Addendum to Technical Drainage Study for Centennial Subaru

March 2021

Prepared for:

Ascent Auto Group Nevada – Leo Butler
6600 W. Sahara Avenue
Las Vegas, Nevada 89146

Prepared by:

Lochsa Engineering
6345 South Jones Boulevard, Suite 100
Las Vegas, Nevada 89118
(702) 365-9312

Lochsa Job No. 201057

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: CENTENNIAL SUBARU Date: MARCH 3, 2021

Location of Development: a) Descriptive (Cross Streets) North/South: US 95 South

East/West: Centennial Center Blvd.

b) Section: 28 Township: 19 SOUTH Range: 60 EAST

c) APN : 125-28-510-004

Name of Owner: Ascent Auto Group Nevada - Leo Butler

Telephone No.: N/A Fax No.: E-Mail Address: N/A

Address: 6600 W. Sahara Avenue Las Vegas, NV 89146

Contact Person-Name: CHRIS BLAKE, EI **Telephone No.:** 702-365-9312

* **E-Mail Address:** CHRIS.BLAKE@LOCHSA.COM **Fax No.:** 702-365-9317

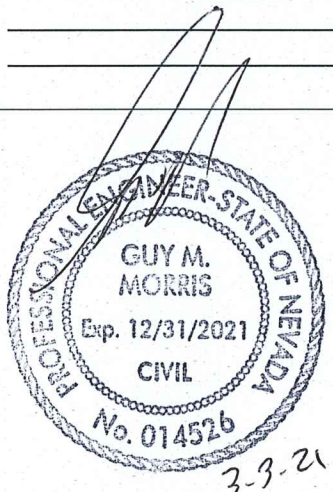
Firm: LOCHSA ENGINEERING

Address: 6345 S JONES BLVD STE 100 LAS VEGAS NV 89118

Type of Land Development/Land Disturbance Process:

	Rezoning		Subdivision Map		Clearing and Grading Only
	Parcel Map		Planned Unit Development		Other (Please specify below)
	Large Parcel Map	✔	Building Permit		

1. Total Owned Land Area: At Site: 5.49+/- ACRES Being Developed/Disturbed: 5.49 +/- ACRES
2. Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? ☐ **Yes**** ☑ **No**
3. Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? ☑ **Yes**** ☐ **No**
4. Proposed type of development (Residential, Commercial, Etc.): COMMERCIAL
5. Approximate upstream land area which drains to the subject site: 40+/- ACRES
6. Has the site drainage been evaluated in the past? ☐ **YES** ☑ **NO** If yes, please identify documentation:
7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: NEAR NORTHEAST CORNER OF SITE and SOUTHEAST CORNER OF THE SITE
8. Briefly describe your proposed schedule for the subject project: ASAP



Engineer's Seal

Submit this form as part of the required drainage study to the local entity which has jurisdiction over the subject property. This form may provide sufficient information to serve as the Conceptual Drainage Study.

*New Required Field

**Review and concurrence of the Clark County Regional Flood Control District is required.

Revision	Date

Local Entity File No.

REFERENCE:

STANDARD FORM 1

Updated 05/01/2008

T 702-365-9312 | F 702-365-9317
6345 S Jones Blvd, Suite 100
Las Vegas, NV 89118

Lochsa engineering

March 3, 2021

Albert Sung, P.E.
City of Las Vegas Public Works Department
(Flood Control Division)
495 S. Main Street
Las Vegas, NV 89101

Subject: **Technical Drainage Study for Centennial @ Subaru**
Lochsa Job No. 201057

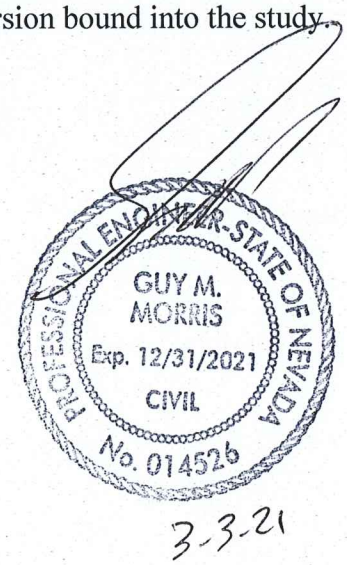
Mr. Sung:

This letter certifies that all items provided on the **Technical Drainage Study for Centennial @ Subaru** electronic submittal matches the paper version bound into the study.

Respectfully submitted,

LOCHSA ENGINEERING

Guy Morris, P.E.



3-3-21

COMMENT LETTER

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM				DATE: February 18, 2021
TO: **Land Development Services** Department of Building & Safety				FROM: Jennifer Shinn, P.E. Flood Control, Engr. Associate Department of Public Works
SUBJECT:	Drainage Study for:			**COPIES TO:**
Centennial Subaru				Lochsa Engineering
Cross Streets:	US 95 South and Centennial Center Blvd.			Ascent Auto Group Nevada
File Number:	F:\Depot\DSMemos\DS5416A.doc			Bart Anderson, P.E., DevCo
Parcel Number:	125-28-510-004			CCRFCD
Zoning Action:				
FEMA Flood Zone	YES	NO **X**		
Proposed Storm Drain	YES **X**	NO		

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1st Submittal	1/21/2021	2/15/2021	See Comments Below	$400.00	4139342: $400
			TOTAL FEES (LDDRS):	**$400.00**	-----

REMARKS:

The Drainage Study for the subject project has been reviewed and:

	is approved subject to conformance to all City standards and the following conditions:
X	must be resubmitted or supplemented including the following:
	is conditionally approved subject to Clark County Regional Flood Control District concurrence.
	is conditionally approved subject to Clark County Public Works Department concurrence.

The following are comments pertaining to the subject site specific drainage study and grading plans:

1. Provide a copy of the zoning/planning conditions associated with this site with the next submittal to verify compliance with conditions. *Flood Control* will not issue conditional approval of the drainage study without the associated zoning/planning conditions (issued by the *City Council*). Any associated conditions of approval that revise the site drainage parameters will require that the drainage study be revised and resubmitted.
2. The site is adjacent to or crosses an existing or proposed Clark County Regional Flood Control District (CCRFCD) master planned facility. Therefore, CCRFCD concurrence is required prior to final approval of the drainage study.

   Please note that effective March 15, 2019, the CCRFCD adopted new requirements for drainage study concurrence submittal. Follow the link below for specific guidance.

   http://gustfront.ccrfcd.org/LandDev/LandDev.aspx

   Please note that effective April 6, 2020, only electronic submittals to the CCRFCD will be accepted for regional concurrence. Contact cwang@regionalflood.org for direction.

   When it's applicable, structural calculations of facilities must be approved by the City prior to submittal to the Clark County Regional Flood Control District for their review and concurrence.

3. Provide Existing Basin Map with existing Offsite and Onsite flows. The Existing Basin map referenced is not sufficient because half of the proposed site is cut off.
4. Provide quality control of all call outs and corresponding construction notes in the grading plans.
5. Only one calculation for the BMP swales has been provided, however there are several swales (5 total) proposed on the grading plans which they also vary in slope and flow acceptance. Provide calculations for the BMP swales.
6. **In Report**: Section 2.4 states the referenced concrete channel has a flow of 2631cfs, however the MPU reference table shows 1766 cfs. Provide explanation to where the 2631 cfs comes from.
7. **DR2:** ND5 is 0.17 ac and on the report states 0.31ac. Revise accordingly.
8. **DR2:** Show CPD1 in the drainage map.
9. **C4.00:** Call out existing inlets on the north and south west side of the project site.
10. **C4.02**: Section E on grading plans does not match corresponding detailed section in C7.01.
11. **C7.01**: Section H shows regional facility RCHB-0034 as part of the proposed site's property. Provide additional modeling for this facility as the proposed changes this facility from open channel condition to closed storm drain condition requiring new hydraulic modeling. Revising the facility from an open channel to a box may require a Master Plan Amendment. Coordinate requirements with CCRFCD.
12. Label all existing easements with recorded document numbers.
13. Label all existing storm drain facilities with CLV drawing numbers.
14. Please note there are two (2) existing maintenance access points for the drainage channel. Maintain access to the existing drainage channel and provide the required 12' minimum access path along the top of the channel.
15. Provide structural details for the proposed channel cap and penetrations into the existing channel. Structural plans for the storm drain improvements must be submitted for review. Provide a soils report, structural calculations and specifications, two wet stamped structural sets, and a grading plan to the Building Department for processing. The engineer must provide a copy of Building Department approval of the structures to Flood Control prior to final acceptance of the drainage study.
16. Add a note on the Grading Plans: "All onsite storm drain facilities are privately owned and maintained."

NOTE: Please be advised that all land surface area disturbances over 1 acre or any area adjacent to a water way must submit to the *Nevada Division of Environmental Protection* a "Notice of Intent" to discharge that certifies a stormwater pollution prevention plan has been developed and is maintained on site; for inclusion in the Stormwater General Permit No. NVR100000. A phased construction unit in a contiguous subdivision is considered under construction until all stripped or disturbed surface areas have been covered by paving, building construction or planting. For more information, including forms and applications see http://ndep.nv.gov/bwpc/storm01.htm or call (775) 687-9429.

END OF REMARKS
HDR/JKS

T/R/S: T19S/R60E/S28
AREA G-28

T 702-365-9312 | F 702-365-9317
6345 S Jones Blvd, Suite 100
Las Vegas, NV 89118

Lochsa engineering

March 4, 2021

Albert Sung, P.E.
City of Las Vegas Public Works Department
Flood Control Division
495 S. Main Street
Las Vegas, NV 89101

Subject: **Addendum to the Technical Drainage Study for Centennial Subaru**
CLV DS5416A
Parcel Number 125-28-510-004
Lochsa Job #201057

Dear Albert Sung,

Before we address the comments, please note that the site plan has changed and a revised design and onsite analysis has been performed. I have included the revised hydrology and hydraulics at the beginning of this Addendum. The revised developed condition exhibit DR2 has also been included in the back map pocket. Please note that even though the site changed, the only real change in onsite hydrology were onsite basins ND1 and ND2. I did speak to Jennifer Shinn and she said it was ok to address the site design change in the Addendum.

Lochsa Engineering is in receipt of your comment letter for the above referenced project. In response to your comments, the following responses are being offered:

1. Provide a copy of the zoning/planning conditions associated with this site with the next submittal to verify compliance with conditions. *Flood Control* will not issue conditional approval of the drainage study without the associated zoning/planning conditions (issued by the *City Council*). Any associated conditions of approval that revise the site drainage parameters will require that the drainage study be revised and resubmitted.

Response 1: Noted. We have included it again, as this was already submitted initially in the TDS.

2. The site is adjacent to or crosses an existing or proposed Clark County Regional Flood Control District (CCRFCD) master planned facility. Therefore, CCRFCD concurrence is required prior to final approval of the drainage study.

   Please note that effective March 15, 2019, the CCRFCD adopted new requirements for drainage study concurrence submittal. Follow the link below for specific guidance.

   http://gustfront.ccrfcd.org/LandDev/LandDev.aspx

   Please note that effective April 6, 2020, only electronic submittals to the CCRFCD will be accepted for regional concurrence. Contact cwang@regionalflood.org for direction.

   When it's applicable, structural calculations of facilities must be approved by the City prior to submittal to the Clark County Regional Flood Control District for their review and concurrence.

Response 2: Noted.

3. Provide Existing Basin Map with existing Offsite and Onsite flows. The Existing Basin map referenced is not sufficient because half of the proposed site is cut off.

Response 3: Noted. Instead of referencing flows from our site which was analyzed in other referenced studies as offsite basins, we have decided to include our own Existing Condition Onsite analysis and have performed the hydrology and included an existing drainage basin map DR1 in the back map pocket. See additional hydrology calculations for existing conditions included in Addendum.

4. Provide quality control of all call outs and corresponding construction notes in the grading plans.

Response 4: Noted.

5. Only one calculation for the BMP swales has been provided, however there are several swales (5 total) proposed on the grading plans which they also vary in slope and flow acceptance. Provide calculations for the BMP swales.

Response 5: Our one calculation for the BMP swale was to show the worse-case capacity of the swale. BMP swales are used to only convey the 2yr flow per Section 1500 of HCDDM. They are not intended to fully convey the 100yr flow. The multiple BMP swales on site are designed to settle out sediment and pollutant of the water quality design flows, prior to exiting the project site. We have included the worse-case scenario for the capacity of one of our BMP swales at 1%. This shows our BMP swales can convey the 2yr flow of the drainage area that is discharging through each of them.

6. **In Report**: Section 2.4 states the referenced concrete channel has a flow of 2631cfs, however the MPU reference table shows 1766 cfs. Provide explanation to where the 2631 cfs comes from.

Response 6: Noted. This was an error in the report. A revised report page has been included to show the correct flow of 1766cfs.

7. **DR2:** ND5 is 0.17 ac and on the report states 0.31ac. Revise accordingly.

Response 7: Noted. Please see revised page from report as this basin has not changed from the new Site Plan.

8. **DR2:** Show CPD1 in the drainage map.

Response 8: Noted.

9. **C4.00:** Call out existing inlets on the north and south west side of the project site.

Response 9: Noted. See revised plans.

10. **C4.02**: Section E on grading plans does not match corresponding detailed section in C7.01.

Response 10: Noted. The necessary changes have been made on the plans to match accordingly.

11. **C7.01**: Section H shows regional facility RCHB-0034 as part of the proposed site's property. Provide additional modeling for this facility as the proposed changes this facility from open channel condition to closed storm drain condition requiring new hydraulic modeling. Revising the facility from an open channel to a box may require a Master Plan Amendment. Coordinate requirements with CCRFCD.

Response 11: With the revised Site, the regional facility is remaining an open channel and no additional modeling is now needed.

12. Label all existing easements with recorded document numbers.

Response 12: Noted. We have done our best with what we have found to label as many as the existing easements as we could. If we missed any, I am sure we will get help from CLV planning to label the ones we missed.

13. Label all existing storm drain facilities with CLV drawing numbers.

Response 13: Noted. We have done the best we could with what information we were able to find. Again, just like Comment #12, if we did miss any, I am sure we will get some assistance down the road from CLV planning during the reviews.

14. Please note there are two (2) existing maintenance access points for the drainage channel. Maintain access to the existing drainage channel and provide the required 12' minimum access path along the top of the channel.

Response 14: Noted. The maintenance road has been labeled and dimensioned on our plans. We did maintain the minimum of 12ft access path along the top of the channel on the southern side.

15. Provide structural details for the proposed channel cap and penetrations into the existing channel. Structural plans for the storm drain improvements must be submitted for review. Provide a soils report, structural calculations and specifications, two wet stamped structural sets, and a grading plan to the Building Department for processing. The engineer must provide a copy of Building Department approval of the structures to Flood Control prior to final acceptance of the drainage study.

Response 15: Noted.

16. Add a note on the Grading Plans: "All onsite storm drain facilities are privately owned and maintained."

Response 16: Noted.

If you have any questions or comments, please do not hesitate to contact our office at your earliest convenience.

Sincerely,
LOCHSA ENGINEERING

Chris Blake, EI
Hydrologist

PROFESSIONAL ENGINEER-STATE OF NEVADA
GUY M. MORRIS
Exp. 12/31/2021
CIVIL
No. 014526
3-3-21

Site Changed

(revised onsite hydrology and hydraulics)

Revised Developed Condition Hydrology

(Onsite Only)

DEVELOPMENT: CENTENNIAL SUBARU
CALCULATED BY: CB
PROJECT NUMBER: 201057

DATE: November 20, 2020

SUB-BASIN DATA				INITIAL/OVERLAND TIME (ti)			TRAVEL TIME (tt)				tc CHECK (URBANIZED BASINS)		FINAL tc	REMARKS			
DESIGN (1)	K (2)	AREA Ac (3)	AREA Sq. Mile (4)	LENGTH Ft (5)	SLOPE % (6)	ti Min (7)	LENGTH Ft (8)	SLOPE % (9)	VELOCITY FPS (10)	tt Min (11)	TOTAL LENGTH Ft (12)	tc =(L/180)+10 Min (13)	Min (14)	CN (15)	tL Hrs (16)	Urbanized? (17)	Soil Type (18)
ND1	0.8728	2.53	0.00395	50	3.5	1.9	730	1.5	2.0	6.2	780	14.3	8.1	95.7	0.081	YES	A,B,D
ND2	0.8728	2.07	0.00323	50	4.0	1.8	500	0.8	2.1	4.0	550	13.1	5.8	95.7	0.058	YES	A,B,D
ND3	0.8728	0.33	0.00052	40	3.0	1.8	165	1.3	1.4	2.0	205	11.1	3.8	95.7	0.050	YES	A,B,D
ND4	0.8728	0.31	0.00048	30	2.9	1.6	150	2.3	1.7	1.5	180	11.0	3.1	95.7	0.050	YES	A,B,D
ND5	0.9036	0.17	0.00027	20	1.2	1.5	100	3.2	1.9	0.9	120	10.7	2.4	98.0	0.050	YES	A,B,D
ND6	0.5393	0.08	0.00013	25	3.3	3.4	50	9.0	1.8	0.5	75	10.4	3.9	70.4	0.050	YES	A,B,D
HWY	0.9036	0.20	0.00031	30	2.0	1.5	180	1.4	1.6	1.8	210	11.2	3.4	98.0	0.050	YES	A,B,D
NX1	0.7996	2.07	0.00323	45	4.0	2.3	385	1.7	1.6	4.0	430	12.4	6.3	90.1	0.063	YES	A,B,D
NX2	0.7416	3.06	0.00478	45	4.4	2.6	500	1.3	1.5	5.5	545	13.0	8.2	85.7	0.082	YES	A,B,D

ti = 1.8 (1.1 - K) L^(0.5) / S^(1/3)

K = 0.0132 CN - 0.39

tt = L / (60 V)

tc = ti + tt

tL= tLAG = 0.6 tc

LOCATION: Onsite and Offsite
HYDROLOGIC CONDITION: Existing and Developed

TRIAL: Final Iteration

Curve Number Calculations
CENTENNIAL SUBARU

Sub-Basin: **ND1**
Total Area: 2.53 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Cruve Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	1.29	A	51%	98	50.0
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.81	B	32%	98	31.4
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.18	D	7%	98	6.9
Natural desert landscaping (pervious areas only)	0.10	A	4%	63	2.5
Natural desert landscaping (pervious areas only)	0.08	B	3%	77	2.3
Natural desert landscaping (pervious areas only)	0.08	D	3%	88	2.6
Total:	2.53	-	100%	-	95.7

Curve Number Calculations
CENTENNIAL SUBARU

Sub-Basin: **ND2**
Total Area: 2.07 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Cruve Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	1.06	A	51%	98	50.0
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.66	B	32%	98	31.4
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.14	D	7%	98	6.9
Natural desert landscaping (pervious areas only)	0.08	A	4%	63	2.5
Natural desert landscaping (pervious areas only)	0.06	B	3%	77	2.3
Natural desert landscaping (pervious areas only)	0.06	D	3%	88	2.6
Total:	2.07	-	100%	-	95.7

Curve Number Calculations
CENTENNIAL SUBARU

Sub-Basin: **ND3**
Total Area: 0.33 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Cruve Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.17	A	51%	98	50.0
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.11	B	32%	98	31.4
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.02	D	7%	98	6.9
Natural desert landscaping (pervious areas only)	0.01	A	4%	63	2.5
Natural desert landscaping (pervious areas only)	0.01	B	3%	77	2.3
Natural desert landscaping (pervious areas only)	0.01	D	3%	88	2.6
Total:	0.33	-	100%	-	95.7

Curve Number Calculations
CENTENNIAL SUBARU

Sub-Basin: **ND4**
Total Area: 0.31 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Cruve Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.16	A	51%	98	50.0
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.10	B	32%	98	31.4
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.02	D	7%	98	6.9
Natural desert landscaping (pervious areas only)	0.01	A	4%	63	2.5
Natural desert landscaping (pervious areas only)	0.01	B	3%	77	2.3
Natural desert landscaping (pervious areas only)	0.01	D	3%	88	2.6
Total:	0.31	-	100%	-	95.7

Curve Number Calculations
CENTENNIAL SUBARU

Sub-Basin: **ND5**
Total Area: 0.17 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Cruve Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.09	A	55%	98	53.9
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.06	B	35%	98	34.3
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.02	D	10%	98	9.8
Total:	0.17	-	100%	-	98.0

Curve Number Calculations
CENTENNIAL SUBARU

Sub-Basin: **ND6**
Total Area: 0.08 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Cruve Number [CN]	Product {CN x P}
Natural desert landscaping (pervious areas only)	0.04	A	55%	63	34.7
Natural desert landscaping (pervious areas only)	0.03	B	35%	77	27.0
Natural desert landscaping (pervious areas only)	0.01	D	10%	88	8.8
Total:	0.08	-	100%	-	70.4

Curve Number Calculations
CENTENNIAL SUBARU

Sub-Basin: **HWY**
Total Area: 0.20 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Cruve Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.11	A	55%	98	53.9
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.07	B	35%	98	34.3
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.02	D	10%	98	9.8
Total:	0.20	-	100%	-	98.0

AVERAGE VELOCITY

Input Variables		Basin ND1	Basin ND2	Basin ND3	Basin ND4	Basin ND5	Basin ND6		Basin HWY		Basin NX1	Basin NX2				
Bottom Width, B, (ft):		3.0	2.0	2.0	2.0	2.0	5.0		2.0		5.0	5.0				
Right Side Slope, Zr:		100	50	0	0	100	50		50		100	100				
Left Side Slope, Zl:		100	0	100	100	0	50		0		100	100				
Manning's n:		0.016	0.016	0.015	0.015	0.015	0.025		0.015		0.020	0.020				
Geometric Slope, So (ft/ft):	0.000	0.015	0.008	0.013	0.023	0.032	0.090	0.000	0.014	0.000	0.017	0.013	0.000	0.000	0.000	0.000
Flowrate, Q (cfs) *:		4	3.5	0.5	0.5	0.5	0.5		0.5		3	3.5				
							Output Variables									
Normal Depth, Yn (ft):		0.13	0.22	0.07	0.06	0.06	0.04		0.08		0.11	0.13				
Area of Flow, A, (sf):		2.04	1.67	0.37	0.30	0.26	0.28		0.31		1.86	2.31				
Velocity, V (fps):		1.96	2.09	1.36	1.68	1.91	1.77		1.63		1.61	1.51				
Wetted Perimeter, p (ft):		28.74	13.31	8.87	8.04	7.56	9.02		5.97		27.76	30.83				
Hydraulic Radius, Rh (ft):		0.07	0.13	0.04	0.04	0.03	0.03		0.05		0.07	0.08				
Free SurfaceTop Width, T (ft):		28.74	13.09	8.80	7.98	7.51	9.02		5.89		27.76	30.83				
Centroid, Y*, (ft):		0.05	0.08	0.03	0.02	0.02	0.02		0.03		0.04	0.05				

*** NOTE : HALF OF THE 100-YEAR STORM RUNOFF FLOWS IS USED TO DETERMINE THE BASIN TRAVEL VELOCITY REQUIRED FOR THE LAG TIME CALCULATIONS**

Revised Developed Condition HEC-1 Analysis

Peak Flow Summary
Developed Condition

HEC-1 ID	Area (acres)	10-year Flow (cfs)	100-year Flow (cfs)	
HWY	0.20	<1	1	
ND1	2.53	4	8	
ND3	0.33	1	1	
ND4	0.31	1	1	
ND5	0.17	<1	1	
CPD1	-	6	11	(ND1+ND3+ND4+ND5)
ND6	0.08	<1	<1	
ND2	2.07	4	7	

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1*****************************************
*****************************************
 *                                       *
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *                                       *
 *                JUN   1998             *
 *                                       *
 *             VERSION 4.1               *
 *                                       *
 *                                       *
 *                                       *
 *  RUN DATE   01MAR21  TIME  14:05:20   *
 *                                       *
 *                                       *
 *****************************************
*****************************************
```

```
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*            (916) 756-1104             *
*                                       *
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
   1          ID
   2          ID        ***********--TECHNICAL DRAINAGE STUDY *****************
   3          ID        CENTENNIAL SUBARU
   4          ID        INTERIM / DEVELOPED CONDITION - ONSITE AND OFFSITE
   5          ID        USING SCS METHODS AND KINEMATIC WAVE ROUTING
   6          ID        MASTER PLAN ADJUSTED 6-HOUR RAINFALL AND STORM DISTRIBUTION
   7          ID
   8          ID
   9          ID
  10          ID
  11          ID        INPUT FILE NAME:  D.DAT
  12          ID
  13          ID        MARCH 2021
  14          ID
  15          ID      ************************************************************************
  16          ID      ************************************************************************
  17          ID             McCARRAN AIRPORT RAINFALL AREA
  18          ID             10 & 100 YEAR - 6 HOUR STORM EVENT
  19          ID             PRECIPITATION:
  20          ID                 10-YEAR          : 1.58 INCHES
  21          ID                 100-YEAR         : 2.77 INCHES
  22          ID                 10-YEAR/100-YEAR : 1.58/2.77= 0.5704
  23          ID      ************************************************************************
  24          ID      ************************************************************************
  25          ID
  26          ID    *********************
  27          ID    *    SDN 3  VALUES  *
  28          ID    *********************
  29          ID
              *DIAGRAM
  30          JR    PREC     .57    1.00
  31          IT       5       0       0     200
  32          IO       5       0       0
  33          IN       5       0       0
              *
  34          KK     HWY
  35          KM   WEST OFFSITE BASIN OF THE EASTERN HALF US 95 STREET BASIN DRAINING SOUTH TO C
  36          PB    2.77
  37          BA   .00031
  38          PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
  39          PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
  40          PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
  41          PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
  42          PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
  43          PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
  44          PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
  45          PC    .998    .999   1.00
  46          LS       0   98.0
  47          UD    .050
              *
```



```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
  48          KK     ND1
  49          KM   MIDDLE PORTION OF ONITE AREA DISCHARGING TO EAST BOUNDARY THEN SOUTH THROUGH
  50          KM   BEFORE DISCHARGING INTO CENTENNIAL CENTER BLVD.
  51          BA  .00395
  52          LS       0    95.7
  53          UD    .081
              *
  54          KK     ND3
```

```
55          KM   ONSITE BASIN AT SWC OF SITE WHERE FLOWS ARE CONVEYED THRU A BMP SWALE BEFORE
56          KM   INTO CENTENNIAL CENTER BLVD.
57          BA  .00052
58          LS        0    95.7
59          UD    .050
            *

60          KK     ND4
61          KM   ONSITE BASIN ALONG THE SOUTH BOUNDARY AT CENTRAL SECTION OF SITE WHERE FLOWS
62          KM   THRU A BMP SWALE BEFORE DISCHARGING INTO CENTENNIAL CENTER BLVD.
63          BA  .00048
64          LS        0    95.7
65          UD    .050
            *

66          KK     ND5
67          KM   ONSITE BASIN AT SEC OF SITE DRAINING SOUTH TO CENTENNIAL THRU THE DRIVEWAY
68          BA  .00027
69          LS        0    98.0
70          UD    .050
            *

71          KK    CPD1
72          KM   TOTAL FLOWS DISCHARGING SOUTH INTO CENTENNIAL CENTER BLVD. FROM OUR SITE
73          HC        4
            *

74          KK     ND6
75          KM   ONSITE BASIN AT NWC OF SITE DRAINING NORTH INTO REGIONAL FACILITY
76          BA  .00013
77          LS        0    70.4
78          UD    .050
            *

79          KK     ND2
80          KM   NORTHERN CENTRAL ONSITE BASIN DISCHARGING TO ONSITE DROP INLET AT NEC OF SITE
81          BA  .00323
82          LS        0    95.7
83          UD    .058
            *

84          ZZ
1
              SCHEMATIC DIAGRAM OF STREAM NETWORK

 INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   34         HWY
               .
               .
   48          .          ND1
               .            .
               .            .
   54          .            .         ND3
               .            .          .
               .            .          .
   60          .            .          .         ND4
               .            .          .          .
               .            .          .          .
   66          .            .          .          .         ND5
               .            .          .          .          .
               .            .          .          .          .
   71          .          CPD1.....................................
               .            .
               .            .
   74          .            .         ND6
               .            .          .
               .            .          .
   79          .            .          .         ND2

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
****************************************
 *                                      *                                      *
 *                                      *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                      *    U.S. ARMY CORPS OF ENGINEERS
 *                                      *                                      *
 *              JUN   1998              *                                      *    HYDROLOGIC ENGINEERING CENTER
 *                                      *                                      *
 *            VERSION 4.1               *                                      *         609 SECOND STREET
 *                                      *                                      *
 *                                      *                                      *      DAVIS, CALIFORNIA 95616
 *                                      *                                      *
 *  RUN DATE   01MAR21  TIME  14:05:20  *                                      *           (916) 756-1104
 *                                      *                                      *
 *                                      *                                      *
 ****************************************
****************************************

            ************--TECHNICAL DRAINAGE STUDY *****************
            CENTENNIAL SUBARU
            INTERIM / DEVELOPED CONDITION - ONSITE AND OFFSITE
            USING SCS METHODS AND KINEMATIC WAVE ROUTING
            MASTER PLAN ADJUSTED 6-HOUR RAINFALL AND STORM DISTRIBUTION


            INPUT FILE NAME:  D.DAT

            MARCH 2021

           ********************************************************************
           ********************************************************************
```

d

10 & 100 YEAR - 6 HOUR STORM EVENT
PRECIPITATION:
10-YEAR : 1.58 INCHES
100-YEAR : 2.77 INCHES
10-YEAR/100-YEAR : 1.58/2.77= 0.5704

****
* SDN 3 VALUES *
****

```
  32 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                      NMIN          5  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1   0  STARTING DATE
                     ITIME       0000  STARTING TIME
                        NQ        200  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      1   0  ENDING DATE
                    NDTIME       1635  ENDING TIME
                     ICENT         19  CENTURY MARK

                  COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE   16.58 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT

     JP          MULTI-PLAN OPTION
                      NPLAN          1  NUMBER OF PLANS

     JR          MULTI-RATIO OPTION
                     RATIOS OF PRECIPITATION
                     .57     1.00
1

            PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
                                FLOWS IN CUBIC FEET PER SECOND,  AREA IN SQUARE MILES
                                                TIME TO PEAK IN HOURS

                                                                    RATIOS APPLIED TO PRECIPITATION
 OPERATION       STATION     AREA    PLAN              RATIO 1  RATIO 2
                                                                      .57     1.00

 HYDROGRAPH AT
+                  HWY       .00     1   FLOW             0.       1.
                                         TIME           3.50     3.50

 HYDROGRAPH AT
+                  ND1       .00     1   FLOW             4.       8.
                                         TIME           3.50     3.50

 HYDROGRAPH AT
+                  ND3       .00     1   FLOW             1.       1.
                                         TIME           3.50     3.50

 HYDROGRAPH AT
+                  ND4       .00     1   FLOW             1.       1.
                                         TIME           3.50     3.50

 HYDROGRAPH AT
+                  ND5       .00     1   FLOW             0.       1.
                                         TIME           3.50     3.50

   4 COMBINED AT
+                 CPD1       .01     1   FLOW             6.      11.
                                         TIME           3.50     3.50

 HYDROGRAPH AT
+                  ND6       .00     1   FLOW             0.       0.
                                         TIME           3.50     3.50

 HYDROGRAPH AT
+                  ND2       .00     1   FLOW             4.       7.
                                         TIME           3.50     3.50


 *** NORMAL END OF HEC-1 ***
```

Street Flow Summary
(Existing / Developed Condition)

10-year, 6-hour Storm

Street	Right of Way Width (ft)	Hydraulic Cross-Section Identifier	10-Year Flow [Q10] (cfs)	10-Year Velocity [v] (fps)	10-Year Flow Depth [d] (ft)	10-Year Velocity x Depth [v x d]	Dry Lane Width [v] x [d]
Ramp Connector to Hwy 95 (half street) Centennial Center Boulevard	40 70	A B	1 * 17	2.09 3.90	0.26 0.43	0.54 1.68	N/A N/A

Street Flow Summary
(Existing / Developed Condition)

100-year, 6-hour Storm

Street	1/2 Right of Way Width (ft)	Hydraulic Cross-Section Identifier	100-Year Flow [Q100] (cfs)	100-Year Velocity [v] (fps)	100-Year Flow Depth [d] (ft)	100-Year Velocity x Depth [v x d]
Ramp Connector to Hwy 95 (half street) Centennial Center Boulevard	40 70	A B	1 * 81.6	2.09 5.01	0.26 0.68	0.54 3.41

*DS #2589

Revised Onsite Hydraulic Sections 'C' and 'D'

On-site Sections
(Developed Condition)

Hydraulic Cross-Section Identifier	100-Year Flow [Q100] (cfs)	100-Year Velocity [v] (fps)	100-Year Flow Depth [d] (ft)	100-Year [v] x [d]
C	1	0.22	0.33	0.07
D	7	2.01	0.50	1.01

Onsite Section 'C' - 100year
Worksheet for Irregular Channel

Project Description	
Worksheet	Onsite Section 'C' - 100yr
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	.005000	ft/ft
Discharge	1.00	cfs

upstream end of ND1 basin

Options	
Current Roughness Method	Lotter's Method
Open Channel Weighting	Lotter's Method
Closed Channel Weighting	Horton's Method

Results		
Mannings Coefficient	0.143	
Water Surface Elev.	18.18	ft
Elevation Range	.85 to 20.29	
Flow Area	4.6	ft²
Wetted Perimeter	28.56	ft
Top Width	28.55	ft
Actual Depth	0.33	ft
Critical Elevation	17.98	ft
Critical Slope	0.744756	ft/ft
Velocity	0.22	ft/s
Velocity Head	7.37e-4	ft
Specific Energy	18.18	ft
Froude Number	0.10	
Flow Type	Subcritical	

← d_{100}

← v_{100}

.33 x .22 = .07 < 8 OK

FF = 18.60'

W.S.E. = 18.18'

d_{100} = .33'

18.51' < 18.60' (GARAGE FF)

FF meets ✓

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+52.50	0.160
0+52.50	0+55.50	0.130
0+55.50	0+84.00	0.160
0+84.00	0+84.50	0.130

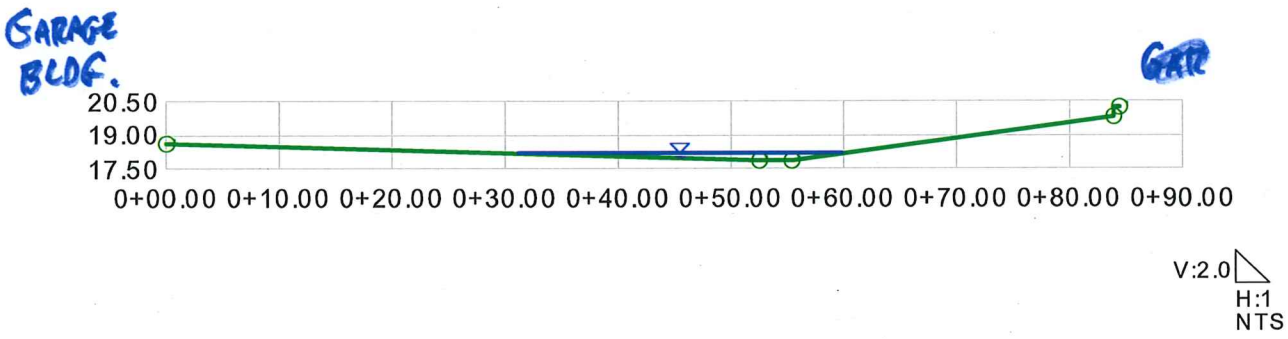
Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	18.60
0+52.50	17.89
0+54.00	17.85
0+55.50	17.89
0+84.00	19.79
0+84.00	20.29
0+84.50	20.29

Lochsa Engineering
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Onsite Section 'C' - 100year
Cross Section for Irregular Channel

Project Description	
Worksheet	Onsite Section 'C' - 100
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.143	
Slope	0.005000	ft/ft
Water Surface Elev	18.18	ft
Elevation Range	'.85 to 20.29	
Discharge	1.00	cfs



Onsite Section 'D' - 100year
Worksheet for Irregular Channel

Project Description	
Worksheet	Onsite Section 'D' - 100yr
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	.004000	ft/ft
Discharge	7.00	cfs

← ND2 Flow

Options	
Current Roughness Meth	oved Lotter's Method
Open Channel Weighting	oved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.015	
Water Surface Elev.	17.98	ft
Elevation Range	.48 to 18.55	
Flow Area	3.5	ft²
Wetted Perimeter	19.46	ft
Top Width	18.91	ft
Actual Depth	0.50	ft
Critical Elevation	17.95	ft
Critical Slope	0.006023	ft/ft
Velocity	2.01	ft/s
Velocity Head	0.06	ft
Specific Energy	18.05	ft
Froude Number	0.82	
Flow Type	Subcritical	

← d_{100}

← V_{100}

$.50 \times 2.01 = 1.00 < 8$ OK ✓

$FF = 18.60'$

$W.S.E. = 17.98'$

$+ d_{100} = .50'$

$18.48' < 18.60'$ (FF)

GARAGE FF

FF Meets ✓

Calculation Messages:
Water elevation exceeds lowest end station by 0.45012443e-2 ft.

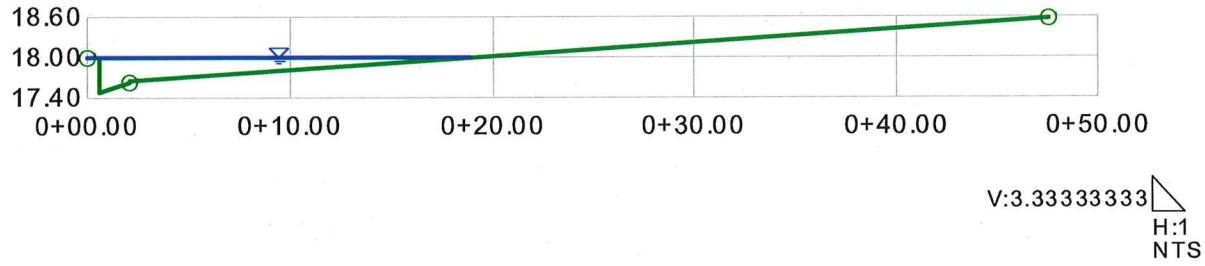
Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+02.00	0.013
0+02.00	0+47.50	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	17.98
0+00.50	17.98
0+00.50	17.48
0+02.00	17.61
0+02.00	17.65
0+47.50	18.55

Onsite Section 'D' - 100year
Cross Section for Irregular Channel

Project Description	
Worksheet	Onsite Section 'D' - 100
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.015	
Slope	0.004000	ft/ft
Water Surface Elev	17.98	ft
Elevation Range	'.48 to 18.55	
Discharge	7.00	cfs



Onsite 3ft x 3ft Grate Sump Inlet

(Interim/Developed Conditions)

Project: CENTENNIAL @ SUBARU

Project Number: 201057

Date: March, 2021

Rating Table for the Proposed Onsite 3ft x 3ft Grate

Orifice Equation: Q=KCA(2gh)^0.5

Effective Area of Grate: A= 0.60 x Area

3ft x 3ft Grate

Length of Grate (L):	3.0	ft
Width of Grate (W):	3.00	ft
Orifice Coefficient (C):	0.65	
Clogging Factor (K):	50.00%	%
Effective Area Coef. :	0.60	%

Top of Grate Elev.: **15.83**

Headwater Elevation (ft)	Head Above Grate (h) (ft)	Effective Area of Grate (A) (sf)	Flow into Grate (Q) (cfs)	
15.83	0.00	5.4	0.0	
15.88	0.05	5.4	3.1	
15.91	0.08	5.4	4.0	
15.92	0.09	5.4	4.2	
15.93	0.10	5.4	4.5	
15.98	0.15	5.4	5.5	
16.13	**0.30**	**5.4**	**7.7**	**< -- Q100 = 7cfs from ND2**
16.33	0.50	5.4	10.0	
16.48	0.65	5.4	11.4	
16.63	0.80	5.4	12.6	
16.78	0.95	5.4	13.7	
16.93	1.10	5.4	14.8	
17.08	1.25	5.4	15.7	
17.23	1.40	5.4	16.7	
17.38	1.55	5.4	17.5	
17.53	1.70	5.4	18.4	
17.68	1.85	5.4	19.2	
17.83	2.00	5.4	19.9	
17.98	2.15	5.4	20.7	
18.13	2.30	5.4	21.4	
18.28	2.45	5.4	22.0	
18.43	2.60	5.4	22.7	
18.58	2.75	5.4	23.4	

below curb height

COMMENT #1

PLANNING / ZONING CONDITIONS

November 19, 2020

Mr. Joshua R. Holm
OM Real Estate/Las Vegas, LLC
1375 Enclave Parkway
Houston, Texas 77077

RE: 20-0137-GPA1 AND 20-0137-SDR1
CITY COUNCIL MEETING OF NOVEMBER 18, 2020

Dear Mr. Holm:

The City Council at a regular meeting held on November 18, 2020 voted to ***APPROVE*** the following Land Use Entitlement project requests on 5.49 acres located on the north side of Centennial Center Boulevard, approximately 1,680 feet west of Azure Drive (APN 125-28-510-004), T-C (Town Center) Zone, Ward 6 (Fiore).

20-0137-GPA1 - TO REMOVE A PORTION OF THE TOWN CENTER MULTI-USE TRAIL ALIGNMENT.

20-0137-SDR1 - FOR A PROPOSED 63,930 SQUARE-FOOT MOTOR VEHICLE SALES (NEW) DEVELOPMENT WITH WAIVERS OF TOWN CENTER DESIGN STANDARDS.

20-0137-GPA1 was approved subject to no conditions:

20-0137-SDR1 approval is subject to the following conditions:

Planning

1. Approval of a General Plan Amendment (20-0137-GPA1) shall be required, if approved.

2. This approval shall be void two years from the date of final approval, unless exercised pursuant to the provisions of LVMC Title 19.16. An Extension of Time may be filed for consideration by the City of Las Vegas.

3. All development shall be in conformance with the site plan and landscape plan, date stamped 09/17/20 and the building elevations date stamped 08/24/20, except as amended by conditions herein.

4. A Waiver from the Town Center Development Standards Manual is hereby approved, to allow a parking lot in front of the building where required to be located at the side or rear of buildings.

5. A Waiver from LVMC Title 19.08 is hereby approved, to allow a six-foot perimeter landscape buffer along a portion of the north property line where 15 feet is required.

6. A Waiver of the Town Center Development Standards Manual is hereby approved to allow no parking lot screen berms where such is required.

7. A Waiver of the Town Center Development Standards Manual is hereby approved to allow no articulated roofline where such is required.

8. An Exception from LVMC Title 19.08 is hereby approved to allow no landscape materials within the north landscape buffer where such are required.

9. All necessary building permits shall be obtained and final inspections shall be completed in compliance with Title 19 and all codes as required by the Department of Building and Safety.

10. These Conditions of Approval shall be affixed to the cover sheet of any plan set submitted for building permit.

11. A technical landscape plan, signed and sealed by a Registered Architect, Landscape Architect, Residential Designer or Civil Engineer, must be submitted prior to or at the same time application is made for a building permit. A permanent underground sprinkler system is required, which shall be permanently maintained in a satisfactory manner; the landscape plan shall include irrigation specifications. Installed landscaping shall not impede visibility of any traffic control device.

12. A fully operational fire protection system, including fire apparatus roads, fire hydrants and water supply, shall be installed and shall be functioning prior to construction of any combustible structures.

13. All City Code requirements and design standards of all City Departments must be satisfied, except as modified herein.

Public Works

14. The sidewalks along Centennial Center Boulevard adjacent to this site shall meet Public Right-of-Way Accessibility Guidelines (PROWAG) in accordance with code requirements of Title 13.56.040 to the satisfaction of the City Engineer concurrent with development of this site. Grant any Pedestrian Access Easement, if any, needed to complete this requirement.

15. Concurrent with development, construct a median island in Centennial Center Boulevard restricting the southern driveway to no left out movements unless otherwise allowed by the City Traffic Engineer.

16. Landscape and maintain all unimproved rights-of-way, if any, adjacent to this site. All landscaping and private improvements installed with this project shall be situated and maintained so as to not create sight visibility obstructions for vehicular traffic at all development access drives and abutting street intersections.

17. Submit a License Agreement for landscaping and private improvements in public rights-of-way, if any, adjacent to this site prior to this issuance of permits for these improvements. The applicant must carry an insurance policy for the term of the License Agreement and add the City of Las Vegas as an additionally insured entity on this insurance policy. If requested by the City, the applicant shall remove property encroaching in the public right-of-way at the applicant's expense pursuant to the terms of the City's License Agreement. The installation and maintenance of all private improvements in the public right of way shall be the responsibility of the adjacent property owner(s) and shall be transferred with the sale of the property for the entire term of the License Agreement. Coordinate all requirements for the License Agreement with the Land Development Section of the Department of Building and Safety (702-229-4836).

18. Connect to the existing Public Sewer Stub in Centennial Boulevard unless otherwise allowed by the City Engineer.

19. A Drainage Plan and Technical Drainage Study must be submitted to and approved by the Department of Public Works prior to the issuance of any building or grading permits or submittal of any construction drawings, whichever may occur first. Provide and improve all drainageways recommended in the approved drainage plan/study. The developer of this site shall be responsible to construct such neighborhood or local drainage facility improvements as are recommended by the City of Las Vegas Neighborhood Drainage Studies and approved Drainage Plan/Study concurrent with development of this site.

The Notice of Final Action was filed with the Las Vegas City Clerk on November 19, 2020.

Sincerely,

Peter Lowenstein, AICP
Deputy Planning Director
Department of Planning

PL:clb

cc: Mr. Lee Butler
Lexus of Las Vegas
6600 West Sahara Avenue
Las Vegas, Nevada 89146

Ms. Lora Dreja
Brown, Brown & Premsrirut
520 South 4th Street
Las Vegas, Nevada 89101

COMMENT #3

EXISTING CONDITION HYDROLOGY

Existing Condition Hydrology

DEVELOPMENT: CENTENNIAL SUBARU
CALCULATED BY: CB
PROJECT NUMBER: 201057

DATE: November 20, 2020

SUB-BASIN DATA				INITIAL/OVERLAND TIME (ti)			TRAVEL TIME (tt)				tc CHECK (URBANIZED BASINS)		FINAL tc	REMARKS			
DESIGN (1)	K (2)	AREA Ac (3)	AREA Sq. Mile (4)	LENGTH Ft (5)	SLOPE % (6)	ti Min (7)	LENGTH Ft (8)	SLOPE % (9)	VELOCITY FPS (10)	tt Min (11)	TOTAL LENGTH Ft (12)	tc =(L/180)+10 Min (13)	Min (14)	CN (15)	tL Hrs (16)	Urbanized? (17)	Soil Type (18)
ND1	0.8728	2.53	0.00395	50	3.5	1.9	730	1.5	2.0	6.2	780	14.3	8.1	95.7	0.081	YES	A,B,D
ND2	0.8728	2.07	0.00323	50	4.0	1.8	500	0.8	2.1	4.0	550	13.1	5.8	95.7	0.058	YES	A,B,D
ND3	0.8728	0.33	0.00052	40	3.0	1.8	165	1.3	1.4	2.0	205	11.1	3.8	95.7	0.050	YES	A,B,D
ND4	0.8728	0.31	0.00048	30	2.9	1.6	150	2.3	1.7	1.5	180	11.0	3.1	95.7	0.050	YES	A,B,D
ND5	0.9036	0.17	0.00027	20	1.2	1.5	100	3.2	1.9	0.9	120	10.7	2.4	98.0	0.050	YES	A,B,D
ND6	0.5393	0.08	0.00013	25	3.3	3.4	50	9.0	1.8	0.5	75	10.4	3.9	70.4	0.050	YES	A,B,D
HWY	0.9036	0.20	0.00031	30	2.0	1.5	180	1.4	1.6	1.8	210	11.2	3.4	98.0	0.050	YES	A,B,D
NX1	0.7996	2.07	0.00323	45	4.0	2.3	385	1.7	1.6	4.0	430	12.4	6.3	90.1	0.063	YES	A,B,D
NX2	0.7416	3.06	0.00478	45	4.4	2.6	500	1.3	1.5	5.5	545	13.0	8.2	85.7	0.082	YES	A,B,D

ti = 1.8 (1.1 - K) L^(0.5) / S^(1/3)

K = 0.0132 CN - 0.39

tt = L / (60 V)

tc = ti + tt

tL= tLAG = 0.6 tc

LOCATION: Onsite and Offsite
HYDROLOGIC CONDITION: Existing and Developed

TRIAL: Final Iteration

Curve Number Calculations
CENTENNIAL SUBARU

Sub-Basin: **NX1**
Total Area: 2.07 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Cruve Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.56	A	27%	98	26.5
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.36	B	17%	98	17.0
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.11	D	5%	98	5.2
Newly graded area (pervious area only, no vegetation)	0.55	A	27%	77	20.5
Newly graded area (pervious area only, no vegetation)	0.35	B	17%	86	14.5
Newly graded area (pervious area only, no vegetation)	0.14	D	7%	94	6.4
Total:	2.07	-	100%	-	90.1

Curve Number Calculations
CENTENNIAL SUBARU

Sub-Basin: **NX2**
Total Area: 3.06 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Cruve Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.40	A	13%	98	12.8
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.26	B	8%	98	8.3
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.07	D	2%	98	2.2
Newly graded area (pervious area only, no vegetation)	1.28	A	42%	77	32.2
Newly graded area (pervious area only, no vegetation)	0.81	B	26%	86	22.8
Newly graded area (pervious area only, no vegetation)	0.24	D	8%	94	7.4
Total:	3.06	-	100%	-	85.7

AVERAGE VELOCITY

Input Variables		Basin ND1	Basin ND2	Basin ND3	Basin ND4	Basin ND5	Basin ND6		Basin HWY		Basin NX1	Basin NX2				
Bottom Width, B, (ft):		3.0	2.0	2.0	2.0	2.0	5.0		2.0		5.0	5.0				
Right Side Slope, Zr:		100	50	0	0	100	50		50		100	100				
Left Side Slope, Zl:		100	0	100	100	0	50		0		100	100				
Manning's n:		0.016	0.016	0.015	0.015	0.015	0.025		0.015		0.020	0.020				
Geometric Slope, So (ft/ft):	0.000	0.015	0.008	0.013	0.023	0.032	0.090	0.000	0.014	0.000	0.017	0.013	0.000	0.000	0.000	0.000
Flowrate, Q (cfs) *:		4	3.5	0.5	0.5	0.5	0.5		0.5		3	3.5				
							Output Variables									
Normal Depth, Yn (ft):		0.13	0.22	0.07	0.06	0.06	0.04		0.08		0.11	0.13				
Area of Flow, A, (sf):		2.04	1.67	0.37	0.30	0.26	0.28		0.31		1.86	2.31				
Velocity, V (fps):		1.96	2.09	1.36	1.68	1.91	1.77		1.63		1.61	1.51				
Wetted Perimeter, p (ft):		28.74	13.31	8.87	8.04	7.56	9.02		5.97		27.76	30.83				
Hydraulic Radius, Rh (ft):		0.07	0.13	0.04	0.04	0.03	0.03		0.05		0.07	0.08				
Free SurfaceTop Width, T (ft):		28.74	13.09	8.80	7.98	7.51	9.02		5.89		27.76	30.83				
Centroid, Y*, (ft):		0.05	0.08	0.03	0.02	0.02	0.02		0.03		0.04	0.05				

*** NOTE : HALF OF THE 100-YEAR STORM RUNOFF FLOWS IS USED TO DETERMINE THE BASIN TRAVEL VELOCITY REQUIRED FOR THE LAG TIME CALCULATIONS**

Existing Condition HEC-1 Analysis

Peak Flow Summary
Existing Condition

HEC-1 ID	Area (acres)	10-year Flow (cfs)	100-year Flow (cfs)	
HWY	0.20	<1	1	
NX1	2.07	3	6	
CPX1	-	3	7	(HWY+NX1)
NX2	3.06	3	7	

X

```
1*****************************************
*****************************************
 *                                   *                                   *
 *                                   *                                   *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                   *    U.S. ARMY CORPS OF ENGINEERS
 *                                   *                                   *
 *               JUN   1998          *                                   *    HYDROLOGIC ENGINEERING CENTER
 *                                   *                                   *
 *            VERSION 4.1            *                                   *         609 SECOND STREET
 *                                   *                                   *
 *                                   *                                   *       DAVIS, CALIFORNIA 95616
 *                                   *                                   *
 *  RUN DATE   01MAR21  TIME  09:39:31   *                                   *          (916) 756-1104
 *                                   *                                   *
 *                                   *                                   *
 *****************************************
*****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X                X
XXXXXXX  XXXX     X        XXXXX   X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX          XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


```
          LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
            1       ID
            2       ID        ***********--TECHNICAL DRAINAGE STUDY *****************
            3       ID        CENTENNIAL SUBARU
            4       ID        EXISTING CONDITION - ONSITE AND OFFSITE
            5       ID        USING SCS METHODS AND KINEMATIC WAVE ROUTING
            6       ID        MASTER PLAN ADJUSTED 6-HOUR RAINFALL AND STORM DISTRIBUTION
            7       ID
            8       ID
            9       ID
           10       ID
           11       ID        INPUT FILE NAME:  X.DAT
           12       ID
           13       ID        MARCH 2021
           14       ID
           15       ID      ************************************************************************
           16       ID      ************************************************************************
           17       ID             McCARRAN AIRPORT RAINFALL AREA
           18       ID             10 & 100 YEAR - 6 HOUR STORM EVENT
           19       ID             PRECIPITATION:
           20       ID                 10-YEAR          : 1.58 INCHES
           21       ID                 100-YEAR         : 2.77 INCHES
           22       ID                 10-YEAR/100-YEAR : 1.58/2.77= 0.5704
           23       ID      ************************************************************************
           24       ID      ************************************************************************
           25       ID
           26       ID    *********************
           27       ID    *    SDN 3  VALUES  *
           28       ID    *********************
           29       ID
                   *DIAGRAM
           30       JR    PREC     .57    1.00
           31       IT       5       0       0     200
           32       IO       5       0       0
           33       IN       5       0       0
                    *
           34       KK     HWY
           35       KM   WEST OFFSITE BASIN OF THE EASTERN HALF US 95 STREET BASIN DRAINING SOUTH TO C
           36       PB    2.77
           37       BA   .00031
           38       PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
           39       PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
           40       PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
           41       PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
           42       PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
           43       PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
           44       PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
           45       PC    .998    .999   1.00
           46       LS       0   98.0
           47       UD    .050
                    *
```



```
          LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
           48       KK     NX1
           49       KM   SOUTHERN PORTION OF ONITE AREA DISCHARGING SOUTHEAST TO CENTENNIAL CTR. BLVD.
           50       BA   .00323
           51       LS       0    90.1
           52       UD    .063
                    *
           53       KK    CPX1
           54       KM   TOTAL FLOWS DISCHARGING SOUTH INTO CENTENNIAL CENTER BLVD. FROM OUR SITE
```

```
            55           HC       2
                         *
            56           KK     NX2
            57           KM   NORTHERN PORTION OF ONSITE AREA DISCHARGING NORTH TO REGIONAL FACILITY AT NEC
            58           BA  .00478
            59           LS       0    85.7
            60           UD    .082
                         *
            61           ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    34          HWY
                  .
                  .
    48            .          NX1
                  .           .
                  .           .
    53          CPX1.....     .
                  .
                  .
    56            .          NX2

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
****************************************
 *                                      *                                      *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                      *    U.S. ARMY CORPS OF ENGINEERS
*
 *               JUN   1998             *                                      *    HYDROLOGIC ENGINEERING CENTER
*
 *            VERSION 4.1               *                                      *         609 SECOND STREET
*
 *                                      *                                      *       DAVIS, CALIFORNIA 95616
*
 *  RUN DATE   01MAR21  TIME  09:39:31  *                                      *           (916) 756-1104
*
 *                                      *                                      *
*
 ****************************************
****************************************
```

```
                          ***********--TECHNICAL DRAINAGE STUDY *****************
                          CENTENNIAL SUBARU
                          EXISTING CONDITION - ONSITE AND OFFSITE
                          USING SCS METHODS AND KINEMATIC WAVE ROUTING
                          MASTER PLAN ADJUSTED 6-HOUR RAINFALL AND STORM DISTRIBUTION



                          INPUT FILE NAME:  X.DAT

                          MARCH 2021

                         ************************************************************************
                         ************************************************************************
                               McCARRAN AIRPORT RAINFALL AREA
                               10 & 100 YEAR - 6 HOUR STORM EVENT
                               PRECIPITATION:
                                   10-YEAR          : 1.58 INCHES
                                   100-YEAR         : 2.77 INCHES
                                   10-YEAR/100-YEAR : 1.58/2.77= 0.5704
                         ************************************************************************
                         ************************************************************************

                        *********************
                        *    SDN 3  VALUES  *
                        *********************


   32 IO          OUTPUT CONTROL VARIABLES
                        IPRNT          5  PRINT CONTROL
                        IPLOT          0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                         NMIN           5  MINUTES IN COMPUTATION INTERVAL
                        IDATE      1    0  STARTING DATE
                        ITIME        0000  STARTING TIME
                           NQ         200  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE      1    0  ENDING DATE
                       NDTIME        1635  ENDING TIME
                       ICENT           19  CENTURY MARK

                     COMPUTATION INTERVAL     .08 HOURS
                        TOTAL TIME BASE   16.58 HOURS

            ENGLISH UNITS
                 DRAINAGE AREA          SQUARE MILES
                 PRECIPITATION DEPTH    INCHES
                 LENGTH, ELEVATION      FEET
                 FLOW                   CUBIC FEET PER SECOND
                 STORAGE VOLUME         ACRE-FEET
                 SURFACE AREA           ACRES
                 TEMPERATURE            DEGREES FAHRENHEIT

      JP          MULTI-PLAN OPTION
                        NPLAN           1  NUMBER OF PLANS

      JR          MULTI-RATIO OPTION
```

X

RATIOS OF PRECIPITATION
.57 1.00

1

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1 .57	RATIO 2 1.00
HYDROGRAPH AT						
+	HWY	.00	1	FLOW	0.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	NX1	.00	1	FLOW	3.	6.
				TIME	3.50	3.50
2 COMBINED AT						
+	CPX1	.00	1	FLOW	3.	7.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	NX2	.00	1	FLOW	3.	7.
				TIME	3.50	3.50

*** NORMAL END OF HEC-1 ***

COMMENT #5

BMP Swale Capacity
Worksheet for Triangular Channel

(Worse-case)

(6' WIDE, 4:1 SS, .5% slope)

Project Description	
Worksheet	BMP Swale Capacity
Flow Element	Triangular Char
Method	Manning's Form
Solve For	Discharge

Input Data		
Mannings Coeffic	0.033	
Slope	.005000	ft/ft
Depth	0.75	ft
Left Side Slope	4.00	H : V
Right Side Slope	4.00	H : V

4" riprap

Results		
Discharge	3.65	cfs
Flow Area	2.2	ft²
Wetted Perim	6.18	ft
Top Width	6.00	ft
Critical Depth	0.55	ft
Critical Slope	0.025361	ft/ft
Velocity	1.62	ft/s
Velocity Head	0.04	ft
Specific Energ	0.79	ft
Froude Numb	0.47	
Flow Type	Subcritical	

capacity > 2yr Flow for all BASINS ONSITE

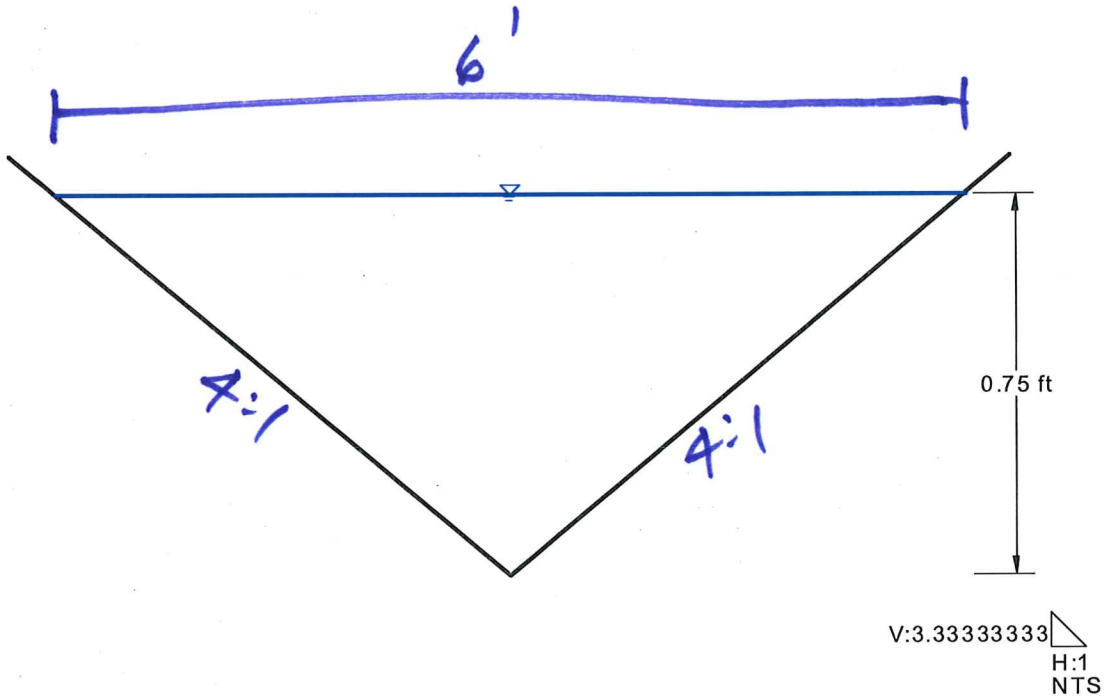
NON-ERUSIVE

Lochsa Engineering
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

BMP Swale Capacity
Cross Section for Triangular Channel

Project Description	
Worksheet	BMP Swale Cap
Flow Element	Triangular Char
Method	Manning's Form
Solve For	Discharge

Section Data		
Mannings Coeffic	0.033	
Slope	005000	ft/ft
Depth	0.75	ft
Left Side Slope	4.00	H : V
Right Side Slope	4.00	H : V
Discharge	3.65	cfs



COMMENT #6

Normal depth hydraulic street calculations are also provided for US 95 Ramp adjacent to our site to the west. We utilized flows from basin HWY (1/1cfs). As shown in the attached Flow Master output, the flows within the perimeter street is well below the maximum allowable velocity x depth (v x d) values of 6.0 and 8.0 during 10- and 100-year storm events, respectively. Dry lane is also met in the 10yr storm event. Our site is not discharging any flows west into this Private Street.

2.3 Future Drainage Condition

For the future condition, both the site and all the local offsite basins are assumed to be fully developed. Since the offsite watershed is assumed already entirely developed from our interim/developed condition analysis, the future drainage pattern and runoff values remain as described for the interim condition.

2.4 Master Planning Information

The "*2018 Las Vegas Valley Flood Control Master Plan Update*" (2018 MPU, Reference 2), dated September 2018, as prepared by ATKINS, illustrates the existing and proposed regional master planned facilities. The CCRFCD facility exhibits and inventory tables were updated in 2018. Review of Figure F-17 of the 2018 MPU indicates that proposed improvements are adjacent to a regional facility (Facility ID RCHB-0034). It is a rectangular concrete channel that is 21ft wide, 0:1 SS and 8ft deep with a channel slope of 1.19% and a flow of 1,766cfs.

COMMENT #7

Onsite basin ND5 (0.17ac) is located near the southeast corner of the site and mainly consists of the east driveway off of Centennial Center Blvd. ND5 discharges flows <1/1cfs (10yr/100yr storm) south through the driveway to Centennial Center Blvd.

Onsite basins ND1, ND3, ND4 and ND5 all discharge south to Centennial Center Blvd. but at various locations. The total flow discharging into Centennial Center Blvd. from our site is 6 and 12cfs in the 10 and 100yr storm events respectively. We show a combination point CPD1 in our HEC-1 Analysis (Interim / Developed conditions) just to show the total flow from our site impacting Centennial Center Blvd. This amount of flow is what was expected from our site development in previous approved studies and hence the flows have been accounted for in storm drain design and downstream properties.

Onsite basin ND6 (0.08ac) is located near the northwest corner of the site and mainly consists of an area of landscaping that slopes toward the regional facility (open rectangular channel). ND6 discharges flows <1/<1cfs (10yr/100yr storm) north into the open channel.