

FINAL UTILITY REPORT

FOR

**Avilla Founders Village
TOWN OF CASTLE ROCK, COUNTY OF DOUGLAS
STATE OF COLORADO**

**Lot 1, Block 1
Founders Village Filing No.24 Amendment 1
Located at the northwest corner of Mickelson Boulevard & Mitchell Street**

Town of Castle Rock Project Manager:
Larry Hearold

July 29, 2022
Revised: April 10, 2023

HKS Project Number 210431
Town of Castle Rock Project Number CD22-0035

Prepared for:

NexMetro Communities
5601 Olde Wadsworth Blvd
Arvada, CO 80002
Phone: 720-728-1221

Prepared by:



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UTILITY REPORT APPROVAL BLOCKS

Engineer's Statement:

The enclosed utility report, and exhibits, were prepared by me or under my direct supervision and is correct to the best of my knowledge and belief. Said utility report has been prepared in accordance with applicable Town of Castle Rock criteria and is in conformance with the master utility plans for the affected area. I accept responsibility for any liability caused by negligent acts, errors, or omissions on my part in preparing this report.

Signature: _____

Registered Professional Engineer

State Of Colorado No. 54450

Owner/Developer's Statement:

As Owner/Developer of Land(s) identified within this report; I agree to proceed, implement and comply with all recommendations and requirements outlined herein.

Name of Developer

Authorized Signature

I. INTRODUCTION

This letter will serve as the Preliminary Utility Report and as a supplement to the Site Development Plan. We have completed initial research and coordination with the Town of Castle Rock to better understand the existing water and sanitary sewer infrastructure located adjacent to the proposed multi-family development.

1. Location

Avilla Bella Mesa - Castle Rock development ("Site") is located at the northwest corner of Mikelson Boulevard and Mitchell Street. The site is located in the Southeast $\frac{1}{4}$ of Section 8, Township 8 South, Range 66 West of the 6th Principal Meridian, City of Castle Rock, County of Douglas, State of Colorado. The Site is bounded on the south by Mickelson Boulevard, on the east by North Mitchell Street and west by the Mitchell Gulch Trail. There is an undeveloped lot to the north separating the Site from Mesa Middle School. A vicinity map can be found in Appendix F.

2. Description of Property

The existing ground cover for the 9.03-acre site consists of native grasses and trees. The Site generally slopes to the west with Shallow slopes near the public roadways and steeper slopes to the west. The slopes vary from 3% up to 25%. The total number of SFEs for the proposed development was calculated to be 68.25. The proposed land use consists of 105 multi-family residential dwelling units (11.6 DU/AC) resulting in 68.25 SFEs. The Site will include a leasing office and stand-alone garage buildings with associated infrastructure, hardscape, and landscaping. The proposed use for the Site is multi-family. It is assumed that 40% of the total site acreage (3.61 acres) will be irrigated open space including native seed, sod, and tree/shrub planting areas.

Easements will be provided around water mains, fire hydrants, public storm and sanitary sewer mains outside of the public rights-of-way in accordance with the Town of Castle Rock (Town) standards regarding location and size. The proposed easements will be dedicated with the new plat.

There are no navigable water ways, and the site is not in any major/minor drainageways or floodplains. There are no existing irrigation canals. There are no significant geologic features or topography. There are no existing on-site wastewater treatment systems. There is no phasing proposed for this development.

II. WATER INFRASTRUCTURE

1. Calculated Water Demands

The design of the water distribution system was based on the information provided in Section 4.4.1 of the Town of Castle Rock Water System Design Criteria Manual (Water Manual). Demands were computed for the full build out of the Project. The water demand calculations by building can be found in Appendix A.

2. Average Day Demands (ADD)

The Average Daily Demand rate is 260 GPD/Dwelling Unit for Multi-Family Residential per the Water Manual.

Land Use	Dwelling Units	ADD (GPD)	ADD (GPM)	ADD (AF/YR)
Multi-Family Residential	105	27,300	18.96	30.58

3. Max Day Demands (MDD)

The Maximum Day Demand rate is (Domestic ADD X 2.5) + Irrigation ADD per the Water Manual.

Land Use	Dwelling Units	Domestic ADD (GPD)	Irrigation ADD (GPD)	MDD (GPD)	MDD (GPM)
Multi-Family Residential	105	27,300	13,545	81,795	56.80

The largest residential fire flow calculated is 1,500 GPM. All the proposed residential buildings will be equipped with a NFPA 13-R sprinkler system, the Leasing Center will not have a building sprinkler system. There are no proposed commercial or industrial fire flows.

The Irrigation Demand Rate is 3,750 GPD/Irrigated Acre per Table 4.4.1 of the Water Manual. 40 % of the Site's 9.03 acres are assumed to be irrigated. The Irrigation Max Day Demand rate is 2.5 * Irrigation ADD.

Land Use	Acres	ADD (GPD)
Landscape/Open Space	3.61	13,545

The storage requirements are calculated by adding the Max Day Demand (MG) and the Fire Flow (MG)

Domestic MDD (Gal)	Irrigation ADD (Gal)	2-Hr Fire Flow (Gal)	Total (Gal)	Total (MG)
81,795	13,545	180,000	261,795	0.262

Storage Calculations can be found in Appendix B

4. Peak Hour Demands (PHD)

The Peak Hour Demand rate is (Domestic ADD X 5.5) + Irrigation ADD per the Water Manual

Land Use	Dwelling Units	Domestic ADD (GPD)	Irrigation ADD (GPD)	PHD (GPD)	PHD (GPM)
Multi-Family Residential	105	27,300	13,545	163,695	113.7

Per section 4.4.1.2 of the Water Manual, “Peaking factors are not applied to irrigation ADD demands.” Therefore, the Irrigation PHD is equivalent to the Irrigation ADD of 13,545 GPD.

5. Irrigation Demands

Irrigation demand was calculated with the assumption that 40% of the total Site area would be irrigated. Based on Table 4.4.1 of the Town of Castle Rock’s Water System Design Criteria Manual, the irrigation demand is calculated as 3,750 GPD per acre of irrigated land. 40% of the 9.03 total acres is 3.61 acres, therefore the calculated irrigation demand is 13,545 GPD (564.4 GPH).

Water demand calculations can be found in Appendix A.

6. Existing Water System

The proposed development will be served by the Town of Castle Rock’s water infrastructure. Currently, a 12-inch PVC water main exists in Mikelson Boulevard and Mitchell Street. Two stubs are provided off the main in Mitchell Street and will be used for the proposed connection points. The connections to the existing stubs are proposed within the Green pressure zone.

No known bottlenecks or shortcomings are anticipated for water distribution. The fire flow test results, taken in the vicinity of the proposed connection points, show static pressures of 92 psi pre-test and 91 psi post-test. The fire flow test and flow rate has been provided in Appendix C of this report.

The MDD plus the maximum fire flow is computed to be 1556.8 GPM at full build-out. The pump station capacity for the Founders WTP Pump Station is stated as 3,400 GPM. Since the required MDD plus max fire flow is less than the capacity of the Founders WTP Pump Station, it will have the capacity to serve the Site.

7. Existing Water Facilities

Based on the 2017 Water and Wastewater Master Plans, it appears that the Site has been considered and the proposed site appears to be in compliance with the water demands anticipated in the master plans. The site is part of the Founders Village Planned Development zone which is not yet fully developed. The site is within the Green

Pressure Zone and east of storage tank 16. Tank 16 has an active storage capacity of 3.11 Million Gallons. The lowest elevation proposed on the Site is 6544.45ft, which is above the Lowest elevation served within the Green Pressure Zone of 6537ft. The highest proposed elevation proposed on the Site is 6582.80ft. The required storage of the proposed development is 0.262 Million Gallons, which is less than the total capacity of tank 16, therefore tank 16 will be able to serve the Site. Water storage calculations can be found in Appendix B.

The anticipated minimum and maximum static pressures are 91 psi and 92 psi, respectively. A fire flow test was conducted by the Utilities Department on May 31, 2022, results can be found in Appendix C.

8. Proposed Water System

The proposed water design will include an internal 8-inch loop that will run through the private drives and connect to the existing water stubs from the main in Mitchell Street as previously mentioned. Unit clusters will be serviced by a single water meter. Service lines will branch after the meter to deliver water to the individual units. No supply facilities are proposed for the Site. See Appendix F to see the proposed water mains and service layout.

Any future development of the existing water infrastructure needed to serve this Site is the responsibility of the Developer. It is not anticipated that the proposed SFEs will exceed the allocated number to the Founders Village Planned Development Zone. No assumptions were noted in the Town's Water Master Plan.

There are three residential building types proposed, 1-Bedroom Duplex, 2-Bedroom, and 3-Bedroom. All of which will be equipped with a NFPA 13-R sprinkler system. The 1-Bedroom Duplex building type is 1,276-square feet of construction type V-B, therefore it will have a required fire flow of 1,500 gpm at 20 psi for a duration of 2 hours. The 2-Bedroom building type is 962-square feet of construction type V-B, therefore it will have a required fire flow of 1,500 gpm at 20 psi for a duration of 2 hours. The 3-Bedroom building type is 1,289-square feet of construction type V-B, therefore it will have a required fire flow of 1,500 gpm at 20 psi for a duration of 2 hours.

The Fire Flow Confirmation Memo can be found in Appendix A.

According to Section 16.08.040 of the Town of Castle Rock municipal code, the land dedication requirement for this development will be the following:

$$105 \text{ Dwelling Units} * 0.0027 \text{ Acres/DU} = \mathbf{0.2835 \text{ acres}}$$

As stated earlier in this report, easements will be provided around water mains, fire hydrants, public storm and sanitary sewer mains outside of the public rights-of-way in

accordance with the Town of Castle Rock (Town) standards regarding location and size. The proposed easements will be dedicated with the new plat.

There are no anticipated areas that could potentially be difficult to maintain.

9. Proposed Water System Analysis & Modeling

A static WaterCAD analysis was performed to evaluate the capacity of the proposed 8-inch main. Based on the 2017 City's Water Master Plan the Site lies within the green pressure zone. The green pressure zone has a max HGL of 6824 ft. This HGL was utilized at the reservoirs in this analysis. Proposed site elevations (6544.45 ft – 6582.80 ft) are above the Lowest elevation served within the Green Pressure Zone of 6537ft. A Hazen Williams 'C' Factor of 120 was used.

The City of Castle Rock Water Criteria manual specifies 260 gpd/dwelling unit which translates to 0.181 gallons per minute demand per unit. To evaluate demands throughout the site nodes for each cluster of units utilize this demand multiplied by the number of units served in each cluster. Max and Peak Hour demand scenarios use the specified demand factors for each, 2.5 and 5.5 respectively. Junctions noted are named alphabetically with a dash and a number. The number represents the number of units served by the junction. Network pressures remained within the acceptable limits of 43 psi – 125 psi. Static Network pressures with no domestic demand were between 101 psi and 105 psi for 20% tank stage and 109 psi and 113 psi for 100% tank Stage. Static Network pressures for fire demand scenarios were between 94 psi and 105 psi.

Pipe velocities for each demand scenario were below the maximum allowable limits. The peak hour demand had a maximum velocity of 0.35 ft/s which is below the maximum 10 ft/s. Max Day demand had a maximum velocity of 0.14 ft/s which is below the maximum 5 ft/s. Max Day demand and fire flow had a maximum velocity of 9.67 ft/s which is below the maximum 15 ft/s. For the fire scenario pipe "p-1" was closed to isolate the loop through the site from each end. No transmission mains are proposed with this development. See Appendix C for junction demands and pressures.

A fire flow test was performed by the Utilities Department on May 31, 2022. Hydrant 2103 was tested for pressure, resulting in a pre-test static pressure of 92 psi, a residual pressure of 70 psi, and a post-test static pressure of 91 psi. Hydrant 2102 was tested for flowing using a 4" orifice. The calculated flowrate and estimated discharge volume were reported as 1,931 GPM and 3,862 gallons, respectively. The results yielded a calculated flow rate of 1,931 GPM at 34 psi (pitot). The fire flow test and flow rate has been provided in Appendix C of this report along with a map of the hydrant locations.

III. POTENTIAL SUBDIVISION IMPROVEMENTS AGREEMENT (SIA) ITEM

There are no anticipated items to be inspected as public improvements.

IV. POTENTIAL PERMITTING REQUIREMENT

There are no additional permitting requirements above and beyond the permitting requirements of the Town of Castle Rock

V. PROPOSED WASTEWATER INFRASTRUCTURE

1. Calculated Wastewater Flows

Wastewater demands for the Bella Mesa development are shown below:

AVILLA BELLA MESA

SANITARY SEWER DESIGN FLOW CALCULATIONS

<i>SITE AREA</i>	<i>UNITS</i>	<i>DENSITY</i>	<i>FLOW PER UNIT*</i>	<i>AVERAGE FLOW</i>	<i>AVERAGE FLOW</i>	<i>CALCULATED PEAK FACTOR*</i>	<i>MAX PEAK FACTOR*</i>	<i>PEAK DESIGN FLOW RATE**</i>	<i>PEAK FLOW</i>
<i>acres</i>		<i>units/acre</i>	<i>GPD</i>	<i>GPD</i>	<i>MGPD</i>			<i>GPD</i>	<i>CFS</i>
9.03	105	11.6	130	13,650.0	0.0137	7.51	5	69,615.0	0.108

* Per City of Castle Rock

** Includes infiltration

Sanitary design flows can also be found in Appendix D.

Total Average Daily Flow = **13,650 GPD**
= **9.48 GPM**
= **0.0211 CFS**

Peak Flow: Total Site

Peaking Factor = $3.65 * [\text{Average Flow (MGD)}]^{-0.168}$, maximum PF = 5.0
= $3.65 * [0.0137]^{-0.168} = 7.51$, **Use 5.0**

Average Daily Flow * Peaking Factor: $13,650 \text{ GPD} * 5.0 = \mathbf{68,250 \text{ GPD}}$
= $68,250 \text{ GPD} / 1440 \text{ min/day} = \mathbf{47.40 \text{ GPM}}$

Peak Flow = 0.068 MGD
= 0.108 CFS

2. Existing Wastewater System

The Site will be connecting to an existing 8-inch sanitary sewer line located in Mickelson Boulevard which will convey wastewater to the west. The Site falls entirely in the Mitchell Creek Lift Station Basin, as shown in Figure 3.1 in the 2016 Town of Castle Rock Wastewater Master Plan, which can be found in Appendix F. The Mitchell Creek Lift Station has a build out capacity of 2,945 SFEs and reported a use, as of 2016, of 2,054

SFEs. Therefore, the Mitchell Creek Lift Station has capacity to serve the 68.25 SFEs for this project. No known bottlenecks or shortcomings are anticipated for the proposed wastewater collection system. There were no assumptions in the Town's Wastewater Master Plan regarding the proposed development area.

3. Proposed Wastewater System

The proposed 8-inch PVC sanitary sewer will be located in the internal private drive. 4-inch PVC service laterals will be extended between buildings to provide service to a maximum of 11 units. The sanitary sewer mains within the private drives are proposed at 0.63% slope or steeper and will convey wastewater from the residential buildings to the existing 8-inch sanitary sewer main within Mickelson Boulevard. See Appendix F to see the proposed sewer mains and service layout.

A Sanitary Sewer Operations and Maintenance Manual can be found in Appendix G, which outlines how the proposed sanitary sewer system is designed and will be maintained in the future, to mitigate any potential issues with the sanitary sewer system.

Any future development of the existing wastewater infrastructure needed to serve this Site is the responsibility of the Developer.

There are no proposed wastewater facilities such as lift stations, force mains, or pretreatment facilities proposed for this development.

As stated previously in this report, the land dedication requirement for this development will be 0.2835 acres. As stated earlier in the report, easements will be provided around sanitary sewer mains outside of the public rights-of-way in accordance with the Town of Castle Rock (Town) standards regarding location and size. The proposed easements will be dedicated with the new plat.

4. Proposed Wastewater System Analysis & Modeling

Due to the absence of modeling of the existing sanitary sewer network under the as-built condition, analysis has been provided for the on-site pipe. In order to provide self-cleaning sewer velocities of 2.0 ft/s or greater for the peak hour sewer flows the on-site sewer main will need to have pipe slopes of 0.63% or greater. A hydraulic analysis of the on-site average and peak hour flow for the pipe connecting to the existing main and the service with the most tributary SFEs can be found in Appendix E.

Analysis has been provided for the 8-inch PVC main serving the Site at a slope of 0.63 percent, using a Manning's "n" coefficient of 0.011. Under peak loading conditions from the Site, the pipe is flowing at 14% full at a velocity of 2.02 feet per second. As the main is running above the 0.40 percent minimum, flowing above the minimum of 2.0 feet per

second, and does not exceed 75% of the maximum pipe flow, this sanitary system is in accordance with Chapter 4 of the Town of Castle Rock's Wastewater Manual.

Pipe Tabulations for the Site are shown below:

Pipe ID	Pipe Size	Pipe Slope (%)	Upstream MH ID	Downstream MH ID	Tributary SFEs	Average Daily Flow (ADF) (GPM)	Peaking Factor	Peak Design Flow (PDF) (GPM)	Full Pipe Flow (GPM)	Max Capacity (GPM)	PDF/Max Capacity (%)
A-1	8"	0.63%	A2	A1	68.25	9.48	5	47.40	429.04	321.78	14.73%
A-2	8"	0.63%	A3	A2	54.60	7.58	5	37.92	429.04	321.78	11.78%
A-3	8"	0.63%	A4	A3	42.25	5.87	5	29.34	429.04	321.78	9.12%
A-4	8"	0.63%	A5	A4	42.25	5.87	5	29.34	429.04	321.78	9.12%
A-5	8"	0.63%	A6	A5	24.70	3.43	5	17.15	429.04	321.78	5.33%
A-6	8"	0.63%	A7	A6	21.45	2.98	5	14.90	429.04	321.78	4.63%
A-7	8"	0.63%	A8	A7	21.45	2.98	5	14.90	429.04	321.78	4.63%
A-8	8"	0.63%	A9	A8	5.20	0.72	5	3.61	429.04	321.78	1.12%
B-1	8"	3.01%	B1	A2	7.15	0.99	5	4.97	937.69	703.2675	0.71%
C-1	8"	0.63%	C1	A2	3.90	0.54	5	2.71	429.04	321.78	0.84%
D-1	8"	0.63%	D1	A3	3.25	0.45	5	2.26	429.04	321.78	0.70%
E-1	8"	0.63%	E1	A5	3.90	0.54	5	2.71	429.04	321.78	0.84%
F-1	8"	0.63%	F1	A6	3.25	0.45	5	2.26	429.04	321.78	0.70%

The pipe tabulation table can also be found in Appendix E.

Pipe reports for both the 8" main and a 4" service lateral under peak loading conditions are included in Appendix E. Service Line B serves the most dwelling units (11), and was chosen to be modeled as the service line as all services have the same slope of 2% and it would have the highest flow. The Overall Sanitary System Plan can be found in Appendix F.

VI. POTENTIAL SUBDIVISION IMPROVEMENTS AGREEMENT (SIA) ITEMS

There are no anticipated items to be inspected as public improvements.

VII. POTENTIAL PERMITTING REQUIREMENTS

There are no additional permitting requirements above and beyond the permitting requirements of the Town of Castle Rock.

VIII. Conclusion

Water and sanitary sewer service will be provided through both existing and proposed facilities. Proposed water and wastewater loads & demands on the existing infrastructure appear to be in compliance with town of Castle Rock water and wastewater design criteria. Adverse impacts to the existing infrastructure due to the development of the subject Site are not anticipated.

REFERENCES

1. 2016 Wastewater Master Plan Update, Castle Rock Water Engineering.
2. 2017 Water Master Plan Update, Castle Rock Water Engineering.
3. Wastewater Collection Design Criteria Manual, Town of Castle Rock, December 2018
4. Water System Design Criteria Manual, Town of Castle Rock, December 2018

APPENDIX A – WATER DEMANDS

Castle Rock Fire and Rescue Department

300 Perry Street - Castle Rock, CO 80104
(303) 660-1066

PLAN REVIEW

PROJECT LOCATION Mitchell Street and Mikelson Blvd	PROJECT # 4984
PROJECT DESCRIPTION Avilla Founders Village - Mikelson and Mitchel - NEW DEVELOPMENT	OCCUPANCY ID
AREA INVOLVED IN ENTIRE PROJECT Avilla Founders Village - Mikelson and Mitchel - NEW DEVELOPMENT	ALTERNATE ID

PERMIT # 13522	PERMIT DESCRIPTION Fire Flow Evaluation		
AREA AFFECTED BY THIS PERMIT Avilla Founders Village - Mitchell Street and Mikelson Blvd - FIREFLOW		SQUARE FEET	VALUE OF WORK
CONTACT NAME	NOTIFY BY	NOTIFY AT	
REASON FOR SUBMITTAL Review Only	PLAN REVIEWER ssullivan	SUBMITTED 10/25/2022	COMPLETED 10/27/2022

CONTRACTOR See Trakit (ID 3577)	BUSINESS PHONE	FAX NUMBER
STREET ADDRESS	CITY, STATE, ZIP	
E-MAIL ADDRESS	STATE LICENSE NUMBER	

CASTLE ROCK FIRE AND RESCUE DEPARTMENT

** PLAN REVIEW LETTER **

<< PLEASE READ THE FOLLOWING CAREFULLY >>

On 10-27-2022 a review was conducted on the submitted FIRE FLOW requirements for the Avilla Bella Mesa, located on (no exact address designated) Mitchell Street. The following comments pertain to the project:

CODE USED IN REVIEW:

The submitted plans have been reviewed for compliance to the 2018 edition of the International Fire Code (IFC).

REVIEW COMMENTS:

INFORMATION ON THE PROJECT:

The project consists of a new medical office building that will be fully sprinkler protected. From the information currently known to the fire department the following comments pertain to the required fire flows:

The largest proposed building is a presumed 1-Story, 1,289 square foot building, constructed of Type V-B construction, with a full NFPA 13 Fire Sprinkler system. The base required fire flow as noted in the 2018 IFC - Table B105.1, would be: 1,500 gpm for a duration of 2-Hours

FINAL FIRE FLOW REQUIRED:

2018 International Fire Code (IFC), Appendix B, as amended by the Town of Castle Rock requires a MINIMUM fire flow requirement of 1500 gpm @ 20 psi for a duration of 2-hours. This fire flow shall be from 1 fire hydrant within 250 feet of the structure.



BUILDING INFORMATION:

Type of Construction: The proposed project is shown as being located in a building of V-B

Occupancy Classification: The proposed occupancy classification for this project has been reviewed for compliance with the 2018 IFC and IBC. The occupancy classification of the project is shown as being a Group "R-3" Occupancy.

ACTION TAKEN BY THE FIRE DEPARTMENT:

Approval of the above fire flow is based on the information known to the fire department as of the date of this review, as the result of additional information or inspections if the fire flow changes, corrective action may be required.

Should you have any questions please feel free to contact me.

Kevin Sullivan - Fire Prevention Officer - Ksullivan@crgov.com

DATE RECEIVED	BY:		
DATE FEE PAID	PLAN REVIEW FEE	CHECK #	RECEIPT #
10/27/2022	0.00		

PICKED UP BY	COMPANY	DATE





DENVER • DALLAS/FORT WORTH

Castle Rock Fire and Rescue Department
300 Perry Street
Castle Rock, CO 80104

October 25, 2022

RE: Confirmation Memo of Required Fire Flow

To Life Safety Division,

Please accept the following required fire flow evaluations based upon the currently adopted 2018 International Fire Code for review and confirmation for each of the following proposed buildings.

Duplex – 1 Bedroom Unit

Total Fire Flow Calculation Area: **1,276**-square feet

Building Construction Type: **V-B**

Are fire sprinklers provided throughout this building? **YES**

Are you proposing a reduction in Required Fire Flow for fire sprinklers? **YES**

Are fire walls provided in this building? **No**

Reference Appendix B, Table B105.1

Required Fire Flow: **1,500** gpm at 20-psi

Flow Duration: **2**-hours

Calculated Fire Flow including reduction for sprinklers: **1,500** gpm at 20psi

Flow Duration: **2**-hours

Reference Appendix C, Table C105.1

Required Number of Fire Hydrants: **1**

Average Spacing: **500 feet**

Maximum required distance from Fire Hydrant to Building: **250 feet**, as a truck would drive.

2 Bedroom Unit

Total Fire Flow Calculation Area: **962**-square feet

Building Construction Type: **V-B**

Are fire sprinklers provided throughout this building? **YES**

Are you proposing a reduction in Required Fire Flow for fire sprinklers? **YES**

Are fire walls provided in this building? **No**

Reference Appendix B, Table B105.1

Required Fire Flow: **1,500** gpm at 20-psi

Flow Duration: **2**-hours

Calculated Fire Flow including reduction for sprinklers: **1,500** gpm at 20psi

Flow Duration: **2**-hours

Reference Appendix C, Table C105.1



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Required Number of Fire Hydrants: **1**

Average Spacing: **500 feet**

Maximum required distance from Fire Hydrant to Building: **250 feet**, as a truck would drive.

Building 3

Total Fire Flow Calculation Area: **1,289**-square feet

Building Construction Type: **V-B**

Are fire sprinklers provided throughout this building? **YES**

Are you proposing a reduction in Required Fire Flow for fire sprinklers? **YES**

Are fire walls provided in this building? **No**

Reference Appendix B, Table B105.1

Required Fire Flow: **1,500** gpm at 20-psi

Flow Duration: **2**-hours

Calculated Fire Flow including reduction for sprinklers: **1,500** gpm at 20psi

Flow Duration: **2**-hours

Reference Appendix C, Table C105.1

Required Number of Fire Hydrants: **1**

Average Spacing: **500 feet**

Maximum required distance from Fire Hydrant to Building: **250 feet**, as a truck would drive.

Design Engineers Signature: _____ Date: 10-25-2022

The determined Required Fire Flow, Number of Fire Hydrants and Hydrant Spacing as shown above satisfy the fire protection requirements of the Castle Rock Fire and Rescue Department.

Final fire hydrant placement will be determined and approved during the Site Development (SDP) and/or Construction Document (CD) review phase.

Castle Rock Fire Signature: _____ Date: _____

Fire Department Plan Review Number: **Fire Review 13522**

Castle Rock Fire & Rescue Department



These plans have been reviewed and accepted subject to any/all corrections in compliance with the International Fire Code as amended and adopted by the Town of Castle Rock.

Comments and Corrections will be in the attached plan review letter and/or marked on the plans.

All projects are subject to changes in the field in accordance with the current codes and ordinances.

Completed by: *K. J. Sullivan*

Kevin Sullivan
ICC FIRE INSPECTOR II : 9533547
COLORADO FIRE INSPECTOR III: 216312661

Avilla Bella Mesa Utility Report Calculation
WATER DESIGN FLOW CALCULATIONS

<i>SITE AREA</i>	<i>UNITS</i>	<i>DENSITY</i>	<i>POTABLE WATER AVERAGE DAILY DEMAND *</i>	<i>IRRIGATION WATER AVERAGE DAILY DEMAND *</i>	<i>SINGLE FAMILY EQUIVALENT (SFE)</i>	<i>POTABLE AVERAGE DAILY FLOW</i>	<i>POTABLE AVERAGE DAILY FLOW</i>	<i>IRRIGATION AVERAGE DAILY FLOW**</i>	<i>IRRIGATION AVERAGE DAILY FLOW**</i>	<i>MAXIMUM DAY DEMAND/ AVERAGE DAY DEMAND</i>		<i>POTABLE WATER PEAK HOUR DEMAND/ AVERAGE DAY DEMAND</i>
<i>acres</i>		<i>units/acre</i>	<i>gpd/dwelling unit</i>	<i>gpd/irrigated acre</i>	<i>SFE</i>	<i>GPD</i>	<i>MGD</i>	<i>GPD</i>	<i>MGD</i>			
9.03	105	11.6	260	3750	68.25	27,300.0	0.0273	13,545.0	0.0135	2.50		5.50

<i>POTABLE WATER MAXIMUM DAY DEMAND</i>	<i>POTABLE WATER MAXIMUM DAY DEMAND</i>	<i>POTABLE WATER PEAK HOUR DEMAND</i>	<i>IRRIGATION WATER PEAK HOUR DEMAND</i>	<i>POTABLE WATER MAXIMUM DAY DEMAND FLOW</i>	<i>POTABLE WATER PEAK HOUR DEMAND FLOW</i>	<i>IRRIGATION WATER PEAK HOUR DEMAND FLOW</i>	FIRE FLOW REQUIRMENTS	<i>TWO HOUR FIRE FLOW STORAGE</i>	<i>MAXIMUM DAILY DEMAND WATER STORAGE</i>	<i>TOTAL STORAGE</i>
<i>GPD</i>	<i>MGD</i>	<i>GPH</i>	<i>GPH</i>	<i>CFS</i>	<i>CFS</i>	<i>CFS</i>	<i>gpm</i>	<i>gal</i>	<i>gal</i>	<i>MG</i>
68,250.0	0.0682500	6,256.3	564.4	0.106	0.232	0.021	1500.00	180000.00	81,795.00	0.262

* Per Castle Rock Water Criteria Manual

** Assumed 40%of site is irrigated

APPENDIX B – WATER STORAGE



Avilla Founders Village
Water System Design Criteria – Storage Requirements
HKS Project #: 210431
ToCR Project #: SDP 21-0059
Date: 06/03/2022

Storage Volume (MG) = Max Day Demand (MG) + Fire Flow (MG)

Town of Caste Rock Design Demand = 260 GPD/Dwelling Unit

Town of Caste Rock Irrigation Design Demand = 3,750 GPD/Irrigated Acre

Proposed Unit Count = 105

Irrigated Acreage = 9.03 x 0.40

- Assumed 40% Irrigated

Max Day Demand (MG) = [(Domestic ADD) x (Max Day Factor)] + Irrigation ADD

*Max Day Demand (MG) = [(Unit Count) x (260 GPD) x (2.5)] +
[(Site Acreage) x (0.40) x (3,750 GPD)]*

Max Day Demand (MG) = [(105) x (260 GPD) x (2.5)] + [(9.03) x (0.40) x (3,750 GPD)]

*Max Day Demand (MG) = 81,795 gal = **0.082 MG***

Fire Flow (MG) = (Fire Flow) x (60 minutes) x (2 hours)

Fire Flow (MG) = (1,500 GPM) x (60 Minutes) x (2 hours)

*Fire Flow (MG) = 180,000 gal = **0.180 MG***

Storage Volume (MG) = 0.082 MG + 0.180 MG

*Storage Volume (MG) = **0.262 MG***

APPENDIX C – WATER HYDRAULIC ANALYSIS & MODELING



TOWN OF CASTLE ROCK FIRE FLOW TEST FORM

5/27/2022

Colton Hochevar

303-623-6300

chochevar@hkseng.com

F F12-2022
P _____

N Michell Street and Rock Canyon Trail

Test Conducted By: Joey W Steven T Michelle S

Date: 5/31/22

Start Time 11:10

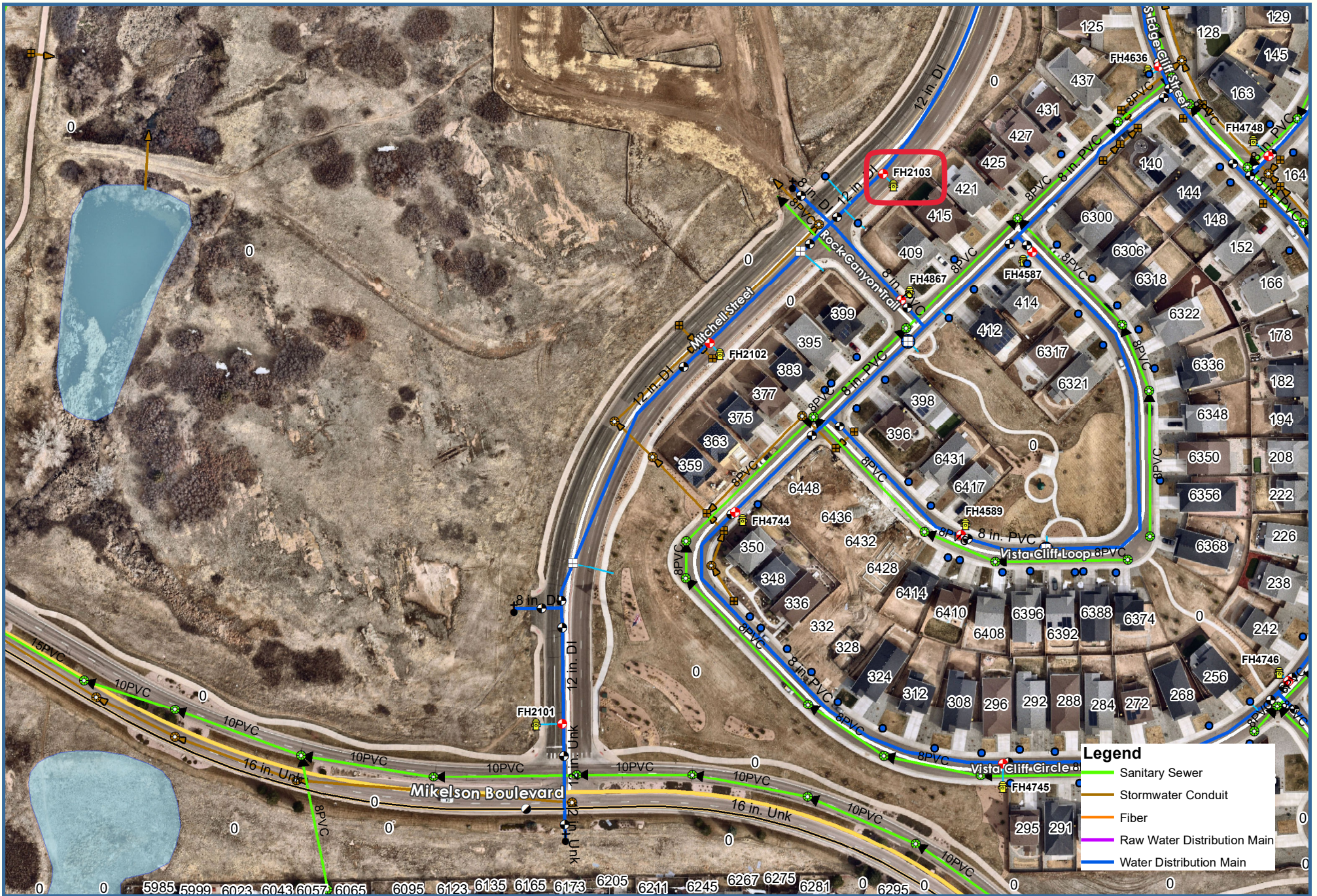
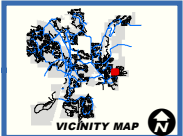
End Time 11:12

Pressure Hydrant

Hydrant ID	FH	2103	
Pre-test Static Pressure (Ps1)		92	psi
Residual Pressure (Pr)		70	psi
Post-test Static Pressure (Ps2)		91	psi
Flowing Hydrant			
Hydrant ID	FH	2102	
Orifice Side (D)		4"	in
Main Size (Dp)		12"	in
Calculated Flowrate (Qr)		1931	gpm
Estimated Volume Discharged (Q)		3862	gallons

Notes: Please see map attached

Pedo-34 → 1931



0 70 140 280 420 Feet

Date: 5/27/2022 1 inch = 166 feet

Document Path: \\CRSAN1\UTUsers\jwells\Desktop\JW Letter Landscape.mxd



Disclaimer: The data presented has been compiled from various sources, each of which introduces varying degrees of inaccuracies or inconsistencies. Such discrepancies in data are inherent and in supplying this product the Town of Castle Rock assumes no liability for its use or accuracy. Questions or comments regarding the cartographic composition of this map including, but not limited to, errors, omissions, corrections, and/or updates, should be directed to the Utilities Department, Town of Castle Rock, (720) 733-6056. Copyright 2020, Town of Castle Rock Utilities Mapping.

**CASTLE ROCK
UTILITIES MAP
(INTERNAL USE ONLY)**

Scenario: 0 Demand 100% Tank



Scenario: 0 Demand 20% Tank
Current Time Step: 0.000 h
FlexTable: Pipe Table

Label	Length (Scaled) (ft)	Diameter (in)	Material	Hazen- Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/1000ft)	Headloss (ft)
P-1	41	8.0	PVC	120.0	0	0.00	0.000	0.00
P-2	11	8.0	PVC	120.0	0	0.00	0.000	0.00
P-3	14	12.0	PVC	120.0	0	0.00	0.000	0.00
P-4	16	12.0	PVC	120.0	0	0.00	0.000	0.00
P-5	23	8.0	PVC	120.0	0	0.00	0.000	0.00
P-6	24	12.0	PVC	120.0	0	0.00	0.000	0.00
P-7	27	8.0	PVC	120.0	0	0.00	0.000	0.00
P-8	53	8.0	PVC	120.0	0	0.00	0.000	0.00
P-9	54	8.0	PVC	120.0	0	0.00	0.000	0.00
P-10	56	8.0	PVC	120.0	0	0.00	0.000	0.00
P-11	83	8.0	PVC	120.0	0	0.00	0.000	0.00
P-12	86	8.0	PVC	120.0	0	0.00	0.000	0.00
P-13	105	8.0	PVC	120.0	0	0.00	0.000	0.00
P-14	154	8.0	PVC	120.0	0	0.00	0.000	0.00
P-15	145	8.0	PVC	120.0	0	0.00	0.000	0.00
P-16	348	8.0	PVC	120.0	0	0.00	0.000	0.00
P-17	636	12.0	PVC	120.0	0	0.00	0.000	0.00
P-18	11	8.0	PVC	120.0	0	0.00	0.000	0.00
P-19	84	8.0	PVC	120.0	0	0.00	0.000	0.00
P-20	11	8.0	PVC	120.0	0	0.00	0.000	0.00
P-21	26	8.0	PVC	120.0	0	0.00	0.000	0.00

K:\210431\Documents\Utilities\Water\WaterCAD\Avilla Bella Mesa.wtg

Scenario: 0 Demand 20% Tank
Current Time Step: 0.000 h
FlexTable: Junction Table

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)
A-11	6,570.70	0	101
B-10	6,564.86	0	104
C-1	6,564.20	0	104
D-12	6,563.64	0	104
E-8	6,563.30	0	105
F-5	6,563.00	0	105
FH1	6,565.80	0	103
FH2	6,563.00	0	105
FH3	6,564.00	0	104
FH4	6,569.00	0	102
G-7	6,562.11	0	105
H-5	6,562.00	0	105
J-12	6,566.22	0	103
K-12	6,567.31	0	103
L-11	6,569.00	0	102
M-12	6,569.00	0	102
Y	6,571.00	0	101
Z	6,571.00	0	101

K:\210431\Documents\Utilities\Water\WaterCAD\Avilla Bella Mesa.wtg

Scenario: 0 Demand 100% Tank
Current Time Step: 0.000 h
FlexTable: Junction Table

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)
A-11	6,570.70	0	110
B-10	6,564.86	0	112
C-1	6,564.20	0	112
D-12	6,563.64	0	113
E-8	6,563.30	0	113
F-5	6,563.00	0	113
FH1	6,565.80	0	112
FH2	6,563.00	0	113
FH3	6,564.00	0	112
FH4	6,569.00	0	110
G-7	6,562.11	0	113
H-5	6,562.00	0	113
J-12	6,566.22	0	112
K-12	6,567.31	0	111
L-11	6,569.00	0	110
M-12	6,569.00	0	110
Y	6,571.00	0	109
Z	6,571.00	0	109

K:\210431\Documents\Utilities\Water\WaterCAD\Avilla Bella Mesa.wtg

Scenario: 0 Demand 100% Tank
Current Time Step: 0.000 h
FlexTable: Pipe Table

Label	Length (Scaled) (ft)	Diameter (in)	Material	Hazen- Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/1000ft)	Headloss (ft)
P-1	41	8.0	PVC	120.0	0	0.00	0.000	0.00
P-2	11	8.0	PVC	120.0	0	0.00	0.000	0.00
P-3	14	12.0	PVC	120.0	0	0.00	0.000	0.00
P-4	16	12.0	PVC	120.0	0	0.00	0.000	0.00
P-5	23	8.0	PVC	120.0	0	0.00	0.000	0.00
P-6	24	12.0	PVC	120.0	0	0.00	0.000	0.00
P-7	27	8.0	PVC	120.0	0	0.00	0.000	0.00
P-8	53	8.0	PVC	120.0	0	0.00	0.000	0.00
P-9	54	8.0	PVC	120.0	0	0.00	0.000	0.00
P-10	56	8.0	PVC	120.0	0	0.00	0.000	0.00
P-11	83	8.0	PVC	120.0	0	0.00	0.000	0.00
P-12	86	8.0	PVC	120.0	0	0.00	0.000	0.00
P-13	105	8.0	PVC	120.0	0	0.00	0.000	0.00
P-14	154	8.0	PVC	120.0	0	0.00	0.000	0.00
P-15	145	8.0	PVC	120.0	0	0.00	0.000	0.00
P-16	348	8.0	PVC	120.0	0	0.00	0.000	0.00
P-17	636	12.0	PVC	120.0	0	0.00	0.000	0.00
P-18	11	8.0	PVC	120.0	0	0.00	0.000	0.00
P-19	84	8.0	PVC	120.0	0	0.00	0.000	0.00
P-20	11	8.0	PVC	120.0	0	0.00	0.000	0.00
P-21	26	8.0	PVC	120.0	0	0.00	0.000	0.00

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Scenario: Max Day
Current Time Step: 0.000 h
FlexTable: Junction Table

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)
A-11	6,570.70	5	101
B-10	6,564.86	5	104
C-1	6,564.20	0	104
D-12	6,563.64	5	104
E-8	6,563.30	0	105
F-5	6,563.00	2	105
FH1	6,565.80	0	103
FH2	6,563.00	0	105
FH3	6,564.00	0	104
FH4	6,569.00	0	102
G-7	6,562.11	0	105
H-5	6,562.00	2	105
J-12	6,566.22	5	103
K-12	6,567.31	5	103
L-11	6,569.00	5	102
M-12	6,569.00	5	102
Y	6,571.00	0	101
Z	6,571.00	0	101

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Scenario: Max Day
Current Time Step: 0.000 h
FlexTable: Pipe Table

Label	Length (Scaled) (ft)	Diameter (in)	Material	Hazen- Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/1000ft)	Headloss (ft)
P-1	41	8.0	PVC	120.0	-7	0.05	0.000	0.00
P-2	11	8.0	PVC	120.0	13	0.08	0.000	0.00
P-3	14	12.0	PVC	120.0	-11	0.03	0.000	0.00
P-4	16	12.0	PVC	120.0	-10	0.03	0.000	0.00
P-5	23	8.0	PVC	120.0	-17	0.11	0.021	0.00
P-6	24	12.0	PVC	120.0	20	0.06	0.000	0.00
P-7	27	8.0	PVC	120.0	3	0.02	0.000	0.00
P-8	53	8.0	PVC	120.0	-13	0.08	0.009	0.00
P-9	54	8.0	PVC	120.0	-3	0.02	0.000	0.00
P-10	56	8.0	PVC	120.0	-12	0.08	0.000	0.00
P-11	83	8.0	PVC	120.0	8	0.05	0.000	0.00
P-12	86	8.0	PVC	120.0	-3	0.02	0.000	0.00
P-13	105	8.0	PVC	120.0	-17	0.11	0.014	0.00
P-14	154	8.0	PVC	120.0	-22	0.14	0.022	0.00
P-15	145	8.0	PVC	120.0	13	0.08	0.010	0.00
P-16	348	8.0	PVC	120.0	19	0.12	0.014	0.00
P-17	636	12.0	PVC	120.0	-3	0.01	0.000	0.00
P-18	11	8.0	PVC	120.0	-5	0.03	0.000	0.00
P-19	84	8.0	PVC	120.0	-5	0.03	0.000	0.00
P-20	11	8.0	PVC	120.0	-7	0.05	0.046	0.00
P-21	26	8.0	PVC	120.0	-7	0.05	0.000	0.00

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Scenario: Max Day + Fire (P-1 Closed)
Current Time Step: 0.000 h
FlexTable: Pipe Table

Label	Length (Scaled) (ft)	Diameter (in)	Material	Hazen- Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/1000ft)	Hydraulic Grade Line (ft)
P-1	41	8.0	PVC	120.0	0	0.00	0.000	6,804.99
P-2	11	8.0	PVC	120.0	20	0.13	0.047	6,804.99
P-3	14	12.0	PVC	120.0	-131	0.37	0.069	6,805.00
P-4	16	12.0	PVC	120.0	-121	0.34	0.060	6,805.00
P-5	23	8.0	PVC	120.0	-1,567	10.00	85.312	6,785.94
P-6	24	12.0	PVC	120.0	1,346	3.82	5.100	6,805.00
P-7	27	8.0	PVC	120.0	10	0.06	0.000	6,804.99
P-8	53	8.0	PVC	120.0	-1,563	9.97	48.418	6,783.38
P-9	54	8.0	PVC	120.0	5	0.03	0.009	6,804.99
P-10	56	8.0	PVC	120.0	-1,562	9.97	48.404	6,780.69
P-11	83	8.0	PVC	120.0	15	0.10	0.006	6,804.99
P-12	86	8.0	PVC	120.0	5	0.03	0.000	6,804.99
P-13	105	8.0	PVC	120.0	-1,567	10.00	63.375	6,787.93
P-14	154	8.0	PVC	120.0	-1,572	10.03	66.923	6,794.56
P-15	145	8.0	PVC	120.0	20	0.13	0.017	6,804.99
P-16	348	8.0	PVC	120.0	26	0.16	0.025	6,805.00
P-17	636	12.0	PVC	120.0	-226	0.64	0.187	6,804.88
P-18	11	8.0	PVC	120.0	2	0.01	0.000	6,804.99
P-19	84	8.0	PVC	120.0	2	0.01	0.000	6,804.99
P-20	11	8.0	PVC	120.0	0	0.00	0.000	6,778.28
P-21	26	8.0	PVC	120.0	-1,557	9.94	91.032	6,778.28

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Scenario: Max Day + Fire (P-1 Closed)
Current Time Step: 0.000 h
FlexTable: Junction Table

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)
A-11	6,570.70	5	97
B-10	6,564.86	5	96
C-1	6,564.20	0	95
D-12	6,563.64	5	94
E-8	6,563.30	0	93
F-5	6,563.00	2	105
FH1	6,565.80	0	96
FH2	6,563.00	1,557	93
FH3	6,564.00	0	104
FH4	6,569.00	0	102
G-7	6,562.11	0	105
H-5	6,562.00	2	105
J-12	6,566.22	5	103
K-12	6,567.31	5	103
L-11	6,569.00	5	102
M-12	6,569.00	5	102
Y	6,571.00	0	101
Z	6,571.00	0	101

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Scenario: Max Day + Fire (P-14 Closed)
Current Time Step: 0.000 h
FlexTable: Junction Table

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)
A-11	6,570.70	5	79
B-10	6,564.86	5	82
C-1	6,564.20	0	82
D-12	6,563.64	5	82
E-8	6,563.30	0	83
F-5	6,563.00	2	84
FH1	6,565.80	0	81
FH2	6,563.00	1,557	82
FH3	6,564.00	0	88
FH4	6,569.00	0	93
G-7	6,562.11	0	86
H-5	6,562.00	2	86
J-12	6,566.22	5	88
K-12	6,567.31	5	88
L-11	6,569.00	5	90
M-12	6,569.00	5	94
Y	6,571.00	0	101
Z	6,571.00	0	101

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Scenario: Max Day + Fire (P-14 Closed)
Current Time Step: 0.000 h
FlexTable: Pipe Table

Label	Length (Scaled) (ft)	Diameter (in)	Material	Hazen- Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/1000ft)	Hydraulic Grade Line (ft)
P-1	41	8.0	PVC	120.0	1,572	10.03	52.809	6,757.19
P-2	11	8.0	PVC	120.0	1,593	10.16	163.225	6,785.82
P-3	14	12.0	PVC	120.0	-778	2.21	1.860	6,804.97
P-4	16	12.0	PVC	120.0	-722	2.05	1.620	6,804.97
P-5	23	8.0	PVC	120.0	5	0.03	0.000	6,753.36
P-6	24	12.0	PVC	120.0	98	0.28	0.041	6,805.00
P-7	27	8.0	PVC	120.0	1,582	10.10	49.556	6,771.83
P-8	53	8.0	PVC	120.0	10	0.06	0.009	6,753.36
P-9	54	8.0	PVC	120.0	1,577	10.06	59.339	6,770.47
P-10	56	8.0	PVC	120.0	10	0.06	0.000	6,753.36
P-11	83	8.0	PVC	120.0	1,588	10.13	53.722	6,776.27
P-12	86	8.0	PVC	120.0	1,577	10.06	62.770	6,767.24
P-13	105	8.0	PVC	120.0	5	0.03	0.000	6,753.36
P-14	154	8.0	PVC	120.0	0	0.00	0.000	6,753.36
P-15	145	8.0	PVC	120.0	1,593	10.16	54.025	6,784.10
P-16	348	8.0	PVC	120.0	1,598	10.20	55.117	6,804.97
P-17	636	12.0	PVC	120.0	98	0.28	0.040	6,805.00
P-18	11	8.0	PVC	120.0	1,574	10.05	49.081	6,761.85
P-19	84	8.0	PVC	120.0	1,574	10.05	49.103	6,761.30
P-20	11	8.0	PVC	120.0	1,572	10.03	158.751	6,755.04
P-21	26	8.0	PVC	120.0	15	0.10	0.018	6,753.36

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Scenario: Peak Hour
Current Time Step: 0.000 h
FlexTable: Junction Table

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)
A-11	6,570.70	11	101
B-10	6,564.86	10	104
C-1	6,564.20	1	104
D-12	6,563.64	13	104
E-8	6,563.30	0	105
F-5	6,563.00	5	105
FH1	6,565.80	0	103
FH2	6,563.00	0	105
FH3	6,564.00	0	104
FH4	6,569.00	0	102
G-7	6,562.11	7	105
H-5	6,562.00	5	105
J-12	6,566.22	13	103
K-12	6,567.31	13	103
L-11	6,569.00	11	102
M-12	6,569.00	12	102
Y	6,571.00	0	101
Z	6,571.00	0	101

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Scenario: Peak Hour
Current Time Step: 0.000 h
FlexTable: Pipe Table

Label	Length (Scaled) (ft)	Diameter (in)	Material	Hazen- Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/1000ft)	Headloss (ft)
P-1	41	8.0	PVC	120.0	-20	0.13	0.012	0.00
P-2	11	8.0	PVC	120.0	34	0.22	0.093	0.00
P-3	14	12.0	PVC	120.0	-28	0.08	0.000	0.00
P-4	16	12.0	PVC	120.0	-26	0.07	0.000	0.00
P-5	23	8.0	PVC	120.0	-44	0.28	0.084	0.00
P-6	24	12.0	PVC	120.0	47	0.13	0.021	0.00
P-7	27	8.0	PVC	120.0	10	0.07	0.018	0.00
P-8	53	8.0	PVC	120.0	-34	0.21	0.046	0.00
P-9	54	8.0	PVC	120.0	-3	0.02	0.000	0.00
P-10	56	8.0	PVC	120.0	-33	0.21	0.035	0.00
P-11	83	8.0	PVC	120.0	23	0.15	0.018	0.00
P-12	86	8.0	PVC	120.0	-3	0.02	0.000	0.00
P-13	105	8.0	PVC	120.0	-44	0.28	0.075	0.01
P-14	154	8.0	PVC	120.0	-55	0.35	0.117	0.02
P-15	145	8.0	PVC	120.0	34	0.22	0.044	0.01
P-16	348	8.0	PVC	120.0	46	0.29	0.074	0.03
P-17	636	12.0	PVC	120.0	-7	0.02	0.001	0.00
P-18	11	8.0	PVC	120.0	-8	0.05	0.000	0.00
P-19	84	8.0	PVC	120.0	-15	0.09	0.012	0.00
P-20	11	8.0	PVC	120.0	-20	0.13	0.046	0.00
P-21	26	8.0	PVC	120.0	-20	0.13	0.018	0.00

K:\210431\Documents\Utilities\Water\WaterCAD\Avilla Bella Mesa.wtg

APPENDIX D – WASTEWATER FLOWS

AVILLA BELLA MESA

SANITARY SEWER DESIGN FLOW CALCULATIONS

<i>SITE AREA</i>	<i>UNITS</i>	<i>DENSITY</i>	<i>FLOW PER UNIT*</i>	<i>AVERAGE FLOW</i>	<i>AVERAGE FLOW</i>	<i>CALCULATED PEAK FACTOR*</i>	<i>MAX PEAK FACTOR*</i>	<i>PEAK DESIGN FLOW RATE**</i>	<i>PEAK FLOW</i>
<i>acres</i>		<i>units/acre</i>	<i>GPD</i>	<i>GPD</i>	<i>MGPD</i>			<i>GPD</i>	<i>CFS</i>
9.03	105	11.6	130	13,650.0	0.0137	7.51	5	69,615.0	0.108

* Per City of Castle Rock

** Includes infiltration

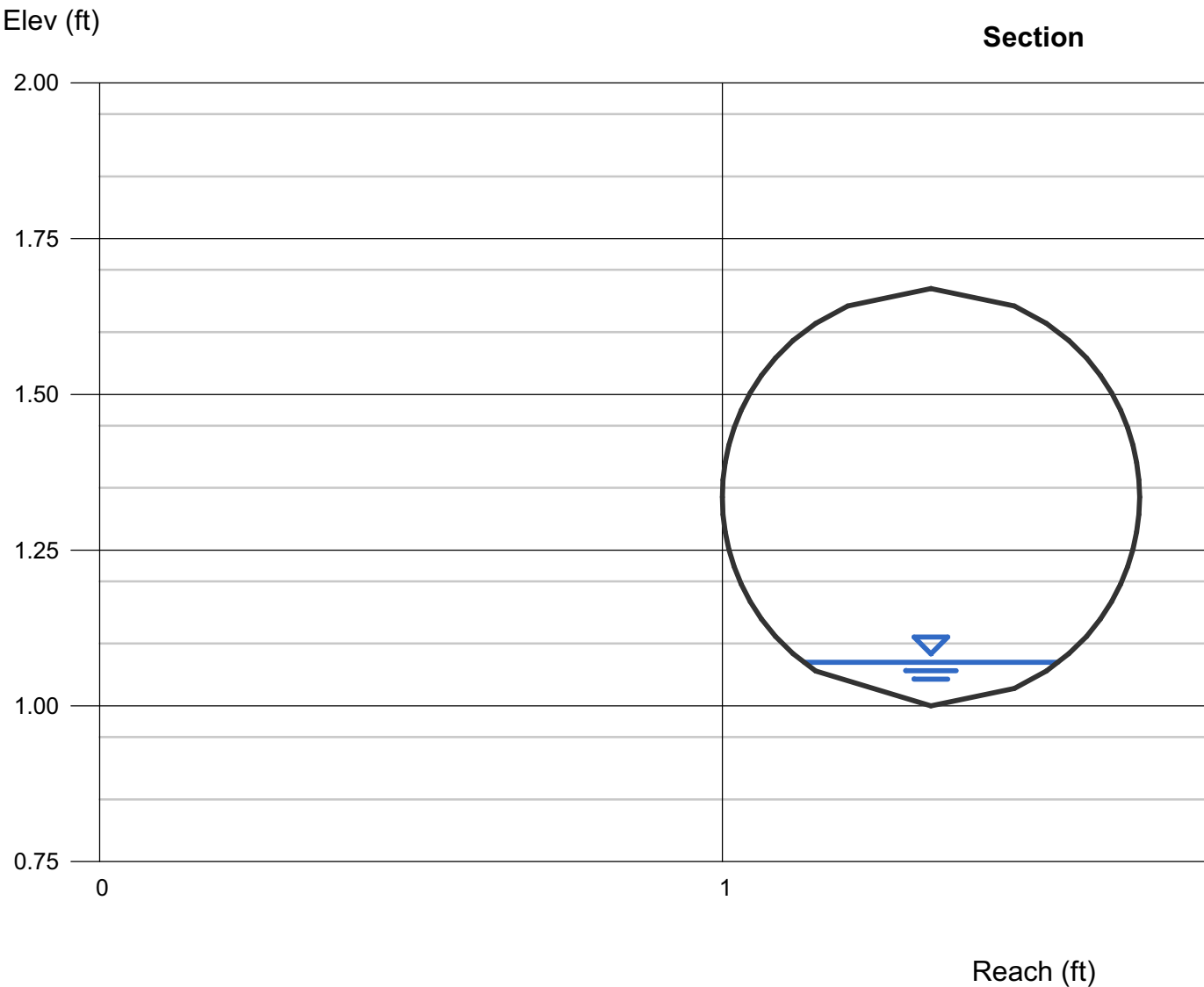
APPENDIX E – WASTEWATER HYDRAULIC MODELING

Avilla Bella Mesa											
Sanitary Sewer Pipe Tabulation											
Pipe ID	Pipe Size	Pipe Slope (%)	Upstream MH ID	Downstream MH ID	Tributary SFEs	Average Daily Flow (ADF) (GPM)	Peaking Factor	Peak Design Flow (PDF) (GPM)	Full Pipe Flow (GPM)	Max Capacity (GPM)	PDF/Max Capacity (%)
A-1	8"	0.63%	A2	A1	68.25	9.48	5	47.40	429.04	321.78	14.73%
A-2	8"	0.63%	A3	A2	54.60	7.58	5	37.92	429.04	321.78	11.78%
A-3	8"	0.63%	A4	A3	42.25	5.87	5	29.34	429.04	321.78	9.12%
A-4	8"	0.63%	A5	A4	42.25	5.87	5	29.34	429.04	321.78	9.12%
A-5	8"	0.63%	A6	A5	24.70	3.43	5	17.15	429.04	321.78	5.33%
A-6	8"	0.63%	A7	A6	21.45	2.98	5	14.90	429.04	321.78	4.63%
A-7	8"	0.63%	A8	A7	21.45	2.98	5	14.90	429.04	321.78	4.63%
A-8	8"	0.63%	A9	A8	5.20	0.72	5	3.61	429.04	321.78	1.12%
B-1	8"	3.01%	B1	A2	7.15	0.99	5	4.97	937.69	703.2675	0.71%
C-1	8"	0.63%	C1	A2	3.90	0.54	5	2.71	429.04	321.78	0.84%
D-1	8"	0.63%	D1	A3	3.25	0.45	5	2.26	429.04	321.78	0.70%
E-1	8"	0.63%	E1	A5	3.90	0.54	5	2.71	429.04	321.78	0.84%
F-1	8"	0.63%	F1	A6	3.25	0.45	5	2.26	429.04	321.78	0.70%

Channel Report

Sanitary Main - Average Loading

Circular		Highlighted	
Diameter (ft)	= 0.67	Depth (ft)	= 0.07
		Q (cfs)	= 0.021
		Area (sqft)	= 0.02
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 1.07
Slope (%)	= 0.63	Wetted Perim (ft)	= 0.44
N-Value	= 0.011	Crit Depth, Yc (ft)	= 0.07
		Top Width (ft)	= 0.41
		EGL (ft)	= 0.09
Calculations			
Compute by:	Known Q		
Known Q (cfs)	= 0.02		



Channel Report

Sanitary Main - Peak Loading

Circular

Diameter (ft) = 0.67

Invert Elev (ft) = 1.00

Slope (%) = 0.63

N-Value = 0.011

Calculations

Compute by: Known Q

Known Q (cfs) = 0.11

Highlighted

Depth (ft) = 0.14

Q (cfs) = 0.108

Area (sqft) = 0.05

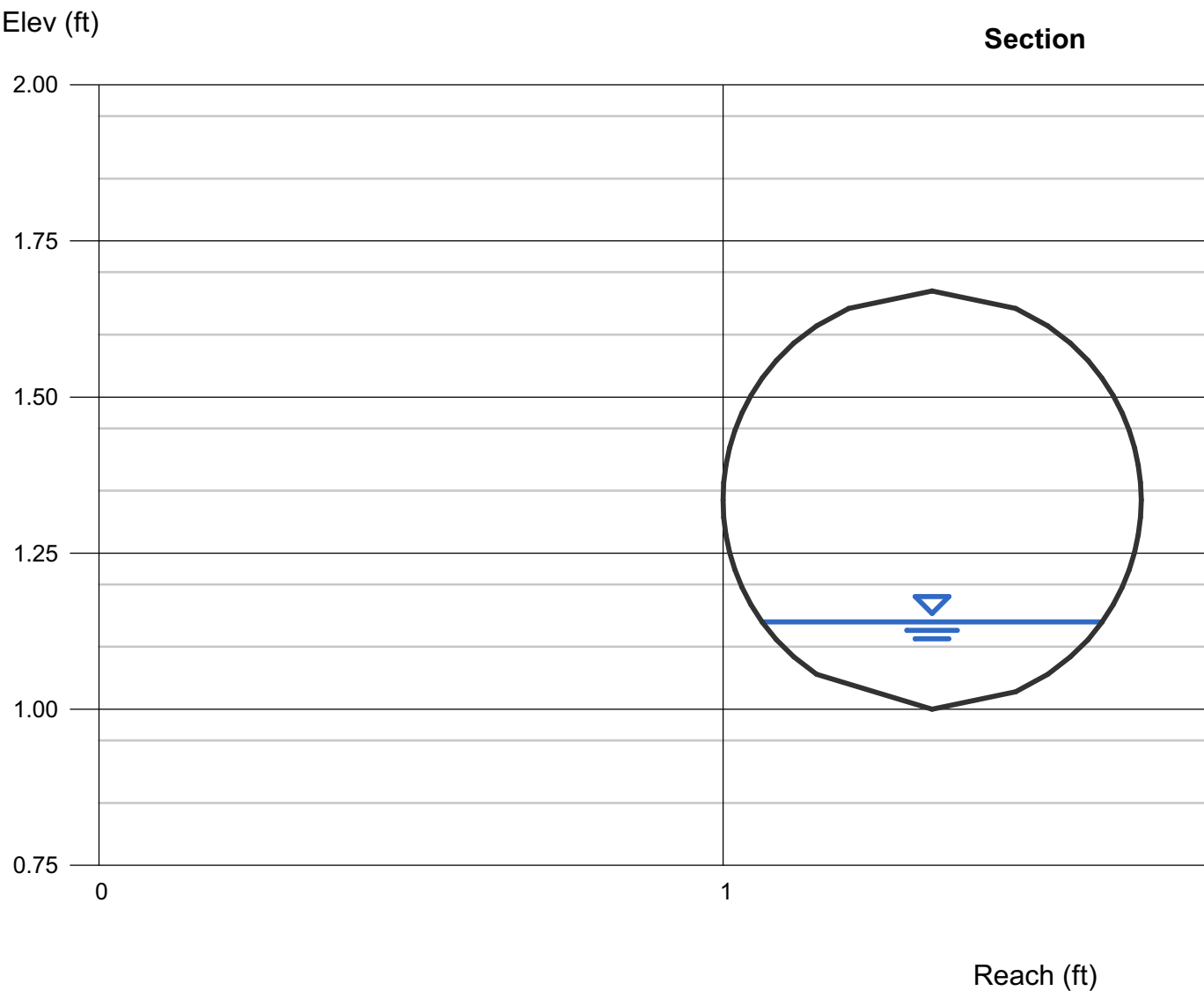
Velocity (ft/s) = 2.02

Wetted Perim (ft) = 0.64

Crit Depth, Yc (ft) = 0.15

Top Width (ft) = 0.54

EGL (ft) = 0.20



Channel Report

Sanitary Service - Average Loading

Circular

Diameter (ft) = 0.33

Invert Elev (ft) = 1.00

Slope (%) = 2.00

N-Value = 0.002

Calculations

Compute by: Known Q

Known Q (cfs) = 0.00

Highlighted

Depth (ft) = 0.01

Q (cfs) = 0.002

Area (sqft) = 0.00

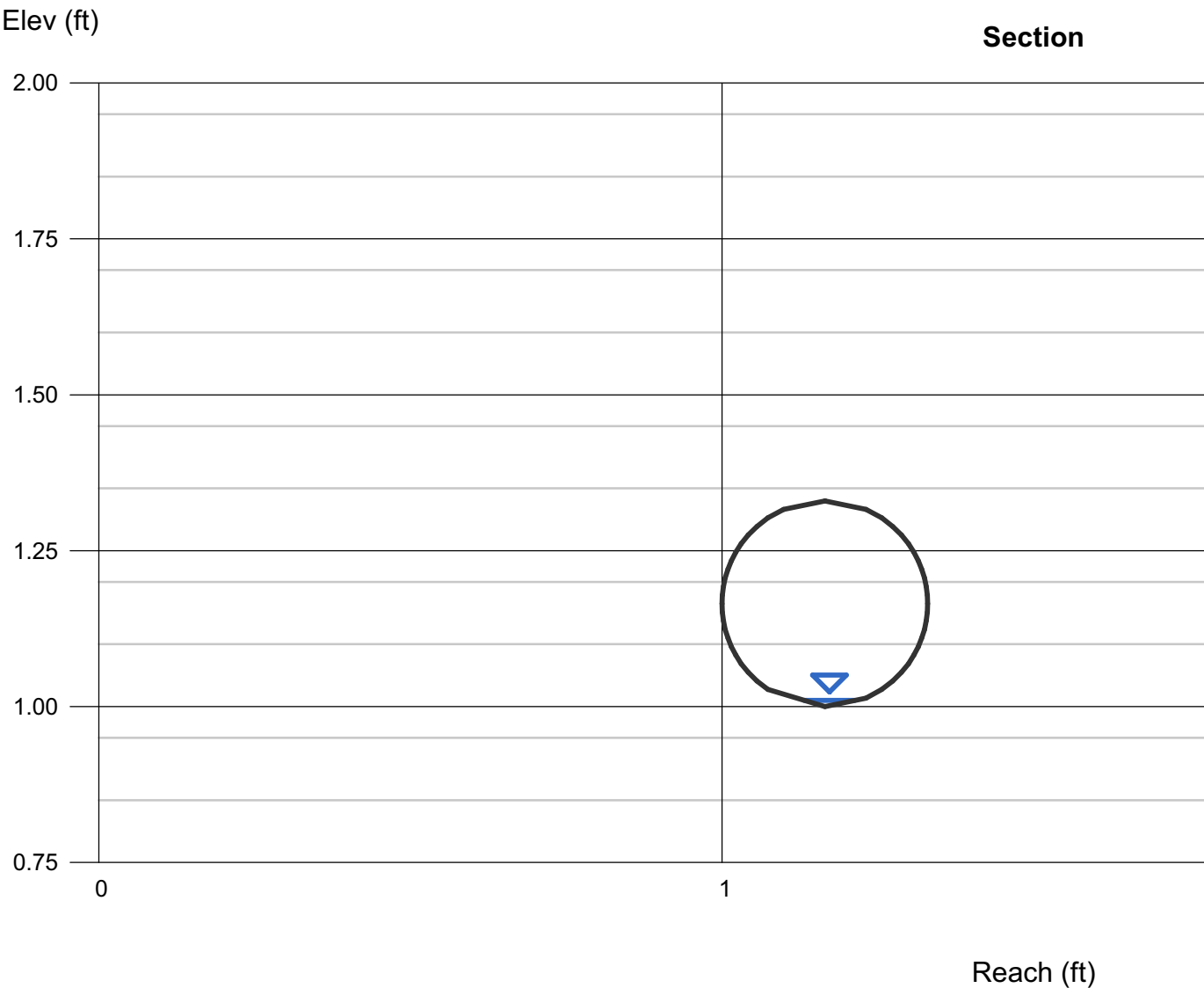
Velocity (ft/s) = 2.90

Wetted Perim (ft) = 0.12

Crit Depth, Yc (ft) = 0.03

Top Width (ft) = 0.11

EGL (ft) = 0.14



Channel Report

Sanitary Service - Peak Loading

Circular

Diameter (ft) = 0.33

Invert Elev (ft) = 1.00

Slope (%) = 2.00

N-Value = 0.011

Calculations

Compute by: Known Q

Known Q (cfs) = 0.01

Highlighted

Depth (ft) = 0.05

Q (cfs) = 0.011

Area (sqft) = 0.01

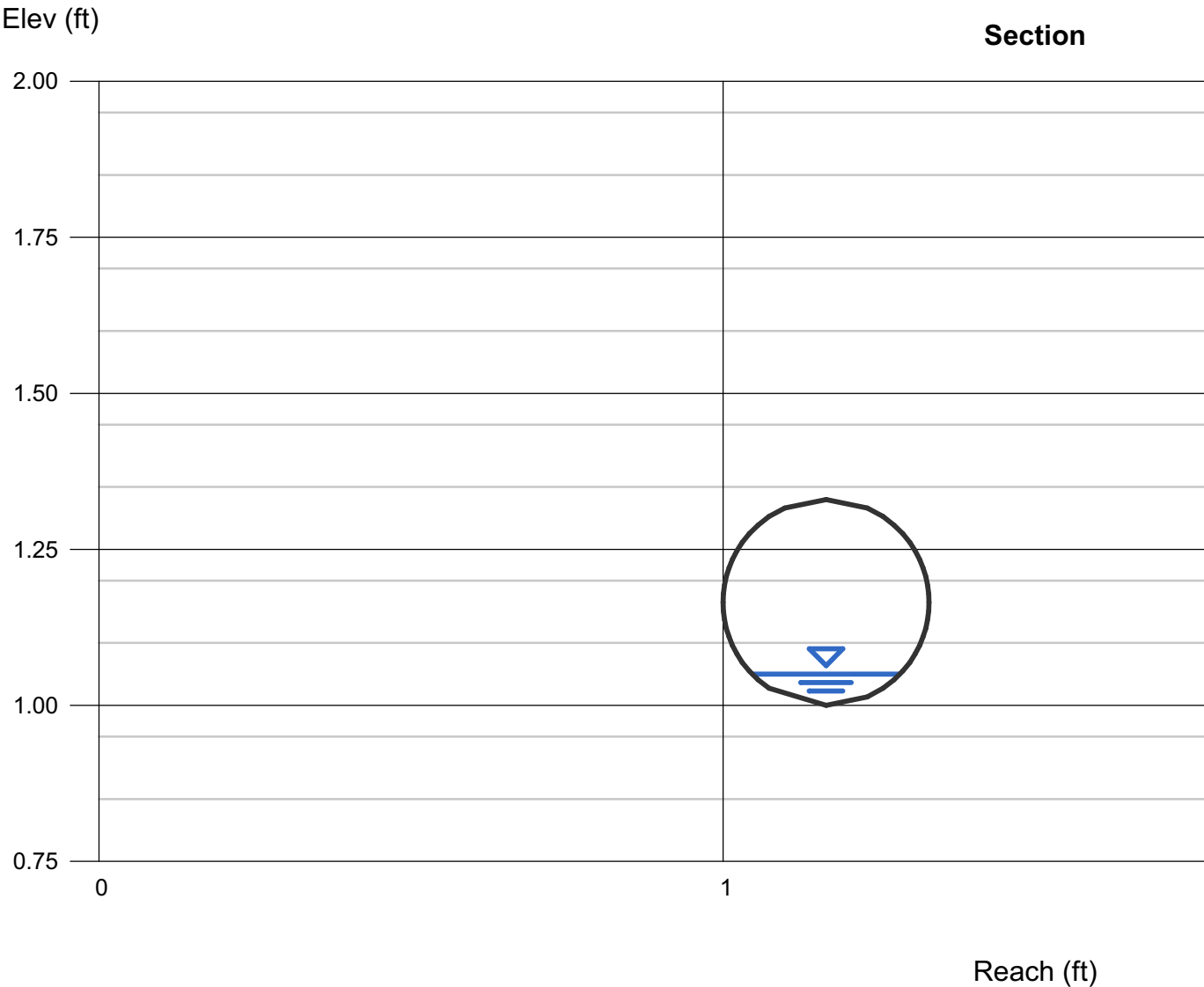
Velocity (ft/s) = 1.35

Wetted Perim (ft) = 0.26

Crit Depth, Yc (ft) = 0.06

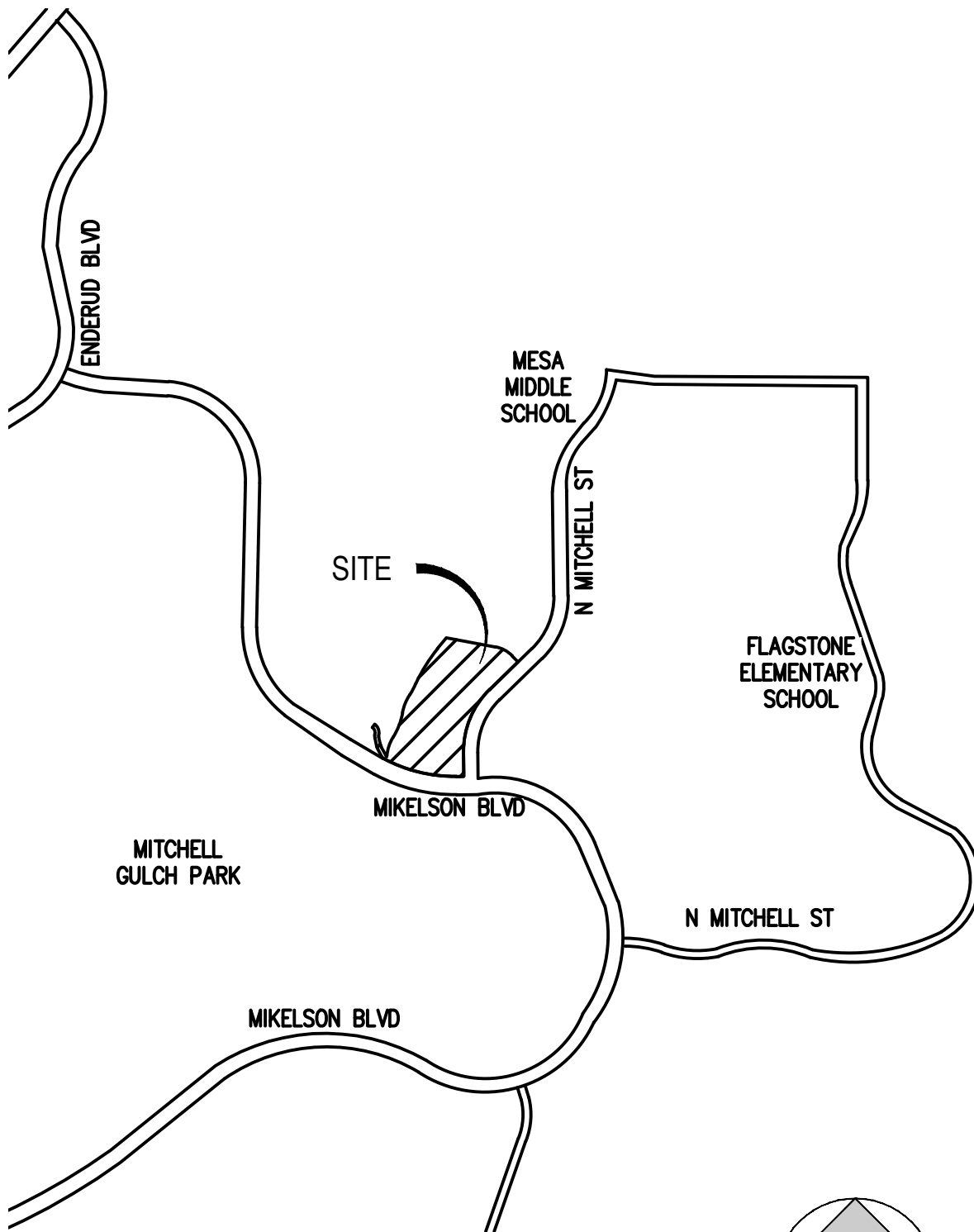
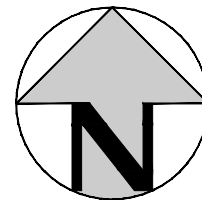
Top Width (ft) = 0.24

EGL (ft) = 0.08

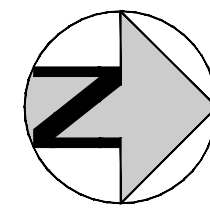
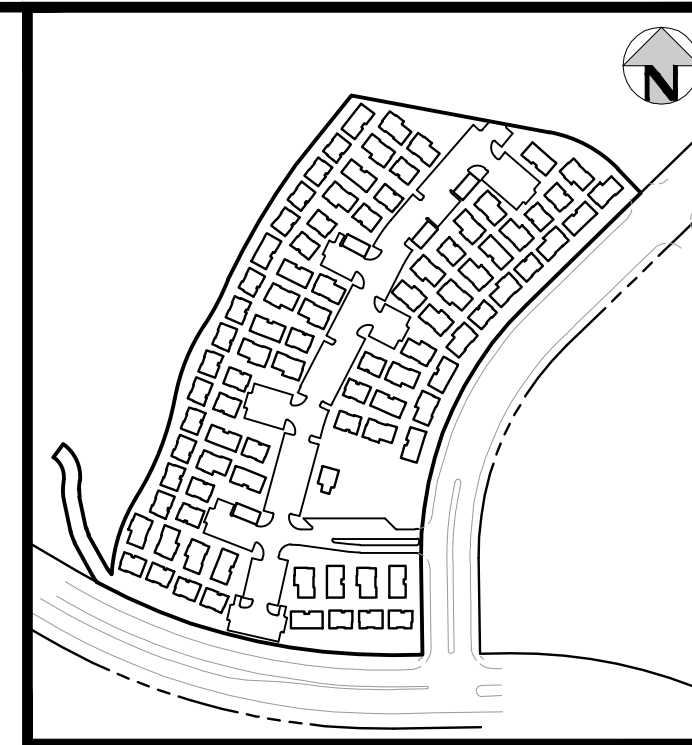


APPENDIX F – MAPS & PLANS

Plotted: TUE 11/30/21 11:56:09A By: Rachel Patton Filepath: k:\210431\engineering\ref\vic map.dwg Layout: layout1



SCALE: 1" = 1000'

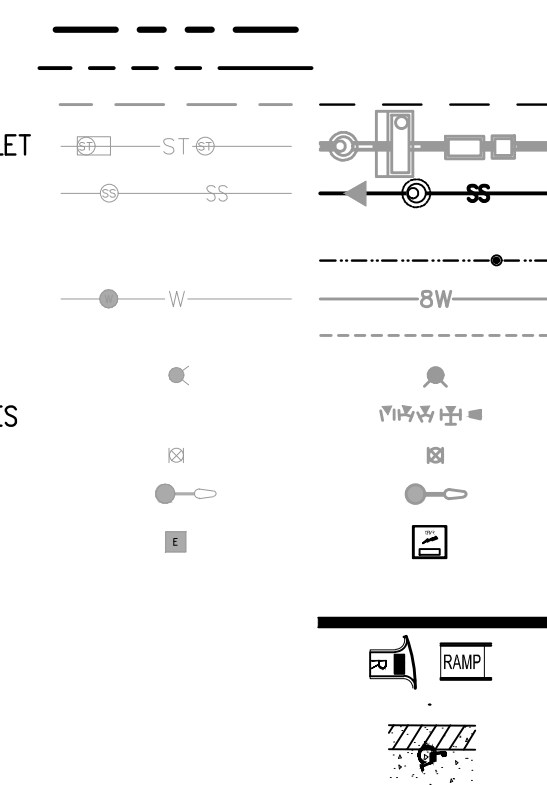


TRACT S
FOUNDERS VILLAGE FILING NO. 24
REC NO. 2006064806
OWNER: TOWN OF CASTLE ROCK

LEGEND

PROPERTY BOUNDARY
RIGHT-OF-WAY
UTILITY EASEMENT
STORM SEWER W/ MANHOLE AND INLET
SANITARY SEWER W/ MANHOLE
AND FLOW DIRECTION
SANITARY SERVICE W/ CLEANOUT
WATER LINE W/ MANHOLE
WATER SERVICE
FIRE HYDRANT
WATER FITTINGS AND APPURTENANCES
GATE VALVE
STREET LIGHT
ELECTRICAL TRANSFORMER
A/C UNIT
RETAINING WALL
HANDICAP RAMP
SIGN
HANDICAP PARKING

EXISTING	PROPOSED
----------	----------



GENERAL SANITARY NOTES:

1. THE CONTRACTOR SHALL NOTIFY COLORADO 811 PRIOR TO EXCAVATION, IN ACCORDANCE WITH COLORADO STATE STATUTES.
2. THE LOCATION OF EXISTING UNDERGROUND UTILITIES IS APPROXIMATE AND SHOWING ACCORDING TO THE BEST INFORMATION AVAILABLE, AS SUPPLIED BY THE UTILITY OWNERS. PRIOR TO EXCAVATION, THE CONTRACTOR SHALL VERIFY EXISTENCE, SIZE, AND LOCATION OF EXISTING UTILITIES AND IMMEDIATELY NOTIFY HARRIS KOCHER SMITH OF ANY DISCREPANCIES. THE CONTRACTOR IS RESPONSIBLE FOR ANY AND ALL DAMAGES TO EXISTING UTILITIES.
3. LOCATION OF EXISTING UTILITIES SHALL BE VERIFIED BY CONTRACTOR PRIOR TO START OF CONSTRUCTION.
4. PIPE LENGTHS ARE MEASURED FROM CENTER OF MANHOLE TO CENTER OF MANHOLE. ALL COORDINATES ARE AT THE CENTER OF THE STRUCTURE UNLESS OTHERWISE INDICATED.
5. ALL WORK, INCLUDING CORRECTION WORK, SHALL BE INSPECTED BY THE UTILITY PROVIDER'S REPRESENTATIVE WHO SHALL HAVE THE AUTHORITY TO HALT CONSTRUCTION WHEN THERE IS A LACK OF ADHERENCE TO STANDARD CONSTRUCTION PRACTICES.
6. WATER MAINS AND SERVICES IN ACCORDANCE WITH STATE OF COLORADO AND JURISDICTIONAL UTILITY PROVIDER SPECIFICATIONS.
7. FOR ALL NON-CONCENTRIC MANHOLES, MANHOLE RINGS/COVERS AND STEPS LIDS SHALL BE ROTATED AS SHOWN IN PLAN VIEW.
8. CONTRACTOR SHALL ADJUST ALL EXISTING IRON ELEVATIONS TO MATCH THE PROPOSED GRADE.
9. ALL SANITARY SEWER CLEANOUTS LOCATED ADJACENT TO A BUILDING SHALL BE TWO-WAY CLEANOUTS.
10. THE CONTRACTOR IS RESPONSIBLE FOR:
 - a. MAINTAIN ALL APPLICABLE LICENSES, BONDS, PERMITS, STANDARDS AND SPECIFICATIONS FOR SEWER MAIN INSTALLATION.
 - b. VERIFYING THE LOCATION AND DEPTH OF EXISTING UTILITIES AND NOTIFYING THE ENGINEER OF ANY DISCREPANCIES.
 - c. RESTORING ALL DISTURBED AREAS TO ORIGINAL CONDITION, OR AS INDICATED ON THE PLANS.
 - d.
11. CONTRACTOR SHALL PROVIDE A MINIMUM SEVENTY TWO (72) HOURS' NOTICE TO THE ON-SITE TOR CONSTRUCTION INSPECTOR, (720) 733-2200, PRIOR TO MAKING ANY CONNECTIONS OR TIE-INS TO EXISTING SANITARY SEWER AND STORM SEWER SYSTEMS PROVIDED THAT THE UTILITY TIE-IN DOES NOT IMPAIR SERVICE TO EXISTING OR WATER CUSTOMERS. IF THE TIE-IN WILL DISRUPT UTILITY SERVICE, THEN THE CONTRACTOR SHALL PROVIDE A MINIMUM OF THREE (3) WEEKS' NOTICE TO THE TOR CONSTRUCTION INSPECTOR TO ALLOW TIME FOR OR WATER TO PROVIDE WRITTEN NOTIFICATION TO EXISTING CUSTOMERS AFFECTED BY THE TIE-IN. ALL TOWN UTILITY TIE-INS MUST BE APPROVED BY OR WATER PRIOR TO COMMENCING WORK.
12. WHERE SANITARY SEWER MAINS ARE CONSTRUCTED IN FILL AREAS, ALL FILL MATERIALS SHALL BE PLACED AND COMPACTED TO FINAL GRADE PRIOR TO THE INSTALLATION OF THE SEWER MAIN AND APPURTENANCES. ALL FILL MATERIAL SHALL MEET THE TOWN'S STANDARDS AND BE APPROVED BY CASTLE ROCK WATER. SEWER MAINS WITHIN FILL AREAS SHALL HAVE RESTRAINED JOINTS IN ACCORDANCE WITH STANDARD DETAIL W-18.
13. CONTRACTOR SHALL PROVIDE BYPASS PLAN AND DETAILS TO THE TOWN OF CASTLEROCK AT THE PRE-CONSTRUCTION MEETING FOR THE INSTALLATION OF MANHOLE A1.

HORIZONTAL CONTROL

BEARINGS ARE BASED ON THE NORTH LINE OF THE NORTHEAST QUARTER OF THE SOUTHEAST QUARTER OF SECTION 8, AS MONUMENTED AT THE EAST CORNER BY A #6 REBAR WITH A 3.25" ALUMINUM CAP STAMPED: SURVCON 2006 PLS 30289 AND AT THE CENTER-EAST SIXTEENTH CORNER BY A 2.5" PIPE WITH A 3.5" ALUMINUM CAP STAMPED: 1986 PLS 22100, AS BEARING SOUTH 88°58'05" WEST, PER THE PLAT OF FOUNDERS VILLAGE FILING NO. 24 AMENDMENT NO. 1.

PROFESSIONAL ENGINEER CERTIFICATION

I HEREBY AFFIRM THAT THESE FINAL CONSTRUCTION PLANS WERE PREPARED UNDER MY DIRECT SUPERVISION, IN ACCORDANCE WITH ALL APPLICABLE TOWN OF CASTLE ROCK AND STATE OF COLORADO STANDARDS AND STATUTES, RESPECTIVELY; AND THAT I AM FULLY RESPONSIBLE FOR ALL DESIGN AND REVISIONS RELATIVE TO SAID PLANS.

PRELIMINARY
NOT FOR
CONSTRUCTION

RACHEL C PATTON, P.E. #54450	DATE
TOWN APPROVAL BLOCK	
TOWN OF CASTLE ROCK APPROVAL	
PLANS ARE HEREBY APPROVED FOR ONE YEAR FROM	
DATE OF DEVELOPMENT SERVICES APPROVAL	
Approved By:	
Development Services	Date

Development Services Date

PROJECT #: 210431

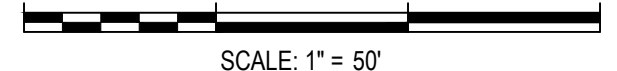
SHEET NUMBER

47

47 OF 87



Know what's below.
Call before you dig



DESIGNED BY: CLH
CHECKED BY: RCP
DRAWN BY: CLH

ISSUE DATE: 08-11-2022	
DATE	REVISION COMMENTS
10-31-2022	PER TOWN OF CASTLE ROCK COMMENTS
04-10-2023	PER TOWN OF CASTLE ROCK COMMENTS



1120 Lincoln Street, Suite 1000
Denver, Colorado 80203
P: 303.623.6300 F: 303.623.6311
HarrisKocherSmith.com



AVILLA FOUNDERS VILLAGE OVERALL SANITARY SYSTEM PLAN

PROJECT #: 210431

SHEET NUMBER

47

47 OF 87



- Water Valve
- Curb Stop Valve
- Fire Hydrant
- Water Manhole
- Water Lateral
- Water Main
- Sanitary Sewer Manhole
- Sanitary Sewer Gravity Main
- Pressurized Sanitary main
- Culvert
- Storm Inlet
- Storm Manhole
- Storm Pipe
- Storm Pond
- Storm Outfall
- Water Dept Electrical Line

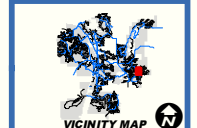


0 125 250 500 Feet

Date: 4/14/2021 1 inch = 250 feet



Disclaimer: The data presented has been compiled from various sources, each of which introduces varying degrees of inaccuracies or inconsistencies. Such discrepancies in data are inherent and in supplying this product the Town of Castle Rock assumes no liability for its use or accuracy. Questions or comments regarding the cartographic composition of this map including, but not limited to, errors, omissions, corrections, and/or updates, should be directed to the Utilities Department, Town of Castle Rock, (720) 733-6087. Copyright 2020, Town of Castle Rock Utilities Mapping.



APPENDIX G – WASTEWATER OPERATIONS & MAINTENANCE

Avilla Founders Village

Sanitary Sewer Operations & Maintenance Plan

INTRODUCTION

The purpose of this Operation and Maintenance (O&M) Plan is to provide a planning document to initiate scheduled maintenance on the Avilla Founders Village sanitary sewer system and also to prevent failures that can result in sanitary sewer overflows or other interruptions in service. The development of the O&M plan for new system is an ongoing process that starts with thoughtful, code compliant design, and evolves to a proactive plan into the future.

This document is not an EPA, State or Local guidance document, and should not be relied upon to identify regulatory requirements. The Avilla Founders Village community is solely responsible for ensuring that it takes the steps necessary to ensure compliance with Federal, State and Local laws. This document must be made available at the Site at all times.

Design

The design of the sanitary sewer system for the Avilla Founders Village multifamily community does not meet Town of Castle Rock requirements of having one service line for each unit/home. Therefore, the design along with O&M routines will ensure access to maintenance and proper function. In order to allow for routine maintenance of the system, cleanouts will be utilized at each unit, each connection to the laterals, as well as any bend from the lateral to the main which will allow maintenance at multiple points along the system going to any unit from the main.

This design will be provided by Colorado licensed engineers, Harris Kocher Smith, and work closely with Castle Rock Water and Sanitation throughout site planning to ensure all requirements are met. During construction of the system the installation will be confirmed by on site quality control process' as well as periodic design engineer site visits to ensure conformance to the intended design as well as all required city inspections. Furthermore, once the community receives certificate of occupancy, the entire site will be professionally managed and maintained by on-site personnel in conjunction with professionally licensed plumbing vendors. This will allow not only prompt responses to any potential unforeseen issues within the system but will allow a proactive preventative maintenance program to be implemented.

Maintenance Activities

The purpose of developing O&M program is to maintain the original design functionality (capacity and integrity) of the system. The ability to effectively operate and maintain a system so it performs as intended depends on development and implementation of a routine inspection and repair program.

Preventative maintenance, which is a proactive response, is defined by a preprogrammed, systematic approach to maintenance activities. This type of maintenance will always result in improved system performance. Preventive maintenance will be scheduled on the basis of the passage of a certain amount of time (calendar period). The preventative maintenance program will allow the community to plan routine maintenance and schedule repair work as needed.

Inspection

Physical inspection is essential to quantify the maintenance characteristics of the sewer system. As part of a preventative maintenance routine, the community should employ both visual and equipment-based techniques. Physical inspection of the system will provide the community with:

- A means of identifying and quantifying the repair and maintenance requirements.
- A preventative maintenance plan.
- An assessment of the current conditions in the system
- A means of preparing an inventory of spare parts for emergency situations.

Visual inspection of visible portions of the system will occur daily throughout the property as on-site management personnel perform other duties. Cleanouts and other portions of the system that are visible at the surface elevation will be visually inspected routinely to check for damage.

The system will be inspected using a camera from the end of the lateral to the main every ten years to visually confirm that unknown buildups, blockages, and damage are discovered before causing issues to the operation of the system.

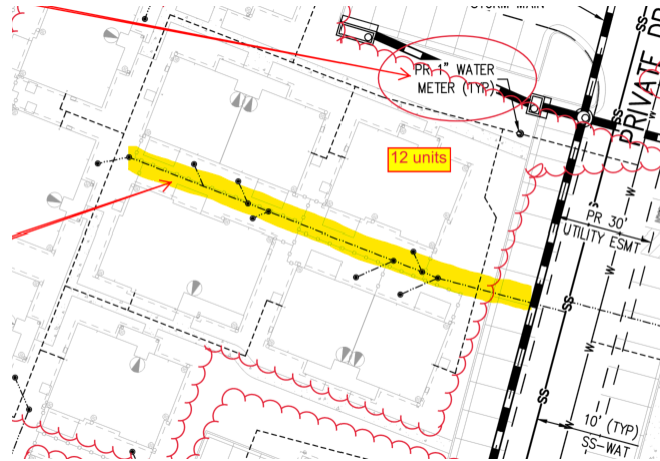


Figure 1: Highlighted lateral example of area to be visually inspected using camera

Cleaning

Prevention of material buildup requires systematic cleaning of the system to insure against system failure. As part of the maintenance program, the community will need to implement a cleaning program. Cleaning a sanitary sewer system minimizes the potential for system blockages and keeps the system operational.

There are various hydraulic and mechanical methods used to clean a sewer system. Hydraulic methods employ high velocity water to clean the inverts of pipes. Cleaning methods are described below.

Hydraulic cleaning of a sewer system is an efficient and effective means of removing debris. High velocity water is used to pull debris along the bottom of the pipe invert until it can be recovered at the manhole.

Hydraulic cleaning of the sanitary system will be performed along the same routes as seen in Figure 1 above, at a frequency of every five years. This will ensure proper operation of the private sanitary system and limit the amount of backups and emergencies that arise with the performance as a whole.