Irrigation Report
For
Rose Creek

Date: January 19, 2023

Prepared by: Vortex Engineering, Inc.
2394 Patterson Road, Suite 201
Grand Junction, CO 81505
970-245-9051
VEI#   F20-707

Submitted to: City of Fruita
250 N. 5th Street
Grand Junction, CO 81501

Type of Design: Major Subdivision

Owners: Rose Creek, LLC
1023 24 Rd
Grand Junction, CO 81505

Property Address: 1123 19 Rd
Fruita, CO 81521

Tax Schedule No.:   2697-094-79-002
2697-094-00-715

Table of Contents

I. Introduction

A. Background

This Irrigation Report has been prepared by Vortex Engineering, Inc., and is required as part of the Rose Creek submittal.

B. Project Location

Rose Creek consists of two parcels of land with an area of 22.8 acres. The project is located in the political boundary of The City of Fruita, Colorado, and bordered by 19 Rd to the east, K Road to the south, and Brandon Estates to the west. The applicant is requesting approval of a new subdivision comprised of 138 lots and tracts. A vicinity map is provided in Appendix A for reference.

C. Property Description

Existing conditions

The existing site slopes from the northeast to the south and southwest and is currently undeveloped and vegetated with grass. Existing agricultural irrigation infrastructure is present at the site.

Proposed Conditions

With the development of the project site, it is planned for irrigation with the source of irrigation water being the Grand Valley Irrigation Company (GVIC). In the proposed conditions, it is estimated that the area to be irrigated is approximately 11.6 acres in size.

D. Irrigation Shares

Currently there are 29 irrigation shares associated with this property, which shall be sufficient for the site

II. Irrigation System Description

The closest source for irrigation water to service the subject site is situated in the northeast corner of the property. A pipe will convey water from the headgate device to an underground settlement and storage vault. A separate pump system will then deliver pressurized irrigation water to the subdivision. See sheet C6.0 thru C6.1 for layout and distribution information.

The proposed irrigation system consists of 4" distribution pipe which carries water from the above-described point of connection throughout the development. The underground vault is sized to store volume required to irrigate 4 (four) zones in 1 (one) irrigation cycle. See calculations and construction plans in the Appendix.

III. Conclusions

The proposed irrigation plan complies with the City of Fruita requirements. This plan shall not adversely affect adjacent properties.

IV. Limitations /Restrictions

This report is a site-specific design for herein described irrigation system and is applicable only for the client for whom our work was performed. Use of this report under other circumstances is not an appropriate application of this document. This report is a product of Vortex Engineering & Architecture Incorporated and is to be taken in its entirety. Excerpts from this report may be taken out of context and may not convey the true intent of the report. It is the owner's and owner's agent's responsibility to read this report and become familiar with recommendations and design guidelines contained herein.

Vortex Engineering and Architectural, Inc. assumes no liability for the accuracy or completeness of information furnished by the client. Site conditions are subject to external environmental effects and may change over time. Use of this plan under different site conditions is inappropriate. If it becomes apparent that current site conditions vary from those anticipated, the design engineer should be contacted to develop any required design modifications. Vortex Engineering & Architecture, Inc. is not responsible and accepts no liability for any variation in assumed design parameters.

Vortex Engineering & Architecture, Inc. represents this report has been prepared within the limits prescribed by the owner and in accordance with the current accepted practice of the civil engineering profession in the area.

No warranty or representation either expressed or implied is included or intended in this report or in any of our contracts.

V. References

City of Fruita Regulations

Appendix A – Location Map

SITE

BRANDON DRIVE

K ROAD

19 ROAD

N
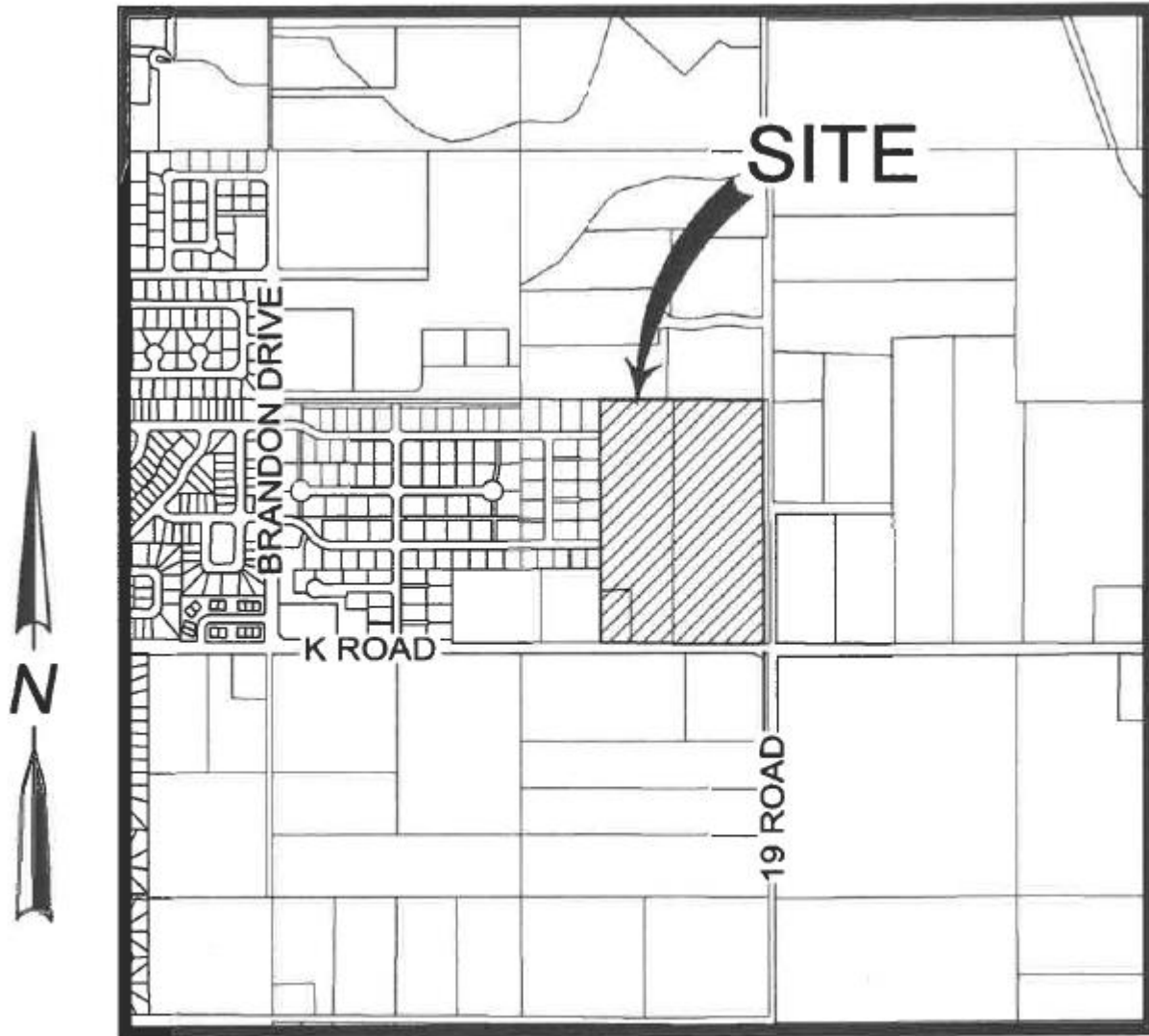
VICINITY MAP
N.T.S.

Appendix B – Irrigation Calculations

Rose Creek Subdivision
Irrigation System Demand and Sizing

Vortex Engineering, Inc
January 19, 2023

Grey shading indicates an output cell:

Irrigated Area

Total Irrigated Area (A)	6.24	acres

Weekly Irrigation Demand

Total # of Lots/Taps (n)	138		
inches of water per week (z)	3.00		
Demand	1.560	acre-feet	
Demand	67954	cubic feet	
Demand (D_V)	508327	gallons	(Eq. 1)

Irrigation Periods

# of periods per day (a)	3		
A given lot recieves water once for every (b)	2	days	
# of waterings per lot per week (c)	3		
Average Irrigation Demand per Period (D_{PA})	28240	gallons	(Eq. 2)
Average Number of Lots/Taps per Period (n_{PA})	23.00		(Eq. 3)
Design Number of Lots/Taps per Period - Rounded up (n_{PD})	45		
Design Irrigation Demand per Period (D_{PD})	55253	gallons	(Eq. 4)

Flow in / Flow out

# of shares supplied	20		
Flow in (Q_{in})	90	gpm	4.5 gpm/share
Supplied Flow per Lot/Tap (Q_L)	12	gpm	
Design Flow out (Q_{out})	540.0	gpm	(Eq. 5)
Required Irrigation Period Duration (t_P)	1.71	hours	(Eq. 6)
Net loss during an irrigation period (V_R)	46044	gallons	(Eq. 7)
Required Recharge time (t_R)	8.53	hours	(Eq. 8)
Sum of Irrigation Periods and Recharge Times (t_T) (Invalid if >24)	30.70	hours	(Eq. 9)

Vault Sizing

Minimum Required Storage Volume (Net Loss) (V_R)	46044	gallons
Length (l)	40	
Width (w)	25	
Depth to Intake*(d_i)	8	
Provided Storage Volume (Design Volume V_D)	59844.0	gallons
Percent of Minimum Storage Provided	130%	

*Do not include total vault depth in design calculations if a sump is used for sediment collection

Equation 1
$$D_V = \left(\frac{z}{12}\right)(A \times 43560) \times 7.4805$$

Equation 2
$$D_{PA} = \frac{D_V}{a \times b \times c}$$

Equation 3
$$n_{PA} = \frac{n}{a \times b}$$

Equation 4
$$D_{PD} = \left(\frac{D_{PA}}{n_{PA}}\right) \times n_{PD}$$

Equation 5
$$Q_{out} = n_{PD} \times Q_L$$

Equation 6
$$t_P = \left(\frac{D_{PD}}{Q_{out}}\right) \div 60$$

Equation 7
$$V_R = 60 \times t_P(Q_{out} - Q_{in})$$

Equation 8
$$t_R = \left(\frac{V_R}{Q_{in}}\right) \div 60$$

Equation 9
$$t_T = a(t_P + t_R)$$

Equation 10
$$v = \frac{Q_{out} \div (60 \times 7.4805)}{\pi \left(\frac{D}{2 \times 12}\right)^2}$$

Equation 11
$$H_v = \frac{v^2}{2 \times 32.2}$$

Equation 12
$$H_P = operating\ pressure\ (psi) \times 2.31$$

Equation 13
$$d_h = \frac{4 \times Cross-section\ area}{Wetted\ Perimeter} = \frac{4\pi\left(\frac{D}{2}\right)^2}{2\pi\frac{D}{2}}$$

Equation 14
$$h_{100ft} = \frac{0.2083\left(\frac{100}{C}\right)^{1.852} \times Q_{out}^{1.852}}{d_h^{4.8655}}$$

Equation 15
$$H_{fr} = \frac{L}{100} \times h_{100ft}$$

Equation 16
$$H_m = K(H_v)$$

Equation 17
$$H_{pump} = H_e + H_v + H_p + H_{fr} + H_m$$

Equation 18
$$hp_D = \frac{Q_{out} + H_{pump}}{3960}$$

Rose Creek Subdivision
Irrigation Pump Sizing

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Vortex Engineering, Inc
January 19, 2023

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Grey shading indicates an output cell:

System Flow

Unit Flow provided per Lot/Tap (Q_L)	12	gpm
Max number of taps per irrigation period (n_{PD})	24	
Design system flow (Q_{out})	288	gpm

Elevation Head

Highest point in the line	4569.5	4558.5
Pump Intake Elevation	4564.7	
Elevation Head (H_e)	4.8	ft

Velocity Head

Pipe Diameter (D)	6	in
Velocity (v)	3.268	ft/s	(Eq. 10)
Velocity Head (H_v)	0.166	ft	(Eq. 11)

Pressure Head

Opperating Pressure	50	psi
Pressure Head (H_p)	116	ft	(Eq. 12)

Head Loss to Friction
(Hazen Williams)

Roughness Coefficient (C)	140	
Hydraulic Diameter (d_h)	6	in	(Eq. 13)
Head Loss per 100 ft (h_{100ft})	0.656	ft/100ft	(Eq. 14)
Length of System (L)	6927	ft
Total Head Loss to Friction (H_{fr})	45.43		(Eq. 15)

Minor Losses

Assumed K (sum of minor loss coefficients) (K)	100	
Minor Losses (H_m)	16.58	ft	(Eq. 16)

Required Pump Specifications

Required Pump Head (H_{pump})	182.5	ft	(Eq. 17)
Calculated Pump Horsepower (hp_D)	13.27	hp	(Eq. 18)
Assumed efficiency	80%	
Horsepower Required	16.59	hp

Appendix C – Irrigation Plans and Details

CONSTRUCTION NOTES:

1. INSTALL IRRIGATION RISER
   RE: DETAIL THIS SHEET
2. IRRIGATION VAULT & PUMP HOUSE. SEE SHEET C7.1
3. 3" PRESSURIZED IRRIGATION DISTRIBUTION LINE
4. 4" PRESSURIZED IRRIGATION DISTRIBUTION LINE
5. 6" PRESSURIZED IRRIGATION DISTRIBUTION LINE
6. 4" GRAVITY IRRIGATION BYPASS LINE
7. INSTALL CLEAN OUT
   RE: DETAIL THIS SHEET
8. INSTALL TWO (2) 45° ELBOWS WITH THRUST BLOCKS AT 90°
   BEND LOCATIONS
   RE: THRUST BLOCK CHART THIS SHEET
9. INSTALL SYSTEM DRAIN
   LOCATION AND DESIGN TO BE DETERMINED
10. INSTALL 4x4x4" TEE WITH THRUST BLOCK
    RE: THRUST BLOCK CHART THIS SHEET
11. INSTALL SLEEVE (SIZE & LENGTH NOTED)
12. INSTALL 8" OVERFLOW LINE TIE TO EX. TRAP DITCH

GENERAL NOTES:

1. NO DIMENSIONS SHALL BE SCALED FROM THESE PLANS.
2. PLACE ALL IRRIGATION LINES IN PVC SLEEVES AT ALL ROAD CROSSINGS 3' BEYOND SIDEWALK

IRRIGATION SYSTEM NOTES:

1. IRRIGATION PIPING SHALL CONSIST OF THE FOLLOWING:
   - IRRIGATION SYSTEM SHALL BE MINIMAL CLASS 160 PVC.
   - MINIMUM OF 2 FEET OF COVER.
   - IRRIGATION LINES BENEATH ROADWAYS AND DRIVEWAYS SHALL BE PLACED IN A SLEEVE EXTENDING A MINIMUM OF 3 FEET BEYOND PAVING.
   - A 90 DEGREE CHANGE IN DIRECTION SHALL BE CONSTRUCTED WITH 2 – 45 DEGREE BENDS.
   - BURIED VALVES SHALL BE STANDARD EPOXY COATED CAST-IRON GLOBE VALVES WITH VALVE BOX
   - IRRIGATION SYSTEM SHALL BE PRESSURE TESTED AT 80 PSI, LEAKAGE (L) IN GALLONS PER HOUR SHALL NOT EXCEED THE FOLLOWING:
     $L = (S \times D \times (P^{0.5})) / 133,200$
     S = LENGTH IN FEET, D = DIAMETER IN INCHES, P TEST PRESSURE IN PSI
   - ALL IRRIGATION LINES SHALL HAVE TRACER WIRE EXTENDED TO GRADE AT ALL CLEANOUTS, VALVES, & RISERS.
   - INSTALL THRUST BLOCKS ON TEES, BENDS, FITTINGS, AND DEAD-ENDS ON ALL DISTRIBUTION PIPING. (PRESSURIZED AND GRAVITY FEED LINES)
   - INSTALL AIR VAC AT IRRIGATION LINE HIGH POINTS

2. ALL IRRIGATION PIPE TO HAVE CAUTION TAPE AND TRACER WIRE, CAUTION TAPE TO BE 12" ±4" ABOVE BURIED PIPE.
3. INSTALL THRUST BLOCKS AT AREAS WHERE WATER CHANGES DIRECTION ON ALL FEED LINES.
4. EACH LOT SERVICE CONNECTION TO HAVE INSTALLED A 15 G.P.M. FLOW CONTROL VALVE.
5. PAINT EXPOSED PVC WITH BLUE LATEX PAINT.

SCALE IN FEET
1" = 60'

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STEPHEN E. SWINDELL
PROFESSIONAL ENGINEER
COLORADO LICENSE No. 57688

THRUST BLOCK SIZING

SIZE	90° A	90° B	45° A	45° B	22.5° A	22.5° B	TEE'S A	TEE'S B	PLUGS C	PLUGS D
4"	5"	7"	4"	5"	2"	5"	5"	5"	7"	10"
6"	8"	10"	6"	8"	3"	8"	8"	9"	10"	15"
8"	12"	12"	8"	10"	5"	9"	9"	12"	12"	20"
10"	16"	14"	10"	12"	6"	10"	11"	14"	14"	25"
12"	19"	16"	12"	14"	8"	11"	14"	16"	16"	30"
14"	23"	18"	114"	16"	10"	12"	16"	18"	18"	34"
16"	26"	20"	16"	18"	11"	13"	18"	20"	20"	38"

PLAN
BENDS

PLAN
TEES

24"MIN-12" & LARGER
18"MIN-10" & SMALLER

SECTION X-X
BENDS & TEES

SECTION Y-Y
PLUGS

1" IRRIGATION SERVICE CONNECTION
N.T.S.

10" ROUND VALVE BOX
1" POLYPROPYLENE BALL VALVE
1" SCH 40 PVC
1" 90° ELBOW
1" SCH 40 PVC
PVC TEE
(SEE PLAN FOR SIZE)

IRRIGATION CLEAN OUT
N.T.S.

WATER TIGHT PLUG
THREADED CAP AND PLUG
NOTE: PLACE IN CONCRETE VALVE BOX IF LOCATED UNDER PAVEMENT
CONCRETE ENCASEMENT
45° RADIUS ELBOW
IRRIGATION MAIN
LONGEST RUN
WYE FITTING

Irrigation Plan
Rose Creek Subdivision
Final
1892 Ottley Ave. (K Road)
Fruita, CO 81521

PROJECT NO: F20-070
DATE: 10/27/22
Irrigation f20-070.dwg

ACCEPTED FOR CONSTRUCTION FOR ONE YEAR FROM THIS DATE
ACCEPTANCE OF THESE PLANS DOES NOT RELIEVE THE DEVELOPER, CONTRACTOR, OR THE ENGINEER FROM CONFORMANCE WITH THE CITY OF FRUITA DESIGN CRITERIA AND CONSTRUCTION SPECIFICATIONS MANUAL.

CITY OF FRUITA ENGINEERING DIVISION REPRESENTATIVE   DATE

SHEET
C7.00