DS #: 5036

APN: 138-02-713.006

PROJECT: 7-11 at Craig & Rancho

SUBMITTAL: 1st

SCANNED BY/DATE:

CHECKED BY/DATE:

CITY OF LAS VEGAS NEVADA

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM				DATE: September 27, 2018
TO: **Land Development Services** Department of Building & Safety				FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT:	Drainage Study for: **7-11 at Craig & Rancho** **(Update to Craig & Rancho Drainage Study)**			**COPIES TO:** Lochsa Engineering
Cross Streets:	SEC of Craig Road & Rancho Drive			Joseph Baniffato
File Number:	F:\Depot\DSMemos\DS5036A.doc			Bart Anderson, P.E., DevCo
Parcel Number:	138-02-713-006			CCRFCD
Zoning Action:	SDR-73856 & SUP-73855			NDOT
FEMA Flood Zone	YES	NO	X	
Proposed Storm Drain	YES	NO	X	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1st Submittal	9/11/2018 & 9/27/2018	9/27/2018	See Comments Below	$400.00	499466: $400
			TOTAL FEES (LDDRS):	**$400.00**	**----**

REMARKS:

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

X	is approved subject to conformance to all City standards and the following conditions:
	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.

NOTE: Any future changes to the proposed design (or design assumptions) as outlined in the approved drainage study and attached preliminary grading plan which affect drainage must be addressed in a Drainage Study Update and accepted by the *City of Las Vegas Flood Control Section*. Additionally, conditional acceptance of a drainage study is valid for a period of one (1) year. If the proposed construction has not been completed in that time period, the *City of Las Vegas* reserves the right to require additional conditions and/or submission and acceptance of a complete drainage study update prior to further construction of a project.

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

ays

T/R/S: T20S/R60E/02

AREA L-02

Update #2 to Craig & Rancho Master Drainage Study
(aka 7-11 at SEC Craig & Rancho)

September 2018

Prepared for:

BP Holdings, Inc. – Joseph Bonifatto
3960 Howard Hughes Parkway
Las Vegas, Nevada 89169
(702) 735-5700

Prepared by:

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

Lochsa Job # 181119

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Update #2 to Craig & Rancho Master Drainage Study Date: September 6, 2018

Location of Development: a) Descriptive (Cross Streets) North/South: Rancho Drive

East/West: Craig Road

b) Section: 2 Township: 20 South Range: 60 East

c) APN : 138-02-713-006

Name of Owner: Joseph Baniffato

Telephone No.: (702) 735-5700 Fax No.: E-Mail Address:

Address: 3960 Howard Hughes Parkway Las Vegas, NV 89169

Contact Person-Name: Chris Blake, EI **Telephone No.:** (702) 365-9312

* **E-Mail Address:** chris.blake@lochsa.com **Fax No.:** (702) 365-9317

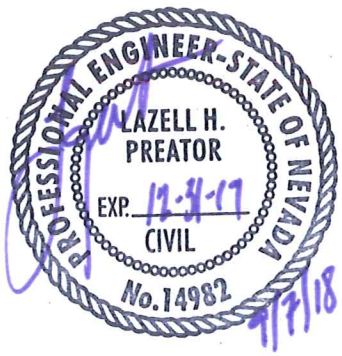
Firm: Lochsa Engineering

Address: 6345 South Jones Boulevard, Suite 100, Las Vegas, Nevada 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: 1.38+/- Acres Being Developed/Disturbed: 1.38 +/- 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: 5 +/- Acres
6. Has the site drainage been evaluated in the past? ☒ **YES** ☐ **NO** If yes, please identify documentation: Master Drainage Study Craig & Rancho (DS4824)
7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: site drains in a southeast direction toward Existing WOW Carwash
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.**

Local Entity File No.

Revision	Date

REFERENCE:

STANDARD FORM 1

Updated 05/01/2008

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

Project Name: 7-11 @ CRAIG + RANCHO	Map ID:
Firm Name: LOCHSA	Engineer: LAZELL PREATOR, PE
Address: 6345 S. JONES BLVD.	
City: LAS VEGAS State: NV Zip: 89118	
Phone Number: (702) 365-9312	Fax Number: (702) 365-9317
Property Owner: BP HOLDINGS, INC. - Joseph Bonifatto	
Address: 3960 HOWARD HUGHES PKWY.	
City: LAS VEGAS State: NV Zip: 89169	

Reviewed By:	Date Received:	Date Accepted for Review:

The following checklist is intended as a guide for the engineer preparing a Technical Drainage Study to submit to the local entity and Clark County Regional Flood Control District (if necessary). The listed items are the minimum information required prior to the entity performing a review. The engineer will remain responsible to ensure the Technical Drainage Study is prepared within the guidelines as set forth in the Clark County Regional Flood Control District (CCRFCD) Hydrologic Criteria and Drainage Design Manual (MANUAL).

This document is intended as an aid in preparing Technical Drainage Studies. Each study submitted is reviewed for compliance with local and regional criteria. This form is not intended to be all inclusive and does not limit the extent of the information, calculations or exhibits which may be necessary to properly evaluate the intended land use.

If items are not applicable for the subject site, provide N/A.

I. GENERAL REQUIREMENT

Yes	No	
✓		Design Manual **Standard Form 1** with the engineer's seal and signature.
✓		Design Manual **Standard Form 4**.
✓		2 copies of the 24" x 36" Drainage Plan.
	N/A	A notarized letter from the adjacent property owner(s) allowing off-site grading or discharge.

II. MAPS AND EXHIBITS

Yes	No	
✓		A copy of a current Flood Insurance Rate Map (FIRM) with the site delineated.
✓		A copy of the current CCRFCD Master Plan Update Figure, (F-x), for Flood Control Facilities and Environmental areas with the site delineated.

REFERENCE:	STANDARD FORM 2

DRAINAGE SUBMITTAL CHECKLIST

II. MAPS AND EXHIBITS (Continued)

Yes	No	
✓		Off-site drainage basin maps for existing, interim and future conditions showing the existing topography, basin boundaries, concentration points, and flows in cfs.
✓		On-site drainage basin maps for existing and proposed conditions showing the existing topography, basin boundaries, concentration points, and on-site and off-site flows in cfs.
✓		Vicinity Map with local and major cross streets identified and a north arrow.

III. DRAINAGE PLAN

Yes	No	
✓		Sheet size: 24" x 36" sealed by a registered engineer in the State of Nevada.
✓		Minimum scale: 1" = 60'.
✓		Project name.
✓		Vicinity Map with local and major cross streets.
✓		Revision box.
✓		North arrow and bar scale.
✓		Engineer's/consultant's address and phone number.
✓		Elevation datum and benchmark.
✓		Legend for symbols and abbreviations.
✓		Cut/fill scarps, where applicable.
✓		Street names, grades, widths.
✓		Proposed future and existing spot grades for top of curbs and street crowns at lot lines, grade breaks, and along curb returns on both sides of the street.
✓		Existing contours encompassing the site and 100 feet beyond with spot elevations for important locations, where appropriate.
✓		Minimum finish floor elevations with top-of-curb elevations at upstream end of lot.
	N/A	Proposed typical street sections.

REFERENCE:	STANDARD FORM 2

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
	N/A	Streets with off-set crowns.
✓		Proposed contours or spot elevations in sufficient detail to exhibit intended drainage patterns and slopes.
✓		Property lines.
✓		Right-of-way lines and widths, existing and proposed.
✓		Existing improvements and their elevations.
✓		Delineation of proposed on-site drainage basins indicating area and 10-year and 100-year storm peak flows at basin concentration points.
✓		Concentration points and drainage flow direction with Q_{100} and V_{100} and D_{100} in streets.
✓		Cumulative flows, velocity, and direction of flow at upstream and downstream ends of site for the 10-year and 100-year flows.
✓		Location and cross-section of street capacity calculations.
✓		Cross-sectional detail for channels, including cutoff wall locations.
✓		Existing and proposed drainage facilities, appurtenances, and connections (i.e., sidewalk, ditches, swales, storm drain systems, unimproved and improved channels, and culverts, etc.) stating size, material, shape, and slope with plan and profile and HGL calculations.
	N/A	Existing and proposed drainage easements and widths shown with sufficient detail. A cross sectional detail must be provided that shows appropriate lining and reinforcement.
	N/A	Location and detail of existing, proposed, and future block wall openings. Minimum size is 16" x 48". Wrought iron gate is required for flows > 10 cfs.
	N/A	Location and detail of flood walls illustrating depth of flow, proposed grouting height, etc.
	N/A	Perimeter retaining wall locations. All existing and proposed walls (retaining screen and flood) must be shown with adjacent ground elevations. Flood walls with 8-inch concrete masonry unit.
✓		Building and/or lot numbers.
✓		Alignment of all existing, proposed, or future Regional Facilities adjacent to the site.
	N/A	Limits of existing floodplain based on current FIRM or best available information; limits of proposed floodplains based on best available information.

REFERENCE:	**STANDARD FORM 2**

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
	N/A	For areas in Zone A, AE, AH, and AO, base flood elevations (BFEs) must be shown for each lot; BFEs may be listed on each lot, or in a table. Finish floor elevations must be a minimum of 18 inches above BFE.
	N/A	Appropriately elevated "humps" 6 inches above the 100 year water surface elevation at site accesses where the intent is to protect the site from the Q_{100} flows.
✓		Street slopes for perimeter and interior streets. The minimum slope is 0.4 percent.
✓		Location and detail of best management practice (BMP) for parking lots and low impact development (LID) (if required).

IV. HYDROLOGIC ANALYSIS

Yes	No	
✓		Appropriate soil information and Soils Map for existing and future conditions with subbasins and property delineated.
✓		Input and output information for existing conditions from computer models (HEC-1 or TR-55). The flow routing diagram must be provided with HEC-1 models.
✓		Input and output information for future conditions from computer models (HEC-1 or TR-55). The flow routing diagram must be provided with HEC-1 models.
✓		Use of correct precipitation values in and around the McCarran Airport rainfall area.
✓		A discussion in the text of the hydrologic analysis justifying subbasin boundaries and cutoffs, supporting assumptions, and calculations.
✓		A summary table of stormwater flows showing basin area, Q_{10} and Q_{100} for both individual basins and combined basin flows, where applicable.
✓		Copies of supporting technical information referenced from a previously approved study and a statement accepting these results.
✓		On-site facilities must perpetuate flows through or around the site without significantly impacting adjacent property owners in accordance with current Nevada Drainage Law.
✓		Calculation for impervious area for parking lots and LIDs (if required).

REFERENCE:	STANDARD FORM 2

DRAINAGE SUBMITTAL CHECKLIST

V. HYDRAULIC ANALYSIS

Yes	No	
	N/A	Flow split calculations and supporting documentation or reference for the method of flow split calculations used.
✓		Normal depth street flow calculations and cross section diagrams for all interior and perimeter streets. Provide "d x v" products for the Q_{100} and Q_{10} flows representing the worst case for interior and all perimeter streets. Q_{100} d x v $\leq$ 8. Q_{10} d x v $\leq$ 6 and 12 foot dry lane for rights-of-way $\geq$ 80 feet. Calculations must be labeled by street name as indicated on the Grading Plan.
✓		A summary table of interior and exterior street capacity calculations showing the street name, Q_{100} flow, slope, depth of flow, velocity and depth times velocity product and streets needing to meet 12 foot dry lane criteria.
	N/A	Appropriate hydraulic calculations for block wall openings assuming a 50 percent vertical clogging factor. (Assume the lower half of the opening is plugged.)
	N/A	Appropriate hydraulic calculations at drainage easement entrance and discharge locations to set finish floor elevations. Hydraulic calculations must include submerged weir, superelevation and tee intersection losses, where appropriate.
✓		Provide necessary freeboard requirements to set the finished floor elevations of all proposed buildings, 2 x depth of flow or depth of flow plus 18 inches of freeboard, whichever is less. The minimum requirement is 6 inches above adjacent upstream top of curb. Buildings adjacent to drainage easements must always be provided with 18 inches of freeboard above the Q_{100} weir height or flow depth, whichever is greater.
	N/A	A complete water surface profile analysis (HEC-2, HEC-RAS, etc.) for channel flows and FEMA Zone A flood zones. • Field survey data. • Input and output information. • Plotted cross-sections based on survey with proper encroachments. • A map showing the location of the cross-sections. • Analysis of both sub and super-critical flow segments. • A summary table and a discussion of the results in the text of the report.
	N/A	Provide a 50 percent clogging factor in the capacity calculation for drop inlets.
	N/A	Hydraulic calculations for culverts and storm drains. D-Load calculations must be provided for storm drain pipes in public rights-of-way, including headwater pool inundation.
✓		The mitigation of nuisance water, both during construction and in the fully developed condition, must be addressed.
✓		Provide BMP type, size and supporting calculations for parking lots and LIDs (if required).

REFERENCE:	STANDARD FORM 2

CITY OF LAS VEGAS

MINIMUM DRAINAGE STUDY CRITERIA
STANDARD FORM 2 CHECKLIST SUPPLEMENT

(Revised 5/18/11)

The following checklist is intended as a supplemental guide for the engineer preparing a Technical Drainage Study submittal to the City of Las Vegas. This supplement focuses on requirements specific to the City of Las Vegas. The requirements presented are in addition to the Clark County Regional Flood Control District (CCRFCD) Manual Standard Form 2. The listed items are the minimum information required prior to the City performing a review. The engineer will remain responsible to ensure the Technical Drainage Study is prepared within the guidelines as set forth in the CCRFCD Hydrologic Criteria and Drainage Design Manual (Design Manual).

An appointment must be made to preview this checklist in conjunction with CCRFCD Standard Form 2 prior to the City accepting a new drainage study for review. The engineer must contact the Flood Control Section at (702) 229-6541 to schedule a submittal appointment.

If items are not applicable for the subject site, provide N/A.

I. GENERAL REQUIREMENT		
Yes	No	
	N/A	A notarized letter from the adjacent property owner(s) allowing off-site grading. (A copy of the letter must be received prior to final acceptance of the drainage study.)
✓		Copies of all conditions of approval for development related to this property. (e.g. zoning, use permit, tentative map, etc.) Verify compliance with conditions.
✓		An electronic copy of the complete submittal is required to be submitted with one original hard copy of the study. Electronic documents should be on a universal computer-readable digital output device replicating your submittal. An Indexed Portable Document Format (PDF) or Print Ready CAD file formats with a minimum of 300dpi are the desired formats. If figures are in color, they must be scanned in color and saved as a separate file. _____ by initial here, the engineer on record acknowledges that the electronic copy is an identical replicate of the original hard copy submitted to the City of Las Vegas.

II. GRADING PLAN INFORMATION		
Yes	No	
✓		(1) 24" X 36" copy of the Grading Plan, (including all Detail Sheets) sealed by the engineer.
✓		Proposed future and existing spot grades for top of curbs and street crowns at lot lines, grade breaks, and along curb returns on both sides of the street. Note: Proposed top of curb elevations must be provided for both sides of roadways even if only half street construction is required.
✓		Label existing topography at a minimum 5 foot elevation interval including adjacent developments, finished floor elevations of existing buildings and top of existing curbs extending 100 feet* around the perimeter of the site. (*Measured from the centerline of the adjacent roadway.)

CITY OF LAS VEGAS MINIMUM DRAINAGE STUDY CRITERIA CHECKLIST

II. GRADING PLAN INFORMATION		
Yes	No	
	N/A	Proposed on-site and off-site storm drains and other flood control facilities with plan and profile sheets for public storm drains showing the class of pipe, (Class III, IV, V, etc.), design hydraulic grade line, (HGL) and 100 year storm flow. A public drainage easement must be provided over on-site storm drains conveying off-site flows. An overflow path must be provided over all storm drains.
	N/A	All existing and "to be constructed" walls with cross-sections showing wall type, (e.g. block wall, retaining wall, flood wall, etc.), with limits clearly defined, adjacent ground elevations. Wall heights must meet current ordinances and in no case exceed 14 feet above the adjacent property.
✓		Street slopes for both interior and perimeter streets. Note: The minimum slope for a roadway is 0.4 percent, a minimum 18-inch storm drain must be provided where minimum slopes cannot be met.
✓		Back of lot elevations and lot drainage pattern for all lots including common lots.
	N/A	Sites with a grade difference two feet above or below existing ground are required to have approval from City of Las Vegas Current Planning. Current Planning approval is required prior to final approval of the drainage study.
✓		On-site facilities must perpetuate flows through or around the site without significantly impacting adjacent property owners. (The project must pass flows through the site every 600 feet where the project is blocking flow paths.)
	N/A	This project uses a solid grouted stem wall (or approved alternate) at the back of sidewalk to provide erosion protection for landscaped areas where the depth of flow in the roadway exceeds the back of walk elevation. A corresponding cross-section detail is included.
✓		Commercial and Common Lot Landscape areas are not allowed to drain over the sidewalk. The grading plans show flow lines with grades and sidewalk under drains for all landscape areas draining to the public ROW.

III. Local Entity Criteria - City of Las Vegas – Manual Section 1600		
Yes	No	
✓		Concrete valley gutters are required in parking lots with slopes less than 1 percent. Slopes through cul-de-sac must be at a 1 percent minimum where flow is drained through the cul-de-sac.
	N/A	Ten-foot wide public drainage easements to be privately maintained are allowed for flow less than 20 cfs. The depth of flow entering the easement must be checked using the submerged weir calculation.
	N/A	The limits of the flood zones and the base flood elevations (BFE) must be shown on all grading plans for all developments within a Special Flood Hazard Zone A, AO, AE, etc.
✓		Minimum finish floor elevation is 6 inches above highest adjacent top of curb. Finish floor calculations must include allowances for super elevations on curves and velocity head for tee intersections.
	N/A	Finished floor elevations for buildings adjacent to public drainage easements must be a minimum of 18 inches above the Q100 weir of submerged weir elevation, whichever is greater.

III. Local Entity Criteria - City of Las Vegas – Manual Section 1600		
Yes	No	
	N/A	Lots with "B and C Type Drainage" that drain from one lot to another through a drainage easement shall be required to install an underground nuisance drainage system or a 2-foot valley gutter. 16" x 24" minimum block wall openings are required for both options.
	N/A	Bubblers are required across 80 foot and greater ROW streets. When flows exceed 10 cfs, bubblers larger than 18 inches will be required up to a maximum of 36". Inlets must be sized to match the pipe size provided.

- Contact the Flood Control Section regarding the drainage study review fee. These fees are payable at the time of submittal.
- The Drainage Study must be conditionally approved prior to submitting improvement plans to the Civil and Planning Development of the Department of Building and Safety for review.

This document is intended as an **aid** in preparing Technical Drainage Studies for the City of Las Vegas. Each study submitted is reviewed for compliance with local and regional criteria. This form is not intended to be all-inclusive and does not limit the extent of the information, calculations or exhibits which may be necessary to properly evaluate the intended land use.

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

Lochsa engineering

September 10, 2018

Mr. Albert Sung, P.E.
Public Works Engineering – Flood Control
333 N. Rancho Drive
Las Vegas, Nevada 89106

Subject: **Update #2 to the Master Technical Drainage Study for Craig & Rancho (DS #4824)**
(AKA: 7-11 @ SEC Craig and Rancho)
Lochsa Job # 181119

Dear Mr. Sung,

This letter is intended as an Update #2 to the approved "*Master Technical Drainage Study for Craig and Rancho*", hereinafter will be referred to as the 'Original Study'. The Original Study was prepared by Lochsa Engineering, and was approved by City of Las Vegas (CLV) on October 27, 2016 (DS #4824). The Original Study provided detailed information for the subject site that is surrounded by Craig Rd. to the north, Jones Blvd. to the east and Rancho Dr. to the west. This area encompasses 50.14 acres. An existing and future condition analysis was done for this 7-11 site. Our site (1.38ac) actually makes up the northwest corner of the site from the Original Study. The improvements for the site include two (2) new buildings along with pavement for parking.

The area of our site was also covered by the recently approved subject WOW Car Wash @ Craig and Rancho TDS Update (DS #4852). The Update was approved January 30, 2017. Our site improvements was shown in this Update to be offsite basins OFF1 and OFF2, which represent our whole site. Per the approved referenced Figure 7 (Developed Drainage Plan), basin OFF1 (0.63 acres) discharges 1/2/2cfs for the 10yr, 25yr and 100yr storm events in a southeast direction. Basin OFF2 (0.69 acres) discharges 1/2/2cfs for the 10yr, 25yr and 100yr storm events in a southeast direction along the Rancho Drive alignment. These offsite basins impact the WOW Car Wash site. These offsite basins were assumed to be nearly entirely impervious to better represent the anticipated Commercial development. The approved plans from this Update Study and reference material are included and will be referred to as 'Update Study' hereinafter.

To give you some background on the previously approved Original Study which included our project site, there was a study done for Craig and Ranch (DS #4824), which consisted of our subject site and the entire surrounding area bordered by Craig Rd., Rancho Dr. and Jones Blvd. All of this area was analyzed as Existing (see Ref. Figure DR1) and Developed (see Ref. Figure DR2). Since the approval of the Original Study, the northeast corner of the site has been developed on. Currently, the Update Study is being constructed, which is located just southeast

of our site. The 'Original Study' and Update Study reports are referenced with this Update #2 since they were used to analyzed offsite flows (perimeter streets) impacting the project area and established overall developed condition drainage patterns for our subject site.

This Update is being submitted as a technical support document to address the proposed revisions to our portion of the site (APN 138-02-713-006) since the approval of the Original Study. As shown in the approved grading plan from the 'Original Study', the improvements included rough-grading the site on our parcel. Our site includes two (2) proposed buildings and onsite parking improvements.

We are adding proposed buildings (7-11 Store) within our parcel. The remainder of the site is parking improvements, curb and gutter and landscaping around the perimeter. The hydrology has remained the same and the drainage pattern for our portion of the site has changed minimally compared to the approved plans from the Original Study. All the flow onsite does sheet flow across the site in a southeasterly direction. The flow is minimal and does not negatively impact downstream properties.

The site occupies a portion of the Northern Half (N1/2) of the Southeast Quarter (SE1/4) of Section 2, Township 20 South, Range 60 East, of the M.D.M., in an incorporated portion of Clark County, Nevada. The area of the subject Update #2 occupies approximately 1.38 acres identified by a portion of Assessor's Parcel Number (APN) 138-02-713-006. Please refer to the attached copy of the Assessor's Parcel Map and Vicinity Map (Figure 1) within our Update #2.

Existing Conditions

There is no change to the existing conditions form the previously approved Original Study. Therefore we have accepted their analysis and no revised hydrology is needed.

Proposed Revisions

Since the Original Study was approved, a site plan has been provided for the northwest corner of the site. Our site is located at the most upstream portion of the site. A car wash is currently being constructed just downstream of our site, which we are tying into for our site.

Flows in the surrounding streets have been determined by the approved Craig and Rancho Master Drainage Study (Original Study). Craig Rd. and Rancho Dr. flows were determined and have been accepted for our analysis. The 10yr, 25yr and 100yr flows in Craig Rd. were quantified in the Original Study to be 3cfs, 3cfs and 5cfs respectively. The 10yr, 25yr and 100yr flows in Rancho Dr. were quantified in the Original Study to be 4cfs, 5cfs and 7cfs respectively.

From the Update Study, their referenced basins OFF1 and OFF2 make up our entire project site and was assumed to be developed as a commercial site. Referenced basin OFF1 and OFF2 each were determined to discharge 1cfs/2cfs/2cfs for the 10yr, 25yr and 100yr storm events respectively.

We analyzed our site with two (2) onsite basins ND1 (0.70ac) and ND2 (0.68ac). Onsite basin ND1 (0.70ac) is comparable to referenced basin OFF2 (0.69ac). The drainage patterns are matching and flows discharge in a southeast direction along the alignment of Rancho Drive. It was determined that Basin ND1 discharges 1cfs/2cfs/2cfs in the 10yr, 25yr and 100yr storm events. This flow matches the approved Update Study and follows the same drainage pattern. Therefore, there is no negative impact to downstream properties, as these same flows were expected from the Update Study.

Onsite basin ND2 (0.68ac) is comparable to referenced basin OFF1 (0.63ac). The drainage patterns are matching and flows discharge in a southeast direction along the northern portion of our site. It was determined that Basin ND2 discharges 1cfs/2cfs/2cfs in the 10yr, 25yr and 100yr storm events. This flow matches the approved Update Study and follows the same drainage pattern. Therefore, there is no negative impact to downstream properties, as these same flows were expected from the Update Study.

Onsite basin ND2 combines with approved referenced basin DEV1 (0.26ac – 0cfs/1cfs/1cfs) from the Update Study and are conveyed to Craig Rd. ultimately. Onsite basin ND1 combines with approved referenced basin DEV3 ((0.67ac – 1cfs/2cfs/2cfs) from the Update Study and are conveyed southeast in the WOW Car Wash drive aisle to a water quality swale and ultimately into the existing rough graded area, following its historical drainage pattern.

We have included the Interim/Developed Conditions HEC-1 Analysis for the onsite basins. The offsite flows in the perimeter streets adjacent to our site have been referenced. The proposed improvements perpetuate the same drainage pattern as shown in the approved Original Study. We have provided an Interim/Developed Condition Basin Map (Figure DR2) that depicts the basins, flow rates (10yr/25yr/100yr storm events) and drainage patterns.

We have included hydraulic street calculations for Craig Road and Rancho Drive. The street flow calculations show that the velocity times depth criteria is met for all conditions. The velocity x depth is below 6 and 8 for the 10 and 100yr storm events respectively. A 12-foot dry lane criteria is required in Craig Road and Rancho Drive. The street calculations show that more than 12-feet of dry lane has been provided in the 10yr storm event condition for both streets.

Our proposed finish floor elevation is more than twice the 100yr flow depth in both perimeter streets. We have provided a landscape berm adjacent to Rancho Drive to keep our onsite flow from draining into Rancho Drive. The berm also provides extra protection for the site even though the depth of flow in Rancho Drive is minimal due to an existing high point adjacent to our site.

Along Craig Rd. there is also an existing high point adjacent to our site. Therefore minimal flows are in the adjacent street. Again, the proposed FF is more than double the 100yr depth of flow.

Also please note that no driveways are being proposed with our subject site. There are existing driveways to Craig Rd. and Rancho Dr. downstream of our site.

The highest adjacent flowline elevation near our proposed building is a minimum 6-inches below the proposed finish floor elevation.

Lochsa Engineering concurs and agree with referenced street flows in Craig Rd. and Rancho Drive and all of the reference material included within our submittal.

The interim/developed condition hydrologic and hydraulic analyses have been utilized to establish the future conditions for the project site. No additional runoff will be conveyed to the adjacent roadways with the project site improvements from the approved Original Study. Therefore, no revisions have been made to the hydraulic street sections from the referenced study.

No increase of flow in NDOT R/W is anticipated with our site development. NDOT requires that the 25-year flows do not spread more than half of the first travel lane. As shown in the Original Study, the 25-year flows are mitigated by the existing storm drain in Craig Road (see reference material). This project does not increase flows in Rancho Drive and the hydraulic conditions in Rancho are existing.

Master Planning Information

The "*2008 Las Vegas Valley Flood Control Master Plan Update*", as prepared by Post Buckley Schuh and Jernigan, Inc. (PBS&J), in association with Louis Berger Group and Parsons Brinckerhoff, illustrates the existing and proposed master planned facilities. The CCRFCD Flood Control Facility Maps and Inventory Tables have also been updated in 2013. As shown in the attached Figure F-20 of the Updated 2013 MPU, our parcel is adjacent to an existing or proposed CCRFCD regional facility. The Gowan Outfall – Alexander Road Facilities (GOAL 0111) is proposed along the frontage of the project in Rancho Drive. The facility will be constructed as a 10ft x 8ft RCB in the future. Therefore, the subject Update is adjacent to an existing or proposed regional facility.

Floodplain Information

As discussed in the Original Study, the project site is covered by Flood Insurance Rate Map (FIRM) for the Clark County, Nevada, and incorporated areas, Community Panel Number: 32003C2155F, Effective Date: November 16, 2011, revised to reflect LOMR dated June 21, 2017. Review of the FIRM indicates that subject project site falls almost entirely within Zone "X" (unshaded), described by FEMA as: "*Areas determined to be outside the 0.2% annual chance floodplain.*" Please refer to the attached Figure 2 for the location of the site on a portion of the FIRM.

Compliance with Regulations and Adopted Plans

The subject drainage study Update is specifically provided as a support document for the aforementioned revisions to the existing site (rough graded). This Update is in conformance with the approved "*Master Technical Drainage Study for Craig & Rancho*" (DS #4824, Original Study).

The building is protected by landscape berms along Rancho and Craig. Please note both 100yr depth of flows in each adjacent street since there are high points at the upstream side of our site and building. Not a lot of flow is generated. The proposed development will mitigate generated onsite storm water flows with proposed onsite grading, curb and gutter and proposed landscaping. Offsite flows do not enter the site. The high point that exists on Rancho Drive adjacent to the site (west of site) does not allow for a large basin that will generate enough flow to enter the site. The same situation goes for Craig Road adjacent to the site to the north.

The drainage design associated with the proposed revisions is based on generally accepted engineering practices and is in compliance with the CCRFCD's "*Hydrologic Criteria and Drainage Design Manual*" and the 2013 MPU. The proposed improvements will not introduce any negative impact to the existing drainage patterns. Please refer to the attached grading plan and details for further clarification of the proposed improvements.

Compliance with CCRFCD Best Management Practices (BMP)

To satisfy the water quality BMP requirement in Section 1500 of the CCRFCD Drainage Design Manual, the project site is designed to accommodate as much as possible Low Impact Development (LID) measures. As shown in the grading plan, three (3) separate riprap-lined swales are being proposed throughout the project site. The swales are designed to settle out sediment and pollutant of the water quality design flows, prior to exiting the project site. As shown in the drainage exhibit (DR2 – Interim/Developed Conditions), most of the onsite area are designed to drain towards separate water quality swales. These swales will handle most of the flows within the onsite basins. Please note that southern area of our site discharges through the adjacent site ultimately and will be treated through their existing water quality swales as well.

As shown in the attached excerpts from Section 1500 of the HCDDM, since the parking lot area of the project site is more than 1 acre, the parking lot is categorized as 'Large' parking. For Large parking lot, water quality BMPs are required for at least 75% of the proposed parking lot. The total area from basins ND1 through ND2 represents the whole site. Thus, the project is designed to provide water quality BMPs for approximately 75% of the site. Again, note that basin ND1 will also discharge through the adjacent site's water quality swale.

Per the design guidelines of Section 1503.4.5, the proposed water quality riprap-lined swales throughout the site are set to a minimum 40ft long. The swales are designed with 0.50% to 1.00% slope, 4(horizontal):1(vertical) side slope, riprap lining with D50=3", and a depth of 0.50ft to 1.00ft depth. A hydraulic calculation has been provided for the worst-case swale. The calculation shows the swale can convey the entire 100yr storm event.

Conclusion

The proposed development does not adversely impact any Master Planned Flood Control Facility and is in compliance with the previously approved Master TDS for Craig and Rancho (DS 4824).

References

1. Clark County Regional Flood Control District, "*Hydrologic Criteria and Drainage Design Manual*", August 1999.
2. Post Buckley, Schuh & Jernigan (PBS&J), Inc., in association with, Louis Berger Group and Parsons Brinckerhoff, "*2008 Las Vegas Valley Flood Control Master Plan Update, Volume 1 and II*", September 2008.
3. Federal Emergency Management Agency, "*Flood Insurance Rate Map; Community Panel Number* 32003C2155F*; Clark County, Nevada and Incorporated Areas*", Effective Date: November 16, 2011, revised to reflect LOMR dated June 21, 2017.
4. Lochsa Engineering, "*Master Drainage Study for Craig & Rancho*", approved by City of Las Vegas on October 27, 2016 (DS4824)
5. McCay Engineering, "*Technical Drainage Study for WOW Carwash @ Craig and Rancho*", approved by City of Las Vegas on January 30, 2017 (DS #4852)

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

Sincerely,
LOCHSA ENGINEERING

Chris Blake, E.I.



NOTICE OF FINAL ACTION

18119
Craig & Rancho

August 15, 2018

Mr. Daniel Sullivan
PRE Rancho Craig LLC
120 Presidential Way, Ste. 300
Woburn, MA 01801

RE: SDR-73856 [PRJ-73596] - SITE DEVELOPMENT PLAN REVIEW RELATED TO SUP-73855
PLANNING COMMISSION MEETING OF AUGUST 14, 2018

Dear Applicant:

Your request for a Site Development Plan Review FOR A PROPOSED 2,974 SQUARE-FOOT GENERAL RETAIL STORE, OTHER THAN LISTED [CONVENIENCE STORE] WITH FUEL PUMPS AND A 866 SQUARE-FOOT RESTAURANT WITH DRIVE THROUGH on 1.38 acres at the southeast corner of Craig Road and Rancho Drive (APN 138-02-713-006), C-2 (General Commercial) Zone, Ward 4 (Anthony) [PRJ-73596], was considered by the Planning Commission on August 14, 2018.

The Planning Commission voted to ***APPROVE*** your request, subject to the following:

Planning

1. Approval of and conformance to the Conditions of Approval for Special Use Permit (SUP-73855) 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, date stamped 06/28/18; landscape plan, date stamped 07/19/18; and building elevations, date stamped 06/28/18 and 07/19/18, except as amended by conditions herein.

4. An Exception from Title 19.08.110(C)(12) is hereby approved, to allow zero landscape island where such is required for every six parking spaces.

5. 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.

CITY OF LAS VEGAS NEVADA

LAS VEGAS CITY COUNCIL
CAROLYN G. GOODMAN
Mayor
LOIS TARKANIAN
Mayor Pro Tem
STAVROS S. ANTHONY
BOB COFFIN
STEVEN G. SEROKA
MICHELE FIORE
CEDRIC CREAR

SCOTT D. ADAMS
City Manager

DEPARTMENT OF PLANNING
ROBERT SUMMERFIELD
DIRECTOR

DEVELOPMENT SERVICES CENTER
DEPARTMENT OF PLANNING
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6. These Conditions of Approval shall be affixed to the cover sheet of any plan set submitted for building permit.

7. 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, and 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.

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

Public Works

9. In accordance with code requirements of Title 13.56, remove all substandard offsite improvements and unused driveways and replace with new improvements meeting current City Standards concurrent with development of this site. Correct all American's with Disabilities Act (ADA) deficiencies on the sidewalks, if any, on Craig Road adjacent to this site concurrent with on-site development activities. All existing paving damaged or removed by this development shall be restored at its original location and to its original width concurrent with development of this site.

10. Obtain an Occupancy Permit from the Nevada Department of Transportation (NDOT) for the construction of improvements in the Craig Road and Rancho Drive public rights-of-way adjacent to this site prior to constructing any improvements within NDOT jurisdiction.

11. Landscape and maintain all unimproved rights-of-way on Craig Road and Rancho Drive 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.

12. Grease interceptors for the convenience store and the coffee shop shall be located onsite.

13. The notes on the existing Commercial Subdivision Final Map (FMP-63304) indicate that on-site sewers are a common element of the Commercial Subdivision. Therefore, this development may share the on-site sewer with the proposed car wash to the east. Alternatively, the proposed development may construct a new sewer lateral in Craig Rd (NDOT permit required). A new lateral in Craig Road would be an 8-inch diameter lateral connecting at a new manhole to the existing 21-inch diameter sewer interceptor in Craig Road.

14. Onsite drains for drainage purposes shall connect to the storm drain system. If any drains are proposed for the fueling station area, the applicant shall meet with the Public Works Department Environmental Compliance Section to determine pre-treatment requirements prior to the issuance of any permits.

15. A Traffic Impact Analysis must be submitted to and approved by the Department of Public Works prior to the issuance of any building or grading permits, submittal of any construction drawings or the recordation of a Map subdividing this site, whichever may occur first. Comply with the recommendations of the approved Traffic Impact Analysis prior to occupancy of the site. The Traffic Impact Analysis shall also include a section addressing Standard Drawings #234.1 #234.2 and #234.3 to determine additional right-of-way requirements for bus turnouts adjacent to this site, if any; dedicate all areas recommended by the approved Traffic Impact Analysis. All additional rights of way required by Standard Drawing #201.1 for exclusive right turn lanes and dual left turn lanes shall be dedicated prior to or concurrent with the commencement of on site development activities unless specifically noted as not required in the approved Traffic Impact Analysis. Phased compliance will be allowed if recommended by the approved Traffic Impact Analysis. No recommendation of the approved Traffic Impact Analysis, nor compliance therewith, shall be deemed to modify or eliminate any condition of approval imposed by the Planning Commission or the City Council on the development of this site.

16. An update to the previously approved Drainage Plan and Technical Drainage Study must be submitted to and approved by the Department of Public Works prior to the issuance of any grading or building permits or submittal of any construction drawings, whichever may occur first. Provide and improve all drainage ways as recommended in the approved drainage plan/study.

17. Site development to comply with all applicable conditions of approval for the Rancho/Craig Tentative Map (TMP-60902), FMP-63304 and all other applicable site-related actions.

This action by the Planning Commission on **August 14, 2018** is final unless a written appeal is filed with the City Clerk within ten days of the date of the Planning Commission's decision as allowed by code or there is a review action filed by the City Council within the same time period. For additional information on appeals or review requests submitted please access http://www.lasvegasnevada.gov/CheckStatus/DevelopmentApp.htm, or contact the Department of Planning and Development at 702.229.6301 after ***August 27, 2018***.

No building permits or business licenses related to these items shall be issued prior to the expiration of the required ten day waiting period, or until any filed appeal is resolved pursuant to LVMC Title 19.18.

Sincerely,

Paul Bengtson
Senior Management Analyst
Case Planning Division

PB:nl

cc:

Mr. Joseph Bonifatto
BP Holdings, Inc.
11700 W. Charleston Blvd., Ste. 170-32
Las Vegas, Nevada 89135

Mr. John Carroll
Pliris Design Studio
1980 Festival Plaza Drive, Ste. 450
Las Vegas, Nevada 89135

LAS VEGAS CITY COUNCIL
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cityoflasvegas
lasvegasnevada.gov

August 15, 2018

Mr. Daniel Sullivan
PRE Rancho Craig LLC
120 Presidential Way, Ste. 300
Woburn, MA 01801

RE: SUP-73855 [PRJ-73596] - SPECIAL USE PERMIT RELATED TO SDR-73856
PLANNING COMMISSION MEETING OF AUGUST 14, 2018

Dear Applicant:

Your request for a Special Use Permit FOR A PROPOSED BEER/WINE/COOLER OFF-SALE ESTABLISHMENT USE at the southeast corner of Craig Road and Rancho Drive (APN 138-02-713-006), C-2 (General Commercial) Zone, Ward 4 (Anthony) [PRJ-73596], was considered by the Planning Commission on August 14, 2018.

The Planning Commission voted to ***APPROVE*** your request, subject to the following:

Planning

1. Conformance to all Minimum Requirements under LVMC Title 19.12 for a Beer/Wine/Cooler On-Sale Establishment use.

2. Approval of and conformance to the Conditions of Approval for Site Development Plan Review (SDR-73856) shall be required.

3. 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.

4. 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.

5. These Conditions of Approval shall be affixed to the cover sheet of any plan set submitted for building permit, as well as submitted as part of any business license application.

6. Approval of this Special Use Permit does not constitute approval of a liquor license.

7. This business shall operate in conformance to Chapter 6.50 of the City of Las Vegas Municipal Code.

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

This action by the Planning Commission on **August 14, 2018** is final unless a written appeal is filed with the City Clerk within ten days of the date of the Planning Commission's decision as allowed by code or there is a review action filed by the City Council within the same time period. For additional information on appeals or review requests submitted please access http://www.lasvegasnevada.gov/CheckStatus/DevelopmentApp.htm, or contact the Department of Planning and Development at 702.229.6301 after ***August 27, 2018***. No building permits or business licenses related to these items shall be issued prior to the expiration of the required ten day waiting period, or until any filed appeal is resolved pursuant to LVMC Title 19.18.

Sincerely,

Paul Bengtson
Senior Management Analyst
Case Planning Division

PB:nl

cc:

Mr. Joseph Bonifatto
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11700 W. Charleston Blvd., Ste. 170-32
Las Vegas, Nevada 89135

Mr. John Carroll
Pliris Design Studio
1980 Festival Plaza Drive, Ste. 450
Las Vegas, Nevada 89135

FLOW AND STREET SUMMARY TABLES

Peak Flow Summary
Interim / Developed Condition

HEC-1 I.D.	Area (acres)	100-year Flow (cfs)	25-year Flow (cfs)	10-year Flow (cfs)
ND1	0.7	1	2	2
ND2	0.68	1	2	2

Street Flow Summary
(Interim / 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 (Within 1/2 ROW) (ft)
Craig Road (Half Street)	60	1	3	1.94	0.30	0.58	N/A
Rancho Drive (Half Street)	62.5	2	4	2.27	0.38	0.86	51.76

Street Flow Summary
(Interim / Developed Condition)

100-year, 6-hour Storm

Street	Right of Way Width (ft)	Hydraulic Cross-Section Identifier	100-Year Flow [Q10] (cfs)	100-year Velocity [v] (fps)	100-year Flow Depth [d] (ft)	100-year Velocity x Depth [v x d]
Craig Road (Half Street)	60	1	5	2.09	0.34	0.71
Rancho Drive (Half Street)	62.5	2	7	2.50	0.45	1.13

Onsite Flow Summary
(Interim / Developed Condition)

100-year, 6-hour Storm

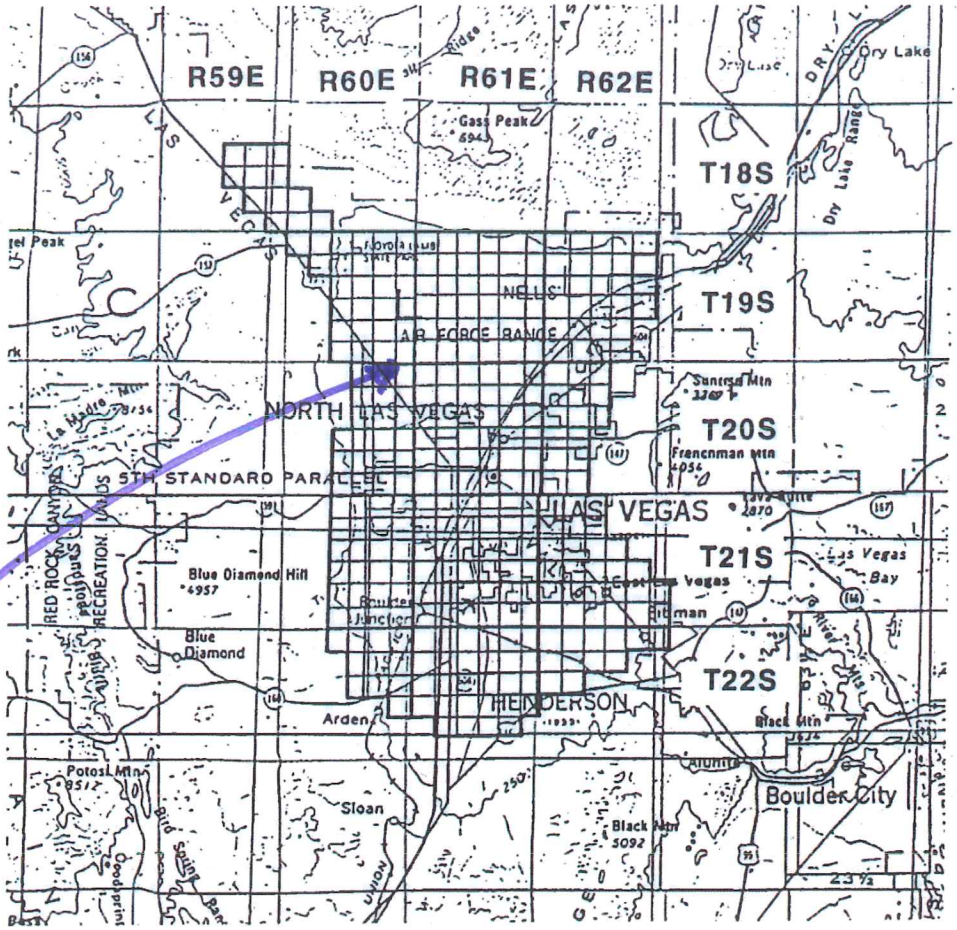
Hydraulic Cross-Section Identifier	100-Year Flow [Q10] (cfs)	100-year Velocity [v] (fps)	100-year Flow Depth [d] (ft)	100-year Velocity x Depth [v x d]
3	2	1.34	0.19	0.25

APPENDIX A

Hydrology

HYDROLOGIC CHARTS

McCARRAN AIRPORT RAINFALL AREA



TOWNSHIP	RANGE	SECTIONS	TOWNSHIP	RANGE	SECTIONS
18 South	59 East	13-15,22-26,36	20 South	62 East	4-9,16-20,29-32
18 South	60 East	30-32	21 South	60 East	1-4,9-16,21-28,33-36
19 South	60 East	1-6,8-16,21-28,33-36	21 South	61 East	ALL SECTIONS
19 South	61 East	ALL SECTIONS	21 South	62 East	4-9,15-23, 25-36
19 South	62 East	2-11,14-23,27-34	22 South	60 East	1-4,10-15,24
20 South	60 East	1-3,10-15,21-28,33-36	22 South	61 East	1-24,26-29
20 South	61 East	ALL SECTIONS	22 South	62 East	1-10,17-18

Sect. 2

Notes:
1. Refer to Table 505 and Figure 516 Depth-Duration- Frequency values in the McCarran Airport Rainfall Area.
2. Refer to Table 506 and Figure 517 for Time-Intensity-Frequency values on the McCarran Airport Rainfall Area.

Revision	Date

WRC ENGINEERING

REFERENCE:
USACE, Los Angeles District, 1988

FIGURE 513

DEPTH-DURATION-FREQUENCY VALUES FOR McCARRAN AIRPORT RAINFALL AREA

(IN INCHES)

TIME	RECURRENCE INTERVAL 2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
5 min.	0.15	0.27	0.35	0.46	0.54	0.63
10 min.	0.25	0.44	0.57	0.74	0.89	1.02
15 min.	0.33	0.57	0.74	0.97	1.15	1.32
30 min.	0.44	0.78	1.01	1.31	1.55	1.79
1 hour	0.52	0.89	1.15	1.50	1.78	2.06
2 hour	0.59	1.01	1.30	1.70	2.01	2.30
3 hour	0.64	1.08	1.39	1.82	2.15	2.48
6 hour	0.72	1.22	1.58	2.05	2.41	2.77
24 hour (TR-55)	1.20	1.60	1.80	2.40	2.70	2.96

NOTE: 1. Refer to Figure 513 for a description and drawing of the area included in the McCarran Airport Rainfall Area.

2. The 24 hour values presented above are for use with TR-55 only.

3. Table 501 adjustments not required.

Revision	Date

WRC ENGINEERING	REFERENCE: USACE, Los Angeles District, 1988	TABLE 505

SIX-HOUR STORM DISTRIBUTIONS

Storm Time (In Minutes)	Percent of Total Storm Depth SDN3	SDN4	SDN5	Storm Time (In Minutes)	Percent of Total Storm Depth SDN3	SDN4	SDN5
0	0.0	0.0	0.0	185	32.2	37.6	43.0
5	2.0	2.0	2.0	190	35.2	41.5	47.7
10	5.7	5.8	5.9	195	40.9	46.2	51.4
15	7.0	7.5	8.0	200	49.9	53.0	56.1
20	8.7	9.9	11.0	205	59.0	61.0	63.0
25	10.8	12.6	14.4	210	71.0	71.0	71.0
30	12.4	13.7	15.0	215	74.4	73.2	72.0
35	13.0	14.5	16.0	220	78.1	75.6	73.1
40	13.0	14.9	16.8	225	81.2	78.2	75.2
45	13.0	15.1	17.1	230	81.9	79.9	77.9
50	13.0	15.5	18.0	235	83.5	81.3	79.0
55	13.0	15.6	18.2	240	85.1	82.3	79.5
60	13.0	15.9	18.7	245	85.6	83.0	80.4
65	13.3	16.2	19.0	250	86.0	83.5	81.0
70	14.0	16.9	19.7	255	86.8	84.4	82.0
75	14.2	17.2	20.2	260	87.6	85.1	82.6
80	14.8	17.9	21.0	265	88.8	86.4	84.0
85	15.8	18.9	22.0	270	91.0	88.5	85.9
90	17.2	20.1	23.0	275	92.6	90.8	88.9
95	18.1	21.1	24.1	280	93.7	92.4	91.0
100	19.0	22.0	25.0	285	95.0	94.4	93.8
105	19.7	22.8	25.9	290	97.0	96.8	96.6
110	19.9	23.2	26.5	295	97.6	97.3	97.0
115	20.0	24.0	28.0	300	98.2	97.8	97.4
120	20.1	24.6	29.0	305	98.5	98.2	97.9
125	20.4	25.2	30.0	310	98.7	98.4	98.1
130	21.4	26.0	30.5	315	98.9	98.6	98.3
135	22.9	26.9	30.9	320	99.0	98.8	98.5
140	24.1	27.6	31.0	325	99.3	99.1	98.9
145	24.9	28.3	31.7	330	99.3	99.2	99.0
150	25.1	28.6	32.1	335	99.4	99.3	99.2
155	25.6	29.2	32.7	340	99.5	99.4	99.3
160	27.0	30.2	33.3	345	99.8	99.7	99.6
165	27.8	31.2	34.6	350	99.8	99.8	99.7
170	28.1	32.1	36.1	355	99.9	99.9	99.9
175	28.3	33.2	38.1	360	100.0	100.0	100.0
180	29.5	35.2	40.8				

Notes:
1. For drainage areas less than 8 square miles in size, use SDN 3.
2. For drainage areas greater than or equal to 8 square miles and less than 12 square miles in size, use SDN 4.
3. For drainage areas greater than or equal to 12 square miles, use SDN 5.
4. A graphical representation of these values is presented on **Figure 515**.

Revision	Date

REFERENCE:

TABLE 503

RUNOFF CURVE NUMBERS
(URBAN AREAS[1])

Cover description		Curve numbers for hydrologic soil group—			
Cover type and hydrologic condition	Average percent impervious area[2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.)[3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only)[4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
See Table 602A					
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)[5]		77	86	91	94

1 Average runoff condition, and $I_a = 0.2S$.

2 The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system. Impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using Figure 603.

3 CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

4 Composite CN's for natural desert landscaping should be computed using Figure 603 based on the impervious area percentage (CN #98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

5 Composite CN's to use for the design of temporary measures during grading and construction should be computed using Figure 603 based on the degree of development impervious area percentage) and the CN's for the newly graded pervious areas.

Revision	Date

HYDROLOGY

DEVELOPMENT: 7-11 SEC Craig & Rancho
CALCULATED BY: CB
PROJECT NUMBER: 181119

DATE: September 4, 2018

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	0.8894	0.70	0.00109	50	1.0	2.7	260	1.6	1.8	2.5	310	11.7	5.1	96.9	0.051	YES	D
ND2	0.8894	0.68	0.00106	50	1.0	2.7	250	2.5	2.1	2.0	300	11.7	4.7	96.9	0.050	YES	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
HYDROLOGIC CONDITION: Interim/Developed

TRIAL: Final Iteration

Curve Number Calculations
7-11 SEC Craig & Rancho

Sub-Basin: **ND1**
Total Area: 0.70 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)	0.47	D	68%	98	66.2
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.16	C	23%	98	22.1
Natural desert landscaping (pervious areas only)	0.05	D	8%	88	6.6
Natural desert landscaping (pervious areas only)	0.02	C	3%	85	2.1
Total:	0.70	-	100%	-	96.9

Curve Number Calculations
7-11 SEC Craig & Rancho

Sub-Basin: **ND2**
Total Area: 0.68 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)	0.46	D	68%	98	66.2
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.15	C	23%	98	22.1
Natural desert landscaping (pervious areas only)	0.05	D	8%	88	6.6
Natural desert landscaping (pervious areas only)	0.02	C	3%	85	2.1
Total:	0.68	-	100%	-	96.9

AVERAGE VELOCITY

Input Variables		Basin ND1	Basin ND2												Basin	
Bottom Width, B, (ft):		2.0	2.0													
Right Side Slope, Zr:		100	0													
Left Side Slope, Zl:		0	100													
Manning's n:		0.015	0.015													
Geometric Slope, So (ft/ft):	0.000	0.016	0.025	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Flowrate, Q (cfs):		1	1													
							Output Variables									
Normal Depth, Yn (ft):		0.09	0.08													
Area of Flow, A, (sf):		0.57	0.48													
Velocity, V (fps):		1.76	2.07													
Wetted Perimeter, p (ft):		10.95	10.11													
Hydraulic Radius, Rh (ft):		0.05	0.05													
Free SurfaceTop Width, T (ft):		10.86	10.03													
Centroid, Y*, (ft):		0.03	0.03													

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

WEB SOIL SURVEY

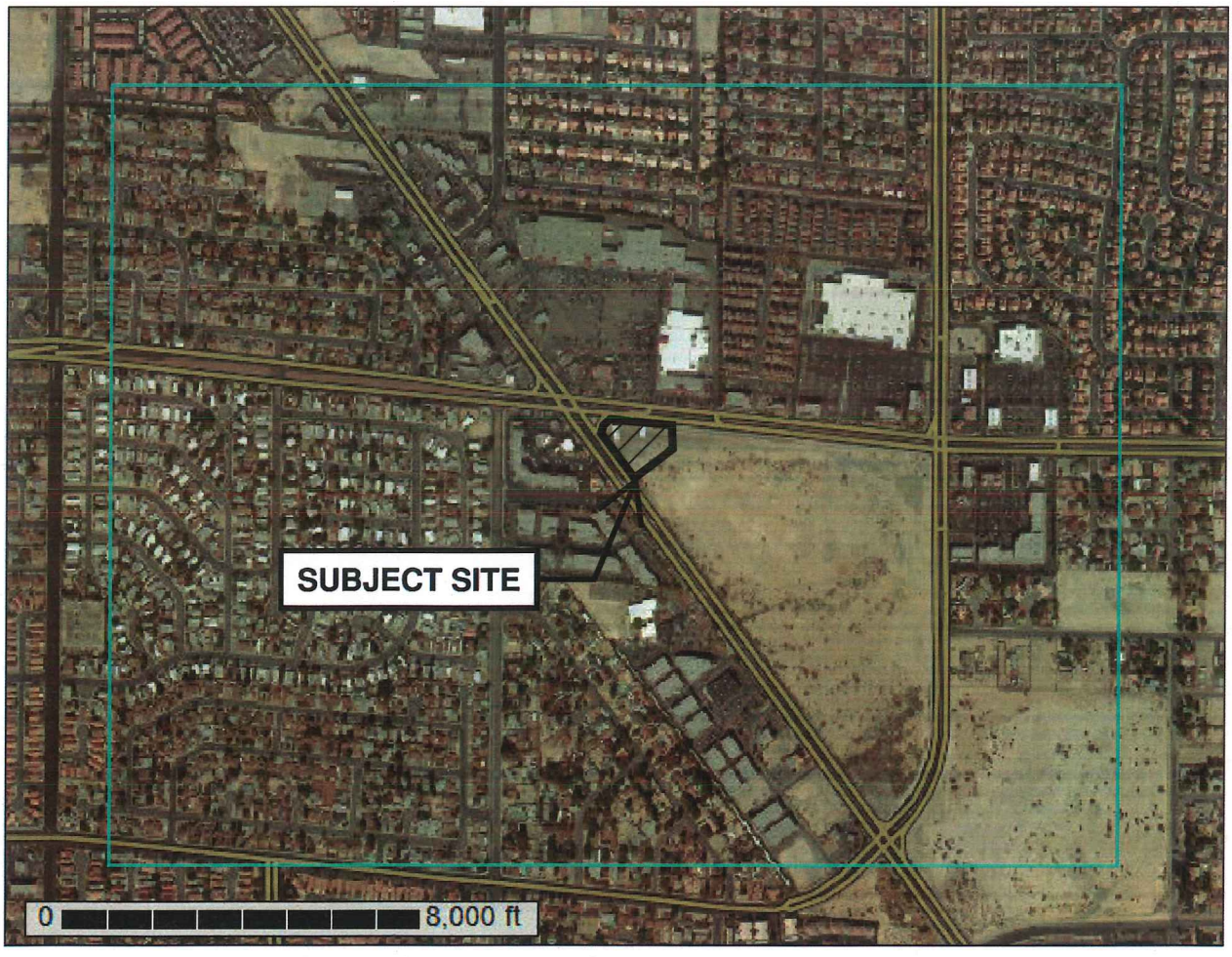
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

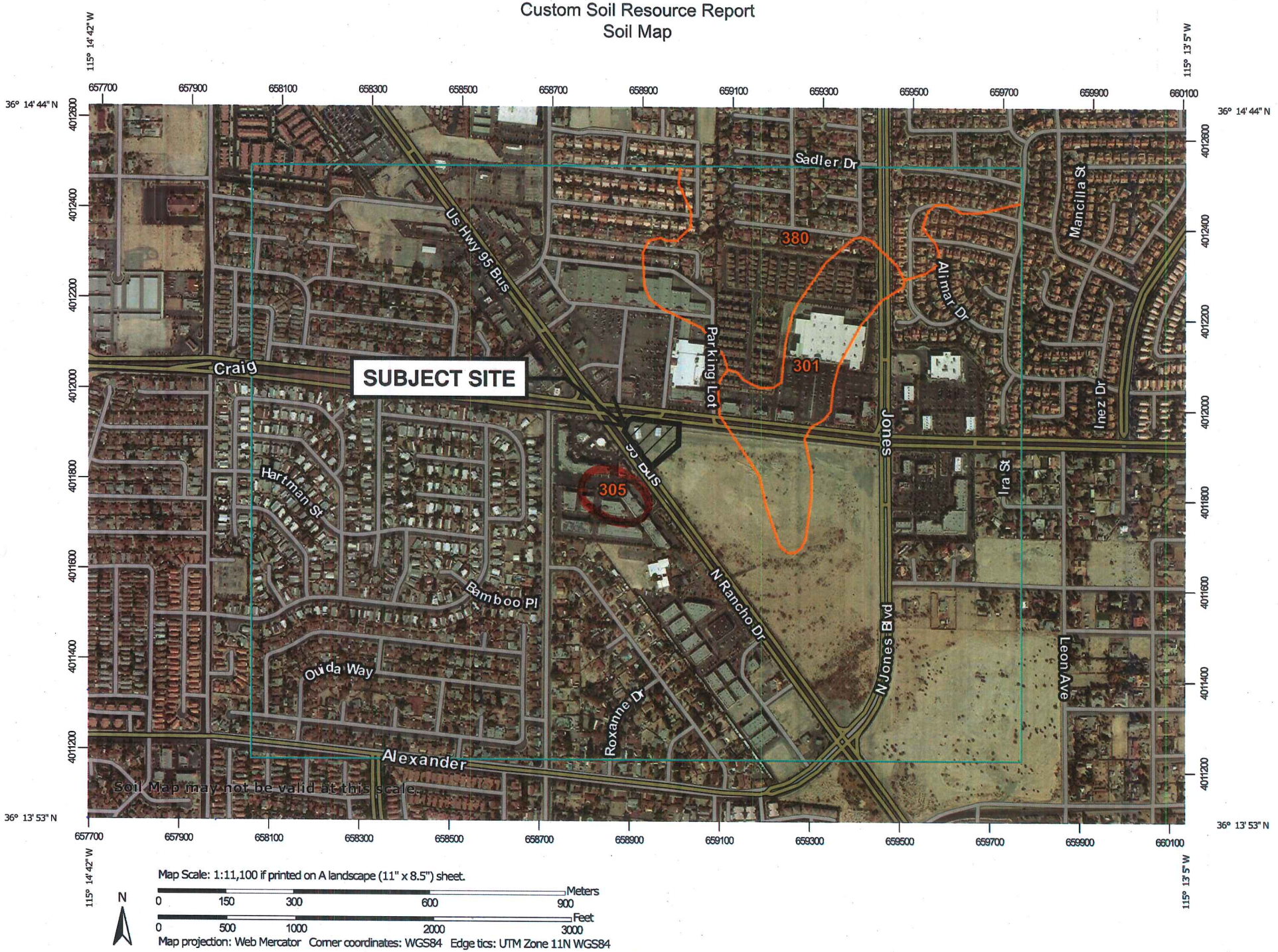
A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Las Vegas Valley Area, Nevada, Part of Clark County



August 23, 2018

Custom Soil Resource Report
Soil Map



Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
301	Las Vegas gravelly fine sandy loam, 2 to 4 percent slopes	25.2	4.5%
305	Las Vegas-DeStazo complex, 0 to 2 percent slopes	482.1	86.5%
380	Skyhaven very fine sandy loam, 0 to 4 percent slopes	49.8	8.9%
Totals for Area of Interest		**557.0**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or

305—Las Vegas-DeStazo complex, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: hrbs
Elevation: 1,400 to 5,200 feet
Mean annual precipitation: 3 to 10 inches
Mean annual air temperature: 55 to 70 degrees F
Frost-free period: 180 to 300 days
Farmland classification: Not prime farmland

Map Unit Composition

Las vegas and similar soils: 60 percent
Destazo and similar soils: 25 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Las Vegas

Setting

Landform: Alluvial flats
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from limestone

Typical profile

H1 - 0 to 2 inches: gravelly fine sandy loam
H2 - 2 to 8 inches: fine sandy loam
H3 - 8 to 12 inches: gravelly sandy clay loam
H4 - 12 to 16 inches: indurated

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 3 to 14 inches to petrocalcic
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 85 percent
Gypsum, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 12.0
Available water storage in profile: Very low (about 1.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D 'D' SOIL
Other vegetative classification: LIMY 3-5" P.Z. (030XB019NV_3)
Hydric soil rating: No

60%

Description of Destazo

Setting

Landform: Alluvial flats
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium

Typical profile

H1 - 0 to 11 inches: fine sandy loam
H2 - 11 to 51 inches: very gravelly sandy clay loam
H3 - 51 to 62 inches: sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 40 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 5.0
Available water storage in profile: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Other vegetative classification: LIMY 3-5" P.Z. (030XB019NV_3)
Hydric soil rating: No

25%

Minor Components

Glencarb

Percent of map unit: 5 percent
Landform: Alluvial flats
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: LOAMY BOTTOM (030XB020NV)
Hydric soil rating: No

Bluepoint

Percent of map unit: 5 percent
Landform: Fan piedmonts, sand sheets
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Other vegetative classification: LIMY SAND 5-7" P.Z. (030XB037NV_2)
Hydric soil rating: No

Skyhaven

Percent of map unit: 5 percent
Landform: Alluvial flats
Down-slope shape: Linear

Assumed 'D' soil

Across-slope shape: Linear
Other vegetative classification: SHALLOW LIMESTONE SLOPE 5-8 P.Z. (030XB030NV_2)
Hydric soil rating: No

380—Skyhaven very fine sandy loam, 0 to 4 percent slopes

Map Unit Setting

National map unit symbol: hrbz
Elevation: 1,800 to 2,300 feet
Mean annual precipitation: 4 to 6 inches
Mean annual air temperature: 63 to 68 degrees F
Frost-free period: 220 to 260 days
Farmland classification: Not prime farmland

Map Unit Composition

Skyhaven and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Skyhaven

Setting

Landform: Alluvial flats
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium

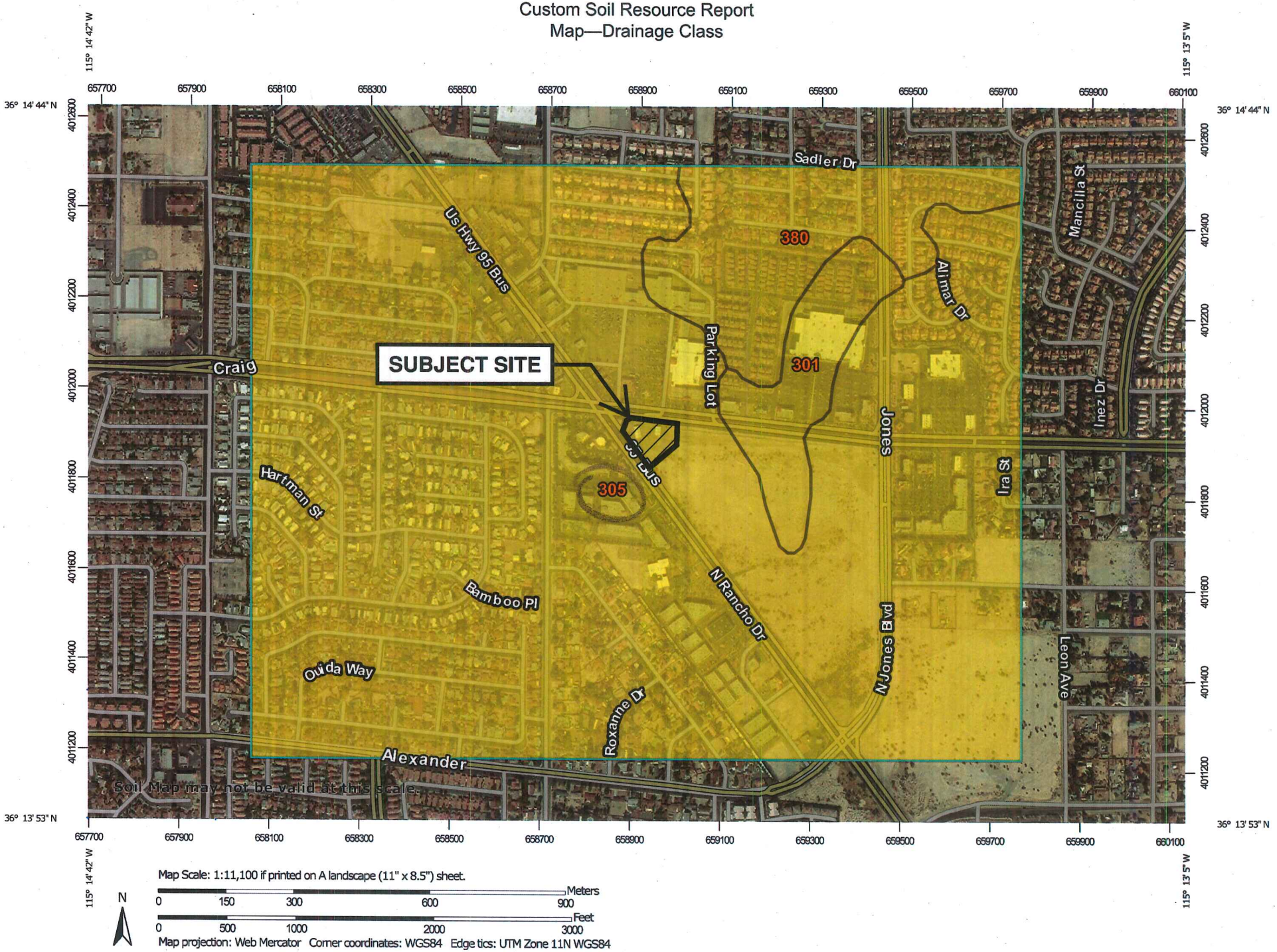
Typical profile

H1 - 0 to 1 inches: very fine sandy loam
H2 - 1 to 8 inches: clay loam
H3 - 8 to 37 inches: gravelly silty clay loam
H4 - 37 to 41 inches: indurated

Properties and qualities

Slope: 0 to 4 percent
Depth to restrictive feature: 24 to 39 inches to petrocalcic
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 90 percent
Gypsum, maximum in profile: 5 percent
Salinity, maximum in profile: Moderately saline to strongly saline (8.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 13.0
Available water storage in profile: Low (about 5.5 inches)

Custom Soil Resource Report
Map—Drainage Class



Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
301	Las Vegas gravelly fine sandy loam, 2 to 4 percent slopes	D	25.2	4.5%
305	Las Vegas-DeStazo complex, 0 to 2 percent slopes	D	482.1	86.5%
380	Skyhaven very fine sandy loam, 0 to 4 percent slopes	C	49.8	8.9%
Totals for Area of Interest			**557.0**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

HEC-1 ANALYSIS

(INTERIM / DEVELOPED CONDITIONS)

```
1*****************************************
*                                       *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *
*              JUN  1998                *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   04SEP18  TIME  10:21:59   *
*                                       *
*****************************************
```

I

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

1 HEC-1 INPUT PAGE 1

```
          LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

            1           ID        TECHNICAL DRAINAGE STUDY FOR
            2           ID        7-11 SEC CRAIG & RANCHO
            3           ID        PROPOSED DEVELOPEMENT - INTERIM/DEVELOPED CONDITIONS
            4           ID        USING SCS METHODS AND KINEMATIC WAVE ROUTING
            5           ID        MASTER PLAN ADJUSTED 6-HOUR RAINFALL AND STORM DISTRIBUTION
            6           ID        LOCHSA JOB# 181119
            7           ID
            8           ID
            9           ID        INPUT FILE NAME:  I.DAT
           10           ID
           11           ID        SEPTEMBER 2018
           12           ID
           13           ID        ************************************************************************
           14           ID        ************************************************************************
           15           ID             WITHIN McCARRAN AIRPORT RAINFALL AREA
           16           ID             10 & 100 YEAR - 6 HOUR STORM EVENT
           17           ID             PRECIPITATION:
           18           ID                   10-YEAR          : 1.58 INCHES
           19           ID                   25-YEAR          : 2.05 INCHES
           20           ID                100-YEAR         : 2.77 INCHES
           21           ID                   10/100-YEAR RATIO: 1.58/2.77 = 0.5704
           22           ID        ************************************************************************
           23           ID        ************************************************************************
                       *DIAGRAM
           24           IT       5                    100
           25           IO       5       0
           26           IN       5
           27           JR    PREC   .5704   .7401     1.0

           28           KK     ND1
           29           KM   ONSITE BASIN DSICHARTGING IN A SOUTHEAST DIRECTION AND FOLLOWING ITS HISTORIC
           30           PB    2.77
           31           PC     0.0     .02    .057     .07    .087    .108    .124     .13     .13     .13
           32           PC     .13     .13     .13    .133     .14    .142    .148    .158    .172    .181
           33           PC     .19    .197    .199      .2    .201    .204    .214    .229    .241    .249
           34           PC    .251    .256     .27    .278    .281    .283    .295    .322    .352    .409
           35           PC    .499     .59     .71    .744    .781    .812    .819    .835    .851    .856
           36           PC     .86    .868    .876    .888     .91    .926    .937     .95     .97    .976
           37           PC    .982    .985    .987    .989     .99    .993    .993    .994    .995    .998
           38           PC    .998    .999     1.0
           39           BA  .00108
           40           LS       0    96.9
           41           UD    .051
                        *

           42           KK     ND2
           43           KM   ONSITE BASIN DISCHARGING IN A SOUTHEAST DIRECTION
           44           BA  .00108
           45           LS       0    96.9
           46           UD    .050
                        *
           47           ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

    28         ND1
               .
               .
    42         .          ND2

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```


1***
*   *
*   FLOOD HYDROGRAPH PACKAGE (HEC-1)   *
****

****
*   *
*   U.S. ARMY CORPS OF ENGINEERS   *

```
*             JUN   1998             *
*          VERSION 4.1               *
*                                    *
*  RUN DATE   04SEP18  TIME  10:21:59 *
*                                    *
**************************************
```


```
*    HYDROLOGIC ENGINEERING CENTER   *
*          609 SECOND STREET         *
*       DAVIS, CALIFORNIA 95616      *
*           (916) 756-1104           *
*                                    *
**************************************
```


TECHNICAL DRAINAGE STUDY FOR
7-11 SEC CRAIG & RANCHO
PROPOSED DEVELOPEMENT - INTERIM/DEVELOPED CONDITIONS
USING SCS METHODS AND KINEMATIC WAVE ROUTING
MASTER PLAN ADJUSTED 6-HOUR RAINFALL AND STORM DISTRIBUTION
LOCHSA JOB# 181119

INPUT FILE NAME: I.DAT

SEPTEMBER 2018

```
*************************************************************************
*************************************************************************
     WITHIN McCARRAN AIRPORT RAINFALL AREA
     10 & 100 YEAR - 6 HOUR STORM EVENT
     PRECIPITATION:
           10-YEAR          : 1.58 INCHES
           25-YEAR          : 2.05 INCHES
          100-YEAR          : 2.77 INCHES
           10/100-YEAR RATIO: 1.58/2.77 = 0.5704
*************************************************************************
*************************************************************************
```

```
  25 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        100  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     1   0  ENDING DATE
                      NDTIME       0815  ENDING TIME
                      ICENT          19  CENTURY MARK

                    COMPUTATION INTERVAL     .08 HOURS
                       TOTAL TIME BASE    8.25 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       .74      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 .74	RATIO 3 1.00
HYDROGRAPH AT							
+	ND1	.00	1	FLOW	1.	2.	2.
				TIME	3.50	3.50	3.50
HYDROGRAPH AT							
+	ND2	.00	1	FLOW	1.	2.	2.
				TIME	3.50	3.50	3.50

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

APPENDIX B

Hydraulic Calculations

NORMAL FLOW DEPTH HYDRAULIC CALCULATIONS

CRAIG RD. AND RANCH0 DRIVE (10yr/25yr/100yr – Existing/Interim/Developed)

Section 1 - Craig - Existing / Interim / Developed - 10year
Worksheet for Irregular Channel

Project Description	
Worksheet	Section 1 - Craig - Existing / Interim / Developed - 10 YEAR
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	.009000	ft/ft
Discharge	3.00	cfs

Ref. 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	0.013	
Water Surface Elev	88.20	ft
Elevation Range	.90 to 88.94	
Flow Area	1.5	ft²
Wetted Perimeter	19.87	ft
Top Width	19.52	ft
Actual Depth	0.30	ft ← d_{10}
Critical Elevation	88.22	ft
Critical Slope	0.005942	ft/ft
Velocity	1.94	ft/s ← v_{10}
Velocity Head	0.06	ft
Specific Energy	88.26	ft
Froude Number	1.22	
Flow Type	Supercritical	

$d \times v = .30 \times 1.94 = .58 < 6$ ok ✓

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+00.00	0.013
0+00.00	0+50.45	0.016
0+50.45	0+52.45	0.013

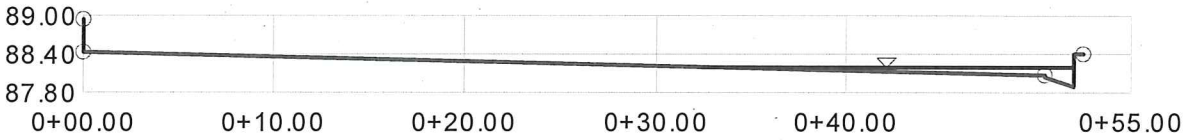
Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	88.94
0+00.00	88.44
0+50.45	88.07
0+50.45	88.03
0+51.95	87.90
0+51.95	88.40
0+52.45	88.40

Section 1 - Craig - Existing / Interim / Developed - 10year
Cross Section for Irregular Channel

Project Description	
Worksheet	Section 1 - Craig - Existing / Interim / Developed
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.013	
Slope	0.009000	ft/ft
Water Surface Elev	88.20	ft
Elevation Range	.90 to 88.94	
Discharge	3.00	cfs

$\frac{88.07 - 88.20}{-.0073} = 17.81' > 12'$ ok ✓



V:3.33333333
H:1
NTS

Section 1 - Craig - Existing / Interim / Developed - 25year
Worksheet for Irregular Channel

Project Description	
Worksheet	Section 1 - Craig - Existing / Interim / Developed - 25 YEAR
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	009000	ft/ft
Discharge	3.00	cfs

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

Results		
Mannings Coefficie	0.013	
Water Surface Elev	88.20	ft
Elevation Range	.90 to 88.94	
Flow Area	1.5	ft²
Wetted Perimeter	19.87	ft
Top Width	19.52	ft
Actual Depth	0.30	ft
Critical Elevation	88.22	ft
Critical Slope	0.005942	ft/ft
Velocity	1.94	ft/s
Velocity Head	0.06	ft
Specific Energy	88.26	ft
Froude Number	1.22	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+00.00	0.013
0+00.00	0+50.45	0.016
0+50.45	0+52.45	0.013

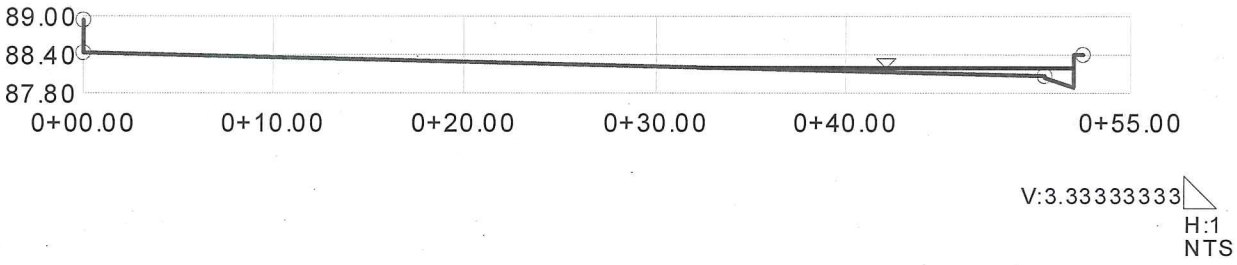
Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	88.94
0+00.00	88.44
0+50.45	88.07
0+50.45	88.03
0+51.95	87.90
0+51.95	88.40
0+52.45	88.40

Section 1 - Craig - Existing / Interim / Developed - 25year
Cross Section for Irregular Channel

Project Description	
Worksheet	Section 1 - Craig - Existing / Interim / Developed
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.013	
Slope	0.009000	ft/ft
Water Surface Elev	88.20	ft
Elevation Range	'.90 to 88.94	
Discharge	3.00	cfs



Section 1 - Craig - Existing / Interim / Developed - 100year
Worksheet for Irregular Channel

Project Description	
Worksheet	Section 1 - Craig - Existing / Interim / Developed - 100 YEAR
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	009000	ft/ft
Discharge	5.00	cfs

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

Results		
Mannings Coefficie	0.014	
Water Surface Elev	88.24	ft
Elevation Range	.90 to 88.94	
Flow Area	2.4	ft²
Wetted Perimeter	25.11	ft
Top Width	24.72	ft
Actual Depth	0.34	ft ← d_{100}
Critical Elevation	88.25	ft
Critical Slope	0.006261	ft/ft
Velocity	2.09	ft/s ← V_{100}
Velocity Head	0.07	ft
Specific Energy	88.31	ft
Froude Number	1.19	
Flow Type	Supercritical	

$d \times V = .34 \times 2.09 = .71 < 8$ ok ✓

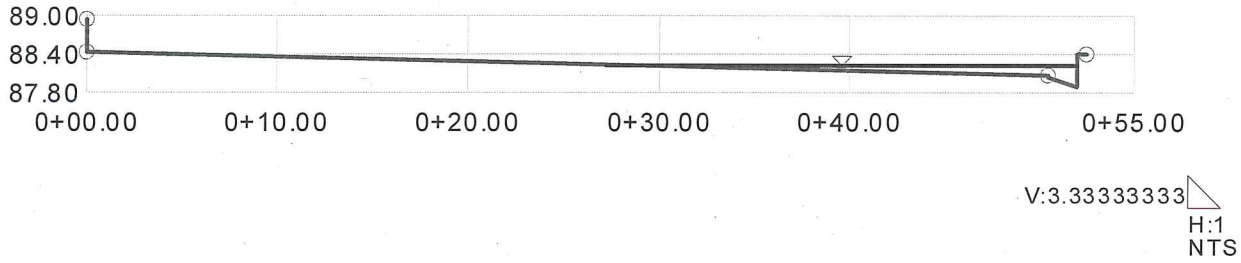
Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+00.00	0.013
0+00.00	0+50.45	0.016
0+50.45	0+52.45	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	88.94
0+00.00	88.44
0+50.45	88.07
0+50.45	88.03
0+51.95	87.90
0+51.95	88.40
0+52.45	88.40

Section 1 - Craig - Existing / Interim / Developed - 100year
Cross Section for Irregular Channel

Project Description	
Worksheet	Section 1 - Craig - Existing / Interim / Developed
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.014	
Slope	0.009000	ft/ft
Water Surface Elev	88.24	ft
Elevation Range	.90 to 88.94	
Discharge	5.00	cfs



Section 2 - Rancho - Existing / Interim / Developed - 10year
Worksheet for Irregular Channel

Project Description	
Worksheet	Section 2 - Rancho - Existing / Interim / Developed - 10YEAR
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	.007000	ft/ft
Discharge	4.00	cfs

REF. FLOW

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

Results		
Mannings Coefficient	0.014	
Water Surface Elev	91.60	ft
Elevation Range	.22 to 93.02	
Flow Area	1.8	ft²
Wetted Perimeter	14.26	ft
Top Width	13.83	ft
Actual Depth	0.38	ft ← d_{10}
Critical Elevation	91.61	ft
Critical Slope	0.005508	ft/ft
Velocity	2.27	ft/s ← v_{10}
Velocity Head	0.08	ft
Specific Energy	91.68	ft
Froude Number	1.12	
Flow Type	Supercritical	

$d \times v = .38 \times 2.27 = .86 < 6$ OK ✓

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.013
0+07.00	0+71.13	0.016
0+71.13	0+71.60	0.013

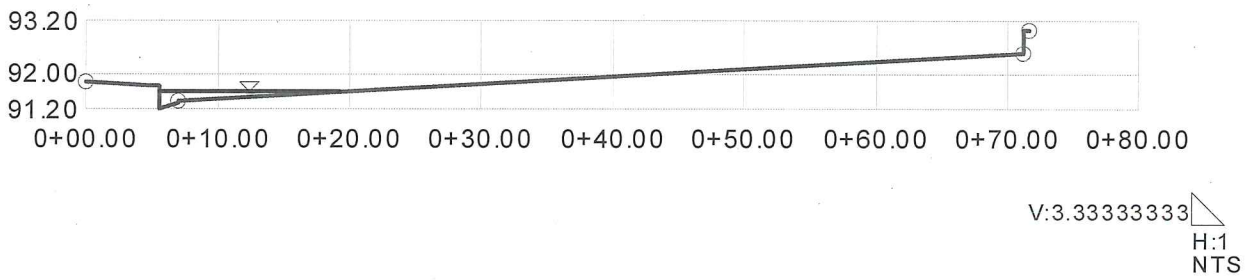
Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	91.82
0+05.00	91.72
0+05.50	91.72
0+05.50	91.22
0+07.00	91.35
0+07.00	91.39
0+71.13	92.48
0+71.13	92.98
0+71.60	93.02

Section 2 - Rancho - Existing / Interim / Developed - 10year
Cross Section for Irregular Channel

Project Description	
Worksheet	Section 2 - Rancho - Existing / Interim / Develope
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.014	
Slope	0.007000	ft/ft
Water Surface Elev	91.60	ft
Elevation Range	.22 to 93.02	
Discharge	4.00	cfs

$\frac{92.48 - 91.60}{.0170} = 51.76' > 12'$ ok ✓



Section 2 - Rancho - Existing / Interim / Developed - 25year
Worksheet for Irregular Channel

Project Description	
Worksheet	Section 2 - Rancho - Existing / Interim / Developed - 25 YEAR
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	007000	ft/ft
Discharge	5.00	cfs

Ref. Flow

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

Results		
Mannings Coefficie	0.014	
Water Surface Elev	91.62	ft
Elevation Range	.22 to 93.02	
Flow Area	2.1	ft²
Wetted Perimeter	15.75	ft
Top Width	15.30	ft
Actual Depth	0.40	ft
Critical Elevation	91.64	ft
Critical Slope	0.005586	ft/ft
Velocity	2.35	ft/s
Velocity Head	0.09	ft
Specific Energy	91.71	ft
Froude Number	1.11	
Flow Type	Supercritical	

d_{25}

V_{25}

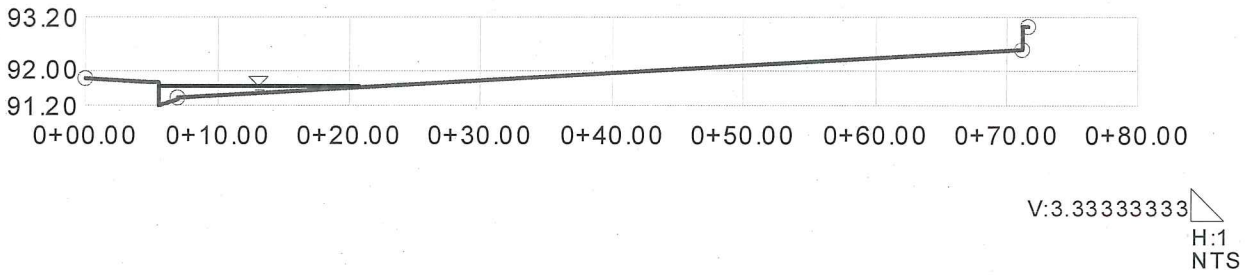
Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.013
0+07.00	0+71.13	0.016
0+71.13	0+71.60	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	91.82
0+05.00	91.72
0+05.50	91.72
0+05.50	91.22
0+07.00	91.35
0+07.00	91.39
0+71.13	92.48
0+71.13	92.98
0+71.60	93.02

Section 2 - Rancho - Existing / Interim / Developed - 25year
Cross Section for Irregular Channel

Project Description	
Worksheet	Section 2 - Rancho - Existing / Interim / Develope
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.014	
Slope	0.007000	ft/ft
Water Surface Elev	91.62	ft
Elevation Range	.22 to 93.02	
Discharge	5.00	cfs



Section 2 - Rancho - Existing / Interim / Developed - 100year
Worksheet for Irregular Channel

Project Description	
Worksheet	Section 2 - Rancho - Existing / Interim / Developed - 100 YEAR
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	.007000	ft/ft
Discharge	7.00	cfs

Ref. Flow

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

Results		
Mannings Coefficie	0.014	
Water Surface Elev	91.67	ft
Elevation Range	.22 to 93.02	
Flow Area	2.8	ft²
Wetted Perimeter	18.20	ft
Top Width	17.71	ft
Actual Depth	0.45	ft ← d_{100}
Critical Elevation	91.68	ft
Critical Slope	0.005643	ft/ft
Velocity	2.50	ft/s ← v_{100}
Velocity Head	0.10	ft
Specific Energy	91.76	ft
Froude Number	1.11	
Flow Type	Supercritical	

$d \times v = .45 \times 2.50 = 1.13 < 8$ ok ✓

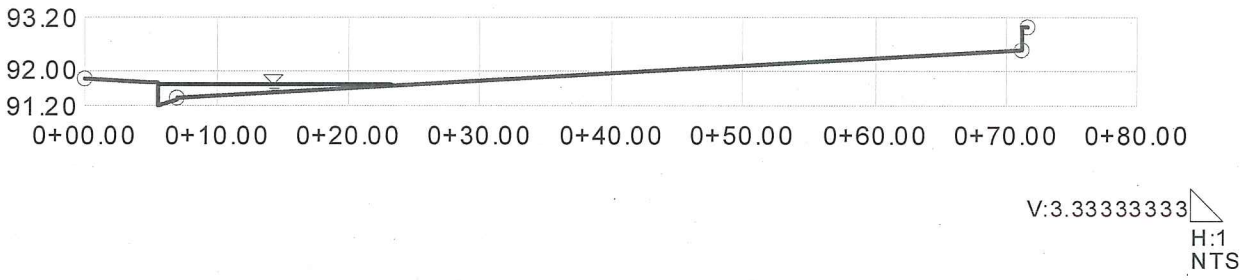
Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.013
0+07.00	0+71.13	0.016
0+71.13	0+71.60	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	91.82
0+05.00	91.72
0+05.50	91.72
0+05.50	91.22
0+07.00	91.35
0+07.00	91.39
0+71.13	92.48
0+71.13	92.98
0+71.60	93.02

Section 2 - Rancho - Existing / Interim / Developed - 100year
Cross Section for Irregular Channel

Project Description	
Worksheet	Section 2 - Rancho - Existing / Interim / Develope
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.014	
Slope	0.007000	ft/ft
Water Surface Elev	91.67	ft
Elevation Range	.22 to 93.02	
Discharge	7.00	cfs



ONSITE – SECTION '3' HYDRAULIC CALCULATION

(Interim / Developed Condition)

Section 3 - Interim / Developed - 100year
Worksheet for Irregular Channel

Project Description	
Worksheet	Section 3 - Existing / Interim / Developed - 100 year
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	005000	ft/ft
Discharge	2.00	cfs

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

Results		
Mannings Coefficie	0.014	
Water Surface Elev	89.69	ft
Elevation Range	.50 to 90.24	
Flow Area	1.5	ft²
Wetted Perimeter	20.26	ft
Top Width	20.26	ft
Actual Depth	0.19	ft ← d_{100}
Critical Elevation	89.68	ft
Critical Slope	0.006785	ft/ft
Velocity	1.34	ft/s ← v_{100}
Velocity Head	0.03	ft
Specific Energy	89.72	ft
Froude Number	0.87	
Flow Type	Subcritical	

$d \times v = .19 \times 1.34 = .25 < 8$ ok ✓

FF = 92.72'

W.S.E. = 89.69'

d_{100} = 0.19'

89.88'

FF meets double 100yr flow depth

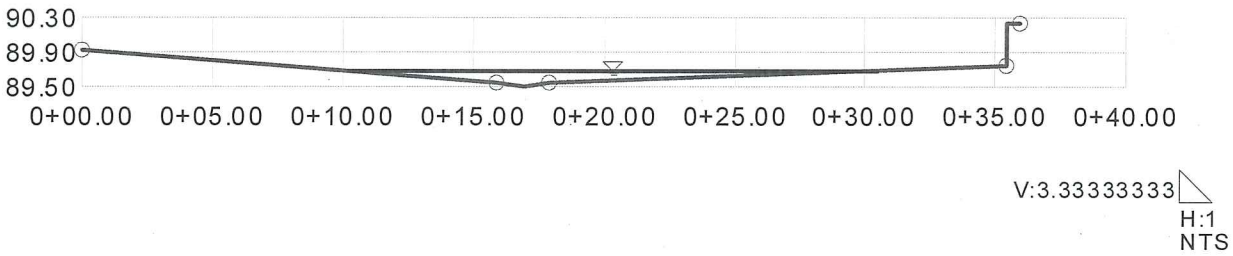
Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+15.91	0.016
0+15.91	0+17.91	0.013
0+17.91	0+35.41	0.016
0+35.41	0+35.91	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	89.92
0+15.91	89.56
0+16.91	89.50
0+17.91	89.56
0+35.41	89.74
0+35.41	90.24
0+35.91	90.24

Section 3 - Interim / Developed - 100year
Cross Section for Irregular Channel

Project Description	
Worksheet	Section 3 - Existing / Interim / Developed -
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.014	
Slope	0.005000	ft/ft
Water Surface Elev	89.69	ft
Elevation Range	).50 to 90.24	
Discharge	2.00	cfs



SECTION 1500 – BMP Practices

Section 1500
Structural Best Management Practices

1501 INTRODUCTION

Presented in this section are design criteria for structural Best Management Practices (BMPs) for the control of surface water quality in Las Vegas Valley. These BMPs have been identified as having potential effectiveness in Las Vegas Valley based on the types of water quality conditions expected in this area, and on documented BMP performance in other areas. Criteria for the following BMPs are presented:

- Parking Lot Low Impact Development (LID)
- General Low Impact Development (LID)
  - Disconnected Impervious Areas
  - Landscape Swale
  - Depressed Medians
  - Depressed Landscaping
  - Buffer Strip
  - Pervious Overflow Parking
  - Sand / Media Filters
  - Oil / Water Separators
  - Oil / Grit Separators
  - On-Site Water Quality Basin
  - Infiltration Trench

There are currently no federal, state or local stormwater regulations which require the installation of specific water quality features in most new or existing developments in the Las Vegas Valley. The exception is new and redeveloped non-residential sites larger than 1.0 acre, for which low impact development (LID) measures are required by the Storm Water Management Plan. LID measures for sites smaller than 1 acre are encouraged for developers *desiring to mitigate the impacts of urban development on surface water resources in* the *Las Vegas Valley.*

There are three general categories of conditions for which urban stormwater quality management practices may be applied: (1) existing urban development; (2) new urban development and substantial redevelopment; and (3) construction activity. The BMPs in this section are primarily applicable to areas of new urban development, where land is available to devote to installations of this type and where design flexibility exists. In certain cases, these structural BMPs may be effective in retrofitting existing developed areas to control water quality problems. However, it is generally more cost-effective to rely on nonstructural BMPs (e.g., source controls, housekeeping practices, public education, and employee training) in these applications. BMPs related to construction activity are primarily directed toward erosion control. This issue

1502 Parking Lot LID Measures

1502.1 Description

Low impact development (LID) measures can be used for managing runoff from areas of new development and significant redevelopment (NDSR). LID measures must be applied to parking lots for all new non-residential sites of 1 acre and larger in the Las Vegas Valley. For the purpose of LID measures, a parking lot is defined as all of the impervious area outside the building footprint. Parking lot LID policies and design criteria are discussed in more detail in *Proposed Parking Lot Low Impact Development Program for Las Vegas Valley,* Las Vegas Valley Stormwater Quality Management Committee, February 2013.

1502.2 Design Criteria

Parking lot designs must be submitted to local entities with the technical drainage study required by Municipal code. A list of accepted parking lot BMPs that can be used in the Las Vegas Valley is provided in **Table 1501**.

BMP requirements shall adhere to this manual. A stepped approach to determine whether a parking lot is categorized as small, medium or large for the purpose of determining required BMPs is shown below. Any project site that is less than 1 acre in size is categorized as small; parking lot size is not a factor in determining required BMPs for small sites. For project sites that are greater than or equal to 1 acre, the parking lot size is used to determine if the category is medium or large. Sites having parking lots that are less than or equal to 1 acre are categorized as medium. Sites with parking lots greater than 1 acre are categorized as large.

Total Site Size	Parking Lot Size	Parking Lot Category
< 1 acre	Not Applicable	Small
≥ 1 acre	≤ 1 acre	Medium
≥ 1 acre	> 1 acre	Large

Once the parking lot category is determined, the BMP requirements for the parking lot design can be determined as shown in **Table 1502**. BMP requirements are more stringent as the parking lot size increases.

The designer may choose how to meet the parking lot BMP design requirements depending on specific site characteristics. In order to maximize the water quality benefit of the parking lot BMPs, the designer is encouraged to locate BMPs to capture runoff from portions of the site with the highest potential to generate pollutants.

There are no specific BMP requirements for small parking lots; however, the designer is encouraged to install any of the BMPs that are listed for parking lots in the medium or large categories.

For the Medium parking lot category, the design requirements consist of disconnecting impervious areas for at least 75 percent of the parking lot area from the onsite drainage network. This may be accomplished by directing runoff to pervious areas such as landscaping, depressed medians, parking strips, or stormwater retention basins. The design criteria are based on meeting the accepted minimum standards for the BMPs selected. The designer may choose to install a treatment BMP listed in the Large parking lot category.

For the Large parking lot category, treatment BMPs are required to treat stormwater runoff from at least 75 percent of the parking lot. Because typical site drainage layouts must account for application of flood control criteria, treatment BMPs may need to be sized to accommodate runoff from the contributing building area as well. BMPs are to be sized for the 85th percentile storm, and hydrologic and hydraulic calculations are required to be submitted for the BMP design.

The requirement to treat 75 percent of the parking lot area, either through disconnecting impervious areas or installing treatment devices, recognizes that grading and other site conditions will prevent directing all site runoff to some type of BMP. However, designers are encouraged to exceed the minimum standard when this can be done cost effectively in order to maximize the potential water quality benefits of the BMP system.

LID measures that are incorporated in the parking lot design should be planned during the site design process. Certain LID measures, including depressed medians, islands, and rock-lined swales, help to disconnect impervious areas and remove suspended particles in the stormwater runoff, prior to connection to the MS4. Parking Lot BMPs can be integrated into perimeter landscaped areas (e.g., buffers) and interior landscaped areas (e.g., medians) required by local development standards whenever possible. When incorporated into landscaping features, tributary areas to individual BMPs should be kept to less than 0.5 acres whenever possible, and should never exceed 1.0 acre.

Figure 1501 through **Figure 1503**, provide ideas on how parking lots can be designed to comply with the water quality regulations. The designer is required to comply with the planning code for the municipality in which the site is located. The conceptual layouts incorporate general planning requirements, however, specific planning requirements such as those for landscape buffers are determined based in part on the adjacent property. The conceptual layouts are designed to represent a commercial property that is approximately 5 acres in size, with the total parking lot area of approximately 3.3 acres.

Figure 1501, Conceptual Layout 1, represents a parking lot that can be designed so that the runoff can be directed towards the perimeter landscape buffer areas that incorporate a landscaped swale. These swales are designed as rock or xeriscaped swales to convey runoff to a low point, which discharges either directly to the MS4 or to a main drainage pipe and then into the MS4. **Figure 1502**, Conceptual Layout 2, represents a parking lot that is not designed to direct all runoff towards swales installed in the perimeter landscape buffer areas. One example could be that the adjacent right-of-way at this area is higher in elevation than the onsite grade. In order to still use the landscape swale BMP, the Developer could use swales in depressed medians within the site, combined with perimeter swales where feasible.

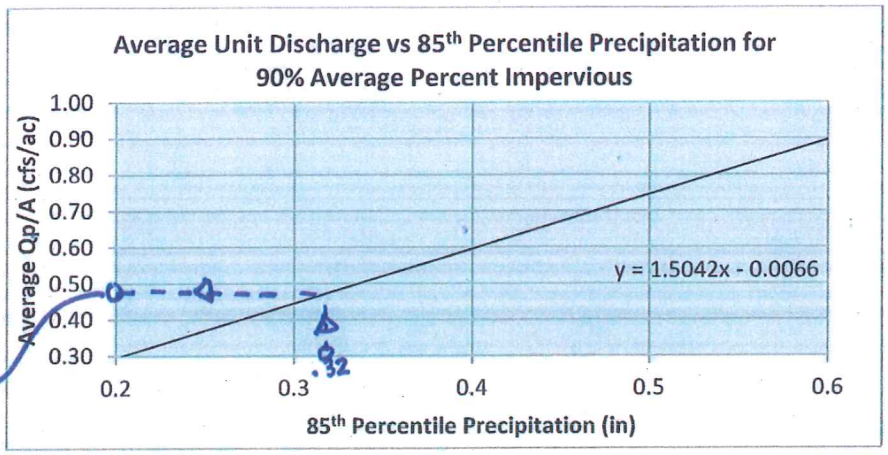
Treatment control devices rather than BMP swales may be used, however, the amount of parking lot area required to be treated would need to be calculated. **Figure 1503**, Conceptual Layout 3, shows a conceptual level layout for this scenario, which relies on a combination of modular pavers, sand/oil separators, and underground detention to provide treatment for at least 75 percent of the parking lot area. To size the treatment control BMPs, the approaches described in section 1502.3 should be used. Note that for treatment devices, hydraulic sizing may need to account for the contribution of runoff from building areas draining through the parking lot.

1502.3 Water Quality Design Storm

This section describes the steps to be followed to determine the design hydrology for sizing parking lot BMPs in the Las Vegas Valley.

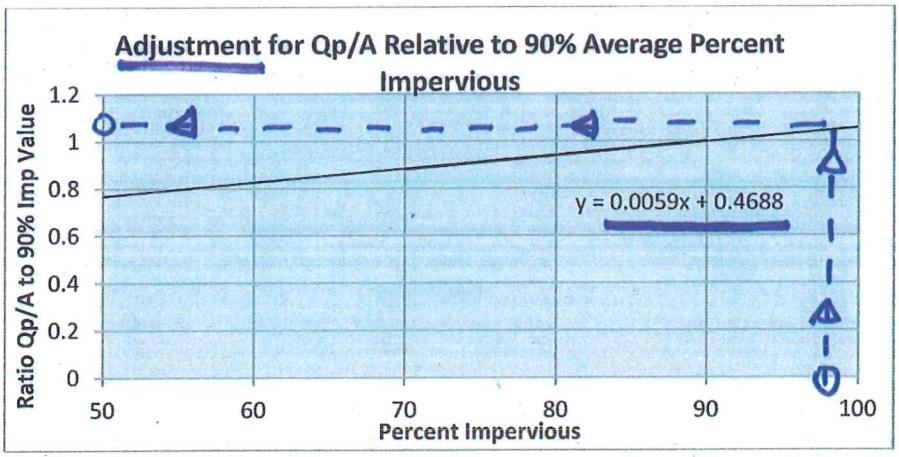
1. Determine BMP Design Precipitation - 85th Percentile Rainfall Depth
   a. Locate site on CCRFCD Design Rainfall Map for 2-year, 6-hour storm
   b. Determine the adjusted 2-year rainfall depth (D_2) for site, per CCRFCD methods
   c. Compute ratio of D_2 site to D_2 for the McCarran Airport Area
   d. Compute 85th percentile rainfall depth (D_{85}) as 0.32 x D_2 ratio (0.32 is D_{85} for McCarran Area)

2. Calculate BMP Design Peak Discharge
   a. Use the following chart or regression equation to calculate the unit discharge (Q_P/A) for the 90 percent average percent impervious area condition based on the D_{85} value.



0.49 cfs/ac

b. Use the following chart or regression equation to calculate the unit discharge for the site based on the actual percent impervious area of the parking lot and associated landscaped areas.

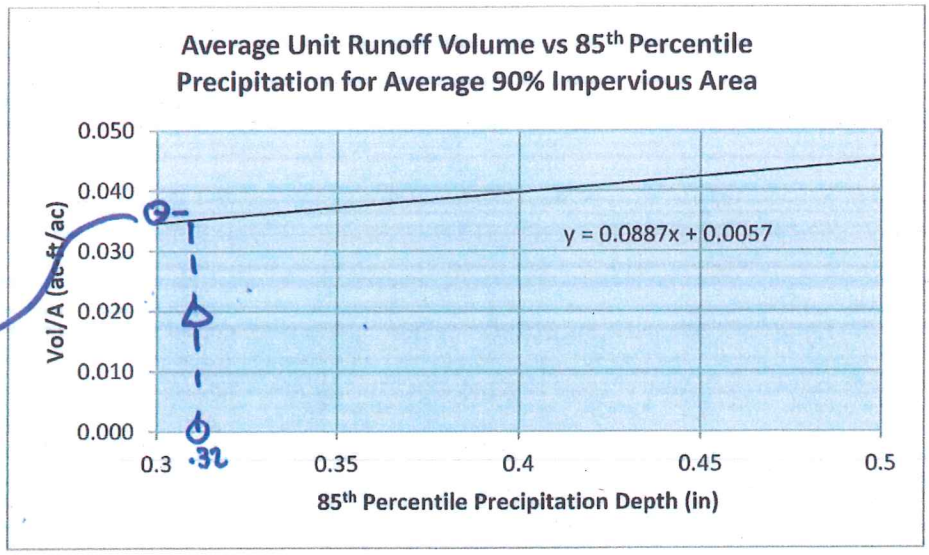


Adjustment Factor = 1.047

c. Calculate the peak design discharge in cfs as $Q_P = Q_P/A \times A$ where Q_P/A is from step (2b) and A is in acres.

3. Calculate BMP Design Runoff Volume

a. Use the following chart or regression equation to calculate the unit runoff volume (Vol/A) for the 90 percent impervious condition based on the D_{85} value.



0.034

.034 * 1.047

b. Use the chart or regression equation in step (2b) to calculate the unit runoff volume for the site based on the actual average percent impervious area of the parking lot and associated landscaped areas.

c. Calculate the design runoff volume in acre-feet as Vol = Vol/A x A where Vol/A is from step (3b) and A is in acres

Sample Calculation

Given: New Commercial Center in Summerlin area
Site Area = 100 acres
D_2 site / D_2 McCarran Area = 1.25
percent impervious area = 85% (parking lot and associated landscaped area)

1. Determine BMP Design Precipitation - 85th Percentile Rainfall Depth (D_{85})

D_{85} = 1.25 x 0.32 = 0.40 inches

2. Calculate BMP Design Discharge

Q_P/A (90%) = 1.5042 x (0.40) + 0.0066 = 0.60

Find Adjustment factor for percent impervious
Q_P/A = 0.60 x [(0.0059[85]) + 0.4688) = 0.58

Q_P = 0.58 x 100 acres = 58 cfs

3. Calculate BMP Design Runoff Volume

Vol/A (90%) = 0.0887 x 0.40 + 0.0057 = 0.04
Vol/A = 0.04 x (0.0059 x [85] + 0.4688) = 0.04; Vol = 0.04 x 100 acres = 4.0 ac-ft.

1503 LOW IMPACT DEVELOPMENT (LID)

1503.1 Description

LID measures can be used for managing runoff from areas of new development and significant redevelopment (NDSR). LIDs consist of a variety of site planning and site design measures or practices to minimize the impact of individual urban developments on stormwater quality and quantity. Developers proposing the use of measures that rely on infiltration to dispose of stormwater must perform studies to demonstrate that infiltration will be effective and will not adversely affect groundwater or downstream surface water quality. LID measures determined to be feasible for use in the Las Vegas Valley NDSR program can be found in **Table 1503**.

The BMPs presented in this section can be utilized for sites complying with the Parking Lot LID program or other site designs requiring BMPs. These BMPs are recommendations and the designer is not limited to the BMPs in this section. The designer is encouraged to contact the local entity when alternative BMPs are considered for use.

1503.2 Water Quality Benefits

Managing site runoff can significantly reduce the amount of pollutants conveyed to receiving waters. By incorporating the LID measures described below into site planning, runoff water quality can be improved by using simple technologies, employing basic practices, and educating those present on the site. Reducing pollutants in site runoff can reduce the need for downstream treatment to meet water quality goals.

1503.3 Disconnected Impervious Areas

1503.3.1 Description

This BMP consists of disconnecting impervious areas from downstream storm drainage infrastructure. Any surface in the landscape that cannot effectively absorb or infiltrate rainfall is an impervious area. This includes driveways, roads, parking lots, rooftops, and sidewalks. On natural landscapes, rainfall is absorbed into the soil and vegetation which naturally slows down, spreads out, and soaks up precipitation and runoff. A stable supply of groundwater is provided from water percolating into the soil, and the runoff is naturally filtered of impurities before it reaches creeks, streams, rivers, and bays.

The amount of impervious cover increases as areas become more developed. Natural filter systems are no longer in place to intercept the runoff which has serious implications for water quality and flood control. Typical pollutants in runoff from impervious areas include oil, litter, sediment, bacteria and in some cases, herbicides and pesticides.

1503.3.2 Water Quality Benefits

Concentrations and loads of the following pollutants are typically reduced by the LID BMP described in this section:

- Trace metals
- Hydrocarbons
- Litter

1503.3.3 Applications

This BMP applies to all urban areas. A beneficial way of mitigating stormwater runoff from impervious areas is to direct the runoff from parking lots and roads to pervious and vegetated soils.

1503.3.4 Limitations

Limitations may occur in areas with poor soils, where infiltration would not occur or could exacerbate groundwater quality problems. Limitations may also occur in ultra-urban areas where the site has no pervious area, including but not limited to high density areas.

1503.3.5 Design Criteria

Ways to mitigate the stormwater runoff by disconnecting impervious areas include:

- Breaking up flow directions from paved surfaces – Impervious surfaces are designed to allow stormwater to run off in a dispersed manner in several directions. The drainage off impervious surfaces is directed onto adjacent vegetated soil and not onto other pavements or into storm sewers.

- Minimize directly connected impervious areas - The impact of impervious surfaces is reduced by minimizing directly connected impervious areas, directing runoff from the impervious areas to pervious areas and/or small depressions, and in the process disconnecting hydrologic flow paths.

- Locating impervious surfaces to drain to natural systems - Existing zones of vegetation, from forested zones to scrub vegetation, are used

for management of stormwater runoff, often with some sort of landforming to achieve volume control. The scale of this technique can vary from microcontrol by redirecting sidewalk and driveway runoff to adjacent vegetation to conveyance of runoff from larger impervious surfaces to natural areas on the development site.

1503.3.6 Maintenance

Sweep impervious areas regularly to collect loose particles and litter. Wipe up spills with rags and other absorbent material immediately, but do not hose down the area to a storm drain. Pervious areas receiving runoff should be cleared regularly of litter and accumulated sediment.

1503.4 Landscape Swale

1503.4.1 Description of Facility

The purpose of the swale is to settle out sediment, which has the potential to have urban pollutants bound to the particulate matter. The required length of the swale to settle out particulate pollutants is dependent on multiple factors, including velocity, characteristics of the stormwater, characteristics of the swale, and length of the swale. For the Parking Lot LID program, sizing of swales will be based on minimizing the slope of the swale to minimize the swale length and flow velocities. Xeriscaped or rock swales can be sized using the standard sizing requirements, as shown in Section 1503.4.5.

Runoff from any impervious areas on a developed site can be directed to swales, including parking lots, roof tops, parking covers, etc. The swales can be installed either within the parking lot area or at the perimeter of the site.

1503.4.2 Water Quality Benefits

Concentrations and loads of the following pollutants are typically reduced by the LID BMP described in this section:

- Sediment
- Total Phosphorus
- Trace Metals
- Hydrocarbons

Estimated pollutant removal efficiencies for vegetated landscape swales are given below. Pollutant removal efficiencies for rock lined or xeriscaped swales are expected to be lower.

Pollutant	Removal Efficiency
TSS	77%
Total Phosphorus	8%
Total Nitrogen	67%
Trace Metals	83-90%

Source: CASQA New Development and Redevelopment Handbook, 2003

1503.4.3 Applications

Landscape swales are typically located in parks, parkways, private landscaped areas, or in development buffers, and can also be used as pre-treatment devices for other structural treatment controls. They are primarily used as stormwater conveyance systems; however they are limited in their ability to mitigate large storms. Landscape swales are best utilized in low to moderate sloped areas as an alternative to ditches and curb and gutter drainage.

1503.4.4 Limitations

The effectiveness of landscape swales is decreased by compacted soils, frozen ground conditions, short grass heights, steep slopes, large storm events, high discharge rates, high velocities, and a short runoff contact time. Landscape swales also require a sufficient amount of available land area and they may not be appropriate for industrial sites or locations where spills may occur. In areas where burrowing animals are abundant, landscape swales may not perform effectively. Additionally, the infiltration rates of local soils can limit the application of landscape swales, unless underdrains are installed. Another possible issue is the formation of mosquito breeding habitat if water does not drain or infiltrate.

1503.4.5 Design Criteria

Tributary Area (ac)	Swale Slope	Minimum Swale Length (ft)	Size of Swale
≤ 0.5	≤ 1%	30	9" deep maximum, 6 ft wide at top average, 4ft wide at top minimum, 4:1 side slope
0.5 - 1.0	≤ 1%	40	9" deep maximum, 6 ft wide at top average, 4ft wide at top minimum, 4:1 side slope

Minimum criteria for sizing landscaped swales for parking lot BMPs using xeriscaped surface treatments are provided below. Sizing was based on minimizing flow velocities and maximizing flow paths to encourage settlement of sediment.

BMP swales should be as long as practically feasible to provide as much treatment as possible. The minimum length is 30 ft for tributary areas up to 0.5 acres, and 40 ft for tributary areas of up to 1.0 acre. When incorporating swales into landscaping features, tributary areas to individual BMPs should be kept to less than 0.5 acre whenever possible, and should never exceed 1.0 acre unless hydrologic and hydraulic calculations are provided. BMP swales should have a minimum average top width of 6 ft, with a minimum top width at any point of 4 ft and a maximum flow depth of 9 inches for water quality flows (approximately 2-yr storm). When combined with a larger flood control facility these dimensions should apply to the portion of the swale carrying low flows. When lined with rock, landscaped swale BMPs should have a minimum rock size of 3-inch D_{50}. When combined with a larger flood control facility, rock lining should be sized based on the anticipated flood velocities in the facility.

The Developer may propose to use an alternative size swale, if supporting calculations are submitted.

1503.4.6 Maintenance

Remove any sediment or debris build-up when the depths exceed 3 inches. Inspect for pools of standing water. At regular intervals, re-grade to restore design grade and re-vegetate.

Use of heavy equipment for mowing and removing plants/debris should be avoided to minimize soil compaction. Disturbed areas should be stabilized with seed and mulch, or rock lining, as necessary.

If a spill occurs and hazardous materials contaminate soils in the swales, the affected areas should be removed immediately and disposed of in a manner that complies with federal and state regulations. The swale soils and materials should be replaced as soon as possible.

1503.5 Depressed Median

1503.5.1 Description of Facility

Medians come in the depressed or raised form, or are made flush with the surface of the carriageways. Only the depressed medians are discussed in this section.

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

ACCEPTED PARKING LOT BMPs IN THE LAS VEGAS VALLEY

	Site Design Measures	Treatment Control Measures	Source Control Measures	Site Maintenance Measures	Code Measures
Usage	• Site design measures accept drainage from impervious parking area to trap pollutants prior to stormwater leaving the site	• Infrastructure accepts site runoff and removes pollutants prior to stormwater leaving site	• Onsite control to reduce pollutants from reaching site design and treatment control measures	• Maintenance and pollution prevention measure to keep pollutants from the site design and treatment control measures.	• Pollution prevention associated with typical parking area appurtenances and activities, to keep potential pollutants from contacting stormwater
Measures	• Minimize Directly Connected Impervious Areas • Landscape Drainage Swale • Depressed Median • Depressed Landscaping • Buffer Strip • Pervious Overflow Parking (modular pavers)	• Sand / Media Filers • Oil & Water Separator • Onsite Water Quality Basin (no infiltration)	• Proposed use & disposal of sorbents • Proposed waste handling & disposal	• Building and Ground Maintenance • Parking Lot Sweeping • Sidewalk cleaning	• Trash Storage Areas • Vehicle & Equipment Washing Areas • Loading Dock Areas • Minimize Parking Requirements
Benefits	• Lower cost than treatment control • Easier construction than treatment control • Lower maintenance than treatment control • Easy to incorporate in most site plans	• Compact design allows for installation in small areas • Relatively efficient removal of many pollutants of concern	• Control measure to prevent pollutants from leaving site	• Aesthetics • Pretreatment control for Site Design and Treatment Control	• Reduce pollutants from high potential sources • Low implementation costs • Close gaps in exiting regulations

Revision	Date

REFERENCE: MWH

Table 1501

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

PARKING LOT BMP DESIGN REQUIREMENTS BY PARKING LOT CATEGORY

Parking Lot Category	BMP Requirement	Total Site Size	Parking Lot Size	Example BMP
Small	None	< 1 acre	Not Applicable	None specifically required. Developer has the option to install any BMPs listed in the Medium or Large Categories.
Medium (minor potential impacts on MS4)	Disconnect at least 75% of parking lot and contributing building area. Design based on accepted minimum standards.	> / = 1 acre	≤ 1 acre	Depressed medians Depressed planter areas Modular pavers Buffer strips Disconnect roof drains Developer has the option to install any BMPs listed in the Large Category.
Large (major potential impacts on MS4)	Provide treatment BMPs for at least 75% of parking lot and contributing building area. Design for 85th percentile storm. Provide supporting hydrologic and hydraulics calculations for BMP design.	≥ 1 acre	> 1 acre	Depressed medians Depressed planter areas Modular pavers Buffer strips Disconnect roof drains Xeriscaped swales Rock swales Retention ponds (if no adverse impacts) Settling basins Sand filters Sand/oil separators

Revision	Date

REFERENCE: MWH

Table 1502

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

FEASIBLE LID MEASURES IN THE LAS VEGAS VALLEY NDSR PROGRAM

LID Category	Specific Measure or Practice	Limitations
Minimize directly connected impervious area	Minimize overall impervious area	-
	Direct runoff onto properly designed unpaved surfaces	-
	Disconnect rooftop drains	-
Parking Lot Design	Depressed medians	Only outside Selenium Management Area; Xeriscaping only
	Buffer strips	Xeriscaping only
	Modular pavers	-
	Minimize parking requirements	-

Revision	Date

REFERENCE: MWH

Table 1503

BMP SWALE CALCULATION

(INTERIM / DEVELOPED CONDITIONS)

BMP Swale
Worksheet for Triangular Channel

Project Description	
Worksheet	BMP Swale
Flow Element	Triangular Char
Method	Manning's Forn
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.031	
Slope	.005000	ft/ft
Left Side Slope	4.00	H : V
Right Side Slope	4.00	H : V
Discharge	2.00	cfs

NDZ Flow (100yr)

Results		
Depth	0.58	ft
Flow Area	1.4	ft²
Wetted Perim	4.82	ft
Top Width	4.68	ft
Critical Depth	0.43	ft
Critical Slope	0.024249	ft/ft
Velocity	1.46	ft/s
Velocity Head	0.03	ft
Specific Energ	0.62	ft
Froude Numb	0.48	
Flow Type	Subcritical	

Flow completely conveyed

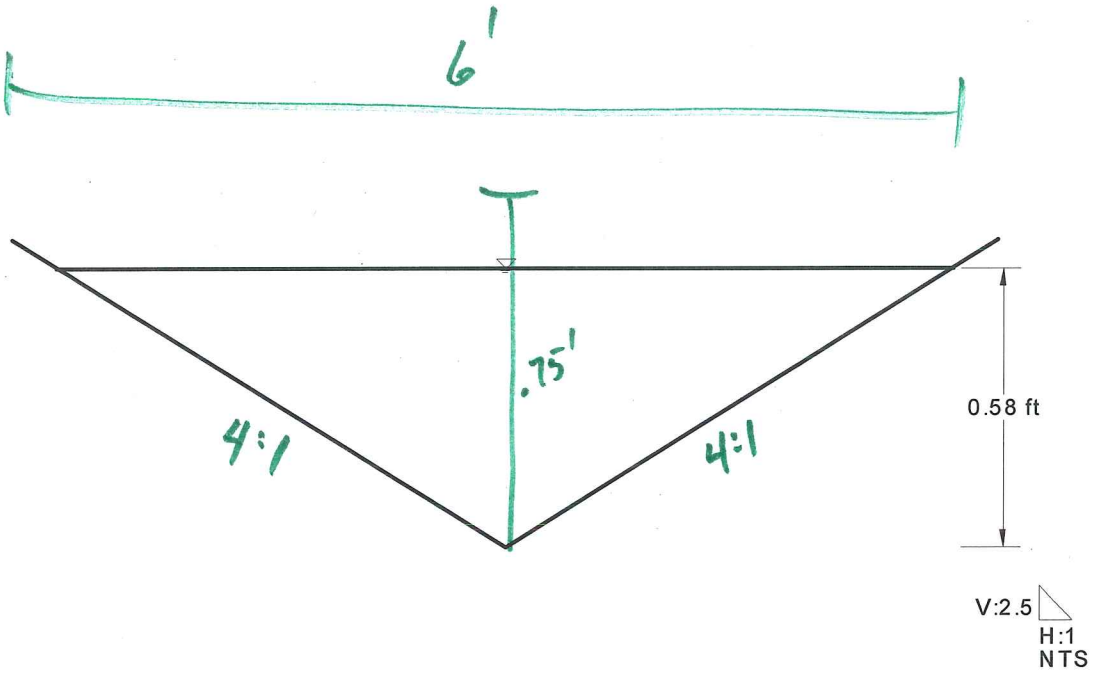
Non-erosive

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

BMP Swale
Cross Section for Triangular Channel

Project Description	
Worksheet	BMP Swale
Flow Element	Triangular Char
Method	Manning's Forr
Solve For	Channel Depth

Section Data		
Mannings Coeffic	0.031	
Slope	005000	ft/ft
Depth	0.58	ft
Left Side Slope	4.00	H : V
Right Side Slope	4.00	H : V
Discharge	2.00	cfs



© Haestad Methods, Inc.

Lochsa Engineering
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666
Project Engineer: Hani Noshi

MANNING'S CALCULATION

Manning's Calculation

7-11 @ SEC CRAIG AND RANCHO Date: September, 2018

Calculated By: Chris Blake

From Section 705.4.4 of Hydrologic Criteria and Drainage Design Manual (HCDDM)
Equation 732:

n = 0.0395(D50)^1/6

n = Manning's coefficient
D50 = Mean stone size in ft, rock size for which 50% (by weight) of the riprap is smaller

Solve for n: D50= 3.0 inches

n = 0.0395(D50)^1/6

D50= 0.250 ft

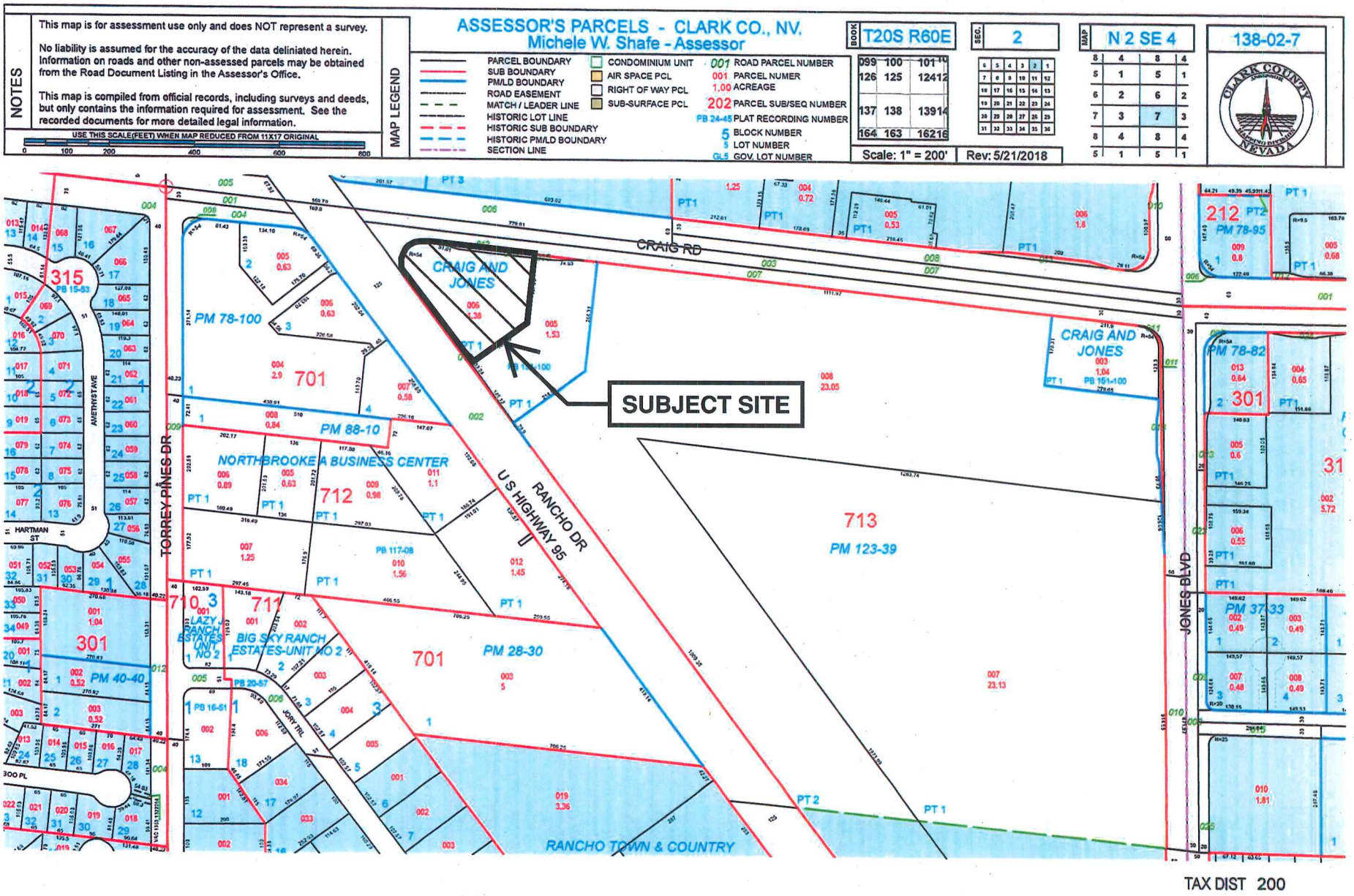
n = **0.031** <<<< Manning's n-value for 3-inch Loose Riprap

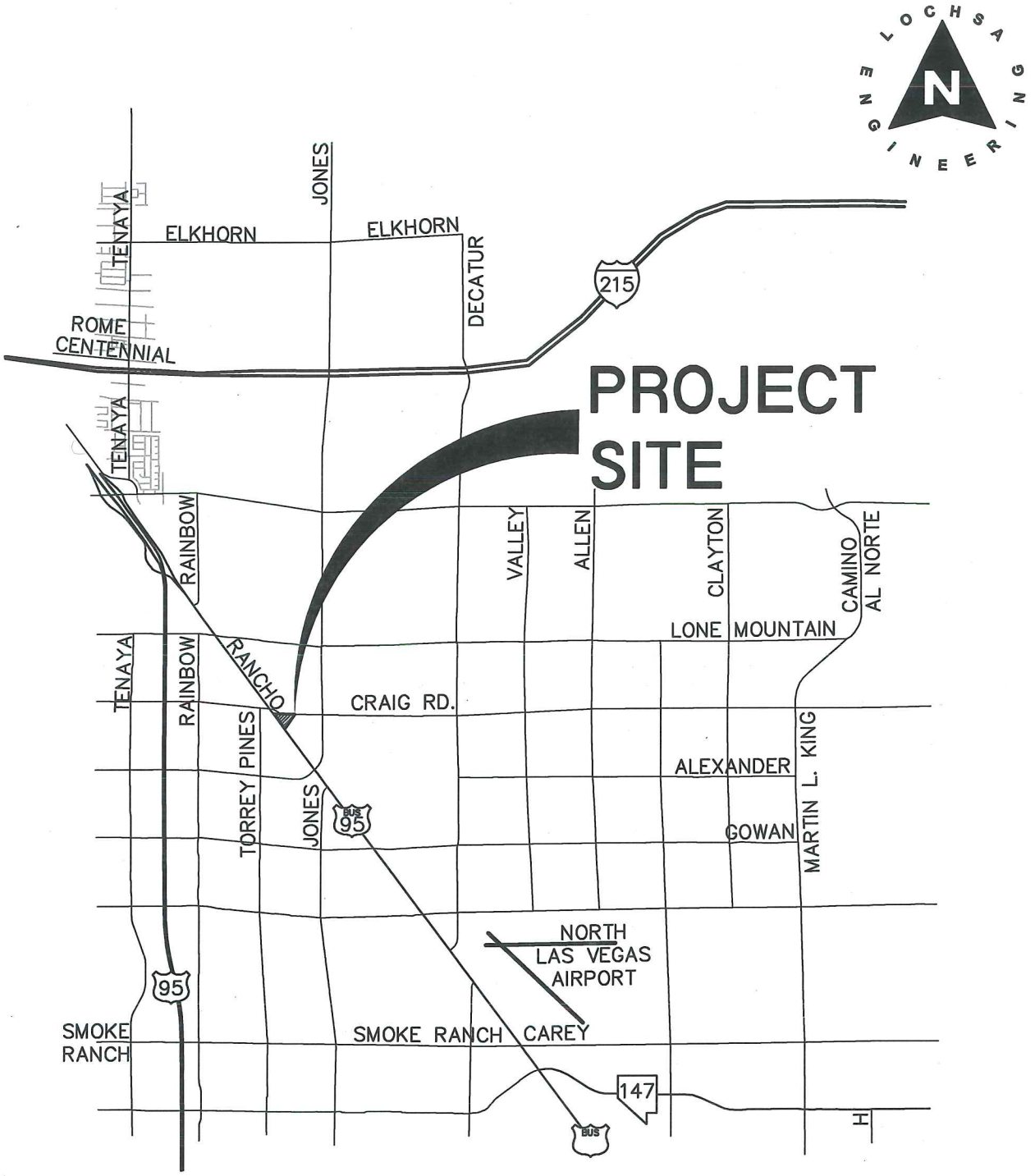


FOR BMP SWALES

APPENDIX C

FIGURES

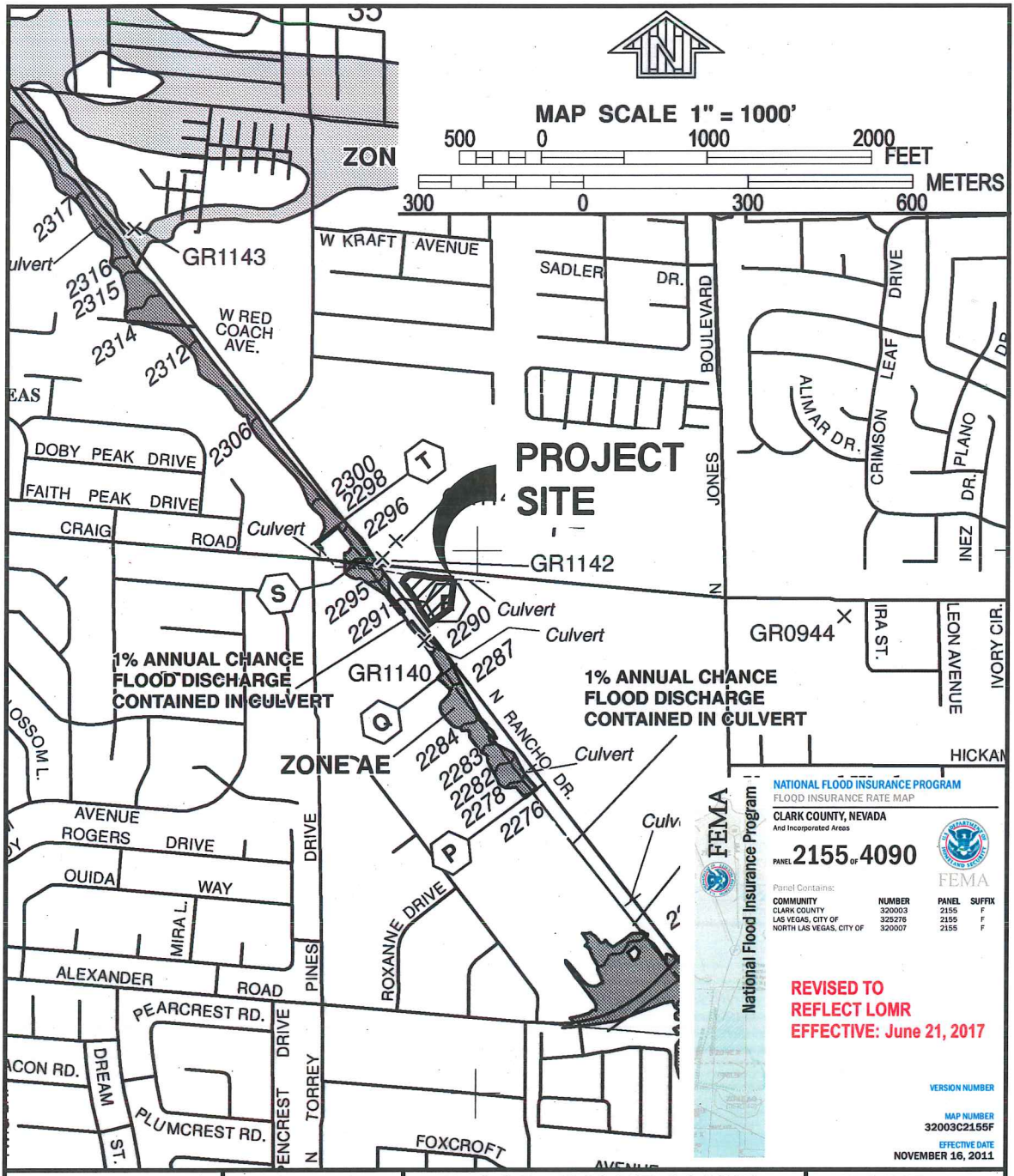

NOTES
This map is for assessment use only and does NOT represent a survey.
No liability is assumed for the accuracy of the data deliniated herein. Information on roads and other non-assessed parcels may be obtained from the Road Document Listing in the Assessor's Office.
This map is compiled from official records, including surveys and deeds, but only contains the information required for assessment. See the recorded documents for more detailed legal information.
USE THIS SCALE(FEET) WHEN MAP REDUCED FROM 11X17 ORIGINAL
0 100 200 400 600 800
MAP LEGEND
ASSESSOR'S PARCELS - CLARK CO., NV.
Michele W. Shafe - Assessor
PARCEL BOUNDARY
SUB BOUNDARY
PM/LD BOUNDARY
ROAD EASEMENT
MATCH / LEADER LINE
HISTORIC LOT LINE
HISTORIC SUB BOUNDARY
HISTORIC PM/LD BOUNDARY
SECTION LINE
CONDOMINIUM UNIT
AIR SPACE PCL
RIGHT OF WAY PCL
SUB-SURFACE PCL
001 ROAD PARCEL NUMBER
001 PARCEL NUMER
1.00 ACREAGE
202 PARCEL SUB/SEQ NUMBER
PB 24-45 PLAT RECORDING NUMBER
5 BLOCK NUMBER
5 LOT NUMBER
GL5 GOV. LOT NUMBER
BOOK T20S R60E
SEC. 2
MAP N 2 SE 4
138-02-7
Scale: 1" = 200'
Rev: 5/21/2018
CLARK COUNTY NEVADA
SUBJECT SITE
CRAIG RD
CRAIG AND JONES
PM 78-100
PM 88-10
NORTHBROOKE A BUSINESS CENTER
PM 78-82
PM 78-95
PM 123-39
PM 28-30
PM 40-40
PM 37-33
PB 151-100
PB 117-08
PB 20-57
PB 16-51
PB 15-83
TORREY PINES DR
AMETHYST AVE
HARTMAN ST
RANCHO DR
US HIGHWAY 95
JONES BLVD
LAZY "J" RANCH ESTATES UNIT NO 2
BIG SKY RANCH ESTATES-UNIT NO 2
JORY TRL
RANCHO TOWN & COUNTRY
315
301
712
711
710
701
713
212
TAX DIST 200



VICINITY MAP

NOT TO SCALE

DRAWN BY: JMD	SCALE: N.T.S.	VICINITY MAP (FIGURE 1)	PROJECT No.: 181119
CHECKED BY: CB	DATE: 8/30/18		SHEET No. 1
Lochsa engineering 6345 South Jones Blvd. Suite 100 Las Vegas, NV 89118 Phone (702) 365-9312 - Fax (702) 365-9317		7-11 SEC CRAIG & RANCHO	SHEET 1 OF 1



DRAWN BY: JMD	SCALE: 1"=1000'	**FLOOD INSURANCE RATE MAP (FIGURE 2)**	PROJECT No.: 181119
CHECKED BY: HMN	DATE: 8/22/18		SHEET No. **2**

Lochsa engineering
6345 South Jones Blvd. Suite 100
Las Vegas, NV 89118
Phone (702) 365-9312 - Fax (702) 365-9317

7-11 SEC CRAIG & RANCHO

SHEET 1 OF 1

REGIONAL FLOOD CONTROL DISTRICT

2008
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE

FIGURE H-20
HYDROLOGIC SUMMARY

LEGEND

- Ultimate Development Boundary
- Watershed Boundary
- Subbasin Boundary
- Drought Ordinance Boundary
- Flow Arrows

Flood Control Facilities

- Existing Facilities
- Category A Proposed Facilities
- Category B Proposed Facilities
- Category A Remove & Replace/ Parallel Facilities
- Category B Remove & Replace/ Parallel Facilities

Type Hydrologic Soil Groups

- A Low Runoff Potential
- B Moderately Low Runoff Potential
- C Moderately High Runoff Potential
- D High Runoff Potential/Rock Outcrops

Typical Land Use

- 1 Undeveloped Land, Open Desert
- 2 Parks, Golf Courses
- 3 Rural
- 4 / 14* Low Density Residential
- 5 / 15* Medium Density Residential
- 6 / 16* High Density Residential
- 7 / 17* Public Facility, Residential
- 8 / 18* Very High Density Residential
- 9 / 19* Commerical, Retail, Casino, High Rise Condominiums
- 10 / 20* Light Industrial
- 11 / 21* Heavy Industrial
- 12 / 22* Schools
- 13 Lakes

* Drought Ordinance Applied

N

0 500 1,000 2,000 3,000
Feet

Scale: 1 inch = 2,000 feet

Refer to Figure G-2 for Aerial Source(s)

US95 I-15 I-215

PBSJ PB

REGIONAL FLOOD CONTROL DISTRICT

2013
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE

FIGURE F- 20
FLOOD CONTROL FACILITIES

LEGEND

- Ultimate Development Boundary
- Existing Facilities
- Category A Proposed Facilities
- Category B Proposed Facilities
- Local Existing Facilities
- Local Proposed Facilities
- Detention Basin

- Stormdrain
- Lined Channel
- Unlined Channel
- Levee/Dike
- Natural Wash/Floodway
- ID-Mile Separator

Remove & Replace/Parallel Facilities

Category A	Category B
Channel	Channel
Stormdrain	Stormdrain

N

0 500 1,000 2,000 3,000
Feet

Scale: 1 inch = 2,000 feet

Refer to Figure G-2 for Aerial Source(s)

US95 I-15 I-215

1	2	3						A1	A2		
4	5	6						A3	A4		
	7	8	9	10				A5	A6		
11	12	13	14	15	16	17					
	18	19	20	21	22	23					
	24	25	26	27	28						
	29	30	31	32	33	34					
	35	36	37	38	39	40					
	41	42	43	44	45	46					
	47	48	49	50	51	52					
	53	54	55	56							
	57	58	59								

SUBJECT SITE

GOAL0111

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
ANWE		**ANN ROAD CHANNEL WEST**						
0000	E	12' X 12' RCB	1400	2214	CNN043-C	CWEST3	3.41	0.66
0027	E	14' X 9' RCB	203	2214	CNN043-C	CWEST3	3.41	0.77
0031	E	12' X 10' RCB	2362	2214	CNN043-C	CWEST3	3.41	1.40
0076	E	16' X 8' RCB	350	2214	CNN043-C	CWEST3	3.41	0.93
0082	E	12' X 11' RCB	2217	1947	CNW3B2-C	CWEST3	2.99	0.71
0122	E	12' X 10' RCB	260	1947	CNW3B2-C	CWEST3	2.99	0.71
0127	E	10' X 8' RCB	1450	1947	CNW3B2-C	CWEST3	2.99	2.55
0157	E	10' X 9' RCB	1112	1257	CNW2D2-C	CWEST3	1.95	1.13
0177	E	12' X 10' RCB	2797	1257	CNW2D2-C	CWEST3	1.95	0.39
0232	E	12 'X 8' RCB	714	1257	CNW2D2-C	CWEST3	1.95	0.43
0245	E	10' X 9' RCB	1721	993	CNW2D1-C	WEST3	6.84	0.80
0279	E	10' X 9' RCB	553	743	2CNW2B5C	WEST3	6.37	0.80
0290	E	8' X 8' RCB	2050	743	2CNW2B5C	WEST3	6.37	0.70
CNEA		**CENTENNIAL PKWY CHANNEL EAST**						
0123	E	14' X 6' RCB	1585	1457	CNN093-C	WEST3	1.67	0.92
0153	E	14' X 6' RCB	1125	1457	CNN093-C	WEST3	1.67	1.34
0175	E	15' X 6' RCB	125	1174	CNN078-C	WEST3	1.35	5.66
0176	E	Conc Chnl 15'W 6.5'D 0:1 SS	540	1174	CNN078-C	WEST3	1.35	0.70
CNWE		**CENTENNIAL PKWY CHANNEL WEST**						
0000	E	2: 27' X 10' RCB	309	4465	CNW3D3-C	WEST3	6.41	1.38
0005	E	4: 13.5' X 10' RCB	762	4465	CNW3D3-C	WEST3	6.41	1.10
0020	E	4: 13' X 10' RCB	310	4465	CNW3D3-C	WEST3	6.41	2.57
0026	E	4: 13.5' X 9' RCB	750	4465	CNW3D3-C	WEST3	6.41	0.61
0045	E	Conc Chnl 56'W 8'D 0:1 SS	1575	4465	CNW3D3-C	WEST3	6.41	0.61
0071	E	3: 18' X 8' RCBC @ Bradley	300	4465	CNW3D3-C	WEST3	6.41	0.61
0075	E	Conc Chnl 54'W 8'D 0:1 SS	775	4465	CNW3D3-C	WEST3	6.41	0.42
0110	E	Conc Chnl 54'W 9'D 0:1 SS	620	4382	2CW3B4-C	WEST3	6.15	0.42
0129	E	3: 18' X 8' RCB	2451	4382	2CW3B4-C	WEST3	6.15	0.40
0150	E	Conc Chnl 40'W 9.5'D 0:1 SS	2279	4233	CNW3B3-C	WEST3	5.64	0.42
0173	E	3: 18' X 8' RCBC @ Torrey Pines	200	4233	CNW3B3-C	WEST3	5.64	0.42
0176	E	Conc Chnl 40'W 9'D 0:1 SS	150	4233	CNW3B3-C	WEST3	5.64	0.41
0189	E	Conc Chnl 36'W 10'D 0:1 SS	1200	4067	CNW2D4-C	WEST3	5.15	0.42
GOA2		**GOWAN OUTFALL - ALEXANDER BRANCH**						
0000	P1	8' X 5' RCB	2281	523	CPT41-C	ALLGOW3	0.61	0.90
GOAL		**GOWAN OUTFALL - ALEXANDER ROAD FACILITIES**						
0000	P1	10' X 9' RCB	5280	1461	CPT5A2-C	ALLGOW3	3.23	1.00
0100	P1	10' X 8' RCB	540	1297	CCPT41-C	ALLGOW3	2.89	1.00
0111	P1	10' X 8' RCB	3000	880	CPT2B2	ALLGOW3	2.28	0.83
0168	P1	10' X 8' RCB	4200	880	CPT2B2	ALLGOW3	2.28	0.50
GOCL		**GOWAN OUTFALL - CLAYTON BRANCH**						
0000	P1	9' X 8' RCB	6785	814	CPT2B-1	ALLGOW3	1.11	0.61
GOCR		**GOWAN OUTFALL - CRAIG ROAD**						
0000	E	Conc Chnl 20'W 7'D 2:1 SS	1380	3101	CPT3D-3	ALLGOW3	5.78	1.06
0022	E	2: 8' X 8' RCB	3000	1120	CPT4C-2	ALLGOW3	1.75	0.50
0080	E	120" RCP	5850	995	CPT4C-1	ALLGOW3	1.50	0.50
0180	E	114" RCP	350	238	PT4B3-C	ALLGOW3	0.28	0.30
0201	E	96" RCP	1090	238	PT4B3-C	ALLGOW3	0.28	0.35
GOLO		**GOWAN OUTFALL - LONE MTN. ROAD BRANCH**						
0000	E	72" RCP	1370	308^	CPT2AD-1^	ALLGOW3	3.28	0.53
0001	E	13' X 8' RCB	1370	1433^	CPT2AD-1^	ALLGOW3	3.28	0.45
0025	E	16' X 8' RCB	1464	1741	CPT2AD-1	ALLGOW3	3.28	0.39
0052	E	16' X 8' RCB	2564	1741	CPT2AD-1	ALLGOW3	3.28	0.42
0100	E	16' X 8' RCB	2732	1605	C2AC2-C	ALLGOW3	2.96	0.37
0152	E	10' X 10' RCB	700	1605	C2AC2-C	ALLGOW3	2.96	0.71
0165	E	10' X 8' RCB	3300	1415	CPT2AB2	ALLGOW3	2.59	1.21
0228	E	10' X 8' RCB	1300	1244	C2AB1C	ALLGOW3	2.31	1.00
0253	E	10' X 6' RCB	1200	986	CPT3AC1	ALLGOW3	2.10	1.25
0275	E	8' X 6' RCB	3000	590	CPT3AA2	ALLGOW3	1.16	0.77

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
GOOF		**GOWAN OUTFALL FACILITIES**						
0000	E	Conc Chnl 20'W 7'D 2:1 SS	2500	5233	CPT-2B-3	GW5SC	14.66	1.25
0040	E	Conc Chnl 20'W 7'D 2:1 SS	1900	5058	CCPT2C1*	GW4SC	11.84	0.60
0074	E	2: 16' X 7' RCBC @ Camino Al Norte	131	5058	CCPT2C1*	GW4SC	11.84	1.30
0077	E	Conc Chnl 20'W 7'D 2:1 SS	3157	5058	CCPT2C1*	GW4SC	11.84	1.40
0146	E	3: 12' X 5' RCBC @ Clayton	150	4014^	CCPT2C1*^	GW4SC	11.84	1.33
0147	P1	Add 1: 12' X 7' RCBC @ Clayton	150	1044^	CCPT2C1*^	GW4SC	11.84	1.33
0149	E	Conc Chnl 20'W 7'D 2:1 SS	1228	5058	CCPT2C1	GW4SC	11.84	1.13
0150	E	Conc Chnl 20'W 7'D 2:1 SS	612	4772	CCPT3D-3	GW4SC	10.86	1.13
0162	E	Confluence Structure	678	4772	CCPT3D-3	GW4SC	10.86	0.90
0196	E	37.66' X 5.66' Bridge @ Simmons	112	3101	CPT3D-3	ALLGOW3	5.78	0.90
0198	E	14' X 6' RCB	1344	1164^	CPT4C-3^	GW3SC	5.85	0.41
0199	P1	Add 1: 24' X 6' RCB	1171	1581^	CPT4C-3^	GW3SC	5.85	0.40
0200	E	24' X 6' RCB	173	1581^	CPT4C-3^	GW3SC	5.85	0.89
0224	P1	1: 20' X 6' RCB and 1: 14' X 6' RCB	2700	2745	CPT4C-3	GW3SC	5.85	0.40
0275	P1	1: 16' X 8' RCB and 1: 14' X 6' RCB	515	2582	CPT5C-3	GW3SC	5.59	0.40
0285	P1	2: 14' X 8' RCB	2650	2582	CPT5C-3	GW3SC	5.59	0.45
0325	P1	2: 14' X 8' RCB	2650	2458	CPT5C-2	GW3SC	5.36	0.37
0375	P1	2: 12' X 8' RCB	2700	2375	CPT5C-1	GW3SC	5.17	0.56
0427	E	96" RCP	1510	630	DGOW2A	GW3SC	1.38	0.47
0485	E	90" RCP	1080	630	DGOW2A	GW3SC	1.38	0.47
0486	E	8' X 5' RCB	3300	630	DGOW2A	GW3SC	1.38	0.60
0511	E	8' X 5' RCB	8390	699	CPT6B-C	GW3SC	1.08	0.50
LV03		**CLAYTON STREET CHANNEL**						
0000	E	33' X 16' RCBC @ Hammer	400	1044	CNN057-C	WEST3	1.22	0.42
0006	E	Conc Chnl 9'W 9.4'D 1.5:1 SS	1300	1044	CNN057-C	WEST3	1.22	0.42
0030	E	2: 9' X 7' RCBC @ Ann	120	1044	CNN057-C	WEST3	1.22	0.42
0031	E	Conc Chnl 8'W 8.1'D 1.5:1 SS	2600	757	CNN054-C	WEST3	0.81	0.40
0081	E	2: 10' X 7' RCBC @ Tropical	100	757	CNN054-C	WEST3	0.81	0.42
0082	E	Conc Chnl 7'W 7.1'D 1.5:1 SS	2444	757	CNN054-C	WEST3	0.81	2.80
0128	E	Conc Chnl 7'W 7.1'D 1.5:1 SS	167	257	1/2NN052-C	WEST3	0.55	2.80
0129	E	2: 10' X 6' RCB	801	257	1/2NN052-C	WEST3	0.55	1.60
0131	E	10' X 6' RCB	665	257	1/2NN052-C	WEST3	0.55	1.28
LV05		**WESTERN TRIBUTARY AT ALEXANDER RD**						
0131	E	Conc Chnl 28'W 3'D 3:1 SS	1300	567	CLV99B-3	WEST3	0.64	0.76
LV06		**WESTERN TRIBUTARY AT CRAIG RD**						
0053	E	16' X 6' RCAP	782	1080	CLV99A-3	WEST3	1.31	1.56
0063	E	14' X 6' RCAP	526	1080	CLV99A-3	WEST3	1.31	1.88
0075	E	12' X 6' RCB	1608	1080	CLV99A-3	WEST3	1.31	0.72
0105	E	2: 8' X 6' RCBC @ Revere	158	1080	CLV99A-3	WEST3	1.31	1.71
0107	E	Conc Chnl 17.3'W 6'D 0:1 SS	140	1080	CLV99A-3	WEST3	1.31	3.79
0110	E	Conc Chnl 12'W 5.5'D 2:1 SS	2451	1080	CLV99A-3	WEST3	1.31	0.87
0147	E	12' X 6' RCBC @ Alexander	150	629	CLV99A-2	WEST3	0.74	1.16
LVMD		**LAS VEGAS WASH - MIDDLE**						
1877	E	Conc Chnl 30'W 10'D 1:1 SS	1570	6423	CNN104-C	WEST5	44.33	1.10
1905	E	Conc Chnl 12'W 10'D 1.65:1 SS	2440	3245	CNN086-C	WEST5	29.30	1.00
1953	E	2: 24' X 10' RCBC @ Camino Al Norte	145	3245	CNN086-C	WEST5	29.30	0.94
1954	E	Conc Chnl 32'W 7'D 2:1 SS	1587	3245	CNN086-C	WEST5	29.30	0.99
1984	E	Transition Structure	550	3221	LOWERDB	CWEST5	19.67	0.99
2048	E	68,000 cfs PMF Spillway		68000	LOWERIN	CWEST5	19.67	
2049	E	4: 7' X 7' RCB Outlet	200	3221	LOWERDB	CWEST5	19.67	
2050	E	700 ac-ft Lower Las Vegas Wash Detention Basin		6729	LOWERIN	CWEST5	19.67	
2052	P1	Conc Chnl 50'W 6'D 0:1 SS	240	6636	2C057-C	CWEST5	19.28	3.11
2053	P1	Conc Chnl 60'W 12'D 0:1 SS	690	6636	2C057-C	CWEST5	19.28	0.15
2054	P1	Conc Chnl 60'W 12'D 0:1 SS	260	6636	2C057-C	CWEST5	19.28	3.80
2055	P1	Conc Chnl 60'W 12'D 0:1 SS	165	6636	2C057-C	CWEST5	19.28	9.10
2060	E	4: 12.75' X 16' RCBC @ Clayton	144	6171	2C044-C	CWEST5	18.06	0.15
2061	E	Conc Chnl 54'W 16'D 0:1 SS	425	6171	2C044-C	CWEST5	18.06	0.15
2062	E	Conc Chnl 54'W 9'D 0:1 SS	1200	6171	2C044-C	CWEST5	18.06	1.35
2089	E	Conc Chnl 54'W 9'-9.5'D 0:1 SS	908	6171	2C044-C	CWEST5	18.06	0.50
2124	E	2: 26.5' X 10' RCBC @ Simmons	110	6046	2C043-C	CLVMD5	15.94	0.50

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
LVMD		**LAS VEGAS WASH - MIDDLE**						
2125	E	Conc Chnl 54'W 9'D 0:1 SS	1571	6046	2C043-C	CLVMD5	15.94	0.77
2170	E	4: 12' X 10' RCBC @ Ann Road	500	6046	2C043-C	CLVMD5	15.94	1.42
2172	E	Conc Chnl 50'W 10'D 0:1 SS	1289	5734	2C3D4-C*	CLVMD4	11.98	1.15
2192	E	2: 24.5' X 10' RCBC @ Allen	110	5734	2C3D4-C*	CLVMD4	11.98	1.15
2197	E	Conc Chnl 50'W 10'D 0:1 SS	1385	5734	2C3D4-C*	CLVMD4	11.98	1.37
2223	E	50' X 10' RCBC @ El Campo Grande	275	5734	2C3D4-C*	CLVMD4	11.98	1.60
2228	E	Conc Chnl 50'W 10'D 0:1 SS	1600	5734	2C3D4-C*	CLVMD4	11.98	1.83
2266	E	2: 24.5' X 10' RCBC @ Tropical	575	5734	2C3D4-C*	CLVMD4	11.98	0.80
2276	E	Conc Chnl 50'D 10'D 0:1 SS	985	5734	2C3D4-C*	CLVMD4	11.98	0.80
2294	E	2: 24.5' X 10' RCBC @ Ranchhouse	292	5734	2C3D4-C	CLVMD4	11.98	1.04
2300	E	Transition Structure	200	5734	2C3D4-C	CLVMD4	11.98	1.50
2304	E	Conc Chnl 70'W 10'D 0:1 SS	220	5734	2C3D4-C	CLVMD4	11.98	1.50
2308	E	Confluence Structure	480	5734	2C3D4-C	CLVMD4	11.98	0.90
2322	E	2: 15' X 9' RCB	1200	3317	CNW3D4-C	CWEST3	6.88	1.50
2324	E	2: 14' X 8' RCB	5485	3317	CNW3D4-C	CWEST3	6.88	0.40
LVSM		**LAS VEGAS WASH-SIMMONS**						
0000	E	12' X 8' RCB	195	790	CNN044-C	WEST3	0.81	0.63
0006	E	11' X 6' RCB	1005	790	CNN044-C	WEST3	0.81	0.30
0025	E	10' X 6' RCB	1310	790	CNN044-C	WEST3	0.81	0.44
0050	E	9' X 6' RCB	387	530	CNN040-C	WEST3	0.53	0.50
0057	E	8' X 6' RCB	1113	530	CNN040-C	WEST3	0.53	0.54
0084	E	72" RCP	252	530	CNN040-C	WEST3	0.53	1.49
0089	E	60" RCP	1068	235	NN038-C	WEST3	0.24	2.04
0109	E	48" RCP	2003	235	NN038-C	WEST3	0.24	1.91
TREA		**TROPICAL ROAD CHANNEL EAST**						
0134	E	66" RCP	2700	447	CNN095-C	WEST3	0.57	2.10

GOAL0111: 10x8 RCB

** The HEC-1 node shown identifies the controlling concentration point for the associated facility and is located upstream of this facility due to decreasing peak flow with increasing tributary area caused by storm distribution transitions, depth area reduction factors, or attenuation of flow from routing.*

*** As-built or design slopes were used when available. All other slopes are based on existing topography. The user should verify the facility slope listed prior to performing any facility specific analysis.*

^ For parallel facilities, the existing facility flow equals its normal depth capacity, and the proposed parallel facility flow equals the remaining flow (i.e., HEC-1 Node flow = existing facility normal depth capacity + proposed parallel facility flow).

REGIONAL FLOOD CONTROL DISTRICT

2013 LAS VEGAS VALLEY FLOOD CONTROL MASTER PLAN UPDATE

FACILITY INVENTORY FIGURE F - 20

LEGEND

ID (Facility Identifier) AABB
Parent Stream Name
Stream Name
River Mile 0000
Distance Above Confluence with Parent Stream (Miles)
Miles in Hundredths

Existing Facility.....E
Proposed or Modified Facility.....P
Contingency Level
Category B.....P0
Master Plan.....P1
Preliminary Design.....P2
Design.....P3

Bottom Width.....W
Depth.....D
Side Slope, H:V.....SS

Construction Features

Cast in Place Concrete Pipe.....CIPCP
Corrugated Metal Arch Pipe Culvert.....CMAP
Corrugated Metal Pipe Culvert.....CMPC
High Density Polyethylene.....HDPE
Horizontal Elliptical Reinforced Concrete Pipe.....HERCP
Reinforced Concrete Arch Pipe.....RCAP
Reinforced Concrete Arch Culvert.....RCAC
Reinforced Concrete Box.....RCB
Reinforced Concrete Box Culvert.....RCBC
Reinforced Concrete Pipe.....RCP
Reinforced Concrete Pipe Culvert.....RCPC
Storm Sewer Pipe.....SSP

APPENDIX D

REFERENCES

REFERENCE 5

"Master Technical Drainage Study Craig & Rancho"
(DS4824)

Technical Drainage Study
For
Craig & Rancho Master Drainage Study

August 2016

Prepared for:

Pre Rancho Craig, LLC
120 Presidential Way
Woburn, MA 01801



Prepared by:

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

Lochsa Job # 161051

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM				DATE: October 27, 2016
TO: **Land Development Services** Department of Building & Safety				FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT:	Drainage Study for: **Craig & Rancho Master Drainage Study**			**COPIES TO:** Lochsa Engineering
Cross Streets:	SEC of Craig Road & Rancho Drive			Pre Rancho Craig LLC
File Number:	F:\Depot\DSMemos\DS4824B.doc			Bart Anderson, P.E., DevCo
Parcel Number:	138-02-713-002			CCRFCD
Zoning Action:	N/A			NDOT
FEMA Flood Zone	YES	NO	X	
Proposed Storm Drain	YES	NO	X	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1st Submittal	9/7/2016	9/27/2016	Not Approved	$400.00	457513: $400
2nd Submittal	10/17/2016	10/27/2016	See Comments Below	$400.00	461974: $400
			TOTAL FEES (LDDRS):	**$800.00**	----

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

1. The final approval of this master study is for conceptual drainage pattern only. No onsite improvements are being proposed with this master drainage study. No detail site plan had been submitted for site specific drainage analysis. Technical drainage study/studies will be required upon future site specific developments and when final site plans become available.

2. **This drainage study is acceptable in concept**; however, *City of Las Vegas* will not formally accept the study until the *Clark County Regional Flood Control District* (CCRFCD) has issued a letter of concurrence. The engineer should contact the CCRFCD to confirm that they have begun their review.

3. The project proposes to construct facilities and/or increase flows within *Nevada Department of Transportation* (NDOT) right-of-way. The engineer must contact NDOT for encroachment permit for the proposed project.

4. **Sheet C3.01**: Upsize the proposed 18"-lateral to 24"-diameter at the relocated drop inlet near Station 111+00 in *Craig Road*.

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
ays

T/R/S: T20S/R60E/02
AREA L-02

REGIONAL FLOOD CONTROL DISTRICT

Steven C. Parrish, P.E.
General Manager/Chief Engineer

BOARD OF DIRECTORS

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City of Boulder City

December 15, 2016

Mr. Oh Sang Kwon, P.E.
City of Las Vegas Department of Public Works
333 North Rancho Drive
Las Vegas, NV 89106

DISTRICT CONCURRENCE: **CRAIG & RANCHO MASTER DRAINAGE STUDY (DS4824B) (RFCD No. 16-9754)**

Dear Mr. Kwon:

Clark County Regional Flood Control District (District) reviewed Technical Drainage Study dated September 1, 2016, and Addendum No. 1 dated October 17, 2016 for above-mentioned project as submitted by LOCHSA ENGINEERING. In addition, District is in receipt of the Conditional Letter of Acceptance from City of Las Vegas Department of Public Works dated October 27, 2016.

District concurs with acceptance of this Technical Drainage Study by City of Las Vegas Department of Public Works.

District's review of this project was limited to issues of Regional Flood Control Significance as defined in *Uniform Regulations for the Control of Drainage.*

Please be aware that as additional information becomes available and/or restudies of Flood Insurance Studies are performed, information submitted by LOCHSA ENGINEERING may be superseded. Compliance with regulatory elements and design standards specified in *Uniform Regulations for the Control of Drainage* does not imply a guarantee that properties will be free from flooding or flood damage. The District, its officials, or employees assume no liability for information, data, or conclusions presented by consulting engineers. We, therefore, make no warranties, either expressed or implied, in conducting this review.

STEVEN C. PARRISH, P.E.
General Manager/Chief Engineer

BY:

Ching C. Wang, P.E.
Senior Civil Engineer

Abigail Mayrena, P.E., CFM
Principal Civil Engineer

AM:dd

c: Hani M. Nosi, PH.D, P.E., CFM, Lochsa Engineering

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600 S. Grand Central Parkway, Suite 300 • Las Vegas, Nevada 89106-4511
(702) 685-0000 • FAX: (702) 685-0001
Website: http://www.regionalflood.org

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Craig & Rancho Master Drainage Study Date: October 14, 2016

Location of Development: a) Descriptive (Cross Streets) North/South: Jones Boulevard

East/West: Craig Road

b) Section: 2 Township: 20 South Range: 60 East

c) APN : 138-02-713-002

Name of Owner: Pre Rancho Craig LLC (C/O William S. Parris)

Telephone No.: (805) 898 - 2023 Fax No.: (805) 898 - 9913 E-Mail Address:

Address: 120 Presidential Way, Woburn, MA 01801

Contact Person-Name: Hani M. Noshi, Ph.D., P.E., CFM **Telephone No.:** (702) 365-9312

*** E-Mail Address:** hani@lochsa.com **Fax No.:** (702) 365-9317

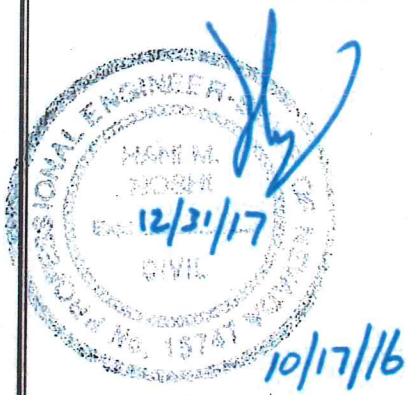
Firm: Lochsa Engineering

Address: 6345 South Jones Boulevard, Suite 100, Las Vegas, Nevada 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: 50.14 +/- Acres Being Developed/Disturbed: 0.0 +/- 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.): Future Commercial Development
5. Approximate upstream land area which drains to the subject site: 5.0 +/- square miles (mainly conveyed through perimeter streets)
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:
   Northeasterly towards Craig Road and easterly towards Jones Boulevard, following existing pattern:
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.**

Local Entity File No.

Revision	Date

REFERENCE:

STANDARD FORM 1

Updated 05/01/2008

utilizes the entire portion of the LOMR HEC-1 model up to the diversion card D5RCHO.

As shown in the attached figures A-1 and A-2 for NDOT Roadway Functional Classification, Craig Road and Rancho Drive are classified as 'Other Principal Arterial'. As shown in the attached Table 3-1 (Roadway Surface Drainage Facilities) from the 2006 NDOT Drainage Manual, the minimum design return frequency for Craig Road and Rancho Drive is the 25-year storm. Therefore, the subject HEC-1 model analyzes the 25-year storm, in addition to the 10- and 100-year storm events.

The 1-ft topographic map is utilized to delineate the subject property into four basins, labeled as NX1(21/31/46cfs, Q10/Q25/Q100), NX2(16/23/34cfs), NX3(15/21/30cfs) and NX4(3/5/7cfs). The delineation of the onsite basins and immediate offsite basin is depicted in Exhibit DR1, labeled as the 'Onsite Drainage Map, Existing Condition'. Onsite basins NX1 and NX2 represents the portion of the site draining easterly and northeasterly towards Jones Boulevard low point. Onsite NX3 represents the portion of the site draining northeasterly towards Craig Road. Onsite NX4 represents the portion of the site draining onto Jones Boulevard, north of the existing high point.

Downstream of our project site

The eastern half of Rancho Drive along the project site is delineated as offsite basins RNCH1(4/5/7cfs) and RNCH2(3/4/6cfs). Similarly, the eastern and western halves of Jones Boulevard draining onto the low point are delineated as basins JONES1(4/5/7cfs) and JONES2(3/4/6cfs). The eastern half of Jones Boulevard draining northerly towards Craig Road is

delineated as offsite basin JONES3(1/2/2cfs). The southern half of Craig Road along the project site is delineated as offsite basins CRAIG1(3/3/5cfs) and CRAIG2(2/2/3cfs).

downstream of our site

As shown in the attached excerpts from Reference 5, the majority of the proposed Murphy Express site was delineated as basin NDA(2/3/4cfs). Since Murphy Express improvements are currently under construction, basin NDA is utilized to represent the existing condition. The subject referenced basin was designed to be intercepted and conveyed into the existing 60"RCP Craig storm drain, through an existing 18"RCP lateral. Thus, referenced basin NDA does not contribute to the surface flows in Craig Road. However, the referenced basin was included in the HEC-1 model.

As shown in the attached output from the HEC-1 model and Exhibit DR1, runoff from RNCH1 is combined with NX1 at CMX1(24/36/53cfs). Similarly, runoff from RNCH2 is combined with NX2 at CMX2(19/27/39cfs). Runoff from CMX1, CMX2 and JONES1 is combined at LOCL-X(45/65/96cfs), which represents the local flows draining towards Jones Boulevard low point from the west. As discussed previously, runoff from the existing 2: 6'x3'RCBCs Rancho culverts is modeled as referenced combination point D5RCHO(20/35/113cfs, DARF= 0.90). Runoff from D5RCHO travels through the site and combine with LOCL-X at combination point TOTL-X(49/81/181cfs), which represents the total flows draining onto Jones Boulevard low point from the west.

The diversion card labeled as JONES-SD(49/79/79cfs) is provided to divert the design flow capacity into the existing 36"/48"RCP Jones storm drain. Thus, the remaining surface flows

exceeding the storm drain capacity is modeled as LOWPNT-X(0/2/102cfs). Runoff from LOWPNT-X is combined with JONES2 at HICKAM-X(3/5/105cfs), which represents the total flows continuing easterly in Hickam Avenue at the intersection with Jones Boulevard.

EXIST. CONDITION (see Ref. Figure DR1)

Runoff from CRAIG1 and CRAIG2 is combined with NX3 at combination point CRG1-X(18/26/36cfs), which represents the total flows conveyed within the southern half of Craig Road along the project site. Runoff from NX4 is combined with JONES3 at combination point JON-X(5/6/9cfs). Runoff from CRG1-X and JON-X is combined at CRG2-X(23/31/44cfs), which represents the total flows conveyed within the southern half of Craig Road at the intersection with Jones Boulevard.

we have accepted & provided reference hydraulic calcs

Normal depth calculations are being provided for Rancho Drive eastern half (sections AA and BB), Craig Road southern half (sections CC and DD) and Jones Boulevard western half (section EE). As shown in the attached FlowMaster output, flows within all perimeter streets are 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. Flows within Rancho Drive and Craig Road also meets the minimum 12-ft dry lane requirement during the 10-year storm events, whereas Jones Boulevard does not meet the minimum 12-ft dry lane requirement.

As stated previously, Rancho Drive and Craig Road are NDOT right-of-way, which is classified as 'Other Principal Arterial' roadway. As shown in the attached excerpts from the '2006 NDOT Drainage Manual', Rancho and Craig are required to satisfy the ½ lane maximum allowable

spread during the 25-year storm events. Therefore, normal depth calculations for the perimeter streets also utilize the 25-year storm events. As shown in the FlowMaster output, Rancho Drive satisfies the NDOT required maximum allowable 25-year spread, whereas the downstream segment of Craig Road does not satisfy the 25-year allowable spread.

our site at upstream of craig/rancho intersection

2.2 Interim Drainage Condition

For interim condition, the offsite flows remain as determined and discussed in the existing condition. **No improvements are being proposed with this Master Drainage Study. However, to establish the future drainage pattern for the ultimate development of the site, the entire property is assumed to be developed in this interim condition. A conceptual grading plan is also being provided to illustrate the recommended future pattern for the subject property.**

The conceptual grading contours are utilized to delineate the subject property into five basins, labeled as ND1(45/60/81cfs), ND2(26/34/46cfs), ND3-1(10/13/17cfs), ND3-2(5/6/8cfs) and ND4(4/6/8cfs). The delineation of the onsite basins and immediate offsite basin is depicted in Exhibit DR2, labeled as the 'Onsite Drainage Map, Developed Condition'. Similar to existing pattern, onsite basins ND1 and ND2 represents the future portion of the site draining easterly and northeasterly towards Jones Boulevard low point. Onsite basins ND3-1 and ND3-2 represent the future portion of the site draining northeasterly towards Craig Road. Onsite basin ND4 represents the future portion of the site draining onto Jones Boulevard, north of the existing high point.

small portion of our site

small portion of site

The perimeter street offsite basins delineation remains as described in the existing

these existing drop inlets, for the existing and ultimate conditions. Since the drop inlets are in sump condition, the calculation utilizes the Orifice Equation for the determination of the required ponding depth. Per the CCRFCD Drainage Design Manual, the calculation assumes the grates are 50% clogged during the storm event. In addition, the calculations assume approximately 60% of the grates' area is blocked by the grate's steel.

Runoff from CRAIG1 is combined with ND3-1 at combination point CRG0-D(12/16/22cfs). Runoff from CRG0-D is combined with CRAIG2 and ND3-2 at combination point CRG1-D(18/24/33cfs), which represents the total flows conveyed within the southern half of Craig Road upon the ultimate development of the subject property. **Comparison between at CRG1-X(18/26/36cfs) and CRG1-D(18/24/33cfs) illustrates that the ultimate development of the subject property will not increase the 10-year, 25-year or 100-year flows within the southern half of Craig Road.** However, if ND3-1 is to drain directly onto Craig Road at CRG0-D, it is expected to further increase the 25-year spread within Craig Road, which may not be acceptable for NDOT. Thus, it is expected that the ultimate development of ND3-1 will either utilize the existing 18"RCP lateral to drain directly into the Craig storm drain, or contain the flows onsite before it drains onto Craig Road near CRG1-X.

Runoff from ND4 is combined with JONES3 at combination point JON-D(6/7/10cfs). Runoff from CRG1-D and JON-D is combined at CRG2-D(24/31/43cfs), which represents the total flows conveyed within the southern half of Craig Road at the intersection with Jones Boulevard upon the ultimate development of the subject property.

Normal depth calculations are being provided for Rancho Drive eastern half (sections AA and BB), Craig Road southern half (sections CC and DD) and Jones Boulevard western half (section EE). As shown in the attached FlowMaster output, flows within all perimeter streets are 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. Flows within Rancho Drive and Craig Road also meets the minimum 12-ft dry lane requirement during the 10-year storm events. Similar to the existing condition, flows within Jones Boulevard at section EE will not meet the minimum 12-ft dry lane requirement. The calculations determined the maximum 10-year flows along Jones Boulevard that will satisfy the 12ft dry lane requirement to be approximately 18cfs. Thus, it is expected that future drop inlet(s) will be proposed along Jones Boulevard to intercept at least 29cfs (i.e. 47cfs -18cfs) during the 10-year storm events.

As stated previously, Rancho Drive and Craig Road are required to satisfy the ½ lane maximum allowable spread during the 25-year storm events. Therefore, normal depth calculations for the perimeter streets also utilize the 25-year storm events. As shown in the FlowMaster output, upon the construction of curbs, Rancho Drive will satisfy the NDOT required maximum allowable 25-year spread at section AA. However, at section BB, the flows at Rancho Road will not meet the 25-year allowable spread. Thus, future on-grade drop inlet(s) is expected to be required along Rancho Drive near section BB to satisfy the maximum allowable spread during the 25-year storm events. The HY-22 program is utilized to provide preliminary sizing of the future drop inlet along Rancho Drive. As shown in the attached HY-22 output, a future 20ft modified type C drop inlet is anticipated near section BB along Rancho Drive. Similar to the existing condition, Craig Road does not satisfy the 25-year allowable spread at section DD.

* Includes referenced flows from the 2009 " Rancho/US 95 LOMR"

Peak Flow Summary
Existing Condition

HEC-1 I.D.	Area (acres)	100-year Flow (cfs)	25-year Flow (cfs)	10-year Flow (cfs)
2C2B3	-	199	36	20
RC2B3	-	197	35	20
5REMAIN	-	84	0	0
D5RCHO	-	113	35	20
RNCH1	2.27	7	5	4
RRNCH1	-	7	5	4
NX1	22.3	46	31	21
CMX1	-	53	36	24
RNCH2	1.94	6	4	3
RRNCH2	-	5	4	3
NX2	14.07	34	23	16
CMX2	-	39	27	19
JONES1	2.2	7	5	4
LOCL-X	-	96	65	45
TOTL-X	-	181	81	49
JONES-SD	-	79	79	49
LOWPNT-X	-	102	2	0
JONES2	2.04	6	4	3
HICKAM-X	-	105	5	3
CRAIG1	1.52	5	3	3
RCRAIG1	-	4	3	2
NX3	11.52	30	21	15
CRAIG2	0.95	3	2	2
CRG1-X	-	36	26	18
NX4	2.35	7	5	3
JONES3	0.71	2	2	1
JON-X	-	9	6	5
CRG2-X	-	44	31	23
NDA^	0.98	4	3	2

Street Flow Summary
(Existing 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 (Within 1/2 ROW) (ft)
Rancho Drive	120	AA	4	2.39	0.37	0.88	40.74
Rancho Drive	120	BB	7	1.77	0.41	0.73	23.88
Craig Road	100	CC	1.5	1.85	0.31	0.57	32.88
Craig Road	100	DD	18	4.70	0.47	2.21	18.18
Jones Boulevard	100	EE	38	3.18	0.79	2.51	5.11

Street Flow Summary
(Existing Condition)
100-year, 6-hour Storm

Street	Right of Way Width (ft)	Hydraulic Cross-Section Identifier	100-Year Flow [Q10] (cfs)	100-year Velocity [v] (fps)	100-year Flow Depth [d] (ft)	100-year Velocity x Depth [v x d]
Rancho Drive	120	AA	7	2.73	0.43	1.17
Rancho Drive	120	BB	13	2.05	0.47	0.96
Craig Road	100	CC	2.5	2.08	0.35	0.73
Craig Road	100	DD	36	5.25	0.58	3.05
Jones Boulevard	100	EE	73	3.91	0.96	3.75

SITE

<1/<1/<1cfs South Half

CRAIG1 1.52 ACRES 3/3/5CFS

CRAIG2 0.95 ACRES 2/2/3CFS

CRAIG RD.

CRG1-X 18/26/36cfs* South Half

CRG2-X 23/31/44cfs South Half

NDA 0.98 ACRES 2/3/4CFS

NX3 11.52 ACRES 15/21/30CFS

NX4 2.35 ACRES 3/5/7CFS

JON-X 5/8/8CFS

JONES3 0.71 ACRES 1/2/2CFS

JONES BLVD.

HIGH POINT

NX1 22.30 ACRES 21/31/46CFS

RNCH1 2.27 ACRES 4/5/7CFS

EX. 6'x3' RCB
(Q100 = 78* CFS)
AS REFERENCED FROM
"RANCHO/US 95 LOMR"

CMX1 24/36/53CFS

JONES-SD 49/78/78CFS*

LOCL-X 45/65/96CFS

TOTL-X* 49/81/181CFS*

LOWPNT-X* 1/2/102CFS*

HICKAM-X* 3/5/105CFS*

MATCHLINE - SEE BOTTOM RIGHT

EX. 6'x3' RCB
(Q100 = 35* CFS)
AS REFERENCED FROM
"RANCHO/US 95 LOMR"

EX. 3'x7' RCB

RNCH2 1.94 ACRES

CMX2 19/27/39CFS

JONES1 2.20 ACRES

JONES2 2.04 ACRES

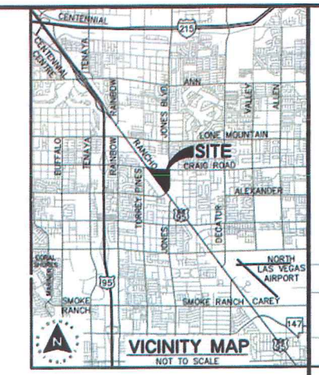
NX2 14.07 ACRES 16/23/34CFS

3/4/6CFS

4/5/7CFS

MATCHLINE - SEE BOTTOM LEFT

EX. 6'x3' RCB
(Q100 = 35* CFS)
AS REFERENCED FROM



GRAPHIC SCALE
100 0 50 100 200
(IN FEET)
1 inch = 100 ft.

DRAINAGE LEGEND

ND1	DRAINAGE BASIN LABEL
•	CONCENTRATION POINT
CMD1	COMBINATION POINT / BASIN BOUNDARY LINE
	OFFSITE BASIN BOUNDARY
2 / 3 / 5	Q10/Q25/Q100 FLOW IN CFS
1 (1.0)(1.2) / 1 (1.0)(1.2)	Q10 (V10)(D10) / Q100 (V100)(D100)
	BASIN FLOW DIRECTION
	COMBINED FLOW DIRECTION
1D	HYDRAULIC CROSS-SECTION
2 / 3	[Q10]N / [Q100]N STORM DRAIN FLOWS IN CFS

LEGEND

CL OR SURVEY LINE	PROPERTY LINE	ROW LINE	EASEMENT LINE	SAWCUT LINE	SCARP LINE	DESCRIPTION:	EXISTING:	PROPOSED:	CONTOUR LINES	EDGE OF PAVEMENT	"A" TYPE CURBS	"L" TYPE CURBS	WALLS	FENCES	AC PAVEMENT	CONCRETE	SPOT ELEVATIONS	SIGNS	MANHOLE W/ DESCRIPTION	MANHOLE DESCRIPTIONS: S = SANITARY SEWER; D = STORM DRAIN; E = ELECTRICAL; T = TELEPHONE	FIRE HYDRANTS	GATE VALVES	REDUCERS	CLEAN OUTS	UTILITY BOX OR VAULT	BACKWATER VALVES	100w HPS STREETLIGHTS	150w HPS STREETLIGHTS	200w HPS STREETLIGHTS	250w HPS STREETLIGHTS
							(2210)	2122									(12.34) BC 12.34									BWV				

ONSITE BASIN MAP
(EXISTING CONDITON)

CRAIG & RANCHO
MASTER DRAINAGE STUDY

Lochsa engineering
6345 South Jones Blvd
Suite 100
Las Vegas, NV 89118
Phone (702) 260-1273
Fax (702) 260-8237
www.lochsa.com

PROJECT No.:	161051
DATE:	08/26/16
SCALE:	1"=100'
DRAWN BY:	HMN
DESIGNED BY:	HMN
CHECKED BY:	HMN

SHEET No. DR1
SHEET 1 2
CLV No. --

DESCRIPTION: | DATE: | BY: | REV.:

* Includes referenced flows from the " Rancho/US 95 LOMR"

Peak Flow Summary
Future Condition

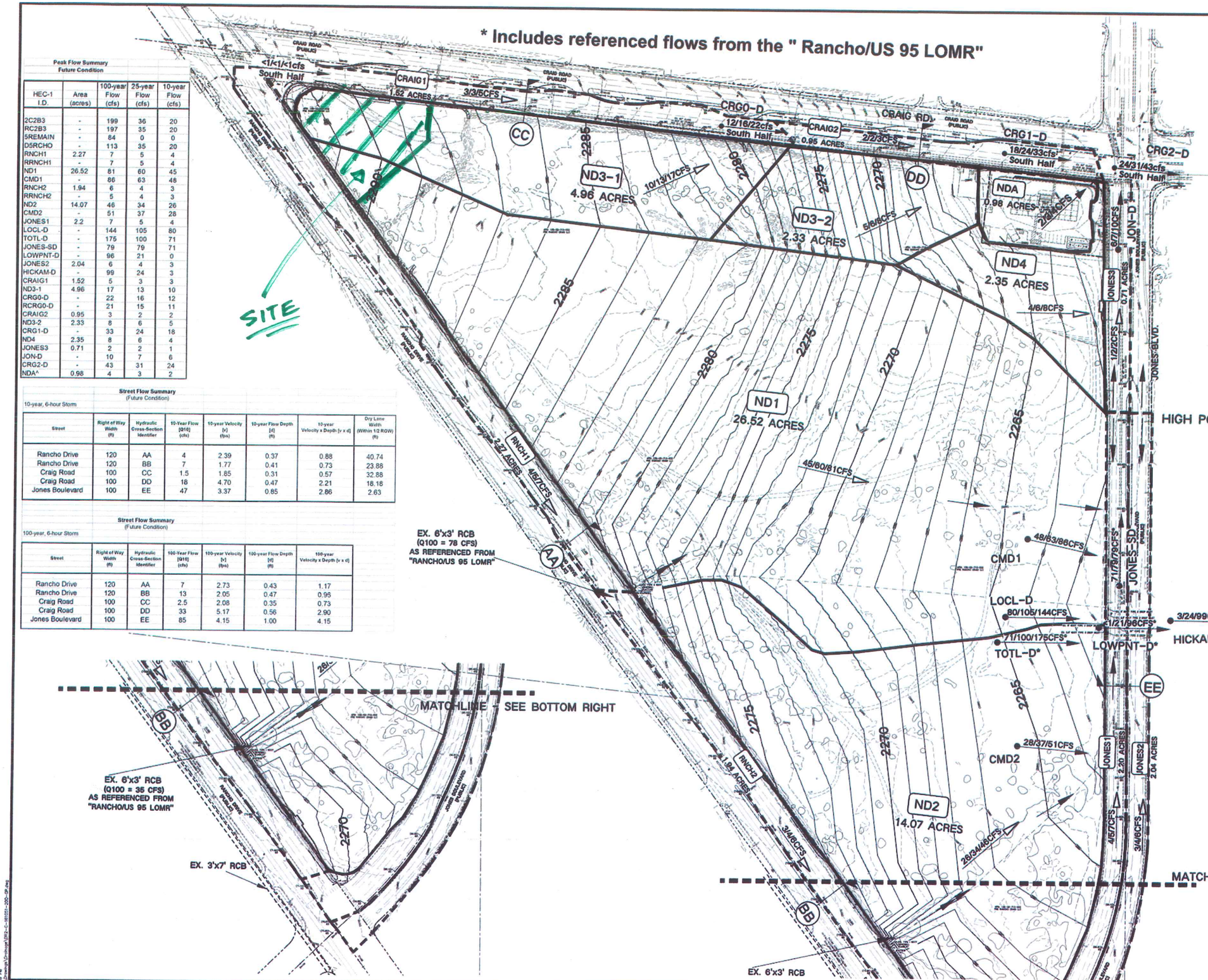
HEC-1 I.D.	Area (acres)	100-year Flow (cfs)	25-year Flow (cfs)	10-year Flow (cfs)
2C2B3	-	199	36	20
RC2B3	-	197	35	20
5REMAIN	-	84	0	0
D5RCHO	-	113	35	20
RNCH1	2.27	7	5	4
RRNCH1	-	7	5	4
ND1	26.52	81	60	45
CMD1	-	86	63	48
RNCH2	1.94	6	4	3
RRNCH2	-	5	4	3
ND2	14.07	46	34	26
CMD2	-	51	37	28
JONES1	2.2	7	5	4
LOCL-D	-	144	105	80
TOTL-D	-	175	100	71
JONES-SD	-	79	79	71
LOWPNT-D	-	96	21	0
JONES2	2.04	6	4	3
HICKAM-D	-	99	24	3
CRAIG1	1.52	5	3	3
ND3-1	4.96	17	13	10
CRG0-D	-	22	16	12
RCRG0-D	-	21	15	11
CRAIG2	0.95	3	2	2
ND3-2	2.33	8	6	5
CRG1-D	-	33	24	18
ND4	2.35	8	6	4
JONES3	0.71	2	2	1
JON-D	-	10	7	6
CRG2-D	-	43	31	24
NDA^	0.98	4	3	2

Street Flow Summary
(Future 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 (Within 1/2 ROW) (ft)
Rancho Drive	120	AA	4	2.39	0.37	0.88	40.74
Rancho Drive	120	BB	7	1.77	0.41	0.73	23.88
Craig Road	100	CC	1.5	1.85	0.31	0.57	32.88
Craig Road	100	DD	18	4.70	0.47	2.21	18.18
Jones Boulevard	100	EE	47	3.37	0.85	2.86	2.63

Street Flow Summary
(Future Condition)
100-year, 6-hour Storm

Street	Right of Way Width (ft)	Hydraulic Cross-Section Identifier	100-Year Flow [Q10] (cfs)	100-year Velocity [v] (fps)	100-year Flow Depth [d] (ft)	100-year Velocity x Depth [v x d]
Rancho Drive	120	AA	7	2.73	0.43	1.17
Rancho Drive	120	BB	13	2.05	0.47	0.95
Craig Road	100	CC	2.5	2.08	0.35	0.73
Craig Road	100	DD	33	5.17	0.56	2.90
Jones Boulevard	100	EE	85	4.15	1.00	4.15





GRAPHIC SCALE
100 0 50 100 200
(IN FEET)
1 inch = 100 ft.

DRAINAGE LEGEND

ND1	DRAINAGE BASIN LABEL
•	CONCENTRATION POINT
CMD1	COMBINATION POINT
	BASIN BOUNDARY LINE
	OFFSITE BASIN BOUNDARY
2 / 3 / 5	Q10/Q25/Q100 FLOW IN CFS
1 (1.0)(1.2) / 1 (1.0)(1.2)	Q10 (V10)(D10) / Q100 (V100)(D100)
	BASIN FLOW DIRECTION
	COMBINED FLOW DIRECTION
1D	HYDRAULIC CROSS-SECTION
2 / 3	[Q10]N / [Q100]N STORM DRAIN FLOWS IN CFS

LEGEND

CL OR SURVEY LINE	EASEMENT LINE	DESCRIPTION:	CONTOUR LINES	EDGE OF PAVEMENT	"A" TYPE CURBS	"L" TYPE CURBS	WALLS	FENCES	AC PAVEMENT	CONCRETE	SPOT ELEVATIONS	SIGNS	MANHOLE W/ DESCRIPTION	MANHOLE DESCRIPTIONS: (S) = SANITARY SEWER, (D) = STORM DRAIN, (E) = ELECTRICAL, (T) = TELEPHONE	FIRE HYDRANTS	GATE VALVES	REDUCERS	CLEAN OUTS	UTILITY BOX OR VAULT	BACKWATER VALVES	100w HPS STREETLIGHTS	150w HPS STREETLIGHTS	200w HPS STREETLIGHTS	250w HPS STREETLIGHTS
PROPERTY LINE	SAWCUT LINE	EXISTING:	(2210)								(12.34) BS, 12.34 BC		S							BWV				
ROW LINE	SCARP LINE	PROPOSED:	2122																	BWV				

©345 South Jones Blvd.
Suite 100
Las Vegas, NV 89116
Phone (702) 365-3572
Fax (702) 365-3317
www.lochsa.com

Lochsa engineering

ONSITE BASIN MAP
(FUTURE CONDITON)

CRAIG & RANCHO
MASTER DRAINAGE STUDY

SHEET
TITLE

PROJECT No.: 161051
DATE: 10/11/16
SCALE: 1"=100'
DRAWN BY: HMN
DESIGNED BY: HMN
CHECKED BY: HMN

SHEET No.
DR2
SHEET 2 2
CLV No.

REV.: DATE: BY: DESCRIPTION:

16/10/2016 4:58 PM
T:\CAD\161051\Drainage\Onsite\161051-C-ONSITE-200-DR.dwg

REFERENCE 6

"Technical Drainage Study Update for WOW Car Wash" (DS #4852)

McCAY ENGINEERING
11700 W. CHARLESTON BLVD., SUITE 170-298
LAS VEGAS, NV 89135
702-860-3897

TECHNICAL DRAINAGE STUDY
FOR WOW CARWASH @ CRAIG & RANCHO
(AKA UPDATE #1 TO THE CRAIG & RANCHO MASTER DRAINAGE STUDY)

LAS VEGAS
November 30, 2016

McCAY ENGINEERING

PREPARED FOR:

S.T. HOLDINGS, LLC
755 YOSEMITE AVE, SUITE J
MERCED, CA 95340

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM			DATE: January 30, 2017
TO: **Land Development Services** Department of Building & Safety			FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT:	Drainage Study for: **WOW Carwash @ Craig & Rancho**		**COPIES TO:** McCay Engineering
Cross Streets:	SEC of Craig Road & Rancho Drive		S. T. Holdings, LLC
File Number:	F:\Depot\DSMemos\DS4852B.doc		Bart Anderson, P.E., DevCo
Parcel Number:	138-02-713-002		CCRFCD
Zoning Action:	SDR-66476		NDOT
FEMA Flood Zone	YES	NO X	
Proposed Storm Drain	YES	NO X	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1st Submittal	12/5/2016	12/21/2016	Not Approved	$400.00	467640: $400
2nd Submittal	1/12/2017	1/30/2017	See Comments Below	$400.00	471841: $400
			TOTAL FEES (LDDRS):	**$800.00**	----

REMARKS:

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

X	is approved subject to conformance to all City standards and the following conditions:
	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.

1. Per ***Condition #7*** of ***TMP-60902***, off-site improvements shown in ***Area 1*** (southeast corner of *Rancho Drive* and *Craig Road*) of the **Phasing Plan** must be constructed or guaranteed prior the issuance of permits for this site.

NOTE: Any future changes to the proposed design (or design assumptions) as outlined in the approved drainage study and attached preliminary grading plan which affect drainage must be addressed in a Drainage Study Update and accepted by the *City of Las Vegas Flood Control Section*. Additionally, conditional acceptance of a drainage study is valid for a period of one (1) year. If the proposed construction has not been completed in that time period, the *City of Las Vegas* reserves the right to require additional conditions and/or submission and acceptance of a complete drainage study update prior to further construction of a project.

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

ays

T/R/S: T20S/R60E/02

AREA L-02

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: **WOW Carwash @ Craig & Rancho** Date: **November 30, 2016**

Location of Development:
a) Descriptive (Cross Streets) North/South: **Rancho Drive**
East/West: **Craig Road**
b) Section: **2** Township: **20S** Range: **60E**
c) APN: **138-02-713-002 (portion of)**

Name of Owner: **S.T. Holdings LLC**

Telephone No.: **209-383-2244** Facsimile No.: _____ Email Address: _____

Address: **755 Yosemite Ave, Suite J Merced CA 95340**

Contact Person Name: **Jeremy McCay** Telephone No: **702-860-3897**

E-mail Address: **jmccay@centurylink.net**

Firm: **McCay Engineering**

Address: **11700 W. Charleston Blvd., Suite 170-298, Las Vegas, NV 89135**

Type of Land Development/Land Disturbance Process:

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

1. Total Owned Land Area: At Site: **1.53 ac** Being Developed/Disturbed: **1.53 ac**
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? **Approx. 1.3 acres**
6. Has the site drainage been evaluated in the past? [YES] NO If yes, please identify documentation:
   The TDS for Craig & Rancho Master Drainage Study (DS 4824)
7. If known, please briefly identify the proposed discharge point(s) of runoff from the site:
   Craig Road, Rancho Drive, and the adjacent property to the east conforming to the approved study.
8. Briefly describe your proposed schedule for the subject project: **As soon as possible**

PROFESSIONAL ENGINEER STATE OF NEVADA
JEREMY S. McCAY
EXP. 12-31-17
CIVIL
No. 15797
Engineer's Seal
12/5/16

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.

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

Revision	Date

Local Entity File No.

Reference: McCay Engineering Project #15164 | **STANDARD FORM 1**

Study Overview and Purpose

McCay Engineering has prepared this drainage study as an update to the approved Technical Drainage Study for Craig & Rancho Master Drainage Study. The original study was approved on October 27, 2016. This study addresses the improvements for the new carwash (approximately 1.53 acres). The improvements include a new building along with pavement for parking. The proposed onsite grading conforms to the approved drainage study.

Location

The project area is within the Southeast Quarter (NE 1/4) of Section 2, Township 20 South, Range 60 East, Mount Diablo Meridian, Las Vegas, Nevada. The site is located on the southeast corner of Craig Road and Rancho Drive (portion of APN 138-02-713-002). See Figure 1 and 1A, *Vicinity Map* and *APN Map*.

Existing Site Description

The WOW Carwash @ Craig & Rancho site is currently undeveloped. The new building and improvements encompass approximately 1.53 acres of the total parcel. The general area slopes to the southeast at approximately 1 to 2 percent. The properties adjacent to the site are predominately commercial properties. See Figure 2, *Site Description Map*.

FEMA Floodplain Information

A review of the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) Community-Panel Number 32003C2155F, effective date November 16, 2011 indicates the site is located within a FEMA Zone 'X'. A Zone 'X' is described by FEMA as areas outside of the 0.2% annual chance floodplain. A map depicting the FEMA flood zones in the vicinity of the site is included in the appendix of this study. (Figure 3- FIRM Map)

CCRFCD Master Plan Information

As shown on Figure F-20 from the *Flood Control Master Plan Update of the Las Vegas Valley* (see Figures 4 and 5 in the Appendix), prepared by PBS&J, Louis Berger Group, etc., the subject site is adjacent to a proposed Master Plan Flood Control Facility. The Gowan Outfall—Alexander Road Facilities (GOAL 0111) is proposed along the frontage of the project in Rancho Drive. The facility will be constructed as a 10' x 8' RCB in the future. Figure H-20 has also been provided (see Figure 6 in the appendix) and the site is a part of basin PD16A3-C.

Existing Drainage Description

There is no change to the existing condition from the previous approved study.

Future Drainage Description

The flows in Craig Road and Rancho Drive were determined in the approved Craig & Rancho Master Drainage Study (see reference material). The 10-year, 25-year, and 100-year flows in Craig Road were quantified in the original study to be 3 cfs, 3 cfs, and 5 cfs, respectively. The 10-year, 25-year, and 100-year flows in Rancho Drive were quantified in the original study to be 4 cfs, 5 cfs, and 7 cfs, respectively. Offsite basins OFF1 and OFF2 were delineated as the area just west of the site and are assumed to be developed as commercial. The basins are conveyed to the western boundary. Onsite basins have been delineated based on the proposed grading plan. Basin DEV1 combines with offsite basin OFF1 and the

combined flows are conveyed to Craig Road. Basin DEV2 is conveyed east in the proposed northern drive aisle. Basin DEV3 combines with offsite basin OFF2 and the combined flows are conveyed southeast in the proposed drive aisle and drainage swale. Basin DEV4 is conveyed in to Rancho Drive. The future HEC-1 model for the onsite and offsite developed condition has been included in the appendix. The proposed improvements perpetuate the same drainage pattern as shown in the approved study. Figure 7 has been provided in the appendix showing the basins and flowrates. The following table is a summary of the future runoff amounts:

10-YEAR / 100-YEAR, 6-HOUR STORM EVENT
FUTURE RUNOFF AMOUNTS

BASIN NAME/ CONCENTRATION POINT	AREA (acres)	10-YEAR FLOW (cfs)	25-YEAR FLOW (cfs)	100-YEAR FLOW (cfs)
DEV1	0.26	0	1	1
DEV2	0.48	1	1	2
DEV3	0.67	1	2	2
DEV4	0.12	0	0	0
OFF1	0.63	1	2	2
OFF2	0.69	1	2	2
COM1	--	2	2	3
COM1*	--	5	5	8
COM2	--	2	3	5
COM3**	--	4	5	7

*Includes flows referenced from the Craig & Rancho Master Study
**Includes flows referenced from the Craig & Rancho Master Study + Basin DEV4

Conclusions

The street calculations show that the *CCRFCD Hydrologic Criteria & Drainage Design Manual* velocity/depth products criteria are met in the future. The velocity/depth products are below 6 and 8 for the 10- and 100-year storms, respectively. A 12-foot dry lane is required in Craig Road and Rancho Drive. The street calculations show that more than 12 feet of dry lane has been provided in the 10-year condition. Offsite and onsite street flow calculations for the 100-year, 6-hour storm event are summarized in the following tables:

STREET FLOW CALCULATIONS

STREET	Q_{10}/ Q_{25}/Q_{100} (cfs)	D_{10}/ D_{25}/D_{100} (ft)	V_{10}/ V_{25}/V_{100} (ft\s)	V x D
Craig Rd (Section 1) COM1*	5/5/8	0.43/0.43/0.49	2.24/2.24/2.50	0.96/0.96/1.23
Rancho Dr (Section 2) COM3**	4/5/7	0.39/0.41/0.45	2.44/2.56/2.77	0.95/1.05/1.25
Section 3 COM1	2/--/3	0.35/--/0.39	1.58/--/1.72	0.55/--/0.67
Section 4 DEV2	1/--/2	0.29/--/0.35	1.34/--/1.55	0.39/--/0.54

The project generates minimal flows during the 100-year storm. The finished floor elevation has been raised a minimum of twice the depth of flow up to 18 inches above the water surface elevation.

Onsite BMPs have been included for this proposed development. The project has been provided with landscape swales for the control of surface water quality and the velocities are mitigated by erosion protection for the 100-year condition (see calculations in the appendix). The 100-year flowrate was used and is conservative since it is considered to be more than what is required to be mitigated in the BMP design. The total mitigated impervious area within this project is more than 75%. The proposed design satisfies BMP requirements

NDOT requires that the 25-year flows not spread more the half of the first travel lane. As shown in the approved Craig & Rancho Master Drainage Study, the 25-year flows are mitigated by the existing stormdrain in Craig Road (see reference material). This project is not increasing flows in Rancho Drive and the hydraulic conditions in the street are existing.

APPENDIX A

FIGURES

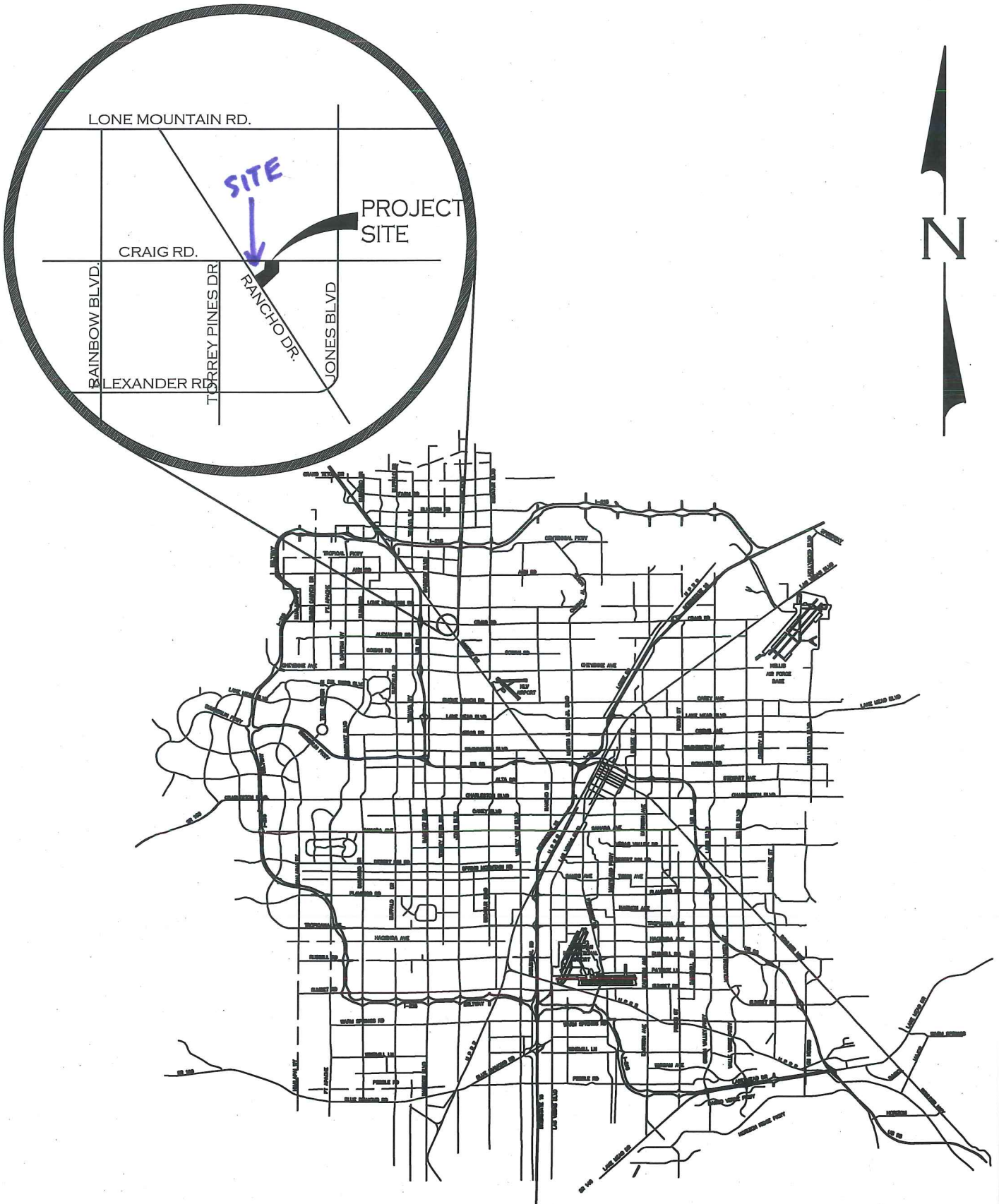


FIGURE 1

VICINITY MAP

JOB NUMBER: 16199
DRAWN BY: JSM | DATED: 11/25/2016

CIVIL ENGINEERING

McCAY ENGINEERING
11700 W. CHARLESTON BLVD.
SUITE #170-298
LAS VEGAS, NEVADA 89135
P 702-860-3897

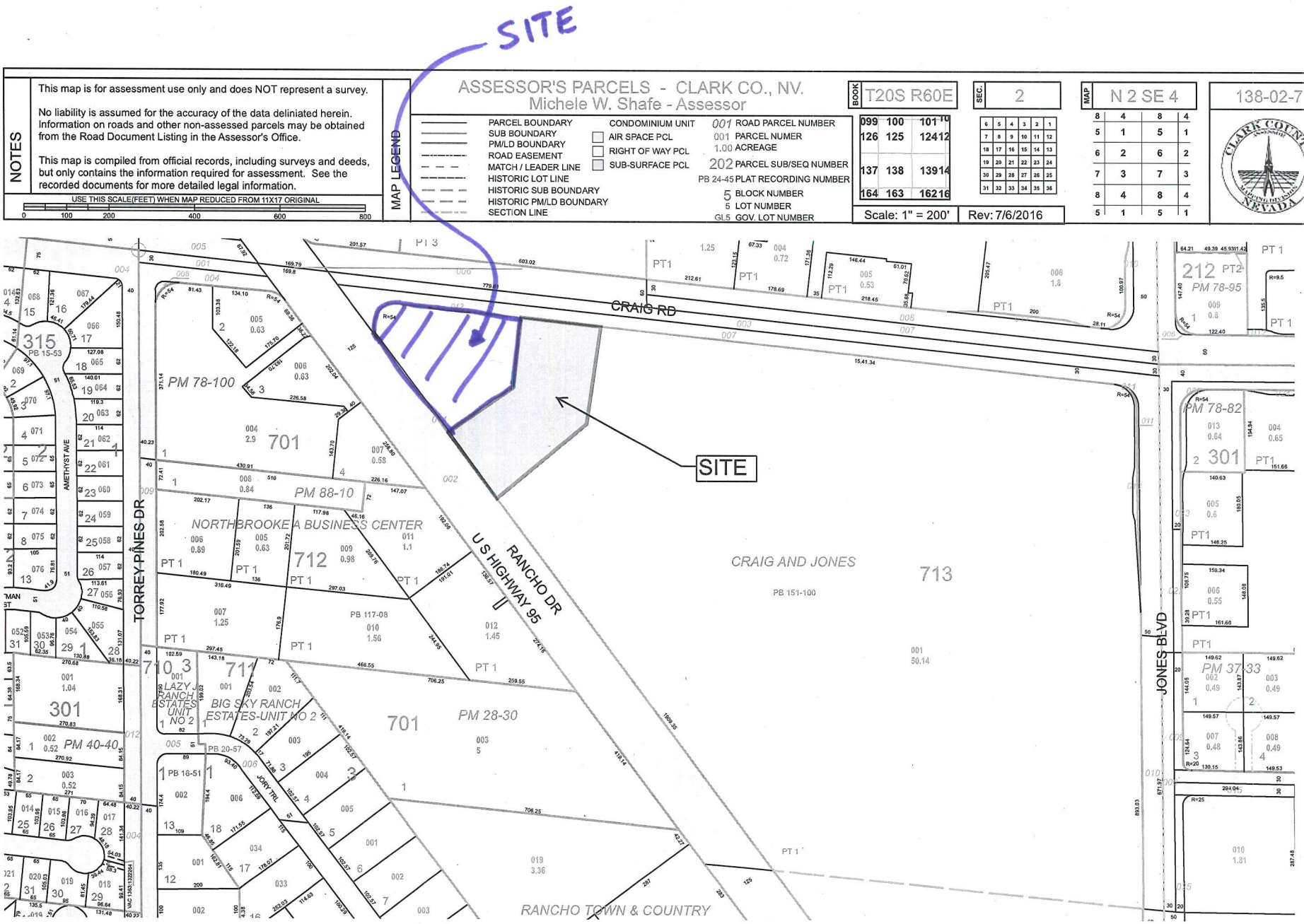

SITE
NOTES
This map is for assessment use only and does NOT represent a survey.
No liability is assumed for the accuracy of the data deliniated herein. Information on roads and other non-assessed parcels may be obtained from the Road Document Listing in the Assessor's Office.
This map is compiled from official records, including surveys and deeds, but only contains the information required for assessment. See the recorded documents for more detailed legal information.
USE THIS SCALE(FEET) WHEN MAP REDUCED FROM 11X17 ORIGINAL
0 100 200 400 600 800
MAP LEGEND
ASSESSOR'S PARCELS - CLARK CO., NV.
Michele W. Shafe - Assessor
PARCEL BOUNDARY
SUB BOUNDARY
PM/LD BOUNDARY
ROAD EASEMENT
MATCH / LEADER LINE
HISTORIC LOT LINE
HISTORIC SUB BOUNDARY
HISTORIC PM/LD BOUNDARY
SECTION LINE
CONDOMINIUM UNIT
AIR SPACE PCL
RIGHT OF WAY PCL
SUB-SURFACE PCL
001 ROAD PARCEL NUMBER
001 PARCEL NUMER
1.00 ACREAGE
202 PARCEL SUB/SEQ NUMBER
PB 24-45 PLAT RECORDING NUMBER
5 BLOCK NUMBER
5 LOT NUMBER
GL5 GOV. LOT NUMBER
BOOK T20S R60E
SEC. 2
MAP N 2 SE 4
138-02-7
Scale: 1" = 200'
Rev: 7/6/2016
CRAIG RD
PM 78-100
PM 88-10
NORTHBROOKE A BUSINESS CENTER
PM 78-95
PM 78-82
PM 37-33
PM 28-30
PM 40-40
CRAIG AND JONES
PB 151-100
RANCHO TOWN & COUNTRY
LAZY RANCH ESTATES UNIT NO 2
BIG SKY RANCH ESTATES-UNIT NO 2
PB 20-57
PB 16-51
PB 117-08
TORREY PINES DR
AMETHYST AVE
RANCHO DR
U S HIGHWAY 95
JONES BLVD
JORY TRL

FIGURE 1A



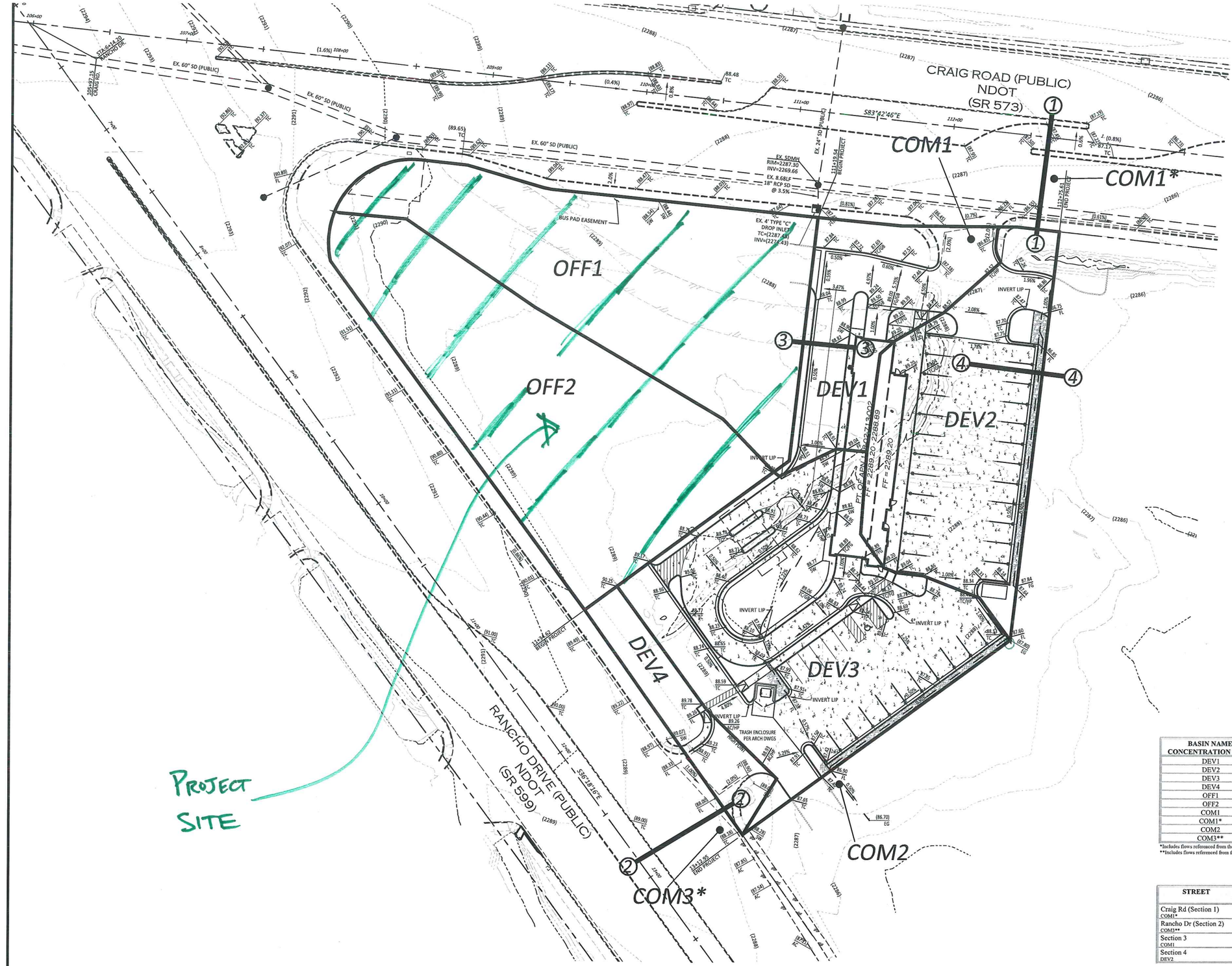
FIGURE 2

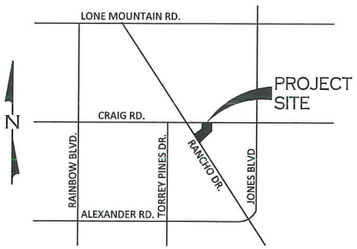
SITE DESCRIPTION MAP

JOB NUMBER: 16199
DRAWN BY: JSM | DATED: 11/25/2016

CIVIL ENGINEERING

McCAY ENGINEERING
11700 W. CHARLESTON BLVD.
SUITE #170-298
LAS VEGAS, NEVADA 89135
P 702-860-3897





VICINITY MAP
SCALE: NTS

N

GRAPHIC SCALE

30 0 15 30 60

(IN FEET)
1 INCH = 30 FT.

LEGEND

- RIGHT-OF-WAY
- PROPERTY LINE
- STREET CENTER LINE
- EXISTING BUILDING
- PROPOSED BUILDING
- EXISTING CURB & GUTTER
- PROPOSED CURB & GUTTER
- EXISTING EDGE OF AC
- 67.62 TC — PROPOSED ELEVATION
- (67.62) TC — EXISTING ELEVATION
- 4.60% — SLOPE & DIRECTION OF SLOPE
- GRADE BREAK — GRADE BREAK
- PROPOSED CMU WALL
- EXISTING CMU WALL
- 2631 — EXISTING 1' CONTOUR
- 2630 — EXISTING 5' CONTOUR
- A — CROSS SECTION

10-YEAR / 100-YEAR, 6-HOUR STORM EVENT
FUTURE RUNOFF AMOUNTS

BASIN NAME/ CONCENTRATION POINT	AREA (acres)	10-YEAR FLOW (cfs)	25-YEAR FLOW (cfs)	100-YEAR FLOW (cfs)
DEV1	0.26	0	1	1
DEV2	0.48	1	1	2
DEV3	0.67	1	2	2
DEV4	0.12	0	0	0
OFF1	0.63	1	2	2
OFF2	0.69	1	2	2
COM1	--	2	2	3
COM1*	--	5	5	8
COM2	--	2	3	5
COM3**	--	4	5	7

*Includes flows referenced from the Craig & Rancho Master Study
**Includes flows referenced from the Craig & Rancho Master Study + Basin DEV4

STREET FLOW CALCULATIONS

STREET	Q_{10}/ Q_{25}/Q_{100} (cfs)	D_{10}/ D_{25}/D_{100} (ft)	V_{10}/ V_{25}/V_{100} (ft\s)	V x D
Craig Rd (Section 1) COM1*	5/5/8	0.43/0.43/0.49	2.24/2.24/2.50	0.96/0.96/1.23
Rancho Dr (Section 2) COM1**	4/5/7	0.39/0.41/0.45	2.44/2.56/2.77	0.95/1.05/1.25
Section 3 COM1	2/--/3	0.35/--/0.39	1.58/--/1.72	0.55/--/0.67
Section 4 DEV2	1/--/2	0.29/--/0.35	1.34/--/1.55	0.39/--/0.54

REV	DATE	BY	REVISION

McCAY ENGINEERING
CIVIL ENGINEERING
11700 W. CHARLESTON BLVD.
SUITE #170-298
LAS VEGAS, NEVADA 89135
P 702-860-3897

S.T. ENTERPRISES, LLC
755 YOSEMITE AVE.
SUITE J
MERCED, CA 95340
P 209-383-2244
F 209-383-2248

FIGURE 7
DRAINAGE PLAN

WOW CARWASH @
CRAIG & RANCHO

DATE: 11/29/2016
DRAWN BY: JSM
PROJECT MGR: JSM
PROJECT NO: 16199
SCALE: 1"=30'

SHEET

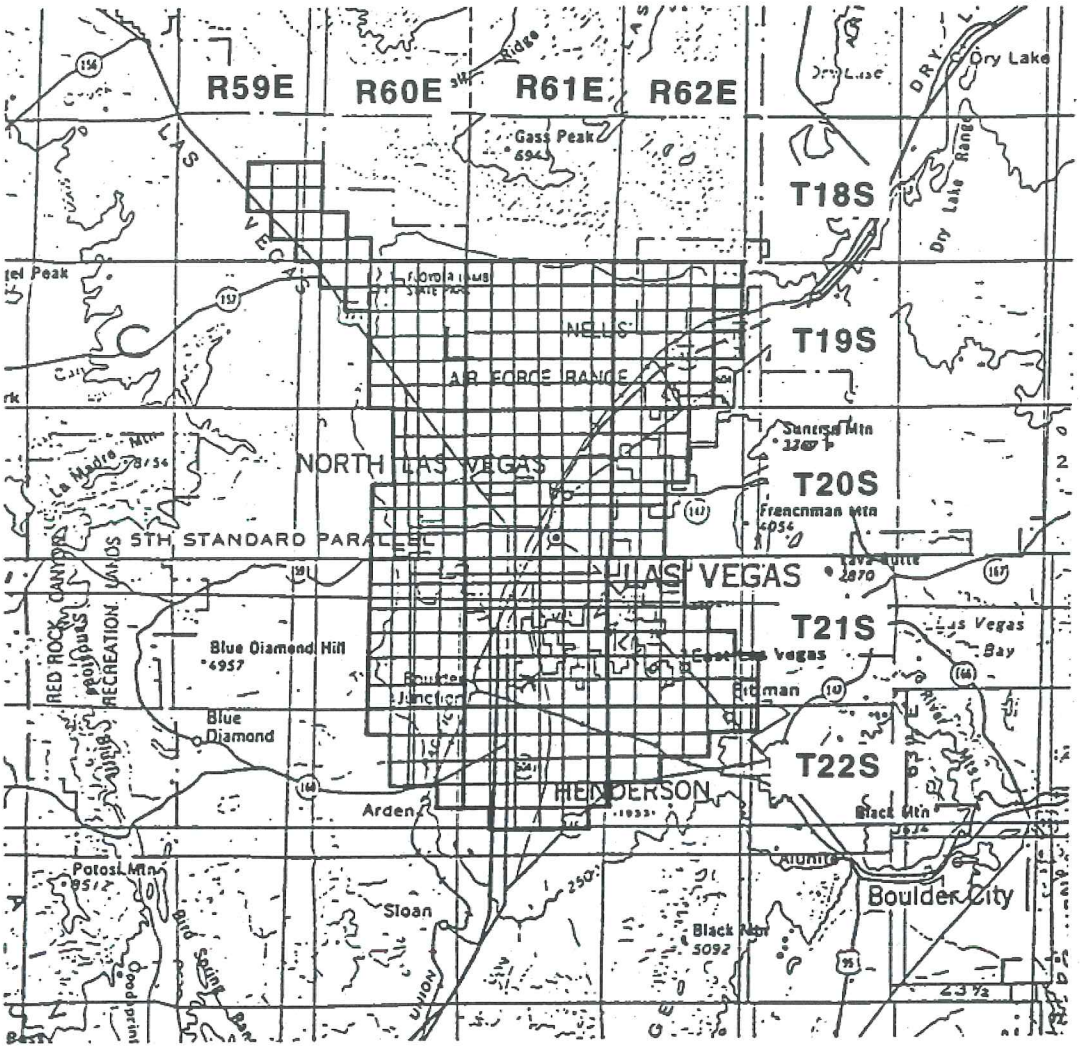
OF SHEETS

DRAWING NO.

APPENDIX B

HYDROLOGIC PARAMETERS

McCARRAN AIRPORT RAINFALL AREA



TOWNSHIP	RANGE	SECTIONS	TOWNSHIP	RANGE	SECTIONS
18 South	59 East	13-15,22-26,36	20 South	62 East	4-9,16-20,29-32
18 South	60 East	30-32	21 South	60 East	1-4,9-16,21-28,33-36
19 South	60 East	1-6,8-16,21-28,33-36	21 South	61 East	ALL SECTIONS
19 South	61 East	ALL SECTIONS	21 South	62 East	4-9,15-23, 25-36
19 South	62 East	2-11,14-23,27-34	22 South	60 East	1-4,10-15,24
20 South	60 East	1-3,10-15,21-28,33-36	22 South	61 East	1-24,26-29
20 South	61 East	ALL SECTIONS	22 South	62 East	1-10,17-18

Notes:
1. Refer to Table 505 and Figure 516 Depth-Duration- Frequency values in the McCarran Airport Rainfall Area.
2. Refer to Table 506 and Figure 517 for Time-Intensity-Frequency values on the McCarran Airport Rainfall Area.

Revision	Date

WRC ENGINEERING

REFERENCE:
USACE, Los Angeles District, 1988

FIGURE 513

SIX HOUR DEPTH-AREA REDUCTION FACTORS

Drainage Area (Square Miles)	Six-Hour Depth-Area Reduction Factor
0.0	1.00
0.5	0.98
1.0	0.97
2.0	0.93
4.0	0.91
6.0	0.90
8.0	0.88
10.0	0.86
20.0	0.79
30.0	0.74
50.0	0.68
100.0	0.60
150.0	0.55
200.0	0.51
300.0	0.46
400.0	0.42
500.0	0.39

NOTES:
1. A graphical representation of these factors is presented in Figure 514.
2. Consult with the local entity and/or the CCRFCD for guidance in using the Depth-Area Reduction Factors for drainage areas greater than 200 square miles.

Revision	Date

SIX-HOUR STORM DISTRIBUTIONS

Storm Time (In Minutes)	Percent of Total Storm Depth SDN3	SDN4	SDN5
0	0.0	0.0	0.0
5	2.0	2.0	2.0
10	5.7	5.8	5.9
15	7.0	7.5	8.0
20	8.7	9.9	11.0
25	10.8	12.6	14.4
30	12.4	13.7	15.0
35	13.0	14.5	16.0
40	13.0	14.9	16.8
45	13.0	15.1	17.1
50	13.0	15.5	18.0
55	13.0	15.6	18.2
60	13.0	15.9	18.7
65	13.3	16.2	19.0
70	14.0	16.9	19.7
75	14.2	17.2	20.2
80	14.8	17.9	21.0
85	15.8	18.9	22.0
90	17.2	20.1	23.0
95	18.1	21.1	24.1
100	19.0	22.0	25.0
105	19.7	22.8	25.9
110	19.9	23.2	26.5
115	20.0	24.0	28.0
120	20.1	24.6	29.0
125	20.4	25.2	30.0
130	21.4	26.0	30.5
135	22.9	26.9	30.9
140	24.1	27.6	31.0
145	24.9	28.3	31.7
150	25.1	28.6	32.1
155	25.6	29.2	32.7
160	27.0	30.2	33.3
165	27.8	31.2	34.6
170	28.1	32.1	36.1
175	28.3	33.2	38.1
180	29.5	35.2	40.8

Storm Time (In Minutes)	Percent of Total Storm Depth SDN3	SDN4	SDN5
185	32.2	37.6	43.0
190	35.2	41.5	47.7
195	40.9	46.2	51.4
200	49.9	53.0	56.1
205	59.0	61.0	63.0
210	71.0	71.0	71.0
215	74.4	73.2	72.0
220	78.1	75.6	73.1
225	81.2	78.2	75.2
230	81.9	79.9	77.9
235	83.5	81.3	79.0
240	85.1	82.3	79.5
245	85.6	83.0	80.4
250	86.0	83.5	81.0
255	86.8	84.4	82.0
260	87.6	85.1	82.6
265	88.8	86.4	84.0
270	91.0	88.5	85.9
275	92.6	90.8	88.9
280	93.7	92.4	91.0
285	95.0	94.4	93.8
290	97.0	96.8	96.6
295	97.6	97.3	97.0
300	98.2	97.8	97.4
305	98.5	98.2	97.9
310	98.7	98.4	98.1
315	98.9	98.6	98.3
320	99.0	98.8	98.5
325	99.3	99.1	98.9
330	99.3	99.2	99.0
335	99.4	99.3	99.2
340	99.5	99.4	99.3
345	99.8	99.7	99.6
350	99.8	99.8	99.7
355	99.9	99.9	99.9
360	100.0	100.0	100.0

Notes:
1. For drainage areas less than 8 square miles in size, use SDN 3.
2. For drainage areas greater than or equal to 8 square miles and less than 12 square miles in size, use SDN 4.
3. For drainage areas greater than or equal to 12 square miles, use SDN 5.
4. A graphical representation of these values is presented on **Figure 515.**

Revision	Date

REFERENCE:

TABLE 503

DEPTH-DURATION-FREQUENCY VALUES FOR McCARRAN AIRPORT RAINFALL AREA

(IN INCHES)

	RECURRENCE INTERVAL					
TIME	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
5 min.	0.15	0.27	0.35	0.46	0.54	0.63
10 min.	0.25	0.44	0.57	0.74	0.89	1.02
15 min.	0.33	0.57	0.74	0.97	1.15	1.32
30 min.	0.44	0.78	1.01	1.31	1.55	1.79
1 hour	0.52	0.89	1.15	1.50	1.78	2.06
2 hour	0.59	1.01	1.30	1.70	2.01	2.30
3 hour	0.64	1.08	1.39	1.82	2.15	2.48
6 hour	0.72	1.22	1.58	2.05	2.41	2.77
24 hour (TR-55)	1.20	1.60	1.80	2.40	2.70	2.96

NOTE: 1. Refer to Figure 513 for a description and drawing of the area included in the McCarran Airport Rainfall Area.

2. The 24 hour values presented above are for use with TR-55 only.

3. Table 501 adjustments not required.

Revision	Date

RUNOFF CURVE NUMBERS
(URBAN AREAS[1])

Cover description		Curve numbers for hydrologic soil group—			
Cover type and hydrologic condition	Average percent impervious area[2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.)[3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only)[4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
See Table 602A					
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)[5]		77	86	91	94

1 Average runoff condition, and $I_a = 0.2S$.

2 The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system. Impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using Figure 603.

3 CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

4 Composite CN's for natural desert landscaping should be computed using Figure 603 based on the impervious area percentage (CN #98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

5 Composite CN's to use for the design of temporary measures during grading and construction should be computed using Figure 603 based on the degree of development impervious area percentage) and the CN's for the newly graded pervious areas.

Revision	Date

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

TIME OF CONCENTRATION

Project No. : 16199

DEVELOPMENT : WOW Carwash @ Craig and Rancho
Future Conditions

CALCULATED BY : PDW

DATE: November 2016

CIVIL ENGINEERING

SUB-BASIN DATA					INITIAL / OVERLAND TIME (Ti)			TRAVEL TIME (Tt)					Tc	Tc CHECK URBANIZED BASINS		FINAL Tc	Min Tc	Tlag	REMARKS
DESIG: (1)	CN	K (2)	AREA (acres) (3)	AREA (mi^2) (4)	LENGTH (ft) (5)	SLOPE (%) (6)	Ti (min) (7)	LENGTH (ft) (8)	SLOPE (%) (9)	LAND COVER k	VELOCITY* (fps) (10)	Tt (min) (11)	Tc = Ti + Tt (min)	TOTAL LENGTH (ft) (12)	Tc = (L/180)+10 (min) (13)	(min) (14)	(min)	Tlag= 0.6Tc/60 (hrs)	
Future Onsite Basins																			
DEV1	94.7	0.8600	0.26	0.0004	25	1.00	2.16	250	0.72	DEV	2.60	1.6	3.8	275.0	11.528	3.76	5.00	**0.050**	minimum Tc used
DEV2	94.7	0.8600	0.48	0.0008	70	1.00	3.61	175	0.50	DEV	2.16	1.3	5.0	245.0	11.361	4.96	5.00	**0.050**	minimum Tc used
DEV3	94.7	0.8600	0.67	0.0010	35	0.50	3.22	225	0.60	DEV	2.37	1.6	4.8	260.0	11.444	4.80	5.00	**0.050**	minimum Tc used
DEV4	94.7	0.8600	0.12	0.0002	35	2.14	1.98	--	--	DEV	--	--	2.0	35.0	10.194	1.98	5.00	**0.050**	minimum Tc used
Future Offsite Basins																			
OFF1	94.7	0.8600	0.63	0.0010	115	1.74	3.85	220	0.68	DEV	2.52	1.5	5.3	335.0	11.861	5.30	5.00	**0.053**	
OFF2	94.7	0.8600	0.69	0.0011	30	5.00	1.38	280	1.07	DEV	3.17	1.5	2.9	310.0	11.722	2.86	5.00	**0.050**	minimum Tc used

OFF1 + OFF2 MAKE UP OUR SITE

Ti = 1.8 (1.1 - K) L^1/2 / S^1/3
Tc = Ti + Tt
K = 0.0132 (CN) - 0.39 Tlag = 0.6Tc

*** The velocity in column 9 was computed using the equation V = CS^.5**
C is a coefficient and S is the travel slope, as outlined in section 602.1 of the CCRFCD Manual.

***As recommended in the CCRFCD Manual, C = 30.6 under developed conditions and C = 29.4 under undeveloped conditions.**

REFERENCE :

STANDARD FORM 4

APPENDIX C

FUTURE HEC-1 MODEL

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              JUN  1998                *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   29NOV16  TIME  23:57:01   *
*                                       *
*****************************************
```

```
*************************************
*                                   *
*    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 FOR WOW CARWASH
  3           ID                        LAS VEGAS, NEVADA
  4           ID
  5           ID        PREPARED FOR:
  6           ID
  7           ID        PREPARED BY:
  8           ID                  MCCAY ENGINEERING
  9           ID                  11700 W. CHARLESTON BLVD, SUITE 170-298
 10           ID                  LAS VEGAS, NV  89135
 11           ID
 12           ID
 13           ID    FUTURE 10-, 25-, & 100-YEAR MODEL
 14           ID    FILENAME:CR-FUTA.DAT
 15           ID    JOB#16199
 16           ID
 17           ID
 18           ID
              *DIAGRAM
 19           IT       5       0       0     300
 20           IO       5
 21           IN       5
 22           JR    PREC    1.00    0.74    0.57
              *

 23           KK    OFF1
 24           KM   FUTURE OFFSITE BASIN OFF1
 25           BA  0.0010
 26           PB    2.77
 27           PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
 28           PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
 29           PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
 30           PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
 31           PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
 32           PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
 33           PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
 34           PC    .998    .999    1.00
 35           LS       0    94.7
 36           UD   0.053
              *

 37           KK    DEV1
 38           KM   FUTURE ONSITE BASIN DEV1
 39           BA  0.0004
 40           LS       0    94.7
 41           UD   0.050
              *

 42           KK    COM1
 43           KM   COMBINE OFF1 AND DEV1
 44           HC       2
              *
```



```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
```

```
45          KK    DEV2
46          KM   FUTURE ONSITE BASIN DEV2
47          BA  0.0008
48          LS       0    94.7
49          UD   0.050
            *

50          KK    OFF2
51          KM   FUTURE OFFSITE BASIN OFF2
52          BA  0.0011
53          LS       0    94.7
54          UD   0.050
            *

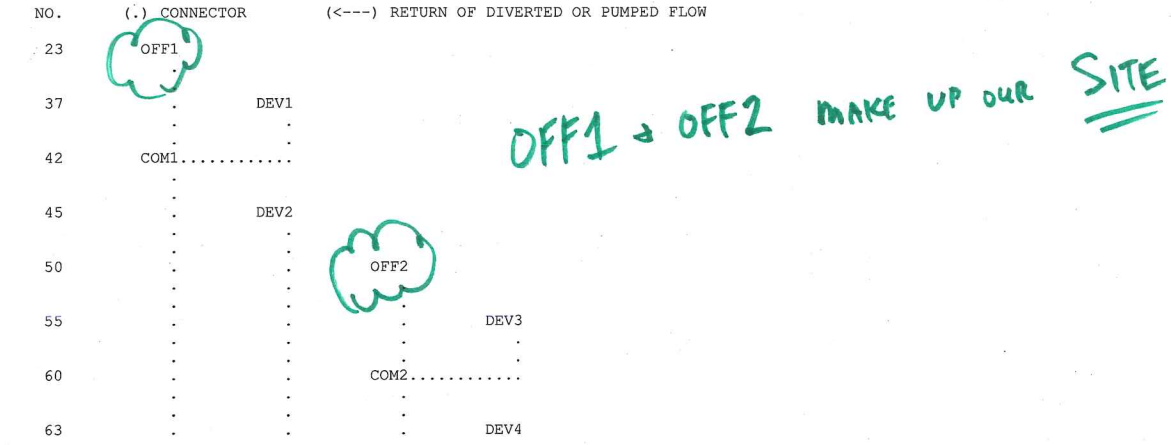
55          KK    DEV3
56          KM   FUTURE ONSITE BASIN DEV3
57          BA  0.0010
58          LS       0    94.7
59          UD   0.050
            *

60          KK    COM2
61          KM   COMBINE OFF2 AND DEV3
62          HC       2
            *

63          KK    DEV4
64          KM   FUTURE ONSITE BASIN DEV4
65          BA  0.0002
66          LS       0    94.7
67          UD   0.050
            *
68          ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK



OFF1 & OFF2 MAKE UP OUR SITE

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*               JUN   1998              *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   29NOV16  TIME  23:57:01   *
*                                       *
*****************************************
```

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

TECHNICAL DRAINAGE STUDY FOR WOW CARWASH
LAS VEGAS, NEVADA

PREPARED FOR:

PREPARED BY:

MCCAY ENGINEERING
11700 W. CHARLESTON BLVD, SUITE 170-298
LAS VEGAS, NV 89135

FUTURE 10-, 25-, & 100-YEAR MODEL
FILENAME:CR-FUTA.DAT
JOB#16199

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  20 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          300  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE       2    0  ENDING DATE
                    NDTIME         0055  ENDING TIME
                     ICENT           19  CENTURY MARK

                  COMPUTATION INTERVAL      .08 HOURS
                      TOTAL TIME BASE   24.92 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
                  1.00       .74       .57
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  RATIO 3
                                                              1.00       .74       .57

 HYDROGRAPH AT
+                 OFF1        .00      1   FLOW                 2.        2.        1.
                                            TIME               3.50      3.50      3.50

 HYDROGRAPH AT
+                 DEV1        .00      1   FLOW                 1.        1.        0.
                                            TIME               3.50      3.50      3.50

  2 COMBINED AT
+                 COM1        .00      1   FLOW                 3.        2.        2.
                                            TIME               3.50      3.50      3.50

 HYDROGRAPH AT
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                                            TIME               3.50      3.50      3.50

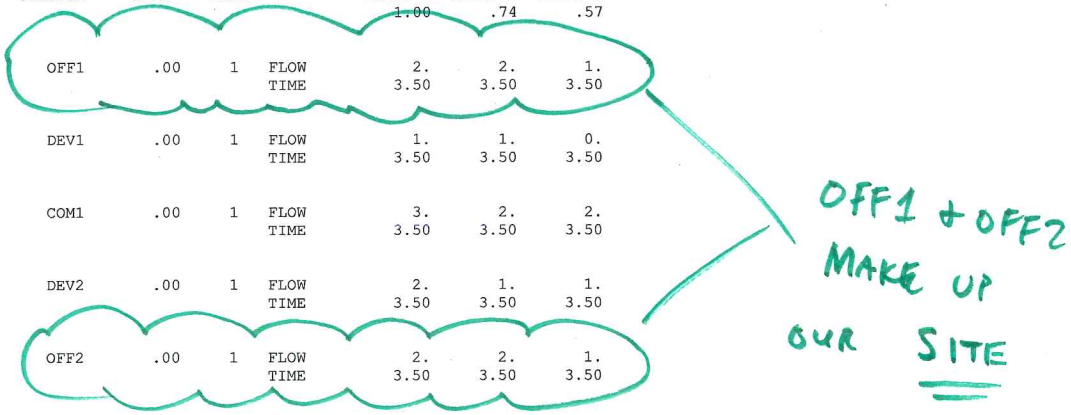
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                                            TIME               3.50      3.50      3.50

 HYDROGRAPH AT
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  2 COMBINED AT
+                 COM2        .00      1   FLOW                 5.        3.        2.
                                            TIME               3.50      3.50      3.50

 HYDROGRAPH AT
+                 DEV4        .00      1   FLOW                 0.        0.        0.
                                            TIME               3.50      3.50      3.50


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



APPENDIX D

HYDRAULIC CALCULATIONS

Worksheet for 10- & 25-Yr Craig Rd (Section 1)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00700	ft/ft
Discharge	5.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+47.00	0.97
0+47.00	1.47

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.13)	0.013
(0+07.00, 0.13)	(0+47.00, 0.97)	0.016
(0+47.00, 0.97)	(0+47.00, 1.47)	0.013

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.43	ft
Elevation Range	0.00 to 1.47 ft	
Flow Area	2.24	ft²

Worksheet for 10- & 25-Yr Craig Rd (Section 1)

Results

Wetted Perimeter		14.97	ft
Hydraulic Radius		0.15	ft
Top Width		14.49	ft
Normal Depth		0.43	ft
Critical Depth		0.43	ft
Critical Slope		0.00694	ft/ft
Velocity		2.24	ft/s
Velocity Head		0.08	ft
Specific Energy		0.51	ft
Froude Number		1.00	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.43	ft
Critical Depth	0.43	ft
Channel Slope	0.00700	ft/ft
Critical Slope	0.00694	ft/ft

Cross Section for 10- & 25-Yr Craig Rd (Section 1)

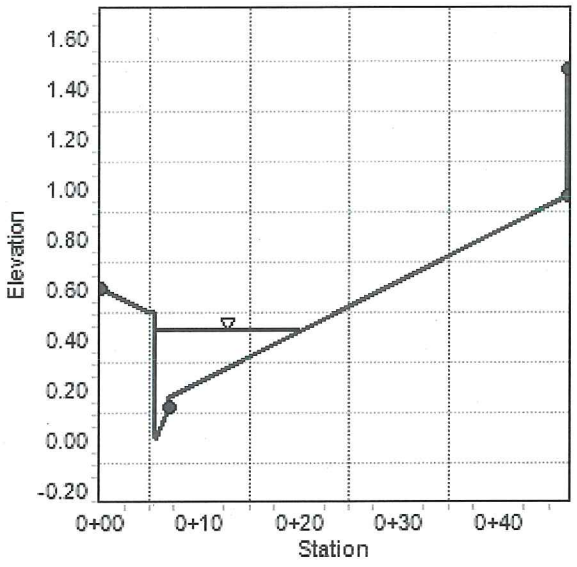
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00700	ft/ft
Normal Depth	0.43	ft
Discharge	5.00	ft³/s

Cross Section Image



Worksheet for 100-Yr Craig Rd (Section 1)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00700	ft/ft
Discharge	8.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+47.00	0.97
0+47.00	1.47

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.13)	0.013
(0+07.00, 0.13)	(0+47.00, 0.97)	0.016
(0+47.00, 0.97)	(0+47.00, 1.47)	0.013

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.49	ft
Elevation Range	0.00 to 1.47 ft	
Flow Area	3.20	ft²

Worksheet for 100-Yr Craig Rd (Section 1)

Results

Wetted Perimeter		18.05	ft
Hydraulic Radius		0.18	ft
Top Width		17.51	ft
Normal Depth		0.49	ft
Critical Depth		0.49	ft
Critical Slope		0.00656	ft/ft
Velocity		2.50	ft/s
Velocity Head		0.10	ft
Specific Energy		0.59	ft
Froude Number		1.03	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.49	ft
Critical Depth	0.49	ft
Channel Slope	0.00700	ft/ft
Critical Slope	0.00656	ft/ft

Cross Section for 100-Yr Craig Rd (Section 1)

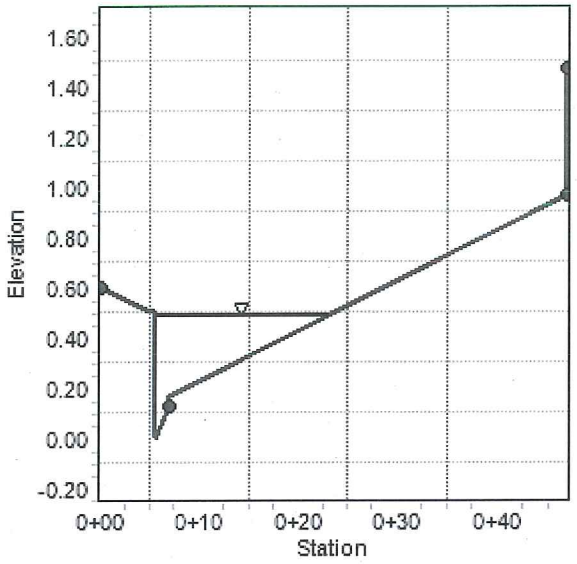
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00700	ft/ft
Normal Depth	0.49	ft
Discharge	8.00	ft³/s

Cross Section Image



Worksheet for 10-Yr Rancho Rd (Section 2)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01000	ft/ft
Discharge	4.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+57.00	1.17
0+57.00	1.67

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.13)	0.013
(0+07.00, 0.13)	(0+57.00, 1.17)	0.016
(0+57.00, 1.17)	(0+57.00, 1.67)	0.013

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.39	ft
Elevation Range	0.00 to 1.67 ft	
Flow Area	1.64	ft²

Worksheet for 10-Yr Rancho Rd (Section 2)

Results

Wetted Perimeter		12.71	ft
Hydraulic Radius		0.13	ft
Top Width		12.28	ft
Normal Depth		0.39	ft
Critical Depth		0.40	ft
Critical Slope		0.00710	ft/ft
Velocity		2.44	ft/s
Velocity Head		0.09	ft
Specific Energy		0.48	ft
Froude Number		1.17	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.39	ft
Critical Depth	0.40	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00710	ft/ft

Cross Section for 10-Yr Rancho Rd (Section 2)

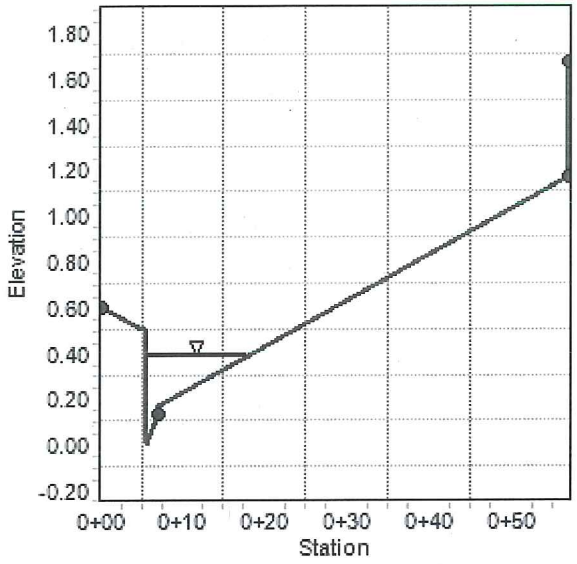
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01000	ft/ft
Normal Depth	0.39	ft
Discharge	4.00	ft³/s

Cross Section Image



Worksheet for 25-Yr Rancho Rd (Section 2)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01000	ft/ft
Discharge	5.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+57.00	1.17
0+57.00	1.67

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.13)	0.013
(0+07.00, 0.13)	(0+57.00, 1.17)	0.016
(0+57.00, 1.17)	(0+57.00, 1.67)	0.013

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.41	ft
Elevation Range	0.00 to 1.67 ft	
Flow Area	1.95	ft²

Worksheet for 25-Yr Rancho Rd (Section 2)

Results

Wetted Perimeter		13.93	ft
Hydraulic Radius		0.14	ft
Top Width		13.47	ft
Normal Depth		0.41	ft
Critical Depth		0.43	ft
Critical Slope		0.00692	ft/ft
Velocity		2.56	ft/s
Velocity Head		0.10	ft
Specific Energy		0.51	ft
Froude Number		1.19	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.41	ft
Critical Depth	0.43	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00692	ft/ft

Cross Section for 25-Yr Rancho Rd (Section 2)

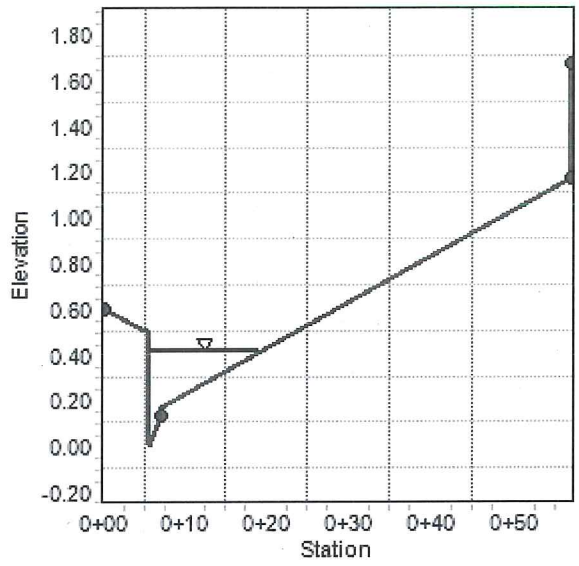
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01000	ft/ft
Normal Depth	0.41	ft
Discharge	5.00	ft³/s

Cross Section Image



Worksheet for 100-Yr Rancho Rd (Section 2)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01000	ft/ft
Discharge	7.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+57.00	1.17
0+57.00	1.67

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.13)	0.013
(0+07.00, 0.13)	(0+57.00, 1.17)	0.016
(0+57.00, 1.17)	(0+57.00, 1.67)	0.013

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.45	ft
Elevation Range	0.00 to 1.67 ft	
Flow Area	2.52	ft²

Worksheet for 100-Yr Rancho Rd (Section 2)

Results

Wetted Perimeter		15.95	ft
Hydraulic Radius		0.16	ft
Top Width		15.45	ft
Normal Depth		0.45	ft
Critical Depth		0.48	ft
Critical Slope		0.00665	ft/ft
Velocity		2.77	ft/s
Velocity Head		0.12	ft
Specific Energy		0.57	ft
Froude Number		1.21	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.45	ft
Critical Depth	0.48	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00665	ft/ft

Cross Section for 100-Yr Rancho Rd (Section 2)

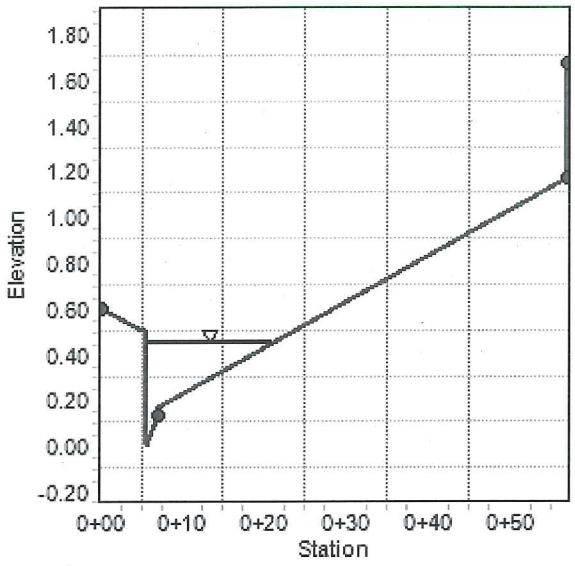
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01000	ft/ft
Normal Depth	0.45	ft
Discharge	7.00	ft^3/s

Cross Section Image



Worksheet for BMPs for DEV2 & DEV3

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.00500	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Discharge	2.00	ft^3/s

Results

Normal Depth	0.61	ft
Flow Area	1.50	ft^2
Wetted Perimeter	5.05	ft
Hydraulic Radius	0.30	ft
Top Width	4.89	ft
Critical Depth	0.44	ft
Critical Slope	0.03091	ft/ft
Velocity	1.34	ft/s
Velocity Head	0.03	ft
Specific Energy	0.64	ft
Froude Number	0.43	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.61	ft
Critical Depth	0.44	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.03091	ft/ft

Cross Section for BMPs for DEV2 & DEV3

Project Description

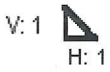
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.00500	ft/ft
Normal Depth	0.61	ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Discharge	2.00	ft³/s

Cross Section Image





McCAY ENGINEERING
11700 W. CHARLESTON BLVD., SUITE 170-298
LAS VEGAS, NV 89135
702-860-3897

ADDENDUM #1 TO THE TECHNICAL DRAINAGE STUDY FOR WOW CARWASH @ CRAIG & RANCHO

(AKA UPDATE #1 TO THE CRAIG & RANCHO MASTER DRAINAGE STUDY)

LAS VEGAS

JANUARY 11, 2017

CIVIL ENGINEERING

McCAY ENGINEERING

PREPARED FOR:

S.T. HOLDINGS, LLC
755 YOSEMITE AVE, SUITE J
MERCED, CA 95340

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: **WOW Carwash @ Craig & Rancho** Date: **January 11, 2017**

Location of Development: a) Descriptive (Cross Streets) North/South: **Rancho Drive**
East/West: **Craig Road**

b) Section: **2** Township: **20S** Range: **60E**

c) APN: **138-02-713-002 (portion of)**

Name of Owner: **S.T. Holdings LLC**

Telephone No.: **209-383-2244** Facsimile No.: _____ Email Address: _____

Address: **755 Yosemite Ave, Suite J Merced CA 95340**

Contact Person Name: **Jeremy McCay** Telephone No: **702-860-3897**

E-mail Address: **jmccay@centurylink.net**

Firm: **McCay Engineering**

Address: **11700 W. Charleston Blvd., Suite 170-298, Las Vegas, NV 89135**

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: **1.53 ac** Being Developed/Disturbed: **1.53 ac**

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

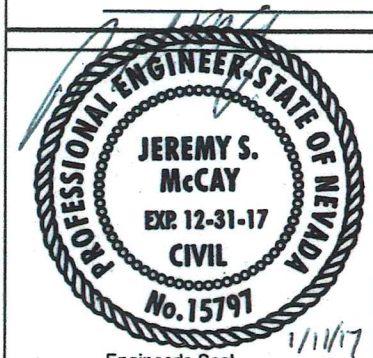
4. Proposed type of development (Residential, Commercial, Etc.)? **Commercial**

5. Approximate upstream land area which drains to the subject site? **Approx. 1.3 acres**

6. Has the site drainage been evaluated in the past? ☒ YES NO If yes, please identify documentation:
The TDS for Craig & Rancho Master Drainage Study (DS 4824)

7. If known, please briefly identify the proposed discharge point(s) of runoff from the site:
Craig Road, Rancho Drive, and the adjacent property to the east conforming to the approved study.

8. Briefly describe your proposed schedule for the subject project: **As soon as possible**



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.

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

Revision	Date

Local Entity File No.

Reference: McCay Engineering Project #15164

STANDARD FORM 1

January 11, 2017

Albert Sung, P.E.
City of Las Vegas Flood Control
333 N. Rancho Drive
Las Vegas, Nevada 89106

RE: ADD #1 TO THE TECHNICAL DRAINAGE STUDY FOR WOW CARWASH @ CRAIG & RANCHO
AKA UPDATE #1 TO THE CRAIG & RANCHO MASTER DRAINAGE STUDY
CLV# DS4852
Job No. 16199

Mr. Sung:

McCay Engineering has received the City of Las Vegas review comments for the above referenced study, on December 21, 2016. The comments in the subject memorandum have been reproduced with accompanying responses as follows:

Comment 1: **Provide a *Phasing Plan* of the whole *Craig & Rancho Master Developments* in the next submittal to identify the portion of *Rancho Road* to be improved with sidewalk and curb & gutter concurrent or prior to the issuance of occupancy permit of the subject *WOW Car Wash* development.**

Response 1: A phasing plan has been included in the appendix.

Comment 2: **Provide a copy of the *Tentative Map* for the *Craig & Rancho Master Developments* to verify that there is a clause for inter-lot drainage right between present and future subdivided parcels within the master development.**

Response 2: The recorded commercial subdivision has been attached. Please refer to Note 1 of the commercial subdivision cover sheet for the necessary language.

Comment 3: **The proposed finish floor elevation of the new building is below the corresponding street grades in *Rancho Drive*. Either a berm or a flood wall must be provided behind the back of sidewalk along *Rancho Drive* for onsite flood protection. The top of the berm or the wall must be at least 18" above the corresponding top of curb elevation in *Rancho*. Review and revise according.**

Response 3: A berm has been implemented on the revised plans.

Comment 4: **Obtain *Occupancy Permit* from the *Nevada Department of Transportation* (NDOT) for the construction of improvements in the *Craig Road* and *Rancho Drive* public right-of-ways adjacent to the subject site prior to constructing any improvements within NDOT jurisdiction.**

Response 4: All offsite improvements within the NDOT ROW are being permitted separately by Lochsa Engineering. No offsite improvements are being proposed in association of this project.

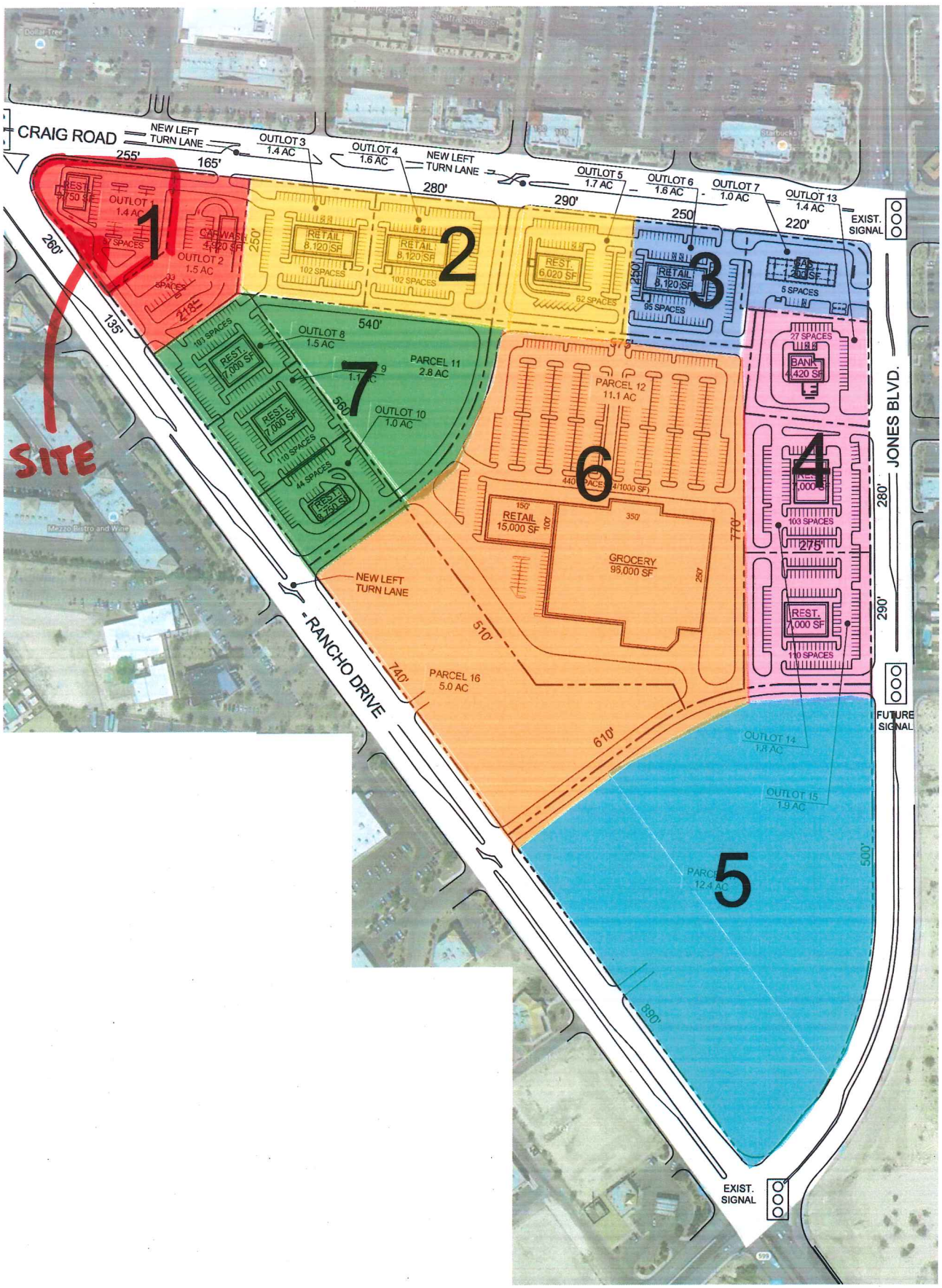
I trust this satisfies your concerns regarding this project. If there are any questions, or additional information necessary, please contact this office.

Sincerely,

McCay Engineering



Jeremy S. McCay, P.E.
Principal



PROPOSED MASTER PLAN

SCALE: 1" = 200'-0"

0 100' 200'

RANCHO DRIVE MASTER PLAN

LAS VEGAS, NEVADA

PARRIS ROBINSON EASTERN, LLC

OKW Architects

DATE: AUGUST 4, 2015

PROJECT NUMBER: 14097

FINAL MAP
CRAIG AND JONES
(A COMMERCIAL SUBDIVISION)

BEING A PORTION OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST, M.D.B. & M. CITY OF LAS VEGAS, CLARK COUNTY, NEVADA

OWNER'S CERTIFICATE OF DEDICATION

WE, PRE RANCHO CRAIG L L C, A NEVADA LIMITED LIABILITY COMPANY DO HEREBY CERTIFY THAT WE ARE THE OWNERS OF THE PARCEL OF LAND WHICH IS SHOWN UPON THE PLAT OF "FINAL MAP OF CRAIG AND JONES", DO HEREBY CONSENT TO THE PREPARATION AND RECORDATION OF THIS PLAT, AND DO HEREBY:

– OFFER AND DEDICATE TO THE CITY OF LAS VEGAS ALL THE STREET (EXCEPT PRIVATE STREETS) AND OTHER PUBLIC RIGHTS–OF–WAY AND PLACES AS INDICATED AND OUTLINED HEREON, FOR THE USE OF THE PUBLIC AND

– GRANT TO THE CITY OF LAS VEGAS THE EASEMENTS, AS INDICATED AND OUTLINED HEREON FOR THE USE OF THE PUBLIC.

FURTHERMORE THE UNDERSIGNED OWNERS DO HEREBY GRANT AND CONVEY TO NEVADA POWER COMPANY, A NEVADA CORPORATION, D/B/A NV ENERGY, CENTRAL TELEPHONE COMPANY, D/B/A CENTURY LINK, SOUTHWEST GAS CORPORATION, LAS VEGAS VALLEY WATER DISTRICT AND COX COMMUNICATIONS LAS VEGAS,INC. JOINTLY AND SEVERALLY, AND TO THEIR RESPECTIVE SUCCESSORS AND ASSIGNS, A PERMANENT EASEMENT WITHIN THE AREA SHOWN HEREON AS PRIVATE STREETS, COMMON AREAS AND ALL AREAS NOT OCCUPIED BY ANY BUILDING FOR THE CONSTRUCTION, MAINTENANCE, OPERATION, FINAL REMOVAL AND/OR ABANDONMENT OF STREET LIGHTS IF ANY, AND FIRE HYDRANTS, UNDERGROUND POWER, TELEPHONE, GAS, WATER AND CABLE TELEVISION LINES AND APPURTENANCES, TOGETHER WITH THE RIGHT OF INGRESS AND EGRESS FROM THESE EASEMENTS.

FURTHER THE UNDERSIGNED OWNERS HEREBY GRANTS AND CONVEYS TO THE CITY OF LAS VEGAS AND TO ITS SUCCESSORS AND ASSIGNS A 5 FOOT WIDE EASEMENT ADJACENT TO ALL PROPERTY LINES WHERE LOTS OR COMMON AREAS ABUT PUBLIC STREETS FOR PURPOSES OF PLACING PUBLIC FIRE HYDRANTS AND PUBLIC STREET LIGHTS AND AN ADDITIONAL EASEMENT FOR UP TO TWO FEET IN RADIUS FROM EACH FIRE HYDRANT AND STREET LIGHT, TO EXTEND BEYOND THE FIVE FOOT EASEMENT IF NECESSARY, TOGETHER WITH THE RIGHT OF INGRESS AND EGRESS FROM THESE EASEMENTS.

FURTHERMORE, THE UNDERSIGNED OWNERS HEREBY GRANT AND CONVEY TO THE CITY OF LAS VEGAS AND ITS SUCCESSORS AND ASSIGNS A PERMANENT EASEMENT WITHIN THE AREA SHOWN HEREON AS PRIVATE STREETS, COMMON AREAS AND ALL AREAS NOT OCCUPIED BY ANY BUILDING, FOR THE CONSTRUCTION, MAINTENANCE, OPERATION AND FINAL REMOVAL OF PUBLIC STREET LIGHTS, OF ANY, TRAFFIC SIGNALS, CONDUITS AND APPURTENANCES AND PUBLIC FIRE HYDRANTS, TOGETHER WITH THE RIGHT OF INGRESS AND EGRESS THEREFROM.

W S Parris Manager 4-26-2016
DATE
PRE RANCHO CRAIG L L C, A NEVADA LIMITED LIABILITY COMPANY
William S. Parris, manager

ACKNOWLEDGMENT

STATE OF ~~NEVADA~~ California
SS
COUNTY OF ~~CLARK~~ SANTA BARBARA

THIS INSTRUMENT WAS ACKNOWLEDGED BEFORE ME ON 4/26/16

BY William S. Parris AS Manager
PRE RANCHO CRAIG L L C, A NEVADA LIMITED LIABILITY COMPANY

Jamie Hansen
JAMIE HANSEN
A NOTARY PUBLIC IN AND FOR SAID COUNTY AND STATE

COMMISSION# 2126869
JAMIE HANSEN
Commission # 2126869
Notary Public - California
Santa Barbara County
My Comm. Expires Sep 17, 2019

MY COMMISSION EXPIRES: 9/17/2019

CITY ENGINEER'S APPROVAL

BY THE SIGNATURE BELOW, THE CITY HEREBY ACCEPT THE EASEMENTS GRANTED TO THE CITY AS DELINEATED AND APPROVED HEREON WITH THIS PLAT, UNLESS OTHERWISE NOTED.

5-5-16
ALLEN PAVELKA P.E. #9029 DATE
CITY ENGINEER

UTILITY AGENCIES AND APPROVALS

WE, THE HEREIN NAMED UTILITY COMPANIES AND AGENCIES, APPROVE THE GRANT OF THE DESIGNATED EASEMENTS.

Yolanda M. Benito Yolanda M. Benito 4.28.2016
NEVADA POWER COMPANY, A NEVADA CORPORATION D/B/A NV ENERGY DATE

5/5/16
LAS VEGAS VALLEY WATER DISTRICT MICHAEL J. SHARI DATE

4.28.16
SOUTHWEST GAS CORPORATION – Mason Safa DATE

Carlos Rodriguez 4/28/16
COX COMMUNICATIONS LAS VEGAS, INC. DATE

Diane M. Schomer 4-28-16
CENTRAL TELEPHONE COMPANY D/B/A CENTURY LINK DIANE M. Schomer DATE

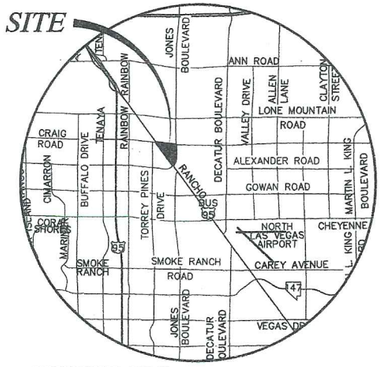
LAS VEGAS VALLEY WATER DISTRICT NOTE

RECORDATION OF THIS SUBDIVISION MAP WILL ESTABLISH A LIMITED WATER COMMITMENT FROM THE LAS VEGAS VALLEY WATER DISTRICT AS FOLLOWS:

LOT/BLOCK	ACRE–FEET/YEAR
1	1.00

MAINTENANCE WORK ON FACILITIES LOCATED WITHIN UTILITY EASEMENTS GRANTED BY THIS MAP AND OWNED AND/OR OPERATED BY THE UTILITIES (BOTH FRANCHISE AND MUNICIPAL) MAY INCLUDE THE PLACEMENT OF ASPHALT OR CONCRETE PATCH AS APPLICABLE. NO EFFORT WILL BE MAKE TO REPLACE OR MATCH ANY DECORATIVE SURFACE, LANDSCAPE FEATURE, OR ANY OTHER IMPROVEMENTS DISTURBED AS A RESULT OF MAINTENANCE ACTIVITIES OF THE UTILITIES OR THEIR AUTHORIZED REPRESENTATIVES.

SITE



VICINITY MAP NO SCALE

LEGAL DESCRIPTION

BEING A PORTION OF THE SOUTHEAST QUARTER (SE1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST, M.D.M., CITY OF LAS VEGAS, CLARK COUNTY, NEVADA, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE NORTHEAST CORNER OF SAID SOUTHEAST QUARTER (SE1/4) OF SECTION 2, ALSO BEING THE CENTER INTERSECTION OF CRAIG ROAD AND JONES BOULEVARD; THENCE SOUTH 00°17'09" EAST, ALONG THE CENTERLINE OF JONES BOULEVARD ALSO BEING THE EASTERLY LINE OF SAID SECTION 2 A DISTANCE OF 102.19 FEET; THENCE DEPARTING SAID LINE, SOUTH 89°42'51" WEST, A DISTANCE OF 55.00 FEET TO A POINT ALONG THE WESTERLY RIGHT–OF–WAY LINE OF SAID JONES BOULEVARD, SAID POINT BEING THE POINT OF BEGINNING;

THENCE SOUTH 00°17'09" EAST A DISTANCE OF 276.54 FEET ALONG SAID RIGHT–OF–WAY LINE; THENCE SOUTH 01°33'31" EAST, A DISTANCE OF 225.06 FEET; THENCE SOUTH 00°17'09" EAST, A DISTANCE OF 915.24 FEET TO THE BEGINNING OF A NON–TANGENT CURVE HAVING A RADIUS OF 783.00 FEET, A RADIAL LINE TO SAID POINT BEARS NORTH 89°42'58" EAST; THENCE ALONG THE ARC OF SAID CURVE TO THE RIGHT CONCAVE WESTERLY THROUGH A CENTRAL ANGLE OF 10°22'29", AN ARC LENGTH OF 141.78 FEET TO THE BEGINNING OF A NON–TANGENT CURVE HAVING A RADIUS OF 778.00 FEET, A RADIAL LINE TO SAID POINT BEARS SOUTH 79°10'57" EAST; THENCE ALONG THE ARC OF SAID CURVE TO THE RIGHT CONCAVE NORTHWESTERLY THROUGH A CENTRAL ANGLE OF 21°32'18", AN ARC LENGTH OF 292.46 FEET, TO THE BEGINNING OF A COMPOUND CURVE HAVING A RADIUS OF 100.00 FEET. A RADIAL LINE TO SAID POINT BEARS SOUTH 52°07'26" EAST; THENCE ALONG THE ARC OF SAID CURVE TO THE RIGHT CONCAVE NORTHWESTERLY THROUGH A CENTRAL ANGLE OF 16°50'21", AN ARC LENGTH OF 29.39 FEET, TO THE BEGINNING OF A REVERSE CURVE HAVING A RADIUS OF 100.00 FEET, A RADIAL LINE TO SAID POINT BEARS NORTH 37°42'27" WEST; THENCE ALONG THE ARC OF SAID CURVE TO THE LEFT CONCAVE SOUTHEASTERLY THROUGH A CENTRAL ANGLE OF 16°50'21", AN ARC LENGTH OF 29.39 FEET, TO THE BEGINNING OF A REVERSE CURVE HAVING A RADIUS OF 768.00 FEET, A RADIAL LINE TO SAID POINT BEARS SOUTH 54°32'48" EAST; THENCE ALONG THE ARC OF SAID CURVE TO THE RIGHT CONCAVE NORTHWESTERLY THROUGH A CENTRAL ANGLE OF 07°00'26", AN ARC LENGTH OF 93.93 FEET, TO THE BEGINNING OF A COMPOUND CURVE HAVING A RADIUS OF 54.00 FEET, A RADIAL LINE TO SAID POINT BEARS SOUTH 47°32'22" EAST; THENCE ALONG THE ARC OF SAID CURVE TO THE RIGHT CONCAVE NORTHERLY THROUGH A CENTRAL ANGLE OF 101°14'06", AN ARC LENGTH OF 95.41 FEET TO A POINT ON THE EASTERLY RIGHT–OF–WAY LINE OF RANCHO DRIVE; THENCE ALONG SAID RIGHT–OF–WAY LINE NORTH 36°18'16" WEST A DISTANCE OF 2601.86 FEET TO THE BEGINNING OF A TANGENT CURVE HAVING A RADIUS OF 54.00 FEET; THENCE ALONG THE ARC OF SAID CURVE TO THE RIGHT CONCAVE EASTERLY, THROUGH A CENTRAL ANGLE OF 132°35'30" AN ARC LENGTH OF 124.97 FEET TO A POINT ON THE SOUTHERLY RIGHT–OF–WAY LINE OF CRAIG ROAD; THENCE ALONG THE RIGHT–OF–WAY LINE OF CRAIG ROAD SOUTH 83°42'46" EAST A DISTANCE OF 1744.32 FEET TO THE BEGINNING OF A TANGENT CURVE HAVING A RADIUS OF 54.00 FEET; THENCE ALONG THE ARC OF SAID CURVE TO THE RIGHT CONCAVE SOUTHWESTERLY THROUGH A CENTRAL ANGLE OF 83°25'38", AN ARC LENGTH OF 78.63 FEET TO A POINT ON THE WESTERLY RIGHT–OF–WAY LINE OF JONES ALSO BEING THE POINT OF BEGINNING

THE ABOVE PARCEL OF LAND CONTAINS APPROXIMATELY AN AREA OF 50.28 ACRES/GROSS.

BASIS OF BEARINGS

THE BASIS OF BEARINGS FOR THIS SURVEY IS THE SOUTHERLY LINE OF THE NORTHEAST QUARTER (NE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST M.D.M. AS SHOWN ON THAT MAP ON FILE IN FILE 192, PAGE 31 OF SURVEYS IN THE CLARK COUNTY RECORDERS OFFICE.

SAID LINE BEARS: NORTH 83°42'46" WEST.

CERTIFICATE OF DIRECTOR OF PLANNING APPROVAL

I CERTIFY THAT THIS FINAL MAP SUBSTANTIALLY COMPLIES WITH THE TENTATIVE MAP AND ANY APPROVED ALTERATIONS THERETO; THAT THE MAP COMPLIES WITH APPLICABLE STATUTORY AND ORDINANCE PROVISIONS; THAT ALL CONDITIONS IMPOSED UPON THE FINAL MAP HAVE BEEN MET; AND THAT THE MAP WAS APPROVED AND THE PARCELS HEREIN WERE ACCEPTED FOR DEDICATION BY THE DIRECTOR OF PLANNING DEVELOPMENT ON THE 18TH DAY OF May, 2016

THOMAS A. PERRICO
DIRECTOR OF PLANNING
CITY OF LAS VEGAS, NEVADA

OVERALL LOT COUNT

1

REFERENCE MAPS

SEE SHEET 2 OF 3 FOR REFERENCE MAP DATA.

COUNTY RECORDER'S NOTE

ANY SUBSEQUENT CHANGES TO THIS MAP SHOULD BE EXAMINED AND MAY BE DETERMINED BY REFERENCE TO COUNTY RECORDER'S CUMULATIVE MAP INDEX. N.R.S. 278.5695

SURVEYOR'S CERTIFICATE

I, GLEN J. DAVIS, A PROFESSIONAL LAND SURVEYOR LICENSED IN THE STATE OF NEVADA, DO HEREBY CERTIFY:

1. THIS PLAT REPRESENTS THE RESULTS OF A SURVEY CONDUCTED UNDER MY SUPERVISION AT THE INSTANCE OF PRE RANCHO CRAIG L L C, A NEVADA LIMITED LIABILITY COMPANY.
2. THE LANDS SURVEYED LIE WITHIN THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 02, TOWNSHIP 20 SOUTH, RANGE 60 EAST, M.D.M., CLARK COUNTY, NEVADA, AND WAS COMPLETED ON DECEMBER 18, 2015.
3. THIS PLAT COMPLIES WITH THE APPLICABLE STATE STATUTES AND ANY LOCAL ORDINANCES IN EFFECT ON THE DATE THAT THE GOVERNING BODY GAVE ITS FINAL APPROVAL.
4. THE MONUMENTS DEPICTED ON THE PLAT ARE OF THE CHARACTER SHOWN, OCCUPY THE POSITIONS INDICATED, AND ARE OF SUFFICIENT NUMBER AND DURABILITY.

GLEN J. DAVIS
PROFESSIONAL LAND SURVEYOR
NEVADA CERTIFICATE NO. 11825
CERTIFICATE EXPIRES: DECEMBER 31, 2016

4-25-16

CITY SURVEYOR'S CERTIFICATE

I, ALAN R RIEKKI, CITY SURVEYOR OF THE CITY OF LAS VEGAS, DO HEREBY CERTIFY THAT I HAVE EXAMINED THE FINAL MAP "CRAIG AND JONES, A COMMERCIAL SUBDIVISION" AND AM SATISFIED THAT THE MAP IS TECHNICALLY CORRECT.

MICHAEL F KINNEY, PLS 21570 6/9/16
FOR: ALAN R RIEKKI PLS
CITY SURVEYOR
CITY OF LAS VEGAS, NEVADA
NEVADA CERTIFICATE NO. 12469

CITY OF LAS VEGAS DEPARTMENT OF PUBLIC WORKS NEVADA

DISTRICT BOARD OF HEALTH CERTIFICATE

THIS FINAL MAP IS APPROVED BY THE SOUTHERN NEVADA HEALTH DISTRICT. THIS APPROVAL CONCERNS SEWAGE DISPOSAL, WATER POLLUTION, WATER QUALITY, AND WATER SUPPLY FACILITIES AND IS PREDICATED UPON PLANS FOR A PUBLIC WATER SUPPLY AND A COMMUNITY SYSTEM FOR DISPOSAL OF SEWAGE.

~~WALTER B. ROSS~~ Brian Northam 5/5/16
SOUTHERN NEVADA HEALTH DISTRICT DATE

DIVISION OF WATER RESOURCES

THIS FINAL MAP IS APPROVED BY THE DIVISION OF WATER RESOURCES OF THE DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES CONCERNING WATER QUANTITY SUBJECT TO THE REVIEW OF APPROVAL ON FILE IN THIS OFFICE.

P.E. 5/5/16
JOHN GUILORY P.E. #15501 DATE
DIVISION OF WATER RESOURCES

NOTE

1. ALL SUBDIVIDED PARCELS COMPRISING THIS COMMERCIAL SUBDIVISION SHALL PROVIDE PERPETUAL INTER–SITE COMMON DRAINAGE RIGHTS ACROSS ALL EXISTING AND FUTURE PARCEL LIMITS.
2. ALL LOTS CREATED BY THIS FINAL MAP SHALL HAVE PERPETUAL, IRREVOCABLE COMMON ACCESS RIGHTS TO ALL DRIVEWAYS SERVICING THIS OVERALL SITE UNLESS INCOMPATIBLE USES CAN BE DEMONSTRATED TO THE SATISFACTION OF THE CITY ENGINEER.
3. RECORDATION OF THIS MAP DOES NOT EXPUNGE ANY VEHICULAR AND PEDESTRIAN ACCESS RIGHTS, SEWER, AND DRAINAGE RIGHTS EXISTING THROUGH RECORDATION OF THE PREVIOUS COMMERCIAL SUBDIVISION MAP, AND SHALL REMAIN IN AFFECT UNLESS AND UNTIL SUCH RIGHTS ARE RELINQUISHED BY THEIR HOLDERS VIA SEPARATE ACTION.
4. NO BARRIERS (E.G. CURBS, WALLS ECT.) SHALL BE ERECTED WITHIN THE BOUNDARIES OF THE OVERALL COMMERCIAL SUBDIVISION MAP SITE WHICH WOULD PROHIBIT ANY VEHICLE ON THIS SITE FROM UTILIZING THE DRIVEWAY CONNECTING THIS COMMERCIAL DEVELOPMENT SITE TO THE ABUTTING PUBLIC STREET.
5. ON SITE SEWERS ARE A COMMON ELEMENT PRIVATELY OWNED AND MAINTAINED PER THE CONDITIONS, COVENANTS, AND RESTRICTIONS (CC&Rs) OF THIS COMMERCIAL SUBDIVISION.

S–3113 FMP–63304

FINAL MAP CRAIG AND JONES (A COMMERCIAL SUBDIVISION)	NO. 1181 FILED AT THE REQUEST OF LOCHSA SURVEYING DATE: 6/9/16 TIME 12:20PM BOOK 151 PAGE 100 OF PLATS OFFICIAL RECORDS BOOK NO. 20160609 CLARK COUNTY, NEVADA RECORDS DEBBIE CONWAY, COUNTY RECORDER FEE $77 DEPUTY GLORD
BEING A PORTION OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST, M.D.B. & M. CITY OF LAS VEGAS, CLARK COUNTY, NEVADA	
LOCHSA SURVEYING 6345 SOUTH JONES BLVD, SUITE 200 LAS VEGAS, NEVADA 89118 PHONE: 702-365-6312 FAX: 702-365-6317	

BOOK 151 PAGE 100

151/100

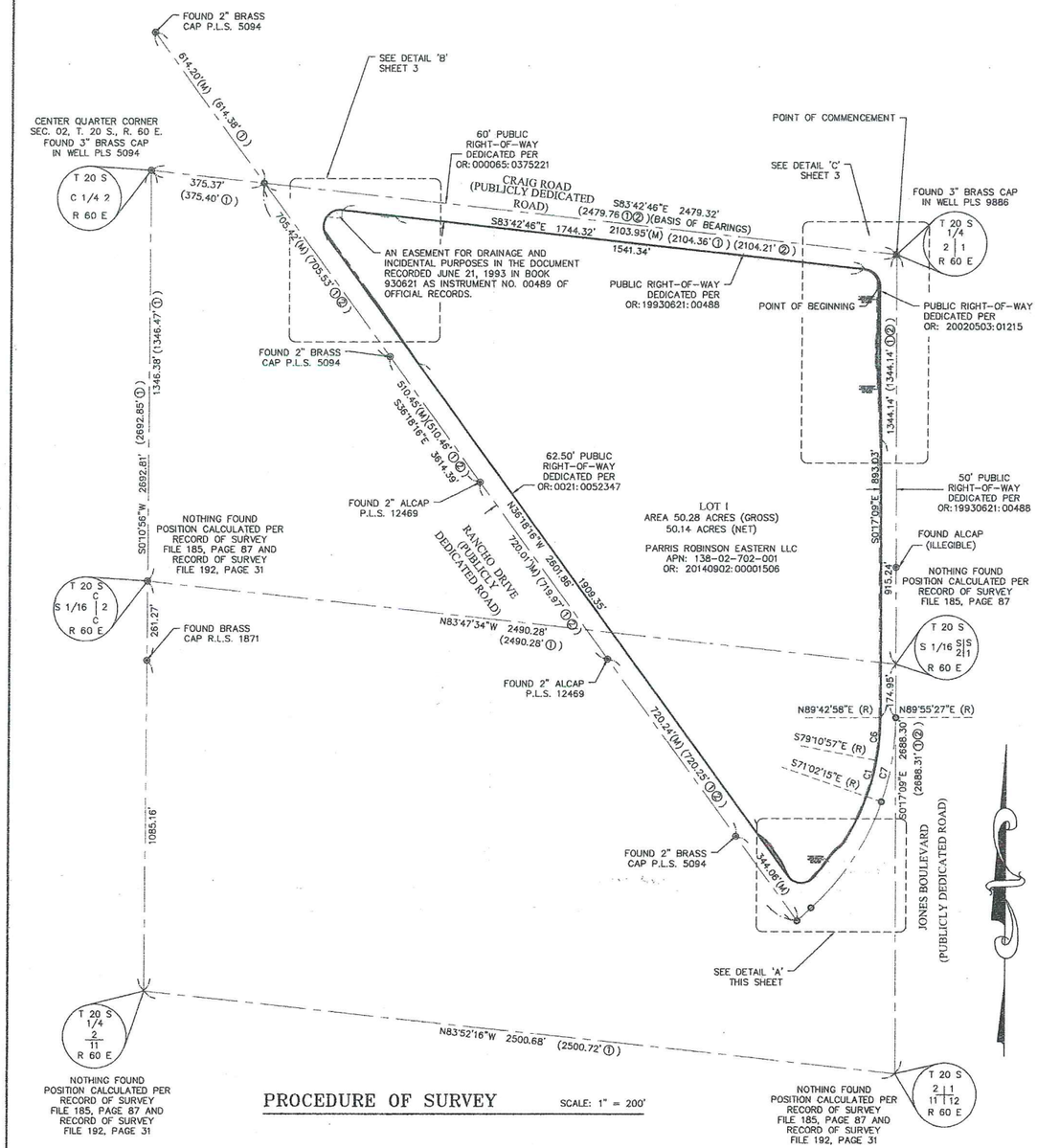
FINAL MAP
CRAIG AND JONES
(A COMMERCIAL SUBDIVISION)

BEING A PORTION OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST, M.D.B. & M. CITY OF LAS VEGAS, CLARK COUNTY, NEVADA

BASIS OF BEARINGS

THE BASIS OF BEARINGS FOR THIS SURVEY IS THE SOUTHERLY LINE OF THE NORTHEAST QUARTER (NE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST M.D.M. AS SHOWN ON THAT MAP ON FILE IN FILE 192, PAGE 31 OF SURVEYS IN THE CLARK COUNTY RECORDERS OFFICE.

SAID LINE BEARS: NORTH 83°42'46" WEST.



PROCEDURE OF SURVEY

SCALE: 1" = 200'

Line Table		
Line #	Direction	Length
L1	S00°17'09"E	102.19'
L2	S89°42'51"W	55.00'
L3	N09°48'58"E	25.86'
L4	N00°17'09"W	80.00'
L5	S73°30'19"E	6.77'
L6	S83°42'30"E	80.00'
L7	N79°19'08"E	2.37'
L9	N17°58'53"W	11.79'
L10	S26°05'48"E	51.96'
L11	S36°18'16"E	80.00'
L16	S53°25'08"E	26.46'
L24	S00°17'09"E	0.69'

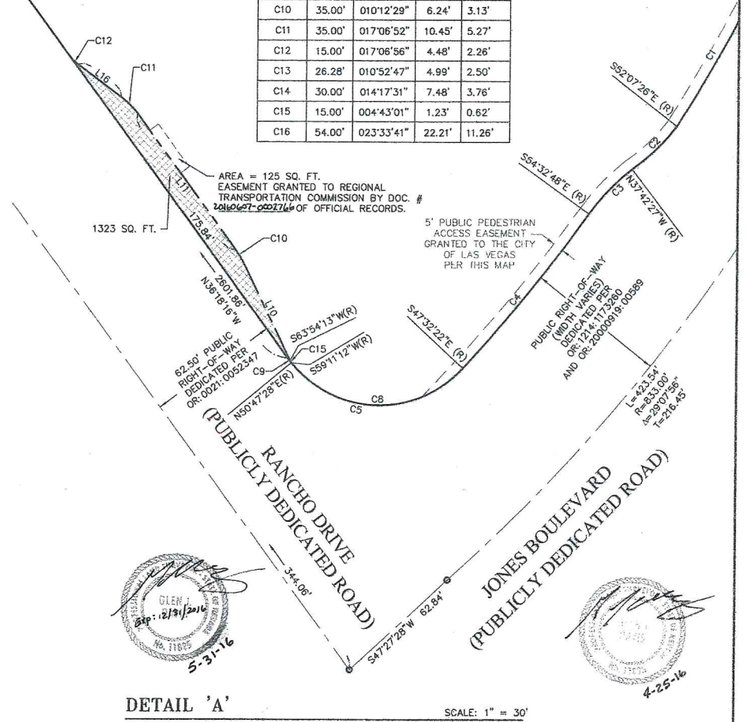
LEGEND

- SUBJECT PROPERTY BOUNDARY LINE
- STREET CENTERLINE
- ADJOINER'S PROPERTY LINE
- EASEMENT LINE
- STREET RIGHT-OF-WAY LINE
- AREA TO BE DEDICATED TO CITY OF LAS VEGAS PER THIS MAP
- SET TYPE III MONUMENT
- FOUND MONUMENT AS SHOWN AND DESCRIBED

REFERENCE MAPS/DOCS

① RECORD OF SURVEY FILE 185 PAGE 87
② RECORD OF SURVEY FILE 192 PAGE 31

Curve Table				
Curve #	Radius	Delta	Length	Tangent
C1	778.00'	021°32'18"	292.46'	147.98'
C2	100.00'	016°50'21"	29.39'	14.80'
C3	100.00'	016°50'21"	29.39'	14.80'
C4	768.00'	007°00'26"	93.93'	47.02'
C5	54.00'	101°14'06"	95.41'	65.78'
C6	783.00'	010°22'29"	141.78'	71.08'
C7	868.92'	018°33'14"	281.38'	141.93'
C8	54.00'	098°20'30"	92.68'	62.50'
C9	54.00'	002°53'36"	2.73'	1.36'
C10	35.00'	010°12'29"	6.24'	3.13'
C11	35.00'	017°06'52"	10.45'	5.27'
C12	15.00'	017°06'56"	4.48'	2.26'
C13	26.28'	010°52'47"	4.99'	2.50'
C14	30.00'	014°17'31"	7.48'	3.76'
C15	15.00'	004°43'01"	1.23'	0.62'
C16	54.00'	023°33'41"	22.21'	11.26'



DETAIL 'A'

SCALE: 1" = 30'

GLEN J. [illegible] No. 11875 Exp: 12/31/2016 5-31-16

4-25-16

151/100

FINAL MAP
CRAIG AND JONES
(A COMMERCIAL SUBDIVISION)

BEING A PORTION OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST, M.D.B. & M. CITY OF LAS VEGAS, CLARK COUNTY, NEVADA

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SAID LINE BEARS: NORTH 83°42'46" WEST.

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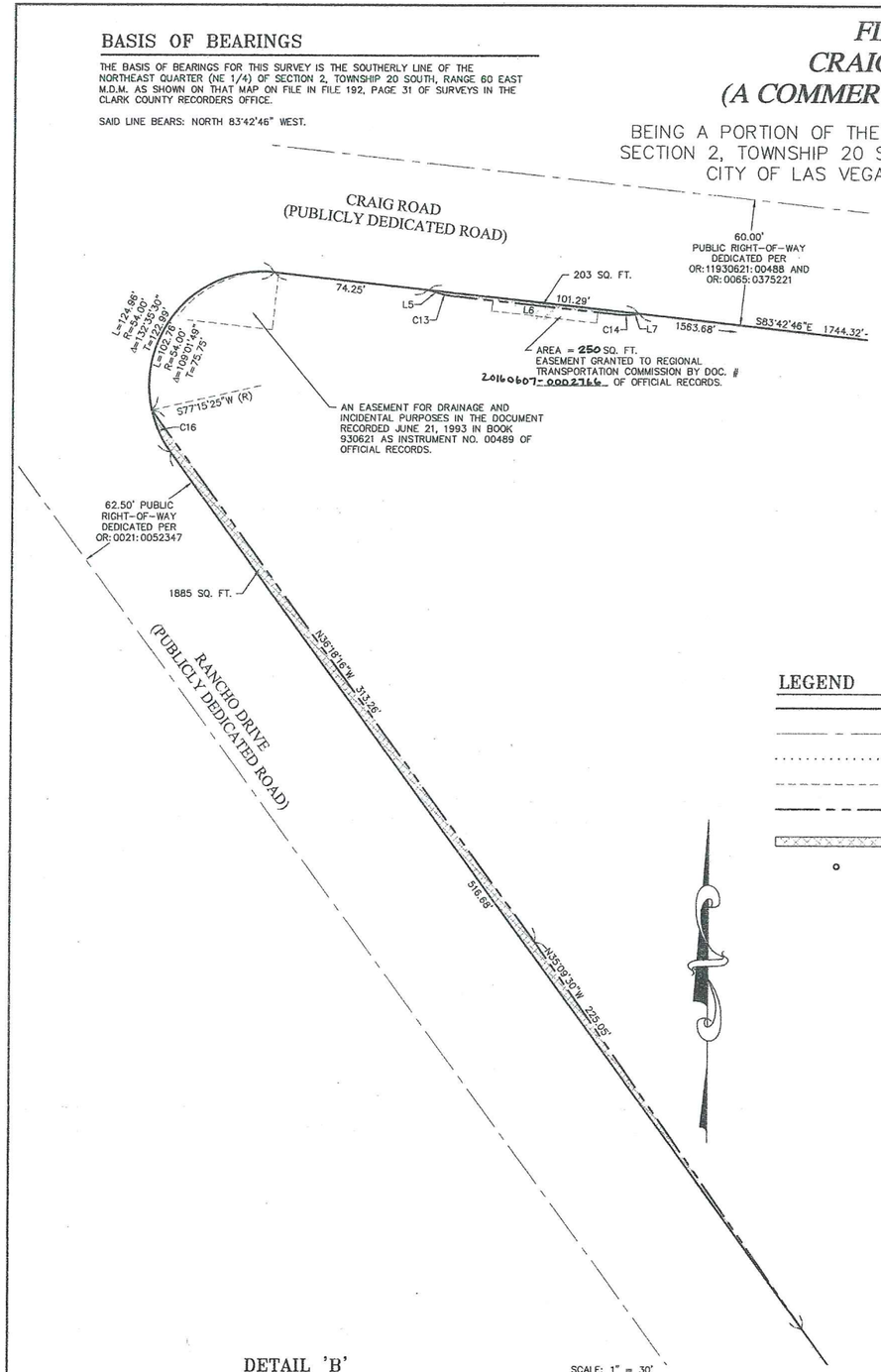
RECORD OF SURVEY	FILE 185 PAGE 87
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LEGEND

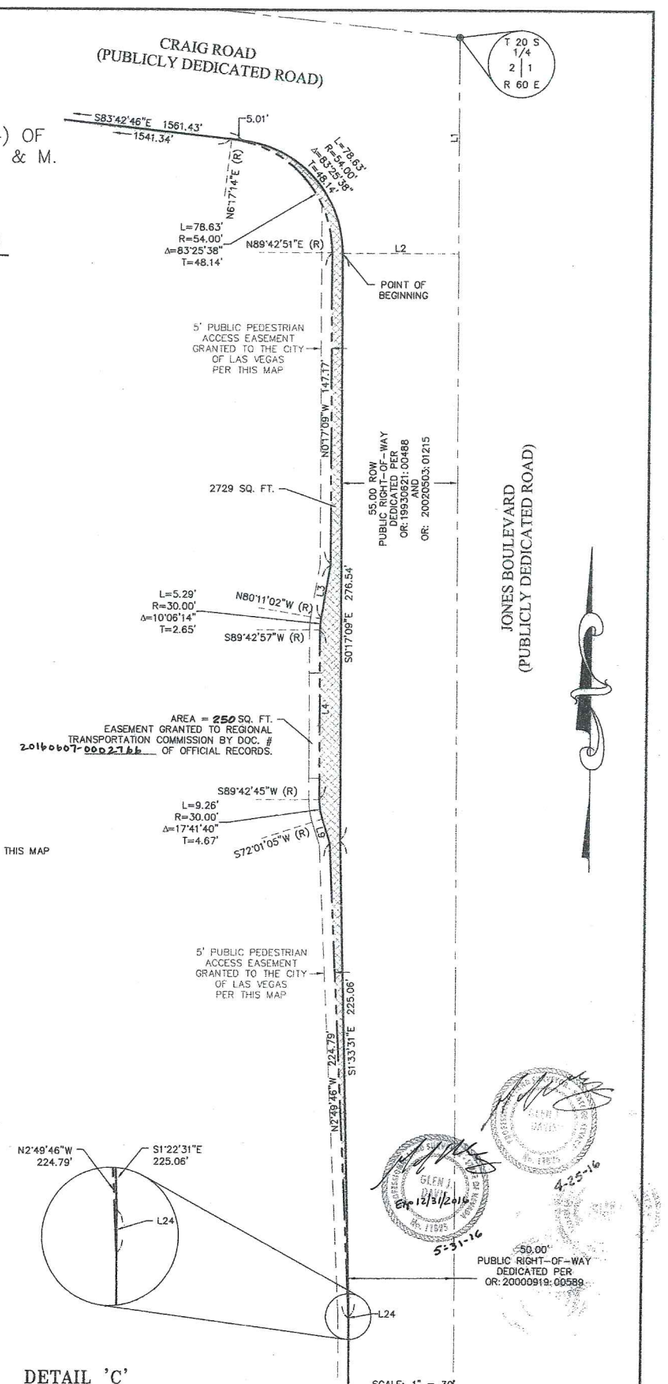
- SUBJECT PROPERTY BOUNDARY LINE
- STREET CENTERLINE
- ADJOINER'S PROPERTY LINE
- EASEMENT LINE
- STREET RIGHT-OF-WAY LINE
- AREA TO BE DEDICATED TO CITY OF LAS VEGAS PER THIS MAP
- SET TYPE III MONUMENT

Curve Table				
Curve #	Radius	Delta	Length	Tangent
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C11	35.00'	017°06'52"	10.45'	5.27'
C12	15.00'	017°06'56"	4.48'	2.26'
C13	26.28'	010°52'47"	4.99'	2.50'
C14	30.00'	014°17'31"	7.48'	3.76'
C15	15.00'	004°43'01"	1.23'	0.62'
C16	54.00'	023°33'41"	22.21'	11.26'



DETAIL 'B'

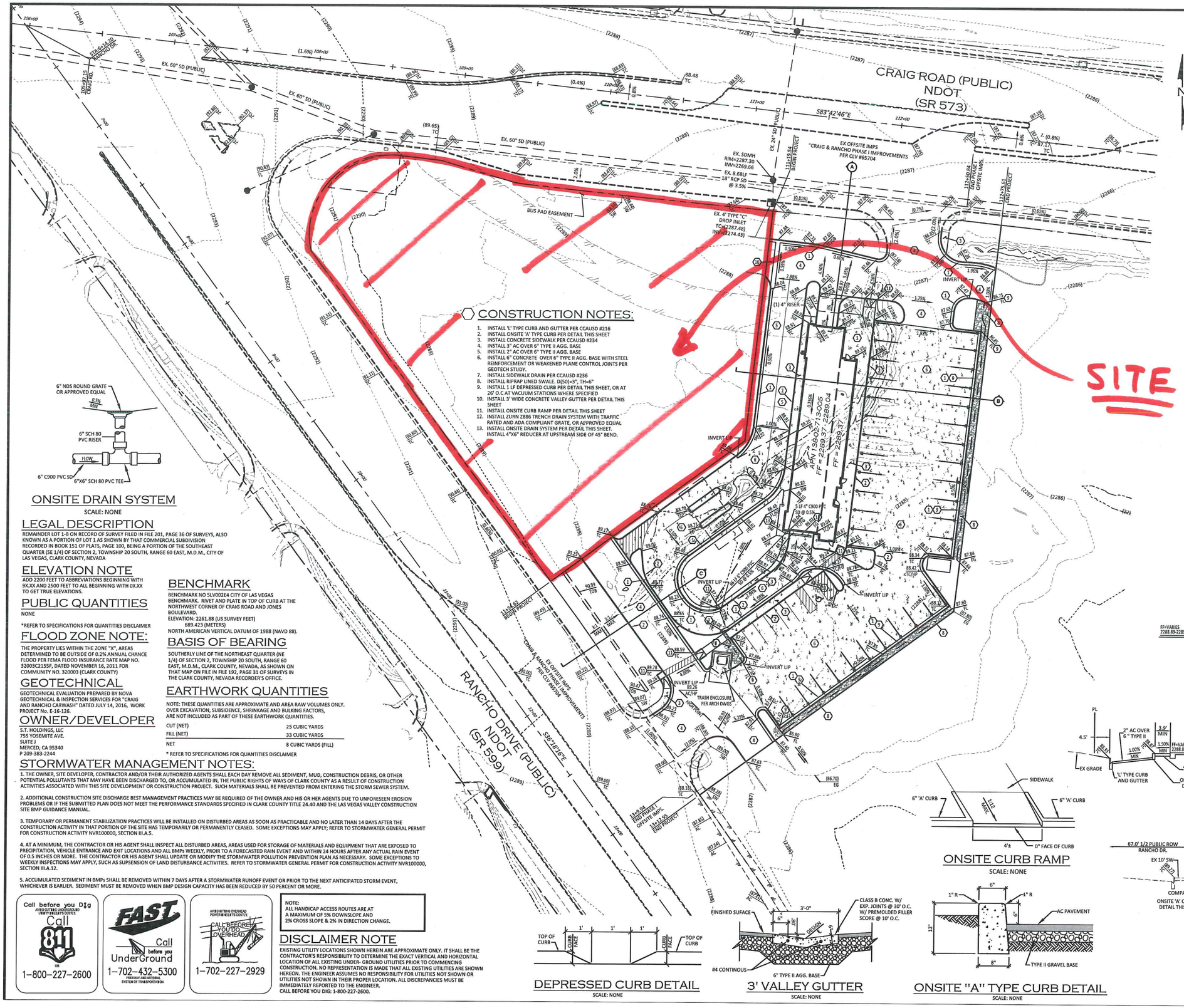
SCALE: 1" = 30'



DETAIL 'C'

SCALE: 1" = 30'

151/100



CONSTRUCTION NOTES:

1. INSTALL 'L' TYPE CURB AND GUTTER PER CCAUSD #216
2. INSTALL ONSITE 'A' TYPE CURB PER DETAIL THIS SHEET
3. INSTALL CONCRETE SIDEWALK PER CCAUSD #234
4. INSTALL 3" AC OVER 6" TYPE II AGG. BASE
5. INSTALL 2" AC OVER 6" TYPE II AGG. BASE
6. INSTALL 6" CONCRETE OVER 6" TYPE II AGG. BASE WITH STEEL REINFORCEMENT OR WEAKENED PLANE CONTROL JOINTS PER GEOTECH STUDY.
7. INSTALL SIDEWALK DRAIN PER CCAUSD #236
8. INSTALL RIPRAP LINED SWALE. D(50)=3", TH=6"
9. INSTALL 1 LF DEPRESSED CURB PER DETAIL THIS SHEET, OR AT 26' O.C AT VACUUM STATIONS WHERE SPECIFIED
10. INSTALL 3' WIDE CONCRETE VALLEY GUTTER PER DETAIL THIS SHEET
11. INSTALL ONSITE CURB RAMP PER DETAIL THIS SHEET
12. INSTALL ZURN Z886 TRENCH DRAIN SYSTEM WITH TRAFFIC RATED AND ADA COMPLIANT GRATE, OR APPROVED EQUAL
13. INSTALL ONSITE DRAIN SYSTEM PER DETAIL THIS SHEET. INSTALL 4"X6" REDUCER AT UPSTREAM SIDE OF 45° BEND.

ONSITE DRAIN SYSTEM

SCALE: NONE

LEGAL DESCRIPTION

REMAINDER LOT 1-B ON RECORD OF SURVEY FILED IN FILE 201, PAGE 36 OF SURVEYS, ALSO KNOWN AS A PORTION OF LOT 1 AS SHOWN BY THAT COMMERCIAL SUBDIVISION RECORDED IN BOOK 151 OF PLATS, PAGE 100, BEING A PORTION OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST, M.D.M., CITY OF LAS VEGAS, CLARK COUNTY, NEVADA

ELEVATION NOTE

ADD 2200 FEET TO ABBREVIATIONS BEGINNING WITH 9X.XX AND 2500 FEET TO ALL BEGINNING WITH 0X.XX TO GET TRUE ELEVATIONS.

PUBLIC QUANTITIES

NONE

*REFER TO SPECIFICATIONS FOR QUANTITIES DISCLAIMER

FLOOD ZONE NOTE:

THE PROPERTY LIES WITHIN THE ZONE "X", AREAS DETERMINED TO BE OUTSIDE OF 0.2% ANNUAL CHANCE FLOOD PER FEMA FLOOD INSURANCE RATE MAP NO. 32003C2155F, DATED NOVEMBER 16, 2011 FOR COMMUNITY NO. 320003 (CLARK COUNTY)

GEOTECHNICAL

GEOTECHNICAL EVALUATION PREPARED BY NOVA GEOTECHNICAL & INSPECTION SERVICES FOR "CRAIG AND RANCHO CARWASH" DATED JULY 14, 2016, WORK PROJECT No. E-16-126.

OWNER/DEVELOPER

S.T. HOLDINGS, LLC
755 YOSEMITE AVE.
SUITE J
MERCED, CA 95340
P 209-383-2244

BENCHMARK

BENCHMARK NO 5LV002E4 CITY OF LAS VEGAS
BENCHMARK. RIVET AND PLATE IN TOP OF CURB AT THE NORTHWEST CORNER OF CRAIG ROAD AND JONES BOULEVARD.
ELEVATION: 2261.88 (US SURVEY FEET)
689.423 (METERS)
NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).

BASIS OF BEARING

SOUTHERLY LINE OF THE NORTHEAST QUARTER (NE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST, M.D.M., CLARK COUNTY, NEVADA, AS SHOWN ON THAT MAP ON FILE IN FILE 192, PAGE 31 OF SURVEYS IN THE CLARK COUNTY, NEVADA RECORDER'S OFFICE.

EARTHWORK QUANTITIES

NOTE: THESE QUANTITIES ARE APPROXIMATE AND AREA RAW VOLUMES ONLY. OVER EXCAVATION, SUBSIDENCE, SHRINKAGE AND BULKING FACTORS, ARE NOT INCLUDED AS PART OF THESE EARTHWORK QUANTITIES.

CUT (NET)	25 CUBIC YARDS
FILL (NET)	33 CUBIC YARDS
NET	8 CUBIC YARDS (FILL)

* REFER TO SPECIFICATIONS FOR QUANTITIES DISCLAIMER

STORMWATER MANAGEMENT NOTES:

1. THE OWNER, SITE DEVELOPER, CONTRACTOR AND/OR THEIR AUTHORIZED AGENTS SHALL EACH DAY REMOVE ALL SEDIMENT, MUD, CONSTRUCTION DEBRIS, OR OTHER POTENTIAL POLLUTANTS THAT MAY HAVE BEEN DISCHARGED TO, OR ACCUMULATED IN, THE PUBLIC RIGHTS OF WAYS OF CLARK COUNTY AS A RESULT OF CONSTRUCTION ACTIVITIES ASSOCIATED WITH THIS SITE DEVELOPMENT OR CONSTRUCTION PROJECT. SUCH MATERIALS SHALL BE PREVENTED FROM ENTERING THE STORM SEWER SYSTEM.

2. ADDITIONAL CONSTRUCTION SITE DISCHARGE BEST MANAGEMENT PRACTICES MAY BE REQUIRED OF THE OWNER AND HIS OR HER AGENTS DUE TO UNFORESEEN EROSION PROBLEMS OR IF THE SUBMITTED PLAN DOES NOT MEET THE PERFORMANCE STANDARDS SPECIFIED IN CLARK COUNTY TITLE 24.40 AND THE LAS VEGAS VALLEY CONSTRUCTION SITE BMP GUIDANCE MANUAL.

3. TEMPORARY OR PERMANENT STABILIZATION PRACTICES WILL BE INSTALLED ON DISTURBED AREAS AS SOON AS PRACTICABLE AND NO LATER THAN 14 DAYS AFTER THE CONSTRUCTION ACTIVITY IN THAT PORTION OF THE SITE HAS TEMPORARILY OR PERMANENTLY CEASED. SOME EXCEPTIONS MAY APPLY; REFER TO STORMWATER GENERAL PERMIT FOR CONSTRUCTION ACTIVITY NVR100000, SECTION III.A.5.

4. AT A MINIMUM, THE CONTRACTOR OR HIS AGENT SHALL INSPECT ALL DISTURBED AREAS, AREAS USED FOR STORAGE OF MATERIALS AND EQUIPMENT THAT ARE EXPOSED TO PRECIPITATION, VEHICLE ENTRANCE AND EXIT LOCATIONS AND ALL BMPs WEEKLY, PROIR TO A FORECASTED RAIN EVENT AND WITHIN 24 HOURS AFTER ANY ACTUAL RAIN EVENT OF 0.5 INCHES OR MORE. THE CONTRACTOR OR HIS AGENT SHALL UPDATE OR MODIFY THE STORMWATER POLLUTION PREVENTION PLAN AS NECESSARY. SOME EXCEPTIONS TO WEEKLY INSPECTIONS MAY APPLY, SUCH AS SUSPENSION OF LAND DISTURBANCE ACTIVITIES. REFER TO STORMWATER GENERAL PERMIT FOR CONSTRUCTION ACTIVITY NVR100000, SECTION III.A.12.

5. ACCUMULATED SEDIMENT IN BMPs SHALL BE REMOVED WITHIN 7 DAYS AFTER A STORMWATER RUNOFF EVENT OR PRIOR TO THE NEXT ANTICIPATED STORM EVENT, WHICHEVER IS EARLIER. SEDIMENT MUST BE REMOVED WHEN BMP DESIGN CAPACITY HAS BEEN REDUCED BY 50 PERCENT OR MORE.

Call before you Dig
AVOID OUTAGE, UNDERGROUND UTILITY DAMAGE & COSTLY FINES
Call 811 OR 1-800-227-2600

FAST Call before you UnderGround
1-702-432-5300
FREEWAY AND ARTERIAL SYSTEM OF TRANSPORTATION

AVOID BEING OVERHEAD POWER LINE COSTLY
CALL BEFORE YOU DIG OVERHEAD
1-702-227-2929

NOTE:
ALL HANDICAP ACCESS ROUTES ARE AT A MAXIMUM OF 5% DOWNSLOPE AND 2% CROSS SLOPE & 2% IN DIRECTION CHANGE.

DISCLAIMER NOTE

EXISTING UTILITY LOCATIONS SHOWN HEREIN ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT VERTICAL AND HORIZONTAL LOCATION OF ALL EXISTING UNDER- GROUND UTILITIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN HEREON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR UTILITIES NOT SHOWN IN THEIR PROPER LOCATION. ALL DISCREPANCIES MUST BE IMMEDIATELY REPORTED TO THE ENGINEER.
CALL BEFORE YOU DIG: 1-800-227-2600.

DEPRESSED CURB DETAIL

SCALE: NONE

3' VALLEY GUTTER

SCALE: NONE

ONSITE "A" TYPE CURB DETAIL

SCALE: NONE

ONSITE CURB RAMP

SCALE: NONE



VICINITY MAP

SCALE: NTS

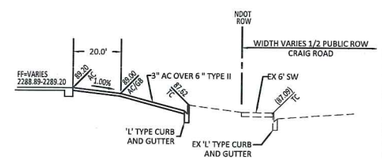
N

GRAPHIC SCALE

30 0 15 30 60
(IN FEET)
1 INCH = 30 FT.

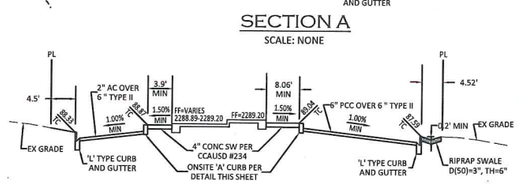
LEGEND

- RIGHT-OF-WAY
- PROPERTY LINE
- STREET CENTER LINE
- EXISTING BUILDING
- PROPOSED BUILDING
- EXISTING CURB & GUTTER
- PROPOSED CURB & GUTTER
- EXISTING EDGE OF AC
- 67.62 TC — PROPOSED ELEVATION
- (67.62) TC — EXISTING ELEVATION
- 4.60% — SLOPE & DIRECTION OF SLOPE
- GRADE BREAK — GRADE BREAK
- PROPOSED CMU WALL
- EXISTING CMU WALL
- 2631 — EXISTING 1' CONTOUR
- 2630 — EXISTING 5' CONTOUR
- A — CROSS SECTION



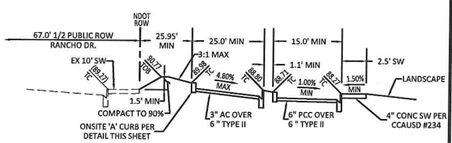
SECTION A

SCALE: NONE



SECTION B

SCALE: NONE



SECTION C

SCALE: NONE

DRAINAGE STUDY COMPLIANCE

I, JEREMY S. MCCAY, HEREBY CERTIFY THAT THIS GRADING PLAN CONFORMS TO THE APPROVED DRAINAGE STUDY ON FILE WITH THE CITY OF LAS VEGAS FOR THIS PROJECT: DS4852A

JEREMY S. McCAY
NEVADA P.E. NO. 15797

DATE

REV	DATE	BY	REVISION

MCCAY ENGINEERING
CIVIL ENGINEERING
11700 W. CHARLESTON BLVD.
SUITE #170-298
LAS VEGAS, NEVADA 89135
P 702.860.3897

S.T. ENTERPRISES, LLC
755 YOSEMITE AVE.
SUITE J
MERCED, CA 95340
P 209-383-2244
F 209-383-2248

GRADING PLAN, SECTIONS & DETAILS

WOW CARWASH @ CRAIG & RANCHO

DATE: 1/11/2017
DRAWN BY: JSM
PROJECT MGR: JSM
PROJECT NO: 16199
SCALE: 1"=30'

PROFESSIONAL ENGINEER - STATE OF NEVADA
JEREMY S. McCAY
Exp: 12/31/17
CIVIL
PROJECT No. 15797

1/11/17

SHEET
C3.01
3 OF 4 SHEETS
DRAWING NO.

FINAL MAP
CRAIG AND JONES
(A COMMERCIAL SUBDIVISION)

BEING A PORTION OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST, M.D.B. & M. CITY OF LAS VEGAS, CLARK COUNTY, NEVADA

OWNER'S CERTIFICATE OF DEDICATION

WE, PRE RANCHO CRAIG L L C, A NEVADA LIMITED LIABILITY COMPANY DO HEREBY CERTIFY THAT WE ARE THE OWNERS OF THE PARCEL OF LAND WHICH IS SHOWN UPON THE PLAT OF "FINAL MAP OF CRAIG AND JONES", DO HEREBY CONSENT TO THE PREPARATION AND RECORDATION OF THIS PLAT, AND DO HEREBY:

– OFFER AND DEDICATE TO THE CITY OF LAS VEGAS ALL THE STREET (EXCEPT PRIVATE STREETS) AND OTHER PUBLIC RIGHTS–OF–WAY AND PLACES AS INDICATED AND OUTLINED HEREON, FOR THE USE OF THE PUBLIC AND

– GRANT TO THE CITY OF LAS VEGAS THE EASEMENTS, AS INDICATED AND OUTLINED HEREON FOR THE USE OF THE PUBLIC.

FURTHERMORE THE UNDERSIGNED OWNERS DO HEREBY GRANT AND CONVEY TO NEVADA POWER COMPANY, A NEVADA CORPORATION, D/B/A NV ENERGY, CENTRAL TELEPHONE COMPANY, D/B/A CENTURY LINK, SOUTHWEST GAS CORPORATION, LAS VEGAS VALLEY WATER DISTRICT AND COX COMMUNICATIONS LAS VEGAS,INC. JOINTLY AND SEVERALLY, AND TO THEIR RESPECTIVE SUCCESSORS AND ASSIGNS, A PERMANENT EASEMENT WITHIN THE AREA SHOWN HEREON AS PRIVATE STREETS, COMMON AREAS AND ALL AREAS NOT OCCUPIED BY ANY BUILDING FOR THE CONSTRUCTION, MAINTENANCE, OPERATION, FINAL REMOVAL AND/OR ABANDONMENT OF STREET LIGHTS IF ANY, AND FIRE HYDRANTS, UNDERGROUND POWER, TELEPHONE, GAS, WATER AND CABLE TELEVISION LINES AND APPURTENANCES, TOGETHER WITH THE RIGHT OF INGRESS AND EGRESS FROM THESE EASEMENTS.

FURTHER THE UNDERSIGNED OWNERS HEREBY GRANTS AND CONVEYS TO THE CITY OF LAS VEGAS AND TO ITS SUCCESSORS AND ASSIGNS A 5 FOOT WIDE EASEMENT ADJACENT TO ALL PROPERTY LINES WHERE LOTS OR COMMON AREAS ABUT PUBLIC STREETS FOR PURPOSES OF PLACING PUBLIC FIRE HYDRANTS AND PUBLIC STREET LIGHTS AND AN ADDITIONAL EASEMENT FOR UP TO TWO FEET IN RADIUS FROM EACH FIRE HYDRANT AND STREET LIGHT, TO EXTEND BEYOND THE FIVE FOOT EASEMENT IF NECESSARY, TOGETHER WITH THE RIGHT OF INGRESS AND EGRESS FROM THESE EASEMENTS.

FURTHERMORE, THE UNDERSIGNED OWNERS HEREBY GRANT AND CONVEY TO THE CITY OF LAS VEGAS AND ITS SUCCESSORS AND ASSIGNS A PERMANENT EASEMENT WITHIN THE AREA SHOWN HEREON AS PRIVATE STREETS, COMMON AREAS AND ALL AREAS NOT OCCUPIED BY ANY BUILDING, FOR THE CONSTRUCTION, MAINTENANCE, OPERATION AND FINAL REMOVAL OF PUBLIC STREET LIGHTS, OF ANY, TRAFFIC SIGNALS, CONDUITS AND APPURTENANCES AND PUBLIC FIRE HYDRANTS, TOGETHER WITH THE RIGHT OF INGRESS AND EGRESS THEREFROM.

W S Parris Manager 4-26-2016
DATE
PRE RANCHO CRAIG L L C, A NEVADA LIMITED LIABILITY COMPANY
William S. Parris, manager

ACKNOWLEDGMENT

STATE OF ~~NEVADA~~ California
SS
COUNTY OF ~~CLARK~~ SANTA BARBARA

THIS INSTRUMENT WAS ACKNOWLEDGED BEFORE ME ON 4/26/16

BY William S. Parris AS Manager
PRE RANCHO CRAIG L L C, A NEVADA LIMITED LIABILITY COMPANY

Jamie Hansen
JAMIE HANSEN
A NOTARY PUBLIC IN AND FOR SAID COUNTY AND STATE

COMMISSION# 2126869
JAMIE HANSEN
Commission # 2126869
Notary Public - California
Santa Barbara County
My Comm. Expires Sep 17, 2019

MY COMMISSION EXPIRES: 9/17/2019

CITY ENGINEER'S APPROVAL

BY THE SIGNATURE BELOW, THE CITY HEREBY ACCEPT THE EASEMENTS GRANTED TO THE CITY AS DELINEATED AND APPROVED HEREON WITH THIS PLAT, UNLESS OTHERWISE NOTED.

5-5-16
ALLEN PAVELKA P.E. #9029 DATE
CITY ENGINEER

UTILITY AGENCIES AND APPROVALS

WE, THE HEREIN NAMED UTILITY COMPANIES AND AGENCIES, APPROVE THE GRANT OF THE DESIGNATED EASEMENTS.

Yolanda M. Benito Yolanda M. Benito 4.28.2016
NEVADA POWER COMPANY, A NEVADA CORPORATION D/B/A NV ENERGY DATE

5/5/16
LAS VEGAS VALLEY WATER DISTRICT MICHAEL J. SHARI DATE

4.28.16
SOUTHWEST GAS CORPORATION – Mason Safa DATE

Carlos Rodriguez 4/28/16
COX COMMUNICATIONS LAS VEGAS, INC. DATE

Diane M. Schomer 4-28-16
CENTRAL TELEPHONE COMPANY D/B/A CENTURY LINK DIANE M. Schomer DATE

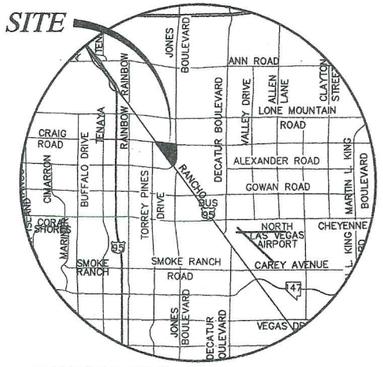
LAS VEGAS VALLEY WATER DISTRICT NOTE

RECORDATION OF THIS SUBDIVISION MAP WILL ESTABLISH A LIMITED WATER COMMITMENT FROM THE LAS VEGAS VALLEY WATER DISTRICT AS FOLLOWS:

LOT/BLOCK	ACRE–FEET/YEAR
1	1.00

MAINTENANCE WORK ON FACILITIES LOCATED WITHIN UTILITY EASEMENTS GRANTED BY THIS MAP AND OWNED AND/OR OPERATED BY THE UTILITIES (BOTH FRANCHISE AND MUNICIPAL) MAY INCLUDE THE PLACEMENT OF ASPHALT OR CONCRETE PATCH AS APPLICABLE. NO EFFORT WILL BE MAKE TO REPLACE OR MATCH ANY DECORATIVE SURFACE, LANDSCAPE FEATURE, OR ANY OTHER IMPROVEMENTS DISTURBED AS A RESULT OF MAINTENANCE ACTIVITIES OF THE UTILITIES OR THEIR AUTHORIZED REPRESENTATIVES.

SITE



VICINITY MAP NO SCALE

LEGAL DESCRIPTION

BEING A PORTION OF THE SOUTHEAST QUARTER (SE1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST, M.D.M., CITY OF LAS VEGAS, CLARK COUNTY, NEVADA, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE NORTHEAST CORNER OF SAID SOUTHEAST QUARTER (SE1/4) OF SECTION 2, ALSO BEING THE CENTER INTERSECTION OF CRAIG ROAD AND JONES BOULEVARD; THENCE SOUTH 00°17'09" EAST, ALONG THE CENTERLINE OF JONES BOULEVARD ALSO BEING THE EASTERLY LINE OF SAID SECTION 2 A DISTANCE OF 102.19 FEET; THENCE DEPARTING SAID LINE, SOUTH 89°42'51" WEST, A DISTANCE OF 55.00 FEET TO A POINT ALONG THE WESTERLY RIGHT–OF–WAY LINE OF SAID JONES BOULEVARD, SAID POINT BEING THE POINT OF BEGINNING;

THENCE SOUTH 00°17'09" EAST A DISTANCE OF 276.54 FEET ALONG SAID RIGHT–OF–WAY LINE; THENCE SOUTH 01°33'31" EAST, A DISTANCE OF 225.06 FEET; THENCE SOUTH 00°17'09" EAST, A DISTANCE OF 915.24 FEET TO THE BEGINNING OF A NON–TANGENT CURVE HAVING A RADIUS OF 783.00 FEET, A RADIAL LINE TO SAID POINT BEARS NORTH 89°42'58" EAST; THENCE ALONG THE ARC OF SAID CURVE TO THE RIGHT CONCAVE WESTERLY THROUGH A CENTRAL ANGLE OF 10°22'29", AN ARC LENGTH OF 141.78 FEET TO THE BEGINNING OF A NON–TANGENT CURVE HAVING A RADIUS OF 778.00 FEET, A RADIAL LINE TO SAID POINT BEARS SOUTH 79°10'57" EAST; THENCE ALONG THE ARC OF SAID CURVE TO THE RIGHT CONCAVE NORTHWESTERLY THROUGH A CENTRAL ANGLE OF 21°32'18", AN ARC LENGTH OF 292.46 FEET, TO THE BEGINNING OF A COMPOUND CURVE HAVING A RADIUS OF 100.00 FEET. A RADIAL LINE TO SAID POINT BEARS SOUTH 52°07'26" EAST; THENCE ALONG THE ARC OF SAID CURVE TO THE RIGHT CONCAVE NORTHWESTERLY THROUGH A CENTRAL ANGLE OF 16°50'21", AN ARC LENGTH OF 29.39 FEET, TO THE BEGINNING OF A REVERSE CURVE HAVING A RADIUS OF 100.00 FEET, A RADIAL LINE TO SAID POINT BEARS NORTH 37°42'27" WEST; THENCE ALONG THE ARC OF SAID CURVE TO THE LEFT CONCAVE SOUTHEASTERLY THROUGH A CENTRAL ANGLE OF 16°50'21", AN ARC LENGTH OF 29.39 FEET, TO THE BEGINNING OF A REVERSE CURVE HAVING A RADIUS OF 768.00 FEET, A RADIAL LINE TO SAID POINT BEARS SOUTH 54°32'48" EAST; THENCE ALONG THE ARC OF SAID CURVE TO THE RIGHT CONCAVE NORTHWESTERLY THROUGH A CENTRAL ANGLE OF 07°00'26", AN ARC LENGTH OF 93.93 FEET, TO THE BEGINNING OF A COMPOUND CURVE HAVING A RADIUS OF 54.00 FEET, A RADIAL LINE TO SAID POINT BEARS SOUTH 47°32'22" EAST; THENCE ALONG THE ARC OF SAID CURVE TO THE RIGHT CONCAVE NORTHERLY THROUGH A CENTRAL ANGLE OF 101°14'06", AN ARC LENGTH OF 95.41 FEET TO A POINT ON THE EASTERLY RIGHT–OF–WAY LINE OF RANCHO DRIVE; THENCE ALONG SAID RIGHT–OF–WAY LINE NORTH 36°18'16" WEST A DISTANCE OF 2601.86 FEET TO THE BEGINNING OF A TANGENT CURVE HAVING A RADIUS OF 54.00 FEET; THENCE ALONG THE ARC OF SAID CURVE TO THE RIGHT CONCAVE EASTERLY, THROUGH A CENTRAL ANGLE OF 132°35'30" AN ARC LENGTH OF 124.97 FEET TO A POINT ON THE SOUTHERLY RIGHT–OF–WAY LINE OF CRAIG ROAD; THENCE ALONG THE RIGHT–OF–WAY LINE OF CRAIG ROAD SOUTH 83°42'46" EAST A DISTANCE OF 1744.32 FEET TO THE BEGINNING OF A TANGENT CURVE HAVING A RADIUS OF 54.00 FEET; THENCE ALONG THE ARC OF SAID CURVE TO THE RIGHT CONCAVE SOUTHWESTERLY THROUGH A CENTRAL ANGLE OF 83°25'38", AN ARC LENGTH OF 78.63 FEET TO A POINT ON THE WESTERLY RIGHT–OF–WAY LINE OF JONES ALSO BEING THE POINT OF BEGINNING

THE ABOVE PARCEL OF LAND CONTAINS APPROXIMATELY AN AREA OF 50.28 ACRES/GROSS.

BASIS OF BEARINGS

THE BASIS OF BEARINGS FOR THIS SURVEY IS THE SOUTHERLY LINE OF THE NORTHEAST QUARTER (NE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST M.D.M. AS SHOWN ON THAT MAP ON FILE IN FILE 192, PAGE 31 OF SURVEYS IN THE CLARK COUNTY RECORDERS OFFICE.

SAID LINE BEARS: NORTH 83°42'46" WEST.

CERTIFICATE OF DIRECTOR OF PLANNING APPROVAL

I CERTIFY THAT THIS FINAL MAP SUBSTANTIALLY COMPLIES WITH THE TENTATIVE MAP AND ANY APPROVED ALTERATIONS THERETO; THAT THE MAP COMPLIES WITH APPLICABLE STATUTORY AND ORDINANCE PROVISIONS; THAT ALL CONDITIONS IMPOSED UPON THE FINAL MAP HAVE BEEN MET; AND THAT THE MAP WAS APPROVED AND THE PARCELS HEREIN WERE ACCEPTED FOR DEDICATION BY THE DIRECTOR OF PLANNING DEVELOPMENT ON THE 18TH DAY OF May, 2016

THOMAS A. PERRICO
DIRECTOR OF PLANNING
CITY OF LAS VEGAS, NEVADA

OVERALL LOT COUNT

1

REFERENCE MAPS

SEE SHEET 2 OF 3 FOR REFERENCE MAP DATA.

COUNTY RECORDER'S NOTE

ANY SUBSEQUENT CHANGES TO THIS MAP SHOULD BE EXAMINED AND MAY BE DETERMINED BY REFERENCE TO COUNTY RECORDER'S CUMULATIVE MAP INDEX. N.R.S. 278.5695

SURVEYOR'S CERTIFICATE

I, GLEN J. DAVIS, A PROFESSIONAL LAND SURVEYOR LICENSED IN THE STATE OF NEVADA, DO HEREBY CERTIFY:

1. THIS PLAT REPRESENTS THE RESULTS OF A SURVEY CONDUCTED UNDER MY SUPERVISION AT THE INSTANCE OF PRE RANCHO CRAIG L L C, A NEVADA LIMITED LIABILITY COMPANY.
2. THE LANDS SURVEYED LIE WITHIN THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 02, TOWNSHIP 20 SOUTH, RANGE 60 EAST, M.D.M., CLARK COUNTY, NEVADA, AND WAS COMPLETED ON DECEMBER 18, 2015.
3. THIS PLAT COMPLIES WITH THE APPLICABLE STATE STATUTES AND ANY LOCAL ORDINANCES IN EFFECT ON THE DATE THAT THE GOVERNING BODY GAVE ITS FINAL APPROVAL.
4. THE MONUMENTS DEPICTED ON THE PLAT ARE OF THE CHARACTER SHOWN, OCCUPY THE POSITIONS INDICATED, AND ARE OF SUFFICIENT NUMBER AND DURABILITY.

GLEN J. DAVIS
PROFESSIONAL LAND SURVEYOR
NEVADA CERTIFICATE NO. 11825
CERTIFICATE EXPIRES: DECEMBER 31, 2016

4-25-16

CITY SURVEYOR'S CERTIFICATE

I, ALAN R RIEKKI, CITY SURVEYOR OF THE CITY OF LAS VEGAS, DO HEREBY CERTIFY THAT I HAVE EXAMINED THE FINAL MAP "CRAIG AND JONES, A COMMERCIAL SUBDIVISION" AND AM SATISFIED THAT THE MAP IS TECHNICALLY CORRECT.

MICHAEL F KINNEY, PLS 21570 6/9/16
FOR: ALAN R RIEKKI PLS
CITY SURVEYOR
CITY OF LAS VEGAS, NEVADA
NEVADA CERTIFICATE NO. 12469

CITY OF LAS VEGAS DEPARTMENT OF PUBLIC WORKS NEVADA

DISTRICT BOARD OF HEALTH CERTIFICATE

THIS FINAL MAP IS APPROVED BY THE SOUTHERN NEVADA HEALTH DISTRICT. THIS APPROVAL CONCERNS SEWAGE DISPOSAL, WATER POLLUTION, WATER QUALITY, AND WATER SUPPLY FACILITIES AND IS PREDICATED UPON PLANS FOR A PUBLIC WATER SUPPLY AND A COMMUNITY SYSTEM FOR DISPOSAL OF SEWAGE.

~~WALTER B. ROSS~~ Brian Northam 5/5/16
SOUTHERN NEVADA HEALTH DISTRICT DATE

DIVISION OF WATER RESOURCES

THIS FINAL MAP IS APPROVED BY THE DIVISION OF WATER RESOURCES OF THE DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES CONCERNING WATER QUANTITY SUBJECT TO THE REVIEW OF APPROVAL ON FILE IN THIS OFFICE.

P.E. 5/5/16
JOHN GUILORY P.E. #15501 DATE
DIVISION OF WATER RESOURCES

NOTE

1. ALL SUBDIVIDED PARCELS COMPRISING THIS COMMERCIAL SUBDIVISION SHALL PROVIDE PERPETUAL INTER–SITE COMMON DRAINAGE RIGHTS ACROSS ALL EXISTING AND FUTURE PARCEL LIMITS.
2. ALL LOTS CREATED BY THIS FINAL MAP SHALL HAVE PERPETUAL, IRREVOCABLE COMMON ACCESS RIGHTS TO ALL DRIVEWAYS SERVICING THIS OVERALL SITE UNLESS INCOMPATIBLE USES CAN BE DEMONSTRATED TO THE SATISFACTION OF THE CITY ENGINEER.
3. RECORDATION OF THIS MAP DOES NOT EXPUNGE ANY VEHICULAR AND PEDESTRIAN ACCESS RIGHTS, SEWER, AND DRAINAGE RIGHTS EXISTING THROUGH RECORDATION OF THE PREVIOUS COMMERCIAL SUBDIVISION MAP, AND SHALL REMAIN IN AFFECT UNLESS AND UNTIL SUCH RIGHTS ARE RELINQUISHED BY THEIR HOLDERS VIA SEPARATE ACTION.
4. NO BARRIERS (E.G. CURBS, WALLS ECT.) SHALL BE ERECTED WITHIN THE BOUNDARIES OF THE OVERALL COMMERCIAL SUBDIVISION MAP SITE WHICH WOULD PROHIBIT ANY VEHICLE ON THIS SITE FROM UTILIZING THE DRIVEWAY CONNECTING THIS COMMERCIAL DEVELOPMENT SITE TO THE ABUTTING PUBLIC STREET.
5. ON SITE SEWERS ARE A COMMON ELEMENT PRIVATELY OWNED AND MAINTAINED PER THE CONDITIONS, COVENANTS, AND RESTRICTIONS (CC&Rs) OF THIS COMMERCIAL SUBDIVISION.

S–3113 FMP–63304

FINAL MAP CRAIG AND JONES (A COMMERCIAL SUBDIVISION)	NO. 1181 FILED AT THE REQUEST OF LOCHSA SURVEYING DATE: 6/9/16 TIME 12:20PM BOOK 151 PAGE 100 OF PLATS OFFICIAL RECORDS BOOK NO. 20160609 CLARK COUNTY, NEVADA RECORDS DEBBIE CONWAY, COUNTY RECORDER FEE $77 DEPUTY GLORD
BEING A PORTION OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST, M.D.B. & M. CITY OF LAS VEGAS, CLARK COUNTY, NEVADA	
LOCHSA SURVEYING 6345 SOUTH JONES BLVD, SUITE 200 LAS VEGAS, NEVADA 89118 PHONE: 702-365-6312 FAX: 702-365-6317	

BOOK 151 PAGE 100

151/100

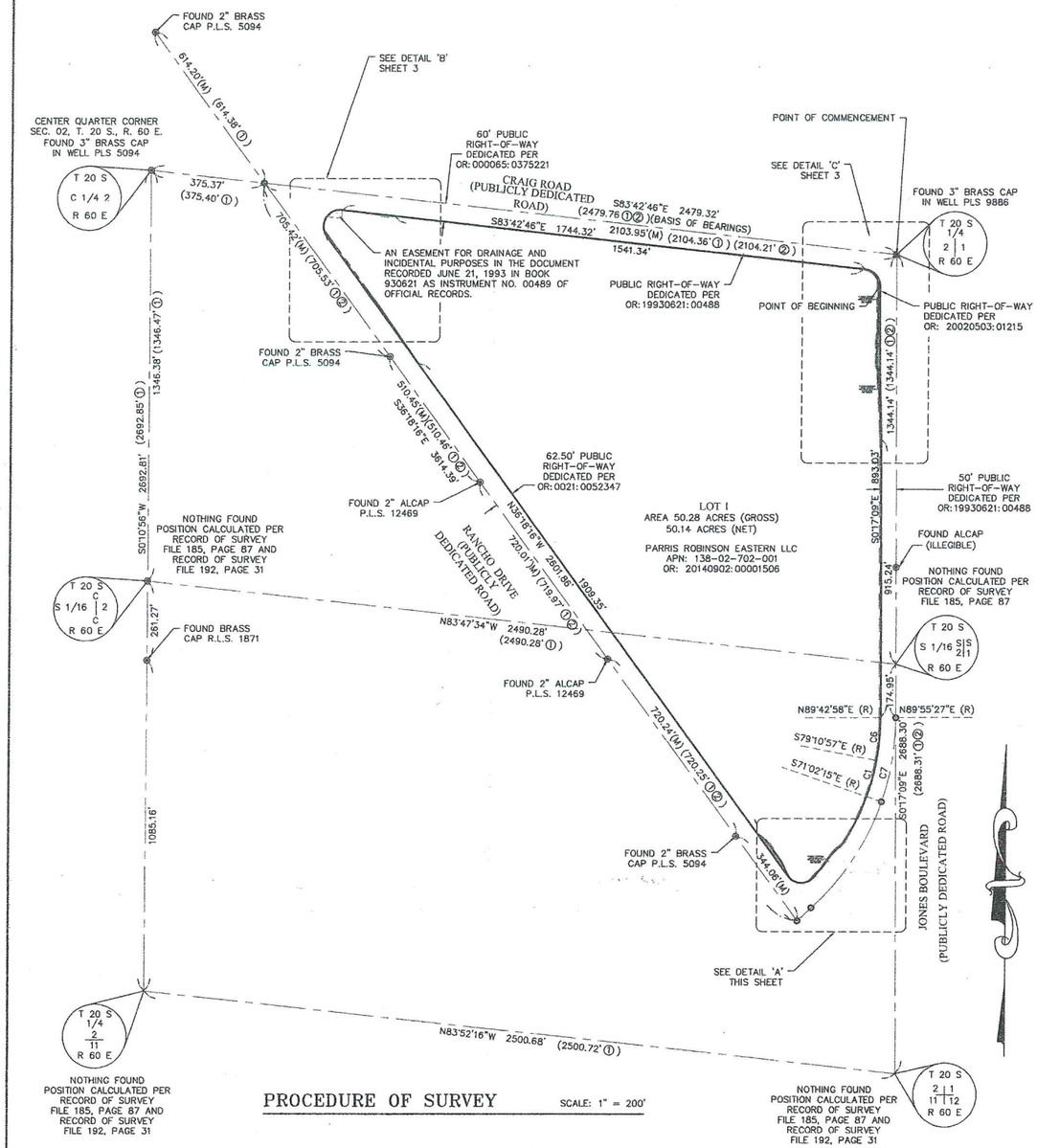
FINAL MAP
CRAIG AND JONES
(A COMMERCIAL SUBDIVISION)

BEING A PORTION OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST, M.D.B. & M. CITY OF LAS VEGAS, CLARK COUNTY, NEVADA

BASIS OF BEARINGS

THE BASIS OF BEARINGS FOR THIS SURVEY IS THE SOUTHERLY LINE OF THE NORTHEAST QUARTER (NE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST M.D.M. AS SHOWN ON THAT MAP ON FILE IN FILE 192, PAGE 31 OF SURVEYS IN THE CLARK COUNTY RECORDERS OFFICE.

SAID LINE BEARS: NORTH 83°42'46" WEST.



PROCEDURE OF SURVEY

SCALE: 1" = 200'

Line Table		
Line #	Direction	Length
L1	S00°17'09"E	102.19'
L2	S89°42'51"W	55.00'
L3	N09°48'58"E	25.86'
L4	N00°17'09"W	80.00'
L5	S73°30'19"E	6.77'
L6	S83°42'30"E	80.00'
L7	N79°19'08"E	2.37'
L9	N17°58'53"W	11.79'
L10	S26°05'48"E	51.96'
L11	S36°18'16"E	80.00'
L16	S53°25'08"E	26.46'
L24	S00°17'09"E	0.69'

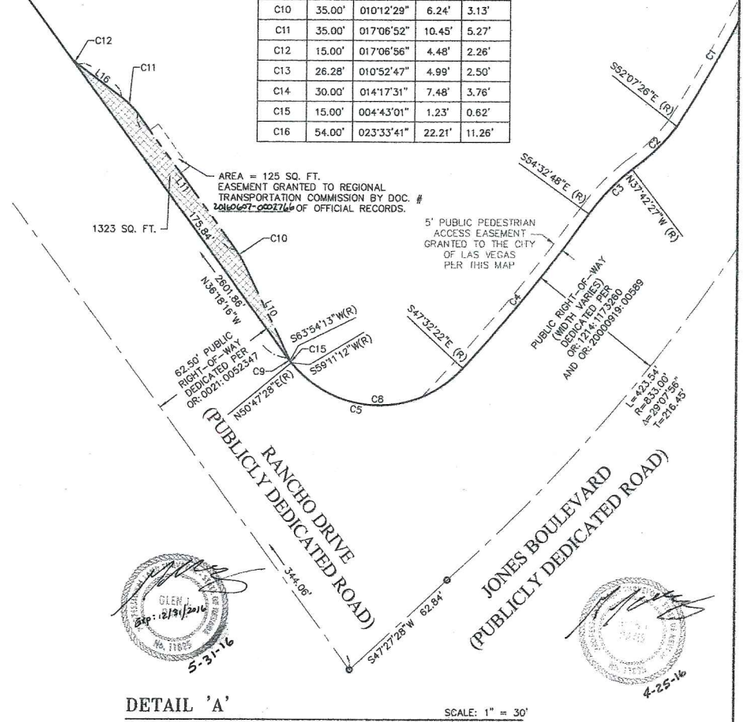
LEGEND

- SUBJECT PROPERTY BOUNDARY LINE
- STREET CENTERLINE
- ADJOINER'S PROPERTY LINE
- EASEMENT LINE
- STREET RIGHT-OF-WAY LINE
- AREA TO BE DEDICATED TO CITY OF LAS VEGAS PER THIS MAP
- SET TYPE III MONUMENT
- FOUND MONUMENT AS SHOWN AND DESCRIBED

REFERENCE MAPS/DOCS

① RECORD OF SURVEY FILE 185 PAGE 87
② RECORD OF SURVEY FILE 192 PAGE 31

Curve Table				
Curve #	Radius	Delta	Length	Tangent
C1	778.00'	021°32'18"	292.46'	147.98'
C2	100.00'	016°50'21"	29.39'	14.80'
C3	100.00'	016°50'21"	29.39'	14.80'
C4	768.00'	007°00'26"	93.93'	47.02'
C5	54.00'	101°14'06"	95.41'	65.78'
C6	783.00'	010°22'29"	141.78'	71.08'
C7	868.92'	018°33'14"	281.38'	141.93'
C8	54.00'	098°20'30"	92.68'	62.50'
C9	54.00'	002°53'36"	2.73'	1.36'
C10	35.00'	010°12'29"	6.24'	3.13'
C11	35.00'	017°06'52"	10.45'	5.27'
C12	15.00'	017°06'56"	4.48'	2.26'
C13	26.28'	010°52'47"	4.99'	2.50'
C14	30.00'	014°17'31"	7.48'	3.76'
C15	15.00'	004°43'01"	1.23'	0.62'
C16	54.00'	023°33'41"	22.21'	11.26'



DETAIL 'A'

SCALE: 1" = 30'

GLEN J. [illegible] No. 11875 Exp: 12/31/2016 5-31-16

4-25-16

151/100

FINAL MAP
CRAIG AND JONES
(A COMMERCIAL SUBDIVISION)

BEING A PORTION OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST, M.D.B. & M. CITY OF LAS VEGAS, CLARK COUNTY, NEVADA

BASIS OF BEARINGS

THE BASIS OF BEARINGS FOR THIS SURVEY IS THE SOUTHERLY LINE OF THE NORTHEAST QUARTER (NE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST M.D.M. AS SHOWN ON THAT MAP ON FILE IN FILE 192, PAGE 31 OF SURVEYS IN THE CLARK COUNTY RECORDERS OFFICE.

SAID LINE BEARS: NORTH 83°42'46" WEST.

REFERENCE MAPS/DOCS

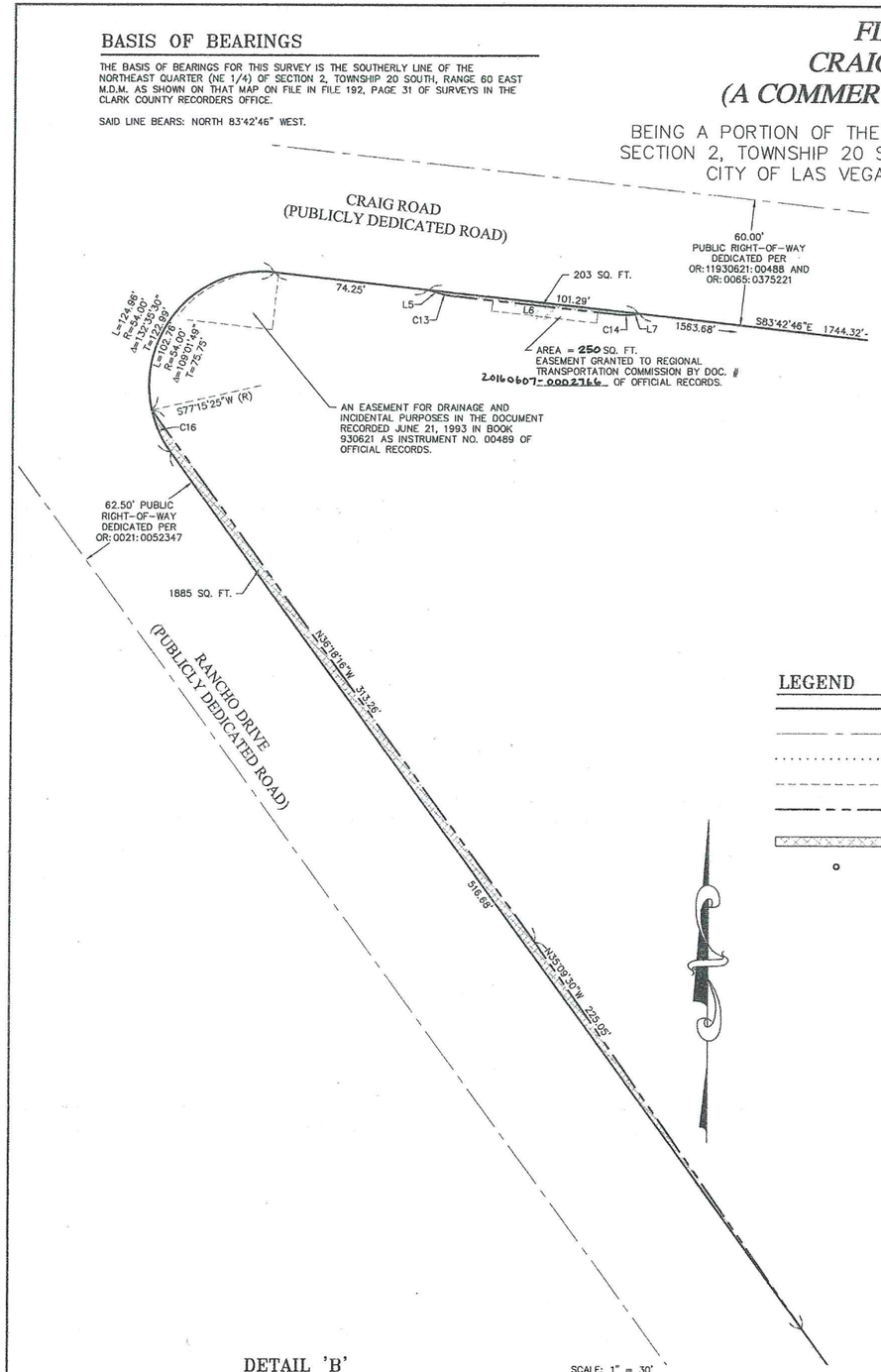
RECORD OF SURVEY	FILE 185 PAGE 87
RECORD OF SURVEY	FILE 192 PAGE 31

Line Table		
Line #	Direction	Length
L1	S00°17'09"E	102.19'
L2	S89°42'51"W	55.00'
L3	N09°48'58"E	25.86'
L4	N00°17'09"W	80.00'
L5	S73°30'19"E	6.77'
L6	S83°42'30"E	80.00'
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L10	S26°05'48"E	51.96'
L11	S36°18'16"E	80.00'
L16	S53°25'08"E	26.46'
L24	S00°17'09"E	0.69'

LEGEND

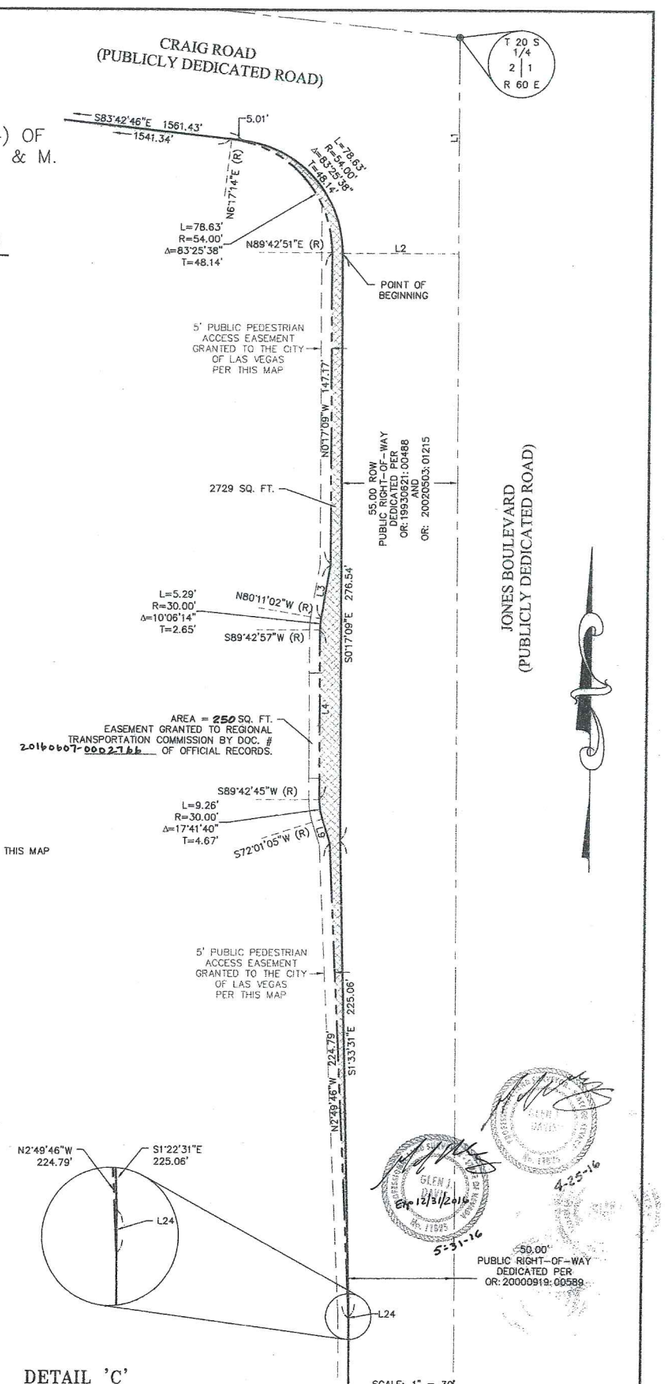
- SUBJECT PROPERTY BOUNDARY LINE
- STREET CENTERLINE
- ADJOINER'S PROPERTY LINE
- EASEMENT LINE
- STREET RIGHT-OF-WAY LINE
- AREA TO BE DEDICATED TO CITY OF LAS VEGAS PER THIS MAP
- SET TYPE III MONUMENT

Curve Table				
Curve #	Radius	Delta	Length	Tangent
C1	778.00'	021°32'18"	292.46'	147.98'
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C10	35.00'	010°12'29"	6.24'	3.13'
C11	35.00'	017°06'52"	10.45'	5.27'
C12	15.00'	017°06'56"	4.48'	2.26'
C13	26.28'	010°52'47"	4.99'	2.50'
C14	30.00'	014°17'31"	7.48'	3.76'
C15	15.00'	004°43'01"	1.23'	0.62'
C16	54.00'	023°33'41"	22.21'	11.26'



DETAIL 'B'

SCALE: 1" = 30'



DETAIL 'C'

SCALE: 1" = 30'

151/100

CRAIG RD.

RANCHO DR.

CRAIG ROAD (PUBLIC)
RIGHT-OF-WAY (SR-573)
PER DOC'S:19930621004888, 0065:0375221 & 0600:1482496

<1/<1/*<1cfs
South Half

3(1.94)(0.30)
5(2.09)(0.34)

*CRAIG1
1.52 ACRES

*3/*3/*5CFS

1

ND2
0.68 ACRES
REMOVED

1/2/2CFS

**0/1/1CFS

**DEV1
0.26 ACRES

**DEV2
0.48 ACRES

**DEV3
0.67 ACRES

**DEV4
0.12 ACRES

**1/1/2CFS

2

4(2.27)(0.38)
72.50](0.45)

2.27 ACRES

*RNCH1

*4/*5/*7CFS

1/2/2CFS

**1/2/2CFS

3

ND1
0.70 ACRES

LINE OF FUEL CANOPY ABOVE

12" MAX DEEPENED FOOTING

CRAIG AND RANCHO LAND HOLDINGS LLC
A.P.N. 1[illegible]-713-005
OR: 201[illegible]00002201
FEES
NOT A PART

EX. SDMH RIM=(2289.78') INV=(2271.81')
EX. SDMH RIM=(2292.13) INV=(2257.66)
EX. SDMH RIM=(2287.19)
EX. SDMH RIM=(2282.24) INV=(2269.66)
EX. SDMH RIM=(2287.39) INV=(2274.43)
EX. 60" SD (P...

PROJECT SITE
S.2, T.20S, R.60E

KEY MAP
NOT TO SCALE

JONES BLVD
CRAIG ROAD
RANCHO DRIVE
TORREY PINES DRIVE
RAINBOW BLVD
ALEXANDER ROAD

GRAPHIC SCALE
20 0 10 20 40
(IN FEET)
1 Inch = 20 ft.

DRAINAGE LEGEND

ND1	DRAINAGE BASIN LABEL
• CMD1	CONCENTRATION POINT / COMBINATION POINT
	OFFSITE BASIN BOUNDARY LINE
	ONSITE BASIN BOUNDARY
1 / 2 / 3	Q10 / Q25 / Q100 — FLOW IN CFS (10 YR. / 25 YR. / 100 YR.)
1 (1.0)(1.2)	Q10 (V10)(D10)
1 (1.0)(1.2)	Q100 (V100)(D100)
	BASIN FLOW DIRECTION
1	HYDRAULIC CROSS-SECTION

Peak Flow Summary
Interim / Developed Condition

HEC-1 I.D.	Area (acres)	100-year Flow (cfs)	25-year Flow (cfs)	10-year Flow (cfs)
ND1	0.7	1	2	2
ND2	0.68	1	2	2

Onsite Flow Summary
(Interim / Developed Condition)
100-year, 6-hour Storm

Hydraulic Cross-Section Identifier	100-Year Flow [Q10] (cfs)	100-year Velocity [v] (fps)	100-year Flow Depth [d] (ft)	100-year Velocity x Depth [v x d]
3	2	1.34	0.19	0.25

Street Flow Summary
(Interim / 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 (Within 1/2 ROW) (ft)
Craig Road (Half Street)	60	1	3	1.94	0.30	0.58	N/A
Rancho Drive (Half Street)	62.5	2	4	2.27	0.38	0.86	51.76

Street Flow Summary
(Interim / Developed Condition)
100-year, 6-hour Storm

Street	Right of Way Width (ft)	Hydraulic Cross-Section Identifier	100-Year Flow [Q10] (cfs)	100-year Velocity [v] (fps)	100-year Flow Depth [d] (ft)	100-year Velocity x Depth [v x d]
Craig Road (Half Street)	60	1	5	2.09	0.34	0.71
Rancho Drive (Half Street)	62.5	2	7	2.50	0.45	1.13

* REFERENCE MASTER TDS CRAIG & RANCHO DS4824

** REFERENCE TDS FOR WOW CARWASH @ CRAIG & RANCHO DS4852

LEGEND

CL OR SURVEY LINE — — — — — —
PROPERTY LINE — — — — — —
ROW LINE — — — — — —
EASEMENT LINE — — — — — —
SAWCUT LINE ~~~~~
SCARP LINE

DESCRIPTION:	BUILDING OUTLINE	EDGE OF PAVEMENT	"A" TYPE CURBS	"L" TYPE CURBS	WALLS	CONTOUR LINES	AC PAVEMENT	CONCRETE	SPOT ELEVATIONS	SIGNS	MANHOLE W/ DESCRIPTION
EXISTING:						(2210)			(12.34) BC		Ⓢ
PROPOSED:						2122			12.34 BC		Ⓢ

MANHOLE DESCRIPTIONS
Ⓢ = SANITARY SEWER
Ⓓ = STORM DRAIN
Ⓔ = ELECTRICAL
Ⓣ = TELEPHONE

FIRE HYDRANTS | GATE VALVES | REDUCERS | CLEAN OUTS | UTILITY BOX OR VAULT

60' ROW LED STREETLIGHTS | 80' ROW LED STREETLIGHTS | 100' ROW LED STREETLIGHTS | INTERSECTION STREETLIGHTS

Lochsa Engineering
6345 South Jones Blvd
Suite 100
Las Vegas, NV 89118
Phone (702) 365-9312
Fax (702) 365-9317
www.lochsa.com

REV.:	DATE:	BY:	DESCRIPTION:

ONSITE BASIN MAP
(INTERIM / DEVELOPED CONDITION)

7-11 SEC CRAIG & RANCHO

SHEET / TITLE

PROJECT No.: 181119
DATE: 9/10/18
SCALE: 1"=20'
DRAWN BY: CB
DESIGNED BY: CB
CHECKED BY: HMN

PROFESSIONAL ENGINEER - STATE OF NEVADA
LAZELL H. PREATOR
EXP. 12-31-19
CIVIL
No. 14982

SHEET No.
DR2
SHEET 1 OF 1
OFFSITE No.

9/7/2018 11:11:17 AM
J:\Projects\2018\181119\Planning\Drainage\DR2.dwg

20 DETAIL

NOT TO SCALE

19 DETAIL

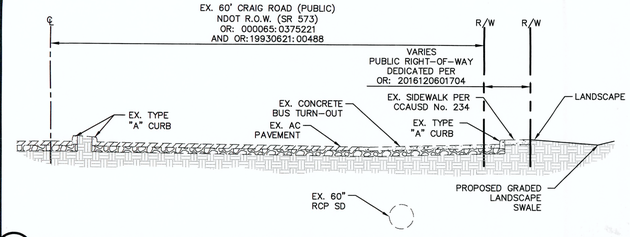
NOT TO SCALE

18 DETAIL

NOT TO SCALE

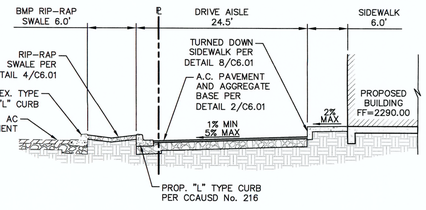
17 SECTION THROUGH CRAIG ROAD (SR 573)

NOT TO SCALE



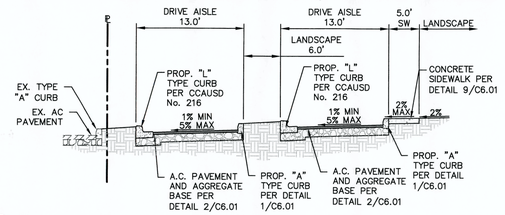
16 SECTION THROUGH EAST PL AND BUILDING

NOT TO SCALE



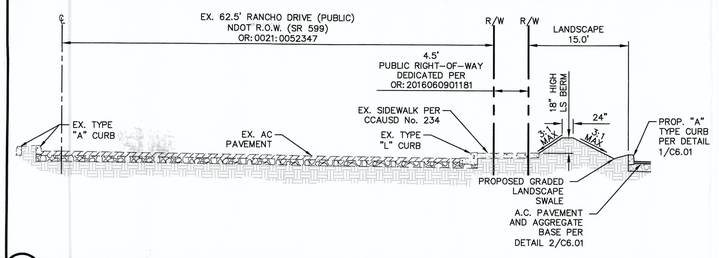
15 SECTION THROUGH EAST PL

NOT TO SCALE



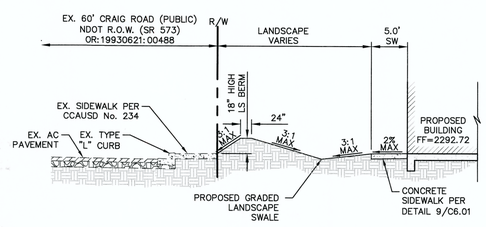
14 SECTION THROUGH RANCHO DRIVE (SR 599)

NOT TO SCALE



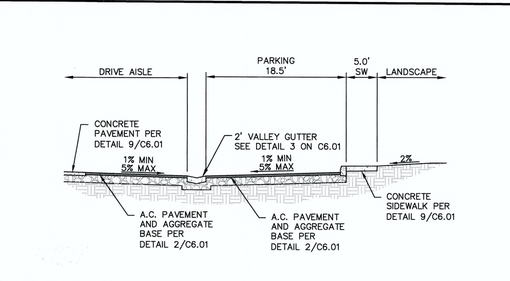
13 SECTION THROUGH NORTHWEST OF BUILDING

NOT TO SCALE



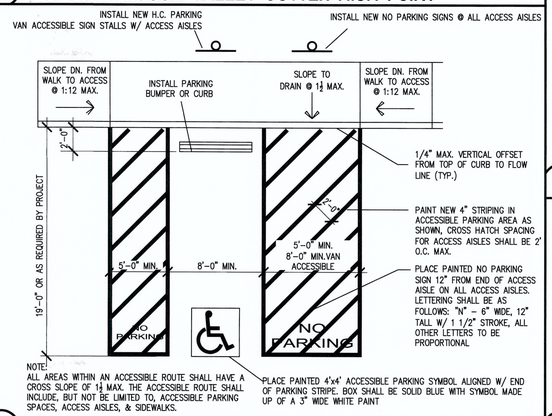
12 SECTION THROUGH VALLEY GUTTER HIGH POINT

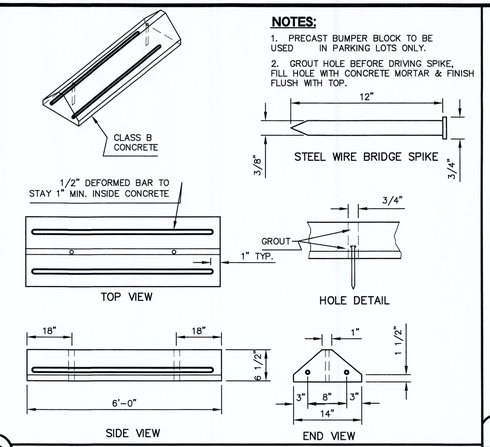
NOT TO SCALE



11 ACCESSIBLE PARKING DETAIL

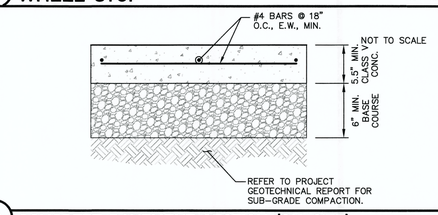
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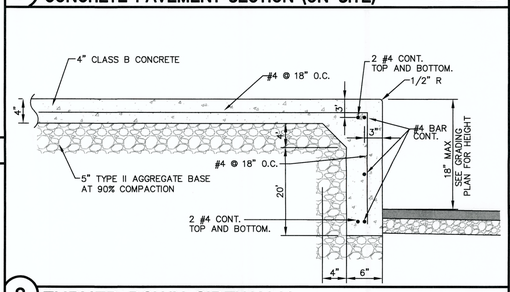
10 WHEEL STOP

NOT TO SCALE



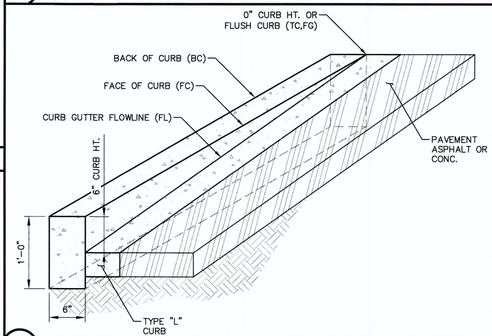
9 CONCRETE PAVEMENT SECTION (ON-SITE)

NOT TO SCALE



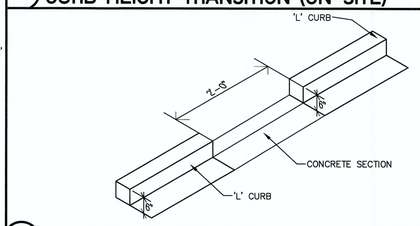
8 TURNED DOWN SIDEWALK

NOT TO SCALE



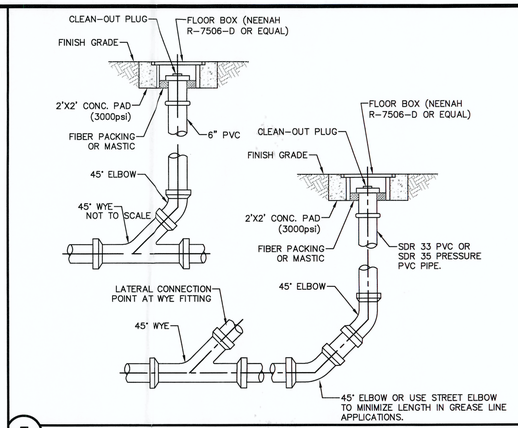
7 CURB HEIGHT TRANSITION (ON-SITE)

NOT TO SCALE



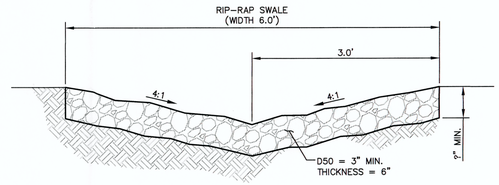
6 2' CURB OPENING

NOT TO SCALE



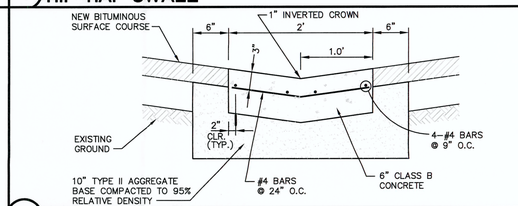
5 SEWER CLEAN-OUT

NOT TO SCALE



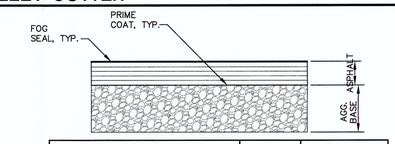
4 RIP-RAP SWALE

NOT TO SCALE



3 2' VALLEY GUTTER

NOT TO SCALE



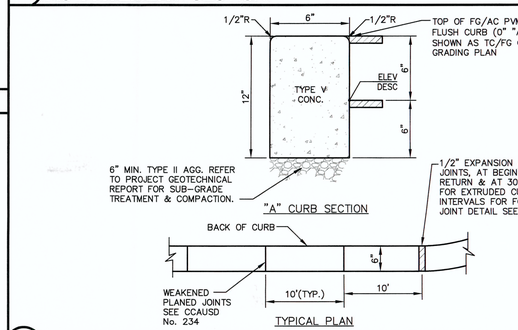
TYPE OF TRAFFIC	ASPHALT (inches)	TYPE II BASE COURSE (inches)
AUTOMOBILE PARKING	2.5	4
DELIVERY TRUCK	2.5	4
HEAVY DUTY TRUCK	3	4

1. REFER TO PROJECT GEOTECHNICAL REPORT FOR ALL SUB-GRADE PREPARATION AND COMPACTION.

PAVEMENT SECTION AS PROPOSED IN GEOTECHNICAL REPORT PREPARED BY:
NINYO & MOORE
PROJ. NO.: 304190001
DATED: SEPTEMBER 11, 2017

2 AC PAVEMENT SECTION

NOT TO SCALE



1 ON-SITE "A" TYPE CURB

NOT TO SCALE

LEGEND

CL OR SURVEY LINE	EASEMENT LINE	DESCRIPTION:	BUILDING OUTLINE, EDGE OF PAVEMENT, "A" TYPE CURBS, "L" TYPE CURBS, WALLS, CONTOUR LINES, AC PAVEMENT, CONCRETE, SPOT ELEVATIONS, SIGNS, MANHOLE W/ DESCRIPTION
PROPERTY LINE	SAWCUT LINE	EXISTING:	(2122)
ROW LINE	SCARP LINE	PROPOSED:	(12.34) BC, 12.34 BC

MANHOLE DESCRIPTIONS: (S) = SANITARY SEWER; (D) = STORM DRAIN; (E) = ELECTRICAL; (T) = TELEPHONE

FIRE HYDRANTS, GATE VALVES, REDUCERS, CLEAN OUTS, UTILITY BOX OR VAULT, 60' ROW LED STREETLIGHTS, 80' ROW LED STREETLIGHTS, 100' ROW LED STREETLIGHTS, INTERSECTION STREETLIGHTS

9/6/2018 1:53 PM
N:\CAD\181119\Drawings\Plot Drawings\C-181119-6.01-07.dwg

REV.:	DATE:	BY:	DESCRIPTION:

Lochsa engineering
6345 South Jones Blvd
Las Vegas, NV 89118
Phone (702) 365-9312
Fax (702) 365-9317
www.lochsa.com

IMPROVEMENT PLANS
DETAIL SHEET

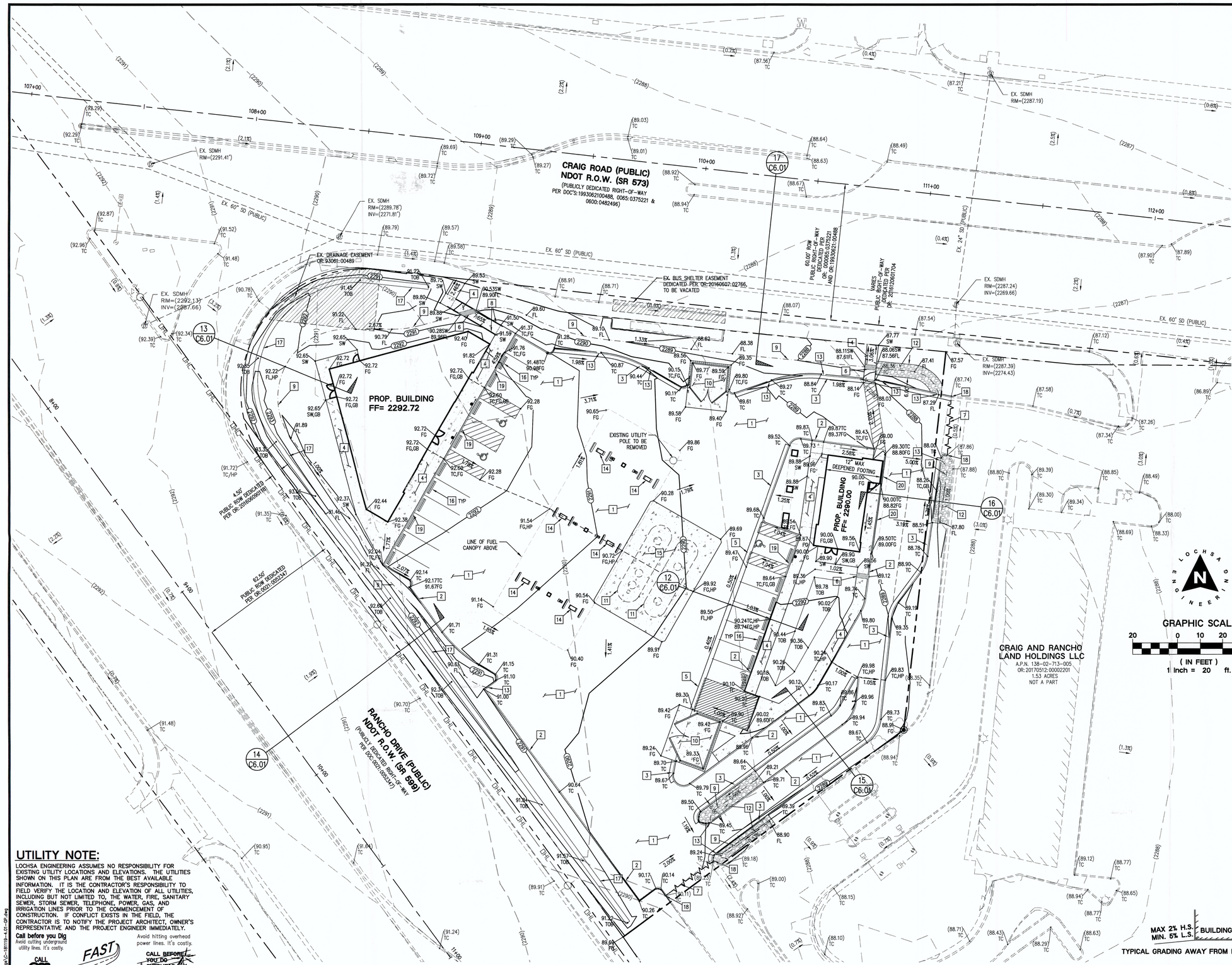
7-11 @ CRAIG & RANCHO
SITE IMPROVEMENTS
LAS VEGAS, NEVADA

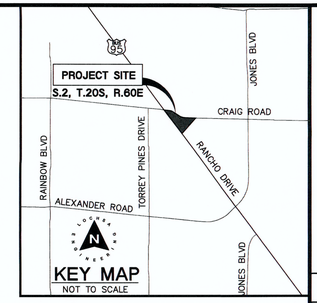
SHEET
TITLE

PROJECT No.: 181119
DATE: 9/10/18
SCALE: NTS
DRAWN BY: BJB
DESIGNED BY: BJB
CHECKED BY: LP

PROFESSIONAL ENGINEER - STATE OF NEVADA
RUZELL H. PREATOR
EXP. 12-31-19
CIVIL
No. 14982
9/7/18

SHEET No. C6.01
SHEET 5 OF 6
OFFSITE No. ----





CONSTRUCTION NOTES:

– ALL CONSTRUCTION TO BE DONE IN ACCORDANCE WITH "CLARK COUNTY AREA UNIFORM STANDARD DRAWINGS (C.C.A.U.S.D.)" LATEST EDITION AND/OR REGULATING ENTITY HAVING JURISDICTION.
– NOT ALL NOTES USED ON THIS SHEET –

1. CONSTRUCT AC PAVEMENT PER DETAIL 2 ON C6.01.
2. CONSTRUCT "A" TYPE CURB PER DETAIL 1 ON C6.01.
3. CONSTRUCT "L" TYPE CURB PER CCAUSD No. 216.
4. CONSTRUCT CONC. SIDEWALK PER DETAIL 9 ON C6.01. REFER TO ARCH. PLANS FOR FINISHING SPECIFICATIONS.
5. CONSTRUCT 2' VALLEY GUTTER PER DETAIL 3 ON C6.01.
6. CONSTRUCT SIDEWALK UNDER DRAIN PER CCAUSD. No. 236.
7. SAWCUT AND MATCH EXISTING.
8. HANDRAIL PER ARCHITECTURAL PLANS.
9. CONSTRUCT GRADED LANDSCAPE SWALE, SLOPE PER PLAN.
10. TRASH ENCLOSURE PER ARCHITECTURAL PLANS.
11. UNDERGROUND FUEL TANK BY OTHERS.
12. INSTALL RIP–RAP BMP AREA, SIZE PER PLAN. Dso=3", TH=6". SEE DETAIL 4 ON C6.01.
13. 2' CURB OPENING PER DETAIL 6, SHEET C6.01.
14. FUELING STATION BY OTHERS.
15. CONCRETE PAVEMENT OVER UNDERGROUND FUEL TANKS PER DETAIL 9 ON C6.01
16. INSTALL WHEEL STOP PER DETAIL 10 ON C6.01.
17. CONSTRUCT 18" HIGH LANDSCAPE BERM.
18. CONNECT TO EXISTING CURB & GUTTER.
19. CONSTRUCT 0" "A" CURB PER DETAIL 1 ON C6.01.
20. CONSTRUCT TURNED DOWN SIDEWALK PER DETAIL 8 ON C6.01.

GRADING NOTES:

1. SLOPES 4:1 OR STEEPER AND FINE–GRAINED MATERIALS THAT HAVE BEEN DISTURBED (SANDY AND SILTY MATERIALS) SHOULD BE PROTECTED WITH BURLAP OR OTHER EROSION CONTROL FABRIC/MATERIAL, UNLESS OTHERWISE SPECIFIED BY LANDSCAPE DRAWINGS AND SPECIFICATIONS OR THE SOILS REPORT.
2. CONTRACTOR SHALL DETERMINE HIS OWN FOOTING OR BASEMENT EXCAVATION QUANTITIES, EVEN THOUGH SHOWN ON ROUGH GRADING PLANS. ADDITIONALLY, STRUCTURE BACKFILL COSTS SHOULD BE INCLUDED IN THE COST OF THE STRUCTURE, UNLESS OTHERWISE SPECIFIED IN THE CONTRACT DOCUMENTS.
3. CONTRACTOR SHALL NOTIFY LOCHSA ENGINEERING WITHIN 24 HOURS OF OMISSIONS AND ERRORS DISCOVERED ON PLANS. LOCHSA ENGINEERING WILL NOT BE RESPONSIBLE FOR ANY "CORRECTIVE" WORK DONE BY OTHERS.
4. CONTRACTOR TO ENSURE POSITIVE DRAINAGE. NO PONDING ALLOWED. CONTRACTOR TO FOLLOW RECOMMENDATIONS AS OUTLINED IN THE PROJECT GEOTECHNICAL REPORT, INCLUDING BUT NOT LIMITED TO EXCAVATION, GRADING AND COMPACTION. REFER TO THE REPORT PREPARED BY NINYO & MOORE, PROJECT No. 304289001.

EXISTING UTILITY NOTE:

CONTRACTOR TO ADJUST ALL EXISTING UTILITIES TO MATCH PROPOSED FINISH GRADE ELEVATIONS.

FLOOD ZONE NOTE:

THE PROJECT SITE IS COVERED BY THE FLOOD INSURANCE RATE MAP (FIRM) FOR THE CLARK COUNTY AND INCORPORATED AREAS, NEVADA, COMMUNITY PANEL NUMBER: 32003C2155F, EFFECTIVE DATE: NOVEMBER 16, 2011, REVISED TO REFLECT: LOMR DATED JUNE 21, 2017. THE PROJECT SITE IS WITHIN ZONE "X" (UNSHADED), DESCRIBED BY FEMA AS: "AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN."

LAS VEGAS VALLEY CONSTRUCTION SITE BEST MANAGEMENT PRACTICES GUIDANCE MANUAL SECTION 3.5.1 STANDARD NOTES 1–5

1. THE OWNER, SITE DEVELOPER, CONTRACTOR, AND/OR THEIR AUTHORIZED AGENTS SHALL EACH DAY REMOVE ALL SEDIMENT, MUD, CONSTRUCTION DEBRIS, OR OTHER POTENTIAL POLLUTANTS THAT MAY HAVE BEEN DISCHARGED TO, OR ACCUMULATED IN, THE PUBLIC RIGHT–OF–WAY OF THE CITY OF LAS VEGAS AS A RESULT OF CONSTRUCTION ACTIVITIES ASSOCIATED WITH THIS SITE DEVELOPMENT OR CONSTRUCTION PROJECT. SUCH MATERIAL SHALL BE PREVENTED FROM ENTERING THE STORM SEWER SYSTEM.
2. ADDITIONAL CONSTRUCTION SITE DISCHARGE BEST MANAGEMENT PRACTICES MAY BE REQUIRED OF THE OWNER AND HIS OR HER AGENTS DUE TO UNFORESEEN EROSION PROBLEMS OR IF THE SUBMITTED PLAN DOES NOT MEET THE PERFORMANCE STANDARDS SPECIFIED IN THE CITY OF LAS VEGAS AND THE LAS VEGAS VALLEY CONSTRUCTION SITE BMP GUIDANCE MANUAL.
3. TEMPORARY OR PERMANENT STABILIZATION PRACTICES WILL BE INSTALLED ON DISTURBED AREAS AS SOON AS PRACTICABLE AND NO LATER THAN 14 DAYS AFTER THE CONSTRUCTION ACTIVITY IN THAT PORTION OF THE SITE HAS TEMPORARILY OR PERMANENTLY CEASED. SOME EXCEPTIONS MAY APPLY; REFER TO THE NEVADA STORMWATER GENERAL PERMIT FOR CONSTRUCTION ACTIVITY NVR10000, SECTION III.A.5.
4. AT A MINIMUM, THE CONTRACTOR OR HIS AGENT SHALL INSPECT ALL DISTURBED AREAS, AREAS USED FOR STORAGE OF MATERIALS AND EQUIPMENT THAT ARE EXPOSED TO PRECIPITATION, VEHICLE ENTRANCE AND EXIT LOCATIONS, AND ALL BMPS WEEKLY, AND WITHIN 24 HOURS AFTER ANY RAIN EVENT OR 0.5 INCHES OR MORE. THE CONTRACTOR OR HIS AGENT SHALL UPDATE OR MODIFY THE STORMWATER POLLUTION PREVENTION PLAN AS NECESSARY. SOME EXCEPTIONS TO WEEKLY INSPECTIONS MAY APPLY, SUCH AS SUSPENSION OF LAND DISTURBANCE ACTIVITIES. REFER TO THE NEVADA STORMWATER GENERAL PERMIT FOR CONSTRUCTION ACTIVITY NVR100000, SECTION III.A.12.
5. ACCUMULATED SEDIMENT IN BMP'S SHALL BE REMOVED WITHIN SEVEN DAYS AFTER A STORMWATER RUNOFF EVENT OR PRIOR TO THE NEXT ANTICIPATED STORM EVENT, WHICHEVER IS EARLIER. SEDIMENT MUST BE REMOVED WHEN BMP DESIGN CAPACITY HAS BEEN REDUCED BY 50 PERCENT OR MORE.

GRAPHIC SCALE
20 0 10 20 40
(IN FEET)
1 inch = 20 ft.

MAX 2% H.S.
MIN. 5% L.S.
BUILDING FF
TYPICAL GRADING AWAY FROM BUILDING

CUT	FILL
32 CY	1,816 CY

NOTE: CUT/FILL QUANTITIES ARE TO FINISHED GRADE & DO NOT INCLUDE MATERIAL THICKNESS, FOOTINGS, ETC.

GRADING PLAN CERTIFICATION

NAME: LAZELL H. PREATOR PE #14982 DATE

CERTIFY THAT THIS GRADING PLAN IS IN CONFORMANCE WITH APPROVED DRAINAGE STUDY FOR THIS SITE ON FILE AT THE CITY OF LAS VEGAS FOR THIS PROJECT.

UTILITY NOTE:

LOCHSA ENGINEERING ASSUMES NO RESPONSIBILITY FOR EXISTING UTILITY LOCATIONS AND ELEVATIONS. THE UTILITIES SHOWN ON THIS PLAN ARE FROM THE BEST AVAILABLE INFORMATION. IT IS THE CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY THE LOCATION AND ELEVATION OF ALL UTILITIES, INCLUDING BUT NOT LIMITED TO, THE WATER, FIRE, SANITARY SEWER, STORM SEWER, TELEPHONE, POWER, GAS, AND IRRIGATION LINES PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. IF CONFLICT EXISTS IN THE FIELD, THE CONTRACTOR IS TO NOTIFY THE PROJECT ARCHITECT, OWNER'S REPRESENTATIVE AND THE PROJECT ENGINEER IMMEDIATELY.

Call before you Dig
Avoid cutting underground utility lines. It's costly.
CALL 811 or 1-800-227-2600

FAST Call before you Underground 1-702-432-5300 FREEWAY & ARTERIAL SYSTEM OF TRANSPORTATION

Avoid hitting overhead power lines. It's costly.
CALL BEFORE YOU DO OVERHEAD 1-702-227-2929

LEGEND			
CL OR SURVEY LINE	EASEMENT LINE	DESCRIPTION:	
PROPERTY LINE	SAWCUT LINE	EXISTING:	
ROW LINE	SCARP LINE	PROPOSED:	

BUILDING OUTLINE | EDGE OF PAVEMENT | "A" TYPE CURBS | "L" TYPE CURBS | WALLS | CONTOUR LINES (2210) / 2122 | AC PAVEMENT | CONCRETE | SPOT ELEVATIONS (12.34 BC / 12.34 BC) | SIGNS | MANHOLE W/ DESCRIPTION

MANHOLE DESCRIPTIONS: (S) = SANITARY SEWER; (D) = STORM DRAIN; (E) = ELECTRICAL; (T) = TELEPHONE

FIRE HYDRANTS | GATE VALVES | REDUCERS | CLEAN OUTS | UTILITY BOX OR VAULT

60' ROW LED STREETLIGHTS | 80' ROW LED STREETLIGHTS | 100' ROW LED STREETLIGHTS | INTERSECTION STREETLIGHTS

Lochsa engineering
6534 South Jones Blvd.
Suite 100
Las Vegas, NV 89118
Phone (702) 383-3212
Fax (702) 383-3217
www.lochsa.com

REV.:	DATE:	BY:	DESCRIPTION:

SHEET: IMPROVEMENT PLANS
GRADING PLAN

TITLE: 7–11 @ CRAIG & RANCHO
SITE IMPROVEMENTS
LAS VEGAS, NEVADA

PROJECT No.: 181119
DATE: 9/10/18
SCALE: 1" = 20'
DRAWN BY: BJB
DESIGNED BY: BJB
CHECKED BY: LP

PROFESSIONAL ENGINEER – STATE OF NEVADA
LAZELL H. PREATOR
EXP. 12–31–19
CIVIL
No. 14982
9/10/18

SHEET No. C4.01
SHEET 4 OF 6
OFFSITE No. ----

9/6/2018 1:53 PM
lpreator
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