MASTER DEVELOPMENT DRAINAGE REPORT FOR THE RIDGE AT CUMBRE VISTA MASTER PLAN AND FINAL DRAINAGE REPORT FOR THE RIDGE AT CUMBRE VISTA FILING NO. 1

October 2014

Prepared for:

Rivers Development, Inc.
13530 Northgate Estates Drive, Suite 200
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Brian Bahr

Prepared by:

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Project #08-024

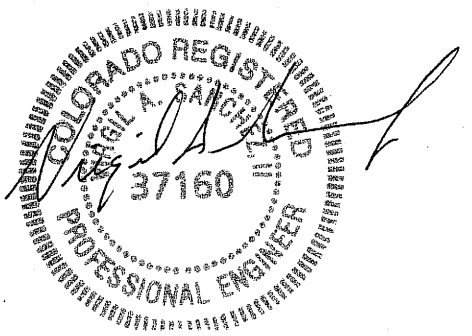
MASTER DEVELOPMENT DRAINAGE REPORT FOR THE RIDGE AT CUMBRE VISTA MASTER PLAN AND FINAL DRAINAGE REPORT FOR THE RIDGE AT CUMBRE VISTA FILING NO. 1

DRAINAGE PLAN STATEMENTS

ENGINEER'S STATEMENT

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria acceptable to the City of Colorado Springs. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

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



DEVELOPER'S STATEMENT

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

BY: _____ DATE: 10/9/14
Jonathan Moore

TITLE: Dir. of Engineering

ADDRESS: Rivers Development, Inc.
13530 Northgate Estates Drive, Suite 200
Colorado Springs, CO 80921

CITY OF COLORADO SPRINGS

Filed in accordance with Section 7-7-906 of the Code of the City of Colorado Springs, 2001, as amended.

BY: _____ DATE: 10/15/14
For The City Engineer

MASTER DEVELOPMENT DRAINAGE REPORT FOR THE RIDGE AT CUMBRE VISTA MASTER PLAN AND FINAL DRAINAGE REPORT FOR THE RIDGE AT CUMBRE VISTA FILING NO. 1

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PURPOSE

The purpose of this Master Development Drainage and Final Drainage Report is to establish the existing conditions and identify and analyze the proposed drainage patterns, determine proposed runoff quantities, size drainage structures for conveyance of developed runoff, and present solutions to drainage impacts on-site and off-site resulting from this development. The site to be known as The Ridge at Cumbre Vista Filing No. 1 will be developed as single family lots with on site detention. This site was annexed into the City of Colorado Springs by the Saddletree Village Annexation.

GENERAL LOCATION AND DESCRIPTION

The site is 13.7 acres and is located in a portion of the southeast quarter of Section 6, Township 13 South, Range 65 West of the 6th Principal Meridian currently within unincorporated El Paso County, Colorado. The site is bounded on the north by the existing Cowpoke Rd., on the south by Tri-Lakes Development Corporation (REC NO. 206170929), on the east by the Kit Carson Riding Club, and on the west by KF 103 CV LLC. (REC NO. 206170929).

The site is contained within the Sand Creek and Cottonwood Creek Basins. Flows from this site are tributary to both Sand Creek and Cottonwood Creek.

SOILS

Soils for this project are delineated by the map in the appendix as Columbine gravelly sandy loam (19). Soils in the study area are shown as mapped by S.C.S. in the "Soils Survey of El Paso County Area" are 51% of Hydrologic Group A and 49% Hydrologic Group B.

HYDROLOGIC CALCULATIONS

Hydrologic calculations were performed using the El Paso County and City of Colorado Springs Storm Drainage Design Criteria manual. The Rational Method was used to estimate storm water runoff anticipated from design storms with 5-year and 100-year recurrence intervals.

HYDRAULIC CALCULATIONS

Hydraulic calculations were estimated using the Manning's Formula and the methods described in the El Paso County and City of Colorado Springs Storm Drainage Design Criteria manual the pertinent data sheets are included in the appendix of this report.

CLIMATE

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

FLOODPLAIN STATEMENT

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panel No. 08041C0529, effective date March 17, 1997, no portion of the site lies within a designated floodplain.

DRAINAGE CRITERIA

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

EXISTING DRAINAGE CONDITIONS

The overall site consists of 13.7 acres, and is currently occupied by three structures. The study area consists of undeveloped land with existing natural, grassy vegetation. The existing topography is sloping from the northwest to the southeast with slopes ranging from 2% to 10%. The initial grading project proposed will disturb 13.7 acres. A portion of the site drains to the Sand Creek Basin (12.64 acres) and the other portion of the site drains to the Cottonwood Creek Basin (1.08 acres). The Ridge at Cumbre Vista Filing No. 1 site proposes 65 single family residential lots. The proposed 65 single family lots will not adversely impact the existing surrounding residential infrastructure. The proposed BMP's in the plan and report shall be installed and maintained to accomplish this task.

As per the Historic Drainage flows map:

Basin A is located in the northwest portion of the site and contains 0.83 of undeveloped land. Basin A has existing flows of 0.7 cfs for the minor storm event (5-Year) and 1.7 cfs for the major storm event (100-Year). Runoff from Basin A will sheet flow offsite to the north of the site and will be conveyed west along Cowpoke Road to the Design Point two and ultimately to the Cottonwood Creek Basin.

Basin A1 is located in the northwest portion of the site and contains 0.25 of undeveloped land. Basin A1 has existing flows of 0.2 cfs for the minor storm event (5-Year) and 0.5 cfs for the major storm event (100-Year). Runoff from Basin A1 will sheet flow offsite to the northwest corner of the site and will combine with flows from Basin A at design point 2. Flows will be conveyed west

along Cowpoke Road and ultimately to the Cottonwood Creek Basin.

Basin B is located in the northeast portion of the site and contains 6.66 of undeveloped land. Basin B has existing flows of 4.4 cfs for the minor storm event (5-Year) and 11.0 cfs for the major storm event (100-Year). Runoff from Basin B will sheet flow offsite to the north and east of the site and will ultimately flow to the Sand Creek Basin.

Basin C is located in the northeast portion of the site and contains 5.98 of undeveloped land. Basin C has existing flows of 4.1 cfs for the minor storm event (5-Year) and 10.1 cfs for the major storm event (100-Year). Runoff from Basin C will sheet flow offsite to the south of the site. Off site developed flows per the "Amendment No. 1 to the Final Drainage Report for Cumbre Vista Filing No. 1 and Preliminary/Final Drainage Report for Cumbre Vista Filing No. 2, 3, 4 and 5,) prepared by JR Engineering, revised January 2007 (see appendix for drainage plan approval page and drainage map), are tributary to Basin C. Per the historic drainage map, Basin OS1 has existing flows of Q5=1.5 cfs and Q100=3.2 cfs at Design Point 1. These flows sheet flow onto Basin C. The combined flows at Design Point 4 ~ Q5=4.9 cfs and Q100=11.8 cfs will ultimately flow to the Sand Creek Basin.

PROPOSED DRAINAGE CONDITIONS

The following is a description of the onsite basins, offsite bypass flows and the overall proposed drainage characteristics for the development of The Ridge at Cumbre Vista Filing No. 1. The following Design Points and Basins were determined using the Rational Method since each individual basin is less then 100 acres and the combined acreage at any Design Point is also less than 100 acres. This method offers a more conservative approach to calculating swale cross sections and storm drain. The proposed drainage design for this subdivision is typical for single family residential, consisting of homes, landscaping, rear and side lot drainage swales curb & gutter, streets, curb inlets, and pipes to convey developed flows downstream.

Basin A is located in the east portion of the site and contains 0.34 acres of single family residential landscaping. Basin A has proposed design flows of 0.4 cfs for the minor storm event (5-Year) and 1.1 cfs for the major storm event (100-Year). Runoff from Basin A will sheet flow offsite to the east of the site and will be conveyed southeasterly to offsite Design Point 5. Design point 5 does not exceed the historic design flows of 4.4 cfs for the minor storm event (5-Year) and 11.0 cfs for the major storm event (100-Year).

Basin B is located in the east central portion of the site and contains 2.21 acres of single family residential lots, homes, landscaping and an asphalt roadway. Basin B has proposed design flows of 3.2 cfs for the minor storm event (5-Year) and 6.6 cfs for the major storm event (100-Year). Runoff from Basin B will flow, via side lot swales, to the curb and gutter and will be conveyed south to Design Point 1, a 10 foot D-10-R inlet in a sump condition. Collected flows from Design Point 1 will be conveyed via a 36 inch RCP (Pipe 1) directly to the water/quality detention facility for The Ridge at Cumbre Vista Filing No.1. In the event of clogging or total inlet failure, flows from Design Point 1 will overtop the curb and be conveyed directly to the water/quality detention facility.

Basin C is located in the central portion of the site and contains 6.84 acres of single family residential lots, homes, landscaping and an asphalt roadway. Basin C has proposed design flows of 12.7 cfs for the minor storm event (5-Year) and 26.3 cfs for the major storm event (100-Year). Runoff from Basin C will flow, via side lot swales, to the curb and gutter and will be conveyed south to Design Point 2, a 10 foot D-10-R inlet in a sump condition. Per this drainage report, Basin C will accept developed flows from Basin OS1 (Exist. Cumbre Vista Filing No. 5) and convey them via side lot swales to curb and gutter. Collected flows at Design Point 2 (Q5= 13.6 cfs, Q100= 28.3 cfs) will be conveyed in a 30 inch RCP (Pipe 2) to Design Point 1. In the event clogging or total inlet failure, flows from Design Point 2 will overtop the curb and be conveyed directly to the water/quality detention facility for The Ridge at Cumbre Vista Filing No. 1.

Basin D is located in the north portion of the site and contains 0.80 acres of single family residential lots, homes, landscaping and an asphalt roadway. Basin D has proposed design flows of 1.7 cfs for the minor storm event (5-Year) and 3.5 cfs for the major storm event (100-Year). Runoff from Basin D will sheet flow to the curb and gutter and will be conveyed north to Design Point 3, the existing curb and gutter located on the south side of Cowpoke Road. Collected flows from Design Point 3 will be conveyed through the existing infrastructure in Cowpoke Road to the Sand Creek Detention Pond No. 6.

Basin E is located in the northwest portion of the site and contains 1.27 acres of single family residential lots, homes, landscaping and an asphalt roadway. Basin E has proposed design flows of 2.0 cfs for the minor storm event (5-Year) and 4.1 cfs for the major storm event (100-Year). Roof drains and runoff, in this basin, shall drain to the front of the lot and will flow, via side lot swales, to the curb and gutter and will be conveyed north to Design Point 4, the existing curb and gutter located on the south side of Cowpoke Road. Collected flows from Design Point 4 will be conveyed through the existing infrastructure in Cowpoke Road west to Cottonwood Creek. Flows from Basin E will remain in the Cottonwood Creek drainage basin.

Water quality has been provided, for this basin, via a curb cut and sidewalk chase on Sunshine Drive which outlet into a T-3 Rain Garden water quality pond. The pond design is per the T-3 bioretention in the Urban Storm Drainage Criteria Manual Volume 3. Actual total capture volume is 949 cu.ft.,. The partial infiltration system will filtrate flow via a 1.5' deep Rain Garden growing media and export via a 4" perforated PVC pipe. A solid 4" PVC pipe will carry flow from the T-3 pond to the downstream curb and gutter on Cowpoke Road and outlet through a Neenah R-3262 storm water curb opening (See Neenah detail in Appendix). In case of system failure, emergency overflow will overtop the north top of berm and outfall onto Cowpoke Road. An emergency over flow has been provided for the 100 year flow. Flow will follow historic patterns along curb and gutter in Cowpoke Road.

Basin F is located in the southeast portion of the site and contains 0.32 acres and is the location of the water/quality detention facility for The Ridge at Cumbre Vista Filing No. 1. Basin F has proposed design flows of 0.4 cfs for the minor storm event (5-Year) and 1.0 cfs for the major storm event (100-Year). Runoff from Basin F is contained within its boundary in the water quality and detention facility. See paragraph **Detention** for pond details.

Basin G is located in the southern portion of the site and contains 0.47 acres of single family residential landscaping. Basin G has proposed design flows of 1.4 cfs for the minor storm event (5-

Year) and 3.0 cfs for the major storm event (100-Year). Runoff from Basin G will sheet flow offsite to the south of the site and will be conveyed south to offsite Design Point 6. Design point 6 does not exceed the historic design flows of of 4.4 cfs for the minor storm event (5-Year) and 11.0 cfs for the major storm event (100-Year).

Basin H is located in the southeast portion of the site and contains 0.12 acres of pond side slope and landscaping. Basin H has proposed design flows of 0.2 cfs for the minor storm event (5-Year) and 0.4 cfs for the major storm event (100-Year). Runoff from Basin H will sheet flow offsite to the south of the site and will be conveyed south to offsite Design Point 7. Design point 7 does not exceed the historic design flows of of 4.4 cfs for the minor storm event (5-Year) and 11.0 cfs for the major storm event (100-Year).

Basin I is located in the north central portion of the site and contains 0.95 acres of single family residential lots, homes, landscaping and an asphalt roadway. Basin I has proposed design flows of 1.8 cfs for the minor storm event (5-Year) and 3.8 cfs for the major storm event (100-Year). Runoff from Basin I will flow, via side lot swales, to the curb and gutter and will be conveyed north to Design Point 8, the existing curb and gutter located on the south side of Cowpoke Road. Collected flows from Design Point 8 will be conveyed through the existing infrastructure in Cowpoke Road to the Sand Creek Detention Pond No. 6.

Basin D & Basin I are tributary to Sand Creek Detention Basin No. 6 and was originally studied in the "Sand Creek Drainage Basin Planning Study Preliminary Design Report" (DBPS) prepared by Kiowa Engineering. This study was then updated in the "Sand Creek Drainage Basin Planning Study Preliminary Design Report Technical Addendum" by Kiowa, revised October 1995.
This site was most currently studied in the "Master Development Drainage Plan Update for Woodmen Heights and Final Drainage Report for Forest Meadows Filing No. 1 and No. 4, and is being revised for a new single-family residential layout. Water quality has been provided within the Sand Creek Detention Pond No. 6 study for release onto Cowpoke Road.

Basin J is located in the west portion of the site and contains 0.05 acres of single family residential landscaping. Basin J has proposed design flows of 0.1 cfs for the minor storm event (5-Year) and 0.2 cfs for the major storm event (100-Year). Runoff from Basin J will sheet flow offsite to the west of the site and will be conveyed southerly, via historic topography within the utility corridor, to Design Point 9.

Basin K is located in the west portion of the site and contains 0.25 acres of single family residential landscaping. Basin K has proposed design flows of 0.3 cfs for the minor storm event (5-Year) and 0.7 cfs for the major storm event (100-Year). Runoff from Basin K will sheet flow offsite to the west of the site and will be conveyed northerly, via historic topography within the utility corridor, to Design Point 11. Basin K flows match those of the Historic Basin A1.

Basin OS1 is located in the west portion of the site and contains 0.54 acres of single family residential landscaping and natural native grass within the utility corridor. Basin OS1 has proposed design flows of 1.1 cfs for the minor storm event (5-Year) and 2.2 cfs for the major storm event (100-Year). Runoff from Basin OS1 will sheet flow onsite to the east onto Basin C and Design Point 2.

DETENTION

The water/quality detention facility will provide sufficient rainfall storage for the entire site. The detention pond will be private and maintained by the Homeowners Association. The pond was designed in accordance with the guidelines set forth by the "El Paso County and City of Colorado Springs Drainage Criteria Manual", Volumes 1 &2. The two stage release control structure shall be constructed for water quality and both the 5-year and 100-year detention requirements. The calculated release rates are provided in the appendix of this report.

All collected flows shall be detained within the 1.3 ac/ft detention pond facility and released through an outlet structure via a 18" PVC pipe discharging into the historic outfall location south of project site. The 18" PVC pipe shall be designed at a 1.0% slope to minimize velocities. A riprap pad with a flow speader will be constructed to dissipate energy and prevent local scour at the outlet. Discharged flows shall be restricted to a release rate of (Q_{100}=9.2cfs) via a restrictor orifice/plate. In the event of clogging or total outlet failure, flows will over top the spillway overflow at elevation 6950.50 and continue southerly to discharge to the historic outfall location south of project site. The restricted release rate does not exceed the historic design flows of of 4.4 cfs for the minor storm event (5-Year) and 11.0 cfs for the major storm event (100-Year).

EROSION CONTROL

It is the policy of the City of Colorado Springs that we submit an erosion control plan with the drainage report. At this time we respectfully request that the erosion control plan be submitted in conjunction with the final grading plan. Proposed straw bale check dams, silt fence, vehicle traffic control, and reseeding are proposed as erosion control measures.

CONSTRUCTION COST OPINION

Public Drainage Facilities NON- Reimbursable

Item	Description	Quantity	Unit Cost		Cost
1.	18" RCP	31 LF	$30/LF		$ 930.00
2.	30" RCP	33 LF	$40/LF		$ 1,320.00
3.	36" RCP	24 LF	$45/LF		$ 1,080.00
4.	10' Sump Inlet	2 EA	$5,000/EA		$10,000.00
5.	WQCV System	1 EA	$4,000/EA		$ 4,000.00
6.	Pond Outlet Structure	1 EA	$12,000/EA		$12,000.00
				Total:	**$29,330.00**

DRAINAGE FEES

A portion of this site is in the Sand Creek Drainage Basin. The 2014 Drainage Bridge and Pond fees per the City of Colorado Springs for THE RIDGE AT CUMBRE VISTA FILING NO. 1, are as follows;

*DRAINAGE FEES:	12.64 acres	x	$10,247.00	=	$129,522.08
BRIDGE FEES:	12.64 acres	x	$ 622.00	=	$ 7,862.08
POND FEES:					
LAND:	12.64 acres	x	$1,070.00	=	$ 13,524.80

FACILITIES:	12.64 acres	x	$3,005.00	=	$ 37,983.20
				Total:	**$188,892.16**

A portion of this site is in the Cottonwood Creek Drainage Basin. The 2014 Drainage Bridge and Pond fees per the City of Colorado Springs for THE RIDGE AT CUMBRE VISTA FILING NO. 1, are as follows;

*DRAINAGE FEES:	1.08 acres	x	$12,532.00	=	$ 13,534.56
BRIDGE FEES:	1.08 acres	x	$ 924.00	=	$ 997.92
				Total:	**$ 14,532.48**

DRAINAGE COST COMPARISON AND CREDIT SUMMARY

Public Facilities:

Total Public, reimbursable on-site drainage facility portion **$0.00**

***The Ridge at Cumbre Vista Filing No. 1 does not contain reimbursable facilities. Therefore, there are no fee off-sets.**

M & S Civil Consultants, Inc. (M & S) cannot and does not guarantee the construction cost will not vary from these opinions of probable costs. These opinions represent our best judgment as design professionals familiar with the construction industry and this development in particular. The above is only an estimate of the facility cost and drainage basin fee amounts in 2014. Upon completion of the aforementioned improvements, M & S shall submit the actual construction costs to the City of Colorado Springs/City Drainage Board for reimbursement.

SUMMARY

Development of this site will provide protection from flooding to all residents and downstream interests for the 100-year storm event. Emergency overflows are provided where necessary. The drainage plan provided here-in fully complies with the "El Paso County and City of Colorado Springs Drainage Criteria Manual", Volumes 1 &2. Therefore, the construction of The Ridge at Cumbre Vista Filing No.1, will not adversely affect the downstream infrastructure of the site.

The Final Drainage Map is provided in the back pocket of this report.

REFERENCES

1.) "El Paso County and City of Colorado Springs Drainage Criteria Manual", Volumes 1 &2.

2.) "Urban Storm Drainage Criteria Manual", Volume 3.

3.) SCS Soils Map for El Paso County.

4.) "Sand Creek Drainage Basin Planning Study Preliminary Design Report" (DBPS), prepared by Kiowa Engineering, revised December 1998.

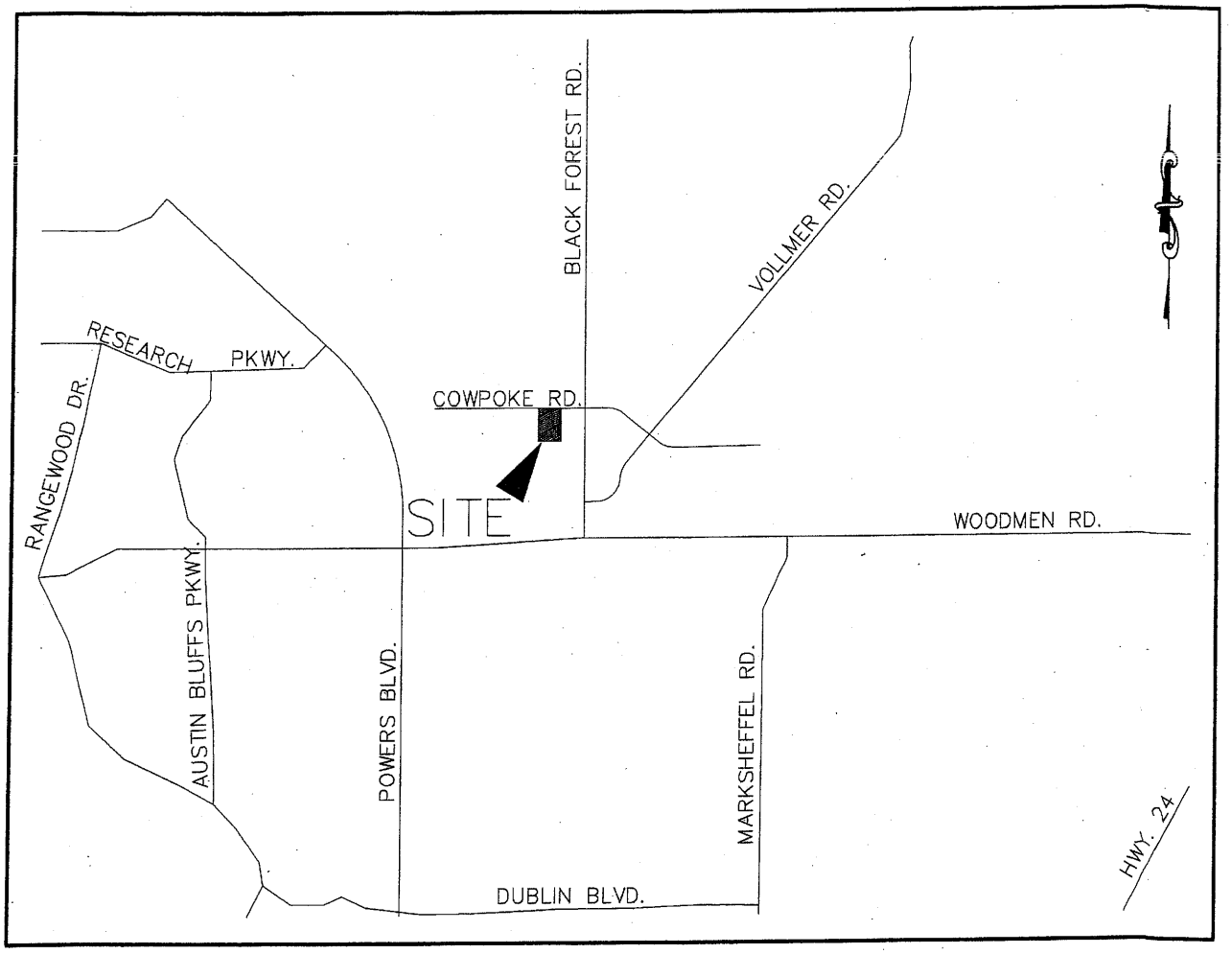
5.) "Sand Creek Drainage Basin Planning Study Preliminary Design Report Technical Addendum", prepared by Kiowa Engineering, revised October 1995.

6.) "Master Development Drainage Plan Update for Woodmen Heights and Final Drainage Report for Forest Meadows Filing No. 1 and No. 4", prepared by Engineering and Surveying, Inc., approved February 5, 2006.

7.) "Amendment No. 1 to the Final Drainage Report for Cumbre Vista Filing No. 1 and Preliminary/Final Drainage Report for Cumbre Vista Filing No. 2, 3, 4 and 5", prepared by JR Engineering, revised January 2007.

APPENDIX

VICINITY MAP

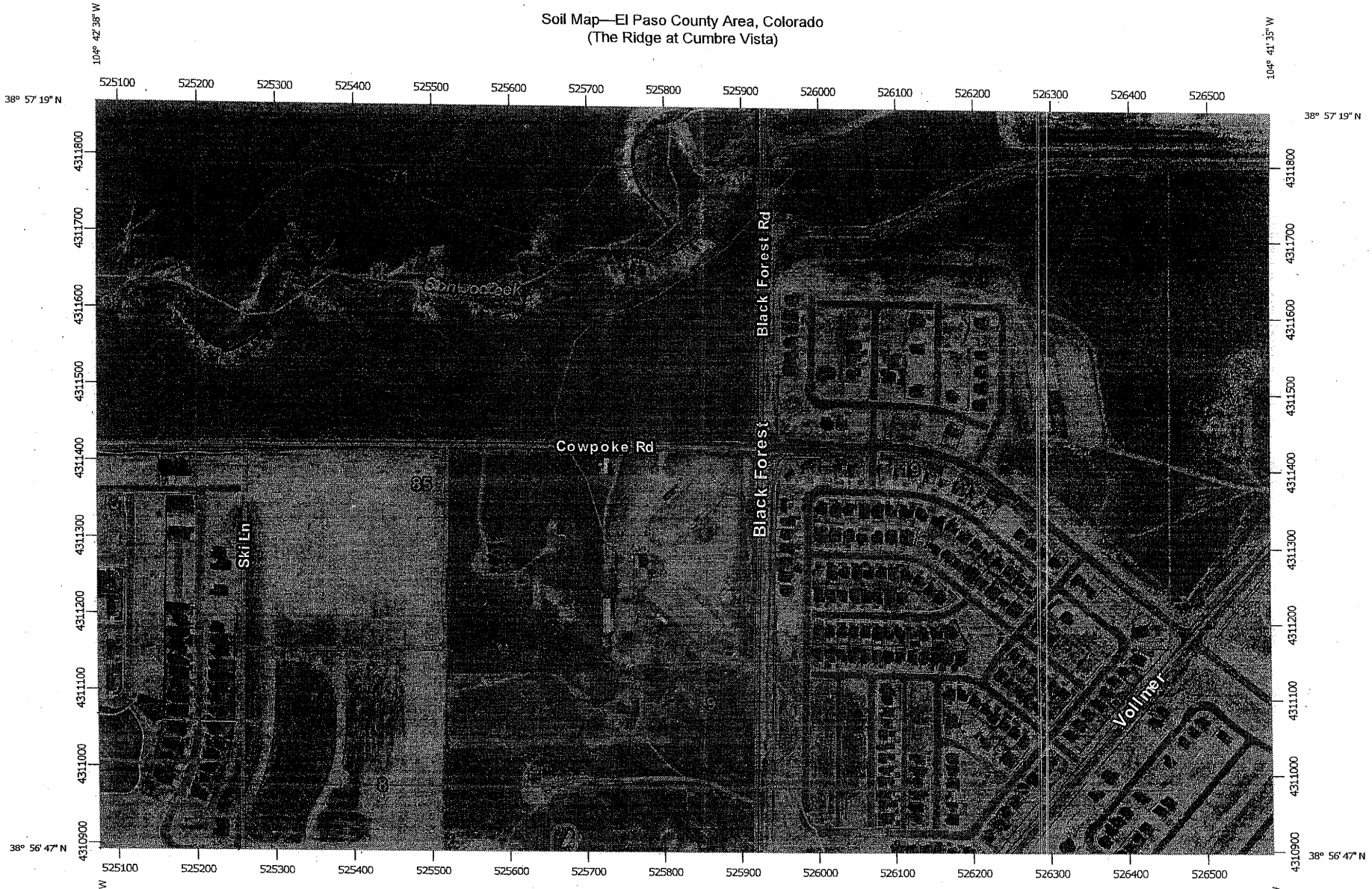


VICINITY MAP

N.T.S.

SOILS MAP

Soil Map—El Paso County Area, Colorado
(The Ridge at Cumbre Vista)



Map Scale: 1:6,890 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 100 200 400 600

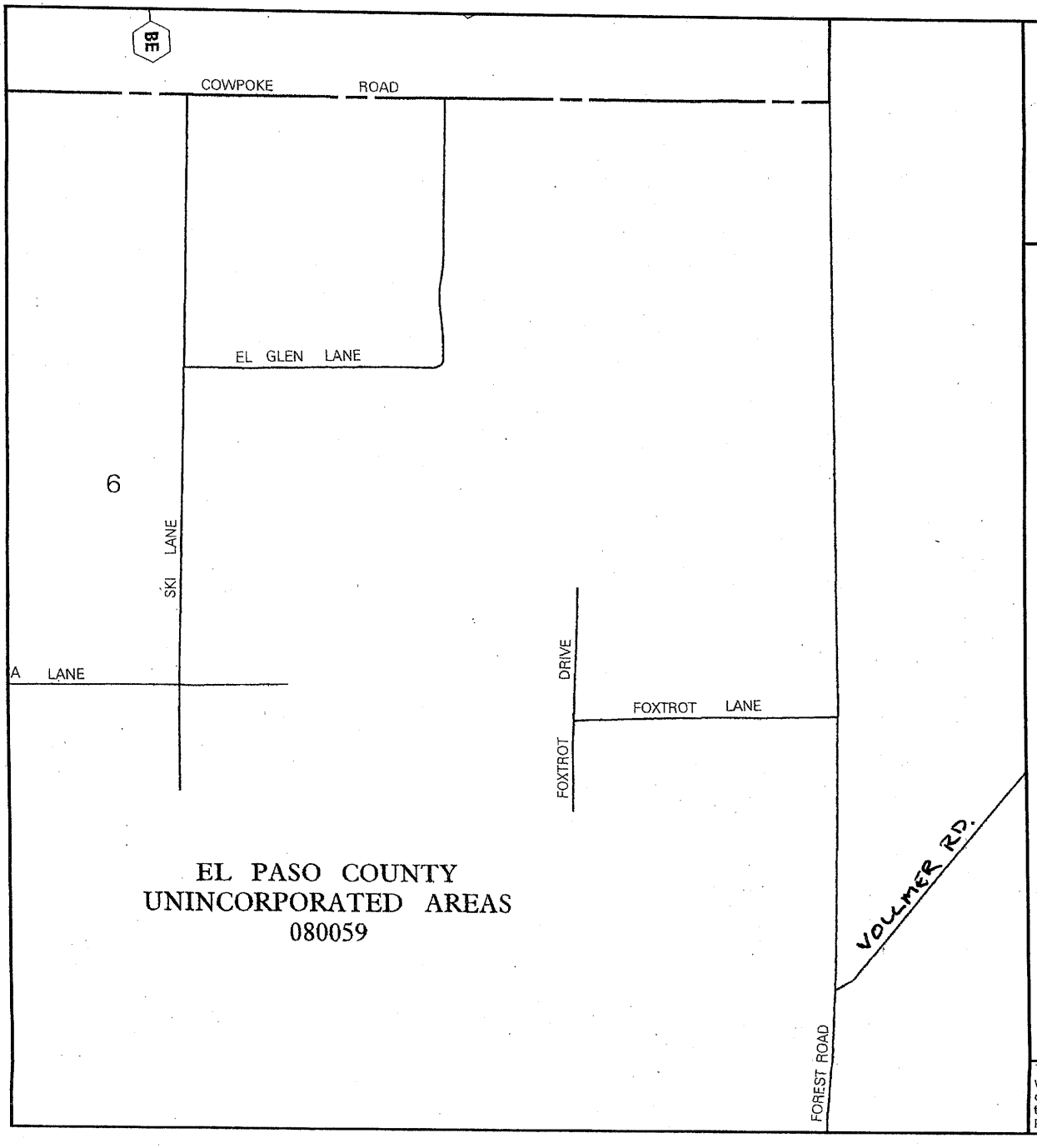
Feet: 0 300 600 1200 1800

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

Map Unit Legend

El Paso County Area, Colorado (CO625)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	0.0	0.0%
9	Blakeland-Fluvaquentic Haplaquolls	10.3	4.1%
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	128.8	51.0%
71	Pring coarse sandy loam, 3 to 8 percent slopes	6.6	2.6%
85	Stapleton-Bernal sandy loams, 3 to 20 percent slopes	106.8	42.3%
Totals for Area of Interest		**252.5**	**100.0%**

FLOODPLAIN MAP



APPROXIMATE SCALE IN FEET

500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 529 OF 1300

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0529	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0529	F

MAP NUMBER
08041C0529 F

EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency

HYDROLOGIC CALCULATIONS

The Ridge at Cumbre Vista Filing No.1
FINAL DRAINAGE REPORT
(Historic Area Drainage Summary)

From *Composite Runoff Coefficient Summary*				*OVERLAND*				*STREET / CHANNEL FLOW*				*Time of Travel (T_t)*	*INTENSITY **		*TOTAL FLOWS*	
BASIN	**AREA TOTAL** *(Acres)*	**C_5** *From DCM Table 5-1*	**C_{100}** *From DCM Table 5-1*	**C_5**	**Length** *(ft)*	**Height** *(ft)*	**T_C** *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	**T_t** *(min)*	**TOTAL** *(min)*	**I_5** *(in/hr)*	**I_{100}** *(in/hr)*	**Q_5** *(c.f.s.)*	**Q_{100}** *(c.f.s.)*
OS1	0.54	0.25	0.35	0.25	62	10	5.0	0	0.0%	0.0	0.0	14.1 *from CVS report	3.6	6.3	***0.5***	***1.2***
A	0.83	0.25	0.35	0.25	280	10	17.5	0	0.0%	0.0	0.0	17.5	3.2	5.7	***0.7***	***1.7***
A1	0.25	0.25	0.35	0.25	215	6.5	16.2	0	0.0%	0.0	0.0	16.2	3.3	6.0	***0.2***	***0.5***
B	6.66	0.25	0.35	0.25	684	30	25.5	0	0.0%	0.0	0.0	25.5	2.7	4.7	***4.4***	***11.0***
C	5.98	0.25	0.35	0.25	684	34	24.5	0	0.0%	0.0	0.0	24.5	2.7	4.8	***4.1***	***10.1***

CA_5	Basin	CA_{100}
0.14	OS1	0.19
0.21	A	0.29
0.06	A1	0.09
1.67	B	2.33
1.50	C	2.09

**** Report for Cumbre Vista Sub.(CVS) FilingN0. 1, 2, 3,4 & 5***

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

Calculated by: ET
Date: 8/22/2014
Checked by: VAS

The Ridge at Cumbre Vista Filing No.1
FINAL DRAINAGE REPORT
(Historic Surface Routing Summary)

Design Point(s)	*Contributing Basins/Design Points*	*Equivalent* CA_5	*Equivalent* CA_{100}	*Maximum* T_C	*Intensity*		*Flow*		*Comments*
					I_5	I_{100}	Q_5	Q_{100}	
1	OS1	0.14	0.19	14.1	3.6	6.3	***0.5***	***1.2***	***SHEET FLOW ONSITE***
2	A & A1	0.27	0.38	17.5	3.2	5.7	***0.9***	***2.2***	***SHEET FLOW OFFSITE***
3	B	1.67	2.33	25.5	2.7	4.7	***4.4***	***11.0***	***SHEET FLOW OFFSITE***
4	C & DP1	1.63	2.28	24.5	2.7	4.8	***4.4***	***11.0***	***SHEET FLOW OFFSITE***

Calculated by: ET
Date: 8/22/2014
Checked by: VAS

The Ridge at Cumbre Vista Filing No.1
FINAL DRAINAGE REPORT
(Area Drainage Summary)

From *Composite Runoff Coefficient Summary*				*OVERLAND*				*STREET / CHANNEL FLOW*				*Time of Travel (T_t)*	*INTENSITY **		*TOTAL FLOWS*	
BASIN	**AREA TOTAL** *(Acres)*	**C_5** *From DCM Table 5-1*	**C_{100}**	**C_5**	**Length** *(ft)*	**Height** *(ft)*	**T_C** *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	**T_t** *(min)*	**TOTAL** *(min)*	**I_5** *(in/hr)*	**I_{100}** *(in/hr)*	**Q_5** *(c.f.s.)*	**Q_{100}** *(c.f.s.)*
A	0.34	0.25	0.35	0.25	20	6	2.3	0	0.0%	0.0	0.0	5.0	5.1	9.1	***0.4***	***1.1***
B	2.21	0.60	0.70	0.25	234	1.5	28.2	550	1.1%	3.7	2.5	30.6	2.4	4.3	***3.2***	***6.6***
C	6.84	0.60	0.70	0.25	335	18	16.7	505	1.0%	3.6	2.4	19.1	3.1	5.5	***12.7***	***26.3***
D	0.80	0.60	0.70	0.25	258	16	14.0	54	3.7%	6.7	0.1	14.1	3.6	6.3	***1.7***	***3.5***
E	1.27	0.60	0.70	0.25	231	2	25.3	274	1.5%	4.2	1.1	26.4	2.6	4.6	***2.0***	***4.1***
F	0.32	0.25	0.35	0.25	23	4	3.0	0	0.0%	0.0	0.0	5.0	5.1	9.1	***0.4***	***1.0***
G	0.47	0.60	0.70	0.25	63	14	4.5	0	0.0%	0.0	0.0	5.0	5.1	9.1	***1.4***	***3.0***
H	0.12	0.25	0.35	0.25	26	8	2.6	0	0.0%	0.0	0.0	5.0	5.1	9.1	***0.2***	***0.4***
I	0.95	0.60	0.70	0.25	78	0.5	16.3	400	1.1%	3.7	1.8	18.0	3.2	5.6	***1.8***	***3.8***
J	0.05	0.25	0.35	0.25	12	4	1.7	0	0.0%	0.0	0.0	5.0	5.1	9.1	***0.1***	***0.2***
K	0.25	0.25	0.35	0.25	48	1	8.6	0	0.0%	0.0	0.0	8.6	4.3	7.7	***0.3***	***0.7***
OS1	0.54	0.55	0.65	0.25	62	10	5.0	0	0.0%	0.0	0.0	14.1 *from CVS report	3.6	6.3	***1.1***	***2.2***

CA_5	Basin	CA_{100}
0.09	A	0.12
1.33	B	1.55
4.10	C	4.79
0.48	D	0.56
0.76	E	0.89
0.08	F	0.11
0.28	G	0.33
0.03	H	0.04
0.57	I	0.67
0.01	J	0.02
0.06	K	0.09
0.30	OS1	0.35

**** Report for Cumbre Vista Sub.(CVS) FilingN0. 1, 2, 3,4 & 5***

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

Calculated by: ET
Date: 9/4/2014
Checked by: VAS

The Ridge at Cumbre Vista Filing No.1
FINAL DRAINAGE REPORT
(Surface Routing Summary)

Design Point(s)	Contributing Basins/Design Points	Equivalent CA_5	Equivalent CA_{100}	Maximum T_C	Intensity		Flow		Comments
					I_5	I_{100}	Q_5	Q_{100}	
5	A	0.09	0.12	5.0	5.1	9.1	0.4	1.1	SHEET FLOW OFFSITE
1	B	1.33	1.55	30.6	2.4	4.3	3.2	6.6	10' SUMP INLET
2	C & DP 9 & DP 11	4.41	5.16	19.1	3.1	5.5	13.6	28.3	10' SUMP INLET
3	D & DP 8	1.05	1.23	14.1	3.6	6.3	3.7	7.8	SAND CREEK BASIN
4	E	0.76	0.89	26.4	2.6	4.6	2.0	4.1	COTTONWOOD BASIN
POND	F & DP1 & DP2	5.82	6.82	30.6	2.4	4.3	13.9	29.0	POND
6	G	0.28	0.33	5.0	5.1	9.1	1.4	3.0	SHEET FLOW OFFSITE
7	H	0.03	0.04	5.0	5.1	9.1	0.2	0.4	SHEET FLOW OFFSITE
8	I	0.57	0.67	18.0	3.2	5.6	1.8	3.8	SAND CREEK BASIN
9	J	0.01	0.02	5.0	5.1	9.1	0.1	0.2	SHEET FLOW OFFSITE
10	K	0.06	0.09	8.6	4.3	7.7	0.3	0.7	SHEET FLOW OFFSITE
11	OS1	0.30	0.35	14.1	3.6	6.3	1.1	2.2	SHEET FLOW BASIN C

Calculated by: ET
Date: 8/4/2014
Checked by: VAS

HYDRAULIC CALCULATIONS

The Ridge at Cumbre Vista Filing No.1
FINAL DRAINAGE REPORT
(Storm Sewer Routing Summary)

Pipe Run	*Contributing Design Points/Pipe Runs*	*Equivalent CA_5*	*Equivalent CA_{100}*	*Maximum T_C*	*Intensity*		*Flow*		*Comments*
					I_5	*I_{100}*	*Q_5*	*Q_{100}*	
1	1 & 2	5.74	6.70	30.6	2.39	4.26	*13.7*	*28.6*	36" RCP
2	2	4.41	5.16	19.1	3.08	5.49	*13.6*	*28.3*	30" RCP

DP - Design Point
INT- Intercepted Flow from Design Point

Calculated by: ET
Date: 8/4/2014
Checked by: VAS

The Ridge at Cumbre Vista Filing No.1
FINAL DRAINAGE REPORT
(Street Capacity Summary - Initial Storm)

Street Name	***Contributing Basins***	*Street Side (Cardinal Directions) at max Q5*	*Street Class*	*Curb Type*	*Street Slope (ft/ft)*	*Actual Q5 (cfs)*	*Max. Q5 (cfs) (10/12/94 Eq's)*	*Depth At Curb Face (ft) (Fig 7-12 Eq.)*	*Q5 Max. Check Max>Actual<20cfs (res ramp), 34cfs(other)*	*Q5 Depth Check*
EAST	B	E	Residential	RAMP	0.026	3.2	18.2	0.19	*OK*	*OK*
WEST	C	W	Residential	RAMP	0.045	13.6	23.9	0.29	*OK*	*OK*

Notes:
1. Cross slope of 2% assumed for all streets.
2. Data shown for critical location within basin.
3. Basin Q's for streets not determined by surface routing have been added together (conservative).

Calculated by: ET

Date: 1/3/2014
Checked by: VAS

THE RIDGE AT CUMBRE VISTA FILING NO.1
FINAL DRAINAGE REPORT
(Inlet Calculations - Sump Condition)

DESIGN POINTS 1 AND 2

Total Flow:

Q_5 = **16.8** cfs *

Q_{100} = **34.8** cfs *

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50'

$Dmax_{100}$ = 0.67'

$$Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$$

where: W = 3 feet

w = 4 inches

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: **6** foot inlet required

100-Year Event: **10** foot inlet required

(Install a Public 10' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at this design point.)

*ASSUME FLOWS SPLIT AT SUMP LOCATION

Calculated by: ET

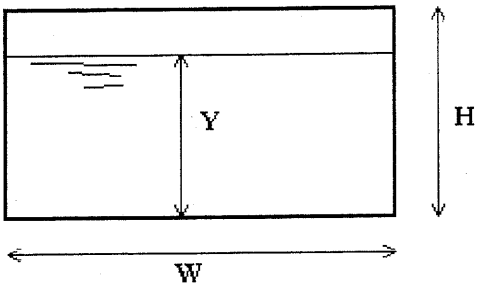
Date: 8/4/2014

Checked by: VAS

BOX CONDUIT FLOW (Normal & Critical Depth Computation)

Project: The Ridge at Cumbre Vista Filing No. 1

Box ID: Curb Cut



Design Information (Input)			
Box conduit invert slope	So =	0.0140	ft/ft
Box Manning's n-value	n =	0.0130	
Box Width	W =	2.00	ft
Box Height	H =	0.67	ft
Design discharge	**Q =**	**2.00**	**cfs**

Full-flow capacity (Calculated)			
Full-flow area	Af =	1.34	sq ft
Full-flow wetted perimeter	Pf =	5.34	ft
Full-flow capacity	Qf =	7.23	cfs

Calculations of Normal Flow Condition			
Normal flow depth (<H)	Yn =	0.23	ft
Flow area	An =	0.45	sq ft
Wetted perimeter	Pn =	2.45	ft
Flow velocity	Vn =	4.40	fps
Discharge	Qn =	2.00	cfs
Percent Full	Flow =	27.7%	of full flow
Normal Depth Froude Number	Fr_n =	1.63	supercritical

Calculation of Critical Flow Condition			
Critical flow depth	Yc =	0.31	ft
Critical flow area	Ac =	0.63	sq ft
Critical flow velocity	Vc =	3.18	fps
Critical Depth Froude Number	Fr_c =	1.00	

Free Online Manning Pipe Flow Calculator

List of Calculators Hydraulics Language

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Can you help me translate this calculator to your language or host this calculator at your web site?

QBC

PIPE CULVERT

Set units: m | mm | ft | inches

Pipe diameter, d_0	30	inches
Manning roughness, n ?	.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.0	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	70	%

Results:

Flow, q	34.3378	cfs
Velocity, v	9.3562	ft/sec
Velocity head, h_v	1.3605	ft
Flow area	3.6702	ft^2
Wetted perimeter	4.9557	ft
Hydraulic radius	0.7406	ft
Top width, T	2.2913	ft
Froude number, F	1.30	
Shear stress (tractive force), tau	1.0927	psf

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List of Calculators Hydraulics Language

Manning Formula Uniform Pipe Flow at Given Slope and Depth

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QBC

PIPE CULVERT

Set units: m | mm | ft | inches

Pipe diameter, d_0	36 inches
Manning roughness, n ?	.013
Pressure slope (possibly ? equal to pipe slope), S_0	1.0 % rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	70 %

Results:

Flow, q	55.8370	cfs
Velocity, v	10.5654	ft/sec
Velocity head, h_v	1.7349	ft
Flow area	5.2851	ft^2
Wetted perimeter	5.9469	ft
Hydraulic radius	0.8887	ft
Top width, T	2.7495	ft
Froude number, F	1.34	
Shear stress (tractive force), tau	1.3112	psf

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List of Calculators Hydraulics Language

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Can you help me translate this calculator to your language or host this calculator at your web site?

Shiloh Mesa

PIPE CULVERT

Set units: m | mm | ft | inches

Pipe diameter, d_0	18	inches
Manning roughness, n ?	.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.0	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	72	%

Results:

Flow, q	9.1167	cfs
Velocity, v	6.6933	ft/sec
Velocity head, h_v	0.6963	ft
Flow area	1.3621	ft^2
Wetted perimeter	3.0396	ft
Hydraulic radius	0.4481	ft
Top width, T	1.3470	ft
Froude number, F	1.17	
Shear stress (tractive force), tau	0.6743	psf

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WQCV EMERGENCY OVERFLOW

Other Calculators

- Air Flow Conversion Calculator
- Atmospheric Calculator
- Block Wall Calculator
- Concrete Column Calculator
- Concrete Volume Calculator
- Energy Conversion Calculator
- Isentropic Flow Relations Calculator
- Laser Real Time Unit Converter
- Normal Flow Relations Calculator
- Oblique Flow Relations Calculator
- Open-channel Flow Calculator
- Properties of Welds Treated as Lines Calculator
- Shaft Speed Calculator
- Torque Transmitted by Clutch Calculator
- Water Pump Engineering
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Open-Channel Flow

This calculator uses Chézy and Manning's formula to calculate the wetted perimeter, hydraulic radius, flow area, Chézy coefficient and flow velocity.

For experimental values of Manning's **n** factor, click here

Required Information

Enter the Slope:	0.01	Enter the Channel Top Width (ft):	12
Enter the Channel Bottom Width (ft):	10	Enter the Channel Height (ft):	0.25
Enter the Flow Depth (ft):	0.25	Enter the n value:	0.035

Results

The wetted perimeter is 12.061 ft

The flow area is 2.75 ft^2

The hydraulic radius is 0.2279 ft

The C value is 33.2741

The flow is 4.36921 ft^3/s

The flow is 1960.905 gal/min

The velocity is 1.58880 ft/s

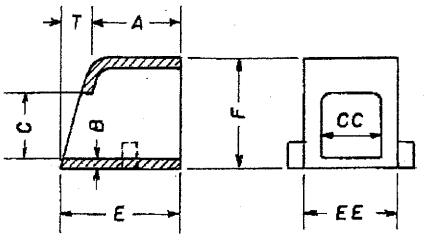
Calculate Reset

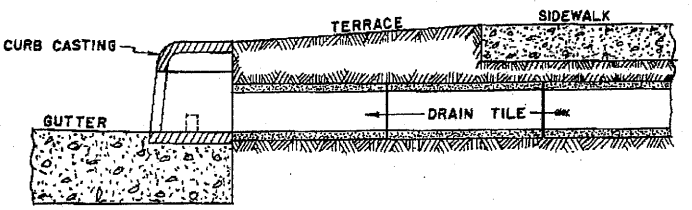
NEENAH FOUNDRY

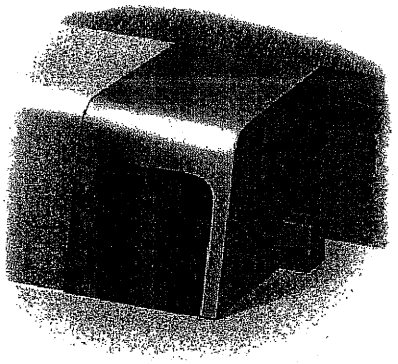
R-3262 Series

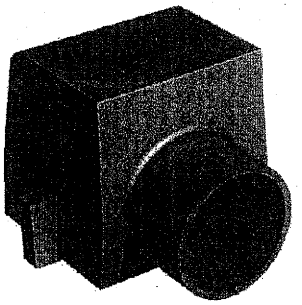
Storm Water Curb Openings

Heavy Duty









Rear view of R-3262-3 only. (optional)

Curb opening castings are used as shown, where it is advantageous to transmit stormwater from downspout in shallow drains and discharge it through the curb to the street gutter.

Catalog No.	A	B	C	C-C	E	E-E	F	T
R-3262-1	5	1/2	4	4	6	5	7	1
R-3262-2	6	1/2	4	4	8 1/4	5	6	2 1/4
R-3262-3*	5	1/2	4	5 1/2	6	6 1/2	6 1/2	1
R-3262-4	5	1/2	4	16	7	17	6 3/8	2
R-3262-6	6	1/2	6	6	8	7 1/4	9	2

* 4" ID outlet is optional

DETENTION POND & WQCV CALCULATIONS

Design Procedure Form: Rain Garden (RG)

Designer: EUGENE TELLEZ
Company: MS CIVIL CONSULTANTS, INC
Date: September 12, 2014
Project: THE RIDGE AT CUMBRE VISTA FILING NO. 1
Location: ADJACENT TO COWPOKE ROAD AND WEST OF BLACK FOREST ROAD

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a (100% if all paved and roofed areas upstream of rain garden)	I_a = 54.0 %
B) Tributary Area's Imperviousness Ratio (i = I_a/100)	i = 0.540
C) Water Quality Capture Volume (WQCV) for a 12-hour Drain Time (WQCV= 0.8 * (0.91* i^3 - 1.19 * i^2 + 0.78 * i)	WQCV = 0.17 watershed inches
D) Contributing Watershed Area (including rain garden area)	Area = 59,677 sq ft
E) Water Quality Capture Volume (WQCV) Design Volume Vol = (WQCV / 12) * Area	V_{WQCV} = 865 cu ft
F) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = _____ in
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume	$V_{WQCV\ OTHER}$ = _____ cu ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{WQCV\ USER}$ = _____ cu ft
2. Basin Geometry	
A) WQCV Depth (12-inch maximum)	D_{WQCV} = 9 in
B) Rain Garden Side Slopes (Z = 4 min., horiz. dist per unit vertical) (Use "0" if rain garden has vertical walls)	Z = 4.00 ft / ft
C) Mimimum Flat Surface Area	A_{Min} = 577 sq ft
D) Actual Flat Surface Area	A_{Actual} = 767 sq ft
E) Area at Design Depth (Top Surface Area)	A_{Top} = 1763 sq ft
F) Rain Garden Total Volume (V_T= ((A_{Top} + A_{Actual}) / 2) * Depth)	V_T= 949 cu ft
3. Growing Media	Choose One: (●) 18" Rain Garden Growing Media ( ) Other (Explain): _____
4. Underdrain System	
A) Are underdrains provided?	Choose One: (●) YES ( ) NO
B) Underdrain system orifice diameter for 12 hour drain time	
i) Distance From Lowest Elevation of the Storage Volume to the Center of the Orifice	y = 1.8 ft
ii) Volume to Drain in 12 Hours	Vol_{12} = 865 cu ft
iii) Orifice Diameter, 3/8" Minimum	D_O = 0.70 in

Design Procedure Form: Rain Garden (RG)

Designer: EUGENE TELLEZ
Company: MS CIVIL CONSULTANTS, INC
Date: September 12, 2014
Project: THE RIDGE AT CUMBRE VISTA FILING NO. 1
Location: ADJACENT TO COWPOKE ROAD AND WEST OF BLACK FOREST ROAD

5. Impermeable Geomembrane Liner and Geotextile Separator Fabric A) Is an impermeable liner provided due to proximity of structures or groundwater contamination?	Choose One ○ YES ○ NO
6. Inlet / Outlet Control A) Inlet Control	Choose One ◉ Sheet Flow- No Energy Dissipation Required ○ Concentrated Flow- Energy Dissipation Provided
7. Vegetation	Choose One ○ Seed (Plan for frequent weed control) ○ Plantings ◉ Sand Grown or Other High Infiltration Sod
8. Irrigation A) Will the rain garden be irrigated?	Choose One ○ YES ◉ NO

Notes:

DETENTION VOLUME BY THE FULL SPECTRUM METHOD

Project: The Ridge @ Cumbre Vista Filing 1
Basin ID: Attenuate runoff from Basins B, C, & F

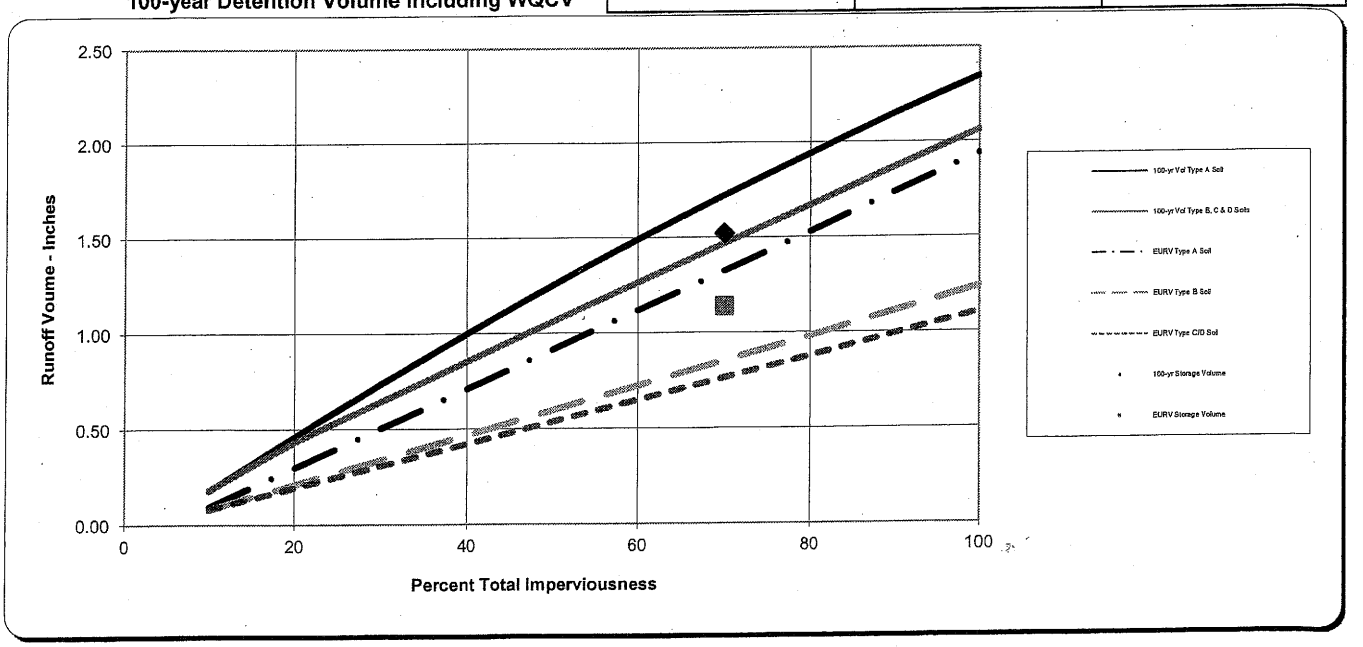
* User input data shown in blue.

Area of Watershed (acres)	13.72	
Subwatershed Imperviousness	70.0%	
Level of Minimizing Directly Connected Impervious Area (MDCIA)	1	1
Effective Imperviousness[1]	66.5%	

Hydrologic Soil Type	Percentage of Area	Area (acres)
Type A	51.0%	7.0
Type B	49.0%	6.7
Type C or D		0.0

Recommended Horton's Equation Parameters for CUHP		
Infiltration (inches per hour)		Decay Coefficient--α
Initial--f_i	Final--fo	
4.755	0.8	0.0012

	Detention Volumes [2,5]		Maximum Allowable Release Rate, cfs[3]
	(watershed inches)	(acre-feet)	
Excess Urban Runoff Volume[4]	1.14	1.30	Design Outlet to Empty EURV in 72 Hours
100-year Detention Volume Including WQCV [5]	1.52	1.74	9.21



Notes:

1) Effective imperviousness is based on Figure ND-1 of the Urban Storm Drainage Criteria Manual (USDCM).

2) Results shown reflect runoff reduction from Level 1 or 2 MDCIA and are plotted at the watershed's total imperviousness value; the impact of MDCIA is reflected by the results being below the curves.

3) Maximum allowable release rates for 100-year event are based on Table SO-1. Outlet for the Excess Urban Runoff Volume (EURV) to be designed to empty out the EURV in 72 hours. Outlet design is similar to one for the WQCV outlet of an extended detention basin (i.e., perforated plate with a micro-pool) and extends to top of EURV water surface elevation.

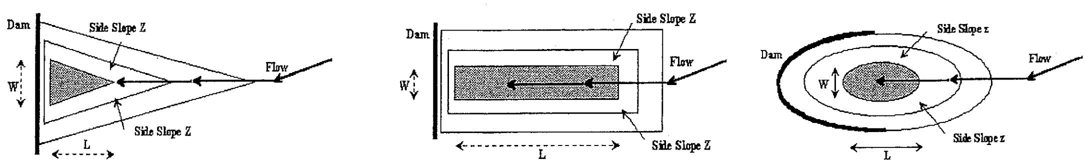
4) EURV approximates the difference between developed and pre-developed runoff volume.

5) 100-yr detention volume includes EURV. No need to add more volume for WQCV or EURV

STAGE-STORAGE SIZING FOR DETENTION BASINS

Project: The Ridge @ Cumbre Vista Filing 1

Basin ID:



Design Information (Input):

Width of Basin Bottom, W = 72.00 ft

Length of Basin Bottom, L = 114.00 ft

Dam Side-slope (H:V), Z_d = 3.00 ft/ft

Check Basin Shape

Right Triangle ☐ OR...

Isosceles Triangle ☐ OR...

Rectangle X OR...

Circle / Ellipse ☐ OR...

Irregular ☐ (Use Overide values in cells G32:G52)

Stage-Storage Relationship:

	MINOR	MAJOR	
Storage Requirement from Sheet 'Modified FAA':			acre-ft.
Storage Requirement from Sheet 'Hydrograph':			acre-ft.
Storage Requirement from Sheet 'Full-Spectrum':	1.30	1.74	acre-ft.

Labels for WQCV, Minor, & Major Storage Stages (input)	Water Surface Elevation ft (input)	Side Slope (H:V) ft/ft Below El. (input)	Basin Width at Stage ft (output)	Basin Length at Stage ft (output)	Surface Area at Stage ft^2 (output)	Surface Area at Stage ft^2 User Overide	Volume Below Stage ft^3 (output)	Surface Area at Stage acres (output)	Volume Below Stage acre-ft (output)	Target Volumes for WQCV, Minor, & Major Storage Volumes (for goal seek)
6943	6943.00		72.00	114.00	8,208.0			0.188	0.000	
	6944.00	3.00	78.00	120.00	9,360.0		8,784	0.215	0.202	
	6945.00	3.00	84.00	126.00	10,584.0		18,756	0.243	0.431	
	6946.00	3.00	90.00	132.00	11,880.0		29,988	0.273	0.688	
	6947.00	3.00	96.00	138.00	13,248.0		42,552	0.304	0.977	
	6948.00	3.00	102.00	144.00	14,688.0		56,520	0.337	1.298	
	6949.00	3.00	108.00	150.00	16,200.0		71,964	0.372	1.652	
	6950.00	3.00	114.00	156.00	17,784.0		88,956	0.408	2.042	
	6950.50	3.00	117.00	159.00	18,603.0		98,053	0.427	2.251	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
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							#N/A		#N/A	
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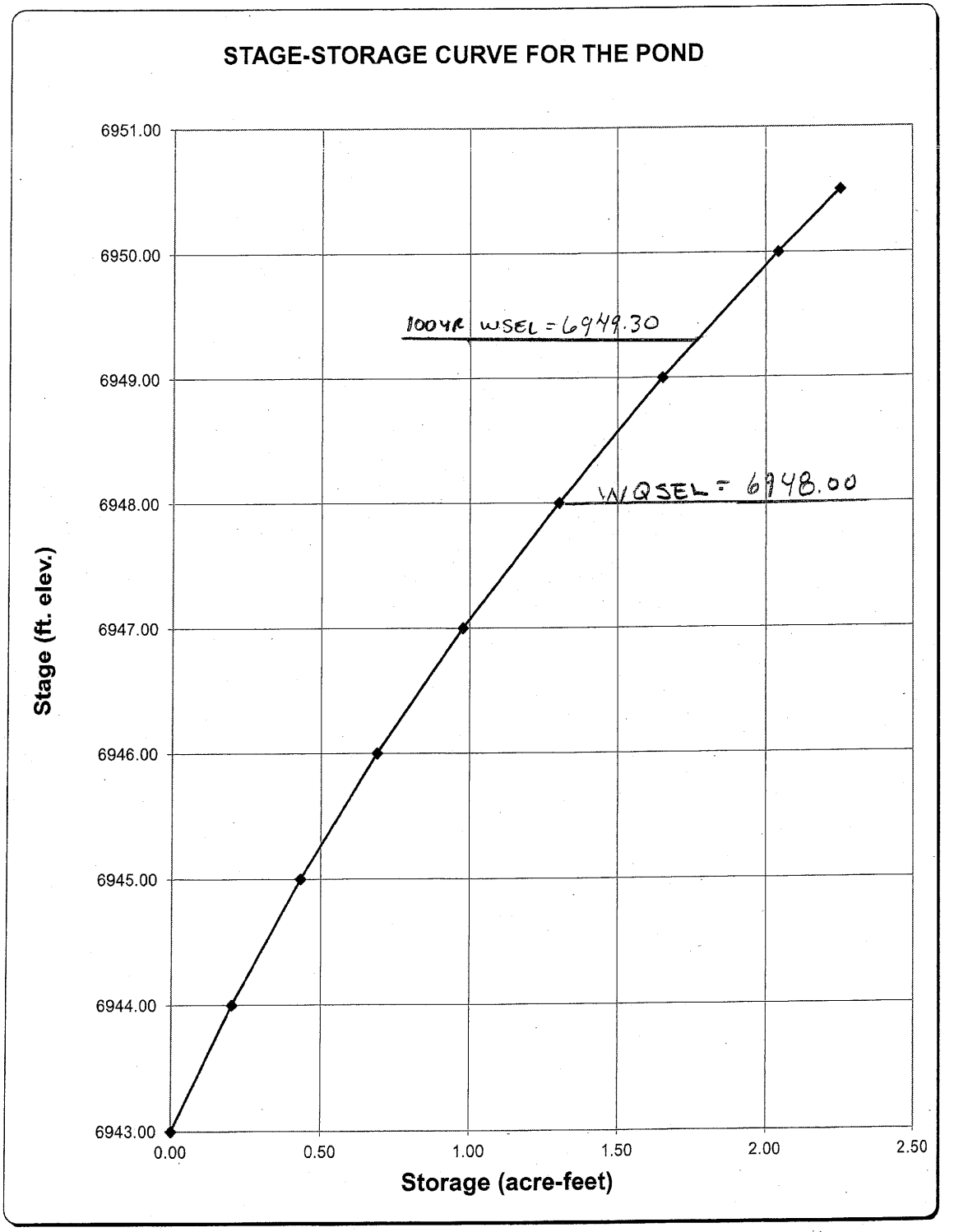
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	

STAGE-STORAGE SIZING FOR DETENTION BASINS

Project: THE RIDGE AT CUMBRE VISTA FILING No. 1
Basin ID:



STAGE-DISCHARGE SIZING OF THE WATER QUALITY CAPTURE VOLUME (WQCV) OUTLET

Project: The Ridge @ Cumbre Vista

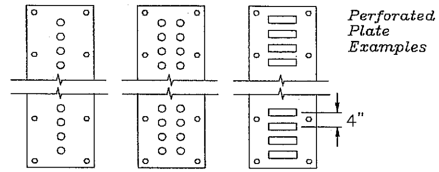
Basin ID:

WQCV Design Volume (Input):

Catchment Imperviousness, I_a = 66.5 percent
Catchment Area, A = 13.70 acres
Depth at WQCV outlet above lowest perforation, H = 1 feet
Vertical distance between rows, h = 4.00 inches
Number of rows, NL = 3
Orifice discharge coefficient, C_o = 0.65
Slope of Basin Trickle Channel, S = 0.005 ft / ft

Diameter of holes, D = in.
Number of holes per row, N =
OR
Height of slot, H = 2.00 in.
Width of slot, W = 5.51 in.

Time to Drain the Pond = 72 hours



Outlet Design Information (Output):

Excess Urban Runoff Volume (From 'Full-Spectrum Sheet') 1.138 watershed inches
N/A
Excess Urban Runoff Volume (From 'Full-Spectrum Sheet') 1.301 acre-feet
Outlet area per row, Ao = 2.53 square inches
Total opening area at each row based on user-input above, Ao = 11.02 square inches
Total opening area at each row based on user-input above, Ao = 0.077 square feet

Calculation of Collection Capacity:

Central Elevations of Rows of Holes in feet

Stage ft (input)	Row 1	Row 2	Row 3	Row 4	Row 5	Row 6	Row 7	Row 8	Row 9	Row 10	Row 11	Row 12	Row 13	Row 14	Row 15	Row 16	Row 17	Row 18	Row 19	Row 20	Row 21	Row 22	Row 23	Row 23	Σ Flow
	6943.33	6943.66	6944.00																					
	Collection Capacity for Each Row of Holes in cfs																							
6943.00	0.0000	0.0000	0.0000																					0.00
6944.00	0.3267	0.2328	0.0000																					0.56
6945.00	0.5159	0.4621	0.3992																					1.38
6946.00	0.6523	0.6106	0.5645																					1.83
6947.00	0.7647	0.7295	0.6914																					2.19
6948.00	0.8626	0.8316	0.7984																					2.49
6949.00	0.9505	0.9225	0.8926																					2.77
6950.00	1.0310	1.0051	0.9778																					3.01
6950.50	1.0689	1.0440	1.0177																					3.13
	#N/A	#N/A	#N/A																					#N/A
	#N/A	#N/A	#N/A																					#N/A
	#N/A	#N/A	#N/A																					#N/A
	#N/A	#N/A	#N/A																					#N/A
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	#N/A	#N/A	#N/A																					#N/A
	#N/A	#N/A	#N/A																					#N/A
	#N/A	#N/A	#N/A																					#N/A
	#N/A	#N/A	#N/A																					#N/A
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	#N/A	#N/A	#N/A																					#N/A
	#N/A	#N/A	#N/A																					#N/A
	#N/A	#N/A	#N/A																					#N/A
	#N/A	#N/A	#N/A																					#N/A
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	#N/A	#N/A	#N/A																					#N/A
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	#N/A	#N/A	#N/A																					#N/A
	#N/A	#N/A	#N/A																					#N/A
	#N/A	#N/A	#N/A																					#N/A
	#N/A	#N/A	#N/A																					#N/A
	#N/A	#N/A	#N/A																					#N/A
	#N/A	#N/A	#N/A																					#N/A
	#N/A	#N/A	#N/A																					#N/A
	#N/A	#N/A	#N/A																					#N/A
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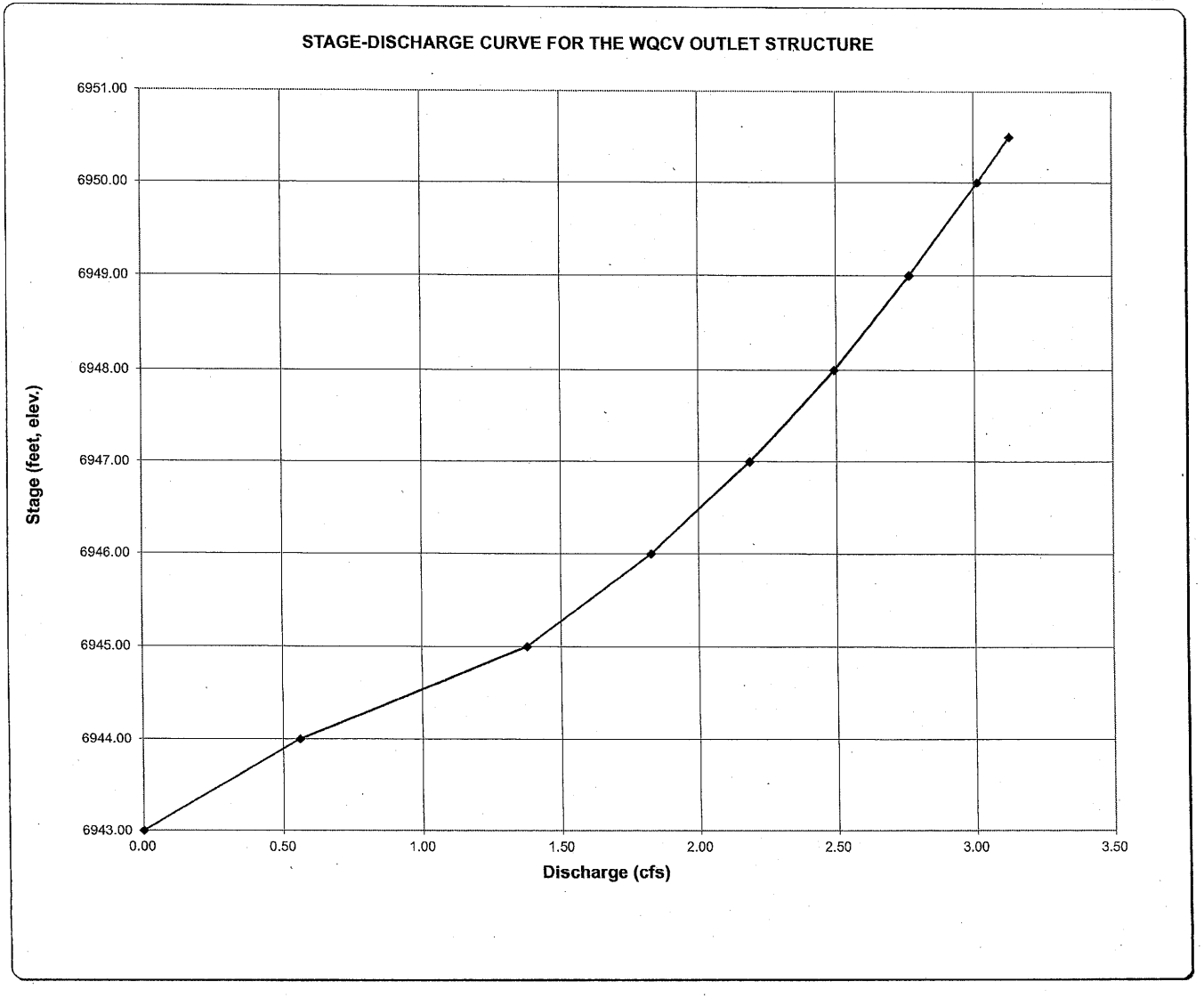
	#N/A	#N/A	#N/A																					#N/A
	#N/A	#N/A	#N/A																					#N/A
	#N/A	#N/A	#N/A																					#N/A

STAGE-DISCHARGE SIZING OF THE WATER QUALITY CAPTURE VOLUME (WQCV) OUTLET

Worksheet Protected

Project: The Ridge @ Cumbre Vista

Basin ID:

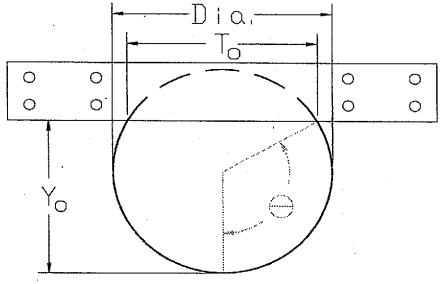


RESTRICTOR PLATE SIZING FOR CIRCULAR VERTICAL ORIFICES

Project: The Ridge @ Cumbre Vista Filing 1

Basin ID:

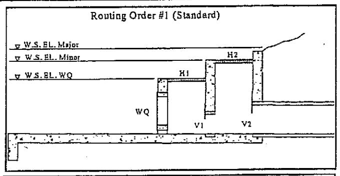
X

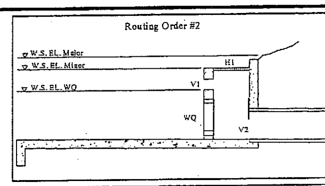


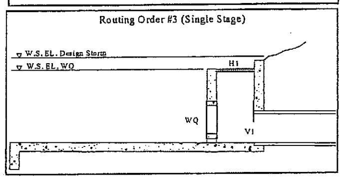
	#1 Vertical Orifice	#2 Vertical Orifice	
Sizing the Restrictor Plate for Circular Vertical Orifices or Pipes (Input)			
Water Surface Elevation at Design Depth	6,949.30		feet
Pipe/Vertical Orifice Entrance Invert Elevation	6,943.00		feet
Required Peak Flow through Orifice at Design Depth	9.20		cfs
Pipe/Vertical Orifice Diameter (inches)	18.0		inches
Orifice Coefficient	0.65		
Full-flow Capacity (Calculated)			
Full-flow area	1.77		sq ft
Half Central Angle in Radians	3.14		rad
Full-flow capacity	21.7		cfs
Percent of Design Flow	236%		
Calculation of Orifice Flow Condition			
Half Central Angle (0<Theta<3.1416)	1.43		rad
Flow area	0.72		sq ft
Top width of Orifice (inches)	17.81		inches
Height from Invert of Orifice to Bottom of Plate (feet)	0.64		feet
Elevation of Bottom of Plate	6,943.64		feet
Resultant Peak Flow Through Orifice at Design Depth	9.2		cfs
Width of Equivalent Rectangular Vertical Orifice	**1.13**		**feet**
Centroid Elevation of Equivalent Rectangular Vertical Orifice	**6,943.32**		**feet**

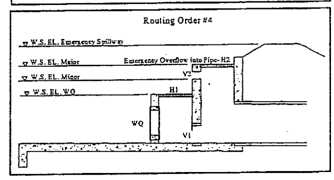
STAGE-DISCHARGE SIZING OF THE WEIRS AND ORIFICES (INLET CONTROL)

Project: The Ridge @ Cumbre Vista Filing 1
Basin ID:









Current Routing Order is #3

Design Information (Input):

			#1 Horiz.	#2 Horiz.	#1 Vert.	#2 Vert.	
Circular Opening:	Diameter in Inches	Dia. =					inches
OR							
Rectangular Opening:	Width in Feet	W =			1.13		ft.
	Length (Height for Vertical)	L or H =			0.64		ft.
	Percentage of Open Area After Trash Rack Reduction	% open =			100		%
	Orifice Coefficient	C_o =			0.65		
	Weir Coefficient	C_w =					
	Orifice Elevation (Bottom for Vertical)	E_o =			6,943.00		ft.

Calculation of Collection Capacity:

		#1 Horiz.	#2 Horiz.	#1 Vert.	#2 Vert.	
Net Opening Area (after Trash Rack Reduction)	A_o =			0.72		sq. ft.
OPTIONAL: User-Overide Net Opening Area	A_o =					sq. ft.
Perimeter as Weir Length	L_w =			ft.		
OPTIONAL: User-Overide Weir Length	L_w =			ft.		

Top Elevation of Vertical Orifice Opening, Top = 6943.64 ft.
Center Elevation of Vertical Orifice Opening, Cen = 6943.32 ft.

Routing 3: Single Stage - Water flows through WQCV plate and #1 horizontal opening into #1 vertical opening. This flow will be applied to culvert sheet (#2 vertical & horizontal openings is not used).

			Horizontal Orifices				Vertical Orifices			
Labels for WQCV, Minor, & Major Storage W.S. Elevations (input)	Water Surface Elevation ft (linked)	WQCV Plate/Riser Flow cfs (User-linked)	#1 Horiz. Weir Flow cfs (output)	#1 Horiz. Orifice Flow cfs (output)	#2 Horiz. Weir Flow cfs (output)	#2 Horiz. Orifice Flow cfs (output)	#1 Vert. Collection Capacity cfs (output)	#2 Vert. Collection Capacity cfs (output)	**Total Collection Capacity cfs (output)**	Target Volumes for WQCV, Minor, & Major Storage Volumes (link for goal seek)
	6943.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	
	6944.00	0.56	0.00	0.00	0.00	0.00	3.11	0.00	**0.56**	
	6945.00	1.38	0.00	0.00	0.00	0.00	4.89	0.00	**1.38**	
	6946.00	1.83	0.00	0.00	0.00	0.00	6.18	0.00	**1.83**	
	6947.00	2.19	0.00	0.00	0.00	0.00	7.24	0.00	**2.19**	
	6948.00	2.49	0.00	0.00	0.00	0.00	8.16	0.00	**2.49**	
	6949.00	2.77	0.00	0.00	0.00	0.00	8.99	0.00	**2.77**	
	6950.00	3.01	0.00	0.00	0.00	0.00	9.75	0.00	**3.01**	
	6950.50	3.13	0.00	0.00	0.00	0.00	10.11	0.00	**3.13**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
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		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
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		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
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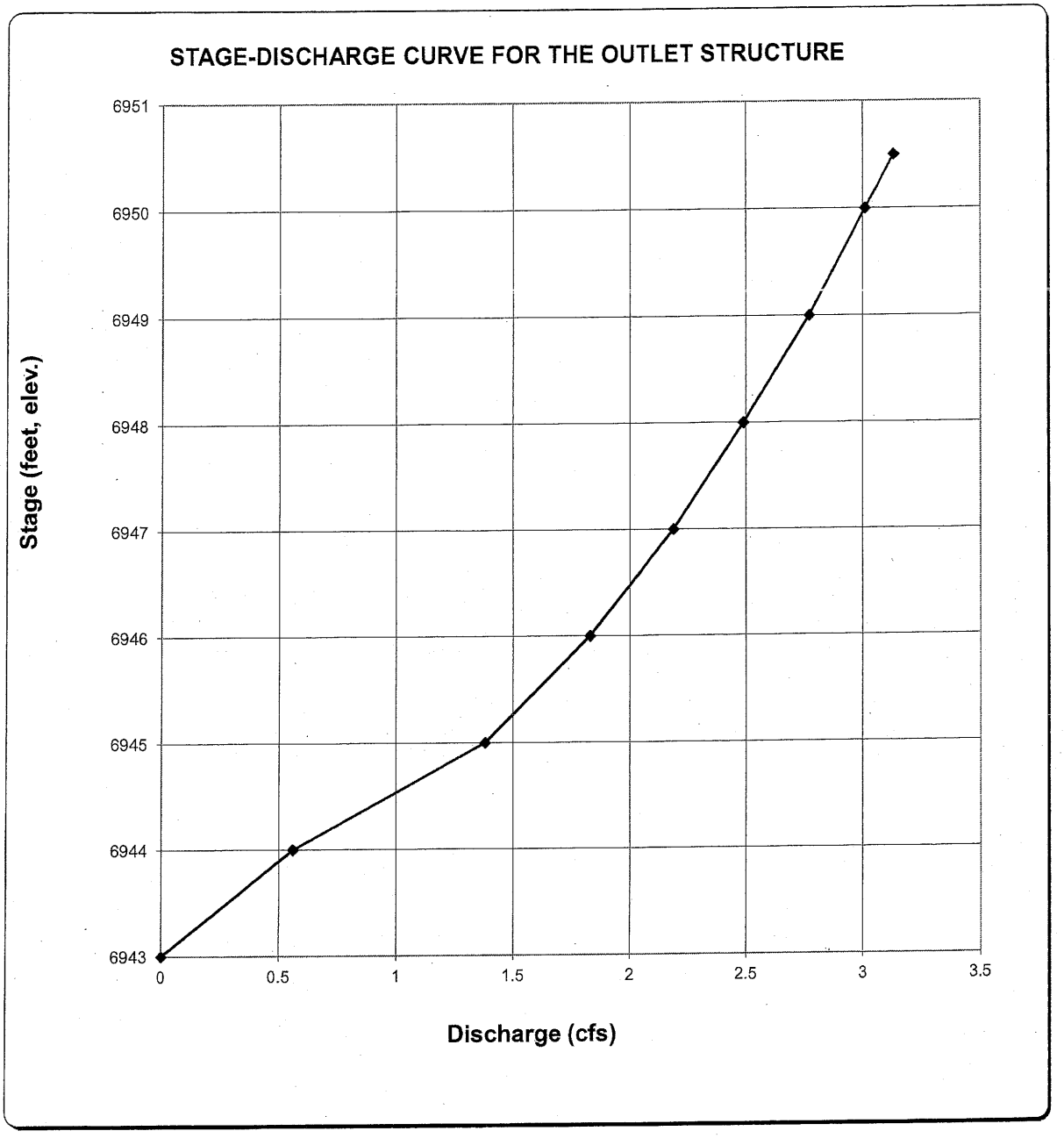
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	

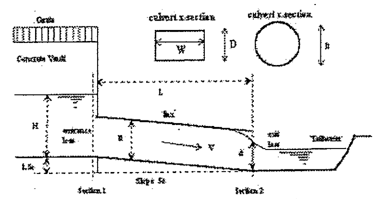
STAGE-DISCHARGE SIZING OF THE WEIRS AND ORIFICES (INLET CONTROL)

Project: The Ridge @ Cumbre Vista Filing 1
Basin ID:



STAGE-DISCHARGE SIZING OF THE OUTLET CULVERT (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: The Ridge @ Cumbre Vista Filing 1
Basin ID:



Status: Culvert Data is valid!

Design Information (Input):

Circular Culvert: Barrel Diameter in Inches	D = 18	in.
Circular Culvert: Inlet Edge Type (choose from pull-down list)	Square End with Headwall	
OR:		
Box Culvert: Barrel Height (Rise) in Feet	Height (Rise) =	ft.
Box Culvert: Barrel Width (Span) in Feet	Width (Span) =	ft.
Box Culvert: Inlet Edge Type (choose from pull-down list)	1.5 : 1 Bevel w/ 90 Deg. Headwall	
Number of Barrels	No = 3	
Inlet Elevation at Culvert Invert	I_{elev} = 6943.00	ft. elev.
Outlet Elevation at Culvert Invert	O_{elev} = 6942.00	ft. elev.
Culvert Length in Feet	L = 30.0	ft.
Manning's Roughness	n = 0.0130	
Bend Loss Coefficient	K_b = 0.00	
Exit Loss Coefficient	K_x = 1.00	

Design Information (calculated):

Entrance Loss Coefficient	K_e = 0.50
Friction Loss Coefficient	K_f = 0.54
Sum of All Loss Coefficients	K_s = 2.04
Orifice Inlet Condition Coefficient	C_d = 0.86
Minimum Energy Condition Coefficient	KE_{low} = -0.09

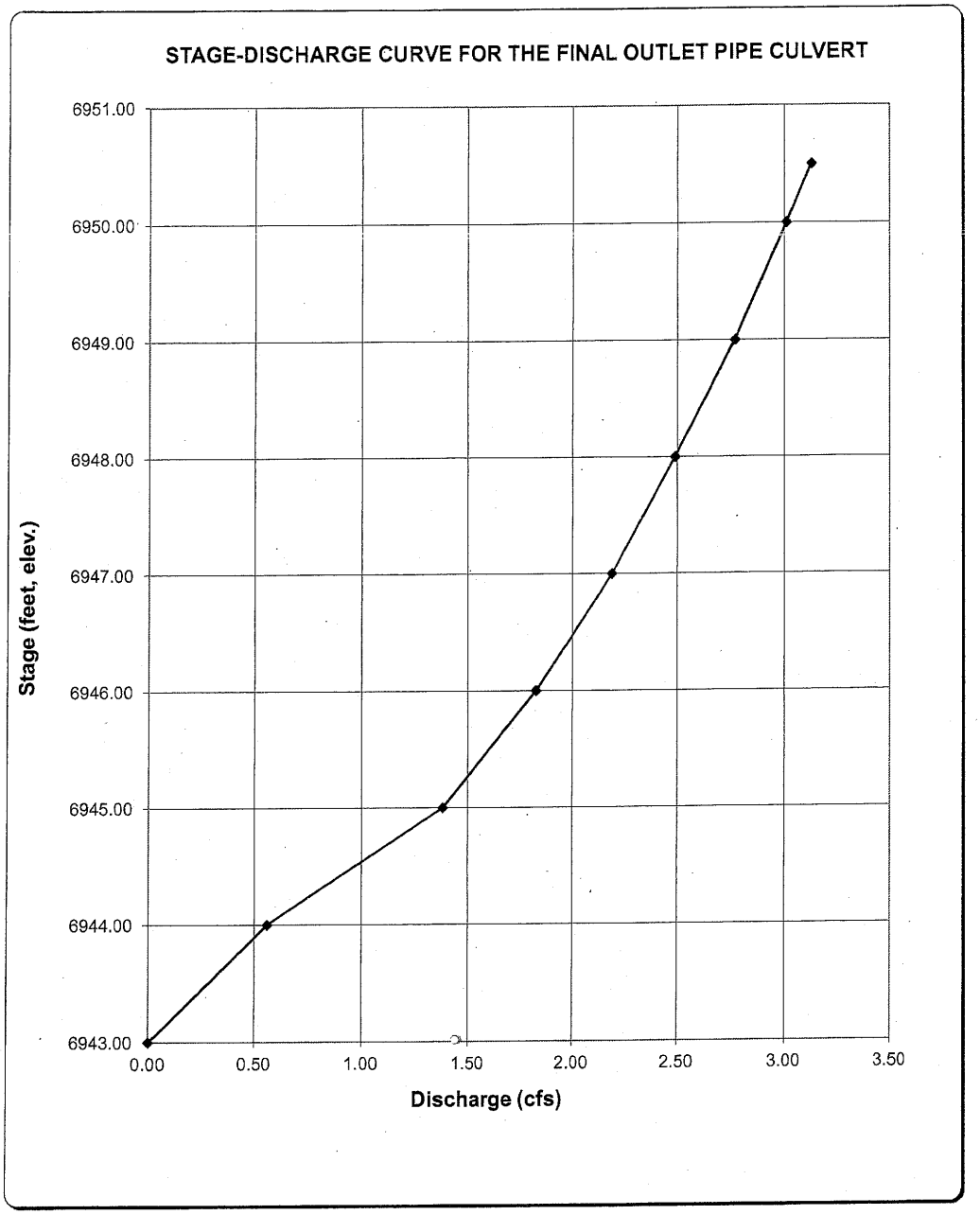
Calculations of Culvert Capacity (output):

Water Surface Elevation From Sheet "Basin" (ft., linked)	Tailwater Surface Elevation ft (Input if known)	Culvert Inlet-Control Flowrate cfs (output)	Culvert Outlet-Control Flowrate cfs (output)	Flowrate Into Culvert From Sheet "Outlet" (cfs, linked)	Controlling Culvert Flowrate cfs (output)	Inlet Equation Used (output)
6943.00	6942.00	0.00	0.00	0.00	0.00	No Flow (WS < inlet)
6944.00	0.00	10.20	21.29	0.56	0.56	Regression Eqn.
6945.00	0.00	27.00	29.92	1.38	1.38	Regression Eqn.
6946.00	0.00	38.10	38.84	1.83	1.83	Regression Eqn.
6947.00	0.00	46.50	45.74	2.19	2.19	Regression Eqn.
6948.00	0.00	53.40	51.78	2.49	2.49	Orifice Eqn.
6949.00	0.00	59.40	57.25	2.77	2.77	Orifice Eqn.
6950.00	0.00	64.80	62.43	3.01	3.01	Orifice Eqn.
6950.50	0.00	67.50	64.73	3.13	3.13	Orifice Eqn.
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)

STAGE-DISCHARGE SIZING OF THE OUTLET CULVERT (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

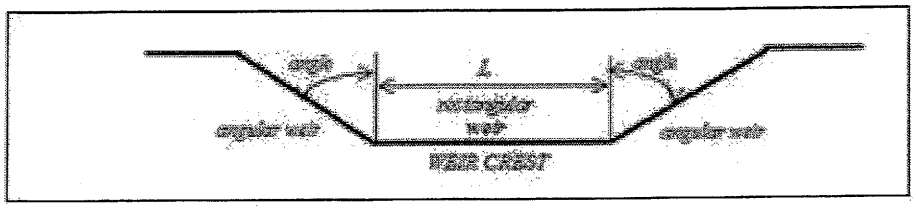
Project: The Ridge @ Cumbre Vista Filing 1

Basin ID:



Project: The Ridge @ Cumbre Vista

Basin ID:



Information (input):

Bottom Length of Weir	L =	10.00	feet
Angle of Side Slope Weir	Angle =	71.57	degrees
Elev. for Weir Crest	EL. Crest =	6,950.00	feet
Coef. for Rectangular Weir	C_w =		
Coef. for Trapezoidal Weir	C_t =	3.10	

Degree

tion of Spillway Capacity (output):

Water Surface Elevation ft. (linked)	Rect. Weir Flowrate cfs (output)	Triangle Weir Flowrate cfs (output)	Total Spillway Release cfs (output)	Total Pond Release cfs (output)
6943.00	0.00	0.00	0.00	0.00
6944.00	0.00	0.00	0.00	0.56
6945.00	0.00	0.00	0.00	1.38
6946.00	0.00	0.00	0.00	1.83
6947.00	0.00	0.00	0.00	2.19
6948.00	0.00	0.00	0.00	2.49
6949.00	0.00	0.00	0.00	2.77
6950.00	0.00	0.00	0.00	3.01
6951.00	0.00	9.30	9.30	12.54
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A

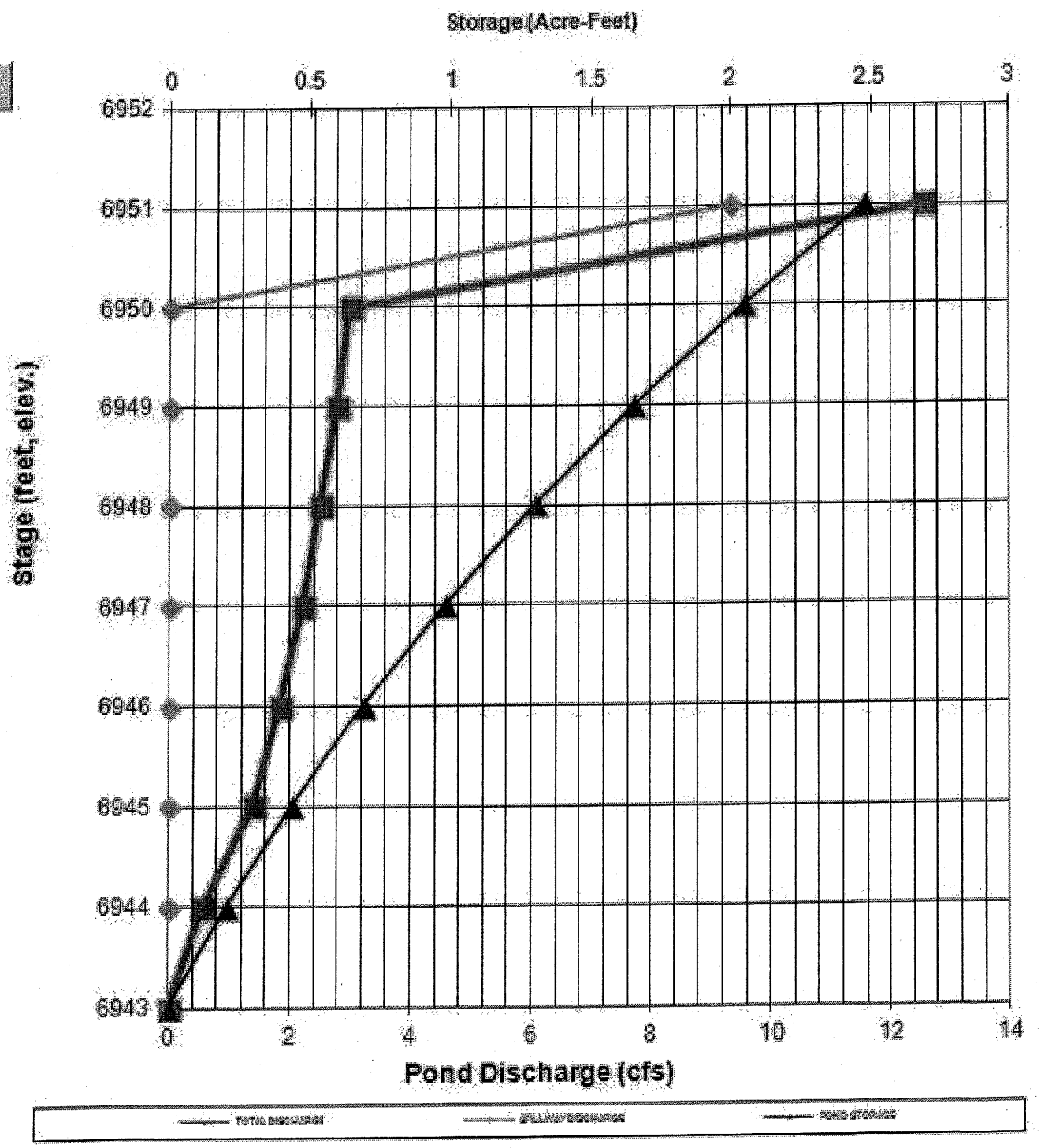
STAGE-DISCHARGE SIZING OF THE SPILLWAY

Project: The Ridge @ Cumbre Vista

Basin ID:

Update Graph

STAGE-STORAGE-DISCHARGE CURVES FOR THE POND



EXISTING DRAINAGE MAP
HISTORIC DRAINAGE MAP
PROPOSED DRAINAGE MAP

AMENDMENT NO. 1 TO THE FINAL DRAINAGE REPORT FOR CUMBRE VISTA FILING NO. 1 AND PRELIMINARY/FINAL DRAINAGE REPORT FOR CUMBRE VISTA FILING NO. 2, 3, 4 AND 5

J·R ENGINEERING
A Westrian Company

DRAINAGE REPORT STATEMENT

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

Vancel Fossinger 2-6-2007

Vancel S. Fossinger, Colorado P.E. #31972 Date
For and On Behalf of JR Engineering

COLORADO REGISTERED VANCEL S FOSSINGER 31972 PROFESSIONAL ENGINEER

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

Business Name: KF 103 - CV, LLC

By:

Edward Gonzalez

Title: Manager

Address: 536 Chapel Hills Drive, Suite 150

Colorado Springs, CO 80920

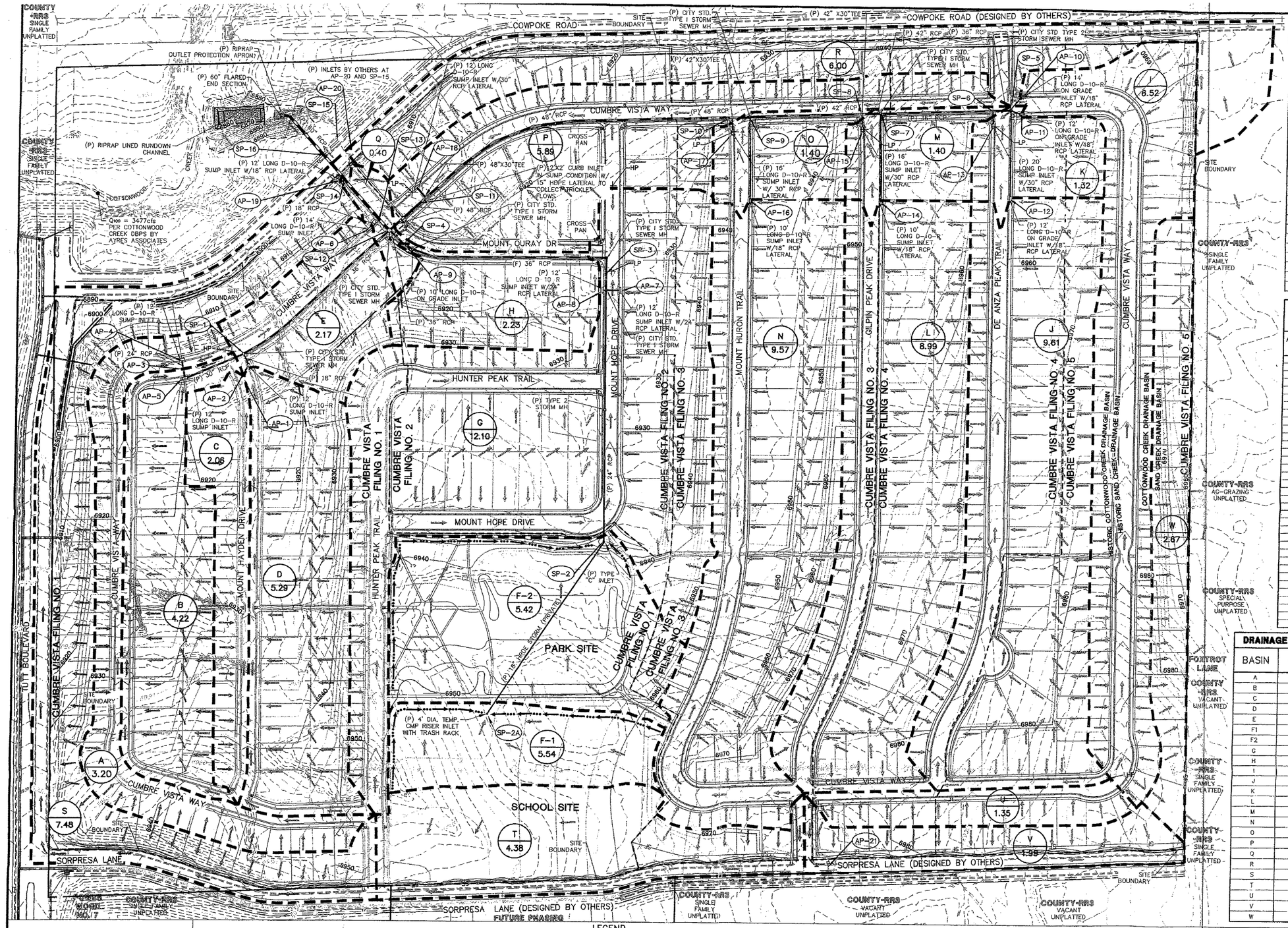
CITY OF COLORADO SPRINGS ONLY:
Filed in accordance with Section 7.7.906 of the Code of the City of Colorado Springs, 2001, as amended.

City Engineer — Date: Jan 30, 2007

City Engineer — Date

Conditions:

4310 ArrowsWest Drive, Colorado Springs, CO 80907
719-593-2593 • Fax: 719-528-6613 • www.jrengineering.com



SURFACE FLOW ROUTING SUMMARY

ANALYSIS POINTS	Q_5 (CFS)	Q_{100} (CFS)
AP-1	15.6	32.3
AP-2	11.2	16.1
AP-3	19.0	46.2
AP-4	6.4	23.1
AP-5	12.6	23.1
AP-6	8.2	14.7
AP-7	11.9	24.6
AP-8	11.9	24.6
AP-9	4.7	9.7
AP-10	8.1	14.0
AP-11	5.4	14.0
AP-12	14.4	18.6
AP-13	15.5	41.4
AP-14	13.7	17.8
AP-15	14.0	34.3
AP-16	14.3	18.6
AP-17	14.6	35.5
AP-18	11.7	24.4
AP-19	5.1	13.3
AP-20	13.4	28.2
AP-21	7.4	15.5

STORM SEWER ROUTING SUMMARY

ANALYSIS POINTS	Q_5 (CFS)	Q_{100} (CFS)
AP-2	7.1	10.2
AP-4	6.4	23.1
AP-5	19.0	46.1
AP-6	5.6	8.0
AP-7	11.9	24.6
AP-8	11.9	24.6
AP-9	3.0	4.6
AP-10	5.2	7.6
AP-11	3.7	6.7
AP-12	6.2	7.1
AP-13	15.5	41.4
AP-14	5.5	8.3
AP-15	14.0	34.3
AP-16	5.8	6.7
AP-17	14.6	35.5
AP-18	11.7	24.4
AP-19	3.3	5.9
AP-20	11.5	23.2
SP-1	25.5	55.3
SP-2	10.3	26.3
SP-2A	6.3	13.6
SP-3	31.2	69.5
SP-4	33.2	72.1
SP-5	14.1	19.8
SP-6	29.6	61.1
SP-7	34.6	66.5
SP-8	48.1	99.6
SP-9	53.2	105.0
SP-10	87.2	139.3
SP-11	75.8	157.1
SP-12	127.0	268.7
SP-13	131.6	275.2
SP-14	133.9	279.1
SP-15	14.3	28.2
SP-16	146.7	304.4

DRAINAGE BASIN DATA SUMMARY

BASIN	AREA (AC)	Q_5 (CFS)	Q_{100} (CFS)
A	3.2	6.5	13.6
B	4.2	8.5	17.6
C	2.1	4.4	9.2
D	5.3	11.2	23.2
E	2.2	4.6	9.6
F1	2.5	6.3	13.6
F2	5.4	5.9	16.8
G	12.1	23.7	49.1
H	2.2	4.7	9.7
I	6.5	13.5	27.9
J	9.6	17.9	37.3
K	1.3	2.6	5.5
L	9.0	17.1	35.5
M	1.4	2.9	6.0
N	9.6	17.9	37.2
O	1.4	2.8	5.8
P	5.9	11.8	24.4
Q	0.4	0.9	1.8
R	6.0	12.3	25.5
S	7.5	15.9	33.1
T	4.4	9.1	19.0
U	1.4	3.1	6.4
V	2.0	4.4	9.2
W	2.7	5.2	11.0

STATEMENT:

THE CITY OF COLORADO SPRINGS RECOGNIZES THE DESIGN ENGINEER AS HAVING RESPONSIBILITY FOR THE DESIGN; THE CITY HAS LIMITED ITS SCOPE OF REVIEW ACCORDINGLY.

RESUBMITTAL REQUIRED IF CONSTRUCTION HAS NOT COMMENCED WITHIN 180 DAYS AFTER REVIEW DATE.

LEGEND

SYMBOL	DESCRIPTION
	10' EXIST. GROUND CONTOUR
	2' EXIST. GROUND CONTOUR
6000	10' PROP. GROUND CONTOUR
	2' PROP. GROUND CONTOUR
AP-#	ANALYSIS POINT
SP-#	SURFACE FLOW ANALYSIS POINT
X / #.##	BASIN DESIGNATION / BASIN AREA (ACRES)
	GENERAL (P) DIRECTION OF DRAINAGE FLOW
HP / LP	HIGH/LOW POINT
	(P) DRAINAGE BASIN BOUNDARY
	FILING BOUNDARY
	(P) SWALE
	HISTORIC DRAINAGE BASIN BOUNDARY
	PROPOSED STORM SEWER

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY REVIEWING APPROPRIATE AGENCIES, JR ENGINEERING APPROVES THEIR USE ONLY FOR PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR
KF 103-CV LLC
536 CHAPEL HILLS DRIVE, SUITE 150
COLORADO SPRINGS, CO 80920
(719) 388-0361

JR ENGINEERING
A Westrian Company
4091 ArrowWest Drive • Colorado Springs, CO 80907
719-593-2593 • Fax: 719-528-6133
www.jrengineering.com

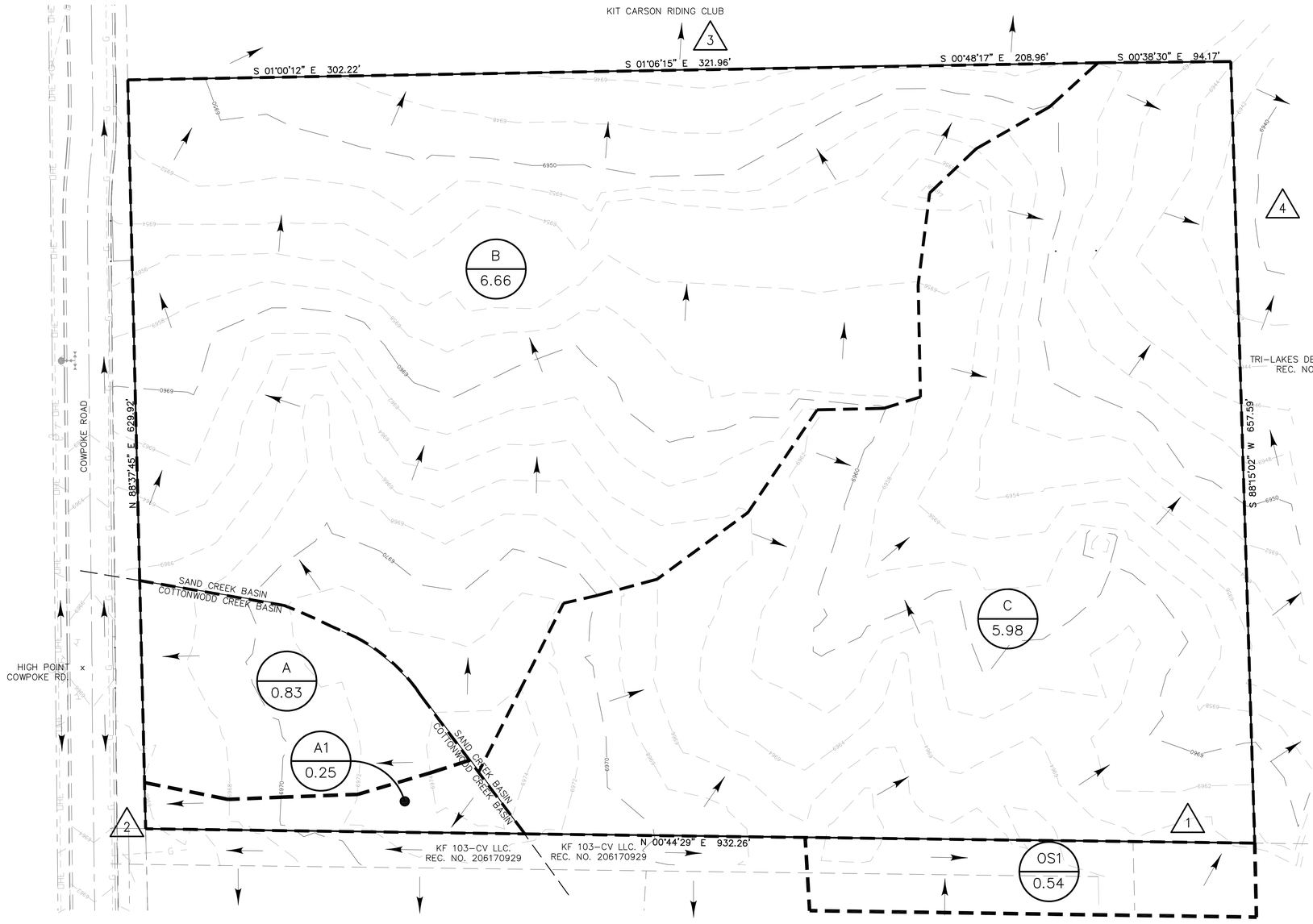
No.	REVISION	BY	DATE

H-SCALE 1"=100'
V-SCALE N/A
DATE 01/25/05
DESIGNED BY VSF
DRAWN BY JAB
CHECKED BY

REPORT FOR CUMBRE VISTA SUBDIVISION FILINGS NO. 1,2,3,4, AND 5
PRELIMINARY/FINAL DRAINAGE MAP
DEVELOPED CONDITION

SHEET 1 OF 1
JOB NO. 29094.45

THE RIDGE AT CUMBRE VISTA FILING NO. 1
HISTORIC DRAINAGE FLOWS



1" = 50'

0 25 50 100

Scale in Feet

LEGEND

EX MAJ CONT

EX MIN CONT

A — BASIN DESCRIPTION

0.10 — BASIN AREA, ACRES

FLOW DIRECTION

2 — SURFACE ROUTING POINT

DESIGN POINT TABLE		
DESIGN PT.	FLOW Q5	FLOW Q100
1	0.5	1.2
2	0.9	2.2
3	4.4	11.0
4	4.4	11.0

THE RIDGE AT CUMBRE VISTA FILING NO. 1
HISTORIC DRAINAGE PLAN
JOB NO. 08-024
DATE PREPARED: JANUARY 8, 2014
DATE REVISED: SEPTEMBER 4, 2014

CIVIL CONSULTANTS, INC.

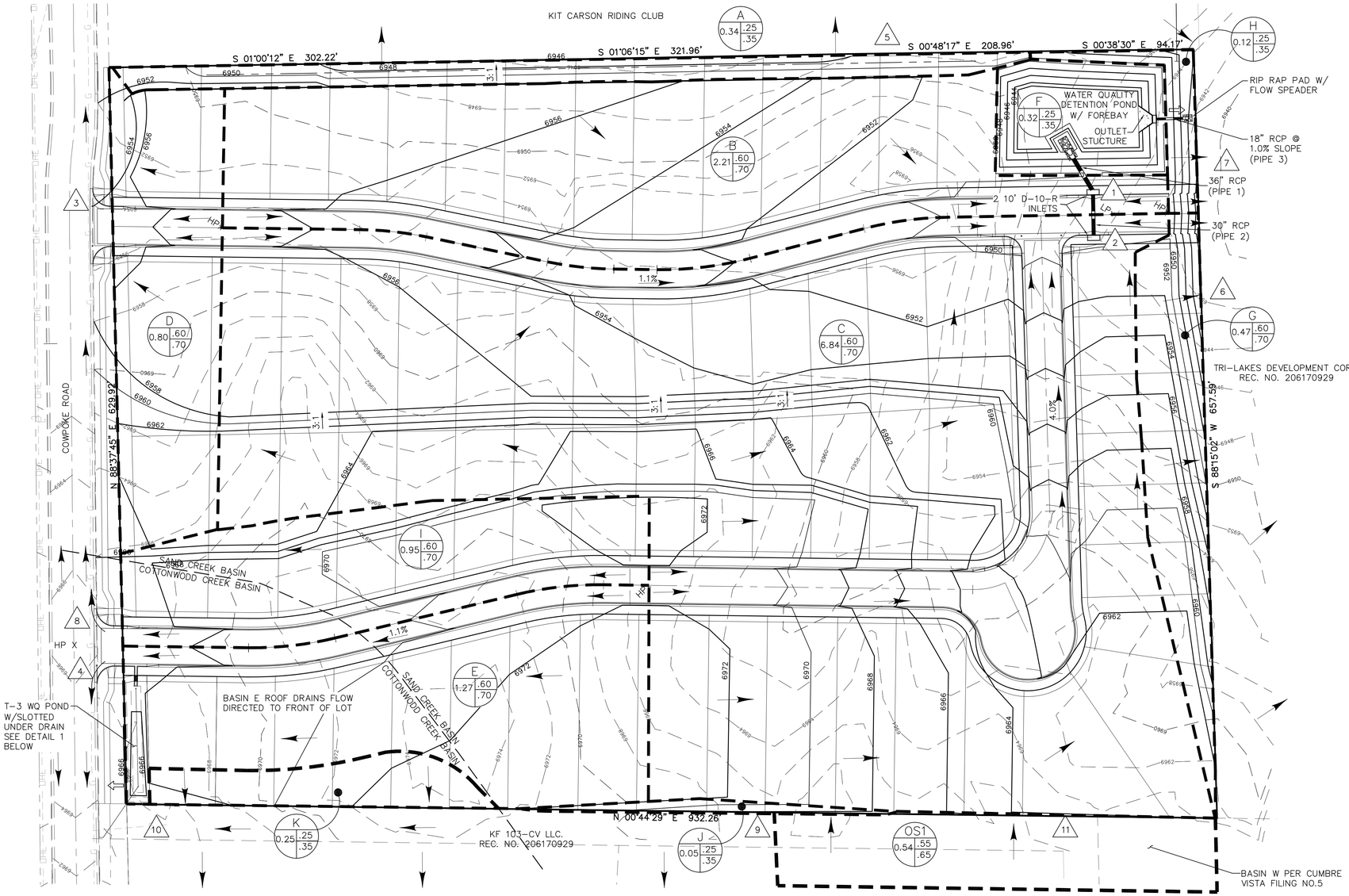
102 E. PIKES PEAK AVE., STE 306
COLORADO SPRINGS,
COLORADO 80903

v 719.235.5249
f 719.444.8427

THE RIDGE AT CUMBRE VISTA FILING NO. 1

FINAL DRAINAGE PLAN

JANUARY 2014



1" = 50'

0 25 50 100

Scale in Feet

LEGEND

DESIGN POINT	1
FLOW DIRECTION	→
EMERGENCY OVERFLOW	⇨
HIGH POINT	HP X
TOP OF BERM	TOP
TOE OF BERM	TOE
FLOW LINE	FL
FINISH GRADE	FG

BASIN DESIGNATION — A — 5.0 — .25 — .35 — C5 — C100 — ACRES

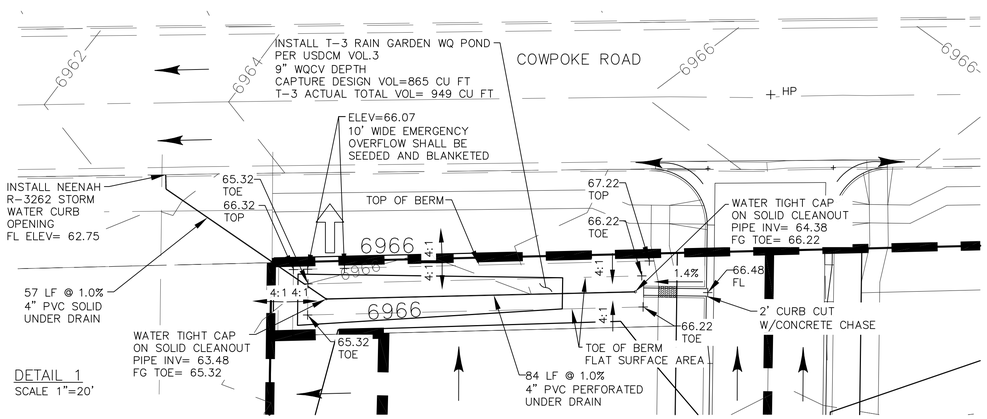
PROPOSED MINOR CONTOUR	———
PROPOSED MAJOR CONTOUR	———
EXISTING MINOR CONTOUR	- - -
EXISTING MAJOR CONTOUR	— — —
BASIN BOUNDARY	▬ ▬ ▬

PIPE TABLE			
PIPE	SIZE	FLOW Q50	FLOW Q100
1	36" RCP	13.7	28.5
2	30" RCP	13.6	28.3
3	18" RCP		9.2

DESIGN POINT TABLE		
DESIGN PT.	FLOW Q5	FLOW Q100
1	3.2	6.6
2	13.6	28.3
3	3.7	7.8
4	2.0	4.1
5	0.4	1.1
6	1.4	3.0
7	0.2	0.4
8	1.8	3.8
9	0.1	2.2
10	0.3	0.7
11	1.1	2.2
POND	13.9	29.0

DETENTION POND INFORMATION	
VOLUME REQUIRED	1.74 AC.-FT.
VOLUME PROVIDED	2.25 AC.-FT.
RELEASE RATE	9.21 CFS
100-YEAR WSEL	6949.30
WQSEL	6948.00
BOTTOM OF POND	6943.00

T-3 WQCV INFORMATION	
VOLUME REQUIRED	865 CU. FT.
VOLUME PROVIDED	949 CU. FT.
VOLUME TO DRAIN	12 HOUR
WQCV DEPTH	9 INCHES
WQSEL	6966.07
BOTTOM OF POND	6965.32



DETAIL 1
SCALE 1"=20'

1" = 20'

0 10 20 40

Scale in Feet

THE RIDGE AT CUMBRE VISTA FILING NO. 1
FINAL DRAINAGE PLAN
JOB NO. 08-024
DATE PREPARED: JANUARY 8, 2014
DATE REVISED: SEPTEMBER 12, 2014

M&S CIVIL CONSULTANTS, INC.
102 E. PIKES PEAK AVE., STE 306
COLORADO SPRINGS, COLORADO 80903
v 719.235.5249
f 719.444.8427