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Master Development Drainage Plan
For
THE RANCH

November 2018
Revised May 2019

Prepared for:
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MASTER DEVELOPMENT DRAINAGE PLAN FOR THE RANCH

DESIGN ENGINEER'S STATEMENT:

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

_____ _____

Kyle R. Campbell, Colorado P.E. #29794 Date

OWNERS/DEVELOPER'S STATEMENT:

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

Name: Pulpit Rock Investments #4, LLC

By: _____

Title: _____

Address: 6385 Corporate Drive, Suite 200

Colorado Springs, CO 80919

EL PASO COUNTY:

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

_____ _____

Jennifer Irvine, P.E. Date

County Engineer / ECM Administrator

Conditions:

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MASTER DEVELOPMENT DRAINAGE PLAN FOR THE RANCH

PURPOSE

The intent of the owner/developer is to develop The Ranch site. The purpose of this Master Development Drainage Plan (MDDP), as part of the sketch plan, is to identify major drainage features and facilities and to estimate peak rates of stormwater runoff, from on-site and off-site sources. Also the purpose is to outline the necessary improvements to safely route developed storm water runoff to adequate outfall facilities as designated within the Drainage Basin Planning Studies for each basin. The concepts within this report are preliminary in nature and final drainage reports are required upon any development within the site.

GENERAL DESCRIPTION

The Ranch is an approximately 610.475-acre site comprising of almost the entire Section 35, Township 12 South, Range 65 West of the Sixth Principal Meridian in the County of El Paso, State of Colorado. The site is bounded on the north by Stapleton Drive and existing subdivisions Stapleton Estates and Paint Brush Hills, to the east by the Meadows Filing 3 subdivision, to the west by existing large lot homes and Bow Valley Subdivision, and to the south by The Meadows Filings 1 and 2 development. This is a PUD development which will consist of varied density residential, a school site, and multiple park and open space areas.

The existing soil types within the proposed site boundary as determined by the "Natural Resources Conservation Service," Web Soil Survey El Paso County Area, Colorado version 6 August 2008 consist of Blakeland loamy sand, Columbine gravelly sandy loam (both Group 'A' soils) and Pring coarse sandy loam (Group 'B' soil). The entire land tributary to The Ranch site to the north is Group 'B' soils. See attached soils maps in the Appendix. All of the previous drainage basin planning studies and master development drainage plans did not decrease the basin hydraulic curve number to account for the presence of the Group 'A' soils in determining the runoff rates of the basins. Therefore, in order to calculate runoff rates similar to these previous reports, all CN & C values used within this analysis are consistent with Group 'B' soils. At this Master Development Drainage Plan stage of the project, continuing the conservative approach of using all Group 'B' Soils will continue to be used. Future, more detailed analysis may use Group 'A' Soils where appropriate.

PREVIOUS REPORTS

The proposed site has been included in multiple drainage studies in the past. The following is a composite list of the existing reports pertaining to this site analysis:

1) "Falcon Area Drainage Basin Planning Study Preliminary Design Report," by URS, December 2000.

2) "Sand Creek Drainage Basin Planning Study Preliminary Design Report," by Kiowa Engineering Corporation, last revised March 1996.

3) "Master Development Drainage Plan Falcon Hills Development," by Kiowa Engineering Corporation, May 2002.

4) "Final Drainage Report for Paint Brush Hills Filing Nos. 10, 11 & 12," by Classic Consulting Engineers & Surveyors, LLC, last revised July 2003.

5) "Drainage Report Stapleton Estates Filing No. 1," by Guenther Polok, March 1982.

6) "Falcon Meadows Subdivision Drainage Report," by Oliver E. Watts Consulting Engineer, April 1981.

7) "Final Drainage and Erosion Control for the Meadows Filing Three Subdivision," by Ladd Engineering, July 2000.

8) "Master Development Drainage Plan and Preliminary Drainage Plan Bent Grass Subdivision," by Kiowa Engineering, last revised December 2006.

9) "Falcon Drainage Basin Planning Study - Selected Plan Report" by Matrix Design Group, September 2015.

DRAINAGE CRITERIA

Hydrologic calculations were performed using the City of Colorado Springs/El Paso County Drainage Criteria Manual, as revised in November 1991 and October 1994 with County adopted Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs/El Paso County Drainage Criteria Manual as revised in May 2014. Detention storage and storm sewer conveyance to Sand Creek Drainage Basin was established with the Sand Creek DBPS. The "Falcon Drainage Basin Planning Study – Selected Plan Report", dated September, 2015, by Matrix Design Group was also consulted in the preparation of this report. The NRCS Unit Hydrograph (Curve Number) was used to estimate stormwater runoff anticipated from design storms for the 2-year, 5-year and 100-year recurrence interval with a 24-hour NRCS Type II distribution.

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Rainfall Depths for Colorado Springs

Return Period	24-Hour Depth
2 Year	2.10
5 Year	2.70
10 Year	3.20
25 Year	3.60
50 Year	4.20
100 Year	4.60

PondPak 10.0 by Bentley Systems was used to model the SCS Hydrograph method for the site. This program was used for its ability to accurately and easily model the existing detention ponds located within the upstream Paint Brush Hills site and to size the on-site proposed detention ponds within the Sand Creek Basin.

EXISTING DRAINAGE CONDITIONS

The Ranch site is within two major drainage basins; the eastern portion is within the Falcon Area Drainage Basin, with the remainder of the site to the west in the Sand Creek Drainage Basin. The major basin delineation line is included on both of the drainage maps in the Appendix of this report. This delineation line generally matches that set forth in both Drainage Basin Planning Studies. The site generally drains from north to south at an average slope of 1 to 3 percent. As mentioned before, due to the size of the proposed site and the large area of tributary land to the north, the SCS Hydrograph method was used to determine the 'historic' flow rates through the site. Maps from the two applicable D.B.P.S. reports are included in the Appendix of this report.

Falcon Area Drainage Basin

The most recent study of this portion of the Falcon Basin, including the eastern portion of The Ranch site, was the The "Falcon Drainage Basin Planning Study – Selected Plan Report", dated September, 2015, by Matrix Design Group and the "MDDP and Preliminary Drainage Plan for Bent Grass Subdivision," by Kiowa Engineering, last revised December 2006. The Bent Grass Subdivision is located downstream (south-east) of The Ranch. The SCS analysis contained within the Bent Grass report was derived from the "MDDP for Falcon Hills Development," by Kiowa Engineering, May 2002. The Falcon Hills Development later changed

its name to Paint Brush Hills, and is located north of the proposed site. The Falcon Hills report specified the need for on-site detention to maintain historic flow rates onto The Ranch site. As a part of this analysis, the detention ponds constructed with the development of Paint Brush Hills have been modeled and basins tributary have been revised to be in accordance with the Final Drainage Report and construction drawings for that subdivision.

Recreation of the HEC-1 model from the Bent Grass and Falcon Hill MDDPs was tried with both HEC-3.3 (updated version) and with PondPak 10.0. Exact results were unachievable with both programs. This is assumed to be caused by the previous inaccurate rainfall distribution used within the previous reports. This assumption is made based upon review the results within these reports and noticing that the majority of the peak flows occur before the 6 hour mark of the 24 hour storm event. A Type II-A distribution has its largest jump in rainfall at the 6 hour mark, subsequently providing peak flows through the basin occurring just after 6 hours. PondPak 10.0 provided the closest results to the approved reports and also provides more accurate and easy to use pond modeling. Therefore this program is used throughout this analysis to determine the peak flow rates through the site

Although the detention facilities of Paint Brush Hills accept runoff from over 100 acres of tributary land, the Final Drainage Report used the modified rational method to final design the pond sizes and outlet structures. Sizing these facilities using the modified rational method essentially computes a 100-yr storm event running its entire rainfall distribution in one hour's time. Whereas, per the approved Falcon Area DBPS, the SCS 100-yr design storm to be used within this basin distributes the entire storm event in a 24 hour time period. This modified rational method equates to a much quicker peak flow into the pond, which resulted in an outlet box design that would limit this quick peak flow amount to the allowable release. When the 24 hour storm event was modeled with the as constructed detention ponds, the peak flow into each pond rises much slower and therefore greatly decreases the peak flow out of the pond. Therefore, by designing these facilities using the modified rational method (1 hour storm event), the 24 hour 100 year peak flow out of each pond is much less than the Falcon Hills MDDP design release rate. The SCS method was used within this MDDP model in accordance with the DBPS and previous overall basin drainage studies.

For the recreation of the basin hydrologic model, the basin configuration and characteristics used within the Falcon Hills and Bent Grass MDDPs was exactly matched to Design Point DBPS WN. The Appendix

old DBPS; new DBPS DP JWT120?

includes the basin calculations (composite CN values, times of concentrations, basin areas, etc.) of any basin downstream of this point that has been altered from these previous reports. Basins have been altered to represent the exact grading and drainage patterns of the upstream Paint Brush Hills subdivision and to provide better basin delineation within the proposed The Ranch site. An Existing Conditions Drainage Map is also located in the Appendix to be used in coordination with the following design point descriptions.

Design Point DBPS WN (Q5 = 66 cfs, Q100 = 706 cfs)

As previously mentioned, all of the drainage basins north of this design point (except Basin W-25) were modeled using the exact basin characteristics as approved with the Falcon Hills and Bent Grass MDDPs. The peak flow is slightly less in this model compared to those MDDPs (Q100 = 750 cfs). This small discrepancy is assumed to be from a minor storm distribution error within the previous reports/models.

Design Point DBPS WP (Q5 = 89 cfs, Q100 = 868 cfs)

This design point is located just downstream of DBPS WN, within the main channel of this portion of the Falcon Area Basin. It includes the restricted release from the Paint Brush Hills Pond C (DBPS Pond W27). The allowable release rate from this pond was determined within the Falcon Hills MDDP to be Q5 = 22 cfs and Q100 = 161 cfs. The upstream Basin W-27R was revised with this report to accurately represent the future developed land that will be tributary to this facility. This was done using the approved Final Drainage Report for Paint Brush Hills and the proposed grading plan for that subdivision. The existing pond size and outlet structure design were modeled using the construction documents for the facility. This pond has been constructed, although the proposed home lots tributary to it have not. The existing area tributary to this pond produces much less flow in and therefore flow out of this pond. Therefore the future, developed conditions were used to analysis this facility. As mentioned earlier, all of the ponds on the Paint Brush Hill development were sized and designed using the modified rational method (1 hour storm event). This results in much lower peak outfall rates when modeling the 24 hour duration storm event. The computed outflow of this facility using the Type IIA 24 hour storm is Q5 = 11 cfs and Q100 = 25 cfs. The peak flows at DP WP are less than previously calculated in the Falcon Hills MDDP (Q100 = 1045 cfs) due to the lower peak outfall rate of the detention pond W27.

DBPS existing flow: _____cfs

Design Point DBPS WP1 (Q5 = 89 cfs, Q100 = 882 cfs)

This design point is located downstream of DBPS WP within the main channel of this portion of the Falcon Area Basin, and at the northern boundary line of The Ranch site. This Design Point includes the restricted release from the Paint Brush Hills Pond A (DBPS Pond W33). The basins tributary to this pond and design point have been revised with this report to be in accordance with the Final Drainage Report and grading of the Paint Brush Hills Subdivision. The compiled characteristics (CN, time of concentration, etc.) of any revised basin are included in the Appendix of this report. The allowable release rate from this pond was determined within the Falcon Hills MDDP to be Q5 = 10 cfs and Q100 = 80 cfs. Using the construction drawings to accurately model this pond outlet, the release rate of the 24 hour storm event is only Q5 = 6 cfs and Q100 = 35 cfs. As with Pond W27, this facility reduces the 'historic' flow amount within this channel of the Falcon Area Basin below what was previously calculated with the Falcon Hills MDDP (Q100 = 1070 cfs). This storm runoff at WP1 exits the improved drainage channel between Paint Brush Hills and Stapleton Estates and continues in a south-easterly direction within an unimproved natural drainage corridor through The Ranch site. This design point and downstream reaches directly correspond to the Falcon Area DBPS (Reach W-18 & W-17).

DBPS existing flow: _____cfs

the Grace Community Church property and

Design Point DBPS WP2 (Q5 = 41 cfs, Q100 = 136 cfs)

This design point is located just off the north-east corner of The Ranch site. This location corresponds with the location of DP WP2 in the Falcon Area DBPS, but the Falcon Hills MDDP shows it in a different location. For the purposes of this discussion, the comparison will be with the original DBPS. This flow quantity is the restricted release from Paint Brush Hills Ponds B1 & B2 (DBPS Pond WP3). The basins and reaches tributary to these ponds and design point have been revised with this report to be in accordance with the Final Drainage Report and grading of the Paint Brush Hills Subdivision. The allowable release rate from this pond was determined within the Falcon Hills MDDP to be Q5 = 19 cfs and Q100 = 186 cfs. This pond was designed using the modified rational method as previously described. Using the construction drawings to accurately model this pond outlet, the release rate of the 24 hour storm event is Q5 = 19 cfs and Q100 = 128 cfs. The flows quantities calculated within the original DBPS at WP2 are Q5 = 34 cfs and Q100 = 243 cfs. These lower release rates exit the Paint Brush Hills subdivision thru a 60" RCP pond outfall pipe and drain onto an existing 5 acre home lot within the Meadows Filing Three subdivision. The storm water continues south-west and drains into an existing stock pond and eventually onto The Ranch site toward DP WQ (Reach WS2-1). This existing stock pond is to be removed per the Falcon Area DBPS recommendations, and was not included in the runoff model.

DBPS existing flow: _____cfs

under Stapleton Drive

See previous redlines from here on.

Design Point DBPS WQ (Q5 = 115 cfs, Q100 = 993 cfs)

This design point is located at the confluence point of the reaches W-17 & WS2-1 within the proposed The Ranch site boundary. The basins tributary to this point and within The Ranch boundary have been modified from the previous reports to accurately represent the existing contours and flow paths. Calculations of all of the basin properties (CN numbers, time of concentrations, etc.) can be found within the Appendix of this report. This location of WQ matches both the Falcon Hills MDDP and the DPBS. The peak flow to this point is less than previously calculated in the Falcon Hills and Bent Grass MDDPs (Q100 = 1,340 cfs) due to the detention ponds within Paint Brush Hills reducing the peak flows over what was required. These flows continue south thru the proposed site within the unimproved natural drainage channel.

Design Point DBPS WQ1 (Q5 = 112 cfs, Q100 = 958 cfs)

This design point is located at the south-east corner of The Ranch site boundary. The peak runoff rates at this point are slightly less than the upstream DP WQ because of the increased time it takes the peak flow to pass through Reach Q-Q1. This runoff rate is significantly less than the calculated rate within the most recent approved Bent Grass MDDP study (Q100 = 1,375 cfs). Again, this is due to the detention completed on the upstream Paint Brush Hills Subdivision more than adequately decreasing the peak flows from its development. The Bent Grass MDDP simply added onto the Falcon Hills MDDP HEC computer model and did not take into consideration the exact construction that was done for these Paint Brush Hills detention facilities. This explains the difference in existing runoff rates calculated at this design point.

Currently the 5 acre lots between this south-east corner of the site and the north-west corner of the future Bent Grass subdivision have been constructed and do not contain adequate drainage improvements to convey this historic amount of storm water. The lots that require significant drainage improvements are within the Meadows Filing Three Subdivision. The approved "Final Drainage Report for the Meadows Filing Three," by Ladd Engineering, approved July 200, inaccurately described an easterly outfall for this large amount of flow although the concurrently reviewed and approved "Falcon Area Drainage Basin Planning Study," by URS, reflected a southerly outfall that matches field conditions. The discrepancies in the overall outfall paths were not caught by the El Paso County Development Service's drainage report and construction plan reviews.

Extensive research has shown that all of the previously approved reports that include the subject area, except the "Final Drainage Report for the Meadows Filing Three," by Ladd Engineering, approved July 2000, show the drainage path of this large amount of flow to be as shown on the attached drainage maps. This natural drainage path runs through existing Lots 1, 3, & 4 of Meadows Filing Three and a corner of Lot 6 of Falcon Meadows Filing 1. An existing drainage easement encompasses the rear of Lot 1 Meadows Three, but ends at the southern edge of the lot. The large 225' wide overhead electric easement continues to the south past this point.

A complete research summary chart is included in the Appendix of this report that lists all of the previous drainage studies and findings as it relates to this existing drainage corridor. The report for Filing Three should have recommended channel improvements necessary for this corridor and/or a prudent line development approach of these now existing homes on Lots 1, 3, & 4 (as recommended in the Falcon Area D.B.P.S.). The Final Plat for these lots specifies a "non-build area" due to unsuitable soils, shallow ground water and or shallow bedrock. This non-build area generally matches the existing drainage corridor through these lots. However, this non-build area does not coincide with the prudent line recommendations of the D.B.P.S. (approximately 500' wide area of no development). The existing homes built on Lots 3 & 4 are closer than this recommendation, therefore subject to flooding in a major storm event.

In addition of not specifying the correct drainage path, the Meadows Filing Three construction of the lots and roadways for both the erroneous easterly and southern outfall were not completed per the recommended drainage improvements described in the final drainage report or the approved construction documents for the Meadows Filing Three Subdivision. The construction documents for Towner Avenue calls for a 120" culvert at the erroneous eastern outfall location, however only a 42" culvert was constructed. Also, the Final Plat for this subdivision shows an additional required 120" culvert at the driveway crossing of Lot 5. Nothing was constructed with the home development of Lot 5 as the Final Plat recommends. This was not required to be reviewed or confirmed, only "recommended" the plot plan review by El Paso County. No additional documentation has been found that discusses why these improvements were not completed as the approved plans specify.

Overall, the final drainage report prepared for this Meadows Filing Three subdivision contains numerous errors and incomplete discussion as it comes to this drainage corridor. Also the review and approval by

El Paso County was inadequate in that houses and inadequate drainage facilities were allowed to be constructed within this general drainage corridor determined within the DBPS and reports for this area prior to the Meadows Filing Three drainage report. Also, the County did not require the storm facilities within the Towner Ave. public right-of-way and the culvert required on Lot 5 per the Final Plat to not be constructed per the approved plans.

Multiple meetings have taken place between Classic Consulting and the El Paso County Development Services Department. Channel improvements through these lots of Meadows Filing Three are required and appropriate funding of such improvements is being determined by El Paso County. See Developed Conditions analysis for discussion of these required channel improvements. The Ranch is required to provide on-site detention to maintain a release rate at this location no higher than the calculated historic flow of Q100 = 958 cfs.

Design Point WE (Q5 = 7 cfs, Q100 = 55 cfs)

This design point is located just west of DP WQ1 and was not defined within the original DBPS or Bent Grass MDDP. This Basin WE1 is still within the overall Falcon Area drainage basin, but is found with examining the existing topography to not reach WQ1 as specified within the Bent Grass MDDP and 2015 Falcon DBPS. The developed release at this point must be less than this calculated historic flow amount in order to not cause any downstream drainage issues.

Sand Creek Drainage Basin

The majority of The Ranch site is within the Sand Creek Drainage Basin, more specifically the East Fork of the Sand Creek Basin. There is a substantial amount of off-site runoff coming onto the site from the north (Stapleton Estates). The Stapleton Estates subdivision construction was completed in 1982, therefore the drainage report offered limited flow calculation details, but enough to re-calculate runoff values at the various culverts draining onto the site under Stapleton Drive. Due to the overall size of the tributary basins, the SCS Hydrograph method was used to quantify runoff rates. The Sand Creek DBPS does not detail the existing basins or calculate any design points within this minor tributary branch of the East Fork of Sand Creek. The DBPS does identify three reach segments (94, 194 & 194A) shown on the Existing Drainage Map, but does not list the flow rates calculated within these reaches. Therefore, the runoff rates calculated within this existing condition analysis will be held as the allowable release rates of any proposed development on The Ranch site.

Design Point SC-1 (Q5 = 27 cfs, Q100 = 171 cfs)

This design point is located west of Falcon DBSP WP1, along the northern boundary of the proposed site. The design point is the total flow tributary to Reach 94A from the existing Stapleton Estates subdivision to the north. There are five existing storm culverts that convey this runoff onto the proposed site. These culverts are discussed in more detail in the Proposed Conditions portion of this report. This runoff continues to the south within the natural unimproved drainage channel toward SC-3.

Design Point SC-2 (Q5 = 23 cfs, Q100 = 130 cfs)

This design point is located at the north-west corner of the proposed site, west of SC-1. The Stapleton Estates drainage report does not specify the drainage outfall for the portion of Basin SC-SF on the west side of Raygor Road. However, it was determined that this area also drains through the existing 36" CMP culvert at this location with the rest of Basin SC-SF. This runoff continues directly south in a natural channel (SC-194) toward DP SC-6.

Design Point SC-3 (Q5 = 26 cfs, Q100 = 193 cfs)

This design point is located downstream of SC-1, after Reach SC-94A. This design point includes the existing Basin SC-G. Reach 94 has been split up into SC-94A & SC-94B within this report due the existing topography available with this report. This change in flow direction may be a result of the man-made diversion berms built within the proposed site; however this runoff still reaches the same ultimate point (SC-6). The storm water continues to the south-west toward SC-4 within the natural channel.

Design Point SC-4 (Q5 = 28 cfs, Q100 = 214 cfs)

This design point is comprised of the flows at SC-3 plus Basin SC-H. From this point, runoff continues south-west within Reach SC 4-6, combining with that from SC-2 prior to entering the existing large stock pond at DP SC-6.

Design Point SC-6 (Q5 = 53 cfs, Q100 = 405 cfs)

This design point is located at the existing large stock pond at the confluence point of the DBPS Reaches 194 & 94. This stock pond contains all the flows from SC-4 & SC-2, as well as Basins SC-I and SC-J. Per the existing topography completed with this report, this stock pond holds about 2.5' depth of water before the water begins to overtop a break in the embankment and continue to the south-west toward SC-7. The

DBPS requires that this pond be removed or made into a permanent facility with adequate pond design. For the purposes of quantifying the historic storm water release at the downstream end of the site, the minor detention this stock pond provides has been ignored, as is typically done with this type of existing impoundment. For more discussion on the detention of this existing stock pond, see Proposed Conditions Design Point SC-7.

Design Point SC-7 (Q5 = 52 cfs, Q100 = 418 cfs)

This design point is located downstream of SC-6, at the south-west corner of The Ranch site boundary. This large amount of flow exits The Ranch site north of the SW corner as shown on the Existing Drainage Map, which corresponds exactly with the Sand Creek DBPS. Sheet EF-34 from the Sand Creek DBPS is included in the Appendix of this report to verify the established drainage path. There are two existing drive aisle/driveways located just off The Ranch site along this SC-194A flow path. A site visit was made to ascertain the existing storm improvements at these crossings, but access to these private properties was not obtained. However from a distance, it does not seem like there are any adequate drainage improvements made to convey this existing runoff amount. Visual observation of minor downstream, degradation directly adjacent to the site is evident. Further downstream conditions appear stable. The homes to the west are very large lot homes and were not required to complete a final drainage report, resulting in no information available pertaining to any improvements made. The Sand Creek DBPS does recommend reimbursable channel improvements for this Reach 194A, but improvements have not been completed through this adjacent lot.

The following design points provide the existing condition release rates onto the existing Falcon Meadows Filing 1 Subdivision to the south. These points are analyzed again within the Developed Condition portion of this report to discuss the impacts to this existing subdivision with the proposed The Ranch development. The Modified Rational Method was used to quantify flows from the small basins, whereas the SCS Hydrograph method was used to quantify the larger basins. The following chart identifies the tributary basins and historic runoff amounts at each of these outfalls.

Design Point	Q5 (cfs)	Q100 (cfs)	Tributary Basin	Tributary Area (acres)	Calculation Method
SC-8	8	20	SC-K	10.85	Rational
SC-9	14	34	SC-M	19.33	Rational
SC-10	5	13	SC-N	7.44	Rational
SC-11	14	35	SC-O	20.61	Rational
SC-12	6	49	SC-P	67.07*	SCS
SC-13	5	12	SC-Q	5.53	Rational
SC-14	8	62	SC-R	81.72*	SCS
SC-15	4	10	SC-S	3.57	Rational

* SCS method was used on these basins with less than 100 acres to provide more conservative historic/allowable release rates.

PROPOSED DRAINAGE CONDITIONS

There has been no change to the overall Falcon Area/Sand Creek Basin delineation line with the proposed condition analysis of this Master Development Drainage Plan. Composite C and CN values were determined for all of the proposed basins by using the sketch plan proposed land uses. Time of concentrations, impervious values, and all other basin and design point calculations can be found within the Appendix of this report. Construction phasing of The Ranch site is believed to be from the north-east of the site toward the south-west. Any required drainage facilities and how they relate to the construction phasing will be discussed within the Final Drainage Report for such development.

Falcon Area Drainage Basin

The Falcon Area DBPS states that any development more dense than 5 acre single-family home lots shall provide its own detention of the increased storm water from the development. Two alternative design concepts relating to the channels were presented in the DBPS. The DBPS recommended a "prudent line" approach for development along the main channel within the site (Reaches W-17, W-18, & Q-Q1). However the selected plan is for the main channel within the Falcon Area Basin is (Alternative 'B') a 100-year storm event improved channel with grade control structures that reduce the longitudinal slope to 1.0% or less. See the Channel Improvements Section for more details on the Falcon Basin channel through the site.

This is from the old DBPS?

The Developed Conditions analysis within the Falcon Area Basin was completed using the Modified Rational Method. This is because all of the proposed detention facilities facilitate less than 100 acres of tributary land. These facilities are "off-line" from the major channel running through the site. Since all of the detention facilities release at or below historic runoff amounts from the same area of land, the flows within the channel section will never be larger than that calculated within the Existing Condition SCS analysis. Design points within the channel (CH-1 thru CH-6) are calculated using the modified rational method in order to compare the on-site flows before and after the proposed development and recommended improvements.

Design Point 1 (Q_5 = 25.0 cfs, Q_{100} = 111.2 cfs) is the specified release rate of Paint Brush Hills Pond B2, taken directly from the approved final drainage report for the site. This runoff is directed onto the adjacent Meadows Filing Three home lot via an existing 60" RCP pond outfall pipe. This runoff continues in a south-western direction across the existing 5 acre lots of Meadows Filing Three and into the existing stock pond located just outside of the site boundary (Design Point 3). With the proposed The Ranch development, Stapleton Road is to be extended into the proposed site from the existing end of roadway (approximately at DP-1). Any roadway construction over this existing 60" RCP shall maintain this pipes functionality.

Design Point 2 (Q_5 = 7.4 cfs, Q_{100} = 16.8 cfs) is the runoff to the south from Paint Brush Hills Basin OS-O, 10.16 acres of overhead electric easement area and back of home lots. This runoff currently enters the site via surface flow and follows the natural drainage path into the stock pond at Design Point 3. With the construction of Stapleton Road, a 24" RCP culvert at 1.0% minimum is capable of conveying this runoff under the roadway and into its natural drainage path toward DP-3. If applicable at time of development, this culvert may be connected into the proposed storm from DP-5a and release directly into the improved channel.

Design Point 3 (Q_5 = 36.9 cfs, Q_{100} = 137.4 cfs) is the combined flow from Design Point 1, Design Point 2, and Basin OS-B, 11.80 acres of existing 5 acre home lots within the Meadows Filing Three subdivision. These flows combine in an existing stock pond located halfway within an existing lot of Meadows Filing Three and halfway in the existing overhead electric easement along the eastern 225' of the proposed site. This stock pond is to be removed per the Falcon Area DBPS recommendations. Coordination with the property owner will be necessary. Final development design and reports are to discuss in more detail.

These flows continue south-west from this point within a natural channel in the electric easement toward DP-4a.

Design Point 4a/4b (Q_5 = 40.4 cfs, Q_{100} = 144.6 cfs) Design Point 4a is the combined flows of DP-3 plus Basin UN-1, 9.61 acres of existing electric easement land that is not to be developed. This existing runoff at this point is to be picked up by a proposed 60" RCP running @ 0.7% minimum slope. This storm pipe is to release this 'off-site' existing runoff directly into the improved channel section. Detention/storm water quality is not needed for this runoff since it has already been treated in Paint Brush Pond B2 and the remainder is from off-site large lot or undeveloped land. Design Point 4b is the point of release into the improved channel.

Design Point 5a (Q_5 = 34.4 cfs, Q_{100} = 78.7 cfs) is the specified release rate from an existing 42" RCP from Paint Brush Hills. This runoff is from approximately 47 acres of existing home lots within the Paint Brush Hills Subdivision and is approved to release directly onto the proposed The Ranch site with no detention; due to the over detention incorporated into other Paint Brush Hills detention facilities. A proposed 42" RCP at 0.7% minimum slope is to connect to this existing 42" pipe and release the existing off-site flows directly into the improved drainage channel (DP-5b). This 42" RCP is to be installed within the proposed Stapleton Drive roadway.

Design Point 5b (Q_5 = 50.2 cfs, Q_{100} = 107.2 cfs) combines the existing runoff from DP-5a with the developed flows from Basin FA-S. Basin FA-S represents a portion of the proposed Stapleton Drive roadway. It was determined that routing the developed flows from this portion of roadway into the 42" RCP from 5a is more ideal than a separate storm system conveying these flows into a proposed pond. Final design of the roadway may dictate a need to revise the routing of Basin FA-S flows. This will be discussed with a future final drainage report for any development.

Design Point 6a (Q_5 = 68.2 cfs, Q_{100} = 161.8 cfs) is the flow into proposed detention/storm water quality Pond FA-A. The developed runoff from the entire Basin FA-1, 57.12 acres of 1-3 DU/Ac. single family residential, is to be conveyed to Pond FA-A. A storm system separate from that of DP-4a/4b is to be designed to intercept and convey all developed runoff to the pond. This system and pond design will be detailed in the final drainage report associated with any development within Basin FA-1. Pond FA-A is estimated to be 3.42 ac.-ft. in size including 0.82 ac.-ft. for storm water quality (57.12 acres @ 27.5%

impervious). A Table detailing the estimated sizes of all the proposed detention ponds is located within the Appendix of this report. ***Design Point 6b*** (Q_5 = 25.8 cfs, Q_{100} = 71.7 cfs) represents the less than historic release of this pond into the improved channel. This is less than historic to account for the direct release of Basins FA-5 & FA-S into the channel with no detention.

Design Point 7a (Q_5 = 32.0 cfs, Q_{100} = 66.3 cfs) is the flow into proposed detention/storm water quality Pond FA-B. The developed runoff from Basin FA-2, 12.39 acres of 5-8 DU/Ac. single family residential, is to be conveyed to the pond. Pond FA-B is estimated to be 1.24 ac.-ft. in size including 0.32 ac.-ft. for storm water quality (12.39 acres @ 65.0% impervious). The storm system and pond design will be detailed in the final drainage report associated with any development within the basin. ***Design Point 7b*** (Q_5 = 8.4 cfs, Q_{100} = 21.0 cfs) represents the historic release rate of this basin into the improved channel. The historic release rate calculations for each basin/pond are included in the Hydrologic Calculations within the Appendix of this report. This runoff continues south within the channel.

Design Point 8a (Q_5 = 30.6 cfs, Q_{100} = 64.4 cfs) is the flow into proposed detention/storm water quality Pond FA-C. This facility receives runoff from Basin FA-3, 14.29 acres of 3-5 DU/Ac. single family residential and adjacent roadways. Pond FA-C is estimated to be 1.24 ac.-ft. in size including 0.27 ac.-ft. for storm water quality (14.29 acres @ 44.2% impervious). The storm system and pond design will be detailed in the final drainage report associated with any development within the basin. ***Design Point 8b*** (Q_5 = 8.5 cfs, Q_{100} = 21.2 cfs) represents the historic release rate of this basin into the improved channel.

Design Point 9a (Q_5 = 57.6 cfs, Q_{100} = 145.5 cfs) is the flow into proposed detention/storm water quality Pond FA-D. The developed runoff from Basin FA-4, 41.55 acres of 2-3.5 DU/Ac. single family residential and 7 acre park site, is to be conveyed to the pond. Pond FA-D is estimated to be 3.49 ac.-ft. in size including 0.60 ac.-ft. for storm water quality (41.55 acres @ 27.4% impervious). The storm system and pond design will be detailed in the final drainage report associated with any development within the basin.

Design Point 9b (Q_5 = 15.2 cfs, Q_{100} = 44.9 cfs) represents the less than historic release rate of this basin into the improved channel. The release rate is less than historic to account for the direct release of Basins FA-S & FA-5. This runoff continues south within the channel.

Design Point FA CH-1 (Q_5 = 17.3 cfs, Q_{100} = 42.1 cfs) Design Point CH-1 is not the total amount of water within the channel. These design points (CH-1 thru CH-6) are used to compare historic site runoff to developed/restricted site runoff. This point consists of Basin OS-A flows. Basin OS-A is 22.56 acres of off-site undeveloped land and the backs of existing home lots of Paint Brush Hills. This flow is to enter the channel via a roadside swale along the north of Stapleton Road. Development within Basin OS-A (church parcel) shall release flows at or below historic values. At this point, the channel crosses under proposed Stapleton Road via a 15' x 4' (width x height) box culvert or equivalent culvert able to convey Q_{100} = 882 cfs, as calculated in the Existing Condition portion of this report.

Design Point FA CH-2 (Q_5 = 96.2 cfs, Q_{100} = 269.4 cfs) This design point consists of flows from DP CH-1, DP 4b, DP 5b, and DP 7b. This is not the total flow within the channel; rather it is the flow only from the proposed site and the restricted upstream release from Paint Brush Hills (DP 1, 2 & 5A). The historic on-site only flow at this point is Q_5 = 85.6 cfs and Q_{100} = 252.0 cfs. The difference is negligible when you consider the total flow within the channel, approximately 993 cfs, and the proposed ultimate improvements to stabilize the channel. A roadway crossing is proposed at this location where an 18' x 4' (width x height) box culvert or equivalent culvert shall be installed.

Design Point FA CH-3 (Q_5 = 98.5 cfs, Q_{100} = 273.7 cfs) This design point consists of flows from DP CH-2 and DP 8b. The total flow at this point within the channel is at most 993 cfs. A roadway crossing is also proposed at this location where another 18' x 4' box culvert or equivalent culvert shall be installed.

Design Point FA CH-4 (Q_5 = 113.3 cfs, Q_{100} = 315.0 cfs) This design point consists of flows from DP CH-3 and DP 6b. These flows continue south within the improved channel. At this time there is not a roadway crossing proposed at this location. The historic on-site only flow at this point is Q_5 = 110.0 cfs and Q_{100} = 309.7 cfs. The difference is negligible when you consider the total flow within the channel, approximately 975 cfs.

Design Point FA CH-5 (Q_5 = 117.7 cfs, Q_{100} = 328.9 cfs) Design Point CH-5 is not the total amount of water within the channel. These design points (CH-1 thru CH-6) are used to compare historic site runoff to developed/restricted site runoff. This design point consists of flows from CH-4 and DP-9b. Any runoff from Basin UN-2, the existing electric easement corridor where development is not allowed, is negligible as the amount will be the same in existing and developed conditions. At this point, the channel crosses

under proposed Woodmen Hills Drive via a 17' x 4' (width x height) box culvert or equivalent culvert able to convey Q_{100} = 958 cfs, as calculated in the Existing Condition portion of this report.

Design Point FA CH-6 (Q_5 = 122.0 cfs, Q_{100} = 336.6 cfs) This design point consists of flows from DP CH-5 and the direct, un-detained release of Basin FA-5. Basin FA-5, 8.59 acres of proposed roadway and open space is required to provide its own storm water quality facility to treat the drainage from the roadway. This facility is estimated as being 0.134 ac.-ft. based upon 8.59 acres @ 31.6% impervious. The historic on-site only flow at this point is Q_5 = 122.1 cfs and Q_{100} = 337.1 cfs. The overall developed release into the improved channel is less than the historic site only flow amount. This is due to the over detention incorporated into ponds FA-A & FA-D. The total amount of storm water in the channel at this point corresponds to DBPS WQ1 (Q_5 = 112 cfs, Q_{100} = 958 cfs). See the Channel Improvements Section for more details on the Falcon Basin channel through the site and the recommendations for the required off-site channel improvements downstream from this design point.

Design Point WE (Q_5 = 3.1 cfs, Q_{100} = 7.5 cfs) This design point corresponds with WE of the Existing Condition analysis. Basin FA-WE, 2.18 acres of single family home lots (2.5 acres/lot) drains via surface flow to this design point. This outfall point onto the existing Meadows Filing 1 lot has been substantially reduced with the proposed development and drainage improvements, therefore no detention is required. Storm water quality is not required for this basin as the proposed land use is low density residential. This runoff continues south in its existing drainage path.

Basin UN-2 (Q_5 = 19.1 cfs, Q_{100} = 47.5 cfs) This Basin is within The Ranch site boundary but as mentioned earlier is a 225' existing overhead electric easement and development within this area is prohibited. Any The Ranch development adjacent to UN-1 or UN-2 shall account for tributary flows from these basins as necessary.

Sand Creek Drainage Basin

The Sand Creek DBPS also requires any development more dense than 5 acre single-family home lots provide its own detention of the increased storm water from the development. The Ranch site is in an upper reach of the East Fork of Sand Creek. The upstream limit of the DBPS study is at the existing large stock pond within the site (See Sheet EF-34 of DBPS in Appendix). Improvements to Reaches/Channel sections 94 & 194 are not identified as reimbursable nor does the DBPS recommend specific

improvements. Based upon the quantity of flow within these reaches, we feel that these improvements may be reimbursable and future drainage reports shall discuss any revision to the drainage fees as deemed necessary. The developer will finance a restudy of the Sand Creek Basin in accordance with the process outlined in Volume 1 of the City/County Drainage Criteria Manual. Until such time as that report is approved by El Paso County, fee and reimbursement will be based upon the current approved Sand Creek Drainage Basin Planning Study. The Reach/Channel section downstream from the stock pond, 194A, is 100% reimbursable and is to include a minimum of (2) grade control structures as recommended in the Sand Creek DBPS. See the Channel Improvements Section for more details on the Sand Creek channel through the site.

The Developed Conditions analysis within the Sand Creek Basin was completed using the SCS Hydrograph Method. This is due to the large amount of area (over 100 acres) being tributary to both proposed detention ponds within the Sand Creek Basin. Also, the proposed channel will receive developed runoff prior to entry into the large Detention Pond SC-A. Using the SCS method allows us to quantify the total within the channel at the specific design points. The Modified Rational Method was used to determine the runoff of the small basins along the southern site boundary.

Design Point SC-1 & SC CH-1 (Q_5 = 27.2 cfs, Q_{100} = 171.4 cfs) is no different than SC-1 calculated within the Existing Conditions portion of the report. This flow quantity does include the off-site runoff from Basins SC-SA, SC-SC, SC-SD, & SC-SE for simplicity sake. At this point, an existing 36" CMP conveys the drainage from SC-SB under existing Stapleton Road and into the proposed channel. At ***DP-A***, an existing 36" CMP pipe conveys the historic runoff from Basin SC-SA under existing Stapleton Road and onto the adjacent off-site parcel (church site). Any development of this parcel shall provide for continual acceptance of this off-site runoff and direct it to a proposed storm sewer where it can be conveyed into the channel. At ***DP-C***, an existing 18" CMP culvert releases the runoff from Basin SC-SC under Stapleton roadway and onto the proposed site. Any development of the proposed 2.5 acre lots shall account for this runoff and direct it accordingly into a storm sewer/channel. The same goes for ***DP-D*** and ***DP-E***, where existing 24" CMP culverts convey the historic flow onto the proposed 2.5 acre lots. Drainage swales shall be installed as necessary to direct these off-site flows around any home lots and into adequate downstream facilities. Final design of such improvements shall be completed at the time of parcel development.

Design Point SC-2 (Q_5 = 23.3 cfs, Q_{100} = 129.8 cfs) is no different than SC-2 calculated within the Existing Conditions portion of the report. This off-site runoff is conveyed onto the proposed site via an existing 36" CMP under Stapleton Dr. Due to the relatively large amount of flow at this location, it is recommended that a storm pipe is installed at this location and directs this runoff directly into the proposed channel at SC CH-2. This storm pipe will be installed within the roadway and can accept developed flow from Basin SC-A as determined necessary. Development of Basin SC-A may dictate an alternate conveyance method to convey this off-site flow to the channel. Proposed storm sizes are not specified as an over lot grading of the parcels has not been completed and exact site and storm configuration is to be determined at a later date.

Design Point SC CH-2 (Q_5 = 62.2 cfs, Q_{100} = 370.8 cfs) consists of flows from SC CH-1 and Basin SC-A. Basin SC-A is 51.91 acres of 2.5 acre lots, 1-2 DU/Ac. parcel, surrounding roadways, and open space. As previously stated, the exact layout and grading of this parcel is unknown at this time. Therefore a storm pipe is shown for conceptual purposes only through this parcel. Exact details will be determined at the final drainage report state for this development area. A roadway crossing is proposed at this location where an 8' x 4' (width x height) box culvert or equivalent culvert shall be installed. See the Channel Improvement Section for more details about the proposed channel section throughout this corridor. Development of the surrounding parcels may change the point of which flows reach the channel, however this is negligible at this time since only conceptual drainage solutions are being proposed.

Design Point SC CH-3 (Q_5 = 88.8 cfs, Q_{100} = 480.8 cfs) consists of flows from SC CH-2 and Basin SC-B. Basin SC-B is 101.18 acres of the adjacent off-site parcel, 2.5 acre lots, a 50 acre 2-3 DU/Ac. parcel, surrounding roadways, parks, and open space. Storm pipes are shown throughout this basin for conceptual purposes only. Site grading has not been completed so it is not possible to know the locations of the storm sewer. All developed runoff from this basin shall be conveyed adequately into the proposed channel via storm pipes and channels. Any development on the adjacent off-site parcel (church parcel) included in this basin shall release storm water at no more than historic rates. A roadway crossing is proposed at this location where a 10' x 4' (width x height) box culvert or equivalent culvert shall be installed.

Design Point SC CH-4 (Q_5 = 105.4 cfs, Q_{100} = 576.6 cfs) consists of flows from SC CH-3 and Basin SC-C. Basin SC-C is 59.88 acres of a proposed 2-3.5 DU/Ac. parcel, a 3-5 DU/Ac. parcel, a 5-8 DU/Ac. parcel, surrounding roadways, a park, and open space. Again, storm pipes are shown throughout this basin for

conceptual purposes only. The existing major basin delineation line was maintained in the developed condition analysis. Site grading of these parcels along this line shall be completed to maintain this delineation as best as possible. Final drainage reports for these parcels will detail the exact drainage patterns of the developments. See the Channel Improvement Section for more details about the proposed channel section throughout this corridor.

Design Point SC CH-5 (Q_5 = 109.5 cfs, Q_{100} = 616.5 cfs) consists of flows from SC CH-4 and Basin SC-D. This flow amount is the total amount of inflow into proposed **Detention Pond SC-A**. Basin SC-D is 41.76 acres of a proposed 2-3 DU/Ac. development, surrounding roadways, and open space. A conceptual storm system is shown picking up the runoff from the adjacent portion of Raygor Road to this parcel. Pond SC-A is to be used to over-detain the developed runoff to this point and to provide storm water quality for the aforementioned development. Pond SC-A is estimated to be 29.55 ac.-ft. in size including 4.41 ac.-ft. for storm water quality (468.19 acres @ 15.2% impervious). Since the Sand Creek D.B.P.S. calls for this pond to be made into a permanent facility, it shall be reimbursable and owned and maintained by El Paso County.

Design Point SC CH-6 (Q_5 = 8.2 cfs, Q_{100} = 125.9 cfs) is the restricted release from Pond SC-A. This release is restricted to much lower than historic rates to decrease the amount of runoff existing the site at SC CH-7. There have been reported drainage issues of the existing off-site lots located within this downstream channel corridor; therefore reducing the release rate will benefit these existing home owners. See the Channel Improvement Section for more details about the proposed channel section downstream of Pond SC-A. A box culvert crossing of proposed Raygor Road is necessary along this stretch between CH-6 and CH-7. A 5' x 3' (width x height) box culvert or equivalent is required to convey this runoff.

Detention Pond SC-B (Q_5 = 61.7 cfs, Q_{100} = 219.1 cfs) consists of flows from Basin SC-E, 130.24 acres of 2-3.5 DU/Ac. residential, surrounding roadways, and the historic release of a 10 acre school site. The 10 acre school site is required to have its own detention/storm water quality facility and shall release no more than historic flow into the storm system of Basin SC-E. This storm system is to also pick up the developed runoff from Woodmen Hills Drive and The Ranch Drive prior to release into Pond SC-B. Pond SC-B is estimated to be 9.52 ac.-ft. in size including 2.08 ac.-ft. for storm water quality (130.24 acres @ 32.8% impervious). The release rate of this pond is to be at or below the historic rate, estimated within this report as Q_{100} = 85 cfs.

Design Point SC CH-7 & SC-7 (Q_5 = 16.6 cfs, Q_{100} = 203.8 cfs) is the overall release into the downstream channel corridor from the proposed site. This includes the restricted release from both Ponds SC-A & SC-B, plus the direct release from Basin SC-F. Basin SC-F is 15.25 acres of Raygor Road, 2-3 DU/Ac. residential, and open space. Storm water quality shall be provided for all developed flows from Basin SC-F, although detention is not required.

This value is much smaller than the historic quantity modeled without stock pond detention (Q_{100} = 418 cfs) in order to lessen the burden to the downstream home lots within this downstream, DBPS defined, corridor. For discussion purposes, the existing stock pond was modeled with the existing tributary basins to determine its detention effect. The historic release at this location with the existing stock pond incorporated is Q_5 = 6 cfs and Q_{100} = 300 cfs. Therefore, the proposed detention facility maintains an overall site release of less than historic even with the minor detention of the existing stock pond. The Sand Creek DBPS did not incorporate the detention of this existing stock pond in its hydrologic modeling. As mentioned within the Existing Condition portion of the report, Sheet EF-34 from the Sand Creek DBPS is included in the appendix of this report to show the defined drainage corridor of this flow. As can be seen from this DBPS map and the Proposed Condition Drainage Map, an 8' x 8' box culvert is to be installed at the intersection of this channel and the new Woodmen Hills Drive roadway. This intersection is off of the proposed site boundary, but improvements shall be detailed with any development of this roadway over the existing drainage path. Due to the decrease in storm water at this point, this box culvert can be reduced in size to a 5' x 4' (width x height) or equivalent.

The following design points correlate directly to those of the Existing Condition analysis. These points compare the developed release rates to the existing release rates onto the Falcon Meadows Filing 1 Subdivision south of the site. The Modified Rational Method was used due to the small basin sizes. Storm water quality is not required at any of these release points due to the proposed land use being low density residential (2.5 acre home lots).

Design Point SC-8 (Q_5 = 0.0 cfs, Q_{100} = 0.0 cfs) The flow to this release point has been cut off by the proposed Woodmen Hills Drive roadway and been routed to Pond SC-B. As mentioned earlier, there have been downstream drainaged issues at this existing home lot south of SC-8. With the development of The Ranch, any flooding due to the flows from The Ranch site is resolved.

Design Point SC-9 (Q_5 = 3.4 cfs, Q_{100} = 8.1 cfs) The flow to this release point is from 3.81 acres of low density residential (2.5 acre lots). This release rate is substantially less than historic due to the proposed Woodmen Hills Drive cutting off the area that is tributary to this point in the existing conditions. Downstream facilities will benefit from this reduction of off-site flow.

Design Point SC-10 (Q_5 = 5.0 cfs, Q_{100} = 12.0 cfs) The flow to this release point is from 5.18 acres of low density residential (2.5 acre lots). This release rate is just less than historic and is therefore acceptable to release south without detention.

Design Point SC-11 (Q_5 = 3.3 cfs, Q_{100} = 8.0 cfs) The flow to this release point is from 3.74 acres of low density residential (2.5 acre lots). This release rate is substantially less than historic due to the proposed Woodmen Hills Drive cutting off the area that is tributary to this point in the existing conditions. Downstream facilities will benefit from this reduction of off-site flow.

Design Point SC-12 (Q_5 = 6.5 cfs, Q_{100} = 15.7 cfs) The flow to this release point is from 6.10 acres of low density residential (2.5 acre lots). This release rate is substantially less than historic due to the proposed Woodmen Hills Drive cutting off the large area (67.07 acres) that is tributary to this point in the existing conditions. Downstream facilities will benefit from this reduction of off-site flow.

Design Point SC-13 (Q_5 = 4.1 cfs, Q_{100} = 9.9 cfs) The flow to this release point is from 4.29 acres of low density residential (2.5 acre lots). This release rate is just less than historic and is therefore acceptable to release south without detention.

Design Point SC-14 (Q_5 = 9.6 cfs, Q_{100} = 23.2 cfs) The flow to this release point is from 10.32 acres of low density residential (2.5 acre lots). This release rate is substantially less than historic due to the proposed Woodmen Hills Drive cutting off the large area (81.72 acres) that is tributary to this point in the existing conditions. Downstream facilities will benefit from this reduction of off-site flow.

Design Point Pond SC-15 (Q_5 = 0.0 cfs, Q_{100} = 0.0 cfs) The flow to this release point has been cut off by the proposed Woodmen Hills Drive roadway and been routed to SC CH-7. As mentioned earlier, there have been reported downstream drainage issues at this existing home lot south of SC-8 & SC-15. With the development of The Ranch, and reduction/elimination of northerly tributary flows, downstream drainage issues should be resolved.

The following chart compares the historic runoff amounts at these points to the developed.

Design Point	Historic Q5 (cfs)	Historic Q100 (cfs)	Developed Q5 (cfs)	Developed Q100 (cfs)
SC-8	7.8	19.5	0.0	0.0
SC-9	13.6	33.7	3.4	8.1
SC-10	5.4	13.4	5.0	12.0
SC-11	14.1	35.1	3.3	8.0
SC-12	6.1	48.7	6.5	15.7
SC-13	4.7	11.7	4.1	9.9
SC-14	7.8	62.1	9.6	23.2
SC-15	3.9	9.6	0.0	0.0

PROPOSED CHANNEL IMPROVEMENTS

Falcon Basin Channel

The Falcon Area DBPS provided recommendations as to the channel improvements that shall be installed along the entire Falcon Basin. For the West Tributary, including the channels within the proposed The Ranch site, the DBPS recommends the alternative of the Prudent Line approach. The conceptual channel drawings, from the DBPS, showing the prudent line setback are included in the Appendix of the report. Also recommended is to remove all existing 'diversion berms' along the channel and to install various 3.0' grade control drop structures. This prudent line approach results in a corridor of approximately 500 LF wide, along the entire stretch of the channel to be non-developable. The Ranch developer would like this corridor to be less wide; therefore we are proposing the other option presented in the DBPS; a 100-year storm event improved channel with grade control structures that reduce the longitudinal slope to 1.0% of less. The improvements associated with the Prudent Line approach were deemed reimbursable by the Falcon Area DBPS. However, the proposed channel improvements recommended within this report are

more cost intensive. Therefore, a revision to the drainage basin fees will be necessary in order for the developer to be reimbursed the entire cost of construction for the stabilized channel.

Per the Existing Condition analysis within this report, the total storm water within the Falcon Area channel varies between 882 cfs and 993 cfs. A typical channel section is proposed that can convey this range of storm water. This channel is to be grass lined and have a longitudinal slope of only 0.50%. Special attention was made in determining this cross section to the allowable shear stress of an all grass channel (1.0 psf). Drop structures with appropriate riprap and concrete check dams will be installed as necessary to make up the vertical difference. The drop structures are conceptually shown on the drainage map (6.0' fall per drop at 10% maximum slope, width is less than or equal to standard bottom width). A bottom of channel width of 50.0' is required, with 4.5' in height side slopes (4:1 maximum). A total of 34' is provided for maintenance access roads and additional 'wiggle room' in the preliminary channel design. This equates to a 120.0' wide corridor which is provided within the concept plan for the proposed site. The typical cross section can be seen on the Proposed Condition Drainage Map. Details of the final channel design including transitions to roadway culvert crossings, drop structures, and maintenance access shall be provided in future final drainage reports or a channel design report.

As previously discussed, the drainage corridor downstream of The Ranch site (FA CH-6) through the existing Meadows Filing Three Subdivision is inadequate to convey the historic storm runoff. Houses have been developed on these existing lots of the Meadows Filing Three Subdivision and two of them (Lots 3 & 4) have significant flooding potential in a major storm event. Channel improvements are necessary through this corridor in order to safely convey the historic storm runoff into the future Bent Grass Subdivision. A conceptual section is recommended in this report that consists of a total corridor width of 62'. This includes a 20' bottom width, 15' of 3:1 side slope on both sides (5.0' deep channel), and a 12' access road on the east side of the corridor. The entire channel is to be riprap stabilized and on the existing natural longitudinal slope of approximately 2.1%. Keeping the channel at the natural slope limits the extents of the grading needed outside of the proposed corridor, but it does increase the velocity and shear stress (which is why the entire channel is to be riprap stabilized). This channel section provides a water surface depth of 3.5', leaving 1.5' of available freeboard to the top of the channel. A calculated required freeboard for this channel is 1.36'; therefore this design is suitable to convey the historic flow of approximately 1,000 cfs. A separate drainage map is included that shows these required off-site channel improvements.

No channel improvements are necessary from Design Point 4A to the proposed Falcon Channel. The DBPS shows the prudent line approach through this corridor; however a 60" storm pipe is proposed to direct this off-site flow directly into the improved channel. Development of Basin FA-1 may dictate an alternative design however.

Sand Creek Channel

The western portion of the proposed The Ranch site is in an upper reach of the East Fork of Sand Creek. The upstream limit of the DBPS study is at the existing large stock pond & proposed Pond SC-A location (See Sheet EF-34 of DBPS in Appendix). Improvements to the channel sections upstream of this pond are not reimbursable nor does the DBPS recommend specific improvements. The Reach/Channel section downstream from the stock pond is 100% reimbursable and is to include a minimum of (2) grade control structures and selective riprap lining as recommended in the Sand Creek DBPS. The reimbursable cost in Table VIII-3 of the Sand Creek DBPS is $185,700 (100% of the estimated cost of construction at the time of the DBPS). However, as with the Falcon channel, the recommended channel improvements not only for this section downstream of the pond, but for the upper proposed channel improvements are much more cost intensive than the reimbursable cost within the DBPS. Therefore, a revision to the drainage basin fees will be necessary in order for the developer to be reimbursed the entire cost of construction for the channels within Sand Creek.

Per the Developed Condition analysis within this report, the total storm water within this channel varies at different points along the corridor. A typical channel section is proposed that has a varying bottom width that corresponds with the varying 100 year storm flows. This channel is to be grass lined and have a longitudinal slope of only 0.50%. Special attention was made in determining this cross section to the allowable shear stress of an all grass channel (1.0 psf). Drop structures with appropriate riprap and concrete check dams will be installed as necessary to make up the vertical difference. The bottom of channel width varies from 5.0' – 25.0'. The entire length of channel is to have 4:1 maximum side slopes of 4.5' in height. Also a total of 30' is provided for maintenance access roads and additional 'wiggle room' in the preliminary channel design. The total width varies from 71.0' – 91.0' and has been provided for in the concept plan for The Ranch. The typical cross section and corresponding bottom and total widths along the corridor can be seen on the Proposed Condition Drainage Map. Details of the final channel design including transitions to roadway culvert crossings and drop structures shall be provided in future

final drainage reports or a channel design report. 6.0' sloping drop structures (10% maximum slope) are schematically shown on the drainage map.

CONSTRUCTION PHASING

Exact phasing of parcel development is unknown at this time, but generally development is to occur starting from the north-east corner of the site and continuing towards the south-west corner. Since the Falcon Area Basin channel through the site conveys the historic flow release rates, complete construction of the channel is not needed as development begins at the most upstream end. Each parcel within this basin is to provide its own detention storm water quality pond that releases at or below historic rates. Channel construction is required as adjacent parcels to the channel are developed in order to achieve the desired alignment and 180' trail/drainage corridor as proposed. Transitions from the limits of channel construction to the existing natural channel shall be described in applicable final drainage reports and appropriate erosion control measures shall be implemented.

However, in the Sand Creek Drainage Basin, development of any parcel will require construction of the proposed detention pond SC-A and the entire channel improvements to the limits of the developed parcel. Since the proposed channel conveys the developed runoff (not historic as in Falcon Basin), channel improvements are necessary to prevent significant erosion of the natural channel. The channel downstream of Pond SC-A shall also be constructed with any development to ensure an adequate release corridor to downstream facilities from the proposed site. More detail of construction phasing of all drainage facilities shall be provided in the subsequent final drainage reports for any development.

STORM WATER QUALITY

Storm water quality is required for all proposed development greater than low density residential (2.5 – 5 acre lots). Full-spectrum detention for all proposed development will be provided. Estimated storm water quality volumes are provided for all of the proposed detention ponds. The Extended Drainage Basin calculation was used throughout this report. Results can be found in the Appendix of this report along with the total detention pond volumes. Final design and approval of storm water quality measures will be achieved at the time of final drainage reports for any development with The Ranch property. All storm water quality improvements shall be in compliance with the El Paso County Drainage Criteria Manual Volume 2.

WATER QUALITY SUMMARY

El Paso County has required the Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainage ways, and implementing long-term source controls. The Four Step Process pertains to management of smaller, frequently occurring storm events, as opposed to larger storms for which drainage and flood control infrastructure are sized. Implementation of these four steps helps to achieve stormwater permit requirements. This site adheres to this Four Step Process as follows:

What does this mean?
Commercial areas?

1. This site is a proposed residential development. In general, most roof drains are intended to drain across landscaping where feasible, and any parking areas contain landscaping to minimize directly connected impervious areas. Where possible, L.I.D. Techniques may be implemented during the next level of drainage analysis.

such as...

2. Permanent BMPs for the overall master planned site will be implemented with initial development of the property in the form of Full Spectrum Detention and Stormwater Quality ponds located within the site in accordance with the future FDR's.

the lower of full-spectrum or

3. Stormwater drainage from the subject property is being routed through stormwater detention /stormwater quality treatment facilities prior to being released to the historic drainage paths. Developed flows will be required to adhere to release rates established within the previously approved reports (DBPS's) and all stormwater discharge to downstream facilities will be required to employ energy dissipation measures to ensure no adverse effect to downstream facilities.

4. A site specific stormwater quality and erosion control plan and narrative will be submitted and approved by El Paso County prior to any disturbance within the project area. Details such as site specific source control construction BMP's as well as permanent BMP's will be detailed in the Grading and Erosion Control plan and in the Stormwater Management Narrative to protect receiving waters. Upon construction of the proposed development, temporary BMP's will be installed and maintained as required. After final stabilization and site improvement completion, any disturbance to the site will need to be evaluated at that time for temporary and permeant BMP provisions.

This needs to address commercial and industrial development BMPS

CLASSIC CONSULTING

DETENTION FACILITIES / STORMWATER QUALITY

Final design of these recommended facilities that include planning for water quality management of storm water runoff features will be designed during final design and construction of the proposed improvements. Storm water quality measures will be utilized in order to reduce the amount of sediment, debris and pollutants that are allowed to enter Sand Creek. These features include but are not limited to the multiple Full Spectrum Extended Detention Basins. Site Planning and design techniques for the large lot, rural areas should limit impervious area, minimize directly impervious area, lengthen time of travel and increase infiltration in order to decrease the rate and volume of stormwater runoff. Facilities that require detention will provide a Water Quality Capture Volume (WQCV) and Excess Urban Runoff Volume (EURV) in the lower portion of the facility storage volume that will release the more frequent storms at a slower rate to help minimize the effects of development of the property. These measures will be taken into consideration upon final design of the individual detention facilities as well as the development of the individual land uses within the site.

MAINTENANCE

The proposed detention/SWQ facilities are to be private facilities with ownership and maintenance by the The Ranch Metropolitan District or Homeowners Association. After completion of construction and upon the Board of County Commissioners acceptance, the Sand Creek and Falcon channels constructed in accordance with DBPS's will be owned and maintained by the El Paso County along with all drainage facilities within the public Right of Way.

Describe the reaches that will match DBPS recommendations.

CHANNEL IMPROVEMENTS

As stated in the two DBPS, the defined drainage corridors are recommended as a floodplain preservation design concept. Given the fact of the current requirements for detention/SWQ with three of these facilities planned for the property and less urbanization anticipated in this reach, the existing drainage way is expected to remain stable. However, localized improvements may be necessary in any steeply incised channel locations and to limit erosion caused by flow concentrations at culverts and storm sewers outfalls. Determination of the specific channel improvements will be made upon further channel analysis/investigation along with the future Preliminary Final Drainage Report(s). However, specifically located grade control and/or drop structures were specified in the Sand Creek and Falcon DBPS through this reach in order to slow the cannel velocity to the recommended 7 feet per second and to prevent localized and long-term stream degradation from affecting channel linings and overbanks. These facilities

Discuss extensive relocation/reconstruction of channels as shown on the Sketch Plan.

will help protect the native wetland vegetation from detrimental effects of stream invert head cutting. A maximum drop height of three feet is recommended with final design following the Urban Drainage Criteria Manual Vol. 2. Concept locations for these facilities are shown on the developed drainage map as recommended in the DBPS. Revegetation would occur wherever the native vegetation is disturbed by channel construction. Selectively located rip-rap bank protection such as outside bends and culvert outlets are also recommended.

WETLANDS MITIGATION

Wetlands are located on site, and will be appropriately permitted and, if needed, mitigated with construction drawing preparation.

Preliminary Plan design and

FLOODPLAIN STATEMENT

No portion of the proposed The Ranch site is located within a floodplain as determined by the Flood Insurance Rate Map (F.I.R.M.) Map Number 08041C0535 G effective date, December 7, 2018 (See Appendix).

FEMA

DRAINAGE AND BRIDGE FEES

This area lies within the Sand Creek and Falcon Area Drainage Basins. Drainage and Bridge Fees are to be paid based upon the amount of impervious area at the time of Final Platting of any parcel within The Ranch property. For the year 2018, Falcon Basin Fees are; Drainage fees - $27,762 per impervious acre & Bridge fees - $3,814 per impervious acre. The Sand Creek Basin Fees are; Drainage fees - $17,197 per impervious acre & Bridge fees - $5,210 per impervious acre. Exact fees and reimbursable facility construction costs will be identified in the various final drainage reports for The Ranch development.

Drainage Credits / Reimbursements

Per the Drainage Basin Fee Addendum – Chapter 3 for El Paso County, drainage credits/reimbursements may be applicable to this development in two forms: full reimbursement for construction costs associated with regional facilities (Sand Creek channel structures) as presented in the DBPS and partial reimbursement for construction of on-site detention facilities that meet County criteria. These specific credits/reimbursements will be better defined in the final drainage reports and site construction drawings.

preliminary and

where downstream DBPS detention facilities have not been constructed

Final Fee estimates for individual future filings will be handled under separate Final Drainage reports upon submission of individual filing plats.

SUMMARY

The proposed The Ranch site is within two major drainage basins (Sand Creek and Falcon Area). Overall basin modeling was completed with this report that generally coincides with the previous reports completed. Revisions were made to upstream basins as determined necessary due to development that has taken place after the previous reports were completed. Recommendations are made within this report concerning necessary detention and channel improvements. All of the points of storm water release from of the proposed site are at or below the calculated historic peak flow quantities. Therefore, the development of the proposed The Ranch does not hinder any downstream facility or property to an extent greater than that which currently exists in the 'historic' conditions. All drainage facilities within this report were sized according to the Drainage Criteria Manuals and storm water quality facilities are recommended where required. All of the channel corridors however are 'public' and as such, maintenance of DBPS improvements constructed to County standards the responsibility of El Paso County. Upon development of the individual parcels within the The Ranch development, separate Preliminary and Final Drainage Reports will be required to be submitted for approval by El Paso County.

PREPARED BY:
Classic Consulting Engineers & Surveyors, LLC

Kyle R. Campbell, P.E.
Director

Verify that proposed improvements will match the DBPS. State that metro district will maintain drainage facilities not eligible for County maintenance.

Review ended here.

REFERENCES

1. "Falcon Drainage Basin Planning Study – Selected Plan Report", by Matrix Design Group, September, 2015

2. "Sand Creek Drainage Basin Planning Study Preliminary Design Report," by Kiowa Engineering Corporation, last revised March 1996.

3. "Master Development Drainage Plan Falcon Hills Development," by Kiowa Engineering Corporation, May 2002.

4. "Final Drainage Report for Paint Brush Hills Filings Nos. 10, 11 & 12," by Classic Consulting Engineers & Surveyors, LLC, last revised July 2003.

5. "Drainage Report Stapleton Estates Filing No. 1," by Guenther Polok, March 1982.

6. "Falcon Meadows Subdivision Drainage Report," by Oliver E. Watts Consulting Engineer, April 1981.

7. "Final Drainage and Erosion Control for the Meadows Filing Three Subdivision," by Ladd Engineering, July 2000.

8. "Master Development Drainage Plan and Preliminary Drainage Plan Bent Grass Subdivision," by Kiowa Engineering, last revised December 2006.

9. City of Colorado Springs/County of El Paso Drainage Criteria Manual dated October 1991.

10. "Drainage Criteria Manual, Volume No. 2," by City of Colorado Springs Engineering Division, dated November 1, 2002.

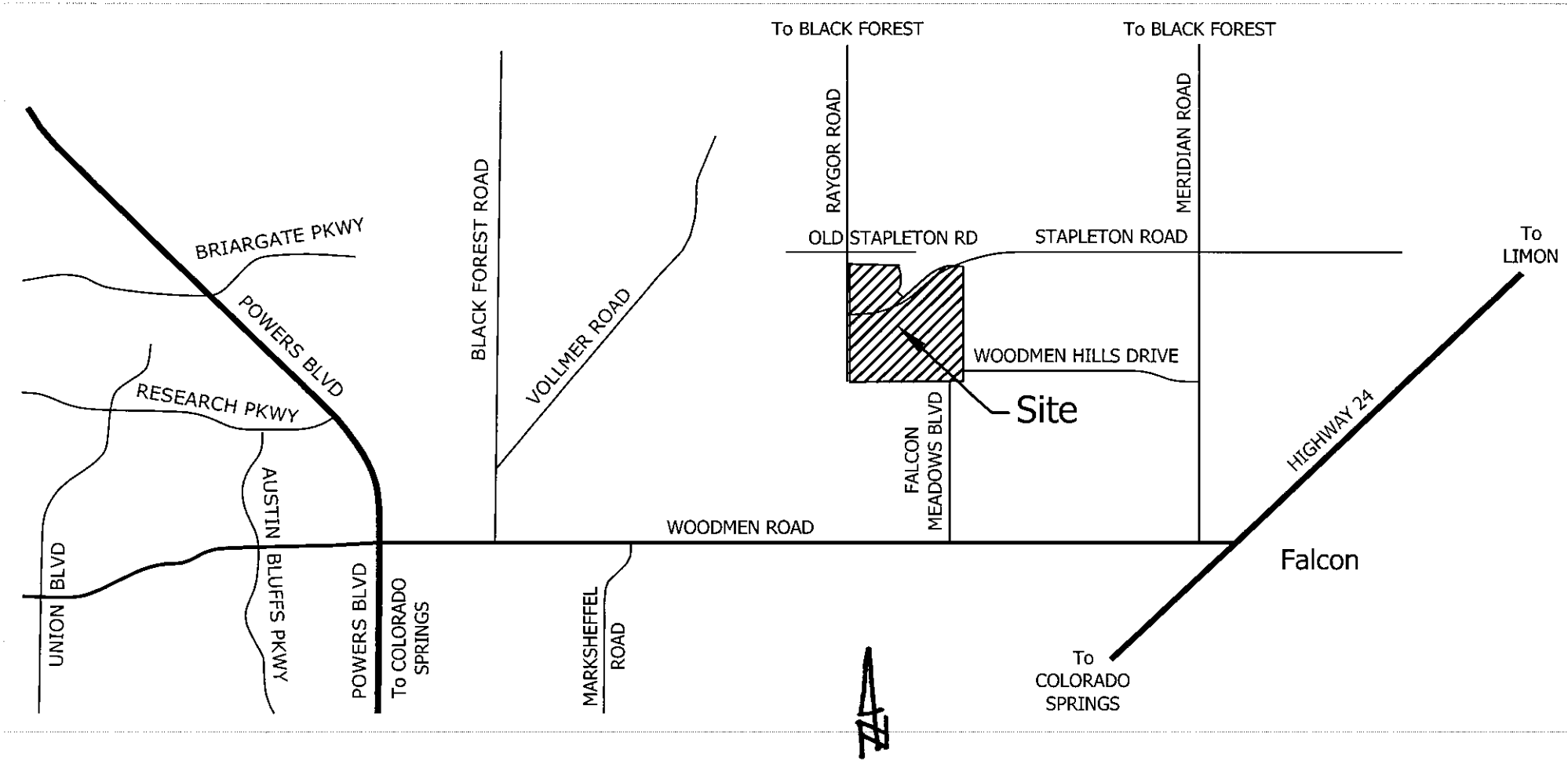
11. "Preliminary and Final Drainage Report Peaceful Ridge at Fountain Valley Subdivision," by Kiowa Engineering Corporation, dated July 2006.

12. "Falcon Drainage Basin Planning Storm Selected Plan Report" by matrix Design Group, September 2015.

APPENDIX

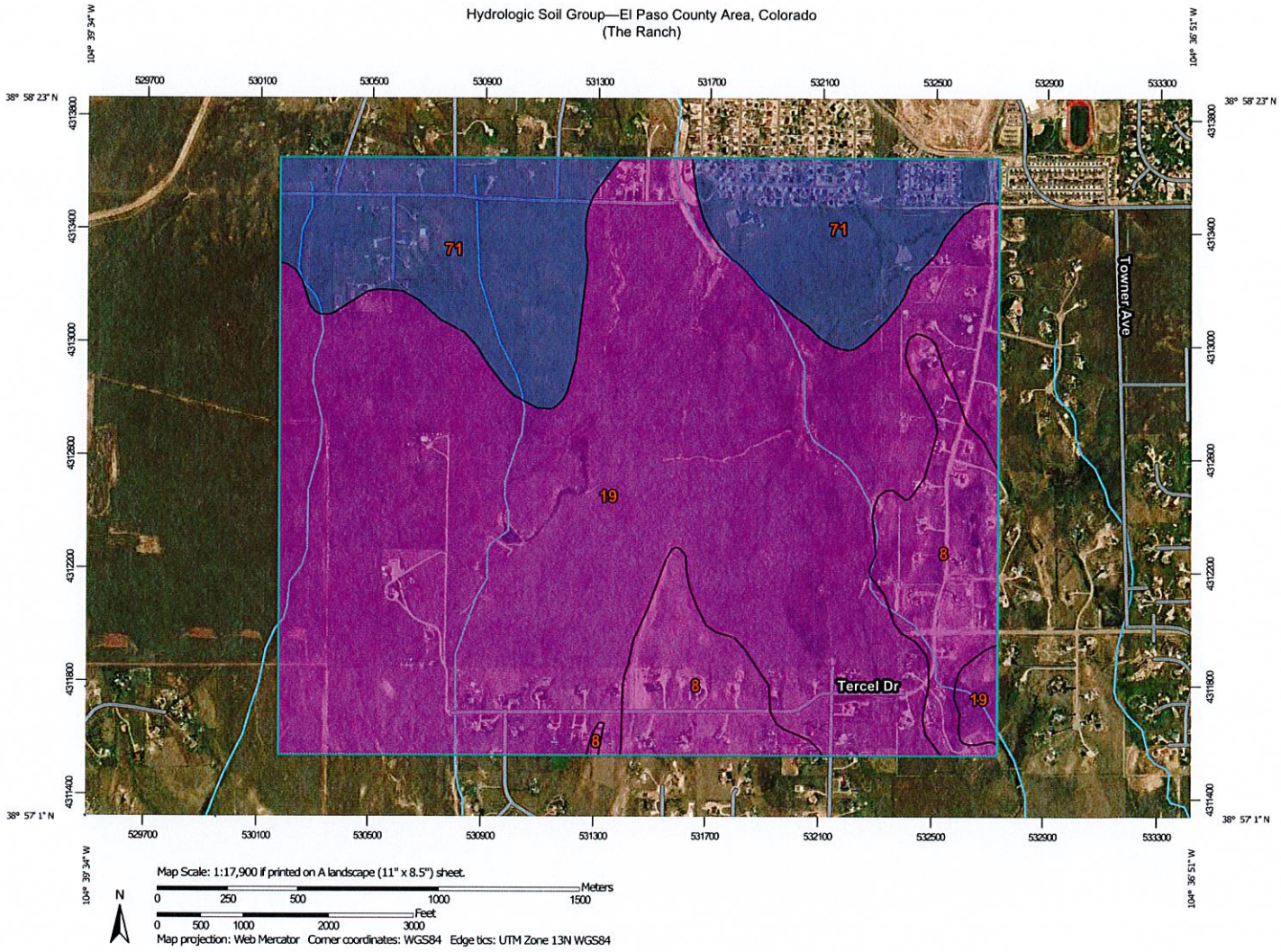
VICINITY MAP

VICINITY MAP



SOILS MAP (S.C.S. SURVEY)

Hydrologic Soil Group—El Paso County Area, Colorado
(The Ranch)



Map Scale: 1:17,900 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 250 500 1000 1500

Feet: 0 500 1000 2000 3000

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

MAP LEGEND

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

Soils

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 16, Sep 10, 2018

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

Date(s) aerial images were photographed: Jun 7, 2016—Aug 17, 2017

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	A	158.1	11.8%
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	898.2	67.0%
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	284.9	21.2%
Totals for Area of Interest			**1,341.2**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

F.E.M.A. MAP

NOTES TO USERS

ip is for use in administering the National Flood Insurance Program. It does essarily identify all areas subject to flooding, particularly from local drainage . of small size. The community map repository should be consulted for updated or additional flood hazard information.

ain more detailed information in areas where Base Flood Elevations (BFEs) floodways have been determined, users are encouraged to consult the Flood and Floodway Data and/or Summary of Stillwater Elevations tables contained the Flood Insurance Study (FIS) report that accompanies this FIRM. Users be aware that BFEs shown on the FIRM represent rounded whole-foot ns. These BFEs are intended for flood insurance rating purposes only and not be used as the sole source of flood elevation information. Accordingly, evation data presented in the FIS report should be utilized in conjunction with M for purposes of construction and/or floodplain management.

l Base Flood Elevations shown on this map apply only landward of 0.0' merican Vertical Datum of 1988 (NAVD88). Users of this FIRM should be hat coastal flood elevations are also provided in the Summary of Stillwater ns table in the Flood Insurance Study report for this jurisdiction. Elevations n the Summary of Stillwater Elevations table should be used for construction floodplain management purposes when they are higher than the elevations on this FIRM.

nes of the floodways were computed at cross sections and interpolated n cross sections. The floodways were based on hydraulic considerations with to requirements of the National Flood Insurance Program. Floodway widths er pertinent floodway data are provided in the Flood Insurance Study report isdiction.

areas not in Special Flood Hazard Areas may be protected by flood control res. Refer to section 2.4 "Flood Protection Measures" of the Flood Insurance eport for information on flood control structures for this jurisdiction.

ojection used in the preparation of this map was Universal Transverse r (UTM) zone 13. The horizontal datum was NAD83, GRS80 spheroid. ces in datum, spheroid, projection or UTM zones zones used in the ion of FIRMs for adjacent jurisdictions may result in slight positional ies in map features across jurisdiction boundaries. These differences do not e accuracy of this FIRM.

levations on this map are referenced to the North American Vertical Datum 8 (NAVD88). These flood elevations must be compared to structure and elevations referenced to the same vertical datum. For information regarding sion between the National Geodetic Vertical Datum of 1929 and the North an Vertical Datum of 1988, visit the National Geodetic Survey website at ww.ngs.noaa.gov/ or contact the National Geodetic Survey at the following

formation Services
NGS12
l Geodetic Survey
L 89202
ser West Highway
pring, MD 20910-3282

n current elevation, description, and/or location information for bench marks on this map, please contact the Information Services Branch of the National c Survey at (301) 713-3242 or visit its website at http://www.ngs.noaa.gov/.

ap information shown on this FIRM was provided in digital format by El Paso Colorado Springs Utilities, and Anderson Consulting Engineers, Inc. These s current as of 2006.

ap reflects more detailed and up-to-date stream channel configurations and lain delineations than those shown on the previous FIRM for this jurisdiction. ndaries and floodways that were transferred from the previous FIRM may en adjusted to conform to these new stream channel configurations. As a the Flood Profiles and Floodway Data tables in the Flood Insurance Study (which contains authoritative hydraulic data) may reflect stream channel as that differ from what is shown on this map. The profile baselines depicted map represent the hydraulic modeling baselines that match the flood profiles odway Data Tables if applicable, in the FIS report. As a result, the profile es may deviate significantly from the new base map channel representation y appear outside of the floodplain.

ate limits shown on this map are based on the best data available at the time cation. Because changes due to annexations or de-annexations may have d after this map was published, map users should contact appropriate nity officials to verify current corporate limit locations.

refer to the separately printed Map Index for an overview map of the county y the layout of map panels; community map repository addresses; and a of Communities table containing National Flood Insurance Program dates for mmunity as well as a listing of the panels on which each community is

FEMA Map Service Center (MSC) via the FEMA Map Information eXchange 1-877-336-2627 for information on available products associated with this Available products may include previously issued Letters of Map Change, a surance Study Report, and/or digital versions of this map. The MSC may be reached by Fax at 1-800-358-9620 and its website at ww.msc.fema.gov/.

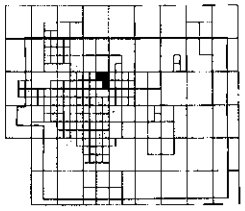
ave questions about this map or questions concerning the National Flood ce Program in general, please call 1-877-FEMA MAP (1-877-336 2627) or FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)

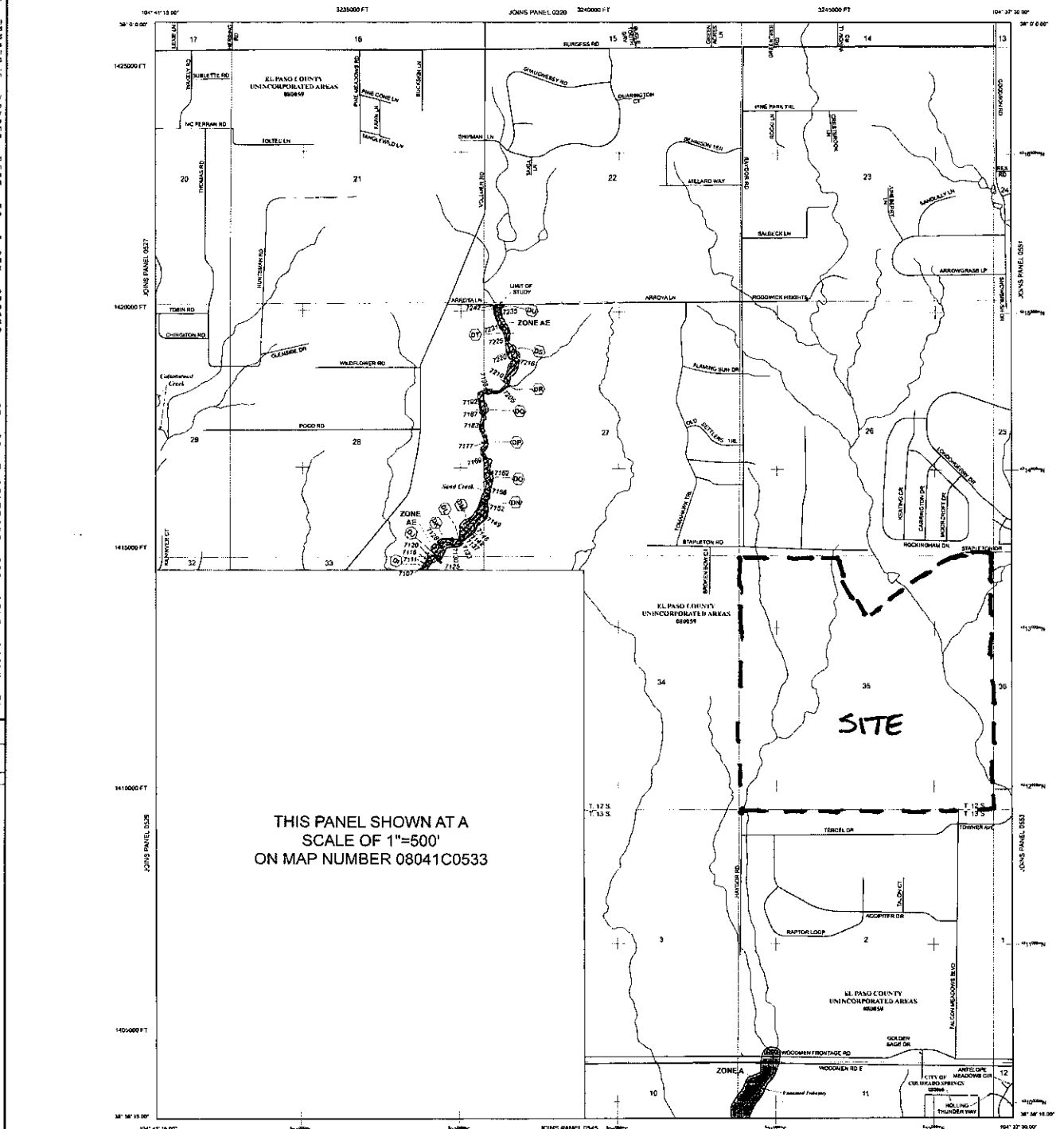
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION

Panel Location Map



Digital Flood Insurance Rate Map (DFIRM) was produced through a ating Technical Partner (CTP) agreement between the State of Colorado r Conservation Board (CWCB) and the Federal Emergency Management cy (FEMA).

Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 12 SOUTH, RANGE 65 WEST, AND TOWNSHIP 13 SOUTH, RANGE 65 WEST.

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A — No Base Flood Elevations determined.
ZONE AE — Base Flood Elevations determined.
ZONE AH — Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR — Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99 — Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V — Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE — Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X — Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X — Areas determined to be outside the 0.2% annual chance floodplain
ZONE D — Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- Floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*
- * Referenced to the North American Vertical Datum of 1988 (NAVD 88)
- A — A — Cross section line
- 23 — 23 — Transect line
- 97° 07' 30.00" / 32° 22' 30.00" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 1000-meter Universal Transverse Mercator grid ticks, zone 13
- 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
- DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'
1000 0 1000 2000 FEET
300 0 300 600 METERS

PANEL 0535G

FIRM

FLOOD INSURANCE RATE MA

EL PASO COUNTY, COLORADO AND INCORPORATED AREA

PANEL 535 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAY

CONTAINS:

COMMUNITY	NUMBER	PANEL	S
COLORADO SPRINGS, CITY OF	080060	0535	
EL PASO COUNTY	080059	0535	

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMB
08041C053

MAP REVIS
DECEMBER 7, 20

Federal Emergency Management Ag

NATIONAL FLOOD INSURANCE PROGRAM

Not checked at this time.
Provide 2015 Falcon DBPS information.

EXISTING D.B.P.S. INFORMATION

old DBPS

Reach W10: Meridian Road – Falcon Hwy

A triple 12'x 6'H RCB under the proposed intersection of Falcon Hwy and Meridian Roads will replace the existing undersized facilities and eliminate the open channel in reach W10. The preferred alternative to the box culverts is a bridge.

Reach W11: Falcon Hwy to SH 24

A 100-year channel concept with grade control to reduce the channel slope to ≤1.0% is recommended to define the channel downstream of Hwy 24.

Reach W12: SH 24 to Pond WU

Much of this reach will be defined by the final design of Regional Detention Pond WU. 100-year channel concepts are recommended upstream and downstream of the pond.

Reach W13: Pond WU - Tamlin Road

A 100-year geotextile lined channel is recommended. A concrete lined channel may be considered in this reach if a commercial developer feels that the extra expense would be offset by the reduced area required by a hard lined channel, however a soft lined channel is preferable for cost, environmental, and aesthetic considerations.

Reach W14: Tamlin Rd to Woodmen Road

A 100-year channel concept with grade control to 0.8% is recommended in this reach. Riprap protection should be considered at major road crossings like Woodmen Road and Tamlin Road.

Reach W15: Woodmen Road to confluence with Subtributary #1

A 100-year channel is proposed for the lower 800 feet of the channel approaching Woodmen Road to contain flow and to protect the adjacent Mountain View Electric property. The prudent line approach is recommended for the remainder of this reach, with a preliminary setback of 100 LF on either side of the 100-year floodplain. Two grade control structures are also recommended and are shown on Preliminary Design Plan Sheets W9 and W10. The area is currently open pasture. The proposed land use, 5 Ac lots, will not generate as much additional runoff as would higher densities. In fact, design flows at Woodmen Road increase by only 10% for the 100-year storm under proposed conditions. The prudent line setback could be easily incorporated into a development as open space, park and/ or trail. The average width of the 100-year floodplain is 220 LF, thus the average width of a prudent line no-build zone would be 420 LF. Detailed geomorphologic studies are recommended for all reaches utilizing a prudent line approach in order to more accurately determine the appropriate setback.

Reach W16: Confluence with Subtributray #1 to Design Point WQ1

This area is also currently open pasture, with a proposed land use of 5 Ac lots. The prudent line approach is recommended for the entire reach, with a preliminary setback of 100 LF on either side of the 100-year floodplain. The average width of the 100-year floodplain is 240 LF, thus the average width of a prudent line no-build zone would be 440 LF. Detailed geomorphologic studies are recommended for all reaches utilizing a prudent line approach in order to more accurately determine the appropriate setback.

Reach W17: Design Point WQ1 to confluence with Subtributary #2

This area is also currently open pasture. The prudent line approach is recommended for the entire reach, with a preliminary setback of 125 LF on either side of the 100-year floodplain. The average width of the 100-year floodplain is 270 LF, thus the average width of a prudent line no-build zone would be 520 LF. Existing SCS diversion berms across the drainageway should be removed. Detailed geomorphologic studies are recommended for all reaches utilizing a prudent line approach in order to more accurately determine the appropriate setback.

Reach W18: Confluence with Subtributary #2 to Confluence with Subtributary #3

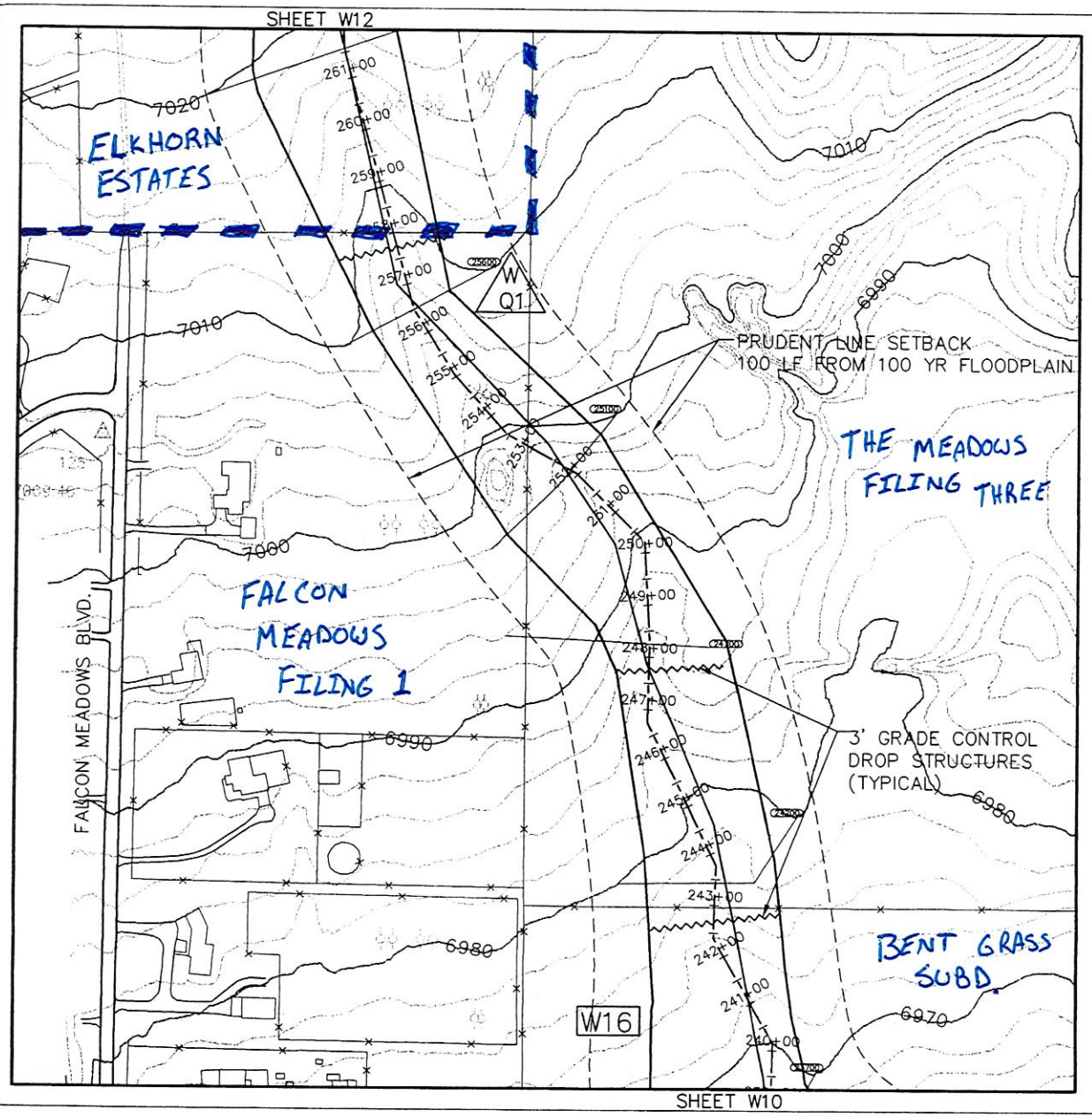
This area is also currently open pasture. The prudent line approach is recommended for the entire reach, with a preliminary setback of 125 LF on either side of the 100-year floodplain. The average width of the 100-year floodplain is 250 LF, thus the average width of a prudent line no-build zone would be 500 LF. Existing SCS diversion berms across the drainageway should be removed. Detailed geomorphologic studies are recommended for all reaches utilizing a prudent line approach in order to more accurately determine the appropriate setback.

Reach W19: Confluence with Subtributary #3 to Design Point WN

This area is also currently open pasture. The prudent line approach is recommended for the entire reach, with a preliminary setback of 100 LF on either side of the 100-year floodplain. The average width of the 100-year floodplain is 160 LF, thus the average width of a prudent line no-build zone would be 360 LF. Detailed geomorphologic studies are recommended for all reaches utilizing a prudent line approach in order to more accurately determine the appropriate setback.

Reach W20: Design Point WN to Confluence with Subtributary #4

The channel is much more defined in this reach than those downstream. The prudent line approach is recommended for the entire reach, with a preliminary setback of 75 LF on either side of the 100-year floodplain. The average width of the 100-year floodplain is 75 LF, thus the average width of a prudent line no-build zone would be 225 LF. Riprap bank protection is recommended at several locations where the channel bends fairly sharply (see Preliminary Design Plan Sheet W16). A grade control check structure is also recommended downstream of the confluence with



THIS DRAWING IS CONCEPTUAL IN NATURE AND IS NOT TO BE USED AS THE SOLE BASIS FOR FINAL DESIGN, CONSTRUCTION, OR REMEDIAL ACTION. FUTHER STUDIES UNDER EPC DOT'S DIRECTION SHOULD BE PERFORMED PRIOR TO SUCH DECISIONS.

REACH	SLOPE (%)	Q_{100} (CFS)	V_{100} (FPS)	Q5 (CFS)	V5 (FPS)
W16	1.0	1623	7.6	162	3.9

RECOMMENDED ALTERNATIVES

REACH W16

ALT A PRUDENT LINE STUDY WITH SELECTIVE GRADE CONTROL

ALT B 100-YR CHANNELIZATION WITH GRADE CONTROL DROPS TO REDUCE SLOPE TO < 1.0%

LEGEND

- W3 — REACH IDENTIFIER
- 4000 — HECRAS CROSS SECTION
- — — FEMA 100-YR FLOODPLAIN
- - - - CONTOURED HECRAS 100-YR FLOODPLAIN
- — - — PRUDENT LINE SETBACK
- △ — DEVELOPED CONDITION HYDROLOGY DESIGN POINT

N

1"=200'

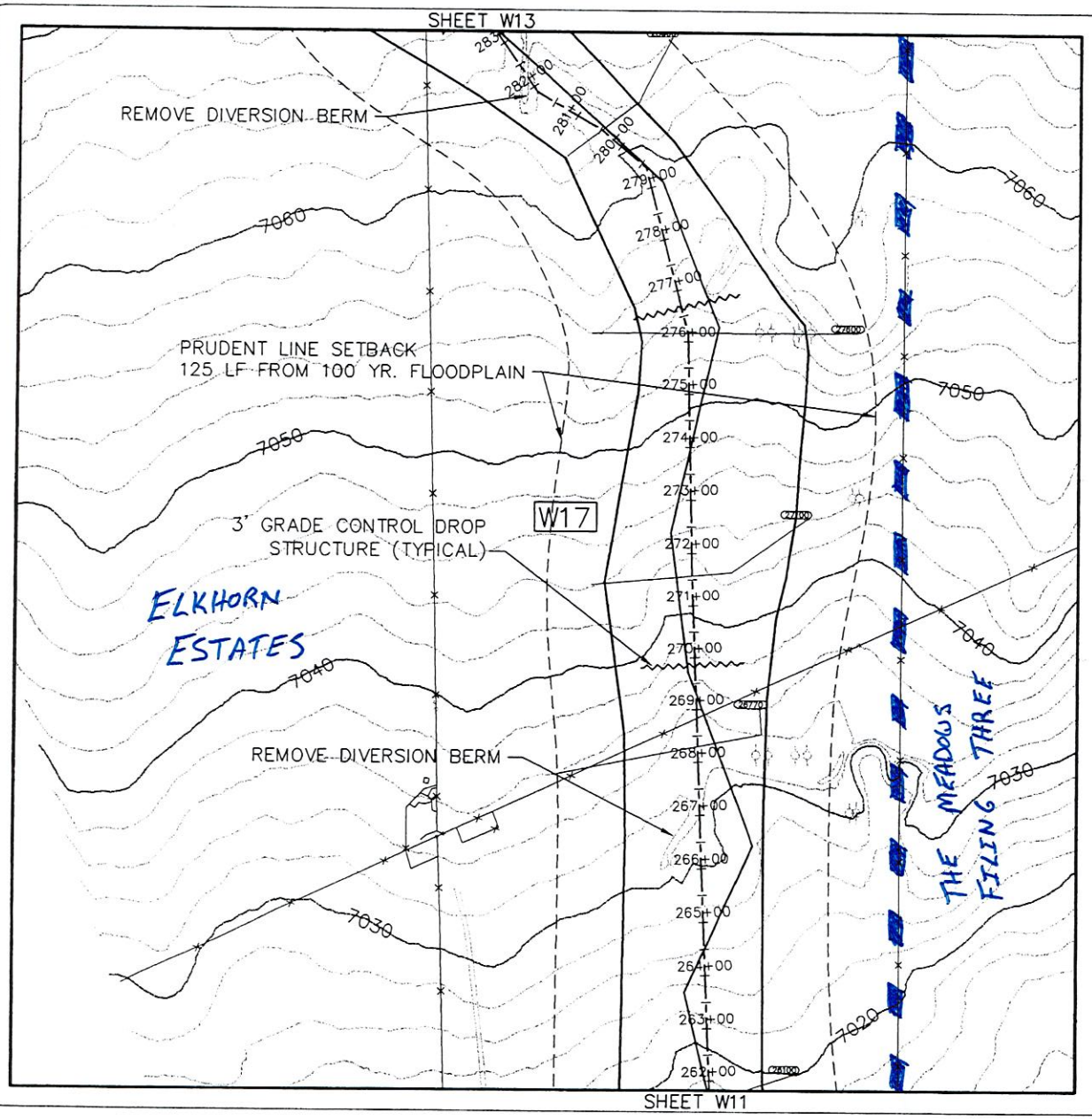
200 0 200 400

FALCON BASIN DRAINAGE BASIN PLANNING STUDY

WEST TRIB.

SHEET W11

FILE = \\Urws167\6742284\CAD\REPTFIGS\plonshts\westtl.dwg



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REACH	SLOPE (%)	Q_{100} (CFS)	V_{100} (FPS)	Q5 (CFS)	V5 (FPS)
W17	1.0	1623	7.4	162	3.7

RECOMMENDED ALTERNATIVES

REACH W17

ALT A PRUDENT LINE STUDY WITH SELECTIVE GRADE CONTROL

ALT B 100-YR CHANNELIZATION WITH GRADE CONTROL DROP STRUCTURES TO REDUCE SLOPE TO < 1.0%

LEGEND

- W3 — REACH IDENTIFIER
- 4000 — HECRAS CROSS SECTION
- FEMA 100-YR FLOODPLAIN
- CONTOURED HECRAS 100-YR FLOODPLAIN
- PRUDENT LINE SETBACK
- △ — DEVELOPED CONDITION HYDROLOGY DESIGN POINT

N

1"=200'

200 0 200 400

FALCON BASIN DRAINAGE BASIN PLANNING STUDY

WEST TRIB.

SHEET W12

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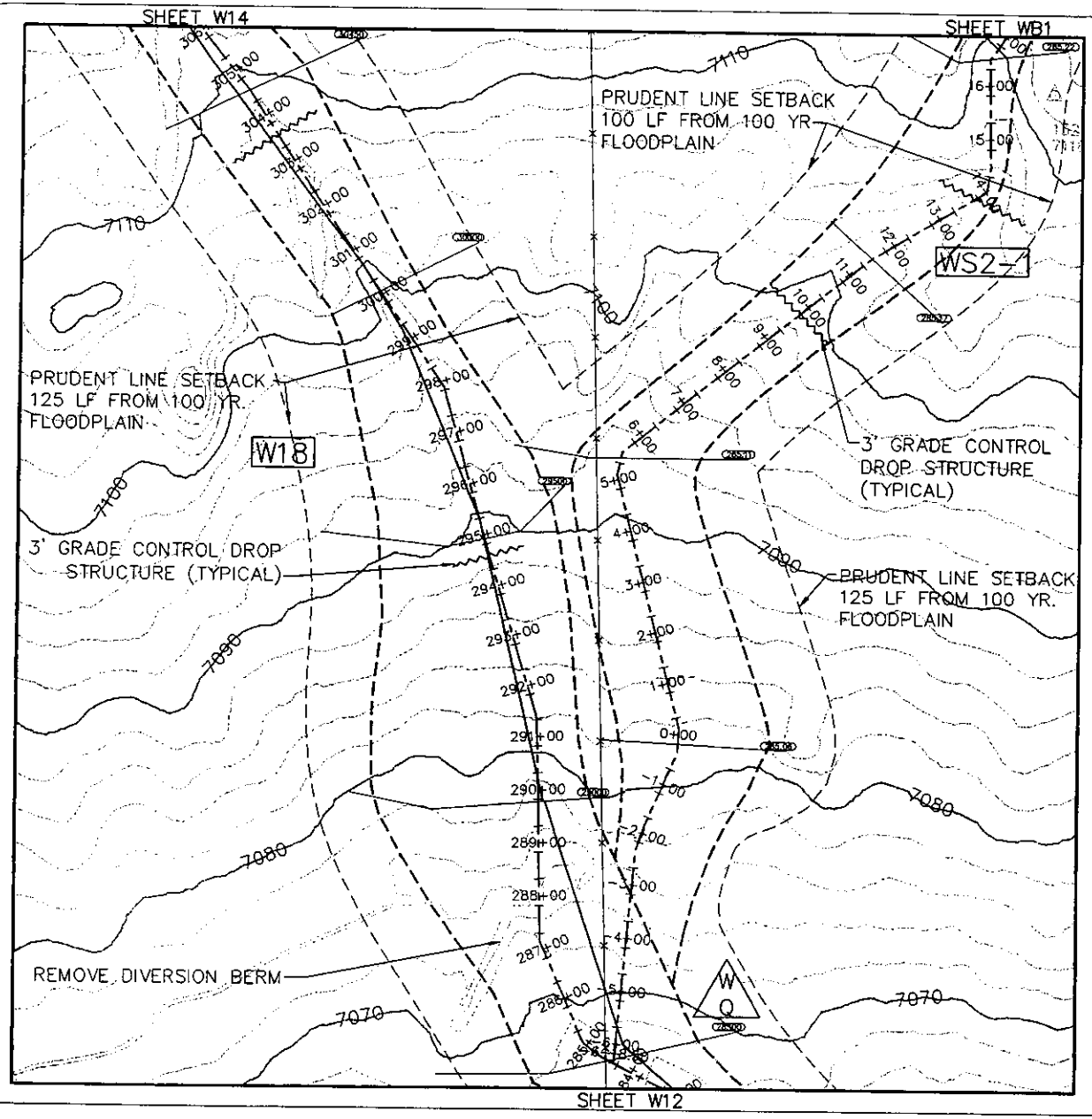

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REACH	SLOPE %	Q_{100} (CFS)	V_{100} (FPS)	Q5 (CFS)	V5 (FPS)
W18	1.0	1467	7.9	141	3.5
WS2-1	1.25	281	5.8	51	3.2

RECOMMENDED ALTERNATIVES
REACH W18
ALT A PRUDENT LINE STUDY WITH SELECTIVE GRADE CONTROL
ALT B 100-YR CHANNELIZATION WITH GRADE CONTROL DROP STRUCTURES TO REDUCE SLOPE TO < 1.0%

RECOMMENDED ALTERNATIVES
REACH WS2-1
ALT A PRUDENT LINE STUDY WITH SELECTIVE GRADE CONTROL
ALT B 100-YR CHANNELIZATION WITH GRADE CONTROL DROP STRUCTURES TO REDUCE SLOPE TO < 1.0%

LEGEND

- W3 — REACH IDENTIFIER
- 4000 — HECRAS CROSS SECTION
- FEMA 100-YR FLOODPLAIN
- CONTOURED HECRAS 100-YR FLOODPLAIN
- PRUDENT LINE SETBACK
- △ — DEVELOPED CONDITION HYDROLOGY DESIGN POINT

N

1"=200'

200 0 200 400

FALCON BASIN DRAINAGE BASIN PLANNING STUDY

WEST TRIB.

SHEET W13

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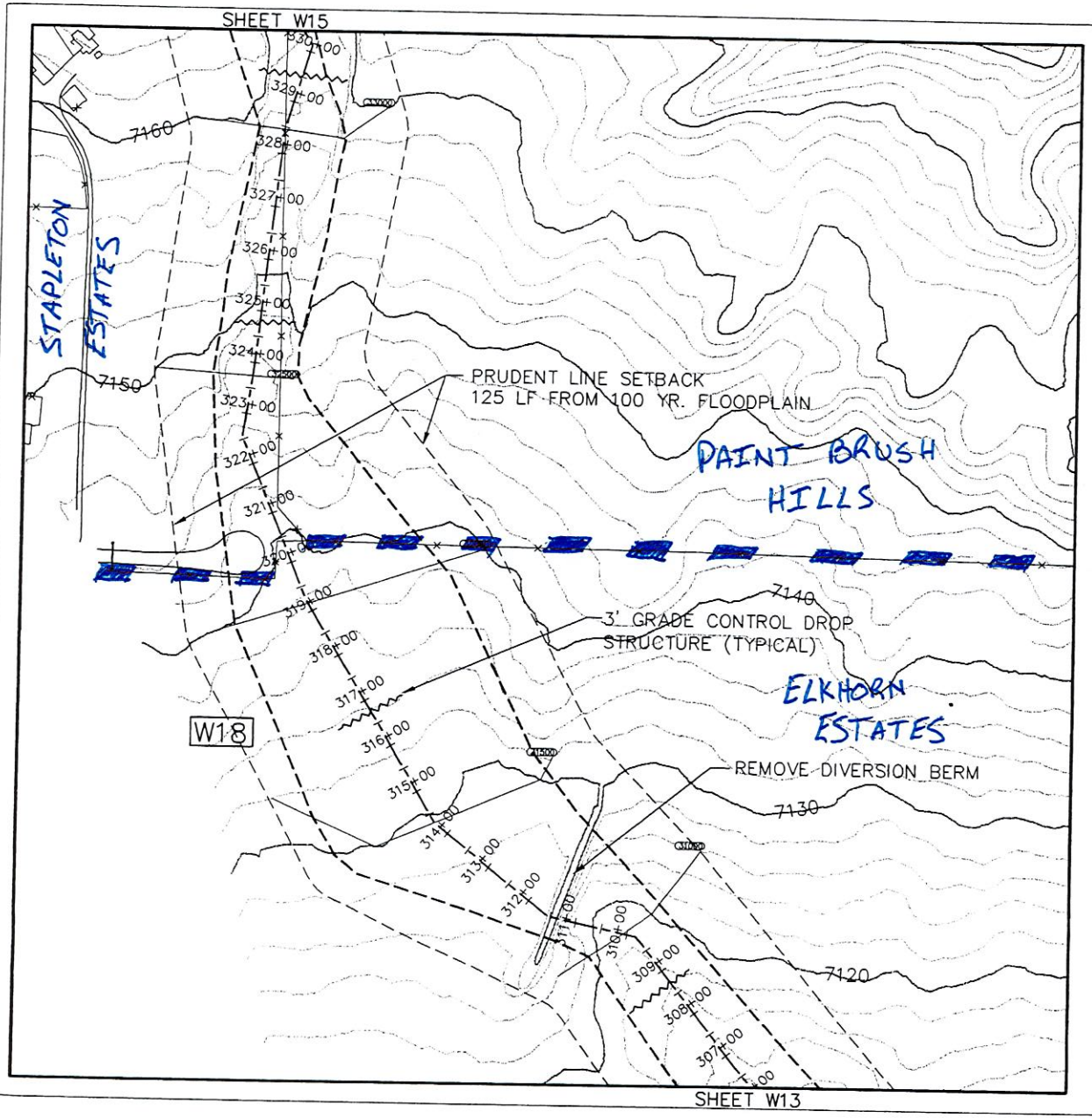

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REACH	SLOPE (%)	Q_{100} (CFS)	V_{100} (FPS)	Q5 (CFS)	V5 (FPS)
W18	1.0	1467	7.9	141	3.5

RECOMMENDED ALTERNATIVES

REACH	W18
ALT A	PRUDENT LINE STUDY WITH SELECTIVE GRADE CONTROL
ALT B	100-YR CHANNELIZATION WITH GRADE CONTROL DROP STRUCTURES TO REDUCE SLOPE TO < 1.0%

LEGEND

- W3 — REACH IDENTIFIER
- 4000 — HECRAS CROSS SECTION
- FEMA 100-YR FLOODPLAIN
- CONTOURED HECRAS 100-YR FLOODPLAIN
- PRUDENT LINE SETBACK
- △ — DEVELOPED CONDITION HYDROLOGY DESIGN POINT

N

1"=200'

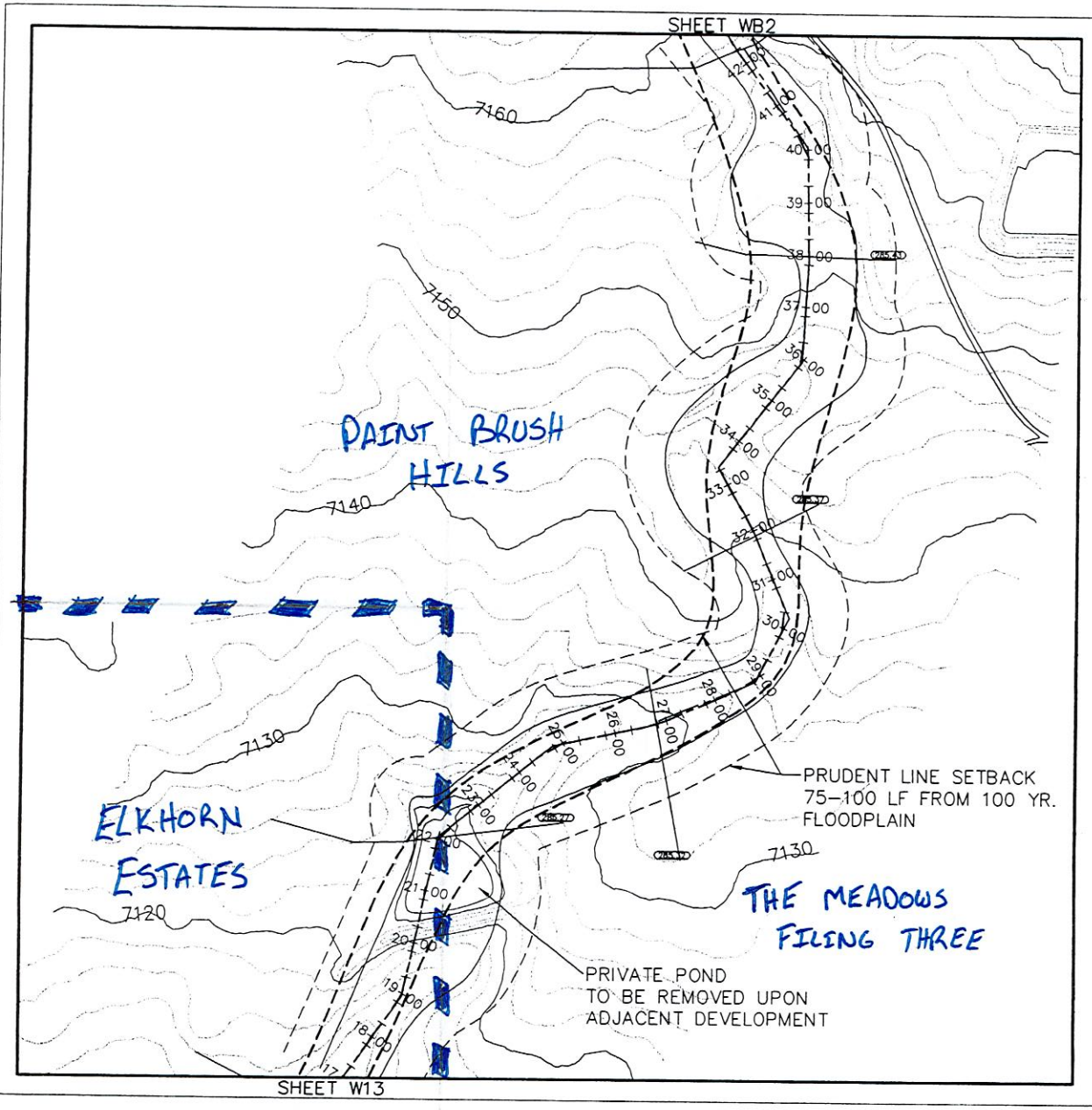
200 0 200 400

FALCON BASIN DRAINAGE BASIN PLANNING STUDY

WEST TRIB.

SHEET W14

FILE = \\Dr-ws167\6742284\CAD\REPTFIGS\planshts\west14.dwg



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REACH	SLOPE (%)	Q_{100} (CFS)	V_{100} (FPS)	Q5 (CFS)	V5 (FPS)
WS2-1	1.25	281	5.8	51	3.2

RECOMMENDED ALTERNATIVES
REACH WS2-1

ALT A PRUDENT LINE STUDY WITH SELECTIVE GRADE CONTROL

ALT B 100-YR CHANNELIZATION WITH GRADE CONTROL DROP STRUCTURES TO REDUCE SLOPE TO < 1.0%

LEGEND

- W3 — REACH IDENTIFIER
- 4000 — HECRAS CROSS SECTION
- ----- CONTOURED HECRAS 100-YR FLOODPLAIN
- - - PRUDENT LINE SETBACK
- △ DEVELOPED CONDITION HYDROLOGY DESIGN POINT

-N-

1"=200'

200 0 200 400

FALCON BASIN DRAINAGE BASIN PLANNING STUDY

WEST TRIB.B

SHEET WB1

FILE = \\Urws167\6742284\CAD\REPTFIGS\plonshts\w_B1.dwg

CHANNEL IMPROVEMENTS

SEGMENT NO.	BOTTOM WIDTH (FT)	CHANNEL TYPE
84	20	SELECTIVE BANK LININGS 3' DEPTH
92	15	SELECTIVE BANK LININGS 3' DEPTH
82	10	SELECTIVE BANK LININGS 2' DEPTH
81	15	SELECTIVE BANK LININGS 2' DEPTH

FOR PROFILE SEE SHEETS EFP-12, EFP-13, WBP-3, WBP-4

THIS DRAWING IS A MASTER PLANNING SHEET REPRESENTING PRELIMINARY AND CONCEPTUAL ENGINEERING. IT SHOULD NOT BE USED FOR CONSTRUCTION PURPOSES. THESE PLANS ARE SUBJECT TO CHANGE.

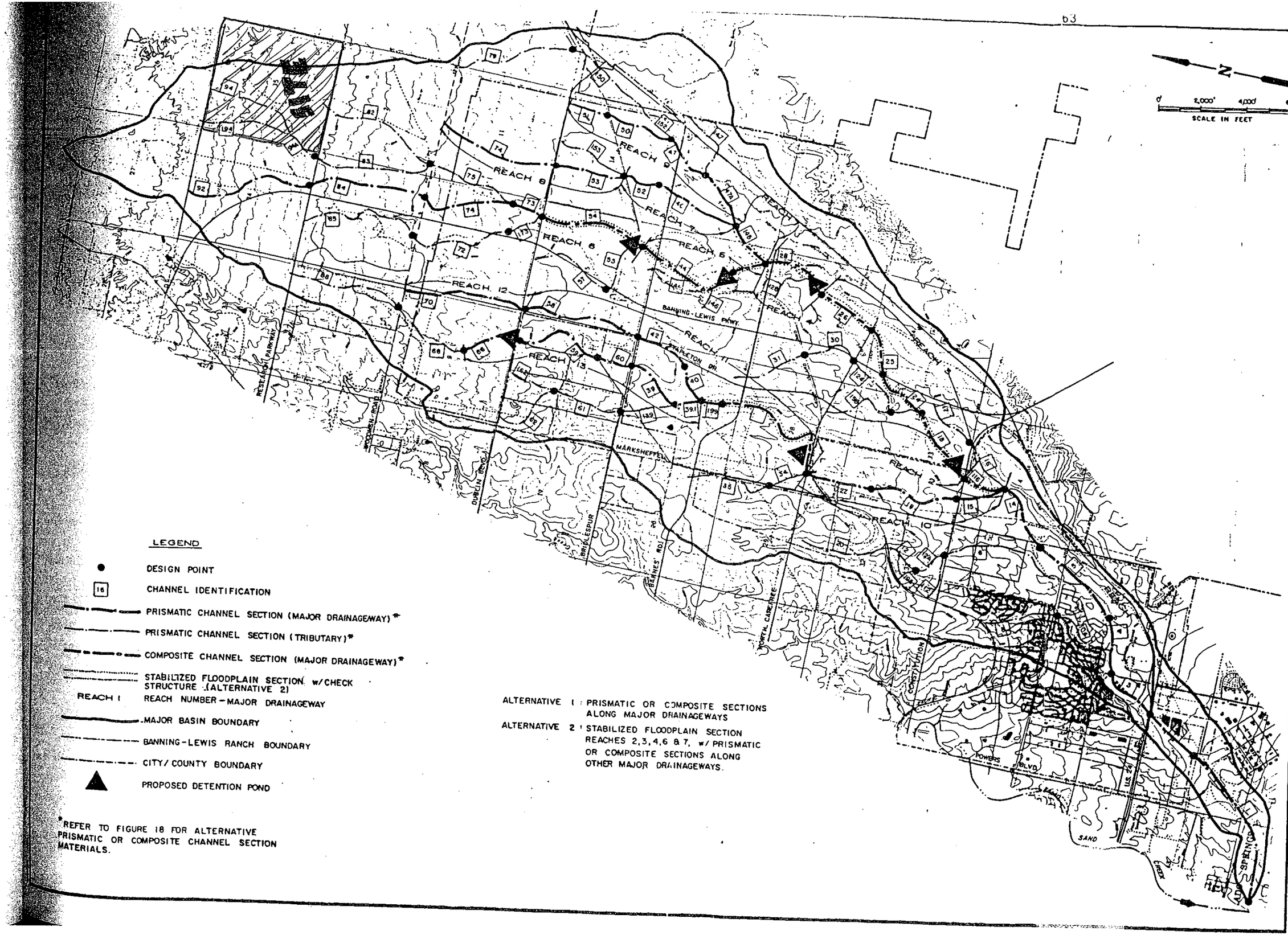
UPSTREAM LIMIT OF STUDY
STA 721+00 CHECK
STA 714+00 CHECK
STA 707+00 CHECK
STA 700+00 CHECK
STA 692+50 CHECK
STA 684+50 CHECK
STA 676+50 CHECK
NEW 10' x 8' CBC
EAST FORK SAND CREEK REACH EF-8
UPSTREAM LIMIT OF STUDY
RESEARCH PARKWAY
UPSTREAM LIMIT OF STUDY
CHECK
Gravel Pit
SELECTIVE BANK LININGS & GRADE CONTROL
CHECK
CHECK
KENOSHA RD.
CHECK
CHECK
CHECK
CHECK
MUSTANG RD
MAVERICK RD.
PONCA RD
PAWNEE RD
BRULE RD.
STA662+50 CHECK
CHECK
CHECK
SELECTIVE BANK LININGS & GRADE CONTROL
STA653+50 CHECK
CHECK
STA644+50 CHECK
CHECK
STA636+00 CHECK
CHECK
STA627+60 CHECK
CHECK
NEW 8'H x 15'W CBC
WOODMEN RD
MATCH SHT EF 32
CHECKS
SELECTIVE BANK LININGS & GRADE CONTROL
NEW 8' x 8' CBC
UPSTREAM LIMITS OF STUDY
SELECTIVE BANK LININGS & GRADE CONTROL
12 CHECKS @ 800' INTERVALS
CHECK
CHECK
CHECK
CHECK
CHECK
STA197+00 CHECK
STA190+50 CHECK
STA174+00 CHECK
STA177+50 CHECK
STA171+00 CHECK
WEST BIJOU CREEK REACH WB-2
STA164+50 CHECK
STA158+00 CHECK
STA151+50 CHECK
STA145+00 DROP
STA143+00 DROP
Beacon
MATCH SHT EF 33
ELKHORN ESTATES
34
35
3
2
1
4
94
92
88
84
83
82
81
0'
1,000'
2000'

Kiowa Engineering Corporation
419 W. Bijou Street
Colorado Springs, Colorado
80905-1308

SAND CREEK DRAINAGE BASIN PLANNING STUDY
PRELIMINARY DESIGN PLANS

Project No	
Date:	
Design:	
Drawn:	
Check:	
Revisions:	

EF-34



Kiowa Engineering Corporation
419 W. Bijou Street
Colorado Springs, Colorado
80905-1308

EAST FORK SAND CREEK
DRAINAGE BASIN PLANNING STUDY

ALTERNATIVE CHANNELIZATION PLANS

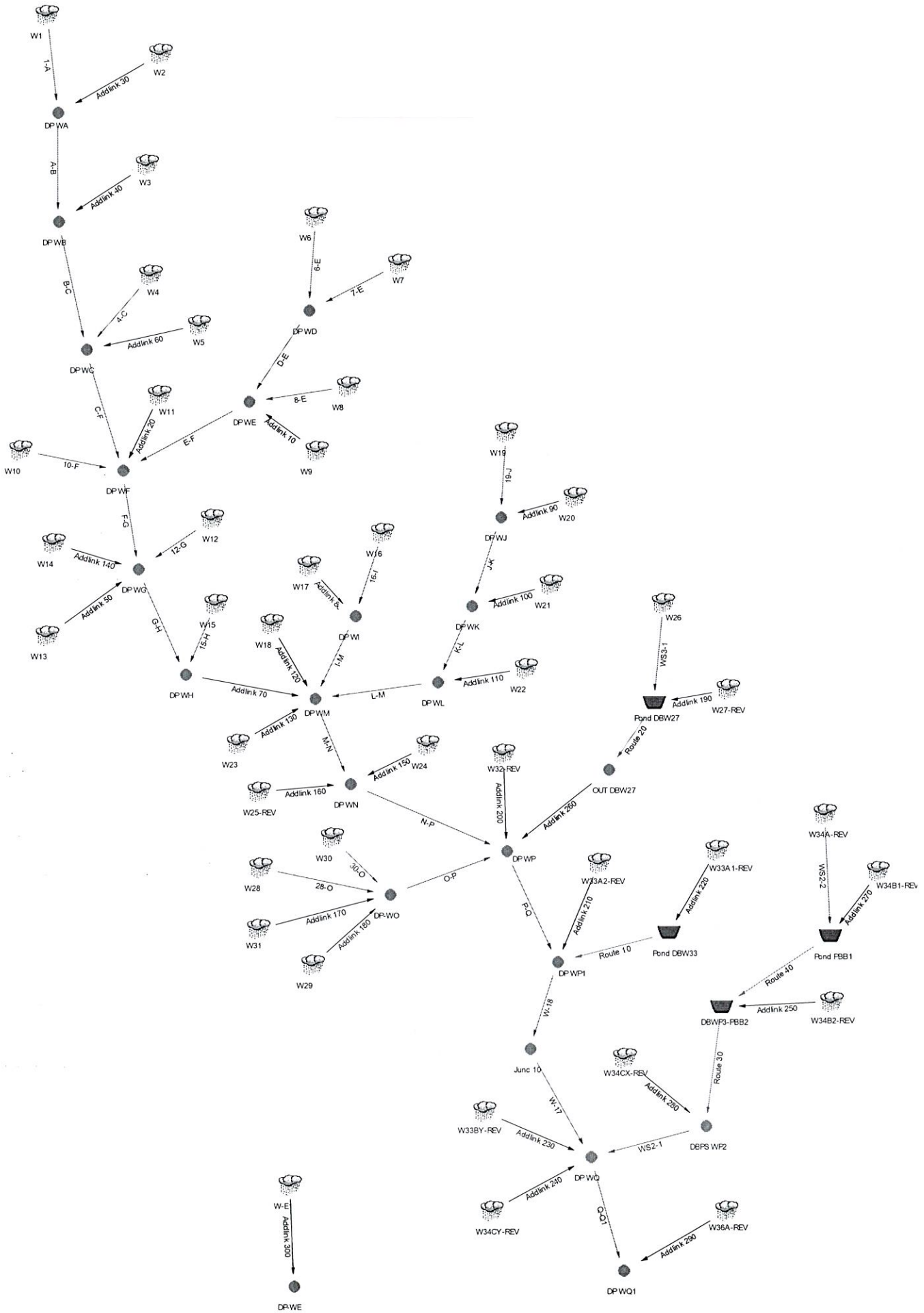
Project No.	88.11.25
Date:	4-89
Design:	JYC
Drawn:	EAK
Check:	
Revisions:	

50

FIGURE VI-1

FALCON AREA – EXISTING CONDITIONS

PONDPAK RESULTS


W1
1-A
W2
Addlink 30
DP WA
A-B
W3
Addlink 40
DP WB
B-C
W4
4-C
Addlink 60
W5
DP WC
C-F
W11
Addlink 20
E-F
W10
10-F
DP WF
F-G
W12
12-G
W14
Addlink 140
DP WG
Addlink 50
G-H
W15
15-H
W13
DP WH
Addlink 70
W6
6-E
7-E
W7
DP WD
D-E
8-E
W8
DP WE
Addlink 10
W9
W19
19-J
Addlink 90
W20
DP WJ
J-K
W16
16-I
W17
Addlink 80
DP WI
I-M
W18
Addlink 120
DP WK
K-L
Addlink 100
W21
W22
Addlink 110
DP WL
L-M
DP WM
Addlink 130
W23
M-N
Addlink 150
W24
W25-REV
Addlink 160
DP WN
N-P
W26
WS3-1
Pond DBW27
Addlink 190
W27-REV
Route 20
OUT DBW27
W32-REV
Addlink 200
Addlink 260
W30
30-O
W28
28-O
O-P
W31
Addlink 170
DP-WO
Addlink 180
W29
DP WP
W33A2-REV
W33A1-REV
Addlink 220
P-Q
Addlink 210
Pond DBW33
Route 10
DP WP1
W34A-REV
WS2-2
W34B1-REV
Addlink 270
Pond PBB1
Route 40
DBWP3-PBB2
Addlink 250
W34B2-REV
W-18
Junc 10
W34CX-REV
Addlink 280
Route 30
W-17
W33BY-REV
Addlink 230
WS2-1
DBPS WP2
DP WQ
Addlink 240
W34CY-REV
Q-Q1
W36A-REV
Addlink 290
DP WQ1
W-E
Addlink 300
DP-WE

FALCON AREA DRAINAGE BASIN - EXISTING SCS ANALYSIS BASIN SUMMARY

BASIN ID	BASIN AREA (ac.)	WEIGHTED C_N	Time of Concentration (hrs.)
W1	30.66	60.0	0.1552
W2	17.79	60.0	0.2560
W3	31.87	61.0	0.2224
W4	3.46	62.0	0.0833
W5	10.18	60.0	0.1200
W6	31.10	60.0	0.1360
W7	13.89	60.0	0.1184
W8	18.30	60.0	0.1104
W9	25.73	61.0	0.1552
W10	27.58	61.0	0.1536
W11	20.10	60.0	0.1232
W12	25.47	60.0	0.1520
W13	71.87	61.0	0.2912
W14	30.27	61.0	0.2160
W15	56.38	61.0	0.2256
W16	18.69	61.0	0.1472
W17	11.78	60.0	0.1360
W18	80.06	60.0	0.3024
W19	27.39	61.0	0.1328
W20	20.16	61.0	0.1136
W21	86.21	60.0	0.2496
W22	5.50	63.0	0.0880
W23	15.62	60.0	0.1792
W24	28.29	60.0	0.2240
W25-REV	53.59	63.7	0.2640
W26	46.08	63.0	0.1456
W27-REV	82.73	68.0	0.3152
W28	25.41	63.0	0.2048
W29	26.18	63.0	0.2320
W30	32.58	63.0	0.1968
W31	7.87	63.0	0.1168
W32-REV	67.00	62.0	0.2720
W33A1-REV	65.04	70.0	0.3216
W33A2-REV	27.52	65.0	0.3117
W33BY-REV	67.85	63.6	0.4467
W34A-REV	83.72	71.8	0.2544
W34B1-REV	92.05	73.7	0.3472
W34B2-REV	59.50	69.8	0.2350
W34CX-REV	47.03	69.2	0.2100
W34CY-REV	29.79	62.1	0.4000
W36A-REV	26.20	61.0	0.4367
W-E1	62.63	61.0	0.4600

Old DBPS??

FALCON AREA DRAINAGE BASIN - EXISTING SCS ANALYSIS REACH SUMMARY

Reach ID	Mannings n	Reach Slope (%)	Reach Length (ft.)	Base Width (ft.)	Side slopes
1-A	0.035	2.63%	1519	5	4:1
A-B	0.035	1.51%	464	5	4:1
B-C	0.035	2.79%	823	5	4:1
4-C	0.035	4.82%	1078	5	4:1
C-F	0.035	4.49%	557	10	4:1
6-E	0.035	3.72%	592	5	4:1
7-E	0.035	14.66%	464	5	4:1
D-E	0.035	4.79%	1044	5	4:1
8-E	0.035	5.04%	1449	5	4:1
E-F	0.035	0.38%	789	5	4:1
10-F	0.035	3.88%	824	5	4:1
F-G	0.035	2.11%	2319	10	4:1
12-G	0.035	3.07%	2478	5	4:1
G-H	0.035	2.17%	2632	15	4:1
15-H	0.035	2.89%	1763	5	4:1
16-I	0.035	3.50%	1345	5	4:1
I-M	0.035	3.70%	2650	15	4:1
19-J	0.035	3.29%	881	5	4:1
J-K	0.035	2.35%	3061	5	4:1
K-L	0.035	2.46%	487	5	4:1
L-M	0.035	2.97%	1786	5	4:1
M-N	0.035	1.49%	1345	20	4:1
N-P	0.035	1.70%	1589	20	4:1
28-O	0.035	2.08%	1345	5	4:1
30-O	0.035	0.74%	1078	5	4:1
O-P	0.035	2.26%	2169	5	4:1
WS3-1	0.040	1.93%	3400	2	2:1
P-Q	0.035	1.82%	1925	25	4:1
W-18	0.035	1.50%	750	25	4:1
W-17	0.035	2.00%	1750	25	4:1
WS2-2	0.035	2.18%	1560	20	4:1
WS2-1	0.040	2.00%	3150	10	2:1
Q-Q1	0.035	2.20%	2940	25	4:1

JOB TITLE
==========

Project Date: 11/1/2009
Project Engineer: Matt Larson
Project Title: Elkhorn Estates - Falcon Area Basin Existing Conditions
Project Comments:

********** MASTER SUMMARY **********

********** DESIGN STORMS SUMMARY **********

********** POND VOLUMES **********

********** OUTLET STRUCTURES **********

********** POND ROUTING **********

MASTER DESIGN STORM SUMMARY

Network Storm Collection: COLO SPRGS

Return Event	Total Depth in	Rainfall Type	RNF ID
100	4.4000	Synthetic Curve	TYPEIIA 24HR
5	2.6000	Synthetic Curve	TYPEIIA 24HR

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
DBPS WP2		JCT	100	40.685		6.7993	136.04		
DBPS WP2		JCT	5	13.488		6.0661	40.54		
DBWP3-PBB2	IN	POND	100	34.675		6.0661	310.06		
DBWP3-PBB2	IN	POND	5	11.656		6.1327	123.04		
DBWP3-PBB2	OUT	POND	100	34.675		6.7993	128.36	7145.01	14.606
DBWP3-PBB2	OUT	POND	5	11.656		6.8660	18.69	7140.56	4.254
DP WA		JCT	100	3.901		6.0661	58.04		
DP WA		JCT	5	.816		6.1327	6.67		
DP WB		JCT	100	6.619		6.0661	94.23		
DP WB		JCT	5	1.417		6.1327	11.43		
DP WC		JCT	100	7.750		6.0661	103.97		
DP WC		JCT	5	1.660		6.1994	10.70		
DP WD		JCT	100	3.621		6.0661	61.98		
DP WD		JCT	5	.758		6.0661	8.06		

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
DP WE	JCT	100	7.290		6.0661	120.76		
DP WE	JCT	5	1.551		6.0661	15.50		
DP WF	JCT	100	19.010		6.0661	267.09		
DP WF	JCT	5	4.070		6.1327	26.60		
DP WG	JCT	100	29.777		6.1327	374.53		
DP WG	JCT	5	6.425		6.1994	35.90		
DP WH	JCT	100	34.585		6.1994	388.77		
DP WH	JCT	5	7.487		6.2660	36.13		
DP WI	JCT	100	2.542		6.0661	39.19		
DP WI	JCT	5	.551		6.0661	5.27		
DP WJ	JCT	100	4.056		5.9994	71.56		
DP WJ	JCT	5	.896		6.0661	10.26		
DP WK	JCT	100	10.996		6.0661	152.35		
DP WK	JCT	5	2.348		6.1327	18.41		
DP WL	JCT	100	11.520		6.1327	148.38		
DP WL	JCT	5	2.476		6.1327	18.28		
DP WM	JCT	100	56.351		6.1327	647.31		
DP WM	JCT	5	12.125		6.1994	63.06		
DP WN	JCT	100	64.009		6.1994	706.20		
DP WN	JCT	5	13.970		6.2660	66.09		
DP WP	JCT	100	93.314		6.1994	868.38		
DP WP	JCT	5	21.558		6.3327	88.94		
DP WP1	JCT	100	104.916		6.2660	882.25		
DP WP1	JCT	5	25.059		6.4660	88.94		

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
DP WQ	JCT	100	155.114		6.3327	992.60		
DP WQ	JCT	5	40.905		6.5993	114.73		
*DP WQ1	JCT	100	157.347		6.3994	958.01		
*DP WQ1	JCT	5	41.398		6.7327	112.16		
*DP-WE	JCT	100	5.353		6.1994	55.46		
*DP-WE	JCT	5	1.182		6.2660	6.93		
DP-WO	JCT	100	8.770		6.0661	130.12		
DP-WO	JCT	5	2.135		6.1327	18.59		
JUNC 10	JCT	100	104.916		6.2660	868.29		
JUNC 10	JCT	5	25.059		6.5327	88.95		
OUT DBW27	JCT	100	14.490		6.7993	24.55		
OUT DBW27	JCT	5	4.048		6.5993	10.89		
POND DBW27 IN	POND	100	14.490		6.0661	196.78		
POND DBW27 IN	POND	5	4.048		6.1327	42.87		
POND DBW27 OUT	POND	100	14.490		6.7993	24.55	7195.72	6.092
POND DBW27 OUT	POND	5	4.048		6.5993	10.89	7192.35	.932
POND DBW33 IN	POND	100	8.693		6.0661	123.08		
POND DBW33 IN	POND	5	2.732		6.1327	33.89		
POND DBW33 OUT	POND	100	8.693		6.3994	34.95	7144.18	3.396
POND DBW33 OUT	POND	5	2.732		6.6660	5.83	7141.54	.840
POND PBB1 IN	POND	100	26.732		6.0661	383.90		
POND PBB1 IN	POND	5	9.160		6.1327	114.05		
POND PBB1 OUT	POND	100	26.732		6.2660	221.81	7151.60	4.798
POND PBB1 OUT	POND	5	9.160		6.1994	97.33	7147.57	.465

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
W-E1	AREA	100	5.353		6.1994	55.46		
W-E1	AREA	5	1.182		6.2660	6.93		
W1	AREA	100	2.469		5.9994	42.03		
W1	AREA	5	.517		6.0661	6.11		
W10	AREA	100	2.354		5.9994	40.81		
W10	AREA	5	.520		6.0661	6.69		
W11	AREA	100	1.617		5.9994	30.27		
W11	AREA	5	.339		6.0661	4.11		
W12	AREA	100	2.051		5.9994	35.30		
W12	AREA	5	.429		6.0661	5.09		
W13	AREA	100	6.134		6.0661	82.64		
W13	AREA	5	1.356		6.1327	11.42		
W14	AREA	100	2.583		6.0661	41.28		
W14	AREA	5	.571		6.0661	5.73		
W15	AREA	100	4.810		6.0661	75.56		
W15	AREA	5	1.063		6.0661	10.17		
W16	AREA	100	1.595		5.9994	28.08		
W16	AREA	5	.353		6.0661	4.58		
W17	AREA	100	.948		5.9994	17.11		
W17	AREA	5	.198		6.0661	2.41		
W18	AREA	100	6.447		6.1327	84.01		
W18	AREA	5	1.349		6.1327	9.88		
W19	AREA	100	2.336		5.9994	42.95		
W19	AREA	5	.516		6.0661	6.74		

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
W2	AREA	100	1.432		6.0661	20.85		
W2	AREA	5	.300		6.1327	2.46		
W20	AREA	100	1.719		5.9994	33.30		
W20	AREA	5	.380		5.9994	4.91		
W21	AREA	100	6.942		6.0661	102.48		
W21	AREA	5	1.453		6.1327	12.08		
W22	AREA	100	.524		5.9994	10.80		
W22	AREA	5	.127		5.9994	2.24		
W23	AREA	100	1.258		6.0661	21.02		
W23	AREA	5	.263		6.0661	2.85		
W24	AREA	100	2.279		6.0661	35.89		
W24	AREA	5	.477		6.0661	4.14		
W25-REV	AREA	100	5.379		6.0661	80.74		
W25-REV	AREA	5	1.368		6.1327	14.84		
W26	AREA	100	4.389		5.9994	79.31		
W26	AREA	5	1.069		6.0661	15.36		
W27-REV	AREA	100	10.102		6.0661	141.77		
W27-REV	AREA	5	2.981		6.1327	35.20		
W28	AREA	100	2.421		6.0661	40.12		
W28	AREA	5	.589		6.0661	7.38		
W29	AREA	100	2.496		6.0661	39.99		
W29	AREA	5	.608		6.0661	6.89		
W3	AREA	100	2.718		6.0661	42.95		
W3	AREA	5	.601		6.0661	5.84		

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
W30	AREA	100	3.104		6.0661	51.78		
W30	AREA	5	.756		6.0661	9.71		
W31	AREA	100	.750		5.9994	14.51		
W31	AREA	5	.183		5.9994	2.72		
W32-REV	AREA	100	6.046		6.0661	87.02		
W32-REV	AREA	5	1.406		6.1327	13.44		
W33A1-REV	AREA	100	8.693		6.0661	123.08		
W33A1-REV	AREA	5	2.732		6.1327	33.89		
W33A2-REV	AREA	100	2.909		6.0661	39.96		
W33A2-REV	AREA	5	.770		6.1327	8.05		
W33BY-REV	AREA	100	6.825		6.1994	75.06		
W33BY-REV	AREA	5	1.735		6.1994	13.15		
W34A-REV	AREA	100	12.187		6.0661	196.73		
W34A-REV	AREA	5	4.056		6.0661	59.92		
W34B1-REV	AREA	100	14.544		6.0661	203.08		
W34B1-REV	AREA	5	5.104		6.1327	64.70		
W34B2-REV	AREA	100	7.943		6.0661	129.63		
W34B2-REV	AREA	5	2.496		6.0661	36.79		
W34CX-REV	AREA	100	6.010		6.0661	100.43		
W34CX-REV	AREA	5	1.832		6.0661	28.05		
W34CY-REV	AREA	100	2.689		6.1327	31.11		
W34CY-REV	AREA	5	.625		6.1994	4.47		
W36A-REV	AREA	100	2.234		6.1994	23.67		
W36A-REV	AREA	5	.494		6.1994	2.96		

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
W4	AREA	100	.311		5.9994	6.49		
W4	AREA	5	.072		5.9994	1.24		
W5	AREA	100	.819		5.9994	15.51		
W5	AREA	5	.171		6.0661	2.08		
W6	AREA	100	2.503		5.9994	45.19		
W6	AREA	5	.524		6.0661	6.37		
W7	AREA	100	1.118		5.9994	21.26		
W7	AREA	5	.234		6.0661	2.83		
W8	AREA	100	1.473		5.9994	28.53		
W8	AREA	5	.308		6.0661	3.65		
W9	AREA	100	2.196		5.9994	37.87		
W9	AREA	5	.485		6.0661	6.23		

Title... Project Date: 11/1/2009
Project Engineer: Matt Larson
Project Title: Elkhorn Estates - Falcon Area Basin
Existing Conditions
Project Comments:

DESIGN STORMS SUMMARY

Design Storm File,ID = COLO SPRGS

Storm Tag Name = 100

Data Type, File, ID = Synthetic Storm TYPEIIA 24HR
Storm Frequency = 100 yr
Total Rainfall Depth= 4.4000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .2500 hrs End= 24.0000 hrs

Storm Tag Name = 5

Data Type, File, ID = Synthetic Storm TYPEIIA 24HR
Storm Frequency = 5 yr
Total Rainfall Depth= 2.6000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .2500 hrs End= 24.0000 hrs

Elevation (ft)	Planimeter (sq.in)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	Volume (ac-ft)	Volume Sum (ac-ft)
7136.00	-----	.0001	.0000	.000	.000
7138.00	-----	.7982	.8079	.539	.539
7140.00	-----	1.9084	3.9409	2.627	3.166
7142.00	-----	2.2717	6.2622	4.175	7.341
7144.00	-----	2.4612	7.0973	4.732	12.072
7146.00	-----	2.6550	7.6724	5.115	17.187
7147.36	-----	2.7915	8.1690	3.703	20.890

POND VOLUME EQUATIONS

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

Elevation (ft)	Planimeter (sq.in)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	Volume (ac-ft)	Volume Sum (ac-ft)
7190.00	-----	.0005	.0000	.000	.000
7192.00	-----	.8853	.9069	.605	.605
7194.00	-----	1.6503	3.7443	2.496	3.101
7196.00	-----	1.8602	5.2625	3.508	6.609
7198.00	-----	2.0808	5.9083	3.939	10.548
7200.00	-----	2.4113	6.7320	4.488	15.036

POND VOLUME EQUATIONS

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

Elevation (ft)	Planimeter (sq.in)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	Volume (ac-ft)	Volume Sum (ac-ft)
7139.00	-----	.0005	.0000	.000	.000
7140.00	-----	.2705	.2827	.094	.094
7142.00	-----	.9286	1.7003	1.134	1.228
7144.00	-----	1.0500	2.9660	1.977	3.205
7146.00	-----	1.1767	3.3383	2.226	5.431
7148.00	-----	1.3087	3.7264	2.484	7.915

POND VOLUME EQUATIONS

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

Elevation (ft)	Planimeter (sq.in)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	Volume (ac-ft)	Volume Sum (ac-ft)
7144.00	-----	.0001	.0000	.000	.000
7146.00	-----	.0339	.0360	.024	.024
7148.00	-----	.9664	1.1815	.788	.812
7150.00	-----	1.1216	3.1292	2.086	2.898
7152.00	-----	1.2895	3.6137	2.409	5.307
7154.00	-----	1.5173	4.2055	2.804	8.111
7154.57	-----	1.5793	4.6446	.882	8.993

POND VOLUME EQUATIONS

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

REQUESTED POND WS ELEVATIONS:

Min. Elev.= 7190.00 ft
Increment = .10 ft
Max. Elev.= 7200.00 ft

****
OUTLET CONNECTIVITY
****

---> Forward Flow Only (UpStream to DnStream)
<--- Reverse Flow Only (DnStream to UpStream)
<---> Forward and Reverse Both Allowed

Structure	No.		Outfall	E1, ft	E2, ft
Stand Pipe	R0	--->	TW	7195.520	7200.000
Culvert-Circular	C0	--->	TW	7190.000	7200.000

TW SETUP, DS Channel

OUTLET STRUCTURE INPUT DATA

Structure ID = R0
Structure Type = Stand Pipe

# of Openings	=	1
Invert Elev.	=	7195.52 ft
Diameter	=	5.5000 ft
Orifice Area	=	23.7583 sq.ft
Orifice Coeff.	=	.500
Weir Length	=	17.28 ft
Weir Coeff.	=	3.000
K, Reverse	=	1.000
Mannings n	=	.0000
Kev,Charged Riser	=	.000
Weir Submergence	=	No
Orifice H to crest	=	Yes

OUTLET STRUCTURE INPUT DATA

Structure ID = C0
Structure Type = Culvert-Circular

No. Barrels	=	1
Barrel Diameter	=	1.5000 ft
Upstream Invert	=	7190.00 ft
Dnstream Invert	=	7189.50 ft
Horiz. Length	=	50.00 ft
Barrel Length	=	50.00 ft
Barrel Slope	=	.01000 ft/ft

OUTLET CONTROL DATA...

Mannings n	=	.0130
Ke	=	.5000 (forward entrance loss)
Kb	=	.018213 (per ft of full flow)
Kr	=	.5000 (reverse entrance loss)
HW Convergence	=	.001 +/- ft

INLET CONTROL DATA...

Equation form	=	0
Inlet Control K	=	.0078
Inlet Control M	=	2.0000
Inlet Control c	=	.02920
Inlet Control Y	=	.7400
T1 ratio (HW/D)	=	.000
T2 ratio (HW/D)	=	1.202
Slope Factor	=	-.500

Use unsubmerged inlet control Form 0 equ. below T1 elev.
Use submerged inlet control Form 0 equ. above T2 elev.

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...
At T1 Elev = 7190.00 ft ---> Flow = 7.58 cfs
At T2 Elev = 7191.80 ft ---> Flow = 8.66 cfs

Structure ID = TW
Structure Type = TW SETUP, DS Channel

FREE OUTFALL CONDITIONS SPECIFIED

CONVERGENCE TOLERANCES...

Maximum Iterations	=	40
Min. TW tolerance	=	.01 ft
Max. TW tolerance	=	.01 ft
Min. HW tolerance	=	.01 ft
Max. HW tolerance	=	.01 ft
Min. Q tolerance	=	.00 cfs
Max. Q tolerance	=	.00 cfs

REQUESTED POND WS ELEVATIONS:

Min. Elev.= 7139.00 ft
Increment = .10 ft
Max. Elev.= 7148.00 ft

****
OUTLET CONNECTIVITY
****

---> Forward Flow Only (UpStream to DnStream)
<--- Reverse Flow Only (DnStream to UpStream)
<---> Forward and Reverse Both Allowed

Structure	No.		Outfall	E1, ft	E2, ft
Stand Pipe	R0	--->	TW	7143.240	7148.000
Culvert-Circular	C0	--->	TW	7139.000	7148.000

TW SETUP, DS Channel

OUTLET STRUCTURE INPUT DATA

Structure ID = R0
Structure Type = Stand Pipe

# of Openings	=	1
Invert Elev.	=	7143.24 ft
Diameter	=	3.0000 ft
Orifice Area	=	7.0686 sq.ft
Orifice Coeff.	=	.500
Weir Length	=	9.42 ft
Weir Coeff.	=	3.000
K, Reverse	=	1.000
Mannings n	=	.0000
Kev,Charged Riser	=	.000
Weir Submergence	=	No
Orifice H to crest	=	Yes

OUTLET STRUCTURE INPUT DATA

Structure ID = C0
Structure Type = Culvert-Circular

No. Barrels	=	1
Barrel Diameter	=	1.0000 ft
Upstream Invert	=	7139.00 ft
Dnstream Invert	=	7138.73 ft
Horiz. Length	=	20.00 ft
Barrel Length	=	20.00 ft
Barrel Slope	=	.01360 ft/ft

OUTLET CONTROL DATA...

Mannings n	=	.0130	
Ke	=	.5000	(forward entrance loss)
Kb	=	.031274	(per ft of full flow)
Kr	=	.5000	(reverse entrance loss)
HW Convergence	=	.001	+/- ft

INLET CONTROL DATA...

Equation form	=	0
Inlet Control K	=	.0078
Inlet Control M	=	2.0000
Inlet Control c	=	.02920
Inlet Control Y	=	.7400
T1 ratio (HW/D)	=	1.129
T2 ratio (HW/D)	=	1.200
Slope Factor	=	-.500

Use unsubmerged inlet control Form 0 equ. below T1 elev.
Use submerged inlet control Form 0 equ. above T2 elev.

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...
At T1 Elev = 7140.13 ft ---> Flow = 2.75 cfs
At T2 Elev = 7140.20 ft ---> Flow = 3.14 cfs

Structure ID = TW
Structure Type = TW SETUP, DS Channel

FREE OUTFALL CONDITIONS SPECIFIED

CONVERGENCE TOLERANCES...

Maximum Iterations	=	40
Min. TW tolerance	=	.01 ft
Max. TW tolerance	=	.01 ft
Min. HW tolerance	=	.01 ft
Max. HW tolerance	=	.01 ft
Min. Q tolerance	=	.00 cfs
Max. Q tolerance	=	.00 cfs

REQUESTED POND WS ELEVATIONS:

Min. Elev.= 7144.00 ft
Increment = .10 ft
Max. Elev.= 7154.57 ft

****
OUTLET CONNECTIVITY
****

---> Forward Flow Only (UpStream to DnStream)
<--- Reverse Flow Only (DnStream to UpStream)
<---> Forward and Reverse Both Allowed

Structure	No.		Outfall	E1, ft	E2, ft
Culvert-Circular	C0	--->	TW	7144.000	7154.570
TW SETUP, DS Channel					

OUTLET STRUCTURE INPUT DATA

Structure ID = C0
Structure Type = Culvert-Circular

No. Barrels	=	2	
Barrel Diameter	=	3.5000	ft
Upstream Invert	=	7144.00	ft
Dnstream Invert	=	7140.26	ft
Horiz. Length	=	187.00	ft
Barrel Length	=	187.04	ft
Barrel Slope	=	.02000	ft/ft

OUTLET CONTROL DATA...

Mannings n	=	.0130	
Ke	=	.5000	(forward entrance loss)
Kb	=	.005885	(per ft of full flow)
Kr	=	.5000	(reverse entrance loss)
HW Convergence	=	.001	+/- ft

INLET CONTROL DATA...

Equation form	=	1	
Inlet Control K	=	.0098	
Inlet Control M	=	2.0000	
Inlet Control c	=	.03980	
Inlet Control Y	=	.6700	
T1 ratio (HW/D)	=	1.150	
T2 ratio (HW/D)	=	1.297	
Slope Factor	=	-.500	

Use unsubmerged inlet control Form 1 equ. below T1 elev.
Use submerged inlet control Form 1 equ. above T2 elev.

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...
At T1 Elev = 7148.03 ft ---> Flow = 63.00 cfs
At T2 Elev = 7148.54 ft ---> Flow = 72.00 cfs

OUTLET STRUCTURE INPUT DATA

Structure ID = TW
Structure Type = TW SETUP, DS Channel

FREE OUTFALL CONDITIONS SPECIFIED

CONVERGENCE TOLERANCES...
Maximum Iterations= 40
Min. TW tolerance = .01 ft
Max. TW tolerance = .01 ft
Min. HW tolerance = .01 ft
Max. HW tolerance = .01 ft
Min. Q tolerance = .00 cfs
Max. Q tolerance = .00 cfs

REQUESTED POND WS ELEVATIONS:

Min. Elev.= 7136.00 ft
Increment = .10 ft
Max. Elev.= 7147.36 ft

****
OUTLET CONNECTIVITY
****

---> Forward Flow Only (UpStream to DnStream)
<--- Reverse Flow Only (DnStream to UpStream)
<---> Forward and Reverse Both Allowed

Structure	No.		Outfall	E1, ft	E2, ft
Stand Pipe	R0	--->	TW	7143.350	7147.360
Culvert-Circular	C0	--->	TW	7136.000	7147.360

TW SETUP, DS Channel

OUTLET STRUCTURE INPUT DATA

Structure ID = R0
Structure Type = Stand Pipe

# of Openings	=	1
Invert Elev.	=	7143.35 ft
Diameter	=	5.0000 ft
Orifice Area	=	19.6350 sq.ft
Orifice Coeff.	=	.500
Weir Length	=	15.71 ft
Weir Coeff.	=	3.000
K, Reverse	=	1.000
Mannings n	=	.0000
Kev,Charged Riser	=	.000
Weir Submergence	=	No
Orifice H to crest	=	Yes

OUTLET STRUCTURE INPUT DATA

Structure ID = C0
Structure Type = Culvert-Circular

No. Barrels	=	1
Barrel Diameter	=	1.5000 ft
Upstream Invert	=	7136.00 ft
Dnstream Invert	=	7135.30 ft
Horiz. Length	=	20.00 ft
Barrel Length	=	20.01 ft
Barrel Slope	=	.03501 ft/ft

OUTLET CONTROL DATA...

Mannings n	=	.0130	
Ke	=	.2000	(forward entrance loss)
Kb	=	.018213	(per ft of full flow)
Kr	=	.2000	(reverse entrance loss)
HW Convergence	=	.001	+/- ft

INLET CONTROL DATA...

Equation form	=	1
Inlet Control K	=	.0045
Inlet Control M	=	2.0000
Inlet Control c	=	.03170
Inlet Control Y	=	.6900
T1 ratio (HW/D)	=	1.078
T2 ratio (HW/D)	=	1.180
Slope Factor	=	-.500

Use unsubmerged inlet control Form 1 equ. below T1 elev.
Use submerged inlet control Form 1 equ. above T2 elev.

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...
At T1 Elev = 7137.62 ft ---> Flow = 7.58 cfs
At T2 Elev = 7137.77 ft ---> Flow = 8.66 cfs

Structure ID = TW
Structure Type = TW SETUP, DS Channel

FREE OUTFALL CONDITIONS SPECIFIED

CONVERGENCE TOLERANCES...

Maximum Iterations	=	40
Min. TW tolerance	=	.01 ft
Max. TW tolerance	=	.01 ft
Min. HW tolerance	=	.01 ft
Max. HW tolerance	=	.01 ft
Min. Q tolerance	=	.00 cfs
Max. Q tolerance	=	.00 cfs

LEVEL POOL ROUTING SUMMARY

HYG Dir = X:\228900\REPORTS\MDDP\
Inflow HYG file = work_pad.hyg - DBWP3-PBB2 IN 100
Outflow HYG file = work_pad.hyg - DBWP3-PBB2 OUT 100

Pond Node Data = DBWP3-PBB2
Pond Volume Data = DBWP3-PBB2
Pond Outlet Data = PBB2 OUT

No Infiltration

INITIAL CONDITIONS

Starting WS Elev	= 7136.00	ft
Starting Volume	= .000	ac-ft
Starting Outflow	= .00	cfs
Starting Infiltr.	= .00	cfs
Starting Total Qout	= .00	cfs
Time Increment	= .0667	hrs

INFLOW/OUTFLOW HYDROGRAPH SUMMARY

Peak Inflow	= 310.06	cfs	at	6.0661 hrs
Peak Outflow	= 128.36	cfs	at	6.7993 hrs
Peak Elevation	= 7145.01	ft		
Peak Storage	= 14.606	ac-ft		

MASS BALANCE (ac-ft)

+ Initial Vol	=	.000
+ HYG Vol IN	=	34.675
- Infiltration	=	.000
- HYG Vol OUT	=	34.675
- Retained Vol	=	.000
Unrouted Vol	=	-.000 ac-ft (.000% of Inflow Volume)

LEVEL POOL ROUTING SUMMARY

HYG Dir = X:\228900\REPORTS\MDDP\
Inflow HYG file = work_pad.hyg - POND DBW27 IN 100
Outflow HYG file = work_pad.hyg - POND DBW27 OUT 100

Pond Node Data = POND DBW27
Pond Volume Data = POND DBW27
Pond Outlet Data = DBW27 OUT

No Infiltration

INITIAL CONDITIONS

Starting WS Elev	=	7190.00 ft
Starting Volume	=	.000 ac-ft
Starting Outflow	=	.00 cfs
Starting Infiltr.	=	.00 cfs
Starting Total Qout	=	.00 cfs
Time Increment	=	.0667 hrs

INFLOW/OUTFLOW HYDROGRAPH SUMMARY

Peak Inflow	=	196.78 cfs	at	6.0661 hrs
Peak Outflow	=	24.55 cfs	at	6.7993 hrs
Peak Elevation	=	7195.72 ft		
Peak Storage	=	6.092 ac-ft		

MASS BALANCE (ac-ft)

+ Initial Vol	=	.000
+ HYG Vol IN	=	14.490
- Infiltration	=	.000
- HYG Vol OUT	=	14.490
- Retained Vol	=	.000
Unrouted Vol	=	-.000 ac-ft (.000% of Inflow Volume)

LEVEL POOL ROUTING SUMMARY

HYG Dir = X:\228900\REPORTS\MDDP\
Inflow HYG file = work_pad.hyg - POND DBW33 IN 100
Outflow HYG file = work_pad.hyg - POND DBW33 OUT 100

Pond Node Data = POND DBW33
Pond Volume Data = POND DBW33
Pond Outlet Data = DBW33 OUT

No Infiltration

INITIAL CONDITIONS

Starting WS Elev	= 7139.00	ft
Starting Volume	= .000	ac-ft
Starting Outflow	= .00	cfs
Starting Infiltr.	= .00	cfs
Starting Total Qout	= .00	cfs
Time Increment	= .0667	hrs

INFLOW/OUTFLOW HYDROGRAPH SUMMARY

Peak Inflow	= 123.08	cfs	at	6.0661 hrs
Peak Outflow	= 34.95	cfs	at	6.3994 hrs
Peak Elevation	= 7144.18	ft		
Peak Storage	= 3.396	ac-ft		

MASS BALANCE (ac-ft)

+ Initial Vol	= .000	
+ HYG Vol IN	= 8.693	
- Infiltration	= .000	
- HYG Vol OUT	= 8.693	
- Retained Vol	= .000	
Unrouted Vol	= -.000	ac-ft (.000% of Inflow Volume)

LEVEL POOL ROUTING SUMMARY

HYG Dir = X:\228900\REPORTS\MDDP\
Inflow HYG file = work_pad.hyg - POND PBB1 IN 100
Outflow HYG file = work_pad.hyg - POND PBB1 OUT 100

Pond Node Data = POND PBB1
Pond Volume Data = POND PBB1
Pond Outlet Data = PBB1 OUT

No Infiltration

INITIAL CONDITIONS

Starting WS Elev	= 7144.00	ft
Starting Volume	= .000	ac-ft
Starting Outflow	= .00	cfs
Starting Infiltr.	= .00	cfs
Starting Total Qout	= .00	cfs
Time Increment	= .0667	hrs

INFLOW/OUTFLOW HYDROGRAPH SUMMARY

Peak Inflow	= 383.90	cfs	at	6.0661 hrs
Peak Outflow	= 221.81	cfs	at	6.2660 hrs
Peak Elevation	= 7151.60	ft		
Peak Storage	= 4.798	ac-ft		

MASS BALANCE (ac-ft)

+ Initial Vol	=	.000
+ HYG Vol IN	=	26.732
- Infiltration	=	.000
- HYG Vol OUT	=	26.732
- Retained Vol	=	.000
Unrouted Vol	=	-.000 ac-ft (.000% of Inflow Volume)

----- C -----
COLO SPRGS... 2.01

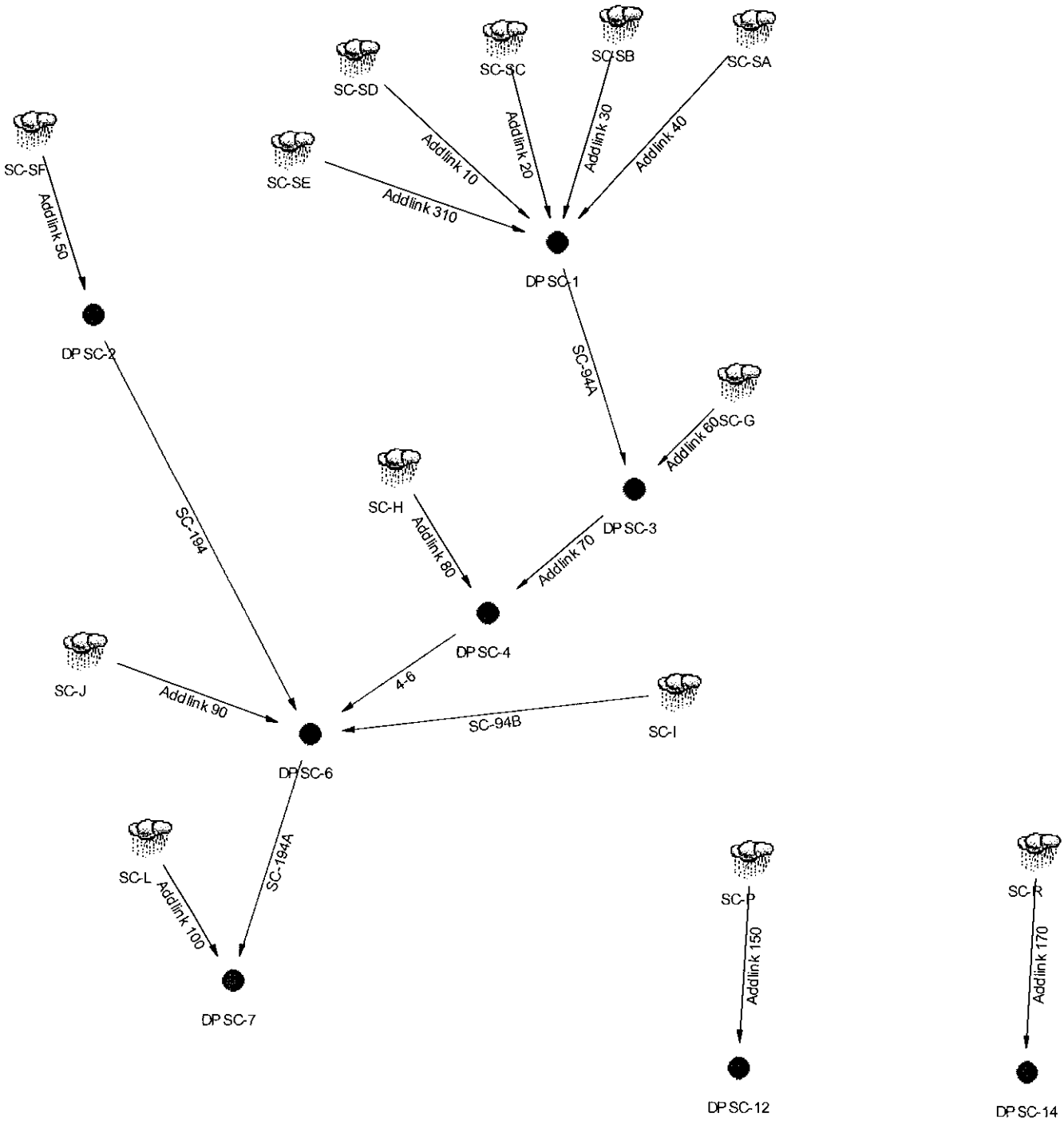
----- D -----
DBW27 OUT... 4.01
DBW33 OUT... 4.04
DBWP3-PBB2... 3.01, 5.01

----- P -----
PBB1 OUT... 4.07
PBB2 OUT... 4.10
POND DBW27... 3.02, 5.02
POND DBW33... 3.03, 5.03
POND PBB1... 3.04, 5.04

----- W -----
Watershed... 1.01

SAND CREEK – EXISTING CONDITIONS

PONDPAK RESULTS


SC-SD
SC-SC
SC-SB
SC-SA
SC-SE
SC-SF
Addlink 10
Addlink 20
Addlink 30
Addlink 40
Addlink 310
Addlink 50
DP SC-1
DP SC-2
SC-194A
SC-G
Addlink 60
SC-H
SC-194
Addlink 80
Addlink 70
DP SC-3
DP SC-4
SC-J
Addlink 90
4-6
SC-94B
SC-I
DP SC-6
SC-L
SC-194A
Addlink 100
DP SC-7
SC-P
Addlink 150
DP SC-12
SC-R
Addlink 170
DP SC-14

JOB TITLE
==========

Project Date: 11/1/2009
Project Engineer: Matt Larson
Project Title: Elkhorn Estates - Sand Creek Historic Conditions
Project Comments:

********** MASTER SUMMARY **********

Watershed..... Master Network Summary 1.01

********** DESIGN STORMS SUMMARY **********

COLO SPRGS..... Design Storms 2.01

********** CHANNEL ANALYSES **********

4-6..... Chn-Trapz. 3.01

SC-194..... Chn-Trapz. 3.03

SC-194A..... Chn-Trapz. 3.05

SC-94A..... Chn-Trapz. 3.07

SC-94B..... Chn-Trapz. 3.09

MASTER DESIGN STORM SUMMARY

Network Storm Collection: COLO SPRGS

Return Event	Total Depth in	Rainfall Type	RNF ID
100	4.4000	Synthetic Curve	TYPEIIA 24HR
5	2.6000	Synthetic Curve	TYPEIIA 24HR

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
DP SC-1	JCT	100	12.099		6.0600	171.37		
DP SC-1	JCT	5	2.900		6.1000	27.17		
*DP SC-12	JCT	100	5.723		6.2600	48.67		
*DP SC-12	JCT	5	1.265		6.3400	6.07		
*DP SC-14	JCT	100	6.973		6.2500	62.13		
*DP SC-14	JCT	5	1.541		6.3300	7.76		
DP SC-2	JCT	100	8.013		6.0500	129.78		
DP SC-2	JCT	5	1.951		6.0800	23.28		
DP SC-3	JCT	100	17.266		6.1500	192.79		
DP SC-3	JCT	5	4.041		6.2300	25.52		
DP SC-4	JCT	100	19.117		6.1500	214.45		
DP SC-4	JCT	5	4.450		6.2300	28.22		
DP SC-6	JCT	100	36.276		6.1600	404.97		
DP SC-6	JCT	5	8.419		6.2400	52.96		

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
*DP SC-7	JCT	100	38.604		6.2000	418.04		
*DP SC-7	JCT	5	8.932		6.3100	51.72		
SC-G	AREA	100	5.170		6.1800	49.99		
SC-G	AREA	5	1.143		6.3100	6.26		
SC-H	AREA	100	1.851		6.1600	21.74		
SC-H	AREA	5	.409		6.2100	2.77		
SC-I	AREA	100	3.003		6.2000	31.59		
SC-I	AREA	5	.664		6.2600	3.99		
SC-J	AREA	100	6.148		6.1600	64.39		
SC-J	AREA	5	1.359		6.2200	8.10		
SC-L	AREA	100	2.330		6.1200	28.49		
SC-L	AREA	5	.515		6.1700	3.68		
SC-P	AREA	100	5.723		6.2600	48.67		
SC-P	AREA	5	1.265		6.3400	6.07		
SC-R	AREA	100	6.973		6.2500	62.13		
SC-R	AREA	5	1.541		6.3300	7.76		
SC-SA	AREA	100	4.075		6.1000	54.46		
SC-SA	AREA	5	.947		6.1500	8.09		
SC-SB	AREA	100	4.638		6.0800	66.01		
SC-SB	AREA	5	1.129		6.1100	11.21		
SC-SC	AREA	100	.443		6.0100	9.05		
SC-SC	AREA	5	.108		6.0200	1.93		
SC-SD	AREA	100	2.099		6.0500	35.81		
SC-SD	AREA	5	.511		6.0800	6.57		

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
SC-SE	AREA	100	.843		6.0200	16.64		
SC-SE	AREA	5	.205		6.0300	3.45		
SC-SF	AREA	100	8.013		6.0500	129.78		
SC-SF	AREA	5	1.951		6.0800	23.28		

Title... Project Date: 11/1/2009
Project Engineer: Matt Larson
Project Title: Elkhorn Estates - Sand Creek Historic Conditions
Project Comments:

DESIGN STORMS SUMMARY

Design Storm File,ID = COLO SPRGS

Storm Tag Name = 100

Data Type, File, ID = Synthetic Storm TYPEIIA 24HR
Storm Frequency = 100 yr
Total Rainfall Depth= 4.4000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .2500 hrs End= 24.0000 hrs

Storm Tag Name = 5

Data Type, File, ID = Synthetic Storm TYPEIIA 24HR
Storm Frequency = 5 yr
Total Rainfall Depth= 2.6000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .2500 hrs End= 24.0000 hrs

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .031000 ft/ft
Mannings n = 0.03500
Invert Elev. = 7040.00 ft
Top of Channel = 7072.00 ft
Base width = 5.00 ft
Rt Side slope = 4.000 horizontal :1 vert.
Lt Side slope = 4.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
7040.000	.00	.00	.00	.0000	.00	.00	.00	0.00
7040.010	.01	.02	.34	.0492	5.08	5.08	.01	0.61
7040.640	.64	21.90	4.52	4.8398	10.12	10.28	.48	1.15
7041.280	1.28	85.68	6.62	12.9503	15.24	15.55	.85	1.27
7041.920	1.92	201.89	8.29	24.3440	20.36	20.83	1.20	1.34
7042.560	2.56	381.18	9.77	39.0159	25.48	26.11	1.53	1.39
7043.200	3.20	633.55	11.12	56.9660	30.60	31.39	1.86	1.44
7043.840	3.84	968.08	12.38	78.1768	35.72	36.66	2.19	1.48
7044.480	4.48	1394.18	13.58	102.6808	40.84	41.94	2.51	1.51
7045.120	5.12	1920.11	14.72	130.4630	45.96	47.22	2.84	1.54
7045.760	5.76	2553.50	15.81	161.4984	51.08	52.50	3.16	1.57
7046.400	6.40	3303.17	16.87	195.8345	56.20	57.77	3.48	1.59
7047.040	7.04	4176.26	17.89	233.4488	61.32	63.05	3.81	1.62
7047.680	7.68	5180.15	18.88	274.3413	66.44	68.33	4.13	1.64
7048.320	8.32	6321.09	19.85	318.4770	71.56	73.61	4.45	1.66
7048.960	8.96	7607.80	20.79	365.9234	76.68	78.89	4.77	1.68
7049.600	9.60	9046.30	21.71	416.6480	81.80	84.16	5.09	1.70
7050.240	10.24	10643.26	22.61	470.6508	86.92	89.44	5.41	1.71
7050.880	10.88	12403.80	23.50	527.8868	92.04	94.72	5.74	1.73
7051.520	11.52	14337.03	24.36	588.4435	97.16	100.00	6.06	1.75
7052.160	12.16	16447.96	25.22	652.2784	102.28	105.28	6.38	1.76
7052.800	12.80	18740.96	26.05	719.3391	107.40	110.55	6.70	1.77
7053.440	13.44	21225.59	26.88	789.7278	112.52	115.83	7.02	1.79
7054.080	14.08	23906.17	27.69	863.3948	117.64	121.11	7.34	1.80
7054.720	14.72	26788.60	28.49	940.3400	122.76	126.39	7.66	1.81
7055.360	15.36	29876.26	29.28	1020.5010	127.88	131.66	7.98	1.83
7056.000	16.00	33179.57	30.05	1104.0000	133.00	136.94	8.30	1.84
7056.640	16.64	36701.94	30.82	1190.7770	138.12	142.22	8.62	1.85
7057.280	17.28	40445.98	31.58	1280.7630	143.24	147.49	8.94	1.86
7057.920	17.92	44422.93	32.33	1374.0940	148.36	152.77	9.26	1.87
7058.560	18.56	48635.47	33.07	1470.7030	153.48	158.05	9.58	1.88
7059.200	19.20	53088.99	33.80	1570.5910	158.60	163.33	9.90	1.89
7059.840	19.84	57785.13	34.53	1673.6770	163.72	168.60	10.22	1.90
7060.480	20.48	62736.34	35.24	1780.1180	168.84	173.88	10.54	1.91
7061.120	21.12	67944.35	35.95	1889.8380	173.96	179.16	10.86	1.92

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .031000 ft/ft
Mannings n = 0.03500
Invert Elev. = 7040.00 ft
Top of Channel = 7072.00 ft
Base width = 5.00 ft
Rt Side slope = 4.000 horizontal :1 vert.
Lt Side slope = 4.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
7061.760	21.76	73410.02	36.65	2002.7480	179.08	184.44	11.18	1.93
7062.400	22.40	79146.84	37.35	2119.0220	184.20	189.71	11.50	1.94
7063.040	23.04	85155.80	38.04	2238.5740	189.32	194.99	11.82	1.95
7063.680	23.68	91441.91	38.72	2361.4040	194.44	200.27	12.14	1.96
7064.320	24.32	98005.01	39.40	2487.4150	199.56	205.55	12.46	1.97
7064.960	24.96	104860.10	40.07	2616.7980	204.68	210.83	12.78	1.98
7065.600	25.60	112007.10	40.74	2749.4600	209.80	216.10	13.11	1.98
7066.240	26.24	119450.90	41.40	2885.4010	214.92	221.38	13.43	1.99
7066.880	26.88	127190.20	42.05	3024.5120	220.04	226.66	13.75	2.00
7067.520	27.52	135241.80	42.70	3167.0060	225.16	231.94	14.07	2.01
7068.160	28.16	143604.40	43.35	3312.7780	230.28	237.21	14.39	2.01
7068.800	28.80	152276.00	43.99	3461.7140	235.40	242.49	14.71	2.02
7069.440	29.44	161274.70	44.62	3614.0400	240.52	247.77	15.03	2.03
7070.080	30.08	170598.40	45.26	3769.6450	245.64	253.05	15.35	2.04
7070.720	30.72	180251.80	45.88	3928.5280	250.76	258.33	15.67	2.04
7071.360	31.36	190231.70	46.51	4090.5630	255.88	263.60	15.99	2.05
7072.000	32.00	200557.80	47.12	4256.0000	261.00	268.88	16.31	2.06

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .030600 ft/ft
Mannings n = 0.03500
Invert Elev. = 7050.00 ft
Top of Channel = 7154.00 ft
Base width = 5.00 ft
Rt Side slope = 4.000 horizontal :1 vert.
Lt Side slope = 4.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
7050.000	.00	.00	.00	.0000	.00	.00	.00	0.00
7050.010	.01	.02	.34	.0492	5.08	5.08	.01	0.60
7052.080	2.08	238.87	8.62	27.7073	21.64	22.15	1.28	1.34
7054.160	4.16	1161.76	12.90	90.0284	38.28	39.31	2.35	1.48
7056.240	6.24	3084.82	16.50	186.9633	54.92	56.46	3.40	1.58
7058.320	8.32	6280.18	19.72	318.4770	71.56	73.61	4.45	1.65
7060.400	10.40	10995.41	22.69	484.6314	88.20	90.76	5.49	1.71
7062.480	12.48	17457.40	25.47	685.3995	104.84	107.91	6.54	1.76
7064.560	14.56	25879.60	28.11	920.7815	121.48	125.07	7.58	1.80
7066.640	16.64	36464.38	30.62	1190.7770	138.12	142.22	8.62	1.84
7068.720	18.72	49405.02	33.04	1495.3870	154.76	159.37	9.66	1.87
7070.800	20.80	64883.24	35.37	1834.5260	171.40	176.52	10.70	1.91
7072.880	22.88	83085.33	37.62	2208.3550	188.04	193.67	11.74	1.94
7074.960	24.96	104181.40	39.81	2616.7980	204.68	210.83	12.78	1.96
7077.040	27.04	128339.60	41.94	3059.8550	221.32	227.98	13.83	1.99
7079.120	29.12	155723.90	44.02	3537.5250	237.96	245.13	14.87	2.01
7081.200	31.20	186494.00	46.05	4049.8100	254.60	262.28	15.91	2.04
7083.280	33.28	220797.50	48.04	4596.5750	271.24	279.43	16.95	2.06
7085.360	35.36	258803.20	49.98	5178.0790	287.88	296.58	17.99	2.08
7087.440	37.44	300652.90	51.89	5794.1970	304.52	313.74	19.03	2.10
7089.520	39.52	346493.50	53.76	6444.9280	321.16	330.89	20.07	2.12
7091.600	41.60	396469.10	55.60	7130.2730	337.80	348.04	21.11	2.13
7093.680	43.68	450721.20	57.42	7850.2320	354.44	365.20	22.15	2.15
7095.760	45.76	509374.90	59.20	8604.6230	371.08	382.34	23.19	2.17
7097.840	47.84	572594.80	60.95	9393.8020	387.72	399.50	24.23	2.18
7099.920	49.92	640502.90	62.69	10217.5900	404.36	416.65	25.27	2.20
7102.000	52.00	713232.30	64.39	11076.0000	421.00	433.80	26.31	2.21
7104.080	54.08	790914.40	66.08	11969.0200	437.64	450.96	27.35	2.23
7106.160	56.16	873678.80	67.74	12896.6500	454.28	468.11	28.39	2.24
7108.240	58.24	961653.60	69.39	13858.9000	470.92	485.26	29.43	2.26
7110.320	60.32	1054943.00	71.01	14855.5200	487.56	502.41	30.47	2.27
7112.400	62.40	1153715.00	72.62	15886.9900	504.20	519.56	31.51	2.28
7114.480	64.48	1258073.00	74.21	16953.0700	520.84	536.72	32.55	2.29
7116.560	66.56	1368138.00	75.78	18053.7700	537.48	553.87	33.59	2.31
7118.640	68.64	1484031.00	77.34	19189.0700	554.12	571.02	34.63	2.32

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .030600 ft/ft
Mannings n = 0.03500
Invert Elev. = 7050.00 ft
Top of Channel = 7154.00 ft
Base width = 5.00 ft
Rt Side slope = 4.000 horizontal :1 vert.
Lt Side slope = 4.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
7120.720	70.721605873.00	78.8820359.0000	570.76	588.17	35.67	2.33		
7122.800	72.801733751.00	80.4021563.2500	587.40	605.32	36.71	2.34		
7124.880	74.881867842.00	81.9122802.3900	604.04	622.48	37.75	2.35		
7126.960	76.962008234.00	83.4124076.1400	620.68	639.63	38.79	2.36		
7129.040	79.042155041.00	84.9025384.5100	637.32	656.78	39.83	2.37		
7131.120	81.122308377.00	86.3726727.4900	653.96	673.93	40.87	2.38		
7133.200	83.202468357.00	87.8328105.0900	670.60	691.09	41.91	2.39		
7135.280	85.282635051.00	89.2729516.9700	687.24	708.24	42.95	2.40		
7137.360	87.362808650.00	90.7130963.7800	703.88	725.39	43.99	2.41		
7139.440	89.442989225.00	92.1332445.2100	720.52	742.54	45.03	2.42		
7141.520	91.523176888.00	93.5433961.2600	737.16	759.69	46.07	2.43		
7143.600	93.603371744.00	94.9535511.9100	753.80	776.85	47.11	2.44		
7145.680	95.683573903.00	96.3437097.1800	770.44	794.00	48.15	2.45		
7147.760	97.763783422.00	97.7238716.6900	787.08	811.15	49.19	2.46		
7149.840	99.844000506.00	99.0940371.1800	803.72	828.30	50.23	2.46		
7151.920	101.924225211.00	100.4642060.2800	820.36	845.45	51.27	2.47		
7154.000	104.004457643.00	101.8143784.0000	837.00	862.61	52.31	2.48		

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .015000 ft/ft
Mannings n = 0.03500
Invert Elev. = 7009.00 ft
Top of Channel = 7030.00 ft
Base width = 5.00 ft
Rt Side slope = 4.000 horizontal :1 vert.
Lt Side slope = 4.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
7009.000	.00	.00	.00	.0000	.00	.00	.00	0.00
7009.010	.01	.01	.24	.0492	5.08	5.08	.01	0.42
7009.420	.42	6.99	2.49	2.8049	8.36	8.46	.34	0.76
7009.840	.84	25.64	3.65	7.0206	11.72	11.93	.60	0.83
7010.260	1.26	57.70	4.56	12.6469	15.08	15.39	.84	0.88
7010.680	1.68	105.41	5.35	19.6928	18.44	18.86	1.07	0.91
7011.100	2.10	170.79	6.07	28.1421	21.80	22.32	1.29	0.94
7011.520	2.52	255.93	6.73	38.0021	25.16	25.78	1.51	0.97
7011.940	2.94	362.77	7.36	49.2727	28.52	29.24	1.73	0.99
7012.360	3.36	493.18	7.96	61.9540	31.88	32.71	1.94	1.01
7012.780	3.78	648.95	8.53	76.0460	35.24	36.17	2.16	1.02
7013.200	4.20	832.05	9.09	91.5675	38.60	39.64	2.37	1.04
7013.620	4.62	1043.75	9.62	108.4825	41.96	43.10	2.59	1.05
7014.040	5.04	1285.88	10.14	126.8082	45.32	46.56	2.80	1.07
7014.460	5.46	1560.04	10.65	146.5445	48.68	50.02	3.01	1.08
7014.880	5.88	1867.79	11.14	167.6915	52.04	53.49	3.22	1.09
7015.300	6.30	2210.64	11.62	190.2492	55.40	56.95	3.43	1.11
7015.720	6.72	2590.55	12.09	214.2462	58.76	60.42	3.65	1.12
7016.140	7.14	3008.10	12.55	239.6269	62.12	63.88	3.86	1.13
7016.560	7.56	3465.16	13.01	266.4182	65.48	67.34	4.07	1.14
7016.980	7.98	3963.11	13.45	294.6203	68.84	70.80	4.28	1.15
7017.400	8.40	4503.35	13.89	324.2329	72.20	74.27	4.49	1.16
7017.820	8.82	5087.25	14.32	355.2563	75.56	77.73	4.70	1.16
7018.240	9.24	5716.89	14.74	387.7289	78.92	81.20	4.91	1.17
7018.660	9.66	6392.15	15.16	421.5753	82.28	84.66	5.12	1.18
7019.080	10.08	7115.02	15.57	456.8323	85.64	88.12	5.33	1.19
7019.500	10.50	7886.80	15.98	493.5000	89.00	91.59	5.54	1.20
7019.920	10.92	8708.76	16.38	531.5784	92.36	95.05	5.76	1.20
7020.340	11.34	9582.14	16.78	571.0674	95.72	98.51	5.97	1.21
7020.760	11.76	10508.19	17.17	611.9672	99.08	101.97	6.18	1.22
7021.180	12.18	11489.30	17.56	654.3276	102.44	105.44	6.39	1.22
7021.600	12.60	12524.41	17.94	698.0504	105.80	108.90	6.60	1.23
7022.020	13.02	13615.81	18.32	743.1837	109.16	112.37	6.81	1.24
7022.440	13.44	14764.70	18.70	789.7278	112.52	115.83	7.02	1.24
7022.860	13.86	15972.24	19.07	837.6826	115.88	119.29	7.23	1.25

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .015000 ft/ft
Mannings n = 0.03500
Invert Elev. = 7009.00 ft
Top of Channel = 7030.00 ft
Base width = 5.00 ft
Rt Side slope = 4.000 horizontal :1 vert.
Lt Side slope = 4.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
7023.280	14.28	17239.60	19.43	887.0480	119.24	122.75	7.44	1.26
7023.700	14.70	18569.51	19.80	937.8840	122.60	126.22	7.65	1.26
7024.120	15.12	19960.01	20.16	990.0724	125.96	129.68	7.86	1.27
7024.540	15.54	21413.75	20.52	1043.6720	129.32	133.15	8.07	1.27
7024.960	15.96	22931.84	20.87	1098.6810	132.68	136.61	8.28	1.28
7025.380	16.38	24515.40	21.22	1155.1020	136.04	140.07	8.49	1.28
7025.800	16.80	26165.51	21.57	1212.9330	139.40	143.53	8.70	1.29
7026.220	17.22	27885.32	21.92	1272.2440	142.76	147.00	8.91	1.29
7026.640	17.64	29671.91	22.26	1332.8980	146.12	150.46	9.12	1.30
7027.060	18.06	31528.30	22.60	1394.9630	149.48	153.93	9.33	1.30
7027.480	18.48	33455.58	22.94	1458.4390	152.84	157.39	9.54	1.31
7027.900	18.90	35454.78	23.27	1523.3250	156.20	160.85	9.75	1.31
7028.320	19.32	37526.98	23.61	1589.6220	159.56	164.32	9.96	1.32
7028.740	19.74	39675.72	23.94	1657.4090	162.92	167.78	10.17	1.32
7029.160	20.16	41897.08	24.27	1726.5280	166.28	171.24	10.38	1.33
7029.580	20.58	44194.54	24.59	1797.0590	169.64	174.71	10.59	1.33
7030.000	21.00	46569.09	24.92	1869.0000	173.00	178.17	10.80	1.34

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .021000 ft/ft
Mannings n = 0.03500
Invert Elev. = 7084.00 ft
Top of Channel = 7136.00 ft
Base width = 5.00 ft
Rt Side slope = 4.000 horizontal :1 vert.
Lt Side slope = 4.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
7084.000	.00	.00	.00	.0000	.00	.00	.00	0.00
7084.010	.01	.01	.28	.0492	5.08	5.08	.01	0.50
7085.040	1.04	46.28	4.86	9.5269	13.32	13.58	.72	1.01
7086.080	2.08	197.88	7.14	27.7073	21.64	22.15	1.28	1.11
7087.120	3.12	491.90	9.02	54.5411	29.96	30.73	1.82	1.18
7088.160	4.16	962.42	10.69	90.0284	38.28	39.31	2.35	1.23
7089.200	5.20	1640.63	12.23	134.1691	46.60	47.88	2.88	1.27
7090.240	6.24	2555.52	13.67	186.9633	54.92	56.46	3.40	1.31
7091.280	7.28	3733.81	15.03	248.3800	63.24	65.03	3.93	1.34
7092.320	8.32	5202.60	16.34	318.4770	71.56	73.61	4.45	1.37
7093.360	9.36	6986.28	17.59	397.2275	79.88	82.18	4.97	1.39
7094.400	10.40	9108.78	18.80	484.6314	88.20	90.76	5.49	1.41
7095.440	11.44	11593.22	19.96	580.6887	96.52	99.34	6.02	1.43
7096.480	12.48	14462.00	21.10	685.3995	104.84	107.91	6.54	1.45
7097.520	13.52	17736.89	22.21	798.7638	113.16	116.49	7.06	1.47
7098.560	14.56	21439.10	23.28	920.7815	121.48	125.07	7.58	1.49
7099.600	15.60	25589.29	24.34	1051.4530	129.80	133.64	8.10	1.51
7100.640	16.64	30207.71	25.37	1190.7770	138.12	142.22	8.62	1.52
7101.680	17.68	35314.13	26.38	1338.7550	146.44	150.79	9.14	1.54
7102.720	18.72	40927.95	27.37	1495.3870	154.76	159.37	9.66	1.55
7103.760	19.76	47065.22	28.34	1660.5920	163.08	167.94	10.18	1.57
7104.800	20.80	53750.37	29.30	1834.5260	171.40	176.52	10.70	1.58
7105.840	21.84	60999.03	30.24	2017.1140	179.72	185.10	11.22	1.59
7106.880	22.88	68829.29	31.17	2208.3550	188.04	193.67	11.74	1.60
7107.920	23.92	77258.96	32.08	2408.2500	196.36	202.25	12.26	1.61
7108.960	24.96	86305.59	32.98	2616.7980	204.68	210.83	12.78	1.63
7110.000	26.00	95986.48	33.87	2834.0000	213.00	219.40	13.31	1.64
7111.040	27.04	106318.70	34.75	3059.8550	221.32	227.98	13.83	1.65
7112.080	28.08	117319.10	35.61	3294.3640	229.64	236.55	14.35	1.66
7113.120	29.12	129004.30	36.47	3537.5250	237.96	245.13	14.87	1.67
7114.160	30.16	141390.80	37.31	3789.3410	246.28	253.71	15.39	1.68
7115.200	31.20	154494.80	38.15	4049.8100	254.60	262.28	15.91	1.69
7116.240	32.24	168332.40	38.98	4318.9320	262.92	270.86	16.43	1.70
7117.280	33.28	182912.40	39.79	4596.5750	271.24	279.43	16.95	1.70
7118.320	34.32	198264.30	40.60	4883.0000	279.56	288.01	17.47	1.71

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .021000 ft/ft
Mannings n = 0.03500
Invert Elev. = 7084.00 ft
Top of Channel = 7136.00 ft
Base width = 5.00 ft
Rt Side slope = 4.000 horizontal :1 vert.
Lt Side slope = 4.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
7119.360	35.36	214396.90	41.40	5178.0790	287.88	296.58	17.99	1.72
7120.400	36.40	231325.70	42.20	5481.8110	296.20	305.16	18.51	1.73
7121.440	37.44	249065.90	42.99	5794.1970	304.52	313.74	19.03	1.74
7122.480	38.48	267632.70	43.76	6115.2350	312.84	322.31	19.55	1.75
7123.520	39.52	287041.00	44.54	6444.9280	321.16	330.89	20.07	1.75
7124.560	40.56	307305.80	45.30	6783.2740	329.48	339.47	20.59	1.76
7125.600	41.60	328441.70	46.06	7130.2730	337.80	348.04	21.11	1.77
7126.640	42.64	350463.30	46.82	7485.9260	346.12	356.62	21.63	1.77
7127.680	43.68	373385.00	47.56	7850.2320	354.44	365.20	22.15	1.78
7128.720	44.72	397221.40	48.31	8223.1910	362.76	373.77	22.67	1.79
7129.760	45.76	421974.70	49.04	8604.6230	371.08	382.34	23.19	1.80
7130.800	46.80	447682.50	49.77	8994.8860	379.40	390.92	23.71	1.80
7131.840	47.84	474347.20	50.50	9393.8020	387.72	399.50	24.23	1.81
7132.880	48.88	501982.90	51.22	9801.3710	396.04	408.07	24.75	1.81
7133.920	49.92	530603.40	51.93	10217.5900	404.36	416.65	25.27	1.82
7134.960	50.96	560222.50	52.64	10642.4700	412.68	425.23	25.79	1.83
7136.000	52.00	590853.70	53.35	11076.0000	421.00	433.80	26.31	1.83

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .021300 ft/ft
Mannings n = 0.03500
Invert Elev. = 7040.00 ft
Top of Channel = 7066.00 ft
Base width = 5.00 ft
Rt Side slope = 4.000 horizontal :1 vert.
Lt Side slope = 4.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
7040.000	.00	.00	.00	.0000	.00	.00	.00	0.00
7040.010	.01	.01	.28	.0492	5.08	5.08	.01	0.50
7040.520	.52	12.31	3.34	3.6818	9.16	9.29	.40	0.93
7041.040	1.04	46.61	4.89	9.5269	13.32	13.58	.72	1.02
7041.560	1.56	107.31	6.12	17.5354	17.48	17.86	1.00	1.08
7042.080	2.08	199.29	7.19	27.7073	21.64	22.15	1.28	1.12
7042.600	2.60	327.19	8.17	40.0425	25.80	26.44	1.55	1.16
7043.120	3.12	495.40	9.08	54.5411	29.96	30.73	1.82	1.19
7043.640	3.64	708.10	9.94	71.2031	34.12	35.02	2.09	1.21
7044.160	4.16	969.27	10.77	90.0284	38.28	39.31	2.35	1.24
7044.680	4.68	1282.78	11.55	111.0171	42.44	43.59	2.62	1.26
7045.200	5.20	1652.30	12.32	134.1691	46.60	47.88	2.88	1.28
7045.720	5.72	2081.45	13.05	159.4845	50.76	52.17	3.14	1.30
7046.240	6.24	2573.71	13.77	186.9633	54.92	56.46	3.40	1.32
7046.760	6.76	3131.90	14.46	216.5766	59.08	60.74	3.67	1.33
7047.280	7.28	3760.39	15.14	248.3800	63.24	65.03	3.93	1.35
7047.800	7.80	4461.91	15.80	282.3468	67.40	69.32	4.19	1.36
7048.320	8.32	5239.63	16.45	318.4770	71.56	73.61	4.45	1.37
7048.840	8.84	6096.65	17.09	356.7706	75.72	77.90	4.71	1.39
7049.360	9.36	7036.01	17.71	397.2275	79.88	82.18	4.97	1.40
7049.880	9.88	8060.68	18.33	439.8477	84.04	86.47	5.23	1.41
7050.400	10.40	9173.61	18.93	484.6314	88.20	90.76	5.49	1.42
7050.920	10.92	10377.68	19.52	531.5784	92.36	95.05	5.76	1.43
7051.440	11.44	11675.74	20.11	580.6887	96.52	99.34	6.02	1.45
7051.960	11.96	13070.57	20.68	631.9625	100.68	103.62	6.28	1.46
7052.480	12.48	14564.94	21.25	685.3995	104.84	107.91	6.54	1.47
7053.000	13.00	16161.56	21.81	741.0000	109.00	112.20	6.80	1.47
7053.520	13.52	17863.14	22.36	798.7638	113.16	116.49	7.06	1.48
7054.040	14.04	19672.30	22.91	858.6910	117.32	120.78	7.32	1.49
7054.560	14.56	21591.69	23.45	920.7815	121.48	125.07	7.58	1.50
7055.080	15.08	23623.88	23.98	985.0354	125.64	129.35	7.84	1.51
7055.600	15.60	25771.42	24.51	1051.4530	129.80	133.64	8.10	1.52
7056.120	16.12	28036.87	25.03	1120.0330	133.96	137.93	8.36	1.53
7056.640	16.64	30422.71	25.55	1190.7770	138.12	142.22	8.62	1.53
7057.160	17.16	32931.43	26.06	1263.6850	142.28	146.51	8.88	1.54

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .021300 ft/ft
Mannings n = 0.03500
Invert Elev. = 7040.00 ft
Top of Channel = 7066.00 ft
Base width = 5.00 ft
Rt Side slope = 4.000 horizontal :1 vert.
Lt Side slope = 4.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
7057.680	17.68	35565.48	26.57	1338.7550	146.44	150.79	9.14	1.55
7058.200	18.20	38327.29	27.07	1415.9890	150.60	155.08	9.40	1.56
7058.720	18.72	41219.26	27.56	1495.3870	154.76	159.37	9.66	1.56
7059.240	19.24	44243.79	28.06	1576.9480	158.92	163.66	9.92	1.57
7059.760	19.76	47400.21	28.54	1660.5920	163.08	167.94	10.18	1.58
7060.280	20.28	50696.78	29.03	1746.4780	167.24	172.23	10.44	1.58
7060.800	20.80	54132.94	29.51	1834.5260	171.40	176.52	10.70	1.59
7061.320	21.32	57710.98	29.98	1924.7390	175.56	180.81	10.96	1.60
7061.840	21.84	61433.19	30.46	2017.1140	179.72	185.10	11.22	1.60
7062.360	22.36	65301.85	30.92	2111.6530	183.88	189.38	11.48	1.61
7062.880	22.88	69319.18	31.39	2208.3550	188.04	193.67	11.74	1.61
7063.400	23.40	73487.45	31.85	2307.2210	192.20	197.96	12.00	1.62
7063.920	23.92	77808.85	32.31	2408.2500	196.36	202.25	12.26	1.63
7064.440	24.44	82285.60	32.76	2511.4430	200.52	206.54	12.52	1.63
7064.960	24.96	86919.88	33.22	2616.7980	204.68	210.83	12.78	1.64
7065.480	25.48	91713.86	33.66	2724.3180	208.84	215.11	13.05	1.64
7066.000	26.00	96669.67	34.11	2834.0000	213.00	219.40	13.31	1.65

----- 4 -----
4-6... 3.01

----- C -----
COLO SPRGS... 2.01

----- S -----
SC-194... 3.03
SC-194A... 3.05
SC-94A... 3.07
SC-94B... 3.09

----- W -----
Watershed... 1.01

- SCS COMPOSITE BASIN CN CALCULATIONS
- MODIFIED RATIONAL EXISTING & DEVELOPED BASIN CALCULATIONS
- SCS BASIN TIME OF CONCENTRATION CALCULATIONS
- DETENTION POND SUMMARY TABLE

COMPOSITE C_N VALUES - HISTORIC CONDITIONS

BASIN (label)	BASIN AREA (ac)	LAND USE BREAKDOWN												TOTAL BASIN AREA (ac)	WEIGHTED C_N
		OPEN SPACE NATURAL RANGE AREA	OPENSPACE Type B Soils CN	2.5 - 5.0 AC. LOTS AREA	2.5 - 5.0 AC. LOTS CN	1.0 AC. LOTS AREA	1 DU/AC CN	2.0 AC. LOTS AREA	2 DU/AC CN	3-5 DU/AC. LOTS AREA	3-5 DU/AC CN	COMMERCIAL AREA	COMMERCIAL CN		
W25-REV	53.59	0.00	61	46.47	63	7.12	68	0.00	70	0.00	75	0.00	92	**53.59**	**63.7**
W27-REV	82.73	0.00	61	0.00	63	82.73	68	0.00	70	0.00	75	0.00	92	**82.73**	**68.0**
W32-REV	67.00	57.00	61	0.00	63	10.00	68	0.00	70	0.00	75	0.00	92	**67.00**	**62.0**
W33A1-REV	65.04	0.00	61	0.00	63	0.00	68	65.04	70	0.00	75	0.00	92	**65.04**	**70.0**
W33A2-REV	27.52	15.23	61	0.00	63	0.00	68	12.29	70	0.00	75	0.00	92	**27.52**	**65.0**
W33BY-REV	67.85	0.00	61	62.49	63	0.00	68	5.36	70	0.00	75	0.00	92	**67.85**	**63.6**
W34A-REV	83.72	19.33	61	0.00	63	0.00	68	0.00	70	64.39	75	0.00	92	**83.72**	**71.8**
W34B1-REV	92.05	16.10	61	0.00	63	0.00	68	0.00	70	69.59	75	6.36	92	**92.05**	**73.7**
W34B2-REV	59.50	22.31	61	0.00	63	0.00	68	0.00	70	37.19	75	0.00	92	**59.50**	**69.8**
W34CX-REV	47.03	5.94	61	0.00	63	0.00	68	38.26	70	2.83	75	0.00	92	**47.03**	**69.2**
W34CY-REV	29.79	13.06	61	16.73	63	0.00	68	0.00	70	0.00	75	0.00	92	**29.79**	**62.1**
SC-SA	45.15	15.14	61	30.01	63	0.00	68	0.00	70	0.00	75	0.00	92	**45.15**	**62.3**
SC-SB	48.68	3.00	61	45.68	63	0.00	68	0.00	70	0.00	75	0.00	92	**48.68**	**62.9**
SC-SC	4.65	0.00	61	4.65	63	0.00	68	0.00	70	0.00	75	0.00	92	**4.65**	**63.0**
SC-SD	22.03	0.00	61	22.03	63	0.00	68	0.00	70	0.00	75	0.00	92	**22.03**	**63.0**
SC-SE	8.85	0.00	61	8.85	63	0.00	68	0.00	70	0.00	75	0.00	92	**8.85**	**63.0**
SC-SF	84.10	0.00	61	84.10	63	0.00	68	0.00	70	0.00	75	0.00	92	**84.10**	**63.0**
SC-G	60.59	60.59	61	0.00	63	0.00	68	0.00	70	0.00	75	0.00	92	**60.59**	**61.0**
SC-H	21.69	21.69	61	0.00	63	0.00	68	0.00	70	0.00	75	0.00	92	**21.69**	**61.0**
SC-I	35.13	35.13	61	0.00	63	0.00	68	0.00	70	0.00	75	0.00	92	**35.13**	**61.0**
SC-J	72.05	72.05	61	0.00	63	0.00	68	0.00	70	0.00	75	0.00	92	**72.05**	**61.0**
SC-K	10.85	10.85	61	0.00	63	0.00	68	0.00	70	0.00	75	0.00	92	**10.85**	**61.0**
SC-L	27.31	27.31	61	0.00	63	0.00	68	0.00	70	0.00	75	0.00	92	**27.31**	**61.0**
SC-M	19.33	19.33	61	0.00	63	0.00	68	0.00	70	0.00	75	0.00	92	**19.33**	**61.0**
SC-N	7.41	7.41	61	0.00	63	0.00	68	0.00	70	0.00	75	0.00	92	**7.41**	**61.0**
SC-O	20.61	20.61	61	0.00	63	0.00	68	0.00	70	0.00	75	0.00	92	**20.61**	**61.0**
SC-P	67.07	67.07	61	0.00	63	0.00	68	0.00	70	0.00	75	0.00	92	**67.07**	**61.0**
SC-Q	5.53	5.53	61	0.00	63	0.00	68	0.00	70	0.00	75	0.00	92	**5.53**	**61.0**
SC-R	81.72	81.72	61	0.00	63	0.00	68	0.00	70	0.00	75	0.00	92	**81.72**	**61.0**
SC-S	3.57	3.57	61	0.00	63	0.00	68	0.00	70	0.00	75	0.00	92	**3.57**	**61.0**

COMPOSITE C_N VALUES - DEVELOPED CONDITIONS

BASIN (label)	BASIN AREA (ac)	LAND USE BREAKDOWN														TOTAL BASIN AREA (ac)	WEIGHTED C_N
		PARK AREA	PARK CN	OPEN SPACE NATURAL RANGE AREA	OPENSPACE Type B Soils CN	2.5 - 5.0 AC. LOTS AREA	2.5 - 5.0 AC. LOTS CN	1-2 DU/AC. LOTS AREA	1-2 DU/AC CN	2-3 DU/AC. LOTS AREA	2-3 DU/AC CN	5-8 DU/AC. LOTS AREA	5-8 DU/AC CN	ROADWAY AREA	ROADWAY CN		
SC-A	51.91		65	3.39	61	24.00	63	20.08	69		71		85	4.44	98	51.91	68.2
SC-B	101.18	6.54	65	19.93	61	11.58	63		69	50.00	71		85	13.13	98	101.18	71.2
SC-C	59.88	7.00	65	2.18	61		63		69	38.11	71	9.16	85	3.43	98	59.88	73.6
SC-D	41.76		65	5.01	61		63		69	35.00	71		85	1.75	98	41.76	70.9
SC-E	130.24		65	10.00	61		63		69	110.80	71		85	9.44	98	130.24	72.2
SC-F	15.25		65	2.11	61		63		69	9.01	71		85	4.13	98	15.25	76.9

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BASIN	LAND USE	TOTAL AREA (AC)	IMPERVIOUS AREA / STREETS			LANDSCAPE/UNDEVELOPED AREAS			WEIGHTED		WEIGHTED CA	
			AREA (AC)	C(5)	C(100)	AREA (AC)	C(5)	C(100)	C(5)	C(100)	CA(5)	CA(100)
W-33A2	(used to derive Tc, SCS Analysis)	27.52	12.29	0.35	0.45	15.23	0.25	0.35	0.29	0.39	**8.11**	**10.86**
W-34B1-R	(used to derive Tc, SCS Analysis)	92.05	75.95	0.53	0.63	16.10	0.25	0.35	0.48	0.58	**44.51**	**53.10**
W-34B2-R	(used to derive Tc, SCS Analysis)	59.50	37.19	0.50	0.60	22.31	0.25	0.35	0.41	0.51	**24.17**	**30.12**
W-34CX-R	(used to derive Tc, SCS Analysis)	47.03	41.09	0.36	0.46	5.94	0.25	0.35	0.35	0.45	**16.28**	**20.98**
W-33BY-R	(used to derive Tc, SCS Analysis)	67.85	67.85	0.50	0.60	0.00	0.25	0.35	0.50	0.60	**33.93**	**40.71**
W-34CY-R	(used to derive Tc, SCS Analysis)	29.79	29.79	0.50	0.60	0.00	0.25	0.35	0.50	0.60	**14.90**	**17.87**
W-36A-R	(used to derive Tc, SCS Analysis)	61.48	61.48	0.50	0.60	0.00	0.25	0.35	0.50	0.60	**30.74**	**36.89**
W-E1	(used to derive Tc, SCS Analysis)	62.63	62.63	0.25	0.35	0.00	0.25	0.35	0.25	0.35	**15.66**	**21.92**
SC-G	(used to derive Tc, SCS Analysis)	60.59	0.00	0.50	0.60	60.59	0.25	0.35	0.25	0.35	**15.15**	**21.21**
SC-H	(used to derive Tc, SCS Analysis)	21.69	0.00	0.50	0.60	21.69	0.25	0.35	0.25	0.35	**5.42**	**7.59**
SC-I	(used to derive Tc, SCS Analysis)	35.13	0.00	0.50	0.60	35.13	0.25	0.35	0.25	0.35	**8.78**	**12.30**
SC-J	(used to derive Tc, SCS Analysis)	72.05	0.00	0.50	0.60	72.05	0.25	0.35	0.25	0.35	**18.01**	**25.22**
SC-K		10.85	0.00	0.50	0.60	10.85	0.25	0.35	0.25	0.35	**2.71**	**3.80**
SC-L	(used to derive Tc, SCS Analysis)	27.31	0.00	0.50	0.60	27.31	0.25	0.35	0.25	0.35	**6.83**	**9.56**
SC-M		19.33	0.00	0.50	0.60	19.33	0.25	0.35	0.25	0.35	**4.83**	**6.77**
SC-N		7.41	0.00	0.50	0.60	7.41	0.25	0.35	0.25	0.35	**1.85**	**2.59**
SC-O		20.61	0.00	0.50	0.60	20.61	0.25	0.35	0.25	0.35	**5.15**	**7.21**
SC-P	(used to derive Tc, SCS Analysis)	67.07	0.00	0.50	0.60	67.07	0.25	0.35	0.25	0.35	**16.77**	**23.47**
SC-Q		5.53	0.00	0.50	0.60	5.53	0.25	0.35	0.25	0.35	**1.38**	**1.94**
SC-R	(used to derive Tc, SCS Analysis)	81.72	0.00	0.50	0.60	81.72	0.25	0.35	0.25	0.35	**20.43**	**28.60**
SC-S		3.57	0.00	0.50	0.60	3.57	0.25	0.35	0.25	0.35	**0.89**	**1.25**
OS-A	Ex. 2 DU/Ac Lots & OS	22.56	5.33	0.35	0.45	17.23	0.25	0.35	0.27	0.37	**6.17**	**8.43**
OS-B	EX. 5 Ac. Lots	11.80	11.80	0.27	0.37	0.00	0.25	0.35	0.27	0.37	**3.19**	**4.37**
UN-1	electric esmt. Area	9.61	0.00	0.50	0.60	9.61	0.25	0.35	0.25	0.35	**2.40**	**3.36**
OS-O	Paint Brush Basin	10.16	10.16	0.33	0.42	0.00	0.25	0.35	0.33	0.42	**3.35**	**4.27**
UN-2	electric esmt. Area	30.30	0.00	0.50	0.60	30.30	0.25	0.35	0.25	0.35	**7.58**	**10.61**
FA-1	HISTORIC	57.12	0.00	0.50	0.60	57.12	0.25	0.35	0.25	0.35	**14.28**	**19.99**
FA-2	HISTORIC	12.39	0.00	0.50	0.60	12.39	0.25	0.35	0.25	0.35	**3.10**	**4.34**
FA-3	HISTORIC	14.29	0.00	0.50	0.60	14.29	0.25	0.35	0.25	0.35	**3.57**	**5.00**
FA-4	HISTORIC	41.55	0.00	0.50	0.60	41.55	0.25	0.35	0.25	0.35	**10.39**	**14.54**
FA-5	HISTORIC	8.59	0.00	0.50	0.60	8.59	0.25	0.35	0.25	0.35	**2.15**	**3.01**
FA-S	HISTORIC	11.53	0.00	0.50	0.60	11.53	0.25	0.35	0.25	0.35	**2.88**	**4.04**

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FINAL DRAINAGE REPORT ~ DEVELOPED BASIN RUNOFF COEFFICIENT SUMMARY

BASIN	LAND USE	TOTAL AREA (AC)	Impervious (%)	IMPERVIOUS AREA / STREETS			LANDSCAPE/UNDEVELOPED AREAS			WEIGHTED			WEIGHTED CA	
				AREA (AC)	C(5)	C(100)	AREA (AC)	C(5)	C(100)	C(5)	C(100)	Composite Impervious (%)	CA(5)	CA(100)
FALCON AREA DRAINAGE BASIN														
FA-1		57.12		0.00	0.90	0.95	0.00	0.25	0.35	0.38	0.50	27.52	**21.43**	**28.58**
	2-3 DU/AC		30	28.77	0.40	0.55								
	1-2 DU/AC		25	28.35	0.35	0.45								
FA-2		12.39		0.00	0.90	0.95	0.00	0.25	0.35	0.60	0.70	65.00	**7.43**	**8.67**
	5-8 DU/AC		65	12.39	0.60	0.70								
FA-3	Roadway	14.29	100	0.99	0.90	0.95	0.00	0.25	0.35	0.53	0.62	44.16	**7.54**	**8.92**
	3-5 DU/AC		40	13.30	0.50	0.60								
FA-4	Roadway	41.55	100	0.76	0.90	0.95	0.00	0.25	0.35	0.39	0.56	27.41	**16.30**	**23.16**
	2-3.5 DU/AC		30	33.79	0.40	0.55								
	PARK		7	7.00	0.30	0.55								
FA-5	Roadway	8.59	100	2.71	0.90	0.95	0.00	0.25	0.35	0.46	0.54	31.55	**3.91**	**4.63**
	OPEN SPACE		0				5.88	0.25	0.35					
FA-S	Roadway	11.53	100	8.65	0.90	0.95	0.00	0.25	0.35	0.74	0.80	75.00	**8.50**	**9.22**
	Landscaping		0				2.88	0.25	0.35					
FA-WE	2.5 AC. LOTS	2.18	0	2.18	0.28	0.38	0.00	0.25	0.35	0.28	0.38	0.00	**0.61**	**0.83**
SAND CREEK DRAINAGE BASIN (SCS ANALYSIS, THESE CALCS USED TO DETERMINE TC & IMPERVIOUS %)														
SC-A	Roadway	51.91	100	4.44	0.90	0.95				N/A	N/A	18.22	**N/A**	**N/A**
	Open Space		0				3.39	0.25	0.35					
	2.5 Ac. Lots		0	24.00	0.28	0.38								
	1-2 DU/AC		25	20.08	0.35	0.45								
SC-B	Roadway	101.18	100	13.13	0.90	0.95				N/A	N/A	27.80	**N/A**	**N/A**
	Open Space		0			0.95	19.93	0.25	0.35					
	2.5 Ac. Lots		0	11.58	0.28	0.38								
	2-3 DU/AC		30	50.00	0.40	0.55								
	Park		7	6.54	0.30	0.55								
SC-C	Roadway	59.88	100	3.43	0.90	0.95				N/A	N/A	35.58	**N/A**	**N/A**
	Open Space		0				2.18	0.25	0.35					
	2-3 DU/AC		30	38.11	0.40	0.55								
	5-8 DU/AC		65	9.16	0.60	0.70								
	Park		7	7.00	0.30	0.55								
SC-D	Roadway	41.76	100	1.75	0.90	0.95				N/A	N/A	29.33	**N/A**	**N/A**
	Open Space		0				5.01	0.25	0.35					
	2-3 DU/AC		30	35.00	0.40	0.55								
SC-E	Roadway	130.24	100	9.44	0.90	0.95				N/A	N/A	32.77	**N/A**	**N/A**
	Open Space (school w/own detention)		0				10.00	0.25	0.35					
	2-3 DU/AC		30	110.80	0.40	0.55								
SC-F	Roadway	15.25	100	4.13	0.90	0.95				N/A	N/A	44.81	**N/A**	**N/A**
	Open Space		0				2.11	0.25	0.35					
	2-3 DU/AC		30	9.01	0.40	0.55								
TOTAL POND A		468.19										15.20		
TOTAL POND B		130.24										32.77		
SC-9	2.5 AC. LOTS	3.81	0	3.81	0.28	0.38	0.00	0.25	0.35	0.28	0.38	0	**1.07**	**1.45**
SC-10	2.5 AC. LOTS	5.18	0	5.18	0.28	0.38	0.00	0.25	0.35	0.28	0.38	0	**1.45**	**1.97**
SC-11	2.5 AC. LOTS	3.74	0	3.74	0.28	0.38	0.00	0.25	0.35	0.28	0.38	0	**1.05**	**1.42**
SC-12	2.5 AC. LOTS	6.10	0	6.10	0.28	0.38	0.00	0.25	0.35	0.28	0.38	0	**1.71**	**2.32**
SC-13	2.5 AC. LOTS	4.29	0	4.29	0.28	0.38	0.00	0.25	0.35	0.28	0.38	0	**1.20**	**1.63**
SC-14	2.5 AC. LOTS	10.32	0	10.32	0.28	0.38	0.00	0.25	0.35	0.28	0.38	0	**2.89**	**3.92**

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FINAL DRAINAGE REPORT ~ HISTORIC BASIN RUNOFF SUMMARY

BASIN	WEIGHTED		OVERLAND				STREET / CHANNEL FLOW				Tc	INTENSITY		TOTAL FLOWS	
	CA(5)	CA(100)	C(5)	Length (ft)	Height (ft)	Tc (min)	Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	TOTAL (min)	I(5) (in/hr)	I(100) (in/hr)	Q(5) (cfs)	Q(100) (cfs)
W-33A2	8.11	10.86	0.35	200	6	13.8	1460	2.1%	5.1	4.8	18.6	3.13	5.56	N/A	N/A
W-34B1-R	44.51	53.10	0.35	350	20	14.8	1650	1.7%	4.6	6.0	20.8	2.96	5.25	N/A	N/A
W-34B2-R	24.17	30.12	0.4	100	4	8.3	2000	2.7%	5.8	5.8	14.1	3.56	6.33	N/A	N/A
W-34CX-R	16.28	20.98	0.4	125	4	10.0	1030	3.5%	6.5	2.6	12.6	3.74	6.65	N/A	N/A
W-33BY-R	33.93	40.71	0.35	500	20	19.8	2100	2.1%	5.0	7.0	26.8	2.58	4.59	N/A	N/A
W-34CY-R	14.90	17.87	0.25	350	14	18.8	1500	1.9%	4.8	5.2	24.0	2.74	4.87	N/A	N/A
W-36A-R	30.74	36.89	0.25	550	16	26.2	0	2.0%	4.9	0.0	26.2	2.61	4.65	N/A	N/A
W-E1	15.66	21.92	0.25	350	8	22.6	1600	2.4%	5.4	4.9	27.6	2.54	4.52	N/A	N/A
SC-G	15.15	21.21	0.25	500	16	24.2	1660	1.9%	4.9	5.7	29.9	2.43	4.31	N/A	N/A
SC-H	5.42	7.59	0.25	350	14	18.8	1520	2.9%	6.0	4.3	23.1	2.80	4.98	N/A	N/A
SC-I	8.78	12.30	0.25	350	10	21.0	1660	2.0%	5.0	5.5	26.6	2.59	4.61	N/A	N/A
SC-J	18.01	25.22	0.25	450	20	20.6	2400	3.3%	6.3	6.3	26.9	2.57	4.57	N/A	N/A
SC-K	2.71	3.80	0.25	350	14	18.8	950	2.3%	5.3	3.0	21.8	2.88	5.13	7.8	19.5
SC-L	6.83	9.56	0.25	350	24	15.8	1500	1.5%	4.3	5.8	21.5	2.90	5.16	N/A	N/A
SC-M	4.83	6.77	0.25	300	8	19.9	1000	2.4%	5.4	3.1	23.0	2.80	4.99	13.6	33.7

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FINAL DRAINAGE REPORT ~ HISTORIC BASIN RUNOFF SUMMARY

BASIN	WEIGHTED		OVERLAND				STREET / CHANNEL FLOW				Tc	INTENSITY		TOTAL FLOWS	
	CA(5)	CA(100)	C(5)	Length (ft)	Height (ft)	Tc (min)	Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	TOTAL (min)	I(5) (in/hr)	I(100) (in/hr)	Q(5) (cfs)	Q(100) (cfs)
SC-N	1.85	2.59	0.25	300	8	19.9	550	3.0%	6.1	1.5	21.4	2.91	5.17	5.4	13.4
SC-O	5.15	7.21	0.25	300	8	19.9	1300	2.3%	5.3	4.1	24.0	2.74	4.87	14.1	35.1
SC-P	16.77	23.47	0.25	450	11	25.1	3500	2.3%	5.3	11.0	36.1	2.17	3.86	N/A	N/A
SC-Q	1.38	1.94	0.25	200	8	14.2	450	2.2%	5.2	1.4	15.7	3.39	6.03	4.7	11.7
SC-R	20.43	28.60	0.25	500	12	26.6	2350	2.4%	5.4	7.3	33.9	2.26	4.01	N/A	N/A
SC-S	0.89	1.25	0.25	62	4	6.8	540	2.0%	4.9	1.8	8.6	4.34	7.71	3.9	9.6
OS-A	6.17	8.43	0.25	550	24	22.9	0	1.0%	3.5	0.0	22.9	2.81	4.99	17.3	42.1
OS-B	3.19	4.37	0.25	100	6	8.8	680	2.1%	5.0	2.3	11.1	3.94	7.01	12.6	30.6
UN-1	2.40	3.36	0.25	100	8	8.0	580	1.6%	4.4	2.2	10.2	4.07	7.24	9.8	24.4
OS-O	3.35	4.27	0.25	1000	30	35.0	0	2.0%	4.9	0.0	35.0	2.22	3.94	7.4	16.8
UN-2	7.58	10.61	0.25	565	14	28.0	0	1.0%	3.5	0.0	28.0	2.52	4.48	19.1	47.5
FA-1	14.28	19.99	0.25	650	26	25.6	1140	1.9%	4.8	3.9	29.6	2.44	4.34	34.9	86.8
FA-2	3.10	4.34	0.25	500	16	24.2	0	1.0%	3.5	0.0	24.2	2.73	4.85	8.4	21.0
FA-3	3.57	5.00	0.25	700	18	30.8	0	1.0%	3.5	0.0	30.8	2.39	4.24	8.5	21.2
FA-4	10.39	14.54	0.25	700	18	30.8	750	2.1%	5.1	2.5	33.3	2.28	4.06	23.7	59.0
FA-5	2.15	3.01	0.25	400	10	23.5	0	1.0%	3.5	0.0	23.5	2.77	4.93	6.0	14.8
FA-S	2.88	4.04	0.25	25	1	5.0	0	1.0%	3.5	0.0	5.0	5.10	9.06	14.7	36.6

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FINAL DRAINAGE REPORT ~ DEVELOPED BASIN RUNOFF SUMMARY

BASIN	WEIGHTED		OVERLAND				STREET / CHANNEL FLOW				Tc	INTENSITY		TOTAL FLOWS	
	CA(5)	CA(100)	C(5)	Length (ft)	Height (ft)	Tc (min)	Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	TOTAL (min)	I(5) (in/hr)	I(100) (in/hr)	Q(5) (cfs)	Q(100) (cfs)
FALCON AREA DRAINAGE BASIN															
FA-1	21.43	28.58	0.4	300	13	14.0	1140	1.9%	4.8	3.9	17.9	3.18	5.66	68.2	161.8
FA-2	7.43	8.67	0.6	100	2	7.4	400	2.0%	4.9	1.3	8.8	4.30	7.65	32.0	66.3
FA-3	7.54	8.92	0.5	100	2	8.9	400	2.0%	4.9	1.3	10.3	4.06	7.22	30.6	64.4
FA-4	16.30	23.16	0.4	150	3	12.8	500	2.3%	5.3	1.6	14.3	3.54	6.28	57.6	145.5
FA-5	3.91	4.63	0.25	10	1	2.4	1000	2.0%	4.9	3.4	5.7	4.93	8.76	19.3	40.6
FA-S	8.50	9.22	0.25	5	0.2	2.2	1000	2.0%	4.9	3.4	5.6	4.95	8.80	42.1	81.2
FA-WE	0.61	0.83	0.25	10	2	1.9	0	1.0%	3.5	0.0	5.0	5.10	9.07	3.1	7.5
SAND CREEK DRAINAGE BASIN															
SC-9	1.07	1.45	0.28	250	6	18.2	0	1.0%	3.5	0.0	18.2	3.16	5.62	3.4	8.1
SC-10	1.45	1.97	0.28	250	10	15.3	0	1.0%	3.5	0.0	15.3	3.43	6.09	5.0	12.0
SC-11	1.05	1.42	0.28	250	6	18.2	0	1.0%	3.5	0.0	18.2	3.16	5.62	3.3	8.0
SC-12	1.71	2.32	0.28	170	8	12.0	0	1.0%	3.5	0.0	12.0	3.82	6.78	6.5	15.7
SC-13	1.20	1.63	0.28	250	10	15.3	0	1.0%	3.5	0.0	15.3	3.43	6.09	4.1	9.9
SC-14	2.89	3.92	0.28	220	6	16.3	0	1.0%	3.5	0.0	16.3	3.33	5.92	9.6	23.2

JOB NAME: *ELKHORN ESTATES MDDP*
JOB NUMBER: *2289.00*
DATE: *11/04/09*
CALCULATED BY: *MAL*

FINAL DRAINAGE REPORT ~ HISTORIC SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Inlet Size
					I(5)	I(100)	Q(5)	Q(100)	
SITE ONLY HISTORIC FLOWS INTO FALCON AREA CHANNEL TO COMPARE TO DEVELOPED SITE FLOWS INTO CHANNEL									
FA CH-1	Historic Basin OS-A	6.17	8.43	22.9	2.81	4.99	17.3	42.1	
FA CH-2	CH-1 + DP-1 + Hist. Basins FA-S + FA-2 + OS-O + OS-B + UN-1 + DP-5a	45.36	75.10	45.5	1.89	3.36	85.6	252.0	
FA CH-3	CH-2 + Hist. Basin FA-3	48.93	80.10	48.9	1.80	3.21	88.3	257.0	
FA CH-4	CH-3 + Hist. Basin FA-1	63.21	100.09	51.8	1.74	3.09	110.0	309.7	
FA CH-5	CH-4 + Hist. Basin FA-4	73.60	114.64	56.9	1.64	2.91	120.7	334.1	
FA CH-6	CH-5 + Hist. Basin FA-5	75.75	117.64	58.4	1.61	2.87	122.1	337.1	
SAND CREEK UNDEVELOPED ON-SITE SMALL BASINS									
SC-8	BASIN SC-K	2.71	3.80	21.8	2.88	5.13	7.8	19.5	
SC-9	BASIN SC-M	4.83	6.77	23.0	2.80	4.99	13.6	33.7	
SC-10	BASIN SC-N	1.85	2.59	21.4	2.91	5.17	5.4	13.4	
SC-11	BASIN SC-O	5.15	7.21	24.0	2.74	4.87	14.1	35.1	
SC-13	BASIN SC-Q	1.38	1.94	15.7	3.39	6.03	4.7	11.7	
SC-15	BASIN SC-S	0.89	1.25	8.6	4.34	7.71	3.9	9.6	

JOB NAME:	*ELKHORN ESTATES MDDP*
JOB NUMBER:	*2289.00*
DATE:	*11/04/09*
CALCULATED BY:	*MAL*

FINAL DRAINAGE REPORT ~ DEVELOPED SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Inlet Size
					I(5)	I(100)	Q(5)	Q(100)	
1	Specified Release from Paint Brush Hills 10, 11, & 12 FDR	12.44	31.09	41.1	2.01	3.57	25.0	111.2	Paint Brush Hill Pond B2 Release 60" RCP Outfall
2	Basin OS-O	3.35	4.27	35.0	2.22	3.94	7.4	16.8	Prop. 24" RCP road crossing
3	DP-1 + DP-2 + Basin OS-B	18.98	39.73	43.4	1.95	3.46	36.9	137.4	Existing Stock Pond to be removed
4a	DP-3 + Basin UN-1	21.38	43.09	45.5	1.89	3.36	40.4	144.6	Ex. Flows onto development area
4b	DP-4a	21.38	43.09	45.5	1.89	3.36	40.4	144.6	Release into improved Channel
5a	Specified Release from Paint Brush Hills 10, 11, & 12 FDR	11.83	15.21	21.4	2.91	5.18	34.4	78.7	Developed Release 42" RCP
5b	DP-5a + Basin FA-S	20.33	24.43	29.0	2.47	4.39	50.2	107.2	Release into improved Channel
6a	Basin FA-1	21.43	28.58	17.9	3.18	5.66	68.2	161.8	Pond FA-A (Q In)
6b	Pond FA-A Historic Release	10.55	16.51	29.6	2.44	4.34	25.8	71.7	100 yr - 15.1 cfs less than historic 5 yr - 9.1 cfs less than historic
7a	Basin FA-2	7.43	8.67	8.8	4.30	7.65	32.0	66.3	Pond FA-B (Q In)
7b	Pond FA-B Historic Release	3.10	4.34	24.2	2.73	4.85	8.4	21.0	Full historic flow quantity
8a	Basin FA-3	7.54	8.92	10.3	4.06	7.22	30.6	64.4	Pond FA-C (Q In)
8b	Pond FA-C Historic Release	3.57	5.00	30.8	2.39	4.24	8.5	21.2	Full historic flow quantity
9a	Basin FA-4	16.30	23.16	14.3	3.54	6.28	57.6	145.5	Pond FA-D (Q In)
9b	Pond FA-D Historic Release	6.66	11.06	33.3	2.28	4.06	15.2	44.9	100 yr - 14.1 cfs less than historic 5 yr - 8.5 cfs less than historic
WE	Basin FA-WE	0.61	0.83	5.0	5.10	9.07	3.1	7.5	Less than historic

JOB NAME:	*ELKHORN ESTATES MDDP*
JOB NUMBER:	*2289.00*
DATE:	*11/04/09*
CALCULATED BY:	*MAL*

FINAL DRAINAGE REPORT ~ DEVELOPED SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Inlet Size
					I(5)	I(100)	Q(5)	Q(100)	
SITE ONLY DEVELOPED FLOWS TO COMPARE TO HISTORIC CHANNEL FLOWS (FALCON AREA)									
FA CH-1	Hist. Basin OS-A	6.17	8.43	22.9	2.81	4.99	17.3	42.1	
FA CH-2	CH-1 + DP-4b + DP-5b + DP-7b	50.98	80.29	45.5	1.89	3.36	96.2	269.4	
FA CH-3	CH-2 + DP-8b	54.55	85.29	48.9	1.80	3.21	98.5	273.7	
FA CH-4	CH-3 + DP-6b	65.11	101.80	51.8	1.74	3.09	113.3	315.0	
FA CH-5	CH-4 + DP-9b	71.77	112.86	56.9	1.64	2.91	117.7	328.9	
FA CH-6	CH-5 + Basin FA-5	75.68	117.49	58.4	1.61	2.87	122.0	336.6	Matches historic site flows
SAND CREEK ON-SITE DEVELOPED SMALL BASINS (SOUTH BOUNDARY)									
SC-9	Basin SC-9	1.07	1.45	18.2	3.16	5.62	3.4	8.1	
SC-10	Basin SC-10	1.45	1.97	15.3	3.43	6.09	5.0	12.0	
SC-11	Basin SC-11	1.05	1.42	18.2	3.16	5.62	3.3	8.0	
SC-12	Basin SC-12	1.71	2.32	12.0	3.82	6.78	6.5	15.7	
SC-13	Basin SC-13	1.20	1.63	15.3	3.43	6.09	4.1	9.9	
SC-14	Basin SC-14	2.89	3.92	16.3	3.33	5.92	9.6	23.2	

JOB NAME:	*ELKHORN ESTATES MDDP*
JOB NUMBER:	*2289.00*
DATE:	*11/04/09*
CALCULATED BY:	*MAL*

FINAL DRAINAGE REPORT ~ TRAVEL TIMES

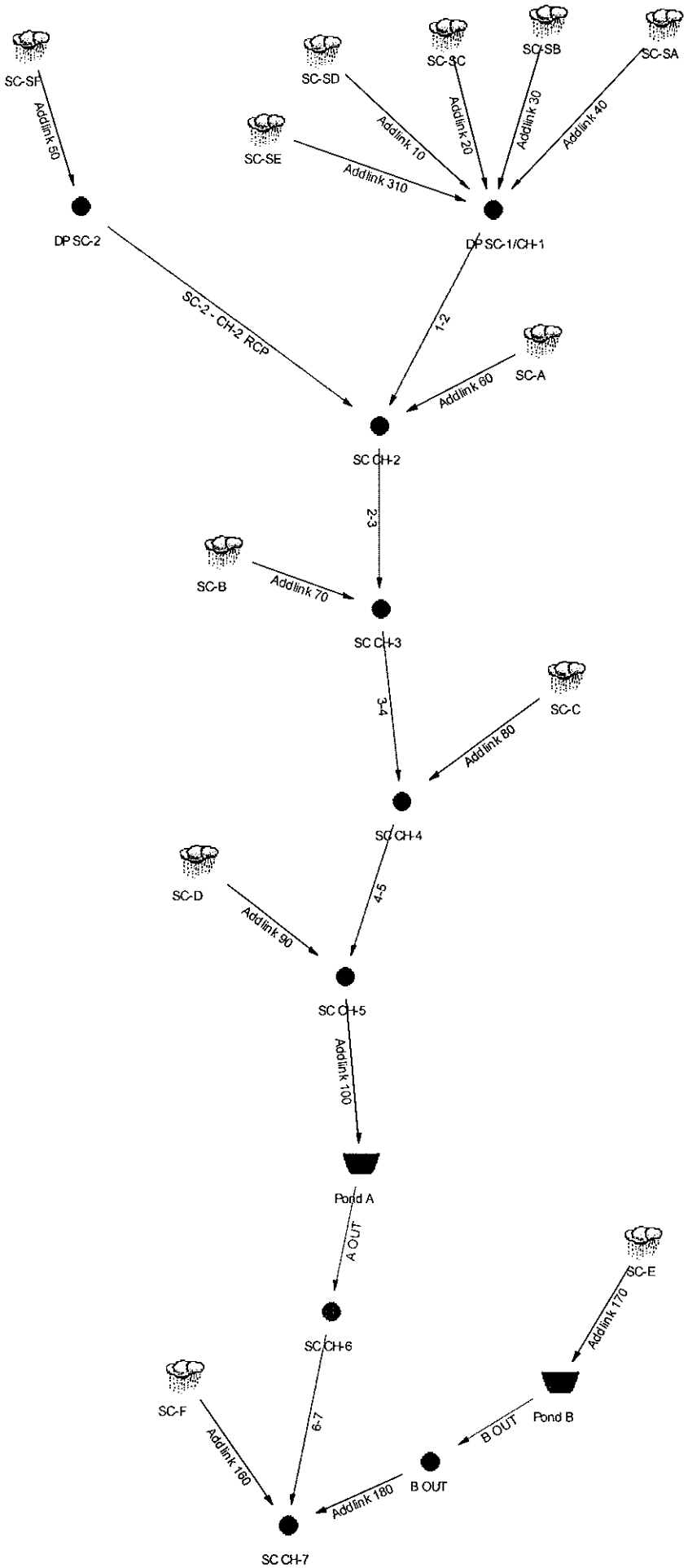
PIPE/CHANNEL RUN	STREET / CHANNEL FLOW			
	Length *(ft)*	Slope *(%)*	Velocity *(fps)*	Tc *(min)*
42" from DP-5	1600	1.0%	3.5	7.6
CH-2 to CH-3	1000	2.0%	4.9	3.4
CH-3 to CH-4	860	2.0%	4.9	2.9
CH-4 to CH-5	1500	2.0%	4.9	5.1
CH-5 to CH-6	450	2.0%	4.9	1.5

DETENTION POND ESTIMATED STORAGE - DEVELOPED CONDITIONS

POND	TRIBUTARY BASINS	TRIBUTARY AREA	IMPERVIOUS VALUE (%) Water Quality Purposes	CALCULATED WQCV REQ'D Acre-Feet	TOTAL WQCV PLUS SEDIMENT ALLOWANCE Acre-Feet (1.2 * WQCV)	PONDPAK 10.0 Required Storage Acre-Feet	*** DESIGN STORAGE VOLUME Storage Vol. + 50% Total WQCV Acre-Feet
FA-A	Basin FA-1	57.12	27.52	0.82	0.98	2.93	3.42
FA-B	Basin FA-2	12.39	65.00	0.32	0.38	1.06	1.24
FA-C	Basin FA-3	14.29	44.16	0.27	0.33	1.08	1.24
FA-D	Basin FA-4	41.55	27.41	0.60	0.71	3.14	3.49
SC-A	Basins SC-A, SC-B, SC-C, SC-D + Off-Site Sand Creek Basins	468.19	15.20	4.41	5.30	26.90	29.55
SC-B	Basin SC-E	130.24	32.77	2.08	2.50	8.27	9.52

SAND CREEK – DEVELOPED CONDITIONS

PONDPAK RESULTS


SC-SF
Addlink 50
SC-SD
Addlink 10
SC-SC
Addlink 20
SC-SB
Addlink 30
SC-SA
Addlink 40
SC-SE
Addlink 310
DP SC-2
DP SC-1/CH-1
SC-2 - CH-2 RCP
1-2
SC-A
Addlink 60
SC CH-2
2-3
SC-B
Addlink 70
SC CH-3
3-4
SC-C
Addlink 80
SC CH-4
SC-D
Addlink 90
4-5
SC CH-5
Addlink 100
Pond A
A OUT
SC-E
Addlink 170
SC CH-6
SC-F
Addlink 160
6-7
Pond B
B OUT
B OUT
Addlink 180
SC CH-7

JOB TITLE
==========

Project Date: 11/1/2009
Project Engineer: Matt Larson
Project Title: Elkhorn Estates - Sand Creek Developed Conditions
Project Comments:

********** MASTER SUMMARY **********

Watershed..... Master Network Summary 1.01

********** DESIGN STORMS SUMMARY **********

COLO SPRGS..... Design Storms 2.01

********** CHANNEL ANALYSES **********

6-7..... Chn-Trapz. 3.01

PIPE SC-2 - CH-2 Chn-Circular 3.03

SC 1-2..... Chn-Trapz. 3.05

SC 2-3..... Chn-Trapz. 3.07

SC 3-4..... Chn-Trapz. 3.09

SC 4-5..... Chn-Trapz. 3.11

********** POND ROUTING **********

POND A OUT 100
Pond Routing Summary 4.01

POND B OUT 100
Pond Routing Summary 4.02

MASTER DESIGN STORM SUMMARY

Network Storm Collection: COLO SPRGS

Return Event	Total Depth in	Rainfall Type	RNF ID
100	4.4000	Synthetic Curve	TYPEIIA 24HR
5	2.6000	Synthetic Curve	TYPEIIA 24HR

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
B OUT		JCT	100	16.172	R	6.5400	84.43		
B OUT		JCT	5	3.593	R	8.1900	5.52		
DP SC-1/CH-1		JCT	100	12.099		6.0600	171.37		
DP SC-1/CH-1		JCT	5	2.900		6.1000	27.17		
DP SC-2		JCT	100	8.013		6.0500	129.78		
DP SC-2		JCT	5	1.951		6.0800	23.28		
POND A	IN	POND	100	55.792	R	6.2000	616.46		
POND A	IN	POND	5	16.454	R	6.3200	109.48		
POND A	OUT	POND	100	47.597	R	6.8600	125.90	7043.75	22.515
POND A	OUT	POND	5	8.989	R	10.4800	8.17	7039.76	8.725
POND B	IN	POND	100	18.958		6.1800	219.08		
POND B	IN	POND	5	6.310		6.1900	61.66		
POND B	OUT	POND	100	16.172	R	6.5400	84.43	7015.80	6.817
POND B	OUT	POND	5	3.593	R	8.1900	5.52	7012.58	3.200

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
SC CH-2	JCT	100	26.448		6.1000	370.81		
SC CH-2	JCT	5	6.720		6.1500	62.21		
SC CH-3	JCT	100	40.555		6.1600	480.81		
SC CH-3	JCT	5	11.282	R	6.2600	88.76		
SC CH-4	JCT	100	49.995	R	6.1800	576.60		
SC CH-4	JCT	5	14.589	R	6.2800	105.39		
SC CH-5	JCT	100	55.792	R	6.2000	616.46		
SC CH-5	JCT	5	16.454	R	6.3200	109.48		
SC CH-6	JCT	100	47.597	R	6.8600	125.90		
SC CH-6	JCT	5	8.989	R	10.4800	8.17		
*SC CH-7	JCT	100	66.440	R	6.7700	203.78		
*SC CH-7	JCT	5	13.590	R	6.0600	16.64		
SC-A	AREA	100	6.338		6.0900	89.33		
SC-A	AREA	5	1.870		6.1300	21.74		
SC-B	AREA	100	14.118		6.2000	143.06		
SC-B	AREA	5	4.569		6.2700	38.53		
SC-C	AREA	100	9.460		6.1000	136.16		
SC-C	AREA	5	3.320		6.1100	43.41		
SC-D	AREA	100	5.827		6.0700	92.04		
SC-D	AREA	5	1.886		6.0800	26.90		
SC-E	AREA	100	18.958		6.1800	219.08		
SC-E	AREA	5	6.310		6.1900	61.66		
SC-F	AREA	100	2.706		6.0400	45.35		
SC-F	AREA	5	1.021		6.0600	16.64		

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
SC-SA	AREA	100	4.075		6.1000	54.46		
SC-SA	AREA	5	.947		6.1500	8.09		
SC-SB	AREA	100	4.638		6.0800	66.01		
SC-SB	AREA	5	1.129		6.1100	11.21		
SC-SC	AREA	100	.443		6.0100	9.05		
SC-SC	AREA	5	.108		6.0200	1.93		
SC-SD	AREA	100	2.099		6.0500	35.81		
SC-SD	AREA	5	.511		6.0800	6.57		
SC-SE	AREA	100	.843		6.0200	16.64		
SC-SE	AREA	5	.205		6.0300	3.45		
SC-SF	AREA	100	8.013		6.0500	129.78		
SC-SF	AREA	5	1.951		6.0800	23.28		

Title... Project Date: 11/1/2009
Project Engineer: Matt Larson
Project Title: Elkhorn Estates - Sand Creek Developed Conditions
Project Comments:

DESIGN STORMS SUMMARY

Design Storm File,ID = COLO SPRGS

Storm Tag Name = 100

Data Type, File, ID = Synthetic Storm TYPEIIA 24HR
Storm Frequency = 100 yr
Total Rainfall Depth= 4.4000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .2500 hrs End= 24.0000 hrs

Storm Tag Name = 5

Data Type, File, ID = Synthetic Storm TYPEIIA 24HR
Storm Frequency = 5 yr
Total Rainfall Depth= 2.6000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .2500 hrs End= 24.0000 hrs

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .010000 ft/ft
Mannings n = 0.03500
Invert Elev. = 7012.00 ft
Top of Channel = 7030.00 ft
Base width = 40.00 ft
Rt Side slope = 4.000 horizontal :1 vert.
Lt Side slope = 4.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
7012.000	.00	.00	.00	.0000	.00	.00	.00	0.00
7012.010	.01	.08	.19	.3910	40.08	40.08	.01	0.35
7012.360	.36	31.27	2.10	14.9125	42.88	42.97	.35	0.63
7012.720	.72	100.62	3.26	30.8834	45.76	45.94	.67	0.70
7013.080	1.08	200.35	4.19	47.8694	48.64	48.91	.98	0.74
7013.440	1.44	328.10	4.98	65.8914	51.52	51.87	1.28	0.78
7013.800	1.80	482.82	5.68	84.9494	54.40	54.84	1.56	0.80
7014.160	2.16	664.33	6.32	105.0714	57.28	57.81	1.83	0.82
7014.520	2.52	872.03	6.91	126.2028	60.16	60.78	2.10	0.84
7014.880	2.88	1106.27	7.46	148.3702	63.04	63.75	2.35	0.86
7015.240	3.24	1367.66	7.97	171.6059	65.92	66.72	2.60	0.87
7015.600	3.60	1655.84	8.45	195.8467	68.80	69.69	2.85	0.88
7015.960	3.96	1971.56	8.92	221.1236	71.68	72.65	3.08	0.89
7016.320	4.32	2315.26	9.36	247.4365	74.56	75.62	3.32	0.91
7016.680	4.68	2687.97	9.78	274.8232	77.44	78.59	3.55	0.92
7017.040	5.04	3089.18	10.19	303.2095	80.32	81.56	3.78	0.92
7017.400	5.40	3519.90	10.58	332.6319	83.20	84.53	4.00	0.93
7017.760	5.76	3980.69	10.96	363.0902	86.08	87.50	4.22	0.94
7018.120	6.12	4472.78	11.33	394.6280	88.96	90.47	4.44	0.95
7018.480	6.48	4995.40	11.69	427.1598	91.84	93.44	4.65	0.96
7018.840	6.84	5549.76	12.05	460.7276	94.72	96.40	4.86	0.96
7019.200	7.20	6137.25	12.39	495.3791	97.60	99.37	5.08	0.97
7019.560	7.56	6756.84	12.72	531.0203	100.48	102.34	5.28	0.98
7019.920	7.92	7409.87	13.05	567.6975	103.36	105.31	5.49	0.98
7020.280	8.28	8096.93	13.37	605.4108	106.24	108.28	5.70	0.99
7020.640	8.64	8819.57	13.69	644.2133	109.12	111.25	5.90	0.99
7021.000	9.00	9576.41	14.00	684.0000	112.00	114.22	6.11	1.00
7021.360	9.36	10368.98	14.31	724.8227	114.88	117.18	6.31	1.00
7021.720	9.72	11198.98	14.61	766.7389	117.76	120.15	6.51	1.01
7022.080	10.08	12064.73	14.90	809.6350	120.64	123.12	6.71	1.01
7022.440	10.44	12967.90	15.19	853.5671	123.52	126.09	6.91	1.02
7022.800	10.80	13909.03	15.48	898.5353	126.40	129.06	7.11	1.02
7023.160	11.16	14890.05	15.76	944.6026	129.28	132.03	7.31	1.03
7023.520	11.52	15908.84	16.04	991.6442	132.16	135.00	7.50	1.03
7023.880	11.88	16967.26	16.32	1039.7220	135.04	137.96	7.70	1.04

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .010000 ft/ft
Mannings n = 0.03500
Invert Elev. = 7012.00 ft
Top of Channel = 7030.00 ft
Base width = 40.00 ft
Rt Side slope = 4.000 horizontal :1 vert.
Lt Side slope = 4.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
7024.240	12.24	18067.38	16.59	1088.9030	137.92	140.94	7.90	1.04
7024.600	12.60	19206.76	16.86	1139.0540	140.80	143.90	8.09	1.05
7024.960	12.96	20387.41	17.13	1190.2410	143.68	146.87	8.28	1.05
7025.320	13.32	21609.86	17.39	1242.4640	146.56	149.84	8.48	1.05
7025.680	13.68	22876.40	17.65	1295.7960	149.44	152.81	8.67	1.06
7026.040	14.04	24184.13	17.91	1350.0920	152.32	155.78	8.86	1.06
7026.400	14.40	25535.27	18.17	1405.4250	155.20	158.74	9.06	1.06
7026.760	14.76	26930.35	18.42	1461.7930	158.08	161.71	9.25	1.07
7027.120	15.12	28371.88	18.67	1519.2760	160.96	164.68	9.44	1.07
7027.480	15.48	29856.47	18.92	1577.7180	163.84	167.65	9.63	1.08
7027.840	15.84	31386.57	19.17	1637.1960	166.72	170.62	9.82	1.08
7028.200	16.20	32964.88	19.42	1697.7930	169.60	173.59	10.01	1.08
7028.560	16.56	34587.63	19.66	1759.3440	172.48	176.56	10.20	1.09
7028.920	16.92	36257.42	19.90	1821.9320	175.36	179.53	10.39	1.09
7029.280	17.28	37974.80	20.14	1885.5550	178.24	182.49	10.58	1.09
7029.640	17.64	39742.68	20.38	1950.3030	181.12	185.46	10.77	1.09
7030.000	18.00	41556.77	20.61	2016.0000	184.00	188.43	10.96	1.10

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .015000 ft/ft
Mannings n = 0.01300
Invert Elev. = 7110.00 ft
Top of Channel = 7114.00 ft
Diameter = 4.0000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
7110.000	.00	.00	.00	.0000	.00	.00	.00	0.00
7110.080	.08	.12	1.97	.0601	1.12	1.14	.05	1.50
7110.160	.16	.53	3.11	.1688	1.57	1.61	.11	1.67
7110.240	.24	1.25	4.05	.3083	1.90	1.98	.16	1.77
7110.320	.32	2.29	4.87	.4706	2.17	2.29	.22	1.84
7110.400	.40	3.67	5.61	.6538	2.40	2.57	.27	1.90
7110.480	.48	5.38	6.30	.8541	2.60	2.83	.33	1.94
7110.560	.56	7.42	6.93	1.0695	2.78	3.07	.39	1.97
7110.640	.64	9.77	7.53	1.2982	2.93	3.29	.44	1.99
7110.720	.72	12.44	8.09	1.5388	3.07	3.51	.50	2.01
7110.800	.80	15.40	8.61	1.7886	3.20	3.71	.56	2.03
7110.880	.88	18.67	9.11	2.0494	3.31	3.91	.62	2.04
7110.960	.96	22.22	9.58	2.3190	3.42	4.10	.68	2.05
7111.040	1.04	26.04	10.03	2.5963	3.51	4.28	.74	2.06
7111.120	1.12	30.13	10.46	2.8807	3.59	4.46	.80	2.06
7111.200	1.20	34.46	10.87	3.1714	3.67	4.64	.87	2.06
7111.280	1.28	39.00	11.25	3.4659	3.73	4.81	.93	2.06
7111.360	1.36	43.78	11.62	3.7671	3.79	4.98	.99	2.06
7111.440	1.44	48.77	11.97	4.0726	3.84	5.15	1.06	2.05
7111.520	1.52	53.94	12.31	4.3819	3.88	5.31	1.13	2.04
7111.600	1.60	59.29	12.63	4.6943	3.92	5.48	1.20	2.03
7111.680	1.68	64.79	12.93	5.0094	3.95	5.64	1.27	2.02
7111.760	1.76	70.39	13.22	5.3246	3.97	5.80	1.34	2.01
7111.840	1.84	76.15	13.49	5.6432	3.99	5.96	1.42	2.00
7111.920	1.92	82.01	13.75	5.9630	4.00	6.12	1.49	1.99
7112.000	2.00	87.96	14.00	6.2832	4.00	6.28	1.57	1.97
7112.080	2.08	93.97	14.23	6.6034	4.00	6.44	1.65	1.95
7112.160	2.16	100.02	14.45	6.9231	3.99	6.60	1.74	1.93
7112.240	2.24	106.09	14.65	7.2418	3.97	6.76	1.82	1.91
7112.320	2.32	112.13	14.84	7.5570	3.95	6.93	1.91	1.89
7112.400	2.40	118.18	15.01	7.8721	3.92	7.09	2.01	1.87
7112.480	2.48	124.19	15.17	8.1845	3.88	7.25	2.11	1.84
7112.560	2.56	130.13	15.32	8.4938	3.84	7.42	2.21	1.82
7112.640	2.64	135.98	15.45	8.7993	3.79	7.59	2.32	1.79
7112.720	2.72	141.72	15.57	9.1005	3.73	7.76	2.44	1.76
7112.800	2.80	147.27	15.68	9.3950	3.67	7.93	2.56	1.73
7112.880	2.88	152.69	15.76	9.6856	3.59	8.11	2.70	1.69

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .015000 ft/ft
Mannings n = 0.01300
Invert Elev. = 7110.00 ft
Top of Channel = 7114.00 ft
Diameter = 4.0000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
7112.960	2.96	157.90	15.84	9.9700	3.51	8.29	2.84	1.66
7113.040	3.04	162.87	15.89	10.2474	3.42	8.47	3.00	1.62
7113.120	3.12	167.57	15.93	10.5169	3.31	8.66	3.17	1.58
7113.200	3.20	171.96	15.96	10.7778	3.20	8.86	3.37	1.53
7113.280	3.28	175.98	15.96	11.0276	3.07	9.06	3.59	1.49
7113.360	3.36	179.62	15.94	11.2682	2.93	9.27	3.84	1.43
7113.440	3.44	182.80	15.90	11.4969	2.78	9.50	4.14	1.38
7113.520	3.52	185.45	15.83	11.7123	2.60	9.74	4.51	1.32
7113.600	3.60	187.49	15.74	11.9126	2.40	9.99	4.96	1.25
7113.680	3.68	188.81	15.61	12.0958	2.17	10.27	5.57	1.17
7113.753	3.75	189.23	15.45	12.2450	1.93	10.56	6.36	1.08
7113.760	3.76	189.23	15.44	12.2581	1.90	10.59	6.45	1.07
7113.840	3.84	188.48	15.20	12.3975	1.57	10.95	7.90	0.95
7113.920	3.92	185.89	14.86	12.5063	1.12	11.43	11.16	0.78
7114.000	4.00	175.92	14.00	12.5664	.00	12.57	****	****

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .006000 ft/ft
Mannings n = 0.03500
Invert Elev. = 7112.00 ft
Top of Channel = 7118.30 ft
Base width = 5.00 ft
Rt Side slope = 4.000 horizontal :1 vert.
Lt Side slope = 4.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
7112.000	.00	.00	.00	.0000	.00	.00	.00	0.00
7112.010	.01	.01	.15	.0492	5.08	5.08	.01	0.27
7112.130	.13	.57	.79	.7169	6.04	6.07	.12	0.41
7112.260	.26	1.88	1.20	1.5687	7.08	7.14	.22	0.45
7112.390	.39	3.87	1.51	2.5595	8.12	8.22	.32	0.47
7112.520	.52	6.53	1.77	3.6818	9.16	9.29	.40	0.49
7112.650	.65	9.91	2.01	4.9390	10.20	10.36	.48	0.51
7112.780	.78	14.04	2.22	6.3312	11.24	11.43	.56	0.52
7112.910	.91	18.98	2.41	7.8643	12.28	12.51	.64	0.53
7113.040	1.04	24.74	2.60	9.5269	13.32	13.58	.72	0.54
7113.170	1.17	31.37	2.77	11.3245	14.36	14.65	.79	0.55
7113.300	1.30	38.92	2.94	13.2570	15.40	15.72	.86	0.56
7113.430	1.43	47.45	3.09	15.3325	16.44	16.79	.93	0.57
7113.560	1.56	56.96	3.25	17.5354	17.48	17.86	1.00	0.57
7113.690	1.69	67.49	3.40	19.8733	18.52	18.94	1.07	0.58
7113.820	1.82	79.11	3.54	22.3462	19.56	20.01	1.14	0.58
7113.950	1.95	91.89	3.68	24.9640	20.60	21.08	1.21	0.59
7114.080	2.08	105.77	3.82	27.7073	21.64	22.15	1.28	0.59
7114.210	2.21	120.85	3.95	30.5855	22.68	23.22	1.35	0.60
7114.340	2.34	137.15	4.08	33.5987	23.72	24.29	1.42	0.60
7114.470	2.47	154.78	4.21	36.7589	24.76	25.37	1.48	0.61
7114.600	2.60	173.65	4.34	40.0425	25.80	26.44	1.55	0.61
7114.730	2.73	193.86	4.46	43.4611	26.84	27.51	1.62	0.62
7114.860	2.86	215.44	4.58	47.0146	27.88	28.58	1.69	0.62
7114.990	2.99	238.51	4.70	50.7172	28.92	29.66	1.75	0.63
7115.120	3.12	262.93	4.82	54.5411	29.96	30.73	1.82	0.63
7115.250	3.25	288.83	4.94	58.5000	31.00	31.80	1.89	0.63
7115.380	3.38	316.24	5.05	62.5939	32.04	32.87	1.95	0.64
7115.510	3.51	345.18	5.17	66.8227	33.08	33.94	2.02	0.64
7115.640	3.64	375.82	5.28	71.2031	34.12	35.02	2.09	0.64
7115.770	3.77	407.95	5.39	75.7023	35.16	36.09	2.15	0.65
7115.900	3.90	441.72	5.50	80.3365	36.20	37.16	2.22	0.65
7116.030	4.03	477.16	5.61	85.1056	37.24	38.23	2.29	0.65
7116.160	4.16	514.44	5.71	90.0284	38.28	39.31	2.35	0.66
7116.290	4.29	553.32	5.82	95.0679	39.32	40.38	2.42	0.66

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .006000 ft/ft
Mannings n = 0.03500
Invert Elev. = 7112.00 ft
Top of Channel = 7118.30 ft
Base width = 5.00 ft
Rt Side slope = 4.000 horizontal :1 vert.
Lt Side slope = 4.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
7116.420	4.42	593.96	5.93	100.2424	40.36	41.45	2.48	0.66
7116.550	4.55	636.39	6.03	105.5519	41.40	42.52	2.55	0.67
7116.680	4.68	680.83	6.13	111.0171	42.44	43.59	2.62	0.67
7116.810	4.81	726.95	6.23	116.5969	43.48	44.66	2.68	0.67
7116.940	4.94	774.96	6.34	122.3118	44.52	45.74	2.75	0.67
7117.070	5.07	824.88	6.44	128.1616	45.56	46.81	2.81	0.68
7117.200	5.20	876.95	6.54	134.1691	46.60	47.88	2.88	0.68
7117.330	5.33	930.80	6.63	140.2893	47.64	48.95	2.94	0.68
7117.460	5.46	986.66	6.73	146.5445	48.68	50.02	3.01	0.68
7117.590	5.59	1044.54	6.83	152.9346	49.72	51.10	3.08	0.69
7117.720	5.72	1104.72	6.93	159.4845	50.76	52.17	3.14	0.69
7117.850	5.85	1166.77	7.02	166.1451	51.80	53.24	3.21	0.69
7117.980	5.98	1230.93	7.12	172.9406	52.84	54.31	3.27	0.69
7118.110	6.11	1297.24	7.21	179.8710	53.88	55.38	3.34	0.70
7118.240	6.24	1365.98	7.31	186.9633	54.92	56.46	3.40	0.70
7118.300	6.30	1398.13	7.35	190.2492	55.40	56.95	3.43	0.70

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .005000 ft/ft
Mannings n = 0.03500
Invert Elev. = 7104.00 ft
Top of Channel = 7110.00 ft
Base width = 15.00 ft
Rt Side slope = 4.000 horizontal :1 vert.
Lt Side slope = 4.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
7104.000	.00	.00	.00	.0000	.00	.00	.00	0.00
7104.010	.01	.02	.14	.1469	15.08	15.08	.01	0.24
7104.120	.12	1.33	.72	1.8595	15.96	15.99	.12	0.37
7104.240	.24	4.27	1.11	3.8344	16.92	16.98	.23	0.41
7104.360	.36	8.47	1.43	5.9160	17.88	17.97	.33	0.44
7104.480	.48	13.85	1.71	8.1212	18.84	18.96	.43	0.46
7104.600	.60	20.36	1.95	10.4419	19.80	19.95	.53	0.47
7104.720	.72	27.96	2.17	12.8781	20.76	20.94	.62	0.49
7104.840	.84	36.60	2.37	15.4190	21.72	21.93	.71	0.50
7104.960	.96	46.37	2.56	18.0855	22.68	22.92	.80	0.51
7105.080	1.08	57.22	2.74	20.8675	23.64	23.91	.88	0.51
7105.200	1.20	69.16	2.91	23.7648	24.60	24.90	.97	0.52
7105.320	1.32	82.16	3.07	26.7651	25.56	25.88	1.05	0.53
7105.440	1.44	96.34	3.22	29.8929	26.52	26.87	1.13	0.54
7105.560	1.56	111.65	3.37	33.1360	27.48	27.86	1.21	0.54
7105.680	1.68	128.13	3.51	36.4946	28.44	28.86	1.28	0.55
7105.800	1.80	145.70	3.65	39.9543	29.40	29.84	1.36	0.55
7105.920	1.92	164.54	3.78	43.5432	30.36	30.83	1.43	0.56
7106.040	2.04	184.60	3.91	47.2476	31.32	31.82	1.51	0.56
7106.160	2.16	205.88	4.03	51.0674	32.28	32.81	1.58	0.57
7106.280	2.28	228.33	4.15	54.9865	33.24	33.80	1.65	0.57
7106.400	2.40	252.14	4.27	59.0367	34.20	34.79	1.73	0.57
7106.520	2.52	277.25	4.39	63.2023	35.16	35.78	1.80	0.58
7106.640	2.64	303.67	4.50	67.4833	36.12	36.77	1.87	0.58
7106.760	2.76	331.31	4.61	71.8617	37.08	37.76	1.94	0.58
7106.880	2.88	360.42	4.72	76.3731	38.04	38.75	2.01	0.59
7107.000	3.00	390.91	4.83	81.0000	39.00	39.74	2.08	0.59
7107.120	3.12	422.80	4.93	85.7423	39.96	40.73	2.15	0.59
7107.240	3.24	456.11	5.03	90.6000	40.92	41.72	2.21	0.60
7107.360	3.36	490.71	5.14	95.5527	41.88	42.71	2.28	0.60
7107.480	3.48	526.91	5.24	100.6408	42.84	43.70	2.35	0.60
7107.600	3.60	564.59	5.33	105.8443	43.80	44.69	2.42	0.60
7107.720	3.72	603.78	5.43	111.1632	44.76	45.68	2.48	0.61
7107.840	3.84	644.32	5.53	116.5753	45.72	46.66	2.55	0.61
7107.960	3.96	686.56	5.62	122.1246	46.68	47.65	2.62	0.61

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .005000 ft/ft
Mannings n = 0.03500
Invert Elev. = 7104.00 ft
Top of Channel = 7110.00 ft
Base width = 15.00 ft
Rt Side slope = 4.000 horizontal :1 vert.
Lt Side slope = 4.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
7108.080	4.08	730.37	5.72	127.7893	47.64	48.65	2.68	0.62
7108.200	4.20	775.76	5.81	133.5695	48.60	49.64	2.75	0.62
7108.320	4.32	822.56	5.90	139.4409	49.56	50.62	2.81	0.62
7108.440	4.44	871.17	5.99	145.4514	50.52	51.61	2.88	0.62
7108.560	4.56	921.43	6.08	151.5774	51.48	52.60	2.94	0.62
7108.680	4.68	973.35	6.17	157.8188	52.44	53.59	3.01	0.63
7108.800	4.80	1026.73	6.25	164.1496	53.40	54.58	3.07	0.63
7108.920	4.92	1082.02	6.34	170.6214	54.36	55.57	3.14	0.63
7109.040	5.04	1139.04	6.43	177.2086	55.32	56.56	3.20	0.63
7109.160	5.16	1197.81	6.51	183.9112	56.28	57.55	3.27	0.64
7109.280	5.28	1258.08	6.60	190.7013	57.24	58.54	3.33	0.64
7109.400	5.40	1320.38	6.68	197.6343	58.20	59.53	3.40	0.64
7109.520	5.52	1384.48	6.76	204.6828	59.16	60.52	3.46	0.64
7109.640	5.64	1450.39	6.85	211.8466	60.12	61.51	3.52	0.64
7109.760	5.76	1517.87	6.93	219.0961	61.08	62.50	3.59	0.64
7109.880	5.88	1587.47	7.01	226.4903	62.04	63.49	3.65	0.65
7110.000	6.00	1658.95	7.09	234.0000	63.00	64.48	3.71	0.65

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .005000 ft/ft
Mannings n = 0.03500
Invert Elev. = 7099.00 ft
Top of Channel = 7104.00 ft
Base width = 20.00 ft
Rt Side slope = 4.000 horizontal :1 vert.
Lt Side slope = 4.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
7099.000	.00	.00	.00	.0000	.00	.00	.00	0.00
7099.010	.01	.03	.14	.1957	20.08	20.08	.01	0.24
7099.100	.10	1.30	.64	2.0420	20.80	20.83	.10	0.36
7099.200	.20	4.17	1.00	4.1642	21.60	21.65	.19	0.40
7099.300	.30	8.22	1.29	6.3556	22.40	22.47	.28	0.43
7099.400	.40	13.38	1.55	8.6377	23.20	23.30	.37	0.45
7099.500	.50	19.56	1.78	11.0000	24.00	24.12	.46	0.46
7099.600	.60	26.72	1.99	13.4424	24.80	24.95	.54	0.48
7099.700	.70	34.83	2.18	15.9650	25.60	25.77	.62	0.49
7099.800	.80	43.82	2.36	18.5548	26.40	26.60	.70	0.50
7099.900	.90	53.77	2.53	21.2373	27.20	27.42	.78	0.51
7100.000	1.00	64.63	2.69	24.0000	28.00	28.25	.86	0.51
7100.100	1.10	76.41	2.85	26.8428	28.80	29.07	.93	0.52
7100.200	1.20	89.10	2.99	29.7658	29.60	29.90	1.01	0.53
7100.300	1.30	102.63	3.13	32.7541	30.40	30.72	1.08	0.53
7100.400	1.40	117.14	3.27	35.8370	31.20	31.54	1.15	0.54
7100.500	1.50	132.57	3.40	39.0000	32.00	32.37	1.22	0.54
7100.600	1.60	148.92	3.53	42.2432	32.80	33.19	1.29	0.55
7100.700	1.70	166.21	3.65	45.5666	33.60	34.02	1.36	0.55
7100.800	1.80	184.35	3.77	48.9533	34.40	34.84	1.42	0.56
7100.900	1.90	203.53	3.88	52.4366	35.20	35.67	1.49	0.56
7101.000	2.00	223.66	3.99	56.0000	36.00	36.49	1.56	0.56
7101.100	2.10	244.76	4.10	59.6436	36.80	37.32	1.62	0.57
7101.200	2.20	266.83	4.21	63.3673	37.60	38.14	1.69	0.57
7101.300	2.30	289.78	4.32	67.1525	38.40	38.96	1.75	0.58
7101.400	2.40	313.83	4.42	71.0362	39.20	39.79	1.81	0.58
7101.500	2.50	338.89	4.52	75.0000	40.00	40.62	1.88	0.58
7101.600	2.60	364.96	4.62	79.0440	40.80	41.44	1.94	0.58
7101.700	2.70	392.05	4.71	83.1681	41.60	42.27	2.00	0.59
7101.800	2.80	420.04	4.81	87.3517	42.40	43.09	2.06	0.59
7101.900	2.90	449.22	4.90	91.6358	43.20	43.91	2.12	0.59
7102.000	3.00	479.45	4.99	96.0000	44.00	44.74	2.18	0.60
7102.100	3.10	510.75	5.08	100.4444	44.80	45.56	2.24	0.60
7102.200	3.20	543.13	5.17	104.9689	45.60	46.39	2.30	0.60
7102.300	3.30	576.43	5.26	109.5509	46.40	47.21	2.36	0.60

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .005000 ft/ft
Mannings n = 0.03500
Invert Elev. = 7099.00 ft
Top of Channel = 7104.00 ft
Base width = 20.00 ft
Rt Side slope = 4.000 horizontal :1 vert.
Lt Side slope = 4.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
7102.400	3.40	610.99	5.35	114.2354	47.20	48.04	2.42	0.61
7102.500	3.50	646.66	5.43	119.0000	48.00	48.86	2.48	0.61
7102.600	3.60	683.46	5.52	123.8448	48.80	49.69	2.54	0.61
7102.700	3.70	721.39	5.60	128.7697	49.60	50.51	2.60	0.61
7102.800	3.80	760.27	5.68	133.7502	50.40	51.33	2.65	0.62
7102.900	3.90	800.49	5.77	138.8350	51.20	52.16	2.71	0.62
7103.000	4.00	841.88	5.85	144.0000	52.00	52.98	2.77	0.62
7103.100	4.10	884.44	5.93	149.2452	52.80	53.81	2.83	0.62
7103.200	4.20	928.19	6.00	154.5705	53.60	54.64	2.88	0.62
7103.300	4.30	972.92	6.08	159.9494	54.40	55.46	2.94	0.63
7103.400	4.40	1019.08	6.16	165.4346	55.20	56.28	3.00	0.63
7103.500	4.50	1066.45	6.24	171.0000	56.00	57.11	3.05	0.63
7103.600	4.60	1115.06	6.31	176.6456	56.80	57.93	3.11	0.63
7103.700	4.70	1164.91	6.39	182.3712	57.60	58.76	3.17	0.63
7103.800	4.80	1215.75	6.46	188.1486	58.40	59.58	3.22	0.63
7103.900	4.90	1268.11	6.54	194.0342	59.20	60.41	3.28	0.64
7104.000	5.00	1321.75	6.61	200.0000	60.00	61.23	3.33	0.64

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .005000 ft/ft
Mannings n = 0.03500
Invert Elev. = 7094.60 ft
Top of Channel = 7099.00 ft
Base width = 25.00 ft
Rt Side slope = 4.000 horizontal :1 vert.
Lt Side slope = 4.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
7094.600	.00	.00	.00	.0000	.00	.00	.00	0.00
7094.610	.01	.03	.14	.2445	25.08	25.08	.01	0.24
7094.690	.09	1.36	.60	2.2784	25.72	25.74	.09	0.35
7094.780	.18	4.35	.94	4.6342	26.44	26.49	.18	0.40
7094.870	.27	8.58	1.22	7.0421	27.16	27.23	.26	0.42
7094.960	.36	13.92	1.46	9.5146	27.88	27.97	.34	0.44
7095.050	.45	20.32	1.68	12.0656	28.60	28.71	.42	0.46
7095.140	.54	27.66	1.89	14.6676	29.32	29.45	.50	0.47
7095.230	.63	35.94	2.07	17.3341	30.04	30.19	.58	0.48
7095.320	.72	45.19	2.25	20.0802	30.76	30.94	.65	0.49
7095.410	.81	55.28	2.42	22.8762	31.48	31.68	.73	0.50
7095.500	.90	66.24	2.57	25.7369	32.20	32.42	.80	0.51
7095.590	.99	78.14	2.72	28.6781	32.92	33.17	.87	0.51
7095.680	1.08	90.84	2.87	31.6682	33.64	33.91	.94	0.52
7095.770	1.17	104.39	3.01	34.7229	34.36	34.65	1.01	0.53
7095.860	1.26	118.80	3.14	37.8422	35.08	35.39	1.08	0.53
7095.950	1.35	134.14	3.27	41.0435	35.80	36.13	1.15	0.54
7096.040	1.44	150.25	3.39	44.2923	36.52	36.87	1.21	0.54
7096.130	1.53	167.21	3.51	47.6056	37.24	37.61	1.28	0.55
7096.220	1.62	185.13	3.63	51.0021	37.96	38.36	1.34	0.55
7096.310	1.71	203.81	3.74	54.4449	38.68	39.10	1.41	0.56
7096.400	1.80	223.34	3.85	57.9523	39.40	39.84	1.47	0.56
7096.490	1.89	243.86	3.96	61.5439	40.12	40.59	1.53	0.56
7096.580	1.98	265.13	4.07	65.1808	40.84	41.33	1.60	0.57
7096.670	2.07	287.27	4.17	68.8823	41.56	42.07	1.66	0.57
7096.760	2.16	310.42	4.27	72.6690	42.28	42.81	1.72	0.57
7096.850	2.25	334.32	4.37	76.5000	43.00	43.55	1.78	0.58
7096.940	2.34	359.11	4.47	80.3956	43.72	44.29	1.84	0.58
7097.030	2.43	384.94	4.56	84.3774	44.44	45.04	1.90	0.58
7097.120	2.52	411.53	4.66	88.4025	45.16	45.78	1.96	0.59
7097.210	2.61	439.02	4.75	92.4921	45.88	46.52	2.02	0.59
7097.300	2.70	467.58	4.84	96.6691	46.60	47.27	2.07	0.59
7097.390	2.79	496.91	4.93	100.8882	47.32	48.01	2.13	0.59
7097.480	2.88	527.16	5.01	105.1720	48.04	48.75	2.19	0.60
7097.570	2.97	558.51	5.10	109.5441	48.76	49.49	2.25	0.60

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .005000 ft/ft
Mannings n = 0.03500
Invert Elev. = 7094.60 ft
Top of Channel = 7099.00 ft
Base width = 25.00 ft
Rt Side slope = 4.000 horizontal :1 vert.
Lt Side slope = 4.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
7097.660	3.06	590.63	5.18	113.9573	49.48	50.23	2.30	0.60
7097.750	3.15	623.70	5.27	118.4351	50.20	50.97	2.36	0.60
7097.840	3.24	657.91	5.35	123.0023	50.92	51.72	2.42	0.61
7097.930	3.33	692.89	5.43	127.6096	51.64	52.46	2.47	0.61
7098.020	3.42	728.83	5.51	132.2815	52.36	53.20	2.53	0.61
7098.110	3.51	765.75	5.59	137.0180	53.08	53.94	2.58	0.61
7098.200	3.60	803.86	5.67	141.8453	53.80	54.69	2.64	0.62
7098.290	3.69	842.75	5.74	146.7112	54.52	55.43	2.69	0.62
7098.380	3.78	882.63	5.82	151.6417	55.24	56.17	2.75	0.62
7098.470	3.87	923.74	5.90	156.6642	55.96	56.91	2.80	0.62
7098.560	3.96	965.64	5.97	161.7242	56.68	57.65	2.85	0.62
7098.650	4.05	1008.55	6.04	166.8488	57.40	58.40	2.91	0.63
7098.740	4.14	1052.73	6.12	172.0663	58.12	59.14	2.96	0.63
7098.830	4.23	1097.70	6.19	177.3204	58.84	59.88	3.01	0.63
7098.920	4.32	1143.71	6.26	182.6391	59.56	60.62	3.07	0.63
7099.000	4.40	1185.59	6.33	187.4341	60.20	61.28	3.11	0.63

LEVEL POOL ROUTING SUMMARY

```
HYG Dir          = X:\228900\REPORTS\MDDP\
Inflow  HYG file = work_pad.hyg - POND A       IN  100
Outflow HYG file = work_pad.hyg - POND A       OUT 100

Pond Node   Data = POND A
Pond Volume Data = POND A
Pond Outlet Data = FA-A OUTLET

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =  7035.00 ft
Starting Volume    =     .000 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .0100 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow       =    616.46 cfs    at    6.2000 hrs
Peak Outflow      =    125.90 cfs    at    6.8600 hrs
-----------------------------------------------------
Peak Elevation    =   7043.75 ft
Peak Storage =         22.515 ac-ft
=====================================================


MASS BALANCE (ac-ft)
---------------------------
+ Initial Vol  =        .000
+ HYG Vol IN   =      55.792
- Infiltration =        .000
- HYG Vol OUT  =      47.597
- Retained Vol =       8.195
                 ----------
Unrouted Vol =        .001 ac-ft  (.001% of Inflow Volume)


WARNING: Inflow hydrograph truncated on right side.
WARNING: Outflow hydrograph truncated on right side.
```

LEVEL POOL ROUTING SUMMARY

HYG Dir = X:\228900\REPORTS\MDDP\
Inflow HYG file = work_pad.hyg - POND B IN 100
Outflow HYG file = work_pad.hyg - POND B OUT 100

Pond Node Data = POND B
Pond Volume Data = POND B
Pond Outlet Data = FA-B-OUTLET

No Infiltration

INITIAL CONDITIONS

Starting WS Elev	= 7008.00	ft
Starting Volume	= .000	ac-ft
Starting Outflow	= .00	cfs
Starting Infiltr.	= .00	cfs
Starting Total Qout	= .00	cfs
Time Increment	= .0100	hrs

INFLOW/OUTFLOW HYDROGRAPH SUMMARY

Peak Inflow	= 219.08	cfs	at	6.1800 hrs
Peak Outflow	= 84.43	cfs	at	6.5400 hrs
Peak Elevation	= 7015.80	ft		
Peak Storage	= 6.817	ac-ft		

MASS BALANCE (ac-ft)

+ Initial Vol	= .000	
+ HYG Vol IN	= 18.958	
- Infiltration	= .000	
- HYG Vol OUT	= 16.172	
- Retained Vol	= 2.786	
Unrouted Vol	= -.000	ac-ft (.001% of Inflow Volume)

WARNING: Outflow hydrograph truncated on right side.

----- 6 -----
6-7... 3.01

----- C -----
COLO SPRGS... 2.01

----- P -----
PIPE SC-2 - CH-2... 3.03, 4.01,
4.02

----- S -----
SC 1-2... 3.05
SC 2-3... 3.07
SC 3-4... 3.09
SC 4-5... 3.11

----- W -----
Watershed... 1.01

PROPOSED CHANNEL SECTIONS

FLOWMASTER CALCULATIONS

Worksheet for Final Falcon Channel

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.00500	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	50.00	ft
Discharge	993.00	ft^3/s

Results

Normal Depth	2.95	ft
Flow Area	182.01	ft^2
Wetted Perimeter	74.29	ft
Top Width	73.57	ft
Critical Depth	2.17	ft
Critical Slope	0.01459	ft/ft
Velocity	5.46	ft/s
Velocity Head	0.46	ft
Specific Energy	3.41	ft
Froude Number	0.61	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.95	ft
Critical Depth	2.17	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.01459	ft/ft

Worksheet for Sand Creek 1-2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.00600	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	5.00	ft
Discharge	160.00	ft^3/s

Results

Normal Depth	2.51	ft
Flow Area	37.67	ft^2
Wetted Perimeter	25.67	ft
Top Width	25.05	ft
Critical Depth	1.98	ft
Critical Slope	0.01720	ft/ft
Velocity	4.25	ft/s
Velocity Head	0.28	ft
Specific Energy	2.79	ft
Froude Number	0.61	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.51	ft
Critical Depth	1.98	ft
Channel Slope	0.00600	ft/ft
Critical Slope	0.01720	ft/ft

Worksheet for Sand Creek 2-3

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.00500	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	15.00	ft
Discharge	352.00	ft^3/s

Results

Normal Depth	2.85	ft
Flow Area	75.08	ft^2
Wetted Perimeter	38.47	ft
Top Width	37.77	ft
Critical Depth	2.12	ft
Critical Slope	0.01574	ft/ft
Velocity	4.69	ft/s
Velocity Head	0.34	ft
Specific Energy	3.19	ft
Froude Number	0.59	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.85	ft
Critical Depth	2.12	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.01574	ft/ft

Worksheet for Sand Creek 3-4

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.00500	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	20.00	ft
Discharge	474.00	ft^3/s

Results

Normal Depth	2.98	ft
Flow Area	95.22	ft^2
Wetted Perimeter	44.59	ft
Top Width	43.86	ft
Critical Depth	2.22	ft
Critical Slope	0.01525	ft/ft
Velocity	4.98	ft/s
Velocity Head	0.39	ft
Specific Energy	3.37	ft
Froude Number	0.60	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.98	ft
Critical Depth	2.22	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.01525	ft/ft

Worksheet for Sand Creek 4-5

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.00500	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	25.00	ft
Discharge	580.00	ft^3/s

Results

Normal Depth	3.03	ft
Flow Area	112.51	ft^2
Wetted Perimeter	49.99	ft
Top Width	49.25	ft
Critical Depth	2.25	ft
Critical Slope	0.01498	ft/ft
Velocity	5.16	ft/s
Velocity Head	0.41	ft
Specific Energy	3.44	ft
Froude Number	0.60	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.03	ft
Critical Depth	2.25	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.01498	ft/ft

Worksheet for Sand Creek 6-7

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.00500	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	5.00	ft
Discharge	204.00	ft^3/s

Results

Normal Depth	2.91	ft
Flow Area	48.31	ft^2
Wetted Perimeter	28.97	ft
Top Width	28.25	ft
Critical Depth	2.22	ft
Critical Slope	0.01665	ft/ft
Velocity	4.22	ft/s
Velocity Head	0.28	ft
Specific Energy	3.18	ft
Froude Number	0.57	
Flow Type	Subcritical	

GVF Input Data

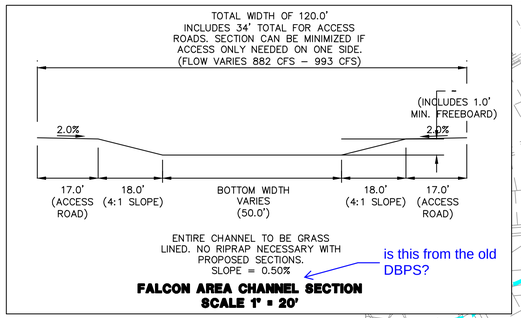
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.91	ft
Critical Depth	2.22	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.01665	ft/ft

EXISTING & DEVELOPED

DRAINAGE MAPS



400 200 0 400 800

SCALE: 1" = 400'

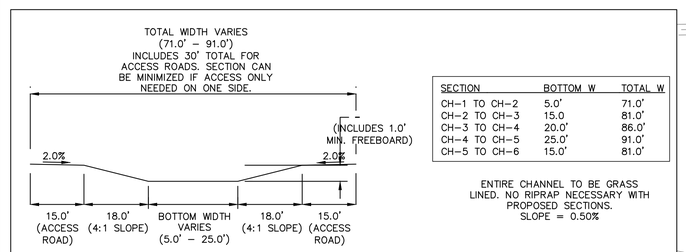
FALCON AREA BASIN DESIGN POINT SUMMARY		
DESIGN POINT	Q5 (CFS)	Q100 (CFS)
1	25.0	111.2
2	7.4	16.8
3	36.9	137.4
4A/4B	40.4	144.6
5A	34.4	78.7
5B	50.2	107.2
6A	68.2	161.8
6B	25.8	71.7

7A	32.0	66.3
7B	8.4	21.0
8A	30.6	64.4
8B	8.5	21.2
9A	57.6	145.5
9B	15.2	44.9
WE	3.1	7.5

SITE ONLY RUNOFF IN CHANNEL DESIGN POINT SUMMARY			TOTAL FLOW IN CHANNEL
DESIGN POINT	Q5 (CFS)	Q100 (CFS)	100 YR (CFS)
FA CH-1	17.3	42.1	882
FA CH-2	96.2	269.4	993
FA CH-3	98.5	273.7	993
FA CH-4	113.3	315.0	975
FA CH-5	117.7	328.9	958
FA CH-6	122.0	336.6	958

SAND CREEK BASIN DESIGN POINT SUMMARY		
DESIGN POINT	Q5 (CFS)	Q100 (CFS)
SC-1/SC CH-1	27.2	171.4
SC-2	23.3	129.8
SC CH-2	62.2	370.8
SC CH-3	88.8	480.8
SC CH-4	105.4	576.6
SC CH-5	109.5	616.5
SC CH-6	8.2	125.9
SC-7/SC CH-7	16.6	203.8
SC-8	0.0	0.0
SC-9	3.4	8.1
SC-10	5.0	12.0
SC-11	3.3	8.0
SC-12	6.5	15.7
SC-13	4.1	9.9
SC-14	9.6	23.2
SC-15	0.0	0.0

ALL BASINS NORTH OF DP-WN ARE MODELED EXACTLY AS DONE WITH THE FALCON HILLS MDDP, RENT GRASS MDDP, AND FALCON AREA DBPS.



SECTION	BOTTOM W	TOTAL W
CH-1 TO CH-2	5.0'	71.0'
CH-2 TO CH-3	15.0	81.0'
CH-3 TO CH-4	20.0'	86.0'
CH-4 TO CH-5	25.0'	91.0'
CH-5 TO CH-6	15.0'	81.0'

ENTIRE CHANNEL TO BE GRASS LINED. NO RIPRAP NECESSARY WITH PROPOSED SECTIONS.
SLOPE = 0.50%

SAND CREEK CHANNEL SECTIONS
SCALE 1" = 20'

Provide a map showing the downstream conveyances for large flows.

REVIEW: Replace existing conditions map

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF CLASSIC CONSULTING ENGINEERS AND SURVEYORS, LLC

KYLE R. CAMPBELL, COLORADO P.E. #29794 DATE

CLASSIC CONSULTING

619 N. Cascade Avenue, Suite 200 (719)785-0790
Colorado Springs, Colorado 80903 (719)785-0799(Fax)

THE RANCH

MDDP DRAINAGE MAP
DEVELOPED CONDITIONS

DESIGNED BY	MAL	SCALE	DATE 11/11/18
DRAWN BY	BB	(H) 1"= 400'	SHEET 2 OF 2
CHECKED BY		(V) 1"= N/A	JOB NO. 1182.10

N:\1182\0\DRAWINGS\DEVELOPMENT\1182D-MDDP-DEVELOPED.dwg, 5/16/2019 12:45:51 PM, 1:1