Drainage Compliance Letter

Circle K at Mainstreet & Jordan Rd., Parker, CO

(Bradbury Ranch – Phase II, Filing 3B – Commercial Lot 1)

September 2021

Prepared for:

Circle K Stores Inc.
Rocky Mountains Division
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Prepared by:

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Matrix Project No. 21.1207.036

Engineer's Certification:

This Drainage Compliance Letter of the Mainstreet and Jordan Rd. Circle K was prepared by me (or under my supervision) in accordance with the provisions of the Town of Parker Storm Drainage & Environmental Criteria Manual and was designed to comply with the provisions thereof. I understand that the Town of Parker and its designated town authority do not, and will not, assume liability for drainage facilities designed by others.

By: _____

Jesse Sullivan Date SEAL
Registered Professional Engineer
State of Colorado #55600

Introduction

This Drainage Compliance Letter has been prepared to support the proposed Circle K at Mainstreet and Jordan Rd. in Parker, Colorado. The purpose of this letter is to demonstrate compliance with the previous Master Drainage Report encompassing the larger development "Final Drainage Report for Bradbury Ranch, Phase II Filing No. 3B" dated February 4, 2000 by Futura Engineering hereinafter referred to as "Master Drainage Report" as well as the previous Drainage Letter encompassing Commercial Lot 1 within the larger Bradbury Ranch Phase II Filing 3B development "Bradbury Ranch – Phase II, Filing 3B – Commercial Lot 1 SW corner of Mainstreet & Jordan – Drainage Design Analysis and Compliance" dated July 16, 2021 by Olsson hereinafter referred to as "Commercial Lot 1 Drainage Letter." This letter largely complies with the previous drainage studies but differs in some divisions of proposed sub-basins. The proposed project will feature a Circle K convenience store, fuel pumps and canopy, underground fuel tanks, asphalt paving, concrete paving, curb & gutter, and landscaping.

General Location and Description

This Circle K project site is 1.6 acres and will be located on the SE corner of Commercial Lot 1, which is a 4.81 acre site that is bound by Mainstreet to the north, Jordan Rd. to the east, Cedar Gulch Pkwy to the south and E Auburn Hills Dr. to the west. Commercial Lot 1 is a portion of the Bradbury Ranch Phase II Filing 3. More specifically, the project is located in the northeast ¼ of the southeast ¼ of Section 20, Township 6 South, Range 66 West of the 6th Principal Meridian, Town of Parker, State of Colorado.

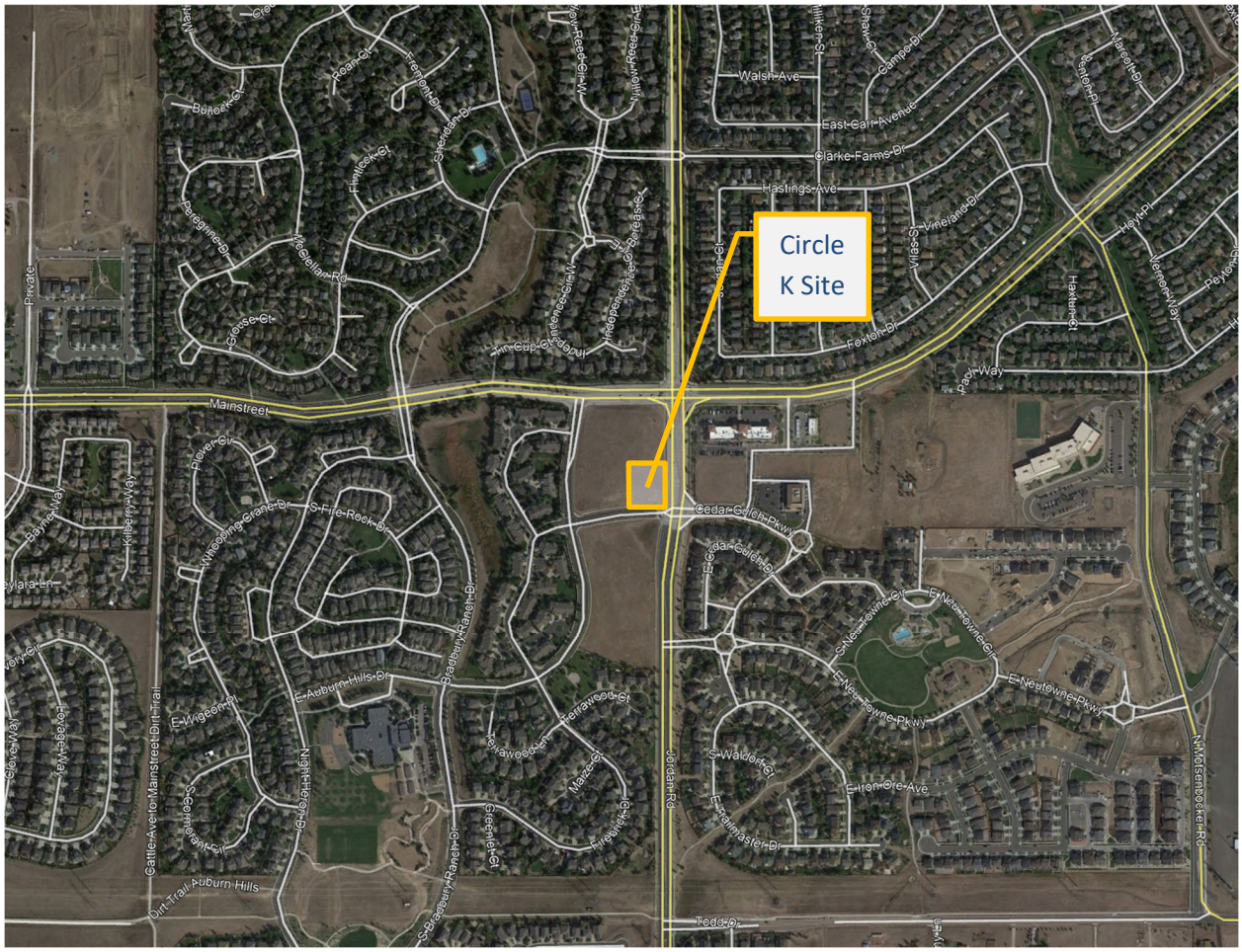


Figure 1 – Vicinity Map

According to the previous studies of the area, predevelopment conditions for the site were grasslands. The Soil type indicated by the previous study and by the USDA Web Soil Survey site is Soil Group C. The property is located in Flood Zone X according to FEMA area 08035C0068G effective March 16, 2016.

This site is located within the Newlin Gulch Drainage Basin. This basin is tributary to Newlin Gulch and Cherry Creek.

Proposed Drainage Descriptions:
The overall site was previously studied in the approved Master Drainage Report by Futura Engineering dated February 4, 2020 as well as the Commercial Lot 1 Drainage Letter by Olsson dated July 16, 2021. The Circle K development site is located within **sub-basin E4** from the Master Drainage Report and **sub-basins PR4 and PR2** from the Commercial Lot 1 Drainage Letter. The site is tributary to the two water quality and detention ponds described in the Master Drainage Report. Table 1 in the Commercial Lot 1 Drainage Letter indicates that both ponds have adequate capacity for development of the proposed sub-basins.

Under proposed conditions, the Circle K site is divided into three sub-basins. One is consistent with sub-basin PR2 from the Commercial Lot 1 Drainage Letter. The other two are PR4-a and PR4-b.

According to the Master Drainage Report, there is an existing water quality and detention pond located directly south of the Circle K site across Cedar Gulch Pkwy called **Pond IVA**. The Commercial Lot 1 Drainage Letter confirmed that this pond has capacity to receive the flows from sub-basin E4. The drainage letter divided sub-basin E4 into proposed sub-basins. It shows the eastern edge of the Circle K site that will slope down to Jordan Rd. as sub-basin **PR2**. Sub-basin PR2 was designed in that letter to flow to the curb and gutter along Jordan Rd., then north to Mainstreet, along curb and gutter to the west to an inlet at the southeast corner of E Auburn Hills Dr. and Mainstreet. From there this flow is routed to another existing water quality and detention pond, regional detention **Pond IV**, located to the west of Commercial Lot 1 on the west side of E Auburn Hills Dr. Table 1 in the Commercial Lot 1 Drainage Letter confirmed that Pond IV had capacity to receive the flows from this sub-basin. Pond IV provides detention and water quality for sub-basin PR2.

This drainage letter differs from the Commercial Lot 1 Drainage Letter only in that the previous study shows all of sub-basin PR4 going to design point 4, but the access road is shown on the map to grade south to Cedar Gulch Pkwy, so this letter divides that portion out as sub-basin **PR4-b.** Sub-basin **PR4-b** drains along curb & gutter south to Cedar Gulch Pkwy and then east to an existing inlet near the intersection with Jordan Rd. The rest of the Circle K site is defined as basins **PR4-a**. Sub-basin PR4-a encompasses the Circle K site as well as any portions of the commercial lot access road that drain onto the Circle K site. Sub-basin PR4-a flows will be collected at a sump inlet at Design Point 4-a at the southeast corner of the Circle K site. Flows from this inlet will be conveyed to the existing inlet on the north side of Cedar Gulch Pkwy near Jordan Rd. From there the flows are routed south into the existing Pond IVA. Pond IVA was confirmed in the Commercial Lot 1 Drainage Letter to have capacity to receive these flows.

The Commercial Lot 1 Drainage Letter showed a Q5 of 3.7cfs and a Q100 of 8.2cfs for sub-basin PR4. The combined flows of proposed sub-basins PR4-a (Q5=3.2, Q100=7.1) and PR4-b (Q5=0.3, Q100=0.6) are less than the flow rates that Olsson verified the storm system and Pond IVA could treat. Table 1 of the Commercial Lot 1 Drainage Letter shows that the flows to each pond from the Master Drainage Report were higher than the proposed flows from the proposed sub-basins. From Table 1, the total 100 year flows from the Master Drainage Report were 21.0 cfs for Pond IV and 13.8 cfs for Pond IVA. The Table then shows the proposed 100 year flows to the ponds as 18.3 cfs for Pond IV and 8.2 cfs for Pond IVA. The Commercial Lot 1 Drainage Letter had 3% impervious for sub-basin PR2 and 80% for PR4. The rational calculations provided with this letter show 3% impervious for sub-basin PR2 and 79.4% for sub-basins PR4-a and PR4-b.

Storm Sewer Facility Design

One 5' Type R storm inlet in sump condition is proposed at the southeast corner of the proposed improvements. This inlet has been sized to fully capture runoff from sub-basin PR4-a. See attached inlet design spreadsheet from MHFD-Inlet (new version of UD-Inlet) for Inlet design. See attached flow rational calculations table for determination of flows for each sub-basin and design point.

Storm Sewer

See attached StormCAD model tables and profiles for Q5 and Q100 flows and hydraulic grade lines for the proposed inlet and pipe.

Water Quality and Detention
Storm water quality and detention are provided by the existing facility: **Pond IVA** designed by Futura Engineering Inc. and located across Cedar Gulch Pkwy directly south of the Circle K site.

Conclusion
The above analysis has demonstrated that the proposed development is within the constraints set upon the property by the previously approved Master Drainage Report by Futura Engineering dated February 4, 2020 as well as the Commercial Lot 1 Drainage Letter by Olsson dated July 16, 2021.

The project will be at or below previously analyzed runoff rates, percent impervious and general drainage patterns, preserve existing and proposed infrastructure, does not increase developed runoff values above those indicated in the governing Master Drainage Report and is consistent with the requirements of the Town of Parker.

Appendix/Attachments

1. Circle K Rational Method Calculations
2. Circle K MHFD-Inlet (UD-Inlet) Calculations
3. Q5 StormCAD tables and profiles
4. Q100 StormCAD tables and profiles
5. Excerpts from Commercial Lot 1 Drainage Letter
6. Excerpts from Master Drainage Report
7. Proposed Drainage Basin Map
8. Drainage Basin Maps from previous studies

Rational Method - Proposed Conditions

Project Name:	MAINSTREET & JORDAN RD.
Project Location:	TOWN OF PARKER
Designer	JTS
Notes:	Proposed Condition, Hydraulic Soil Group B

Average Channel Velocity	4.00 ft/s	(If specific channel vel is used, this will be ignored)
Average Slope for Initial Flow	0.04 ft/ft	(If Elevations are used, this will be ignored)

Channel Flow Type Key

Heavy Meadow	2
Tillage/Field	3
Short Pasture and Lawns	4
Nearly Bare Ground	5
Grassed Waterway	6
Paved Areas	7

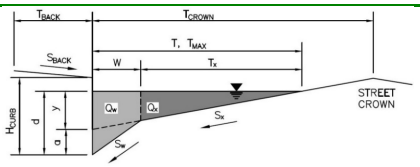
		Area		Rational 'C' Values									Flow Lengths										Tc	Rainfall Intensity & Rational Flow Rate					
Sub-basin / Design Point	**Comments**			Surface Type 1 Streets - Paved (100% Impervious)			Surface Type 2 Undeveloped Lawns (2% Impervious)			Composite		Percent Impervious	Initial	True Initial	Channel	True Channel	Average (decimal)	Initial	Average (%)	Channel Flow Type (See Key above)	Velocity	Channel	Total	i2	Q2	i5	Q5	i100	Q100
		sf	acres	C5	C100	Area (SF)	C5	C100	Area	C5	C100		ft	Length ft	ft	Length ft	Slope	Tc (min)	Slope	Ground Type	(ft/s)	Tc (min)	(min)	in/hr	cfs	in/hr	cfs	in/hr	cfs
PR2 / 2	***See Commercial Lot 1 Drainage Letter by Olsson dated July 16, 2021***	12,196.8	0.28	0.86	0.89	122.0	0.05	0.49	12,074.8	0.06	0.50	3.0	25.0	25	345.0	345	0.03	6.90	0.50	7	1.41	4.07	10.96	0.99	**0.0**	3.62	**0.1**	6.86	**1.0**
PR4-a / 4-a	***See Master Drainage Report by Futura Engineering dated Feb 4, 2020***	54,885.6	1.26	0.86	0.89	43,359.6	0.05	0.49	11,526.0	0.69	0.81	79.4	140	140	242	242	0.01	8.81	1.00	7	2.00	2.02	10.82	0.99	**0.9**	3.64	**3.2**	6.90	**7.1**
PR4-b / 4-b	***See Master Drainage Report by Futura Engineering dated Feb 4, 2020***	3,920.4	0.09	0.86	0.89	3,097.1	0.05	0.49	823.3	0.69	0.81	79.4	61.0	61	310.0	310	0.01	5.82	1.10	7	2.10	2.46	8.27	0.99	**0.1**	4.04	**0.3**	7.62	**0.6**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: **Inlet 4-a**



Gutter Geometry:

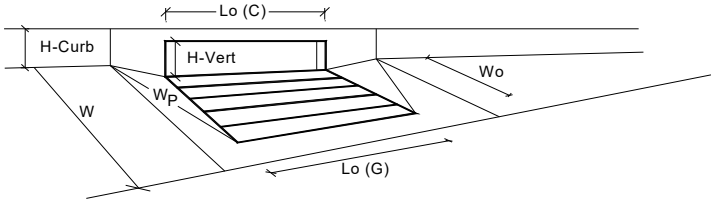
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.064	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	40.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.011	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	25.0	40.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	9.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

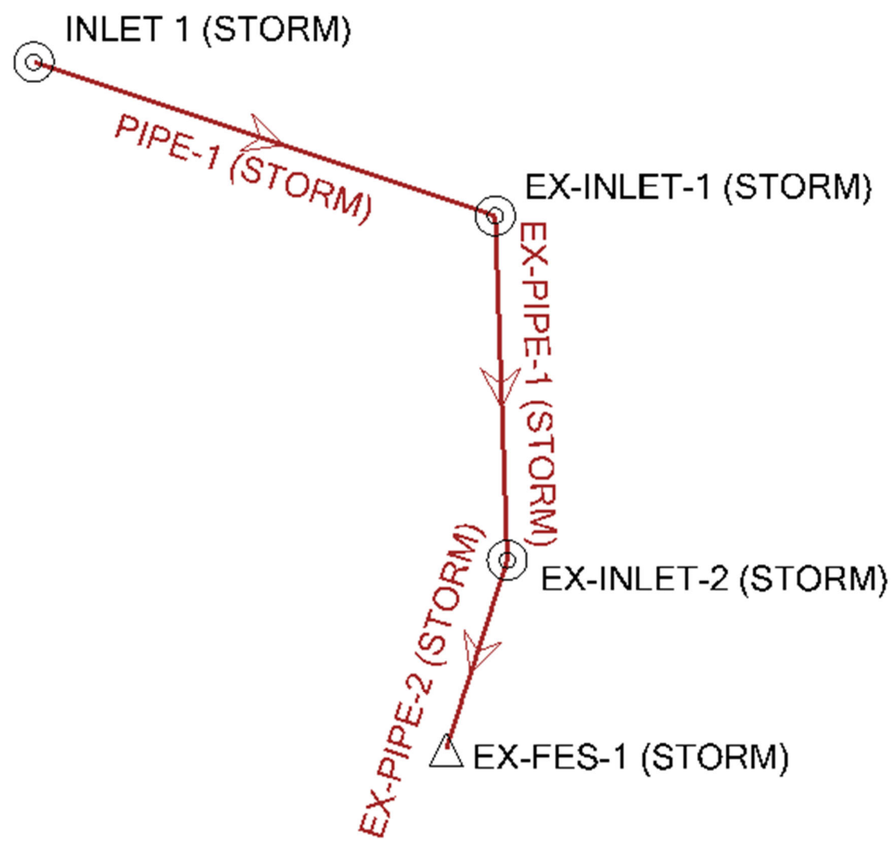
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.0	7.0	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.25	0.42	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.64	0.90	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**3.5**	**7.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	3.2	7.1	cfs


INLET 1 (STORM)
PIPE-1 (STORM)
EX-INLET-1 (STORM)
EX-PIPE-1 (STORM)
EX-INLET-2 (STORM)
EX-PIPE-2 (STORM)
EX-FES-1 (STORM)


N

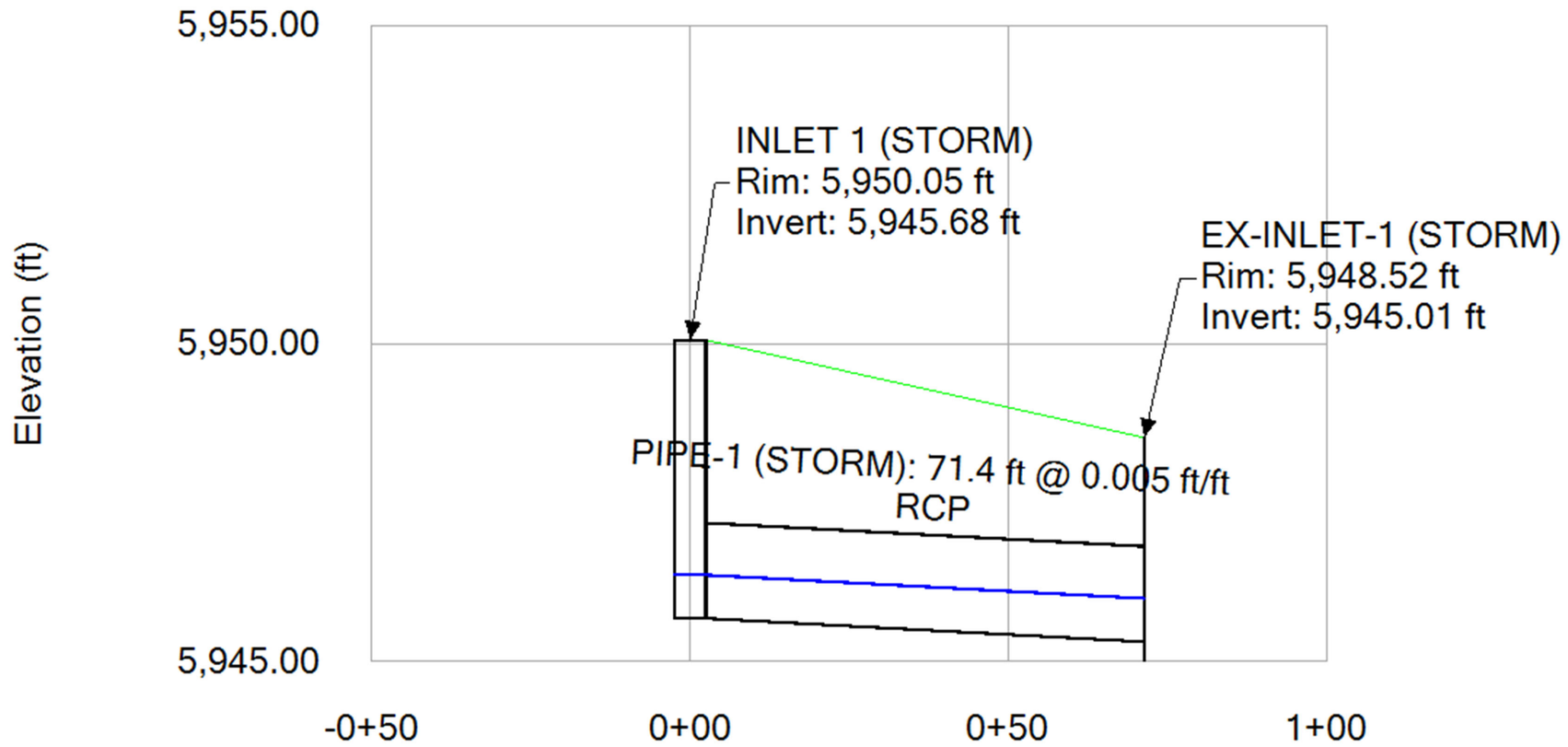
Q5 StormCAD Model

	Label	Start Node	Stop Node	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Length (Unified) (ft)	Rise (Unified) (ft)	Manning's n	Invert (Start) (ft)	Invert (Stop) (ft)	Slope (Calculated) (ft/ft)	Conduit Description	Flow (cfs)	Capacity (Full Flow) (cfs)	Velocity (ft/s)	Froude Number	Depth (In) (ft)	Depth (Out) (ft)
35: PIPE-1 (ST	PIPE-1...	INLET 1...	EX-PIPE-1	5,946.36	5,945.99	71.4	1.50	0.013	5,945.68	5,945.31	0.005		3.20	7.55	4.09	NaN	0.68	0.68

Figure 1 - Q5 - Conduit Report

	ID	Label	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Flow (Total Out) (cfs)	Depth (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss Method	Headloss Coefficient (Standard)	Notes
31: INLET 1 (S	31	INLET 1 (ST...	5,950.05	5,950.05	5,945.68	3.20	0.68	5,946.38	5,946.36	Standard	0.050	5' TYPE R

Figure 2 - Q5 - Node/Manhole Report


5,955.00
5,950.00
5,945.00
Elevation (ft)
INLET 1 (STORM)
Rim: 5,950.05 ft
Invert: 5,945.68 ft
EX-INLET-1 (STORM)
Rim: 5,948.52 ft
Invert: 5,945.01 ft
PIPE-1 (STORM): 71.4 ft @ 0.005 ft/ft
RCP
-0+50
0+00
0+50
1+00
Station (ft)

PIPE-1 (Q5)

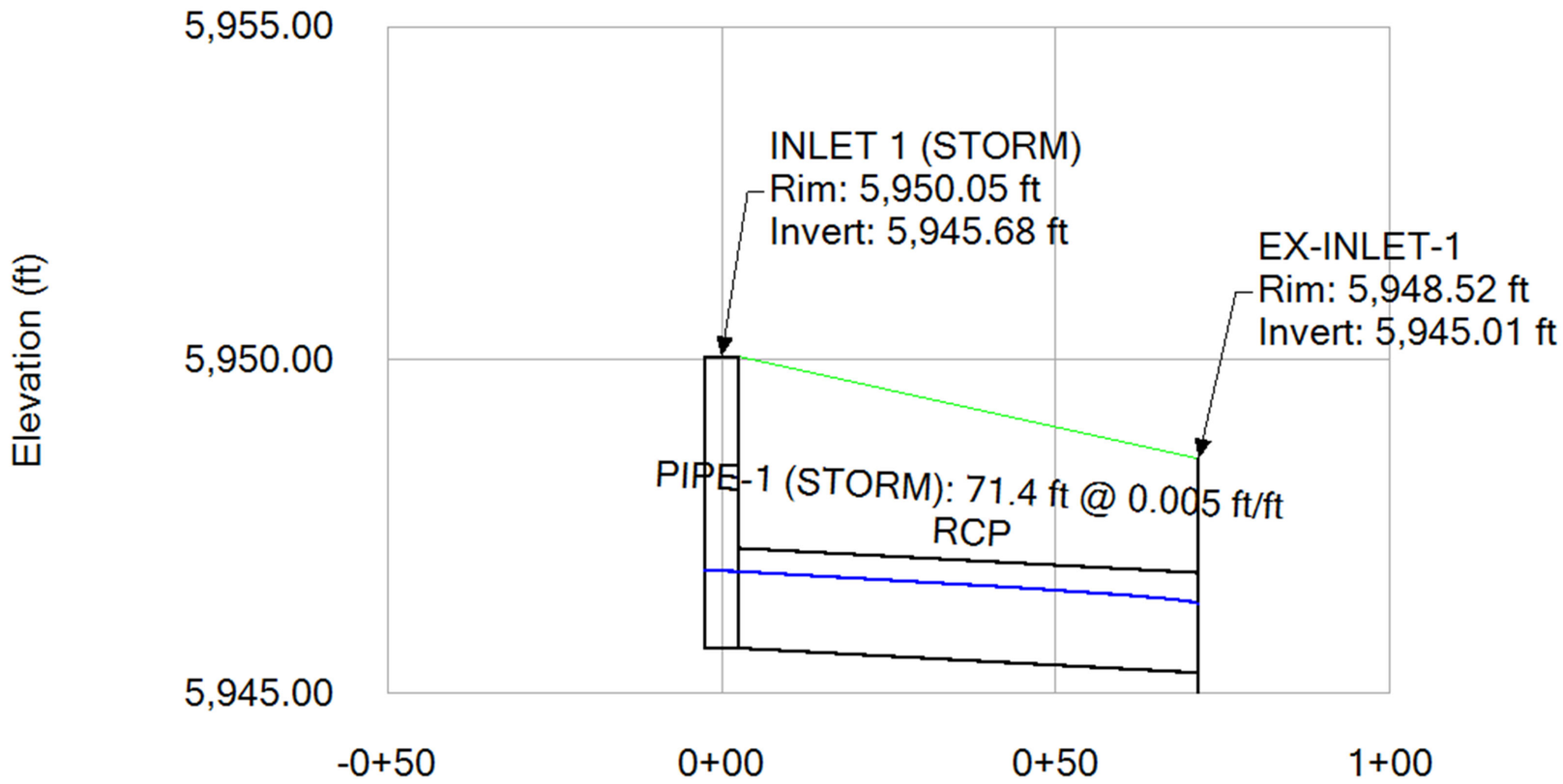
Q100 StormCAD Model

	Label	Start Node	Stop Node	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Length (Unified) (ft)	Rise (Unified) (ft)	Manning's n	Invert (Start) (ft)	Invert (Stop) (ft)	Slope (Calculated) (ft/ft)	Conduit Description	Flow (cfs)	Capacity (Full Flow) (cfs)	Velocity (ft/s)	Froude Number	Depth (In) (ft)	Depth (Out) (ft)
35: PIPE-1 (ST	PIPE-1...	INLET 1...	EX-PIPE-1	5,946.83	5,946.34	71.4	1.50	0.013	5,945.68	5,945.31	0.005		7.10	7.55	4.86	NaN	1.15	1.03

Figure 3 - Q100 - Conduit Report

	ID	Label	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Flow (Total Out) (cfs)	Depth (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss Method	Headloss Coefficient (Standard)	Notes
31: INLET 1 (S	31	INLET 1 (ST...	5,950.05	5,950.05	5,945.68	7.10	1.15	5,946.85	5,946.83	Standard	0.050	5' TYPE R

Figure 4 - Q100 - Node/Manhole Report


5,955.00
5,950.00
5,945.00
Elevation (ft)
INLET 1 (STORM)
Rim: 5,950.05 ft
Invert: 5,945.68 ft
EX-INLET-1
Rim: 5,948.52 ft
Invert: 5,945.01 ft
PIPE-1 (STORM): 71.4 ft @ 0.005 ft/ft
RCP
-0+50
0+00
0+50
1+00
Station (ft)

PIPE-1 (Q100)

July 16, 2021

Town of Parker
20120 E Mainstreet
Parker, CO 80138

RE: Bradbury Ranch - Phase II, Filing 3B – Commercial Lot 1
SW corner of Mainstreet & Jordan - Drainage Design Analysis and Compliance

Parker Engineering Department:

This memo is being submitted as a summary of the stormwater drainage design for Auburn Hills Centre located on Bradbury Ranch Commercial Lot 1 at the southwest corner of the intersection of Mainstreet and Jordan Road north and east of existing detention ponds where stormwater runoff will drain. The purpose of this memo is to verify the final design of Commercial Lot 1 meets the analysis and intent of the "Final Drainage Report for Bradbury Ranch, Phase II Filing No. 3B" (Master Report) dated February 4, 2000 by Futura Engineering. Portion of the Master Report are included with this memo.

Site Description

Commercial Lot 1 (the site) is a 4.81-acre project located southwest of Mainstreet and Jordan Road in Parker, Colorado and is bound by Mainstreet to the north, Jordan Rd to the east, Cedar Gulch Pkwy to the south and E Auburn Hills Dr to the west. The site is within a plat for Bradbury Ranch Filing No. 3. Existing ground cover on site consists mostly of short pastured/lawn and native grasses. The proposed improvements for this site include five commercial lots (currently proposed as a daycare, bank, drive-thru coffee, restaurant/retail, gas/convenience store) with parking and landscaping, potable water and wastewater service connections, and grading and drainage improvements. Generally, the site slopes from the center of the site outward in all directions with average slopes of 3% to 9% except for a high point in the southwest corner of the lot which directed runoff either north in E Auburn Hills Dr or east along Cedar Gulch Pkwy. Soils within the property classify as Hydrologic Soil Group C according to the Custom Soil Resource Report included with this memo. The property is in Flood Zone X according to FEMA area 08035C0068G effective March 16, 2016.

The property is within the Newlin Gulch drainage basin where the drainage pattern transports runoff to Newlin Gulch and Cherry Creek.

Drainage Design

The final drainage design for the site has been completed in accordance with the criteria outlined in the Master Report. Detention and water quality treatment for the site will be provided by two detention ponds within the Bradbury Ranch project defined as the Detention Pond IV, located due

west on the west side of E Auburn Hills Dr, and Detention Pond IVA, located south of the southeast side of the site on the south side of Cedar Gulch Pkwy. Runoff generated on-site will be routed to these detention ponds via storm sewer, overland flow, and street conveyance.

The proposed project is located within Bradbury Ranch, Phase II Filing 3B, Basins B8 and E4. In the Master Drainage Plan, Basin B8 drains to Pond IV and Basin E4 was graded to allow historic flow to be conveyed by the proposed Jordan Road then down W Mainstreet to an existing Type R inlet. Per the Master Plan, the developed flow from Basin E4 (proposed Basin PR3) will tie into the Type R inlet at Jordan Road and Auburn Hills Drive and conveyed to EDB IVA. Note that proposed Basin OS1 is the area of Basin E4 which cannot be captured and routed to Pond IVA. The runoff from Basin OS1 is less than historic Basin E4, therefore, the existing Type R inlet will have capacity for the Basin OS1 stormwater runoff. The north portion of the site will continue to follow its historic drainage pattern to storm sewer in Mainstreet. If overlot grading occurs before development, a swale and sedimentation basin will be constructed on-site so sediment does not runoff into Mainstreet.

In order to verify that the regional detention ponds have adequate capacity for the improvements proposed with the Commercial Lot 1 project, an analysis of planned vs proposed impervious areas tributary to each pond was completed and compared to the impervious area assumed for each pond in the Master Report. Since percent imperviousness was not given in the Master Plan, a comparison of area vs the c-value for the 100-year storm was performed.

Table 1: Runoff Comparison

Tributary Pond	Basin (Planned/ Proposed)	Planned Tributary Area (ac)	Planned C100	Planned Q100 (cfs)	Proposed Tributary Area (ac)	Proposed C100	Proposed Q100 (cfs)
Pond IV	F2/PR1	1.09	.50	4.0	2.09	.81	10.9
Pond IV	B8A*/PR2	1.00	.52	3.2	1.09	.76	6.4
Pond IV	E4/OS1	2.72	.50	13.8	0.28	.50	1.0
Total to Pond IV		4.81	.51	**21.0**	3.46	0.77	**18.3**
Pond IVA	E4/PR3	2.72	.80	13.8	1.35	.81	8.2
Total to Pond IVA		2.72	.80	**13.8**	1.35	.81	**8.2**

*The area of the basin only reflects the area on the project site so proposed and planned basins have the same area.

Pond IV was designed to receive historic runoff from Basin E4 while Pond IVA should receive runoff from the developed basin. Therefore, by comparing effective planned runoff to each pond, it can be seen that both ponds are expected to have adequate capacity for the runoff from the site

Project: Auburn Hills
Job No.: 021-03775
Calculated By: TAW
Date: 7/20/2021

PROPOSED CONDITIONS
STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Design Storm: 5-Year
1-hour rainfall: 1.39

= FORMULA CELLS
= USER INPUT CELLS

BASIN	DIRECT RUNOFF								TOTAL RUNOFF				STREET		PIPE						REMARKS
	DESIGN POINT	AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A (AC)	I (IN/HR)	Q (CFS)	t_c (MIN)	S (C * A) (CA)	I (IN/HR)	Q (CFS)	SLOPE (%)	STREET FLOW	DESIGN FLOW (CFS)	SLOPE (%)	PIPE DIAM. (IN.)	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
PR1			2.09	0.68	12.2	1.43	3.46	**4.9**	12.2	1.43	3.46	**4.9**									To Pond IV
PR2			0.28	0.06	10.5	0.02	3.69	**0.1**	10.5	0.02	3.69	**0.1**									To Pond IV
PR3			1.09	0.58	7.6	0.64	4.16	**2.6**	12.2	2.06	3.46	**7.1**									To Pond IV
PR4			1.35	0.69	8.7	0.94	3.97	**3.7**	8.7	0.94	3.97	**3.7**									To Pond IVA

Project: Auburn Hills
Job No.: 021-03775
Calculated By: TAW
Date: 7/20/2021

PROPOSED CONDITIONS
STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Design Storm: 100-Year
1-hour rainfall: 2.6

= FORMULA CELLS
= USER INPUT CELLS

BASIN	DIRECT RUNOFF								TOTAL RUNOFF				STREET		PIPE						REMARKS
	DESIGN POINT	AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A (AC)	I (IN/HR)	Q (CFS)	t_c (MIN)	S (C * A) (CA)	I (IN/HR)	Q (CFS)	SLOPE (%)	STREET FLOW	DESIGN FLOW (CFS)	SLOPE (%)	PIPE DIAM. (IN.)	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
PR1	1		2.09	0.81	12.2	1.69	6.47	**10.9**	12.2	1.69	6.47	**10.9**									To Pond IV
PR2	4		0.28	0.50	10.5	0.14	6.89	**1.0**	10.5	0.14	6.89	**1.0**									To Pond IV
PR3	2		1.09	0.76	7.6	0.83	7.77	**6.4**	12.2	2.51	6.47	**16.3**									To Pond IV
PR4	3		1.35	0.81	8.7	1.10	7.43	**8.2**	8.7	1.10	7.43	**8.2**									To Pond IVA
Total Runoff								**18.3**													
to Pond IV																					
Total Runoff								**8.2**													
to Pond IVA																					

FINAL DRAINAGE REPORT

BRADBURY RANCH

Phase II Filing No. 3B

SE 1/4 of Sec 20,
T6S, R66W

February 4, 2000
November 19, 1999
July 13, 1999
April 20, 1999
March 28, 1999

Prepared for

AMREPCO INC
5300 DTC PARKWAY
Englewood, Colorado 80111
(303) 220-5600

Prepared by

Futura Engineering Inc.
12741 E. Caley Ave.
Suite 126
Englewood, Colorado 80111
(303) 649-9292
FAX (303) 649-9499

Project No. 78-500.10

Gulch and Cherry Creek. **Due to changes in horizontal alignments in Filing No. 3B, basin numbers have changed from those in the preliminary report.** A copy of the Preliminary Drainage Report and plan has been included in the Appendix also.

3.2 Sub-Basin Description

The existing drainage pattern flows north toward Cherry Creek. A ridge from southwest to northeast from the western border of the property establishes a watershed boundary within the site.

Historically, there are three on-site sub-basins and two small off-site sub-basins on the west and southwest sides of the site. The outfall point is located along the north boundary and south of Main Street. This outfall point contains an existing detention pond and 60" outlet crossing Main Street. **This drainage pattern will not be altered.**

A temporary drainage channel within the project site will consist mainly of open space that will be used to convey runoff to the detention existing detention pond. The alignment of natural drainage ways within the site will generally be maintained as allowed by the land plan.

3.3 Minor Sub-basin Description (Local Drainage).

Minor sub-basins are also labeled A, B, C D and E with Design Points (1-43 and 65) and their respective 2-yr and 100-yr developed flows for residential areas. Some of these basins are in the future Filings but are being graded as part of Filing 3B to maintain drainage patterns consistent with the Preliminary Drainage Study and existing conditions. These offsite basins will be mulched and seeded according to the criteria set by the Towns Drainage Manual. The basins were graded to limit their size to no more than 8 acres in order to provide 2-yr and or 100-year Type R inlets. Most of the inlets are designed in sump condition to take advantage of accepting greater flows than inlets designed for intercepting flows from a continuous grade. Inlets are also sized to 12" increments with the minimum initial size of 5'.

Major storm flows from Basins A1 and A2 will be captured by a Type D inlet and minor storm flows from Basins A3-A7 will be caught by Type R inlets and both are conveyed by 30" to 36" RCP's from Newlin Gulch Road east to a drainage channel on the south side of Auburn Hills Drive. These flows are joined by combined flows from basin B3 and minor flows from basin B4 and conveyed through a 42" RCP culvert to a 4-foot channel running parallel to Bradbury Ranch Drive. Flows from Basins B1 and B2 are captured by a 4-foot channel and conveyed to the Bradbury Ranch Drive channel through a 48" culvert. Combined flows from basin B5 join the channel which then flows through a 60" RCP culvert under Auburn Hills Drive north to Detention Pond IV. Minor flows from basins B6 and B12 are captured by Type R inlets and join the Bradbury Ranch Drive channel north of Auburn Hills Drive. Major storm flows from basins B4, B6, and B12 will be conveyed by the street system to Design Point 32 where they will be captured by Type R inlets and conveyed to Detention Pond IV. Major storm flows from basins A3-A7 will be conveyed by the street system to Design Point 8 in Filing 3A where they will enter the existing temporary drainage channel (See Filing 3A Drainage Report). The channel conveys flows to Design Point 30, which is located on the west side of Bradbury Ranch Drive. The flows are then captured by Type R inlets and a temporary 24" FES and conveyed to Detention Pond IV through 42" RCP.

Basins C1-C3 and D1-D3 are not affected by construction of Filing 3B. Combined flows from basins E2 and E3 are captured by Type R inlets and detained in a proposed Extended Detention Basin along with combined flows from basin E1. The pond is located at Design Point 39 and is designated as EDB IV A. This pond has been sized based on Town of Parker standards to control 10-yr and 100-yr events. Basin E4 will be graded to allow historic flows to be captured by the proposed Jordan Road and conveyed down West Mainstreet to an existing Type R inlet. When developed, a tie-in to the Type R inlet at Jordan Road and Auburn Hills Place may be required, and the storm sewer crossing Auburn Hills Place is sized to convey flows from basin E4 to EDB IVA.

The existing storm sewer system in Filing 3A accepts minor storm flows from Basins A10-A12 that span Filings 3A and 3B. The storm system in Filing 3A was designed to handle the extra flows from developing these basins.

SECTION 4. DRAINAGE DESIGN CRITERIA.

4.1 Regulations

There are **no** FEMA designated 100-year floodplains (Zone A) within this site.

4.2 Development Criteria Reference and Constraints

The Town of Parker's drainage manual and the Urban Drainage and Flood Control District's manual were used to determine the ultimate drainage system for this property.

4.3 Hydrologic Criteria

Hydrologic Criteria for this report is in accordance with Chapter 5.00 Hydrologic Criteria of the SDECM. This includes design rainfall, t_i, t_t, and t_c calculation methods, runoff coefficients and rainfall intensity.

4.3.1 Design Rainfall

Design rainfall is taken from the Figure 5.1 of the SDECM and is included for reference in the APPENDIX.

4.3.2 Runoff Calculation Method

Local runoff calculation is by the Rational Method. Runoff coefficients are included in the APPENDIX.

4.3.3 Detention Discharge and Storage Calculation Methods

Detention storage is determined by the methods as outlined in the Urban Drainage and Flood Control District Manual. Soil information is from the SCS Soil Survey for Douglas County. See Final Drainage Study for Bradbury Ranch Filing 2K. The detention pond at Design Point 39 was designed based on The Town of Parker's drainage manual criteria.

4.3.4 Design Storm Recurrence Intervals

Existing detention storage and outlet structure are sized for the 5 and 100-year events; please see the Amended Drainage Report for Filing 1, dated August 12, 1997and the Final Drainage Study for Bradbury Ranch Filing 2K. Proposed detention and outlet structures are sized for the 10-yr and 100-yr events per The Town of Parker's drainage manual

4.4 Hydraulic Criteria.

4.4.1 Street Capacity References

Street capacity is not an issue on this project. Gutter flow is computed by "measuring" area and wetted perimeter of the curb and gutter section. Minor storm flows are calculated using Table 6.7 of SDECM and major storm (100-yr.) flows are calculated using nomographs from the Douglas County manual for arterial, collector and local streets. The nomographs are included in the APPENDIX.

4.4.2 Other Capacity References

4.4.3 Inlet and Culvert Capacity References.

UD&FCD Type R nomograph was used to determine capacity in a sump condition. Type R inlet capacity on a continuous grade was determined from the Allowable Inlet Capacity Graph, Figure 902 of Storm Drainage Design and Technical Criteria by WRC Engineering, Inc. TM-a, February 1989. The street grades, inlet lengths and their

capacities are included in the appendix to demonstrate the length of the Type R inlet selected is satisfactory. The Type D inlet was sized using the orifice equation below:

$$Q := C \cdot A \cdot \sqrt{2 \cdot g \cdot H}$$

The calculated Q was then reduced by 50% to provide for plugging from debris.

High drainage concentrations within north south street systems contain inlet and pipe systems with 2, and 100 –yr. developed capacities. Explanation of the management of varying flows is explained in previous section 3.3 (Minor Sub-Basin Description Local Drainage).

SECTION 5. DRAINAGE FACILITY DESCRIPTION

5.1 Concept and Typical Drainage Patterns

Local drainage structures and patterns are standard subdivision design. Streets convey storm water until flow width and depth criteria require inlets. The central detention pond provides a focus for local drainage, which minimizes inlets, storm sewer and outfall requirements. The inflow to Pond 4 is improved with the use of water quality control features.

5.2 Off-site Drainage Considerations

A Type D inlet and 36" storm sewer that will accept flows up to 1 cfs per offsite acre accommodates Offsite drainage from Basins A1 and A2. Offsite flow from Basin A3 are accepted by Night Heron Drive and conveyed thru the proposed storm system described above to the existing detention pond. Offsite basins B are captured by a 4 foot trapezoidal channel and conveyed to Detention Pond IV. Offsite flows from Basin C are conveyed by culvert across Jordan Road, following their natural water course.

5.3 Discussion of Equations, Tables and Charts in APPENDIX

The APPENDIX contains local drainage calculations. Local drainage calculations are based on Rational Method hydrology. Appropriate charts, tables and graphs are included from both the Town of Parker Manual and the Urban Drainage and Flood Control District Manual.

The major drainage calculations Bradbury Ranch are based on Colorado Urban Hydrograph Procedure (CUHP-PEPC), hydrograph lagging and adding and reservoir routing. The formal calculation for this method was presented for Pond IV and is contained in the Amended Drainage Study for Filing No. 1(8/12/97). All culverts analyzed operate under inlet control due to slopes and downstream conditions.

5.4 Discussion of Storage Computations and Outlet Design

5.4.1 General

Pond No. IV exists for Bradbury Ranch Phase II. Construction of the subdivision will route sub-basins A and B of the property into the water quality control pond within Pond No. IV. The historic 100-year flow is directed to the present southern edge of Main Street. The developed runoff must also be detained upstream of the common boundary with Main Street.

Pond No. IV A will be constructed for detention and water quality treatment of developed runoff from sub-basin E.

5.4.2 Previous Work

This area has been previously studied by Bell Engineering as noted above, Kiowa Engineering for Urban Drainage and Flood Control District master planning study and by the Federal Emergency Management Agency for the flood insurance rate map. Accepted discharge for historic 100-year event at Pond IV was 473 cfs. Pond IV reduces this to 258 cfs. The channel capacity north of Main Street is 447 cfs. Futura Engineering Inc. has completed a Letter of Map Revision for Jordan Road Tributary from Main Street to the north boundary of Bradbury Ranch.

5.4.3 Detention Pond Conclusions

Pond IV is constructed and provides a sedimentation basin and water quality facility for future construction (See Section 6).

Pond IV A will be constructed and will also provide a sedimentation basin and water quality facility.

5.5 Maintenance Access

All drainage structures will be easily accessed by the use of easements or road rights of way. Common areas within the development will be controlled by an HOA; however drainage easements will be dedicated to the Town for access and maintenance purposes.

5.6 Upstream Drop Structures

5.7 Low Flow Channel

SECTION 6. ENVIRONMENTAL PROTECTION CRITERIA

6.1 Erosion Control Criteria

6.1.1 Soils Information

Per the Douglas County Soil Survey, the soil at the site is listed below:

- Manzanola Clay loam (C)
- Newlin-gravelly sandy loam (B)
- Renohill-Buick Complex (C)
- Fondis Clay Loam (C)
- Renohill-Manzanola Clay Loam (C)

They are assumed to be of medium erodible for the purposes of this report.

6.1.2 Site Vegetation

The site is covered with wheat stubble and native vegetation. Vegetation quality is good with coverage greater than 50%.

6.1.3 Erosion Control Design Criteria.

The grading of the site will consist of filling in the temporary drainage channel at Design Point 2 and grading of the new road alignments for Bradbury Ranch Drive, Jordan Road, Salt Lick Drive, and Grebe Drive. The purpose for including these roads as part of Filing B is to provide secondary access for emergency vehicles. It is anticipated that the portion of Jordan Road south of Grebe Drive will have no traffic at all since there is no outlet. The basins adjacent to Jordan Road will be left in their natural condition and will not drain onto the new road. Therefore, no sedimentation ponds are planned for runoff from sub-basins C and D as part of this Filing. Detention Pond

STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD)
STANDARD FORM SF-1

SUBDIVISION: Bradbury Ranch Filing 3B

DESIGN STORM 2 YEAR RECURRENCE INTERVAL

LOCATION:

COMPUTED BY:

DATE

Street	Design Point	Area Desig.	A (acres)	C	CA (acres)	ΣCA (acres)	t_i	t_t	t_c (Minutes)	i (in/hr)	Q (cfs)	Slope (%)	Length L (feet)	Velocity V (fps)	Δt (Minutes)	Remarks
	19	A19	0.35	0.87	0.30		1.33	2.88	5.00	3.60	1.09					
	20	A20	3.13	0.05	0.16		14.03	6.59	20.63	2.05	0.32					
	21	A21	2.04	0.05	0.10		11.38	10.72	17.17	2.25	0.23					
	22	B1	42.90	0.38	16.30		9.43	17.61	27.04	1.77	28.80					
	23	B2	2.49	0.10	0.25		12.78	1.97	13.71	2.51	0.62					
	24	B3	5.90	0.45	2.66		10.50	14.12	19.80	2.10	5.57					
	25	B4	7.77	0.45	3.50		8.34	5.51	13.85	2.50	8.73					
	26	B5	4.07	0.45	1.83		7.88	6.33	14.21	2.47	4.52					
	27	B6	0.39	0.87	0.34		1.33	4.03	5.37	3.53	1.20					
	28	B7	4.90	0.60	2.94		5.93	5.42	11.34	2.73	8.01					
	29	B8	14.64	0.08	1.17		5.58	7.58	13.16	2.56	2.99					
	30	B9	9.56	0.05	0.48		14.03	13.19	15.68	2.36	1.13					
	31	B10	2.87	0.46	1.32		3.52	8.63	12.14	2.65	3.49					
	32	B11	1.35	0.87	1.17		1.33	4.82	6.16	3.39	3.98					
	44	B12	3.22	0.45	1.45		8.86	1.87	10.73	2.79	4.04					
	33	C1	27.83	0.05	1.39		13.58	10.61	24.18	1.88	2.62					

STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD)
STANDARD FORM SF-1

SUBDIVISION: Bradbury Ranch Filing 3B

DESIGN STORM 2 YEAR RECURRENCE INTERVAL

LOCATION:

COMPUTED BY:

DATE

Street	Design Point	Area Desig.	A (acres)	C	CA (acres)	ΣCA (acres)	t_i	t_t	t_c (Minutes)	i (in/hr)	Q (cfs)	Slope (%)	Length L (feet)	Velocity V (fps)	Δt (Minutes)	Remarks
	34	C2	16.54	0.05	0.83		13.58	11.79	25.36	1.83	1.52					
	35	C3	6.80	0.05	0.34		16.63	11.93	28.55	1.71	0.58					
	36	D1	9.10	0.05	0.46		15.05	16.77	31.82	1.61	0.73					
	37	D2	2.86	0.05	0.14		16.63	5.15	21.78	1.99	0.28					
	38	D3	2.51	0.87	2.18		1.33	12.06	13.40	2.54	5.54					
	39	E1	3.35	0.65	2.18		16.63	7.15	16.66	2.29	4.98					
	40	E2	1.45	0.87	1.26		1.33	8.51	9.85	2.89	3.64					
	41	E3	0.26	0.87	0.23		1.33	1.89	5.00	3.60	0.81					
	42	E4	2.72	0.65	1.77		19.05	2.01	12.86	3.48	6.16					
	43	E5	0.82	0.87	0.71		5.46	4.57	10.03	3.86	2.76					

STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD)
STANDARD FORM SF-1

SUBDIVISION: Bradbury Ranch Filing 3B

DESIGN STORM 100 YEAR RECURRENCE INTERVAL

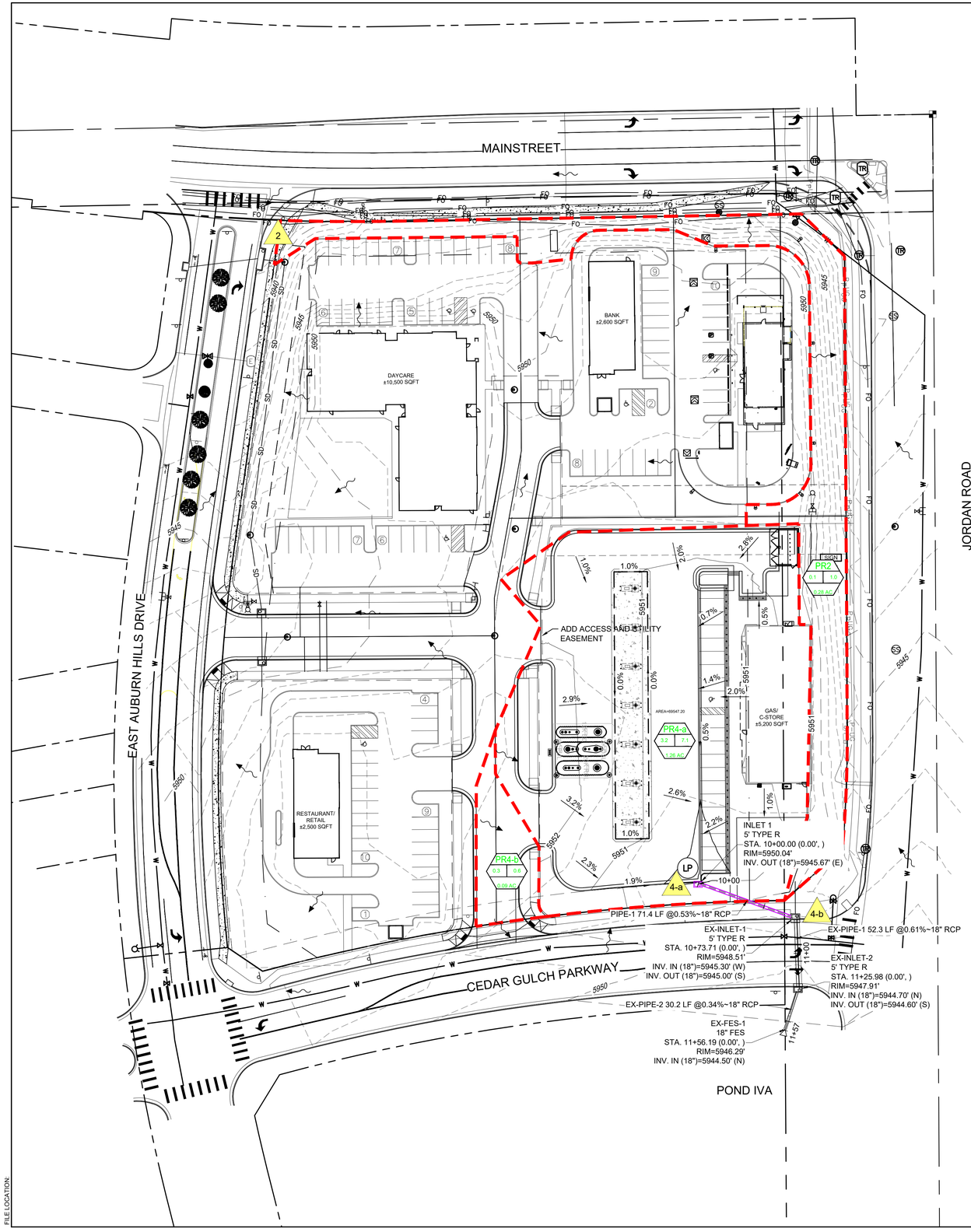
Street	Design Point	Area Desig.	A (acres)	C	CA (acres)	ΣCA (acres)	t_i	t_t	t_c (Minutes)	i (in/hr)	Q (cfs)	Slope (%)	Length L (feet)	Velocity V (fps)	Δt (Minutes)	Remarks
	18	A18	1.67	0.60	1.00		11.38	2.86	13.49	6.20	**6.21**					
	19	A19	0.35	0.93	0.33		1.33	2.88	5.00	8.82	**2.87**					
	20	A20	3.13	0.50	1.57		14.03	6.59	20.63	5.03	**7.88**					
	21	A21	2.04	0.50	1.02		11.38	10.72	17.17	5.53	**5.64**					
	22	B1	42.9	0.59	25.31		9.43	17.61	27.04	4.33	**109.69**					
	23	B2	2.49	0.45	1.12		12.78	1.97	13.71	6.15	**6.89**					
	24	B3	5.9	0.70	4.13		10.50	14.12	19.80	5.14	**21.23**					
	25	B4	7.77	0.70	5.44		8.34	5.51	13.85	6.13	**33.32**					
	26	B5	4.07	0.70	2.85		7.88	6.33	14.21	6.05	**17.25**					
	27	B6	0.39	0.93	0.36		1.33	4.03	5.37	8.65	**3.14**					
	28	B7	4.9	0.80	3.92		5.93	5.42	11.34	6.68	**26.20**					
	29	B8	14.64	0.52	7.61		5.58	7.58	13.16	6.27	**47.71**					
	30	B9	9.56	0.50	4.78		14.03	13.19	15.68	5.78	**27.62**					
	31	B10	2.87	0.72	2.07		3.52	8.63	12.14	6.49	**13.42**					
	32	B11	1.35	0.93	1.26		1.33	4.82	6.16	8.32	**10.44**					

STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD)
STANDARD FORM SF-1

SUBDIVISION: Bradbury Ranch Filing 3B

DESIGN STORM 100 YEAR RECURRENCE INTERVAL

Street	Design Point	Area Desig.	A (acres)	C	CA (acres)	ΣCA (acres)	t_i	t_t	t_c (Minutes)	i (in/hr)	Q (cfs)	Slope (%)	Length L (feet)	Velocity V (fps)	Δt (Minutes)	Remarks
	44	B12	3.22	0.70	2.25		8.86	1.87	10.73	6.84	**15.41**					
	33	C1	27.83	0.50	13.92		13.58	10.61	24.18	4.62	**64.23**					
	34	C2	16.54	0.50	8.27		13.58	11.79	25.36	4.49	**37.17**					
	35	C3	6.8	0.50	3.40		16.63	11.93	28.55	4.20	**14.28**					
	36	D1	9.1	0.50	4.55		15.05	16.77	31.82	3.94	**17.92**					
	37	D2	2.86	0.50	1.43		16.63	5.15	21.78	4.89	**6.99**					
	38	D3	2.51	0.93	2.33		1.33	12.06	13.40	6.22	**14.51**					
	39	E1	3.35	0.80	2.68		16.63	7.15	16.66	5.61	**15.04**					
	40	E2	1.45	0.93	1.35		1.33	8.51	9.85	7.08	**9.54**					
	41	E3	0.26	0.93	0.24		1.33	1.89	5.00	8.82	**2.13**					
	42	E4	2.72	0.80	2.18		19.05	2.01	12.86	6.33	**13.78**					
	43	E5	0.82	0.93	0.76		5.46	4.57	10.03	7.03	**5.36**					



Know what's below. Call before you dig.

LEGEND

- PROPERTY LINE
- PROPOSED CONTOURS (4000 / 4001)
- EXISTING CONTOURS (4000 / 4001)
- HP / LP — HIGH POINT / LOW POINT
- DRAINAGE BASIN BOUNDARY
- FLOW DIRECTION
- DP — DESIGN POINT
- BASIN — SUB BASIN DESIGNATION
- Q5 — 5-YEAR STORM EVENT PEAK FLOW (CFS)
- Q100 — 100-YEAR STORM EVENT PEAK FLOW (CFS)
- AREA — SUB BASIN AREA (AC.)

DRAINAGE NOTES

1. ALL PROPOSED STORM SEWER IS CONSIDERED PRIVATE.

Proposed Design Point Summary
MAINSTREET & JORDAN RD.

Sub-Basin/ Design Point	Total Area (ac.)	Q2 (cfs)	Q5 (cfs)	Q100 (cfs)
PR2 / 2	0.28	0.02	0.1	1.0
PR4-a / 4-a	1.26	0.9	3.2	7.1
PR4-b / 4-b (not total flow to inlet, only that portion of PR4 that goes to inlet)	0.09	0.1	0.3	0.6

N

GRAPHIC SCALE
40' 0' 40' 80'
(IN FEET)
1 inch = 40 ft.

FILE LOCATION:

CIRCLE K SDP

CONSULTANTS:

Matrix
Excellence by Design
2435 RESEARCH PARKWAY, SUITE 300
COLORADO SPRINGS, CO 80920
PHONE: (719) 575-0100
FAX : (719) 575-0208

LAND DEVELOPMENT CONSULTANTS, LLC
950 S. CHERRY STREET, SUITE 512
DENVER, CO 80246

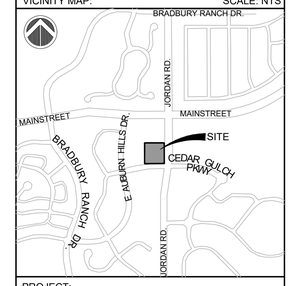
OWNER/DEVELOPER:

CIRCLE K
ROCKY MOUNTAINS DIVISION
5500 S QUEBEC STREET, SUITE 100
GREENWOOD VILLAGE, CO 80111

SEAL

FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC

VICINITY MAP: SCALE: NTS



PROJECT:

CIRCLE K STORES INC.

FINAL DRAINAGE REPORT

MAINSTREET & JORDAN RD.
TOWN OF PARKER, CO

REVISION HISTORY:

NO.	DATE	DESCRIPTION	BY

DRAWING INFORMATION:

PROJECT NO:	21.1207.03
DRAWN BY:	KMZ
CHECKED BY:	JTS
DESIGNED BY:	JTS

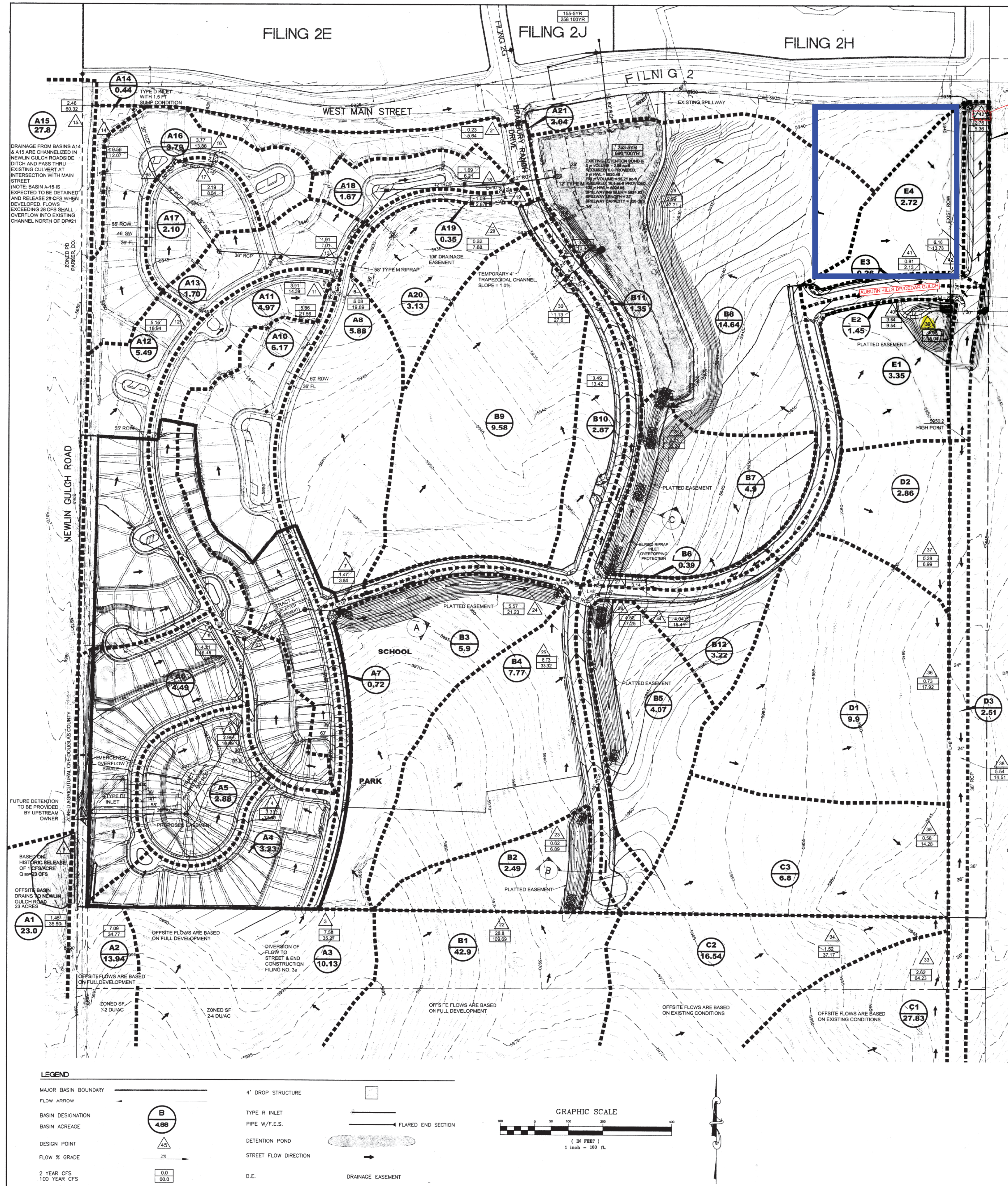
SHEET TITLE:

PROPOSED DRAINAGE MAP

SHEET 1 OF 1

DRMP

CITY FILE NO.:

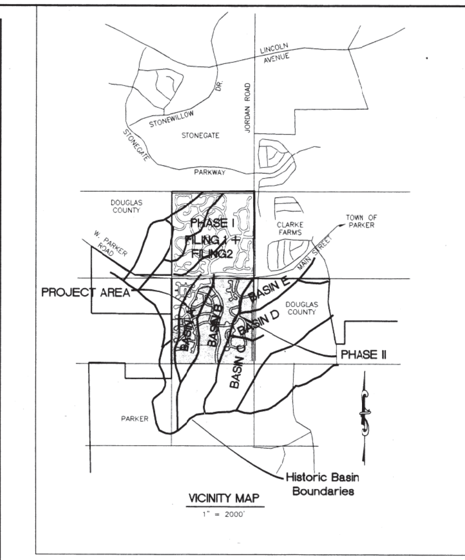


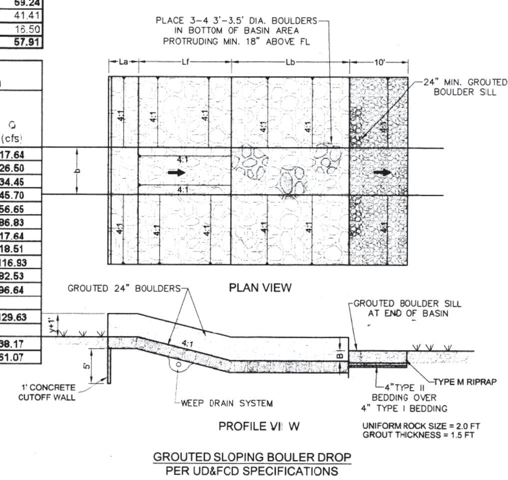
2& 100 YR Flow Accumulation

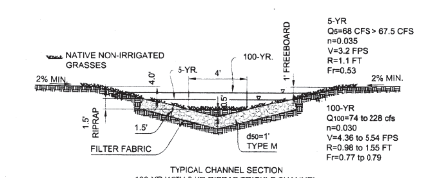
Design Point	Area Desig.	Q (cfs)
1 100-YR	A1	23.00
2 100-YR	A1	
	A2	65.74
3 2-YR	1/2*A3	3.79
4 2-YR	1/2A3-A4	6.49
5 100-YR	A1-A2	64.69
5 2-YR	1/2A3-A5	6.53
		71.21
63 100-YR	A1-A2	64.23
63 2-YR	1/2A3-A6	9.45
		73.68
6	A6	4.21
7 100-YR	A1-A2	63.48
7 2-YR	A3-A7	10.44
		73.92
24 100-YR	A1-A2,B3	74.58
24 2-YR	A3-A7	11.90
		86.48
22 100-YR	B1	109.69
23 100-YR	B1,B2	105.97
26 100-YR	A1,A2,B1-B3,B5	183.68
26 2-YR	A3-A7,B4,B12	14.46
		198.14
27 100-YR	A1,A2,B1-B3,B5	183.50
27 2-YR	A3-A7,B4,B6,B12	14.96
		198.46
28 100-YR	A1,A2,B1-B3,B5,B7	176.34
28 2-YR	A3-A7,B4,B6,B12	13.31
		189.66
20 2-YR	A20	0.32
30 2-YR	A20,B9	1.24
31 2-YR	A20,B9,B10	3.82
32 2-YR	A20,B9-B11	6.09
15 100-YR	A15	27.82
14 100-YR	A14-A15	28.89
16 100-YR	A16	13.88
17 100-YR	A16-A17	21.46
65 100-YR	A14-17	43.88
8 2-YR	A8	6.08
11 2-YR	A8,A10-11	13.97
12 2-YR	A12	5.15
13 2-YR	A8, A10-A13	16.88
		59.24
18 100-YR	A14-A18	41.41
18 2-YR	A10-A13, A19	16.50
		57.91

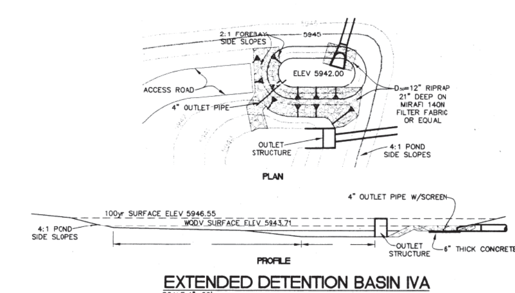
100-YR Flow Accumulation

Design Point	Area Desig.	Q (cfs)
3	1/2A3	17.64
4	A3-A4	26.50
5	A3-A5	34.45
6	A3-A6	45.70
12	A3-A6,A12	56.65
13	A3-A6, A10-A13	86.83
3	1/2 x A3	17.64
7	A3, A7	18.51
8	A3-A8,A10-A13	116.93
20	A3-A8, A10-A13, A20	82.53
30	A3-A8, A10-A13, A20	96.64
	B9	
32	A3-A8, A10-A13, A20	129.63
	B4, B6, B9-B12	
34	C2	38.17
35	C2-C3	61.07









Futura Engineering Inc.
Engineering Consultants and Surveyors
12741 East Caley Avenue, Suite 126
Englewood, Colorado 80111 – (303) 649-9292
FAX (303) 649-9499

FINAL DRAINAGE PLAN
BRADBURY RANCH PHASE II, FILING 3B

Prepared For: AMREPCO INC

DATE: 1-25-99	
DRAWN: TWD	
CHECKED: ABA	
PROJ. NO. 78-500.10	
DWG. NAME	
REVISIONS	DATE
redesign	4/28/99
CH2MHILL	8-27-99

Sheet 1 of 1

LEGEND

SUB-BASIN BOUNDARY

1 CONCENTRATION/DESIGN POINT

C — SUB-BASIN ID#
0.18 (SUB-BASIN AREA (ACRES)) — XX 2 YEAR COEF. / XX 100 YEAR COEF.

EXISTING FLOW ARROW

RUNOFF SUMMARY				
BASIN LABEL	DESIGN POINT	AREA	LOCAL (CFS)	
			Q5	Q100
F2	2	1.09	0.33	4.0
B8A	29	1.00	0.27	3.3
E4	42	2.72	5.99	13.8

EX STORMWATER POND IV

olsson
1880 Fall River Drive, Suite 200
Loveland, CO 80538
970.461.7733
www.olsson.com

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CALL UTILITY NOTIFICATION CENTER OF COLORADO
811
Know what's below. Call before you dig.
CALL 2 BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

REV. NO.	DATE	REVISIONS DESCRIPTION
		REVISIONS

EXISTING DRAINAGE MAP

AUBURN HILLS CENTRE
PHASE II DRAINAGE REPORT

PARKER, CO

2021

drawn by:	XX
checked by:	XX
approved by:	XX
QA/QC by:	XX
project no.:	021-03775
drawing no.:	
date:	

SHEET
EX DRN MAP

DWG: F:\2021\03501-04000\021-03775\40-Design\Reports\GNCV\Drainage\CAD\C_DRN01_02103775.dwg USER: twise
DATE: Jul 19, 2021 8:00am XREFS: C_XBASE_02103775 C_TBLK_02103775 C_PBASE_02103775

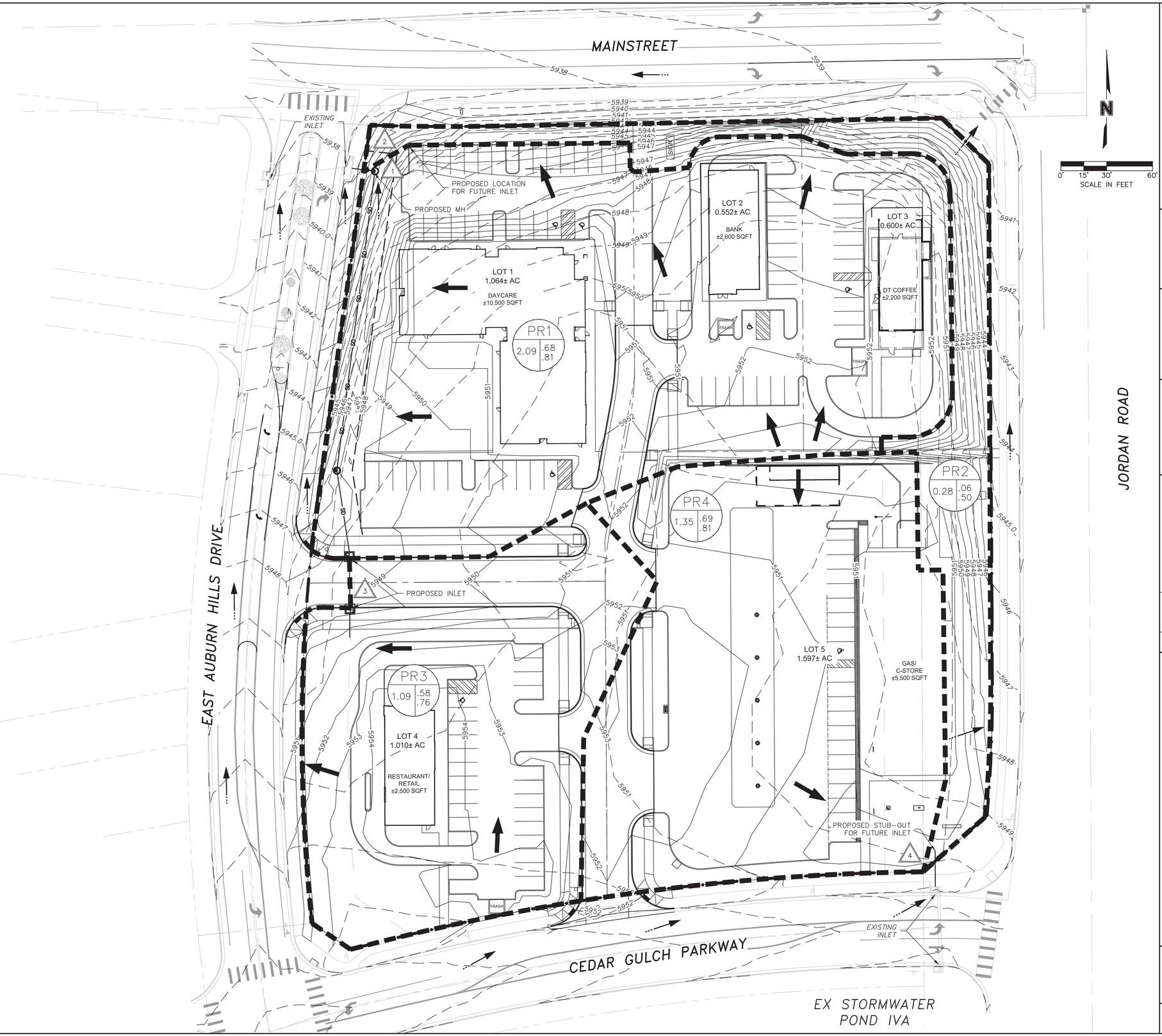
LEGEND

- BASIN BOUNDARY
- CONCENTRATION/DESIGN POINT
- SUB-BASIN ID#
- 5 YEAR COEF.
- 100 YEAR COEF.
- SUB-BASIN AREA (ACRES)
- EXISTING FLOW ARROW
- PROPOSED FLOW ARROW

RUNOFF SUMMARY

BASIN LABEL	DESIGN POINT	AREA	LOCAL (CFS)	
			Q5	Q100
PR1	1	2.09	4.93	10.9
PR2	2	0.28	0.06	0.95
PR3	3	1.09	2.64	6.43
PR4	4	1.35	3.72	8.16

EX STORMWATER POND IV



olsson
1880 Fall River Drive, Suite 200
Loveland, CO 80538
970.461.7733
www.olsson.com

REV. NO.	DATE	REVISIONS DESCRIPTION
		REVISIONS

PROPOSED DRAINAGE MAP

AUBURN HILLS CENTRE
PHASE II DRAINAGE REPORT

PARKER, CO

2021

drawn by:	XX
checked by:	XX
approved by:	XX
QA/QC by:	XX
project no.:	021-03775
drawing no.:	
date:	

SHEET
PR DRN MAP

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