

DS # 4518

DS INDEX:

APN: 139-34-201-023

PROJECT: 500 SOUTH MAIN STREET PARKING GARAGE

SUBMITTAL 1ST





CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM		DATE: February 17, 2011
TO: Land Development Services Department of Public Works		FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT:	Drainage Study for:	COPIES TO:
	500 South Main Street Parking Garage	Kimley-Horn and Associates
Cross Streets:	SWC of Main Street & Clark Avenue	City of Las Vegas
File Number:	F:\Depot\DSMemos\DS4518A.doc	Bart Anderson, P.E., DevCo
Parcel Number:	139-34-201-023	
Zoning Action:	SDR-40772	
FEMA Flood Zone	YES	NO X
Proposed Storm Drain	YES X	NO

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Transaction #
1 st Submittal	2/3/2011	2/17/2011	See Comments Below	\$400.00	162015: \$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-40772**) with the next submittal to verify compliance with conditions. *Flood Control* will not issue conditional approval of the drainage study without the associated zoning/planning conditions (issued by the *City Council*). Any associated conditions of approval that revise the site drainage parameters will require that the drainage study be revised and resubmitted.
2. **Existing and Proposed Conditions Drainage Maps:** Provide hydrologic and hydraulic summary table on each of the maps.
3. Identify an existing storm drain system in Main Street on the grading plan. Label the type and size information of any storm drain inlets, manholes and laterals.
4. Show the proposed storm drain system with drop inlets, manholes and laterals identified clearly with construction notes on the grading plan.
5. Type 3 riser inlet is not allowed in the *City of Las Vegas*. Use *Uniform Standard Drawings (Clark County Area)* Type C-D Modified Drop Inlet. Review and revise all pertinent plans accordingly.
6. Along the north boundary of the development, it is not clear how a proposed concrete flume discharges at the east end. Address and resolve in the next submittal.

7. The grading plan shows that the section of Main Street has plus or minus 3% cross slope. Provide survey data to verify as such.
8. On all cross section details, show the structural section of the concrete section and the concrete flume. Dimension the width of all drainage facilities.
9. On the profile sheet, provide detail how to connect the new concrete pipe to the existing CMP drain at the two ends.

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

END OF REMARKS

ays

T/R/S: T20S/R61E/34
AREA M-34

Rec'd: 2/3/2011

■
Technical Drainage Study

DS 4518

M-34

**500 South Main Street
Parking Garage**

\$400.

SDR-40772

Prepared for:
City of Las Vegas

Prepared by:
Kimley-Horn and Associates, Inc.
2080 East Flamingo Road
Suite 210
Las Vegas, NV 89119-5178

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February 2011
KHA Project #092708000



Kimley-Horn
and Associates, Inc.

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL
DRAINAGE STUDY INFORMATION FORM

Name of Development: 500 South Main Street Parking Garage Date: Feb. 3, 2011

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

East/West: Clark Avenue

b) Section: 34 Township: 20S Range: 61E

c) APN: 139-34-201-023

Name of Owner: City of Las Vegas

Telephone No.: _____ Fax No.: _____ E-Mail Address: _____

Address: _____

Contact Person-Name: Laurie Marin Telephone No.: 702-862-3663

* E-Mail Address: laurie.marin@kimley-horn.com Fax No.: 702-735-4949

Firm: Kimley-Horn and Associates, Inc.

Address: 2080 E. Flamingo Rd. Suite 210, Las Vegas 89119

Type of Land Development/Land Disturbance Process:

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

1. Total Owned Land Area: At Site: 1.9 ac Being Developed/Disturbed: 1.9 ac

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

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

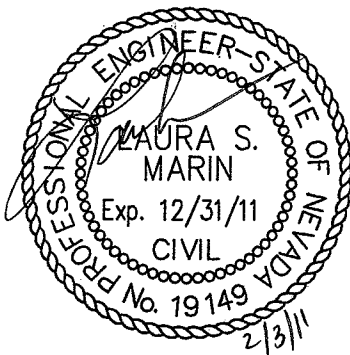
4. Proposed type of development (Residential, Commercial, Etc.): Parking garage, retail

5. Approximate upstream land area which drains to the subject site: 0 ac

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

7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: _____
Site currently drains southeast onto Main Street. This will not change with proposed development.

8. Briefly describe your proposed schedule for the subject project: Grading to start in March, with construction to begin in April.



Engineer's Seal

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

*New Required Field

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

Local Entity File No.	Revision	Date

REFERENCE:

STANDARD FORM 1

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

Project Name: 500 South Main Street Garage

Map ID:

Firm Name: Kimley-Horn and Associates, Inc.

Engineers: Laurie Marin, PE, CFM

Address: 2080 E. Flamingo Rd, Suite 210

City: Las Vegas

State: NV

Zip: 89119

Phone Number: 702-862-3663

Fax Number: 702-735-4949

Property Owner: City of Las Vegas

Address:

City:

State:

Zip:

Reviewed By:

Date Received:

Date Accepted for Review:

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

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

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

I. GENERAL REQUIREMENT

Yes No

Y _____ Design Manual **Standard Form 1** with the engineer's seal and signature.

_____ N _____ Design Manual **Standard Form 4 (Rational Method was used)**

_____ N _____ 2 Copies of the 24"x36" Drainage Plan (1 copy per CLV checklist)

_____ N/A _____ A notarized letter from the adjacent property owner(s) allowing off-site grading or discharge.

REFERENCE: KHA Proj No. 092708000

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

II. MAPS AND EXHIBITS

Yes

No

Y

 A copy of a current Flood Insurance Rate Map (FIRM) with the site delineated.

Y

 A copy of the current CCRFCD Master Plan Update Figure, (F-x), for Flood Control Facilities and Environmental areas with the site delineated.

N/A

 Off-site drainage basin maps for existing, interim and future conditions showing the existing topography, basin boundaries, concentration points, and flows in cfs.

Y

 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.

Y

 Vicinity Map with local and major cross streets identified and a north arrow.

II. DRAINAGE PLAN

Yes

No

Y

 Sheet size: 24x36" sealed by a registered engineer in the State of Nevada

Y

 Minimum scale: 1" = 60'

Y

 Project Name

Y

 Vicinity Map with local and major cross streets

Y

 Revision box

Y

 North arrow and bar scale

Y

 Engineer's/consultant's address and phone number

Y

 Elevation datum and benchmark

Y

 Legend for symbols and abbreviations

Y

 Cut/fill scarps, where applicable

Y

 Street names, grades, widths

Y

 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: KHA Proj No. 092708000

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

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

REFERENCE: KHA Proj No. 092708000

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
<u>Y</u>	<u> </u>	Perimeter retaining wall locations. All existing and proposed walls (retaining, screen & flood) must be shown with adjacent elevations. Flood wall with 8-inch concrete masonry unit.
<u>Y</u>	<u> </u>	Building and/or lot numbers.
<u> </u>	<u>N/A</u>	Alignment of all existing, proposed, or future Regional Facilities adjacent to the site.
<u> </u>	<u>N/A</u>	Limits of existing floodplain based on current FIRM or best available information, limits of proposed floodplains based on best available information.
<u> </u>	<u>N/A</u>	For areas in Zone A, AE, AH, and AO, base flood elevations (BFEs) must be shown for each lot; BFEs may be listed on each lot, or in a table. Finish flood elevations must be a minimum of 18 inches above BFE.
<u>Y</u>	<u> </u>	Appropriately elevated "humps" 6 inches above the 100 year water surface elevations at site accesses where the intent is to protect the site from the Q ₁₀₀ flows.
<u> </u>	<u>N/A</u>	Street slopes for perimeter and interior streets. The minimum slope is 0.4 percent.

IV. HYDROLOGIC ANALYSIS

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

REFERENCE: KHA Proj No. 092708000

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

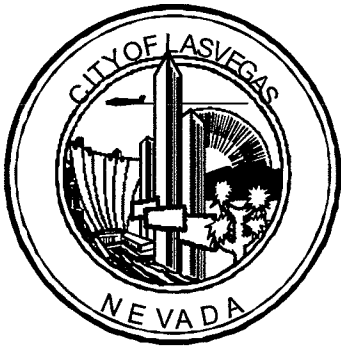
DRAINAGE SUBMITTAL CHECKLIST

V. HYDRAULIC ANALYSIS

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

REFERENCE: KHA Proj No. 092708000

STANDARD FORM 2



CITY OF LAS VEGAS

MINIMUM DRAINAGE STUDY CRITERIA STANDARD FORM 2 CHECKLIST SUPPLEMENT

(Revised 06/06/01)

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

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

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

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

CITY OF LAS VEGAS MINIMUM DRAINAGE STUDY CRITERIA CHECKLIST

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

III. Local Entity Criteria - City of Las Vegas – Manual Section 1600		
Yes	No	
	N/A	Concrete valley gutters are required in parking lots with slopes less than 1 percent. Slopes through cul-de-sac must be at a 1 percent minimum where flow is drained through the cul-de-sac.
	N/A	Ten-foot wide public drainage easements to be privately maintained are allowed for flow less than 20 cfs. The depth of flow entering the easement must be checked using the submerged weir calculation.
	N/A	The limits of the flood zones and the base flood elevations (BFE) must be shown on all grading plans for all developments within a Special Flood Hazard Zone A, AO, AE, etc.
✓		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.
	N/A	Lots with "B and C Type Drainage" shall be required to install an underground nuisance drainage system or a 2-foot valley gutter through the lot. 16" x 24" minimum block wall openings are required for both options.
	N/A	Bubblers are required across 80 foot and greater ROW streets. When flows exceed 10 cfs, bubblers larger than 18 inches will be required up to a maximum of 36". Inlets must be sized to match the pipe size provided.



Kimley-Horn
and Associates, Inc.

Technical Drainage Study

500 South Main Street Parking Garage

Prepared for:
City of Las Vegas

Prepared by:
Kimley-Horn and Associates, Inc.
2080 East Flamingo Road
Suite 210
Las Vegas, NV 89119-5178

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February 2011
KHA Project #092708000

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I. General Location and Development Description

A. Location of Property

The 500 Main Street Parking Garage property is located at 500 South Main Street, between Clark and Bonneville Avenues, on the west side of Main Street in the City of Las Vegas, Nevada. **Figure 1, Appendix A** provides the project location map. The project is located within Section 34, Township 20 South, Range 61 East, M.D.M., Clark County.

There are no regional flood control facilities adjacent to the site. A copy of Figure F-31, "Facilities Inventory" of the Las Vegas Valley Master Plan Update (MPU). **Appendix A** provides a copy of the figure with the project site boundary delineated.

The site is bounded on the north by a parking lot and shed, the east by Main Street, the south by a government building and parking and the west by the Union Pacific Railroad.

B. Description of Property

The existing site is approximately 1.9 acres and the site was previously partially developed with a retail building and parking lot along the frontage of Main Street. On-site buildings and parking were demolished within the last year. Site topography shows the high point of the site is located along the western boundary, with contours generally sloping from west to east.

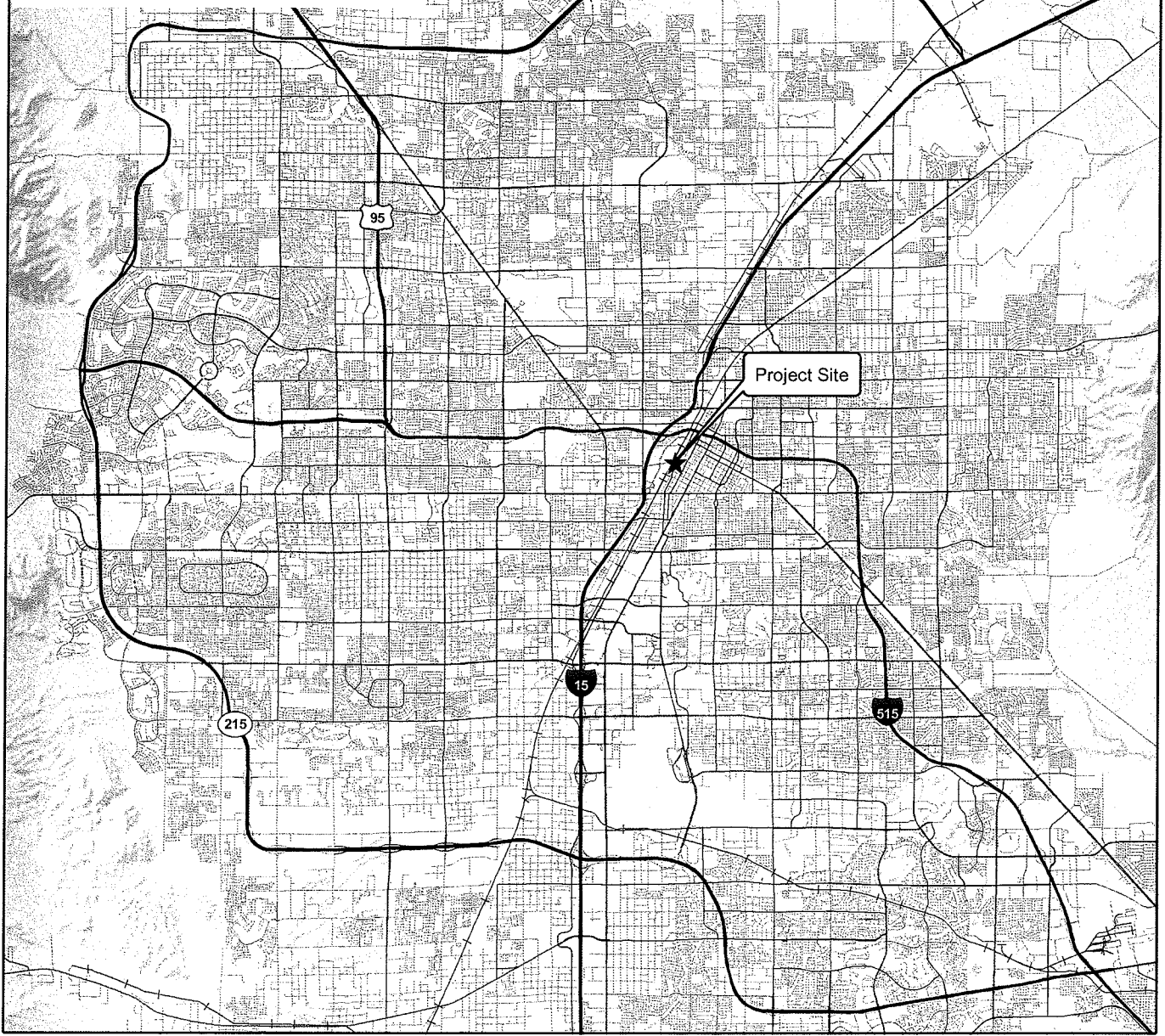
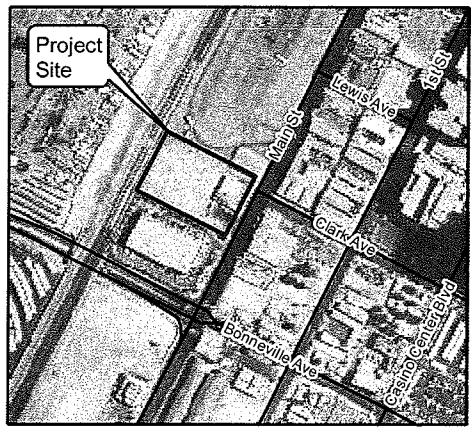
General Project Description and Proposed Land Use

The proposed site development consists of a multi-level 635 space above ground parking garage and a 3,500 SF retail space, with landscaping around the outer edges of the property.

C. Technical Drainage Study Requirement

This Technical Drainage Study has been prepared to demonstrate compliance with the design requirements of the project, as set forth by the City of Las Vegas. Page 3 of the Design Requirements for 500 South Main Street Parking Garage (see **Appendix D**) says the following:

The Design Build Team shall be responsible for preparing and submitting a technical drainage study for review and approval by the City of Las Vegas Flood Control Department. Retail and habitable portion of the Garage shall have a minimum finished floor elevation of approximately 18" above top of curb. Site shall be graded to provide positive drainage away from the building and to drain towards Main Street.



0 1 2 Miles



Kimley-Horn
and Associates, Inc.

City of Las Vegas

Clark County, Nevada

Location Map



II. Drainage Basin Description

A. Off-site Drainage Description

Based on existing topography and site features, no off-site runoff contributes to the property.

B. On-site Drainage Description

Historic On-site Drainage Patterns and Discharge Points

On-site drainage begins at the western site boundary flows easterly and through the property. The site is higher in the middle and generally drains to the north and south sides of the property and east, discharging into Main Street and the northeast and southeast corners of the site, and along the center boundary of the site. There is an existing drop inlet in Main Street in front of the site that drops directly into an 18-inch corrugated metal pipe under the curb along the frontage from south to north.

Historic Drainage Patterns of Upstream Runoff

No upstream runoff impacts the site.

C. Master Planning Information

Currently Adopted Master Plans

This project site is within the 2008 MPU.

Proposed Master Plan Flood Control Facilities

There are no proposed Master Plan Flood Control Facilities on the site.

D. Floodplain Information

The Federal Emergency Management Agency (FEMA) indicates that the site is located in "Zone X" as shown on the Flood Insurance Rate Map (FIRM) No. 32003C2170C, revised September 27, 2002. Zone X is defined by FEMA as "Areas determined to be outside the 0.2% annual chance floodplain." **Appendix A** provides a copy of the FIRM.



III. Proposed Drainage Facilities

A. General Description

The proposed grading on the site maintains historic drainage outfall points. The site is graded with the use of concrete U-ditches to drain the parking garage to the northeast and southeast corners. All of the runoff from the parking garage will drain through downspouts in the garage columns to the U-ditches. No runoff from the garage goes directly to the east or west sides of the site. At the west boundary of the site is a small swale to convey nuisance flow from the back of the property to the U-ditches. See **Appendix C** for calculations. The retail area will sheet flow to Main Street as it does now. At the southeast corner a sidewalk underdrain is proposed to convey the runoff through landscaping to the historic outfall point. On the northeast corner of the site the U-ditch will daylight and flow to the street. Due to many years of overlay of Main Street, the flow line in the curb has been covered and there is no viable curb at that corner of the site, so a sidewalk underdrain cannot be installed.

No storm drain is planned on the site. The existing drop inlet in Main Street is no longer functioning due to years of overlay of the asphalt. The curb line is being re-graded in front of the site, and that inlet will be moved slightly south to the new low point. The size of inlet will be maintained. The City has also requested replacement of the existing 18-inch corrugated metal pipe with 18-inch reinforced concrete pipe. No calculations have been provided for this as it is simply a replacement-in-kind.

The drainage plan meets the Design Criteria as set forth by the City. All runoff continues to discharge into Main Street as it does in current conditions.

B. Compliance with Regulations and Adopted Plans

Master Planned Flood Control Facilities

There are no master planned flood control facilities adjacent to the site.

FEMA Floodplain Regulations

The 500 South Main Street Parking Garage project is located outside the 100-year floodplain.

CCRFCD Manual

All hydrology is based on the Modified Rational Method. Hydraulic calculations are based on generally accepted engineering practices in



accordance with the CCRFCD Hydrologic Criteria and Drainage Design Manual.

C. Hydrologic Analyses

Hydrology was determined using the Modified Rational Method. In existing conditions the site is approximately 33% developed. In the proposed condition, it is 100% developed. The site has been divided into two subbasins in both conditions, see the Drainage Maps in **Appendix A**.

Rainfall Calculations

The site is located within the McCarran Airport area. The rainfall intensity for hydrologic calculations was determined from Figure 517 of the CCRFCD manual. **Appendix B** provides the hydrology calculations.

Peak Flow Rates

Table 1 provides a summary table of the existing conditions runoff in the 10- and 100-year storm events. **Appendix A** provides the Existing Conditions Drainage Map. **Appendix B** provides the Modified Rational Method calculations.

Table 1. Existing Conditions Runoff

Drainage Basin	Area [ac]	Q ₁₀ [cfs]	Q ₁₀₀ [cfs]
005	0.89	0.8	1.7
010	1.01	0.9	1.8
Total	1.90	1.7	3.5

Table 2 provides a summary table of the proposed conditions runoff in the 10- and 100-year storm events. **Appendix A** provides the Proposed Conditions Drainage Map. **Appendix B** provides the Modified Rational Method calculations.

Table 2. Proposed Conditions Runoff

Drainage Basin	Area [ac]	Q ₁₀ [cfs]	Q ₁₀₀ [cfs]
005	1.19	2.0	3.6
010	0.71	1.2	2.2
Total	1.90	3.2	5.8

The Modified Rational Method analyses for existing and proposed conditions shows an increase of 1.5 cfs and 2.3 cfs leaving the site in the 10-year and 100-year storms respectively. The total runoff and the increase in runoff are minor. To illustrate this point, the half street cross section was modeled in FlowMaster, to determine the rise in water surface caused by the increased flow. The cross section was modeled to determine the flow rate the section



could convey at a depth equal to the top of curb elevation. The flow rate was then increased by the increase in flows due to proposed conditions site development, and the depth for that flow rate was determined. See **Table 3** for the results and **Appendix C** for FlowMaster results.

Table 3. Half-Street Cross Section Results

	Flow Rate [ft]	Depth in Section [ft]	Increase in Depth [ft]
Typical Section to Top of Curb	8.5	0.50	N/A
10-Year Storm	10.0	0.55	0.05
100-Year Storm	10.8	0.57	0.07

D. Hydraulic Analyses

Hydraulic analyses of on-site cross sections for the U-channels were conducted using FlowMaster. See **Table 4** for the velocity times depth calculations for the cross sections. Two on-site cross sections were analyzed to determine the 10-year and 100-year depths in the channels. The channels are 2 ft wide and 0.5 ft deep. Cross section A-A is a drainage swale, cross sections B-B and C-C are U-channels.

Table 4. On-Site Cross Sections

Cross Section	10-Year Storm			100-Year Storm		
	Velocity [ft/s]	Depth [ft]	Velocity × Depth [ft ² /s]	Velocity [ft/s]	Depth [ft]	Velocity × Depth [ft ² /s]
A-A*	0.84	0.11	0.09			
B-B	2.91	0.34	0.99	3.51	0.51	1.79
C-C	3.17	0.19	0.60	3.93	0.28	1.10

*Section A-A velocity and depth at full capacity, conveys nuisance flow only

E. Facility Design Calculations

No on-site drainage facilities will be constructed as a part of this project



IV. Conclusions

Compliance with Drainage Laws

The 500 South Main Street Garage project is in compliance with regional and local laws and ordinances. The finished floor for both the garage and retail building are a minimum of 18 inches above the adjacent top of curb as required by the Design Requirements for 500 South Main Street Parking Garage.

Compliance with Master Plans

The 500 South Main Street Garage project is in compliance with the 2008 MPU.

Compliance with FEMA Requirements

The 500 South Main Street Garage project is located outside the 100-year floodplain.

Compliance with MANUAL

Hydrology and hydraulic calculations are based on generally accepted engineering practices and are in accordance with the CCRFCD Hydrologic Criteria and Drainage Design Manual.

Impact of proposed development on off-site property and facilities

The proposed development results in a minor increase in runoff to Main Street. The historic drainage discharge points have been maintained with this design.



V. References

1. City of Las Vegas. Design Requirements for 500 South Main Street Parking Garage, March 2010.
2. Clark County internet website: www.co.clark.nv.us/ accessed January 2011.
3. Clark County Regional Flood Control District. *Hydrologic Criteria and Drainage Manual*. Updated August 1999.
4. Clark County Regional Flood Control District. *2008 Las Vegas Valley Flood Control Master Plan Update*. 2008.
5. Federal Emergency Management Agency website: www.fema.gov accessed January 2011.



Appendix A Exhibits

Assessor's Parcel Maps

FEMA FIRM

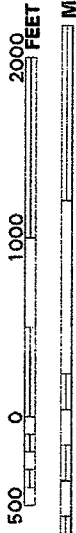
2008 MPU – Facility Inventory Map, Figure F-17

Existing Conditions Drainage Map

Proposed Conditions Drainage Map



MAP SCALE 1" = 1000'



PANEL 2170 E

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

PANEL 2170 OF 4090

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:	NUMBER:	PANEL:	SUFFIX:
CLARK COUNTY, NEVADA AND INCORPORATED AREAS	2170	2170	E
WILLAS CITY OF LAS VEGAS, CITY OF	325276	2170	E

Notice to User: The Map Number shown below should be used when ordering the map. The map number shown above should be used on insurance applications for the subject community.



MAP NUMBER
32003C2170 E

MAP REVISED:
SEPTEMBER 27, 2002

Federal Emergency Management Agency

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



Kimley-Horn
and Associates, Inc.

Modified Rational Method

Project Name

KHA Project No. 092708000

Existing

Calculated by LSM Date 2/2/2011
Checked by ZRS Date 2/2/2011

10-Year Storm Event																
Sub-Basin Data				Initial/Overland Time			Travel Time				t _c Check		10-Year Event			
	Name	K ^a	Area [ac]	Length [ft]	Slope [%]	t ^b [min]	Length [ft]	Slope [%]	Velocity ^c [fps]	t ^d [min]	Total Length [ft]	t _c =(L/180)+10 [min]	Final t _c ^e [min]	Intensity ^f [in/hr]	Runoff Coefficient, C ₁₀ ^g	Q ₁₀ ^h [cfs]
	005	0.56	0.89	136	2.5%	8.3	243	0.8%	1.8	2.3	379	12.1	10.6	3.3	0.56	0.8
	010	0.56	1.01	275	1.2%	15.0	114	1.8%	2.7	0.7	389	12.2	12.2	3.2	0.56	0.9

100-Year Storm Event																
Sub-Basin Data				Initial/Overland Time				Travel Time				t _c Check		100-Year Event		
	Name	K ^a	Area [ac]	Length [ft]	Slope [%]	t ^b _i [min]	Length [ft]	Slope [%]	Velocity ^c [fps]	t ^d _t [min]	Total Length [ft]	t _c =(L/180)+10 [min]	Final t ^e _c [min]	Intensity ^f [in/hr]	Runoff Coefficient, C ^g ₁₀₀	Q ^h ₁₀₀ [cfs]
	005	0.56	0.89	136	2.5%	8.3	243	0.8%	1.8	2.3	379	12.1	10.6	6.2	0.63	1.7
	010	0.56	1.01	275	1.2%	15.0	114	1.8%	2.7	0.7	389	12.2	12.2	5.8	0.63	1.8

Notes:

^a K = C₁₀, 10-year runoff coefficient, from Table 601

^b t_i = 1.8(1.1-K)L^{1/2}/S^{1/3} equation 602, can also use Figure 601

^c Determined from Figure 602

^d t_d = L/60V where V is determined from Figure 602

^e Final t_c is the minimum of t_i + t_d and t_c (Minimum t_c for urban area is 5 minutes)

^f If in McCarran Airport Rainfall Data area, intensity is determined from Figure 517, if outside area, follow procedures in Section 507

^g Determined from Table 601

^h Q = KCIA, where K = 0.5



Kimley-Horn
and Associates, Inc.

Proposed

Calculated by ZRS Date 2/2/2011
Checked by LSM Date 2/2/2011

Modified Rational Method

Project Name
KHA Project No. 092708000

10-Year Storm Event																	
Sub-Basin Data				Initial/Overland Time				Travel Time				t _c Check		10-Year Event			
Name	K ^a	Area [ac]	Length [ft]	Slope [%]	t _i ^b [min]	Length [ft]	Slope [%]	Velocity ^c [fps]	t _t ^d [min]	Total Length [ft]	t _c =(L/180)+10 [min]	Final t _c ^e [min]	Intensity ^f [in/hr]	Runoff Coefficient, C ₁₀ ^g	Q ₁₀ ^h [cfs]		
005	0.88	1.19	80	1.0%	3.5	422	0.8%	1.8	3.9	502	12.8	7.4	3.8	0.88	2.0		
010	0.88	0.71	90	1.0%	3.8	310	1.1%	2.1	2.5	400	12.2	6.2	3.9	0.88	1.2		

100-Year Storm Event																	
Sub-Basin Data				Initial/Overland Time				Travel Time				t _c Check		100-Year Event			
		K ^a	Area [ac]	Length [ft]	Slope [%]	t _i ^b [min]	Length [ft]	Slope [%]	Velocity ^c [fps]	t _t ^d [min]	Total Length [ft]	t _c =(L/180)+10 [min]	Final t _c ^e [min]	Intensity ^f [in/hr]	Runoff Coefficient, C ₁₀₀ ^g	Q ₁₀₀ ^h [cfs]	
		005	0.88	1.19	80	1.0%	3.5	422	0.8%	1.8	3.9	502	12.8	7.4	6.8	0.89	3.6
		010	0.88	0.71	90	1.0%	3.8	310	1.1%	2.1	2.5	400	12.2	6.2	7.1	0.89	2.2

Notes:

^a K = C₁₀, 10-year runoff coefficient, from Table 601

^b t_i = 1.8(1.1-K)^{1/2}/S^{1/3} equation 602, can also use Figure 601

^c Determined from Figure 602

^d t_i = L/60V where V is determined from Figure 602

^e Final t_c is the minimum of t_i + t_i and t_c (Minimum t_c for urban area is 5 minutes)

^f If in McCarran Airport Rainfall Data area, intensity is determined from Figure 517, if outside area, follow procedures in Section 507

^g Determined from Table 601

^h Q = KCIA, where K = 0.5



Kimley-Horn
and Associates, Inc.

Calculated by LSM
Checked by DWM

Date 2/3/2011
Date 2/2/2011

WEIGHTED RUNOFF COEFFICIENT CALCULATIONS

Name	Cover Type	Runoff Coefficients		Percentage of Area	Weighted Coefficient (Runoff Coeff x Percentage)	
		10-Year	100-Year		10-Year	100-Year
Site	Downtown	0.88	0.89	33%	0.29	0.29
	Gravel area	0.40	0.50	67%	0.27	0.34
TOTAL					0.56	0.63

Notes:

^a Determined from Table 601

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

RATIONAL FORMULA METHOD RUNOFF COEFFICIENTS AND AVERAGE PERCENT IMPERVIOUS AREA

LAND USE OR SURFACE CHARACTERISTICS	AVERAGE PERCENT IMPERVIOUS AREA	RUNOFF COEFFICIENTS			
		10-YEAR		100-YEAR	
		GRASS ¹	DESERT ²	GRASS ¹	DESERT ²
<u>Business and Commercial:</u>					
Downtown Areas	95	.88	.88	.89	.89
Neighborhood Areas	70	.70	.75	.80	.83
<u>Residential</u> (Average Lot Size):					
1/8 Acre or less (Multi-Unit)	65	.68	.73	.78	.80
1/4 Acre	38	.55	.62	.65	.74
1/3 Acre	30	.50	.57	.60	.70
1/2 Acre	25	.45	.53	.55	.67
1 Acre	20	.40	.49	.50	.64
2 Acre	12	.35	.45	.40	.60
<u>Industrial:</u>	72	.72	.76	.82	.84
<u>Open Space:</u> (Lawns, Parks, Golf Courses)	5	.10	-	.30	-
<u>Undeveloped Areas:</u> (Natural Vegetation)	0	-	.25	-	.50

<u>Streets and Roads:</u>					
Paved	100	.90		.93	
Gravel	20	.40		.50	
<u>Drives and Walks:</u>	95	.88		.89	
<u>Roofs:</u>	90	.85		.87	

Notes:

- ¹ Grass - Grassed Landscaping or Irrigated Vegetation
² Desert - Desert Landscaping or Natural Vegetation

Revision	Date

**WRC
ENGINEERING**

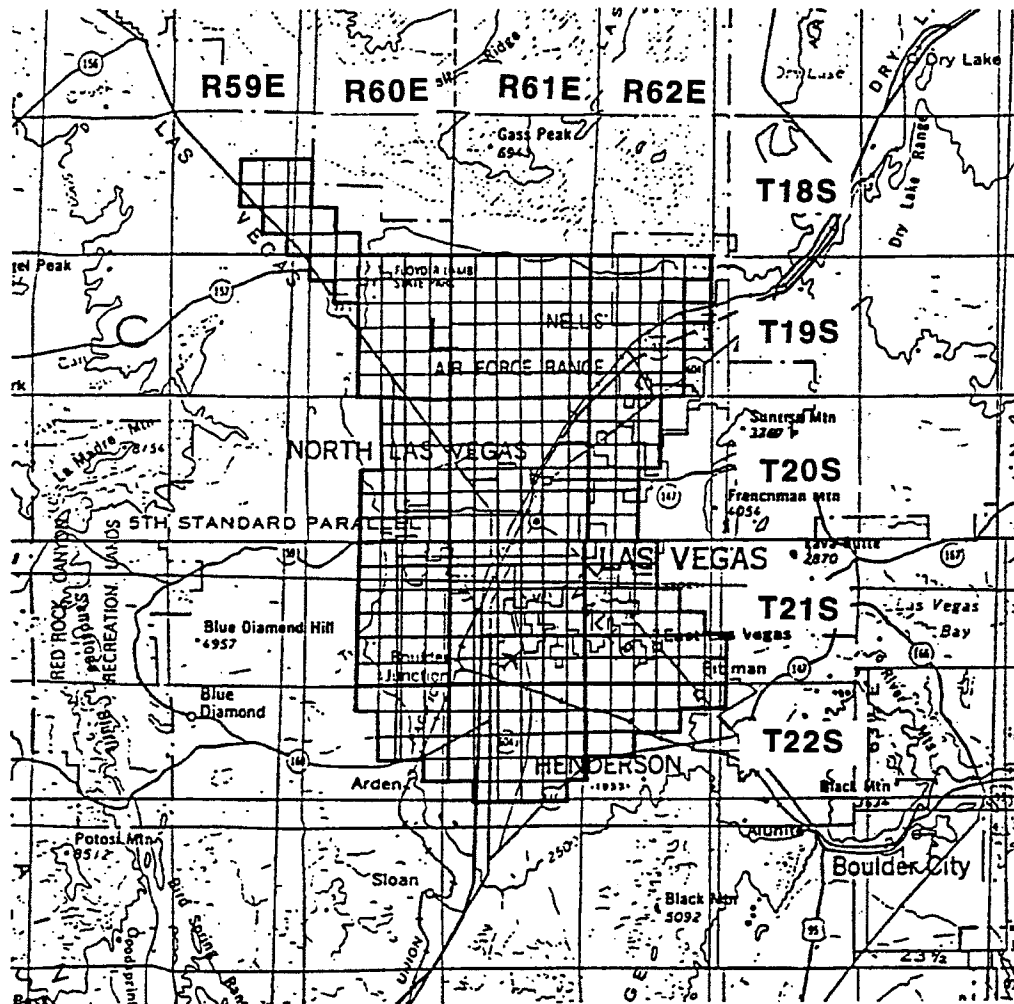
REFERENCE:

USDCM, DRCOG, 1969 (with modifications)

TABLE 601

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

McCARRAN AIRPORT RAINFALL AREA



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

Notes:

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

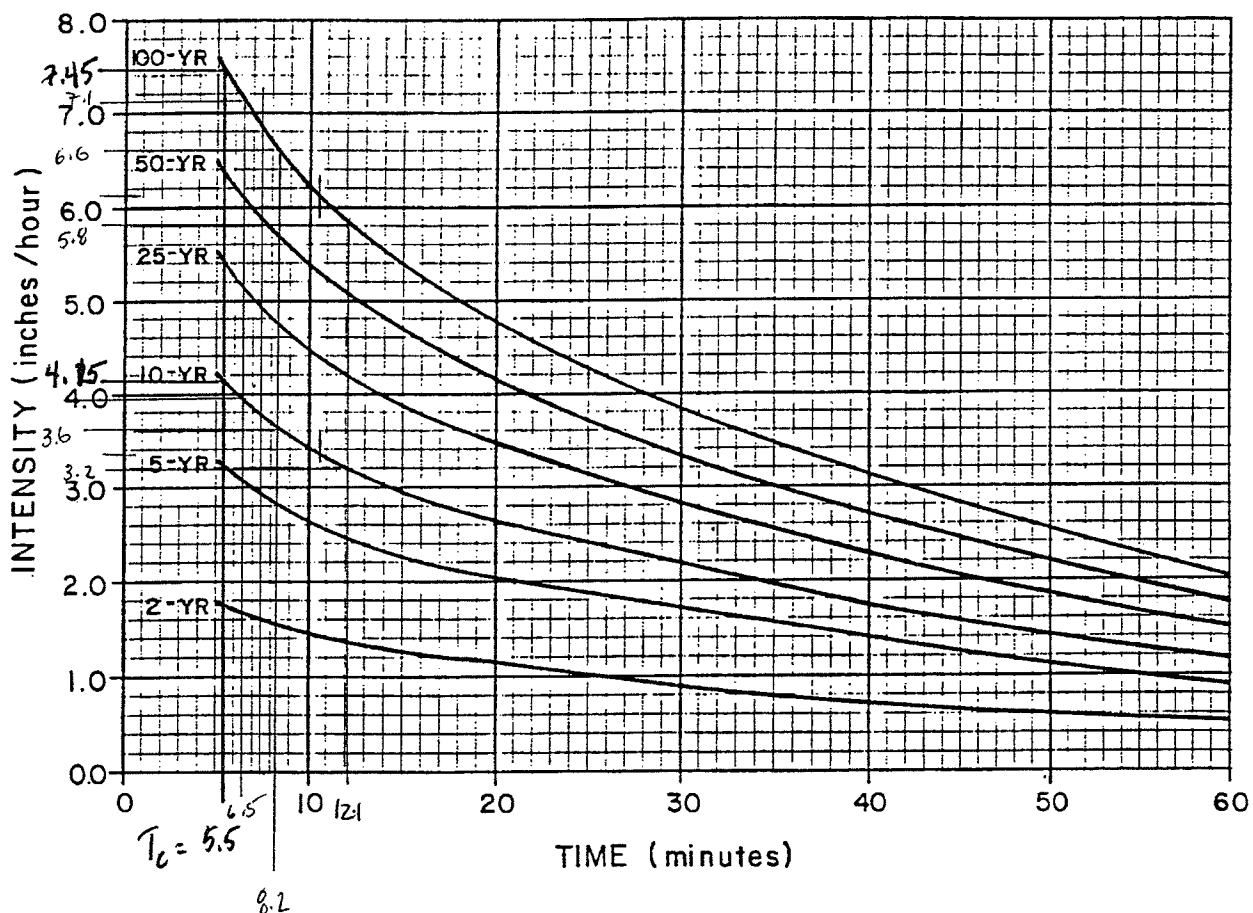
**WRC
ENGINEERING**

REFERENCE:

USACE, Los Angeles District, 1988

FIGURE 513

TIME-INTENSITY-FREQUENCY CURVES FOR McCARRAN AIRPORT RAINFALL AREA

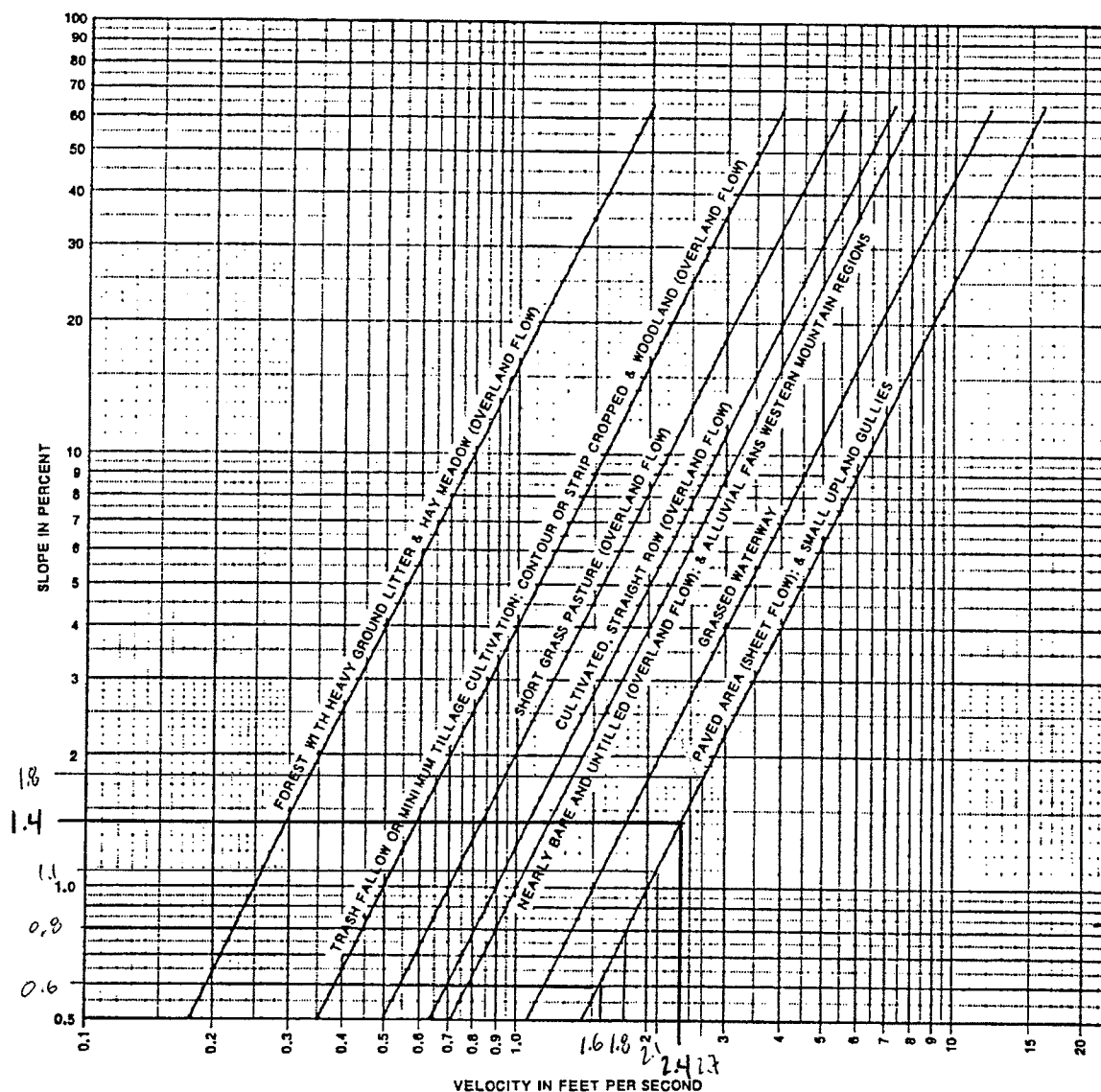


NOTE: 1. Refer to Table 506 for tabulation of Time-Intensity-Frequency Values.

Revision	Date

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

TRAVEL TIME VELOCITY



Revision	Date

**WRC
ENGINEERING**

REFERENCE: SCS National Engineering Handbook
Section 4, Hydrology, March, 1985

FIGURE 602



Kimley-Horn
and Associates, Inc.

500 South Main Street Parking Garage
Technical Drainage Study

***Appendix C Hydraulic
Calculations***

FlowMaster Cross Sections

Worksheet for Capacity of Section A-A

Project Description

Friction Method Manning Formula
Solve For Discharge

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.01880	ft/ft
Normal Depth	0.11	ft
Left Side Slope	2.00	%
Right Side Slope	2.00	%

Results

Discharge	0.51	ft ³ /s
Flow Area	0.61	ft ²
Wetted Perimeter	11.00	ft
Hydraulic Radius	0.05	ft
Top Width	11.00	ft
Critical Depth	0.09	ft
Critical Slope	0.04986	ft/ft
Velocity	0.84	ft/s
Velocity Head	0.01	ft
Specific Energy	0.12	ft
Froude Number	0.63	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.11	ft
Critical Depth	0.09	ft
Channel Slope	0.01880	ft/ft
Critical Slope	0.04986	ft/ft

Worksheet for Proposed Conditions Section B-B (10-yr)

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient 0.013
Channel Slope 0.00400 ft/ft
Bottom Width 2.00 ft
Discharge 2.00 ft³/s

Results

Normal Depth 0.34 ft
Flow Area 0.69 ft²
Wetted Perimeter 2.69 ft
Hydraulic Radius 0.26 ft
Top Width 2.00 ft
Critical Depth 0.31 ft
Critical Slope 0.00521 ft/ft
Velocity 2.91 ft/s
Velocity Head 0.13 ft
Specific Energy 0.48 ft
Froude Number 0.88
Flow Type Subcritical

GVF Input Data

Downstream Depth 0.00 ft
Length 0.00 ft
Number Of Steps 0

GVF Output Data

Upstream Depth 0.00 ft
Profile Description
Profile Headloss 0.00 ft
Downstream Velocity Infinity ft/s
Upstream Velocity Infinity ft/s
Normal Depth 0.34 ft
Critical Depth 0.31 ft
Channel Slope 0.00400 ft/ft
Critical Slope 0.00521 ft/ft

Worksheet for Proposed Conditions Section B-B (100-yr)

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00400	ft/ft
Bottom Width	2.00	ft
Discharge	3.60	ft ³ /s

Results

Normal Depth	0.51	ft
Flow Area	1.02	ft ²
Wetted Perimeter	3.02	ft
Hydraulic Radius	0.34	ft
Top Width	2.00	ft
Critical Depth	0.47	ft
Critical Slope	0.00529	ft/ft
Velocity	3.51	ft/s
Velocity Head	0.19	ft
Specific Energy	0.70	ft
Froude Number	0.87	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.51	ft
Critical Depth	0.47	ft
Channel Slope	0.00400	ft/ft
Critical Slope	0.00529	ft/ft

Worksheet for Proposed Conditions Section C-C (10-yr)

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00895	ft/ft
Bottom Width	2.00	ft
Discharge	1.20	ft ³ /s

Results

Normal Depth	0.19	ft
Flow Area	0.38	ft ²
Wetted Perimeter	2.38	ft
Hydraulic Radius	0.16	ft
Top Width	2.00	ft
Critical Depth	0.22	ft
Critical Slope	0.00531	ft/ft
Velocity	3.17	ft/s
Velocity Head	0.16	ft
Specific Energy	0.35	ft
Froude Number	1.29	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.19	ft
Critical Depth	0.22	ft
Channel Slope	0.00895	ft/ft
Critical Slope	0.00531	ft/ft

Worksheet for Proposed Conditions Section C-C (100-yr)

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00895	ft/ft
Bottom Width	2.00	ft
Discharge	2.20	ft³/s

Results

Normal Depth	0.28	ft
Flow Area	0.56	ft²
Wetted Perimeter	2.56	ft
Hydraulic Radius	0.22	ft
Top Width	2.00	ft
Critical Depth	0.34	ft
Critical Slope	0.00521	ft/ft
Velocity	3.93	ft/s
Velocity Head	0.24	ft
Specific Energy	0.52	ft
Froude Number	1.31	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.28	ft
Critical Depth	0.34	ft
Channel Slope	0.00895	ft/ft
Critical Slope	0.00521	ft/ft

Project Description

Input Data

Normal Depth 0.50 ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.73
0+15	0.50
0+15	0.00
0+17	0.11
0+52	1.56

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.73)	(0+15, 0.50)	0.016
(0+15, 0.50)	(0+17, 0.11)	0.013
(0+17, 0.11)	(0+52, 1.56)	0.016

Options

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

Results

Discharge	8.50	ft³/s
Elevation Range	0.00 to 1.56	ft
Flow Area	2.73	ft²
Wetted Perimeter	11.92	ft
Hydraulic Radius	0.23	ft
Top Width	11.41	ft

Worksheet for Typ Main St. Section

Results

Normal Depth	0.50	ft
Critical Depth	0.54	ft
Critical Slope	0.00603	ft/ft
Velocity	3.12	ft/s
Velocity Head	0.15	ft
Specific Energy	0.65	ft
Froude Number	1.13	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.50	ft
Critical Depth	0.54	ft
Channel Slope	0.00750	ft/ft
Critical Slope	0.00603	ft/ft

Worksheet for Typ Main St. Section to Top of Curb w/Proposed 10-yr

Project Description

Friction Method	Manning Formula
-----------------	-----------------

Solve For	Normal Depth
-----------	--------------

Input Data

Channel Slope	0.00750	ft/ft
---------------	---------	-------

Discharge 10.00 ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.73
0+15	0.50
0+15	0.00
0+17	0.17
0+52	1.56

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.73)	(0+15, 0.50)	0.016
(0+15, 0.50)	(0+17, 0.11)	0.013
(0+17, 0.11)	(0+52, 1.56)	0.016

Options

Current Roughness Weighted Method Pavlovskii's Method

Open Channel Weighting Method Pavlovskii's Method

Closed Channel Weighting Method	Pavlovskii's Method
--	----------------------------

Results

Normal Depth 0.55 ft

Elevation Range 0.00 to 1.56 ft

Flow Area	3.47	ft ²
-----------	------	-----------------

Wetted Perimeter 16.79 ft

Hydraulic Radius	0.21	ft
------------------	------	----

Top Width	16.28	ft
-----------	-------	----

Worksheet for Typ Main St. Section to Top of Curb w/Proposed 10-yr

Results

Normal Depth	0.55	ft
Critical Depth	0.58	ft
Critical Slope	0.00618	ft/ft
Velocity	2.88	ft/s
Velocity Head	0.13	ft
Specific Energy	0.68	ft
Froude Number	1.10	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.55	ft
Critical Depth	0.58	ft
Channel Slope	0.00750	ft/ft
Critical Slope	0.00618	ft/ft

Worksheet for Typ Main St. Section to Top of Curb w/Proposed 100-yr

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.00750 ft/ft
Discharge 10.80 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00	0.73
0+15	0.50
0+15	0.00
0+17	0.11
0+52	1.56

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.73)	(0+15, 0.50)	0.016
(0+15, 0.50)	(0+17, 0.11)	0.013
(0+17, 0.11)	(0+52, 1.56)	0.016

Options

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

Results

Normal Depth 0.57 ft
Elevation Range 0.00 to 1.56 ft
Flow Area 3.77 ft²
Wetted Perimeter 18.41 ft
Hydraulic Radius 0.20 ft
Top Width 17.90 ft

Worksheet for Typ Main St. Section to Top of Curb w/Proposed 100-yr

Results

Normal Depth	0.57	ft
Critical Depth	0.59	ft
Critical Slope	0.00619	ft/ft
Velocity	2.86	ft/s
Velocity Head	0.13	ft
Specific Energy	0.70	ft
Froude Number	1.10	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.57	ft
Critical Depth	0.59	ft
Channel Slope	0.00750	ft/ft
Critical Slope	0.00619	ft/ft



Kimley-Horn
and Associates, Inc.

500 South Main Street Parking Garage
Technical Drainage Study

Appendix D References
Design Requirements

Design Requirements for 500 South Main Street Parking Garage

Introduction

The City of Las Vegas intends to construct, by the Design Build process, a multilevel, 635 space (minimum) parking garage located in Downtown Las Vegas at 500 South Main Street. Design of the Parking Garage shall conform to the open parking garage provisions of the current building codes, Las Vegas Downtown Centennial Plan - Office District Core, and all other applicable laws, codes and ordinances of the authority having jurisdiction. Although the Bridging Document Drawings have been courtesy reviewed by regulatory authorities, no warranty is made that the suggested design indicated on the Bridging Document Drawings complies with all applicable laws, codes and ordinances, as these are not fully developed permit plans. Rather, the Bridging Document Drawings represent one vision of how the project design requirements may be achieved.

The Bridging Documents have been submitted and reviewed by the City of Las Vegas Planning Department for Site Development Review and have received conditional approval. The Design Build Team shall comply with the conditions of the Site Development Review. Design variations from, and enhancements to the design presented in the Bridging Documents are subject to further review by the planning agency, and at its discretion, further review by the City of Las Vegas Planning Department. Gaining such further approval is the responsibility of the Design Build Team.

Building Components

Parking garage structure shall be pre-cast or cast-in-place (or combination of) concrete. All concrete visible from the exterior shall be integral colored or provided with a high performance coating. Natural gray finished concrete is not acceptable.

Concrete columns are permitted at the garage and bay perimeters but not within the drive lanes and parking spaces.

The ceiling and interior surfaces (columns, walls, etc.) of the garage shall be painted white. Exposed pipe and conduits shall be painted to match adjacent surfaces.

Sustainability

As a primarily unoccupied/open structure, the parking garage/retail space is not be required to be LEED certified, but is required to have sustainable design requirements incorporated. Minimum requirements are noted in the bridging documents. Design Build team is encouraged to incorporate additional sustainable design elements to promote the City of Las Vegas sustainability effort.

Building Dimensions

The Design Build Team shall maximize the building footprint on the site, and comply with code required setbacks. The parking garage shall be a multilevel structure, with the minimum clear height for the upper tiers being a minimum of 8'-0". Minimum clear height of the ground floor shall be determined by the requirements of the Nevada Energy Easement, van accessible clearance and delivery/trash vehicles clearance supporting the retail. Encroachment by electrical, plumbing, fire sprinkler, mechanical, etc. into the above referenced clear dimension will not be permitted.

Exterior Elevations

The Parking Garage aesthetic shall visually relate through form, color, materials, detailing or a combination of these elements to the new City Hall building being constructed at the northeast corner of Main Street and Clark Avenue and comply with the City of Las Vegas Downtown Centennial Plan, Office District Core. No physical connection between the new City Hall building and the parking garage, such as

a skybridge, will be allowed. Finish materials shall be durable and low maintenance. E.I.F.S and Stucco are not acceptable finish materials. The Design Build team will be required to submit elevations to the City of Las Vegas Planning Department for Site Development Review.

Elevators

A minimum of three traction type elevators shall be provided with a minimum of two elevators to be located for convenient use by the new City Hall patrons. A minimum of one elevator shall be located within a maximum of 150' travel distance along a designated pedestrian path to the future pedestrian bridge. Elevator cabs shall have finishes that are durable and low maintenance. Elevators shall be climate controlled.

Retail Space

A minimum of 3,500 SF of retail space shall be provided. The retail space shall be arranged such that the space can be subdivided.

Retail space shall be grey shell – unfinished, have a perimeter slab and all utilities capped and stubbed for future use. Retail space perimeter walls shall be durable, maintenance free surface, such as masonry or concrete. Doors shall be located such that the space has two distinct entrances and rear delivery doors.

Building Services

Separate enclosed rooms for the following shall be provided: Elevator controls, emergency generator, main electrical, electrical distribution, emergency electrical, riser/firepump, Telephone/IT, and storage. Perimeter walls shall be durable, maintenance free surface, such as masonry or concrete. See Bridging Documents for minimum room sizes. Provide identification signage on the doors.

Provide screened area for retail space future mechanical equipment.

Trash enclosure shall be designed such that limited structural bearing including the concrete pad and apron, occur within the Nevada Energy Easement. Trash enclosure final location and design shall be coordinated with Republic Services.

Stairs and Guardrails

All stairs shall be substantially open and be provided with overhead weather protection. Handrails and guardrails shall be constructed from metal and finished with a high performance finish.

Chain link fence will not be allowed for any type of guardrail.

Exterior Building Signage

Exterior illuminated building identification signage, to include, but not limited to facility name, address, entrance, etc, shall be provided.

Emphasizing the entrances to the facility is important. At a minimum, identification signage is needed at the entrance locations for the parking patron to clearly recognize the access points.

Provision for two separate signs at the retail space shall be provided.

Parking Design

The parking garage shall have a minimum of 635 parking spaces. Use of parking spaces below finished grade will not be allowed. Compact parking spaces will not be allowed in the minimum number of spaces to be provided

The final design may utilize angled parking, as indicated in the Bridging Documents, or may utilize 90 degree parking, however, generous turning radii shall be incorporated at the ends of drive aisles, which will preclude 90 degree parking from being placed in near proximity to ends of drive aisles. Dimensions for parking spaces and drive aisles shall be per the City of Las Vegas Title 19 Zoning Code. Columns and other obstructions can minimally encroach on the head of parking spaces. The City of Las Vegas requires wheel stops at the head of every parking space.

Parking ramps utilized to access each floor shall not exceed a 6.67% slope.

Accessible parking spaces shall be provided in accordance with the City of Las Vegas Title 19 Zoning Code. Accessible spaces shall be located on the shortest route of travel possible from parking to an accessible pedestrian entrance or elevator. Accessible routes must be placed in front of the parking spaces and be at least 3'-0" wide. The City of Las Vegas allows passing behind ones' own vehicle to an accessible pedestrian entrance without a marked accessible route.

Access Design

Two vehicle entry/exits located on the north and south of the building accessed from Main Street shall be provided with a total of five lanes at the parking control equipment with some lanes capable of acting as ingress and egress. The north entry/exit shall align with the proposed signalized intersection of Clark and Main. The design shall allow for alternate access to the ramps if the area of the Nevada Energy Easement is barricaded. Vehicles are not required to pass thru the parking control equipment under this condition.

Parking Control Equipment

The parking garage shall utilize automated parking control equipment for access/revenue control. Lane devices shall be provided at ingress and egress lanes, with some lanes capable of acting at both directions. North entry/exit parking control equipment shall be set to the back of the garage to allow for vehicle stacking. Automatic pay machines shall be provided for use by the garage patrons. Bollards or other devices shall be placed to deter vehicles from bypassing the equipment. All equipment required for a complete working system shall be provided.

Signage and Graphics

A complete wayfinding and parking fee information signage package shall be provided for both vehicles and pedestrians.

Height clearance bars are required for all the entrances to the facility and where reductions in height occur.

Grading and Drainage

The Design Build Team shall be responsible for preparing and submitting a technical drainage study for review and approval by the City of Las Vegas Flood Control Department. Retail and habitable portion of the Garage shall have a minimum finished floor elevation of approximately 18" above top of curb. Site shall be graded to provide positive drainage away from the building and to drain towards Main Street.

Utilities

The Design Build Team shall be responsible to include all necessary utility connections and provide the required information needed to satisfy submittal requirements for all City of Las Vegas review agencies and utility companies. These utility plans shall include details for all connections, abandonments and relocations necessary for the operation of the proposed improvements. The design build team shall assist the City of Las Vegas in relinquishing any existing utility easements and preparation of any easements required.

Demolition

Previous demolition to the site by separate contract has occurred to include, but not limited to, a 10,000 square foot single story masonry building and associated utilities, asphalt parking lot, abandoned water vault and 20,000 gallon subgrade concrete vault.

Landscape

The landscape design shall include all of the hardscaped areas and the planted areas within the limits of the project, both onsite and offsite. Softscape and hardscape shall be consistent with the Las Vegas Downtown Centennial Plan - Office District Core and City of Las Vegas Title 19 Zoning Code.

A dedicated pedestrian path connecting the two distinct elevator areas shall be provided at ground level. Softscape and hardscape enhancement shall be incorporated.

The general design, shown in the bridging documents, have been submitted and reviewed by the City of Las Vegas for Site Development Review and has received conditional approval. Final landscape design is required to be submitted to the City of Las Vegas Planning Department for Site Development Review.

Irrigation

The irrigation system shall conform to the requirements of the bridging documents. All irrigation equipment shall be located out of the immediate sight of pedestrians and located with consideration to regular maintenance and access. The irrigation shall be a drip system providing adequate water to all plant material based on sound horticultural practice.

Onsite and offsite valves shall be separate. The controller shall be located in a locked enclosure in a room in the parking garage directed by the Owner.

Foundations

Foundations are to be designed for all loads from the superstructure (dead, live, seismic, etc.). Foundation system may be conventional spread footings (isolated pads or continuous wall footings), drilled concrete shafts, piles with pile caps or a concrete mat. Final system selection is subject to the final project geotechnical report. Provide permanent waterproofing and drainage system(s) for foundation portions that extend below the water table such as elevator pits. Concrete compressive strength for all foundation concrete and any concrete that touches soil shall not be less than 4500 psi. Use of wood systems or combustible structural systems is not allowed. Provide concrete slab-on-grade as required to enclose habitable space without excessive subsidence, cracking, or other uncontrolled movement. Minimum slab thickness shall be 5". Slab-on-grade includes floor depressions, trenches, pits, sumps, under floor and perimeter drainage, if required. Provide vapor retarder at all occupied spaces (Retail, etc.). Minimum slab-on-grade concrete compressive strength shall not be less than 4500 psi.

Superstructure

Provide concrete main structural elements (precast or cast-in-place) above grade capable of supporting all anticipated loads without failure or damage. Design and construct elevated floors, ramps, beams, girders, columns, walls, and roofs for dead, live and environmental loads required by building code. Live loads shall include uniformly distributed, concentrated and impact forces required by building code. Environmental loads shall include wind, thermal, ponding, and seismic forces required by the building code. Use durable materials resistant to expansion & contraction, water, moisture vapor, impact and wear. Comply with Owner's requirements for weather resistance, floor slip resistance and surface finishes. Use cast-in-place concrete, pre-cast concrete or a combination of same for main superstructure elements. Do not use wood structural members or non-reinforced masonry. Spray on fireproofing for structural steel members, if used, shall not be left exposed. Pre-cast, pre-stressed double tees shall be

not less than 24" deep plus topping for center of column spans at or exceeding 50'0". Cast-in-place elevated floor systems shall not have vibration or deflection characteristics that exceed the vibration or deflections characteristics of a 24" deep pre-cast double tee floor system composite with 4" thick, 4000 psi concrete topping. Construct stairs and landings with cast-in-place concrete, pre-cast concrete, or steel.

Plumbing

Provide plumbing service (domestic water, sanitary sewer, gas) for parking garage and retail space. Extend utilities into retail space and cap for future tenant improvements. The invert for the sanitary sewer service shall be at least 3'-0" below finish floor. Provide a 1-1/2" domestic water service with shut off valve for each retail space fed by a 2" main with shut-off valve and RPPA. Each retail space shall be provided with a 4" stub for sanitary sewer service and 2-1/2" gas stub. Refer to Bridging Documents for proposed gas meter locations. Provide a 2" sanitary sewer stub in the garage electrical, riser/fire pump, and telephone/IT rooms for floor sinks to collect condensate drain from the split system units. Retail space shall be provided with a stub for a 1,000 gallon grease interceptor and sampling box to protect the sanitary service from future grease production. Hose bibs shall be provided at each level of the garage for routine maintenance.

Rain water from roofs, tiers and ramps of the structure open to the sky shall be routed through a storm drain piping system independently of the sanitary sewer to discharge to a code approved area. Trench and area drains shall prevent rainwater falling on the exposed decks and ramps from draining to lower levels. Overflow building storm drains shall daylight at exterior walls at grade.

Provide a sump pump for the elevator sump with piping terminating at an acceptable location in accordance with the Uniform Plumbing Code.

Fire Protection

The fire sprinkler and stand pipe requirements for the construction of the proposed facility are included in the specifications, division 21. In addition to the design, performance and method requirements included in these sections, the Design Build Team shall comply with the requirements of the City of Las Vegas Building and Fire Departments.

Provide a dry pipe fire sprinkler system for the entire garage facility, except provide a wet pipe system in climate controlled spaces, such as the retail area.

Provide electric fire pump for the fire sprinkler system located in an approved location. The Riser/Fire Pump Room location indicated on the Bridging Documents has been determined acceptable by the City of Las Vegas Fire & Rescue Fire Prevention Division, with justification that the entire access to the room from Main Street is provided with 19 feet+/- clear height and the door to the room is visible from Main Street. Final design locations and details for risers and fire pump shall be submitted to and approved by the authorities having jurisdiction. Design and details of the fire sprinkler systems shall incorporate approved methods for freeze protection of any wet pipe portions of the systems and for enabling access to under slab lengths of lead-in and sprinkler system piping.

The fire sprinkler system serving an existing warehouse building on the adjacent property to the north of the parking garage site is supplied from a fire main that exists on the parking garage property. Re-route and provide a new fire sprinkler lead-in including a new backflow prevention device, exterior valve(s) and fire department connection for the single riser system.

Heating, Ventilation and Air Conditioning (HVAC)

Grey shell space for retail shall be provided with an electric type heating system to prevent the fire sprinkler pipes from freezing. The heating system shall be designed to maintain the rooms at a minimum temperature of 42 degrees F. Provide weather tight block-outs for future mechanical equipment. Refer to

Bridging Documents for proposed sizes and locations.

Split system (cool only) air conditioning systems shall be designed and installed for the emergency electrical room, main electrical, garage electrical, telephone/IT rooms and elevator equipment room. Refrigerant lines shall be hidden from public view to the greatest extent possible. Refer to Bridging Documents for areas allocated for condensing units. Elevators shall be climate controlled.

Riser/ fire pump room shall be provided with an electric type heating system capable of maintaining the rooms at a minimum of 42 degrees F.

The emergency generator shall be provided with a combustion and venting system as required by the generator manufacturer and applicable Codes.

Electrical

Furnish and install a new 1200a, 480V, 3 phase metering switchboard to provide electrical power to the new parking garage. Provide all raceways, wiring, fixtures, devices, equipment etc. for fully operational systems.

The parking garage portion of the project is to be provided with a 800A, 480V, 3 phase metered section within the switchboard. Provide conduits for a maximum of 2 separately metered retail tenants at 200A, 480V, 3 phase each. There will be two electrical distribution rooms located on the ground level to provide power distribution to the entire structure. An emergency generator shall provide power to all emergency loads and an emergency electrical room shall provide distribution for those loads. An electric fire pump shall be located on the ground level and be backed up by the emergency generator.

A lighting control system shall provide automated lighting control to the parking garage. Astronomical time-clocks and photocells connected to the lighting control system shall be used to control the lighting throughout the facility. Energy efficient and architecturally pleasing fluorescent lighting shall provide general lighting throughout the facility. Induction lighting shall be provided for all lighting that is not easily accessible and also on the top tier in the form of pole mounted lighting. All light fixtures shall be rated for heavy duty use and be gasketed and sealed to maintain a wet location listing. Day-lit areas within the parking structure shall be on a separate control to take advantage of day-lighting, wherever possible. Lamp color temperature shall match the color temperature at the new City Hall.

Light levels should be based on IECC with Southern Nevada amendments and IES recommendations. Refer to the electrical specifications for foot-candle requirements at specific areas within the structure.

Emergency lighting shall be provided throughout the entire facility to maintain a 1 foot-candle minimum rating and shall be powered from the emergency generator. Emergency lighting on the exterior shall also be provided at all egress pathways.

Provisions shall be provided for future pedestrian bridge lighting and hydraulic elevators.



**** Duplicate Receipt ****

City of Las Vegas
Development Services Center
731 South Fourth Street
Las Vegas, NV 89101

02/03/2011 16:59 Trn 162015
Cashier 970040

PRJ Permit # D54518	\$400.00
Subtotal	\$400.00
Tax	\$0.00
Total	\$400.00

Received CREDIT	\$400.00
Change	\$0.00

For questions related to this receipt call
702-229-6251

**Appendix E Grading Plan
Sheets**

NOTES

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

0

50

100

200

400

600

800

MAP LEGEND

PARCEL BOUNDARY

SUBD BOUNDARY

ROAD EASEMENT

PM/LD BOUNDARY

NON-PARCEL LOT LINE

MATCH LINE / LEADER LINE

ROAD ID NUMBER

001

1.00

202

5

5

GL5

PARCEL NUMBER

ACREAGE

PARCEL SUB/SEQ NUMBER

PLAT RECORDING NUMBER

BLOCK NUMBER

LOT NUMBER

GOV. LOT NUMBER

ASSESSOR'S PARCELS - CLARK CO., NV.

M. W. Schofield, Assessor

T20S R61E

34

S 2 NW 4

139-34-2

R60E R61E R62E

T19S 125 124 123

T20S 138 139 140

T21S 163 162 161

6 5 4 3 2 1

7 8 9 10 11 12

18 17 16 15 14 13

19 20 21 22 23 24

30 29 28 27 26 25

31 32 33 34 35 36

8 4 8 4

5 1 5 1

6 2 6 2

7 3 7 3

8 4 8 4

5 1 5 1

Scale: 1"=200'

Rev: 05/04/10





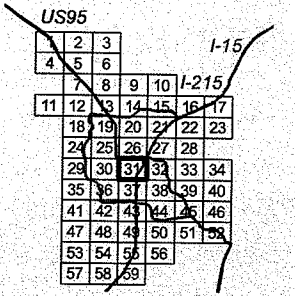
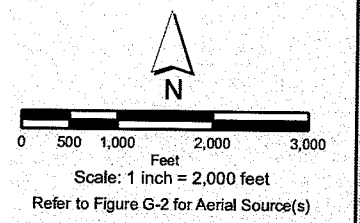
2008
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE

FIGURE F-31
FLOOD CONTROL FACILITIES

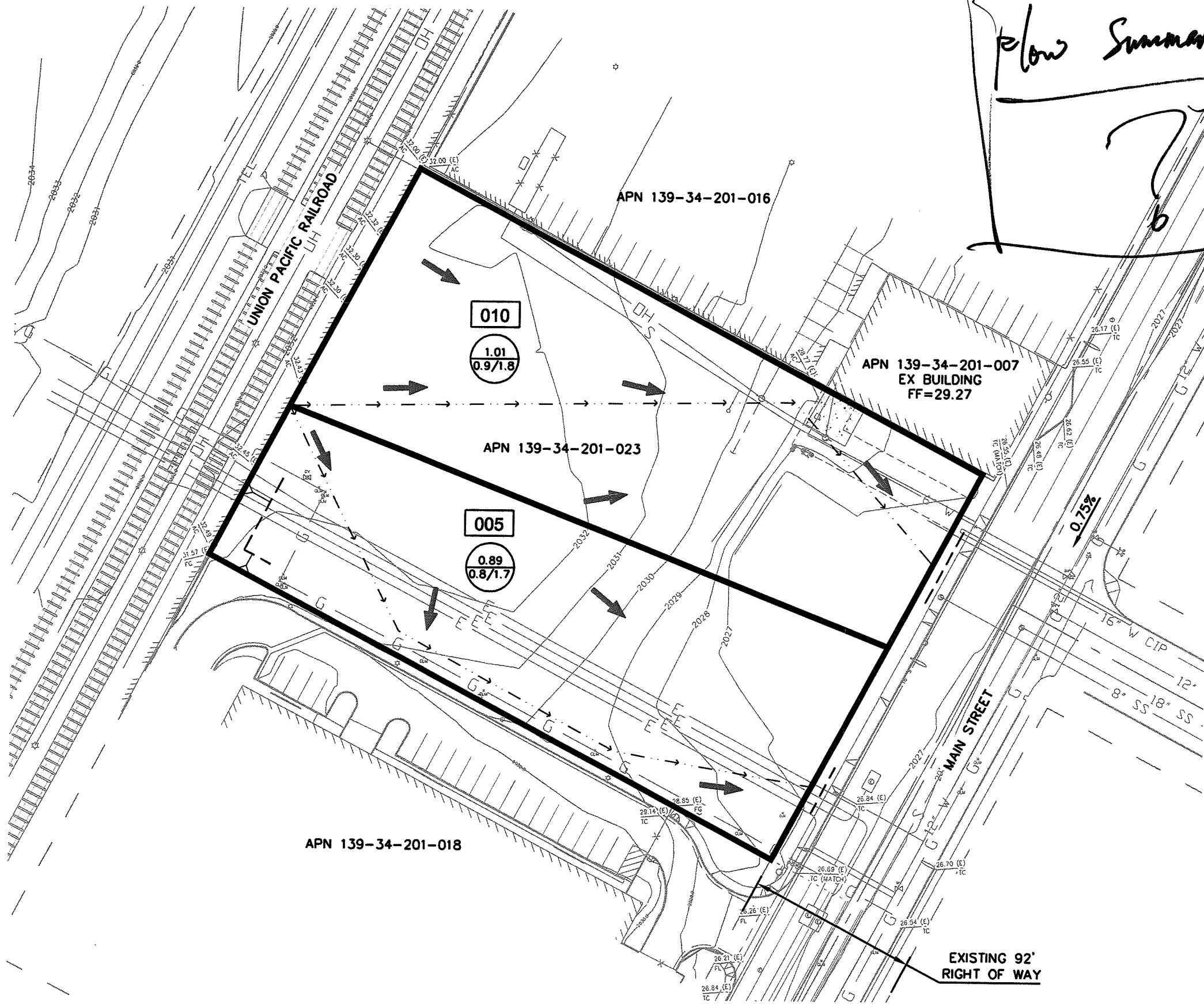
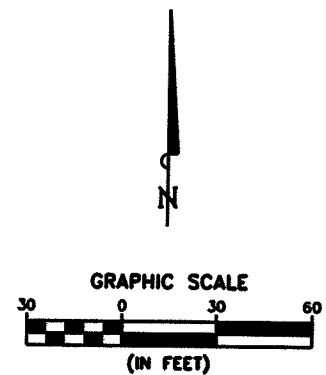
LEGEND

- Ultimate Development Boundary
- Existing Facilities
- Category A Proposed Facilities
- Category B Proposed Facilities
- Local Existing Facilities
- Local Proposed Facilities
- Detention Basin
- Culvert or Bridge Crossing
- Stormdrain
- Lined Channel
- Unlined Channel
- Levee/Dike
- Natural Wash/Floodway
- ID-Mile Separator

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



Flow Summary Table



LEGEND

- SUBBASIN BOUNDARY
- SUBBASIN FLOW PATH
- DIRECTION OF RUNOFF
- SUBBASIN NAME
- SUBBASIN AREA [ACRES]
- SUBBASIN RUNOFF [CFS] FOR 10-YR & 100-YR STORM

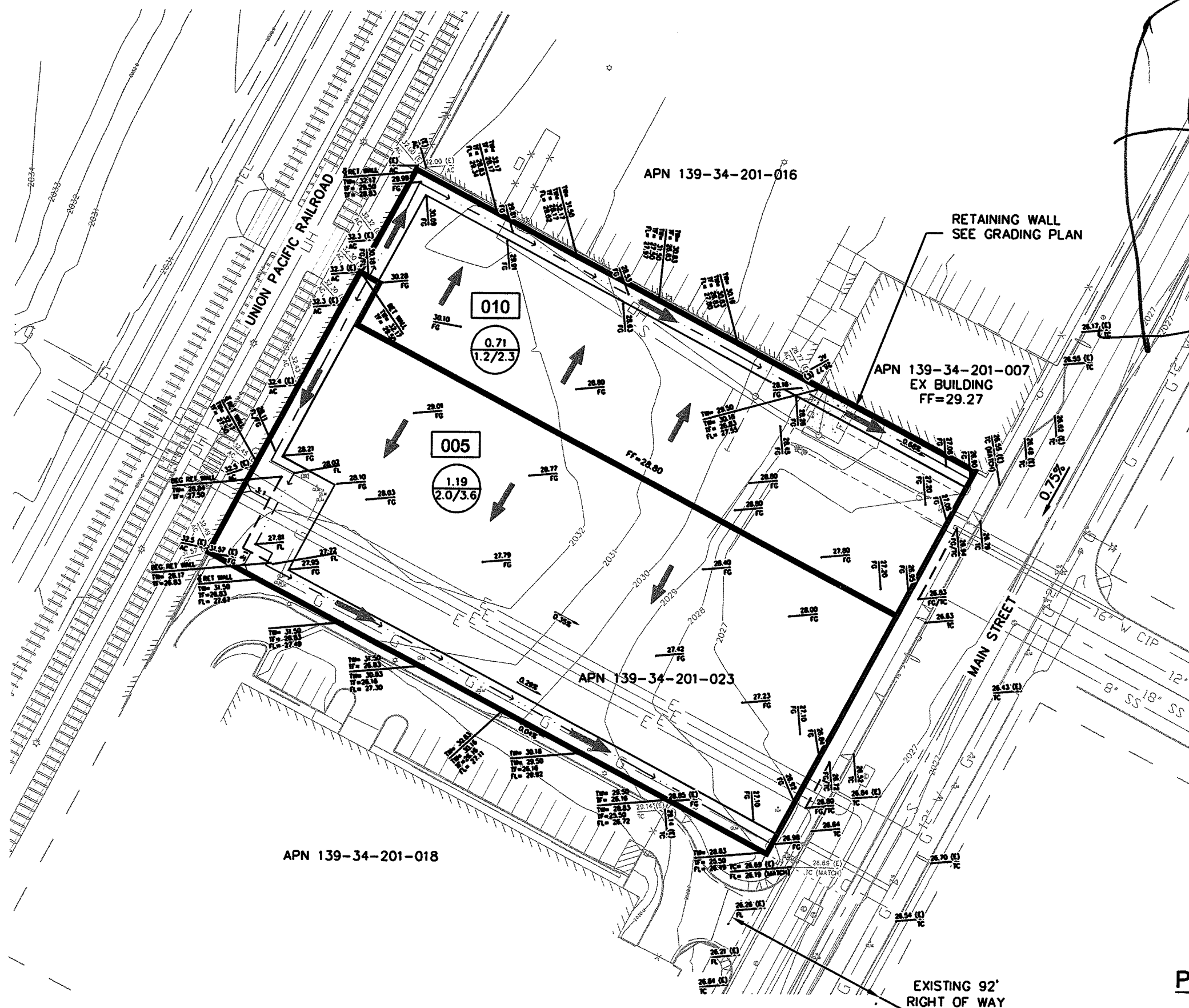
BENCHMARK

CITY OF LAS VEGAS BENCHMARK No. 8LV01 34W4
A RIVET AND PLATE IN THE BASE OF A STREET LIGHT AT THE NORTHEAST CORNER OF MAIN AND BONNEVILLE.
ELEVATION = 617.801 METERS (NAVD 88)
ELEVATION = 2026.90 US SURVEY FEET (NAVD 88)

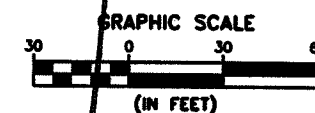
EXISTING CONDITIONS DRAINAGE MAP



K:\AV_Civil\092708 Whiting Turner\000 - 500 S. Main Street\Drawings\Technical Drainage Study\Drawings\Drainage_Existing.dwg Feb 03, 2011 laurie.marin
XREFS: X092708BW X092708V X092708UT X092708PTS X092708AF



How Summary table



LEGEND

- | | |
|---|--|
|  | PROPOSED BUILDING
OUTLINE |
|  | SUBBASIN BOUNDARY |
|  | SUBBASIN FLOW PATH |
|  | DIRECTION OF RUNOFF |
|  | SUBBASIN NAME |
|  | SUBBASIN AREA [ACRES]
SUBBASIN RUNOFF [CFS] FOR
10-YR & 100-YR STORM |

BENCHMARK

CITY OF LAS VEGAS BENCHMARK No. 8LV01 34W4

A RIVET AND PLATE IN THE BASE OF A STREET LIGHT AT THE
NORTHEAST CORNER OF MAIN AND BONNEVILLE.

ELEVATION = 617.801 METERS (NAVD 88)

ELEVATION = 2026.90 US SURVEY FEET (NAVD 88)

PROPOSED CONDITIONS DRAINAGE MAP

