

\*approved FDR  
referenced herein  
can be found in  
EPC file number  
SF2115.

## HYDRAULIC MEMORANDUM

To: El Paso County

From: Brice Hammersland, P.E., CFM  
Kimley-Horn and Associates, Inc

Date: June 29, 2022

Subject: Winsome Filing 2 – Lot 62 Driveway Culvert



## PURPOSE

Kimley-Horn and Associates, Inc. (Kimley-Horn) has prepared this Hydraulic Memorandum for the above referenced project. The purpose of this memorandum (memo) is to present the results of the hydraulic analysis conducted to estimate onsite peak flows tributary to the proposed driveway culvert on Lot 62 of Winsome Filing 2.

## HYDROLOGY

A full hydrologic analysis of the Winsome Filing 2 site was performed by Kimley-Horn and included in the Winsome Subdivision Filing No. 2 Final Drainage Report ("the FDR") dated September 14, 2021. The results of that analysis have been used to determine that approximately 0.30 cfs will be tributary to the location of the proposed driveway culvert for Lot 62 in the 100-yr storm. It should be noted that the FDR estimated a higher 100-yr flow for this lot's driveway culvert. The culvert location was unknown at the time of when the FDR was completed. See Appendix A for excerpts from the FDR which includes a drainage map that shows the area tributary to the culvert.

## CONCLUSION

Although the driveway culvert for Lot 62 was originally sized to be a 24" RCP, an 18" RCP culvert is now being proposed and will have adequate capacity to convey the 100-yr flows that are being directed to the culvert.

Sincerely,

A handwritten signature in black ink, appearing to read "Brice Hammersland".

### **KIMLEY-HORN AND ASSOCIATES, INC.**

Brice Hammersland, P.E., CFM  
Registered Professional Engineer  
State of Colorado No. 56012



**APPENDIX A – Winsome Filing 2 Drainage Map**



Final Drainage Report

## Winsome Subdivision Filing No. 2 El Paso County, Colorado

Prepared for:

**Joe DesJardin**  
**Winsome, LLC**  
**1864 Woodmoor Drive, Suite 100**  
**Monument, CO 80132**

Prepared by:

**Kimley-Horn and Associates, Inc.**  
**2 North Nevada Avenue, Suite 300**  
**Colorado Springs, Colorado 80903**  
**(719) 453-0180**  
**Contact: Brice Hammersland, P.E.**

PCD File No. SF-21-015

Project #: 196106000

Prepared: September 14, 2021

**Kimley»Horn**



**CERTIFICATION**

**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 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 preparation of this report.



SIGNATURE (Affix Seal): \_\_\_\_\_  
Brice Hammersland, P.E.  
Colorado P.E. No. 56012



**OWNER/DEVELOPER'S STATEMENT**

I, the developer, have read and will comply with all of the requirements specified in this Drainage Report and Plan.

Winsome, LLC

Name of Developer

✓ Joseph W. DesJardin 10/29/2022  
Authorized Signature Date

Joseph W. DesJardin  
Printed Name

Director of Entitlements  
Title

1864 Woodmoor Dr, Suite 100, Monument, CO 80132  
Address:

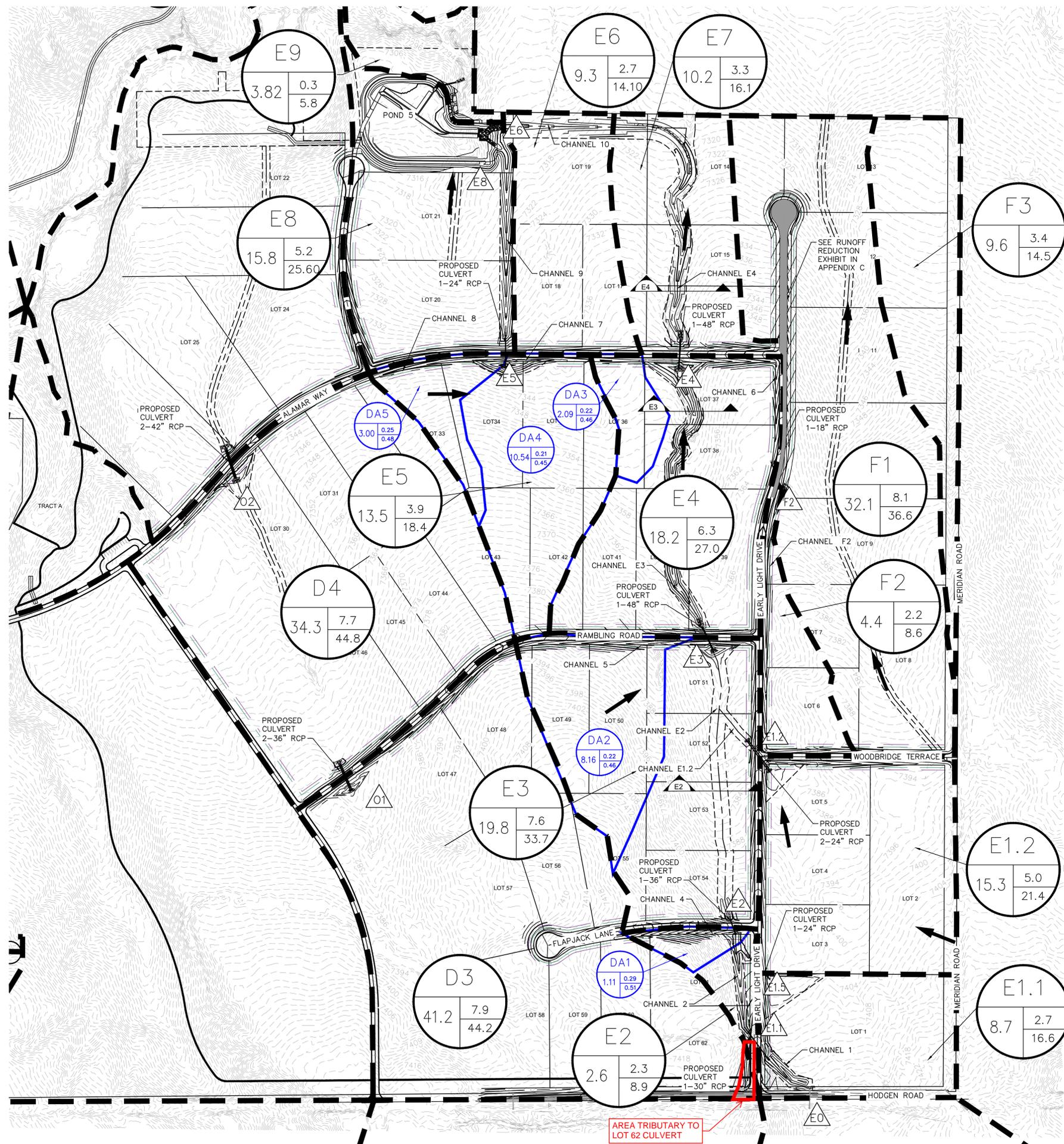
**EL PASO COUNTY**

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:

Plotted By: O'Donnell-Stoep, Theresa - Sheet: WINSOME E2 - Layout: PROP DRN MAP - September 14, 2021 - 02:26:23pm - K:\DEN\_Civil\196106000 - Winsome E2\CADD\Exhibits\019610600 - PROP - DRN.dwg  
 This document, together with the concepts and designs presented herein, is intended only for the specific purpose and client for which it was prepared. Reuse or improper reliance on this document without written authorization and adaptation by Kimley-Horn and Associates, Inc. shall be without liability to Kimley-Horn and Associates, Inc.



### LEGEND

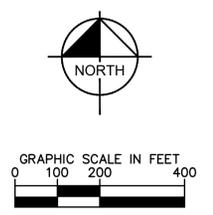
- DRAINAGE BASIN AREAS
- DRAINAGE SUB-BASIN AREAS
  
- A  
B | C  
D A - HEC-HMS BASINS  
B - BASIN ACREAGE  
C - 5-YR RUNOFF  
D - 100-YR RUNOFF
- A  
B | C  
D A - RATIONAL METHOD BASINS\*  
B - BASIN ACREAGE  
C - 5-YR RUNOFF COEFF  
D - 100-YR RUNOFF COEFF
- EO CULVERT DESIGN POINT
- EXISTING CONTOURS
- PROPOSED CONTOURS
- FLOW ARROW
- E4 CHANNEL CROSS SECTION

DEVELOPED RUNOFF					
Design Point	Basin	Direct Runoff (CFS)		Routed Flowrates (CFS)	
		Q5	Q100	Q5	Q100
E1.5	E1.1	2.7	16.60	2.70	16.6
E1.2*	E1.2	5.0	21.4	5.00	21.40
	E0	4.9	24.6	4.9	24.6
E1.1	E0			4.9	24.6
E2	E0+E1.1+E2	2.3	8.90	7.30	36.60
E3	E3	7.6	33.7		
	E1.1+E1.2+E0+E2+E3			18.60	84.60
F2	F2	2.2	8.60		
E4	E4	6.3	27.00		
	DP_E3+F2+E4			26.60	117.60
E7	E7	3.3	16.20		
E5	E5	3.9	18.40	3.90	18.40
E6	E6	2.7	14.10	30.30	137.30
E8	E8	5.2	25.60		
Pond 5	DP_E4+E5+E6+E7			35.30	160.90
Out-1				430.40	2013.70

\*In existing conditions culvert E1.2 will receive flows from Basins E1.1 and E1.2. Once Basin E1.2 is developed, flows from will be directed to Culvert E1.2. Flows from Basin E1.1 will be conveyed through Culvert E1.5.

POND 5 SUMMARY TABLE					
Design Storm	WSEL (ft)	Required Volume (ac-ft)	Provided Volume (ac-ft)	Q_IN (cfs)	Q_OUT (cfs)
WQCV	7300.78	1.03	1.04	-	-
EURV	7301.36	1.83	1.83	-	-
100-yr	7303.92	6.34	7.15	161	94.9

\*RATIONAL METHOD DRAINAGE BASINS REFLECT FLOWS GOING TO ROADSIDE DITCHES.



KHA PROJECT 019610600  
 DATE 01/08/2021  
 SCALE AS SHOWN  
 DESIGNED BY KHTAM  
 DRAWN BY KHTAM  
 CHECKED BY TLC DATE:

LICENSED PROFESSIONAL  
 KEVIN KOFFORD  
 CO LICENSE NUMBER 57234

COUNTY SUBMITTAL #2  
 REVISIONS  
 No. 2  
 DATE 9/9/21 KRC

## PROPOSED DRAINAGE MAP - OVERALL

WINSOME FILING NO. 2  
 PREPARED FOR  
 WINSOME LLC

EL PASO COUNTY

SHEET NUMBER



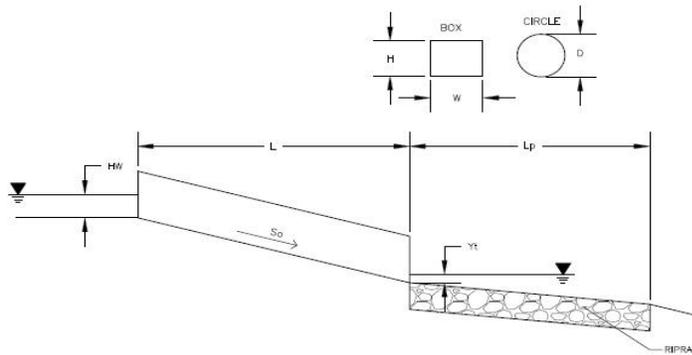
## APPENDIX B – Hydrology and Hydraulic Calculations

Basin ID	Total Basin Area	100-yr Peak Flow [cfs]	Tributary Area (ac)	Fraction of 100YR Flow (cfs)
D3	41.2	44.2	0.28	0.30

# DETERMINATION OF CULVERT HEADWATER AND OUTLET PROTECTION

MHFD-Culvert, Version 4.00 (May 2020)

Project: \_\_\_\_\_  
 ID: \_\_\_\_\_



Soil Type:  
 Choose One:  
 Sandy  
 Non-Sandy

Supercritical Flow! Using Adjusted Diameter to calculate protection type.

Design Information:	
Design Discharge	Q = <input type="text" value="0.3"/> cfs
<b>Circular Culvert:</b>	
Barrel Diameter in Inches	D = <input type="text" value="18"/> inches
Inlet Edge Type (Choose from pull-down list)	Beveled Edge (1:1)
<b>OR:</b>	
<b>Box Culvert:</b>	
Barrel Height (Rise) in Feet	H (Rise) = <input type="text" value="OR"/> ft
Barrel Width (Span) in Feet	W (Span) = <input type="text" value="OR"/> ft
Inlet Edge Type (Choose from pull-down list)	
Number of Barrels	# Barrels = <input type="text" value="1"/>
Inlet Elevation	Elev IN = <input type="text" value="100"/> ft
Outlet Elevation <u>OR</u> Slope	Elev OUT = <input type="text" value="99.3"/> ft
Culvert Length	L = <input type="text" value="35"/> ft
Manning's Roughness	n = <input type="text" value="0.013"/>
Bend Loss Coefficient	k <sub>b</sub> = <input type="text" value="0"/>
Exit Loss Coefficient	k <sub>x</sub> = <input type="text" value="1"/>
Tailwater Surface Elevation	Y <sub>t</sub> , Elevation = <input type="text" value="5"/> ft
Max Allowable Channel Velocity	V = <input type="text" value="5"/> ft/s

**Note:**  
 Arbitrary elevations have been used to represent a slope of 0.02 ft/ft.

Calculated Results:	
Culvert Cross Sectional Area Available	A = <input type="text" value="1.77"/> ft <sup>2</sup>
Culvert Normal Depth	Y <sub>n</sub> = <input type="text" value="0.15"/> ft
Culvert Critical Depth	Y <sub>c</sub> = <input type="text" value="0.20"/> ft
Froude Number	Fr = <input type="text" value="1.86"/> <span style="color: red;">Supercritical!</span>
Entrance Loss Coefficient	k <sub>e</sub> = <input type="text" value="0.20"/>
Friction Loss Coefficient	k <sub>f</sub> = <input type="text" value="0.63"/>
Sum of All Loss Coefficients	k <sub>s</sub> = <input type="text" value="1.83"/> ft
<b>Headwater:</b>	
Inlet Control Headwater	HW <sub>i</sub> = <input type="text" value="0.27"/> ft
Outlet Control Headwater	HW <sub>o</sub> = <input type="text" value="N/A"/> ft
Design Headwater Elevation	HW = <input type="text" value="N/A"/> ft
Headwater/Diameter <u>OR</u> Headwater/Rise Ratio	HW/D = <input type="text" value="N/A"/>
Outlet Control Headwater Approximation Method Inaccurate for Low Flow - Backwater Calculations Required	
<b>Outlet Protection:</b>	
Flow/(Diameter <sup>2.5</sup> )	Q/D <sup>2.5</sup> = <input type="text" value="0.11"/> ft <sup>0.5</sup> /s
Tailwater Surface Height	Y <sub>t</sub> = <input type="text" value="0.60"/> ft
Tailwater/Diameter	Y <sub>t</sub> /D = <input type="text" value="0.40"/>
Expansion Factor	1/(2*tan(Θ)) = <input type="text" value="6.70"/>
Flow Area at Max Channel Velocity	A <sub>t</sub> = <input type="text" value="0.06"/> ft <sup>2</sup>
Width of Equivalent Conduit for Multiple Barrels	W <sub>eq</sub> = <input type="text" value="-"/> ft
Length of Riprap Protection	L <sub>p</sub> = <input type="text" value="5"/> ft
Width of Riprap Protection at Downstream End	T = <input type="text" value="3"/> ft
Adjusted Diameter for Supercritical Flow	Da = <input type="text" value="0.82"/> ft
Minimum Theoretical Riprap Size	d <sub>50 min</sub> = <input type="text" value="0"/> in
Nominal Riprap Size	d <sub>50 nominal</sub> = <input type="text" value="6"/> in
MHFD Riprap Type	Type = <input type="text" value="VL"/>