DS #: 4864

APN: 125-30-101-010

PROJECT: Skyline Summit

SUBMITTAL: 1st

SCANNED BY/DATE:

CHECKED BY/DATE:

CITY OF LAS VEGAS
NEVADA

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM				DATE: February 21, 2017
TO: **Land Development Services** Department of Building & Safety				FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT:	Drainage Study for: **Skyline Summit**			**COPIES TO:** Per4mance Consulting Engineering
Cross Streets:	NEC of Eula Street & Azure Drive			Barbier Greene Revocable Trust
File Number:	F:\Depot\DSMemos\DS4864A.doc			Bart Anderson, P.E., DevCo
Parcel Number:	125-30-101-010			CCPW
Zoning Action:	ANX-65643; VAR-68774; WVR-68775; VAC-68776			
FEMA Flood Zone	YES	NO	**X**	
Proposed Storm Drain	YES	NO	**X**	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1st Submittal	2/6/2017	2/21/2017	See Comments Below	$400.00	474740: $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 (**ANX-65643; VAR-68774; WVR-68775 & VAC-68776**) with the next submittal to verify compliance with conditions. *Flood Control* will not issue conditional approval of the drainage study without the associated zoning/planning conditions (issued by the *City Council*). Any associated conditions of approval that revise the site drainage parameters will require that the drainage study be revised and resubmitted.

2. It appears that a parcel map may need to be processed for this type of development. Please coordinate with *City of Las Vegas Development Coordination Section* (DevCo) for direction. Address and resolve in the next submittal.

3. Sites with a grade difference of 2 feet above or below existing are required to have approval from the *City Planning and Development Department*. The engineer must submit copies of the grading plans and detail sheet with a letter justifying the grade difference to the *City Planning Department* (229-6301). The engineer must provide Planning approval with the next submittal.

4. The site is adjacent to the jurisdiction of Clark County to the north, east and south. The engineer must coordinate with *Clark County Public Works Department* (CCPW) and incorporate any concerns for boundary conditions along the above stated borders. CCPW concurrence is required prior to final acceptance of the study.

5. ***Lot 2*** is proposed to drain through the backyard and perpetuate to the adjacent property to the east. However, it is to the reviewer's opinion that with minor adjustment, the proposed drainage in ***Lot 2*** can perpetuate to *Skyline Summit Circle* without burdening the adjacent property owner. The engineer is welcome to call the reviewer at (702) 229-2001 for a discussion of the alternate design.

6. Private streets must be public drainage easements. Provide a note on the grading plan: "Note: All private streets are P.U.E., Public Sewer Easements and Public Drainage Easements to be privately maintained".

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: T19S/R60E/30
AREA G-30

TECHNICAL DRAINAGE STUDY
FOR
SKYLINE SUMMIT

City of Las Vegas

PREPARED FOR:

PINNACLE HOMES
Attn: Frank Wyatt
9225 W. Flamingo Road, Ste. 101
Las Vegas, NV 89148
(702) 228-0720

PREPARED BY:

Per4mance Engineering, LLC.
9345 W. Sunset Road, Suite 101
Las Vegas, Nevada 89148
(702) 569-9770

Per4mance Project Number 17-0014

January 2017

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Skyline Summit Date: January 2017

Location of Development: a) Descriptive (Cross Streets): North/South: Eula Street
East/West: Azure Drive

b) Section: 30 Township: 19 South Range: 60 East

c) APN: 125-30-101-010

Name of Owner: Barbier Greene Revocable Trust 2006 & Barbier Robert J TRS/Pinnacle Homes

Telephone No.: (702) 228-0720 Fax No.: E-mail Address: frank@pinnaclelv.com

Address: 9225 W. Flamingo Road, Suite 190 Las Vegas NV 89147

Contact Person – Name: Ray Fredericksen, P.E. Telephone No.: (702) 569-9770

*E-mail Address: Ray@per4manceLV.com Fax No.:

Firm: Per4mance Engineering

Address: 9345 Sunset Road Las Vegas NV 89148

Type of Land Development/Land Disturbance Process:

☐	Rezoning	☐	Subdivison 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: 2.50 +/- Ac Being Developed/Disturbed: 2.50 +/- Ac

2. Is a portion or all of the subject property located in a 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.): Residential

5. Approximate upstream land area which drains to the subject site: 150 +/- 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: To Azure Drive thru the site entrance drive

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

PROFESSIONAL ENGINEER - STATE OF NEVADA
RAY F. FREDERICKSEN
Exp. 6/30/17
CIVIL
No. 17471
2/2/17

Engineer's Seal

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

*Newly Required Field

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

Revision	Date

Local Entity File No.

REFERENCE: STANDARD FORM 1

Updated 05/01/2008

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

Project Name: Skyline Summit	Map ID:
Firm Name: Per4mance Engineering	Engineer: Ray Fredericksen, P.E.
Address: 9345 Sunset Road, Siute 101 City: Las Vegas State: NV Zip: 89148	
Phone Number: 702-569-9770	Fax Number:
Property Owner: Barbier Green Revocable Trust 2006 & Barbier Robert J TRS/Pinnacle Homes	
Address: 9225 West Flamingo Road, Suite 190 City: Las Vegas State: NV Zip: 89147	

Reviewed By:	Date Received:	Date Accepted for Review:

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

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

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

I. GENERAL REQUIREMENT

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

II. MAPS AND EXHIBITS

Yes	No	
x	-	A copy of a current Flood Insurance Rate Map (FIRM) with the site delineated.
x	-	A copy of the current CCRFCD Master Plan Update Figure, (F-x), for Flood Control Facilities and Environmental areas with the site delineated.

REFERENCE:	STANDARD FORM 2

DRAINAGE SUBMITTAL CHECKLIST

II. MAPS AND EXHIBITS (Continued)

Yes	No	
x	-	Off-site drainage basin maps for existing, interim and future conditions showing the existing topography, basin boundaries, concentration points, and flows in cfs.
x	-	On-site drainage basin maps for existing and proposed conditions showing the existing topography, basin boundaries, concentration points, and on-site and off-site flows in cfs.
x	-	Vicinity Map with local and major cross streets identified and a north arrow.

III. DRAINAGE PLAN

Yes	No	
x	-	Sheet size: 24" x 36" sealed by a registered engineer in the State of Nevada.
x	-	Minimum scale: 1" = 60'.
x	-	Project name.
x	-	Vicinity Map with local and major cross streets.
x	-	Revision box.
x	-	North arrow and bar scale.
x	-	Engineer's/consultant's address and phone number.
x	-	Elevation datum and benchmark.
x	-	Legend for symbols and abbreviations.
x	-	Cut/fill scarps, where applicable.
x	-	Street names, grades, widths.
x	-	Proposed future and existing spot grades for top of curbs and street crowns at lot lines, grade breaks, and along curb returns on both sides of the street.
x	-	Existing contours encompassing the site and 100 feet beyond with spot elevations for important locations, where appropriate.
x	-	Minimum finish floor elevations with top-of-curb elevations at upstream end of lot.
x	-	Proposed typical street sections.

REFERENCE:	STANDARD FORM 2

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
-	N/A	Streets with off-set crowns.
x	-	Proposed contours or spot elevations in sufficient detail to exhibit intended drainage patterns and slopes.
x	-	Property lines.
x	-	Right-of-way lines and widths, existing and proposed.
x	-	Existing improvements and their elevations.
x	-	Delineation of proposed on-site drainage basins indicating area and 10-year and 100-year storm peak flows at basin concentration points.
x	-	Concentration points and drainage flow direction with Q_{100} and V_{100} and D_{100} in streets.
x	-	Cumulative flows, velocity, and direction of flow at upstream and downstream ends of site for the 10-year and 100-year flows.
x	-	Location and cross-section of street capacity calculations.
-	N/A	Cross-sectional detail for channels, including cutoff wall locations.
x	-	Existing and proposed drainage facilities, appurtenances, and connections (i.e., sidewalk, ditches, swales, storm drain systems, unimproved and improved channels, and culverts, etc.) stating size, material, shape, and slope with plan and profile and HGL calculations.
x	-	Existing and proposed drainage easements and widths shown with sufficient detail. A cross sectional detail must be provided that shows appropriate lining and reinforcement.
-	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.
x	-	Perimeter retaining wall locations. All existing and proposed walls (retaining screen and flood) must be shown with adjacent ground elevations. Flood walls with 8-inch concrete masonry unit.
x	-	Building and/or lot numbers.
-	N/A	Alignment of all existing, proposed, or future Regional Facilities adjacent to the site.
-	N/A	Limits of existing floodplain based on current FIRM or best available information; limits of proposed floodplains based on best available information.

REFERENCE:	STANDARD FORM 2

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
-	N/A	For areas in Zone A, AE, AH, and AO, base flood elevations (BFEs) must be shown for each lot; BFEs may be listed on each lot, or in a table. Finish floor elevations must be a minimum of 18 inches above BFE.
-	N/A	Appropriately elevated "humps" 6 inches above the 100 year water surface elevation at site accesses where the intent is to protect the site from the Q_{100} flows.
x	-	Street slopes for perimeter and interior streets. The minimum slope is 0.4 percent.
-	N/A	Location and detail of best management practice (BMP) for parking lots and low impact development (LID) (if required).

IV. HYDROLOGIC ANALYSIS

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

REFERENCE:	STANDARD FORM 2

DRAINAGE SUBMITTAL CHECKLIST

V. HYDRAULIC ANALYSIS

Yes	No	
-	N/A	Flow split calculations and supporting documentation or reference for the method of flow split calculations used.
x	-	Normal depth street flow calculations and cross section diagrams for all interior and perimeter 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 x v $\leq$ 8. Q_{10} d x v $\leq$ 6 and 12 foot dry lane for rights-of-way $\geq$ 80 feet. Calculations must be labeled by street name as indicated on the Grading Plan.
x	-	A summary table of interior and exterior street capacity calculations showing the street name, Q_{100} flow, slope, depth of flow, velocity and depth times velocity product and streets needing to meet 12 foot dry lane criteria.
-	N/A	Appropriate hydraulic calculations for block wall openings assuming a 50 percent vertical clogging factor. (Assume the lower half of the opening is plugged.)
-	N/A	Appropriate hydraulic calculations at drainage easement entrance and discharge locations to set finish floor elevations. Hydraulic calculations must include submerged weir, superelevation and tee intersection losses, where appropriate.
x	-	Provide necessary freeboard requirements to set the finished floor elevations of all proposed buildings, 2 x depth of flow or depth of flow plus 18 inches of freeboard, whichever is less. The minimum requirement is 6 inches above adjacent upstream top of curb. Buildings adjacent to drainage easements must always be provided with 18 inches of freeboard above the Q_{100} weir height or flow depth, whichever is greater.
-	N/A	A complete water surface profile analysis (HEC-2, HEC-RAS, etc.) for channel flows and FEMA Zone A flood zones. • Field survey data. • Input and output information. • Plotted cross-sections based on survey with proper encroachments. • A map showing the location of the cross-sections. • Analysis of both sub and super-critical flow segments. • A summary table and a discussion of the results in the text of the report.
-	N/A	Provide a 50 percent clogging factor in the capacity calculation for drop inlets.
-	N/A	Hydraulic calculations for culverts and storm drains. D-Load calculations must be provided for storm drain pipes in public rights-of-way, including headwater pool inundation.
x	-	The mitigation of nuisance water, both during construction and in the fully developed condition, must be addressed.
-	N/A	Provide BMP type, size and supporting calculations for parking lots and LIDs (if required).

REFERENCE:	STANDARD FORM 2

CITY OF LAS VEGAS

MINIMUM DRAINAGE STUDY CRITERIA
STANDARD FORM 2 CHECKLIST SUPPLEMENT

(Revised 5/18/11)

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

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

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

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

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

II. GRADING PLAN INFORMATION		
Yes	No	
-	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.
x	-	All existing and "to be constructed" walls with cross-sections showing wall type, (e.g. block wall, retaining wall, flood wall, etc.), with limits clearly defined, adjacent ground elevations. Wall heights must meet current ordinances and in no case exceed 14 feet above the adjacent property.
x	-	Street slopes for both interior and perimeter streets. Note: The minimum slope for a roadway is 0.4 percent, a minimum 18-inch storm drain must be provided where minimum slopes cannot be met.
x	-	Back of lot elevations and lot drainage pattern for all lots including common lots.
x	-	Sites with a grade difference two feet above or below existing ground are required to have approval from City of Las Vegas Current Planning. Current Planning approval is required prior to final approval of the drainage study.
x	-	On-site facilities must perpetuate flows through or around the site without significantly impacting adjacent property owners. (The project must pass flows through the site every 600 feet where the project is blocking flow paths.)
x	-	This project uses a solid grouted stem wall (or approved alternate) at the back of sidewalk to provide erosion protection for landscaped areas where the depth of flow in the roadway exceeds the back of walk elevation. A corresponding cross-section detail is included.
-	N/A	Commercial and Common Lot Landscape areas are not allowed to drain over the sidewalk. The grading plans show flow lines with grades and sidewalk under drains for all landscape areas draining to the public ROW.

III. Local Entity Criteria - City of Las Vegas – Manual Section 1600		
Yes	No	
-	N/A	Concrete valley gutters are required in parking lots with slopes less than 1 percent. Slopes through cul-de-sac must be at a 1 percent minimum where flow is drained through the cul-de-sac.
-	N/A	Ten-foot wide public drainage easements to be privately maintained are allowed for flow less than 20 cfs. The depth of flow entering the easement must be checked using the submerged weir calculation.
-	N/A	The limits of the flood zones and the base flood elevations (BFE) must be shown on all grading plans for all developments within a Special Flood Hazard Zone A, AO, AE, etc.
x	-	Minimum finish floor elevation is 6 inches above highest adjacent top of curb. Finish floor calculations must include allowances for super elevations on curves and velocity head for tee intersections.
-	N/A	Finished floor elevations for buildings adjacent to public drainage easements must be a minimum of 18 inches above the Q100 weir of submerged weir elevation, whichever is greater.

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

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

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

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9345 W. Sunset Road, Suite 101, Las Vegas, Nevada 89148
Phone (702) 569-9770 email:rayf@per4mancelv.com

I. INTRODUCTION

A. Study Overview and Purpose

This report is the technical drainage study for the proposed four lot subdivision by Pinnacle Homes located at the northeast corner of Eula Street and Azure Drive intersection. The site is comprised of approximately 2.50± acres (gross), to be developed into 4-lots of more than 20,000 square foot each with a private entry street. This study is a stand-alone document, which presents the findings of a detailed hydrologic analysis of the site and contributing watershed area. A vicinity map is included as Figure 1 in the appendix.

B. Location

The project site is identified by Assessor's Parcel Number 125-30-101-010 and is located within the Northern Half (N ½) of the Northwest Quarter (NW ¼) of Section 30, Township 19 South and Range 60 East, of the Mount Diablo Meridian, in City of Las Vegas, Nevada.

C. FEMA Flood Zone Determination

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM), Community Panel Numbers 32003C2174E, effective September 27, 2002, the site is located within Zone X (unshaded). Zone X (unshaded) is described by FEMA as areas determined to be outside the 0.2% annual chance flood plain. A copy of the FIRM (Figure 2) indicating the location of the site has been provided in the appendix.

D. Soils Data

The site is also covered by the current 2016 Soil Survey of the Las Vegas Valley Area, a part of Clark County, Nevada. Review of the soil survey indicates that the site and its tributary watershed are mainly located within one soil type identified as soil 190. Soil 190 is described as Dalian very gravelly fine sandy loam and comprises of 10% Hydrologic Soil Group (HSG) "A," 85% HSG "B" and 5% HSG "D". A copy of the soils map indicating the location of the site is provided as Figure 2 in the appendix.

E. CCRFCD & Local Master Plan Information

The site is also covered by the current Flood Control Master Plan Update of the Las Vegas Valley. As shown on Figure F-19 from the 2013 CCRFCD Flood Control Master Plan Update (MPU) of the Las Vegas Valley, the subject site is not located adjacent to or traversed by any existing or proposed CCRFCD Master Plan facility. The MPU Figures H-19 and F-19 have been reproduced to indicate the location of the site and have been included in the appendix of this report as Figures 4 and 5 respectively.

The site is also covered by the City of Las Vegas Northwest Neighborhood Study hereinafter referred to as the CLV Master Plan by PBS&J. Review of the CLV Mater Plan also indicates no existing or proposed City of Las Vegas local Master Plan facility adjacent

to the site. Figures H-04 and F-04 of the CLV Master Plan have been reproduced to indicate the location of the site and have been included in the appendix of this report as Figures 6 and 7 respectively.

F. Previous Drainage Studies

The *Technical Drainage Study Update #1 for Azure & Eula Residential Development* (DS 4741) by Momentum Engineers, LTD, hereinafter referred to as the Azure & Eula Study, provided a comprehensive analysis of the offsite flows impacting the intersection of Azure Drive and Eula Street adjacent to the site. The offsite flows in Eula Street and the combined flows at the intersection of Azure Drive and Eula Street adjacent to the site has been referenced from the Azure & Eula Study. The analyses provided in the referenced Study have been reviewed and Per4mance Engineering concurs with the referenced flow rates established therein. Pertinent reference materials from the Azure & Eula Study have been in included in the appendix.

II. DRAINAGE BASIN DESCRIPTIONS

A. Site Description

The project parcel is currently undeveloped consisting of the characteristic desert shrub vegetation. The adjacent parcels directly north of the site have been fully developed and consist of residential homes. The parcels directly west of the site across Eula Street are currently under improvement plans review for the development of the Azure & Eula Residential subdivision and directly east of the site is an existing undeveloped parcel. Both Eula Street and Azure Drive adjacent to the site consists of standard access road improvements with roadside swales. The existing site generally slopes to the southeast at an average slope of 2.90%.

B. Existing Offsite Drainage Description

The offsite flows impacting the site are generally conveyed south along Eula Street and east along Azure Drive and have been analyzed by the Azure & Eula Study. The flows in Eula Street are estimated to be approximately 37 cfs during the 100-year, 6-hour storm event.

Majority of the offsite flows are conveyed east along the alignment of Azure Drive and are also estimated by the Azure & Eula Study to be approximately 177 cfs during the 100-year, 6-hour storm event. The offsite flows combine at the intersection of Azure Drive and Eula Street and continue east in Azure Drive downstream of the site. The existing site is analyzed as one drainage basin identified as ONX. The portion of Azure Drive adjacent to the site is also analyzed as basin OFX. The offsite flows are algebraically combined with the onsite flow at concentration point CPX (Q_{100}=219 cfs) and the combined flows continues east in Azure Drive downstream of the site. Please refer to the Existing Condition Drainage Map (Sheet DR1) provided in the appendix for the location of the

drainage basins and concentration points.

C. Existing Onsite Drainage Description

The existing site is analyzed as one basin identified as ONX. Onsite flow discharges southeast into Azure Drive thru the adjacent undeveloped parcel and combines with the offsite flows in the street following the existing drainage patterns as described above in Section II (B).

D. Developed Condition Onsite and Offsite Drainage Description

In the proposed condition, the offsite basins flows impacting the site from the west will remain as analyzed in the existing condition. Thus, the offsite basins are not reanalyzed. However, the portion of Azure Drive adjacent to the site is reanalyzed as basin OFD in a fully built out condition to comprise of sidewalk, curb and gutter. Note that the development of the site will only construct the access road with roadside swales. However, the built out condition is provided as a conservative analyses since it is anticipated the full street improvement will be constructed sometime in the future by the City of Las Vegas.

The site will be developed to consist of four lots with one interior private roadway for access. The developed condition of the site is analyzed as one drainage basins identified as OND. Basin OND will discharge into Azure Drive and will combine with offsite flows in the street. The onsite and offsite flows have been algebraically combined at concentration point CPD (Q_{100}=218 cfs) and the combined flows will continue east along Azure Drive downstream of the site.

E. Ultimate Condition Onsite and Offsite Drainage Description

In the ultimate, the drainage patterns for both the onsite and offsite basins will remain same as described in the developed condition section above. Note that the referenced offsite flows from the Azure & Eula study comprises of the ultimate developed flows from the offsite watershed. Therefore, no additional flows or increase in runoff is anticipated in the ultimate condition.

III. HYDROLOGIC CRITERIA

The U.S. Army Corps of Engineers HEC-1 flood hydrograph package was used to determine the peak runoff generated by the 100-year, 6-hour storm event. The HEC-1 computer model has the ability to simulate the surface runoff response of a given basin and smaller sub-basins to rainfall. The computed hydrographs from each sub-basin are then combined at the appropriate locations, from which a final discharge hydrograph is obtained.

A. Precipitation

The project site is located outside the boundaries of the McCarran Airport Rainfall Area. Therefore, the rainfall depths for the 6-hour, 10-year and 100-year storm events were obtained from Figures 503 and 506 and adjusted per Table 501 of the *CCRFCD Hydrologic Criteria and Drainage Design Manual (HCDDM)*. Since the site and its tributary watershed is less than 8-square miles, the SDN3 Storm Distribution was used for the HEC-1 model. HEC-1 parameters are included in the appendix. The adjusted rainfall depths utilized in the HEC-1 models have been summarized in Table 1 below.

B. Hydrologic Abstractions

The SCS curve number method was used to determine the infiltration rates for the drainage basins. The soil groups for the existing project site were determined using the *2016 SCS Soil Survey of the Las Vegas Valley*. Curve Numbers for the drainage basins were determined using Table 602 from the HCDDM. The soil map (Figure 3) depicting the soil type is located in the appendix of this study.

C. Basin Area

Basin areas for the offsite and onsite drainage basins were determined using AutoCad. Note that lag times below ten minutes for the undeveloped condition and five minutes for the developed condition were revised to be at those numbers, per Section 602 and 602.1 of the HCDDM. The HEC-1 parameter calculation utilizing the Standard Form 4 (SF4) per the HCDDM is located in the appendix of this study.

D. SCS Lag-Time with Time of Concentration

Lag-time, T_L, is defined as the time measured from the centroid of excess rainfall to the peak of the outflow hydrograph. It is a measure of the watershed's response time and is related to basin length, slope, roughness characteristics, and land use.

Lag-times for this study were estimated by calculating the drainage basins' time of concentration, T_C. The time of concentration consists of two component times; the initial overland flow time, t_i, and the gutter or channel flow time, t_t. The equation for the time of concentration is: $T_C = t_i + t_t$. The equation for lag-time is: $T_L = 0.6T_C$

Travel times estimated for both existing and developed conditions are based on Manning's equation, per section 602 of the Manual. The following table summarizes the precipitation values for the 10-year and 100-year 6-hour storm event.

Table 1: Adjusted Precipitation Values for 6-hour Storm Event

Recurrence Interval (years)	Precipitation (inches)
10	1.74
100	3.15

IV. MODEL RESULTS

A. Existing Condition Drainage Analysis

Refer to Section II for the description of the onsite and offsite drainage patterns pertinent to the project site. The following table summarizes the peak flows as determined by the HEC-1 analysis for the existing condition. Please refer to the Existing Condition Basin Map (Exhibit DR1) provided in the appendix for the location of the drainage basins and concentration points.

Table 2: Existing Condition Peak Rate Flow Summary

Basin/Concentration Point	Area (ac)	Q_{10} (cfs)	Q_{100} (cfs)
*CPEL	-	10	37
*CPAZ	-	61	177
ONX	2.10	1	3
OFX	0.45	1	2
CPX	-	73	219

*Referenced from the Azure & Eula Study

B. Developed Condition Drainage Analysis

The proposed condition drainage pattern has been described in Section II of this report. The following table summarizes the peak flows as determined by the HEC-1 analysis for the proposed condition. Refer to the Developed Condition Basin Map (Exhibit DR2) provided in the appendix for the location of the drainage basins and concentration points.

Table 3: Developed Condition Peak Flow Rate Summary

Basin/Concentration Point	Area (ac)	Q_{10} (cfs)	Q_{100} (cfs)
*CPEL	-	10	37
*CPAZ	-	61	177
OND	2.10	0	2
OFD	0.45	1	2
CPD	-	72	218

*Referenced from the Azure & Eula Study

It is noted that a portion of the site (the rear yard of lot 2) is designed to discharge into the adjacent parcel to avoid the excessive retaining required to drain the lot into the interior addressed street (Skyline Summit Circle). As a result of the rear yard drainage, the onsite drainage basin is prorated to quantify the portion of the onsite flows that will impact the adjacent parcel and adequately size any facilities that will be required to mitigate the flow. The following table provides a summary of the prorated subbasins and their respective

peak flows determined for the onsite basin. It is noted per Table 4 below that the prorated portion of the onsite flow that will impact the adjacent eastern parcel is less than 1 cfs during the 100-year storm event which is considered insignificant. It is also worthy to note that the drainage of the rear yard is in conformance with the existing drainage pattern.

Table 4: Developed Condition Prorated Peak Flow Rate Summary

Basin	Q_{100} (cfs)	Area (acres)	Q_{100} Unit Flow (cfs/acre)
OND	2	2.10	1.0
Subbasin	**Q_{100} (cfs)**	**Area (acres)**	**Q_{100} Unit Flow (cfs/acre)**
ONDa	2	1.8	1.0
ONDb	0	0.3	1.0
TOTAL	***2***	***2.10***	1.0

C. Ultimate Condition Drainage Analysis

The hydrologic analysis presented in the developed condition incorporates the ultimate developed condition of the site and its tributary watershed. Note that the flows at referenced concentration points CPEL and CPAZ comprises of the ultimate developed flows from the offsite watershed. Therefore, a separate ultimate condition analysis is not necessary and has not been provided.

D. Street Flows

The perimeter streets and interior street normal depth of flow calculations have been provided to analyze and verify that the proposed finished floor elevations are adequately flood protected. Note that the normal depth calculations utilized the worst case ultimate condition flowrates. Note also that the 100-year flows satisfied the 10-year criteria except for Section 2 (Azure Drive) which has significantly high flows. Therefore, only Section 2 has been analyzed for the 10-year storm event. The calculations have been included in the appendix. A summary of the hydraulic calculations have been provided in Tables 5 and 6 below.

Table 5: Street Flow Summary Developed Condition 100-Year

Street Name	Street Description	Section Identifier	Flow [Q100] (cfs)	Slope (%) (fps)	Depth [d] (ft)	Velocity [V] (ft/s)	100-year Velocity x Depth (V x D)
Eula Street	Access Road (min %)	1	37	1.46	0.82	3.94	3.23
	Access Road (Max %)	1	37	1.82	0.79	4.27	3.37
Eula Street	Improved Road (Min %)	1	37	1.46	0.57	3.84	2.19
	Improved Road (Max %)	1	37	1.82	0.55	4.21	2.32

Table 5: Street Flow Summary Developed Condition 100-Year							
Street Name	Street Description	Section Identifier	Flow [Q100] (cfs)	Slope (%) (fps)	Depth [d] (ft)	Velocity [V] (ft/s)	100-year Velocity x Depth (V x D)
Azure Drive	Access Road (Min %)	2	218	2.97	1.05	7.29	7.65
	Access Road (Max %)	2	218	3.27	1.04	7.50	7.80
Azure Drive	Improved Road (Min %)	2	218	2.97	0.81	9.01	7.30
	Improved Road (Max %)	2	218	3.27	0.80	9.27	7.42
Skyline Summit Circle	Improved Road (Min %)	3	2	0.50	0.29	1.77	0.51
	Improved Road (Max %)	3	2	1.33	0.27	2.30	0.62

Table 6: Street Flow Summary - Developed Condition 10-Year							
Street Name	Street Description	Section Identifier	Flow [Q10] (cfs)	Slope (%)	Depth [D] (ft)	Velocity [V] (fps)	10-year Velocity x Depth (V x D)
Azure Drive	Access Road (Min %)	2	72	2.97	0.78	5.03	3.23
	Access Road (Max %)	2	72	3.27	0.77	5.22	3.37
Azure Drive	Improved Road (Min %)	2	72	2.97	0.61	5.86	3.57
	Improved Road (Max %)	2	72	3.27	0.61	6.06	3.70

Review of the above tables indicates that the street flow design criteria of depth (D) and velocity times depth (VxD) product per the HCDDM are satisfied for both the 10-year and 100-year storm event. Note that street calculations have been provided for both the proposed access road condition with roadside swales as well as for the anticipated ultimate built out condition by the City of Las Vegas with sidewalk, curb and gutter.

E. Finished Floor Elevations

The proposed finish floors elevations have been designed to be flood protected at more than twice the 100-year flow depth in both Eula Street and Azure Drive adjacent to the site. In addition, the finished floors are also set at a minimum of 18-inches above the adjacent top of curb and/or street centerline elevation in Skyline Summit Circle measured at the middle of the lot (buildings). Therefore, the proposed buildings will be adequately flood protected from any flooding due to the 100-year storm event. Note that 3-course solid grouting of the walls along Eula Street and the upstream portion of Azure Drive are required for flood protection of the adjacent lots from the flows within the perimeter streets.

V. CONCLUSIONS

A. Summary & Recommendations

Development of the site is in conformance with the CCRFCD Master Plan Update and the hydraulic design meets all the criteria stipulated in the HCDDM. Onsite runoff generated by the site will discharge into Azure Drive thru Skyline Summit Circle.

Since the perimeter streets will be remain as access roads to maintain the planned use of Rural Neighborhood Preservation (RNP), roadside swales have been provided to convey offsite flows adjacent to the site. It is noted that the flow velocities along Azure Drive are erosive (>5.0 fps); therefore, riprap protection consisting D_{50}=9" and Thickness=18" have been specified for erosion protection. The street flows have been analyzed and determined to satisfy both the 10-year and 100-year depth and velocity times depth (VxD) criteria.

The portion of the site (rear yard of lot 2) designed to discharge east into the adjacent parcel have been determined to generate insignificant flows (<1 cfs) during the 100-year storm event. However, in order to mitigate the insignificant flows, an area drain with 12" pipe penetrating thru the perimeter wall is proposed to perpetuate the flow. Note that the bottom of the area drain will be perforated with drain rocks below to allow the infiltration of nuisance water into the ground.

The finished floor elevation(s) have been designed to satisfy the required criteria as set forth in the HCDDM.

B. Conclusions

The following conclusions have been reached based on the research, hydrologic and hydraulic analyses conducted for this project.

1. The site is located within a Zone X (unshaded) which is not a designated Special Flood Hazard Area (SFHA). Therefore, coordination and/or notification to FEMA will not be required for this project.

2. The site is not adjacent to or traversed by any existing of future CCRFCD master plan facilities. Therefore, concurrence from CCRFCD will not be required for this study.

3. The design finished floor elevations have been set to satisfy the criteria per the HCDDM and therefore, will be adequately flood protected from the 100-year, 6-hour storm event.

4. Onsite 30" roll curb and gutter will be constructed to convey onsite flows along Skyline Summit Circle to Azure Drive.

VI. REFERENCES

1. CCRFCD Hydrologic Criteria and Drainage Design Manual (HCDDM); WRC Engineering, 1999.

2. Flood Insurance Rate Map (FIRM), Community Panel Number 320032174E Clark County, Nevada; Federal Emergency Management Agency (FEMA), effective date; September 27, 2002.

3. Soil Survey of Las Vegas Valley Area, Nevada, Part of Clark County; USDA Soil Conservation Service, 2016.

4. CCRFCD Flood Control Master Plan Update; PBS&J, in association with Louis Berger Group and Parsons Brinkerhoff, 2008 & 2013.

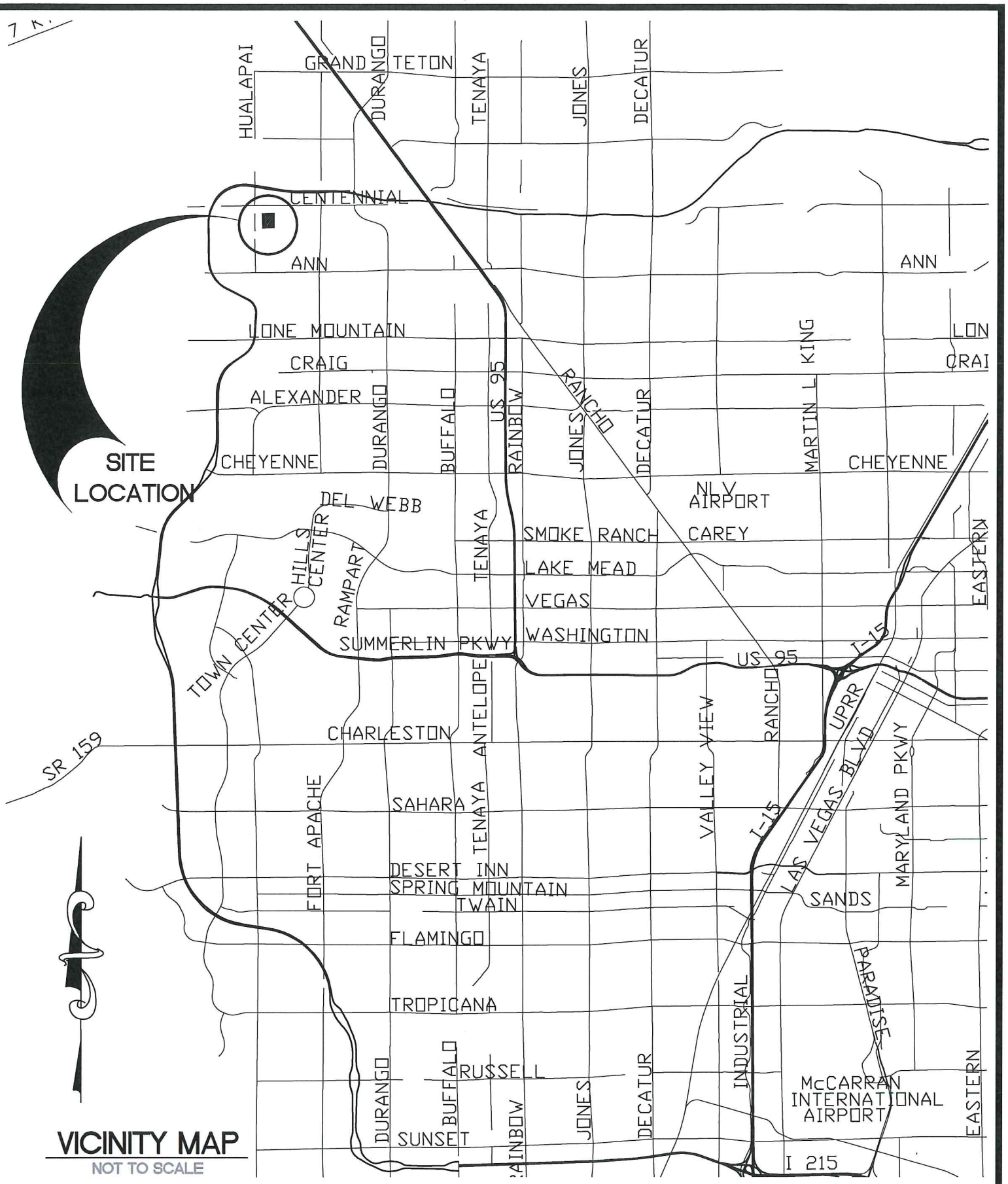
5. City of Las Vegas Northwest Neighborhood Study; PBS&J, April 1996.

6. Technical Drainage Study and Update #1 for Azure and Eula Residential Development (DS 4741); Momentum Engineers, LTD., approved on July 2016 and Concurrence from CCPW on August 2016.

APPENDIX A

Drainage Maps & Exhibits

7 K.



VICINITY MAP

NOT TO SCALE

PER4MANCE ENGINEERING
197 CARLSBAD CAVERNS ST., HENDERSON, NEVADA 89012
TEL: (702)569-9770 EMAIL: RAYF@PER4MANCELV.COM

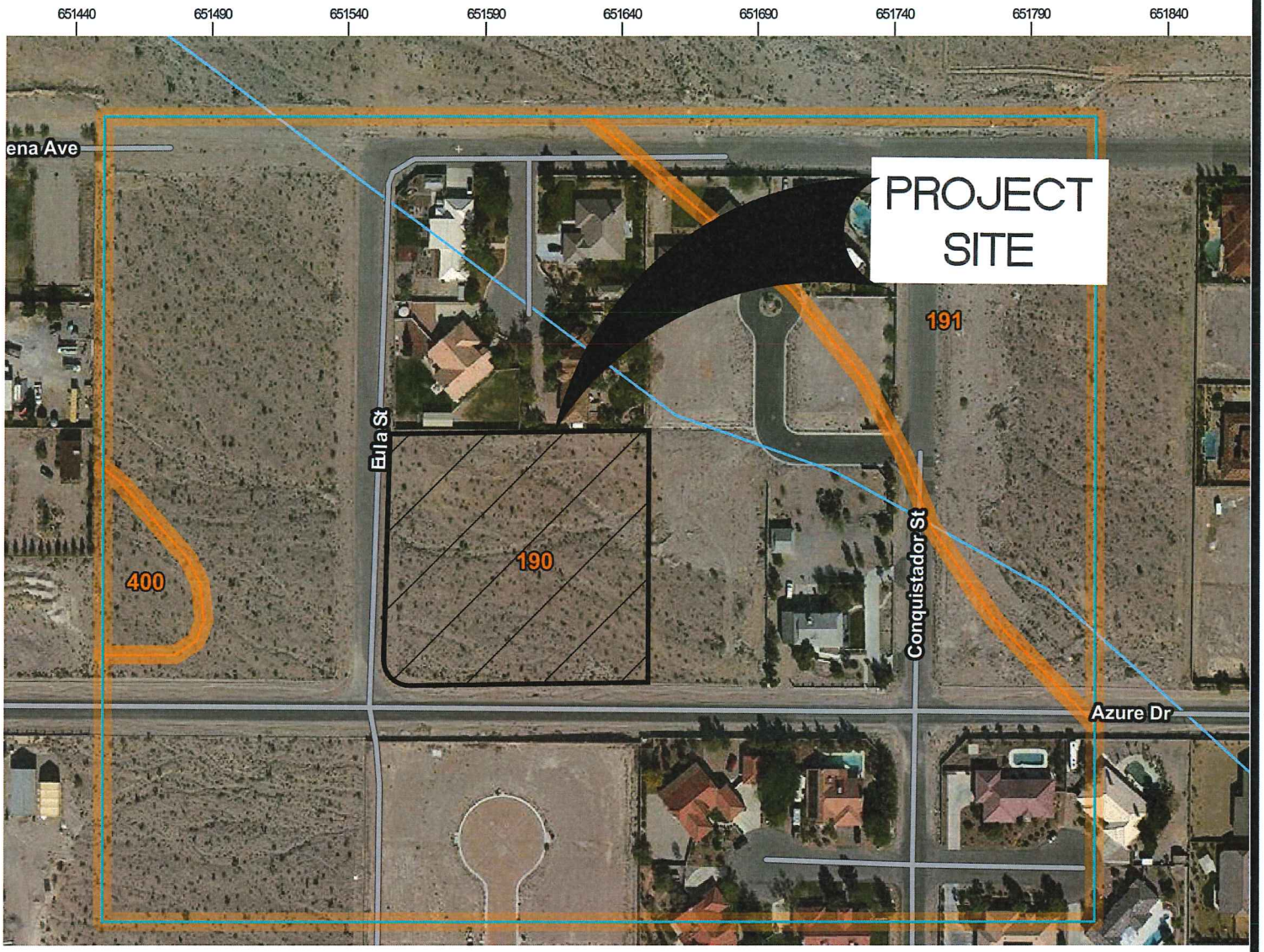
PROJECT No.	17-0014
SCALE	N.T.S.
DATE	JAN 2017
DRAWN BY	RFF

SKYLINE SUMMIT VICINITY MAP (FIGURE 1)

EXHIBIT

1 OF 7

Custom Soil Resource Report
Soil Map



NORTH

GRAPHIC SCALE

200 0 100 200 400 800

(IN FEET)
1 inch = 200 ft.

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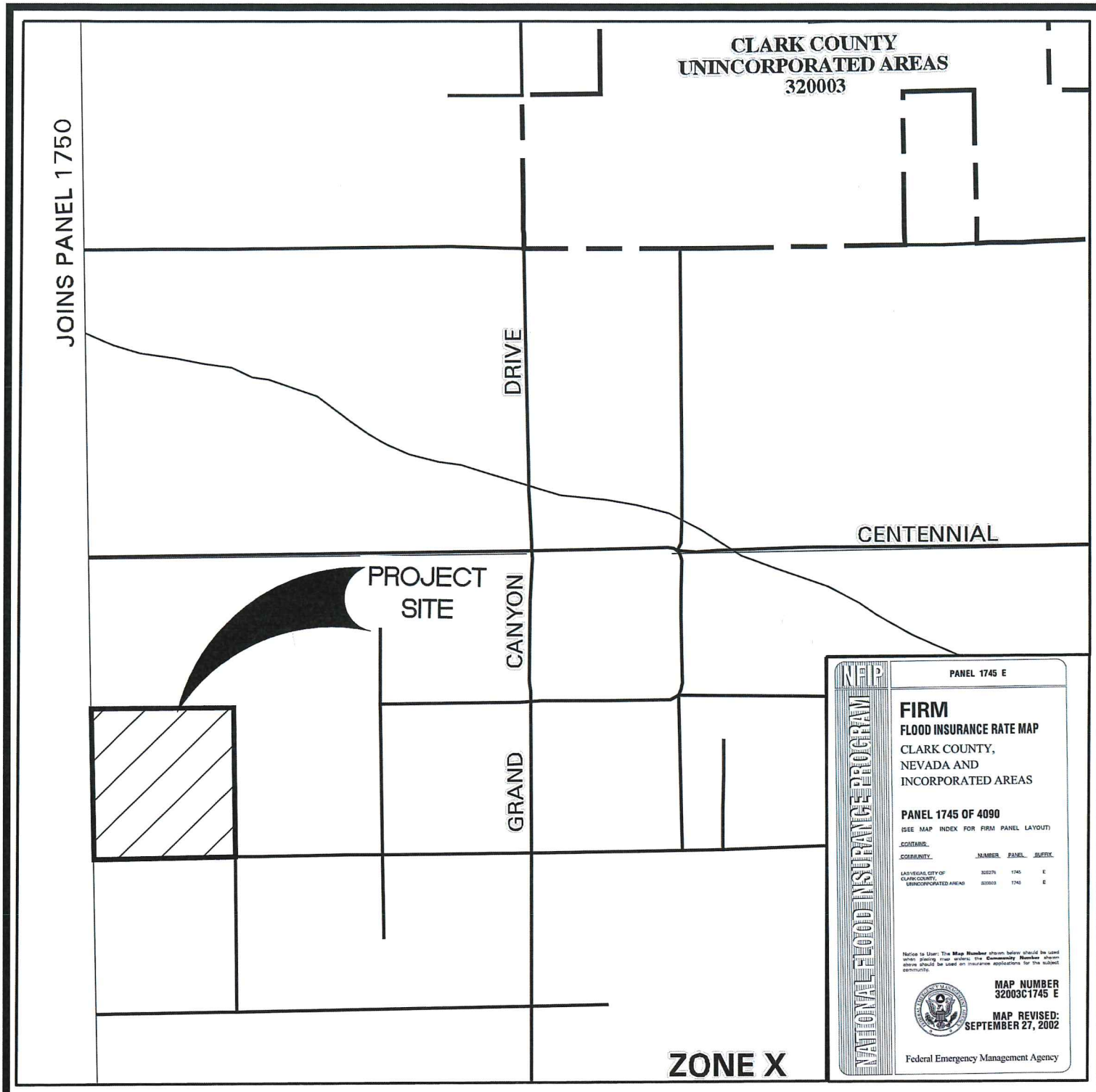
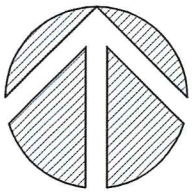
SCALE	1"=200'
DATE	JAN 2017
DRAWN BY	RFF

SKYLINE SUMMIT SOILS MAP (FIGURE 2)

EXHIBIT 2 OF 7





NORTH

GRAPHIC SCALE

(IN FEET)
1 inch = 1000 ft.

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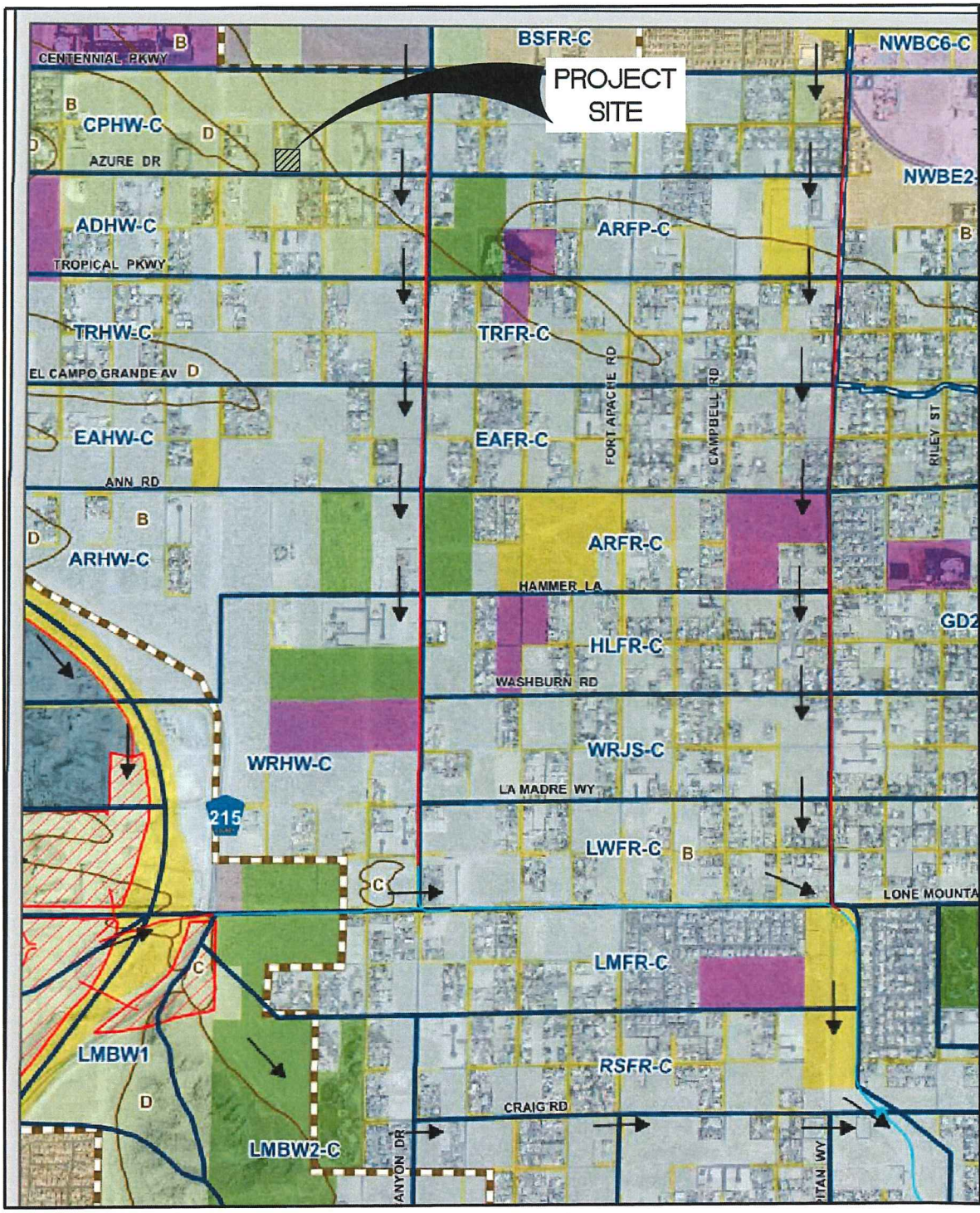
SCALE	1"=1000'
DATE	JAN 2017
DRAWN BY	RFF

SKYLINE SUMMIT FIRM MAP (FIGURE 3)

EXHIBIT 3 OF 7



NORTH

GRAPHIC SCALE

2000 0 1000 2000 4000 8000

(IN FEET)
1 inch = 2000 ft.

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DATE	JAN 2017
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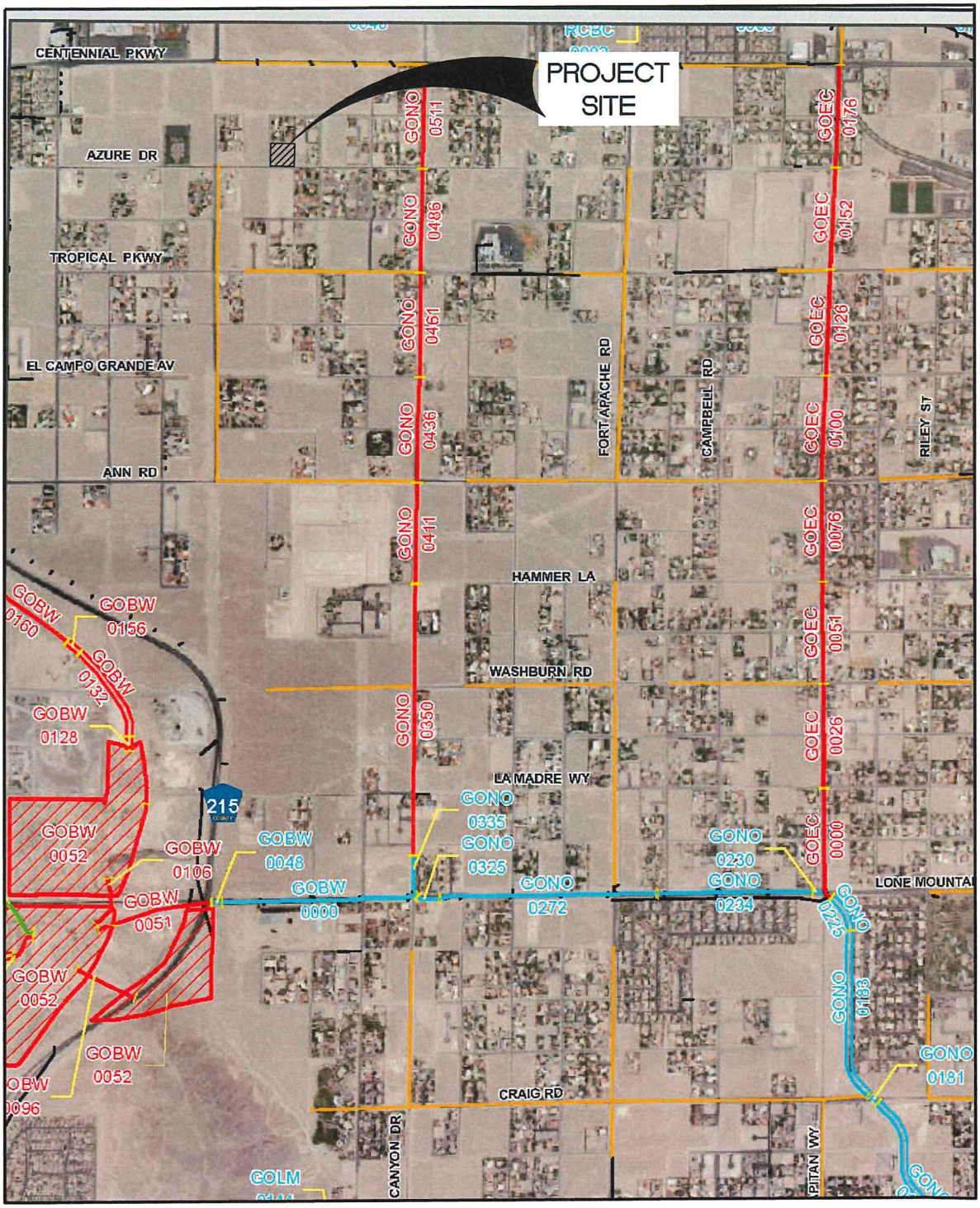
SKYLINE SUMMIT MPU HYDROLOGY MAP (FIGURE 4)

EXHIBIT 4 OF 7



REGIONAL FLOOD CONTROL DISTRICT

2013
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE

FIGURE F- 19

FLOOD CONTROL FACILITIES

LEGEND

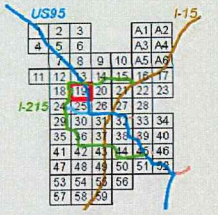
- Ultimate Development Boundary
- Existing Facilities
- Category A Proposed Facilities
- Category B Proposed Facilities
- Local Existing Facilities
- Local Proposed Facilities
- Detention Basin
- Stormdrain
- Lined Channel
- Unlined Channel
- Levee/Dike
- Natural Wash/Floodway
- ID-Mile Separator

Remove & Replace/Parallel Facilities

Category A	Category B
Channel	Channel
Stormdrain	Stormdrain

N

0 500 1,000 2,000 3,000
Feet
Scale: 1 inch = 2,000 feet
Refer to Figure G-2 for Aerial Source(s)



NORTH

GRAPHIC SCALE

2000 0 1000 2000 4000 8000

(IN FEET)
1 inch = 2000ft.

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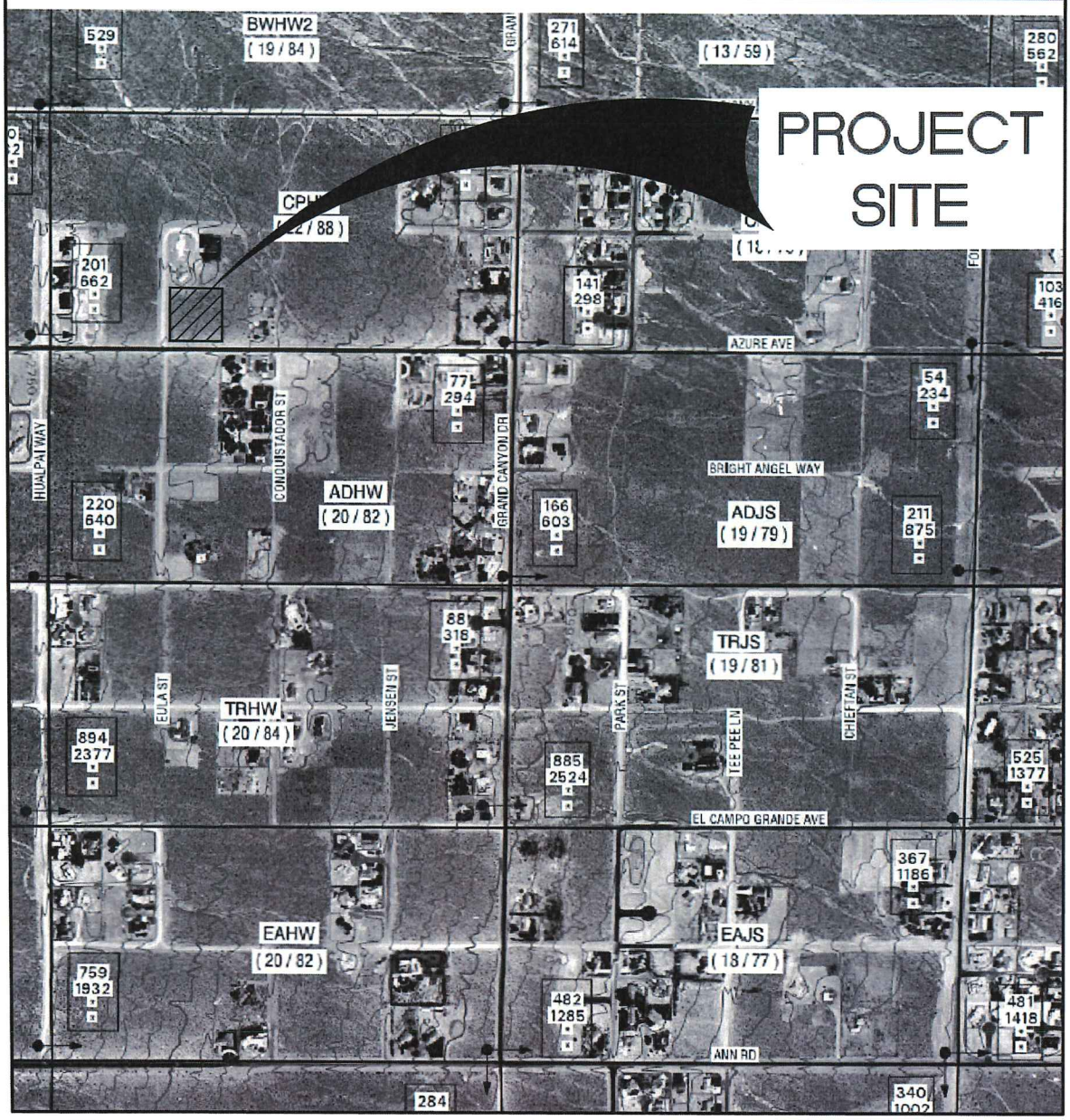
TEL: (702)569-9770 EMAIL: RAYF@PER4MANCELV.COM

PROJECT No.	17-0014
SCALE	1"=2000'
DATE	JAN 2017
DRAWN BY	RFF

SKYLINE SUMMIT MPU FACILITIES MAP (FIGURE 5)

EXHIBIT 5 OF 7



CITY OF LAS VEGAS NEVADA

NORTHWEST NEIGHBORHOOD STUDY

LEGEND

SUB-BASIN BOUNDARY

FLOW ARROW

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

(FLOWS IN CFS)

BWJS — Basin-ID

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

PHOTO DATE: APRIL 1996

FIGURE E-4

NORTH

GRAPHIC SCALE

1000 0 500 1000 2000 4000

(IN FEET)
1 inch = 1000 ft.

EXISTING DRAINAGE CONDITIONS

PBSJ POST, BUCKLEY, SCHUH & JERNIGAN, INC.

ENGINEERING PLANNING SURVEYING GIS

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

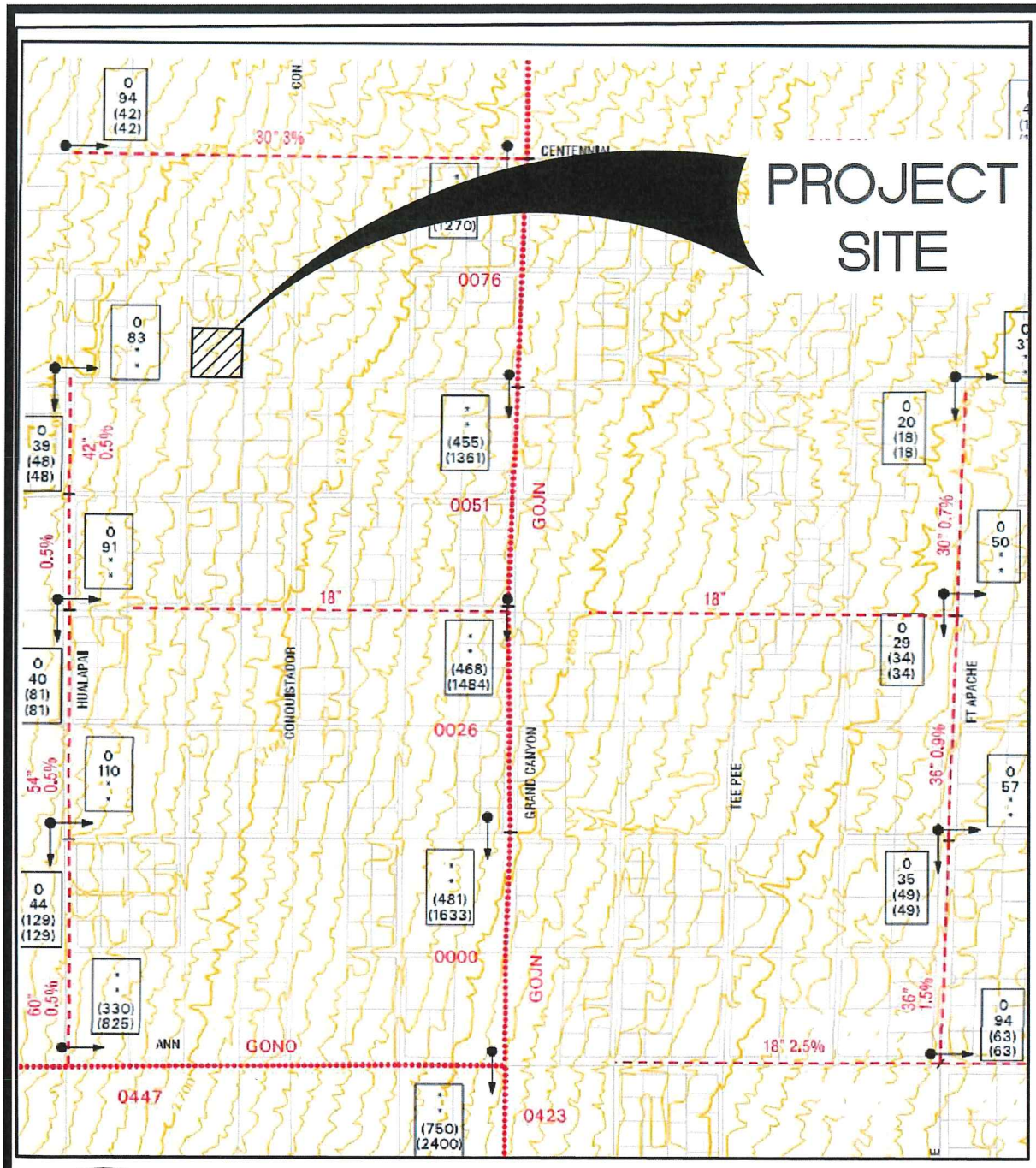
PER4MANCE ENGINEERING

197 CARLSBAD CAVERNS ST., HENDERSON, NEVADA 89012
TEL: (702)569-9770 EMAIL: RAYF@PER4MANCELV.COM

PROJECT No.	17-0014
SCALE	1"=1000'
DATE	JAN 2017
DRAWN BY	RFF

SKYLINE SUMMIT
CLV NW NEIGHBORHOOD
MPU HYDROLOGY MAP
(FIGURE 6)

EXHIBIT
6 OF 7



CITY OF LAS VEGAS NEVADA

NORTHWEST NEIGHBORHOOD STUDY

LEGEND

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

FIGURE F-4

NORTH

GRAPHIC SCALE

1000 0 500 1000 2000 4000

(IN FEET)
1 inch = 1000 ft.

FUTURE DRAINAGE CONDITIONS

PBSJ
POST, BUCKLEY, SCHUH & JERNIGAN, INC.
ENGINEERING PLANNING SURVEYING GIS
901, N. Green Valley Pkwy, Ste 100, Henderson NV 89014
Phone: (702) 263-7275 Fax: (702) 263-7200

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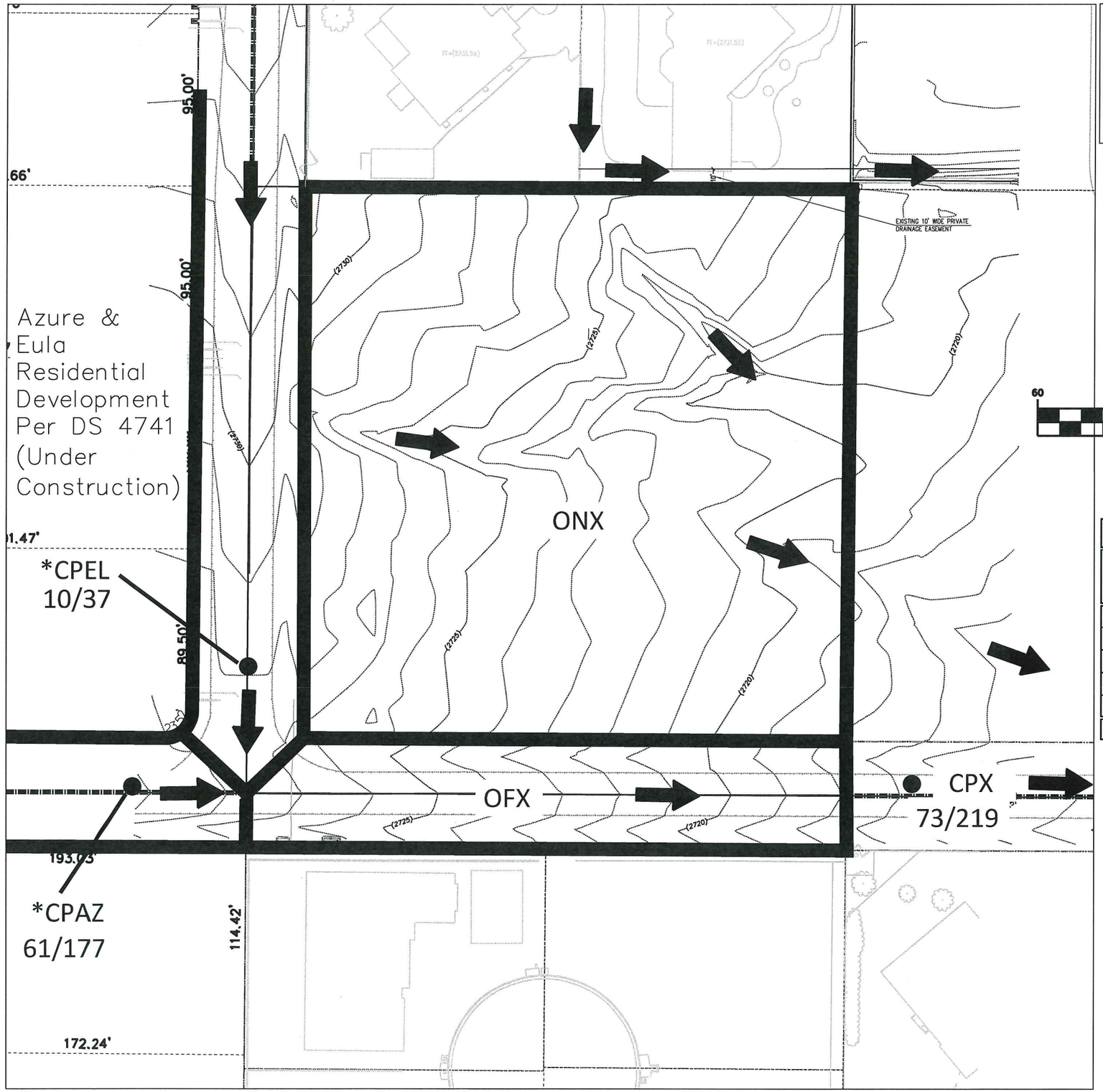
197 CARLSBAD CAVERNS ST., HENDERSON, NEVADA 89012
TEL: (702)569-9770 EMAIL: RAYF@PER4MANCELV.COM

PROJECT No.	17-0014
SCALE	1"=1000'
DATE	JAN 2017
DRAWN BY	RFF

SKYLINE SUMMIT
CLV NW NEIGHBORHOOD
MPU FACILITIES MAP
(FIGURE 7)

EXHIBIT
7 OF 7



NOTE:
* Denotes Flows at Concentration Points that are referenced from the Azure & Eula Study (DS 4741)

NORTH

GRAPHIC SCALE

60 0 30 60 120 240

(IN FEET)
1 inch = 60 ft.

Existing Condition Peak Flow Summary Table

Basin/Concentration Point	Area (ac)	Q_{10} (cfs)	Q_{100} (cfs)
*CPEL	-	10	37
*CPAZ	-	61	177
ONX	2.10	1	3
OFX	0.45	1	2
CPX	-	73	219

*Referenced from the Azure & Eula Study

LEGEND

- DRAINAGE BASIN LINE
- FLOW DIRECTION ARROW
- FLOW CROSS-SECTION
- xx/xx cfs — 10-YR/100-YR FLOWS
- OND — DRAINAGE BASIN NAME

EXHIBIT DR1
1 OF 2

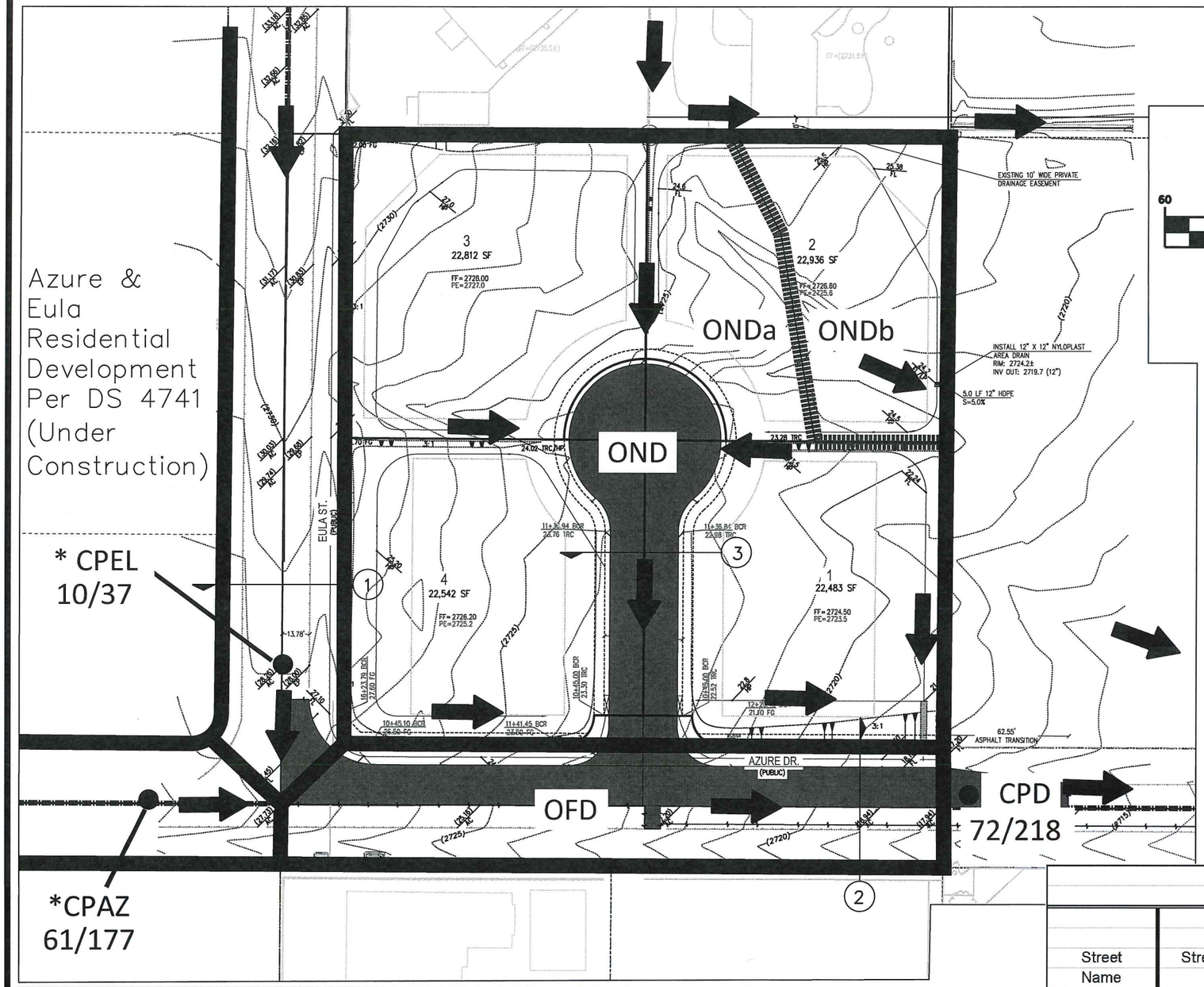
SKYLINE SUMMIT
CITY OF LAS VEGAS NEVADA

EXISTING CONDITION BASIN MAP

SHEET:

PROJECT No. 17-0014
SCALE NTS
DATE Jan 2017
DRAWN BY RFF

PERFORMANCE ENGINEERING
9345 W. SUNSET RD. STE 101, LAS VEGAS, NEVADA 89148
TEL: (702)569-9770 EMAIL: RAYF@PER4MANCELV.COM



NOTE:
* Denotes Flows at Concentration Points that are referenced from the Azure & Eula Study (DS 4741)

GRAPHIC SCALE

60 0 30 60 120 240

(IN FEET)
1 inch = 60 ft.

NORTH

Developed Condition Peak Flow Summary Table

Basin/Concentration Point	Area (ac)	Q_{10} (cfs)	Q_{100} (cfs)
*CPEL	-	10	37
*CPAZ	-	61	177
OND	2.10	0	2
OFD	0.45	1	2
CPD	-	72	218

*Referenced from the Azure & Eula Study

Prorated Flow Summary
Developed Condition

Basin	Q_{100} (cfs)	Area (acres)	Q_{100} Unit Flow (cfs/acre)
OND	2	2.10	1.0
Subbasin	**Q_{100} (cfs)**	**Area (acres)**	**Q_{100} Unit Flow (cfs/acre)**
ONDa	2	1.8	1.0
ONDb	0	0.3	1.0
TOTAL	***2***	***2.10***	1.0

Street Flow Summary
Developed Condition - 10-YR

Street Name	Street Description	Section Identifier	Flow [Q10] (cfs)	Slope (%)	Depth [D] (ft)	Velocity [V] (fps)	10-year Velocity x Depth (V x D)
Azure Drive	Access Road (Min %)	2	72	2.97	0.78	5.03	3.92
	Access Road (Max %)	2	72	3.27	0.77	5.22	4.02
Azure Drive	Improved Road (Min %)	2	72	2.97	0.61	5.86	3.57
	Improved Road (Max %)	2	72	3.27	0.61	6.06	3.70

Street Flow Summary
Developed Condition - 100YR

Street Name	Street Description	Section Identifier	Flow [Q100] (cfs)	Slope (%)	Depth [d] (ft)	Velocity [V] (ft/s)	100-year Velocity x Depth (V x D)
Eula Street	Access Road (min %)	1	37	1.46	0.82	3.94	3.23
	Access Road (Max %)	1	37	1.82	0.79	4.27	3.37
Eula Street	Improved Road (Min %)	1	37	1.46	0.57	3.84	2.19
	Improved Road (Max %)	1	37	1.82	0.55	4.21	2.32
Azure Drive	Access Road (Min %)	2	218	2.97	1.05	7.29	7.65
	Access Road (Max %)	2	218	3.27	1.04	7.50	7.80
Azure Drive	Improved Road (Min %)	2	218	2.97	0.81	9.01	7.30
	Improved Road (Max %)	2	218	3.27	0.80	9.27	7.42
Skyline Summit Circle	Improved Road (Max %)	3	2	0.50	0.29	1.77	0.51
	Improved Road (Max %)	3	2	1.33	0.27	2.30	0.62

LEGEND

	DRAINAGE BASIN LINE
	FLOW DIRECTION ARROW
①	FLOW CROSS-SECTION
xx/xx cfs	10-YR/100-YR FLOWS
OND	DRAINAGE BASIN NAME
ONDa	PRORATED BASIN NAME

EXHIBIT DR2 2 OF 2

SKYLINE SUMMIT
CITY OF LAS VEGAS NEVADA

DEVELOPED CONDITION BASIN MAP

SHEET:

PROJECT No. 17-0014
SCALE NTS
DATE Jan 2017
DRAWN BY RFF

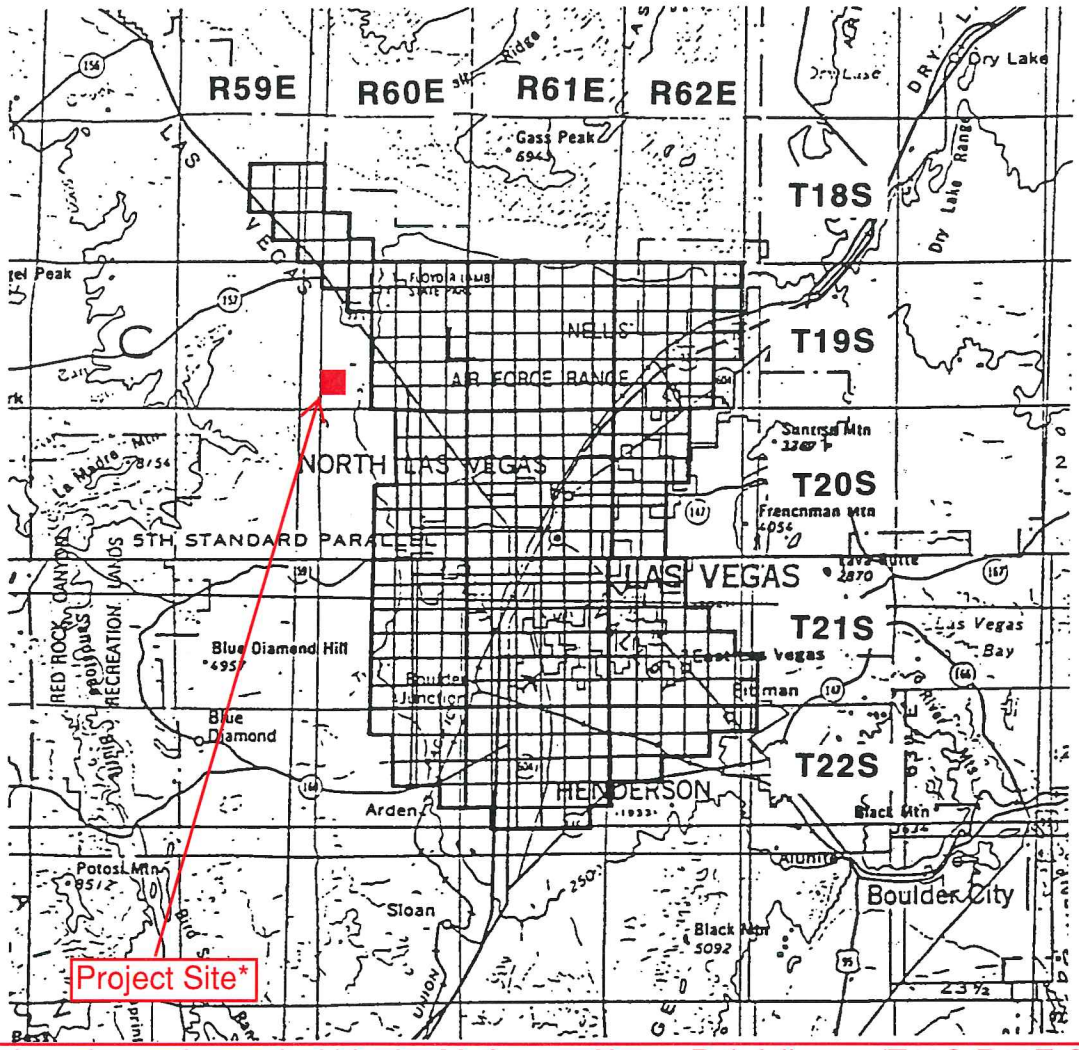
PERMANGE ENGINEERING
9345 W. SUNSET RD. STE 101, LAS VEGAS, NEVADA 89148
TEL: (702)569-9770 EMAIL: RAYF@PER4MANGELV.COM

APPENDIX B

Precipitation, Curve Number & Lag Time Data

HCDDM Reference Rainfall Data Figure & Tables

McCARRAN AIRPORT RAINFALL AREA



*Project site not located within the McCarran Airport Rainfall area (T19S-R60E-S30)

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.

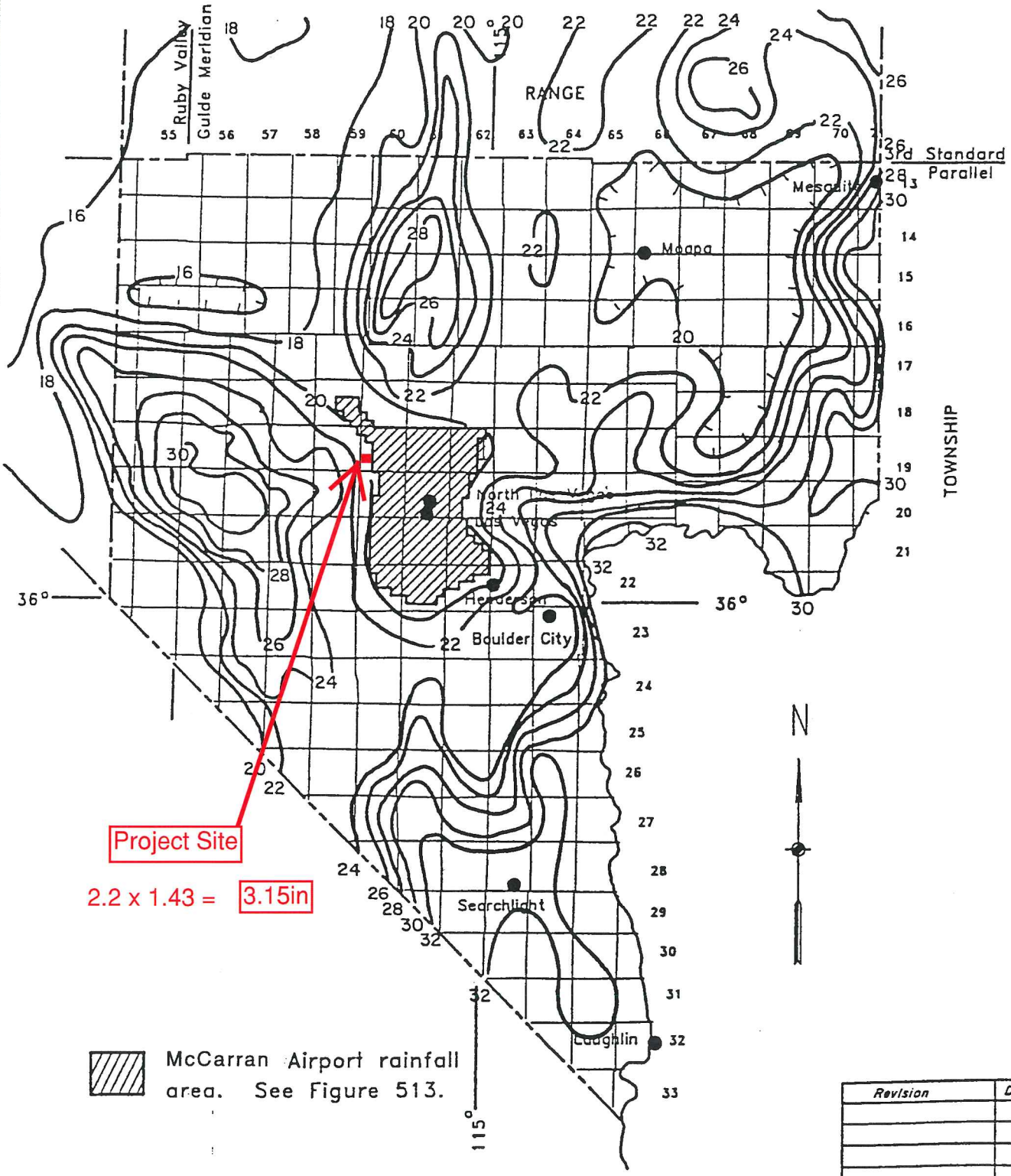
Revision	Date

WRC ENGINEERING

REFERENCE:
USACE, Los Angeles District, 1988

FIGURE 513

RAINFALL DEPTH-DURATION-FREQUENCY
100-YEAR, 6-HOUR
(DEPTHS IN TENTHS OF INCHES)



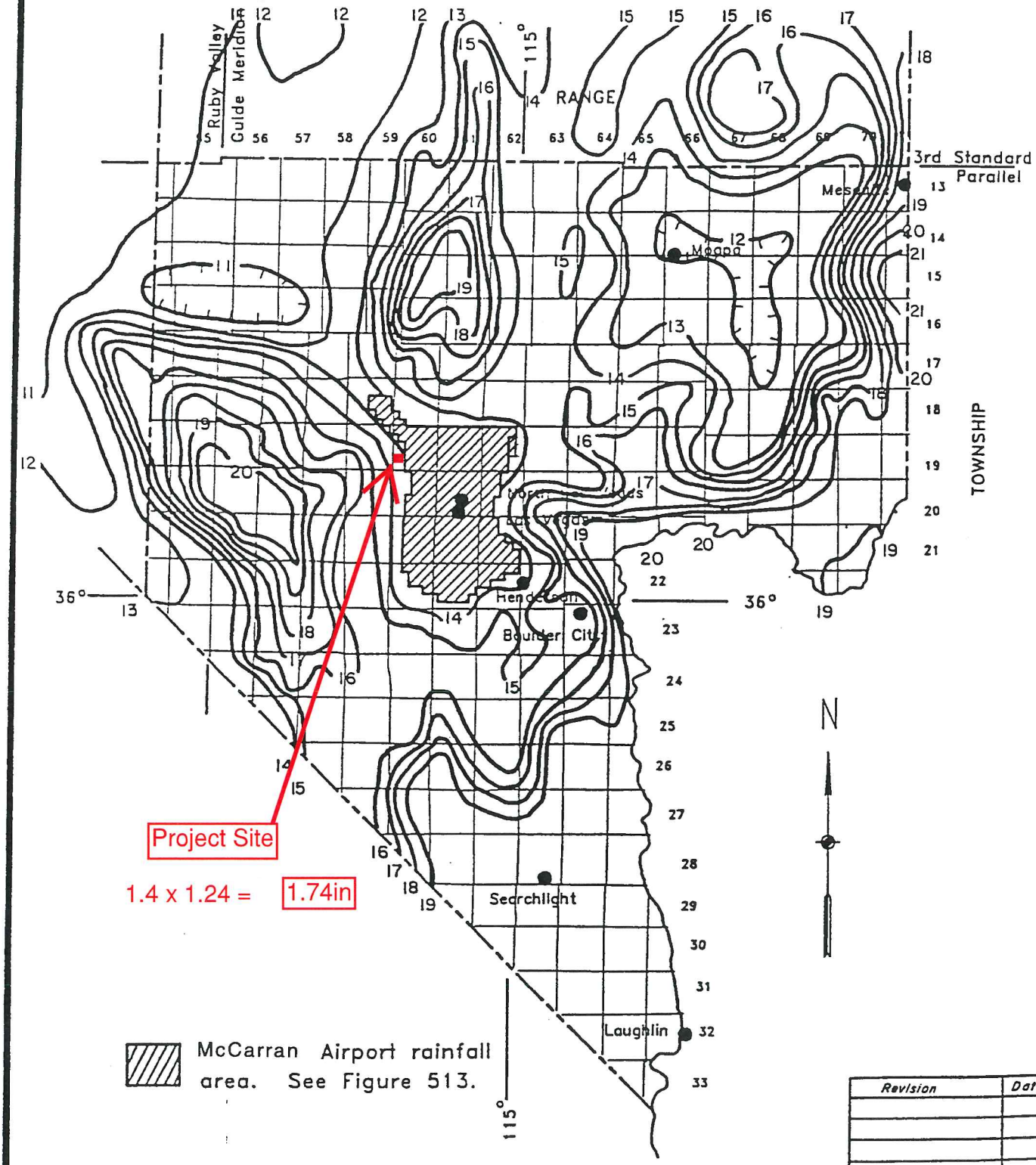
Revision	Date

WRC ENGINEERING

REFERENCE:
NOAA ATLAS 2, VOLUME VII NEVADA, 1973

FIGURE 506

RAINFALL DEPTH-DURATION-FREQUENCY
10-YEAR, 6-HOUR
(DEPTHS IN TENTHS OF INCHES)



Revision	Date

WRC ENGINEERING

REFERENCE:
NOAA ATLAS 2, VOLUME VII NEVADA, 1973

FIGURE 503

PRECIPITATION ADJUSTMENT RATIOS

Recurrence Interval	Ratio to NOAA Atlas 2
2-year	1.00
5-year	1.16
10-year	1.24
25-year	1.33
50-year	1.39
100-year	1.43

NOTE:
1. Multiply the values obtained from the NOAA Atlas 2 by the above ratios to obtain the adjusted precipitation values.
2. NOAA Atlas 2 values for use with TR-55 shall not be adjusted by the above ratios.
3. Tables 505 and 506 require no adjustments.

Revision	Date

REFERENCE:
USACE, Los Angeles District, 1988

SIX HOUR DEPTH-AREA REDUCTION FACTORS

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

NOTES:

1. A graphical representation of these factors is presented in Figure 514.
2. Consult with the local entity and/or the CCRFCD for guidance in using the Depth-Area Reduction Factors for drainage areas greater than 200 square miles.

Revision	Date

SIX-HOUR STORM DISTRIBUTIONS

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

HCDDM Runoff Curve Number Table 602

RUNOFF CURVE NUMBERS
(URBAN AREAS[1])

Cover description		Curve numbers for hydrologic soil group—			
Cover type and hydrologic condition	Average percent impervious area[2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.)[3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only)[4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
See Table 602A					
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)[5]		77	86	91	94

1 Average runoff condition, and $I_a = 0.2S$.
2 The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system. Impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using Figure 603.
3 CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.
4 Composite CN's for natural desert landscaping should be computed using Figure 603 based on the impervious area percentage (CN #98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.
5 Composite CN's to use for the design of temporary measures during grading and construction should be computed using Figure 603 based on the degree of development impervious area percentage) and the CN's for the newly graded pervious areas.

Revision	Date

RUNOFF CURVE NUMBERS
(SEMIARID RANGELANDS[1])

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

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

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

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

Revision	Date

RUNOFF CURVE NUMBERS - RESIDENTIAL DISTRICTS

Average Lot Size or Usage[1]	Percent Impervious[2]	Curve Number for Hydrologic Soil Groups			
		A	B	C	D
Apartments/Condos	72	81	88	91	93
Townhouses/6,000 sq ft lots or less[3]	69	80	87	90	92
7,000 sq ft lots	63	76	84	89	91
8,000 sq ft lots	58	73	82	88	90
10,000 sq ft lots	38	61	75	83	87
14,000 sq ft lots	30	57	72	81	86
20,000 sq ft lots	25	54	70	80	85
40,000 sq ft lots	20	51	68	79	84
80,000 sq ft lots	12	46	65	77	82

1 Lot size should represent the size of the average lot and not the gross acreage divided by the number of lots.
2 Actual percent impervious value should be compared to selected land use type.
3 In cases where average residential lots are smaller than 6,000 sq ft, commercial/business/industrial land use should be used.

Revision	Date

REFERENCE:

TABLE 602A

NRCS Reference Soil Data

United States Department of Agriculture

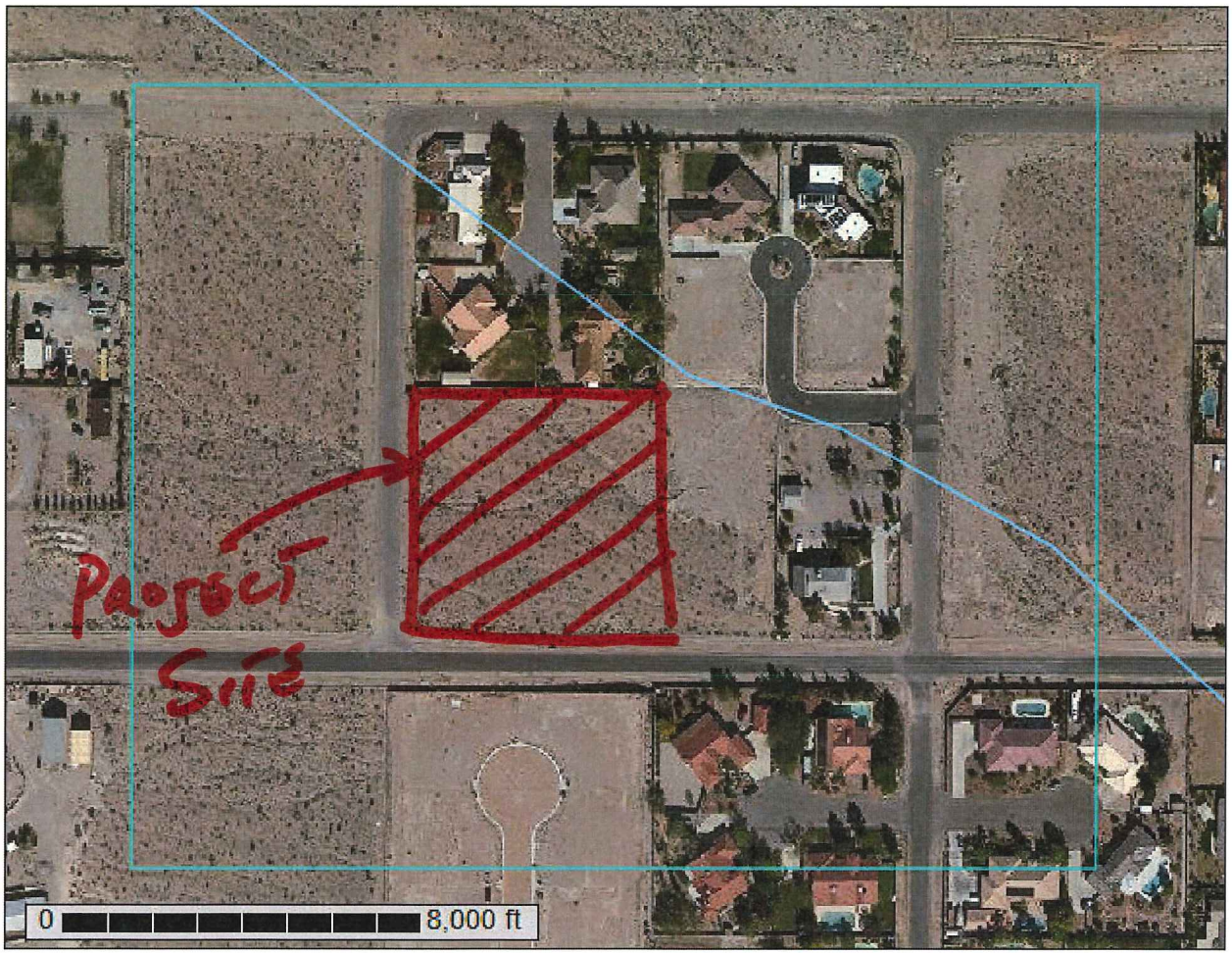
NRCS

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

Eula & Azure



January 26, 2017

Custom Soil Resource Report
Soil Map

Map Scale: 1:2,480 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

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

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**
190	Dalian very gravelly fine sandy loam, 2 to 4 percent slopes	21.3	80.8%
191	Dalian very cobbly fine sandy loam, 2 to 8 percent slopes	4.6	17.6%
400	Tencee very gravelly fine sandy loam, 2 to 8 percent slopes	0.4	1.6%
Totals for Area of Interest		**26.3**	**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.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Las Vegas Valley Area, Nevada, Part of Clark County

190—Dalian very gravelly fine sandy loam, 2 to 4 percent slopes

Map Unit Setting

National map unit symbol: hrb3
Elevation: 2,200 to 3,400 feet
Mean annual precipitation: 4 to 6 inches
Mean annual air temperature: 61 to 66 degrees F
Frost-free period: 210 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Dalian

Setting

Landform: Fan skirts
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Alluvium derived from limestone and dolostone

Typical profile

H1 - 0 to 4 inches: very gravelly fine sandy loam
H2 - 4 to 61 inches: extremely gravelly fine sandy loam

Properties and qualities

Slope: 2 to 4 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 60 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Hydric soil rating: No

191—Dalian very cobbly fine sandy loam, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: hrb4
Elevation: 2,200 to 3,400 feet
Mean annual precipitation: 4 to 6 inches
Mean annual air temperature: 61 to 66 degrees F
Frost-free period: 210 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Dalian

Setting

Landform: Fan skirts
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Alluvium derived from limestone and dolostone

Typical profile

H1 - 0 to 5 inches: very cobbly fine sandy loam
H2 - 5 to 60 inches: very gravelly fine sandy loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 60 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Hydric soil rating: No

400—Tencee very gravelly fine sandy loam, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: hrc1
Elevation: 2,400 to 5,700 feet
Mean annual precipitation: 4 to 10 inches
Mean annual air temperature: 57 to 64 degrees F
Frost-free period: 180 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Tencee

Setting

Landform: Fan remnants
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Alluvium derived from limestone and dolomite

Typical profile

H1 - 0 to 9 inches: very gravelly fine sandy loam
H2 - 9 to 15 inches: very gravelly sandy loam
H3 - 15 to 19 inches: indurated

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: 7 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
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 2.0
Available water storage in profile: Very low (about 1.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Hydric soil rating: No

Soil Information for All Uses

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

Water Features

This folder contains tabular reports that present soil hydrology information. The reports (tables) include all selected map units and components for each map unit. Water Features include ponding frequency, flooding frequency, and depth to water table.

Water Features (Eula & Azure)

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

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

The four hydrologic soil groups are:

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

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

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

soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

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

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

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

The *months* in the table indicate the portion of the year in which a water table, ponding, and/or flooding is most likely to be a concern.

Water table refers to a saturated zone in the soil. The water features table indicates, by month, depth to the top (*upper limit*) and base (*lower limit*) of the saturated zone in most years. Estimates of the upper and lower limits are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

Ponding is standing water in a closed depression. Unless a drainage system is installed, the water is removed only by percolation, transpiration, or evaporation. The table indicates *surface water depth* and the *duration* and *frequency* of ponding. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, rare, occasional, and frequent. *None* means that ponding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of ponding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs, on the average, once or less in 2 years (the chance of ponding is 5 to 50 percent in any year); and *frequent* that it occurs, on the average, more than once in 2 years (the chance of ponding is more than 50 percent in any year).

Flooding is the temporary inundation of an area caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, and water standing in swamps and marshes is considered ponding rather than flooding.

Duration and *frequency* are estimated. Duration is expressed as *extremely brief* if 0.1 hour to 4 hours, *very brief* if 4 hours to 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, very rare, rare, occasional, frequent, and very frequent. *None* means that flooding is not probable; *very rare* that it is very unlikely but possible under extremely unusual weather conditions (the chance of flooding is less than 1 percent in any year); *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is 1 to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); *frequent* that it is likely to occur often under normal weather conditions (the chance of flooding is more than 50 percent in any year but is less than 50 percent in all months in any year); and *very frequent* that it is likely to occur very often under

normal weather conditions (the chance of flooding is more than 50 percent in all months of any year).

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

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

Water Features–Las Vegas Valley Area, Nevada, Part of Clark County										
Map unit symbol and soil name	Hydrologic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface depth	Duration	Frequency	Duration	Frequency
				Ft	*Ft*	*Ft*				
190—Dalian very gravelly fine sandy loam, 2 to 4 percent slopes										
Dalian	A	Very low	January	—	—	—	—	None	—	None
			February	—	—	—	—	None	—	None
			March	—	—	—	—	None	—	None
			April	—	—	—	—	None	—	None
			May	—	—	—	—	None	—	None
			June	—	—	—	—	None	—	None
			July	—	—	—	—	None	—	None
			August	—	—	—	—	None	—	None
			September	—	—	—	—	None	—	None
			October	—	—	—	—	None	—	None
			November	—	—	—	—	None	—	None
			December	—	—	—	—	None	—	None

Water Features–Las Vegas Valley Area, Nevada, Part of Clark County										
Map unit symbol and soil name	Hydrologic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface depth	Duration	Frequency	Duration	Frequency
				Ft	*Ft*	*Ft*				
191—Dalian very cobbly fine sandy loam, 2 to 8 percent slopes										
Dalian	A	Low	January	—	—	—	—	None	—	None
			February	—	—	—	—	None	—	None
			March	—	—	—	—	None	—	None
			April	—	—	—	—	None	—	None
			May	—	—	—	—	None	—	None
			June	—	—	—	—	None	—	None
			July	—	—	—	—	None	—	None
			August	—	—	—	—	None	—	None
			September	—	—	—	—	None	—	None
			October	—	—	—	—	None	—	None
			November	—	—	—	—	None	—	None
			December	—	—	—	—	None	—	None

Water Features–Las Vegas Valley Area, Nevada, Part of Clark County										
Map unit symbol and soil name	Hydrologic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface depth	Duration	Frequency	Duration	Frequency
				Ft	*Ft*	*Ft*				
400—Tencee very gravelly fine sandy loam, 2 to 8 percent slopes										
Tencee	D	Very high	January	—	—	—	—	None	—	None
			February	—	—	—	—	None	—	None
			March	—	—	—	—	None	—	None
			April	—	—	—	—	None	—	None
			May	—	—	—	—	None	—	None
			June	—	—	—	—	None	—	None
			July	—	—	—	—	None	—	None
			August	—	—	—	—	None	—	None
			September	—	—	—	—	None	—	None
			October	—	—	—	—	None	—	None
			November	—	—	—	—	None	—	None
			December	—	—	—	—	None	—	None

Composite and Weighted Curve Number Computations

Soil & Curve Number Computation

Project Name: Skyline Summit
Date: 1/31/2017 17:11
File Name: Curve Number Calcs v120529.xlsx
By: RFF

Data: Ultimate Condition **Reference:**

Soil Type & Description		A	B	C	D
190	Dalian very gravelly fine sandy loam, 2 to 4 percent slopes	10%	85%	0%	5%
191	Dalian very cobbly fine sandy loam, 2 to 8 percent slopes	5%	85%	0%	10%

Exhibit 7
SCS Soil Data

Land Use	A	B	C	D
Desert Shrub (poor)	63	77	85	88
Paved Open Ditches	83	89	92	93
Roadway	98	98	98	98
Residential (20,000 sf)	54	70	80	85

Existing Condition

BASIN ID	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP				LAND USE CN				SUBAREA ACRES	CALCULATED CN
				A	B	C	D	A	B	C	D		
ONX	190	100.0%	Desert Shrub (poor)	10%	85%	0%	5%	63	77	85	88	2.10	76.15
TOTAL PERCENT		100.0%									TOTAL AREA	2.10	**76.15**

BASIN ID	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP				LAND USE CN				SUBAREA ACRES	CALCULATED CN
				A	B	C	D	A	B	C	D		
OFX	190	48.9%	Paved Open Ditches	10%	85%	0%	5%	83	89	92	93	0.22	43.32
	190	51.1%	Roadway	10%	85%	0%	5%	98	98	98	98	0.23	50.09
TOTAL PERCENT		100.0%									TOTAL AREA	0.45	**93.40**

Developed Condition

BASIN ID	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP				LAND USE CN				SUBAREA ACRES	CALCULATED CN
				A	B	C	D	A	B	C	D		
OND	190	100.0%	Residential (20,000 sf)	10%	85%	0%	5%	54	70	80	85	8.07	69.15
TOTAL PERCENT		100.0%									TOTAL AREA	8.07	**69.15**

BASIN ID	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP				LAND USE CN				SUBAREA ACRES	CALCULATED CN
				A	B	C	D	A	B	C	D		
OFD	190	48.9%	Roadway	10%	85%	0%	5%	98	98	98	98	0.22	47.91
	190	51.1%	Roadway	10%	85%	0%	5%	98	98	98	98	0.23	50.09
TOTAL PERCENT		100.0%									TOTAL AREA	0.45	**98.00**

9345 W. Sunset Road Suite 101 - Las Vegas, NV 89148
Ph. 702-569-9770

Standard Form 4 Lag Time Computations

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL
TIME OF CONCENTRATION

PER4MANCE CONSULTING & ENGINEERING

Project Name: Skyeline Summit
Project No.: 17-0014
File Name: Lag Time Standard Form 4 v130321.xls
By: RFF
Date: 1/31/2017

SUB-BASIN DATA						INITIAL / OVERLAND TIME (Ti)			TRAVEL TIME (Tt)					Tc	Tc Check Urbanized Basins		Tlag
DESIG:	DEV./EX. (D or E)	CN	K [1]	AREA Ac	AREA Mi^2 [2]	INITIAL LENGTH Feet	SLOPE %	Ti Min [3]	TRAVEL LENGTH Feet	SLOPE %	V1 VELOCITY FPS [4]	V2 VELOCITY FPS [5]	Tt Min [6]	Tc Calc. [7]	Total Length Feet [8]	Tc Check [9]	Tlag Hours [10]
EXISTING CONDITION																	
ONX	E	76.2	0.615	2.10	0.0033	105	3.80	5.73	214	2.10	2.14	4.26	1.66	7.39			0.100
OFX	D	93.4	0.843	0.45	0.0007	115	3.00	3.44	234	2.99	3.49	5.29	1.12	4.56	349	11.939	0.050
DEVELOPED CONDITION																	
OND	D	69.2	0.523	2.10	0.0033	196	1.00	14.55	222	0.50	1.43	2.16	2.59	17.14	418	12.322	0.123
OFD	D	98.0	0.904	0.45	0.0007	30	2.00	1.54	349	2.99	3.49	5.29	1.67	3.20	379	12.106	0.050

[1] K = 0.0132 (CN) - 0.39
[2] A = Area/640
[3] Ti = (1.8 (1.1-K) L^0.5)/S^0.33
[4] For Existing Conditions: V1 = 14.8 * (S/100)^0.5
For Developed Conditions: V1 = 20.2 * (S/100)^0.5
[5] For Existing Conditions: V2 = 29.4 * (S/100)^0.5
For Developed Conditions: V2 = 30.6 * (S/100)^0.5
[6] Tt = L/(60*V)
[7] Tc = Ti + Tt
[8] Total L = Initial L + Travel L
[9] Tc = (L/180) + 10
[10] Tlag = (0.6*Tc)/60
[11] Min Tlag =0.05
Note: For Travel Time Calcs: V1 applies to first 500 feet and V2 applies to remaining distance.

REFERENCE :

STANDARD FORM 4

APPENDIX C

HEC-1 Analysis

Existing & Developed Conditions

```
1****************************************                                    ****************************************
 *                                      *                                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                                    *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                                    *          609 SECOND STREET           *
 *                                      *                                    *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   31JAN17  TIME  12:35:22  *                                    *          (916) 756-1104              *
 *                                      *                                    *                                      *
 ****************************************                                    ****************************************


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


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

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

1                                                   HEC-1 INPUT                                                  PAGE  1

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

                        *DIAGRAM
            1           ID     SKYLINE SUMMIT - TECHNICAL DRAINAGE STUDY
            2           ID     10-YR & 100-YR, 6 HOUR STORM
            3           ID     EXISTING CONDITION
            4           ID     @@@@@@@@@@@@@@@@@@@
            5           ID
            6           ID     Project Number: 16-0014
            7           ID     PER4MANCE ENGINEERING
            8           ID     197 Carlbad Carverns Street
            9           ID     Henderson, Nevada 89012
           10           ID
           11           ID     FILENAME ------------ EX.H1
           12           ID     DATE ---------------- JAN 2016
           13           ID     MODELED BY ---------- RFF
           14           ID
           15           ID     ************************************************************
           16           ID     * SDN 3 VALUES - OUTSIDE McCARRAN AIRPORT RAINFALL AREA *
           17           ID     ************************************************************
           18           ID
           19           ID
           20           IT       5       0       0     300
           21           IO       5       0       0
           22           IN       5       0       0
           23           JR    PREC    1.00    0.51
                        *

           24           KK     ONX
           25           KM   EXISTING ONSITE BASIN
           26           BA   .0033
           27           PB    3.15
           28           PC       0   0.020   0.057   0.070   0.087   0.108   0.124   0.130   0.130   0.130
           29           PC   0.130   0.130   0.130   0.133   0.140   0.142   0.148   0.158   0.172   0.181
           30           PC   0.190   0.197   0.199   0.200   0.201   0.204   0.214   0.229   0.241   0.249
           31           PC   0.251   0.256   0.270   0.278   0.281   0.283   0.295   0.322   0.352   0.409
           32           PC   0.499   0.590   0.710   0.744   0.781   0.812   0.819   0.835   0.851   0.856
           33           PC   0.860   0.868   0.876   0.888   0.910   0.926   0.937   0.950   0.970   0.976
           34           PC   0.982   0.985   0.987   0.989   0.990   0.993   0.993   0.994   0.995   0.998
           35           PC   0.998   0.999   1.000
           36           LS       0    76.2
           37           UD   0.100
                        *

           38           KK     OFX
           39           KM   EXISTING AZURE DRIVE ROADWAY BASIN
           40           BA   .0007
           41           LS       0    93.4
           42           UD   0.050
           43           ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

    24         ONX
                .
                .
    38          .         OFX

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************                                    ****************************************
 *                                      *                                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                                    *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                                    *          609 SECOND STREET           *
 *                                      *                                    *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   31JAN17  TIME  12:35:22  *                                    *          (916) 756-1104              *
 *                                      *                                    *                                      *
 ****************************************                                    ****************************************
```

SKYLINE SUMMIT - TECHNICAL DRAINAGE STUDY
10-YR & 100-YR, 6 HOUR STORM
EXISTING CONDITION
@@@@@@@@@@@@@@@@@@@

```
                    Project Number: 16-0014
                    PER4MANCE ENGINEERING
                    197 Carlbad Carverns Street
                    Henderson, Nevada 89012

                    FILENAME ------------ EX.H1
                    DATE ---------------- JAN 2016
                    MODELED BY ---------- RFF

                    ************************************************************
                    * SDN 3 VALUES - OUTSIDE McCARRAN AIRPORT RAINFALL AREA *
                    ************************************************************


  21 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
                  1.00       .51
1

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


                                                     RATIOS APPLIED TO PRECIPITATION
 OPERATION       STATION     AREA    PLAN            RATIO 1  RATIO 2
                                                       1.00      .51

 HYDROGRAPH AT
+                  ONX       .00     1   FLOW           3.       1.
                                         TIME         3.50     3.58

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


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

CPX = ONX + OFX + Ref (CPA2 + CPEL)

```
1****************************************                                    ****************************************
 *                                      *                                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *   U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998              *                                    *   HYDROLOGIC ENGINEERING CENTER      *
 *           VERSION 4.1                *                                    *          609 SECOND STREET           *
 *                                      *                                    *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   31JAN17  TIME  12:37:56  *                                    *          (916) 756-1104              *
 *                                      *                                    *                                      *
 ****************************************                                    ****************************************

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

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

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

1                                                   HEC-1 INPUT                                                  PAGE  1

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

                       *DIAGRAM
            1          ID     SKYLINE SUMMIT - TECHNICAL DRAINAGE STUDY
            2          ID     10-YR & 100-YR, 6 HOUR STORM
            3          ID     DEVELOPED CONDITION
            4          ID     @@@@@@@@@@@@@@@@@@@
            5          ID
            6          ID     Project Number: 16-0014
            7          ID     PER4MANCE ENGINEERING
            8          ID     9345 W. Sunset Road, Suite 101
            9          ID     Las Vegas, Nevada 89148
           10          ID
           11          ID     FILENAME ------------ DV.H1
           12          ID     DATE ---------------- JAN 2016
           13          ID     MODELED BY ---------- RFF
           14          ID
           15          ID     ********************************************************
           16          ID     * SDN 3 VALUES - OUTSIDE McCARRAN AIRPORT RAINFALL AREA *
           17          ID     ********************************************************
           18          ID
           19          ID
           20          IT       5       0       0     300
           21          IO       5       0       0
           22          IN       5       0       0
           23          JR    PREC    1.00    0.51
                       *

           24          KK     OND
           25          KM   DEVELOPED ONSITE BASIN
           26          BA   .0033
           27          PB    3.15
           28          PC       0   0.020   0.057   0.070   0.087   0.108   0.124   0.130   0.130   0.130
           29          PC   0.130   0.130   0.130   0.133   0.140   0.142   0.148   0.158   0.172   0.181
           30          PC   0.190   0.197   0.199   0.200   0.201   0.204   0.214   0.229   0.241   0.249
           31          PC   0.251   0.256   0.270   0.278   0.281   0.283   0.295   0.322   0.352   0.409
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           33          PC   0.860   0.868   0.876   0.888   0.910   0.926   0.937   0.950   0.970   0.976
           34          PC   0.982   0.985   0.987   0.989   0.990   0.993   0.993   0.994   0.995   0.998
           35          PC   0.998   0.999   1.000
           36          LS       0    69.2
           37          UD   0.123
                       *

           38          KK     OFD
           39          KM   DEVELOPED AZURE DRIVE ROADWAY BASIN
           40          BA   .0007
           41          LS       0    98.0
           42          UD   0.050
           43          ZZ
1
                 SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

    24         OND
                .
                .
    38          .         OFD

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************                                    ****************************************
 *                                      *                                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *   U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998              *                                    *   HYDROLOGIC ENGINEERING CENTER      *
 *           VERSION 4.1                *                                    *          609 SECOND STREET           *
 *                                      *                                    *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   31JAN17  TIME  12:37:56  *                                    *          (916) 756-1104              *
 *                                      *                                    *                                      *
 ****************************************                                    ****************************************
```

SKYLINE SUMMIT - TECHNICAL DRAINAGE STUDY
10-YR & 100-YR, 6 HOUR STORM
DEVELOPED CONDITION
@@@@@@@@@@@@@@@@@@@

```
                    Project Number: 16-0014
                    PER4MANCE ENGINEERING
                    9345 W. Sunset Road, Suite 101
                    Las Vegas, Nevada 89148

                    FILENAME ------------ DV.H1
                    DATE ---------------- JAN 2016
                    MODELED BY ---------- RFF

                    ************************************************************
                    * SDN 3 VALUES - OUTSIDE McCARRAN AIRPORT RAINFALL AREA *
                    ************************************************************


  21 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
                    1.00       .51
1

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


                                                        RATIOS APPLIED TO PRECIPITATION
 OPERATION       STATION     AREA    PLAN            RATIO 1  RATIO 2
                                                       1.00      .51

 HYDROGRAPH AT
+                  OND       .00     1   FLOW           2.       0.
                                         TIME         3.58     3.75

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


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

CPD = OND + OFD + Ref(CPAZ + CPBL)

APPENDIX D

Street Capacity Calculations

Perimeter Street and Interior Drive Aisle

Eula Street @ Section 1 - (100-Year Max %)
Worksheet for Irregular Channel

Project Description	
Worksheet	Eula Street @ Section 1 - (100-Year Max %)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	1.820	%
Discharge	37.00	cfs

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

Results		
Mannings Coefficient	0.025	
Water Surface Elevation	0.79	ft
Elevation Range	0.00 to 1.32	
Flow Area	8.7	ft²
Wetted Perimeter	22.24	ft
Top Width	22.02	ft
Actual Depth	0.79	ft
Critical Elevation	0.85	ft
Critical Slope	1.230	%
Velocity	4.27	ft/s
Velocity Head	0.28	ft
Specific Energy	1.07	ft
Froude Number	1.20	
Flow Type	Supercritical	

Calculation Messages:
Flow is divided.

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+14.00	0.025
0+14.00	0+46.00	0.016
0+46.00	0+60.00	0.025

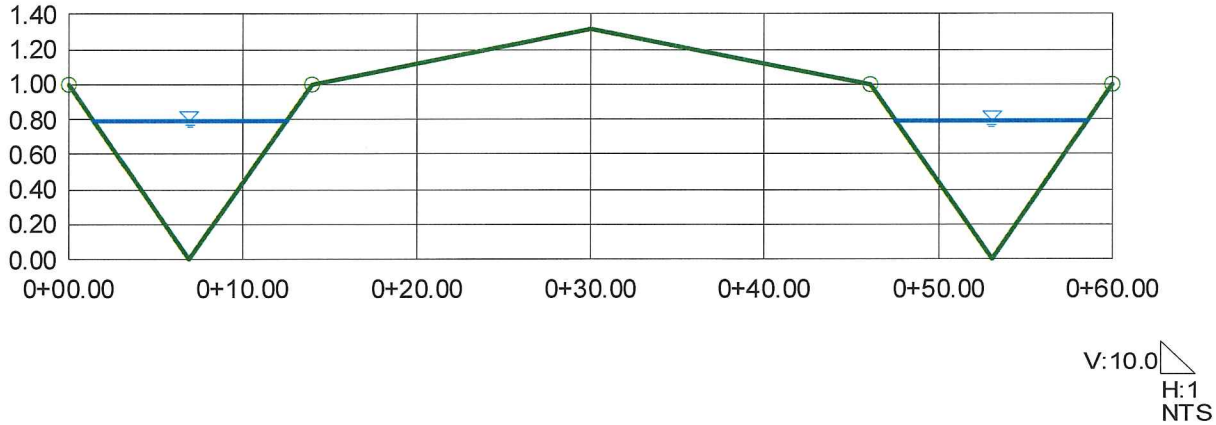
Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	1.00
0+07.00	0.00
0+14.00	1.00
0+30.00	1.32
0+46.00	1.00
0+53.00	0.00
0+60.00	1.00

Eula Street @ Section 1 - (100-Year Max %)
Cross Section for Irregular Channel

Project Description	
Worksheet	Eula Street @ Section 1 - (100-Year Max %)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.025	
Channel Slope	1.820	%
Water Surface Elevation	0.79	ft
Elevation Range	0.00 to 1.32	
Discharge	37.00	cfs



Eula Street @ Section 1 - (100-Year Min %)
Worksheet for Irregular Channel

Project Description	
Worksheet	Eula Street @ Section 1 - (100-Year Min %)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	1.460	%
Discharge	37.00	cfs

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

Results		
Mannings Coefficient	0.025	
Water Surface Elevation	0.82	ft
Elevation Range	0.00 to 1.32	
Flow Area	9.4	ft²
Wetted Perimeter	23.18	ft
Top Width	22.95	ft
Actual Depth	0.82	ft
Critical Elevation	0.85	ft
Critical Slope	1.230	%
Velocity	3.94	ft/s
Velocity Head	0.24	ft
Specific Energy	1.06	ft
Froude Number	1.08	
Flow Type	Supercritical	

Calculation Messages:
Flow is divided.

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+14.00	0.025
0+14.00	0+46.00	0.016
0+46.00	0+60.00	0.025

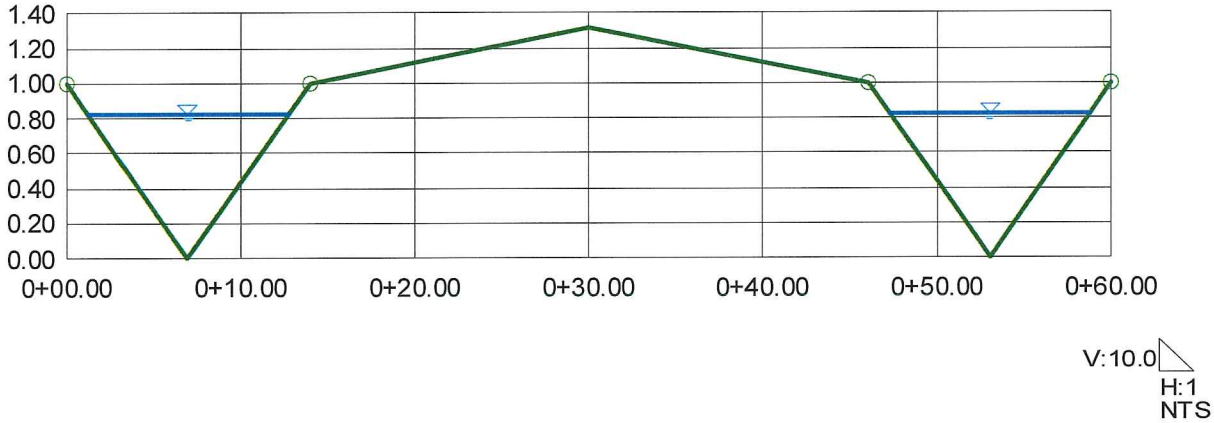
Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	1.00
0+07.00	0.00
0+14.00	1.00
0+30.00	1.32
0+46.00	1.00
0+53.00	0.00
0+60.00	1.00

Eula Street @ Section 1 - (100-Year Min %)
Cross Section for Irregular Channel

Project Description	
Worksheet	Eula Street @ Section 1 - (100-Year Min %)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.025
Channel Slope	1.460 %
Water Surface Elevation	0.82 ft
Elevation Range	0.00 to 1.32
Discharge	37.00 cfs



Eula Street @ Secion 1 w/ SW, Curb & Gutter (100-Year Max %)
Worksheet for Irregular Channel

Project Description	
Worksheet	Eula Street @ Secion 1 w/ SW, Curb & Gutter (100-Year Max %)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	1.820	%
Discharge	37.00	cfs

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

Results		
Mannings Coefficient	0.015	
Water Surface Elevation	0.55	ft
Elevation Range	0.00 to 0.63	
Flow Area	8.8	ft²
Wetted Perimeter	47.80	ft
Top Width	46.70	ft
Actual Depth	0.55	ft
Critical Elevation	0.64	ft
Critical Slope	0.578	%
Velocity	4.21	ft/s
Velocity Head	0.28	ft
Specific Energy	0.82	ft
Froude Number	1.71	
Flow Type	Supercritical	

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+53.00	0.016
0+53.00	0+60.00	0.013

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

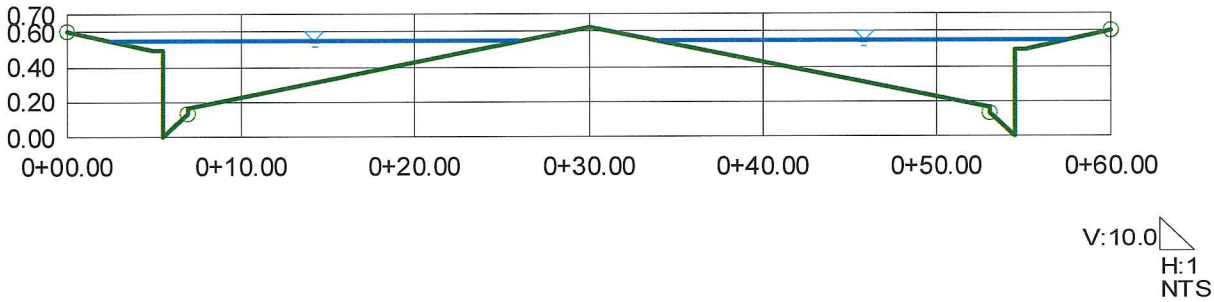
Eula Street @ Secion 1 w/ SW, Curb & Gutter (100-Year Max %)
Worksheet for Irregular Channel

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

Eula Street @ Secion 1 w/ SW, Curb & Gutter (100-Year Max %)
Cross Section for Irregular Channel

Project Description	
Worksheet	Eula Street @ Secion 1 w/ SW, Curb & Gutter (100-Year Max %)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.015
Channel Slope	1.820 %
Water Surface Elevation	0.55 ft
Elevation Range	0.00 to 0.63
Discharge	37.00 cfs



Eula Street @ Secion 1 w/ SW, Curb & Gutter (100-Year Min %)
Worksheet for Irregular Channel

Project Description	
Worksheet	Eula Street @ Secion 1 w/ SW, Curb & Gutter (100-Year Min %)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	1.460	%
Discharge	37.00	cfs

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

Results		
Mannings Coefficient	0.015	
Water Surface Elevation	0.57	ft
Elevation Range	0.00 to 0.63	
Flow Area	9.6	ft²
Wetted Perimeter	51.36	ft
Top Width	50.26	ft
Actual Depth	0.57	ft
Critical Elevation	0.64	ft
Critical Slope	0.575	%
Velocity	3.84	ft/s
Velocity Head	0.23	ft
Specific Energy	0.80	ft
Froude Number	1.54	
Flow Type	Supercritical	

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+53.00	0.016
0+53.00	0+60.00	0.013

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

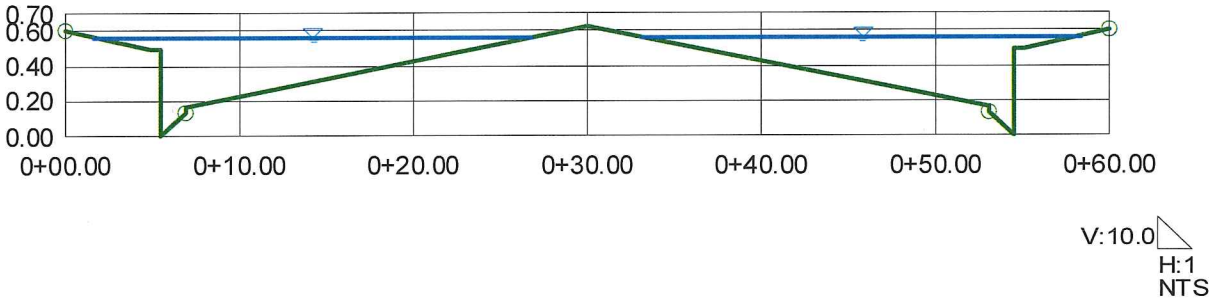
Eula Street @ Secion 1 w/ SW, Curb & Gutter (100-Year Min %)
Worksheet for Irregular Channel

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

Eula Street @ Secion 1 w/ SW, Curb & Gutter (100-Year Min %)
Cross Section for Irregular Channel

Project Description	
Worksheet	Eula Street @ Secion 1 w/ SW, Curb & Gutter (100-Year Min %)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.015	
Channel Slope	1.460	%
Water Surface Elevation	0.57	ft
Elevation Range	0.00 to 0.63	
Discharge	37.00	cfs



Azure Drive @ Section 2 w/ Roadside Swale - (10-Year Max %)
Worksheet for Irregular Channel

Project Description	
Worksheet	Azure Drive @ Section 2 w/ Roadside Swale - (10-Year Max %)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	3.270	%
Discharge	72.00	cfs

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

Results		
Mannings Coefficient	0.023	
Water Surface Elevation	0.77	ft
Elevation Range	0.00 to 1.00	
Flow Area	13.8	ft²
Wetted Perimeter	47.34	ft
Top Width	47.17	ft
Actual Depth	0.77	ft
Critical Elevation	0.91	ft
Critical Slope	1.056	%
Velocity	5.22	ft/s
Velocity Head	0.42	ft
Specific Energy	1.19	ft
Froude Number	1.70	
Flow Type	Supercritical	

Calculation Messages:
Flow is divided.

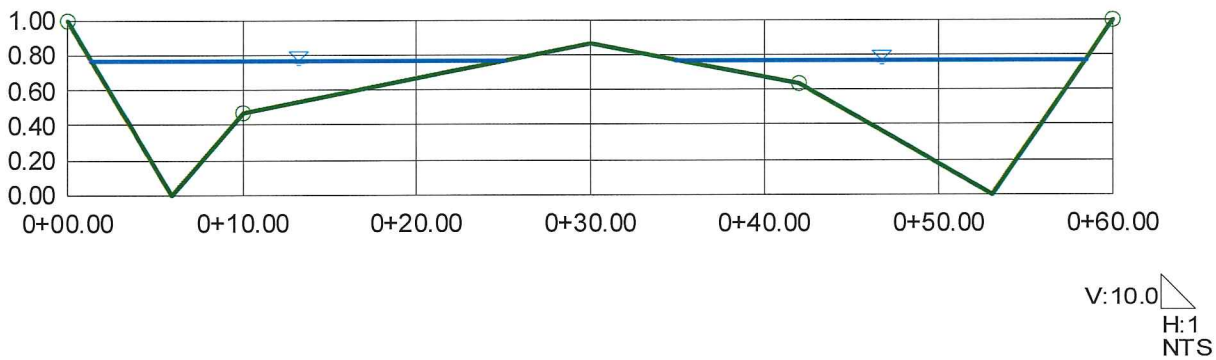
Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+10.00	0.037
0+10.00	0+42.00	0.016
0+42.00	0+60.00	0.025

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	1.00
0+06.00	0.00
0+10.00	0.47
0+30.00	0.87
0+42.00	0.63
0+53.00	0.00
0+60.00	1.00

Azure Drive @ Section 2 w/ Roadside Swale - (10-Year Max %)
Cross Section for Irregular Channel

Project Description	
Worksheet	Azure Drive @ Section 2 w/ Roadside Swale - (10-Year Max %)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.023	
Channel Slope	3.270	%
Water Surface Elevation	0.77	ft
Elevation Range	0.00 to 1.00	
Discharge	72.00	cfs



Azure Drive @ Section 2 w/ Roadside Swale - (10-Year Min %)
Worksheet for Irregular Channel

Project Description	
Worksheet	Azure Drive @ Section 2 w/ Roadside Swale - (10-Year Min %)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	2.970	%
Discharge	72.00	cfs

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

Results		
Mannings Coefficient	0.023	
Water Surface Elevation	0.78	ft
Elevation Range	0.00 to 1.00	
Flow Area	14.3	ft²
Wetted Perimeter	48.54	ft
Top Width	48.37	ft
Actual Depth	0.78	ft
Critical Elevation	0.91	ft
Critical Slope	1.046	%
Velocity	5.03	ft/s
Velocity Head	0.39	ft
Specific Energy	1.18	ft
Froude Number	1.63	
Flow Type	Supercritical	

Calculation Messages:
Flow is divided.

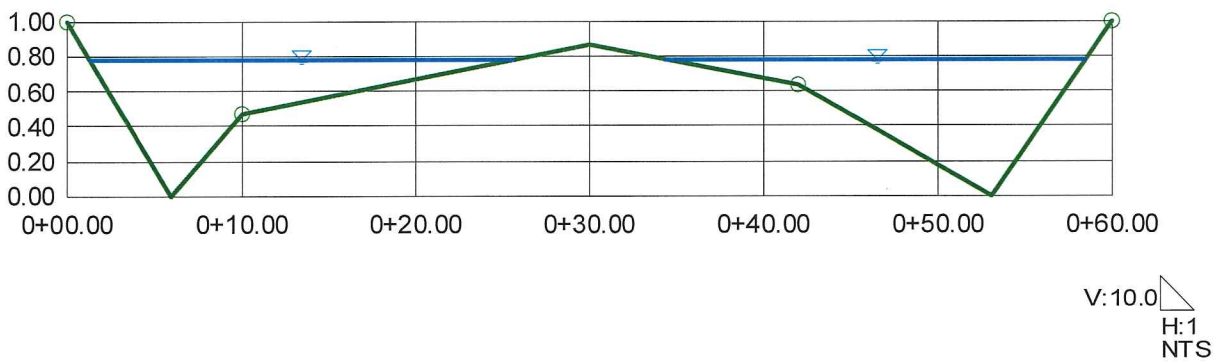
Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+10.00	0.037
0+10.00	0+42.00	0.016
0+42.00	0+60.00	0.025

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	1.00
0+06.00	0.00
0+10.00	0.47
0+30.00	0.87
0+42.00	0.63
0+53.00	0.00
0+60.00	1.00

Azure Drive @ Section 2 w/ Roadside Swale - (10-Year Min %)
Cross Section for Irregular Channel

Project Description	
Worksheet	Azure Drive @ Section 2 w/ Roadside Swale - (10-Year Min %)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.023	
Channel Slope	2.970	%
Water Surface Elevation	0.78	ft
Elevation Range	0.00 to 1.00	
Discharge	72.00	cfs



Azure Drive @ Section 2 w/ Roadside Swale - (100-Year Max %)
Worksheet for Irregular Channel

Project Description	
Worksheet	Azure Drive @ Section 2 w/ Roadside Swale - (100-Year Max %)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	3.270	%
Discharge	218.00	cfs

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

Results		
Mannings Coefficient	0.022	
Water Surface Elevation	1.04	ft
Elevation Range	0.00 to 1.00	
Flow Area	29.1	ft²
Wetted Perimeter	60.28	ft
Top Width	60.00	ft
Actual Depth	1.04	ft
Critical Elevation	1.30	ft
Critical Slope	0.795	%
Velocity	7.50	ft/s
Velocity Head	0.87	ft
Specific Energy	1.91	ft
Froude Number	1.90	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.39532798e-1 ft.

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+10.00	0.037
0+10.00	0+42.00	0.016
0+42.00	0+60.00	0.025

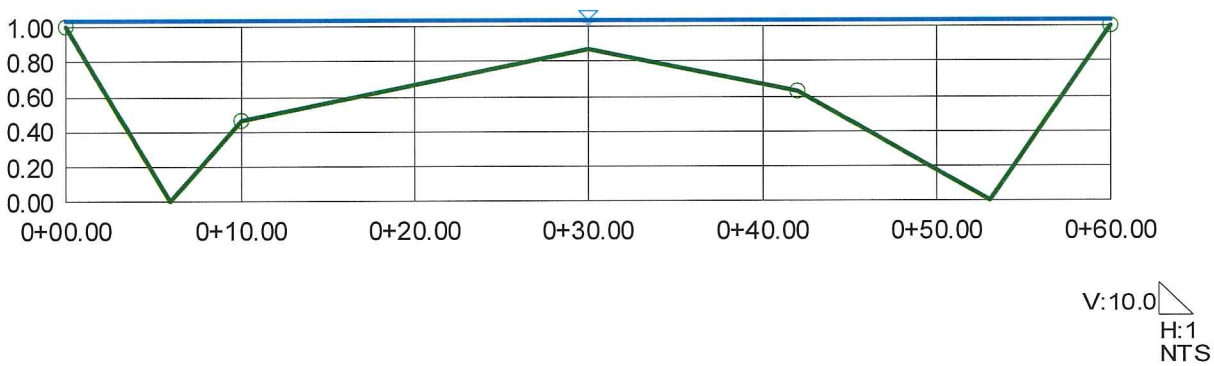
Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	1.00
0+06.00	0.00
0+10.00	0.47
0+30.00	0.87
0+42.00	0.63
0+53.00	0.00
0+60.00	1.00

Azure Drive @ Section 2 w/ Roadside Swale - (100-Year Max %)
Cross Section for Irregular Channel

Project Description	
Worksheet	Azure Drive @ Section 2 w/ Roadside Swale - (100-Year Max %)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.022	
Channel Slope	3.270	%
Water Surface Elevation	1.04	ft
Elevation Range	0.00 to 1.00	
Discharge	218.00	cfs



Azure Drive @ Section 2 w/ Roadside Swale - (100-Year Min %)
Worksheet for Irregular Channel

Project Description	
Worksheet	Azure Drive @ Section 2 w/ Roadside Swale - (100-Year Min %)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	2.970	%
Discharge	218.00	cfs

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

Results		
Mannings Coefficient	0.022	
Water Surface Elevation	1.05	ft
Elevation Range	0.00 to 1.00	
Flow Area	29.9	ft²
Wetted Perimeter	60.31	ft
Top Width	60.00	ft
Actual Depth	1.05	ft
Critical Elevation	1.30	ft
Critical Slope	0.793	%
Velocity	7.29	ft/s
Velocity Head	0.83	ft
Specific Energy	1.88	ft
Froude Number	1.82	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.5350218e-1 ft.

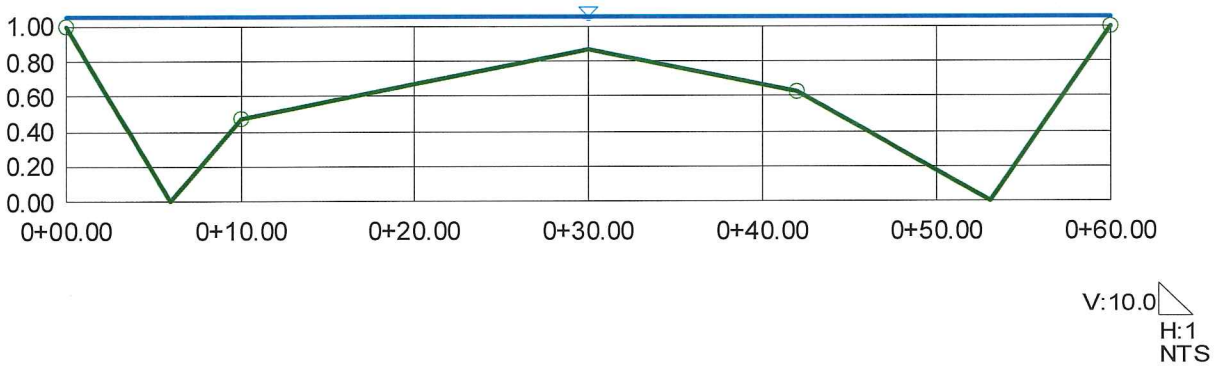
Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+10.00	0.037
0+10.00	0+42.00	0.016
0+42.00	0+60.00	0.025

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	1.00
0+06.00	0.00
0+10.00	0.47
0+30.00	0.87
0+42.00	0.63
0+53.00	0.00
0+60.00	1.00

Azure Drive @ Section 2 w/ Roadside Swale - (100-Year Min %)
Cross Section for Irregular Channel

Project Description	
Worksheet	Azure Drive @ Section 2 w/ Roadside Swale - (100-Year Min %)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.022	
Channel Slope	2.970	%
Water Surface Elevation	1.05	ft
Elevation Range	0.00 to 1.00	
Discharge	218.00	cfs



Azure Drive @ Section 2 w/ SW, Curb & Gutter (10-Year Max %)
Worksheet for Irregular Channel

Project Description	
Worksheet	Azure Drive @ Secion 2 w/ SW, Curb & Gutter (10-Year Max %)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	3.270	%
Discharge	72.00	cfs

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

Results		
Mannings Coefficient	0.015	
Water Surface Elevation	0.61	ft
Elevation Range	0.00 to 0.63	
Flow Area	11.9	ft²
Wetted Perimeter	58.87	ft
Top Width	57.76	ft
Actual Depth	0.61	ft
Critical Elevation	0.77	ft
Critical Slope	0.494	%
Velocity	6.06	ft/s
Velocity Head	0.57	ft
Specific Energy	1.18	ft
Froude Number	2.35	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.75572643e-2 ft.
Flow is divided.

Roughness Segments

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

Natural Channel Points

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

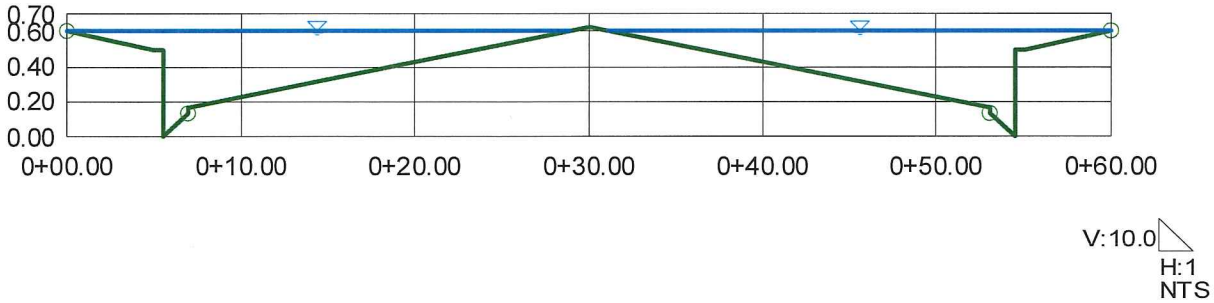
Azure Drive @ Section 2 w/ SW, Curb & Gutter (10-Year Max %)
Worksheet for Irregular Channel

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

Azure Drive @ Section 2 w/ SW, Curb & Gutter (10-Year Max %)
Cross Section for Irregular Channel

Project Description	
Worksheet	Azure Drive @ Secion 2 w/ SW, Curb & Gutter (10-Year Max %)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.015
Channel Slope	3.270 %
Water Surface Elevation	0.61 ft
Elevation Range	0.00 to 0.63
Discharge	72.00 cfs



Azure Drive @ Section 2 w/ SW, Curb & Gutter (10-Year Min %)
Worksheet for Irregular Channel

Project Description	
Worksheet	Azure Drive @ Secion 2 w/ SW, Curb & Gutter (10-Year Min %)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	2.970	%
Discharge	72.00	cfs

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

Results		
Mannings Coefficient	0.015	
Water Surface Elevation	0.61	ft
Elevation Range	0.00 to 0.63	
Flow Area	12.3	ft²
Wetted Perimeter	59.60	ft
Top Width	58.47	ft
Actual Depth	0.61	ft
Critical Elevation	0.76	ft
Critical Slope	0.495	%
Velocity	5.86	ft/s
Velocity Head	0.53	ft
Specific Energy	1.15	ft
Froude Number	2.25	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.14664423e-1 ft.
Flow is divided.

Roughness Segments

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

Natural Channel Points

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

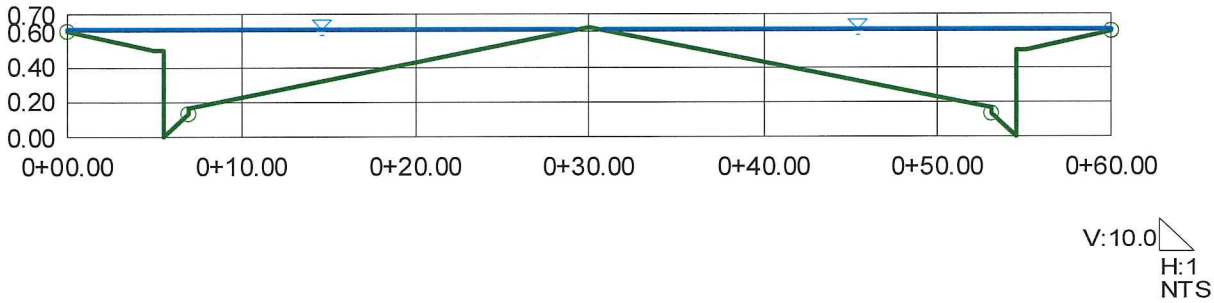
Azure Drive @ Section 2 w/ SW, Curb & Gutter (10-Year Min %)
Worksheet for Irregular Channel

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

Azure Drive @ Section 2 w/ SW, Curb & Gutter (10-Year Min %)
Cross Section for Irregular Channel

Project Description	
Worksheet	Azure Drive @ Secion 2 w/ SW, Curb & Gutter (10-Year Min %)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.015
Channel Slope	2.970 %
Water Surface Elevation	0.61 ft
Elevation Range	0.00 to 0.63
Discharge	72.00 cfs



Azure Drive @ Section 2 w/ SW, Curb & Gutter (100-Year Max %)
Worksheet for Irregular Channel

Project Description	
Worksheet	Azure Drive @ Secion 2 w/ SW, Curb & Gutter (100-Year Max %)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	3.270	%
Discharge	218.00	cfs

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

Results		
Mannings Coefficient	0.015	
Water Surface Elevation	0.80	ft
Elevation Range	0.00 to 0.63	
Flow Area	23.5	ft²
Wetted Perimeter	61.51	ft
Top Width	60.00	ft
Actual Depth	0.80	ft
Critical Elevation	1.15	ft
Critical Slope	0.393	%
Velocity	9.27	ft/s
Velocity Head	1.34	ft
Specific Energy	2.14	ft
Froude Number	2.61	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.20172053 ft.

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

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

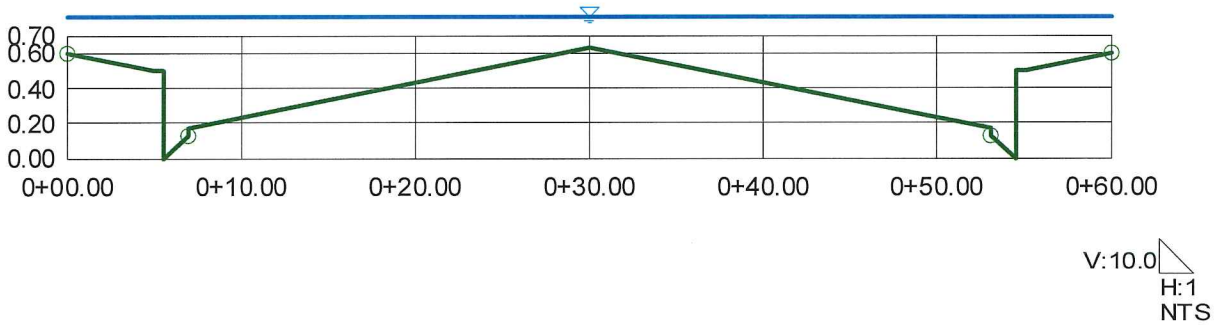
Azure Drive @ Section 2 w/ SW, Curb & Gutter (100-Year Max %)
Worksheet for Irregular Channel

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

Azure Drive @ Section 2 w/ SW, Curb & Gutter (100-Year Max %)
Cross Section for Irregular Channel

Project Description	
Worksheet	Azure Drive @ Secion 2 w/ SW, Curb & Gutter (100-Year Max %)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.015	
Channel Slope	3.270	%
Water Surface Elevation	0.80	ft
Elevation Range	0.00 to 0.63	
Discharge	218.00	cfs



Azure Drive @ Section 2 w/ SW, Curb & Gutter (100-Year Min %)
Worksheet for Irregular Channel

Project Description	
Worksheet	Azure Drive @ Secion 2 w/ SW, Curb & Gutter (100-Year Min %)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	2.970	%
Discharge	218.00	cfs

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

Results		
Mannings Coefficient	0.015	
Water Surface Elevation	0.81	ft
Elevation Range	0.00 to 0.63	
Flow Area	24.2	ft²
Wetted Perimeter	61.53	ft
Top Width	60.00	ft
Actual Depth	0.81	ft
Critical Elevation	1.15	ft
Critical Slope	0.393	%
Velocity	9.01	ft/s
Velocity Head	1.26	ft
Specific Energy	2.07	ft
Froude Number	2.50	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.21323678 ft.

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

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

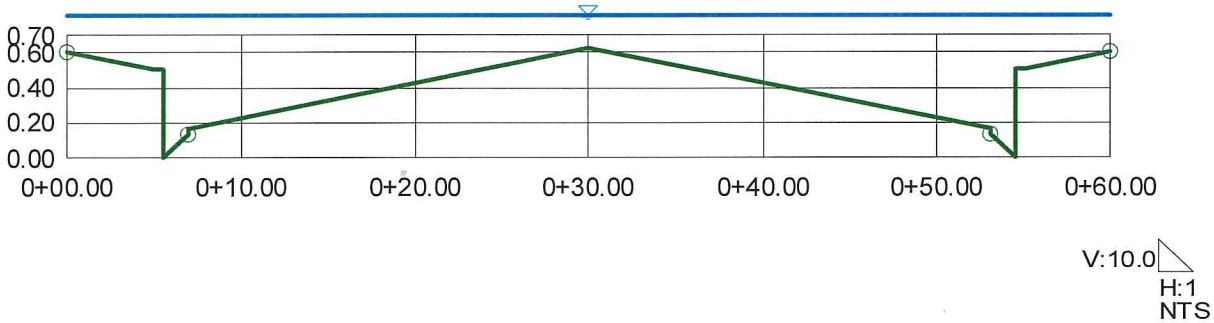
Azure Drive @ Section 2 w/ SW, Curb & Gutter (100-Year Min %)
Worksheet for Irregular Channel

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

Azure Drive @ Section 2 w/ SW, Curb & Gutter (100-Year Min %)
Cross Section for Irregular Channel

Project Description	
Worksheet	Azure Drive @ Secion 2 w/ SW, Curb & Gutter (100-Year Min %)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.015
Channel Slope	2.970 %
Water Surface Elevation	0.81 ft
Elevation Range	0.00 to 0.63
Discharge	218.00 cfs



Skyline Summit Circle @ Section 3 (100-Year Max%)
Worksheet for Irregular Channel

Project Description	
Worksheet	Skyline Summit Circle @ Section 3 (100-Year Max%)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	1.330	%
Discharge	2.00	cfs

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

Results		
Mannings Coefficient	0.015	
Water Surface Elevation	0.27	ft
Elevation Range	0.00 to 1.14	
Flow Area	0.9	ft²
Wetted Perimeter	9.20	ft
Top Width	9.12	ft
Actual Depth	0.27	ft
Critical Elevation	0.29	ft
Critical Slope	0.743	%
Velocity	2.30	ft/s
Velocity Head	0.08	ft
Specific Energy	0.35	ft
Froude Number	1.32	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+02.50	0.013
0+02.50	0+36.50	0.016
0+36.50	0+39.00	0.013

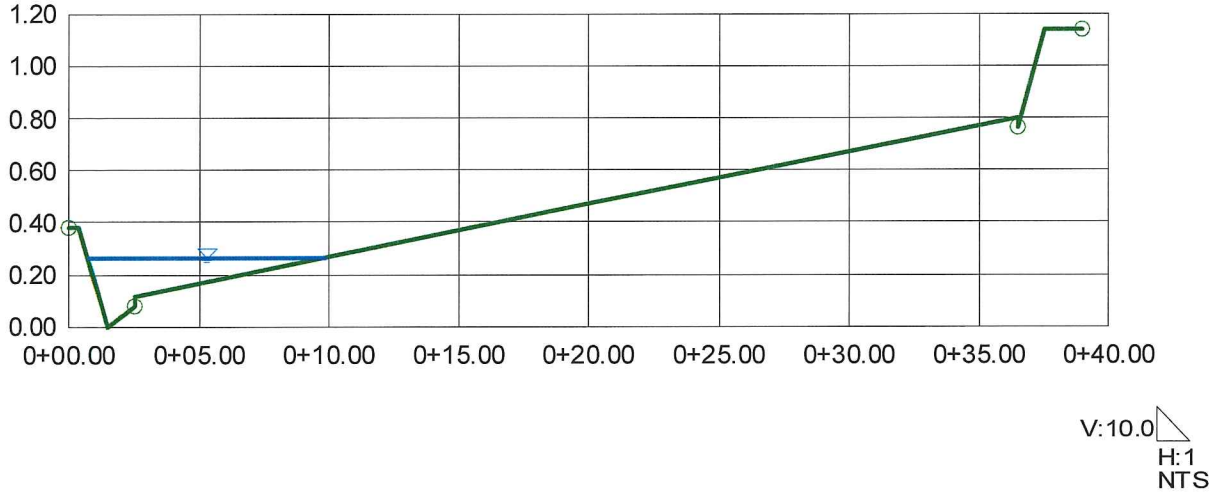
Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	0.38
0+00.38	0.38
0+01.50	0.00
0+02.50	0.08
0+02.50	0.12
0+19.50	0.46
0+36.50	0.80
0+36.50	0.76
0+37.50	1.14
0+39.00	1.14

Skyline Summit Circle @ Section 3 (100-Year Max%)
Cross Section for Irregular Channel

Project Description	
Worksheet	Skyline Summit Circle @ Section 3 (100-Year Max%)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.015
Channel Slope	1.330 %
Water Surface Elevation	0.27 ft
Elevation Range	0.00 to 1.14
Discharge	2.00 cfs



Skyline Summit Circle @ Section 3 (100-Year Min%)
Worksheet for Irregular Channel

Project Description	
Worksheet	Skyline Summit Circle @ Section 3 (100-Year Min%)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.500	%
Discharge	2.00	cfs

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

Results		
Mannings Coefficient	0.013	
Water Surface Elevation	0.29	ft
Elevation Range	0.00 to 1.14	
Flow Area	1.1	ft²
Wetted Perimeter	10.61	ft
Top Width	10.51	ft
Actual Depth	0.29	ft
Critical Elevation	0.29	ft
Critical Slope	0.554	%
Velocity	1.77	ft/s
Velocity Head	0.05	ft
Specific Energy	0.34	ft
Froude Number	0.95	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+02.50	0.013
0+02.50	0+36.50	0.016
0+36.50	0+39.00	0.013

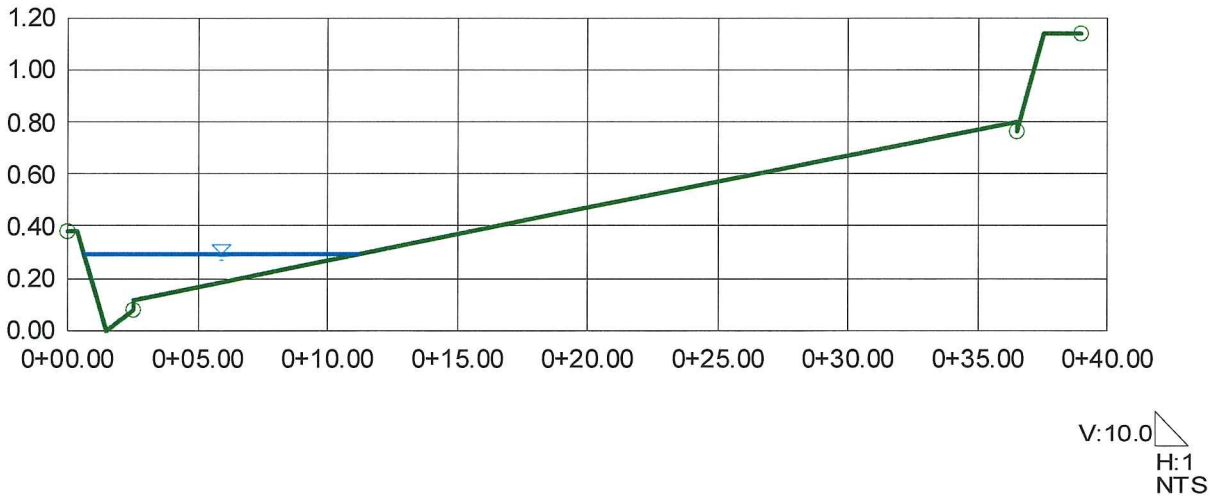
Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	0.38
0+00.38	0.38
0+01.50	0.00
0+02.50	0.08
0+02.50	0.12
0+19.50	0.46
0+36.50	0.80
0+36.50	0.76
0+37.50	1.14
0+39.00	1.14

Skyline Summit Circle @ Section 3 (100-Year Min%)
Cross Section for Irregular Channel

Project Description	
Worksheet	Skyline Summit Circle @ Section 3 (100-Year Min%)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.013	
Channel Slope	0.500	%
Water Surface Elevation	0.29	ft
Elevation Range	0.00 to 1.14	
Discharge	2.00	cfs



Riprap Calculations

Skyline Summit

DATE: January 2017

Riprap Sizing Computation - Azure Drive Roadside Swale

Calculated By: RFF

Equation 734, Section 405.4.6 of the 1999 Hydrologic Criteria and Drainage Design Manual

V=3(d50^0.5)(Ss-1)/(S^0.17)

V=Mean channel velocity in fps;
S=Longitudinal channel slope in feet per foot
Ss=Specific gravity of rock (minimum Ss=2.50)
d50=Rock size in feet for which 50% of the riprap (by weight) is smaller

Roadside Swale

Solve for d50:

d50=[V(S^0.17)/(3(Ss-1))]^2

V=	7.5	fps	<<<< From FlowMaster Azure Drive @ Section 2 - 100-Year, Max %
S=	0.0327	ft/ft	<<<< Maximum Street Slope
Ss=	2.65		

d50= 0.72 ft
8.6 inches
*** d50=9-inches loose Riprap is used for Swale**

From Equation 732:

n = 0.0395(d50)1/6

n = Manning's coefficient
d50 = Rock size in feet for which 50% of the riprap by weight is smaller

Solve for n: d50= 8.6 inches

n = 0.0395(d50)1/6

d50= 0.718 ft

n = **0.037** <<<< Manning's n-value for 9-inch Loose Riprap

APPENDIX E

Reference Materials

UP

16-7177
7/14/16
~~Supp#1~~
Update

City of Las Vegas Update #1
AND
Clark County Supplemental Information
FOR THE
TECHNICAL DRAINAGE STUDY
FOR
Azure & Eula
Residential Development

City of Las Vegas, NEVADA

Prepared for:

D R Horton
1081 Whitney Ranch Drive, #141
Henderson, Nevada 89014
Office: (702)672-1939
Fax: (800)538-0735

Prepared by:

Triton Engineering
6757 W. Charleston Blvd., Suite B
Las Vegas, NV 89146
Office: (702) 254-1480
Fax: (702) 254-3062

APN 125-30-201-002; 125-30-101-008

JULY 2016

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM	DATE: July 13, 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: **Azure & Eula Residential Development – Update #1** (To Be Annexed to the City of Las Vegas)	COPIES TO: Triton Engineering
Cross Streets: SWC of Regena Avenue & Eula Street	D.R. Horton
File Number: F:\Depot\DSMemos\DS4741D.doc	Bart Anderson, P.E., DevCo
Parcel Number: 125-30-201-002 & 125-30-101-008	CCPW
Zoning Action: TMP-62109; ANX-59773 & ANX-59825; WVR-61857; WVR-61858 & VAR-61859	
FEMA Flood Zone: YES / NO X	
Proposed Storm Drain: YES / NO X	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1st Submittal	7/2/2015 & 9/1/2015	9/3/2015	Not Approved	$400.00	404423: $400
2nd Submittal	11/9/2015 & 11/23/2015	12/9/2015	Not Approved	$400.00	421974: $400
3rd Submittal	1/19/2016	2/10/2016	Conditional Approval	$400.00	429809: $400
4th Submittal	6/30/2016	7/13/2016	See Comments Below	$100.00	451014: $100
			TOTAL FEES (LDDRS):	**$1,300.00**	----

REMARKS:

4th Submittal: Update #1 for minor changes along the west boundary between Azure Drive and Bright Angel Way

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

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

1. The site is adjacent to the jurisdiction of *Clark County* to the east, west and south. The engineer must coordinate with *Clark County Department of Public Works* (CCPW) and incorporate any concerns for boundary conditions along those borders. CCPW concurrence is required prior to final acceptance of the study.
2. All drainage easements must be public drainage easements to be privately maintained and common lots to be labeled on the grading plans and to be dedicated as such in the final map.
3. The engineer must provide a table on the grading plans that shows a quantity estimate of all drainage improvements within Public Drainage Easements. All drainage improvements within Public Drainage Easements must be bonded and inspected.

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: T19S/R60E/30
AREA G-30

20

Department of Public Works

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

Denis Cederburg, P.E., Director • E-Mail: dlc@ClarkCountyNV.gov

LTR

Drainage Study Concurrence Letter 16-7177

[redacted]

Date: August 2, 2016
Firm: Triton Engineering, LLC
Engineer: Kelly J. Wittwer, P.E
Address: 6757 West Charleston Blvd. Suite B, Las Vegas NV 89146
Phone: (702) 254-1480
Fax: (702) 254-3062
E-mail: kwittwer@tritoneng.com

Subject: Technical Drainage Study for Azure & Eula
Location: NWC and SWC of Azure and Eula
APN: 125-30-101-008 and 125-30-201-002
Sec, Township, Range: S30, T19S, R60E
Flood Zone & Panel: Zone X, 1750E, dated September 27, 2002
Application Number: 16-7177

Submittals	Date Received	Date Returned	Reviewer	Miscellaneous
Technical	02/17/2016	03/18/2016	BC	
Addendum 1	04/05/2016	05/10/2016	BC	
Supplement	05/18/2016	05/25/2016	BC	
Update	07/14/2016	08/02/2016	BC	

Technical / Add1/Add2
all FILED UNDER TDS.

BOARD OF COUNTY COMMISSIONERS
STEVE SISOLAK, Chairman • LARRY BROWN, Vice Chairman
SUSAN BRAGER • CHRIS GIUNCHIGLIANI • MARILYN KIRKPATRICK • MARY BETH SCOW • LAWRENCE WEEKLY
DONALD G. BURNETTE, County Manager

The above-referenced project is located within the **City of Las Vegas** adjacent to Clark County unincorporated areas. The drainage study was submitted to the County for concurrence on February 17, 2016. In addition, the County has received the City of Las Vegas acceptance letters dated February 10, 2016 and July 13, 2016 for the Technical Drainage Study (CLV DS4741).

The County concurs with the acceptance of this Drainage Study by the City of Las Vegas. Please note that the County's review of this development is limited to drainage issues significant to Clark County unincorporated areas. The site shall be graded with respect to drainage as shown on "**Azure & Eula**", improvement plan sheets 1 thru 11, signed and sealed by James M. Pearce, P.E., on June 30, 2016.

Check appropriate conditions

	Retaining/screen wall combination may be in excess of current **Clark County Unified Development Code, Chapter 30.64.050.**
	A FEMA Elevation Certificate, completed by a licensed surveyor, must be submitted to and approved by CCPW Development Review Plan Check prior to the issuance of Certificates of Occupancy for those structures.
X	Mylars of the grading plan must be submitted to the CCPW Development Review Plan Check for approval signatures prior to map recordation (residential) or permit issuance (commercial).
	An administrative variance to allow the finished floor elevation(s) to be set below the current Clark County criteria must be approved. The finished floor variance must be submitted to CCPW Development Review front counter after drainage study approval and prior to offsite final review.
	The grading plan will be reviewed by the Building Office Operations Division to ensure compliance with the ADA access requirements. Revisions to the grading plan may be required if the site accessibility design does not comply with the requirements set forth in the Accessibility Chapter of the Clark County Building Code.
X	The plans show work is proposed outside of the project boundary. Notarized written permission must be obtained **prior to grading plan approval.**
X	Right-of-way dedication must be verified.
	Any previously approved drainage easements that are not being used must be vacated.
	Per *Regional Flood Control District policies and Procedures manual, Section VIII. D. 13. Uniform Regulations for the Control of Drainage*, the Engineer of Record shall provide As-Built plans or record drawings to the District after completion and final inspection of such privately installed flood control facilities that have regional flood control significance.
	Structural calculations are required. The structural calculations, plans, and details must be approved prior to "Offsite" submittal and prior to CCRFCD submittal, if applicable.
X	Plan revisions can be found on the red-lined plans and must be addressed.
	Prepare drainage easement documents as shown on the grading plans.

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

Brian Churchill, P.E., CFM
Associate Engineer
Development Review
Brian.Churchill@ClarkCountyNV.gov

for W. Layne Weber, P.E., CFM
Principal Engineer
Development Review
wlweber@ClarkCountyNV.gov

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Technical Drainage Study for Azure & Eula Update 1 Supplement for CCPW Date: July 2016

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

East/West: Azure

b) Section: 30 Township: 19S Range: 60E

c) APN : 125-30-201-002; 125-30-101-008

Name of Owner: DR Horton, Developers

Telephone No.: (702)672-1939 Fax No.: (702) 538-0735 E-Mail Address: MEJones3@DRHorton.com

Address: 1081 Whitney Ranch Drive #141, Henderson, NV 89014

Contact Person-Name: Kelly J. Wittwer, P.E. **Telephone No.:** (702) 254-1480

*** E-Mail Address:** KWittwer@tritoneng.com **Fax No.:** (702) 254-3062

Firm: Triton Engineering, LLC

Address: 6757 West Charleston Boulevard, Suite B, Las Vegas, NV 89146

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: 10 ac Being Developed/Disturbed: 10 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.): Residential
5. Approximate upstream land area which drains to the subject site: 250 acres
6. Has the site drainage been evaluated in the past? ☐ YES ☒ NO If yes, please identify documentation:
7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: Discharge to natural flow paths to the east.
8. Briefly describe your proposed schedule for the subject project: ASAP

PROFESSIONAL ENGINEER STATE OF NEVADA
BARBARA M. BROWN
Exp: 12-31-16
CIVIL
No.9909
7-14-16

Engineer's Seal

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

*New Required Field

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

Revision	Date

Local Entity File No.

REFERENCE:

STANDARD FORM 1

Updated 05/01/2008

Triton
Engineering

July 14, 2016

W. Layne Weber, P.E. CFM
Clark County Department of Public Works
500 South Grand Central Parkway
Box 554000
Las Vegas, NV 89155-4000

Subject: Supplement for Clark County concurrence for
Update #1 to the Technical Drainage Study for Azure & Eula
CLV DS4741A; CCPW H T E #16-7177

Mr. Weber:

The purpose of this Supplemental document is to provide additional information for your concurrence review of the subject project.

Several meetings and other coordination efforts have been made for the project, including a field visit. The field visit was held on June 22, 2016 at 9:00 a.m. At the field visit, were staff members of City of Las Vegas, Clark County, DR Horton, the public, the adjacent property owner, and Triton Engineering.

Since that time, a 2-foot wide gutter was added along the western boundary of the subject site. As a result, the drawings changed slightly and the City of Las Vegas had requested an Update to the drainage study. That Update has since been approved, and is attached with this supplement. All of this has been discussed and agreed upon at the coordination meeting with you at the Clark County building on June 29, 2016.

6757 W. Charleston Blvd., Suite B • Las Vegas, Nevada 89146
Office: (702) 254-1480 • Fax: (702) 254-3062 • www.tritoneng.com

The normal depth calculations for Bright Angel Way were performed as agreed to by Brian Churchill in the field visit on June 22, 2016. It was concluded that there is no adverse impact to the flow conditions in Bright Angel Way with the construction of the subject site. It is noted that even with the best of intentions, the calculation is still considered an estimate, and is intended only for purposes of comparing existing conditions with future conditions along that street alignment.

A hydraulic cross section was taken as agreed at the location of an existing barn (not a viable structure) on the property located to the south of the Bright Angel Way alignment. The existing conditions, 100-year, 6-hour peak flow rate of 225 cfs was placed in that hydraulic section and a normal depth water surface elevation was calculated (2727.92 feet). The cross section was revised to include riprap in the ditch on the north side of the street and a vertical wall at the northern right-of-way line. Using the extremely conservative approach that the development of the subject site may cause an increase in the peak flow rate in the street by 4 cfs, the revised cross section, representing the proposed conditions, was calculated using the proposed conditions peak flow rate of 229 cfs, and the water surface elevation did not change (2727.92 feet).

It was requested by Brian Churchill at the meeting(s) to provide a (normal depth) velocity head calculation for flow exiting the street of the proposed development into the Bright Angel Way. That calculation is included in the Appendix of this submittal.

It was also requested by Brian Churchill at the meeting(s) to provide a (normal depth) velocity head calculation for flow exiting the proposed 2-foot concrete valley gutter, which widens at the outlet to Bright Angel Way. That calculation is also included in the Appendix of this submittal.

As stated in the Update to this study, which was approved by the City of Las Vegas, the new 2-foot wide valley gutter and space it takes up is not a drainage easement. Therefore the documents for the HOA of the subject site must state that the space cannot be reclaimed at any time in the future. In addition, the HOA must take full responsibility for maintenance of the facility.

Note that the facility is not intended to convey nor contain a specific amount of flow; the facility is intended only to improve the discharge path of runoff flow from the adjacent (private) parcel.

The drawings in this submittal package have been revised to show the new valley gutter and maintenance access fencing improvements.

We hope that this response satisfies all your issues concerning the project. If you have any questions, please contact me at 702-376-8801, email Momentum1@cox.net.

Sincerely,

Barbara M. Brown

PROFESSIONAL ENGINEER - STATE OF NEVADA
BARBARA M. BROWN
Exp. 12-31-16
CIVIL
No. 9909

7-14-16

Momentum Engineers, Ltd.
Barbara M. Brown, P. E.
Subcontractor for
Triton Engineering, LLC

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Technical Drainage Study for Azure & Eula Update #1 Date: June 2016

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

East/West: Azure

b) Section: 30 Township: 19S Range: 60E

c) APN : 125-30-201-002; 125-30-101-008

Name of Owner: DR Horton, Developers

Telephone No.: (702)672-1939 Fax No.: (702) 538-0735 E-Mail Address: MEJones3@DRHorton.com

Address: 1081 Whitney Ranch Drive #141, Henderson, NV 89014

Contact Person-Name: Kelly J. Wittwer, P.E. Telephone No.: (702) 254-1480

* E-Mail Address: KWittwer@tritoneng.com Fax No.: (702) 254-3062

Firm: Triton Engineering, LLC

Address: 6757 West Charleston Boulevard, Suite B, Las Vegas, NV 89146

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: 10 ac Being Developed/Disturbed: 10 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.): Residential
5. Approximate upstream land area which drains to the subject site: 250 acres
6. Has the site drainage been evaluated in the past? ☐ YES ☒ NO If yes, please identify documentation:
7. If known, please briefly identify the proposed discharge point(s) of runoff from the site:
   Discharge to natural flow paths to the east.
8. Briefly describe your proposed schedule for the subject project: ASAP

PROFESSIONAL ENGINEER - STATE OF NEVADA
BARBARA M. BROWN
Exp: 12-31-16
CIVIL
No.9909

6-29-16

Engineer's Seal

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

*New Required Field

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

Revision	Date

Local Entity File No.

REFERENCE:

STANDARD FORM 1

Updated 05/01/2008

COPY OF UPDATE 1
SUBMITTED TO CITY OF LAS VEGAS

Triton
Engineering

June 29, 2016

Albert Sung, P.E
Land Development Services
333 North Rancho Drive
Las Vegas, NV 89106

Subject: Update #1 to the Technical Drainage Study for Azure & Eula
DS4741A

Mr. Sung:

The purpose of this Update document is to add minor changes to the grading plans for the subject site that do not change the hydrology/hydraulic calculations of the original Technical Drainage Study. The change to the site plan is specifically the placement of a 2-foot wide concrete valley gutter along the western boundary of the site, which will be fenced by utilizing wrought iron gates at the north and south ends (see attached grading plan and details).

Update did not Impact the referenced hydrologic analysis

The new 2-foot valley gutter and space it takes up is not a drainage easement. Therefore the documents for the HOA of the subject site must state that the space cannot be reclaimed at any time in the future. In addition, the HOA must take full responsibility for maintenance of the facility.

Note that the facility is not intended to convey nor contain a specific amount of flow; the facility is intended only to improve the discharge path of runoff flow from the adjacent (private) parcel.

The drawings in this submittal package have been revised to show the new valley gutter improvements.

6757 W. Charleston Blvd., Suite B • Las Vegas, Nevada 89146
Office: (702) 254-1480 • Fax: (702) 254-3062 • www.tritoneng.com

We hope that this response satisfies all your issues concerning the project. If you have any questions, please contact me at 702-376-8801, email Momentum1@cox.net.

Sincerely,

Barbara M. Brown

PROFESSIONAL ENGINEER-STATE OF NEVADA
BARBARA M. BROWN
Exp. 12-31-16
CIVIL
No. 9909

6-29-16

Momentum Engineers, Ltd.
Barbara M. Brown, P. E.
Subcontractor for
Triton Engineering, LLC

TECHNICAL DRAINAGE STUDY

FOR

Azure & Eula
Residential Development

Clark County, NEVADA

Prepared for:

D R Horton

1081 Whitney Ranch Drive, #141
Henderson, Nevada 89014
Office: (702)672-1939
Fax: (800)538-0735

Prepared by:

Triton Engineering

6757 W. Charleston Blvd., Suite B
Las Vegas, NV 89146
Office: (702) 254-1480
Fax: (702) 254-3062

APN 125-30-201-002; 125-30-101-008

JUNE 2015

DEVELOPED DRAINAGE DESCRIPTION

The developed drainage scenario consists of onsite and offsite basins becoming fully developed. It is noted that in areas like the subject site, sometimes development of the land causes a decrease in runoff rates. However, both existing and developed drainage scenarios were modeled and the developed conditions analysis was found to be slightly higher (within 1%) so it was used for design purposes, and for the detailed Flo2D analysis.

Under developed conditions, the subject site is impacted by runoff flow that is generated from watersheds offsite and west of the site. The upstream limit of the watershed to the west under existing conditions is existing regional Facility GOAN 0070, an 10-ft wide, 4 to 7-ft deep soil cement channel that directs offsite flows south into the existing Ann Road Detention Basin Facility GOAN 0061. Referring to *Figure 4, Developed Conditions Drainage Basins,* offsite basins are illustrated in yellow and magenta. Yellow basins are generally referenced from previously approved drainage studies. Magenta basins and concentration points are newly created.

Runoff flow from area CNTL flows into area DOF6B, combining at point CP8 in the Regena Avenue alignment. At point CP8, it is released into natural flow paths to the east, and it is assumed to flow in similar flow paths as under existing conditions.

Runoff flow from area DOF4B impacts the western boundary of the Centennial/Hualapai project, where it is directed southerly into the Regena Avenue alignment. All onsite basins for the Centennial/Hualapai project were referenced and inserted into the HEC1 hydrologic analysis. Runoff flow from areas DON1RR and DON2RR combines at point CP1, where it flows into Regena Avenue for combination at point CP6. Flow continues easterly in the Regena Avenue alignment, combining with street flow from areas RGNA2 and RGNA3 at point CP12, where it flows southerly in the Hualapai Way alignment.

Runoff flow from areas DON3RR thorough DON4RR combines at point CP4, where it flows into Regena Avenue. From point CP4, flow turns easterly, combining with street flow from area RGNA1 at point CP7. From point CP7, runoff flow continues easterly in the Regena Avenue alignment.

Runoff flow from street area DOF8 (at the I-215 near Azure) flows into area DON1, combining at point CD5. From point CD5, it continues easterly in the Bright Angel Way alignment, combining with flow from areas OND-4, PTS4, PON1, PON2, and PST3 at point CP3. From point CP3, runoff is released into natural flow paths to the east, and is considered to run similarly under developed conditions.

Runoff flow that is generated upstream of I-215 (Beltway) crosses under the beltway through three culverts, discharging from referenced offsite basins upstream. There is an existing 48-inch diameter RCP culvert under the I-215 just south of Centennial Boulevard. This runoff flow crosses basin DOF2R and enters street area basin LNCHP, continuing eastward to point C5, where it combines with runoff flow from the Centennial/Alpine Ridge project, from point C5, it enters basin OND-1 in a concrete drainage easement, where flow continues southerly to combination point C6, where it combines with

additional flow from the west as follows:

There are two existing culverts underneath the I-215 that pass flow from west to east between the Regena and Azure street alignments. One is an existing 72-inch RCP and one is an existing 3-barrel 8'x5' reinforced concrete box (RCB). Flow from these two culverts passes under the I-215 from the west (see research material), through area OND-3, to point C9 in the Azure Drive alignment. Some of the flow is apparently flowing underground in a pipe, while some is flowing overland for combination at point C6, where all flow is released on the surface, into the street section of Azure Drive. The 100--year peak flow rate at point C6 is relatively high, at 418 cfs. Since it is very difficult to determine flow paths from this point into the downstream area toward the site, a Flo2D model was set up as the most reasonable method of determining flow paths.

It is noted that in watersheds such as the subject one, it is possible that development of the area may actually DECREASE the runoff potential. As a result, it was found to be crucial to run both the existing and fully developed hydrologic analysis to see which produces the higher runoff. For the subject project, the developed conditions produced slightly higher (within 1%) peak flow rates than the existing conditions model. Since there was so very little difference, a Flo2D analysis was not performed for the existing conditions. Instead the Flo2D analysis was performed using the developed conditions hydrographs, in order to determine the peak flow rates at points FTD1, FTD2, and FTD3. It is noted that the peak hydrograph at point FTD3 exits the watershed by flowing south on Hualapai Way. A full description of the Flo2D analysis is included in the Hydraulics section of this report.

Runoff flow from large area DOF5B impacts the north and south halves of the subject site. Again, since flow paths are very difficult to determine, the Flo2D model was utilized to determine location of impacts at points FTD1 and FTD2.

Referring to *Figure 7, Developed Conditions Onsite Drainage Basins*, runoff flow from the back yard of area DOF1 enters the western boundary of the subject site, entering a block wall opening. Runoff flow enters onsite basin DN1, flowing in a 5-foot private drainage easement to point CDN1, where it is released into Azure Drive. Flow from point FTD1 (determined by Flo2D analysis) flows easterly in Azure Drive, combining with onsite flow (CDN1) and street flow (AZR) at point CPAZ. From point CPAZ, runoff flow continues easterly in the Azure Drive alignment away from the site.

Again referring to *Figure 7, Developed Conditions Onsite Drainage Basins*, runoff flow in Regena Avenue bordering the site on the north, was referenced from the Centennial/Hualapai study. From point CP7, runoff flow turns south on Eula Street, combining with onsite flow from area DN3 and street flow from area ELA at point CPEL, where it continues easterly in the Azure Drive alignment away from the site.

Again referring to *Figure 7, Developed Conditions Onsite Drainage Basins*, runoff flow from point FTD2 (determined by Flo2D analysis) flows easterly in Bright Angel Way, combining with flow from offsite basin DOF7B and onsite basin DN4, and street basin BAW at point CPBA, where it continues easterly in the Bright Angel Way alignment away from the site.

HYDROLOGIC ANALYSIS

COMPUTER MODELING

The HEC-1 Flood Hydrograph Package was used to compute the storm water runoff peak flow rates for the hydrologic analysis. Standard Form 4 from the Drainage Manual was implemented as a spreadsheet used for tabulation of the variables for input to the HEC-1 modeling program, and are attached to this report.

Results of the computer modeling are summarized on Figures 3, 4 and 7 of this report.

RAINFALL

Rainfall was referenced from the multitude of studies outlining the upstream watershed. The rainfall depths were adjusted as much as possible to match with the input of the referenced studies. Notes are given on the actual HEC1 input/output files. Reference material has been copied, annotated, and included in the appendix.

RUNOFF

The Soil Conservation Services (SCS) Curve Number methodology was used in this computation within the HEC-1 computer model. The Hydrologic Soils Group for the watershed studied was determined from the USDA Soils Conservation Service website and from the CCRFCD 2008 Master Plan Update to be Hydrologic Soils Groups D and B, as shown outlined on Figures 3 and 4 of this report. Curve numbers were selected from the Drainage Manual for the land usage and hydrologic condition of each drainage basin. Times of concentration were calculated on the Drainage Manual Form 4, and were input to the HEC-1 computer model.

HYDRAULIC ANALYSIS

FLO2D TWO-DIMENSIONAL FLOW ANALYSIS

Flo2D Parameters Elevation points that were input to the model were taken from the Autocad surface developed from very recent topography, in the most important area of the analysis at the middle of the watershed where flow paths tend to converge, however, there are enough existing roads and housing pads that work to divert the flow in odd directions. Five-foot contours downloaded from the Clark County Geographical Information website were used to fill in around the edges of the newly-flown 1-foot contour area. The two sets of contour data were created as one surface in autocad, and elevation points were extracted from the surface at 10-foot grid intervals and input to the Flo2D model. In the FLO-2D model, the individual elements were then interpolated to the elevation points. There were no adjustments made to the terrain elements, except for blocking out elements where existing homes will not allow flow to pass.

The Flo2D model was run using 100-foot grid elements, as the most reasonable element width for the flow input and drainage area studied.

There were no adjustments made to the Manning's n values in the model; all elements were set with the default of n=0.04.

The FLO-2D model was run using a 24- hour modeling period using the 10- and 100-year, 6-hour storm events, having 0.1 hour calculation increments.

Precipitation runoff flow was added to the model using the 10- and 100-year, 6-hour storm peak hydrographs from the HEC1 analysis. Hydrographs were input for the 10- and 100-year, 6-hour storms, at concentration points CP12, CP8, CPD5B and CP3. The largest hydrograph was found to be CPD5B; it was divided into two and inserted into 2 elements of the model. All hydrographs were inserted at their geographical locations (See Figures 5 and 6), except for hydrograph CPD5B, which was inserted in the location of (with inclusion of) concentration point CP6, which is the location where runoff flow will be discharged from a large pipe into the Azure Drive street section. This is a reasonable application, since the hydrograph should reasonably have a chance to slightly attenuate as it approaches the site. No further precipitation was added to the model downstream of the hydrograph input locations.

Since the area studied is located within material that likely can be transported with precipitation events, a "hard surface" model is not logical for simulation. Instead, a sedimentation analysis is highly applicable to the terrain, whose surface can be considered "alluvial" and could change over the time period of the storm. Sedimentation analysis was performed within the model using the method recommended as a default in the model, the Yang method. This method is considered a moderate sediment transport capacity method for a wide range of field conditions, and is utilized since the soil size grain distribution of the area is unknown at this point.

Three cross sections were taken across the flood plain so that the 10- and 100-year, 6-hour hydrographs could be plotted by the model at the locations of interest; see Figures 5 and 6.

Flo2D Model Results Results were mapped using the Mapping application in the Flo2D software, to map the Grid Element Maximum Flow Depth, as shown on Figures 5 and 6. Section 1 (point FTD1), which impacts the northern half, and enters Azure Drive, under existing as well as developed conditions, was found to pass 60cfs/173 cfs in the 10- and 100-year, 6-hour storm events, respectively. Section 2 (point FTD2), which impacts the southern half, and enters Bright Angel Way under existing as well as developed conditions, was found to likewise pass 51cfs/215 cfs Section 3(point FTD3) represents runoff flow that will flow southerly on Hualapai Way, out of the subject watershed. This cross section was found to pass 31cfs/81cfs in the 10- and 100-yr, 6-hour storm events, respectively.

The peak flow results from the Flo2D analysis at points FTD1 and FTD2 were added directly to the peak hydrographs calculated in the HEC1 analysis downstream of the points. Results are shown on Figures 3, 4 and 7.

NORMAL DEPTH CALCULATIONS

Normal depth street flows were calculated using the FlowMaster computer program. Results are presented on *Figure 7, Developed Conditions Onsite Drainage Basins,* and calculations are included in the appendix. Finished floor elevations were set at an elevation based on Drainage Manual criteria, or were flood-proofed to an equal elevation based on solid-grouting of the surrounding walls or utilization of retaining walls. All streets were found to meet V times D product criteria.

```
1****************************************
 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
 *              JUN   1998              *
 *           VERSION 4.1                *
 *                                      *
 *  RUN DATE   30JUN15  TIME  20:34:59  *
 *                                      *
 ****************************************
```

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

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

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

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


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

              *DIAGRAM
   1          ID
   2          ID     DEVELOPED CONDITIONS 10- AND 100-YEAR, 6-HOUR STORMS MODEL
   3          ID     AZURE & EULA RESIDENTIAL DEVELOPMENT
   4          ID     MOMENTUM ENGINEERS FOR TRITON ENGINEERING - B BROWN
   5          ID
   6          ID
   7          ID     6-HOUR STORM DISTRIBUTION #3
   8          ID     10- AND 100-YEAR STORM EVENTS
   9          ID
  10          ID
  11          ID
  12          ID
  13          IT       5       0       0     300
  14          IO       5       0       0
  15          IN       5       0       0
  16          JR    PREC    0.55       1

  17          KK  DON1RR
  18          KM            REFERENCED FROM CENTENNIAL HUALAPAI 06-36202 BASIN DON1
  19          BA   .0057
  20          PB    3.00
```

DEVELOPED

```
 21          KM            SDN #3
 22          PC   0.000   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   0.148   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          LS       0      82
 31          UD   0.106
             *

 32          KK  DON2RR
 33          KM            REFERENCED FROM CENTENNIAL HUALAPAI 06-36202 BASIN DON2
 34          BA  0.0078
 35          LS       0      79
 36          UD   0.118
             *

 37          KK   RGNA3
 38          KM            REFERENCED FROM CENTENNIAL HUALAPAI 06-36202
 39          BA   .0016
 40          LS       0      98
 41          UD   0.050
             *

 42          KK   DOF4B
 43          KM            CREATED BASIN
 44          BA   .0105
 45          LS       0      75
 46          UD   0.136
             *
```



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

 47          KK     CP6
 48          KM            COMBINE FLOWS AT REGENA RUFFIAN
 49          HC       4
             *

 50          KK   RGNA2
 51          KM            REFERENCED FROM CENTENNIAL HUALAPAI 06-36202
 52          BA   .0017
 53          LS       0      98
 54          UD   0.050
             *

 55          KK    CP12
 56          KM            COMBINE FLOWS AT REGENA RUFFIAN (FLOWS S) <<<<<<<<<<<FLO2D POINT
 57          KO       1
 58          HC       2
             *

 59          KK  DON3RR
 60          KM            REFERENCED FROM CENTENNIAL HUALAPAI 06-36202 BASIN DON3
 61          BA  0.0140
 62          LS       0      77
```

```
 63          UD   0.140
             *

 64          KK  DON4RR
 65          KM            REFERENCED FROM CENTENNIAL HUALAPAI 06-36202 BASIN DON4
 66          BA  0.0026
 67          LS       0      75
 68          UD   0.119
             *

 69          KK  DON5RR
 70          KM            REFERENCED FROM CENTENNIAL HUALAPAI 06-36202 BASIN DON5
 71          BA  0.0113
 72          LS       0      79
 73          UD   0.131
             *

 74          KK   RGNA1
 75          KM            REFERENCED FROM CENTENNIAL HUALAPAI 06-36202
 76          BA   .0016
 77          LS       0      98
 78          UD   0.050
             *

 79          KK     CP7
 80          KM            COMBINE FLOWS AT REGENA EULA     <<<<<<<<<<<<<<<<<<<<<FLO2D POINT
 81          KO       1
 82          HC       4
             *
1                                        HEC-1 INPUT                                        PAGE  3

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

 83          KK     DN2
 84          KM            CREATED BASIN
 85          BA   .0003
 86          LS       0      75
 87          UD   0.081
             *

 88          KK     DN3
 89          KM            CREATED BASIN
 90          BA   .0045
 91          LS       0      75
 92          UD   0.127
             *

 93          KK     ELA
 94          KM            CREATED BASIN
 95          BA   .0014
 96          LS       0      98
 97          UD   0.085
             *

 98          KK    CPEL
 99          HC       4
             *

100          KK    CNTL
```

```
101          KM            CREATED BASIN
102          BA    .0025
103          LS        0      98
104          UD    0.065
             *

105          KK    DOF6B
106          KM            CREATED BASIN
107          BA    .0169
108          LS        0      75
109          UD    0.168
             *

110          KK      CP8
111          KM            COMBINE FLOWS AT REGENA          <<<<<<<<<<<<<<<<<<<<<FLO2D POINT
112          KO        1
113          HC        2
             *

114          KK    DUMMY
115          HC        3
             *
```



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

116          KK    DON1R
117          KM            REFERENCED FROM CENTENNIAL ALPINE RIDGE 06-35295 BASIN DON1
118          KM            PB CARD IS CHANGED TO 3.10 TO CONCUR WITH HEC1 FROM THE CENTENNIAL
119          KM           ALPINE RIDGE BASINS
120          BA    .0045
121          PB     3.10
122          LS        0      83
123          UD    0.095
             *

124          KK    DON2R
125          KM            REFERENCED FROM CENTENNIAL ALPINE RIDGE 06-35295 BASIN DON2
126          BA    .0050
127          LS        0      87
128          UD    0.085
             *

129          KK    DON3R
130          KM            REFERENCED FROM CENTENNIAL ALPINE RIDGE 06-35295 BASIN DON3
131          BA    .0035
132          LS        0      82
133          UD    0.107
             *

134          KK    DOF2R
135          KM            CREATED BASIN - PB CARD NOT REVISED...TO CONCUR WITH
136          KM            PREVIOUS BASINS
137          BA    .0075
138          LS        0      87
139          UD    0.095
             *

140          KK    LNCHP
```

```
 141          KM            REFERENCED FROM CENTENNIAL ALPINE RIDGE 06-35295
 142          BA   .0016
 143          LS       0      98
 144          UD   0.050
              *

 145          KK    ALPN
 146          KM            REFERENCED FROM CENTENNIAL ALPINE RIDGE 06-35295
 147          BA   .0016
 148          LS       0      98
 149          UD   0.050
              *

 150          KK      C5
 151          HC       6
              *
```



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

 152          KK   OND-1
 153          KM            REFERENCED FROM CONSTELLATION ESTATES 01-470
 154          KM            PB CARD IS CHANGED TO 3.05 TO CONCUR WITH HEC1 FROM THE
 155          KM             CONSTELLATION ESTATES BASINS
 156          BA   .0121
 157          PB    3.05
 158          LS       0      75
 159          UD   0.112
              *

 160          KK     C6N
 161          HC       2
              *

 162          KK    ONB8
 163          KM            REFERENCED FROM CENTENNIAL APARTMENTS DEVELOPED CONDITIONS
 164          KM            CLV DS 4217
 165          BA   .0021
 166          LS       0      93
 167          UD   0.059
              *

 168          KK    ONB9
 169          KM            REFERENCED FROM CENTENNIAL APARTMENTS DEVELOPED CONDITIONS
 170          KM             CLV DS 4217
 171          BA   .0022
 172          LS       0      93
 173          UD   0.090
              *

 174          KK    CP-1
 175          KM            REFERENCED FROM CENTENNIAL APARTMENTS DEVELOPED CONDITIONS
 176          KM             CLV DS 4217
 177          HC       2
              *

 178          KK    DOF4
 179          KM            REFERENCED FROM TROPICAL & 215 13-4178
 180          BA  0.0177
```

```
 181          BF       0
 182          LS       0      95
 183          UD   0.057
              *

 184          KK      R1
 185          KM            REFERENCED FROM TROPICAL & 215 13-4178
 186          RK     820   0.040   0.013            TRAP       5      20
              *
1                                          HEC-1 INPUT                                                    PAGE  6

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

 187          KK    DOF6
 188          KM            REFERENCED FROM TROPICAL & 215 13-4178
 189          BA  0.0088
 190          LS       0    88.7
 191          UD   0.071
              *

 192          KK     CD1
 193          HC       3
              *

 194          KK    DOF1
 195          KM            REFERENCED FROM TROPICAL & 215 13-4178
 196          BA  0.0147
 197          LS       0      91
 198          UD   0.063
              *

 199          KK    ONB1
 200          KM            REFERENCED FROM CENTENNIAL APARTMENTS DEVELOPED CONDITIONS
 201          KM      CLV DS 4217
 202          BA   .0029
 203          LS       0      93
 204          UD   0.092
              *

 205          KK    ONB2
 206          KM            REFERENCED FROM CENTENNIAL APARTMENTS DEVELOPED CONDITIONS
 207          KM            CLV DS 4217
 208          BA   .0054
 209          LS       0      93
 210          UD   0.100
              *

 211          KK    CP-2
 212          KM            REFERENCED FROM CENTENNIAL APARTMENTS DEVELOPED CONDITIONS
 213          KM            CLV DS 4217
 214          HC       3
              *

 215          KK    DOF2
 216          KM            REFERENCED FROM TROPICAL & 215 13-4178
 217          BA   .0336
 218          BF       0
 219          LS       0      91
 220          UD   0.122
```

```
                 *
 221             KK   ONB4A
 222             KM            REFERENCED FROM CENTENNIAL APARTMENTS DEVELOPED CONDITIONS
 223             KM           CLV DS 4217
 224             BA   .0006
 225             LS       0      93
 226             UD   0.087
                 *
1                                          HEC-1 INPUT                                          PAGE  7

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

 227             KK    ONB3
 228             KM            REFERENCED FROM CENTENNIAL APARTMENTS DEVELOPED CONDITIONS
 229             KM            CLV DS 4217
 230             BA   .0047
 231             LS       0      93
 232             UD   0.099
                 *

 233             KK    CP-3
 234             KM            REFERENCED FROM CENTENNIAL APARTMENTS DEVELOPED CONDITIONS
 235             KM             CLV DS 4217
 236             HC       3
                 *

 237             KK    DOF3
 238             KM            REFERENCED FROM TROPICAL & 215 13-4178
 239             BA   .0561
 240             BF       0
 241             LS       0      91
 242             UD   0.119
                 *

 243             KK   ONB4B
 244             KM            REFERENCED FROM CENTENNIAL APARTMENTS DEVELOPED CONDITIONS
 245             KM             CLV DS 4217
 246             BA   .0004
 247             LS       0      93
 248             UD   0.056
                 *

 249             KK    ONB5
 250             KM            REFERENCED FROM CENTENNIAL APARTMENTS DEVELOPED CONDITIONS
 251             KM            CLV DS 4217
 252             BA   .0011
 253             LS       0      93
 254             UD   0.050
                 *

 255             KK    ONB6
 256             KM            REFERENCED FROM CENTENNIAL APARTMENTS DEVELOPED CONDITIONS
 257             KM            CLV DS 4217
 258             BA   .0013
 259             LS       0      93
 260             UD   0.058
                 *
```

```
 261          KK    CP-4
 262          KM            REFERENCED FROM CENTENNIAL APARTMENTS DEVELOPED CONDITIONS
 263          KM            CLV DS 4217
 264          HC       4
              *
1                                        HEC-1 INPUT                                          PAGE  8

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

 265          KK    DOF5
 266          KM            REFERENCED FROM TROPICAL & 215 13-4178
 267          BA   .0227
 268          BF       0
 269          LS       0      95
 270          UD   0.060
              *

 271          KK     CD2
 272          HC       4
              *

 273          KK      R2
 274          KM            REFERENCED FROM TROPICAL & 215 13-4178
 275          RD     400   0.040   0.013             TRAP       5      20
              *

 276          KK    DOF7
 277          KM            REFERENCED FROM TROPICAL & 215 13-4178
 278          BA   .0014
 279          LS       0      98
 280          UD   0.050
              *

 281          KK     CD3
 282          HC       2
              *

 283          KK     CP4
 284          HC       2
              *

 285          KK   OND-3
 286          KM            REFERENCED FROM CONSTELLATION ESTATES 01-470
 287          KM            PB CARD IS CHANGED TO 3.05 TO CONCUR WITH HEC1 FROM THE
 288          KM           CONSTELLATION ESTATES BASINS
 289          PB    3.05
 290          BA   .0236
 291          LS       0      82
 292          UD   0.118
              *

 293          KK      C9
 294          HC       2
              *

 295          KK      C6
 296          KM            COMBINE FLOWS AT AZURE
 297          HC       2
              *
```

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

  298         KK   DOF5B
  299         KM            CREATED BASIN
  300         KM            PB CARD IS CHANGED TO 3.00 TO CONCUR WITH SUBJECT STUDY BASINS
  301         BA   .1558
  302         PB    3.00
  303         LS       0      75
  304         UD   0.221
              *

  305         KK   CPD5B
  306         KM            COMBINE FLOWS AT APPROACH TO SITE <<<<<<<<<<<<<<<<<<<<<FLO2D POINT
  307         KM            FLO2D MODEL ASSUMES THE HYDROGRAPH FOR THIS POINT APPROACHES THE
  308         KM             SITE FROM POINT C6 (WORST CASE)
  309         KO       1
  310         HC       2
              *

  311         KK    DOF8
  312         KM            REFERENCED FROM TROPICAL & 215 13-4178
  313         KM            PB CARD IS CHANGED TO 3.15 TO CONCUR WITH HEC1 FROM THE TROPICAL &
  314         KM            215 BASINS
  315         BA   .0023
  316         PB    3.15
  317         LS       0      98
  318         UD   0.056
              *

  319         KK    DON1
  320         KM            REFERENCED FROM TROPICAL & 215 13-4178
  321         BA   .0089
  322         LS       0    84.4
  323         UD   0.110
              *

  324         KK     CD5
  325         HC       2
              *

  326         KK   OND-4
  327         KM            REFERENCED FROM CONSTELLATION ESTATES 01-470
  328         KM            PB CARD IS CHANGED TO 3.05 TO CONCUR WITH HEC1 FROM THE
  329         KM            CONSTELLATION ESTATES BASINS
  330         BA   .0122
  331         PB    3.05
  332         LS       0      71
  333         UD   0.114
              *

  334         KK    PON1
  335         KM            REFERENCED FROM ALPINE RIDGE ESTATES 05-46472
  336         KM            PB CARD IS CHANGED TO 3.15 TO CONCUR WITH HEC1 FROM THE ALPINE
  337         KM            RIDGE  ESTATES BASINS
  338         BA   .0058
  339         PB    3.15
```

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

 340          LS       0    78.1
 341          UD   0.140
              *

 342          KK    PON2
 343          KM            REFERENCED FROM ALPINE RIDGE ESTATES 05-46472
 344          BA   .0074
 345          LS       0      75
 346          UD   0.150
              *

 347          KK     CP1
 348          HC       2
              *

 349          KK    RST3
 350          RD     150   0.005   0.016            DEEP    34.5       1
              *

 351          KK    PTS3
 352          KM            REFERENCED FROM ALPINE RIDGE ESTATES 05-46472
 353          BA   .0006
 354          LS       0      89
 355          UD   0.060
              *

 356          KK    PTS4
 357          KM            REFERENCED FROM ALPINE RIDGE ESTATES 05-46472
 358          BA   .0007
 359          LS       0      91
 360          UD   0.050
              *

 361          KK     CP3
 362          KM            COMBINE FLOWS AT BRIGHT ANGEL <<<<<<<<<<<<<<<<<<<<<FLO2D POINT
 363          KO       1
 364          HC       5
              *

 365          KK    DOF1
 366          KM            CREATED BASIN
 367          KM            PB CARD IS CHANGED TO 3.00 TO CONCUR WITH SUBJECT STUDY BASINS
 368          BA   .0008
 369          PB    3.00
 370          LS       0      70
 371          UD   0.078
              *

 372          KK     DN1
 373          KM            CREATED BASIN
 374          BA   .0018
 375          LS       0      75
 376          UD   0.131
              *
```


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

```
377          KK    CDN1
378          HC       2
             *

379          KK     AZR
380          KM             CREATED BASIN
381          BA   .0007
382          LS       0      98
383          UD   0.050
             *

384          KK    CPAZ
385          HC       2
             *

386          KK     DN4
387          KM             CREATED BASIN
388          BA   .0072
389          LS       0      75
390          UD   0.137
             *

391          KK     BAW
392          KM             CREATED BASIN
393          BA   .0007
394          LS       0      98
395          UD   0.050
             *

396          KK   DOF7B
397          KM             CREATED BASIN
398          BA   .0037
399          LS       0      75
400          UD   0.099
             *

401          KK    CPBA
402          HC       3
             *
403          ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

    17      DON1RR
                 .
                 .
    32           .      DON2RR
                 .           .
                 .           .
    37           .           .       RGNA3
                 .           .           .
                 .           .           .
    42           .           .           .       DOF4B
                 .           .           .           .
```

```
 47        CP6.................................
 50          RGNA2
 55       CP12............
 59          DON3RR
 64                 DON4RR
 69                        DON5RR
 74                                   RGNA1
 79            CP7.................................
 83                   DN2
 88                          DN3
 93                                     ELA
 98           CPEL.................................
100                  CNTL
105                         DOF6B
110                   CP8............
114     DUMMY......................
116          DON1R
124                 DON2R
129                         DON3R
134                                   DOF2R
```

```
140                                                  LNCHP
                                                        .
145                                                     .          ALPN
                                                        .            .
150                C5.......................................................
                    .
                    .
152                 .       OND-1
                    .          .
                    .          .
160                C6N............
                    .
                    .
162                 .       ONB8
                    .          .
                    .          .
168                 .          .        ONB9
                    .          .          .
                    .          .          .
174                 .       CP-1............
                    .          .
                    .          .
178                 .          .        DOF4
                    .          .          V
                    .          .          V
184                 .          .         R1
                    .          .          .
                    .          .          .
187                 .          .          .        DOF6
                    .          .          .          .
                    .          .          .          .
192                 .        CD1........................
                    .          .
                    .          .
194                 .          .        DOF1
                    .          .          .
                    .          .          .
199                 .          .          .        ONB1
                    .          .          .          .
                    .          .          .          .
205                 .          .          .          .        ONB2
                    .          .          .          .          .
                    .          .          .          .          .
211                 .          .        CP-2........................
                    .          .          .
                    .          .          .
215                 .          .          .        DOF2
                    .          .          .          .
                    .          .          .          .
221                 .          .          .          .        ONB4A
                    .          .          .          .          .
                    .          .          .          .          .
227                 .          .          .          .          .        ONB3
                    .          .          .          .          .          .
                    .          .          .          .          .          .
233                 .          .          .        CP-3........................
                    .          .          .          .
```

```
237                                                  DOF3
                                                       .
243                                                    .        ONB4B
                                                       .          .
249                                                    .          .        ONB5
                                                       .          .          .
255                                                    .          .          .        ONB6
                                                       .          .          .          .
261                                                    .          .          .          .
                                                       CP-4.......................................
                                                       .
265                                                    .        DOF5
                                                       .          .
                                                       .          .
271                                          CD2.......................................
                                             V
                                             V
273                                          R2
                                             .
                                             .
276                                          .        DOF7
                                             .          .
                                             .          .
281                                          CD3............
                                             .
                                             .
283                                   CP4............
                                      .
                                      .
285                                   .       OND-3
                                      .         .
                                      .         .
293                                   C9............
                                      .
                                      .
295                            C6............
                               .
                               .
298                            .       DOF5B
                               .         .
                               .         .
305                      CPD5B............
                               .
                               .
311                            .       DOF8
                               .         .
                               .         .
319                            .       DON1
                               .         .
                               .         .
324                            .       CD5............
                               .         .
                               .         .
326                            .       OND-4
                               .         .
```

```
334                                  PON1
                                       .
342                                    .        PON2
                                       .          .
347                                    .        CP1............
                                       .          V
                                       .          V
349                                    .        RST3
                                       .          .
351                                    .          .        PTS3
                                       .          .          .
356                                    .          .          .        PTS4
                                       .          .          .          .
361                          CP3.......................................
                                       .
365                                    .      DOF1
                                       .        .
372                                    .        .        DN1
                                       .        .          .
377                                    .      CDN1............
                                       .        .
379                                    .        .        AZR
                                       .        .          .
384                                    .      CPAZ............
                                       .        .
386                                    .        .        DN4
                                       .        .          .
391                                    .        .          .        BAW
                                       .        .          .          .
396                                    .        .          .          .        DOF7B
                                       .        .          .          .          .
401                                    .        .        CPBA........................
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *              JUN   1998               *
 *           VERSION 4.1                 *
 *                                       *
 *  RUN DATE   30JUN15  TIME  20:34:59   *
 *                                       *
 *****************************************
```

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

CUMULATIVE AREA = .04 SQ MI

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 .55	RATIO 2 1.00
HYDROGRAPH AT +	DON1RR	.01	1	FLOW	2.	7.
				TIME	3.58	3.58
HYDROGRAPH AT +	DON2RR	.01	1	FLOW	2.	8.
				TIME	3.58	3.58
HYDROGRAPH AT +	RGNA3	.00	1	FLOW	2.	4.
				TIME	3.50	3.50
HYDROGRAPH AT +	DOF4B	.01	1	FLOW	2.	9.
				TIME	3.58	3.58
4 COMBINED AT +	CP6	.03	1	FLOW	8.	27.
				TIME	3.58	3.58
HYDROGRAPH AT +	RGNA2	.00	1	FLOW	2.	4.
				TIME	3.50	3.50
2 COMBINED AT +	CP12	.03	1	FLOW	10.	31.
				TIME	3.50	3.50
HYDROGRAPH AT +	DON3RR	.01	1	FLOW	3.	13.
				TIME	3.58	3.58
HYDROGRAPH AT +	DON4RR	.00	1	FLOW	0.	2.
				TIME	3.58	3.58
HYDROGRAPH AT +	DON5RR	.01	1	FLOW	3.	12.
				TIME	3.58	3.58
HYDROGRAPH AT +	RGNA1	.00	1	FLOW	2.	4.
				TIME	3.50	3.50
4 COMBINED AT +	CP7	.03	1	FLOW	8.	30.

```
                                        TIME          3.58      3.58

 HYDROGRAPH AT
+                    DN2       .00     1  FLOW          0.        0.
                                        TIME          3.50      3.50

 HYDROGRAPH AT
+                    DN3       .00     1  FLOW          1.        4.
                                        TIME          3.58      3.58

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

  4 COMBINED AT
+                   CPEL       .04     1  FLOW         10.       37.
                                        TIME          3.58      3.58

 HYDROGRAPH AT
+                   CNTL       .00     1  FLOW          3.        6.
                                        TIME          3.50      3.50

 HYDROGRAPH AT
+                  DOF6B       .02     1  FLOW          3.       13.
                                        TIME          3.67      3.58

  2 COMBINED AT
+                    CP8       .02     1  FLOW          5.       17.
                                        TIME          3.58      3.58

  3 COMBINED AT
+                  DUMMY       .08     1  FLOW         24.       83.
                                        TIME          3.58      3.58

 HYDROGRAPH AT
+                  DON1R       .00     1  FLOW          2.        6.
                                        TIME          3.50      3.50

 HYDROGRAPH AT
+                  DON2R       .00     1  FLOW          3.        9.
                                        TIME          3.50      3.50

 HYDROGRAPH AT
+                  DON3R       .00     1  FLOW          2.        5.
                                        TIME          3.58      3.58

 HYDROGRAPH AT
+                  DOF2R       .01     1  FLOW          5.       13.
                                        TIME          3.50      3.50

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

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

  6 COMBINED AT
+                     C5       .02     1  FLOW         16.       41.
```

				TIME	3.50	3.50
HYDROGRAPH AT						
+	OND-1	.01	1	FLOW	2.	11.
				TIME	3.58	3.58
2 COMBINED AT						
+	C6N	.04	1	FLOW	18.	51.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	ONB8	.00	1	FLOW	2.	5.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	ONB9	.00	1	FLOW	2.	4.
				TIME	3.50	3.50
2 COMBINED AT						
+	CP-1	.00	1	FLOW	4.	9.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DOF4	.02	1	FLOW	21.	42.
				TIME	3.50	3.50
ROUTED TO						
+	R1	.02	1	FLOW	20.	41.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DOF6	.01	1	FLOW	7.	17.
				TIME	3.50	3.50
3 COMBINED AT						
+	CD1	.03	1	FLOW	32.	67.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DOF1	.01	1	FLOW	14.	31.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	ONB1	.00	1	FLOW	3.	6.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	ONB2	.01	1	FLOW	5.	11.
				TIME	3.50	3.50
3 COMBINED AT						
+	CP-2	.02	1	FLOW	22.	48.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DOF2	.03	1	FLOW	26.	59.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	ONB4A	.00	1	FLOW	1.	1.

```
                                        TIME          3.50      3.50

 HYDROGRAPH AT
+                   ONB3      .00     1  FLOW           4.        9.
                                         TIME          3.50      3.50

  3 COMBINED AT
+                   CP-3      .04     1  FLOW          31.       69.
                                         TIME          3.58      3.58

 HYDROGRAPH AT
+                   DOF3      .06     1  FLOW          44.       99.
                                         TIME          3.58      3.58

 HYDROGRAPH AT
+                  ONB4B      .00     1  FLOW           0.        1.
                                         TIME          3.50      3.50

 HYDROGRAPH AT
+                   ONB5      .00     1  FLOW           1.        3.
                                         TIME          3.50      3.50

 HYDROGRAPH AT
+                   ONB6      .00     1  FLOW           1.        3.
                                         TIME          3.50      3.50

  4 COMBINED AT
+                   CP-4      .06     1  FLOW          46.      103.
                                         TIME          3.58      3.50

 HYDROGRAPH AT
+                   DOF5      .02     1  FLOW          27.       54.
                                         TIME          3.50      3.50

  4 COMBINED AT
+                    CD2      .14     1  FLOW         123.      273.
                                         TIME          3.50      3.50

 ROUTED TO
+                     R2      .14     1  FLOW         120.      268.
                                         TIME          3.50      3.50

 HYDROGRAPH AT
+                   DOF7      .00     1  FLOW           2.        4.
                                         TIME          3.50      3.50

  2 COMBINED AT
+                    CD3      .14     1  FLOW         122.      272.
                                         TIME          3.50      3.50

  2 COMBINED AT
+                    CP4      .18     1  FLOW         154.      339.
                                         TIME          3.50      3.50

 HYDROGRAPH AT
+                  OND-3      .02     1  FLOW          10.       30.
                                         TIME          3.58      3.58

  2 COMBINED AT
+                     C9      .20     1  FLOW         162.      367.
```

				TIME	3.50	3.50
2 COMBINED AT						
+	C6	.24	1	FLOW	180.	418.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DOF5B	.16	1	FLOW	23.	111.
				TIME	3.75	3.67
2 COMBINED AT						
+	CPD5B	.39	1	FLOW	189.	489.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DOF8	.00	1	FLOW	3.	6.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DON1	.01	1	FLOW	5.	13.
				TIME	3.58	3.58
2 COMBINED AT						
+	CD5	.01	1	FLOW	8.	19.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	OND-4	.01	1	FLOW	1.	9.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	PON1	.01	1	FLOW	2.	6.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	PON2	.01	1	FLOW	1.	7.
				TIME	3.58	3.58
2 COMBINED AT						
+	CP1	.01	1	FLOW	3.	13.
				TIME	3.58	3.58
ROUTED TO						
+	RST3	.01	1	FLOW	3.	13.
				TIME	3.67	3.58
HYDROGRAPH AT						
+	PTS3	.00	1	FLOW	1.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	PTS4	.00	1	FLOW	1.	2.
				TIME	3.50	3.50
5 COMBINED AT						
+	CP3	.04	1	FLOW	12.	40.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	DOF1	.00	1	FLOW	0.	1.

```
+                    DN1        .00     1   FLOW          0.       2.
                                            TIME        3.58     3.58
  2 COMBINED AT
+                    CDN1       .00     1   FLOW          0.       2.
                                            TIME        3.58     3.58
  HYDROGRAPH AT
+                    AZR        .00     1   FLOW          1.       2.
                                            TIME        3.50     3.50
  2 COMBINED AT
+                    CPAZ       .00     1   FLOW          1.       4.
                                            TIME        3.50     3.50
  HYDROGRAPH AT
+                    DN4        .01     1   FLOW          1.       6.
                                            TIME        3.58     3.58
  HYDROGRAPH AT
+                    BAW        .00     1   FLOW          1.       2.
                                            TIME        3.50     3.50
  HYDROGRAPH AT
+                    DOF7B      .00     1   FLOW          1.       3.
                                            TIME        3.58     3.58
  3 COMBINED AT
+                    CPBA       .01     1   FLOW          2.      10.
1                                           TIME        3.58     3.58
```

CPAZ algebraically adds FTD1 (173 cfs) along Azure Dr.

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

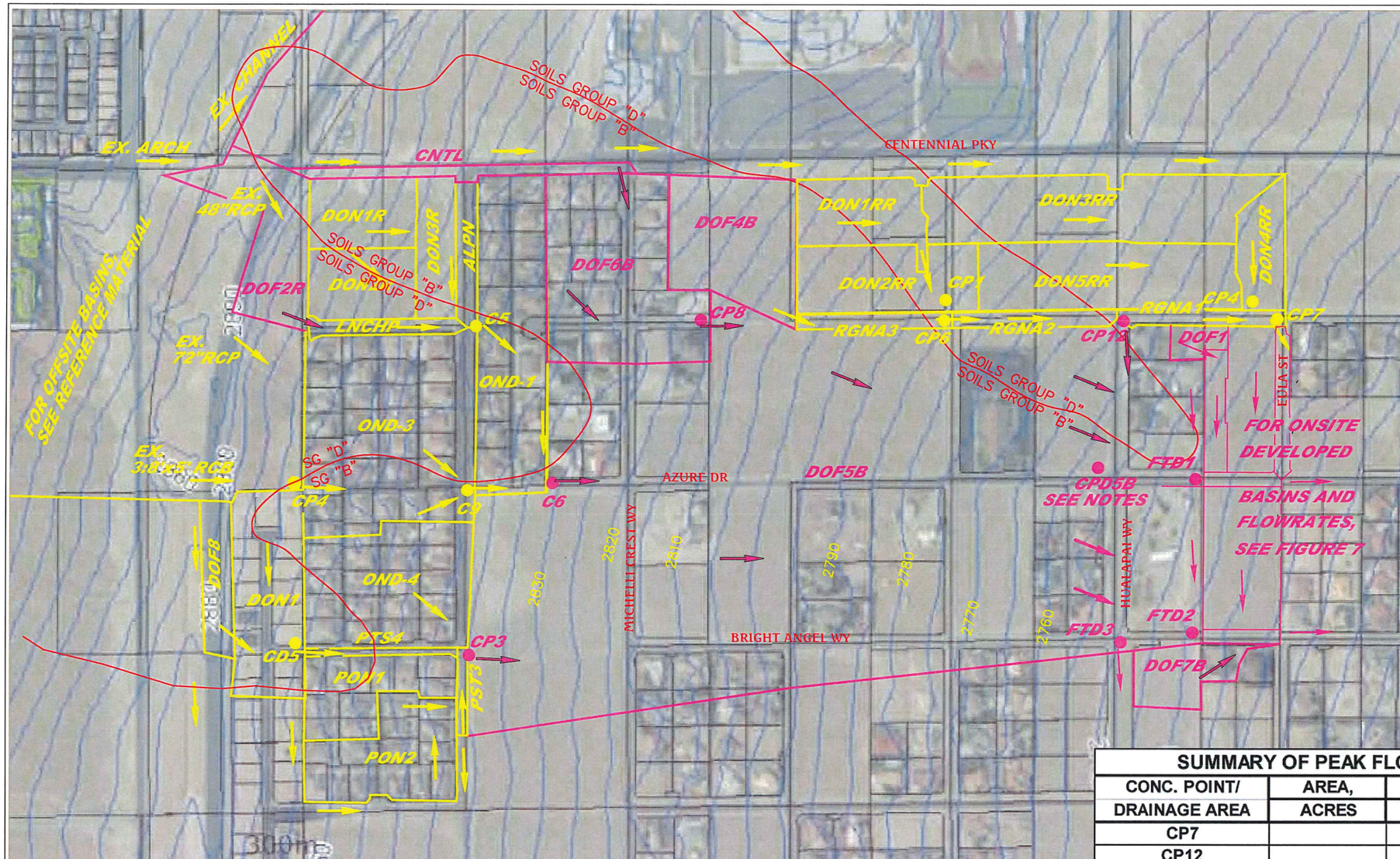
ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	INTERPOLATED TO COMPUTATION INTERVAL DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)
FOR PLAN = 1 RATIO= .55									
R1	MANE	.46	21.05	210.65	1.18	5.00	20.42	210.00	1.18

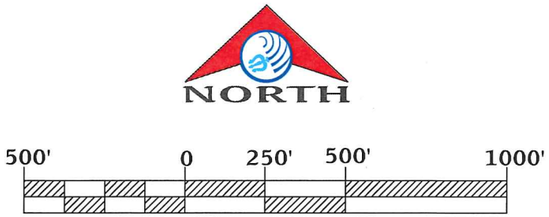
CONTINUITY SUMMARY (AC-FT) - INFLOW= .1112E+01 EXCESS= .0000E+00 OUTFLOW= .1113E+01 BASIN STORAGE= .1727E-09 PERCENT ERROR= -.1

FOR PLAN = 1 RATIO= 1.00									
R1	MANE	.54	41.55	210.37	2.50	5.00	41.00	210.00	2.50

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2358E+01 EXCESS= .0000E+00 OUTFLOW= .2359E+01 BASIN STORAGE= .1533E-09 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
R2	MANE	.51	122.52	210.78	.95	5.00	120.15	210.00	.95





1 INCH = 500 FEET
CONTOUR INTERVAL = 5 FEET

DRAINAGE LEGEND	
XT32	BASIN IDENTIFICATION
———	BASIN BOUNDARY
•CPT4	CONCENTRATION POINT
→	FLOW PATH

SUMMARY OF PEAK FLOW RATES				
CONC. POINT/	AREA,	PEAK FLOW, CFS		
DRAINAGE AREA	ACRES	10-YR	100-YR	NOTES
CP7		8	30	
CP12		10	31	
CP8		5	17	
C6		180	418	
DOF5B	99.74	23	111	
CPD5B		189	489	
CP3		12	40	
FTD1		60	173	3
FTD2		51	215	3
FTD3		31	81	3,6
DOF7B	2.38	1	3	
DOF1	0.52	0	1	
6/30/2015				

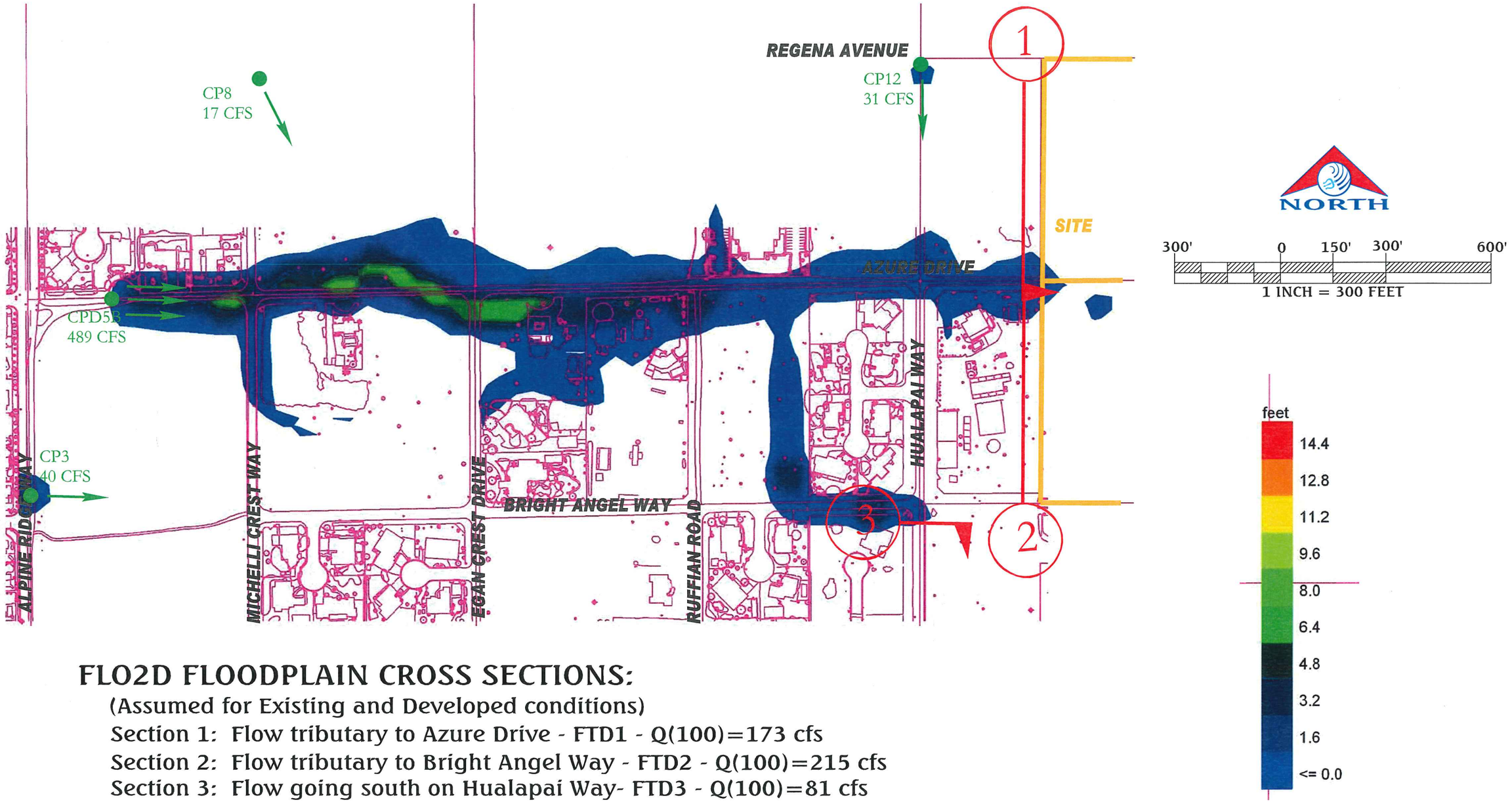
Notes:
1. All basins shown in yellow are referenced from research material, included in the HEC1 analysis, but not listed in the flow summary table. Magenta basins and concentration points are newly created and all but the onsite basins are listed in the summary table on this figure.
2. Existing and developed conditions in the offsite watershed resulted in nearly identical runoff flow quantities (within 1% of each other). A Flo2D analysis was prepared using the developed to determine the peak flow rates which impact the subject site from the west; since the peak hydrographs were so similar, a Flo2D analysis was not performed for existing conditions.
3. Hydrographs at FTD1, FTD2, and FTD3 were generated by the Flo2D analysis.
4. Hydrograph from point FTD1 is added directly to the peak at this point60/173+2/8=62/181..
5. Hydrograph from point FTD2 is added directly to the peak at this point 51/215+3/1=51/226.
6. Flow at this point FTD3 exits the watershed flowing south on Hualapai Way.
7. For developed onsite basins, see Figure 7.

FIGURE 4

Technical Drainage Study for Azure & Eula

DEVELOPED CONDITIONS DRAINAGE BASINS

Triton Engineering



FLO2D FLOODPLAIN CROSS SECTIONS:

(Assumed for Existing and Developed conditions)

Section 1: Flow tributary to Azure Drive - FTD1 - Q(100)=173 cfs

Section 2: Flow tributary to Bright Angel Way - FTD2 - Q(100)=215 cfs

Section 3: Flow going south on Hualapai Way- FTD3 - Q(100)=81 cfs

FLO2D HYDROGRAPH INPUT LOCATIONS:

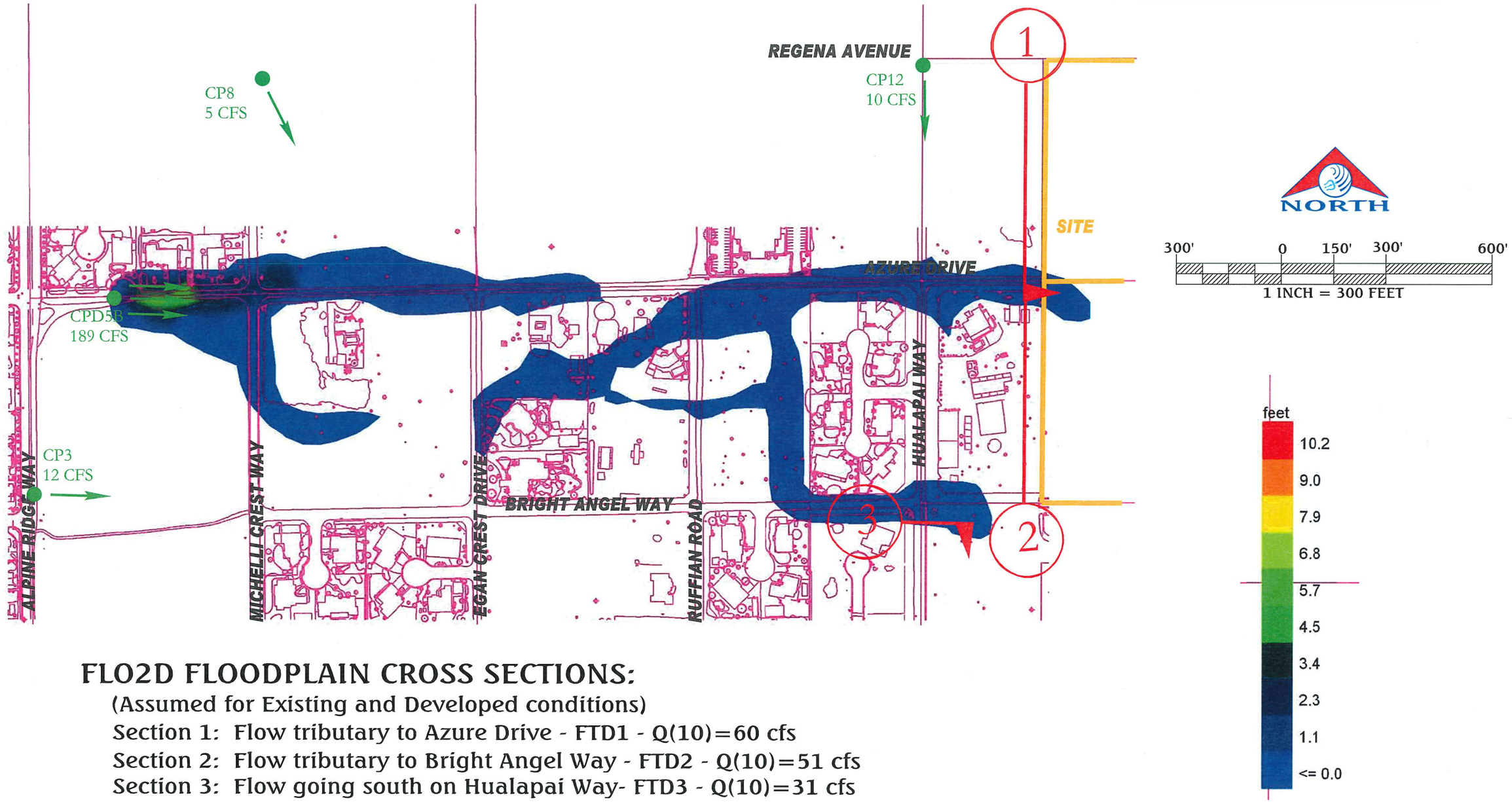
LABELED AS A GREEN DOT

FIGURE 5

Technical Drainage Study for Azure & Eula

FLO2D MAXIMUM FLOW DEPTH PLOT - 100-YR, 6-HR STORM

Triton Engineering



FLO2D FLOODPLAIN CROSS SECTIONS:

(Assumed for Existing and Developed conditions)

Section 1: Flow tributary to Azure Drive - FTD1 - Q(10)=60 cfs

Section 2: Flow tributary to Bright Angel Way - FTD2 - Q(10)=51 cfs

Section 3: Flow going south on Hualapai Way- FTD3 - Q(10)=31 cfs

FLO2D HYDROGRAPH INPUT LOCATIONS:

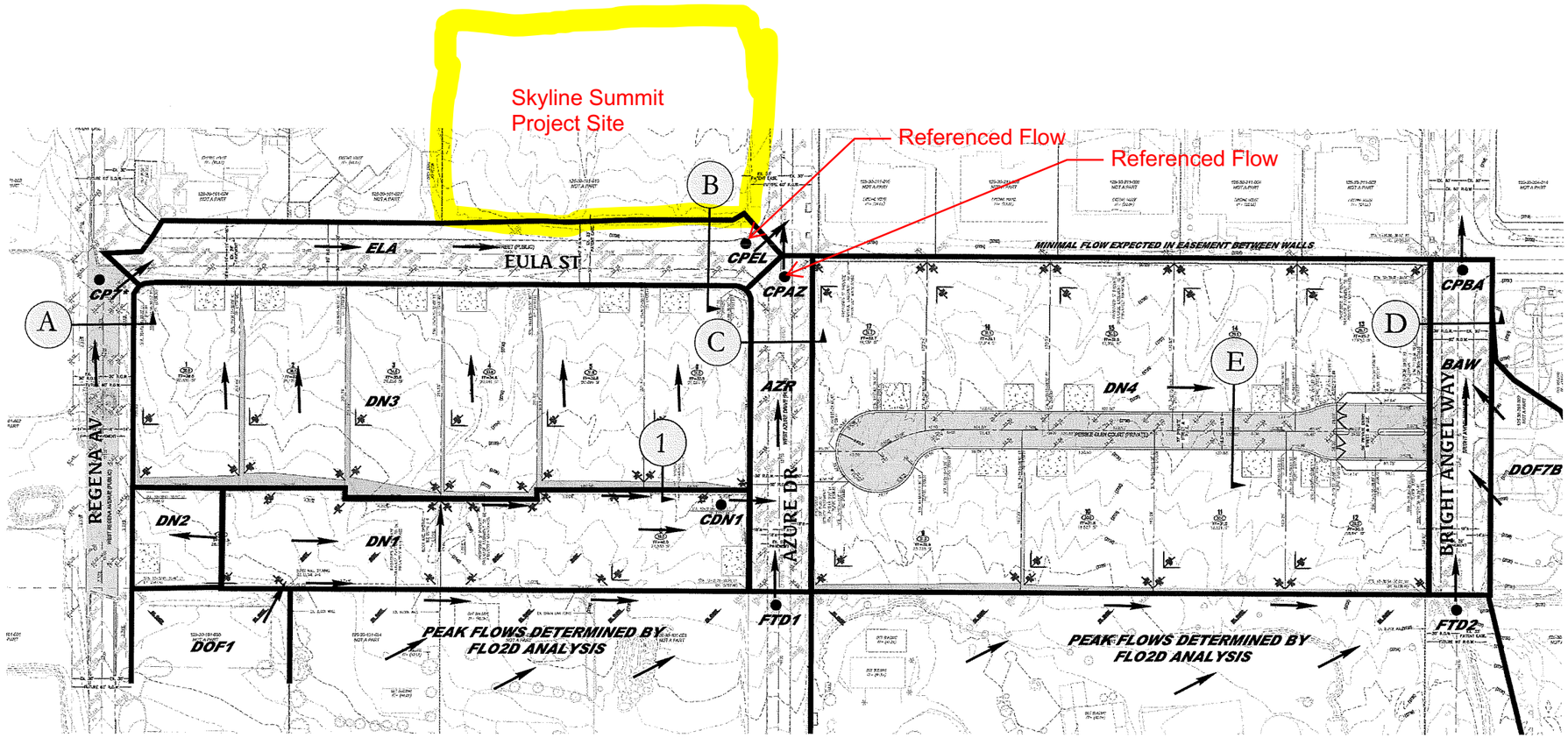
LABELED AS A GREEN DOT

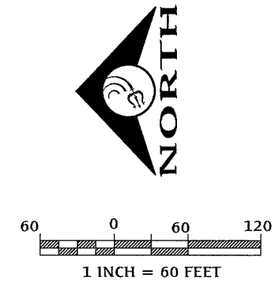
FIGURE 6

Technical Drainage Study for Azure & Eula

FLO2D MAXIMUM FLOW DEPTH PLOT - 10-YR, 6-HR STORM

Triton Engineering





DRAINAGE LEGEND	
XT32	BASIN IDENTIFICATION
	BASIN BOUNDARY
CPT4	CONCENTRATION POINT
→	FLOW PATH
(B)	HYDRAULIC X –SECTION

NOTE: A. OFFSITE IMPACTS WERE DETERMINED BY FLO2D ANALYSIS; SEE FIGURES 3 THROUGH 6.
B. FOR EXTENTS OF OFFSITE DRAINAGE AREAS SEE FIGURE 4.
C. HYDROLOGIC SOILS GROUPS ARE NOT MAPPED SINCE ALL AREAS ARE WITHIN HYDROLOGIC SOILS GROUP "B".

NORMAL DEPTH FLOW CALCULATIONS

HYDRAULIC SECTION	SLOPE, %	Q_{10} / Q_{100} CFS	D_{10} / D_{100}, FEET	V_{10} / V_{100}, FPS	V_{10} * D_{10} / V_{100} * D_{100}
A - Regena Ave*- 60-foot full improvements developed	2.49	9 / 30	0.36 / 0.49	3.5 / 4.6	1.3 / 2.3
B - Eula St - 60-foot rural improvements developed	0.49	10 / 37	0.51 / 0.78	1.4 / 2.0	0.7 / 1.6
C - Azure Dr - 60-foot rurual improvements developed	3.61	61 / 177	0.66 / 0.91	4.7 / 6.7	3.1 / 6.1
D - Bright Angel Way - 60-foot rural improvements developed	2.92	61 / 225	0.69 / 1.02	4.4 / 6.9	3.0 / 7.0
E - Onsite Street - 37' B/C L-curb	0.50	1 / 6	0.21 / 0.35	1.7 / 2.3	0.4 / 0.8

*Flow depth referenced from Technical Drainage Study for Centennial / Hualapai by CVL Consultants, February 2007, H T E #06-36202

6/30/2015

NORMAL DEPTH CALCULATIONS DEVELOPED CONDITIONS

HYDRAULIC SECTION LABEL	DESCRIPTION	SLOPE, PERCENT	Q_{100} CFS	D_{100} NORMAL FEET	V_{100} NORMAL FEET/SEC	Vel Head FEET
1	5-FT Private Drainage Esmt	1.00	2	0.53	2.4	0.10

SUMMARY OF PEAK FLOW RATES

CONC. POINT/ DRAINAGE AREA	AREA, ACRES	PEAK FLOW, CFS 10-YR	PEAK FLOW, CFS 100-YR	NOTES
CP7		8	30	
FTD1		60	173	1
FTD2		51	215	1
DN1	1.15	<1	2	
DOF7B	2.38	1	3	
DN2	0.20	<1	<1	
DN3	2.86	1	4	
DN4	4.62	1	6	
BAW	0.46	1	2	
AZR	0.52	1	2	
CDN1		<1	2	
CPAZ		61	177	2
CPBA		61	225	
CPEL		10	37	

6/30/2015

1. Peak flow rate at this point was generated in the Flo2D analysis.
2. Peak flow rate from point FTD1 was added directly to the peak at this point (60/173+1/4=61/177).
3. Peak flow rate from point FTD2 was added directly to the peak at this point (51/215+2/10=61/225).

CPAZ + CPEL are referenced along Azure Drive and combines w/ onsite flows

FIGURE 7

Technical Drainage Study for Azure & Eula

DEVELOPED CONDITIONS ONSITE DRAINAGE BASINS

Triton Engineering

APPENDIX F

Improvement Plans

Call before you Dig
Avoid cutting underground utility lines. It's costly.
Call 811
or
1-800-227-2600
CLARK COUNTY TRAFFIC OPERATIONS
1-702-455-7544

AVOID HITTING UNDERGROUND TRAFFIC SIGNAL SYSTEMS AND STREET LIGHT SYSTEM CONDUITS. IT'S COSTLY.
Call before you do UnderGround
1-702-455-7511
CLARK COUNTY TRAFFIC OPERATIONS
AND
1-702-432-5300
LAS VEGAS AREA COMPUTERIZED TRAFFIC SYSTEM

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

IMPROVEMENT PLANS
FOR
SKYLINE SUMMIT

A SINGLE FAMILY RESIDENTIAL DEVELOPMENT

APN 125-30-101-010

LEGAL DESCRIPTION

THE SOUTH HALF (S 1/2) OF WEST HALF (W 1/2) OF THE SOUTHEAST QUARTER (SE 1/4) OF THE NORTHWEST QUARTER (NW 1/4) SECTION 30, TOWNSHIP 19 SOUTH, RANGE 60 EAST, M.D.M., CLARK COUNTY, NEVADA.

BENCHMARK

CITY OF LAS VEGAS BENCHMARK "7LV90 30N6", BEING A RIVET AND ROUND PLATE IN CABLE TV PAD @ NE CORNER OF AZURE DR. & GRAND CANYON DR.

ELEVATION: 2671.33 (US SURVEY FEET)
814.22 (METERS)

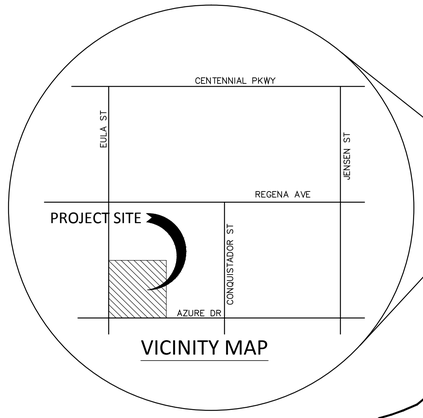
BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).

BASIS OF BEARINGS

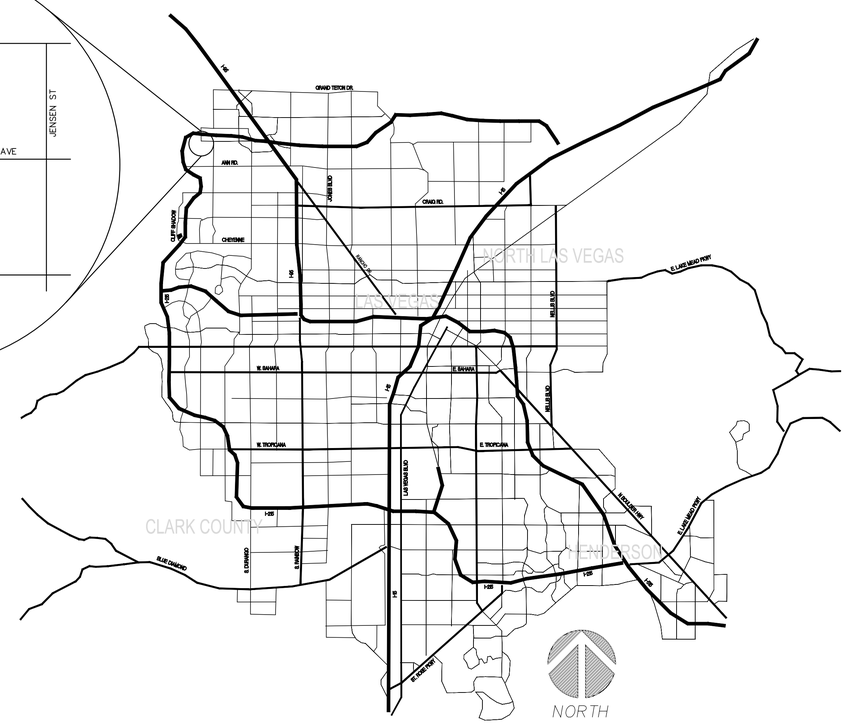
SOUTH 89°45'27" EAST, BEING THE BEARING OF THE CENTERLINE OF AZURE DRIVE AND THE SOUTH LINE OF THE NORTHWEST QUARTER (NW 1/4) OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 30, TOWNSHIP 19 SOUTH, RANGE 60 EAST, M.D.M., CLARK COUNTY, NEVADA, AS SHOWN ON FILE IN FILE 107 OF PARCEL MAPS, AT PAGE 99, OFFICIAL RECORDS OF CLARK COUNTY, NEVADA.

FLOOD ZONE NOTE:

ACCORDING TO THE FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) FLOOD INSURANCE RATE MAP (FIRM), COMMUNITY PANEL 1745 OF 4090, MAP NUMBER 32003C1745F, EFFECTIVE NOVEMBER 16, 2011, SITE IS LOCATED WITHIN ZONE "X". ZONE "X" IS DESCRIBED AS AN AREA OUTSIDE THE 0.2% ANNUAL CHANCE FLOOD PLAIN.



VICINITY MAP



VICINITY MAP

OWNER / DEVELOPER

PINNACLE HOMES
9225 W. FLAMINGO RD., STE 101
LAS VEGAS, NV 89148
C/O FRANK WYATT
PH (702) 228-0720, EXT. 23

ENGINEER

PER4MANCE ENGINEERING, LLC.
9345 W. SUNSET RD., STE. 101
LAS VEGAS, NV 89148
PH (702) 569-9770

SHEET INDEX

SHEET NUMBER	SHEET DESCRIPTION	SHEET TITLE
1	C-1	COVER SHEET
2	N-1	GENERAL NOTES AND QUANTITIES
3	GP-1	GRADING PLAN
4	DT-1	DETAIL SHEET
5	UT-1	UTILITY PLAN
6	T-1	TRAFFIC CONTROL/STRIPING PLAN
7	PP-1	PLAN AND PROFILE - EULA ST.
8	PP-2	PLAN AND PROFILE - AZURE DR.
9	PP-3	PLAN AND PROFILE - SKYLINE SUMMIT CIRCLE

APPROVALS

CITY OF LAS VEGAS

"APPROVAL OF THESE PLANS BY THE CITY ENGINEER IS LIMITED TO THOSE IMPROVEMENTS CONSTRUCTED IN THE DEDICATED RIGHTS-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 STANDARDS" THE ENGINEER SHALL RESOLVE ANY DEVIATION OTHER THAN THOSE LISTED IN "DEVIATION FROM STANDARDS" IN FAVOR OF THE SUMMERLIN IMPROVEMENT STANDARDS AND SPECIFICATIONS CLARK COUNTY AREA NEVADA".

DAVID BOWERS, P.E. #16736, PTOE — DATE
CITY ENGINEER
CITY OF LAS VEGAS, NEVADA

CHRIS KNIGHT, DIRECTOR BUILDING AND SAFETY DEPARTMENT — DATE
CITY OF LAS VEGAS, NEVADA
THIS PLAN MEETS THE APPLICABLE STANDARDS OF THE PLANNING AND DEVELOPMENT DEPARTMENT.

LAS VEGAS FIRE AND RESCUE — 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.

NV ENERGY — DATE

"THE AFFIXED CENTRAL TELEPHONE COMPANY DBA 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."

CENTRAL TELEPHONE COMPANY DBA CENTURYLINK — DATE

SOUTHWEST GAS CORPORATION — DATE

COX COMMUNICATIONS LAS VEGAS, INC. — DATE

APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER
DATE: _____ PROJECT NO: XXXXXX
LVVWD APPROVED FIRE FLOW X,XXX GPM AT 20 PSI RESIDUAL
(SHEETS 1, 2, 5, 7-9)

NOTE:

EXISTING UTILITY LOCATIONS SHOWN HEREIN ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT VERTICAL AND HORIZONTAL LOCATION OF ALL EXISTING UNDERGROUND UTILITIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN HEREON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR UTILITIES NOT SHOWN IN THEIR PROPER LOCATIONS. CALL BEFORE YOU DIG: (800) 227-2600.

NOTE:

APPROVAL OF THESE PLANS BY CITY OF LAS VEGAS IS LIMITED TO THOSE IMPROVEMENTS CONSTRUCTED IN THE DEDICATED RIGHTS-OF-WAY AND/OR DEDICATED EASEMENTS. THIS APROVAL DOES NOT AUTHORIZE THE CONSTRUCTION OF ANY IMPROVEMENTS THAT DEVIATE FROM ADOPTED STANDARDS AND/OR SPECIFICATIONS EXCEPT THOSE SPECIFICALLY IDENTIFIED AS "DEVIATIONS FROM STANDARDS". THE ENGINEER SHALL RESOLVE ANY DEVIATIONS OTHER THAN THOSE LISTED IN "DEVIATIONS FROM STANDARDS" IN FAVOR OF THE UNIFORM STANDARDS DRAWINGS AND SPECIFICATIONS CLARK COUNTY AREA NEVADA.", (CURRENT EDITIONS).

NOTE:

THE ENGINEER SHOULD CONTACT THE NEVADA DIVISION OF ENVIRONMENTAL PROTECTION (NDEP) TO OBTAIN A NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT PRIOR TO CONSTRUCTION. ALL CONSTRUCTION PROJECTS ONE ACRE OR LARGER MUST APPLY FOR THE PERMIT THROUGH THE NDEP. ALL QUESTIONS REGARDING THE NPDES PERMIT REQUIREMENTS SHOULD BE DIRECTED TO THE NDEP (775) 687-9429

FIRE DEPARTMENT APPROVAL:
APPROVAL BY THE FIRE DEPARTMENT HAVING JURISDICTION IS REQUIRED PRIOR TO OBTAINING FINAL APPROVAL FROM THE LVVWD.

UTILITY DATA

POWER:	NV ENERGY
WATER:	LAS VEGAS VALLEY WATER DISTRICT
SEWER:	CITY OF LAS VEGAS
GAS:	SOUTHWEST GAS CO
TELEPHONE:	CENTRAL TELEPHONE COMPANY DBA CENTURYLINK
DISPOSAL:	REPUBLIC SERVICES

NO.	REVISION	BY	DATE	APP.	DATE
6					
5					
4					
3					
2					
1					

SKYLINE SUMMIT
CITY OF LAS VEGAS NEVADA
SHEET: COVER SHEET

PER4MANCE ENGINEERING
9345 W. SUNSET RD. STE 101, LAS VEGAS, NEVADA 89148
TEL: (702)569-9770 EMAIL:RAYF@PER4MANCELV.COM

DEVELOPER:
PINNACLE HOMES

SEAL
PROFESSIONAL ENGINEER - STATE OF NEVADA
RAY F. FREDERICKSEN
Exp. 06/30/17
CIVIL
No. 17471

DESIGNED BY: RFF
DRAWN BY: RFF
CHECKED BY: RFF
SCALE: 1"=30'
PROJECT DATE: FEBRUARY 1, 2016

SHEET C-1
1 OF 9

AGENCY DWG. NO. CLV#16-XXXXX

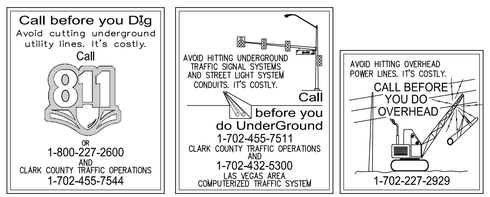
F:\Projects\2016 - 2.5 oz Azure - Pinnacle\MP\01-CV.dwg roy Wed, 01 Feb 2017 - 10:28am

CITY OF LAS VEGAS GENERAL NOTES

1. ALL CONSTRUCTION AND MATERIALS SHALL BE IN ACCORDANCE WITH THE "UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION OFF-SITE IMPROVEMENTS, CLARK COUNTY AREA NEVADA" , LATEST REVISED EDITION; THE "SUMMERLIN IMPROVEMENTS STANDARDS" FOR WORK IN THE SUMMERLIN AREA; AND OTHER APPLICABLE APPROVED STANDARDS ISSUED BY THE CONTROLLING AGENCY; THE UNIFORM BUILDING CODE; AND ALL LOCAL CITY CODES AND ORDINANCES APPLICABLE, EXCEPT AS NOTED ON THIS SHEET AS "DEVIATIONS FROM STANDARDS".
2. THE EXISTENCE AND LOCATION OF ANY OVERHEAD OR UNDERGROUND UTILITY LINES, PIPES, OR STRUCTURES SHOWN ON THESE PLANS ARE OBTAINED BY A RESEARCH OF THE AVAILABLE RECORDS. EXISTING UTILITIES AS SHOWN FROM CLV PLANS LIBRARY ARE APPROXIMATE AND FOR RECORD PURPOSES. EXISTING UTILITIES ARE LOCATED ON PLANS ONLY FOR THE CONVENIENCE OF THE CONTRACTOR. EXISTING UTILITY SERVICE LATERALS MAY NOT BE SHOWN ON THE PLANS. THE CONTRACTOR SHALL, AT HIS OWN EXPENSE, LOCATE ALL UNDERGROUND AND OVERHEAD INTERFERENCE'S WHICH MAY AFFECT HIS OPERATION DURING CONSTRUCTION AND SHALL TAKE ALL NECESSARY PRECAUTIONS TO AVOID DAMAGE TO SAME. THE CONTRACTOR SHALL USE EXTREME CAUTION WHEN WORKING NEAR OVERHEAD UTILITIES SO AS TO SAFELY PROTECT ALL PERSONNEL AND EQUIPMENT, AND SHALL BE RESPONSIBLE FOR ALL COST AND LIABILITY IN CONNECTION THEREWITH.
3. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT EXISTING UTILITY LINES, STRUCTURES AND STREET IMPROVEMENTS WHICH ARE TO REMAIN IN PLACE, FROM DAMAGE, AND ALL SUCH IMPROVEMENTS OR STRUCTURES DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE REQUIRED OR REPLACED SATISFACTORY TO THE CITY ENGINEER AND OWNING UTILITY COMPANY AT THE EXPENSE OF THE CONTRACTOR.
4. ALL CONSTRUCTION SHALL BE SHOWN ON THESE PLANS, ANY REVISIONS SHALL HAVE THE PRIOR WRITTEN APPROVAL OF THE CITY ENGINEER.
5. TYPE V CEMENT SHALL BE USED IN ALL OFF-SITE CONCRETE WORK. CONCRETE TO BE 3000 P.S.I. MINIMUM @28 DAYS. MIX DESIGN TO BE APPROVED BY THE CITY ENGINEER, PRIOR TO THE USE ON THE PROJECT.
6. PERMITS ARE REQUIRED FOR ANY WORK IN THE PUBLIC RIGHT-OF-WAY. THE CONTRACTOR SHALL SECURE ALL PERMITS AND INSPECTIONS REQUIRED FOR THIS CONSTRUCTION.
7. EXPANSION JOINTS REQUIRED, MAXIMUM EVERY 150' IN EXTRUDED-TYPE CURB, PER SUMMERLIN IMPROVEMENT STANDARDS.
8. AC PAVEMENT TO BE ONE-HALF INCH (1/2") ABOVE LIP OF ALL GUTTERS AFTER COMPACTION, EXCEPT AT SIDEWALK RAMPS AND CROSS GUTTERS.
9. CURB AND GUTTER FOUND TO BE UNACCEPTABLE TO THE CITY OF LAS VEGAS SHALL BE REMOVED AND REPLACED PER CLARK COUNTY AREA UNIFORM STANDARD DRAWING 216.
10. SIDEWALK RAMPS SHALL BE CONSTRUCTED IN EACH QUADRANT OF AN INTERSECTION PER STANDARD SUMMERLIN DRAWINGS. EXACT LOCATION OF RAMPS MAY BE ADJUSTED IN THE FIELD BY A CITY INSPECTOR.
11. CONTRACTOR SHALL PROVIDE ALL NECESSARY HORIZONTAL AND VERTICAL TRANSITIONS BETWEEN NEW CONSTRUCTION AND EXISTING SURFACES TO PROVIDE FOR PROPER DRAINAGE AND FOR INGRESS AND EGRESS TO NEW CONSTRUCTION. THE EXTENT OF TRANSITIONS TO BE AS SHOWN ON PLANS.
12. ALL GRADING WORK SHALL CONFORM TO THE SOILS REPORT AS PREPARED BY TERRACON, PROJECT NO. 64965481, AND AS SHOWN ON THESE PLANS.
13. EXACT LOCATION OF ALL SAWCUT LINES MAY BE ADJUSTED OR DETERMINED IN THE FIELD BY A CITY OF LAS VEGAS ENGINEER IF LOCATION ON PLANS IS NOT CLEARLY SHOWN, OR EXISTING PAVEMENT CONDITION REQUIRES RELOCATIONS.
14. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONS NECESSARY TO PROTECT EXISTING PERMANENT SURVEY MONUMENTS. ANY MONUMENTS DISTURBED SHALL BE REPLACED AND ADJUSTED PER AVAILABLE RECORDS IN ACCORDANCE WITH N.R.S. NO. 625.550.
15. UTILITY COMPANY METER BOXES, MANHOLE LIDS, VALVE COVERS, ETC., SHALL BE LOCATED OUT OF DRIVEWAYS, DRIVEWAY APRONS, FLOWLINES, AND CROSS GUTTERS UNLESS WRITTEN APPROVAL IS GRANTED BY THE UTILITY COMPANY AND THE CITY ENGINEER.
16. WALL NOTES:
    ALL WALLS, NEW OR EXISTING, ARE ONLY SHOWN ON CIVIL PLANS FOR THE PURPOSE OF REVIEWING GRADING RELATIONSHIPS; FLOOD CONTROL AND SIGHT DISTANCE AT INTERSECTIONS. NEW WALLS REQUIRE A SEPERATE PERMIT AND INSPECTION BY THE BUILDING DEPARTMENT.
17. ASPHALT MIX DESIGN MUST BE SUBMITTED AND APPROVED BY THE CITY ENGINEER PRIOR TO THE PLACEMENT OF ASPHALT WITHIN CITY RIGHT-OF-WAY.
18. CONTRACTOR SHALL ADJUST ALL NEW AND EXISTING INLETS, VALVE BOXES, MANHOLE RIMS, AND SEWER CLEAN OUTS, ETC. TO FINISH GRADE AS APPLICABLE WHETHER OR NOT THEY ARE SHOWN ON THE PLANS.
19. MATERIALS, HANDLING AND PLACEMENT OF PORTLAND CEMENT CONCRETE SHALL BE IN ACCORDANCE WITH APPLICABLE SECTIONS OF NDOT OR THE CLARK COUNTY AREA SPECIFICATIONS (AS APPLICABLE) AND THE PLANS AND DETAILS SHOWN HEREON.
20. WHEN INSTALLING UNDERGROUND FACILITIES THAT REQUIRE UNDERGROUND LOCATING DEVICES SUCH AS MARKER BALLS, LOCATING RIBBON, ETC. THE CONTRACTOR SHALL SHALL PROVIDE WRITTEN DOCUMENTATION TO OFFSITE INSPECTION AND TESTING CERTIFYING THAT ALL DEVICES HAVE BEEN PLACED AND VERIFIED TO BE IN GOOD WORKING CONDITION PRIOR TO CONSTRUCTION OF ANY ROAD BASE.
21. SANITARY SEWER AND STORM DRAIN FINAL LOCATION MAP(S) SHALL BE PROVIDED TO THE OFFSITE INSPECTION AND TESTING SECTION PRIOR TO PROJECT ACCEPTANCE. THE MAP(S) SHALL INCLUDE THE HORIZONTAL AND VERTICAL (INVERT) LOCATION OF PUBLIC SEWER MANHOLES, STORM DRAIN MANHOLES, STORM DRAIN LATERALS AT THE CONNECTION TO THE STORM DRAIN MAIN AND AT THE CONNECTION TO A DROP INLET, AND THE CONNECTION OF SEWER SERVICE LATERALS TO THE SEWER MAIN AND WHERE, THE SEWER SERVICE LATERAL EXIT THE PUBLIC RIGHT OF WAY. THE LOCATION SHALL BE DESCRIBED BY STATE PLANE COORDINATES WHICH SHALL BE BASED ON THE "NEVADA COORDINATE SYSTEM OF 1983, EAST ZONE" AS DEFINED BY THE NEVADA REVISED STATUTES CHAPTER 327, AND TIED TO THE CITY OF LAS VEGAS VERTICAL CONTROL BENCHMARK NETWORK. COORDINATES MUST BE CERTIFIED BY A NEVADA PROFESSIONAL LAND SURVEYOR TO HAVE POSITIONAL CERTAINTIES OF +/- 0.1 METER (+/- 0.3 FEET) A SEPERATE ELECTRONIC COMMA DELINEATED FILE FOR THE SANITARY SEWER AND STORM DRAIN COORDIANTES SHALL ALSO ACCOMPANY THE SANITARY SEWER AND STROM DRAIN FINAL LOCATION MAP(S).
22. SANITARY SEWER SERVICE LATERALS REQUIRE THE INSTALLATION OF A MARKER BALL AT THE CONNECTION OF THE SEWER SERVICE LATERAL TO THE SEWER MAIN AND WHERE THE SEWER SERVICE LATERAL EXITS THE PUBLIC RIGHT OF WAY. STORM DRAIN LATERALS REQUIRE THE INSTALLATION OF A MARKER BALL AT THE CONNECTION OF THE STORM DRAIN LATERAL TO TEH STORM DRAIN MAIN AND WHERE THE STORM DRAIN LATERAL EXITS THE PUBLIC RIGHT OF WAY OR WHERE THE STORM DRAIN LATERAL CONNECTS TO A DROP INLET. THE MARKER BALL SHALL BE 3M 4" MARKER BALL 1404-XR OR APPROVED EQUAL.
23. CCTV VIDEO INSPECTION IS REQUIRED FOR ALL SEWER AND STORM DRAINS. CCTV VIDEO INSPECTIONS NEED TO BE PERFORMED PER THE DESIGN AND CONSTRUCTION STANDARDS FOR WASTEWATER COLLECTION SYSTEMS LATEST ADDITION.
24. A SEPERATE BORING PERMIT IS REQUIRED FOR ALL BORING ACTIVITIES.

CITY OF LAS VEGAS SEWER NOTES

1. ALL CONSTRUCTION AND MATERIALS SHALL BE IN ACCORDANCE WITH THE LATEST EDITION OF THE DESIGN AND CONSTRUCTION STANDARDS FOR WASTEWATER COLLECTION SYSTEMS AND THE UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS' CONSTRUCTION OFF-SITE IMPROVEMENTS, CLARK COUNTY AREA, NEVADA, AS AMENDED.
   IT WILL BE THE RESPONSIBILITY OF THE CONTRACTOR TO BE AWARE OF THE CONTENTS OF THE ABOVE SPECIFICATIONS.
2. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO PERFORM CONSTRUCTION AS PER PLANS. ANY ADDITIONS, DELETIONS, OR CHANGES SHALL FIRST MEET WITH THE APPROVAL OF THE CITY ENGINEER.
3. CHISEL "S" OR "G" IN CURBS WHERE SEWER OR GAS LATERALS PASS UNDER THE CURB.
4. POLYVINYL (PVC) SEWER PIPE SHALL MEET ASTM D-3034 SDR 35 SPECIFICATIONS, INSTALLED WITH SAND BEDDING AND BACKFILL OF TYPE II AGGREGATE BASE.
5. ALL MANHOLES PAVED IN STREETS EIGHTY (80') FOOT R/W AND LARGER SHALL HAVE CONCRETE COLLARS.
   STREETS LESS THAN EIGHTY (80') FOOT R/W WILL REQUIRE RETROFIT IF PAVING DOES NOT CONFORM TO CITY STANDARDS AT THE MANHOLE.
6. TEE SADDLES SHALL BE USED TO CONNECT SEWER LATERALS TO EXISTING MAIN LINES UP TO TWELVE INCH (12") DIAMETER. CONNECTIONS TO FIFTEEN INCH (15") OR LARGER MAINS SHALL REQUIRE SPECIAL PROCEDURES.
   IN LINE "Y" "S SHALL BE USED ON LINES TWELVE INCHES (12") OR ABOVE.
7. WATER MAINS SHALL BE PROTECTED IN ACCORDANCE WITH LVVWD STANDARDS WHENEVER A SEWER MAIN CROSSES OVER A WATER MAIN OR THE SEWER IS LESS THAN EIGHTEEN INCH (18") UNDER A WATER MAIN.
8. ALL CONTRACTORS INSTALLING SEWER MAINS THAT WILL BE UNDER THE JURISDICTION OF THE CITY OF LAS VEGAS MUST BE STATE OF NEVADA CLASS "A" CONTRACTORS.
9. THE CITY OF LAS VEGAS WILL NOT ACCEPT ANY SEWER MAINS WHICH HAVE A VERTICAL DEFLECTION OF MORE THAN ONE TENTH (0.1) OF A FOOT FROM THE APPROVED CONSTRUCTION PLANS AT ANY LOCATION. SEWER MAINS FOUND TO EXCEED THIS TOLERANCE WILL HAVE TO BE REPAIRED OR REMOVED OR REPLACED TO THE SATISFACTION OF THE CITY ENGINEER PRIOR TO ACCEPTANCE BY THE CITY OF LAS VEGAS.
10. INSTALLATION OF CURVED SEWER REQUIRES THE USE OF C-900 PVC PIPE WHICH ALLOWS FOR PIPE DEFLECTION AT THE JOINTS.



CITY OF LAS VEGAS GRADING NOTES

1. IN THE EVENT THAT ANY UNFORESEEN CONDITIONS NOT COVERED BY THESE NOTES ARE ENCOUNTERED DURING GRADING OPERATIONS, THE OWNER/ENGINEER SHALL BE IMMEDIATELY NOTIFIED FOR DIRECTION.
2. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO PERFORM ALL NECESSARY CUTS AND FILLS WITHIN THE LIMITS OF THIS PROJECT AND THE RELATED OFF-SITE WORK, SO AS TO GENERATE THE DESIRED SUBGRADE, FINISH GRADES AND SLOPES.
3. CONTRACTOR SHALL TAKE FULL RESPONSIBILITY FOR ALL EXCAVATION. ADEQUATE SHORING SHALL BE DESIGNED AND PROVIDED BY THE CONTRACTOR TO PREVENT UNDERMINING OF ANY ADJACENT FEATURES OR FACILITIES AND/OR CAVING OF THE EXCAVATION.
4. THE CONTRACTOR IS WARNED THAT AN EARTHWORK BALANCE WAS NOT NECESSARILY THE INTENT OF THIS PROJECT. ANY ADDITIONAL MATERIAL REQUIRED OR LEFTOVER MATERIAL FOLLOWING EARTHWORK OPERATIONS BECOMES THE RESPONSIBILITY OF THE CONTRACTOR.
5. THE GRADING CONTRACTOR IS RESPONSIBLE TO COORDINATE WITH THE OWNER TO PROVIDE FOR THE REQUIREMENTS OF THE PROJECT STORM WATER POLLUTION PREVENTION PLAN (SWPPP) AND ASSOCIATED PERMIT.
6. CONTRACTOR SHALL GRADE TO THE LINES AND ELEVATIONS SHOWN ON THE PLANS WITHIN THE FOLLOWING HORIZONTAL AND VERTICAL TOLERANCES AND DEGREES OF COMPACTION, IN THE AREAS INDICATED:

	HORIZONTAL	VERTICAL	COMPACTION
A. PAVEMENT AREA SUBGRADE	0.1'+	+0.0' TO -0.1'	SEE SOILS REPORT
B. ENGINEERED FILL	0.5'+	+0.1' TO -0.1'	SEE SOILS REPORT

   COMPACTION TESTING WILL BE PERFORMED BY THE OWNER OR HIS REPRESENTATIVE AND COPIES OF TEST RESULTS WILL BE PROVIDED TO THE CITY.
7. ALL CUT AND FILL SLOPES SHALL BE PROTECTED UNTIL EFFECTIVE EROSION CONTROL HAS BEEN ESTABLISHED.
8. THE USE OF POTABLE WATER WITHOUT A SPECIAL PERMIT FOR BUILDING OR CONSTRUCTION PURPOSES INCLUDING CONSOLIDATION OF BACKFILL OR DUST CONTROL IS PROHIBITED. THE CONTRACTOR SHALL OBTAIN ALL NECESSARY PERMITS FOR CONSTRUCTION WATER.
9. THE CONTRACTOR SHALL MAINTAIN THE STREETS, SIDEWALKS AND ALL OTHER PUBLIC RIGHT-OF-WAY IN A CLEAN, SAFE AND USABLE CONDITION. ALL SPILLS OF SOIL, ROCK OR CONSTRUCTION DEBRIS SHALL BE PROMPTLY REMOVED FROM THE PUBLICLY OWNED PROPERTY DURING CONSTRUCTION AND UPON COMPLETION OF THE PROJECT. ALL ADJACENT PROPERTY, PRIVATE OR PUBLIC, SHALL BE MAINTAINED IN A CLEAN, SAFE AND USABLE CONDITION.
10. IN THE EVENT THAT ANY TEMPORARY CONSTRUCTION ITEM IS REQUIRED THAT IS NOT SHOWN ON THESE DRAWINGS, THE OWNER AGREES TO PROVIDE AND INSTALL SUCH ITEM AT HIS OWN EXPENSE AT THE DIRECTION OF THE CITY ENGINEER. TEMPORARY CONSTRUCTION INCLUDES DITCHES, BERMS, ROAD SIGNS AND BARRICADES, ETC.

CITY OF LAS VEGAS TRAFFIC NOTES

1. ALL CONSTRUCTION SIGNING, BARRICADING, AND TRAFFIC DELINEATION SHALL CONFORM TO THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES", LATEST EDITION.
2. THE STREET SIGN CONTRACTOR SHALL OBTAIN STREET NAMES AND BLOCK NUMBERING FROM THE PLANNING DEPARTMENT PRIOR TO CONSTRUCTION.
3. BEFORE ANY WORK IS STARTED IN THE RIGHT-OF-WAY, THE CONTRACTOR SHALL INSTALL ALL ADVANCE WARNING SIGNS FOR THE CONSTRUCTION ZONE. THE CONTRACTOR SHALL INSTALL TEMPORARY STOP SIGNS AT ALL NEW STREET ENCROACHMENTS INTO EXISTING CITY STREETS WHERE WARRANTED IMMEDIATELY AFTER FIRST GRADING WORK IS ACCOMPLISHED, AND SHALL MAINTAIN SAID SIGNS UNTIL PERMANENT SIGNS ARE INSTALLED.
4. WHEN A DESIGNATED "SAFE ROUTE TO SCHOOL" IS ENCROACHED UPON BY A CONSTRUCTION WORK ZONE AND PUBLIC WORKS STAFF IDENTIFIES A NEED FOR STUDENTS TO BE ASSISTED IN THE SAFE CROSSING THROUGH THAT WORK ZONE, THE CONTRACTOR SHALL BE REQUIRED TO PROVIDE A QUALIFIED "CROSSING GUARD". THE GUARD SHALL BE PRESENT FOR THE FULL DURATION OF TIME THAT CHILDREN ARE LIKELY TO BE PRESENT.
5. IF THE IMPROVEMENTS NECESSITATE THE OBLITERATION, TEMPORARY OBSTRUCTION, TEMPORARY REMOVAL OR RELOCATION OF ANY EXISTING TRAFFIC PAVEMENT MARKING, SUCH PAVEMENT MARKING SHALL BE RESTORED OR REPLACED WITH LIKE MATERIALS TO THE SATISFACTION OF THE CITY TRAFFIC ENGINEER.
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING AND INSTALLING ALL PERMANENT SIGNS SHOWN ON THE PLANS. STREET NAME SIGNS SHALL CONFORM IN THEIR ENTIRETY TO CURRENT CITY STANDARDS. ALL OTHER SIGNS SHALL BE STANDARD SIZE UNLESS OTHERWISE SPECIFIED ON THE PLANS. ALL SIGN POSTS SHALL BE INSTALLED IN ACCORDANCE WITH THE CURRENT CITY STANDARDS.
7. WHEN A PROPOSED STREET LIGHT STANDARD IS LOCATED WITHIN FIVE FEET (5') OF ANY PROPOSED SIGN SHOWN ON THE PLANS TO BE MOUNTED ON A SIGNPOST, THE SIGN SHALL BE MOUNTED ON THE STREET LIGHT STANDARD AND THE SIGNPOST SHALL BE ELIMINATED.
8. ALL PERMANENT TRAFFIC CONTROL DEVICES CALLED FOR HEREON SHALL BE IN PLACE AND IN FINAL POSITION PRIOR TO ALLOWING ANY NON-TRAFFIC INTO THE PORTIONS OF THE ROAD(S) BEING IMPROVED HEREUNDER, REGARDLESS OF THE STATUS OF COMPLETION OF PAVING OR OTHER OFF-SITE IMPROVEMENTS CALLED FOR BY THESE PLANS.
9. STREET SIGNS AND STOP SIGNS SHALL BE INSTALLED PER CITY STANDARD SPECIFICATIONS FOR PLACEMENT OF STREET NAME SIGNS.
10. THE CONTRACTOR SHALL PROVIDE ALL NECESSARY TRAFFIC CONTROL DEVICES AND FLAGGERS TO ENSURE THE SAFETY OF THE PUBLIC IN OR AROUND THE WORK AREA. THE CONTRACTOR SHALL HAVE A CERTIFIED ATSSA TRAFFIC CONTROL TECHNICIAN OR IMSA WORK ZONE SAFETY SPECIAL IST SET-UP, MAINTAIN AND/OR REMOVE ALL TRAFFIC CONTROL DEVICES IN THE CITY OF LAS VEGAS RIGHTS OF WAY.
11. WORK IN PUBLIC STREETS, ONCE BEGUN, SHALL BE EXPEDITED TO COMPLETION SO AS TO PROVIDE A MINIMUM INCONVENIENCE TO ADJACENT PROPERTY OWNERS AND TO THE TRAVELING PUBLIC.
12. THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING CITIZENS AREA TRANSIT (C.A.T.) IF THE CONSTRUCTION INTERRUPTS OR RELOCATES A BUS STOP OR HAS AN ADVERSE EFFECT ON BUS SERVICE ON THAT STREET AND TO ARRANGE FOR TEMPORARY RELOCATION OF STOP.
13. GUARDS SHALL BE OBTAINED BY CONTACTING THE METROPOLITAN POLICE DEPARTMENT SPECIAL EVENTS UNIT (PHONE NO. IS 828-3442) WHO WILL PROVIDE OFFICERS PROPERLY TRAINED IN TRAFFIC CONTROL. FEES FOR THE USE OF THESE OFFICERS SHALL BE SET BY METRO AND WILL BE PAID BY THE CONTRACTOR. THE CONTRACTOR IS RESPONSIBLE FOR ALL ARRANGEMENTS WITH METRO.
14. ANY WORK WITHIN 300' OF A SIGNALIZED INTERSECTION WILL BE NIGHT WORK, UNLESS DIRECTED BY THE CITY OF LAS VEGAS TRAFFIC ENGINEER.
15. THE CONTRACTOR SHALL CONTACT THE TRAFFIC ENGINEERING DIVISION (TRANSPORTATION SECTION) THROUGH THE PROJECTS OFFSITE INSPECTOR PRIOR TO INITIATING PAVING TO RECEIVE DIRECTION FOR ANY PERMANENT OR TEMPORARY MODIFICATIONS TO THE APPROVED DRAWINGS REGARDING FINAL PAVEMENT TRANSITIONS MARKINGS AND SIGNING THAT ARE REQUIRED TO MATCH ADJACENT ROADWAY SEGMENTSTHE CONTRACTOR SHALL PROVIDE A DRAWING FOR APPROVAL BY THE TRAFFIC ENGINEERING DIVISION DEPICTING ANY ADJUSTMENTS TO THE FINAL PAVEMENT MARKINGS AND SIGNAGE, WHICH MAY INCLUDE OMITTING, ADDING OR MODIFYING PAVEMENT MARKINGS AND TRAFFIC CONTROL SIGNS SUCH THAT ADEQUATE TRANSITIONS AND LANE TERMINATIONS BETWEEN ADJACENT ROADWAY SEGMENTS ARE CONSTRUCTED.

CITY OF LAS VEGAS STREETLIGHT NOTES

1. ALL STREET LIGHTING INSTALLATIONS SHALL BE IN ACCORDANCE WITH THE STREET LIGHTING PLANS, THE "UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION OFF-SITE IMPROVEMENTS, CLARK COUNTY AREA, NEVADA", LATEST REVISION, AND THE "UNIFORM STANDARD DRAWINGS FOR PUBLIC WORKS CONSTRUCTION OFF-SITE IMPROVEMENTS, CLARK COUNTY AREA, NEVADA", LATEST REVISION, AND "SUMMERLIN IMPROVEMENT STANDARDS", LATEST REVISION.
2. NO DEVIATION OF STREET LIGHT, PULL BOX, CONDUITS (ETC.) LOCATIONS SHALL BE PERMITTED WITHOUT WRITTEN APPROVAL OF THE TRAFFIC/ELECTRICAL FIELD OPERATIONS DIVISION AND THE CITY ENGINEER. ANY DEVIATION FROM THE PLAN LOCATION WILL REQUIRE COMPLIANCE WITH SECTION 623.0.03 (E) OF THE SPECIFICATIONS.
3. ALL EXISTING STREET LIGHTING SHALL REMAIN OPERATIONAL DURING CONSTRUCTION.
4. ALL STREET LIGHTING CONDUITS STUB SHALL HAVE AT LEAST ONE GREEN #8 THW WIRE INSTALLED, AS TRACER WIRE. WHEN "EMPTY" CONDUIT IS COMPLETELY INSTALLED FROM PB TO PB. IT SHALL HAVE A MINIMUM OF 2 #4 AND 1 #8 THW WIRE WITH THE ENDS TAPED OR "SAFE OFF" PRIOR TO FINAL INSPECTION.
5. ANY STRUCTURE SUCH AS BLOCK WALLS, CHAIN LINK FENCES, RETAINING WALLS, ETC., SHALL LEAVE A MINIMUM CLEARANCE IN ACCORDANCE WITH THE USD 3204.
6. AS-BUILT DRAWINGS SHALL BE SUPPLIED TO THE TEFO PRIOR TO ANY PREFINAL INSPECTION.
   THE AS-BUILT DRAWING NEEDS TO BE STAMPED AS-BUILT AND SIGNED BY THE PREPARER.
7. SERVICE POINT SHALL BE COORDINATED WITH NV ENERGY, AND WHEREVER POSSIBLE, BE LOCATED NEAR THE CENTER OF THE CIRCUIT. SERVICE POINTS SHALL BE SHOWN ON THE PLANS.
8. IT SHALL BE ASSUMED THAT IN THE ABSENCE OF AN EXISTING, WORKABLE CIRCUIT TO ATTACH TO, ALL INSTALLATIONS SHALL REQUIRE A NEW SERVICE FOR OPERATION OF THE CIRCUIT.
9. WHEREVER THERE IS AN OVERHEAD UTILITY THAT MAY CONFLICT WITH THE INSTALLATION OF STREET LIGHTING CIRCUITS AND/OR POLES, THESE CONFLICTS MUST BE RESOLVED BETWEEN THE DEVELOPER AND THE UTILITIES INVOLVED BEFORE STREETLIGHT BASES ARE INSTALLED AT NO EXPENSE TO THE CITY OF LAS VEGAS.
10. THE CONTRACTOR SHALL FURNISH COMPLETE SERVICE TO TRANSFORMERS AND CONTROL SYSTEMS IF REQUIRED ON PLANS.
11. THE DEVELOPER/OWNER WILL BE REQUIRED TO SUPPLY POWER TO ALL NEW PUBLIC STREET LIGHTS INSTALLED UNDER THIS DESIGN PRIOR TO BOND RELEASE OR PROJECT COMPLETION. THE DEVELOPER/OWNER WILL BE RESPONSIBLE FOR ALL ITEMS ASSOCIATED WITH THE INSTALLATION, CONSTRUCTION, ENERGIZING, MAINTENANCE, AND OPERATIONAL COSTS OF SAID STREET LIGHTS PRIOR TO PROJECT COMPLETION. REFER TO THE PLAN FOR ANY NEW SERVICE REQUIREMENT. THE TRANSFER OF OWNERSHIP FROM THE DEVELOPER/OWNER TO THE CITY OF LAS VEGAS FOR ALL NEW PUBLIC STREET LIGHTS AND/OR SERVICES INSTALLED UNDER THIS PLAN DESIGN WILL BE IN CONJUNCTION WITH THIS PROJECT COMPLETION. COORDINATE ALL MAINTENANCE AND OPERATIONAL TRANSFERS WITH THE CITY OF LAS VEGAS TRAFFIC ENGINEERING DEPARTMENT (TEFO) (702) 229-6331.

CITY OF LAS VEGAS FIRE DEPARTMENT NOTES

1. ALL WORK SHALL BE DONE IN STRICT ACCORDANCE WITH THE CITY OF LAS VEGAS FIRE DEPARTMENT'S ORDINANCE # 6124, FOR HYDRANT SPECIFICATIONS AND HYDRANT INSTALLATION SPECIFICATION.
2. AUTHORIZED FIRE HYDRANTS FOR THIS PROJECT ARE:
   A. KENNEDY – GUARDIAN MODELS K81A AND K81D
   B. MUELLER – SUPER CENTURION 250 MODEL A-423
   C. CLOW – MEDALLION MODEL F-2546LVD
   D. U.S. PIPE – METROFLOW/M-03
3. A PERMIT IS REQUIRED FROM LAS VEGAS FIRE AND RESCUE FOR THE INSTALLATION OF ON-SITE WATER LINES AND FIRE HYDRANTS. THE PERMIT AND CONTRACTOS MATERIAL TEST CERTIFICATE FOR UNDERGROUND PIPING FORM SHALL BE OBTAINED FROM THE FIRE PROTECTION ENGINEER BEFORE COMMENCEMENT OF WORK.
4. ON ANY RESIDENTIAL OR COMMERCIAL INSTALLATIONS FIRE HYDRANTS SHALL BE INSTALLED AND FIRE APPARATUS ACCESS ROADS SHALL BE MAINTAINED BEFORE COMMENCEMENT OF ANY COMBUSTIBLE CONSTRUCTION. ALL FIRE HYDRANTS SHALL BE IN GOOD WORKING ORDER AND SHALL BE CAPABLE OF DELIVERING THE REQUIRED FIRE FLOW. SNFC#6124, SECTION 1412.
5. TO IDENTIFY THE FIRE HYDRANT LOCATIONS, CONTRACTOR SHALL PLACE A BLUE REFLECTIVE MARKER AT THE CENTER LINE OF STREET ADJACENT TO SNFC #6124 SECTION 507.5.7.3.
6. ALL UNDERGROUND INSPECTIONS, PRESSURE AND FLUSH VERIFICATIONS OF ALL FIRE HYDRANTS AND FIRE LINES, SHALL BE CONDUCTED BEFORE COVERING THE LINES. CENTER LOADING IS ACCEPTABLE FOR THE HYDRO TEST WITH PRIOR FIRE PREVENTION APPROVAL.
7. ALL ONSITE UNDERGROUND WATER MAINS AND MATERIALS SHALL BE UL LISTED A.W.W.A. APPROVED AND SHALL BE RATED FOR THE APPROPRIATE WORKING PRESSURE. SNFC 507.2.1, NFPA 24.
8. PAINTING OF THE CURBS, FIRE HYDRANTS, PADS, PROTECTION OF FIRE HYDRANTS FROM PHYSICAL DAMAGE, AND ALL OTHER WORK NECESSARY PER PLANS, SHALL BE COMPLETED BEFORE APPROVAL BY THE CITY OF LAS VEGAS FIRE AND RESCUE, FIRE PREVENTION DIVISION. IFC 507; NFPA24.
9. PRIVATE FIRE HYDRANTS SHALL BE PAINTED RED. SNFC 507.5.7.1
10. PRIOR TO THE FINAL OCCUPANCY, A FLOW TEST MUST BE WITNESSED BY THE CITY OF LAS VEGAS FIRE AND RESCUE, FIRE PREVENTION DIVISION TO VERIFY AVAILABILITY OF THE REQUIRED FIRE FLOW. IFC 507. SNFC 507.1.
11. FIRE HYDRANTS SPACING SHALL BE:
    RESIDENTIAL – 500 FEET UNSPRINKLERED; 600 FEET SPRINKLERED.
    COMMERCIAL – 300 FEET UNSPRINKLERED; 400 FEET SPRINKLERED.
12. WHERE NEW WATER MAINS ARE EXTENDED ALONG STREETS OR NEW STREETS ARE INSTALLED WHERE FIRE HYDRANTS ARE NOT NEEDED FOR PROTECTION OF THE STRUCTURES, FIRE HYDRANTS SHALL BE INSTALLED AT MAXIMUM 1,000 FOOT SPACING, TO PROVIDE FOR TRANSPORTATION HAZARDS. WHERE STREETS ARE PROVIDED WITH MEDIAN DIVIDERS OR HAVE FOUR OR MORE TRAFFIC LANES AND HAVE A TRAFFIC COUNT OF MORE THAN 30,000 PER DAY, HYDRANTS ARE REQUIRED ON EACH SIDE OF THE STREET SPACED AT 500 FEET ON AN ALTERNATING BASIS.
13. NO FIRE HYDRANTS SHALL BE LOCATED WITHIN THE REQUIRED RADIUS OF A CUL-DE-SAC OR WITHIN 20 FEET OF THE PERIMETER OF THE RADIUS OF THE CUL-DE-SAC.
14. NO FIRE HYDRANTS SHALL BE LOCATED WITHIN 6 FEET OF ANY CURB RETURN, DRIVEWAY, POWER POLE, STREETLIGHT OR ANY OTHER OBSTRUCTION. FNFC C102.12.
15. THE MAXIMUM DISTANCE FROM A FIRE HYDRANT TO A ONE-TWO FAMILY DWELLING SHALL NOT EXCEED 300 FEET, AS MEASURED BY AN APPROVED ROUTE. SNFC 102.4
16. THE MAXIMUM DISTANCE FROM A FIRE HYDRANT TO A FIRE DEPARTMENT CONNECTION (FDC) SHALL NOT EXCEED 100 FEET, AS MEASURED BY AN APPROVED ROUTE. SNFC 102.6.
17. THE MAXIMUM DISTANCE FROM A FIRE HYDRANT TO THE END OF A DEAD-END STREET SHALL NOT EXCEED 200 FEET. SNFC 102.6.
18. TWO SOURCES OF SUPPLY ARE REQUIRED WHENEVER THERE ARE 4 OR MORE FIRE HYDRANTS/SPRINKLER LEAD-INS ARE INSTALLED ON A SINGLE SYSTEM. SECTIONAL CONTROL VALVES SHALL BE INSTALLED SO THAT NO MORE THAN 2 FIRE HYDRANTS CAN BE OUT OF SERVICE DUE TO A BREAK IN A WATER MAIN.
19. ALL FIRE APPARATUS ACCESS ROADS SHALL BE PAVED TO PROVIDE ALL-WEATHER DRIVING CAPABILITIES, AND SHALL BE DESIGNED AND MAINTAINED TO SUPPORT THE IMPOSED LOADS OF THE FIRE APPARATUS. SNFC 503.2.3.
20. THE GRADIENT FOR THE FIRE APPARATUS ACCESS ROADS SHALL NOT EXCEED 12% ANGLES OF APPROACH AND ANGLES OF DEPARTURE SHALL NOT EXCEED 6% FOR 25 FEET PRIOR TO OR AFTER THE GRADE CHANGE ADJACENT TOT HE STRUCTURES GRADIENT SHALL NOT EXCEED 6% SNFC 503.2.7/503.2.8.
21. THE TURNING RADIUS OF THE FIRE APPARATUS ACCESS ROADS SHALL BE NO LESS THAN 52 FEET OUTSIDE AND 28 FEET INSIDE TURNING RADIUS. SNFC 503.2.4
22. VERTICAL CLEARANCE OF ALL FIRE APPARATUS ACCESS ROADS SHALL BE NOT LESS THAN 13 FEET 6 INCHES SNFC 503.2.1.1/IFC 503..
23. FIRE DEPARTMENT ACCESS ROADS IN ALL RESIDENTIAL DE

Call before you Dig
Avoid cutting underground utility lines. It's costly.
Call 811 or 1-800-227-2600

AVOID HITTING UNDERGROUND TRAFFIC SIGNAL SYSTEMS AND STREET LIGHT SYSTEM CONDUITS. IT'S COSTLY.
Call before you do UnderGround
1-702-432-5300
LAS VEGAS AREA COMPUTERIZED TRAFFIC SYSTEM

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

STORMWATER MANAGEMENT NOTES:

A) THE OWNER, SITE DEVELOPER, CONTRACTOR, AND/OR THEIR AUTHORIZED AGENTS SHALL EACH DAY REMOVE ALL SEDIMENT, MUD CONSTRUCTION DEBRIS, OR POTENTIAL POOLUTANTS THAT MAY HAVE BEEN DISCHARGED TO, OR ACCUMULATED IN, THE PUBLIC RIGHTS OF WAY OF CLARK COUNTY AS A RESULT OF CONSTRUCTION ACTIVITIES ASSOCIATED WITH THIS SITE DEVELOPMENT OR CONSTRUCTION PROJECT. SUCH MATERIALS SHALL BE PREVENTED FROM ENTERING THE STORM SEWER SYSTEM.

B) ADDITIONAL CONSTRUCTION SITE DISCHARGE BEST MANAGEMENT PRACTICES MAY BE REQUIRED OF THE OWNER AND HIS OR HER AGENTS DUE TO UNFORESEEN EROSION PROBLEMS OR IF THE SUBMITTED PLAN DOES NOT MEET THE PERFORMANCE STANDARDS SPECIFIED IN CLARK COUNTY TITLE 24.40 AND THE LAS VEGAS VALLEY CONSTRUCTION SITE BMP GUIDANCE MANUAL.

C) TEMPORARY OR PERMANENT STABILIZATION PRACTICES WILL BE INSTALLED ON DISTURBED AREAS AS SOON AS PRACTICABLE AND NO LATER THAN 14 DAYS AFTER THE CONSTRUCTION ACTIVITY IN THAT PORTION OF THE SITE HAS TEMPORARILY OR PERMANENTLY CEASED. SOME EXCEPTIONS MAY APPLY. REFER TO THE NEVADA STORMWATER GENERAL PERMIT FOR CONSTRUCTION ACTIVITY NVR100000, SECTION III.A.5.

D) AT A MINIMUM, THE CONTRACTOR OR HIS AGENT SHALL INSPECT ALL DISTURBED AREAS, AREAS USED FOR STORAGE OF MATERIALS AND EQUIPMENT THAT AREA EXPOSED TO PRECIPITATION, VEHICLE ENTRANCE AND EXIT LOCATIONS, AND ALL BMP's WEEKLY AND WITHIN 24 HOURS AFTER A RAIN EVENT OF 0.5 INCHES OR MORE. THE CONTRACTOR OR HIS AGENT SHALL UPDATE OR MODIFY THE STORMWATER POLLUTION PREVENTION PLAN AS NECESSARY. SOME EXCEPTIONS TO WEEKLY INSPECTIONS MAY APPLY, SUCH AS SUSPENSION OF LAND DISTURBANCE ACTIVITIES. REFER TO THE NEVADA STORMWATER GENERAL PERMIT FOR CONSTRUCTION ACTIVITY NVR100000, SECTION III.A.12

E) ACCUMULATED SEDIMENT IN BMP's SHALL BE REMOVED WITHIN 7 DAYS AFTER A STORMWATER RUNOFF EVENT OR PRIOR TO THE NEXT ANTICIPATED STORM EVENT, WHICHEVER IS EARLIER. SEDIMENT MUST BE REMOVED WHEN BMP DESIGN CAPACITY HAS BEEN REDUCED BY 50% OR MORE.

GEOTECHNICAL REPORT

REPORT PREPARED BY: WRIGHT ENGINEERS
FILE No. 162142 DATED: DECEMBER 16, 2016

NORTH

GRAPHIC SCALE
30 0 15 30 60 120
(IN FEET)
1 inch = 30 ft.

PAD, FINISH FLOOR ELEVATION NOTE:

THE FINISH FLOOR ELEVATION IS TO BE CONSTRUCTED AS NOTED ON THIS PLAN. THE PAD ELEVATION IS A FUNCTION OF THE REQUIRED FINISH FLOOR ELEVATION LESS THE STRUCTURAL SECTION OF THE SLAB, BASE AND SUB BASE MATERIAL DETERMINED BY THE STRUCTURAL ENGINEER ASSIGNED TO THIS PROJECT. ALL SUB GRADE, SUBSURFACE, SOIL PREPARATION AND GEOTECHNICAL ENGINEERING PARAMETERS ARE DICTATED BY THE FOLLOWING REPORT

REPORT #162142 BY WRIGHT ENGINEERS
STAMPED & DATED: DECEMBER 16, 2016

BENCHMARK

CITY OF LAS VEGAS BENCHMARK "7LV90 30N6", BEING A RIVET AND ROUND PLATE IN CABLE TV PAD @ NE CORNER OF AZURE DR. & GRAND CANYON DR.

ELEVATION: 2671.33 (US SURVEY FEET)
814.22 (METERS)

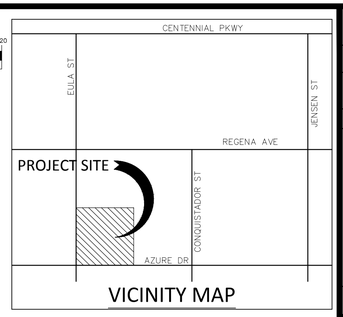
BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).

BASIS OF BEARINGS

SOUTH 89°45'27" EAST, BEING THE BEARING OF THE CENTERLINE OF AZURE DRIVE AND THE SOUTH LINE OF THE NORTHWEST QUARTER (NW 1/4) OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 30, TOWNSHIP 19 SOUTH, RANGE 60 EAST, M.D.M., CLARK COUNTY, NEVADA, AS SHOWN ON FILE IN FILE 107 OF PARCEL MAPS, AT PAGE 99, OFFICIAL RECORDS OF CLARK COUNTY, NEVADA.

SIGHT VISIBILITY ZONE NOTE:

NO WALLS, FENCES, SHRUBS, UTILITY APPURTENANCES OR ANY OTHER OBJECT, OTHER THAN TRAFFIC CONTROL DEVICES, FIRE HYDRANTS, TREES, AND STREET LIGHT POLES, MAY BE CONSTRUCTED OR INSTALLED WITHIN THE SIGHT VISIBILITY ZONE UNLESS SAID OBJECT IS MAINTAINED AT LESS THAN 24 INCHES IN HEIGHT, MEASURED FROM TOP OF CURB, OR WHERE NO CURB EXISTS, A HEIGHT OF 27 INCHES MEASURED FROM THE TOP OF ADJACENT ASPHALT, GRAVEL OR PAVEMENT STREET SURFACE. THIS RESTRICTION EXTENDS ALONG THE SIGHT VISIBILITY LINE THROUGH LANDSCAPED MEDIANS.



VICINITY MAP

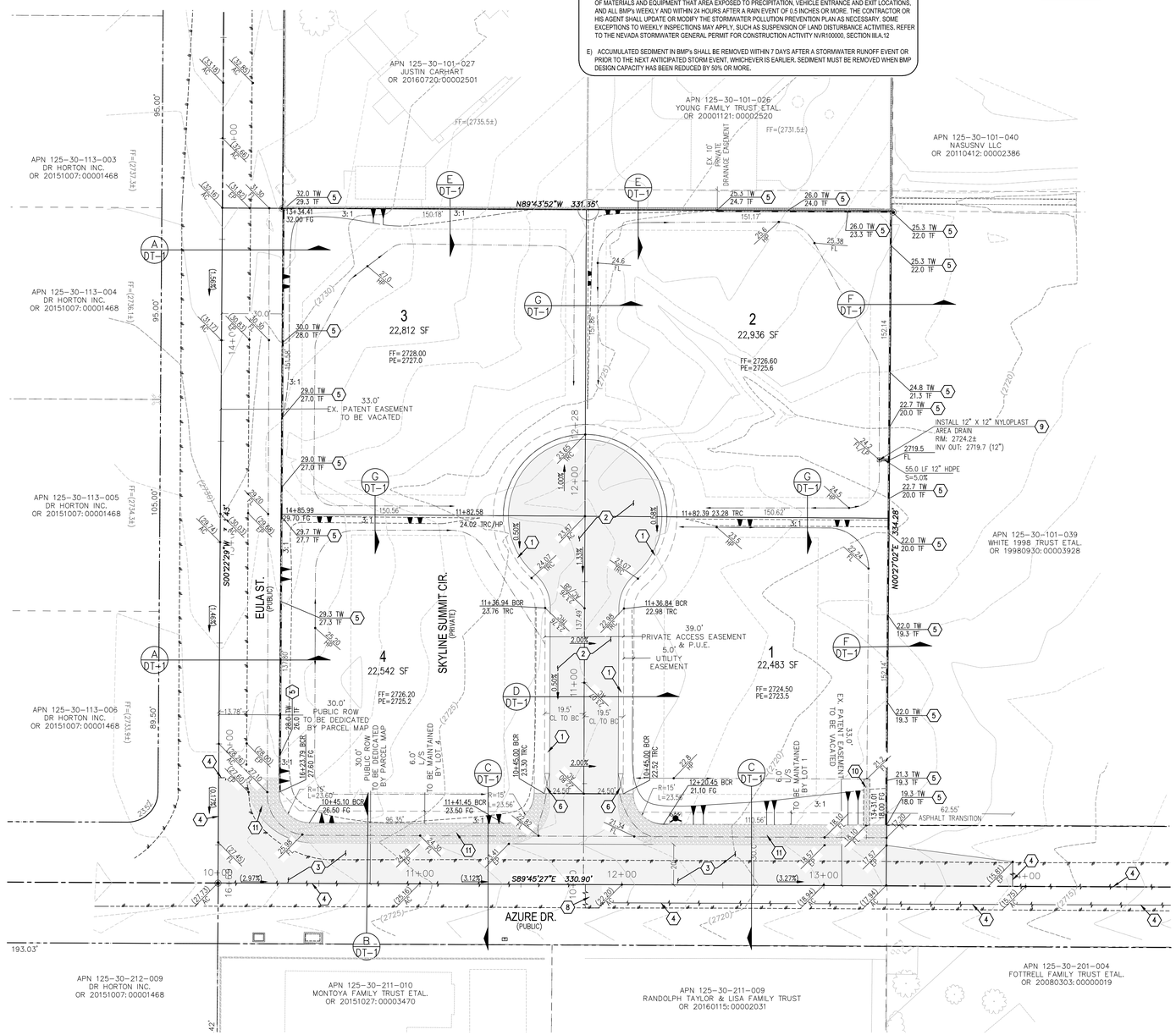
FLOOD ZONE NOTE:

ACCORDING TO THE FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) FLOOD INSURANCE RATE MAP (FIRM), COMMUNITY PANEL 1745 OF 4090, MAP NUMBER 32003C1745E, EFFECTIVE SEPTEMBER 27, 2002, SITE IS LOCATED WITHIN ZONE "X". ZONE "X" IS DESCRIBED AS AN AREA OUTSIDE THE 0.2% ANNUAL CHANCE FLOOD PLAIN.

GRADING NOTES

1. INSTALL "ROLL" TYPE CURB AND GUTTER PER CCAUSD #217.S1
2. INSTALL 2" AC OVER 4" TYPE II AGGREGATE BASE PER SOILS REPORT
3. INSTALL 3" AC OVER 4" TYPE II AGGREGATE BASE PER SOILS REPORT
4. SAWCUT AND MATCH EXISTING PAVEMENT. DUE TO THE EXISTING FIELD CONDITIONS AND VARYING SLOPES THE LENGTH AND WIDTH OF SAWCUT AND PATCH TO BE DETERMINED BY THE INSPECTOR IN THE FIELD. WIDTHS MAY VARY.
5. CONSTRUCT RETAINING WALL, HEIGHT PER PLAN. STRUCTURAL DESIGN BY OTHERS
6. INSTALL ROLL CURB TO ZERO CURB TRANSITION PER DETAIL 1, SHEET DT-1.
7. SIGHT VISIBILITY ZONE.
8. TRENCH BACKFILL AND AC PAVEMENT RESTORATION PER CCAUSD#503, 500.4, & 500.5.
9. INSTALL 12" X 12" NYLOPLAST AREA DRAIN. CONTRACTOR TO DRILL 2-INCH HOLES IN BOTTOM. INSTALL 12-INCHES OF AGGREGATE BASE. FOR NUISANCE WATER TO DRAIN
10. INSTALL RIP RAP PAD D50=6" THICKNESS=1 FT
11. INSTALL RIP RAP PAD D50=9" THICKNESS=18 INCHES

SEE SHEET N-1 FOR LEGEND, GENERAL NOTES, AND QUANTITIES



LEGEND

	PROPOSED SCARPING	0.50%	DIRECTION OF FLOW
	LOT LINES	(76.59) TC	EXISTING SPOT GRADE
	PROPOSED SAWCUT	76.59 TC	PROPOSED SPOT GRADE
2550	EXISTING INDEX CONTOURS (5' INTERVAL)	100.00	PROPERTY LINE DIMENSION
	EXISTING INTERMEDIATE CONTOURS (1' INTERVAL)		AC PAVEMENT
[2404]	FINISH GRADE CONTOUR (1' INTERVAL)		SIDEWALK, CURB & GUTTER
	BOUNDARY		AC TO BE REMOVED
	GRADE BREAK	PAD= XX.XX	PAD ELEVATION
	STREET CENTERLINE	F.F. ELEV.=XX.XX	FINISH FLOOR ELEVATION
	DRAINAGE EASEMENT		
	RETAINING WALL		

GRADING NOTES

1. PER4MANCE ENGINEERING SHALL BE NOTIFIED IMMEDIATELY OF ANY DISCREPANCY IN THE PLANS OR CONDITIONS IN THE FIELD.
2. ALL WORK TO BE PERFORMED OUTSIDE OF THE PROJECT BOUNDARY AND ON PRIVATE PROPERTY SHALL NOT BE PERFORMED UNTIL WRITTEN PERMISSION AND EASEMENT HAVE BEEN OBTAINED FROM THE OFFSITE OWNER AND GIVEN TO THE CLARK COUNTY.
3. FOR AREAS THAT ARE FLATTER THAN 3:1 SLOPE, OR LESS THAN 1' ELEVATION DIFFERENCE, SCARPS ARE NOT SHOWN ON PLAN FOR CLARITY PURPOSES.
4. ALL SLOPE AREAS SHALL HAVE A MINIMUM ONE FOOT SHOULDER NEXT TO WALL PRIOR TO STARTING SLOPE.
5. THERE SHALL BE NO GRUBBING, GRADING OR CLEARING PRIOR TO THE APPROVAL OF THE CIVIL IMPROVEMENT PLANS AND FINAL GRADING PLANS BY THE PUBLIC WORKS DIRECTOR AND THE ISSUANCE OF A GRADING PERMIT. GRUBBING, GRADING AND CLEARING ARE TO OCCUR ONLY WITHIN THE AREAS IDENTIFIED ON THE APRROVED GRADING PLAN.
6. ALL PORTIONS OF THE SITE OR LOT TO BE LEFT UNGRADED ARE TO REMAIN UNDISTURBED AREAS AND ARE NOT TO BE USED FOR STOCKPILING OF MATERIALS OR EXCESS FILL.
7. DRIVEWAYS PER THE GRADING PLANS SHALL NOT EXCEED 4.0% MAX DRIVEWAY SLOPES.
8. FOR ALL TRUNCATED NUMBERS ADD 2700-FT TO THE ELEVATION.

LIST OF BONDABLE DRAINAGE QUANTITIES:

30-INCH "ROLL-CURB"	415 L.F.
RIP-RAP PAD	70 SQ.FT.
RIP-RAP PAD (d50=9")	3145 SQ.FT.

EARTHWORK QUANTITIES

CUT (NET): 2,228.9 CY
FILL (NET): 5,984.5 CY
IMPORT : 3,755.5 CY

THIS INFORMATION SHOULD BE USED FOR BIDDING PURPOSES ONLY. ALL CONTRACTORS ARE RESPONSIBLE FOR VERIFYING THEIR OWN EARTHWORK QUANTITIES. THESE ESTIMATES ARE SUBJECT TO CHANGE BASED ON SITE SPECIFIC GEOTECHNICAL EVALUATIONS.

DRAINAGE STUDY NOTE:

I CERTIFY THAT THIS GRADING PLAN IS IN CONFORMANCE WITH THE APPROVED DRAINAGE STUDY ON FILE AT CITY OF LAS VEGAS FOR THIS PROJECT. DS-xxxxx

BY:

RAY F. FREDERICKSEN, P.E. No.17471 DATE

NO.	REVISION	BY	DATE	APP.	DATE
6					
5					
4					
3					
2					
1					

SKYLINE SUMMIT
CITY OF LAS VEGAS NEVADA
SHEET:
GRADING PLAN

PER4MANCE ENGINEERING
9345 W. SUNSET RD. STE 101, LAS VEGAS, NEVADA 89148
TEL: (702)569-9770 EMAIL:RAYF@PER4MANCELV.COM

DEVELOPER:
PINNACLE HOMES

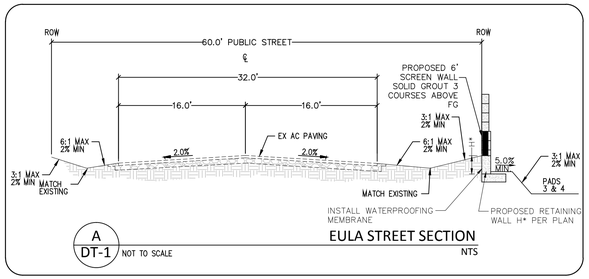
SEAL
PROFESSIONAL ENGINEER - STATE OF NEVADA
RAY F. FREDERICKSEN
Exp. 06/30/17
CIVIL
No.17471

DESIGNED BY: RFF
DRAWN BY: RFF
CHECKED BY: RFF
SCALE: 1"=30'
PROJECT DATE: FEBRUARY 1, 2016

SHEET
GP-1
3 OF 9

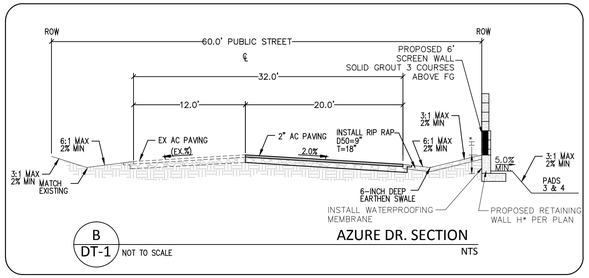
AGENCY DWG. NO.
CLV#16-XXXXX

F:\Projects\2016 - 2.5 ac Azure - Pinnacle\MP\03-GP.dwg ray Wed, 01 Feb 2017 - 11:28am



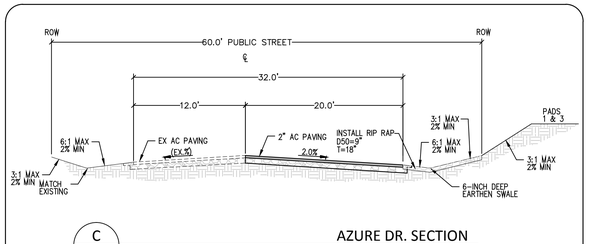
A DT-1 EULA STREET SECTION

NOT TO SCALE NTS



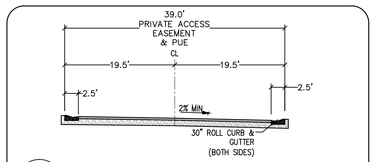
B DT-1 AZURE DR. SECTION

NOT TO SCALE NTS



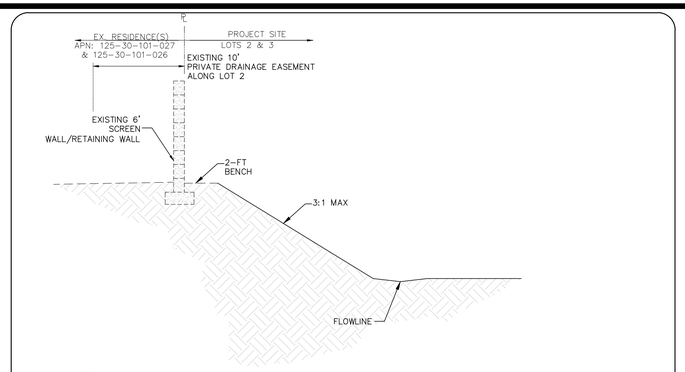
C DT-1 AZURE DR. SECTION

NOT TO SCALE NTS



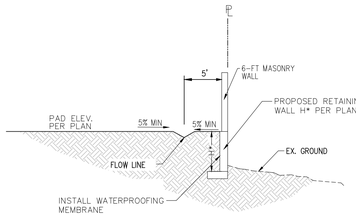
D DT-1 39' SKYLINE SUMMIT CIRCLE (PRIVATE)

NTS



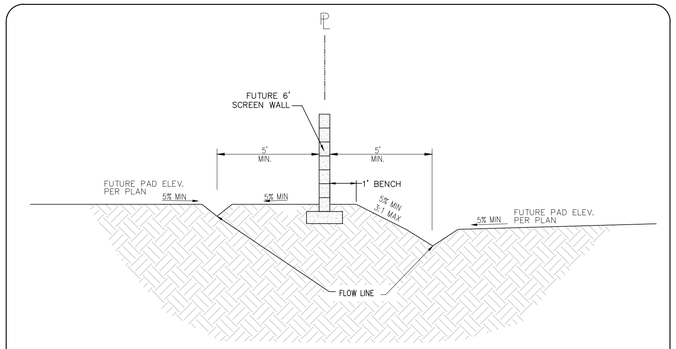
E DT-1 NORTH PL CROSS SECTION

NTS



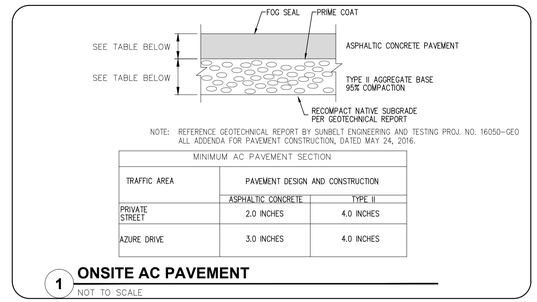
F DT-1 EAST PL SECTION

NTS



G DT-1 PAD TO PAD SECTION WITH SLOPE

NTS



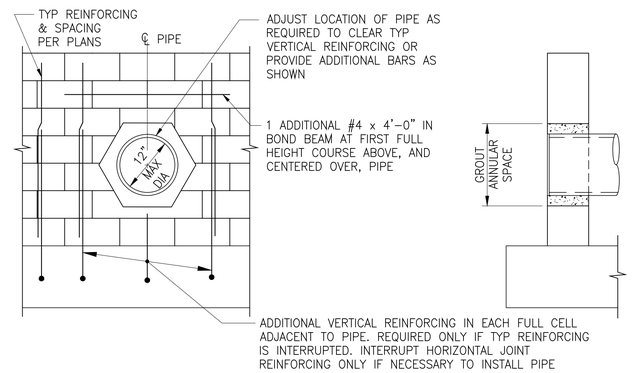
NOTE: REFERENCE GEOTECHNICAL REPORT BY SUNBELT ENGINEERING AND TESTING PROJ. NO. 16050-GEO ALL ADDENDA FOR PAVEMENT CONSTRUCTION, DATED MAY 24, 2016.

MINIMUM AC PAVEMENT SECTION

TRAFFIC AREA	PAVEMENT DESIGN AND CONSTRUCTION	
	ASPHALTIC CONCRETE	TYPE II
PRIVATE STREET	2.0 INCHES	4.0 INCHES
AZURE DRIVE	3.0 INCHES	4.0 INCHES

1 ONSITE AC PAVEMENT

NOT TO SCALE



- PIPE PENETRATION DETAIL

- SCALE: 1/2" = 1'-0" MAS1-0007

NO.	REVISION	BY	DATE	APP.	DATE
6					
5					
4					
3					
2					
1					

SKYLINE SUMMIT

CITY OF LAS VEGAS NEVADA

SHEET: DETAIL SHEET

PERIMANCE ENGINEERING
9345 W. SUNSET RD. STE 101, LAS VEGAS, NEVADA 89148
TEL: (702)569-9770 EMAIL:RAYF@PERIMANCELV.COM

DEVELOPER: PINNACLE HOMES

SEAL: PROFESSIONAL ENGINEER - STATE OF NEVADA — RAY F. FREDERICKSEN — Exp. 06/30/17 — CIVIL — No.17471

DESIGNED BY: RFF

DRAWN BY: RFF

CHECKED BY: RFF

SCALE: 1"=30'

PROJECT DATE: FEBRUARY 1, 2016

SHEET DT-1 4 OF 9

AGENCY DWG. NO. CLV#16-XXXXX

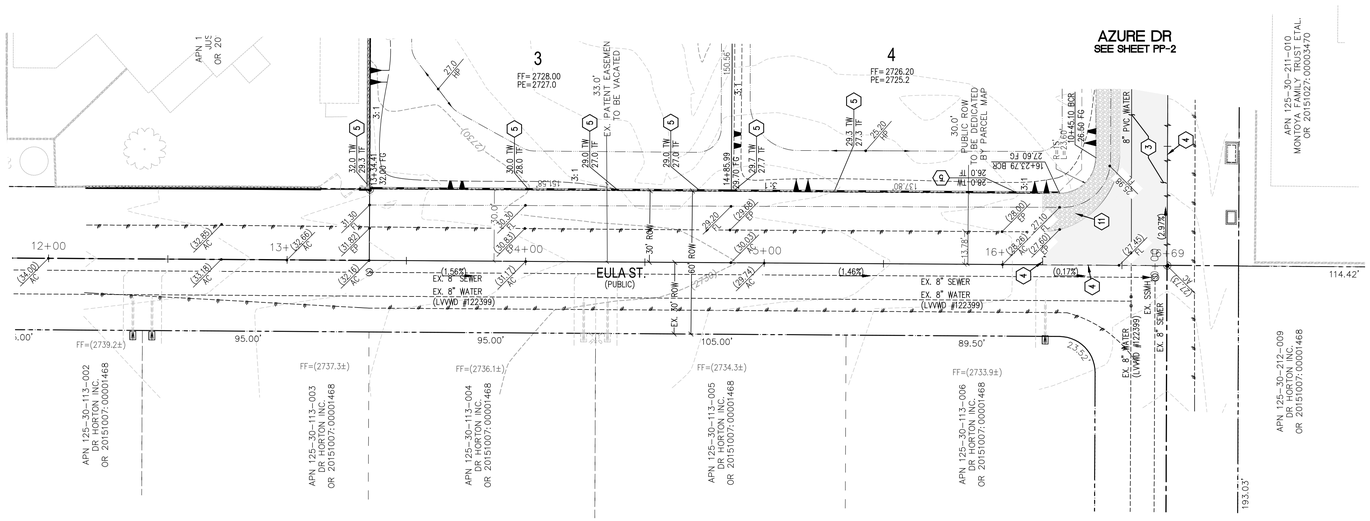
F:\Projects\2016 - 2.5 ac Azure - Pinnacle\MP\04-DT.dwg roy Wed, 01 Feb 2017 - 11:40am

GRAPHIC SCALE

30 0 15 30 60 120

(IN FEET)
1 inch = 30 ft.

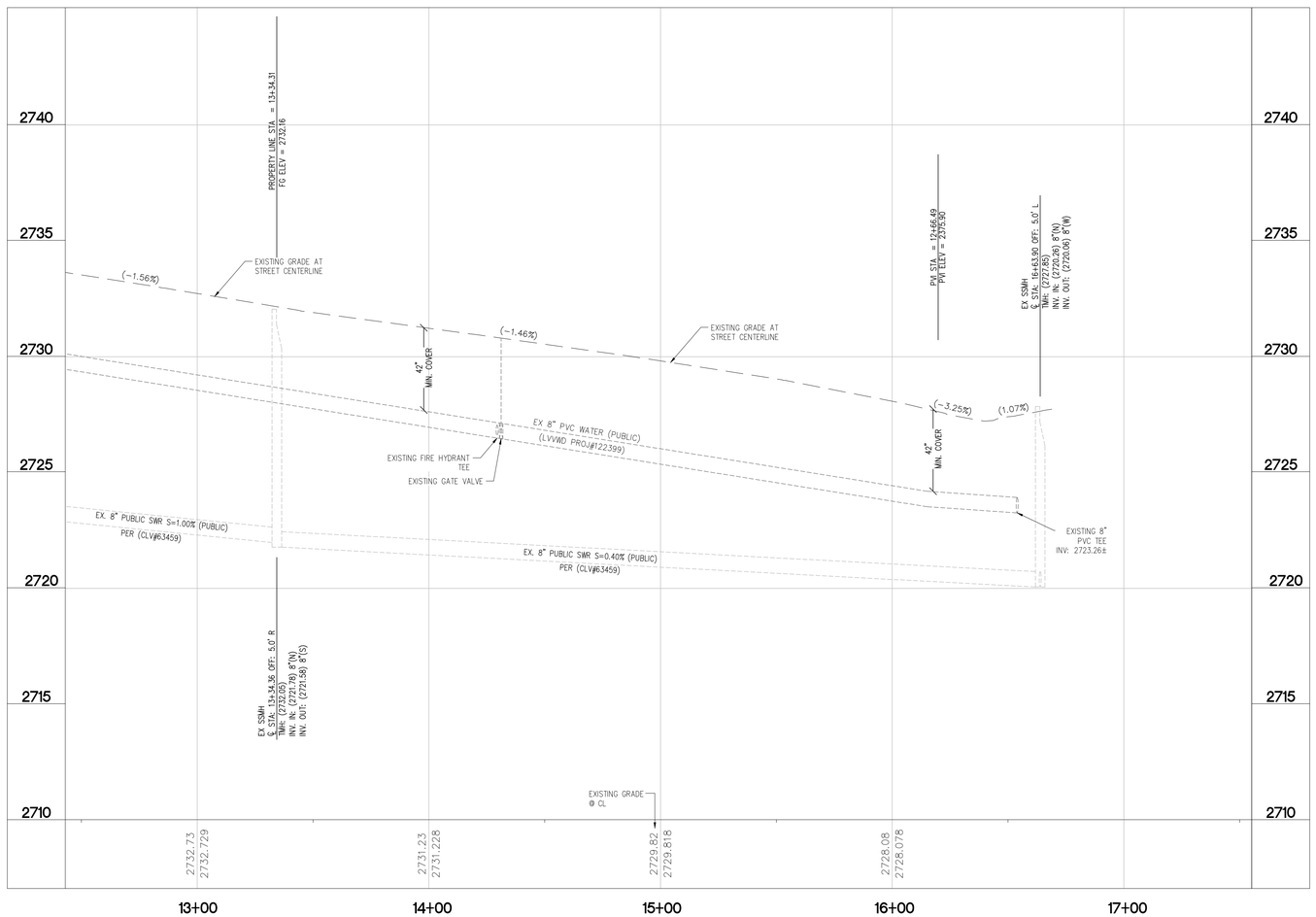
NORTH

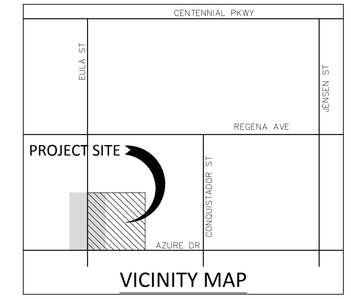


EULA ST. (PUBLIC)

PLAN AND PROFILE

1"=30' HORIZONTAL
1"=3' VERTICAL





VICINITY MAP

BENCHMARK

CITY OF LAS VEGAS BENCHMARK "7LV90 30N5", BEING A RIVET AND ROUND PLATE IN CABLE TV PAD ⊕ NE CORNER OF AZURE DR. & GRAND CANYON DR.

ELEVATION: 2671.33 (US SURVEY FEET)
814.22 (METERS)

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

BASIS OF BEARINGS

SOUTH 89°45'27" EAST, BEING THE BEARING OF THE CENTERLINE OF AZURE DRIVE AND THE SOUTH LINE OF THE NORTHWEST QUARTER (NW 1/4) OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 30, TOWNSHIP 19 SOUTH, RANGE 60 EAST, M.D.M., CLARK COUNTY, NEVADA, AS SHOWN ON FILE IN FILE 107 OF PARCEL MAPS, AT PAGE 99, OFFICIAL RECORDS OF CLARK COUNTY, NEVADA.

CLARK COUNTY
PUBLIC WORKS
DEVELOPMENT REVIEW

ACCEPTANCE OF PLANS FOR FILING

BY: _____

ACCEPTANCE OF THESE PLANS FOR FILING SHALL NOT BE CONSTRUED TO BE A PERMIT 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 HEREIN.

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

APPROVED FOR CONSTRUCTION

_____
LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER
DATE: _____ PROJECT NO. 124560

NO.	REVISION	BY	DATE	APP	DATE
6					
5					
4					
3					
2					
1					

SKYLINE SUMMIT
CITY OF LAS VEGAS NEVADA

SHEET:
PLAN AND PROFILE
EULA ST

PER4MANCE ENGINEERING
9345 W. SUNSET RD. STE 101, LAS VEGAS, NEVADA 89148
TEL: (702)569-9770 EMAIL:RAYF@PER4MANCELV.COM

DEVELOPER:
PINNACLE HOMES

SEAL
PROFESSIONAL ENGINEER – STATE OF NEVADA
RAY F. FREDERICKSEN
Exp. 06/30/17
CIVIL
No.17471

DESIGNED BY: RFF
DRAWN BY: RFF
CHECKED BY: RFF
SCALE: 1"=30'
PROJECT DATE: FEBRUARY 1, 2016

SHEET
PP-1
7 OF 9

AGENCY DWG. NO.
CLV#16-XXXXX

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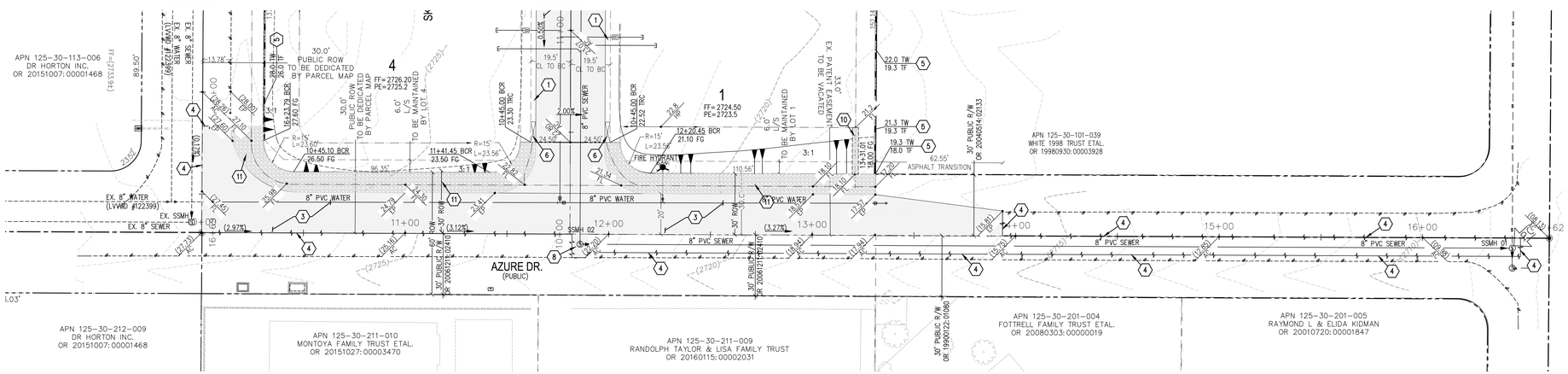

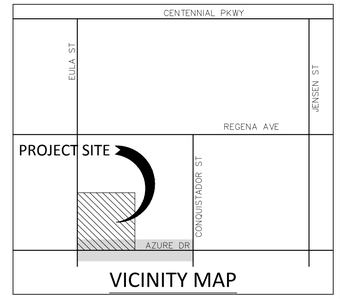

VICINITY MAP

BENCHMARK

CITY OF LAS VEGAS BENCHMARK "7LV90 30N6", BEING A RIVET AND ROUND PLATE IN CABLE TV PAD @ NE CORNER OF AZURE DR. & GRAND CANYON DR.

ELEVATION: 2671.33 (US SURVEY FEET)
814.22 (METERS)

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

BASIS OF BEARINGS

SOUTH 89°45'27" EAST, BEING THE BEARING OF THE CENTERLINE OF AZURE DRIVE AND THE SOUTH LINE OF THE NORTHWEST QUARTER (NW 1/4) OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 30, TOWNSHIP 19 SOUTH, RANGE 60 EAST, M.D.M., CLARK COUNTY, NEVADA, AS SHOWN ON FILE IN FILE 107 OF PARCEL MAPS, AT PAGE 99, OFFICIAL RECORDS OF CLARK COUNTY, NEVADA.

GRADING NOTES

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7. SIGHT VISIBILTY ZONE.
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10. INSTALL RIP RAP PAD D50=6" THICKNESS=1 FT
11. INSTALL RIP RAP PAD D50=9" THICKNESS=18 INCHES

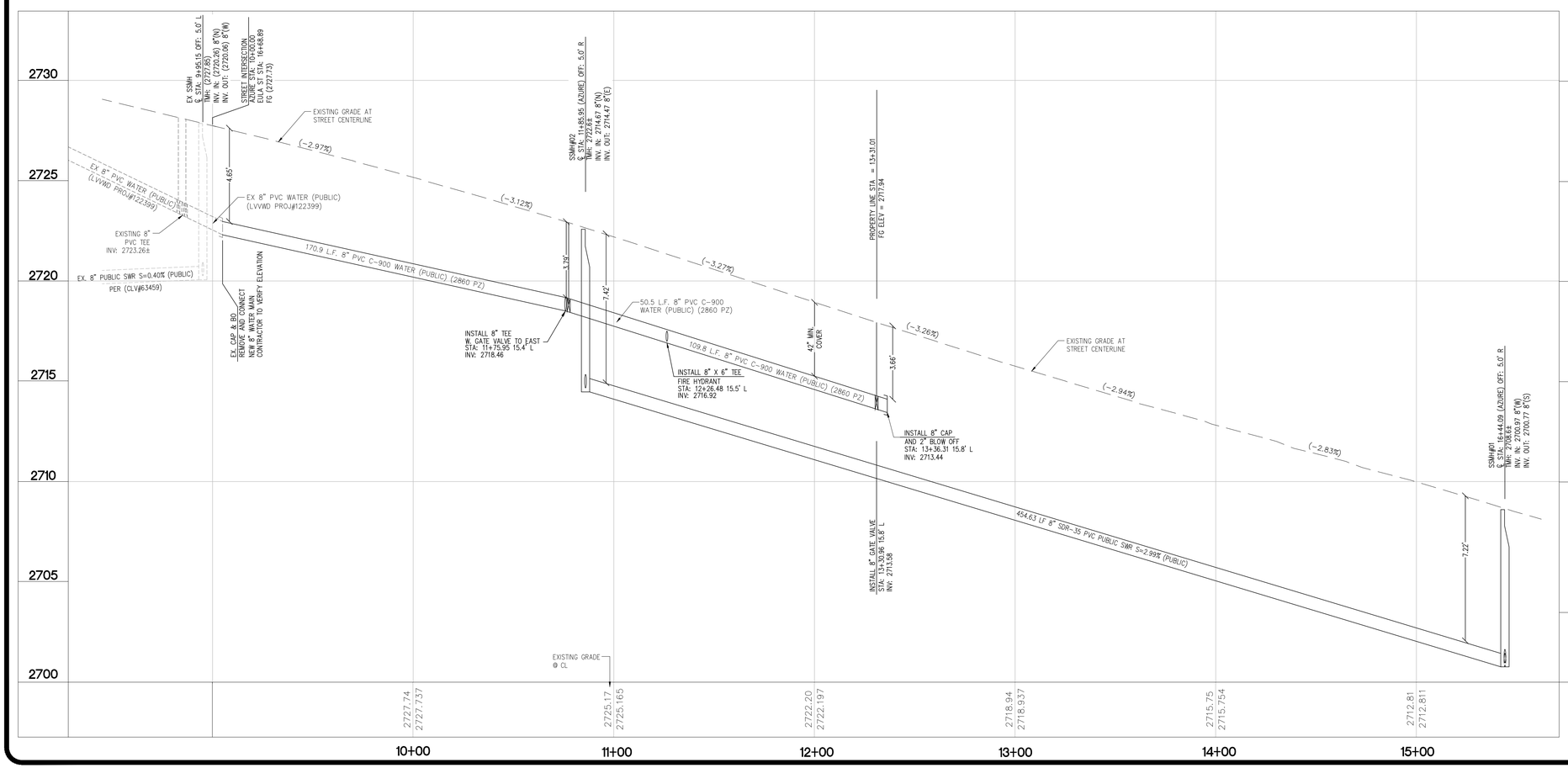
AZURE DR. (PUBLIC)

PLAN AND PROFILE

1"=30' HORIZONTAL
1"=3' VERTICAL

LVVWD NOTE

MINIMUM 24-INCH COVER PER UDACS SEC 2.08.04.
GRADING MUST BE COMPLETED PRIOR TO WATERLINE INSTALLATION.



CLARK COUNTY
PUBLIC WORKS
DEVELOPMENT REVIEW

ACCEPTANCE OF PLANS FOR FILING

BY:
ACCEPTANCE OF THESE PLANS FOR FILING SHALL NOT BE CONSTRUED TO BE A PERMIT 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 HEREIN.

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APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER
DATE: _____ PROJECT NO: XXXXXX

NO.	REVISION	BY	DATE	APP.	DATE
6					
5					
4					
3					
2					
1					

SKYLINE SUMMIT
CITY OF LAS VEGAS NEVADA
SHEET:
PLAN AND PROFILE
AZURE DRIVE

PERMANGE ENGINEERING
9345 W. SUNSET RD. STE 101, LAS VEGAS, NEVADA 89148
TEL: (702)569-9770 EMAIL:RAYF@PER4MANCELV.COM

DEVELOPER:
PINNACLE HOMES

SEAL
PROFESSIONAL ENGINEER - STATE OF NEVADA
RAY F. FREDERICKSEN
Exp. 06/30/17
CIVIL
No. 17471

DESIGNED BY: RFF
DRAWN BY: RFF
CHECKED BY: RFF
SCALE: 1"=30'
PROJECT DATE: FEBRUARY 1, 2016

SHEET
PP-2
8 OF 9

AGENCY DWG. NO.
CLV#16-XXXXX

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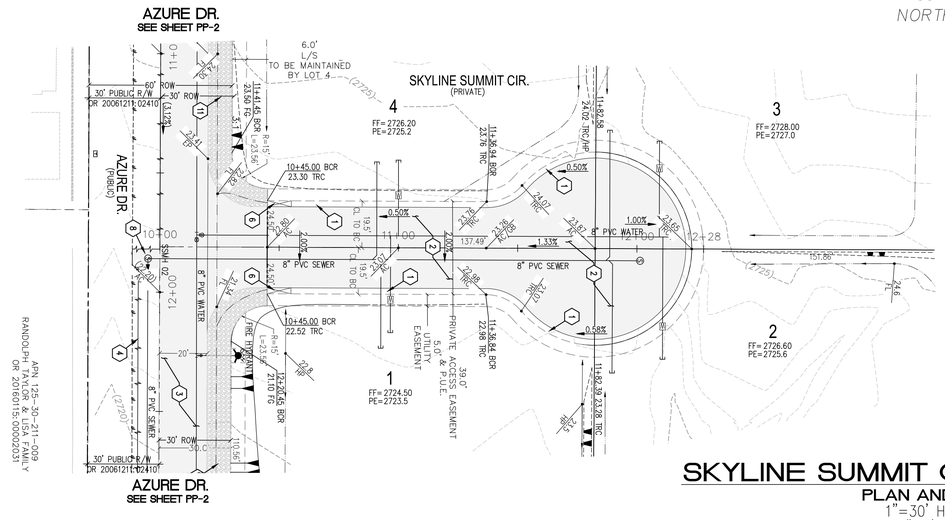
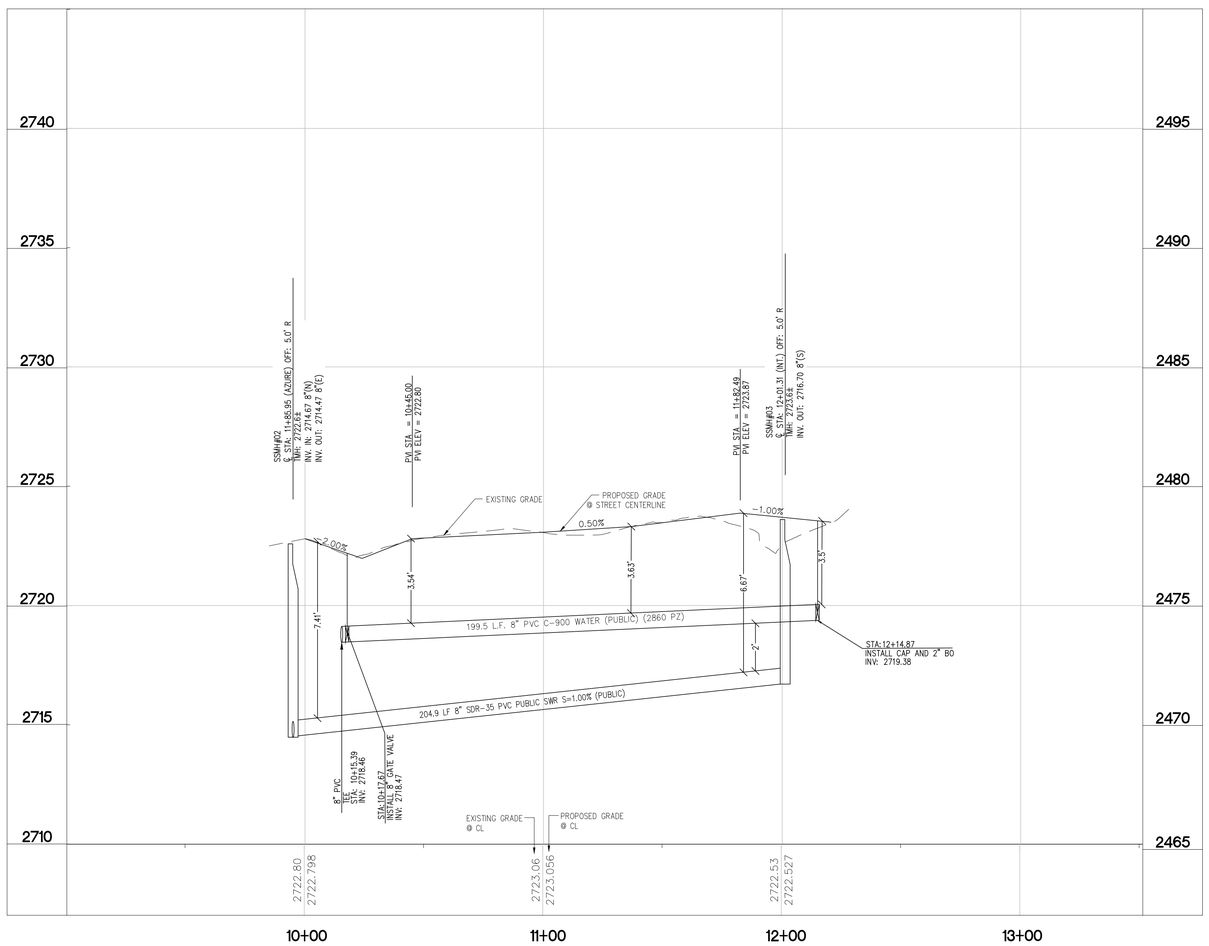
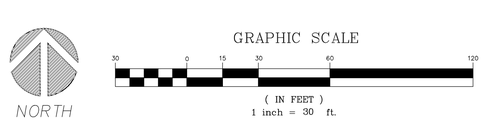


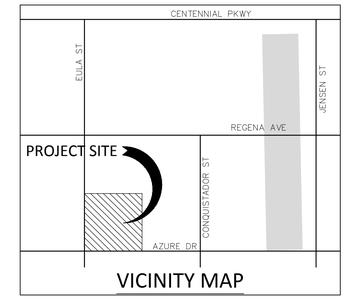
SKYLINE SUMMIT CIRCLE (PRIVATE)

PLAN AND PROFILE

1"=30' HORIZONTAL
1"=3' VERTICAL







BENCHMARK

CITY OF LAS VEGAS BENCHMARK "7LV90 30N6", BEING A RIVET AND ROUND PLATE IN CABLE TV PAD @ NE CORNER OF AZURE DR. & GRAND CANYON DR.

ELEVATION: 2671.33 (US SURVEY FEET)
814.22 (METERS)

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

BASIS OF BEARINGS

SOUTH 89°45'27" EAST, BEING THE BEARING OF THE CENTERLINE OF AZURE DRIVE AND THE SOUTH LINE OF THE NORTHWEST QUARTER (NW 1/4) OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 30, TOWNSHIP 19 SOUTH, RANGE 60 EAST, M.D.M., CLARK COUNTY, NEVADA, AS SHOWN ON FILE IN FILE 107 OF PARCEL MAPS, AT PAGE 99, OFFICIAL RECORDS OF CLARK COUNTY, NEVADA.

GRADING NOTES

1. INSTALL "ROLL" TYPE CURB AND GUTTER PER CCAUSD #217.S1
2. INSTALL 2" AC OVER 4" TYPE II AGGREGATE BASE PER SOILS REPORT
3. INSTALL 3" AC OVER 4" TYPE II AGGREGATE BASE PER SOILS REPORT
4. SAWCUT AND MATCH EXISTING PAVEMENT. DUE TO THE EXISTING FIELD CONDITIONS AND VARYING SLOPES THE LENGTH AND WIDTH OF SAWCUT AND PATCH TO BE DETERMINED BY THE INSPECTOR IN THE FIELD. WIDTHS MAY VARY.
5. CONSTRUCT RETAINING WALL, HEIGHT PER PLAN. STRUCTURAL DESIGN BY OTHERS
6. INSTALL ROLL CURB TO ZERO CURB TRANSITION PER DETAIL 1, SHEET DT-1.
7. SIGHT VISIBILTY ZONE.
8. TRENCH BACKFILL AND AC PAVEMENT RESTORATION PER CCAUSD#503, 500.4, & 500.5.
9. INSTALL 12" X 12" NYLOPLAST AREA DRAIN. CONTRACTOR TO DRILL 2-INCH HOLES IN BOTTOM. INSTALL 12-INCHES OF AGGREGATE BASE. FOR NUISANCE WATER TO DRAIN
10. INSTALL RIP RAP PAD D50=6" THICKNESS=1 FT
11. INSTALL RIP RAP PAD D50=9" THICKNESS=18 INCHES

CLARK COUNTY
PUBLIC WORKS
DEVELOPMENT REVIEW

ACCEPTANCE OF PLANS FOR FILING

BY: _____

ACCEPTANCE OF THESE PLANS FOR FILING SHALL NOT BE CONSTRUED TO BE A PERMIT 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 HEREIN.

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

APPROVED FOR CONSTRUCTION

_____
LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER
DATE: _____ PROJECT NO. _xxxxxxx_____

NO.	REVISION	BY	DATE	APP.	DATE
6					
5					
4					
3					
2					
1					

SKYLINE SUMMIT
CITY OF LAS VEGAS NEVADA
SHEET:
PLAN AND PROFILE
INTERIOR ST.

PER ENGINEERING
9345 W. SUNSET RD. STE 101, LAS VEGAS, NEVADA 89148
TEL: (702)569-9770 EMAIL:RAYF@PER4MANCELV.COM

DEVELOPER:
PINNACLE HOMES

SEAL
PROFESSIONAL ENGINEER - STATE OF NEVADA
RAY F. FREDERICKSEN
Exp. 06/30/17
CIVIL
No. 17471

DESIGNED BY: RFF
DRAWN BY: RFF
CHECKED BY: RFF
SCALE: 1"=30'
PROJECT DATE: FEBRUARY 1, 2016

SHEET
PP-3
9 OF 9

AGENCY DWG. NO.
CLV#16-XXXXX

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