

DS #: 4535

APN: 139-36-303-001

PROJECT: VARIETY SCHOOL

SUBMITTAL: 1ST

SCANNED BY/DATE: _____

CHECKED BY/DATE: _____





CITY OF LAS VEGAS		DATE:
INTER-OFFICE MEMORANDUM		August 16, 2011
TO: Land Development Services Department of Public Works		FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT:	Drainage Study for: Variety School	COPIES TO: Slater Hanifan Group
Cross Streets:	SEC Stewart Avenue & 28 th Street	Clark County School District
File Number:	F:\Depot\DSMemos\DS4535A.doc	Bart Anderson, P.E., DevCo
Parcel Number:	139-36-303-001	
Zoning Action:	SDR-42251	
FEMA Flood Zone	YES NO X	
Proposed Storm Drain	YES NO X	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Transaction #
1 st Submittal	8/3/2011	8/16/2011	See Comments Below	N/C	N/C
			TOTAL FEES (LDDRS):		----

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.

1. Provide a copy of the zoning/planning conditions associated with this site (**SDR-42251**) with the next submittal to verify compliance with conditions. *Flood Control* will not issue conditional approval of the drainage study without the associated zoning/planning conditions (issued by the *City Council*). Any associated conditions of approval that revise the site drainage parameters will require that the drainage study be revised and resubmitted.
2. The anticipated 100-year flow depth in Stewart Avenue is 1.44' and the velocity is erosive. Per **Section Detail F/D-1**, a 7'-wide multi-use path will be totally inundated in the erosive flow during a major flood event. Provide a minimum 2'-high solid grouted stem wall (use 8"-CMU) at the back of the 5'-landscape for flood protection. Review and revise accordingly.
3. **Construction Note #8** calls for a 2'-sidewalk underdrain but only to be found nowhere on the grading plan. Review and address in the next submittal.
4. Revise **Construction Note #9** to install a layer of geotextile filter fabric between the proposed riprap and the subbase.
5. Label the finish floor elevations of existing buildings on the north side of *Stewart Avenue* on the grading plan.

In an effort to increase administrative efficiency, the City of Las Vegas Public Works Department requires all soil reports, drainage studies and traffic impact analysis submittals to be accompanied by an electronic copy of the submittal. Electronic documents must be submitted with one original hard copy of the study. Electronic documents should be on a universal computer-readable digital output replicating your submittal to be used for archival or display purposes. This may be more than one file if necessary. An Indexed Portable Document Format (PDF) or Print Ready CAD file formats with a minimum of 300dpi are the desired formats, but provided it is a high quality digitized replication of the submittal, other formats may be acceptable. If figures are in color, they must be scanned in color and saved as a separate file. The new submittal requirement is effective on July 1, 2011. If there are any questions regarding these new requirements, please contact Robert Welch in the Flood Section at (702) 229-2177 or Rick Schroder in Traffic Engineering at (702) 229-6327.

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.

NOTES: This drainage study assumes that the project will be constructed in one phase. If improvement plans are submitted to break the project into separate phases, a drainage study update will be required for each phase addressing the interim condition.

END OF REMARKS
ays

T/R/S: T20S/R61E/36
AREA M-36

TRANSACTION REPORT

P. 01

AUG-16-2011 TUE 02:21 PM

FOR: CITY OF LAS VEGAS

7023828551

SEND

DATE	START	RECEIVER	TX TIME	PAGES	TYPE	NOTE	M#	DP
AUG-16	02:21 PM	2845399	29"	2	FAX TX	OK	866	

TOTAL : 29S PAGES: 2

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NOTES: This drainage study assumes that the project will be constructed in one phase. If improvement plans are submitted to break the project into separate phases, a drainage study update will be required for each phase addressing the interim condition.

END OF REMARKS
ays

T/R/S: T20S/R61E/36
AREA M-36

TECHNICAL DRAINAGE STUDY

Variety School

City of Las Vegas, Nevada

Job No.: CSD1103-001

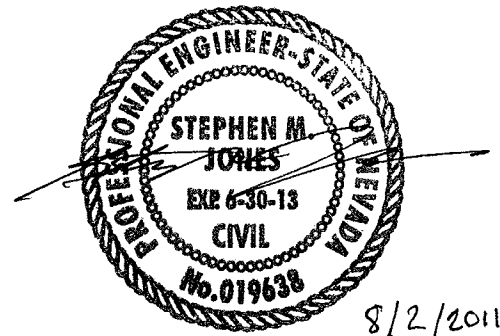
Date: August 2011

Prepared By:

Slater Hanifan Group, Inc.
5740 S. Arville Street, Suite 216
Las Vegas, Nevada 89118
Phone: 702-284-5300 • Fax: 702-284-5399

Prepared For:

KGA Architecture
9075 West Diablo Drive, 3rd Floor
Las Vegas, Nevada 89148
Phone: 702-367-6900



8/2/2011

Steve Jones, P.E.
NV Professional Engineer No. 19638

Assisted by: Kellin Collins, E.I.

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL
DRAINAGE STUDY INFORMATION FORM

Name of Development: Variety School Date: August 2011

Location of Development: a) Descriptive (Cross Streets) North/South: 28th Street
East/West: Stewart Avenue

b) Section: 36 Township: 20 Range: 61
c) APN : 139-36-303-001

Name of Owner: Owner - Clark County School District (Developer - KGA Architecture)
Telephone No.: 702-367-6900 Fax No.: _____ E-Mail Address: _____
Address: 9075 West Diablo Drive, 3rd Floor, Las Vegas, NV 89148

Contact Person-Name: Kellin Collins, E.I. Telephone No.: 702-284-5300
* E-Mail Address: kcollins@shg-inc.com Fax No.: 702-284-5399
Firm: Slater Hanifan Group
Address: 5740 S. Arville Street, Suite 216 Las Vegas, NV 89118

Type of Land Development/Land Disturbance Process:

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

1. Total Owned Land Area: At Site: 11.7 +/- acres Being Developed/Disturbed: 5.4 +/- 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

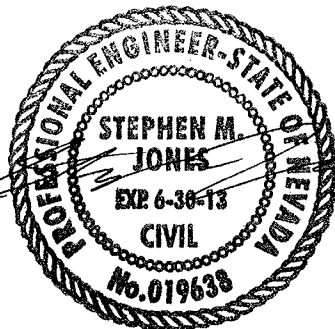
4. Proposed type of development (Residential, Commercial, Etc.): School

5. Approximate upstream land area which drains to the subject site: 266 +/- acres

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

7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: North onto Stewart Avenue and west onto 28th Street

8. Briefly describe your proposed schedule for the subject project: ASAP



Engineer's Seal

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

*New Required Field

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

Revision	Date

Local Entity File No. _____

REFERENCE:

STANDARD FORM 1

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

Project Name: Variety School		Map ID:
Firm Name: Slater Hanifan Group (SHG)		Steve Jones, P.E.
Address: 5740 S. Arville St., Suite 216		
City: Las Vegas	State: Nevada	Zip: 89118
Phone Number: 702-284-5300	Fax Number: 702-284-5399	
Property Owner: Clark County School District (KGA Architecture)		
Address: 9075 West Diablo Drive, 3 rd Floor		
City: Las Vegas	State: NV	Zip: 89148
Reviewed By:	Date Received:	Date Accepted for Review:

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

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

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

I. GENERAL REQUIREMENT:

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

III. DRAINAGE PLAN

Yes	No	
☒	☐	Sheet size: 24" x 36" sealed by a registered engineer in the State of Nevada.
☒	☐	Minimum scale: 1" = 60'.
☒	☐	Project name.
☒	☐	Vicinity Map with local and major cross streets.
☒	☐	Revision box.
☒	☐	North arrow and bar scale.
☒	☐	Engineer's/consultant's address and phone number.
☒	☐	Elevation datum and benchmark.
☒	☐	Legend for symbols and abbreviations.
☒	☐	Cut/fill scarps, where applicable.
☒	☐	Street names, grades, widths.
☒	☐	Proposed future and existing spot grades for top of curbs and street crowns at lot lines, grade breaks, and along curb returns on both sides of the street.

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
<u>x</u>	<u> </u>	Existing contours encompassing the site and 100 feet beyond with spot elevations for important locations, where appropriate.
<u>x</u>	<u> </u>	Minimum finish floor elevations with top-of-curb elevations at upstream end of lot.
<u> </u>	<u>n/a</u>	Proposed typical street sections.
<u> </u>	<u>n/a</u>	Streets with off-set crowns.
<u>x</u>	<u> </u>	Proposed contours or spot elevations in sufficient detail to exhibit intended drainage patterns and slopes.
<u>x</u>	<u> </u>	Property lines.
<u>x</u>	<u> </u>	Right-of-way lines and widths, existing and proposed.
<u>x</u>	<u> </u>	Existing improvements and their elevations.
<u>x</u>	<u> </u>	Delineation of proposed on-site drainage basins indicating area and 10-year and 100-year storm peak flows at basin concentration points.
<u>x</u>	<u> </u>	Concentration points and drainage flow direction with Q_{100} and V_{100} and D_{100} in streets.
<u>x</u>	<u> </u>	Cumulative flows, velocity, and direction of flow at upstream and downstream ends of site for the 10-year and 100-year flows.
<u>x</u>	<u> </u>	Location and cross-section of street capacity calculations.
<u> </u>	<u>n/a</u>	Cross-sectional detail for channels, including cutoff wall locations.
<u>x</u>	<u> </u>	Existing and proposed drainage facilities, appurtenances, and connections (i.e., sidewalk, ditches, swales, storm drain systems, unimproved and improved channels, and culverts, etc.) stating size, material, shape, and slope with plan and profile and HGL calculations.
<u> </u>	<u>n/a</u>	Existing and proposed drainage easements and widths shown with sufficient detail. A cross sectional detail must be provided that shows appropriate lining and reinforcement.
<u> </u>	<u>n/a</u>	Location and detail of existing, proposed, and future block wall openings. Minimum size is 16"x48". Wrought iron gate is required for flows > 10 cfs.
<u> </u>	<u>n/a</u>	Location and detail of flood walls illustrating depth of flow, proposed grouting height, etc.

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
	<u> n/a </u>	Perimeter retaining wall locations. All existing and proposed walls (retaining screen and flood) must be shown with adjacent ground elevations. Flood Walls with 8-inch concrete masonry unit.
<u> x </u>	<u> </u>	Building and/or lot numbers.
	<u> n/a </u>	Alignment of all existing, proposed, or future Regional Facilities adjacent to the site.
	<u> n/a </u>	Limits of existing floodplain based on current FIRM or best available information; limits of proposed floodplains based on best available information.
	<u> n/a </u>	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.
	<u> n/a </u>	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.
	<u> n/a </u>	Street slopes for perimeter and interior streets. The minimum slope is 0.4 percent.

IV. HYDROLOGIC ANALYSIS

Yes	No	
<u> x </u>	<u> </u>	Appropriate soil information and Soils Map for existing and future conditions with subbasins and property delineated.
<u> x </u>	<u> </u>	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.
<u> x </u>	<u> </u>	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.
<u> x </u>	<u> </u>	Use of correct precipitation values in and around the McCarran Airport Rainfall Area.
<u> x </u>	<u> </u>	A discussion in the text of the hydrologic analysis justifying subbasin boundaries and cutoffs, supporting assumptions, and calculations.
<u> x </u>	<u> </u>	A summary table of storm water flows showing basin area, Q ₁₀ and Q ₁₀₀ for both individual basins and combined basin flows, where acceptable.
<u> x </u>	<u> </u>	Copies of supporting technical information referenced from a previously approved study and a statement accepting these results.
<u> x </u>	<u> </u>	On-site facilities must perpetuate flows through or around the site without significantly impacting adjacent property owners in accordance with current Nevada Drainage Law.

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

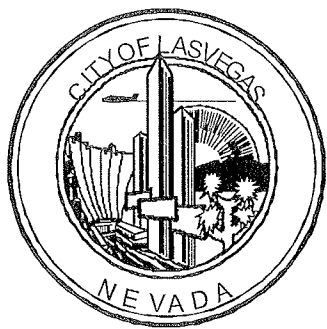
DRAINAGE SUBMITTAL CHECKLIST

V. HYDRAULIC ANALYSIS

Yes	No	
	n/a	Flow split calculations and supporting documentation or reference for the method of flow split calculations used.
x		Normal depth street flow calculations and cross section diagrams for all interior and perimeter streets. Provide "d x v" products for the Q_{100} and Q_{10} flows representing the worst case for interior and all perimeter streets. $Q_{100} d \times v \leq 8$. $Q_{10} d \times v \leq 6$ and 12 foot dry lane for rights-of-way ≥ 80 feet. Calculations must be labeled by street name as indicated on the Grading Plan.
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.
	n/a	Appropriate hydraulic calculations for block wall openings assuming a 50 percent vertical clogging factor. (Assume the lower half of the opening is plugged.)
	n/a	Appropriate hydraulic calculations at drainage easement entrance and discharge locations to set finish floor elevations. Hydraulic calculations must include submerged weir, superelevation and tee intersection losses, where appropriate.
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.
		• Field survey data. • Input and output information. • Plotted cross-sections based on survey with proper encroachments. • A map showing the location of the cross-sections. • Analysis of both sub- and super-critical flow segments. • A summary table and a discussion of the results in the text of the report.
	n/a	Provide a 50 percent clogging factor in the capacity calculation for drop inlets.
	n/a	Hydraulic calculations for culverts and storm drains. D-Load calculations must be provided for storm drain pipes in public rights-of-way, including headwater pool inundation.
x		The mitigation of nuisance water, both during construction and in the fully developed condition, must be addressed.

REFERENCE:

STANDARD FORM 2



CITY OF LAS VEGAS

MINIMUM DRAINAGE STUDY CRITERIA STANDARD FORM 2 CHECKLIST SUPPLEMENT

(Revised 06/06/01)

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 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 Clark County Regional Flood Control District (CCRFCD) Hydrologic Criteria and Drainage Design Manual (Design Manual).

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

I. GENERAL REQUIREMENT		
Yes	No	
	N/A	A notarized letter from the adjacent property owner(s) allowing off-site grading. (A copy of the letter must be received prior to final acceptance of the drainage study.)
	✓	Copies of all conditions of approval for development related to this property. (e.g. zoning, use permit, tentative map, etc.) Verify compliance with conditions.

will provide at a later date

II. GRADING PLAN INFORMATION		
Yes	No	
✓		(1) 24" X 36" copy of the Grading Plan, (including all Detail Sheets) sealed by the engineer.
✓		Proposed future and existing spot grades for top of curbs and street crowns at lot lines, grade breaks, and along curb returns on both sides of the street. Note: Proposed top of curb elevations must be provided for both sides of roadways even if only half street construction is required.
✓		Label existing topography at a minimum 5 foot elevation interval including adjacent developments, finished floor elevations of existing buildings and top of existing curbs extending 100 feet* around the perimeter of the site. (*Measured from the centerline of the adjacent roadway.)
	N/A	Proposed on-site and off-site storm drains and other flood control facilities with plan and profile sheets for public storm drains showing the class of pipe, (Class III, IV, V, etc.), design hydraulic grade line, (HGL) and 100 year storm flow. A public drainage easement must be provided over on-site storm drains conveying off-site flows. An overflow path must be provided over all storm drains.
✓		All existing and "to be constructed" walls with cross-sections showing wall type, (e.g. block wall, retaining wall, flood wall, etc.), with limits clearly defined, adjacent ground elevations. Wall heights must meet current ordinances and in no case exceed 14 feet above the adjacent property.
✓		Street slopes for both interior and perimeter streets. Note: The minimum slope for a roadway is 0.4 percent, a minimum 18-inch storm drain must be provided where minimum slopes cannot be met.

CITY OF LAS VEGAS MINIMUM DRAINAGE STUDY CRITERIA CHECKLIST

II. GRADING PLAN INFORMATION		
Yes	No	
✓		Back of lot elevations and lot drainage pattern for all lots including common lots.
		Sites with a grade difference two feet above or below existing ground are required to have approval from City of Las Vegas Current Planning. Current Planning approval is required prior to final approval of the drainage study.
✓		On-site facilities must perpetuate flows through or around the site without significantly impacting adjacent property owners. (The project must pass flows through the site every 600 feet where the project is blocking flow paths.)
	✓	This project uses a solid grouted stem wall (or approved alternate) at the back of sidewalk to provide erosion protection for landscaped areas where the depth of flow in the roadway exceeds the back of walk elevation. A corresponding cross-section detail is included.
✓		Commercial and Common Lot Landscape areas are not allowed to drain over the sidewalk. The grading plans show flow lines with grades and sidewalk under drains for all landscape areas draining to the public ROW.

III. Local Entity Criteria - City of Las Vegas – Manual Section 1600		
Yes	No	
✓		Concrete valley gutters are required in parking lots with slopes less than 1 percent. Slopes through cul-de-sac must be at a 1 percent minimum where flow is drained through the cul-de-sac.
	N/A	Ten-foot wide public drainage easements to be privately maintained are allowed for flow less than 20 cfs. The depth of flow entering the easement must be checked using the submerged weir calculation.
	N/A	The limits of the flood zones and the base flood elevations (BFE) must be shown on all grading plans for all developments within a Special Flood Hazard Zone A, AO, AE, etc.
	✓	Minimum finish floor elevation is 6 inches above highest adjacent top of curb. Finish floor calculations must include allowances for super elevations on curves and velocity head for tee intersections. <i>instead on 0.5-ft there is 0.19-ft</i>
	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.
	N/A	Lots with "B and C Type Drainage" shall be required to install an underground nuisance drainage system or a 2-foot valley gutter through the lot. 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.

CITY OF LAS VEGAS MINIMUM DRAINAGE STUDY CRITERIA CHECKLIST

- An appointment must be made to preview this checklist in conjunction with Clark County Regional Flood Control District Manual Standard Form 2 prior to the City accepting a new Drainage Study for review. The engineer may contact the Flood Control Section at 229-6541.
- Following the acceptance of the Drainage Study (meeting the minimum acceptable information above), there will be a charge of \$250 for each Drainage Study review submittal. These fees are payable at the time the Grading Permit is obtained.
- The Drainage Study must be accepted prior to submitting grading plans to the Land Development Section 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.

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6-Jun-01

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- Hydrologic Methodology Discussion
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1 INTRODUCTION

1.1 Project Overview & Study Purpose

KGA Architecture and Clark County School District (CCSD) is proposing to re-develop an existing school site on approximately ± 5.4 acres. The proposed improvements are identified as *Variety School* (hereafter referred to in this study as the project site). The project site is located within the City of Las Vegas, Nevada at the southeast corner of the Stewart Avenue and 28th Street intersection. Associated with the project site is a new driveway entrance off of 28th Street.

The purpose of this study is to provide a detailed hydrologic and hydraulic analysis for the project site in order to protect the property from onsite and offsite runoff in accordance with local storm water criteria. This study will also provide an inventory of existing storm water facilities in the vicinity as well as provide recommendations for site specific facilities necessary to control runoff impacting the project site.

1.2 Site Description

The project site is bounded by Stewart Avenue and 28th Street to the north and west, respectively. To the east is an existing soccer field and to the south is the existing Roy Martin Middle School. The project site is located within the north half of APN 139-36-303-001. A location map, identified as Exhibit A, has been included in Appendix A for reference.

1.3 FEMA Flood Zone Designation

The project site is located on Flood Insurance Rate Map (FIRM) Panel 32003C2186E, dated September 27, 2002. The site is currently located within a FEMA designated Zone X. A Zone X is described as an area determined to be outside the 0.2% annual chance flood. Exhibit B, identifying the site on the current FIRM Panel, has been included in Appendix A for your reference.

1.4 CCRFCD Facility Information

Per the 2008 CCRFCD MPU (Reference 1), the project site is not adjacent to, nor is it crossed by any existing or future CCRFCD facility. The site has been identified on the current 2008 CCRFCD MPU Figure F-32, identified as Exhibit C, respectively. The exhibit is included in Appendix A for your reference.

1.5 Reference Studies

The following three (3) existing approved drainage studies have been utilized in the preparation of this study. The studies identified below have been reviewed and determined acceptable for reference.

Technical Drainage Study Update for Roy Martin Middle School Replacement (hereafter referred to as the Roy Study) prepared by Nevada by Design, CLV No. 4069 analyzed the

proposed condition drainage pattern and flow rates to the 28th Street and to Stewart Avenue just east of 28th Street. Relevant reference material from the Roy Study has been included in Appendix D. The following were specifically referenced from the Roy Study.

- The basin delineation and flow rates of Basins OFP1, ONP4, ONP5, ONP6, ONP7, ONP8 and ONP9.

Technical Drainage Study for Sunrise Acres Elementary School (hereafter referred to as the Sunrise Study) prepared by Nevada By Design, CLV No. 2800 analyzed the proposed condition drainage pattern and flow rates of the Sunrise Acres Elementary School development. Relevant reference material from the Sunrise Study has been included in Appendix E. The following were specifically referenced from the Sunrise Study.

- The basin delineation and flow rates of Basins ON1, ON2, ON3D, ON4D, ST1E and ST2E.

2005 City of Las Vegas Central Neighborhood Study (hereafter referred to as the Central Study) prepared by PBS&J, analyzed the existing and future condition drainage pattern and flow rate to the intersection of Stewart Avenue and Eastern Avenue. Relevant reference material from the Central Study has been included in Appendix F. The following were specifically referenced from the Central Study.

- The existing condition flow rate drain east on Stewart Avenue at Eastern Avenue.
- The future condition surface flow rate drain east on Stewart Avenue at Eastern Avenue.

2 METHODOLOGY

2.1 Compliance

The methodologies utilized in the preparation of this study are in compliance with the Clark County Regional Flood Control District's Hydrologic and Drainage Design Manual (CCRFCD Manual, Reference 2).

2.2 Hydrologic Modeling

Modeling: The SCS Unit Hydrograph Method (SCS Method) was utilized to determine peak flow rates. The SCS Method utilizes precipitation, drainage area, curve number and lag time parameters to determine peak flow rates. The SCS Method routine within the U.S. Army Corp of Engineers HEC-1 Flood Hydrograph Package program was utilized to model the drainage basins analyzed by this study.

Precipitation: The site is located inside of the McCarran Rainfall Area. The precipitation values utilized in the HEC-1 model are 1.58 and 2.77 inches for the 10-year and 100-year storm events, respectively. Additionally, since the drainage area is less than 8 square miles, the SDN 3 design storm distribution referenced from Table 503 of the CCRFCD Manual was used, and has been included in Appendix B.

Curve Number: The SCS curve number loss rate methodology has been utilized to approximate infiltration for the drainage basins. The soils information for the site has been

obtained from *Soil Survey of Las Vegas Valley Area Nevada*, United States Department of Agriculture, Soil Conservation Service (Soil Survey, Reference 2). Per the Soil Survey, the project site and Offsite Improvements lies within Soil Type 270 and 282. Soil Type 270 has a composite makeup of 100% Hydrologic Soil Group (HSG) B. Soil Type 282 has a composite makeup of 10% HSG B and 90% HSG C.

The project site consists of a school building, parking and landscaping. Therefore, per CCRFCD Manual Table 602A, a curve number associated with “commercial” has been selected for the proposed improvement. For drainage areas that are roadway, a curve number associated with “roadway and streets” has been selected from CCRFCD Manual Table 602A. For basins that consist of commercial development, a “commercial” curve number has been selected from the CCRFCD Manual. Additionally, basins consisting of apartments, an “apartment/condo” curve number has been selected from the CCRFCD Manual. Due to the composite makeup of the soil in which development is proposed on, composite curve numbers have been utilized in this study’s hydrologic analysis. All composite curve number computations, CCRFCD Manual curve number tables and soil data have been included in Appendix B.

Lag Time: The lag time is defined as the time measured from the center of mass of effective rainfall to the time to peak of the outflow hydrograph. The lag time is related to the time of concentration as 0.6 times the time of concentration. The time of concentration is defined as the time required for runoff to flow from the hydraulically most distant point of a basin to the outlet point of the basin. Standard Form 4, as outlined in the CCRFCD Manual, was utilized to determine the lag times for basins modeled. A copy of the lag time computations is included in Appendix B.

2.3 Hydraulic Modeling

Street Flow: Street flow is analyzed utilizing the Flowmaster Version 7.0 software by Haestad Methods. In accordance with the CCRFCD Manual, the velocity times depth factor ($v \times d$) for street flow for the 10-year storm event must be less than or equal to 6 with a maximum depth of 1 foot. The velocity times depth factor ($v \times d$) for street flow for the 100-year storm event must be less than or equal to 8 with a maximum depth of 2 feet. Additionally, street capacity calculations are performed for the flattest and steepest slopes. Erosion protection landscaping or a pony wall at the back of sidewalk is required should the 100-year street flow depth exceed 0.5-ft in depth and consist of a velocity greater than 5 fps. For 80-ft and greater right-of-ways, a 12-ft dry lane (not utilizing the center turning lane) must be provided in the 10-year storm event.

3 EXISTING DRAINAGE CONDITION

3.1 Discussion of Existing Drainage Condition

In the existing condition, the project site is developed. Offsite basins are described as they currently exist. Stewart Avenue and 28th Street are fully improved with curb gutter and sidewalk and not a part of the project site.

3.2 Discussion of Existing Condition Drainage Patterns

Refer to Exhibit E, included in Appendix A, for a detailed illustration of the existing condition drainage patterns for the project site. Six (6) basins are referenced from the Sunrise Study and seven (7) basins are referenced from the Roy Study. Additionally, three (3) basins are delineated for the existing condition: OFF1 thru OFF3.

The following basins drain onto 28th Street to be combined at Concentration Point CP1: OFP1***, OFF1, ONP4***, ON3D**, ONP5***, ONP6***, ST2E**, ON4D** and ONP9***. Per the Central Neighborhood Study, in the existing condition there is 149 cfs and 371 cfs (during the 10-year and 100-year storm event respectively) which drains east in Stewart Avenue at Eastern Avenue. This flow is identified as Concentration Point CNSE. Concentration points CP1 and CNSE combines with Basins ON1**, ON2**, ST1E** and OFF2 at Concentration Point CP2. Concentration Point CP2 quantifies the flows in Stewart Avenue at 28th Street. Flows from Concentration Points CP1 and CP2 then combines with Basins ONP7***, ONP8*** and OFF3 at Concentration Point CP3. Concentration Point CP3 quantifies the flows in Stewart Avenue at the eastern limit of the project site.

3.3 Summary of Existing Condition Flows

Existing condition flow rates, as determined by referenced material and a HEC-1 analysis, have been summarized below in Table 1. Refer to Appendix B for the HEC-1 Analysis.

Table 1: Summary of Existing Condition Flow Rates		
Basin / Concentration Point	Q ₁₀₀ (cfs)	Q ₁₀ (cfs)
ON1**	15.0	8.0
ON2**	6.0	2.0
ON3D**	16.0	9.0
ON4D**	24.0	13.0
ST1E**	10.0	5.0
ST2E**	4.0	2.0
OFP1***	14.0	7.1
OFP4***	1.6	0.9
OFP5***	4.4	2.4
OFP6***	5.4	2.9
ONP7***	3.5	1.0
ONP8***	10.9	5.5
ONP9***	6.2	3.3
OFF1	1.0	1.0
OFF2	16.0	7.0
OFF3	4.0	2.0
CNSE*		
Q = Ref. from Central Neighborhood Study	371.0	149.0
CP1 Q = OFP1*** + OFF1 + ONP4*** + ONP5*** + ON3D** + ONP6*** + ST2E** + ONP9*** + ON4D**	76.6	41.6
CP2 Q = CNSE* + ON1** + ON2** + ST1E** + OFF2 + CP1	418.0	171.0
CP3 Q = CP1 + CP2 + ONP7*** + ONP8*** + OFF3	513.0	221.1

*Referenced from the Central Study, Existing Condition
 **Referenced from the Sunrise Study, Proposed Condition
 ***Referenced from the Roy Study, Proposed Condition

Table 2 below summarizes the flow rates generated in the existing condition in Stewart Avenue at the eastern limit of the project site as well as in 28th Street south of Stewart Avenue in comparison to the flow rates established in the Roy Study. Relevant reference material from the Roy Study has been included in Appendix D.

Table 5: Existing Condition Comparison – This Study vs. Roy Study				
Location	This Study		Roy Study	
	Concentration Point ID	Q _{100/10} (cfs)	Concentration Point ID	Q _{100/10} (cfs)
28 th Street south of Stewart Avenue	CP1	76.6/41.6	TS	66.6/35.5
Stewart at the eastern limit of the project site	CP3	513.0/221.1	ST	476/203

Upon inspection of Table 2, there is an increase in flow in comparison to the Roy Study. The reasons for the increase in flow are as follows:

- Concentration Point TS failed to include the flows from basin OFP1 and account for the area in 28th Street which contributes runoff to Concentration Point TS (this area is identified as Basin OFF1 in this study).
- Concentration Point ST failed to account for the commercial and apartments located north of Stewart between Eastern and 28th Street contributing runoff to Stewart Avenue (this area is identified as Basin OFF2 in this study). Additionally, no basin was delineated for Stewart Avenue between 28th Street and the eastern limit of the project site (this area is identified as Basin OFF3 in this Study). Note that the miscalculation at Concentration Point TS also impacts the flow rate at Concentration Point ST.

4 PROPOSED DRAINAGE CONDITION

4.1 Definition of Proposed Condition

The proposed condition considers the project site re-developed. The project site and offsite basin remains as described in the existing condition.

4.2 Discussion of Proposed Condition Drainage Patterns

Refer to Exhibit F, included in Appendix A, for a detailed illustration of the proposed condition drainage patterns for the project site. The drainage pattern and flow rate to Concentration Point CP2 remains as described in the existing condition.

The following basins drain onto 28th Street to be combined at Concentration Point CP1: OFP1***, OFF1, ONP4***, ON3D**, ONP5***, ONP6***, ST2E**, ON4D** and ON1. Flows from Concentration Points CP1 and CP2 then combines with Basins ONP7***, ON2 and OFF3 at Concentration Point CP3. Note that flows from Basin ONP7*** enters the project site via a concrete flume.

4.3 Summary of Proposed Condition Flows

Proposed condition flow rates, as determined by reference material and a HEC-1 analysis, have been summarized below in Table 3. Refer to Appendix B for the HEC-1 analysis.

Table 3: Summary of Proposed Condition Flow Rates		
Basin / Concentration Point	Q ₁₀₀ (cfs)	Q ₁₀ (cfs)
ON1**	15.0	8.0
ON2**	6.0	2.0
ON3D**	16.0	9.0
ON4D**	24.0	13.0
ST1E**	10.0	5.0
ST2E**	4.0	2.0
OFP1***	14.0	7.1
OFP4***	1.6	0.9
OFP5***	4.4	2.4
OFP6***	5.4	2.9
ONP7***	3.5	1.0
ON1	1.0	0.0
ON2	13.0	7.0
OFF1	1.0	1.0
OFF2	16.0	7.0
OFF3	4.0	2.0
CNSE*	371.0	149.0
Q = Ref. from Central Neighborhood Study		
CP1 Q = OFP1*** + OFF1 + ONP4*** + ONP5*** + ON3D** + ONP6*** + ST2E** + ON1 + ON4D**	70.4	39.3
CP2 Q = CNSE* + ON1** + ON2** + ST1E** + OFF2 + CP1	418.0	171.0
CP3 Q = CP1 + CP2 + ONP7*** + ON2 + OFF3	509.9	219.3

*Referenced from the Central Study, Existing Condition

**Referenced from the Sunrise Study, Proposed Condition

***Referenced from the Roy Study, Proposed Condition

Table 4 below summarizes difference in flow rates between the existing and proposed condition provided in this study.

Table 4: Flow Rate Comparison – Existing Condition vs. Proposed Condition				
Location	Existing Condition		Proposed Condition	
	Q ₁₀₀ (cfs)	Q ₁₀ (cfs)	Q ₁₀₀ (cfs)	Q ₁₀ (cfs)
Project Site	17.1 ¹	8.8 ¹	14.0 ²	7.0 ²
CP1	76.6	41.6	70.4	39.3
CP2	418.0	171.0	418.0	171.0
CP3	513.0	221.1	509.9	219.3

¹ Existing Condition flow rate is based on the sum of Basins ONP8*** and ONP9***

² Proposed Condition flow rate is based on the sum of Basins ON1 and ON2

In reviewing Table 4, there is a decrease in runoff from the project site in the proposed condition. Note that the area and land use has not changed from the existing condition. The reason for the decrease in runoff is due to the hydrologic methodology used to quantify the basins. The existing condition which references the flows from the Roy Study utilized the CCRFCD's DDMS versus this study utilizing the HEC-1 program. Both methodologies are considered acceptable. The decrease in project site runoff and the change in the drainage pattern of the project site resulted in the lower flow rates found in the proposed condition for Concentration Point CP1 and CP3.

The following Table 5 prorates the flows of Basin ON2. The proration of flow is used to quantify the flow in the interior drive isle of the project site and used to ensure the proposed FFE is properly elevated from the flow depth in the drive isle.

Table 5: Prorate Subbasin Flow Summary			
Basin ID	Area (ac)	Q ₁₀₀ (cfs)	Ratio ₁₀₀
ON2	5.12	13	2.5
Subbasin ID	Area (ac)	Ratio ₁₀₀	Q ₁₀₀ (cfs)
ON2A	3.93	2.5	10.0
ON2B	1.19	2.5	3.0

4.4 Summary of Proposed Condition Street Flows

A summary of the street flow hydraulic characteristics is provided in Table 6 and 7 below, and the computations have been included in Appendix C. Refer to Exhibit F provided in Appendix A for cross section locations.

Table 6: Summary of Proposed Condition 10-Year Street Flow Hydraulics						
Street Section ID	Q ₁₀₀ (cfs)	Slope (%)	Velocity, V (ft/s)	Depth, D (ft)	VxD	Dry Lane (ft)
28TH Q = CP1	39.3	0.67	2.91	0.64	1.86	n/a
STW Q = CP3	219.3	0.50	4.54	1.07	4.86	0.0

Table 7: Summary of Proposed Condition 100-Year Street Flow Hydraulics					
Street Section ID	Q ₁₀₀ (cfs)	Slope (%)	Velocity, V (ft/s)	Depth, D (ft)	DxV
28TH Q = CP1	70.4	0.67	3.67	0.73	2.68
STW Q = CP3	509.9	0.50	6.30	1.44	9.07
ISL Q = ON2A + ONP7***	13.5	0.50	2.30	0.78	n/a

Table 7: Summary of Proposed Condition 100-Year Street Flow Hydraulics					
Street Section ID	Q ₁₀₀ (cfs)	Slope (%)	Velocity, V (ft/s)	Depth, D (ft)	DxV
FLM Q = ONP7***	3.5	0.40	3.20	0.37	n/a

The flows in 28th Street has been found to meet CCRFCD criteria as set forth in Section 2.3 of the report. In reviewing Table 6 and 7, Stewart Avenue does not meet the CCRFCD criteria as set forth in Section 2.3 of the report. However, the conditions of the Stewart Avenue are not worsened by the redevelopment of the project site. Therefore, the condition of Stewart Avenue is considered acceptable. Note that per the Central Neighborhood Study, a future storm drain facility is planned in Stewart Avenue from Bruce Street to Mohave Road. Cross Section ISL is to ensure the proposed FFE is elevated above the WSE of the internal drive isle. Refer to Section 4.5 for finished floor elevation discussion. Cross Section FLM is to ensure that the proposed flume conveying the flows from Basin ONP7*** has capacity. The results from Table 7 show that the flume does have capacity.

Additionally, the 100-year flow depth for Stewart Avenue exceeds the back of curb and is greater than 5 fps. D₅₀ of 6-inches is proposed in the landscaping along Stewart Avenue up to the depth of flow as erosion protection. The riprap sizing calculation is provided in Appendix C.

4.5 Summary of Finished Floor

Utilizing the street flow characteristics summarized in Table 6, the proposed finished floor elevation has been protected a vertical distance above the gutter flow line of twice the depth of flow in the adjacent streets and the interior drive isle on the high side of the building. The finished floor analysis showing that the proposed finished floor meet criteria and has been provided in Appendix C.

Please note that the finished floor elevation does not satisfy the CLV criteria of being 6-inches above the adjacent high TC. The finished floor elevation is only 0.19-ft above the adjacent high TC of 1833.01-ft. It is believed that this will be acceptable to the CLV since the high TC is located at a high point in the drive isle that has no flow and the finished floor elevation is protected from the flows in the adjacent roadways and the eastern drive isle.

5 ULTIMATE DRAINAGE CONDITION

5.1 Definition of Ultimate Condition

The ultimate condition assumes that the project site is re-developed. Offsite basins are also fully developed and storm drain facilities identified in the Central Neighborhood Study is constructed.

5.2 Discussion of Ultimate Condition Drainage Patterns

Refer to Exhibit F, included in Appendix A, for a detailed illustration of the ultimate condition drainage patterns for the project site. The drainage pattern described in the proposed condition remains the same. However, per the Central Neighborhood Study, in the future condition the flow draining east on Stewart at Eastern Avenue is reduced to 0 cfs and 237 cfs (during the 10-year and 100-year storm event respectively) due to future planned storm drain improvements. This flow is identified as Concentration Point CNSF.

5.3 Summary of Ultimate Condition Flows

Ultimate condition flow rates, as determined by the reference material and a HEC-1 analysis, have been summarized below in Table 8. Refer to Appendix B for the HEC-1 analysis.

Table 8: Summary of Ultimate Condition Flow Rates		
Basin / Concentration Point	Q ₁₀₀ (cfs)	Q ₁₀ (cfs)
ON1**	15.0	8.0
ON2**	6.0	2.0
ON3D**	16.0	9.0
ON4D**	24.0	13.0
ST1E**	10.0	5.0
ST2E**	4.0	2.0
OFP1***	14.0	7.1
OFP4***	1.6	0.9
OFP5***	4.4	2.4
OFP6***	5.4	2.9
ONP7***	3.5	1.0
ON1	1.0	0.0
ON2	13.0	7.0
OFF1	1.0	1.0
OFF2	16.0	7.0
OFF3	4.0	2.0
CNSE*	237.0	0.0
Q = Ref. from Central Neighborhood Study		
CP1 Q = OFP1*** + OFF1 + ONP4*** + ONP5*** + ON3D** + ONP6*** + ST2E** + ON1 + ON4D**	71.4	38.3
CP2 Q = CNSF* + ON1** + ON2** + ST1E** + OFF2 + CP1	284.0	22.0
CP3 Q = CP1 + CP2 + ONP7*** + ON2 + OFF3	375.9	70.3

*Referenced from the Central Neighborhood Study, Existing Condition

**Referenced from the Sunrise Study

***Referenced from the Roy Study

5.4 Summary of Ultimate Condition Street Flows

Street flow hydraulic computations have been analyzed utilizing the larger proposed condition flow rates. In the proposed condition, flow is on the surface, whereas in the ultimate condition, a portion of the runoff is collected and conveyed in storm drain facilities.

Therefore, refer to Section 4.4 of this report for a detailed discussion of street flow hydraulic characteristics.

6 CONCLUSIONS & RECOMMENDATIONS

1. The project site is not located within a FEMA designated SFHA. Therefore, FEMA acceptance and CCRFCD concurrence is not required.
2. The project site is not adjacent to an existing or future planned CCRFCD regional facility, per the 2008 MPU. Therefore, CCRFCD concurrence is not required.
3. Stewart Avenue does not meet street flow criteria in the existing and will not meet street flow criteria with the redevelopment of the project site. However, the conditions are not worsened by the redevelopment of the project site.
4. Riprap is proposed along Stewart Avenue in the landscaping to serve as erosion protection against velocities exceeding 5 fps and flow depths of 1.44-ft. Note that riprap is place 6-inches above the street flow depth.
5. The site entrance off of 28th Street is humped a minimum of 6-inch above the street flow depth to prevent flows from entering the project site.
6. The proposed building is elevated a vertical distance above the gutter flow line of twice the depth of flow in the street on the high side of the lot up to 18-inches.
7. The proposed building is only 0.19-ft above the adjacent high TC. This is considered acceptable since the high TC is at the high point of the drive isle where there is no flow.
8. The grading plan, profile and detail sheets included in Appendix H of this study support the drainage patterns, conclusions and/or recommendations detailed in this study.

7 REFERENCES

1. *CCRFCD 2008 Las Vegas Valley Flood Control Master Plan Update*. PBS&J 2008.
2. *Hydrologic Criteria and Drainage Design Manual*. Clark County Regional Flood Control District, 1990.
3. *Soil Survey of Las Vegas Valley Area Nevada*, United States Department of Agriculture, Soil Conservation Service.
4. *Technical Drainage Study Update for Roy Martin Middle School Replacement*. Nevada By Design, March 2008.
5. *Technical Drainage Study for Sunrise Acres Elementary School*. Nevada By Design, November 2000.
6. *2005 City of Las Vegas Central Neighborhood Study*. PBS&J 2005

APPENDIX A

Drainage Exhibits

j:\csd1103-001 variety school\drainage\technical study\figures\csd1103-001 exhibit a vicinity map.dwg 8/1/2011 9:21 AM Kellin Collins



SLATER
HANIFAN
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KGA ARCHITECTURE
VARIETY SCHOOL
LOCATION MAP

DATE: AUG 2011
DRAFTER: KC
DESIGNER: KC
CHECKED: SJ

PROJECT NO.
CSD1103-001
EXHIBIT A
SHEET 1 OF 1

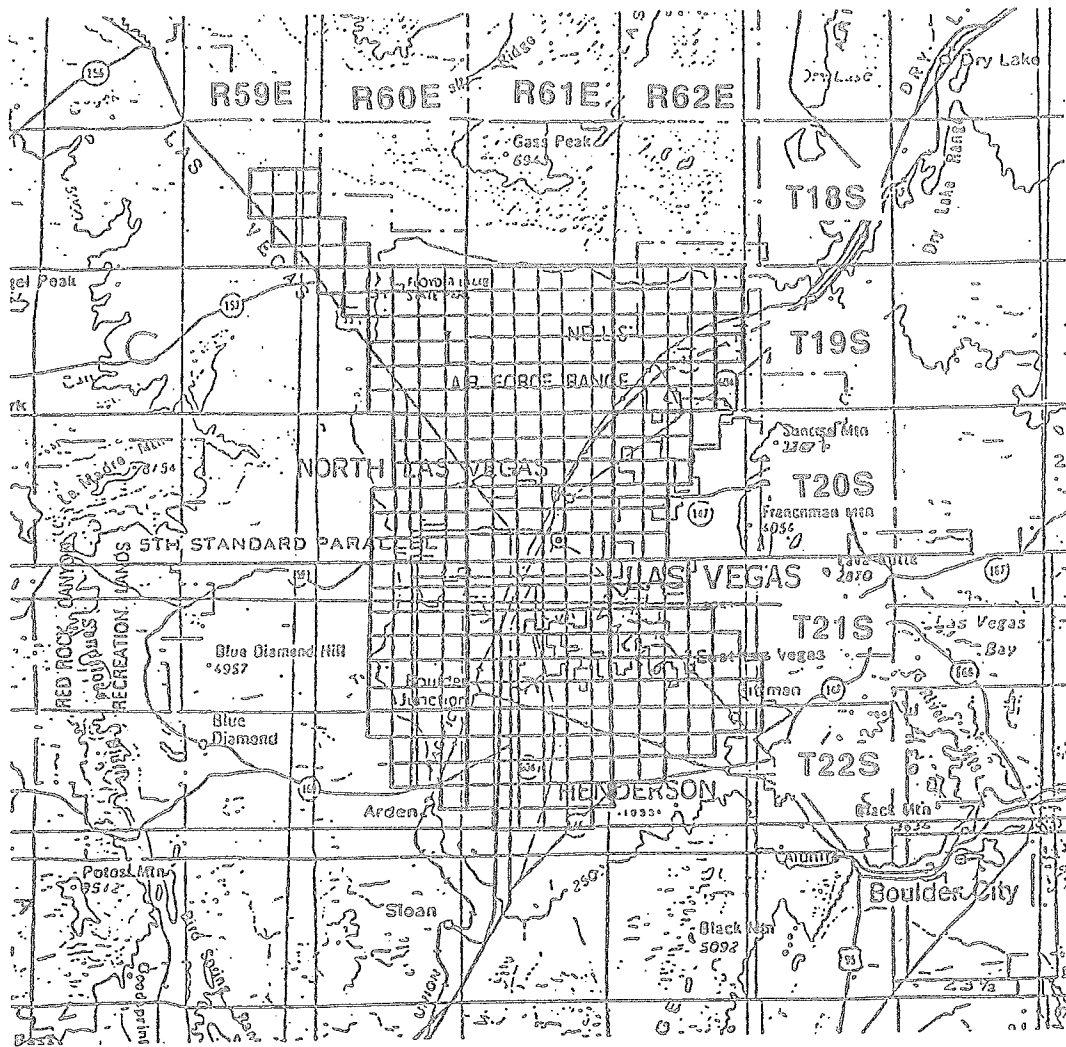
APPENDIX B

Hydrology Analyses

Precipitation, Curve Number & Lag Time Data

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

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:

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

Revision	Date

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DEPTH-DURATION-FREQUENCY VALUES FOR McCARRAN AIRPORT RAINFALL AREA (IN INCHES)

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

- NOTE: 1. Refer to Figure 513 for a description and drawing of the area included in the McCarran Airport Rainfall Area.
2. The 24 hour values presented above are for use with TR-55 only.
3. Table 501 adjustments not required.

Revision	Date

WRC
ENGINEERING

REFERENCE:

USACE, Los Angeles District, 1988

TABLE 505

Soil & Curve Number Computation

Project Name: Variety School

Date: August 2011

File Name: CSD1103-001 Composite_CN_Calculation.xlsx

By: K.C.

Data:

Reference:

Soil Type & Description	A	B	C	D
270 Land silt loam, drained	0%	100%	0%	0%
282 Land silty clay loam	0%	10%	90%	0%

Exhibits E, F & G
SCS Soil Data

Land Use	A	B	C	D
Apartments & Condos	81	88	91	93
Commercial	89	92	94	95
Roadway	98	98	98	98

BASIN ID	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP				LAND USE CN				SUBAREA ACRES	CALCULATED CN
				A	B	C	D	A	B	C	D		
OFF1	270	100.0%	Roadway	0%	100%	0%	0%	98	98	98	98	0.46	98.0
TOTAL PERCENT		100.0%	TOTAL AREA									0.46	98.0

BASIN ID	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP				LAND USE CN				SUBAREA ACRES	CALCULATED CN
				A	B	C	D	A	B	C	D		
OFF2	270	90.2%	Apartments & Condos	0%	100%	0%	0%	81	88	91	93	6.82	79.4
	270	9.8%	Commercial	0%	100%	0%	0%	89	92	94	95	0.74	9.0
TOTAL PERCENT		100.0%	TOTAL AREA									7.56	88.4

BASIN ID	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP				LAND USE CN				SUBAREA ACRES	CALCULATED CN
				A	B	C	D	A	B	C	D		
OFF3	270	88.0%	Roadway	0%	100%	0%	0%	98	98	98	98	1.32	86.2
	282	12.0%	Roadway	0%	10%	90%	0%	98	98	98	98	0.18	11.8
TOTAL PERCENT		100.0%	TOTAL AREA									1.50	98.0

BASIN ID	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP				LAND USE CN				SUBAREA ACRES	CALCULATED CN
				A	B	C	D	A	B	C	D		
ON1	270	85.2%	Commercial	0%	100%	0%	0%	89	92	94	95	0.23	78.4
	282	14.8%	Commercial	0%	10%	90%	0%	89	92	94	95	0.04	13.9
TOTAL PERCENT		100.0%	TOTAL AREA									0.27	92.3

BASIN ID	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP				LAND USE CN				SUBAREA ACRES	CALCULATED CN
				A	B	C	D	A	B	C	D		
ON2	270	23.0%	Commercial	0%	100%	0%	0%	89	92	94	95	1.18	21.2
	282	77.0%	Commercial	0%	10%	90%	0%	89	92	94	95	3.94	72.2
TOTAL PERCENT		100.0%	TOTAL AREA									5.12	93.4

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

RUNOFF CURVE NUMBERS - RESIDENTIAL DISTRICTS

Average Lot Size or Usage ¹	Percent Impervious ²	Curve Number for Hydrologic Soil Groups			
		A	B	C	D
X Apartments/Condos	72	81	88	91	93
Townhouses/6,000 sq ft lots or less	69	80	87	90	92
7,000 sq ft lots	63	76	84	89	91
8,000 sq ft lots	58	73	82	88	90
10,000 sq ft lots	38	61	75	83	87
14,000 sq ft lots	30	57	72	81	86
20,000 sq ft lots	25	54	70	80	85
40,000 sq ft lots	20	51	68	79	84
80,000 sq ft lots	12	46	65	77	82

1 Lot size should represent the size of the average lot and not the gross acreage divided by the number of lots.

2 Actual percent impervious value should be compared to selected land use type.

3 In cases where average residential lots are smaller than 6,000 sq ft, commercial/business/industrial land use should be used.

Revision	Date

REFERENCE:

TABLE 602A

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

RUNOFF CURVE NUMBERS (URBAN AREAS¹)

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

See Table 602A

Developing urban areas

Newly graded areas (pervious areas only, no vegetation) ⁵	77	86	91	94
--	----	----	----	----

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

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

fine sand, and the lower part to a depth of 60 inches or more is pink, stratified extremely gravelly fine sand to very gravelly loamy fine sand.

Permeability of this Jean soil is rapid. Available water capacity is very low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high if the surface is disturbed. This soil is subject to occasional periods of very brief, high-velocity flooding from June through September.

This unit is used mainly as habitat for desert wildlife and for recreation. It is also used for urban development.

The main limitation for construction of dwellings is the hazard of flooding. Flooding can be controlled only by use of major flood control structures. Excavating in areas of the Jean soils can expose material that is highly susceptible to soil blowing.

The main limitations for septic tank absorption fields are inadequate filtration of effluent and the hazard of flooding in areas of the Jean, flooded, soil. Because the substratum is highly permeable, special design may be needed to avoid polluting ground water and nearby water supplies. If the density of housing is moderate to high, community sewage systems are needed to prevent contamination of water supplies as a result of seepage from onsite sewage disposal systems. Dikes and channels that have outlets for floodwater can be used to protect onsite sewage disposal systems from flooding.

The Jean, flooded, soil is limited for roads because of the hazard of flooding. Flooding can be controlled only by use of major flood control structures.

The main limitations for lawns and landscaping are the very low available water capacity and the desert pavement on the Jean, flooded, soil. Frequent irrigation of lawns, gardens, and most other plantings is needed because of the limited available water capacity of the soil. Removing the desert pavement is necessary for best results when landscaping, particularly in areas used for lawns.

This map unit is in capability subclasses IVw, irrigated, and VIIw, nonirrigated. It is in horticultural group 3.

264—Jean very gravelly loamy fine sand, 2 to 4 percent slopes. This very deep, excessively drained soil is on inset fans. It formed in alluvium derived from various kinds of rock.

Typically, about 60 percent of the surface is covered with a desert pavement of pebbles. The surface layer is pink very gravelly loamy fine sand about 1 inch thick. The upper 17 inches of the underlying material is light reddish brown loamy fine sand, and the lower part to a depth of 60 inches or more is pink, stratified extremely gravelly sand to very gravelly loamy fine sand.

Permeability of this Jean soil is rapid. Available water capacity is very low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high if the surface

is disturbed. This soil is subject to rare periods of flooding during prolonged, high-intensity storms. Channeling and deposition are common along streambanks.

This unit is used mainly as habitat for desert wildlife and for recreation. It is also used for urban development.

The main limitation for construction of dwellings is the hazard of flooding. Dikes and channels that have outlets for floodwater can be used to protect buildings from flooding. Excavating in areas of the Jean soil can expose material that is highly susceptible to soil blowing.

The main limitation for septic tank absorption fields is inadequate filtration of effluent. Because the substratum is highly permeable, special design may be needed to avoid polluting ground water and nearby water supplies. If the density of housing is moderate to high, community sewage systems are needed to prevent contamination of water supplies as a result of seepage from onsite sewage disposal systems.

Channeling and deposition can be minimized and maintenance costs reduced by protecting roads from flooding. Unless an adequate wearing surface is maintained, stones and cobbles in the soil create road hazards and increase maintenance costs.

The main limitations for lawns and landscaping are the desert pavement and the very low available water capacity. Removing the desert pavement is necessary for best results when landscaping, particularly in areas used for lawns. Frequent irrigation of lawns, gardens, and most other plantings is needed because of the limited available water capacity of the soil.

This map unit is in capability subclasses IVs, irrigated, and VIIs, nonirrigated. It is in horticultural group 3.

***270—Land silt loam, drained.** This very deep, somewhat poorly drained soil is on recent alluvial flats. The drainage has been artificially altered. The soil formed in alluvium derived from various kinds of rock. Slope is 0 to 2 percent.

Typically, the surface layer is pink silt loam that is high in soluble salts and is about 6 inches thick. The underlying material to a depth of 60 inches or more is pink, stratified silty clay to silt loam and is high in soluble salts.

Included in this unit are about 5 percent Glencarb soils on recent alluvial flats and 5 percent McCarran soils on relict alluvial flats. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Land soil is moderately slow. Available water capacity is high. Effective rooting depth is limited by a seasonal high water table that is at a depth of 3.5 to 6.0 feet from March through September. Runoff is very slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is subject to rare periods of flooding during prolonged, high-intensity storms. Channeling and deposition are

common along streambanks. This soil is strongly affected by salts.

This unit is used mainly as habitat for desert wildlife and for recreation. It is also used for urban development and irrigated hay.

Some areas of this unit may be subject to salt heaving because of the expansion of sodium sulfate salts. This action may cause concrete slab floors, driveways, and sidewalks to crack. Removal of the sodium sulfate salts by mechanical means, deep leaching, or chemical treatment can alleviate this problem.

The main limitation for construction of dwellings is the hazard of flooding. Dikes and channels that have outlets for floodwater can be used to protect buildings from flooding. Sodium sulfate in the soil can induce electrochemical action that corrodes concrete. This limitation can be overcome by using cement that is resistant to sulfate corrosion.

The main limitation for septic tank absorption fields is the restricted permeability of the soil. Using long absorption lines and backfilling the trench with sandy material help to compensate for the restricted permeability.

This unit is limited for roads because of the limited ability of the soil to support a load and the presence of sodium sulfate salts. Roads and streets should be designed to compensate for the instability of the soil. Local roads and streets may require a special base to avoid damage from the expansion of sodium sulfate salts.

The main limitation for lawns and landscaping is excessive salts in the soil. Because of the content of sodium sulfate and other salts in the soil, salt-tolerant plants should be selected.

If this unit is used for irrigated hay, pasture, or other crops, the main limitations are excessive salts in the soil and low soil fertility. Intensive management is required to reduce the salinity and maintain soil productivity. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Content of toxic salts is reduced by leaching and returning crop residue to the soil. Tile drainage can be used to maintain or lower the level of the water table if a suitable outlet is available. Crops respond to nitrogen and phosphorus. The average yield is 5 tons per acre for alfalfa hay grown under a high level of management.

This map unit is in capability subclasses Vlw, irrigated, and VIIw, nonirrigated. It is in horticultural group 5.

278—Land very fine sandy loam, wet. This very deep, somewhat poorly drained soil is on recent alluvial flats. The drainage has been altered by seepage in the area. The soil formed in mixed alluvium derived dominantly from limestone, gypsum, quartzite, and sandstone and undifferentiated volcanic and sedimentary rock. Slope is 0 to 2 percent.

Typically, the surface layer is light yellowish brown very fine sandy loam about 2 inches thick. The upper 8 inches of the underlying material is pinkish gray gravelly sandy loam, and the lower part to a depth of 60 inches or more is light brown or brown silt loam and silty clay loam and is high in soluble salts.

Included in this unit is about 5 percent Glencarb soils on the recent alluvial flats.

Permeability of this Land soil is moderately slow. Available water capacity is high. Effective rooting depth is limited by a seasonal high water table that is at a depth of 1.5 to 3 feet from January through December. Runoff is very slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is subject to rare periods of flooding during prolonged, high-intensity storms. Channeling and deposition are common along streambanks. This soil is moderately affected by salts to a depth of 2 inches, and it is strongly affected by salts below this depth.

This unit is used as habitat for desert wildlife and for recreation.

This unit is limited for roads because of the limited ability of the soil to support a load and because of the content of sodium sulfate salts. Roads and streets should be designed to compensate for the instability of the soil. Local roads and streets may require a special base to avoid damage from the expansion of sodium sulfate salts. Sodium sulfate in the soil can induce electrochemical action that corrodes concrete. This limitation can be overcome by using cement that is resistant to sulfate corrosion.

This map unit is in capability subclasses Vlw, irrigated, and VIIw, nonirrigated. It is in horticultural group 5.

*** 282—Land silty clay loam.** This very deep, somewhat poorly drained soil is on recent alluvial flats. It formed in alluvium derived from various kinds of rock. Slope is 0 to 2 percent.

Typically, the surface layer is very pale brown silty clay loam about 2 inches thick. The upper 5 inches of the underlying material is pale brown silt loam, the next 3 inches is pale brown loam, and the lower part to a depth of 64 inches is pale brown to light yellowish brown silty clay loam that is high in soluble salts. In some areas of similar included soils, the surface layer is silt loam.

Included in this unit are about 5 percent Glencarb soils, slightly wet, saline, 5 percent McCarran soils, and 5 percent Spring soils on alluvial flats. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Land soil is moderately slow. Available water capacity is high. Effective rooting depth is limited by a seasonal high water table that is at a depth of 3 to 5 feet from January through December. Runoff is very slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is subject to rare periods of flooding during prolonged,

high-intensity storms. Channeling and deposition are common along streambanks. This soil is strongly affected by salts.

This unit is used mainly as habitat for desert wildlife and for recreation. It is also used for urban development.

The main limitation for construction of dwellings is the hazard of flooding. Dikes and channels that have outlets for floodwater can be used to protect buildings from flooding. Some areas of this unit may be subject to salt heaving because of the expansion of sodium sulfate salts. This action may cause concrete slab floors, driveways, and sidewalks to crack. Removal of the sodium sulfate salts by mechanical means, deep leaching, or chemical treatment can alleviate this problem. Sodium sulfate in the soil can induce electrochemical action that corrodes concrete. This limitation can be overcome by using cement that is resistant to sulfate corrosion.

The main limitation for septic tank absorption fields is restricted permeability of the soil. Using long absorption lines and backfilling the trench with sandy material help to compensate for the restricted permeability.

This unit is limited for roads because of limited ability of the soil to support a load and because of the presence of sodium sulfate salts. Roads and streets should be designed to compensate for the instability of the soil. Local roads and streets may require a special base to avoid damage from the expansion of sodium sulfate salts.

The main limitations for lawns and landscaping are excessive soluble salts in the soil. Because of the content of sodium sulfate and other salts in the soil, salt-tolerant plants should be selected. Content of toxic salts can be reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil.

This map unit is in capability subclasses VIw, irrigated, and VIIw, nonirrigated. It is in horticultural group 5.

300—Las Vegas gravelly fine sandy loam, 0 to 2 percent slopes. This shallow, well drained soil is on basin floor remnants. It formed in alluvium derived dominantly from limestone and dolomite.

Typically, about 25 percent of the surface is covered with a desert pavement of hardpan fragments and pebbles. The surface layer is very pale brown gravelly fine sandy loam about 1 inch thick. The upper 6 inches of the underlying material is very pale brown fine sandy loam, and the next 4 inches is very pale brown gravelly sandy clay loam. A white, indurated, lime-cemented hardpan is at a depth of about 11 inches. Depth to the hardpan ranges from 3 to 14 inches.

Included in this unit are about 5 percent Destazo soils, 0 to 4 percent slopes, and 5 percent Grapevine soils, 0 to 4 percent slopes, on erosional fan remnants. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Las Vegas soil is moderately slow above the hardpan. Available water capacity is very low. Effective rooting depth is 3 to 14 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is subject to rare periods of flooding during prolonged, high-intensity storms. Channeling and deposition are common along streambanks.

This unit is used mainly as habitat for desert wildlife and for recreation. It is also used for urban development.

The main limitations for construction of dwellings are the hazard of flooding and the limited depth to the hardpan. Dikes and channels that have outlets for floodwater can be used to protect buildings from flooding. Excavation for building sites is limited by the hardpan. Heavy equipment is needed for excavation.

The main limitation for septic tank absorption fields is the limited depth to the hardpan. Special design of septic tank absorption fields is needed. Excavation is limited by the hardpan. Heavy equipment is needed for excavation.

This unit is limited for roads because of the limited depth to the hardpan. Roads should be designed to minimize cuts. Heavy equipment is needed for excavation.

The main limitation for lawns and landscaping is the limited depth to the hardpan. It is difficult to establish plants in areas where the pan is exposed. Mulching and fertilizing cut areas help to establish plants. Lawn grasses, shrubs, and trees that are not sensitive to lime-induced chlorosis are well suited to use in landscaping. Annual applications of iron chelates reduce the effects of chlorosis.

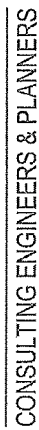
This map unit is in capability subclass VII_s, nonirrigated, and in horticultural group 6.

301—Las Vegas gravelly fine sandy loam, 2 to 4 percent slopes. This shallow, well drained soil is on deeply dissected basin floor remnants. It formed in alluvium derived dominantly from limestone and dolomite.

Typically, about 30 percent of the surface is covered with a desert pavement of hardpan fragments and pebbles. The surface layer is very pale brown gravelly fine sandy loam about 1 inch thick. The upper 6 inches of the underlying material is very pale brown fine sandy loam, and the next 4 inches is very pale brown gravelly sandy clay loam. A white, indurated, lime-cemented hardpan is at a depth of about 11 inches. Depth to the hardpan ranges from 3 to 14 inches.

Included in this unit is about 5 percent Destazo soils, 8 to 15 percent slopes, on side slopes of erosional fan remnants.

Permeability of the Las Vegas soil is moderately slow above the hardpan. Available water capacity is very low. Effective rooting depth is 3 to 14 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is subject to rare periods of



Project Name: Variety School

Description: Existing and Ultimate Condition

File Name: CSD1103-001 Standard Form 4

By: K. C.

Date: Augst 2011

[1]	K = 0.0132 (CN) - 0.39	[5]	For Existing Conditions: V2 = 29.4 * (S/100)^0.5	[9]	Tc = (L/180) + 10
[2]	A = Area/640		For Developed Conditions: V2 = 30.6 * (S/100)^0.5	[10]	Flag = (0.6*Tc)/60
[3]	Ti = (1.8 (1.1-K) L^0.5)/S^0.33	[6]	Tt = L/(60^0.5V)	[11]	Min Flag = 0.05
[4]	For Existing Conditions: V1 = 14.8 * (S/100)^0.5	[7]	Tc = Ti + Tt	Note: For Travel Time Calcs: V1 applies to first 500 feet and V2 applies to remaining distance.	

REFERENCE:

STANDARD FORM 4

HEC-1 Model

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*****
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JUN 1998
* VERSION 4.1
* RUN DATE 01AUG11 TIME 09:04:43
*****

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CDS1103.OUT

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

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

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -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 *DIAGRAM
2 ID VARIETY SCHOOL
3 ID TECHNICAL DRAINAGE STUDY
4 ID EXISTING & ULTIMATE CONDITION
5 ID RETURN PERIOD ----- 10- AND 100-YEAR
6 ID DISTRIBUTION ----- 6-HOUR SDN3
7 ID PROJECT NO. ----- CSD1103.001
8 ID FILENAME ----- CSD1103.H1
9 ID DATE ----- AUGUST 2011
10 ID MODELED BY ----- SLATER HANIFAN GROUP
11 ID
12 ID SIX HOUR DEPTH-AREA REDUCTION FACTORS
13 ID DRAINAGE AREA (MI^2) DARF
14 ID 100-YR 0.990
15 ID 10-YR 0.570
16 ID
17 IT 5 0 0 300
18 IO 5 0 0
19 IN 5 0 0
20 JR PREC 0.990 0.570
*
21 KK OFF1
22 BA .0007
23 PB 2.77
24 PC 0 0.020 0.057 0.070 0.087 0.108 0.124 0.130 0.130 0.130
25 PC 0.130 0.130 0.130 0.133 0.140 0.142 0.148 0.158 0.172 0.181
26 PC 0.190 0.197 0.199 0.200 0.201 0.204 0.214 0.229 0.241 0.249
27 PC 0.251 0.256 0.270 0.278 0.281 0.283 0.295 0.322 0.352 0.409
28 PC 0.499 0.590 0.710 0.744 0.781 0.812 0.819 0.835 0.851 0.856
29 PC 0.860 0.868 0.876 0.888 0.910 0.926 0.937 0.950 0.970 0.976
30 PC 0.982 0.985 0.987 0.989 0.990 0.993 0.993 0.994 0.995 0.998
31 PC 0.998 0.999 1.000
32 LS 0 98.0
33 UD 0.081
*
34 KK OFF2
35 BA .0118
36 LS 0 88.4
37 UD 0.161
*
38 KK OFF3
39 BA .0023
40 LS 0 98.0
41 UD 0.114
*

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1 HEC-1 INPUT PAGE 2

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LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
42 KK ON1
43 BA .0004
44 LS 0 92.3
45 UD 0.050
*
46 KK ON2
47 BA .0080
48 LS 0 93.4
49 UD 0.111
*
50 ZZ

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1 SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT LINE (V) ROUTING (--->) DIVERSION OR PUMP FLOW
NO. (.) CONNECTOR (<---) RETURN OF DIVERTED OR PUMPED FLOW
21 OFF1
.
.
34 OFF2
.
.
38 OFF3
.
.
42 ON1
.
.
46 ON2
.
.

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(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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

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

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* JUN 1998 *
 * VERSION 4.1 *
 * RUN DATE 01AUG11 TIME 09:04:43 *

CDS1103.OUT

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

VARIETY SCHOOL
 TECHNICAL DRAINAGE STUDY
 EXISTING & ULTIMATE CONDITION

RETURN PERIOD ----- 10- AND 100-YEAR
 DISTRIBUTION ----- 6-HOUR SDN3
 PROJECT NO. ----- CSD1103.001
 FILENAME ----- CSD1103.H1
 DATE ----- AUGUST 2011
 MODELED BY ----- SLATER HANIFAN GROUP

SIX HOUR DEPTH-AREA REDUCTION FACTORS
 DRAINAGE AREA (MI^2) DARF
 100-YR 0.990
 10-YR 0.570

18 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
 .99 .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 .99	RATIO 2 .57
HYDROGRAPH AT					
+	OFF1	.00	1 FLOW TIME	1. 3.50	1. 3.50
HYDROGRAPH AT					
+	OFF2	.01	1 FLOW TIME	16. 3.58	7. 3.58
HYDROGRAPH AT					
+	OFF3	.00	1 FLOW TIME	4. 3.50	2. 3.50
HYDROGRAPH AT					
+	ON1	.00	1 FLOW TIME	1. 3.50	0. 3.50
HYDROGRAPH AT					
+	ON2	.01	1 FLOW TIME	13. 3.50	7. 3.58

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

APPENDIX C

Hydraulic Analyses

10-Year Cross Section Computations

28TH (10-YR) Worksheet for Irregular Channel

Project Description	
Worksheet	28TH (10-YR)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.6700 %
Discharge	39.30 cfs

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

Results	
Mannings Coefficient	0.015
Water Surface Elevation	0.64 ft
Elevation Range	0.00 to 0.63
Flow Area	13.5 ft ²
Wetted Perimeter	61.17 ft
Top Width	60.00 ft
Actual Depth	0.64 ft
Critical Elevation	0.65 ft
Critical Slope	0.5642 %
Velocity	2.91 ft/s
Velocity Head	0.13 ft
Specific Energy	0.77 ft
Froude Number	1.08
Flow Type	Supercritical

Calculation Messages:
Water elevation exceeds lowest end station by 0.35166716e-1 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.013
0+07.00	0+53.00	0.016
0+53.00	0+60.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+30.00	0.63
0+53.00	0.17

28TH (10-YR) Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+53.00	0.13
0+54.50	0.00
0+54.50	0.50
0+55.00	0.50
0+60.00	0.60

Notes: 28th just south of Stewart; 60-ft ROW without center median.

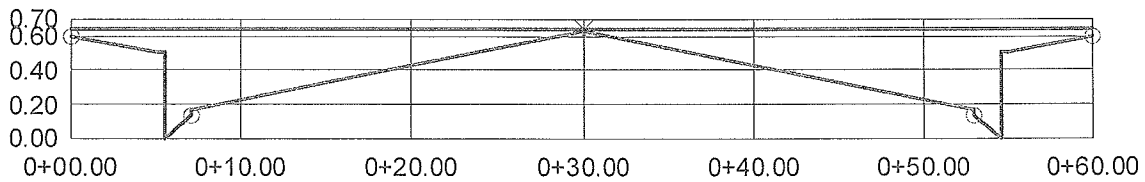
28TH (10-YR)
Cross Section for Irregular Channel

Project Description

Worksheet	28TH (10-YR)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data

Mannings Coefficient	0.015
Channel Slope	0.6700 %
Water Surface Elevation	0.64 ft
Elevation Range	0.00 to 0.63
Discharge	39.30 cfs



V:10.0
H:1
NTS

STW (100-YR)

Worksheet for Irregular Channel

Project Description	
Worksheet	STW (10-YR)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.5000 %
Discharge	219.30 cfs

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

Results	
Mannings Coefficient	0.015
Water Surface Elevation	1.07 ft
Elevation Range	0.00 to 1.40
Flow Area	48.3 ft ²
Wetted Perimeter	89.41 ft
Top Width	87.00 ft
Actual Depth	1.07 ft
Critical Elevation	1.10 ft
Critical Slope	0.4263 %
Velocity	4.54 ft/s
Velocity Head	0.32 ft
Specific Energy	1.40 ft
Froude Number	1.08
Flow Type	Supercritical

Calculation Messages:

Flow is divided.

Water elevation exceeds lowest end station by 0.47479842 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.013
0+07.00	0+43.50	0.016
0+43.50	0+56.50	0.013
0+56.50	0+93.00	0.016
0+93.00	1+00.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13

STW (100-YR)
Worksheet for Irregular Channel

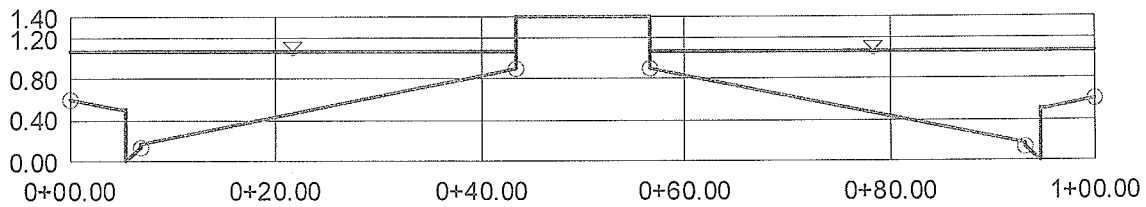
Natural Channel Points	
Station (ft)	Elevation (ft)
0+07.00	0.17
0+43.50	0.90
0+43.50	1.40
0+56.50	1.40
0+56.50	0.90
0+93.00	0.17
0+93.00	0.13
0+94.50	0.00
0+94.50	0.50
0+95.00	0.50
1+00.00	0.60

Notes: Stewart just east of 28th; 100-ft ROW with center median.

STW (100-YR) Cross Section for Irregular Channel

Project Description	
Worksheet	STW (10-YR)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.015
Channel Slope	0.5000 %
Water Surface Elevation	1.07 ft
Elevation Range	0.00 to 1.40
Discharge	219.30 cfs



V:10.0
H:1
NTS

100-Year Cross Section Computations

28TH (100-YR)

Worksheet for Irregular Channel

Project Description	
Worksheet	28TH (100-YR)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.6700 %
Discharge	70.40 cfs

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

Results	
Mannings Coefficient	0.015
Water Surface Elevation	0.73 ft
Elevation Range	0.00 to 0.63
Flow Area	19.2 ft ²
Wetted Perimeter	61.36 ft
Top Width	60.00 ft
Actual Depth	0.73 ft
Critical Elevation	0.76 ft
Critical Slope	0.4977 %
Velocity	3.67 ft/s
Velocity Head	0.21 ft
Specific Energy	0.94 ft
Froude Number	1.14
Flow Type	Supercritical

Calculation Messages:
Water elevation exceeds lowest end station by 0.12969062 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.013
0+07.00	0+53.00	0.016
0+53.00	0+60.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+30.00	0.63
0+53.00	0.17

28TH (100-YR)
Worksheet for Irregular Channel

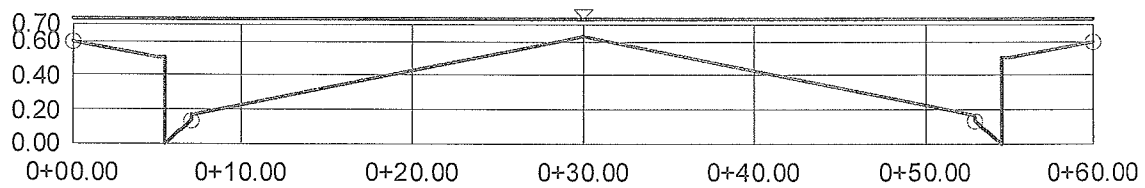
Natural Channel Points	
Station (ft)	Elevation (ft)
0+53.00	0.13
0+54.50	0.00
0+54.50	0.50
0+55.00	0.50
0+60.00	0.60

Notes: 28th just south of Stewart; 60-ft ROW without center median.

28TH (100-YR) Cross Section for Irregular Channel

Project Description	
Worksheet	28TH (100-YR)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.015
Channel Slope	0.6700 %
Water Surface Elevation	0.73 ft
Elevation Range	0.00 to 0.63
Discharge	70.40 cfs



V:10.0
H:1
NTS

STW (100-YR) Worksheet for Irregular Channel

Project Description	
Worksheet	STW (100-YR)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.5000 %
Discharge	509.90 cfs

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

Results	
Mannings Coefficient	0.014
Water Surface Elevation	1.44 ft
Elevation Range	0.00 to 1.40
Flow Area	80.9 ft ²
Wetted Perimeter	103.80 ft
Top Width	100.00 ft
Actual Depth	1.44 ft
Critical Elevation	1.57 ft
Critical Slope	0.3141 %
Velocity	6.30 ft/s
Velocity Head	0.62 ft
Specific Energy	2.06 ft
Froude Number	1.23
Flow Type	Supercritical

Calculation Messages:
Water elevation exceeds lowest end station by 0.8439469 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.013
0+07.00	0+43.50	0.016
0+43.50	0+56.50	0.013
0+56.50	0+93.00	0.016
0+93.00	1+00.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17

STW (100-YR) Worksheet for Irregular Channel

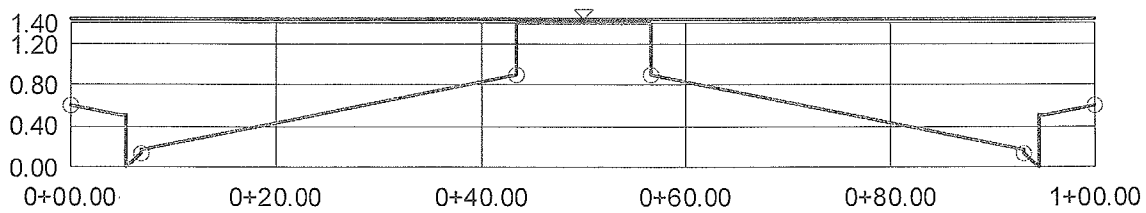
Natural Channel Points	
Station (ft)	Elevation (ft)
0+43.50	0.90
0+43.50	1.40
0+56.50	1.40
0+56.50	0.90
0+93.00	0.17
0+93.00	0.13
0+94.50	0.00
0+94.50	0.50
0+95.00	0.50
1+00.00	0.60

Notes: Stewart just east of 28th; 100-ft ROW with center median.

STW (100-YR) Cross Section for Irregular Channel

Project Description	
Worksheet	STW (100-YR)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.014
Channel Slope	0.5000 %
Water Surface Elevation	1.44 ft
Elevation Range	0.00 to 1.40
Discharge	509.90 cfs



V:10.0
H:1
NTS

ISL (100-YR)

Worksheet for Irregular Channel

Project Description	
Worksheet	ISL (100-YR)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.5000 %
Discharge	13.50 cfs

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

Results	
Mannings Coefficient	0.015
Water Surface Elevation	0.78 ft
Elevation Range	0.00 to 1.21
Flow Area	5.9 ft²
Wetted Perimeter	31.41 ft
Top Width	30.10 ft
Actual Depth	0.78 ft
Critical Elevation	0.76 ft
Critical Slope	0.6031 %
Velocity	2.30 ft/s
Velocity Head	0.08 ft
Specific Energy	0.86 ft
Froude Number	0.92
Flow Type	Subcritical

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+24.50	0.016
0+24.50	0+43.00	0.013
0+43.00	0+52.00	0.022

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	1.21
0+24.50	0.48
0+24.50	0.98
0+40.50	0.50
0+40.50	0.00
0+43.00	0.00
0+43.00	0.50
0+52.00	0.80

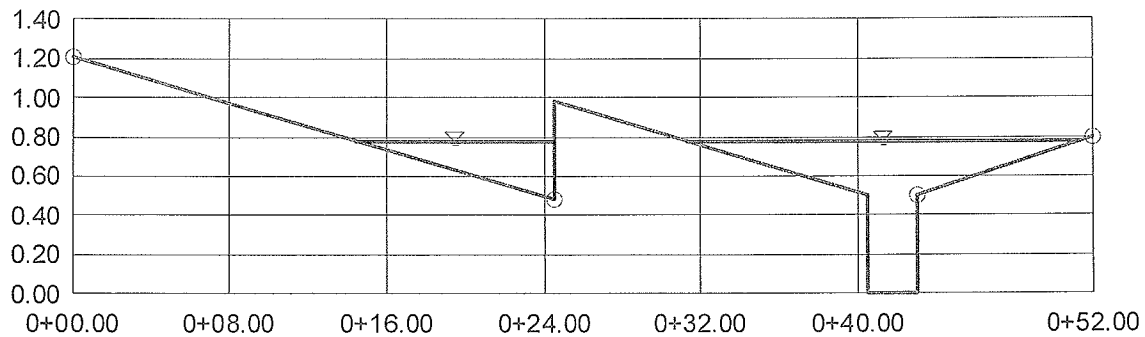
ISL (100-YR) Cross Section for Irregular Channel

Project Description

Worksheet	ISL (100-YR)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data

Mannings Coefficient	0.015
Channel Slope	0.5000 %
Water Surface Elevation	0.78 ft
Elevation Range	0.00 to 1.21
Discharge	13.50 cfs



V:10.0
H:1
NTS

FLM (100-YR)

Worksheet for Rectangular Channel

Project Description

Worksheet	FLM (100-YR)
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data

Mannings Coefficient	0.013
Channel Slope	0.4000 %
Bottom Width	3.00 ft
Discharge	3.50 cfs

Results

Depth	0.37 ft
Flow Area	1.1 ft ²
Wetted Perimeter	3.73 ft
Top Width	3.00 ft
Critical Depth	0.35 ft
Critical Slope	0.4624 %
Velocity	3.20 ft/s
Velocity Head	0.16 ft
Specific Energy	0.52 ft
Froude Number	0.93
Flow Type	Subcritical

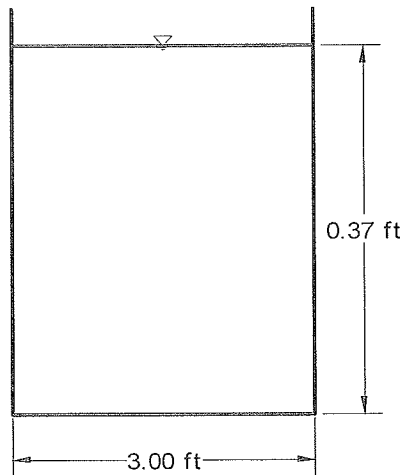
FLM (100-YR)
Cross Section for Rectangular Channel

Project Description

Worksheet	FLM (100-YR)
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data

Mannings Coefficient	0.013
Channel Slope	0.4000 %
Depth	0.37 ft
Bottom Width	3.00 ft
Discharge	3.50 cfs



V:10.0
H:1
NTS

Riprap Sizing Computation

Rip Rap Sizing Computation

Project Name: Variety School

Date: August 2011

File Name: CSD1103-001 Riprap Calculation

By: K.C.

Location:

Known Information:

Reference:

Rip Rap protection at

V = Velocity (fps)	6.3	WSPG Hydraulic / Flowmaster Calculations
S _g = Specific Gravity of Rock (typ=2.5)	2.5	Use Typical
s = Longitudinal Channel Slope (ft/ft)	0.005	Grading Plan

Solve For:

d ₅₀ =	0.32	ft	- Average Rock Size
d ₅₀ =	4	in	- Average Rock Size
Thickness =	8	in	- Thickness of Rip Rap protection
Manning's 'n' =	0.033		- Roughness Coefficient

Equations:

Based upon a Stable Channel Lining

$$d_{50} = ((vel * S^{0.17}) / (3 * (S_g - 1)))^2 \quad \text{Equation 734*}$$

$$n = 0.0395(d_{50})^{1/6} \quad \text{Equation 732*}$$

Recommendations:

Use D50 = 6-inches in landscaping up to 0.5-ft above WSE in Stewart.

* Equations taken from the Clark County Regional Flood Control District - Hydrologic Criteria and Drainage Design Manual

Finished Floor Analysis

[illegible]

APPENDIX D

Reference Material

Technical Drainage Study Update for Roy Martin Middle School Replacement

Approval Letters

CITY OF LAS VEGAS		DATE:
INTER-OFFICE MEMORANDUM		April 30, 2008
TO: Land Development Services Department of Public Works		FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT:	Drainage Study for	COPIES TO:
	Roy Martin Middle School Replacement - Update	Nevada by Design
Cross Streets:	SEC of Stewart Avenue & 28 th Street	Clark County School District
File Number:	F:\Depot\DSMemos\DS4069E.doc	Bart Anderson, P.E., DevCo
Parcel Number:	139-36-303-001 & 139-36-303-003	CCDDS
Zoning Action:	GPA-14376; ZON-14378 & SDR-14380	
FEMA Flood Zone:	YES NO ☒	
Proposed Storm Drain:	YES NO ☒	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Transaction #
1 st Submittal	9/7/2006	9/21/2006	Not Approved	N/C	----
2 nd Submittal	3/6/2007	3/19/2007	Not Approved	N/C	----
3 rd Submittal	3/28/2007 & 4/12/2007	4/12/2007	Conditional Approval	N/C	----
CCDDS	6/4/2007	6/6/2007	Concurrence Recv'd	N/C	----
4 th Submittal	4/16/2008	4/30/2008	See Comments Below	N/C	----
TOTAL FEES (LDDRS):				N/C	----

REMARKS:

4th Submittal: Update to preserve the existing buildings along Stewart Avenue and to Re-iterate the previous approved drainage conditions

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

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

- The *Clark County School District* had issued a letter indemnify the City for any liability for any future flooding potential in the enclosed courtyard area. This letter suffices in lieu of the courtyard drainage meeting the City's minimum requirement.

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 of a project.

Hydrologic Methodology Discussion

HYDROLOGIC METHODOLOGY AND CRITERIA

The Clark County Flood Control and Hydraulic Engineers have adapted for smaller contributing basins the *Modified Rational Formula Method*. This modification assures the formula matches the Flood Hydrograph Package (HEC-1) and is used to determine the peak runoff generated by the 100- and 10-year, 6-hour storm event. The Rational Formula method can produce satisfactory peak flow analysis. The modified Rational Formula: $Q = KCIA$

"Q" is defined as the maximum peak flow of runoff in cubic feet per second (cfs). "K" is the factor that adjusts the formula to the local vicinity; in Clark County this number is 0.5. "C" is a runoff coefficient and represents the condition and land use of the area of concern. "I" is the intensity of rainfall and is given in inches per hour. "A" is the area being evaluated.

The Rational Formula makes the following assumptions:

1. The computed maximum runoff at the point of interest is directly related to the average and is a function of the rainfall rate during the time of concentration.
2. The maximum rate of rainfall occurs during the time of concentration and the design rainfall depth during the time of concentration is converted to the average rainfall intensity for the time of concentration.
3. The maximum runoff occurs when the entire area is contributing flow. However, this assumption has been modified from time to time when local rainfall/runoff data was used to improve calculated results.

The CCRFCD's Drainage Design Management System (DDMS) was utilized to obtain the 10-year and 100-year flood discharge quantities.

HYDROLOGIC PARAMETERS

Basin Area

The existing on-site drainage basins were determined from a 2005 Survey Map at 1-foot contour intervals, produced by Nevada By Design. The proposed on-site areas were determined from the available 30-scale on-site grading plans produced by Nevada By Design. The Drainage Basin Maps for the existing and proposed conditions are included in Map Pockets 1 and 2 respectively. These areas were delineated in order to determine the discharge resulting from the 100-year storm event at various points throughout the project.

Proposed Condition Drainage Map

APPENDIX E

Reference Material

Technical Drainage Study for Sunrise Acres Elementary School

Approval Letters

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM		DATE: March 5, 2001
TO: Land Development Services Department of Public Works		FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT:	Drainage Study for:	
CCSD - Sunrise Acres Elementary School		COPIES TO:
Cross Streets:	Stewart Ave. and North 28 th St.	Nevada By Design
FILE NO.:	F:\Depot\DSMEMOS\DS2800C.doc	Clark County School District
Parcel Number:	139-36-302-001	Cheri Edleman, P.E. DEVCO
Zoning Action:		
FEMA Flood Zone	YES	No X
Proposed Storm Drain	YES X	No

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES
1 st Submittal	11/16/2000	11/28/2000	Not Accepted	NC
2 nd Submittal	1/18/2001	1/31/2001	Not Accepted	NC
3 rd Submittal	2/21/2001	3/5/2001	See Comments Below	NC
TOTAL FEES (LDDRS):				NC

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. Show the inundation area into the driveway at Stewart Avenue on the grading plan.
2. As the estimated water surface elevation at the driveway entrance along Stewart Ave. is expected to be 1840.0 feet, the proposed restroom building finish floor must be raised.
3. Add notes to the detail of the stem wall, include reference to height and solid grout cells.

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 of a project.

END OF REMARKS
B&H/kb

T/R/S: T20S/R61E/36
AREA M-36

Proposed Condition Drainage Map

APPENDIX F

Reference Material

2005 City of Las Vegas Central Neighborhood Study

APPENDIX G

Improvement Plans

TRANSMITTAL

To: Albert Sung, P.E.

Date: August 3, 2011

City of Las Vegas

Project No.: CSD1103-001

From: Kellin Collins

Subject: Variety School

CC: Steve Jones, SHG

CC: Mark Failla, SHG

CC: Brent Parrish, SHG

CC: _____

CC: _____

CC: _____

Transmitting Via:

- ☐ Mail
☒ Messenger / MDS
☐ Federal Express
☐ Pickup

For:

- ☒ Review & Comment
☐ Per your Request
☐ Information/File

Acknowledgement of Receipt:

- ☐ Not Required
☒ Acknowledgement Required

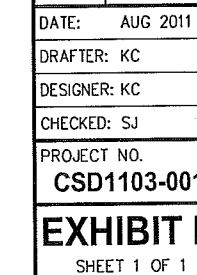
Received By: _____

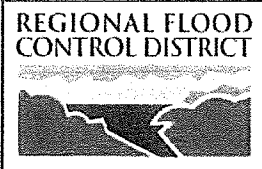
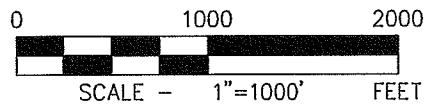
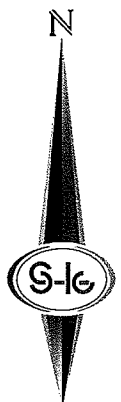
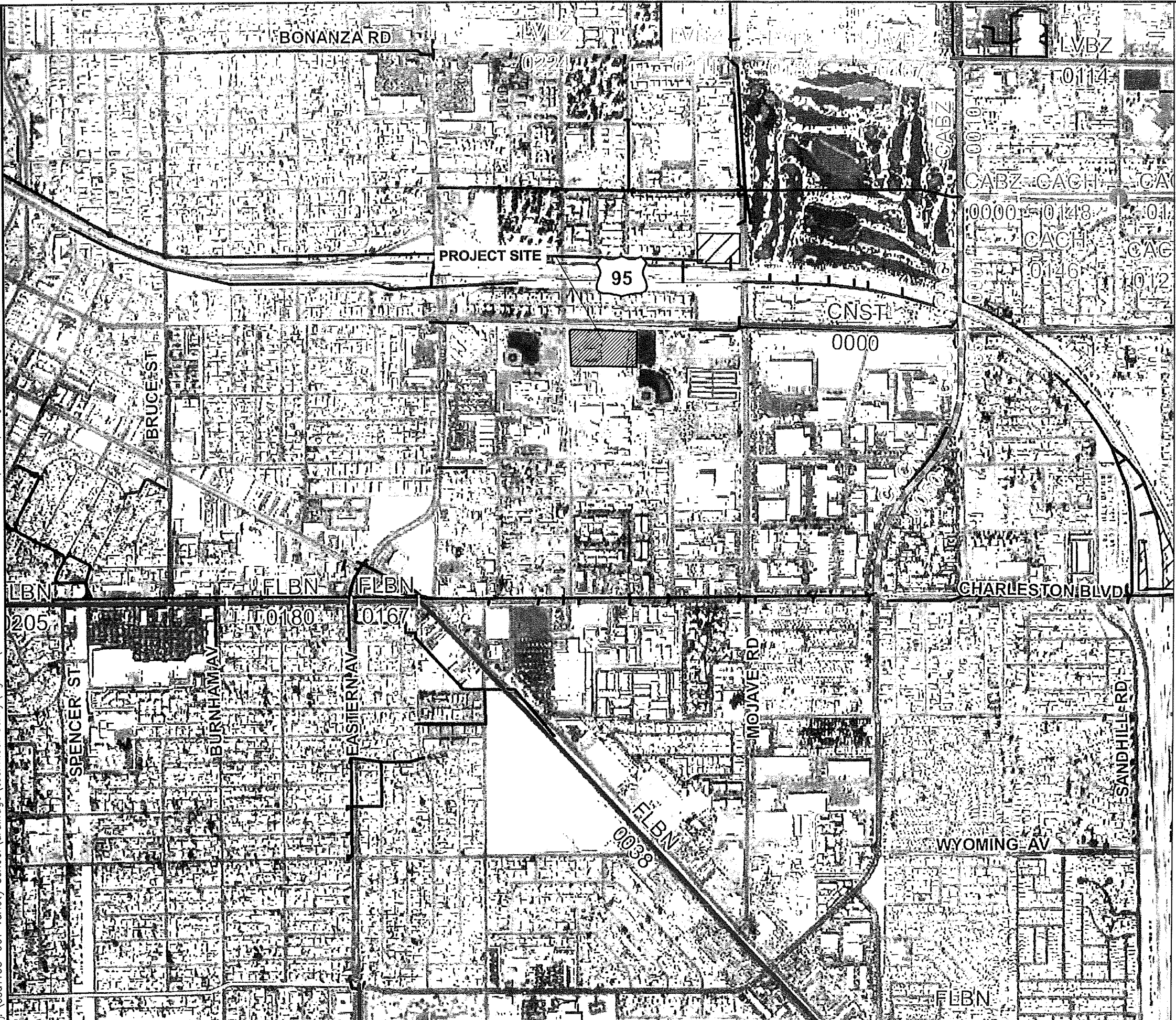
Date: _____ Time: _____

Copies	Description
<u>1</u>	<u>\$400 submittal check</u>
<u>1</u>	<u>Technical Drainage Study for Variety School</u>
<u>1</u>	<u>CD/PDF of the Technical Drainage Study for Variety School</u>
_____	_____
_____	_____
_____	_____
_____	_____

Comments:

Signed: Kellin Collins
Kellin Collins, Engineering Intern 2





2008
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE
FIGURE F-32
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
- Culvert or Bridge Crossing
- Stormdrain
- Lined Channel
- Unlined Channel
- Levee/Dike
- Natural Wash/Floodway
- ID-Mile Separator

- Remove & Replace/Parallel Facilities**
- | | |
|-------------------|-------------------|
| Category A | Category B |
| Channel | Channel |
| Stormdrain | Stormdrain |
| Crossing | Crossing |

SLATER HANIFAN GROUP
S-I-G
CONSULTING ENGINEERS & PLANNERS
5740 S. ARVILLE STREET #216, LAS VEGAS, NV 89116
PHONE (702) 284-5300 FAX (702) 284-5390

APP. DATE	DATE	BY	DESCRIPTION	NO.

KGA ARCHITECTURE
VARIETY SCHOOL
CCRFGD 2008 MPU F MAP

DATE:	AUG 2011
DRAFTER:	KC
DESIGNER:	KC
CHECKED:	SJ
PROJECT NO.	CS1103-001
EXHIBIT C	SHEET 1 OF 1

CENTRAL NEIGHBORHOOD FLOOD
CONTROL MASTER PLAN
REF. FIGURE E-11
Q@Intersection of Eastern&Stewart

(RS/E) Q10 = 149cfs
Q100 = 371cfs

(RC4)

Q@Stewart Ave.
REF. C4 (DS#2858)
Q10 = 12cfs
Q100 = 24cfs

EAST LAS VEGAS
NEIGHBORHOOD CENTER
(DS#2858)

(RC2)

Q@28th St.
REF. C2 (DS#2858)
Q10 = 28cfs
Q100 = 49cfs

SUNRISE ACRES
ELEMENTARY SCHOOL
(DS#2800)

VARIETY SCHOOL

CURRICULUM &
PROFESSIONAL
DEVELOPMENT CENTER
(DS#3048)

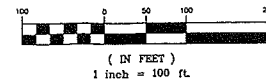
REF. HS@Sunrise Ave.
(DS#3048)

(RSA) Q10 = 12cfs
Q100 = 42cfs

PROJECT
SITE



GRAPHIC SCALE



PROPOSED CONDITION

BASIN/REFERENCED CP	AREA (acres)	Q10 (cfs)	Q100 (cfs)
(ONP1)	5.3	7.1	14
(ONP2)	1.9	3	5.6
(ONP3)	1.2	2.2	4.2
(ONP4)	0.5	0.9	1.6
(ONP5)	1.3	2.4	4.4
(ONP6)	1.5	2.9	5.4
(ONP7)	3.1	1	3.5
(ONP8)	3.6	5.5	10.9
(ONP9)	1.8	3.3	6.2
(OFF1)	5.3	7.1	14
(OFF2)	0.8	1.4	2.7
(OFF3)	1.9	2.6	4.9
(RSA)	--	12	42
(RS/E)	--	149	371
(RC4)	--	12	24
(RC2)	--	26	49

CONCENTRATION POINT (PROPOSED CONDITION):	Q10 (cfs)	Q100 (cfs)
(SA) RSA+OFF2+OFF3+ONP1+ONP2+ONP3	28.3	73.4
(TS) RC2+ONP4+ONP5+ONP6+ONP9	35.5	66.6
(ST) RS/E+RC4+TS+ONP7+ONP8	203	476

HYDRAULIC SECTION	SLOPE (%)	Q10 (cfs)	Q100 (cfs)	DEPTH 10-yr (ft)	DEPTH 100-yr (ft)	V10 (ft/s)	V100 (ft/s)	VD 10-yr	VD 100-yr
(SA)	1.36	28.3	73.4	0.49	0.65	3.68	4.83	1.8	3.14
(TS)	0.56	35.5	66.6	0.63	0.74	2.7	3.41	1.7	2.52
(ST)	0.50	203	476	1.03	1.36	4.18	5.84	4.31	7.94

NOTE:

1. REFERENCED FLOWS USED IN OUR HYDRAULIC MODELS ARE INDICATED WITH AN R-PREFIX AS FOLLOWS:
RS/E FROM FIGURE E-11 OF THE CENTRAL NEIGHBORHOOD FLOOD CONTROL MASTER PLAN;
RC4 FROM DS#2858, RC2 FROM DS#2800 AND RSA FROM DS#3048.

LEGEND	
(P) (O)	BASIN LABEL
→	FLOW DIRECTION
---	BASIN BOUNDARY
---	CONCENTRATION POINT
Q10/Q100	10 YEAR/100 YEAR FLOW RATES

This drawing is a
part of a drainage study
401-1 which was received
on 4/16/08 and completed on
9/30/08. Page 17 of 18

ROY MARTIN MIDDLE SCHOOL REPLACEMENT

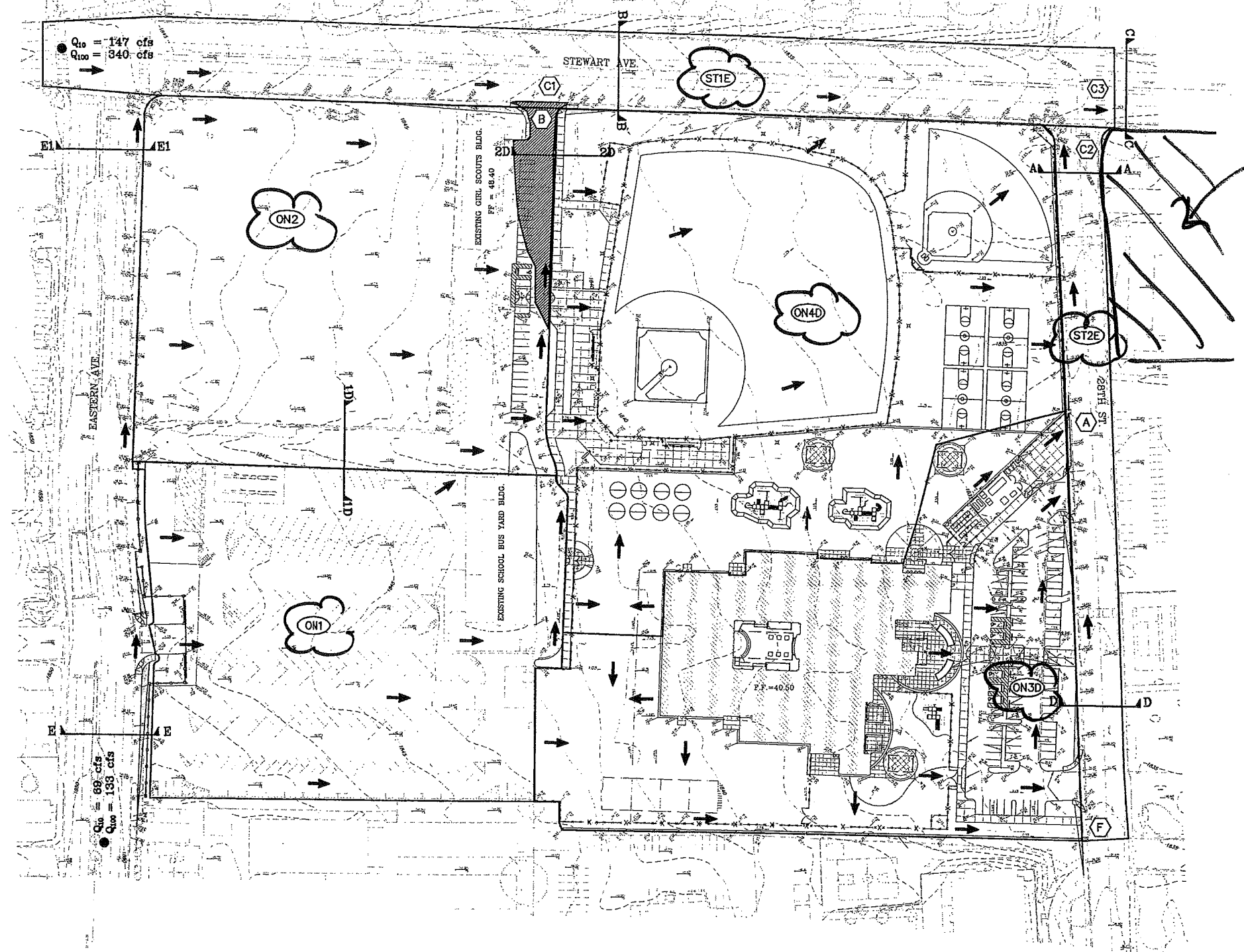
DRAINAGE BASIN MAP
PROPOSED CONDITION

SHEET NO.:

FIG 6U

(DS Update)

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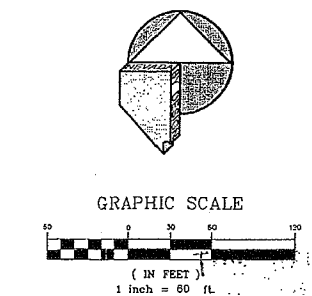
PROJECT SITE

- LEGEND**
- ON1 ONSITE DRAINAGE BASIN (PROPOSED)
 - ST1 STREET DRAINAGE BASIN (EXISTING)
 - CP CONCENTRATION POINT
 - FLOW DIRECTION
 - /// INUNDATION AREA

BASIN	AREA (ACRES)	Q10 (CFS)	Q100 (CFS)
* ON1	4.74	8	15
* ON2	5.34	2	6
* B	N/A	10	21
* ON3D	5.56	9	16
* ON4D	7.61	13	24
* OFF	1.61	2	5
* A	N/A	24	45
* ST1E	2.97	5	10
* ST2E	1.15	2	4
* C1	N/A	162	371
* C2	N/A	26	49
* C3	N/A	188	420

BENCHMARK
 CLV BM 2LV0126W4: RIVET & PLATE IN TOP OF CURB, S.E. CORNER, STEWART AVENUE AND EASTERN AVENUE, ELEVATION: 1846.00' (NAVIGS)

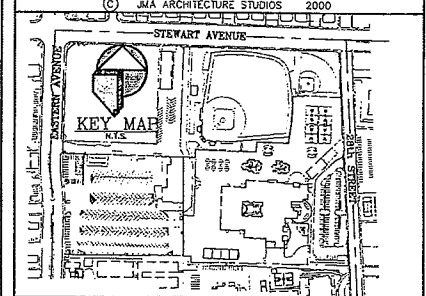
BASIS OF BEARING
 S 44°48'20" E, BEING THE GRID BEARING BETWEEN CLARK COUNTY GIS CONTROL POINTS 816 AND 827, AS SHOWN ON A RECORD OF SURVEY IN FILE 88, PAGE 53 OF SURVEYS, OFFICIAL RECORDS, CLARK COUNTY, NEVADA.



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REVISIONS

REV	DESCRIPTION	DATE	BY



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

SUNRISE ACRES ELEMENTARY SCHOOL

PROPOSED DRAINAGE BASIN MAP



City of Las Vegas

CENTRAL NEIGHBORHOOD FLOOD CONTROL MASTER PLAN

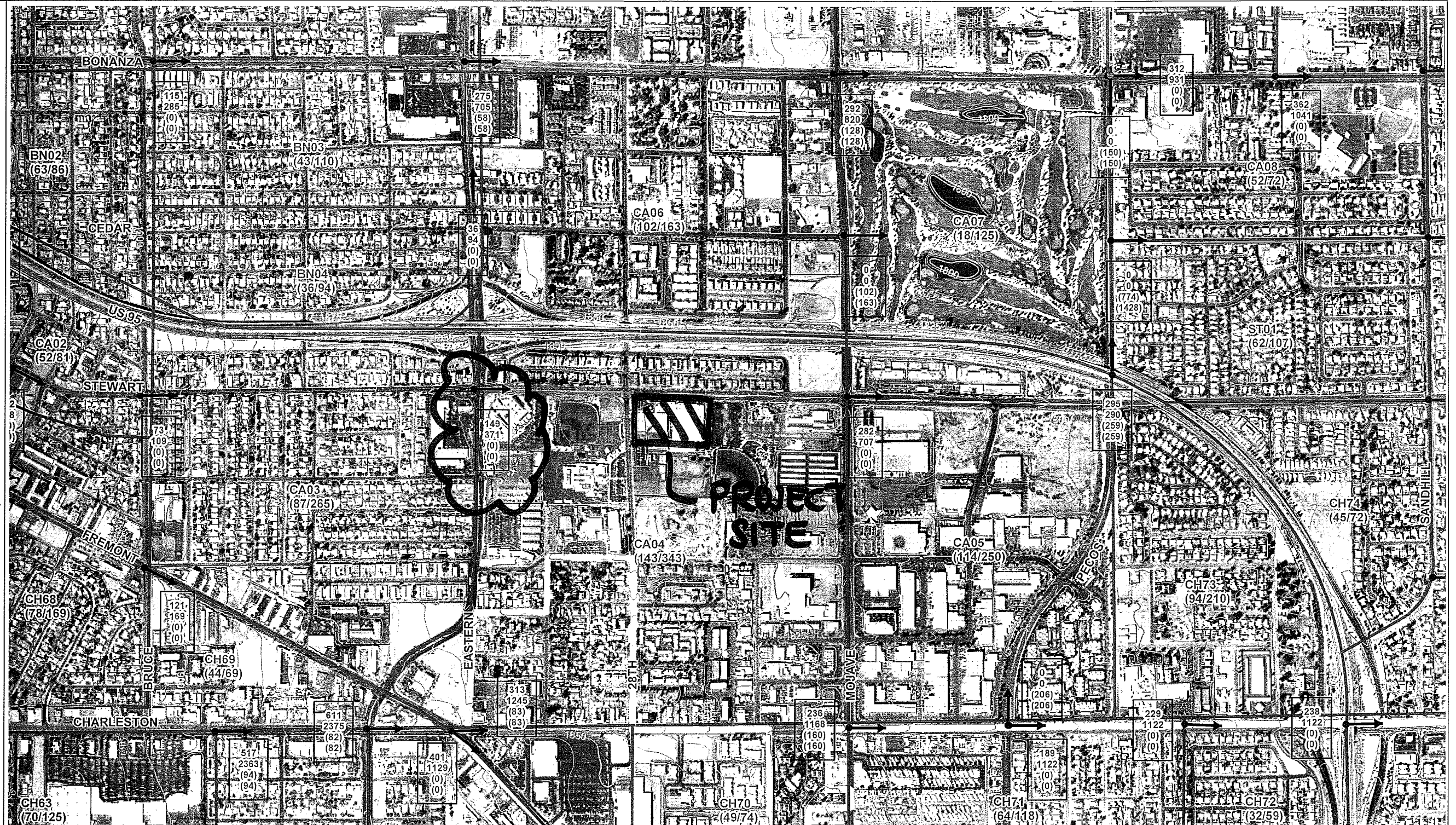
LEGEND

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

(Flows in CFS)
- Study Area Limit

PHOTO DATE: SPRING 2004

FIGURE E-11



EXISTING DRAINAGE CONDITIONS



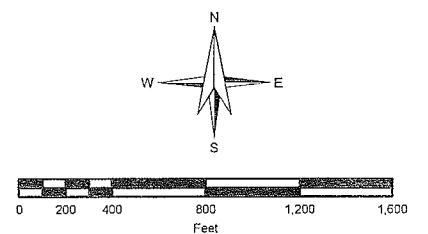
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Henderson, NV 89074
(702) 263-7275
Fax: (702) 263-7200

	Durango	Rainbow	Decatur	Toropah	5th	Pecos	Nellis
Lake Mead				1	2		
Washington				3	4	5	6
Charleston	7	8	9	10	11	12	
Sahara	13	14	15	16	17		
Desert Inn		18	19				

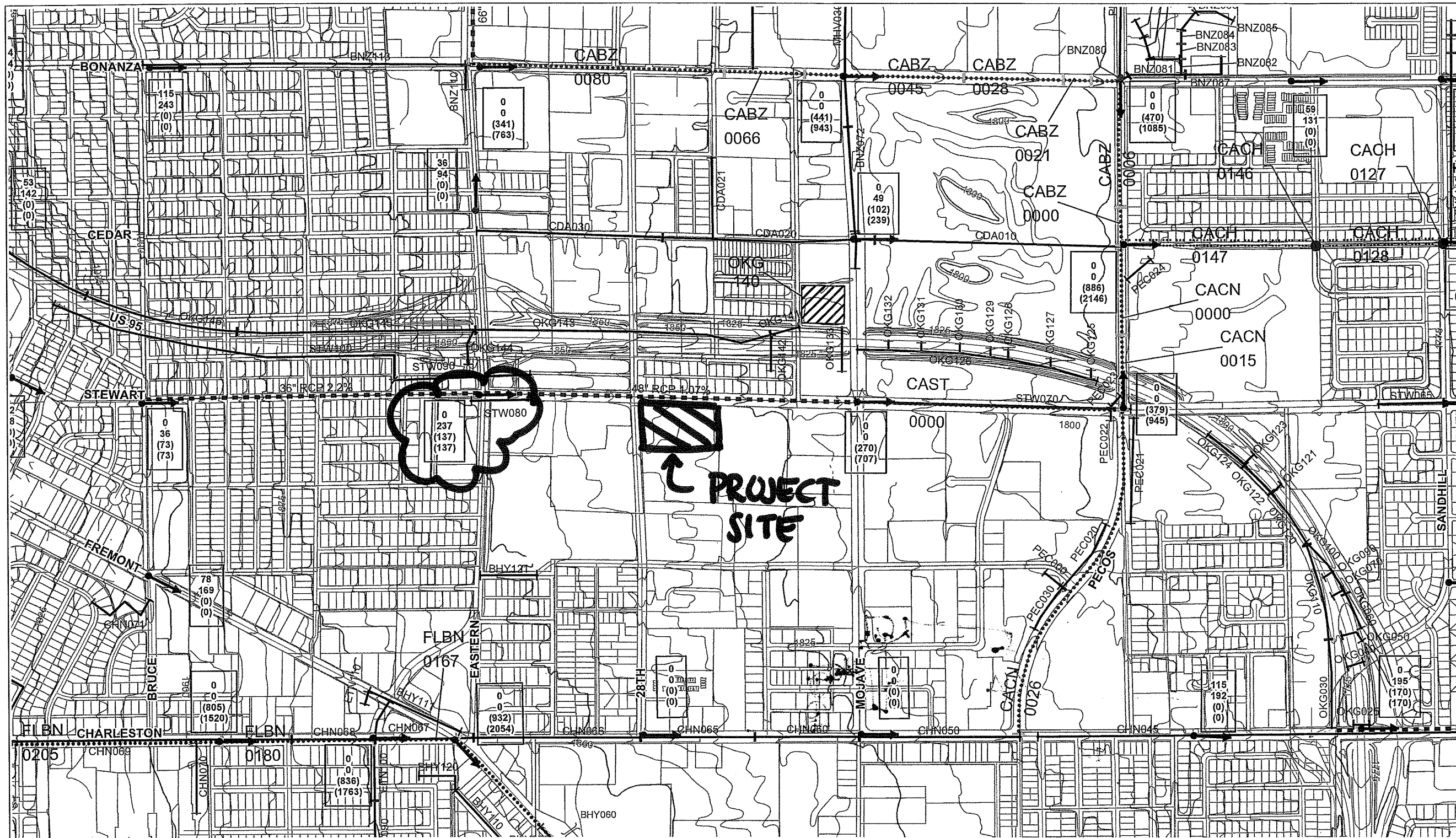
NOTE:

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 explanation.



SCALE: 1 inch = 800 feet



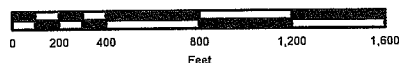
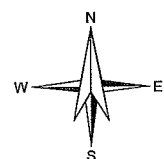
City of Las Vegas

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
- Local Detention Basin
- Local Storm Drain
- Local Culvert
- Proposed Local Storm Drain
- Regional ID-Mile Separator
- Local Facility Separator

FIGURE F-11



SCALE: 1 inch = 800 feet

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)

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 explanation.

Durango	Rainbow	Decatur	Tonopah	5th	Pecos	Nellis
Lake Mead			1	2		
Washington			3	4	5	6
Charleston	7	8	9	10	11	12
Sahara	13	14	15	16	17	
Desert Inn		18	19			

FUTURE DRAINAGE CONDITIONS



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