DS #: 4927

APN: 139-20-301-016 & 002

PROJECT: Ollie Detwiler Elementary School

SUBMITTAL: 1st

SCANNED BY/DATE:

CHECKED BY/DATE:

CITY OF LAS VEGAS NEVADA

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM				DATE: October 31, 2017
TO: **Land Development Services** Department of Building & Safety				FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT:	Drainage Study for: **Ollie Detwiler Elementary School**			**COPIES TO:** Collins Engineers Inc.
Cross Streets:	SEC of Ferrell Street & Coran Lane			School Board of Trustees Clark County School District
File Number:	F:\Depot\DSMemos\DS4927A.doc			Bart Anderson, P.E., DevCo
Parcel Number:	139-20-301-016 & 002			CNLV
Zoning Action:	SDR-71687 & VAR-71686			
FEMA Flood Zone	YES	NO	X	
Proposed Storm Drain	YES	NO	X	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1st Submittal	10/12/2017 & 10/25/2017	10/30/2017	See Comments Below	$400.00	490550: $400
			TOTAL FEES (LDDRS):	**$400.00**	----

REMARKS:

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

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

1. Provide a copy of the zoning/planning conditions associated with this site (**SDR-71687 & VAR-71686**) with the next submittal to verify compliance with conditions. *Flood Control* will not issue conditional approval of the drainage study without the associated zoning/planning conditions (issued by the *City Council*). Any associated conditions of approval that revise the site drainage parameters will require that the drainage study be revised and resubmitted.
2. It appears that the existing drainage channel along the adjacent parcel to the south (APN:139-20-301-011) should be an existing public drainage easement. Please label the drainage easement record number on the grading sheets.
3. Provide a flowmaster report including the calculated flow depth for the proposed 2' valley gutter between the proposed classroom building and the existing classroom building, and for the on-site swale along the north side of the proposed classroom building.
4. Provide existing flowline elevations along the valley gutter located on the east side of the site to confirm the delineation of the drainage boundary and the direction of flow.
5. Please note that the "future building footprint" is not approved per this study and any additional construction will require a technical drainage study update.

6. The K value for the Existing Condition Time of Concentration calculations is shown to be 0.766 for the curve number 88, per the given equation K=0.0132 (CN)-0.39 this value should be 0.7716, please revise.

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
WSP/AYS

T/R/S: T20S/R61E/20
AREA M-20

****
*** FAX TX REPORT ***
****

TRANSMISSION OK

JOB NO.	0754
DESTINATION ADDRESS	7022488070
PSWD/SUBADDRESS	
DESTINATION ID	
ST. TIME	10/31 14:07
USAGE T	00'37
PGS.	2
RESULT	OK

CITY OF LAS VEGAS
INTER-OFFICE MEMORANDUM

DATE: October 31, 2017

TO:
Land Development Services
Department of Building & Safety

FROM:
Albert Sung, P.E.
Flood Control Project Engineer
Department of Public Works

SUBJECT: Drainage Study for:
Ollie Detwiler Elementary School

COPIES TO:
Collins Engineers Inc.
School Board of Trustees Clark County School District
Bart Anderson, P.E., DevCo
CNLV

Cross Streets:	SEC of Ferrell Street & Coran Lane
File Number:	F:\Depot\DSMemos\DS4927A.doc
Parcel Number:	139-20-301-016 & 002
Zoning Action:	SDR-71687 & VAR-71686

FEMA Flood Zone	YES	NO X
Proposed Storm Drain	YES	NO X

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1st Submittal	10/12/2017 & 10/25/2017	10/30/2017	See Comments Below	$400.00	490550: $400
			TOTAL FEES (LDDRS):	**$400.00**	-----

REMARKS:

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

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

1. Provide a copy of the zoning/planning conditions associated with this site (**SDR-71687 & VAR-71686**) with the next submittal to verify compliance with conditions. *Flood Control* will not issue conditional approval of the drainage study without the associated zoning/planning conditions (issued by the *City Council*). Any associated conditions of approval that revise the site drainage parameters will require that the drainage study be revised and resubmitted.
2. It appears that the existing drainage channel along the adjacent parcel to the south (APN:139-20-301-011) should be an existing public drainage easement. Please label the drainage easement

Albert Sung

From: Said Mohammed <smohammed@collinsengr.com>
Sent: Wednesday, November 29, 2017 8:12 AM
To: Albert Sung
Cc: Thomas Miller; Armando Pineda
Subject: TDS Application Pull out Request for Detwiler Elementary School (DS 4927)

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

SUBJECT: TDS Application Pull out Request for Detwiler Elementary School (DS 4927)
Collins Engineers Project No. 10483

Dear Mr. Sung:

Due to the SDR (Key Number 644037) of the project, Flood Control Section conditional approval with the requirement to meet with Flood Control Department to establish the finished floor elevation, I am politely requesting to pull out the application for this study and request a finished floor elevation meeting with you.

If you have any suggestion or additional information, please feel free to contact this office.

Respectfully,

Said A. Mohammed, P.E.*, C.F.M, Ph.D.
Sr Project Engineer
COLLINS ENGINEERS, INC.
3130 South Durango Drive, Suite 404
Las Vegas, NV 89117
Direct 702-505-8280
Main 702-248-8000
Mobile 702-327-8821
Fax 702-248-8070
smohammed@collinsengr.com
24-Hour Emergency Response 877.346.3234
Visit us at www.collinsengr.com
* Licensed in the State of Nevada









Technical Drainage Study
For
Ollie Detwiler Elementary School
APN:139-20-301-016 & 139-20-301-002

October 2017

Prepared for:

School Board of Trustees
Clark County School District
4170 McLeod Dr.
LasVegas, NV,89121
Contact: Steve Drews
Phone: (702) 799-8710 Ext. 5226
E-mail: drewss@nv.ccsd.net

Prepared by:

COLLINS ENGINEERS INC.

3130 S. Durango Drive, Suite 404
Las Vegas, Nevada 89117
702.248.8000 • www.collinsengr.com

COLLINS ENGINEERS INC.

October 2, 2017

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

Subject: **Technical Drainage Study for Ollie Detwiler Elementary School**
Collins Engineers Project No. 10483

Dear Mr. Sung:

Enclosed please find one (1) copy of the Technical Drainage Study and the CD (An electronic copy of the Study) for Ollie Detwiler Elementary School Improvement for your review comment and approval.

The proposed development is an additional classroom building and surface parking lot on ±1.1 acres of 11.87 acres school properties (APN: 139-20-301-016 and 002). The site is located on the Southwest corner of Lake Mead Boulevard and Simmons Street, Las Vegas, NV.

The following study shows the proposed development is in compliance with City of Las Vegas and Clark County Regional Flood Control criteria.

If you have any questions or additional information is needed, please feel free to contact our office.

Respectfully,

Said A. Mohammed, P.E., CFM, Ph.D.
Sr. Project Engineer
Collins Engineers, Inc.

James Yancey, P.E.
Group Manager
Collins Engineers, Inc.

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HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: **Ollie Detwiler Elementary School** Date: 10/5/2017

Location of Development: a) Descriptive (Cross Streets) North/South:Simmons Street

East/West:Lake Mead Bolevard

b) Section: **20** Township: **20 South** Range: **61 East**

C) APN: **139-20-301-016 & 002**

Name of Owner :School Board of Trustees, % Real PPTY MGT

Telephone Number: **702-799-8710 ext. 5226** Fax No: **Email Address:**

Address: 1180 Military Tribute PL , Henderson , NV, 89074

Contact Person Name: **Said A. Mohammed** **Telephone Number: (702) 248-8000**

*** Email Address** Smohammed@collinsengr.com **Fax Number: (702) 248-8070**

Firm: Collins Engineers, Inc.

Address: 3130 South Durango Dr., Suite 404, Las Vegas, Nevada 89117

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	X	**Building Permit**		

1. Total Owned Land Area: At Site: **±11.87 Ac.** Being Developed: **± 1.1 Ac**
2. Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? ☐ **Yes**** ☒ No
3. Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? ☐ Yes** ☒ No
4. Proposed type of development (Residential, Commercial, Etc.)? **School (Commercial)**
5. Approximate upstream land area which drains to the subject site? **± 6 Ac**
6. Has the site drainage been evaluated in the past? Yes ☒ No ☐

   IF Yes, Please identify documentation: TDS for Ollie Detwiler Elementary School (.HTE # 98-18795)

7. If known, please briefly identify the proposed discharge point(s) of runoff from the site:

   Runoff from the site drains towards Coran Ln., and via the existig wall openting towards the existing channel.
8. Briefly describe your proposed schedule for the subject project: **As Soon As Possible**

PROFESSIONAL ENGINEER-STATE OF NEVADA
SAID ALI MOHAMMED
EXP. 12-31-17
CIVIL
No.19273
10/05/17

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: Collins Engineers Project No. 10483

STANDARD FORM 1

updated 05/01/2008

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

Project Name: Ollie Detwiler Elementary School	Map ID:	
Firm Name: Collins Engineers	Engineer: Said A. Mohammed, P.E.	
Address: 3130 South Durango Drive, Suite 404		
City: Las Vegas	State: NV	Zip: 89117
Phone Number: (702) 248-8000	Fax Number: (702) 248-8070	
Property Owner: School Board of Trustees		
Address: %Real PPTYMGT, 1180 Military Tribute PL	Contact: (702) 7998710 Ext 5226	
City: Henderson	State: NV	Zip: 89074
Revised 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 (HC&DDM).

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 REQUIREMENTS

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

REFERENCE:	**STANDARD FORM 2**

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

II. MAPS AND EXHIBITS

YES	NO	
X		A copy of a current Flood Insurance Rate Map (FIRM) with the site delineated.
X		A copy of the current CCRFCD Master Plan Update Figure, for Flood Control Facilities and Environmental areas with the site delineated.
X		Off-site drainage basin maps for existing, interim and future conditions showing the existing topography, basin boundaries, concentration points, and flows in cfs.
X		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.
X		Vicinity Map with local and major cross streets identified and a north arrow.

III. DRAINAGE PLAN

YES	NO	
X		Sheet size: 24" x 36" sealed by a registered engineer in the State of Nevada
X		Minimum scale: 1"=60'
X		Project Name.
X		Vicinity Map with local and major cross streets.
X		Revision box.
X		North arrow and bar scale.
X		Engineer's /consultants address and phone number.
X		Elevation datum and benchmark.
X		Legend for symbols and abbreviations.
X		Cut/fill scarps, where applicable.
X		Street names, grades, widths.
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.
X		Existing contours encompassing the site and 100 feet beyond with spot elevations for important locations, where appropriate.

REFERENCE:	**STANDARD FORM 2**

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

YES	NO	
X		Minimum finished floor elevations with top-of-curb elevations at upstream end of lot.
X		Proposed typical street sections.
	N/A	Streets with offset crowns.
X		Proposed contours or spot elevations in sufficient detail to exhibit intended drainage patterns and slopes.
X		Property lines.
X		Right-of-way lines and widths, existing and proposed.
X		Existing improvements and their elevations.
X		Delineation of proposed on-site drainage basins indicating area and 10-year and 100-year storm peak flows at basin concentration points.
X		Concentration points and drainage flow direction with Q_{100} and V_{100} and D_{100} in streets.
X		Cumulative flows, velocity, and direction of flow at upstream and downstream ends of site for the 10-year and 100-year flows.
X		Location and cross-section of street capacity calculations.
X		Cross-sectional detail for channels, including cutoff wall locations.
X		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.
X		Existing and proposed drainage easements and widths shown with sufficient detail. A cross sectional detail must be provided that shows appropriate lining and reinforcement.
X		Location and detail of existing, proposed, and future block wall openings. Minimum size is 16" x 48". Wrought iron gate is required for flows > 10 cfs.
	N/A	Location and detail of flood walls illustrating depth of flow, proposed grouting height, etc.
X		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.
	N/A	Building and/or lot numbers.

REFERENCE: | **STANDARD FORM 2**

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

YES	NO	
	N/A	Alignment of all existing, proposed, or future Regional Facilities adjacent to the site. Facilities are not listed as Regional.
	N/A	Limits of existing floodplain based on current FIRM or best available information; limits of proposed floodplains based on best available information.
	N/A	For areas in Zone A, AE, AH, and AO, base flood elevations (BFEs) must be shown for each lot; BFEs may be listed on each lot, or in a table. Finish floor elevations must be a minimum of 18 inches above BFE. N/A
	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.
	N/A	Street slopes for perimeters and interior streets. The minimum slope is 0.4 percent.
	N/A	Location and detail of best management practice (BMP) for parking lots and low impact development (LID) (if required).

IV. Hydrologic Analysis

X		Appropriate soil information for existing and future conditions.
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 sub-basin boundaries and cutoffs, supporting assumptions, and calculations.
X		A summary table of stormwater flows showing basin area, Q10 and Q100 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 owners in accordance with current Nevada Drainage Law.
	N/A	Calculations for impervious area for parking lots and LIDs (if required)

REFERENCE: | **STANDARD FORM 2**

DRAINAGE SUBMITTAL CHECKLIST

V. HYDRAULIC ANALYSIS

YES	NO	
	N/A	Flow split calculations and supporting documentation or reference for the method of flow split calculations used.
X		Normal depth street flow calculations and cross section diagrams for all interior and perimeter street. Provide "d x v" products for the Q_{100} and Q_{10} flows representing the worst case for interior and all perimeter streets. Q_{100} d x v $\leq$8. Q_{10} d x v $\leq$ 6 and 12 foot dry lane for rights-of –way $\geq$ 80 feet. Calculations must be labeled by street name as indicated on the Grading Plan.
X		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.
	X	Appropriate hydraulic calculations for block wall openings assuming a 50 percent vertical clogging factor. (Assume the lower half of the opening is plugged.)
	X	Appropriate hydraulic calculations at drainage easement entrance and discharge locations to set finish floor elevations. Hydraulic calculations must include submerged weir, super elevation and tee intersection losses, where appropriate.
X		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, which ever is greater.
	N/A	A complete water surface profile analysis (HEC-2, HEC-RAS, etc.) for channel flows and FEMA Zone A flood zones. N/A - 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 this report.
X		Provide a 50 percent clogging factor in the capacity calculations for drop inlets.
X		Hydraulic calculations for culverts and storm drains. D-load calculations must be provided for storm drain pipes in public right-of-way, including headwater pool inundation.
X		The mitigation of nuisance water, both during construction and in the fully developed condition, must be addressed.
	N/A	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. SAM 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.)

II. GRADING PLAN INFORMATION		
Yes	No	
X		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.
X		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.
X		Back of lot elevations and lot drainage pattern for all lots including common lots.
X		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.
X		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.)
X		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	
	N/A	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?

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.

I. GENERAL DESCRIPTION

A. Study Overview And Purpose

This study has been prepared as the Technical Drainage Study for Ollie Detwiler Elementary School development within the properties: APN 139-20-301-016 and 002. The development consists of one (1) additional classroom building with ±15, 750 square foot foot-print area at the northeast corner of the site, a surface parking lot at the southwest portion of the site, and a driveway from Ferrell Street.

This study was conducted in accordance with the criteria set forth by Clark County Regional Flood Control District (CCRFCD) Hydrologic Criteria and Drainage Design Manual (Criteria Manual), adopted August 1999, by WRC Engineering (updated by Montgomery Watson) and revised September 12, 2013.

The following tasks were performed in the preparation of this report:

- Review of the Approved Technical Drainage Study for the properties and in the vicinity of the site.
- Identification of the Federal Emergency Management Agency (FEMA) Flood Plain designation for the project site,
- Identification of known, existing or planned Clark County Regional Flood Control District (CCRFCD) or local drainage facilities that affect or are affected by the site and,
- Estimation of runoff generated within and around the project site for the 10 and 100-year storm events to set the finished floor elevation of the proposed building and design storm drain facilities.

The purpose of this analysis is to obtain an approved drainage study to allow development of the site.

B. Site Description and Location

Ollie Detwiler Elementary School is located on the Southwest corner of Lake Mead Boulevard and Simmons Street. The site is bordered: on the west, by fully developed Ferrell Street, and residential property (APN 139-20-310-041); on the south, by fully developed multifamily residential property (APN: 139-20-301-011); on the east, by fully developed RE residential property (APN: 139-20-301-003); and on the north, by fully developed Public Street (Coran Lane). The subject properties are identified by APN: 139-20-301-016 and 002. For more information see Figure 1 (Assessor's Parcel Map), Figure 1-A (Aerial Map), and Figure 2 (Vicinity Map) in Appendix A.

C. Master Planning Information

Figures 3 and 4 are the reproductions of the Clark County Regional Flood Control District 2013 Las Vegas Valley Flood Control Master Plan Update F-26. Per these figures, there is no proposed, or existing CCRFCD Facility adjacent to the site properties. A 36" RCP Facility LVLM0224 is located one property along Lake Mead Boulevard, but the site does not drain towards the existing facility. Figure 3 and 4 are included in Appendix A.

D. FEMA Floodplain Information

Figure 5 is a reproduction of the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map for Clark County, Nevada, Community Panel Number 32003C2160F effective

November 16, 2011. Figure 5 shows that part of the proposed site is located within Un-Shaded Flood Zone "X". Un- Shaded Flood Zone "X" is defined by FEMA as an area outside the 500-year floodplain. Figure 5 is included in Appendix A.

E. Previous Drainage Study

The following approved drainage study was reviewed in the preparation of this technical drainage study.

- Technical Drainage Study for Ollie Detwiler Elementary School, DS # 2333 & HTE # 98-18795, by PBS&J, July 1st, 1998. The Clark County approved the study on February 5, 1999, and the City of Las Vegas on July 29, 1998.

- Technical Drainage Study for Lake Mead and Simmons, HTE # 06-13355, by Integrity Engineering, March 5, 2006, and approved by Clark County on October 31st, 2006.

Collins Engineers has reviewed the PBS &J and Integrity Engineering studies and concurs with, and accepts, the analysis as presented in this approved drainage study. Refer to specific cited and highlighted sections of these studies in Appendix D.

II. HYDROLOGIC PARAMETERS

The SCS Unit Hydrograph Methodology in conjunction with the HEC-1 Flood Hydrograph Package, from the US Army Corps of Engineers, was used to determine the peak runoff generated by the 10-year and 100-year, 6-hour storm events. Parameters used in the HEC analyses are described in the following paragraphs (refer to HEC-1 output data in Appendix B.)

A. Precipitation

Figure 513 of the Clark County Regional Flood Control District Hydrologic Criteria and Drainage Design Manual (The Manual) shows the property is located within the McCarran Airport Rainfall Area. The 6-Hour, 10-year and 100-year storm event rainfall depths were obtained from Table 505 of the Manual. The values referenced are 1.58 inches and 2.77 inches for 10 and 100-Year Storm events respectively. The six-hour depth-area reduction factor of 1.00 is accepted based on the site area which is less than 0.5 square miles. The 10-year/100-year precipitation depth ratio, for the HEC-1 analysis, is calculated and accepted as 0.57 (see Precipitation Depth Calculation, Appendix B). To incorporate the 10 and 100-year diverted flows into the HEC-1 model separately this ratio was not used in the calculation. The existing and developed HEC-1 models are calculated separately for 10 and 100-Year storm events. See Appendix B for all models.

The Rainfall Calculation Table for the final precipitation values and referenced materials are included in Appendix B.

B. Soil Classification

The soil information for the study area was determined from the 2008 Las Vegas Valley Flood Control Master Plan Update (Hydrologic Subareas, Land Use & Soils) H-26 (Figure 6 is included in Appendix A). Using the type of soil indicated on the map, the site soil accepts as soil type "D."

According to the Web Soil Survey (WSS) Map, the proposed site is located on Soil Map Unity Symbol 300 -Las Vegas gravelly fine sandy loam, 0 to 2 percent slopes. Per WSS, Map Unity

Symbol is classified as Hydrologic Soil Group" D". The current Web Soil Survey Map and Table15 are included in Appendix B.

In the existing condition, the west portion of the school property is fully developed with building and paved area. It is considered as a fully developed commercial property. Per the Manual (Table 602, Sheet 1 of 4) a curve number 95 is used for HEC -1 analysis. The east portion is fully covered by grass (a curve number CN=88 is used.) For existing condition HEC-1 analysis composite curve numbers are calculated based on the grass coverage of the area.

In developed condition, the project site will be a full developed commercial property, so per Table 602 (Sheet 1 of 4) a curve number (CN) 95 is accepted for developed HEC-1 analysis. The curve number summary table is included in Appendix B.

C. Time of Concentration and Lag Time

Time of Concentration calculations were performed per section 602 of the HCDDM for basins less than one square mile. The methodology was developed by the Federal Aviation Administration (FAA1970) and is outlined as follows:

$$t_c = t_i + t_t$$

TLAG = 0.60* t_c / 60 (hr.) – Lag time used in HEC1 model

In which t_c = Time of Concentration (min)
t_i = Initial, Inlet, or Overland Flow Time (min)
t_t = Travel Time in the Ditch, Gutter, Storm Sewer, etc. (min)

The initial overland flow time is calculated as follows:

$$t_i = 1.8(1.1\text{-}K)L_o^{1/2}/S^{1/3}$$

Where K = flow resistance factor
L_o = overland flow length
L = length of channel (etc.)
S = average slope of basin (%)

For SCS & TR55 unit hydrographic Methods

$$K = 0.0132(CN) - 0.39$$

Where: CN = SCS runoff curve number
t_t = L/60V (min)
V = average channel velocity (ft. /sec)

Velocity determination for time of concentration

At the upstream end of a drainage area, the initial overland flows begin to collect and gradually increase from small, shallow flows to larger, deeper flows with greater velocities. To estimate the average velocity for flow condition that constantly varies throughout the length of drainage area, two generalized relationships can be used. Velocity V_1 applies to the small shallow flows in the first 500 feet or less of travel distance and velocity V_2 applies to the remainder of the travel distance

where the velocity is greater. Manning's equation was used to derive formulas for estimating the two travel time velocities. The equations are as follows:

$V = CS^{1/2}$ $C = 1.49/n\ R^{2/3}$ $R = A/P$

Where: V = Average Velocity (fps)
S = Average Slope (ft./ft.)
N = Manning's Roughness Coefficient
R = Hydraulic Radius (ft.)
P = Wetted Perimeter (ft.)
A = Area of Flow (sq. ft.)

Two sets of coefficients were determined, one for developed conditions and the other for undeveloped conditions. For the first developed-conditions velocity (V1), the appropriate coefficient (C=20.2) represents street flow with n = 0.016 and a depth of flow in the gutter of 0.3 feet. For the second developed-conditions velocity (V2), the appropriate coefficient (C=30.6) represents curb height street flow. As may be noted, V2 is approximately equal to 1.5 times V1. Typically, drainage areas are delineated such that the channelized flow considered in the calculations of travel times is within streets and other minor watercourses and does not include significant lengths of major improvement floodway and channels in the travel distance for the time of concentration. For the first undeveloped conditions velocity (V1), the appropriate coefficient (C = 14.8) represents wide channel flow with D = 0.25' and n = 0.04. For the second undeveloped conditions velocity (V2), the appropriate coefficient (C = 29.4) represents wide channel flow with a depth of 0.7 feet and n = 0.04.

For urbanized basins, the time of concentration should not exceed the time of concentration calculated by the following equation.

$t_c = L/180 + 10$

Where: L = Watershed Length (ft.)

Additionally, the minimum t_c for urbanized areas is 5 minutes.

These methods are consistent with the methods outlined in Technical Release 55, SCS (TR55) for calculating the time of concentration and should provide times of concentration and lag times that are consistent with one another and with the degree of accuracy of typical hydrologic modeling.

The Standard Form 4 for Existing and Developed conditions are included in Appendix B.

III. HYDROLOGY

A. Hydrologic Methodology and Criteria

The U.S. Army Corps of Engineers HEC-1 Flood Hydrograph Package was used to determine the peak runoff values generated by the 10 and 100-Year, 6-hour storm events. The HEC-1 input and output values for the existing and developed condition are included in Appendix B.

B. Existing Drainage Condition

The following description refers to Figure 9, Existing Condition Drainage Basin Map which is included in Appendix A.

The existing on-site drainage basins were determined from the available aerial topography, GISMO, and field investigation. Based on the topography and surrounding property conditions, the site property is divided into 3 sub-basins. The northwestern portion of the site (ONX1) with 3.2 acres generates 4/8 cfs in 10 and 100-year storm events respectively. It drains towards Coran Ln

The northeastern portion of the site (basin ONX2) with 2.4 acres generates 3/7 cfs. It drains towards the northeast corner of the school property and discharges into Coran Ln.

The southern portion of the site (basin ONX3) with 6.5 acres generates 7/16 cfs. This flow with the off-site flow which enters to the site from the Cul-de-sac of Ferrell Street drain towards the existing 4: block wall openings. The basin area and flow rates during the 10-year and 100-year storm events are included in Table 1.

Off-site Flow

Off-site flow at Coran Lane is taken from the referenced study (REF 2 @ CP4). Per this study, Coran Ln. carries 33/101 cfs in 10 and 100-year storm events.

The site property accepts off-site flow from the southwest side of the school property via existing sidewalk drain which is located at the Cul-De-Sac of Ferrell Street. Per the approved study for the property (Ref. 1), the school property accepts a total of 6/14 cfs. This flow with the on-site flow drains towards the existing 4:16"x48" block wall openings, then it discharges into the existing drainage channel south of the properties. The channel discharges its flow into the Simmons Street ROW.

C. Developed Drainage Condition

The following description refers to Figure 10, Developed Condition Drainage Basin Map which is included in Appendix A.

The Ollie Detwiler Elementary School flow pattern was set per the approved study for the site (Ref 1). The current development does not affect any of the site general drainage pattern and flow quantity.

Basin OND1 remains the same as in existing condition. Onsite basin OND2 has a minor change (a portion of the grass coverage changed to the commercial type of coverage), and the composite curve number (CN) changed to 95. However, the flow quantity remains the same.

In developed condition a portion of onsite basin OND3 is replaced by proposed surface parking lot. Since the type of cover does not change from the existing condition, the flow quantity remains the same.

In the developed condition, the off-site flow pattern and quantity does not change. Offsite flow from Ferrell Street drains via the proposed parking lot towards the existing block wall opening. The new development does not affect the general flow pattern on the site along the south side of the property.

The basin area and flow rates during the 10-year and 100-year storm events are included in Table 1.

D. Future Drainage Condition

The properties around the site are fully developed and the developed condition flows will remain the same as in the future condition, so no additional evaluation is required.

IV. HYDRAULIC ANALYSIS

A. Peak Flows

The following Table 1 shows a summary of the runoff generated by each basin determined from the HEC-1 model. The HEC-1 analyses in the existing and developed conditions are included in Appendix B.

Table 1
Peak Flow Summary

Basin	Area (ac)	10-year Flow (cfs)	100-year Flow (cfs)
Existing Condition			
ONX1	3.2	4	8
ONX2	2.4	3	7
ONX3	6.5	7	16
Developed Condition			
OND1	3.2	4	8
OND2	2.4	3	7
OND3	6.5	7	16

B. Flow Depth Analysis

The Flow Master V8i computer program was utilized to determine the maximum velocity and depth for the on-site and off-site Street flows. Table 2 summarizes the flow depth analysis for the 10-year and 100-year storm events for the hydraulic sections shown in Figure 8. Copies of the flow depth calculations are included in Appendix C.

The finished floor elevation of the proposed building is set at 2111.75' (±2.7' above the highest TC elevation in Coran Ln, and ±3.3' above the center line finished grade elevation at the middle of the building).

Per the referenced study (REF 2) flow depth analysis, in Coran Ln. The 100-year flow (Q_{100} = 101 cfs) creates a 0.86' depth of flow. Taking the average slope of Coran Lane (0.75%) the 100-year flow creates 0.79' depth of flow in Coran Ln. Based on the worst condition (0.86' depth of flow which is taken from REF2), the proposed building finished floor elevation (2111.75) is set ±2.5' above the 100-year water surface elevation at the high side of the building (WSE=FLE+d_{100}=8.39+0.86=9.25).

Table 2
Flow Depth Analysis

Hydraulic Section	Street Width (ft.)	Slope %	Q_{100} (Cfs.)	D_{100} (ft.)	V_{100} (Fps.)	VD_{100}	Q_{10} (Cfs.)	D_{10} (ft.)	V_{10} (fps	VD_{10}
FM1	60	0.75	101	0.79	4.38	3.46	33	0.60	2.87	1.72
FM2	N/A	0.4	4.6	0.42	1.39	-	-	-	-	-

The site accepts off-site flow from Ferrell Street, conveys through and discharges via the existing 4:16"x48" wall opening into the existing storm drain channel which is located south of the site properties.

C. Storm Drain Capacity Analysis

The Ollie Detwiler Elementary School drainage pattern was set per the 1998 study (Ref 1). Off-site and on-site flow from the southern portion of the site property (ONX3/OND3) drains towards the existing 4-16"x48" block wall openings (BWO), These block wall opening discharge their flows into the existing drainage channel in the south adjacent property (APN 139-20-301-011) which carries towards Simmons Street. The total flow (30 cfs) from basin OND3 and REF 1 are conveyed by existing four (4) block wall openings (the maximum carrying capacity of one BWO with 50% clogging factor is 8.2 cfs). The block wall opening capacity analysis is included in Appendix C.

The rest, basin OND1, and OND2, surface drain towards Coran Lane, but the courtyard area which is conveyed by the existing 8" PVC and discharged into the south side of Coran Lane.

D. Onsite Parking Lot Storm Water Treatment

The Ollie Detwiler Elementary School classroom building addition and surface parking lot development are located on ±1.1 acres of 11.87 school property area. The parking lot covers only ±0.4 acres. Per the manual, it is considered as a small parking lot category, so it is not required a parking lot BMP area.

V. SUMMARY

A. Conclusion

As detailed in this study, the Ollie Detwiler Elementary School classroom building addition and parking lot improvement complies with the CCRFCD HC&DDM.

- Runoff from the project site will continue to flow in accordance with the natural, historical drainage patterns and conform to the approved drainage study flow pattern.

- Flow generated by onsite basin and off-site flow will be conveyed by the existing 4: 16"x48" block wall openings towards the existing storm drain channel.

- The west school property (APN 139-20-301-016) accepts off-site flow from Anderson Ln. and south portion of Ferrell Street conveys via the proposed parking lot area and discharges into the existing drainage channel south of the property. This channel conveys flow and discharges into Simmons Street.

- Per the approved study, the drainage easement requirement was waived by the Clark County Public Works on July 07, 1998.

B. References

1 Clark County Regional Flood Control District Hydrologic Criteria and Drainage Design Manual, Adopted August 1999, WRC Engineering (updated by Montgomery Watson).Revised September 12, 2013

2 Clark County Regional Flood Control District Website, http://www.ccrfcd.org

3 2013 and 2008 Clark County Regional Flood Control District Flood Control Master Plan Update, PBS&J, G.C. Wallace and Louis Berger Group.

4 HEC-1 Flood Hydrograph Package Version 4.1, June 1998, U.S. Army Corps of Engineers.

5 Flood Insurance Rate Map Number 32003C2160F, map revised November 16, 2011, Federal Emergency Management Agency.

6 Federal Emergency Management Agency Website, https://msc.fema.gov/webapp/wcs/stores/servlet/info?storeId=10001&catalogId=10001&langId=-1&content=firmetteHelp_A&title=FIRMettes

7 Web soil survey website, http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

8 FlowMaster Version V8i, 2009, Bentley Systems, Inc.

9 Soil Survey of Las Vegas Area, Nevada part of Clark County, by US Department of Agriculture Soil conservation Service, July 1985.

10 Technical Drainage Study for Ollie Detwiler Elementary School, DS # 2323 & HTE # 98-18795, by PBS&J, July 1st, 1998. The Clark County approved the study on February 5, 1999, and the City of Las Vegas on July 29, 1998.

11 Technical Drainage Study for Lake Mead and Simmons, HTE # 06-13355, by Integrity Engineering, March 5, 2006, and approved by Clark County on October 31st, 2006.

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APPENDIX D
(Reference Studies)

- Technical Drainage Study for Ollie Detwiler Elementary School, DS # 2333 & HTE # 98-18795, by PBS&J, July 1st, 1998. Clark County approved the study on February 5, 1999, and City of Las Vegas on July 29, 1998.
- Technical Drainage Study for Lake Mead and Simmons, HTE # 06-13355, by Integrity Engineering, March 5, 2006, and approved by Clark County on October 31st, 2006.

APPENDIX E
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- General Notes Sheet
- Grading Plan
- Detail Sheet

APPENDIX A
(Figures)

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NOTES

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

No liability is assumed for the accuracy of the data deliniated herein. Information on roads and other non-assessed parcels may be obtained from the Road Document Listing in the Assessor's Office.

This map is compiled from official records, including surveys and deeds, but only contains the information required for assessment. See the recorded documents for more detailed legal information.

USE THIS SCALE(FEET) WHEN MAP REDUCED FROM 11X17 ORIGINAL

0 100 200 400 600 800

MAP LEGEND

- PARCEL BOUNDARY
- SUB BOUNDARY
- PM/LD BOUNDARY
- ROAD EASEMENT
- MATCH / LEADER LINE
- HISTORIC LOT LINE
- HISTORIC SUB BOUNDARY
- HISTORIC PM/LD BOUNDARY
- SECTION LINE
- CONDOMINIUM UNIT
- AIR SPACE PCL
- RIGHT OF WAY PCL
- SUB-SURFACE PCL
- 001 ROAD PARCEL NUMBER
- 001 PARCEL NUMER
- 1.00 ACREAGE
- 202 PARCEL SUB/SEQ NUMBER
- PB 24-45 PLAT RECORDING NUMBER
- 5 BLOCK NUMBER
- 5 LOT NUMBER
- GL5 GOV. LOT NUMBER

ASSESSOR'S PARCELS - CLARK CO., NV.
Michele W. Shafe - Assessor

BOOK T20S R61E

SEC. 20

MAP N 2 SW 4

139-20-3

125	124
138	139
163	162

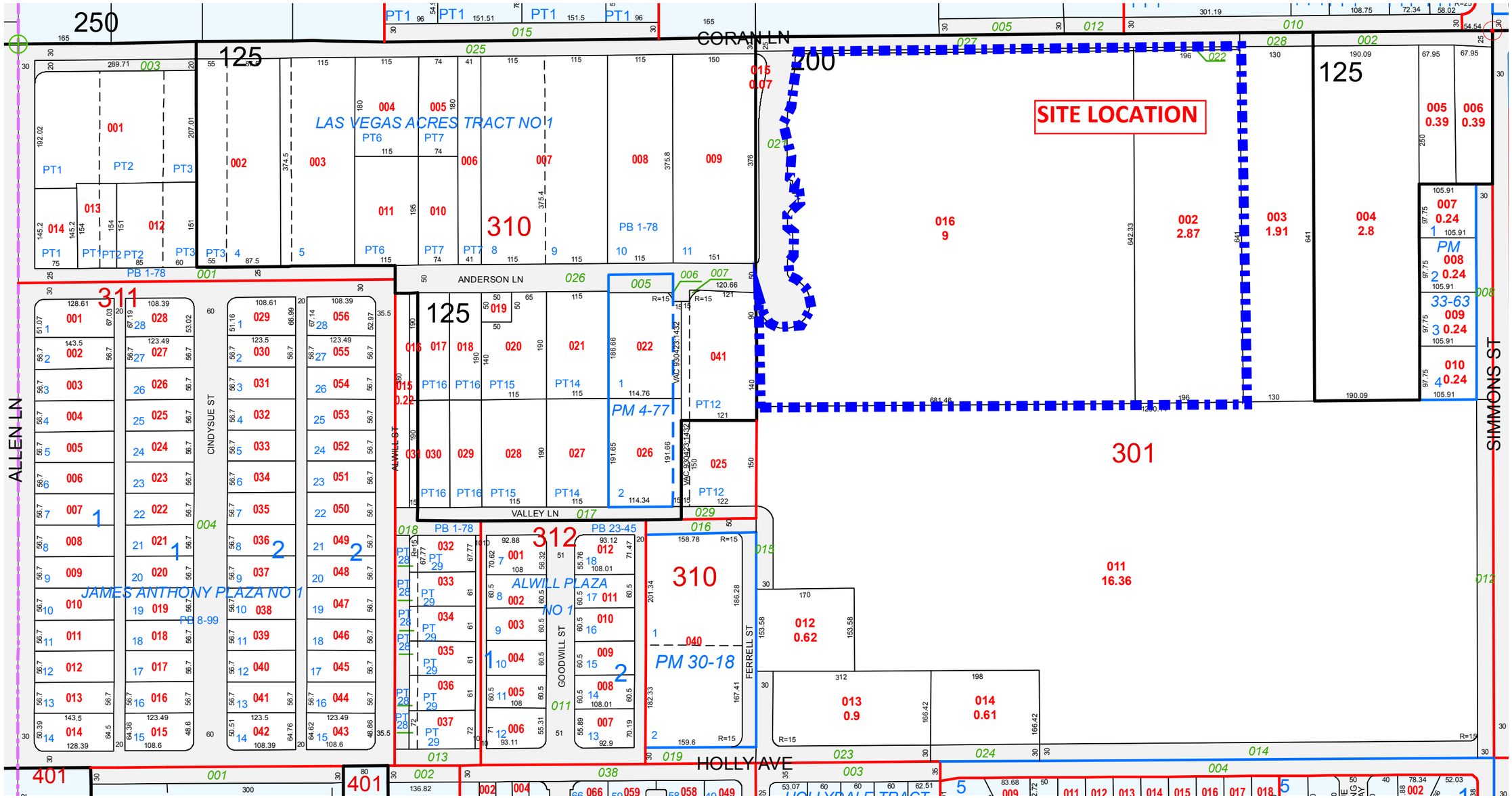
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30	29	28	27	26	25
31	32	33	34	35	36

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

Scale: 1" = 200'

Rev: 6/18/2015

CLARK COUNTY ASSESSOR MAPPING DIVISION NEVADA



TAX DIST 125,200

FIGURE 1

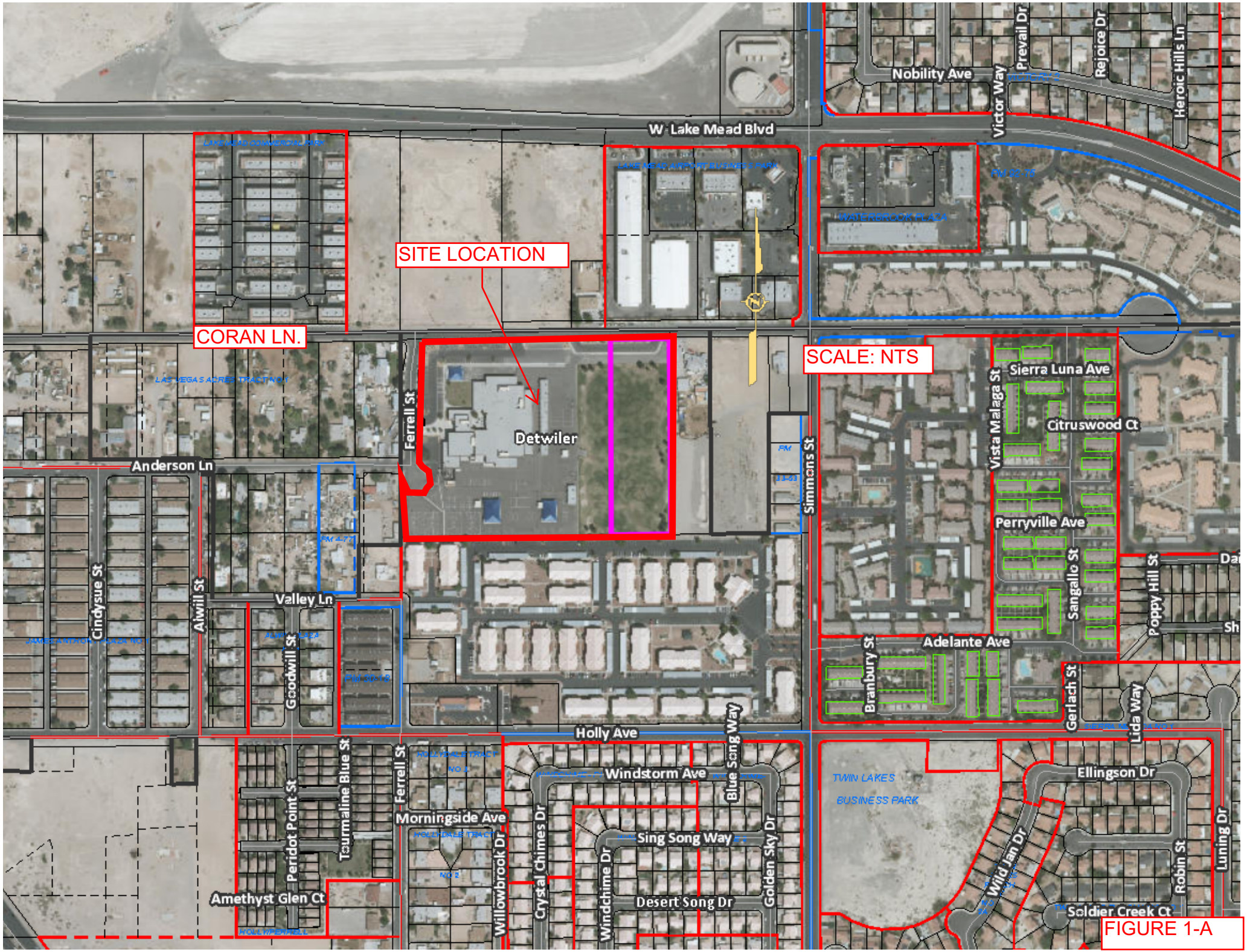
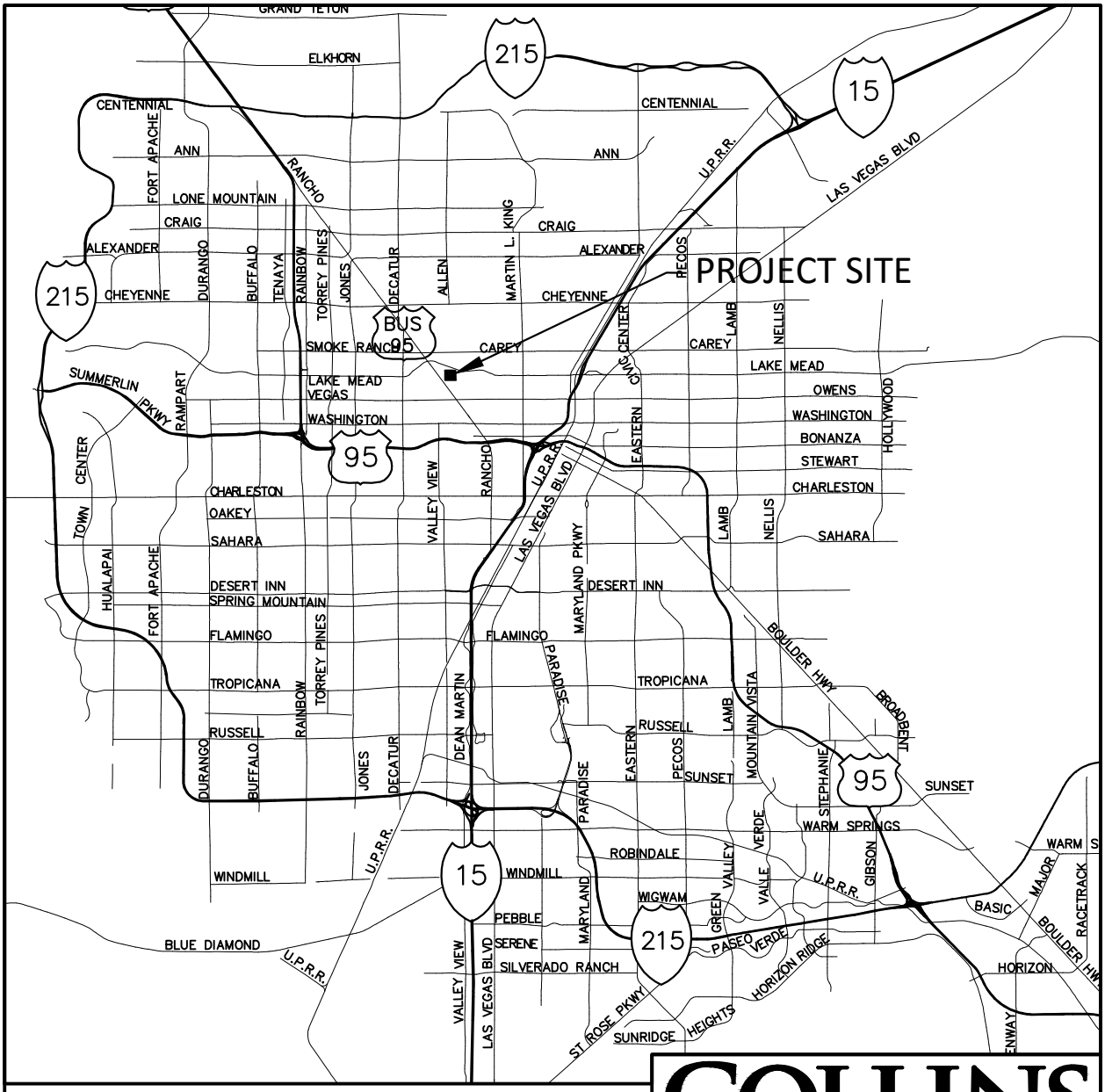

SITE LOCATION
CORAN LN.
SCALE: NTS
W Lake Mead Blvd
Nobility Ave
Victor Way
Prevail Dr
Rejoice Dr
Heroic Hills Ln
Detwiler
Ferrell St
Simmons St
Anderson Ln
Valley Ln
Cindysue St
Awill St
Goodwill St
Vista Malaga St
Sierra Luna Ave
Citruswood Ct
Perryville Ave
Sangallo St
Poppy Hill St
Adelante Ave
Branbury St
Gerlach St
Lida Way
Holly Ave
Blue Song Way
Windstorm Ave
Ellingson Dr
TWIN LAKES
BUSINESS PARK
Peridot Point St
Tourmaline Blue St
Morningside Ave
Crystal Chimes Dr
Sing Song Way
Golden Sky Dr
Windchime Dr
Desert Song Dr
Willowbrook Dr
Amethyst Glen Ct
Wild Jan Dr
Robin St
Luning Dr
Soldier Creek Ct

FIGURE 1-A



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FAX: (702) 248-8070
www.collinsengr.com

VICINITY MAP

1/18/2017
MAP NTS

FIG 2

REGIONAL FLOOD CONTROL DISTRICT

2013
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE

FIGURE F- 26

FLOOD CONTROL FACILITIES

LEGEND

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

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

Remove & Replace/Parallel Facilities

Category A	Category B
Channel	Channel
Stormdrain	Stormdrain

N

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

Scale: 1 inch = 2,000 feet

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

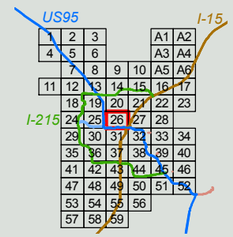


FIGURE-3

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
FW15		**FREEWAY CHANNEL FROM DESERT INN TO EXPRESSWAY**						
0000	E	3: 12' X 10' RCB	2170	3728	CAL93	SW4	10.63	0.17
GOOF		**GOWAN OUTFALL FACILITIES**						
0485	E	90" RCP	1160	630	DGOW2A	GW3SC	1.38	0.47
0486	E	8' X 5' RCB	3300	630	DGOW2A	GW3SC	1.38	0.60
0511	E	8' X 5' RCB	8390	699	CPT6B-C	GW3SC	1.08	0.50
LAAS		**NORTH LAS VEGAS AIR TERMINAL - SIMMONS**						
0000	E	14' X 6' RCB	760	698	CR2-CA	NW3	2.57	0.80
0014	E	12' X 6' RCB	1350	698	CR2-CA	NW3	2.57	1.12
0040	E	10' X 6' RCB	2105	698	CR2-CA	NW3	2.57	1.50
0080	E	66" RCP	157	285	R-C	NW3	0.27	1.10
0083	E	60" RCP	620	285	R-C	NW3	0.27	1.40
0095	E	54" RCP	400	285	R-C	NW3	0.27	1.44
0103	E	48" RCP	405	285	R-C	NW3	0.27	1.75
LAAT		**NORTH LAS VEGAS AIR TERMINAL**						
0000	E	3: 8' X 5' RCBC	650	1331	CB3-1	NW3	4.17	0.50
0006	E	Conc Chnl 20'W 8'D 1.5:1 SS	380	1331	CB3-1	NW3	4.17	0.50
0014	E	10' X 6' RCB	934	1331	CB3-1	NW3	4.17	1.84
0031	E	10' X 6' RCB	1618	1079	CB3-2	NW3	3.87	1.05
0062	E	12' X 8' RCB	511	1079	CB3-2	NW3	3.87	0.50
0070	E	12' X 6' RCB	376	1079	CB3-2	NW3	3.87	0.56
0078	E	10' X 6' RCB	1055	1079	CB3-2	NW3	3.87	0.58
0098	E	10' X 4' RCB	2207	677	CCA1-C	NW3	3.08	0.60
0140	E	Conc Chnl 6'W 4'D 1.5:1 SS	338	677	CCA1-C	NW3	3.08	0.64
0146	E	Conc Chnl 6'W 3'D 1.5:1 SS	1388	677	CCA1-C	NW3	3.08	0.68
0172	E	76" X 48" HERCP	536	480	CA1-C	NW3	2.87	0.75
0182	E	Conc Chnl 6'W 3'D 1.5:1 SS	997	480	CA1-C	NW3	2.87	0.83
0201	E	Conc Chnl 6'W 3'D 1.5:1 SS	184	294	A1-C1	NW3	0.31	0.37
0204	E	76" X 48" RCP	425	294	A1-C1	NW3	0.31	0.37
LANO		**NORTH LAS VEGAS AIR TERMINAL NORTH**						
0000	E	Conc Chnl 0'W 3'D 1.5:1 SS	470	294	A1-C1	NW3	0.31	0.30
LCCH		**LAS VEGAS CREEK CHANNEL**						
0000	E	2: 12' X 7' RCB	730	2894	CLC20-C	MEADOWS4	9.68	1.28
0013	E	2: 12' X 6' RCB	2035	2894	CLC20-C	MEADOWS4	9.68	0.82
0051	E	2:14' X 7' RCB	3113	2894	CLC20-C	MEADOWS4	9.68	0.60
0110	E	Transition Structure	220	2798	CCLC16-C	MEADOWS4	9.51	
0114	E	2: 14' X 7' RCB	670	2329	CRMEDET	MEADOWS4	8.25	0.80
0127	E	Transition Structure	110	2329	CRMEDET	MEADOWS4	8.25	
0129	E	2: 14' X 7' RCB	1130	2329	CRMEDET	MEADOWS4	8.25	0.50
0150	E	2: 13' X 7' RCB	200	2329	CRMEDET	MEADOWS4	8.25	0.95
0154	E	Transition Structure	190	2329	CRMEDET	MEADOWS4	8.25	
0157	E	2: 12' X 6' RCB	1650	1631	CCLC14-C	SW3	2.99	1.06
0188	E	2: 12' X 6' RCB	2225	1631	CCLC14-C	SW3	2.99	1.36
0230	E	12' X 6' RCB	2140	1381	CLC14-C	SW3	2.54	1.74
0270	E	12' X 6' RCB	1705	774	CCWA02-C	SW3	1.84	0.54
0302	E	8' X 6' RCB	3940	774	CCWA02-C	SW3	1.84	2.49
0377	E	10' X 7' RCB	1226	774	CCWA02-C	SW3	1.84	0.74
0400	E	Transition Structure	110	437	CWA02-C	SW3	1.47	0.49
0402	E	8' X 6' RCB @ Jones	535	437	CWA02-C	SW3	1.47	0.49
0412	E	60" RCP	1370	437	CWA02-C	SW3	1.47	1.08
0438	E	60" RCP	1090	162	CLC01-C	SW3	1.20	1.60
0458	E	60" RCP	1060	162	CLC01-C	SW3	1.20	1.60
0478	E	60" RCP	1110	162	CLC01-C	SW3	1.20	0.55
LCDE		**LAS VEGAS CREEK - DECATUR**						
0000	E	6' X 5' RCB	1800	404	LC11-C	SW3	0.38	1.26
0034	E	72" RCP	700	404	LC11-C	SW3	0.38	0.50

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
LCJO		**LAS VEGAS CREEK - JONES**						
0000	E	6' X 6' RCB	380	358	AL01B-C	SW3	0.37	0.50
0007	E	6' X 5' RCB	675	358	AL01B-C	SW3	0.37	0.62
LCLT		**LAS VEGAS CREEK - LATERAL**						
0000	E	6' X 6' RCB	490	250	WA10D	SW3	0.45	0.50
0006	E	Conc Chnl 10'W 4'D 0:1 SS	1364	250	WA10D	SW3	0.45	0.50
0033	E	10' X 4' RCBC @ Washington	96	405	WA10-C	NW3	0.45	0.50
0034	E	Grass Chnl 12'W 5'D 1:1 SS	1750	405	WA10-C	SW3	0.45	0.20
LCME		**LAS VEGAS CREEK - MEADOWS**						
0000	E	14' X 8' RCB	895	1423	MEADOWDB	SW3SC	5.67	0.72
0016	E	Stilling Basin	140	1423	MEADOWDB	SW3SC	5.67	0.21
0017	E	3,300 cfs Spillway (Replace w/ LCME0018)		3300	MEADOWIN	SW3SC	5.67	
0018	P1	Modify Spillway, raise height by 1' (Replaces LCME0017)		3300	MEADOWIN	SW3SC	5.67	
0019	E	1: 11' X 5' RCB and 1: 11.5' X 5' RCB	110	1423	MEADOWDB	SW3SC	5.67	0.81
0020	E	213 ac-ft Meadows Detention Basin		4713	MEADOWIN	SW3SC	5.67	
0021	P1	Upgrade to 235 ac-ft Meadows Detention Basin		4713	MEADOWIN	SW3SC	5.67	
LCRA		**LAS VEGAS CREEK - RANCHO**						
0000	E	12' X 8' RCB	380	783	CLC16-C	SW3	1.71	0.60
0004	E	12' X 6' RCB	2367	783	CLC16-C	SW3	1.71	0.77
0050	E	8' X 6' RCB	355	526	WA13D	SW3	1.40	0.50
LMDE		**LAKE MEAD BOULEVARD - DECATUR BRANCH**						
0000	P1	10' X 5' RCB	2640	665	DCVG04-C	NW3	1.26	0.90
LV15		**FREEWAY CHANNEL**						
0316	E	11' X 6' RCB	3010	985	CWA20-C	NW3	4.46	0.59
0372	E	9' X 6' RCB	1970	985	CWA20-C	NW3	4.46	0.66
0409	E	7' X 6' RCB	815	542	CWA15A-C	NW3	3.67	0.91
0424	P1	8' X 6' RCB	2500	542	CWA15A-C	NW3	3.67	0.73
0472	P1	2: 66" RCP	1200	265	WA15A-C	NW3	0.37	0.42
0474	P1	8' X 6' RCB	2880	322	CCWA13-C	NW3	3.29	0.73
0528	P1	8' X 7' RCB	4420	869	CWA13-C	NW3	1.39	1.19
0602	P1	2: 66" RCP	5980	504	CWA09-C	NW3	0.61	1.59
LVLM		**LAS VEGAS WASH - LAKE MEAD**						
0033	E	60" RCP (Replace w/ LVLM0034)	1186	994	CLM20-C	NW3SC	1.36	1.62
0034	P0	12' X 5' RCB (Replaces LVLM0033)	1186	994	CLM20-C	NW3SC	1.36	1.62
0059	E	72" RCP (Replace w/ LVLM0060)	5952	994	CLM20-C	NW3SC	1.36	0.66
0060	P0	12' X 6' RCB (Replaces LVLM0059)	5952	994	CLM20-C	NW3SC	1.36	0.66
0170	E	78" RCP	2421	378	CLM16A-C	NW3SC	0.38	1.17
0221	E	48" RCP Outlet	270	168	DR2	NW4	11.78	
0222	E	48" RCP Outlet	500	208	DCAREY	NW4	11.78	
0224	E	36" RCP	2429					0.53
0225	E	90" RCP (Replace w/ LVLM0226)	641	1933	CLM10-C	NW3	3.02	1.35
0226	P0	2: 10' X 8' RCB (Replaces LVLM0225)	641	1933	CLM10-C	NW3	3.02	0.50
0227	E	10,000 cfs PMF Spillway		10000	CARYLMIN	NW4	11.78	
0228	E	607 ac-ft Carey-Lake Mead Detention Basin		5184	CARYLMIN	NW4	11.78	
0270	E	90" RCP (Replace w/ LVLM0271)	3473	1933	CLM10-C	NW3	3.02	1.35
0271	P0	12' X 8' RCB (Replaces LVLM0270)	3473	1933	CLM10-C	NW3	3.02	1.35
0336	E	84" RCP (Replace w/ LVLM0337)	1050	1652	CLM06-C	NW3	2.61	1.16
0337	P0	12' X 8' RCB (Replaces LVLM0336)	1050	1652	CLM06-C	NW3	2.61	1.16
0355	E	90" RCP (Replace w/ LVLM0356)	1840	1652	CLM06-C	NW3	2.61	0.40
0356	P0	12' X 11' RCB (Replaces LVLM0355)	1840	1652	CLM06-C	NW3	2.61	0.40
0388	E	84" RCP	520	852	CLM05-C	NW3	1.00	1.40
0399	E	78" RCP	803	852	CLM05-C	NW3	1.00	1.07
0416	E	72" RCP	1320	852	CLM05-C	NW3	1.00	1.00
0442	E	60" RCP	725	565	CLM03-C	NW3	0.63	1.28
0453	E	54" RCP	589	565	CLM03-C	NW3	0.63	2.37
0460	E	54" RCP	1464	235	LM02-C	NW3	0.29	2.05
0475	E	48" RCP	2632	235	LM02-C	NW3	0.29	1.24
0525	E	48" RCP	2600	542	CLM01-C	NW3	0.64	1.24
LVOE		**OWENS AVENUE - EAST**						
0345	P1	13' X 11' RCB	1685	2369	DLVOE	SW5	22.79	0.60

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
LVOW		**OWENS AVENUE SYSTEM**						
0003	E	96" RCP	7500	1089	CLM16B-C	NW3	2.40	0.70
0146	E	84" RCP	4800	570	DCVG20-C	NW3	2.02	0.90
0241	E	66" RCP	5800	381	CVG20-C	NW3	1.57	1.40
0351	E	8' X 6' RCB	3000	829	CVG04-C	NW3	1.26	1.44
0360	P1	8' X 6' RCB	2300	829	CVG04-C	NW3	1.26	1.48
0460	P1	7' X 6' RCB	2700	616	CVG03-C	NW3	0.95	1.48
LVPK		**PEAK DRIVE SYSTEM**						
0000	E	Conc Chnl 15'W 6'D 0:1 SS	606	1024	CPD04B-C	NW3	1.59	1.22
0019	E	Conc Chnl 20'W 5.5'D 0:1 SS	2190	1024	CPD04B-C	NW3	1.59	0.57
0056	E	10' X 5' RCB	103	703	CCY04A-C	NW3	1.12	0.40
0058	E	9' X 6' RCB	2542	703	CCY04A-C	NW3	1.12	0.95
0104	E	10' X 6' RCB	76	703	CCY04A-C	NW3	1.12	1.26
0106	E	8' X 6' RCB	1235	703	CCY04A-C	NW3	1.12	0.54
0130	E	7' X 5' RCB	1435	400	CPD01-C	NW3	0.67	0.61
LVRA		**LAS VEGAS WASH - RANCHO**						
0000	E	12' X 8' RCB	612	1317	CCPD04BC	NW3	3.87	1.56
0012	E	12' X 8' RCB	2838	1317	CCPD04BC	NW3	3.87	0.78
0066	E	14' X 5' RCB	65	1317	CCPD04BC	NW3	3.87	1.22
LVSR		**LAS VEGAS WASH - SMOKE RANCH**						
0045	E	54" RCP (Replace w/ LVSR0046)	1180	1244	CS1-C	NW3SC	1.42	3.41
0046	P1	10' X 5' RCB (Replaces LVSR0045)	1180	1244	CS1-C	NW3SC	1.42	3.41
0070	E	66" RCP (Replace w/ LVSR0071)	4118	1244	CS1-C	NW3SC	1.42	0.73
0071	P1	10' X 9' RCB (Replaces LVSR0070)	4118	1244	CS1-C	NW3SC	1.42	0.73
0148	E	54" RCP (Replace w/ LVSR0149)	2587	951	CS	NW3SC	0.95	0.58
0149	P1	11' X 7' RCB (Replaces LVSR0148)	2587	951	CS	NW3SC	0.95	0.58
0197	E	30" RCP (Replace w/ LVSR0198)	581	445	CR2-C	NW3SC	0.38	0.86
0198	P1	8' x 5' RCB (Replaces LVSR0197)	581	445	CR2-C	NW3SC	0.38	0.86
0208	E	54" RCP (Replace w/ LVSR0209)	2060	445	CR2-C	NW3SC	0.38	1.41
0209	P1	7' X 5' RCB (Replaces LVSR0208)	2060	445	CR2-C	NW3SC	0.38	1.41
0210	E	14' X 8' RCB	800	2889	CB1-C	NW3	6.44	1.73
0221	E	Transition Structure	100	2889	CB1-C	NW3	6.44	7.08
0223	E	Conc Chnl 14'W 8'D 1.5:1 SS	2150	2889	CB1-C	NW3	6.44	0.96
0263	E	14' X 8' RCB	707	2889	CB1-C	NW3	6.44	0.63
0273	E	11' X 11' RCB	1140	2889	CB1-C	NW3	6.44	0.92
0295	E	11' X 11' RCB	510	2683	CCSR05B	NW3	6.16	2.85
0312	E	8' X 8' RCB	460	1607	CSR05B	NW3	2.30	1.63
0359	E	66" RCP (Replace w/ LVSR0360)	1690	1607	CSR05B	NW3	2.30	0.67
0360	P1	10' X 10' RCB (Replaces LVSR0359)	1690	1607	CSR05B	NW3	2.30	0.75
0396	E	60" RCP (Replace w/ LVSR0397)	2640	1461	CSR05D	NW3	1.94	1.14
0397	P1	10' X 9' RCB (Replaces LVSR0396)	2640	1461	CSR05D	NW3	1.94	0.87
0446	E	54" RCP (Replace w/ LVSR0447)	2530	1461	CSR05D	NW3	1.94	1.14
0447	P1	10' X 8' RCB (Replaces LVSR0446)	2530	1461	CSR05D	NW3	1.94	1.25
0496	P1	10' X 7' RCB	2855	1245	CSR02E	NW3	1.64	1.27
0500	E	60" RCP	1290					1.97
0525	E	54" RCP	1340					0.30
0546	P1	8' X 8' RCB	2640	758	CSR00A	NW3	1.01	0.57
LVWH		**WASHINGTON AVENUE CHANNEL**						
0431	E	3: 14.33' X 10' RCB	665	2870	DCLC21	SW5	22.79	0.15
0446	E	Junction Structure	69	2870	DCLC21	SW5	22.79	0.15
0447	E	3: 14.33' X 10' RCB	1955	4978	CCAL93	SW5	22.19	0.15
0484	E	Confluence Structure	455	4978	CCAL93	SW5	22.19	0.15
WAGC		**WASHINGTON AVENUE CHANNEL - GRAND CENTRAL**						
0000	E	2: 12' X 4' RCB	700	557	LC21	SW3	0.60	0.20
0014	E	1: 12' X 4' RCB and 1: 11' X 4' RCB	2440	557	LC21	SW3	0.60	0.20

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

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

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

REGIONAL FLOOD CONTROL DISTRICT

2013 LAS VEGAS VALLEY FLOOD CONTROL MASTER PLAN UPDATE

FACILITY INVENTORY FIGURE F - 26

LEGEND

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

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

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

Construction Features

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

FIGURE-4

PANEL IS LOCATED WITHIN TOWNSHIP 20 SOUTHH, RANGE 61 EAST AND TOWNSHIP 19 SOUTH, RANGE 61 EAST.

MAP SCALE 1" = 1000'
500 0 1000 2000 FEET METE

ZONE X
ZONE X
ZONE X
ZONE A
ZONE AO (DEPTH 1')
ZONE X
1% ANNUAL CHANCE FLOOD DISCHARGE CONTAINED IN CULVERT
ANNUAL ANCE OOD SCHARGE NTAINED CHANNEL
Carey –Lake Mead Detention Basin
SITE LOCATION
CLARK COUNTY UNINCORPORATED AREAS 320003
CITY OF LAS VEGAS
LIMIT OF STUDY
LIMIT OF STUD
Channel
Culvert

17 16 20 21

W BROOKS AVENUE
TRADE DRIVE
PLYMOUTH AVEN
CLAYTON STREET
RADIO CT.
WINDSOR AVENUE
WIZARD AVE.
W EVANS AVENUE
SABER DRIVE
LIDIA STREET
JEFFERY AVE.
CITIZEN AVE.
SIMMONS STREET
SUNSET STREET
TAMERIND STREET
WARD ST.
JUNE AVENUE
CARTIER AVENUE
BLUFF AVENUE
HELEN AVENUE
W NELSON AVENUE
W MCDONALD AVENUE
WEST STREET
MORTON AVENUE
PONTIAC AVENUE
CONCORD STREET
SHIELD ST.
ROYAL STREET
CASTLE STREET
DUKE
LANCE AVEN
ROSSMOYNE AVE
DUCHESS AVENUE
KINGS AVENUE
PRINCESS AVENUE
COUNT AVENUE
KINGS AVE
PRINCESS
BURGOS AVEN
DESERT SENNA AVE.
SAND SAGE AVE
MILLER AVENUE
ELIZEBETH AVENUE
GR0999
GR1000
GR0998
VAN ERT AVENUE
BENNETT STREET
PRIME ADVANTAGE AVE.
BALZAR AVENUE
HASSELL AVENUE
HART AVENUE
W BARTLETT AVENUE
CARVER
DRIVE
PREVAIL
REJOICE
W LAKE MEAD BOULEVARD
CORAN LANE
ALWILL STR.
HOLLY AVENUE
ADELANTE AVE.
HILL STR.
KING
TONOPAH
PORT AVE.
LUDWIG DR.
SAPHIRE STONE AVENUE
EMERALD GREEN AV.
FERRELL STREET
N
J
JIMMY AVENUE
LEXINGTON STR.
DOOLITTLE AVENUE
WYATT AVENUE
E STREET
WEAVER DRIVE
H STREET
LEONARD AVE.
WALKER
BOWMAN AVE.
FREDERICK AVENUE
LEONA
GEORGE PLA
KASPER AVE.
STR.
WYATT AVENUE
E STREET
LEONARD AVENUE

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 2160F

FIRM
FLOOD INSURANCE RATE MAP
CLARK COUNTY, NEVADA
AND INCORPORATED AREAS

PANEL 2160 OF 4090
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
CLARK COUNTY	320003	2160	F
LAS VEGAS, CITY OF	325276	2160	F
NORTH LAS VEGAS, CITY OF	320007	2160	F

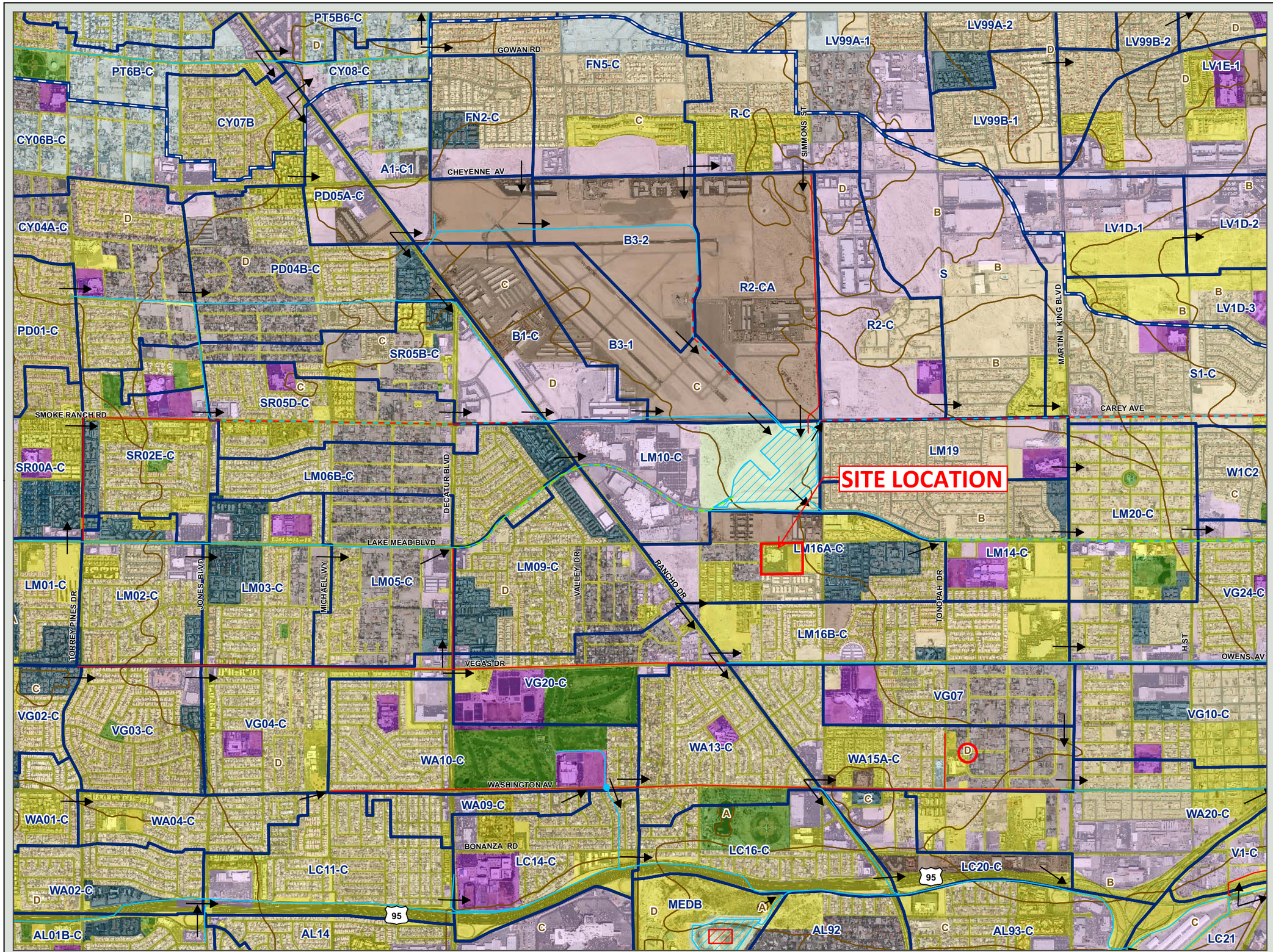
Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
32003C2160F
MAP REVISED
NOVEMBER 16, 2011

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

FIGURE-5



REGIONAL FLOOD CONTROL DISTRICT

2008
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE

FIGURE H- 26
HYDROLOGIC SUMMARY

LEGEND

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

Flood Control Facilities

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

Type Hydrologic Soil Groups

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

Typical Land Use

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

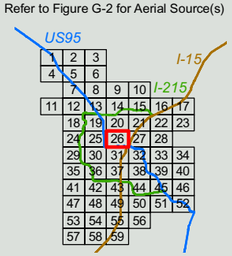
* Drought Ordinance Applied

N

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

Scale: 1 inch = 2,000 feet

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



PBS&J
PB

FIGURE-6

City of Las Vegas

CENTRAL NEIGHBORHOOD FLOOD CONTROL MASTER PLAN

LEGEND

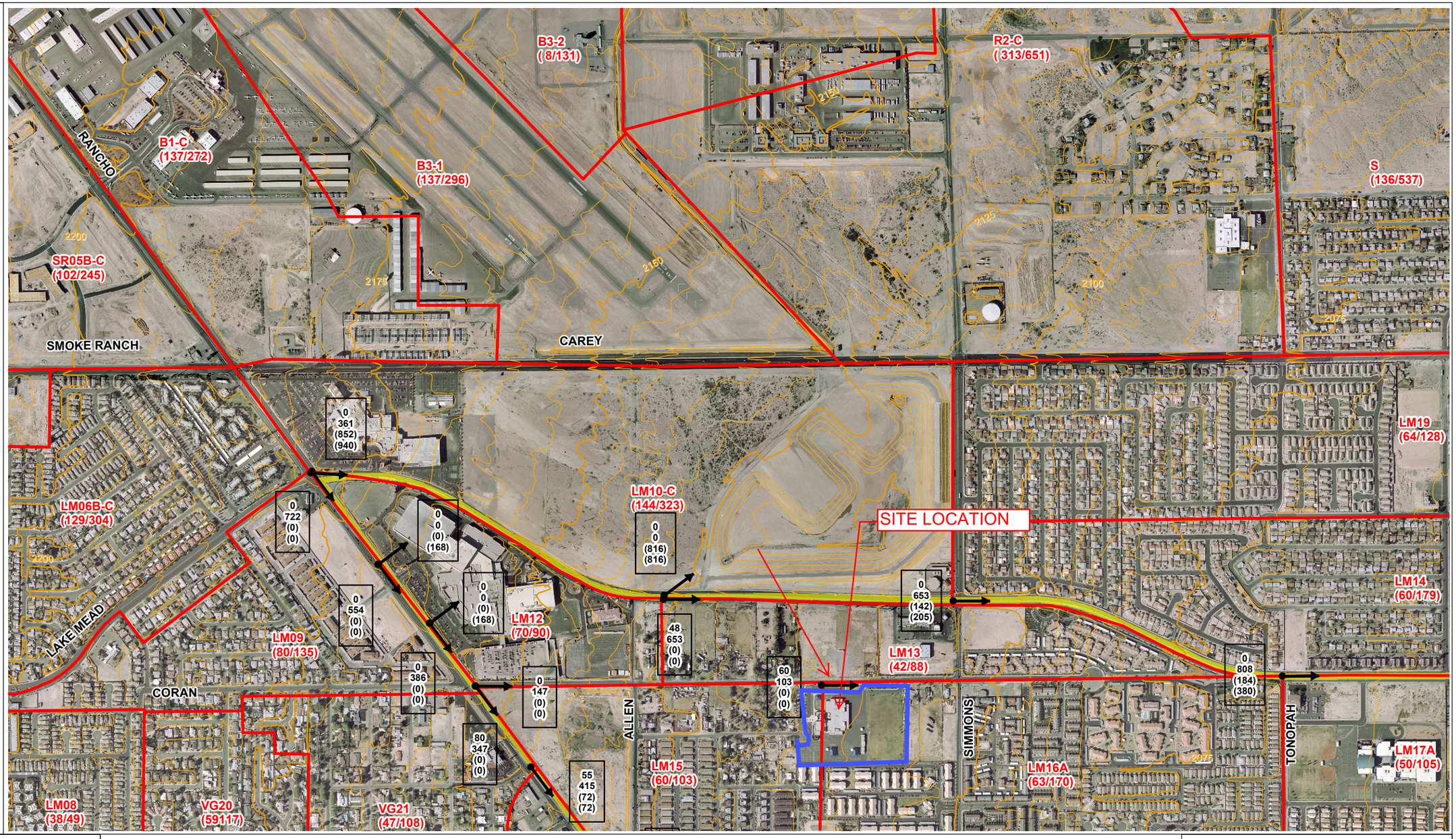
- Sub-basin Boundary
- LV12 — Basin ID
- (10yr./100yr.) — Contributing flow from the basin (cfs)
- Flow Arrow
- 250 / 500 / (300) / (800) — 10-Year Street Flow / 100-Year Street Flow / 10-Year Facility Flow / 100-Year Facility Flow

(Flows in CFS)

- Study Area Limit

PHOTO DATE: SPRING 2004

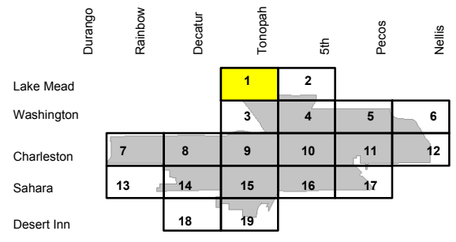
FIGURE E-1



EXISTING DRAINAGE CONDITIONS

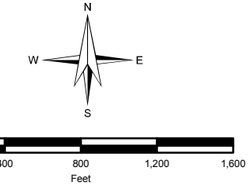
PBS&J

2270 Corporate Circle, Suite 100
Henderson, NV 89074
(702) 263-7275
Fax: (702) 263-7200



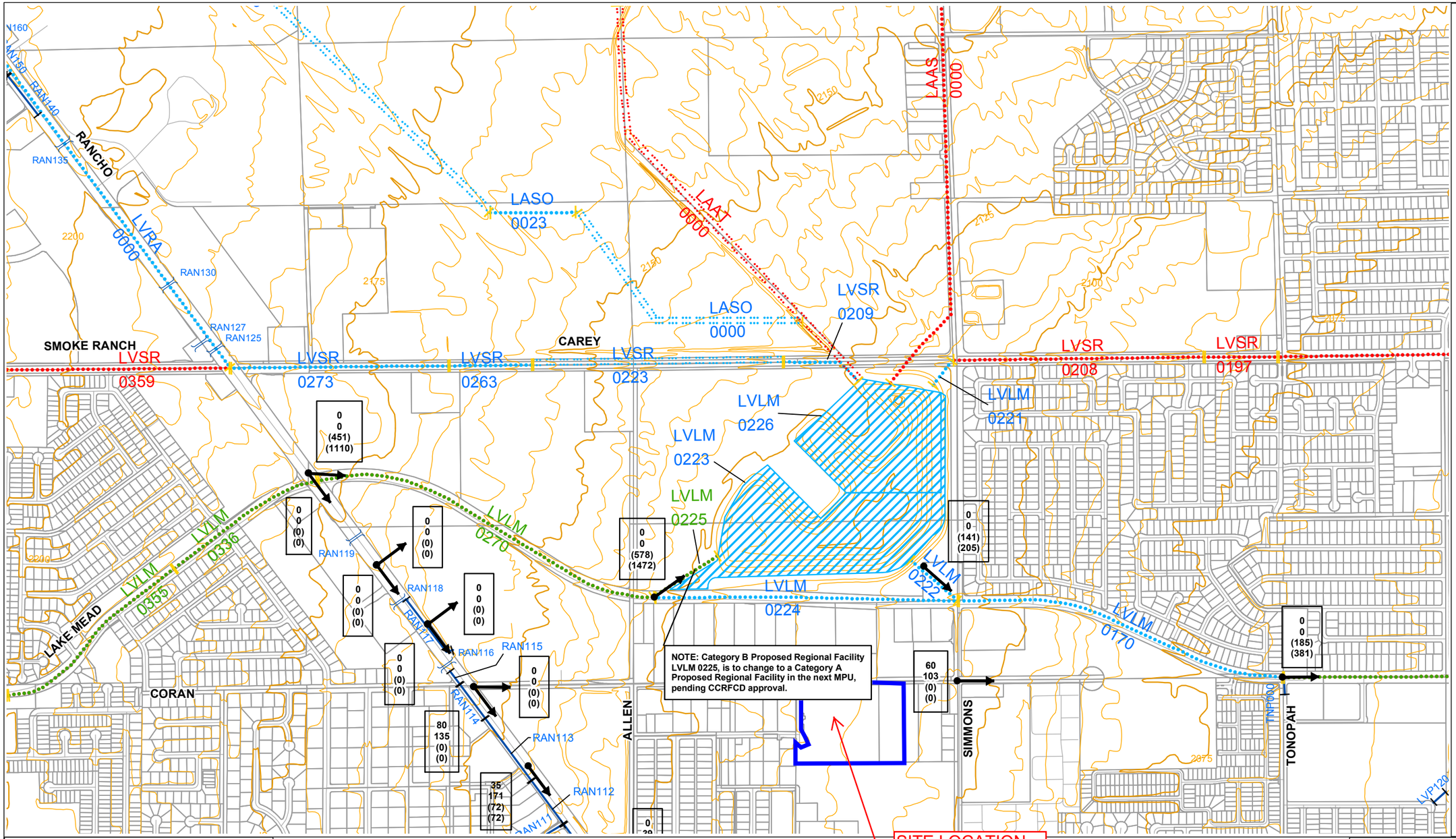
NOTE:
Existing conditions are based on future Curve Number values with only existing local and CCRFCD facilities in place.

100-Year flows at locations where a 100-Year subbasin concentration point does not exist in the hydrology model were based on an area-weighted ratio of the 100-Year flows from concentration points upstream and downstream of the location. See Volume I for a more detailed explaination.



SCALE: 1 inch = 800 feet

FIGURE-7



City of Las Vegas

CENTRAL NEIGHBORHOOD FLOOD CONTROL MASTER PLAN

LEGEND

- Existing Regional Facility
- Category A Proposed Regional Facility (2002 MPU)
- Category B Proposed Regional Facility (2002 MPU)
- Category A Proposed Regional Facility (2004 CNFCMP)
- Existing Local Facility
- Proposed Local Facility
- Regional Culvert
- Regional Bridge
- Regional Pipeline
- Regional Channel
- Regional Levee
- Regional Detention Basin
- Local Storm Drain
- Local Culvert
- Proposed Local Storm Drain
- Regional ID-Mile Separator
- Local Facility Separator

FIGURE F-1

N W E S

0 200 400 800 1,200 1,600
Feet

SCALE: 1 inch = 800 feet

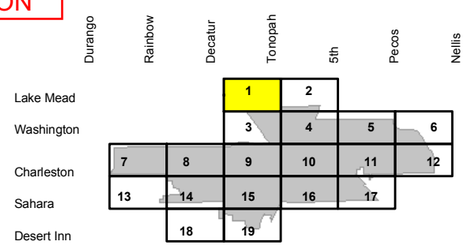
Flow Arrow

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 Curve Number values with all flood control facilities in place.

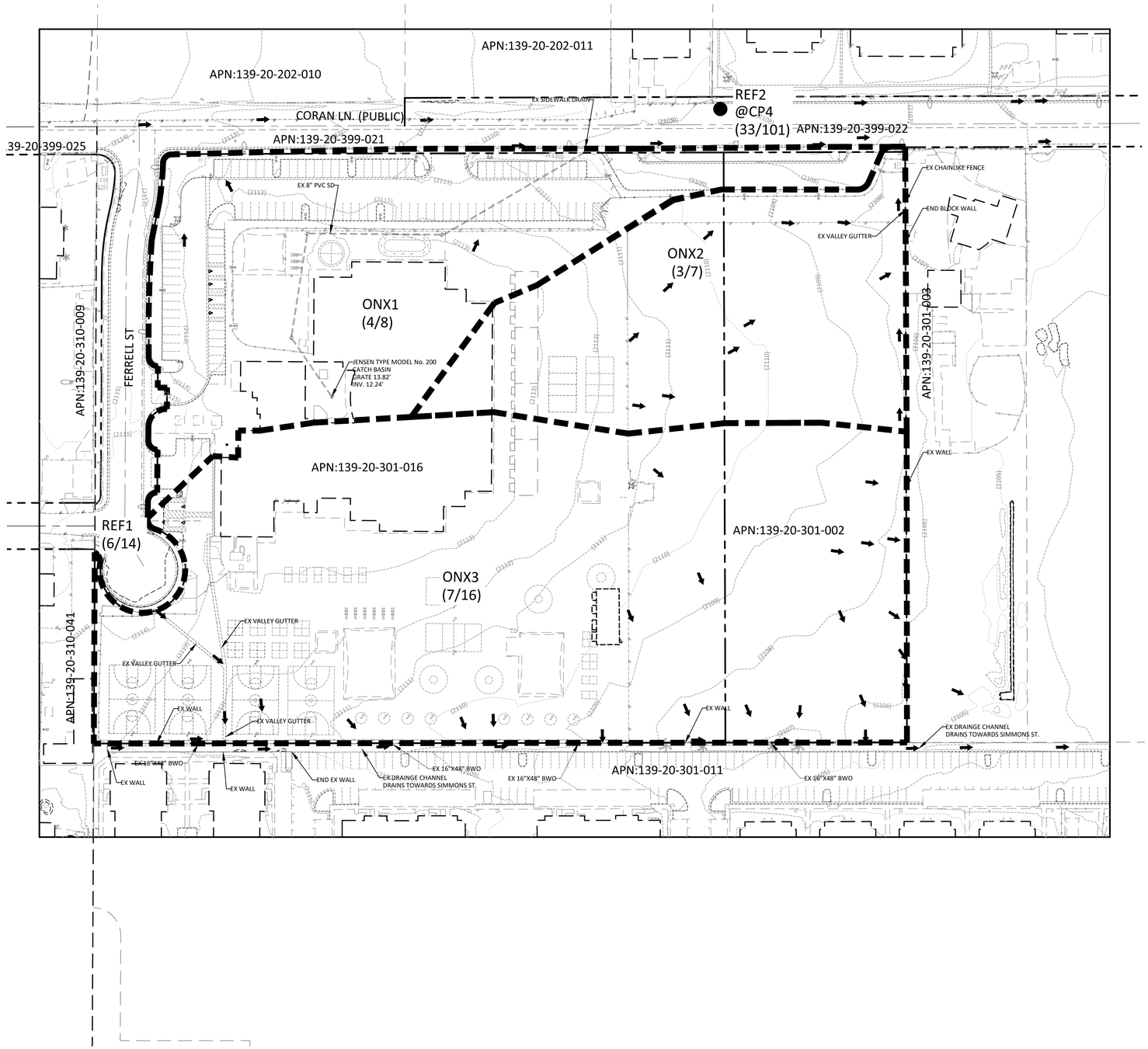
100-Year flows at locations where a 100-Year subbasin concentration point does not exist in the hydrology model were based on an area-weighted ratio of the 100-Year flows from concentration points upstream and downstream of the location. See Volume I for a more detailed explaination.

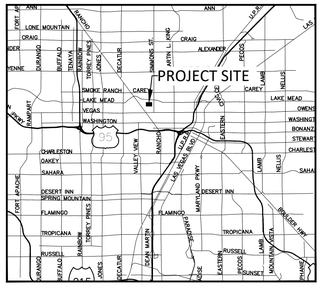


FUTURE DRAINAGE CONDITIONS

PBS&J
2270 Corporate Circle, Suite 100
Henderson, NV 89074
(702) 263-7275
Fax: (702) 263-7200

FIGURE-8





VICINITY MAP
NTS

DRAINAGE AREA SUMMARY TABLE			
BASIN ID	AREA (ACRES)	Q_{10} (CFS)	Q_{100} (CFS)
ONX1	3.2	4	8
ONX2	2.4	3	7
ONX2	6.5	7	16

GRAPHIC SCALE

60 0 30 60

SCALE: 1"=60'

FLOOD ZONE NOTE:

THE PROJECT SITE LIES WITHIN UN-SHADED FLOOD ZONE "X". PER FIRM PANEL 32003C2160F REVISED NOVEMBER 16, 2011. PER FEMA, UN-SHADED FLOOD ZONE "X" IS AN AREAS OF OUTSIDE THE 500-YEAR FLOODPLAIN.

DRAINAGE LEGEND

($Q_{10/100}$)	PEAK 10 YR FLOW / PEAK 100 YR FLOW
	DRAINAGE AREA BOUNDARY
	SOIL BOUNDARY
	DRAINAGE AREA FLOW DIRECTION
ONX1	AREA DESIGNATION
CP1 ●	CONCENTRATION FLOW POINT
FM1	LOCATION OF HYDRAULIC CROSS SECTION

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www.collinsengr.com

NO.	DESCRIPTION OF REVISIONS	DATE	APPROVAL

OLLIE DETWILER ELEMENTARY SCHOOL

APN: 139-20-301-016 & 002

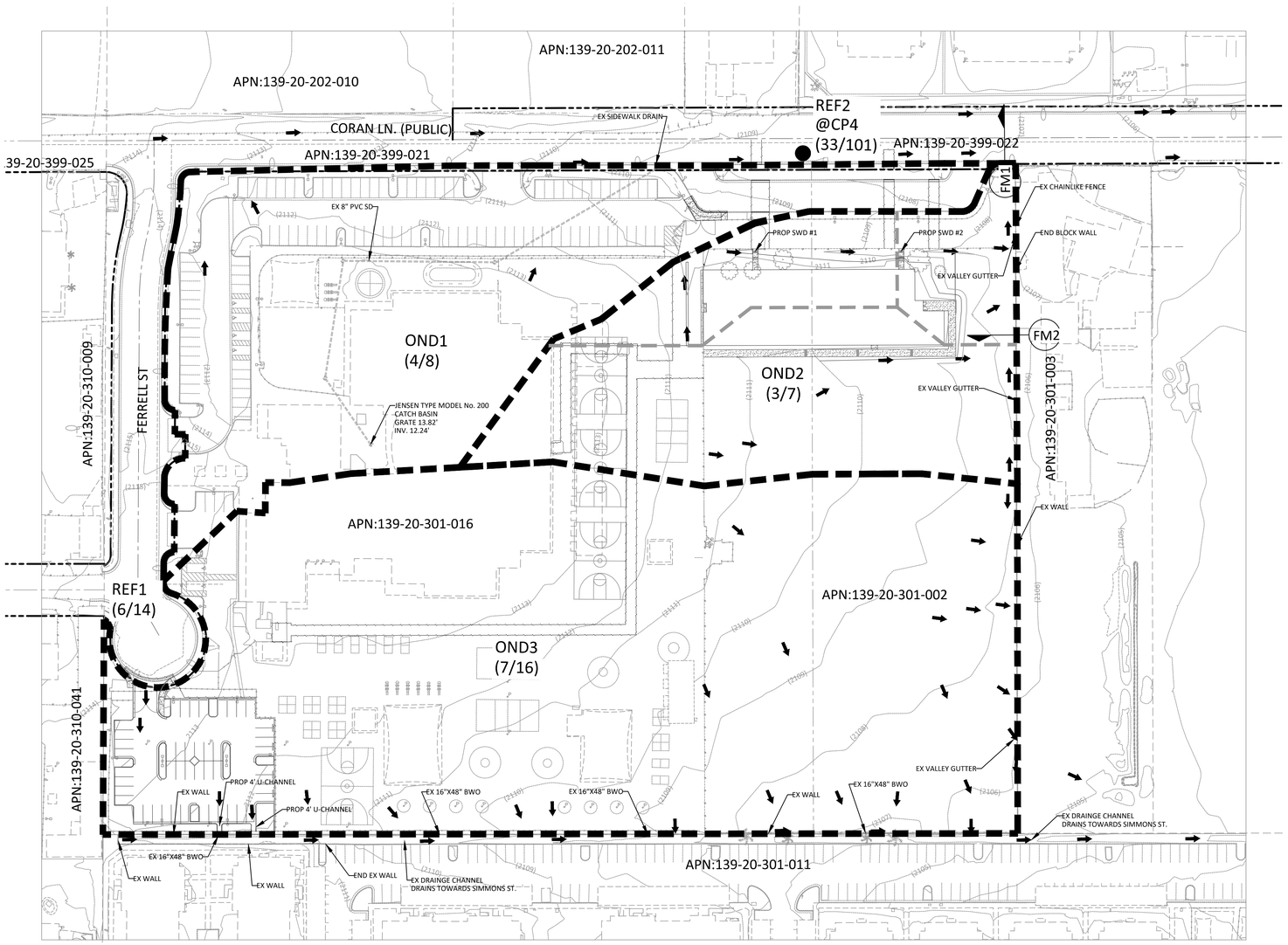
EXISTING CONDITION DRAINAGE BASIN MAP

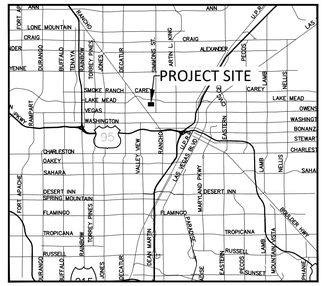
DATE:	10/05/17
JOB NUMBER:	10483
DESIGNED:	ASNI
DRAWN:	ASNI
CHECKED:	S. MOHAMMED P.E

SHEET NUMBER

FIG. 9

H:\CAD\LAND\10483\ADMIN\DRAINAGE\DWG\FIG-9-EX.DWG 10/02/2017 11:59:47 AM





VICINITY MAP
NTS

DRAINAGE AREA SUMMARY TABLE			
BASIN ID	AREA (ACRES)	Q_{10} (CFS)	Q_{100} (CFS)
OND1	3.2	4	8
OND2	2.4	3	7
OND2	6.5	7	16

REF1: Technical Drainage Study For Ollie Detwiler Elementry School, HTE#98-18795
REF2: Technical Drainage Study For Lake Mead and Simmons, HTE #06-13355

GRAPHIC SCALE

60 0 30 60
SCALE: 1"=60'

FLOOD ZONE NOTE:
THE PROJECT SITE LIES WITHIN UN-SHADED FLOOD ZONE "X". PER FIRM PANEL 32003C2160F REVISED NOVEMBER 16, 2011. PER FEMA, UN-SHADED FLOOD ZONE "X" IS AN AREAS OF OUTSIDE THE 500-YEAR FLOODPLAIN.

DRAINAGE LEGEND

$(Q_{10/100})$	PEAK 10 YR FLOW / PEAK 100 YR FLOW
	DRAINAGE AREA BOUNDARY
	SOIL BOUNDARY
	DRAINAGE AREA FLOW DIRECTION
ONX1	AREA DESIGNATION
CP1 ●	CONCENTRATION FLOW POINT
FM1	LOCATION OF HYDRAULIC CROSS SECTION
SWD	SIDEWALK DRAIN

FLOW DEPTH ANALYSIS SUMMARY										
SECTION	ST. WIDTH (FT)	SLOPE (%)	Q_{100} (CFS)	D_{100} (ft)	V_{100} (ft/sec)	$D_{100} \times V_{100}$	Q_{10}	D_{10} (ft)	V_{10} (ft/sec)	$D_{10} \times V_{10}$
FM1	60	0.75	101	0.79	4.38	3.46	33	0.60	2.87	1.72
FM2	N/A	0.4	4.6	0.42	1.39	N/A	-	-	-	-

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NO.	DESCRIPTION OF REVISIONS	DATE	APPROVAL

OLLIE DETWILER ELEMENTARY SCHOOL

APN: 139-20-301-016 & 002

DEVELOPED CONDITION DRAINAGE BASIN MAP

DATE:	10/05/17
JOB NUMBER:	10483
DESIGNED:	ASNI
DRAWN:	ASNI
CHECKED:	S. MOHAMMED P.E

SHEET NUMBER

FIG. 10

H:\CAD\LAND\10483\ADMIN\DRAINAGE\DWG\FIG-10-DEV.DWG 10/02/2017 11:59:13 AM

APPENDIX B
(Hydrologic Parameters)

- Rainfall Depth Calculation
- McCarran Airport Rainfall Area (Figure 513)
- Depth-Duration-Frequency Values for McCarran Airport Rainfall Area (Table 505)
- Six-Hour Depth Area Reduction Factors (Table 502)
- Six-Hour Storm Distributions (Table 503)
- Soil Map and Soil Group Info
- Soil Survey of Las Vegas Valley Area, Clark County (Table 15)
- Runoff Curve Numbers – Urban Area (Table 602 Sheet 1 of 4)
- Runoff Curve Numbers – Semiarid Rangelands (Table 602 Sheet 4 of 4)
- Curve Number Summary Tables
- Standard Form 4 and HEC-1 Analysis (Existing Condition)
- Standard Form 4 and HEC-1 Analysis (Developed Condition)

Ollie Detwiler Elementary Schaool
Job No. 10483
Sheet 1 OF 2
Rainfall Depth Calcualtion

Per Figure 513 of the Hydrologic Criteria and Design Manual the subject site *is within the McCarran Airport Rainfall Area*

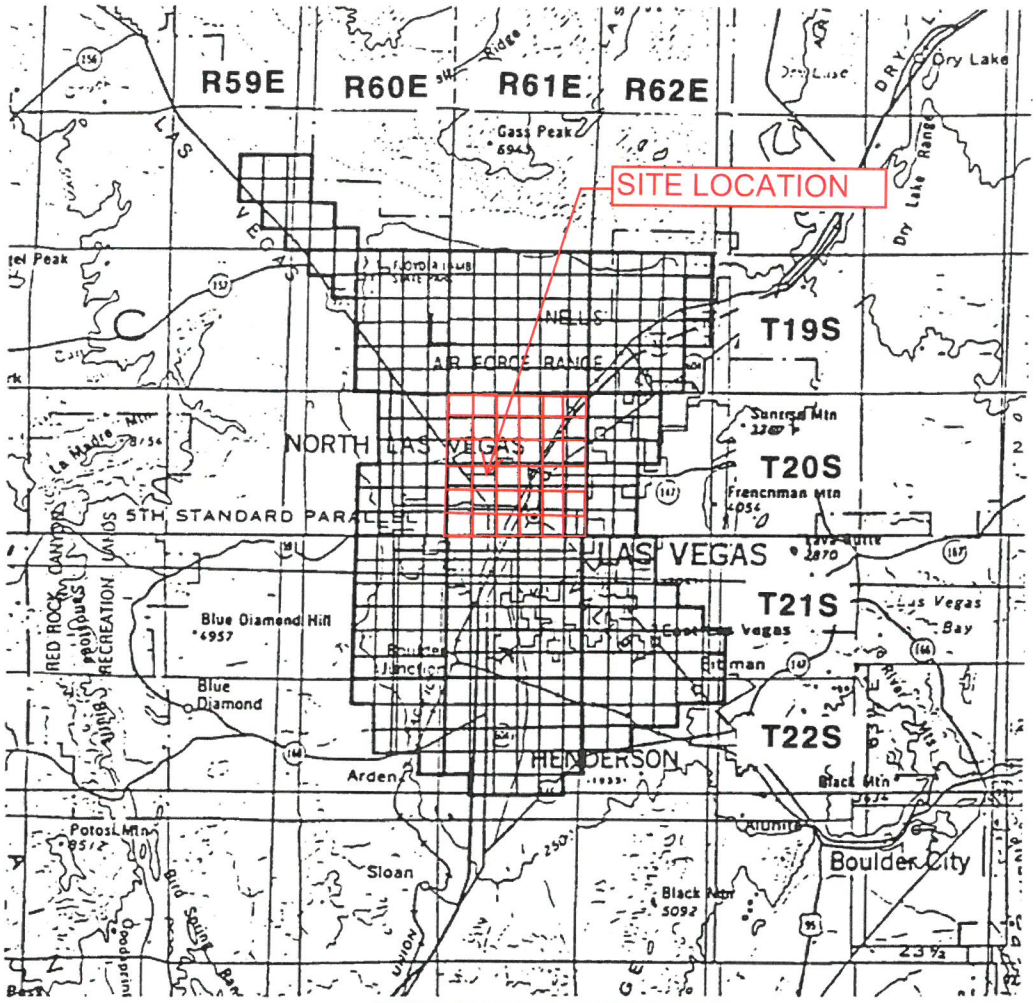
Per Table 505, 502 and 503 of the *Hydrologic Criteria and Drainage Design Manual:*

STORM EVENT	RAINFALL DEPTH (IN)	PRECIPITATION ADJUSTMENT RATIOS	SIX-HOUR DEPTH AREA REDUCTION FACTORS	DESIGN RAINFALL DEPTH (IN)
10-YEAR	1.58	1.00	1.00	1.58
100-YEAR	2.77	1.00	1.00	2.77

10YEAR/100-YEAR DESIGN RAINFALL DEPTH PB CARD RATIO: 0.57

NOTE:
1. Rainfall Depth are taken from Table 505 of the Drainage Design Manual.
2. Six-Hour Depth Area Reduction Factors is taken from Table 502.

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

DEPTH-DURATION-FREQUENCY VALUES FOR McCARRAN AIRPORT RAINFALL AREA

(IN INCHES)

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

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

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

3. Table 501 adjustments not required.

Revision	Date

SIX HOUR DEPTH-AREA REDUCTION FACTORS

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

NOTES: 1. A graphical representation of these factors is presented in Figure 514.

2. Consult with the local entity and/or the CCRFCD for guidance in using the Depth-Area Reduction Factors for drainage areas greater than 200 square miles.

Revision	Date

SIX-HOUR STORM DISTRIBUTIONS

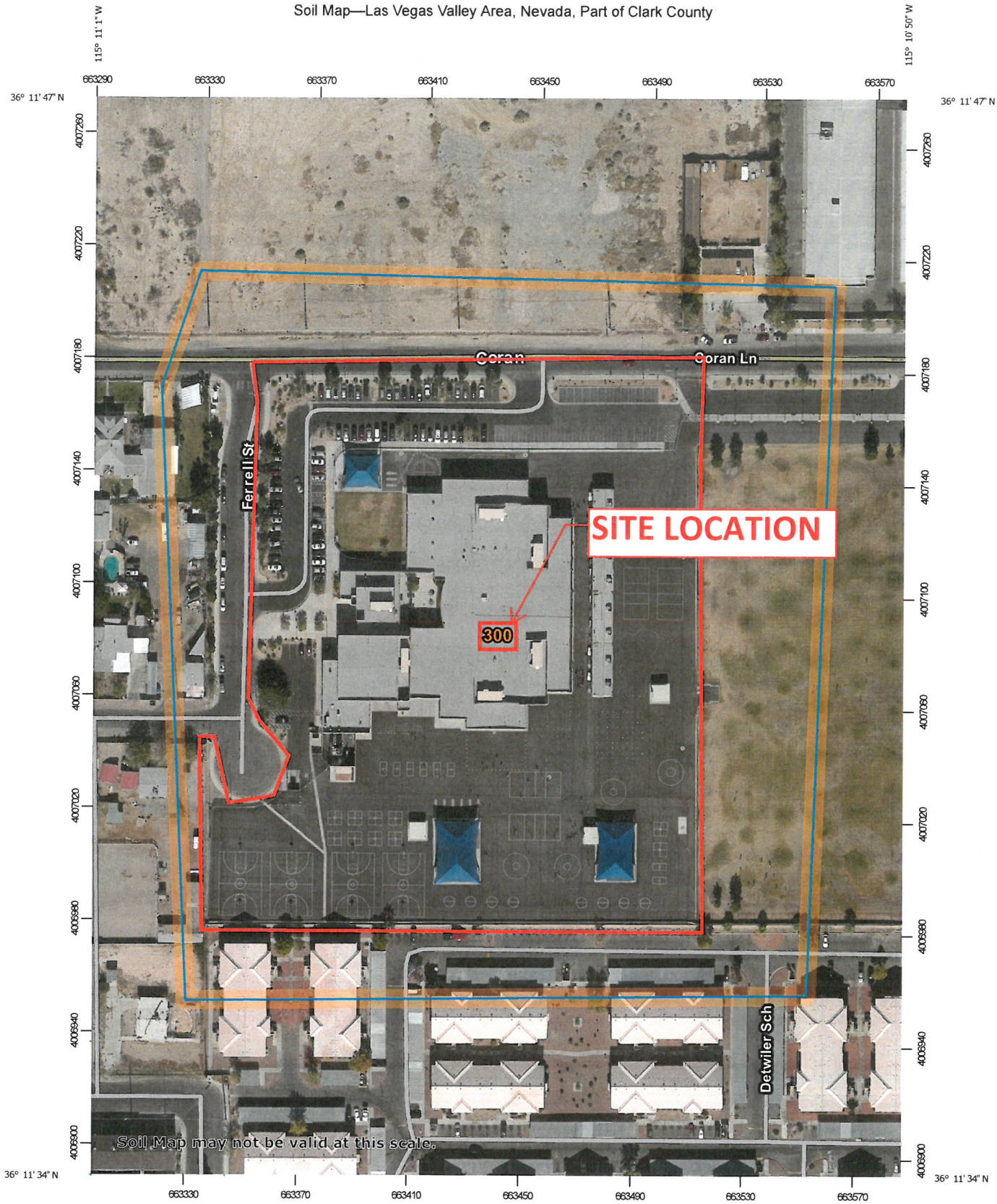
Storm Time (In Minutes)	Percent of Total Storm Depth		
	SDN3	SDN4	SDN5
0	0.0	0.0	0.0
5	2.0	2.0	2.0
10	5.7	5.8	5.9
15	7.0	7.5	8.0
20	8.7	9.9	11.0
25	10.8	12.6	14.4
30	12.4	13.7	15.0
35	13.0	14.5	16.0
40	13.0	14.9	16.8
45	13.0	15.1	17.1
50	13.0	15.5	18.0
55	13.0	15.6	18.2
60	13.0	15.9	18.7
65	13.3	16.2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

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

Revision	Date

REFERENCE:

TABLE 503



Map Scale: 1:1,870 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Las Vegas Valley Area, Nevada, Part of Clark County
Survey Area Data: Version 11, Sep 16, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 26, 2013—Feb 25, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Las Vegas Valley Area, Nevada, Part of Clark County (NV788)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
300	Las Vegas gravelly fine sandy loam, 0 to 2 percent slopes	14.7	100.0%
Totals for Area of Interest		**14.7**	**100.0%**

Hydrologic Soil Group and Surface Runoff

This table gives estimates of various soil water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas.

Surface runoff refers to the loss of water from an area by flow over the land surface. Surface runoff classes are based on slope, climate, and vegetative cover. The concept indicates relative runoff for very specific conditions. It is assumed that the surface of the soil is bare and that the retention of surface water resulting from irregularities in the ground surface is minimal. The classes are negligible, very low, low, medium, high, and very high.

Report—Hydrologic Soil Group and Surface Runoff

Absence of an entry indicates that the data were not estimated. The dash indicates no documented presence.

Hydrologic Soil Group and Surface Runoff–Las Vegas Valley Area, Nevada, Part of Clark County			
Map symbol and soil name	**Pct. of map unit**	**Surface Runoff**	**Hydrologic Soil Group**
300—Las Vegas gravelly fine sandy loam, 0 to 2 percent slopes			
Las vegas	100	Very high	D

Data Source Information

Soil Survey Area: Las Vegas Valley Area, Nevada, Part of Clark County
Survey Area Data: Version 11, Sep 16, 2016

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding		High water table		Bedrock		Cemented pan		Risk of corrosion	
		Frequency	Months	Depth	Months	Depth	Thickness	Depth	Hardness	Uncoated steel	Concrete
				Ft		In		In			
270---------- Land	B	Rare---------	---	3.5-6.0	Mar-Sep	>60	---	---	---	High-------	High.
278---------- Land	D	Rare---------	---	1.5-3.0	Jan-Dec	>60	---	---	---	High-------	High.
282---------- Land	C	Rare---------	---	3.0-3.5	Jan-Dec	>60	---	---	---	High-------	High.
300, 301---------- Las Vegas	D	Rare---------	---	>6.0	---	>60	---	3-14	Thick	High-------	High.
302*: Las Vegas---------	D	Rare---------	---	>6.0	---	>60	---	3-14	Thick	High-------	High.
McCarran----------	B	Rare---------	---	>6.0	---	>60	---	---	---	High-------	High.
Grapevine---------	B	Rare---------	---	>6.0	---	>60	---	---	---	High-------	High.
305*: Las Vegas---------	D	Rare---------	---	>6.0	---	>60	---	3-14	Thick	High-------	High.
Destazo----------	B	Rare---------	---	>6.0	---	>60	---	---	---	High-------	High.
307*: Las Vegas---------	D	Rare---------	---	>6.0	---	>60	---	3-14	Thick	High-------	High.
Skyhaven----------	C	Rare---------	---	>6.0	---	>60	---	24-40	Thick	High-------	High.
325, 326---------- McCarran	B	Rare---------	---	>6.0	---	>60	---	---	---	High-------	High.
341---------- Paradise	C	Rare---------	---	3.0-5.0	Dec-Mar	>60	---	---	---	High-------	Low.
360*: Rock outcrop.											
St. Thomas--------	D	None---------	---	>6.0	---	4-20	Hard	---	---	High-------	Low.
380---------- Skyhaven	C	Rare---------	---	>6.0	---	>60	---	24-40	Thick	High-------	High.
390---------- Spring	C	Rare---------	---	>6.0	---	>60	---	---	---	High-------	High.
403---------- Tencee	D	None---------	---	>6.0	---	>60	---	7-20	Thick	High-------	Low.
415---------- Aztec	B	None---------	---	>6.0	---	>60	---	---	---	High-------	High.
417*: Aztec----------	B	None---------	---	>6.0	---	>60	---	---	---	High-------	High.
Rock outcrop.											
418*: Aztec----------	B	None---------	---	>6.0	---	>60	---	---	---	High-------	High.
Nickel----------	B	None---------	---	>6.0	---	40-60	Hard	---	---	High-------	Low.
Knob Hill---------	B	None---------	---	>6.0	---	>60	---	---	---	High-------	Low.

See footnote at end of table.

RUNOFF CURVE NUMBERS
(URBAN AREAS[1])

Cover description		Curve numbers for hydrologic soil group—			
Cover type and hydrologic condition	Average percent impervious area[2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.)[3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved: curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only)[4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					

See Table 602A

Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)[5]		77	86	91	94

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

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

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

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

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

Revision	Date

RUNOFF CURVE NUMBERS
(SEMIARID RANGELANDS[1])

Cover description		Curve numbers for hydrologic soil group—			
Cover type	Hydrologic condition[2]	A[3]	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

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

[2]*Poor:* <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: >70% ground cover.

[3]Curve numbers for group A have been developed only for desert shrub.

Revision	Date

Ollie Detwiler Elementary School
Job No. 10483
Sheet 1 OF 2

CURVE NUMBER TABLE

Per Table 602 Sheet 1 of 4 and Table 602 Sheet 4 of 4 in the *Hydrologic Criteria and Drainage Design Manual and the National Cooperative Soil Survey*

Soil #300-Las Vegas gravelly fine sandy loam, 0 to 2 percent slopes.					
SOIL	**%**	**HYDRO-LOGIC GROUP**	**Existing Condition** *SEE NOTE #1*	**Dev.> 75% G/ cover** *SEE NOTE #2*	**Dev. Commercial** *SEE NOTE #2*
300	100	D	88	80	95

CN = CURVE NUMBER

NOTE:

1 Existing curve numbers are accepted per Table sheet 4 of 4.

2 Developed curve numbers are accepted per Table sheet 1 of 4.

Ollie Detwiler Elementary School
JOB NO 10483
Sheet 2 OF 2

Curve Number Summary

Per Table 602 Sheet 1 of 4 , and Table 602 Sheet 4 of 4 in the Hydrologic Criteria and *Drainage Design Manual and the National Cooperative Soil Survey*

EXISTING CONDITION

BASIN	TYPE OF DEVELOPMENT	SOIL300 COMM DEV 95	SOIL300 GRASS DEV 80	SOIL300 ASPHALT(98)	CURVE NUMBER
ONX1	DEVELOPED	100%	0%	0%	95
ONX2	DEVELOPED	51%	49%	0%	88
ONX3	DEVELOPED	76%	24%	0%	91

DEVELOPED CONDITION

BASIN	TYPE OF DEVELOPMENT	SOIL300 DEV (95)	SOIL300 ASPHALT(98)	CURVE NUMBER	
OND1	DEVELOPED	100%	0%	0%	95
OND2	DEVELOPED	100%	0%	0%	95
OND3	DEVELOPED	76%	24%	0%	91

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

TIME OF CONCENTRATION

Collins Engineers				Technical Drainage Study														
File: Standardform4.xls				For Ollie Detwiler Elementary School										BY:		SM		
Project No.10483				Existing Condition										DATE:		9/13/17		
SUB-BASIN						INITIAL / OVERLAND			TRAVEL TIME					Tc		Tlag	REMARKS	
DATA						TIME (Ti)			(Tt)									
						INITIAL			TRAVEL		V1	V2				Tlag=	RAINFALL	
DESIG:	DEV./EX.	CN	K	AREA	AREA	LENGTH	SLOPE	Ti	LENGTH	SLOPE	VELOCITY	VELOCITY	Tt	Tc	Tc	0.6Tc/60	Inches	
	(D or E)			Ac	Mi^2	Feet	%	Min	Feet	%	FPS	FPS	Min	Calc.	Check	Hours		
(1)			(2)	(3)		(4)	(5)	(6)	(7)	(8)	(9a)	(9b)	(10)	(13)		Per Tc Calc	100-Yr	
EXISTING CONDITION																		
ONX1	D	95	0.8640	3.20	0.00500	240	0.40	8.9	982	0.70	1.7	2.6	8.1	17.0	16.8	**0.168**	2.77	
ONX2	D	88	0.7666	2.40	0.00375	321	0.90	11.1	675	0.70	1.7	2.6	6.1	17.2	15.5	**0.155**	2.77	
ONX3	D	91	0.8112	6.50	0.01016	187	1.10	6.9	607	1.00	2.0	3.1	4.7	11.6	14.4	**0.116**	2.77	
Tc = Ti + Tt Tt = L/V Tlag = 0.6 Tc					For the travel time (Tt) calculations,					Existing	V1 = 14.8*(S/100)^1/2			Developed		V1 = 20.2*(S/100)^1/2		
Ti = 1.8 (1.1 - K) L^1/2 / S^1/3					V1 applies to the first 500 feet of travel distance;													
K = 0.0132 (CN) - 0.39					V2 applies to the remaining travel distance.					Existing	V2 = 29.4*(S/100)^1/2			Developed		V2 = 30.6*(S/100)^1/2		
REFERENCE :														STANDARD FORM 4				

Note: Per sec-602.1 of Clark County Regional Flood Control District Hydrologic Criteria and Drainage Design Manual, the minimum TC are recommended 10 minutes(Tlag-0.10) for undeveloped area and TC=5 (TLAG=0.05) fpr developed area.

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             JUN  1998                 *
*           VERSION 4.1                 *
*                                       *
*  RUN DATE   13SEP17  TIME  08:28:45   *
*                                       *
*****************************************
```

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

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

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

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

1

HEC-1 INPUT


```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
   1          ID        TECHNICAL DRAINAGE STUDY FOR OLLIE DETWILER ELEMENTARY SCHOOL
   2          ID                     LAS VEGAS, NEVADA
   3          ID
   4          ID
   5          ID        PREPARED BY:
   6          ID                     COLLINS ENGINEERS
   7          ID                     3130 S. DURANGO DRIVE SUITE 404
   8          ID                     LAVEGAS, NV  89117
   9          ID
  10          ID
  11          ID    EXISTING CONDITIONS 10-YEAR AND 100-YEAR
  12          ID    FILENAME:EX.DAT
  13          ID    JOB#10483
  14          ID
  15          ID    JR RATIOS
  16          ID    1.00 100-YEAR NO DARF
  17          ID    0.57 10-YEAR NO DARF
  18          ID
              *DIAGRAM
  19          IT       5       0       0     300
  20          IO       5
  21          IN       5
  22          JR    PREC    0.57     1.00
              *

  23          KK    ONX1
  24          KM   FULLY DEVELOPED (COMMERCIAL) NORTHWESTERN PORTION OF ON-SITE BASIN
  25          BA  .00500
  26          PB    2.77
  27          PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
  28          PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
  29          PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
  30          PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
  31          PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
  32          PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
  33          PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
  34          PC    .998    .999   1.00
  35          LS       0      95
  36          UD    .168
              *

  37          KK    ONX2
  38          KM   FULLY DEVELOPED (COMMERCIAL/GRASS COVER) NORTHEASTERN PORTION OF ON-SITE BASI
  39          LS       0      88
  40          UD    .155
              *

  41          KK    ONX3
  42          KM   FULLY DEVELOPED (COMMERCIAL/FRASS COVER) SOURTHERN PORTION OF ON-SITE BASIN
  43          BA  .01016
  44          LS       0      91
  45          UD    .116
              *
  46          ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

   23       ONX1
              .
              .
   37         .        ONX2
              .          .
              .          .
   41         .          .        ONX3
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *              JUN  1998                *
 *            VERSION 4.1                *
 *                                       *
 *  RUN DATE   13SEP17  TIME  08:28:45   *
 *                                       *
 *****************************************
```


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


TECHNICAL DRAINAGE STUDY FOR OLLIE DETWILER ELEMENTARY SCHOOL
LAS VEGAS, NEVADA

PREPARED BY:
COLLINS ENGINEERS
3130 S. DURANGO DRIVE SUITE 404
LAVEGAS, NV 89117

EXISTING CONDITIONS 10-YEAR AND 100-YEAR
FILENAME:EX.DAT
JOB#10483

JR RATIOS
1.00 100-YEAR NO DARF
0.57 10-YEAR NO DARF

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

     IT          HYDROGRAPH TIME DATA
                       NMIN           5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2    0  ENDING DATE
                     NDTIME        0055  ENDING TIME
                      ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL      .08 HOURS
                      TOTAL TIME BASE   24.92 HOURS

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

     JP          MULTI-PLAN OPTION
                      NPLAN           1  NUMBER OF PLANS

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

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

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1 .57	RATIO 2 1.00
HYDROGRAPH AT						
+	ONX1	.00	1	FLOW	4.	8.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	ONX2	.00	1	FLOW	3.	7.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	ONX3	.01	1	FLOW	7.	16.
				TIME	3.58	3.58

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

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

TIME OF CONCENTRATION

Collins Engineers				Technical Drainage Study															
File: Standardform4.xls				For Ollie Detwiler Elementary School											BY:		SM		
Project No.10483				Developed Condition											DATE:		9/13/17		
SUB-BASIN DATA						INITIAL / OVERLAND TIME (Ti)			TRAVEL TIME (Tt)						Tc		Tlag	REMARKS	
						INITIAL			TRAVEL		V1	V2					Tlag=	RAINFALL	
DESIG:	DEV./EX.	CN	K	AREA	AREA	LENGTH	SLOPE	Ti	LENGTH	SLOPE	VELOCITY	VELOCITY	Tt	Tc	Tc		0.6Tc/60	Inches	
	(D or E)			Ac	Mi^2	Feet	%	Min	Feet	%	FPS	FPS	Min	Calc.	Check		Hours		
(1)			(2)	(3)		(4)	(5)	(6)	(7)	(8)	(9a)	(9b)	(10)	(13)			Per Tc Calc	100-Yr	
EXISTING CONDITION																			
OND1	D	95	0.8640	3.20	0.00500	240	0.40	8.9	982	0.70	1.7	2.6	8.1	17.0	16.8		**0.168**	2.77	
OND2	D	95	0.8640	2.40	0.00375	321	0.90	7.9	675	0.70	1.7	2.6	6.1	14.0	15.5		**0.140**	2.77	
OND3	D	91	0.8112	6.50	0.01016	187	1.10	6.9	607	1.00	2.0	3.1	4.7	11.6	14.4		**0.116**	2.77	
Tc = Ti + Tt Tt = L/V Tlag = 0.6 Tc					For the travel time (Tt) calculations,					Existing	V1 = 14.8*(S/100)^1/2			Developed			V1 = 20.2*(S/100)^1/2		
Ti = 1.8 (1.1 - K) L^1/2 / S^1/3					V1 applies to the first 500 feet of travel distance;														
K = 0.0132 (CN) - 0.39					V2 applies to the remaining travel distance.					Existing	V2 = 29.4*(S/100)^1/2			Developed			V2 = 30.6*(S/100)^1/2		
REFERENCE :														STANDARD FORM 4					

Note: Per sec-602.1 of Clark County Regional Flood Control District Hydrologic Criteria and Drainage Design Manual, the minimum TC are recommended 10 minutes(Tlag-0.10) for undeveloped area and TC=5 (TLAG=0.05) fpr developed area.

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*               JUN   1998              *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   13SEP17  TIME  08:28:57   *
*                                       *
*****************************************
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*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
*****************************************
```

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

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

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

1 HEC-1 INPUT PAGE 1

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LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
  1           ID        TECHNICAL DRAINAGE STUDY FOR OLLIE DETWILER ELEMENTARY SCHOOL
  2           ID                  LAS VEGAS, NEVADA
  3           ID
  4           ID
  5           ID        PREPARED BY:
  6           ID                  COLLINS ENGINEERS
  7           ID                  3130 S. DURANGO DRIVE SUITE 404
  8           ID                  LAVEGAS, NV  89117
  9           ID
 10           ID
 11           ID    DEVELOPED CONDITIONS 10-YEAR AND 100-YEAR
 12           ID    FILENAME:EX.DAT
 13           ID    JOB#10483
 14           ID
 15           ID    JR RATIOS
 16           ID    1.00 100-YEAR NO DARF
 17           ID    0.57 10-YEAR NO DARF
 18           ID
              *DIAGRAM
 19           IT       5       0       0     300
 20           IO       5
 21           IN       5
 22           JR    PREC    0.57     1.00
              *

 23           KK    OND1
 24           KM   FULLY DEVELOPED (COMMERCIAL) NORTHWESTERN PORTION OF ON-SITE BASIN
 25           BA  .00500
 26           PB    2.77
 27           PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
 28           PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
 29           PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
 30           PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
 31           PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
 32           PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
 33           PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
 34           PC    .998    .999   1.00
 35           LS       0      95
 36           UD    .168
              *

 37           KK    OND2
 38           KM   FULLY DEVELOPED (COMMERCIAL) NORTHEASTERN PORTION OF ON-SITE BASIN
 39           BA  .00375
 40           LS       0      95
 41           UD    .140
              *

 42           KK    OND3
 43           KM   FULLY DEVELOPED (COMMERCIAL/GRASS COVER) SOURTHERN PORTION OF ON-SITE BASIN
 44           BA  .01016
 45           LS       0      91
 46           UD    .116
              *
 47           ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

    23        OND1
                .
                .
    37          .        OND2
                .          .
                .          .
    42          .          .        OND3

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*               JUN   1998              *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   13SEP17  TIME  08:28:57   *
*                                       *
*****************************************
```

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

TECHNICAL DRAINAGE STUDY FOR OLLIE DETWILER ELEMENTARY SCHOOL
LAS VEGAS, NEVADA

PREPARED BY:
COLLINS ENGINEERS
3130 S. DURANGO DRIVE SUITE 404
LAVEGAS, NV 89117

DEVELOPED CONDITIONS 10-YEAR AND 100-YEAR
FILENAME:EX.DAT
JOB#10483

JR RATIOS
1.00 100-YEAR NO DARF
0.57 10-YEAR NO DARF

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

     IT          HYDROGRAPH TIME DATA
                       NMIN           5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME         0000  STARTING TIME
                         NQ          300  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2    0  ENDING DATE
                     NDTIME         0055  ENDING TIME
                     ICENT           19  CENTURY MARK

                  COMPUTATION INTERVAL      .08 HOURS
                       TOTAL TIME BASE   24.92 HOURS

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

     JP          MULTI-PLAN OPTION
                       NPLAN           1  NUMBER OF PLANS

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

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

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1	RATIO 2
					.57	1.00
HYDROGRAPH AT						
+	OND1	.00	1	FLOW	4.	8.
				TIME	3.58	3.58

HYDROGRAPH AT

+	OND2	.00	1	FLOW	3.	7.
				TIME	3.58	3.58

HYDROGRAPH AT

+	OND3	.01	1	FLOW	7.	16.
				TIME	3.58	3.58

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

APPENDIX C
(Hydraulic Analysis)

- Flow Depth Analysis

Prorated Flow for Onsite FlowMaster Sections						
Section	Contributing Area		Prorated	Area	Q_{10}	Q_{100}
	Area (Sq. Ft.)	Acre	From			
FM	68595	1.6	OND2	2.40	2.0	4.6
SWD #1	11094	0.3	OND2	2.40	0.3	0.7
SWD #2	23575	0.5	OND2	2.40	0.7	1.6
4 BWO	Q_{100} (OFFSITE+OND3)=14+16=30 CFS					

Maximum capacity of existing 4 block wall openings =4*8.2=32.8 cfs

SWD: Sidewalk drains which are proposed north of the proposed building

The worst scenario (SWD #2) is analyzed.

Cross Section for FM1-Q10–CORAN LN

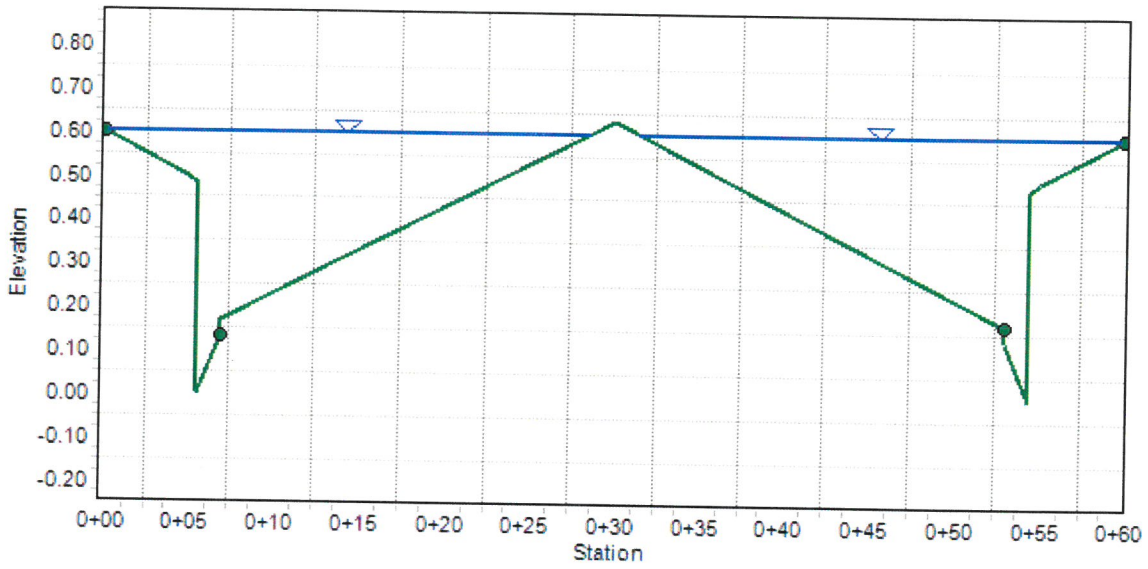
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00750	ft/ft
Normal Depth	0.60	ft
Discharge	33.00	ft³/s

Cross Section Image



Worksheet for FM1-Q10--CORAN LN

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00750	ft/ft
Discharge	33.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.48
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+30.00	0.63
0+53.00	0.17
0+53.00	0.13
0+54.50	0.00
0+54.50	0.48
0+55.00	0.50
0+60.00	0.60

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.13)	0.013
(0+07.00, 0.13)	(0+53.00, 0.17)	0.016
(0+53.00, 0.17)	(0+60.00, 0.60)	0.013

Options

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

Worksheet for FM1-Q10–CORAN LN

Results

Normal Depth		0.60	ft
Elevation Range	0.00 to 0.63 ft		
Flow Area		11.52	ft²
Wetted Perimeter		57.98	ft
Hydraulic Radius		0.20	ft
Top Width		56.92	ft
Normal Depth		0.60	ft
Critical Depth		0.62	ft
Critical Slope		0.00585	ft/ft
Velocity		2.87	ft/s
Velocity Head		0.13	ft
Specific Energy		0.72	ft
Froude Number		1.12	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.60	ft
Critical Depth	0.62	ft
Channel Slope	0.00750	ft/ft
Critical Slope	0.00585	ft/ft

Cross Section for FM1-Q100-CORAN LN

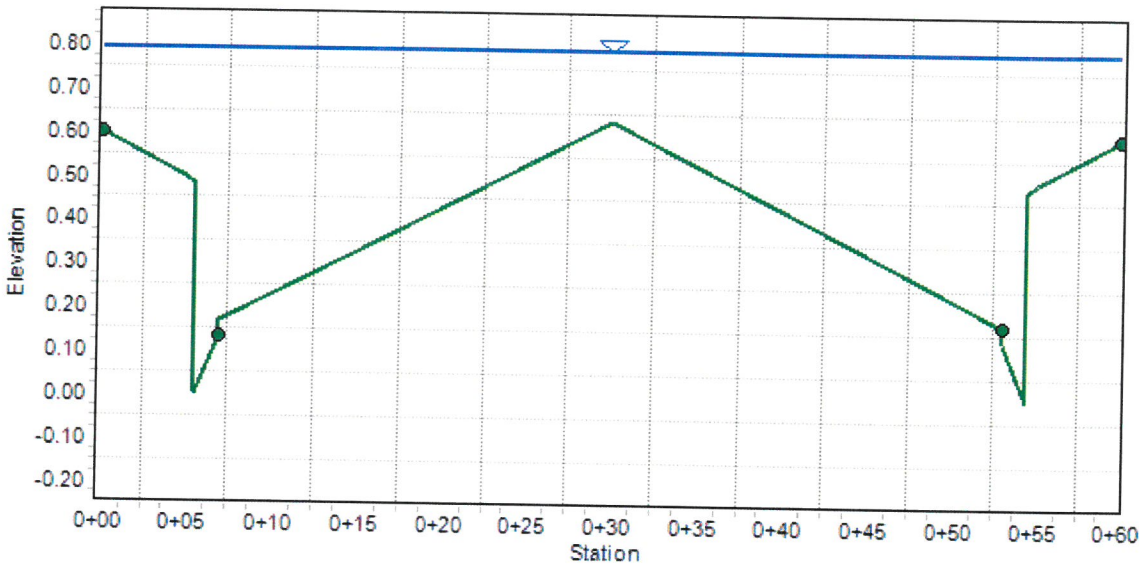
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00750	ft/ft
Normal Depth	0.79	ft
Discharge	101.00	ft³/s

Cross Section Image



Worksheet for FM1-Q100-CORAN LN

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00750	ft/ft
Discharge	101.00	ft^3/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.48
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+30.00	0.63
0+53.00	0.17
0+53.00	0.13
0+54.50	0.00
0+54.50	0.48
0+55.00	0.50
0+60.00	0.60

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.13)	0.013
(0+07.00, 0.13)	(0+53.00, 0.17)	0.016
(0+53.00, 0.17)	(0+60.00, 0.60)	0.013

Options

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

Worksheet for FM1-Q100-CORAN LN

Results

Normal Depth		0.79	ft
Elevation Range	0.00 to 0.63 ft		
Flow Area		23.07	ft²
Wetted Perimeter		61.44	ft
Hydraulic Radius		0.38	ft
Top Width		60.00	ft
Normal Depth		0.79	ft
Critical Depth		0.85	ft
Critical Slope		0.00463	ft/ft
Velocity		4.38	ft/s
Velocity Head		0.30	ft
Specific Energy		1.09	ft
Froude Number		1.24	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.79	ft
Critical Depth	0.85	ft
Channel Slope	0.00750	ft/ft
Critical Slope	0.00463	ft/ft

Cross Section for FM2

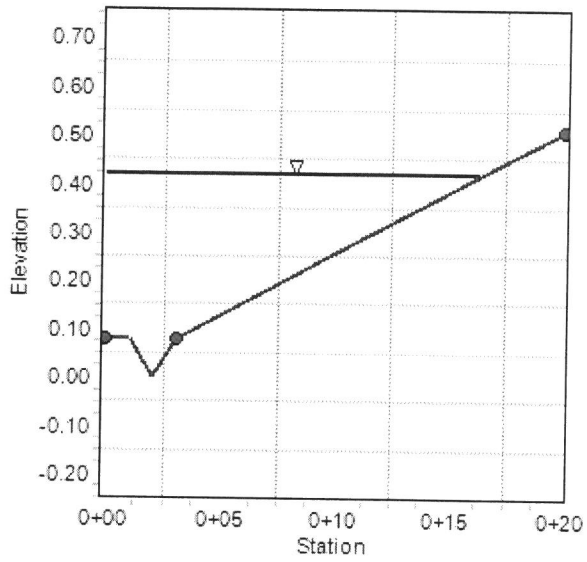
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00400	ft/ft
Normal Depth	0.42	ft
Discharge	4.60	ft^3/s

Cross Section Image



Worksheet for FM2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00400	ft/ft
Discharge	4.60	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.08
0+01.00	0.08
0+02.00	0.00
0+03.00	0.08
0+10.00	0.26
0+20.00	0.51

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.08)	(0+03.00, 0.08)	0.013
(0+03.00, 0.08)	(0+20.00, 0.51)	0.025

Options

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

Results

Normal Depth		0.42	ft
Elevation Range	0.00 to 0.51 ft		
Flow Area		3.32	ft²
Wetted Perimeter		16.72	ft
Hydraulic Radius		0.20	ft
Top Width		16.37	ft

Worksheet for FM2

Results

Normal Depth		0.42	ft
Critical Depth		0.33	ft
Critical Slope		0.01476	ft/ft
Velocity		1.39	ft/s
Velocity Head		0.03	ft
Specific Energy		0.45	ft
Froude Number		0.54	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.42	ft
Critical Depth	0.33	ft
Channel Slope	0.00400	ft/ft
Critical Slope	0.01476	ft/ft

Cross Section for SWD #2

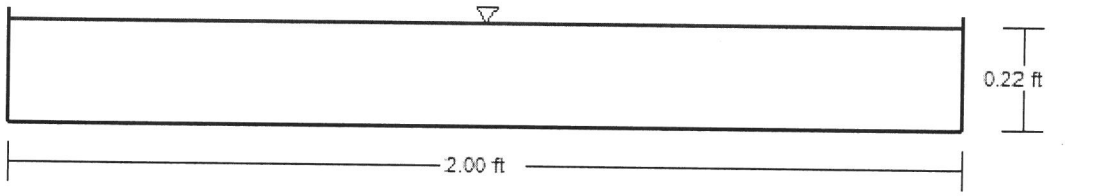
Project Description

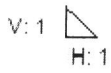
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Normal Depth	0.22	ft
Bottom Width	2.00	ft
Discharge	1.60	ft³/s

Cross Section Image





Worksheet for SWD #2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Bottom Width	2.00	ft
Discharge	1.60	ft^3/s

Results

Normal Depth	0.22	ft
Flow Area	0.44	ft^2
Wetted Perimeter	2.44	ft
Hydraulic Radius	0.18	ft
Top Width	2.00	ft
Critical Depth	0.27	ft
Critical Slope	0.00524	ft/ft
Velocity	3.64	ft/s
Velocity Head	0.21	ft
Specific Energy	0.43	ft
Froude Number	1.37	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.22	ft
Critical Depth	0.27	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00524	ft/ft

Project	Ollie Detwiler Elementary School				
Subject	Ex. Block Wall Opening Capacity Analysis				
Designed by	SM	*Date*	September 21, 2017	*Job No.*	21-10483
Checked by		*Date*		*Sheet No.*	1 of 1

Capacity of Wall Opening

Q	8.2	: Magnitude of Flow (cfs)
Cf	**0.5**	**: Clogging Factor**
Cw	3	: Weir Coefficient
Co	0.67	: Orifice Coefficient
L	4.00	: Length of Wall Opening (feet)
H	1.33	: Height of Wall Opening (feet)
D		: Depth of water surface (feet)

4 Openings will have 32.8 cfs capacity
Total flow (off-site 14 cfs +16 cfs from onsite)=30 cfs

Weir Equation

$$D_w = \left(\frac{Q}{CL}\right)^{2/3}$$

D_w = 1.44

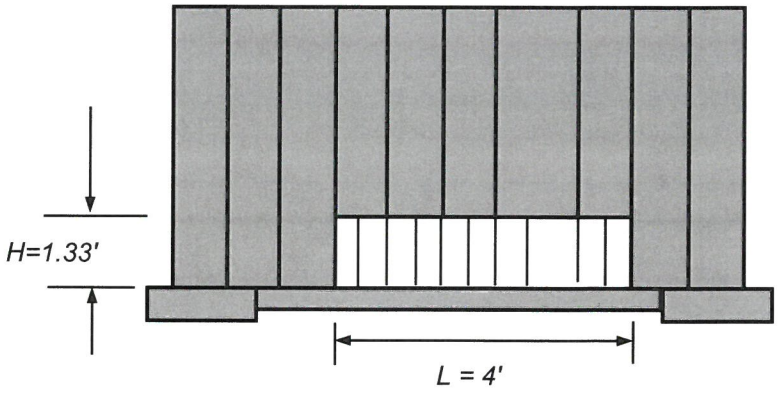
Orifice Equation

$$D_O = \left(\frac{1}{2g}\right)^{1/2}\left(\frac{Q}{C_O C_f L H}\right)^2 + \frac{3}{2}C_f H$$

D_o = 1.33

If the Weir Depth is greater than the height of the opening then the Orifice Equation Governs Otherwise the Weir Equation Governs. Therefore,

Do= 1.33



APPENDIX D
(Reference #1)

Technical Drainage Study for Ollie Detwiler Elementary School, DS # 2333 & HTE # 98-18795, by PBS&J, July 1st, 1998. The study was approved by the Clark County on February 5, 1999 and by the City of Las Vegas on July 29, 1998.

The study material is used to support: the off-site flow from Anderson Ln. and Ferrell Street; to support the approved flow pattern, the location of the approved block wall openings, and Valley gutters along the east and west property lines.

DS# 2333

DS INDEX 56062

APN 139-20-310:001 & 002

PROJECT Ollie Detwiler Elementary School

SUBMITTAL 1st Submittal - Drainage study

scanning.doc

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM				DATE: July 29, 1998
TO: Land Development Services Department of Public Works				FROM: Dennis W. Stransky, P.E. Flood Control Project Manager Department of Public Works
SUBJECT:	Drainage Study for:			COPIES TO:
Ollie Detwiler Elementary School				PBS&J
Cross Streets:	Coran and Simmons			Clark Count School district
FILE NO.	\\KHAN\flood\Depot\DSMEMOS\DS2333A.doc			Cheri Edelman, P.E. DEVCO
Parcel Number:	139-20-310-001/002			
Zoning Action:	none			
FEMA Flood Zone	YES	No	X	
Proposed Storm Drain	YES	No	X	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES
1st Submittal	7/17/98	7/29/98	See Comments Below	N/C
			TOTAL FEES	N/C

REMARKS:

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

X	is acceptable in concept subject to conformance to all City standards and the following conditions.
	must be resubmitted or supplemented including the following:
	must have Clark County Regional Flood Control District concurrence

1. The berm along the north side of the building must be extended south along the west side of the building to a point where the top of berm is 6-inches above the depth of flow in Coran Avenue. The top of curb elevations must be provided along the west side of the access road. A cross section showing the berm should be provided in this area as well as along the south side of Coran Avenue.
2. The grades shown in the area around the entrance north of the building indicate that flow from Coran will enter the parking lot during the 100 year event. The flow line in the street gutter, (11.15) is higher than the flow line at the east end of the valley gutter, (11.01). the engineer should review the grades in this area and revise accordingly.
3. A detail should be provided for the connection of the on-site 8-inch storm drain to the under sidewalk drain.
4. The On-site Basin Map is labeled as "Grading Plan" and should be revised.

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

PLANS SENT TO LAND DEVELOPMENT yes (initial)

END OF REMARKS

dws

T/R/S: 20S/61E/20

AREA M20

DRAINAGE STUDY 98-18795

PROJECT NAME:

Ollie Detwiler Elementary Sch

SECTION-TOWNSHIP-RANGE:

20 20 61

CROSS STREETS:

CORAN/Simmons

ASSESSOR'S PARCEL NUMBER:

NEW ASSESSOR'S PARCEL NUMBER:

139-20-301 310-001

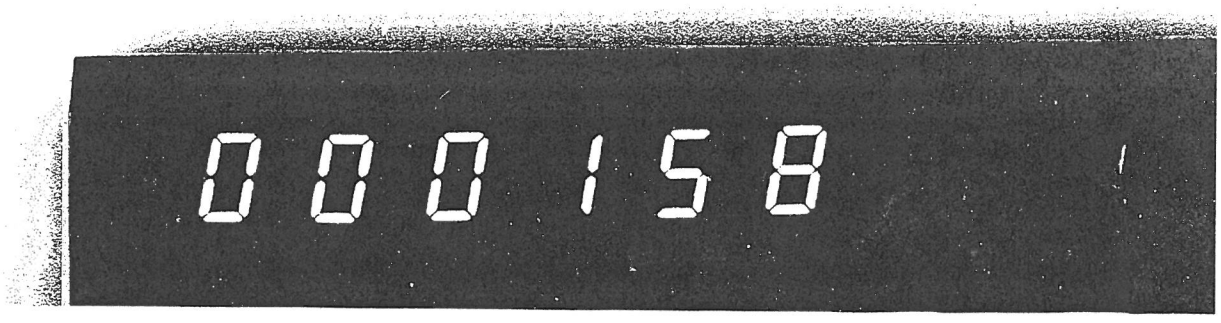
ACREAGE:

13.

SUBMITTAL DATE:

7.98

DSA



TECHNICAL DRAINAGE STUDY
FOR
OLLIE DETWILER ELEMENTARY SCHOOL

Prepared for:
Clark County School District
4828 Pearl Street
Las Vegas, NV 89121

Prepared by:
P B S & J
901 North Green Valley Parkway Suite #100
Henderson, Nevada 89014

Reference Number 51690.07

July 1998

PBS&J

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: OLLIE DETWILER ELEMENTARY SCHOOL Date: JULY 1998

Location of Development: a) Descriptive SW 1/4

b) Sect. 20 Twn. 20S Rng. 61E

Name of Owner: CLARK COUNTY SCHOOL DISTRICT Assessors Parcel No: 139-20-310-001/002

Contact Person Name: Gene Ramos Telephone No: (702) 263-7275

Firm: P B S & J

Address: 901 N. Green valley Parkway, Suite 100

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: 13.0+/- acres Being Developed/Disturbed: 13.0+/- 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 ☒

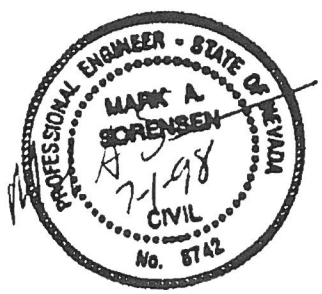
4. Proposed type of development (Residential, Commercial, Etc.)? Elementary School

5. Approximate upstream land area which drains to the subject site? 14.4+/-acres

6. Has the site drainage been evaluated in the past? YES ☐ NO ☒
If yes, please identify documentation:

7. If known, please briefly identify the proposed discharge point(s) of runoff from the site:

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.

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

98-18795
Local Entity File No.

Revision	Date

PBS&J Job Number: 51690.07

STANDARD FORM 1

Department of Public Works

500 S Grand Central Pky • PO Box 554000 • Las Vegas NV 89155-4000
(702) 455-6000 • Fax (702) 455-6040

M.J. Manning, Director • E-Mail: mjm@co.clark.nv.us

February 5, 1999

PBS&J, Inc.
901 N. Green Valley Parkway, Suite 100
Henderson, NV 89014

Dear Sirs:

Re: Willdan/Clark County Public Works Plan Review Contract
Technical Drainage Study for Ollie Detwiler Elementary School **(2728)**
Study Dated: July 1, 1998
First Addendum Dated: September 14, 1998
First Supplemental Dated: October 2, 1998
Second Addendum Dated: November 12, 1998
Second Supplemental Dated: December 9, 1998
Location: South side of Coran Avenue between Allen Lane and Simmons Street (Sec. 20, T. 20 S., R. 61 E.)
HTE # 98-18795

The referenced **Technical Drainage Study** has been reviewed and is accepted as complying with minimum improvement standards. As set forth in the subject drainage study, the following measures will be taken to mitigate flood hazards:

1. The site shall be graded with respect to drainage as shown on "Ollie Detwiler Elementary School Onsite Grading Plan," sheet C3.01, signed and sealed by Vernon R. Harkins, P.E., on December 8, 1998, and "Ollie Detwiler Elementary School Details," sheets C6.01 and C6.02, signed and sealed by Vernon R. Harkins, P.E., on September 9, 1998;

2. The following drainage facilities shall be constructed:

   a. An 8-foot-wide valley gutter crossing each of the four entrances to the site on Coran Lane

   b. A 2-foot-wide sidewalk underdrain on Coran Lane adjacent to the two eastern most driveway entrances

BOARD OF COUNTY COMMISSIONERS
BRUCE L. WOODBURY, Chairman • ERIN KENNY, Vice-Chair
YVONNE ATKINSON GATES • DARIO HERRERA • MARY J. KINCAID • LANCE M. MALONE • MYRNA WILLIAMS
DALE W. ASKEW, County Manager

c. A 1-foot high stem wall along the north side of the building and along a portion of the west side of the building as shown on the plan

d. A 2-foot-wide sidewalk underdrain at the end of the cul-de-sac on the access road

e. A 2-foot-wide valley gutter from the outlet of the sidewalk underdrain mentioned above in 2(d) to the existing swale along the southern boundary to outlet nuisance flows

3. A bond estimate must be submitted to Clark County Public Works for the above-mentioned stormwater management facilities;

4. The minimum finished floor elevation for the proposed structure shall be constructed as follows:

FF = 2114.07

5. The subject site is located within Zone X, as shown on FIRM Community Panel Number 32003C 2160D, revised August 16, 1995. Zone X is determined to be outside the 500-year flood plain;

6. Mylars of the grading plan must be submitted to the Clark County Plan Check department for approval signatures prior to permit issuance;

7. The grading plan will be reviewed by the building department to ensure compliance with the handicap access requirements. Revisions to the grading plan may be required if the site accessibility design does not comply with the requirements set forth in the Accessibility Chapter of the Clark County Building Code;

8. At the request of Clark County Public Works, drainage/grading plans for the proposed development have been reviewed for compliance to the requirements set forth in the "Minimum Drainage Study Criteria Checklist," "Drainage Plan Information," dated July 15, 1997. **The drainage/grading plan submitted for this project appears to meet the minimum standards outlined in the above-referenced regulation;**

No liability is assumed by the County for information, data, and conclusions of the consulting engineer.

M.J. MANNING
DIRECTOR OF PUBLIC WORKS

BY _____
Steve Parrish, P.E.
Associate Engineer
Community Development Division

SP/ca

cc: Development File
Clark County School District

A:\2728.wpd

WILLDAN ASSOCIATES ☐ ENGINEERS & PLANNERS

Professional Consulting Services Since 1964

MEMORANDUM

TO: Bill Hunter, P.E. COS for

FROM: Glenn S. Hale

OFFICE: Las Vegas

DATE: July 10, 1998

SUBJECT: Willdan/Clark County Public Works Plan Review Contract
Technical Drainage Study for Ollie Detwiler Elementary School **(2728)**
Study Dated: July 1, 1998
Location: Southside of Coran Avenue between Allen Lane and Simmons Street
(Sec.20, T. 20 S., R. 61 E.)
HTE # 98-18795
Prepared by Post, Buckley, Schuh and Jernigan, Inc.

We have completed our initial review of the above-referenced **Technical Drainage Study**, and have the following comments:

1. It is unclear from the reference material provided where the 100-year 608 cfs was determined for Rancho Drive and Coran Avenue and must be addressed;

2. Based on a review of the site location, it appears that Allen Lane has a high point just south of Coran Avenue and that no split flow will occur at the intersection. The study must revise the quantity of flow that will be conveyed easterly in Coran Avenue and revise all subsequent calculations . The finished floor elevation must be revised accordingly;

3. Offsite runoff that is conveyed through the site must be within a drainage easement. The easement must be at least equal to the top width of the channel. Clark County policy requires that all drainage easements must be lined with a permanent facility. The presently-accepted facility consists of a 3-foot-minimum width concrete valley gutter;

4. The velocity estimation calculations for basin OFFDEV-1 must be provided;

5. The study must provide supporting calculations to the offsite basin flow split at the Access Road;

2725 E. DESERT INN ROAD, SUITE 100 • LAS VEGAS, NEVADA 89121 • TEL: (702) 734-3001 • FAX: (702) 734-0888

6. The proposed berm adjacent to Coran Avenue must be extended along the Access Road or a hump at the entrance to the Access Road must be provided to keep offsite flows from entering the onsite driveways;

7. deleted The velocity times depth value in Coran Avenue exceeds the Clark County RFCD Design Manual standards, therefore, corrective measures must be provided in the study and plans to meet the Clark County standard;

8. Provide a flow summary table;

9. At the request of Clark County Public Works, drainage/grading plans for the proposed development have been reviewed for compliance to the requirements set forth in the "Minimum Drainage Study Criteria Checklist, "Drainage Plan Information," dated July 15, 1997. **The plans submitted do not meet the minimum requirements and must be revised prior to Drainage Study approval, to address the following:**

   a. Raise the entrance to the Access Road

   b. Label right-of-way widths

   c. Provide a vicinity map

   d. Identify facility at outlet of private storm drain

   e. Provide typical street section for Coran Avenue

   f. Provide a berm detail

The grading plan has been red-lined and is being returned to the engineer. The red-lined grading plan must be resubmitted with the revised drawings. Failure to resubmit the re-lined grading plan will prevent further review of the project.

All addenda must be submitted directly to Clark County. Any drainage studies or addenda submitted directly to Willdan will be returned to Clark County for the necessary log-in procedures.

The items listed herein must be thoroughly addressed and submitted for review prior to acceptance of this study.

A study review workshop with Willdan Associates may be scheduled if there are questions concerning the above listed comments.

CONCURRENCE BY CLARK COUNTY PUBLIC WORKS:

Steve Bainl — 07/22/98 *

Signature — Date

COMMENTS: Item 3. Lining may be waived for the school project.

Item 7. May be deleted. Not required for V x D = 8.14.

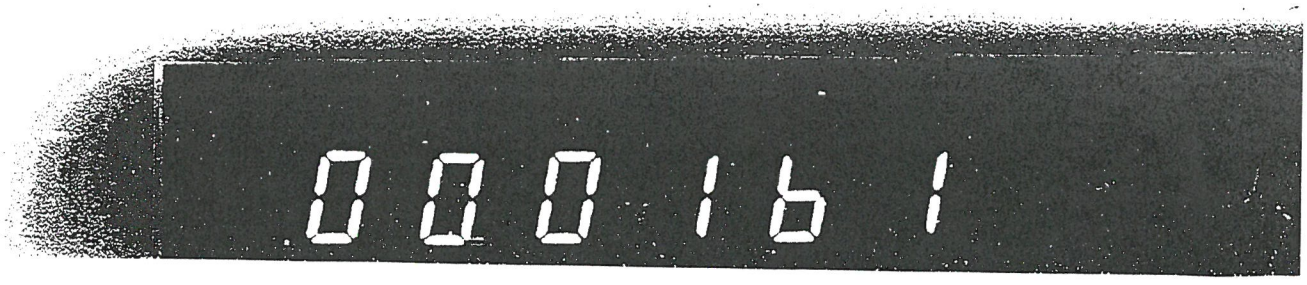
cc: Kurt Schaake, P.E.
Clark County School District

e:\contracts\ccpw\Drainage-3226\projects5\2728-1

Additional comment.

* The site must be plotted on Fig. 4a : City Wide Hydro. Study Update.

ps 7-22-98



ADDENDUM #1 TO THE TECHNICAL DRAINAGE STUDY FOR THE OLLIE DETWILER ELEMENTARY SCHOOL

Prepared for:

Clark County School District
4828 Pearl Street
Las Vegas, Nevada 89121

Prepared by:

P B S & J
901 North Green Valley Parkway Suite #100
Henderson, Nevada 89014

Reference Number 51690.00
September 1998

PBS&J

This report is intended to serve as the *Addendum #1 to the Technical Drainage Study for the Ollie Detwiler Elementary School* prepared by PBS&J dated July 1, 1998. The revisions in this addendum are intended to supersede the data contained in the technical study.

The responses to comments in a letter dated July 24, 1998 from the Clark County Public Works are included below:

Comment 1: **It is unclear from the reference material provided where the 100-year 608 cfs was determined for Rancho Drive and Coran Avenue and must be addressed.**

Response 1: Information has been highlighted in the HEC-1 runs from the City-Wide Report, which determines the flow in Coran Avenue. Row A gives the name of the location of the flow. Row I, II, III, IV, and V give the Depth Area Reduction Ratio's for areas of 0, 1, 2, 6, and 10 square miles, respectively. The interpolation calculation (between the Q's for bracketing D.A.R.F. values) for the flow is also included.

Comment 2: **Based on a review of the site location, it appears that Allen Lane has a high point just south of Coran Avenue and that no flow split will occur at the intersection. The study must revise all subsequent calculations. The finished floor elevation must be revised accordingly.**

Response 2: This information has been noted, and all calculations have been adjusted to accommodate the change. The flow of 608 cfs was used to calculate street flow depth and finish floor / berm requirements. The street flow depth is 1.44 ft above flow line. This gives 1.54ft of freeboard (relative to the finish floor where the berm ends), and is 0.97ft below the top of berm. Please see included grading plans

Comment 3: **Deleted**

Comment 4: **The velocity estimation calculations for basin OFFDEV-1 must be provided.**

Response 4: After further analysis OFFDEV-1 was split into two basins. The velocity estimations were performed and are included in this addendum. Please see **Figure 4 and 6.**

Comment 5: **The study must provide supporting calculations to the offsite basin flow split at the Access Road.**

Response 5: As discussed above, the basin was separated into two individual basins and was reevaluated. The flow from OFFDEV-1A is routed to the section north of the grade break on the access road, and OFFDEV-1B is routed to the section south of the grade break on the access road. All calculations for the two basins are included. Please see **Figure 4 and 6.**

Comment 6: **The proposed berm adjacent to Coran Avenue must be extended along the Access Road or a hump at the entrance to the Access Road must be provided to keep offsite flows from entering the onsite driveways.**

Response 6: The berm has been extended please see plans included in back.

Comment 7: **Deleted**

Comment 8: **Provide a flow summary table.**

Response 8: A flow summary table is included in herein.

Comment 9: **At the request of Clark County Public Works, drainage/ grading plans for the proposed development have been reviewed for compliance to the requirements set forth in the "Minimum Drainage Study Criteria Checklist, Drainage Plan Information", dated July 15, 1997. The plans**

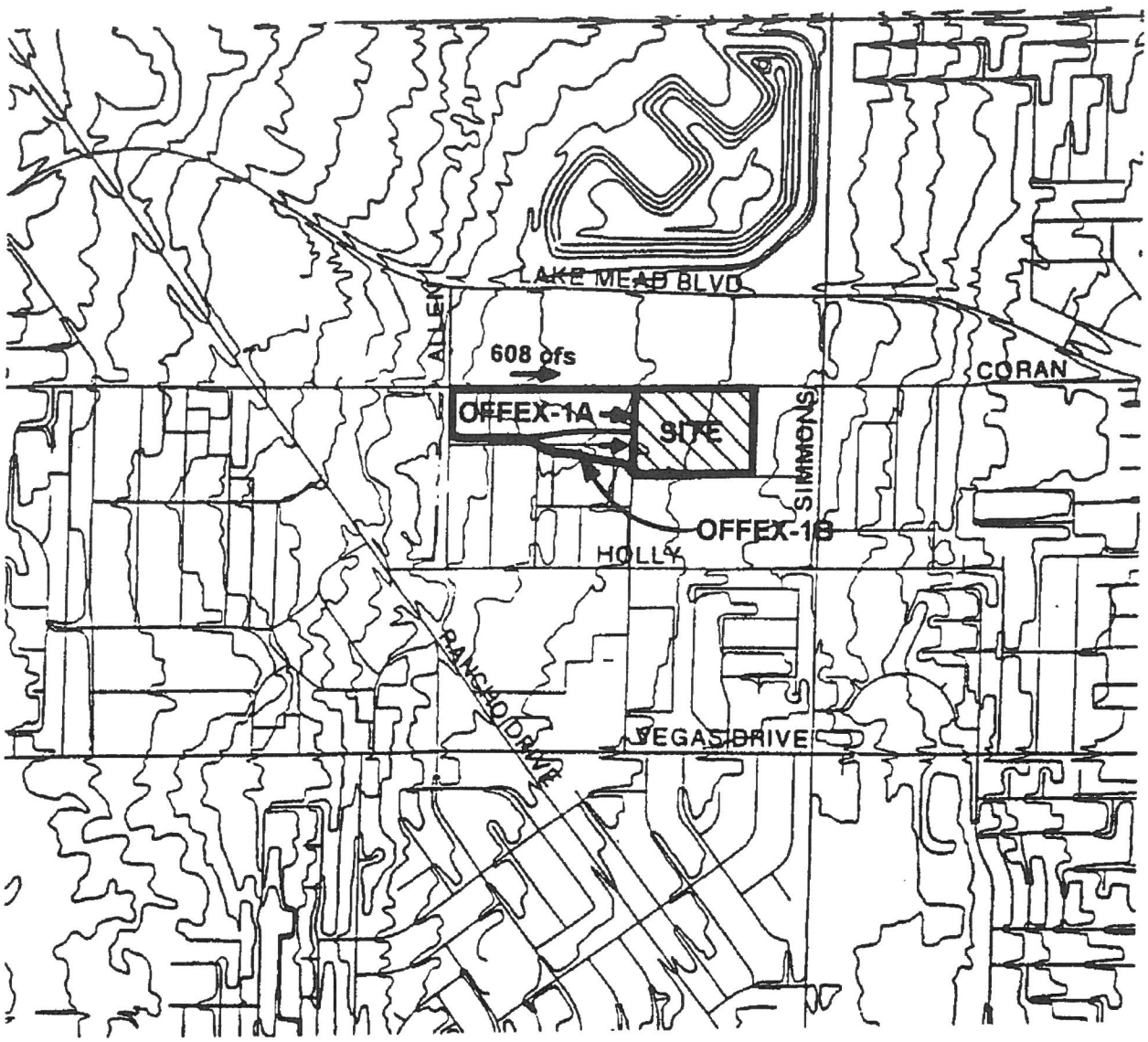
submitted do not meet minimum requirements and must be revised prior to Drainage Study approval, to address the following:

a. Raise the entrance to the Access Road.
b. Label right-of –way widths.
c. Provide a vicinity map.
d. Identify facility at outlet of private storm drain.
e. Provide typical street section for Coran Avenue.
f. Provide a berm detail.

Response 9: Please see revised grading plans included in this addendum

TABLE 2
FLOW DEPTH AND VELOCITY SUMMARY

BASIN ID	VELOCITY (fps)	DEPTH (ft)	D-V (ft^2/s)	Q100 (cfs)	Q10 (cfs)	STREET WIDTH (ft)
OFFDEV-1A	4.92	0.35	1.72	29	13	N/A
OFFDEV-1B	3.78	0.23	0.87	14	6	N/A
ONDEV-1	1.1	0.25	0.28	1	1	40
ONDEV-2	1.8	0.25	0.45	8	4	N/A
ONDEV-3	1.4	0.21	0.29	3	2	N/A
ONDEV-4	1.2	0.19	0.23	2	1	N/A
ONDEV-5	1.2	0.22	0.26	3	1	N/A
ONDEV-6	1.0	0.20	0.20	2	1	N/A
ONDEV-7	1.9	0.27	0.51	7	2	N/A
CORAN AVE 100-YEAR Q	9.82	1.44	14.14	608	N/A	60



CONTOUR INTERVAL = 5 FEET

OFFEX-1A = 29 cfs → 4.92 ft/s

OFFEX-1B = 14 cfs → 3.78 ft/s

1200 600 0 1200 2400 3600

APPROX. SCALE: 1" = 1200'

N

OFFSITE DRAINAGE BASINS

FIGURE 4

POST, BUCKLEY, SCHUH & JERNIGAN
955 N. Green Valley Pkwy
Suite 100
Henderson, Nevada 89014
Telephone: 702/263-7275
Fax: 702/263-7200
ENGINEERING · PLANNING · SURVEYING · CONSTRUCTION SERVICES

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

TIME OF CONCENTRATION

PBS&J, Inc. DEVELOPMEN OLLIE DETWILER SCHOOL
Project No. 51690
File: STDRFRM4.XLS CALCULATED BY : GENE RAMOS DATE: JUNE 1998

SUB-BASIN DATA					INITIAL / OVERLAND TIME (Ti)			TRAVEL TIME (Tt)					Tc	Tc CHECK URBANIZED BASINS		FINAL Tc	Tlag	REMARKS
DESIG: (1)	CN	K (2)	AREA (acres) (3)	AREA (mi^2)	LENGTH (ft) (4)	SLOPE (%) (5)	Ti (min) (6)	LENGTH (ft) (7)	SLOPE (%) (8)	LAND COVER k	VELOCITY* (fps) (9)	Tt (min) (10)	Tc = Ti + Tt (min) (11)	TOTAL LENGTH (ft) (12)	Tc = (L/180)+10 (min) (13)	(min) (14)	Tlag= 0.6Tc/60 (hrs)	
OFFDEV-1	92	0.824	14.4	0.0225	200	1.3	6.4	240	1.3	NA	3.1	1.3	7.7	440	NA	7.7	0.077	
ONDEV-1	98	0.904	0.4	0.0006	40	0.4	3.0	220	0.4	NA	1.1	3.4	6.4	260	11.4	6.4	0.064	
ONDEV-2	97	0.890	2.5	0.0039	275	0.5	7.9	130	0.5	NA	1.8	1.2	9.1	405	12.3	9.1	0.091	
ONDEV-3	94	0.851	1.3	0.0020	300	0.5	9.8	210	1.6	NA	1.4	2.5	12.3	510	12.8	12.3	0.123	
ONDEV-4	80	0.666	1.5	0.0023	130	1.5	7.8	180	1.3	NA	1.2	2.6	10.4	310	11.7	10.4	0.104	
ONDEV-5	80	0.666	1.8	0.0028	115	0.9	8.7	260	1.2	NA	1.2	3.5	12.2	375	12.1	12.1	0.121	
ONDEV-6	80	0.666	1.5	0.0023	125	2.0	6.9	380	0.9	NA	1.0	6.3	13.2	505	12.8	12.8	0.128	
ONDEV-7	83	0.706	3.7	0.0058	135	0.4	11.2	400	2.0	NA	1.9	3.6	14.8	535	13.0	13.0	0.130	

Tc = Ti + Tt Ti = 1.8 (1.1 - K) L^1/2 / S^1/3

Tlag = 0.6Tc K = 0.0132 (CN) - 0.39

* The velocity in column 9 is based on approximate channel properties.

REFERENCE :

STANDARD FORM 4

```
1**********************************
*                                *
*  FLOOD HYDROGRAPH PACKAGE (HEC-1)  *
*        SEPTEMBER 1990          *
*         VERSION 4.0            *
*                                *
*  RUN DATE 06/30/1998 TIME 08:42:15 *
*                                *
**********************************

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

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

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

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

1                                                HEC-1 INPUT                                                PAGE  1

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

             1          ID       File: 690DEV.DAT
             2          ID
             3          ID  Post, Buckley, Schuh & Jernigan, Inc.
             4          ID
             5          ID   DEVELOPED DRAINAGE CONDITIONS RUN
             6          ID
             7          ID  ****************************
             8          ID  ****************************
             9          ID  *                          *
            10          ID  *    OLLIE DETWILER SCHOOL  *
            11          ID  *                          *
            12          ID  *                          *
            13          ID  *        DEVELOPED         *
            14          ID  *     ONSITE & OFFSITE     *
            15          ID  *       CONDITIONS         *
            16          ID  *                          *
            17          ID  ****************************
            18          ID  ****************************
            19          ID
                        *DIAGRAM
*** FREE ***
            20          IT       5       0       0     300
            21          IO       5       0       0
            22          IN       5       0       0
            23          JR    PREC    1.00    0.57
                        *

            24          KK OFFDEV-1
            25          KM   OFFSITE DEVELOPED BASIN OFFDEV-1
            26          BA  0.0225
            27          PB    2.77
            28          PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
            29          PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
            30          PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
            31          PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
            32          PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
            33          PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
            34          PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
            35          PC    .998    .999   1.00
            36          LS       0      92
            37          UD   0.077
                        *

            38          KK    RT-1
            39          KM   ROUTE RUNOFF FROM OFFSITE DEVELOPED OFFDEV-1 THROUGH ONSITE
            40          KM   DEVELOPED BASIN ONDEV-1
            41          RK     330  0.0087   0.016           TRAP      60       1
                        *

            42          KK ONDEV-1
            43          KM   SUBBASIN ONDEV-1
            44          BA  0.0006
            45          LS       0      98
            46          UD   0.064
                        *

1                                                HEC-1 INPUT                                                PAGE  2

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

            47          KK    RT-2
            48          KM   ROUTE RUNOFF FROM ONSITE DEVELOPED ONDEV-1 THROUGH ONSITE
            49          KM   DEVELOPED BASIN ONDEV-2
            50          RK     330  0.0087   0.016           TRAP      60       1
                        *
                        *

            51          KK ONDEV-2
            52          KM   SUBBASIN ONDEV-2
```

```
                53          BA  0.0039
                54          LS       0      97
                55          UD  0.091
                            *

                56          KK  COMB-1
                57          KM   COMBINE RUNOFF FROM OFFSITE SUBBASIN OFFDEV-1 AND ONSITE
                58          KM   SUBBASIN ONDEV-2 AND SUBBASIN ONDEV-1
                59          HC       3
                            *

                60          KK    RT-3
                61          KM   ROUTE RUNOFF FROM ONDEV-3
                62          RK     450  0.0087   0.016            TRAP      60
                            *

                63          KK ONDEV-3
                64          KM   RUNOFF FROM ONSITE SUBBASIN ONDEV-3
                65          BA  0.0020
                66          LS       0      94
                67          UD   0.123
                            *

                68          KK    RT-4
                69          KM   ROUTE COMB-1 WITH ONDEV-3
                70          RK     280  0.0087   0.016            TRAP      30       1
                            *

                71          KK  COMB-2
                72          HC       2
                            *

                73          KK ONDEV-4
                74          KM   RUNOFF FROM ONSITE SUBBASIN ONDEV-4
                75          BA  0.0023
                76          LS       0      80
                77          UD   0.104
                            *

                78          KK ONDEV-5
                79          KM   RUNOFF FROM ONSITE SUBBASIN ONDEV-5
                80          BA  0.0028
                81          LS       0      80
                82          UD   0.121
                            *
1                                                    HEC-I INPUT                                                    PAGE  3

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

                83          KK ONDEV-6
                84          KM   RUNOFF FROM ONSITE SUBBASIN ONDEV-6
                85          BA  0.0023
                86          LS       0      80
                87          UD   0.128
                            *

                88          KK ONDEV-7
                89          KM   SUBBASIN ONSITE DEVELOPED ONDEV-7
                90          BA  0.0058
                91          LS       0      83
                92          UD   0.130
                            *
                93          ZZ
1
                    SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

    24    OFFDEV-1
             V
             V
    38       RT-1
             .
             .
    42       .      ONDEV-1
             .           V
             .           V
    47       .        RT-2
             .          .
             .          .
    51       .          .      ONDEV-2
             .          .          .
             .          .          .
    56    COMB-1.....................
             V
             V
    60       RT-3
             .
             .
    63       .      ONDEV-3
             .           V
             .           V
    68       .        RT-4
             .          .
             .          .
    71    COMB-2.....
             .
             .
    73       .      ONDEV-4
             .          .
             .          .
    78       .          .      ONDEV-5
             .          .          .
             .          .          .
```

```
     83          .          .          .     ONDEV-6
                 .          .          .        .
                 .          .          .        .
     88          .          .          .        .     ONDEV-7
 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```

```
*****************************************
*                                       *
*  FLOOD HYDROGRAPH PACKAGE (HEC-1)     *
*        SEPTEMBER 1990                 *
*        VERSION 4.0                    *
*                                       *
*  RUN DATE 06/30/1998 TIME 08:42:15    *
*                                       *
*****************************************
```

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

File: 690DEV.DAT

Post, Buckley, Schuh & Jernigan, Inc.

DEVELOPED DRAINAGE CONDITIONS RUN

```
*******************************
*******************************
*                             *
*    OLLIE DETWILER SCHOOL    *
*                             *
*                             *
*        DEVELOPED            *
*     ONSITE & OFFSITE        *
*       CONDITIONS            *
*                             *
*******************************
*******************************
```

```
 21 IO        OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    OSCAL          0  HYDROGRAPH PLOT SCALE

    IT        HYDROGRAPH TIME DATA
                    NMIN           5  MINUTES IN COMPUTATION INTERVAL
                   IDATE     1    0  STARTING DATE
                   ITIME       0000  STARTING TIME
                      NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                  NDDATE     2    0  ENDING DATE
                  NDTIME        0055  ENDING TIME
                   ICENT          19  CENTURY MARK

                COMPUTATION INTERVAL      08 HOURS
                    TOTAL TIME BASE   24.92 HOURS

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

    JP        MULTI-PLAN OPTION
                  NPLAN           1  NUMBER OF PLANS

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

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

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1 1.00	RATIO 2 .57
HYDROGRAPH AT	OFFDEV-1	.02	1	FLOW	41.	20.
				TIME	3.50	3.50
ROUTED TO	RT-1	.02	1	FLOW	40.	19.
				TIME	3.50	3.50
HYDROGRAPH AT	ONDEV-1	.00	1	FLOW	1.	1.
				TIME	3.50	3.50
ROUTED TO	RT-2	.00	1	FLOW	1.	1.
				TIME	3.50	3.58
HYDROGRAPH AT	ONDEV-2	.00	1	FLOW	8.	4.
				TIME	3.50	3.50
3 COMBINED AT	COMB-1	.03	1	FLOW	49.	23.
				TIME	3.50	3.50

```
 ROUTED TO
+                RT-3        03     1   FLOW          47.       22.
                                         TIME        3.50      3.50

 HYDROGRAPH AT
+             ONDEV-3        .00     1   FLOW           3.        2.
                                         TIME        3.58      3.58

 ROUTED TO
+                RT-4        .00     1   FLOW           3.        2.
                                         TIME        3.58      3.58

   2 COMBINED AT
+             COMB-2         .03     1   FLOW          50.       24.
                                         TIME        3.50      3.50

 HYDROGRAPH AT
+             ONDEV-4        .00     1   FLOW           2.        1.
                                         TIME        3.58      3.58

 HYDROGRAPH AT
+             ONDEV-5        .00     1   FLOW           3.        1.
                                         TIME        3.58      3.58

 HYDROGRAPH AT
+             ONDEV-6        .00     1   FLOW           2.        1.
                                         TIME        3.58      3.58

 HYDROGRAPH AT
+             ONDEV-7        .01     1   FLOW           7.        2.
                                         TIME        3.58      3.58
1
                                SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                    (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                  INTERPOLATED TO
                                                                                  COMPUTATION INTERVAL
          ISTAO    ELEMENT        DT       PEAK     TIME TO PEAK    VOLUME      DT      PEAK     TIME TO PEAK    VOLUME
                                  (MIN)     (CFS)      (MIN)         (IN)      (MIN)    (CFS)      (MIN)         (IN)
        FOR PLAN = 1  RATIO= 1.00
            RT-1  MANE            .42      41.24      210.84         1.95       5.00    40.22      210.00         1.95

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .2334E+01 EXCESS= .0000E+00 OUTFLOW= .2336E+01 BASIN STORAGE= .6073E-06 PERCENT ERROR= -.1

        FOR PLAN = 1  RATIO=  57
            RT-1  MANE            .51      19.31      211.21          .87       5.00    18.58      210.00          87

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .1041E+01 EXCESS= .0000E+00 OUTFLOW= .1043E+01 BASIN STORAGE= .6016E-06 PERCENT ERROR= -.2

        FOR PLAN = 1  RATIO= 1.00
            RT-2  MANE           1.47       1.30      212.56         2.57       5.00     1.20      210.00         2.56

 CONTINUITY SUMMARY (AC-FT) - INFLOW= 8126E-01 EXCESS= .0000E+00 OUTFLOW= 8217E-01 BASIN STORAGE= .6529E-06 PERCENT ERROR= -1.1

        FOR PLAN = 1  RATIO=  57
            RT-2  MANE           1 64        .73      212.83         1 37       5.00       66      215.00         1 37

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .4345E-01 EXCESS= .0000E+00 OUTFLOW= 4381E-01 BASIN STORAGE= .5744E-06 PERCENT ERROR= - 8

        FOR PLAN = 1  RATIO= 1.00
            RT-3  MANE            .45      49.10      210.99         2.04       5.00    47.34      210.00         2 04

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .2928E+01 EXCESS= .0000E+00 OUTFLOW= .2932E+01 BASIN STORAGE= 6445E-05 PERCENT ERROR= - 1

        FOR PLAN = 1  RATIO=  57
            RT-3  MANE            .76      23.16      211.25          .94       5.00    22.05      210.00          94

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .1351E+01 EXCESS= .0000E+00 OUTFLOW= .1353E+01 BASIN STORAGE= .6390E-05 PERCENT ERROR= - 2

        FOR PLAN = 1  RATIO= 1.00
            RT-4  MANE            .59       3.41      215.91         2.13       5.00     3 40      215.00         2.13

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .2270E+00 EXCESS= .0000E+00 OUTFLOW= .2273E+00 BASIN STORAGE= .9701E-07 PERCENT ERROR= - 1

        FOR PLAN = 1  RATIO=  57
            RT-4  MANE            .91       1 70      216.20         1.01       5.00     1.69      215.00         1.01

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .1075E+00 EXCESS= .0000E+00 OUTFLOW= .1077E+00 BASIN STORAGE= .1109E-06 PERCENT ERROR= - 2


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

PBS&J POST, BUCKLEY, SCHUH & JERNIGAN, INC.

CONSTRUCTION SERVICES
ENGINEERING · PLANNING
SURVEYING

January 8, 1999

Mr. Robert Thompson, P.E.
Principal Civil Engineer
Clark County Public Works
500 South Grand Central Parkway
Las Vegas, Nevada 89155-4000

RE: SUPPLEMENT #2 TO ADDENDUM #2 TO THE TECHNICAL DRAINAGE STUDY FOR OLLIE DETWILER ELEMENTARY SCHOOL
PBS&J REFERENCE NO.: 51690

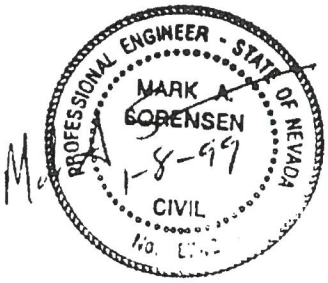
Dear Mr. Thompson,

Submitted for your review are two copies of the *Supplement #2 to Addendum #2 to the Technical Drainage Study for the Ollie Detwiler Elementary School.*

If you have any questions regarding this addendum, please contact our office at (702) 263-7275.

Sincerely,

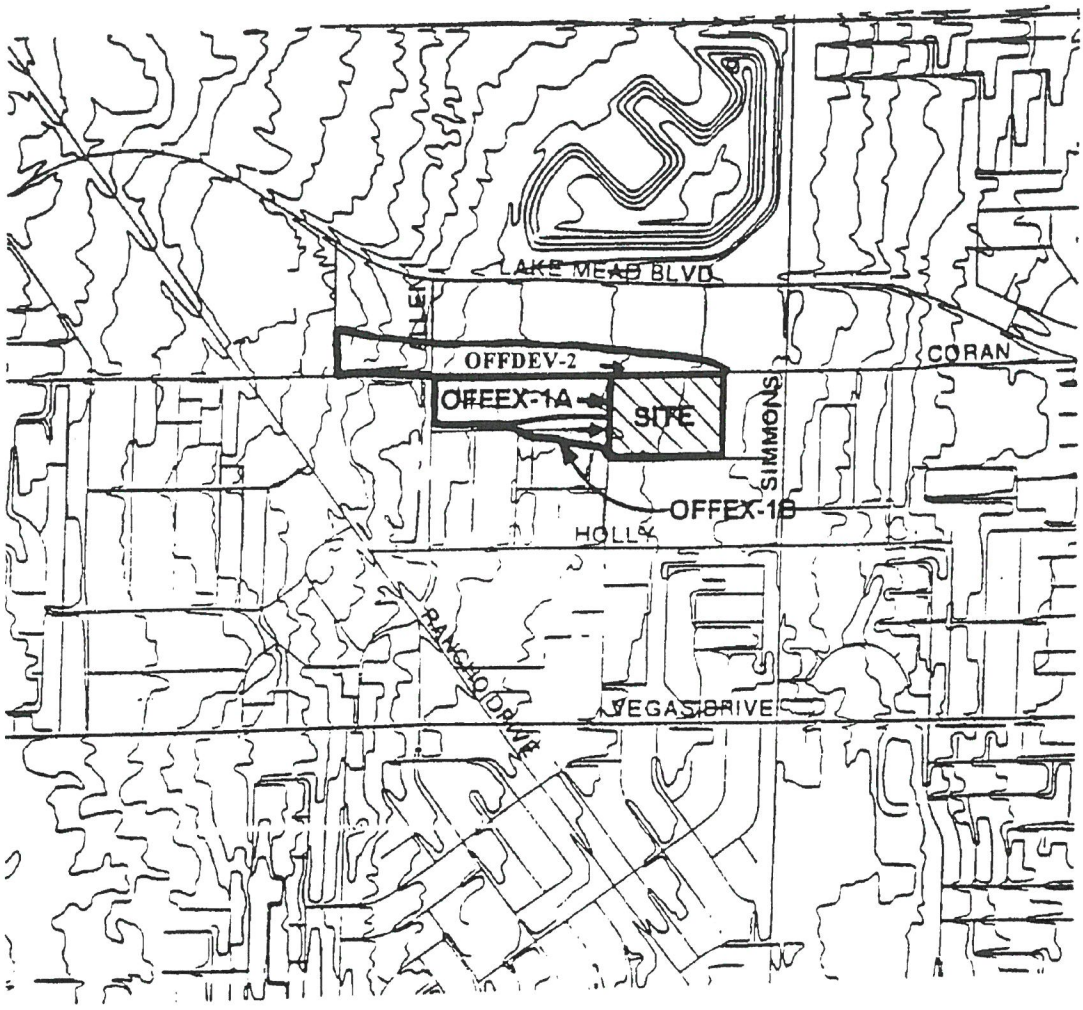
P B S & J



Gene Ramos, E.I.
Hydrologist

Mark A. Sorensen, P.E.
Manager, Drainage Services

901 North Green Valley Parkway · Suite One Hundred · Henderson, Nevada 89014-6139 · Telephone: 702/263-7275 · Fax: 702/263-7200

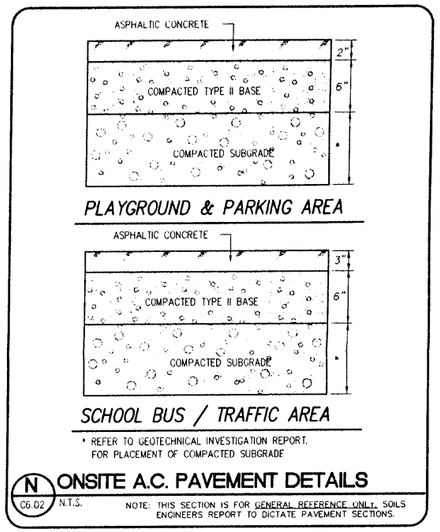


OFFSITE DRAINAGE BASINS

FIGURE 4

POST, BUCKLEY, SCHUH & JERNIGAN
921 N. Green Valley Pkwy
Suite 100
Henderson, Nevada 89014
Telephone 702/263-7273
Fax: 702/263-7200
ENGINEERING • PLANNING • SURVEYING • CONSTRUCTION SERVICES

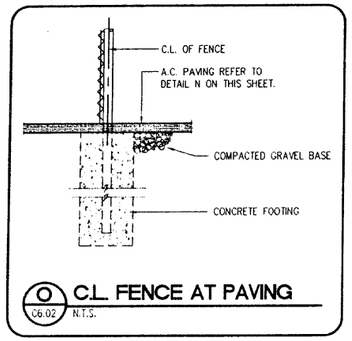




N ONSITE A.C. PAVEMENT DETAILS

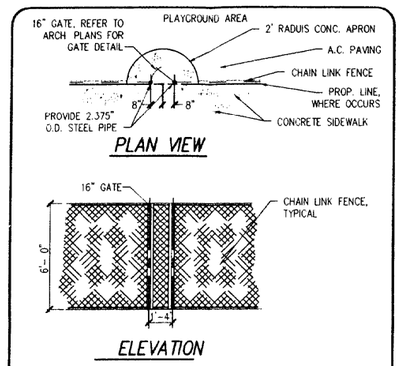
C6.02 N.T.S.

NOTE: THIS SECTION IS FOR GENERAL REFERENCE ONLY. SOILS ENGINEERS REPORT TO DICTATE PAVEMENT SECTIONS.



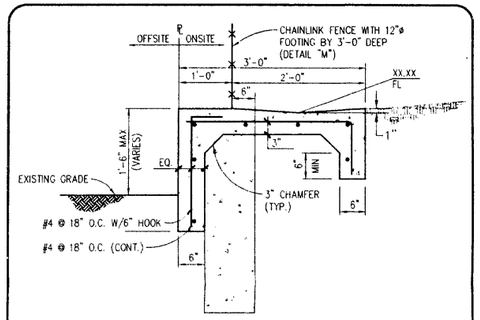
O C.L. FENCE AT PAVING

C6.02 N.T.S.



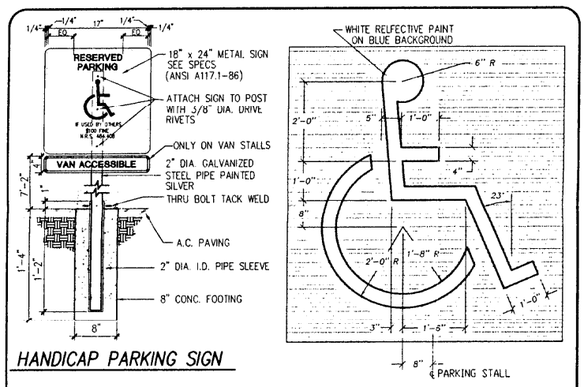
P MAZE

C6.02 N.T.S.



Q TURN DOWN VALLEY GUTTER ON-SITE

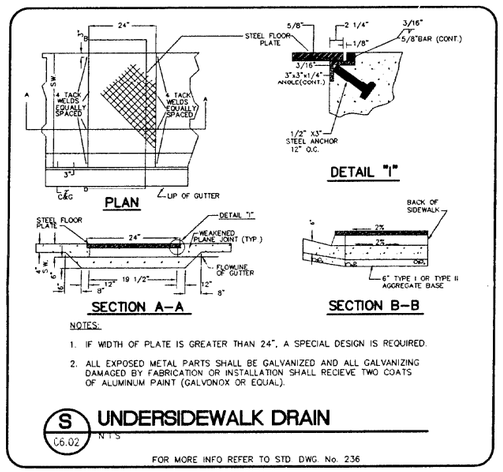
C6.02 N.T.S.



HANDICAP PARKING SIGN

R INTERNATIONAL HANDICAP SYMBOL

C6.02 N.T.S.



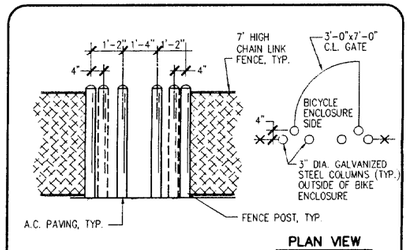
NOTES:

1. IF WIDTH OF PLATE IS GREATER THAN 24", A SPECIAL DESIGN IS REQUIRED.
2. ALL EXPOSED METAL PARTS SHALL BE GALVANIZED AND ALL GALVANIZING DAMAGED BY FABRICATION OR INSTALLATION SHALL RECIEVE TWO COATS OF ALUMINUM PAINT (GALVONOX OR EQUAL).

S UNDERSIDEWALK DRAIN

C6.02 N.T.S.

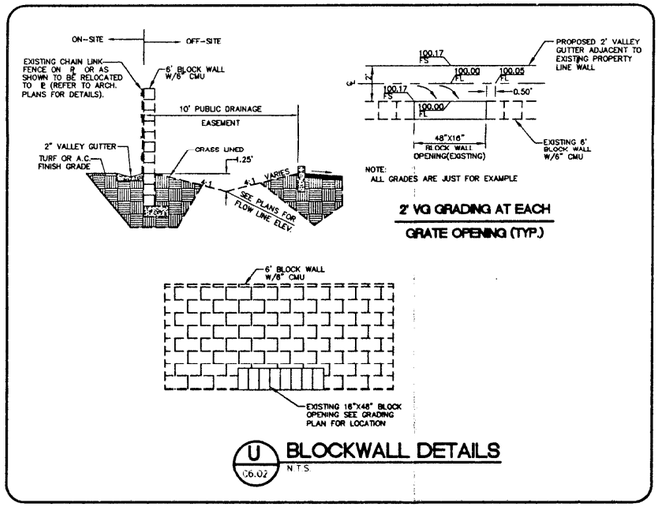
FOR MORE INFO REFER TO STD. DWG. No. 236



PLAN VIEW

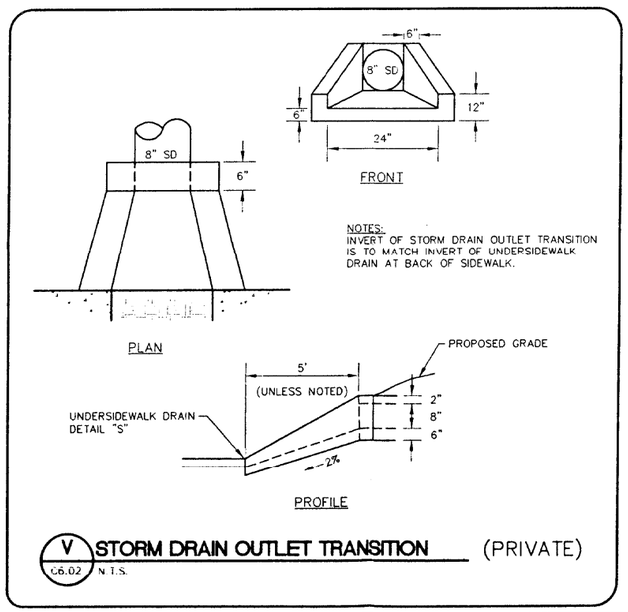
T BICYCLE AREA ACCESS GATE

C6.02 N.T.S.



U BLOCKWALL DETAILS

C6.02 N.T.S.



V STORM DRAIN OUTLET TRANSITION (PRIVATE)

C6.02 N.T.S.

REVISIONS

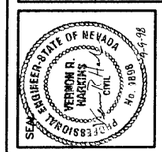
REV	DESCRIPTION	DATE	BY

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Call before you Dig. 1-800-227-2600

Call before you OVERHEAD 1-702-363-8111

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JOB PROJECT NO.	0690
CODE REVIEW	
APPROVED BY	
DATE	9/8/98
DRAWN BY	JTC
CHECKED BY	VRH
SUBMITTAL	100%
JOB PROJECT NO.	97296

PBS&J
SUITE 1, 8290 W. Sahara Ave., Las Vegas, Nevada 89117
PHONE: (702) 255-4300 FAX: (702) 255-4305
ENGINEERING · PLANNING · SURVEYING · CONSTRUCTION SERVICES

Domingo Cambeiro Corporation
ARCHITECTURE · ENGINEERING · PLANNING · INTERIORS
3555 PECOS-McLEOD IC. LAS VEGAS, NEVADA 89121-3805 (702) 732-0084

CLARK COUNTY SCHOOL DISTRICT
CONSTRUCTION MANAGEMENT
4828 PEARL ST. LAS VEGAS, NEVADA 89121

OLLIE DETWILER
ELEMENTARY SCHOOL

DETAILS

SHEET NO.
C6.02
SHEET 17 OF 17

JOB NO. 51-690
FILE NO. 690-DT2

PLOT DATE: 09/08/98 10:40:11

(Reference #2)

Technical Drainage Study for Lake Mead and Simmons, HTE # 06-13355, by Integrity Engineering, March 5, 2006, and approved by Clark County on October 31st, 2006.

The study material is used to support off-site flow quantity on Coran Lane.

06-48039 ADD2

ADDENDUM #2 TO THE

TECHNICAL DRAINAGE STUDY

FOR

LAKE MEAD AND SIMMONS

THE CITY OF NORTH LAS VEGAS, NEVADA

Prepared for:

DDM INVESTMENTS LLC
BLUE LAGOON LAS VEGAS LLC
4397 W SUNSET RD #A
Las Vegas, NV 89118-6848

Prepared by:

INTEGRITY ENGINEERING
5230 W. Patrick Lane
Las Vegas, NV 89119

IE Project No. 59-105

October 2006

INTEGRITY ENGINEERING

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Lake Mead and Simmons Date: 10/12/06

Location of Development: a) Descriptive (Cross Streets) North/South: Simmons Street East/West: Lake Mead Blvd

b) Sect. 20 Twn. 20S Rng. 61E

Name of Owner: DDM INVESTMENTS LLC Assessors Parcel No: 139-20-202-010 and 011

Telephone No: (702) 251-4888 Facsimile No: (702) 251-5525

Address: 4397 W. Sunset RD #A

Las Vegas, NV 89118-6848

Contact Person-Name: Godwin Sorkpa Agbleze Telephone No: 702-456-4664

Firm: Integrity Engineering

Address: 5230 W. Patrick Lane, Las Vegas, NV 89118

Type of Land Development/Land Disturbance Process:

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

1. Total Owned Land Area: At Site: 8.68 Acres Being Developed/Disturbed: 8.68 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.)? Industrial
5. Approximate upstream land area which drains to the subject site? 30.75 Acres
6. Has the site drainage been evaluated in the past? YES (NO) If yes, please identify documentation:
7. If known, please briefly identify the proposed discharge point(s) of runoff from the site:
   The proposed discharge point of runoff is north into Lake Mead Boulevard and south into Coran Lane.
8. Briefly describe your proposed schedule for the subject project: ASAP

PROFESSIONAL ENGINEER-STATE OF NEVADA
JAE M. KIM
EXP 6-30-07
CIVIL
No. 15927
10-12-06

Engineer's Seal

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

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

Local Entity File No.

Revision	Date

REFERENCE:

STANDARD FORM 1

Department of Development Services
Civil Engineering Division

500 S Grand Central Pky 1st Fl • Box 551799 • Las Vegas NV 89155-1799
(702) 455-4600 • Fax (702) 388-2550

Phil Rosenquist, Director

October 31, 2006

06-13355
RETURN DRAINAGE STUDY
REDLINES WITH ALL FUTURE
SUBMITTALS FOR THIS PROJECT

Integrity Engineering
2480 East Tompkins Ave. Suite 232
Las Vegas, NV 89108

SUBJECT: WILLDAN/Clark County Development Services Dept. Plan Review Contract
Technical Drainage Study for Tenaya Marketplace **(5201)**
Study Dated: March 15, 2006
Addendum Dated: June 12, 2006
Second Addendum Dated: August 16, 2006
Third Addendum Dated: September 15, 2006
Fourth Addendum Dated: October 2, 2006
Location: Northeast corner of Sunset Road and Tenaya Way
(Sec. 34, T21S, R60E)
HTE# 06-13355

The Referenced **Technical Drainage Study** has been reviewed and is accepted as complying with the minimum improvement standards. As set forth in the subject drainage study, the following measures will be taken to mitigate flood hazards.

1. The site shall be graded with respect to drainage as shown on "Tenaya Marketplace Grading Plan," sheets C3.01, C3.02 C3.03, C3.04, C3.05, C3.06, C3.07, C3.08, C3.09, C6.01, C6.02, C6.03, signed and sealed by Jae M. Kim, P.E., on October 2, 2006.

2. The following drainage facilities shall be constructed:

   a. A storm drain system extending north on Tenaya Way and east on Post Road, consisting of approximately 725 lf of 36-inch RCP, 294 lf of 24-inch RCP, 96 lf of 18-inch RCP laterals, 635 lf of 12-inch RCP bleeder line, with one (1) 18-foot Modified Type C drop inlets with 4 grates, one (1) 20-foot Modified Type C drop inlets with 6 grates, one (1) 8-foot Modified Type C drop inlet with 2 grates, one (1) 48-inch x 48-inch Jensen precast drop inlet with a beehive grate, two (2) 60-inch Type I manholes, and three (3) 60-inch Type 3 manholes, as shown on sheets C3.04, C3.05, C3.07 and C6.02

BOARD OF COUNTY COMMISSIONERS
RORY REID, Chairman • MYRNA WILLIAMS, Vice Chair
TOM COLLINS • YVONNE ATKINSON GATES • CHIP MAXFIELD • LYNETTE BOGGS McDONALD • BRUCE L. WOODBURY
VIRGINIA VALENTINE, P.E., County Manager

b. A storm drain system extending east on Sunset Road, consisting of approximately 587 lf of 18-inch RCP, with one (1) 48-inch x 48-inch Jensen precast drop inlet and two (2) 48-inch Type I manholes, as shown on sheet C3.08

c. Approximately 22 lf of 24-inch RCP lateral extending east across Tenaya Way connecting into the above-mentioned storm drain system 2(a) with a headwall and cutoff wall at the inlet, with a 3-foot x 3-foot rip-rap pad (d50 = 6 inches, thickness = 12 inches) above the headwall, as shown on sheet C3.07

d. An 8-foot wide concrete valley gutter in the following locations:

- North side of Sunset Road crossing the driveway entrance of Unit 1
- East side of Tenaya Way crossing the southern driveway entrance of Unit 1
- East side of Tenaya Way crossing the northern driveway entrance of Unit 1
- East side of Tenaya Way crossing the northern driveway entrance of Unit 2
- South side of Post Road crossing the driveway entrance of Unit 2
- North side of Post Road crossing the driveway entrance of Unit 3
- East side of Tenaya Way crossing the driveway entrance to Unit 3

e. A 1.5-foot wide concrete U-gutter at the northeast corner of Unit 2, with a 2-foot wide sidewalk underdrain at the outlet on the south side of Post Road as shown on sheet C3.02

f. A 1.5-foot wide concrete u-gutter on the east side of Unit 3, onsite, as shown on sheet C3.03

g. A graded v-ditch on the west ½ of Tenaya Way as shown on sheet C3.02 and details D/C6.01 and F/C6.02

h. Onsite 3-foot wide concrete valley gutters in various locations as shown on the above-mentioned grading plans

3. A bond estimate must be submitted to Clark County Civil Engineering Division for the above-mentioned stormwater management facilities, except 2(h);

4. Please provide the following statement on each sheet of the grading plan set near the lower right corner: Section 2 or Section 3 of the Clark County Building

Office Operations Division Drainage Compliance Report must be completed by the engineer;

5. The subject site is located within Zone X as shown on FIRM Community Panel Number 32003C2535E, revised September 27, 2002, revised to reflect a LOMR dated September 3, 2004. Zone X is determined to be outside the 0.2% annual chance flood plain;

6. The minimum finished floor elevations for the proposed structures shall be constructed as shown on the above-mentioned grading plans;

7. As a condition of final approval, an administrative variance to allow the finished floor elevation(s) to be set below the current Clark County criteria must be approved. The finished floor variance must be submitted to Development Services Civil Engineering front counter after drainage study approval and prior to offsite final review;

8. Mylars of the grading plan must be submitted to the Clark County Civil Engineering Division Plan Check for approval signatures prior to permit issuance;

9. The grading plan will be reviewed by the Building Office Operations Division to ensure compliance with the handicap access requirements. Revisions to the grading plan may be required if the site accessibility design does not comply with the requirements set forth in the Accessibility Chapter of the Clark County Building Code;

10. Coordination is required with the projects to the east.

11. Clark County Regional Flood Control District (CCRFCD) concurrence is required as the site is within 8-feet of a Floodzone A. As a condition of final approval, the applicant must submit a copy of the drainage study and any addenda to the CCRFCD. Permits will not be issued until concurrence is obtained from the CCRFCD;

12. **As a condition of final approval, the drainage/grading plans submitted for this project require the following modifications prior to Civil Engineering Plan Check submittal:**

    a. The rip-rap thickness for the rip-rap pad above the headwall must be equal to twice the d50 (thickness = 12 inches)

    b. The slope of the 12-inch bleeder line is incorrect and must be revised on the profile sheets C3.07 and C3.09 to 0.3%

c. The length of the 12-inch bleeder line must be consistent on sheets C3.07 and C3.09

d. The minimum Type I manhole size is 48-inch. The manhole size must be revised on sheet C3.08 for both proposed manholes

The County's review is solely based on the information submitted by the Engineer of Record. The County's review is strictly limited to compliance with minimum County Codes and Standards. The Engineer of Record is responsible for researching and addressing situations that may require designs above and beyond the minimum codes for issues of public safety and impacts to upstream, downstream and adjacent properties. The County assumes no liability for information data, designs or conclusions of the Engineer of Record;

DEPARTMENT OF DEVELOPMENT SERVICES

BY: _____
Jeffery Jensen, P.E
Senior Engineer
Civil Engineering Division

JJ/tc/wg

cc: Tenaya Marketplace, LLC
Andrew Trelease, CCRFCD
Development File

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL - STANDARD FORM 4

Development: LAKE MEAD AND SIMMONS
Calculated by: GSA
Integrity Project #: 59-105
Date: 09/12/06

TIME OF CONCENTRATION

	SUB-BASIN DATA				INITIAL / OVERLAND TIME, t(i)				TRAVEL TIME t(t)					CONCENTRATION TIME t(c)			
DESIG.	AREA Acres	AREA Sq. Mi.	EX/DEV EX = 1 DEV = 2	CN	K	LENGTH Ft.	SLOPE %	t(i) Min	LENGTH Ft.	SLOPE %	VEL. 1 FPS	VEL. 2 FPS	t(t) Min	T_c Ft.	t(c) URBANIZED = (L/180)+10 Min	FINAL t(c)	t(lag) =(0.6*T_c)/60 Hr.
EXISTING CONDITIONS																	
XOF5	1.2	0.0019	1	84	0.7188	130	0.50	9.86	280	1.0	1.5	N/A	3.15	410	N/A	13.01	0.1301
XON1	8.68	0.0136	1	84	0.7188	450	1.10	14.10	540	0.9	1.4	2.8	6.17	990	N/A	20.27	0.2027
XOF6	1.2	0.0019	1	84	0.7188	130	0.90	8.10	280	0.7	1.2	N/A	3.77	410	N/A	11.87	0.1187
XOF7	1.29	0.0020	1	84	0.7188	130	0.80	8.43	360	0.5	1.0	N/A	5.73	490	N/A	14.16	0.1416
XOF8	5.19	0.0081	1	93	0.8376	250	1.24	6.95	500	1	1.5	N/A	5.63	750	N/A	12.58	0.1258
XOF9	0.76	0.0012	1	98	0.9036	25	2.00	1.40	554	0.9	1.4	2.8	6.26	579	N/A	10.00	0.1000
PROPOSED CONDITIONS																	
XOF5	1.20	0.0019	1	84	0.7188	130	0.50	9.86	280	1.0	1.5	N/A	3.15	410	N/A	13.01	0.1301
DON1	4.80	0.0075	2	93	0.8376	96	1.22	4.33	836	0.5	1.4	2.2	8.42	932	15.18	12.75	0.1275
DON2	3.88	0.0061	2	93	0.8376	55	1.78	2.89	790	0.5	1.4	2.2	8.07	845	14.69	10.96	0.1096
XOF6	1.20	0.0019	1	84	0.7188	130	0.90	8.10	280	0.7	1.2	N/A	3.77	410	N/A	11.87	0.1187
XOF7	1.29	0.0020	1	84	0.7188	130	0.80	8.43	360	0.5	1.0	N/A	5.73	490	N/A	14.16	0.1416
XOF8	5.19	0.0081	1	93	0.8376	250	1.24	6.95	500	1	1.5	N/A	5.63	750	N/A	12.58	0.1258
XOF9	0.76	0.0012	1	98	0.9036	25	2.00	1.40	554	0.9	1.4	2.8	6.26	579	N/A	10.00	0.1000
ULTIMATE CONDITIONS																	
DOF5	1.2	0.0019	2	93	0.8376	130	0.50	6.79	280	1.0	2.0	N/A	2.31	410	12.28	9.10	0.0910
DON1	4.8	0.0075	2	93	0.8376	96	1.22	4.33	836	0.5	1.4	2.2	8.42	932	15.18	12.75	0.1275
DON2	3.88	0.0061	2	93	0.8376	55	1.78	2.89	790	0.5	1.4	2.2	8.07	845	14.69	10.96	0.1096
DOF6	1.20	0.0019	2	93	0.8376	130	0.90	5.58	280	0.7	1.7	N/A	2.76	410	12.28	8.34	0.0834
DOF7	1.29	0.0020	2	93	0.8376	130	0.80	5.80	360	0.5	1.4	N/A	4.20	490	12.72	10.00	0.1000
DOF8	5.19	0.0081	2	93	0.8376	250	1.24	6.95	500	1	2.0	N/A	4.13	750	14.17	11.08	0.1108
DOF9	0.76	0.0012	2	98	0.9036	25	2.00	1.40	554	0.9	1.9	2.9	4.66	579	13.22	6.06	0.0606

Tc=Ti+Tt

Ti =1.8(1.1-K)L^1/2 / S^1/3

K=0.0132(CN)-0.39

NOTE: Travel Time Velocity Calculation

If EX=1, 14.8 x (slope/100)^0.5 VEL. 1

If DEV=2, 20.2 x (slope/100)^0.5 VEL. 1

For VEL. 2, travel length must be > 500 ft

If EX =1, 29.4 x (slope/100)^0.5 VEL. 2

If DEV =2, 30.6 x (slope/100)^0.5 VEL. 2

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             JUN  1998                 *
*          VERSION 4.1                  *
*                                       *
*  RUN DATE   08SEP06  TIME  16:49:54   *
*                                       *
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**************************************
*                                    *
*   U.S. ARMY CORPS OF ENGINEERS     *
*   HYDROLOGIC ENGINEERING CENTER    *
*        609 SECOND STREET           *
*      DAVIS, CALIFORNIA 95616       *
*          (916) 756-1104            *
*                                    *
**************************************
```

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

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1EF.

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 26 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
                    *DIAGRAM
 *** FREE ***
               1    ID  **************************************************************
               2    ID  * ------------------------------------------------------------ *
               3    ID  * :                  LAKE MEAD AND SIMMONS                   : *
               4    ID  * :                TECHNICAL DRAINAGE STUDY                  : *
               5    ID  * :                  EXISTING CONDITION                      : *
               6    ID  * :              CLIENT:  DDM INVESTMENTS LLC                : *
               7    ID  * :..........................................................: *
               8    ID  * :              RETURN PERIOD_____10/100 YEAR               : *
               9    ID  * :              DISTRIBUTION_____6-HOUR SCHS                : *
              10    ID  * :              PROJECT NO_____59-105                       : *
              11    ID  * :              FILENAME_____LAKE MEAD_EX.DAT               : *
              12    ID  * :              DATE_____07-14-06                           : *
              13    ID  * :                                                          : *
              14    ID  * :           RATIOS: 0.57  10-YEAR STORM EVENT              : *
              15    ID  * :                   1.00  100-YEAR STORM EVENT             : *
              16    ID  * :                                                          : *
              17    ID  * :..........................................................: *
              18    ID  * :..........................................................: *
              19    ID  **************************************************************
              20    ID
              21    IT      5       0       0     300
              22    IO      5       0
              23    IN      5       0       0
              24    JR    PREC    0.57    1.0
                    *
              25    KK    XOF5
              26    KM    RUNOFF GENERATED FROM EXISTING OFFSITE BASIN XOF1
              27    BA  .0019
              28    PB  2.77
              29    PC  .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
              30    PC  .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
              31    PC  .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
              32    PC  .251    .256    .270    .278    .281    .283    .285    .322    .352    .409
              33    PC  .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
              34    PC  .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
              35    PC  .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
              36    PC  .998    .999   1.00
              37    LS    0   84.00
              38    UD  .1301
                    *
              39    KK    XSN1
              40    KM    RUNOFF GENERATED FROM EXISTING ONSITE BASIN XSN1
              41    BA  .0136
              42    LS    0   84.00
              43    UD  .2027
                    *
```

1 HEC-1 INPUT PAGE 2

```
          LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9.......10
              44    KK    CP-3
              45    KM    COMBINES FLOWS FROM XOF5,XSN1
```

```
                46          EC      2
                            *
                47          KK    XDF6
                48          KM    RUNOFF GENERATED FROM EXISTING OFFSITE BASIN XDF5
                49          BA    .0019
                50          LS       0   84.00
                51          UD    .1107
                            *
                52          KK    XDF7
                53          KM    RUNOFF GENERATED FROM DEVELOPED OFFSITE BASIN XDN1
                54          BA    .0020
                55          LS       0   84.00
                56          UD    .1416
                            *
                57          KK    CP-1
                58          KM    COMBINES FLOWS FROM XDF6 AND XDF7
                59          HC       2
                            *
                60          KK    XDF8
                61          KM    RUNOFF GENERATED FROM DEVELOPED OFFSITE BASIN XDN1
                62          BA    .0081
                63          LS       0   93.00
                64          UD    .1258
                            *
                65          KK    XDF9
                66          KM    RUNOFF GENERATED FROM DEVELOPED OFFSITE BASIN XDN1
                67          BA    .0012
                68          LS       0   98.00
                69          UD    .1000
                            *
                70          KK    CP-4
                71          KM    COMBINES FLOWS FROM CP-1, XDF8 AND XDF9
                72          HC       3
                            *
                73          ZZ
1
                    SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

    25        XDF5
                .
                .
    39          .         XDN1
                .           .
                .           .
    44          CP-3.........
                .
                .
    47          .         XDF6
                .           .
                .           .
    52          .           .         XDF7
                .           .           .
                .           .           .
    57          .         CP-1.........
                .           .
                .           .
    60          .           .         XDF8
                .           .           .
                .           .           .
    65          .           .           .         XDF9
                .           .           .           .
                .           .           .           .
    70          .         CP-4.........................

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
 *                                       *
 *    FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
 *                JUN  1998              *
 *             VERSION 4.1               *
 *                                       *
 *                                       *
 *  RUN DATE   08SEP06  TIME  16:49:54   *
 *                                       *
 *****************************************

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

 ************************************************************
 * ........................................................ *
 * :                                                      : *
 * :                LAKE MEAD AND SIMMONS                 : *
 * :              TECHNICAL DRAINAGE STUDY                : *
 * :                 EXISTING CONDITION                   : *
 * :            CLIENT:  DDM INVESTMENTS LLC              : *
```

```
*  :.....................................................:  *
*  :            RETURN PERIOD_____10/100 YEAR            :  *
*  :            DISTRIBUTION_____6-HOUR SCS3             :  *
*  :            PROJECT NO _____99-105                   :  *
*  :            FILENAME_______LAKE MEAD_EX.DAT          :  *
*  :            DATE_ _ _ _ _ _ _07-14-06                :  *
*  :                                                     :  *
*  :          RATIOS: 0.57  10-YEAR STORM EVENT          :  *
*  :                  1.00  100-YEAR STORM EVENT         :  *
*  :                                                     :  *
*  :.....................................................:  *
*****************************************************************
```

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

    IT         HYDROGRAPH TIME DATA
                     MAIN          5  MINUTES IN COMPUTATION INTERVAL
                    IDATE     1    0  STARTING DATE
                    ITIME          0000  STARTING TIME
                       NQ          300  NUMBER OF HYDROGRAPH ORDINATES
                    NDATE     2    0  ENDING DATE
                    NTIME          0055  ENDING TIME
                    ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL      .08 HOURS
                    TOTAL TIME BASE    24.92 HOURS

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

    JP         MULTI-PLAN OPTION
                    NPLAN          1  NUMBER OF PLANS

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

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

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1 .57	RATIO 2 1.00
HYDROGRAPH AT						
+	XOF5	.00	1	FLOW	1.	2.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	XOM1	.01	1	FLOW	5.	14.
				TIME	3.67	3.67
2 COMBINED AT						
+	CP-3	.02	1	FLOW	5.	16.
				TIME	3.67	3.58
HYDROGRAPH AT						
+	XOF6	.00	1	FLOW	1.	2.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	XOF7	.00	1	FLOW	1.	2.
				TIME	3.58	3.58
2 COMBINED AT						
+	CP-1	.00	1	FLOW	2.	5.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	XOF8	.01	1	FLOW	7.	13.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	XOF9	.00	1	FLOW	1.	2.
				TIME	3.50	3.50
3 COMBINED AT						
+	CP-4	.01	1	FLOW	9.	20.
				TIME	3.58	3.58

$\rightarrow [XOF5] + [XOM1] + {}^{3}CP\text{-}A = 19/34$

$\rightarrow [XOF6] + [XOF7] + [XOF8] + [XOF9] + {}^{3}CP\text{-}B = 19/74$

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             JUN  1998                 *
*          VERSION 4.1                  *
*                                       *
*  RUN DATE   08SEP06  TIME  17:17:59   *
*                                       *
*****************************************
```

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

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

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

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

1 HEC-1 INPUT PAGE 1

```
          LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9.......10
                    *DIAGRAM
 *** FREE ***
               1    ID   **************************************************************
               2    ID   * ---------------------------------------------------------- *
               3    ID   * :                  LAKE MEAD AND SIMMONS                 : *
               4    ID   * :               TECHNICAL DRAINAGE STUDY                 : *
               5    ID   * :                  PROPOSED CONDITION                    : *
               6    ID   * :.               CLIENT:  DDM INVESTMENTS LLC            : *
               7    ID   * :________________________________________________________: *
               8    ID   * :            RETURN PERIOD_ _ _ _10/100 YEAR            : *
               9    ID   * :            DISTRIBUTION_ _ _ _S-BUCK SDM3             : *
              10    ID   * :            PROJECT NO _ _ _ _ _59-105                 : *
              11    ID   * :            FILENAME_ _ _ _ _ _LAKE MEAD_PROP.DAT      : *
              12    ID   * :            DATE_ _ _ _ _ _ _ _07-14-06                : *
              13    ID   * :                                                       : *
              14    ID   * :          RATIOS: 0.57  10-YEAR STORM EVENT            : *
              15    ID   * :                  1.00  100-YEAR STORM EVENT           : *
              16    ID   * :                                                       : *
              17    ID   * :_______________________________________________________: *
              18    ID   * ---------------------------------------------------------- *
              19    ID   **************************************************************
              20    ID
              21    IT      5       0       0     300
              22    IO      5       0
              23    IN      5       0       0
              24    JR    FREC    0.57     1.0
                    *
              25    KK    XOF5
              26    KM    RUNOFF GENERATED FROM EXISTING OFFSITE BASIN XOF5
              27    BA   .0019
              28    PB   2.77
              29    PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
              30    PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
              31    PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
              32    PC    .251    .256    .270    .278    .281    .283    .285    .322    .352    .409
              33    PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
              34    PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
              35    PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
              36    PC    .998    .999   1.00
              37    LS      0   84.00
              38    UD   .1301
                    *
              39    KK    DOM1
              40    KM    RUNOFF GENERATED FROM EXISTING ONSITE BASIN XOM1
              41    BA   .0075
              42    LS      0      93
              43    UD   .1275
                    *
```

1 HEC-1 INPUT PAGE 2

```
          LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9.......10
              44    KK    CP-3
              45    KM    COMBINES FLOWS FROM XOF5,DOM1
```

```
                46          BC       2
                            *
                47          KK    XOF6
                48          KM    RUNOFF GENERATED FROM EXISTING OFFSITE BASIN XOF5
                49          BA    .0019
                50          LS       0   84.00
                51          UD    .0910
                            *
                52          KK    XOF7
                53          KM    RUNOFF GENERATED FROM DEVELOPED OFFSITE BASIN XDN1
                54          BA    .0020
                55          LS       0   84.00
                56          UD    .1416
                            *
                57          KK    CP-1
                58          KM    COMBINES FLOWS FROM XOF6 AND XOF7
                59          HC       2
                            *
                60          KK    DON2
                61          KM    RUNOFF GENERATED FROM EXISTING ONSITE BASIN XDN1
                62          BA    .0061
                63          LS       0      93
                64          UD    .1096
                            *
                65          KK    XOF8
                66          KM    RUNOFF GENERATED FROM DEVELOPED OFFSITE BASIN XDN1
                67          BA    .0081
                68          LS       0   93.00
                69          UD    .1258
                            *
                70          KK    XOF9
                71          KM    RUNOFF GENERATED FROM DEVELOPED OFFSITE BASIN XDN1
                72          BA    .0012
                73          LS       0   98.00
                74          UD    .1000
                            *
                75          KK    CP-4
                76          KM    COMBINES FLOWS FROM CP-1, DON2, XOF8 AND XOF9
                77          HC       4
                78          ZZ
1
                    SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

    25       XOF5
                .
                .
    39          .        DON1
                .          .
                .          .
    44       CP-3.....     .
                .          .
                .          .
    47          .        XOF6
                .          .
                .          .
    52          .          .        XOF7
                .          .          .
                .          .          .
    57          .        CP-1.....    .
                .          .          .
                .          .          .
    60          .          .        DON2
                .          .          .
                .          .          .
    65          .          .          .        XOF8
                .          .          .          .
                .          .          .          .
    70          .          .          .          .        XOF9
                .          .          .          .          .
                .          .          .          .          .
    75          .        CP-4.....................................

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             JUN  1998                 *
*           VERSION 4.1                 *
*                                       *
*  RUN DATE   08SEP06  TIME  17:17:59   *
*                                       *
*****************************************

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

```
*************************************************************
* .......................................................... *
* :                  LAKE MEAD AND SIMMONS                 : *
* :                TECHNICAL DRAINAGE STUDY                : *
* :                   PROPOSED CONDITION                   : *
* :                CLIENT:  DDM INVESTMENTS LLC            : *
* :.....................................................:  *
* :                  RETURN PERIOD_ _ _ _10/100 YEAR      : *
* :                  DISTRIBUTION_ _ _ _ 6-HOUR SCS3      : *
* :                  PROJECT NO_ _ _ _ _ _ 58-105         : *
* :                  FILENAME_ _ _ _ _ _ _LAKE MEAD_PROP.DAT : *
* :                  DATE_ _ _ _ _ _ _ _ _07-14-06        : *
* :                                                       : *
* :              RATIOS: 0.57  10-YEAR STORM EVENT        : *
* :                      1.00  100-YEAR STORM EVENT       : *
* :                                                       : *
* :.....................................................:  *
*************************************************************
```

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

    IT           HYDROGRAPH TIME DATA
                     NMIN           5  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1   0  STARTING DATE
                     ITIME         0000  STARTING TIME
                       NQ          300  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     2   0  ENDING DATE
                     NDTIME        0055  ENDING TIME
                     ICENT           19  CENTURY MARK

                   COMPUTATION INTERVAL      .08 HOURS
                     TOTAL TIME BASE   24.92 HOURS

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

    JP           MULTI-PLAN OPTION
                     NPLAN            1  NUMBER OF PLANS

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

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

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1 .57	RATIO 2 1.00
HYDROGRAPH AT						
+	XOF5	.00	1	FLOW	1.	2.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	DDM1	.01	1	FLOW	6.	12.
				TIME	3.58	3.58
2 COMBINED AT						
+	CP-3	.01	1	FLOW	7.	15.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	XOF6	.00	1	FLOW	1.	2.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	XOF7	.00	1	FLOW	1.	2.
				TIME	3.58	3.58
2 COMBINED AT						
+	CP-1	.00	1	FLOW	2.	5.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	DDM2	.01	1	FLOW	5.	10.
				TIME	3.50	3.50

→ [XOF5] + [DDM1] + ^{3}CP-A = 20/822

```
 HYDROGRAPH AT
+                XOF8        .01    1  FLOW          7.        13.
                                       TIME        3.58      3.58

 HYDROGRAPH AT
+                XOF9        .00    1  FLOW          1.         2.
                                       TIME        3.50      3.50

  4 COMBINED AT
+                CP-4        .02    1  FLOW         14.        30.
                                       TIME        3.58      3.58

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

→ [XOF6] + [XOFT] + [XOF8] + [XOF9] + $\sum$ CP-B

= 24/24

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             JUN  1998                 *
*           VERSION 4.1                 *
*                                       *
*  RUN DATE   08SEP06  TIME  17:14:14   *
*                                       *
*****************************************
```

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

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

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

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


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

                    *DIAGRAM
*** FREE ***
               1    ID   ********************************************************************
               2    ID   * ..................................................................... *
               3    ID   * :                    LAKE MEAD AND SIMMONS                        : *
               4    ID   * :                  TECHNICAL DRAINAGE STUDY                       : *
               5    ID   * :                    ULTIMATE CONDITION                           : *
               6    ID   * :                 CLIENT:  DDM INVESTMENTS LLC                    : *
               7    ID   * :.................................................................: *
               8    ID   * :              RETURN PERIOD_ _ _ _ _10/100 YEAR                  : *
               9    ID   * :              DISTRIBUTUION_ _ _ _ _6-HOUR HDM3                  : *
              10    ID   * :              PROJECT NO_ _ _ _ _ _ _39-105                      : *
              11    ID   * :              FILENAME_ _ _ _ _ _ _ _LAKE MEAD_IN.DAT            : *
              12    ID   * :              DATE_ _ _ _ _ _ _ _ _ _07-14-06                    : *
              13    ID   * :                                                                 : *
              14    ID   * :           RATIOS: 0.57  10-YEAR STORM EVENT                     : *
              15    ID   * :                   1.00  100-YEAR STORM EVENT                    : *
              16    ID   * :                                                                 : *
              17    ID   * :.................................................................: *
              18    ID   * :                                                                 : *
              19    ID   ********************************************************************
              20    ID
              21    IT      5       0       0     300
              22    IO      5       0
              23    IN      5       0       0
              24    JR    PREC    0.57     1.0
                    *
              25    KK    DOF5
              26    KM    RUNOFF GENERATED FROM EXISTING OFFSITE BASIN DOF5
              27    BA   .0019
              28    PB   2.77
              29    PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
              30    PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
              31    PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
              32    PC    .251    .256    .270    .278    .291    .293    .295    .322    .352    .409
              33    PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
              34    PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
              35    PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
              36    PC    .998    .999   1.00
              37    LS       0   93.00
              38    UD   .0910
                    *
              39    KK    DOM1
              40    KM    RUNOFF GENERATED FROM EXISTING ONSITE BASIN DOM1
              41    BA   .0075
              42    LS       0   93.00
              43    UD   .1275
                    *
```



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

              44    KK    CP-3
              45    KM    COMBINES FLOWS FROM DOF5,DOM1, AND DOM2
```

```
 46          BC      2
             *
 47          KK   DOF6
 48          KM   RUNOFF GENERATED FROM EXISTING OFFSITE BASIN XOF5
 49          BA   .0019
 50          LS      0   93.00
 51          UD   .0834
             *
 52          KK   DOF7
 53          KM   RUNOFF GENERATED FROM DEVELOPED OFFSITE BASIN XON1
 54          BA   .0020
 55          LS      0   93.00
 56          UD   .1000
             *
 57          KK   CP-1
 58          KM   COMBINES FLOWS FROM DOF6 AND DOF7
 59          BC      2
             *
 60          KK   DON2
 61          KM   RUNOFF GENERATED FROM EXISTING ONSITE BASIN XON1
 62          BA   .0061
 63          LS      0   93.00
 64          UD   .1096
             *
 65          KK   DOF8
 66          KM   RUNOFF GENERATED FROM DEVELOPED OFFSITE BASIN XON1
 67          BA   .0081
 68          LS      0   93.00
 69          UD   .1108
             *
 70          KK   DOF9
 71          KM   RUNOFF GENERATED FROM DEVELOPED OFFSITE BASIN XON1
 72          BA   .0012
 73          LS      0   98.00
 74          UD   .1108
             *
 75          KK   CP-4
 76          KM   COMBINES FLOWS FROM CP-1, DON2, DOF8 AND DOF9
 77          BC      3
 78          ZZ
1
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

  25       DOF5
             .
             .
  39         .        DON1
             .          .
             .          .
  44       CP-3.........
             .
             .
  47         .        DOF6
             .          .
             .          .          DOF7
             .          .            .
             .          .            .
  57         .        CP-1.........
             .          .
             .          .
  60         .          .          DON2
             .          .            .
             .          .            .
  65         .          .            .          DOF8
             .          .            .            .
             .          .            .            .
  70         .          .            .            .          DOF9
             .          .            .            .            .
             .          .            .            .            .
  75         .          .          CP-4...........................
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1**************************************
*                                    *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             JUN  1998              *
*          VERSION 4.1               *
*                                    *
*  RUN DATE   08SEP06  TIME  17:14:14   *
*                                    *
**************************************
```

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

```
*************************************************************
* :.....................................................: *
* :                    LAKE MEAD AND SIDWINDER          : *
* :                  TECHNICAL DRAINAGE STUDY           : *
* :                    ULTIMATE CONDITION               : *
* :                CLIENT:  DDM INVESTMENTS LLC         : *
* :.....................................................: *
* :            RETURN PERIOD_ _ _ _10/100 YEAR          : *
* :            DISTRIBUTUION_ _ _ _6-HOUR SDM3          : *
* :            PROJECT NO_ _ _ _ _ _59-105              : *
* :            FILENAME_ _ _ _ _ _LAKE MEAD_IN.DAT      : *
* :            DATE_ _ _ _ _ _ _ _07-14-06              : *
* :                                                     : *
* :          RATIOS: 0.57  10-YEAR STORM EVENT          : *
* :                  1.00  100-YEAR STORM EVENT         : *
* :                                                     : *
* :.....................................................: *
*************************************************************
```

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

     IT         HYDROGRAPH TIME DATA
                    NMIN           5  MINUTES IN COMPUTATION INTERVAL
                    IDATE      1   0  STARTING DATE
                    ITIME         0000  STARTING TIME
                    NQ             300  NUMBER OF HYDROGRAPH ORDINATES
                    NDATE      2   0  ENDING DATE
                    NTIME         0055  ENDING TIME
                    ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL      .08 HOURS
                     TOTAL TIME BASE   24.92 HOURS

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

     JP         MULTI-PLAN OPTION
                    NPLAN          1  NUMBER OF PLANS

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

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

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

 HYDROGRAPH AT
+                DOP5        .00     1  FLOW             2.       3.
                                        TIME          3.50     3.50

 HYDROGRAPH AT
+                DOM1        .01     1  FLOW             6.      12.
                                        TIME          3.58     3.58

  2 COMBINED AT
+                CP-3        .01     1  FLOW             8.      15.
                                        TIME          3.58     3.58

 HYDROGRAPH AT
+                DOP6        .00     1  FLOW             2.       4.
                                        TIME          3.50     3.50

 HYDROGRAPH AT
+                DOP7        .00     1  FLOW             2.       4.
                                        TIME          3.50     3.50

  2 COMBINED AT
+                CP-1        .00     1  FLOW             3.       7.
                                        TIME          3.50     3.50

 HYDROGRAPH AT
+                DOM2        .01     1  FLOW             5.      10.
                                        TIME          3.50     3.50
```

→ [DOP5]+[DOM1]+ ^{3}CP-A = 31/367

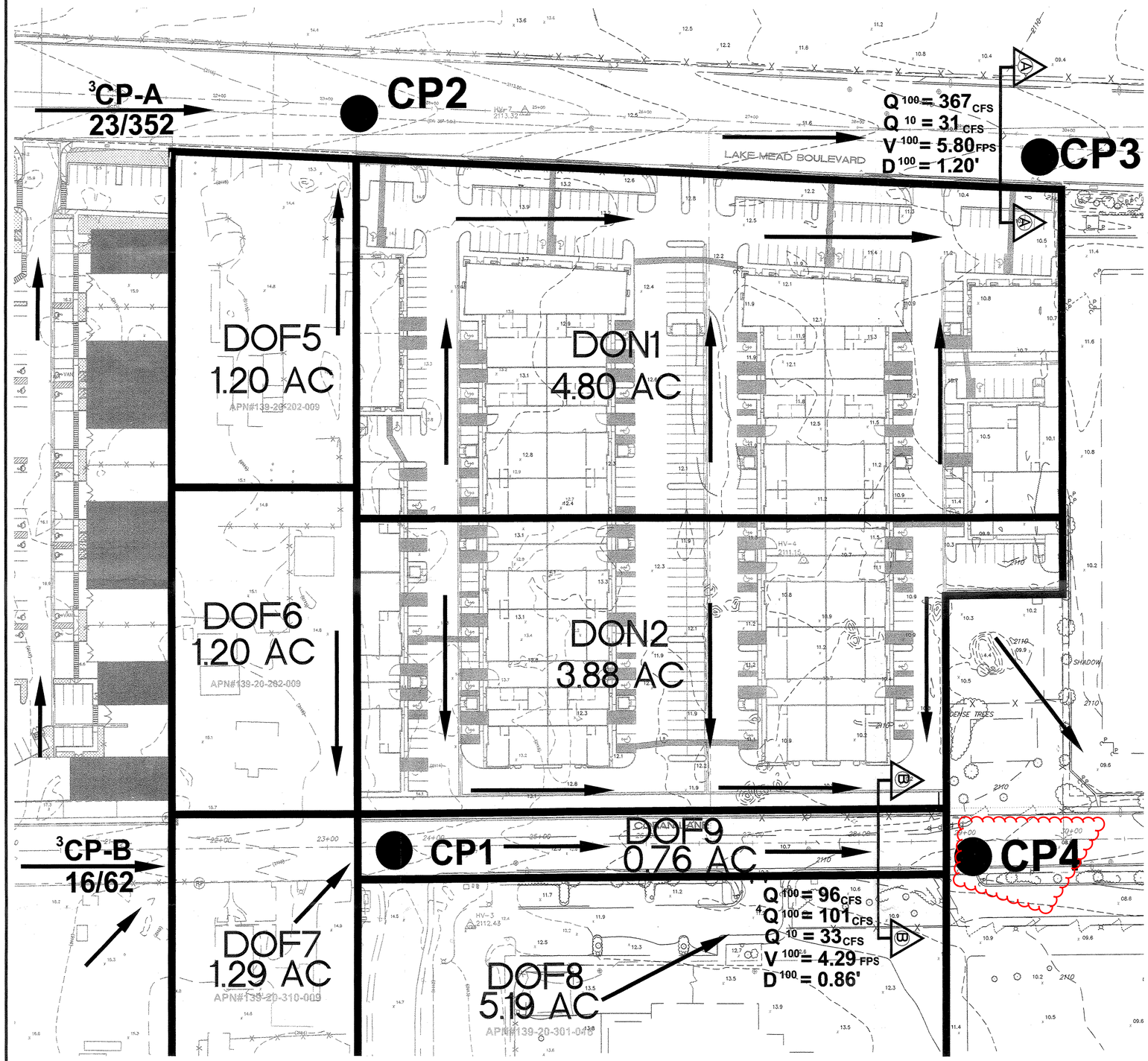
```
HYDROGRAPH AT
+                DOF8      .01     1   FLOW          7.      14.
                                       TIME        3.58    3.50

HYDROGRAPH AT
+                DOF9      .01     1   FLOW          1.       2.
                                       TIME        3.50    3.50

3 COMBINED AT
+                CP-4      .02     1   FLOW         13.      26.
                                       TIME        3.50    3.50

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

→ [DOF6]+[DOF7]+[DOF8]+[DOF9]+[DOM2]
+ ^{B}CP·B = 33/96



LEGEND

- EXISTING CONTOURS (1-FOOT INTERVAL)
- CENTER LINE
- PROPERTY LINE
- FLOW DIRECTION
- BASIN DELINEATION
- DON1 / 1.0 AC — BASIN DESIGNATION / AREA IN ACRES
- HYDRAULIC CROSS SECTION
- CP1 — CONCENTRATION POINT
- 20/46 — INTERIM 10/100 YEAR SURFACE FLOWS
- [20/46] — ULTIMATE 10/100 YEAR SURFACE FLOWS
- Q^{100}= 99 CFS, Q^{10} = 48 CFS, V^{100}= 5.7 FPS, D^{100}= 1.24' — CROSS SECTION FLOW SUMMARY

GRAPHIC SCALE

50 0 25 50 100 200

(IN FEET)
1 inch = 50 ft.

ULTIMATE FLOW RATES

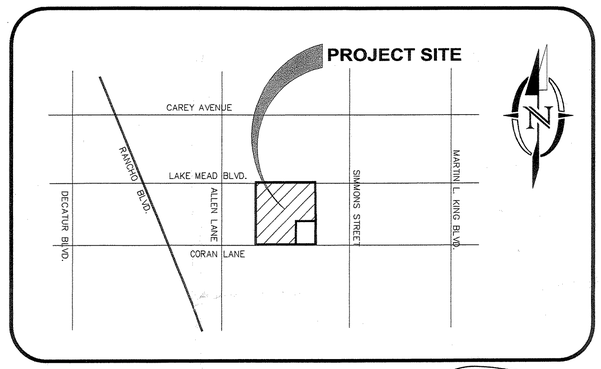
DRAINAGE BASIN / CONCENTRATION POINT	BASIN AREA (AC)	Q10 (CFS)	CUMULATIVE Q10 (CFS)	Q100 (CFS)	CUMULATIVE Q100 (CFS)
CP-A	---	---	23	---	352
DOF5	1.20	2	---	3	---
CP2	---	---	25	---	355
DON1	4.8	6	---	12	---
CP3	---	---	31	---	367
CP-B	---	---	16	---	62
DOF6	1.20	2	---	4	---
DOF7	1.29	2	---	4	---
CP1	---	---	20	---	70
DON2	3.88	5	---	10	---
DOF8	5.19	7	---	14 (12)*	---
DOF9	0.76	1	---	2	---
CP4	---	---	33	---	96 (101)

[1]OFFSITE FLOWS FROM THE "CITYWIDE HYDROLOGY STUDY UPDATE", CITY OF LAS VEGAS, 1997 –SEE FIGURE 3– OFFSITE BASIN MAP
[2]OFFSITE FLOWS FROM THE "TECHNICAL DRAINAGE STUDY FOR TEXAS GAMBLING HALL AND HOTEL", 1999 –SEE FIGURE 3– OFFSITE BASIN MAP
[3]OFFSITE FLOWS FROM THE "TECHNICAL DRAINAGE STUDY FOR LAKE MEAD COMMERCIAL PARK", 2005 –SEE FIGURE 3– OFFSITE BASIN MAP
[4]OFFSITE FLOWS FROM THE "SUPPLEMENT #2 OF TECHNICAL DRAINAGE STUDY FOR OLLIE ELEMENTARY SCHOOL", 1999 BY PBS&J

HYDRAULIC CALCULATION SUMMARY - ULTIMATE CONDITION

STREET/SECTION	SLOPE (%)	Q10/Q100 (cfs)	D10/D100 (ft)	V10/V100 (fps)	VxD	DRY LANE (ft)
LAKE MEAD BLVD/SECTION A	0.68	31/367	0.59/1.20	2.73/5.80	1.61/6.96	21.51
CORAN LN/SECTION A	0.62	33/96	0.61/0.80	2.68/4.06	1.635/3.25	N/A
CORAN LN/SECTION A*	0.62	33/101	0.61/0.81	2.68/4.06	1.635/3.35	N/A

*HYDRAULIC CALCULATION IN CORAN LANE USING PBS&J'S OLLIE ELEMENTARY SCHOOL DS FLOW.



VICINITY MAP

NOT TO SCALE

AD-48039
ADDMAP2

BENCHMARK

CITY OF NORTH LAS VEGAS RIVET AND PLATE IN TOP OF CURB, NORTHWEST CORNER OF CORAN LN. AND ALLEN LN.
METERS 648.648
FEET 2128.11

BENCHMARK # 35
CNLV
01-19E4

BASIS OF BEARING

BASIS OF BEARING N. 89°24'46" E. ALONG CENTERLINE OF CORAN LANE AS SHOWN UPON FILE 95, PAGE 88, RECORD OF SURVEY CLARK COUNTY, NEVADA OFFICIAL RECORDS

AVOID CUTTING UNDERGROUND UTILITY LINES. IT'S COSTLY.
Call before you Dig.
1-800-227-2600
UNDERGROUND SERVICE (USA)

AVOID HITTING OVERHEAD POWER LINES. IT'S COSTLY
CALL BEFORE YOU CRANE
1-702-227-2929

REV. #	BY	DATE	DESCRIPTION	APP.

REVISION APPROVAL BLOCK

SCALE: 1"=50'
DRAWN BY: GSA
DESIGNED BY: GSA
CHECKED BY: JMK
DATE:
JOB NO: 59-105

2480 E. Tompkins Ave.
Suite # 232
Las Vegas, NV 89121
phone: 702.456.4664
fax: 702.456.4919

INTEGRITY ENGINEERING

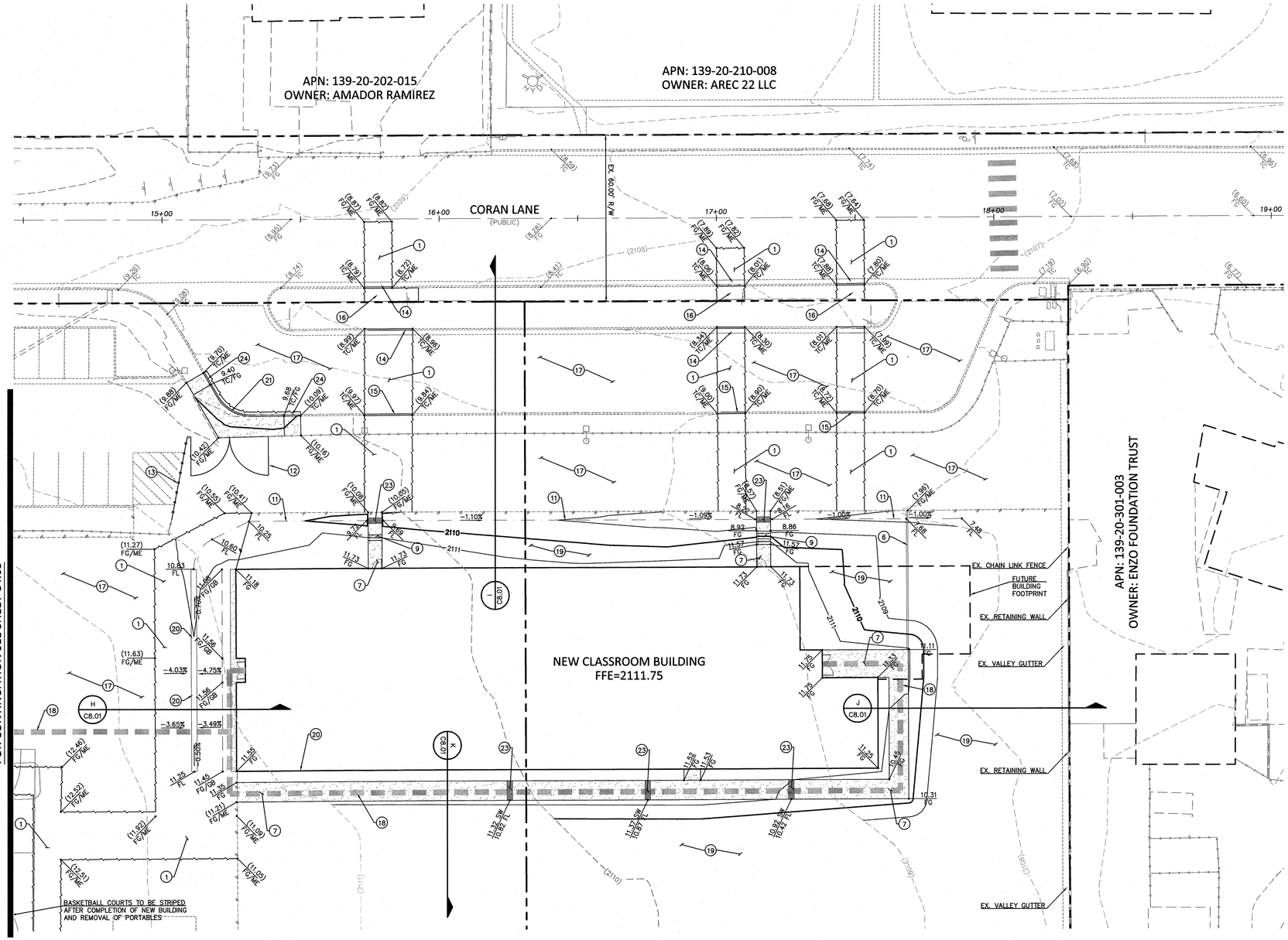
LAKE MEAD AND SIMMONS
ULTIMATE DRAINAGE PLAN

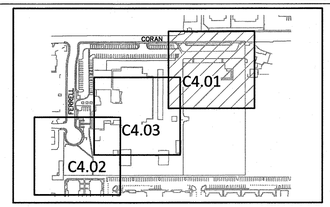
SHEET
FIG 8
1 OF 1 SHEETS
DRAWING NO.

ADDMAP2

APPENDIX E
(Plans)

- Cover and Approval Sheet
- General Notes Sheet
- Grading Plan
- Detail Sheet





KEY MAP
NTS

GRAPHIC SCALE

20 0 10 20

SCALE: 1"=20'

BASIS OF BEARING

NORTH 89°49'30" EAST, BEING THE BEARING OF THE CENTERLINE OF CORAN AVENUE AND THE NORTH LINE OF THE SOUTHWEST QUARTER (SW 1/4) OF SECTION 20, TOWNSHIP 20 SOUTH, RANGE 61 EAST, M.D.M., CITY OF LAS VEGAS, CLARK COUNTY, NEVADA, AS SHOWN IN FILE 126 OF SURVEYS, AT PAGE 60, OFFICIAL RECORDS OF CLARK COUNTY, NEVADA.

BENCHMARK

CITY OF LAS VEGAS BENCHMARK "5LV0120C4", BEING A RIVET AND PLATE IN THE TOP OF CURB @ SE CORNER OF SIMMONS & CORAN.

ELEVATION: 2102.47 (US SURVEY FEET)
640.83 (METERS)

BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).

CONSTRUCTION NOTES

NO.	ITEM USDCCA: UNIFORM STANDARD DRAWINGS CLARK COUNTY AREA
1	SAWCUT, REMOVE, AND REPLACE AC PAVEMENT PER USDCCA NO. 500.3 & 500.5.
2	CONSTRUCT 3" AC PAVEMENT OVER 7.5" TYPE II AGGREGATE BASE.
3	CONSTRUCT 2.5" AC PAVEMENT OVER 4" TYPE II AGGREGATE BASE.
4	CONSTRUCT MODIFIED TYPE 'A' CURB PER DETAIL 'A' ON SHEET C8.01
5	CONSTRUCT TYPE 'L' CURB PER USDCCA NO. 216.
6	CONSTRUCT MOW CURB PER DETAIL 'B' SHEET C8.01.
7	CONSTRUCT 4" CONCRETE SIDEWALK TO MEET ALL ADA CODE.
8	CONSTRUCT 4' CONCRETE FLUME PER DETAIL 'D' SHEET C8.01.
9	CONSTRUCT CONCRETE STEPS.
10	CONSTRUCT DRIVE ENTRANCE PER USDCCA DWG NO. 224
11	CONSTRUCT GRADED SWALE.
12	INSTALL NEW FIRE ACCESS GATE PER ARCHITECTURAL PLANS.
13	INSTALL CHAIN LINK FENCE PER ARCHITECTURAL PLANS.
14	REMOVE AND REPLACE 'L' CURB.
15	REMOVE AND REPLACE 'A' CURB.
16	REMOVE AND REPLACE SIDEWALK.
17	EXISTING ASPHALT TO REMAIN IN PLACE.
18	ADA ACCESSIBLE PATH.
19	LANDSCAPE AREA. SEE LANDSCAPE PLANS FOR DETAILS.
20	CONSTRUCT 2' CONCRETE VALLEY GUTTER PER DETAIL 'E' SHEET C8.01.
21	CONSTRUCT 0" TYPE 'A' CURB PER DETAIL 'K' ON SHEET C8.01.
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23	CONSTRUCT SIDEWALK UNDERDRAIN PER USDCCA DWG NO. 236
24	CONSTRUCT TRANSITION FROM 6" CURB TO 0" CURB PER DETAIL 'F' SHEET C8.01
25	CONSTRUCT 1.5' CONCRETE FLUME PER DETAIL 'G' SHEET C8.01

CUT & FILL CALCS:

TOTAL

CUT.....2.46 C.Y.
FILL.....40.35 C.Y.
NET.....37.89 C.Y. (FILL)

GENERAL NOTE:

IT IS THE CONTRACTOR'S RESPONSIBILITY TO FILE A NOTICE OF INTENT/REQUEST TO BE INCLUDED IN THE STORM WATER GENERAL PERMIT, AND SUBMIT THE ASSOCIATED STORM WATER POLLUTION PREVENTION PLAN (SWPPP) AS REQUIRED BY FEDERAL, AND MONITORED BY THE NEVADA DIVISION OF ENVIRONMENTAL PROTECTION.

NOTE:

PROPERTY OWNER IS RESPONSIBLE TO MAINTAIN THE BEST MANAGEMENT PRACTICES SUCH AS BUT NOT LIMITED TO THE REMOVAL OF ACCUMULATED SEDIMENT AND DEBRIS AND CARE OF THE VEGETATION.

NOTE TO CONTRACTOR:

CONTRACTOR SHALL PROVIDE EROSION CONTROL IN ALL LANDSCAPE AREAS WHERE ROOF DRAINS DISCHARGE TO GRADE UNLESS OTHERWISED NOTED HEREON.

FLOOD ZONE NOTE:

THE PROJECT SITE LIES WITHIN ZONE X AS PER FEMA FIRM PANEL 32003C2160F DATED NOVEMBER 16, 2011. PROPERTY IS LOCATED WITHIN UNSHADED FLOOD ZONE "X". UNSHADED FLOOD ZONE "X" IS DESCRIBED BY FEMA AS AN AREA TO BE OUTSIDE THE 500-YEAR FLOODPLAIN.

I CERTIFY THAT THIS GRADING PLAN CONFORMS TO THE APPROVED DRAINAGE STUDY FOR THIS SITE ON FILE WITH CITY OF LAS VEGAS.

N/A
CHRISTINE A COBB, P.E. 24211 DATE

CALL BEFORE YOU DIG
AVOID CUTTING UNDERGROUND UTILITY LINES. IT'S COSTLY
Call 811 or 1-800-227-2600

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

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CALL BEFORE YOU DIG OVERHEAD WORK
1-702-227-2929

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LEGEND

EXISTING	PROPOSED	
(0.00%)	0.00%	SLOPE
(0.00) XX	0.00 XX	ELEVATION TAG
Ⓓ	Ⓓ	STORM MANHOLE
		DROP INLET
--00--	--00--	CONTOUR
		RETAINING WALL
		SCREEN WALL

EXISTING	PROPOSED	
		AC PAVEMENT
		6" TYPE "A" CURB
		24" TYPE "L" CURB & GUTTER
		30" ROLL CURB

PL-RIGHT-OF-WAY
PL-ADJACENT
CENTERLINE
EASEMENT LINE
FLOW LINE
SAWCUT LINE
ADA ACCESS PATH

COLLINS ENGINEERS
3130 S. DURANGO DR., SUITE 404
LAS VEGAS, NV 89117
PHONE: (702) 248-8000
FAX: (702) 248-8070
www.collinsengr.com

PROFESSIONAL ENGINEER - STATE OF NEVADA
CHRISTINE A. COBB
EXP. 06-30-18
CIVIL
NO. 24211
10/11/17

OLLIE DETWILER ELEMENTARY SCHOOL
APN: 139-20-301-016 & 139-20-301-002

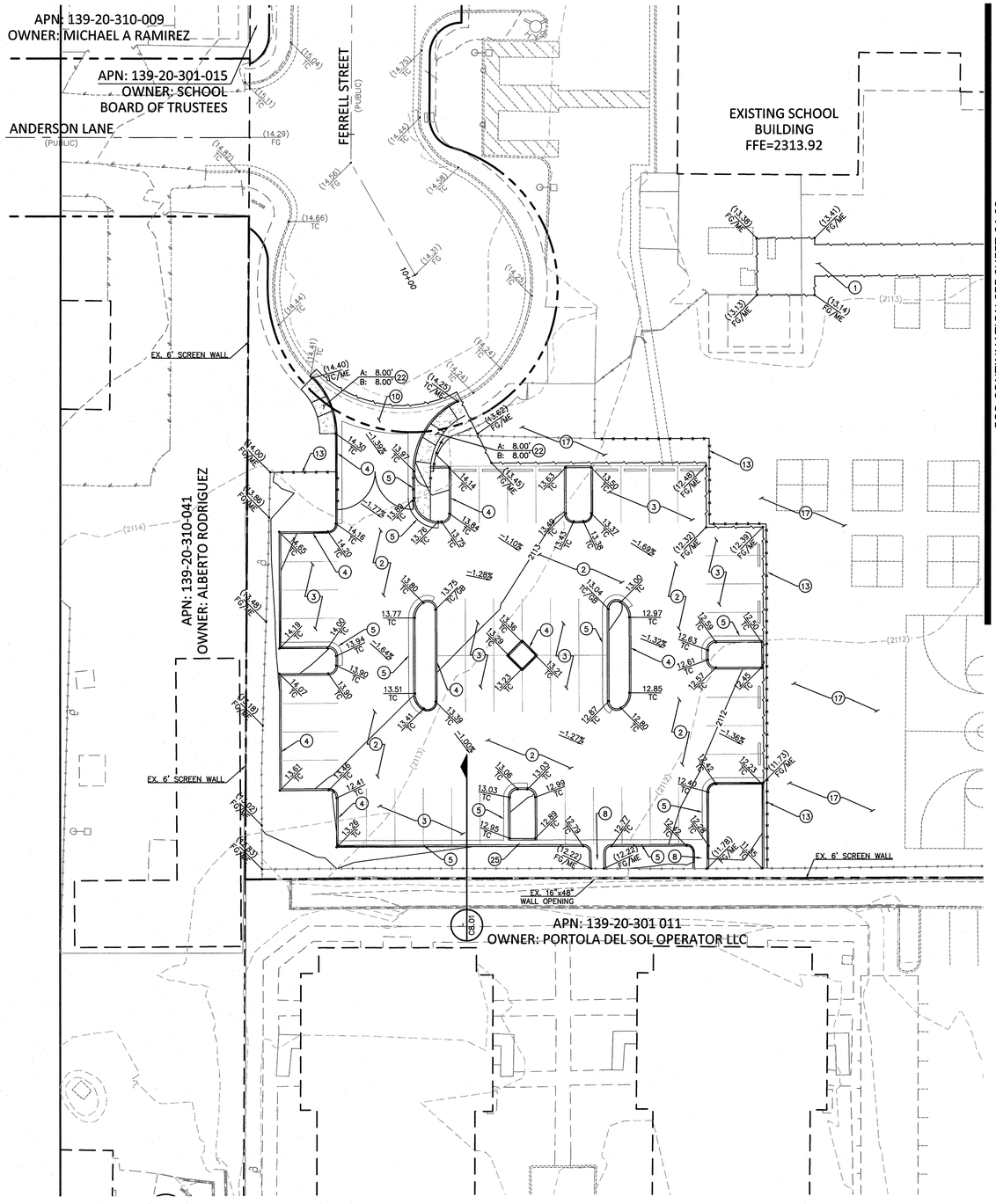
GRADING PLAN

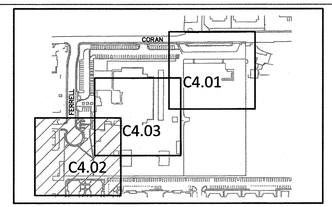
FERRELL STREET
CITY OF LAS VEGAS, NEVADA

NO.	DATE	DESIGN BY	DESCRIPTION

CEI PROJECT:	10483
DESIGN BY:	CC
DRAWN BY:	CS
CHECKED BY:	JY
DATE:	9/25/17
SCALE:	1" = 20'
SHEET NUMBER	C4.01
	SHEET 9 OF 17
	HTE#XX

H:\CAD\LAND\10483\DWG\SHEETS\10483-C4.01-GRD.DWG 10/11/2017 02:06:41 PM





KEY MAP
NTS

GRAPHIC SCALE

20 0 10 20

SCALE: 1"=20'

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FILL.....40.35 C.Y.
NET.....37.89 C.Y. (FILL)

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N/A
CHRISTINE A COBB, P.E. 24211 DATE

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Call 811 or 1-800-227-2600

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

AVOID HITTING OVERHEAD POWER LINES. IT'S COSTLY.
CALL BEFORE YOU DO OVERHEAD WORK
1-702-227-2929

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(0.00) XX	0.00 XX	ELEVATION TAG
(D)	(D)	STORM MANHOLE
		DROP INLET
--00--	--00--	CONTOUR
		RETAINING WALL
		SCREEN WALL

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PL-RIGHT-OF-WAY
PL-ADJACENT
CENTERLINE
EASEMENT LINE
FLOW LINE
SAWCUT LINE
ADA ACCESS PATH

COLLINS ENGINEERS
3130 S. DURANGO DR., SUITE 404
LAS VEGAS, NV 89117
PHONE: (702) 248-8000
FAX: (702) 248-8070
www.collinsengr.com

PROFESSIONAL ENGINEER-STATE OF NEVADA
CHRISTINE A. COBB
EXP. 12/31/18
CIVIL
NO. 24211
10/11/17

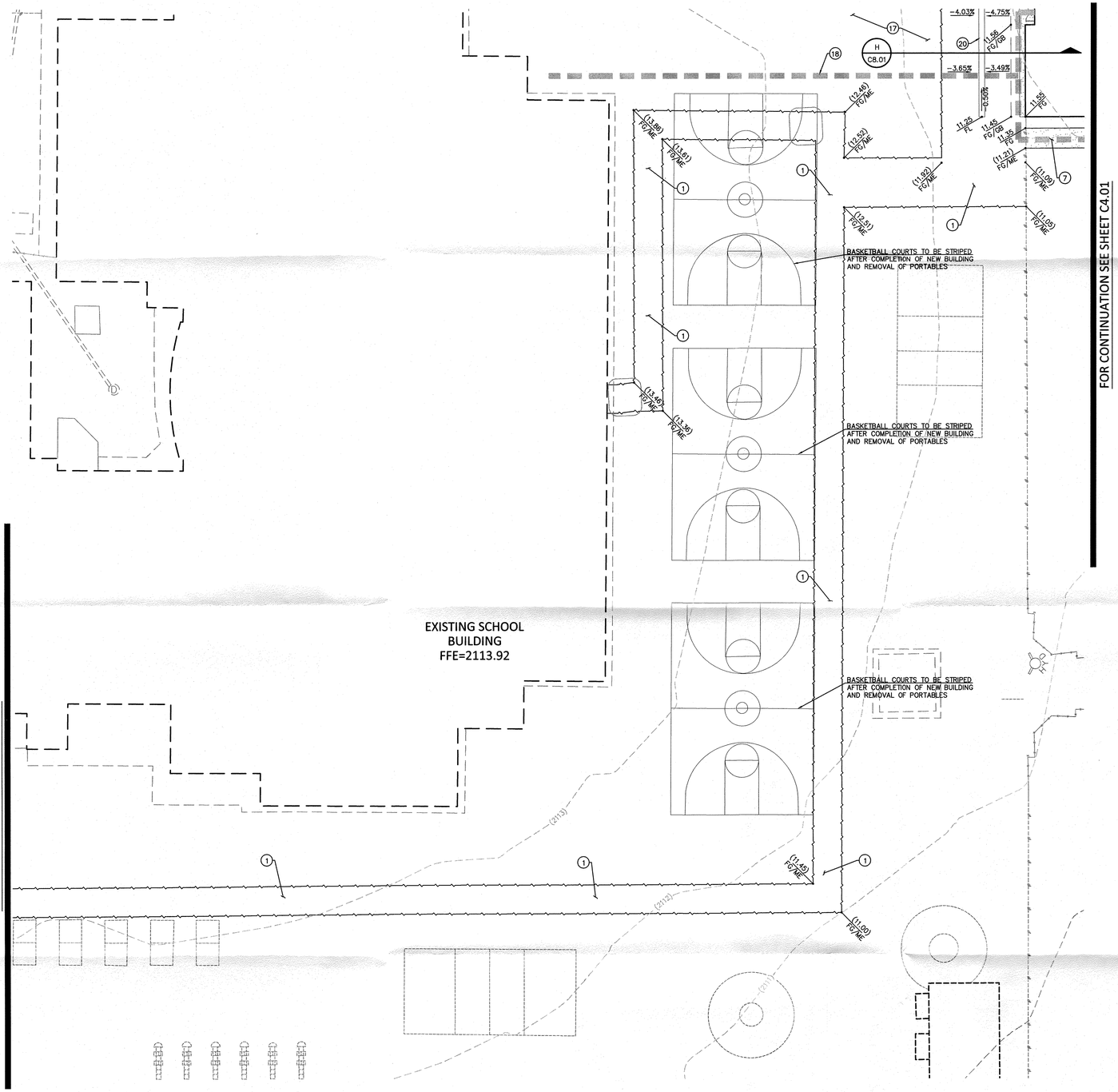
OLLIE DETWILER ELEMENTARY SCHOOL
APN: 139-20-301-016 & 139-20-301-002

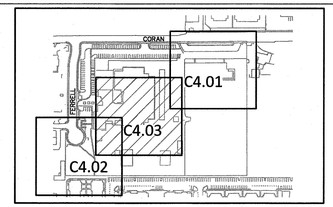
GRADING PLAN

FERRELL STREET
CITY OF LAS VEGAS, NEVADA

NO.	DATE	DESIGN BY	DESCRIPTION

CEI PROJECT:	10483
DESIGN BY:	CC
DRAWN BY:	CS
CHECKED BY:	JY
DATE:	9/25/17
SCALE:	1" = 20'
SHEET NUMBER	C4.02
SHEET 10 OF 17	
HTE#XX	





KEY MAP
NTS

GRAPHIC SCALE
20 0 10 20
SCALE: 1"=20'

BASIS OF BEARING

NORTH 89°49'30" EAST, BEING THE BEARING OF THE CENTERLINE OF CORAN AVENUE AND THE NORTH LINE OF THE SOUTHWEST QUARTER (SW 1/4) OF SECTION 20, TOWNSHIP 20 SOUTH, RANGE 61 EAST, M.D.M., CITY OF LAS VEGAS, CLARK COUNTY, NEVADA, AS SHOWN IN FILE 126 OF SURVEYS, AT PAGE 60, OFFICIAL RECORDS OF CLARK COUNTY, NEVADA.

BENCHMARK

CITY OF LAS VEGAS BENCHMARK "5LV0120C4", BEING A RIVET AND PLATE IN THE TOP OF CURB @ SE CORNER OF SIMMONS & CORAN.

ELEVATION: 2102.47 (US SURVEY FEET)
640.83 (METERS)

BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).

CONSTRUCTION NOTES

NO.	ITEM USDCCA: UNIFORM STANDARD DRAWINGS CLARK COUNTY AREA
1	SAWCUT, REMOVE, AND REPLACE AC PAVEMENT PER USDCCA NO. 500.3 & 500.5.
2	CONSTRUCT 3" AC PAVEMENT OVER 7.5" TYPE II AGGREGATE BASE.
3	CONSTRUCT 2.5" AC PAVEMENT OVER 4" TYPE II AGGREGATE BASE.
4	CONSTRUCT MODIFIED TYPE 'A' CURB PER DETAIL 'A' ON SHEET C8.01
5	CONSTRUCT TYPE 'L' CURB PER USDCCA NO. 216.
6	CONSTRUCT MOW CURB PER DETAIL 'B' SHEET C8.01.
7	CONSTRUCT 4" CONCRETE SIDEWALK TO MEET ALL ADA CODE.
8	CONSTRUCT 4' CONCRETE FLUME PER DETAIL 'D' SHEET C8.01.
9	CONSTRUCT CONCRETE STEPS.
10	CONSTRUCT DRIVE ENTRANCE PER USDCCA DWG NO. 224
11	CONSTRUCT GRADED SWALE.
12	INSTALL NEW FIRE ACCESS GATE PER ARCHITECTURAL PLANS.
13	INSTALL CHAIN LINK FENCE PER ARCHITECTURAL PLANS.
14	REMOVE AND REPLACE 'L' CURB.
15	REMOVE AND REPLACE 'A' CURB.
16	REMOVE AND REPLACE SIDEWALK.
17	EXISTING ASPHALT TO REMAIN IN PLACE.
18	ADA ACCESSIBLE PATH.
19	LANDSCAPE AREA. SEE LANDSCAPE PLANS FOR DETAILS.
20	CONSTRUCT 2' CONCRETE VALLEY GUTTER PER DETAIL 'E' SHEET C8.01.
21	CONSTRUCT 0" TYPE 'A' CURB PER DETAIL 'K' ON SHEET C8.01.
22	CONSTRUCT SIDEWALK RAMP PER USDCCA DWG NO. 235 CASE I.
23	CONSTRUCT SIDEWALK UNDERDRAIN PER USDCCA DWG NO. 236
24	CONSTRUCT TRANSITION FROM 6" CURB TO 0" CURB PER DETAIL 'F' SHEET C8.01
25	CONSTRUCT 1.5' CONCRETE FLUME PER DETAIL 'G' SHEET C8.01

CUT & FILL CALCS:

TOTAL

CUT.....2.46 C.Y.
FILL.....40.35 C.Y.
NET.....37.89 C.Y. (FILL)

GENERAL NOTE:

IT IS THE CONTRACTOR'S RESPONSIBILITY TO FILE A NOTICE OF INTENT/REQUEST TO BE INCLUDED IN THE STORM WATER GENERAL PERMIT, AND SUBMIT THE ASSOCIATED STORM WATER POLLUTION PREVENTION PLAN (SWPPP) AS REQUIRED BY FEDERAL, AND MONITORED BY THE NEVADA DIVISION OF ENVIRONMENTAL PROTECTION.

NOTE:

PROPERTY OWNER IS RESPONSIBLE TO MAINTAIN THE BEST MANAGEMENT PRACTICES SUCH AS BUT NOT LIMITED TO THE REMOVAL OF ACCUMULATED SEDIMENT AND DEBRIS AND CARE OF THE VEGETATION.

NOTE TO CONTRACTOR:

CONTRACTOR SHALL PROVIDE EROSION CONTROL IN ALL LANDSCAPE AREAS WHERE ROOF DRAINS DISCHARGE TO GRADE UNLESS OTHERWISED NOTED HEREON.

FLOOD ZONE NOTE:

THE PROJECT SITE LIES WITHIN ZONE X AS PER FEMA FIRM PANEL 32003C2160F DATED NOVEMBER 16, 2011. PROPERTY IS LOCATED WITHIN UNSHADED FLOOD ZONE "X". UNSHADED FLOOD ZONE "X" IS DESCRIBED BY FEMA AS AN AREA TO BE OUTSIDE THE 500-YEAR FLOODPLAIN.

I CERTIFY THAT THIS GRADING PLAN CONFORMS TO THE APPROVED DRAINAGE STUDY FOR THIS SITE ON FILE WITH CITY OF LAS VEGAS.

N/A
CHRISTINE A COBB, P.E. 24211 DATE

CALL BEFORE YOU DIG
AVOID CUTTING UNDERGROUND UTILITY LINES. IT'S COSTLY
Call 811 or 1-800-227-2600

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

AVOID HITTING OVERHEAD POWER LINES. IT'S COSTLY.
CALL BEFORE YOU DO OVERHEAD WORK
1-702-227-2929

COLLINS ENGINEERS ASSUMES NO RESPONSIBILITY FOR EXISTING UTILITY LOCATIONS AND ELEVATIONS. THE UTILITIES SHOWN ON THIS DRAWING HAVE BEEN PLOTTED FROM THE BEST AVAILABLE INFORMATION. IT IS, HOWEVER, THE CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY THE LOCATION AND ELEVATION OF ALL UTILITIES PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION. CONTRACTOR TO FIELD VERIFY ALL EXISTING SITE CONDITIONS PRIOR TO CONSTRUCTION. IF A CONFLICT EXISTS BETWEEN WHAT IS SHOWN ON THESE DRAWINGS AND WHAT EXISTS IN THE FIELD, THE CONTRACTOR IS TO NOTIFY THE ARCHITECT OR ENGINEER IMMEDIATELY.

LEGEND

EXISTING	PROPOSED	
(0.00%)	0.00%	SLOPE
(0.00) XX	0.00 XX	ELEVATION TAG
Ⓓ	Ⓓ	STORM MANHOLE
		DROP INLET
--00--	--00--	CONTOUR
		RETAINING WALL
		SCREEN WALL

EXISTING	PROPOSED	
		AC PAVEMENT
		6" TYPE "A" CURB
		24" TYPE "A" CURB & GUTTER
		30" ROLL CURB

PL-RIGHT-OF-WAY
PL-ADJACENT
CENTERLINE
EASEMENT LINE
FLOW LINE
SAWCUT LINE
ADA ACCESS PATH

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FAX: (702) 248-8070
www.collinsengr.com

PROFESSIONAL ENGINEER - STATE OF NEVADA
CHRISTINE A COBB
EXP. 11-30-18
CIVIL
NO. 24211
10/11/17

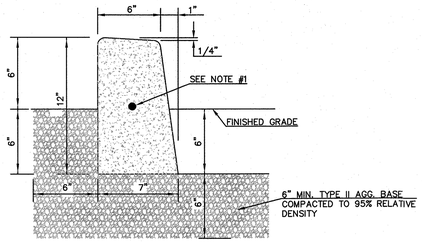
OLLIE DETWILER ELEMENTARY SCHOOL
APN: 139-20-301-016 & 139-20-301-002

GRADING PLAN
FERRELL STREET
CITY OF LAS VEGAS, NEVADA

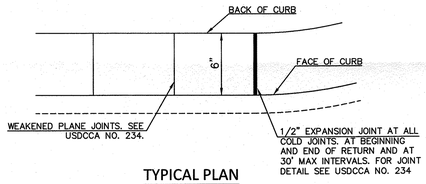
NO.	DATE	DESIGN BY	DESCRIPTION

CEI PROJECT:	10483
DESIGN BY:	CC
DRAWN BY:	CS
CHECKED BY:	JY
DATE:	9/25/17
SCALE:	1" = 20'
SHEET NUMBER	C4.03
SHEET 11 OF	17
HTE#XX	

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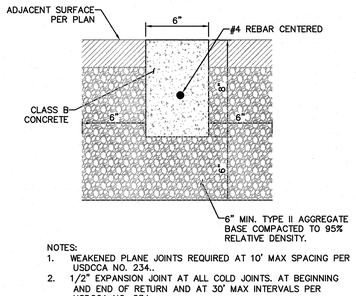
'A' CURB SECTION



TYPICAL PLAN

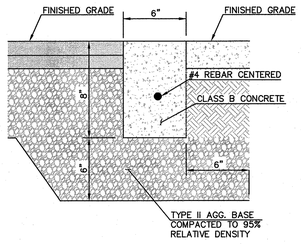
NOTES:
1. CONTINOUS #4 REBAR IN RADIUS OF CURB ONLY

A / C8.01 — TYPE 'A' CURB — NTS

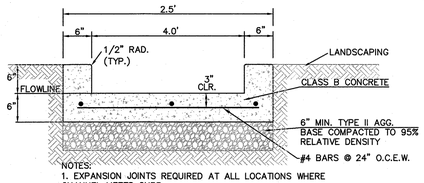


NOTES:
1. WEAKENED PLANE JOINTS REQUIRED AT 10' MAX SPACING PER USDCCA NO. 234.,
2. 1/2" EXPANSION JOINT AT ALL COLD JOINTS. AT BEGINNING AND END OF RETURN AND AT 30' MAX INTERVALS PER USDCCA NO. 234.

B / C8.01 — MOW CURB — NTS

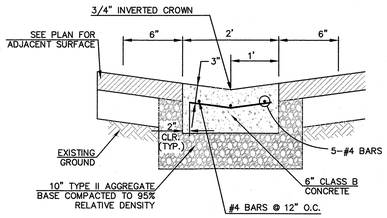


C / C8.01 — 0" TALL TYPE 'A' CURB — NTS

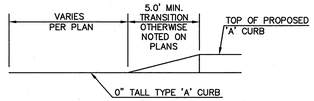


NOTES:
1. EXPANSION JOINTS REQUIRED AT ALL LOCATIONS WHERE CHANNEL MEETS CURB.
2. WEAKENED PLANE JOINTS REQUIRED AT 10' MAX. SPACING.

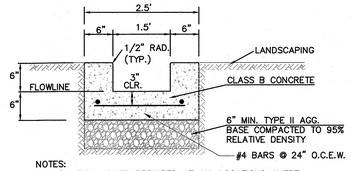
D / C8.01 — 4' CONCRETE FLUME — NTS



E / 8.01 — 2' CONCRETE GUTTER — NTS

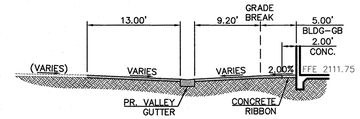


F / C8.01 — ONSITE CURB TRANSITION — NTS

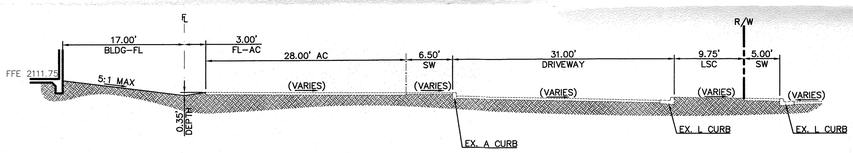


NOTES:
1. EXPANSION JOINTS REQUIRED AT ALL LOCATIONS WHERE CHANNEL MEETS CURB.
2. WEAKENED PLANE JOINTS REQUIRED AT 10' MAX. SPACING.

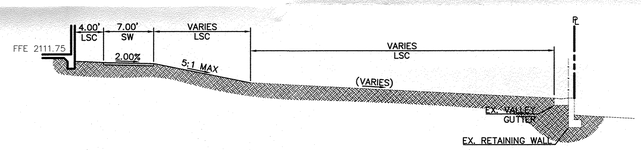
G / C8.01 — 1.5' CONCRETE FLUME — NTS



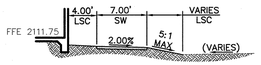
H / C8.01 — SECTION VIEW — NTS



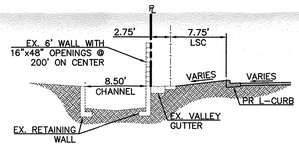
I / C8.01 — SECTION VIEW — NTS



J / C8.01 — SECTION VIEW — NTS



K / C8.01 — SECTION VIEW — NTS



L / C8.01 — SECTION VIEW — NTS

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APN: 139-20-301-016 & 139-20-301-002

DETAIL SHEET

FERRELL STREET
CITY OF LAS VEGAS, NEVADA

NO.	DATE	DESIGN BY	DESCRIPTION

CEI PROJECT:	10483
DESIGN BY:	CC
DRAWN BY:	CS
CHECKED BY:	JY
DATE:	9/25/17
SCALE:	N.T.S.
SHEET NUMBER	C8.01
SHEET 17 OF 17	
HTE#XX	