

DS #: 4822

APN: 163.02.601.005

PROJECT: Opportunity Village (AKA Dakey Campus)

SUBMITTAL: 1st

SCANNED BY/DATE:

CHECKED BY/DATE:



CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM		DATE: September 1, 2016
TO: Land Development Services Department of Building & Safety		FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT: Drainage Study for: Opportunity Village (AKA Oakey Campus)		COPIES TO: Lochsa Engineering
Cross Streets:	NWC of Oakey Blvd & Community College Dr	State of Nevada, Division of Lands
File Number:	F:\Depot\DSMemos\DS4822A.doc	Bart Anderson, P.E., DevCo
Parcel Number:	163-02-601-005	
Zoning Action:	SDR-64479 & VAR-66259	
FEMA Flood Zone	YES NO X	
Proposed Storm Drain	YES NO X	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1 st Submittal	8/18/2016	9/1/2016	See Comments Below	\$400.00	455400: \$400
			TOTAL FEES (LDDRS):	\$400.00	----

REMARKS:

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

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

1. Provide a copy of the zoning/planning conditions associated with this site (**SDR-64479 & VAR-66259**) 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.

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

END OF REMARKS

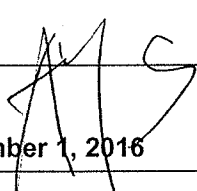
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T/R/S: T21S/R60E/02
AREA Q-02

*** FAX TX REPORT ***

TRANSMISSION OK

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 PSWD/SUBADDRESS
 DESTINATION ID
 ST. TIME 09/01 16:46
 USAGE T 00' 28
 PGS. 1
 RESULT OK

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM		DATE:  September 1, 2016
TO: Land Development Services Department of Building & Safety		FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
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Update to Technical Drainage Study For Opportunity Village (AKA Oakey Campus)

August 2016

Prepared for:

State of Nevada Division of Lands
Charles Donohue
901 S. Stewart Street, Suite 5003
Carson City, Nevada 89701
(775) 684-2720

Prepared by:

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

Lochsa Job # 151161

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL
DRAINAGE STUDY INFORMATION FORM

Name of Development: Opportunity Village Oakley Campus Date: August 3, 2016

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

East/West: Oakley Blvd.

b) Section: 02 Township: 21 South Range: 60 East

c) APN : 163-02-601-005

Name of Owner: State of Nevada Division of Lands - Charles Donohue

Telephone No.: (775) 684-2720 Fax No.: _____ E-Mail Address: _____

Address: 901 S. Stewart Street, Suite 5003 Carson City, Nevada 89701

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

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

Firm: Lochsa Engineering

Address: 6345 South Jones Boulevard, Suite 100, Las Vegas, Nevada 89118

Type of Land Development/Land Disturbance Process:

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

1. Total Owned Land Area: At Site: 6.94 +/- Acres Being Developed/Disturbed: 2.30 +/- Acres

2. Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? ☐ Yes** ☒ No

3. Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? ☒ Yes** ☐ No

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

5. Approximate upstream land area which drains to the subject site: 15 +/- Acres

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

TDS for Opportunity Village - DS# 521

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

To the southeast corner through a proposed driveway entrance to Community College Drive. The other discharge points are located at the northeast corner of the site and the northwest corner of the site.

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

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

***New Required Field**

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

Revision	Date

Engineer's Seal

Local Entity File No.

REFERENCE:

STANDARD FORM 1

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

Project Name: Opportunity Village Oakey Campus	Map ID:
Firm Name: Lochsa Engineering	Engineer: Guy Morris, PE

Address: 6345 South Jones Boulevard Suite 100			
City: Las Vegas	State: Nevada	Zip: 89118	

Phone Number: (702) 365-9312	Fax Number: (702) 365-9317
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Property Owner: Charles Donohue

Address: 901 S. Stewart Street, Suite 5003

City: Carson City	State: NV	Zip: 89701
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Reviewed By:	Date Received:	Date Accepted for Review:
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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 is reviewed for compliance with local and regional criteria. This form is not intended to be all inclusive and does not limit the extent of the information, calculations or exhibits which may be necessary to properly evaluate the intended land use.

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

I. GENERAL REQUIREMENT

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

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.
☒	☐	Off-site drainage basin maps for existing, interim and future conditions showing the existing topography, basin boundaries, concentration points, and flows in cfs.
☒	☐	On-site drainage basin maps for existing and proposed conditions showing the existing topography, basin boundaries, concentration points, and on-site and off-site flows in cfs.
☒	☐	Vicinity Map with local and major cross streets identified and a north arrow.

III. DRAINAGE PLAN

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

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
☒	☐	Existing contours encompassing the site and 100 feet beyond with spot elevations for important locations, where appropriate.
☒	☐	Minimum finish floor elevations with top-of-curb elevations at upstream end of lot.
☐	☐ N/A	Proposed typical street sections.
☐	☐ N/A	Streets with off-set crowns.
☒	☐	Proposed contours or spot elevations in sufficient detail to exhibit intended drainage patterns and slopes.
☒	☐	Property lines.
☒	☐	Right-of-way lines with widths, existing and proposed.
☒	☐	Existing improvements and their elevations.
☒	☐	Delineation of proposed on-site drainage basins indicating area and 10-year and 100-year storm peak flows at basin concentration points.
☒	☐	Concentration points and drainage flow directions with Q_{100} and V_{100} and D_{100} in streets.
☒	☐	Cumulative flows, velocity, and direction of flow at upstream and downstream ends of site for the 10-year and 100-year flows.
☒	☐	Location and cross-section of street capacity calculations.
☐	☐ N/A	Cross-sectional detail for channels, including cutoff wall locations.
☒	☐	Existing and proposed drainage facilities, appurtenances, and connections (i.e., sidewalk, ditches, swales, storm drain systems, unimproved and improved channels, and culverts, etc.) stating size, material, shape, and slope with plan and profile and HGL calculations.
☐	☐ N/A	Existing and proposed drainage easements and widths shown with sufficient detail. A cross sectional detail must be provided that shows appropriate lining and reinforcement.
☐	☐ N/A	Location and detail of existing, proposed, and future block wall openings. Minimum size is 16" x 48". Wrought iron gate is required for flows > 10 cfs.
☐	☐ N/A	Location and detail of flood walls illustrating depth of flow, proposed grouting height, etc.

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
☐	☒	Perimeter retaining wall locations. All existing and proposed walls (retaining screen and flood) must be shown with adjacent ground elevations. Flood walls with 8-inch concrete masonry unit.
☒	☐	Building and/or lot numbers.
☒	☐	Alignment of all existing, proposed, or future Regional Facilities adjacent to the site.
☐	☒	Limits of existing floodplain based on current FIRM of best available information; limits of proposed floodplains based on best available information.
☐	☒	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.
☒	☐	Appropriately elevated "humps" 6 inches above the 100 year water surface elevation at site accesses where the intent is to protect the site from the Q_{100} flows.
☒	☐	Street slopes for perimeter and interior streets. The minimum slope is 0.4 percent.

IV. HYDROLOGIC ANALYSIS

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

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

V. HYDRAULIC ANALYSIS

Yes	No	
☐	<u>N/A</u>	Flow split calculations and supporting documentation or reference for the method of flow split calculations used.
☒	☐	Normal depth street flow calculations and cross section diagrams for all interior and perimeter streets. Provide "d x v" products for the Q_{100} and Q_{10} flows representing the worst case for interior and all perimeter streets. $Q_{100} d \times v \leq 8$. $Q_{10} d \times v \leq 6$ and 12 foot dry lane for rights-of-way ≥ 80 feet. Calculations must be labeled by street name as indicated on the Grading Plan.
☒	☐	A summary table of interior and exterior street capacity calculations showing the street name, Q_{100} flow, slope, depth of flow, velocity and depth times velocity product and streets needing to meet 12 foot dry lane criteria.
☐	<u>N/A</u>	Appropriate hydraulic calculations for block wall openings assuming a 50 percent vertical clogging factor. (Assume the lower half of the opening is plugged).
☒	☐	Appropriate hydraulic calculations at drainage easement entrance and discharge locations to set finish floor elevations. Hydraulic calculations must include submerged weir, superelevation and tee intersection losses, where appropriate.
☒	☐	Provide necessary freeboard requirements to set the finished floor elevations of all proposed buildings, 2 x depth of flow of 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 of flow depth, which ever is greater.
☐	<u>N/A</u>	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 locations 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.
		Provide a 50 percent clogging factor in the capacity calculation for drop inlets.
☐	<u>N/A</u>	Hydraulic calculations for culverts and storm drains. D-Load calculations must be provided for storm drain pipes in public rights-of-way, including headwater pool inundation.
☒	☐	The mitigation of nuisance water, both during construction and in the fully developed condition, must be addressed.

REFERENCE:

STANDARD FORM 2



CITY OF LAS VEGAS

MINIMUM DRAINAGE STUDY CRITERIA STANDARD FORM 2 CHECKLIST SUPPLEMENT

(Revised 5/18/11)

The following checklist is intended as a supplemental guide for the engineer preparing a Technical Drainage Study submittal to the City of Las Vegas. This supplement focuses on requirements specific to the City of Las Vegas. The requirements presented are in addition to the Clark County Regional Flood Control District (CCRFCDD) 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 CCRFCDD Hydrologic Criteria and Drainage Design Manual (Design Manual).

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

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

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

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

CITY OF LAS VEGAS MINIMUM DRAINAGE STUDY CRITERIA CHECKLIST

II. GRADING PLAN INFORMATION		
Yes	No	
	✓	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.
✓		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.
	✓	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.
	✓	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.
	✓	Finished floor elevations for buildings adjacent to public drainage easements must be a minimum of 18 inches above the Q100 weir of submerged weir elevation, whichever is greater.

CITY OF LAS VEGAS MINIMUM DRAINAGE STUDY CRITERIA CHECKLIST

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

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

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

August 10, 2016

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

Subject: **Drainage Study Update for Opportunity Village –
(AKA Opportunity Village Oakey Campus)
(Previous DS521)
Lochsa Job No. 151161**

Dear Mr. Sung,

This letter is intended as an Update to the approved “*Technical Drainage Study for Opportunity Village*,” hereinafter will be referred to as the ‘Original Study’. The Original Study was prepared by Martin & Martin and was approved by the City of Las Vegas (CLV) on January 22, 1991 (DS 521). The Original Study provided detailed information for the subject Opportunity Village improvements, along the north side of Oakey Blvd. and west side of Community College Dr. The area covered by the subject Opportunity Village improvements is shown in the Original Study to be mostly impervious to represent the development. This Update is being submitted as a technical support document to address some onsite revisions to the existing project site since the approval of the Original Study.

The subject revision primarily consists of removing the putting golf course, the kitchen, and removing the exterior portion along the west side of the LIED building. These areas will be replaced with the addition and expansion of proposed buildings. In addition to the proposed buildings, there are some minor grade revisions. Minor grade revisions are associated with the proposed buildings to match the existing grades onsite in order to follow the historical drainage patterns as close as possible.

Other revisions include removing and replacing the onsite drive aisle. The proposed drive aisle will be all concrete (in place of asphalt) and will be regraded to continue to discharge east (following the existing drainage pattern) toward a proposed drive thru drop off area. We have provided a Grading Plan to clearly show the locations of the proposed improvements.

The project site (Total Site = 6.94 acres with 2.30 acres disturbed) is located at the northwest corner of Community College Drive and West Oakey Blvd. Oakey Blvd. borders the project site to the south and Community College Drive to the east. An existing parking lot borders the project site to the north and an existing fire station borders the project site to the west. The site occupies a portion of the Southern Half (S1/2) of the Northeast Quarter (NE1/4) of Section 02, Township 21 South, Range 60 East, of the M.D.M., City of Las Vegas, Nevada. The project site occupies a portion of the parcel identified by Assessor's Parcel Number (APN) 163-02-601-005. Please refer to the copy of the Assessor's parcel map provided in Appendix C. The Vicinity Map for the subject site, in relation to the surrounding streets, is also provided as Figure 1 in Appendix C.

The project site currently has existing buildings, a putting golf course, concrete walkways, asphalt pavement (drive aisle) and some surface parking south of the surrounding existing buildings as constructed per the approved "Technical Drainage Study for Opportunity Village" (DS 521), hereinafter will be referred to as the Original study. Our project site is proposing to grade and match the existing surrounding boundaries and meet the intent of the previously approved drainage study. Thus, the revised Grading Plan maintains the same drainage scheme per the approved technical drainage study.

Hydrologic Analysis and Calculations

Existing Condition

The Original Study (site is already constructed) has already analyzed the developed conditions hydrology and hydraulics of all the watersheds tributary to the site. In addition, the developed condition analyzed in the Original study depicts the current condition (existing) of the site, and the hydraulic design of the site as constructed is based on the results of the developed condition hydrology. Thus, no significant onsite flows are being conveyed through the existing parking surrounding the proposed buildings. In addition for our site, the construction of the proposed Building expansion will not alter the established drainage patterns. We are also matching the existing finish floors. Therefore, no additional hydrologic or hydraulic analyses are being provided for the proposed Buildings.

The Original Study analyzed Oakey Blvd. flows from the west as far as Canyon Gate Country Club. Flow from that development and runoff from the area between Durango Drive and Torrey Pines Drive and between Charleston Blvd. and Sahara Avenue drain to the Opportunity Village site. This was a "worst case" scenario at the time (1990). The offsite area was determined to be approx. 950 acres at this time.

Since the approval of the Original Study, a **201 ac-ft. Oakey Detention Basin** located at the southwest corner of Oakey Blvd. and Torrey Pines Drive has since been constructed. The “City Wide Hydrology Study Update – 1997” flows reflect the detention basin as being constructed since the flows (17/42cfs) shown on Figure E-14 (City Wide Hydrology Study Update – 1997) have been significantly reduced in Oakey Blvd. since the approval of the Original Study.

A more recently approved “Technical Drainage Study for SNAMHS – 150 Bed Psychiatric Hospital” (Ref. 6), that is just downstream of our site, utilized the revised flows from the City Wide Hydrology Study Update - 1997 (17/42cfs) in Oakey Blvd. The flow rates in Oakey Blvd. utilized in the approved Study (Ref. 6) were shown at the intersection of Oakey Blvd. and Community College Dr., which is at the southeast corner of our site. The Study (Ref. 6) adopted these flows at our subject site to be conservative. Please note that the more recent “City of Las Vegas Central Neighborhood Flood Control Master Plan – Spring 2004” shows Oakey Blvd. to have 20/29cfs in the street along our site in the 10 and 100 year storm events. To be conservative (based on 100yr storm), we are utilizing the 17/42cfs (existing/developed) in Oakey Blvd at the southeast corner of our site for our design.

From the Original Study, basins ‘C’ and ‘D’ represented the onsite basins. Basin ‘C’ (approx. 4.29ac.) consists of the majority of the site except for the northeast corner of the site. Basin C was analyzed with a curve number of 96 and produces 6 and 12cfs in the 10 and 100 year storm events that discharges east through the onsite drive aisle to Community College Drive. The flow will then continue south to Oakey Blvd. due to a high point adjacent to our site. Basin ‘D’ (approx. 1.80ac.) is the northeast portion of the site and discharges 2/4cfs for the 10 and 100 year storm events respectively. The flow continues east to Community College Drive and continues north due to a high point adjacent to our site. We have illustrated our subject site in reference to the approved onsite basins in our Figure DR2 (Developed Drainage Plan). The site is clearly depicted to show the boundaries of our site in respect to the approved basins onsite. Since the developed conditions of the Original Study represent the existing condition for the subject project site, we will not be providing an existing hydrologic analysis.

As previously stated, the developed condition analyzed in the previous study depicts the current condition (existing) of the site, and the hydraulic design of the site as constructed is based on the results of the developed condition hydrology. Unfortunately, due to the Study being old (1990), we could not find a proposed drainage exhibit from the approved study DS 521. However, the text portion of the Original Study and a drainage exhibit from a separate reference study clarified the onsite basin delineation for the Opportunity Village (Original Study) developed conditions. A site visit also clarified the drainage patterns on the site.

Normal depth calculations (from Ref. 6) have been provided for Oakey Blvd. (Section 1) from Ref. 6 along the project site using the existing flows (17/42cfs). As shown in the attached referenced Flow Master output, flows meet the maximum allowable velocity x depth ($v \times d$) values of 6.0 and 8.0 in existing and developed conditions at Section 1 during the 10 and 100-year storm events, respectively. The flows within Oakey Blvd. meet the minimum 12-ft dry lane requirement during the 10-year storm events for both existing and developed conditions. Please note that the 17/42cfs includes the Opportunity Village site onsite flow.

Proposed Condition

In the proposed conditions, we have included Figure DR2 (Developed Drainage Plan). We have delineated Basins ND1 (1.43ac.), ND2 (1.34ac.), ND3 (1.52ac.), ND4 (1.24ac.) and offsite basin FD1 (0.26ac.). Basins ND1, ND2, ND3 and ND4 make up the previously approved onsite basins 'C' and 'D' from the previously approved proposed Ref. 5 basin map from the "TDS for Opportunity Village".

Basins ND1 (3/5cfs) and ND2 (3/5cfs) discharges east along the southern portion of the site before discharging into Community College Drive just north of Oakey Blvd, following the historical drainage pattern. The proposed buildings and boundary on our parcel consists of the hydrologic cover type (commercial and pavement) as analyzed in the Original Study. The Original Study used curve numbers of 96 for their onsite basins. Our curve number calculations used for the onsite basins are a little more conservative (greater than 96-conservative). Please note these onsite basins follow their historical drainage pattern and the generated flow has not been increased from the Original Study. Basin 'C' from the Original Study discharged 6/12cfs to Community College Drive, while our analysis shows 6/10cfs (ND1 + ND2) discharging east to Community College Drive. Therefore, we are not negatively impacting the downstream properties at this location. The reason for the 2cfs discrepancy in the 100yr storm event is due to the northwest portion of the site (existing and developed conditions) is actually draining north to an adjacent existing parking lot and ultimately discharges east through the existing parking lot to Community College Drive.

Basin ND3 (2/4cfs) is the northwest portion of the site and this area discharges north through an existing chain-link gate to the adjacent site into the parking lot. The flow follows its historical drainage pattern. Basin ND4 (2/4cfs) follows its historical drainage pattern and discharges east toward an 8ft valley gutter that runs along Community College Drive. Due to the highpoint just south of the discharge point at Community College Drive, the flow will continue north and not impact our site, following its historical drainage pattern.

As shown in our Figure DR2, there is no change in grading patterns from the previously approved Original Study. We have matched the existing finish floors (2326.20ft) for the proposed buildings and expansion (FF=2326.20ft). A section 3 was performed using the worst case flows onsite (10cfs (ND1 + ND2) - conservative since this location is where onsite basin ND2 begins) and we have a depth of 0.35ft onsite. The highest adjacent flow line elevation at the upstream side of the proposed buildings is 2325.63ft, which meets the minimum 0.50ft beneath the FF elevations ($2326.20 - 2325.63 = 0.57\text{ft}$). Since the historical flow pattern for the onsite flow discharges to Community College Drive already, we feel we are not negatively impacting Community College Drive since all of the discharge locations remain the same for the entire site. The flows have remained the same along Oakey Blvd. There is no negative impact since the whole offsite area is already developed and the onsite flow continues to follow its historical drainage pattern.

For the determination of Oakey Blvd. flows, we have adopted the approved "*Technical Drainage Study for SNAMHS-150 Bed Psychiatric Hospital*," (located just east of our site) which was prepared by The WLB Group and was approved by the City of Las Vegas (CLV). Please note that we could not find the actual approval letter for this Approved Study on the CLV link website.

Since the approval of the Study (Ref. 6), the City of Las Vegas provided a more recent "*Central Neighborhood Study*" (Figure E-14) that has revised street flows (existing conditions) for Oakey Blvd. adjacent to our site. As shown in the referenced Figure E-14 of the Central Neighborhood Study, the subject site is located within basin OK03. The flow rates in Oakey Blvd. are shown in the referenced Central Neighborhood Study to be 20 and 29cfs during the 10-year and 100-year storm events respectively. These flow rates are not utilized for our Study for the hydrologic and hydraulic analyses for Oakey Blvd. and instead we have utilized the Ref. 6 flows (17/42cfs) to be conservative based on the 100yr storm. Please note the flow rates we are utilizing are conservative (for the 100yr storm event). Thus, for Oakey Blvd. flows, we have adopted the referenced flows (existing and developed) at the southeast corner of our project site. Please note that finished floors on site are not a minimum 18-inches above the street centerline or the top-of-curb elevations. This is also an existing condition. We have provided some protection from Oakey Blvd. street flows by grading a landscaped swale along the north side of Oakey Blvd that protects our site from any street flows (D100 = 0.55ft).

For the determination of Community College Drive, we have delineated a FD1 basin (0.26acres). There is an existing high point just east of our site. Therefore there is very minimal flow affecting our site in this street. The flow discharging south to Oakey Blvd from basin FD1 is 1/1cfs for the 10 and 100 year storm events. This flow combines with ND1 and ND2 flow at the driveway before discharging south to Oakey Blvd.

Normal depth calculations have been provided for Oakey Blvd. (Section 1) along the project site using the 17/42cfs for the existing and developed conditions in the 10 and 100 year storm events. As shown in the attached referenced Flow Master output, flows do meet the maximum allowable velocity x depth ($v \times d$) values of 6.0 and 8.0 in existing/developed conditions at Section 1 during the 10 and 100-year storm events, respectively. In the existing/developed condition, flows within Oakey Blvd. do meet the minimum 12-ft dry lane requirement during the 10-year storm events.

Normal depth calculations have been provided for Community College Drive (Section 2) along the project site using the existing/developed flows from the already developed basin FD1 (1/1cfs). Please note that we did not use the concentration point CMD1 flows (6/11cfs) for Community College Drive due to the fact that once these flows reach Community College Drive, they almost immediately get to Oakey Blvd and does not impact our site due to the discharge location of the flow. As shown in the attached Flow Master output, flows do meet the maximum allowable velocity x depth ($v \times d$) values of 6.0 and 8.0 in existing conditions at Section 2 during the 10 and 100-year storm events, respectively. In the existing/developed condition, flows within Community College Drive do meet the minimum 12-ft dry lane requirement during the 10-year storm events.

We have provided a developed HEC-1 analysis for the onsite basins, a Standard Form-4, curve number calculations, Firm exhibit, vicinity map, and hydraulic calculations. Please note our finished floors match the existing finish floors, but they are not a minimum 18 inches above the street centerline elevations. Also, the proposed FF does not satisfy the requirement of being double the 100-year flow depth (1.10ft) above Oakey Blvd. flow line. Please note that this is an Existing condition also. To accommodate this issue, we have built up a landscaped berm along Oakey Blvd. to protect the site. We will apply for a finish floor waiver if it is required. Please note we have reviewed and accepted the reference study flows. We have utilized their flows for both our Developed Onsite Drainage Plan (DR2) and hydraulic calculations.

As shown in the revised Grading Plan, the FF elevations being proposed for the building expansion (Kitchen and Cafeteria) matches the existing finish floor elevation of 2326.20ft of the LIED building. All the revised grading around the building expansion matches the existing surrounding boundaries and meets the intent of the approved Grading Plan. Therefore, the drainage pattern remains the same as the previously approved Study.

Future Condition

In the future condition, all onsite and offsite drainage areas are considered to be fully developed. The referenced Central Neighborhood Study (Figure F-14) has analyzed flow rates in Oakey Blvd. for Ultimate Conditions. The flow rates in Oakey Blvd. are shown in Figure F-14 of the referenced City Wide Hydrology Study at the intersection of Oakey Blvd. and Torrey Pines St to be 7/16cfs for the 10 and 100 year storm events respectively. The Central Neighborhood Study also indicates that a 24-inch and 30-inch storm drain system exists in Oakey Blvd. that intercepts 13/13cfs of the surface runoff conveyed within Oakey Blvd. adjacent to the project site. Therefore, minimal flow will be adjacent to our site.

No hydraulic sections have been provided for Future conditions for Oakey Blvd. nor Community College Drive. Since Oakey Blvd. will have minimal flow adjacent to our site, we can assume Oakey Blvd. will meet the maximum allowable velocity x depth (v x d) values of 6.0 and 8.0 in future conditions at Section 1 during the 10 and 100-year storm events, respectively. In the future condition, flows within Oakey Blvd. will also meet the minimum 12-ft dry lane requirement during the 10-year storm events.

For Community College Drive, flows remain the same as in existing and developed conditions (1/1cfs). Community College Drive will meet the maximum allowable velocity x depth (v x d) values of 6.0 and 8.0 in future conditions at Section 2 during the 10 and 100-year storm events, respectively. In the future condition, flows within Community College Drive will also meet the minimum 12-ft dry lane requirement (excluding center turn lane) during the 10-year storm events.

Master Planning Information

The “2008 Las Vegas Valley Flood Control Master Plan Update”, as prepared by Post Buckley Schuh and Jernigan, Inc. (PBS&J), in association with Louis Berger Group and Parsons Brinckerhoff, for the Clark County Regional Flood Control District (CCRFCDD) illustrates the existing and proposed master planned facilities. The CCRFCDD facility exhibits and inventory tables were updated in 2013. As shown in Figure F-31 of the 2013 MPU, the site is bordered by existing CCRFCDD regional facilities (24” and 30” RCPs). Even though our site is adjacent to an existing facility, the subject update does not impact the existing regional facilities that run along Oakey Blvd south of our site. All the flow exits the site east onto Community College Drive.

Review of the 2008 MPU’s Figure H-31 indicates that the site is located within hydrologic soil groups C and D, defined as soils with “moderately high runoff potential” and “high runoff potential.” Review of the Natural Resources Conservation Service (NRCS) Web Soil Survey 2.0 (Reference 3) indicates that the site is located within soil numbers 610 and 152. As shown in the attached referenced information, soil type 152 is determined to be 100% soil type ‘D’. Soil type ‘D’ is defined as soils with “low infiltration rate, and high runoff potential”.

Soil type 610 was not shown on the Web Soil Survey as a certain soil type. We have used soil type "C" for this portion of the site referenced from Figure H-31.

Floodplain Information

The project site is covered by Flood Insurance Rate Map (FIRM) for the Clark County, Nevada, and incorporated areas, Community Panel Number: 32003C2165D, Effective Date: November 16, 2011 (Reference 4). The FIRM panel is not printed, as the panel is entirely within FEMA Flood Zone "X" (un-shaded), defined as: "*Areas determined to be outside the 0.2% annual chance floodplain*". Please refer to the attached Figure 2 for the location of the site on a portion of the FIRM Map Index.

Compliance with Regulations and Adopted Plans

The subject drainage study update is specifically provided as a support document to the proposed improvements and revised grading plan for the Opportunity Village Oakey Campus improvements. This Update is in conformance with the approved "*Technical Drainage Study for Opportunity Village*" (DS 521, by Martin & Martin). The drainage design associated with the proposed improvements is based on generally accepted engineering practices and is in compliance with the CCRFCD's "*Hydrologic Criteria and Drainage Design Manual*" and the 2008 MPU. The proposed improvements will not introduce negative impact to the existing drainage patterns. Please refer to the attached grading plan and details for further clarification of the proposed improvements. Street capacity calculations have been addressed in the Update. This Update is provided in support of the plan revision to incorporate the proposed building expansion.

Compliance with CCRFCD Best Management Practices (BMP)

Due to the site already being developed, we were not able to provide a BMP swale that discharges flow to Community College Drive, following the historical drainage pattern. There was not enough room for a 40ft swale.

References

1. Clark County Regional Flood Control District, "*Hydrologic Criteria and Drainage Design Manual*", August 1999.
2. Post Buckley, Schuh & Jernigan (PBS&J), Inc., in association with, Louis Berger Group and Parsons Brinckerhoff, "*2008 Las Vegas Valley Flood Control Master Plan Update, Volume 1 and II*", September 2008.
4. Federal Emergency Management Agency, "*Flood Insurance Rate Map; Community Panel Number 32003C2165D; Clark County, Nevada and Incorporated Areas*", Effective Date: November 16, 2011.
5. Martin & Martin, "*Technical Drainage Study for Opportunity Village*," approved by the City of Las Vegas on January 22, 1991 (DS 521).
6. WLB Group, "*Technical Drainage Study for SNAMHS – 150 Bed Psychiatric Hospital*," approved by the City of Las Vegas.

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

Sincerely,
LOCHSA ENGINEERING

Chris Blake, EI

**Peak Flow Summary
Developed Condition**

HEC-1 I.D.	Area (acres)	10-year Flow (cfs)	100-year Flow (cfs)
ND1	1.43	3	5
ND2	1.34	3	5
FD1	0.26	1	1
CMD1	-	6	11
ND3	1.52	3	6
ND4	1.24	2	4

(ND1 + ND2 + FD1)

Street Flow Summary
(Existing / Developed Condition)

10-year, 6-hour Storm

Street	Right of Way Width (ft)	Hydraulic Cross-Section Identifier	10-Year Flow [Q10] (cfs)	10-year Velocity [v] (fps)	10-year Flow Depth [d] (ft)	10-year Velocity x Depth [v x d]	Dry Lane Width (Within 1/2 ROW) (ft)
*Oakey Blvd.	80	1	17	3.51	0.41	1.44	19.00
Community College Dr.	90	2	6	2.62	0.43	1.13	24.50

*As referenced from the approved "TDS for SNAMHS - 150 Bed Psychiatric Hospital," DS3557

Street Flow Summary
(Existing / Developed Condition)

100-year, 6-hour Storm

Street	Right of Way Width (ft)	Hydraulic Cross-Section Identifier	100-Year Flow [Q10] (cfs)	100-year Velocity [v] (fps)	100-year Flow Depth [d] (ft)	100-year Velocity x Depth [v x d]
*Oakey Blvd.	80	1	42	3.92	0.55	2.16
Community College Dr.	90	2	11	2.72	0.52	1.41

*As referenced from the approved "TDS for SNAMHS - 150 Bed Psychiatric Hospital," DS3557

Hydraulic Sections
Existing/Developed Condition (100yr)

Hydraulic Section	Area (acres)	100-year Flow (cfs)	100-year Depth (ft)
3	-	10	.35

(ND1 + ND2)

APPENDIX A

Hydrologic Calculations

Opportunity Village Oakey Campus
CB
151161

151161

ti = 1.8 (1.1 - K) L ^α (0.5) / S ^α (1/3)	tc = ti + tt	LOCATION:	Onsite
K = 0.0132 CN - 0.39	tl = tLAG = 0.6 tc	HYDROLOGIC CONDITION:	Interim and Developed
tt = L / (60 V)		TRIAL:	Final Iteration

Curve Number Calculations
Opportunity Village Oakey Campus

Sub-Basin: ND1
Total Area: 1.43 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Crue Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	1.22	D	85%	98	83.3
Commercial and buisness	0.21	D	15%	95	14.3

Total: 1.43 - 100% - 97.6

Curve Number Calculations
Opportunity Village Oakey Campus

Sub-Basin: ND2
Total Area: 1.34 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Crue Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.54	D	40%	98	39.2
Commercial and buisness	0.80	D	60%	95	57.0

Total: 1.34 - 100% - 96.2

Curve Number Calculations
Opportunity Village Oakey Campus

Sub-Basin: ND3
Total Area: 1.52 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Crue Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	1.29	D	85%	98	83.3
Commercial and buisness	0.23	D	15%	95	14.3

Total: 1.52 - 100% - 97.6

Curve Number Calculations
 Opportunity Village Oakey Campus

Sub-Basin: ND4
Total Area: 1.24 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Curve Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.62	D	50%	98	49.0
Commercial and buisness	0.62	D	50%	95	47.5

Total: 1.24 - 100% - 96.5

Curve Number Calculations
Opportunity Village Oakey Campus

Sub-Basin: FD1
Total Area: 0.26 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Crue Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.26	D	100%	98	98.0

Total: 0.26 - 100% - 98.0

AVERAGE VELOCITY

Input Variables	Basin ND1	Basin ND2	Basin ND3	Basin ND4	Basin FD1	Output Variables				
Bottom Width, B (ft):	2.0	2.0	2.0	2.0	2.0					
Right Side Slope, Zr:	50	0	50	50	0					
Left Side Slope, Zl:	50	50	0	50	50					
Manning's n:	0.015	0.015	0.015	0.015	0.015					
Geometric Slope, So (ft/ft):	0.021	0.017	0.010	0.016	0.008					
Flowrate, Q (cfs) *:	2.5	2.5	3	2	0.5					0.000

Normal Depth, Yn (ft):	0.12	0.16	0.19	0.12	0.09					
Area of Flow, A, (sf):	1.01	0.94	1.31	0.95	0.38					
Velocity, V (fps):	2.46	2.67	2.29	2.10	1.33					
Wetted Perimeter, p (ft):	14.39	10.05	11.80	13.95	6.53					
Hydraulic Radius, Rh (ft):	0.07	0.09	0.11	0.07	0.06					
Free Surface Top Width, T (ft):	14.39	9.89	11.61	13.94	6.44					
Centroid, Y*, (ft):	0.05	0.06	0.07	0.04	0.04					

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

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.):					
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					
<i>Developing urban areas</i>					
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

**WRC
ENGINEERING**

REFERENCE:
SCS TR-55, USDA, June 1986.

**TABLE 602
1 of 4**

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

SIX-HOUR STORM DISTRIBUTIONS

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

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

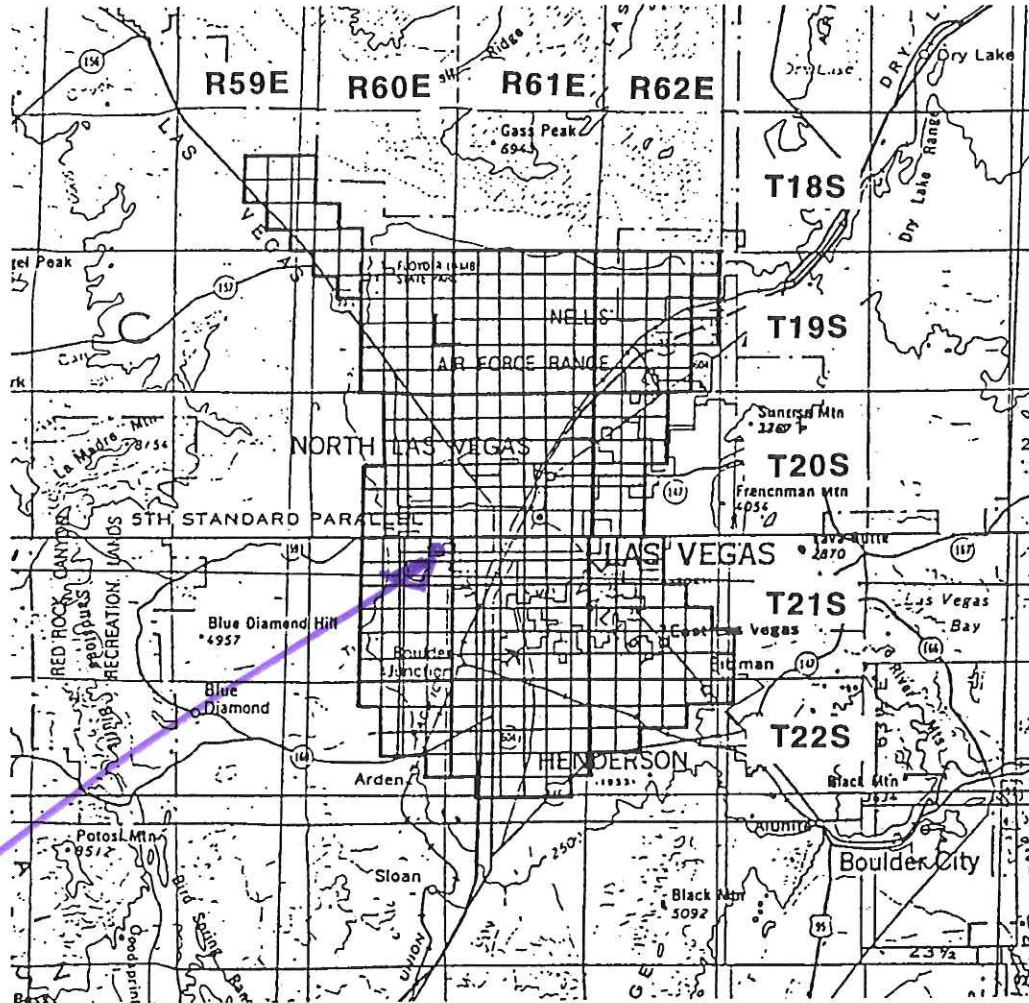
Revision	Date

REFERENCE:

TABLE 503

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

McCARRAN AIRPORT RAINFALL AREA



PROJECT
SITE

SECTION 2

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

Notes:

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

Revision	Date

WRC
ENGINEERING

REFERENCE:

USACE, Los Angeles District, 1988

FIGURE 513

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

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

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

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

Revision	Date

**WRC
ENGINEERING**

REFERENCE:

USACE, Los Angeles District, 1988

TABLE 505



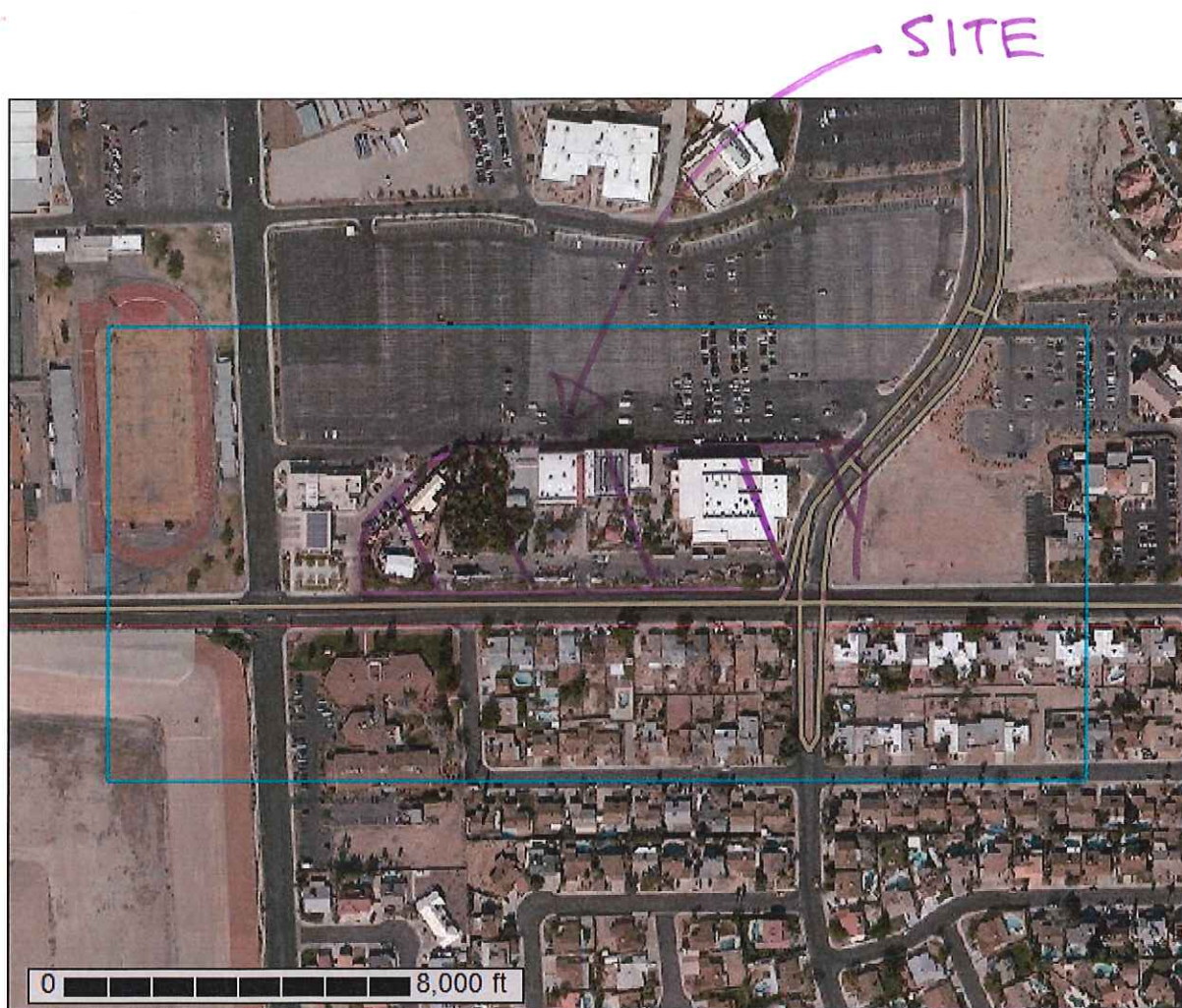
United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

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

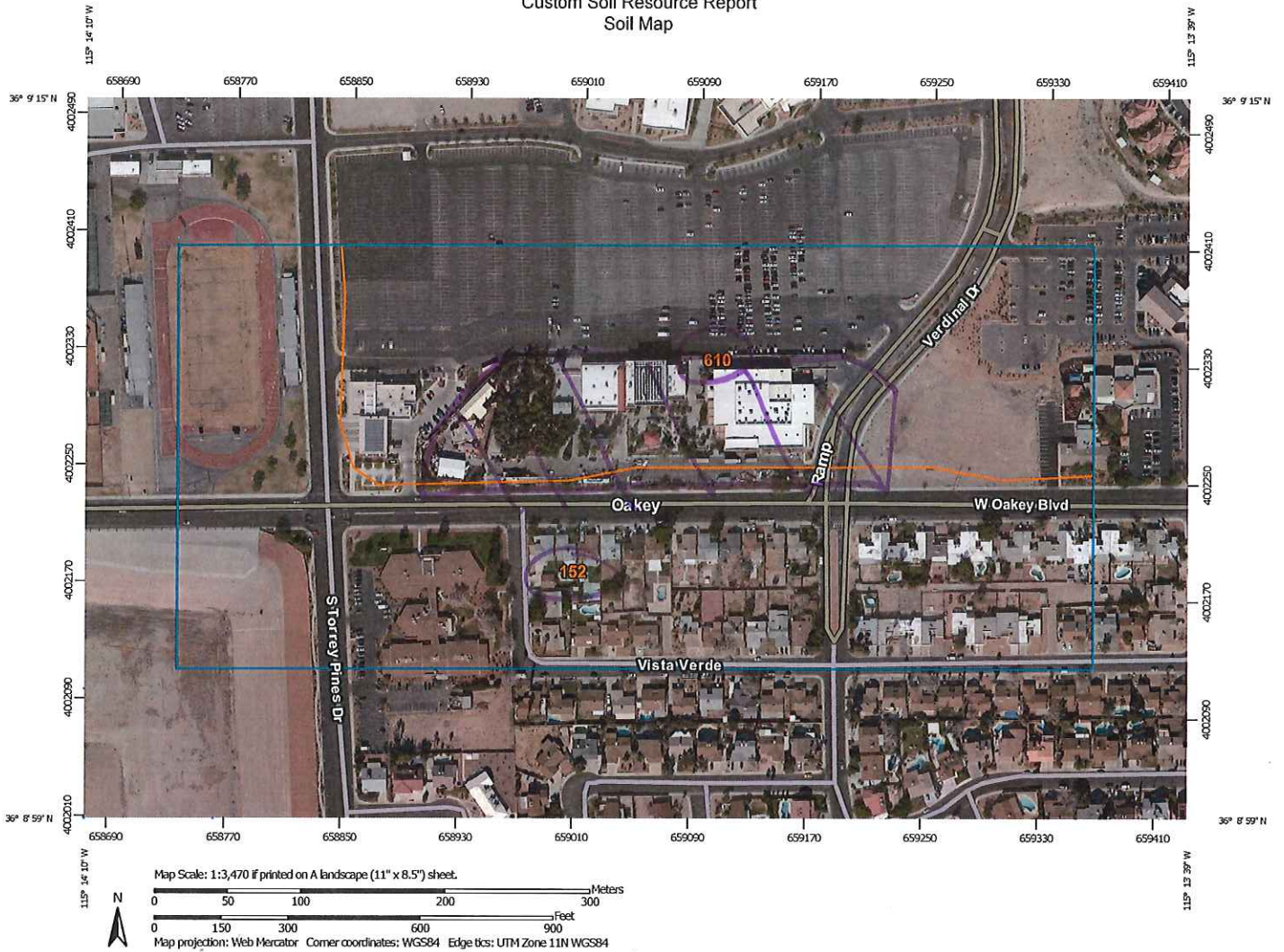
Custom Soil Resource Report for Las Vegas Valley Area, Nevada, Part of Clark County



July 18, 2016

610 + 152
(85%) (15%)

Custom Soil Resource Report
Soil Map



Map Unit Legend

Las Vegas Valley Area, Nevada, Part of Clark County (NV788)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
152	Cave gravelly fine sandy loam, 0 to 4 percent slopes	25.2	55.7%
610	Pits, gravel	20.1	44.3%
Totals for Area of Interest		45.3	100.0%

Map Unit Descriptions

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

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

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

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Las Vegas Valley Area, Nevada, Part of Clark County

152—Cave gravelly fine sandy loam, 0 to 4 percent slopes

Map Unit Setting

National map unit symbol: hr9v
Elevation: 2,000 to 4,800 feet
Mean annual precipitation: 4 to 12 inches
Mean annual air temperature: 57 to 70 degrees F
Frost-free period: 180 to 280 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Cave

Setting

Landform: Fan remnants
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Mixed alluvium

Typical profile

H1 - 0 to 12 inches: gravelly fine sandy loam
H2 - 12 to 36 inches: indurated
H3 - 36 to 60 inches: very gravelly sandy loam

Properties and qualities

Slope: 0 to 4 percent
Depth to restrictive feature: 4 to 20 inches to petrocalcic
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 40 percent
Gypsum, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 12.0
Available water storage in profile: Very low (about 1.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Other vegetative classification: LIMY 3-5" P.Z. (030XB019NV_3)

'D' Soil

610—Pits, gravel

Map Unit Composition

Pits: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pits

Setting

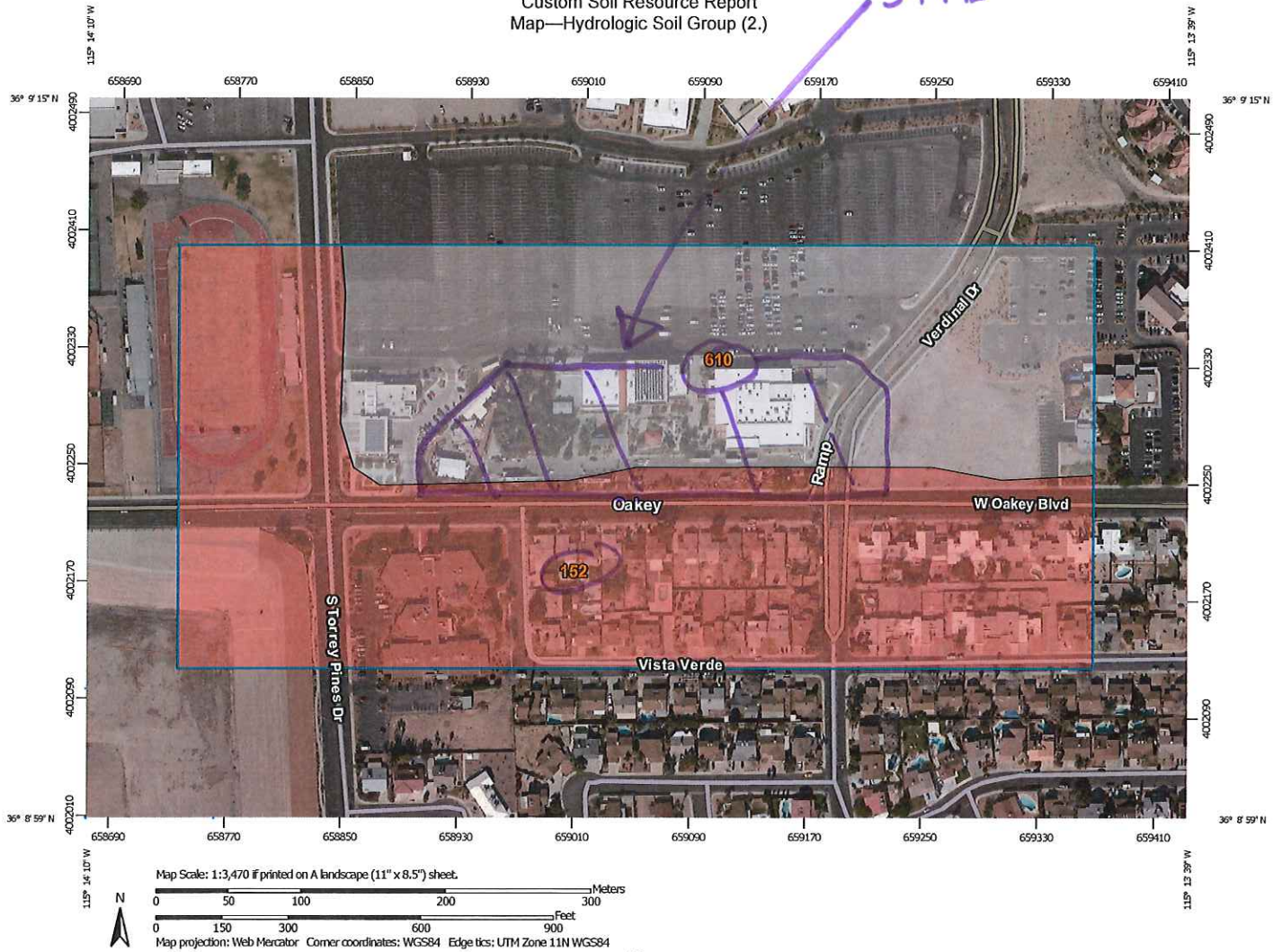
Landform: Hills

Down-slope shape: Linear

Across-slope shape: Convex

Custom Soil Resource Report
Map—Hydrologic Soil Group (2.)

SITE



Table—Hydrologic Soil Group (2.)

Hydrologic Soil Group— Summary by Map Unit — Las Vegas Valley Area, Nevada, Part of Clark County (NV788)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
152	Cave gravelly fine sandy loam, 0 to 4 percent slopes	D	25.2	55.7%
610	Pits, gravel		20.1	44.3%
Totals for Area of Interest			45.3	100.0%

Rating Options—Hydrologic Soil Group (2.)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Drainage Class (3.)

"Drainage class (natural)" refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized-excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained. These classes are defined in the "Soil Survey Manual."

HEC-1 Output

(Developed Conditions)

```

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
*   JUN 1998
*   VERSION 4.1
*
* RUN DATE 04AUG16 TIME 05:22:43
*
*****

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D

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

```

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

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

1

HEC-1 INPUT

PAGE 1

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LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
1          ID
2          ID
3          ID      TECHNICAL DRAINAGE STUDY FOR OPPORTUNITY VILLAGE OAKLEY CAMPUS
4          ID      DEVELOPED CONDITION
5          ID      USING SCS METHODS AND KINEMATIC WAVE ROUTING
6          ID      MASTER PLAN ADJUSTED 6-HOUR RAINFALL AND STORM DISTRIBUTION
7          ID      LOCHSA JOB# 151161
8          ID
9          ID
10         ID      INPUT FILE NAME: D.DAT
11         ID
12         ID      AUGUST 2016
13         ID
14         ID      *****
15         ID      *****
16         ID      INSIDE MCCARRAN AIRPORT RAINFALL AREA
17         ID
18         ID      10 & 100 YEAR - 6 HOUR STORM EVENT
19         ID      PRECIPITATION BASED ON FIGURES 503 AND 506 OF THE HCDDM
20         ID
21         ID
22         ID      10-YEAR RAINFALL DEPTH = 1.58 INCHES
23         ID      100-YEAR RAINFALL DEPTH = 2.77 INCHES
24         ID
25         ID      10-YEAR RAINFALL DEPTH RATIO (JR CARD) = 1.58/2.77 = 0.57
26         ID
27         ID      *****
28         ID      *****
29         ID      *****
30         ID      *DIAGRAM
31         IT      5          73
32         IO      5          0
33         IN      5
34         JR      PREC      .5700      1.00
35         KK      ND1
36         KM      DEVELOPED ONSITE BASIN DRAINING EAST
37         PB      2.77
38         PC      0.0      .02      .057      .07      .087      .108      .124      .13      .13      .13
39         PC      .13      .13      .13      .133      .14      .142      .148      .158      .172      .181
40         PC      .19      .197      .199      .2      .201      .204      .214      .229      .241      .249
41         PC      .251      .256      .27      .278      .281      .283      .295      .322      .352      .409
42         PC      .499      .59      .71      .744      .781      .812      .819      .835      .851      .856
43         PC      .86      .868      .876      .888      .91      .926      .937      .95      .97      .976
44         PC      .982      .985      .987      .989      .99      .993      .993      .994      .995      .998
45         PC      .998      .999      1.0
46         BA      .00223
47         LS      0          97.6
48         UD      .050
49         *

```

1

HEC-1 INPUT

PAGE 2

```

LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
48         KK      ND2
49         KM      DEVELOPED ONSITE BASIN DRAINING EAST
50         BA      .00209
51         LS      0          96.2
52         UD      .051
53         *
54         KK      FD1
55         KM      DEVELOPED OFFSITE BASIN DRAINING SOUTH (COMMUNITY COLLEGE DRIVE)
56         BA      .00041
57         LS      0          98.0
58         UD      .050
59         *

```

D

```

58      KK      CMD1
59      KM      SOUTHEAST CORNER OF SITE DISCHARGING INTO OAKLEY AND COMMUNITY COLLEGE DRIVE I
60      HC      3
      *

61      KK      ND3
62      KM      DEVELOPED ONSITE BASIN DRAINING NORTH INTO ADJACENT SITE IN EXISTING PARKING
63      BA      .00238
64      LS      0      97.6
65      UD      .050
      *

66      KK      ND4
67      KM      DEVELOPED ONSITE BASIN DRAINING EAST INTO COMMUNITY COLLEGE DRIVE
68      BA      .00194
69      LS      0      96.5
70      UD      .060
71      ZZ

```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

```

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

34      ND1
      .
48      .      ND2
      .
53      .      .      FD1
      .
58      CMD1 .....
      .
61      .      ND3
      .
66      .      .      ND4

```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```

1*****
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* JUN 1998 *
* VERSION 4.1 *
* RUN DATE 04AUG16 TIME 05:22:43 *
*****

```

```

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

```

TECHNICAL DRAINAGE STUDY FOR OPPORTUNITY VILLAGE OAKLEY CAMPUS
 DEVELOPED CONDITION
 USING SCS METHODS AND KINEMATIC WAVE ROUTING
 MASTER PLAN ADJUSTED 6-HOUR RAINFALL AND STORM DISTRIBUTION
 LOCHSA JOB# 151161

INPUT FILE NAME: D.DAT

AUGUST 2016

```

*****
*****
INSIDE MCCARRAN AIRPORT RAINFALL AREA

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

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

10-YEAR RAINFALL DEPTH RATIO (JR CARD) = 1.58/2.77 = 0.57
*****
*****

```

31 IO

```

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

```

IT

```

HYDROGRAPH TIME DATA
NMIN      5 MINUTES IN COMPUTATION INTERVAL
IDATE      1 0 STARTING DATE
ITIME      0000 STARTING TIME
NQ         73 NUMBER OF HYDROGRAPH ORDINATES
NDDATE     1 0 ENDING DATE
NOTIME     0600 ENDING TIME
ICENT      19 CENTURY MARK

COMPUTATION INTERVAL .08 HOURS
TOTAL TIME BASE 6.00 HOURS

```

ENGLISH UNITS

DRAINAGE AREA
 PRECIPITATION DEPTH
 LENGTH, ELEVATION
 FLOW
 STORAGE VOLUME
 SURFACE AREA
 TEMPERATURE

SQUARE MILES
 INCHES
 FEET
 CUBIC FEET PER SECOND
 ACRE-Feet
 ACRES
 DEGREES FAHRENHEIT

D

JP MULTI-PLAN OPTION
 NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
 RATIOS OF PRECIPITATION
 .57 1.00

1

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

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION	
					RATIO 1 .57	RATIO 2 1.00
HYDROGRAPH AT +	ND1	.00	1	FLOW TIME	3. 3.50	5. 3.50
HYDROGRAPH AT +	ND2	.00	1	FLOW TIME	3. 3.50	5. 3.50
HYDROGRAPH AT +	FD1	.00	1	FLOW TIME	1. 3.50	1. 3.50
3 COMBINED AT +	CMD1	.00	1	FLOW TIME	6. 3.50	11. 3.50
HYDROGRAPH AT +	ND3	.00	1	FLOW TIME	3. 3.50	6. 3.50
HYDROGRAPH AT +	ND4	.00	1	FLOW TIME	2. 3.50	4. 3.50

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

APPENDIX B

HYDRAULIC ANALYSIS

HYDRAULIC CALCULATIONS

Normal Flow Depth Calculations for
Community College Dr. (10/100yr-Existing/Developed)

Onsite Section 3

Community College Dr. - 10yr Existing/Developed Worksheet for Irregular Channel

Project Description	
Worksheet	Community College Dr. - 10yr Existing/
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	.008000 ft/ft
Discharge	6.00 cfs

CMD1 Flow

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

Results	
Mannings Coefficient	0.014
Water Surface Elev	0.43 ft
Elevation Range	0.00 to 1.42
Flow Area	2.3 ft ²
Wetted Perimeter	16.40 ft
Top Width	15.76 ft
Actual Depth	0.43 ft
Critical Elevation	0.45 ft
Critical Slope	0.005310 ft/ft
Velocity	2.62 ft/s
Velocity Head	0.11 ft
Specific Energy	0.53 ft
Froude Number	1.21
Flow Type	Supercritical

d₁₀

v₁₀

$$d \times v = .43 \times 2.62 = \underline{\underline{1.13 < 6 \text{ OK}}}$$

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.013
0+07.00	0+44.50	0.016
0+44.50	0+59.50	0.013
0+59.50	0+83.00	0.016
0+83.00	0+90.00	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

**Community College Dr. - 10yr Existing/Developed
Worksheet for Irregular Channel**

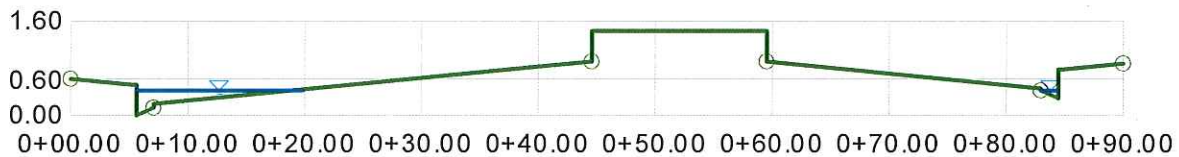
Natural Channel Points	
Station (ft)	Elevation (ft)
0+44.50	0.92
0+44.50	1.42
0+59.50	1.42
0+59.50	0.92
0+83.00	0.45
0+83.00	0.41
0+84.50	0.28
0+84.50	0.78
0+85.00	0.78
0+90.00	0.88

Community College Dr. - 10yr Existing/Developed Cross Section for Irregular Channel

Project Description	
Worksheet	Community College Dr. - 10yr Existing/Dev.
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.014
Slope	0.008000 ft/ft
Water Surface Elev	0.43 ft
Elevation Range	.00 to 1.42
Discharge	6.00 cfs

$$\text{dry lane} = \frac{.92 - .43}{.02} = 24.50 \text{ ft} \geq 19 \text{ ft OK} \checkmark$$



V:5.0
H:1
NTS

Community College Dr. - 100yr Existing/Developed Worksheet for Irregular Channel

Project Description

Worksheet	Community College Dr. - 100yr Existing / Dev.
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data

Slope	.008000 ft/ft
Discharge	11.00 cfs

CMD1 Flow

Options

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

Results

Mannings Coefficient	0.014
Water Surface Elev	0.52 ft
Elevation Range	0.00 to 1.42
Flow Area	4.0 ft ²
Wetted Perimeter	25.69 ft
Top Width	24.86 ft
Actual Depth	0.52 ft
Critical Elevation	0.54 ft
Critical Slope	0.005598 ft/ft
Velocity	2.72 ft/s
Velocity Head	0.12 ft
Specific Energy	0.63 ft
Froude Number	1.19
Flow Type	Supercritical

← d₁₀₀

← v₁₀₀

$$d \times v = .52 \times 2.72 = \underline{\underline{1.41 < 8 \text{ OK}}}$$

Calculation Messages:
Flow is divided.

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.013
0+07.00	0+44.50	0.016
0+44.50	0+59.50	0.013
0+59.50	0+83.00	0.016
0+83.00	0+90.00	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

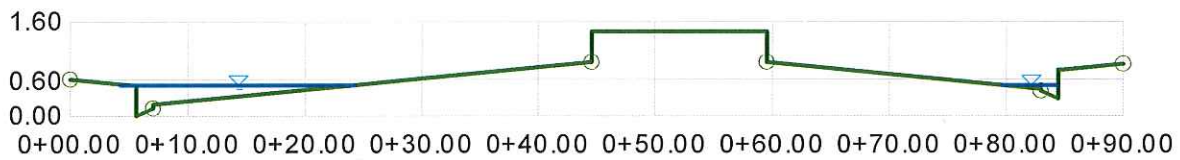
Community College Dr. - 100yr Existing/Developed Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+44.50	0.92
0+44.50	1.42
0+59.50	1.42
0+59.50	0.92
0+83.00	0.45
0+83.00	0.41
0+84.50	0.28
0+84.50	0.78
0+85.00	0.78
0+90.00	0.88

Community College Dr. - 100yr Existing/Developed Cross Section for Irregular Channel

Project Description	
Worksheet	Community College Dr. - 100yr Existing
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.014
Slope	0.008000 ft/ft
Water Surface Elev	0.52 ft
Elevation Range	.00 to 1.42
Discharge	11.00 cfs



V:5.0
H:1
NTS

Onsite Section #3 - 100yr (Worst Case) **Worksheet for Irregular Channel**

Project Description	
Worksheet	Onsite Section #3 - 100yr (Worst Case)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	.004000 ft/ft
Discharge	10.00 cfs

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

Results	
Mannings Coefficient	0.016
Water Surface Elev	25.98 ft
Elevation Range	25.63 to 26.70
Flow Area	5.5 ft ²
Wetted Perimeter	31.40 ft
Top Width	31.39 ft
Actual Depth	0.35 ft
Critical Elevation	25.94 ft
Critical Slope	0.006916 ft/ft
Velocity	1.83 ft/s
Velocity Head	0.05 ft
Specific Energy	26.03 ft
Froude Number	0.77
Flow Type	Subcritical

$$d \times v = .35 \times 1.83 = 0.64 < 6 \text{ OK} \checkmark$$

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+70.00	0.016

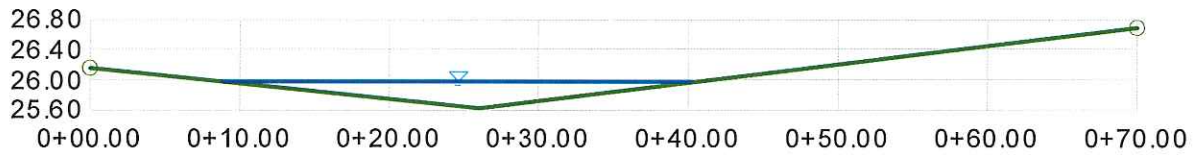
Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	26.16
0+26.00	25.63
0+70.00	26.70

Cross Section

Cross Section for Irregular Channel

Project Description	
Worksheet	Onsite Section #3 - 100yr (Worst)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.016
Slope	0.004000 ft/ft
Water Surface Elev	25.98 ft
Elevation Range	25.63 to 26.70
Discharge	10.00 cfs

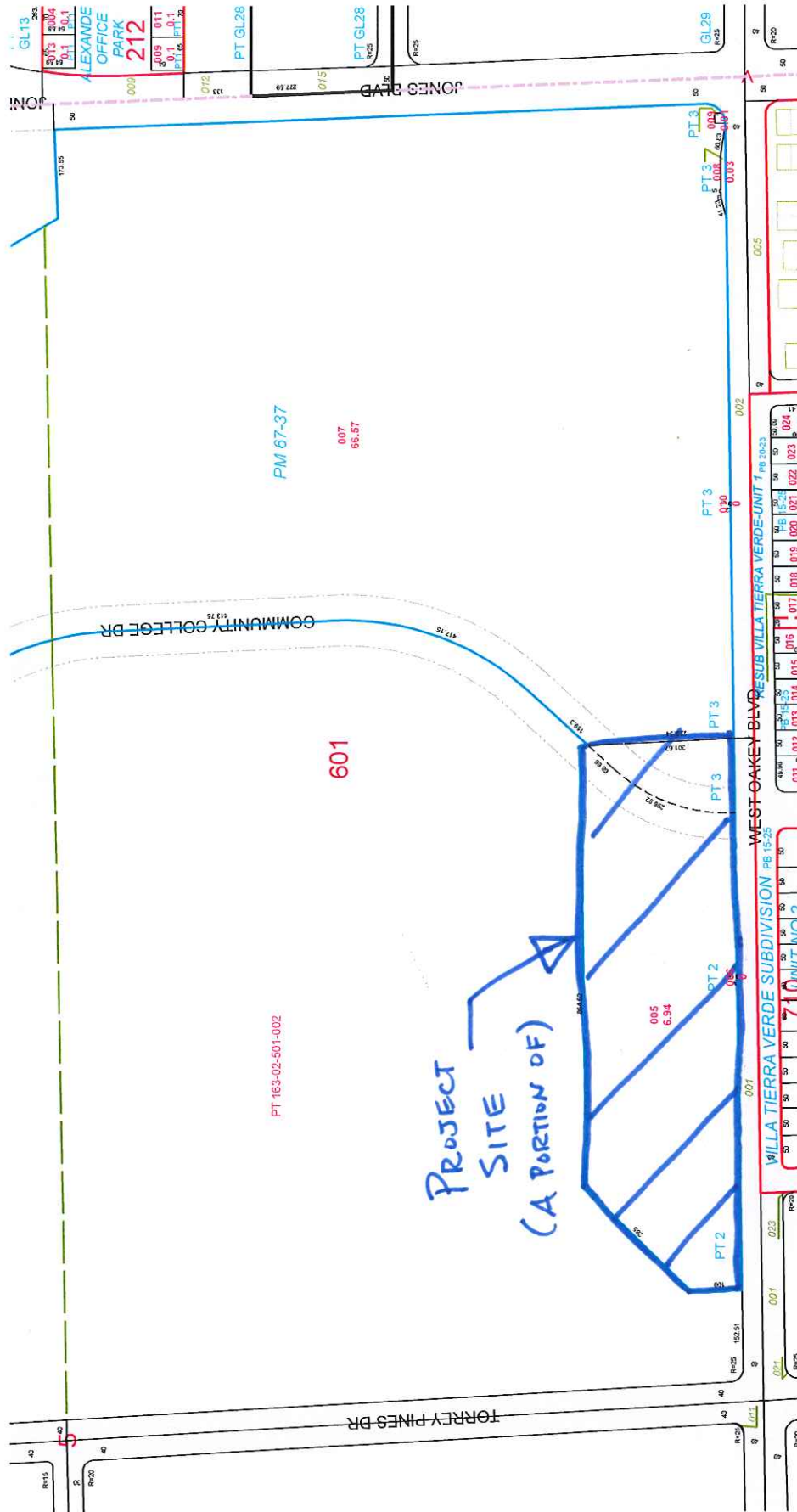


V:5.0
H:1
NTS

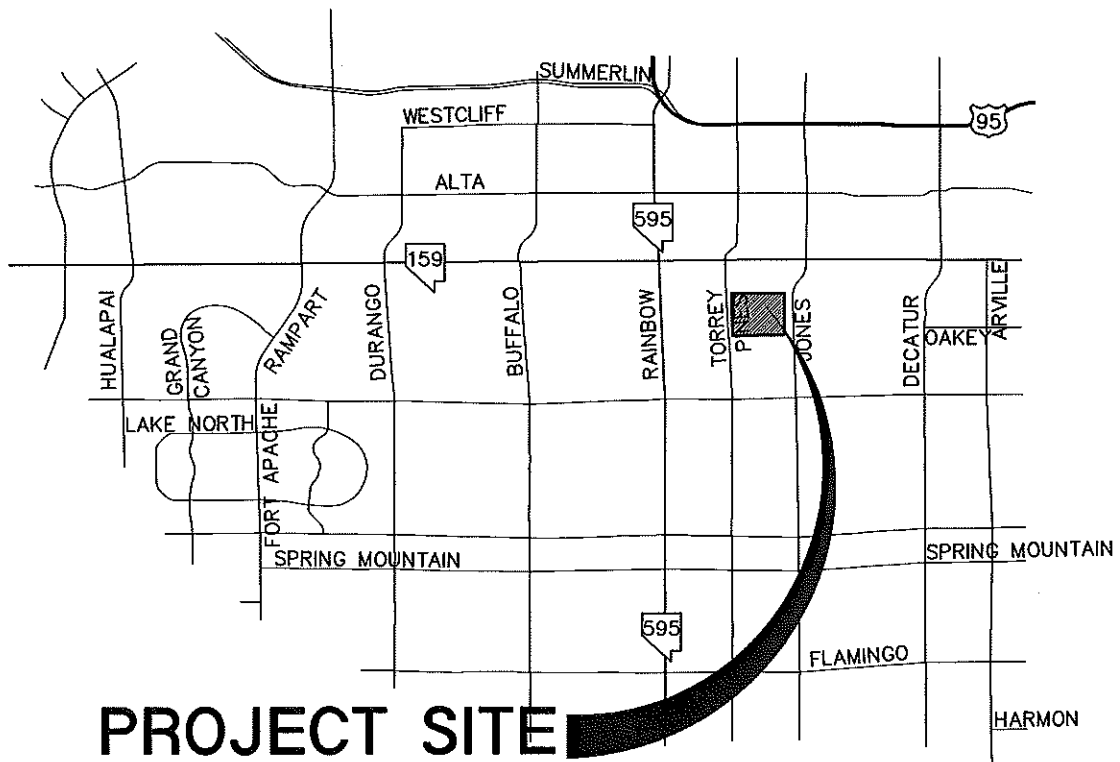
APPENDIX C

FIGURES

NOTES		MAP LEGEND	
This map is for assessment. Use only and does NOT represent a survey. No liability is assumed for the accuracy of the data delineated herein. Information on roads and other non-assessed parcels may be obtained from the Road Document Listing in the Assessor's Office. This map is compiled from official records, including surveys and deeds, but only contains the information required for assessment. See the recorded documents for more detailed legal information.		USE THIS SCALE(FEET) WHEN MAP REDUCED FROM 11x17 ORIGINAL	
ASSESSOR'S PARCELS - CLARK CO., NV. Michele W. Shafe - Assessor			
T21S R60E SEC. 2 BOOK		CONDOMINIUM UNIT AIR SPACE POL RIGHT OF WAY POL SUB-SURFACE POL MATCH / LEADER LINE HISTORIC SUB BOUNDARY HISTORIC PLAT BOUNDARY SECTION LINE	
PARCEL BOUNDARY SUB BOUNDARY PLAT BOUNDARY FENCE EASEMENT ENCROACHMENT ADJACENT UNASSESSED PARCEL ADJACENT ASSESSED PARCEL ADJACENT ROAD		001 ROAD PARCEL NUMBER 001 PARCEL NUMBER 1.00 ACREAGE 202 PARCEL SUB/SEQ NUMBER PB 24-45 PLAT RECORDING NUMBER 5 BLOCK NUMBER LOT NUMBER GUS. SEV. LOT NUMBER	
126 125 124 123 137 138 139 140 184 183 182 181 175 176 177 178		8 4 3 4 5 1 5 1 6 2 6 2 7 3 7 3 8 4 8 4 5 1 5 1	
MAP		S 2 NE 4 163-02-6	



TAX DIST 200



**FIGURE 1
VICINITY MAP**

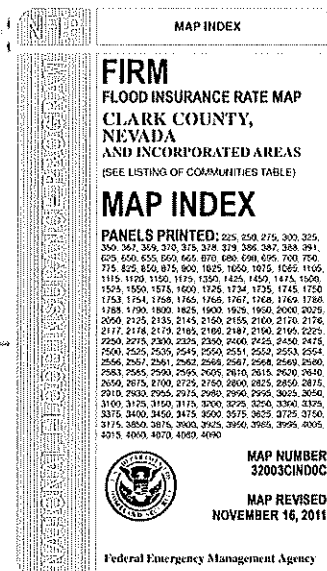
**OPPORTUNITY VILLAGE
OAKLEY CAMPUS**

PROJECT No.:
151161

SHEET No.

FIG1

SHEET 1 OF 1

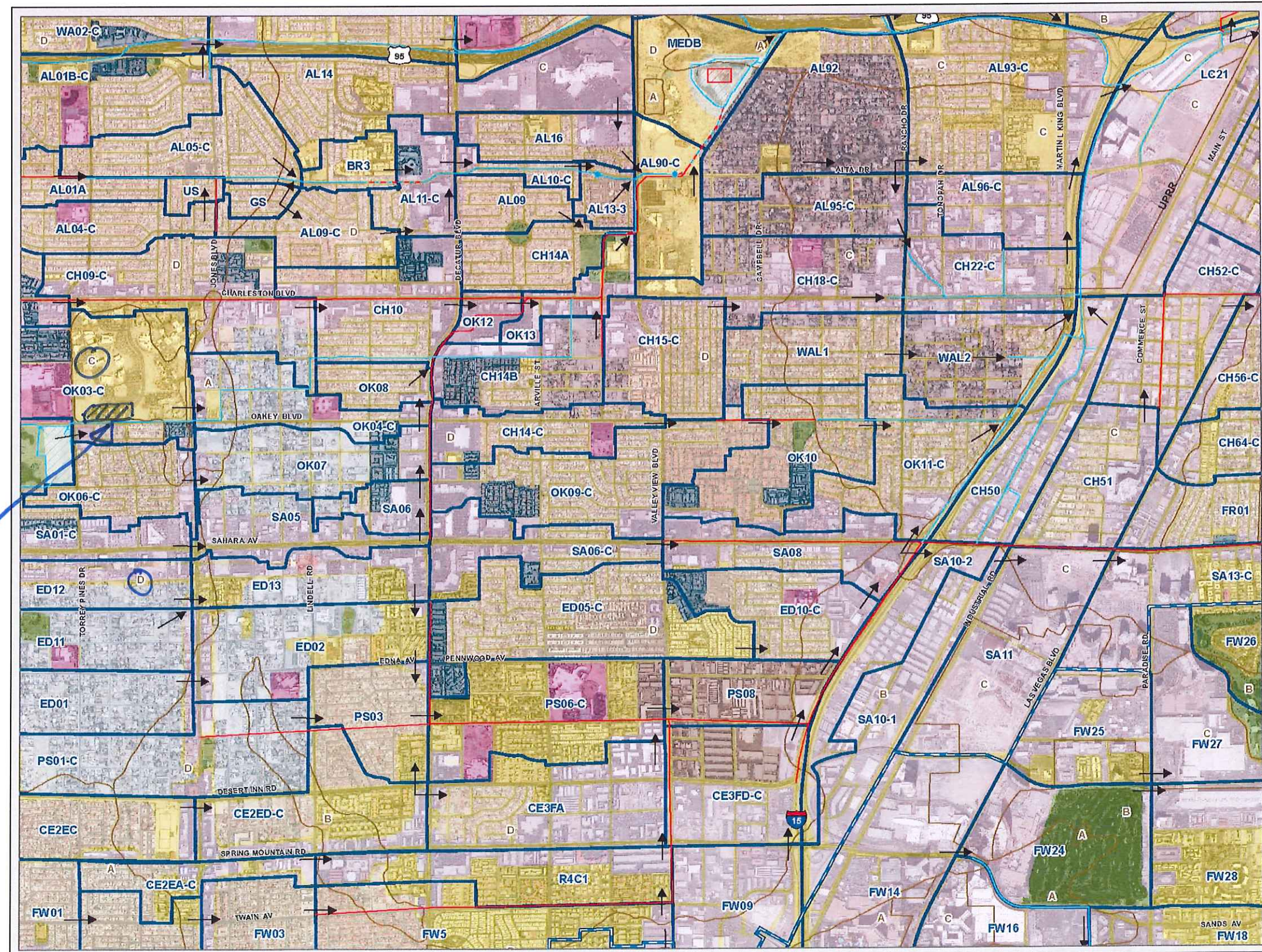


SHEET 1 OF 1



2008
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE
FIGURE H-31
HYDROLOGIC SUMMARY

- LEGEND**
- Ultimate Development Boundary
 - Watershed Boundary
 - Subbasin Boundary
 - Drought Ordinance Boundary
 - Flow Arrows
- Flood Control Facilities**
- Existing Facilities
 - Category A Proposed Facilities
 - Category B Proposed Facilities
 - Category A Remove & Replace/Parallel Facilities
 - Category B Remove & Replace/Parallel Facilities
- Hydrologic Soil Groups**
- A Low Runoff Potential
 - B Moderately Low Runoff Potential
 - C Moderately High Runoff Potential
 - D High Runoff Potential/Rock Outcrops
- Typical Land Use**
- 1 Undeveloped Land, Open Desert
 - 2 Parks, Golf Courses
 - 3 Rural
 - 4 / 14* Low Density Residential
 - 5 / 15* Medium Density Residential
 - 6 / 16* High Density Residential
 - 7 / 17* Public Facility, Residential
 - 8 / 18* Very High Density Residential
 - 9 / 19* Commercial, Retail, Casino, High Rise Condominiums
 - 10 / 20* Light Industrial
 - 11 / 21* Heavy Industrial
 - 12 / 22* Schools
 - 13 Lakes
- * Drought Ordinance Applied
- Scale: 1 inch = 2,000 feet
Refer to Figure G-2 for Aerial Source(s)



PROJECT
SITE
(C' & D'
SOIL)





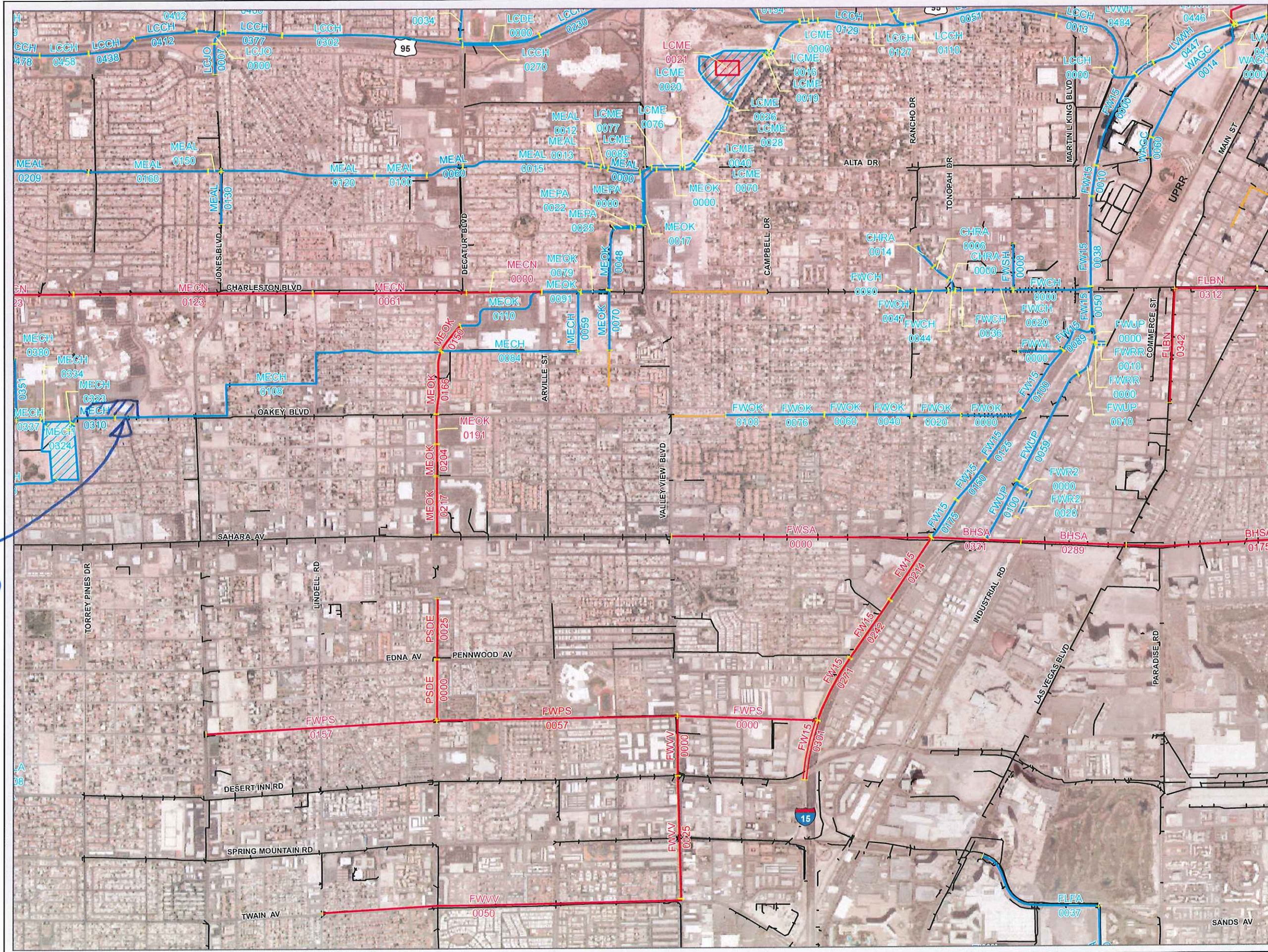
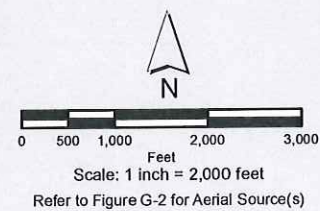
2013
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE

**FIGURE F- 31
FLOOD CONTROL FACILITIES**

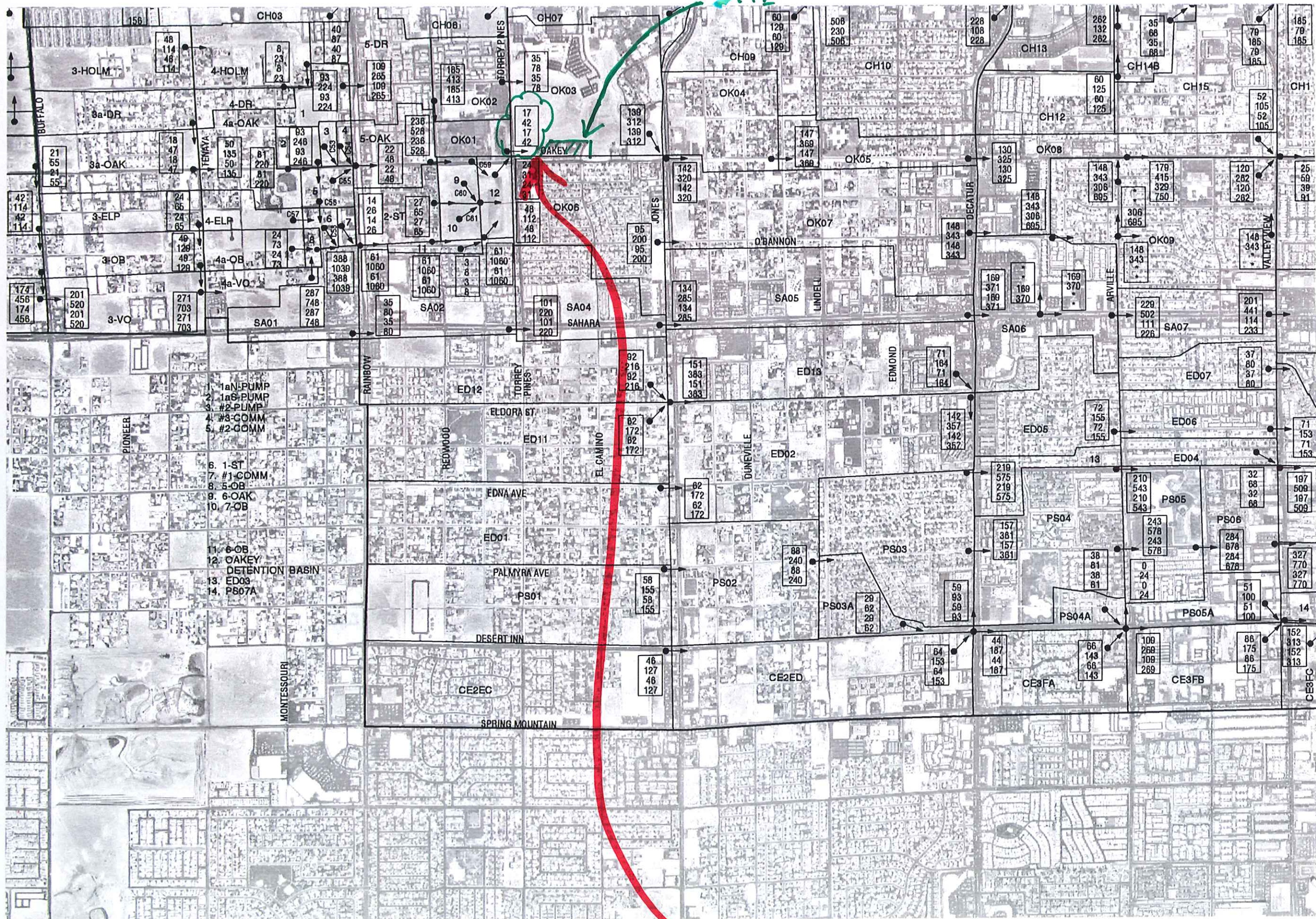
LEGEND

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

- Stormdrain
 - Lined Channel
 - Unlined Channel
 - Levee/Dike
 - Natural Wash/Floodway
 - ID-Mile Separator
- Remove & Replace/Parallel Facilities
- | Category A | Category B |
|------------|------------|
| Channel | Channel |
| Stormdrain | Stormdrain |



ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
BHSA 0175	P1	BOULDER HIGHWAY SAHARA AVENUE 14' X 14' RCB	6000	3837	CSA13	SW3	7.93	0.67
0289	P1	14' X 12' RCB	2300	3566	CSA11	SW3	7.55	0.87
0331	P1	14' X 11' RCB	2000	3232	CSA10-1	SW3	7.15	1.00
CHRA 0000	E	WEST CHARLESTON DRAINS - RANCHO 6' X 5' RCB	310	286	CAL95	SW3	0.62	1.92
0006	E	5' X 5' RCB	420	286	CAL95	SW3	0.62	1.00
0014	E	5' X 4' RCB	600	286	CAL95	SW3	0.62	1.50
FLBN 0281	P1	FLAMINGO - BOULDER HIGHWAY NORTH 10' X 7' RCB	1300	1259	CCH56	SW3	1.64	1.33
0312	P1	7' X 4' RCB	1800	555	CCH52	SW3	0.55	4.20
0342	P1	7' X 4' RCB	2500	555	CCH52	SW3	0.55	4.20
FLFA 0000	E	FLAMINGO - FASHION 12' X 5' RCB	2050	747	CFW17N	FLAM3A	0.72	0.28
0037	E	8' X 5' RCB	3060	526	FW14	FLAM3A	0.44	0.45
FW15 0000	E	FREEWAY CHANNEL FROM DESERT INN TO EXPRESSWAY 3: 12' X 10' RCB	2170	3728	CAL93	SW4	10.63	0.17
0010	E	3: 12' X 10' RCB	677	3403	CAL96	SW4	10.10	0.17
0038	E	3: 12' X 10' RCB	1945	3344	CCCH22	SW4	9.92	0.17
0050	E	3: 12' X 10' RCB	870	2813	CCH50	SW4	8.54	0.17
0089	E	3: 12' X 10' RCB	980	2448	CCWAL2	SW4	8.28	0.17
0100	E	3: 12' X 9' RCB	1575	2295	COK11C	SW3	7.83	0.17
0125	E	2: 10' X 8' RCB	1350	1450	DCCSA08	SW3	6.67	0.80
0150	E	2: 10' X 8' RCB	1067	1450	DCCSA08	SW3	6.67	0.80
0175	E	2: 10' X 8' RCB	985	1450	DCCSA08	SW3	6.67	0.75
0214	P1	2: 12' X 10' RCB	1610	4104	CED10-C	SW3	6.25	0.73
0242	P1	2: 12' X 9' RCB	1500	3968	CCPS08	SW3	6.03	0.93
0271	P1	2: 12' X 10' RCB	1520	3674	CPS08	SW3	5.59	0.59
0301	P1	Conc Chnl 12'W 4'D 2:1 SS	1300	433	CCE3FD-C	SW3	0.54	0.42
FWCH 0000	E	WEST CHARLESTON DRAIN 10' X 7' RCB	1710	1008	CCH22	SW3	1.38	0.74
0020	E	10' X 7' RCB	840	783	CCCH18-C	SW3	1.15	0.40
0036	E	9' X 7' RCB	425	783	CCCH18-C	SW3	1.15	0.40
0044	E	9' X 7' RCB	145	538	CCH18-C	SW3	0.53	0.40
0047	E	7' X 5' RCB	710	538	CCH18-C	SW3	0.53	2.05
0060	E	5' X 4' RCB	400	538	CCH18-C	SW3	0.53	0.40
FWOK 0000	E	OAKY DRAIN 10' X 8' RCB	1350	928	1COK11C	SW3	1.16	0.62
0020	E	10' X 8' RCB	1025	928	1COK11C	SW3	1.16	0.60
0040	E	8' X 8' RCB	960	721	COK10	SW3	0.85	1.00
0060	E	5' X 5' RCB	970	453	COK09-C	SW3	0.55	1.50
0076	E	6' X 6' RCB	1175	453	COK09-C	SW3	0.55	9.40
0100	E	6' X 6' RCB	980	453	COK09-C	SW3	0.55	1.98
FWPS 0000	P1	PALMYRA / SIRIUS DRAIN 12' X 11' RCB	3000	3240	CCPS06	SW3	4.88	1.50
0057	P1	10' X 10' RCB	5220	1941	CPS08	SW3	2.78	1.28
0157	P1	2: 66" RCP	5100	521	CPS03	SW3	0.60	1.15
FWR2 0000	E	FREEWAY CHANNEL - RAILROAD CHANNEL 5' X 5' RCB	377					1.60
0020	E	Earth Chnl 10'W 4'D 2:1 SS	650					0.50
FWRR 0000	E	FREEWAY CHANNEL BYPASS FACILITY RR BRANCH 48" RCP	70					1.22
0010	E	Conc Chnl 4'W 4'D 0:1 SS	220					1.22
FWSA 0000	P1	FREEWAY CHANNEL - SAHARA 7' X 5' RCB	5700	486	CSA08	SW3	0.42	1.49
FWSH 0000	E	SHADOW LANE DRAIN 7' X 4' RCB	950	253	CH22-C	SW3	0.23	0.20
FWUP 0000	E	FREEWAY CHANNEL BYPASS FACILITY 10' X 9' RCB	350	242	CH50	SW3	0.26	0.37
0010	E	10' X 8' RCB	804	242	CH50	SW3	0.26	0.37
0059	E	10' X 6' RCB	2680	242	CH50	SW3	0.26	0.40
0100	E	8' X 4' RCB	1440	242	CH50	SW3	0.26	0.47
FWVV 0000	P1	VALLEY VIEW DRAIN 12' X 11' RCB	1320	1475	CCE3FA	SW3	2.67	0.30
0025	P1	10' X 10' RCB	2665	1006	CR4C1	SW3	1.74	0.30
0050	P1	8' X 6' RCB	7785	712	DFW5	SW3	1.34	1.50
FWWL 0000	E	FREEWAY CHANNEL-WALDMAN AVENUE 6' X 6' RCB	1000	418	CWAL2	SW3	0.45	0.20
LCCH 0000	E	LAS VEGAS CREEK CHANNEL 2: 12' X 7' RCB	730	2894	CLC20-C	MEADOWS4	9.68	1.28
0013	E	2: 12' X 6' RCB	2035	2894	CLC20-C	MEADOWS4	9.68	0.82
0051	E	2:14' X 7' RCB	3113	2894	CLC20-C	MEADOWS4	9.68	0.80
0110	E	Transition Structure	220	2798	CCLC16-C	MEADOWS4	9.51	
0114	E	2: 14' X 7' RCB	670	2329	CRMEDET	MEADOWS4	8.25	0.80
0127	E	Transition Structure	110	2329	CRMEDET	MEADOWS4	8.25	
0129	E	2: 14' X 7' RCB	1130	2329	CRMEDET	MEADOWS4	8.25	0.50
0150	E	2: 13' X 7' RCB	200	2329	CRMEDET	MEADOWS4	8.25	0.95
0154	E	Transition Structure	190	2329	CRMEDET	MEADOWS4	8.25	
0157	E	2: 12' X 6' RCB	1650	1631	CCLC14-C	SW3	2.99	1.06
0230	E	12' X 6' RCB	2140	1381	CLC14-C	SW3	2.54	1.74
0270	E	12' X 6' RCB	1705	774	CCWA02-C	SW3	1.84	0.54
0302	E	8' X 6' RCB	3940	774	CCWA02-C	SW3	1.84	2.49
0377	E	10' X 7' RCB	1226	774	CCWA02-C	SW3	1.84	0.74
0400	E	Transition Structure	110	437	CWA02-C	SW3	1.47	0.49
0402	E	8' X 6' RCB @ Jones	535	437	CWA02-C	SW3	1.47	0.49
0412	E	60" RCP	1370	437	CWA02-C	SW3	1.47	1.08
0438	E	60" RCP	1090	162	CLC01-C	SW3	1.20	1.60
0458	E	60" RCP	1060	162	CLC01-C	SW3	1.20	1.60
0478	E	60" RCP	1110	162	CLC01-C	SW3	1.20	0.55
LCDE 0000	E	LAS VEGAS CREEK - DECATUR 6' X 5' RCB	1800	404	LC11-C	SW3	0.38	1.26
0034	E	72" RCP	700	404	LC11-C	SW3	0.38	0.50
LCJO 0000	E	LAS VEGAS CREEK - JONES 6' X 6' RCB	380	358	AL01B-C	SW3	0.37	0.50
0007	E	6' X 5' RCB	675	358	AL01B-C	SW3	0.37	0.62
LCME 0000	E	LAS VEGAS CREEK - MEADOWS 14' X 8' RCB	895	1423	MEADOWDB	SW3SC	5.67	0.72
0016	E	Stilling Basin	140	1423	MEADOWDB	SW3SC	5.67	0.21
0017	E	3,300 cfs Spillway (Replace w/ LCME0018)	3300		MEADOWIN	SW3SC	5.67	
0018	P1	Modify Spillway, raise height by 1' (Replaces LCME0017)	3300		MEADOWIN	SW3SC	5.67	
0019	E	1: 11' X 5' RCB and 1: 11.5' X 5' RCB	110	1423	MEADOWDB	SW3SC	5.67	0.81
0020	E	213 ac-ft Meadows Detention Basin	4713		MEADOWIN	SW3SC	5.67	
0021	P1	Upgrade to 235 ac-ft Meadows Detention Basin	4713		MEADOWIN	SW3SC	5.67	
0026	E	Energy Dissipator	110	4713	MEADOWIN	SW3SC	5.67	2.94
0028	E	Conc Chnl 42'W 9'D 0:1 SS	922	4713	MEADOWIN	SW3SC	5.67	0.40
0040	E	Conc Chnl 40'W 10'D 0:1 SS	525	4593	CAL90-C	SW3SC	5.44	0.40
0070	E	Conc Chnl 40'W 8.5'D 0:1 SS	255	4593	CAL90-C	SW3SC	5.44	0.40
0076	E	Free Span Bridge 18'W 8'D @ Alta	100	4441	CCAL16	SW3SC	5.27	1.89
0077	E	Conc Chnl 18'W 8'D 1:1 SS	618	4441	CCAL16	SW3SC	5.27	1.89
0085	E	10' X 6' RCB @ Valley View	275	1661	1CAL16	SW3	2.09	1.89
LCRA 0000	E	LAS VEGAS CREEK - RANCHO 12' X 8' RCB	380	783	CLC16-C	SW3	1.71	0.60
0004	E	12' X 6' RCB	2367	783	CLC16-C	SW3	1.71	0.77
LVOE 0345	P1	OWENS AVENUE - EAST 13' X 11' RCB	1685	2369	DLVOE	SW5	22.79	0.60
LVWH 0431	E	WASHINGTON AVENUE CHANNEL 3: 14.33' X 10' RCB	665	2870	DCLC21	SW5	22.79	0.15
0446	E	Junction Structure	69	2870	DCLC21	SW5	22.79	0.15
0447	E	3: 14.33' X 10' RCB	1955	4978	CCAL93	SW5	22.19	0.15
0484	E	Confluence Structure	455	4978	CCAL93	SW5	22.19	0.15
MEAL 0000	E	MEADOWS ALTA Conc Chnl 8'W 11'D 1:1 SS	700	1207	CAL13-3	SW3	1.48	1.58
0012	E	12' X 6' RCB @ Red Sky	160	1161	CAL10-C	SW3	1.42	3.03
0013	E	Conc Chnl 8'W 11'D 1:1 SS	320	1161	CAL10-C	SW3	1.42	3.03
0015	E	72" RCP	2500	1126	CAL11-C	SW3	1.38	1.94
0060	E	60" RCP	905	792	CBR3	SW3	1.08	1.00
0100	E	72" RCP	1160	792	CBR3	SW3	1.08	1.00
0120	E	60" RCP	3500	733	CAL05-C	SW3	1.01	1.00
0130	E	6' X 4' RCB	1150	186	AL04-C	SW3	0.18	0.40
0150	E	60" RCP	285	499	CCUS	SW3	0.74	1.40
0160	E	36" RCP	2600	331	CUS	SW3	0.56	1.25
0209	E	48" RCP	2500	150	DCR2	SW3	0.41	1.70
MECH 0059	E	EXTENSION OF MEADOWS / CHARLESTON 36" RCP	1310					0.25
0084	E	30" RCP	2960					1.26
0108	E	30" RCP	8550	32	OAKYOT	SW3	1.88	1.43
0310	E	24" RCP	1000	32	OAKYOT	SW3	1.88	1.43
0323	E	15" RCP Outlet	200	32	OAKYDB	SW3	1.88	
0324	E	201 ac-ft Oakley Detention Basin		1652	OAKYIN	SW3	1.88	
0334	E	11' X 6' RCB	200	573	C5-OAK-C	SW3	0.56	0.50
0337	E	9' X 6' RCB	520	573	C5-OAK-C	SW3	0.56	0.50
0338	E	10' X 8' RCB	2060	1131	C3A-OAKC	SW3	1.32	1.62
0351	E	90" RCP	1350	573	C5-OAK-C	SW3	0.56	0.50
MECN 0000	P1	MEADOWS - CHARLESTON 9' X 8' RCB	1570	1105	CCH10	SW3	1.00	1.09
0061	P1	8' X 7' RCB	3300	1105	CCH10	SW3	1.00	1.82
0123	P1	8' X 6' RCB	5200	821	CCH09-C	SW3	0.72	1.64
0223	P1	8' X 5' RCB	2700	422	CCH05-C	SW3	0.34	2.04
MEOK 0000	E	OAKY MEADOWS STORMDRAIN 19' X 7' RCB	900	2718	COK13	SW3SC	2.94	0.91
0017	E	19' X 8' RCB	1550	2718	COK13	SW3SC	2.94	0.80
0048	E	18' X 9' RCB	1700	2718	COK13	SW3SC	2.94	0.50
0070	E	7' X 6' RCB	1320	226	CH14B	SW3	0.22	0.44
0079	E	18' X 8' RCB	630	2450	COK12	SW3SC	2.62	0.50
0091	E	18' X 8' RCB	850	2450	COK12	SW3SC	2.62	0.50
0110	E	12' X 8' RCB	2304	1491	COK08	SW3	1.58	0.77
0150	P3	12' X 8' RCB	642	1491	COK08	SW3	1.58	0.77
0166	P3	12' X 9' RCB	1350	1491	COK08	SW3	1.58	0.45
0191	P3	12' X 7' RCB	660	957	COK07	SW3	0.93	0.71
0204	P3	12' X 6' RCB	655	957	COK07	SW3	0.93	0.71
0217	P3	12' X 5' RCB	1276	556	CSA06	SW3	0.52	0.44
MEPA 0000	E	MEADOWS PARALLEL 10' X 6' RCB	1370	259	CCH14A	SW3	0.25	0.50
0022	E	6' X 5' RCB	200	259	CCH14A	SW3	0.25	1.45
0025	E	78" RCP	470	259	CCH14A	SW3	0.25	1.16
PSDE 0000	P1	PALMYRA / SIRIUS DRAIN - DECATUR LATERAL 12' X 8' RCB	1330	1018	CED02	SW3	1.21	0.38
0025	P1	10' X 8' RCB	1320	598	CED13	SW3	0.65	0.25
WAGC 0000	E	WASHINGTON AVENUE CHANNEL - GRAND CENTRAL 2: 12' X 4' RCB	700	557	LC21	SW3	0.60</	



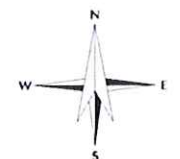
CITY WIDE HYDROLOGY STUDY UPDATE - 1997

LEGEND

- SUB-BASIN BOUNDARY
- FLOW ARROW
- 250 10-YEAR EXISTING FLOW
- 500 100-YEAR EXISTING FLOW
- 300 10-YEAR ULTIMATE FLOW
- 800 100-YEAR ULTIMATE FLOW

(FLOWS IN CFS)

NOTE:
Facility flows must be subtracted from flows shown to determine surface flows.
(See "F" sheets for facility flows)



1 INCH = 1600 FEET

FIGURE H-17

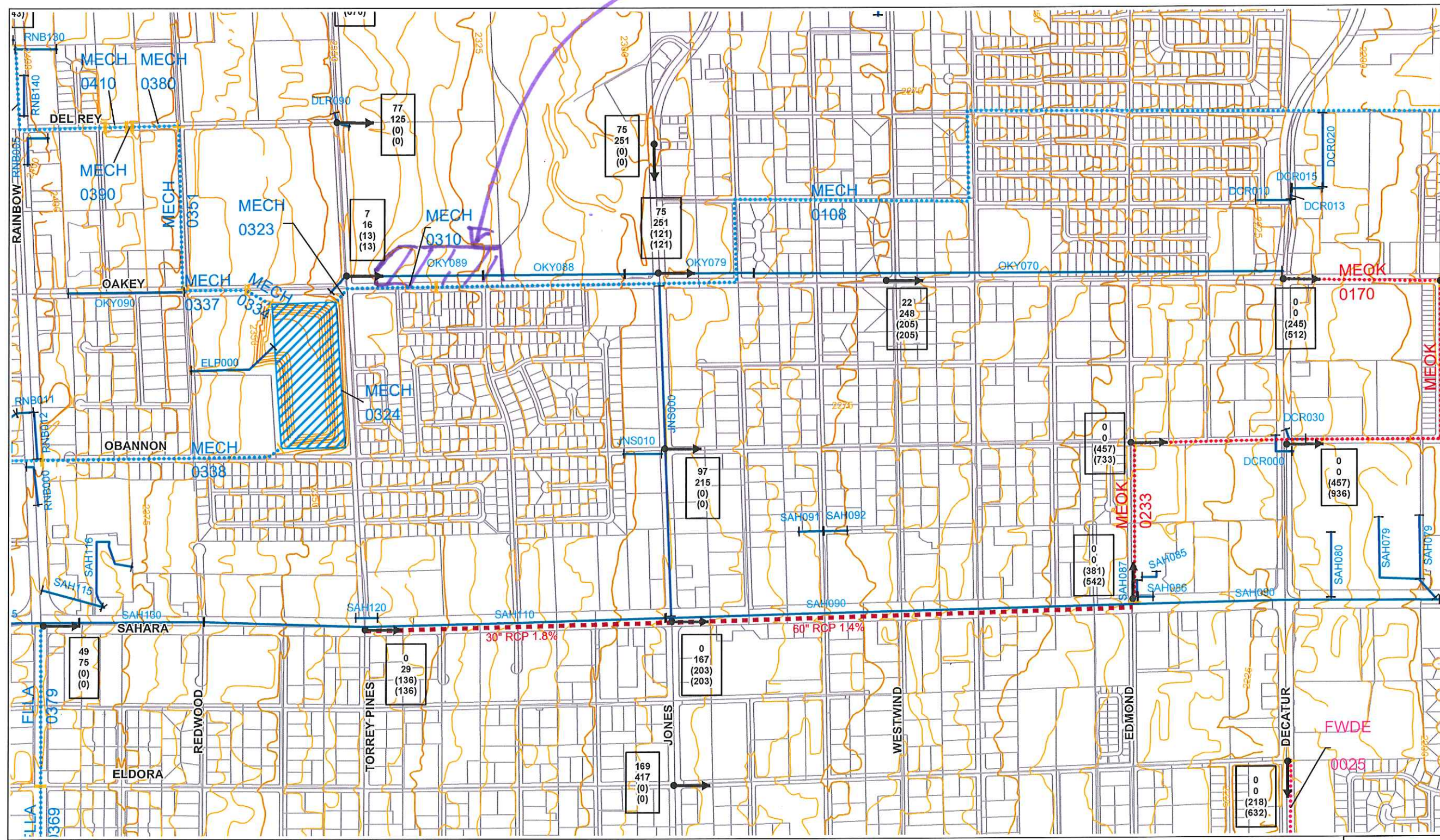
1	2			
3	4			
5	6			
7	8	9	10	
11	12	13	14	15
16	17	18	19	

PHOTO DATE: APRIL 1996

PBSJ POST, BUCKLEY, SCHUH & JERNIGAN, INC.

UTILIZED FOR OUR STUDY (17/42 cfs)

PROJECT SITE (7/16 cfs in street - OAKY) - FUTURE

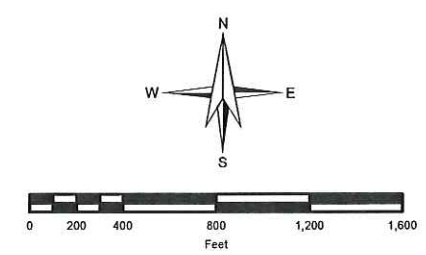


City of Las Vegas
**CENTRAL
NEIGHBORHOOD
FLOOD CONTROL
MASTER PLAN**

LEGEND

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

FIGURE F-14

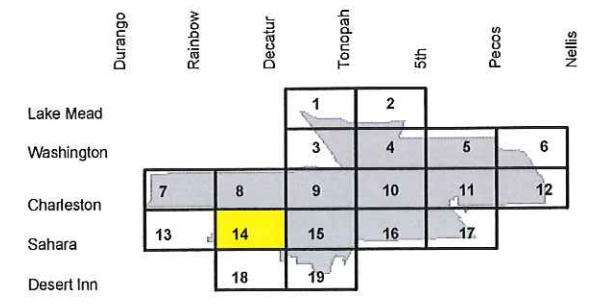


SCALE: 1 inch = 800 feet

- Flow Arrow
- | | |
|-------|------------------------|
| 250 | 10-Year Street Flow |
| 500 | 100-Year Street Flow |
| (300) | 10-Year Facility Flow |
| (800) | 100-Year Facility Flow |
- (Flows in CFS)

NOTE:
Ultimate drainage conditions are based on future Curve Number values with all flood control facilities in place.

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



FUTURE DRAINAGE CONDITIONS



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

PROJECT SITE (20/29 cfs street flow in Oakey) — EXISTING



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

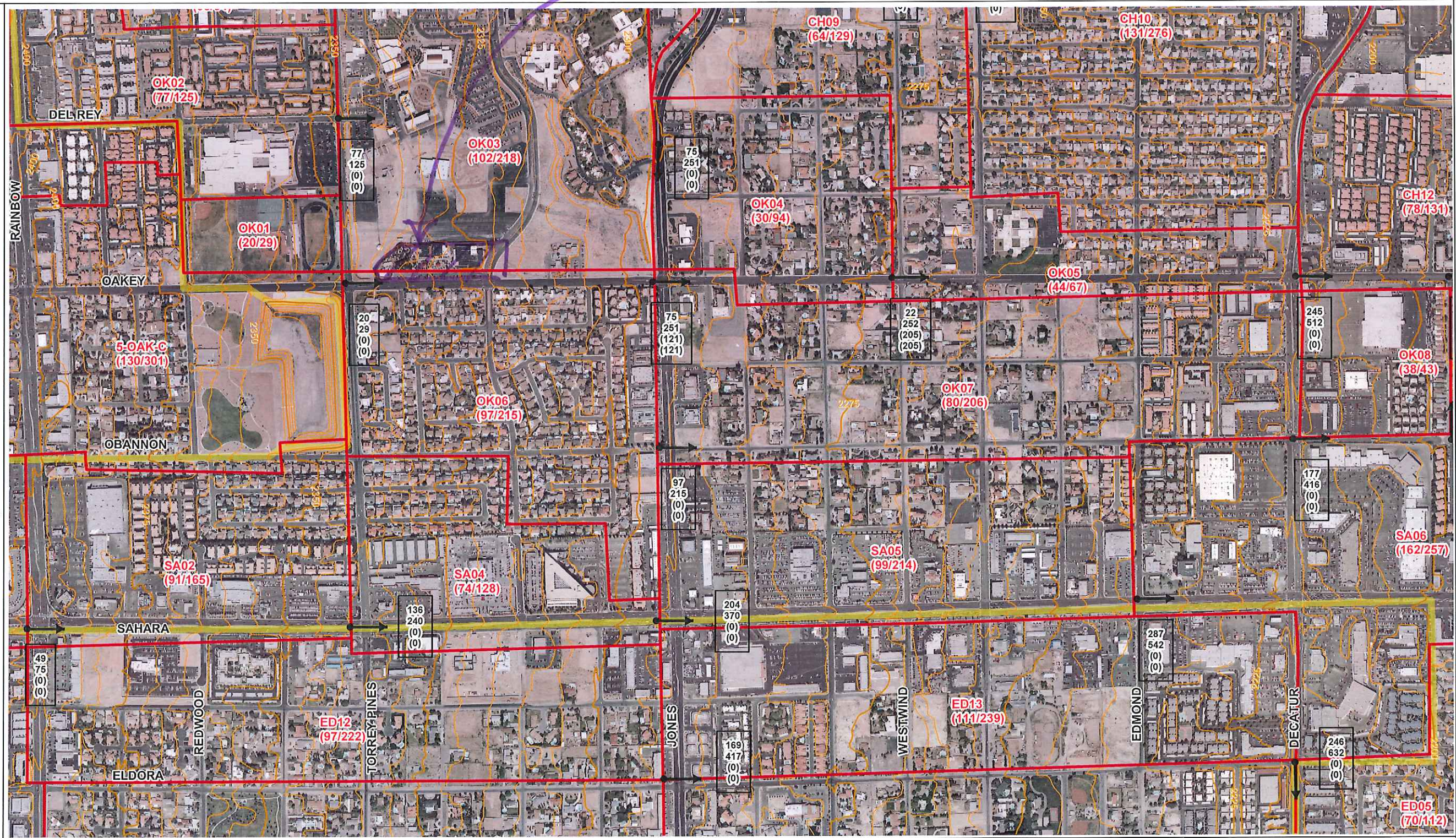


FIGURE E-14

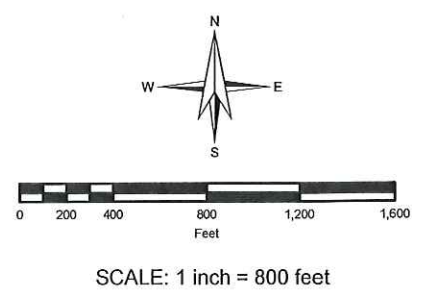
EXISTING DRAINAGE CONDITIONS

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

	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				

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.



APPENDIX D

REFERENCES

REFERENCE 5

"Technical Drainage Study for Opportunity Village"

(DS# 521)

CITY OF LAS VEGAS

DATE:

INTER-OFFICE MEMORANDUM

January 22, 1991

TO:

Charles Turk
Land Development Services
Department of Public Works

FROM:

T. Chiatovich, PE
Chief Flood Control
Dept. Public Works

SUBJECT:

Drainage Study for "OPPORTUNITY VILLAGE"

File No. DS521B

Date of Engineer's Stamp: 01/22/91

Date Received by City: 01/17/91

COPIES TO:

Martin & Martin
Charles Kajkowski, PE
John McNellis, PE

HISTORY:

1st Submittal

12/12/90 - Not Acceptable

REMARKS:

2nd Submittal (Addendum 1)

The drainage study for the subject project has been reviewed and

X is acceptable in concept subject to the following conditions:

_____ must be resubmitted or supplemented.

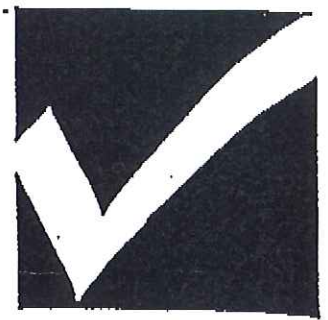
1. A stamped copy of the Grading Plan must be provided prior to Final Map approval.

END OF REMARKS

ssn

T/R/S: 21/60/02

Q2



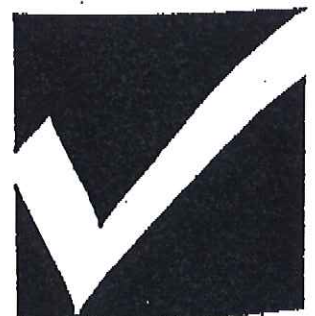
DS# 521

DS INDEX 837

APN 103-02-001-005

PROJECT Opportunity Village

SUBMITTAL 1ST Submittal - Drainage Study



DRAINAGE STUDY
OPPORTUNITY VILLAGE
CITY OF LAS VEGAS, NEVADA

NOVEMBER 8, 1990

prepared for:

Opportunity Village, Inc.,
Mr. Mike Hustad

by

Martin & Martin, Civil Engineers
1701 W. Charleston Boulevard, Suite 420
Las Vegas, Nevada 89102
702-386-8005



11/8/90

1.0 INTRODUCTION/BACKGROUND

1.1 SCOPE

Opportunity Village, Inc. has contracted with Martin & Martin Civil Engineers to provide a drainage study for the new Opportunity Village site. The purpose of this report is to present the existing and proposed drainage patterns for this proposed project and to provide hydrologic and hydraulic analyses to support the design of this site. This report addresses both off-site and on-site drainage impacting this project.

1.2 SITE LOCATION AND DESCRIPTION

The proposed 6.0± acre project is to be located along the north half of Oakey Boulevard 220'± east of Torrey Pines Drive. It will be bounded on the south by Oakey and on the east by proposed Campus Drive. This project is a portion of the overall master planned Clark County Community College Campus. Bonanza High School is located just west of Torrey Pines and north of Oakey. The site is a portion of the Southwest Quarter (SW 1/4) of the Northeast Quarter (NE 1/4) of Section 2, T.21.S., R.60.E., M.D.M, City of Las Vegas, Nevada. It is a portion of Assessors Parcel Number 310-360-001.

Currently the site is undeveloped desert with some scrub brush and piles of discarded dirt, trash and concrete.

1.3 FLOOD HAZARD ZONE

The flood hazard areas within this portion of Clark County (Nevada) are currently delineated on the National Flood Insurance Program - Flood Insurance Rate Maps, dated September 29, 1989. As indicated in Community Panel No. 320003 1205B of the Flood Hazard Maps, the 6 acre site is located within a Zone X Flood Hazard Zone (Figure 2). It lies within an area determined to be outside the 500 year flood plain.

1.4 WATERSHED CHARACTERISTICS

The off-site runoff affecting this site could originate as far west as Foothills Country Club (Canyon Gate) (6). Flow from that development and runoff from the area between Durango Drive and Torrey Pines Drive and between Charleston Boulevard and Sahara Avenue drain to near the Opportunity Village Site. This is a "worst case" scenario. The watershed slopes west to east at approximately 2.42% slope. Currently the watershed is partially developed with commercial and residential properties. The off-site area was determined to be around 950± acres.

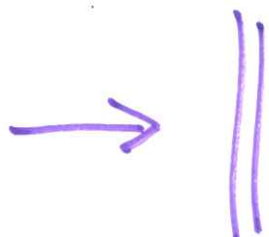
1.5 PROPOSED FLOOD CONTROL FACILITIES

The Clark County Regional Flood Control District Master Plan (5) recommends major flood control improvements for the Clark County Area. Figure A2-7 of the Master Plan shows a detention

*Before the detention
basin was designed*

"Precipitation-Frequency Atlas of the Western United States, Volume VII, Nevada", (Ref. 3) and adjusted per the ratios found in the Clark County Regional Flood Control District Drainage Design Manual (5). The 6-hour precipitation depths used for this analysis are as follows:

TABLE 1
ADJUSTED NOAA ATLAS PRECIPITATION DEPTHS
6-HOUR EVENT.



10 YEAR	-	1.65 inches
25 YEAR	-	2.02 inches
100 YEAR	-	2.72 inches

The HEC-1 computer model requires rainfall distribution information. See the Appendix for the adjusted rainfall calculations and the distribution utilized for this analysis.

2.3 SOILS GROUPS

The drainage basin boundaries shown on Figures 2 and 3 are based on the 7.5 minute USGS Blue Diamond NE, Nev. quadrangle map which includes Section 2, Township 21 South, Range 60 East. The drainage basin boundaries used in this study are consistent with the Clark County Flood Control Master Plan (Ref. 2).

Curve numbers for the drainage basins have been estimated using procedures and data documented in the Soil Conservation

Service (SCS) Technical Release 55 (Ref. 4). The computed curve numbers are based on soil types, future land uses and the assumed antecedent soil moisture condition (AMC II).

Soils types for all off-site and on-site development is within Hydrological Soils Group 'D'. A curve number of 87 was used for Foothills runoff and CN=88 was used for Basin A and predeveloped Basin B. The proposed on-site curve number was determined to be 92.

Based on these assumptions, TR-55 was utilized to determine curve numbers for all existing and proposed off-site and on-site basins. Assumptions and estimates were also made on the limits of permeable and impermeable ground cover. Composite curve were determined for all basins based on the percentage of impervious area. A curve number of 98 was assumed for all impervious areas. *
A summary of the watershed parameters used for the HEC-1 analysis is included in the Appendix. Lag times were estimated and calculations are also shown in the Appendix.

2.4 EXISTING ROUTING

Refer to Figure 3. As stated in Section 1.4, runoff will emanate in the Canyon Gate development, flow through an R.C.P. under Durango, combine with runoff east of Durango and flow easterly as shallow concentrated flow. This runoff continues past the site and either ponds behind dikes on the state property east of the site or reaches either Meadows Detention Basin or Charleston Boulevard. ✓

2.5 PROPOSED ROUTING

Refer to the 2 . 24" X 36" on-site Grading Plan and Basin Boundary Map. Off-site runoff concentrates near the southwest corner of the site with in Oakey Boulevard. Due to the proposed improvements, that runoff will be confined to the street and routed easterly past the site and will combine with runoff from on-site Basin C and concentrate at CP3 - the southeast corner of the site. Runoff from on-site Basin D will exit the site at the northeast corner of the site - CP 4. The existing drainage patterns will not be altered.

2.6 RESULTS

The HEC-1 computer model has been used to compute the peak 10, 25 and 100 year - 6 hour runoff rates for both existing and design conditions. The HEC-1 models for both existing and design conditions are included in the Appendix. The results are as follows:

TABLE 2

Q(peak flow - 6 hour) C.F.S.

Location (Basin)	<u>10yr.</u>	<u>25 yr.</u>	<u>100 yr.</u>
<u>EXISTING CONDITION</u>			
Q (Foothills C. C.)	55	77	125 ✓
A	319	444	709
B (On-Site)	6	9	14
CP3	372	520	830

TABLE 2 CONTINUED

Q(peak flow - 6 hour) C.F.S.

PROPOSED CONDITION

Q	55	77	125
A	319	444	709
C	6	8	12
D	2	3	4
CP3	372	520	830

ON SITE

16 cfs total

↑ 10yr (8 cfs total)

↑ 100yr

Concentrations at CP3 will not change from the proposed to developed condition due to the different times to peak for the on-site and off-site basins.

ON SITE

 $\frac{Q_{10}}{8}$ $\frac{Q_{100}}{16}$

*

3.0 HYDRAULIC ANALYSIS3.1 STREET HYDRAULICS

The capacity of the proposed streets to convey stormwater runoff were determined using Mannings Equation. Calculations are shown in the Appendix.

TABLE 3

STREET CAPACITIES (CAP.)

STREET	MIN. SLOPE	100 year Flow Depth (830 c.f.s.)	FULL WIDTH CAP. C.F.S. (to B.S.W.)
Oakey Boulevard	1.88%	1.28'	27.3

← revised

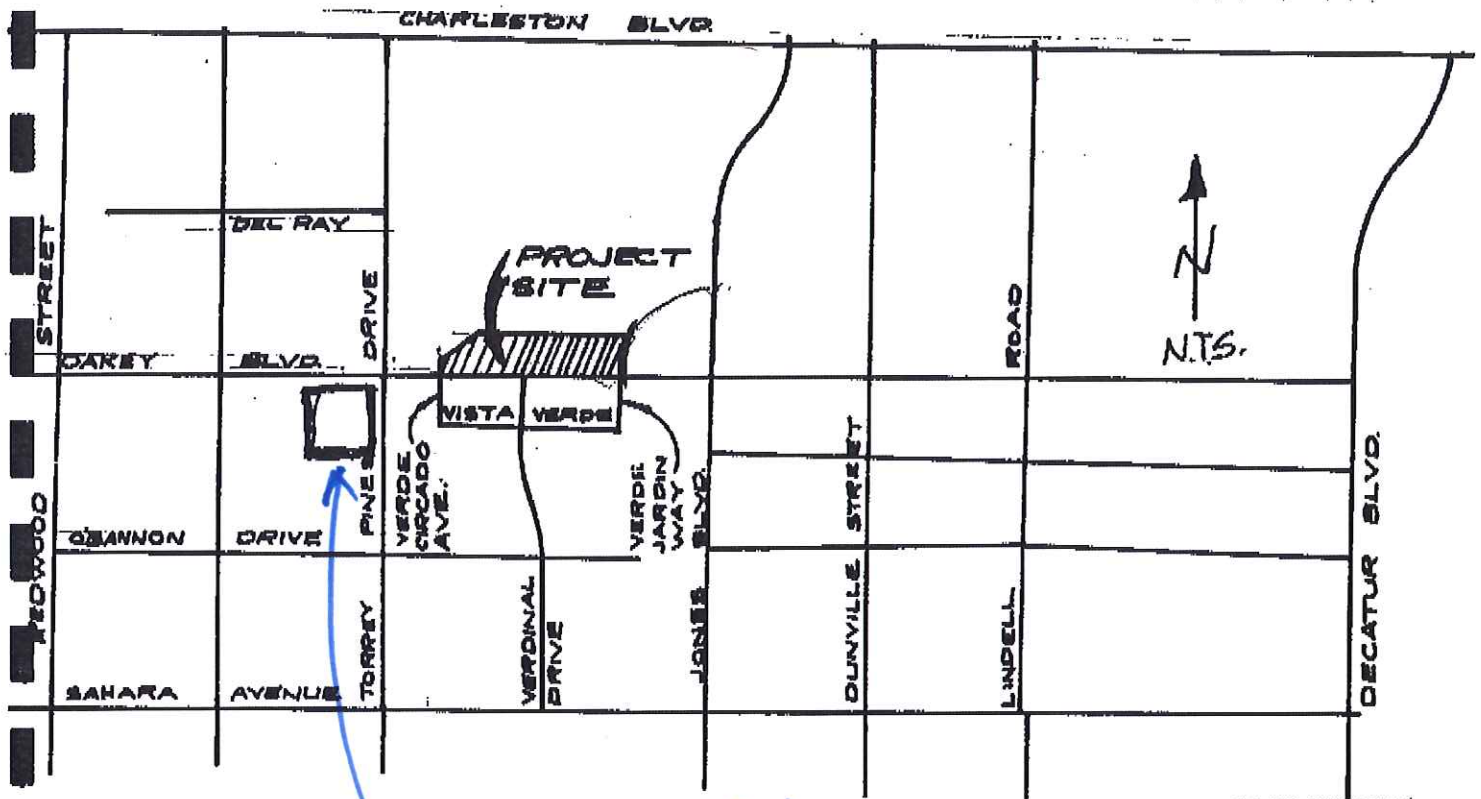
A landscaped berm will be constructed along Oakey Boulevard. This will assist in confining runoff to the street.

4.0 CONCLUSIONS/RECOMMENDATIONS

The HEC-1 computer model has been used to evaluate off-site and on-site drainage for both existing and future conditions. Hydraulic computations have been performed to evaluate the capacities of adjacent streets. The results of the hydrologic and hydraulic analyses indicate that:

- a) the proposed development is consistent with the Clark County Regional Flood Control District Flood Control Master Plan (Ref. 2);
 - b) the proposed project does not significantly impact or alter the existing drainage patterns;
 - c) the project site is not located within any special flood hazard zones;
 - d) finished floor elevations should be established as shown on the grading plans and are of sufficient elevation to avoid flooding during major storm events;
 - e) the proposed detention basin at the S.W. corner of Oakey and Torrey Pines should be constructed as soon as possible.
- ← COMPLETE

In conclusion, the results of this study indicate that if the proposed development is constructed in accordance to the recommendations of this study, the development should be free of flooding problems and should not adversely impact surrounding and downstream properties.



*Detention Basin
Since - been constructed
NOW*

VICINITY MAP

POINT RAINFALL - 6 HOUR DESIGN STORM

10 yr. - 1.4"

25 yr. - 1.6"

100 yr. - 2.0"

NOAA ADJUSTMENT FACTOR - RATIO

10 yr. - 1.24

25 yr. - 1.33

100 yr. - 1.43

DEPTH/AREA ADJUSTMENT FACTOR

≈ 0.95

ADJUSTED RAINFALL

10 yr = $1.4 \times 1.24 \times 0.95 = 1.65"$

25 yr = $1.6 \times 1.33 \times 0.95 = 2.02"$

100 yr = $2.0 \times 1.43 \times 0.95 = 2.72"$

METHOD PER CCRFCD DESIGN
MANUAL - 10/90

USE SDN3 DISTRIBUTION
(AREA $< 10 \text{ mi}^2$)

TR-55 CURVE NUMBER COMPUTATION

VERSION 1.11

Project : OPPORTUNITY VILLAGE

User : MLH

Date: 11-03-90

County : CLARK

State: NV

Checked: _____

Date: _____

Subtitle: PROPOSED CONDITIONS - ONSITE

Subarea : C

COVER DESCRIPTION	Hydrologic Soil Group			
	A	B	C	D
	Percent (CN)			
FULLY DEVELOPED URBAN AREAS (Veg Estab.)				
Open space (Lawns, parks etc.)				
Good condition; grass cover > 75%	-	-	-	10(80)
Impervious Areas				
Paved parking lots, roofs, driveways	-	-	-	90(98)
Total Area (by Hydrologic Soil Group)				100

SUBAREA: C

TOTAL DRAINAGE AREA: 100 Percent

WEIGHTED CURVE NUMBER: 96



TR-55 CURVE NUMBER COMPUTATION

VERSION 1.11

Project : OPPORTUNITY VILLAGE
 County : CLARK State: NV
 Subtitle: PROPOSED CONDITIONS - ONSITE
 Subarea : D

User: MLH Date: 11-03-90
 Checked: _____ Date: _____

COVER DESCRIPTION	Hydrologic Soil Group			
	A	B	C	D
		Percent (CN)		

FULLY DEVELOPED URBAN AREAS (Veg Estab.)				
Open space (Lawns, parks etc.)				
Good condition; grass cover > 75%	-	-	-	10(80)
Impervious Areas				
Paved parking lots, roofs, driveways	-	-	-	90(98)
Total Area (by Hydrologic Soil Group)				100
				=====

SUBAREA: D TOTAL DRAINAGE AREA: 100 Percent WEIGHTED CURVE NUMBER: 96




```
*****
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* BY THE COE IN FEBRUARY 1981 *
* REVISED 02 AUG 88 *
* RUN DATE 11/03/1990 TIME 13:41:04 *
*****
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*****
* DOUSON AND ASSOCIATES, INC. *
* HYDROLOGIST AND CIVIL ENGINEERS *
* 7015 W TIDWELL SUITE 107 *
* HOUSTON, TEXAS 77092 *
* (713) 895-8322 *
*****
```

```

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

```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1RW.

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

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

1 ID OPPORTUNITY VILLAGE

2 ID PROPOSED CONDITION - ONSITE AND OFFSITE 

3 ID USING SCS METHODS AND KINEMATIC WAVE ROUTING

4 ID MASTER PLAN ADJUSTED 6-HOUR RAINFALL AND STORM DISTRIBUTION

5 ID INPUT FILE NAME:OPVILPRO OUTPUT FILE:OPVILPROUT

6 ID

7 ID *****

8 ID

9 ID 10, 25, & 100 YEAR - 6 HOUR STORM EVENT

10 ID

11 ID *****

*DIAGRAM

12 IT 5 300

13 IO 6 0

14 IN 5

15 JR PNEC 0.61 0.74 1.0

16 KK Q1 OFFSITE RUNOFF BASIN Q1 FOOTHILLS COUNTRY CLUB

17 PB 2.72

18 PC 0.0 .02 .057 .07 .087 .108 .124 .13 .13 .13

19 PC .13 .13 .13 .133 .14 .142 .148 .158 .172 .181

20 PC .19 .197 .199 .2 .201 .204 .214 .229 .241 .249

21 PC .251 .256 .27 .278 .281 .283 .295 .322 .352 .409

22 PC .499 .59 .71 .744 .781 .812 .819 .835 .851 .856

23 PC .86 .868 .876 .888 .91 .926 .937 .95 .97 .978

24 PC .982 .985 .987 .989 .99 .993 .993 .994 .995 .998

25 PC .998 .999 1.0

26 BA 0.24

27 LS 0 87 0

28 UD .85

29 KK Q1>2 ROUTE Q1 TO CP2

30 RK 13200 2.42 .02 TRAP 40 2

31 KK A OFFSITE BASIN A

32 BA 1.255

33 LS 0 88 0

34 UD 0.81

35 KK CP2 COMBINE Q1 AND BASIN A AT CP2

36 HC 2

37 KK 2>3 ROUTE CP2 TO CP3

38 RK 1150 2.2 .02 TRAP 40 2

39 KK C PROPOSED ONSITE BASIN C

40 BA .0067

41 LS 0 92 0

42 UD .0693

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

43 KK CP3 COMBINE CP2 AND BASIN C AT CP3

44 HC 2

45 KK D PROPOSED ONSITE BASIN D

46 BA .0025

47 LS 0 92 0

48 UD .0818

49 ZZ

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT
LINE

(V) ROUTING

(--->) DIVERSION OR PUMP FLOW

NO.

(.) CONNECTOR

(<---) RETURN OF DIVERTED OR PUMPED FLOW

16

Q1

V

V

29

Q1>2

.

31

.

A

.

35

CP2.....

V

V

37

2>3

.

39

.

C

.

43

CP3.....

.

45

.

D

ONSITE BASINS

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

 * FLOOD HYDROGRAPH PACKAGE (HEC-1) *
 * BY THE COE IN FEBRUARY 1981 *
 * REVISED 02 AUG 88 *
 *
 * RUN DATE 11/03/1990 TIME 13:41:04 *
 *

 *
 * DODSON AND ASSOCIATES, INC. *
 * HYDROLOGIST AND CIVIL ENGINEERS *
 * 7015 W TIDWELL SUITE 107 *
 * HOUSTON, TEXAS 77082 *
 * (713) 895-8322 *
 *

OPPORTUNITY VILLAGE
 PROPOSED CONDITION - ONSITE AND OFFSITE
 USING SCS METHODS AND KINEMATIC WAVE ROUTING
 MASTER PLAN ADJUSTED 6-HOUR RAINFALL AND STORM DISTRIBUTION
 INPUT FILE NAME:OPVILPRO OUTPUT FILE:OPVILPROUT

 10, 25, & 100 YEAR - 6 HOUR STORM EVENT

13 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
 .61 .74 1.00

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION			
				RATIO 1	RATIO 2	RATIO 3	
				.61	.74	1.00	
HYDROGRAPH AT	Q1	.24	1	FLOW TIME	55. 4.33	77. 4.33	125. 4.33
ROUTED TO	Q1>2	.24	1	FLOW TIME	54. 4.42	77. 4.42	125. 4.42
HYDROGRAPH AT	A	1.25	1	FLOW TIME	319. 4.33	444. 4.25	709. 4.25
2 COMBINED AT	CP2	1.50	1	FLOW TIME	372. 4.33	519. 4.33	830. 4.25
ROUTED TO	2>3	1.50	1	FLOW TIME	372. 4.33	519. 4.33	829. 4.25
HYDROGRAPH AT	C	.01	1	FLOW TIME	8. 3.50	8. 3.50	12. 3.50
2 COMBINED AT	CP3	1.50	1	FLOW TIME	372. 4.33	520. 4.33	830. 4.25
HYDROGRAPH AT	D	.00	1	FLOW TIME	2. 3.50	3. 3.50	4. 3.50

ONSITE

ONSITE

10yr 100yr

NORMAL END OF HEC-1 ***

NORMAL END OF HEC-1 ***

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Opportunity Village, Inc. Date: 11-8-90

Location of Development: a) Descriptive PT. SW 1/4 of the NE 1/4
b) Sect. 2 Twn. 21 Rng. 60

Name of Owner: State of Nevada Assessors Parcel No: 310-360-001

Contact Person-Name: Mark L. Hedge Telephone No: (702) 386-8005

Firm: Martin & Martin, Inc.

Address: 1701 W. Charleston Boulevard, Suite # 420

Las Vegas, Nevada 89102

Type of Land Development/Land Disturbance Process:

- ☐ Reasoning ☐ 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: 160⁺ Acres Being Developed/Disturbed: 6.0 Acres

2. Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? YES* X NO

3. Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? YES* X NO

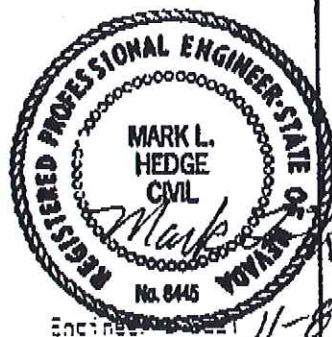
4. Proposed type of development (Residential, Commercial, etc.)? Commercial

5. Approximate upstream land area which drains to the subject site? 957 Acres

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

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

8. Briefly describe your proposed schedule for the subject project: 1 year⁺



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

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

Revision	Date

Local Entity File No. _____

REFERENCE:

STANDARD FORM 1



DS# 521

DS INDEX 838

APN 103-02-601-005

PROJECT Opportunity Village

SUBMITTAL 2nd Submittal - Addendum 1



HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Opportunity Village, Inc. Date: 11-8-90

Location of Development: a) Descriptive PT. SW 1/4 of the NE 1/4
b) Sect. 2 Twn. 21 Rng. 60

Name of Owner: State of Nevada Assessors Parcel No: 310-360-001

Contact Person Name: Mark L. Hedge Telephone No: (702) 386-8005

Firm: Martin & Martin, Inc.

Address: 1701 W. Charleston Boulevard, Suite # 420

Las Vegas, Nevada 89102

Type of Land Development/Land Disturbance Process:

☐ Rezonning
☐ Parcel Map
☐ Large Parcel Map

☐ Subdivision Map
☐ Planned Unit Development
☒ Building Permit

☒ Clearing and Grading Only
☐ Other (Please specify below)

1. Total Owned Land Area: At Site: 160⁺ Acres Being Developed/Disturbed: 6.0 Acres

2. Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? YES* X NO

3. Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? YES* X NO

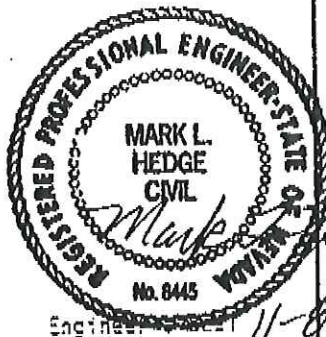
4. Proposed type of development (Residential, Commercial, Etc.)? Commercial

5. Approximate upstream land area which drains to the subject site? 957 Acres

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

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

8. Briefly describe your proposed schedule for the subject project: 1 year⁺



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

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

Local Entity File No. _____

Revision	Date

REFERENCE:

STANDARD FORM 1

REFERENCE 6

“Technical Drainage Study for SNAMHS – 150 Bed Psychiatric Hospital”

(DS# 3557)

SNAMHS – 150 Bed Psychiatric Hospital

TECHNICAL DRAINAGE STUDY

LAS VEGAS, NEVADA

That portion of the Southern Half of the Northeast Quarter (NE 1/4) of Section 02,
Township 21 South, Range 60 East, M.D.M.

Prepared For: HMC Architects
50 West Liberty Street, Suite 800
Reno, Nevada 89501
Phone: (775) 322-9475
Fax: (775) 322-3816

Prepared By: The WLB Group
2551 N. Green Valley Parkway, Suite A425
Henderson, NV. 89014
Ph: (702) 458-2551
FAX (702) 434-0491

DRAINAGE STUDY INFORMATION FORM

Name of Development: SNAMHS - 150 Bed Psych Hospital Date: 4/13/04Location of Development: a) Descriptive (Cross Streets) North/South Jones Blvd East/West Oakeyb) Sect. 02 Twn. 21 S. Rng. 00 E.Name of Owner: State of Nevada Div of Lands Assessors Parcel No: 163-02-601-007Telephone No: (702) 486-5115 Ext 233 Facsimile No: (702) 470-0871Address: 1830 E. Sahara Blvd, Suite 204 Las Vegas, NV 89104Contact Person-Name: Luke Bowland Telephone No: (702) 458-2551Firm: The WLB Group, Inc.Address: 2551 N Green Valley Pkwy, Suite A425 Henderson, NV 89014

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: 66.57 Being Developed/Disturbed: 12.092. Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? YES* NO3. Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? YES* NO4. Proposed type of development (Residential, Commercial, Etc.)? Commercial (Hospital)5. Approximate upstream land area which drains to the subject site? 135 acres6. Has the site drainage been evaluated in the past? YES NO If yes, please identify documentation:7. If known, please briefly identify the proposed discharge point(s) of runoff from the site:
The site drains to an existing 48" RCP storm drain at the intersection of Jones + Oakey8. Briefly describe your proposed schedule for the subject project: Begin Construction ASAP

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

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

Local Entity File No.

Revision

Date

REFERENCE:

STANDARD FORM 1



Engineering • Planning
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Landscape Architecture

April 12, 2004

City of Las Vegas
731 S. Fourth Street
Las Vegas, NV 89101

Attn: Flood Control

Re: SNAMHS – 150 Bed Psychiatric Hospital
Technical Drainage Study
WLB Job # 403055-A001

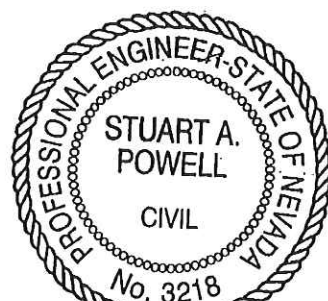
Submitted herewith for your approval is the technical drainage study for SNAMHS – 150 Bed Psychiatric Hospital. The 12.09-acre site is located on the northwest corner of Jones Boulevard and Oakey Boulevard.

The rainfall runoff quantities calculated with respect to the 10-year and 100-year storm events indicate flood flows will not significantly increase flows in the area.

Should you have any questions, please call us at (702) 458-2551.

Respectfully,
The WLB Group

Luke Bowland, E.I.
Engineer Intern



EXPIRES 12/31/05

Stuart Powell, P.E.
Director of Operations

Cc: Sunny K. Kamath, AIA, NCARB (State of Nevada Public Works)
Thomas A. Casazza, AIA (HMC Architects)

II. EXISTING DRAINAGE BASIN DESCRIPTION

1. OFF-SITE DRAINAGE BASINS

There are two off-site basins that affect this site. They are shown as OFF-1E and OFF-2E on Figure 6 in Appendix II. Basin OFF-1E consists of a 3.11-acre area, which drains to the southwest corner of the site and * combines with flows from Basin EX-1 before entering the existing natural drainage channel. OFF-2E consists of a 7.20-acre area, which drains south through the natural drainage channel.

The off-site flows from the storm drains under Community College Drive were obtained from the Lochsa Engineering "Community College of Southern Nevada – Phase IV and Community College Expansion" drainage study. This study shows 100-year flows conveyed through the storm drains under Community College Drive to be 248 cfs.

2. ON-SITE DRAINAGE BASINS

The 12.09-acre site is currently undeveloped desert land in poor condition. There is one existing drainage basin on the project site. Basin EX-1 drains from the northwest to a 48" storm drain at the southeast corner of the site by means of an existing natural drainage channel. This storm drain flows to a 48" storm drain flowing east in Oakey Boulevard. The on and off site drainage basins can be seen in Figure 6 of Appendix II.

SNAMHS - 150 Bed Psychiatric Hospital
Technical Drainage Study

The 10-year and 100-year, 6-hour storms (SDN 3) were analyzed for storm water runoff. Precipitation depths were obtained from the Clark County Regional Flood Control District Hydraulic Criteria and Drainage Manual. McCarran Airport rainfall data was used. Rainfall depths were found to be the following:

100-year: 2.77"

10-year: 1.58"

The Curve Number calculations are shown on Figure 4 in Appendix II. HEC-1 output files are included in Appendix II.

TABLE 1 – STORM FLOWS FOR EXISTING CONDITIONS

DRAINAGE AREA	PEAK FLOWS (CFS)	
	100-YEAR	10-YEAR
EXISTING		
BASIN EX - 1	24	9
BASIN OFF - 1E	6	2
BASIN OFF - 2E	7	3
CP1	268	112
CMT (CCSN flows)	248	107

affects our
site - downstream

TABLE 2 - STORM FLOWS FOR DEVELOPED CONDITIONS

DRAINAGE AREA	PEAK FLOWS (CFS)	
	100-YEAR	10-YEAR
Basin ON-1	19	11
Basin ON-2	13	7
Basin ON-3	2	1
Basin ON-4	5	2
Basin OFF-1P	6	2
Basin OFF-2P	7	3
CP1	285	124
CMP (CCSN flows)	248	107

at down
stream intersection
Oakey/Commun.
College Dr.

B. STREET FLOW ANALYSIS - FLOWMASTER

The Flowmaster computer program was used for calculations of the street flow depths, and printouts are located in Appendix III.

Flows in Community College Drive will not be affected by this development. Flows in Oakey Boulevard will only change to the east of the proposed drainage channel. A portion of the channel flow will weir out of the channel into Oakey Boulevard during a 100-year event. It has been determined that 153 cfs will enter Oakey. Please see the Stream Flow Modeling section of this report for more details. Results are listed in Table 3.

SNAMHS - 150 Bed Psychiatric Hospital
Technical Drainage Study

TABLE 3 – ROADWAY FLOW VALUES

STREET DESCRIPTION	Q (cfs)	DEPTH (ft)	VELOCITY (ft/sec)	DEPTH*VELOCITY (ft ² /sec)
EXISTING				
Community College Drive (10 Year)	16	0.62	2.41	1.49 < 6 OK
Community College Drive (100Year)	62	0.91	3.54	3.22 < 8 OK
Oakey Boulevard (10 year)	17	0.41	3.51	1.44 < 6 OK
Oakey Boulevard (100 year)	42	0.55	3.92	2.16 < 8 OK
DEVELOPED				
Community College Drive (10 Year)	16	0.62	2.41	1.49 < 6 OK
Community College Drive (100Year)	62	0.91	3.54	3.22 < 8 OK
Oakey Boulevard (10 year) West of Proposed Drainage Channel	17	0.41	3.51	1.44 < 6 OK
Oakey Boulevard (100 year) West of Proposed Drainage Channel	42	0.55	3.92	2.16 < 8 OK
Oakey Boulevard (10 year) East of Proposed Drainage Channel	17	0.41	3.51	1.44 < 6 OK
Oakey Boulevard (100 year) East of Proposed Drainage Channel	195	1.03	6.12	6.30 < 8 OK

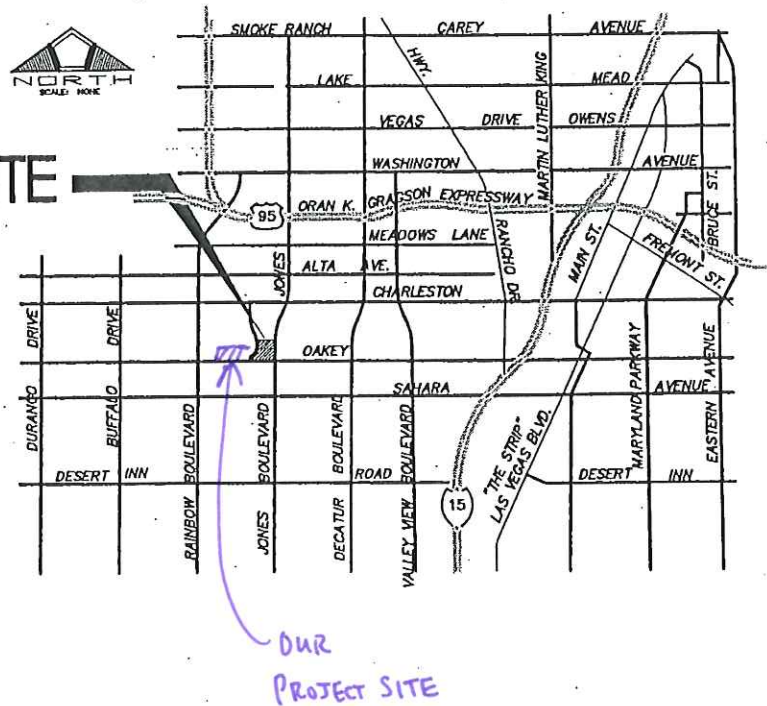
* Community College Dr. - 16/62 cfs for 10 & 100 YR
Oakey Blvd. - 17/42 cfs for 10 & 100 YR

C. STREAM FLOW MODELING – HEC-RAS

The drainage channel located on the property has been modeled for existing and proposed conditions. Flow has been modeled as steady state flow with a flow rate of 312 cfs. This flow rate was obtained from the City of Las Vegas Flood Control Facilities Inventory and City Wide Hydrology Analysis, Volume II December 1997, and is higher than the runoff determined in both the existing and proposed HEC-1 analysis. This flow rate will be used for a conservative analysis.

PROJECT SITE
SNAMHS

CITY OF
LAS VEGAS



LOCATION MAP

N.T.S.

The
WLB
Group
INC.

WLB

FIGURE 1
VICINITY MAP

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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

BASIN AREA < 1 M²

SHEETFLOW				SHALLOW OPEN FLOW							CHANNEL FLOW																
SUB-BASIN DATA				INITIAL/OVERLAND TIME (T)				TRAVEL TIME (T) $V=CS^{1/2}$							MANNING EQUATION $V=1.49nS^{2/3}R^{4/3}$							TOTAL Tc		Tc CHECK (URBANIZED BASINS)		FINAL Tc	T _{tot}
AREA sq. ft.	DESIG (1)	K (2)	CN (3)	AREA (Ac) (4)	LENGTH R (5)	SLOPE % (6)	Ti Mn (7)	LENGTH R (8)	SLOPE (F/FT) (9)	C (10)	VEL FPS (11)	n	SLOPE R/R	AREA Sq R (12)	P R (13)	R AP (14)	VEL FPS (15)	LENGTH R (16)	Tic Mn (17)	Ti + Ti + Tic Mn (18)	TOTAL Tc (19)	TOTAL Tc (20)	TOTAL Tc (21)	Tc Mn (22)	T _{tot} (23)	T _{tot} (24)	
0.0049	OFF-1E	0.73	85.00	3.11	710.00	2.82	12.54														12.54			12.54	0.1254		
0.00458	OFF-2E	0.73	85.00	2.93	125.00	7.20	3.85					0.025	0.010	1.93	2.35	0.82	5.23	183.00	0.58	4.44				4.44	0.0444		
0.0165	EX-1	0.73	85.00	10.55	160.00	6.25	4.58					0.025	0.010	62.69	23.24	2.39	10.59	1185.00	1.85	6.44				6.44	0.0644		
0.004659	OFF-1P	0.73	85.00	3.11	710.00	2.82	12.54														12.54			12.54	0.1254		
0.00458	OFF-2P	0.73	85.00	2.93	125.00	7.20	3.85					0.025	0.010	1.93	2.35	0.82	5.23	183.00	0.58	4.44				4.44	0.0444		
0.0089	CN-1	0.90	98.00	5.70	24.00	2.00	1.38	500.00	0.005	20.20	1.43	5.83	0.012	0.007	1.50	1.20	1.25	12.04	305.00	0.42	7.64	830.00	14.61	7.64	0.0764		
0.0065	CN-2	0.90	98.00	4.22	346.00	4.76	3.93	510.00	0.005	20.20	1.43	5.86									9.88	885.00	14.76	9.88	0.0988		
0.0011	CN-3	0.90	98.00	0.70	345.00	1.57	5.66					0.022	0.010	62.69	23.24	2.39	12.03	775.00	1.07	6.73	1120.00	15.22	6.73	0.0573			
0.0024	CN-4	0.78	89.00	1.54								0.022	0.010	65.00	20.00	3.25	14.74	1450.00	1.64	1.64	1450.00	18.05	1.64	0.0164			

C VALUES FOR URBANIZED FLOW

C=20.2 (DEPTH OF GUTTER OF 0.3 FEET)

C=30.6 (CURB HEIGHT STREET FLOW)

C VALUES FOR NON-URBANIZED FLOW

C=14.8 (WIDE CHANNEL FLOW W/ D=0.25 FEET)

C=29.4 (WIDE CHANNEL FLOW W/ D=0.7 FEET)

(VALUES OBTAINED FROM CCRFCO PG606)



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

$$T_{tc} = L / ((60) V)$$

$$T_t = 1.8 ((1.1 - K) L^{0.5} / S^{0.33})$$

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

FIGURE 5


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*****
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
*   JUN 1998
*   VERSION 4.1
*
* RUN DATE 19MAR04 TIME 15:36:16
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* U.S. ARMY CORPS OF ENGINEERS
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* 609 SECOND STREET
* DAVIS, CALIFORNIA 95616
* (916) 756-1104
*****

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X   X   XXXXXXXX   XXXXX   X
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XXXXXXX   XXXX   X   XXXXX   X
X   X   X   X   X   X   X
X   X   X   X   X   X   X
X   X   XXXXXXXX   XXXXX   XXX

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PROPOSED CONDITIONS

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

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

1 HEC-1 INPUT PAGE 1

```

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
1 ID
2 ID
3 ID BEGINNING DESCRIBES ON AND OFF SITE FLOWS FOR THE
4 ID SOUTHERN NEVADA PSYCHIATRIC HOSPITAL
5 ID ON AND OFF SITE DRAINAGE BASINS
6 ID SIX HOUR STORM, SDN 3
7 ID REVIEWED BY: JOHN P MENG, E.I.
8 ID REVIEWED AND RECOMMENDED BY STUART POWELL, P.E.
9 ID PREPARED BY LUKE BOWLAND, E.I.
10 ID
11 ID RATIO 1=100-YEAR STORM EVENT
12 ID RATIO 2=10-YEAR STORM EVENT
13 ID
14 ID HEC-1 FILE: 403055-P.IH1
15 ID
16 IT 5 0 0 300
17 IO 5 0 0
18 IN 5 0 0
19 JR PREC .57 1.0
*
20 KK OFFIAK
21 PB 2.77
22 PC 0.0 0.020 0.057 0.070 0.087 0.108 0.124 0.130 0.130 0.130
23 PC 0.130 0.130 0.130 0.133 0.140 0.142 0.146 0.158 0.172 0.181
24 PC 0.190 0.197 0.199 0.200 0.201 0.204 0.214 0.229 0.241 0.249
25 PC 0.251 0.256 0.270 0.278 0.281 0.283 0.295 0.322 0.352 0.409
26 PC 0.499 0.590 0.710 0.744 0.781 0.812 0.819 0.835 0.851 0.856
27 PC 0.860 0.868 0.876 0.888 0.910 0.926 0.937 0.950 0.970 0.976
28 PC 0.982 0.985 0.987 0.989 0.990 0.993 0.993 0.994 0.995 0.998
29 PC 0.998 0.999 1.000
30 KM BEGIN "CCSN PHASE IV" PROPOSED HEC-1 BY LOCHSA ENGINEERING
31 BA .0185
32 LS 0 92
33 UD .172
*
34 KK DWS
35 KM ROUTE OFFIAK TO SOUTHERN DWS
36 RK 260 .005 .013 TRAP 2 25
*
37 KK OFFIBK
38 KM FLOW FROM OFFSITE BASIN OFFIBK AG SPANOS APARTMENT COMPLEX
39 BA .0085
40 LS 0 92
41 UD .101
*

```

1 HEC-1 INPUT PAGE 2

```

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
42 KK TPD
43 KM FLOW FROM TORREY PINES DRIVE ADJACENT TO-SITE
44 BA .00216

```

45 LS 0 92
 46 UD .119
 *
 47 KK DWS
 48 KM COMBINE FLOWS FROM OFF1AK, OFF1BK, & TPD
 49 HC 3
 *
 50 KK DIVERT
 51 KM DIVERT DROP INLET CAPACITY
 52 DT DI1K
 53 DI 0 10 20 30 40 41
 54 DQ 0 1 1 1 1 1
 *
 55 KK CP1K
 56 KM ROUTE OFF1AK TO END OF PIPE
 57 RK 280 .012 .016 TRAP 50 5
 *
 58 KK OFF1CK
 59 KM FLOW FROM OFFSITE BASIN OFF1CK, A.G. SPANOS COMPLEX
 60 BA .005
 61 LS 0 92
 62 UD .109
 *
 63 KK OFF2K
 64 KM FLOW FROM CONTRIBUTING PORTION OF BONANZA HIGH SCHOOL
 65 BA .0247
 66 LS 0 92
 67 UD .0115
 *
 68 KK TPD2
 69 KM FLOW IN TORREY PINES DRIVE SOUTH OF DEL REY
 70 BA .00152
 71 LS 0 93
 72 UD 0.97
 *
 73 KK DRS
 74 KM COMBINE OFF2K WITH TPD2 - OFFSITE FLOW SOUTH OF DEL REY
 75 HC 2
 *

HEC-1 INPUT

PAGE 3

1
 LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
 76 KK DI2-5K
 77 KM COMBINE FLOWS FROM BONANZA HIGH SCHOOL AND OFF1CK
 78 HC 2
 *
 79 KK DIVERT
 80 KM DIVERT DROP INLET CAPACITY
 81 DT DI2-5K
 82 DI 0 10 20 30 40 50
 83 DQ 0 4 4 4 4 4
 *
 84 KK ->CP1K
 85 KM ROUTE FLOW FROM OFF2TO END OF PIPE
 86 RK 100 .011 .016 TRAP 50 5
 *
 87 KK CP1K
 88 KM COMBINE FLOWS AT END OF PIPE
 89 HC 2
 *
 90 KK RETURN
 91 KM RETURN FROM DI1K
 92 DR DI1K
 *
 93 KK RETURN
 94 KM RETURN FROM DI1K
 95 DR DI2-5K
 *
 96 KK CP1K
 97 KM COMBINE FLOWS AT CP1K
 98 HC 3
 *
 99 KK ->CP2K
 100 KM ROUTE OFF1K AND OFF2K TO CP2K
 101 RK 350 .007 .03 TRAP 5 25
 *
 102 KK KNPR
 103 KM FLOW FROM BASIN KNPR (KNPR RADIO STATION)

104 BA .00280
105 LS 0 95
106 UD .060
*

HEC-1 INPUT

PAGE 4

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

107 KK CP2K
108 KM COMBINE KNPR WITH ROUTED FLOW AT CP2K
109 HC 2
*

110 KK R1
111 KM ROUTE CP2K TO CM1
112 RK 1440 .02 .02 TRAP 0 50
*

113 KK FT-1
114 KM FUTURE BASIN 1
115 BA .03770
116 LS 0 95
117 UD .182
*

118 KK CM1
119 KM COMBINE FT-1 WITH ROUTED FLOW R1
120 HC 2
*

121 KK FT-2
122 BA .00791
123 LS 0 95
124 UD .112
*

125 KK FT-3
126 BA .00980
127 LS 0 95
128 UD .117
*

129 KK CM2
130 KM COMBINE FT-2 & FT-3 WITH CM1
131 HC 3
*

132 KK OFF1F
133 KM EXISTING OFFSITE BASIN OFF1F
134 BA .00605
135 LS 0 95
136 UD .068
*

137 KK P4-A
138 KM PHASE 4 - BASIN A
139 BA .00109
140 LS 0 95
141 UD .075
*

HEC-1 INPUT

PAGE 5

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

142 KK CM3
143 KM COMBINE OFF-1F AND P4-A
144 HC 2
*

145 KK R2
146 KM ROUTE OFF-1F AND P4-A
147 RK 350 .018 .02 TRAP 0 50
*

148 KK P4-B
149 KM PHASE 4 = BASIN B
150 BA .00280
151 LS 0 95
152 UD .055
*

153 KK CM4
154 KM COMBINE P4-B WITH ROUTED FLOWS R2
155 HC 2
*

156 KK R3
157 KM ROUTE CM4 TO CM5
158 RK 430 .018 .02 TRAP 0 50
*

159 KK OFF2F
160 KM OFFSITE BASIN OFF-2F

161 BA .00383
162 LS 0 95
163 UD .113
*

164 KK CM5
165 KM COMBINE OFF-2P WITH ROUTED FLOWS R3
166 HC 2
*

167 KK OFF4F
168 KM EXISTING OFFSITE BASIN OFF2F
169 BA .01072
170 LS 0 95
171 UD .134
*

172 KK CM6
173 KM COMBINE OFF4F WITH CM5
174 HC 2
*

HEC-1 INPUT

PAGE 6

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

175 KK R4
176 KM ROUTE CM6 TO EXISTING DROP INLET ADJACENT TO JUVENILE TREATMENT CENTER
177 RK 580 .004 .020 TRAP 2 50
*

178 KK FT-4
179 BA .01288
180 LS 95
181 UD .123
*

182 KK CM-D1
183 KM COMBINE FT-4 WITH ROUTED FLOWS R4
184 HC 2
*

185 KK BYPASS
186 KM FLOW DIVERTED TO EAST IN EXISTING STORM DRAIN
187 DT SD
188 DI 0 30 500
189 DQ 0 30 30
*

190 KK FT-5
191 BA .00861
192 LS 95
193 UD .119
*

194 KK CM7
195 KM COMBINE FT-5 WITH BYPASS FLOW FROM DROP INLET AT JUVENILE TREATMENT CENTER
196 HC 2
*

197 KK R5
198 KM ROUTE FLOW TO TO CM8 IN CAMPUS DRIVE
199 RK 640 .004 .018 TRAP 2 50
*

200 KK CD
201 BA .00306
202 LS 95
203 UD .103
*

204 KK CM8
205 KM COMBINE CD WITH ROUTED FLOW R5
206 HC 2
*

HEC-1 INPUT

PAGE 7

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

207 KK OV
208 KM RUNOFF FROM OPPORTUNITY VILLAGE
209 BA .00495
210 LS 95
211 UD .124
*

212 KK CM9
213 KM COMBINE OV WITH CM8
214 HC 2
*

215 KK CMT
216 KM TOTAL FLOW DOWNSTREAM OF PROPOSED CULVERT FACILITY
217 KM END "CCSN PHASE IV" PROPOSED HEC-1 BY LOCHSA ENGINEERING

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

```

V
V
34 DWS
37 OFF1BK
42 TPD
47 DWS
52 -----> DI1K
50 DIVERT
V
V
55 CP1K
58 OFF1CK
63 OFF2K
68 TPD2
73 DR5
76 DI2-5K
81 -----> DI2-5K
79 DIVERT
V
V
84 ->CP1K
87 CP1K
92 <----- DI1K
90 RETURN
95 <----- DI2-5K
93 RETURN
96 CP1K
V
V
99 ->CP2K
102 KNPR
107 CP2K
V
V
110 R1
113 FT-1
118 CM1
121 FT-2
125 FT-3
129 CH2
132 OFF1F
137 P4-A
142 CH3
V
V
145 R2

```


148	.	P4-B
153	CM4.....	
	V	
	V	
156	R3	
159	.	OFF2F
164	CM5.....	
167	.	OFF4F
172	CM6.....	
	V	
	V	
175	R4	
178	.	FT-4
182	CM-D1.....	
187	.	
185	BYPASS	SD
190	.	FT-5
194	CM7.....	
	V	
	V	
197	R5	
200	.	CD
204	CM8.....	
207	.	OV
212	CM9.....	
215	CM1.....	
	V	
	V	
219	R1	
222	OFF-2P	
	V	
	V	
226	R2	
229	.	ON-3
	V	
	V	
233	R3	
236	.	OFF-1P
	V	
	V	
240	R4	
	V	
	V	
243	R5	
246	.	ON-2
	V	
	V	
250	R6	
253	.	ON-1
	V	
	V	
257	R7	

260

ON-4

265

CPI.....

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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1*****
+ FLOOD HYDROGRAPH PACKAGE (HEC-1) +
+   JUN 1998                     +
+   VERSION 4.1                   +
+ RUN DATE 19MAR04 TIME 15:36:16 +
+*****

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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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*****
BEGINNING DESCRIBES ON AND OFF SITE FLOWS FOR THE
SOUTHERN NEVADA PSYCHIATRIC HOSPITAL
ON AND OFF SITE DRAINAGE BASINS
SIX HOUR STORM, SDN 3
REVIEWED BY: JOHN F MENG, E.I.
REVIEWED AND RECOMMENDED BY STUART POWELL, P.E.
PREPARED BY LUKE BOWLAND, E.I.
*****

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RATIO 1=100-YEAR STORM EVENT
RATIO 2=10-YEAR STORM EVENT

```

```

HEC-1 FILE: 403055-P.IH1
*****

```

17 IO

OUTPUT CONTROL VARIABLES

```

IPRNT      5 PRINT CONTROL
IPLOT      0 PLOT CONTROL
QSCAL      0. HYDROGRAPH PLOT SCALE

```

IT

HYDROGRAPH TIME DATA

```

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

```

```

COMPUTATION INTERVAL .08 HOURS
TOTAL TIME BASE 24.92 HOURS

```

ENGLISH UNITS

```

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

```

JP

MULTI-PLAN OPTION

```

NPLAN      1 NUMBER OF PLANS

```

JR

MULTI-RATIO OPTION

```

RATIOS OF PRECIPITATION
.57      1.00

```

1

```

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

```

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION	
				RATIO 1 .57	RATIO 2 1.00
HYDROGRAPH AT	OFF1AK	.02	1	13.	28.
				3.58	3.58
ROUTED TO	DWS	.02	1	13.	27.
				3.58	3.58
HYDROGRAPH AT	OFF1BK	.01	1	7.	14.
				3.50	3.50
HYDROGRAPH AT	TPD	.00	1	2.	3.
				3.50	3.50

3 COMBINED AT	DWS	.03	1	FLOW TIME	21. 3.58	44. 3.58
DIVERSION TO	DI1K	.03	1	FLOW TIME	1. 3.42	1. 3.25
HYDROGRAPH AT	DIVERT	.03	1	FLOW TIME	20. 3.58	43. 3.58
ROUTED TO	CP1K	.03	1	FLOW TIME	19. 3.58	43. 3.58
HYDROGRAPH AT	OFF1CK	.00	1	FLOW TIME	4. 3.58	8. 3.50
HYDROGRAPH AT	OFF2K	.02	1	FLOW TIME	25. 3.50	52. 3.50
HYDROGRAPH AT	TPD2	.00	1	FLOW TIME	0. 4.42	1. 4.42
2 COMBINED AT	DRS	.03	1	FLOW TIME	25. 3.50	52. 3.50
2 COMBINED AT	DI2-5K	.03	1	FLOW TIME	29. 3.50	60. 3.50
DIVERSION TO	DI2-5K	.03	1	FLOW TIME	4. 3.33	4. 3.17
HYDROGRAPH AT	DIVERT	.03	1	FLOW TIME	25. 3.50	56. 3.50
ROUTED TO	->CP1K	.03	1	FLOW TIME	24. 3.50	56. 3.50
2 COMBINED AT	CP1K	.06	1	FLOW TIME	41. 3.50	94. 3.50
HYDROGRAPH AT	RETURN	.00	1	FLOW TIME	1. 3.42	1. 3.25
HYDROGRAPH AT	RETURN	.00	1	FLOW TIME	4. 3.33	4. 3.17
3 COMBINED AT	CP1K	.06	1	FLOW TIME	46. 3.50	99. 3.50
ROUTED TO	->CP2K	.06	1	FLOW TIME	43. 3.50	94. 3.50
HYDROGRAPH AT	KNPR	.00	1	FLOW TIME	3. 3.50	6. 3.50
2 COMBINED AT	CP2K	.06	1	FLOW TIME	46. 3.50	100. 3.50
ROUTED TO	R1	.06	1	FLOW TIME	44. 3.58	94. 3.58
HYDROGRAPH AT	FT-1	.04	1	FLOW TIME	31. 3.58	61. 3.58
2 COMBINED AT	CM1	.10	1	FLOW TIME	75. 3.58	155. 3.58
HYDROGRAPH AT	FT-2	.01	1	FLOW TIME	7. 3.50	14. 3.50
HYDROGRAPH AT	FT-3	.01	1	FLOW TIME	9. 3.58	17. 3.50

3 COMBINED AT	CM2	.12	1	FLOW TIME	91. 3.58	186. 3.58
HYDROGRAPH AT	OFF1F	.01	1	FLOW TIME	6. 3.50	12. 3.50
HYDROGRAPH AT	P4-A	.00	1	FLOW TIME	1. 3.50	2. 3.50
2 COMBINED AT	CM3	.01	1	FLOW TIME	7. 3.50	14. 3.50
ROUTED TO	R2	.01	1	FLOW TIME	7. 3.50	13. 3.50
HYDROGRAPH AT	P4-B	.00	1	FLOW TIME	3. 3.50	6. 3.50
2 COMBINED AT	CM4	.01	1	FLOW TIME	10. 3.50	19. 3.50
ROUTED TO	R3	.01	1	FLOW TIME	9. 3.50	19. 3.50
HYDROGRAPH AT	OFF2F	.00	1	FLOW TIME	3. 3.50	7. 3.50
2 COMBINED AT	CM5	.01	1	FLOW TIME	13. 3.50	25. 3.50
HYDROGRAPH AT	OFF4F	.01	1	FLOW TIME	10. 3.50	19. 3.50
2 COMBINED AT	CM6	.02	1	FLOW TIME	22. 3.58	43. 3.50
ROUTED TO	R4	.02	1	FLOW TIME	22. 3.50	42. 3.58
HYDROGRAPH AT	FT-4	.01	1	FLOW TIME	12. 3.58	23. 3.58
2 COMBINED AT	CM-D1	.04	1	FLOW TIME	33. 3.58	65. 3.58
DIVERSION TO	SD	.04	1	FLOW TIME	30. 3.50	30. 3.33
HYDROGRAPH AT	BYPASS	.04	1	FLOW TIME	3. 3.50	35. 3.58
HYDROGRAPH AT	FT-5	.01	1	FLOW TIME	8. 3.58	15. 3.58
2 COMBINED AT	CM7	.05	1	FLOW TIME	11. 3.58	50. 3.58
ROUTED TO	R5	.05	1	FLOW TIME	9. 3.67	48. 3.58
HYDROGRAPH AT	CD	.00	1	FLOW TIME	3. 3.50	6. 3.50
2 COMBINED AT	CM8	.05	1	FLOW TIME	12. 3.58	54. 3.50
HYDROGRAPH AT	OV	.00	1	FLOW TIME	4. 3.58	9. 3.58
2 COMBINED AT	CM9	.05	1	FLOW	16.	62.

				TIME	3.58	3.58
2 COMBINED AT						
+	CMT	.17	1	FLOW TIME	107.	248.
					3.58	3.58
ROUTED TO						
+	R1	.17	1	FLOW TIME	103.	241.
					3.58	3.58
HYDROGRAPH AT						
+	OFF-2P	.00	1	FLOW TIME	3.	7.
					3.50	3.50
ROUTED TO						
+	R2	.00	1	FLOW TIME	3.	6.
					3.58	3.58
HYDROGRAPH AT						
+	ON-3	.00	1	FLOW TIME	1.	2.
					3.50	3.50
ROUTED TO						
+	R3	.00	1	FLOW TIME	1.	2.
					3.58	3.58
HYDROGRAPH AT						
+	OFF-1P	.00	1	FLOW TIME	2.	6.
					3.58	3.58
ROUTED TO						
+	R4	.00	1	FLOW TIME	2.	6.
					3.67	3.58
ROUTED TO						
+	R5	.00	1	FLOW TIME	2.	6.
					3.67	3.67
HYDROGRAPH AT						
+	ON-2	.01	1	FLOW TIME	7.	13.
					3.50	3.50
ROUTED TO						
+	R6	.01	1	FLOW TIME	7.	12.
					3.58	3.58
HYDROGRAPH AT						
+	ON-1	.01	1	FLOW TIME	11.	19.
					3.50	3.50
ROUTED TO						
+	R7	.01	1	FLOW TIME	10.	19.
					3.50	3.50
HYDROGRAPH AT						
+	ON-4	.00	1	FLOW TIME	2.	5.
					3.50	3.50
7 COMBINED AT						
+	CP1	.20	1	FLOW TIME	124.	285.
					3.58	3.58

1

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

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	INTERPOLATED TO COMPUTATION INTERVAL			VOLUME
						DT	PEAK	TIME TO PEAK	
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
FOR PLAN = 1	RATIO=	.57							
DWS	MANE	.51	12.89	216.10	.87	5.00	12.62	215.00	.87
CONTINUITY SUMMARY (AC-FT) - INFLOW= .8563E+00 EXCESS= .0000E+00 OUTFLOW= .8564E+00 BASIN STORAGE= .3131E-10 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	1.00							
DWS	MANE	.40	27.79	215.68	1.95	5.00	27.41	215.00	1.95
CONTINUITY SUMMARY (AC-FT) - INFLOW= .1919E+01 EXCESS= .0000E+00 OUTFLOW= .1919E+01 BASIN STORAGE= .4860E-10 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.57							
CP1K	MANE	.39	19.57	215.59	.80	5.00	19.36	215.00	.80
CONTINUITY SUMMARY (AC-FT) - INFLOW= .1240E+01 EXCESS= .0000E+00 OUTFLOW= .1240E+01 BASIN STORAGE= .3658E-07 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	1.00							
CP1K	MANE	.38	43.05	215.57	1.82	5.00	42.94	215.00	1.83

APPENDIX III
STREET FLOW ANALYSIS – FLOWMASTER

Oakey Blvd (100 year storm)
Worksheet for Irregular Channel

just downstream of our Site

Project Description	
Project File	h:\fmw\403055.fm2
Worksheet	Oakey Blvd (100 year storm)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data					
Channel Slope		0.014000 ft/ft			
Elevation range: 0.00 ft to 0.79 ft.					
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness	
0.00	0.60	0.00	7.00	0.013	
5.00	0.50	7.00	73.00	0.016	
5.50	0.50	73.00	80.00	0.013	
5.50	0.00				
7.00	0.13				
40.00	0.79				
73.00	0.13				
74.50	0.00				
74.50	0.50				
75.00	0.50				
80.00	0.60				
Discharge	42.00	ft ³ /s			

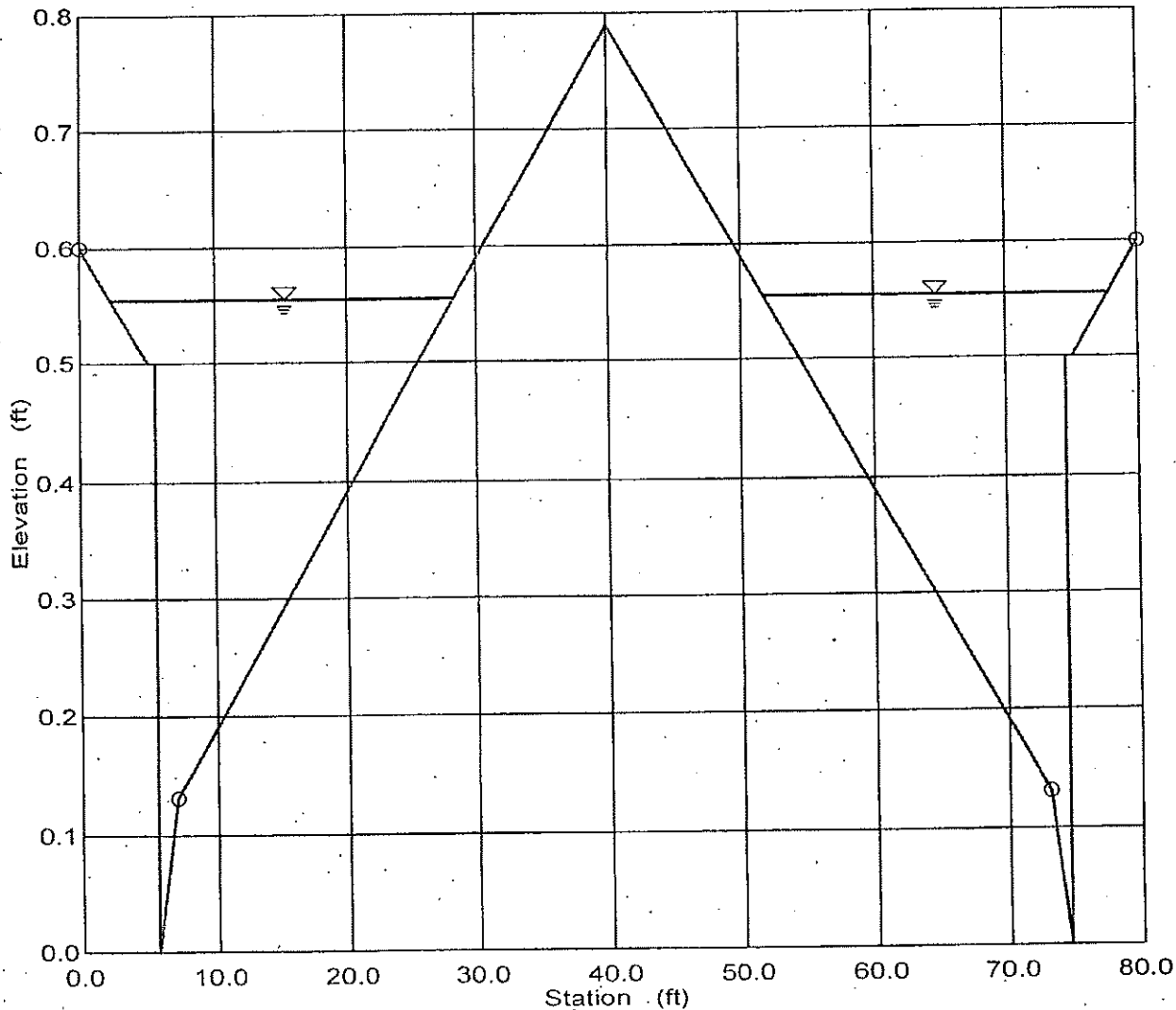
Results			
Wtd. Mannings Coefficient	0.015		
Water Surface Elevation	0.55	ft	
Flow Area	10.71	ft ²	
Wetted Perimeter	53.02	ft	
Top Width	52.00	ft	
Depth	0.55	ft	
Critical Water Elev.	0.63	ft	
Critical Slope	0.005658	ft/ft	
Velocity	3.92	ft/s	
Velocity Head	0.24	ft	
Specific Energy	0.79	ft	
Froude Number	1.52		
Full Flow Capacity	54.51	ft ³ /s	
Flow is supercritical.			
Flow is divided.			

$d \times v = 2.16 < 8 \text{ OK}$

Oakey Blvd (100 year storm)
Cross Section for Irregular Channel

Project Description	
Project File	h:\fmw\403055.fm2
Worksheet	Oakey Blvd (100 year storm)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.015
Channel Slope	0.014000 ft/ft
Water Surface Elevation	0.55 ft
Discharge	42.00 ft ³ /s



Oakey Blvd (10 year storm)
Worksheet for Irregular Channel

— just downstream of our Site

Project Description	
Project File	h:\fmw\403055.fm2
Worksheet	Oakey Blvd (10 year storm)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data

Channel Slope 0.014000 ft/ft

Elevation range: 0.00 ft to 0.79 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	0.60	0.00	7.00	0.013
5.00	0.50	7.00	73.00	0.016
5.50	0.50	73.00	80.00	0.013
5.50	0.00			
7.00	0.13			
40.00	0.79			
73.00	0.13			
74.50	0.00			
74.50	0.50			
75.00	0.50			
80.00	0.60			
Discharge	17.00	ft ³ /s		

Results	
Wtd. Mannings Coefficient	0.014
Water Surface Elevation	0.41 ft
Flow Area	4.85 ft ²
Wetted Perimeter	31.49 ft
Top Width	30.66 ft
Depth	0.41 ft
Critical Water Elev.	0.47 ft
Critical Slope	0.005730 ft/ft
Velocity	3.51 ft/s
Velocity Head	0.19 ft
Specific Energy	0.60 ft
Froude Number	1.55
Full Flow Capacity	54.51 ft ³ /s
Flow is supercritical.	
Flow is divided.	

slope

Q₁₀

d₁₀

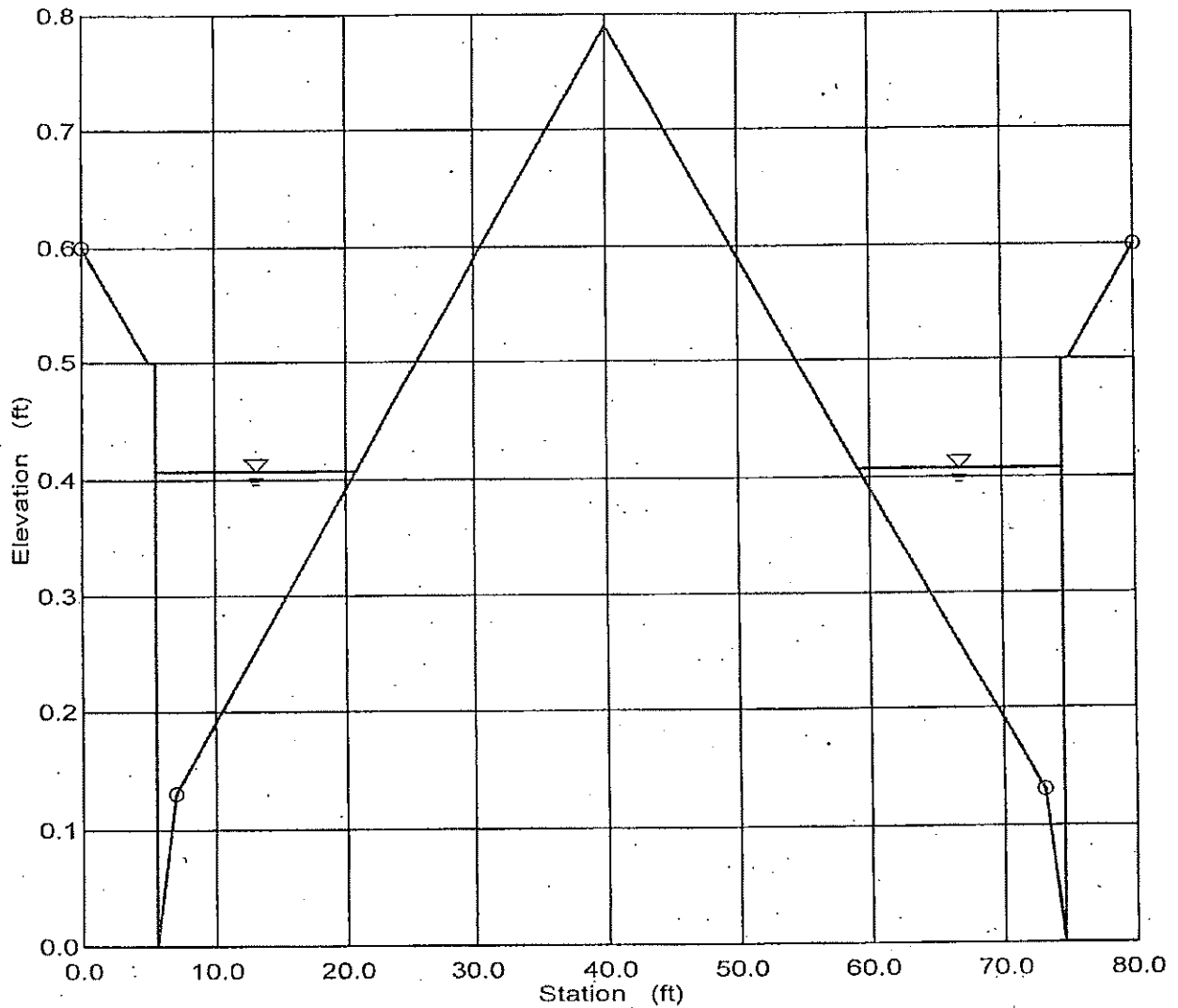
v₁₀

$$d \times v = .41 \times 3.51 = 1.44 < 6 \text{ ok} \checkmark$$

Oakey Blvd (10 year storm)
Cross Section for Irregular Channel

Project Description	
Project File	h:\fmw\403055.fm2
Worksheet	Oakey Blvd (10 year storm)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.014
Channel Slope	0.014000 ft/ft
Water Surface Elevation	0.41 ft
Discharge	17.00 ft ³ /s



Community College Drive (100 year storm)
Worksheet for Irregular Channel

(EAST OF OUR SITE -
Not typical crowned
street)

Project Description	
Project File	h:\fmw\403055.fm2
Worksheet	Community College Drive (100 year storm)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data					
Channel Slope	0.006000 ft/ft				
Elevation range: 0.00 ft to 1.84 ft.					
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness	
0.00	1.84	0.00	100.00	0.017	
5.00	1.74				
5.50	1.74				
5.50	1.24				
7.00	1.36				
7.00	1.41				
19.00	1.60				
93.00	0.17				
93.00	0.13				
94.50	0.00				
94.50	0.50				
95.00	0.50				
100.00	0.60				
Discharge	62.00	ft ³ /s			

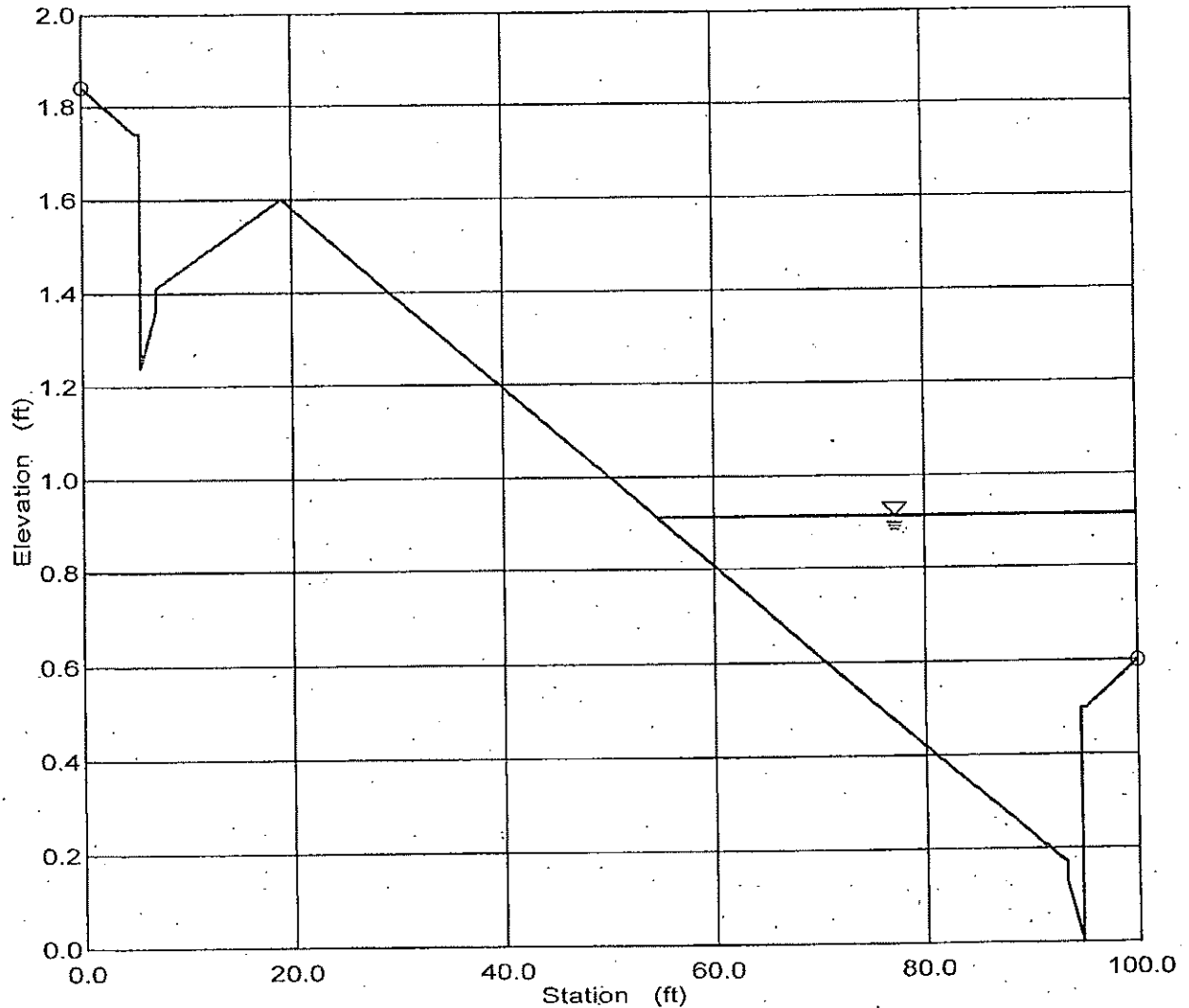
Results	
Wtd. Mannings Coefficient	0.017
Water Surface Elevation	0.91 ft
Flow Area	17.50 ft ²
Wetted Perimeter	46.22 ft
Top Width	45.36 ft
Depth	0.91 ft
Critical Water Elev.	0.91 ft
Critical Slope	0.005928 ft/ft
Velocity	3.54 ft/s
Velocity Head	0.20 ft
Specific Energy	1.11 ft
Froude Number	1.01
Full Flow Capacity	514.26 ft ³ /s
Flow is supercritical.	
Water elevation exceeds lowest end station by 0.31 ft.	

$d \times v = .91 \times 3.54 = 3.22 < 8$
OK

Community College Drive (100 year storm)
Cross Section for Irregular Channel

Project Description	
Project File	h:\fmw\403055.fm2
Worksheet	Community College Drive (100 year storm)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.017
Channel Slope	0.006000 ft/ft
Water Surface Elevation	0.91 ft
Discharge	62.00 ft ³ /s



Community College Drive (10-year storm)
Worksheet for Irregular Channel

EAST OF OUR
PROJECT SITE
(road is not typical section)

Project Description	
Project File	h:\fmw\403055.fm2
Worksheet	Community College Drive (10 year storm)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data					
Channel Slope	0.006000 ft/ft				
Elevation range: 0.00 ft to 1.84 ft.					
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness	
0.00	1.84	0.00	100.00	0.017	
5.00	1.74				
5.50	1.74				
5.50	1.24				
7.00	1.36				
7.00	1.41				
19.00	1.60				
93.00	0.17				
93.00	0.13				
94.50	0.00				
94.50	0.50				
95.00	0.50				
100.00	0.60				
Discharge	16.00	ft ³ /s			

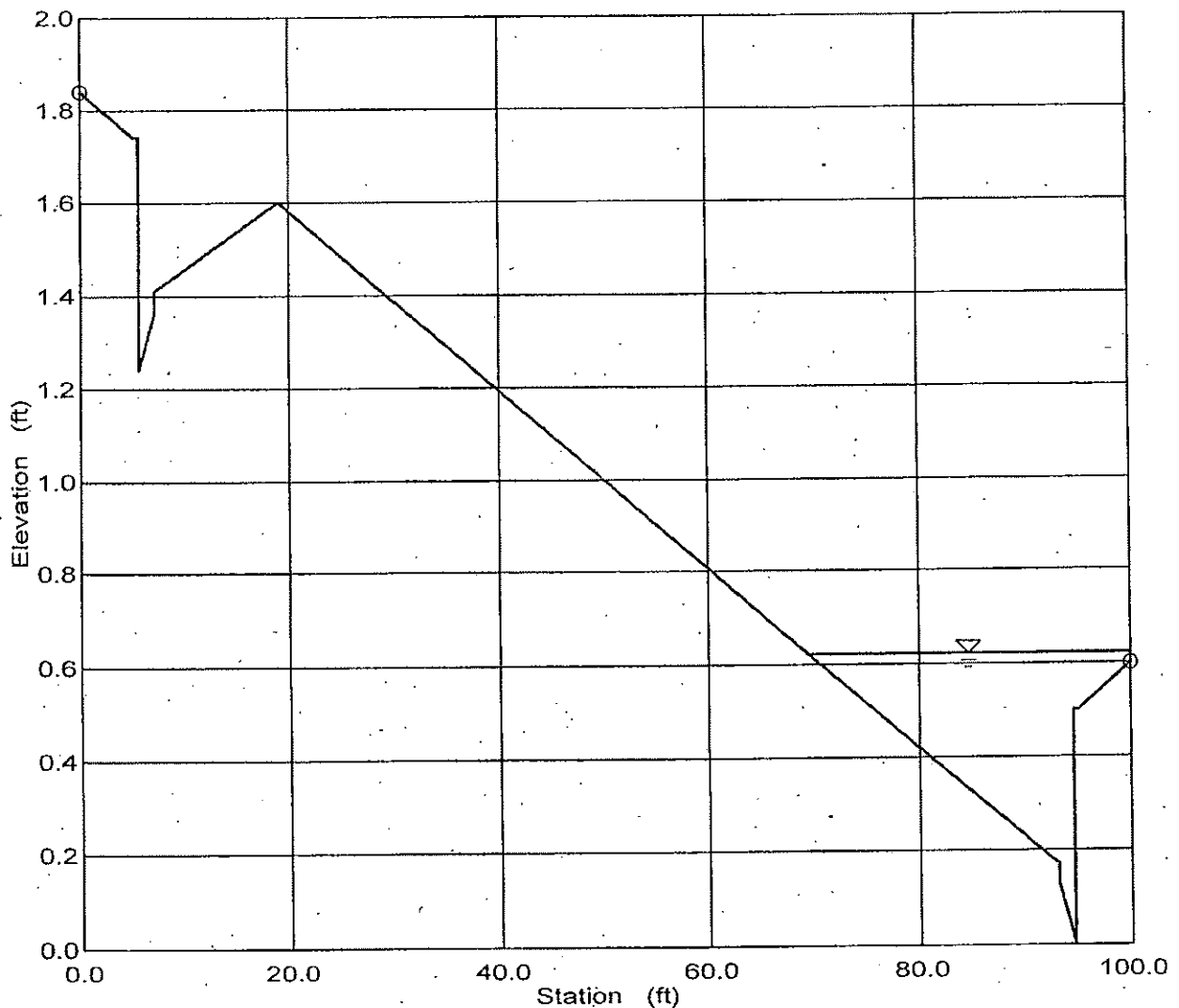
Results	
Wtd. Mannings Coefficient	0.017
Water Surface Elevation	0.62 ft
Flow Area	6.63 ft ²
Wetted Perimeter	31.11 ft
Top Width	30.53 ft
Depth	0.62 ft
Critical Water Elev.	0.61 ft
Critical Slope	0.007290 ft/ft
Velocity	2.41 ft/s
Velocity Head	0.09 ft
Specific Energy	0.72 ft
Froude Number	0.91
Full Flow Capacity	514.26 ft ³ /s
Flow is subcritical.	
Water elevation exceeds lowest end station by 0.02 ft.	

$d \times v = .62 \times 2.41 = 1.49 < 6$ OK ✓

**Community College Drive (10⁰ year storm)
Cross Section for Irregular Channel**

Project Description	
Project File	h:\fmw\403055.fm2
Worksheet	Community College Drive (10 year storm)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.017
Channel Slope	0.006000 ft/ft
Water Surface Elevation	0.62 ft
Discharge	16.00 ft ³ /s



EAST OF PROJECT SITE

100-Year Discharge
Worksheet for Irregular Channel

PROPOSED CONDITIONS
(WORST CASE)

Project Description	
Project File	c:\art\1297\1297.fm2
Worksheet	Campus Drive
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Campus Drive = Community College Drive

Input Data

Channel Slope 0.004000 ft/ft

Elevation range: 0.00 ft to 1.84 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
100.00	1.84	100.00	107.00	0.013
105.00	1.74	107.00	193.00	0.018
105.50	1.74	193.00	200.00	0.015
105.50	1.24			
107.00	1.36			
107.00	1.41			
119.00	1.60			
193.00	0.17			
193.00	0.13			
194.50	0.00			
194.50	0.50			
195.00	0.50			
200.00	0.60			
Discharge	63.00	cfs		

Q_{100} (TOTAL)

Results

Wtd. Mannings Coefficient	0.017	
Water Surface Elevation	0.98	ft ← d_w
Flow Area	20.77	ft ²
Wetted Perimeter	49.85	ft
Top Width	48.91	ft
Height	0.98	ft
Critical Depth	0.92	ft
Critical Slope	0.006115	ft/ft
Velocity	3.03	ft/s ← V_{100}
Velocity Head	0.14	ft
Specific Energy	1.12	ft
Froude Number	0.82	

Flow is subcritical.

Water elevation exceeds lowest end station by 0.38 ft.

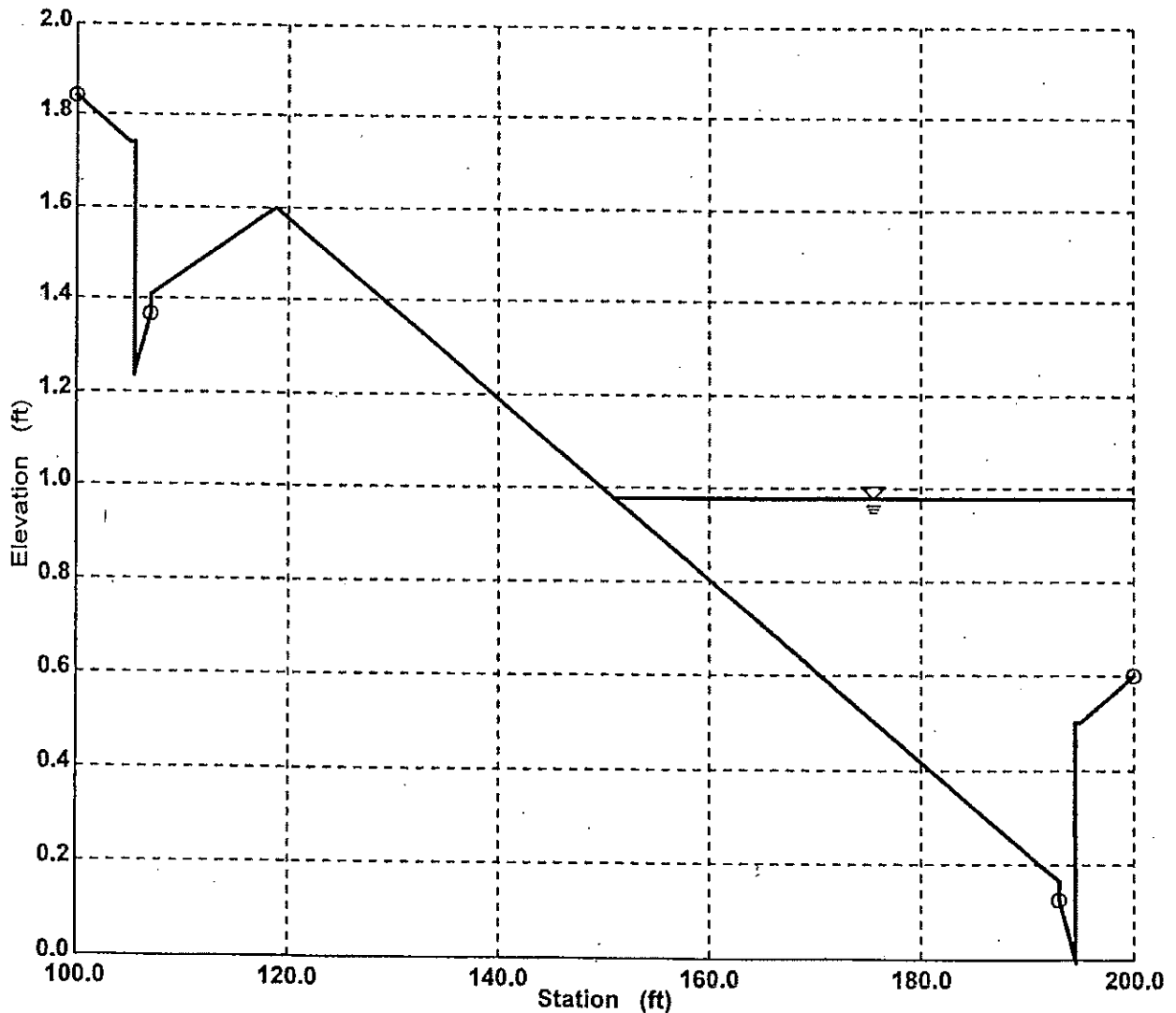
100-Year Discharge
Cross Section for Irregular Channel

PROPOSED CONDITION:
(WORST CASE)

Project Description	
Project File	c:\art\1297\1297.fm2
Worksheet	Campus Drive
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Campus Drive = Community College Drive

Section Data	
Wtd. Mannings Coefficient	0.017
Channel Slope	0.004000 ft/ft
Water Surface Elevation	0.98 ft
Discharge	63.00 cfs



PROJECT SITE

17/420fs - EXISTING & ULTIMATE (AT PROJECT SITE)



CITY WIDE
HYDROLOGY STUDY
UPDATE - 1997

LEGEND

SUB-BASIN BOUNDARY

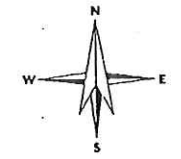
FLOW ARROW

250 10-YEAR EXISTING FLOW
500 100-YEAR EXISTING FLOW
300 10-YEAR ULTIMATE FLOW
800 100-YEAR ULTIMATE FLOW

(FLOWS IN CFS)

NOTE:

Facility flows must be subtracted from flows shown to determine surface flows. (See "F" sheets for facility flows)



1 INCH = 1600 FEET

FIGURE H-17

1	2			
3	4			
5	6			
7	8	9	10	
11	12	13	14	15
16	17	18	19	

PBS POST, BUCKLEY, SCHUH & JERNIGAN, INC.

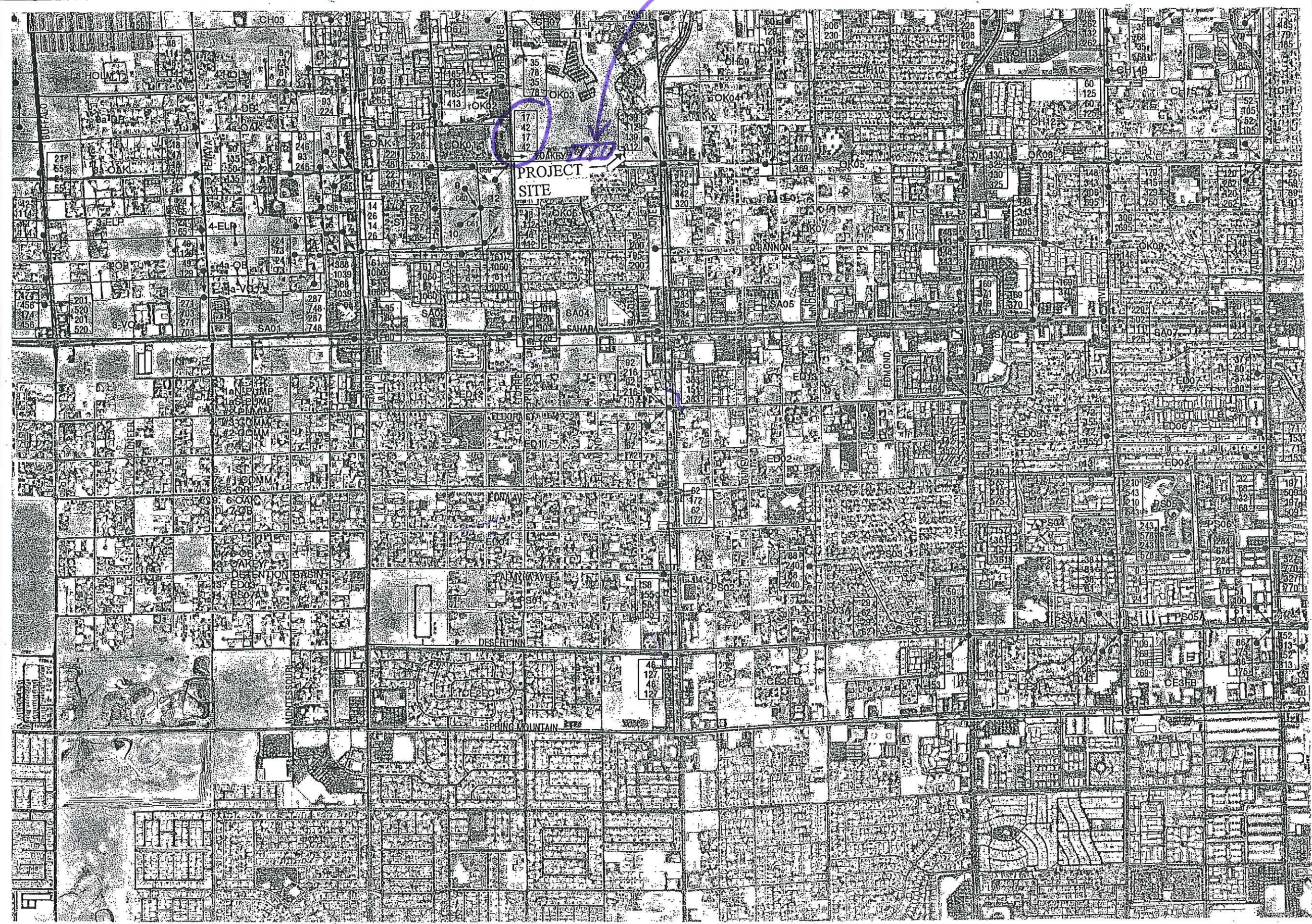
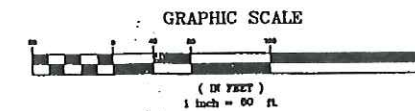


PHOTO DATE: APRIL 1996

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EXISTING CONDITIONS FLOW SUMMARY

BASIN NAME/ STREET NAME	Q100 (CFS)	Q10 (CFS)	FLOW DEPTH (FT.) (100 YR)	VELOCITY (FT./S) (100 YR)
CMT	248	107	—	—
OFF - 1E	6	2	—	—
OFF - 2E	7	3	—	—
EX - 1	24	9	—	—
CP - 1	268	112	—	—
COMMUNITY COLLEGE DRIVE	62	16	0.91	3.54
OAKLEY BOULEVARD	42	17	0.55	3.92

LEGEND

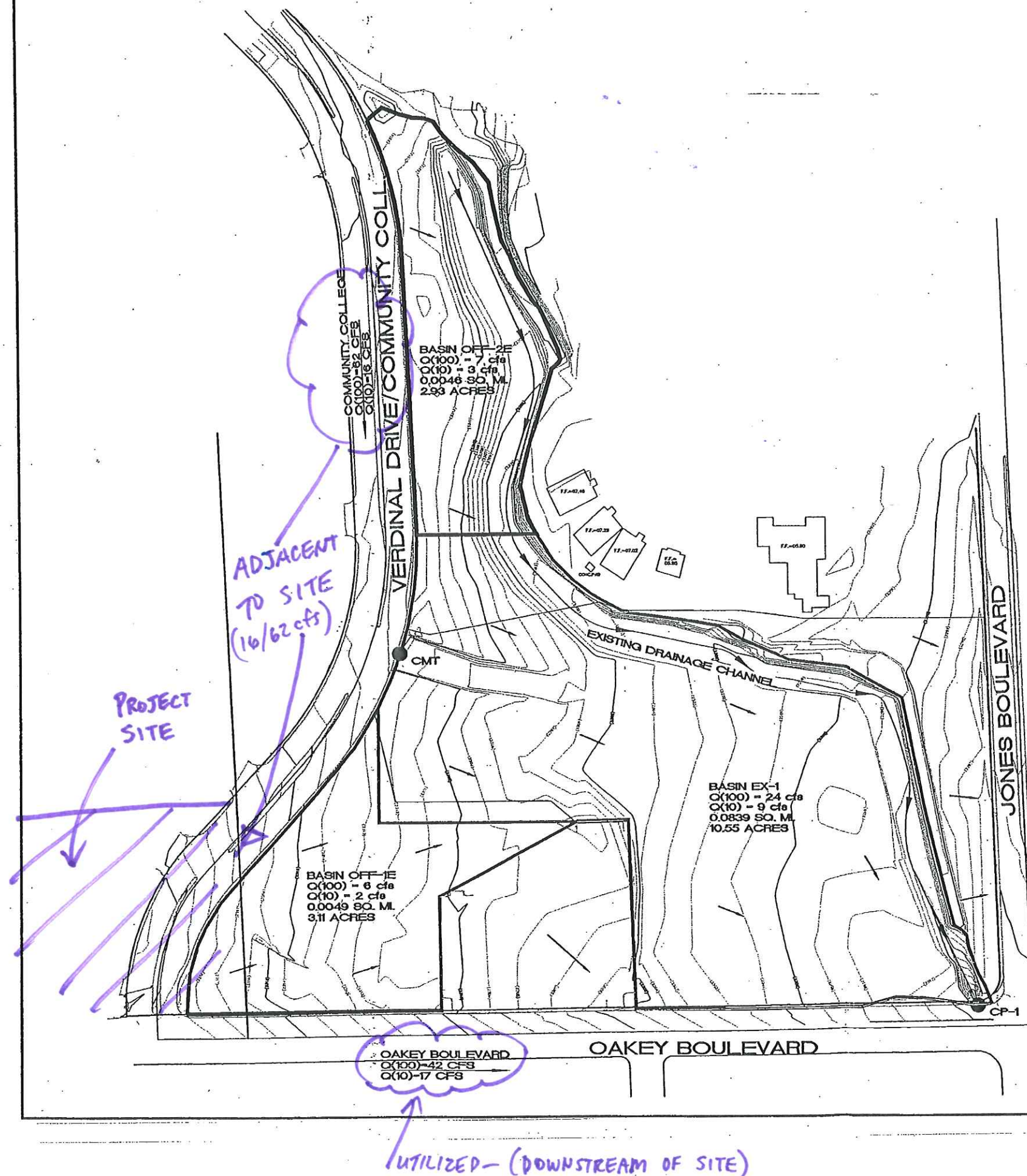
BASIN D1
Q(100) = 100 CFS
Q(10) = 10 CFS
0.00156 SQ. MI./ 1 ACRE
N.A.P.

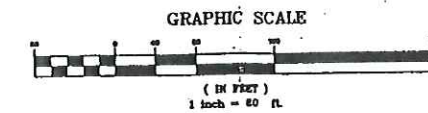
BASIN DESCRIPTION
100 YEAR FLOW RATE
10 YEAR FLOW RATE
BASIN AREA
NOT A PART
FLOW DIRECTION
BASIN BOUNDARY
SOIL BOUNDARY

BASIS OF BEARINGS

BENCHMARK:

**FIGURE 6
DRAINAGE BASINS
EXISTING CONDITIONS**
(24 X 36 INCLUDED)





PROPOSED CONDITIONS FLOW SUMMARY

BASIN NAME/ STREET NAME	Q100 (CFS)	Q10 (CFS)	FLOW DEPTH (FT.) (100 YR)	VELOCITY (FT./S) (100 YR)
CMT	248	107		
OFF-1P	6	2		
OFF-2P	7	3		
ON-1	19	11		
ON-2	13	7		
ON-3	2	1		
ON-4	5	2		
COMMUNITY COLLEGE DRIVE	62	16	0.01	3.54
OAKLEY BOULEVARD (WEST OF CHANNEL)	42	17	0.55	3.92
OAKLEY BOULEVARD (EAST OF CHANNEL)	195	17	1.03	6.12

REFERENCED

LEGEND

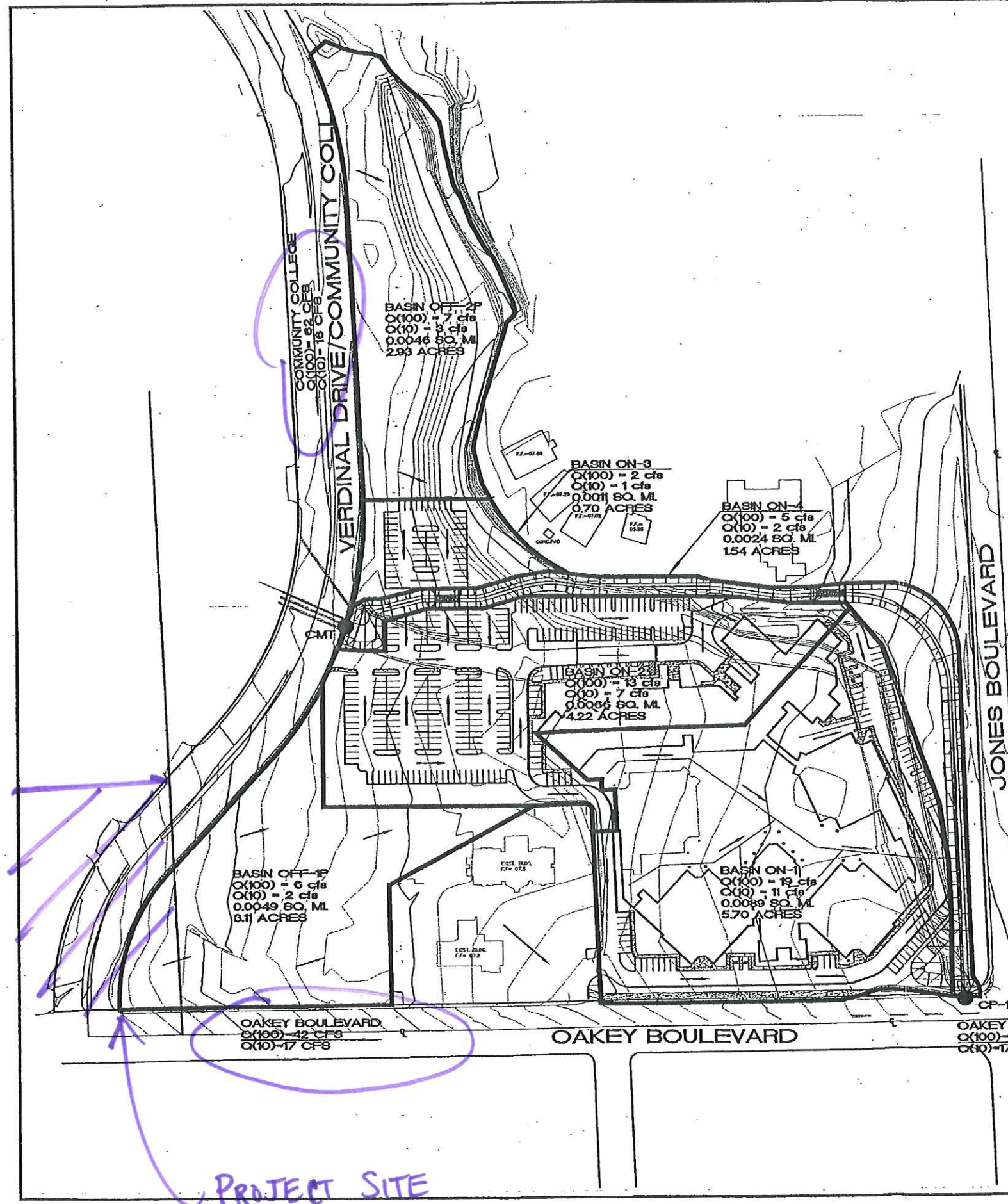
BASIN D1
 Q(100) = 100 CFS
 Q(10) = 10 CFS
 0.00156 SQ. MI. / 1 ACRE
 N.A.P.

BASIN DESCRIPTION
 100 YEAR FLOW RATE
 10 YEAR FLOW RATE
 BASIN AREA
 NOT A PART
 FLOW DIRECTION
 BASIN BOUNDARY
 SOIL BOUNDARY

BASIS OF BEARINGS
 S 89°16'15" W BEING THE SOUTH LINE OF THE
 N.E. 1/4, SECTION 2, AS SHOWN ON RECORD OF
 SURVEY RECORDED IN FILE 47, PAGE 58 OF
 SURVEYS, CLARK COUNTY RECORDS.

BENCHMARK:
 7C101W4
 RIVET AND SQUARE ALUMINUM PLATE IN TOP OF CURB,
 NORTHEAST CORNER OF JONES BLVD. AND OAKLEY BLVD.
 NEAR THE P.C. OF JONES BLVD.
 NAVD 88 ELEVATION = 2294.388
 METERS = 699.331

FIGURE 7
DRAINAGE BASINS
PROPOSED CONDITIONS
 (24 X 36 INCLUDED)



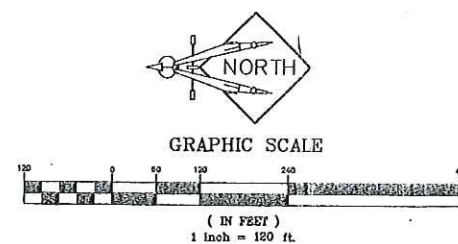
The map is a detailed site plan of the University of California, Riverside campus. It shows various buildings, parking lots, and roads. Key features include the Juvenile Treatment Center, Community College Drive, and Oakley Boulevard. A red outline highlights a specific area on the right side of the map, labeled 'Opportunity Village'. The map includes a north arrow and a graphic scale in feet.

Map Labels and Features:

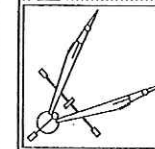
- Streets:** CHARLESTON BLVD., COMMUNITY COLLEGE DRIVE, OAKLEY BOULEVARD, DEL RAY AVENUE.
- Buildings and Areas:**
 - Juvenile Treatment Center
 - EX-1 (1.53 AC), EX-2 (2.08 AC), EX-3 (3.40 AC), EX-4 (10.01 AC), EX-5 (2.21 AC), EX-6 (3.29 AC)
 - OFF-1F (3.87 AC), OFF-2F (2.45 AC), OFF-3F (1.53 AC), OFF-4F (5.85 AC), OFF-5F (1.79 AC), OFF-6F (1.38 AC), OFF-7F (1.53 AC), OFF-8F (1.53 AC), OFF-9F (1.53 AC), OFF-10F (1.53 AC), OFF-11F (1.53 AC), OFF-12F (1.53 AC), OFF-13F (1.53 AC), OFF-14F (1.53 AC), OFF-15F (1.53 AC), OFF-16F (1.53 AC), OFF-17F (1.53 AC), OFF-18F (1.53 AC), OFF-19F (1.53 AC), OFF-20F (1.53 AC), OFF-21F (1.53 AC), OFF-22F (1.53 AC), OFF-23F (1.53 AC), OFF-24F (1.53 AC), OFF-25F (1.53 AC), OFF-26F (1.53 AC), OFF-27F (1.53 AC), OFF-28F (1.53 AC), OFF-29F (1.53 AC), OFF-30F (1.53 AC), OFF-31F (1.53 AC), OFF-32F (1.53 AC), OFF-33F (1.53 AC), OFF-34F (1.53 AC), OFF-35F (1.53 AC), OFF-36F (1.53 AC), OFF-37F (1.53 AC), OFF-38F (1.53 AC), OFF-39F (1.53 AC), OFF-40F (1.53 AC), OFF-41F (1.53 AC), OFF-42F (1.53 AC), OFF-43F (1.53 AC), OFF-44F (1.53 AC), OFF-45F (1.53 AC), OFF-46F (1.53 AC), OFF-47F (1.53 AC), OFF-48F (1.53 AC), OFF-49F (1.53 AC), OFF-50F (1.53 AC), OFF-51F (1.53 AC), OFF-52F (1.53 AC), OFF-53F (1.53 AC), 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LEGEND

- | | |
|---|------------------------|
|  | FLOW DIRECTION |
| FT-1 | BASIN NAME |
| 24.13 | BASIN AREA |
|  | BASIN DELINEATION |
| CM9 | FLOW COMBINATION POINT |
|  | |
| R1 | ROUTED FLOW |



This grading plan is a part of drainage study # 3557 which was received on 6/11/14 and on 6/11/14. Page 6 of 6



08 TITLE
COMMUNITY COLLEGE
OF SOUTHERN
NEVADA

DRAINAGE PLAN
EXISTING CONDITION

[illegible]

DATE: JAN. 16, 1998

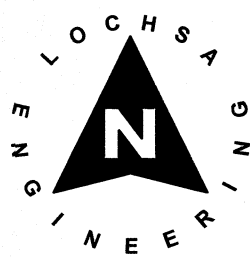
JOB No. 1207

DESIGN BY:

DRABAY:

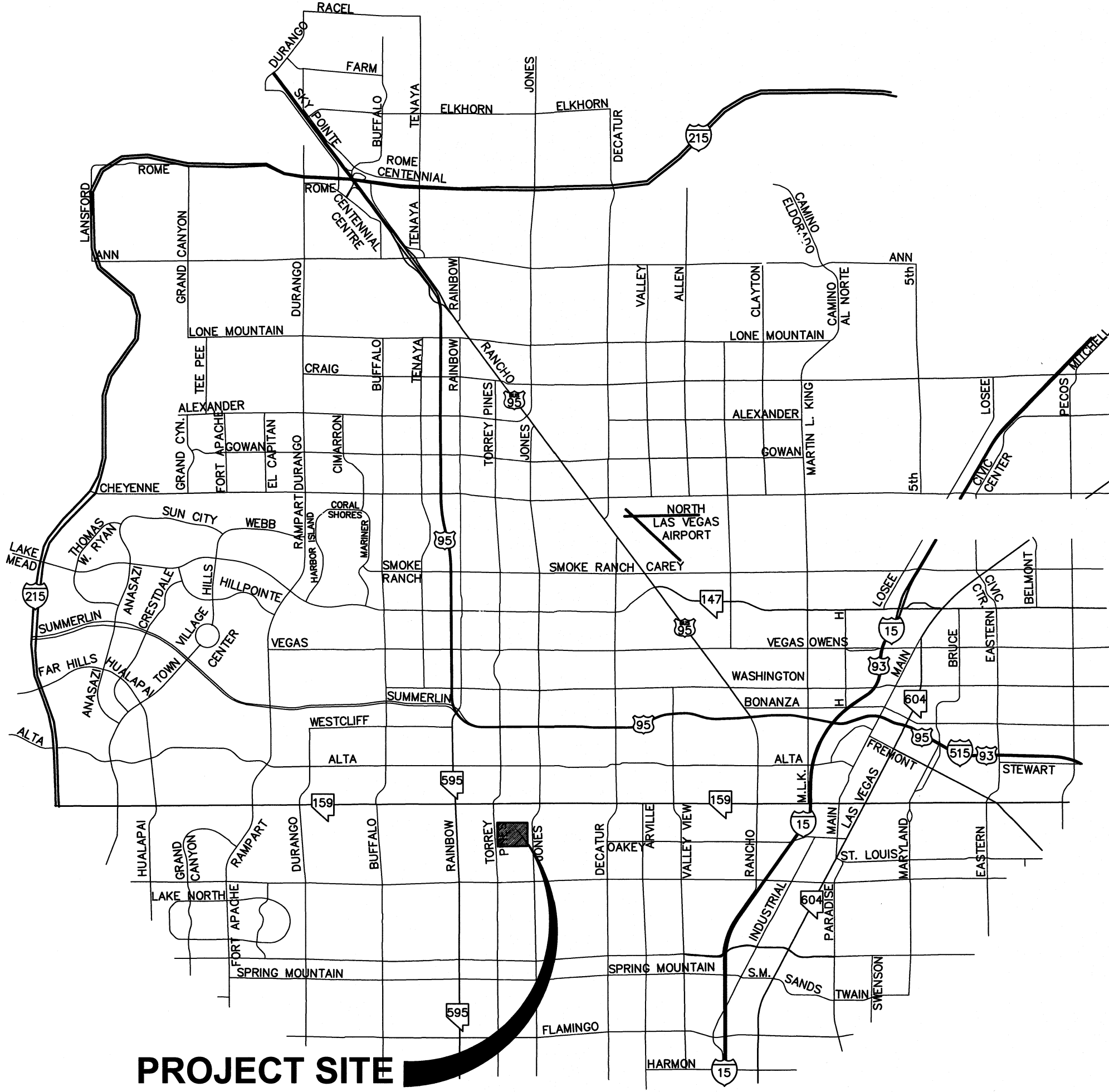
SHEET No.

SHEET 1 OF 3



IMPROVEMENT PLANS FOR OPPORTUNITY VILLAGE OAKY CAMPUS CITY OF LAS VEGAS, NEVADA

A PORTION OF THE NORTHEAST QUARTER (NE 1/4) OF SECTION 2,
TOWNSHIP 21 SOUTH, RANGE 60 EAST, M.D.B.&M. CITY OF LAS VEGAS
NEVADA. LOT 2.
A.P.N.: 163-02-601-005



PROJECT SITE

ABBREVIATIONS

ABAN	ABANDON	INV	INVERT
AIP	ABANDON IN PLACE	IS	ISLAND
AGG	AGGREGATE	JB	JUNCTION BOX
ALT	ALTERNATE	LOC	LENGTH OF CURB
A	AND	LT	LEFT
ACP	ASBESTOS CEMENT PIPE	LF	LINEAR FEET
ACP	ASPHALTIC CONCRETE	LVWD	LAS VEGAS VALLEY WATER DISTRICT
AVE	AVENUE	MH	MANHOLE
BC	BACK OF CURB	MAX	MAXIMUM
BCR	BACK OF CURB RADIUS	MIN	MINIMUM
BVC	BEGINNING OF VERTICAL CURVE	MON	MONOLITHIC
BM	BENCHMARK	N/O	NORTH OF
BDRY LINE	BOUNDARY LINE	NTS	NOT TO SCALE
CATV	CABLE TELEVISION	OC	ON CENTER
C-C	CENTER TO CENTER	OG	OPEN-GRADED PAVEMENT, ORIGINAL GROUND
C-C	CENTERLINE	PMT	POINT OF INTERSECTION
CBC	CITY OF BOULDER CITY	PRC	POINT OF REVERSE CURVE
CLV	CITY OF LAS VEGAS	PC	POINT OF CURVE
COH	CITY OF HENDERSON	PT	POINT OF TANGENCY
CM	CITY OF MESQUITE	PCC	POINT OF COMPOUND CURVE
CNLV	CITY OF NORTH LAS VEGAS	PCC, CONC	PORTLAND CEMENT CONCRETE
CC	CLARK COUNTY	PP	POWER POLE
CCWRD	CLARK COUNTY WATER RECLAMATION DISTRICT	P	POWER
CO	CLEAN OUT, SEWER	PL	PROPERTY LINE
COMM	COMMERCIAL	PROP	PROPOSED
CONC	CONCRETE	RP	RADIUS POINT
CONST	CONSTRUCTION OR CONSTRUCT	R	RADIUS
COR	CORNER	RR	RAILROAD
CMF	CORRUGATED METAL PIPE	REINF	REINFORCED
CSAP	CORRUGATED STEEL ARCH PIPE	RC	REINFORCED CONCRETE
CSP	CORRUGATED STEEL PIPE	RCB	REINFORCED CONCRETE BOX
C&G	CURB & GUTTER	RCP	REINFORCED CONCRETE PIPE
CIP	CAST IRON PIPE	RELOC	RELOCATE
COL	COLUMN	RT	RIGHT
CU YD, CY	CUBIC YARD	R/W	RIGHT-OF-WAY
CU FT, CF	CUBIC FOOT	SS	SANITARY SEWER
CULV	CULVERT	SHT	SHEET
CF	CURB FACE	S/O	SOUTH OF
DEPT	DEPARTMENT	SW	SIDEWALK
DIA	DIAMETER	SO FT, SF	SQUARE FOOT
DWY	DRIVEWAY	SO YD, SY	SQUARE YARD
DI	DROP INLET	STA	STATION
ESMT	EASEMENT	SHIP	STEEL HIGH-PRESSURE PIPE
E/O	EDGE OF PAVEMENT	STD	STANDARD
EP	EDGE OF OIL	STDR	STORM DRAIN
E	ELECTRIC	STRUCT	STRUCTURAL OR STRUCTURE
EM	ELECTRIC METER	SURV	SURVEY
ELEV	ELEVATION	SUT	STREETLIGHT
EMBK	EMBANKMENT	TEMP	TEMPORARY
END	END OF CURB RETURN	TO BE ADJUSTED	TO BE ADJUSTED
EC	END OF CURVE	TO BE REMOVED	TO BE REMOVED
EBS	CATHODE PROTECTION BOND STATION	TC	TOP OF CURB
ETS	CATHODE PROTECTION TEST STATION	TP	TOP OF PIPE
EVC	END OF VERTICAL CURVE	TS	TRAFFIC SIGNAL
EXIST	EXISTING	TSI	TRAFFIC SIGNAL INTERCONNECT
FE	FEET/FOOT	TRANS	TRANSITION
FG	FINISH GRADE	UG	UNDERGROUND
FA	FIRE ALARM	VAR	VARIABLE
FH	FIRE HYDRANT	VERT	VERTICAL
FLW LINE	FLOW LINE	VC	VERTICAL CURVE
GALV	GLAZANIZED	VG	VALLEY GUTTER
GM	GAS METER	VCP	VITRIFIED CLAY PIPE
GR	GAS PRESSURE REGULATOR	W	WATER
PL-G	PLASTIC GAS	WM	WATER METER
SG	STEEL GAS	W/O	WEST OF
GB	GRADE BREAK	YD	YARD
GUT	GUTTER		
HDWL	HEADWALL		
IN	INCH		
INT	INTERSECTION		

DEVELOPER

OPPORTUNITY VILLAGE
6300 W OAKY BLVD
LAS VEGAS, NEVADA 89146
LAS VEGAS, NEVADA 89146
CONTACT: ERIC HANNAH
PHONE: 702-743-5760
FAX: ----

OWNER

STATE OF NEVADA DIV OF LANDS
901 S. STEWART STREET, STE. 5003
CARSON CITY, NEVADA 89701
CONTACT: CHARLES DONOHUE
PHONE: 775-684-2720

UTILITY PROVIDERS

WATER:	LAS VEGAS VALLEY WATER DISTRICT
SEWER:	CITY OF LAS VEGAS
GAS:	SOUTHWEST GAS CORPORATION
ELECTRIC:	NV ENERGY
TELEPHONE:	CENTURYLINK
CABLE TV:	COX COMMUNICATIONS LAS VEGAS, INC.
TRASH:	REPUBLIC SILVER STATE DISPOSAL SERVICE

APPROVALS

ALLEN PAVELKA, P.E., #9029 CITY ENGINEER	DATE
APPROVAL OF THESE PLANS IS LIMITED TO THOSE IMPROVEMENTS CONSTRUCTED IN THE DEDICATED RIGHT-OF-WAY AND/OR DEDICATED EASEMENTS. THIS APPROVAL DOES NOT AUTHORIZE THE CONSTRUCTION OF ANY IMPROVEMENTS THAT DEVIATE FROM ADOPTED STANDARDS AND/OR SPECIFICATIONS, EXCEPT THOSE SPECIFICALLY LISTED UNDER DEVIATIONS FROM STANDARD. THE ENGINEER SHALL RESOLVE ANY DEVIATION OTHER THAN THOSE LISTED IN DEVIATIONS FROM STANDARDS IN FAVOR OF THE UNIFORM STANDARDS DRAWINGS AND SPECIFICATIONS CLARK COUNTY AREA, NEVADA.	
CHRIS KNIGHT, DIRECTOR -- BUILDING AND SAFETY	DATE
NOTE: THIS PLAN CONFORMS TO THE APPLICABLE STANDARDS OF THE PLANNING DEPARTMENT.	
LAS VEGAS FIRE AND RESCUE	DATE
LAS VEGAS VALLEY WATER DISTRICT APPROVED FOR CONSTRUCTION	
LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER PROJECT NO. XXXX SHEETS: XXXXX LVWD APPROVED FIRE FLOW = XXXX GPM AT 20 PSI RESIDUAL	DATE
SOUTHWEST GAS CORPORATION	DATE
NV ENERGY	DATE
NV ENERGY ACKNOWLEDGES THAT WE HAVE RECEIVED YOUR PLANS AND WILL PROVIDE SERVICE TO ALL ELECTRICAL NEEDS ASSOCIATED WITH THIS PROJECT. NV ENERGY RESERVES THE RIGHT TO ADDRESS ANY EXISTING OR FUTURE CONFLICTS ONCE THE FINAL DESIGN IS COMPLETED. THE NEW SERVICE AND THE RESOLUTION OF ANY CONFLICTS WILL BE ACCOMPLISHED PURSUANT TO THE NEVADA PUBLIC UTILITY COMMISSION'S RULES AND REGULATIONS.	
COX COMMUNICATIONS LAS VEGAS, INC.	DATE
CENTRAL TELEPHONE COMPANY D.B.A. CENTURY LINK	DATE
THE AFFIXED CENTURYLINK APPROVAL DOES NOT ASSUME OR GUARANTEE LIABILITY FOR KNOWN OR UNKNOWN CONFLICTS WITH EXISTING OR PROPOSED IMPROVEMENTS. RESOLUTION OF ANY CONFLICT WILL BE ACCOMPLISHED PURSUANT TO LOCAL ORDINANCES, NEVADA REVISED STATUTES AND/OR PUBLIC UTILITY COMMISSION RULES AND REGULATIONS.	

SHEET INDEX

Sheet List Table

Sheet Title	Sheet	Utility Plans
General		
COVER SHEET	C1.01	SHEET 1 OF 3 C4.01
NOTE SHEET	C1.02	SHEET 2 OF 3 C4.02
Demolition Plans		SHEET 3 OF 3 C4.03
SHEET 1 OF 3	C2.01	Grading Plans
SHEET 2 OF 3	C2.02	SHEET 1 OF 3 C5.01
SHEET 3 OF 3	C2.03	SHEET 2 OF 3 C5.02
Horizontal Control Plans		SHEET 3 OF 3 C5.03
SHEET 1 OF 3	C3.01	BLOW UP DETAILS AND SECTIONS
SHEET 2 OF 3	C3.02	Detail Sheets
SHEET 3 OF 3	C3.03	SHEET 1 C6.01

GENERAL SITE INFORMATION

NOTE: ALL LOCATIONS OF UTILITIES SHOWN ARE APPROXIMATE.

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

A.P.N.:

163-02-601-005

BASIS OF BEARINGS:

THE BASIS OF BEARING FOR THIS SURVEY IS THE SOUTH LINE OF THE NORTHEAST QUARTER (NE 1/4) OF SECTION 2, AS SHOWN ON FILE 67, PAGE 37 OF PARCEL MAPS, IN THE CLARK COUNTY RECORDERS OFFICE. SAID LINE BEARS: NORTH 89°18'15" EAST

BENCHMARK:

CITY OF LAS VEGAS BENCHMARK NO. 1LV10 2C4 RIVET AND PLATE IN TOP OF CURB @ SE CORNER OF TORREY PINES AND OAKY. ELEVATION=2,341.03 FEET / 713.546 METERS (NAVD 88)

Call before you Dig
Avoid cutting underground utility lines. It's costly.



FAST
Call before you Dig
Underground

Avoid hitting overhead power lines. It's costly.



1-800-227-2800

1-702-432-6300

1-702-227-2929

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

GENERAL COVER SHEET
OPPORTUNITY VILLAGE
OAKY CAMPUS
CITY OF LAS VEGAS, NEVADA

PROJECT No.: 151161

DATE: 08/18/2016

SCALE: 1"=20'

DRAWN BY: JNC

DESIGNED BY: JNC

CHECKED BY: GMM

SHEET No. C1.01

SHEET 1 OF 16

DATE: 08/18/2016

BY: JNC

DATE: 08/18/2016

DATE: 08/18/2016

DATE: 08/18/2016

DATE: 08/18/2016

DATE: 08/18/2016

DATE: 08/18/2016

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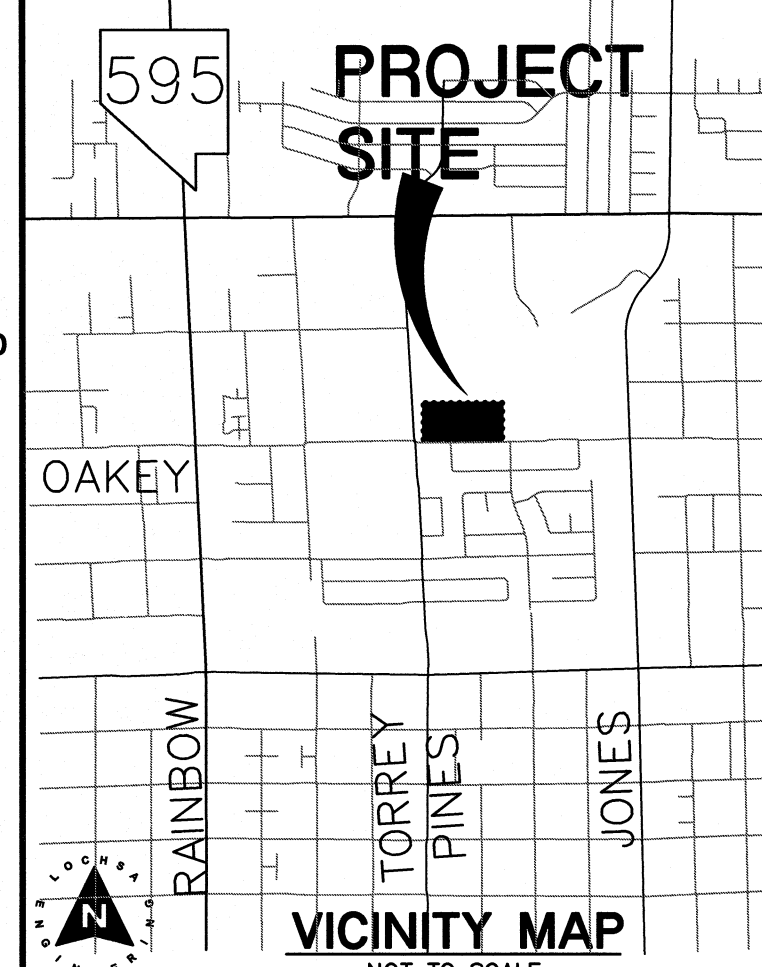
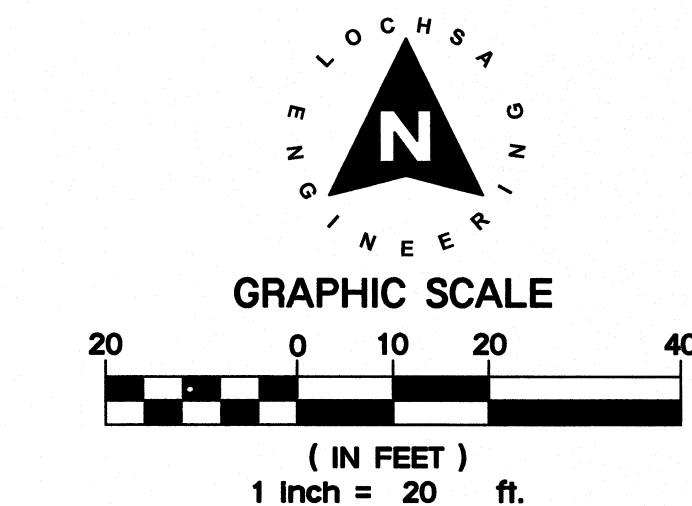
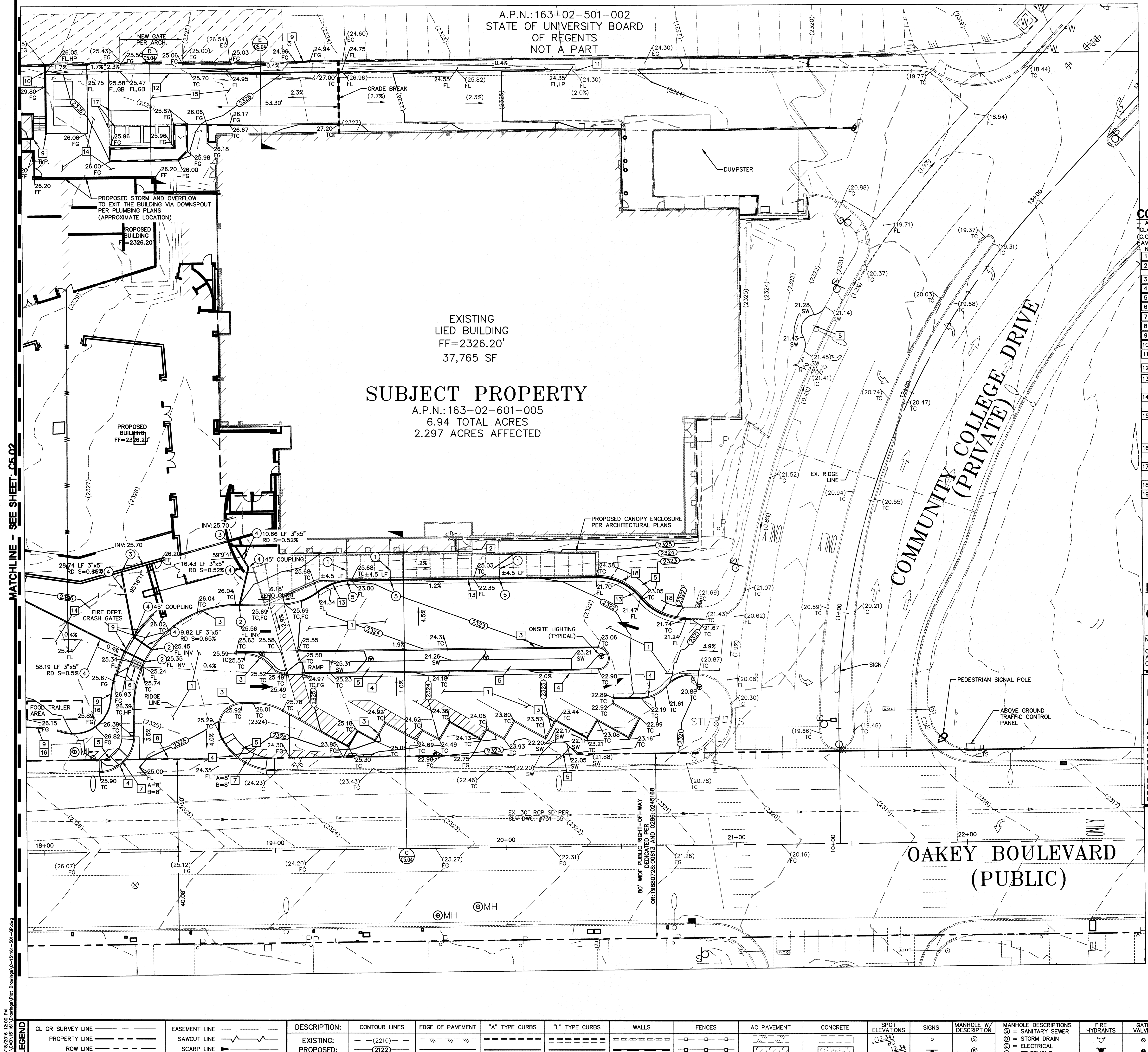
LEGEND

- ## LEGEND

LEGEND

LEGEND

[illegible]



- CONSTRUCTION NOTES:**
- 1. ALL CONSTRUCTION TO BE DONE IN ACCORDANCE WITH CLARK COUNTY AREA UNIFORM STANDARD DRAWINGS (C.C.A.U.S.D.) LATEST EDITION AND/OR REGULATING ENTITY JURISDICTION.
 - 2. NOT ALL NOTES USED ON THIS SHEET -
 - 3. CONSTRUCT AC PAVEMENT PER DETAIL 2 ON C6.01.
 - 4. INSTALL STAIRS PER ARCHITECTURAL PLANS. SEE BLOW-UP DETAILS ON C5.01 FOR FINAL GRADES.
 - 5. CONSTRUCT "A" TYPE CURB PER DETAIL 1 ON C6.01.
 - 6. CONSTRUCT "L" TYPE CURB PER CCAUSD No. 216.
 - 7. CONSTRUCT CONC. SIDEWALK PER CCAUSD No. 234.
 - 8. CONSTRUCT SIDEWALK DRAIN PER CCAUSD No. 236.
 - 9. CONSTRUCT SIDEWALK RAMP CCAUSD No. 235 CASE I.
 - 10. CONSTRUCT COMMERCIAL DRIVEWAY PER CCAUSD No. 225.
 - 11. CONSTRUCT WALL/FENCING PER ARCHITECTURAL PLANS.
 - 12. INSTALL 2' WALL OPENING PER DETAIL 11 ON C6.01.
 - 13. CONSTRUCT 2' WIDE CURB OPENING PER DETAIL 5 ON C6.01.
 - 14. CONSTRUCT 2' VALLEY GUTTER PER DETAIL 8 ON C6.01.
 - 15. CONSTRUCT RETAINING WALL W/ GUTTER PER DETAIL 9 ON C6.01. SEE STRUCTURAL PLANS BY OTHERS FOR STRUCTURAL SPECIFICATIONS.
 - 16. CONSTRUCT COLORED AND TEXTURED CONC. PAVEMENT PER ARCHITECTURAL PLANS. SUBGRADE, CONCRETE AND TYPE-II THICKNESS PER GEOTECHNICAL REPORT.
 - 17. CONSTRUCT CONC. PAVEMENT PER ARCHITECTURAL PLANS. 7" TYPE "V" PORTLAND CEMENT OVER 6" TYPE II OVER 6" COMPACTED STRUCTURAL FILL PER GEOTECHNICAL REPORT. SEE STRUCTURAL PLANS BY OTHERS FOR REINFORCEMENT DETAILS.
 - 18. CONSTRUCT 2' MAX. RETAINING WALL AS NECESSARY PER SOUTHERN NEVADA BUILDING OFFICIALS REGIONAL STANDARD DRAWING B-100.
 - 19. CONSTRUCT TRASH ENCLOSURE AND SCREEN WALL PER ARCHITECTURAL PLANS. DUMPSTER APPROACH AND PAD PER NOTE 15 ABOVE.
 - 20. INSTALL HANDRAIL PER ARCHITECTURAL PLANS.
 - 21. WATER PROOFING REQUIRED ON NEW MODULAR UNIT 12" ABOVE FINISHED FLOOR.

- STORM DRAIN CONSTRUCTION NOTES:**
- 1. NOT ALL NOTES USED ON THIS SHEET -
 - 2. CONNECT TO EXISTING ROOF DRAIN PIPE. MATCH EXISTING SIZE AND MATERIAL.
 - 3. DAYLIGHT ROOF DRAIN THRU CURB PER DETAIL 6 ON C6.01.
 - 4. STUB AND CAP ROOF DRAIN, REFER TO PLUMBING PLANS FOR CONTINUATION.
 - 5. INSTALL RECTANGULAR UNDERWALK DRAIN PIPE, COUPLINGS AND ADAPTERS AS NEEDED. SUPERIOR PIPE OR APPROVED EQUAL.
 - 6. DAYLIGHT ROOF DRAIN THRU PARA-TRANSIT QUEUE LINE RETAINING WALL PER DETAIL 9 ON C6.01.

TYPICAL GRADING IN LANDSCAPE AREAS AWAY FROM BUILDING

CUT	FILL
2,003 CY	1,614 CY

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

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

FLOOD ZONE NOTE:
THE SUBJECT SITE IS COVERED BY A FLOOD INSURANCE RATE MAP (FIRM) FOR THE CLARK COUNTY, NEVADA, AND INCORPORATED AREAS. COMMUNITY PANEL NUMBER 3200321650, EFFECTIVE DATE: NOVEMBER 16, 2011. REVIEW OF THE FIRM INDICATES THAT THE SITE IS LOCATED WITHIN DESIGNATED ZONE "X" (UNSHADED), ZONE "X" (UNSHADED) S DEFINED FROM THE COAS OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN.

NOTE:
ADD 2300 TO ALL ELEVATION TAGS SHOWN.

GRADING PLAN CERTIFICATION

NAME: GUY M. MORRIS PE #14526 DATE _____

CERTIFY THAT THIS GRADING PLAN IS IN CONFORMANCE WITH APPROVED DRAINAGE STUDY HTE# xx-xxxxx FOR THIS SITE ON FILE AT CLARK COUNTY FOR THIS PROJECT.

CLARK COUNTY DEPARTMENT OF PUBLIC WORKS DEVELOPMENT REVIEW ACCEPTANCE OF PLANS FOR FILING

BY: _____

ACCEPTANCE OF THESE PLANS FOR FILING SHALL NOT BE CONSTRUED TO BE A PERMIT FOR OR AN APPROVAL OF ANY VIOLATION OF ANY OF THE PROVISIONS OF THE STATE OR COUNTY LAWS AND/OR SPECIFICATIONS. CLARK COUNTY SHALL BE HELD FREE FROM DAMAGES WHICH MAY RESULT FROM THE CONSTRUCTION OF THE IMPROVEMENTS FROM THE ENGINEERING DESIGN DEPICTED HERE.

NOTE: POWER POLES AND/OR OTHER EXISTING FACILITIES NOT IN PROPER LOCATION BASED ON PROPOSED IMPROVEMENTS SHOWN HEREON WILL BE RELOCATED AT NO EXPENSE TO CLARK COUNTY.

- GRADING NOTES:**
1. SLOPES 4:1 OR STEEPER AND FINE-GRAINED MATERIALS THAT HAVE BEEN DISTURBED (SANDY AND SILTY MATERIALS) SHOULD BE PROTECTED WITH BURLAP OR OTHER EROSION CONTROL FABRIC/MATERIAL, UNLESS OTHERWISE SPECIFIED BY LANDSCAPE DRAWINGS AND SPECIFICATIONS OR THE SOILS REPORT.
 2. CONTRACTOR SHALL DETERMINE HIS OWN FOOTING OR BASEMENT EXCAVATION QUANTITIES, EVEN THOUGH SHOWN ON ROUGH GRADING PLANS. ADDITIONALLY, STRUCTURE BACKFILL COSTS SHOULD BE INCLUDED IN THE COST OF THE STRUCTURE, UNLESS OTHERWISE SPECIFIED IN THE CONTRACT DOCUMENTS.
 3. CONTRACTOR SHALL NOTIFY LOCHSA ENGINEERING WITHIN 24 HOURS OF OMISSIONS AND ERRORS DISCOVERED ON PLANS. LOCHSA ENGINEERING WILL NOT BE RESPONSIBLE FOR ANY "CORRECTIVE" WORK DONE BY OTHERS.
 4. CONTRACTOR TO ENSURE POSITIVE DRAINAGE, NO PONDING ALLOWED. CONTRACTOR TO FOLLOW RECOMMENDATIONS AS OUTLINED IN THE PROJECT GEOTECHNICAL REPORT, INCLUDING BUT NOT LIMITED TO EXCAVATION, GRADING AND COMPACTION. REFER TO THE REPORT PREPARED BY: MINVI & MOORE, PROJECT No. 303989001, DATED: FEBRUARY 22, 2016. HTE # xx-xxxxx

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

A.P.N.:
163-02-601-005

BASIS OF BEARINGS:
THE BASIS OF BEARING FOR THIS SURVEY IS THE SOUTH LINE OF THE NORTHEAST QUARTER (NE 1/4) OF SECTION 2, AS SHOWN ON FILE 617, PAGE 37 OF PARCEL MAPS, IN THE CLARK COUNTY RECORDERS OFFICE. SAID LINE BEARS: NORTH 89°18'15" EAST

BENCHMARK:
CITY OF LAS VEGAS BENCHMARK NO. 11V10 204 RIVET AND PLATE IN TOP OF CURB @ SE CORNER OF TORREY PINES AND OAKLEY. ELEVATION=2,341.03 FEET / 713.546 METERS (NAVD 88)

Call before you Dig
Avoid cutting underground utility lines. It's costly.

FAST
Call before you Dig
Underground

Call before you Dig
Avoid hitting overhead power lines. It's costly.

MATCHLINE - SEE SHEET C5.02

9/18/2016 12:00 PM
C:\Users\GMM\Documents\163-02-601-005\163-02-601-005.dwg

CL OR SURVEY LINE	EASEMENT LINE	DESCRIPTION:	CONTOUR LINES	EDGE OF PAVEMENT	"A" TYPE CURBS	"L" TYPE CURBS	WALLS	FENCES	AC PAVEMENT	CONCRETE	SPOT ELEVATIONS	SIGNS	MANHOLE W/ DESCRIPTION	MANHOLE DESCRIPTIONS	FIRE HYDRANTS	GATE VALVES	REDUCERS	CLEAN OUTS	UTILITY BOX OR VAULT	BACKWATER VALVES	150W HPS STREETLIGHTS	200W HPS STREETLIGHTS	250W HPS STREETLIGHTS
PROPERTY LINE	SAWCUT LINE	EXISTING:	(2210)																				
ROW LINE	SCARP LINE	PROPOSED:	(2122)																				

595

PROJECT SITE

OAKLEY

RAINBOW

TORREY PINES

JONES

VICINITY MAP

NOT TO SCALE

Lochsa Engineering

6445 South Jones Blvd.
Las Vegas, NV 89118
Phone (702) 365-5312
Fax (702) 365-5317
www.lochsa.com

GRADING PLANS

SHEET 3 OF 3

OPPORTUNITY VILLAGE

OPPORTUNITY CAMPUS

CITY OF LAS VEGAS, NEVADA

PROJECT No.: 151161

DATE: 08/18/2016

SCALE: 1"=20'

DRAWN BY: JNC

DESIGNED BY: JNC

CHECKED BY: GMM

SEAL

GUY M. MORRIS

EXP. 12-31-17

CIVIL

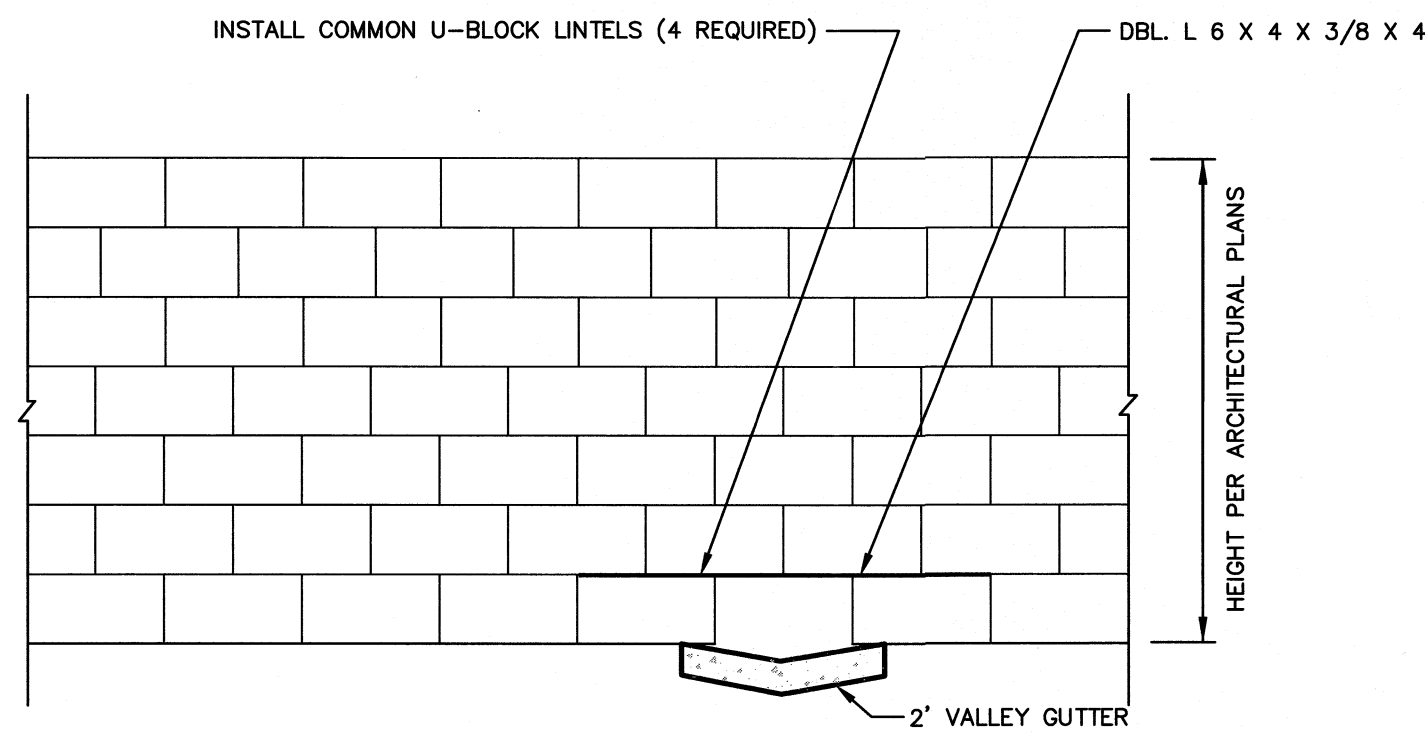
No. 14526

08/18/2016

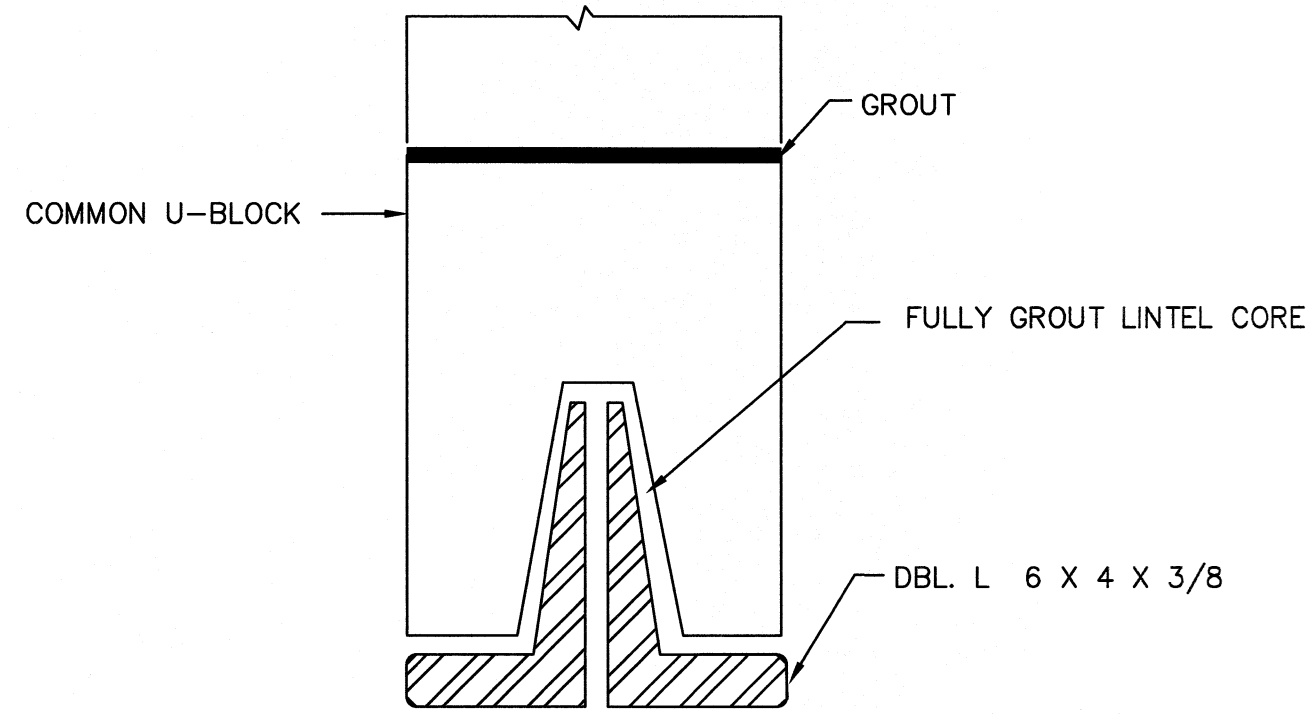
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SHEET 14 OF 16

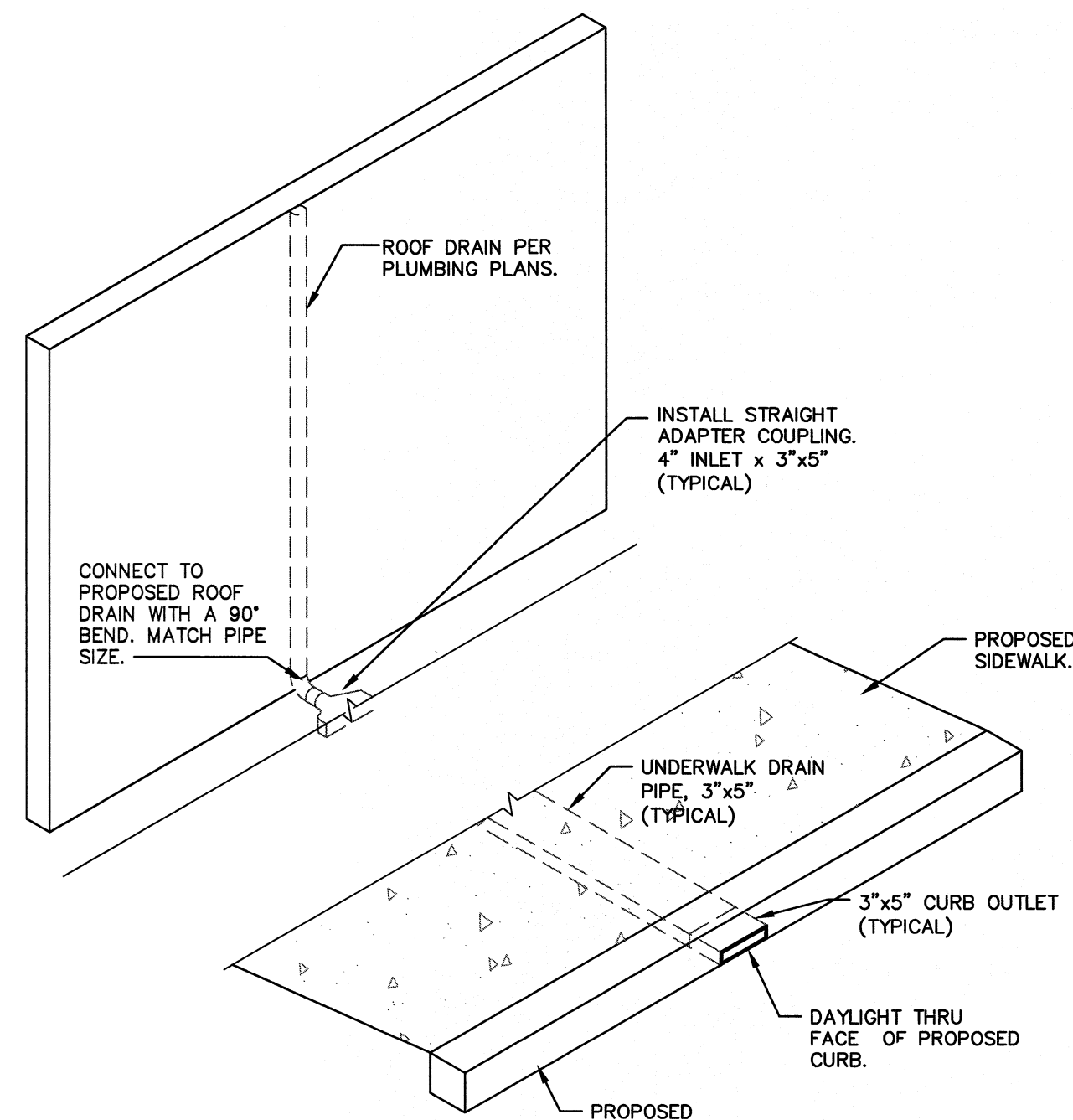
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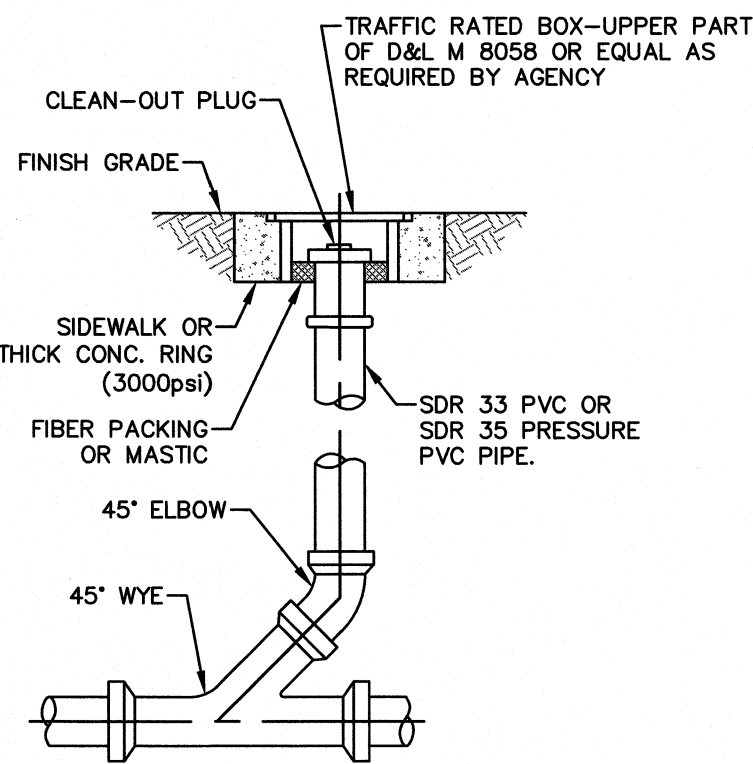
SECTION "A-A"



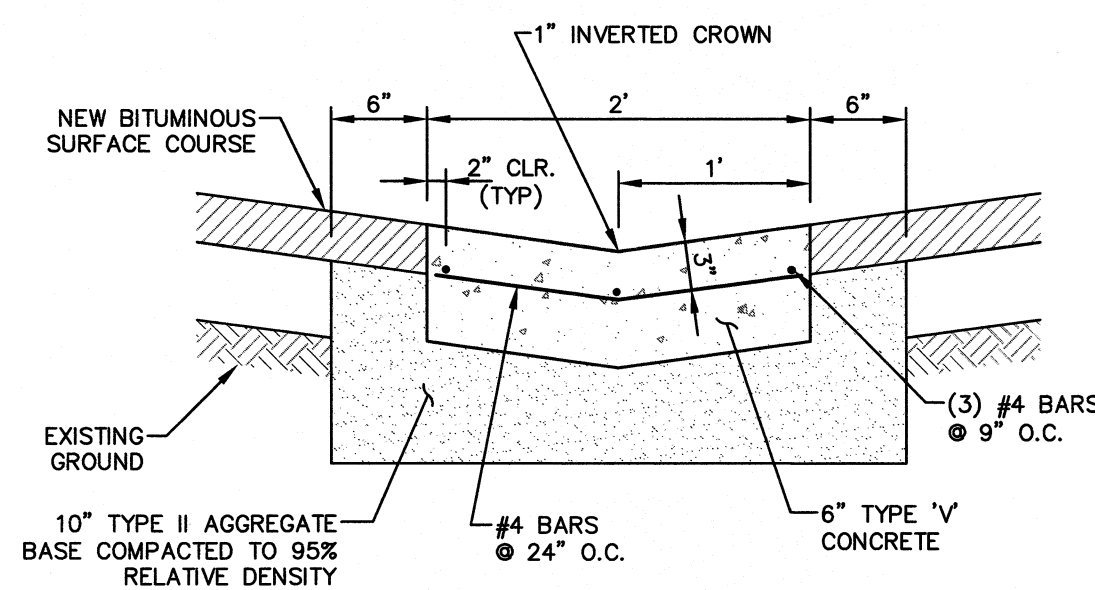
TYPICAL LINTEL SECTION



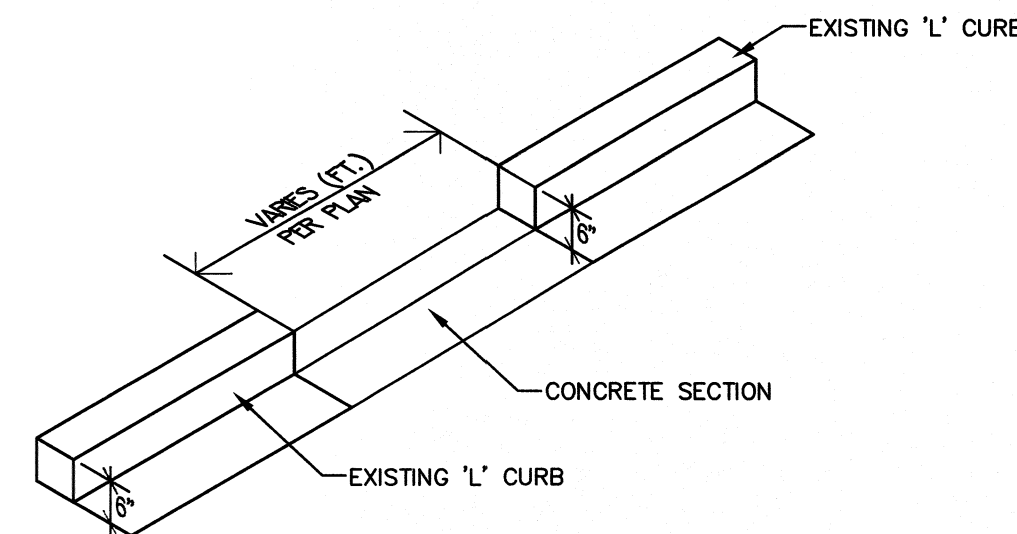
6 DAYLIGHT THRU CURB FACE



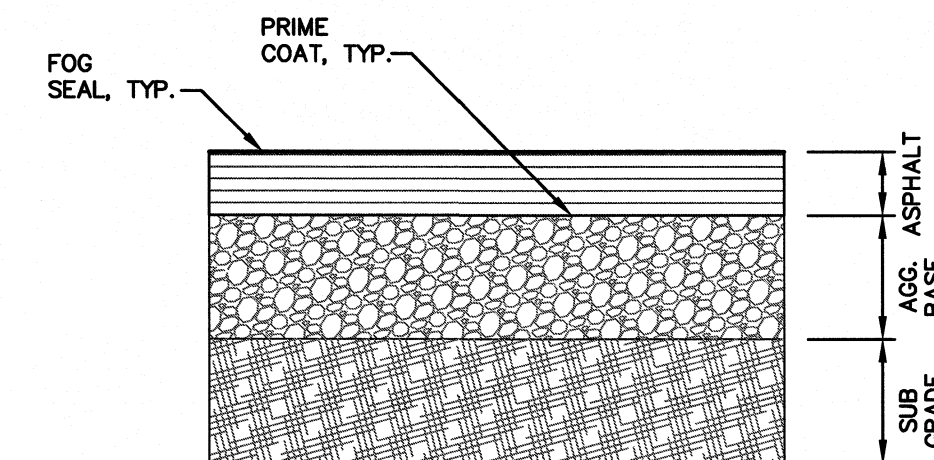
3 INLINE CLEANOUT



8 2' VALLEY GUTTER



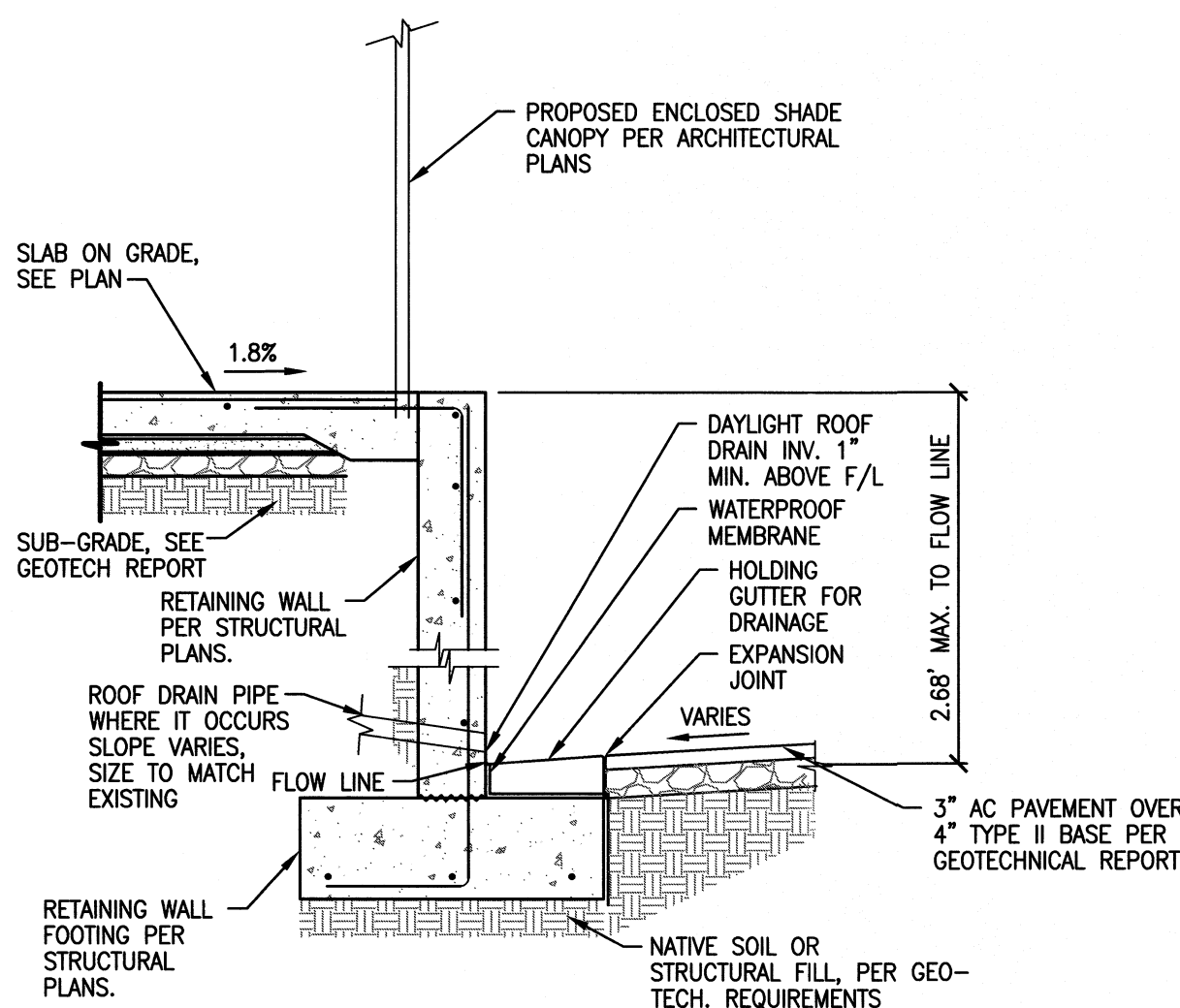
5 CURB OPENING



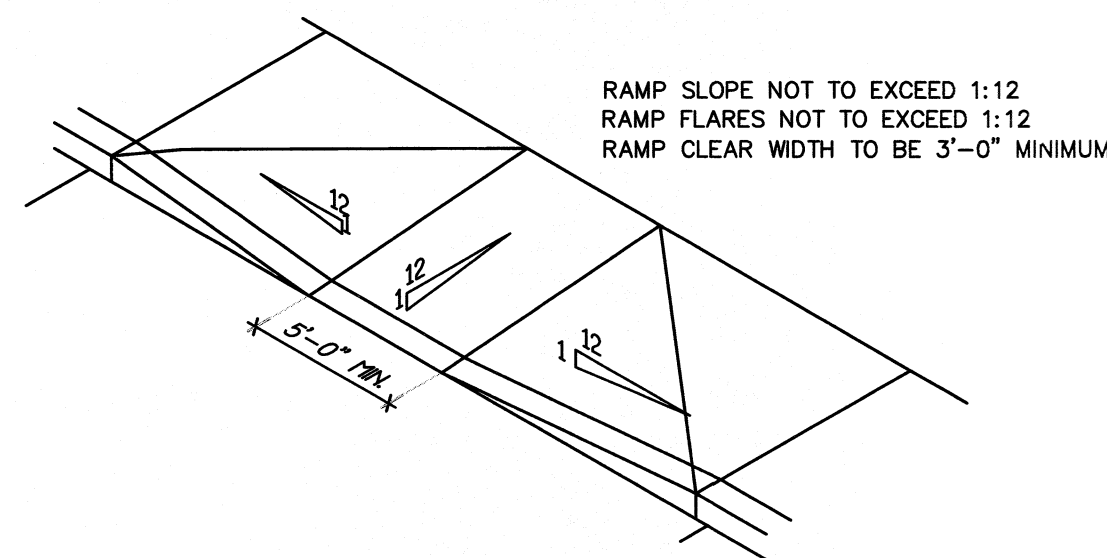
TYPE OF TRAFFIC	ASPHALT (inches)	TYPE II BASE COURSE (inches)	SUBGRADE (inches)
AUTOMOBILE	2.5	4	6
DELIVERY TRUCK ACCESS	2.5	4	6
HEAVY DUTY TRUCK & BUS ACCESS	3	4	6

PAVEMENT SECTION AS PROPOSED IN GEOTECHNICAL REPORT PREPARED BY: NINYO & MOORE
PROJ. NO.: 303989001
DATED: FEBRUARY 26, 2016

2 AC PAVEMENT SECTION



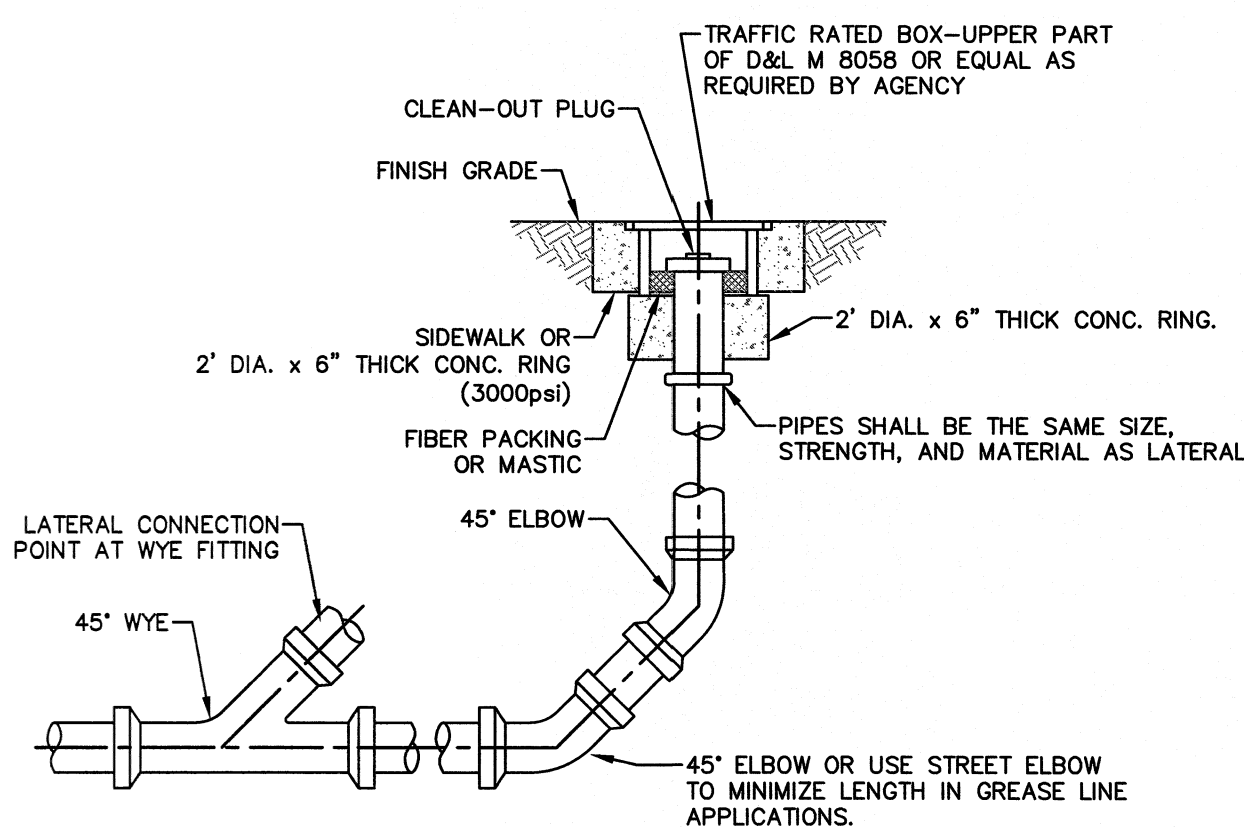
9 PARA-TRANSIT QUEUE LINE RETAINING WALL



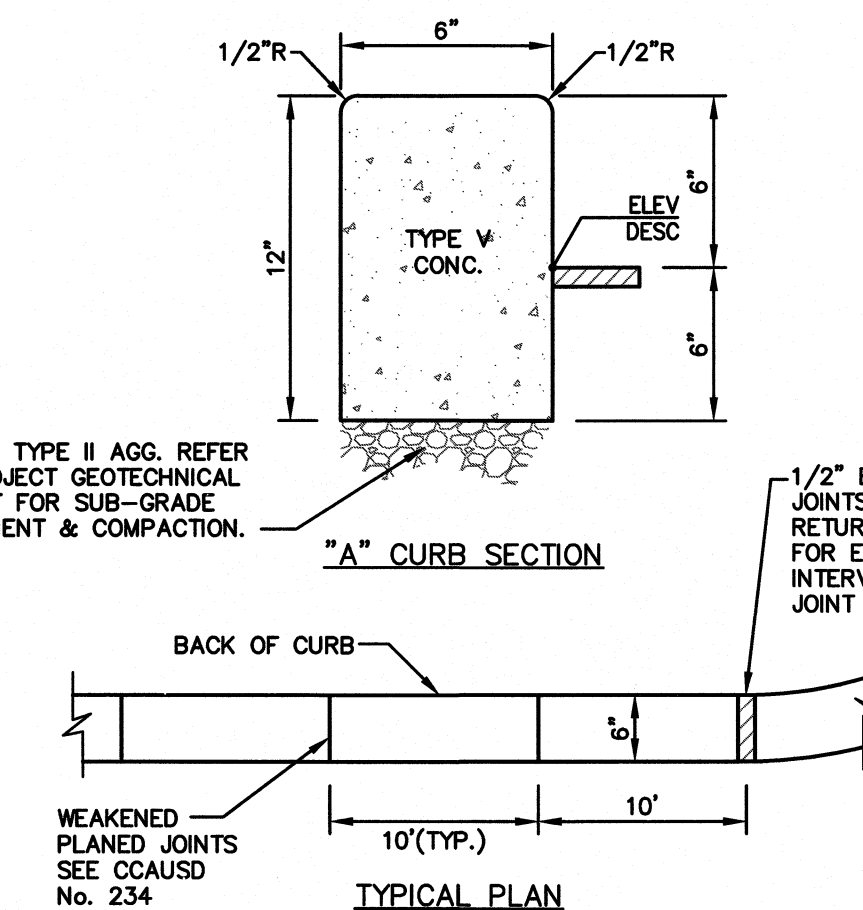
RAMP NOTES: (FOR ALL ACCESSIBLE ROUTE SLOPES GREATER THAN 1:20)

1. RAMP LENGTHS SHALL BE 6'-0" (72") MAXIMUM FOR EACH 6" RISE
2. RAMP LANDINGS SHALL BE FLAT FOR A MINIMUM DISTANCE OF 5'-0"
3. RAMP CROSS SLOPES SHALL NOT TO EXCEED 1:48
4. RAMP SLOPES SHALL NOT TO EXCEED 1:12
5. HEIGHT OF CURBS (OR EDGES) SHALL NOT TO EXCEED 6".
6. RAMP CLEAR WIDTHS TO BE 3'-0" MINIMUM.
7. RAMP HEIGHTS ARE NOT INTENDED TO EXCEED 6" IN HT. PER EA. RUN.

7 ADA CURB RAMP



4 CLEAN-OUT - TERMINAL



1 ON-SITE "A" TYPE CURB

Lochsa

engineering

DETAIL SHEETS
SHEET 1

OPPORTUNITY VILLAGE
OAKLEY CAMPUS
CITY OF LAS VEGAS, NEVADA

PROJECT No.:

151161

DATE:

08/18/2016

SCALE:

1"=20'

DRAWN BY:

JNC

DESIGNED BY:

JNC

CHECKED BY:

GMM

SHEET No.

C6.01

SHEET No.

16 OF 16

HTE No.

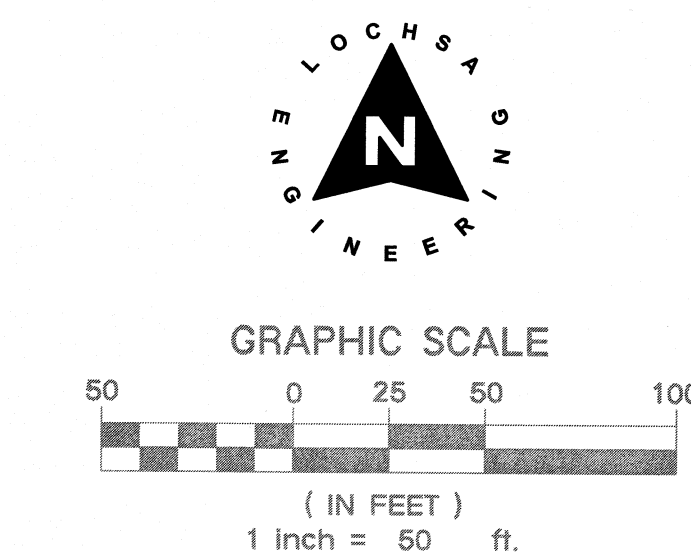
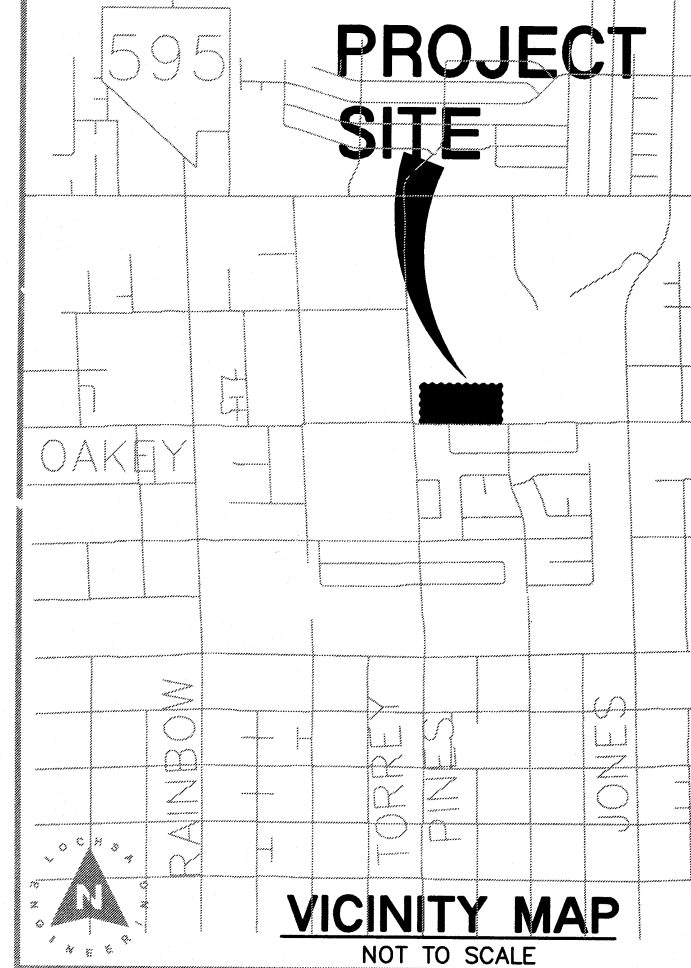
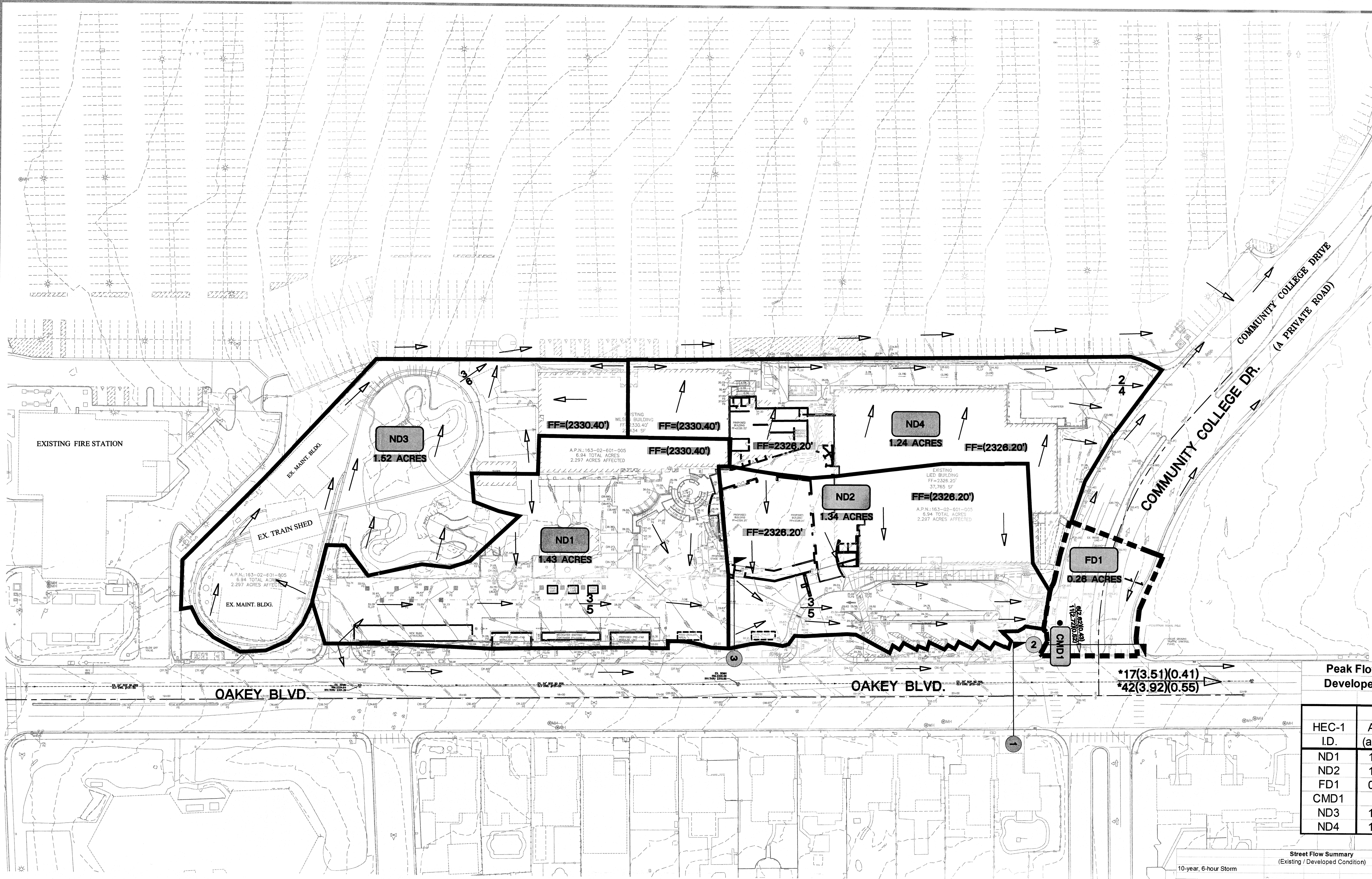
DESCRIPTION:

REV.:

DATE:

BY:

DESCRIPTION:



DRAINAGE LEGEND	
ND1	DRAINAGE BASIN LABEL
CMD1	CONCENTRATION POINT
2/3	COMBINATION POINT
1 (1.0)(1.2)	ON-SITE BASIN BOUNDARY
1 (1.0)(1.2)	Q10 FLOW IN CFS (10 YR.)
	Q100 FLOW IN CFS (100 YR.)
	Q10 (V10)(D10)
	Q100 (V100)(D100)
	BASIN FLOW DIRECTION
	COMBINED FLOW DIRECTION
AA	HYDRAULIC CROSS-SECTION

Peak Flow Summary Developed Condition			
HEC-1 I.D.	Area (acres)	10-year Flow (cfs)	100-year Flow (cfs)
ND1	1.43	3	5
ND2	1.34	3	5
FD1	0.26	1	1
CMD1	-	6	11
ND3	1.52	3	6
ND4	1.24	2	4
		(ND1 + ND2 + FD1)	

Street Flow Summary (Existing / Developed Condition)						
Street	Right of Way Width (ft)	Hydraulic Cross-Section Identifier	10-Year Flow [Q10] (cfs)	10-year Velocity [V] (fps)	10-year Flow Depth [d] (ft)	10-year Velocity x Depth [v x d] (ft)
*Oakley Blvd.	80	1	17	3.51	0.41	1.44
Community College Dr.	90	2	6	2.62	0.43	1.13

Street Flow Summary (Existing / Developed Condition)						
Street	Right of Way Width (ft)	Hydraulic Cross-Section Identifier	100-Year Flow [Q100] (cfs)	100-year Velocity [V] (fps)	100-year Flow Depth [d] (ft)	100-year Velocity x Depth [v x d] (ft)
*Oakley Blvd.	80	1	42	3.92	0.55	2.16
Community College Dr.	90	2	11	2.72	0.52	1.41

Hydraulic Sections Existing/Developed Condition (100yr)			
Hydraulic Section	Area (acres)	100-year Flow (cfs)	100-year Depth (ft)
3	-	10	.35
(ND1 + ND2)			

CL OR SURVEY LINE

PROPERTY LINE

ROW LINE

EASEMENT LINE

SAWCUT LINE

SCARP LINE

DESCRIPTION:

EXISTING:

PROPOSED:

CONTOUR LINES

EDGE OF PAVEMENT

"A" TYPE CURBS

"L" TYPE CURBS

WALLS

FENCES

AC PAVEMENT

CONCRETE

SPOT ELEVATIONS

SIGNS

MANHOLE W/ DESCRIPTION

MANHOLE DESCRIPTIONS

FIRE HYDRANTS

GATE VALVES

REDUCERS

CLEAN OUTS

UTILITY BOX OR VAULT

BACKWATER VALVES

100w HPS STREETLIGHTS

150w HPS STREETLIGHTS

200w HPS STREETLIGHTS

250w HPS STREETLIGHTS

9/17/2016 8:02 AM

\\VAD\151161\Drawings\Plan_Drainage\DR2.dwg

DR2

SHEET OF

HTE No.

Lochsa

engineering

6045 South Jones Blvd.
Las Vegas, NV 89118
Phone (702) 365-9312
www.lochsa.com

PROJECT No.: 151161

DATE: 08/01/2016

SCALE: 1" = 50'

DRAWN BY: CB

DESIGNED BY: CB

CHECKED BY: GMV

SEAL

GUY M. MORRIS

EXP. 12-31-17

CIVIL

No. 14526

08/01/2016

DR2

SHEET OF

HTE No.