

Technical Drainage Study for Hollywood Plaza @ Rancho and Jones

October 2022

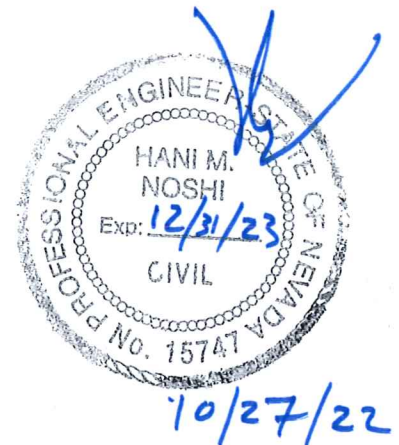
Prepared for:

JSAAT Inc.
2016 Redbird Drive,
Las Vegas, Nevada 89134
(702) 956 - 1611

Prepared by:

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

Lochsa Job # 221174



HYDROLOGIC CRITERIA AND DRAINAGE MANUAL
DRAINAGE STUDY INFORMATION FORM

Name of Development: Hollywood Plaza @ Rancho and Jones Date: October 27, 2022
Location of Development: a) Descriptive (Cross Streets) North/South: Jones Boulevard
East/West: Rancho Road
b) Section: 2 Township: 20 South Range: 60 East
c) APN : 138-02-804-001
Name of Owner: JSAAT Inc.
Telephone No.: (805) 898 - 2023 Fax No.: _____ E-Mail Address: _____
Address: 2016 Redbird Drive, Las Vegas, Nevada 89134

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: +/- 1.70 Acres Being Developed/Disturbed: +/- 1.70 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: +/- 4.0 acres (conveyed in perimeter streets)
6. Has the site drainage been evaluated in the past? ☒ YES ☐ NO If yes, please identify documentation: "Master TDS for Craig & Rancho" DS4824 and "TDS for Rancho and Jones Residential Unit 3" (DS5060)
7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: Northerly towards Jones Blvd. (following existing drainage 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

October 27, 2022

Albert Sung, P.E.
City of Las Vegas Public Works Department
(Flood Control Division)
333 North Rancho Drive
Las Vegas, NV 89106

Subject: **Technical Drainage Study for Hollywood Plaza @ Rancho and Jones**
Lochsa Job No. 221174

Mr. Sung:

This letter certifies that all items provided on the attached electronic compact disc match the hard copy version of the study.

Respectfully submitted,

Sincerely,
Lochsa Engineering

Hani Noshi, Ph.D., PE, CFM
Principal



10/27/22

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

Project Name: Hollywood Plaza @ Rancho and Jones		Map ID:
Firm Name: Lochsa Engineering		Engineer: Hani M. Noshi, Ph.D., P.E., CFM
Address: 6345 South Jones Boulevard, Suite 100		
City: Las Vegas	State: Nevada	Zip: 89118
Phone Number: (702) 365-9312	Fax Number: (702) 365-9317	
Property Owner: JSAAT Inc.		
Address: 2016 Redbird Drive,		
City: Las Vegas	State: NV	Zip: 89134
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.
☐	☒	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

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

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.
- ☒ ☐ Proposed typical street sections.

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
<u> </u>	<u>N/A</u>	Streets with off-set crowns.
<u> X </u>	<u> </u>	Proposed contours or spot elevations in sufficient detail to exhibit intended drainage patterns and slopes.
<u> X </u>	<u> </u>	Property lines.
<u> X </u>	<u> </u>	Right-of-way lines and widths, existing and proposed.
<u> X </u>	<u> </u>	Existing improvements and their elevations.
<u> X </u>	<u> </u>	Delineation of proposed on-site drainage basins indicating area and 10-year and 100-year storm peak flows at basin concentration points.
<u> X </u>	<u> </u>	Concentration points and drainage flow direction with Q_{100} and V_{100} and D_{100} in streets.
<u> X </u>	<u> </u>	Cumulative flows, velocity, and direction of flow at upstream and downstream ends of site for the 10-year and 100-year flows.
<u> X </u>	<u> </u>	Location and cross-section of street capacity calculations.
<u> </u>	<u>N/A</u>	Cross-sectional detail for channels, including cutoff wall locations.
<u> X </u>	<u> </u>	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.
<u> </u>	<u>N/A</u>	Existing and proposed drainage easements and widths shown with sufficient detail. A cross sectional detail must be provided that shows appropriate lining and reinforcement.
<u> </u>	<u>N/A</u>	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.
<u> </u>	<u>N/A</u>	Location and detail of flood walls illustrating depth of flow, proposed grouting height, etc.
<u> </u>	<u>N/A</u>	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.
<u> X </u>	<u> </u>	Building and/or lot numbers.
<u> </u>	<u> X </u>	Alignment of all existing, proposed, or future Regional Facilities adjacent to the site.
<u> </u>	<u>N/A</u>	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

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

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.
- X 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.
- X Street slopes for perimeter and interior streets. The minimum slope is 0.4 percent.
- X Location and detail of best management practice (BMP) for parking lots and low impact development (LID) (if required).

IV. HYDROLOGIC ANALYSIS

Yes No

- X Appropriate soil information and Soils Map for existing and future conditions with subbasins and property delineated.
- X 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.
- X 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.
- X Use of correct precipitation values in and around the McCarran Airport rainfall area.
- X A discussion in the text of the hydrologic analysis justifying subbasin boundaries and cutoffs, supporting assumptions, and calculations.
- X A summary table of stormwater flows showing basin area, Q_{10} and Q_{100} for both individual basins and combined basin flows, where applicable.
- X Copies of supporting technical information referenced from a previously approved study and a statement accepting these results.
- X On-site facilities must perpetuate flows through or around the site without significantly impacting adjacent property owners in accordance with current Nevada Drainage Law.
- X Calculation for impervious area for parking lots and LIDs (if required).

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

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. $Q_{100} d \times v \leq 8$. $Q_{10} d \times v \leq 6$ and 12 foot dry lane for rights-of-way ≥ 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.)
X		Copies of all conditions of approval for development related to this property. (e.g. zoning, use permit, tentative map, etc.) Verify compliance with conditions.
X		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. <u>H.N.</u> 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	
X		(1) 24" X 36" copy of the Grading Plan, (including all Detail Sheets) sealed by the engineer.
X		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.
X		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.
X		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.
	N/A	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.
	N/A	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.
X		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	
X		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.
X		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.

CITY OF LAS VEGAS MINIMUM DRAINAGE STUDY CRITERIA CHECKLIST

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.

Technical Drainage Study For Hollywood Plaza @ Rancho and Jones

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1. GENERAL LOCATION AND DEVELOPMENT DESCRIPTION

1.1 Purpose

Lochsa Engineering has been retained by JSAAT Inc. to provide a Technical Drainage Study for the Hollywood Plaza, located at the southeast corner of Rancho Drive and Jones Boulevard, within the City of Las Vegas, Nevada. The proposed improvements consist of a drive-through building, surface parking and drive aisles, as well as a right turn and driveway entrances onto Rancho Drive and Jones Boulevard.

The purpose of this study is to provide a detailed hydrologic analysis of the site and watershed impacting it, and to substantiate the flood control design for the proposed improvements. The Clark County Regional Flood Control District (CCRFCD) Hydrologic Criteria and Drainage Design Manual (HCDDM) and the 2018 Las Vegas Valley Flood Control Master Plan Update (2018 MPU) have been compiled and utilized to prepare this study.

This report presents summary of the hydrologic and hydraulic analyses, methodology and results of the study.

1.2 Location of Property

The site represents approximately 1.70 acres at the southeast corner of Rancho Drive and Jones Boulevard. Rancho Drive is a Nevada Department of Transportation (NDOT) right-of-way. The site is bordered to the east by the existing Mosaic Falls single-family residential development.

The site occupies a portion of the Southern Half (S1/2) of the Southeast Quarter (SE1/4) of Section 02, Township 20 South, Range 60 East, of the M.D.M., in the City of Las Vegas, Nevada. The site occupies the parcel identified by Assessor's Parcel Number (APN) 138-02-804-001. Please refer to the copy of the Assessor's parcel map provided in Appendix C. The Vicinity Map for the subject site, in relation to the surrounding streets, is also provided in Figure 1 of the Appendix.

1.3 Description of Property

The project site occupies approximately 1.70 acres and generally slopes to the north and northeast with average slope of approximately +/- 0.8%. The entire site appears to have been cleared, disturbed and graded. Jones Boulevard and the east half of Rancho Drive along the site are fully improved, with curb and sidewalks. A review of the 2018 MPU's **Figure W-4** indicates that the entire site is located within Soil no. 1305. As shown in the attached referenced information from the 2018 MPU Curve Number matrix, Soil no. 1305 consists of 5% hydrologic soil group 'A' (soils with "high infiltration rate, low runoff potential"), 35% hydrologic soil group 'C' (soils with "low infiltration rate, moderately high runoff potential") and 60% hydrologic soil group 'D' (soils with "very low infiltration rate, high runoff potential"). The hydrologic soil group designation from the 2018 MPU is being utilized in the hydrologic analysis in this subject study.

2. DRAINAGE DESCRIPTION

In the CCRFCD's 2018 MPU (Reference 2), the valley was hydrologically divided into ten watersheds, and each watershed was further subdivided into sub-basins. The onsite and offsite basins impacting the subject project area fall within the Gowan watershed. As shown in Figure W-4 of the 2018 MPU, the project site is located within sub-basin PT4B2-C.

2.1 Existing Drainage Conditions

The offsite flows impacting the subject property are conveyed along Rancho Drive and Jones Boulevard. A large watershed impact the west half of Rancho Drive near the project site. The most current and detailed analysis for relevant offsite flows from the west were provided in the "Rancho Drive/US95 Flood Hazard Mapping Restudy, by Louis Berger Group, Inc., approved by FEMA in November 2009 (will be referred to as the **LOMR Study**). The Rancho/US95 LOMR Study provided detailed hydrologic and hydraulic analysis for the offsite flows along the west side of Rancho Drive. As shown in the attached referenced information, the detailed hydraulic modeling from the LOMR Study determined the entire 100-year surface flows from the west will continue travelling southeasterly along the west side of Rancho Drive. As shown in referenced Exhibits C6R and C7R from the Rancho/US95 LOMR Study, the detailed HEC-RAS model illustrates that southeasterly offsite flows are **confined to the western half of Rancho Drive**. Thus, the LOMR illustrates that flows travelling within the eastern half of Rancho Drive along the project site will be limited to the local flows.

The most relevant and more current determination for the local flows conveyed within the

eastern half of Rancho Drive and the southern half of Jones Boulevard was provided in the “*Master Drainage Study for Craig & Rancho*” (CLV DS4824, will be referred to as the **Craig & Rancho Master Study**), by Lochsa Engineering, approved by the City of Las Vegas (CLV) on October 27, 2016.

The project area was also covered by the 1997 CLV “*Northwest Neighborhood Study Area Phase I*”, by PBS &J, Inc. Referenced Figures E-12(Existing) and F-12(Ultimate) from the Northwest Neighborhood Study are included with the study. However, as established previously, the LOMR Study and the Craig & Rancho Master Study represent the most current information for the area.

As shown in the attached figure A-1 for NDOT Roadway Functional Classification, Rancho Drive is 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 Rancho Drive is the 25-year storm. Therefore, the hydrologic analysis in this project will analyze the 25-year storm, in addition to the 10- and 100-year storm events.

The Craig & Rancho Master Study utilized the referenced HEC-1 model from the Rancho/US95 LOMR Study to determine the relevant flows impacting Rancho Drive from the west. The Master Study also analyzed the local flows conveyed within the eastern half of Rancho Drive and within Jones Boulevard. The Craig & Rancho Master Study utilized a 1-ft topographic map to delineate the local flows conveyed through Rancho Drive and Jones Boulevard. As shown

in referenced Exhibit DR2 (Onsite Drainage Map, Future Condition), flows within the eastern half of Rancho Drive (at the intersection with Jones Boulevard) was determined by manually adding the runoff from referenced offsite basins RNCH1(4/5/7cfs, 10-/25-/100-year) and RNCH2(3/4/6cfs). Thus, the total flows conveyed within the eastern half of Rancho Drive (at the intersection with Jones Blvd.) were determined to be 7/9/13cfs (Q10/Q25/Q100). The Craig & Rancho Master Study also delineated the northern and southern halves of Jones Boulevard (between Rancho and Hickam) as referenced basins JONES1(4/5/7cfs) and JONES2(3/4/6cfs), respectively.

Since the approval of the Craig & Rancho Master Study, several more recent updates and drainage studies were approved by the CLV for the Craig/Rancho area. The “Technical Drainage Study for Rancho and Jones Residential”, prepared by Actus, was approved by CLV on January 19, 2019 (**DS 5060**). Similarly, the “Technical Drainage Study for Oil Change at Craig and Rancho”, prepared by Lochsa Engineering, was also approved by CLV on April 5, 2022 (**DS 5547**). However, these studies did not revise or alter the determined flows for Rancho Drive east half (at the intersection with Jones Blvd.) from the Craig & Rancho Master Study.

The HEC-1 Flood Hydrograph Package is utilized in this subject study to determine the relevant onsite and offsite runoff flows. Utilizing the 1-ft topographic map for the project, the site is delineated into one onsite basin labeled as NX1(2/3/4cfs). The delineation of the onsite basins is depicted on Exhibit D1, labeled as the ‘Onsite Drainage Map, Existing Condition’. As discussed above and shown in referenced information, the Craig & Rancho Master Study determined the

flows within the eastern half of Rancho Drive (at the intersection with Jones Boulevard) to be 7/9/13cfs (Q10/Q25/Q100), by manually adding runoff from referenced offsite basins RNCH1(4/5/7cfs) and RNCH2(3/4/6cfs). **This runoff within the east half of Rancho Drive will turn northeasterly to travel within the northern half of Jones Boulevard.**

Offsite basin JON(1/2/3cfs) is delineated to represent the runoff flows generated through the southern half of Jones Boulevard along the project site. Similarly, offsite basin RNCH(1/1/2cfs) is delineated to represent the runoff flows generated through the eastern half of Rancho Drive along the project site. As shown in the HEC-1 output and Exhibit D1, runoff from NX1 is combined with JON at combination point CX1(3/4/6cfs), which represents the total flows conveyed within the south half of Jones Boulevard along the project site.

Normal depth calculations are being provided for Rancho Drive east half (Section A) and Jones Boulevard south half (Section B). As shown in the attached FlowMaster output, flows within perimeter streets are well below the maximum allowable velocity x depth ($v \times d$) values of 6.0 and 8.0 during 10- and 100-year storm events, respectively. Flows within Rancho Drive and Jones Boulevard also meet the minimum 12-ft dry lane requirement during the 10-year storm events.

As stated previously, Rancho Drive is 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 Drive is required to satisfy the ½ lane maximum allowable spread during the 25-year storm events. Therefore, normal depth calculations for Rancho Drive also utilize the 25-year

storm events. As shown in the FlowMaster output, Rancho Drive east half satisfies the NDOT required maximum allowable 25-year spread.

2.2 Interim Drainage Condition

For interim condition, the offsite flows remain as determined and discussed in the existing condition. Thus, the offsite runoff flow values and pattern upstream the subject site remains as described in the existing condition. As discussed previously, the proposed improvements consist of a drive-through building, surface parking and drive aisles, as well as a right turn and driveway entrances onto Rancho Drive and Jones Boulevard.

As discussed in the existing condition, the Craig & Rancho Master Study determined the local flows conveyed within the eastern half of Rancho Drive at the intersection with Jones Boulevard. As shown in the referenced information, the total flows conveyed within the eastern half of Rancho Drive (at the intersection with Jones Blvd.) were determined to be 7/9/13cfs (Q10/Q25/Q100) by manually adding runoff from referenced offsite basins RNCH1(4/5/7cfs) and RNCH2(3/4/6cfs). The Craig & Rancho Master Study also delineated the northern and southern halves of Jones Boulevard (between Rancho and Hickam) as referenced basins JONES1(4/5/7cfs) and JONES2(3/4/6cfs), respectively.

The HEC-1 Flood Hydrograph Package is utilized in this subject study to determine the relevant onsite and offsite runoff flows. Utilizing the grading plan for the project, the site is delineated into three onsite basins labeled as ND1(1/2/2cfs), ND2(1/2/3cfs) and

ND3(1/1/1cfs). The delineation of the onsite basins is depicted on Exhibit D2, labeled as the 'Onsite Drainage Map, Developed Condition'. Onsite basins ND1 and ND2 represent the vast majority of the project site, which drains northerly onto Jones Boulevard through sidewalk underdrains and the proposed driveway entrance. Onsite basin ND3 represents the very narrow strip that drains onto Rancho Drive through the proposed driveway entrance.

As discussed above and shown in referenced information, the Craig & Rancho Master Study determined the flows within the eastern half of Rancho Drive (at the intersection with Jones Boulevard) to be 7/9/13cfs (Q10/Q25/Q100). This runoff within the east half of Rancho Drive will turn northeasterly to travel within the northern half of Jones Boulevard.

Offsite basin JON(1/2/3cfs) remains unchanged from the existing condition and represents the runoff flows generated through the southern half of Jones Boulevard along the project site. Similarly, offsite basin RNCH(1/1/2cfs) remains unchanged and represents the runoff flows generated through the eastern half of Rancho Drive along the project site. As shown in the HEC-1 output and Exhibit D2, runoff from ND1 and ND2 is combined with JON at combination point CD1(4/6/8cfs), which represents the total flows conveyed within the south half of Jones Boulevard along the project site.

Runoff from onsite basin ND3 is combined with RNCH at combination point CD2(1/1/2cfs), which represents the total flows conveyed within the eastern half of Rancho Drive along the project site. **As shown from the comparison between the HEC-1 output from the**

existing (basin RNCH) and developed (combination point CD2) conditions, the proposed flows within the eastern half of Rancho Drive remain unchanged from the existing condition.

Normal depth calculations are being provided for Rancho Drive east half (Section A) and Jones Boulevard south half (Section B). As shown in the attached FlowMaster output, flows within perimeter streets are well below the maximum allowable velocity x depth ($v \times d$) values of 6.0 and 8.0 during 10- and 100-year storm events, respectively. Flows within Rancho Drive and Jones Boulevard also meet the minimum 12-ft dry lane requirement during the 10-year storm events.

As stated previously, Rancho Drive is 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 Drive is required to satisfy the ½ lane maximum allowable spread during the 25-year storm events. Therefore, normal depth calculations for Rancho Drive also utilize the 25-year storm events. **As shown in the FlowMaster output, Rancho Drive flows remain unchanged from existing condition and remain to satisfy the NDOT required maximum allowable 25-year spread.**

As shown in the attached grading plan and Exhibit D2, the finished floor (FF) elevation for the proposed building (2270ft) is set to elevation that is more than twice the 100-year flow depth (0.47ft) above Jones Boulevard flowline elevation (measured along the upstream side of the building). Similarly, the FF is set to elevation that is more than twice the 100-year flow depth (0.35ft) above Rancho Drive flowline elevations (measured along the upstream side of the

building). **In addition, the proposed finished grades (FG) elevations along the Rancho/Jones intersection are set to elevations that provide additional flood protection to more than twice the 100-year flow depth within Rancho Drive and Jones Boulevard.**

Normal flow depth calculation are provided at Sections 1, 2 and 3, adjacent to the proposed building. As shown in the attached FlowMaster output, flows within the site are well below the maximum $v \times d$ value of 6.0ft. The calculation also illustrates that the proposed FF elevation is set more than twice the 100-year flow depth above the adjacent flowline elevations at Sections 1, 2 and 3. Flow capacity calculation is also provided for the proposed riprap-lined swale to drain onsite basin ND1 towards Jones Boulevard, to illustrate its sufficient capacity to convey the 100-year design flows.

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, exhibit **D2** and the attached Parking Lot Area calculations, onsite basins ND1(0.75acres), ND2(0.81acres) and ND3(0.14acres) all represent an area that may be categorized as Parking for water quality purpose.

The entire runoff from basin ND1 will travel through a proposed +/-40ft riprap-lined swale. Similarly, water quality flows from basin ND2 will travel through a +/-80ft riprap-lined swale along the north corner of the project site. **As shown in the attached Parking Lot Area calculations**, the landscaping, pervious areas and building roof areas are subtracted from each

onsite basin area to determine the basin's area categorized as **Parking Lot Area**. As shown, the total area categorized as 'Parking' area, for the purpose of water quality, is determined to be approximately **1.09acres**. The total 'Parking' area being treated through the proposed swales is determined to be approximately **1.02acres**. Thus, the proposed riprap-lined swales are determined to provide water quality treatment to approximately 92.70% of the proposed Parking area.

2.3 Future Drainage Condition

For the future condition, both the site and all the offsite basins are typically assumed to be fully developed. The upstream offsite basins impacting the project site are already analyzed as fully-developed. Therefore, Future drainage runoff flow patterns and values will remain to match the Interim/Developed condition discussed above. Thus, no additional Future analysis is being analyzed for the upstream watershed.

2.4 Master Planning Information

The "2018 Las Vegas Valley Flood Control Master Plan Update" (2018 MPU, Reference 2), dated September 2018, as prepared by ATKINS, illustrates the existing and proposed regional master planned facilities. Review of Figure F-18 of the updated 2018 MPU indicates there are future regional facilities adjacent to our site. The MPU shows Facility ID GOAL 0100 (Category A proposed facility). The facility is identified as future 10'x8'RCB storm drain as part of the Gowan Outfall – Alexander Road Facilities. The future facility is proposed within Rancho Drive and is determined as 10ft x 8ft RCB, with 1334cfs design flow.

2.5 Floodplain Information

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 October 4, 2019. Review of the FIRM indicates that subject project site falls entirely within Zone "X" (unshaded), described by FEMA as: "*Areas determined to be outside the 0.2% annual chance floodplain.*" Figure 2 in Appendix C illustrates the location of the site on a portion of the referenced FIRM.

2.6 Previous Drainage Studies

The overall area is covered within the CCRFCD "*2018 Las Vegas Valley Flood Control Master Plan Update, Volume I and II*" (Reference 2) and the Natural Resources Conservation Service (NRCS), "*1985 Soil Survey of the Las Vegas Valley*", Issued in July 1985 (Reference 3). The site is also covered in the FIRM with Community Panel Number: 32003C2155F, Effective Date: November 16, 2011, revised to reflect LOMR dated October 4, 2019.

The most relevant and more current determination for the local flows conveyed within the eastern half of Rancho Drive and the southern half of Jones Boulevard was provided in the "*Master Drainage Study for Craig & Rancho*" (CLV DS4824), by Lochsa Engineering, approved by CLV on October 27, 2016. The Craig & Rancho Master Study was utilized to determine the flows within the east half of Rancho Drive, which will turn northeasterly into north half of Jones Blvd.

Since the approval of the Craig & Rancho Master Study, several more recent updates and

drainage studies were approved by the CLV for the Craig/Rancho area. The “Technical Drainage Study for Rancho and Jones Residential”, prepared by Actus, was approved by CLV on January 19, 2019 (**DS 5060**). Similarly, the “Technical Drainage Study for Oil Change at Craig and Rancho”, prepared by Lochsa Engineering, was also approved by CLV on April 5, 2022 (**DS 5547**). However, these studies did not revise or alter the determined flows for Rancho Drive east half (at the intersection with Jones Blvd.) from the Craig & Rancho Master Study.

Lochsa Engineering generally concurs with the pertinent referenced analyses utilized in this study.

2.7 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 attached excerpts from Section 1500 of the HCDDM, since the parking lot area of the project site is more than 1 acre, the proposed improvements are categorized as ‘**Large**’ parking. For Large parking lot, water quality BMPs are required for at least 75% of the proposed parking lot.

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, exhibit **D2** and the attached Parking Lot Area calculations, onsite basins ND1(0.75acres), ND2(0.81acres) and ND3(0.14acres) all

represent an area that may be categorized as Parking for water quality purpose.

The entire runoff from basin ND1 will travel through a proposed +/-40ft riprap-lined swale. Similarly, water quality flows from basin ND2 will travel through a +/-80ft riprap-lined swale along the north corner of the project site. As shown in the attached Parking Lot Area calculations, the landscaping, pervious areas and building roof areas are subtracted from each onsite basin area to determine the basin's area categorized as Parking Lot Area. As shown, the total area categorized as 'Parking' area, for the purpose of water quality, is determined to be approximately 1.09acres. The total 'Parking' area being treated through the proposed swales is determined to be approximately 1.02acres. Thus, the proposed riprap-lined swales are determined to provide water quality treatment to approximately 92.70% of the proposed Parking area.

3. PROPOSED DRAINAGE FACILITIES

3.1 General Description

As discussed previously, the proposed improvements consist of a drive-through building, surface parking and drive aisles, as well as a right turn and driveway entrances onto Rancho Drive and Jones Boulevard.

3.2 Compliance with Regulations and Adopted Plans

The hydrologic analysis and drainage design of this development is in compliance with local requirements, including the CCRFCD "*Hydrologic Criteria and Drainage Design Manual*" (HCDDM) (Reference 1), and the CCRFCD "*2008 Las Vegas Valley Flood Control Master Plan Update*" (Reference 2). The site design is also in compliance with the Natural Resources

Conservation Service (NRCS) Web Soil Survey and the 1995 SCS Soil Survey of Las Vegas Area (Reference 3), as well as FEMA's FIRM with panel number 23003C2155F (Reference 4).

3.3 Hydrologic Criteria

The onsite and offsite basins of the subject project area all fall within the Gowan watershed. The hydrologic and hydraulic analyses presented in this report are carried out in accordance with the CCRFCD's HCDDM (Reference 1). The rainfall values used for the hydrologic analysis of the site represent the 10-year, 25-year and 100-year storm recurrence events, each with six-hour duration. The site is within the boundary for using the McCarran Airport Rainfall Data. Therefore, point precipitation values were determined using Table 505 of the HCDDM. The adjusted point rainfall values for the 6-hour, 10-year, 25-year and 100-year storm events are determined from Table 505 as 1.58, 2.05 and 2.77 inches, respectively.

The rainfall losses due to infiltration, interception, etc. are represented using the SCS curve number (CN) method recommended in the CCRFCD HCDDM (Reference 1). The SCS method divides the soils into four hydrologic groups as A, B, C and D. A review of the 2018 MPU's **Figure W-4** indicates that the entire site is located within Soil no. 1305. As shown in the attached referenced information from the 2018 MPU Curve Number matrix, Soil no. 1305 consists of 5% hydrologic soil group 'A' (soils with "high infiltration rate, low runoff potential"), 35% hydrologic soil group 'C' (soils with "low infiltration rate, moderately high runoff potential") and 60% hydrologic soil group 'D' (soils with "very low infiltration rate, high runoff potential"). The hydrologic soil group designation from the 2018 MPU is being utilized in the hydrologic analysis

in this subject study.

The CN values for the different land use are determined from Table 602 of the CCRFCD HCDDM. The runoff hydrograph is determined for each sub-basin using the Soil Conservation Service (SCS) unit hydrograph method. Calculations used in the hydrologic analysis for the offsite and onsite basins for existing and proposed conditions are attached in Appendix A.

3.4 Facility Design Calculations

All drainage facilities within this project have been designed in accordance with the CCRFCD “*Hydrologic Criteria and Drainage Design Manual*” (Reference 1). The onsite drainage plan has been developed to closely resemble existing drainage patterns and the ultimate drainage pattern established in the 2018 MPU. The drainage plan is also designed to minimize any impact to the perimeter streets or adjacent properties.

Normal depth calculations are being provided for Rancho Drive east half (Section A) and Jones Boulevard south half (Section B). As shown in the attached FlowMaster output, flows within perimeter streets are well below the maximum allowable velocity x depth ($v \times d$) values of 6.0 and 8.0 during 10- and 100-year storm events, respectively. Flows within Rancho Drive and Jones Boulevard also meet the minimum 12-ft dry lane requirement during the 10-year storm events.

As stated previously, Rancho Drive is 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 Drive is required to satisfy the ½ lane maximum allowable spread during the 25-year storm events. Therefore, normal depth calculations for Rancho Drive also utilize the 25-year storm events. **As shown in the FlowMaster output, Rancho Drive flows remain unchanged from existing condition and remain to satisfy the NDOT required maximum allowable 25-year spread.**

Normal flow depth calculation are provided at Sections 1, 2 and 3, adjacent to the proposed building. As shown in the attached FlowMaster output, flows within the site are well below the maximum v x d value of 6.0ft. The calculations also illustrate that the proposed FF elevation is set more than twice the 100-year flow depth above the adjacent flowline elevations at Sections 1, 2 and 3. Flow capacity calculation is also provided for the proposed riprap-lined swale to drain onsite basin ND1 towards Jones Boulevard, to illustrate its sufficient capacity to convey the 100-year design flows.

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, Exhibit **D2** and the attached Parking Lot Area calculations, the entire runoff from basin ND1 will travel through a proposed +/-40ft riprap-lined swale. Similarly, water quality flows from basin ND2 will travel through a +/-80ft riprap-lined swale along the north corner of the project site. **As shown in the attached Parking Lot Area calculations**, the total area categorized as 'Parking' area, for the purpose of water quality, is determined to be approximately **1.09acres**. The total 'Parking' area being treated

through the proposed swales is determined to be approximately **1.02acres**. Thus, the proposed riprap-lined swales are determined to provide water quality treatment to approximately 92.70% of the proposed Parking area.

4. CONCLUSIONS AND RECOMMENDATIONS

1. This project is in compliance with the applicable drainage laws as recognized by the State of Nevada.
2. This project is in compliance with the CCRFCD “2018 Las Vegas Valley Flood Control Master Plan”, as well as the CCRFCD “*Hydrologic Criteria and Drainage Design Manual*”.
3. The site is located entirely within areas designated by FEMA as Zone “X”(unshaded), described by FEMA as “*Areas determined to be outside the 0.2% annual chance floodplain.*”
4. The drainage facilities for this project have been designed to convey runoff from the 100-year storm safely through the site. In addition, the facilities have been designed based on generally accepted engineering practices.

5. REFERENCES

1. Clark County Regional Flood Control District, “*Hydrologic Criteria and Drainage Design Manual*”, August 1999.
2. Atkins, “*2018 Las Vegas Valley Flood Control Master Plan Update, Volume 1 and II*”. December 2018.
3. Natural Resources Conservation Service (NRCS), “*1985 Soil Survey of the Las Vegas Valley*”, Issued July 1985, in conjunction with the Web Soil Survey.
4. Federal Emergency Management Agency, “*Flood Insurance Rate Maps; Community Panel Number 32003C2155F; Clark County, Nevada and Incorporated Areas*”, dated November 16, 2011, revised to reflect the LOMR dated October 4, 2019.
5. Lochsa Engineering, “*Master Drainage Study for Craig & Rancho*”, approved by City of Las Vegas on October 27, 2016 (DS4824)

**Peak Flow Summary
Existing Condition**

HEC-1 I.D.	Area (acres)	10-year Flow (cfs)	25-year Flow (cfs)	100-year Flow (cfs)
JON	0.78	1	2	3
NX1	1.7	2	3	4
CX1	-	3	4	6
RNCH	0.48	1	1	2

**Peak Flow Summary
Developed Condition**

HEC-1 I.D.	Area (acres)	100-year Flow (cfs)	25-year Flow (cfs)	10-year Flow (cfs)
JON	0.78	1	2	3
ND1	0.75	1	2	2
ND2	0.81	1	2	3
CD1	-	4	6	8
RNCH	0.48	1	1	2
ND3	0.14	<1	<1	<1
CD2	-	1	1	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 (East Half)	130	A	1	1.38	0.29	0.40	49.78
Jones Boulevard(South Half)	110	B	3	2.30	0.35	0.81	31.56

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 (East Half)	130	A	2	1.60	0.35	0.56
Jones Boulevard(South Half)	110	B	6	2.67	0.43	1.15

Street Flow Summary
(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)
Rancho Drive (East Half)	130	A	1	1.38	0.29	0.40	49.78
Jones Boulevard(South Half)	110	B	4	2.50	0.38	0.95	30.24

Street Flow Summary
(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]
Rancho Drive (East Half)	130	A	2	1.60	0.35	0.56
Jones Boulevard(South Half)	110	B	8	2.81	0.47	1.32

Copy of the Approved Site Development Plan Review Conditions for
the Site



**LAS VEGAS
CITY COUNCIL**

CAROLYN G. GOODMAN
Mayor

STAVROS S. ANTHONY
Mayor Pro Tem

MICHELE FIORE
CEDRIC CREAR
BRIAN KNUDSEN
VICTORIA SEAMAN
OLIVIA DIAZ

JORGE CERVANTES
City Manager

DEPARTMENT OF
COMMUNITY DEVELOPMENT

SETH T. FLOYD

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cityoflasvegas
lasvegasnevada.gov

October 13, 2022

Mr. Jon Basso
JSAAT Inc
2016 Redbird Drive
Las Vegas, Nevada 89134

**RE: 22-0493-SDR1 - ADMINISTRATIVE SITE DEVELOPMENT PLAN
REVIEW
ADMINISTRATIVE CYCLE - OCTOBER 2022**

Dear Applicant:

Your Land Use Entitlement project request for a Minor Amendment to previously approved Site Development Plan Review (22-0050-SDR1) FOR A PROPOSED 4,860 SQUARE-FOOT COMMERCIAL DEVELOPMENT CONSISTING OF A GENERAL RETAIL BUILDING WITH A 403 SQUARE-FOOT PROJECTION SCREEN; TWO DRIVE THROUGH RESTAURANTS AND TWO WALK-UP ONLY RESTAURANTS on 1.30 acres at the northeast corner of Rancho Drive and Jones Boulevard (APN 138-02-804-001), C-1 (Limited Commercial) Zone, Ward 1 (Knudsen), was considered administratively by the Department of Planning staff.

The Department of Planning has administratively **APPROVED** your request subject to the following:

Planning

1. Conformance to the Conditions of Approval for Special Use Permit (22-0050-SUP1 and SUP2) and Site Development Plan Review (22-0050-SDR1) shall be required, except as amended herein.
2. Variance (22-0050-VAR1) to allow no loading space where one is required is hereby expunged.
3. Special Use Permit (22-0050-SUP3) for a proposed drive through use is hereby expunged.
4. This approval is a minor amendment to, and shall run concurrently with, the approval for Site Development Plan Review (22-0050-SDR1). No further action is needed, as this approval is extended, exercised or expired with 22-0050-SDR1.
5. All development shall be in conformance with the site plan, landscape plan, and building elevations, date stamped 09/20/22, except as amended by conditions herein.

6. 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.
7. These Conditions of Approval shall be affixed to the cover sheet of any plan set submitted for building permit.
8. A technical landscape plan, signed and sealed by a Registered Architect, Landscape Architect, Residential Designer or Civil Engineer, must be submitted prior to or at the same time application is made for a building permit. A permanent underground sprinkler system is required, which shall be permanently maintained in a satisfactory manner; the landscape plan shall include irrigation specifications. Installed landscaping shall not impede visibility of any traffic control device.
9. A fully operational fire protection system, including fire apparatus roads, fire hydrants and water supply, shall be installed and shall be functioning prior to construction of any combustible structures.
10. All City Code requirements and design standards of all City Departments must be satisfied, except as modified herein.

Public Works

11. Connect to public sewer at a size, depth, and location acceptable to the Sanitary Sewer Engineering Section of the Department of Public Works.
12. Comply with all applicable conditions of approval for 22-0050-SDR1 and any other Site related actions.

This action by the Department of Planning staff October 13, 2022 is final unless a written appeal is filed with the Director of the Department of Community Development within ten days of the date of this letter.

Sincerely;



Nicole Eddowes
Community Development Coordinator
Case Planning Division

NE:nl



**LAS VEGAS
CITY COUNCIL**

CAROLYN G. GOODMAN
Mayor

STAVROS S. ANTHONY
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cityoflasvegas
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June 15, 2022

Daniel Sullivan
PRE Rancho Jones LLC
One Marina Park Drive, Ste. 1500
Boston, MA 02210

**RE: 22-0050-VAR1, 22-0050-SUP1, 22-0050-SUP2, 22-0050-SUP3 AND
22-0050-SDR1
CITY COUNCIL MEETING OF JUNE 15, 2022**

Dear Applicant:

The City Council at a regular meeting held on June 15, 2022 voted to **APPROVE** the following Land Use Entitlement project requests on 1.30 acres at the northeast corner of Rancho Drive and Jones Boulevard (APN 138-02-804-001), C-1 (Limited Commercial) Zone, Ward 1 (Knudsen). [NOTE: This item is in Ward 5 (Crear).]

- 22-0050-VAR1 - VARIANCE - TO ALLOW NO LOADING SPACE WHERE ONE IS REQUIRED
- 22-0050-SUP1 - SPECIAL USE PERMIT - FOR A PROPOSED DRIVE THROUGH USE [B]
- 22-0050-SUP2 - SPECIAL USE PERMIT - FOR A PROPOSED DRIVE THROUGH USE [C]
- 22-0050-SUP3 - SPECIAL USE PERMIT - FOR A PROPOSED DRIVE THROUGH USE [D]
- 22-0050-SDR1 - SITE DEVELOPMENT PLAN REVIEW - FOR A PROPOSED COMMERCIAL DEVELOPMENT CONSISTING OF A GENERAL RETAIL BUILDING FEATURING A 760 SQUARE-FOOT PROJECTION SCREEN, THREE DRIVE THROUGH ONLY RESTAURANTS AND A WALK-UP ONLY RESTAURANT WITH WAIVERS OF PERIMETER LANDSCAPE BUFFER AND BUILDING ORIENTATION REQUIREMENTS

This approval is subject to the following conditions:

22-0050-VAR1 CONDITIONS

Planning

1. Approval of and conformance to the Conditions of Approval for Special Use Permits (22-0050-SUP1 through SUP3) and Site Development Plan Review (22-0050-SDR1) 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 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.
4. These Conditions of Approval shall be affixed to the cover sheet of any plan set submitted for building permit.
5. All City Code requirements and design standards of all City departments must be satisfied, except as modified herein.

22-0050-SUP1 CONDITIONS

Planning

1. Approval of and conformance to the Conditions of Approval for Variance (22-0050-VAR1), Special Use Permits (22-0050-SUP2 and SUP3) and Site Development Plan Review (22-0050-SDR1) 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 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.
4. 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.
5. All City Code requirements and design standards of all City departments must be satisfied, except as modified herein.

22-0050-SUP2 CONDITIONS

Planning

1. Approval of and conformance to the Conditions of Approval for Variance (22-0050-VAR1), Special Use Permits (22-0050-SUP1 and SUP3) and Site Development Plan Review (22-0050-SDR1) 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 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.
4. 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.
5. All City Code requirements and design standards of all City departments must be satisfied, except as modified herein.

22-0050-SUP3 CONDITIONS

Planning

1. Approval of and conformance to the Conditions of Approval for Variance (22-0050-VAR1), Special Use Permits (22-0050-SUP1 and SUP2) and Site Development Plan Review (22-0050-SDR1) 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 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.
4. 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.
5. All City Code requirements and design standards of all City departments must be satisfied, except as modified herein.

22-0050-SDR1 CONDITIONS

Planning

1. Approval of and conformance to the Conditions of Approval for Variance (22-0050-VAR1) and Special Use Permits (22-0050-SUP1 through SUP3) 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. If approved, the proposed development shall adhere to all Clark County – Department of Aviation requirements.
4. All development shall be in conformance with the site plan and landscape plan, date stamped 04/19/22 and building elevations, date stamped 03/14/22, except as amended by conditions herein.
5. A Waiver from Title 19.08.040 is hereby approved, to allow the buildings to not orient to the corner where such is required.
6. A Waiver from Title 19.08.070 is hereby approved, to allow a zero to ten-foot landscape buffer width adjacent to the right-of-way where 15 feet is required.
7. An Exception from Title 19.08.040 is hereby approved, to allow 52 perimeter landscape buffer trees where 56 are required.
8. An Exception from Title 19.08.110 is hereby approved, to allow no interior parking area trees where 25 are required.
9. All necessary building permits shall be obtained and final inspections shall be completed in compliance with Title 19 and all codes as required by the Department of Building and Safety.
10. These Conditions of Approval shall be affixed to the cover sheet of any plan set submitted for building permit.
11. Pursuant to LVMC Title 19.08.040.G for commercial and industrial properties, a perimeter wall shall be constructed adjacent to any residential zoning district or property used solely for residential purposes. The wall or fence is intended to screen the commercial or industrial activity from the residential property, and shall be of a solid decorative material that is a minimum of six feet in height measured from the side of the commercial or industrial property. In no case shall the wall or fence exceed the overall height limitation applicable to the adjacent zoning district or property unless approved through a Variance or other applicable means. The overall height of a wall or fence shall be measured from the side with the greatest vertical exposure above finished grade.

12. A technical landscape plan, signed and sealed by a Registered Architect, Landscape Architect, Residential Designer or Civil Engineer, must be submitted prior to or at the same time application is made for a building permit. A permanent underground sprinkler system is required, which shall be permanently maintained in a satisfactory manner; the landscape plan shall include irrigation specifications. Installed landscaping shall not impede visibility of any traffic control device.
13. A fully operational fire protection system, including fire apparatus roads, fire hydrants and water supply, shall be installed and shall be functioning prior to construction of any combustible structures.
14. Prior to the submittal of a building permit application, the applicant shall meet with Department of Planning staff to develop a comprehensive address plan for the subject site. A copy of the approved address plan shall be submitted with any future building permit applications related to the site.
15. All City Code requirements and design standards of all City Departments must be satisfied, except as modified herein.

Public Works

16. Unless otherwise allowed in the approved Traffic Impact Analysis, dedicate a bus turnout per Standard Drawing #234.1 prior to issuance of permits. Additionally, grant a Bus Shelter Pad Easement in conformance with Standard Drawing #234.2 for a future bus stop on Jones Boulevard adjacent to this site unless the Regional Transportation Commission (RTC) acknowledges in writing that this easement is not required.
17. Construct all incomplete half street improvements on Rancho Drive adjacent to this site concurrent with development of this site. Additionally, construct a bus turnout per Standard Drawing #234.1 concurrent with development of this site unless otherwise allowed in the approved Traffic Impact Analysis. 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.
18. The sidewalk adjacent to this site shall meet Public Right-of-Way Accessibility Guidelines (PROWAG) in accordance with code requirements of Title 13.56.040 to the satisfaction of the City Engineer concurrent with development of this site. Grant any Pedestrian Access Easement needed to complete this requirement.
19. The driveway on Rancho Drive shall be ingress only and the driveway on Jones Boulevard shall be egress only. The final geometric design of the driveway on Rancho Drive must be acceptable to the Nevada Department of Transportation (NDOT) and the final geometric design of the driveway on Jones Boulevard must be acceptable to the City Traffic Engineer.

20. Coordinate with the Environmental Compliance & Enforcement staff of the Department of Public Works to locate any required grease interceptor and sand/oil interceptors in acceptable locations prior to submittal of sewer-related plans. Comply with the recommendations and requirements of the Environmental Compliance & Enforcement staff prior to issuance of permits. The team may be contacted at 702-229-2338 or emailed at ece@lasvegasnevada.gov.
21. Contact the City Engineer's Office at 702-229-6272 to coordinate the development of this project with the Rancho Drive project and any other public improvement projects adjacent to this site. Comply with the recommendations of the City Engineer.
22. Obtain an Occupancy Permit from the Nevada Department of Transportation (NDOT) for all driveways or other private improvements in the Rancho Drive public right-of-way adjacent to this site prior to constructing any improvements within NDOT jurisdiction.
23. Landscape and maintain all unimproved right-of-way 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.
24. Submit a License Agreement for landscaping and private improvements in the public rights of way, if any, prior to the issuance of permits for these improvements. The applicant must carry an insurance policy for the term of the License Agreement and add the City of Las Vegas as an additionally insured entity on this insurance policy. If requested by the City, the applicant shall remove property within the public right-of-way at the applicant's expense pursuant to the terms of the City's License Agreement. The installation and maintenance of all private improvements in the public right of way shall be the responsibility of the applicant and any successors in interest to the property and assign pursuant to the terms of the License Agreement. Coordinate all requirements for the License Agreement with the Land Development Section of the Department of Building and Safety (229-4836).
25. 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. 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. The Traffic Impact Analysis shall also include a pedestrian circulation/access plan to identify nearby pedestrian attractors and recommend measures to accommodate pedestrians, such as but not limited to pedestrian access.

June 15, 2022

crosswalk, pedestrian activated flashers and temporary sidewalks. Comply with the recommendations of the approved Traffic Impact Analysis prior to occupancy of the site. 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.

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

The Notice of Final Action was filed with the Las Vegas City Clerk on June 15, 2022.

Sincerely,



Seth T. Floyd
Director of Community Development
Department of Planning

STF:PL:ew

cc:

Jon Brasso
2016 Redbird Drive
Las Vegas, Nevada 89134

Arthur Song
450 Fremont Street
Las Vegas, Nevada 89101

Parking Lot Area Calculations for Water Quality

&

Relevant Information from Section 1500 of the CCRFCD Drainage
Design Manual for Best Management Practices

Project: Hollywood Plaza @ Rancho and Jones

Project Number: 221174

Date: October, 2022

Parking Lot Area Calculations for Water Quality

Onsite Basin Label	Basin Area (acres)	Building Roof Area & Pervious Area (acres)	Parking Lot Area (acres)	W.Q. Approach	Parking Area Bypassing W.Q. Swale (acres)	W.Q. Area Treated (acres)	Notes
<u>ND1</u>	0.75	0.16	0.59	Proposed +/-40ft Water Quality Swale	0.00	0.59	
<u>ND2</u>	0.81	0.34	0.47	Proposed +/-80ft Water Quality Swale	0.05	0.42	+/- 0.05acres represents the small driveway portion draining directly onto the Jones Blvd.
<u>ND3</u>	0.14	0.11	0.03		0.03	0.00	
Totals	1.70	0.61	1.09			1.02	

Total Treated Parking Area = **1.02** acres

Total Parking Area = **1.09** acres <<<----- 'Large' Parking Size Category

Hence, approximately **92.7%** being treated of the Total Parking Lot Area

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.

Project Site represents
'Large' Parking

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

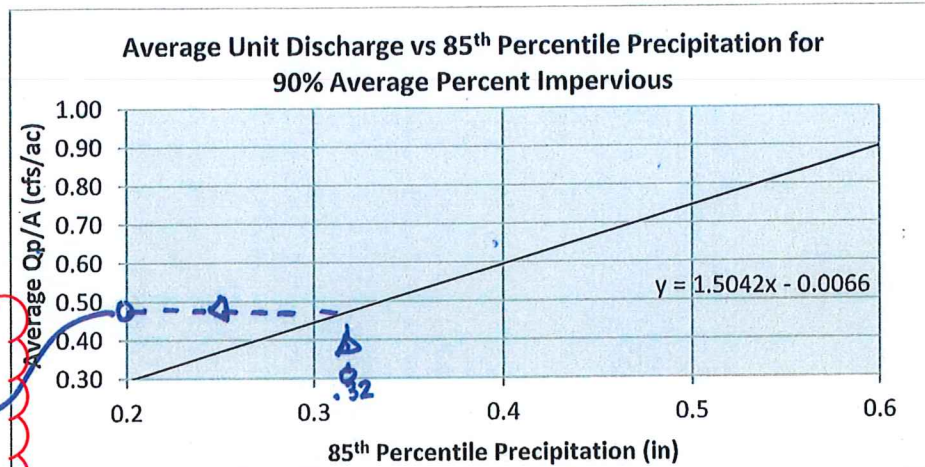
- Locate site on CCRFCD Design Rainfall Map for 2-year, 6-hour storm
- Determine the adjusted 2-year rainfall depth (D_2) for site, per CCRFCD methods
- Compute ratio of D_2 site to D_2 for the McCarran Airport Area
- Compute 85th percentile rainfall depth (D_{85}) as $0.32 \times D_2$ ratio (0.32 is D_{85} for McCarran Area)

D_{85}

2. Calculate BMP Design Peak Discharge

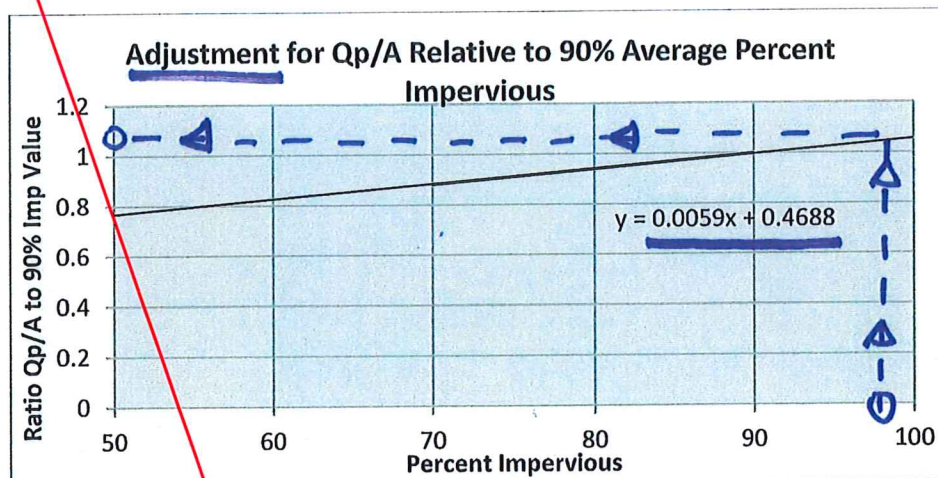
- Use the following chart or regression equation to calculate the unit discharge (Q_p/A) for the 90 percent average percent impervious area condition based on the D_{85} value.

Q_p / area



0.49 cfs/ac

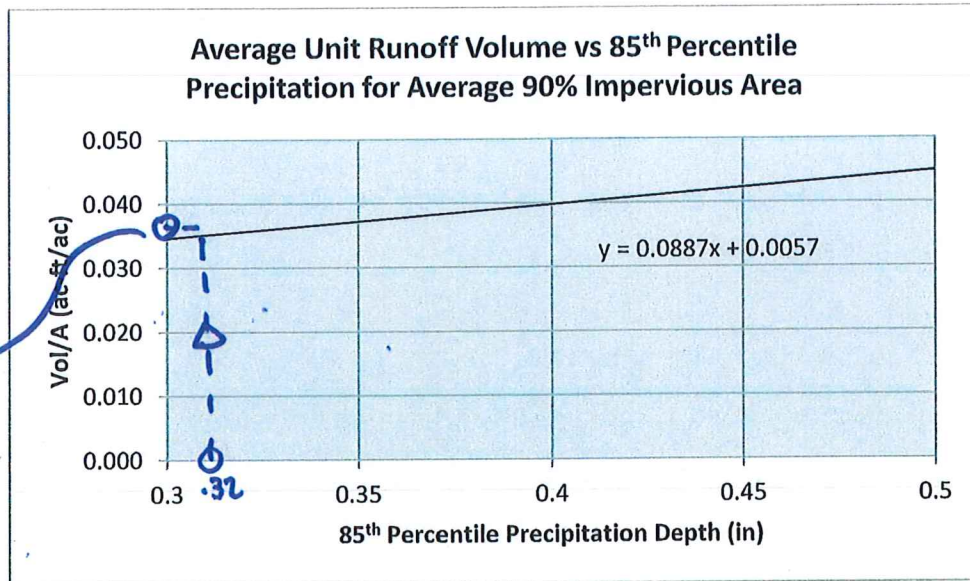
- b. Use the following chart or regression equation to calculate the unit discharge for the site based on the actual percent impervious area of the parking lot and associated landscaped areas.



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 D₈₅ value.

$Q_{\text{water quality peak}} = 0.49 \times 1.047 = 0.51 \text{ cfs/acre}$



- 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 $Vol = Vol/A \times A$ 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

D₂ site / D₂ 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})

$$D_{85} = 1.25 \times 0.32 = 0.40 \text{ inches}$$

2. Calculate BMP Design Discharge

$$Q_P/A (90\%) = 1.5042 \times (0.40) + 0.0066 = 0.60$$

Find Adjustment factor for percent impervious

$$Q_P/A = 0.60 \times [(0.0059[85]) + 0.4688] = 0.58$$

$$Q_P = 0.58 \times 100 \text{ acres} = 58 \text{ cfs}$$

3. Calculate BMP Design Runoff Volume

$$\text{Vol/A (90\%)} = 0.0887 \times 0.40 + 0.0057 = 0.04$$

$$\text{Vol/A} = 0.04 \times (0.0059 \times [85] + 0.4688) = 0.04; \text{Vol} = 0.04 \times 100 \text{ acres} = 4.0 \text{ ac-ft.}$$

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.

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.

<u>Pollutant</u>	<u>Removal Efficiency</u>
→ 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

<u>Tributary Area (ac)</u>	<u>Swale Slope</u>	<u>Minimum Swale Length (ft)</u>	<u>Size of Swale</u>
→ ≤ 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

Adopted September 11, 2014

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 D₅₀. 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.

APPENDIX A

HYDROLOGIC ANALYSIS

HEC-1 MODEL OUTPUT

(Existing Condition)

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1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JUN 1998
* VERSION 4.1
*
* RUN DATE 26OCT22 TIME 18:26:23
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X

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

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LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
1 ID HOLLYWOOD PLAZA @ RANCHO AND JONES
2 ID TECHNICAL DRAINAGE STUDY
3 ID EXISTING CONDITION
4 ID USING SCS METHODS AND KINEMATIC WAVE ROUTING
5 ID MASTER PLAN ADJUSTED 6-HOUR RAINFALL AND STORM DISTRIBUTION
6 ID
7 ID LOCHSA JOB NO. 221174
8 ID
9 ID
10 ID INPUT FILE NAME: X.DAT
11 ID
12 ID OCTOBER 2022
13 ID
14 ID *****
15 ID *****
16 ID INSIDE MCCARRAN AIRPORT RAINFALL AREA
17 ID
18 ID 10, 25 & 100 YEAR - 6 HOUR STORM EVENT
19 ID PRECIPITATION BASED ON FIGURES 503 AND 506 OF THE HCDDM
20 ID
21 ID
22 ID 10-YEAR RAINFALL DEPTH = 1.58 INCHES
23 ID 25-YEAR RAINFALL DEPTH = 2.05 INCHES
24 ID 100-YEAR RAINFALL DEPTH = 2.77 INCHES
25 ID
26 ID 10-YEAR RAINFALL DEPTH RATIO (JR CARD) = 1.58/2.77 = 0.57
27 ID 25-YEAR RAINFALL DEPTH RATIO (JR CARD) = 2.05/2.77 = 0.74
28 ID
29 ID *****
30 ID *****
31 ID
32 ID *DIAGRAM
33 IT 5 73
34 IO 5 0
35 IN 5
36 JR PREC 0.57 0.74 1.00
37
38 KK JON
39 KM OFFSITE BASIN JON
40 KM RUNOFF GENERATED THROUGH JONES BLVD. SOUTH HALF ALONG THE PROJECT SITE
41 PB 2.77
42 PC 0.0 .02 .057 .07 .087 .108 .124 .13 .13 .13
43 PC .13 .13 .13 .133 .14 .142 .148 .158 .172 .181
44 PC .19 .197 .199 .2 .201 .204 .214 .229 .241 .249
45 PC .251 .256 .27 .278 .281 .283 .295 .322 .352 .409
46 PC .499 .59 .71 .744 .781 .812 .819 .835 .851 .856
47 PC .86 .868 .876 .888 .91 .926 .937 .95 .97 .976
48 PC .982 .985 .987 .989 .99 .993 .994 .995 .998
49 PC .998 .999 1.0
50 BA .00122
51 LS 0 98.0
52 UD .070
53 *

```

1 HEC-1 INPUT PAGE 2

```

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
51 KK NX1
52 KM EXISTING ONSITE BASIN NX1
53 KM RUNOFF GENERATED THROUGH THE ENTIRE SITE, DRAINING ONTO JONES BLVD.
54 BA .00266
55 LS 0 92.1
56 UD .155
57 *
58 KK CX1
59 KM COMBINE JON AND NX1
60 KM TOTAL FLOWS CONVEYED THROUGH THE SOUTH HALF OF JONES BLVD. ALONG PROJECT SITE
61 HC 2
62 *
63 KK RNCH
64 KM OFFSITE BASIN RNCH

```


63 KM RUNOFF GENERATED THROUGH RANCHO DRIVE EAST HALF ALONG THE PROJECT SITE
64 BA .00074
65 LS 0 98.0
66 UD .060
67 ZZ

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE (V) ROUTING (--->) DIVERSION OR PUMP FLOW
NO. (.) CONNECTOR (<---) RETURN OF DIVERTED OR PUMPED FLOW
36 JON
51 NX1
57 CX1.....
61 RNCH

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

1*****
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* JUN 1998 *
* VERSION 4.1 *
* RUN DATE 26OCT22 TIME 18:26:23 *

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

HOLLYWOOD PLAZA @ RANCHO AND JONES
TECHNICAL DRAINAGE STUDY
EXISTING CONDITION
USING SCS METHODS AND KINEMATIC WAVE ROUTING
MASTER PLAN ADJUSTED 6-HOUR RAINFALL AND STORM DISTRIBUTION
LOCHSA JOB NO. 221174

INPUT FILE NAME: X.DAT

OCTOBER 2022

INSIDE MCCARRAN AIRPORT RAINFALL AREA
10, 25 & 100 YEAR - 6 HOUR STORM EVENT
PRECIPITATION BASED ON FIGURES 503 AND 506 OF THE HCDDM

10-YEAR RAINFALL DEPTH = 1.58 INCHES
25-YEAR RAINFALL DEPTH = 2.05 INCHES
100-YEAR RAINFALL DEPTH = 2.77 INCHES

10-YEAR RAINFALL DEPTH RATIO (JR CARD) = 1.58/2.77 = 0.57
25-YEAR RAINFALL DEPTH RATIO (JR CARD) = 2.05/2.77 = 0.74

33 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 73 NUMBER OF HYDROGRAPH ORDINATES
NDDATE 1 0 ENDING DATE
NDTIME 0600 ENDING TIME
ICENT 19 CENTURY MARK

COMPUTATION INTERVAL .08 HOURS
TOTAL TIME BASE 6.00 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	RATIO 2	RATIO 3
				.57	.74	1.00

Page 2

							X
HYDROGRAPH AT							
+	JON	.00	1	FLOW TIME	1. 3.50	2. 3.50	3. 3.50
HYDROGRAPH AT							
+	NX1	.00	1	FLOW TIME	2. 3.58	3. 3.58	4. 3.58
2 COMBINED AT							
+	CX1	.00	1	FLOW TIME	3. 3.50	4. 3.50	6. 3.50
HYDROGRAPH AT							
+	RNCH	.00	1	FLOW TIME	1. 3.50	1. 3.50	2. 3.50

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

HEC-1 MODEL OUTPUT

(Developed Condition)

```

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JUN 1998
* VERSION 4.1
*
* RUN DATE 26OCT22 TIME 18:24:46
*
*****

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D

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

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X X XXXXXX XXXX X
X X X X X
X X X X X
XXXXXX XXXX X XXXX
X X X X X
X X X X X
X X XXXXXX XXXX XXX

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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 -AMSK- 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 HOLLYWOOD PLAZA @ RANCHO AND JONES
2 ID TECHNICAL DRAINAGE STUDY
3 ID DEVELOPED CONDITION
4 ID USING SCS METHODS AND KINEMATIC WAVE ROUTING
5 ID MASTER PLAN ADJUSTED 6-HOUR RAINFALL AND STORM DISTRIBUTION
6 ID
7 ID LOCHSA JOB NO. 221174
8 ID
9 ID
10 ID INPUT FILE NAME: D.DAT
11 ID
12 ID OCTOBER 2022
13 ID
14 ID *****
15 ID *****
16 ID INSIDE MCCARRAN AIRPORT RAINFALL AREA
17 ID
18 ID 10, 25 & 100 YEAR - 6 HOUR STORM EVENT
19 ID PRECIPITATION BASED ON FIGURES 503 AND 506 OF THE HCDDM
20 ID
21 ID
22 ID 10-YEAR RAINFALL DEPTH = 1.58 INCHES
23 ID 25-YEAR RAINFALL DEPTH = 2.05 INCHES
24 ID 100-YEAR RAINFALL DEPTH = 2.77 INCHES
25 ID
26 ID 10-YEAR RAINFALL DEPTH RATIO (JR CARD) = 1.58/2.77 = 0.57
27 ID 25-YEAR RAINFALL DEPTH RATIO (JR CARD) = 2.05/2.77 = 0.74
28 ID
29 ID *****
30 ID *****
31 ID
32 ID *DIAGRAM
33 IT 5 73
34 IO 5 0
35 IN 5
36 JR PREC 0.57 0.74 1.00
37
38 KK JON
39 KM OFFSITE BASIN JON
40 KM RUNOFF GENERATED THROUGH JONES BLVD. SOUTH HALF ALONG THE PROJECT SITE
41 PB 2.77
42 PC 0.0 .02 .057 .07 .087 .108 .124 .13 .13 .13
43 PC .13 .13 .13 .133 .14 .142 .148 .158 .172 .181
44 PC .19 .197 .199 .2 .201 .204 .214 .229 .241 .249
45 PC .251 .256 .27 .278 .281 .283 .295 .322 .352 .409
46 PC .499 .59 .71 .744 .781 .812 .819 .835 .851 .856
47 PC .86 .868 .876 .888 .91 .926 .937 .95 .97 .976
48 PC .982 .985 .987 .989 .99 .993 .993 .994 .995 .998
49 PC .998 .999 1.0
50 BA .00122
51 LS 0 98.0
52 UD .070
53 *

```

1 HEC-1 INPUT PAGE 2

```

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
51 KK ND1
52 KM PROPOSED ONSITE BASIN ND1, WESTERN HALF OF THE PROJECT SITE
53 KM DRAINING ONTO JONES BLVD. THROUGH UNDER DRAIN
54 BA .00116
55 LS 0 96.2
56 UD .070
57 *
58 KK ND2
59 KM PROPOSED ONSITE BASIN ND2, EASTERN HALF OF THE PROJECT SITE
60 KM DRAINING ONTO JONES BLVD. THROUGH UNDER DRAIN AND DRIVEWAY ENTRANCE
61 BA .00126
62 LS 0 95.5
63 UD .076
64 *

```


D

```

63      KK      CD1
64      KM      COMBINE JON, ND1 AND ND2
65      KM      TOTAL FLOWS CONVEYED THROUGH THE SOUTH HALF OF JONES BLVD.
66      KM      ALONG THE PROJECT SITE
67      HC      3
        *

68      KK      RNCH
69      KM      OFFSITE BASIN RNCH
70      KM      RUNOFF GENERATED THROUGH RANCHO DRIVE EAST HALF ALONG THE PROJECT SITE
71      BA      .00074
72      LS      0      98.0
73      UD      .060
        *

74      KK      ND3
75      KM      PROPOSED ONSITE BASIN ND3, SOUTHERN STRIP ALONG RANCHO DRIVE
76      KM      DRAINING ONTO RANCHO DRIVE THROUGH DRIVEWAY ENTRANCE
77      BA      .00022
78      LS      0      88.2
79      UD      .055
        *

80      KK      CD2
81      KM      COMBINE RNCH AND ND3
82      KM      TOTAL FLOWS CONVEYED THROUGH EAST HALF OF RANCHO DRIVE ALONG PROJECT SITE
83      HC      2
84      ZZ

```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

```

INPUT LINE      (V) ROUTING      (--->) DIVERSION OR PUMP FLOW
NO.      (.) CONNECTOR      (<---) RETURN OF DIVERTED OR PUMPED FLOW

36      JON
      .
51      .      ND1
      .
57      .      ND2
      .
63      CD1.....
      .
68      .      RNCH
      .
74      .      ND3
      .
80      .      CD2.....

```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```

1*****
*      FLOOD HYDROGRAPH PACKAGE (HEC-1)
*      JUN 1998
*      VERSION 4.1
*      RUN DATE 26OCT22 TIME 18:24:46
*
*****

```

```

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

```

HOLLYWOOD PLAZA @ RANCHO AND JONES
 TECHNICAL DRAINAGE STUDY
 DEVELOPED CONDITION
 USING SCS METHODS AND KINEMATIC WAVE ROUTING
 MASTER PLAN ADJUSTED 6-HOUR RAINFALL AND STORM DISTRIBUTION

LOCHSA JOB NO. 221174

INPUT FILE NAME: D.DAT

OCTOBER 2022

 INSIDE MCCARRAN AIRPORT RAINFALL AREA

10, 25 & 100 YEAR - 6 HOUR STORM EVENT
 PRECIPITATION BASED ON FIGURES 503 AND 506 OF THE HCDDM

10-YEAR RAINFALL DEPTH = 1.58 INCHES
 25-YEAR RAINFALL DEPTH = 2.05 INCHES
 100-YEAR RAINFALL DEPTH = 2.77 INCHES

10-YEAR RAINFALL DEPTH RATIO (JR CARD) = 1.58/2.77 = 0.57
 25-YEAR RAINFALL DEPTH RATIO (JR CARD) = 2.05/2.77 = 0.74

33 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 73 NUMBER OF HYDROGRAPH ORDINATES

NDDATE 1 0 ENDING DATE
 NDTIME 0600 ENDING TIME
 ICENT 19 CENTURY MARK

D

COMPUTATION INTERVAL .08 HOURS
 TOTAL TIME BASE 6.00 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 +	JON	.00	1	FLOW TIME	1. 3.50	2. 3.50	3. 3.50
HYDROGRAPH AT +	ND1	.00	1	FLOW TIME	1. 3.50	2. 3.50	2. 3.50
HYDROGRAPH AT +	ND2	.00	1	FLOW TIME	1. 3.50	2. 3.50	3. 3.50
3 COMBINED AT +	CD1	.00	1	FLOW TIME	4. 3.50	6. 3.50	8. 3.50
HYDROGRAPH AT +	RNCH	.00	1	FLOW TIME	1. 3.50	1. 3.50	2. 3.50
HYDROGRAPH AT +	ND3	.00	1	FLOW TIME	0. 3.50	0. 3.50	0. 3.50
2 COMBINED AT +	CD2	.00	1	FLOW TIME	1. 3.50	1. 3.50	2. 3.50

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

HYDROLOGIC PARAMETERS

DATE: October 24, 2022

[illegible]

TRIAL: Final Iteration

Curve Number Calculations

Hollywood Plaza @ Rancho and Jones

Sub-Basin: NX1

Total Area: 1.70 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Curve Number [CN]	Product {CN x P}
Newly graded area (pervious area only, no vegetation)	0.09	A	5%	77	3.9
Newly graded area (pervious area only, no vegetation)	0.60	C	35%	91	31.9
Newly graded area (pervious area only, no vegetation)	1.02	D	60%	94	56.4

Total: 1.70 - 100% - 92.1

Curve Number Calculations

Hollywood Plaza @ Rancho and Jones

Sub-Basin: ND1
Total Area: 0.75 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Crue Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.03	A	4%	98	4.2
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.22	C	30%	98	29.2
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.38	D	51%	98	50.0
Natural desert landscaping (pervious areas only)	0.01	A	1%	63	0.5
Natural desert landscaping (pervious areas only)	0.04	C	5%	85	4.5
Natural desert landscaping (pervious areas only)	0.07	D	9%	88	7.9

Total: 0.75 - 100% - 96.2

85%
15%

Curve Number Calculations

Hollywood Plaza @ Rancho and Jones

Sub-Basin: ND2
Total Area: 0.81 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Crue Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.03	A	4%	98	3.9
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.23	C	28%	98	27.4
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.39	D	48%	98	47.0
Natural desert landscaping (pervious areas only)	0.01	A	1%	63	0.6
Natural desert landscaping (pervious areas only)	0.06	C	7%	85	6.0
Natural desert landscaping (pervious areas only)	0.10	D	12%	88	10.6

Total: 0.81 - 100% - 95.5

80%
20%

Curve Number Calculations

Hollywood Plaza @ Rancho and Jones

Sub-Basin: ND3
Total Area: 0.14 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Crue Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.00	A	1%	98	1.0
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.01	C	7%	98	6.9
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.02	D	12%	98	11.8
Natural desert landscaping (pervious areas only)	0.01	A	4%	63	2.5
Natural desert landscaping (pervious areas only)	0.04	C	28%	85	23.8
Natural desert landscaping (pervious areas only)	0.07	D	48%	88	42.2

Total: 0.14 - 100% - 88.2

20%
80%

Curve Number Calculations

Hollywood Plaza @ Rancho and Jones

Sub-Basin: JON

Total Area: 0.78 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Crue Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.04	A	5%	98	4.9
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.27	C	35%	98	34.3
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.47	D	60%	98	58.8

Total: 0.78 - 100% - 98.0

Curve Number Calculations

Hollywood Plaza @ Rancho and Jones

Sub-Basin: RNCH

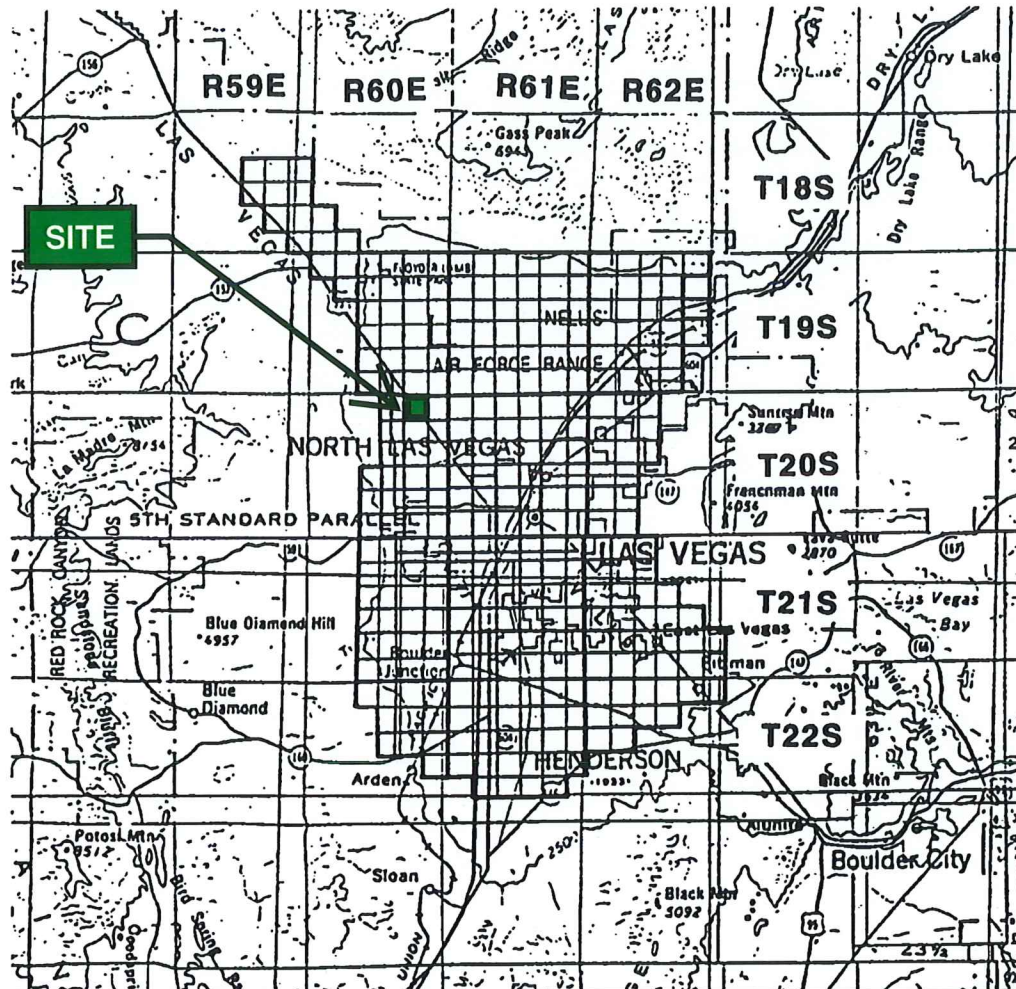
Total Area: 0.48 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Crue Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.02	A	5%	98	4.9
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.17	C	35%	98	34.3
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.29	D	60%	98	58.8

Total: 0.48 - 100% - 98.0

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

McCARRAN AIRPORT RAINFALL AREA



***SITE LOCATED OUTSIDE 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

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

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

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

SIX HOUR DEPTH-AREA REDUCTION FACTORS

<u>Drainage Area (Square Miles)</u>	<u>Six-Hour Depth-Area Reduction Factor</u>
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.

<i>Revision</i>	<i>Date</i>

**WRC
ENGINEERING**

REFERENCE:

USACE, Los Angeles District, 1988

TABLE 502

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

SIX-HOUR STORM DISTRIBUTIONS

Percent of Total Storm Depth				Percent of Total Storm Depth			
Storm Time (In Minutes)	SDN3	SDN4	SDN5	Storm Time (In Minutes)	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 AREAS¹)

Cover description		Curve numbers for hydrologic soil group--			
Cover type and hydrologic condition	Average percent impervious area ²	A	B	C	D
<i>Fully developed urban areas (vegetation established)</i>					
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 $I_p = 0.2S$.

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

APPENDIX B

HYDRAULIC ANALYSIS

Normal Depth Calculations for Perimeter Streets

(Existing and Developed Conditions)

Rancho Drive @ Section A (10-Year and 25-Year, Existing and Developed) Worksheet for Irregular Channel

Project Description	
Worksheet	Rancho Drive @ Section A (10-Year and 25-Year, Existing and Developed)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.05000 ft/ft
Discharge	1.00 cfs

← see below Q_{10}/Q_{25}

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

Results	
Manning's Coefficient	0.015
Water Surface Elev.	69.01 ft
Elevation Range	68.72 to 70.50
Flow Area	0.7 ft ²
Wetted Perimeter	8.06 ft
Top Width	7.72 ft
Actual Depth	0.29 ft
Critical Elevation	69.00 ft
Critical Slope	0.008219 ft/ft
Velocity	1.38 ft/s
Velocity Head	0.03 ft
Specific Energy	69.04 ft
Froude Number	0.79
Flow Type	Subcritical

← D_{10}, D_{25}

← V_{10}, V_{25}

Roughness Segments		
Start Station	End Station	Manning's Coefficient
0+00.00	0+07.00	0.013
0+07.00	0+63.00	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	69.32
0+05.00	69.22
0+05.50	69.22
0+05.50	68.72
0+07.00	68.85
0+07.00	68.89
0+63.00	70.00
0+63.00	70.50

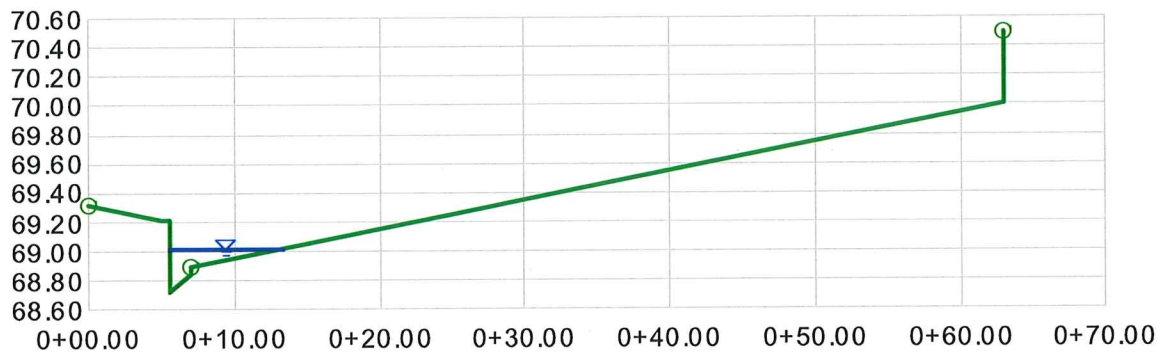
Notes: * $Q_{10}/Q_{25}/Q_{100} = 1/1/2\text{cfs}$ = runoff generated through offsite basin RNCH(1/1/2cfs) or runoff from combination point CD2(1/1/2cfs) ←

Rancho Drive @ Section A (10-Year and 25-Year, Existing and Developed) Cross Section for Irregular Channel

Project Description	
Worksheet	Rancho Drive @ Section A (10-Year and 25-Year, Existin
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.015
Slope	0.005000 ft/ft
Water Surface Elev.	69.01 ft
Elevation Range	68.72 to 70.50
Discharge	1.00 cfs

→ Dry Lane ≈ 49.78' >> 12' ←



V:10.0
H:1
NTS

Rancho Drive @ Section A (100-Year, Existing and Developed) Worksheet for Irregular Channel

Project Description	
Worksheet	Rancho Drive @ Section A (100-Year, Existing a
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	005000 ft/ft
Discharge	2.00 cfs

← see below Q_{100}

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

Results	
Mannings Coefficient	0.016
Water Surface Elev.	69.07 ft
Elevation Range	68.72 to 70.50
Flow Area	1.2 ft ²
Wetted Perimeter	11.00 ft
Top Width	10.60 ft
Actual Depth	0.35 ft
Critical Elevation	69.05 ft
Critical Slope	0.007697 ft/ft
Velocity	1.60 ft/s
Velocity Head	0.04 ft
Specific Energy	69.11 ft
Froude Number	0.82
Flow Type	Subcritical

← D_{100}

← V_{100}

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.013
0+07.00	0+63.00	0.016

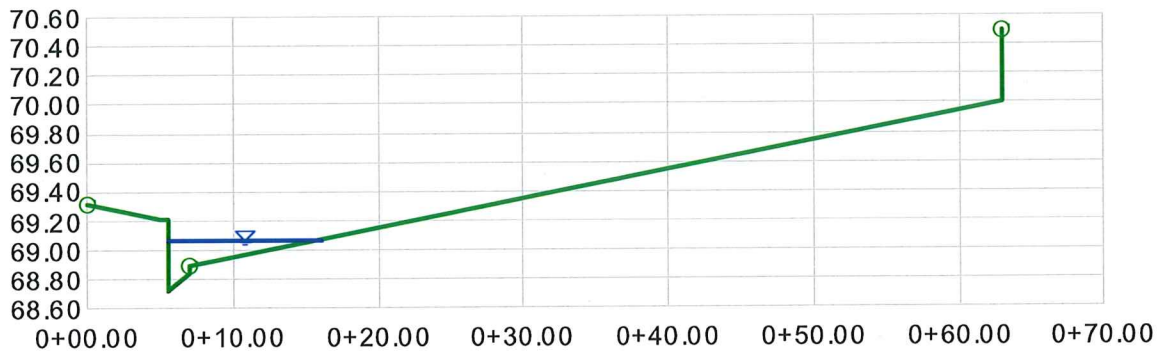
Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	69.32
0+05.00	69.22
0+05.50	69.22
0+05.50	68.72
0+07.00	68.85
0+07.00	68.89
0+63.00	70.00
0+63.00	70.50

Notes: * $Q_{10}/Q_{25}/Q_{100} = 1/1/2\text{cfs}$ = runoff generated through offsite basin RNCH(1/1/2cfs) or runoff from combination point CD2(1/1/2cfs) ←

Rancho Drive @ Section A (100-Year, Existing and Developed) Cross Section for Irregular Channel

Project Description	
Worksheet	Rancho Drive @ Section A (100-Year, Existing a
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.016
Slope	0.005000 ft/ft
Water Surface Elev.	69.07 ft
Elevation Range	68.72 to 70.50
Discharge	2.00 cfs



V:10.0
H:1
NTS

Jones Blvd. @ Section B(10-Year, Existing)

Worksheet for Irregular Channel

Project Description	
Worksheet	Jones Blvd. @ Section B(10-Year,
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	008000 ft/ft
Discharge	3.00 cfs

← Q_{10}

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

Results	
Mannings Coefficient	0.013
Water Surface Elev.	66.48 ft
Elevation Range	66.13 to 67.60
Flow Area	1.3 ft ²
Wetted Perimeter	11.34 ft
Top Width	10.94 ft
Actual Depth	0.35 ft
Critical Elevation	66.50 ft
Critical Slope	0.005141 ft/ft
Velocity	2.30 ft/s
Velocity Head	0.08 ft
Specific Energy	66.57 ft
Froude Number	1.18
Flow Type	Supercritical

← D_{10}

← V_{10}

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+41.00	0.016
0+41.00	0+48.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	67.60
0+00.00	67.10
0+41.00	66.30
0+41.00	66.26
0+42.50	66.13
0+42.50	66.63
0+43.00	66.63
0+48.00	66.73

Notes: $Q_{10}/Q_{100} = 3/6\text{cfs}$ = runoff from combination point CX1(3/4/6cfs)

←

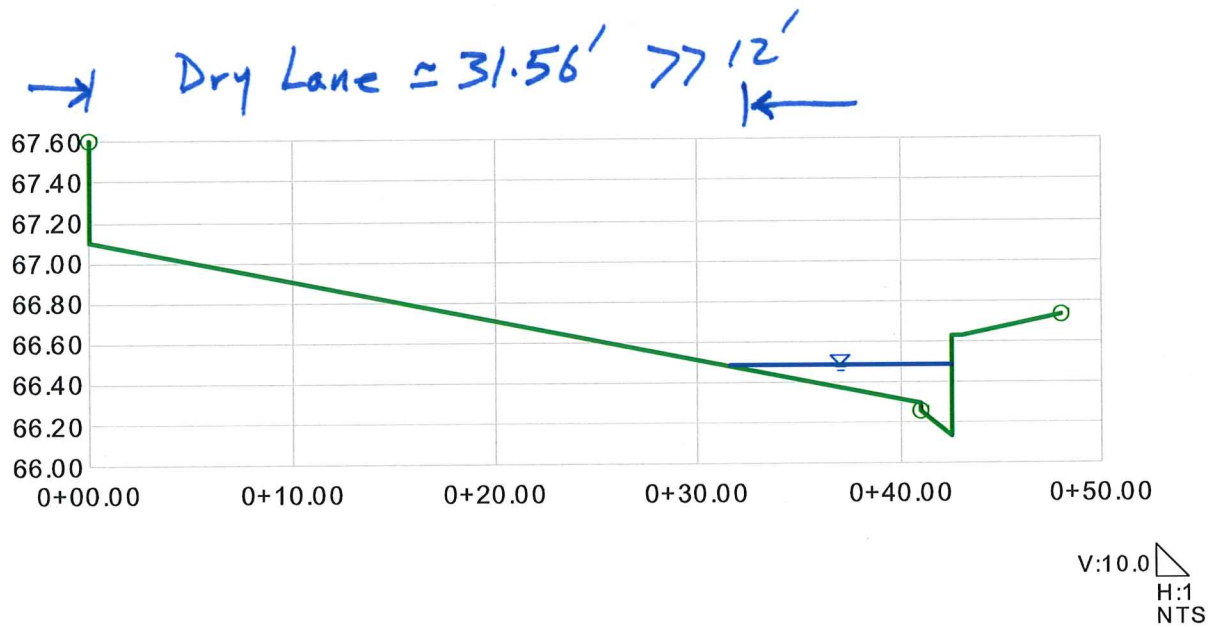
Jones Blvd. @ Section B(10-Year, Existing) **Cross Section for Irregular Channel**

Project Description

Worksheet	Jones Blvd. @ Section B(10-Year,
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data

Mannings Coefficient	0.013
Slope	0.008000 ft/ft
Water Surface Elev.	66.48 ft
Elevation Range	66.13 to 67.60
Discharge	3.00 cfs



Jones Blvd. @ Section B(100-Year, Existing)

Worksheet for Irregular Channel

Project Description	
Worksheet	Jones Blvd. @ Section B(100-Year,
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	008000 ft/ft
Discharge	6.00 cfs

← Q_{100}

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

Results	
Mannings Coefficient	0.014
Water Surface Elev.	66.56 ft
Elevation Range	66.13 to 67.60
Flow Area	2.2 ft ²
Wetted Perimeter	15.20 ft
Top Width	14.72 ft
Actual Depth	0.43 ft
Critical Elevation	66.58 ft
Critical Slope	0.005396 ft/ft
Velocity	2.67 ft/s
Velocity Head	0.11 ft
Specific Energy	66.67 ft
Froude Number	1.20
Flow Type	Supercritical

← D_{100}

← V_{100}

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+41.00	0.016
0+41.00	0+48.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	67.60
0+00.00	67.10
0+41.00	66.30
0+41.00	66.26
0+42.50	66.13
0+42.50	66.63
0+43.00	66.63
0+48.00	66.73

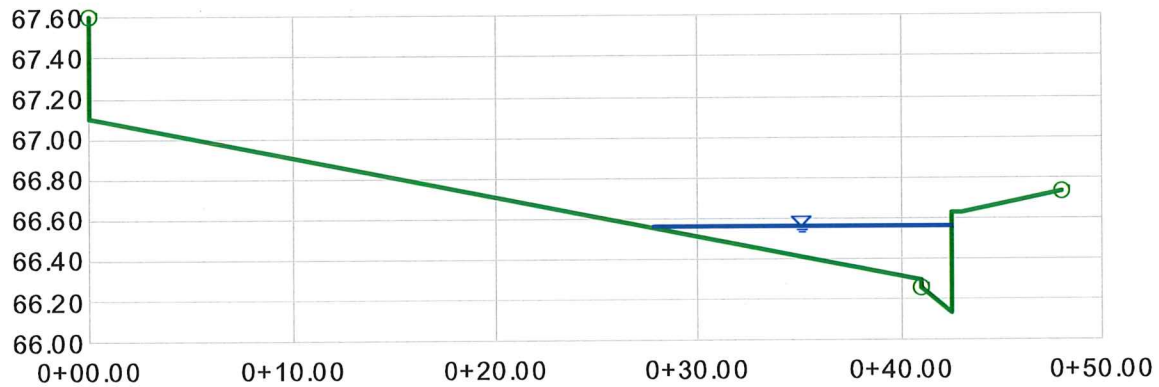
Notes: $Q_{10}/Q_{100} = 3/6\text{cfs} = \text{runoff from combination point CX1}(3/4/6\text{cfs})$

←

Jones Blvd. @ Section B(100-Year, Existing)
Cross Section for Irregular Channel

Project Description	
Worksheet	Jones Blvd. @ Section B(100-Year,
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.014
Slope	0.008000 ft/ft
Water Surface Elev.	66.56 ft
Elevation Range	66.13 to 67.60
Discharge	6.00 cfs



V:10.0
H:1
NTS

Jones Blvd. @ Section B(10-Year, Developed) Worksheet for Irregular Channel

Project Description	
Worksheet	Jones Blvd. @ Section B(10-Year, Developed)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	008000 ft/ft
Discharge	4.00 cfs

← Q₁₀

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

Results	
Manning's Coefficient	0.013
Water Surface Elev.	66.51 ft
Elevation Range	66.13 to 67.60
Flow Area	1.6 ft ²
Wetted Perimeter	12.68 ft
Top Width	12.26 ft
Actual Depth	0.38 ft
Critical Elevation	66.53 ft
Critical Slope	0.005249 ft/ft
Velocity	2.50 ft/s
Velocity Head	0.10 ft
Specific Energy	66.61 ft
Froude Number	1.22
Flow Type	Supercritical

← D₁₀

← V₁₀

Roughness Segments		
Start Station	End Station	Manning's Coefficient
0+00.00	0+41.00	0.016
0+41.00	0+48.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	67.60
0+00.00	67.10
0+41.00	66.30
0+41.00	66.26
0+42.50	66.13
0+42.50	66.63
0+43.00	66.63
0+48.00	66.73

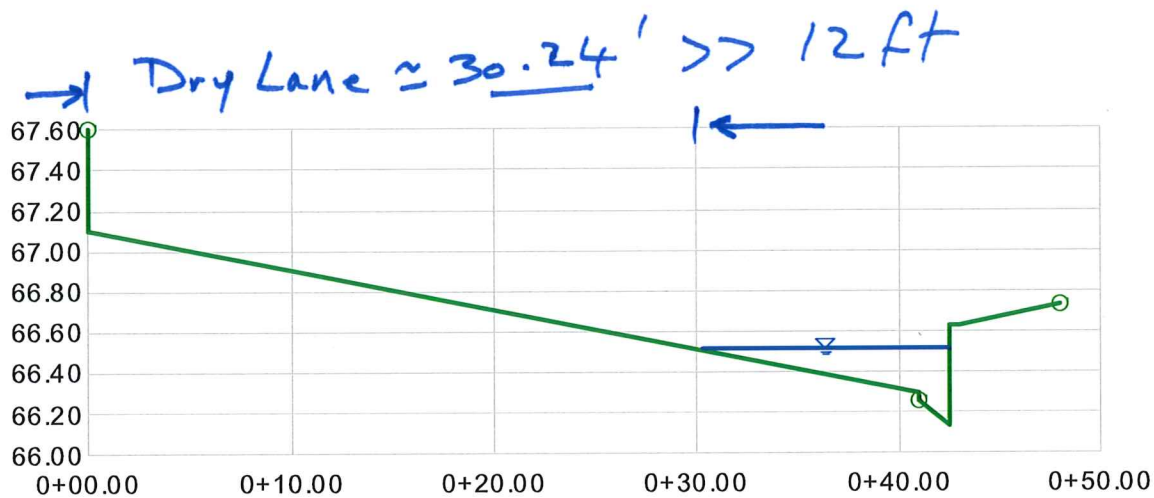
Notes: Q₁₀/Q₁₀₀ = 4/8cfs = runoff from combination point CD1(4/6/8cfs)

←

Jones Blvd. @ Section B(10-Year, Developed) **Cross Section for Irregular Channel**

Project Description	
Worksheet	Jones Blvd. @ Section B(10-Year, I
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.013
Slope	0.008000 ft/ft
Water Surface Elev.	66.51 ft
Elevation Range	66.13 to 67.60
Discharge	4.00 cfs



V:10.0
H:1
NTS

Jones Blvd. @ Section B(100-Year, Developed)

Worksheet for Irregular Channel

Project Description	
Worksheet	Jones Blvd. @ Section B(100-Year,
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	008000 ft/ft
Discharge	8.00 cfs

← Q_{100}

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

Results	
Mannings Coefficient	0.014
Water Surface Elev.	66.60 ft
Elevation Range	66.13 to 67.60
Flow Area	2.8 ft ²
Wetted Perimeter	17.19 ft
Top Width	16.67 ft
Actual Depth	0.47 ft
Critical Elevation	66.62 ft
Critical Slope	0.005439 ft/ft
Velocity	2.81 ft/s
Velocity Head	0.12 ft
Specific Energy	66.72 ft
Froude Number	1.20
Flow Type	Supercritical

← D_{100}

← V_{100}

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+41.00	0.016
0+41.00	0+48.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	67.60
0+00.00	67.10
0+41.00	66.30
0+41.00	66.26
0+42.50	66.13
0+42.50	66.63
0+43.00	66.63
0+48.00	66.73

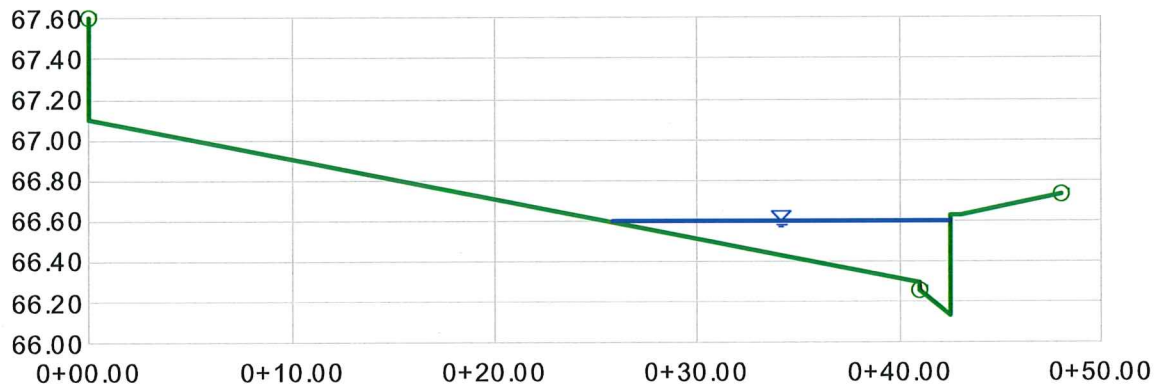
Notes: $Q_{10}/Q_{100} = 4/8\text{cfs}$ = runoff from combination point CD1(4/6/8cfs)

←

Jones Blvd. @ Section B(100-Year, Developed) **Cross Section for Irregular Channel**

Project Description	
Worksheet	Jones Blvd. @ Section B(100-Year,
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.014
Slope	0.008000 ft/ft
Water Surface Elev.	66.60 ft
Elevation Range	66.13 to 67.60
Discharge	8.00 cfs



V:10.0
H:1
NTS

Onsite Normal Depth Calculations

(100-Year, Developed Condition)

Onsite Flow Summary
(Developed Condition)

100-year, 6-hour Storm

Hydraulic Cross-Section Identifier	100-Year Flow [Q100] (cfs)	100-Year Velocity [v] (ft/s)	100-Year Flow Depth [d] (ft)	100-Year Velocity x Depth [v x d] (ft^2/s)
1	2	1.26	0.21	0.26
2	1.5	1.03	0.28	0.29
3	3	1.80	0.39	0.70
Riprap Swale for ND1	2	1.57	0.45	0.71

Onsite Section 1(100-Year, Developed) Worksheet for Irregular Channel

Project Description	
Worksheet	Onsite Section 1(100-Year, De
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	004000 ft/ft
Discharge	2.00 cfs

← Q_{100}

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

Results	
Mannings Coefficient	0.013
Water Surface Elev	69.36 ft
Elevation Range	69.15 to 70.06
Flow Area	1.6 ft ²
Wetted Perimeter	20.49 ft
Top Width	20.48 ft
Actual Depth	0.21 ft
Critical Elevation	69.34 ft
Critical Slope	0.005945 ft/ft
Velocity	1.26 ft/s
Velocity Head	0.02 ft
Specific Energy	69.38 ft
Froude Number	0.80
Flow Type	Subcritical

← D_{100}

← V_{100}

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+54.00	0.016
0+54.00	0+57.00	0.013
0+57.00	0+80.00	0.016

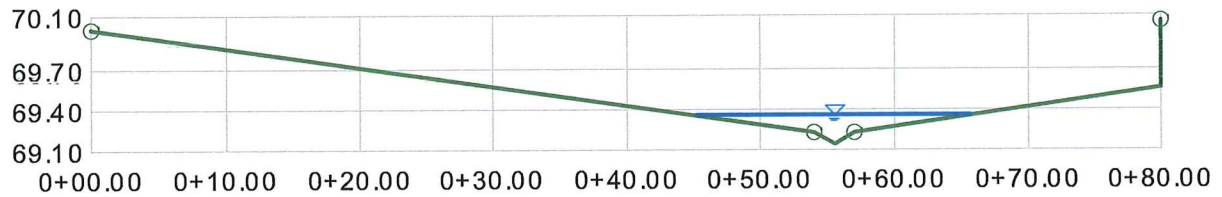
Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	70.00
0+54.00	69.23
0+55.50	69.15
0+57.00	69.23
0+80.00	69.56
0+80.00	70.06

Notes: * $Q_{100} = 2\text{cfs}$ = conservatively assuming the entire 100-year runoff from onsite basin ND1(1/2/2cfs) ←

Onsite Section 1(100-Year, Developed) Cross Section for Irregular Channel

Project Description	
Worksheet	Onsite Section 1(100-Year, De
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.013
Slope	0.004000 ft/ft
Water Surface Elev	69.36 ft
Elevation Range	1.15 to 70.06
Discharge	2.00 cfs



V:10.0
H:1
NTS

Onsite Section 2(100-Year, Developed) Worksheet for Irregular Channel

Project Description	
Worksheet	Onsite Section 2(100-Year, De
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	004000 ft/ft
Discharge	1.50 cfs

← Q_{100}

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

Results	
Mannings Coefficient	0.016
Water Surface Elev	69.70 ft
Elevation Range	69.42 to 70.20
Flow Area	1.5 ft ²
Wetted Perimeter	22.85 ft
Top Width	22.53 ft
Actual Depth	0.28 ft
Critical Elevation	69.68 ft
Critical Slope	0.009604 ft/ft
Velocity	1.03 ft/s
Velocity Head	0.02 ft
Specific Energy	69.71 ft
Froude Number	0.72
Flow Type	Subcritical

← D_{100}

← V_{100}

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+21.50	0.016
0+21.50	0+23.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	70.20
0+00.00	69.70
0+21.50	69.59
0+21.50	69.55
0+23.00	69.42
0+23.00	69.92

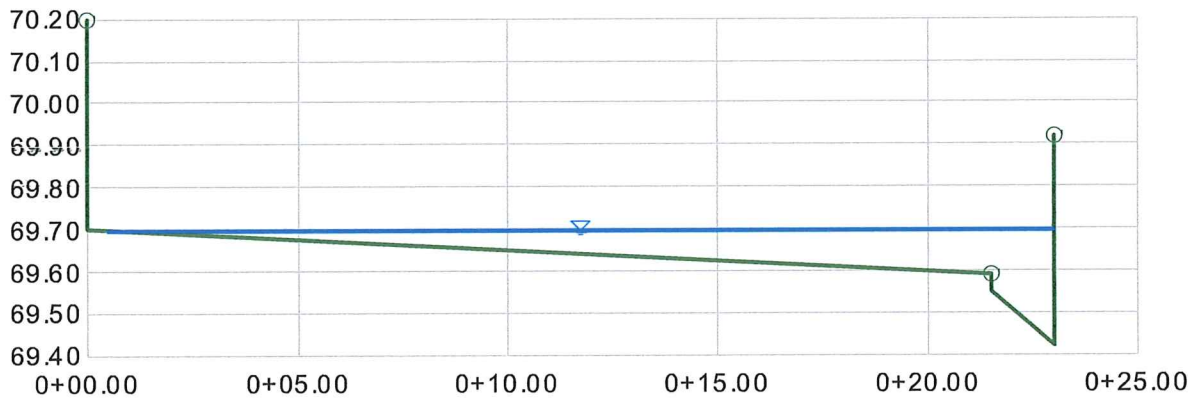
Notes: * $Q_{100} = 1.5\text{cfs}$ = conservatively assuming half of the 100-year runoff from onsite basin ND2(1/2/3cfs)

←
Half

Onsite Section 2(100-Year, Developed) Cross Section for Irregular Channel

Project Description	
Worksheet	Onsite Section 2(100-Year, De
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.016
Slope	0.004000 ft/ft
Water Surface Elev	69.70 ft
Elevation Range	69.42 to 70.20
Discharge	1.50 cfs



V:10.0
H:1
NTS

Onsite Section 3(100-Year, Developed) Worksheet for Irregular Channel

Project Description	
Worksheet	Onsite Section 3(100-Year, De
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	004000 ft/ft
Discharge	3.00 cfs

← Q_{100}

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

Results	
Mannings Coefficient	0.014
Water Surface Elev	69.39 ft
Elevation Range	1.00 to 70.11
Flow Area	1.7 ft ²
Wetted Perimeter	12.69 ft
Top Width	12.25 ft
Actual Depth	0.39 ft
Critical Elevation	69.37 ft
Critical Slope	0.005549 ft/ft
Velocity	1.80 ft/s
Velocity Head	0.05 ft
Specific Energy	69.44 ft
Froude Number	0.86
Flow Type	Subcritical

← D_{100}

← V_{100}

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+21.50	0.016
0+21.50	0+23.00	0.013

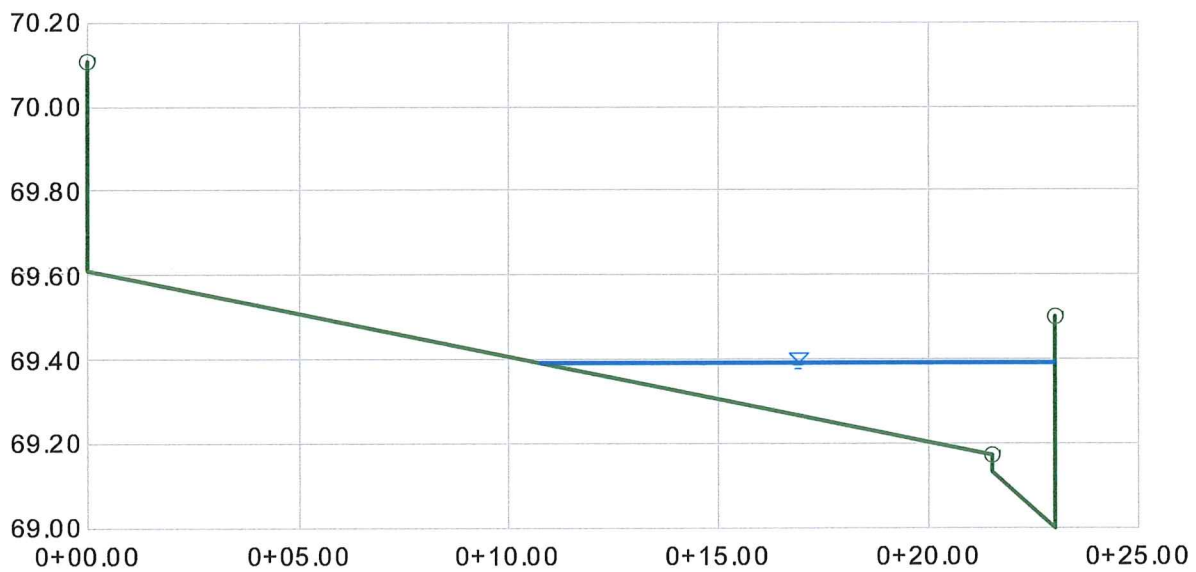
Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	70.11
0+00.00	69.61
0+21.50	69.17
0+21.50	69.13
0+23.00	69.00
0+23.00	69.50

Notes: * $Q_{100} = 3\text{cfs}$ = conservatively assuming the entire 100-year runoff from onsite basin ND2(1/2/3cfs)

Onsite Section 3(100-Year, Developed) Cross Section for Irregular Channel

Project Description	
Worksheet	Onsite Section 3(100-Year, De
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.014
Slope	0.004000 ft/ft
Water Surface Elev	69.39 ft
Elevation Range	1.00 to 70.11
Discharge	3.00 cfs



V:10.0
H:1
NTS

Onsite Normal Depth Calculation for the Proposed Riprap-Lined Swale
for Basin ND1

(100-Year, Developed Condition)

Riprap-Lined Swale for ND1(100-Year, Developed) Worksheet for Irregular Channel

Project Description	
Worksheet	Riprap-Lined Swale for ND1(100-Year,
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	009000 ft/ft
Discharge	2.00 cfs ← Q₁₀₀

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

Results	
Mannings Coefficient	0.033
Water Surface Elev	68.84 ft
Elevation Range	68.39 to 69.30
Flow Area	1.3 ft ²
Wetted Perimeter	5.69 ft
Top Width	5.62 ft
Actual Depth	0.45 ft ← D₁₀₀
Critical Elevation	68.75 ft
Critical Slope	0.028504 ft/ft
Velocity	1.57 ft/s ← V₁₀₀
Velocity Head	0.04 ft
Specific Energy	68.88 ft
Froude Number	0.58
Flow Type	Subcritical

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+08.00	0.033

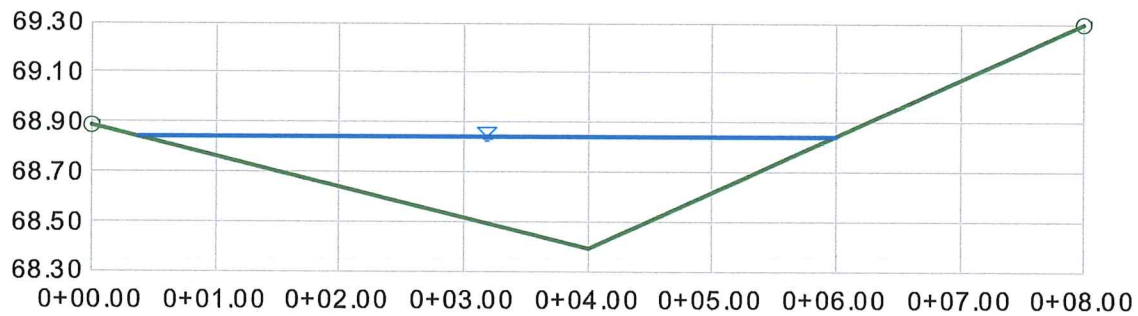
Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	68.89
0+04.00	68.39
0+08.00	69.30

Notes: * Q₁₀₀ = 2cfs = 100-year runoff from onsite basin ND1(1/2/2cfs)

Riprap-Lined Swale for ND1(100-Year, Developed) Cross Section for Irregular Channel

Project Description	
Worksheet	Riprap-Lined Swale for ND1(100-Year,
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.033
Slope	0.009000 ft/ft
Water Surface Elev	68.84 ft
Elevation Range	68.39 to 69.30
Discharge	2.00 cfs



V:2.0
H:1
NTS

Manning's Calculation

Hollywood Plaza @ Rancho and Jones

Date: October, 2022

Calculated By: HMN

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= 4.0 inches ←

$$n = 0.0395(D50)^{1/6}$$

D50= 0.333 ft

n = 0.033 <<<< Manning's n-value for 4-inch Loose Riprap

APPENDIX C

FIGURES

This map is for assessment use only and does NOT represent a survey.

No liability is assumed for the accuracy of the data delineated 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

MAP LEGEND

- PARCEL BOUNDARY
- SUB BOUNDARY
- PAVED BOUNDARY
- ROAD EASEMENT
- MATCH / LEADER LINE
- HISTORIC LOT LINE
- HISTORIC SUB BOUNDARY
- HISTORIC PMLD BOUNDARY
- SECTION LINE

ASSESSOR'S PARCELS - CLARK COUNTY, NV.

Briana Johnson - Assessor

T20S R60E

2

S2 SE4

138-02-8

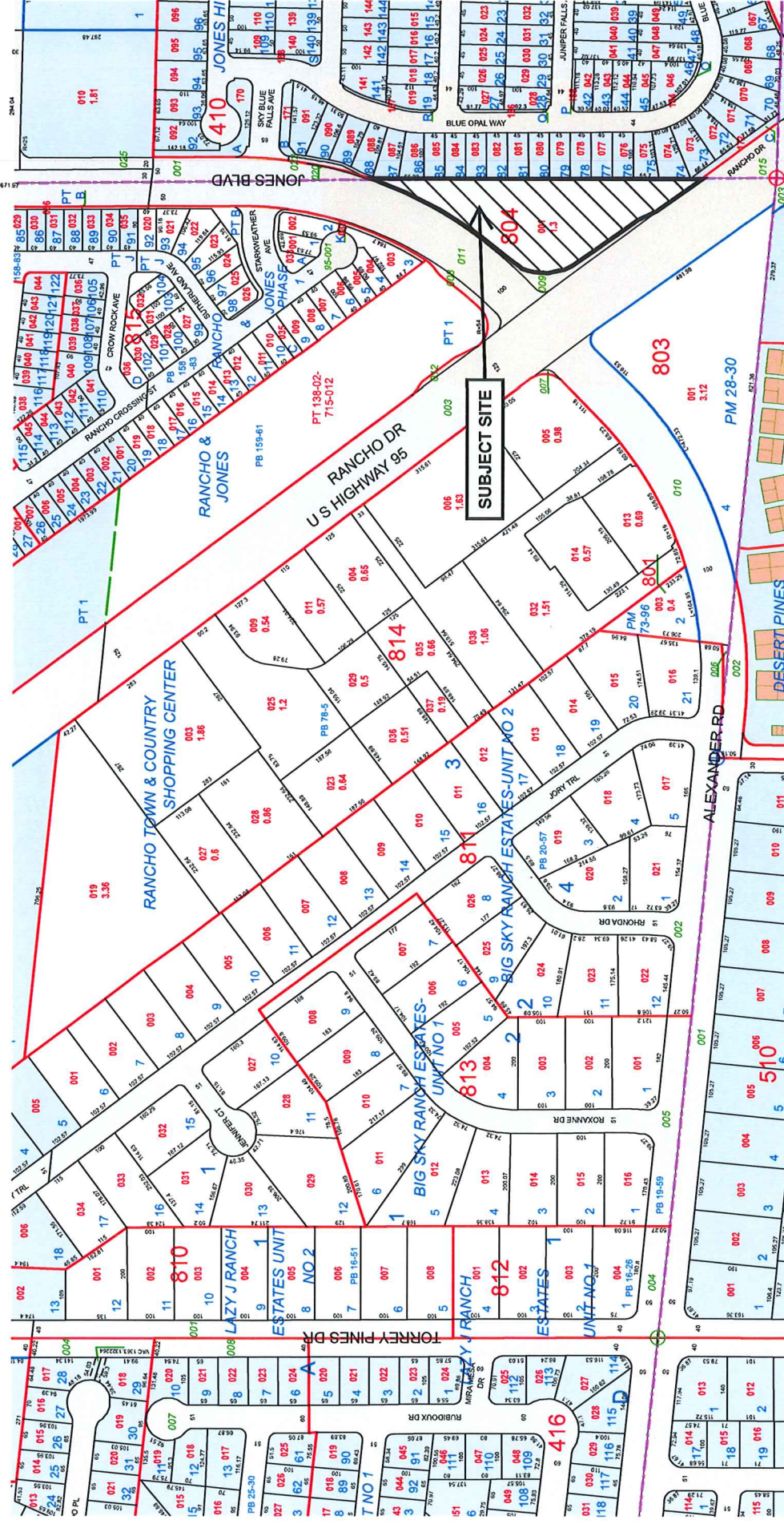
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1	5	1	5	1
2	6	2	6	2
3	7	3	7	3
4	8	4	8	4

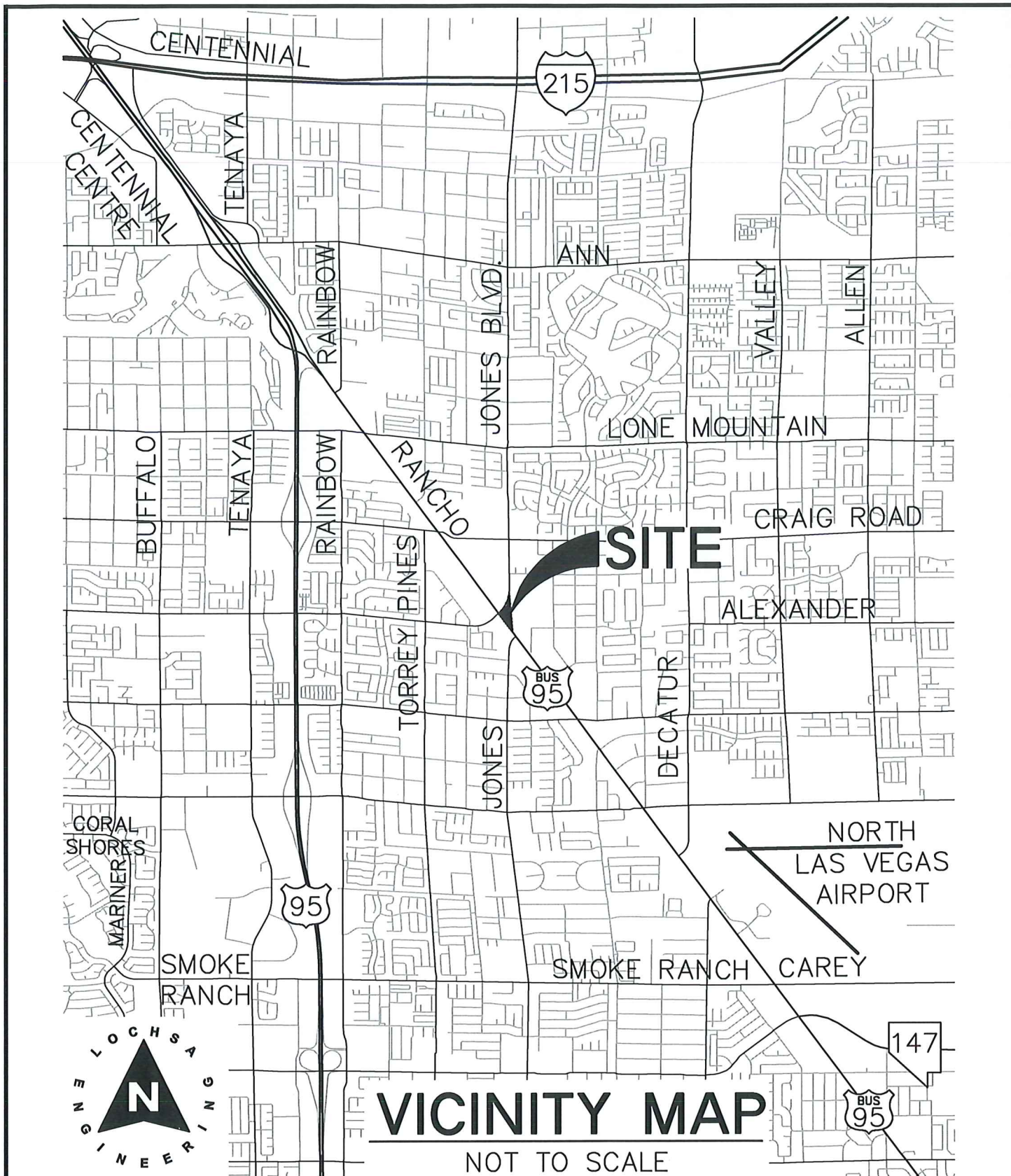
REV	10/18/2022
1	5
2	1
3	1
4	1

Scale: 1" = 200'

Rev: 10/18/2022

138-02-8





DRAWN BY: JD SCALE: N.T.S.

CHECKED BY: HN DATE: 10/25/22

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

VICINITY MAP (FIGURE 1)

**HOLLYWOOD PLAZA @
RANCHO AND JONES**

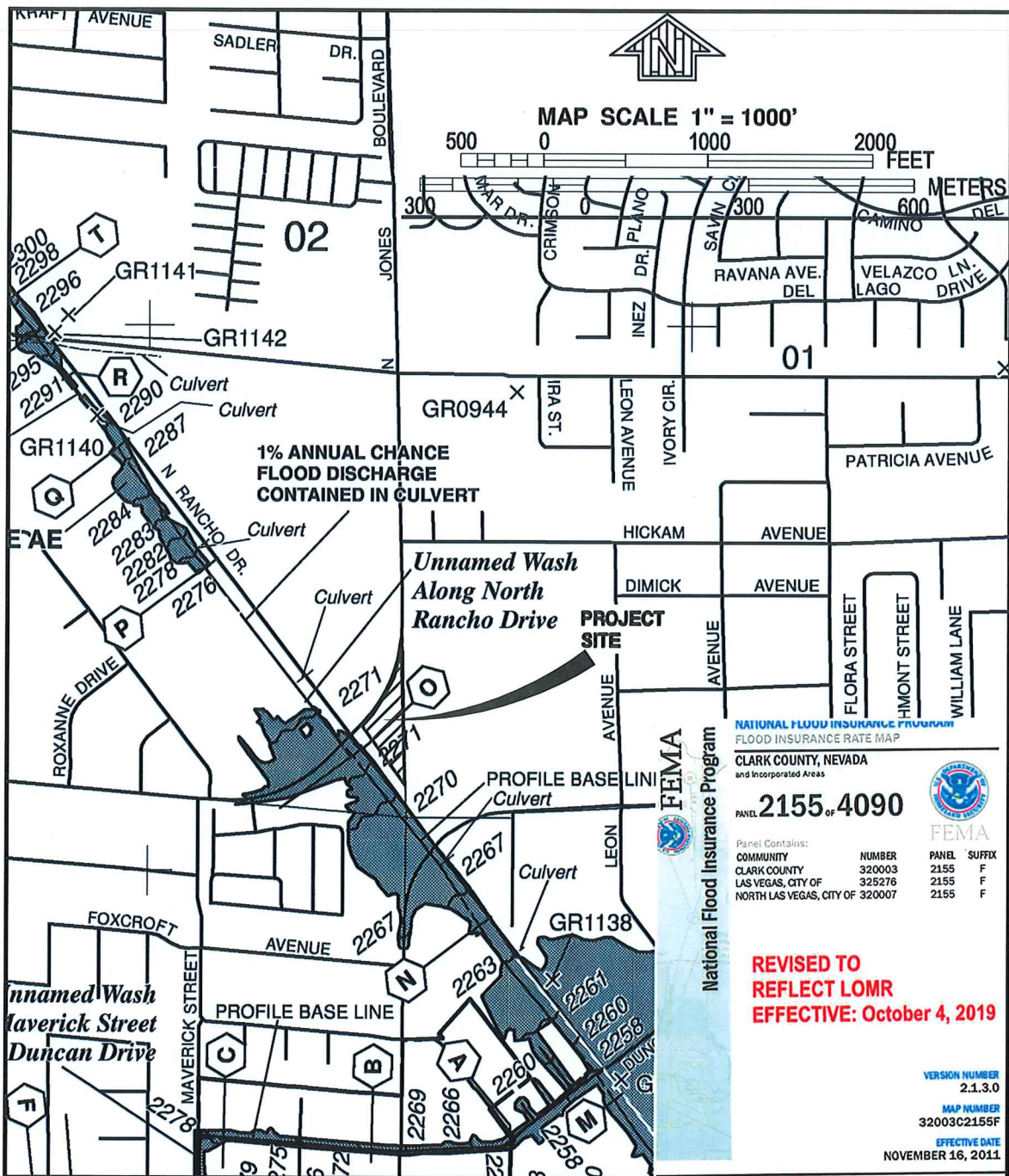
PROJECT No.:

221174

SHEET No.

1

SHEET 1 OF 1



DRAWN BY: JD SCALE: 1"=1000'

CHECKED BY: HN DATE: 10/4/22

Lochsa
engineering

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

FLOOD INSURANCE RATE MAP (FIGURE 2)

**HOLLYWOOD PLAZA @
RANCHO AND JONES**

PROJECT No.:

221174

SHEET No.

2

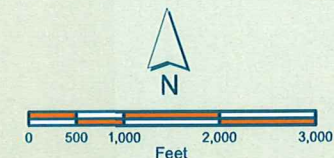
SHEET 1 OF 1



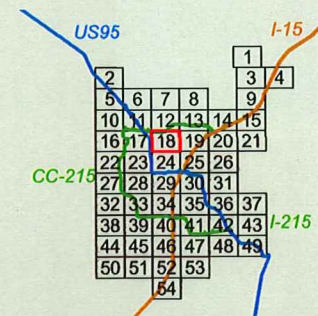
2018
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE

**FIGURE F-18
FLOOD CONTROL FACILITIES**

- LEGEND**
- Ultimate Development Boundary
 - Existing Facilities
 - Category A Proposed Facilities
 - Category B Proposed Facilities
 - Local Existing Facilities
 - Detention Basin
 - Culvert or Bridge Crossing
 - 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 |
| Crossing | Crossing |

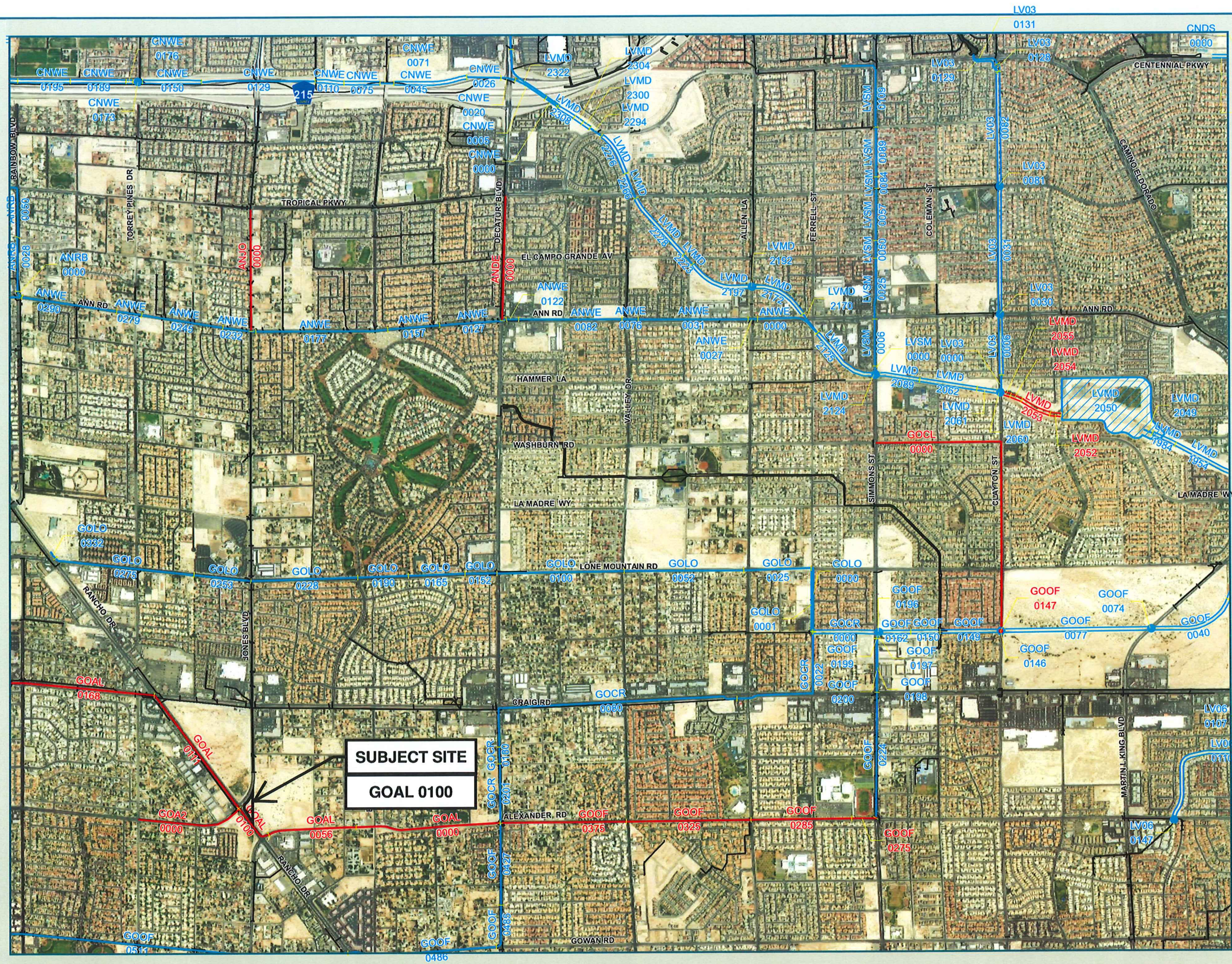


AerialSource:Esri World Imagery 2017



ATKINS
Member of the SNC-Lavalin Group

Louis Berger



ID / Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
ANDE 0000	P	ANN ROAD CHANNEL WEST - DECATUR 10' X 5' RCB	2650	775	CNV3B1-C	WEST3	0.79	1.60
ANJO 0000	P	ANN ROAD CHANNEL WEST - JONES 10' X 4' RCB	2600	296	NW2C2-C	WEST3	0.24	0.30
ANRB 0000	E	ANN ROAD CHANNEL WEST - RAINBOW 9' X 8' RCB	167	817	CNV2B5-C	WEST3	0.99	0.30
0028	E	11' X 5' RCB	1140	817	CNV2B5-C	WEST3	0.99	0.23
0050	E	10' X 3' RCB	1240	517	CNV2A3-C	WEST3	0.63	0.35
ANWE 0000	E	ANN ROAD CHANNEL WEST 12' X 12' RCB	1400	2685	CNN043-C	CWEST3	3.41	0.66
0027	E	14' X 9' RCB	203	2685	CNN043-C	CWEST3	3.41	0.77
0031	E	12' X 10' RCB	2362	2685	CNN043-C	CWEST3	3.41	1.40
0076	E	16' X 8' RCB	350	2685	CNN043-C	CWEST3	3.41	0.93
0082	E	12' X 11' RCB	2217	2420	CNV3B2-C	CWEST3	2.99	0.71
0122	E	12' X 10' RCB	260	2420	CNV3B2-C	CWEST3	2.99	0.71
0127	E	10' X 8' RCB	1450	2420	CNV3B2-C	CWEST3	2.99	2.55
0157	E	10' X 9' RCB	1112	1576	CNV2D2-C	CWEST3	1.94	1.13
0177	E	12' X 10' RCB	2797	1576	CNV2D2-C	CWEST3	1.94	0.39
0232	E	12' X 8' RCB	714	1576	CNV2D2-C	CWEST3	1.94	0.43
0245	E	10' X 9' RCB	1721	1187	CNV2D1-C	CWEST3	1.46	0.80
0279	E	10' X 9' RCB	553	1187	CNV2D1-C	CWEST3	1.46	0.80
0290	E	8' X 8' RCB	2050	817	2CNW2B5C	CWEST3	0.99	0.70
0327	E	6' X 6' RCB	2360	135	RCH0DB	WEST3	4.61	0.87
CNEA 0176	E	CENTENNIAL PKWY CHANNEL EAST CONC CHNL 15W 6.5D 0.1 SS	540	1178	CNN078-C	WEST3	1.35	0.70
CNWE 0000	E	CENTENNIAL PKWY CHANNEL WEST 4: 13' X 10' RCB	309	4145	CNV3D3-C	WEST3	6.40	1.38
0005	E	4: 13.5' X 10' RCB	762	4145	CNV3D3-C	WEST3	6.40	1.08
0020	E	4: 13' X 10' RCB	310	4145	CNV3D3-C	WEST3	6.40	2.57
0026	E	4: 13.5' X 9' RCB	750	4145	CNV3D3-C	WEST3	6.40	0.61
0045	E	CONC CHNL 56W 8D 0.1 SS	1575	4145	CNV3D3-C	WEST3	6.40	0.61
0071	E	3: 18' X 8' RCB @ BRADLEY	300	4145	CNV3D3-C	WEST3	6.40	0.61
0075	E	CONC CHNL 54W 8D 0.1 SS	775	4145	CNV3D3-C	WEST3	6.40	0.42
0110	E	CONC CHNL 54W 9D 0.1 SS	620	4145	CNV3D3-C	WEST3	6.40	0.42
0129	E	3: 18' X 8' RCB	2450	3994	2CW3B4-C	WEST3	6.14	0.42
0150	E	CONC CHNL 40W 9.5D 0.1 SS	1279	3994	2CW3B4-C	WEST3	6.14	0.42
0173	E	3: 18' X 8' RCB @ TORREY PINES	200	3771	CNV3B3-C	WEST3	5.64	0.42
0176	E	CONC CHNL 40W 9D 0.1 SS	150	3771	CNV3B3-C	WEST3	5.64	0.41
0189	E	CONC CHNL 36W 10D 0.1 SS	1200	3771	CNV3B3-C	WEST3	5.64	0.42
0195	E	CONC CHNL 36W 9D 0.1 SS	1130	3771	CNV3B3-C	WEST3	5.64	0.60
0200	E	CONC CHNL 36W 9D 0.1 SS	1340	3523	CNV2D4-C	WEST3	5.14	1.00
GOA2 0000	P	GOWAN OUTFALL - ALEXANDER BRANCH 8' X 6' RCB	2281	558	CPT41-C	GOW3A	0.61	0.90
GOAL 0000	P	GOWAN OUTFALL - ALEXANDER ROAD FACILITIES 19' X 6' RCB	3031	1684	CPT5B6-N	GOW3A	3.47	0.65
0058	P	14' X 6' RCB	1874	1535	CPT5A2-C	GOW3A	3.28	1.40
0100	P	10' X 8' RCB	938	1334	CPT41-C	GOW3A	2.93	1.00
0111	P	10' X 6' RCB	3000	829	CPT2B2	GOW3A	2.32	0.83
0168	P	10' X 7' RCB	4200	829	CPT2B2	GOW3A	2.32	0.50
GOCL 0000	P	GOWAN OUTFALL - CLAYTON BRANCH 9' X 8' RCB	6785	930	CPT2B-1	GOW3A	1.14	0.61
GOCR 0000	E	GOWAN OUTFALL - CRAIG ROAD CONC CHNL 20W 7D 2.1 SS	1380	3370	CPT3D-3	GOW3A	5.71	1.06
0022	E	2: 8' X 8' RCB	3000	1142	CPT4C-2	GOW3A	1.67	0.50
0080	E	120" RCP	5850	1034	CPT4C-1	GOW3A	1.46	0.50
0180	E	114" RCP	350	269	PT4B3-C	GOW3A	0.28	0.30
0201	E	96" RCP	1280	269	PT4B3-C	GOW3A	0.28	0.35
GOLO 0000	E	GOWAN OUTFALL - LONE MTN. ROAD BRANCH 72" RCP	1370	308*	CPT2AD-1*	GOW3A	3.29	0.53
0001	E	13' X 8' RCB	1370	1564*	CPT2AD-1*	GOW3A	3.29	0.45
0025	E	16' X 8' RCB	1452	1872	CPT2AD-1	GOW3A	3.29	0.39
0052	E	16' X 8' RCB	2564	1872	CPT2AD-1	GOW3A	3.29	0.42

ID / Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
GOLO 0100	E	GOWAN OUTFALL - LONE MTN. ROAD BRANCH 16' X 8' RCB	2732	1703	C2AC2-C	GOW3A	2.97	0.37
0152	E	14' X 7' RCB	694	1703	C2AC2-C	GOW3A	2.97	1.00
0165	E	14' X 7' RCB	1210	1495	CPT2AB2	GOW3A	2.60	4.00
0190	E	12' X 7' RCB	1130	1495	CPT2AB2	GOW3A	2.60	2.30
0228	E	10' X 7' RCB	2255	1315	C2AB1C	GOW3A	2.32	1.10
0253	E	8' X 6' RCB	1260	1009	CPT3AC1	GOW3A	2.11	0.75
0275	E	8' X 6' RCB	3000	580	CPT3AA2	GOW3A	1.17	1.04
0332	E	8' X 6' RCB	150	492	CC3AA1	GOW3A	1.02	1.90
GOOF 0000	E	GOWAN OUTFALL FACILITIES CONC CHNL 20W 7D 2.1 SS	2500	5755	CPT-2B-3	GOW5B	14.64	1.25
0040	E	CONC CHNL 20W 7D 2.1 SS	1900	5576	CRCPT2C2	GOW5B	14.13	0.60
0074	E	2: 16' X 7' RCB @ CAMINO AL NORTE	131	5551	CCPT2C1*	GOW4B	11.88	1.30
0077	E	CONC CHNL 20W 7D 2.1 SS	3157	5551	CCPT2C1*	GOW4B	11.88	1.40
0146	E	3: 12' X 5' RCB @ CLAYTON	150	4014*	CCPT2C1*	GOW4B	11.88	1.33
0147	P	ADD 1: 14' X 7' RCB @ CLAYTON	150	1537*	CCPT2C1*	GOW4B	11.88	1.33
0149	E	CONC CHNL 20W 7D 2.1 SS	1228	5551	CCPT2C1	GOW4B	11.88	1.13
0150	E	CONC CHNL 20W 7D 2.1 SS	612	5225	CCPT3D-3	GOW4B	10.92	1.13
0162	E	CONFLUENCE STRUCTURE	625	5225	CCPT3D-3	GOW4B	10.92	0.90
0196	E	37.66' X 5.66' BRIDGE @ SIMMONS	112	3370	CPT3D-3	GOW3A	5.71	0.90
0197	E	15' X 6' RCB	167	1939*	CPT4C-3*	GOW3B	5.99	0.95
0198	E	14' X 6' RCB	1157	1164*	CPT4C-3*	GOW3B	5.99	0.41
0199	E	24' X 6' RCB	173	1093*	CPT4C-3*	GOW3B	5.99	0.89
0200	E	24' X 6' RCB	1171	1868*	CPT4C-3*	GOW3B	5.99	0.40
0224	E	2: 18' X 6' RCB	2700	3032	CPT4C-3	GOW3B	5.99	0.40
0275	P	2: 16' X 8' RCB	515	2858	CPT5C-3	GOW3B	5.73	0.40
0285	P	2: 14' X 8' RCB	2168	2858	CPT5C-3	GOW3B	5.73	0.45
0325	P	2: 14' X 8' RCB	2650	2896	CPT5C-2	GOW3B	5.48	0.37
0375	P	2: 12' X 8' RCB	2700	2549	CPT5C-1	GOW3B	5.25	0.56
0427	E	96" RCP	1765	790	CPT5B6-S	GOW3B	1.56	0.47
0485	E	90" RCP	1080	630	DGOW2A	GOW3B	1.37	0.47
0486	E	8' X 5' RCB	3200	630	DGOW2A	GOW3B	1.37	0.60
0511	E	8' X 5' RCB	8390	740	CPT6B-C	GOW3B	1.08	0.50
LV03 0000	E	CLAYTON STREET CHANNEL 33' X 16' RCB @ HAMMER	400	1183	CNN057-C	WEST3	1.23	0.42
0006	E	CONC CHNL 9W 9.4D 1.5:1 SS	1300	1183	CNN057-C	WEST3	1.23	0.42
0030	E	2: 9' X 7' RCB @ ANN	120	1183	CNN057-C	WEST3	1.23	0.42
0031	E	CONC CHNL 8W 8.1D 1.5:1 SS	2600	817	CNN054-C	WEST3	0.82	0.40
0081	E	2: 10' X 7' RCB @ TROPICAL	100	817	CNN054-C	WEST3	0.82	0.42
0082	E	CONC CHNL 7W 7.1D 1.5:1 SS	2444	817	CNN054-C	WEST3	0.82	2.80
0128	E	CONC CHNL 7W 7.1D 1.5:1 SS	166	167*	NN052-C*	WEST3	0.56	2.80
0129	E	2: 10' X 6' RCB	801	390*	NN052-C*	WEST3	0.56	1.60
0131	E	10' X 6' RCB	665	167*	NN052-C*	WEST3	0.56	1.28
LV08 0110	E	WESTERN TRIBUTARY AT CRAIG RD CONC CHNL 12W 5.5D 2.1 SS	2451	968	CLV98A-3	WEST3	1.37	0.87
0147	E	12' X 6' RCB @ ALEXANDER	150	570	CLV98A-2	WEST3	0.79	1.16
LVMD 1954	E	LAS VEGAS WASH - MIDDLE CONC CHNL 32W 7D 2.1 SS	1587	3263	CNN086-C	WEST5	28.84	0.99
1984	E	TRANSITION STRUCTURE	550	3231	LOWERDB	CWEST5	19.40	0.99
2048	E	68,000 CFS PMF SPILLWAY	68000		LOWERIN	CWEST5	19.40	
2049	E	4: 7' X 7' RCB OUTLET	200	3231	LOWERDB	CWEST5	19.40	1.23
2050	E	700 AC-FT LOWER LAS VEGAS WASH DETENTION BASIN	6703		LOWERIN	CWEST5	19.40	
2052	P	CONC CHNL 50W 6D 0.1 SS	240	6573	2C057-C	CWEST5	19.01	3.11
2053	P	CONC CHNL 60W 6D 0.1 SS	690	6573	2C057-C	CWEST5	19.01	1.50
2054	P	CONC CHNL 60W 5.5D 0.1 SS	260	6573	2C057-C	CWEST5	19.01	3.80
2055	P	CONC CHNL 60W 5D 0.1 SS	165	6573	2C057-C	CWEST5	19.01	9.10
2060	E	4: 12.75' X 16' RCB @ CLAYTON	144	6023	2C044-C	CWEST5	17.78	0.15
2061	E	CONC CHNL 54W 16D 0.1 SS	425	6023	2C044-C	CWEST5	17.78	0.15
2062	E	CONC CHNL 54W 9D 0.1 SS	1200	6023	2C044-C	CWEST5	17.78	1.35
2089	E	CONC CHNL 54W 9-9.5D 0.1 SS	908	6023	2C044-C	CWEST5	17.78	0.50
2124	E	2: 28.5' X 10' RCB @ SIMMONS	110	5895	2C043-C	CLVMD5	15.66	0.50
2125	E	CONC CHNL 54W 9D 0.1 SS	1571	5895	2C043-C	CLVMD5	15.66	0.77

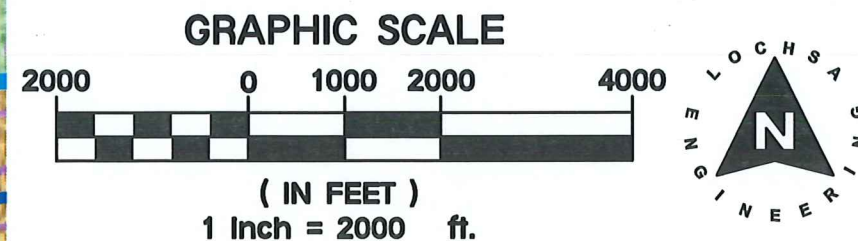
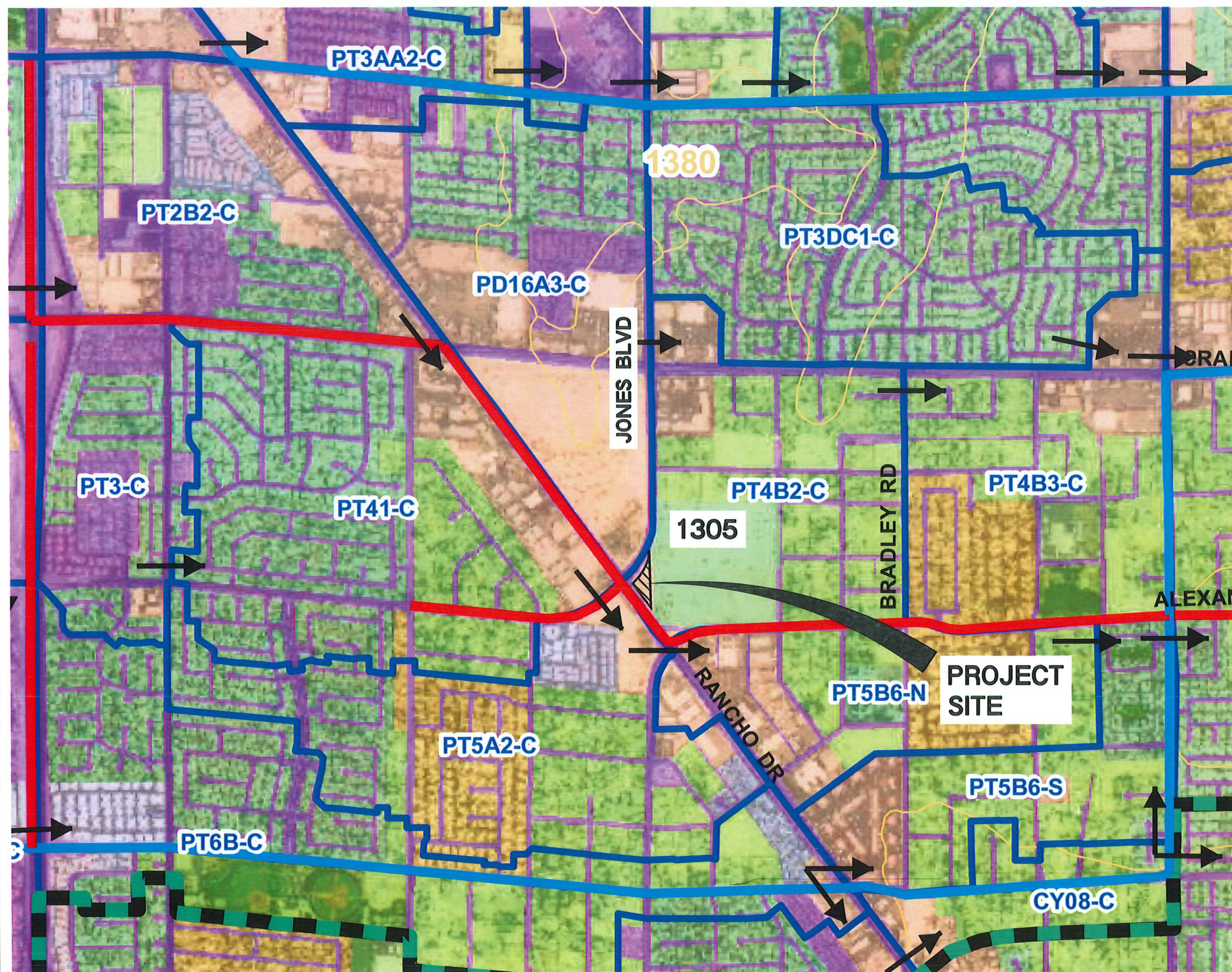
ID / Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
LVMD 2170	E	LAS VEGAS WASH - MIDDLE 4: 12' X 10' RCB @ ANN ROAD	500	5249	CNN011-C*	CLVMD4	11.97	1.42
2172	E	CONC CHNL 50W 10D 0.1 SS	1289	5249	CNN011-C*	CLVMD4	11.97	1.15
2192	E	2: 24.5' X 12' RCB @ ALLEN	110	5249	CNN011-C*	CLVMD4	11.97	1.15
2197	E	CONC CHNL 50W 10D 0.1 SS	1385	5249	CNN011-C*	CLVMD4	11.97	1.37
2223	E	2: 24.5' X 12' RCB @ EL CAMPO GRANDE	275	5249	CNN011-C*	CLVMD4	11.97	1.60
2228	E	CONC CHNL 50W 10D 0.1 SS	1600	5249	CNN011-C*	CLVMD4	11.97	1.83
2266	E	2: 24.5' X 12' RCB @ TROPICAL	575	5249	CNN011-C	CLVMD4	11.97	0.80
2276	E	CONC CHNL 50D 10D 0.1 SS	985	5249	CNN011-C	CLVMD4	11.97	0.80
2294	E	2: 24.5' X 12' RCAC @ CENTENNIAL	292	5182	2C3D4-C	CLVMD4	11.70	1.04
2300	E	TRANSITION STRUCTURE	200	5182	2C3D4-C	CLVMD4	11.70	1.50
2304	E	CONC CHNL 70W 10D 0.1 SS	220	5182	2C3D4-C	CLVMD4	11.70	1.50
2308	E	CONFLUENCE STRUCTURE	421	5182	2C3D4-C	CLVMD4	11.70	0.90
2322	E	2: 15' X 9' RCB	1660	2867	CNV3D4-C	CWEST3	6.62	1.50
2324	E	2: 15' X 8' RCB	4810	2748	CNV3C2-C	CWEST3	6.38	0.53
LVSM 0000	E	LAS VEGAS WASH-SIMMONS 12' X 8' RCB	195	824	CNN044-C	WEST3	0.80	0.63
0006	E	11' X 6' RCB	1005	824	CNN044-C	WEST3	0.80	0.30
0025	E	10' X 6' RCB	1310	824	CNN044-C	WEST3	0.80	0.44
0050	E	9' X 6' RCB	387	551	CNN040-C	WEST3	0.52	0.50
0057	E	8' X 6' RCB	1113	551	CNN040-C	WEST3	0.52	0.54
0084	E	72" RCP	252	551	CNN040-C	WEST3	0.52	1.49
0089	E	60" RCP	1068	551	CNN040-C	WEST3	0.52	2.04
0109	E	48" RCP	2003	240	NN038-C	WEST3	0.23	1.91

GOAL 0100: 10

Curve Number Matrix

SOIL MAP UNIT	HYDROLOGIC SOIL GROUP					LAND USE CATEGORY INDEX NUMBER												
	A	B	C	D	ROCK OUTCROP	1	2	3	4	5	6	7	8	9	10	11	12	13
	CN --->					63	47	57	60	62	74	84	89	92	86	92	71	30
		CN --->				77	66	73	74	76	83	89	93	94	91	94	81	30
			CN --->			85	77	82	83	84	88	92	95	95	93	95	87	30
				CN --->		88	83	86	87	88	91	94	96	96	95	96	90	30
					CN --->	90	90	92	92	92	94	96	96	97	96	97	94	30
	%	%	%	%	%	SOIL TYPE COMPOSITE CN FOR LAND USE CATEGORY												
1301	0	0	0	100	0	88.0	83.0	86.0	87.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0
1302	35	20	0	45	0	77.0	67.0	73.0	75.0	76.0	83.0	89.0	93.0	94.0	91.0	94.0	82.0	30.0
1305	5	0	35	60	0	86.0	79.0	83.0	84.0	85.0	89.0	93.0	95.0	96.0	94.0	96.0	88.0	30.0
1307	10	0	30	60	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	96.0	93.0	96.0	87.0	30.0
1313	8	68	0	24	0	79.0	68.0	75.0	76.0	78.0	84.0	90.0	93.0	94.0	91.0	94.0	82.0	30.0
1314	80	5	0	15	0	67.0	53.0	62.0	65.0	67.0	77.0	86.0	91.0	92.0	88.0	92.0	74.0	30.0
1320	0	2	0	83	15	88.0	83.0	87.0	87.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0
1323	0	0	0	85	15	88.0	84.0	87.0	88.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	91.0	30.0
1325	100	0	0	0	0	63.0	47.0	57.0	60.0	62.0	74.0	84.0	89.0	92.0	86.0	92.0	71.0	30.0
1326	100	0	0	0	0	63.0	47.0	57.0	60.0	62.0	74.0	84.0	89.0	92.0	86.0	92.0	71.0	30.0
1340	9	0	0	71	20	86.0	81.0	85.0	85.0	86.0	90.0	93.0	95.0	96.0	94.0	96.0	89.0	30.0
1341	0	100	0	0	0	77.0	66.0	73.0	74.0	76.0	83.0	89.0	93.0	94.0	91.0	94.0	81.0	30.0
1342	0	7	0	78	15	88.0	83.0	86.0	87.0	87.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0
1360	15	0	0	35	50	85.0	81.0	84.0	85.0	86.0	90.0	93.0	95.0	96.0	94.0	96.0	89.0	30.0
1380	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1390	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1400	0	0	0	100	0	88.0	83.0	86.0	87.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0
1415	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1417	5	0	55	10	30	86.0	80.0	84.0	85.0	86.0	89.0	93.0	95.0	96.0	94.0	96.0	89.0	30.0
1419	35	0	55	10	0	78.0	67.0	74.0	75.0	77.0	83.0	89.0	93.0	94.0	91.0	94.0	82.0	30.0
1440	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1450	1	0	0	89	10	88.0	83.0	86.0	87.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0
1484	0	0	0	100	0	88.0	83.0	86.0	87.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0
1500	60	0	0	35	5	73.0	61.0	69.0	71.0	73.0	81.0	88.0	92.0	93.0	89.0	93.0	79.0	30.0
1501	100	0	0	0	0	63.0	47.0	57.0	60.0	62.0	74.0	84.0	89.0	92.0	86.0	92.0	71.0	30.0
1502	60	0	0	40	0	73.0	61.0	69.0	71.0	72.0	80.0	88.0	92.0	93.0	89.0	93.0	79.0	30.0
1505	55	0	0	40	5	74.0	63.0	70.0	72.0	74.0	81.0	88.0	92.0	94.0	90.0	94.0	80.0	30.0
1506	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1508	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1510	10	0	0	55	35	86.0	82.0	85.0	86.0	87.0	90.0	93.0	95.0	96.0	94.0	96.0	89.0	30.0
1540	100	0	0	0	0	63.0	47.0	57.0	60.0	62.0	74.0	84.0	89.0	92.0	86.0	92.0	71.0	30.0
1541	4	0	0	76	20	87.0	83.0	86.0	87.0	87.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0
1542	60	0	30	10	0	72.0	59.0	67.0	69.0	71.0	80.0	87.0	92.0	93.0	89.0	93.0	78.0	30.0
1545	60	0	10	30	0	73.0	60.0	68.0	70.0	72.0	80.0	88.0	92.0	93.0	89.0	93.0	78.0	30.0
1600	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1605	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1610	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1615	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1630	0	0	0	100	0	88.0	83.0	86.0	87.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0
1635	7	0	5	63	25	87.0	82.0	85.0	86.0	87.0	90.0	94.0	96.0	96.0	94.0	96.0	89.0	30.0
1640	0	0	0	10	90	90.0	90.0	91.0	91.0	92.0	94.0	96.0	96.0	97.0	96.0	97.0	94.0	30.0
1645	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1674	27	26	0	45	2	78.0	69.0	75.0	76.0	78.0	84.0	90.0	93.0	94.0	91.0	94.0	83.0	30.0
1700	0	0	3	93	4	88.0	83.0	86.0	87.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0
1710	2	89	0	9	0	78.0	67.0	74.0	75.0	77.0	83.0	89.0	93.0	94.0	91.0	94.0	82.0	30.0
1731	10	2	0	88	0	85.0	79.0	83.0	84.0	85.0	89.0	93.0	95.0	96.0	94.0	96.0	88.0	30.0
1732	3	0	0	96	1	87.0	82.0	85.0	86.0	87.0	90.0	94.0	95.0	96.0	94.0	96.0	89.0	30.0
1753	0	8	0	90	2	87.0	81.0	85.0	86.0	87.0	90.0	93.0	95.0	96.0	94.0	96.0	89.0	30.0
1850	0	0	0	94	6	88.0	83.0	86.0	87.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0
1853	0	0	0	85	15	88.0	84.0	87.0	88.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	91.0	30.0
1871	17	0	0	83	0	84.0	76.0	81.0	82.0	83.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1999	100	0	0	0	0	63.0	47.0	57.0	60.0	62.0	74.0	84.0	89.0	92.0	86.0	92.0	71.0	30.0

5% A-SOIL
35% C-SOIL
60% D-SOIL



2018 Las Vegas Valley
Master Plan Update

Figure W-4
Gowan Watershed

Legend

- Flow Arrows
- Concentration Points
- Existing Facilities
- Category A Proposed Facilities
- Category B Proposed Facilities
- Ultimate Development Boundary
- Watershed
- Subbasins
- Soils
- 1: Undeveloped Land, Open desert
- 2: Parks, Golf Courses
- 3: Rural, 0.5-1 units per acre (uses 1 unit/acre)
- 4: Low-Density Residential, 1-2 units per acre (uses 2 units/acre)
- 5: Medium-Density Residential, 2-4 units per acre (uses 3 units/acre)
- 6: High-Density Residential, 4-8 units per acre (uses 6 units/acre)
- 7: Public Facility and Residential, 8-12 units/acre
- 8: Very High-Density Residential, 12 units/acre or more
- 9: Commercial, Retail, Casino, High Rise Condominiums
- 10: Light Industrial
- 11: Heavy Industrial
- 12: Schools
- 13: Lakes

**SUBBASIN:
PT4B2-C**

**1305:
5% A-SOIL
35% C-SOIL
60% D-SOIL**

DRAWN BY: JD	SCALE: 1"=2000'	FILE NAME: C-221174-WMAP
CHECKED BY: HN	DATE: 10/4/22	
LOCHSA ENGINEERING 6345 SOUTH JONES BLVD., SUITE 100 LAS VEGAS, NV 89118 P: 702 365-9312, F: 702 365-9317		
LEGEND FOUND MONUMENTATION CENTER LINE _____ ROW LINE _____ EASEMENT LINE _____ SECTION LINE _____ PROPERTY LINE _____ ADJACENT PROPERTY LINE _____		

**FIGURE W-5
GOWAN WATERSHED**

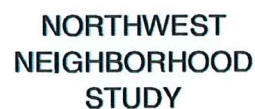
**HOLLYWOOD PLAZA
© RANCHO AND JONES**

PROJECT No.:
221174

SHEET No.

W-5

SHEET 1 OF 1



SUB-BASIN BOUNDARY

●→ FLOW ARROW

250 10-YEAR STREET FLOW
500 100-YEAR STREET FLOW
300 10-YEAR FACILITY FLOW
800 100-YEAR FACILITY FLOW

(FLOWS IN CFS)

BWJS ↔ Basin-ID

(13 / 59) ← Contributing flow
(10-Year / 100-Year)
from the basin (cfs)

PHOTO DATE: APRIL 1996

FIGURE E-12



EXISTING DRAINAGE CONDITIONS



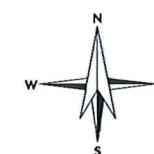
ENGINEERING PLANNING SURVEYING GIS
901, N. Green Valley Pkwy, Ste 100, Henderson NV 89014
Phone: (702) 263-7275 Fax: (702) 263-7200

HUALPAI	FT. APACHE	DURANGO	BUFFALO	RAINBOW	JONES	DECATUR	ELKHORN
1	2	3					CENTENNIAL
4	5	6					ANN
7	8	9					LONE MOUNTAIN
10	11	12					ALEXANDER
		13	14				CHEYENNE
		15	16				SMOKE RANCH
		17	18				

- Project Site

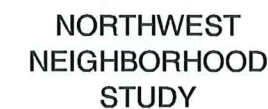
NOTE:

Existing conditions are based on future CN values with only existing local and CCRFCD facilities in place



(IN FEET)

SCALE: 1 INCH = 800 FEET



	EXISTING REGIONAL DETENTION BASINS
	PROPOSED REGIONAL DETENTION BASINS
	EXISTING LOCAL DETENTION BASINS
	EXISTING REGIONAL BRIDGES
	PROPOSED REGIONAL BRIDGES
	EXISTING LOCAL BRIDGES
	EXISTING REGIONAL CULVERT
	PROPOSED REGIONAL CULVERT
	EXISTING LOCAL CULVERT
	EXISTING REGIONAL PIPELINE
	PROPOSED REGIONAL PIPELINE
	EXISTING LOCAL PIPELINE
	PROPOSED LOCAL PIPELINE
	EXISTING REGIONAL CHANNEL
	PROPOSED REGIONAL CHANNEL
	EXISTING LOCAL CHANNEL
	PROPOSED REGIONAL PIPELINE (Not included in 1996 MPU)
	PROPOSED REGIONAL CHANNEL (Not included in 1996 MPU)
	EXISTING REGIONAL DIKE/LEVEE
	PROPOSED REGIONAL DIKE/LEVEE
	EXISTING LOCAL DIKE/LEVEE
	EXISTING STORM WATER PUMPING STATION
	PROPOSED BELTWAY ALIGNMENT



●→ FLOW ARROW

250	10-YEAR STREET FLOW
500	100-YEAR STREET FLOW
(300)	10-YEAR FACILITY FLOW
(800)	100-YEAR FACILITY FLOW

(FLOWS IN CFS)

NOTE:

Ultimate drainage conditions are based on future CN values with all flood control facilities in place

- * The capacity of the proposed regional facility is based on the "1996 Clark County Regional Flood Control Master Plan Update for the Las Vegas Valley." The facility may need to be enlarged in final design.

HUALPAIN	FT. APACHE	DURANGO	BUFFALO	RAINBOW	JONES	DECATUR	ELKHORN
1	2	3	CENTENNIAL				
4	5	6	ANIN				
7	8	9	LONE MOUNTAIN				
10	11	12	ALEXANDER				
		13	14	CHEYENNE			
		15	16	SMOKE RAIN			
		17	18				

FUTURE DRAINAGE CONDITIONS:



**POST,
BUCKLEY,
SCHUH &
JERNIGAN, INC.**

ENGINEERING PLANNING SURVEYING GIS
901, N. Green Valley Pkwy, Ste 100, Henderson NV 89014
Phone: (702) 263-7275 Fax: (702) 263-7200

APPENDIX D

REFERENCES

REFERENCE 5

"Master Drainage Study for Craig & Rancho"

(DS 4824)

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

CCRFCFCD

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 #
1 st Submittal	9/7/2016	9/27/2016	Not Approved	\$400.00	457513: \$400
2 nd 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.

- 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.
- 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* (CCRFCFCD) has issued a letter of concurrence. The engineer should contact the CCRFCFCD to confirm that they have begun their review.
- 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.
- 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

Lawrence L. Brown, III
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Clark County

Debra March
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City of North Las Vegas

Mayor Allan Litman
City of Mesquite

Dr. Lois Tarkanian
City of Las Vegas

Mayor Rodney Woodbury
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.

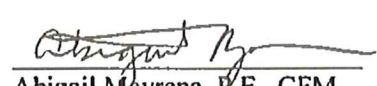
District's review of this project was limited to issues of Regional Flood Control Significance as defined in *Uniform Regulations for the Control of Drainage*.

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

P:\Letters and Memos\Local Drainage\Land Development & Drainage\2016\L-16-9754.doc

Craig & Rancho Master Drainage Study

(Addendum #1)

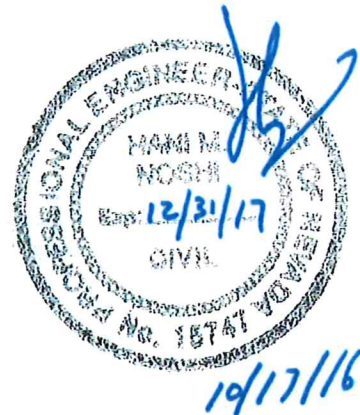
October 2016

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

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

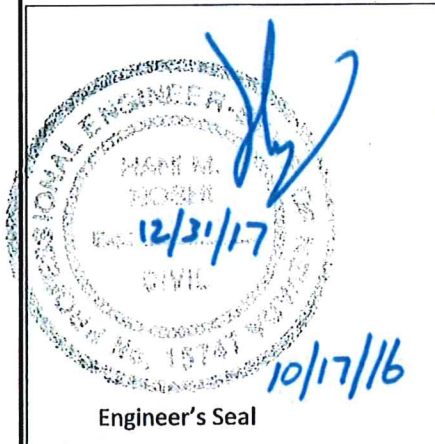
5. Approximate upstream land area which drains to the subject site: 5.0 +/- square miles (mainly conveyed through perimeter streets)

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



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

*New Required Field

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

	Revision	Date

Local Entity File No. _____

REFERENCE:

STANDARD FORM 1

* 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
DSRCHO	-	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
CRG0-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)	10-year Velocity (ft/s)	10-year Flow Depth (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

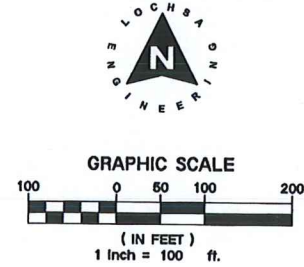
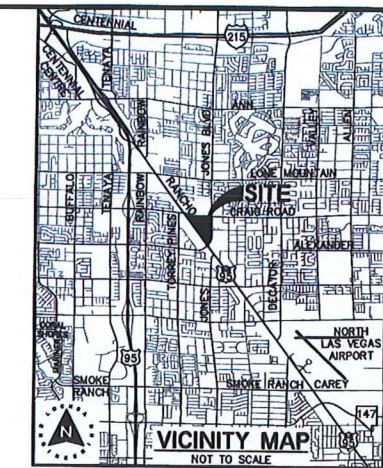
Street Flow Summary (Future Condition)						
100-year, 6-hour Storm						
Street	Right of Way Width (ft)	Hydraulic Cross-Section Identifier	100-Year Flow (Q100)	100-year Velocity (ft/s)	100-year Flow Depth (ft)	100-year Velocity x Depth (v x d)
Rancho Drive	120	AA	7	2.73	0.43	1.17
Rancho Drive	120	BB	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

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

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

EX. 3'x7' RCB

Hollywood
Plaza Site



DRAINAGE LEGEND	
ND1	DRAINAGE BASIN LABEL
CMD1	CONCENTRATION POINT
-----	BASIN BOUNDARY LINE
-----	OFFSITE BASIN BOUNDARY
2 / 3 / 5	Q10/Q25/Q100 FLOW IN CFS
1 (1.0)(1.2)	Q10 (V10)(D10)
1 (1.0)(1.2)	Q100 (V100)(D100)
→	BASIN FLOW DIRECTION
→	COMBINED FLOW DIRECTION
(1D)	HYDRAULIC CROSS-SECTION
2	Q10IN
3	Q100IN
→	STORM DRAIN FLOWS IN CFS

ONSITE BASIN MAP
(FUTURE CONDITION)

CRAIG & RANCHO
MASTER DRAINAGE STUDY

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

SHEET No.
DR2
SHEET 2

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



09/01/16

Lochsa Job # 161051

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL
DRAINAGE STUDY INFORMATION FORM

Name of Development: Craig & Rancho Master Drainage Study Date: August 31, 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

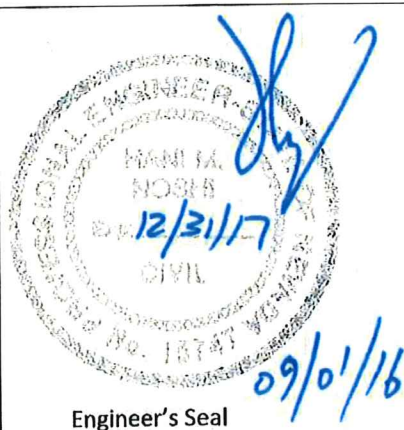
5. Approximate upstream land area which drains to the subject site: 5.0 +/- square miles (mainly conveyed through perimeter streets)

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

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.

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

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.

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.

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 ($v \times d$) 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.

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.

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

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 ($v \times d$) 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 $\frac{1}{2}$ 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.

illustrate the recommended future pattern for the subject property. The proposed ultimate onsite runoff has been designed to follow as much as possible the existing drainage pattern.

3.2 Compliance with Regulations and Adopted Plans

The hydrologic analysis and drainage design of this development is in compliance with local requirements, including the CCRFCD “*Hydrologic Criteria and Drainage Design Manual*” (HCDDM) (Reference 1), and the CCRFCD “*2008 Las Vegas Valley Flood Control Master Plan Update*” (Reference 2). The site design is also in compliance with the Natural Resources Conservation Service (NRCS) Web Soil Survey and the 1995 SCS Soil Survey of Las Vegas Area (Reference 3), as well as FEMA’s FIRM with panel number 23003C2155F (Reference 4).

3.3 Hydrologic Criteria

The onsite and offsite basins of the subject project area all fall within the Gowan watershed. The hydrologic and hydraulic analyses presented in this report are carried out in accordance with the CCRFCD’s HCDDM (Reference 1). The rainfall values used for the hydrologic analysis of the site represent the 10-year, 25-year and 100-year storm recurrence events, each with six-hour duration. The site is within the boundary for using the McCarran Airport Rainfall Data. Therefore, point precipitation values were determined using Table 505 of the HCDDM. The adjusted point rainfall values for the 6-hour, 10-year, 25-year and 100-year storm events are determined from Table 505 as 1.58, 2.05 and 2.77 inches, respectively.

APPENDIX A

HYDROLOGIC ANALYSIS

HYDROLOGIC PARAMETERS

DEVELOPMENT:
CALCULATED BY:
PROJECT NUMBER:

Craig Rancho Master Study

HN
161051

DATE: August 24, 2016

SUB-BASIN DATA				INITIAL/OVERLAND TIME (ti)				TRAVEL TIME (tt)				tc CHECK (URBANIZED BASINS)		FINAL REMARKS			
DESIGN	K	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 Min (13)	Min (14)	CN (15)	tiL Hrs (16)	Urbanized? (17)	Soil Type (18)
NX1	0.8191	22.30	0.034839	200	1.5	6.2	1,760	1.3	1.9	15.8	-	-	22.0	91.6	0.220	NO	D
NX2	0.8189	14.07	0.021982	160	1.3	5.9	930	1.1	1.6	9.5	-	-	15.5	91.6	0.155	NO	D
NX3	0.8508	11.52	0.018005	100	2.5	3.3	1570	2.2	2.0	12.8	-	-	16.1	94.0	0.161	NO	D
NX4	0.8508	2.35	0.00366	100	2.0	3.6	330	2.1	1.2	4.4	-	-	8.0	94.0	0.100	NO	D
RNCH1	0.9036	2.27	0.003554	70	2.0	2.3	1410	0.9	2.3	10.2	1,480	18.2	12.5	98.0	0.125	YES	D
RNCH2	0.9036	1.94	0.003039	70	2.0	2.3	1300	0.6	1.9	11.3	1,370	17.6	13.7	98.0	0.137	YES	D
JONES1	0.9036	2.20	0.003436	55	2.0	2.1	1155	0.8	2.2	8.9	1,210	16.7	10.9	98.0	0.109	YES	D
JONES2	0.9036	2.04	0.003192	90	2.0	2.7	1190	0.8	2.1	9.6	1,280	17.1	12.3	98.0	0.123	YES	D
JONES3	0.9036	0.71	0.00111	55	2.0	2.1	490	0.4	1.2	6.6	545	13.0	8.7	98.0	0.087	YES	D

$$ti = 1.8 (1.1 - K) L^{0.5} / S^{0.5}$$

$$K = 0.0132 CN - 0.39$$

$$tt = L / (60 V)$$

$$tc = ti + tt$$

$$tiL = tiLag + 0.6 tc$$

LOCATION: Onsites and Offsites
HYDROLOGIC CONDITION: Existing and Developed

TRIAL: Final Iteration

AVERAGE VELOCITY

Input Variables	Basin NX1	Basin NX2	Basin NX3	Basin NX4	Basin RNCH1	Basin RNCH2	Basin JONES1	Basin JONES2	Basin JONES3		
Bottom Width, B, (ft):	10.0	10.0	10.0	20.0	2.0	2.0	2.0	2.0	2.0		
Right Side Slope, Zr:	50	50	50	50	50	50	50	0	50		
Left Side Slope, Zl:	50	50	50	50	0	0	0	50	0		
Manning's n:	0.035	0.035	0.035	0.035	0.015	0.015	0.015	0.015	0.015		
Geometric Slope, So (ft/ft):	0.013	0.011	0.022	0.021	0.009	0.006	0.008	0.008	0.004	0.000	0.000
Flowrate, Q (cfs) *:	23	17	15	3.5	3.5	3	3.5	3	1		

Output Variables

Normal Depth, Yn (ft):	0.41	0.37	0.30	0.11	0.21	0.21	0.22	0.20	0.14		
Area of Flow, A, (sf):	12.38	10.46	7.36	2.80	1.51	1.57	1.61	1.45	0.81		
Velocity, V (fps):	1.86	1.63	2.04	1.25	2.31	1.91	2.17	2.07	1.24		
Wetted Perimeter, p (ft):	50.76	46.82	39.65	30.99	12.67	12.89	13.07	12.42	9.34		
Hydraulic Radius, Rh (ft):	0.24	0.22	0.19	0.09	0.12	0.12	0.12	0.12	0.09		
Free Surface Top Width, T (ft):	50.75	46.82	39.64	30.99	12.46	12.68	12.85	12.21	9.20		
Centroid, Y* (ft):	0.16	0.14	0.12	0.05	0.08	0.08	0.08	0.08	0.06		

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

Curve Number Calculations
Craig Rancho Master Study

Sub-Basin: RNCH1

Total Area: 2.27 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Crue Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	2.27	D	100%	98	98.0

Total: 2.27 - 100% - 98.0

Curve Number Calculations
Craig Rancho Master Study

Sub-Basin: RNCH2

Total Area: 1.94 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Crue Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	1.94	D	100%	98	98.0

Total: 1.94 - 100% - 98.0

Curve Number Calculations
Craig Rancho Master Study

Sub-Basin: JONES1
Total Area: 2.20 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Crue Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	2.20	D	100%	98	98.0

Total: 2.20 - 100% - 98.0

Curve Number Calculations
Craig Rancho Master Study

Sub-Basin: JONES2
Total Area: 2.04 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Crue Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	2.04	D	100%	98	98.0

Total: 2.04 - 100% - 98.0

Curve Number Calculations
Craig Rancho Master Study

Sub-Basin: JONES3
Total Area: 0.71 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Crue Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.71	D	100%	98	98.0

Total: 0.71 - 100% - 98.0

HEC-1 MODEL OUTPUT

(FUTURE CONDITION)

1*****
 *
 * FLOOD HYDROGRAPH PACKAGE (HEC-1)
 * JUN 1998
 * VERSION 4.1
 *
 * RUN DATE 31AUG16 TIME 20:25:02
 *

DLOMR

 *
 * 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   X
XXXXXXX XXXX X   XXXXX X
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

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LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
1         ID      CRAIG/RANCHO MASTER DRAINAGE STUDY
2         ID      DEVELOPED (INTERIM/FUTURE) CONDITION
3         ID      USING SCS METHODS AND KINEMATIC WAVE ROUTING
4         ID      MASTER PLAN ADJUSTED 6-HOUR RAINFALL AND STORM DISTRIBUTION
5         ID
6         ID      LOCHSA JOB# 161051
7         ID
8         ID
9         ID      INPUT FILE NAME: DLOMR.DAT
10        ID
11        ID      AUGUST 2016
12        ID
13        ID      *****
14        ID      *****
15        ID      INSIDE MCCARRAN AIRPORT RAINFALL AREA
16        ID
17        ID      10, 25 & 100 YEAR - 6 HOUR STORM EVENT
18        ID      PRECIPITATION BASED ON FIGURES 503 AND 506 OF THE HCDDM
19        ID
20        ID
21        ID      10-YEAR RAINFALL DEPTH = 1.58 INCHES
22        ID      25-YEAR RAINFALL DEPTH = 2.05 INCHES
23        ID      100-YEAR RAINFALL DEPTH = 2.77 INCHES
24        ID
25        ID      10-YEAR RAINFALL DEPTH RATIO (JR CARD) = 1.58/2.77 = 0.57
26        ID      25-YEAR RAINFALL DEPTH RATIO (JR CARD) = 2.05/2.77 = 0.74
27        ID      *****
28        ID
29        ID
30        ID      DARF RATIOS FOR AREAS OF 5.20 SQUARE MILES FOR
31        ID      RANCHO AND JONES BLVD. FLOWS = 0.90
32        ID
33        ID      10-YEAR RAINFALL DEPTH RATIO (JR CARD) = (1.58/2.77) X 0.90 = 0.51
34        ID      25-YEAR RAINFALL DEPTH RATIO (JR CARD) = (2.05/2.77) X 0.90 = 0.67
35        ID
36        ID      *****
37        ID      *****
38        ID
39        ID      ***** AUGUST 2016 *****
40        ID
41        ID
42        ID      (1) ***** BEGINNING OF REFERENCED HEC-1 MODEL *****
43        ID
44        ID      ***** FROM THE "RANCHO/US 95 LOMR *****
45        ID      ***** ISSUED ON NOVEMBER 30, 2009 *****
46        ID
47        ID      ***** AUGUST 2016 *****
48        ID
49        ID      *****
50        ID      *****
51        ID

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*** FREE ***

1

HEC-1 INPUT

PAGE 2

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LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
40        ID      RANCHO/US95 CLOMR
41        ID      FOR: CITY OF LAS VEGAS, NV AND THE CLARK COUNTY REGIONAL FLOOD CONTROL DISTR
42        ID      THIS IS THE PROPOSED HEC1 MODEL FOR UPPER RANCHO DRIVE (NORTH OF GOWAN ROAD)
43        ID      FILENAME:UPPRSDN3.DAT
44        ID
45        ID      CAM10 DETENTION BASIN AND THE WESTERN BELTWAY CHANNEL ARE INCLUDED IN THE EN
46        ID      NOT IN THE SDN3 WATERSHED.
47        ID
48        ID
49        ID      MODIFIED BY LBG SEPT 2005
50        ID      SDN3 CREATED BY REDUCING THE SIZE OF CRAIG SUBBASIN TO 1.434 SQUARE MILES
51        ID      ADD INTERIM BELTWAY AND GOWAN NORTH PHASE III

```

Page 1

52 ID BY MODIFYING THE CRAIG SUBBASIN FROM PBS&J MODEL
 53 ID
 54 ID LVRA0000 (PEAK CHANNEL AND RANCHO DRIVE IMPROVEMENTS) ADDED BY DIVERTING
 55 ID FLOW FROM CONCENTRATION POINT CX1X4
 56 ID
 57 ID TRUVAL FLOW SPLIT, REMOVED FROM CVL MODEL, HAS BEEN PUT BACK IN.
 58 ID
 59 ID JR CARD RATIOS REPRESENT DEPTH-AREA REDUCTION FACTORS (DARF'S)
 60 ID
 61 ID 100-YEAR, 6-HOUR STORM, SDN3
 62 ID DARF RATIOS FOR AREAS OF 0, 0.5, 1.0, 2.0, 4.0, 6.0, 8.0 AND 10 SQUARE MILES
 63 ID FOR THE 100-YEAR EVENT.
 64 IT 5 0 0 100
 65 IO 5 0 0
 66 IN 5

***** BEGINNING AUGUST 2016 REVISION *****

 * UTILIZED THE RATIOS RELEVANT FOR THE SUBJECT STUDY JUST SWITCHING SREMAIN AND
 * (CULVERT 27 AND CULVERT 26) CAN BE ROUTED AND COMBINED WITH THE LOCAL
 * FLOWS WITHIN THE STUDY

67 JR PREC 1.00 0.74 0.57 0.90 0.67 0.51
 ***** END AUGUST 2016 REVISION *****

68 KK ANN
 69 PB 2.85
 70 BA 0.259
 71 PC 0.000 0.020 0.057 0.070 0.087 0.108 0.124 0.130 0.130 0.130
 72 PC 0.130 0.130 0.130 0.133 0.140 0.142 0.148 0.158 0.172 0.181
 73 PC 0.190 0.197 0.199 0.200 0.201 0.204 0.214 0.229 0.241 0.249
 74 PC 0.251 0.256 0.270 0.278 0.281 0.283 0.295 0.322 0.352 0.409
 75 PC 0.499 0.590 0.710 0.744 0.781 0.812 0.819 0.835 0.851 0.856
 76 PC 0.860 0.868 0.876 0.888 0.910 0.926 0.937 0.950 0.970 0.976
 77 PC 0.982 0.985 0.987 0.989 0.990 0.993 0.993 0.994 0.995 0.998
 78 PC 0.998 0.999 1.000
 79 LS 0 76.8
 80 UD 0.499

HEC-1 INPUT

PAGE 3

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

81 KK RANN
 82 KM ROUTE TO GD29B
 83 RK 2600 0.015 0.015 0 TRAP 100 2
 84 KK GD29B
 85 PB 2.77
 86 BA 0.138
 87 LS 0 74.3
 88 UD 0.298

89 KK CGD29B
 90 HC 2
 91 KK RGD29B
 92 KM ROUTE TO ANN1B
 93 RK 2700 0.015 0.015 0 TRAP 100 2
 94 KK ANN1B
 95 PB 2.77
 96 BA 0.135
 97 LS 0 82.7
 98 UD 0.305

99 KK CANN1B
 100 HC 2
 101 KK RANN1B
 102 KM ROUTE TO ANN1C2
 103 RK 2000 0.007 0.015 0 TRAP 100 2
 104 KK ANN1C2
 105 PB 2.77
 106 BA 0.091
 107 LS 0 80.7
 108 UD 0.275

109 KK CANN1C2
 110 HC 2
 111 KK RANN1C2
 112 KM ROUTE TO PDGCC3
 113 RK 1250 0.0074 0.013 0 TRAP 12 2

HEC-1 INPUT

PAGE 4

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

114 KK PDGCC3
 115 PB 2.77
 116 BA 0.047

Ref.
LOMR

DLOMR

2: 6'x3' RCBs

835 KK C2B1
836 HC 2
*
837 KK R2B1
838 KM ROUTE TO C2B3
839 RK 300 0.007 0.015 0 TRAP 80 2
*

HEC-1 INPUT

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

840 KK 2C2B3
841 HC 2
*
842 KK RC2B3
843 KM ROUTE TO 5REMAIN (UPPER RANCHO HECRAS STA 53+82)
844 RK 1600 0.0076 0.03 0 TRAP 80 2
*

***** BEGINNING AUGUST 2016 REVISION *****

***** JUST SWITCHING 5REMAIN AND D5RCHO, SO THAT RUNOFF FROM THE RANCHO CULVERTS (CULVERT 27 AND CULVERT 26) CAN BE ROUTED AND COMBINED WITH THE LOCAL FLOWS WITHIN THE STUDY *****

845 KK D5RCHO
846 KM DIVERT FLOW EAST ACROSS RANCHO IN TWO 6' X 3' RCB'S. THE FIRST RCB IS JUST
847 KM UPSTREAM OF THE 7' X 3' RCB (CULVERT 27) THAT PARALLELS RANCHO ON THE WEST
848 KM SIDE. DIVERT 78 CFS OF 185 CFS TO THE FIRST 6' X 3' RCB (CULVERT 26). THE
849 KM REMAINING 107 CFS ENTERS THE 7' X 3' RCB. THE SECOND 6' X 3' RCB
850 KM CULVERT 28) IS CONNECTED INTO THE SIDE OF THE 7' X 3' RCB. DIVERT 35 CFS OF
851 KM THE 107 CFS TO THE SECOND 6' X 3' RCB. THE REMAINING 72 CFS CONTINUES
852 KM TO THE SOUTH SIDE OF ALEXANDER IN THE 7' X 3' RCB. UPPER RANCHO HECRAS
853 KM HAS CULVERT 27 IN IT BETWEEN STA. 52+64 AND 38+36.
854 DT 5REMAIN
855 DI 0 113 155 197 308
856 DQ 0 0 42 84 195
*

***** END AUGUST 2016 REVISION *****

***** AUGUST 2016 *****

(1) ***** END OF REFERENCED HEC-1 MODEL ***** (1)

***** FROM THE "RANCHO/US 95 LOMR *****
***** ISSUED ON NOVEMBER 30, 2009 *****

***** AUGUST 2016 *****

HEC-1 INPUT

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

857 KK RRNCH1
858 KM NORTHERN PORTION OF EXISTING RANCHO DRIVE ALONG THE PROJECT SITE
859 BA .00355
860 LS 0 98.0
861 UD .125
*

862 KK RRNCH1
863 KM ROUTE RUNOFF FROM RRNCH1 THROUGH ND1 TO JONES LOW POINT
864 RK 1660 0.013 0.015 0 TRAP 2 50
*

865 KK ND1
866 KM FUTURE ONSITE BASIN ND1 DRAINING SOUTHEASTERLY TOWARD JONES BLVD LOW POINT
867 BA .04176
868 LS 0 98.0
869 UD .105
*

870 KK CMD1
871 KM COMBINE RRNCH1 AND ND1
872 HC 2
*

873 KK RRNCH2
874 KM SOUTHERN PORTION OF EXISTING RANCHO DRIVE ALONG THE PROJECT SITE
875 BA .00304
876 LS 0 98.0
877 UD .137
*

878 KK RRNCH2
879 KM ROUTE RUNOFF FROM RRNCH1 THROUGH ND2 TO JONES LOW POINT
880 RK 600 0.011 0.015 0 TRAP 2 50
*

881 KK ND2
882 KM FUTURE ONSITE BASIN ND2 DRAINING EASTERLY AND SOUTHEASTERLY TOWARDS
883 KM JONES BLVD LOW POINT
884 BA .02198
885 LS 0 98.0
886 UD .081
*

887 KK CMD2
888 KM COMBINE RRNCH2 AND ND2
889 HC 2
*

HEC-1 INPUT

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

890 KK JONES1
891 KM WESTERN HALF OF JONES BOULEVARD DRAINING DIRECTLY TOWARDS EXISTING DROP INLET
892 KM AT THE LAS VEGAS BOULEVARD LOW POINT
893 BA .00344
894 LS 0 98.0
895 UD .109
*

896 KK LOCL-D
897 KM COMBINE CMD1, CMD2 AND JONES1
898 KM FUTURE LOCAL FLOWS DRAINING ONTO THE EXISTING DROP INLETS AT
899 KM JONES BLVD. LOW POINT
900 HC 3
*

901 KK TOTL-D
902 KM COMBINE LOCL-D AND D5RCHO
903 KM FUTURE TOTAL FLOWS DRAINING ONTO THE EXISTING DROP INLETS AT
904 KM JONES BLVD. LOW POINT
905 HC 2
*

906 KKLOWPNT-D
907 KM DIVERT FLOWS INTO EXISTING JONES BOULEVARD STORM DRAIN
908 KM REMAINING FLOWS WILL CONTINUE EASTERLY INTO HICKAM AVENUE
909 DTJONES-SD
910 DI 0 79 100 200 300
911 DQ 0 79 79 79 79
*

912 KK JONES2
913 KM EASTERN HALF OF JONES BOULEVARD TOWARDS HICKAM AVE. AT THE INTERSECTION
914 BA .00319
915 LS 0 98.0
916 UD .123
*

917 KK HICKAM-D
918 KM COMBINE LOWPNT-D AND JONES2
919 KM FUTURE TOTAL FLOWS CONTINUING INTO HICKAM AVENUE
920 KM AT INTERSECTION WITH JONES BLVD. LOW POINT
921 HC 2
*

* KKR5REM
* KMROUTE TO CPT51 (UPPER RANCHO HECRAS STA 38+36) 0
* RK1428 0.006 0.03 0 TRAP 7

* KKPT51
* PB2.77
* BA0.070
* LS0 90.4
* UD0.262
*

* KKCPT51
* HC2
*

* KKD95Fa
* KMRETRIEVE FLOW FROM WIER DIVERSION AT US95 AND ALEXANDER
* DRD95Fa
*

* THESE TWO DIVERSIONS CARRY A TOTAL TRIBUTARY AREA OF 18.68.
* THIS IS NOT IN ADDITION TO THE 1.49 SQUARE MILES AND 2.35
* SQUARE MILES BROUGHT IN BY D95B AND D95E RESPECTIVELY, SO THE TOTAL
* TRIBUTARY AREA AT THE ALEXANDER/RANCHO INTERSECTION IS 19.69 SQUARE MILES.
* (18.68 + 1.01)
*

* KKDCSD2
* KM RETRIEVE FLOWS CONVEYED THROUGH THE CRAIG ROAD STORM DRAIN
* DRDCSD2
*

* KKDCSD1
* KM RETRIEVE FLOWS CONVEYED THROUGH THE CRAIG ROAD STORM DRAIN
* DRDCSD1
*

* KK CRGSD
* HC 2
*

HEC-1 INPUT

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

922 KK CRAIG1
923 KM WESTERN PORTION OF EXISTING SOUTH-HALF OF CRAIG ROAD ALONG THE PROJECT SITE
924 BA .00237
925 LS 0 98.0
926 UD .098
*

927 KK ND3-1
928 KM FUTURE ONSITE BASIN ND3-1 DRAINING NORTHEASTERLY TOWARDS
929 KM CRAIG ROAD

DL-OMR

[illegible]

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 1.00	RATIO 2 .74	RATIO 3 .57	RATIO 4 .90	RATIO 5 .67	RATIO 6 .51	
HYDROGRAPH AT +	ANN	.26	1	FLOW TIME	123. 4.00	62. 4.00	30. 4.08	99. 4.00	48. 4.00	21. 4.08
ROUTED TO +	RANN	.26	1	FLOW TIME	122. 4.08	62. 4.08	30. 4.17	98. 4.08	48. 4.08	20. 4.17

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$$DARF = 0.90$$

DLOMR

HYDROGRAPH AT +	4REMAIN	.18	1	FLOW TIME	229. 3.83	119. 3.75	74. 3.75	176. 3.83	100. 3.75	60. 3.75
ROUTED TO +	R4MAIN	.18	1	FLOW TIME	224. 3.83	118. 3.83	74. 3.83	175. 3.92	99. 3.83	60. 3.83
HYDROGRAPH AT +	PT2B3	.02	1	FLOW TIME	32. 3.67	22. 3.67	15. 3.67	28. 3.67	19. 3.67	13. 3.67
2 COMBINED AT +	C2B3	.20	1	FLOW TIME	248. 3.83	134. 3.83	86. 3.83	194. 3.83	114. 3.83	70. 3.83
DIVERSION TO +	DCSD2	.20	1	FLOW TIME	120. 3.58	120. 3.75	85. 3.83	120. 3.58	113. 3.83	69. 3.83
HYDROGRAPH AT +	D2B3	.20	1	FLOW TIME	128. 3.83	14. 3.83	1. 3.83	74. 3.83	1. 3.83	1. 3.83
HYDROGRAPH AT +	PT2A2	.06	1	FLOW TIME	63. 3.67	37. 3.67	22. 3.67	53. 3.67	31. 3.67	18. 3.67
ROUTED TO +	R2A2	.06	1	FLOW TIME	61. 3.75	37. 3.75	22. 3.75	51. 3.75	31. 3.75	17. 3.75
HYDROGRAPH AT +	PT2A1	.06	1	FLOW TIME	63. 3.75	39. 3.75	24. 3.75	53. 3.75	33. 3.75	19. 3.75
HYDROGRAPH AT +	D95E	.00	1	FLOW TIME	184. 4.00	83. 4.17	21. 4.33	148. 4.08	55. 4.25	14. 4.08
ROUTED TO +	RD95E	.00	1	FLOW TIME	184. 4.08	82. 4.25	21. 4.42	147. 4.17	55. 4.25	14. 4.17
3 COMBINED AT +	C2A2	.13	1	FLOW TIME	255. 4.00	113. 4.17	53. 3.83	202. 4.00	83. 3.92	41. 3.83
DIVERSION TO +	DCSD1	.13	1	FLOW TIME	90. 3.58	90. 3.75	52. 3.83	90. 3.58	82. 3.92	40. 3.83
HYDROGRAPH AT +	DPT2A1	.13	1	FLOW TIME	165. 4.00	23. 4.17	1. 3.58	112. 4.00	1. 3.50	1. 3.58
ROUTED TO +	R2A2	.13	1	FLOW TIME	164. 4.00	22. 4.25	1. 4.17	111. 4.08	1. 4.00	1. 4.17
HYDROGRAPH AT +	PT2B1	.07	1	FLOW TIME	72. 3.67	43. 3.67	26. 3.67	61. 3.67	36. 3.67	20. 3.67
2 COMBINED AT +	C2B1	.20	1	FLOW TIME	197. 4.00	43. 3.67	26. 3.67	133. 4.08	36. 3.67	20. 3.67
ROUTED TO +	R2B1	.20	1	FLOW TIME	197. 4.00	43. 3.67	25. 3.67	133. 4.08	35. 3.67	19. 3.67
2 COMBINED AT +	2C2B3	.40	1	FLOW TIME	312. 3.92	54. 3.75	26. 3.67	199. 3.92	36. 3.67	20. 3.67
ROUTED TO +	RC2B3	.40	1	FLOW TIME	308. 3.92	52. 3.83	25. 3.83	197. 4.00	35. 3.83	20. 3.83
DIVERSION TO +	5REMAIN	.40	1	FLOW TIME	195. 3.92	0. .00	0. .00	84. 4.00	0. .00	0. .00
HYDROGRAPH AT +	D5RCHO	.40	1	FLOW TIME	113. 3.75	52. 3.83	25. 3.83	113. 3.75	35. 3.83	20. 3.83
HYDROGRAPH AT +	RNCH1	.00	1	FLOW TIME	7. 3.58	5. 3.58	4. 3.58	6. 3.58	4. 3.58	3. 3.58
ROUTED TO +	RRNCH1	.00	1	FLOW TIME	7. 3.67	5. 3.67	4. 3.67	6. 3.67	4. 3.67	3. 3.67
HYDROGRAPH AT +	ND1	.04	1	FLOW TIME	81. 3.50	60. 3.50	45. 3.50	73. 3.50	54. 3.50	40. 3.50
2 COMBINED AT +	CMD1	.05	1	FLOW TIME	86. 3.50	63. 3.50	48. 3.50	77. 3.50	57. 3.50	42. 3.50
HYDROGRAPH AT +	RNCH2	.00	1	FLOW TIME	6. 3.58	4. 3.58	3. 3.58	5. 3.58	4. 3.58	3. 3.58

				DLOMR					
ROUTED TO	RRNCH2	.00	1	FLOW TIME	6. 3.58	4. 3.58	3. 3.58	5. 3.58	4. 3.58
HYDROGRAPH AT	ND2	.02	1	FLOW TIME	46. 3.50	34. 3.50	26. 3.50	41. 3.50	31. 3.50
2 COMBINED AT	CMD2	.03	1	FLOW TIME	51. 3.50	37. 3.50	28. 3.50	46. 3.50	34. 3.50
HYDROGRAPH AT	JONES1	.00	1	FLOW TIME	7. 3.50	5. 3.50	4. 3.50	6. 3.50	4. 3.50
3 COMBINED AT	LOCL-D	.07	1	FLOW TIME	144. 3.50	105. 3.50	80. 3.50	129. 3.50	95. 3.50
2 COMBINED AT	TOTL-D	.47	1	FLOW TIME	203. 3.67	116. 3.58	81. 3.50	175. 3.75	100. 3.58
DIVERSION TO	JONES-SD	.47	1	FLOW TIME	79. 3.33	79. 3.42	79. 3.50	79. 3.33	79. 3.50
HYDROGRAPH AT	LOWPNT-D	.47	1	FLOW TIME	124. 3.67	37. 3.58	2. 3.50	96. 3.75	21. 3.58
HYDROGRAPH AT	JONES2	.00	1	FLOW TIME	6. 3.58	4. 3.58	3. 3.58	5. 3.58	4. 3.58
2 COMBINED AT	HICKAM-D	.48	1	FLOW TIME	128. 3.67	41. 3.58	5. 3.50	99. 3.75	24. 3.58
HYDROGRAPH AT	CRAIG1	.00	1	FLOW TIME	5. 3.50	3. 3.50	3. 3.50	4. 3.50	3. 3.50
HYDROGRAPH AT	ND3-1	.01	1	FLOW TIME	17. 3.50	13. 3.50	10. 3.50	16. 3.50	11. 3.50
2 COMBINED AT	CRG0-D	.01	1	FLOW TIME	22. 3.50	16. 3.50	12. 3.50	20. 3.50	15. 3.50
ROUTED TO	RCRG0-D	.01	1	FLOW TIME	21. 3.50	15. 3.50	11. 3.50	19. 3.50	14. 3.50
HYDROGRAPH AT	CRAIG2	.00	1	FLOW TIME	3. 3.50	2. 3.50	2. 3.50	3. 3.50	2. 3.50
HYDROGRAPH AT	ND3-2	.00	1	FLOW TIME	8. 3.50	6. 3.50	5. 3.50	8. 3.50	6. 3.50
3 COMBINED AT	CRG1-D	.02	1	FLOW TIME	33. 3.50	24. 3.50	18. 3.50	29. 3.50	21. 3.50
HYDROGRAPH AT	ND4	.00	1	FLOW TIME	8. 3.50	6. 3.50	4. 3.50	7. 3.50	5. 3.50
HYDROGRAPH AT	JONES3	.00	1	FLOW TIME	2. 3.50	2. 3.50	1. 3.50	2. 3.50	2. 3.50
2 COMBINED AT	JON-D	.00	1	FLOW TIME	10. 3.50	7. 3.50	6. 3.50	9. 3.50	7. 3.50
2 COMBINED AT	CRG2-D	.02	1	FLOW TIME	43. 3.50	31. 3.50	24. 3.50	38. 3.50	28. 3.50
HYDROGRAPH AT	NDA^	.00	1	FLOW TIME	4. 3.50	3. 3.50	2. 3.50	3. 3.50	2. 3.50

1

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	DT	INTERPOLATED TO COMPUTATION PEAK	INTERVAL TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
FOR PLAN = 1	RATIO= 1.00								
RANN	MANE	1.82	122.44	242.51	.96	5.00	121.58	245.00	.96

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1323E+02 EXCESS= .0000E+00 OUTFLOW= .1322E+02 BASIN STORAGE= .1053E-01 PERCENT ERROR= .0

FOR PLAN = 1	RATIO= .74								
RANN	MANE	2.49	61.90	246.24	.50	5.00	61.81	245.00	.50

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6912E+01 EXCESS= .0000E+00 OUTFLOW= .6899E+01 BASIN STORAGE= .9157E-02 PERCENT ERROR= .0

APPENDIX B

HYDRAULIC ANALYSIS

HYDRAULIC CALCULATIONS

Normal Flow Depth Calculations for Rancho Drive

(Existing and Future Conditions)

Section BB - Rancho (10-Year, Existing and Future)

Worksheet for Irregular Channel

Project Description	
Worksheet	Section BB - Rancho (10-Year, Existing and Future)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.05000 ft/ft
Discharge	7.00 cfs

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

Results	
Manning's Coefficient	0.015
Water Surface Elev	73.04 ft
Elevation Range	72.63 to 73.73
Flow Area	4.0 ft ²
Wetted Perimeter	31.07 ft
Top Width	30.62 ft
Actual Depth	0.41 ft
Critical Elevation	73.02 ft
Critical Slope	0.006740 ft/ft
Velocity	1.77 ft/s
Velocity Head	0.05 ft
Specific Energy	73.09 ft
Froude Number	0.87
Flow Type	Subcritical

Roughness Segments		
Start Station	End Station	Manning's Coefficient
0+00.00	0+60.00	0.015

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	73.23
0+05.00	73.13
0+05.50	73.13
0+05.50	72.63
0+07.00	72.76
0+07.00	72.80
0+60.00	73.23
0+60.00	73.73

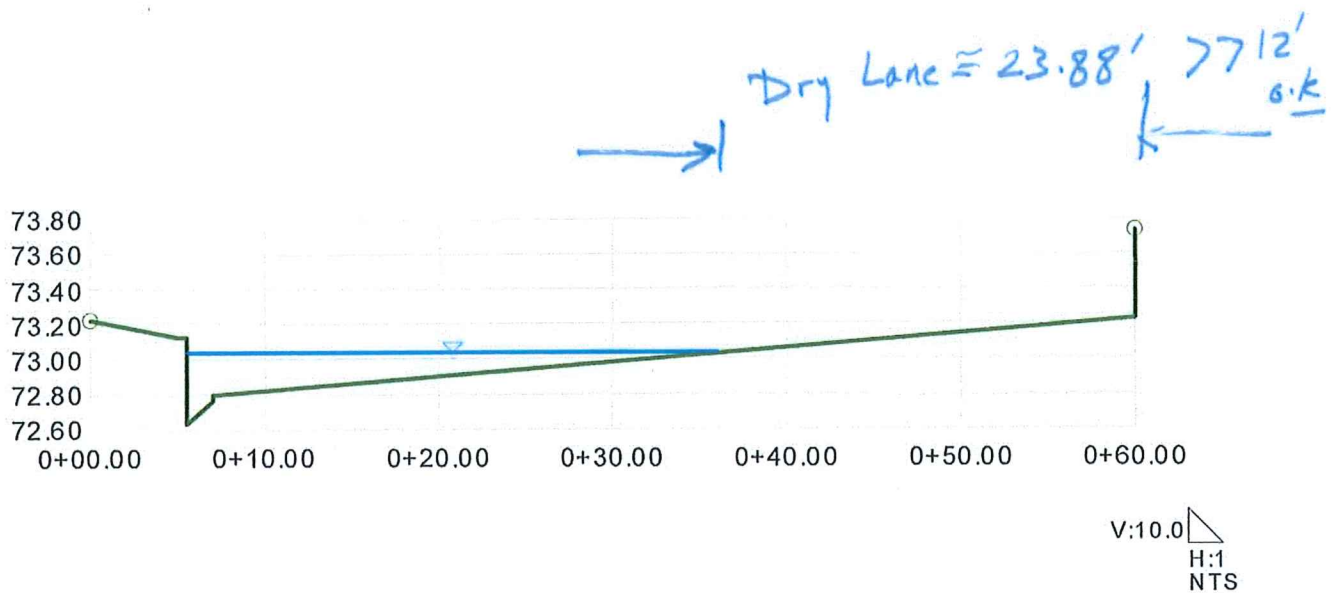
Notes: * $Q_{10}/Q_{25}/Q_{100} = 7/9/13\text{cfs}$ = conservatively assumed as runoff generated through offsite basins $RNCH1(4/5/7\text{cfs}) + RNCH2(3/4/6\text{cfs})$

* Manning's $n=0.015$ as referenced from NDOT Drainage Manual Section 3.3.2.2, Page 3-6.

Section BB - Rancho (10-Year, Existing and Future) Cross Section for Irregular Channel

Project Description	
Worksheet	Section BB - Rancho (10-Year, Existing and Future)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.015
Slope	0.005000 ft/ft
Water Surface Elev	73.04 ft
Elevation Range	72.63 to 73.73
Discharge	7.00 cfs



Section BB - Rancho (25-Year, Existing and Future)

Worksheet for Irregular Channel

Project Description	
Worksheet	Section BB - Rancho (25-Year, Existing and Future)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.005000 ft/ft
Discharge	9.00 cfs

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

Results	
Manning's Coefficient	0.015
Water Surface Elev	73.06 ft
Elevation Range	72.63 to 73.73
Flow Area	4.8 ft ²
Wetted Perimeter	34.26 ft
Top Width	33.78 ft
Actual Depth	0.43 ft
Critical Elevation	73.05 ft
Critical Slope	0.006519 ft/ft
Velocity	1.88 ft/s
Velocity Head	0.06 ft
Specific Energy	73.12 ft
Froude Number	0.88
Flow Type	Subcritical

Roughness Segments		
Start Station	End Station	Manning's Coefficient
0+00.00	0+60.00	0.015

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	73.23
0+05.00	73.13
0+05.50	73.13
0+05.50	72.63
0+07.00	72.76
0+07.00	72.80
0+60.00	73.23
0+60.00	73.73

Notes: * Q10/Q25/Q100 = 7/9/13cfs = conservatively assumed as runoff generated through offsite basins RNCH1(4/5/7cfs) + RNCH2(3/4/6cfs)

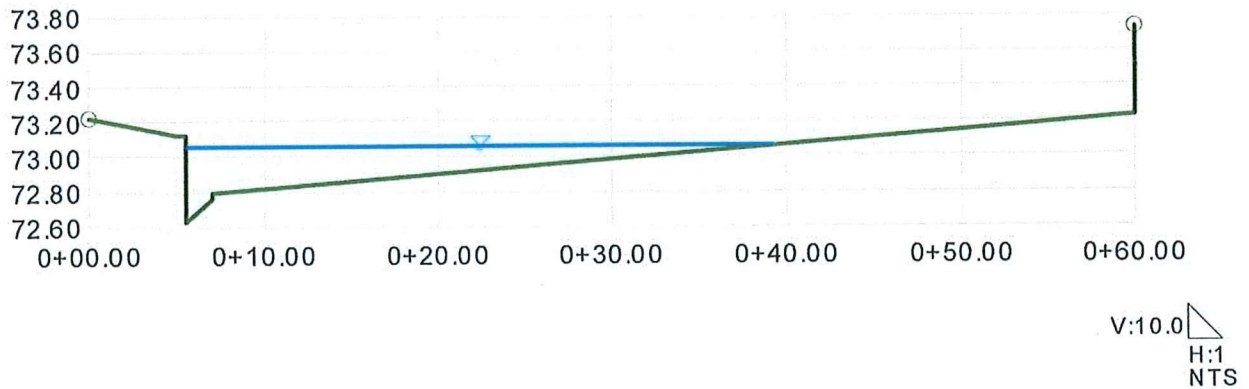
* Manning's n=0.015 as referenced from NDOT Drainage Manual Section 3.3.2.2, Page 3-6.

Section BB - Rancho (25-Year, Existing and Future)

Cross Section for Irregular Channel

Project Description	
Worksheet	Section BB - Rancho (25-Year, Existing and Future)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.015
Slope	0.005000 ft/ft
Water Surface Elev	73.06 ft
Elevation Range	72.63 to 73.73
Discharge	9.00 cfs



Section BB - Rancho (100-Year, Existing and Future)

Worksheet for Irregular Channel

Project Description	
Worksheet	Section BB - Rancho (100-Year, Existing and Future)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.005000 ft/ft
Discharge	13.00 cfs

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

Results	
Mannings Coefficient	0.015
Water Surface Elev	73.10 ft
Elevation Range	72.63 to 73.73
Flow Area	6.3 ft ²
Wetted Perimeter	39.48 ft
Top Width	38.96 ft
Actual Depth	0.47 ft
Critical Elevation	73.09 ft
Critical Slope	0.006207 ft/ft
Velocity	2.06 ft/s
Velocity Head	0.07 ft
Specific Energy	73.17 ft
Froude Number	0.90
Flow Type	Subcritical

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+60.00	0.015

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	73.23
0+05.00	73.13
0+05.50	73.13
0+05.50	72.63
0+07.00	72.76
0+07.00	72.80
0+60.00	73.23
0+60.00	73.73

Notes: * Q10/Q25/Q100 = 7/9/13cfs = conservatively assumed as runoff generated through offsite basins RNCH1(4/5/7cfs) + RNCH2(3/4/6cfs)

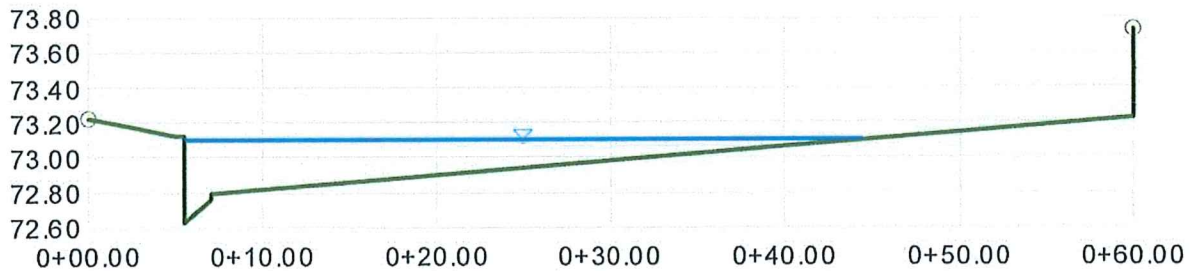
* Mannings n=0.015 as referenced from NDOT Drainage Manual Section 3.3.2.2, Page 3-6.

Section BB - Rancho (100-Year, Existing and Future)

Cross Section for Irregular Channel

Project Description	
Worksheet	Section BB - Rancho (100-Year, Existing and Future)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

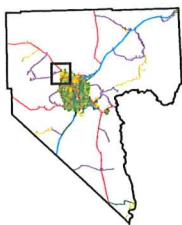
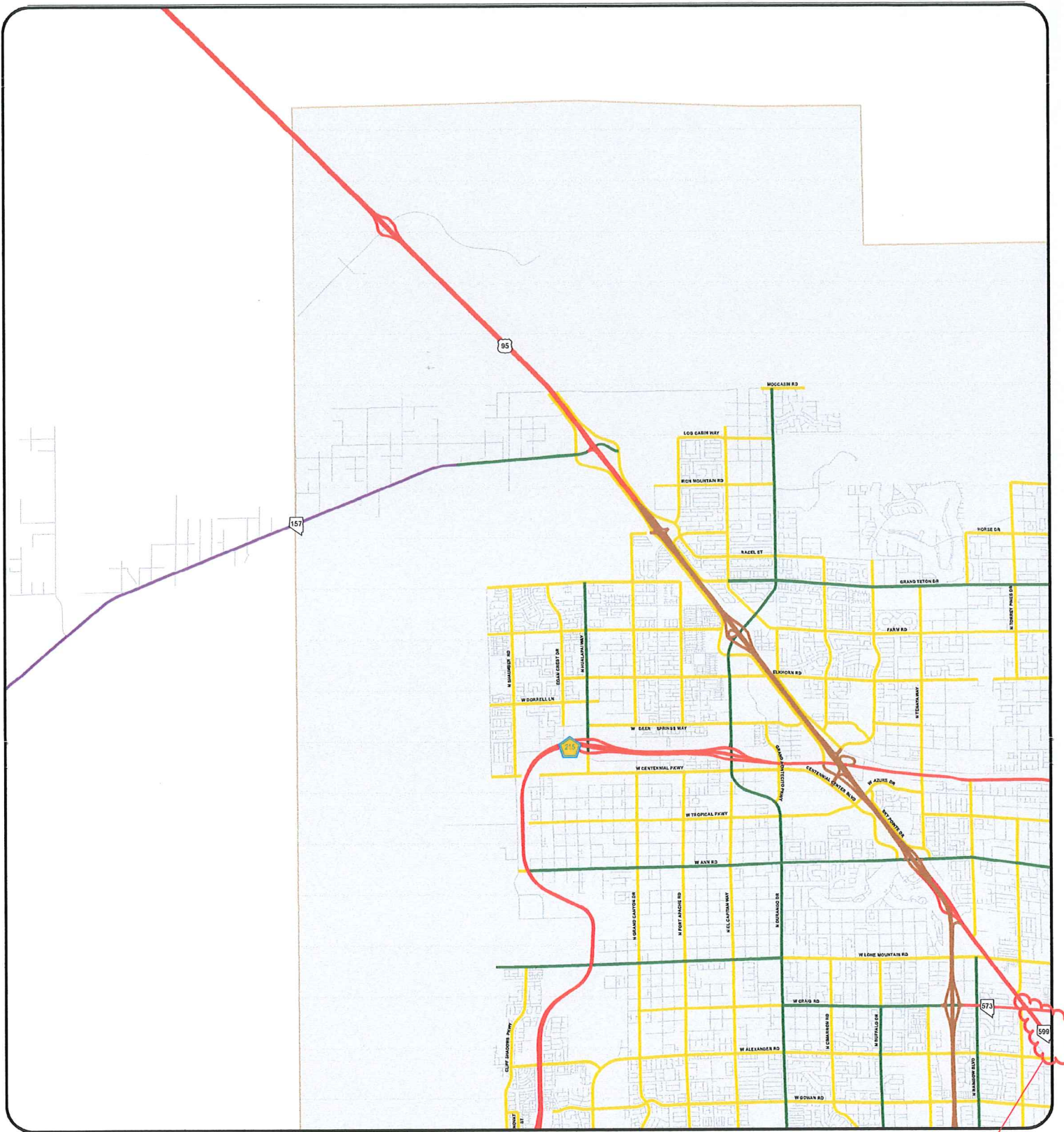
Section Data	
Mannings Coefficient	0.015
Slope	0.005000 ft/ft
Water Surface Elev	73.10 ft
Elevation Range	72.63 to 73.73
Discharge	13.00 cfs



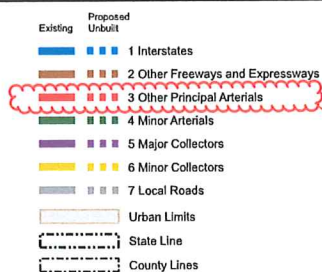
V:10.0
H:1
NTS

Relevant Excerpts from NDOT Roadway Functional Classifications and

the 2006 "NDOT Drainage Manual", Second Edition



PREPARED BY
THE NEVADA DEPARTMENT OF TRANSPORTATION



Hollywood Plaza Site

ROADWAY FUNCTIONAL
CLASSIFICATION

LAS VEGAS URBANIZED A-1

CLARK COUNTY, NEVADA

Rancho Drive

NEVADA DEPARTMENT OF TRANSPORTATION



Jeff Fontaine, P.E.
Director

DRAINAGE MANUAL



Kenny Guinn
Governor



Prepared By: Hydraulics Section
2nd Edition
December 2006

Section 3

3. Design Guidelines

3.1 Introduction

This section is intended to provide technical guidance and criteria for use in developing drainage designs, including a brief overview of available methods, and NDOT's interpretation of their applicability and limitations. The following are general hydraulic design guidelines:

- The level of design studies should be commensurate with the risk associated with the improvement and with other economic, engineering, social, or environmental concerns.
- Established drainage patterns within NDOT right-of-way shall be perpetuated and/or improved through the roadway prism to the extent practicable, up to the 100-year event.
- The design must be assessed to verify no adverse drainage effects have been created up to the 100-year event.
- Design of local regional flood control facilities within NDOT right-of-way shall conform to established local policies, criteria, and standards to the extent practicable.
- For impoundments and diversions, consideration should be given to water rights impacts.
- Consideration should be given to public safety when designing hydraulic facilities.
- The use of drainage systems (channels, detention basins, etc.) as multi-use facilities (parks, bike paths, etc) is not supported, unless all liability, maintenance, and ownership are assumed by a local entity. The CHE must be notified of any proposed multi-use facility.

3.2 Hydrology

3.2.1 General

For a complete discussion of hydrologic analysis, the reader is referred to [Hydraulic Design Series No. 2 \(HDS 2\)](#): Highway Hydrology, by FHWA, and Guidelines for Hydrology - Volume II, Highway Drainage Guidelines, prepared by AASHTO.

A design storm frequency shall be selected based on the facility to be designed and the roadway classification. Design storm frequency tables for various facilities are as follows:

Table 3-1 Roadway Surface Drainage Facilities		
Roadway Classification ⁽¹⁾	Minimum Design Return Frequency (Years)	Maximum Allowable Spread Into Adjacent Travel Lane ⁽³⁾
Interstate Highways ⁽²⁾	25	0
Principal Arterials & Other Freeways and Expressways ⁽²⁾	25	0
Other Principal Arterial	25	½ lane
Minor Arterial	10	½ lane
Rural Major Collector	10	½ lane
Urban or Rural Minor Collector	10	½ lane
Frontage Roads (if not classified)	10	½ lane

- (1) Contact the NDOT Planning Division for the latest roadway [functional classification maps](#).
 (2) Including ramps
 (3) Spread limits specified are as measured into the traveled lane beyond any available parking lanes, bike lanes, and shoulder widths. Turn pockets and bus turnouts are not considered as the travel lane. Auxiliary lanes are considered as travel lane.

Table 3-2 Design Storm Selection Guidelines for Off-Site Flow Facilities (Culverts, Channels, Bridges)	
Roadway Classification ⁽¹⁾	Minimum Design Return Frequency (years) ⁽²⁾
Interstate Highways ⁽³⁾	50
Principal Arterials & Other Freeways and Expressways ⁽³⁾	50
Other Principal Arterial	25
Minor Arterial	25
Rural Major Collector	25
Urban or Rural Minor Collector	10
Frontage Roads (if not classified)	10

- (1) Contact the NDOT Planning Division for the latest roadway [functional classification maps](#).
 (2) If an existing roadway is known to have been designed for a higher return frequency than indicated in the above table, the higher return frequency shall be used for design.
 (3) Including ramps.

The hydrologic analysis shall consider the existing and future 20-year development or ultimate build-out condition in the contributing watershed. Verify assumptions with the Principal Hydraulic Engineer (PHE). The existing conditions shall be evaluated based on current development and current flood control facilities in place. If proposed flood control

Relevant Excerpts from the "Rancho/US95 Flood Hazard Mapping Restudy" 





NATIONAL FLOOD INSURANCE PROGRAM
FEMA PRODUCTION AND TECHNICAL SERVICES CONTRACTOR

November 30, 2009

The Honorable Sheri L. Buck
Mayor, City of North Las Vegas
2200 Civic Center Drive
North Las Vegas, NV 89030

IN REPLY REFER TO:
Case No.: 09-09-1685P
Community: City of North Las Vegas, NV
Community No.: 320007

316-PMR

Dear Mayor Buck:

This is in reference to a May 12, 2009, request that the Department of Homeland Security's Federal Emergency Management Agency (FEMA) issue a revision to the effective Flood Insurance Rate Map (FIRM) and Flood Insurance Study (FIS) for Clark County, Nevada and Incorporated Areas. Information pertinent to this revision request is listed below.

Requester:	Syndi Flippin-Dudley, Ph.D., P.E.
Identifier:	Rancho Drive / U.S. 95
Flooding Sources:	Unnamed Wash along U.S. Highway 95, Unnamed Wash along North Rancho Drive, Unnamed Wash along Gowan Road, and Unnamed Wash along Maverick Street and Duncan Drive
FIRM Panels Affected:	32003C2155 E and 32003C2160 E

At the request of FEMA, we reviewed the information submitted in support of this request and determined that the FIRM and FIS report should be revised as a Physical Map Revision (PMR). As a result of this PMR, the flood hazard information along the following areas will be revised: the Unnamed Wash along U.S. Highway 95, from approximately 1,480 feet upstream of Craig Road to just upstream of Gowan Road; the Unnamed Wash along North Rancho Drive, from approximately 260 feet upstream of Craig Road to approximately 100 feet upstream of Riverside Drive; the Unnamed Wash along Gowan Road, from just upstream of U.S. Highway 95 to just upstream of North Rancho Drive; and the Unnamed Wash along Maverick Street and Duncan Drive, from just upstream of North Rancho Drive to Gowan Road. However, because another PMR for Clark County, Nevada and Incorporated Areas is currently being processed, this PMR could not be processed at this time. At the request of your community, FEMA will incorporate this PMR into the ongoing PMR for Clark County, Nevada and Incorporated Areas.

Because this revision request also affects the City of Las Vegas and unincorporated areas of Clark County, separate letters for those communities will be issued on the same date as this letter.

LOMC Clearinghouse, 6730 Santa Barbara Court, Elkridge, MD 21075 PH: 1-877-FEMA MAP

BakerAECOM, under contract with the FEDERAL EMERGENCY MANAGEMENT AGENCY, is a
Production and Technical Services Contractor for the National Flood Insurance Program

2009 DEC - 7 PM 2:10
RFCD

The revision area described above is known collectively as the Unnamed Washes along U.S. 95 and North Rancho Drive and Gowan Road in the City of Las Vegas, Nevada. The property is approximately bounded on the west by North Tenaya Way, on the south by Riverside Drive, on the east by a line parallel to and approximately 1,000 feet east of Rancho Drive, and on the north by a line parallel to and approximately 350 feet north of West Craig Road.

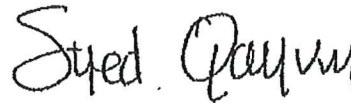
So that we may provide your community with the most up-to-date information possible, we request that your community review the affected FIRM panels and revised FIS report to determine if any additional changes are warranted. Examples of possible changes include updates to corporate limits or new streets. To assist us in processing the revised FIRM and FIS report in a timely manner, we request that your community submit such changes within 30 days of the date of this letter. Please submit any requested changes, along with supporting documentation (e.g., annotated copies of FIRM panels, corporate limits map, topographic mapping), to the address shown at the bottom of this page.

Before we initiate the revision and republication process, we will review and incorporate, as appropriate, any requested changes to the affected FIRM panel or revised FIS report that are received during this 30-day period. We will send preliminary copies of the revised FIRM and FIS report to your community for review. At that time, your community will have an additional 30 days to provide information to support other changes to the affected portions of the FIS report and map. We will review all information submitted during that 30-day period and incorporate it, as appropriate, before the FIS report and map are republished and distributed.

Your submittal of requested changes during the initial 30-day period will facilitate the revision and republication process. While it may be possible to incorporate requested changes later, it will likely cause significant delays in the revision and republication process. Therefore, if the data to support additional changes are not immediately available, or if additional time is needed, please inform us immediately.

If you have general questions about this case, the review and revision process, FEMA policy, or the National Flood Insurance Program, please call the FEMA Map Assistance Center, toll free, at 1-877-FEMA MAP (1-877-336-2627). If you have specific questions concerning this case, please contact your Revisions Coordinator for this request, Mr. Joseph Kuechenmeister, CFM, by e-mail at jkuechenmeister@mbakercorp.com or by telephone at (720) 479-3181.

Sincerely,



Syed Qayum, CFM
LOMR Technical Manager
BakerAECOM, LCC.

cc: Mr. Randy Fultz, P.E., CFM
Assistant City Engineer
City of Las Vegas

Mr. Kevin Eubanks, P.E., CFM
Assistant General Manager
Clark County Regional Flood Control District

RANCHO DRIVE / US 95 Flood Hazard Mapping Restudy

Additional Documents

Prepared For:

**CITY OF LAS VEGAS
DEPARTMENT OF PUBLIC WORKS
731 S. FOURTH STREET
LAS VEGAS, NV 89101**

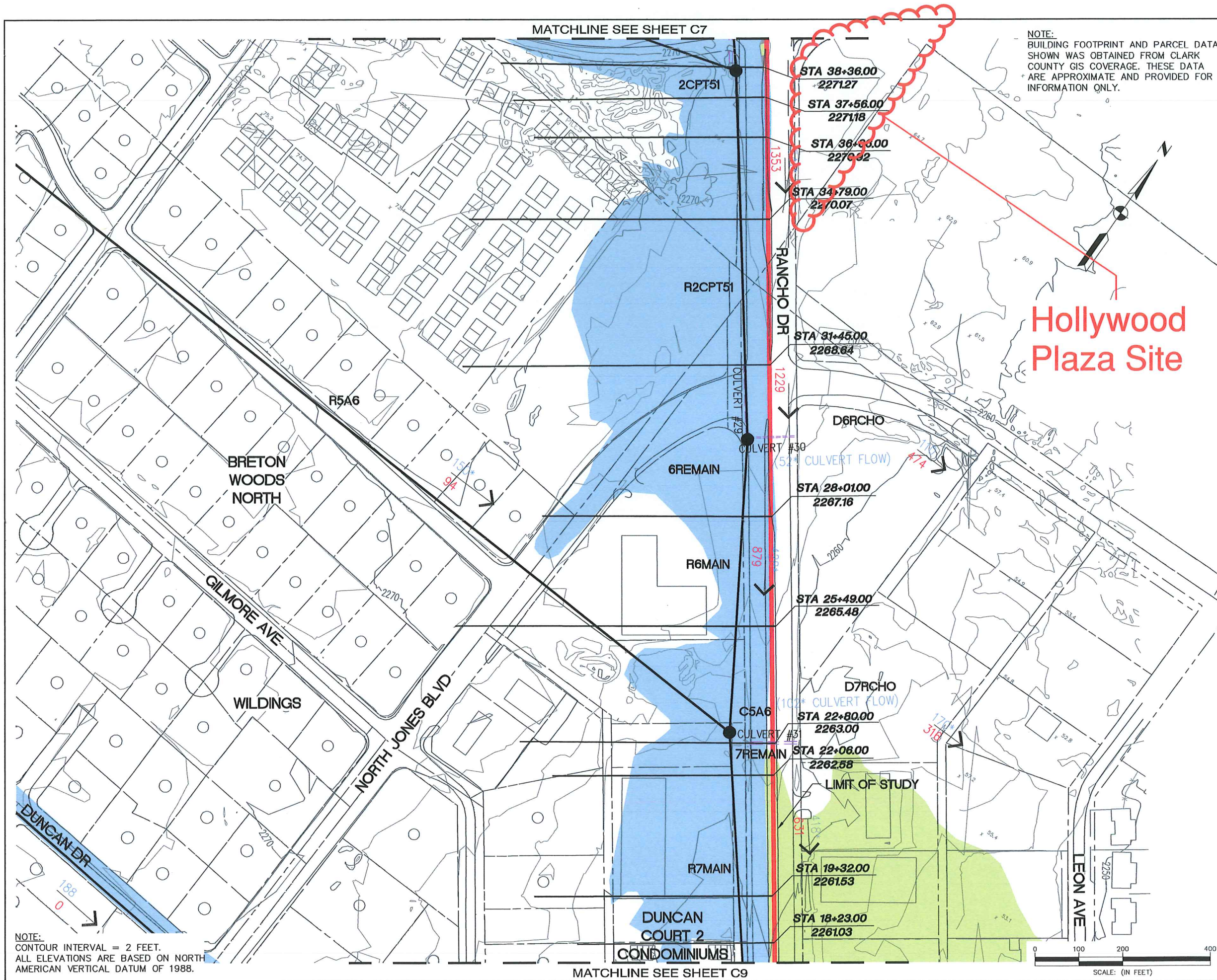


Prepared By:

**THE LOUIS BERGER GROUP, INC.
500 E. AMIGO COURT, SUITE 100
LAS VEGAS, NV 89119**



July 24, 2009



CITY OF LAS VEGAS
DEPARTMENT OF PUBLIC WORKS

RANCHO/US 95 LOMR
FLOODPLAIN DELINEATION

THE Louis Berger Group, INC.
500 E. Amigo Court, Suite 100 Las Vegas, Nevada 89119 Voice: 702-736-6632 Fax: 702-736-0704

LEGEND

- PROPOSED FLOOD ZONE AE
- EFFECTIVE FLOOD ZONE A OR FLOOD ZONE AE
- EFFECTIVE FLOOD ZONE X (SHADED)
- PROPOSED FLOOD ZONE X (SHADED)
- EXISTING CULVERT
- STA 0+00.00 2323.22 HEC-RAS CROSS-SECTION MARKER, STATION AND 100-YEAR BFE
- STA 0+00.00 WSPG WSPG STATION MARKER
- 1037 PROPOSED SDN5
- 1037* PROPOSED SDN3
- 1037 100-YEAR FLOW INDICATOR
- 1037* EFFECTIVE US95 FISR SDN5
- (1037) EFFECTIVE US95 FISR SDN3
- (FF=24.24) EFFECTIVE NLV FIS
- 20.8 FINISH FLOOR ELEVATION
- 2250 AERIAL TOPOGRAPHY SPOT ELEVATION AND MARKER
- 2 FOOT CONTOUR LINES
- HEC-1 NODE
- LIMITS OF RANCHO/US 95 LOMR STUDY

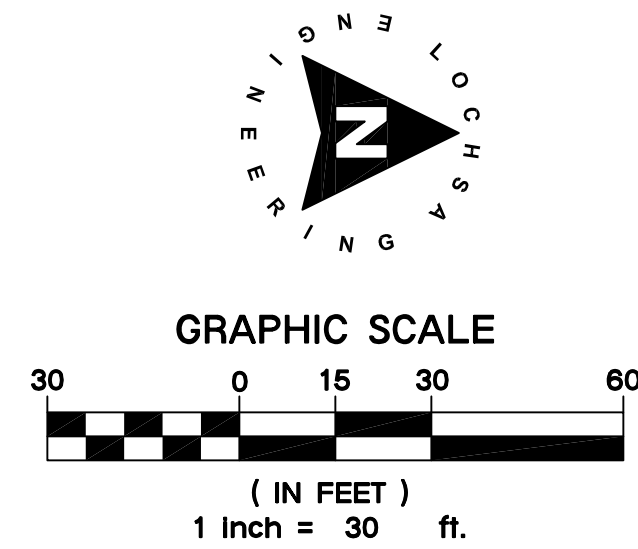
KEY MAP
NTS

CITY OF LAS VEGAS
CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

Drafted by: ARB/FKR Scale: AS NOTED Job Number: CB881
Checked by: FKR File Name: Sheet Number: C8R
Date: 07/10/09 881-C8.DWG

APPENDIX E

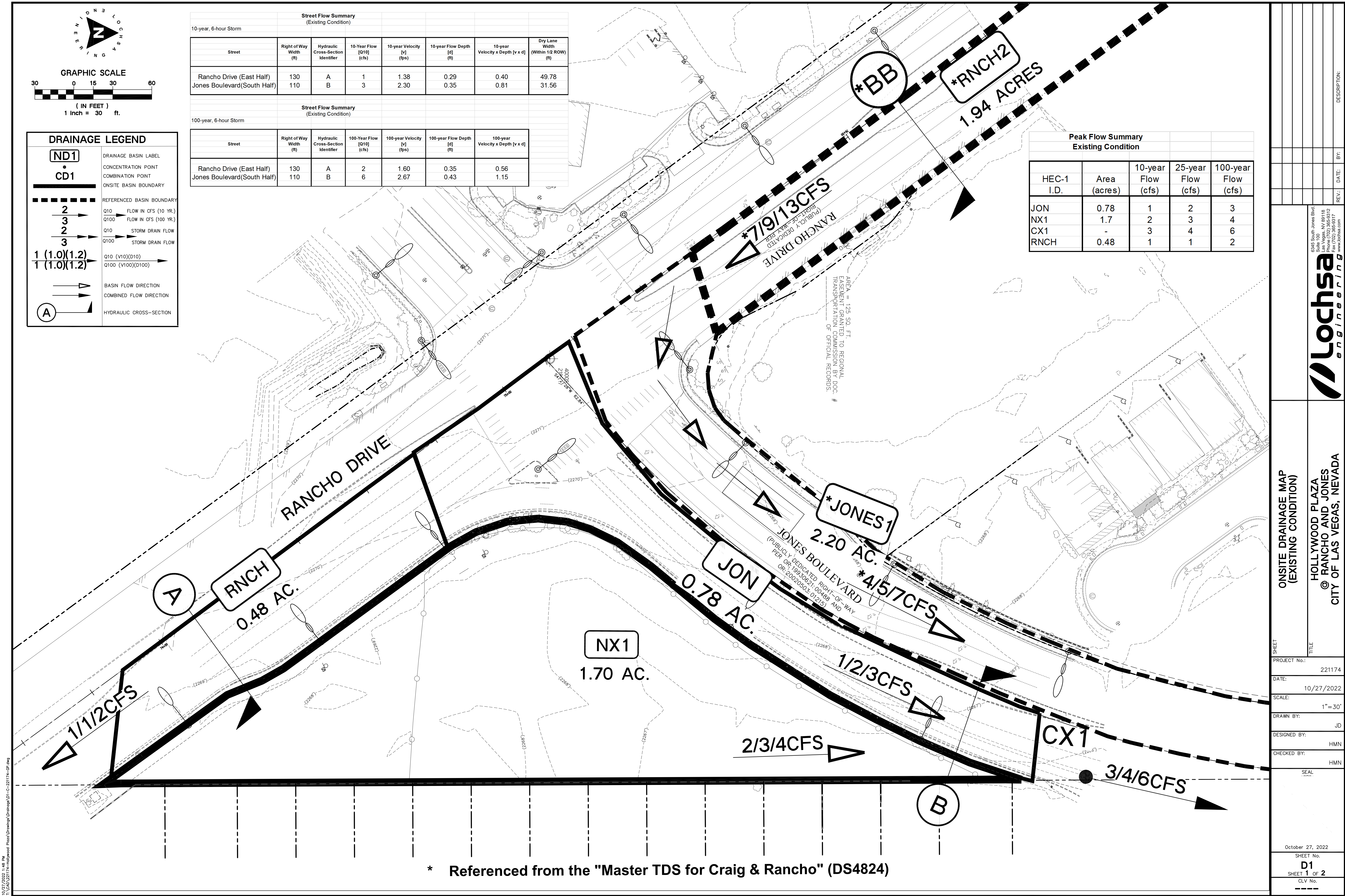
DRAINAGE MAPS

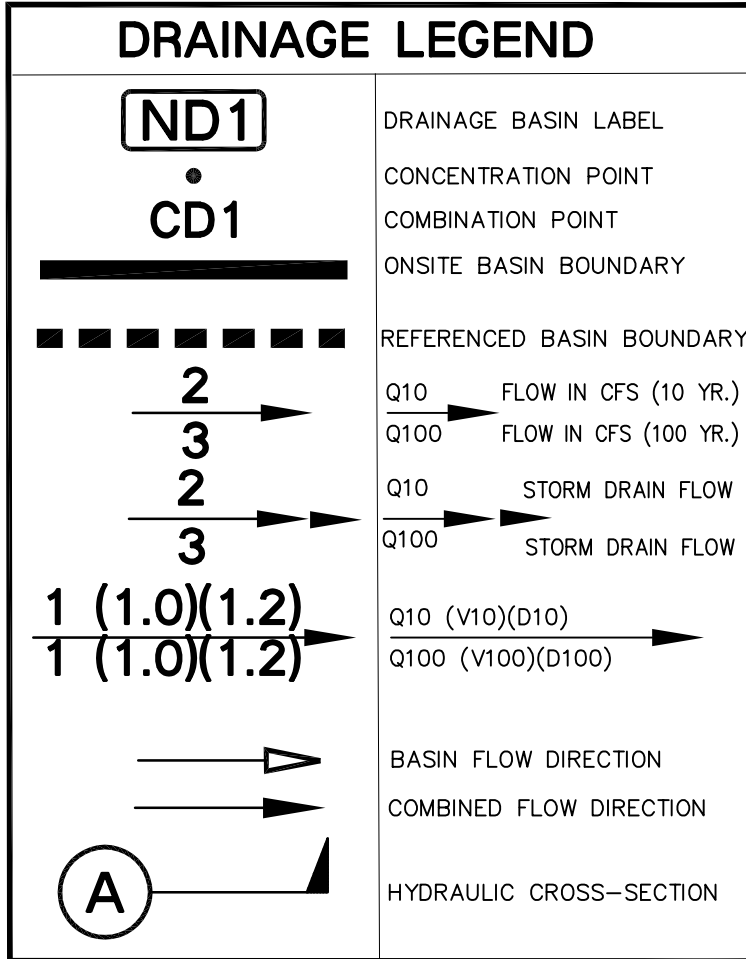
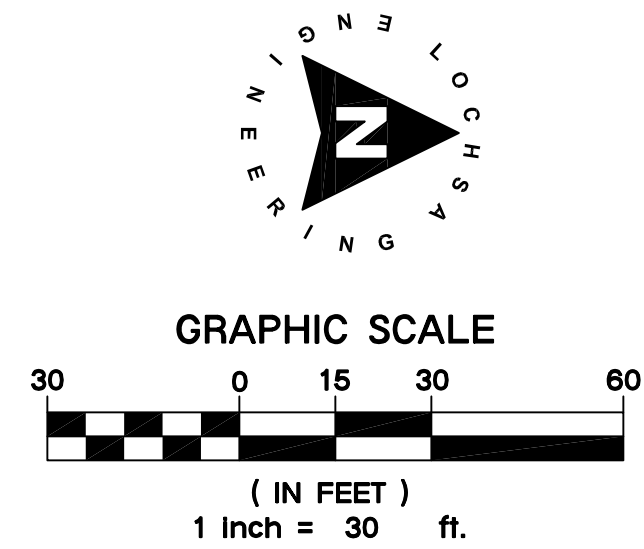


DRAINAGE LEGEND	
ND1	DRAINAGE BASIN LABEL
•	CONCENTRATION POINT
CD1	COMBINATION POINT
---	ONSITE BASIN BOUNDARY
---	REFERENCED BASIN BOUNDARY
2	Q10 FLOW IN CFS (10 YR.)
3	Q100 FLOW IN CFS (100 YR.)
2	Q10 STORM DRAIN FLOW
3	Q100 STORM DRAIN FLOW
1 (1.0)(1.2)	Q10 (V10)(D10)
1 (1.0)(1.2)	Q100 (V100)(D100)
→	BASIN FLOW DIRECTION
→	COMBINED FLOW DIRECTION
A	HYDRAULIC CROSS-SECTION

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 (East Half)	130	A	1	1.38	0.29	0.40	49.78
Jones Boulevard(South Half)	110	B	3	2.30	0.35	0.81	31.56
100-year, 6-hour Storm							
Street	Right of Way Width (ft)	Hydraulic Cross-Section Identifier	100-Year Flow [Q100] (cfs)	100-year Velocity [V] (fps)	100-year Flow Depth [d] (ft)	100-year Velocity x Depth [v x d]	
Rancho Drive (East Half)	130	A	2	1.60	0.35	0.56	
Jones Boulevard(South Half)	110	B	6	2.67	0.43	1.15	

Peak Flow Summary Existing Condition				
HEC-1 I.D.	Area (acres)	10-year Flow (cfs)	25-year Flow (cfs)	100-year Flow (cfs)
JON	0.78	1	2	3
NX1	1.7	2	3	4
CX1	-	3	4	6
RNCH	0.48	1	1	2





Street Flow Summary (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)
Rancho Drive (East Half)	130	A	1	1.38	0.29	0.40	49.78
Jones Boulevard(South Half)	110	B	4	2.50	0.38	0.95	30.24

Street Flow Summary (Developed Condition)							
100-year, 6-hour Storm							
Street	Right of Way Width (ft)	Hydraulic Cross-Section Identifier	100-Year Flow [Q100] (cfs)	100-year Velocity [V] (fps)	100-year Flow Depth [d] (ft)	100-year Velocity x Depth [v x d]	
Rancho Drive (East Half)	130	A	2	1.60	0.35	0.56	
Jones Boulevard(South Half)	110	B	8	2.81	0.47	1.32	

Onsite Flow Summary (Developed Condition)				
100-year, 6-hour Storm				
Hydraulic Cross-Section Identifier	100-Year Flow [Q100] (cfs)	100-Year Velocity [V] (fps)	100-Year Flow Depth [d] (ft)	100-Year Velocity x Depth [v x d] (ft²/s)
1	2	1.26	0.21	0.26
2	1.5	1.03	0.28	0.29
3	3	1.80	0.39	0.70
Riprap Swale for ND1	2	1.57	0.45	0.71

Peak Flow Summary Developed Condition				
HEC-1 I.D.	Area (acres)	100-year Flow (cfs)	25-year Flow (cfs)	10-year Flow (cfs)
JON	0.78	1	2	3
ND1	0.75	1	2	2
ND2	0.81	1	2	3
CD1	-	4	6	8
RNCH	0.48	1	1	2
ND3	0.14	<1	<1	<1
CD2	-	1	1	2

