STORMWATER DRAINAGE REPORT

for

QuikTrip No. 4273

Wolfensberger Road & Caprice Drive
Castle Rock, Douglas County, Colorado 80109

Prepared For (Owner/Developer):
QuikTrip Corporation
5725 Foxridge Drive
Mission, Kansas 66202

Prepared By (Engineer):
Midwest Design Group
P.O. Box 860015
Shawnee, Kansas 66286-0015
913.248.9385

Date Submitted: 04/22/2025

Revisions Log:

Revision No.	Description	Date

ENGINEER'S CERTIFICATION
Stormwater Drainage Report
QuikTrip Store #4273

Wolfensberger Road & Caprice Drive
Castle Rock, Douglas County, Colorado 80109

I Hereby Certify that this Engineering Document was prepared by me and that I am a duly Registered Professional Engineer under the laws of the State of Kansas.

Darla Holman, P.E.
Project Manager
CO Registration No. 0056104

04-22-2025
Date

Seal

REPORT PURPOSE

This stormwater drainage report has been prepared to detail the stormwater drainage design for the QuikTrip No. 4273 project to be located in Castle Rock, Colorado. This study will confirm that the proposed development will be designed to comply with the design parameters set forth by the Town of Castle Rock's Storm Drainage Design and Technical Criteria Manual (SDDTCM) and the Mile High Flood District's (MHFD) Urban Storm Drainage Criteria Manual, Volumes 1-3.

PROJECT SUMMARY

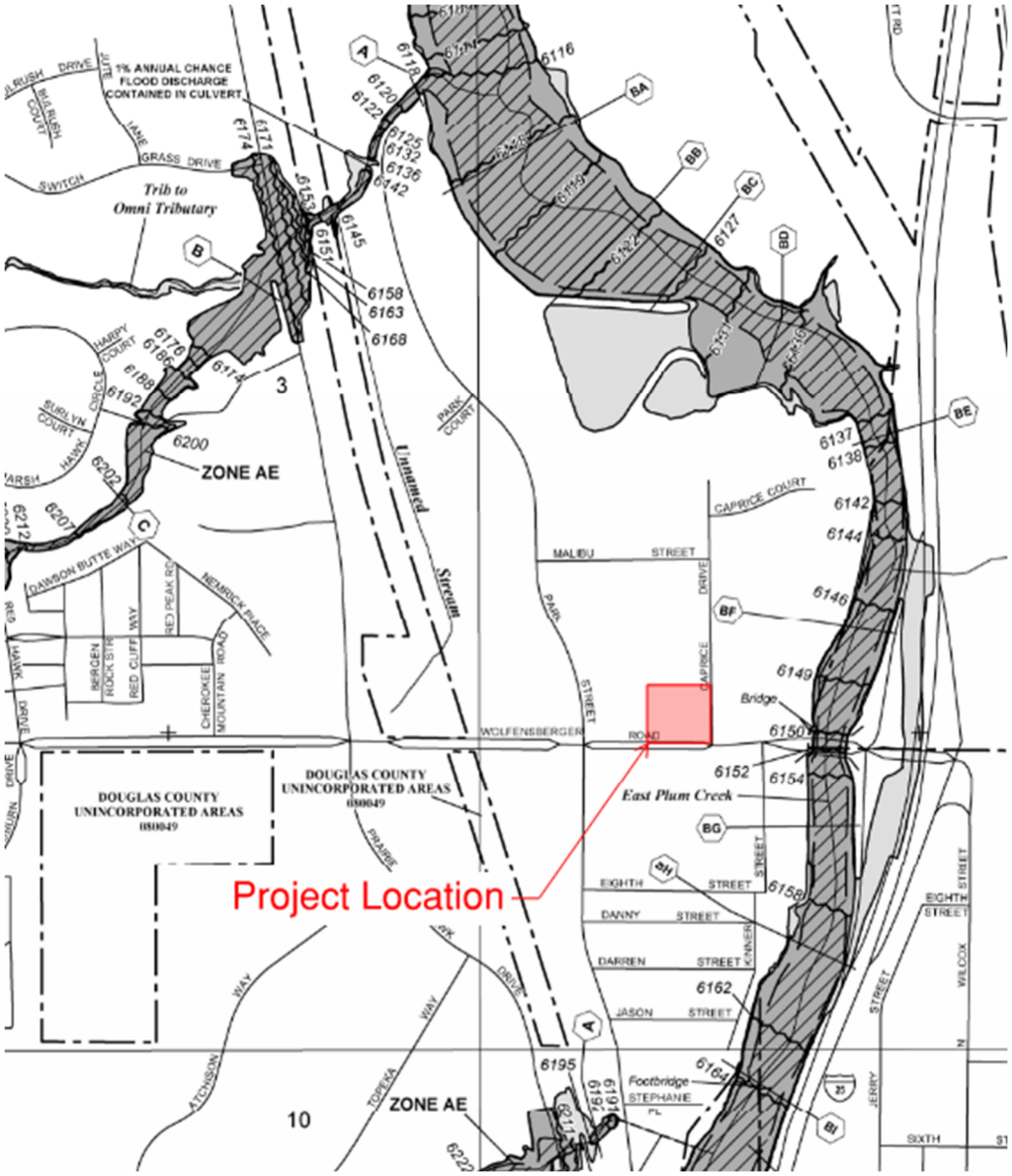
QuikTrip Corporation is proposing to build a new convenience store with fuel offerings in the northwest corner of the intersection of Wolfensberger Road and Caprice Drive in Castle Rock, Douglas County, Colorado. The QuikTrip development will include a convenience store, auto fuel canopy, parking lot, and private drive entrances. The store will be oriented to face Wolfensberger Road (south) with an auto fuel canopy west of the store. The new QuikTrip facility will be constructed on properties currently platted as *Lot 1A, Village North Amended Subdivision Reception #254392* and *Lot 1 and Lot 2, William's Subdivision Reception #348102 & Correction #9021814.* The entire property is currently zoned B (Business/Commercial) and contains 80,520 s.f. (1.848 acres). The Site Plan is included in the Appendix of this report for reference.

WATERSHED

This property lies within the East Plum Creek Watershed, which ultimately drains to Plum Creek.

FLOODPLAIN CERTIFICATE

According to the National Flood Insurance Program (NFIP) Flood Insurance Rate Map (FIRM) Panel No. 08035C0188G, effective March 16, 2016 as published by the Federal Emergency Management Agency, the subject property lies within Flood Zone "X", areas determined to be “outside the 0.2% annual chance floodplain”.



Map taken from FIRM Panel

SITE SOIL CHARACTERISTICS

This property contains soils classified as:

- BrB – Bresser sandy loam, 1 to 3 percent slopes, HSG B
- Newlin gravelly sandy loam, 8 to 30 percent slopes, HSG B

The hydrologic soil group used for this site is B. The USDA/NRCS soil survey can be found in the Appendix.

Map taken from USDA/NRCS Soil Survey

WETLANDS

Per the U.S. Fish and Wildlife Service's National Wetlands Inventory (NWI) mapping system, there are no existing wetlands within the limits of disturbance or property limits for this project.

Refer to the NWI map provided in the Appendix.

METHODOLOGY

Hydrologic and detention calculations were performed using the MHFD's *Detention Basin Design Workbook* excel spreadsheet. The MHFD detention basin worksheet uses the Colorado Urban Hydrograph Procedure (CUHP) to generate hydrographs and to determine pre-development peak release rates for all design storm events. The Castle Rock SDDTCM was used for the 1-hour rainfall depth, which was input into the MHFD spreadsheet as a user override for the rainfall data.

EXISTING DEVELOPMENT

The existing property is developed commercial land consisting of mostly impervious surfaces. It is bordered on the north by a commercial property (Safelite AutoGlass), on the west by a commercial property (OYO Hotel), on the east by Caprice Drive, and on the south by Wolfensberger Road. This property is currently zoned B, Business/Commercial.

In the existing conditions, the site generally drains south to north. It does not appears there is any existing storm sewer system on site. The western portion of the site (existing restaurant) drains as overland flow north into an existing drainage swale north of the property that appears to drain west along the north property line. The eastern portion of the site drains as overland flow north onto the adjacent property (Safelite AutoGlass). It appears there is an existing grated inlet on the Safelite AutoGlass property that captures runoff in a low point south of the Safelite building. It is unknown where this inlet drains to. Ultimately, the entire site drains to East Plum Creek.

The existing property contains approximately 72,917 sf of impervious surfaces. Refer to Pre-Developed Drainage Map in the Appendix.

PROPOSED DEVELOPMENT

The proposed development will be graded to generally maintain existing drainage patterns. Stormwater runoff from most of the QuikTrip site will be collected in a private storm sewer system that will convey runoff to an underground detention facility. The detention facility will have a control structure that will convey runoff to daylight into a proposed concrete drainage channel that will outlet into the gutter of Caprice Drive. The on-site private storm sewer system will convey the 100-year design storm to the detention facility. The storm sewer system, detention facility, and associated calculations can be found in the Appendix (storm sewer calculations pending Phase III Drainage Report).

The proposed site consists of 63,710 sf of impervious areas (79.1%) and 16,810 sf of pervious areas (20.9%). This is a decrease of 9,207 sf in impervious area. A post-development Curve Number (CN) was calculated for all drainage areas using the NRCS Soils Report and TR-55 Curve Number tables. The weighted Curve Number for the proposed site is 94.2. Refer to Post-Developed Drainage Map in the Appendix for more details.

DETENTION / WQCV / EURV REQUIREMENTS

Per Castle Rock's SDDTCM, Section 13.1.1, Full-spectrum Detention shall be provided for all new development and redevelopment. Full-spectrum Detention storage volume and release rate criteria is based on three design events: the Water Quality Capture Volume (WQCV), Excess Urban Runoff Volume (EURV), and 100-year event. These design events are defined and further explained in the MHFD Urban Storm Drainage Criteria Manual, Volumes 2 and 3.

Additionally, per Castle Rock's SSDTCM, Section 13.1.4, *the site may exclude up to twenty percent, not to exceed one acre, when the design engineer has demonstrated that it is not practicable to capture runoff from portions of the site that will not drain towards control measures, and that the implementation of a separate control measure for that portion of the site is not practicable*. The QuikTrip development will have 15,683 sf (drainage areas DA-9 and DA-10) of uncontrolled runoff (excluded area), which is 19.5% of the site. These areas consist of steep grades, drive connections, adjacent Owner parking stalls, and/or proposed sidewalks that will not allow for capture and conveyance to the detention facility. The size and slopes of these areas are also not conducive to providing separate control measures.

Although there will be excluded area from the detention calculations, the WQCV and EURV volumes will be sized for the entire site. The WQCV volume (0.049 ac-ft) was calculated using Equation 3-1 from MHFD Urban Storm Drainage Criteria Manual, Volume 3. The EURV volume (0.161 ac-ft) was calculated using simplified Equation 12-2 (soil type B) from MHFD Urban Storm Drainage Criteria Manual, Volume 2.

Stormwater, from the improved, captured areas of the site, will be detained in the proposed underground detention facility. The detention facility will have a control structure. Peak discharges will be controlled with orifices inside the outlet structure. The runoff that bypasses the detention facility is excluded and will not be accounted for in the allowable post-developed release rates. In the event of a storm in excess of 100-year or if the control structure is clogged, the runoff will overtop the weir wall within the control structure. The proposed detention system has been designed to control runoff, as a result of the proposed improvements, to the allowable release rates per the MHFD criteria. See Appendix for MHFD Detention Basin Design Workbook results and additional detention information and design calculations.

DOWNSTREAM DRAINAGE IMPACTS

The proposed stormwater detention system will control peak runoff so that there will be no adverse impacts to downstream drainage facilities.

STORMWATER TREATMENT

QuikTrip will install a dual SNOUT water quality unit at the detention outlet structure, and inlet filter inserts will be installed at all inlets upstream of the detention facility. Bio-skirts will be added to the SNOUT units for oil absorption. Information on these water quality units is provided in the Appendix.

FLOOD STUDY

The QuikTrip No. 4273 property will be within Zone "X", as shown in the Floodplain Certificate section. This development is not expected to incur damages as a result of flooding.

U.S. ARMY CORPS OF ENGINEERS RQUIREMENTS

The QuikTrip No. 4273 project will not disturb jurisdictional waters or wetlands of the U.S.

CONCLUSION

The QuikTrip No. 4273 development has been designed to comply with the design parameters set forth by the Town of Castle Rock's Storm Drainage Design and Technical Criteria Manual (SDDTCM) and the Mile High Flood District's (MHFD) Urban Storm Drainage Criteria Manual, Volumes 1-3. An on-site stormwater detention facility will provide the required WQCV and EURV and control the peak stormwater runoff from the site to the allowable release rates. Per the Town of Castle Rock's SDDTCM, a variance will be required for the underground detention. A private stormwater drainage system will convey runoff to the stormwater detention facilities. Best Management Practices will be implemented to help improve water quality. No adverse effects are expected on adjacent properties or downstream drainage systems after the proposed improvements are completed.

QuikTrip No. 4273 – Release Rate Summary Table

Storm Event	CUHP Pre-Developed Peak Release Rate (cfs)	Post-Developed Peak Release Rate (With Detention) (cfs)
2-year	0.03	0.11
5-year	0.47	0.16
10-year	0.71	0.18
25-year	1.09	0.19
50-year	1.86	0.94
100-year	2.42	1.96

QuikTrip No. 4273

Wolfensberger Road & Caprice Drive
Castle Rock, Douglas County, Colorado 80109

APPENDIX

Castle Rock Water
175 Kellogg Court, Castle Rock CO 80109
720-733-6000

Phase II Drainage Report Checklist

The Phase II Drainage Report must be in conformance with the latest Town of Castle Rock Storm Drainage Design and Technical Criteria Manual available on the Town's website.

The Phase II Drainage Report must be signed and sealed by a Professional Engineer licensed in the State of Colorado. The purpose of the Phase II Drainage Report is to identify and refine conceptual stormwater management solutions to the challenges that may be present or occur on-site and off-site.

The preparer should contact and work with the Town Stormwater Engineering Staff regarding any design, master planning and existing system questions (720-733-6000). The following outline sets forth the **required minimum** content to be provided in the Phase II Drainage Report that shall be submitted with the Planned Development Plan or Straight Zoning documents. A copy of this checklist must be submitted with the Phase II Drainage Report.

Please see Chapter 4 of the Town of Castle Rock Storm Drainage Design and Technical Criteria Manual for additional details and information. Please check off the following items to assure your report is complete. Appropriate notations shall be provided with the checklist. For example, if a specific item is not addressed or not applicable, an explanation needs to be provided.

Included	N/A	
		I. COVER SHEET
X		A. Name of Project, including legal name of development
X		B. Address
X		C. Owner
X		D. Developer
X		E. Engineer
X		F. Submittal date and revision dates as applicable
		II. GENERAL LOCATION AND DESCRIPTION
X		A. Site Location
X		B. Description of Property and Land Use
		III. DRAINAGE BASIN AND SUB-BASINS
X		A. Major Drainage Basins
X		B. Minor Drainage Basins
		IV. DRAINAGE DESIGN CRITERIA
X		A. Regulations
	X	B. Drainage Studies, Master Plans, Site Constraints
X		C. Hydrology
	X	D. Hydraulics
X		E. Water Quality Enhancement

Phase II Drainage Report Checklist

Included	N/A	
		V. STORMWATER MANAGEMENT FACILITY DESIGN
X		A. Stormwater Conveyance Facilities
X		B. Stormwater Storage Facilities
X		C. Water Quality Enhancement Best Management Practices
	X	D. Floodplain Modification
	X	E. Additional Permitting Requirements
		F. General
		VI. CONCLUSIONS
X		A. Compliance with Standards
X		B. Variances
X		C. Drainage Concept
		VII. REFERENCES
		VIII. APPENDICES
X		A. Hydrologic Computations
	X	B. Hydraulic Computations (If known at this time—not required)
X		C. Water Quality Enhancement Best Management Practices
X		D. Referenced Information
X		**OVERALL DRAINAGE PLAN (IN POCKET)**
X		**DETAILED DRAINAGE PLANS (IN POCKET)**

Notes/Comments:

QuikTrip No. 4273

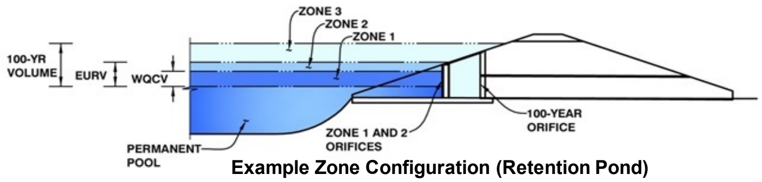
MHFD Detention Basin Design Workbook Results

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: QuikTrip No. 4273

Basin ID: Underground Detention



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	1.49	acres
Watershed Length =	318	ft
Watershed Length to Centroid =	159	ft
Watershed Slope =	0.030	ft/ft
Watershed Imperviousness =	87.50%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.049	acre-feet	0.049	acre-feet
Excess Urban Runoff Volume (EURV) =	0.161	acre-feet	0.161	acre-feet
2-yr Runoff Volume (P1 = 1.06 in.) =	0.103	acre-feet	1.06	inches
5-yr Runoff Volume (P1 = 1.43 in.) =	0.146	acre-feet	1.43	inches
10-yr Runoff Volume (P1 = 1.66 in.) =	0.173	acre-feet	1.66	inches
25-yr Runoff Volume (P1 = 1.74 in.) =	0.184	acre-feet	1.74	inches
50-yr Runoff Volume (P1 = 2.26 in.) =	0.247	acre-feet	2.26	inches
100-yr Runoff Volume (P1 = 2.6 in.) =	0.289	acre-feet	2.60	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	0.355	acre-feet		inches
Approximate 2-yr Detention Volume =	0.104	acre-feet		
Approximate 5-yr Detention Volume =	0.145	acre-feet		
Approximate 10-yr Detention Volume =	0.177	acre-feet		
Approximate 25-yr Detention Volume =	0.174	acre-feet		
Approximate 50-yr Detention Volume =	0.209	acre-feet		
Approximate 100-yr Detention Volume =	0.224	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.049	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.112	acre-feet
Zone 3 (100yr + 1 / 2 WQCV - Zones 1 & 2) =	0.087	acre-feet
Total Detention Basin Volume =	0.248	acre-feet

Depth Increment = 0.25 ft

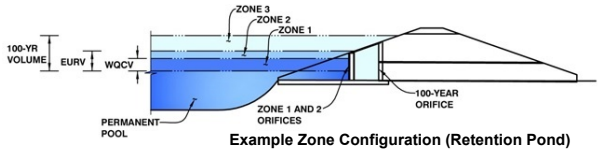
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	4,600	0.106		
Floor	--	0.25	--	--	--	4,600	0.106	1,150	0.026
	--	0.50	--	--	--	4,600	0.106	2,300	0.053
	--	0.75	--	--	--	4,600	0.106	3,450	0.079
	--	1.00	--	--	--	4,600	0.106	4,600	0.106
	--	1.25	--	--	--	4,600	0.106	5,750	0.132
	--	1.50	--	--	--	4,600	0.106	6,900	0.158
	--	1.75	--	--	--	4,600	0.106	8,050	0.185
Detention	--	2.00	--	--	--	4,600	0.106	9,200	0.211
	--	2.25	--	--	--	20	0.000	9,777	0.224
	--	2.50	--	--	--	20	0.000	9,782	0.225
	--	2.75	--	--	--	20	0.000	9,787	0.225
	--	3.00	--	--	--	20	0.000	9,792	0.225
	--	3.25	--	--	--	20	0.000	9,797	0.225
	--	3.50	--	--	--	20	0.000	9,802	0.225
	--	3.75	--	--	--	20	0.000	9,807	0.225
	--	4.00	--	--	--	20	0.000	9,812	0.225
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: QuikTrip No. 4273

Basin ID: Underground Detention



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.47	0.049	Orifice Plate
Zone 2 (EURV)	1.53	0.112	Circular Orifice
Z3 (100+1/2WQCV)	#VALUE!	0.087	Rectangular Orifice
Total (all zones)		0.248	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =		ft (distance below the filtration media surface)	Underdrain Orifice Area =		ft²
Underdrain Orifice Diameter =		inches	Underdrain Orifice Centroid =		feet

Calculated Parameters for Underdrain

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	5.486E-03	ft²
Depth at top of Zone using Orifice Plate =	1.53	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	19.00	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	0.79	sq. inches (diameter = 1 inch)	Elliptical Slot Area =	N/A	ft²

Calculated Parameters for Plate

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00							
Orifice Area (sq. inches)	0.79							

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Circular	Zone 3 Rectangular			Zone 2 Circular	Zone 3 Rectangular	
Invert of Vertical Orifice =	0.50	1.58	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.03	1.33	ft²
Depth at top of Zone using Vertical Orifice =	1.53	2.00	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.10	0.17	feet
Vertical Orifice Diameter or Height =	2.50	4.00	inches				
Vertical Orifice Width =		48.00	inches				

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Not Selected	Not Selected			Not Selected	Not Selected	
Overflow Weir Front Edge Height, Ho =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	N/A	N/A	feet
Overflow Weir Front Edge Length =	N/A	N/A	feet	Overflow Weir Slope Length =	N/A	N/A	feet
Overflow Weir Grate Slope =	N/A	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	N/A	N/A	
Horiz. Length of Weir Sides =	N/A	N/A	feet	Overflow Grate Open Area w/o Debris =	N/A	N/A	ft²
Overflow Grate Type =	N/A	N/A		Overflow Grate Open Area w/ Debris =	N/A	N/A	ft²
Debris Clogging % =	N/A	N/A	%				

Calculated Parameters for Overflow Weir

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Not Selected	Not Selected			Not Selected	Not Selected	
Depth to Invert of Outlet Pipe =	N/A	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	N/A	N/A	ft²
Circular Orifice Diameter =	N/A	N/A	inches	Outlet Orifice Centroid =	N/A	N/A	feet
				Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	2.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.54	feet
Spillway Crest Length =	5.00	feet	Stage at Top of Freeboard =	3.54	feet
Spillway End Slopes =	0.00	H:V	Basin Area at Top of Freeboard =	0.00	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	0.23	acre-ft

Calculated Parameters for Spillway

Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.06	1.43	1.66	1.74	2.26	2.60	3.14
CUHP Runoff Volume (acre-ft) =	0.049	0.161	0.103	0.146	0.173	0.184	0.247	0.289	0.355
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.103	0.146	0.173	0.184	0.247	0.289	0.355
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.03	0.47	0.71	1.09	1.86	2.42	3.21
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.02	0.32	0.48	0.73	1.25	1.63	2.16
Peak Inflow Q (cfs) =	N/A	N/A	2.18	3.07	3.63	3.96	5.33	6.06	7.41
Peak Outflow Q (cfs) =	0.0	0.2	0.11	0.16	0.18	0.19	0.94	1.96	3.22
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.3	0.3	0.2	0.5	0.8	1.0
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 2	Vertical Orifice 2	Vertical Orifice 2
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	55	64	64	65	64	64	62	60	57
Time to Drain 99% of Inflow Volume (hours) =	**60**	73	71	73	74	74	73	71	70
Maximum Ponding Depth (ft) =	0.47	1.53	0.87	1.21	1.43	1.53	1.74	1.85	1.96
Area at Maximum Ponding Depth (acres) =	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Maximum Volume Stored (acre-ft) =	0.050	0.162	0.091	0.127	0.151	0.161	0.184	0.194	0.207

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.02	0.14
	0:15:00	0.00	0.00	0.29	0.58	0.72	0.39	0.65	0.67	0.87
	0:20:00	0.00	0.00	1.10	1.54	1.81	0.99	1.37	1.53	1.93
	0:25:00	0.00	0.00	2.18	3.07	3.63	2.08	2.82	3.11	3.87
	0:30:00	0.00	0.00	2.16	2.98	3.39	3.96	5.33	6.06	7.41
	0:35:00	0.00	0.00	1.68	2.28	2.60	3.66	4.88	5.93	7.22
	0:40:00	0.00	0.00	1.30	1.72	1.96	3.07	4.07	4.88	5.93
	0:45:00	0.00	0.00	0.94	1.30	1.52	2.32	3.08	3.87	4.71
	0:50:00	0.00	0.00	0.70	1.01	1.14	1.90	2.51	3.09	3.75
	0:55:00	0.00	0.00	0.52	0.75	0.88	1.37	1.82	2.37	2.88
	1:00:00	0.00	0.00	0.45	0.64	0.77	1.03	1.37	1.87	2.28
	1:05:00	0.00	0.00	0.43	0.60	0.74	0.87	1.16	1.65	2.01
	1:10:00	0.00	0.00	0.36	0.59	0.73	0.72	0.96	1.22	1.49
	1:15:00	0.00	0.00	0.32	0.53	0.72	0.64	0.85	0.98	1.21
	1:20:00	0.00	0.00	0.30	0.48	0.65	0.53	0.71	0.72	0.88
	1:25:00	0.00	0.00	0.29	0.45	0.55	0.48	0.63	0.58	0.71
	1:30:00	0.00	0.00	0.28	0.43	0.49	0.40	0.53	0.48	0.59
	1:35:00	0.00	0.00	0.27	0.42	0.45	0.36	0.47	0.43	0.53
	1:40:00	0.00	0.00	0.27	0.36	0.43	0.34	0.44	0.42	0.51
	1:45:00	0.00	0.00	0.27	0.32	0.42	0.32	0.43	0.41	0.50
	1:50:00	0.00	0.00	0.27	0.30	0.41	0.32	0.42	0.41	0.50
	1:55:00	0.00	0.00	0.22	0.29	0.39	0.31	0.41	0.41	0.50
	2:00:00	0.00	0.00	0.18	0.27	0.34	0.31	0.41	0.41	0.50
	2:05:00	0.00	0.00	0.10	0.15	0.20	0.18	0.24	0.23	0.29
	2:10:00	0.00	0.00	0.06	0.09	0.11	0.10	0.14	0.13	0.16
	2:15:00	0.00	0.00	0.03	0.05	0.06	0.05	0.07	0.07	0.09
	2:20:00	0.00	0.00	0.01	0.02	0.03	0.03	0.04	0.04	0.04
	2:25:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02
	2:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]
Detention Bottom	0.00	4,600	0.106	0	0.000	0.00
Zone 1 - WQCV Top	0.47	4,600	0.106	2,162	0.050	0.02
	0.50	4,600	0.106	2,300	0.053	0.02
	1.00	4,600	0.106	4,600	0.106	0.13
	1.50	4,600	0.106	6,900	0.158	0.19
Zone 2 - EURV Top	1.53	4,600	0.106	7,038	0.162	0.19
Zone 3 - Detention 100-yr WSE	1.85	4,600	0.106	8,510	0.195	2.01
Overflow Spillway Invert	2.00	4,600	0.106	9,200	0.211	3.46
	2.50	20	0.000	9,782	0.225	11.14
Overflow Spillway WSE	2.54	20	0.000	9,783	0.225	11.94
Control Structure Top Slab	3.00	20	0.000	9,792	0.225	22.49

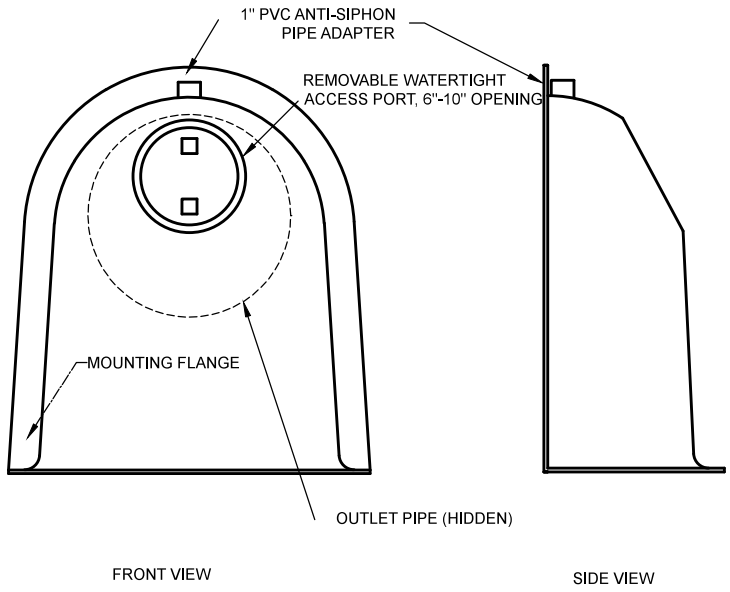
For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

QuikTrip No. 4273

BMP Water Quality Measures
SNOUT & Bio-Skirt
ADS FlexStorm Inlet Inserts

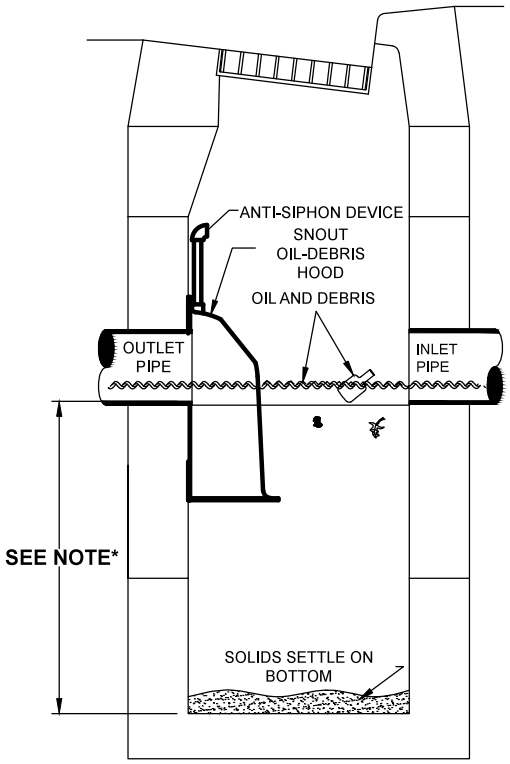
CONFIGURATION DETAIL



SNOUT OIL-WATER-DEBRIS SEPARATOR

CORRECT SNOUT SIZE ALWAYS LARGER
THAN PIPE SIZE. SEE NOTE 4 BELOW.

TYPICAL INSTALLATION



***NOTE-** SUMP DEPTH OF 36" MIN. FOR UP TO 12" ID PIPE. OUTLET. FOR PIPES 15" ID AND ABOVE SUMP DEPTH OF 2.5 TO 3 TIMES PIPE ID RECOMMENDED (E.G. 5' DEEP for 24" PIPE)

NOTES:

1. ALL HOODS AND TRAPS FOR CATCH BASINS AND WATER QUALITY STRUCTURES SHALL BE AS MANUFACTURED BY:
   BEST MANAGEMENT PRODUCTS, INC.
   9 MATHEWS DRIVE, UNIT A1-A2.
   EAST HADDAM, CT 06423
   TOLL FREE: (800) 504-8008 OR (888) 434-0277, FAX: (877) 434-3197
   WEB SITE: www.bmpinc.com
   OR PRE-APPROVED EQUAL

2. ALL HOODS SHALL BE CONSTRUCTED OF A GLASS REINFORCED RESIN COMPOSITE WITH ISO GEL COAT EXTERIOR FINISH WITH A MINIMUM 0.125" LAMINATE THICKNESS.

3. ALL HOODS SHALL BE EQUIPPED WITH A WATERTIGHT ACCESS PORT, A MOUNTING FLANGE, AND AN ANTI-SIPHON VENT PIPE AND ELBOW AS DRAWN. (SEE CONFIGURATION DETAIL)

4. THE SIZE AND POSITION OF THE HOOD SHALL BE DETERMINED BY OUTLET PIPE SIZE AS PER MANUFACTURER'S RECOMMENDATION. NOTE: THE CORRECT SNOUT SIZE WILL ALWAYS BE LARGER THAN NOMINAL PIPE SIZE (E.G. 12" ID PIPE REQS. 18 SERIES SNOUT OR LARGER).

5. THE BOTTOM OF THE HOOD SHALL EXTEND DOWNWARD A MINIMUM DISTANCE EQUAL TO 1/2 THE OUTLET PIPE DIAMETER WITH A MINIMUM DISTANCE OF 6" FOR PIPES <12" I.D.

6. THE SURFACE OF THE STRUCTURE WHERE THE HOOD IS MOUNTED SHALL BE FINISHED SMOOTH AND FREE OF LOOSE MATERIAL AND PIPE SHALL BE FINISHED FLUSH TO WALL.

7. THE ANTI-SIPHON VENT SHALL EXTEND ABOVE HOOD BY MINIMUM OF 3" AND A MAXIMUM OF 12" ACCORDING TO STRUCTURE CONFIGURATION.

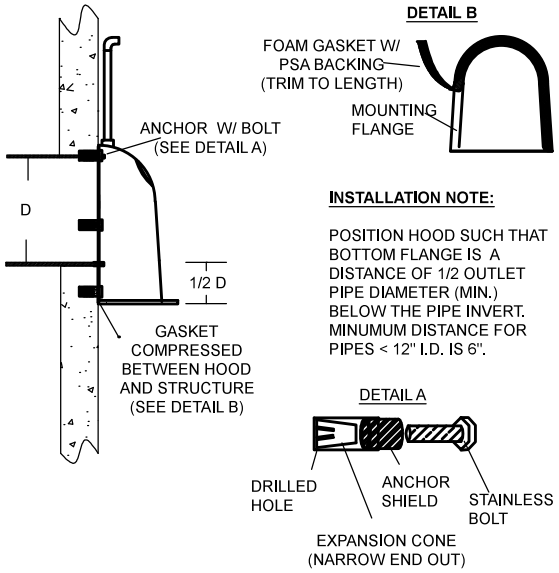
8. ALL STRUCTURE JOINTS SHALL BE WATERTIGHT.

9. THE HOOD SHALL BE SECURELY ATTACHED TO STRUCTURE WALL WITH $\frac{3}{8}$" STAINLESS STEEL BOLTS AND OIL-RESISTANT GASKET AS SUPPLIED BY MANUFACTURER. (SEE INSTALLATION DETAIL)

10. INSTALLATION INSTRUCTIONS SHALL BE FURNISHED WITH MANUFACTURER SUPPLIED INSTALLATION KIT.
    INSTALLATION KIT SHALL INCLUDE:
    A. INSTALLATION INSTRUCTIONS
    B. PVC ANTI-SIPHON VENT PIPE AND ADAPTER
    C. OIL-RESISTANT CRUSHED CELL FOAM GASKET WITH PSA BACKING
    D. 3/8" STAINLESS STEEL BOLTS
    E. ANCHOR SHIELDS

US Patent # 6126817, 7951294, 7857966, 8512556
Canada Patent # 2285146, 2690156, 2690156 others pending

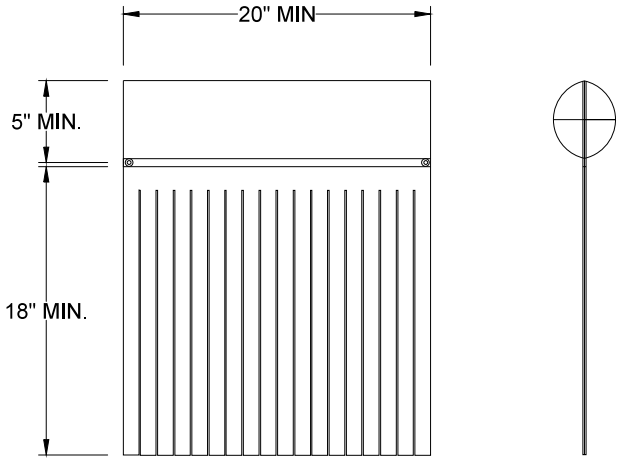
INSTALLATION DETAIL



HOOD SPECIFICATION FOR CATCH BASINS AND WATER QUALITY STRUCTURES

DESCRIPTION	DATE	SCALE
OIL- DEBRIS HOOD SPECIFICATION AND INSTALLATION (TYPICAL)	01/08/20	NONE
	DRAWING NUMBER	SP-SN

CONFIGURATION DETAIL

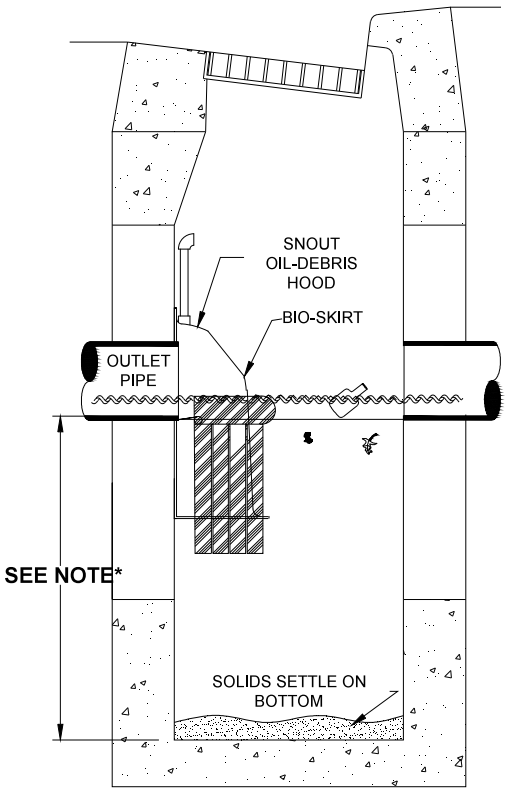


FRONT VIEW

SIDE VIEW

The BIO-SKIRT
HYDROCARBON ADSORBING SKIRTED BOOM

TYPICAL INSTALLATION



***NOTE-** ATTACH BIO-SKIRT STRUTURE WALL SUCH THAT IT IS APPROXIMATELY AT SAME ELEVATION AS STATIC WATER LEVEL

NOTES:

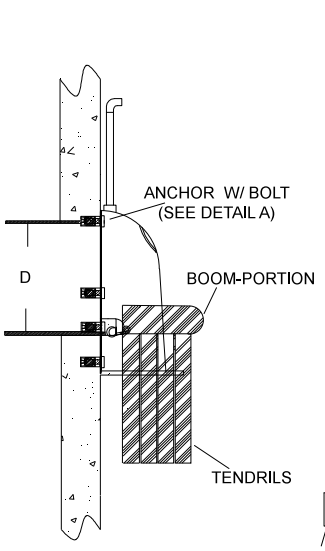
1. All new and/or existing catch basins or water quality structures shall be outfitted with the Bio-Skirt(R) Hydrocarbon reducing skirted boom as manufactured by:
   BEST MANAGEMENT PRODUCTS, INC.
   53 MT. ARCHER RD.
   LYME, CT 06371
   (860) 434-0277, (860) 434-3195 FAX
   TOLL FREE: (800) 504-8008 OR (888) 434-0277
   WEB SITE: www.bmpinc.com
   or pre-approved equal.

2. The skirted boom shall be comprised of an upper boom portion that is an adsorbent fabric covered floating boom of 5" minimum diameter with an integral lower skirt portion comprised of fabric tendrils of an 18" minimum length that hang beneath the boom.
3. All booms shall be made from geo-textile quality needle-woven filtration fabric manufactured from 100% recycled select fibers with a .125" minimum thickness.
4. All fabric shall be protected with a covalently surface bonded non-leaching antimicrobial agent and booms shall display a tag indicating "Antimicrobial" which preserves the service life of the unit.
5. The Bio-Skirt shall be positioned in front of the exit pipe and SNOUT® Oil-Debris Separator if so equipped (the preferred application of the Bio-Skirt is to be deployed with the SNOUT).
6. The skirted boom shall be securely attached to the structure wall on each side of the exit pipe with 3/8" stainless steel bolts, stainless steel tabs, plastic-composite hooks and elastomeric cord as found in manufacturer supplied in installation kit.
7. For applications where multiple Bio-Skirts are deployed together for larger SNOUTs (e.g. on 24" and larger SNOUTs per schedule below*), connect skirts grommet to grommet with hooks and cord as supplied in the installation kit.

Typical Deployment Schedule:
12-18" SNOUT- One Bio-Skirt
24-30" SNOUT- Two Bio-Skirts
36-52" SNOUT- Three Bio-Skirts
72" and up, Call 800-504-8008 for guidance.

SNOUT US Patent # 6126817

INSTALLATION DETAIL



DETAIL B

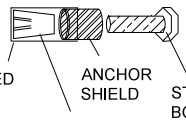
L-SHAPED TAB

HOOK

INSTALLATION NOTE:

PLACE ANCHORS SUCH THAT POSITION OF BOTTOM OF BOOM-PORTION OF BIO-SKIRT IS AT SAME ELEVATION AS PIPE INVERT. TENDRILS TO HANG DOWNWARD.

DETAIL A

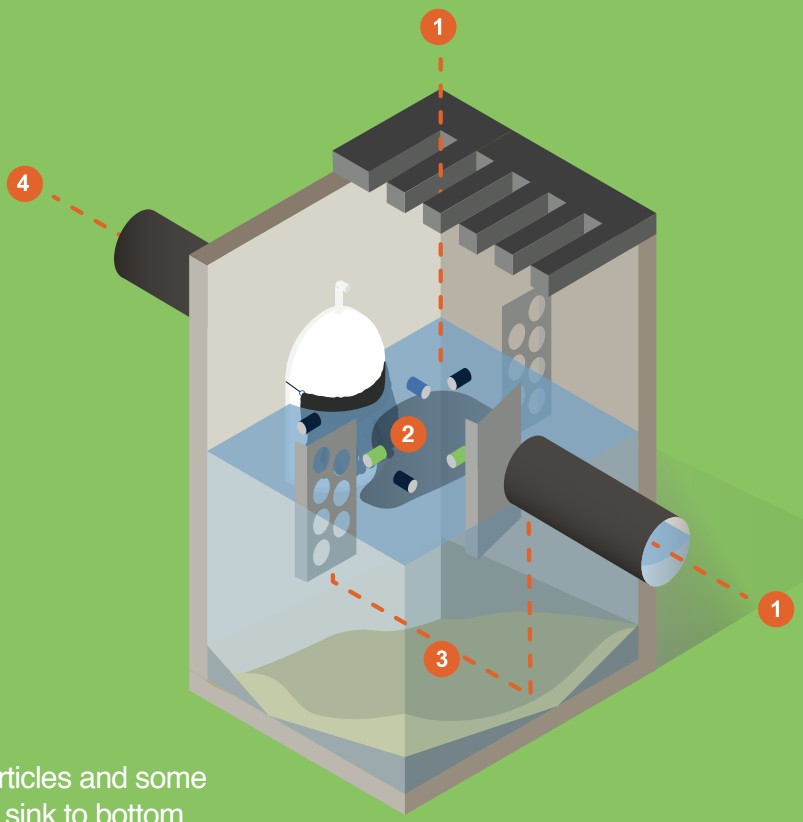


OIL ADSORBENT SPECIFICATION FOR CATCH BASINS AND WATER QUALITY STRUCTURES

DESCRIPTION	DATE	SCALE
BIO-SKIRT (TM) SPECIFICATION AND INSTALLATION (TYPICAL)	10/29/14	NONE
	DRAWING NUMBER	SP-BIO

The Quality Stormwater Management System

Helping you do more water quality improvement with less budget.



1. Stormwater and trash enter through grate or pipe.
2. Oil and floatable debris on surface cannot exit pipe.
3. Gross particles and some sediment sink to bottom.
4. Cleaner water exits from under SNOUT®.

Make the most of your stormwater dollars with the SNOUT® system.

We have stormwater quality experts on staff to help you with our wide range of products, including the SNOUT®, Bio-Skirt®, Stainless Steel TrashScreen™, and our new Turbo Plate® to reduce turbulence and and increase sediment capture.

Whether it is for highway or municipal drainage, governmental, educational, or residential facilities, we have the experience for your stormwater quality improvement needs.

Best Management Products
The Stormwater Quality Experts
20TH ANNIVERSARY

Made in the USA with over 80,000 SNOUT®s installed since 1999.

For more information on how our system can solve your stormwater quality issues, contact us at *(800) 504-8008* or visit us at *bmpinc.com*

Products for a better environment.

Best Management Products
The Stormwater Quality Experts

More than 80,000 SNOUTs® installed. Made in the USA since 1999.

For more information on how our systems can solve any stormwater situation, contact us at **800.504.8008** or visit us at **bmpinc.com**

Design and Maintenance Considerations for SNOUT® Stormwater Quality Systems

Background:

The SNOUT system from Best Management Products, Inc. (BMP, Inc.) is based on a vented hood that can reduce floatable trash and debris, free oils, and other solids from stormwater discharges. In its most basic application, a SNOUT hood is installed over the outlet pipe of a catch basin or other stormwater quality structure with a deep sump (see Installation Drawing). The SNOUT forms a baffle that traps floatable debris and free oils on the surface, while permitting heavier solids to sink to the bottom of the sump. The clarified intermediate layer is forced out of the structure through the open bottom of the SNOUT by displacement from incoming flow. The resultant discharge contains considerably less unsightly trash and other gross pollutants, and can also offer reductions of free-oils and finer solids.

As with any structural stormwater quality design, maintenance considerations will have a dramatic impact on SNOUT system performance over the life of the facility. The most important factor to consider when designing structures with a SNOUT is the depth of the sump. Sump is defined as the depth from the invert of the outlet pipe to the bottom of the structure. *Simply put, the deeper the sump, the more effective the unit will be both in terms of pollutant removals and reducing frequency of maintenance.* More volume in a structure means more quiescence, thus allowing the pollutants a better chance to separate out. Secondly, more volume means fewer cycles between maintenance, because the structure has a greater capacity. Of equal importance to good performance is putting SNOUTs in multiple structures. The closer one captures pollution to where it enters the infrastructure (e.g. at the inlet), the less mixing of runoff there is, and the easier it will be to separate out pollutants. Putting SNOUTs and deep sumps in all inlets that can be easily maintained develops a powerful structural treatment train with a great deal of effective storage volume, where even finer particles may have chance to settle out.

Design Notes:

- The SNOUT size is ALWAYS greater than the nominal pipe size. The SNOUT should cover the pipe OD and optimally the grouted area around the pipe (e.g. for a 12” pipe, an 18” SNOUT is the correct choice).
- As a rule of thumb, BMP, Inc. recommends *minimum* sump depths based on outlet pipe inside diameters of 2.5 to 3 times the outlet pipe size.
- For best performance, the inlet pipe and outlet pipe should have inverts close to the same elevation (a six inch or less deviation is optimal).
- Special note for smaller pipes: A minimum sump depth of 36 inches for all

pipe sizes 12 inches ID or less, and 48 inches for pipe 15-18 inches ID is required if collection of finer solids is desired.

- The plan dimension of the structure should be up to 6 to 7 times the flow area of the outlet pipe. Increasing area beyond that has a minimal impact on performance. However, the structure wall where the SNOUT is mounted must accommodate the size of the SNOUT (either the correct diameter or enough width).
- To optimize pollutant removals establish a "treatment train" with SNOUTs placed in as many inlets where it is feasible to do so (this protocol applies to most commercial, institutional or municipal applications and any application with direct discharge to surface waters).
- At a minimum, SNOUTs should be used in every third structure for less critical applications (less critical areas might include flow over grassy surfaces, very low traffic areas in private, non-commercial or non-institutional settings, single family residential sites).
- Use Bio-Skirts® for increased hydrocarbon reduction. Bio-Skirts are highly recommended for fueling or vehicle service stations, convenience stores, restaurants, loading docks, marinas, beaches, schools or high traffic applications. Each Bio-Skirt can retain about one gallon of oils.
- Use the Stainless TrashScreen for "Full Trash Capture" requirements.
- Use BMP Turbo Plates™ for increased sediment capture.
- The "R" series SNOUTs (12R, 18R, 24R, 30R, 30R/96, 42RTB/60, 52RTB/72, 52RTB/84 and 72RTB/96) are available for round manhole type structures of up to 96" ID; the "F" series SNOUTs (LP318F, 12F, 18F, 24F, 30F, 36F, 48F, 72F and 96F) are available for flat walled structures; the "NP" series SNOUTs (NP1218R, NP1524R, NP1830R, and NP2430R) are available for smaller diameter structures up to 30" ID.

Example Structure Sizing Calculation:

A SNOUT equipped structure with a 15 inch ID outlet pipe (1.23 sqft. flow area) will offer best performance with a minimum plan area of 7.4 sqft. and 48 inch sump. Thus, a readily available 48 inch diameter manhole-type structure, or a rectangular structure of 2 feet x 4 feet will offer sufficient size when combined with a sump depth of 48 inches or greater.

Maintenance Recommendations:

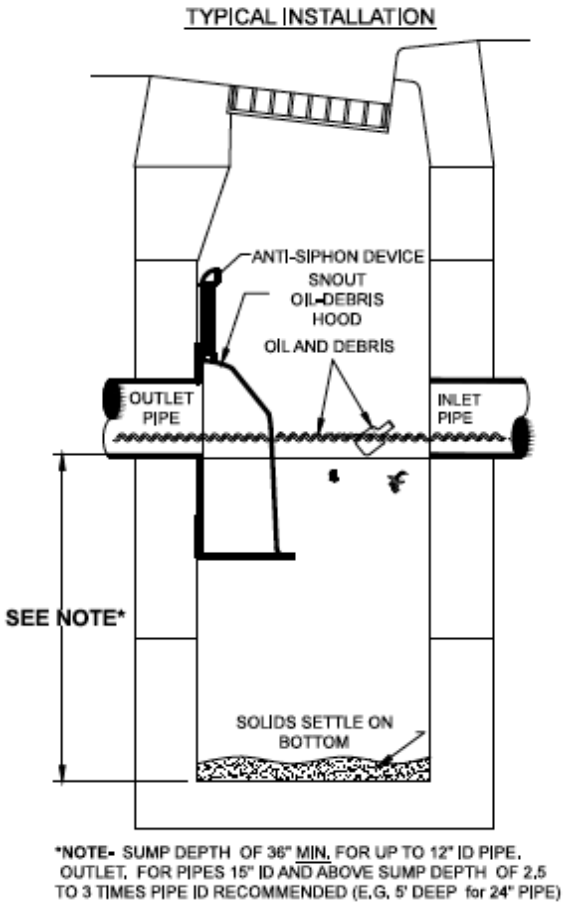
- Monthly monitoring for the first year of a new installation after the site has been stabilized is a recommended practice.
- Measurements should be taken after each rain event of .5 inches or more, or monthly, as determined by local weather conditions.
- Checking sediment depth and noting the surface pollutants in the structure will be helpful in planning maintenance.
- The pollutants collected in SNOUT equipped structures will consist of floatable debris and oils on the surface of the captured water, and grit and sediment on the bottom of the structure.
- It is best to schedule maintenance based on the solids collected in the sump.
- Optimally, the structure should be cleaned when the sump is half full (e.g. when 2 feet of material collects in a 4 foot sump, clean it out).
- Structures should also be cleaned if a spill or other incident causes a larger

than normal accumulation of pollutants in a structure.

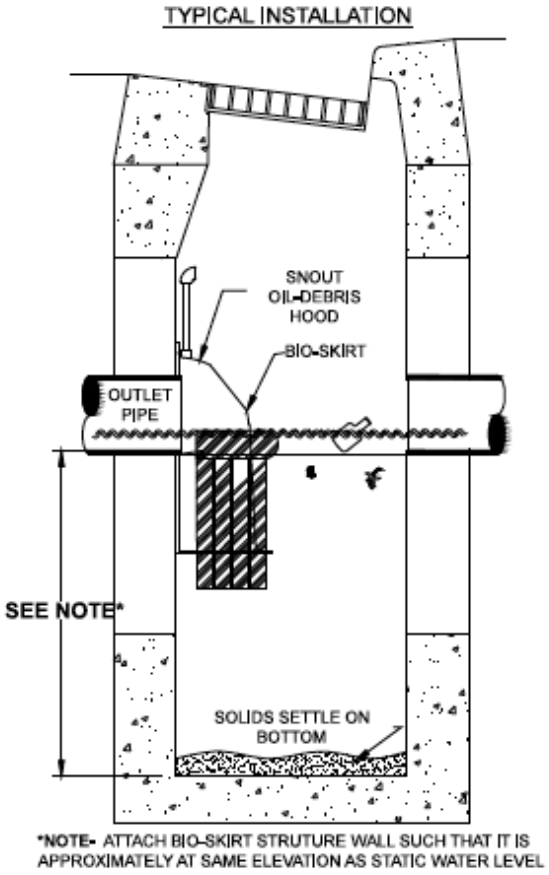
- Maintenance is best done with a vacuum truck.
- If Bio-Skirts are being used in the structure to enhance hydrocarbon capture, they should be checked on a monthly basis for the first year, and serviced or replaced when more than 2/3 of the boom is submerged, indicating a nearly saturated state. Assuming a typical pollutant-loading environment exists, Bio-Skirts should be serviced* annually or replaced as necessary.
- In the case of an oil spill, the structure should be checked and serviced and Bio-Skirts (if present) replaced or serviced immediately.
- All collected wastes must be handled and disposed of according to local environmental requirements.
- To maintain the SNOUT hoods, an annual inspection of the anti-siphon vent and access hatch are recommended. A simple flushing of the vent, or a gentle rodding with a flexible wire are all that's typically needed to maintain the anti-siphon properties. Opening and closing the access hatch once a year ensures a lifetime of trouble-free service.

*To extend the service life of a Bio-Skirt, the unit may be "wrung out" to remove oils and washed in an industrial washing machine with warm water. The Bio-Skirt may then be re-deployed if the material maintains it's structural integrity. A maintained Bio-Skirt can last for several years. Each Bio-Skirt can hold about on gallon of oils.

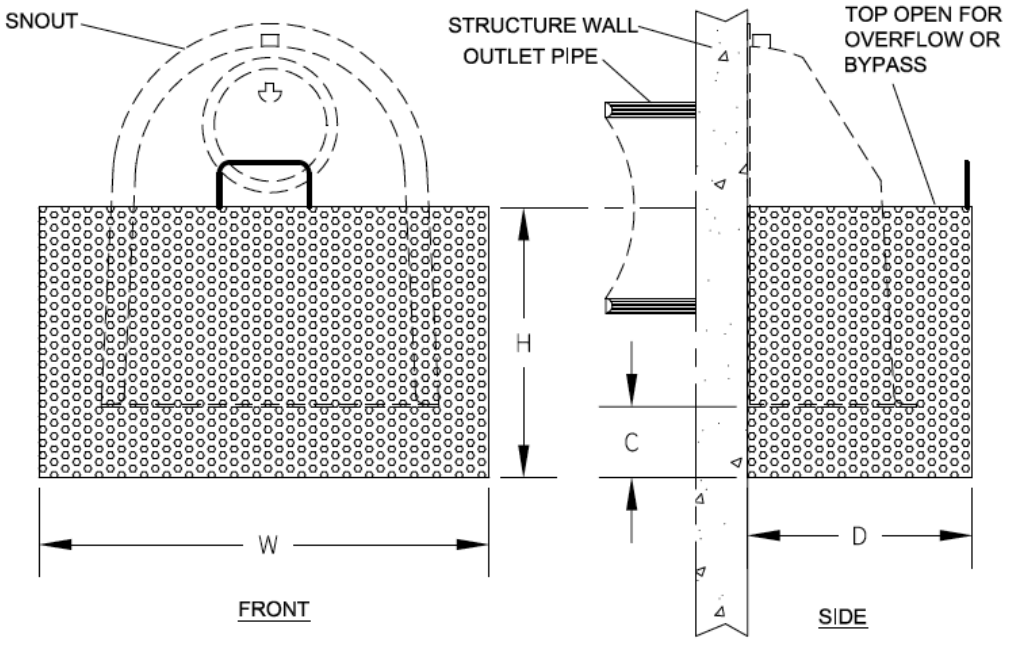
SNOUT INSTALLATION:



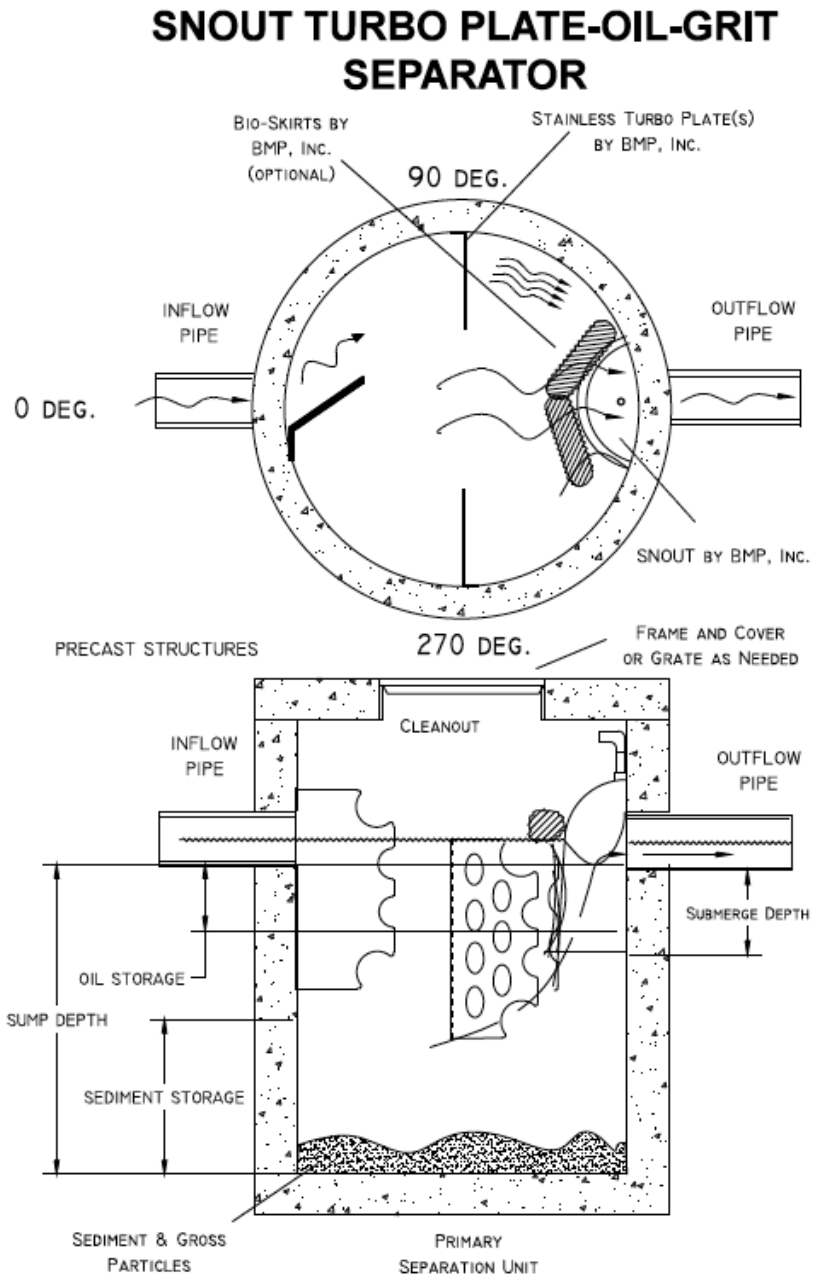
BIO-SKIRT INSTALLATION:



STAINLESS TRASHSCREEN INSTALLATION:



TURBO PLATE INSTALLATION:



Contact Information: Please contact T. J. Mullen at 800-504-8008, tjm@bmpinc.com or Matt White at 888-434-0277, mwhite@bmpinc.com for design assistance.

Website: www.bmpinc.com

Bio-Skirt™ Installation Instructions

1. Select the appropriate number of Bio-Skirts according to the size of the SNOUT® as follows: For 12" and 18" SNOUTs or NP1218 or NP1524 (use one Bio-Skirt); For 24" and 30" SNOUTs or NP1830 or NP2430 (use two Bio-Skirts); 36" to 54" SNOUT (use three Bio-Skirts); for SNOUT sizes over 54" consult with BMP application engineer.

2. To optimally position the Bio-skirt, it should be centered across the width of the Snout, and placed vertically so that the blue webbing stripe with grommets will float approximately at the same elevation as the static waterline (see photo 3). To do this, place one anchor bolt on each side of the SNOUT at the invert of the pipe the SNOUT covers. If this is an existing Snout installation, follow the instructions below to secure the mounting bolts and clips, directly onto the structure wall to which the Snout is attached (see photo 1). You may also utilize existing bolts on either side of the Snout if it will allow the Bio-skirt to float at the static waterline.

3. Install the Anchor Assemblies and Clips s follows.

   For Concrete Structures:

   Mark the location of where the anchors will be placed:

   (1) Drill a 3/4"hole into the base material to the required depth (approximately 1-1/4" deep.)

   (2) Blow the hole clean of dust and other material.

   (3) Insert the anchor into the hole. Narrow end of cone must point out, lead shield slides over cone.

   (4) Position the setting tool or a 9/16 socket against the anchor outer sleeve. (The outer rim of the tool or socket should seat onto the lead shield rim.) Set the anchor by driving the lead sleeve over the cone using several <u>sharp</u> hammer blows. Be sure the anchor is at the required embedment depth (flush or slightly below face of concrete)

   (5) Attach the clip, aligned vertically, onto anchor with the supplied bolt and washer. (see photo 1)

   Plastic Structure Install:

   (1) Mark and pre-drill (To match holes in SNOUT®) six pilot holes (3/16") for the 14 x 1 1/4" SS self tapping hex drive screws provided in kit. Install ¼ x 1" Neoprene Backed Washers on each screw and tighten to approximately 10-15 pounds.

   (2) Attach the clip, vertically, onto anchor via supplied bolt and washer. (see photo 1).

3. Assemble the Bio-skirt tether, using the provided black adjustable hooks and blue elastomeric cord (see photo 2). Cut cord to length as needed.

4. Attach the Bio-Skirt using the two tethers, one per side, and four hooks, two per side, one hook attached to grommet and one hook to clip on each side.

5. For applications where multiple Bio-Skirts are deployed together for larger SNOUTs (e.g. on 24” and larger SNOUTs per schedule below), connect skirts grommet to grommet with hooks and cord as supplied in installation kit. Trim cord sections to length between Bio-Skirts to loosely span circumference of SNOUT.

Bio-Skirt Installation Kit Items :

2- 3/8”expansion anchor assemblies (anchors, stainless bolts & stainless washers)
4- Plastic Hooks(1) 1" or 2” female pipe adapter
2- Stainless Steel Connector Tabs
1- 6’ Length Elastomeric Cord (cut two pieces to length)

Photo 1. Clip on SNOUT (Align vertically)

Photo 2. Hook and Cord Assembly

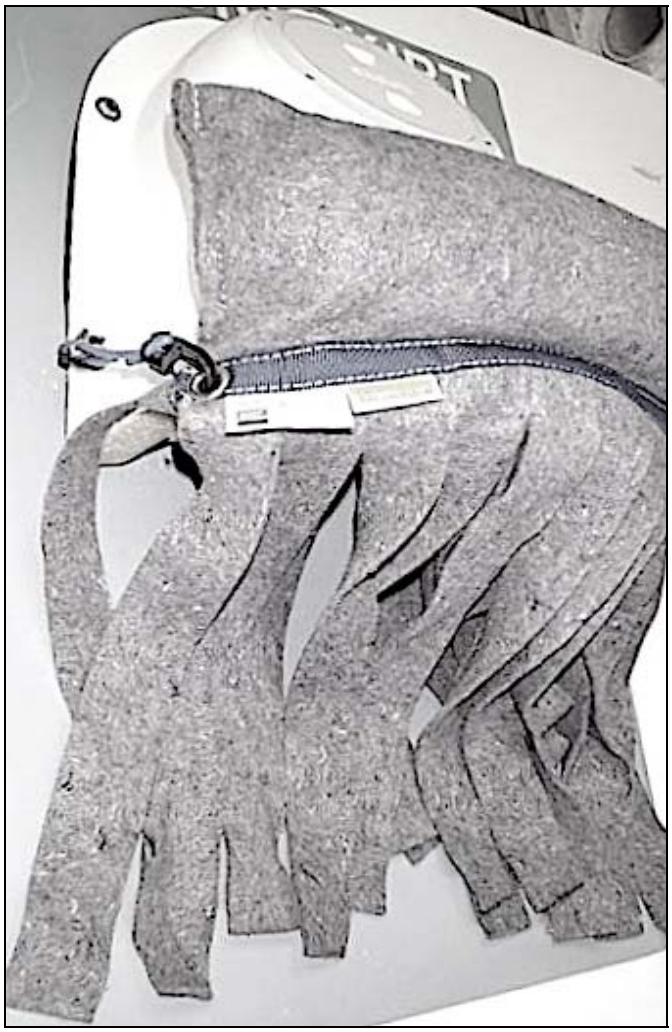


Photo 3. Installed Bio-Skirt, grommet and clip at static water line.

Maintenance Note: Should Bio-Skirt become saturated with oil, it can be wrung out and re-deployed. It can also be washed in a washing machine and re-deployed. The Anti-microbial properties that protect the fabric will stay intact, even after washing. Dispose of any captured oils or the Bio-Skirt themselves according to local regulations.

Removal of Emulsified Oil with Bio-Skirt™ Media

Stubborn emulsions where oil has become dispersed are one of the most challenging filtration problems for industrial wastewater. In an emulsion, oil is partially dissolved. Consequently, most sorbents and filtration products are completely ineffective.

Method

Testing was performed using a laboratory prepared stock solution of 5 ml of motor oil and 5 ml of diesel fuel to 200 ml of water. 10 ml of a citrus-based degreaser was added to the solution and vigorously agitated creating a known emulsion.

Three separate concentrations of stock solution were created and tested:

Low - 1.0 ml of stock solution to 1.0 liter of water
Medium - 10 ml of stock solution to 1.0 liter of water
High - 100 ml of stock solution to 1.0 liter of water

A 15 cm by 6 cm filter housing was used and filled with 20 grams of the bulk filtration Bio-Skirt media. The Bio-Skirt was wetted prior to the commencement of the test. The test solution was run through the Bio-Skirt at a rate of 500 ml per minute and the first filtrate was discarded. An additional portion of the test solution was run through the Bio-Skirt and collected for analysis. Filtered and unfiltered test solutions were sampled by USEPA Method 418 (USEPA Method 418 measures petroleum hydrocarbons as well as fats in soaps).

The samples were extracted and a silica gel cleanup was performed to remove the fatty acids and soaps from the samples allowing accurate measurement of the motor oil and diesel components.

Results of analytical chemistry are presented in the table below.

Results

Sample	Result (ppm) Unfiltered	Result (ppm) with Bio-Skirt	% Oil Removed
Low	**24**	**3.2**	**87%**
Med	**140**	**7**	**95%**
High	**960**	**24**	**97%**

Conclusions

At the medium and high levels Bio-Skirt™ media removed greater than 90 percent of the oil. Competing products that remove floating oil have generally proven ineffective with partially dissolved or emulsified oil. While this data should not be construed to predict performance in the field for any given SNOUT + Bio-Skirt application, it does give an accurate indication of the potential for oil removals of the Bio-Skirt media in a filtration application.

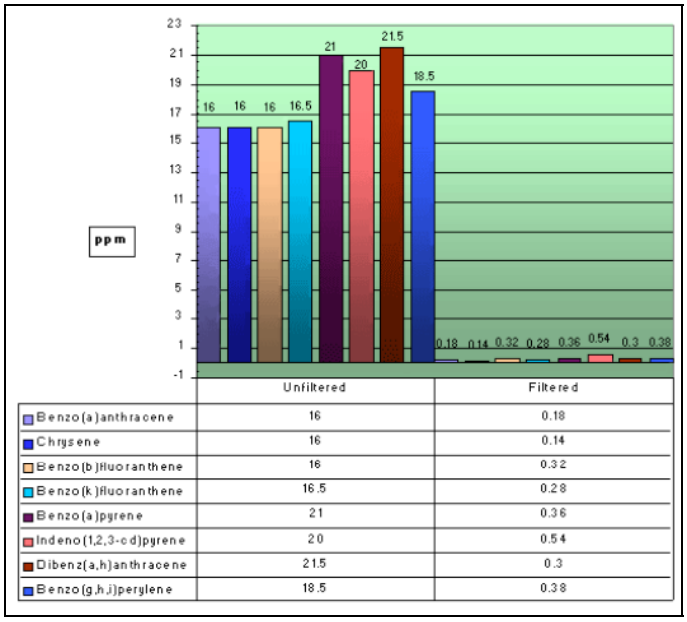
Polynuclear Aromatic Hydrocarbon (PAH) Removal with Bio-Skirt™ media

Many situations exist where PAHs need to be removed, especially in groundwater remediation efforts, and to a lesser extent in stormwater quality applications.

Method

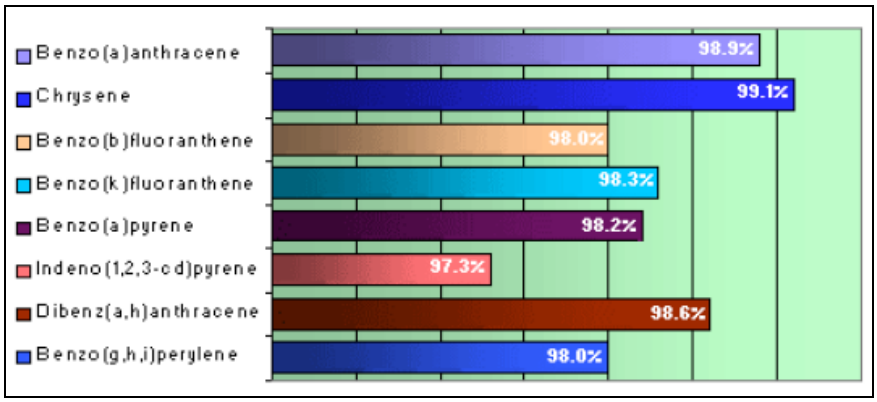
Analytical laboratory spiked aqueous samples were analyzed for PAH concentrations by USEPA Method 8270. Those spiked samples were then poured through 20 grams of Bio-Skirt geo-textile filtration fabric and the water passing through the Bio-Skirt fabric was again analyzed by USEPA Method 8270 providing the results of analytical chemistry presented in the graphs below.

PAH removal when filtered with Bio-Skirt media:



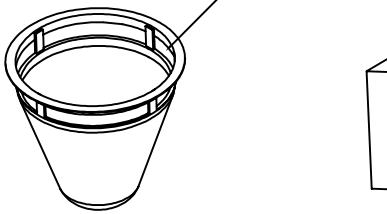
	Unfiltered	Filtered
Benzo(a)anthracene	16	0.18
Chrysene	16	0.14
Benzo(b)fluoranthene	16	0.32
Benzo(k)fluoranthene	16.5	0.28
Benzo(a)pyrene	21	0.36
Indeno(1,2,3-cd)pyrene	20	0.54
Dibenz(a,h)anthracene	21.5	0.3
Benzo(g,h,i)perylene	18.5	0.38

Percent removal of PAHs:

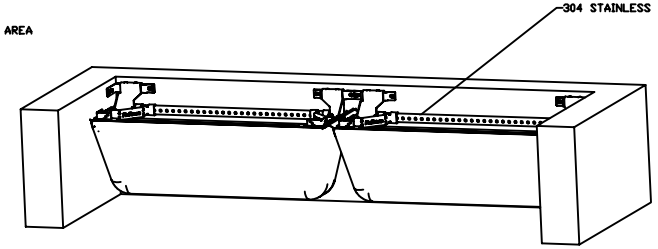


Conclusions: The PAH removal efficiency of Bio-Skirt media is in excess of 97%. While this data should not be construed to predict performance in the field for any given SNOUT + Bio-Skirt application, it does give an accurate indication of the potential for oil removals of the Bio-Skirt media in a filtration application.

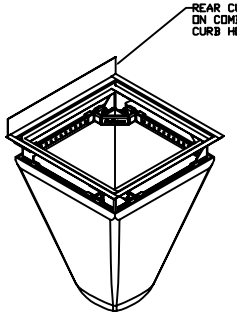
FLEXSTORM PURE FILTERS FOR PERMANENT INLET PROTECTION
PRODUCT SELECTION AND SPECIFICATION DRAWING



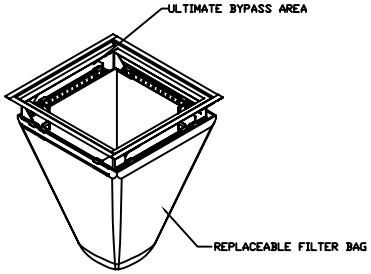
FLEXSTORM PURE INLET FILTERS
FOR ROUND OPENINGS



FLEXSTORM PURE WALL MOUNT INLET
FILTERS FOR OPEN THROAT GUTTERS



FLEXSTORM PURE INLET FILTERS
FOR COMBINATION INLETS



FLEXSTORM PURE INLET FILTERS
FOR RECTANGULAR OPENINGS
WITH GRATES

For Round Openings with Grates		Minimum Bypass Flow Rates (CFS)*
Drop Thru Opening Size Dia	Flexstorm Frame P/N	Based on Nominal Frame Size with minimum 2" Bypass flow gap
Small: 10.0" - 18.0"	62SHDR	1.6
Medium: 18.1" - 24.0"	62MHDR	2.7
Large: 24.1" - 36.0"	62LHDR	3.8

For Open Throat Curb Inlets - Mounted to Wall Beneath Curb Opening	
Curb Opening Size	Flexstorm Frame P/N
Up to 4' curb openings (1 Filter)	62HDWM1
Between 4' and 8' curb openings (2 Filters)	62HDWM2
Between 8' and 12' curb openings (3 Filters)	62HDWM3
Between 12' and 16' curb openings (4 Filters)	62HDWM4

For Rectangular/Square Openings with Grates			Minimum Bypass Flow Rates (CFS)*
Clear Drop Thru Opening Size *(not grate or seat size)*	Flexstorm Frame P/N	Combination P/N	Based on Nominal Frame Size with minimum 2" Bypass flow gap
Small: 12" x 12" up to 16" x 16" (or 64" max perimeter)	62SHD	62SHDCB	2.4
Medium: 18" x 18" up to 24" x 24" (or 96" max perimeter)	62MHD	62MHDCB	3.5
Large: 26" x 26" up to 30" x 30" (or 120" max perimeter)	62LHD	62LHDCB	5.0
XL: 32" x 32" up to 48" x 48" (or 192" max perimeter) typ 2 pc set	62XLHD	62XLHDCB	7.2

CREATE YOUR ADS FLEXSTORM PART NUMBER BY COMBINING FRAME P/N AND BAG P/N

1. IDENTIFY YOUR FLEXSTORM FRAME PART NUMBER FROM TABLES ABOVE
2. SELECT YOUR BAG PART NUMBER BASED ON APPLICATION NEEDS

FLEXSTORM FILTER BAGS	(22" depth) STD Bag P/N	(12" depth) Short Bag P/N	Clean Water Flow Rate (GPM/SqFt)	Min A.O.S. (US Sieve)
FX: Standard Woven Bag	FX	FX-S	200	40
FX+: Woven w/ MyCelx	FXP	FXP-S	200	40
FXO: Woven w/ Oil Boom	FXO	FXO-S	200	40
PC: Post Construction Bag	PC	PC-S	137	140
PC+: PC Bag w/ MyCelx	PCP	PCP-S	137	140
LL: Litter and Leaf Bag	LL	LL-S	High	3.5
IL: IDOT Non-Woven Bag	IL	IL-S	145	70

SPECIFICATIONS FOR STANDARD BAGS BY NOMINAL BAG / FRAME SIZE

Nominal Bag Size *Matched to Frame Size*	Solids Storage (CuFt)	Filtered Flow Rate at 50% Max (CFS) FX (Woven)	PC (Post Constr)	IL (NonWoven)	* PC Oil Retention (Oz)	**PC+ Oil Retention (Oz)	**FX+ Oil Retention (Oz)
Small	1.6	1.2	0.8	0.9	79	168	89
Medium	2.1	1.7	1.2	1.3	115	204	89
Large	3.8	2.7	1.8	1.9	173	262	89
XL	4.2	3.6	2.4	2.6	230	319	178
Filtration Efficiency		82%	NA	Large scale 3rd party testing per ASTM D 7351 using 7% concentration USDA Sandy Loam			
TSS (total suspended solids rem)		NA	99%	Large Scale testing at 90 GPM using US Silica OK-110 sand at 1750 mg/L measuring TSS per SM 2540D.			
TPH (tot petroleum hydrocarbons)		NA	96%	Large Scale testing at 90 GPM with used motor oil at 243 mg/L measuring per EPA Method 1664A.			

* PC filter bag at 50% max adsorption capacity

** PC filter bag at 50% capacity and MyCelx skimmer at 100% capacity

3. CREATE YOUR FLEXSTORM INLET FILTER PART NUMBER

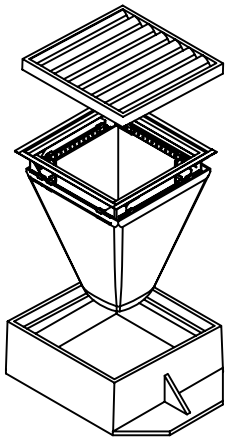
Frame P/N from Step 1. Filter Bag P/N from Step 2.

NOTES:

1. ALL FRAMING IS CONSTRUCTED OF 304 STAINLESS STEEL FOR 25 YEAR SERVICE LIFE RATING
2. TOTAL BYPASS CAPACITY: BYPASS CAPACITY WILL VARY WITH EACH SIZE DRAINAGE STRUCTURE. FLEXSTORM DESIGNS FRAMING BYPASS TO MEET OR EXCEED THE DESIGN FLOW OF THE PARTICULAR DRAINAGE STRUCTURE.
3. UPON ORDERING CONFIRMATION OF THE DOT CALLOUT, PRECAST OR CASTING MAKE AND MODEL, OR DETAILED DIMENSIONAL FORMS MUST BE PROVIDED TO CONFIGURE AND ASSEMBLE YOUR CUSTOMIZED FLEXSTORM INLET FILTER. PART NUMBER ALONE IS NOT SUFFICIENT.
4. FOR WRITTEN SPECIFICATIONS AND MAINTENANCE GUIDELINES VISIT WWW.INLETFILTERS.COM

INSTALLATION:

1. REMOVE GRATE
2. DROP FLEXSTORM INLET FILTER ONTO LOAD BEARING LIP OF CASTING OR CONCRETE STRUCTURE
3. REPLACE GRATE

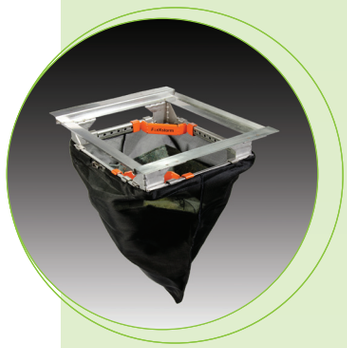


FLEXSTORM INLET FILTERS™
PURE

ALL PRODUCTS MANUFACTURED
BY INLET & PIPE PROTECTION, INC
A DIVISION OF ADS, INC.
WWW.INLETFILTERS.COM
(866) 287-8655 PH
(630) 355-3477 FX
INFO@INLETFILTERS.COM

SIZE	DWG NO	REV
C	FLEXSTORM_PURE	A
SCALE		SHEET 1 OF 1

FLEXSTORM® PURE PERMANENT INLET PROTECTION



SPECIFY WITH CONFIDENCE

State DOTs and Municipalities across the country now have a universal structural BMP to address the issue of storm sewer inlet protection: FLEXSTORM PURE Inlet Filters.

The FLEXSTORM PURE system is the preferred choice for permanent inlet protection and storm water runoff control. Constructed of versatile stainless steel, FLEXSTORM PURE Inlet Filters will fit any drainage structure and are available with site-specific filter bags providing various levels of filtration. Whether you're the specifier or the user, it's clear to see how FLEXSTORM PURE Inlet Filters outperform the competition.

APPLICATIONS:

Car Washes	Gas Stations
Commercial	Parking Lots
Loading Ramps	Dock Drains
Industrial	Maintenance

FEATURES:

- Stainless Steel filter framing is custom configured to fit perfectly into any drainage structure, whether a standard design or obstructed inlet opening
- Filtered Flow Rates and Ultimate Bypass Rates are designed to meet your specific inlet requirements
- Multiple Filter Bags are available targeting site specific removal of trash, litter, leaves, or small particles, oil and grease
- Filters work below grade with an ultimate bypass allowing inlet area to drain with a full bag
- Units install in seconds and are easily maintained with the FLEXSTORM Universal Removal Tool (no heavy machinery required)

BENEFITS:

- Receive payback on your investment: durable stainless steel framing provides extended service life while replaceable filter bags handle loads with a safety factor of 5
- Meet stringent removal requirements:
  –FX filter bags are rated for > 80% removal efficiency of street sweep-size particles
  –PC/PC+ filter bags have been tested to 99% TSS removal of OK-110 US Silica Sand and 97% TPH (total petroleum hydrocarbon) removal
- Help prevent fines: FLEXSTORM Inlet Filters comply with EPA NPDES initiatives as a temporary or permanent BMP
- Available through 5,000 ADS distributors nationwide
- If not in stock, orders up to 100 pcs can ship within 48 hours

ADS Service: ADS representatives are committed to providing you with the answers to all your questions, including selecting the proper filter, specifications, installation and more. Also try the ADS FLEXSTORM Online Product Configurator at www.inletfilters.com

*THE MOST **ADVANCED** NAME IN WATER MANAGEMENT SOLUTIONS™*

FLEXSTORM PURE INLET FILTERS SPECIFICATION

IDENTIFICATION

The installer shall inspect the plans and/or worksite to determine the quantity of each drainage structure casting type. The foundry casting number, exact grate size and clear opening size, or other information will be necessary to finalize the FLEXSTORM part number and dimensions. The units are shipped to the field configured precisely to fit the identified drainage structure.

MATERIAL AND PERFORMANCE

The FLEXSTORM Inlet Filter system is comprised of a corrosion resistant steel frame and a replaceable geotextile filter bag attached to the frame with a stainless steel locking band. The filter bag hangs suspended at a distance below the grate that shall allow full water flow into the drainage structure if the bag is completely filled with sediment. The standard Woven Polypropylene FX filter bags are rated for 200 gpm/sqft with a removal efficiency of 82% when filtering a USDA Sandy Loam sediment load. The Post Construction PC filter bags are rated for 137 gpm/sqft and have been 3rd party tested at 99% TSS removal to 110 micron and 97% TPH removal of used motor oil hydrocarbon mix.

INSTALLATION

Remove the grate from the casting or concrete drainage structure. Clean the ledge (lip) of the casting frame or drain- age structure to ensure it is free of stone and dirt. Drop in the FLEXSTORM Inlet Filter through the clear opening and be sure the suspension hangers rest firmly on the inside ledge (lip) of the casting. Replace the grate and confirm it is elevated no more than 1/8", which is the thickness of the steel hangers. For wall mount units, follow instructions for attaching the stainless steel mounting brackets using the provided concrete fasteners.

INSPECTION FREQUENCY

Construction site inspection should occur following each 1⁄2" or more rain event. Post Construction inspections should occur three times per year (every four months) in areas with mild year round rainfall and four times per year (every three months Feb–Nov) in areas with summer rains before and after the winter snowfall season. Industrial application site inspections (loading ramps, wash racks, maintenance facilities) should occur on a regularly scheduled basis no less than three times per year.

MAINTENANCE GUIDELINES

Empty the filter bag if more than half filled with sediment and debris, or as directed by the Engineer. Remove the grate, engage the lifting bars or handles with the FLEXSTORM Removal Tool, and lift from the drainage structure. Dispose of the sediment or debris as directed by the Engineer or Maintenance Contract in accordance with EPA guidelines.

As an alternative, an industrial vacuum may be used to collect the accumulated sediment. Remove any caked on silt from the sediment bag and reverse flush the bag with medium spray for optimal filtration. Replace the bag if torn or punctured to 1⁄2" diameter or greater on the lower half of the bag. Post Construction PC/PC+ Bags should be maintained prior to 50% oil saturation. The average 2' x 2' PC filter bag will retain approx. 96 oz (5.4 lbs) of oil at which time it should be serviced or replaced. It can be centrifuged or passed through a wringer to recover the oils, and the fabric reused with 85% to 90% efficacy. It may also be recycled for its fuel value through waste to energy incineration. When utilizing the Cleartec Rubberizer Pouches in the + bags, note that these oil skimmers will gradually turn brown and solidify as they become saturated, indicating time for replacement. Each pouch will absorb approximately 62 oz (4 lbs) of oil before requiring replacement. The spent media may also be recycled for its fuel value through waste to energy incineration. Dispose of all oil contaminated products in accordance with EPA guidelines.

FILTER BAG REPLACEMENT

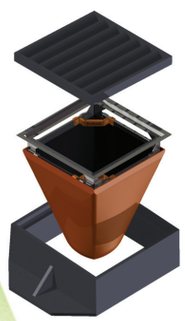
Remove the bag by loosening or cutting off the clamping band. Take the new filter bag, which is equipped with a stainless steel worm drive clamping band, and use a screw driver to tighten the bag around the frame channel. Ensure the bag is secure and that there is no slack around the perimeter of the band.

Lift Handles ease installation and maintenance

Replaceable Sediment Bag

1/8" thick steel hangers& channels; precision stampings **configured to fit each individual casting**

CAD drawings, work instructions and test reports on website: ***www.inletfilters.com***



For more information on FLEXSTORM Inlet Filters and other ADS products, please contact our Customer Service Representatives at 1-800-821-6710
Try the ADS FLEXSTORM Online Product Configurator at www.inletfilters.com.

Advanced Drainage Systems, Inc.
1-800-821-6710 www.ads-pipe.com

FLEXSTORM www.inletfilters.com

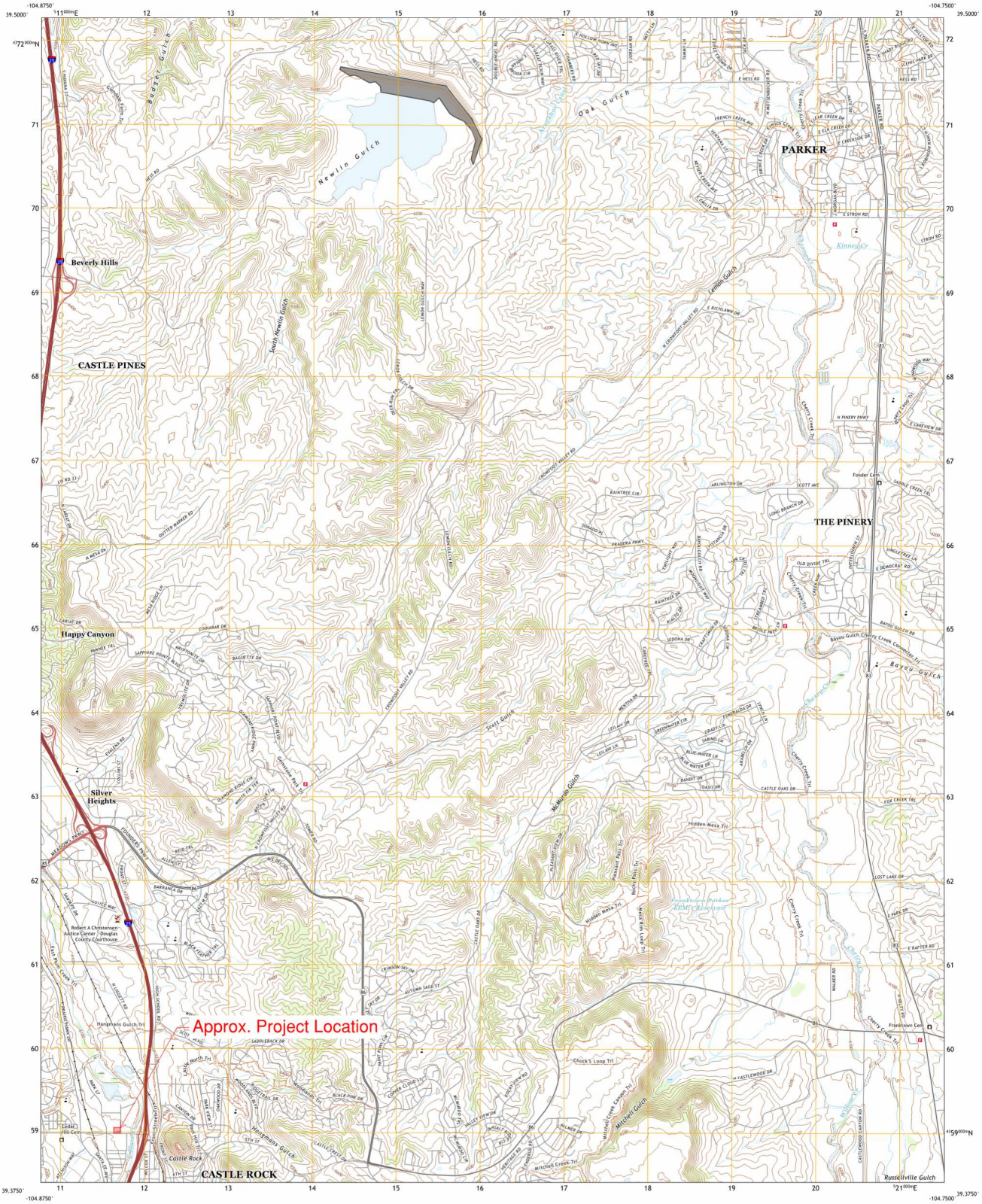
QuikTrip No. 4273

USGS Map
FEMA Map
NRCS Soils Map
NWI Wetland Map

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map US Topo

CASTLE ROCK NORTH QUADRANGLE
COLORADO - DOUGLAS COUNTY
7.5-MINUTE SERIES



Produced by the United States Geological Survey

North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1 000-meter grid:Universal Transverse Mercator, Zone 13S

This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery.....NAIP, August 2017 - January 2018
Roads.....U.S. Census Bureau, 2016
Names.....GNIS, 1978 - 2021
Hydrography.....National Hydrography Dataset, 2003 - 2019
Contours.....National Elevation Dataset, 2022
Boundaries.....Multiple sources; see metadata file 2019 - 2021
Public Land Survey System.....BLM, 2021
Wetlands.....FWS National Wetlands Inventory 1984

UTM GRID AND 2019 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

U.S. National Grid
100,000 - m Square ID
EID
Grid Zone Designation 13S

SCALE 1:24 000

1 0.5 0 KILOMETERS 1 2
1000 500 0 METERS 1000 2000
1 0.5 0 1
MILES
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000
FEET

CONTOUR INTERVAL 20 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard.

COLORADO
QUADRANGLE LOCATION

ADJOINING QUADRANGLES

1	2	3
4		5
6	7	8

1 Highlands Ranch
2 Parker
3 Piney Creek
4 Sedalia
5 Ponderosa Park
6 Dawson Butte
7 Castle Rock South
8 Russellville Gulch

ROAD CLASSIFICATION

Expressway — Local Connector
Secondary Hwy — Local Road
Ramp — 4WD
Interstate Route — US Route — State Route

CASTLE ROCK NORTH, CO
2022

NSN
NGA REF NO. USGS 24760165

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

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

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Floodway Data table shown on this FIRM.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

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

Base map information shown on this FIRM was provided by the Douglas County GIS Department and the Town of Castle Rock GIS Department. Additional input was provided by the City of Lone Tree and Town of Parker. These data are current as of 2010.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

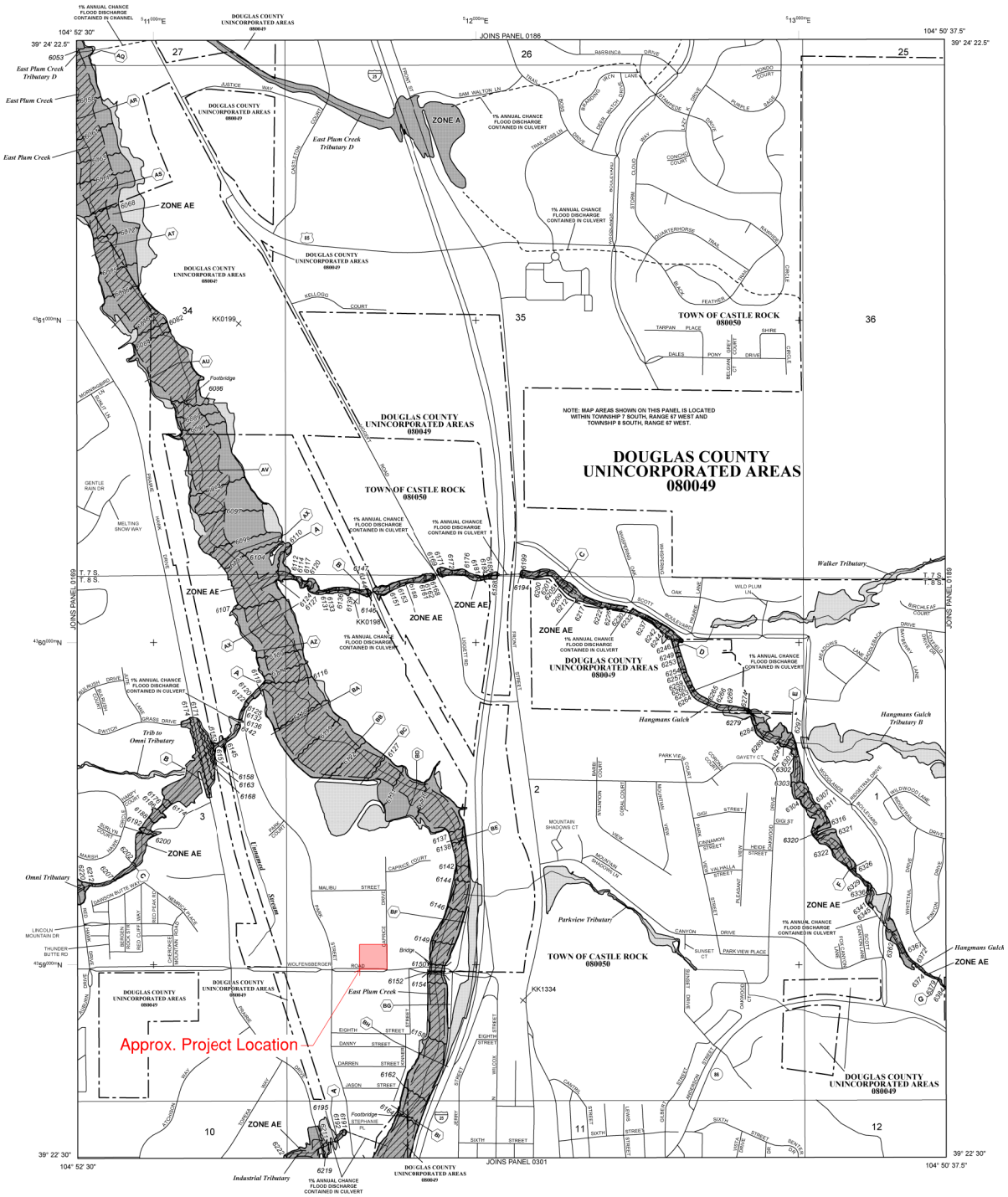
Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

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

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

For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map,** how to order products, or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at **1-877-FEMA-MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.



LEGEND

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

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

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

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

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

1% Annual Chance Floodplain Boundary

0.2% Annual Chance Floodplain Boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.

513 (EL 987) Base Flood Elevation line and value; elevation in feet*

Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

A — A Cross section line

23 — 23 Transect line

45° 02' 08", 93° 02' 12" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere

4189000mN 1000-meter Universal Transverse Mercator grid values, zone 13

DX5510 × Bench mark (see explanation in Notes to Users section of this FIRM panel)

M1.5 River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP

SEPTEMBER 30, 2005

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

MARCH 16, 2016: to update corporate limits, to change base flood elevations, to add base flood elevations, to add special flood hazard areas, to update map format, to add roads and road names, to reflect updated topographic information, to incorporate previously issued letters of map revision.

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

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

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0188G

FIRM

FLOOD INSURANCE RATE MAP

DOUGLAS COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 188 OF 495

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
CASTLE ROCK, TOWN OF	080050	0188	G
DOUGLAS COUNTY	080049	0188	G

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

MAP NUMBER
08035C0188G
MAP REVISED
MARCH 16, 2016

Federal Emergency Management Agency

Hydrologic Soil Group—Castle Rock Area, Colorado
(QT4273 Castle Rock)

Map Scale: 1:700 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 10 20 40 60

Feet
0 30 60 120 180

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Soil Rating Lines

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Soil Rating Points

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Water Features

Streams and Canals

Transportation

Rails
Interstate Highways
US Routes
Major Roads
Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

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

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

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

Soil Survey Area: Castle Rock Area, Colorado
Survey Area Data: Version 17, Aug 29, 2024

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

Date(s) aerial images were photographed: Mar 1, 2023—Sep 1, 2023

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BrB	Bresser sandy loam, cool, 1 to 3 percent slopes	B	1.3	72.4%
NeE	Newlin gravelly sandy loam, 8 to 30 percent slopes	B	0.5	27.6%
Totals for Area of Interest			**1.9**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

U.S. Fish and Wildlife Service
National Wetlands Inventory

QT4273 Castle Rock

April 10, 2025

Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

QuikTrip No. 4273

Plan Sheets

LOT 4A
PARCEL ID # 2505-023-13-021
OWNER: BERKENKOTTER HOLDINGS LLC
ZONE: B WOLFENSBERGER OVERLAY

LOT 5
KOLACNY'S ADD. TO CASTLE ROCK
RECEPTION #155843

1 STORY METAL BUILDING #1133

GETTY SUBDIVISION

LOT 2
PARCEL ID # 2505-023-14-012
OWNER: BERKENKOTTER HOLDINGS, LLC
ZONE: B WOLFENSBERGER OVERLAY

LOT 1C
PARCEL ID # 2505-023-13-006
OWNER: JOON CHO
ZONE: B WOLFENSBERGER OVERLAY

N01°21'28"W 189.69' M
(N01°08'52"W 189.57' R)

PARCEL ID # 2505-023-13-020
OWNER: BALBACH STREET PROPERTIES LLC
ZONE: B WOLFENSBERGER OVERLAY

Reciprocal Ingress & Egress Easement Doc #360165 (Bk590, Pg706)

Drainage & Utility Easement Doc #254392

S88°42'11"W 140.00'

50' ROW

N1°08'52"W 49.47'

16' Utility EasementT Doc #254392

10' Bldg/Stbk

S89°35'50"E 197.37'

12.6'

11.97'

37.49'

53.08'

LOT 1

WILLIAM'S SUBDIVISION
RECEPTION #348102 &
CORRECTION #9021814

TFR

15' Bldg/Stbk

132.00'

54.45'

N01°08'52"W 132.00'

PROPOSED 5' CONCRETE SIDEWALK

LOT 1A

VILLAGE NORTH AMENDED SUBDIVISION
RECEPTION #254392

N88°42'11"E 140.00'

N1°08'52"W 264.00'

LOT 1B
PARCEL ID # 2505-023-13-013
OWNER: 1020 PARK ST CASTLE ROCK INC
ZONE: B WOLFENSBERGER OVERLAY

N0°24'10"E 220.48'

PARCEL ID # 2505-023-13-008
OWNER: BERKENKOTTER HOLDINGS LLC
COMMITMENT FILE NO. 00505502-201-TH7-NB
ZONE: B WOLFENSBERGER OVERLAY

214.53'

54.6'

CAPRICE DRIVE (PUBLIC)

MOST OF LOT 2
PARCEL ID # 2505-023-14-018
OWNER: SUNSET VILLAS LLC
ZONE: B WOLFENSBERGER OVERLAY

MOST OF LOT 1
PARCEL ID # 2505-023-14-017
OWNER: CSC METRO LLC
ZONE: B WOLFENSBERGER OVERLAY

REPLAT OF LOT 1 GETTY SUBDIVISION

LOT 2
PARCEL ID # 2505-023-13-012
OWNER: HARLAN H WILLIAMS FAMILY TR.
COMMITMENT FILE NO. 00505501-201-TH7-NB
ZONE: B WOLFENSBERGER OVERLAY

N01°08'52"W 132.00'

89.83'

56.28'

15' Bldg/Stbk

8' Fnc/Stbk

203.26'

140.00'

S88°42'11"W 343.26'

25' Roadway Easement Bk 213 Pg 185

50' ROW

10' Drainage & Utility Easement Doc #204598

WOLFENSBERGER ROAD (PUBLIC)

78.5' ROW

88.4' ROW

PROPOSED 5' CONCRETE SIDEWALK

REPLAT OF CASTLE PARK WEST 1ST AMD

LOT 1
PARCEL ID # 2505-023-12-025
OWNER: RED SNIPS LLC
ZONE: B

LOT 2
PARCEL ID # 2505-023-12-026
OWNER: WH CAPITAL LLC
ZONE: B

HH SUB 1ST AMENDMENT

LOT 1
PARCEL ID # 2505-023-12-013
OWNER: DDP WARD LLC
ZONE: B

LOT 2
PARCEL ID # 2505-023-12-014
OWNER: TOTOTLAN LLC
ZONE: B

H & H SUBDIVISION

LOT 2
PARCEL ID # 2505-023-12-007
OWNER: CST METRO LLC
ZONE: B

N

30 15 0 30 60

FILE LOCATION:\\DESKTOP-HIMC8GB\Civil 3D Projects\QT4273 Castle Rock, CO\83-4273 Civil.dwg TAB NAME:Overall Plan Layout USER:dkhol SAVED:4/22/2025 6:38 PM PLOTTED:4/22/2025 6:40 PM

COLORADO LICENSED PROFESSIONAL ENGINEER
DA[illegible]MAN
#.0056104
PRELIMINARY

PROJECT NO.:83-4273

MDG
Midwest Design Group
Kansas City
PO Box 860015
Shawnee, KS 66286-0015
P 913.248.9385

QuikTrip No. 4273

WOLFENSBERGER ROAD & CAPRICE DRIVE
CASTLE ROCK, DOUGLAS COUNTY, COLORADO 80109

QT

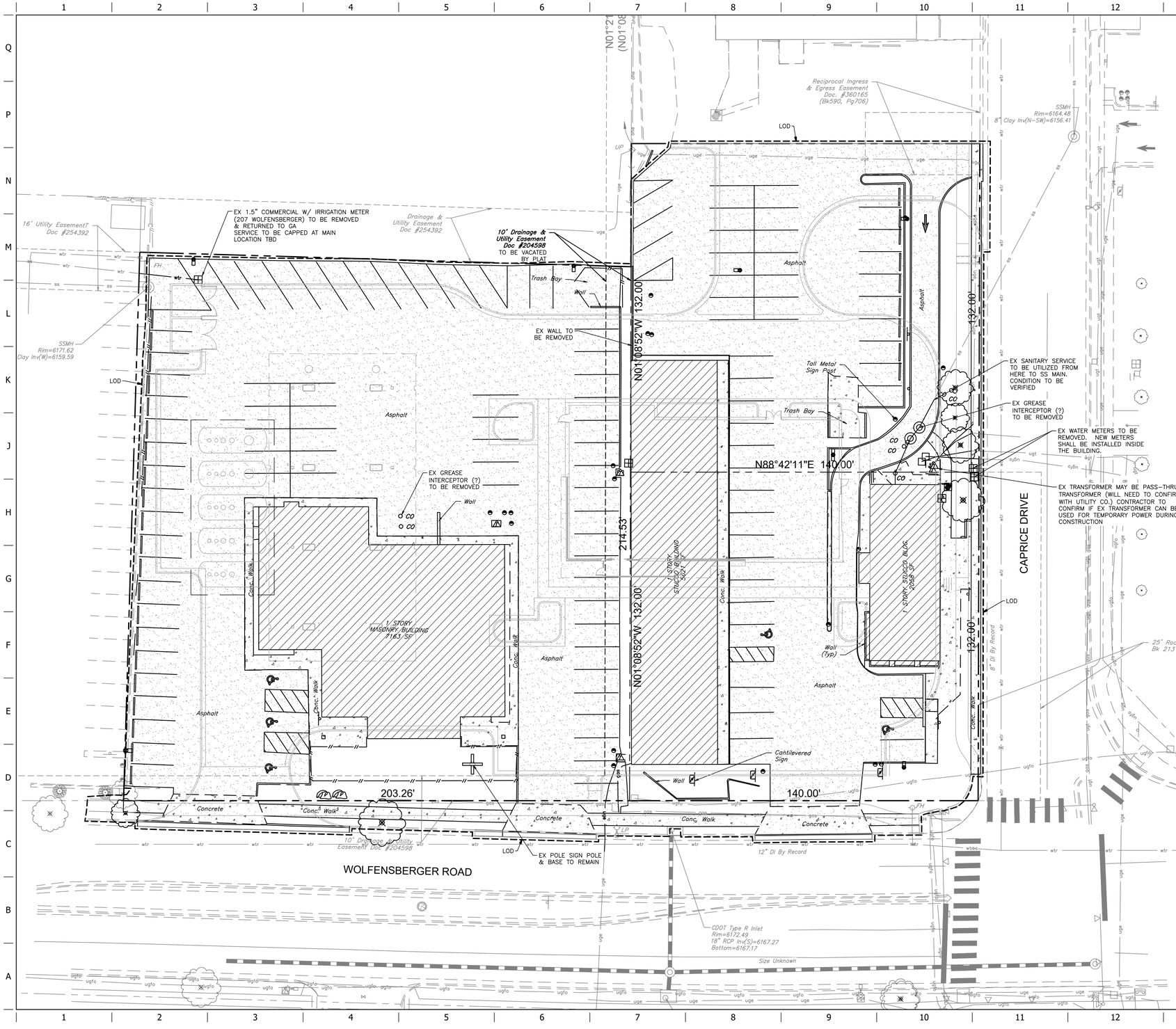
PROTOTYPE:	P-121
DIVISION:	83
VERSION:	001
DESIGNED BY:	DKH
DRAWN BY:	CSH
REVIEWED BY:	AMG

REV	DATE	DESCRIPTION

ORIGINAL ISSUE DATE: 04/22/2025

SHEET TITLE:
SITE DEVELOPMENT PLAN
OVERALL SITE PLAN

SHEET NUMBER:
2 OF 23



DEMOLITION LEGEND

- EX CONCRETE PAVEMENT /SIDEWALK REMOVAL
- EX ASPHALT PAVEMENT REMOVAL
- EX BUILDING DEMOLITION
- LIMITS OF DISTURBANCE (LOD)

DEMOLITION NOTES:

1. ALL ITEMS IN BOLD ARE TO BE DEMOLISHED.
2. ALL TREES/BRUSH/LANDSCAPE ROCK WITHIN CONSTRUCTION LIMITS ARE TO BE REMOVED.
3. DEMOLITION CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING AND PAYING FOR ALL TOWN, COUNTY, STATE AND FEDERAL PERMITS REQUIRED TO COMPLETE THE DEMOLITION WORK.
4. THE DEMOLITION CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING ALL OF THE EXISTING UTILITY DISCONNECTIONS AND PERFORMING THOSE DISCONNECTIONS NOT PERFORMED BY ASSOCIATED UTILITY COMPANIES. ALL DISCONNECTIONS SHALL BE PERFORMED IN ACCORDANCE WITH GOVERNING AGENCY SPECIFICATIONS.
5. THE EXISTING FEATURES SHOWN ON THESE PLANS ARE THOSE NOTED IN THE FIELD AND THOSE TAKEN FROM RECORD DRAWINGS. THERE IS NO GUARANTEE THAT ALL FEATURES (BOTH ABOVE AND BELOW GROUND) ARE SHOWN ON THE PLANS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO VISIT THE SITE TO DETERMINE THE EXTENT OF DEMOLITION REQUIRED.
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR RAZING AND REMOVAL OF ANY EXISTING STRUCTURES (INCLUDING FOOTINGS), RELATED UTILITIES, PAVING, AND ANY OTHER EXISTING IMPROVEMENTS AS NOTED AND/OR NECESSARY FOR THE CONSTRUCTION OF THE PROPOSED IMPROVEMENTS. REFER TO SITE WORK SPECIFICATIONS.
7. THE CONTRACTOR IS TO REMOVE AND DISPOSE OF (OFF-SITE) ALL DEBRIS, RUBBISH AND OTHER MATERIALS RESULTING FROM PREVIOUS AND CURRENT DEMOLITION OPERATIONS. DISPOSAL WILL BE IN ACCORDANCE WITH ALL LOCAL, STATE AND/OR FEDERAL REGULATIONS GOVERNING SUCH OPERATIONS. ANY HAZARDOUS MATERIALS SHALL BE DISPOSED OF IN ACCORDANCE WITH APPLICABLE ENVIRONMENTAL LAWS. REFER TO ENVIRONMENTAL REPORT. CONTRACTOR TO CONTACT QT ENVIRONMENTAL COMPLIANCE ENGINEER WITH DISPOSAL PLAN.
8. THE CONTRACTOR SHALL PROVIDE PROPER PROTECTION OF EXISTING FEATURES THAT ARE TO REMAIN TO THE SATISFACTION OF THE OWNER AND GOVERNING AGENCIES. ANY EXISTING FEATURES DAMAGED DURING THE COURSE OF DEMOLITION/CONSTRUCTION SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE.
9. THE CONTRACTOR SHALL PROVIDE A FULL DEPTH SAW CUT WHERE PAVEMENT DEMOLITION ABUTS PAVEMENT THAT REMAINS IN PLACE. WHERE NEW PAVEMENT IS TO BE PLACED ADJACENT TO THIS SAW CUT, THE SAW CUT EDGE IS TO BE PROTECTED UNTIL NEW PAVEMENT IS PLACED. IN THE EVENT THE SAW CUT BECOMES DAMAGED THE CONTRACTOR SHALL PROVIDE A NEW SAW CUT TO ESTABLISH A "CLEAN" EDGE FOR THE NEW PAVEMENT TO ABUT.

COLORADO LICENSED PROFESSIONAL ENGINEER
PRELIMINARY
DAVID K. HAMAN
E.0056104

PROJECT NO.:83-4273

MDG
Midwest Design Group
Kansas City
PO Box 860015
Shawnee, KS 66286-0015
P 913.248.9385

QuikTrip No. 4273

WOLFENSBERGER ROAD & CAPRICE DRIVE
CASTLE ROCK, DOUGLAS COUNTY, COLORADO 80109

PROTOTYPE:	P-121
DIVISION:	83
VERSION:	001
DESIGNED BY:	DKH
DRAWN BY:	CSH
REVIEWED BY:	AMG

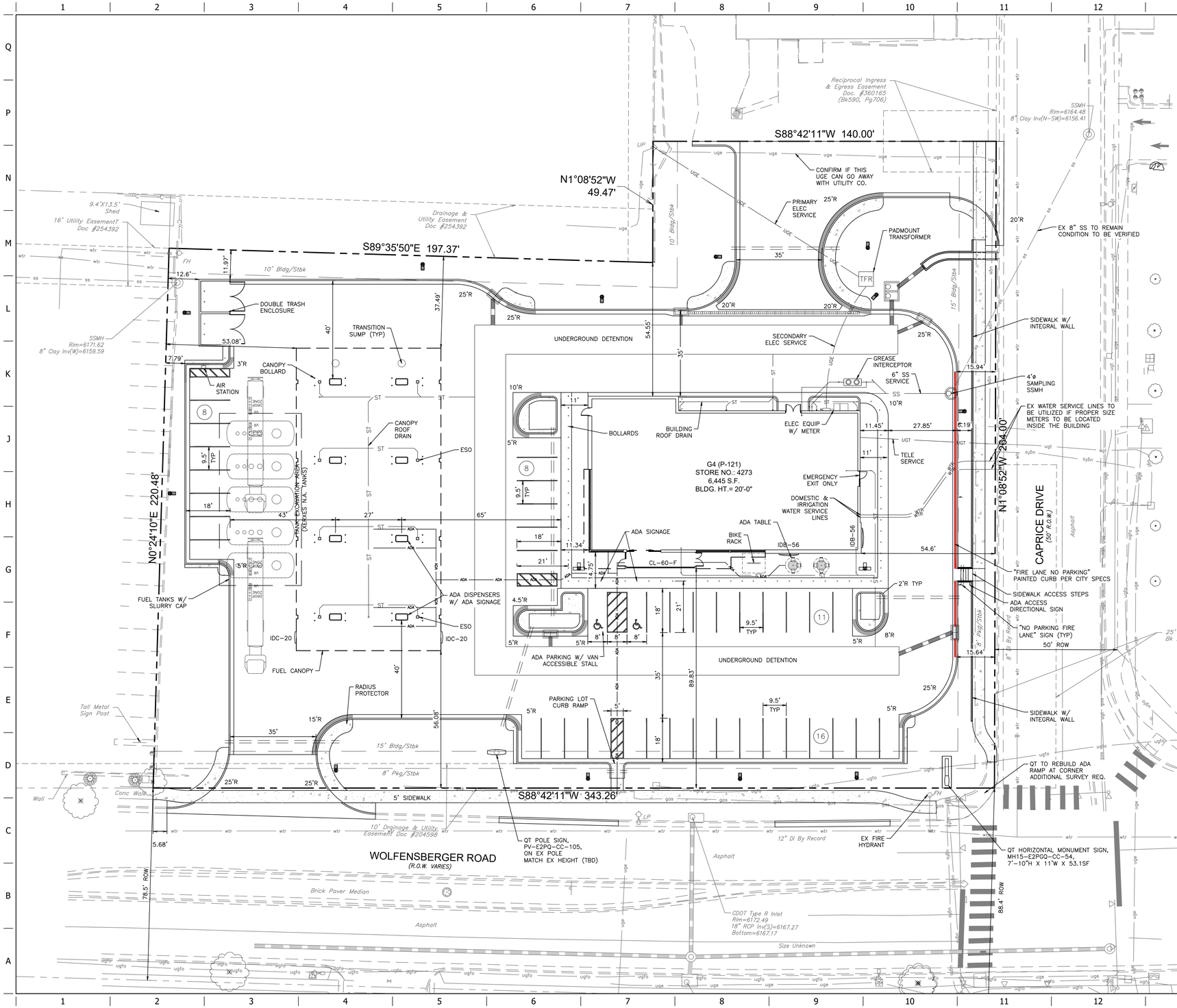
REV	DATE	DESCRIPTION

ORIGINAL ISSUE DATE: 04/22/2025

SHEET TITLE:
SITE DEVELOPMENT PLAN
DEMOLITION PLAN

SHEET NUMBER:
3 OF 23

FILE LOCATION:\\DESKTOP-HIMC8GB\Civil 3D Projects\QT4273 Castle Rock, CO\83-4273 Civil.dwg TAB NAME:Demo USER:dkhol SAVED:4/22/2025 6:38 PM PLOTTED:4/22/2025 6:40 PM



SITE LEGEND

- BOUNDARY LINE
- CONCRETE CURB AND GUTTER
- MOUNTABLE CURB W/RADIUS PROTECTOR
- PARKING SPACE INDICATOR
- AREA LIGHT
- MULTIPLE PRODUCT DISPENSER WITH CANOPY COLUMN AND BOLLARDS
- TRANSFORMER
- FUEL SYSTEM ACCESS MANWAY

SITE NOTES:

1. ALL DIMENSIONS SHOWN ARE TO FACE OF CURB UNLESS OTHERWISE NOTED.
2. THE MAXIMUM CROSS SLOPE ON ALL PROPOSED SIDEWALKS, INCLUDING PUBLIC AND PRIVATE SIDEWALK DRIVEWAY CROSSINGS, IS 1.5%.
3. REFERENCE PHOTOMETRIC SITE PLAN FOR SITE LIGHTING DETAILS. LIGHT POLE LOCATIONS CAN BE SCALED FROM DRAWINGS OR STAKED BY CONSTRUCTION STAKING CONTRACTOR.
4. OUTSIDE TABLE INSTALLATION SHALL CONFORM TO MANUFACTURER SPECIFICATIONS.
5. REGULATORY SIGNAGE SHALL CONFORM TO M.U.T.C.D.
6. ALL IMPROVEMENTS WITHIN PUBLIC RIGHT OF WAY SHALL BE CONSTRUCTED IN ACCORDANCE WITH GOVERNING AGENCY SPECIFICATIONS.

COLORADO LICENSED PROFESSIONAL ENGINEER
DA[illegible]MAN
#.0056104
PRELIMINARY

PROJECT NO.:83-4273

MDG
Midwest Design Group
Kansas City
PO Box 860015
Shawnee, KS 66286-0015
P 913.248.9385

QuikTrip No. 4273

WOLFENSBERGER ROAD & CAPRICE DRIVE
CASTLE ROCK, DOUGLAS COUNTY, COLORADO 80109

PROTOTYPE:	P-121
DIVISION:	83
VERSION:	001
DESIGNED BY:	DKH
DRAWN BY:	CSH
REVIEWED BY:	AMG

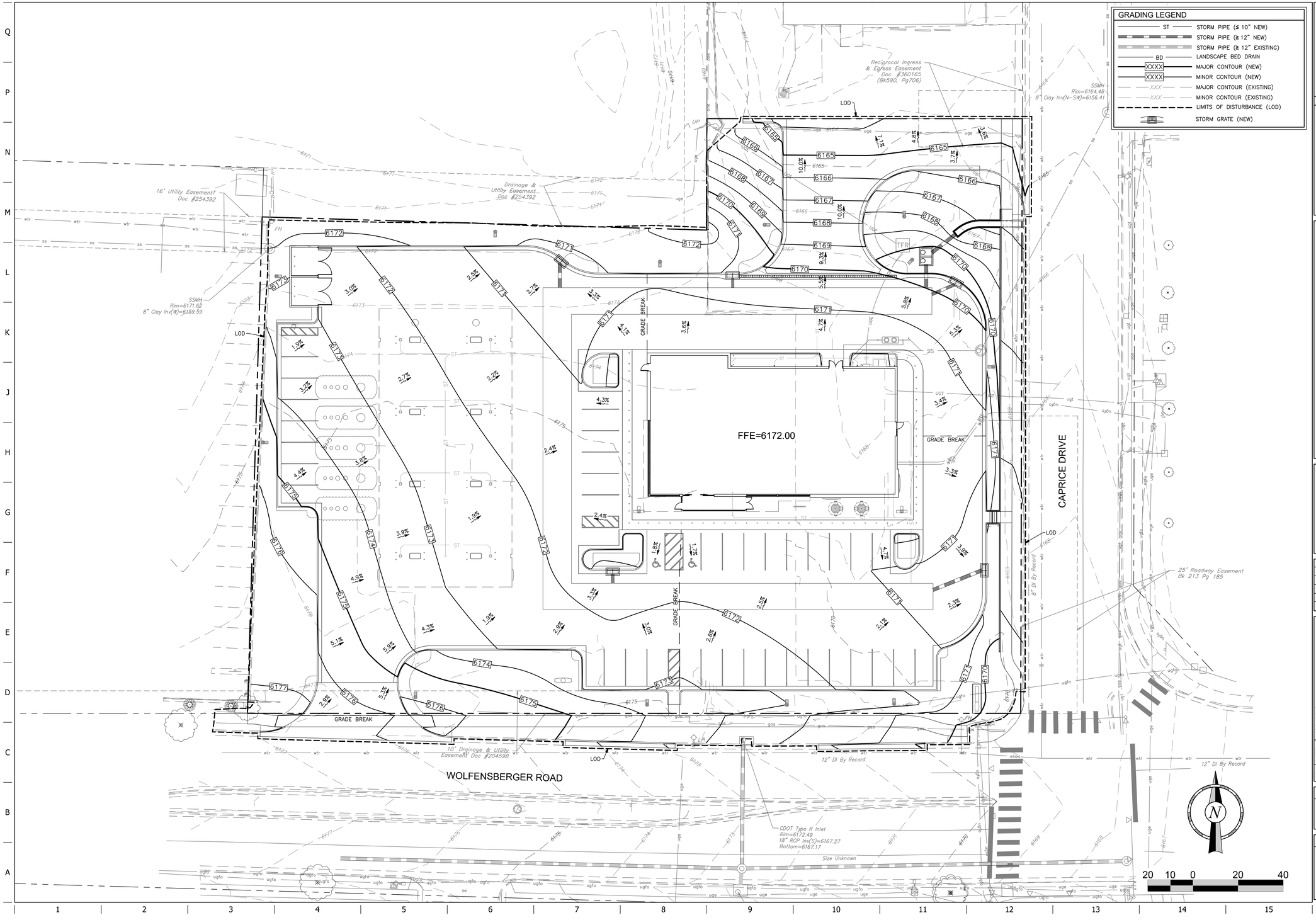
REV	DATE	DESCRIPTION

ORIGINAL ISSUE DATE: 04/22/2025

SHEET TITLE:
SITE DEVELOPMENT PLAN
SITE PLAN

SHEET NUMBER:
4 OF 23

FILE LOCATION:\\DESKTOP-HMC8GBV\Civil 3D Projects\QT4273 Castle Rock, CO\83-4273 Civil.dwg TAB NAME:Site USER:dkhol SAVED:4/22/2025 6:38 PM PLOTTED:4/22/2025 6:40 PM



FILE LOCATION:\\DESKTOP-HIMC8GB\Civil 3D Projects\QT4273 Castle Rock, CO\83--4273 Civil.dwg TAB NAME:Grading USER:dkhol SAVED:4/22/2025 6:38 PM PLOTTED:4/22/2025 6:40 PM

COLORADO LICENSED PROFESSIONAL ENGINEER
PRELIMINARY
DA[illegible]MAN
E.0056104

PROJECT NO.:83-4273

MDG
Midwest Design Group
Kansas City
PO Box 860015
Shawnee, KS 66286-0015
P 913.248.9385

QuikTrip No. 4273

WOLFENSBERGER ROAD & CAPRICE DRIVE
CASTLE ROCK, DOUGLAS COUNTY, COLORADO 80109

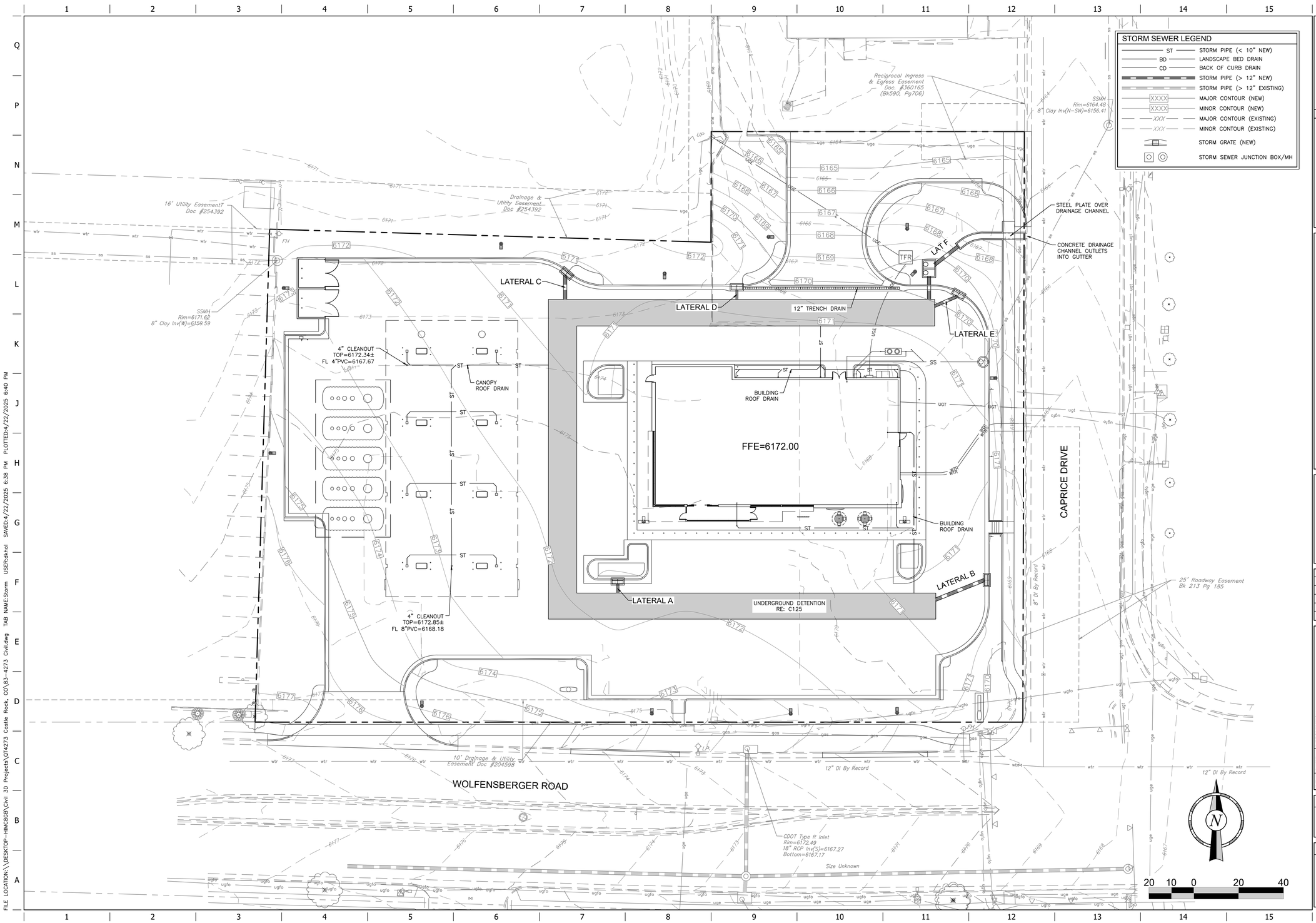
PROTOTYPE:	P-121
DIVISION:	83
VERSION:	001
DESIGNED BY:	DKH
DRAWN BY:	CSH
REVIEWED BY:	AMG

REV	DATE	DESCRIPTION

ORIGINAL ISSUE DATE: 04/22/2025

SHEET TITLE:
SITE DEVELOPMENT PLAN
GRADING PLAN

SHEET NUMBER:
7 OF 23



FILE LOCATION:\\DESKTOP-HMC8GBR\Civil 3D Projects\QT4273 Castle Rock, CO\63-4273 Civil.dwg TAB NAME:Storm USER:dkhol SAVED:4/22/2025 6:38 PM PLOTTED:4/22/2025 6:40 PM

PRELIMINARY

COLORADO LICENSED
DA[illegible]MAN
#.0056104
PROFESSIONAL ENGINEER

PROJECT NO.:83-4273

MDG
Midwest Design Group
Kansas City
PO Box 860015
Shawnee, KS 66286-0015
P 913.248.9385

QuikTrip No. 4273

WOLFENSBERGER ROAD & CAPRICE DRIVE
CASTLE ROCK, DOUGLAS COUNTY, COLORADO 80109

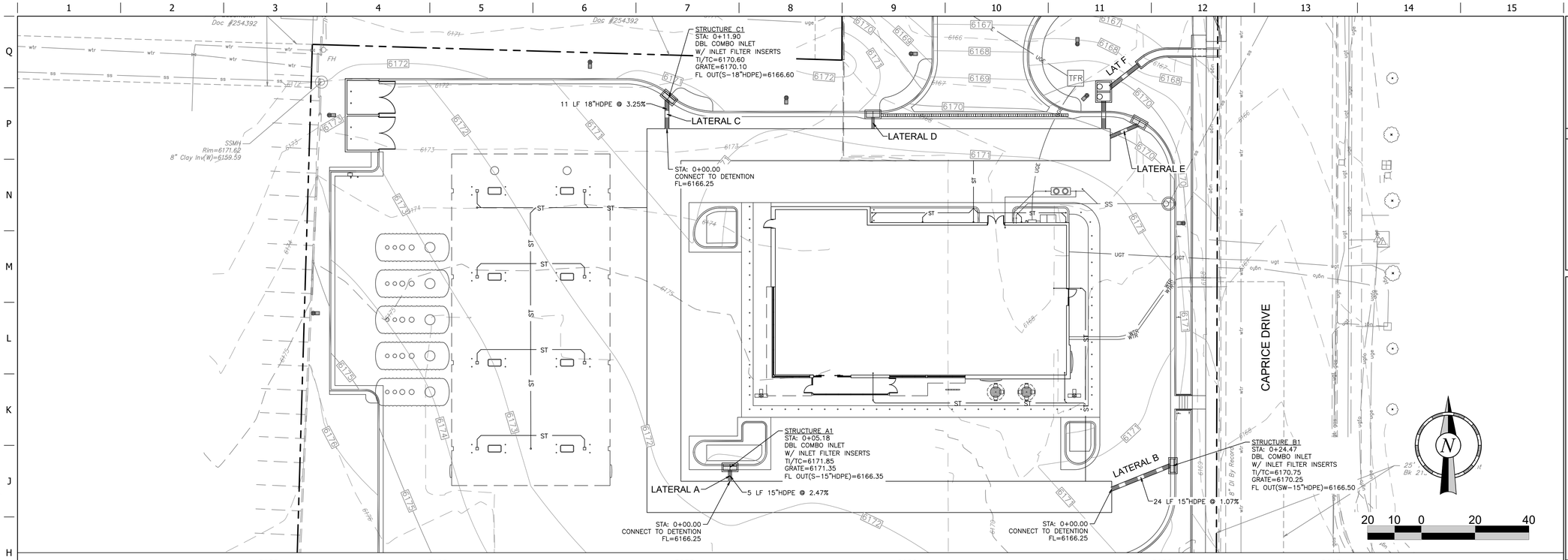
PROTOTYPE:	P-121
DIVISION:	83
VERSION:	001
DESIGNED BY:	DKH
DRAWN BY:	CSH
REVIEWED BY:	AMG

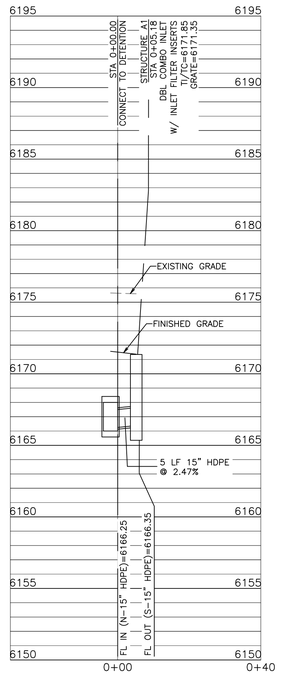
REV	DATE	DESCRIPTION

ORIGINAL ISSUE DATE: 04/22/2025

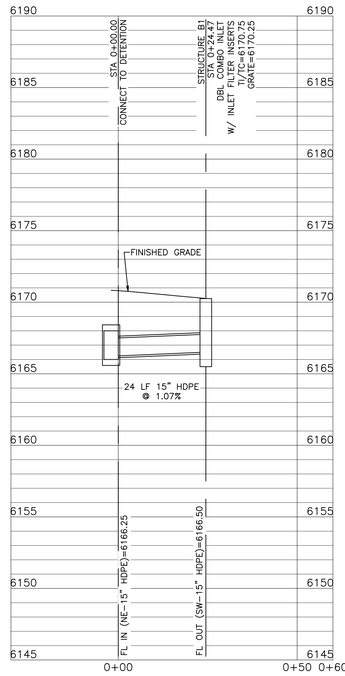
SHEET TITLE:
SITE DEVELOPMENT PLAN
STORM SEWER PLAN

SHEET NUMBER:
8 OF 23



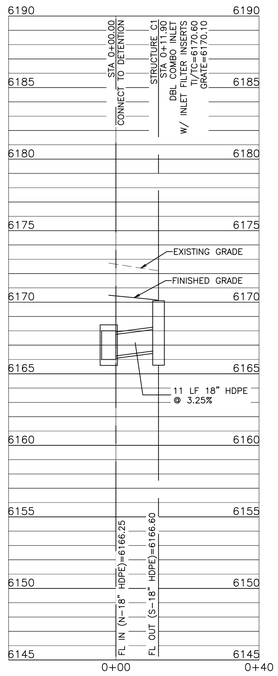


STORM LATERAL A PROFILE



STORM LATERAL B PROFILE

WHERE FINISHED GRADE IS ABOVE EXISTING GRADE, CONTRACTOR TO INSTALL COMPACTED FILL PRIOR TO STORM SEWER INSTALLATION



STORM LATERAL C PROFILE

1"=20' HORZ
1"=5' VERT

FILE LOCATION:\\DESKTOP-HMK2BQB\Civil 3D Projects\QT4273 Castle Rock, CO\83--4273 Civil.dwg TAB NAME:Storm (2) USER:dkhol SAVED:4/22/2025 6:38 PM PLOTTED:4/22/2025 6:40 PM

COLORADO LICENSED PROFESSIONAL ENGINEER
PRELIMINARY
DAVID K. HOLMAN
E.0056104

PROJECT NO.:83-4273

MDG
Midwest Design Group
Kansas City
PO Box 860015
Shawnee, KS 66286-0015
P 913.248.9385

QuikTrip No. 4273

WOLFENSBERGER ROAD & CAPRICE DRIVE
CASTLE ROCK, DOUGLAS COUNTY, COLORADO 80109

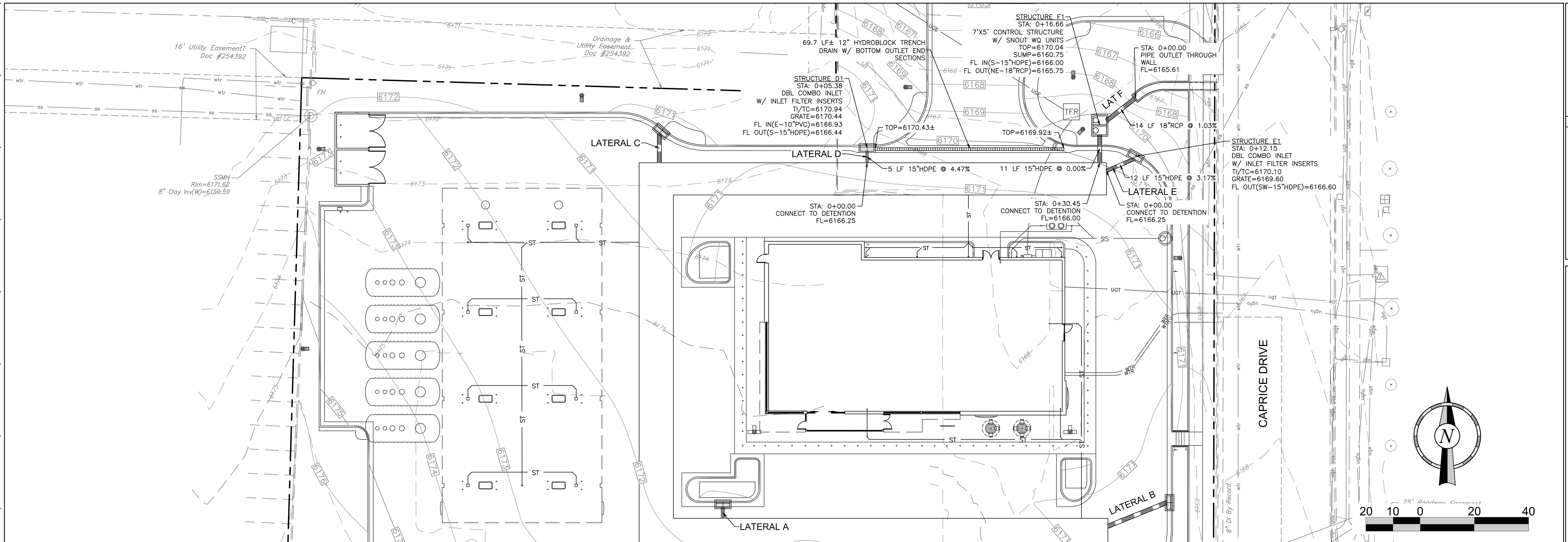
PROTOTYPE:	P-121
DIVISION:	83
VERSION:	001
DESIGNED BY:	DKH
DRAWN BY:	CSH
REVIEWED BY:	AMG

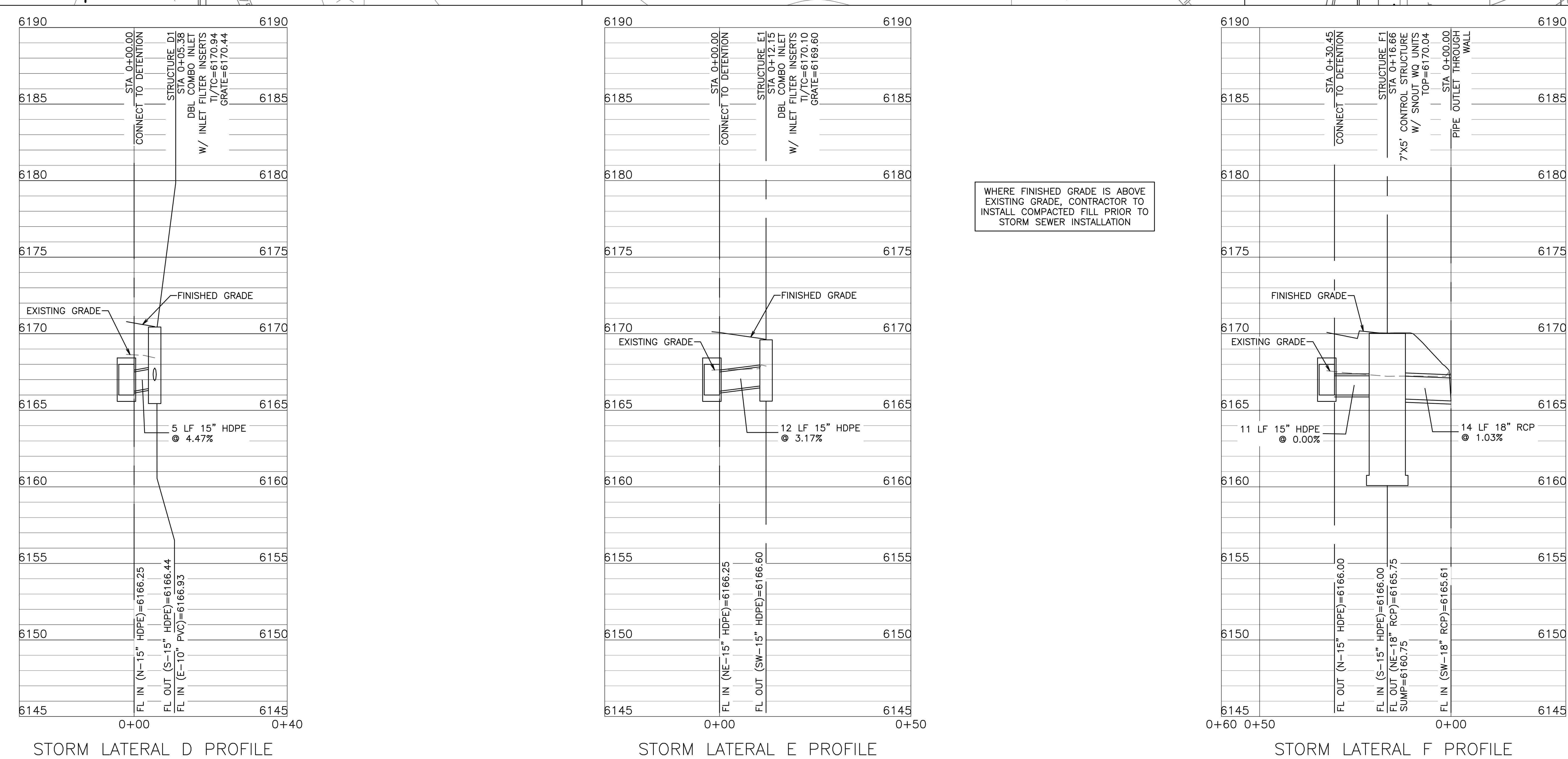
REV	DATE	DESCRIPTION

ORIGINAL ISSUE DATE: 04/22/2025

SHEET TITLE:
SITE DEVELOPMENT PLAN
STORM SEWER LATERALS A, B & C PLAN & PROFILE

SHEET NUMBER:
9 OF 23





COLORADO LICENSED PROFESSIONAL ENGINEER — PRELIMINARY

PROJECT NO.:83-4273

MDG
Midwest Design Group
Kansas City
PO Box 860015
Shawnee, KS 66286-0015
P 913.248.9385

QuikTrip No. 4273

WOLFENSBERGER ROAD & CAPRICE DRIVE
CASTLE ROCK, DOUGLAS COUNTY, COLORADO 80109

PROTOTYPE: P-121
DIVISION: 83
VERSION: 001
DESIGNED BY: DKH
DRAWN BY: CSH
REVIEWED BY: AMG

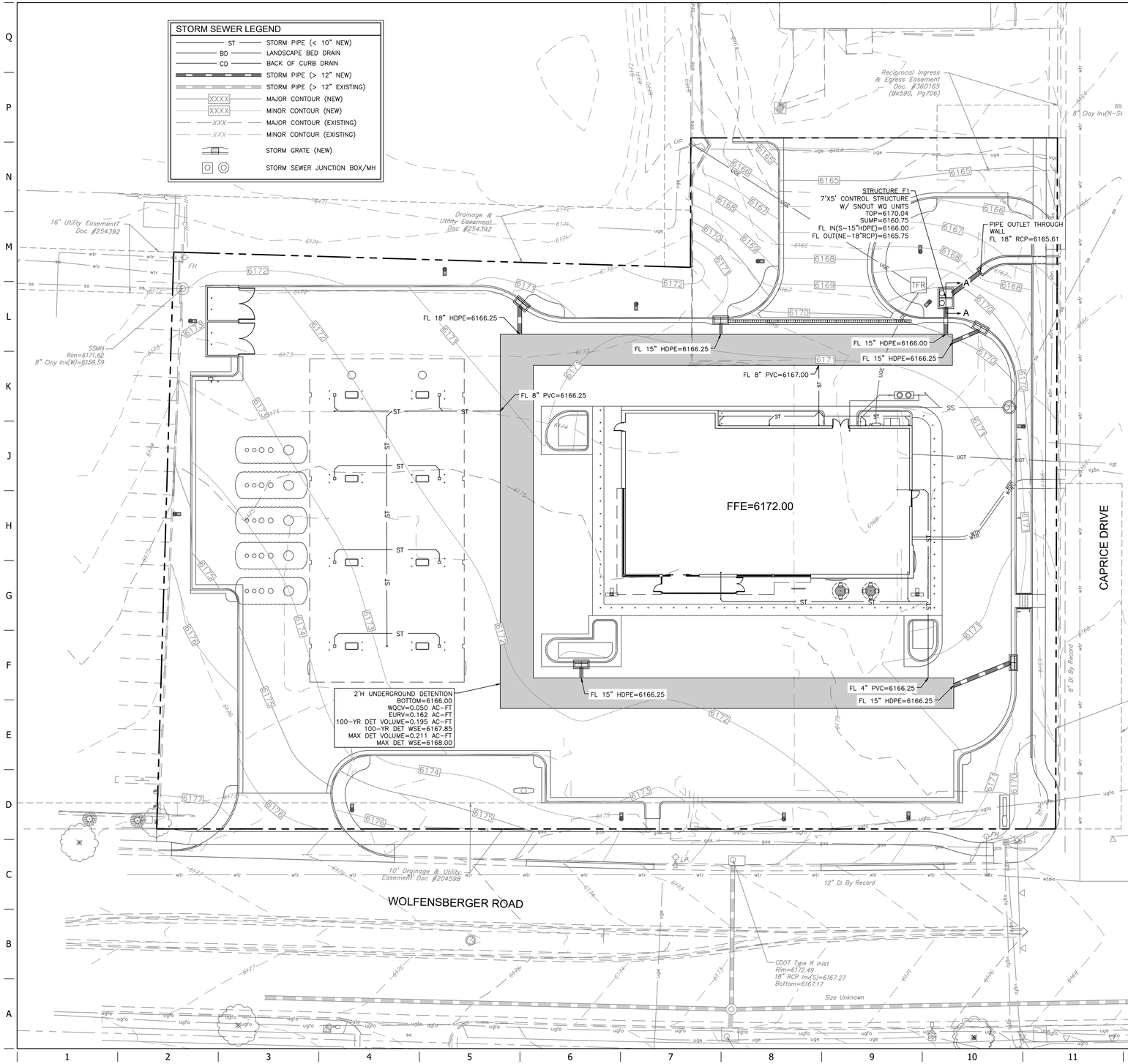
REV	DATE	DESCRIPTION

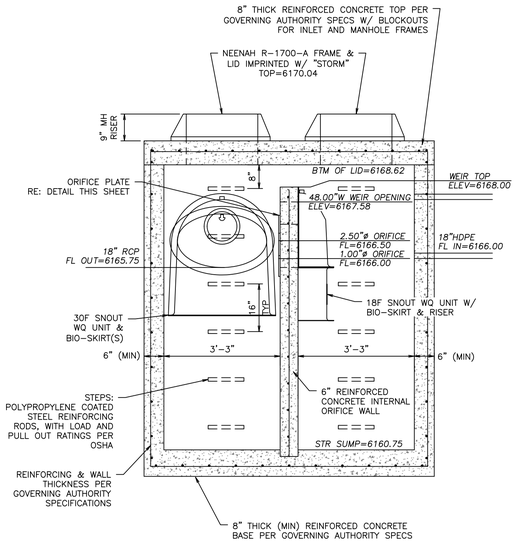
ORIGINAL ISSUE DATE: 04/22/2025

SHEET TITLE:
SITE DEVELOPMENT PLAN
STORM SEWER LATERALS D, E & F PLAN & PROFILE

SHEET NUMBER:

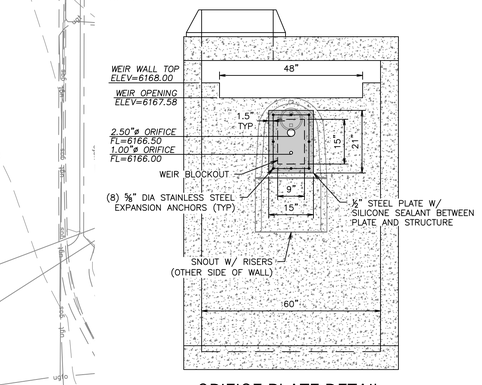
FILE LOCATION:\\DESKTOP-HMC8GBV\Civil 3D Projects\QT4273 Castle Rock, CO\83-4273 Civil.dwg TAB NAME:Storm (3) USER:dkhol SAVED:4/22/2025 6:38 PM PLOTTED:4/22/2025 6:40 PM





SECTION A-A
DETENTION CONTROL STRUCTURE DETAIL

N.T.S.



ORIFICE PLATE DETAIL

N.T.S.

20 10 0 20 40

COLORADO LICENSED PROFESSIONAL ENGINEER
DAVID K. HOLMAN
#.0056104
PRELIMINARY

PROJECT NO.:83-4273

MDG
Midwest Design Group
Kansas City
PO Box 860015
Shawnee, KS 66286-0015
P 913.248.9385

QuikTrip No. 4273

WOLFENSBERGER ROAD & CAPRICE DRIVE
CASTLE ROCK, DOUGLAS COUNTY, COLORADO 80109

PROTOTYPE:	P-121
DIVISION:	83
VERSION:	001
DESIGNED BY:	DKH
DRAWN BY:	CSH
REVIEWED BY:	AMG

REV	DATE	DESCRIPTION

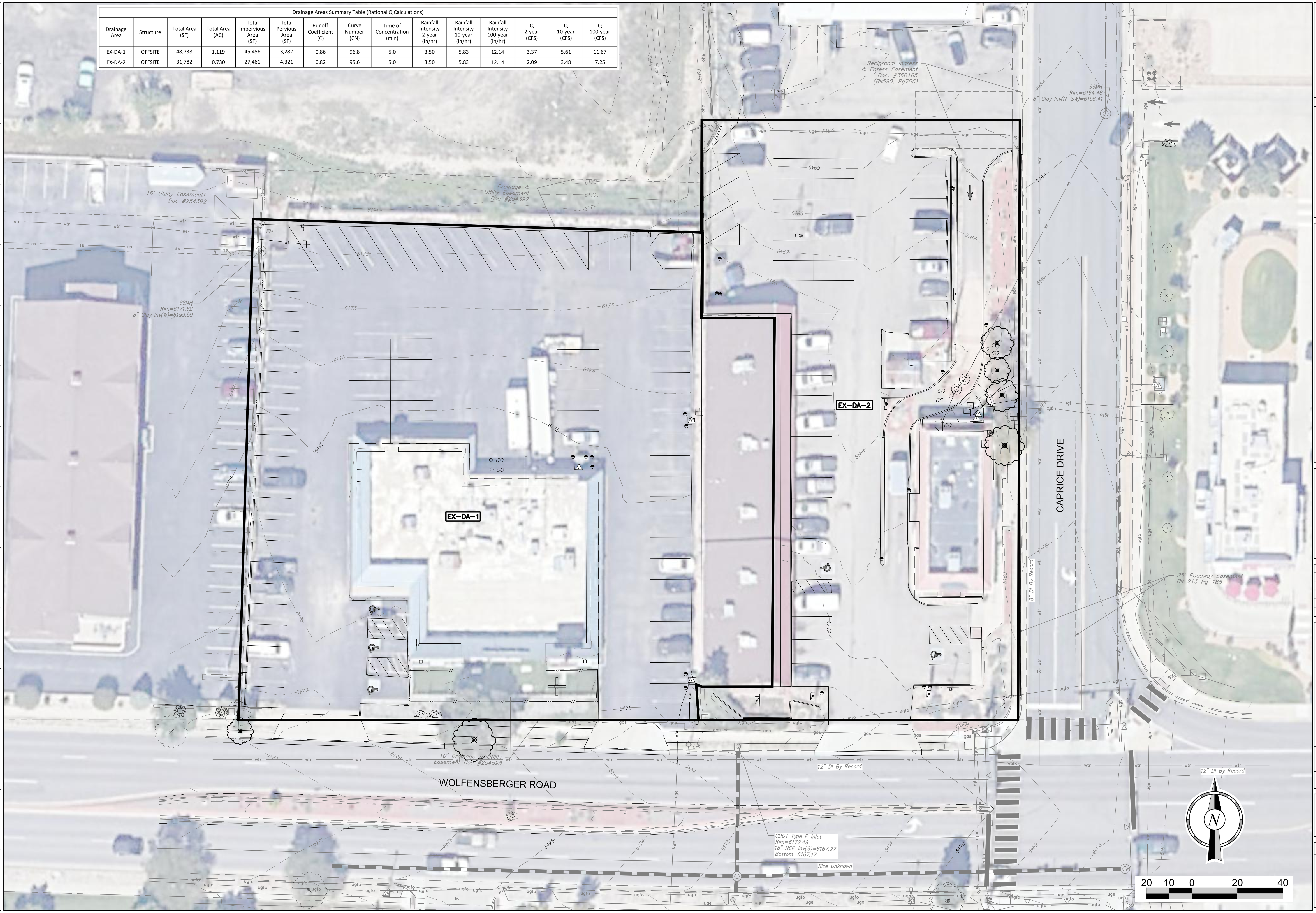
ORIGINAL ISSUE DATE: 04/22/2025

SHEET TITLE:
SITE DEVELOPMENT PLAN
STORMWATER DETENTION PLAN

SHEET NUMBER:
11 OF 23

FILE LOCATION:\\DESKTOP-HIMC8GB\Civil 3D Projects\QT4273 Castle Rock, CO\83-4273 Civil.dwg TAB NAME:Detention USER:dkholl SAVED:4/22/2025 6:38 PM PLOTTED:4/22/2025 6:40 PM

Drainage Areas Summary Table (Rational Q Calculations)														
Drainage Area	Structure	Total Area (SF)	Total Area (AC)	Total Impervious Area (SF)	Total Pervious Area (SF)	Runoff Coefficient (C)	Curve Number (CN)	Time of Concentration (min)	Rainfall Intensity 2-year (in/hr)	Rainfall Intensity 10-year (in/hr)	Rainfall Intensity 100-year (in/hr)	Q 2-year (CFS)	Q 10-year (CFS)	Q 100-year (CFS)
EX-DA-1	OFFSITE	48,738	1.119	45,456	3,282	0.86	96.8	5.0	3.50	5.83	12.14	3.37	5.61	11.67
EX-DA-2	OFFSITE	31,782	0.730	27,461	4,321	0.82	95.6	5.0	3.50	5.83	12.14	2.09	3.48	7.25



COLORADO LICENSED PROFESSIONAL ENGINEER
PRELIMINARY

PROJECT NO.:83-4273

MDG

Midwest Design Group
Kansas City

PO Box 860015
Shawnee, KS 66286-0015
P 913.248.9385

QuikTrip No. 4273

WOLFENSBERGER ROAD & CAPRICE DRIVE
CASTLE ROCK, DOUGLAS COUNTY, COLORADO 80109

QT

PROTOTYPE: P-121
DIVISION: 83
VERSION: 001
DESIGNED BY: DKH
DRAWN BY: CSH
REVIEWED BY: AMG

REV	DATE	DESCRIPTION

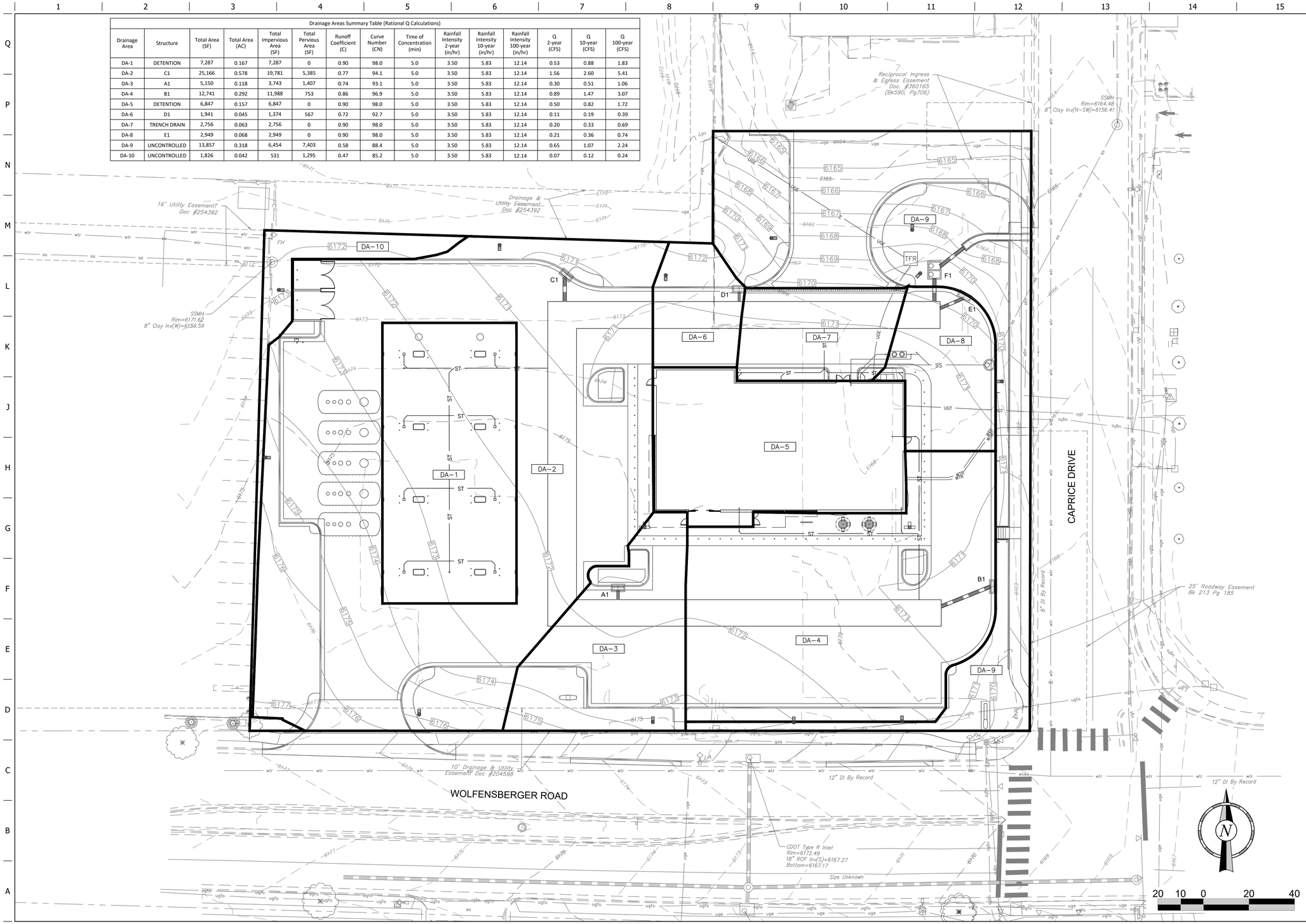
ORIGINAL ISSUE DATE: 04/22/2025

SHEET TITLE:
SITE DEVELOPMENT PLAN
PRE-DEVELOPED DRAINAGE AREA MAP

SHEET NUMBER:
12 OF 23

FILE LOCATION:\\DESKTOP-HMC8GB\Civil 3D Projects\QT4273 Castle Rock, CO\83-4273 Civil.dwg TAB NAME:Pre Dev Map USER:dkhol SAVED:4/22/2025 6:38 PM PLOTTED:4/22/2025 6:40 PM

Drainage Areas Summary Table (Rational Q Calculations)														
Drainage Area	Structure	Total Area (SF)	Total Area (AC)	Total Impervious Area (SF)	Total Pervious Area (SF)	Runoff Coefficient (C)	Curve Number (CN)	Time of Concentration (min)	Rainfall Intensity 2-year (in/hr)	Rainfall Intensity 10-year (in/hr)	Rainfall Intensity 100-year (in/hr)	Q 2-year (CFS)	Q 10-year (CFS)	Q 100-year (CFS)
DA-1	DETENTION	7,287	0.167	7,287	0	0.90	98.0	5.0	3.50	5.83	12.14	0.53	0.88	1.83
DA-2	C1	25,166	0.578	19,781	5,385	0.77	94.1	5.0	3.50	5.83	12.14	1.56	2.60	5.41
DA-3	A1	5,150	0.118	3,743	1,407	0.74	93.1	5.0	3.50	5.83	12.14	0.30	0.51	1.06
DA-4	B1	12,741	0.292	11,988	753	0.86	96.9	5.0	3.50	5.83	12.14	0.89	1.47	3.07
DA-5	DETENTION	6,847	0.157	6,847	0	0.90	98.0	5.0	3.50	5.83	12.14	0.50	0.82	1.72
DA-6	D1	1,941	0.045	1,374	567	0.72	92.7	5.0	3.50	5.83	12.14	0.11	0.19	0.39
DA-7	TRENCH DRAIN	2,756	0.063	2,756	0	0.90	98.0	5.0	3.50	5.83	12.14	0.20	0.33	0.69
DA-8	E1	2,949	0.068	2,949	0	0.90	98.0	5.0	3.50	5.83	12.14	0.21	0.36	0.74
DA-9	UNCONTROLLED	13,857	0.318	6,454	7,403	0.58	88.4	5.0	3.50	5.83	12.14	0.65	1.07	2.24
DA-10	UNCONTROLLED	1,826	0.042	531	1,295	0.47	85.2	5.0	3.50	5.83	12.14	0.07	0.12	0.24



FILE LOCATION:\\DESKTOP-HMC8GBR\Civil 3D Projects\QT4273 Castle Rock, CO\63-4273 Civil.dwg TAB NAME:Post Dev Map USER:dkhol SAVED:4/22/2025 6:38 PM PLOTTED:4/22/2025 6:41 PM

COLORADO LICENSED PROFESSIONAL ENGINEER
PRELIMINARY
DA[illegible]MAN
E.0056104

PROJECT NO.:83-4273

MDG
Midwest Design Group
Kansas City
PO Box 860015
Shawnee, KS 66286-0015
P 913.248.9385

QuikTrip No. 4273

WOLFENSBERGER ROAD & CAPRICE DRIVE
CASTLE ROCK, DOUGLAS COUNTY, COLORADO 80109

PROTOTYPE: P-121
DIVISION: 83
VERSION: 001
DESIGNED BY: DKH
DRAWN BY: CSH
REVIEWED BY: AMG

REV	DATE	DESCRIPTION

ORIGINAL ISSUE DATE: 04/22/2025

SHEET TITLE:
SITE DEVELOPMENT PLAN
POST-DEVELOPED DRAINAGE AREA MAP

SHEET NUMBER:
13 OF 23