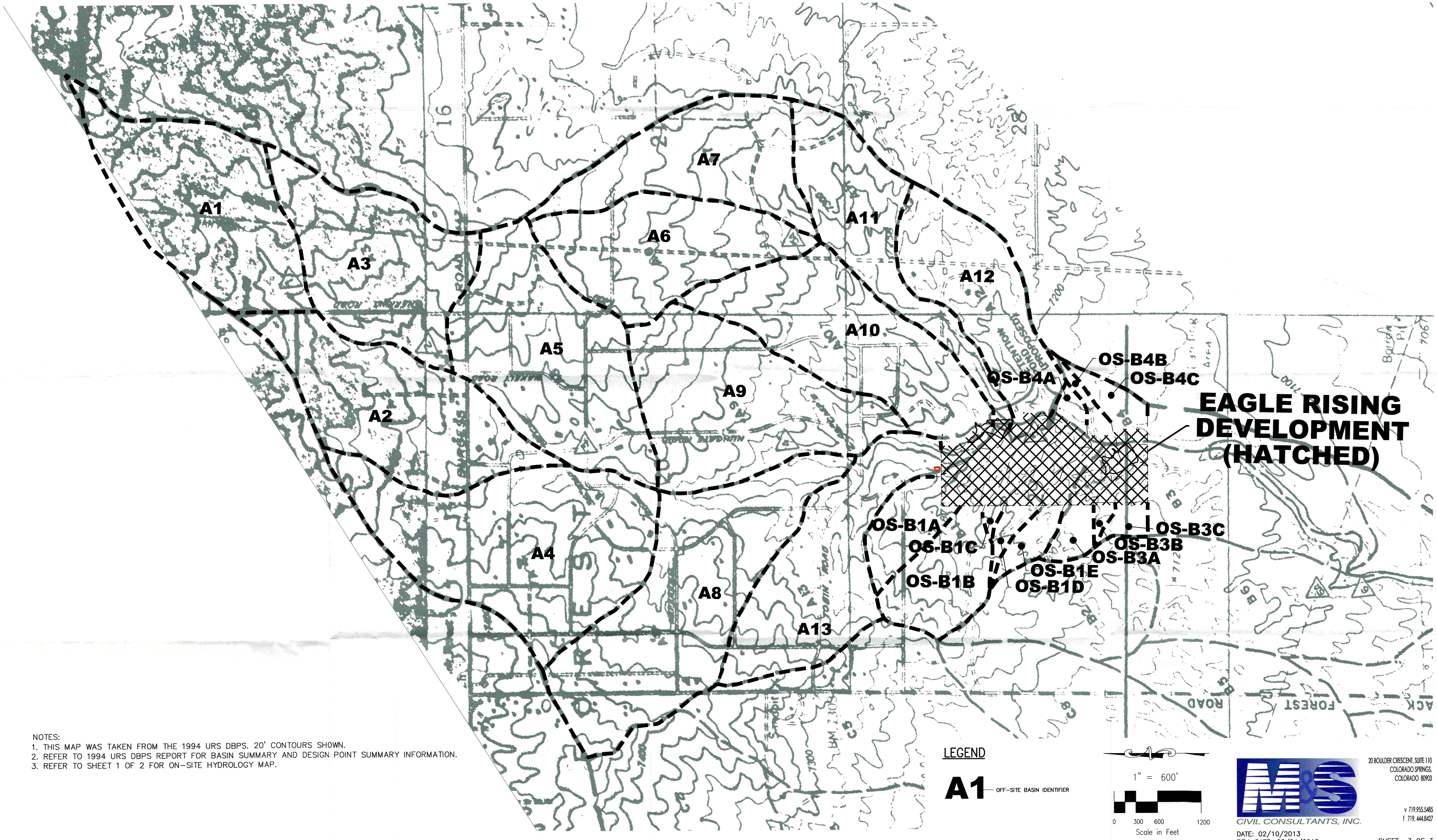
LEGEND

A — ON-SITE BASIN IDENTIFIER
1 — DESIGN POINT
FLOW ARROW
FEMA 100-YR FLOODPLAIN (ZONE A)
M&S CIVIL 100-YR FLOODPLAIN BOUNDARY

M&S CIVIL CONSULTANTS, INC.
COLORADO SPRINGS, COLORADO 80903
v 719.955.5485
f 719.444.8427

DATE: 9/12/2012
REV. DATE: 7/31/2015

EAGLE RISING
HYDROLOGY MAP
(OFF-SITE)



NOTES:
1. THIS MAP WAS TAKEN FROM THE 1994 URS DBPS. 20' CONTOURS SHOWN.
2. REFER TO 1994 URS DBPS REPORT FOR BASIN SUMMARY AND DESIGN POINT SUMMARY INFORMATION.
3. REFER TO SHEET 1 OF 2 FOR ON-SITE HYDROLOGY MAP.

LEGEND

A1 — OFF-SITE BASIN IDENTIFIER

1" = 600'

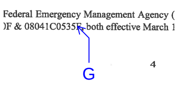
0 300 600 1200
Scale in Feet

M&S CIVIL CONSULTANTS, INC.
20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS,
COLORADO 80903
v 719.955.5485
f 719.444.8427

DATE: 02/10/2013
REV. DATE: 08/04/2015

Markup Summary

dsdrice (8)



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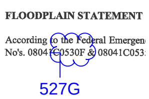
Author: dsdrice
Date: 11/29/2018 2:13:10 PM
Color: ■

G



Subject: Cloud+
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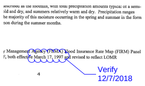
527G



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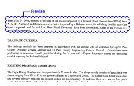
Author: dsdrice
Date: 11/29/2018 2:14:13 PM
Color: ■

Verify 12/7/2018



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Page Label: 5
Author: dsdrice
Date: 11/29/2018 2:15:01 PM
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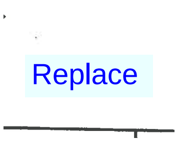
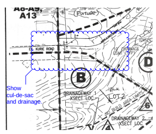
Revise



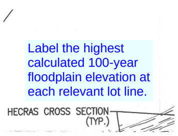
Subject: Text Box
Page Label: 26
Author: dsdrice
Date: 11/29/2018 2:16:14 PM
Color: ■

Replace



Subject: Cloud+
Page Label: 63
Author: dsdrice
Date: 11/29/2018 3:35:11 PM
Color: ■

Show cul-de-sac and drainage.



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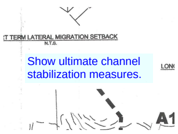
Page Label: 63
Author: dsdrice
Date: 11/29/2018 3:37:40 PM
Color: ■

Label the highest calculated 100-year floodplain elevation at each relevant lot line.



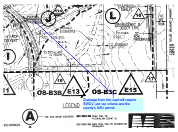
Subject: Text Box
Page Label: 63
Author: dsdrice
Date: 11/29/2018 3:38:08 PM
Color: ■

Show ultimate channel stabilization measures.

Steve Kuehster (18)

Subject: text box
Page Label: 63
Author: Steve Kuehster
Date: 11/27/2018 11:44:21 AM
Color:

Please darken the line for the area to be platted.

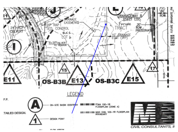


Subject: arrow & box
Page Label: 63
Author: Steve Kuehster
Date: 11/27/2018 11:45:19 AM
Color:

Drainage from the road will require SWCV. per our criteria and the county's MS4 permit.

Subject: arrow & box
Page Label: 7
Author: Steve Kuehster
Date: 11/27/2018 11:51:40 AM
Color:

And the proposed roadway area will need SWQCV Treatment.



Subject: Arrow
Page Label: 63
Author: Steve Kuehster
Date: 11/27/2018 11:56:57 AM
Color:

Subject: text box
Page Label: 5
Author: Steve Kuehster
Date: 11/27/2018 11:59:12 AM
Color:

Add section: "Four Step Process"

Subject: arrow & box
Page Label: 9
Author: Steve Kuehster
Date: 11/27/2018 12:34:38 PM
Color:

Channel improvements need to match County criteria for the proposed velocities

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Subject: text box
Page Label: 1
Author: Steve Kuehster
Date: 11/27/2018 7:46:56 AM
Color:

SF-18-029

Subject: arrow & box
Page Label: 2
Author: Steve Kuehster
Date: 11/27/2018 7:48:34 AM
Color:

Jennifer Irvine, P.E.

Subject: text box
Page Label: 3
Author: Steve Kuehster
Date: 11/27/2018 7:50:11 AM
Color:

Add section: "Four Step Process"

Subject: Highlight
Page Label: 3
Author: Steve Kuehster
Date: 11/27/2018 7:50:24 AM
Color:

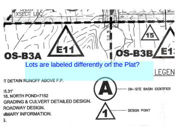
Subject: Highlight
Page Label: 3
Author: Steve Kuehster
Date: 11/27/2018 7:50:25 AM
Color:

Subject: text box
Page Label: 3
Author: Steve Kuehster
Date: 11/27/2018 7:51:27 AM
Color:

The HECRAS is not included?

Subject: Highlight
Page Label: 14
Author: Steve Kuehster
Date: 11/27/2018 7:56:43 AM
Color:

Subject: Highlight
Page Label: 14
Author: Steve Kuehster
Date: 11/27/2018 7:56:44 AM
Color:



Subject: text box
Page Label: 63
Author: Steve Kuehster
Date: 11/27/2018 8:23:14 AM
Color:

Lots are labeled differently on the Plat?

Subject: Arrow
Page Label: 5
Author: Steve Kuehster
Date: 11/27/2018 8:32:17 AM
Color:

Subject: text box
Page Label: 5
Author: Steve Kuehster
Date: 11/27/2018 8:32:42 AM
Color:

Revise for Filing 1 and Filing 2. Explain the subdividing of the 70.9 acres

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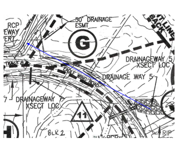

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