CORE
ENGINEERING GROUP

15004 1st Avenue S.
Burnsville, MN 55306
Telephone: (719) 570-1100
E-mail: rich@ceg1.com

Date: April 5, 2018 (REV 6/23/2018)

Project Number: 100.043

MEMORANDUM

To:	El Paso County DSD	**From:**	Richard Schindler
Re:	Drainage Memo for Lorson Boulevard Construction from JCC to Stingray Ln (CDR 18-006)		

The following drainage memorandum is to provide drainage calculations for storm sewer design on Lorson Boulevard construction between Jimmy Camp Creek and Stingray Lane. Lorson Boulevard is a non-residential collector street and the proposed construction is approximately 2,400 feet and is built to a 40' wide asphalt street with curb & gutter on both sides. The proposed ROW width is an 80' minimum width with a utility/landscape tract on the north side. The south side is currently unplatted and does not contain any 100-year floodplain.

Existing Conditions:
The adjacent areas north of the proposed Lorson Boulevard have been developed and consist of The Meadows at Lorson Ranch Filing No. 4, Allegiant at Lorson Ranch, and The Meadows at Lorson Ranch Filing No. 3. The adjacent area west of JCC has been developed as Carriage Meadows South at Lorson Ranch and the area to the east of Stingray Lane is currently being developed at Lorson Ranch East Filing No. 1. The adjacent area south of Lorson Boulevard is unplatted at this time. There is one existing Detention/WQ Pond within the project area called Pond C1. Pond C1 has been sized to accept runoff from Lorson Boulevard per the approved MDDP1 for Lorson Ranch and the final drainage report for Allegiant at Lorson Ranch. Pond C1 is a combined detention/WQ pond on the south side of Lorson Boulevard with a dual stage outlet that drains south to the East Tributary of JCC. There are no anticipated modifications to be made to Pond C1 for this construction.

Proposed Conditions:
Basin 3.1 – Basin 3.1 was taken from the final drainage report for The Meadows at Lorson Ranch Filing No. 4. This 2.05 acre basin drains the north side of Lorson Boulevard from a high point at Jimmy Camp Creek and flows east in the proposed curb/gutter to an existing 24' wide CDOT Type R inlet located in the NW corner of Kearsarge Drive and Lorson Boulevard. The existing inlet was sized for the runoff from this basin and the storm sewer drains southeast to Pond C1.

Basin D1 – Basin D1 is a 1.91 acre drainage basin taken from the Allegiant at Lorson Ranch final drainage report. This 1.91 acre basin drains the north side of Lorson Boulevard from a high point at Stingray Lane and flows west in the proposed curb/gutter to an existing 25' wide CDPT Type R inlet located in the NE corner of Old Glory Drive and Lorson Boulevard. The existing inlet was sized for the runoff from this basin and the storm sewer drains southwest to Pond C1.

Basin A – Basin A is a 5.0 acre drainage basin that drains the south side of Lorson Boulevard and future residential areas. The basin in bounded on the east side by a high point in Stingray Lane and the west side by a high point at the Jimmy Camp Creek Bridge. All flow on the south side of Lorson Boulevard flows to a low point just north of Pond C1 at proposed Inlet DP-2. The flow from this basin is estimated to be 11.4cfs and 20.2cfs in the 5/100-year storm events.

Basin B – Basin B is a 3.7 acre drainage basin that drains the north side of Lorson Boulevard and adjacent residential areas. The basin in bounded on the east side by a high point in Stingray Lane and the west side at Kearsarge Drive. The runoff flows to a low point in Lorson Boulevard just north of Pond C1 at proposed Inlet DP-1. The flow from this basin is estimated to be 11.3cfs and 23.1cfs in the 5/100-year storm events.

Inlet DP1 – Inlet DP1 is located at a low point in Lorson Boulevard on the north side and accepts runoff from Basin B. This inlet is sized per Urban Drainage Excel Spreadsheets in a sump condition. The proposed inlet is a 15' wide CDOT Type R inlet. The inlet collects 11.3cfs in the 5-year storm event and 20.3cfs in the 100-year storm event. Approximately 2.8cfs of runoff in the 100-year storm event that overtops the crown and is collected by Inlet DP2. Inlet DP1 flows south to Inlet DP2 in a proposed 18" storm sewer at a 1% slope. The street slope is 0.6% and the street capacity is 10.6cfs/32.1cfs for half the street in the 5/100year storm events. Since half the drainage basin flows to one side of the inlet the street capacities are not exceeded.

Inlet DP2 – Inlet DP2 is located at a low point in Lorson Boulevard on the south side and accepts runoff from Basin A. This inlet is sized per Urban Drainage Excel Spreadsheets in a sump condition. The proposed inlet is a 20' wide CDOT Type R inlet. The inlet collects 11.4cfs in the 5-year storm event and 23.0cfs (20.2+2.8) in the 100-year storm event. Inlet DP2 flows south to Pond C1 in a proposed 24" storm sewer at a 3.4% slope. A sedimentation forebay is proposed for the 24" storm sewer as it enters Pond C1. The street slope is 0.6% and the street capacity is 10.6cfs/32.1cfs for half the street in the 5/100year storm events. Since half the drainage basin flows to one side of the inlet the street capacities are not exceeded.

Pond C1 – Pond C1 was built in 2008 as part of the Allegiant at Lorson Ranch subdivision in accordance with the MDDP1 for Lorson Ranch. It detains and treats runoff from several subdivisions north of Lorson Boulevard and it is designed to accept runoff from Lorson Boulevard as well. Pond C1 does not require any modifications other than the sedimentation forebay required at the new 24" storm sewer outfall entering the pond.

Cc: Maps, drainage calcs.

From: Richard L. Schindler, P.E.

CORE ENGINEERING GROUP

Standard Form SF-1. Time of Concentration-Proposed

Calculated By: Richard Schindler
Date: April 5, 2018
Checked By: Richard Schindler

Job No: 100.043
Project: Lorson Boulevard FDR

Sub-Basin Data				Initial Overland Time (t_i)				Travel Time (t_t)					t_c Check (urbanized Basins)		Final t_c
BASIN or DESIGN	C_5	AREA (A) acres	NRCS Convey.	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_i minutes	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_t minutes	Computed t_c Minutes	TOTAL LENGTH (L) feet	Regional tc tc=(L/180)+10 minutes	USDCM Recommended t_c=t_i+t_t (min)
A	0.90	5.00	15.0	30.00	2.00%	0.32	1.57	2080.0	0.70%	1.25	27.62	29.20	2110.00	21.72	29.20
B	0.70	3.70	15.0	50.00	4.00%	0.26	3.23	400.0	0.70%	1.25	5.31	8.54	450.00	12.50	8.54

CORE ENGINEERING GROUP

Standard Form SF-2. Storm Drainage System Design (Rational Method Procedure)

Calculated By: Leonard Beasley
Date: April 5, 2018
Checked By: Richard Schindler

Job No: 100.043
Project: Lorson Boulevard
Design Storm: **5 - Year Event, Proposed Conditions**

Street or Basin	Design Point	Direct Runoff							Total Runoff				Street		Pipe			Travel Time			Remarks
		Area Design	Area (A)	Runoff Coeff. (C)	t_c	CA	i	Q	t_c	$\sum$ (CA)	i	Q	Slope	Street Flow	Design Flow	Slope	Pipe Size	Length	Velocity	t_t	
			ac.		min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	min	
A			5.00	0.90	29.00	4.50	2.53	11.4													
B			3.70	0.70	8.50	2.59	4.37	11.3													

CORE ENGINEERING GROUP

Standard Form SF-2. Storm Drainage System Design (Rational Method Procedure)

Calculated By: Leonard Beasley
Date: APRIL 5, 2018
Checked By: rls

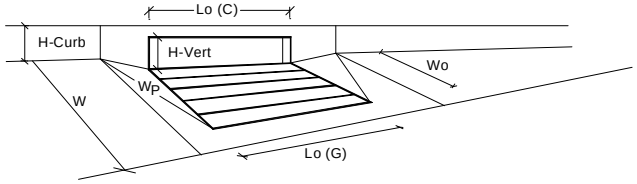
Job No: 100.043
Project: Lorson Blvd
Design Storm: **100 - Year Event, Proposed Conditions**

Street or Basin	Design Point	Direct Runoff							Total Runoff				Street		Pipe			Travel Time			Remarks
		Area Design	Area (A)	Runoff Coeff. (C)	t_c	CA	i	Q	t_c	$\sum$ (CA)	i	Q	Slope	Street Flow	Design Flow	Slope	Pipe Size	Length	Velocity	t_t	
			ac.		min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	min	
A			5.00	0.95	29.00	4.75	4.25	20.2													
B			3.70	0.85	8.50	3.15	7.34	23.1													

INLET IN A SUMP OR SAG LOCATION

Project = Lorson Blvd FDR #100.043

Inlet ID = Inlet DP-1

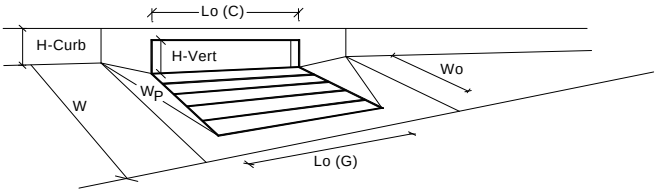


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.5	8.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
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) =	15.00	15.00	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	
Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate Capacity as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
Grate Capacity as a Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	**Q_{Grate} =**	**N/A**	**N/A**	**cfs**
Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.31	1.31	
Clogging Factor for Multiple Units	Clog =	0.04	0.04	
Curb Opening as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	12.45	21.18	cfs
Interception with Clogging	Q_{wa} =	11.90	20.25	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	30.33	33.57	cfs
Interception with Clogging	Q_{oa} =	29.00	32.11	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	18.07	24.80	cfs
Interception with Clogging	Q_{ma} =	17.28	23.72	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**11.90**	**20.25**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	15.00	15.00	feet
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	T =	39.3	52.1	ft.>T-Crown
Resultant Flow Depth at Street Crown	d_{CROWN} =	2.7	4.2	inches
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**11.9**	**20.3**	**cfs**
WARNING: Inlet Capacity less than Q Peak for MAJOR Storm	$Q_{PEAK\ REQUIRED}$ =	11.3	23.1	cfs

INLET IN A SUMP OR SAG LOCATION

Project = Lorson Boulevard #100.043

Inlet ID = Inlet DP-2



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	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 =	6.5	8.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
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) =	20.00	20.00	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	
Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate Capacity as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
Grate Capacity as a Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	**Q_{Grate} =**	**N/A**	**N/A**	**cfs**
Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.33	1.33	
Clogging Factor for Multiple Units	Clog =	0.03	0.03	
Curb Opening as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	15.79	26.87	cfs
Interception with Clogging	Q_{wa} =	15.27	25.98	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	40.44	44.76	cfs
Interception with Clogging	Q_{oa} =	39.09	43.28	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	23.50	32.26	cfs
Interception with Clogging	Q_{ma} =	22.72	31.18	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**15.27**	**25.98**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	20.00	20.00	feet
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	T =	39.3	52.1	ft.>T-Crown
Resultant Flow Depth at Street Crown	d_{CROWN} =	2.7	4.2	inches
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**15.3**	**26.0**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	11.4	23.0	cfs

Hydraflow Plan View

Project File: 100.043-100YR.stm	No. Lines: 2	03-19-2018

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1		22.70	24 c	63.0	5686.50	5689.02	4.000	5688.19	5690.71	0.30	5690.71	End
2		11.30	18 c	22.7	5690.87	5691.10	1.013	5692.23	5692.46	0.21	5692.67	1

Project File: 100.043-5YR.stm | Number of lines: 2 | Run Date: 03-19-2018

NOTES: c = cir; e = ellip; b = box; Return period = 5 Yrs.

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1		43.30	24 c	63.0	5686.50	5689.02	4.000	5688.47	5690.99	n/a	5690.99	End
2		20.30	18 c	22.7	5690.87	5691.10	1.013	5692.37*	5693.22*	0.62	5693.84	1

Project File: 100.043-100YR.stm | Number of lines: 2 | Run Date: 03-19-2018

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; *Surcharged (HGL above crown).

LEGEND

- DRAINAGE MINOR BASIN
- BASIN I.D. / ACREAGE / 5 YR/100 YR CFS
- DIRECTION OF FLOW
- 6690 EXISTING CONTOUR
- 6670 CONTOUR GRADED BY LORSON
- 6670 PROPOSED CONTOUR
- HP HIGH POINT
- LP LOW POINT
- TIME OF CONCENTRATION
- 100-YR FLOODPLAIN (FEMA)

MEADOWS NO. 4

PHANTOM WAY

KEARSARGE DR

SEAWOLF DR

18" RCP

LP

EXISTING INLET

EXISTING INLET I-20e 24' TYPE R

EX 54" RCP

SEE EXHIBIT 1b

BASIN FROM MEADOWS 4 FINAL DRAINAGE REPORT

C3.1 2.05 AC 8.7 | 16.5

A 5.0 AC 11.4 | 20.2

CARRIAGE MEADOWS SOUTH

HP

LORSON BLVD

GRADING PER LORSON BRIDGE CDR177

JIMMY CAMP CREEK

UNPLATTED

ETRIB OF JCC

5700 5698 5696 5690

24"SS 12"SS

N

150 75 0 150 300

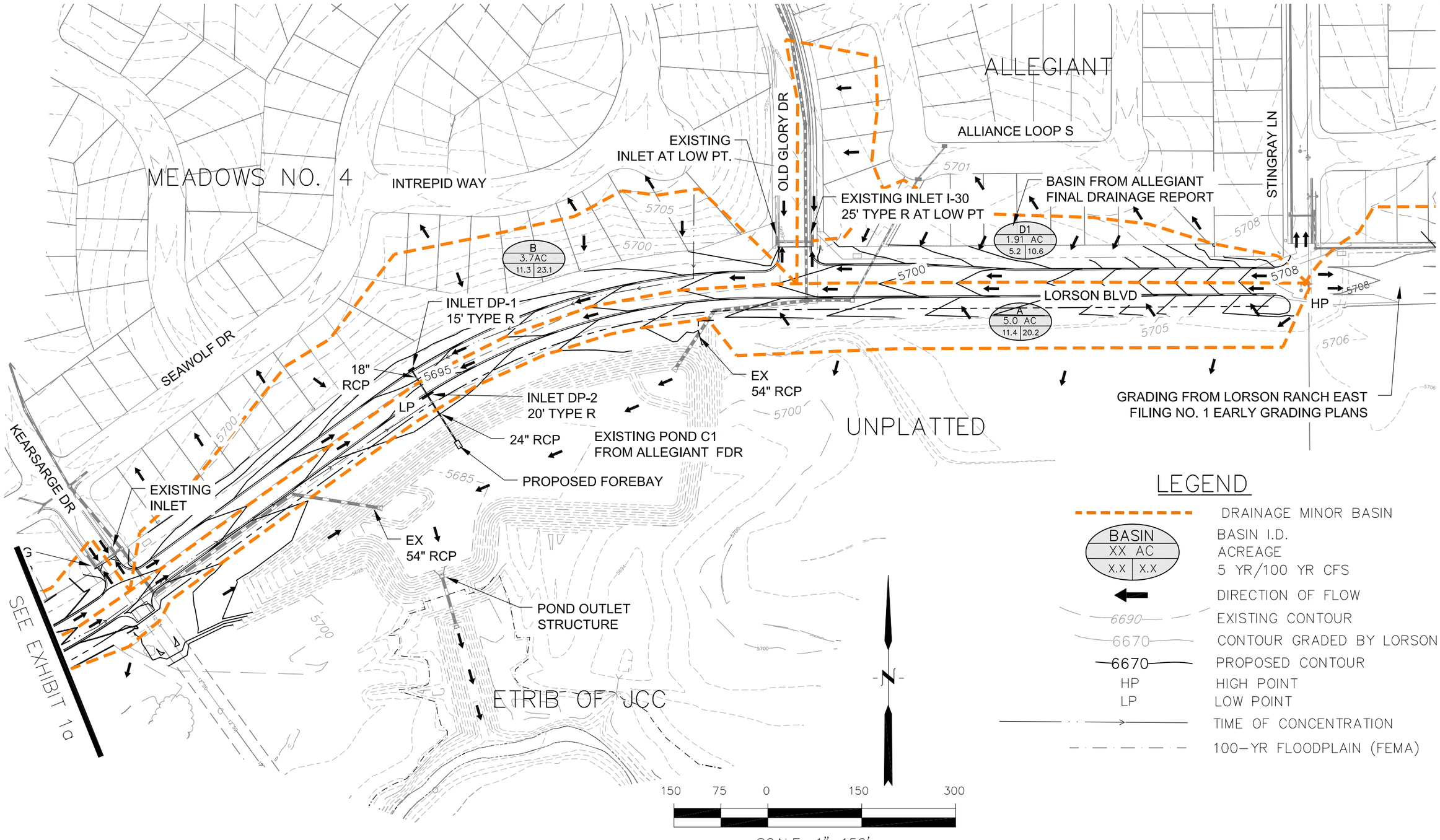
SCALE: 1"=150'

CORE ENGINEERING GROUP

15004 1ST AVENUE S.
BURNSVILLE, MN 55306
PH: 719.570.1100
CONTACT: RICHARD L. SCHINDLER, P.E.
EMAIL: Rich@ceg1.com

LORSON BOULEVARD DEVELOPED CONDITIONS

DATE:	JOB NO:
JUNE 23, 2018	100.043
SCALE: AS SHOWN AS SHOWN	FIGURE NO: 1a



LEGEND

- DRAINAGE MINOR BASIN
- BASIN (XX AC; X.X | X.X) — BASIN I.D., ACREAGE, 5 YR/100 YR CFS
- DIRECTION OF FLOW
- 6690 — EXISTING CONTOUR
- 6670 — CONTOUR GRADED BY LORSON
- 6670 — PROPOSED CONTOUR
- HP — HIGH POINT
- LP — LOW POINT
- TIME OF CONCENTRATION
- 100-YR FLOODPLAIN (FEMA)

CORE ENGINEERING GROUP

15004 1ST AVENUE S.
BURNSVILLE, MN 55306
PH: 719.570.1100
CONTACT: RICHARD L. SCHINDLER, P.E.
EMAIL: Rich@ceg1.com

LORSON BOULEVARD
DEVELOPED CONDITIONS

DATE: JUNE 23, 2018

JOB NO: 100.043

SCALE: AS SHOWN
AS SHOWN

FIGURE NO: 1b