

Technical Drainage Study
for

ANN ROAD & HUALAPAI WAY

Date Prepared:
April 2021

Prepared for:
Richmond American Homes of Nevada, Inc.
7770 Dean Martin Drive, Suite 308
Las Vegas, NV 89193
702.240.5605

Prepared by:
Kimley-Horn and Associates, Inc.
6671 Las Vegas Boulevard South, Suite 320
Las Vegas, NV 89119
702.862.3600

Kimley»Horn



April 6, 2021

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

RE: *Technical Drainage Study for Ann Road and Hualapai Way*

Dear Mr. Sung,

This letter certifies that all items provided on the Technical Drainage Study for Ann Road and Hualapai Way electronic submittal matches the paper version bound into the study.

With Kimley-Horn, you should expect more and will experience better. Please contact me at (702) 790-0206 or michael.schwab@kimley-horn.com should you have any questions or concerns.

Sincerely,

A handwritten signature in black ink, appearing to read "Michael Schwab".

Michael E. Schwab, P.E.

A handwritten signature in blue ink, appearing to read "Mikayla Baillie".

Mikayla Baillie, E.I.T

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL
DRAINAGE STUDY INFORMATION FORM

Name of Development: Ann Road & Hualapai Way Date: April 2021

Location of Development: a) Descriptive (Cross Streets) North/South: Hualapai Way
East/West: Ann Road

b) Section: 31 Township: 19S Range: 60E

c) APN : 125-31-101-001

Name of Owner: Richmond American Homes of Nevada, Inc.

Telephone No.: 702.240.5605 Fax No.: _____ E-Mail Address: angela.pinley@mdch.com

Address: 7770 Dean Martin Drive, Suite 308 Las Vegas, NV 89139

Contact Person-Name: Michael Schwab, P.E. Telephone No.: 702.790.0206

* E-Mail Address: michael.schwab@kimley-horn.com Fax No.: _____

Firm: KIMLEY-HORN

Address: 6671 Las Vegas Boulevard South, Suite 320 Las Vegas, NV 89119

Type of Land Development/Land Disturbance Process:

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

1. Total Owned Land Area: At Site: +/- 25.9 acres Being Developed/Disturbed: +/- 25.9 acres

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

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

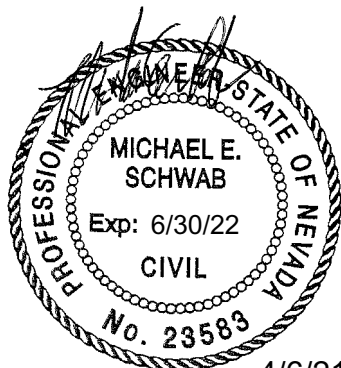
4. Proposed type of development (Residential, Commercial, Etc.): Residential

5. Approximate upstream land area which drains to the subject site: N/A

6. Has the site drainage been evaluated in the past? ☒ YES ☐ NO If yes, please identify documentation: TDS for Ann & Grand Canyon

7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: Two drainage easements to the north; undeveloped parcel to the south

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



Engineer's Seal

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

***New Required Field**

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

	Revision	Date
Local Entity File No. _____		

REFERENCE:

STANDARD FORM 1

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL			
DRAINAGE SUBMITTAL CHECKLIST			
Project Name:	Ann Road and Hualapai Way	Map ID:	
Firm Name:	Kimley-Horn	Engineer:	Michael E. Schwab
Address:	6671 Las Vegas Boulevard South, Suite 320		
City:	Las Vegas	State:	Nevada
		Zip:	89119
Phone No.:	(702) 790-0206	Fax No.:	
Property Owner:	Richmond American Homes of Nevada, Inc.		
Address:	7770 Dean Martin Drive, Suite 308		
City:	Las Vegas	State:	NV
		Zip:	89119
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 (CCRCD) 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 N/A

- | | | | |
|-------------------------------------|--------------------------|-------------------------------------|--|
| ☒ | ☐ | ☐ | Design Manual Standard Form 1 with the Engineer's seal and signature. |
| ☒ | ☐ | ☐ | Design Manual Standard Form 4 . |
| ☒ | ☐ | ☐ | 2 copies of the 24" x 36" Drainage Plan . |
| ☐ | ☐ | ☒ | A notarized letter from the adjacent property owner(s) allowing off-site grading or discharge. |

II. MAPS AND EXHIBITS

YES NO N/A

- | | | | |
|-------------------------------------|--------------------------|--------------------------|--|
| ☒ | ☐ | ☐ | A copy of a current Flood Insurance Rate Map (FIRM) with the site delineated. |
| ☒ | ☐ | ☐ | A copy of the current CCRCD Master Plan Update Figure, (F-x), for Flood Control Facilities and Environmental areas with the site delineated. |
| ☒ | ☐ | ☐ | Off-site drainage basin maps for existing, interim, and future conditions showing the existing topography, basin boundaries, concentration points, and flows in cfs. |

II. MAPS AND EXHIBITS (CONTINUED)

- | | | | |
|-------------------------------------|--------------------------|--------------------------|---|
| ☒ | ☐ | ☐ | Vicinity Map with local and major cross streets identified and a north arrow. |
|-------------------------------------|--------------------------|--------------------------|---|

III. DRAINAGE PLAN

YES	NO	N/A	
☒	☐	☐	Sheet size: 24"x36" sealed by a registered engineer in the State of Nevada.
☒	☐	☐	Minimum scale: 1"=60'
☒	☐	☐	Project name.
☒	☐	☐	Vicinity Map with local and major cross streets.
☒	☐	☐	Revision box.
☒	☐	☐	North arrow and bar scale.
☒	☐	☐	Engineer's/consultant's address and phone number.
☒	☐	☐	Elevation datum and benchmark.
☒	☐	☐	Legend for symbols and abbreviations.
☒	☐	☐	Cut/Fill scarps, where applicable.
☒	☐	☐	Street names, grades, widths.
☒	☐	☐	Proposed future and existing spot grades for top of curbs and street crowns at lot lines, grade breaks, and along curb returns on both sides of the street.
☒	☐	☐	Existing contours encompassing the site and 100-feet beyond with spot elevations for important locations, where appropriate.
☒	☐	☐	Minimum finish floor elevations with top-of-curb elevations at upstream end of lot.
☒	☐	☐	Proposed typical street sections.
☒	☐	☐	Streets with offset crowns.
☒	☐	☐	Proposed contours or spot elevations in sufficient detail to exhibit intended drainage patterns and slopes.
☒	☐	☐	Property lines.
☒	☐	☐	Right-of-way lines and widths, existing and proposed.
☒	☐	☐	Existing improvements and their elevations.
☒	☐	☐	Delineation of proposed on-site drainage basins indicating area and 10-year and 100-year peak flows at basin concentration points.
☒	☐	☐	Concentration points and drainage flow directions with Q_{100} and V_{100} and D_{100} in streets.
☒	☐	☐	Cumulative flows, velocity, and direction of flow at upstream and downstream ends of site for the 10-year and 100-year flows.
☒	☐	☐	Location and cross-section of street capacity calculations.
☒	☐	☐	Cross-sectional detail for channels, including cutoff wall locations.

III. DRAINAGE PLAN (CONTINUED)

YES	NO	N/A	
☒	☐	☐	Existing and proposed drainage facilities, appurtenances, and connections (i.e., sidewalk ditches, swales, storm drain systems, unimproved channels, and culverts, etc.) stating size, material shape, and slope with plan and profile and HGL calculations.
☒	☐	☐	Existing and proposed drainage easements and widths shown with sufficient detail. A cross-sectional detail must be provided that shows appropriate lining and reinforcement.
☐	☐	☒	Location and detail of existing, proposed, and future block wall openings. Minimum size is 16"x48". Wrought iron gate is required for flows > 10 cfs.
☒	☐	☐	Location and detail of flood-wall(s) illustrating depth of flow, proposed grouting height, etc.
☒	☐	☐	Perimeter retaining wall locations. All existing and proposed walls (retaining screen and flood) must be shown with adjacent ground elevations. Flood walls with 8-inch concrete masonry unit.
☒	☐	☐	Building and/or lot numbers.
☒	☐	☐	Alignment of all existing, proposed, or future Regional Facilities adjacent to the site.
☐	☐	☒	Limits of existing floodplain based on current FIRM or best available information; limits of proposed floodplains based on best available information.
☐	☐	☒	For areas in Zone A, AE, AH, and AO, base flood elevations (BFEs) must be shown for each lot; BFEs may be listed on each lot, or in a table. Finish floor elevations must be a minimum of 18 inches above BFE.
☒	☐	☐	Appropriately elevated "humps" 6 inches above the 100-year water surface elevation at the accesses where the intent is to protect the site from the Q ₁₀₀ flows.
☒	☐	☐	Street slopes for perimeter and interior streets. The minimum slope is 0.4 percent.
☐	☐	☒	Location and detail of best management practice (BMP) for parking lots and low impact development (LID) (if required)

IV. HYDROLOGIC ANALYSIS

YES	NO	N/A	
☒	☐	☐	Appropriate soil information and Soils Map for existing and future conditions with sub-basins and property delineated.
☒	☐	☐	Input and Output information for existing conditions from computer models (HEC-1 or TR-55). The flow routing diagram must be provided with HEC-1 models.
☒	☐	☐	Input and Output information for proposed conditions from computer models (HEC-1 or TR-55). The flow routing diagram must be provided with HEC-1 models.
☒	☐	☐	Use of correct precipitation values in and around the McCarran Airport rainfall area.
☒	☐	☐	A discussion in the text of the hydrologic analysis justifying sub-basin boundaries and cutoffs, supporting assumptions, and calculations.
☒	☐	☐	A summary table of stormwater flows showing basin area Q ₁₀ and Q ₁₀₀ for both individual basins and combined basin flows, where applicable.

IV. HYDROLOGIC ANALYSIS (CONTINUED)

- | | | | |
|-------------------------------------|--------------------------|-------------------------------------|--|
| ☒ | ☐ | ☐ | Copies of supporting technical information referenced from a previously approved study and a statement accepting these results. |
| ☒ | ☐ | ☐ | On-site facilities must perpetuate flows through or around the site without significantly impacting adjacent property owners in accordance with current Nevada Drainage Law. |
| ☐ | ☐ | ☒ | Calculation for impervious area for parking lots and LIDs (if required) |

V. HYDRAULIC ANALYSIS

YES NO N/A

- | | | | |
|-------------------------------------|--------------------------|-------------------------------------|--|
| ☐ | ☐ | ☒ | Flow split calculations and supporting documentation or reference for the method of flow calculation used. |
| ☒ | ☐ | ☐ | Normal depth street flow calculations and cross-section diagrams for all interior and perimeter streets. Provide "d x v" products for the Q ₁₀₀ and Q ₁₀ flows representing the worst case for interior and all perimeter streets. Q ₁₀₀ d x v ≤ 8. Q ₁₀ d x v ≤ 6 and 12 foot dry lane for rights-of-way ≥ 80 feet. Calculations must be labeled by street name as indicated on the Grading Plan . |
| ☒ | ☐ | ☐ | A summary table of interior and exterior street capacity calculations showing the street name, Q ₁₀₀ flow, slope, depth of flow, velocity and depth times velocity product and streets needing to meet 12 foot dry lane criteria. |
| ☐ | ☐ | ☒ | Appropriate hydraulic calculations for block wall openings assuming a 50 percent vertical clogging factor. (Assume the lower half of the opening is plugged.) |
| ☒ | ☐ | ☐ | Appropriate hydraulic calculations at drainage easement entrance and discharge locations to set finish floor elevations. Hydraulic calculations must include submerged weir, superelevation and tee intersection losses, where appropriate. |
| ☒ | ☐ | ☐ | Provide necessary freeboard requirements to set the finished floor elevations of all proposed buildings, 2 x depth of flow or depth of flow plus 18 inches of freeboard, whichever is less. The minimum requirement is 6 inches above adjacent upstream top of curb. Building 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. |
| ☐ | ☐ | ☒ | <p>A complete water surface profile analysis (HEC-2, HEC-RAS, etc.) for channel flows and FEMA Zone A flood zones.</p> <ul style="list-style-type: none"> • 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. |
| ☐ | ☐ | ☒ | Provide a 50 percent clogging factor in the capacity calculation for drop inlets. |
| ☐ | ☐ | ☒ | Hydraulic calculations for culverts and storm drains. D-Load calculations must be provided for storm drainpipes in public rights-of-way, including headwater pool inundation. |
| ☒ | ☐ | ☐ | The mitigation of nuisance water, both during construction and in the fully developed condition must be addressed. |
| ☐ | ☐ | ☒ | Provide BMP type, size and supporting calculations for parking lots and LIDs (if required) |

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INTRODUCTION

Richmond American has contracted with Kimley-Horn (KH) to provide design services for the **Ann Road and Hualapai Way** improvements southeast of Ann Road and Hualapai Way. Richmond American is proposing to develop **26± acre residential subdivision** and half street improvements for Hualapai Way, and half and full-street improvements for Eula Street. In general, existing drainage patterns will be maintained throughout the site.

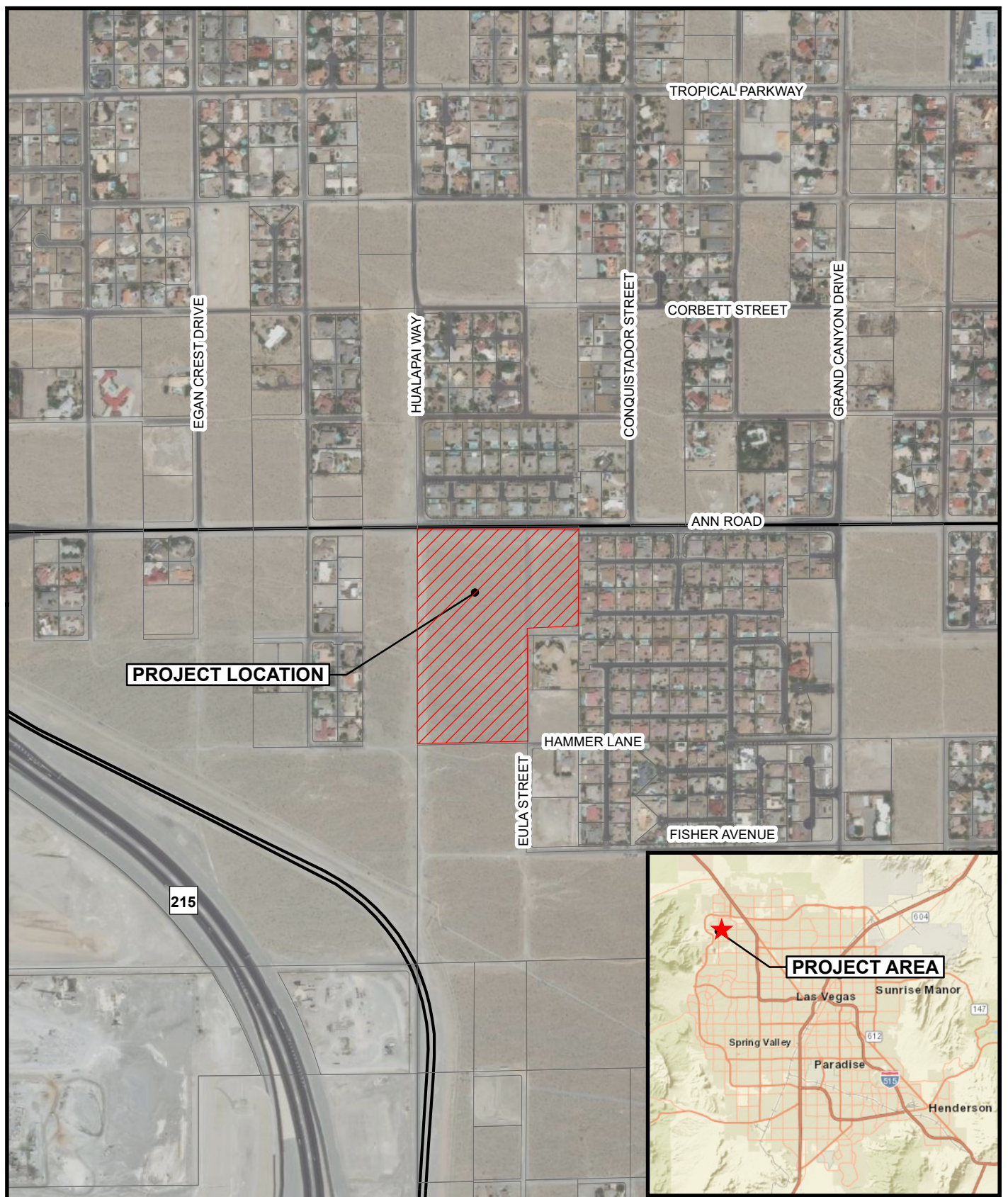
The purpose of this report is to accompany the grading plans and to provide detailed hydrologic and hydraulic analyses for the proposed residential site. The following tasks were performed in the preparation of this report:

1. Identify previous drainage studies for the project site and surrounding areas.
2. Identify the FEMA floodplain designation for the project site.
3. Identify existing and proposed regional drainage facilities adjacent to the site.
4. Estimate runoff generated for the peak 100-year and 10-year return period storms for existing and proposed conditions.
5. Verify proposed finished floor elevations meet CLV Criteria.
6. Recommend drainage features to protect the project from storm runoff.

LOCATION AND DEVELOPMENT DESCRIPTION

Ann and Hualapai is located within Section 31, Township 19 South, Range 60 East, M.D.M., in Clark County, Nevada. The proposed project will consist of **40 single-family residential units** within **±25.93 acres of APN 125-31-101-001**. A copy of the *Assessor's Parcel Map* is included in **Appendix A**. Please refer to **Figure 1 – Vicinity Map** for the location of the project.

Currently, the site is undeveloped with sparse vegetation. The site is bordered by the partially developed Ann Road to the north, undeveloped Hammer Lane to the south, an existing residential development to the east, and a residential development under construction to the west. The existing site generally slopes from west to the east via natural washes toward the existing residential development. The proposed interior streets will consist of 36-foot wide private drive aisles with a normal crown section, roll-type curb and gutter and a 5-foot sidewalk on one side. The entry off Ann Road, Eula Street, will consist of a 60-foot wide private drive aisle with a normal crown section, 6-foot swales and 8-foot decorative treatment on both sides. Drainage improvements will include roadway improvements, swales, and valley gutters to convey onsite storm runoff through the site and into the two existing drainage easements and undeveloped parcel to the east.



**FIGURE 1 - VICINITY MAP
ANN & HUALAPAI**

Half street improvements in Ann Road and Hualapai Way will be constructed as part of this project. The half street improvements (50-foot to 40-foot wide ROW) proposed with the study will consist of the southern half of Ann Road and the eastern half of Hualapai Way adjacent to the project site such that the future built out street improvements shall have a 100-foot and 80-foot wide ROW, respectively, as measured from back-of-sidewalk to back-of-sidewalk, which includes a normal crown section, “L”-type curb and gutter, a 5-foot wide sidewalk on both.

PREVIOUS DRAINAGE STUDIES

Previous hydrology studies that was utilized in the preparation of this report:

1. *Technical Drainage Study for Ann and Grand Canyon Residential Development. Approved October 4, 2010* (Grand Canyon Study, October 2010, PW No. 10-18993)
 - a. The *Grand Canyon Study* establishes the existing conditions surface flows for the project site as well as approved discharge flows to the adjacent property
2. *Technical Drainage Study for Ann & 215 – Phase 1. Approved July 13, 2020.* (215 Study, July 2020, PW No. 20-11651)
 - a. The 215 Study established the flowrates impacting the project site from the west in Hualapai Way in the Interim and Ultimate Conditions. In the Interim Condition, a flow rate of 17/75 cfs, 10-year and 100-year respectively, is present at a low point in Hualapai Way west of the project site near Street “E”. In the Ultimate Condition, a flow rate of 5/32 cfs, 10-year and 100-year respectively, is present at the low point in Hualapai Way west of the project site.

Kimley-Horn has reviewed the reference studies listed and agrees with the information included therein. The information referenced is for determining the existing and proposed development patterns and quantities of flow adjacent to the proposed project site. Flows referenced are indicated throughout this report and are accepted by Kimley-Horn for this study. Pertinent reference material is included in **Appendix D**.

CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT (CCRFCD) MASTER PLAN FACILITIES

“*The Las Vegas Valley Flood Control Master Plan Update*”, **Figure F-17**, dated December 2018, as prepared by the Clark County Regional Flood Control District (CCRFCD) illustrates the existing and proposed master planned facilities in the area (**See Appendix A**). As shown on the exhibit, the project site is **not** located adjacent to any existing or proposed regional master planned facilities.

FEMA FLOOD HAZARD DESIGNATION

The Special Flood Hazard Areas (SFHA) for both the unincorporated and the incorporated portions of Clark County, Nevada, are outlined in the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps. This subject site is located on FEMA Flood Insurance Rate Map (FIRM) Community Panel No. **32003C 1750E and 32003C 1745E**, revised September 27, 2002. As shown on the FEMA FIRM Exhibit (see **Appendix A**), the subject site is located within a FEMA-designated **Zone X**. Therefore, this project is not currently located in a FEMA-designated SFHA. Areas described as Zone X are areas determined to be outside the 0.2% annual chance floodplain.

HYDROLOGIC METHODOLOGY

The hydrologic model and design of this site development are in compliance with local requirements, including Clark County (CC), the CCRFCD's *"Hydrologic Criteria and Drainage Design Manual"*, and the CCRFCD's *"Flood Control Master Plan Update"*.

MODEL DESCRIPTION

The hydrologic model utilized in this study is the **HEC-1** Flood Hydrograph Package developed by the U.S. Army Corps of Engineers Hydrologic Engineering Center. **HEC-1** is a rainfall runoff event simulation model utilizing an interconnected system of hydrologic and hydraulic components to simulate the surface runoff response of a drainage area to precipitation. The calculations of this study were performed using the SCS Unit Hydrograph of the **HEC-1** Flood Hydrograph Model. The detailed explanation of the theory and background is presented in Section 4 of the SCS National Engineering Handbook and the **HEC-1** User Manual. Since the drainage area for the overall watershed is less than 8 square miles, and **SDN3** design storm was selected for the use in the HEC-1 computer model.

PRECIPITATION

According to Figure **513** of the Manual, the project is **not** located within the **McCarran Airport Rainfall Area**; therefore, point rainfall values for the 10-year and 100-year, six-hour storm event were adjusted per **Table 501** and calculated to be **1.74** and **3.15** inches, respectively (see **Appendix B**).

CURVE NUMBER

The soils information for the project watershed was referenced from the Soil Survey of Las Vegas Area, Nevada, Part of Clark County" prepared by the United States Department of Agriculture Natural Resources Conservation Services (USDA NRCS). A *Custom Soil Resource Report* for the project site is included in **Appendix B**. The report indicates that the project area consists of Soil Type 190 (Dalian) which is classified as Hydrologic Soil Group **"A"**. HSG **"A"** is characterized as having low runoff potential.

The land uses / Land covers for the project site consist of: “**Streets**” for half street improvements and “**14,000 sf lots**” for developed areas.

For the given soil, CN values were determined from appropriate columns of **Table 602 and 602A** of the Manual. Curve numbers ranging from **57 to 98** were determined for the proposed conditions subbasins. Existing conditions curve numbers and offsite subbasins were referenced from the *Grand Canyon Study* and *215 Study* respectively.

A copy of “*The Las Vegas Valley Flood Control Master Plan Update*”, Figure **W-2B**, dated December 2018, as prepared by CCRFCD is included in **Appendix A** to illustrate Regional’s hydrologic subareas, land use and soils in the area.

DRAINAGE AREAS AND FLOW PATTERNS

The subbasins and flow patterns used for the hydrologic modeling were determined from elevations established for the project site in a master grading digital file. Aerial topography with 1-foot contour intervals and survey data has been used for subbasin delineations.

LAG TIME

The time between a brief, heavy rain and maximum runoff rate is called Lag Time. Lag Time can be estimated from historical hydrographs or it can be estimated from specific watershed characteristics such as watershed length, slope and flow impedance. Based on studies of many storm events for a range of watershed conditions, the following empirical relationship between Lag Time (T) and Time of Concentration (T_c) was derived:

$$T = 0.6T_c$$

The Time of Concentration (T_c) is defined as the time required for runoff to the flow from the most remote part of the drainage basin to the outlet or to a combination point. The procedure for calculating the T_c is outlined in **Section 602** of CCRFCD’s “*Hydrologic Criteria and Drainage Design Manual*”. Lag time calculations for this site are included in **Appendix B** as shown on **Standard Form 4**.

HYDROLOGY

Existing Conditions hydrology was referenced from the *Grand Canyon Study*. Proposed and Ultimate Conditions hydrology has been prepared to address the proposed improvements. Existing, Proposed, and Ultimate condition subbasins have been included on **Figures EX-1, PRO-1, and ULT-1**, respectively, and depict the drainage patterns used in the hydrologic analysis for the project. Copies of the figures are included in **Appendix A**. HEC-1 Models for Proposed and Ultimate Conditions subbasins have been included in **Appendix B**. Tables summarizing the results of the HEC-1 Models have been included on **Figures EX-1, PRO-1, and ULT-1** in **Appendix A**.

EXISTING CONDITIONS

Existing conditions assume the site undeveloped and the development to the west is in its proposed condition such that Phase 1 of the *215 Study* is complete and Phase 2 is mass graded. Additionally, existing conditions assume the west half street improvement in Hualapai is built out with Phase 1 of the adjacent Ann & 215 project, and that the Ann CIP improvements by Clark County Public Works, from 215 to Hualapai, are complete. Offsite flows from the property to the west are conveyed east through natural washes through the project site and discharged to two drainage easements at the development to the east, and to a natural channel on the eastern property boundary that conveys flows east to a concrete channel. See **Figure EX-1** in **Appendix A**.

The project-specific existing conditions hydrology consists of three (3) onsite subbasins that were referenced from the *Grand Canyon Study* (*EXOF2, *EXOF3, *EXOF4). Referenced basins *EXOF2 and *EXOF4 were prorated to identify the onsite flow rates for basin EON3 and EON2, respectively. **Table 2** summarizes the prorated existing condition flow rates, and **Table 1** summarizes the onsite flow rates. Offsite flows are referenced from the *215 Study* and are assumed to be the same in the proposed condition. The referenced hydrologic calculations have been included in **Appendix D**.

Table 1: Existing Condition Flow Summary

BASIN ID/ COMB. PT.	BASIN AREA	10-YR FLOW	100-YR FLOW
	(ac)	(cfs)	(cfs)
EON1 (*EXOF3)	2.1	5	18
EON2	12.3	7	28
EON3	11.1	2	8

*Referenced from the Grand Canyon Study (PW# 10-18993)

Table 2: Existing Condition Prorated Flow Summary

Existing Onsites					
Subbasin	Q ₁₀ (cfs)	Q ₁₀₀ (cfs)	Area (ac)	cfs/acre _{10yr}	cfs/acre _{100yr}
*EXOF2	32	137	99.80	0.32	1.37
*EXOF4	5	25	18.37	0.27	1.36
Existing Onsite Prorated Basins					
Subbasin	Q ₁₀₀ (cfs)	Q ₁₀₀ (cfs)	Area (ac)	cfs/acre _{100yr}	cfs/acre _{10yr}
EON3	4	15	11.11	0.32	1.37
REMAINDER *EXOF2	28	122	88.69	0.32	1.37
TOTAL	32	137	99.80	NA	NA
EON2	3	17	12.35	0.27	1.36
REMAINDER *EXOF4	2	8	6.02	0.27	1.36
TOTAL	5	25	18.37	NA	NA

*Referenced from the Grand Canyon Study (PW #10-18993)

PROPOSED CONDITIONS

The proposed conditions drainage patterns assume the offsite area as described in existing conditions with the proposed site and adjacent half streets as developed. The proposed onsite flow patterns are similar to existing conditions. See **Figure PRO-1** in **Appendix A**. The project-specific proposed conditions hydrology consists of one (1) onsite subbasin (**ON**) and one (1) offsite street subbasin (**ANN1**). Additional offsite Subbasins ****OFF1**, ****ON2AP**, ****OFF3U**, ****OFF2P**, ****OFF4P**, ****ON1A**, ****ON1B**, and ****HUAL2** combine at ****CP3** in Hualapai Way have been referenced from the *215 Study as shown on Exhibit F* in **Appendix D**. This flow will continue through the project sight, conveyed through a drainage easement and Private Street "E" where it discharges to Eula Way and ultimately flows to an existing concrete channel that conveys flow south. Onsite basin **DON1** was prorated to determine flowrates impacting the proposed improvements. A unit flowrate (cfs/acre) for the onsite subbasin was calculated by dividing the total flowrate of the subbasin by the overall subbasin area. The total flowrate generated by areas shown on **Figure PRO-1** is approximated by multiplying the calculated unit flow rate (cfs/acre) by the delineated portion of the tributary area (acres). Prorate calculations for the onsite subbasin have been included on **Figure PRO-1**. **Table 3** summarizes the HEC-1 results for proposed conditions and **Table 4** summarizes the prorated proposed conditions flowrates. Hydrologic calculations have been included in **Appendix B**.

Table 3: Proposed Condition Flow Summary

BASIN ID / COMB. PT	BASIN AREA	100-YR FLOW	10 YR FLOW
	(ac)	(cfs)	(cfs)
**ANN	4.5	8	15
**OFF1P	4.8	5	13
**CP1	-	13	28
ANN1	1.6	3	6
CP1	-	16	34
**ON2AP	27.6	11	43
**OFF3U	2.2	<1	<1
**OFF2P	9.1	4	16
**CP2A	-	15	59
**OFF4P	20.1	<1	6
**CP2B	-	15	64
**ON1A	4.9	<1	1
**CP2	-	15	66
**ON1B	18.1	<1	5
**HUAL-2	2.2	5	9
**CP3	-	18	75
**HUAL-1	1.3	3	5
DON1	22.5	<1	7
DVSD1	-	<1	3
CP2	-	20	81

**Referenced/Revised from the 215 Study

Table 4: Proposed Condition Prorated Flow Summary

Proposed Onsites			
SUBBASIN	Q ₁₀₀ (cfs)	AREA (ac)	CFS/ACRE
DON1	7	22.5	0.31
Proposed Onsite Prorated Basins			
SUBBASIN	Q ₁₀₀ (cfs)	AREA (ac)	CFS/ACRE
DON1-A	1	3.0	0.31
DON1-B	0.5	2.3	0.31
DON1-C	1	3.3	0.31
DON1-D	0.5	1.5	0.31
DON1-E	1	3.1	0.31
DON1-F	1	2.6	0.31
DON1-G	1	2.8	0.31
DON1-H	1	3.9	0.31
TOTAL	7	22.5	NA

Flows generated by onsite subbasin **DON1-A through DON1-D** will be discharged east to the adjacent development via one of two drainage easements that discharge to the adjacent drives. Flows generated by onsite subbasins **DON1-E through DON1-H** combine at **CP2** with the offsite flows from the *215 Study* and discharges to the existing natural wash to the east. A 100-year flowrate of **0.5 cfs (DON1-D)** will discharge to the drainage easement to the north, **2.5 cfs (DON1-C)** will discharge out the drainage easement to the south, and **81 cfs (CP2)** will discharge to the existing natural wash. Please note these flow rates are less than previously approved flow rates. See **Figure PRO-1** in **Appendix A**.

ULTIMATE CONDITIONS

The ultimate conditions drainage patterns assume the project site and offsite parcels as fully developed. The ultimate onsite flow patterns match the proposed condition flow patterns. The ultimate condition flow rates are less than the proposed condition flow rates. This is due to Phase 2 of the *215 Study* going from Newly Graded (CN of 78.2) to Residential – 20,000 sf lots (CN of 56.7). Therefore, all design of flood protection facilities and finished floor elevations used the worst-case proposed condition flow rates. **Table 5** summarizes the HEC-1 results for ultimate conditions. See **Figure ULT-1** in **Appendix A**.

Table 5: Ultimate Condition Flow Summary

BASIN ID / COMB. PT	BASIN AREA	100-YR FLOW	10 YR FLOW
	(ac)	(cfs)	(cfs)
**ANN	4.5	8	15
**OFF1P	4.7	4	11
**CP1	-	12	26
ANN1	1.6	3	6
CP1	-	15	31
**ON2AP	28.2	0	7
**OFF3U	2.2	<1	<1
**OFF2P	9.2	3	13
**CP2A	-	3	18
**OFF4P	20.1	<1	4
**CP2B	-	3	22
**ON1A	4.9	<1	1
**CP2	-	3	23
**ON1B	18.1	<1	5
**HUAL-2	2.2	6	12
**CP3	-	8	33
**HUAL-1	1.3	3	5
DON1	22.5	<1	7
CP2	-	11	42

HYDRAULIC CALCULATIONS

STREETS

The resulting street flow data is based on the flows generated during proposed conditions as the proposed condition yields the highest flows. The resulting flow depths and velocities are presented in **Tables 6** and **7**. **Figure PRO-1** in **Appendix A** show the locations of the cross sections corresponding to the calculations included in **Tables 6**. Pertinent reference material has been included in **Appendix D**. The onsite normal depth sections and flow rates have been calculated from their respective tributary subbasins and are presented in **Table 7**. Private drive aisles (36') have been modeled as full street sections with a normal crown, roll-type curb and gutter, and a 5-foot sidewalk on one side. The hydraulic calculations can be found in **Appendix C**.

Table 6: Proposed Condition Hydraulic Street Sections

SECTION	SLOPE (%)	Q ₁₀₀ (cfs)	FLOW DEPTH (ft)	V ₁₀₀ (fps)	D*V	Q ₁₀ (cfs)	FLOW DEPTH (ft)	V ₁₀ (fps)	D*V	DRY LANE (ft)
ANN-1	3.55	34	0.60	5.93	3.56	16	0.48	5.39	2.59	27.50
HUAL-1	1.32	5	0.21	2.35	0.49	3	0.17	2.07	0.35	18.50
HUAL-2	1.95	75	0.53	5.35	2.84	18	0.31	3.74	1.16	11.50

Table 7: Proposed Condition Hydraulic Onsite Sections

STREET SECTION	TRIBUTARY BASINS	CHANNEL SLOPE	Q ₁₀₀	FLOW DEPTH	VELOCITY	D*V
		%	(cfs)	(ft)	(ft/s)	ft ² /s
ON1-A1	DON1-A	0.73	1	0.21	1.33	0.28
ON1-A2	DON1-A	0.63	1	0.21	1.25	0.26
ON1-B1	DON1-A+DON1-B	2.00	1.5	0.20	2.15	0.43
ON1-C1	DON1-A+DON1-B+DON1-C	3.04	2.5	0.10	2.28	0.23
ON1-C3	DON1-A+DON1-B+DON1-C	2.87	2.5	0.22	2.75	0.61
ON1-D	DON1-D	3.00	0.5	0.12	2.69	0.32
ON1-E1	**HUAL1+DON1-E	1.50	6	0.31	2.58	0.80
ON1-F1	**HUAL1+DON1-E+DON1-F	4.12	7	0.28	3.95	1.11
ON1-F2	**HUAL1+DON1-E+DON1-F	0.60	7	0.27	1.98	0.53
ON1-G	DON1-G	1.64	1	0.19	1.85	0.35
ON1-H2A	**CP3	3.87	75	0.55	7.71	4.24
ON1-H2B	**CP3+DON1-G+DON1-H	3.50	77	0.56	7.55	4.23
ON1-H4	CP2	0.50	81	0.75	4.48	3.36

Based on the calculated flow characteristics, the Manual criteria for depth (D) and velocity times depth (V*D) during the 100-year storm event will be met.

The Manual criteria for a major roadway requires a 12-foot wide dry lane in addition to a dry center turn lane in each direction for streets with a ROW greater than 80 feet during a 10-year storm event. The street hydraulic sections show that dry-lane criteria will be met with the development of this site.

SWALES AND DRAINAGE EASEMENTS

There are two points for this project that discharge to existing private drainage easements to be privately maintained. The north easement will convey **0.5 cfs (DON1-D)** and the south easement will convey **2.5 cfs (DON1-C)** to the residential development to the east. Additional onsite drainage easements will be required to convey offsite flow through the project site. Easements represented by sections **ON1-E2, ON1-B2, and ON1-C2** convey flow from the north half of Hualapai Way through the

site to the drainage easements to the east. The easement analyzed by sections **ON1-E2** will be 10-foot wide, concrete lined, with 2% cross slopes. The easements analyzed by sections **ON1-B2 and ON1-C2** will be 30-foot wide, concrete lined, with 2% side slopes. Easements represented by sections **ON1-H1 and ON1-H3** convey flow from the adjacent site to the west through the site to be discharged in the existing natural wash to the east. These easements will also be 30-foot wide, concrete lined, with 2% side slopes.

The hydraulic calculations can be found in **Appendix C** and the results are presented in **Table 8**. The location of the sections are shown on **Figures INT-1**.

Table 8: Proposed Condition Hydraulic Easement Sections

SECTION	CHANNEL SLOPE	Q ₁₀₀	FLOW DEPTH	VELOCITY	D*V	TYPE	SIDE SLOPES	
	%	(cfs)	(ft)	(ft/s)	ft ² /s			
ON1-B2	5.12	1.5	0.10	2.90	0.29	V	2%	2%
ON1-C2	1.71	2.5	0.15	2.17	0.33	V	2%	2%
ON1-E2	4.85	4	0.14	4.23	0.59	V	2%	2%
ON1-H1	3.40	75	0.47	7.90	3.71	V	2%	2%
ON1-H3	2.00	77	0.53	6.79	3.60	V	2%	2%

FINISHED FLOOR ELEVATION

The Clark County Regional Flood Control District requirement for the finish floor elevation (FF) is that it must be 18 inches above the centerline grade of the adjacent street or be elevated to twice the depth of flow up to 18 inches above the water surface elevation (WSE). Additional criteria requires the finished floor elevation to be a minimum 6 inches above adjacent upstream top of curb. The proposed finished floor elevations have been elevated to or above at least twice the depth of flow in the adjacent drive aisles. Additionally, the finished floors adjacent to the onsite drainage easements will be elevated 18 inches above the water surface elevation or the drainage easements will be separated from the lots with a block wall that will be solid grouted. Please refer to the grading plans included in **Appendix E**. A finished floor elevation table has been provided in **Appendix C**.

CONCLUSIONS AND RECOMMENDATIONS

The proposed Ann Road and Hualapai Way development will not adversely impact the surrounding areas in the 100-year and 10-year storm events. The development of this project site is in compliance with the *CCRFCD Hydrologic Criteria and Design Manual* and Clark County criteria.

1. This project is in compliance with the applicable drainage laws recognized by the State of Nevada.
2. This project is in compliance with the CCRFCD's "*Master Plan Update*" and will **not** conflict with any Master Planned Facilities.
3. This project is in compliance with the CCRFCD's "*Hydrologic Criteria and Drainage Design Manual*", with the exceptions noted in the study.
4. This project lies within FEMA-designated **Flood Zone X**. Therefore, the project is not currently located in a FEMA-designated Special Flood Hazard Area.
5. The drainage facilities for this project have been designed to control and convey the onsite runoff from the 100-year storm safely through the site to match existing drainage patterns. In addition, they have been designed based upon generally accepted engineering practices and in accordance with local requirements.
6. Homes to be constructed with this project will have adequate freeboard or solid grouted wall protection from flows conveyed in the adjacent streets.
7. Runoff generated from, or conveyed by, the project will not adversely impact any downstream properties or facilities.

REFERENCES

1. Clark County Regional Flood Control District, “*Hydrologic Criteria and Drainage Design Manual*,” August 1999, Revise September 2013.
2. Clark County Regional Flood Control District, “*2018 Las Vegas Valley Flood Control Master Plan Update*,” November 2018.
3. U. S. Department of Agriculture Soil Conservation Service, *Soil Survey of Las Vegas Valley Area, Nevada, Part of Clark County*, September 2019, Version 14.
4. U.S. Army Corps of Engineers. HEC-1 Flood Hydrograph Package. Revised June 1998.
5. *Technical Drainage Study for Ann and Grand Canyon Residential Development, Prepared by Taney Engineering, October 2010.*
6. *Technical Drainage Study for Ann & 215 – Phase 1*, Prepared by Slater Hanifan Group, A Westwood Team, July 2020.

LIST OF APPENDICES

Appendix A – Documents & Figures

- EX-1 Existing Conditions Basin Map
- PRO-1 Proposed Conditions Basin Map
- ULT-1 Ultimate Conditions Basin Map
- Assessor's Parcel Map
- FIRM Exhibits
- Figure F-17 Flood Control Facilities
- Figure W Hydrologic Subareas, Land Use & Soils
- Entitlements

Appendix B – Hydrologic Calculations

- Figure 513 McCarran Airport Rainfall Area
- Figure 506 100-Year 6-Hour Rainfall Depth-Duration-Frequency
- Figure 503 10-Year 6-Hour Rainfall Depth-Duration-Frequency
- Table 501 Precipitation Adjustment Ratios
- Table 502 Six-hour Depth-Area Reduction Factors
- Table 503 Six-hour Storm Distributions
- Table 602 page 1 of 4 Runoff Curve Numbers (Urban Areas)
- Table 602 page 4 of 4 Runoff Curve Numbers (Semiarid Rangelands)
- Table 602A Runoff Curve Numbers-Residential Districts
- Adjusted Precipitation Depth Calculation
- USDA NRCS Custom Soils Resource Report for Las Vegas Valley
- Curve Number Calculations
- Proposed and Ultimate Condition Standard Form 4
- Proposed Condition HEC-1 Output
- Ultimate Condition HEC-1 Output

Appendix C – Hydraulic Calculations

- Hydraulic Sections – Streets
- Hydraulic Sections – Onsites
- Hydraulic Sections – Easements
- Riprap Calculations
- Finished Floor Elevation Checks

Appendix D – Reference Materials

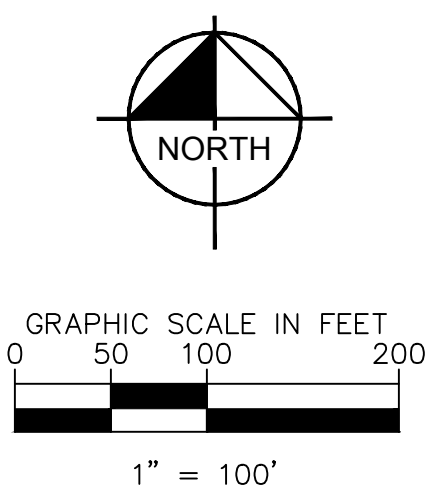
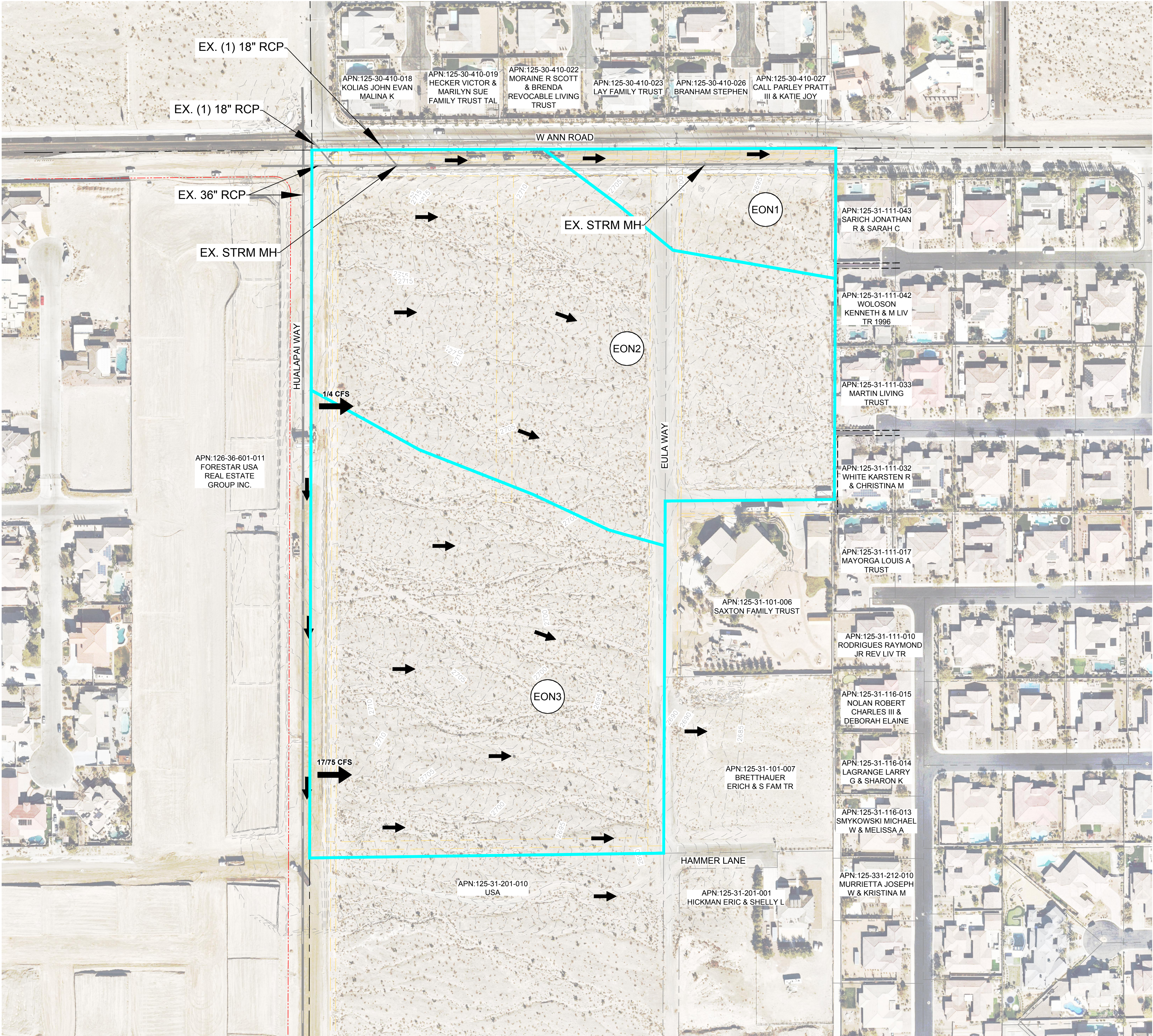
- *Technical Drainage Study for Ann and Grand Canyon Residential Development. Approved October 4, 2010 (Grand Canyon Study, October 2010, PW No. 10-18993)*
- *Technical Drainage Study for Ann & 215 – Phase 1. Approved July 13, 2020. (215 Study, July 2020, PW No. 20-11651)*

Appendix E – Improvement Plans

Appendix A – Documents & Figures

- EX-1 Existing Condition Basin Map
- PRO-1 Proposed Condition Basin Map
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- Figure F-17 Flood Control Facilities
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- LEGEND**
- XXX BASIN ID
 - XXXX PRORATED BASIN ID
 - BASIN BOUNDARY
 - PRORATED BASIN BOUNDARY
 - FUTURE CCRFCD REGIONAL FACILITY
 - EXITING DRAINAGE FACILITY
 - ➔ FLOW ARROW
 - CPX CONCENTRATION POINT
 - X⁺
XX SECTION ID

Ann & Hualapai			
EXISTING FLOW SUMMARY TABLE			
BASIN ID/ COMB. PT.	BASIN AREA (ac)	10-YR FLOW (cfs)	100-YR FLOW (cfs)
EON1 (*EXOF3)	15.8	5	18
EON2	24.4	7	28
EON3	7.3	2	8

*Referenced from the Grand Canyon Study (PW# 10-18993)

EXISTING CONDITION PRORATED FLOW SUMMARY					
Existing Onsites					
Subbasin	Q ₁₀ (cfs)	Q ₁₀₀ (cfs)	Area (ac)	cfs/acre _{10yr}	cfs/acre _{100yr}
*EXOF2	32	137	99.80	0.32	1.37
*EXOF4	5	25	18.37	0.27	1.36
Existing Onsite Prorated Basins					
Subbasin	Q ₁₀₀ (cfs)	Q ₁₀₀ (cfs)	Area (ac)	cfs/acre _{100yr}	cfs/acre _{100yr}
EON3	4	15	11.11	0.32	1.37
REMAINDER *EXOF2	28	122	88.69	0.32	1.37
TOTAL	32	137	99.80	NA	NA
EON2	3	17	12.35	0.27	1.36
REMAINDER *EXOF4	2	8	6.02	0.27	1.36
TOTAL	5	25	18.37	NA	NA

ANN ROAD AND HUALAPAI WAY
PREPARED FOR
RICHMOND HOMES

CITY OF LAS VEGAS

EXISTING CONDITION
DRAINAGE MAP

NEVADA

KHA PROJECT
291400024

DATE
01/29/2021

SCALE AS SHOWN

DESIGNED BY
MK

DRAWN BY
JE

CHECKED BY
TC

Kimley»Horn

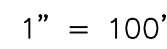
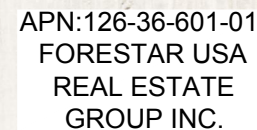
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01/29/2021

PRELIMINARY

REVISIONS

No.	DATE	BY



SECTION 15

BASIN ID/ COMB. PT.	BASIN AREA	10-YR FLOW	100-YR FLOW
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Ultimate Onsites			
SUBBASIN	C (cfs)	AREA (sq)	CEQ/ACRE

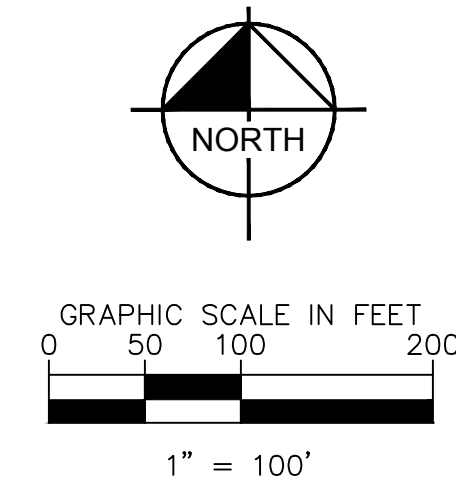
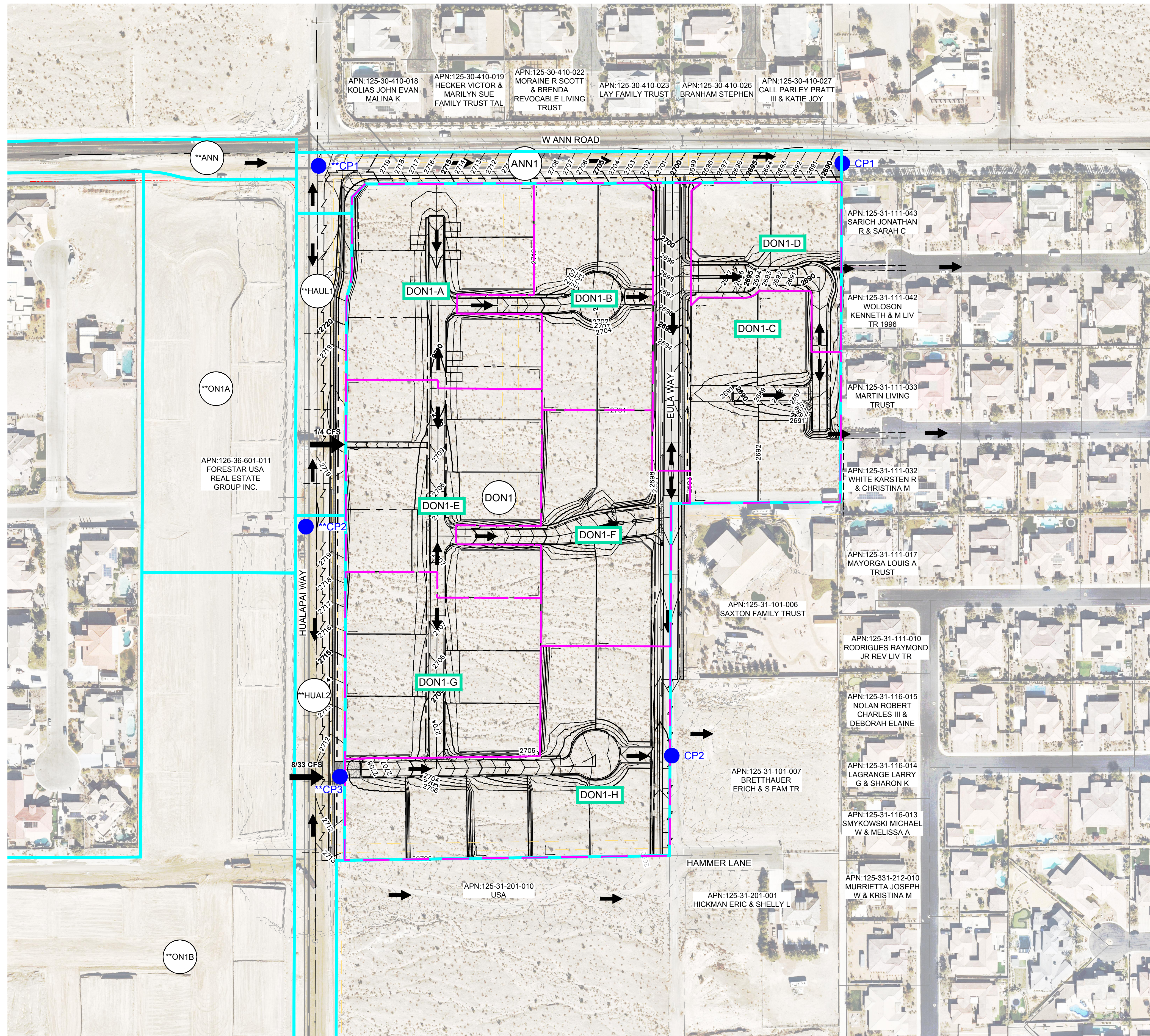
DON1-A	1	3.0	0.31
DON1-B	0.5	2.2	0.31

STREET	TRIBUTARY BASINS	CHANNEL SLOPE	Q ₁₀₀	FLOW DEPTH	VELOCITY	D*V
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SECTION	SLOPE (%)	Q ₁₀₀ (cfs)	FLOW DEPTH (ft)	VELOCITY (ft/s)	TYPE	SIDE SLOPE
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**Referenced/Revised from 215 Study (PW #20-11651

STREET SECTION	SLOPE	Q ₁₀₀	FLOW DEPTH	VELOCITY	D*V	Q ₁₀₀	FLOW DEPTH	VELOCITY	D*V	DRY LAN
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LEGEND

	BASIN ID
	PRORATED BASIN ID
	BASIN BOUNDARY
	PRORATED BASIN BOUNDARY
	FUTURE CCRFCD REGIONAL FACILITY
	EXITING DRAINAGE FACILITY
	FLOW ARROW
	CONCENTRATION POINT

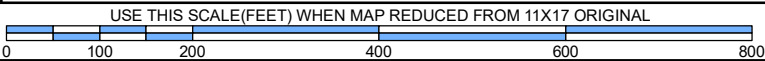
Ann & Hualapai			
ULTIMATE FLOW SUMMARY TABLE			
BASIN ID/ COMB. PT.	BASIN AREA	10-YR FLOW	100-YR FLOW
	(ac)	(cfs)	(cfs)
**ANN	4.5	8	15
**OFF1P	4.7	4	11
**CP1	-	12	26
ANN1	1.6	3	6
CP1	-	15	31
**ON2AP	28.2	0	7
**OFF3U	2.2	<1	<1
**OFF2P	9.2	3	13
**CP2A	-	3	18
**OFF4P	20.1	<1	4
**CP2B	-	3	22
**ON1A	4.9	<1	1
**CP2	-	3	23
**ON1B	18.1	<1	5
**HUAL-2	2.2	6	12
**CP3	-	8	33
**HUAL-1	1.3	3	5
DON1	22.5	<1	7
CP2	-	11	42

ULTIMATE CONDITION PRORATED FLOW SUMMARY			
Ultimate Onsites			
SUBBASIN	Q ₁₀₀ (cfs)	AREA (ac)	CFS/ACRE
DON1	7	22.5	0.31
Ultimate Onsite Prorated Basins			
SUBBASIN	Q ₁₀₀ (cfs)	AREA (ac)	CFS/ACRE
DON1-A	1	3.0	0.31
DON1-B	0.5	2.3	0.31
DON1-C	1	3.3	0.31
DON1-D	0.5	1.5	0.31
DON1-E	1	3.1	0.31
DON1-F	1	2.6	0.31
DON1-G	1	2.8	0.31
DON1-H	1	3.9	0.31
TOTAL	7	22.5	NA

**Referenced/Revised from the 215 Study (PW# 20-11651)

NOTES

MAP LEGEND



BOOK T19S R60E

SEC.	31
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MAP	N 2 NW 4
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125-31-1



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

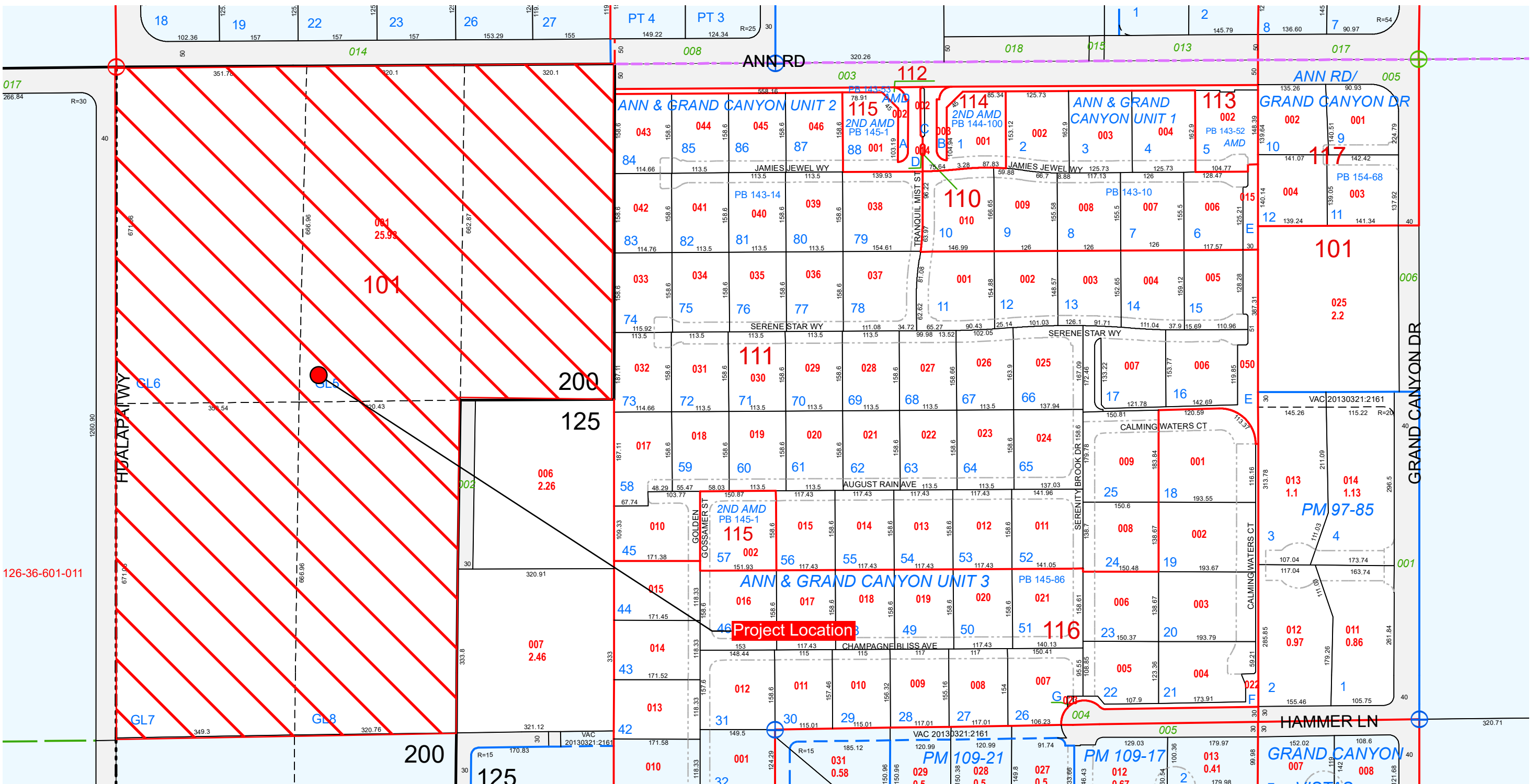
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36 137	138 139
65 164	163 162

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7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

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

Scale: 1" = 200'

Rev: 10/8/2020



TAX DIST 125,200

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevation** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevation (BFEs) shown on this map apply only landward of 0.0' North American Vertical Datum (NAVD). Users of this FIRM should be aware that coastal flood elevations may also be provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this community. Elevations shown in the Summary of Stillwater Elevations table should be used for construction, and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures in this jurisdiction.

The **projection** used in the preparation of this map is Universal Transverse Mercator (UTM) Zone 11. The **horizontal datum** is NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

Vertical Network Branch, N/CG13
National Geodetic Survey, NOAA
Silver Spring Metro Center 3
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3181

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit their website at www.ngs.noaa.gov.

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Phone: 800-368-9616
FAX: 800-368-9620
www.fema.gov/msc

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA website at www.fema.gov.

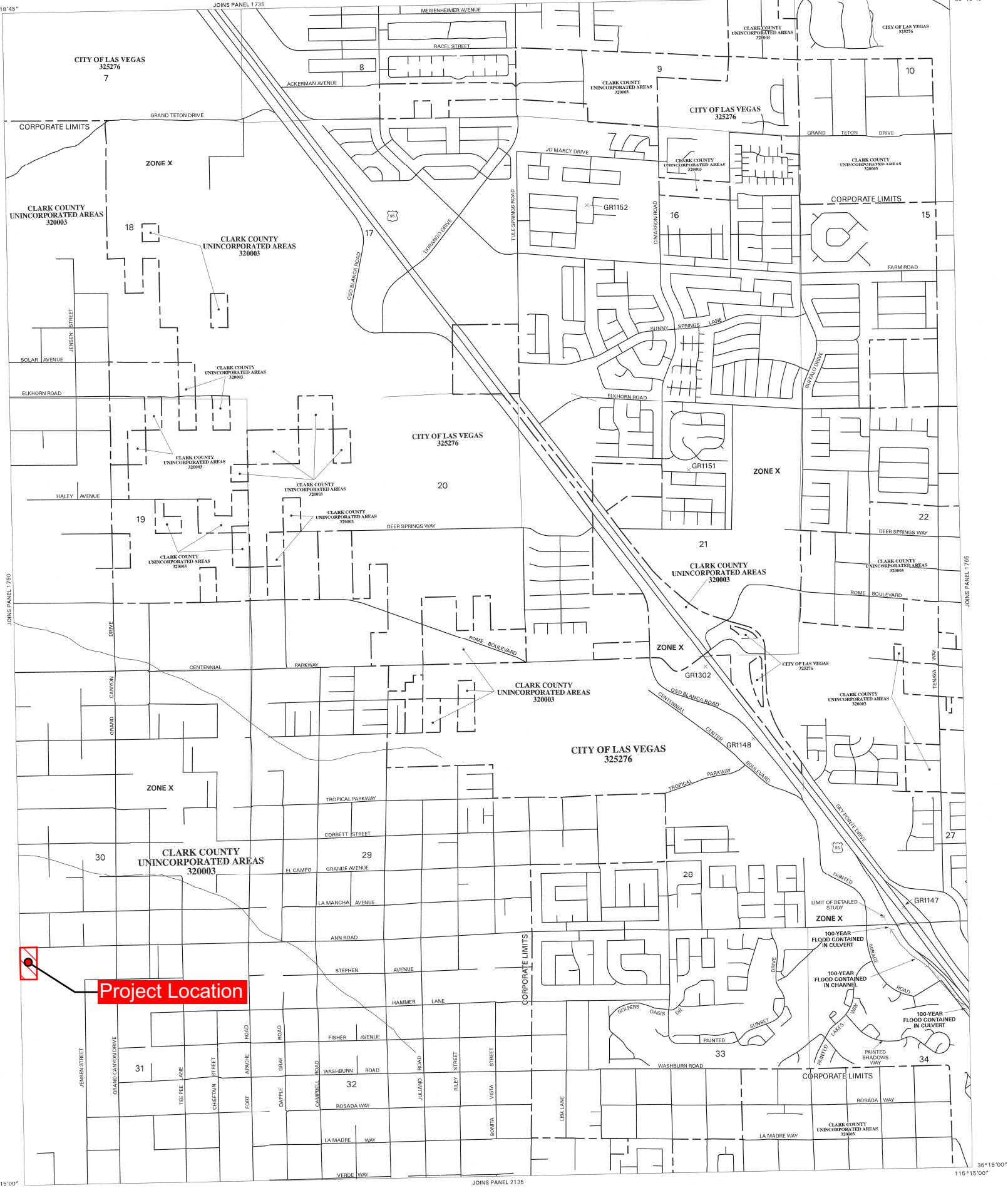
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This DFIRM reflects several innovative features. These include:
+ Southern Nevada GIS-- Cooperation among local governmental agencies throughout Clark County. The foundation of cooperation is the GIS Interlocal Agreements formed between fourteen regional participants. In part, the agreements specify that the Clark County GIS Management Office (GISMO) will be responsible for maintaining a GIS data warehouse and associated Southern Nevada GIS Metadata.

+ The GISMO's responsibilities go beyond maintaining the GIS data warehouse. GISMO also maintains the Street Centerline Database used by 911 dispatch services. This centerline database serves as the base map for this DFIRM.

DIGITAL DATA AVAILABILITY: <http://www.co.clark.nv.us/cert/gismo/gismo.htm>



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD EVENT

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water surface elevation of the 1% annual chance flood.

- ZONE A** No base flood elevations determined.
- ZONE AE** Base flood elevations determined.
- ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE AR** Area of special flood hazard formerly protected from the 1% annual chance flood event by a flood control system that was subsequently derelictified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood event.
- ZONE A99** Area to be protected from 1% annual chance flood event by a Federal flood protection system under construction; no base flood elevations determined.
- ZONE V** Coastal flood zone with velocity hazard (wave action); no base flood elevations determined.
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FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- Floodplain Boundary
- Floodway Boundary
- Zone D Boundary
- Coastal Barrier Boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or velocities.
- Base Flood Elevation line and value; elevation in feet*
- Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

- Cross Section Line
- Transect Line
- Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 1000-meter Universal Transverse Mercator grid values, zone 11
- 5000-foot grid ticks

Bench mark (see explanation in Notes to Users section of this FIRM panel).

River Mile

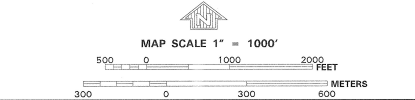
MAP REPOSITORY
Refer to Repository Listing on Index Map

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
AUGUST 16, 1995
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

September 27, 2002: To update corporate limits, to change base flood elevations, to add base flood elevations, to add special flood hazard areas, to change special flood hazard areas, to delete special flood hazard areas, to change zone designations, to add roads and road names, to incorporate previously issued letters of map revision, to incorporate previously issued letters of map amendment, and to change floodway.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at (800) 638-6620.



PANEL 1745 E

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

PANEL 1745 OF 4090

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:	COMMUNITY	NUMBER	PANEL	SUFFIX
	LAS VEGAS, CITY OF	325276	1745	E
	CLARK COUNTY, UNINCORPORATED AREAS	320003	1745	E

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



MAP NUMBER
32003C1745 E

MAP REVISED:
SEPTEMBER 27, 2002

Federal Emergency Management Agency

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevation (BFEs)** and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevation (BFEs) shown on this map apply only landward of 0.0' North American Vertical Datum (NAVD). Users of this FIRM should be aware that coastal flood elevations may also be provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this community. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures in this jurisdiction.

The **projection** used in the preparation of this map is Universal Transverse Mercator (UTM) Zone 11. The **horizontal datum** is NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

Vertical Network Branch, NCG13
National Geodetic Survey, NOAA
Silver Spring Metro Center 3
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3181

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DIGITAL DATA AVAILABILITY: <http://www.co.clark.nv.us/cetit/gismo/gismo.htm>



THIS AREA IS SHOWN ON MAP NUMBER 32003C1735

THIS AREA IS SHOWN ON MAP NUMBER 32003C1734

THIS AREA IS SHOWN ON MAP NUMBER 32003C1745

Project Location

LEGEND

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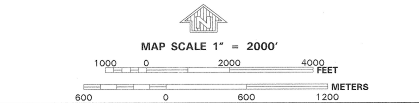
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PANEL 1750 E

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

PANEL 1750 OF 4090

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

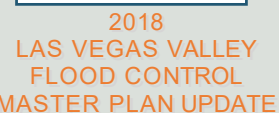
COMMUNITY	NUMBER	PANEL	SUFFIX
LAS VEGAS, CITY OF	325276	1750	E
CLARK COUNTY, UNINCORPORATED AREAS	320003	1750	E

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MAP NUMBER
32003C1750 E

MAP REVISED:
SEPTEMBER 27, 2002

Federal Emergency Management Agency



LEGEND

- Remove & Replace/Parallel Facilities**

Category A	Category B
 Channel	 Channel
 Stormdrain	 Stormdrain
 Crossing	 Crossing

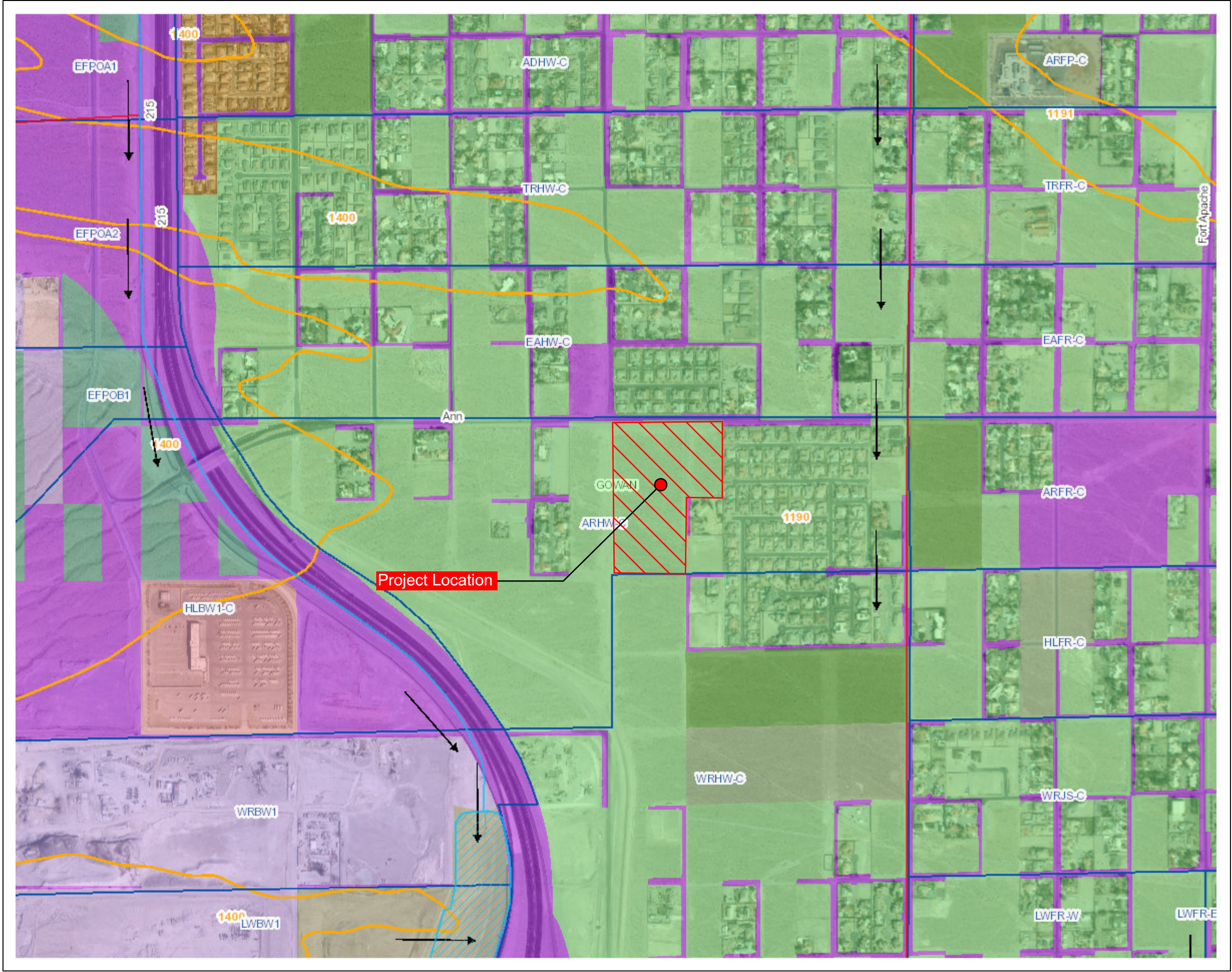


AerialSource:Esri World Imagery 2017



ID / Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
ANRB		ANN ROAD CHANNEL WEST - RAINBOW						
0000	E	9' X 6' RCB	167	817	CNW2B5-C	WEST3	0.99	0.30
0028	E	11' X 5' RCB	1140	817	CNW2B5-C	WEST3	0.99	0.23
0050	E	10' X 3' RCB	1240	517	CNW2A3-C	WEST3	0.63	0.35
ANWE		ANN ROAD CHANNEL WEST						
0290	E	8' X 8' RCB	2050	817	2CNW2B5C	CWEST3	0.99	0.70
0327	E	6' X 6' RCB	2360	135	RCHODB	WEST3	4.61	0.87
0371	E	6' X 6' RCB	760	135	RCHODB	WEST3	4.61	0.34
0385	E	54" RCP	1950	135	RCHODB	WEST3	4.61	1.17
CNWE		CENTENNIAL PKWY CHANNEL WEST						
0195	E	CONC CHNL 36"W 9"D 0:1 SS	1130	3771	CNW3B3-C	WEST3	5.64	0.60
0200	E	CONC CHNL 36"W 9"D 0:1 SS	1340	3523	CNW2D4-C	WEST3	5.14	1.00
0226	E	2: 18' X 8.5' RCBC @ RIO VISTA	100	3523	CNW2D4-C	WEST3	5.14	0.51
0241	E	CONC CHNL 36"W 9.5"D 0:1 SS	405	3523	CNW2D4-C	WEST3	5.14	0.51
0251	E	CONC CHNL 36"W 9"D 0:1 SS	575	3234	CNW2D3-C	WEST3	4.64	0.51
0271	E	CONC CHNL 32"W 10"D 0:1 SS	229	3234	CNW2D3-C	WEST3	4.64	0.51
0274	E	32' X 10' RCBC @ TENAYA	142	3234	CNW2D3-C	WEST3	4.64	0.51
0277	E	CONC CHNL 32"W 9"D 0:1 SS	579	3234	CNW2D3-C	WEST3	4.64	0.64
0287	E	CONC CHNL 32"W 8"D 0:1 SS	865	2992	CNW2B2-C	WEST3	3.83	1.59
0301	E	2: 15' X 7' RCB	1738	2992	CNW2B2-C	WEST3	3.83	1.30
0304	E	22' X 7' RCB	3410	2992	CNW2B2-C	WEST3	3.83	1.85
GO95		GOWAN OUTFALL - U.S. 95 CHANNEL						
0000	P	CONC CHNL 12"W 4"D 2:1 SS	2640	318	GD17BG-C	GOW3A	0.36	0.30
0050	P	CONC CHNL 12"W 4"D 2:1 SS	2450	318	GD17BG-C	GOW3A	0.36	0.30
GOAL		GOWAN OUTFALL - ALEXANDER ROAD FACILITIES						
0168	P	10' X 7' RCB	4200	829	CPT2B2	GOW3A	2.32	0.50
0247	P	CONC CHNL 12"W 5.5"D 2:1 SS	2640	574	CGD20BMC	GOW3A	2.02	0.30
GOBU		GOWAN NORTH - BUFFALO BRANCH						
0000	E	2: 12' X 6' RCB	1705	421	CGD14CBC	GOW3A	2.52	0.20
0032	E	2: 12' X 5' RCB	1248	343	CGD14AAC	GOW3A	2.29	0.25
0058	E	2: 11' X 4' RCB	1398	301	CGD17AAC	GOW3A	1.87	0.25
0085	E	11' X 5' RCB	1356	241	CGD17ABC	GOW3A	1.49	0.25
0112	E	8' X 5' RCB	1380	180	CGD20ACC	GOW3A	1.12	0.65
0136	E	5' X 5' RCB	2740	72	GD20AA-C	GOW3A	0.44	0.50
GOBW		GOWAN BELTWAY WEST						
0000	E	48" RCP	2527	115	LMBWDB	GOW4A	10.81	4.37
0048	E	72" RCP	131	115	LMBWDB	GOW4A	10.81	2.21
0051	E	72" RCP OUTLET	1522	115	LMBWDB	GOW4A	10.81	0.30
0052	E	588 AC-FT LONE MOUNTAIN-BELTWAY DETENTION BASIN		5316	CLMBW1	GOW3B	3.64	
0082	E	17,100 CFS PMF SPILLWAY		17100	CLMBW1	GOW3B	3.64	
0097	E	60" RCP	375	660	UVB1-1	GOW3A	0.37	8.06
0100	E	ENERGY DISSIPATOR	162	660	UVB1-1	GOW3A	0.37	50.00
0103	E	42" RCP	92	660	UVB1-1	GOW3A	0.37	7.00
0106	E	8' X 8' RCB CONNECTOR PIPE UNDER LONE MOUNTAIN	699					0.25
0128	E	20' X 10' RCB	100	3589	CWRBW1	GOW3B	2.41	25.00
0132	E	14' X 9' RCB	648	3156	CHLBW1-C	GOW3A	5.83	1.27
0156	E	14' X 9' RCB	1182	3156	CHLBW1-C	GOW3A	5.83	2.89
0183	E	14' X 9' RCB	3414	3156	CHLBW1-C	GOW3A	5.83	1.77
0227	E	10' X 8' RCB	739	1823	CEFPOA2	GOW3A	4.94	2.78
GOBX		GOWAN BOX CANYON						
0000	E	66" RCP	258	696	LWBW1	GOW3A	0.47	10.00
0005	E	ENERGY DISSIPATOR	206	696	LWBW1	GOW3A	0.47	39.00
0009	E	6' X 4' RCB	95	696	LWBW1	GOW3A	0.47	4.72
0015	P	66" RCP	6783	39	BOXDET	GOW3A	3.41	6.55
GODU		GOWAN NORTH - DURANGO BRANCH						
0000	E	12' X 6' RCB	2629	905	CLV14-C	GOW3A	1.40	0.91
0050	E	9' X 6' RCB	865	681	CLV20-C	GOW3A	0.98	1.50
GOEC		GOWAN NORTH - EL CAPITAN BRANCH						
0000	E	10' X 8' RCB	1436	474	CWRJS-C*	GOW3A	1.95	1.07
0026	E	10' X 7' RCB	1330	474	CWRJS-C	GOW3A	1.95	0.82
0051	E	10' X 7' RCB	1290	439	CHLFR-C	GOW3A	1.69	1.06
0076	E	10' X 7' RCB	1335	392	CARFR-C	GOW3A	1.45	0.54
GOEC		GOWAN NORTH - EL CAPITAN BRANCH						
0100	P	10' X 6' RCB	1320	321	CEAFR-C	GOW3A	1.21	0.76
0126	P	10' X 7' RCB	1320	290	CTRFR-C	GOW3A	0.96	0.38
0152	P	7' X 6' RCB	1320	238	CARFP-C	GOW3A	0.70	0.77
0176	P	78" RCP	1320	190	CCPFR-C	GOW3A	0.46	1.15
GOL2		GOWAN LONE MOUNTAIN SYSTEM-BRANCH 2						
0000	E	5' X 4' RCB	150	359	CRBW	GOW3A	0.36	14.60
0003	E	66" RCP	607	359	CRBW	GOW3A	0.36	1.97
0014	E	84" RCP @ ALEXANDER	125	359	CRBW	GOW3A	0.36	4.00
GOL3		GOWAN LONE MOUNTAIN SYSTEM-BRANCH 3						
0000	E	2: 10' X 10' RCBC @ BELTWAY	500	3713	CLMT5	GOW3A	7.83	3.39
0010	E	CONC CHNL 20"W 10"D 0:1 SS	3037	3277	CRCLMT1R	GOW3A	7.31	2.78
GOL5		GOWAN LONE MOUNTAIN SYSTEM-BRANCH 5						
0000	E	6' X 5' RCB	309	421	UVB2	GOW3A	0.33	7.69
0006	E	CONC CHNL 6"W 5"D 0:1 SS	740	421	UVB2	GOW3A	0.33	3.85
0020	E	6' X 5' RCBC @ ALEXANDER RD	615	421	UVB2	GOW3A	0.33	2.08
0032	E	CONC CHNL 6"W 5"D 0:1 SS	1756	421	UVB2	GOW3A	0.33	1.67
GOLM		GOWAN LONE MOUNTAIN SYSTEM						
0000	E	78" RCP	2590	278	CLV15-C	GOW4A	11.09	1.80
0049	E	6' X 5' RCB	585	278	CLV15-C	GOW4A	11.09	1.87
0060	E	66" RCP	817	278	CLV15-C	GOW4A	11.09	2.40
0075	E	60" RCP	1385	278	CLV15-C	GOW4A	11.09	2.55
0101	E	54" RCP	700	184	LMTNDB	GOW4A	10.74	1.74
0115	E	48" RCP	1799	184	LMTNDB	GOW4A	10.74	3.08
0140	E	42" RCP	438	184	LMTNDB	GOW4A	10.74	1.60
0142	E	48" RCP	348	184	LMTNDB	GOW4A	10.74	2.14
0144	E	66" RCP	196	184	LMTNDB	GOW4A	10.74	5.44
0145	E	66" RCP OUTLET	378	184	LMTNDB	GOW4A	10.74	0.90
0146	E	888 AC-FT LONE MOUNTAIN DETENTION BASIN		6518	LMTNIN	GOW3B	6.43	
0147	E	36,000 CFS PMF SPILLWAY		36000	LMTNIN	GOW3B	6.43	
0150	E	DROP STRUCTURE	481	5731	CGABW	GOW3B	5.49	
0162	E	28' X 8' RCBC @ HUALAPAI	625	5731	CGABW	GOW3B	5.49	1.86
0174	E	CONC CHNL 28"W 8"D 0:1 SS	2715	5532	CCLMT5	GOW3B	5.19	3.20
0226	E	10' X 10' RCBC @ BELTWAY	246	2246	CUVB2	GOW3A	1.67	2.50
0230	E	10' X 10' RCB	290	1931	CLMT3	GOW3A	1.34	2.50
0236	E	CONC CHNL 15"W 8"D 0:1 SS	869	1931	CLMT3	GOW3A	1.34	3.69
GOLO		GOWAN OUTFALL - LONE MTN. ROAD BRANCH						
0275	E	8' X 6' RCB	3000	580	CPT3AA2	GOW3A	1.17	1.04
0332	E	8' X 6' RCB	150	492	C33AA1	GOW3A	1.02	1.90
GONO		GOWAN NORTH SYSTEM						
0000	E	8' X 8' RCB OUTLET	184	523	GWNNDB	GOW5A	68.55	0.51
0001	E	8' X 8' RCB OUTLET	156	523	GWNNDB	GOW5A	68.55	0.63
0006	E	30,780 CFS PMF SPILLWAY		30780	CCLV43-C*	GOW4B	11.91	
0008	E	921 AC-FT GOWAN NORTH DETENTION BASIN		2599	CCLV43-C*	GOW4B	11.91	
0009	E	3: 13' X 8' RCB	1662	2281	CLV43-C	GOW4B	11.22	0.62
0012	E	CONC CHNL 30"W 8'5" 8.5"D 0:1 SS	2665	2131	CCLV36-C	GOW4B	8.53	1.18
0062	E	BRIDGE 30'W 8.5'D @ CIMARRON	80	1912	CCLV15-C	GOW4B	8.02	0.30
0063	E	CONC CHNL 30"W 8.5'-10"D 0:1 SS	2302	1912	CCLV15-C	GOW4B	8.02	1.00
0110	E	2: 12' X 8' RCAC @ ALEXANDER	547	1392	CHAFR2-C	GOW3B	6.26	1.00
0117	E	2: 12' X 8' RCAP	424	1392	CHAFR2-C	GOW3B	6.26	1.10
0124	E	CONC CHNL 24"W 9"D 0:1 SS	887	1392	CHAFR2-C	GOW3B	6.26	1.36
0141	E	CONC CHNL 24"W 9'-10.5"D 0:1 SS	2064	1367	CCRSFR-C	GOW3B	6.12	0.59
0181	E	BRIDGE 30'W 7'D @ CRAIG	142	1367	CCRSFR-C	GOW3B	6.12	0.65
0183	E	CONC CHNL 22"W 8'-10.6"D 0:1 SS	2193	1185	CCRSFR-C	GOW3B	5.19	0.72
0225	E	CONC CHNL WIDTH VARIES DEPTH VARIES 0:1 SS	508	1144	CCLWFR-E	GOW3B	4.54	1.05
0230	E	13' X 5' RCB	256	766	CLWFR-W	GOW3B	2.46	2.78
0234	E	12' X 6' RCB	2010	766	CLWFR-W	GOW3B	2.46	1.67
0272	E	10' X 6' RCB	2797	766	CLWFR-W	GOW3B	2.46	3.15
0325	E	15' X 7' RCB	291	749	CWWRHW-C	GOW3B	2.34	4.20
0335	E	15' X 7' RCB	529	749	CWWRHW-C	GOW3A	2.34	0.40
0350	P	10' X 6' RCB	3473	749	CWRHW-C	GOW3A	2.34	0.88
0411	P	10' X 6' RCB	1320	679	CARHW-C	GOW3A	1.84	0.76
GONO		GOWAN NORTH SYSTEM						
0436	P	8' X 6' RCB	1320	607	CEAHW-C	GOW3A	1.50	1.14
0461	P	8' X 7' RCB	1320	508	CTRHW-C	GOW3A	1.21	0.38
0486	P	7' X 5' RCB	1320	400	CADHW-C	GOW3A	0.90	0.76
0511	P	6' X 5' RCB	1320	326	CCPHW-C	GOW3A	0.60	1.14
GOOF		GOWAN OUTFALL FACILITIES						
0511	E	8' X 5' RCB	8390	740	CPT6B-C	GOW3B	1.08	0.50
0531	E	8' X 5' RCB	1300	523	GWNNDB	GOW5A	68.55	0.50
0551	E	72" RCP	524	523	GWNNDB	GOW5A	68.55	0.62
0773	E	60" RCP	803	255	LV30-C	GOW3A	0.42	1.40
0775	E	60" RCP	1300	255	LV30-C	GOW3A	0.42	1.00
RCBC		RANCHO ROAD SYSTEM - BELTWAY CHANNEL						
0140	E	CONC CHNL 10"W 5"D 0:1 SS	2155	475	CDMNA1	WEST3	0.43	1.65
RCHB		RANCHO ROAD SYSTEM - BELTWAY						
0000	E	2: 12' X 8.5' RCAP	1700	1766	CNW1C-W*	WEST3	3.91	0.63
0034	E	CONC CHNL 21"W 8"D 0:1 SS	1000	1766	CNW1C-W	WEST3	3.91	1.19
0053	E	2: 12' X 8' RCBC @ SOUTH RAMP CONNECTOR	85	1465	CDW1C1-C	WEST3	3.55	1.40
0054	E	CONC CHNL 21"W 8"D 0:1 SS	432	1465	CDW1C1-C	WEST3	3.55	1.51
0062	E	TRANSITION STRUCTURE	130	1465	CDW1C1-C	WEST3	3.55	1.51
0065	E	24' X 7' RCB	480	1465	CDW1C1-C	WEST3	3.55	0.30
0074	E	24' X 6' RCB	50	1414	CNWB6C-C	WEST3	3.41	0.30
0075	E	20' X 6' RCBC @ BELTWAY	428	1414	CNWB6C-C	WEST3	3.41	2.81
0083	P	20' X 4' RCB	950	1414	CNWB6C-C	WEST3	3.41	2.49
0101	P	CONC CHNL 20"W 5"D 0:1 SS	980	1414	CNWB6C-C	WEST3	3.41	2.38
0120	E	20' X 6' RCBC @ GRAND MONTECITO	120	1414	CNWB6C-C	WEST3	3.41	1.00
0122	P	CONC CHNL 16'-20'W 6"D 0:1 SS	350	1414	CNWB6C-C	WEST3	3.41	1.84
RCHO		RANCHO ROAD SYSTEM						
0000	E	60" RCP W/ 36" ORIFICE PLATE	1183	135	RCHODB	WEST3	4.61	0.74
0025	E	321 AC-FT RANCHO ROAD DETENTION BASIN		2057	RCHOIN			

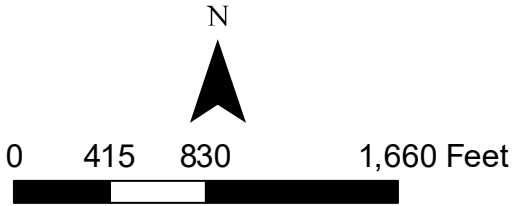
Ann & Hualapai



Legend

- Flow Arrows
- Concentration Points
- Existing Facilities
- Category A Proposed Facilities
- Category B Proposed Facilities
- Ultimate Development Boundary
- Watershed
- Subbasins
- Soils
- 1: Undeveloped Land, Open desert
- 2: Parks, Golf Courses
- 3: Rural, 0.5-1 units per acre (uses 1 unit/acre)
- 4: Low-Density Residential, 1-2 units per acre (uses 2 units/acre)
- 5: Medium-Density Residential, 2-4 units per acre (uses 3 units/acre)
- 6: High-Density Residential, 4-8 units per acre (uses 6 units/acre)
- 7: Public Facility and Residential, 8-12 units/acre
- 8: Very High-Density Residential, 12 units/acre or more
- 9: Commercial, Retail, Casino, High Rise Condominiums
- 10: Light Industrial
- 11: Heavy Industrial
- 12: Schools
- 13: Lakes
- SFHA Zone AE
- SFHA Zone A
- SFHA Zone AO
- Zone X (Shaded)

1 inch = 833 feet





**LAS VEGAS
CITY COUNCIL**

CAROLYN G. GOODMAN
Mayor

STAVROS S. ANTHONY
Mayor Pro Tem

MICHELE FIORE
CEDRIC CREAR
BRIAN KNUDSEN
VICTORIA SEAMAN
OLIVIA DIAZ

JORGE CERVANTES
City Manager

DEPARTMENT OF PLANNING
ROBERT SUMMERFIELD
DIRECTOR

CITY HALL
495 S. MAIN ST.
3RD FLOOR
LAS VEGAS, NV 89101
702.229.6301 | VOICE
702.464.2545 | FAX
711 | TTY



cityoflasvegas
lasvegasnevada.gov

March 10, 2021

Mr. Chris Johnson
Vegas Capital Ventures, LLC
P.O. Box 94313
Las Vegas, Nevada 89193

**RE: 21-0017-VAR1 AND 21-0017-TMP1
PLANNING COMMISSION MEETING OF MARCH 9, 2021**

Dear Applicant:

The Planning Commission at a regular meeting held on *March 9, 2021* voted to **APPROVE** the following Land Use Entitlement project requests on 25.93 acres on the southeast corner of Ann Road and Hualapai Way (APN 125-31-101-001), R-E (Residence Estates) Zone, Ward 6 (Fiore).

21-0017-VAR1 - VARIANCE - TO ALLOW STUB STREETS WHERE CUL-DE-SACS ARE REQUIRED AND RURAL STREET STANDARDS FOR ANN ROAD, HUALAPAI WAY AND EULA STREET.

21-0017-TMP1 - TENTATIVE MAP - ANN & HUALAPAI - FOR A PROPOSED 40-LOT SINGLE-FAMILY RESIDENTIAL SUBDIVISION.

This approval is subject to the following conditions:

21-0017-VAR1 CONDITIONS

Planning

1. Approval of and conformance to the Conditions of Approval for Tentative Map (21-0017-TMP1) shall be required, if approved.
2. A Variance is hereby approved to allow stub street terminations where cul-de-sacs are required.
3. This approval shall be void two years from the date of final approval, unless exercised pursuant to the provisions of LVMC Title 19.16. An Extension of Time may be filed for consideration by the City of Las Vegas.
4. All necessary building permits shall be obtained and final inspections shall be completed in compliance with Title 19 and all codes as required by the Department of Building and Safety.

21-0017-VAR1 AND 21-0017-TMP1 - Page Two
March 10, 2021

5. These Conditions of Approval shall be affixed to the cover sheet of any plan set submitted for building permit.
6. All City Code requirements and design standards of all City departments must be satisfied, except as modified herein.

Public Works

7. In accordance with Title 19.02.025.F, the applicant shall make an improvement contribution equal to 100% of the City's bond estimate costs for deferred improvements on Hualapai Way and 50% of the City's bond estimate costs for all deferred improvements on Eula Street based on the Regional Transportation Commission's (RTC) rural standards. If all RTC standards are followed, no deferral contribution is required.
8. Prior to the issuance of permits, sign a Covenant Running with Land agreement for the possible future installation of half-street improvements per City Standards (including curb and gutter, sidewalks, streetlighting, permanent paving and possibly fire hydrants and sewers) on Eula Street and Hualapai Way adjacent to this site. The Covenant agreement must be recorded with the County Recorder and a copy of the recorded document must be provided to the City prior to the release of this parcel map for recordation.

21-0017-TMP1 CONDITIONS

Planning

1. Approval of the Tentative Map shall be for no more than four (4) years. If a Final Map is not recorded on all or a portion of the area embraced by the Tentative Map within four (4) years of the approval of the Tentative Map, this action is void.
2. Approval of Variance (21-0017-VAR1) shall be required, if approved.
3. Street names must be provided in accordance with the City's Street Naming Regulations.
4. The applicant shall provide a letter from Republic Services stating the proposed residential subdivision with stub streets will be serviced prior to the issuance of a building permit.
5. A fully operational fire protection system, including fire apparatus roads, fire hydrants and water supply, shall be installed and shall be functioning prior to construction of any combustible structures.

6. In conjunction with creation, declaration and recordation of the subject common-interest community, and prior to recordation of the Covenants, Codes and Restrictions ("CC&R"), or conveyance of any unit within the community, the Developer is required to record a Declaration of Private Maintenance Requirements ("DPMR") as a covenant on all associated properties, and on behalf of all current and future property owners. The DPMR is to include a listing of all privately owned and/or maintained infrastructure improvements, along with assignment of maintenance responsibility for each to the common interest community or the respective individual property owners, and is to provide a brief description of the required level of maintenance for privately maintained components. The DPMR must be reviewed and approved by the City of Las Vegas Department of Field Operations prior to recordation, and must include a statement that all properties within the community are subject to assessment for all associated costs should private maintenance obligations not be met, and the City of Las Vegas be required to provide for said maintenance. Also, the CC&R are to include a statement of obligation of compliance with the DPMR. Following recordation, the Developer is to submit copies of the recorded DPMR and CC&R documents to the City of Las Vegas Department of Field Operations.
7. All development is subject to the conditions of City Departments and State Subdivision Statutes.

Public Works

8. A Vacation of Patent Easements for the north half of the Hammer Lane alignment shall record concurrent with or subsequent to the recordation of a Final Map for this site.
9. Dedicate 50 feet of right-of-way for Ann Road, 40 feet for Hualapai Way, with 10 feet of additional right-of-way for the right turn lane, and a 30-foot half street width for Eula Street. Additionally, dedicate a 25-foot radius at the southeast and southwest corners of Ann Road and Eula Street and at the southeast corner of Hualapai Way and Ann Road along with a Traffic Signal Chord Easement.
10. Construct all incomplete half street improvements on Ann Road, Hualapai Way, and Eula Street adjacent to this site per Regional Transportation Commission Standards 244.10, 244.11, and 244.12 and in compliance with 20-0017-VAR1. Modifications on Eula Street may be approved administratively to place improvements where legally able (abutting Assessor's Parcel Number 125-31-101-007).

11. Private streets shall be granted as "Public Sewer and Drainage Easements to be Privately Maintained" on the Final Map for this site. Public Sewer and Public Drainage Easements overlying Common Elements "G" and "E" shall be granted on the Final Map for this site. No structures, and no trees or vegetation taller than three feet shall be allowed within any Public Sewer Easements.
12. Coordinate with the Sanitary Sewer Section of the Department of Public Works to connect to public sewer in Washburn Avenue as there is not enough capacity in Fisher Lane. Prior to the issuance of any permits, obtain a grant by separate document for a minimum 20' wide Public Sewer Easement centered over the proposed sewer line on Assessor Parcel #125-31-101-007, or alternatively, if a patent reservation exists and is proposed to be used for this purpose, provide all necessary documentation and material needed to file and obtain a Declaration of Utilization of said patent reservation.
13. A working sanitary sewer connection shall be in place prior to final inspection of any units within this development. Full permanent improvements on all major access streets, including all required landscaped areas between the perimeter wall and adjacent public street, shall be constructed and accepted by the City prior to issuance of any building permits beyond 50% of all units within this development. All off-site improvements adjacent to this site, including all required landscaped areas between the perimeter walls and adjacent public streets, shall be constructed and accepted prior to issuance of building permits beyond 75%. The above thresholds notwithstanding, all required Improvements shall be constructed in accordance with Title 19.02.130.
14. All landscaping shall be situated and maintained so as to not create sight visibility obstructions for vehicular traffic at all development access drives and abutting street intersections.
15. A Drainage Plan and Technical Drainage Study must be submitted to and approved by the Department of Public Works prior to the issuance of any building or grading permits or submittal of any construction drawings, whichever may occur first. Provide and improve all drainageways recommended in the approved drainage plan/study. The developer of this site shall be responsible to construct such neighborhood or local drainage facility improvements as are recommended by the City of Las Vegas Neighborhood Drainage Studies and approved Drainage Plan/Study concurrent with development of this site.

16. The approval of all Public Works related improvements shown on this Tentative Map is in concept only. Specific design and construction details relating to size, type and/or alignment of improvements, including but not limited to street, sewer and drainage improvements, shall be resolved prior to approval of the construction plans by the City. No deviations from adopted City Standards shall be allowed unless specific written approval for such is received from the City Engineer prior to the recordation of a Final Map or the approval of subdivision related construction plans, whichever may occur first. Approval of this Tentative Map does not constitute approval of any deviations. If such approval cannot be obtained, a revised Tentative Map must be submitted showing elimination of such deviations.

This action by the Planning Commission on **March 9, 2021** is final unless a written appeal is filed with the City Clerk within ten days of the date of the Planning Commission's decision as allowed by code or there is a review action filed by the City Council within the same time period. For additional information on appeals or review requests submitted please access <https://www.lasvegasnevada.gov/Business/Permits-Licenses/Building-Permits/Permit-Application-Status>, or contact the Department of Planning and Development at 702.229.6301 after **March 22, 2021**. No building permits or business licenses related to these items shall be issued prior to the expiration of the required ten day waiting period, or until any filed appeal is resolved pursuant to LVMC Title 19.18.

Sincerely,

Sincerely,



Eric McCammond
Senior Management Analyst
Case Planning Division

EM:nl

cc:

Ms. Angela Pinley, PE
Richmond American Homes
7770 S. Dean Martin Drive, Ste. 308
Las Vegas, Nevada 89139

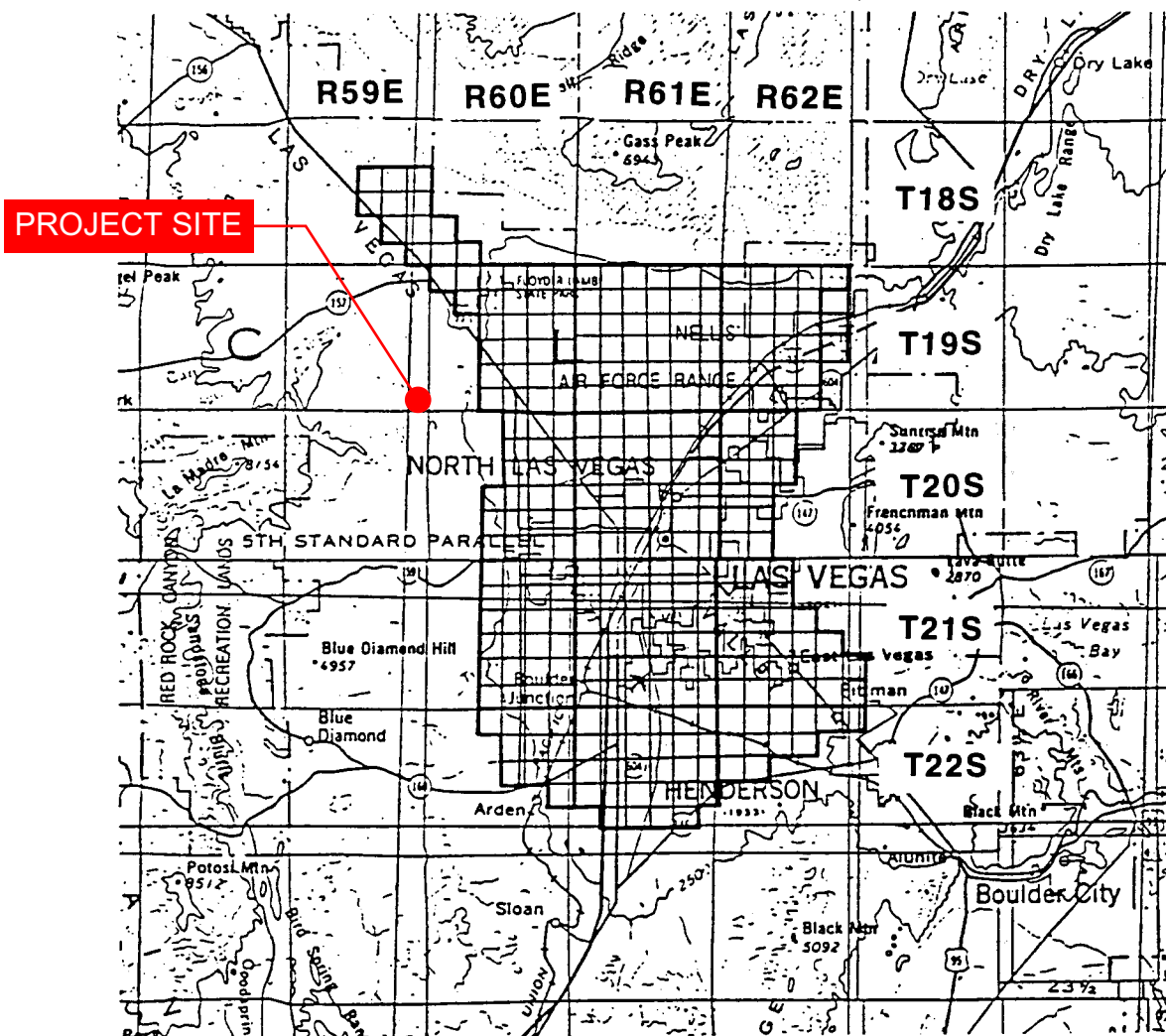
Mr. Eric Hopkins, PE
Kimley-Horn
6671 Las Vegas Blvd, South
Las Vegas, Nevada 89119

Appendix B – Hydrologic Calculations

- Figure 513 McCarran Airport Rainfall Area
- Figure 506 100-Year 6-Hour Rainfall Depth-Duration-Frequency
- Figure 503 10-Year 6-Hour Rainfall Depth-Duration-Frequency
- Table 501 Precipitation Adjustment Ratios
- Table 502 Six-hour Depth-Area Reduction Factors
- Table 503 Six-hour Storm Distributions
- Table 602 page 1 of 4 Runoff Curve Numbers (Urban Areas)
- Table 602 page 4 of 4 Runoff Curve Numbers (Semiarid Rangelands)
- Table 602A Runoff Curve Numbers-Residential Districts
- Adjusted Precipitation Depth Calculation
- USDA NRCS Custom Soils Resource Report for Las Vegas Valley
- Curve Number Calculations
- Proposed and Ultimate Condition Standard Form 4
- Proposed Condition HEC-1 Output
- Ultimate Condition HEC-1 Output

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

McCARRAN AIRPORT RAINFALL AREA



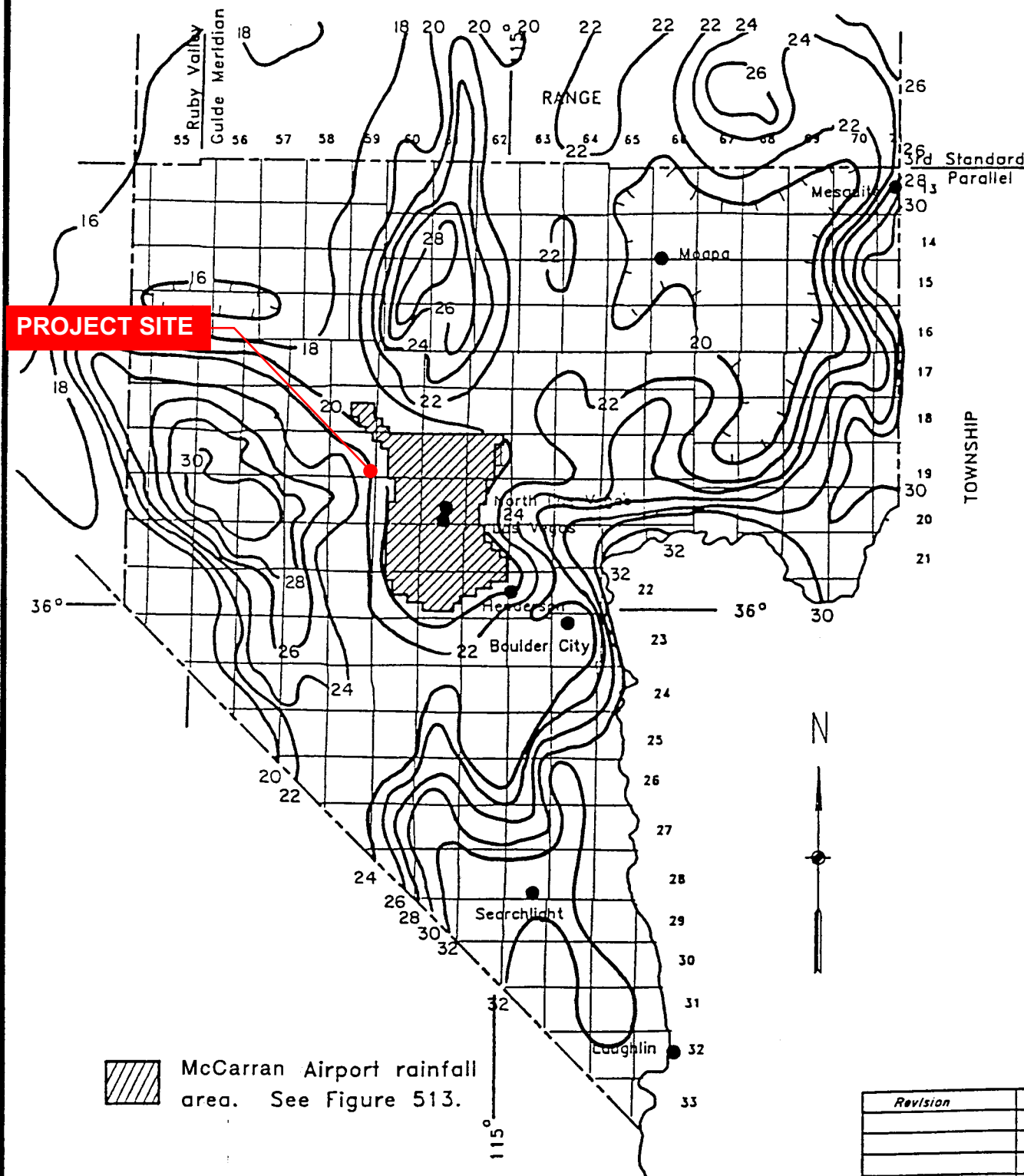
TOWNSHIP	RANGE	SECTIONS	TOWNSHIP	RANGE	SECTIONS
18 South	59 East	13-15,22-26,36	20 South	62 East	4-9,16-20,29-32
18 South	60 East	30-32	21 South	60 East	1-4,9-16,21-28,33-36
19 South	60 East	1-6,8-16,21-28,33-36	21 South	61 East	ALL SECTIONS
19 South	61 East	ALL SECTIONS	21 South	62 East	4-9,15-23, 25-36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

Notes:

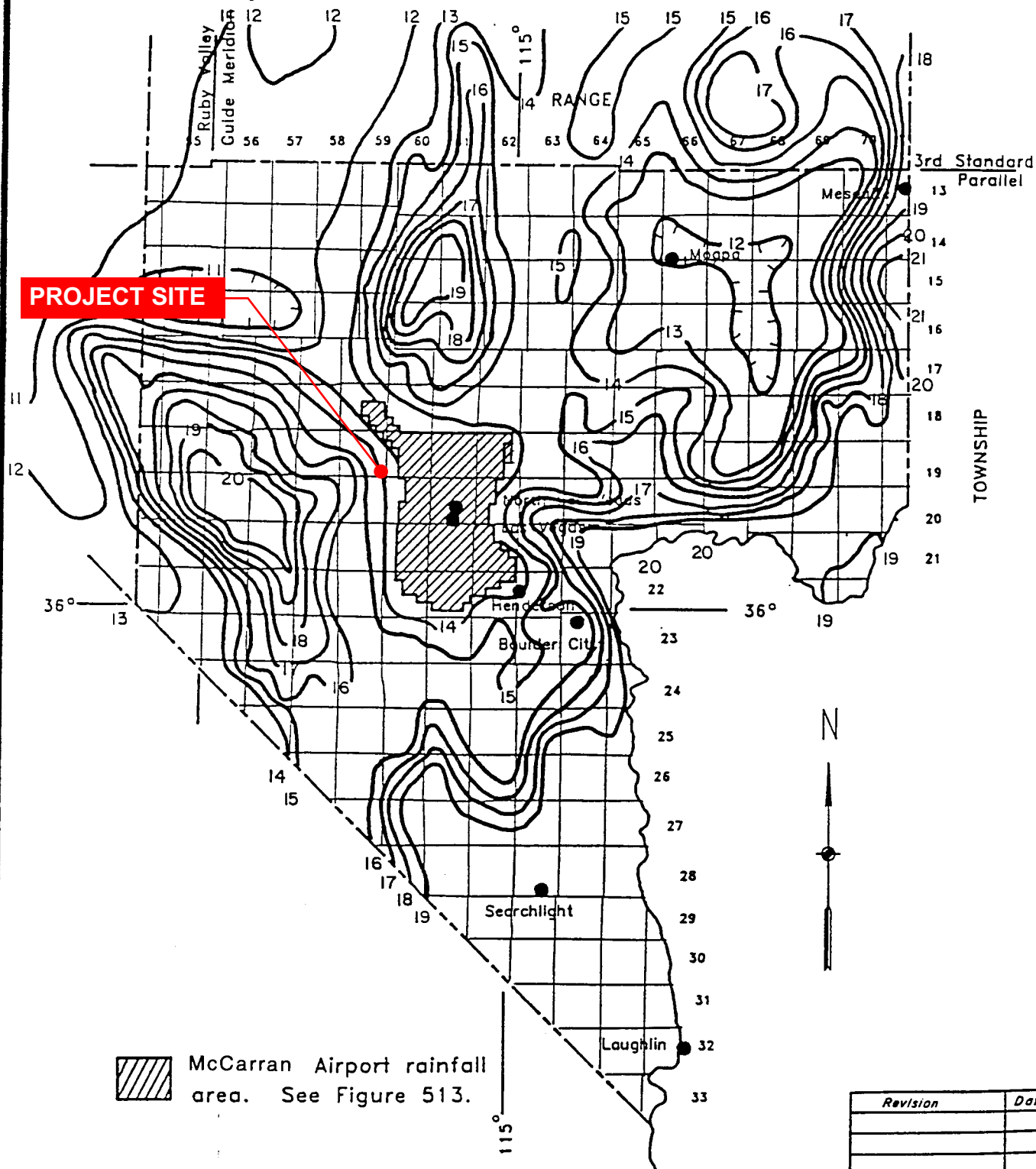
1. Refer to Table 505 and Figure 516 Depth-Duration- Frequency values in the McCarran Airport Rainfall Area.
2. Refer to Table 506 and Figure 517 for Time-Intensity-Frequency values on the McCarran Airport Rainfall Area.

Revision	Date

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



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



PRECIPITATION ADJUSTMENT RATIOS

<u>Recurrence Interval</u>	<u>Ratio to NOAA Atlas 2</u>
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.

<i>Revision</i>	<i>Date</i>

SIX HOUR DEPTH-AREA REDUCTION FACTORS

<u>Drainage Area (Square Miles)</u>	<u>Six-Hour Depth-Area Reduction Factor</u>
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.

<i>Revision</i>	<i>Date</i>

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

SIX-HOUR STORM DISTRIBUTIONS

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

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

Revision	Date

REFERENCE:

TABLE 503

RUNOFF CURVE NUMBERS (URBAN AREAS¹)

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

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

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

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

RUNOFF CURVE NUMBERS (SEMIARID RANGELANDS¹)

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

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

²Poor: <30% ground cover (litter, grass, and brush overstory).

Fair: 30 to 70% ground cover.

Good: >70% ground cover.

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

Revision	Date

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

RUNOFF CURVE NUMBERS - RESIDENTIAL DISTRICTS

Average Lot Size or Usage ¹	Percent Impervious ²	Curve Number for Hydrologic Soil Groups			
		A	B	C	D
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

**PRECIPITATION DEPTH CALCULATIONS
FOR AREAS OUTSIDE MCCARRAN AIRPORT RAINFALL DATA**

Calculated by:	MSB
Checked by:	MS
Project Name:	ANN & HUALAPAI
Date:	4/6/2021

10-YEAR STORM EVENT

PRECIPITATION DEPTH: REFERENCE (FIGURES & TABLES FROM CCRFCD MANUAL)
1.4 INCHES FIGURE 503

PRECIPITATION ADJUSTMENT:
1.24 TABLE 501

ADJUSTED POINT PRECIPITATION
= 1.45 X 1.24 = **1.74** TABLE 501, NOTE 1

100-YEAR STORM EVENT

PRECIPITATION DEPTH: REFERENCE (FIGURES & TABLES FROM CCRFCD MANUAL)
2.20 INCHES FIGURE 506

PRECIPITATION ADJUSTMENT:
1.43 TABLE 501

ADJUSTED POINT PRECIPITATION
= 2.10 X 1.43 = **3.15** TABLE 501, NOTE 1

HEC-1 10-YEAR RATIO

$$\frac{1.74}{3.15} = \mathbf{\underline{0.55}}$$

HEC-1 100-YEAR RATIO

$$\frac{3.15}{3.15} = \mathbf{\underline{1.00}}$$



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



March 15, 2021

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

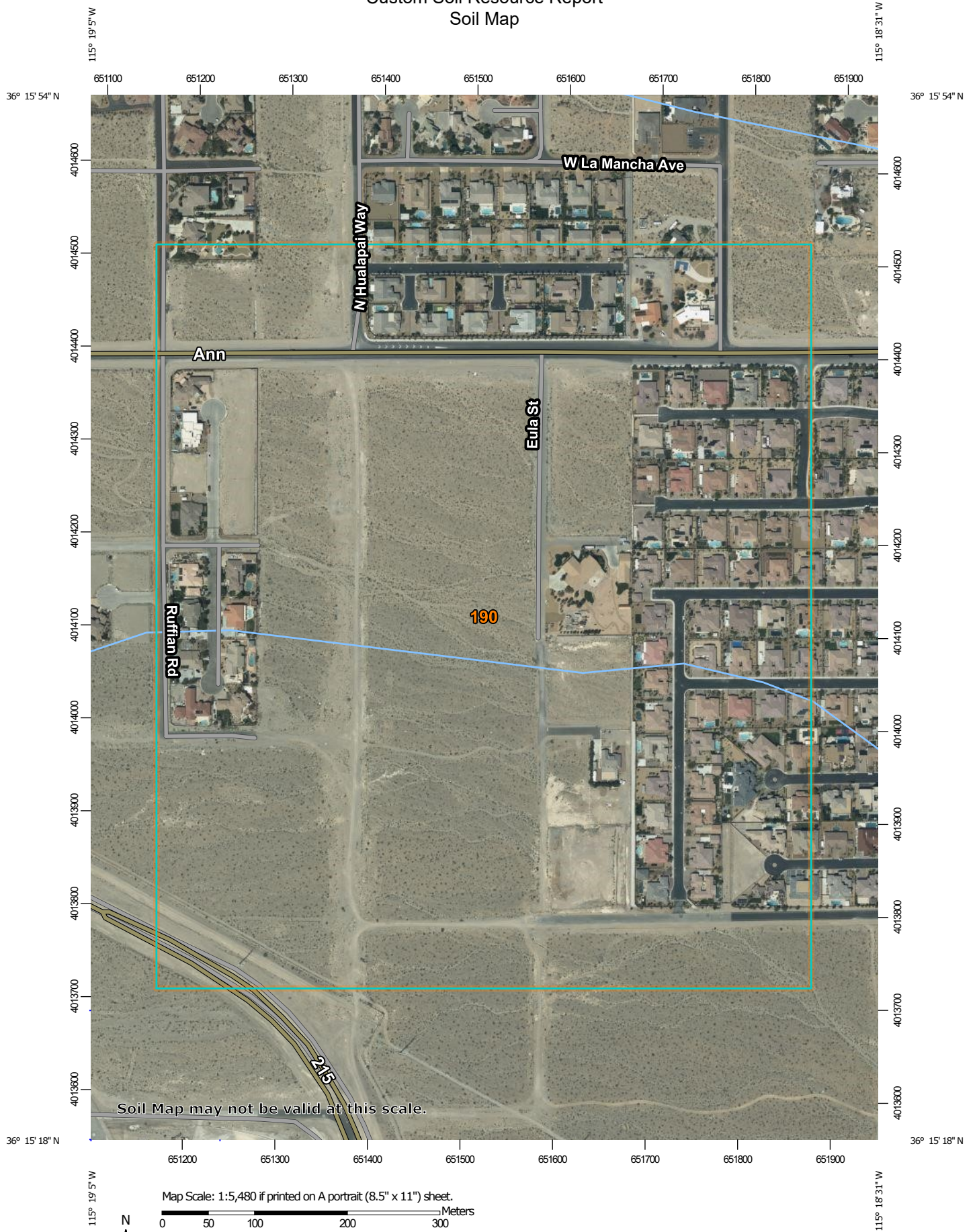
Custom Soil Resource Report

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report Soil Map



Map Scale: 1:5,480 if printed on A portrait (8.5" x 11") sheet.

0 50 100 200 300 Meters

0 250 500 1000 1500 Feet

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

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features

 Blowout

 Borrow Pit

 Clay Spot

 Closed Depression

 Gravel Pit

 Gravelly Spot

 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water

 Perennial Water

 Rock Outcrop

 Saline Spot

 Sandy Spot

 Severely Eroded Spot

 Sinkhole

 Slide or Slip

 Sodic Spot

 Spoil Area

 Stony Spot

 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

Water Features

 Streams and Canals

Transportation

 Rails

 Interstate Highways

 US Routes

 Major Roads

 Local Roads

Background

 Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Las Vegas Valley Area, Nevada, Part of Clark County

Survey Area Data: Version 16, Aug 26, 2020

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

Date(s) aerial images were photographed: Apr 3, 2019—May 14, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
190	Dalian very gravelly fine sandy loam, 2 to 4 percent slopes	140.5	100.0%
Totals for Area of Interest		140.5	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
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 content: 60 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: 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

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.

Soil Physical Properties

This folder contains a collection of tabular reports that present soil physical properties. The reports (tables) include all selected map units and components for each map unit. Soil physical properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Engineering Properties (Ann & Hualapai)

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Hydrologic soil group is a group of soils having similar runoff potential under similar storm and cover conditions. The criteria for determining Hydrologic soil group is found in the National Engineering Handbook, Chapter 7 issued May 2007(<http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba>). Listing HSGs by soil map unit component and not by soil series is a new concept for the engineers. Past engineering references contained lists of HSGs by soil series. Soil series are continually being defined and redefined, and the list of soil series names changes so frequently as to make the task of maintaining a single national list virtually impossible. Therefore, the criteria is now used to calculate the HSG using the component soil properties and no such national series lists will be maintained. All such references are obsolete and their use should be discontinued. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission

rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. The influence of ground cover is treated independently. There are four hydrologic soil groups, A, B, C, and D, and three dual groups, A/D, B/D, and C/D. In the dual groups, the first letter is for drained areas and the second letter is for undrained areas.

The four hydrologic soil groups are described in the following paragraphs:

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.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group

Custom Soil Resource Report

index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Percentage of rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

References:

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Custom Soil Resource Report

Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007(<http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba>). Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Engineering Properties—Las Vegas Valley Area, Nevada, Part of Clark County														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			<i>In</i>				<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>
190—Dalian very gravelly fine sandy loam, 2 to 4 percent slopes														
Dalian	100	A	0-4	Very gravelly fine sandy loam	GM	A-1	0- 0- 0	0- 0- 0	30-43-55	25-38-50	20-30-40	10-18-25	0-7 -14	NP
			4-61	Very gravelly sandy loam, extremely gravelly fine sandy loam, very gravelly fine sandy loam	GM, GP-GM	A-1	0- 0- 0	5- 8- 10	30-30-55	25-25-50	20-20-40	10-12-25	0-7 -14	NP

References

- American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.
- American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.
- Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.
- Federal Register. July 13, 1994. Changes in hydric soils of the United States.
- Federal Register. September 18, 2002. Hydric soils of the United States.
- Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.
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- Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262
- Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577
- Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580
- Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.
- United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.
- United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374
- United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. <http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084>

Custom Soil Resource Report

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

ANN & HUALAPAI
SOILS DESCRIPTION TABLES

DATE:
FILE:
BY:

4/6/2021
CNTABLE.xls
MSB

Hydrologic Soil Group	Newly Graded Areas	Desert Shrub (Poor Condition)	Streets
A	77	63	98
B	86	77	98
C	91	85	94
D	94	88	98
ROCK	94	92	98

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

Description	Type	%	Newly Graded Areas	Desert Shrub (Poor Condition)	Streets
Dalian	A	100%	77	63	98
Composite CN		100%	77	63	98

ANN & HUALAPAI						
WEIGHTED CURVE NUMBERS AND PRECIPITATION VALUES						
PROPOSED CONDITIONS						
Basin	Soil	Percent	CN	LandUse	WCN	PREC
DON1	190	100.0%	57.0	14,000 sf lots	57.0	2.86
ANN1	190	100.0%	98.0	Streets	98.0	2.86
HUA1	190	100.0%	98.0	Streets	98.0	2.86

TIME OF CONCENTRATION / LAG TIME DETERMINATION



ANN & HUALAPAI ANN ROAD AND HUALAPAI WAY PROPOSED & ULTIMATE CONDITIONS

Project No: 192054000
Date: 4/6/21
Calculated by: MB/MS

SUB-BASIN						INITIAL / OVERLAND			TRAVEL TIME							T _{lag}	REMARKS
DATA						TIME (Ti)			(Tt)								
Basin ID	DEV./UNDEV.	CN	K	AREA	AREA	INITIAL LENGTH	SLOPE	Ti	TRAVEL LENGTH	SLOPE	V ₁	V ₂	Tt	Tc	Tc Check	T _{lag}	
											VELOCITY	VELOCITY				0.6Tc/60	RAINFALL
	(1)	(D or U)	(3)	(4)	Ac	Mi ²	Feet	%	Min	Feet	%	FPS	FPS	Min	Min	Min	Hours
(1)	(2)	(3)	(4)	(5a)	(5b)	(6)	(7)	(8)	(9)	(10)	(10a)	(10b)	(11)	(12)	(13)	(14)	(15)
DON1	D	57.0	0.3624	22.51	0.0352	40	2.00	6.7	1830	1.75	2.7	4.0	8.6	15.3	20.4	0.153	3.15
ANN1	D	98.0	0.9036	1.56	0.0024	45	2.00	1.9	995	3.51	3.8	5.7	3.6	5.5	15.8	0.055	3.15
**HUAL1	D	98.0	0.9036	1.28	0.0020	40	2.00	1.8	365	3.00	3.5	5.3	1.7	3.5	12.3	0.050	3.15
**HUAL2	D	98.0	0.9036	2.17	0.0034	40	2.00	1.8	655	1.00	2.0	3.1	5.0	6.7	13.9	0.067	3.15
**Referenced/Revised from the 215 Study (PW# 20-11651)																	
NOTE:																	
(1) Subbasin Name						(7) Initial Slope						(10b) V ₂ applies to the remaining travel distance;					
(2) Developed or Undeveloped Subbasin						(8) Ti = 1.8 (1.1 - K) L ^{1/2} / S ^{1/3}						Developed V ₂ = 30.6*(S/100) ^{1/2} Undeveloped V ₂ = 29.4*(S/100) ^{1/2}					
(3) Curve Number (See Subbasin CN Calculations)						(9) Travel Length						(11) Tt = 500/(V ₁ *60)+(Travel Length-500)/(V ₂ *60)					
(4) K = 0.0132 (CN) - 0.39						(10) Slope						(12) Tc = Ti + Tt (15) Rainfall in inches					
(5a) & (5b) Area						(10a) Slope V ₁ applies to the first 500 feet of travel distance;						(13) Tc Check = L/180+10 (select smaller Tc)					
(6) Initial Length						Developed V ₁ = 20.2*(S/100) ^{1/2} Undeveloped V ₁ = 14.8*(S/100) ^{1/2}						(14) Tlag = 0.6 Tc/60					
REFERENCE: Calculations based on the Clark County Regional Flood Control District HCDDM														STANDARD FORM 4			

```

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
*   JUN 1998
*   VERSION 4.1
*
* RUN DATE 02APR21 TIME 11:03:53
*
*****

PRO.OUT

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

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

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

1 HEC-1 INPUT PAGE 1

```

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

*** FREE ***

*DIAGRAM
1 ID
2 ID *****
3 ID *
4 ID * ANN AND HUALAPAI *
5 ID * PROPOSED CONDITION *
6 ID *
7 ID * PROJECT No: _ _ _ 291448001 *
8 ID * FILE: _ _ _ _ _ PRO.H1 *
9 ID * DATE MODELED: _ _ 03/23/21 *
10 ID * MODELED BY: _ _ _ MSB/MS *
11 ID *
12 ID *****
13 ID
14 ID *****
15 ID * RETURN PERIOD: _ _100- & 10- YEAR *
16 ID * DISTRIBUTION: _ _ 6-HOUR SDN3 *
17 ID *****
18 ID
19 ID JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:
20 ID
21 ID AREA (SQUARE MILES) DARF
22 ID
23 ID 0 - 0.5 1.000
24 ID 10YR 0.550
25 ID
26 ID IT 5 0 0 300
27 ID IO 5
28 ID IN 5
29 ID JR PREC 1.00 0.550

30 KK **ANN
31 BA .0070
32 PB 3.15
33 PC .000 .020 .057 .070 .087 .108 .124 .130 .130 .130
34 PC .130 .130 .130 .133 .140 .142 .148 .158 .172 .181
35 PC .190 .197 .199 .200 .201 .204 .214 .229 .241 .249
36 PC .251 .256 .270 .278 .281 .283 .295 .322 .352 .409
37 PC .499 .590 .710 .744 .781 .812 .819 .835 .851 .856
38 PC .860 .868 .876 .888 .910 .926 .937 .950 .970 .976
39 PC .982 .985 .987 .989 .990 .993 .993 .994 .995 .998
40 PC .998 .999 1.00
41 LS 0 98.0
42 UD .120
*

43 KK **OFF1P
44 BA .0075
45 LS 0 88.0
46 UD .108

```


1

HEC-1 INPUT

PAGE 2

LINE	ID	1	2	3	4	5	6	7	8	9	10
47	KK	**CP1									
48	HC	2									
	*										
49	KK	ANN1									
50	BA	.0024									
51	LS	0	98.0								
52	UD	.055									
	*										
53	KK	CP1									
54	HC	2									
	*										
55	KK	**ON2AP									
56	BA	.0432									
57	LS	0	78.2								
58	UD	.181									
	*										
59	KK	**OFF3U									
60	BA	.0035									
61	LS	0	54.0								
62	UD	.125									
	*										
63	KK	**OFF2P									
64	BA	.0143									
65	LS	0	77.3								
66	UD	.106									
	*										
67	KK	**CP2A									
68	HC	3									
	*										
69	KK	**OFF4P									
70	BA	.0314									
71	LS	0	57.1								
72	UD	.153									
	*										
73	KK	**CP2B									
74	HC	2									
	*										
75	KK	**ON1A									
76	BA	.0077									
77	LS	0	57.0								
78	UD	.145									
	*										

1

HEC-1 INPUT

PAGE 3

LINE	ID	1	2	3	4	5	6	7	8	9	10
79	KK	**CP2									
80	HC	2									
	*										
81	KK	**ON1B									
82	BA	.0283									
83	LS	0	57.0								
84	UD	.201									
	*										
85	KK**HUAL-2										
86	BA	.0034									
87	LS	0	98								
88	UD	.067									
	*										
89	KK	**CP3									
90	HC	3									
	*										
91	KK**HUAL-1										
92	BA	.0020									
93	LS	0	98								
94	UD	.050									
	*										
95	KK	DON1									

PRO.OUT

```
96      BA  .0352
97      LS   0   57.0
98      UD  .153
      *

99      KK  DVDON1
100     KM  DIVERT OUT FLOW THAT IS DISCHARGING TO DRAINAGE EASEMENTS
101     DT  DVSD1
102     DI   0     0     7
103     DQ   0     0     3
      *

104     KK   CP2
105     HC   3
      *
106     ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

30    **ANN
      .
      .
43    .    **OFF1P
      .
      .
47    **CP1.....
      .
      .
49    .    ANN1
      .
      .
53    CP1.....
      .
      .
55    .    **ON2AP
      .
      .
59    .    .    **OFF3U
      .
      .
63    .    .    **OFF2P
      .
      .
67    .    **CP2A.....
      .
      .
69    .    .    **OFF4P
      .
      .
73    .    **CP2B.....
      .
      .
75    .    .    **ON1A
      .
      .
79    .    **CP2.....
      .
      .
81    .    .    **ON1B
      .
      .
85    .    .    **HUAL-2
      .
      .
89    .    **CP3.....
      .
      .
91    .    .    **HUAL-1
      .
      .
95    .    .    .    DON1
      .
      .
101   .    .    .    .-----> DVSD1
99    .    .    .    DVDON1
      .
      .
104   .    CP2.....
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JUN 1998
* VERSION 4.1
```

```
*****
*
* U.S. ARMY CORPS OF ENGINEERS
* HYDROLOGIC ENGINEERING CENTER
* 609 SECOND STREET
```


PRO.OUT

*
* RUN DATE 02APR21 TIME 11:03:53 *
*

* DAVIS, CALIFORNIA 95616 *
* (916) 756-1104 *
*

*
* ANN AND HUALAPAI *
* PROPOSED CONDITION *
*
* PROJECT No: _ _ _ 291448001 *
* FILE: _ _ _ _ _ PRO.H1 *
* DATE MODELED: _ _ _ 03/23/21 *
* MODELED BY: _ _ _ MSB/MS *
*

*
* RETURN PERIOD: _ 100- & 10- YEAR *
* DISTRIBUTION: _ _ 6-HOUR SDN3 *

JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:

AREA (SQUARE MILES) DARF

0 - 0.5 1.000
10YR 0.550

27 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 .55

1

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION	
				RATIO 1	RATIO 2
				1.00	.55
HYDROGRAPH AT					
+	**ANN	.01	1 FLOW	15.	8.
			TIME	3.50	3.58
HYDROGRAPH AT					
+	**OFF1P	.01	1 FLOW	13.	5.
			TIME	3.50	3.58
2 COMBINED AT					
+	**CP1	.01	1 FLOW	28.	13.
			TIME	3.50	3.58

PRO.OUT

HYDROGRAPH AT +	ANN1	.00	1	FLOW TIME	6. 3.50	3. 3.50
2 COMBINED AT +	CP1	.02	1	FLOW TIME	34. 3.50	16. 3.50
HYDROGRAPH AT +	**ON2AP	.04	1	FLOW TIME	43. 3.58	11. 3.67
HYDROGRAPH AT +	**OFF3U	.00	1	FLOW TIME	0. 3.75	0. .00
HYDROGRAPH AT +	**OFF2P	.01	1	FLOW TIME	16. 3.58	4. 3.58
3 COMBINED AT +	**CP2A	.06	1	FLOW TIME	59. 3.58	15. 3.58
HYDROGRAPH AT +	**OFF4P	.03	1	FLOW TIME	6. 3.67	0. 4.92
2 COMBINED AT +	**CP2B	.09	1	FLOW TIME	64. 3.58	15. 3.58
HYDROGRAPH AT +	**ON1A	.01	1	FLOW TIME	1. 3.67	0. 4.92
2 COMBINED AT +	**CP2	.10	1	FLOW TIME	66. 3.58	15. 3.58
HYDROGRAPH AT +	**ON1B	.03	1	FLOW TIME	5. 3.75	0. 5.00
HYDROGRAPH AT +	**HUAL-2	.00	1	FLOW TIME	9. 3.50	5. 3.50
3 COMBINED AT +	**CP3	.13	1	FLOW TIME	75. 3.58	18. 3.58
HYDROGRAPH AT +	**HUAL-1	.00	1	FLOW TIME	5. 3.50	3. 3.50
HYDROGRAPH AT +	DON1	.04	1	FLOW TIME	7. 3.67	0. 4.92
DIVERSION TO +	DVSD1	.04	1	FLOW TIME	3. 3.67	0. 4.92
HYDROGRAPH AT +	DVDON1	.04	1	FLOW TIME	4. 3.67	0. 4.92
3 COMBINED AT +	CP2	.17	1	FLOW TIME	81. 3.58	20. 3.58

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


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1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JUN 1998
* VERSION 4.1
*
* RUN DATE 29MAR21 TIME 15:00:51
*
*****

                                ULT.OUT

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

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

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

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
 THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
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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

*** FREE ***

```

1 ID
2 ID *****
3 ID *
4 ID * ANN AND HUALAPAI *
5 ID * ULTIMATE CONDITION *
6 ID *
7 ID * PROJECT No: _ _ _ 291448001 *
8 ID * FILE: _ _ _ _ _ ULT.H1 *
9 ID * DATE MODELED: _ _ 03/29/21 *
10 ID * MODELED BY: _ _ _ MSB/MS *
11 ID *
12 ID *****
13 ID
14 ID *****
15 ID * RETURN PERIOD: _ _100- & 10- YEAR *
16 ID * DISTRIBUTION: _ _ 6-HOUR SDN3 *
17 ID *****
18 ID
19 ID JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:
20 ID
21 ID AREA (SQUARE MILES) DARF
22 ID
23 ID 0 - 0.5 1.000
24 ID 10YR 0.550
25 ID
26 ID IT 5 0 0 300
27 ID IO 5
28 ID IN 5
29 ID JR PREC 1.00 0.550
30 KK **ANN
31 BA .0070
32 PB 3.15
33 PC .000 .020 .057 .070 .087 .108 .124 .130 .130 .130
34 PC .130 .130 .130 .133 .140 .142 .148 .158 .172 .181
35 PC .190 .197 .199 .200 .201 .204 .214 .229 .241 .249
36 PC .251 .256 .270 .278 .281 .283 .295 .322 .352 .409
37 PC .499 .590 .710 .744 .781 .812 .819 .835 .851 .856
38 PC .860 .868 .876 .888 .910 .926 .937 .950 .970 .976
39 PC .982 .985 .987 .989 .990 .993 .993 .994 .995 .998
40 PC .998 .999 1.00
41 LS 0 98.0
42 UD .120
*
43 KK **OFF1P
44 BA .0073
45 LS 0 86.7
46 UD .151

```

1

HEC-1 INPUT

PAGE 2

LINE	ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
47	KK **CP1
48	HC 2
	*
49	KK ANN1
50	BA .0024
51	LS 0
52	UD .055
	*
53	KK CP1
54	HC 2
	*
55	KK **ON2AP
56	BA .0441
57	LS 0
58	UD .223
	*
59	KK **OFF3U
60	BA .0035
61	LS 0
62	UD .125
	*
63	KK **OFF2P
64	BA .0144
65	LS 0
66	UD .143
	*
67	KK **CP2A
68	HC 3
	*
69	KK **OFF4P
70	BA .0314
71	LS 0
72	UD .162
	*
73	KK **CP2B
74	HC 2
	*
75	KK **ON1A
76	BA .0077
77	LS 0
78	UD .145
	*

1

HEC-1 INPUT

PAGE 3

LINE	ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
79	KK **CP2
80	HC 2
	*
81	KK **ON1B
82	BA .0283
83	LS 0
84	UD .201
	*
85	KK**HUAL-2
86	BA .0047
87	LS 0
88	UD .067
	*
89	KK **CP3
90	HC 3
	*
91	KK**HUAL-1
92	BA .0020
93	LS 0
94	UD .050
	*
95	KK DON1

ULT.OUT

96 BA .0352
97 LS 0 57.0
98 UD .153
*

99 KK CP2
100 HC 3
*
101 ZZ

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

30 **ANN
.
.
43 . **OFF1P
.
.
47 **CP1.....
.
.
49 . ANN1
.
.
53 CP1.....
.
.
55 . **ON2AP
.
.
59 . . **OFF3U
.
.
63 . . . **OFF2P
.
.
67 . **CP2A.....
.
.
69 . . **OFF4P
.
.
73 . **CP2B.....
.
.
75 . . **ON1A
.
.
79 . **CP2.....
.
.
81 . . **ON1B
.
.
85 . . . **HUAL-2
.
.
89 . **CP3.....
.
.
91 . . **HUAL-1
.
.
95 . . . DON1
.
.
99 . CP2.....

(**) RUNOFF ALSO COMPUTED AT THIS LOCATION

1*****
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* JUN 1998 *
* VERSION 4.1 *
* RUN DATE 29MAR21 TIME 15:00:51 *

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

```

*
* ANN AND HUALAPAI
* ULTIMATE CONDITION
*
* PROJECT No: _ _ _ 291448001
* FILE: _ _ _ _ _ ULT.H1
* DATE MODELED: _ _ _ 03/29/21
* MODELED BY: _ _ _ MSB/MS
*
*****

```

```

*****
* RETURN PERIOD: _ 100- & 10- YEAR
* DISTRIBUTION: _ _ 6-HOUR SDN3
*****

```

JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:

```

AREA (SQUARE MILES)  DARF

0 - 0.5                1.000
10YR                  0.550

```

```

27 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      .55

```

1

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION	
				RATIO 1 1.00	RATIO 2 .55
HYDROGRAPH AT +	**ANN	.01	1 FLOW TIME	15. 3.50	8. 3.58
HYDROGRAPH AT +	**OFF1P	.01	1 FLOW TIME	11. 3.58	4. 3.58
2 COMBINED AT +	**CP1	.01	1 FLOW TIME	26. 3.58	12. 3.58
HYDROGRAPH AT +	ANN1	.00	1 FLOW TIME	6. 3.50	3. 3.50
2 COMBINED AT +	CP1	.02	1 FLOW TIME	31. 3.50	15. 3.50
HYDROGRAPH AT +	**ON2AP	.04	1 FLOW	7.	0.

					TIME	3.75	5.00	ULT.OUT
HYDROGRAPH AT								
+	**OFF3U	.00	1	FLOW	0.	0.		
				TIME	3.75	.00		
HYDROGRAPH AT								
+	**OFF2P	.01	1	FLOW	13.	3.		
				TIME	3.58	3.58		
3 COMBINED AT								
+	**CP2A	.06	1	FLOW	18.	3.		
				TIME	3.67	3.58		
HYDROGRAPH AT								
+	**OFF4P	.03	1	FLOW	4.	0.		
				TIME	3.75	5.83		
2 COMBINED AT								
+	**CP2B	.09	1	FLOW	22.	3.		
				TIME	3.67	3.58		
HYDROGRAPH AT								
+	**ON1A	.01	1	FLOW	1.	0.		
				TIME	3.67	4.92		
2 COMBINED AT								
+	**CP2	.10	1	FLOW	23.	3.		
				TIME	3.67	3.58		
HYDROGRAPH AT								
+	**ON1B	.03	1	FLOW	5.	0.		
				TIME	3.75	5.00		
HYDROGRAPH AT								
+	**HUAL-2	.00	1	FLOW	12.	6.		
				TIME	3.50	3.50		
3 COMBINED AT								
+	**CP3	.13	1	FLOW	33.	8.		
				TIME	3.58	3.50		
HYDROGRAPH AT								
+	**HUAL-1	.00	1	FLOW	5.	3.		
				TIME	3.50	3.50		
HYDROGRAPH AT								
+	DON1	.04	1	FLOW	7.	0.		
				TIME	3.67	4.92		
3 COMBINED AT								
+	CP2	.17	1	FLOW	42.	11.		
				TIME	3.58	3.50		
*** NORMAL END OF HEC-1 ***								

Appendix C – Hydraulic Calculations

- Normal Depth Calculations – Streets
- Normal Depth Calculations – Onsite
- Normal Depth Calculations – Easements
- Riprap Sizing Calculations
- Finished Floor Elevation Checks

ANN1 (10YR)

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	3.550 %
Discharge	16.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	3.93
0+10.00	0.60
0+15.00	0.50
0+15.50	0.48
0+15.50	0.00
0+17.00	0.13
0+17.00	0.17
0+60.00	1.03

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 3.93)	(0+60.00, 1.03)	0.016

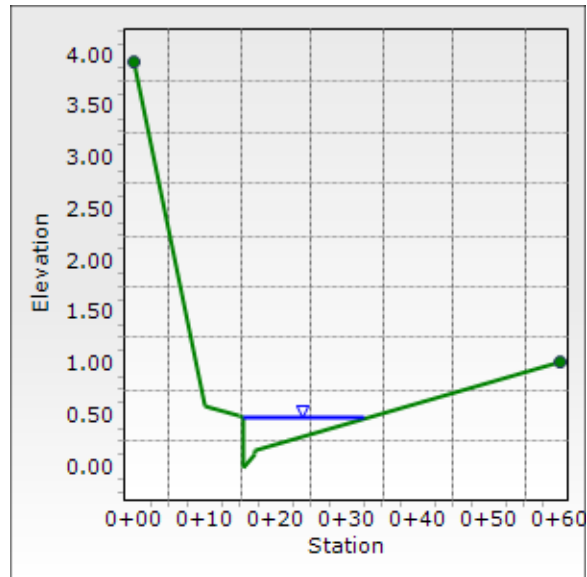
Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.48 ft
Roughness Coefficient	0.016
Elevation	0.48 ft
Elevation Range	0.00 to 3.93 ft
Flow Area	3.0 ft ²
Wetted Perimeter	17.36 ft
Hydraulic Radius	0.17 ft
Top Width	16.84 ft
Normal Depth	0.48 ft
Critical Depth	0.61 ft
Critical Slope	0.643 %
Velocity	5.39 ft/s
Velocity Head	0.45 ft

Results	
Specific Energy	0.93 ft
Froude Number	2.262
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.48 ft
Critical Depth	0.61 ft
Channel Slope	3.550 %
Critical Slope	0.643 %

Cross Section for ANN1 (10YR)

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	3.550 %
Normal Depth	0.48 ft
Discharge	16.00 cfs



ANN1 (100YR)

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	3.550 %
Discharge	34.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	3.93
0+10.00	0.60
0+15.00	0.50
0+15.50	0.48
0+15.50	0.00
0+17.00	0.13
0+17.00	0.17
0+60.00	1.03

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 3.93)	(0+60.00, 1.03)	0.016

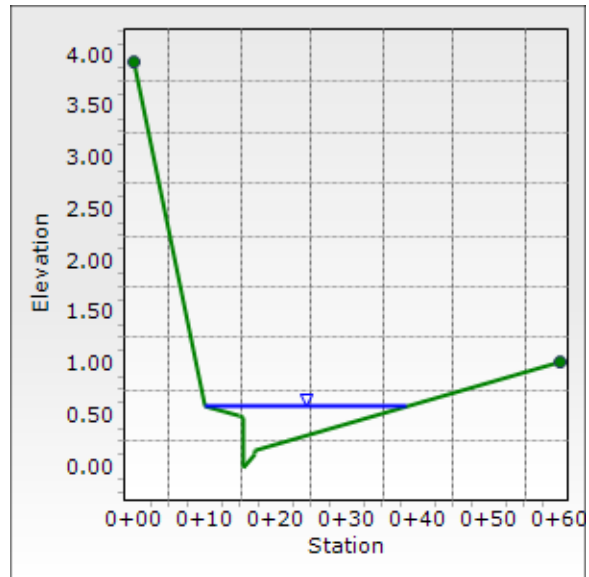
Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.60 ft
Roughness Coefficient	0.016
Elevation	0.60 ft
Elevation Range	0.00 to 3.93 ft
Flow Area	5.7 ft ²
Wetted Perimeter	29.04 ft
Hydraulic Radius	0.20 ft
Top Width	28.50 ft
Normal Depth	0.60 ft
Critical Depth	0.76 ft
Critical Slope	0.570 %
Velocity	5.93 ft/s
Velocity Head	0.55 ft

Results	
Specific Energy	1.15 ft
Froude Number	2.332
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.60 ft
Critical Depth	0.76 ft
Channel Slope	3.550 %
Critical Slope	0.570 %

Cross Section for ANN1 (100YR)

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	3.550 %
Normal Depth	0.60 ft
Discharge	34.00 cfs



HUAL1 (10YR)

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	1.320 %
Discharge	3.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.56
0+28.00	0.00
0+55.00	0.54

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.56)	(0+55.00, 0.54)	0.016

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

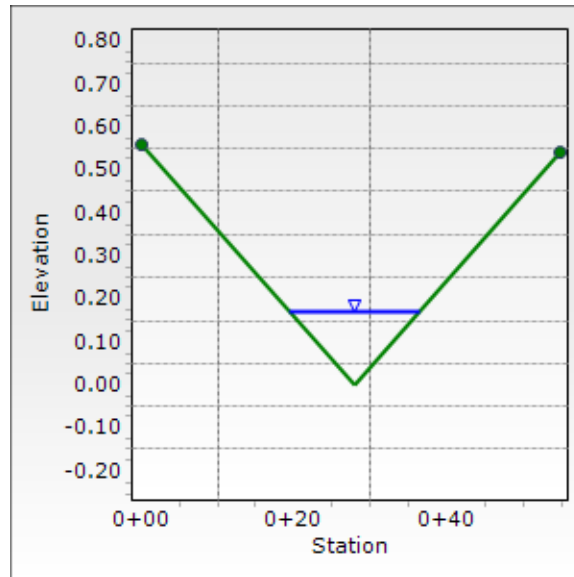
Results	
Normal Depth	0.17 ft
Roughness Coefficient	0.016
Elevation	0.17 ft
Elevation Range	0.00 to 0.56 ft
Flow Area	1.4 ft ²
Wetted Perimeter	17.03 ft
Hydraulic Radius	0.09 ft
Top Width	17.03 ft
Normal Depth	0.17 ft
Critical Depth	0.19 ft
Critical Slope	0.823 %
Velocity	2.07 ft/s
Velocity Head	0.07 ft
Specific Energy	0.24 ft
Froude Number	1.250
Flow Type	Supercritical

GVF Input Data

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.17 ft
Critical Depth	0.19 ft
Channel Slope	1.320 %
Critical Slope	0.823 %

Cross Section for HUAL1 (10YR)

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	1.320 %
Normal Depth	0.17 ft
Discharge	3.00 cfs



HUAL1 (100YR)

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	1.320 %
Discharge	5.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.56
0+28.00	0.00
0+55.00	0.54

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.56)	(0+55.00, 0.54)	0.016

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

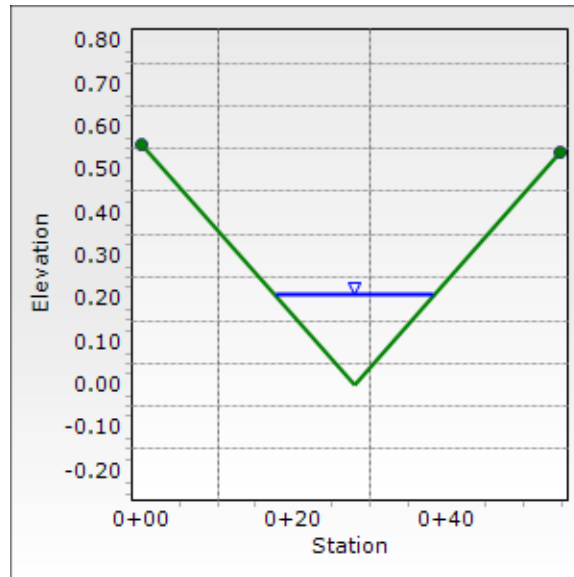
Results	
Normal Depth	0.21 ft
Roughness Coefficient	0.016
Elevation	0.21 ft
Elevation Range	0.00 to 0.56 ft
Flow Area	2.1 ft ²
Wetted Perimeter	20.63 ft
Hydraulic Radius	0.10 ft
Top Width	20.63 ft
Normal Depth	0.21 ft
Critical Depth	0.23 ft
Critical Slope	0.769 %
Velocity	2.35 ft/s
Velocity Head	0.09 ft
Specific Energy	0.29 ft
Froude Number	1.291
Flow Type	Supercritical

GVF Input Data

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.21 ft
Critical Depth	0.23 ft
Channel Slope	1.320 %
Critical Slope	0.769 %

Cross Section for HUAL1 (100YR)

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	1.320 %
Normal Depth	0.21 ft
Discharge	5.00 cfs



HUAL2 (10YR)

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	1.950 %
Discharge	18.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.56
0+28.00	0.00
0+55.00	0.54

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.56)	(0+55.00, 0.54)	0.016

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

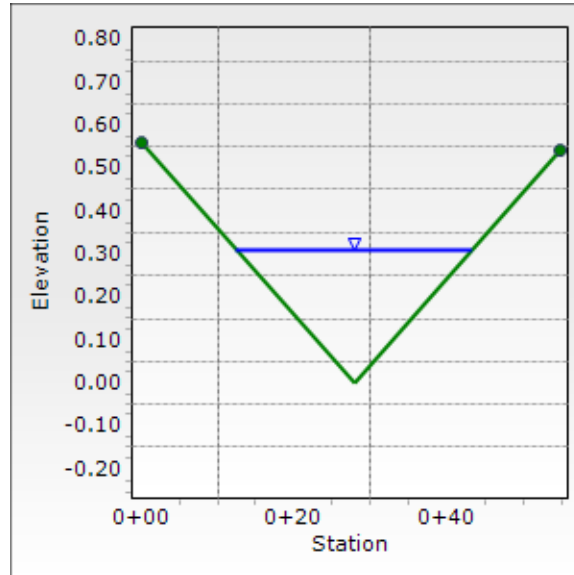
Results	
Normal Depth	0.31 ft
Roughness Coefficient	0.016
Elevation	0.31 ft
Elevation Range	0.00 to 0.56 ft
Flow Area	4.8 ft ²
Wetted Perimeter	31.04 ft
Hydraulic Radius	0.16 ft
Top Width	31.03 ft
Normal Depth	0.31 ft
Critical Depth	0.38 ft
Critical Slope	0.648 %
Velocity	3.74 ft/s
Velocity Head	0.22 ft
Specific Energy	0.53 ft
Froude Number	1.673
Flow Type	Supercritical

GVF Input Data

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.31 ft
Critical Depth	0.38 ft
Channel Slope	1.950 %
Critical Slope	0.648 %

Cross Section for HUAL2 (10YR)

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	1.950 %
Normal Depth	0.31 ft
Discharge	18.00 cfs



HUAL2 (100YR)

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	1.950 %
Discharge	75.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.56
0+28.00	0.00
0+55.00	0.54

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.56)	(0+55.00, 0.54)	0.016

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

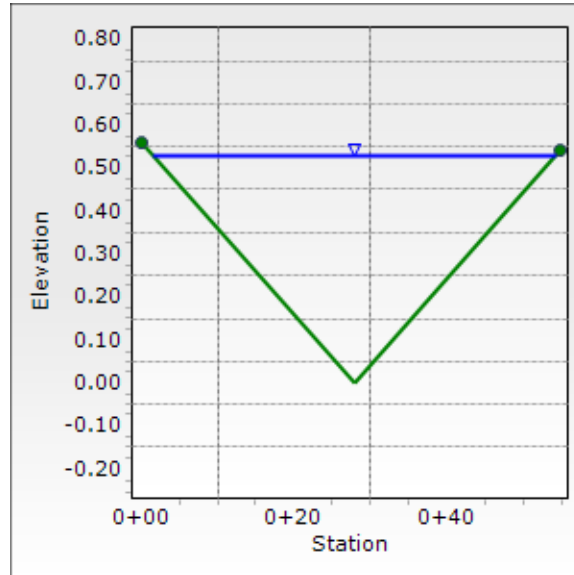
Results	
Normal Depth	0.53 ft
Roughness Coefficient	0.016
Elevation	0.53 ft
Elevation Range	0.00 to 0.56 ft
Flow Area	14.0 ft ²
Wetted Perimeter	52.95 ft
Hydraulic Radius	0.26 ft
Top Width	52.94 ft
Normal Depth	0.53 ft
Critical Depth	0.66 ft
Critical Slope	0.515 %
Velocity	5.35 ft/s
Velocity Head	0.45 ft
Specific Energy	0.97 ft
Froude Number	1.834
Flow Type	Supercritical

GVF Input Data

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.53 ft
Critical Depth	0.66 ft
Channel Slope	1.950 %
Critical Slope	0.515 %

Cross Section for HUAL2 (100YR)

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	1.950 %
Normal Depth	0.53 ft
Discharge	75.00 cfs



DON1-A1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.730 %
Discharge	1.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.48
0+05.00	0.38
0+06.50	0.00
0+07.50	0.08
0+07.50	0.13
0+20.50	0.39
0+33.50	0.13
0+33.50	0.08
0+34.50	0.00
0+35.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.48)	(0+35.00, 0.38)	0.016

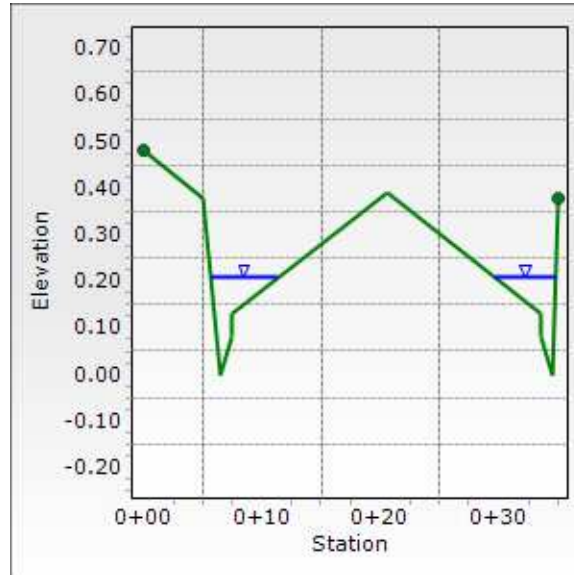
Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.21 ft
Roughness Coefficient	0.016
Elevation	0.21 ft
Elevation Range	0.00 to 0.48 ft
Flow Area	0.8 ft ²
Wetted Perimeter	11.10 ft
Hydraulic Radius	0.07 ft
Top Width	10.89 ft
Normal Depth	0.21 ft
Critical Depth	0.20 ft
Critical Slope	0.943 %

Results	
Velocity	1.33 ft/s
Velocity Head	0.03 ft
Specific Energy	0.24 ft
Froude Number	0.889
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.21 ft
Critical Depth	0.20 ft
Channel Slope	0.730 %
Critical Slope	0.943 %

Cross Section for DON1-A1

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.730 %
Normal Depth	0.21 ft
Discharge	1.00 cfs



DON1-A2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.630 %
Discharge	1.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.48
0+05.00	0.38
0+06.50	0.00
0+07.50	0.08
0+07.50	0.13
0+20.50	0.39
0+33.50	0.13
0+33.50	0.08
0+34.50	0.00
0+35.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.48)	(0+35.00, 0.38)	0.016

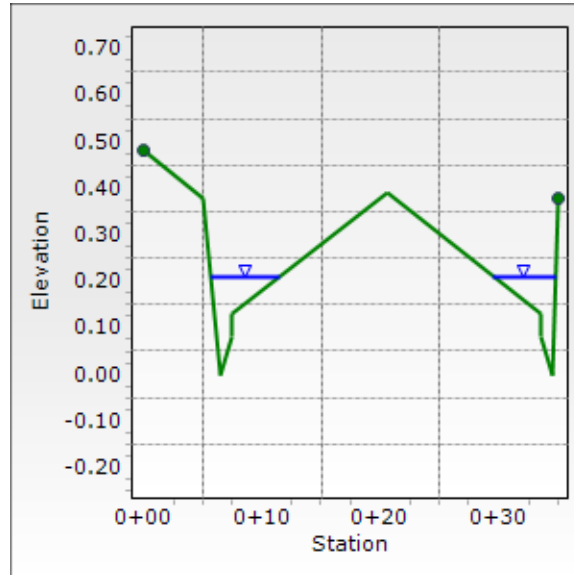
Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.21 ft
Roughness Coefficient	0.016
Elevation	0.21 ft
Elevation Range	0.00 to 0.48 ft
Flow Area	0.8 ft ²
Wetted Perimeter	11.54 ft
Hydraulic Radius	0.07 ft
Top Width	11.33 ft
Normal Depth	0.21 ft
Critical Depth	0.20 ft
Critical Slope	0.943 %

Results	
Velocity	1.25 ft/s
Velocity Head	0.02 ft
Specific Energy	0.24 ft
Froude Number	0.829
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.21 ft
Critical Depth	0.20 ft
Channel Slope	0.630 %
Critical Slope	0.943 %

Cross Section for DON1-A2

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.630 %
Normal Depth	0.21 ft
Discharge	1.00 cfs



DON1-B1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	2.000 %
Discharge	1.50 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.48
0+05.00	0.38
0+06.50	0.00
0+07.50	0.08
0+07.50	0.13
0+20.50	0.39
0+33.50	0.13
0+33.50	0.08
0+34.50	0.00
0+35.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.48)	(0+35.00, 0.38)	0.016

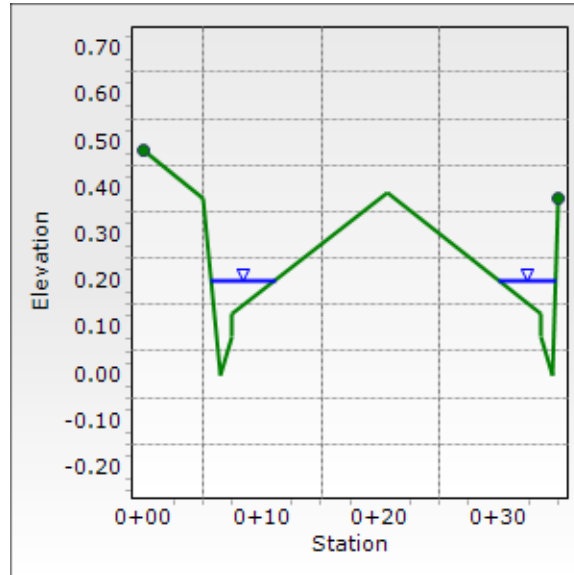
Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.20 ft
Roughness Coefficient	0.016
Elevation	0.20 ft
Elevation Range	0.00 to 0.48 ft
Flow Area	0.7 ft ²
Wetted Perimeter	10.53 ft
Hydraulic Radius	0.07 ft
Top Width	10.33 ft
Normal Depth	0.20 ft
Critical Depth	0.23 ft
Critical Slope	0.902 %

Results	
Velocity	2.15 ft/s
Velocity Head	0.07 ft
Specific Energy	0.27 ft
Froude Number	1.461
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.20 ft
Critical Depth	0.23 ft
Channel Slope	2.000 %
Critical Slope	0.902 %

Cross Section for DON1-B1

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	2.000 %
Normal Depth	0.20 ft
Discharge	1.50 cfs



DON1-C1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	3.040 %
Discharge	2.50 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	2.22
0+06.00	0.22
0+17.00	0.00
0+36.00	0.38
0+55.00	0.00
0+66.00	0.22
0+72.00	2.22

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2.22)	(0+72.00, 2.22)	0.016

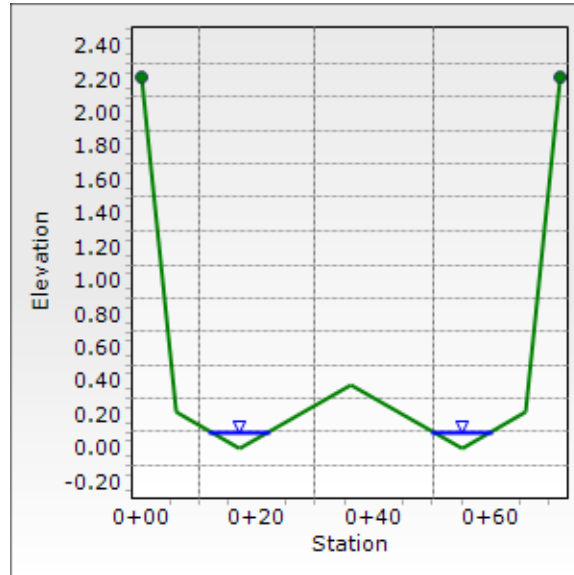
Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.10 ft
Roughness Coefficient	0.016
Elevation	0.10 ft
Elevation Range	0.00 to 2.22 ft
Flow Area	1.1 ft ²
Wetted Perimeter	20.97 ft
Hydraulic Radius	0.05 ft
Top Width	20.96 ft
Normal Depth	0.10 ft
Critical Depth	0.13 ft
Critical Slope	0.925 %
Velocity	2.28 ft/s
Velocity Head	0.08 ft
Specific Energy	0.19 ft

Results	
Froude Number	1.753
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.10 ft
Critical Depth	0.13 ft
Channel Slope	3.040 %
Critical Slope	0.925 %

Cross Section for DON1-C1

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	3.040 %
Normal Depth	0.10 ft
Discharge	2.50 cfs



DON1-C3

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	2.870 %
Discharge	2.50 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.48
0+05.00	0.38
0+06.50	0.00
0+07.50	0.08
0+07.50	0.13
0+20.50	0.39
0+33.50	0.13
0+33.50	0.08
0+34.50	0.00
0+35.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.48)	(0+35.00, 0.38)	0.016

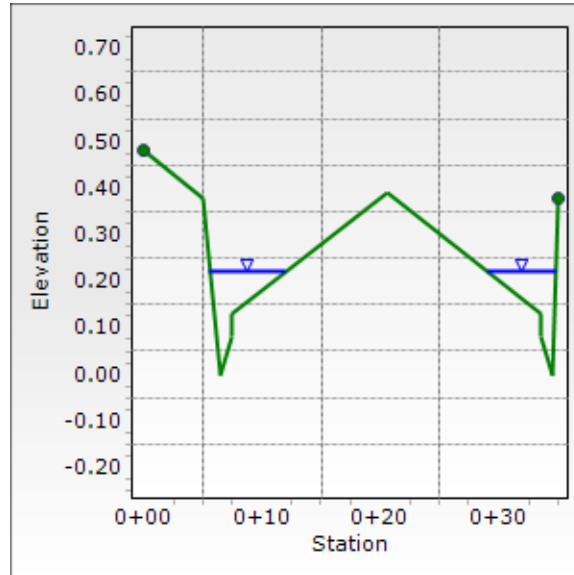
Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.22 ft
Roughness Coefficient	0.016
Elevation	0.22 ft
Elevation Range	0.00 to 0.48 ft
Flow Area	0.9 ft ²
Wetted Perimeter	12.51 ft
Hydraulic Radius	0.07 ft
Top Width	12.30 ft
Normal Depth	0.22 ft
Critical Depth	0.26 ft
Critical Slope	0.849 %

Results	
Velocity	2.75 ft/s
Velocity Head	0.12 ft
Specific Energy	0.34 ft
Froude Number	1.784
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.22 ft
Critical Depth	0.26 ft
Channel Slope	2.870 %
Critical Slope	0.849 %

Cross Section for DON1-C3

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	2.870 %
Normal Depth	0.22 ft
Discharge	2.50 cfs



DON1-D

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	3.000 %
Discharge	0.50 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.48
0+05.00	0.38
0+06.50	0.00
0+07.50	0.08
0+07.50	0.13
0+20.50	0.39
0+33.50	0.13
0+33.50	0.08
0+34.50	0.00
0+35.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.48)	(0+35.00, 0.38)	0.016

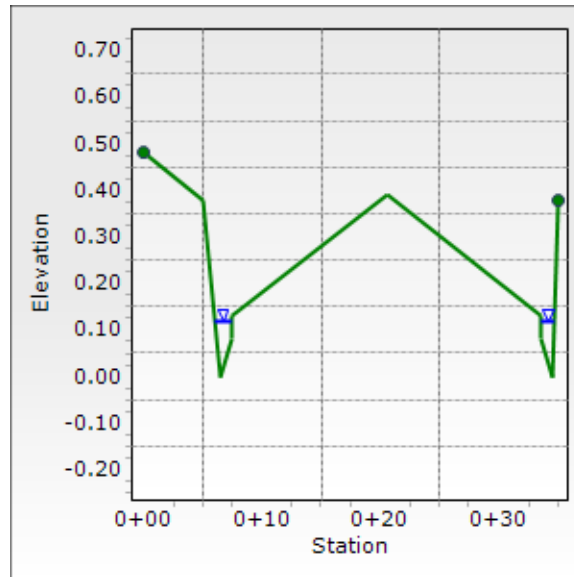
Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.12 ft
Roughness Coefficient	0.016
Elevation	0.12 ft
Elevation Range	0.00 to 0.48 ft
Flow Area	0.2 ft ²
Wetted Perimeter	2.74 ft
Hydraulic Radius	0.07 ft
Top Width	2.61 ft
Normal Depth	0.12 ft
Critical Depth	0.16 ft
Critical Slope	0.990 %

Results	
Velocity	2.69 ft/s
Velocity Head	0.11 ft
Specific Energy	0.23 ft
Froude Number	1.773
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.12 ft
Critical Depth	0.16 ft
Channel Slope	3.000 %
Critical Slope	0.990 %

Cross Section for DON1-D

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	3.000 %
Normal Depth	0.12 ft
Discharge	0.50 cfs



DON1-E1

Project Description	
Friction Method	Manning
Solve For	Formula
	Normal Depth
Input Data	
Channel Slope	1.500 %
Discharge	6.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.48
0+05.00	0.38
0+06.50	0.00
0+07.50	0.08
0+07.50	0.13
0+20.50	0.39
0+33.50	0.13
0+33.50	0.08
0+34.50	0.00
0+35.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.48)	(0+35.00, 0.38)	0.016

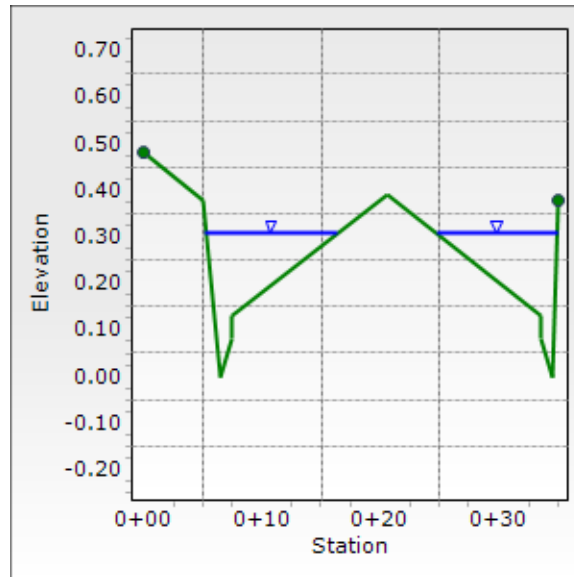
Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.31 ft
Roughness Coefficient	0.016
Elevation	0.31 ft
Elevation Range	0.00 to 0.48 ft
Flow Area	2.3 ft ²
Wetted Perimeter	21.45 ft
Hydraulic Radius	0.11 ft
Top Width	21.20 ft
Normal Depth	0.31 ft
Critical Depth	0.34 ft
Critical Slope	0.760 %

Results	
Velocity	2.58 ft/s
Velocity Head	0.10 ft
Specific Energy	0.41 ft
Froude Number	1.374
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.31 ft
Critical Depth	0.34 ft
Channel Slope	1.500 %
Critical Slope	0.760 %

Cross Section for DON1-E1

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	1.500 %
Normal Depth	0.31 ft
Discharge	6.00 cfs



DON1-F2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.600 %
Discharge	7.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	2.22
0+06.00	0.22
0+17.00	0.00
0+36.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2.22)	(0+36.00, 0.38)	0.016

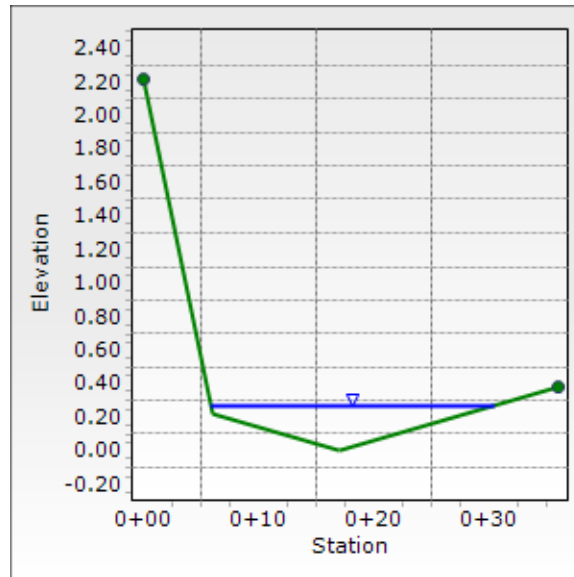
Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.27 ft
Roughness Coefficient	0.016
Elevation	0.27 ft
Elevation Range	0.00 to 2.22 ft
Flow Area	3.5 ft ²
Wetted Perimeter	24.56 ft
Hydraulic Radius	0.14 ft
Top Width	24.55 ft
Normal Depth	0.27 ft
Critical Depth	0.26 ft
Critical Slope	0.722 %
Velocity	1.98 ft/s
Velocity Head	0.06 ft
Specific Energy	0.33 ft
Froude Number	0.918
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	0.27 ft
Critical Depth	0.26 ft
Channel Slope	0.600 %
Critical Slope	0.722 %

Cross Section for DON1-F2

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.600 %
Normal Depth	0.27 ft
Discharge	7.00 cfs



DON1-G

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	1.640 %
Discharge	1.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.48
0+05.00	0.38
0+06.50	0.00
0+07.50	0.08
0+07.50	0.13
0+20.50	0.39
0+33.50	0.13
0+33.50	0.08
0+34.50	0.00
0+35.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.48)	(0+35.00, 0.38)	0.016

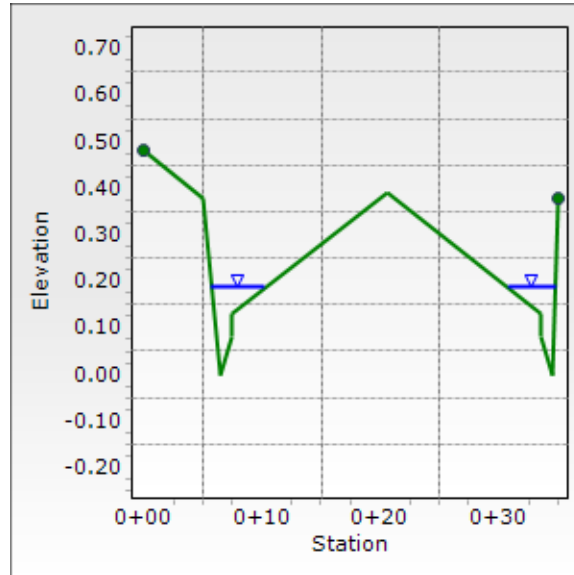
Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.19 ft
Roughness Coefficient	0.016
Elevation	0.19 ft
Elevation Range	0.00 to 0.48 ft
Flow Area	0.5 ft ²
Wetted Perimeter	8.79 ft
Hydraulic Radius	0.06 ft
Top Width	8.59 ft
Normal Depth	0.19 ft
Critical Depth	0.20 ft
Critical Slope	0.943 %

Results	
Velocity	1.85 ft/s
Velocity Head	0.05 ft
Specific Energy	0.24 ft
Froude Number	1.299
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.19 ft
Critical Depth	0.20 ft
Channel Slope	1.640 %
Critical Slope	0.943 %

Cross Section for DON1-G

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	1.640 %
Normal Depth	0.19 ft
Discharge	1.00 cfs



DON1-H2A

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	3.870 %
Discharge	75.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	3.48
0+00.00	0.48
0+05.00	0.38
0+06.50	0.00
0+07.50	0.08
0+07.50	0.13
0+20.50	0.39
0+33.50	0.13
0+33.50	0.08
0+34.50	0.00
0+35.00	0.38
0+35.00	3.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 3.48)	(0+35.00, 3.38)	0.016

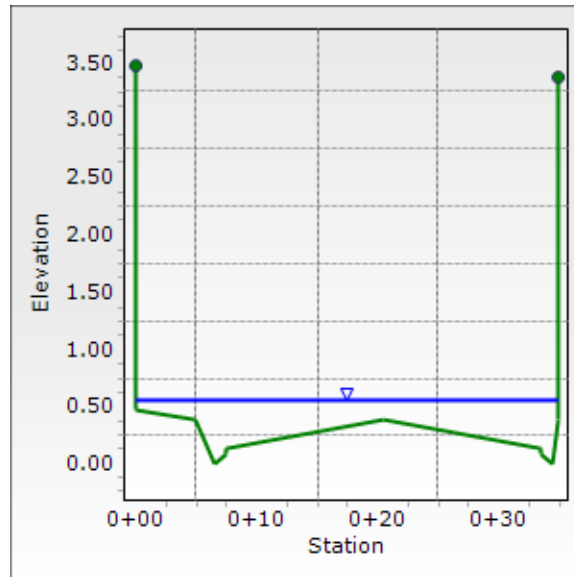
Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.55 ft
Roughness Coefficient	0.016
Elevation	0.55 ft
Elevation Range	0.00 to 3.48 ft
Flow Area	9.7 ft ²
Wetted Perimeter	35.52 ft
Hydraulic Radius	0.27 ft
Top Width	35.00 ft
Normal Depth	0.55 ft

Results	
Critical Depth	0.79 ft
Critical Slope	0.481 %
Velocity	7.71 ft/s
Velocity Head	0.92 ft
Specific Energy	1.47 ft
Froude Number	2.577
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.55 ft
Critical Depth	0.79 ft
Channel Slope	3.870 %
Critical Slope	0.481 %

Cross Section for DON1-H2A

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	3.870 %
Normal Depth	0.55 ft
Discharge	75.00 cfs



DON1-H2B

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	3.500 %
Discharge	77.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	3.48
0+00.00	0.48
0+05.00	0.38
0+06.50	0.00
0+07.50	0.08
0+07.50	0.13
0+20.50	0.39
0+33.50	0.13
0+33.50	0.08
0+34.50	0.00
0+35.00	0.38
0+35.00	3.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 3.48)	(0+35.00, 3.38)	0.016

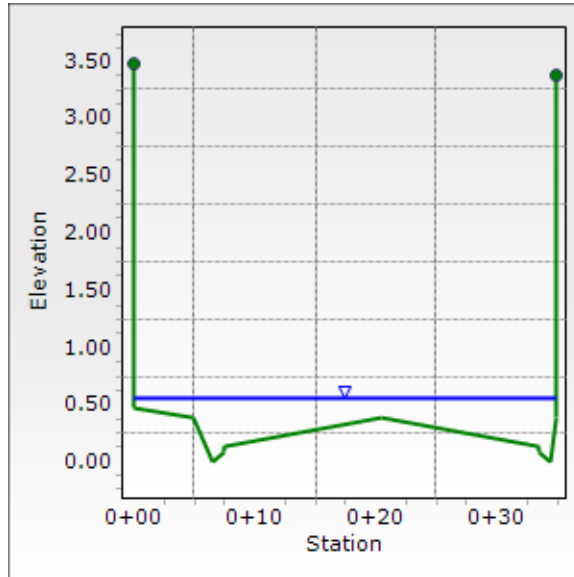
Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.56 ft
Roughness Coefficient	0.016
Elevation	0.56 ft
Elevation Range	0.00 to 3.48 ft
Flow Area	10.2 ft ²
Wetted Perimeter	35.55 ft
Hydraulic Radius	0.29 ft
Top Width	35.00 ft
Normal Depth	0.56 ft

Results	
Critical Depth	0.80 ft
Critical Slope	0.478 %
Velocity	7.55 ft/s
Velocity Head	0.89 ft
Specific Energy	1.45 ft
Froude Number	2.468
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.56 ft
Critical Depth	0.80 ft
Channel Slope	3.500 %
Critical Slope	0.478 %

Cross Section for DON1-H2B

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	3.500 %
Normal Depth	0.56 ft
Discharge	77.00 cfs



DON1-H4

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.500 %
Discharge	81.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	2.22
0+06.00	0.22
0+17.00	0.00
0+36.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2.22)	(0+36.00, 0.38)	0.016

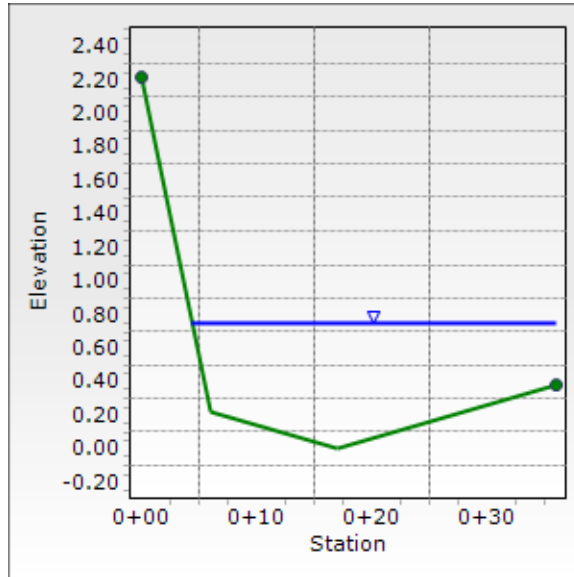
Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.75 ft
Roughness Coefficient	0.016
Elevation	0.75 ft
Elevation Range	0.00 to 2.22 ft
Flow Area	18.1 ft ²
Wetted Perimeter	32.05 ft
Hydraulic Radius	0.56 ft
Top Width	31.59 ft
Normal Depth	0.75 ft
Critical Depth	0.77 ft
Critical Slope	0.454 %
Velocity	4.48 ft/s
Velocity Head	0.31 ft
Specific Energy	1.06 ft
Froude Number	1.045
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.75 ft
Critical Depth	0.77 ft
Channel Slope	0.500 %
Critical Slope	0.454 %

Cross Section for DON1-H4

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.500 %
Normal Depth	0.75 ft
Discharge	81.00 cfs



ON1-B2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	5.120 %
Discharge	1.50 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	6.00
0+00.00	0.30
0+15.00	0.00
0+30.00	0.30
0+30.00	6.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 6.00)	(0+30.00, 6.00)	0.016

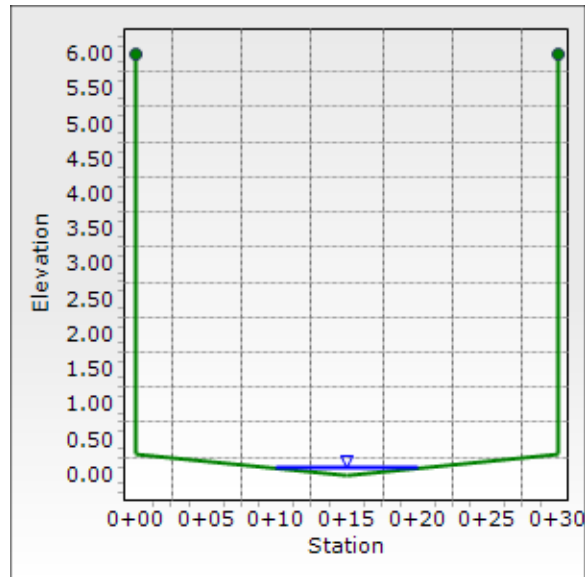
Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.10 ft
Roughness Coefficient	0.016
Elevation	0.10 ft
Elevation Range	0.00 to 6.00 ft
Flow Area	0.5 ft ²
Wetted Perimeter	10.18 ft
Hydraulic Radius	0.05 ft
Top Width	10.18 ft
Normal Depth	0.10 ft
Critical Depth	0.14 ft
Critical Slope	0.903 %
Velocity	2.90 ft/s
Velocity Head	0.13 ft
Specific Energy	0.23 ft
Froude Number	2.264
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.10 ft
Critical Depth	0.14 ft
Channel Slope	5.120 %
Critical Slope	0.903 %

Cross Section for ON1-B2

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	5.120 %
Normal Depth	0.10 ft
Discharge	1.50 cfs



ON1-C2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	1.710 %
Discharge	2.50 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	6.00
0+00.00	0.30
0+15.00	0.00
0+30.00	0.30
0+30.00	6.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 6.00)	(0+30.00, 6.00)	0.016

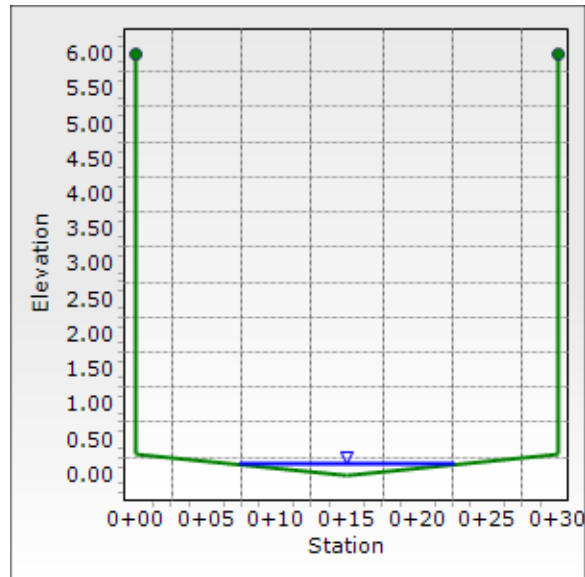
Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.15 ft
Roughness Coefficient	0.016
Elevation	0.15 ft
Elevation Range	0.00 to 6.00 ft
Flow Area	1.1 ft ²
Wetted Perimeter	15.17 ft
Hydraulic Radius	0.08 ft
Top Width	15.16 ft
Normal Depth	0.15 ft
Critical Depth	0.17 ft
Critical Slope	0.844 %
Velocity	2.17 ft/s
Velocity Head	0.07 ft
Specific Energy	0.23 ft
Froude Number	1.393
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.15 ft
Critical Depth	0.17 ft
Channel Slope	1.710 %
Critical Slope	0.844 %

Cross Section for ON1-C2

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	1.710 %
Normal Depth	0.15 ft
Discharge	2.50 cfs



ON1-E2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	4.850 %
Discharge	4.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	6.00
0+00.00	0.10
0+05.00	0.00
0+10.00	0.10
0+10.00	6.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 6.00)	(0+10.00, 6.00)	0.016

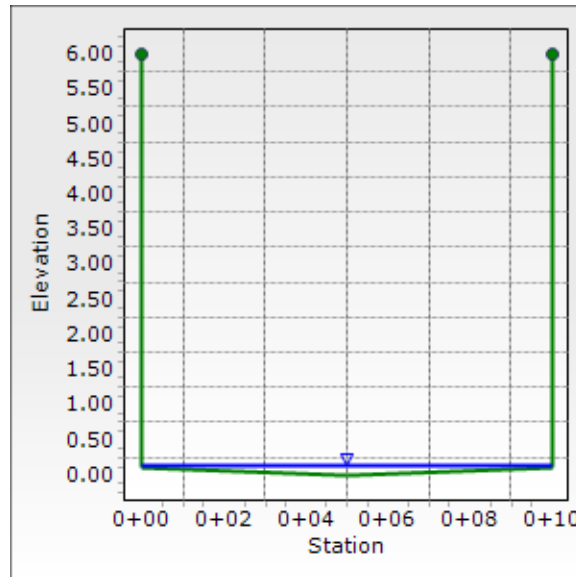
Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.14 ft
Roughness Coefficient	0.016
Elevation	0.14 ft
Elevation Range	0.00 to 6.00 ft
Flow Area	0.9 ft ²
Wetted Perimeter	10.09 ft
Hydraulic Radius	0.09 ft
Top Width	10.00 ft
Normal Depth	0.14 ft
Critical Depth	0.22 ft
Critical Slope	0.694 %
Velocity	4.23 ft/s
Velocity Head	0.28 ft
Specific Energy	0.42 ft
Froude Number	2.425
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.14 ft
Critical Depth	0.22 ft
Channel Slope	4.850 %
Critical Slope	0.694 %

Cross Section for ON1-E2

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	4.850 %
Normal Depth	0.14 ft
Discharge	4.00 cfs



ON1-H1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	3.400 %
Discharge	75.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	6.00
0+00.00	0.30
0+15.00	0.00
0+30.00	0.30
0+30.00	6.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 6.00)	(0+30.00, 6.00)	0.016

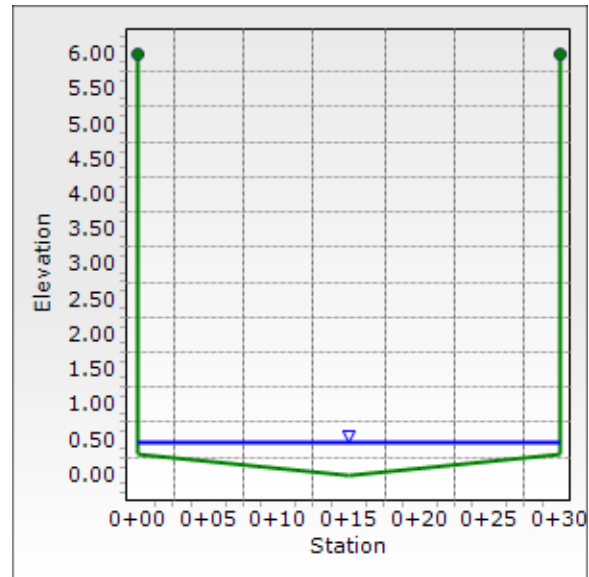
Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.47 ft
Roughness Coefficient	0.016
Elevation	0.47 ft
Elevation Range	0.00 to 6.00 ft
Flow Area	9.5 ft ²
Wetted Perimeter	30.34 ft
Hydraulic Radius	0.31 ft
Top Width	30.00 ft
Normal Depth	0.47 ft
Critical Depth	0.73 ft
Critical Slope	0.465 %
Velocity	7.90 ft/s
Velocity Head	0.97 ft
Specific Energy	1.44 ft
Froude Number	2.474
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.47 ft
Critical Depth	0.73 ft
Channel Slope	3.400 %
Critical Slope	0.465 %

Cross Section for ON1-H1

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	3.400 %
Normal Depth	0.47 ft
Discharge	75.00 cfs



ON1-H3

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	2.000 %
Discharge	77.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	6.00
0+00.00	0.30
0+15.00	0.00
0+30.00	0.30
0+30.00	6.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 6.00)	(0+30.00, 6.00)	0.016

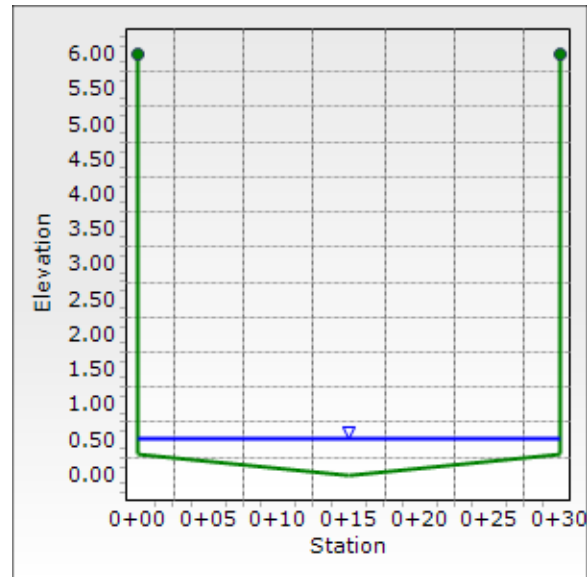
Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.53 ft
Roughness Coefficient	0.016
Elevation	0.53 ft
Elevation Range	0.00 to 6.00 ft
Flow Area	11.3 ft ²
Wetted Perimeter	30.46 ft
Hydraulic Radius	0.37 ft
Top Width	30.00 ft
Normal Depth	0.53 ft
Critical Depth	0.74 ft
Critical Slope	0.462 %
Velocity	6.79 ft/s
Velocity Head	0.72 ft
Specific Energy	1.24 ft
Froude Number	1.948
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.53 ft
Critical Depth	0.74 ft
Channel Slope	2.000 %
Critical Slope	0.462 %

Cross Section for ON1-H3

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	2.000 %
Normal Depth	0.53 ft
Discharge	77.00 cfs



Date 04/06/21 Project 291400024

By MSB

Riprap Lining Calculation ON1-H2A

$$d_{50} = (3V * (S^{0.17}/S_s - 1))^2$$

V = 6.83 ft/s

S = 0.025 ft/ft

S_s = 2.65 Specific Gravity

d₅₀ = 0.5432 = 0.5432 x 12in/ft = 6.52-inches → Use d₅₀ = 6-inches

Date 04/06/21 Project 291400024

By MSB

Riprap Lining Calculation
ON1-H2B

$$d_{50} = (3V * (S^{0.17}/S_s - 1))^2$$

V = 5.17 ft/s

S = 0.01 ft/ft

S_s = 2.65 Specific Gravity

d₅₀ = 0.2279 = 0.2279 x 12in/ft = 2.73-inches → Use d₅₀ = 6-inches

Ann and Hualapai - Technical Drainage Study								
LOT #	FFE	High	Low	Criteria	Depth	Freeboard	Section #	Remarks
1	104.90	100.72	99.08	0.40	0.20	4.16	DON1-B1	Street B
1	104.90	100.34	95.85	0.20	0.10	4.74	DON1-C1	Eula Way
1	104.90	105.46	102.55	1.20	0.60	-1.38	ANN	Ann Road, Solid grout 1 courses
1	104.90	100.64	97.40	1.60	0.10	4.44	DON1-B2	Drainage Easement, Solid grout 3 courses
2	108.50	105.57	100.72	0.40	0.20	2.91	DON1-B1	Street B
2	108.50	109.43	105.29	1.20	0.60	-1.75	ANN	Ann Road, Solid grout 1 course
3	113.30	110.88	109.78	0.42	0.21	2.38	DON1-A1	Street F
3	113.30	109.78	105.57	0.40	0.20	3.50	DON1-B1	Street B
4	114.30	115.78	109.43	1.20	0.60	-2.30	ANN	Ann Road, Solid grout 1 course
4	114.30	111.68	110.88	0.42	0.21	2.58	DON1-A1	Street F
5	113.90	111.68	110.46	0.42	0.21	2.18	DON1-A1	Street F
5	113.90	120.58	115.78	1.20	0.60	-7.50	ANN	Ann Road, Solid grout 2 courses
5	113.90	123.00	122.56	0.38	0.19	-9.10	HUAL1	Hualapai Way, Solid grout 1 course
6	113.40	110.46	110.08	0.42	0.21	2.90	DON1-A1	Street F
6	113.40	122.56	120.10	0.38	0.19	-9.16	HUAL1	Hualapai Way, Solid grout 1 course
7	113.40	110.53	110.08	0.42	0.21	2.83	DON1-A2	Street F
7	113.40	120.10	118.08	0.38	0.19	-6.70	HUAL1	Hualapai Way, Solid grout 1 course
8	113.20	110.53	109.37	0.28	0.14	2.77	DON1-E2	Street F
8	113.20	118.12	118.08	0.38	0.19	-4.92	HUAL1	Hualapai Way, Solid grout 1 course
8	113.20	117.05	109.37	1.64	0.14	-3.75	DON1-E2	Drainage Easement, Solid grout 3 courses
9	111.60	109.37	107.35	0.58	0.29	2.03	DON1-E1	Street F
9	111.60	119.50	118.12	0.38	0.19	-7.90	HUAL1	Hualapai Way, Solid grout 1 course
9	111.60	117.05	109.35	1.64	0.14	-5.35	DON1-E2	Drainage Easement, Solid grout 3 courses
10	111.00	107.69	107.35	0.58	0.29	3.11	DON1-E1	Street F
10	111.00	119.50	118.26	1.06	0.53	-9.18	HUAL2	Hualapai Way, Solid grout 2 courses
11	110.50	107.69	106.96	0.38	0.19	2.81	DON1-G	Street F
11	110.50	118.26	115.65	1.06	0.53	-8.44	HUAL2	Hualapai Way, Solid grout 2 courses
12	109.30	106.96	104.92	0.38	0.19	2.34	DON1-G	Street F
12	109.30	115.65	113.30	1.06	0.53	-7.03	HUAL2	Hualapai Way, Solid grout 2 courses
13	107.20	104.92	103.69	0.38	0.19	2.28	DON1-G	Street F
13	107.20	113.30	111.48	1.06	0.53	-6.78	HUAL2	Hualapai Way, Solid grout 2 courses
13	107.20	108.81	104.77	1.10	0.55	-2.33	DON1-H2A	Street E, Solid grout 2 courses
13	107.20	110.08	108.96	1.97	0.47	-3.44	DON1-H1	Drainage Easement, Solid grout 3 courses
14	111.20	108.81	105.71	1.10	0.55	1.67	DON1-H2A	Street E
14	111.20	113.10	111.48	1.06	0.53	-2.58	HUAL2	Hualapai Way, Solid grout 2 courses
14	111.20	110.08	108.96	1.97	0.47	0.56	DON1-H1	Drainage Easement, Solid grout 3 courses
15	107.60	105.53	101.23	1.10	0.55	1.35	DON1-H2A	Street E
16	103.10	101.23	96.89	1.10	0.55	1.15	DON1-H2A	Street E
17	98.80	96.89	93.36	1.10	0.55	1.19	DON1-H2A	Street E
18	95.80	93.36	91.73	1.18	0.59	1.64	DON1-H2B	Street E
18	95.80	89.45	88.98	1.52	0.76	5.21	DON1-H4	Eula Street
18	95.80	91.73	89.45	2.03	0.53	3.39	DON1-H3	Drainage Easement, Solid grout 4 courses
19	95.80	92.81	91.68	1.18	0.59	2.19	DON1-H2B	Street E
19	95.80	91.38	89.65	1.52	0.76	3.28	DON1-H4	Eula Street
19	95.80	91.68	89.65	2.03	0.53	3.44	DON1-H3	Drainage Easement, Solid grout 4 courses
20	98.30	96.14	92.81	1.18	0.59	1.36	DON1-H2B	Street E
21	107.30	104.61	103.08	0.38	0.19	2.69	DON1-G	Street F
21	107.30	102.02	96.14	1.18	0.59	4.48	DON1-H2B	Street E
22	109.00	106.35	104.61	0.38	0.19	2.65	DON1-G	Street F
23	110.50	107.86	106.35	0.38	0.19	2.64	DON1-G	Street F
24	110.50	107.89	106.97	0.58	0.29	2.41	DON1-E1	Street F
24	110.50	105.98	104.80	0.54	0.27	4.36	DON1-F1	Street D
25	103.00	100.50	96.35	0.54	0.27	2.34	DON1-F1	Street D
26	98.90	96.35	93.46	0.54	0.27	2.39	DON1-F1	Street D
26	98.90	92.66	91.38	0.50	0.25	6.12	DON1-F2	Eula Street
27	99.00	96.37	93.86	0.54	0.27	2.47	DON1-F1	Street D
27	99.00	93.73	93.23	0.50	0.25	5.15	DON1-F2	Eula Street
28	103.40	100.50	96.37	0.54	0.27	2.74	DON1-F1	Street D
29	111.10	109.60	106.97	0.58	0.29	1.30	DON1-E1	Street F
29	111.10	105.98	100.50	0.54	0.27	4.96	DON1-F1	Street D
30	112.60	110.07	109.60	0.58	0.29	2.33	DON1-E1	Street F
31	113.60	110.26	110.07	0.58	0.29	3.14	DON1-E1	Street F
32	113.10	110.26	109.75	0.42	0.21	2.80	DON1-A2	Street F
32	113.10	109.04	104.79	0.40	0.20	4.04	DON1-B1	Street B

LOT #	FFE	High	Low	Criteria	Depth	Freeboard	Section #	Remarks
33	107.30	104.79	100.70	0.40	0.20	2.49	DON1-B1	Street B
34	105.00	100.70	98.54	0.40	0.20	4.28	DON1-B1	Street F
34	105.00	95.85	93.23	0.20	0.10	9.33	DON1-C1	Eula Street
34	105.00	100.72	97.20	1.60	0.10	4.46	DON1-B2	Drainage Easement, Solid grout 3 courses
35	98.30	100.13	99.13	0.20	0.10	-1.65	DON1-C1	Eula Street, Solid grout 1 course
35	98.30	97.85	92.82	0.24	0.12	0.59	DON1-D	Street A
35	98.30	98.75	94.05	1.20	0.60	-1.27	ANN	Ann Road, Solid grout 2 courses
36	94.90	92.82	89.28	0.24	0.12	2.22	DON1-D	Street A
36	94.90	94.05	89.30	1.20	0.60	0.03	ANN	Ann Road, Solid grout 2 courses
37	91.60	93.74	90.43	0.24	0.12	-2.00	DON1-D	Street A, Solid grout 1 course
37	91.60	88.81	87.29	0.24	0.12	2.93	DON1-D	Street I
37	91.60	89.28	87.29	0.44	0.22	2.26	DON1-C3	Street C
38	93.30	97.86	92.40	0.24	0.12	-4.42	DON1-D	Street A, Solid grout 1 course
38	93.30	95.85	92.58	0.20	0.10	-2.37	DON1-C1	Eula Street, Solid grout 1 course
38	93.30	90.55	89.28	0.44	0.22	2.69	DON1-C3	Street C
38	93.30	92.58	90.57	1.65	0.15	0.80	DON1-C2	Drainage Easement, Solid grout 3 courses
39	93.70	93.54	92.88	0.20	0.10	0.34	DON1-C1	Eula Street, Solid grout 1 course
39	93.70	90.55	89.32	0.44	0.22	3.09	DON1-C3	Street C
39	93.70	92.58	90.57	1.65	0.15	1.20	DON1-C2	Drainage Easement, Solid grout 3 courses
40	91.80	89.32	86.66	0.44	0.22	2.42	DON1-C3	Street C

Appendix D – Reference Materials

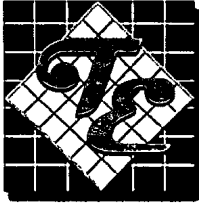
- Technical Drainage Study for Ann and Grand Canyon Residential Development. Approved October 4, 2010 (Grand Canyon Study, October 2010, PW No. 10-18993)
- Technical Drainage Study for Ann & 215 – Phase 1. Approved July 13, 2020. (215 Study, July 2020, PW No. 20-11651)

~~ADD2~~

~~10-18993~~

~~16-10~~

~~ADD-2~~



TANEY ENGINEERING

Addendum #2
TO THE
TECHNICAL DRAINAGE STUDY
FOR
Ann & Grand Canyon
Residential Development

CLARK COUNTY
NEVADA

September 15, 2010

Prepared by:

Taney Engineering
6030 S. Jones, Suite #100
Las Vegas, Nevada 89118
Telephone: (702) 362-8844
Fax: (702) 362-5233

Prepared for:

William Lyon Homes
500 Pilot Road Suite #G
Las Vegas, NV 89119
Telephone: (702) 263-8200
Fax: (702) 263-8220



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@co.clark.nv.us

LTR

Drainage Study Approval Letter **10-18993**

Date: October 4, 2010
Firm: Taney Engineering
Engineer: Edward F. Taney, P.E.
Address: 6030 S. Jones Boulevard, Suite 100, Las Vegas, NV 89118
Phone: (702) 362-8844
Fax: (702) 362-5233
E-mail:

Subject: Technical Drainage Study for Ann & Grand Canyon Residential Development (Serenity Ridge)
Location: SW of Ann Road and Grand Canyon Drive
APN: 125-31-201-003 & 125-31-101-002, -004, -008, -009, -016, -018, -019, -020, -021, -022, -026
Sec, Township, Range: S31, T19S, R60E
Flood Zone & Panel: Zone X, 1745E, Revised September 27, 2002
Application Tracking #: 10-18993



Submittals	Date Received	Date Returned	Reviewer	Miscellaneous
Technical	07/21/2010	08/11/2010	WG	
Addendum #1	08/25/2010	09/09/2010	WG	
Addendum #2	09/16/2010	09/27/2010	WG	

Concurrence Required: (Must be obtained prior to permit issuance)	Reason Concurrence is required
City of Henderson	Adjacent to or Impacts Henderson
City of Las Vegas	Adjacent to or Impacts Las Vegas
City of North Las Vegas	Adjacent to or Impacts North Las Vegas
Nevada Department of Transportation	Impacts NDOT Facility
Union Pacific Rail Road	Adjacent to or Impacts a UPRR Facility
US Army Corp of Engineers	Impacts a USACE Facility
Clark County Regional Flood Control District	Adjacent to or Impacts CCRFCD MPU Facility or in a SFHA

BOARD OF COUNTY COMMISSIONERS
RORY REID, Chairman • SUSAN BRAGER, Vice-Chair
LARRY BROWN • TOM COLLINS • CHRIS GIUNCHIGLIANI • STEVE SISOLAK • LAWRENCE WEEKLY
VIRGINIA VALENTINE, P.E., County Manager

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

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.
	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.
	<i>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.</i>
X	Structural calculations are required. The structural calculations, plans, and details must be approved prior to "Offsite" submittal.
X	Plan revisions can be found on the red-lined plans and must be addressed.
X	Prepare drainage easement documents as shown on the grading plans.

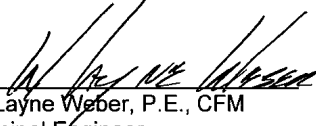
The site shall be graded with respect to drainage as shown on "**Ann and Grand Canyon (Serenity Ridge) Rough Grading Plan**", sheets RG1, RG2, RG3, RG4, RG5 signed and sealed by Robert D. Cunningham, P.E., on September 16, 2010. "**Ann and Grand Canyon – Unit 1 (Serenity Ridge)**", sheet C2 signed and sealed by Robert D. Cunningham, P.E., on August 25, 2010 and sheets G1, GD1, PP1, PP2, PP3, PP4, PP5 signed and sealed by Robert D. Cunningham, P.E., on September 16, 2010. "**Ann and Grand Canyon – Unit 2 (Serenity Ridge)**", sheet C2 signed and sealed by Robert D. Cunningham, P.E., on August 25, 2010 and sheets G1, G2, G3, G4, GD1, GD2, PP1, PP2, PP3, PP4, PP5, PP6, PP7, PP8 signed and sealed by Robert D. Cunningham, P.E., on September 16, 2010. "**Ann and Grand Canyon – Unit 3 (Serenity Ridge)**", sheet C2 signed and sealed by Robert D. Cunningham, P.E., on August 25, 2010 and sheets G1, G2, G3, GD1, GD2, PP1, PP2, PP3, PP4 signed and sealed by Robert D. Cunningham, P.E., on September 16, 2010.

This approval letter has been revised to replace the letter dated September 27, 2010 and remove previous comment # 1 regarding excessive fill.

Additional Conditions:

1. All residential finished floor elevations must be a minimum of 8-inches above the rear lot high point, as specified on Figure 302 of the *CCRFCD Manual*. Verify all FF elevations and revise Lot 50.

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.

By 
W. Layne Weber, P.E., CFM
Principal Engineer
Clark County Public Works
Development Review

cc: Lyon Homes

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL
DRAINAGE STUDY INFORMATION FORM

Name of Development: Ann & Grand Canyon Residential Development Addendum 1 Date: Aug 24, 2010

Location of Development: a) Descriptive (Cross Streets) North/South: Grand Canyon
East/West: Ann

b) Section: 31 Township: 19S Range: 60E

c) APN : 125-31-201-003; 125-31-101-002; -004; -008; -009; -016; -018; -019; -020; -021; -022; -026

Name of Owner: William Lyon Homes

Telephone No.: (702) 263-8200 Fax No.: (702) 263-8220 E-Mail Address: _____

Address: 500 Pilot Rd Suite #G Las Vegas, NV 89119

Contact Person-Name: Barbara Brown, P.E. Telephone No.: (702) 362-8844

* E-Mail Address: Barbarab@taneycorp.com Fax No.: (702) 362-5233

Firm: Taney Engineering

Address: 6030 S. Jones, Suite 100, Las Vegas NV. 89118

Type of Land Development/Land Disturbance Process:

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

1. Total Owned Land Area: At Site: 45+/- acres Being Developed/Disturbed: 45+/- acres

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

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

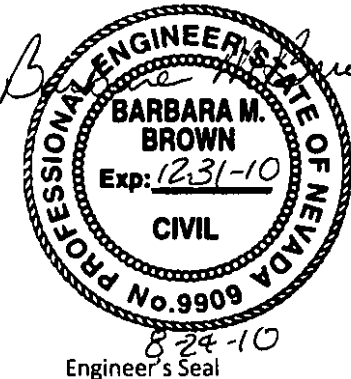
4. Proposed type of development (Residential, Commercial, Etc.): Residential

5. Approximate upstream land area which drains to the subject site: 0+/- acres

6. Has the site drainage been evaluated in the past? ☒ YES ☐ NO If yes, please identify documentation: Document HTE #05-47575 applies to the subject site; however, was not referenced for use in the subject study.

7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: The site drains to the east, discharging runoff flow into Hammer Lane and Fisher Avenue.

8. Briefly describe your proposed schedule for the subject project: A.S.A.P



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

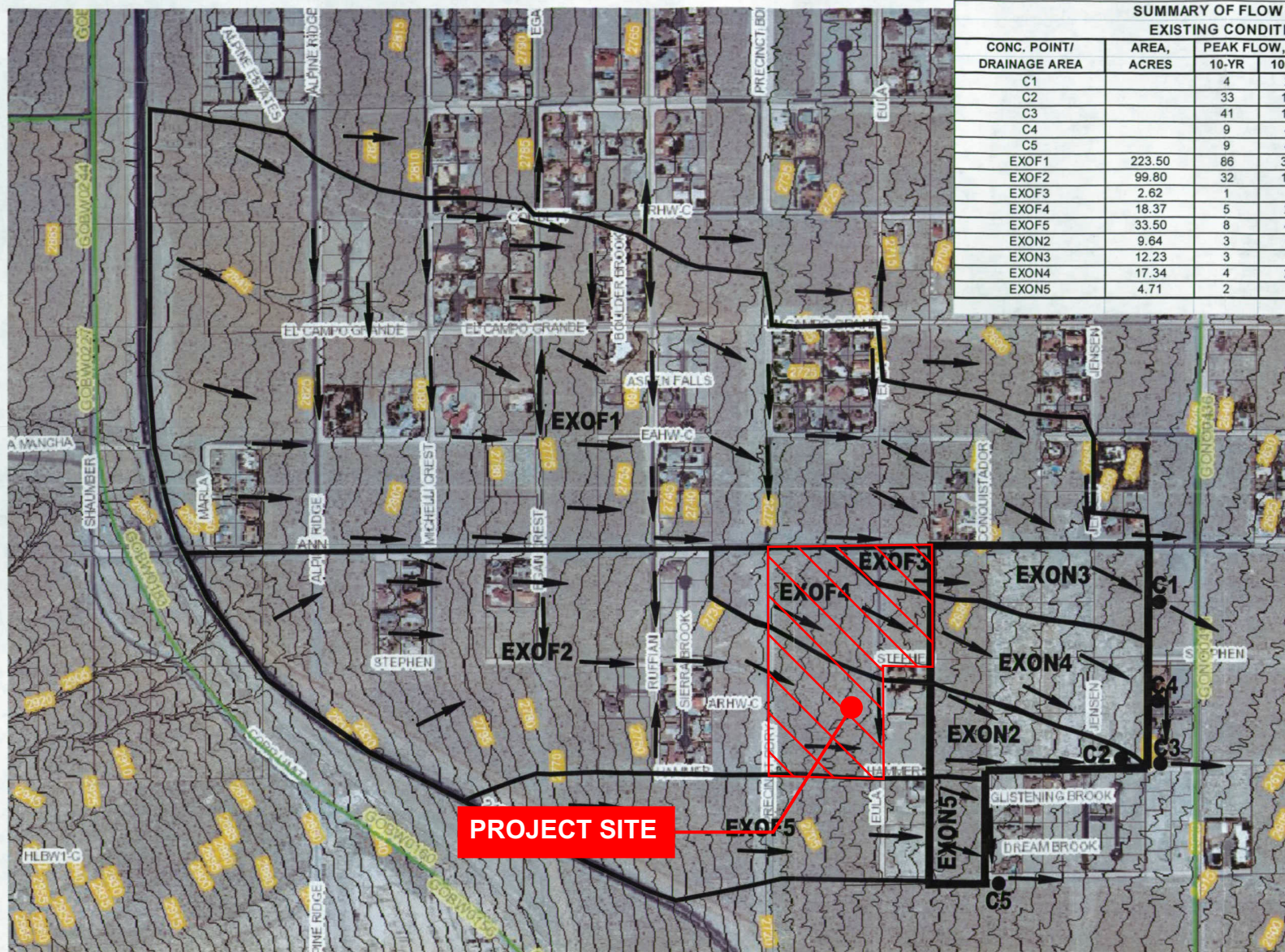
*New Required Field

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

Local Entity File No.	Revision	Date

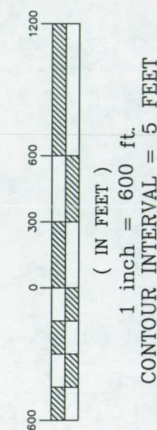
REFERENCE:

STANDARD FORM 1



SUMMARY OF FLOW RATES				
EXISTING CONDITIONS				
CONC. POINT/ DRAINAGE AREA	AREA, ACRES	PEAK FLOW, CFS		NOTES
		10-YR	100-YR	
C1		4	21	NO DARF APPLIED
C2		33	146	AREA=0.18 SQ MI; DARF=0.99
C3		41	193	AREA=0.23 SQ MI; DARF=0.99
C4		9	48	NO DARF APPLIED
C5		9	48	NO DARF APPLIED
EXOF1	223.50	86	319	AREA=.35 SQ MI; DARF=0.98
EXOF2	99.80	32	137	NO DARF APPLIED
EXOF3	2.62	1	4	NO DARF APPLIED
EXOF4	18.37	5	25	NO DARF APPLIED
EXOF5	33.50	8	43	NO DARF APPLIED
EXON2	9.64	3	13	NO DARF APPLIED
EXON3	12.23	3	17	NO DARF APPLIED
EXON4	17.34	4	23	NO DARF APPLIED
EXON5	4.71	2	8	NO DARF APPLIED

8/24/2010



LEGEND	
EXON4	BASIN NAME
—	BASIN BOUNDARY
→	FLOW DIRECTION

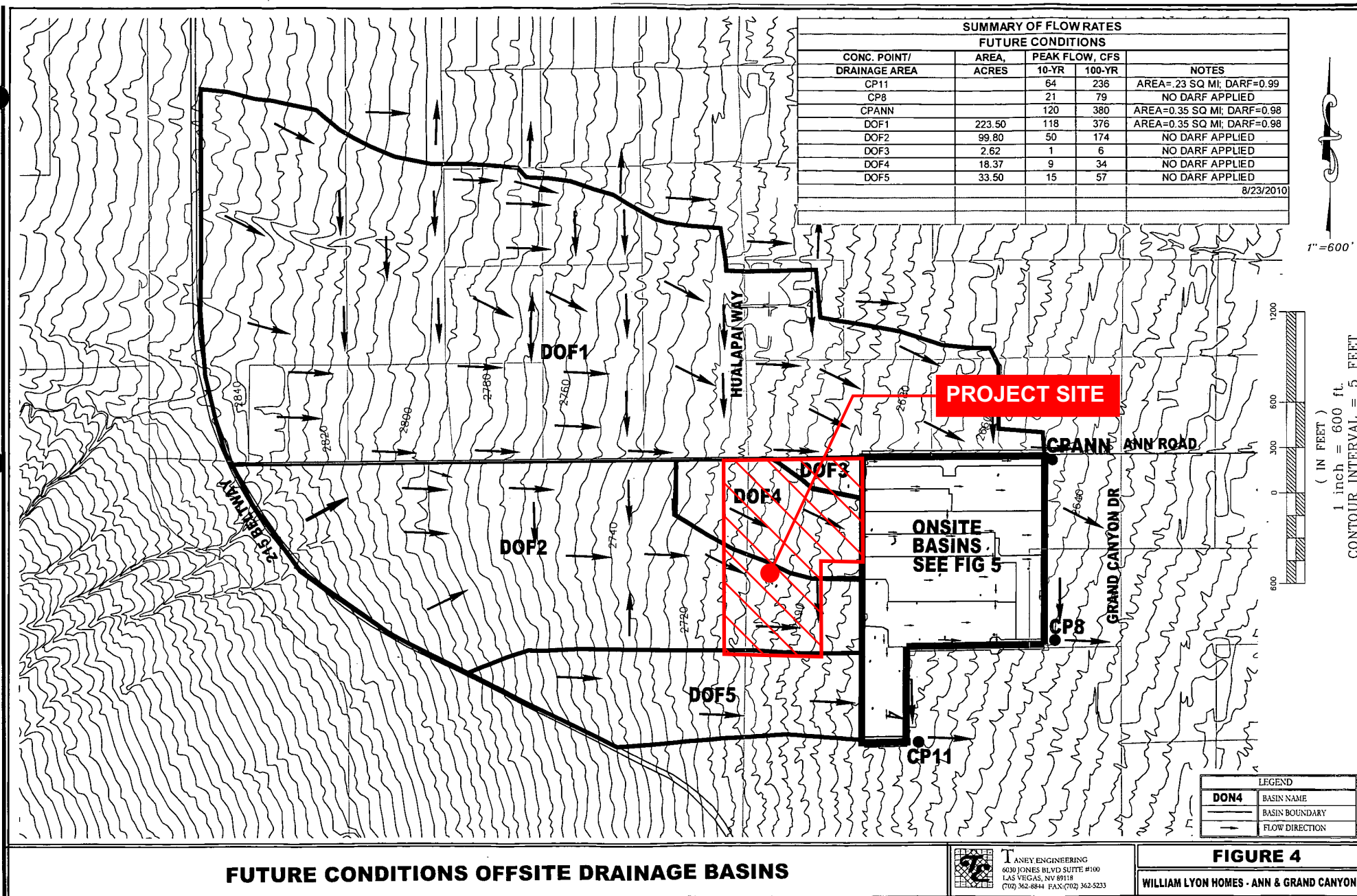
EXISTING CONDITIONS DRAINAGE BASINS



TANEY ENGINEERING
6050 JONES BLVD SUITE #100
LAS VEGAS, NV 89118
(702) 362-8844 FAX: (702) 362-5233

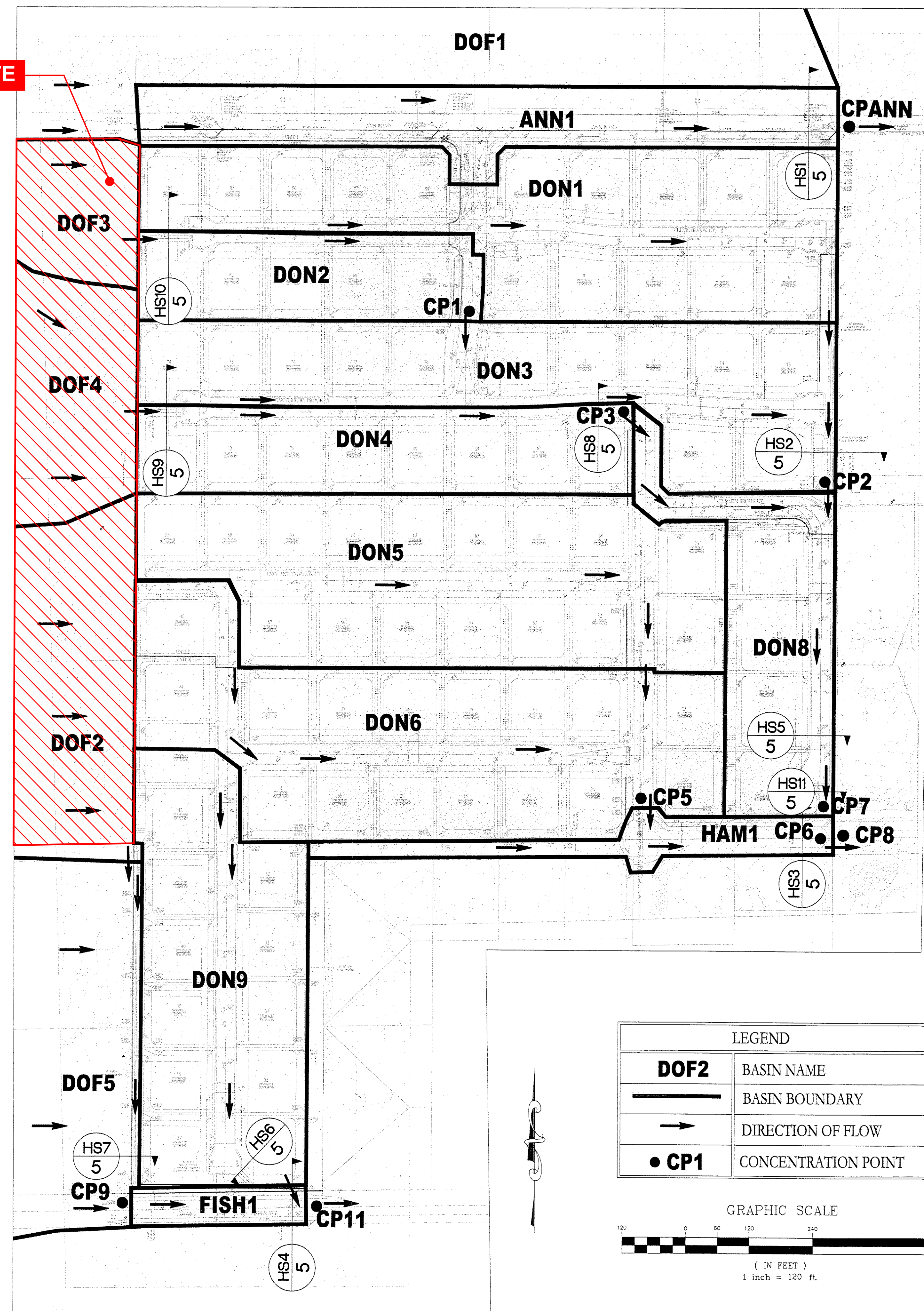
FIGURE 3

WILLIAM LYON HOMES - ANN & GRAND CANYON



PROJECT SITE

FOR EXTENTS OF OFFSITE BASINS
SEE FIGURE 4



FUTURE CONDITIONS ONSITE DRAINAGE BASINS

SUMMARY OF FLOW RATES FUTURE CONDITIONS				
CONC. POINT/ DRAINAGE AREA	AREA, ACRES	PEAK FLOW, CFS		NOTES
		10-YR	100-YR	
ANN1	3.39	7	13	NO DARF APPLIED
CP1		3	10	NO DARF APPLIED
CP11		64	236	AREA=.23 SQ MI; DARF=0.99
CP2		10	36	NO DARF APPLIED
CP3		10	41	NO DARF APPLIED
CP5		8	30	NO DARF APPLIED
CP6		9	32	NO DARF APPLIED
CP7		12	47	NO DARF APPLIED
CP8		21	79	NO DARF APPLIED
CP9		62	227	AREA=0.21; DARF=0.99
CPANN		120	380	AREA=0.35 SQ MI; DARF=0.98
DOF1	223.50	118	376	AREA=0.35 SQ MI; DARF=0.98
DOF2	99.80	50	174	NO DARF APPLIED
DOF3	2.62	1	6	NO DARF APPLIED
DOF4	18.37	9	34	NO DARF APPLIED
DOF5	33.50	15	57	NO DARF APPLIED
DON1	6.92	4	14	NO DARF APPLIED
DON2	2.29	1	5	NO DARF APPLIED
DON3	5.78	3	12	NO DARF APPLIED
DON4	3.36	2	7	NO DARF APPLIED
DON5	7.06	4	14	NO DARF APPLIED
DON6	7.56	4	15	NO DARF APPLIED
DON8	3.05	2	7	NO DARF APPLIED
DON9	5.12	3	10	NO DARF APPLIED
FISH1	0.49	1	2	NO DARF APPLIED
HAM1	1.08	2	4	NO DARF APPLIED

8/23/2010

MISCELLANEOUS FLOW CALCULATIONS 100-YEAR PEAK FLOW RATES - FUTURE CONDITIONS						
SECTION NUMBER	DESCRIPTION	SLOPE, PERCENT	Q(100) CFS	D(100) FEET	V(100) FPS	VEL. HEAD, FEET
HS2	20-FOOT PAVED EASEMENT	1.31	36	0.32	5.6	0.50
HS6	10-FOOT WEIR		10	0.48	NA	NA
HS6	10-FOOT CONC. EASEMENT	2.97	10	0.19	5.9	0.54
HS7	15-FOOT CONC. EASEMENT	1.25	227	1.33	12.7	2.50
HS9	15-FOOT CONC. EASEMENT	1.77	34	0.35	6.9	0.73
HS10	10-FOOT CONC. EASEMENT	1.54	6	0.17	3.9	0.24
HS11	25-FOOT CONC. EASEMENT	0.97	47	0.38	5.0	0.39

8/23/2010

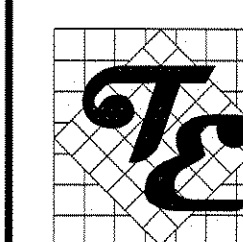
STREET CALCULATIONS BASED ON NORMAL DEPTH FUTURE CONDITIONS						
SECTION NUMBER	STREET NAME	SLOPE, PERCENT	Q(10) / Q(100) CFS	D(10) / D(100), FEET	V(10) / V(100), FPS	V(10)*D(10) / V(100)*D(100)
HS1*	ANN ROAD	2.99	48 / 308	0.57 / 0.93	5.1 / 8.6	2.9 / 8.0
HS3	HAMMER STREET	3.35	21 / 79	0.36 / 0.57	3.6 / 5.3	1.3 / 3.0
HS4	FISHER AVENUE	3.22	64 / 236	0.59 / 0.90	5.4 / 8.1	3.2 / 7.3
HS5**	ONSITE NORTH-SOUTH	0.68	8 / 30	0.52 / 0.82	2.9 / 4.0	2.5 / 3.3
HS8***	ONSITE EAST-WEST	3.33	20 / 77	0.38 / 0.56	4.7 / 7.1	1.8 / 4.0

8/23/2010

*Calculation is for surface flow; 72 cfs flows in subsurface storm drain pipe in the 10- and 100-year storm events.

**HS5 Represents the worst case scenario for all onsite north-south street normal depth calculations.

***HS8 Represents the worst case scenario for all onsite east-west street normal depth calculations (CP3+CP2=10/41+10/36=20/77)



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FIGURE 5

WILLIAM LYON HOMES
ANN + GRAND CANYON

10-18993

ADD MAP 1

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL - STANDARD FORM 4



Taney Engineering
6030 S. Jones, Suite #100
Las Vegas, NV 89118

PROJECT NO. : WLL-10-068

PROJECT: Ann & Grand Canyon

FILE : STD_FRM4

CALCULATED BY: BB

DATE : 08/23/10

Sub-Basin Data					Initial/Overland Time (T _i)			Travel Time (T _t)					T _c	T _c Check (Urbanized Basins)		Final T _c	T _{lag}	Remarks
DESIG	CN	K	AREA (acres)	AREA (mi ²)	LENGTH (ft)	SLOPE (%)	T _i (min)	LENGTH (ft)	SLOPE (%)	V ₁ (fps)	V ₂ (fps)	T _t (min)	T _c =T _i +T _t (min)	TOTAL (ft)	T _c (min)	T _c (min)	T _{lag} (hrs)	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
EXISTING CONDITION																		
EXOF1	83	0.706	223.50	0.3492	300	1.0	12.3	6130	3.3	2.70	5.37	20.5	32.8	N/A	N/A	32.84	0.328	
EXOF2	80	0.666	99.80	0.1559	300	1.0	13.5	4280	3.6	2.81	5.58	14.3	27.8	N/A	N/A	27.79	0.278	
EXOF3	77	0.626	2.62	0.0041	100	1.0	8.5	540	3.3	2.69	5.34	3.2	11.7	N/A	N/A	11.75	0.117	
EXOF4	77	0.626	18.37	0.0287	300	1.0	14.8	1370	3.3	2.69	5.34	5.8	20.6	N/A	N/A	20.58	0.206	
EXOF5	77	0.626	33.50	0.0523	300	1.0	14.8	2450	3.4	2.73	5.42	9.0	23.8	N/A	N/A	23.81	0.238	
EXON2	77	0.626	9.64	0.0151	300	1.0	14.8	1050	3.4	2.73	5.42	4.7	19.5	N/A	N/A	19.51	0.195	
EXON3	77	0.626	12.23	0.0191	300	1.0	14.8	1060	3.3	2.69	5.34	4.8	19.6	N/A	N/A	19.61	0.196	
EXON4	77	0.626	17.34	0.0271	300	1.0	14.8	1230	3.3	2.69	5.34	5.4	20.1	N/A	N/A	20.14	0.201	
EXON5	77	0.626	4.71	0.0074	100	1.0	8.5	270	3.3	2.69	N/A	1.7	10.2	N/A	N/A	10.20	0.102	
DEVELOPED CONDITION																		
DON1	82	0.692	6.92	0.0108	140	1.0	8.7	1180	3.3	3.67	5.56	4.3	13.0	1320.0	17.3	13.0	0.130	
DON2	82	0.692	2.29	0.0036	140	1.0	8.7	680	2.9	3.44	5.21	3.0	11.7	820.0	14.6	11.7	0.117	
DON3	82	0.692	5.78	0.0090	140	1.0	8.7	1180	3.3	3.67	5.56	4.3	13.0	1320.0	17.3	13.0	0.130	
DON4	82	0.692	3.36	0.0053	140	1.0	8.7	940	3.2	3.61	5.47	3.6	12.3	1080.0	16.0	12.3	0.123	
DON5	82	0.692	7.06	0.0110	140	1.0	8.7	1090	3.4	3.72	5.64	4.0	12.7	1230.0	16.8	12.7	0.127	
DON6	82	0.692	7.56	0.0118	140	1.0	8.7	900	3.0	3.50	5.30	3.6	12.3	1040.0	15.8	12.3	0.123	
DON8	82	0.692	3.05	0.0048	140	1.0	8.7	1.3	1.1	2.12	N/A	0.0	8.7	141.3	10.8	8.7	0.087	
DON9	82	0.692	5.12	0.0080	140	1.0	8.7	780	0.8	1.78	2.70	6.4	15.1	920.0	15.1	15.1	0.151	
DOF1	86	0.745	223.50	0.3492	300	1.0	11.1	6130	3.3	3.67	5.56	19.2	30.2	6430.0	45.7	30.2	0.302	
DOF2	84	0.719	99.80	0.1559	300	1.0	11.9	4280	3.6	3.83	5.81	13.0	24.9	4580.0	35.4	24.9	0.249	
DOF3	82	0.692	2.62	0.0041	100	1.0	7.3	540	3.3	3.67	5.56	2.4	9.7	640.0	13.6	9.7	0.097	
DOF4	82	0.692	18.37	0.0287	300	1.0	12.7	1370	3.4	3.72	5.64	4.8	17.5	1670.0	19.3	17.5	0.175	
DOF5	82	0.692	33.50	0.0523	300	1.0	12.7	2450	3.4	3.72	5.64	8.0	20.7	2750.0	25.3	20.7	0.207	
FISH1	98	0.904	0.49	0.0008	30	2.0	1.5	305	3.6	3.83	N/A	1.3	2.9	335.0	11.9	2.9	0.050	
ANN1	98	0.904	3.39	0.0053	43	2.0	1.8	1280	3.1	3.56	5.39	4.8	6.6	1323.0	17.4	6.6	0.066	
HAM1	98	0.904	1.08	0.0017	30	2.0	1.5	390	3.1	3.56	N/A	1.8	3.4	420.0	12.3	3.4	0.050	

$$T_i = (1.8(1.1-K)L^{1/2}) / (S^{1/3})$$

$$T_c = T_i + T_t$$

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

$$T_{lag} = 0.6T_c$$

For the travel time (T_i) calculations,

V₁ applies to the first 500 feet of travel distance;

V₂ applies to the remaining travel distance.

Travel Time Velocity Formulas

Existing

$$V_1 = 14.8(S/100)^{1/2}$$

$$V_2 = 29.4(S/100)^{1/2}$$

Developed

$$V_1 = 20.2(S/100)^{1/2}$$

$$V_2 = 30.6(S/100)^{1/2}$$

All basins over one square mile are calculated by the equation $T_{lag} = 20Kn(L^{1/2}/S^{0.5})^{0.33}$ and denoted by shaded gray (See Worksheet).

REFERENCE:

CCRFCD HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

STANDARD FORM 4

```

1 .....
*
*   FLOOD HYDROGRAPH PACKAGE   (HEC-1)
*       JUN      1998
*       VERSION 4.1
*
*
*   RUN DATE   23AUG10   TIME   13:55:11
*
* .....

```

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

```

X      X  XXXXXXXX  XXXXX      X
X      X  X      X      X      XXX
X      X  X      X      X      X
XXXXXXXXXX  XXXX  X      XXXXXX  X
X      X  X      X      X      X
X      X  X      X      X      X
X      X  XXXXXXXX  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

PAGE 1

```

LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
          *DIAGRAM
1         ID
2         ID      <><><><><><><><><><><><><><><><><><><><>
3         ID      ANN & GRAND CANYON
4         ID      HYDROLOGIC MODEL
5         ID      -----
6         ID      EXISTING AND FUTURE CONDITIONS
7         ID      10-YR & 100-YR STORM EVENT
8         ID      -----
9         ID      TANEY ENGINEERING
10        ID
11       ID      FILE: AGC.DAT
12       ID      PROJECT No: WLL-10-068
13       ID      DATE: JULY 2010
14       ID      <><><><><><><><><><><><><><><><><><><><>
15       ID
16       ID      ---> 6-HOUR / SDN 3 <---
17       ID
18       IT      5           0           0           300
19       IO      5
20       IN      5
21       JR      PREC      1.00      0.99      0.98      0.51      0.50

22       KK      EXOF3
23       KM      *****BEGIN EXISTING CONDITIONS ANALYSIS*****
24       BA      .0041
25       PB      3.09
26       PC      .000      .020      .057      .070      .087      .108      .124      .130      .130      .130
27       PC      .130      .130      .130      .133      .140      .142      .148      .158      .172      .181
28       PC      .190      .197      .199      .200      .201      .204      .214      .229      .241      .249
29       PC      .251      .256      .270      .278      .281      .283      .295      .322      .352      .409
30       PC      .499      .590      .710      .744      .781      .812      .819      .835      .851      .855

```

EXISTING
+
DEVELOPED

42	KK	EXOF4	
43	BA	.0287	
44	LS	0	77
45	UD	.206	
	*		

HEC-1 INPUT

PAGE 2

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

68	KK	EXON5	
69	BA	.0074	
70	LS	0	77
71	UD	.102	

72 KK C5

73 HC 2
 *
 74 KK EXOF1
 75 BA .3492
 76 LS 0 83
 77 UD .328
 *

HEC-1 INPUT

PAGE 3

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

78 KK DUMMY
 79 HC 4
 *

80 KK DOF1
 81 KM *****BEGIN FUTURE CONDITIONS*****
 82 BA .3492
 83 LS 0 86
 84 UD .302
 *

85 KK ANN1
 86 BA .0053
 87 LS 0 98
 88 UD .066
 *

89 KK CPANN
 90 HC 2
 *

91 KK DOF3
 92 BA .0041
 93 LS 0 82
 94 UD .097
 *

95 KK DON2
 96 BA .0036
 97 LS 0 82
 98 UD .117
 *

99 KK CP1
 100 HC 2
 *

101 KK DON3
 102 BA .0090
 103 LS 0 82
 104 UD .130
 *

105 KK DON1
 106 BA .0108
 107 LS 0 82
 108 UD .130
 *

HEC-1 INPUT

PAGE 4

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

109 KK CP2
 110 HC 3
 *

111	KK	DOF4	
112	BA	.0287	
113	LS	0	82
114	UD	.175	
	*		
115	KK	DON4	
116	BA	.0053	
117	LS	0	82
118	UD	.123	
	*		
119	KK	CP3	
120	HC	2	
	*		
121	KK	DON8	
122	BA	.0048	
123	LS	0	82
124	UD	.087	
	*		
125	KK	CP7	
126	HC	2	
	*		
127	KK	DON5	
128	BA	.0110	
129	LS	0	82
130	UD	.127	
	*		
131	KK	DON6	
132	BA	.0118	
133	LS	0	82
134	UD	.123	
	*		
135	KK	CP5	
136	HC	2	
	*		
137	KK	HAM1	
138	BA	.0017	
139	LS	0	98
140	UD	.050	
	*		

1

HEC-1 INPUT

PAGE 5

LINE	ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10			
141	KK	CP6		
142	HC	2		
	*			
143	KK	CP8		
144	HC	2		
	*			
145	KK	DOF2		
146	BA	.1559		
147	LS	0	84	
148	UD	.249		
	*			
149	KK	DOF5		
150	BA	.0523		
151	LS	0	82	
152	UD	.207		

153	KK	CP9	
154	HC	2	
	*		
155	KK	DON9	
156	BA	.0080	
157	LS	0	82
158	UD	.151	
	*		
159	KK	FISH1	
160	BA	.0008	
161	LS	0	98
162	UD	.050	
	*		
163	KK	CP11	
164	HC	3	
	*		
165	ZZ		

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE	(V) ROUTING	(--->) DIVERSION OR PUMP FLOW
NO.	(.) CONNECTOR	(<---) RETURN OF DIVERTED OR PUMPED FLOW
22	EXOF3	
	.	
36	EXON3	
	.	
40	C1.....	
	.	
42	EXOF4	
	.	
46	EXON4	
	.	
50	CP4.....	
	.	
52	EXOF2	
	.	
56	EXON2	
	.	
60	C2.....	
	.	
62	C3.....	
	.	
64	EXOF5	
	.	
68	EXON5	
	.	
72	C5.....	
	.	
74	EXOF1	
	.	

78	DUMY	.	.	.		
80		DOF1	.	.		
85			ANN1	.		
89		CPANN	.	.		
91			DOF3	.		
95				DON2		
99			CP1	.		
101				DON3		
105					DON1	
109			CP2	.	.	
111				DOF4	.	
115					DON4	
119				CP3	.	
121					DON8	
125				CP7	.	
127					DON5	
131						DON6
135					CP5	.
137						HAM1
141					CP6	.
143				CP8	.	.
145					DOF2	.
149						DOF5

```

153      .      .      .      .      CP9.....
      .      .      .      .
155      .      .      .      .      DON9
      .      .      .      .
159      .      .      .      .      FISH1
      .      .      .      .
163      .      .      .      CP11.....

```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```

*****
*
*   FLOOD HYDROGRAPH PACKAGE   (HEC-1)
*   JUN      1998
*   VERSION  4.1
*
*   RUN DATE   23AUG10   TIME   13:55:11
*
*****

```

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

```

*****
ANN & GRAND CANYON
HYDROLOGIC MODEL
-----
EXISTING AND FUTURE CONDITIONS
10-YR & 100-YR STORM EVENT
-----
TANEY ENGINEERING

FILE: AGC.DAT
PROJECT No: WLL-10-068
DATE: JULY 2010
*****

```

---> 6-HOUR / SDN 3 <---

```

19 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
           NDDTIME    0055  ENDING TIME
           ICENT      19  CENTURY MARK

           COMPUTATION INTERVAL      .08 HOURS
           TOTAL TIME BASE      24.92 HOURS

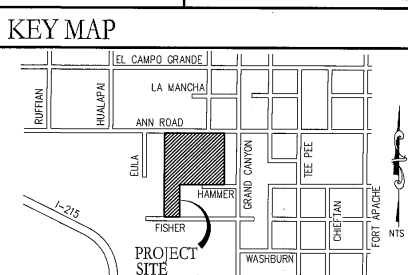
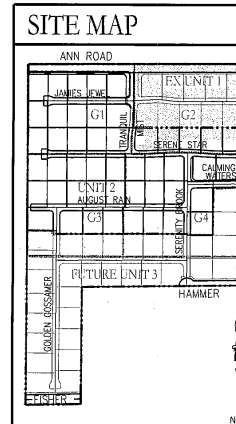
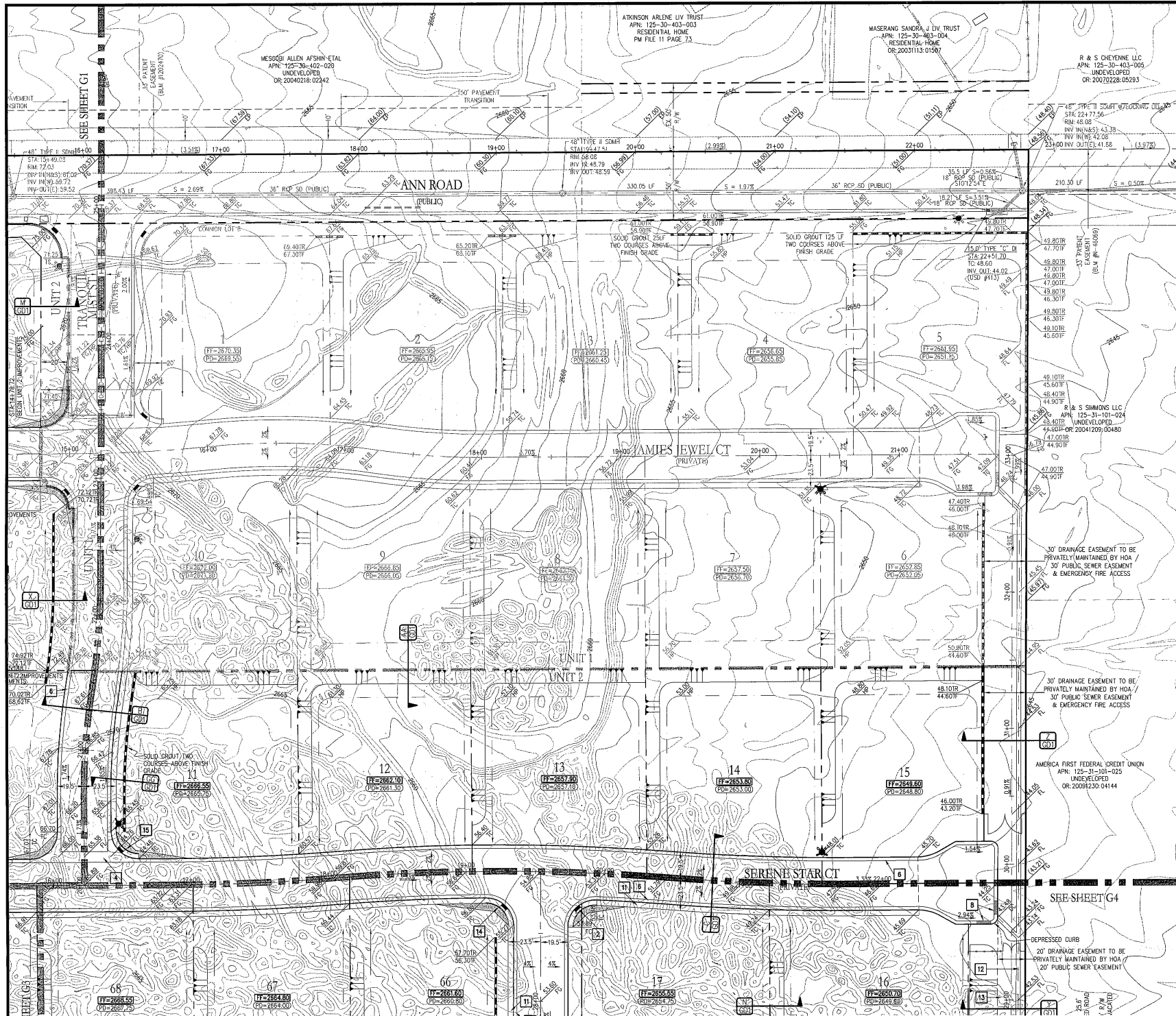
ENGLISH UNITS
DRAINAGE AREA      SQUARE MILES
PRECIPITATION DEPTH  INCHES
LENGTH, ELEVATION  FEET
FLOW              CUBIC FEET PER SECOND
STORAGE VOLUME     ACRE-FEET
SURFACE AREA       ACRES
TEMPERATURE        DEGREES FAHRENHEIT

```


+	EXOF1	.35	1	FLOW TIME	329. 3.75	324. 3.75	319. 3.75	3.83	86. 3.83
+	4 COMBINED AT DUMMY	.66	1	FLOW TIME	584. 3.75	574. 3.75	564. 3.75	148. 3.75	138. 3.75
+	HYDROGRAPH AT DOF1	.35	1	FLOW TIME	387. 3.75	381. 3.75	376. 3.75	123. 3.75	118. 3.75
+	HYDROGRAPH AT ANN1	.01	1	FLOW TIME	13. 3.50	13. 3.50	13. 3.50	7. 3.50	6. 3.50
+	2 COMBINED AT CPANN	.35	1	FLOW TIME	392. 3.75	386. 3.75	380. 3.75	125. 3.75	120. 3.75
+	HYDROGRAPH AT DOF3	.00	1	FLOW TIME	6. 3.50	5. 3.50	5. 3.50	1. 3.58	1. 3.58
+	HYDROGRAPH AT DON2	.00	1	FLOW TIME	5. 3.58	5. 3.58	5. 3.58	1. 3.58	1. 3.58
+	2 COMBINED AT CP1	.01	1	FLOW TIME	10. 3.50	10. 3.50	10. 3.50	3. 3.58	3. 3.58
+	HYDROGRAPH AT DON3	.01	1	FLOW TIME	12. 3.58	11. 3.58	11. 3.58	3. 3.58	3. 3.58
+	HYDROGRAPH AT DON1	.01	1	FLOW TIME	14. 3.58	14. 3.58	13. 3.58	4. 3.58	4. 3.58
+	3 COMBINED AT CP2	.03	1	FLOW TIME	36. 3.58	35. 3.58	34. 3.58	10. 3.58	9. 3.58
+	HYDROGRAPH AT DOF4	.03	1	FLOW TIME	34. 3.58	33. 3.58	33. 3.58	9. 3.67	8. 3.67
+	HYDROGRAPH AT DON4	.01	1	FLOW TIME	7. 3.58	7. 3.58	7. 3.58	2. 3.58	2. 3.58
+	2 COMBINED AT CP3	.03	1	FLOW TIME	41. 3.58	40. 3.58	39. 3.58	10. 3.58	10. 3.58
+	HYDROGRAPH AT DON8	.00	1	FLOW TIME	7. 3.50	7. 3.50	7. 3.50	2. 3.50	2. 3.50
+	2 COMBINED AT CP7	.04	1	FLOW TIME	47. 3.58	46. 3.58	45. 3.58	12. 3.58	12. 3.58
+	HYDROGRAPH AT DON5	.01	1	FLOW TIME	14. 3.58	14. 3.58	14. 3.58	4. 3.58	4. 3.58
+	HYDROGRAPH AT DON6	.01	1	FLOW TIME	15. 3.58	15. 3.58	15. 3.58	4. 3.58	4. 3.58

2 COMBINED AT								
+	CP5	.02	1	FLOW TIME	30. 3.58	29. 3.58	29. 3.58	8. 3.58
HYDROGRAPH AT								
+	HAM1	.00	1	FLOW TIME	4. 3.50	4. 3.50	4. 3.50	2. 3.50
2 COMBINED AT								
+	CP6	.02	1	FLOW TIME	32. 3.58	32. 3.58	31. 3.58	9. 3.58
2 COMBINED AT								
+	CP8	.06	1	FLOW TIME	79. 3.58	77. 3.58	76. 3.58	21. 3.58
HYDROGRAPH AT								
+	DOF2	.16	1	FLOW TIME	174. 3.67	171. 3.67	168. 3.67	50. 3.67
HYDROGRAPH AT								
+	DOF5	.05	1	FLOW TIME	57. 3.67	56. 3.67	55. 3.67	15. 3.67
2 COMBINED AT								
+	CP9	.21	1	FLOW TIME	231. 3.67	227. 3.67	223. 3.67	65. 3.67
HYDROGRAPH AT								
+	DON9	.01	1	FLOW TIME	10. 3.58	10. 3.58	10. 3.58	3. 3.58
HYDROGRAPH AT								
+	FISH1	.00	1	FLOW TIME	2. 3.50	2. 3.50	2. 3.50	1. 3.50
3 COMBINED AT								
+	CP11	.22	1	FLOW TIME	240. 3.67	236. 3.67	233. 3.67	68. 3.67

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



- ### CONSTRUCTION NOTES
1. 24" L-TYPE CURB & GUTTER (USD #216)
 2. SIDEWALK RAMPS USING ARMOR TILE (CASE 1 A=8.0') TRUNCATED DOMES OR EQUIVALENT (USD #235)
 3. 4" THICK CONCRETE SIDEWALK (USD #234)
 4. 8" CROSS GUTTER (USD #228)
 5. SAWCUT & MATCH EXISTING AC PAVEMENT
 6. 30" ROLL TYPE CURB & GUTTER (USD #217A)
 7. CURB CUT (SEE P/GD1)
 8. 10" TRANSITION FROM ROLL TO DEPRESSIONED CURB (SEE R/GD1)
 9. WROUGHT IRON FENCE (SEE K/GD1)
 10. WROUGHT IRON FENCE W/ SCREEN AND GATE (SEE Q/GD1)
 11. 5" THICK CONCRETE SIDEWALK (USD #234)
 12. 3.0' VALLEY GUTTER (SEE L/GD1)
 13. AC PAVEMENT
 14. SIDEWALK RAMPS USING ARMOR TILE (CASE 1 A=9.5' B=4.5') TRUNCATED DOMES OR EQUIVALENT (USD #235)
 15. SIDEWALK RAMPS USING ARMOR TILE (CASE 1 A=12.0' B=4.5') TRUNCATED DOMES OR EQUIVALENT (USD #235)
 16. WROUGHT IRON FENCE W/ SCREEN AND GATE (SEE KK/GD2)

GRADING NOTES

COMPLETION OF SECTION II OF DRAINAGE COMPLIANCE REPORT REQUIRED.

ADD 2600 FEET TO ALL GRADE TAGS TO GET ACTUAL ELEVATION.

THE ELEVATION DIFFERENCE BETWEEN THE PAD AND FINISH FLOOR IS DETERMINED FROM THE MINIMUM THICKNESS REQUIRED PER THE GEOTECHNICAL REPORT. FINISH FLOORS MAY INCREASE DEPENDING ON THE TYPE OF SOIL AND FOUNDATION PLAN USED. NOTE THAT THE STRUCTURAL PLANS & GEOTECHNICAL REPORT SHALL SUPERSEDE THE CIVIL IMPROVEMENT PLANS.

ALL PRIVATE STREETS AND DRAINAGE EASEMENTS ARE TO BE PRIVATELY OWNED AND MAINTAINED BY THE HOMEOWNERS ASSOCIATION (H.O.A.).

ALL WORK TO BE PERFORMED OUTSIDE OF THE PROJECT BOUNDARY AND ON PRIVATE PROPERTY SHALL NOT BE PERFORMED UNTIL WRITTEN PERMISSION AND EASEMENTS HAVE BEEN OBTAINED FROM THE OFFSITE OWNER AND GIVEN TO CLARK COUNTY.

CONTRACTOR SHALL VERIFY HORIZONTAL AND VERTICAL LOCATION OF EXISTING UTILITIES AND NOTIFY THE DESIGN ENGINEER IMMEDIATELY OF ANY DISCREPANCIES PRIOR TO CONSTRUCTION.

GRADING CERTIFICATION

I CERTIFY THIS GRADING PLAN COMPLIES WITH THE APPROVED DRAINAGE STUDY, HTE 10-18993, ON FILE WITH CLARK COUNTY FOR THIS PROJECT.

APPROVAL BLOCK

ACCEPTANCE OF PLANS FOR FILING

BY: _____ DATE: _____

DEVELOPMENT AND FLOOD CONTROL

LEGEND

	EXISTING (10.00)	PROPOSED (10.00)
DESIGN ELEVATION		
FUTURE ELEVATION		
SCARP (SLOPE VARIES)		
CONTOUR (1' INTERVAL)		
CONTOUR (5' INTERVAL)		
DIRECTION OF FLOW		
RETAINING WALL		
CMU WALL		
CENTERLINE		
RIGHT-OF-WAY		
CUT LINE-ASPHALT		
CURB AND GUTTER		
POWER POLE		
SIDEWALK RAMP		
CURB DROP INLET		
STORM DRAIN W/MANHOLE		
SIDEWALK		
PROPERTY LINE		
CUT-FILL LINE		
EDGE OF PAVEMENT		
SIGHT VISIBILITY ZONE		

PRIVATE STREET EASEMENTS

ALL PRIVATE STREETS ARE P.U.E., PUBLIC SEWER EASEMENTS, AND PUBLIC DRAINAGE EASEMENTS TO BE PRIVATELY MAINTAINED BY THE H.O.A.

FLOOD ZONE

THIS PROJECT IS LOCATED IN ZONE X, AN AREA OUTSIDE THE 100-YEAR FLOOD ZONE. ACCORDING TO FIRM PANEL NO. 32003C1745 DATED SEPT. 27, 2002.

EARTHWORK

TOTAL FOR OVERALL DEVELOPMENT: 204 CY CUT
16,315 CY FILL

THIS OPINION OF THE CUT AND FILL QUANTITIES IS PROVIDED AS REQUIRED BY CLARK COUNTY BUILDING CODE REQUIREMENTS. THIS INFORMATION SHOULD NOT BE USED FOR BIDDING PURPOSES. ALL CONTRACTORS ARE RESPONSIBLE FOR THEIR OWN QUANTITIES. THESE TOTALS ARE RAW AND DO NOT ACCOUNT FOR SHRINKAGE AND SUBSIDENCE.

GEOTECHNICAL

GEOTECH, INC.
6835 S. ESCONCADO ST. STE. A
LAS VEGAS, NEVADA 89119
702-697-1424

REPORT NO: 9786-LV6
DATE 03/11/2010

SCALE

1" = 40'

LEGAL DESCRIPTION

BEING A PORTION OF THE NORTHWEST QUARTER (34) OF SECTION 31, TOWNSHIP 19 SOUTH, RANGE 60 EAST, M.B.D. & M. CLARK COUNTY, NEVADA.

BASIS OF BEARINGS

S 89°14'18" E, BEING THE NORTH LINE OF THE SE 1/4, NW 1/4, SECTION 31, T19S, R60E, M.D.M. AS SHOWN ON FILE 97, PAGE 55 OF PARCEL MAPS, CLARK COUNTY, NEVADA OFFICIAL RECORDS.

BENCHMARK

B.M. #BLV90-31C4 CLY RIVET & ROUND PLATE IN 60NC PAD WEST SIDE OF GRAND CANYON DR., 720 FEET SOUTH OF WASHBURN ROAD.

ELEVATION = 795.579 M (2010.16 FEET) NAVD 83

ABBREVIATIONS

AC	ASPHALTIC CONCRETE	NTS	NOT TO SCALE
BC	BACK OF CURB	OC	ON CENTER
BR	BACK OF CURB RADIUS	PC	PULL BOX
BW	BENCHMARK	POC	POINT OF CURVE
BVC	BEIGN VERTICAL CURVE	PCC	POINT OF COMPOUND CURVE
BW	BOTTOM OF EXISTING WALL	PTH	POLYETHYLENE
CAV	CABLE TELEVISION	PI	POINT OF INTERSECTION
CC	CLARK COUNTY	PL	PROPERTY LINE
CL	CENTERLINE	POC	POINT OF CONNECTION
CLV	CITY OF LAS VEGAS	PP	POWER POLE
CMP	CORRUGATED METAL PIPE	PRC	POINT OF REVERSE CURVE
CNV	CITY OF NORTH LAS VEGAS	P1	POINT OF TANGENCY
CO	CLEAN OUT SEWER	R	RADIUS
COH	CITY OF HENDERSON	PVC	POLYVINYL CHLORIDE
CY	CUBIC YARD	R/CB	REINFORCED CONCRETE BOX
DC	DESIGN GRADE	RCP	REINFORCED CONCRETE PIPE
DI	DROP INLET	R/W	RIGHT-OF-WAY
DIP	DUCTILE IRON PIPE	RT	RIGHT
EC	END OF CURVE	SD	STORM DRAIN
ED	EDGE OF PAVEMENT	SL	STREET LIGHT
EVC	END VERTICAL CURVE	SNWA	SOUTHERN NEVADA WATER AUTHORITY
EX	EXISTING	SS	SANITARY SEWER
FF	FINISH FLOOR ELEVATION	STATION	STATION
FG	FINISH GRADE	STD	STANDARD
FI	FIRE HYDRANT	SVZ	SIGHT VISIBILITY ZONE
FL	FLOW LINE	SW	SIDEWALK
FT	FEET	TC	TOP OF CURB
GB	GRADE BREAK	TF	TOP OF FOOTING
GFT	GARAGE FINISH FLOOR	TR	TOP OF RETAINING
HP	HOT POINT	TW	TOP OF WALL
INV	INVERT	TYP	TYPICAL
LF	LINEAR FEET	UCD	UNIFORM STANDARD DRAWING
LV	LAS VEGAS VALLEY WATER DISTRICT	VC	VERTICAL CURVE
LVWD	LAS VEGAS VALLEY WATER DISTRICT	VCD	VITRIFIED CLAY PIPE
MAX	MAXIMUM	W	WATER
MA	MANHOLE	W	WATER
MIN	MINIMUM	ZC	ZERO UP CURB

WILLIAM LYON HOMES
500 PILOT ROAD, STE. G
LAS VEGAS, NV 89119
(702) 263-8200 FAX: (702) 263-8220

TANEY ENGINEERING
6805 JONES BLVD, STE. 100
LAS VEGAS, NV 89118
(702) 362-8844 FAX: (702) 362-5333

ANN AND GRAND CANYON - UNIT 2
(SERENITY RIDGE)
A RESIDENTIAL SUBDIVISION

GRADING PLAN - NORTH EAST

DATE: 09.16.10

SCALE: 1"=40'

JOB NO: WLL-10-068

DESIGNED BY: MC

CHECKED BY: RDC

SHEET NAME: G2

SHEET: 4 OF 24

ENGINEER'S SEAL

ROBERT D. CUNNINGHAM
Exp. 12-31-10
CIVIL

No. 15725

Call Before You Dig
AVOID HITTING UNDERGROUND UTILITY LINES IT'S COSTLY.

CALL 811

CLARK COUNTY TRAFFIC OPERATIONS
1-800-227-2600
AND
CLARK COUNTY TRAFFIC OPERATIONS
1-800-455-7544

UnderGround
1-702-455-7511
CLARK COUNTY TRAFFIC OPERATIONS
1-702-229-6611
LAS VEGAS AREA COMPUTERIZED
TRAFFIC SIGNALS

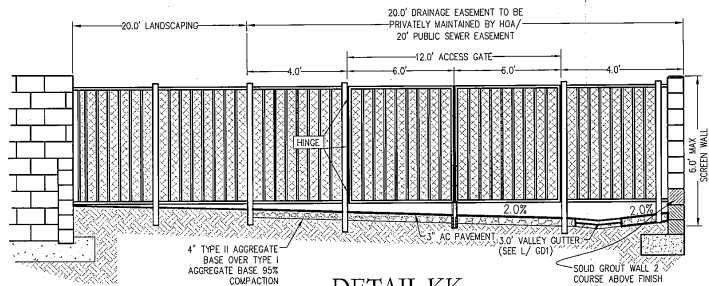
Call Before You Dig
AVOID HITTING OVERHEAD POWER LINES IT'S COSTLY.

CALL 811

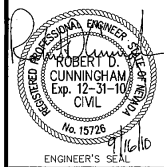
CLARK COUNTY TRAFFIC OPERATIONS
1-800-227-2600
AND
CLARK COUNTY TRAFFIC OPERATIONS
1-800-455-7544

FILE NAME: WLL0504P.DWG

FILE NAME: WLOGBUP.DWG



DETAIL KK
WROUGHT IRON FENCE W/ SCREEN AND GATE



DATE: 09.16.10

SCALE: 1"=40'

JOB NO: WLL-10-068

DESIGNED BY: MC

CHECKED BY: RDC

SHEET NAME: GD2

SHEET: 8 OF 24

ANN AND GRAND CANYON - UNIT 2
(SERENITY RIDGE)
A RESIDENTIAL SUBDIVISION

GRADING DETAILS AND SECTIONS

WILLIAM LYON HOMES
300 PILOT ROAD STE G
LAKESIDE, NY 11935
(703) 263-8200 FAX: (703) 263-8220



TANEY ENGINEERING
600 S. JENSEN BLVD. SUITE 200
LAS VEGAS, NV 89118
(703) 363-8844 FAX: (703) 363-5333

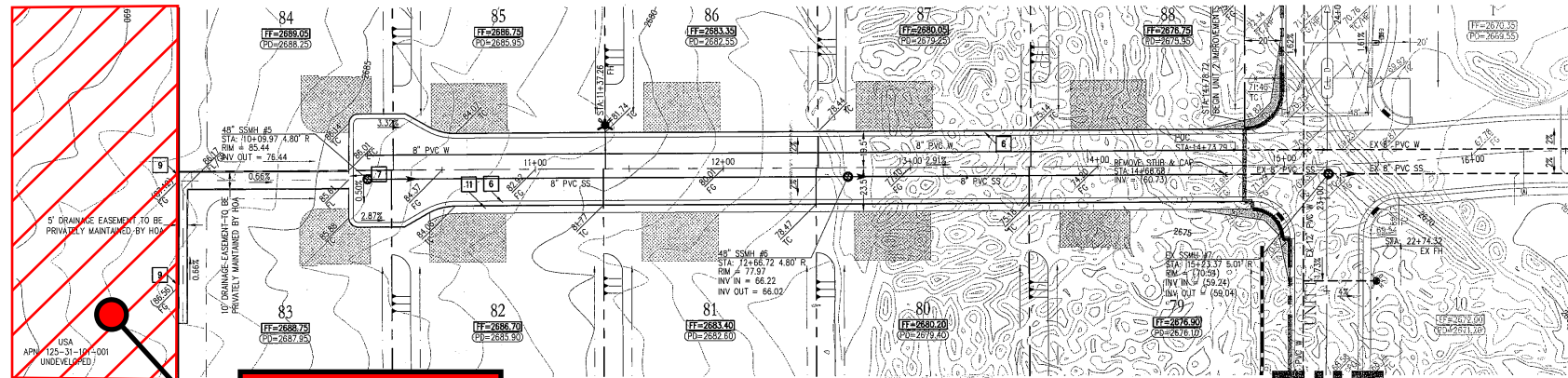
DESCRIPTION

BY DATE

APPR.

NO.

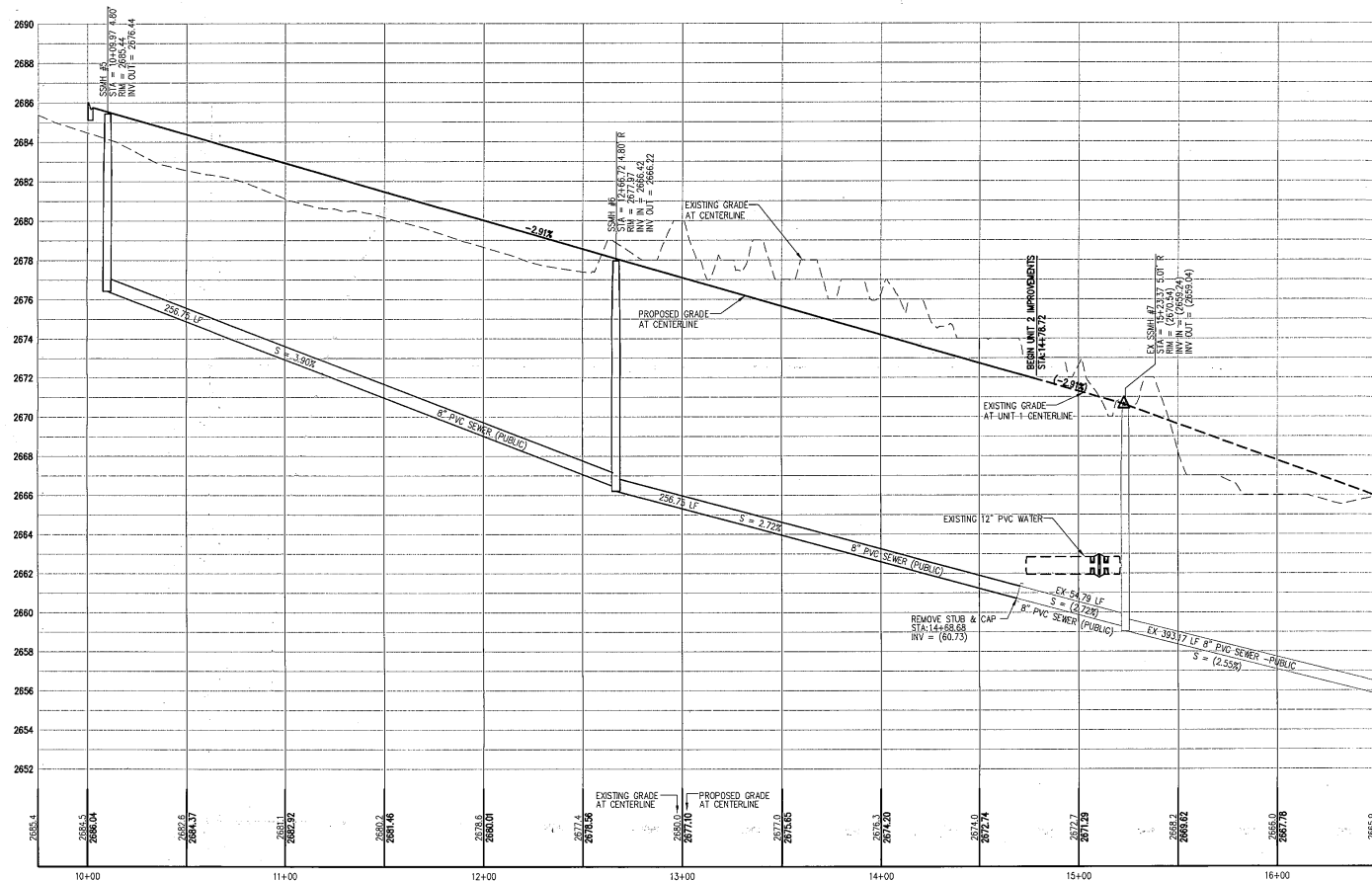
REVISIONS



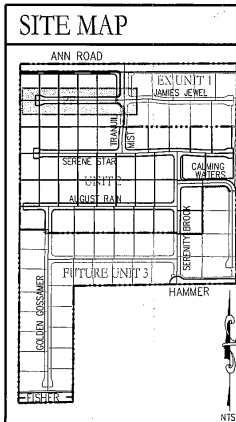
PROJECT AREA

JAMIES JEWEL COURT- PLAN
STA: 10+0.00 TO 16+50.00

SEE SHEET PP5
TRANQUIL MIST



JAMIES JEWEL COURT- PROFILE
STA: 10+0.00 TO 16+50.00
SCALE: 1"=40' HORIZ., 1"=4' VERT.



LEGEND	
EXISTING	PROPOSED
DESIGN ELEVATION	(10.00)
FUTURE ELEVATION	(10.00)
SCARP (SLOPE VARIES)	
CONTOUR (1' INTERVAL)	
CONTOUR (5' INTERVAL)	
DIRECTION OF FLOW	
CENTERLINE	
RIGHT-OF-WAY	
CUT LINE- ASPHALT	
CURB AND GUTTER	
CURB DROP INLET	
STORM DRAIN W/ MANHOLE	
SEWER	
PROPERTY LINE	
EDGE OF PAVEMENT	
2" BLOW OFF VALVE	
WATERLINE FIXTURES	
GATE VALVE	
FIRE HYDRANT	
PROPOSED SEWER LINE	
PROPOSED WATER LINE	

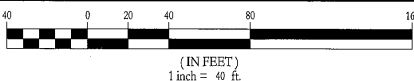
CONSTRUCTION NOTES

- 24" L-TYPE CURB & GUTTER (USD #216)
- SIDEWALK RAMP USING ARMOR TILE (CASE 1 A=8-0.7) TRUNCATED DOMES OR EQUIVALENT (USD #235)
- 4" THICK CONCRETE SIDEWALK (USD #234)
- 8" CROSS GUTTER (USD #228)
- SAW CUT & MATCH EXISTING AC PAVEMENT
- 30" ROLL TYPE CURB & GUTTER (USD #217A)
- CURB CUT (SEE P/GD1)
- 10' TRANSITION FROM ROLL TO DEPRESSION CURB (SEE R/GD1)
- WROUGHT IRON FENCE (SEE K/GD1)
- WROUGHT IRON FENCE W/ SCREEN AND GATE (SEE Q/GD1)
- 5" THICK CONCRETE SIDEWALK (USD #234)
- 3.0' VALLEY GUTTER (SEE L/GD1)
- AC PAVEMENT
- SIDEWALK RAMP USING ARMOR TILE (CASE 1 A=9.5' B=4.5') TRUNCATED DOMES OR EQUIVALENT (USD #235)
- SIDEWALK RAMP USING ARMOR TILE (CASE 1 A=12.0' B=4.5') TRUNCATED DOMES OR EQUIVALENT (USD #235)
- WROUGHT IRON FENCE W/ SCREEN AND GATE (SEE K/GD2)

GEOTECHNICAL

GEOTECH, INC.
6835 S. ESCONDIDO ST., STE. A
LAS VEGAS, NEVADA 89119
702-897-1424
REPORT NO: 9786-LVS
DATE 03/11/2010

SCALE



LEGAL DESCRIPTION

BEING A PORTION OF THE NORTHWEST QUARTER (X) OF SECTION 31, TOWNSHIP 19 SOUTH, RANGE 60 EAST, M.B.D. & M. CLARK COUNTY, NEVADA

BASIS OF BEARINGS

S 89°14'18" E, BEING THE NORTH LINE OF THE SE 1/4, NW 1/4, SECTION 31, T19S, R60E; M.D.M. AS SHOWN ON FILE 97, PAGE 85 OF PARCEL MAPS, CLARK COUNTY, NEVADA OFFICIAL RECORDS.

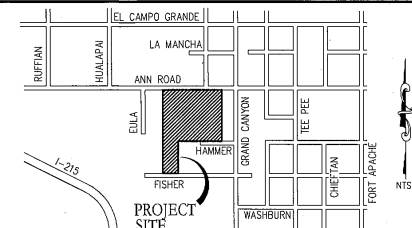
BENCHMARK

B.M. #BLV90-31C4 CLV RIVET & ROUND PLATE IN CONC PAD WEST SIDE OF GRAND CANYON DR., 120 FEET SOUTH OF WASHBURN ROAD.
ELEVATION = 795.579 M (2010.16 FEET) NAVD 88

ABBREVIATIONS

AC	ASPHALTIC CONCRETE	NTS	NOT TO SCALE
BC	BACK OF CURB	OC	ON CENTER
BCR	BACK OF CURB RADIUS	PC	PULL BOX
BM	BENCHMARK	PC	POINT OF CURVE
BVC	BEFORE VERTICAL CURVE	PC	POINT OF COMPOUND CURVE
BT	BOTTOM OF EXISTING WALL	PE	POLYETHYLENE
CATV	CABLE TELEVISION	PI	POINT OF INTERSECTION
CC	CLARK COUNTY	PL	PROPERTY LINE
CD	CENTERLINE	PC	POINT OF CONNECTION
CLV	CITY OF LAS VEGAS	PP	POWER POLE
CMP	CORRUGATED METAL PIPE	PRC	POINT OF REVERSE CURVE
CNV	CITY OF NORTH LAS VEGAS	PT	POINT OF TANGENCY
CO	CLEAN OUT, SEWER	PVC	POLYVINYL CHLORIDE
COH	CITY OF HENDERSON	R	RADIUS
CO	CURB YARD	RCB	REINFORCED CONCRETE BOX
DC	DESIGN GRADE	RCP	REINFORCED CONCRETE PIPE
DP	DROP INLET	R/W	RIGHT-OF-WAY
EC	END OF CURVE	RT	RIGHT
ED	EDGE OF PAVEMENT	SD	STORM DRAIN
EV	EDGE OF VERTICAL CURVE	SL	STREETLIGHT
EX	EXISTING	SNWA	SOUTHERN NEVADA WATER AUTHORITY
FG	FINISH GRADE	SS	SANITARY SEWER
FI	FIRE HYDRANT	STA	STATION
FL	FLOW LINE	STD	STANDARD
FT	FEET	SVZ	SOFT VISIBILITY ZONE
GB	GRADE BREAK	SW	SEWER
GP	GRADE FINISH FLOOR	TC	TOP OF CURB
HP	HIGH POINT	TF	TOP OF FOOTING
INV	INVERT	TR	TOP OF RETAINING
LF	LINEAL FEET	TYP	TYPICAL
LT	LEFT	UD	UNIFORM STANDARD DRAINING
LYVD	LAS VEGAS VALLEY WATER DISTRICT	VC	VERTICAL CURVE
MAX	MAXIMUM	VCP	VERTICAL CLAY PIPE
MH	MANHOLE	VG	VALLEY GUTTER
MN	MINIMUM	W	WATER
		ZC	ZERO LIP CURB

KEY MAP



GRADING NOTES

COMPLETION OF SECTION II OF DRAINAGE COMPLIANCE REPORT REQUIRED.
ADD 2600 FEET TO ALL GRADE TAGS TO GET ACTUAL ELEVATION.
THE ELEVATION DIFFERENCE BETWEEN THE PAD AND FINISH FLOOR IS DETERMINED FROM THE MINIMUM THICKNESS REQUIRED PER THE GEOTECHNICAL REPORT. FINISH FLOORS MAY INCREASE DEPENDING ON THE TYPE OF SOIL AND FOUNDATION PLAN USED. NOTE THAT THE STRUCTURAL PLANS & GEOTECHNICAL REPORT SHALL SUPERSEDE THE CIVIL IMPROVEMENT PLANS.
ALL PRIVATE STREETS AND DRAINAGE EASEMENTS ARE TO BE PRIVATELY OWNED AND MAINTAINED BY THE HOMEOWNERS ASSOCIATION (H.O.A.).
ALL WORK TO BE PERFORMED OUTSIDE OF THE PROJECT BOUNDARY AND ON PRIVATE PROPERTY SHALL NOT BE PERFORMED UNTIL WRITTEN PERMISSION AND EASEMENTS HAVE BEEN OBTAINED FROM THE OFFSITE OWNER AND GIVEN TO CLARK COUNTY.
CONTRACTOR SHALL VERIFY HORIZONTAL AND VERTICAL LOCATION OF EXISTING UTILITIES AND NOTIFY THE DESIGN ENGINEER IMMEDIATELY OF ANY DISCREPANCIES PRIOR TO CONSTRUCTION.

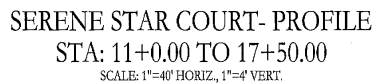
UnderGround
1-702-455-7511
1-702-229-6611
LAS VEGAS AREA COMPUTERIZED TRAFFIC SYSTEM

Call Before You Dig
1-800-227-2600
1-800-455-7544
CLARK COUNTY TRAFFIC OPERATIONS

Call Before You Dig
1-800-227-2600
1-800-455-7544
CLARK COUNTY TRAFFIC OPERATIONS



SERENE STAR COURT- PLAN
STA: 11+0.00 TO 17+50.00



COMPLETION OF SECTION B OF DRAINAGE COMPLIANCE REPORT REQUIRED.

ADD 2600 FEET TO ALL GRADE TAGS TO GET ACTUAL ELEVATION.

THE ELEVATION DIFFERENCE BETWEEN THE PAD AND FINISH FLOOR IS DETERMINED FROM THE MINIMUM FINISH FLOOR ELEVATION. THE FINISH FLOOR MAY INCREASE DEPENDING ON THE TYPE OF SOIL AND FOUNDATION PLAN USED. NOTE THAT THE STRUCTURAL PLANS & GEOTECHNICAL REPORT SHALL SUPERSEDE THE CIVIL IMPROVEMENT PLANS.

ALL PRIVATE STREETS AND DRAINAGE EASEMENTS ARE TO BE PRIVATELY OWNED AND MAINTAINED BY THE HOMEOWNERS ASSOCIATION (H.O.A.).

ALL WORK TO BE PERFORMED OUTSIDE OF THE PROJECT BOUNDARY AND ON PRIVATE PROPERTY SHALL NOT BE PERFORMED UNTIL WRITTEN PERMISSION AND EASEMENTS HAVE BEEN OBTAINED FROM THE OFFSITE OWNER AND GIVEN TO CLEARANCE.

CONTRACTOR SHALL VERIFY HORIZONTAL AND VERTICAL LOCATION OF EXISTING UTILITIES AND NOTIFY THE DESIGN ENGINEER IMMEDIATELY OF ANY DISCREPANCIES PRIOR TO CONSTRUCTION.

The map shows the project area located at the intersection of I-215 and Fisher. The project site is highlighted with a hatched pattern and labeled 'PROJECT SITE'. Surrounding areas include La Mancha, Ann Road, Fisher, and various residential streets like Ruffian, Hulapal, Eula, Tee Pee, Chet'An, Washburn, and Fort Apache. A north arrow is also present.

	EXISTING (10.00)	PROPOSED 10.00 [10.00]
DESIGN ELEVATION		
FUTURE ELEVATION		
SCARP (SLOPE VARES)		
CONTOUR (1' INTERVAL)		
CONTOUR (5' INTERVAL)		
DIRECTION OF FLOW		
CENTERLINE		
RIGHT-OF-WAY		
CUT LINE-ASPHALT		
CURB AND GUTTER		
CURB DROP INLET		
STORY DRAIN W/MAINHOLE		
SIDEWALK		
PROPERTY LINE		
EDGE OF PAVEMENT		
2' BLOW OFF VALVE		
WATERLINE FIXTURES		
GATE VALVE		
FIRE HYDRANT		
PROPOSED SEWER LINE		
PROPOSED WATER LINE		

- 1 — 24" L-TYPE CURB & GUTTER (USD #216)
- 2 — SIDEWALK RAMPS USING ARMOR TILE (CASE 1 $A=8.0'$)
TRUNCATED DOWNS OR EQUIVALENT (USD #235)
- 3 — 8" THICK CONCRETE SIDEWALK (USD #234)
- 4 — 6" CROSS GUTTER (USD #228)
- 5 — SAWCUT & MATCH EXISTING AC PAVEMENT
- 6 — 30" ROLL TYPE CURB & GUTTER (USD #217A)
- 7 — CURB CUT (SEE P/001)
- 8 — 10" TRANSITION FROM ROLL TO DEPRESSIONED CURB (SEE R/G001)
- 9 — WROUGHT IRON FENCE (SEE K/G001)
- 10 — WROUGHT IRON FENCE W/ SCREEN AND GATE (SEE G/G001)
- 11 — 8" THICK CONCRETE SIDEWALK (USD #234)
- 12 — 30" VALLEY GUTTER (SEE I/G001)
- 13 — AC PAVEMENT
- 14 — SIDEWALK RAMPS USING ARMOR TILE (CASE 1 $A=9.5'$ $B=4.5'$)
TRUNCATED DOWNS OR EQUIVALENT (USD #235)
- 15 — SIDEWALK RAMPS USING ARMOR TILE (CASE 1 $A=12.0'$ $B=4.5'$)
TRUNCATED DOWNS OR EQUIVALENT (USD #235)
- 16 — WROUGHT IRON FENCE W/ SCREEN AND GATE (SEE K/G002)

GEOTEK, INC.
6835 S. ESCONDIDO ST. STE# A
LAS VEGAS, NEVADA 89119
702-897-1424

(IN FEET)
1 inch = 40 ft.

BEING A PORTION OF THE NORTHWEST QUARTER (¼) OF SECTION 31, TOWNSHIP 19
SOUTH, RANGE 60 EAST, N.B.D. & M. CLARK COUNTY, NEVADA

S 89°14'18" E, BEING THE NORTH LINE OF THE SE ¼, NW ¼, SECTION 31, T19S, R6E;
M.D.M. AS SHOWN ON FILE 97, PAGE 85 OF PARCEL MAPS, CLARK COUNTY, NEVADA
OFFICIAL RECORDS.

ELEVATION = 795.579 M (2010.16 FEET) NAVD 88

[illegible]

	ANN AND GRAND CANYON - UNIT 2 (SERENITY RIDGE) A RESIDENTAL SUBDIVISION	WILLIAM LYON HOMES 5000 WILLOW RIDGE LAS VEGAS, NV 89119 (702) 263-8200 FAX: (702) 263-8220	 TANEY ENGINEERING 6035 WILLOW RIDGE UNIT 100 LAS VEGAS, NV 89118 (702) 362-8844 FAX: (702) 362-5233	NO. _____		DESCRIPTION	BY DATE	APPR.
				REVISIONS				
DATE: 09.16.10			SCALE: 1"=40'			JOB NO: WLL-10-068		
DESIGNED BY: MC			CHECKED BY: RDC			SHEET NAME: PP2		
SHEET: 14 OF 24								



Call Before You Dig
 AVOID CUTTING UNDERGROUND
 UTILITY LINES. IT'S COSTLY.
CALL

 OR
 1-800-227-2600
 AND
 CLARK COUNTY TRAFFIC OPERATIONS
 1-800-455-7544

ADD 3 PW 20-1165/
6/29/20
Add 43
Westwood

ADDENDUM NO.3 TO THE TECHNICAL DRAINAGE STUDY

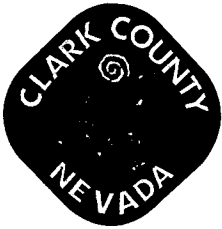
Ann & 215 – Phase 1

City of Las Vegas, Nevada

June 2020

Prepared For:

UpGrowth NV Partners, LLC
11411 Southern Highlands Parkway, Suite 300
Las Vegas, NV 89141
Phone: 702-220-6565 – Fax: 702-220-6566



LTR PW 20-11651

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

Drainage Study Concurrence Letter

Date: July 13, 2020
Firm: Westwood PS
Engineer: Kellin Collins, P.E.
Address: 5740 South Arville Street, Suite 216, Las Vegas, NV 89118
Phone: (702) 284-5300
Fax: (702) 284-5399
E-mail: Kellin.Collins@westwoodps.com

Subject: Technical Drainage Study for Ann/Hualapai (BLM 120) Phase I
Location: SWC of Ann and Hualapai
APN: 126-36-601-011 thru -013 and 126-36-501-043
Sec, Township, Range: S36, T19S, R59E
Flood Zone & Panel: Zone X, 1750E, Dated September 27, 2002
Application Number: PW20-11651

Submittals	Date Received	Date Returned	Reviewer	Miscellaneous
Technical/Add1/Add2	02/19/2020	03/04/2020	BC	
Addendum 3	06/29/2020	07/02/2020	BC	
Supplement	07/10/2020	07/13/2020	BC	

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 19, 2020. In addition, the County has received the City of Las Vegas acceptance letter dated February 18, 2020 for the Technical Drainage Study (DS5211C).

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.

BOARD OF COUNTY COMMISSIONERS
MARILYN KIRKPATRICK, Chair • LAWRENCE WEEKLY, Vice Chair
LARRY BROWN • JAMES B. GIBSON • JUSTIN C. JONES • MICHAEL NAFT • TICK SEGERBLOM
YOLANDA T. KING, County Manager

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

The site shall be graded with respect to drainage as shown on "**Ann and Hualapai – Phase 1**", grading plan sheets C-1 thru C-3, G-1 thru G-16, D-1 thru D-5, and PP-1 thru PP-32 signed and sealed by Todd J. Steadham, P.E., on July 8, 2020.

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 <i>Regional Flood Control District policies and Procedures manual, Section VIII. D. 13. Uniform Regulations for the Control of Drainage</i> , 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.
X	Prepare drainage easement documents as shown on the grading plans.

Additional Conditions:

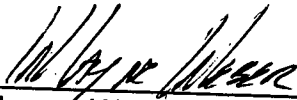
1. Offsite flow is conveyed thru the rough graded portion of the site. Dedicate easements to perpetuate offsite flows thru the site.
2. Any improvements within Clark county jurisdiction not depicted on the above mentioned grading plans may require an Update to this Technical Drainage Study.

The drainage/grading plans have been red-lined and require modifications prior to the next submittal. Failure to resubmit the red-lined grading plan will require an additional \$400 review fee.

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
Senior Civil Engineer
Development Review
Brian.Churchill@ClarkCountyNV.gov



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

cc: Albert Sung, P.E., City of Las Vegas

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL
DRAINAGE STUDY INFORMATION FORM

Name of Development: Ann and 215 Phase 1 (Addendum No. 3) Date: June 2020
 Location of Development: a) Descriptive (Cross Streets): North/South: Hualapai Way
East/West: Ann Road
 b) Section: 36 Township: 19S Range: 59E
 c) APN: 126-36-601-011, Portion of 126-36-601-012, Portion of 126-36-601-013

Name of Owner: Uppgrowth NV Partners, LLC
 Telephone No.: 702-220-6565 Fax No.: 702-220-6566 E-mail Address: mbolduc@olympiacompanies.com
 Address: 11411 Southern Highlands Parkway, Suite 300 Las Vegas NV 89141

Contact Person – Name: Kellin Collins, P.E. Telephone No.: (702) 284-5300
 *E-mail Address: kellin.collins@westwoodps.com Fax No.: (702) 284-5399
 Firm: Slater Hanifan Group, A Westwood Team
 Address: 5740 S. Arville #216 Las Vegas NV 89118

Type of Land Development/Land Disturbance Process:

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

1. Total Owned Land Area: At Site: 88.5 +/- acres Being Developed/Disturbed: 53.2 +/- acres

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.): single- family residential

5. Approximate upstream land area which drains to the subject site: 64 +/- acres

6. Has the site drainage been evaluated in the past? ☒ Yes** ☐ No If yes, please identify documentation: Conceptual Drainage Study for Ann and 215 (DS 5138)

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

8. Briefly describe your proposed schedule for the subject project: Phase 1: ASAP, Phase 2: TBD



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

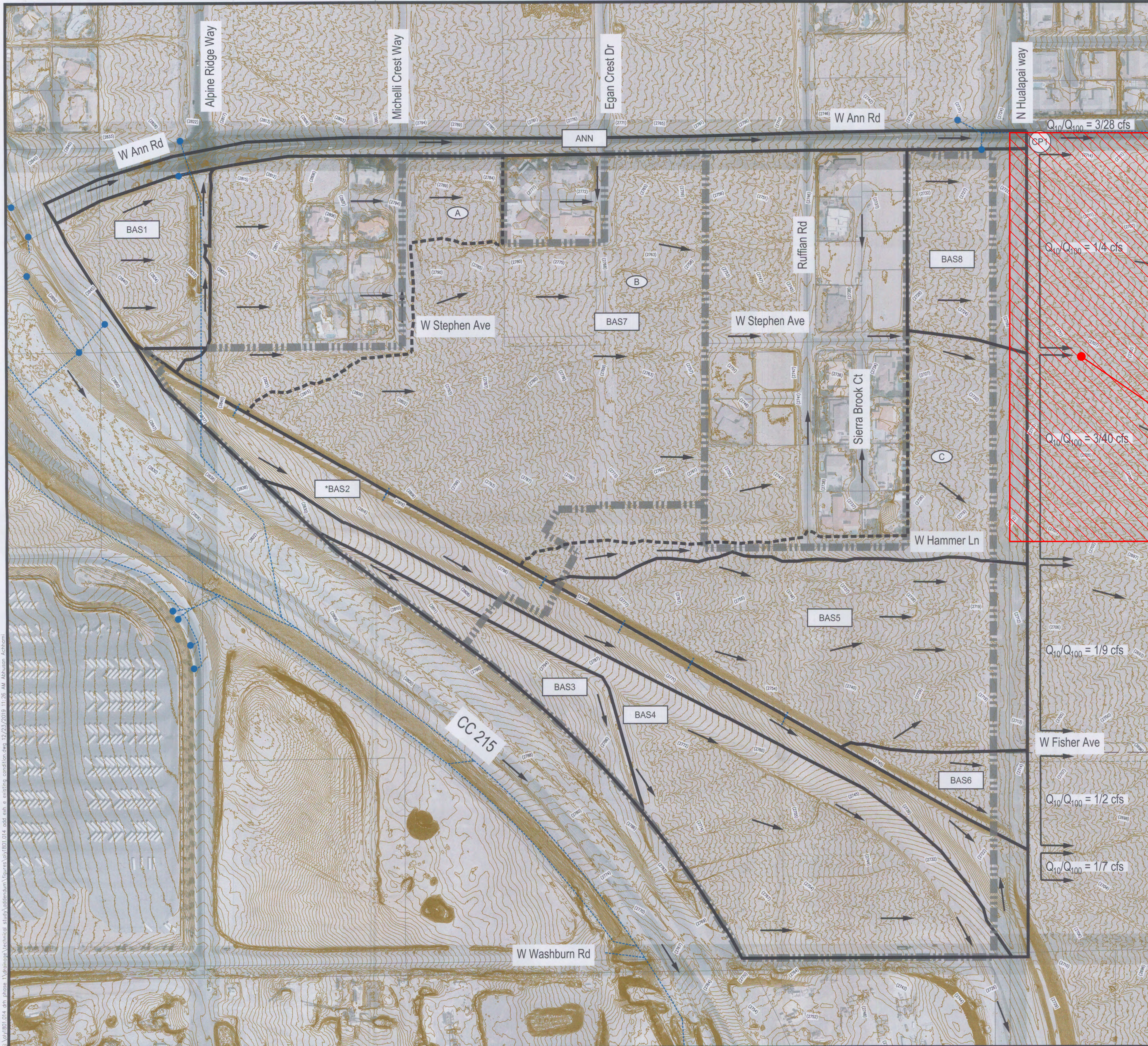
Revision	Date

Local Entity File No. _____

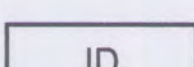
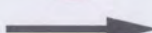
REFERENCE:

STANDARD FORM 1

Updated 05/01/2008



LEGEND

	BASIN BOUNDARY
	PHASE BOUNDARY
	EXISTING FACILITY
	SUBBASIN BOUNDARY
	BASIN ID
	SUBBASIN ID
	CONCENTRATION POINT ID
	FLOW DIRECTION

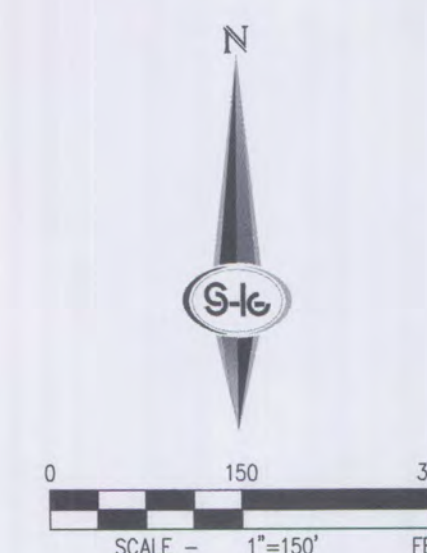
Existing Condition Flow Rate Summary			
Basin/Concentration Point ID	Area (ac)	Q ₁₀₀ (cfs)	Q ₁₀ (cfs)
BAS1	5.0	13	5
*BAS2	10.1	7	1
BAS3	3.3	2	<1
BAS4	17.1	9	1
BAS5	16.2	9	1
BAS6	2.3	2	<1
BAS7	72.0	40	3
BAS8	5.7	4	<1
ANN	4.5	15	8
CP1			
Q = BAS1 + ANN	N/A	28	13

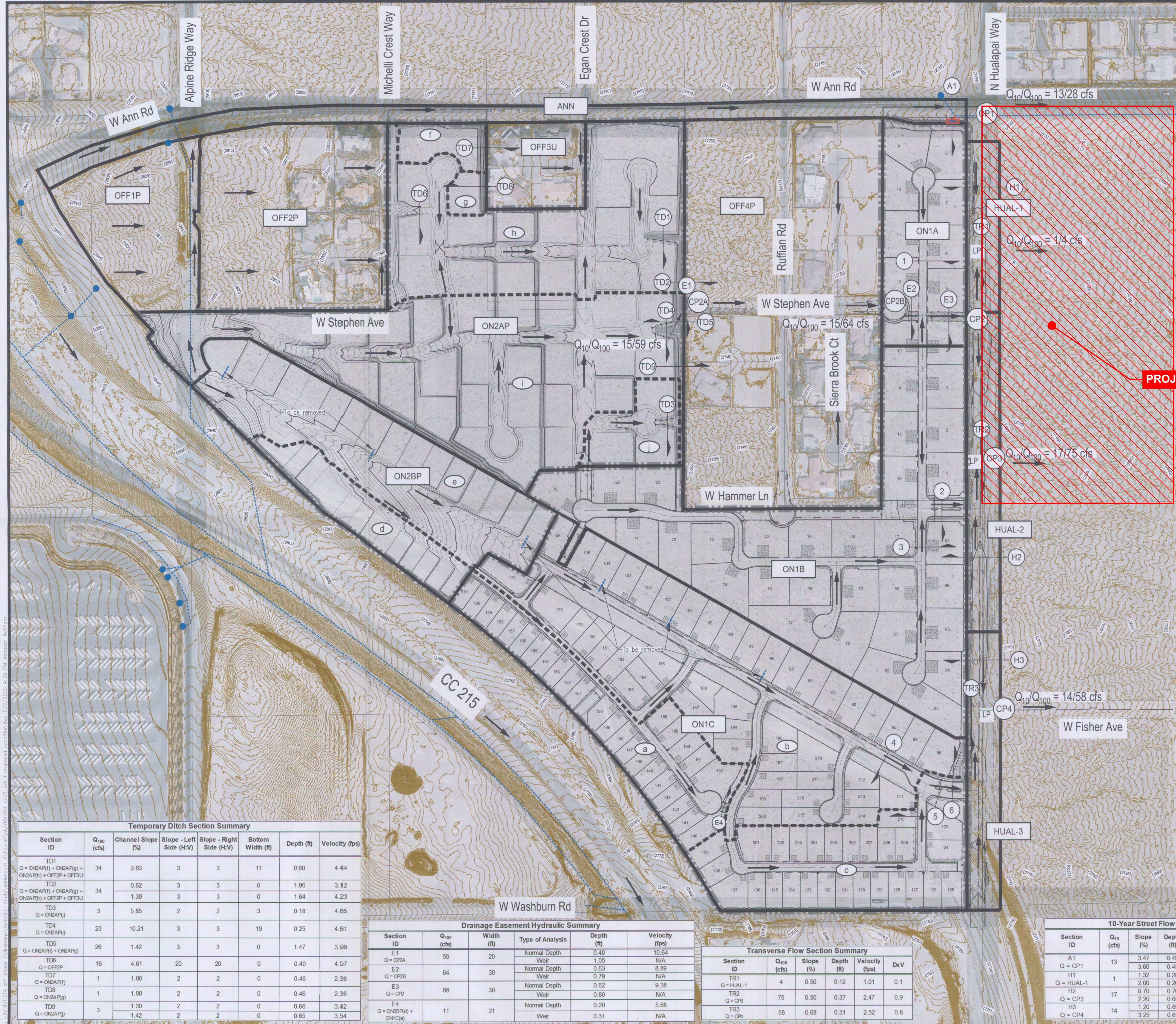
Prorated Flow Summary			
Basin ID	Q ₁₀₀ (cfs)	Area (acres)	100-yr U Flow (cfs/acre)
BAS7	40	72.00	0.6
Subbasin ID	Q ₁₀₀ (cfs)	Area (acres)	100-yr U Flow (cfs/acre)
BAS7(A)	7	13.46	0.6
BAS7(B)	28	49.70	0.6
BAS7(C)	5	8.84	0.6
TOTAL	40	72.00	

PROJECT SITE

NOTES:

* Review of the topography shows that no defined flow line directs flows in the culverts along the north edge of drainage basin and the culverts are not aligned in a manner that is effective in intercepting any approaching watershed. Therefore, flows crossing the existing culverts are not reflected in the existing condition hydrology.





LEGEND

- BASIN BOUNDARY
- PHASE BOUNDARY
- EXISTING FACILITY
- SUBBASIN BOUNDARY
- PROPOSED DRAINAGE FACILITY
- BASIN ID
- SUBBASIN ID
- CONCENTRATION POINT ID
- FLOW DIRECTION
- FLOWMASTER SECTION

Proposed Condition Flow Rate Summary

Basin/Concentration Point ID	Area (ac)	Q ₁₀₀ (cfs)	Q ₁₀ (cfs)
OFF1P	4.8	13	5
OFF2P	9.1	16	4
OFF3U	2.2	<1	<1
OFF4P	20.1	6	<1
ON2AP	27.6	43	11
ON2BP	10.3	18	5
ON1A	4.9	1	<1
ON1B	18.1	5	<1
ON1C	27.5	36	8
HUAL-1	1.5	4	1
HUAL-2	3.0	7	2
HUAL-3	2.2	6	2
ANN	4.5	15	8
CP1	N/A	28	13
Q = OFF1P + ANN	N/A	59	15
CP2A	N/A	64	15
Q = OFF2P + OFF3U + ON2AP	N/A	64	15
CP2B	N/A	66	15
Q = CP2A + OFF4P	N/A	75	17
CP2	N/A	75	17
Q = CP2B + ON1A	N/A	58	14
CP3	N/A	58	14
Q = CP2 + ON1B + HUAL-2	N/A	58	14
CP4	N/A	58	14
Q = ON1C + ON2BP + HUAL-3	N/A	58	14

Prorated Flow Summary

Basin ID	Q ₁₀₀ (cfs)	Area (acres)	100-yr Unit Flow (cfs/acre)
ON1C	36	27.51	1.3
ON2BP	18	10.28	1.8
ON2AP	43	27.64	1.6
SUBBASIN ID	Q₁₀₀ (cfs)	Area (acres)	100-yr Unit Flow (cfs/acre)
ON1C(a)	7	5.20	1.3
ON1C(b)	20	15.69	1.3
ON1C(c)	9	6.62	1.3
TOTAL	36	27.51	
ON2BP(d)	4	2.54	1.8
ON2BP(e)	14	7.74	1.8
TOTAL	18	10.28	
ON2AP(f)	1	0.93	1.6
ON2AP(g)	1	0.41	1.6
ON2AP(h)	15	9.86	1.6
ON2AP(i)	23	14.74	1.6
ON2AP(j)	3	1.70	1.6
TOTAL	43	27.64	

100-Year Street Flow Summary (Proposed)

Section ID	Q ₁₀₀ (cfs)	Slope (%)	Depth (ft)	Velocity (fps)	DxV
1	1.29	0.22	1.85	0.4	
2	2.00	0.34	2.78	0.9	
3	5.24	0.30	4.07	1.2	
4	1.14	0.33	2.30	0.8	
5	5.61	0.27	4.32	1.2	
6	1.89	0.55	5.41	3.0	
7	6.41	0.47	7.81	3.7	
8	2.00	0.36	3.25	1.2	
9	7.25	0.31	5.38	1.7	
10	3.20	0.59	6.21	3.7	
11	3.47	0.58	5.42	3.1	
12	3.60	0.58	5.50	3.2	
13	1.32	0.48	2.95	1.4	
14	2.20	0.43	3.58	1.5	
15	0.70	1.07	4.30	4.6	
16	2.20	0.93	6.29	5.8	
17	1.20	0.95	4.70	4.5	
18	3.25	0.84	6.73	5.7	

10-Year Street Flow Summary

Section ID	Q ₁₀ (cfs)	Slope (%)	Depth (ft)	Velocity (fps)	DxV	Dry Lane (ft)
A1	3.47	0.45	5.15	2.32	42.00	
Q = CP1	3.60	0.45	5.22	2.35	42.00	
H1	1.32	0.28	2.08	0.58	25.00	
Q = HUAL-1	2.00	0.26	2.52	0.66	25.00	
H2	0.70	0.76	2.73	2.07	12.00	
Q = CP3	2.20	0.68	4.09	2.78	16.00	
H3	1.20	0.69	3.12	2.15	15.50	
Q = CP4	3.25	0.63	4.61	2.90	18.50	

Temporary Ditch Section Summary

Section ID	Q ₁₀₀ (cfs)	Channel Slope (%)	Slope - Left Side (H:V)	Slope - Right Side (H:V)	Bottom Width (ft)	Depth (ft)	Velocity (fps)
TD1	34	2.63	3	3	11	0.60	4.44
TD2	34	0.62	3	3	0	1.90	3.12
TD3	34	1.39	3	3	0	1.64	4.23
TD4	3	5.85	2	2	3	0.18	4.85
TD5	23	10.21	3	3	19	0.25	4.61
TD6	16	4.61	20	20	0	0.40	4.97
TD7	1	1.00	2	2	0	0.46	2.36
TD8	1	1.00	2	2	0	0.46	2.36
TD9	3	1.30	2	2	0	0.66	3.42
TD10	3	1.42	2	2	0	0.65	3.54

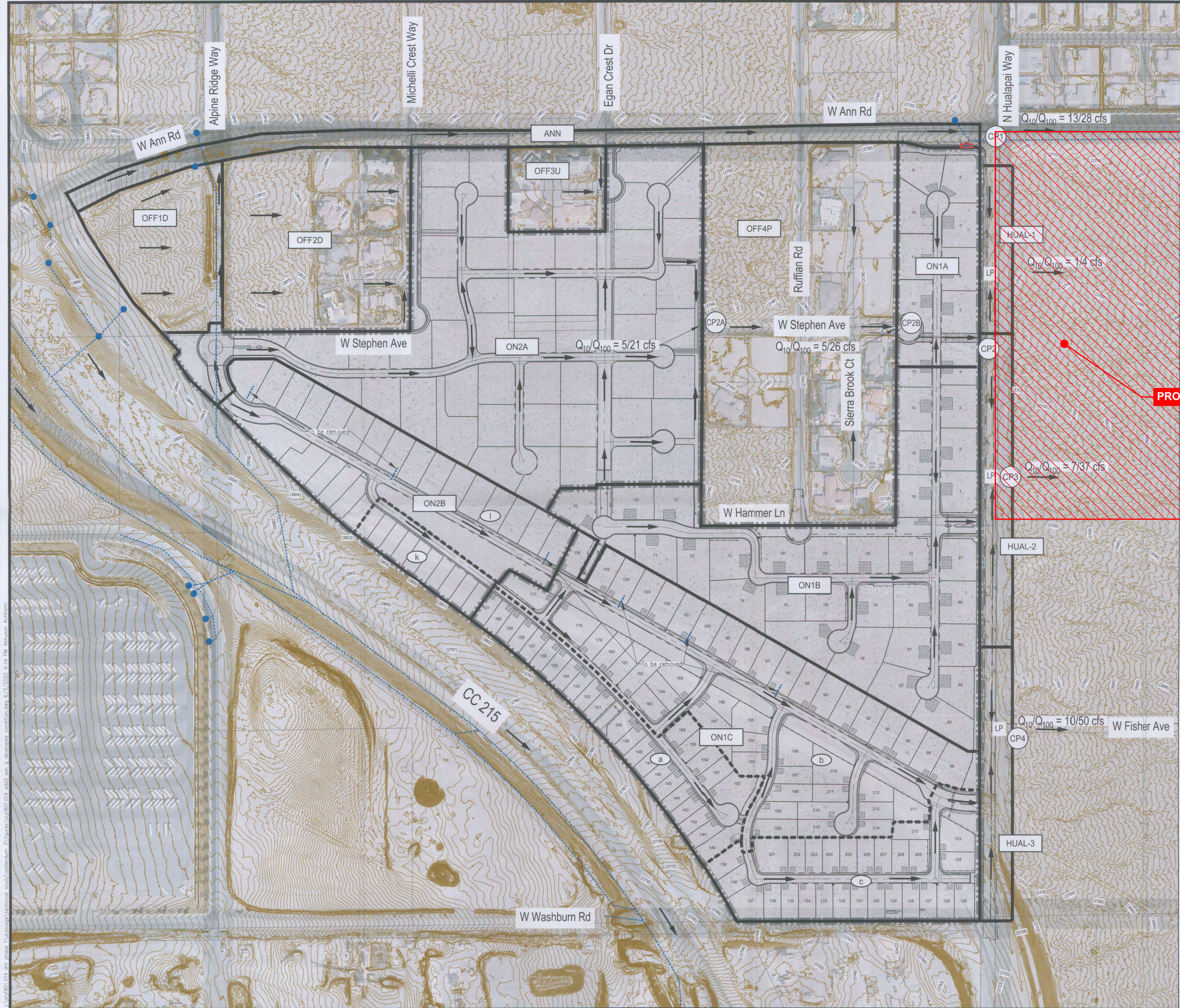
Drainage Easement Hydraulic Summary

Section ID	Q ₁₀₀ (cfs)	Width (ft)	Type of Analysis	Depth (ft)	Velocity (fps)
E1	59	20	Normal Depth	0.40	10.64
E2	64	30	Weir	1.05	N/A
E3	66	30	Normal Depth	0.63	8.89
E4	66	30	Weir	0.79	N/A
E5	66	30	Normal Depth	0.62	9.38
E6	66	30	Weir	0.80	N/A
E7	11	21	Normal Depth	0.20	5.68
E8	11	21	Weir	0.31	N/A

Transverse Flow Section Summary

Section ID	Q ₁₀₀ (cfs)	Slope (%)	Depth (ft)	Velocity (fps)	DxV
TR1	4	0.50	0.12	1.01	0.1
TR2	75	0.50	0.37	2.47	0.9
TR3	58	0.68	0.31	2.52	0.8

I:\OLY1801.014.dwg phase 1\drainage\technical study\addendum 3\figures\oly1801.014_add3_enh.g developed condition.dwg 6/3/2020 4:14 PM Abhishek Achomti



LEGEND

- BASIN BOUNDARY
- PHASE BOUNDARY
- EXISTING FACILITY
- SUBBASIN BOUNDARY
- PROPOSED DRAINAGE FACILITY
- ID BASIN ID
- ID SUBBASIN ID
- ID CONCENTRATION POINT ID
- FLOW DIRECTION

Developed Condition Flow Rate Summary

Basin/Concentration Point ID	Area (ac)	Q ₁₀₀ (cfs)	Q ₁₀ (cfs)
OFF1D	4.7	13	5
OFF2D	9.2	17	5
OFF3U	2.2	<1	<1
OFF4P	20.1	6	<1
ON2A	28.2	7	<1
ON2B	10.3	10	2
ON1A	4.9	1	<1
ON1B	18.1	5	<1
ON1C	27.5	36	8
HUAL-1	1.5	4	1
HUAL-2	3.0	7	2
HUAL-3	2.2	6	2
CP1	4.5	15	8
Q = OFF1D + ANN	N/A	28	13
CP2A	N/A	21	5
Q = OFF2D + OFF3U + ON2A	N/A	26	5
CP2B	N/A	26	5
Q = CP2A + OFF4P	N/A	27	5
CP2	N/A	27	5
Q = CP2B + ON1A	N/A	37	7
CP3	N/A	37	7
Q = CP2 + ON1B + HUAL-2	N/A	50	10
CP4	N/A	50	10
Q = ON1C + ON2B + HUAL-3	N/A	50	10

Prorated Flow Summary

Basin ID	Q ₁₀₀ (cfs)	Area (acres)	100-yr Unit Flow (cfs/acre)
ON1C	36	27.51	1.3
ON2B	10	10.28	1.0
Subbasin ID	Q ₁₀₀ (cfs)	Area (acres)	100-yr Unit Flow (cfs/acre)
ON1C(a)	7	5.20	1.3
ON1C(b)	21	15.69	1.3
ON1C(c)	9	6.62	1.3
TOTAL	36	27.51	
ON2B(k)	2	1.79	1.0
ON2B(l)	8	8.49	1.0
TOTAL	10	10.28	



SLATER HANIFAN GROUP
a Westwood team
5740 S. ARVILLE STREET #216, LAS VEGAS, NV 89118
PHONE (702) 284-5300 FAX (702) 284-5399

UPGROWTH NV PARTNERS, LLC

ANN & 215 PHASE 1

DEVELOPED CONDITION DRAINAGE MAP

DATE: JUNE 2020

DRAFTER: AA

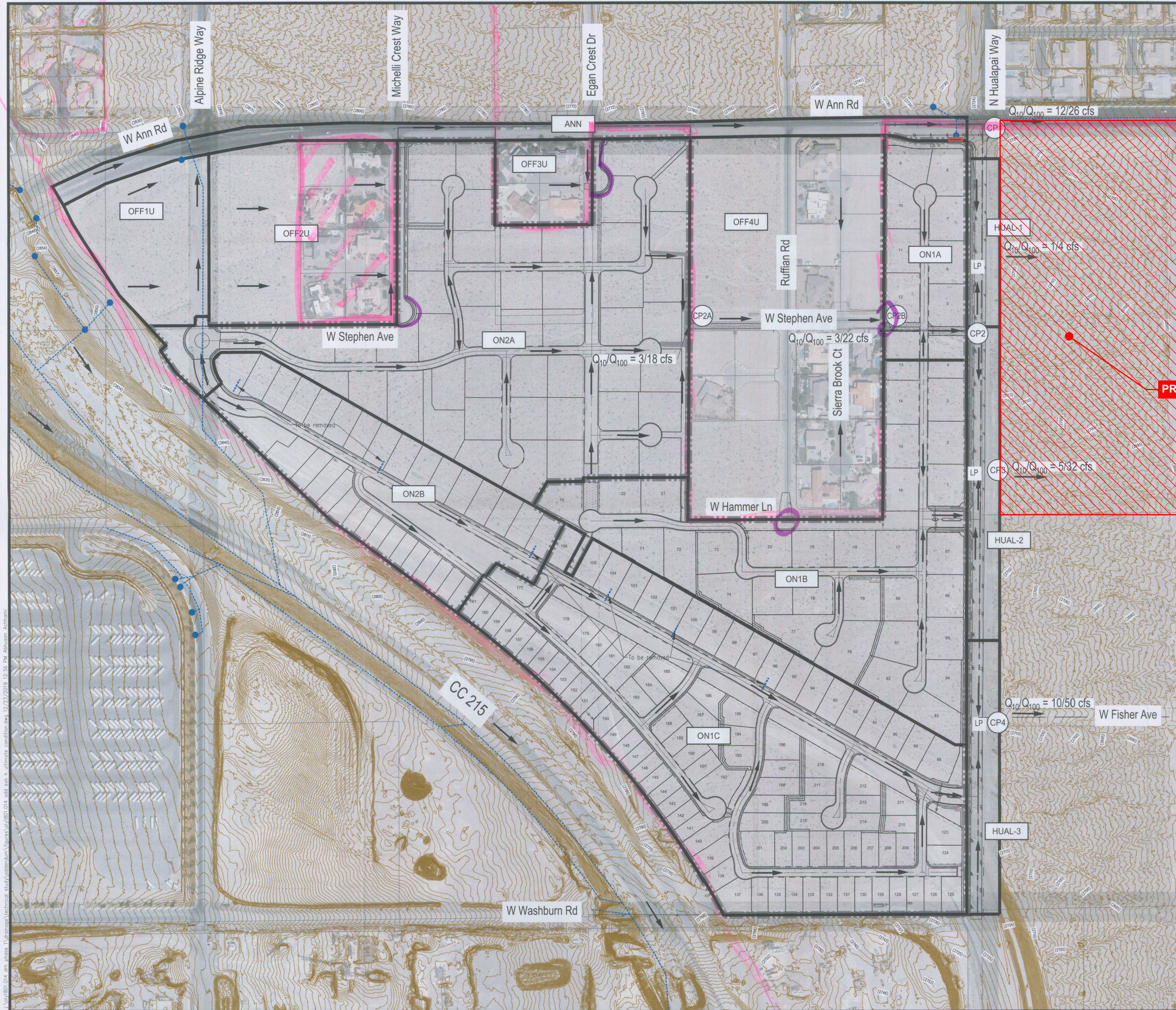
DESIGNER: AA

CHECKED: KC

PROJECT NO.
OLY1801.014

EXHIBIT G
SHEET 1 OF 1

ADD MAP 3 PW 20-11051



LEGEND

- BASIN BOUNDARY
- PHASE BOUNDARY
- EXISTING FACILITY
- PROPOSED DRAINAGE FACILITY
- ID BASIN ID
- ID CONCENTRATION POINT ID
- FLOW DIRECTION

Ultimate Condition Flow Rate Summary

Basin/Concentration Point ID	Area (ac)	Q ₁₀₀ (cfs)	Q ₁₀ (cfs)
OFF1U	4.7	11	4
OFF2U	9.2	17	5
OFF3U	2.2	<1	<1
OFF4U	20.1	4	<1
ON2A	28.2	7	<1
ON2B	10.3	10	2
ON1A	4.9	1	<1
ON1B	18.1	5	<1
ON1C	27.5	36	8
HUAL-1	1.5	4	1
HUAL-2	3.0	7	2
HUAL-3	2.2	6	2
ANN	4.5	15	8
1 U + ANN	N/A	26	12
Q = OFF2U + OFF3U + ON2A	N/A	18	3
Q = CP2A + OFF4U	N/A	22	3
Q = CP2B + ON1A	N/A	23	3
Q = CP2 + ON1B + HUAL-2	N/A	32	5
Q = ON1C + ON2B + HUAL-3	N/A	50	10



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UPGROWTH NV PARTNERS, LLC
ANN & 215 PHASE 1
ULTIMATE CONDITION DRAINAGE MAP

DATE: DEC 2019
DRAFTER: AA
DESIGNER: AA
CHECKED: KC
PROJECT NO.
OLY1801.014

EXHIBIT H
SHEET 1 OF 1



**SLATER
HANIFAN
GROUP**
a Westwood team

Soil Data & Curve Number Computation

Project Name & Number: Ann & 215 Phase 1, OLY1801.014

Date: 10/14/2019

By: AA

Data:

Reference:

Exhibit D
NRCS Soil Data

Soil Type - Soil Survey Area & Version, Soil Description				A	B	C	D
LV	190	Las Vegas Valley 2016	Dalian very gravelly fine sandy loam, 2 to 4 percent slopes	100%	0%	0%	0%
LV	400	Las Vegas Valley 2016	Tencee very gravelly fine sandy loam, 2 to 8 percent slopes	0%	0%	0%	100%

Note: The basins which are composed entirely of roadway utilize the 98 curve number for roadway regardless of soil type. Therefore, no curve number computations are provided for these basins. This applies to all conditions.

Land Use	A	B	C	D
Residential(8,000,sf)	73	82	88	90
Residential(14,000,sf)	57	72	81	86
Residential(20,000,sf)	54	70	80	85
Desert Shrub(poor)	63	77	85	88
Roadway	98	98	98	98
Paved Open Ditches	83	89	92	93
Newly Graded	77	86	91	94

*Commercial land use per Note 3

EXISTING CONDITION

BASIN ID	SURVEY AREA	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP PERCENTS				LAND USE CN				SUBAREA ACRES	CURVE NUMBER
					A	B	C	D	A	B	C	D		
BAS1	LV	400	100.0%	Desert Shrub (poor)	0%	0%	0%	100%	63	77	85	88	5.02	88.00
TOTAL PERCENT			100.0%	TOTAL AREA & COMPOSITE CURVE NUMBER:									5.02	88.0

BASIN ID	SURVEY AREA	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP PERCENTS				LAND USE CN				SUBAREA ACRES	CURVE NUMBER
					A	B	C	D	A	B	C	D		
BAS2	LV	190	88.4%	Desert Shrub (poor)	100%	0%	0%	0%	63	77	85	88	8.93	55.70
	LV	400	11.6%	Desert Shrub (poor)	0%	0%	0%	100%	63	77	85	88	1.17	10.19
TOTAL PERCENT			100.0%	TOTAL AREA & COMPOSITE CURVE NUMBER:									10.10	65.9

BASIN ID	SURVEY AREA	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP PERCENTS				LAND USE CN				SUBAREA ACRES	CURVE NUMBER
					A	B	C	D	A	B	C	D		
BAS3	LV	190	100.0%	Desert Shrub (poor)	100%	0%	0%	0%	63	77	85	88	3.31	63.00
TOTAL PERCENT			100.0%	TOTAL AREA & COMPOSITE CURVE NUMBER:									3.31	63.0

BASIN ID	SURVEY AREA	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP PERCENTS				LAND USE CN				SUBAREA ACRES	CURVE NUMBER
					A	B	C	D	A	B	C	D		
BAS4	LV	190	100.0%	Desert Shrub (poor)	100%	0%	0%	0%	63	77	85	88	17.13	63.00
TOTAL PERCENT			100.0%	TOTAL AREA & COMPOSITE CURVE NUMBER:									17.13	63.0

BASIN ID	SURVEY AREA	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP PERCENTS				LAND USE CN				SUBAREA ACRES	CURVE NUMBER
					A	B	C	D	A	B	C	D		
BAS5	LV	190	100.0%	Desert Shrub (poor)	100%	0%	0%	0%	63	77	85	88	16.19	63.00
TOTAL PERCENT			100.0%	TOTAL AREA & COMPOSITE CURVE NUMBER:									16.19	63.0

BASIN ID	SURVEY AREA	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP PERCENTS				LAND USE CN				SUBAREA ACRES	CURVE NUMBER
					A	B	C	D	A	B	C	D		
BAS6	LV	190	100.0%	Desert Shrub (poor)	100%	0%	0%	0%	63	77	85	88	2.34	63.00
TOTAL PERCENT			100.0%	TOTAL AREA & COMPOSITE CURVE NUMBER:									2.34	63.0

BASIN ID	SURVEY AREA	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP PERCENTS				LAND USE CN				SUBAREA ACRES	CURVE NUMBER
					A	B	C	D	A	B	C	D		
BAS7	LV	190	24.4%	Residential(20,000,sf)	100%	0%	0%	0%	54	70	80	85	17.59	13.19
	LV	400	3.3%	Residential(20,000,sf)	0%	0%	0%	100%	54	70	80	85	2.41	2.85
	LV	190	61.6%	Desert Shrub (poor)	100%	0%	0%	0%	63	77	85	88	44.31	38.78
	LV	400	10.7%	Desert Shrub (poor)	0%	0%	0%	100%	63	77	85	88	7.68	9.39
TOTAL PERCENT			100.0%	TOTAL AREA & COMPOSITE CURVE NUMBER:									71.99	64.2

BASIN ID	SURVEY AREA	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP PERCENTS				LAND USE CN				SUBAREA ACRES	CURVE NUMBER
					A	B	C	D	A	B	C	D		
BAS8	LV	190	100.0%	Desert Shrub (poor)	100%	0%	0%	0%	63	77	85	88	5.72	63.00
TOTAL PERCENT			100.0%	TOTAL AREA & COMPOSITE CURVE NUMBER:									5.72	63.0

BASIN ID	SURVEY AREA	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP PERCENTS				LAND USE CN				SUBAREA ACRES	CURVE NUMBER
					A	B	C	D	A	B	C	D		
ANN	LV	190	100.0%	Roadway	100%	0%	0%	0%	98	98	98	98	4.47	98.00
TOTAL PERCENT			100.0%	TOTAL AREA & COMPOSITE CURVE NUMBER:										4.47 98.0

PROPOSED CONDITION

BASIN ID	SURVEY AREA	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP PERCENTS				LAND USE CN				SUBAREA ACRES	CURVE NUMBER
					A	B	C	D	A	B	C	D		
OFF1P	LV	400	100.0%	Desert Shrub (poor)	0%	0%	0%	100%	63	77	85	88	4.79	88.00
TOTAL PERCENT			100.0%	TOTAL AREA & COMPOSITE CURVE NUMBER:										4.79 88.0

BASIN ID	SURVEY AREA	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP PERCENTS				LAND USE CN				SUBAREA ACRES	CURVE NUMBER
					A	B	C	D	A	B	C	D		
OFF2P	LV	190	10.9%	Desert Shrub (poor)	100%	0%	0%	0%	63	77	85	88	0.99	6.84
	LV	400	39.9%	Desert Shrub (poor)	0%	0%	0%	100%	63	77	85	88	3.64	35.12
	LV	190	21.1%	Residential (20,000 sf)	100%	0%	0%	0%	54	70	80	85	1.92	11.37
	LV	400	28.2%	Residential (20,000 sf)	0%	0%	0%	100%	54	70	80	85	2.57	23.95
TOTAL PERCENT			100.0%	TOTAL AREA & COMPOSITE CURVE NUMBER:										9.12 77.3

BASIN ID	SURVEY AREA	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP PERCENTS				LAND USE CN				SUBAREA ACRES	CURVE NUMBER
					A	B	C	D	A	B	C	D		
OFF3U	LV	190	100.0%	Residential (20,000 sf)	100%	0%	0%	0%	54	70	80	85	2.21	54.00
TOTAL PERCENT			100.0%	TOTAL AREA & COMPOSITE CURVE NUMBER:										2.21 54.0

BASIN ID	SURVEY AREA	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP PERCENTS				LAND USE CN				SUBAREA ACRES	CURVE NUMBER
					A	B	C	D	A	B	C	D		
ON2AP	LV	190	93.2%	Newly Graded	100%	0%	0%	0%	77	86	91	94	25.75	71.73
	LV	400	6.8%	Newly Graded	0%	0%	0%	100%	77	86	91	94	1.89	6.43
TOTAL PERCENT			100.0%	TOTAL AREA & COMPOSITE CURVE NUMBER:										27.64 78.2

BASIN ID	SURVEY AREA	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP PERCENTS				LAND USE CN				SUBAREA ACRES	CURVE NUMBER
					A	B	C	D	A	B	C	D		
ON2BP	LV	190	85.9%	Newly Graded	100%	0%	0%	0%	77	86	91	94	8.83	66.14
	LV	400	14.1%	Newly Graded	0%	0%	0%	100%	77	86	91	94	1.45	13.26
TOTAL PERCENT			100.0%	TOTAL AREA & COMPOSITE CURVE NUMBER:										10.28 79.4

BASIN ID	SURVEY AREA	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP PERCENTS				LAND USE CN				SUBAREA ACRES	CURVE NUMBER
					A	B	C	D	A	B	C	D		
OFF4P	LV	190	34.4%	Desert Shrub (poor)	100%	0%	0%	0%	63	77	85	88	6.91	21.67
	LV	190	65.6%	Residential (20,000 sf)	100%	0%	0%	0%	54	70	80	85	13.18	35.43
TOTAL PERCENT			100.0%	TOTAL AREA & COMPOSITE CURVE NUMBER:										20.09 57.1

BASIN ID	SURVEY AREA	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP PERCENTS				LAND USE CN				SUBAREA ACRES	CURVE NUMBER
					A	B	C	D	A	B	C	D		
ON1A	LV	190	100.0%	Residential (14,000 sf)	100%	0%	0%	0%	57	72	81	86	4.91	57.00
TOTAL PERCENT			100.0%	TOTAL AREA & COMPOSITE CURVE NUMBER:										4.91 57.0

BASIN ID	SURVEY AREA	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP PERCENTS				LAND USE CN				SUBAREA ACRES	CURVE NUMBER
					A	B	C	D	A	B	C	D		
ON1B	LV	190	100.0%	Residential (14,000 sf)	100%	0%	0%	0%	57	72	81	86	18.08	57.00
TOTAL PERCENT			100.0%	TOTAL AREA & COMPOSITE CURVE NUMBER:										18.08 57.0

BASIN ID	SURVEY AREA	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP PERCENTS				LAND USE CN				SUBAREA ACRES	CURVE NUMBER
					A	B	C	D	A	B	C	D		
ON1C	LV	190	77.1%	Residential (6,000 sf)	100%	0%	0%	0%	80	87	90	92	21.21	61.68
	LV	190	22.9%	Residential (14,000 sf)	100%	0%	0%	0%	57	72	81	86	6.30	13.05
TOTAL PERCENT			100.0%	TOTAL AREA & COMPOSITE CURVE NUMBER:										27.51 74.7

BASIN ID	SURVEY AREA	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP PERCENTS				LAND USE CN				SUBAREA ACRES	CURVE NUMBER
					A	B	C	D	A	B	C	D		
HUAL-12	LV	190	100.0%	Paved Open Ditches	100%	0%	0%	0%	83	89	92	93	1.48	83.00
TOTAL PERCENT			100.0%	TOTAL AREA & COMPOSITE CURVE NUMBER:										1.48 83.0

BASIN ID	SURVEY AREA	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP PERCENTS				LAND USE CN				SUBAREA ACRES	CURVE NUMBER
					A	B	C	D	A	B	C	D		
HUAL-2	LV	190	100.0%	Paved Open Ditches	100%	0%	0%	0%	83	89	92	93	3.01	83.00
TOTAL PERCENT			100.0%	TOTAL AREA & COMPOSITE CURVE NUMBER:									3.01	83.0

BASIN ID	SURVEY AREA	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP PERCENTS				LAND USE CN				SUBAREA ACRES	CURVE NUMBER
					A	B	C	D	A	B	C	D		
HUAL-3	LV	190	100.0%	Paved Open Ditches	100%	0%	0%	0%	83	89	92	93	2.19	83.00
TOTAL PERCENT			100.0%	TOTAL AREA & COMPOSITE CURVE NUMBER:									2.19	83.0

DEVELOPED CONDITION

BASIN ID	SURVEY AREA	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP PERCENTS				LAND USE CN				SUBAREA ACRES	CURVE NUMBER
					A	B	C	D	A	B	C	D		
OFF1D	LV	400	87.1%	Desert Shrub (poor)	0%	0%	0%	100%	63	77	85	88	4.06	76.67
	LV	400	12.9%	Paved Open Ditches	0%	0%	0%	100%	83	89	92	93	0.60	11.97
TOTAL PERCENT			100.0%	TOTAL AREA & COMPOSITE CURVE NUMBER:									4.66	88.6

BASIN ID	SURVEY AREA	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP PERCENTS				LAND USE CN				SUBAREA ACRES	CURVE NUMBER
					A	B	C	D	A	B	C	D		
OFF2D	LV	190	12.1%	Desert Shrub (poor)	100%	0%	0%	0%	63	77	85	88	1.10	7.60
	LV	400	39.9%	Desert Shrub (poor)	0%	0%	0%	100%	63	77	85	88	3.64	35.12
	LV	190	21.1%	Residential (20,000'sf)	100%	0%	0%	0%	54	70	80	85	1.92	11.37
	LV	400	28.2%	Residential (20,000'sf)	0%	0%	0%	100%	54	70	80	85	2.57	23.95
TOTAL PERCENT			101.2%	TOTAL AREA & COMPOSITE CURVE NUMBER:									9.23	78.0

BASIN ID	SURVEY AREA	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP PERCENTS				LAND USE CN				SUBAREA ACRES	CURVE NUMBER
					A	B	C	D	A	B	C	D		
ON2A	LV	190	91.3%	Residential (20,000'sf)	100%	0%	0%	0%	54	70	80	85	25.75	49.31
	LV	400	8.7%	Residential (20,000'sf)	0%	0%	0%	100%	54	70	80	85	2.45	7.38
TOTAL PERCENT			100.0%	TOTAL AREA & COMPOSITE CURVE NUMBER:									28.20	56.7

BASIN ID	SURVEY AREA	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP PERCENTS				LAND USE CN				SUBAREA ACRES	CURVE NUMBER
					A	B	C	D	A	B	C	D		
ON2B	LV	190	42.9%	Residential (6,000'sf)	100%	0%	0%	0%	80	87	90	92	4.42	34.36
	LV	190	42.9%	Residential (14,000'sf)	100%	0%	0%	0%	57	72	81	86	4.42	24.48
	LV	400	14.1%	Residential (20,000'sf)	0%	0%	0%	100%	54	70	80	85	1.45	11.99
TOTAL PERCENT			100.0%	TOTAL AREA & COMPOSITE CURVE NUMBER:									10.28	70.8

ULTIMATE CONDITION

BASIN ID	SURVEY AREA	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP PERCENTS				LAND USE CN				SUBAREA ACRES	CURVE NUMBER
					A	B	C	D	A	B	C	D		
OFF1U	LV	400	87.1%	Residential (20,000'sf)	0%	0%	0%	100%	54	70	80	85	4.06	74.06
	LV	400	12.9%	Roadway	0%	0%	0%	100%	98	98	98	98	0.60	12.62
TOTAL PERCENT			100.0%	TOTAL AREA & COMPOSITE CURVE NUMBER:									4.66	86.7

BASIN ID	SURVEY AREA	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP PERCENTS				LAND USE CN				SUBAREA ACRES	CURVE NUMBER
					A	B	C	D	A	B	C	D		
OFF2U	LV	190	32.7%	Residential (20,000'sf)	100%	0%	0%	0%	54	70	80	85	3.02	17.67
	LV	400	67.3%	Residential (20,000'sf)	0%	0%	0%	100%	54	70	80	85	6.21	57.19
TOTAL PERCENT			100.0%	TOTAL AREA & COMPOSITE CURVE NUMBER:									9.23	74.9

BASIN ID	SURVEY AREA	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP PERCENTS				LAND USE CN				SUBAREA ACRES	CURVE NUMBER
					A	B	C	D	A	B	C	D		
OFF4U	LV	190	100.0%	Residential (20,000'sf)	100%	0%	0%	0%	54	70	80	85	20.09	54.00
TOTAL PERCENT			100.0%	TOTAL AREA & COMPOSITE CURVE NUMBER:									20.09	54.0

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**SLATER
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GROUP**

a **Westwood** team

Rainfall and Precipitation Computation

Project Name: ANN & 215 PHASE 1

Date: 10/17/2019

File Name: OLY1801.014 TDS Precipitation Calcs.xls

By: AA

Data:

Project is located in: Township: 19 S. Range: 59 E. Section: 36

Reference:

APN Map

Site is NOT located in the McCarran Airport Rainfall Area

Figure 513*

Rainfall Depth-Duration-Frequency 10-Year, 6-Hour: 1.40 inches

Figure 503*

Rainfall Depth-Duration-Frequency 100-Year, 6-Hour: 2.20 inches

Figure 506*

Precipitation Adjustment Ratios:

10-Year: 1.24

Table 501*

100-Year: 1.43

Table 501*

Six Hour Depth Area Reduction Factors (DARF):

Area (gross acres): 88.5 = 0.1383 square miles

Table 502*

DARF = 1.00

Calculations:

$P_{10} = 1.74$ 10-Year Precipitation (in)

$P_{100} = 3.15$ 100-Year Precipitation (in)

$P_{10}/P_{100} = 0.55$ HEC-1 Multiple Ratio Value

Equations:

$$P = (\text{Rainfall}) * (\text{Precipitation Adjustment Ratio}) * (\text{Depth Area Reduction Factor})$$

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

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HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

TIME OF CONCENTRATION

Project Name & Number: Ann & 215 Phase 1, OLY1801.014

Description: Existing, Proposed, Developed, and Ultimate Condition

By: AA

Date: 10/14/2019

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																	
BAS1	E	88.0	0.772	5.02	0.0078	400	6.0	6.51	600	2.0	2.09	4.16	4.38	10.89			0.109
BAS2	E	65.9	0.480	10.10	0.0158	275	7.0	9.68	3310	4.0	2.96	5.88	10.78	20.46			0.205
BAS3	E	63.0	0.442	3.31	0.0052	140	8.0	7.01	1445	9.0	4.44	8.82	3.66	10.67			0.107
BAS4	E	63.0	0.442	17.13	0.0268	400	6.0	13.04	1560	4.0	2.96	5.88	5.82	18.86			0.189
BAS5	E	63.0	0.442	16.19	0.0253	380	8.0	11.55	1535	5.0	3.31	6.57	5.14	16.69			0.167
BAS6	E	63.0	0.442	2.34	0.0037	100	15.0	4.81	545	5.0	3.31	6.57	2.63	7.44			0.100
BAS7	E	64.2	0.457	71.99	0.1125	470	5.0	14.66	3055	5.0	3.31	6.57	9.00	23.66			0.237
BAS8	E	63.0	0.442	5.72	0.0089	230	6.0	9.89	460	4.0	2.96	5.88	2.59	12.48			0.125
ANN	D	98.0	0.904	4.47	0.0070	50	2.0	1.98	3295	4.0	4.04	6.12	9.67	11.66	3345	28.583	0.117
PROPOSED CONDITION																	
OFF1P	E	88.0	0.772	4.79	0.0075	400	6.0	6.51	585	2.0	2.09	4.16	4.32	10.83			0.108
OFF2P	E	77.3	0.630	9.12	0.0143	250	7.0	6.99	775	4.0	2.96	5.88	3.59	10.58			0.106
OFF3U	D	54.0	0.323	2.21	0.0035	160	1.0	17.70	290	2.0	2.86	4.33	1.69	19.39	450	12.500	0.125
ON2AP	D	78.2	0.642	27.64	0.0432	210	1.0	11.94	2000	4.0	4.04	6.12	6.15	18.09	2210	22.278	0.181
ON2BP	D	79.4	0.658	10.28	0.0161	195	1.0	11.11	1300	3.0	3.50	5.30	4.90	16.01	1495	18.306	0.160
OFF4P	E	57.1	0.364	20.09	0.0314	135	3.0	10.68	665	2.0	2.09	4.16	4.64	15.32			0.153
ON1A	D	57.0	0.362	4.91	0.0077	205	1.0	19.01	610	2.0	2.86	4.33	3.34	22.35	815	14.528	0.145
ON1B	D	57.0	0.362	18.08	0.0283	195	1.0	18.54	1620	4.0	4.04	6.12	5.11	23.65	1815	20.083	0.201
ON1C	D	74.7	0.596	27.51	0.0430	150	1.0	11.11	2105	4.0	4.04	6.12	6.43	17.54	2255	22.528	0.175
HUAL-1	D	83.0	0.706	1.48	0.0023	40	2.0	3.56	365	3.0	3.50	5.30	1.74	5.30	405	12.250	0.053
HUAL-2	D	83.0	0.706	3.01	0.0047	40	2.0	3.56	655	1.0	2.02	3.06	4.97	8.53	695	13.861	0.085
HUAL-3	D	83.0	0.706	2.19	0.0034	40	2.0	3.56	550	2.0	2.86	4.33	3.11	6.67	590	13.278	0.067
DEVELOPED CONDITION																	
OFF1D	D	88.6	0.780	4.66	0.0073	400	6.00	6.35	550	2.00	2.86	4.33	3.11	9.46	950	15.278	0.095
OFF2D	D	78.0	0.640	9.23	0.0144	250	7.00	6.85	775	4.0	4.04	6.12	2.81	9.66	1025	15.694	0.097
ON2A	D	56.7	0.358	28.20	0.0441	210	1.00	19.34	2000	4.00	4.04	6.12	6.15	25.49	2210	22.278	0.223
ON2B	D	70.8	0.545	10.28	0.0161	195	1.00	13.96	1300	3.00	3.50	5.30	4.90	18.86	1495	18.306	0.183

ULTIMATE CONDITION																		
OFF1U	D	86.7	0.754	4.66	0.0073	375	1.00	12:05	545	2.00	2:86	4:33	3:09	15:14	920	15:11	0:15	
OFF2U	D	74.9	0.599	9.23	0.0144	160	1.00	11:41	805	4.00	4:04	6:12	2:89	14:31	965	15:36	0:14	
OFF4U	D	54.0	0.323	20.09	0.0314	155	1.00	17:42	960	2.00	2:86	4:33	4:69	22:11	1:15	16:19	0:16	
[1]	K = 0.0132 (CN) - 0.39					[5]	For Existing Conditions: $V2 = 29.4 * (S/100)^{0.5}$					[9]	$Tc = (L/180) + 10$					
[2]	A = Area/640						For Developed Conditions: $V2 = 30.6 * (S/100)^{0.5}$					[10]	$Tlag = (0.6 * Tc)/60$					
[3]	$Ti = (1.8 (1.1-K) L^{0.5})/S^{0.33}$					[6]	$Tt = L/(60 * V)$					[11]	Min Tlag = 0.05					
[4]	For Existing Conditions: $V1 = 14.8 * (S/100)^{0.5}$					[7]	$Tc = Ti + Tt$					Note: For Travel Time Calcs: V1 applies to first 500 feet and V2 applies to remaining distance.						
	For Developed Conditions: $V1 = 20.2 * (S/100)^{0.5}$					[8]	Total L = Initial L + Travel L											
REFERENCE :														STANDARD FORM 4				

Proposed Condition HEC-1 Model


```

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
*   JUN 1998
*   VERSION 4.1
*
* RUN DATE 14OCT19 TIME 14:51:39
*
*****

```

pro.out

```

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

```

```

X X XXXXXX XXXX X
X X X X X XX
X X X X X X
XXXXXX XXXX X XXXXX X
X X X X X X
X X X X X X
X X XXXXXX XXXX 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 -AMSK- 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

*** FREE ***

```

*DIAGRAM
1 ID SLATER HANIFAN GROUP, A WESTWOOD TEAM
2 ID ANN AND 215, PHASE 1
3 ID TECHNICAL DRAINAGE STUDY
4 ID OCTOBER 2019
5 ID PROPOSED DRAINAGE CONDITION
6 ID
7 ID RETURN PERIOD ----- 100-YR AND 10-YR
8 ID DISTRIBUTION ----- 6-HOUR SDN3
9 ID PROJECT NO. ----- OLY1001.014
10 ID FILENAME ----- PRO.H1
11 ID DATE ----- 10/11
12 ID MODELED BY ----- AA
13 ID
14 ID PRECIPITATION STORM EVENT RATIOS
15 ID STORM EVENT RATIO
16 ID 100-YR 1.00
17 ID 10-YR 0.55
18 ID
19 IT 5 0 0 300
20 IO 5 0 0
21 IN 5 0 0
22 JR PREC 1.00 .55
*
23 KK ANN
24 BA 0.0070
25 PC 0 0.020 0.057 0.070 0.087 0.108 0.124 0.130 0.130 0.130
26 PC 0.130 0.130 0.130 0.133 0.140 0.142 0.148 0.158 0.172 0.181
27 PC 0.190 0.197 0.199 0.200 0.201 0.204 0.214 0.229 0.241 0.249
28 PC 0.251 0.256 0.270 0.278 0.281 0.283 0.295 0.322 0.352 0.409
29 PC 0.499 0.590 0.710 0.744 0.781 0.812 0.819 0.835 0.851 0.856
30 PC 0.860 0.868 0.876 0.888 0.910 0.926 0.937 0.950 0.970 0.976
31 PC 0.982 0.985 0.987 0.989 0.990 0.993 0.993 0.994 0.995 0.998
32 PC 0.998 0.999 1
33 PB 3.15
34 LS 0 98.0
35 UD 0.120
*
36 KK OFF1P
37 BA 0.0075
38 LS 0 88.0
39 UD 0.108
*
40 KK CP1
41 HC 2
*

```

1 HEC-1 INPUT PAGE 2

pro.out

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

42 KK ON2AP
43 BA 0.0432
44 LS 0 78.2
45 UD 0.181
*

46 KK OFF3U
47 BA 0.0035
48 LS 0 54.0
49 UD 0.125
*

50 KK OFF2P
51 BA 0.0143
52 LS 0 77.3
53 UD 0.106
*

54 KK CP2A
55 HC 3
*

56 KK OFF4P
57 BA 0.0314
58 LS 0 57.1
59 UD 0.153
*

60 KK CP2B
61 HC 2
*

62 KK ON1A
63 BA 0.0077
64 LS 0 57.0
65 UD 0.145
*

66 KK CP2
67 HC 2
*

68 KK ON1B
69 BA 0.0283
70 LS 0 57.0
71 UD 0.201
*

72 KK HUAL-2
73 BA 0.0047
74 LS 0 83.0
75 UD 0.085
*

1

HEC-1 INPUT

PAGE 3

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

76 KK CP3
77 HC 3
*

78 KK HUAL-3
79 BA 0.0034
80 LS 0 83.0
81 UD 0.067
*

82 KK ON1C
83 BA 0.0430
84 LS 0 74.7
85 UD 0.175
*

86 KK ON2BP
87 BA 0.0161
88 LS 0 79.4
89 UD 0.160
*

90 KK CP4
91 HC 3
*

92 KK HUAL-1

pro.out

93 BA 0.0023
94 LS 0 83.0
95 UD 0.053
*
96 ZZ

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

23 ANN
.
.
36 . OFF1P
.
40 CP1.....

42 .
ON2AP
.
46 . OFF3U
.
50 . OFF2P
.
54 CP2A.....
.
56 . OFF4P
.
60 CP2B.....
.
62 . ON1A
.
66 CP2.....
.
68 . ON1B
.
72 . HUAL-2
.
76 CP3.....

78 .
HUAL-3
.
82 . ON1C
.
86 . ON2BP
.
90 CP4.....
.
92 . HUAL-1

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* JUN 1998 *
* VERSION 4.1 *
*
* RUN DATE 14OCT19 TIME 14:51:39 *
*

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

SLATER HANIFAN GROUP, A WESTWOOD TEAM
ANN AND 215, PHASE 1
TECHNICAL DRAINAGE STUDY
OCTOBER 2019
PROPOSED DRAINAGE CONDITION

pro.out

RETURN PERIOD ----- 100-YR AND 10-YR
DISTRIBUTION ----- 6-HOUR SDN3
PROJECT NO. ----- OLY1801.014
FILENAME ----- PRO.H1
DATE ----- 10/11
MODELED BY ----- AA

PRECIPITATION STORM EVENT RATIOS
STORM EVENT RATIO
100-YR 1.00
10-YR 0.55

20 IO OUTPUT CONTROL VARIABLES

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

IT HYDROGRAPH TIME DATA

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

COMPUTATION INTERVAL .08 HOURS
TOTAL TIME BASE 24.92 HOURS

ENGLISH UNITS

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

JP MULTI-PLAN OPTION

NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION

RATIOS OF PRECIPITATION
1.00 .55

1

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION	
				RATIO 1 1.00	RATIO 2 .55
HYDROGRAPH AT					
+	ANN	.01	1 FLOW	15.	8.
			TIME	3.50	3.58
HYDROGRAPH AT					
+	OFF1P	.01	1 FLOW	13.	5.
			TIME	3.50	3.58
2 COMBINED AT					
+	CP1	.01	1 FLOW	28.	13.
			TIME	3.50	3.58
HYDROGRAPH AT					
+	ON2AP	.04	1 FLOW	43.	11.
			TIME	3.58	3.67
HYDROGRAPH AT					
+	OFF3U	.00	1 FLOW	0.	0.
			TIME	3.75	.00
HYDROGRAPH AT					
+	OFF2P	.01	1 FLOW	16.	4.
			TIME	3.58	3.58
3 COMBINED AT					
+	CP2A	.06	1 FLOW	59.	15.
			TIME	3.58	3.58
HYDROGRAPH AT					
+	OFF4P	.03	1 FLOW	6.	0.
			TIME	3.67	4.92
2 COMBINED AT					

							pro.out
+	CP2B	.09	1	FLOW TIME	64. 3.58	15. 3.58	
HYDROGRAPH AT							
+	ON1A	.01	1	FLOW TIME	1. 3.67	0. 4.92	
2 COMBINED AT							
+	CP2	.10	1	FLOW TIME	66. 3.58	15. 3.58	
HYDROGRAPH AT							
+	ON1B	.03	1	FLOW TIME	5. 3.75	0. 5.00	
HYDROGRAPH AT							
+	HUAL-2	.00	1	FLOW TIME	7. 3.50	2. 3.50	
3 COMBINED AT							
+	CP3	.13	1	FLOW TIME	75. 3.58	17. 3.58	
HYDROGRAPH AT							
+	HUAL-3	.00	1	FLOW TIME	6. 3.50	2. 3.50	
HYDROGRAPH AT							
+	ON1C	.04	1	FLOW TIME	36. 3.58	8. 3.67	
HYDROGRAPH AT							
+	ON2BP	.02	1	FLOW TIME	18. 3.58	5. 3.58	
3 COMBINED AT							
+	CP4	.06	1	FLOW TIME	58. 3.58	14. 3.67	
HYDROGRAPH AT							
+	HUAL-1	.00	1	FLOW TIME	4. 3.50	1. 3.50	

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

Developed Condition HEC-1 Model

1*****	DEV.OUT	*****
* FLOOD HYDROGRAPH PACKAGE (HEC-1)		* U.S. ARMY CORPS OF ENGINEERS
* JUN 1998		* HYDROLOGIC ENGINEERING CENTER
* VERSION 4.1		* 609 SECOND STREET
* RUN DATE 14OCT19 TIME 14:56:19		* DAVIS, CALIFORNIA 95616
*****		* (916) 756-1104

```

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

```

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

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -AMSK- 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

*** FREE ***

```

*DIAGRAM
1 ID SLATER HANIFAN GROUP, A WESTWOOD TEAM
2 ID ANN AND 215, PHASE 1
3 ID TECHNICAL DRAINAGE STUDY
4 ID OCTOBER 2019
5 ID DEVELOPED DRAINAGE CONDITION
6 ID
7 ID RETURN PERIOD ----- 100-YR AND 10-YR
8 ID DISTRIBUTION ----- 6-HOUR SDN3
9 ID PROJECT NO. ----- OLY1801.014
10 ID FILENAME ----- DEV.H1
11 ID DATE ----- 10/11
12 ID MODELED BY ----- AA
13 ID
14 ID PRECIPITATION STORM EVENT RATIOS
15 ID STORM EVENT RATIO
16 ID 100-YR 1.00
17 ID 10-YR 0.55
18 ID
19 IT 5 0 0 300
20 IO 5 0 0
21 IN 5 0 0
22 JR PREC 1.00 .55
*
23 KK ANN
24 BA 0.0070
25 PC 0 0.020 0.057 0.070 0.087 0.108 0.124 0.130 0.130 0.130
26 PC 0.130 0.130 0.130 0.133 0.140 0.142 0.148 0.158 0.172 0.181
27 PC 0.190 0.197 0.199 0.200 0.201 0.204 0.214 0.229 0.241 0.249
28 PC 0.251 0.256 0.270 0.278 0.281 0.283 0.295 0.322 0.352 0.409
29 PC 0.499 0.590 0.710 0.744 0.781 0.812 0.819 0.835 0.851 0.856
30 PC 0.860 0.868 0.876 0.888 0.910 0.926 0.937 0.950 0.970 0.976
31 PC 0.982 0.985 0.987 0.989 0.990 0.993 0.993 0.994 0.995 0.998
32 PC 0.998 0.999 1
33 PB 3.15
34 LS 0 98.0
35 UD 0.120
*
36 KK OFF1D
37 BA 0.0073
38 LS 0 88.6
39 UD 0.095
*
40 KK CP1
41 HC 2
*

```

1 HEC-1 INPUT PAGE 2

DEV.OUT

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

42 KK ON2A
43 BA 0.0441
44 LS 0 56.7
45 UD 0.223
*

46 KK OFF3U
47 BA 0.0035
48 LS 0 54.0
49 UD 0.125
*

50 KK OFF2D
51 BA 0.0144
52 LS 0 78.0
53 UD 0.097
*

54 KK CP2A
55 HC 3
*

56 KK OFF4P
57 BA 0.0314
58 LS 0 57.1
59 UD 0.153
*

60 KK CP2B
61 HC 2
*

62 KK ON1A
63 BA 0.0077
64 LS 0 57.0
65 UD 0.145
*

66 KK CP2
67 HC 2
*

68 KK ON1B
69 BA 0.0283
70 LS 0 57.0
71 UD 0.201
*

72 KK HUAL-2
73 BA 0.0047
74 LS 0 83.0
75 UD 0.085
*

1

HEC-1 INPUT

PAGE 3

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

76 KK CP3
77 HC 3
*

78 KK HUAL-3
79 BA 0.0034
80 LS 0 83.0
81 UD 0.067
*

82 KK ON1C
83 BA 0.0430
84 LS 0 74.7
85 UD 0.175
*

86 KK ON2B
87 BA 0.0161
88 LS 0 70.8
89 UD 0.183
*

90 KK CP4
91 HC 3
*

92 KK HUAL-1

DEV.OUT

93 BA 0.0023
94 LS 0 83.0
95 UD 0.053
*
96 ZZ

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

23 ANN
.
36 . OFF1D
.
40 CP1.....
.
42 . ON2A
.
46 . OFF3U
.
50 . OFF2D
.
54 . CP2A.....
.
56 . OFF4P
.
60 . CP2B.....
.
62 . ON1A
.
66 . CP2.....
.
68 . ON1B
.
72 . HUAL-2
.
76 . CP3.....
.
78 . HUAL-3
.
82 . ON1C
.
86 . ON2B
.
90 . CP4.....
.
92 . HUAL-1

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* JUN 1998 *
* VERSION 4.1 *
*
* RUN DATE 14OCT19 TIME 14:56:19 *
*

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

SLATER HANIFAN GROUP, A WESTWOOD TEAM
ANN AND 215, PHASE 1
TECHNICAL DRAINAGE STUDY
OCTOBER 2019
DEVELOPED DRAINAGE CONDITION

DEV.OUT

RETURN PERIOD ----- 100-YR AND 10-YR
 DISTRIBUTION ----- 6-HOUR SDN3
 PROJECT NO. ----- OLY1801.014
 FILENAME ----- DEV.H1
 DATE ----- 10/11
 MODELED BY ----- AA

PRECIPITATION STORM EVENT RATIOS
 STORM EVENT RATIO
 100-YR 1.00
 10-YR 0.55

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

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

 COMPUTATION INTERVAL .08 HOURS
 TOTAL TIME BASE 24.92 HOURS

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

 JP MULTI-PLAN OPTION
 NPLAN 1 NUMBER OF PLANS

 JR MULTI-RATIO OPTION
 RATIOS OF PRECIPITATION
 1.00 .55

1

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION	
				RATIO 1 1.00	RATIO 2 .55
HYDROGRAPH AT					
+	ANN	.01	1 FLOW TIME	15. 3.50	8. 3.58
HYDROGRAPH AT					
+	OFF1D	.01	1 FLOW TIME	13. 3.50	5. 3.50
2 COMBINED AT					
+	CP1	.01	1 FLOW TIME	28. 3.50	13. 3.50
HYDROGRAPH AT					
+	ON2A	.04	1 FLOW TIME	7. 3.75	0. 5.00
HYDROGRAPH AT					
+	OFF3U	.00	1 FLOW TIME	0. 3.75	0. .00
HYDROGRAPH AT					
+	OFF2D	.01	1 FLOW TIME	17. 3.50	5. 3.58
3 COMBINED AT					
+	CP2A	.06	1 FLOW TIME	21. 3.58	5. 3.58
HYDROGRAPH AT					
+	OFF4P	.03	1 FLOW TIME	6. 3.67	0. 4.92
2 COMBINED AT					

							DEV.OUT
+	CP2B	.09	1	FLOW TIME	26. 3.58	5. 3.58	
HYDROGRAPH AT							
+	ON1A	.01	1	FLOW TIME	1. 3.67	0. 4.92	
2 COMBINED AT							
+	CP2	.10	1	FLOW TIME	27. 3.58	5. 3.58	
HYDROGRAPH AT							
+	ON1B	.03	1	FLOW TIME	5. 3.75	0. 5.00	
HYDROGRAPH AT							
+	HUAL-2	.00	1	FLOW TIME	7. 3.50	2. 3.50	
3 COMBINED AT							
+	CP3	.13	1	FLOW TIME	37. 3.58	7. 3.58	
HYDROGRAPH AT							
+	HUAL-3	.00	1	FLOW TIME	6. 3.50	2. 3.50	
HYDROGRAPH AT							
+	ON1C	.04	1	FLOW TIME	36. 3.58	8. 3.67	
HYDROGRAPH AT							
+	ON2B	.02	1	FLOW TIME	10. 3.67	2. 3.75	
3 COMBINED AT							
+	CP4	.06	1	FLOW TIME	50. 3.58	10. 3.67	
HYDROGRAPH AT							
+	HUAL-1	.00	1	FLOW TIME	4. 3.50	1. 3.50	

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

Ultimate Condition HEC-1 Model

ult.out

```
1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JUN 1998
* VERSION 4.1
*
* RUN DATE 14OCT19 TIME 15:04:06
*
*****
```

```
*****
*
* 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 X
XXXXXX XXXX X XXXX X
X X X X X X
X X X X X X
X X XXXXXXX XXXXX XXX
```

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

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

1 HEC-1 INPUT PAGE 1

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

*** FREE ***

```
*DIAGRAM
ID SLATER HANIFAN GROUP, A WESTWOOD TEAM
ID ANN AND 215, PHASE 1
ID TECHNICAL DRAINAGE STUDY
ID OCTOBER 2019
ID ULTIMATE DRAINAGE CONDITION
ID
ID RETURN PERIOD ----- 100-YR AND 10-YR
ID DISTRIBUTION ----- 6-HOUR SDN3
ID PROJECT NO. ----- OLY1801.014
ID FILENAME ----- ULT.H1
ID DATE ----- 10/11
ID MODELED BY ----- AA
ID
ID PRECIPITATION STORM EVENT RATIOS
ID STORM EVENT RATIO
ID 100-YR 1.00
ID 10-YR 0.55
ID
IT 5 0 0 300
IO 5 0 0
IN 5 0 0
JR PREC 1.00 .55
*
23 KK ANN
24 BA 0.0070
25 PC 0 0.020 0.057 0.070 0.087 0.108 0.124 0.130 0.130 0.130
26 PC 0.130 0.130 0.130 0.133 0.140 0.142 0.148 0.158 0.172 0.181
27 PC 0.190 0.197 0.199 0.200 0.201 0.204 0.214 0.229 0.241 0.249
28 PC 0.251 0.256 0.270 0.278 0.281 0.283 0.295 0.322 0.352 0.409
29 PC 0.499 0.590 0.710 0.744 0.781 0.812 0.819 0.835 0.851 0.856
30 PC 0.860 0.868 0.876 0.888 0.910 0.926 0.937 0.950 0.970 0.976
31 PC 0.982 0.985 0.987 0.989 0.990 0.993 0.993 0.994 0.995 0.998
32 PC 0.998 0.999 1
33 PB 3.15
34 LS 0 98.0
35 UD 0.120
*
36 KK OFF1U
37 BA 0.0073
38 LS 0 86.7
39 UD 0.151
*
40 KK CP1
41 HC 2
*
```

1 HEC-1 INPUT PAGE 2

LINE	ID	1	2	3	4	5	6	7	8	9	10
42	KK	ON2A									
43	BA	0.0441									
44	LS	0	56.7								
45	UD	0.223									
	*										
46	KK	OFF3U									
47	BA	0.0035									
48	LS	0	54.0								
49	UD	0.125									
	*										
50	KK	OFF2U									
51	BA	0.0144									
52	LS	0	74.9								
53	UD	0.143									
	*										
54	KK	CP2A									
55	HC	3									
	*										
56	KK	OFF4U									
57	BA	0.0314									
58	LS	0	54.0								
59	UD	0.162									
	*										
60	KK	CP2B									
61	HC	2									
	*										
62	KK	ON1A									
63	BA	0.0077									
64	LS	0	57.0								
65	UD	0.145									
	*										
66	KK	CP2									
67	HC	2									
	*										
68	KK	ON1B									
69	BA	0.0283									
70	LS	0	57.0								
71	UD	0.201									
	*										
72	KK	HUAL-2									
73	BA	0.0047									
74	LS	0	83.0								
75	UD	0.085									
	*										

1

HEC-1 INPUT

PAGE 3

LINE	ID	1	2	3	4	5	6	7	8	9	10
76	KK	CP3									
77	HC	3									
	*										
78	KK	HUAL-3									
79	BA	0.0034									
80	LS	0	83.0								
81	UD	0.067									
	*										
82	KK	ON1C									
83	BA	0.0430									
84	LS	0	74.7								
85	UD	0.175									
	*										
86	KK	ON2B									
87	BA	0.0161									
88	LS	0	70.8								
89	UD	0.183									
	*										
90	KK	CP4									
91	HC	3									
	*										
92	KK	HUAL-1									

ult.out

93 BA 0.0023
94 LS 0 83.0
95 UD 0.053
*
96 ZZ

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

23 ANN
.
36 OFF1U
.
40 CP1.....
.
42 ON2A
.
46 OFF3U
.
50 OFF2U
.
54 CP2A.....
.
56 OFF4U
.
60 CP2B.....
.
62 ON1A
.
66 CP2.....
.
68 ON1B
.
72 HUAL-2
.
76 CP3.....
.
78 HUAL-3
.
82 ON1C
.
86 ON2B
.
90 CP4.....
.
92 HUAL-1

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

1*****
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* JUN 1998 *
* VERSION 4.1 *
* RUN DATE 14OCT19 TIME 15:04:06 *
* *****

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

SLATER HANIFAN GROUP, A WESTWOOD TEAM
ANN AND 215, PHASE 1
TECHNICAL DRAINAGE STUDY
OCTOBER 2019
ULTIMATE DRAINAGE CONDITION

ult.out

RETURN PERIOD ----- 100-YR AND 10-YR
 DISTRIBUTION ----- 6-HOUR SDN3
 PROJECT NO. ----- OLY1801.014
 FILENAME ----- ULT.H1
 DATE ----- 10/11
 MODELED BY ----- AA

PRECIPITATION STORM EVENT RATIOS
 STORM EVENT RATIO
 100-YR 1.00
 10-YR 0.55

20 IO OUTPUT CONTROL VARIABLES
 IPRNT 5 PRINT CONTROL
 IPLOT 0 PLOT CONTROL
 QSCAL 0. HYDROGRAPH PLOT SCALE
 IT HYDROGRAPH TIME DATA
 NMIN 5 MINUTES IN COMPUTATION INTERVAL
 IDATE 1 0 STARTING DATE
 ITIME 0000 STARTING TIME
 NQ 300 NUMBER OF HYDROGRAPH ORDINATES
 NDDATE 2 0 ENDING DATE
 NDTIME 0055 ENDING TIME
 ICENT 19 CENTURY MARK
 COMPUTATION INTERVAL .08 HOURS
 TOTAL TIME BASE 24.92 HOURS

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

JP MULTI-PLAN OPTION
 NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
 RATIOS OF PRECIPITATION
 1.00 .55

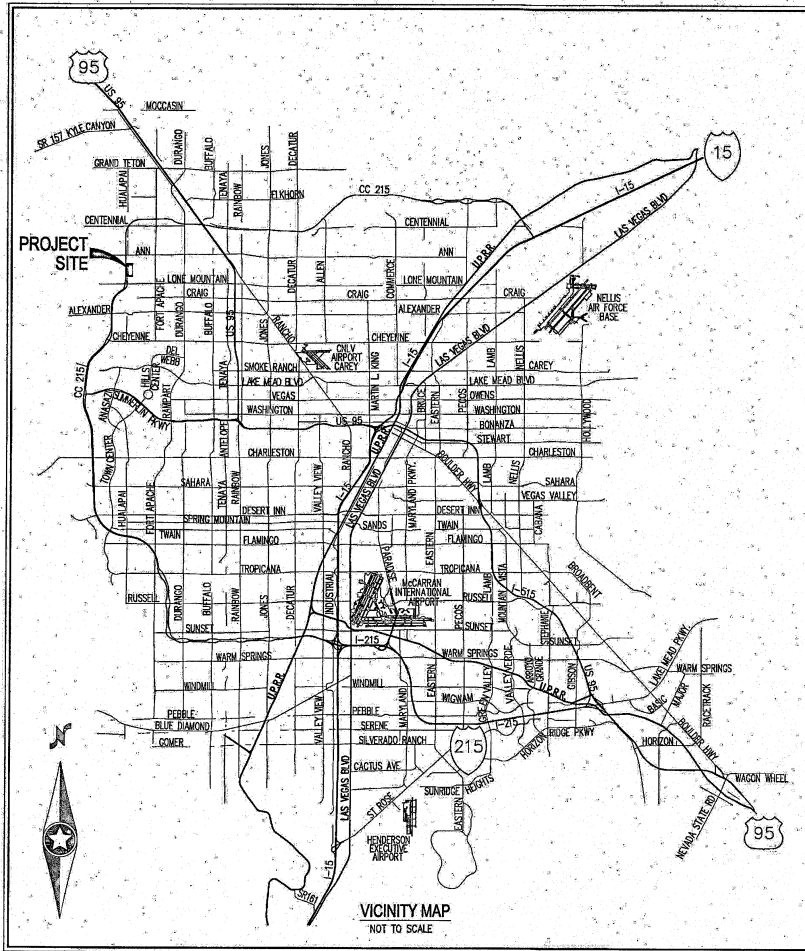
1

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION	
				RATIO 1 1.00	RATIO 2 .55
HYDROGRAPH AT +	ANN	.01	1 FLOW TIME	15. 3.50	8. 3.58
HYDROGRAPH AT +	OFF1U	.01	1 FLOW TIME	11. 3.58	4. 3.58
2 COMBINED AT +	CP1	.01	1 FLOW TIME	26. 3.58	12. 3.58
HYDROGRAPH AT +	ON2A	.04	1 FLOW TIME	7. 3.75	0. 5.00
HYDROGRAPH AT +	OFF3U	.00	1 FLOW TIME	0. 3.75	0. .00
HYDROGRAPH AT +	OFF2U	.01	1 FLOW TIME	13. 3.58	3. 3.58
3 COMBINED AT +	CP2A	.06	1 FLOW TIME	18. 3.67	3. 3.58
HYDROGRAPH AT +	OFF4U	.03	1 FLOW TIME	4. 3.75	0. 5.83
2 COMBINED AT					

							ult.out
+	CP28	.09	1	FLOW TIME	22. 3.67	3. 3.58	
HYDROGRAPH AT							
+	ON1A	.01	1	FLOW TIME	1. 3.67	0. 4.92	
2 COMBINED AT							
+	CP2	.10	1	FLOW TIME	23. 3.67	3. 3.58	
HYDROGRAPH AT							
+	ON1B	.03	1	FLOW TIME	5. 3.75	0. 5.00	
HYDROGRAPH AT							
+	HUAL-2	.00	1	FLOW TIME	7. 3.50	2. 3.50	
3 COMBINED AT							
+	CP3	.13	1	FLOW TIME	32. 3.67	5. 3.58	
HYDROGRAPH AT							
+	HUAL-3	.00	1	FLOW TIME	6. 3.50	2. 3.50	
HYDROGRAPH AT							
+	ON1C	.04	1	FLOW TIME	36. 3.58	8. 3.67	
HYDROGRAPH AT							
+	ON2B	.02	1	FLOW TIME	10. 3.67	2. 3.75	
3 COMBINED AT							
+	CP4	.06	1	FLOW TIME	50. 3.58	10. 3.67	
HYDROGRAPH AT							
+	HUAL-1	.00	1	FLOW TIME	4. 3.50	1. 3.50	

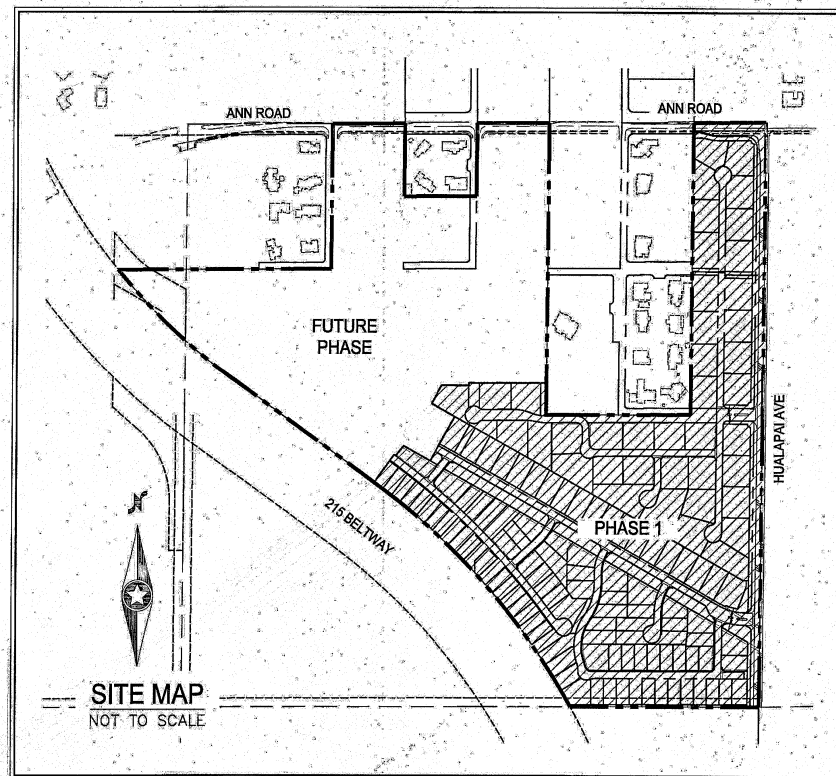
*** NORMAL END OF HEC-1 ***



D.R. HORTON

IMPROVEMENT PLANS FOR ANN AND HUALAPAI - PHASE 1

CITY OF LAS VEGAS, NEVADA
RESIDENTIAL SUBDIVISION
A PORTION OF APN: 126-36-601-011, 126-36-601-012,
126-36-601-013, 126-36-501-043, 126-36-699-002,
126-36-599-014, 126-36-599-015, & 126-36-599-016



DEVIATIONS FROM STANDARDS

NONE

SWPPP NOTE

NOTE: ALL LAND SURFACE AREA DISTURBANCES OVER 1 ACRE REQUIRE A STORMWATER DISCHARGE PERMIT ISSUED BY THE NEVADA DIVISION OF ENVIRONMENTAL PROTECTION (NDEP). A PHASED CONSTRUCTION UNIT IN A CONTIGUOUS SUBDIVISION IS CONSIDERED UNDER CONSTRUCTION UNTIL ALL STRIPPED SURFACE AREAS HAVE BEEN COVERED BY PAVING, BUILDING CONSTRUCTION OR PLANTING. A STORMWATER DISCHARGE PERMIT APPLICATION AND ASSOCIATED INFORMATION MAY BE DOWNLOADED FROM THE WEB SITE: <http://www.state.nv.us/nvdeq/stormwater.htm>. PROJECTS THAT DISTURB MORE THAN ONE ACRE OF LAND MUST SUBMIT TO NDEP A "NOTICE OF INTENT" FOR INCLUSION UNDER STORMWATER PERMIT NO. NVRT00000 ALONG WITH THE APPROPRIATE FILING FEE.

PROJECT INFORMATION - PHASE 1

ACREAGE (GROSS): 53.68 AC
ACREAGE (NET): 35.90 AC
ACREAGE (NET-NET): 31.98 AC
DENSITY (LOTS/NET ACRE): 6.82 DU/NET ACRE
ZONING: R-E & R-1
TOTAL NO. OF RESIDENTIAL LOTS: 218
TOTAL NO. OF COMMON ELEMENTS: 15
MINIMUM LOT SIZE: 6,157 SF±
MAXIMUM LOT SIZE: 29,276 SF±
PROVIDED OPEN SPACE: 170,755 SF±

EARTHWORK SUMMARY (UNADJUSTED)

CUT: 181,783 CY
FILL: 348,005 CY
NET: 166,222 CY (FILL)

GEOTECHNICAL ENGINEER

PREPARED BY: SOUTHWEST GEOTECHNICAL
ADDRESS: 5275 ARVILLE ST, SUITE 108, LAS VEGAS, NV 89118
PHONE: (702) 323-6000
PROJECT NO. 182116
DATED: 03/02/2018

Sheet List Table		
#	SHEET	DESCRIPTION
1	C-1	COVER SHEET
2	C-2	GENERAL NOTES SHEET
3	C-3	ABBREVIATIONS AND QUANTITIES
4	G-1	GRADING SHEET I
5	G-2	GRADING SHEET II
6	G-3	GRADING SHEET III
7	G-4	GRADING SHEET IV
8	G-5	GRADING SHEET V
9	G-6	GRADING SHEET VI
10	G-7	GRADING SHEET VII
11	G-8	GRADING SHEET VIII
12	G-9	GRADING SHEET IX
13	G-10	GRADING SHEET X
14	G-11	GRADING SHEET XI
15	G-12	GRADING SHEET XII
16	G-13	GRADING SHEET XIII
17	G-14	GRADING SHEET XIV
18	G-15	GRADING SHEET XV
19	G-16	GRADING SHEET XVI
20	D-1	DETAIL SHEET I
21	D-2	DETAIL SHEET II
22	D-3	DETAIL SHEET III
23	D-4	DETAIL SHEET IV
24	D-5	DETAIL SHEET V
25	PP-1	PLAN AND PROFILE - ANN ROAD
26	PP-2	PLAN AND PROFILE - ANN ROAD STORM LATERALS
27	PP-3	PLAN AND PROFILE - HUALAPAI AVE STA 10+00 TO 15+50
28	PP-4	PLAN AND PROFILE - HUALAPAI AVE STA 15+50 TO 21+50
29	PP-5	PLAN AND PROFILE - HUALAPAI AVE STA 21+50 TO 27+50
30	PP-6	PLAN AND PROFILE - HUALAPAI AVE STA 27+50 TO 33+50
31	PP-7	PLAN AND PROFILE - HUALAPAI AVE STA 33+50 TO 37+00
32	PP-8	PLAN AND PROFILE - HICKORY TREE ST STA 10+00 TO 15+00
33	PP-9	PLAN AND PROFILE - HICKORY TREE ST STA 15+00 TO 21+50
34	PP-10	PLAN AND PROFILE - HICKORY TREE ST STA 21+50 TO 26+50
35	PP-11	PLAN AND PROFILE - ARBOR VIEW AVE
36	PP-12	PLAN AND PROFILE - CASCADIA VALLEY CT
37	PP-13	PLAN AND PROFILE - WHITE ROCK RUN ST & BALSAM FIR CT
38	PP-14	PLAN AND PROFILE - REDWOOD CANYON STA 10+00 TO 13+00
39	PP-15	PLAN AND PROFILE - REDWOOD CANYON STA 13+00 TO 16+50
40	PP-16	PLAN AND PROFILE - SWEET HOLLY PL STA 27+00 TO 21+50
41	PP-17	PLAN AND PROFILE - SWEET HOLLY PL STA 21+50 TO 15+50
42	PP-18	PLAN AND PROFILE - SWEET HOLLY PL STA 15+50 TO 10+00
43	PP-19	PLAN AND PROFILE - SEQUOIA FALLS PL STA 22+00 TO 16+00
44	PP-20	PLAN AND PROFILE - SEQUOIA FALLS PL STA 16+00 TO 13+00
45	PP-21	PLAN AND PROFILE - SEQUOIA FALLS PL STA 13+00 TO 10+00
46	PP-22	PLAN AND PROFILE - GLEAMING BAY & BLUE BELL GROVE
47	PP-23	PLAN AND PROFILE - AURORA LAKE LN
48	PP-24	PLAN AND PROFILE - MYSTIC IVY DR STA 10+00 TO 13+00
49	PP-25	PLAN AND PROFILE - MYSTIC IVY DR STA 13+00 TO 16+00
50	PP-26	PLAN AND PROFILE - SWEET OLEANDER STA 10+00 TO 15+00
51	PP-27	PLAN AND PROFILE - SWEET OLEANDER & SAVANNAH ROSE
52	PP-28	PLAN AND PROFILE - SAVANNAH ROSE
53	PP-29	PLAN AND PROFILE - WASHBURN SEWER
54	PP-30	PLAN AND PROFILE - 12 INCH WATERLINE EASEMENT
55	PP-31	PLAN AND PROFILE - STEPHEN AVE & FUTURE PHASE SEWER
56	PP-32	PLAN AND PROFILE - CE H
57	MUT-1	MASTER UTILITY PLAN
58	U-1	UTILITY PLAN I
59	U-2	UTILITY PLAN II
60	U-3	UTILITY PLAN III
61	U-4	UTILITY PLAN IV
62	U-5	UTILITY PLAN V
63	U-6	UTILITY PLAN VI
64	U-7	UTILITY PLAN VII
65	U-8	UTILITY PLAN VIII
66	U-9	UTILITY PLAN IX
67	U-10	UTILITY PLAN X
68	PRV-1	PRV STATION SITE PLAN
69	PRV-2	PRV STATION DETAILS I
70	PRV-3	PRV STATION DETAILS II
71	PRV-4	PRV STATION DETAILS III
72	T-1	TRAFFIC PLAN I
73	T-2	TRAFFIC PLAN II
74	T-3	TRAFFIC PLAN III
75	T-4	TRAFFIC PLAN IV
76	T-5	TRAFFIC PLAN V
77	T-6	TRAFFIC PLAN VI
78	T-7	TRAFFIC PLAN VII
79	T-8	TRAFFIC PLAN VIII
80	T-9	TRAFFIC PLAN IX
81	T-10	TRAFFIC PLAN X

APPROVALS

LAS VEGAS FIRE AND RESCUE DATE

CENTRAL TELEPHONE CO. DBA CENTURYLINK DATE

THE AFFIXED CENTURYLINK APPROVAL DOES NOT ASSUME OR GUARANTEE LIABILITY FOR KNOWN OR UNKNOWN CONFLICTS WITH EXISTING OR PROPOSED IMPROVEMENTS. RESOLUTION OF ANY CONFLICT WILL BE ACCOMPLISHED PURSUANT TO LOCAL ORDINANCES, NEVADA REVISED STATUTES AND / OR PUBLIC UTILITY COMMISSION RULES AND REGULATIONS.

APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES
PROJECT NO. 137430 FIRST APPROVED DATE:
LWMV APPROVED FIRE FLOW 1,500 GPM AT 20 PSI RESIDUAL
MAXIMUM AVAILABLE FIRE SPRINKLER FLOW 20 GPM
SHEETS: C-1, C-2, C-3, PP-1 THROUGH PP-32, MUT-1, U-1 THROUGH U-10,
PRV-1 THROUGH PRV-4

NV ENERGY DATE

NV ENERGY ACKNOWLEDGES THAT WE HAVE RECEIVED YOUR PLANS AND WILL PROVIDE SERVICE TO ALL ELECTRICAL NEEDS ASSOCIATED WITH THIS PROJECT. NV ENERGY RESERVES THE RIGHT TO ADDRESS ANY EXISTING OR FUTURE CONFLICTS. ONCE THE FINAL DESIGN IS COMPLETED, THE NEW SERVICE AND THE RESOLUTION OF ANY CONFLICTS WILL BE ACCOMPLISHED PURSUANT TO THE NEVADA PUBLIC UTILITY COMMISSION'S RULES AND REGULATIONS.

SOUTHWEST GAS CORPORATION DATE

COX COMMUNICATIONS LAS VEGAS, INC. DATE

DEVELOPER

DR HORTON INC.
1081 WHITNEY RANCH DR, SUITE 141
HENDERSON, NV 89014
PH: 702-432-3000
FX: 702-432-8008

ENGINEER

WESTWOOD
5740 S. ARVILLE STREET, SUITE 216
LAS VEGAS, NV 89118
PH: (702) 324-5300
CONTACT: TRACY STRATTON

OWNER

FORESTAR (USA) REAL ESTATE
2221 E. LAMAR BLVD SUITE 750
ARLINGTON, TX 76010

UPGROWTH NV PARTNERS, LLC
11411 SOUTHERN HIGHLANDS PKWY
LAS VEGAS, NV 89141
PH: 702-220-6595

LEGAL DESCRIPTION

BEING A PORTION OF SECTION 36, TOWNSHIP 19 SOUTH, RANGE 30 EAST
M.D.M., CLARK COUNTY, NEVADA.

BENCHMARK

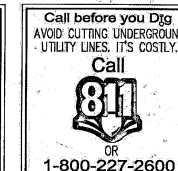
BENCHMARK #BLV90-3104, CLV RIVET & ROUND PLATE IN CONC PAD WEST SIDE
OF GRAND CANYON DR., 120 FEET SOUTH OF WASHBURN ROAD.
ELEVATION = 795.579 METERS (2010.16 FEET) NAVD 88

BASIS OF BEARINGS

S 89°41'18" E, BEING THE NORTH LINE OF THE SE 1/4, NW 1/4 OF SECTION 31
TOWNSHIP 19 SOUTH, RANGE 30 EAST, M.D.M. AS SHOWN ON FILE 97, PAGE 85
OF PARCEL MAPS ON FILE AT THE RECORDERS OFFICE OF CLARK COUNTY, NV
OPTICAL RECORDS.

FEMA FLOOD ZONE INFORMATION

THE PROJECT SITE IS LOCATED WITHIN A FEMA DESIGNATED ZONE "X" (AREA
OUTSIDE THE 500 YEAR FLOODPLAIN AND 0.2% CHANCE ANNUAL FLOODING), PER
THE FEMA FIRM PANELS MAP NUMBER 22003C1750 E, DATED SEPTEMBER 27,
2002.



Westwood
7740 S. Arville Street
Suite 216
Las Vegas, NV 89118
Phone Fax
(702) 284-5300
(702) 284-5399
westwoodps.com
Westwood Professional Services, Inc.

CITY OF LAS VEGAS, NV
DATE BY APP. DATE
DESCRIPTION NO.

CITY OF LAS VEGAS, NV
DATE BY APP. DATE
DESCRIPTION NO.

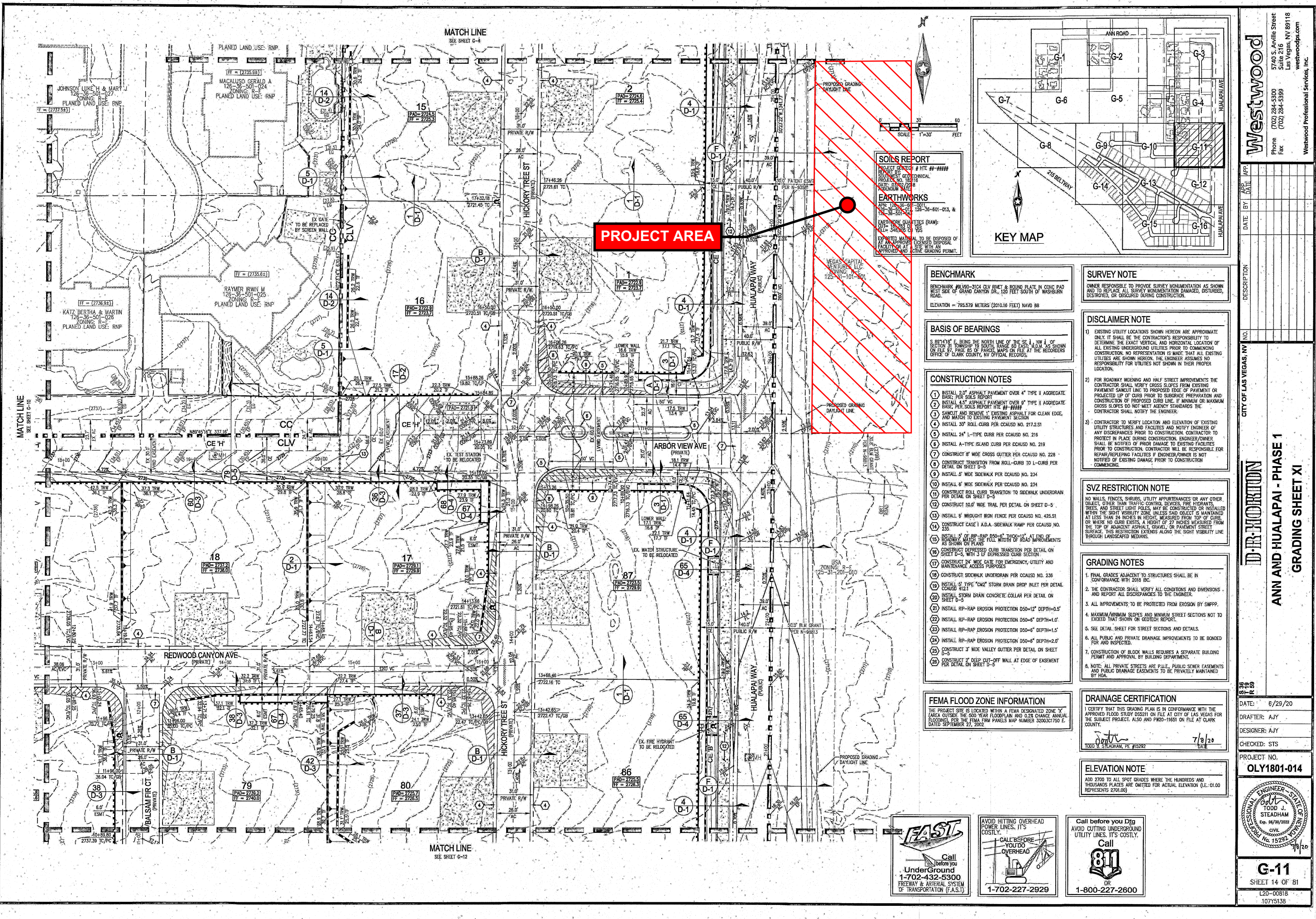
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DATE BY APP. DATE
DESCRIPTION NO.

CITY OF LAS VEGAS, NV
DATE BY APP. DATE
DESCRIPTION NO.

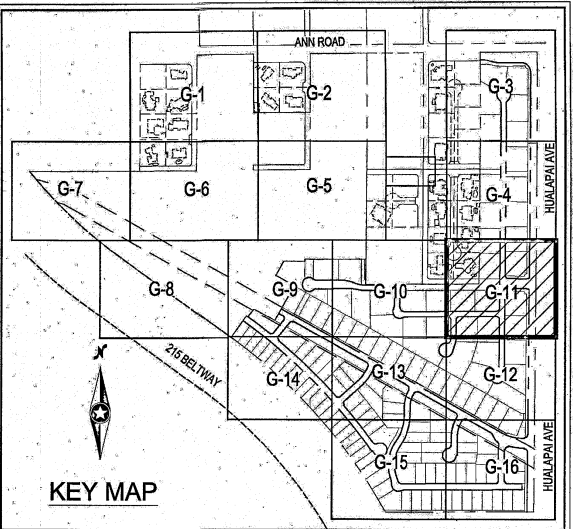
CITY OF LAS VEGAS, NV
DATE BY APP. DATE
DESCRIPTION NO.

CITY OF LAS VEGAS, NV
DATE BY APP. DATE
DESCRIPTION NO.

CITY OF LAS VEGAS, NV
DATE BY APP. DATE
DESCRIPTION NO.



SOILS REPORT
PROJECT: 12-001-001
DATE: 08/20/2022
EARTHWORKS
EARTHWORK QUANTITIES (RAW):
EXISTING: 12,500.00 CY
IMPORT: 12,500.00 CY
EXPORT: 0.00 CY
EXPORTED MATERIAL TO BE DISPOSED OF AT AN APPROVED LANDFILL WITH AN APPROVED AND ACTIVE GRADING PERMIT.



BENCHMARK
BENCHMARK: 12-001-001
ELEVATION = 795.579 METERS (2010.16 FEET) NAVD 88

BASIS OF BEARINGS
S 89°14'16\"/>

- CONSTRUCTION NOTES**
1. INSTALL 2\"/>
 2. INSTALL 4\"/>
 3. SAWCUT AND REMOVE 1\"/>
 4. INSTALL 30\"/>
 5. INSTALL 24\"/>
 6. INSTALL A-TYPE ISLAND CURB PER CAUSAD NO. 219
 7. CONSTRUCT 8\"/>
 8. CONSTRUCT TRANSITION FROM ROLL-CURB TO L-CURB PER DETAIL ON SHEET D-5
 9. INSTALL 5\"/>
 10. INSTALL 6\"/>
 11. CONSTRUCT ROLL CURB TRANSITION TO SIDEWALK UNDERDRAIN PER DETAIL ON SHEET D-5
 12. CONSTRUCT 10.0\"/>
 13. INSTALL 6\"/>
 14. CONSTRUCT CASE 1 A.B.A. SIDEWALK RAMP PER CAUSAD NO. 235
 15. INSTALL 5\"/>
 16. CONSTRUCT DEPRESSION CURB TRANSITION PER DETAIL ON SHEET D-5 WITH 1\"/>
 17. CONSTRUCT 24\"/>
 18. CONSTRUCT SIDEWALK UNDERDRAIN PER CAUSAD NO. 235
 19. INSTALL 5\"/>
 20. INSTALL STORM DRAIN CONCRETE COLLAR PER DETAIL ON SHEET D-5
 21. INSTALL RP-RAP EROSION PROTECTION D50=12\"/>
 22. INSTALL RP-RAP EROSION PROTECTION D50=6\"/>
 23. INSTALL RP-RAP EROSION PROTECTION D50=6\"/>
 24. INSTALL RP-RAP EROSION PROTECTION D50=6\"/>
 25. CONSTRUCT 3\"/>
 26. CONSTRUCT 2\"/>

FEMA FLOOD ZONE INFORMATION
THE PROJECT SITE IS LOCATED WITHIN A FEMA DESIGNATED ZONE X (AREA OUTSIDE THE 500-YEAR FLOODPLAIN AND 0.2% CHANCE ANNUAL FLOODING). PER THE FEMA FIRM PANELS MAP NUMBER 32003C1750 E. DATED SEPTEMBER 27, 2002.

SURVEY NOTE
OWNER RESPONSIBLE TO PROVIDE SURVEY MONUMENTATION AS SHOWN AND TO REPLACE ALL SURVEY MONUMENTATION DAMAGED, DISTURBED, DESTROYED, OR OBSOLETE DURING CONSTRUCTION.

DISCLAIMER NOTE

1. EXISTING UTILITY LOCATIONS SHOWN HEREON 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 IN THEIR PROPER LOCATION.
2. FOR ROADWAY WIDENING AND HALF STREET IMPROVEMENTS THE CONTRACTOR SHALL VERIFY CROSS SLOPES FROM EXISTING PAVEMENT SAWCUT LINE TO PROPOSED EDGE OF PAVEMENT OR PROJECTED LIP OF CURB PRIOR TO SUBGRADE PREPARATION AND CONSTRUCTION OF PROPOSED CURB LINE. IF MINIMUM OR MAXIMUM CROSS SLOPES DO NOT MEET AGENCY STANDARDS THE CONTRACTOR SHALL NOTIFY THE ENGINEER.
3. CONTRACTOR TO VERIFY LOCATION AND ELEVATION OF EXISTING UTILITY STRUCTURES AND FACILITIES AND NOTIFY ENGINEER OF ANY DISCREPANCIES PRIOR TO CONSTRUCTION. CONTRACTOR TO PROTECT IN PLACE DURING CONSTRUCTION. ENGINEER/OWNER SHALL BE NOTIFIED OF PRIOR DAMAGE TO EXISTING FACILITIES PRIOR TO CONSTRUCTION. CONTRACTOR WILL BE RESPONSIBLE FOR REPAIR/REPLACING FACILITIES IF ENGINEER/OWNER IS NOT NOTICED OF EXISTING DAMAGE PRIOR TO CONSTRUCTION COMMENCING.

SVZ RESTRICTION NOTE
NO WALLS, FENCES, SHRUBS, UTILITY APPURTENANCES OR ANY OTHER OBJECTS OTHER THAN TRAFFIC CONTROL DEVICES, FIRE HYDRANTS, TREES, AND STREET LIGHT POLES MAY BE CONSTRUCTED OR INSTALLED WITHIN THE SVZ UNLESS SAID OBJECT IS MAINTAINED AT A MINIMUM 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 VISION LINE THROUGH LANDSCAPED MEDIAN.

GRADING NOTES

1. FINAL GRADES ADJACENT TO STRUCTURES SHALL BE IN CONFORMANCE WITH 2018 IBC.
2. THE CONTRACTOR SHALL VERIFY ALL CONDITIONS AND DIMENSIONS AND REPORT ALL DISCREPANCIES TO THE ENGINEER.
3. ALL IMPROVEMENTS TO BE PROTECTED FROM EROSION BY SWPPP.
4. MAXIMUM/MINIMUM SLOPES AND MINIMUM STREET SECTIONS NOT TO EXCEED THAT SHOWN ON GEOTECH REPORT.
5. SEE DETAIL SHEET FOR STREET SECTIONS AND DETAILS.
6. ALL PUBLIC AND PRIVATE DRAINAGE IMPROVEMENTS TO BE BONDED FOR AND INSURED.
7. CONSTRUCTION OF BLOCK WALLS REQUIRES A SEPARATE BUILDING PERMIT AND APPROVAL BY BUILDING DEPARTMENT.
8. NOTE: ALL PRIVATE STREETS ARE P.U.E., PUBLIC SEWER EASEMENTS AND PUBLIC DRAINAGE EASEMENTS TO BE PRIVATELY MAINTAINED BY HOA.

DRAINAGE CERTIFICATION
I CERTIFY THAT THIS GRADING PLAN IS IN CONFORMANCE WITH THE APPROVED FLOOD STUDY D55211 ON FILE AT CITY OF LAS VEGAS FOR THE SUBJECT PROJECT. ALSO AND P1920-11651 ON FILE AT CLARK COUNTY.
TODD J. STEADHAM, PE #15292 7/8/20

ELEVATION NOTE
ADD 2700 TO ALL SPOT GRADES WHERE THE HUNDREDS AND THOUSANDS PLACES ARE OMITTED FOR ACTUAL ELEVATION (I.E.: 01.00 REPRESENTS 2701.00)

FAST
Call before you dig
UnderGround
1-702-432-5300
FREEWAY & ARTERIAL SYSTEM OF TRANSPORTATION (F.A.S.T.)

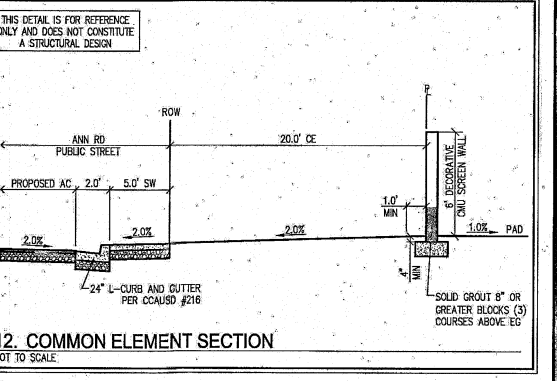
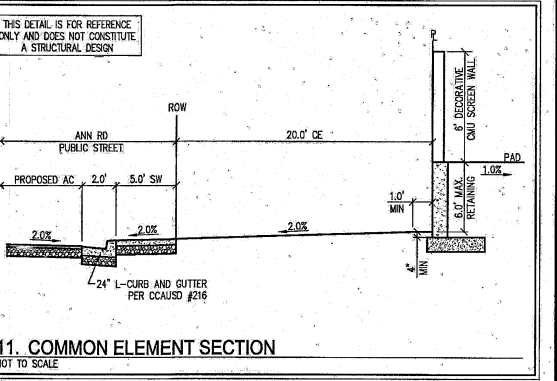
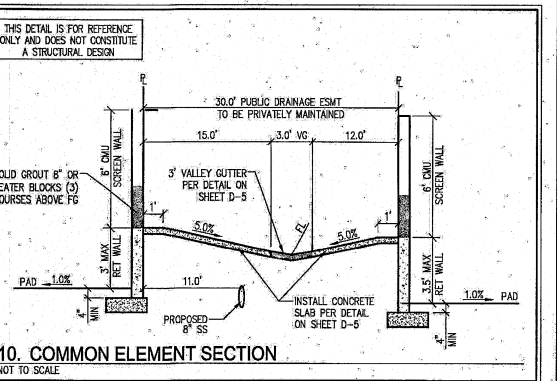
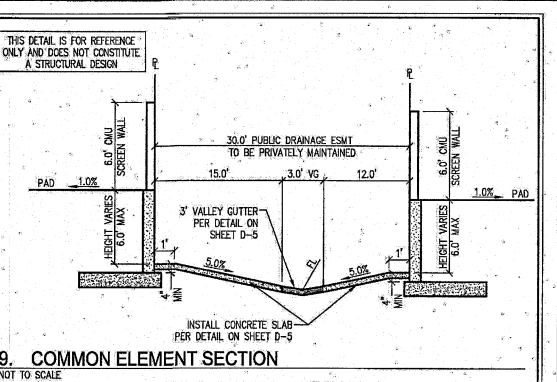
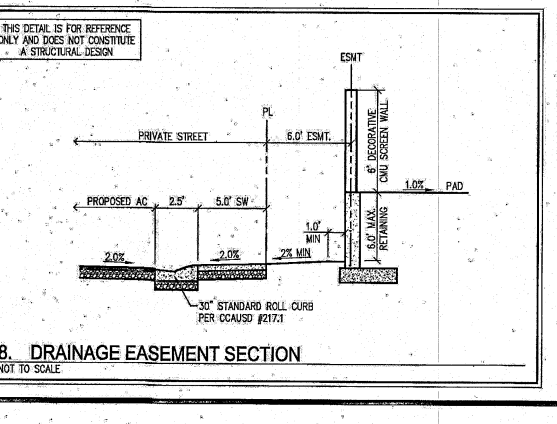
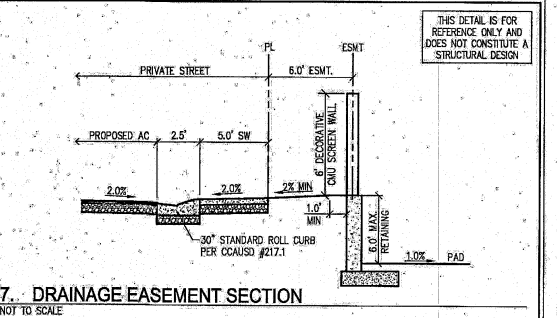
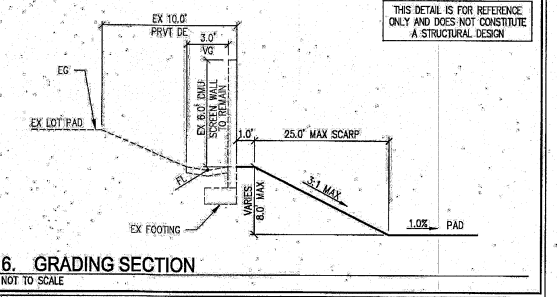
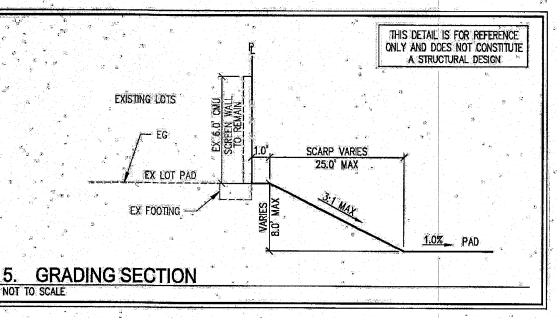
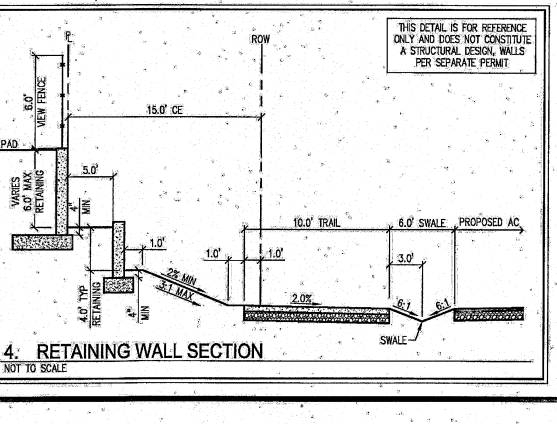
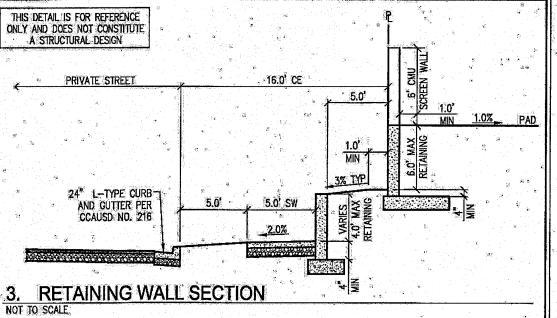
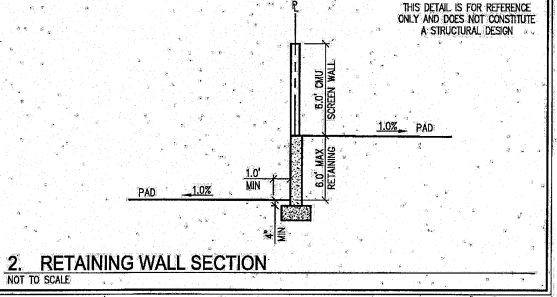
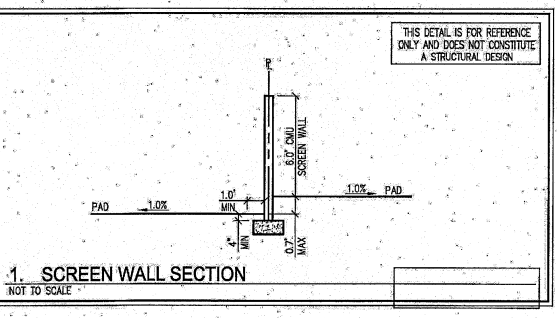
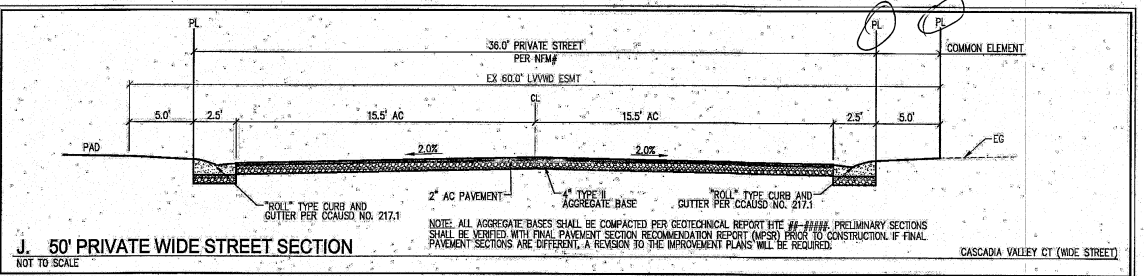
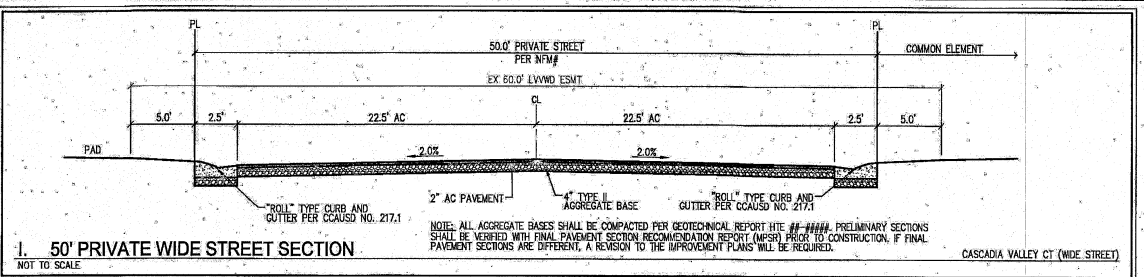
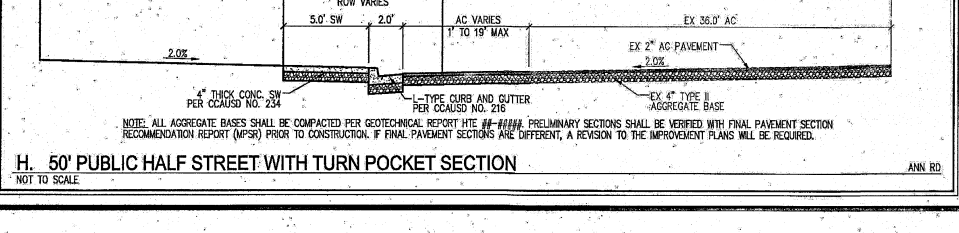
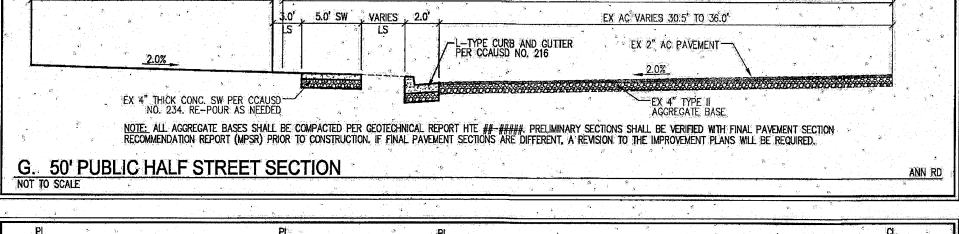
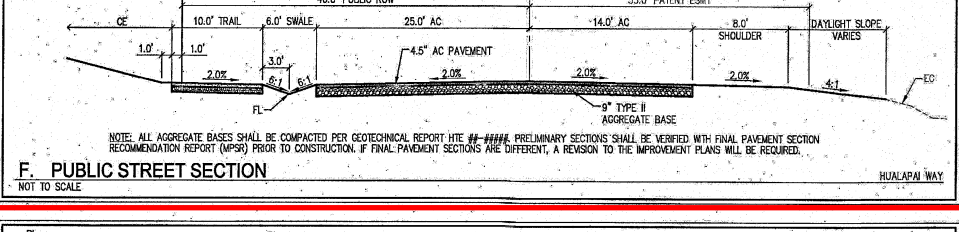
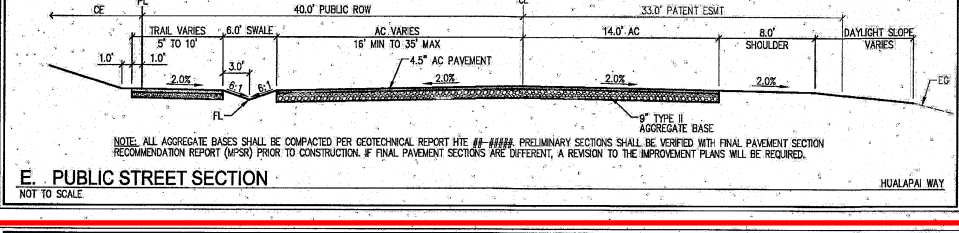
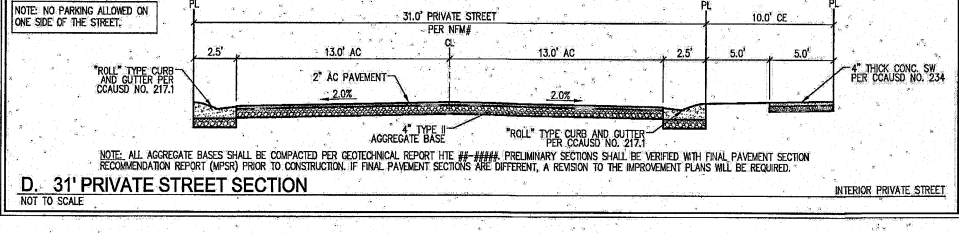
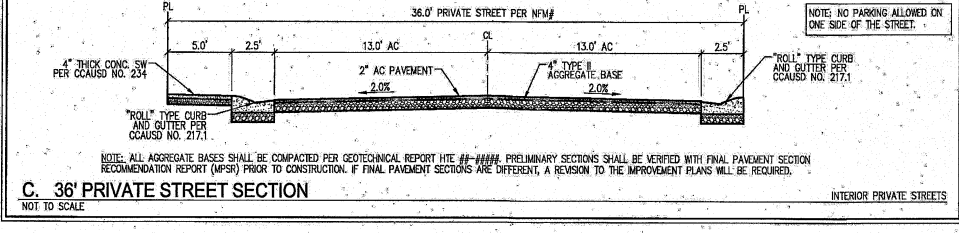
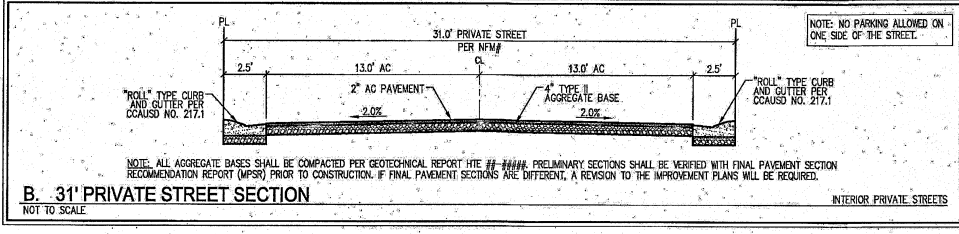
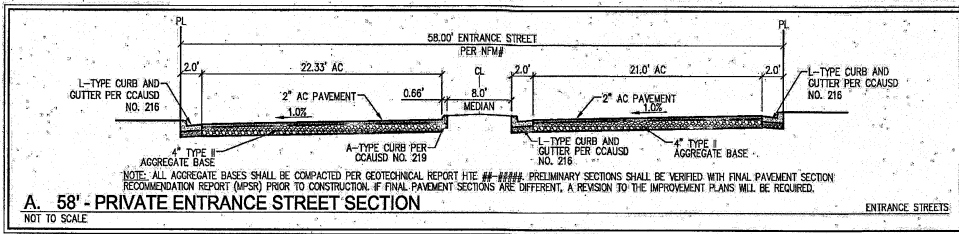
AVOID HITTING OVERHEAD POWER LINES. IT'S COSTLY.
CALL BEFORE YOU DIG OVERHEAD
1-702-227-2929

Call before you dig
Call 811
OR
1-800-227-2600

Westwood
5740 S. Anville Street
Suite 216
Las Vegas, NV 89118
Phone (702) 284-5300
Fax (702) 284-5399
westwoodps.com
Westwood Professional Services, Inc.

CITY OF LAS VEGAS, NV
ANN AND HUALAPAI - PHASE 1
GRADING SHEET XI

DATE: 6/29/20
DRAFTER: AJY
DESIGNER: AJY
CHECKED: STS
PROJECT NO. OLY1801-014
G-11
SHEET 14 OF 81
L20-00618
1075138



FEMA ZONE INFO
THE PROJECT SITE IS LOCATED WITHIN A FEMA DESIGNATED ZONE 'X' (UNSHARED) AREA OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN. PER FEMA FIRM PANELS 22000C2185P DATED NOVEMBER 16, 2011. REVISED TO REFLECT LOWR EFFECTIVE SEPTEMBER 22, 2016.

FAST
Call before you Dig
Underground
1-702-432-5300
FREELAND & ARTERIAL SYSTEM OF TRANSPORTATION (F.A.S.T.)

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

Call before you Dig
AVOID CUTTING UNDERGROUND UTILITY LINES. IT'S COSTLY.
Call
811
OR
1-800-227-2600

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Las Vegas, NV 89116
Phone (702) 284-5300
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CITY OF LAS VEGAS, NV

ANN AND HUALAPAI - PHASE 1

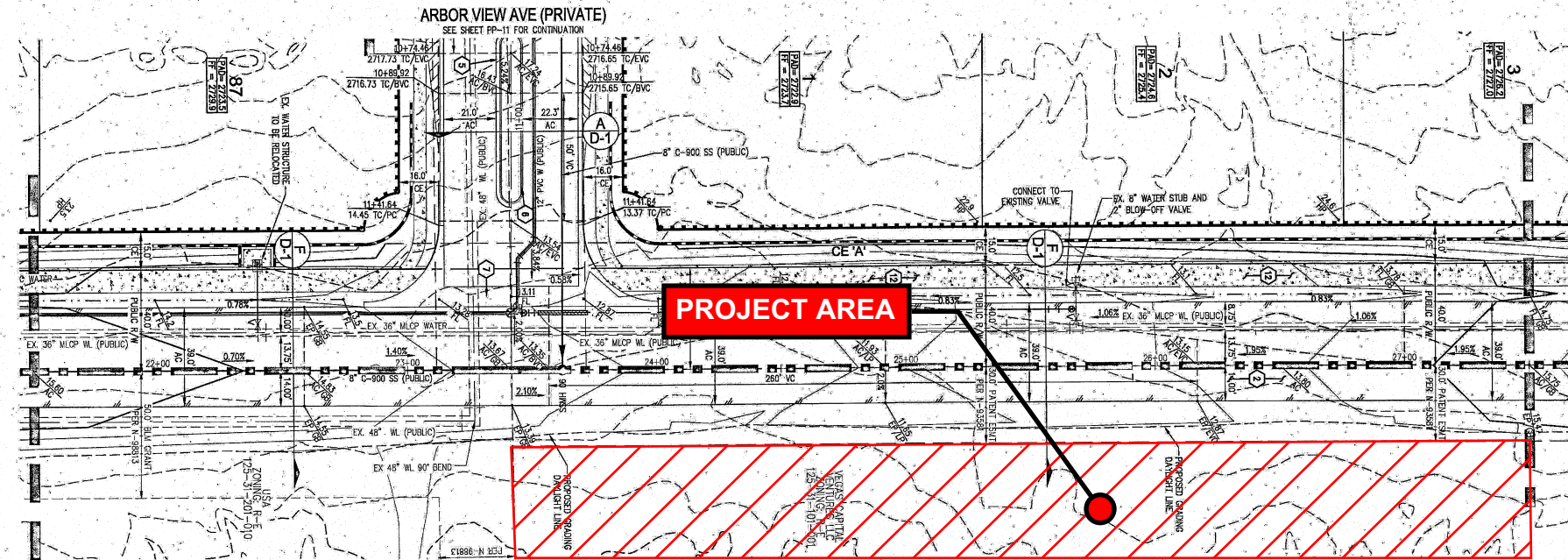
DETAIL SHEET I

DATE: 6/29/20
DRAFTER: AJY
DESIGNER: AJY
CHECKED: STS
PROJECT NO.: OLY1801-014

ENGINEER - STATE OF NV
TODD J. STEADHAM
Exp. 06/30/2022
CIVIL
Exp. No. 15292

D-1
SHEET 20 OF 81
120-00818
1075138

MATCHLINE STA: 21+50
SEE SHEET PP-4 FOR CONTINUATION



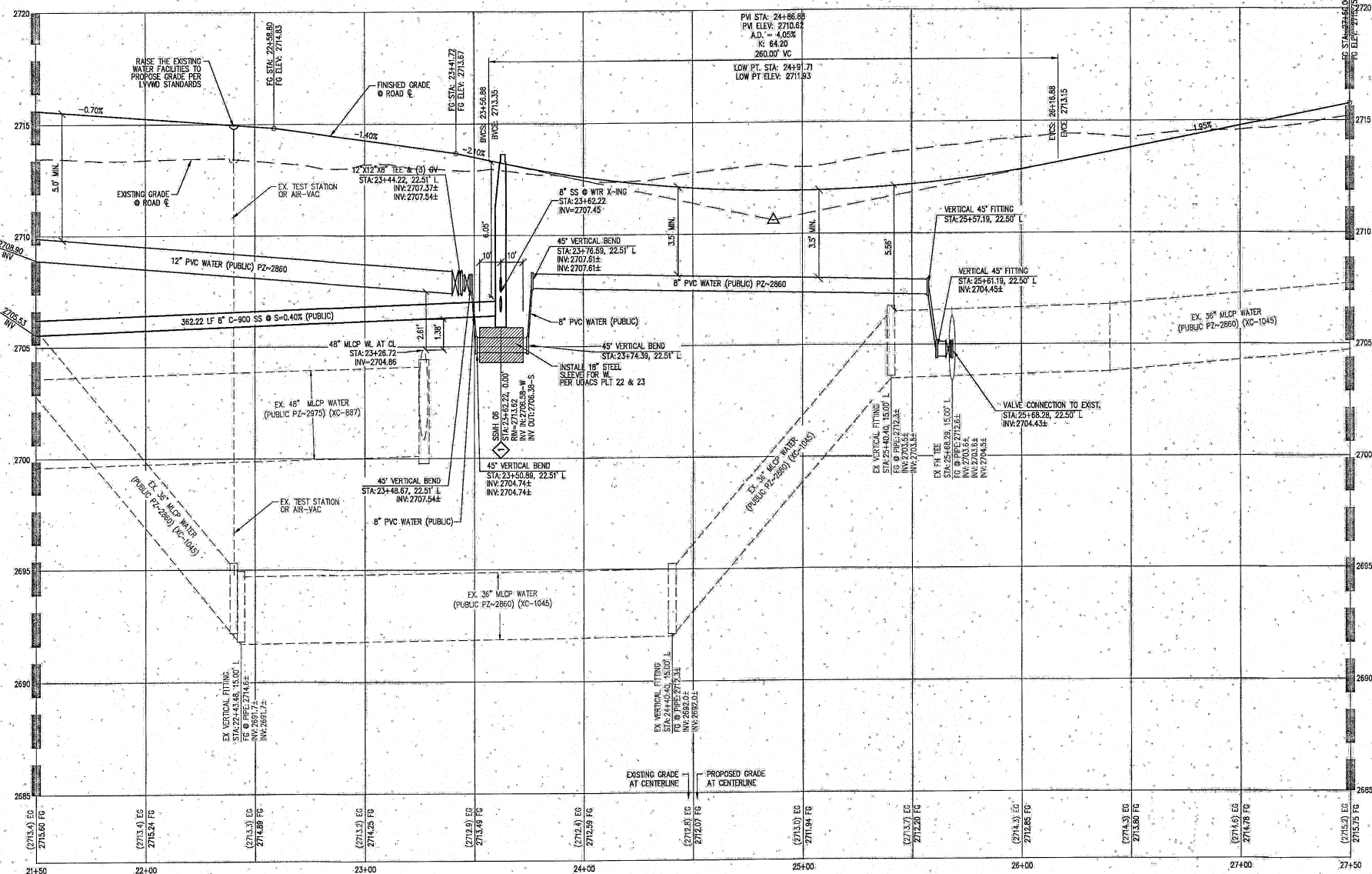
MATCHLINE STA: 27+50
SEE SHEET PP-6 FOR CONTINUATION

HUALAPAI WAY (PUBLIC) - PLAN VIEW

SCALE: 1" = 30'

SCALE: 1" = 30'
FEET

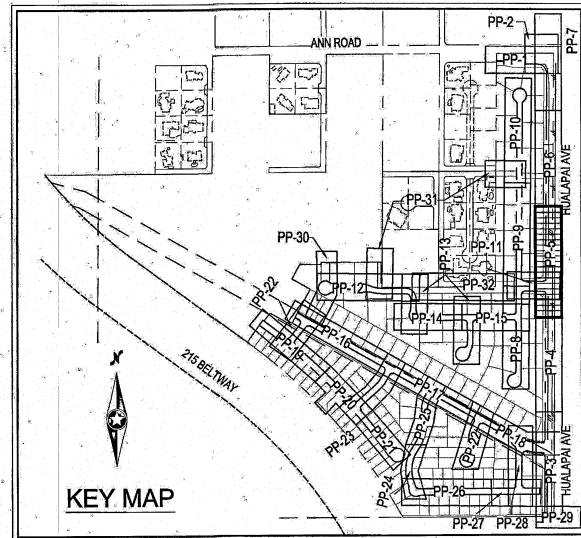
MATCHLINE STA: 21+50
SEE SHEET PP-4 FOR CONTINUATION



MATCHLINE STA: 27+50
SEE SHEET PP-6 FOR CONTINUATION

HUALAPAI WAY (PUBLIC) - PROFILE VIEW

HORIZ: 1" = 30'
VERT: 1" = 3'



KEY MAP

BENCHMARK

BENCHMARK #19190-3104 OLV RIVET & ROUND PLATE IN CONC PAD
WEST SIDE OF GRAND CANYON DR. 120 FEET SOUTH OF WASHINGTON
ROAD.
ELEVATION = 755.579 METERS (2010.16 FEET) NAVD 88

BASIS OF BEARINGS

S. 88°14'18" E. BEING THE NORTH LINE OF THE SE 1/4, NW 1/4 OF
SECTION 31 TOWNSHIP 19 SOUTH RANGE 60 EAST, M.D.M. AS SHOWN
ON FILE 57, PAGE 65 OF PARCEL MAPS ON FILE AT THE RECORDERS
OFFICE OF CLARK COUNTY, NV OFFICIAL RECORDS.

CONSTRUCTION NOTES

1. INSTALL 2" ASPHALT PAVEMENT OVER 4" TYPE II AGGREGATE
BASE, PER SOILS REPORT.
2. INSTALL 4" ASPHALT PAVEMENT OVER 8" TYPE II AGGREGATE
BASE, PER SOILS REPORT HITE #11111.
3. SAWCUT AND REMOVE 1" EXISTING ASPHALT FOR CLEAN EDGE,
AND MATCH TO EXISTING PAVEMENT SECTION.
4. INSTALL 30" ROLL CURB PER CCAUSD NO. 217.2.51
5. INSTALL 24" L-TYPE CURB PER CCAUSD NO. 216
6. INSTALL A-TYPE ISLAND CURB PER CCAUSD NO. 219
7. CONSTRUCT 8" WIDE CROSS GUTTER PER CCAUSD NO. 228
8. CONSTRUCT TRANSITION FROM ROLL-CURB TO L-CURB PER
DETAIL ON SHEET D-5
9. INSTALL 6" WIDE SIDEWALK PER CCAUSD NO. 234
10. CONSTRUCT ROLL CURB TRANSITION TO SIDEWALK UNDERDRAIN
PER DETAIL ON SHEET D-5
11. CONSTRUCT 100' WIDE TRAIL PER DETAIL ON SHEET D-5
12. INSTALL 6" WROUGHT IRON FENCE PER CCAUSD NO. 425.51
13. CONSTRUCT CASE 1 A.D.A. SIDEWALK RAMP PER CCAUSD NO.
235
14. INSTALL 5' OF RIP-RAP D50-10" THICK-12" AT END OF
ROADWAY AND THE FULL WIDTH OF ROAD IMPROVEMENTS
AS SHOWN ON PLANS
15. CONSTRUCT DEPRESSIONED CURB TRANSITION PER DETAIL ON
SHEET D-5, WITH A 1/2" DEPRESSIONED CURB SECTION
16. CONSTRUCT SIDEWALK UNDERDRAIN PER CCAUSD NO. 235
17. CONSTRUCT 24" WIDE GATE FOR EMERGENCY, UTILITY AND
MAINTENANCE ACCESS PURPOSES
18. CONSTRUCT SIDEWALK UNDERDRAIN PER CCAUSD NO. 235
19. INSTALL 5" TYPE "CMZ" STORM DRAIN DROP INLET PER DETAIL
CAUSD 4121
20. INSTALL STORM DRAIN CONCRETE COLLAR PER DETAIL ON
SHEET D-5
21. INSTALL RIP-RAP EROSION PROTECTION D50-12" DEPTH=0.5'
22. INSTALL RIP-RAP EROSION PROTECTION D50=6" DEPTH=1.0'
23. INSTALL RIP-RAP EROSION PROTECTION D50=6" DEPTH=1.5'
24. INSTALL RIP-RAP EROSION PROTECTION D50=6" DEPTH=2.0'
25. CONSTRUCT 3" WIDE VALLEY GUTTER PER DETAIL ON SHEET
D-5
26. CONSTRUCT 2' DEEP CUT-OFF WALL AT EDGE OF EASEMENT
PER DETAIL ON SHEET D-5
27. INSTALL STEEL SLEEVE FOR WATER MAIN PER UDACS PLT 22 &
23

SEWER CONNECTION NOTE

ONE OR MORE SEGMENTS OF THE DOWNSTREAM SEWER SYSTEM THAT
WILL SERVE THIS PROJECT HAS NOT BEEN COMPLETED AND/OR
ACCEPTED FOR MAINTENANCE BY THE CITY OF LAS VEGAS. ANY
WORK DONE ON THIS PROJECT PRIOR TO THE COMPLETION AND/OR
ACCEPTANCE OF THE DOWNSTREAM SEWER SYSTEMS SHALL BE DONE
AT THE DEVELOPER'S OWN RISK. THE CITY OF LAS VEGAS RESERVES
THE RIGHT TO PREVENT THE PHYSICAL CONNECTION OF THIS PROJECT
INTO THE DOWNSTREAM SEWER SYSTEM UNTIL ALL SEGMENTS HAVE
BEEN COMPLETED AND ACCEPTED FOR MAINTENANCE, OR UNTIL SUCH
TIME AS THEY ARE DEEMED AVAILABLE FOR SERVICE.

SURVEY NOTE

OWNER RESPONSIBLE TO PROVIDE SURVEY MONUMENTATION AS SHOWN
AND TO REPLACE ALL SURVEY MONUMENTATION DAMAGED, DISTURBED,
DESTROYED, OR OBSOLETE DURING CONSTRUCTION.

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NOTIFIED OF EXISTING DAMAGE PRIOR TO CONSTRUCTION
COMMENCING.

SVZ RESTRICTION NOTE

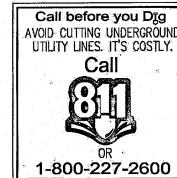
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OBJECT, OTHER THAN TRAFFIC CONTROL DEVICES, FIRE HYDRANTS,
TREES, AND STREET LIGHT POLES, MAY BE CONSTRUCTED OR INSTALLED
WITHIN THE SVZ UNLESS SUCH OBJECT IS MAINTAINED
AT LESS THAN 24 INCHES IN HEIGHT, MEASURED FROM TOP OF CURB,
OR WHERE NO CURB 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.

SEWER CONSTRUCTION NOTES

1. INSTALL 48" DIAMETER SANITARY SEWER MANHOLE WITH
WATER-TIGHT JOINTS & SINGLE 24" LID PER DCSWCS SD-1, SD-3,
SD-4 AND SD-9
2. FIELD VERIFY EXISTING SSMH INVERT ELEVATION & CONNECT PER
DCSWCS STANDARDS
3. INSTALL SDR-35 PVC SANITARY SEWER PIPE (PUBLIC)
4. INSTALL C900 PVC SANITARY SEWER PIPE (PUBLIC)
5. INSTALL SEWER STUB AND CAP W/ 1.0 CUBIC FOOT OF
CONCRETE FOR FUTURE CONNECTION
6. REMOVED OR ADD GRADE RINGS AS NEEDED TO BRING EXISTING
MANHOLE COVER TO PROPOSED GRADES SHOWN ON PLANS
7. INSTALL 72" DIAMETER SANITARY SEWER MANHOLE WITH DUAL
COVERS PER DCSWCS SD-2
8. INSTALL CORROSION PROTECTION PER DCSWCS 2.13.10H AND
3.16.8
9. INSTALL C900 SS LATERAL PROTECTION PER SD-19 AND
SD-21

APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES
PROJECT No. 137430, FIRST APPROVED DATE



Westwood

5740 S. Anville Street
Suite 216
Las Vegas, NV 89118
Phone (702) 284-5300
Fax (702) 284-5399
westwoodps.com
Westwood Professional Services, Inc.

DATE: 6/29/20
BY: AJY

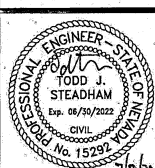
DESCRIPTION: ANN AND HUALAPAI - PHASE 1

CITY OF LAS VEGAS, NV

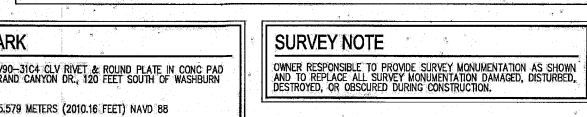
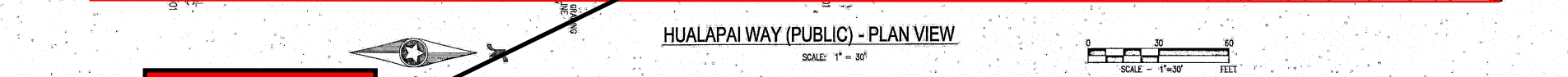
PROJECT NO. OLY1801-014

DATE: 6/29/20
DRAFTER: AJY
DESIGNER: AJY
CHECKED: STS

PROJECT NO. OLY1801-014



PP-5
SHEET 29 OF 81
L20-00818
107Y5138



BENCHMARK #9LV90-31C4 CLV RIVET & ROUND PLATE IN CONC PAD
WEST SIDE OF GRAND CANYON DR., 120 FEET SOUTH OF WASHBURN
ROAD.
ELEVATION = 795.579 METERS (2010.16 FEET) NAVD 88

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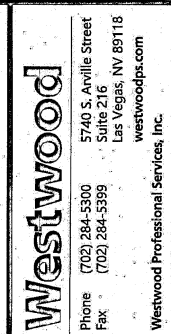
- 2) FOR ROADWAY WIDENING AND HALF STREET IMPROVEMENTS THE CONTRACTOR SHALL VERIFY CROSS SLOPES FROM EXISTING PAVEMENT SAWCUT LINE TO PROPOSED EDGE OF PAVEMENT OR PROJECTED LINE OF CURB PRIOR TO SUBGRADE PREPARATION AND CONSTRUCTION OF PROPOSED CURB LINE. IF MINIMUM OR MAXIMUM SLOPES DO NOT MEET AGENCY STANDARDS THE CONTRACTOR SHALL NOTIFY THE ENGINEER.
- 3) CONTRACTOR TO VERIFY LOCATION AND ELEVATION OF EXISTING UTILITY STRUCTURES AND FACILITIES AND NOTIFY ENGINEER OF ANY CHANGES PRIOR TO CONSTRUCTION. CONTRACTOR TO PROTECT IN PLACE DURING CONSTRUCTION. ENGINEER/OWNER SHALL BE NOTIFIED OF PRIOR DAMAGE TO EXISTING FACILITIES PRIOR TO CONSTRUCTION. CONTRACTOR WILL BE RESPONSIBLE FOR REPAIR/REPLACING FACILITIES IF ENGINEER/OWNER IS NOT NOTIFIED OF EXISTING DAMAGE PRIOR TO CONSTRUCTION COMMENCING.

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- 1 INSTALL 48" DIAMETER SANITARY SEWER MANHOLE WITH WATERTIGHT JOINTS & SINGLE 24" LID PER DCSWS SD-1, SD-3 & SD-4 AND SD-9
- 2 FIELD VERIFY EXISTING SSMH INVERT ELEVATION & CONNECT PER DCSWS STANDARDS
- 3 INSTALL SDR-35 PVC SANITARY SEWER PIPE (PUBLIC)
- 4 INSTALL SDR00 PVC SANITARY SEWER PIPE (PUBLIC)
- 5 INSTALL SEWER STUB AND CAP W/ 1.0 CUBIC FOOT OF CONCRETE FOR FUTURE CONNECTION.
- 6 REMOVED OR ADD GRADE RINGS AS NEEDED TO BRING EXISTING MANHOLE TO PROPOSED GRADES SHOWN ON PLANS
- 7 INSTALL 72" DIAMETER SANITARY SEWER MANHOLE WITH DUAL 24" LID PER DCSWS SD-2
- 8 INSTALL CORROSION PROTECTION PER DCSWS 213.19H AND 316.8
- 9 INSTALL 900 SS LATERAL PROTECTION PER SD-19 AND SD-21

ONE OR MORE SEGMENTS OF THE DOWNSTREAM SEWER SYSTEM THAT WILL SERVE THIS PROJECT HAS NOT BEEN COMPLETED AND/OR ACCEPTED FOR MAINTENANCE BY THE CITY OF LAS VEGAS. ANY WORK DONE ON THIS PROJECT PRIOR TO THE COMPLETION AND/OR ACCEPTANCE OF THE DOWNSTREAM SEWER SYSTEM(S) SHALL BE DONE AT THE DEVELOPER'S OWN RISK. THE CITY OF LAS VEGAS RESERVES THE RIGHT TO PREVENT THE PHYSICAL CONNECTION OF THIS PROJECT INTO THE DOWNSTREAM SEWER SYSTEM UNTIL ALL SEGMENTS HAVE BEEN COMPLETED AND ACCEPTED FOR MAINTENANCE, OR UNTIL SUCH TIME AS THEY ARE DEEMED AVAILABLE FOR SERVICE.

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES
PROJECT No. 137430 FIRST APPROVED DATE _____

[illegible][illegible]

0 TO 33+50

CLASS 1
STA 27+50

D. R. HORTON
AND HUALAPAI - PHOENIX
- HUALAPAI AVENUE

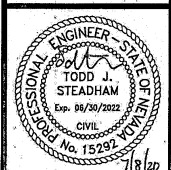
ANN AND PLAN AND PROFILE

DATE: 6/29/20

DRAFTER: AJY
DESIGNER: AJY

CHECKED: STS

PROJECT NO.
OLY1801-014



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