TECHNICAL DRAINAGE STUDY

Grand Canyon & Washburn

MARCH 2023

PREPARED FOR:

Greystone Nevada, LLC
Las Vegas, Nevada

PREPARED BY:

Westwood

Westwood

Grand Canyon & Washburn

Technical Drainage Study

City of Las Vegas, NV

Prepared For:

Greystone Nevada, LLC
9275 W. Russell Rd, Suite 400
Las Vegas, Nevada 89148

Prepared By:

Westwood Professional Services
5725 W. Badura Avenue, Suite 100
Las Vegas, NV 89118
Phone: (702) 284-5300



Project Number: LEN2206
Date: January 2023

Kellin Collins, P.E.
NV Professional Engineer No. 21860

Assisted by: Christopher Wolf

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Grand Canyon & Washburn Date: March 2023

Location of Development: a) Descriptive (Cross Streets): North/South: Grand Canyon Drive

East/West: Washburn Road

b) Section: 31 Township: 19 Range: 60

c) APN: 125-31-201-010 and 125-31-301-014

Name of Owner: Greystone Nevada, LLC

Telephone No.: Fax No.: E-mail Address:

Address: 9275 W. Russell Rd, Suite 400 Las Vegas NV 89148

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: Westwood Professional Services

Address: 5725 W. Badura Ave, #100 Las Vegas NV 89118

Type of Land Development/Land Disturbance Process:

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

1. Total Owned Land Area: At Site: 90 +/- acres Being Developed/Disturbed: 90 +/- 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.): Residential

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

6. Has the site drainage been evaluated in the past? ☐ Yes** ☒ No If yes, please identify documentation:

7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: East towards Grand Canyon Drive

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

PROFESSIONAL ENGINEER-STATE OF NEVADA
KELLIN COLLINS
Exp. 12-31-2024
CIVIL
No. 21860
3/29/23

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

Local Entity File No.

Revision	Date

REFERENCE: STANDARD FORM 1

Updated 05/01/2008

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

Project Name: Grand Canyon & Washburn	Map ID:
Firm Name: Westwood Professional Services	Engineer: Kellin Collins, P.E.
Address: 5725 W. Badura Ave, #100	
City: Las Vegas	State: NV Zip: 89118
Phone Number: (702) 284-5300	Fax Number: (702) 284-5399
Property Owner: Greystone Nevada, LLC	
Address: 9275 W. Russell Rd, Suite 400	
City: Las Vegas	State: NV Zip: 89148

Reviewed By:	Date Received:	Date Accepted for Review:

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

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

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

I. GENERAL REQUIREMENT

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

II. MAPS AND EXHIBITS

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

REFERENCE:	**STANDARD FORM 2**

DRAINAGE SUBMITTAL CHECKLIST

II. MAPS AND EXHIBITS (Continued)

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

III. DRAINAGE PLAN

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

REFERENCE:	**STANDARD FORM 2**

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
-	N/A	Streets with off-set crowns.
X	-	Proposed contours or spot elevations in sufficient detail to exhibit intended drainage patterns and slopes.
X	-	Property lines.
X	-	Right-of-way lines and widths, existing and proposed.
X	-	Existing improvements and their elevations.
X	-	Delineation of proposed on-site drainage basins indicating area and 10-year and 100-year storm peak flows at basin concentration points.
X	-	Concentration points and drainage flow direction with Q_{100} and V_{100} and D_{100} in streets.
X	-	Cumulative flows, velocity, and direction of flow at upstream and downstream ends of site for the 10-year and 100-year flows.
X	-	Location and cross-section of street capacity calculations.
-	N/A	Cross-sectional detail for channels, including cutoff wall locations.
X	-	Existing and proposed drainage facilities, appurtenances, and connections (i.e., sidewalk, ditches, swales, storm drain systems, unimproved and improved channels, and culverts, etc.) stating size, material, shape, and slope with plan and profile and HGL calculations.
X	-	Existing and proposed drainage easements and widths shown with sufficient detail. A cross sectional detail must be provided that shows appropriate lining and reinforcement.
-	N/A	Location and detail of existing, proposed, and future block wall openings. Minimum size is 16" x 48". Wrought iron gate is required for flows > 10 cfs.
X	-	Location and detail of flood walls illustrating depth of flow, proposed grouting height, etc.
X	-	Perimeter retaining wall locations. All existing and proposed walls (retaining screen and flood) must be shown with adjacent ground elevations. Flood walls with 8-inch concrete masonry unit.
X	-	Building and/or lot numbers.
X	-	Alignment of all existing, proposed, or future Regional Facilities adjacent to the site.
X	-	Limits of existing floodplain based on current FIRM or best available information; limits of proposed floodplains based on best available information.

REFERENCE:	**STANDARD FORM 2**

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

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

IV. HYDROLOGIC ANALYSIS

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

REFERENCE:	**STANDARD FORM 2**

DRAINAGE SUBMITTAL CHECKLIST

V. HYDRAULIC ANALYSIS

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

REFERENCE:	**STANDARD FORM 2**

CITY OF LAS VEGAS

MINIMUM DRAINAGE STUDY CRITERIA
STANDARD FORM 2 CHECKLIST SUPPLEMENT

(Revised 5/18/11)

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

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

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

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

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

II. GRADING PLAN INFORMATION		
Yes	No	
X	-	Proposed on-site and off-site storm drains and other flood control facilities with plan and profile sheets for public storm drains showing the class of pipe, (Class III, IV, V, etc.), design hydraulic grade line, (HGL) and 100 year storm flow. A public drainage easement must be provided over on-site storm drains conveying off-site flows. An overflow path must be provided over all storm drains.
X	-	All existing and "to be constructed" walls with cross-sections showing wall type, (e.g. block wall, retaining wall, flood wall, etc.), with limits clearly defined, adjacent ground elevations. Wall heights must meet current ordinances and in no case exceed 14 feet above the adjacent property.
X	-	Street slopes for both interior and perimeter streets. Note: The minimum slope for a roadway is 0.4 percent, a minimum 18-inch storm drain must be provided where minimum slopes cannot be met.
X	-	Back of lot elevations and lot drainage pattern for all lots including common lots.
X	-	Sites with a grade difference two feet above or below existing ground are required to have approval from City of Las Vegas Current Planning. Current Planning approval is required prior to final approval of the drainage study.
X	-	On-site facilities must perpetuate flows through or around the site without significantly impacting adjacent property owners. (The project must pass flows through the site every 600 feet where the project is blocking flow paths.)
X	-	This project uses a solid grouted stem wall (or approved alternate) at the back of sidewalk to provide erosion protection for landscaped areas where the depth of flow in the roadway exceeds the back of walk elevation. A corresponding cross-section detail is included.
X	-	Commercial and Common Lot Landscape areas are not allowed to drain over the sidewalk. The grading plans show flow lines with grades and sidewalk under drains for all landscape areas draining to the public ROW.

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

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

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

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

Westwood

Grand Canyon & Washburn

Technical Drainage Study

City of Las Vegas, NV

Prepared For:

Greystone Nevada, LLC
9275 W. Russell Rd, Suite 400
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Westwood

Table of Contents

Table of Contents i

List of Tables iii

List of Appendices iv

1.0 Introduction 1
1.1 Project Overview 1
1.2 Study Purpose 1
1.3 Site Description 1
1.4 Preliminary Entity Coordination 1
1.5 FEMA Flood Zone Designation 2
1.6 CCRFCD Facility Information 2
1.7 CCRFCD Watershed Information 2
1.8 Referenced Documents 2

2.0 Methodology 3
2.1 Compliance 3
2.2 Hydrologic Modeling 3
2.3 Hydraulic Modeling 5

3.0 Existing Drainage Condition 5
3.1 Definition of Existing Condition 5
3.2 Discussion of Existing Condition 5
3.3 Summary of Existing Condition Flows 6

4.0 Interim Drainage Condition 6
4.1 Definition of Interim Condition 6
4.2 Discussion of Interim Condition 6
4.3 Summary of Interim Condition Flows 7

5.0 Proposed Drainage Condition 7
5.1 Definition of Proposed Condition 7
5.2 Discussion of Proposed Condition 7
5.3 Summary of Proposed Condition Flows 7

6.0 Developed Drainage Condition 8
6.1 Definition of Developed Condition 8
6.2 Discussion of Developed Condition 8
6.3 Summary of Developed Condition Flows 8

7.0 Ultimate Drainage Condition 8
7.1 Definition of Ultimate Condition 8
7.2 Discussion of Ultimate Condition 8

7.3 Summary of Ultimate Condition Flows....8

8.0 Flow Rate Comparison 9

9.0 Street Improvements....10

10.0 Drainage Facilities 11

10.1Storm Drain System in Fisher Ave 11
10.2Storm Drain System Washburn Ave 11
10.3Storm Drain System Rosada Way 11
10.4Storm Drain System between Rosada Way and La Madre Way....12
10.5Drainage Laterals to La Madre Way 12
10.6Temporary Ditches 12

11.0 Drainage Easements....12

12.0 Finished Floor Elevations....13

13.0 Conclusions & Recommendations 13

14.0 References....14

List of Tables

Table 1: Comparison of 100-year Flow Rates 9

List of Appendices

Appendix A **Drainage Exhibits**
- Exhibit A – Location Map
- Exhibit B – FEMA FIRM Map
- Exhibit C1 – CCRFCD MPU Facilities Map
- Exhibit C2 – CCRFCD MPU Facilities Inventory
- Exhibit C3 – CCRFCD MPU Hydrologic Map
- Exhibit D – Soils Map
- Exhibit E – CLV Northwest Neighborhood Study Figure E-7
- Exhibit F – CLV Northwest Neighborhood Study Figure F-7
- Exhibit G – Existing Condition Drainage Map
- Exhibit H – Interim Condition Drainage Map
- Exhibit I – Proposed Condition Drainage Map
- Exhibit J – Developed Condition Drainage Map

Appendix B **Hydrologic Analyses**
- Precipitation Data
- CN Computation, Soils & Land Use Data
- Lag Time Computations (Standard Form 4)
- Existing Condition HEC-1 Model
- Interim Condition HEC-1 Model
- Proposed Condition HEC-1 Model
- Developed Condition HEC-1 Model

Appendix C **Street & Hydraulic Sections**
- Existing Condition Flow Split Computations – 100 Yr
- Existing Condition Flow Split Computations – 10 Yr
- Proposed Condition Flow Split Computations – 100 Yr
- Proposed Condition Flow Split Computations – 10 Yr
- Developed Condition Flow Split Computations – 100 Yr
- Developed Condition Flow Split Computations – 10 Yr
- Perimeter Street Flow Computations – 100 Yr
- Perimeter Street Flow Computations – 10 Yr
- Interior Street Flow Computations – 100 Yr
- LaMadre Street Flow Comparison
- Temporary Ditch Computations
- Drainage Easement Computations

Appendix D **Storm Drain Analyses**
- Inlet Sizing Computations
- Inlet Control Nomographs
- Lateral Sizing Computations

Appendix E **Finished Floor Analyses**

Appendix F **Reference Material**
***Technical Drainage Study for Ann Road & Hualapai Way* (PW21-16399)**
- Approval Letters
- Referenced Drainage Exhibits

Appendix G **Reference Material**
Technical Drainage Study for Ann and 215 Phase 1
(DS 5211)
- Approval Letters
- Referenced Drainage Exhibits

Appendix H **Reference Material**
Technical Drainage Study for Park & Hammer Residential
(PW21-17227)
- Approval Letters
- Referenced Drainage Exhibits

Appendix I **Reference Material**
Technical Drainage Study for Grand Canyon & Rosada
(DS 4924)
- Approval Letters
- Referenced Drainage Exhibits

Appendix J **Reference Material**
Technical Drainage Study for Park Meadows
(PW19-15982)
- Approval Letters
- Referenced Drainage Exhibits

Appendix K **Reference Material**
Technical Drainage Study Update for Morley Properties
(PW18-1227)
- Approval Letters
- Referenced Improvement Plans

Appendix L **Reference Material**
Technical Drainage Study for MSM 19-600022
(PW19-14561)
- Approval Letters
- Referenced Improvement Plans

Appendix M **Reference Material**
Technical Drainage Study for Infante – 2 Lots
(PW18-11461)
- Approval Letters
- Referenced Drainage Exhibits

Appendix N **Reference Material**
Technical Drainage Study for Cristian & Shari Grimes Residence
(PW07-42495)
- Approval Letters
- Referenced Drainage Exhibits

Appendix O **Zoning & Planning Conditions**

Appendix P **Improvement Plans**

1.0 Introduction

1.1 Project Overview

Greystone Nevada, LLC is proposing to develop 90.0 ± acres into a residential subdivision, generally located west of Grand Canyon Drive and north and south of Washburn Road within the City of Las Vegas, Nevada. The project site is identified as *Grand Canyon & Washburn* (hereinafter referred to as the project site). The proposed improvements include single-family lots as well as interior and perimeter roadways, utilities, and drainage facilities. The overall project site will be developed in two (2) phases.

1.2 Study Purpose

The purpose of this study is to provide detailed hydrologic and hydraulic analysis for the project site to protect the property from onsite and offsite runoff in accordance with local stormwater criteria. The study addresses offsite drainage impacts to the project site, establishes onsite drainage patterns, and accommodates the allowable discharge restrictions at appropriate downstream locations. The study also assesses the required drainage infrastructure and establishes finished floor elevations of the proposed lots. Specifically, this study will technically design both Grand Canyon & Washburn Phase 1 (hereinafter referred to as Phase 1) and Grand Canyon & Washburn Phase 2 (hereinafter referred to as Phase 2).

1.3 Site Description

The project site is located within APN 125-31-201-010 and 125-31-301-014 and is generally bound by Hualapai Way, Fisher Avenue, and Grand Canyon Drive to the west, north, and east, respectively. To the south are partially developed land and La Madre Way. The current condition of the project site is undeveloped desert terrain with sparse desert shrub typical of southern Nevada.

A total of 136 single-family residential lots are proposed, ranging in size from a minimum of 18,000 square feet to a maximum of 33,900 square feet with an overall density of 1.5 dwelling units per acre. The lots are oriented where some front onto private interior roadways with curb and gutter and some front public roadways with rural street design (no curb and gutter). Associated with the project site development are improvements to the adjacent Hualapai Way, Eula Street, Fisher Lane, Grand Canyon Drive, Washburn Road, Rosada Way, and La Madre Way.

A location map identified as Exhibit A has been included in Appendix A for reference.

The Tentative Map (TM) for the project site has been approved. A copy of the planning and zoning conditions for project site are included in Appendix G.

1.4 Preliminary Entity Coordination

The project site design incorporates the preliminary coordination with the City of Las Vegas (CLV) and Clark County Public Works – Development Review (CCPW-DW) conducted on January 24, 2023 and January 18, 2023, respectively. The coordination was specific to the necessary drainage facilities at Fisher Ave, Washburn Rd, Rosada Way, and La Madre Way just west of Grand Canyon Drive. The necessary facilities are to facilitate the interception and routing of runoff from the west (via inlets and laterals) into the planned future MPU facility in Grand Canyon.

Per coordination with CLV, it was agreed upon that Greystone Nevada, LLC will provide cost contribution to CLV of the necessary drainage facilities to meet the intent of the planned MPU facility in leu of constructing the inlets and laterals at this time since the MPU facility in Grand Canyon Drive is not yet constructed. As such, this technical drainage study will present enough

technical data to support inlet and lateral sizes and the improvement plans will identify the anticipated drainage facility locations, alignments, lengths, and vertical data.

1.5 FEMA Flood Zone Designation

The project site is not located within a FEMA designated Special Flood Hazard Area (SFHA). The project site has been identified on the current FEMA FIRM Panel Maps 32003C1750E and 32003C1745E, both dated September 27, 2002 as Exhibit B, included in Appendix A. Per the FIRM Panel, the project site is located within a FEMA designated unshaded Zone 'X'. An unshaded Zone 'X' is located outside the 0.20% annual chance floodplain.

1.6 CCRFCD Facility Information

The project site is located within Figure F-17 of the 2018 Las Vegas Valley Flood Control Master Plan Update (hereinafter referred to as the 2018 MPU, Reference 1) which is included in Appendix A as Exhibit C1. Exhibit C1 shows that the project site is adjacent to a planned MPU regional facility (along Grand Canyon Drive, GONO 0350). Exhibit C2, also provided in Appendix A, is the 2018 MPU facilities inventory for Figure F-17.

1.7 CCRFCD Watershed Information

Figure W-4 from the 2018 MPU shows that the project site is located in subbasin WRHW-C and drains southeast. Exhibit C3, identifying the project site on the 2018 MPU hydrologic figure, has been included in Appendix A for reference.

1.8 Referenced Documents

This study was prepared in coordination with various relevant documents, studies and improvement plans previously reviewed and approved by the governing agency. The following drainage studies and improvement plans were utilized in the preparation of this study. These approved studies have been reviewed and are considered acceptable for referencing with exceptions noted in this report.

- *Technical Drainage Study for Ann Road & Hualapai Way* (PW21-16399, hereinafter referred to as the AH SEC Study) prepared by Kimley Horn, established the approaching watershed from the north that is not reflected on the readily available topography. The relevant reference material from the AH SEC Study has been included in Appendix F.

- *Technical Drainage Study for Ann and 215 Phase 1* (DS 5211, hereinafter referred to as the Phase 1 Study) prepared by Westwood Professional Services, established the approaching watershed from the west that is not reflected on the readily available topography. The relevant reference material from the Phase 1 Study has been included in Appendix G.

- *Technical Drainage Study for Park & Hammer Residential* (PW21-17227, hereinafter referred to as the Hammer Study) prepared by Taney Engineering, recently established the anticipated flow rate in Fisher Avenue east of Grand Canyon Drive. The relevant reference material from the Hammer Study has been included in Appendix H.

- *Technical Drainage Study for Grand Canyon & Rosada* (DS 4924, hereinafter referred to as the Rosada Study) prepared by Taney Engineering, recently established the anticipated flow rate in Washburn Road and Rosada Way east of Grand Canyon Drive. The relevant reference material from the Rosada Study has been included in Appendix I.

- *Technical Drainage Study for Park Meadows* (PW19-15982, hereinafter referred to as the Meadows Study) prepared by Per4mance Engineering, recently established the

anticipated flow rate in Grand Canyon Drive south of Rosada Way. The relevant reference material from the Meadows Study has been included in Appendix J.

- *Technical Drainage Study Update for Morley Properties* (PW18-1227, hereinafter to as the Morley Study) prepared by Dwyer Engineering, established the drainage pattern upon completion of two single family residential lots, located off of Rosada Street, with roadway improvements along Eula Street between Rosada Street and La Madre Way. The Morley Study establishes the approaching watershed from the west that is not reflected on the readily available topography. The relevant reference material from the Morley Study has been included in Appendix K.
- *Technical Drainage Study for MSM 19-600022* (PW19-14561, hereinafter to as the MSM Study) prepared by Infinity Engineering, established the drainage pattern of upon completion of two single family residential lots that are located off of Eula Street, located north of the La Madre Way alignment. The MSM Study establishes the approaching watershed from the west that is not reflected on the readily available topography. The relevant reference material from the Morley Study has been included in Appendix L.
- *Technical Drainage Study for Infante – 2 Lots* (PW18-11461, hereinafter referred to as the Infante Study) prepared by Architectural Civil Group, established the anticipated flow rate La Madre Way at Jensen Street. The relevant reference material from the Infante Study has been included in Appendix M.
- *Technical Drainage Study for Cristian & Shari Grimes Residence* (PW07-42495, hereinafter referred to as the Grimes Study) prepared by Ken Nicholson-Engineer, established the anticipated flow rate in La Madre Way at Grand Canyon Drive. The relevant reference material from the Grimes Study has been included in Appendix N.

2.0 Methodology

2.1 Compliance

The methodologies utilized in the preparation of this study are in compliance with the Clark County Regional Flood Control District's Hydrologic and Drainage Design Manual (hereinafter referred to as the CCRFCD Manual, adopted in 1999, Reference 2).

2.2 Hydrologic Modeling

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

100-year and 10-year Precipitation: The project site is located outside of the McCarran Airport Rainfall Area. The adjusted precipitation values utilized in the HEC-1 models, per CCRFCD Manual Figures 503 and 506 and Table 501, range from 1.64 to 1.74 inches for the 10-year and from 2.97 to 3.15 inches for the 100-year storm events. Referenced tables and figures from the CCRFCD Manual are included in Appendix B. For this study, basins to the west of Hualapai use a precipitation of 3.15 inches and basins to the east use 3.12 inches.

Storm Distribution: Since the drainage area of the contributing watershed is less than 8 square miles, the SDN 3 design storm distribution as taken from Table 503 in the CCRFCD Manual is used. Referenced tables and figures from the CCRFCD Manual are included in Appendix B.

Curve Number: The SCS curve number loss rate methodology has been utilized to approximate infiltration for the drainage basins. The soils information for the site has been obtained from the NRCS Web Soil Survey of the Las Vegas Valley Area (hereinafter referred to as the Soil Survey, Reference 3). Exhibit D, included in Appendix A, depicts the project site on a soils map. Per the Soil Survey, the basins delineated for this study lie within the following soil types and associated hydrologic soil group (HSG) for each soil type:

- Soil Type 190 (Dalian very gravelly fine sandy loam, 2 to 4 percent slopes); 100% HSG 'A'
- Soil Type 400 (Tencee very gravelly fine sandy loam, 2 to 8 percent slopes); 100% HSG 'D'

The curve numbers utilized for the basins analyzed with this study were determined based on the following land uses which have been referenced from the 2018 MPU and the CCRFCD Manual:

- **1 – Undeveloped Land / Open Desert:** utilized anywhere that improvements do not exist
- **3 – Rural (0.5-1 units/acre):** utilized according to density within the range of 0.5 to 1 unit per acre
- **4 – Low Density Residential (1-2 units/acre):** utilized according to density within the range of 1 to 2 units per acre
- **5 – Medium Density Residential (2-4 units/acre):** utilized according to density within the range of 2 to 4 units per acre
- **6 – High Density Residential (4-8 units/acre):** utilized according to density within the range of 4 to 8 units per acre
- **Paved Open Ditches:** utilized for temporary or incomplete roadway improvements per the CCRFCD Manual
- **Roadway:** utilized for fully improved perimeter roadway per the CCRFCD Manual
- **Newly Graded:** utilized for graded areas per the CCRFCD Manual

Refer to Appendix B for the composite curve number computations for each analyzed basin.

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

2.3 Hydraulic Modeling

Street Flow: Street flows have been analyzed utilizing FlowMaster Connect Edition Update 3 by Bentley Systems. In accordance with Section 304.4 of the CCRFCD Manual, the depth times velocity factor (D x V) for street flow for the minor 10-year storm event must be less than or equal to 6, with a maximum depth of 1-ft. The depth times velocity factor (D x V) for street flow for the major 100-year storm event must be less than or equal to 8, with a maximum depth of 2-ft.

Specific to streets with rights-of-way width that are 80-ft wide or greater, they are required to meet the 10-year dry lane criteria. A 12-ft wide dry lane (excluding center turning lane) must be provided in each direction of traffic during the 10-year storm event.

Cul-de-sacs within the City of Las Vegas requires a minimum slope of 1%.

Drop Inlets: Drop inlets have been assessed using an in-house computation spreadsheet which utilizes equations outlined in Section 805 of the CCRFCD Manual, which includes a 50% clogging factor in determining sizes.

Storm Drains: Storm drain conveyance have been analyzed utilizing the FlowMaster Connect Edition Update 3 by Bentley Systems. The pipes have been sized based on full flow diameter, rounded to a standard size plus 6-inches. Therefore, the HGL is within the pipe. Additionally, inlet control nomograph assessments are provided at all inlet structures to ensure the headwater depth is a minimum of 1-ft below the grate elevation.

Drainage Easements: Drainage easements conveying surface flows have been analyzed utilizing the FlowMaster Connect Edition Update 3 by Bentley Systems. A submerged weir computation is provided at the upstream end of the drainage easement and a normal depth computation is provided through the drainage easement. Drainage easement design are in conformance with criteria in Section 303.10 and 1600 of the CCRFCD Manual.

The finished floor elevations (FFE) of lots immediately adjacent to the drainage easement are compared to the drainage easement water surface elevation. The FFE of the lots immediately adjacent to the drainage easements are to be elevated a minimum of 18-inch above the weir or normal depth WSE of the drainage easement, whichever is greater.

3.0 Existing Drainage Condition

3.1 Definition of Existing Condition

The existing drainage condition considers the watershed in its current condition. The onsite watershed is undeveloped with sparse desert shrub. The offsite watershed also reflects its current condition in the existing drainage condition and is partially developed with residential homes. The planned CCRFCD MPU facility in Grand Canyon Drive is not yet constructed.

3.2 Discussion of Existing Condition

Refer to Exhibit G, included in Appendix A, for a detailed illustration of the existing condition drainage patterns. Given the geometric shape of the project site boundary, the watershed is not defined by onsite and offsite basins. Instead, the focus is on establishing flow rates as key roadway locations and downstream comparison points.

The watershed impacting the project site is from the north and west. Runoff approaching from the north is conveyed via existing rural roadways. The runoff approaching from the west is a combination of discharge from a residential subdivision to the west of Hualapai Way and some undeveloped land with natural washes. As flows traverses the project site, it drains in a southeasterly direction towards Grand Canyon Drive. Flows splits occur along Grand Canyon Drive at Hammer Lane, Fisher Avenue, Washburn Avenue, and Rosada Way. At the Grand Canyon Drive and La Madre Way intersection, the flows continue east in La Madre Way.

Note that the portion of the offsite watershed from the west that located south of the Washburn Rd alignment is extended to the existing I-215 Beltway. The residual berm from the old Beltway alignment is ignored to better reflect the historic drainage pattern.

3.3 Summary of Existing Condition Flows

A summary of existing condition flow rates, as determined by the HEC-1 and reference material, are presented in a summary table on Exhibit G in Appendix A. Refer to Appendix B for the existing condition HEC-1 model. Relevant hydrologic data for the referenced basins are provided in the appendix of the appropriate reference study. Note that select basins are further divided into subbasins with prorated flows to help quantify flows in key locations. The flow split analysis to support the existing condition hydrologic analysis is provided in Appendix C.

4.0 Interim Drainage Condition

4.1 Definition of Interim Condition

The interim drainage condition considers Phase 1 constructed with residential development and Phase 2 graded. The offsite watershed remains as described for the existing condition. The planned CCRFCD MPU facility in Grand Canyon Drive is not yet constructed.

4.2 Discussion of Interim Condition

Refer to Exhibit H, included in Appendix A, for a detailed illustration of the interim condition drainage patterns. The approaching watershed from the north remains as described during the existing condition because it is nearly fully developed. However, the basin boundary (BAS3) has been adjusted due to the proposed site development. Similarly of the approaching watershed from the west, the watershed limit and drainage pattern are the similar but the basin boundaries are adjusted to reflect the proposed project site improvements.

During the interim condition, the graded Phase 2 portion routes the approaching offsite flows from the west (north of Washburn Ave) and north via roadway alignments in an easterly direction. There are two locations where a temporary ditch is recommended to accept offsite flows onto the project site to be routed into a roadway alignment and are described as follows:

- At the existing low point in Haulapai Way, adjacent to the project site, a trapezoidal riprap lined ditch is provided to route the flows into a future interior roadway alignment (Ember Light Ct).
- At a proposed low point in Eula St, between Washburn Ave and Rosada Way, an earthen trapezoidal ditch is provided to route the flows into a future interior roadway alignment (Nightly Shine Pl).

There is one additional temporary ditch to discharge the onsite flows onto Eula St (north of Fisher Avenue).

The developed Phase 1 portion of the project site accepts the runoff from the Phase 2 portion of the project site as well as offsite runoff from west and routes them southeasterly towards Grand Canyon Drive. Drainage easements throughout Phase 1 are recommended to intercept offsite flows and discharge onsite flows. The flow splits along Grand Canyon Drive at Hammer Lane, Fisher Avenue, Washburn Avenue, and Rosada Way still occurs. With the partially developed and graded project site, the flow rate along Grand Canyon Drive at the intersection of Fisher Avenue, Washburn Avenue, and Rosada Way has changed which results in differing flow split quantities. The flow split at Grand Canyon Drive and Hammer Lane remains unchanged from the existing condition.

4.3 Summary of Interim Condition Flows

A summary of interim condition flow rates, as determined by the HEC-1 and reference material, are presented in a summary table on Exhibit H in Appendix A. Refer to Appendix B for the interim condition HEC-1 model. Relevant hydrologic data for the referenced basins are provided in the appendix of the appropriate reference study. Note that select basins are further divided into subbasins with prorated flows to help quantify flows in key locations. The flow split analysis to support the interim condition hydrologic analysis is provided in Appendix C.

5.0 Proposed Drainage Condition

5.1 Definition of Proposed Condition

The proposed drainage condition considers the offsite watershed as partially developed as defined for the existing condition. The onsite watershed is developed with the planned (Phase 1 and 2) residential development. The planned CCRFCD MPU facility in Grand Canyon Drive is not yet constructed.

5.2 Discussion of Proposed Condition

Refer to Exhibit I, included in Appendix A, for a detailed illustration of the proposed condition drainage patterns. While the planned CCRFCD MPU facility in Grand Canyon Drive is not yet constructed and the project site is not constructing any storm drain facilities, both regional and local facilities are illustrated on the proposed condition drainage map but are not accounted for. These drainage facilities are illustrated to identify the flow rates that are used in the facility sizing to establish the cost contribution as identified in Section 1.4 of this report.

The drainage pattern during the proposed condition is identical to the interim condition. The difference is the Phase 2 portion is developed with residential lots and roadways. The temporary ditches are replaced with drainage easements. The drainage easements identified for the interim condition for Phase 1 remains for the proposed condition. Again, the flow rates along Grand Canyon Drive at the intersection of Fisher Avenue, Washburn Avenue, and Rosada Way has changed which results in differing flow split quantities. The flow split at Grand Canyon Drive and Hammer Lane remains unchanged from the existing condition.

5.3 Summary of Proposed Condition Flows

A summary of proposed condition flow rates, as determined by the HEC-1 and reference material, are presented in a summary table on Exhibit I in Appendix A. Refer to Appendix B for the proposed condition HEC-1 model. Relevant hydrologic data for the referenced basins are provided in the appendix of the appropriate reference study. Note that select basins are further divided into

subbasins with prorated flows to help quantify flows in key locations. The flow split analysis to support the interim condition hydrologic analysis is provided in Appendix C.

6.0 Developed Drainage Condition

6.1 Definition of Developed Condition

The developed drainage condition considers the offsite and onsite fully developed. The planned CCRFCD MPU facility in Grand Canyon Drive is not yet constructed.

6.2 Discussion of Developed Condition

Refer to Exhibit J, included in Appendix A, for a detailed illustration of the developed condition drainage patterns. While the planned CCRFCD MPU facility in Grand Canyon Drive is not yet constructed and the project site is not constructing any storm drain facilities, both regional and local facilities are illustrated on the drainage map but are not accounted for. These drainage facilities are illustrated to identify the flow rates that are used in the facility sizing to establish the cost contribution as identified in Section 1.4 of this report.

The drainage pattern and basin boundaries during the developed condition are identical to the proposed condition. The only difference is basins WBAS9 and WBAS13 are considered fully developed. Again, the flow rates along Grand Canyon Drive at the intersection of Fisher Avenue, Washburn Avenue, and Rosada Way has changed which results in differing flow split quantities. The flow split at Grand Canyon Drive and Hammer Lane remains unchanged from the existing condition.

6.3 Summary of Developed Condition Flows

A summary of developed condition flow rates, as determined by the HEC-1 and reference material, are presented in a summary table on Exhibit J in Appendix A. Refer to Appendix B for the developed condition HEC-1 model. Relevant hydrologic data for the referenced basins are provided in the appendix of the appropriate reference study. Note that select basins are further divided into subbasins with prorated flows to help quantify flows in key locations. The flow split analysis to support the interim condition hydrologic analysis is provided in Appendix C.

7.0 Ultimate Drainage Condition

7.1 Definition of Ultimate Condition

The ultimate condition considers the offsite and onsite watershed fully developed. Additionally, the planned MPU facility along Grand Canyon Drive is considered complete.

7.2 Discussion of Ultimate Condition

During the ultimate condition the MPU facility GONO 0350, a 10’x6’ RCB is assumed to be constructed within Grand Canyon which will function as a hydrologic cutoff for properties to the east of Grand Canyon Drive.

7.3 Summary of Ultimate Condition Flows

The flows impacting the project site during the ultimate condition are the same at the developed condition. Therefore, no additional assessment is provided.

8.0 Flow Rate Comparison

The following table summarizes the previously anticipated flow rates to the flow rates established by the drainage conditions presented in this study.

TABLE 1: COMPARISON OF 100-YEAR FLOW RATES

Location		Anticipated By Others Q_{100} (cfs)	Existing Condition Q100 (cfs)	Interim Condition Q100 (cfs)	Proposed Condition Q100 (cfs)	Developed Condition Q100 (cfs)
Grand Canyon Drive & Fisher Avenue	East in Fisher Ave	212 DIV2*	83 FS2E	62 FS2E	59 FS2E	58 FS2E
	South in Grand Canyon Drive	63 (Per Map Callout*)	55 FS2S	40 FS2S	37 FS2S	37 FS2S
Grand Canyon Drive & Washburn Road	East in Washburn Rd	570 (Per NWNS**)	40 FS3E	78 FS3E	65 FS3E	65 FS3E
	South in Grand Canyon Drive	139 (Per NWNS**)	21 FS3S	48 FS3S	38 FS3S	38 FS3S
Grand Canyon & Rosada Way	East in Rosada Way	139 NPM**	42 FS4E	59 FS4E	47 FS4E	46 FS4E
	South in Grand Canyon Drive	45 CP1A****	19 FS4S	28 FS4S	22 FS4S	22 FS4S
La Madre Way & Jensen Street	East in La Madre Way	16 DOFF2*****	17 BAS13E(N)	21 WBAS13I + BAS13I(N)	21 WBAS13I + BAS13I(N)	20 WBAS13D + BAS13I(N)
Grand Canyon & La Madre Way	La Madre Way West of Grand Canyon	55**** CP1	20 BAS13E	25 CP5.1	25 CP5.1	23 CP5.1
	La Madre Way at Grand Canyon (From the Northwest)	100 CP2****	53 CP5	59 CP5	53 CP5	51 CP5

* Data obtained from the Hammer Study
** Data obtained from the Rosada Study
*** Data obtained from the Meadows Study
**** Data obtained from the Grimes Study
***** Data obtained from Infante Study

The following discussion is provided for each location based on the findings presented in Table 1 and its acceptability:

- Grand Canyon Drive & Fisher Avenue: The flow rate to this location during the interim, proposed, and developed condition are less than the existing and anticipated flow rates. As such, there are no adverse impacts.
- Grand Canyon Drive & Washburn Road: While the flow rate to this location during the interim, proposed, and developed condition are greater than the existing, it is substantially less than anticipated. Therefore, the interim, proposed, and developed condition flow rates are considered acceptable. Note that the higher interim condition flows are temporary until the completion of the Phase 2 residential improvements.
- Grand Canyon Drive & Rosada Way – East in Rosada Way: The flow rate to this location during the interim, proposed, and developed condition are greater than the existing but less than anticipated flow draining east in Rosada Way. Therefore, the interim, proposed, and developed condition flow rates are considered acceptable.
- Grand Canyon Drive & Rosada Way – South in Grand Canyon Drive: The flow rate to this location during the interim, proposed, and developed condition are greater than the existing but less than the anticipated. Therefore, there is no adverse impacts.
- La Madre Way & Jensen Street: The flow rate to this location during the interim, proposed, and developed condition are greater than the existing and the anticipated. The increase is considered acceptable for the following reasons:
    - Street flow criteria is met with higher flow rate.
    - The existing and interim condition flow comparison depths and velocity show a negligible increase. Depth and velocity increased by 0.03-ft and 0.11 fps, respectively. The supporting comparison computations for LaMadre Way is provided in Appendix C.
- Grand Canyon Drive & La Madre Way –The flow rate to this location during the interim, proposed, and developed condition are greater than the existing but less than the anticipated. Therefore, there is no adverse impacts.

9.0 Street Improvements

A summary table of the street flow hydraulic computations for the perimeter and interior roadways has been provided on Exhibits H, I, and J, in Appendix A. Hydraulic calculations for the perimeter and interior roadways are provided in Appendix C. All sections have been analyzed to meet 100-year and 10-year criteria stated in Section 2.3.

Perimeter Section(s): There are 11 sections provided to assess the perimeter roadways adjacent to the project site. The higher flow rate from the various drainage conditions is utilized and assessed with the minimum and maximum street slope were applicable:

- Hualapai Way
- Eula Street, north of Fisher Avenue
- Eula Street, between Washburn Way and Rosada Way
- Fisher Avenue
- Washburn Avenue
- Rosada Way
- LaMadre Way west of Jensen Street
- LaMadre Way west of Grand Canyon Drive

- Grand Canyon Drive, between Fisher Avenue and Washburn Avenue
- Grand Canyon Drive, between Washburn Avenue and Rosada Way
- Grand Canyon Drive, between Rosada Way and LaMadre Way

The perimeter 100-yr street flow assessment shows compliance with the 10-yr criteria for maximum flow depth and DxV. However, the 10-yr assessments for Hualapai Way and Grand Canyon Drive street are provided to illustrate the 10-yr dry lane compliance.

Interior Section(s): There are 7 sections provided to assess the interior roadways. Note that Sections 1 though 7 are only assessed and provided for the higher condition flow rates. For Sections 1 and 3, the interim condition flows are not applicable because the roadway does not exists during the interim condition.

10.0 Drainage Facilities

As part of the project site design, at the request of CLV, inlets and storm drain are provided at all locations where the project site contributes flows that will ultimately be intercepted by the planned CCRFCD MPU Facility in Grand Canyon Drive. Per CLV agreement, this study will provide supporting computations to size the anticipated inlets and storm drain in order to determine a cost contribution for the installation of the infrastructure at a later time by CLV. The following location infrastructure are to connect to the planned CCRFCD MPU Facility anticipated to be within the east half of the roadway. The recommended drainage infrastructures and its functionality are as follows:

10.1 Storm Drain System in Fisher Ave

The project site located to the south of Fisher Avenue; as such, inlet(s) are only provided for the south half of Fisher Avenue just west of Grand Canyon Drive. In order to limit the ponding depth, two inlets (FDI#1a and FDI#1b) in series are provided with a connector pipe (FDI1a's lateral) and a pipe (F0) connecting to the planned CCRFCD MPU facility.

10.2 Storm Drain System Washburn Ave

The project site is located to the north and south of Washburn Avenue so inlets are provided for the north and south half of Washburn Avenue west of Grand Canyon D . Since the project site has an easement discharging flows into Washburn Avenue, west of Grand Canyon way, an inlet (FDI#2) is recommended at the downstream end of the drainage easement located in the north half of Washburn Avenue. This inlet intercepts a portion of the runoff and the bypass flows are intercepted by another recommended inlet (FDI#3) that is located closer to Grand Canyon Way. An inlet (FDI#4) is located in the south half of Washburn Avenue. The storm drain system extends west from FDI#2 to FDI#3 and then a pipe (F2) in a southeasterly direction to connect to the planned CCRFCD MPU facility. FDI#4 (via F1) and the associated lateral would directly connect to the planned CCRFCD MPU facility. Note that the storm drain system is this area was not combined into a single connection to the planned CCRFCD MPU facility because the available depth to cross the existing waterline does not accommodate the necessary headwater depth with a combined system; therefore, two crossings/connections are provided for the storm drain facilities in this area.

10.3 Storm Drain System Rosada Way

The project site is located to the north and south of Rosada Way so inlets are provided for the north (FDI#5) and south (FDI#6) half of Rosada Way just west of Grand Canyon Drive. The storm

drain system extends west from FDI#5 to FDI#6 and then southeasterly (F3) to the planned CCRFCD MPU facility.

10.4 Storm Drain System between Rosada Way and La Madre Way

The project site discharges to Grand Canyon Drive via a drainage easement at the southern terminus of Dusk Skyscrape Street. An inlet (FDI#7) is provided at the downstream end of the drainage easement with a lateral that connects to the planned CCRFCD MPU facility.

10.5 Drainage Laterals to La Madre Way

The project site located to the north of La Madre Way; as such, an inlet (FDI#8) is only provided for the north half of La Madre Way just west of Grand Canyon Drive. From the inlet is a lateral that connects to the planned CCRFCD MPU facility.

10.6 Temporary Ditches

With the proposed grading of the Phase 2 limit with the Phase 1 improvement plan set, there are two locations where flows are being routed onsite and one location to discharge runoff from the project site. They are identified as TD1 through TD3 on Exhibit H, provided in Appendix A. The temporary ditches are sized for containment plus a minimum of 6" freeboard. The resulting velocity are appropriate for the recommended lining. Refer to Appendix C for the temporary ditch and riprap lining computations.

11.0 Drainage Easements

As part of the project site design, drainage easements are proposed to accept and discharge the runoff. All drainage easements are designed and assessed for surface flow and are described with the following design considerations:

Phase 1 (Refer to Exhibit H, in Appendix A, for the drainage easement locations)**:**

- DE1 is located at the southern terminus of Golden Twilight Ct. The drainage easement accommodates a flow rate greater than 20 cfs. As such, the easement is 20-ft wide.
- DE2 is located at the southern terminus of Dusk Skyscape Steet. The drainage easement accommodates a flow rate less than 20 cfs. As such, the easement is only 10-ft wide. A grade break is provided within the drainage easement to help reduce the flow velocity before the flows are discharged onto a rural roadway section.
- DE3 and DE4 is located along the west edge of the project site between Rosada Way and LaMadre Way. While the drainage easement is 20-ft wide, it is intercepting a flow rate less than 20 cfs. The easement is accepting runoff from the west at various locations where there is an existing wash/flow line. A 10-ft wide irregular concrete pad section is provided the route the flows north and south towards the DE5 easement.
- DE5 is located at the western terminus of Sparkling Moon Street routes the flows from DE3 and DE4 onto Sparkling Moon Street. The easement here is 10-ft wide for a flow rate less than 20 cfs.
- DE6 is located at the southern terminus of Sparkling Moon Street and routes flows between an existing residential four-lot subdivision and a Kern River Gas easement. The physical distance between the walls of the four-lot subdivision and the Kern River Gas easement is 11-ft. As such, a 10-ft wide u-channel is provided to convey the flows. Since the adjacent walls are existing, the depth of the u-channel has been increased to provide flood protection for the existing walls/lots.

Phase 2 (Refer to Exhibit I, in Appendix A, for the drainage easement locations):

- DE7 is located off a low point on Eclipsed Moon Street that discharges the project site flows onto Eula Street. Note that DE7 replaces TD2 provided for the interim condition. The easement here is 10-ft wide for a flow rate less than 20 cfs. A grade break is provided within the drainage easement to help reduce the flow velocity before the flows are discharged onto a rural roadway section.
- DE8 is located off a low point in Haulapai Way that accepts offsite runoff. The easement consists of a varying width u-channel as the flows turn twice within the easement. The north-south running segment is an 11-ft wide u-channel, while the east-west portions consist of a 19-ft wide u-channel.
- DE9 is located off a low point in Eula Street between Washburn Avenue and Rosada Way. The easement is located within a common element and discharges onto Nightly Shine Place. A 9-ft wide u-channel is provided to convey the flows

Supporting drainage easement hydraulic analyses are provided in Appendix C.

12.0 Finished Floor Elevations

Finished floor elevations for the proposed lots (within the City of Las Vegas) are determined to be a vertical distance above the gutter flow line of twice the depth of flow in the street on the high side of the lot, and 6-inches above the top of curb at the high side of the lot, whichever is higher.

Lots adjacent to drainage easements are assessed with the drainage easement's weir and normal depth. Lots adjacent to flows turning 90 degrees are assessed with the specific energy of the approaching flows. A spreadsheet showing the finished floor analysis and the supplemental assessments have been included in Appendix D. Where necessary for flood protection, solid grouting of walls is proposed.

13.0 Conclusions & Recommendations

1. This project site is in compliance with the applicable drainage laws as recognized by the state of Nevada and with the CCRFCD Manual.

2. The project site is not located within a FEMA designated Special Flood Hazard Area (SFHA). The project site and the proposed improvements are located within a FEMA Flood Zone "X" (unshaded). Therefore, FEMA notification will not be required.

3. The project site is adjacent to a planned CCRFCD regional facility along Grand Canyon Drive. Therefore, concurrence from CCRFCD is anticipated.

4. The project site is adjacent to Clark County jurisdiction. Therefore, concurrence from Clark County is anticipated.

5. As indicated in Section 1.4, drainage facilities are sizes to provide a cost contribution of the anticipated facilities associated with the project site in leu of constructing the inlets and laterals at this time since the MPU facility in Grand Canyon is not yet constructed.

6. The recommended storm drain facilities meet all CCRFCD Manual criteria as discussed in Section 2.3 of this report.

7. The perimeter and interior roadways meet all CCRFCD Manual criteria as discussed in Section 2.3 of this report.

8. Finished floor elevations for the proposed lots (within the City of Las Vegas) are determined to be a vertical distance above the gutter flow line of twice the depth of flow in the street on the high side of the lot, and 6-inches above the top of curb at the high side of the lot, whichever is higher.

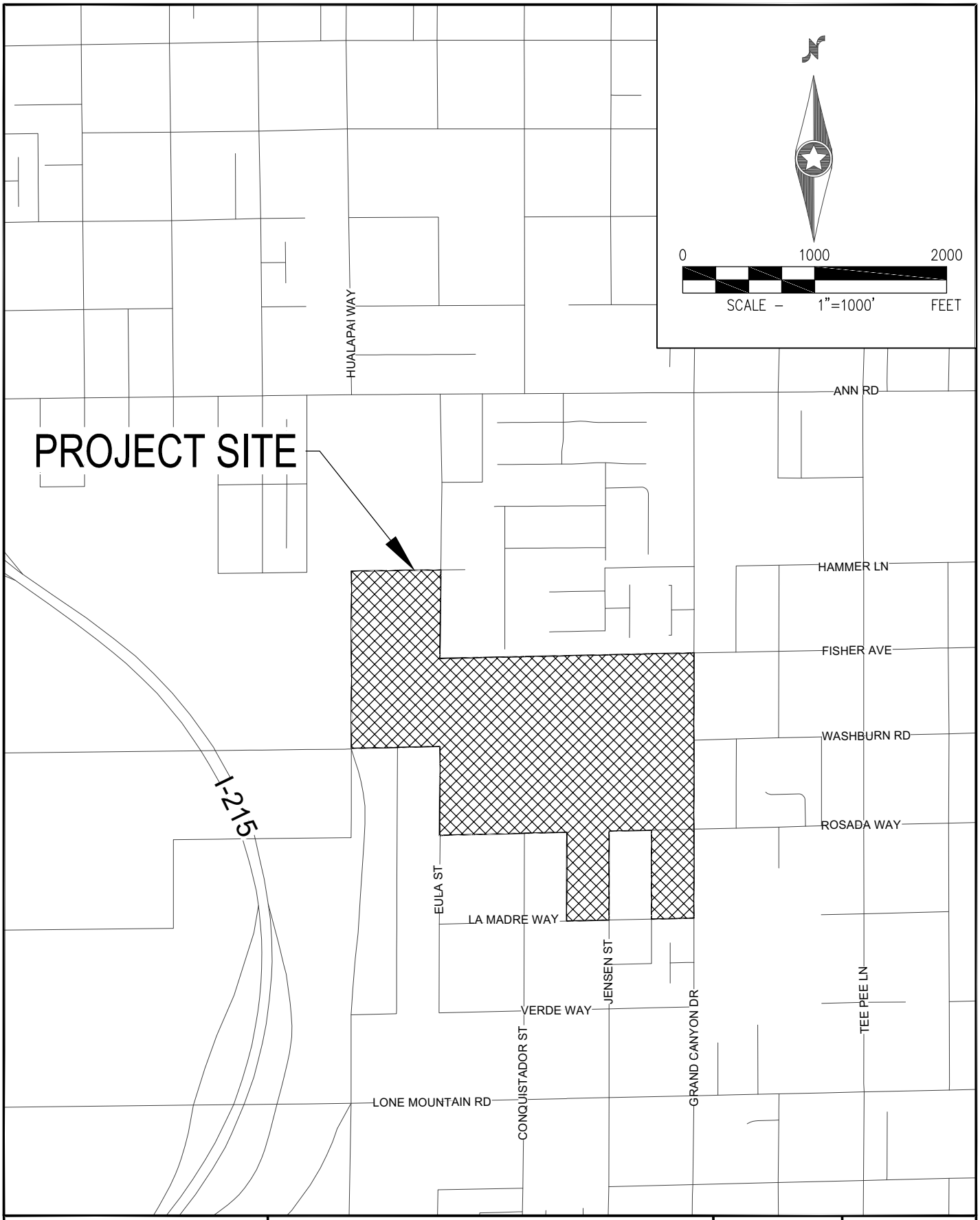
9. The improvement plans for this project are included in the last appendix of this study. These improvement plans support the drainage patterns and conclusions detailed in this study.

14.0 References

1. *Las Vegas Valley Flood Control Master Plan Update*. Atkins, 2018.
2. *Hydrologic Criteria and Drainage Design Manual*. Clark County Regional Flood Control District, 1999.
3. *Soil Survey of Las Vegas Valley Area, Nevada*. U.S. Department of Agriculture, Soil Conservation Service, September 2022.

APPENDIX A

Drainage Exhibits



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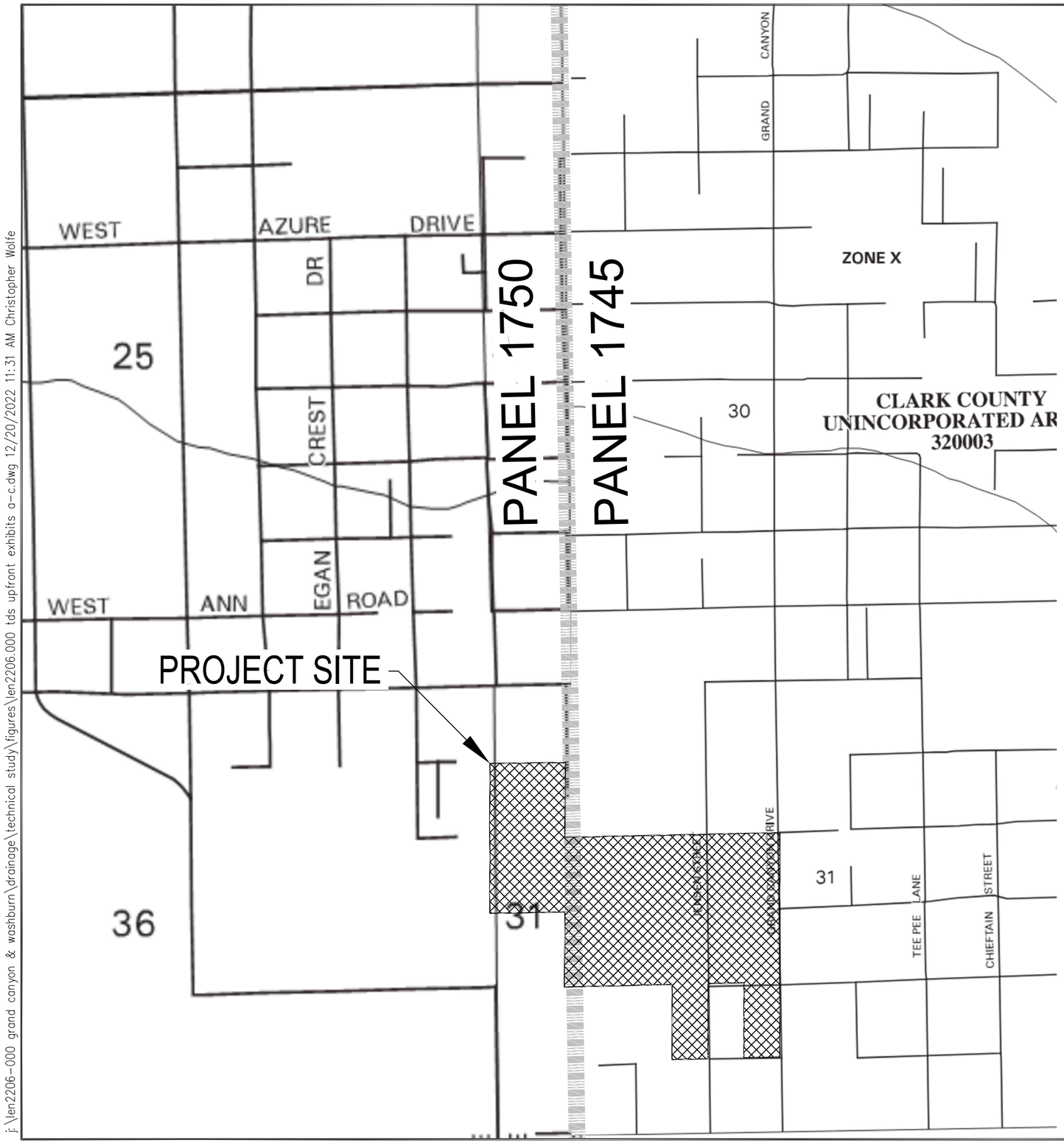
LENNAR HOMES

GRAND CANYON & WASHBURN
LOCATION MAP

DATE:	JAN 2023
DRAFTER:	CW
DESIGNER:	KC
CHECKED:	KC

PROJECT NO.
LEN2206-000

EXHIBIT A
SHEET 1 OF 1



NFIP NATIONAL FLOOD INSURANCE PROGRAM

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

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
32003C1750 E

MAP REVISED:
SEPTEMBER 27, 2002

Federal Emergency Management Agency

NFIP NATIONAL FLOOD INSURANCE PROGRAM

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

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 decertified. 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.

ZONE VE Coastal flood zone with velocity hazard (wave action); base flood elevations determined.

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.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

- (A)—(A) Cross Section Line
- (23)—(23) Transect Line
- 97°07'30", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 4276000M — 1000-meter Universal Transverse Mercator grid values, zone 11
- 600000 FT — 5000-foot grid ticks
- DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel).
- M1.5 — River Mile

0 1000 2000

SCALE – 1"=1000' FEET

Westwood

Phone (702) 284-5300
Fax (702) 284-5399

5725 W. Badura Ave.
Suite 100
Las Vegas, NV 89118

westwoodps.com

Westwood Professional Services, Inc.

NO.	DESCRIPTION	DATE	BY	APP. DATE	APP

LENNAR HOMES

GRAND CANYON & WASHBURN
FEMA FIRM MAP

DATE: JAN 2023
DRAFTER: CW
DESIGNER: KC
CHECKED: KC

PROJECT NO.
LEN2206-000

EXHIBIT B
SHEET 1 OF 1

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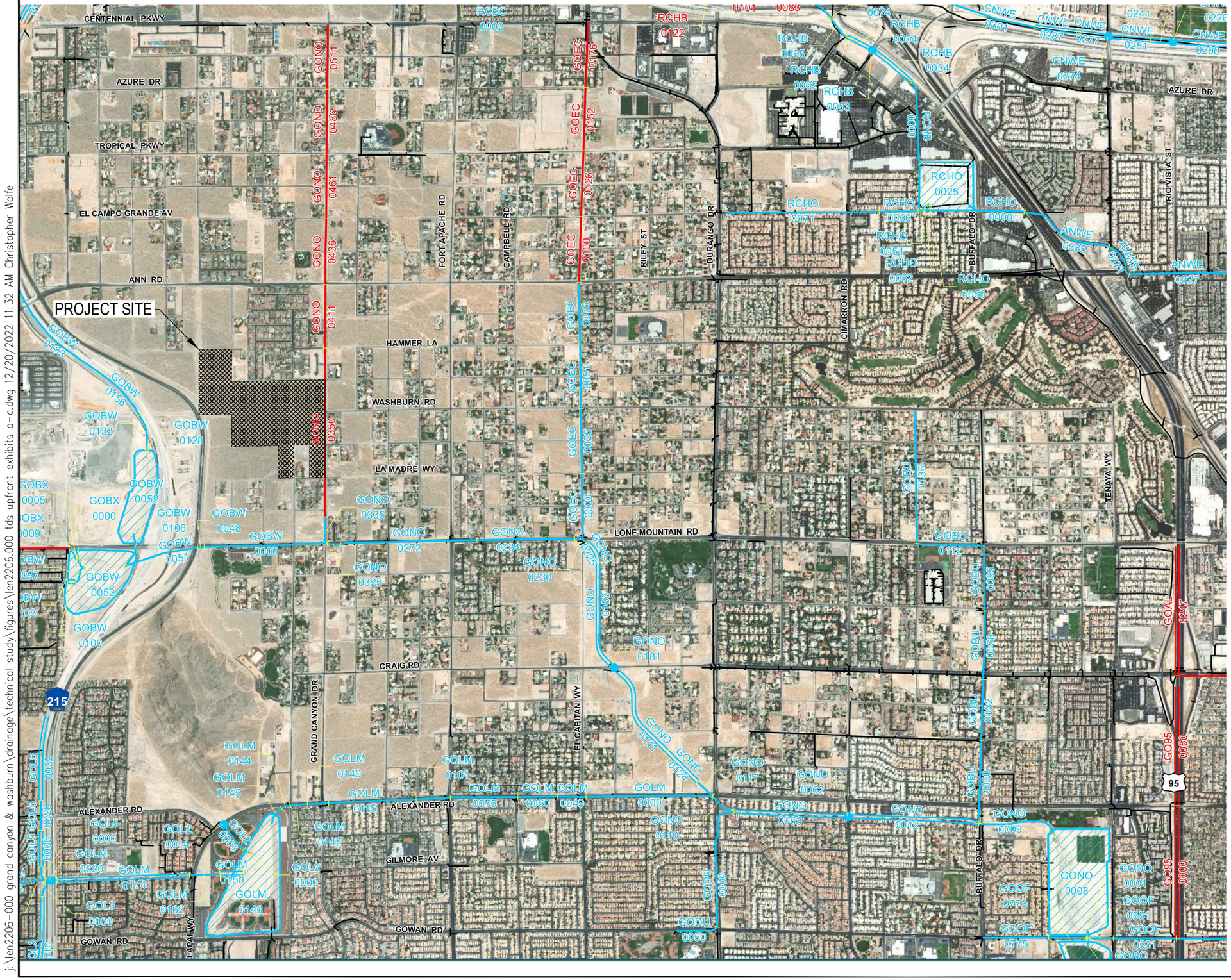

REGIONAL FLOOD CONTROL DISTRICT

2018
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE

FIGURE F-17
FLOOD CONTROL FACILITIES

LEGEND

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

Remove & Replace/Parallel Facilities

Category A	Category B
Channel	Channel
Stormdrain	Stormdrain
Crossing	Crossing

0 2000 4000
SCALE – 1"=2000' FEET

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Suite 100
Las Vegas, NV 89118
westwoodps.com
Westwood Professional Services, Inc.

NO.	DESCRIPTION	DATE	BY	APP DATE	APP

LENNAR HOMES
GRAND CANYON & WASHBURN
CCRFCD MPU FACILITIES MAP

DATE: JAN 2023
DRAFTER: CW
DESIGNER: KC
CHECKED: KC
PROJECT NO. LEN2206-000

EXHIBIT C1
SHEET 1 OF 1

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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	GD24AA-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 CUTLET	1522	115	LMBWDB	GOW4A	10.81	0.30
0052	E	589 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	438	CHLFR-C	GOW3A	1.69	1.06
0076	E	10' X 7' RCB	1335	392	CARFR-C	GOW3A	1.45	0.54

ID / Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
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	14.50
0003	E	66" RCP	607	359	CRBW	GOW3A	0.36	1.97
0014	E	84" RCPC @ 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	1.60
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 6' 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	245	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	CC3AA1	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	155	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'-9.5'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	837	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	CRSFR-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	CCWRHW-C	GOW3B	2.34	4.20
0335	E	15' X 7' RCB	529	749	CWRHW-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

ID / Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
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	CNWBC6-C	WEST3	3.41	0.30
0075	E	20' X 6' RCBC @ BELTWAY	428	1414	CNWBC6-C	WEST3	3.41	2.81
0083	P	20' X 4' RCB	950	1414	CNWBC6-C	WEST3	3.41	2.40
0101	P	CONC CHNL 20'W 5'D 0:1 SS	980	1414	CNWBC6-C	WEST3	3.41	2.38
0120	E	20' X 6' RCBC @ GRAND MONTECITO	120	1414	CNWBC6-C	WEST3	3.41	1.00
0122	P	CONC CHNL 15'-20'W 5'D 0:1 SS	350	1414	CNWBC6-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	WEST3	4.61	
0027	E	18,000 CFS PMF SPILLWAY		18000	RCHOIN	WEST3	4.61	
0050	E	ENERGY DISSIPATOR	65	240	CNW1A4-C	WEST3	0.50	
0052	E	CONC CHNL 10'W 10'D 0:1 SS	115	240	CNW1A4-C	WEST3	0.50	11.73
0054	E	10' X 5' RCB	115	240	CNW1A4-C	WEST3	0.50	0.50
0056	E	10' X 5' RCB	805	240	CNW1A4-C	WEST3	0.50	0.49
0071	E	72" RCP	3126	240	CNW1A4-C	WEST3	0.50	1.60

*The HEC-1 node shown identifies the controlling concentration point for the associated facility and is located upstream of this facility due to decreasing peak flow with increasing tributary area caused by storm distribution transitions, depth area reduction factors, or attenuation of flow from routing.
**As-built or design slopes were used when available. All other slopes are based on existing topography. The user should verify the facility slope listed prior to performing any facility specific analysis.
^ For parallel facilities, the existing facility flow equals its normal depth capacity, and the proposed parallel facility flow equals the remaining flow (i.e. HEC-1 Node flow = existing facility normal depth capacity + proposed parallel facility flow).

REGIONAL FLOOD CONTROL DISTRICT

2018 LAS VEGAS VALLEY FLOOD CONTROL MASTER PLAN UPDATE

FACILITY INVENTORY FIGURE F-17

LEGEND

ID (Facility Identifier) AABB
Parent Stream Name
Stream Name
Mile 0000
Distance Above Confluence with Parent Stream (Miles)
Miles in Hundredths

Existing Facility..... E
Proposed or Modified Facility..... P
Contingency Level
Category A..... P
Category B..... P0

Bottom Width..... W
Depth..... D
Side Slope, H:V..... SS

Construction Features

Cast in Place Concrete Pipe..... CIPCP
Corrugated Metal Arch Pipe Culvert..... CMAP
Corrugated Metal Pipe Culvert..... CMPC
High Density Polyethylene..... HDPE
Horizontal Elliptical Reinforced Concrete Pipe..... HERCP
Reinforced Concrete Arch Pipe..... RCAP
Reinforced Concrete Arch Culvert..... RCAC
Reinforced Concrete Box..... RCB
Reinforced Concrete Box Culvert..... RCBC
Reinforced Concrete Pipe..... RCP
Reinforced Concrete Pipe Culvert..... RCPC
Storm Sewer Pipe..... SSP

ATKINS
Member of the SNC Lavalin Group
Louis Berger

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NO.	DESCRIPTION	DATE	BY	APP. DATE	APP

LENNAR HOMES
GRAND CANYON & WASHBURN
CCRFCD MPUFACILITIES INVENTORY

DATE: JAN 2023
DRAFTER: CW
DESIGNER: KC
CHECKED: KC
PROJECT NO. LEN2206-000

EXHIBIT C2
SHEET 1 OF 1

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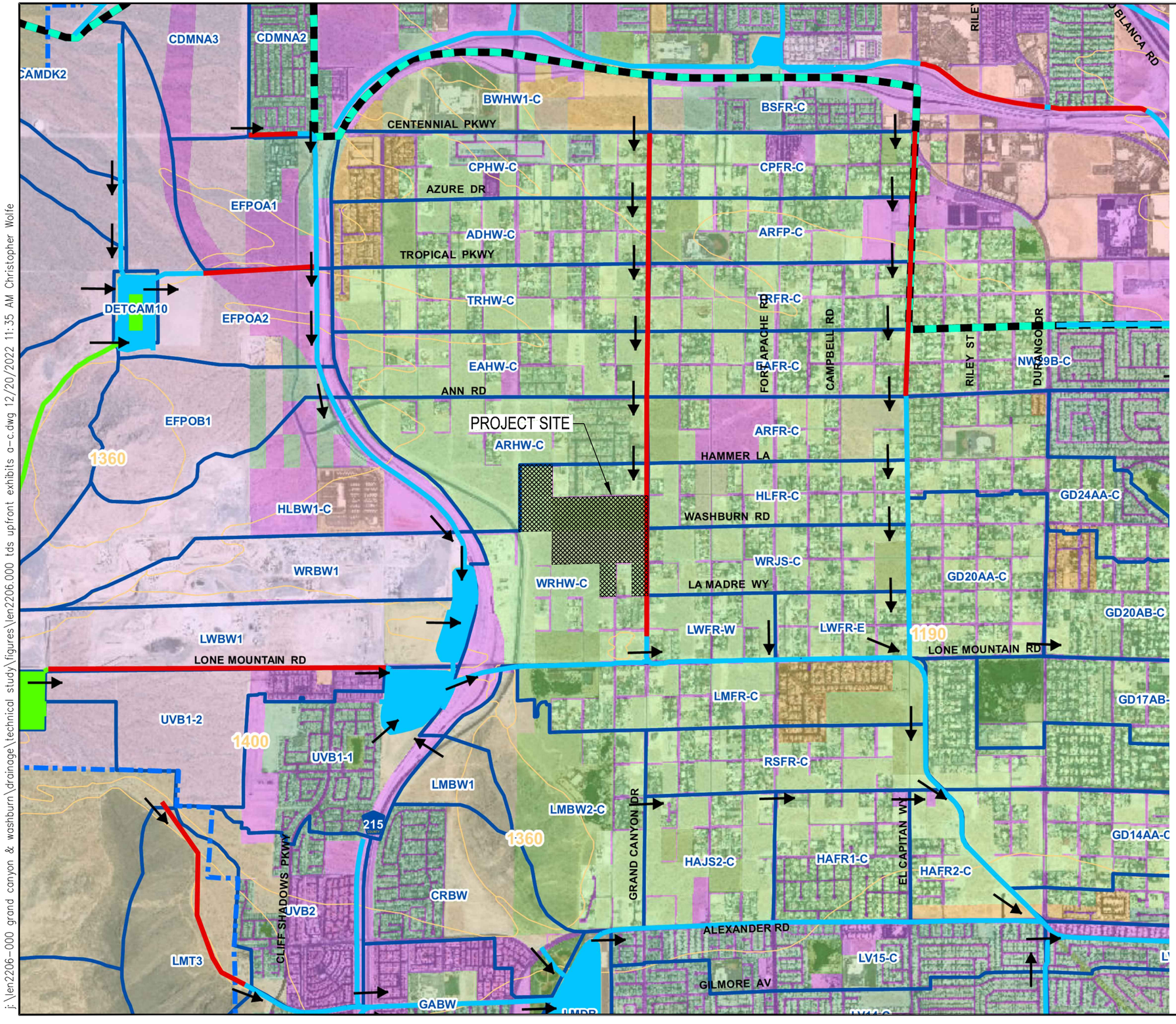

REGIONAL FLOOD CONTROL DISTRICT

2018 Las Vegas Valley Master Plan Update

Figure W-4
Gowan Watershed

Legend

- Flow Arrows
- NodeID flow(cfs) — Concentration Points
- Existing Facilities
- Category A Proposed Facilities
- Category B Proposed Facilities
- Ultimate Development Boundary
- Watershed
- BasinID — Subbasins
- MUSYM — 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

0 2000 4000
SCALE – 1"=2000' FEET

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LENNAR HOMES

GRAND CANYON & WASHBURN
2018 CCRFCD MPU HYDROLOGIC MAP

DATE: JAN 2023
DRAFTER: CW
DESIGNER: KC
CHECKED: KC
PROJECT NO. LEN2206-000

EXHIBIT C3
SHEET 1 OF 1

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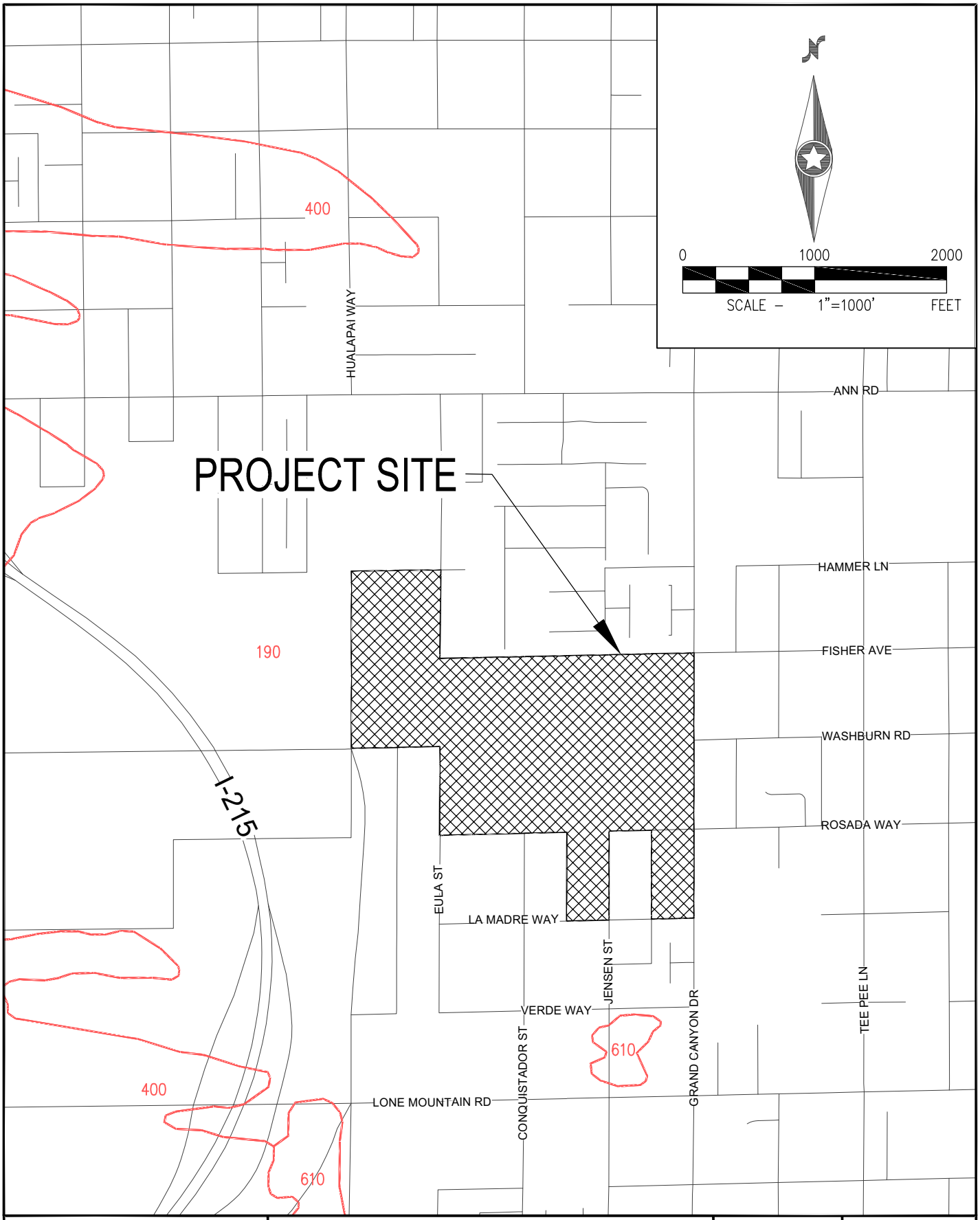

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GRAND CANYON & WASHBURN
SOILS MAP

DATE:	JAN 2023
DRAFTER:	CW
DESIGNER:	KC
CHECKED:	KC

PROJECT NO.
LEN2206-000

EXHIBIT D

SHEET 1 OF 1

CITY OF LAS VEGAS NEVADA

NORTHWEST NEIGHBORHOOD STUDY

LEGEND

SUB-BASIN BOUNDARY

FLOW ARROW

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

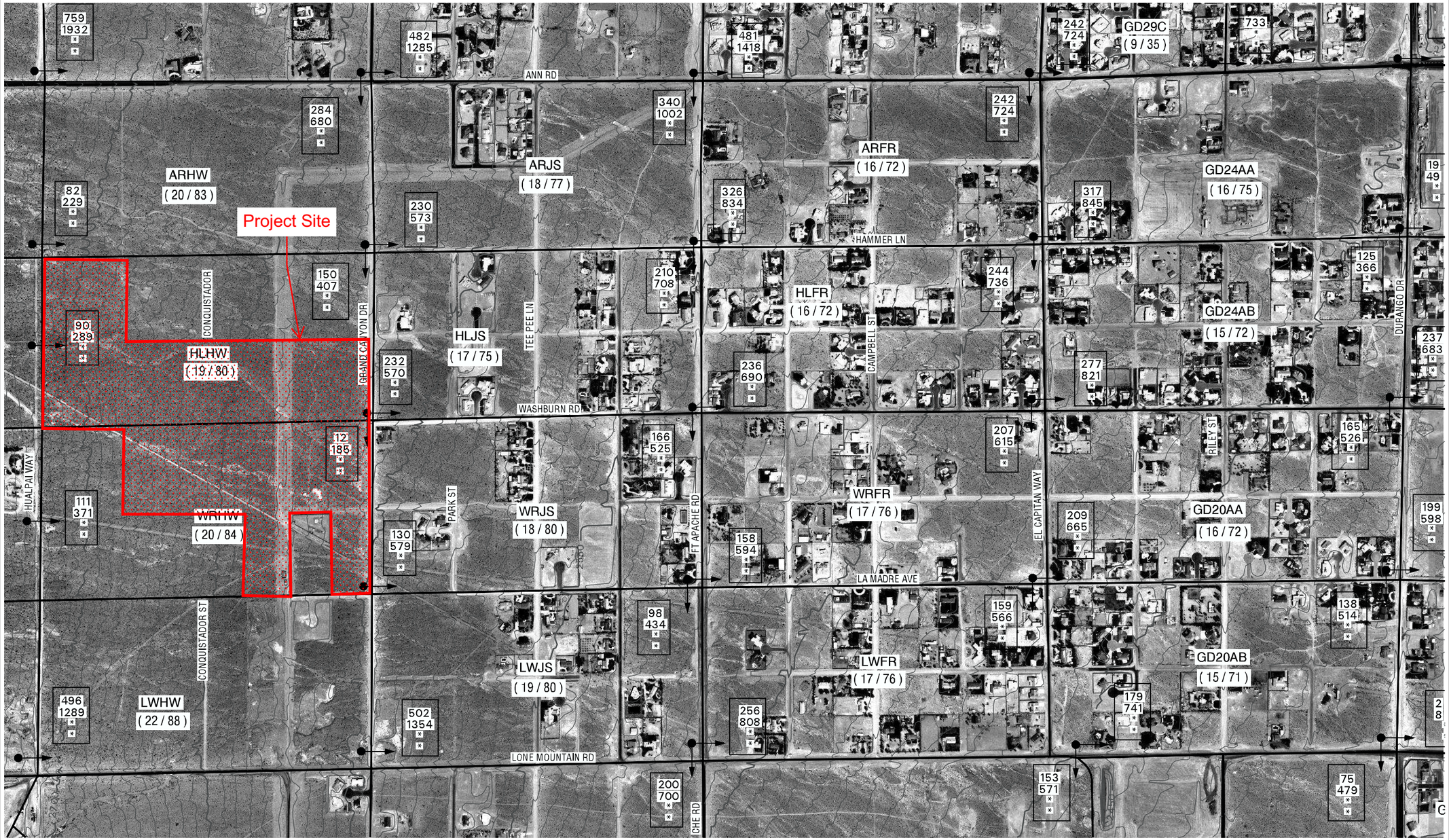
(FLOWS IN CFS)

BWJS ←→ Basin-ID

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

PHOTO DATE: APRIL 1996

FIGURE E-7



EXISTING DRAINAGE CONDITIONS

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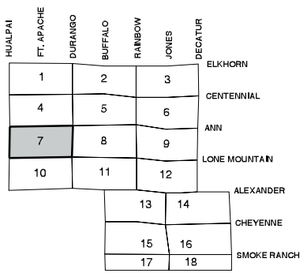
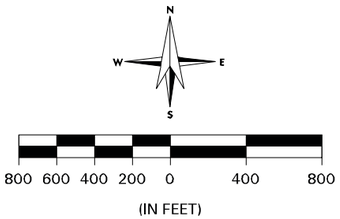


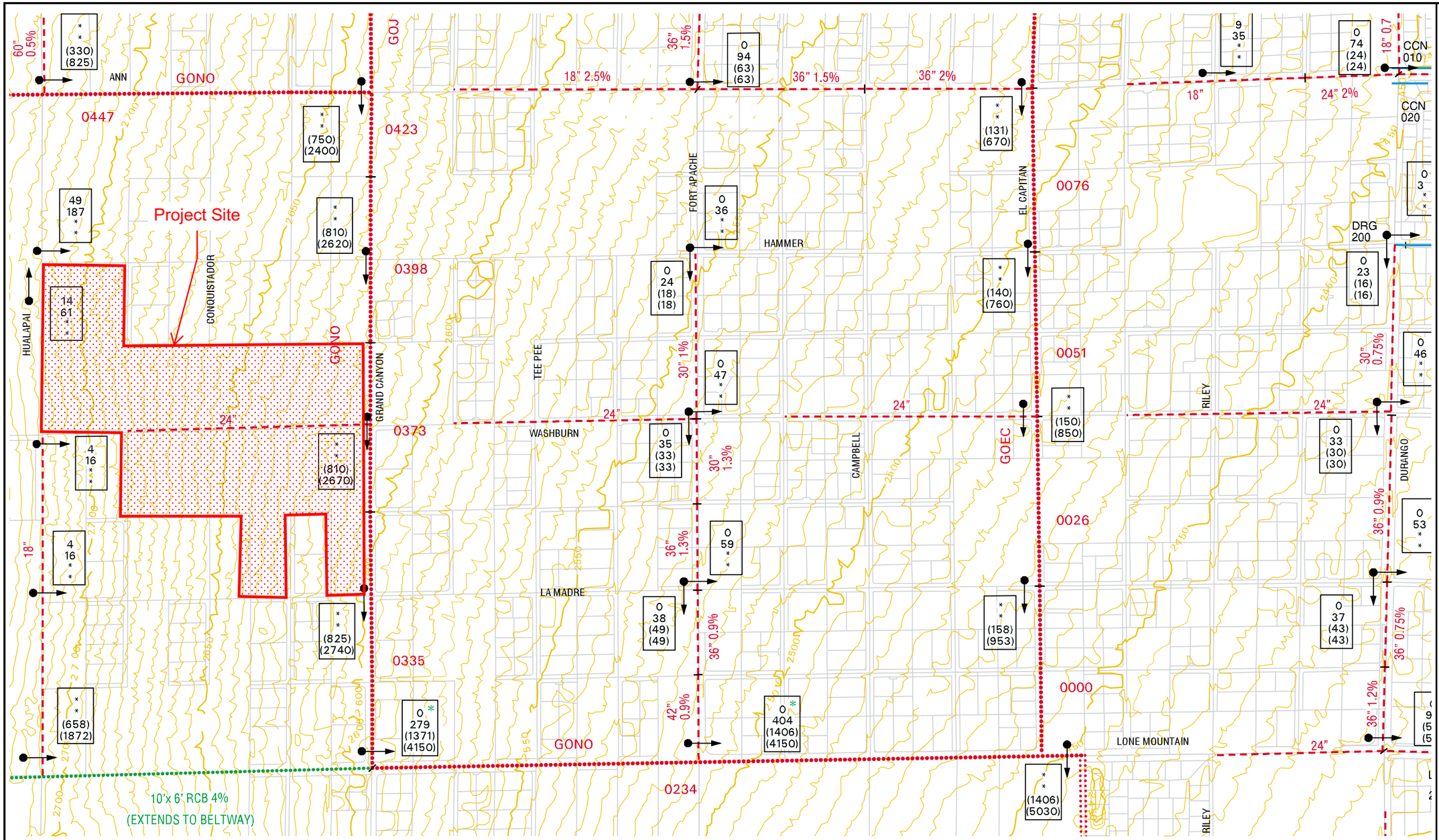
REVISED SEPTEMBER 1999

NOTE:
Existing conditions are based on future CN values with only existinig local and CCRFCD facilities in place



SCALE: 1 INCH = 800 FEET

EXHIBIT E



NORTHWEST NEIGHBORHOOD STUDY

LEGEND

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

FIGURE F-7

N W E S

800 600 400 200 0 400 800

(IN FEET)

SCALE: 1 INCH = 800 FEET

→ FLOW ARROW

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

(FLOWS IN CFS)

NOTE:

Ultimate drainage conditions are based on future CN values with all flood control facilities in place

* The capacity of the proposed regional facility is based on the "1996 Clark County Regional Flood Control Master Plan Update for the Las Vegas Valley." The facility may need to be enlarged in final design.

HUALAPAI	FT. APACHE	DURANGO	BUFFALO	RAINBOW	JONES	DECATUR	
1		2		3			ELKHORN
4		5		6			CENTENNIAL
7		8		9			ANN
10		11		12			LONE MOUNTAIN
			13	14			ALEXANDER
			15	16			CHEYENNE
			17	18			SMOKE RANCH

FUTURE DRAINAGE CONDITIONS

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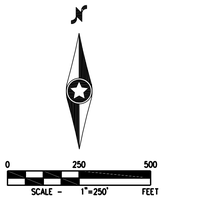
EXHIBIT F





LEGEND

- PROJECT SITE BOUNDARY
- BASIN BOUNDARY
- PRORATED SUBBASIN BOUNDARY
- ID — BASIN ID
- ID — PRORATED SUBBASIN ID
- ID — CONCENTRATION POINT ID
- FLOW DIRECTION
- Q= CFS — FLOW SPLIT

Existing Condition Flow Rate Summary

Basin/Concentration Point ID	Area (ac)	Q_{100} (cfs)	Q_{10} (cfs)
BAS1E	85.0	55	4
BAS2E	39.9	41	7
BAS3E	55.1	31	2
BAS4E	46.8	16	1
BAS5E	9.1	4	0
BAS6E	4.5	3	0
BAS7E	10.3	6	0
BAS8E	0.6	2	1
BAS9E	73.9	39	3
BAS10E	1.1	2	0
BAS11E	20.5	14	1
BAS12E	0.6	1	0
BAS13E	36.5	20	2
FS1E (CP1)	N/A	11	0.5
FS1S (CP1)	N/A	9	0.5
FS2E (CP2)	N/A	83	7.5
FS2S (CP2)	N/A	55	5.0
FS3E (CP3)	N/A	40	3.5
FS3S (CP3)	N/A	21	2.5
FS4E (CP4)	N/A	42	3.5
FS4S (CP4)	N/A	19	2.0
CP1 Q = BAS4E + BAS5E	N/A	20	1.0
CP2 Q = FS1S + BAS1E + BAS2E + BAS3E + BAS6E	N/A	138	12.5
CP3 Q = FS2S + BAS7E + BAS8E	N/A	61	6.0
CP4 Q = FS3S + BAS9E + BAS10E	N/A	61	5.5
CP5 Q = FS4S + BAS11E + BAS12E + BAS13E	N/A	53	5.0

Existing Condition Subbasin Prorated Flow Rate Summary

Basin ID	Q_{100} (cfs)	Q_{10} (cfs)	Area (acres)	100-yr Unit Flow (cfs/acre)	10-yr Unit Flow (cfs/acre)
BAS3E	31	2	55.1	0.6	0.0
BAS4E	16	1	46.8	0.3	0.0
BAS13E	20	2	36.5	0.5	0.1
Subbasin ID	**Q_{100} (cfs)**	**Q_{10} (cfs)**	**Area (acres)**	**100-yr Unit Flow (cfs/acre)**	**10-yr Unit Flow (cfs/acre)**
BAS3E(A)	1.0	0.1	1.7	0.6	0.0
BAS3E(B)	7.2	0.5	12.8	0.6	0.0
BAS3E(C)	19.4	1.3	34.6	0.6	0.0
BAS3E(D)	3.4	0.2	6.1	0.6	0.0
TOTAL	***31***	***2***	***55.1***		
(E)	ID Not Used				
BAS4E(F)	3	0	8.3	0.3	0.0
BAS4E(G)	1	0	1.6	0.3	0.0
BAS4E(H)	13	1	36.9	0.3	0.0
TOTAL	***16***	***1***	***46.8***		
(I) thru (M)	ID Not Used				
BAS13E(N)	17	2	31.2	0.5	0.1
BAS13E(O)	3	0	5.7	0.5	0.1
TOTAL	***20***	***2***	***36.9***		

NOTES:

WHERE CONCENTRATION POINTS ARE INCLUSIVE OF FLOW SPLIT FLOWS, THE CONCENTRATION POINT FLOW RATE IS AN ALGEBRAIC SUMMATION OF FLOW SPLIT RUNOFF AND HEC-1 MODEL'S CONCENTRATION POINT OR BASIN(S).

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NO.	DESCRIPTION	DATE	BY	APP. DATE	APP

LENNAR HOMES

GRAND CANYON & WASHBURN

EXISTING CONDITION

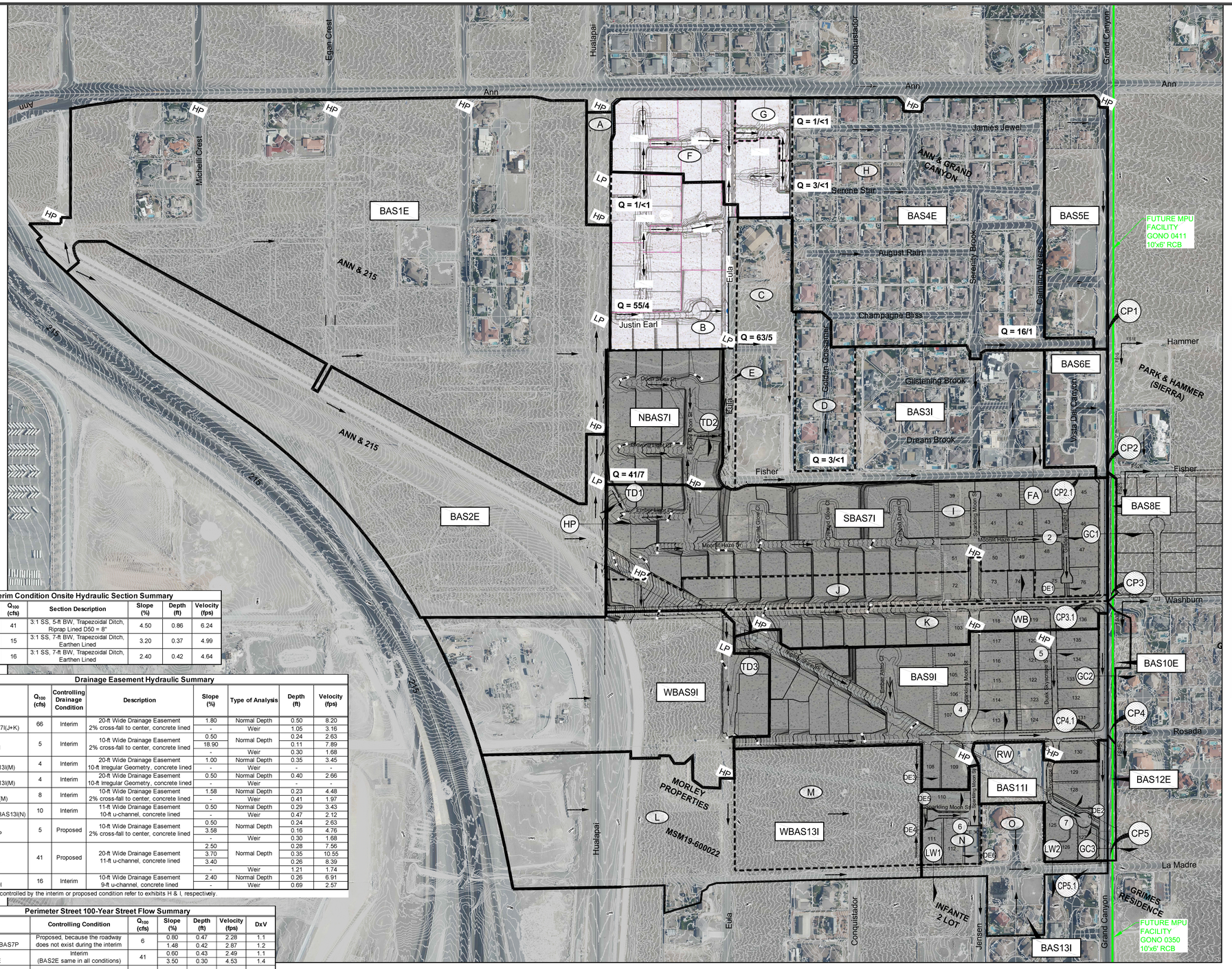
DATE: MARCH 2023
DRAFTER: CW
DESIGNER: KC
CHECKED: KC

PROJECT NO.
LEN2206-000

EXHIBIT G
SHEET 1 OF 1

PVCL #2020_____

J:\Len\2206-000 grand canyon & washburn\drainage\technical study\figures\len2206.000 tds exhibit g — existing condition.dwg 3/28/2023 10:31 AM Kelin Collins



LEGEND

- BASIN BOUNDARY
- PRORATED SUBBASIN BOUNDARY
- ANTICIPATED DRAINAGE FACILITY
- ID — BASIN ID
- (ID) — PRORATED SUBBASIN ID
- (ID) — CONCENTRATION POINT ID
- FLOW DIRECTION
- ID — FLOWMASTER SECTION
- ID — FACILITY ID
- Q= CFS — FLOW SPLIT
- Q= CFS

Interim Condition Flow Rate Summary

Basin/Concentration Point ID	Area (ac)	Q_{100} (cfs)	Q_{10} (cfs)
BAS4E	46.8	16	1
BAS5E	9.1	4	0
BAS1E	85.0	55	4
BAS3I	45.5	26	2
NBAS7I	9.4	15	4
BAS6E	4.5	3	0
BAS2E	39.9	41	7
SBAS7I	45.1	50	9
BAS8E	0.7	2	1
WBAS9I	25.0	16	1
BAS9I	23.6	23	3
BAS10E	1.1	2	0
WBAS13I	33.0	19	1
BAS13I	8.4	6	0
BAS12E	0.6	1	0
BAS11I	6.3	5	0
FS1E (CP1)	N/A	11	0.5
FS1S (CP1)	N/A	9	0.5
FS2E (CP2)	N/A	62	4.5
FS2S (CP2)	N/A	40	3.0
FS3E (CP3)	N/A	78	11.0
FS3S (CP3)	N/A	48	7.0
FS4E (CP4)	N/A	59	7.0
FS4S (CP4)	N/A	28	4.0
CP1 Q = BAS4E + BAS5E	N/A	20	1.0
CP2.1 Q = BAS1E + BAS3I + NBAS7I	N/A	90	7.0
CP2 Q = FS1S + CP2.1 + BAS6E	N/A	102	7.5
CP3.1 Q = BAS2E + BAS7I	N/A	85	15.0
CP3 Q = FS2S + CP3.1 + BAS8E	N/A	126	18.0
CP4.1 Q = WBAS9I + BAS9I	N/A	38	4.0
CP4 Q = FS3S + CP4.1 + BAS10E	N/A	87	11.0
CP5.1 Q = WBAS13I + BAS13I	N/A	25	2.0
CP5 Q = FS4S + CP5.1 + BAS11I + BAS12E	N/A	59	6.0

Interim Condition Onsite Hydraulic Section Summary

Section ID	Q_{100} (cfs)	Section Description	Slope (%)	Depth (ft)	Velocity (fps)
Section TD1 Q = BAS2E	41	3:1 SS, 5-ft BW, Trapezoidal Ditch, Riprap Lined D50 = 8"	4.50	0.86	6.24
Section TD2 Q = NBAS7I	15	3:1 SS, 7-ft BW, Trapezoidal Ditch, Earthen Lined	3.20	0.37	4.99
Section TD3 Q = WBAS9I	16	3:1 SS, 7-ft BW, Trapezoidal Ditch, Earthen Lined	2.40	0.42	4.64

Drainage Easement Hydraulic Summary

Section ID	Q_{100} (cfs)	Controlling Drainage Condition	Description	Slope (%)	Type of Analysis	Depth (ft)	Velocity (fps)
DE1 Q = CP3.1 - SBAS7I(J+K)	66	Interim	20-ft Wide Drainage Easement 2% cross-fall to center, concrete lined	1.80	Normal Depth	0.50	8.20
				-	Weir	1.05	3.16
DE2 Q = BAS1I	5	Interim	10-ft Wide Drainage Easement 2% cross-fall to center, concrete lined	0.50	Normal Depth	0.24	2.63
				18.90		0.11	7.89
				-	Weir	0.30	1.68
DE3 Q = 1/2 * WBAS13I(M)	4	Interim	20-ft Wide Drainage Easement 10-ft Irregular Geometry, concrete lined	1.00	Normal Depth	0.35	3.45
				-	Weir	-	-
DE4 Q = 1/2 * WBAS13I(M)	4	Interim	20-ft Wide Drainage Easement 10-ft Irregular Geometry, concrete lined	0.50	Normal Depth	0.40	2.66
				-	Weir	-	-
DE5 Q = WBAS13I(M)	8	Interim	10-ft Wide Drainage Easement 2% cross-fall to center, concrete lined	1.58	Normal Depth	0.23	4.48
				-	Weir	0.41	1.97
DE6 Q = WBAS13I(M) + BAS13I(N)	10	Interim	11-ft Wide Drainage Easement 10-ft u-channel, concrete lined	0.50	Normal Depth	0.29	3.43
				-	Weir	0.47	2.12
DE7 Q = NBAS7P	5	Proposed	10-ft Wide Drainage Easement 2% cross-fall to center, concrete lined	0.50	Normal Depth	0.24	2.63
				3.58		0.16	4.76
				-	Weir	0.30	1.68
DE8 Q = BAS2E	41	Proposed	20-ft Wide Drainage Easement 11-ft u-channel, concrete lined	2.50	Normal Depth	0.28	7.56
				3.70		0.35	10.55
				3.40		0.26	8.39
				-	Weir	1.21	1.74
DE9 Q = WBAS9I	16	Interim	10-ft Wide Drainage Easement 9-ft u-channel, concrete lined	2.40	Normal Depth	0.26	6.91
				-	Weir	0.69	2.57

Note: For easements controlled by the interim or proposed condition refer to exhibits H & I, respectively.

Perimeter Street 100-Year Street Flow Summary

Section ID	Controlling Condition	Q_{100} (cfs)	Slope (%)	Depth (ft)	Velocity (fps)	DxV
ES1 Q = BAS3I(E) + NBAS7P	Proposed, because the roadway does not exist during the interim	6	0.80	0.47	2.28	1.1
			1.48	0.42	2.87	1.2
HP Q = BAS2E	Interim (BAS2E same in all conditions)	41	0.60	0.43	2.49	1.1
			3.50	0.30	4.53	1.4
FA Q = CP2.1	Interim	90	4.50	0.79	6.41	5.1
GC1 [1] Q = FS2S + 2*BAS8E	Interim	44	1.20	0.79	3.02	2.4
WB Q = SBAS7I(J + K)	Interim	19	2.50	0.25	3.07	0.8
			10.74	0.19	5.10	1.0
ES2 Q = WBAS9P	Proposed, because the roadway does not exist during the interim	16	0.70	0.30	1.85	0.6
RW Q = CP4.1	Interim	38	3.90	0.66	5.22	3.4
			6.50	0.64	5.80	3.7
GC2 [1] Q = FS3S + 2*BAS10E	Interim	52	1.20	0.82	3.19	2.6
LW1 Q =WBAS13I(L)	Interim	11	5.00	0.44	4.90	2.2
LW2 Q = CP5.1	Interim	25	4.25	0.65	4.92	3.2
GC3 Q = FS4S + BAS11I + BAS12E	Interim	34	1.20	0.75	2.78	2.1

1 - In lieu of a prorated subbasin for the west half of Grand Canyon, the flow rate established for the east half is doubled.

Interior Street 100-Year Street Flow Summary

Section ID	Controlling Condition	Q_{100} (cfs)	Slope (%)	Depth (ft)	Velocity (fps)	DxV
1 Q = NBAS7P	Proposed, because the roadway does not exist during the interim	5	1.01	0.30	2.12	0.6
			4.50	0.24	3.76	0.9
2 Q = CP3.1 - SBAS7I(J+K)	Interim	66	0.70	0.70	4.58	3.2
			5.38	0.49	8.49	4.2
3 Q = WBAS9P + 1/2*BAS9P	Proposed, because the roadway does not exist during the interim	23	0.70	0.48	3.02	1.4
			5.10	0.37	5.67	2.1
4 Q = 1/3*BAS9P	Proposed	5	1.26	0.29	2.31	0.7
5 Q = 1/3*BAS9P	Proposed	5	1.98	0.27	2.75	0.7
6 Q = WBAS13I(M) + BAS13I(N)	Interim/Proposed	10	0.60	0.39	2.07	0.8
			4.50	0.29	4.43	1.3
7 Q = BAS11I	Interim/Proposed	5	1.75	0.28	2.63	0.7

10-Year Street Flow Summary

Section ID	Controlling Condition	Q_{10} (cfs)	Slope (%)	Depth (ft)	Velocity (fps)	DxV	Dry Lane (ft)
HP Q = BAS2E	Interim (same in all conditions)	7	0.60	0.22	1.41	0.3	17.0
			3.50	0.16	2.67	0.4	20.0
GC1 [1] Q = FS2S + 2*BAS8E	Interim	5	1.20	0.41	2.53	1.0	16.0
GC2 [1] Q = FS3S + 2*BAS10E	Interim	7	1.20	0.46	2.75	1.3	16.0
GC3 Q = FS4S + BAS11I + BAS12E	Interim	4	1.20	0.37	2.40	0.9	16.0

1 - In lieu of a prorated subbasin for the west half of Grand Canyon, the flow rate established for the east half is doubled.

Interim Condition Subbasin Prorated Flow Rate Summary

Basin ID	Q_{100} (cfs)	Q_{10} (cfs)	Area (acres)	100-yr Unit Flow (cfs/acre)	10-yr Unit Flow (cfs/acre)
BAS3I	26	2	45.5	0.6	0.0
BAS4E	16	1	46.8	0.3	0.0
SBAS7I	50	9	45.1	1.1	0.2
WBAS13I	19	1	33.0	0.6	0.0
BAS13I	6	0	8.4	0.7	0.0
Subbasin ID	**Q_{100} (cfs)**	**Q_{10} (cfs)**	**Area (acres)**	**100-yr Unit Flow (cfs/acre)**	**10-yr Unit Flow (cfs/acre)**
BAS3I(A)	1	0	1.7	0.6	0.0
BAS3I(B)	7	1	12.8	0.6	0.0
BAS3I(C)	14	1	24.9	0.6	0.0
BAS3I(D)	3	0	5.1	0.6	0.0
BAS3I(E)	1	0	1.1	0.6	0.0
TOTAL	***26***	***2***	***45.5***		
BAS4E(F)	3	0	8.3	0.3	0.0
BAS4E(G)	1	0	1.6	0.3	0.0
BAS4E(H)	13	1	36.9	0.3	0.0
TOTAL	***16***	***1***	***46.8***		
SBAS7I(I)	31	6	28.4	1.1	0.2
SBAS7I(J)	10	2	8.5	1.1	0.2
SBAS7I(K)	9	2	8.2	1.1	0.2
TOTAL	***50***	***9***	***45.1***		
WBAS13I(L)	11	1	19.6	0.6	0.0
WBAS13I(M)	8	0	13.4	0.6	0.0
TOTAL	***19***	***1***	***33.0***		
BAS13I(N)	2	0	2.8	0.7	0.0
BAS13I(O)	4	0	5.7	0.7	0.0
TOTAL	***6***	***0***	***8.4***		

NOTES:

WHERE CONCENTRATION POINTS ARE INCLUSIVE OF FLOW SPLIT FLOWS, THE CONCENTRATION POINT FLOW RATE IS AN ALGEBRAIC SUMMATION OF FLOW SPLIT RUNOFF AND HEC-1 MODEL'S CONCENTRATION POINT OR BASIN(S).

0 250 500
SCALE - 1"=250' FEET

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Westwood Professional Services, Inc.

NO.	DESCRIPTION	DATE	BY	APP. DATE	APP

LENNAR HOMES

GRAND CANYON & WASHBURN

INTERIM CONDITION

DATE: MARCH 2023
DRAFTER: CW
DESIGNER: KC
CHECKED: KC
PROJECT NO.
LEN2206-000

EXHIBIT H
SHEET 1 OF 1
PVCL#2020_____

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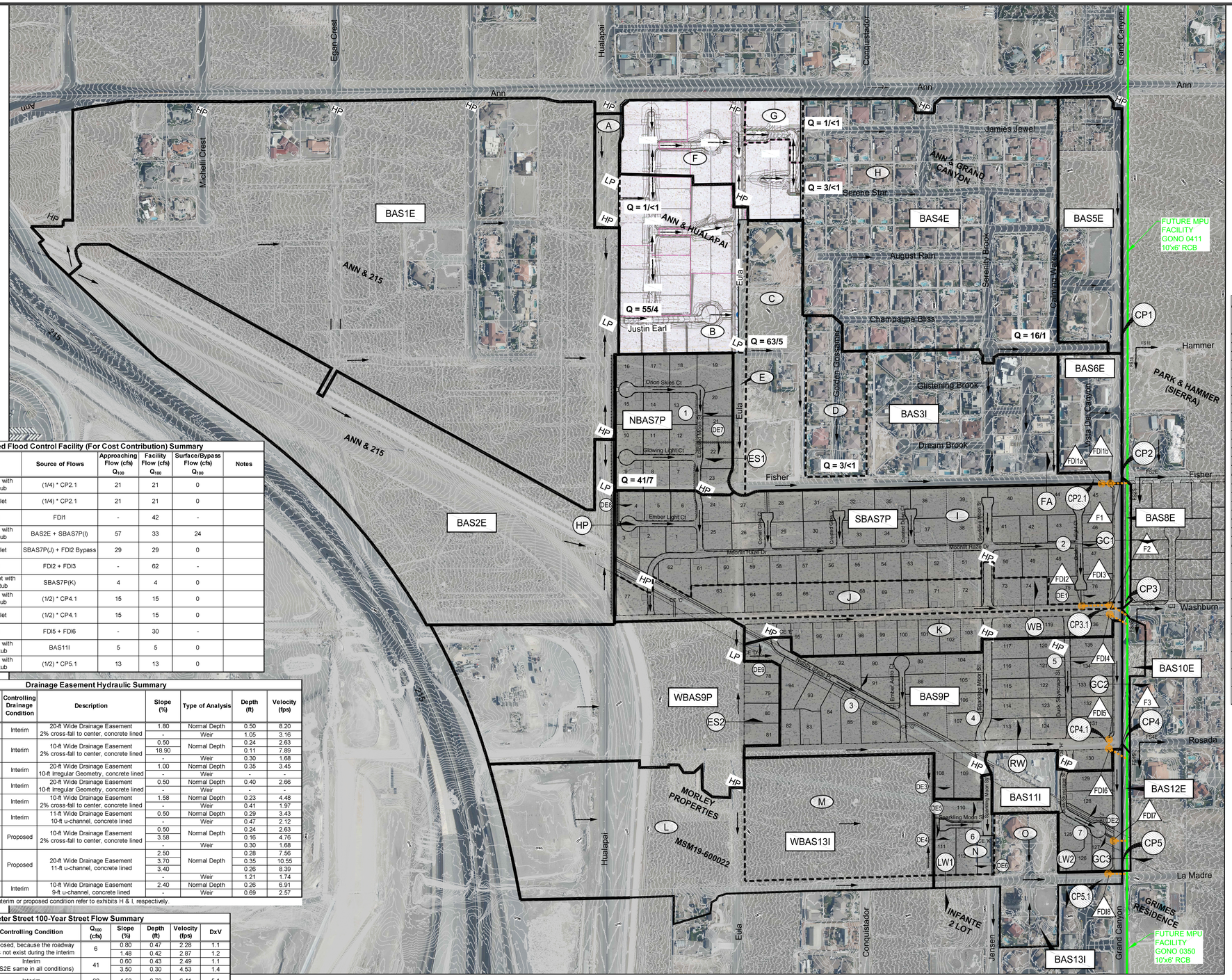

LEGEND

- BASIN BOUNDARY
- PRORATED SUBBASIN BOUNDARY
- ANTICIPATED DRAINAGE FACILITY
- ID — BASIN ID
- ID — PRORATED SUBBASIN ID
- ID — CONCENTRATION POINT ID
- FLOW DIRECTION
- ID — FLOWMASTER SECTION
- ID — FACILITY ID
- Q= CFS — FLOW SPLIT

Proposed Condition Flow Rate Summary

Basin/Concentration Point ID	Area (ac)	Q_{100} (cfs)	Q_{10} (cfs)
BAS4E	46.8	16	1
BAS5E	9.1	4	0
BAS1E	85.0	55	4
BAS3I	45.5	26	2
NBAS7P	9.4	5	0
BAS6E	4.5	3	0
BAS2E	39.9	41	7
SBAS7P	45.1	25	2
BAS8E	0.7	2	1
WBAS9P	25.0	16	1
BAS9P	23.6	14	1
BAS10E	1.1	2	0
WBAS13P	33.0	19	1
BAS13I	8.4	6	0
BAS11I	6.3	5	0
BAS12E	0.6	1	0
FS1E (CP1)	N/A	11	0.5
FS1S (CP1)	N/A	9	0.5
FS2E (CP2)	N/A	59	4.0
FS2S (CP2)	N/A	37	2.5
FS3E (CP3)	N/A	65	7.0
FS3S (CP3)	N/A	38	4.5
FS4E (CP4)	N/A	47	4.0
FS4S (CP4)	N/A	22	2.5
CP1 Q = BAS4E + BAS5E	N/A	20	1.0
CP2.1 Q = BAS1E + BAS3I + NBAS7P	N/A	84	6.0
CP2 Q = FS1S + CP2.1 +BAS6E	N/A	96	6.5
CP3.1 Q = BAS2E + SBAS7P	N/A	65	9.0
CP3 Q = FS2S + CP3.1 + BAS8E	N/A	103	11.5
CP4.1 Q = WBAS9P + BAS9P	N/A	29	2.0
CP4 Q = FS3S + CP4.1 + BAS10E	N/A	69	6.5
CP5.1 Q = WBAS13I + BAS13I	N/A	25	2.0
CP5 Q = FS4S + CP5.1 + BAS11I + BAS12E	N/A	53	4.5

Recommended Flood Control Facility (For Cost Contribution) Summary

Facility ID	Facility Description	Source of Flows	Approaching Flow (cfs) Q_{100}	Facility Flow (cfs) Q_{100}	Surface/Bypass Flow (cfs) Q_{100}	Notes
FDI1a	Future 5'x6' NDOT Field Inlet with Future 30" RCP Lateral Stub	(1/4) * CP2.1	21	21	0	
FDI1b	Future 5'x6' NDOT Field Inlet	(1/4) * CP2.1	21	21	0	
F1	Future 36" RCP Lateral	FDI1	-	42	-	
FDI2	Future 5'x6' NDOT Field Inlet with Future 30" RCP Lateral Stub	BAS2E + SBAS7P(I)	57	33	24	
FDI3	Future 5'x6' NDOT Field Inlet	SBAS7P(J) + FDI2 Bypass	29	29	0	
F2	Future 42" RCP Lateral	FDI2 + FDI3	-	62	-	
FDI4	Future 2.5'x2' NDOT Field Inlet with Future 18" C900 Lateral Stub	SBAS7P(K)	4	4	0	
FDI5	Future 5'x6' NDOT Field Inlet with Future 24" RCP Lateral Stub	(1/2) * CP4.1	15	15	0	
FDI6	Future 5'x6' NDOT Field Inlet	(1/2) * CP4.1	15	15	0	
F3	Future 30" RCP Lateral	FDI5 + FDI6	-	30	-	
FDI7	Future 3'x2' NDOT Field Inlet with Future 18" C900 Lateral Stub	BAS11I	5	5	0	
FDI8	Future 5'x6' NDOT Field Inlet with Future 24" C900 Lateral Stub	(1/2) * CP5.1	13	13	0	

Drainage Easement Hydraulic Summary

Section ID	Q_{100} (cfs)	Controlling Drainage Condition	Description	Slope (%)	Type of Analysis	Depth (ft)	Velocity (fps)
DE1 Q = CP3.1 - SBAS7I(J+K)	66	Interim	20-ft Wide Drainage Easement 2% cross-fall to center, concrete lined	1.80	Normal Depth	0.50	8.20
				-	Weir	1.05	3.16
DE2 Q = BAS11I	5	Interim	10-ft Wide Drainage Easement 2% cross-fall to center, concrete lined	0.50	Normal Depth	0.24	2.63
				18.90		0.11	7.89
				-	Weir	0.30	1.68
DE3 Q = 1/2 * WBAS13I(M)	4	Interim	20-ft Wide Drainage Easement 10-ft Irregular Geometry, concrete lined	1.00	Normal Depth	0.35	3.45
				-	Weir	-	-
DE4 Q = 1/2 * WBAS13I(M)	4	Interim	20-ft Wide Drainage Easement 10-ft Irregular Geometry, concrete lined	0.50	Normal Depth	0.40	2.66
				-	Weir	-	-
DE5 Q = WBAS13I(M)	8	Interim	10-ft Wide Drainage Easement 2% cross-fall to center, concrete lined	1.58	Normal Depth	0.23	4.48
				-	Weir	0.41	1.97
DE6 Q = WBAS13I(M) + BAS13I(N)	10	Interim	11-ft Wide Drainage Easement 10-ft u-channel, concrete lined	0.50	Normal Depth	0.29	3.43
				-	Weir	0.47	2.12
DE7 Q = NBAS7P	5	Proposed	10-ft Wide Drainage Easement 2% cross-fall to center, concrete lined	0.50	Normal Depth	0.24	2.63
				3.58		0.16	4.76
				-	Weir	0.30	1.68
DE8 Q = BAS2E	41	Proposed	20-ft Wide Drainage Easement 11-ft u-channel, concrete lined	2.50	Normal Depth	0.28	7.56
				3.70		0.35	10.55
				3.40		0.26	8.39
				-	Weir	1.21	1.74
DE9 Q = WBAS9I	16	Interim	10-ft Wide Drainage Easement 9-ft u-channel, concrete lined	2.40	Normal Depth	0.26	6.91
					Weir	0.69	2.57

Note: For easements controlled by the interim or proposed condition refer to exhibits H & I, respectively.

Perimeter Street 100-Year Street Flow Summary

Section ID	Controlling Condition	Q_{100} (cfs)	Slope (%)	Depth (ft)	Velocity (fps)	DxV
ES1 Q = BAS3I(E) + NBAS7P	Proposed, because the roadway does not exist during the interim	6	0.80	0.47	2.28	1.1
			1.48	0.42	2.87	1.2
HP Q = BAS2E	Interim (BAS2E same in all conditions)	41	0.60	0.43	2.49	1.1
			3.50	0.30	4.53	1.4
FA Q = CP2.1	Interim	90	4.50	0.79	6.41	5.1
GC1 [1] Q = FS2S + 2*BAS8E	Interim	44	1.20	0.79	3.02	2.4
WB Q = SBAS7I(J + K)	Interim	19	2.50	0.25	3.07	0.8
			10.74	0.19	5.10	1.0
ES2 Q = WBAS9P	Proposed, because the roadway does not exist during the interim	16	0.70	0.30	1.85	0.6
RW Q = CP4.1	Interim	38	3.90	0.66	5.22	3.4
			6.50	0.64	5.80	3.7
GC2 [1] Q = FS3S + 2*BAS10E	Interim	52	1.20	0.82	3.19	2.6
LW1 Q =WBAS13I(L)	Interim	11	5.00	0.44	4.90	2.2
LW2 Q = CP5.1	Interim	25	4.25	0.65	4.92	3.2
GC3 Q = FS4S + BAS11I + BAS12E	Interim	34	1.20	0.75	2.78	2.1

1 - In lieu of a prorated subbasin for the west half of Grand Canyon, the flow rate established for the east half is doubled.

Interior Street 100-Year Street Flow Summary

Section ID	Controlling Condition	Q_{100} (cfs)	Slope (%)	Depth (ft)	Velocity (fps)	DxV
1 Q = NBAS7P	Proposed, because the roadway does not exist during the interim	5	1.01	0.30	2.12	0.6
			4.50	0.24	3.76	0.9
2 Q = CP3.1 - SBAS7I(J+K)	Interim	66	0.70	0.70	4.58	3.2
			5.38	0.49	8.49	4.2
3 Q = WBAS9P + 1/2*BAS9P	Proposed, because the roadway does not exist during the interim	23	0.70	0.48	3.02	1.4
			5.10	0.37	5.67	2.1
4 Q = 1/3*BAS9P	Proposed	5	1.26	0.29	2.31	0.7
5 Q = 1/3*BAS9P	Proposed	5	1.98	0.27	2.75	0.7
6 Q = WBAS13I(M) + BAS13I(N)	Interim/Proposed	10	0.60	0.39	2.07	0.8
			4.50	0.29	4.43	1.3
7 Q = BAS11I	Interim/Proposed	5	1.75	0.28	2.63	0.7

10-Year Street Flow Summary

Section ID	Controlling Condition	Q_{10} (cfs)	Slope (%)	Depth (ft)	Velocity (fps)	DxV	Dry Lane (ft)
HP Q = BAS2E	Interim (same in all conditions)	7	0.60	0.22	1.41	0.3	17.0
			3.50	0.16	2.67	0.4	20.0
GC1 [1] Q = FS2S + 2*BAS8E	Interim	5	1.20	0.41	2.53	1.0	16.0
GC2 [1] Q = FS3S + 2*BAS10E	Interim	7	1.20	0.46	2.75	1.3	16.0
GC3 Q = FS4S + BAS11I + BAS12E	Interim	4	1.20	0.37	2.40	0.9	16.0

1 - In lieu of a prorated subbasin for the west half of Grand Canyon, the flow rate established for the east half is doubled.

Proposed Condition Subbasin Prorated Flow Rate Summary

Basin ID	Q_{100} (cfs)	Q_{10} (cfs)	Area (acres)	100-yr Unit Flow (cfs/acre)	10-yr Unit Flow (cfs/acre)
BAS3I	26	2	45.5	0.6	0.0
BAS4E	16	1	46.8	0.3	0.0
SBAS7P	25	2	45.1	0.6	0.0
WBAS13I	19	1	33.0	0.6	0.0
BAS13I	6	0	8.4	0.7	0.0
Subbasin ID	**Q_{100} (cfs)**	**Q_{10} (cfs)**	**Area (acres)**	**100-yr Unit Flow (cfs/acre)**	**10-yr Unit Flow (cfs/acre)**
BAS3I(A)	1	0	1.7	0.6	0.0
BAS3I(B)	7	1	12.8	0.6	0.0
BAS3I(C)	14	1	24.9	0.6	0.0
BAS3I(D)	3	0	5.1	0.6	0.0
BAS3I(E)	1	0	1.1	0.6	0.0
TOTAL	***26***	***2***	***45.5***		
BAS4E(F)	3	0	8.3	0.3	0.0
BAS4E(G)	< 1	0	1.6	0.3	0.0
BAS4E(H)	13	1	36.9	0.3	0.0
TOTAL	***16***	***1***	***46.8***		
SBAS7P(I)	16	1	28.4	0.6	0.0
SBAS7P(J)	5	0	8.5	0.6	0.0
SBAS7P(K)	4	0	8.2	0.6	0.0
TOTAL	***25***	***2***	***45.1***		
WBAS13I(L)	11	1	19.6	0.6	0.0
WBAS13I(M)	8	0	13.4	0.6	0.0
TOTAL	***19***	***1***	***33.0***		
BAS13I(N)	2	0	2.8	0.7	0.0
BAS13I(O)	4	0	5.7	0.7	0.0
TOTAL	***6***	***0***	***8.4***		

NOTES:

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0 250 500
SCALE — 1"=250' — FEET

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Westwood Professional Services, Inc.

NO.	DESCRIPTION	DATE	BY	APP. DATE	APP

LENNAR HOMES

GRAND CANYON & WASHBURN

PROPOSED CONDITION

DATE: MARCH 2023
DRAFTER: CW
DESIGNER: KC
CHECKED: KC
PROJECT NO.
LEN2206-000

EXHIBIT I
SHEET 1 OF 1
PVCL#2020-_____

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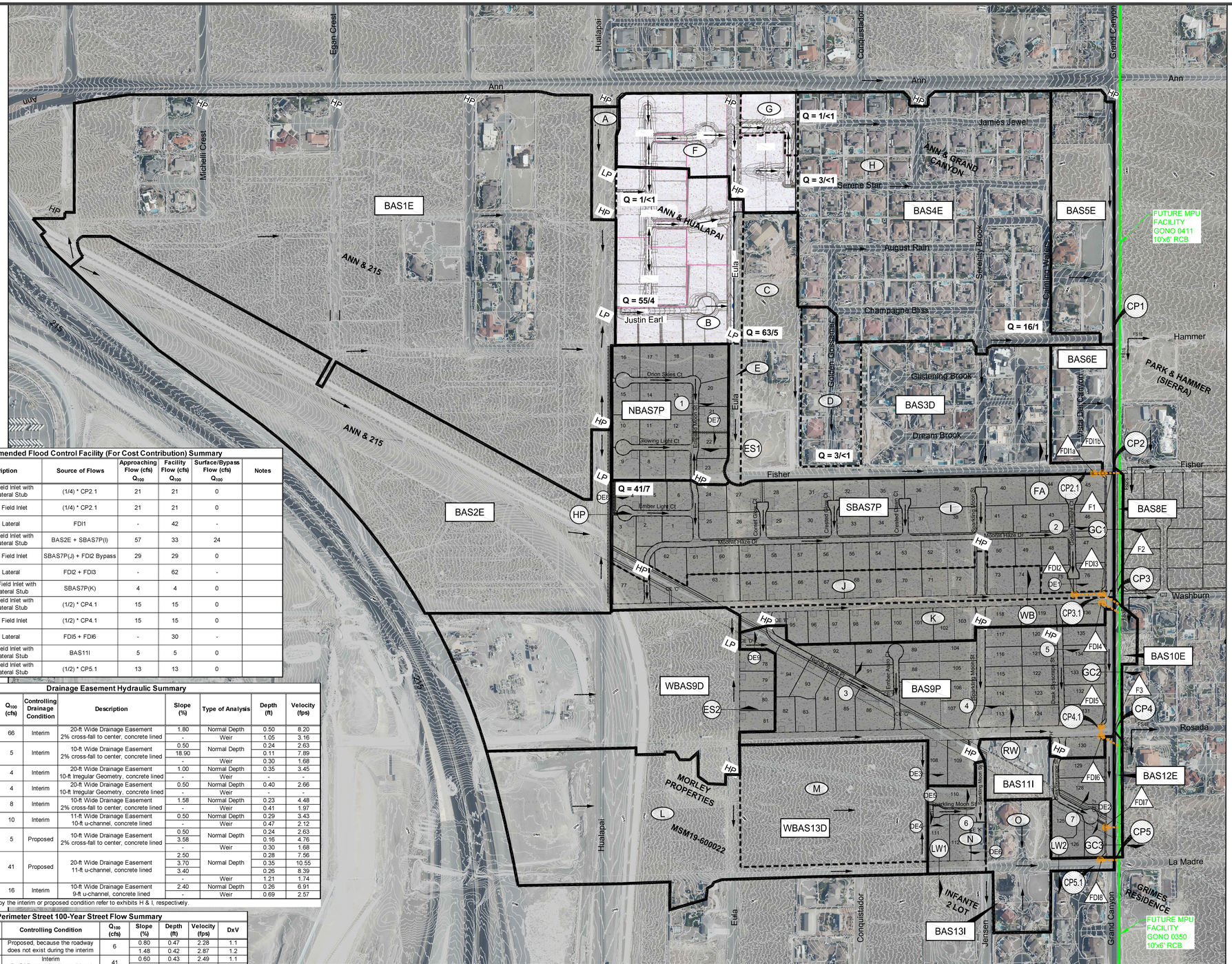

LEGEND

- BASIN BOUNDARY
- PRORATED SUBBASIN BOUNDARY
- ANTICIPATED DRAINAGE FACILITY
- ID — BASIN ID
- ID — PRORATED SUBBASIN ID
- ID — CONCENTRATION POINT ID
- FLOW DIRECTION
- ID — FLOWMASTER SECTION
- ID — FACILITY ID
- Q= CFS — FLOW SPLIT
- Q= CFS

Developed Condition Flow Rate Summary

Basin/Concentration Point ID	Area (ac)	Q_{100} (cfs)	Q_{10} (cfs)
BAS4E	46.8	16	1
BAS5E	9.1	4	0
BAS1E	85.0	55	4
BAS3D	45.5	25	2
NBAS7P	9.4	5	0
BAS6E	4.5	3	0
BAS2E	39.9	41	7
SBAS7P	45.1	25	2
BAS8E	0.7	2	1
WBAS9D	25.0	15	1
BAS9P	23.6	14	1
BAS10E	1.1	2	0
BAS13I	8.4	6	0
WBAS13D	33.0	18	1
BAS11I	6.3	5	0
BAS12E	0.6	1	0
FS1E (CP1)	N/A	11	0.5
FS1S (CP1)	N/A	9	0.5
FS2E (CP2)	N/A	58	4.0
FS2S (CP2)	N/A	37	2.5
FS3E (CP3)	N/A	65	7.0
FS3S (CP3)	N/A	38	4.5
FS4E (CP4)	N/A	46	4.0
FS4S (CP4)	N/A	22	2.5
CP1 Q = BAS4E + BAS5E	N/A	20	1.0
CP2.1 Q = BAS1E + BAS3D + NBAS7P	N/A	84	6.0
CP2 Q =FS1S + CP2.1 + BAS6E	N/A	95	6.5
CP3.1 Q = BAS2E + SBAS7P	N/A	65	9.0
CP3 Q = FS2S + CP3.1 + BAS8E	N/A	103	11.5
CP4.1 Q = WBAS9D + BAS9P	N/A	29	2.0
CP4 Q = FS3S + CP4.1 + BAS10E	N/A	68	6.5
CP5.1 Q = WBAS13D + BAS13I	N/A	23	2.0
CP5 Q = FS4S + CP5.1 + BAS11I + BAS12E	N/A	51	4.5

Developed Condition Subbasin Prorated Flow Rate Summary

Basin ID	Q_{100} (cfs)	Q_{10} (cfs)	Area (acres)	100-yr Unit Flow (cfs/acre)	10-yr Unit Flow (cfs/acre)
BAS3D	25	2	45.5	0.5	0.0
BAS4E	16	1	46.8	0.3	0.0
SBAS7P	25	2	45.1	0.6	0.0
WBAS13D	18	1	33.0	0.5	0.0
BAS13I	6	0	8.4	0.7	0.0
Subbasin ID	**Q_{100} (cfs)**	**Q_{10} (cfs)**	**Area (acres)**	**100-yr Unit Flow (cfs/acre)**	**10-yr Unit Flow (cfs/acre)**
BAS3D(A)	1	0	1.7	0.5	0.0
BAS3D(B)	7	1	12.8	0.5	0.0
BAS3D(C)	14	1	24.9	0.5	0.0
BAS3D(D)	3	0	5.1	0.5	0.0
BAS3D(E)	1	0	1.1	0.5	0.0
TOTAL	***22***	***2***	***45.5***		
BAS4E(F)	3	0	8.3	0.3	0.0
BAS4E(G)	< 1	0	1.6	0.3	0.0
BAS4E(H)	13	1	36.9	0.3	0.0
TOTAL	***16***	***1***	***46.8***		
SBAS7P(I)	16	1	28.4	0.6	0.0
SBAS7P(J)	5	0	8.5	0.6	0.0
SBAS7P(K)	5	0	8.2	0.6	0.0
TOTAL	***25***	***2***	***45.1***		
WBAS13D(L)	11	1	19.6	0.5	0.0
WBAS13D(M)	7	0	13.4	0.5	0.0
TOTAL	***18***	***1***	***33.0***		
BAS13I(N)	2	0	2.8	0.7	0.0
BAS13I(O)	4	0	5.7	0.7	0.0
TOTAL	***6***	***0***	***8.4***		

NOTES:

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0 250 500
SCALE - 1"=250' FEET

Recommended Flood Control Facility (For Cost Contribution) Summary

Facility ID	Facility Description	Source of Flows	Approaching Flow (cfs) Q_{100}	Facility Flow (cfs) Q_{100}	Surface/Bypass Flow (cfs) Q_{100}	Notes
FDI1a	Future 5'x6' NDOT Field Inlet with Future 30" RCP Lateral Stub	(1/4) * CP2.1	21	21	0	
FDI1b	Future 5'x6' NDOT Field Inlet	(1/4) * CP2.1	21	21	0	
F1	Future 36" RCP Lateral	FDI1	-	42	-	
FDI2	Future 5'x6' NDOT Field Inlet with Future 30" RCP Lateral Stub	BAS2E + SBAS7P(I)	57	33	24	
FDI3	Future 5'x6' NDOT Field Inlet	SBAS7P(J) + FDI2 Bypass	29	29	0	
F2	Future 42" RCP Lateral	FDI2 + FDI3	-	62	-	
FDI4	Future 2.5'x2' NDOT Field Inlet with Future 18" C900 Lateral Stub	SBAS7P(K)	4	4	0	
FDI5	Future 5'x6' NDOT Field Inlet with Future 24" RCP Lateral Stub	(1/2) * CP4.1	15	15	0	
FDI6	Future 5'x6' NDOT Field Inlet	(1/2) * CP4.1	15	15	0	
F3	Future 30" RCP Lateral	FDI5 + FDI6	-	30	-	
FDI7	Future 3'x2' NDOT Field Inlet with Future 18" C900 Lateral Stub	BAS11I	5	5	0	
FDI8	Future 5'x6' NDOT Field Inlet with Future 24" C900 Lateral Stub	(1/2) * CP5.1	13	13	0	

Drainage Easement Hydraulic Summary

Section ID	Q_{100} (cfs)	Controlling Drainage Condition	Description	Slope (%)	Type of Analysis	Depth (ft)	Velocity (fps)
DE1 Q = CP3.1 - SBAS7I(J+K)	66	Interim	20-ft Wide Drainage Easement 2% cross-fall to center, concrete lined	1.80	Normal Depth	0.50	8.20
				-	Weir	1.05	3.16
DE2 Q = BAS11I	5	Interim	10-ft Wide Drainage Easement 2% cross-fall to center, concrete lined	0.50	Normal Depth	0.24	2.63
				18.90		0.11	7.89
				-	Weir	0.30	1.68
DE3 Q = 1/2 * WBAS13I(M)	4	Interim	20-ft Wide Drainage Easement 10-ft Irregular Geometry, concrete lined	1.00	Normal Depth	0.35	3.45
				-	Weir	-	-
DE4 Q = 1/2 * WBAS13I(M)	4	Interim	20-ft Wide Drainage Easement 10-ft Irregular Geometry, concrete lined	0.50	Normal Depth	0.40	2.66
				-	Weir	-	-
DE5 Q = WBAS13I(M)	8	Interim	10-ft Wide Drainage Easement 2% cross-fall to center, concrete lined	1.58	Normal Depth	0.23	4.48
				-	Weir	0.41	1.97
DE6 Q = WBAS13I(M) + BAS13I(N)	10	Interim	11-ft Wide Drainage Easement 10-ft u-channel, concrete lined	0.50	Normal Depth	0.29	3.43
				-	Weir	0.47	2.12
DE7 Q = NBAS7P	5	Proposed	10-ft Wide Drainage Easement 2% cross-fall to center, concrete lined	0.50	Normal Depth	0.24	2.63
				3.58		0.16	4.76
				-	Weir	0.30	1.68
DE8 Q = BAS2E	41	Proposed	20-ft Wide Drainage Easement 11-ft u-channel, concrete lined	2.50	Normal Depth	0.28	7.56
				3.70		0.35	10.55
				3.40		0.26	8.39
				-	Weir	1.21	1.74
DE9 Q = WBAS9I	16	Interim	10-ft Wide Drainage Easement 9-ft u-channel, concrete lined	2.40	Normal Depth	0.26	6.91
				-	Weir	0.69	2.57

Note: For easements controlled by the interim or proposed condition refer to exhibits H & I, respectively.

Perimeter Street 100-Year Street Flow Summary

Section ID	Controlling Condition	Q_{100} (cfs)	Slope (%)	Depth (ft)	Velocity (fps)	DxV
ES1 Q = BAS3I(E) + NBAS7P	Proposed, because the roadway does not exist during the interim	6	0.80	0.47	2.28	1.1
HP Q = BAS2E	Interim (BAS2E same in all conditions)	41	0.60	0.43	2.49	1.1
			3.50	0.30	4.53	1.4
FA Q = CP2.1	Interim	90	4.50	0.79	6.41	5.1
GC1 [1] Q = FS2S + 2*BAS8E	Interim	44	1.20	0.79	3.02	2.4
WB Q = SBAS7I(J + K)	Interim	19	2.50	0.25	3.07	0.8
			10.74	0.19	5.10	1.0
ES2 Q = WBAS9P	Proposed, because the roadway does not exist during the interim	16	0.70	0.30	1.85	0.6
RW Q = CP4.1	Interim	38	3.90	0.66	5.22	3.4
			6.50	0.64	5.80	3.7
GC2 [1] Q = FS3S + 2*BAS10E	Interim	52	1.20	0.82	3.19	2.6
LW1 Q =WBAS13I(L)	Interim	11	5.00	0.44	4.90	2.2
LW2 Q = CP5.1	Interim	25	4.25	0.65	4.92	3.2
GC3 Q = FS4S + BAS11I + BAS12E	Interim	34	1.20	0.75	2.78	2.1

1 - In lieu of a prorated subbasin for the west half of Grand Canyon, the flow rate established for the east half is doubled.

Interior Street 100-Year Street Flow Summary

Section ID	Controlling Condition	Q_{100} (cfs)	Slope (%)	Depth (ft)	Velocity (fps)	DxV
1 Q = NBAS7P	Proposed, because the roadway does not exist during the interim	5	1.01	0.30	2.12	0.6
			4.50	0.24	3.76	0.9
2 Q = CP3.1 - SBAS7I(J+K)	Interim	66	0.70	0.70	4.58	3.2
			5.38	0.49	8.49	4.2
3 Q = WBAS9P + 1/2*BAS9P	Proposed, because the roadway does not exist during the interim	23	0.70	0.48	3.02	1.4
			5.10	0.37	5.67	2.1
4 Q = 1/3*BAS9P	Proposed	5	1.26	0.29	2.31	0.7
5 Q = 1/3*BAS9P	Proposed	5	1.98	0.27	2.75	0.7
6 Q = WBAS13I(M) + BAS13I(N)	Interim/Proposed	10	0.60	0.39	2.07	0.8
			4.50	0.29	4.43	1.3
7 Q = BAS11I	Interim/Proposed	5	1.75	0.28	2.63	0.7

10-Year Street Flow Summary

Section ID	Controlling Condition	Q_{10} (cfs)	Slope (%)	Depth (ft)	Velocity (fps)	DxV	Dry Lane (ft)
HP Q = BAS2E	Interim (same in all conditions)	7	0.60	0.22	1.41	0.3	17.0
			3.50	0.16	2.67	0.4	20.0
GC1 [1] Q = FS2S + 2*BAS8E	Interim	5	1.20	0.41	2.53	1.0	16.0
GC2 [1] Q = FS3S + 2*BAS10E	Interim	7	1.20	0.46	2.75	1.3	16.0
GC3 Q = FS4S + BAS11I + BAS12E	Interim	4	1.20	0.37	2.40	0.9	16.0

1 - In lieu of a prorated subbasin for the west half of Grand Canyon, the flow rate established for the east half is doubled.

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NO.	DESCRIPTION	DATE	BY	APP. DATE	APP.

LENNAR HOMES

GRAND CANYON & WASHBURN

DEVELOPED CONDITION

DATE: MARCH 2023
DRAFTER: CW
DESIGNER: KC
CHECKED: KC
PROJECT NO.
LEN2206-000

EXHIBIT J
SHEET 1 OF 1

PVCL#2020_____

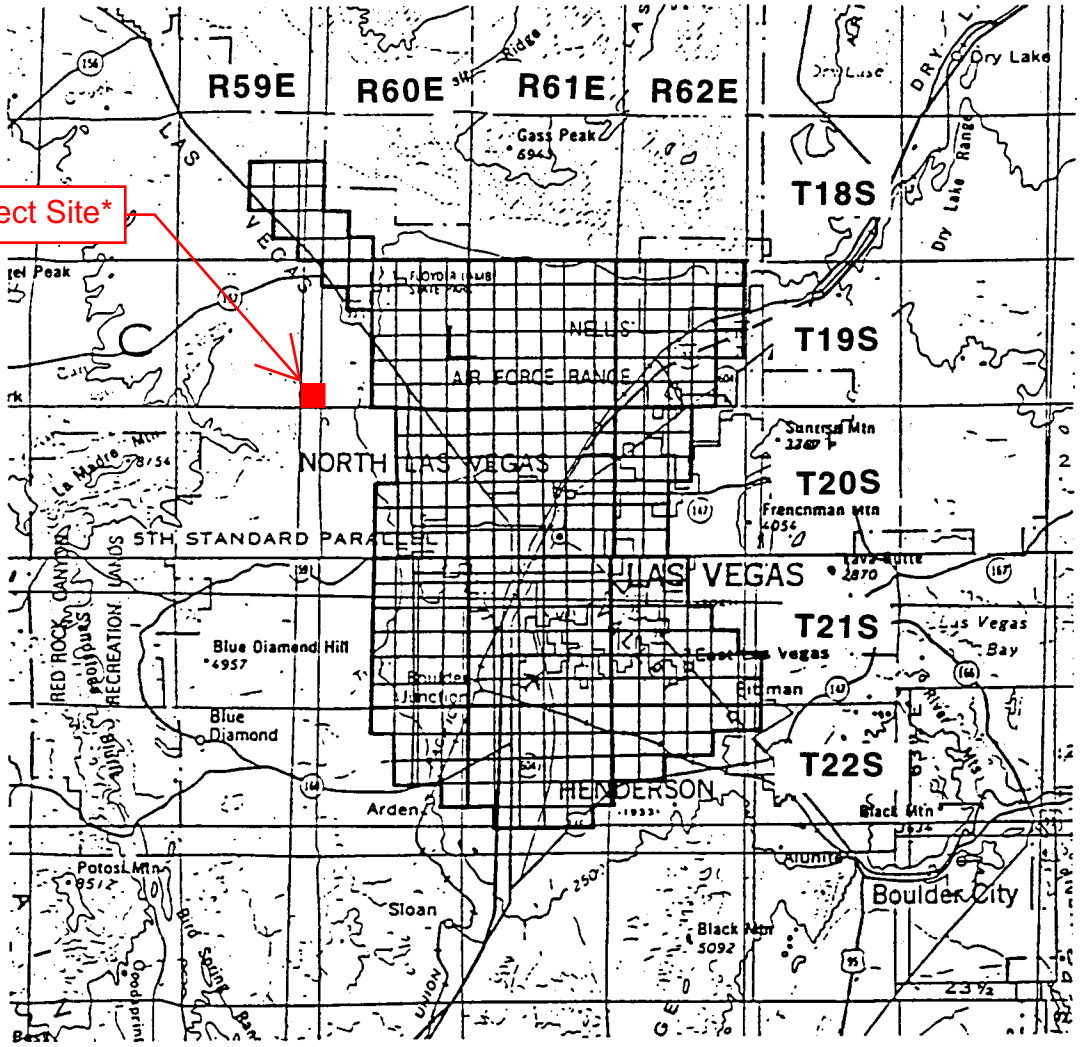
J:\en\2206-000 grand canyon & washburn\drainage\technical study\figures\en2206.000 tds exhibit j – developed condition.dwg 3/29/2023 11:33 AM Kellin Collins

APPENDIX B

Hydrologic Analyses

Precipitation Data

McCARRAN AIRPORT RAINFALL AREA



*Project site not located within the McCarran Rainfall area (T22-R62-S22)

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

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

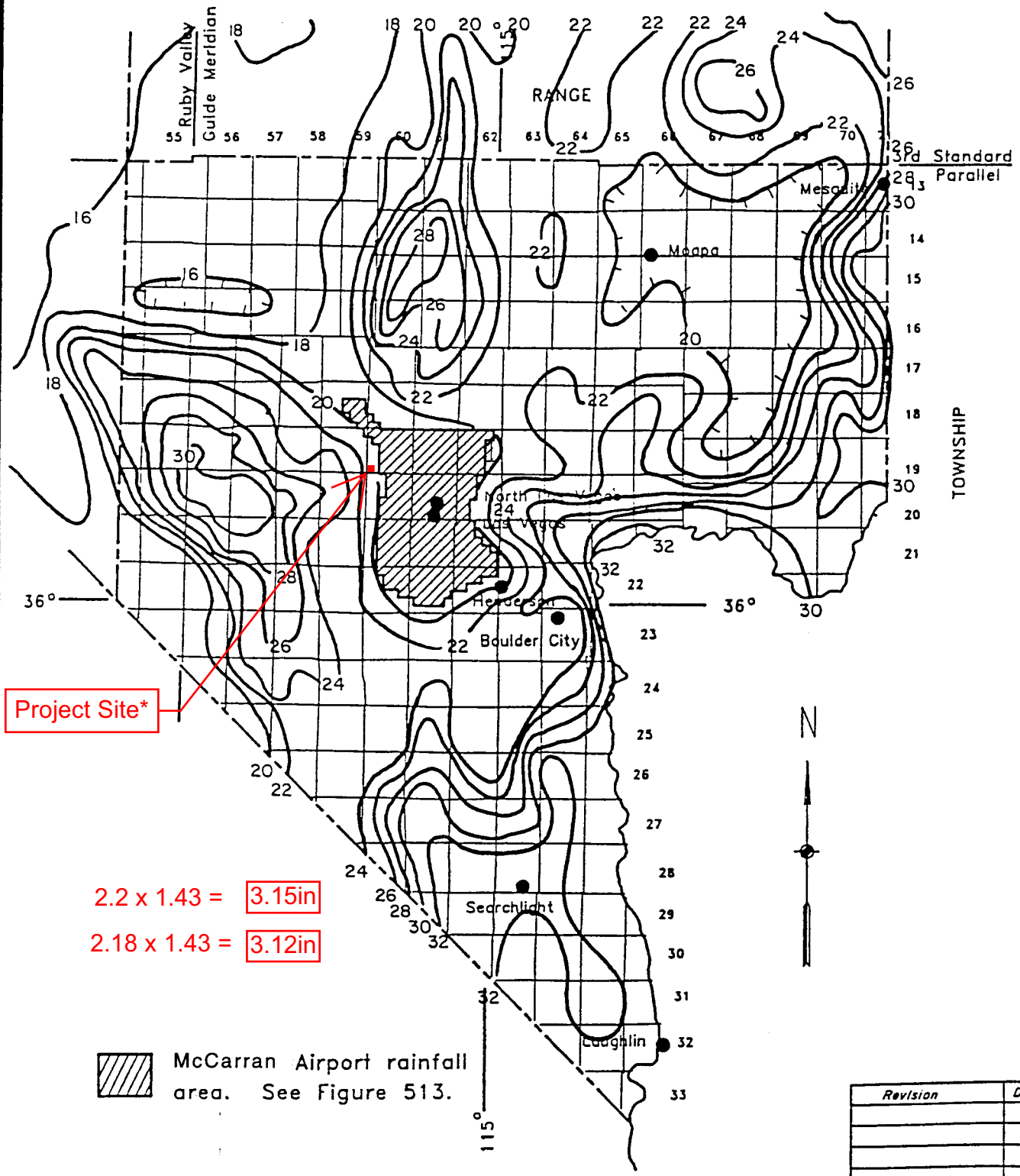
Revision	Date

WRC ENGINEERING

REFERENCE:
USACE, Los Angeles District, 1988

FIGURE 513

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



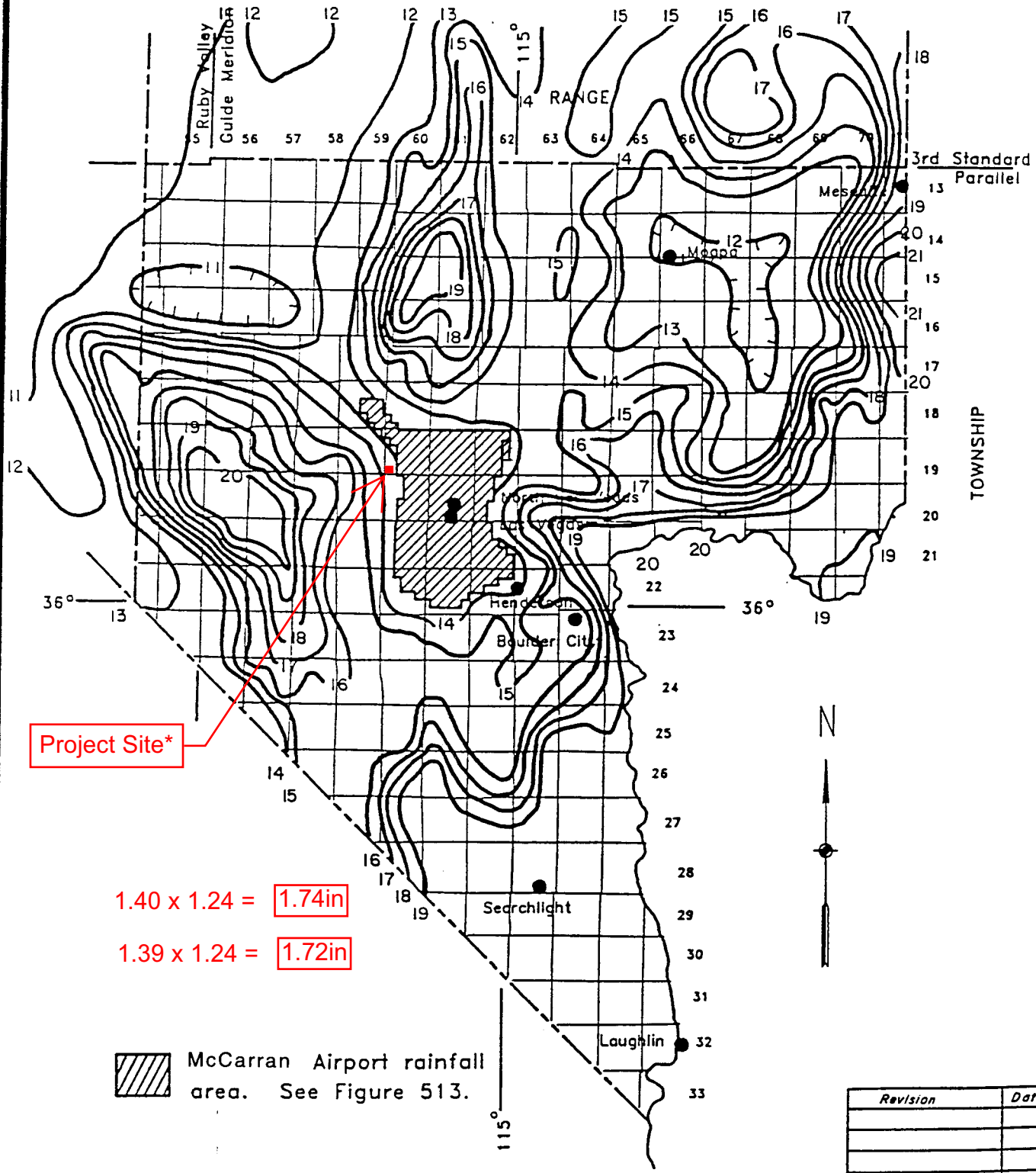
Revision	Date

WRC ENGINEERING

REFERENCE:
NOAA ATLAS 2, VOLUME VII NEVADA, 1973

FIGURE 506

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



Revision	Date

WRC ENGINEERING

REFERENCE:
NOAA ATLAS 2, VOLUME VII NEVADA, 1973

FIGURE 503

PRECIPITATION ADJUSTMENT RATIOS

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

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

Revision	Date

SIX HOUR DEPTH-AREA REDUCTION FACTORS

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

NOTES: 1. A graphical representation of these factors is presented in Figure 514.

2. Consult with the local entity and/or the CCRFCD for guidance in using the Depth-Area Reduction Factors for drainage areas greater than 200 square miles.

Revision	Date

SIX-HOUR STORM DISTRIBUTIONS

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

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

Revision	Date

REFERENCE:

TABLE 503

CN Computation, Soils & Land Use Data

Soil Data & Curve Number Computation

Project Name & Number: LEN2206 - Grand Canyon & Washburn
By: PLM
Date: 3/27/2023

Data:

Reference:
2018 MPU
NRCS Soil Data

Soil Type - Soil Survey Area & Version, Soil Description				A	B	C	D
LV	190	Las Vegas Valley (NV788)	Dalian very gravelly fine sandy loam, 2 to 4 percent slopes	100%	0%	0%	0%
LV	400	Las Vegas Valley (NV788)	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
1 Undeveloped Land, Open Desert	63	77	85	88
2 Parks, Golf Courses	47	66	77	83
3 Rural, 0.5-1 units/acre	57	73	82	86
4 Low-Den Res, 1-2 units/acre	60	74	83	87
5 Med-Den Res, 2-4 units/acre	62	76	84	88
7 Public Facility/Res, 8-12 units/acre	84	89	92	94
8 Very High-Den Res, >12 units/acre	89	93	95	96
9 Commercial, Retail, Casino, High Rise	92	94	95	96

*Commercial land use per Note 3

Existing Condition

BASIN ID	BAS1E			TOTAL AREA & COMPOSITE CURVE NUMBER:								85.04	64.2
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		
LV	190	2.7%	Paved Open Ditches	100%	0%	0%	0%	83	89	92	93	2.32	2.26
LV	190	9.4%	1 Undeveloped Land, Open Desert	100%	0%	0%	0%	63	77	85	88	8.01	5.93
LV	190	50.6%	4 Low-Den Res, 1-2 units/acre	100%	0%	0%	0%	60	74	83	87	43.06	30.38
LV	190	27.0%	5 Med-Den Res, 2-4 units/acre	100%	0%	0%	0%	62	76	84	88	22.99	16.76
LV	400	4.3%	1 Undeveloped Land, Open Desert	0%	0%	0%	100%	63	77	85	88	3.64	3.77
LV	400	5.9%	4 Low-Den Res, 1-2 units/acre	0%	0%	0%	100%	60	74	83	87	5.02	5.14
PERCENT		100.0%											

BASIN ID	BAS2E			TOTAL AREA & COMPOSITE CURVE NUMBER:								39.92	72.3
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		
LV	400	5.3%	Paved Open Ditches	0%	0%	0%	100%	83	89	92	93	2.12	4.94
LV	400	3.6%	4 Low-Den Res, 1-2 units/acre	0%	0%	0%	100%	60	74	83	87	1.45	3.16
LV	190	26.9%	5 Med-Den Res, 2-4 units/acre	100%	0%	0%	0%	62	76	84	88	10.72	16.65
LV	190	64.2%	6 High-Den Res, 4-8 units/acre	100%	0%	0%	0%	74	83	88	91	25.63	47.51
PERCENT		100.0%											

BASIN ID	BAS3E			TOTAL AREA & COMPOSITE CURVE NUMBER:								55.13	64.1
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		
LV	190	11.1%	Paved Open Ditches	100%	0%	0%	0%	83	89	92	93	6.12	9.21
LV	190	26.6%	1 Undeveloped Land, Open Desert	100%	0%	0%	0%	63	77	85	88	14.66	16.75
LV	190	7.9%	3 Rural, 0.5-1 units/acre	100%	0%	0%	0%	57	73	82	86	4.36	4.51
LV	190	6.0%	4 Low-Den Res, 1-2 units/acre	100%	0%	0%	0%	60	74	83	87	3.32	3.61
LV	190	48.4%	5 Med-Den Res, 2-4 units/acre	100%	0%	0%	0%	62	76	84	88	26.67	29.99
PERCENT		100.0%											

BASIN ID	BAS4E			TOTAL AREA & COMPOSITE CURVE NUMBER:								46.77	60.0
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		
LV	190	100.0%	4 Low-Den Res, 1-2 units/acre	100%	0%	0%	0%	60	74	83	87	46.77	60.00
PERCENT		100.0%											

BASIN ID	BAS5E			TOTAL AREA & COMPOSITE CURVE NUMBER:								9.08	60.9
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		
LV	190	9.0%	Paved Open Ditches	100%	0%	0%	0%	83	89	92	93	0.82	7.50
LV	190	2.3%	Roadway	100%	0%	0%	0%	98	98	98	98	0.21	2.26
LV	190	68.9%	3 Rural, 0.5-1 units/acre	100%	0%	0%	0%	57	73	82	86	6.26	39.30
LV	190	19.7%	4 Low-Den Res, 1-2 units/acre	100%	0%	0%	0%	60	74	83	87	1.79	11.83
PERCENT		100.0%											

BASIN ID	BAS6E			TOTAL AREA & COMPOSITE CURVE NUMBER:								4.49	64.6
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		
LV	190	20.0%	Paved Open Ditches	100%	0%	0%	0%	83	89	92	93	0.90	16.63
LV	190	80.0%	4 Low-Den Res, 1-2 units/acre	100%	0%	0%	0%	60	74	83	87	3.59	47.98
PERCENT		100.0%											

BASIN ID	BAS7E			TOTAL AREA & COMPOSITE CURVE NUMBER:								10.32	63.0
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		
LV	190	100.0%	1 Undeveloped Land, Open Desert	100%	0%	0%	0%	63	77	85	88	10.32	63.00
PERCENT		100.0%											

BASIN ID	BAS8E			TOTAL AREA & COMPOSITE CURVE NUMBER:								0.66	83.0
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		
LV	190	100.0%	Paved Open Ditches	100%	0%	0%	0%	83	89	92	93	0.66	83.00
PERCENT		100.0%											

BASIN ID	BAS9E			TOTAL AREA & COMPOSITE CURVE NUMBER:								73.89	63.3
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		
LV	190	1.7%	Paved Open Ditches	100%	0%	0%	0%	83	89	92	93	1.27	1.43
LV	190	98.3%	1 Undeveloped Land, Open Desert	100%	0%	0%	0%	63	77	85	88	72.62	61.92
PERCENT		100.0%											

BASIN ID	BAS10E			TOTAL AREA & COMPOSITE CURVE NUMBER:								1.09	74.0
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		
LV	190	56.0%	Paved Open Ditches	100%	0%	0%	0%	83	89	92	93	0.61	46.45
LV	190	26.6%	1 Undeveloped Land, Open Desert	100%	0%	0%	0%	63	77	85	88	0.29	16.76
LV	190	17.4%	5 Med-Den Res, 2-4 units/acre	100%	0%	0%	0%	62	76	84	88	0.19	10.81
PERCENT		100.0%											

BASIN ID	BAS11E			TOTAL AREA & COMPOSITE CURVE NUMBER:								20.50	65.4
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		
LV	190	4.5%	Paved Open Ditches	100%	0%	0%	0%	83	89	92	93	0.92	3.72
LV	190	11.8%	Newly Graded	100%	0%	0%	0%	77	86	91	94	2.41	9.05
LV	190	80.0%	1 Undeveloped Land, Open Desert	100%	0%	0%	0%	63	77	85	88	16.40	50.40
LV	190	3.8%	4 Low-Den Res, 1-2 units/acre	100%	0%	0%	0%	60	74	83	87	0.77	2.25
PERCENT		100.0%											

BASIN ID	BAS12E			TOTAL AREA & COMPOSITE CURVE NUMBER:								0.58	83.0
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		
LV	190	100.0%	Paved Open Ditches	100%	0%	0%	0%	83	89	92	93	0.58	83.00
PERCENT		100.0%											

BASIN ID	BAS13E			TOTAL AREA & COMPOSITE CURVE NUMBER:								34.41	64.0
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		
LV	190	7.4%	Paved Open Ditches	100%	0%	0%	0%	83	89	92	93	2.53	6.10
LV	190	67.7%	1 Undeveloped Land, Open Desert	100%	0%	0%	0%	63	77	85	88	23.29	42.64
LV	190	12.5%	4 Low-Den Res, 1-2 units/acre	100%	0%	0%	0%	60	74	83	87	4.30	7.50
LV	190	12.5%	5 Med-Den Res, 2-4 units/acre	100%	0%	0%	0%	62	76	84	88	4.29	7.73
PERCENT		100.0%											

Interim Condition

BASIN ID	BAS3I			TOTAL AREA & COMPOSITE CURVE NUMBER:								45.51	64.3
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		
LV	190	13.4%	Paved Open Ditches	100%	0%	0%	0%	83	89	92	93	6.12	11.16
LV	190	11.1%	1 Undeveloped Land, Open Desert	100%	0%	0%	0%	63	77	85	88	5.04	6.98
LV	190	9.6%	3 Rural, 0.5-1 units/acre	100%	0%	0%	0%	57	73	82	86	4.36	5.46
LV	190	7.3%	4 Low-Den Res, 1-2 units/acre	100%	0%	0%	0%	60	74	83	87	3.32	4.38
LV	190	58.6%	5 Med-Den Res, 2-4 units/acre	100%	0%	0%	0%	62	76	84	88	26.67	36.33
PERCENT		100.0%											

BASIN ID	NBAS7I			TOTAL AREA & COMPOSITE CURVE NUMBER:								9.43	77.0
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		
LV	190	100.0%	Newly Graded	100%	0%	0%	0%	77	86	91	94	9.43	77.00
PERCENT		100.0%											

BASIN ID	SBAS7I			TOTAL AREA & COMPOSITE CURVE NUMBER:								45.05	72.8
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		
LV	190	3.8%	Paved Open Ditches	100%	0%	0%	0%	83	89	92	93	1.72	3.17
LV	190	66.4%	Newly Graded	100%	0%	0%	0%	77	86	91	94	29.93	51.16
LV	190	29.7%	5 Med-Den Res, 2-4 units/acre	100%	0%	0%	0%	62	76	84	88	13.40	18.44
PERCENT		100.0%											

BASIN ID	WBAS9I			TOTAL AREA & COMPOSITE CURVE NUMBER:								25.03	64.2
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		
LV	190	6.3%	Paved Open Ditches	100%	0%	0%	0%	83	89	92	93	1.58	5.24
LV	190	90.6%	1 Undeveloped Land, Open Desert	100%	0%	0%	0%	63	77	85	88	22.68	57.09
LV	190	3.1%	4 Low-Den Res, 1-2 units/acre	100%	0%	0%	0%	60	74	83	87	0.77	1.85
PERCENT		100.0%											

BASIN ID	BAS9I			TOTAL AREA & COMPOSITE CURVE NUMBER:								23.56	70.5
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		
LV	190	7.3%	Paved Open Ditches	100%	0%	0%	0%	83	89	92	93	1.72	6.06
LV	190	46.5%	Newly Graded	100%	0%	0%	0%	77	86	91	94	10.95	35.79
LV	190	46.2%	5 Med-Den Res, 2-4 units/acre	100%	0%	0%	0%	62	76	84	88	10.89	28.66
PERCENT		100.0%											

BASIN ID	BAS11I			TOTAL AREA & COMPOSITE CURVE NUMBER:								6.28	66.8
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		
LV	190	9.2%	Paved Open Ditches	100%	0%	0%	0%	83	89	92	93	0.58	7.67
LV	190	18.0%	Newly Graded	100%	0%	0%	0%	77	86	91	94	1.13	13.86
LV	190	20.5%	1 Undeveloped Land, Open Desert	100%	0%	0%	0%	63	77	85	88	1.29	12.94
LV	190	52.2%	5 Med-Den Res, 2-4 units/acre	100%	0%	0%	0%	62	76	84	88	3.28	32.38
PERCENT		100.0%											

BASIN ID	WBAS13I			TOTAL AREA & COMPOSITE CURVE NUMBER:								33.02	63.6
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		
LV	190	4.8%	Paved Open Ditches	100%	0%	0%	0%	83	89	92	93	1.58	3.97
LV	190	82.2%	1 Undeveloped Land, Open Desert	100%	0%	0%	0%	63	77	85	88	27.14	51.78
LV	190	13.0%	4 Low-Den Res, 1-2 units/acre	100%	0%	0%	0%	60	74	83	87	4.30	7.81
PERCENT		100.0%											

BASIN ID	BAS13I			TOTAL AREA & COMPOSITE CURVE NUMBER:								8.43	65.5
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		
LV	190	16.5%	Paved Open Ditches	100%	0%	0%	0%	83	89	92	93	1.39	13.69
LV	190	83.5%	5 Med-Den Res, 2-4 units/acre	100%	0%	0%	0%	62	76	84	88	7.04	51.78
PERCENT		100.0%											

Proposed Condition

BASIN ID	NBAS7P			TOTAL AREA & COMPOSITE CURVE NUMBER:								9.43	62.0
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		

LV	190	100.0%	5 Med-Den Res, 2-4 units/acre	100%	0%	0%	0%	62	76	84	88	9.43	62.00
PERCENT		100.0%											

BASIN ID	SBAS7P											TOTAL AREA & COMPOSITE CURVE NUMBER:	45.05	64.0
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			
LV	190	9.4%	Paved Open Ditches	100%	0%	0%	0%	83	89	92	93		4.23	7.79
LV	190	3.7%	Natural Desert Landscaping	100%	0%	0%	0%	63	77	85	88		1.67	2.34
LV	190	86.9%	5 Med-Den Res, 2-4 units/acre	100%	0%	0%	0%	62	76	84	88		39.15	53.88
PERCENT		100.0%												

BASIN ID	WBAS9P											TOTAL AREA & COMPOSITE CURVE NUMBER:	25.03	64.1
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			
LV	190	6.3%	Paved Open Ditches	100%	0%	0%	0%	83	89	92	93		1.58	5.24
LV	190	83.7%	1 Undeveloped Land, Open Desert	100%	0%	0%	0%	63	77	85	88		20.94	52.71
LV	190	7.0%	5 Med-Den Res, 2-4 units/acre	100%	0%	0%	0%	62	76	84	88		1.74	4.31
LV	190	3.1%	4 Low-Den Res, 1-2 units/acre	100%	0%	0%	0%	60	74	83	87		0.77	1.85
PERCENT		100.0%												

BASIN ID	BAS9P											TOTAL AREA & COMPOSITE CURVE NUMBER:	23.56	64.6
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			
LV	190	12.3%	Paved Open Ditches	100%	0%	0%	0%	83	89	92	93		2.89	10.18
LV	190	87.7%	5 Med-Den Res, 2-4 units/acre	100%	0%	0%	0%	62	76	84	88		20.67	54.39
PERCENT		100.0%												

Developed Condition

BASIN ID	BAS3D			TOTAL AREA & COMPOSITE CURVE NUMBER:								45.51	64.0
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		
LV	190	13.4%	Paved Open Ditches	100%	0%	0%	0%	83	89	92	93	6.12	11.16
LV	190	9.6%	3 Rural, 0.5-1 units/acre	100%	0%	0%	0%	57	73	82	86	4.36	5.46
LV	190	18.4%	4 Low-Den Res, 1-2 units/acre	100%	0%	0%	0%	60	74	83	87	8.36	11.02
LV	190	58.6%	5 Med-Den Res, 2-4 units/acre	100%	0%	0%	0%	62	76	84	88	26.67	36.33
PERCENT		100.0%											

BASIN ID	WBAS9D			TOTAL AREA & COMPOSITE CURVE NUMBER:								25.03	64.8
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		
LV	190	13.7%	Paved Open Ditches	100%	0%	0%	0%	83	89	92	93	3.44	11.41
LV	190	3.1%	4 Low-Den Res, 1-2 units/acre	100%	0%	0%	0%	60	74	83	87	0.77	1.85
LV	190	83.2%	5 Med-Den Res, 2-4 units/acre	100%	0%	0%	0%	62	76	84	88	20.82	51.57
PERCENT		100.0%											

BASIN ID	WBAS13D			TOTAL AREA & COMPOSITE CURVE NUMBER:								33.02	63.7
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		
LV	190	9.2%	Paved Open Ditches	100%	0%	0%	0%	83	89	92	93	3.05	7.67
LV	190	13.0%	4 Low-Den Res, 1-2 units/acre	100%	0%	0%	0%	60	74	83	87	4.30	7.81
LV	190	77.7%	5 Med-Den Res, 2-4 units/acre	100%	0%	0%	0%	62	76	84	88	25.67	48.20
PERCENT		100.0%											

industrial, heavy industrial and commercial areas (land use categories 8 through 11) are assumed 100% fair condition desert shrub for the open space distribution. Parks/golf courses and schools (land use categories 2 and 12) are assumed 70% open landscaping (grass) in good condition and 30% fair condition desert shrub for the open space distribution. This 70%-30% split was determined after reviewing the Spring 2016 aerial imagery.

4. All designated right-of-way areas were categorized as public facility (land use category 7) to be consistent throughout the Las Vegas Valley.

It should be noted that undeveloped land, open desert (land use category 1) will continue to use 100% poor condition desert shrub (<30% ground cover).

The directly connected impervious area percentages and corresponding open space distribution of each land use category is presented in **Table 2-2**:

Table 2-2 - Land Use Categories

Land Use Index	Land Use Description	Impervious* (%)	Open Landscape Good Condition Grass (%)	Open Desert Shrub Fair Condition Natural Desert Landscaping (%)
1	Undeveloped Land, Open Desert	0	0	100**
2	Parks, Golf Courses	5	66.5	28.5
3	Rural, 0.5-1 units per acre (uses 1 unit/acre)	20	40	40
4	Low-Density Residential, 1-2 units per acre (uses 2 units/acre)	25	37.5	37.5
5	Medium-Density Residential, 2-4 units per acre (uses 3 units/acre)	30	35	35
6	High-Density residential, 4-8 units per acre (uses 6 units/acre)	52	24	24
7	Public Facility and Residential, 8-12 units/acre	72	14	14
8	Very High-Density Residential, 12 units/acre or more	80	0	20
9	Commercial, Retail, Casino, High Rise Condominiums	85	0	15
10	Light Industrial	72	0	28
11	Heavy Industrial	85	0	15
12	Schools	50	35	15
13	Lakes	0	0	0

* Impervious areas are directly connected to the drainage system
** Open Desert Shrub Poor Condition is applied for Undeveloped Land, Open Desert (Land Use Index Number 1)

The land use data used with the 2018 MPU is shown on the W-Maps. **Figure 2-1** shows the geographic comparison between the 2018 and 2008 MPU land use coverages in terms of percent imperviousness. The increase or decrease in impervious area represents an increase or decrease, respectively, in the runoff potential for a given area.

Curve Number Matrix

SOIL MAP UNIT	HYDROLOGIC SOIL GROUP					LAND USE CATEGORY INDEX NUMBER												
	A	B	C	D	ROCK OUTCROP	1	2	3	4	5	6	7	8	9	10	11	12	13
	CN --->					63	47	57	60	62	74	84	89	92	86	92	71	30
		CN --->				77	66	73	74	76	83	89	93	94	91	94	81	30
			CN --->			85	77	82	83	84	88	92	95	95	93	95	87	30
				CN --->		88	83	86	87	88	91	94	96	96	95	96	90	30
					CN --->	90	90	92	92	92	94	96	96	97	96	97	94	30
	%	%	%	%	%	SOIL TYPE COMPOSITE CN FOR LAND USE CATEGORY												
1100	6	0	0	59	35	87.0	83.0	86.0	87.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0
1105	55	40	0	5	0	70.0	56.0	65.0	67.0	69.0	78.0	86.0	91.0	93.0	88.0	93.0	76.0	30.0
1107	0	100	0	0	0	77.0	66.0	73.0	74.0	76.0	83.0	89.0	93.0	94.0	91.0	94.0	81.0	30.0
1112	100	0	0	0	0	63.0	47.0	57.0	60.0	62.0	74.0	84.0	89.0	92.0	86.0	92.0	71.0	30.0
1113	100	0	0	0	0	63.0	47.0	57.0	60.0	62.0	74.0	84.0	89.0	92.0	86.0	92.0	71.0	30.0
1117	100	0	0	0	0	63.0	47.0	57.0	60.0	62.0	74.0	84.0	89.0	92.0	86.0	92.0	71.0	30.0
1120	100	0	0	0	0	63.0	47.0	57.0	60.0	62.0	74.0	84.0	89.0	92.0	86.0	92.0	71.0	30.0
1127	100	0	0	0	0	63.0	47.0	57.0	60.0	62.0	74.0	84.0	89.0	92.0	86.0	92.0	71.0	30.0
1129	100	0	0	0	0	63.0	47.0	57.0	60.0	62.0	74.0	84.0	89.0	92.0	86.0	92.0	71.0	30.0
1130	65	0	25	10	0	71.0	58.0	66.0	68.0	70.0	79.0	87.0	91.0	93.0	89.0	93.0	77.0	30.0
1132	100	0	0	0	0	63.0	47.0	57.0	60.0	62.0	74.0	84.0	89.0	92.0	86.0	92.0	71.0	30.0
1133	70	0	10	0	20	71.0	58.0	67.0	68.0	70.0	79.0	87.0	91.0	93.0	89.0	93.0	77.0	30.0
1134	100	0	0	0	0	63.0	47.0	57.0	60.0	62.0	74.0	84.0	89.0	92.0	86.0	92.0	71.0	30.0
1135	84	0	0	16	0	67.0	52.0	62.0	64.0	66.0	76.0	85.0	90.0	92.0	87.0	92.0	74.0	30.0
1140	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1141	8	0	2	70	20	86.0	81.0	85.0	86.0	86.0	90.0	93.0	95.0	96.0	94.0	96.0	89.0	30.0
1150	0	0	0	100	0	88.0	83.0	86.0	87.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0
1151	41	0	0	59	0	78.0	68.0	74.0	76.0	77.0	84.0	90.0	93.0	94.0	91.0	94.0	82.0	30.0
1152	0	0	0	100	0	88.0	83.0	86.0	87.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0
1155	0	0	0	100	0	88.0	83.0	86.0	87.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0
1156	1	10	0	89	0	87.0	81.0	84.0	85.0	86.0	90.0	93.0	95.0	96.0	94.0	96.0	89.0	30.0
1160	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1160dn	46	1	0	53	0	76.0	66.0	73.0	74.0	76.0	83.0	89.0	93.0	94.0	91.0	94.0	81.0	30.0
1165	32	40	15	13	0	75.0	64.0	71.0	73.0	74.0	82.0	88.0	92.0	94.0	90.0	94.0	80.0	30.0
1181	100	0	0	0	0	63.0	47.0	57.0	60.0	62.0	74.0	84.0	89.0	92.0	86.0	92.0	71.0	30.0
1182	95	0	5	0	0	64.0	48.0	58.0	61.0	63.0	74.0	84.0	90.0	92.0	86.0	92.0	72.0	30.0
1183	100	0	0	0	0	63.0	47.0	57.0	60.0	62.0	74.0	84.0	89.0	92.0	86.0	92.0	71.0	30.0
1184	100	0	0	0	0	63.0	47.0	57.0	60.0	62.0	74.0	84.0	89.0	92.0	86.0	92.0	71.0	30.0
1187	100	0	0	0	0	63.0	47.0	57.0	60.0	62.0	74.0	84.0	89.0	92.0	86.0	92.0	71.0	30.0
1190	100	0	0	0	0	63.0	47.0	57.0	60.0	62.0	74.0	84.0	89.0	92.0	86.0	92.0	71.0	30.0
1191	100	0	0	0	0	63.0	47.0	57.0	60.0	62.0	74.0	84.0	89.0	92.0	86.0	92.0	71.0	30.0
1192	55	35	0	10	0	70.0	57.0	66.0	68.0	70.0	79.0	87.0	91.0	93.0	88.0	93.0	76.0	30.0
1200	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1206	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1207	3	85	5	7	0	78.0	67.0	74.0	75.0	77.0	83.0	89.0	93.0	94.0	91.0	94.0	82.0	30.0
1222	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1225	9	20	50	21	0	82.0	73.0	79.0	80.0	81.0	86.0	91.0	94.0	95.0	92.0	95.0	85.0	30.0
1230	54	0	0	46	0	75.0	63.0	70.0	72.0	74.0	81.0	88.0	92.0	94.0	90.0	94.0	80.0	30.0
1235	66	25	0	9	0	69.0	55.0	64.0	66.0	68.0	77.0	86.0	91.0	93.0	88.0	93.0	75.0	30.0
1236	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1237	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1240	0	0	0	100	0	88.0	83.0	86.0	87.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0
1252	0	100	0	0	0	77.0	66.0	73.0	74.0	76.0	83.0	89.0	93.0	94.0	91.0	94.0	81.0	30.0
1255	0	100	0	0	0	77.0	66.0	73.0	74.0	76.0	83.0	89.0	93.0	94.0	91.0	94.0	81.0	30.0
1260	100	0	0	0	0	63.0	47.0	57.0	60.0	62.0	74.0	84.0	89.0	92.0	86.0	92.0	71.0	30.0
1262	75	0	0	25	0	69.0	56.0	64.0	67.0	69.0	78.0	86.0	91.0	93.0	88.0	93.0	76.0	30.0
1263	95	0	0	5	0	64.0	48.0	59.0	61.0	64.0	74.0	84.0	90.0	92.0	86.0	92.0	72.0	30.0
1264	100	0	0	0	0	63.0	47.0	57.0	60.0	62.0	74.0	84.0	89.0	92.0	86.0	92.0	71.0	30.0
1270	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1278	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1282	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1300	0	0	0	100	0	88.0	83.0	86.0	87.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0

Lag Time Computations (Standard Form 4)

Westwood

Time of Concentration (Standard Form 4)

Project Name & Number: LEN2206 - Grand Canyon & Washburn
By: PLM
Date: 3/11/2023

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																	
BAS1E	D	64.2	0.458	85.04	0.1329	28.5	2.00	4.90	3415	3.44	3.75	5.67	10.79	15.68	3444	29.131	0.157
BAS2E	D	72.3	0.564	39.92	0.0624	165	1.00	12.40	3295	3.48	3.77	5.71	10.37	22.77	3460	29.222	0.228
BAS3E	D	64.1	0.456	55.13	0.0861	28	2.00	4.87	4307	2.35	3.09	4.69	16.23	21.10	4335	34.083	0.211
BAS4E	D	60.0	0.402	46.77	0.0731	140	1.00	14.87	3492	2.52	3.21	4.86	12.86	27.73	3632	30.178	0.277
BAS5E	D	60.9	0.414	9.08	0.0142	130	1.00	14.09	1332	1.35	2.35	3.56	7.45	21.53	1462	18.122	0.181
BAS6E	D	64.6	0.463	4.49	0.0070	150	1.00	14.05	710	1.97	2.84	4.30	3.75	17.80	860	14.778	0.148
BAS7E	E	63.0	0.442	10.32	0.0161	177	2.82	11.15	1471	2.72	2.44	4.85	6.75	17.91			0.179
BAS8E	D	83.0	0.706	0.66	0.0010	25	2.00	2.82	665	1.20	2.22	3.36	4.58	7.40	690	13.833	0.074
BAS9E	E	63.3	0.446	73.89	0.1155	140	3.25	9.40	3550	4.10	3.00	5.95	11.32	20.72			0.207
BAS10E	D	74.0	0.587	1.09	0.0017	60	1.50	6.25	665	1.05	2.07	3.14	4.90	11.14	725	14.028	0.111
BAS11E	E	65.4	0.474	20.50	0.0320	110	3.30	7.94	3300	4.17	3.02	6.01	10.53	18.47			0.185
BAS12E	D	83.0	0.706	0.58	0.0009	25	2.00	2.82	615	0.89	1.91	2.89	5.02	7.84	640	13.556	0.078
BAS13E	E	64.0	0.454	34.41	0.0538	140	3.25	9.28	3480	4.25	3.05	6.06	10.93	20.21			0.202
Interim Condition																	
BAS3I	D	64.3	0.459	45.51	0.0711	28	2.00	4.85	4307	2.35	3.09	4.69	16.23	21.08	4335	34.083	0.211
NBAS7I	D	77.0	0.626	9.43	0.0147	140	1.00	10.09	830	2.50	3.19	4.84	3.75	13.83	970	15.389	0.138
SBAS7I	D	72.8	0.571	45.05	0.0704	140	1.00	11.28	2945	4.10	4.09	6.20	8.61	19.89	3085	27.139	0.199
WBAS9I	E	64.2	0.457	25.03	0.0391	140	3.25	9.24	1775	4.10	3.00	5.95	6.35	15.60			0.156
BAS9I	D	70.5	0.541	23.56	0.0368	180	1.00	13.51	1935	3.90	3.99	6.04	6.05	19.55	2115	21.750	0.196
BAS11I	D	66.8	0.492	6.28	0.0098	180	1.00	14.67	775	3.60	3.83	5.81	2.96	17.64	955	15.306	0.153
WBAS13I	E	63.6	0.449	33.02	0.0516	140	3.25	9.36	2555	4.25	3.05	6.06	8.38	17.74			0.177
BAS13I	D	65.5	0.474	8.43	0.0132	180	1.00	15.12	1160	3.80	3.94	5.97	3.96	19.08	1340	17.444	0.174

Proposed Condition																	
NBAS7P	D	62.0	0.428	9.43	0.0147	140	1.00	14.30	830	2.50	3.19	4.84	3.75	18.05	970	15.389	0.154
SBAS7P	D	64.0	0.455	45.05	0.0704	140	1.00	13.74	2945	4.10	4.09	6.20	8.61	22.35	3085	27.139	0.224
WBAS9P	D	64.1	0.456	25.03	0.0391	140	3.25	9.26	1775	4.10	4.09	6.20	5.47	14.72	1915	20.639	0.147
BAS9P	D	64.6	0.462	23.56	0.0368	180	1.00	15.40	1935	3.90	3.99	6.04	6.05	21.44	2115	21.750	0.214
Developed Condition																	
BAS3D	D	64.0	0.455	45.51	0.0711	28	2.00	4.88	4307	2.35	3.09	4.69	16.23	21.11	4335	34.083	0.211
WBAS9D	D	64.8	0.466	25.03	0.0391	140	1.00	13.51	2160	3.80	3.94	5.97	6.75	20.26	2300	22.778	0.203
WBAS13D	D	63.7	0.451	33.02	0.0516	140	1.00	13.83	2570	3.80	3.94	5.97	7.90	21.73	2710	25.056	0.217

[1] K = 0.0132 (CN) - 0.39

[2] A = Area/640

[3] Ti = (1.8 (1.1-K) L^0.5)/S^0.33

[4] For Existing Conditions: V1 = 14.8 * (S/100)^0.5
For Developed Conditions: V1 = 20.2 * (S/100)^0.5

[5] For Existing Conditions: V2 = 29.4 * (S/100)^0.5
For Developed Conditions: V2 = 30.6 * (S/100)^0.5

[6] Tt = L/(60*V)

[7] Tc = Ti + Tt

[8] Total L = Initial L + Travel L

[9] Tc = (L/180) + 10

[10] Tlag = (0.6*Tc)/60

[11] Min Tlag =0.05

Note: For Travel Time Calcs: V1 applies to first 500 feet and V2 applies to remaining distance.

Existing Condition HEC-1 Model

```
1****************************************                                                  ****************************************
 *                                      *                                                  *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                  *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                                                  *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                                                  *          609 SECOND STREET           *
 *                                      *                                                  *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   31JAN23  TIME  13:58:33  *                                                  *           (916) 756-1104             *
 *                                      *                                                  *                                      *
 ****************************************                                                  ****************************************


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


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

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


1                                                  HEC-1 INPUT                                                  PAGE  1

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

 *** FREE ***
                       *DIAGRAM
            1          ID     WESTWOOD PROFESSIONAL SERVICES
            2          ID     GRAND CANYON & WASHBURN
            3          ID     TECHNICAL DRAINAGE STUDY
            4          ID     EXISTING DRAINAGE CONDITION
            5          ID
            6          ID     RETURN PERIOD ------- 100-YR & 10-YR
            7          ID     DISTRIBUTION -------- 6-HOUR SDN3
            8          ID     PROJECT NO. --------- LEN2206.000
            9          ID     FILENAME ------------ EX.H1
           10          ID     DATE ---------------- FEB 2023
           11          ID     MODELED BY ---------- KC/CW
           12          ID
           13          ID        SIX HOUR DEPTH-AREA REDUCTION FACTORS
           14          ID        STORM EVENT             RATIO
           15          ID        100-YR                  1.00
           16          ID        10-YR                   0.55
           17          ID
           18          IT       5       0       0     300
           19          IO       5       0       0
           20          IN       5       0       0
           21          JR    PREC    1.00    0.55
                       *

           22          KK   BAS1E
           23          BA   .1329
           24          PC       0   0.020   0.057   0.070   0.087   0.108   0.124   0.130   0.130   0.130
           25          PC   0.130   0.130   0.130   0.133   0.140   0.142   0.148   0.158   0.172   0.181
           26          PC   0.190   0.197   0.199   0.200   0.201   0.204   0.214   0.229   0.241   0.249
           27          PC   0.251   0.256   0.270   0.278   0.281   0.283   0.295   0.322   0.352   0.409
           28          PC   0.499   0.590   0.710   0.744   0.781   0.812   0.819   0.835   0.851   0.856
           29          PC   0.860   0.868   0.876   0.888   0.910   0.926   0.937   0.950   0.970   0.976
           30          PC   0.982   0.985   0.987   0.989   0.990   0.993   0.993   0.994   0.995   0.998
           31          PC   0.998   0.999   1.000
           32          PB    3.15
           33          LS       0    64.2
           34          UD   0.157
                       *

           35          KK  RBAS1E
           36          KM   ROUTE BAS1E TO CP2
           37          KM   THROUGH BAS3E AND ALONG FISHER NORTH HALF ROADSIDE DITCH
           38          RD    3268   0.028   0.025       0    TRAP       0       6
                       *

           39          KK   BAS3E
           40          BA   .0861
           41          PB    3.12
           42          LS       0    64.1
           43          UD   0.211
                       *
1                                                  HEC-1 INPUT                                                  PAGE  2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  44          KK   BAS6E
  45          BA   .0070
  46          PB    3.15
  47          LS       0    64.6
  48          UD   0.148
              *

  49          KK   BAS2E
  50          BA   .0624
  51          PB    3.15
  52          LS       0    72.3
  53          UD   0.228
              *

  54          KK  RBAS2E
  55          KM   ROUTE BAS2E TO CP2
  56          KM   ALONG FISHER NORTH HALF ROADSIDE DITCH
  57          RD    2475   0.038   0.025       0    TRAP       0       6
              *

  58          KK     CP2
  59          HC       4
              *

  60          KK   BAS4E
  61          BA   .0731
  62          PB    3.15
  63          LS       0    60.0
  64          UD   0.277
              *

  65          KK   BAS5E
  66          BA   .0142
  67          PB    3.15
  68          LS       0    60.9
  69          UD   0.181
              *

  70          KK     CP1
  71          HC       2
              *

  72          KK   BAS7E
  73          BA   .0161
  74          PB    3.12
  75          LS       0    63.0
  76          UD   0.179
              *
1                                      HEC-1 INPUT                                          PAGE  3

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

  77          KK   BAS8E
  78          BA   .0010
  79          PB    3.12
  80          LS       0    83.0
  81          UD   0.074
              *

  82          KK     CP3
  83          HC       2
              *

  84          KK   BAS9E
  85          BA   .1155
  86          PB    3.12
  87          LS       0    63.3
  88          UD   0.207
              *

  89          KK  BAS10E
  90          BA   .0017
  91          PB    3.12
  92          LS       0    74.0
  93          UD   0.111
              *

  94          KK     CP4
  95          HC       2
              *

  96          KK  BAS11E
  97          BA   .0320
  98          PB    3.12
  99          LS       0    65.4
 100          UD   0.185
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                     *

           101       KK  BAS12E
           102       BA   .0009
           103       PB    3.12
           104       LS       0    83.0
           105       UD   0.078
                     *

           106       KK  BAS13E
           107       BA   .0538
           108       PB    3.12
           109       LS       0    64.0
           110       UD   0.202
                     *
1                                          HEC-1 INPUT                                          PAGE  4

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


           111       KK     CP5
           112       HC       3
                     *
           113       ZZ
1
               SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

    22       BAS1E
                 V
                 V
    35      RBAS1E
                 .
                 .
    39           .       BAS3E
                 .          .
                 .          .
    44           .          .       BAS6E
                 .          .          .
                 .          .          .
    49           .          .          .       BAS2E
                 .          .          .          V
                 .          .          .          V
    54           .          .          .      RBAS2E
                 .          .          .          .
                 .          .          .          .
    58         CP2.....................................
                 .
                 .
    60           .       BAS4E
                 .          .
                 .          .
    65           .          .       BAS5E
                 .          .          .
                 .          .          .
    70           .         CP1.....................
                 .          .
                 .          .
    72           .          .       BAS7E
                 .          .          .
                 .          .          .
    77           .          .          .       BAS8E
                 .          .          .          .
                 .          .          .          .
    82           .          .         CP3.....................
                 .          .          .
                 .          .          .
    84           .          .          .       BAS9E
                 .          .          .          .
                 .          .          .          .
    89           .          .          .          .      BAS10E
                 .          .          .          .          .
                 .          .          .          .          .
    94           .          .          .         CP4.....................
                 .          .          .          .
                 .          .          .          .
    96           .          .          .          .      BAS11E
                 .          .          .          .          .
                 .          .          .          .          .
   101           .          .          .          .          .      BAS12E
                 .          .          .          .          .          .
                 .          .          .          .          .          .
   106           .          .          .          .          .          .      BAS13E
                 .          .          .          .          .          .          .
                 .          .          .          .          .          .          .
   111           .          .          .          .         CP5.........................

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```

```
1*****************************************                                                  ****************************************
 *                                       *                                                  *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                  *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998               *                                                  *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                 *                                                  *          609 SECOND STREET           *
 *                                       *                                                  *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   31JAN23  TIME  13:58:33   *                                                  *           (916) 756-1104             *
 *                                       *                                                  *                                      *
 *****************************************                                                  ****************************************
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                              WESTWOOD PROFESSIONAL SERVICES
                              GRAND CANYON & WASHBURN
                              TECHNICAL DRAINAGE STUDY
                              EXISTING DRAINAGE CONDITION

                              RETURN PERIOD ------- 100-YR & 10-YR
                              DISTRIBUTION -------- 6-HOUR SDN3
                              PROJECT NO. --------- LEN2206.000
                              FILENAME ------------ EX.H1
                              DATE ---------------- FEB 2023
                              MODELED BY ---------- KC/CW

                                 SIX HOUR DEPTH-AREA REDUCTION FACTORS
                                 STORM EVENT             RATIO
                                 100-YR                  1.00
                                 10-YR                   0.55


   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
                       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


                                                          RATIOS APPLIED TO PRECIPITATION
 OPERATION       STATION     AREA    PLAN            RATIO 1  RATIO 2
                                                       1.00      .55

 HYDROGRAPH AT
+                 BAS1E       .13     1   FLOW          55.       4.
                                          TIME         3.58     4.92

 ROUTED TO
+                RBAS1E       .13     1   FLOW          54.       4.
                                          TIME         3.75     5.08

 HYDROGRAPH AT
+                 BAS3E       .09     1   FLOW          31.       2.
                                          TIME         3.67     4.92

 HYDROGRAPH AT
+                 BAS6E       .01     1   FLOW           3.       0.
                                          TIME         3.58     4.92
```

```
 HYDROGRAPH AT
+                 BAS2E       .06     1   FLOW          41.       7.
                                           TIME         3.67     3.75

 ROUTED TO
+                RBAS2E       .06     1   FLOW          41.       7.
                                           TIME         3.75     3.92

  4 COMBINED AT
+                   CP2       .29     1   FLOW         129.      12.
                                           TIME         3.75     4.00

 HYDROGRAPH AT
+                 BAS4E       .07     1   FLOW          16.       1.
                                           TIME         3.83     5.00

 HYDROGRAPH AT
+                 BAS5E       .01     1   FLOW           4.       0.
                                           TIME         3.67     4.92

  2 COMBINED AT
+                   CP1       .09     1   FLOW          20.       1.
                                           TIME         3.83     5.00

 HYDROGRAPH AT
+                 BAS7E       .02     1   FLOW           6.       0.
                                           TIME         3.67     4.92

 HYDROGRAPH AT
+                 BAS8E       .00     1   FLOW           2.       1.
                                           TIME         3.50     3.50

  2 COMBINED AT
+                   CP3       .02     1   FLOW           6.       1.
                                           TIME         3.67     3.50

 HYDROGRAPH AT
+                 BAS9E       .12     1   FLOW          39.       3.
                                           TIME         3.67     4.92

 HYDROGRAPH AT
+                BAS10E       .00     1   FLOW           2.       0.
                                           TIME         3.58     3.58

  2 COMBINED AT
+                   CP4       .12     1   FLOW          40.       3.
                                           TIME         3.67     4.92

 HYDROGRAPH AT
+                BAS11E       .03     1   FLOW          14.       1.
                                           TIME         3.67     4.92

 HYDROGRAPH AT
+                BAS12E       .00     1   FLOW           1.       0.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                BAS13E       .05     1   FLOW          20.       2.
                                           TIME         3.67     4.92

  3 COMBINED AT
+                   CP5       .09     1   FLOW          34.       3.
                                           TIME         3.67     4.92
1
                                       SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                           (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                 INTERPOLATED TO
                                                                               COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                      PEAK                                     PEAK

                                 (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

          FOR PLAN = 1  RATIO=  .00
            RBAS1E  MANE         1.25     56.39    222.50       .54      5.00     54.32    225.00         .54


 CONTINUITY SUMMARY (AC-FT) - INFLOW= .3856E+01 EXCESS= .0000E+00 OUTFLOW= .3857E+01 BASIN STORAGE= .1118E-02 PERCENT ERROR=   -.1


          FOR PLAN = 1  RATIO=  .00
            RBAS1E  MANE         2.00      4.08    306.00       .06      5.00      4.08    305.00         .06


 CONTINUITY SUMMARY (AC-FT) - INFLOW= .4360E+00 EXCESS= .0000E+00 OUTFLOW= .4365E+00 BASIN STORAGE= .1043E-02 PERCENT ERROR=   -.4


          FOR PLAN = 1  RATIO=  .00
            RBAS2E  MANE         4.00     41.21    224.00       .91      5.00     41.08    225.00         .92
```

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3044E+01 EXCESS= .0000E+00 OUTFLOW= .3045E+01 BASIN STORAGE= .7487E-03 PERCENT ERROR= -.1

FOR PLAN = 1 RATIO= .00

RBAS2E	MANE	1.50	7.34	234.00	.19	5.00	7.22	235.00	.19	

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6476E+00 EXCESS= .0000E+00 OUTFLOW= .6480E+00 BASIN STORAGE= .6375E-03 PERCENT ERROR= -.2

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

Interim Condition HEC-1 Model

```
1****************************************                                                  ****************************************
 *                                      *                                                  *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                  *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                                                  *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                                                  *          609 SECOND STREET           *
 *                                      *                                                  *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   22FEB23  TIME  12:19:01  *                                                  *           (916) 756-1104             *
 *                                      *                                                  *                                      *
 ****************************************                                                  ****************************************
```

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

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

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

 *** FREE ***
                        *DIAGRAM
             1          ID     WESTWOOD PROFESSIONAL SERVICES
             2          ID     GRAND CANYON & WASHBURN
             3          ID     TECHNICAL DRAINAGE STUDY
             4          ID     INTERIM DRAINAGE CONDITION
             5          ID
             6          ID     RETURN PERIOD ------- 100-YR & 10-YR
             7          ID     DISTRIBUTION -------- 6-HOUR SDN3
             8          ID     PROJECT NO. --------- LEN2206.000
             9          ID     FILENAME ------------ INT.H1
            10          ID     DATE ---------------- FEB 2023
            11          ID     MODELED BY ---------- KC/CW
            12          ID
            13          ID        SIX HOUR DEPTH-AREA REDUCTION FACTORS
            14          ID        STORM EVENT             RATIO
            15          ID        100-YR                  1.00
            16          ID        10-YR                   0.55
            17          ID
            18          IT       5       0       0     300
            19          IO       5       0       0
            20          IN       5       0       0
            21          JR    PREC    1.00    0.55
                        *

            22          KK   BAS4E
            23          BA   .0731
            24          PB    3.15
            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          LS       0    60.0
            34          UD   0.277
                        *

            35          KK   BAS5E
            36          BA   .0142
            37          PB    3.15
            38          LS       0    60.9
            39          UD   0.181
                        *

            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   BAS1E
             43          BA   .1329
             44          PB    3.15
             45          LS       0    64.2
             46          UD   0.157
                         *

             47          KK  RBAS1E
             48          KM   ROUTE BAS1E TO CP2
             49          KM   THROUGH BAS3I AND ALONG FISHER NORTH HALF ROADSIDE DITCH
             50          RD    3268   0.028   0.025       0    TRAP       0       6
                         *

             51          KK   BAS3I
             52          BA   .0711
             53          PB    3.12
             54          LS       0    64.3
             55          UD   0.211
                         *

             56          KK  NBAS7I
             57          BA   .0147
             58          PB    3.12
             59          LS       0    77.0
             60          UD   0.138
                         *

             61          KK   CP2.1
             62          HC       3
                         *

             63          KK   BAS6E
             64          BA   .0070
             65          PB    3.15
             66          LS       0    64.6
             67          UD   0.148
                         *

             68          KK     CP2
             69          HC       2
                         *

             70          KK   BAS2E
             71          BA   .0624
             72          PB    3.15
             73          LS       0    72.3
             74          UD   0.228
                         *
```



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

             75          KK  RBAS2E
             76          KM   ROUTE BAS2E TO CP3
             77          KM   THROUGH BAS7I AND DOWN WASHBURN
             78          RD    3205   0.033   0.025       0    TRAP       0       6
                         *

             79          KK  SBAS7I
             80          BA   .0704
             81          PB    3.12
             82          LS       0    72.8
             83          UD   0.199
                         *

             84          KK   CP3.1
             85          HC       2
                         *

             86          KK   BAS8E
             87          BA   .0010
             88          PB    3.12
             89          LS       0    83.0
             90          UD   0.074
                         *

             91          KK     CP3
             92          HC       2
                         *

             93          KK  WBAS9I
             94          BA   .0391
             95          PB    3.12
             96          LS       0    64.2
             97          UD   0.156
                         *

             98          KK   BAS9I
```

```
             99           BA   .0368
            100           PB    3.12
            101           LS       0    70.5
            102           UD   0.196
                          *

            103           KK   CP4.1
            104           HC       2
                          *

            105           KK  BAS10E
            106           BA   .0017
            107           PB    3.12
            108           LS       0    74.0
            109           UD   0.111
                          *
```



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


            110           KK     CP4
            111           HC       2
                          *

            112           KK WBAS13I
            113           BA   .0516
            114           PB    3.12
            115           LS       0    63.6
            116           UD   0.177
                          *

            117           KK  BAS13I
            118           BA   .0132
            119           PB    3.12
            120           LS       0    65.5
            121           UD   0.174
                          *

            122           KK   CP5.1
            123           HC       2
                          *

            124           KK  BAS11I
            125           BA   .0098
            126           PB    3.12
            127           LS       0    66.8
            128           UD   0.153
                          *

            129           KK  BAS12E
            130           BA   .0009
            131           PB    3.12
            132           LS       0    83.0
            133           UD   0.078
                          *

            134           KK     CP5
            135           HC       3
                          *
            136           ZZ
```

1

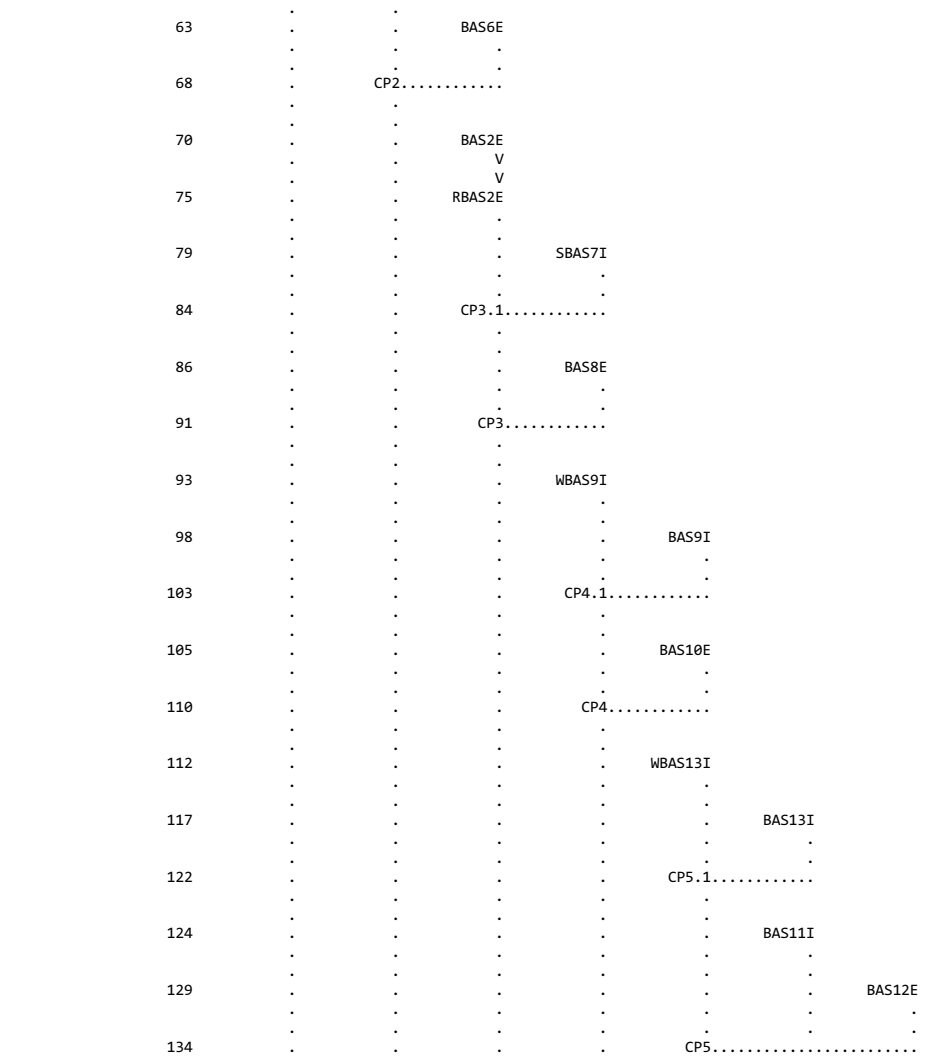
SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

    22       BAS4E
                .
                .
    35          .       BAS5E
                .          .
                .          .
    40         CP1.............
                .
                .
    42          .       BAS1E
                .          V
                .          V
    47          .      RBAS1E
                .          .
                .          .
    51          .          .       BAS3I
                .          .          .
                .          .          .
    56          .          .          .      NBAS7I
                .          .          .           .
                .          .          .           .
    61          .       CP2.1.........................
                .          .
```

```
                .          .
   63           .          .      BAS6E
                .          .          .
                .          .          .
   68           .        CP2...........
                .          .
                .          .
   70           .          .      BAS2E
                .          .          V
                .          .          V
   75           .          .     RBAS2E
                .          .          .
                .          .          .
   79           .          .          .     SBAS7I
                .          .          .          .
                .          .          .          .
   84           .          .      CP3.1...........
                .          .          .
                .          .          .
   86           .          .          .      BAS8E
                .          .          .          .
                .          .          .          .
   91           .          .        CP3...........
                .          .          .
                .          .          .
   93           .          .          .     WBAS9I
                .          .          .          .
                .          .          .          .
   98           .          .          .          .      BAS9I
                .          .          .          .          .
                .          .          .          .          .
  103           .          .          .      CP4.1...........
                .          .          .          .
                .          .          .          .
  105           .          .          .          .     BAS10E
                .          .          .          .          .
                .          .          .          .          .
  110           .          .          .        CP4...........
                .          .          .          .
                .          .          .          .
  112           .          .          .          .    WBAS13I
                .          .          .          .          .
                .          .          .          .          .
  117           .          .          .          .          .     BAS13I
                .          .          .          .          .          .
                .          .          .          .          .          .
  122           .          .          .          .      CP5.1...........
                .          .          .          .          .
                .          .          .          .          .
  124           .          .          .          .          .     BAS11I
                .          .          .          .          .          .
                .          .          .          .          .          .
  129           .          .          .          .          .          .     BAS12E
                .          .          .          .          .          .          .
                .          .          .          .          .          .          .
  134           .          .          .          .        CP5........................
```



```
 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************                                                  ****************************************
 *                                      *                                                  *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                  *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                                                  *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                                                  *          609 SECOND STREET           *
 *                                      *                                                  *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   22FEB23  TIME  12:19:01  *                                                  *           (916) 756-1104             *
 *                                      *                                                  *                                      *
 ****************************************                                                  ****************************************
```

```
                              WESTWOOD PROFESSIONAL SERVICES
                              GRAND CANYON & WASHBURN
                              TECHNICAL DRAINAGE STUDY
                              INTERIM DRAINAGE CONDITION

                              RETURN PERIOD ------- 100-YR & 10-YR
                              DISTRIBUTION -------- 6-HOUR SDN3
                              PROJECT NO. --------- LEN2206.000
                              FILENAME ------------ INT.H1
                              DATE ---------------- FEB 2023
                              MODELED BY ---------- KC/CW

                                 SIX HOUR DEPTH-AREA REDUCTION FACTORS
                                 STORM EVENT            RATIO
                                 100-YR                 1.00
                                 10-YR                  0.55


  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
                  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


                                                                  RATIOS APPLIED TO PRECIPITATION
 OPERATION       STATION     AREA    PLAN            RATIO 1  RATIO 2
                                                        1.00      .55

 HYDROGRAPH AT
+                 BAS4E       .07     1   FLOW          16.       1.
                                           TIME         3.83     5.00

 HYDROGRAPH AT
+                 BAS5E       .01     1   FLOW           4.       0.
                                           TIME         3.67     4.92

  2 COMBINED AT
+                   CP1       .09     1   FLOW          20.       1.
                                           TIME         3.83     5.00

 HYDROGRAPH AT
+                 BAS1E       .13     1   FLOW          55.       4.
                                           TIME         3.58     4.92

 ROUTED TO
+                RBAS1E       .13     1   FLOW          54.       4.
                                           TIME         3.75     5.08

 HYDROGRAPH AT
+                 BAS3I       .07     1   FLOW          26.       2.
                                           TIME         3.67     4.92

 HYDROGRAPH AT
+                 NBAS7I      .01     1   FLOW          15.       4.
                                           TIME         3.58     3.58

  3 COMBINED AT
+                 CP2.1       .22     1   FLOW          90.       7.
                                           TIME         3.67     4.92

 HYDROGRAPH AT
+                 BAS6E       .01     1   FLOW           3.       0.
                                           TIME         3.58     4.92

  2 COMBINED AT
+                   CP2       .23     1   FLOW          93.       7.
                                           TIME         3.67     4.92

 HYDROGRAPH AT
+                 BAS2E       .06     1   FLOW          41.       7.
                                           TIME         3.67     3.75

 ROUTED TO
+                RBAS2E       .06     1   FLOW          40.       7.
                                           TIME         3.75     3.92

 HYDROGRAPH AT
```

```
+                SBAS7I       .07     1   FLOW          50.       9.
                                         TIME         3.67     3.75

  2 COMBINED AT
+                 CP3.1       .13     1   FLOW          85.      15.
                                         TIME         3.75     3.83

 HYDROGRAPH AT
+                 BAS8E       .00     1   FLOW           2.       1.
                                         TIME         3.50     3.50

  2 COMBINED AT
+                   CP3       .13     1   FLOW          86.      15.
                                         TIME         3.75     3.83

 HYDROGRAPH AT
+                WBAS9I       .04     1   FLOW          16.       1.
                                         TIME         3.58     4.92

 HYDROGRAPH AT
+                 BAS9I       .04     1   FLOW          23.       3.
                                         TIME         3.67     3.75

  2 COMBINED AT
+                 CP4.1       .08     1   FLOW          38.       4.
                                         TIME         3.67     3.75

 HYDROGRAPH AT
+                BAS10E       .00     1   FLOW           2.       0.
                                         TIME         3.58     3.58

  2 COMBINED AT
+                   CP4       .08     1   FLOW          39.       4.
                                         TIME         3.67     3.75

 HYDROGRAPH AT
+               WBAS13I       .05     1   FLOW          19.       1.
                                         TIME         3.67     4.92

 HYDROGRAPH AT
+                BAS13I       .01     1   FLOW           6.       0.
                                         TIME         3.67     4.92

  2 COMBINED AT
+                 CP5.1       .06     1   FLOW          25.       2.
                                         TIME         3.67     4.92

 HYDROGRAPH AT
+                BAS11I       .01     1   FLOW           5.       0.
                                         TIME         3.58     3.75

 HYDROGRAPH AT
+                BAS12E       .00     1   FLOW           1.       0.
                                         TIME         3.50     3.50

  3 COMBINED AT
+                   CP5       .08     1   FLOW          31.       2.
                                         TIME         3.67     4.92
1
                                     SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                         (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                 INTERPOLATED TO
                                                                              COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                      PEAK                                     PEAK

                                  (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

          FOR PLAN = 1  RATIO=  .00
            RBAS1E  MANE         1.25     56.39    222.50       .54      5.00     54.32    225.00         .54


 CONTINUITY SUMMARY (AC-FT) - INFLOW= .3856E+01 EXCESS= .0000E+00 OUTFLOW= .3857E+01 BASIN STORAGE= .1118E-02 PERCENT ERROR=   -.1


          FOR PLAN = 1  RATIO=  .00
            RBAS1E  MANE         2.00      4.08    306.00       .06      5.00      4.08    305.00         .06


 CONTINUITY SUMMARY (AC-FT) - INFLOW= .4360E+00 EXCESS= .0000E+00 OUTFLOW= .4365E+00 BASIN STORAGE= .1043E-02 PERCENT ERROR=   -.4


          FOR PLAN = 1  RATIO=  .00
            RBAS2E  MANE         4.00     41.52    228.00       .92      5.00     40.26    225.00         .92


 CONTINUITY SUMMARY (AC-FT) - INFLOW= .3044E+01 EXCESS= .0000E+00 OUTFLOW= .3046E+01 BASIN STORAGE= .1123E-02 PERCENT ERROR=   -.1


          FOR PLAN = 1  RATIO=  .00
            RBAS2E  MANE         1.50      7.37    235.50       .19      5.00      7.32    235.00         .19
```

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6476E+00 EXCESS= .0000E+00 OUTFLOW= .6483E+00 BASIN STORAGE= .9686E-03 PERCENT ERROR=   -.3

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

Proposed Condition HEC-1 Model

```
1****************************************                                                  ****************************************
 *                                      *                                                  *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                  *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                                                  *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                                                  *          609 SECOND STREET           *
 *                                      *                                                  *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   22FEB23  TIME  12:38:05  *                                                  *           (916) 756-1104             *
 *                                      *                                                  *                                      *
 ****************************************                                                  ****************************************
```

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

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

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
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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     WESTWOOD PROFESSIONAL SERVICES
             2          ID     GRAND CANYON & WASHBURN
             3          ID     TECHNICAL DRAINAGE STUDY
             4          ID     PROPOSED DRAINAGE CONDITION
             5          ID
             6          ID     RETURN PERIOD ------- 100-YR & 10-YR
             7          ID     DISTRIBUTION -------- 6-HOUR SDN3
             8          ID     PROJECT NO. --------- LEN2206.000
             9          ID     FILENAME ------------ PRO.H1
            10          ID     DATE ---------------- FEB 2023
            11          ID     MODELED BY ---------- KC/CW
            12          ID
            13          ID        SIX HOUR DEPTH-AREA REDUCTION FACTORS
            14          ID        STORM EVENT             RATIO
            15          ID        100-YR                  1.00
            16          ID        10-YR                   0.55
            17          ID
            18          IT       5       0       0     300
            19          IO       5       0       0
            20          IN       5       0       0
            21          JR    PREC    1.00    0.55
                        *

            22          KK   BAS4E
            23          BA   .0731
            24          PB    3.15
            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          LS       0    60.0
            34          UD   0.277
                        *

            35          KK   BAS5E
            36          BA   .0142
            37          PB    3.15
            38          LS       0    60.9
            39          UD   0.181
                        *

            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   BAS1E
             43          BA   .1329
             44          PB    3.15
             45          LS       0    64.2
             46          UD   0.157
                         *

             47          KK  RBAS1E
             48          KM   ROUTE BAS1E TO CP2
             49          KM   THROUGH BAS3P AND ALONG FISHER NORTH HALF ROADSIDE DITCH
             50          RD    3268   0.028   0.025       0    TRAP       0       6
                         *

             51          KK   BAS3I
             52          BA   .0711
             53          PB    3.12
             54          LS       0    64.3
             55          UD   0.211
                         *

             56          KK  NBAS7P
             57          BA   .0147
             58          PB    3.12
             59          LS       0    62.0
             60          UD   0.154
                         *

             61          KK   CP2.1
             62          HC       3
                         *

             63          KK   BAS6E
             64          BA   .0070
             65          PB    3.15
             66          LS       0    64.6
             67          UD   0.148
                         *

             68          KK     CP2
             69          HC       2
                         *

             70          KK   BAS2E
             71          BA   .0624
             72          PB    3.15
             73          LS       0    72.3
             74          UD   0.228
                         *
1                                          HEC-1 INPUT                                          PAGE  3

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

             75          KK  RBAS2E
             76          KM   ROUTE BAS2E TO CP3
             77          KM   THROUGH BAS7P AND DOWN WASHBURN
             78          RD    3205   0.033   0.025       0    TRAP       0       6
                         *

             79          KK  SBAS7P
             80          BA   .0704
             81          PB    3.12
             82          LS       0    64.0
             83          UD   0.224
                         *

             84          KK   CP3.1
             85          HC       2
                         *

             86          KK   BAS8E
             87          BA   .0010
             88          PB    3.12
             89          LS       0    83.0
             90          UD   0.074
                         *

             91          KK     CP3
             92          HC       2
                         *

             93          KK  WBAS9P
             94          BA   .0391
             95          PB    3.12
             96          LS       0    64.1
             97          UD   0.147
                         *

             98          KK   BAS9P
```

```
             99          BA   .0368
            100          PB    3.12
            101          LS       0    64.6
            102          UD   0.214
                         *

            103          KK   CP4.1
            104          HC       2
                         *

            105          KK  BAS10E
            106          BA   .0017
            107          PB    3.12
            108          LS       0    74.0
            109          UD   0.111
                         *
```



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


            110          KK     CP4
            111          HC       2
                         *

            112          KK WBAS13I
            113          BA   .0516
            114          PB    3.12
            115          LS       0    63.6
            116          UD   0.177
                         *

            117          KK  BAS13I
            118          BA   .0132
            119          PB    3.12
            120          LS       0    65.5
            121          UD   0.174
                         *

            122          KK   CP5.1
            123          HC       2
                         *

            124          KK  BAS11I
            125          BA   .0098
            126          PB    3.12
            127          LS       0    66.8
            128          UD   0.153
                         *

            129          KK  BAS12E
            130          BA   .0009
            131          PB    3.12
            132          LS       0    83.0
            133          UD   0.078
                         *

            134          KK     CP5
            135          HC       3
                         *
            136          ZZ
```

1

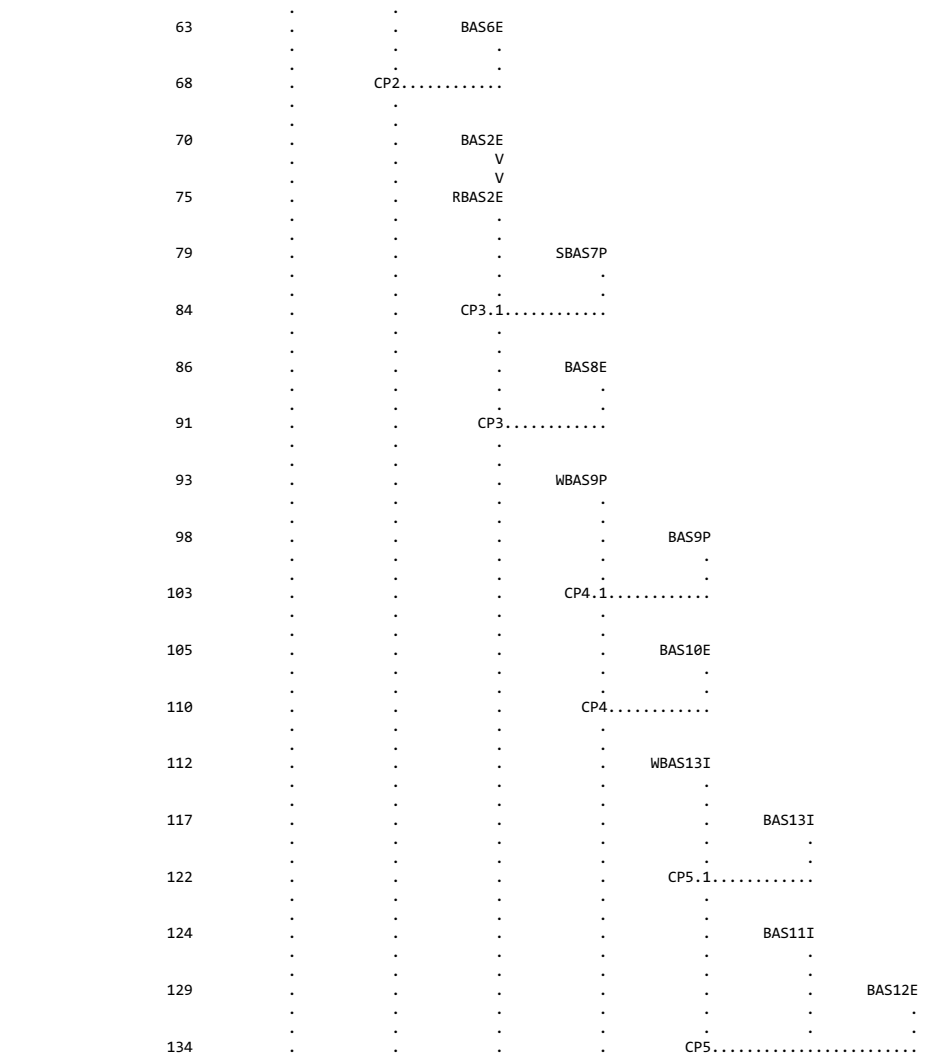
SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

    22       BAS4E
                 .
                 .
    35           .       BAS5E
                 .          .
                 .          .
    40         CP1.............
                 .
                 .
    42           .       BAS1E
                 .          V
                 .          V
    47           .      RBAS1E
                 .          .
                 .          .
    51           .          .       BAS3I
                 .          .          .
                 .          .          .
    56           .          .          .      NBAS7P
                 .          .          .           .
                 .          .          .           .
    61           .       CP2.1.........................
                 .          .
```

```
                .          .
   63           .          .      BAS6E
                .          .          .
                .          .          .
   68           .        CP2...........
                .          .
                .          .
   70           .          .      BAS2E
                .          .          V
                .          .          V
   75           .          .     RBAS2E
                .          .          .
                .          .          .
   79           .          .          .     SBAS7P
                .          .          .          .
                .          .          .          .
   84           .          .      CP3.1...........
                .          .          .
                .          .          .
   86           .          .          .      BAS8E
                .          .          .          .
                .          .          .          .
   91           .          .        CP3...........
                .          .          .
                .          .          .
   93           .          .          .     WBAS9P
                .          .          .          .
                .          .          .          .
   98           .          .          .          .      BAS9P
                .          .          .          .          .
                .          .          .          .          .
  103           .          .          .      CP4.1...........
                .          .          .          .
                .          .          .          .
  105           .          .          .          .     BAS10E
                .          .          .          .          .
                .          .          .          .          .
  110           .          .          .        CP4...........
                .          .          .          .
                .          .          .          .
  112           .          .          .          .    WBAS13I
                .          .          .          .          .
                .          .          .          .          .
  117           .          .          .          .          .     BAS13I
                .          .          .          .          .          .
                .          .          .          .          .          .
  122           .          .          .          .      CP5.1...........
                .          .          .          .          .
                .          .          .          .          .
  124           .          .          .          .          .     BAS11I
                .          .          .          .          .          .
                .          .          .          .          .          .
  129           .          .          .          .          .          .     BAS12E
                .          .          .          .          .          .          .
                .          .          .          .          .          .          .
  134           .          .          .          .        CP5........................
```



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1****************************************                                                  ****************************************
 *                                      *                                                  *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                  *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                                                  *    HYDROLOGIC ENGINEERING CENTER     *
 *            VERSION 4.1               *                                                  *          609 SECOND STREET           *
 *                                      *                                                  *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   22FEB23  TIME  12:38:05  *                                                  *           (916) 756-1104             *
 *                                      *                                                  *                                      *
 ****************************************                                                  ****************************************
```

```
                              WESTWOOD PROFESSIONAL SERVICES
                              GRAND CANYON & WASHBURN
                              TECHNICAL DRAINAGE STUDY
                              PROPOSED DRAINAGE CONDITION

                              RETURN PERIOD ------- 100-YR & 10-YR
                              DISTRIBUTION -------- 6-HOUR SDN3
                              PROJECT NO. --------- LEN2206.000
                              FILENAME ------------ PRO.H1
                              DATE ---------------- FEB 2023
                              MODELED BY ---------- KC/CW

                                 SIX HOUR DEPTH-AREA REDUCTION FACTORS
                                 STORM EVENT            RATIO
                                 100-YR                 1.00
                                 10-YR                  0.55


  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
                  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


                                                                  RATIOS APPLIED TO PRECIPITATION
 OPERATION       STATION     AREA    PLAN            RATIO 1  RATIO 2
                                                        1.00      .55

 HYDROGRAPH AT
+                 BAS4E       .07     1   FLOW          16.       1.
                                           TIME         3.83     5.00

 HYDROGRAPH AT
+                 BAS5E       .01     1   FLOW           4.       0.
                                           TIME         3.67     4.92

  2 COMBINED AT
+                   CP1       .09     1   FLOW          20.       1.
                                           TIME         3.83     5.00

 HYDROGRAPH AT
+                 BAS1E       .13     1   FLOW          55.       4.
                                           TIME         3.58     4.92

 ROUTED TO
+                RBAS1E       .13     1   FLOW          54.       4.
                                           TIME         3.75     5.08

 HYDROGRAPH AT
+                 BAS3I       .07     1   FLOW          26.       2.
                                           TIME         3.67     4.92

 HYDROGRAPH AT
+                NBAS7P       .01     1   FLOW           5.       0.
                                           TIME         3.67     4.92

  3 COMBINED AT
+                 CP2.1       .22     1   FLOW          84.       6.
                                           TIME         3.75     4.92

 HYDROGRAPH AT
+                 BAS6E       .01     1   FLOW           3.       0.
                                           TIME         3.58     4.92

  2 COMBINED AT
+                   CP2       .23     1   FLOW          87.       6.
                                           TIME         3.75     4.92

 HYDROGRAPH AT
+                 BAS2E       .06     1   FLOW          41.       7.
                                           TIME         3.67     3.75

 ROUTED TO
+                RBAS2E       .06     1   FLOW          40.       7.
                                           TIME         3.75     3.92

 HYDROGRAPH AT
```

```
+                SBAS7P       .07     1   FLOW          25.       2.
                                         TIME         3.75     4.92

  2 COMBINED AT
+                 CP3.1       .13     1   FLOW          65.       9.
                                         TIME         3.75     3.92

 HYDROGRAPH AT
+                 BAS8E       .00     1   FLOW           2.       1.
                                         TIME         3.50     3.50

  2 COMBINED AT
+                   CP3       .13     1   FLOW          66.       9.
                                         TIME         3.75     3.92

 HYDROGRAPH AT
+                WBAS9P       .04     1   FLOW          16.       1.
                                         TIME         3.58     4.92

 HYDROGRAPH AT
+                 BAS9P       .04     1   FLOW          14.       1.
                                         TIME         3.67     4.92

  2 COMBINED AT
+                 CP4.1       .08     1   FLOW          29.       2.
                                         TIME         3.67     4.92

 HYDROGRAPH AT
+                BAS10E       .00     1   FLOW           2.       0.
                                         TIME         3.58     3.58

  2 COMBINED AT
+                   CP4       .08     1   FLOW          31.       2.
                                         TIME         3.67     4.92

 HYDROGRAPH AT
+               WBAS13I       .05     1   FLOW          19.       1.
                                         TIME         3.67     4.92

 HYDROGRAPH AT
+                BAS13I       .01     1   FLOW           6.       0.
                                         TIME         3.67     4.92

  2 COMBINED AT
+                 CP5.1       .06     1   FLOW          25.       2.
                                         TIME         3.67     4.92

 HYDROGRAPH AT
+                BAS11I       .01     1   FLOW           5.       0.
                                         TIME         3.58     3.75

 HYDROGRAPH AT
+                BAS12E       .00     1   FLOW           1.       0.
                                         TIME         3.50     3.50

  3 COMBINED AT
+                   CP5       .08     1   FLOW          31.       2.
                                         TIME         3.67     4.92
1
                                     SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                         (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                 INTERPOLATED TO
                                                                              COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                      PEAK                                     PEAK

                                 (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

          FOR PLAN = 1  RATIO=  .00
            RBAS1E  MANE         1.25     56.39    222.50       .54      5.00     54.32    225.00         .54


 CONTINUITY SUMMARY (AC-FT) - INFLOW= .3856E+01 EXCESS= .0000E+00 OUTFLOW= .3857E+01 BASIN STORAGE= .1118E-02 PERCENT ERROR=   -.1


          FOR PLAN = 1  RATIO=  .00
            RBAS1E  MANE         2.00      4.08    306.00       .06      5.00      4.08    305.00         .06


 CONTINUITY SUMMARY (AC-FT) - INFLOW= .4360E+00 EXCESS= .0000E+00 OUTFLOW= .4365E+00 BASIN STORAGE= .1043E-02 PERCENT ERROR=   -.4


          FOR PLAN = 1  RATIO=  .00
            RBAS2E  MANE         4.00     41.52    228.00       .92      5.00     40.26    225.00         .92


 CONTINUITY SUMMARY (AC-FT) - INFLOW= .3044E+01 EXCESS= .0000E+00 OUTFLOW= .3046E+01 BASIN STORAGE= .1123E-02 PERCENT ERROR=   -.1


          FOR PLAN = 1  RATIO=  .00
            RBAS2E  MANE         1.50      7.37    235.50       .19      5.00      7.32    235.00         .19
```

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6476E+00 EXCESS= .0000E+00 OUTFLOW= .6483E+00 BASIN STORAGE= .9686E-03 PERCENT ERROR=   -.3

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

Developed Condition HEC-1 Model

```
1****************************************                                                  ****************************************
 *                                      *                                                  *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                  *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                                                  *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                                                  *          609 SECOND STREET           *
 *                                      *                                                  *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   22FEB23  TIME  12:48:12  *                                                  *           (916) 756-1104             *
 *                                      *                                                  *                                      *
 ****************************************                                                  ****************************************


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


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

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


1                                                  HEC-1 INPUT                                                  PAGE  1

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

 *** FREE ***
                       *DIAGRAM
            1          ID     WESTWOOD PROFESSIONAL SERVICES
            2          ID     GRAND CANYON & WASHBURN
            3          ID     TECHNICAL DRAINAGE STUDY
            4          ID     DEVELOPED DRAINAGE CONDITION
            5          ID
            6          ID     RETURN PERIOD ------- 100-YR & 10-YR
            7          ID     DISTRIBUTION -------- 6-HOUR SDN3
            8          ID     PROJECT NO. --------- LEN2206.000
            9          ID     FILENAME ------------ DEV.H1
           10          ID     DATE ---------------- FEB 2023
           11          ID     MODELED BY ---------- KC/CW
           12          ID
           13          ID        SIX HOUR DEPTH-AREA REDUCTION FACTORS
           14          ID        STORM EVENT             RATIO
           15          ID        100-YR                  1.00
           16          ID        10-YR                   0.55
           17          ID
           18          IT       5       0       0     300
           19          IO       5       0       0
           20          IN       5       0       0
           21          JR    PREC    1.00    0.55
                       *

           22          KK   BAS4E
           23          BA   .0731
           24          PC       0   0.020   0.057   0.070   0.087   0.108   0.124   0.130   0.130   0.130
           25          PC   0.130   0.130   0.130   0.133   0.140   0.142   0.148   0.158   0.172   0.181
           26          PC   0.190   0.197   0.199   0.200   0.201   0.204   0.214   0.229   0.241   0.249
           27          PC   0.251   0.256   0.270   0.278   0.281   0.283   0.295   0.322   0.352   0.409
           28          PC   0.499   0.590   0.710   0.744   0.781   0.812   0.819   0.835   0.851   0.856
           29          PC   0.860   0.868   0.876   0.888   0.910   0.926   0.937   0.950   0.970   0.976
           30          PC   0.982   0.985   0.987   0.989   0.990   0.993   0.993   0.994   0.995   0.998
           31          PC   0.998   0.999       1
           32          PB    3.15
           33          LS       0    60.0
           34          UD   0.277
                       *

           35          KK   BAS5E
           36          BA   .0142
           37          PB    3.15
           38          LS       0    60.9
           39          UD   0.181
                       *

           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   BAS1E
             43          BA   .1329
             44          PB    3.15
             45          LS       0    64.2
             46          UD   0.157
                         *

             47          KK  RBAS1E
             48          KM   ROUTE BAS1E TO CP2
             49          KM   THROUGH BAS3E AND ALONG FISHER NORTH HALF ROADSIDE DITCH
             50          RD    3268   0.028   0.025       0    TRAP       0       6
                         *

             51          KK   BAS3D
             52          BA   .0711
             53          PB    3.12
             54          LS       0    64.0
             55          UD   0.211
                         *

             56          KK  NBAS7P
             57          BA   .0147
             58          PB    3.12
             59          LS       0    62.0
             60          UD   0.154
                         *

             61          KK   CP2.1
             62          HC       3
                         *

             63          KK   BAS6E
             64          BA   .0070
             65          PB    3.15
             66          LS       0    64.6
             67          UD   0.148
                         *

             68          KK     CP2
             69          HC       2
                         *

             70          KK   BAS2E
             71          BA   .0624
             72          PB    3.15
             73          LS       0    72.3
             74          UD   0.228
                         *
1                                          HEC-1 INPUT                                          PAGE  3

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

             75          KK  RBAS2E
             76          KM   ROUTE BAS2E TO CP3
             77          KM   THROUGH BAS7P AND DOWN WASHBURN
             78          RD    3205   0.033   0.025       0    TRAP       0       6
                         *

             79          KK  SBAS7P
             80          BA   .0704
             81          PB    3.12
             82          LS       0    64.0
             83          UD   0.224
                         *

             84          KK   CP3.1
             85          HC       2
                         *

             86          KK   BAS8E
             87          BA   .0010
             88          PB    3.12
             89          LS       0    83.0
             90          UD   0.074
                         *

             91          KK     CP3
             92          HC       2
                         *

             93          KK  WBAS9D
             94          BA   .0391
             95          PB    3.12
             96          LS       0    64.8
             97          UD   0.203
                         *

             98          KK   BAS9P
```

```
             99           BA   .0368
            100           PB    3.12
            101           LS       0    64.6
            102           UD   0.214
                          *

            103           KK   CP4.1
            104           HC       2
                          *

            105           KK  BAS10E
            106           BA   .0017
            107           PB    3.12
            108           LS       0    74.0
            109           UD   0.111
                          *
```



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


            110           KK     CP4
            111           HC       2
                          *

            112           KK WBAS13D
            113           BA   .0516
            114           PB    3.12
            115           LS       0    63.7
            116           UD   0.217
                          *

            117           KK  BAS13I
            118           BA   .0132
            119           PB    3.12
            120           LS       0    65.5
            121           UD   0.174
                          *

            122           KK   CP5.1
            123           HC       2
                          *

            124           KK  BAS11I
            125           BA   .0098
            126           PB    3.12
            127           LS       0    66.8
            128           UD   0.153
                          *

            129           KK  BAS12E
            130           BA   .0009
            131           PB    3.12
            132           LS       0    83.0
            133           UD   0.078
                          *

            134           KK     CP5
            135           HC       3
                          *
            136           ZZ
```

1

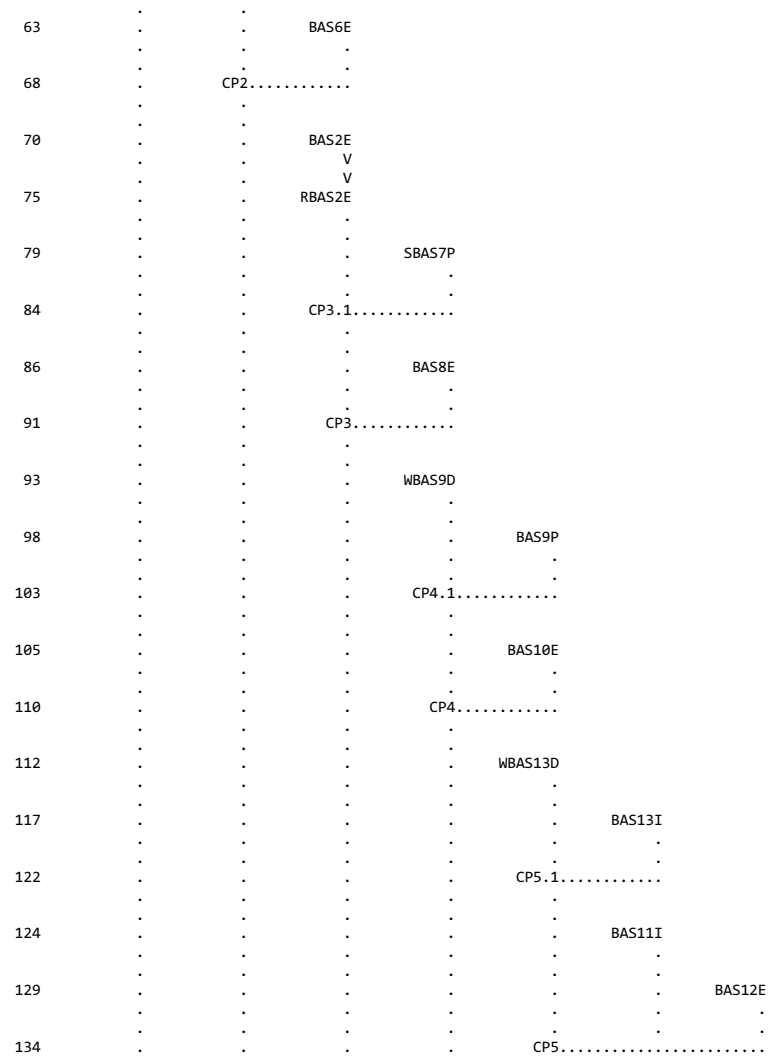
SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

    22       BAS4E
                .
                .
    35          .       BAS5E
                .          .
                .          .
    40         CP1.............
                .
                .
    42          .       BAS1E
                .          V
                .          V
    47          .      RBAS1E
                .          .
                .          .
    51          .          .       BAS3D
                .          .          .
                .          .          .
    56          .          .          .      NBAS7P
                .          .          .           .
                .          .          .           .
    61          .       CP2.1.........................
                .          .
```

```
                .          .
   63           .          .      BAS6E
                .          .          .
                .          .          .
   68           .        CP2...........
                .          .
                .          .
   70           .          .      BAS2E
                .          .          V
                .          .          V
   75           .          .     RBAS2E
                .          .          .
                .          .          .
   79           .          .          .     SBAS7P
                .          .          .          .
                .          .          .          .
   84           .          .      CP3.1...........
                .          .          .
                .          .          .
   86           .          .          .      BAS8E
                .          .          .          .
                .          .          .          .
   91           .          .        CP3...........
                .          .          .
                .          .          .
   93           .          .          .     WBAS9D
                .          .          .          .
                .          .          .          .
   98           .          .          .          .      BAS9P
                .          .          .          .          .
                .          .          .          .          .
  103           .          .          .      CP4.1...........
                .          .          .          .
                .          .          .          .
  105           .          .          .          .     BAS10E
                .          .          .          .          .
                .          .          .          .          .
  110           .          .          .        CP4...........
                .          .          .          .
                .          .          .          .
  112           .          .          .          .    WBAS13D
                .          .          .          .          .
                .          .          .          .          .
  117           .          .          .          .          .     BAS13I
                .          .          .          .          .          .
                .          .          .          .          .          .
  122           .          .          .          .      CP5.1...........
                .          .          .          .          .
                .          .          .          .          .
  124           .          .          .          .          .     BAS11I
                .          .          .          .          .          .
                .          .          .          .          .          .
  129           .          .          .          .          .          .     BAS12E
                .          .          .          .          .          .          .
                .          .          .          .          .          .          .
  134           .          .          .          .        CP5........................
```



```
 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************                                                  ****************************************
 *                                      *                                                  *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                  *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                                                  *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                                                  *          609 SECOND STREET           *
 *                                      *                                                  *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   22FEB23  TIME  12:48:12  *                                                  *           (916) 756-1104             *
 *                                      *                                                  *                                      *
 ****************************************                                                  ****************************************
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                              WESTWOOD PROFESSIONAL SERVICES
                              GRAND CANYON & WASHBURN
                              TECHNICAL DRAINAGE STUDY
                              DEVELOPED DRAINAGE CONDITION

                              RETURN PERIOD ------- 100-YR & 10-YR
                              DISTRIBUTION -------- 6-HOUR SDN3
                              PROJECT NO. --------- LEN2206.000
                              FILENAME ------------ DEV.H1
                              DATE ---------------- FEB 2023
                              MODELED BY ---------- KC/CW

                                 SIX HOUR DEPTH-AREA REDUCTION FACTORS
                                 STORM EVENT            RATIO
                                 100-YR                 1.00
                                 10-YR                  0.55


  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
                  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


                                                                  RATIOS APPLIED TO PRECIPITATION
 OPERATION       STATION     AREA    PLAN            RATIO 1  RATIO 2
                                                        1.00      .55

 HYDROGRAPH AT
+                 BAS4E       .07     1   FLOW          16.       1.
                                           TIME         3.83     5.00

 HYDROGRAPH AT
+                 BAS5E       .01     1   FLOW           4.       0.
                                           TIME         3.67     4.92

  2 COMBINED AT
+                   CP1       .09     1   FLOW          20.       1.
                                           TIME         3.83     5.00

 HYDROGRAPH AT
+                 BAS1E       .13     1   FLOW          55.       4.
                                           TIME         3.58     4.92

 ROUTED TO
+                RBAS1E       .13     1   FLOW          54.       4.
                                           TIME         3.75     5.08

 HYDROGRAPH AT
+                 BAS3D       .07     1   FLOW          25.       2.
                                           TIME         3.67     4.92

 HYDROGRAPH AT
+                NBAS7P       .01     1   FLOW           5.       0.
                                           TIME         3.67     4.92

  3 COMBINED AT
+                 CP2.1       .22     1   FLOW          84.       6.
                                           TIME         3.75     4.92

 HYDROGRAPH AT
+                 BAS6E       .01     1   FLOW           3.       0.
                                           TIME         3.58     4.92

  2 COMBINED AT
+                   CP2       .23     1   FLOW          86.       6.
                                           TIME         3.75     4.92

 HYDROGRAPH AT
+                 BAS2E       .06     1   FLOW          41.       7.
                                           TIME         3.67     3.75

 ROUTED TO
+                RBAS2E       .06     1   FLOW          40.       7.
                                           TIME         3.75     3.92

 HYDROGRAPH AT
```

```
+                SBAS7P       .07     1   FLOW          25.       2.
                                         TIME         3.75     4.92

  2 COMBINED AT
+                 CP3.1       .13     1   FLOW          65.       9.
                                         TIME         3.75     3.92

 HYDROGRAPH AT
+                 BAS8E       .00     1   FLOW           2.       1.
                                         TIME         3.50     3.50

  2 COMBINED AT
+                   CP3       .13     1   FLOW          66.       9.
                                         TIME         3.75     3.92

 HYDROGRAPH AT
+                WBAS9D       .04     1   FLOW          15.       1.
                                         TIME         3.67     4.92

 HYDROGRAPH AT
+                 BAS9P       .04     1   FLOW          14.       1.
                                         TIME         3.67     4.92

  2 COMBINED AT
+                 CP4.1       .08     1   FLOW          29.       2.
                                         TIME         3.67     4.92

 HYDROGRAPH AT
+                BAS10E       .00     1   FLOW           2.       0.
                                         TIME         3.58     3.58

  2 COMBINED AT
+                   CP4       .08     1   FLOW          30.       2.
                                         TIME         3.67     4.92

 HYDROGRAPH AT
+               WBAS13D       .05     1   FLOW          18.       1.
                                         TIME         3.75     4.92

 HYDROGRAPH AT
+                BAS13I       .01     1   FLOW           6.       0.
                                         TIME         3.67     4.92

  2 COMBINED AT
+                 CP5.1       .06     1   FLOW          23.       2.
                                         TIME         3.67     4.92

 HYDROGRAPH AT
+                BAS11I       .01     1   FLOW           5.       0.
                                         TIME         3.58     3.75

 HYDROGRAPH AT
+                BAS12E       .00     1   FLOW           1.       0.
                                         TIME         3.50     3.50

  3 COMBINED AT
+                   CP5       .08     1   FLOW          29.       2.
                                         TIME         3.67     4.92
1
                                     SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                         (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                 INTERPOLATED TO
                                                                              COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                      PEAK                                     PEAK

                                 (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

          FOR PLAN = 1  RATIO=  .00
            RBAS1E  MANE         1.25     56.39    222.50       .54      5.00     54.32    225.00         .54


 CONTINUITY SUMMARY (AC-FT) - INFLOW= .3856E+01 EXCESS= .0000E+00 OUTFLOW= .3857E+01 BASIN STORAGE= .1118E-02 PERCENT ERROR=   -.1


          FOR PLAN = 1  RATIO=  .00
            RBAS1E  MANE         2.00      4.08    306.00       .06      5.00      4.08    305.00         .06


 CONTINUITY SUMMARY (AC-FT) - INFLOW= .4360E+00 EXCESS= .0000E+00 OUTFLOW= .4365E+00 BASIN STORAGE= .1043E-02 PERCENT ERROR=   -.4


          FOR PLAN = 1  RATIO=  .00
            RBAS2E  MANE         4.00     41.52    228.00       .92      5.00     40.26    225.00         .92


 CONTINUITY SUMMARY (AC-FT) - INFLOW= .3044E+01 EXCESS= .0000E+00 OUTFLOW= .3046E+01 BASIN STORAGE= .1123E-02 PERCENT ERROR=   -.1


          FOR PLAN = 1  RATIO=  .00
            RBAS2E  MANE         1.50      7.37    235.50       .19      5.00      7.32    235.00         .19
```

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6476E+00 EXCESS= .0000E+00 OUTFLOW= .6483E+00 BASIN STORAGE= .9686E-03 PERCENT ERROR=   -.3

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

APPENDIX C

Street & Hydraulic Sections

Existing Condition Flow Split Computations – 100 Yr

Worksheet for FS1E-Hammer (60' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.30 %
Discharge	11.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.50
0+07.00	0.00
0+14.00	0.50
0+30.00	0.82
0+46.00	0.50
0+53.00	0.00
0+60.00	0.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.50)	(0+14.00, 0.50)	0.025
(0+14.00, 0.50)	(0+46.00, 0.50)	0.016
(0+46.00, 0.50)	(0+60.00, 0.50)	0.025

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	0.34 ft
Roughness Coefficient	0.025
Elevation	0.34 ft
Elevation Range	0.00 to 0.82 ft
Flow Area	3.30 ft²
Wetted Perimeter	19.27 ft
Hydraulic Radius	0.17 ft
Top Width	19.22 ft
Normal Depth	0.34 ft
Critical Depth	0.39 ft
Critical Slope	1.57 %
Velocity	3.33 ft/s

Worksheet for FS1E-Hammer (60' ROW)-100

Results	
Velocity Head	0.17 ft
Specific Energy	0.52 ft
Froude Number	1.419
Flow Type	Supercritical

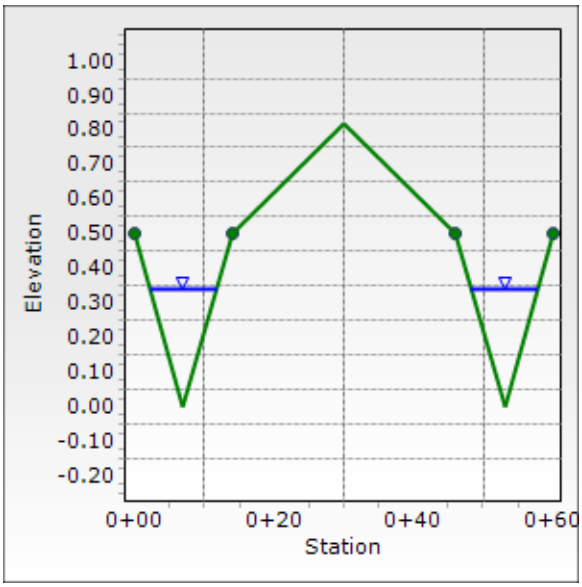
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.34 ft
Critical Depth	0.39 ft
Channel Slope	3.30 %
Critical Slope	1.57 %

Cross Section for FS1E-Hammer (60' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.30 %
Normal Depth	0.34 ft
Discharge	11.00 cfs



Worksheet for FS1S-Grand Canyon (80' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.50 %
Discharge	9.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.66
0+08.00	0.50
0+16.00	0.00
0+24.00	0.50
0+28.00	0.58
0+40.00	0.82
0+52.00	0.58
0+56.00	0.50
0+64.00	0.00
0+72.00	0.50
0+80.00	0.66

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.66)	(0+28.00, 0.58)	0.025
(0+28.00, 0.58)	(0+52.00, 0.58)	0.016
(0+52.00, 0.58)	(0+80.00, 0.66)	0.025

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	0.35 ft
Roughness Coefficient	0.025
Elevation	0.35 ft
Elevation Range	0.00 to 0.82 ft
Flow Area	3.95 ft²
Wetted Perimeter	22.52 ft
Hydraulic Radius	0.18 ft
Top Width	22.47 ft

Worksheet for FS1S-Grand Canyon (80' ROW)-100

Results	
Normal Depth	0.35 ft
Critical Depth	0.35 ft
Critical Slope	1.64 %
Velocity	2.28 ft/s
Velocity Head	0.08 ft
Specific Energy	0.43 ft
Froude Number	0.960
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	0.35 ft
Critical Depth	0.35 ft
Channel Slope	1.50 %
Critical Slope	1.64 %

Worksheet for FS1S-Grand Canyon (80' ROW)-100

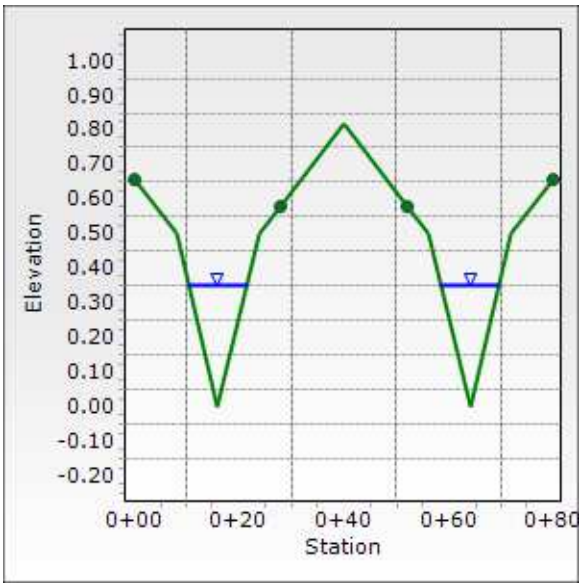
Messages:

Flow is divided.

Cross Section for FS1S-Grand Canyon (80' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.50 %
Normal Depth	0.35 ft
Discharge	9.00 cfs



Worksheet for FS2E-Fisher (60' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.20 %
Discharge	83.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.22
0+02.00	0.18
0+08.00	0.00
0+14.00	0.18
0+30.00	0.50
0+46.00	0.18
0+52.00	0.00
0+58.00	0.18
0+60.00	0.22

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.22)	(0+14.00, 0.18)	0.025
(0+14.00, 0.18)	(0+46.00, 0.18)	0.016
(0+46.00, 0.18)	(0+60.00, 0.22)	0.025

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	0.49 ft
Roughness Coefficient	0.021
Elevation	0.49 ft
Elevation Range	0.00 to 0.50 ft
Flow Area	15.80 ft²
Wetted Perimeter	59.96 ft
Hydraulic Radius	0.26 ft
Top Width	59.40 ft
Normal Depth	0.49 ft
Critical Depth	0.62 ft

Worksheet for FS2E-Fisher (60' ROW)-100

Results	
Critical Slope	0.88 %
Velocity	5.25 ft/s
Velocity Head	0.43 ft
Specific Energy	0.92 ft
Froude Number	1.796
Flow Type	Supercritical

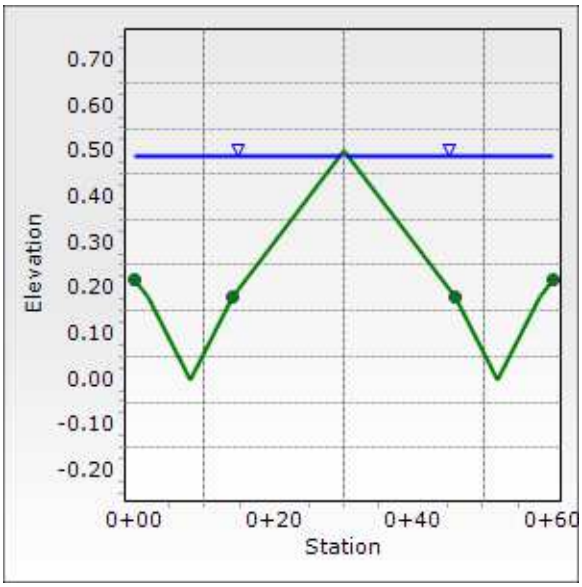
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.49 ft
Critical Depth	0.62 ft
Channel Slope	3.20 %
Critical Slope	0.88 %

Cross Section for FS2E-Fisher (60' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.20 %
Normal Depth	0.49 ft
Discharge	83.00 cfs



Worksheet for FS2S-Grand Canyon (80' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Discharge	55.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.40
0+08.00	0.24
0+16.00	0.00
0+24.00	0.24
0+40.00	0.43
0+52.00	0.29
0+56.00	0.24
0+64.00	0.00
0+72.00	0.24
0+80.00	0.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.40)	(0+24.00, 0.24)	0.025
(0+24.00, 0.24)	(0+52.00, 0.29)	0.016
(0+52.00, 0.29)	(0+80.00, 0.40)	0.025

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	0.49 ft
Roughness Coefficient	0.022
Elevation	0.49 ft
Elevation Range	0.00 to 0.43 ft
Flow Area	19.39 ft²
Wetted Perimeter	80.20 ft
Hydraulic Radius	0.24 ft
Top Width	80.00 ft
Normal Depth	0.49 ft

Worksheet for FS2S-Grand Canyon (80' ROW)-100

Results	
Critical Depth	0.49 ft
Critical Slope	1.16 %
Velocity	2.84 ft/s
Velocity Head	0.13 ft
Specific Energy	0.61 ft
Froude Number	1.016
Flow Type	Supercritical

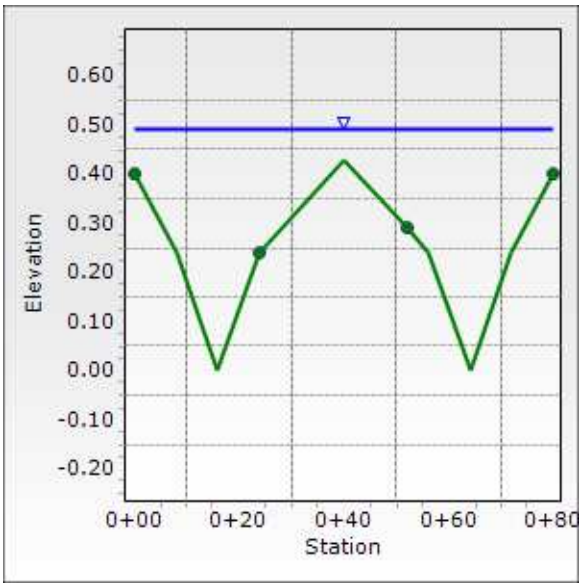
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.49 ft
Critical Depth	0.49 ft
Channel Slope	1.20 %
Critical Slope	1.16 %

Cross Section for FS2S-Grand Canyon (80' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Normal Depth	0.49 ft
Discharge	55.00 cfs



Worksheet for FS3E-Washburn (60' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.00 %
Discharge	40.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.22
0+02.00	0.18
0+08.00	0.00
0+14.00	0.18
0+30.00	0.50
0+46.00	0.18
0+52.00	0.00
0+58.00	0.18
0+60.00	0.22

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.22)	(0+14.00, 0.18)	0.025
(0+14.00, 0.18)	(0+46.00, 0.18)	0.016
(0+46.00, 0.18)	(0+60.00, 0.22)	0.025

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	0.38 ft
Roughness Coefficient	0.022
Elevation	0.38 ft
Elevation Range	0.00 to 0.50 ft
Flow Area	9.80 ft²
Wetted Perimeter	48.58 ft
Hydraulic Radius	0.20 ft
Top Width	48.24 ft
Normal Depth	0.38 ft
Critical Depth	0.46 ft

Worksheet for FS3E-Washburn (60' ROW)-100

Results	
Critical Slope	1.10 %
Velocity	4.08 ft/s
Velocity Head	0.26 ft
Specific Energy	0.64 ft
Froude Number	1.597
Flow Type	Supercritical

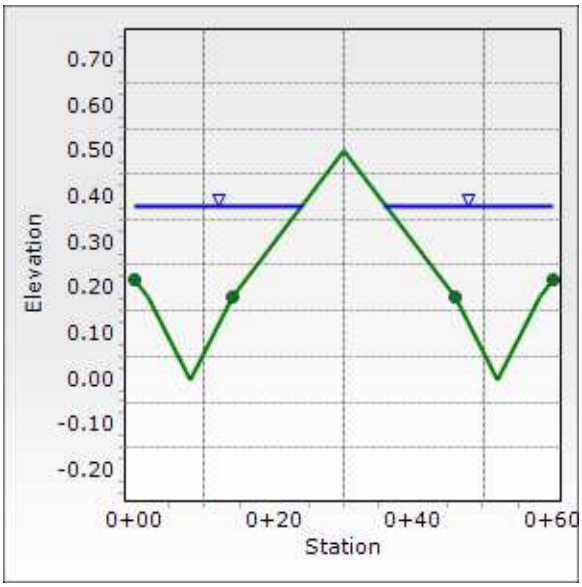
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.38 ft
Critical Depth	0.46 ft
Channel Slope	3.00 %
Critical Slope	1.10 %

Cross Section for FS3E-Washburn (60' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.00 %
Normal Depth	0.38 ft
Discharge	40.00 cfs



Worksheet for FS3S-Grand Canyon (80' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Discharge	21.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.40
0+08.00	0.24
0+16.00	0.00
0+24.00	0.24
0+28.00	0.32
0+40.00	0.56
0+52.00	0.32
0+56.00	0.24
0+64.00	0.00
0+72.00	0.24
0+80.00	0.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.40)	(0+28.00, 0.32)	0.025
(0+28.00, 0.32)	(0+52.00, 0.32)	0.016
(0+52.00, 0.32)	(0+80.00, 0.40)	0.025

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	0.38 ft
Roughness Coefficient	0.024
Elevation	0.38 ft
Elevation Range	0.00 to 0.56 ft
Flow Area	10.19 ft²
Wetted Perimeter	59.72 ft
Hydraulic Radius	0.17 ft
Top Width	59.70 ft

Worksheet for FS3S-Grand Canyon (80' ROW)-100

Results	
Normal Depth	0.38 ft
Critical Depth	0.36 ft
Critical Slope	1.57 %
Velocity	2.06 ft/s
Velocity Head	0.07 ft
Specific Energy	0.44 ft
Froude Number	0.879
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	0.38 ft
Critical Depth	0.36 ft
Channel Slope	1.20 %
Critical Slope	1.57 %

Worksheet for FS3S-Grand Canyon (80' ROW)-100

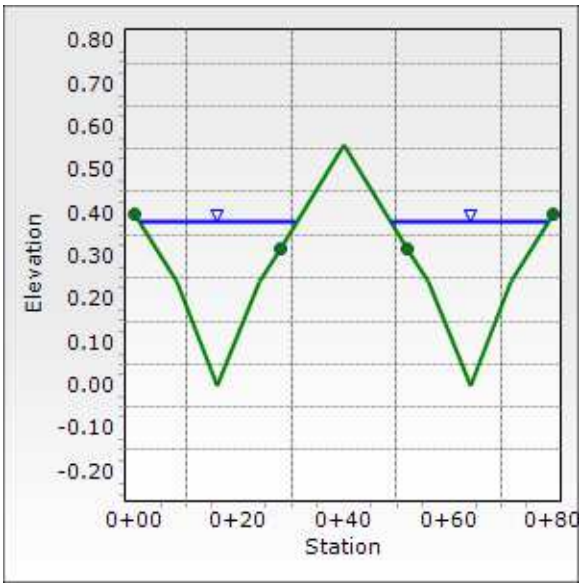
Messages:

Flow is divided.

Cross Section for FS3S-Grand Canyon (80' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Normal Depth	0.38 ft
Discharge	21.00 cfs



Worksheet for FS4E-Rosada (60' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.77 %
Discharge	42.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.22
0+02.00	0.18
0+08.00	0.00
0+14.00	0.18
0+30.00	0.50
0+46.00	0.18
0+52.00	0.00
0+58.00	0.18
0+60.00	0.22

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.22)	(0+14.00, 0.18)	0.025
(0+14.00, 0.18)	(0+46.00, 0.18)	0.016
(0+46.00, 0.18)	(0+60.00, 0.22)	0.025

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	0.37 ft
Roughness Coefficient	0.022
Elevation	0.37 ft
Elevation Range	0.00 to 0.50 ft
Flow Area	9.38 ft²
Wetted Perimeter	47.68 ft
Hydraulic Radius	0.20 ft
Top Width	47.36 ft
Normal Depth	0.37 ft
Critical Depth	0.47 ft

Worksheet for FS4E-Rosada (60' ROW)-100

Results	
Critical Slope	1.10 %
Velocity	4.48 ft/s
Velocity Head	0.31 ft
Specific Energy	0.69 ft
Froude Number	1.775
Flow Type	Supercritical

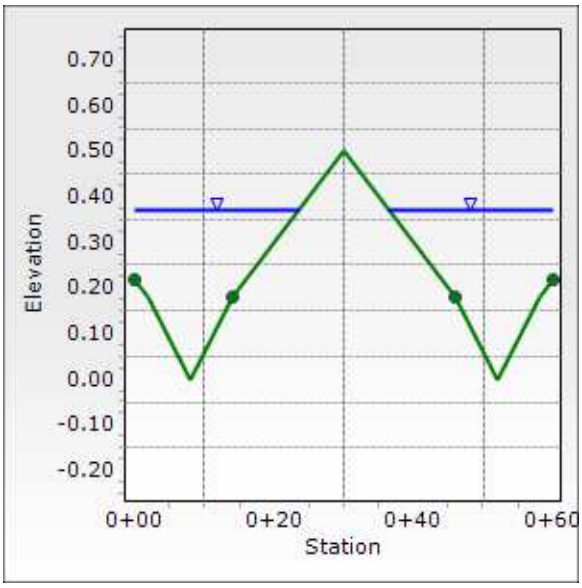
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.37 ft
Critical Depth	0.47 ft
Channel Slope	3.77 %
Critical Slope	1.10 %

Cross Section for FS4E-Rosada (60' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.77 %
Normal Depth	0.37 ft
Discharge	42.00 cfs



Worksheet for FS4S-Grand Canyon (80' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.02 %
Discharge	19.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.40
0+08.00	0.24
0+16.00	0.00
0+24.00	0.24
0+28.00	0.32
0+40.00	0.56
0+52.00	0.32
0+56.00	0.24
0+64.00	0.00
0+72.00	0.24
0+80.00	0.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.40)	(0+28.00, 0.32)	0.025
(0+28.00, 0.32)	(0+52.00, 0.32)	0.016
(0+52.00, 0.32)	(0+80.00, 0.40)	0.025

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	0.38 ft
Roughness Coefficient	0.024
Elevation	0.38 ft
Elevation Range	0.00 to 0.56 ft
Flow Area	10.05 ft²
Wetted Perimeter	59.26 ft
Hydraulic Radius	0.17 ft
Top Width	59.24 ft

Worksheet for FS4S-Grand Canyon (80' ROW)-100

Results	
Normal Depth	0.38 ft
Critical Depth	0.35 ft
Critical Slope	1.59 %
Velocity	1.89 ft/s
Velocity Head	0.06 ft
Specific Energy	0.43 ft
Froude Number	0.809
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	0.38 ft
Critical Depth	0.35 ft
Channel Slope	1.02 %
Critical Slope	1.59 %

Worksheet for FS4S-Grand Canyon (80' ROW)-100

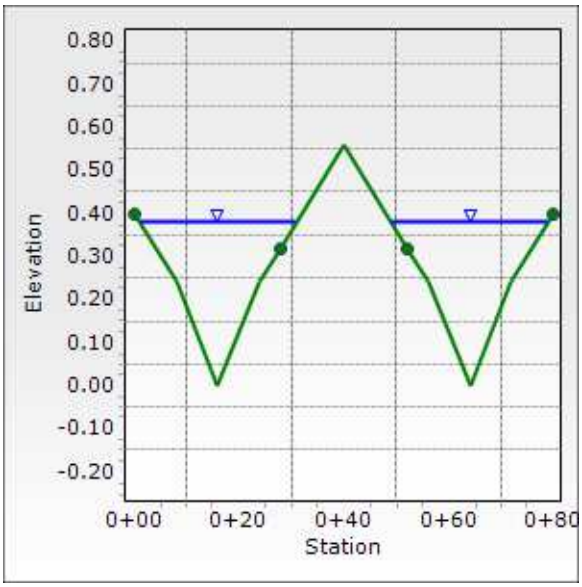
Messages:

Flow is divided.

Cross Section for FS4S-Grand Canyon (80' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.02 %
Normal Depth	0.38 ft
Discharge	19.00 cfs



Existing Condition Flow Split Computations – 10 Yr

Worksheet for FS1E-Hammer (60' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.30 %
Discharge	0.50 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.50
0+07.00	0.00
0+14.00	0.50
0+30.00	0.82
0+46.00	0.50
0+53.00	0.00
0+60.00	0.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.50)	(0+14.00, 0.50)	0.025
(0+14.00, 0.50)	(0+46.00, 0.50)	0.016
(0+46.00, 0.50)	(0+60.00, 0.50)	0.025

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	0.11 ft
Roughness Coefficient	0.025
Elevation	0.11 ft
Elevation Range	0.00 to 0.82 ft
Flow Area	0.33 ft²
Wetted Perimeter	6.05 ft
Hydraulic Radius	0.05 ft
Top Width	6.04 ft
Normal Depth	0.11 ft
Critical Depth	0.11 ft
Critical Slope	2.37 %
Velocity	1.54 ft/s

Worksheet for FS1E-Hammer (60' ROW)-10

Results	
Velocity Head	0.04 ft
Specific Energy	0.14 ft
Froude Number	1.168
Flow Type	Supercritical

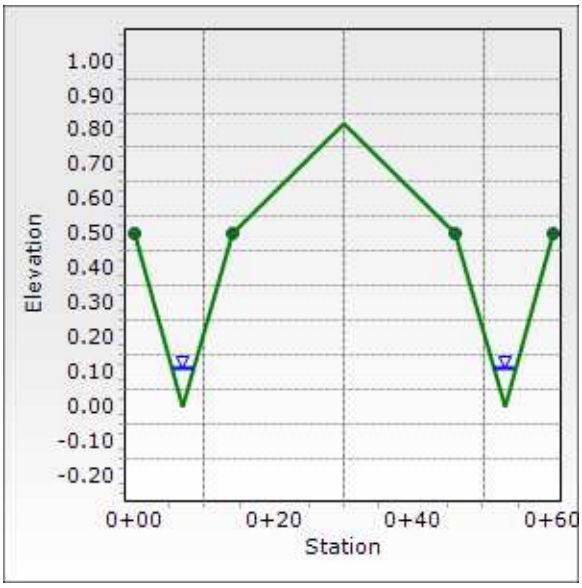
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.11 ft
Critical Depth	0.11 ft
Channel Slope	3.30 %
Critical Slope	2.37 %

Cross Section for FS1E-Hammer (60' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.30 %
Normal Depth	0.11 ft
Discharge	0.50 cfs



Worksheet for FS1S-Grand Canyon (80' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.50 %
Discharge	0.50 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.66
0+08.00	0.50
0+16.00	0.00
0+24.00	0.50
0+28.00	0.58
0+40.00	0.82
0+52.00	0.58
0+56.00	0.50
0+64.00	0.00
0+72.00	0.50
0+80.00	0.66

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.66)	(0+28.00, 0.58)	0.025
(0+28.00, 0.58)	(0+52.00, 0.58)	0.016
(0+52.00, 0.58)	(0+80.00, 0.66)	0.025

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	0.025
Elevation	0.12 ft
Elevation Range	0.00 to 0.82 ft
Flow Area	0.45 ft²
Wetted Perimeter	7.62 ft
Hydraulic Radius	0.06 ft
Top Width	7.60 ft

Worksheet for FS1S-Grand Canyon (80' ROW)-10

Results	
Normal Depth	0.12 ft
Critical Depth	0.11 ft
Critical Slope	2.41 %
Velocity	1.11 ft/s
Velocity Head	0.02 ft
Specific Energy	0.14 ft
Froude Number	0.801
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	0.12 ft
Critical Depth	0.11 ft
Channel Slope	1.50 %
Critical Slope	2.41 %

Worksheet for FS1S-Grand Canyon (80' ROW)-10

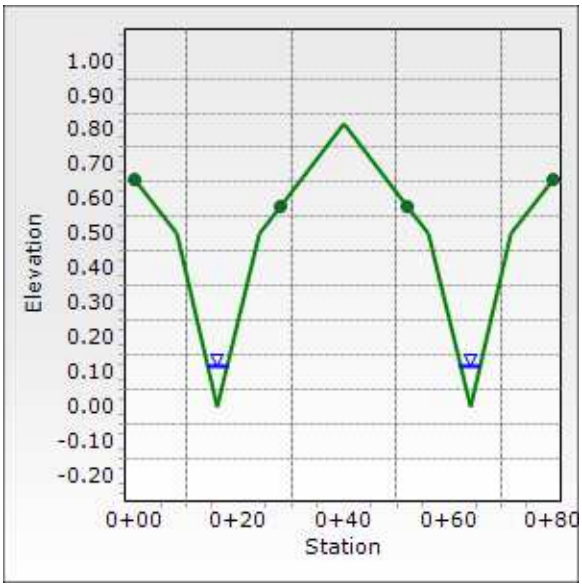
Messages:

Flow is divided.

Cross Section for FS1S-Grand Canyon (80' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.50 %
Normal Depth	0.12 ft
Discharge	0.50 cfs



Worksheet for FS2E-Fisher (60' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.20 %
Discharge	7.50 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.22
0+02.00	0.18
0+08.00	0.00
0+14.00	0.18
0+30.00	0.50
0+46.00	0.18
0+52.00	0.00
0+58.00	0.18
0+60.00	0.22

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.22)	(0+14.00, 0.18)	0.025
(0+14.00, 0.18)	(0+46.00, 0.18)	0.016
(0+46.00, 0.18)	(0+60.00, 0.22)	0.025

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	0.024
Elevation	0.22 ft
Elevation Range	0.00 to 0.50 ft
Flow Area	3.15 ft²
Wetted Perimeter	31.17 ft
Hydraulic Radius	0.10 ft
Top Width	31.16 ft
Normal Depth	0.22 ft
Critical Depth	0.24 ft

Worksheet for FS2E-Fisher (60' ROW)-10

Results	
Critical Slope	1.75 %
Velocity	2.38 ft/s
Velocity Head	0.09 ft
Specific Energy	0.30 ft
Froude Number	1.322
Flow Type	Supercritical

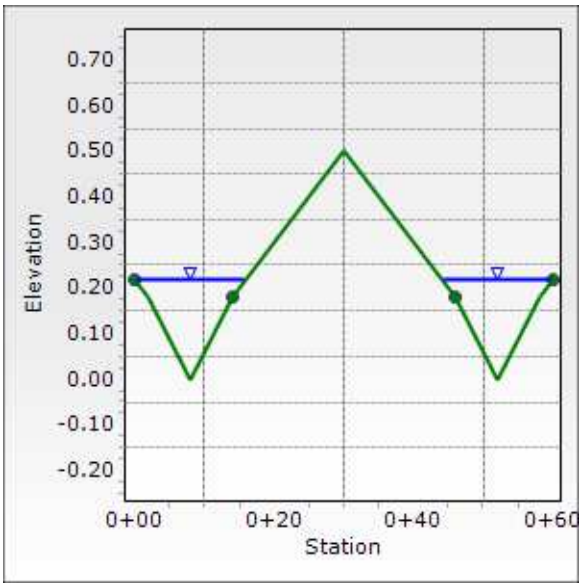
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.24 ft
Channel Slope	3.20 %
Critical Slope	1.75 %

Cross Section for FS2E-Fisher (60' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.20 %
Normal Depth	0.22 ft
Discharge	7.50 cfs



Worksheet for FS2S-Grand Canyon (80' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Discharge	5.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.40
0+08.00	0.24
0+16.00	0.00
0+24.00	0.24
0+40.00	0.43
0+52.00	0.29
0+56.00	0.24
0+64.00	0.00
0+72.00	0.24
0+80.00	0.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.40)	(0+24.00, 0.24)	0.025
(0+24.00, 0.24)	(0+52.00, 0.29)	0.016
(0+52.00, 0.29)	(0+80.00, 0.40)	0.025

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	0.025
Elevation	0.22 ft
Elevation Range	0.00 to 0.43 ft
Flow Area	3.32 ft²
Wetted Perimeter	29.78 ft
Hydraulic Radius	0.11 ft
Top Width	29.77 ft
Normal Depth	0.22 ft

Worksheet for FS2S-Grand Canyon (80' ROW)-10

Results	
Critical Depth	0.20 ft
Critical Slope	1.95 %
Velocity	1.50 ft/s
Velocity Head	0.04 ft
Specific Energy	0.26 ft
Froude Number	0.794
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	0.22 ft
Critical Depth	0.20 ft
Channel Slope	1.20 %
Critical Slope	1.95 %

Worksheet for FS2S-Grand Canyon (80' ROW)-10

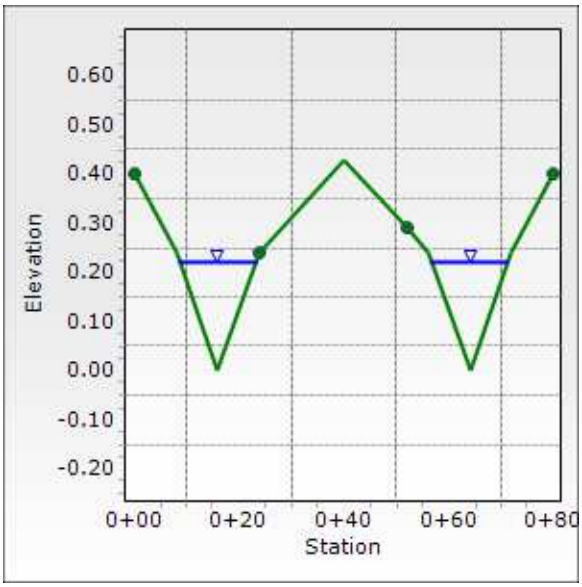
Messages:

Flow is divided.

Cross Section for FS2S-Grand Canyon (80' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Normal Depth	0.22 ft
Discharge	5.00 cfs



Worksheet for FS3E-Washburn (60' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.00 %
Discharge	3.50 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.22
0+02.00	0.18
0+08.00	0.00
0+14.00	0.18
0+30.00	0.50
0+46.00	0.18
0+52.00	0.00
0+58.00	0.18
0+60.00	0.22

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.22)	(0+14.00, 0.18)	0.025
(0+14.00, 0.18)	(0+46.00, 0.18)	0.016
(0+46.00, 0.18)	(0+60.00, 0.22)	0.025

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	0.16 ft
Roughness Coefficient	0.025
Elevation	0.16 ft
Elevation Range	0.00 to 0.50 ft
Flow Area	1.80 ft²
Wetted Perimeter	21.90 ft
Hydraulic Radius	0.08 ft
Top Width	21.89 ft
Normal Depth	0.16 ft
Critical Depth	0.18 ft

Worksheet for FS3E-Washburn (60' ROW)-10

Results	
Critical Slope	2.05 %
Velocity	1.95 ft/s
Velocity Head	0.06 ft
Specific Energy	0.22 ft
Froude Number	1.198
Flow Type	Supercritical

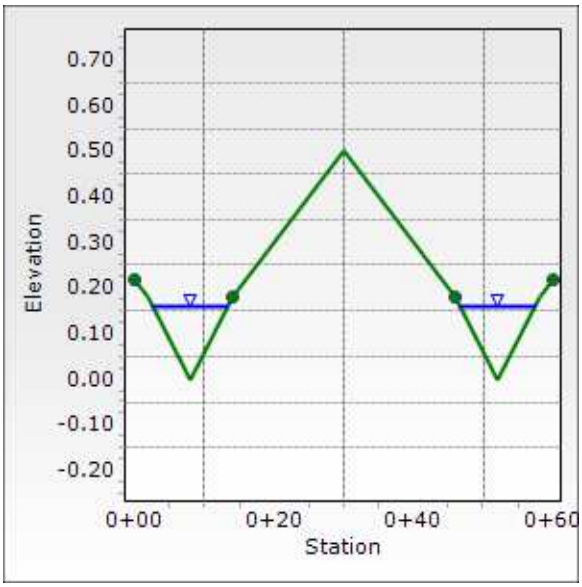
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.16 ft
Critical Depth	0.18 ft
Channel Slope	3.00 %
Critical Slope	2.05 %

Cross Section for FS3E-Washburn (60' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.00 %
Normal Depth	0.16 ft
Discharge	3.50 cfs



Worksheet for FS3S-Grand Canyon (80' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Discharge	2.50 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.40
0+08.00	0.24
0+16.00	0.00
0+24.00	0.24
0+28.00	0.32
0+40.00	0.56
0+52.00	0.32
0+56.00	0.24
0+64.00	0.00
0+72.00	0.24
0+80.00	0.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.40)	(0+28.00, 0.32)	0.025
(0+28.00, 0.32)	(0+52.00, 0.32)	0.016
(0+52.00, 0.32)	(0+80.00, 0.40)	0.025

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	0.025
Elevation	0.17 ft
Elevation Range	0.00 to 0.56 ft
Flow Area	1.97 ft²
Wetted Perimeter	22.91 ft
Hydraulic Radius	0.09 ft
Top Width	22.90 ft

Worksheet for FS3S-Grand Canyon (80' ROW)-10

Results	
Normal Depth	0.17 ft
Critical Depth	0.15 ft
Critical Slope	2.14 %
Velocity	1.27 ft/s
Velocity Head	0.03 ft
Specific Energy	0.20 ft
Froude Number	0.764
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	0.17 ft
Critical Depth	0.15 ft
Channel Slope	1.20 %
Critical Slope	2.14 %

Worksheet for FS3S-Grand Canyon (80' ROW)-10

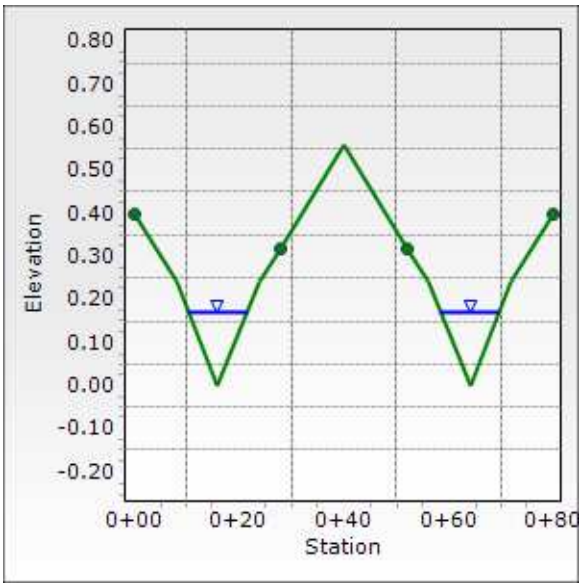
Messages:

Flow is divided.

Cross Section for FS3S-Grand Canyon (80' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Normal Depth	0.17 ft
Discharge	2.50 cfs



Worksheet for FS4E-Rosada (60' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.77 %
Discharge	3.50 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.22
0+02.00	0.18
0+08.00	0.00
0+14.00	0.18
0+30.00	0.50
0+46.00	0.18
0+52.00	0.00
0+58.00	0.18
0+60.00	0.22

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.22)	(0+14.00, 0.18)	0.025
(0+14.00, 0.18)	(0+46.00, 0.18)	0.016
(0+46.00, 0.18)	(0+60.00, 0.22)	0.025

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	0.16 ft
Roughness Coefficient	0.025
Elevation	0.16 ft
Elevation Range	0.00 to 0.50 ft
Flow Area	1.65 ft²
Wetted Perimeter	20.97 ft
Hydraulic Radius	0.08 ft
Top Width	20.96 ft
Normal Depth	0.16 ft
Critical Depth	0.18 ft

Worksheet for FS4E-Rosada (60' ROW)-10

Results	
Critical Slope	2.05 %
Velocity	2.12 ft/s
Velocity Head	0.07 ft
Specific Energy	0.23 ft
Froude Number	1.336
Flow Type	Supercritical

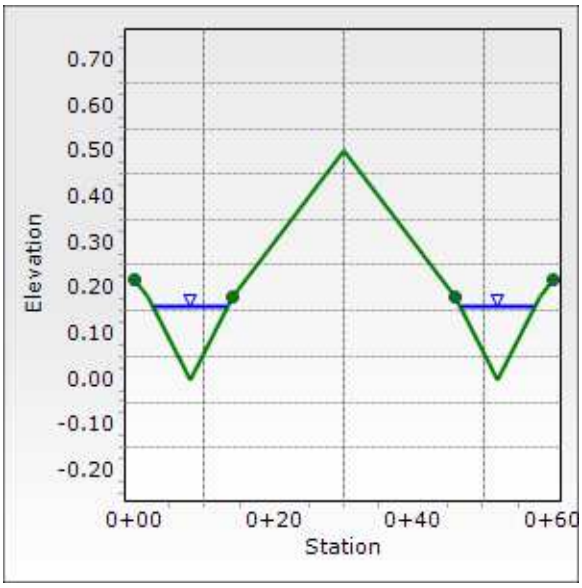
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.16 ft
Critical Depth	0.18 ft
Channel Slope	3.77 %
Critical Slope	2.05 %

Cross Section for FS4E-Rosada (60' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.77 %
Normal Depth	0.16 ft
Discharge	3.50 cfs



Worksheet for FS4S-Grand Canyon (80' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.02 %
Discharge	2.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.40
0+08.00	0.24
0+16.00	0.00
0+24.00	0.24
0+28.00	0.32
0+40.00	0.56
0+52.00	0.32
0+56.00	0.24
0+64.00	0.00
0+72.00	0.24
0+80.00	0.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.40)	(0+28.00, 0.32)	0.025
(0+28.00, 0.32)	(0+52.00, 0.32)	0.016
(0+52.00, 0.32)	(0+80.00, 0.40)	0.025

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	0.16 ft
Roughness Coefficient	0.025
Elevation	0.16 ft
Elevation Range	0.00 to 0.56 ft
Flow Area	1.77 ft²
Wetted Perimeter	21.72 ft
Hydraulic Radius	0.08 ft
Top Width	21.71 ft

Worksheet for FS4S-Grand Canyon (80' ROW)-10

Results	
Normal Depth	0.16 ft
Critical Depth	0.14 ft
Critical Slope	2.20 %
Velocity	1.13 ft/s
Velocity Head	0.02 ft
Specific Energy	0.18 ft
Froude Number	0.699
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	0.16 ft
Critical Depth	0.14 ft
Channel Slope	1.02 %
Critical Slope	2.20 %

Worksheet for FS4S-Grand Canyon (80' ROW)-10

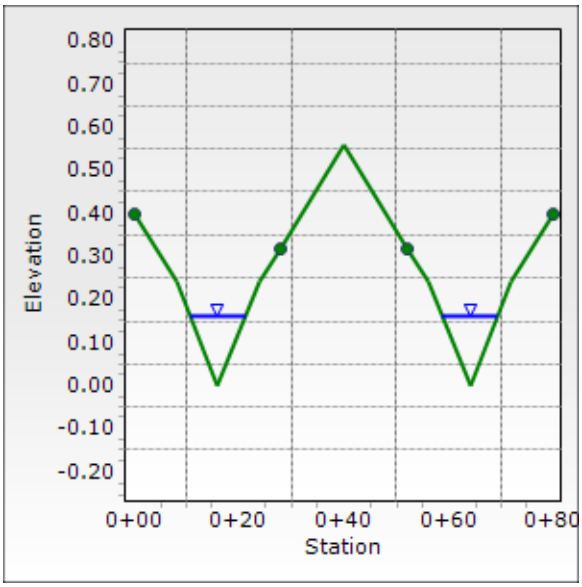
Messages:

Flow is divided.

Cross Section for FS4S-Grand Canyon (80' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.02 %
Normal Depth	0.16 ft
Discharge	2.00 cfs



Interim Condition Flow Split Computations – 100 Yr

Worksheet for FS2E-Fisher (60' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.20 %
Discharge	62.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.22
0+02.00	0.18
0+08.00	0.00
0+14.00	0.18
0+30.00	0.50
0+46.00	0.18
0+52.00	0.00
0+58.00	0.18
0+60.00	0.22

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.22)	(0+14.00, 0.18)	0.025
(0+14.00, 0.18)	(0+46.00, 0.18)	0.016
(0+46.00, 0.18)	(0+60.00, 0.22)	0.025

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	0.44 ft
Roughness Coefficient	0.021
Elevation	0.44 ft
Elevation Range	0.00 to 0.50 ft
Flow Area	12.92 ft²
Wetted Perimeter	54.79 ft
Hydraulic Radius	0.24 ft
Top Width	54.33 ft
Normal Depth	0.44 ft
Critical Depth	0.55 ft

Worksheet for FS2E-Fisher (60' ROW)-100

Results	
Critical Slope	0.97 %
Velocity	4.80 ft/s
Velocity Head	0.36 ft
Specific Energy	0.80 ft
Froude Number	1.735
Flow Type	Supercritical

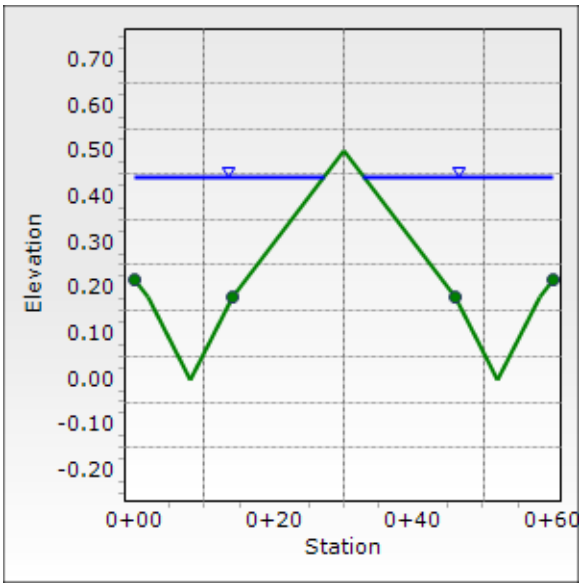
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.44 ft
Critical Depth	0.55 ft
Channel Slope	3.20 %
Critical Slope	0.97 %

Cross Section for FS2E-Fisher (60' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.20 %
Normal Depth	0.44 ft
Discharge	62.00 cfs



Worksheet for FS2S-Grand Canyon (80' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Discharge	40.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.40
0+08.00	0.24
0+16.00	0.00
0+24.00	0.24
0+40.00	0.43
0+52.00	0.29
0+56.00	0.24
0+64.00	0.00
0+72.00	0.24
0+80.00	0.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.40)	(0+24.00, 0.24)	0.025
(0+24.00, 0.24)	(0+52.00, 0.29)	0.016
(0+52.00, 0.29)	(0+80.00, 0.40)	0.025

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	0.45 ft
Roughness Coefficient	0.022
Elevation	0.45 ft
Elevation Range	0.00 to 0.43 ft
Flow Area	16.00 ft²
Wetted Perimeter	80.11 ft
Hydraulic Radius	0.20 ft
Top Width	80.00 ft
Normal Depth	0.45 ft

Worksheet for FS2S-Grand Canyon (80' ROW)-100

Results	
Critical Depth	0.44 ft
Critical Slope	1.24 %
Velocity	2.50 ft/s
Velocity Head	0.10 ft
Specific Energy	0.54 ft
Froude Number	0.985
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	0.45 ft
Critical Depth	0.44 ft
Channel Slope	1.20 %
Critical Slope	1.24 %

Worksheet for FS2S-Grand Canyon (80' ROW)-100

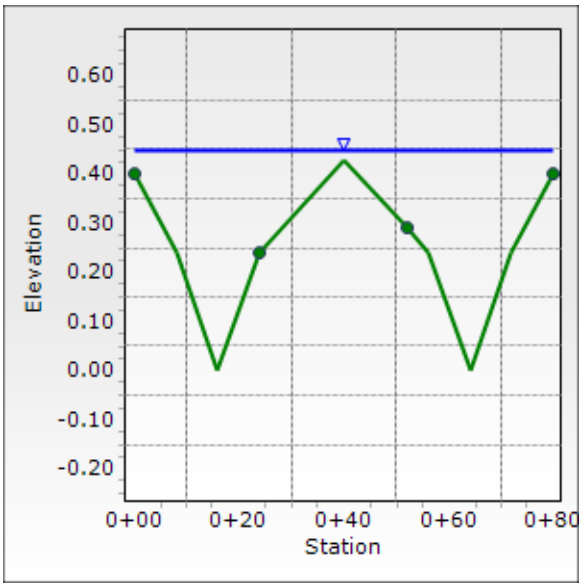
Messages:

Water Surface Elevation exceeds lowest end station by 0.0462655817840133ft.

Cross Section for FS2S-Grand Canyon (80' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Normal Depth	0.45 ft
Discharge	40.00 cfs



Worksheet for FS3E-Washburn (60' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.00 %
Discharge	78.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.22
0+02.00	0.18
0+08.00	0.00
0+14.00	0.18
0+30.00	0.50
0+46.00	0.18
0+52.00	0.00
0+58.00	0.18
0+60.00	0.22

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.22)	(0+14.00, 0.18)	0.025
(0+14.00, 0.18)	(0+46.00, 0.18)	0.016
(0+46.00, 0.18)	(0+60.00, 0.22)	0.025

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	0.49 ft
Roughness Coefficient	0.021
Elevation	0.49 ft
Elevation Range	0.00 to 0.50 ft
Flow Area	15.47 ft²
Wetted Perimeter	59.39 ft
Hydraulic Radius	0.26 ft
Top Width	58.83 ft
Normal Depth	0.49 ft
Critical Depth	0.61 ft

Worksheet for FS3E-Washburn (60' ROW)-100

Results	
Critical Slope	0.89 %
Velocity	5.04 ft/s
Velocity Head	0.40 ft
Specific Energy	0.88 ft
Froude Number	1.734
Flow Type	Supercritical

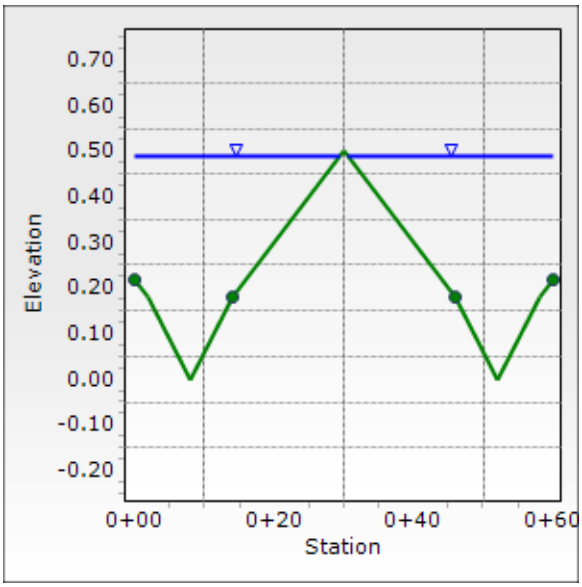
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.49 ft
Critical Depth	0.61 ft
Channel Slope	3.00 %
Critical Slope	0.89 %

Cross Section for FS3E-Washburn (60' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.00 %
Normal Depth	0.49 ft
Discharge	78.00 cfs



Worksheet for FS3S-Grand Canyon (80' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Discharge	48.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.40
0+08.00	0.24
0+16.00	0.00
0+24.00	0.24
0+28.00	0.32
0+40.00	0.56
0+52.00	0.32
0+56.00	0.24
0+64.00	0.00
0+72.00	0.24
0+80.00	0.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.40)	(0+28.00, 0.32)	0.025
(0+28.00, 0.32)	(0+52.00, 0.32)	0.016
(0+52.00, 0.32)	(0+80.00, 0.40)	0.025

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	0.49 ft
Roughness Coefficient	0.023
Elevation	0.49 ft
Elevation Range	0.00 to 0.56 ft
Flow Area	17.65 ft²
Wetted Perimeter	73.15 ft
Hydraulic Radius	0.24 ft
Top Width	72.95 ft

Worksheet for FS3S-Grand Canyon (80' ROW)-100

Results	
Normal Depth	0.49 ft
Critical Depth	0.48 ft
Critical Slope	1.27 %
Velocity	2.72 ft/s
Velocity Head	0.11 ft
Specific Energy	0.60 ft
Froude Number	0.975
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	0.49 ft
Critical Depth	0.48 ft
Channel Slope	1.20 %
Critical Slope	1.27 %

Worksheet for FS3S-Grand Canyon (80' ROW)-100

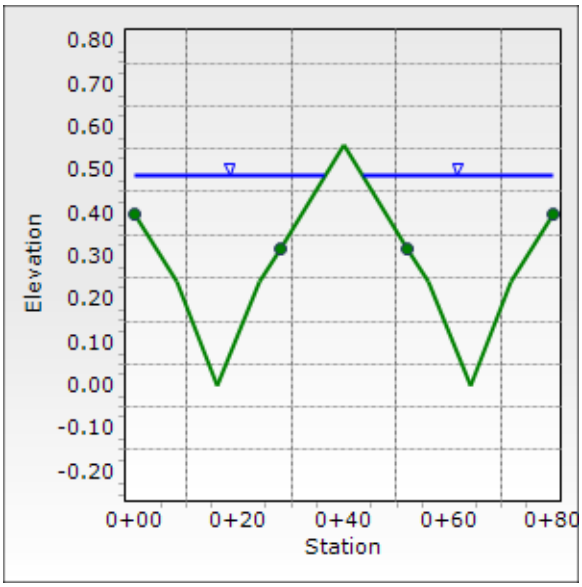
Messages:

Water Surface Elevation exceeds lowest end station by 0.0895286138505024ft. Flow is divided.

Cross Section for FS3S-Grand Canyon (80' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Normal Depth	0.49 ft
Discharge	48.00 cfs



Worksheet for FS4E-Rosada (60' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.77 %
Discharge	59.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.22
0+02.00	0.18
0+08.00	0.00
0+14.00	0.18
0+30.00	0.50
0+46.00	0.18
0+52.00	0.00
0+58.00	0.18
0+60.00	0.22

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.22)	(0+14.00, 0.18)	0.025
(0+14.00, 0.18)	(0+46.00, 0.18)	0.016
(0+46.00, 0.18)	(0+60.00, 0.22)	0.025

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	0.42 ft
Roughness Coefficient	0.021
Elevation	0.42 ft
Elevation Range	0.00 to 0.50 ft
Flow Area	11.81 ft²
Wetted Perimeter	52.67 ft
Hydraulic Radius	0.22 ft
Top Width	52.24 ft
Normal Depth	0.42 ft
Critical Depth	0.54 ft

Worksheet for FS4E-Rosada (60' ROW)-100

Results	
Critical Slope	0.99 %
Velocity	5.00 ft/s
Velocity Head	0.39 ft
Specific Energy	0.81 ft
Froude Number	1.853
Flow Type	Supercritical

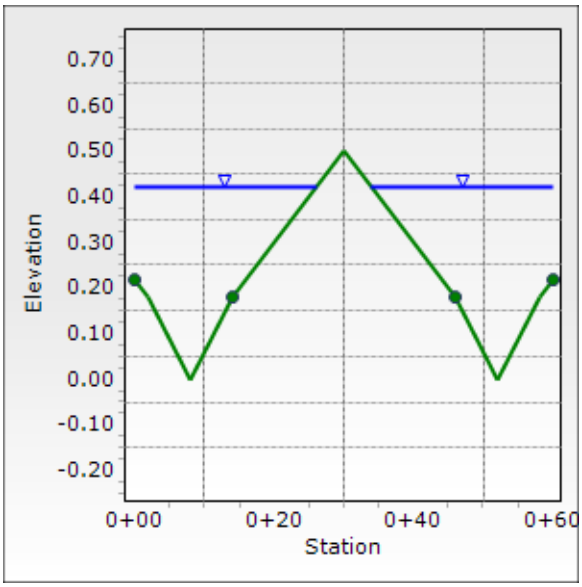
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.42 ft
Critical Depth	0.54 ft
Channel Slope	3.77 %
Critical Slope	0.99 %

Cross Section for FS4E-Rosada (60' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.77 %
Normal Depth	0.42 ft
Discharge	59.00 cfs



Worksheet for FS4S-Grand Canyon (80' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.02 %
Discharge	28.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.40
0+08.00	0.24
0+16.00	0.00
0+24.00	0.24
0+28.00	0.32
0+40.00	0.56
0+52.00	0.32
0+56.00	0.24
0+64.00	0.00
0+72.00	0.24
0+80.00	0.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.40)	(0+28.00, 0.32)	0.025
(0+28.00, 0.32)	(0+52.00, 0.32)	0.016
(0+52.00, 0.32)	(0+80.00, 0.40)	0.025

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	0.42 ft
Roughness Coefficient	0.024
Elevation	0.42 ft
Elevation Range	0.00 to 0.56 ft
Flow Area	13.13 ft²
Wetted Perimeter	66.54 ft
Hydraulic Radius	0.20 ft
Top Width	66.47 ft

Worksheet for FS4S-Grand Canyon (80' ROW)-100

Results	
Normal Depth	0.42 ft
Critical Depth	0.40 ft
Critical Slope	1.46 %
Velocity	2.13 ft/s
Velocity Head	0.07 ft
Specific Energy	0.50 ft
Froude Number	0.846
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	0.42 ft
Critical Depth	0.40 ft
Channel Slope	1.02 %
Critical Slope	1.46 %

Worksheet for FS4S-Grand Canyon (80' ROW)-100

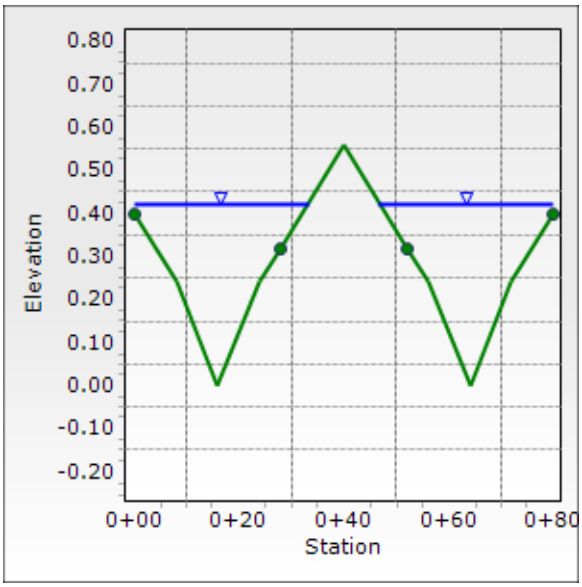
Messages:

Water Surface Elevation exceeds lowest end station by 0.0247044216447747ft. Flow is divided.

Cross Section for FS4S-Grand Canyon (80' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.02 %
Normal Depth	0.42 ft
Discharge	28.00 cfs



Interim Condition Flow Split Computations – 10 Yr

Worksheet for FS2E-Fisher (60' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.20 %
Discharge	4.50 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.22
0+02.00	0.18
0+08.00	0.00
0+14.00	0.18
0+30.00	0.50
0+46.00	0.18
0+52.00	0.00
0+58.00	0.18
0+60.00	0.22

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.22)	(0+14.00, 0.18)	0.025
(0+14.00, 0.18)	(0+46.00, 0.18)	0.016
(0+46.00, 0.18)	(0+60.00, 0.22)	0.025

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	0.18 ft
Roughness Coefficient	0.025
Elevation	0.18 ft
Elevation Range	0.00 to 0.50 ft
Flow Area	2.12 ft²
Wetted Perimeter	23.78 ft
Hydraulic Radius	0.09 ft
Top Width	23.77 ft
Normal Depth	0.18 ft
Critical Depth	0.20 ft

Worksheet for FS2E-Fisher (60' ROW)-10

Results	
Critical Slope	2.00 %
Velocity	2.12 ft/s
Velocity Head	0.07 ft
Specific Energy	0.25 ft
Froude Number	1.254
Flow Type	Supercritical

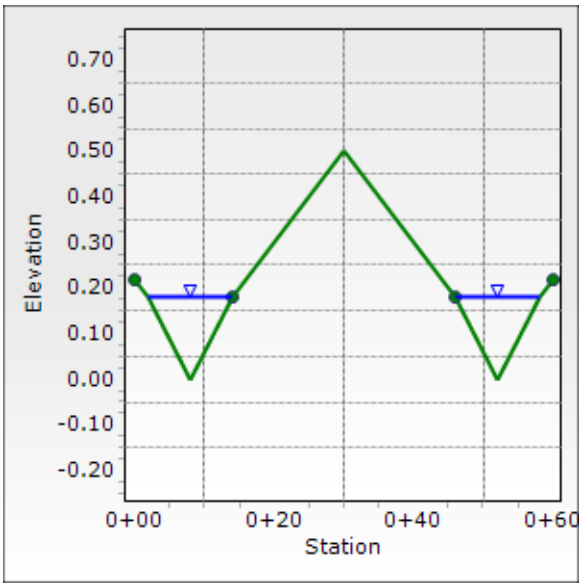
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.18 ft
Critical Depth	0.20 ft
Channel Slope	3.20 %
Critical Slope	2.00 %

Cross Section for FS2E-Fisher (60' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.20 %
Normal Depth	0.18 ft
Discharge	4.50 cfs



Worksheet for FS2S-Grand Canyon (80' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Discharge	3.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.40
0+08.00	0.24
0+16.00	0.00
0+24.00	0.24
0+40.00	0.43
0+52.00	0.29
0+56.00	0.24
0+64.00	0.00
0+72.00	0.24
0+80.00	0.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.40)	(0+24.00, 0.24)	0.025
(0+24.00, 0.24)	(0+52.00, 0.29)	0.016
(0+52.00, 0.29)	(0+80.00, 0.40)	0.025

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	0.18 ft
Roughness Coefficient	0.025
Elevation	0.18 ft
Elevation Range	0.00 to 0.43 ft
Flow Area	2.26 ft²
Wetted Perimeter	24.56 ft
Hydraulic Radius	0.09 ft
Top Width	24.54 ft
Normal Depth	0.18 ft

Worksheet for FS2S-Grand Canyon (80' ROW)-10

Results	
Critical Depth	0.17 ft
Critical Slope	2.09 %
Velocity	1.33 ft/s
Velocity Head	0.03 ft
Specific Energy	0.21 ft
Froude Number	0.772
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	0.18 ft
Critical Depth	0.17 ft
Channel Slope	1.20 %
Critical Slope	2.09 %

Worksheet for FS2S-Grand Canyon (80' ROW)-10

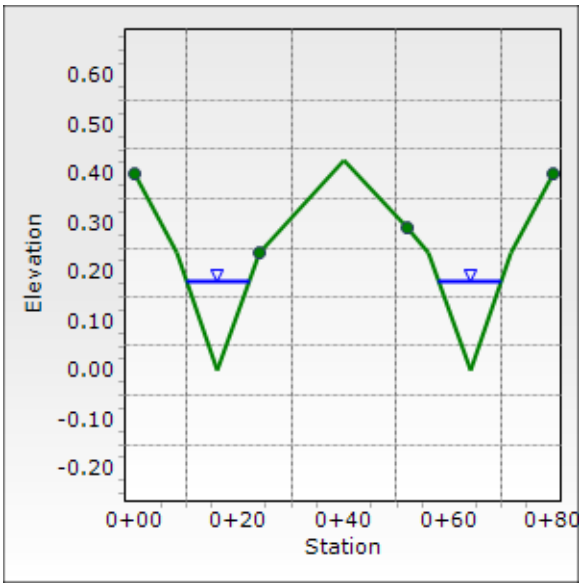
Messages:

Flow is divided.

Cross Section for FS2S-Grand Canyon (80' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Normal Depth	0.18 ft
Discharge	3.00 cfs



Worksheet for FS3E-Washburn (60' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.00 %
Discharge	11.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.22
0+02.00	0.18
0+08.00	0.00
0+14.00	0.18
0+30.00	0.50
0+46.00	0.18
0+52.00	0.00
0+58.00	0.18
0+60.00	0.22

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.22)	(0+14.00, 0.18)	0.025
(0+14.00, 0.18)	(0+46.00, 0.18)	0.016
(0+46.00, 0.18)	(0+60.00, 0.22)	0.025

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	0.25 ft
Roughness Coefficient	0.024
Elevation	0.25 ft
Elevation Range	0.00 to 0.50 ft
Flow Area	4.14 ft²
Wetted Perimeter	34.66 ft
Hydraulic Radius	0.12 ft
Top Width	34.59 ft
Normal Depth	0.25 ft
Critical Depth	0.28 ft

Worksheet for FS3E-Washburn (60' ROW)-10

Results	
Critical Slope	1.57 %
Velocity	2.66 ft/s
Velocity Head	0.11 ft
Specific Energy	0.36 ft
Froude Number	1.353
Flow Type	Supercritical

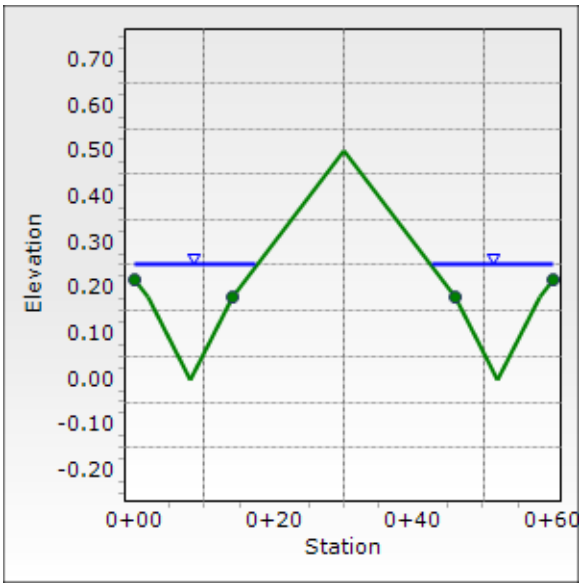
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.25 ft
Critical Depth	0.28 ft
Channel Slope	3.00 %
Critical Slope	1.57 %

Cross Section for FS3E-Washburn (60' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.00 %
Normal Depth	0.25 ft
Discharge	11.00 cfs



Worksheet for FS3S-Grand Canyon (80' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Discharge	7.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.40
0+08.00	0.24
0+16.00	0.00
0+24.00	0.24
0+28.00	0.32
0+40.00	0.56
0+52.00	0.32
0+56.00	0.24
0+64.00	0.00
0+72.00	0.24
0+80.00	0.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.40)	(0+28.00, 0.32)	0.025
(0+28.00, 0.32)	(0+52.00, 0.32)	0.016
(0+52.00, 0.32)	(0+80.00, 0.40)	0.025

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	0.25 ft
Roughness Coefficient	0.025
Elevation	0.25 ft
Elevation Range	0.00 to 0.56 ft
Flow Area	4.32 ft²
Wetted Perimeter	34.90 ft
Hydraulic Radius	0.12 ft
Top Width	34.88 ft

Worksheet for FS3S-Grand Canyon (80' ROW)-10

Results	
Normal Depth	0.25 ft
Critical Depth	0.23 ft
Critical Slope	1.87 %
Velocity	1.62 ft/s
Velocity Head	0.04 ft
Specific Energy	0.30 ft
Froude Number	0.811
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	0.25 ft
Critical Depth	0.23 ft
Channel Slope	1.20 %
Critical Slope	1.87 %

Worksheet for FS3S-Grand Canyon (80' ROW)-10

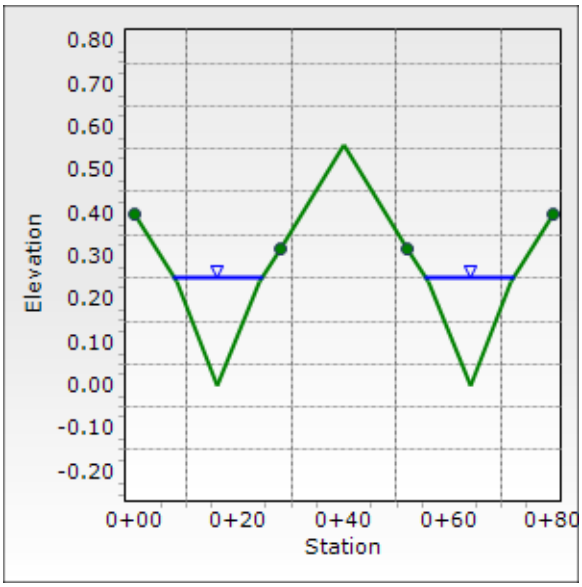
Messages:

Flow is divided.

Cross Section for FS3S-Grand Canyon (80' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Normal Depth	0.25 ft
Discharge	7.00 cfs



Worksheet for FS4E-Rosada (60' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.77 %
Discharge	7.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.22
0+02.00	0.18
0+08.00	0.00
0+14.00	0.18
0+30.00	0.50
0+46.00	0.18
0+52.00	0.00
0+58.00	0.18
0+60.00	0.22

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.22)	(0+14.00, 0.18)	0.025
(0+14.00, 0.18)	(0+46.00, 0.18)	0.016
(0+46.00, 0.18)	(0+60.00, 0.22)	0.025

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	0.024
Elevation	0.20 ft
Elevation Range	0.00 to 0.50 ft
Flow Area	2.79 ft²
Wetted Perimeter	28.82 ft
Hydraulic Radius	0.10 ft
Top Width	28.81 ft
Normal Depth	0.20 ft
Critical Depth	0.23 ft

Worksheet for FS4E-Rosada (60' ROW)-10

Results	
Critical Slope	1.80 %
Velocity	2.50 ft/s
Velocity Head	0.10 ft
Specific Energy	0.30 ft
Froude Number	1.418
Flow Type	Supercritical

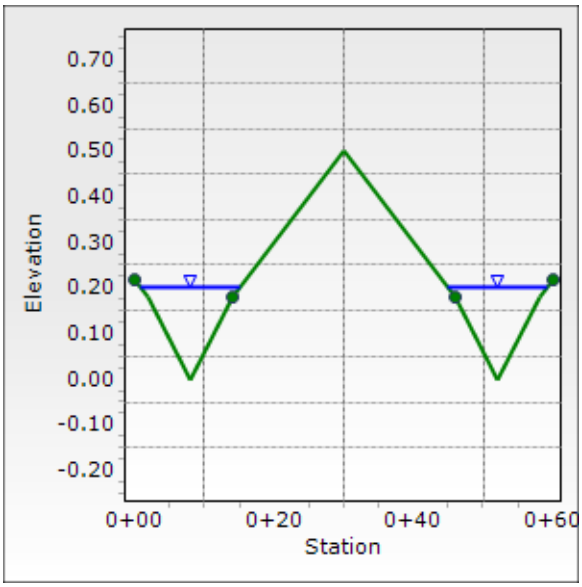
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	3.77 %
Critical Slope	1.80 %

Cross Section for FS4E-Rosada (60' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.77 %
Normal Depth	0.20 ft
Discharge	7.00 cfs



Worksheet for FS4S-Grand Canyon (80' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.02 %
Discharge	4.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.40
0+08.00	0.24
0+16.00	0.00
0+24.00	0.24
0+28.00	0.32
0+40.00	0.56
0+52.00	0.32
0+56.00	0.24
0+64.00	0.00
0+72.00	0.24
0+80.00	0.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.40)	(0+28.00, 0.32)	0.025
(0+28.00, 0.32)	(0+52.00, 0.32)	0.016
(0+52.00, 0.32)	(0+80.00, 0.40)	0.025

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	0.025
Elevation	0.21 ft
Elevation Range	0.00 to 0.56 ft
Flow Area	2.98 ft²
Wetted Perimeter	28.20 ft
Hydraulic Radius	0.11 ft
Top Width	28.19 ft

Worksheet for FS4S-Grand Canyon (80' ROW)-10

Results	
Normal Depth	0.21 ft
Critical Depth	0.19 ft
Critical Slope	2.01 %
Velocity	1.34 ft/s
Velocity Head	0.03 ft
Specific Energy	0.24 ft
Froude Number	0.728
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	0.19 ft
Channel Slope	1.02 %
Critical Slope	2.01 %

Worksheet for FS4S-Grand Canyon (80' ROW)-10

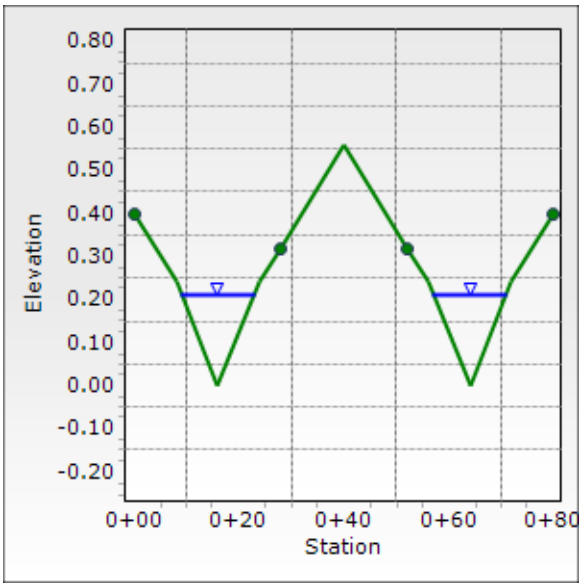
Messages:

Flow is divided.

Cross Section for FS4S-Grand Canyon (80' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.02 %
Normal Depth	0.21 ft
Discharge	4.00 cfs



Proposed Condition Flow Split Computations – 100 Yr

Worksheet for FS2E-Fisher (60' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.20 %
Discharge	59.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.22
0+02.00	0.18
0+08.00	0.00
0+14.00	0.18
0+30.00	0.50
0+46.00	0.18
0+52.00	0.00
0+58.00	0.18
0+60.00	0.22

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.22)	(0+14.00, 0.18)	0.025
(0+14.00, 0.18)	(0+46.00, 0.18)	0.016
(0+46.00, 0.18)	(0+60.00, 0.22)	0.025

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	0.44 ft
Roughness Coefficient	0.021
Elevation	0.44 ft
Elevation Range	0.00 to 0.50 ft
Flow Area	12.49 ft²
Wetted Perimeter	53.98 ft
Hydraulic Radius	0.23 ft
Top Width	53.53 ft
Normal Depth	0.44 ft
Critical Depth	0.54 ft

Worksheet for FS2E-Fisher (60' ROW)-100

Results	
Critical Slope	0.98 %
Velocity	4.72 ft/s
Velocity Head	0.35 ft
Specific Energy	0.78 ft
Froude Number	1.724
Flow Type	Supercritical

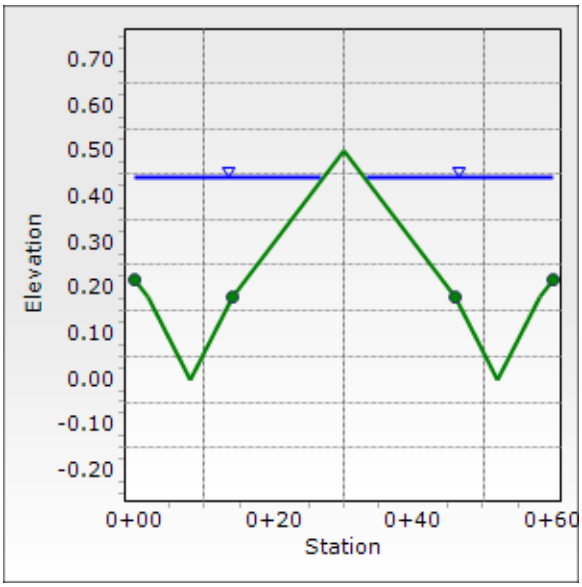
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.44 ft
Critical Depth	0.54 ft
Channel Slope	3.20 %
Critical Slope	0.98 %

Cross Section for FS2E-Fisher (60' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.20 %
Normal Depth	0.44 ft
Discharge	59.00 cfs



Worksheet for FS2S-Grand Canyon (80' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Discharge	37.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.40
0+08.00	0.24
0+16.00	0.00
0+24.00	0.24
0+40.00	0.43
0+52.00	0.29
0+56.00	0.24
0+64.00	0.00
0+72.00	0.24
0+80.00	0.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.40)	(0+24.00, 0.24)	0.025
(0+24.00, 0.24)	(0+52.00, 0.29)	0.016
(0+52.00, 0.29)	(0+80.00, 0.40)	0.025

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	0.44 ft
Roughness Coefficient	0.022
Elevation	0.44 ft
Elevation Range	0.00 to 0.43 ft
Flow Area	15.27 ft²
Wetted Perimeter	80.09 ft
Hydraulic Radius	0.19 ft
Top Width	80.00 ft
Normal Depth	0.44 ft

Worksheet for FS2S-Grand Canyon (80' ROW)-100

Results	
Critical Depth	0.43 ft
Critical Slope	1.26 %
Velocity	2.42 ft/s
Velocity Head	0.09 ft
Specific Energy	0.53 ft
Froude Number	0.978
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	0.44 ft
Critical Depth	0.43 ft
Channel Slope	1.20 %
Critical Slope	1.26 %

Worksheet for FS2S-Grand Canyon (80' ROW)-100

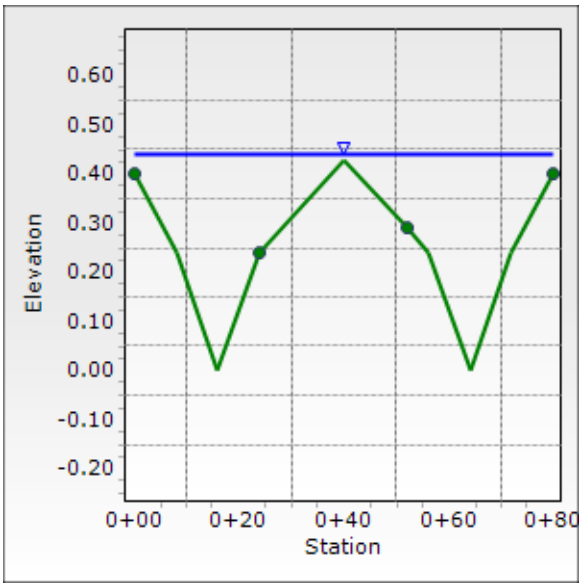
Messages:

Water Surface Elevation exceeds lowest end station by 0.0371036696329095ft.

Cross Section for FS2S-Grand Canyon (80' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Normal Depth	0.44 ft
Discharge	37.00 cfs



Worksheet for FS3E-Washburn (60' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.00 %
Discharge	65.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.22
0+02.00	0.18
0+08.00	0.00
0+14.00	0.18
0+30.00	0.50
0+46.00	0.18
0+52.00	0.00
0+58.00	0.18
0+60.00	0.22

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.22)	(0+14.00, 0.18)	0.025
(0+14.00, 0.18)	(0+46.00, 0.18)	0.016
(0+46.00, 0.18)	(0+60.00, 0.22)	0.025

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	0.46 ft
Roughness Coefficient	0.021
Elevation	0.46 ft
Elevation Range	0.00 to 0.50 ft
Flow Area	13.64 ft²
Wetted Perimeter	56.13 ft
Hydraulic Radius	0.24 ft
Top Width	55.64 ft
Normal Depth	0.46 ft
Critical Depth	0.56 ft

Worksheet for FS3E-Washburn (60' ROW)-100

Results	
Critical Slope	0.95 %
Velocity	4.76 ft/s
Velocity Head	0.35 ft
Specific Energy	0.81 ft
Froude Number	1.697
Flow Type	Supercritical

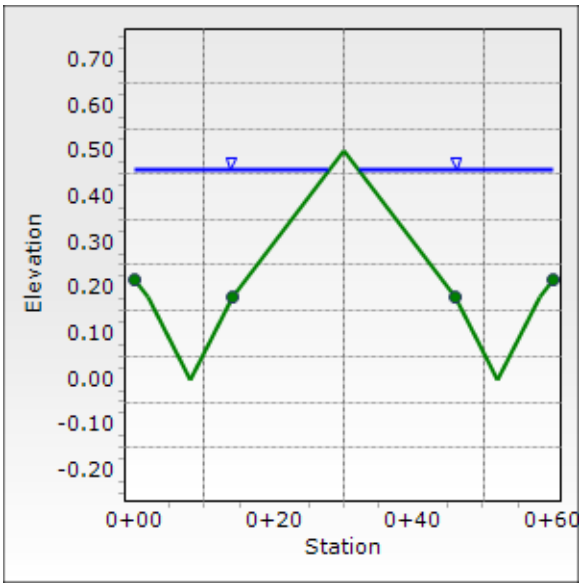
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.46 ft
Critical Depth	0.56 ft
Channel Slope	3.00 %
Critical Slope	0.95 %

Cross Section for FS3E-Washburn (60' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.00 %
Normal Depth	0.46 ft
Discharge	65.00 cfs



Worksheet for FS3S-Grand Canyon (80' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Discharge	38.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.40
0+08.00	0.24
0+16.00	0.00
0+24.00	0.24
0+28.00	0.32
0+40.00	0.56
0+52.00	0.32
0+56.00	0.24
0+64.00	0.00
0+72.00	0.24
0+80.00	0.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.40)	(0+28.00, 0.32)	0.025
(0+28.00, 0.32)	(0+52.00, 0.32)	0.016
(0+52.00, 0.32)	(0+80.00, 0.40)	0.025

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	0.45 ft
Roughness Coefficient	0.024
Elevation	0.45 ft
Elevation Range	0.00 to 0.56 ft
Flow Area	15.16 ft²
Wetted Perimeter	69.58 ft
Hydraulic Radius	0.22 ft
Top Width	69.45 ft

Worksheet for FS3S-Grand Canyon (80' ROW)-100

Results	
Normal Depth	0.45 ft
Critical Depth	0.45 ft
Critical Slope	1.36 %
Velocity	2.51 ft/s
Velocity Head	0.10 ft
Specific Energy	0.55 ft
Froude Number	0.946
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	0.45 ft
Critical Depth	0.45 ft
Channel Slope	1.20 %
Critical Slope	1.36 %

Worksheet for FS3S-Grand Canyon (80' ROW)-100

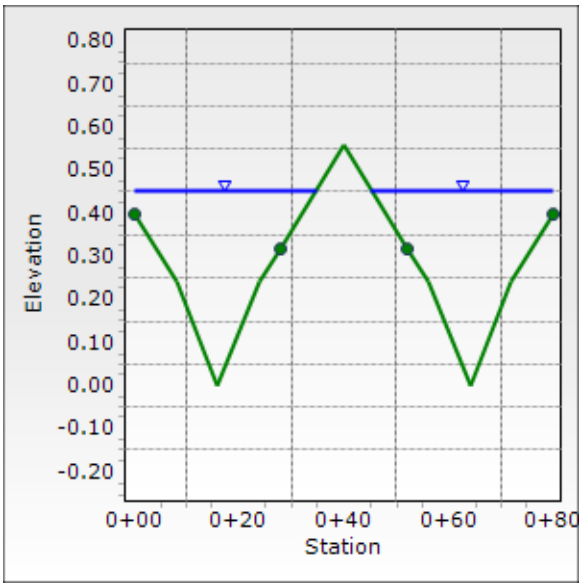
Messages:

Water Surface Elevation exceeds lowest end station by 0.0545027324609083ft. Flow is divided.

Cross Section for FS3S-Grand Canyon (80' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Normal Depth	0.45 ft
Discharge	38.00 cfs



Worksheet for FS4E-Rosada (60' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.77 %
Discharge	47.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.22
0+02.00	0.18
0+08.00	0.00
0+14.00	0.18
0+30.00	0.50
0+46.00	0.18
0+52.00	0.00
0+58.00	0.18
0+60.00	0.22

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.22)	(0+14.00, 0.18)	0.025
(0+14.00, 0.18)	(0+46.00, 0.18)	0.016
(0+46.00, 0.18)	(0+60.00, 0.22)	0.025

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	0.39 ft
Roughness Coefficient	0.022
Elevation	0.39 ft
Elevation Range	0.00 to 0.50 ft
Flow Area	10.12 ft²
Wetted Perimeter	49.27 ft
Hydraulic Radius	0.21 ft
Top Width	48.91 ft
Normal Depth	0.39 ft
Critical Depth	0.50 ft

Worksheet for FS4E-Rosada (60' ROW)-100

Results	
Critical Slope	1.07 %
Velocity	4.64 ft/s
Velocity Head	0.34 ft
Specific Energy	0.72 ft
Froude Number	1.799
Flow Type	Supercritical

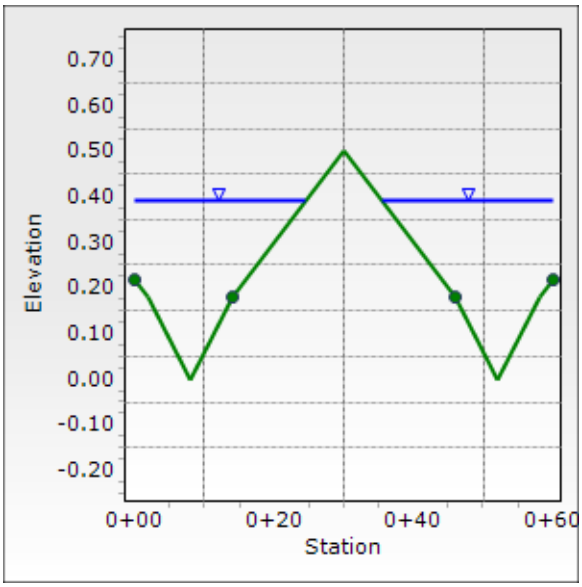
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.39 ft
Critical Depth	0.50 ft
Channel Slope	3.77 %
Critical Slope	1.07 %

Cross Section for FS4E-Rosada (60' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.77 %
Normal Depth	0.39 ft
Discharge	47.00 cfs



Worksheet for FS4S-Grand Canyon (80' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.02 %
Discharge	22.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.40
0+08.00	0.24
0+16.00	0.00
0+24.00	0.24
0+28.00	0.32
0+40.00	0.56
0+52.00	0.32
0+56.00	0.24
0+64.00	0.00
0+72.00	0.24
0+80.00	0.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.40)	(0+28.00, 0.32)	0.025
(0+28.00, 0.32)	(0+52.00, 0.32)	0.016
(0+52.00, 0.32)	(0+80.00, 0.40)	0.025

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	0.39 ft
Roughness Coefficient	0.024
Elevation	0.39 ft
Elevation Range	0.00 to 0.56 ft
Flow Area	11.19 ft²
Wetted Perimeter	62.99 ft
Hydraulic Radius	0.18 ft
Top Width	62.97 ft

Worksheet for FS4S-Grand Canyon (80' ROW)-100

Results	
Normal Depth	0.39 ft
Critical Depth	0.37 ft
Critical Slope	1.54 %
Velocity	1.97 ft/s
Velocity Head	0.06 ft
Specific Energy	0.45 ft
Froude Number	0.822
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	0.39 ft
Critical Depth	0.37 ft
Channel Slope	1.02 %
Critical Slope	1.54 %

Worksheet for FS4S-Grand Canyon (80' ROW)-100

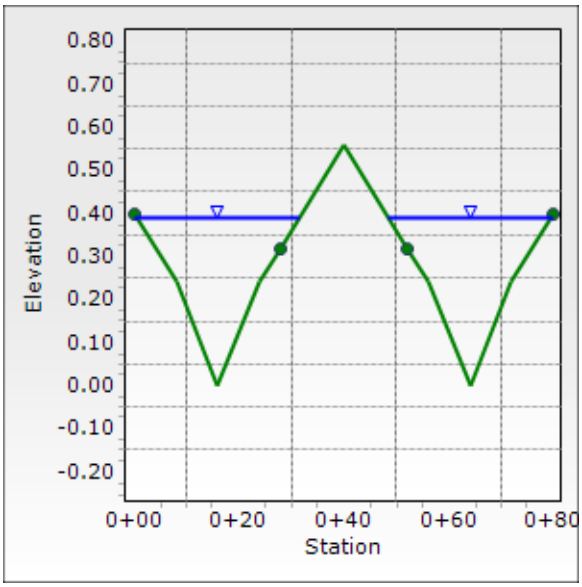
Messages:

Flow is divided.

Cross Section for FS4S-Grand Canyon (80' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.02 %
Normal Depth	0.39 ft
Discharge	22.00 cfs



Proposed Condition Flow Split Computations – 10 Yr

Worksheet for FS2E-Fisher (60' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.20 %
Discharge	4.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.22
0+02.00	0.18
0+08.00	0.00
0+14.00	0.18
0+30.00	0.50
0+46.00	0.18
0+52.00	0.00
0+58.00	0.18
0+60.00	0.22

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.22)	(0+14.00, 0.18)	0.025
(0+14.00, 0.18)	(0+46.00, 0.18)	0.016
(0+46.00, 0.18)	(0+60.00, 0.22)	0.025

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	0.025
Elevation	0.17 ft
Elevation Range	0.00 to 0.50 ft
Flow Area	1.94 ft²
Wetted Perimeter	22.74 ft
Hydraulic Radius	0.09 ft
Top Width	22.73 ft
Normal Depth	0.17 ft
Critical Depth	0.19 ft

Worksheet for FS2E-Fisher (60' ROW)-10

Results	
Critical Slope	2.02 %
Velocity	2.06 ft/s
Velocity Head	0.07 ft
Specific Energy	0.24 ft
Froude Number	1.247
Flow Type	Supercritical

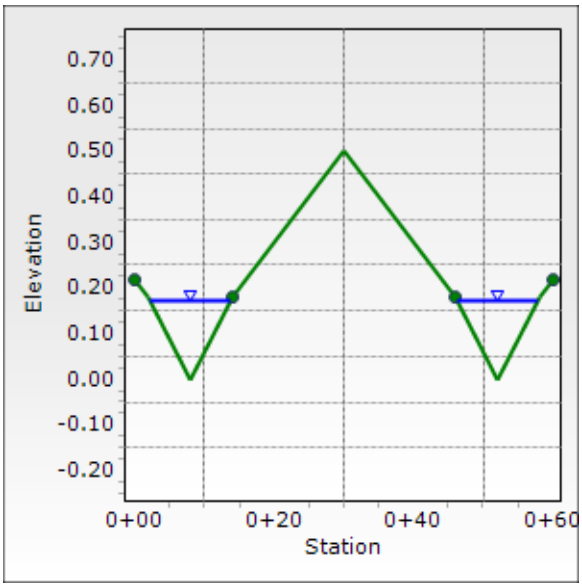
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.17 ft
Critical Depth	0.19 ft
Channel Slope	3.20 %
Critical Slope	2.02 %

Cross Section for FS2E-Fisher (60' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.20 %
Normal Depth	0.17 ft
Discharge	4.00 cfs



Worksheet for FS2S-Grand Canyon (80' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Discharge	2.50 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.40
0+08.00	0.24
0+16.00	0.00
0+24.00	0.24
0+40.00	0.43
0+52.00	0.29
0+56.00	0.24
0+64.00	0.00
0+72.00	0.24
0+80.00	0.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.40)	(0+24.00, 0.24)	0.025
(0+24.00, 0.24)	(0+52.00, 0.29)	0.016
(0+52.00, 0.29)	(0+80.00, 0.40)	0.025

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	0.025
Elevation	0.17 ft
Elevation Range	0.00 to 0.43 ft
Flow Area	1.97 ft²
Wetted Perimeter	22.94 ft
Hydraulic Radius	0.09 ft
Top Width	22.93 ft
Normal Depth	0.17 ft

Worksheet for FS2S-Grand Canyon (80' ROW)-10

Results	
Critical Depth	0.15 ft
Critical Slope	2.14 %
Velocity	1.27 ft/s
Velocity Head	0.02 ft
Specific Energy	0.20 ft
Froude Number	0.762
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	0.17 ft
Critical Depth	0.15 ft
Channel Slope	1.20 %
Critical Slope	2.14 %

Worksheet for FS2S-Grand Canyon (80' ROW)-10

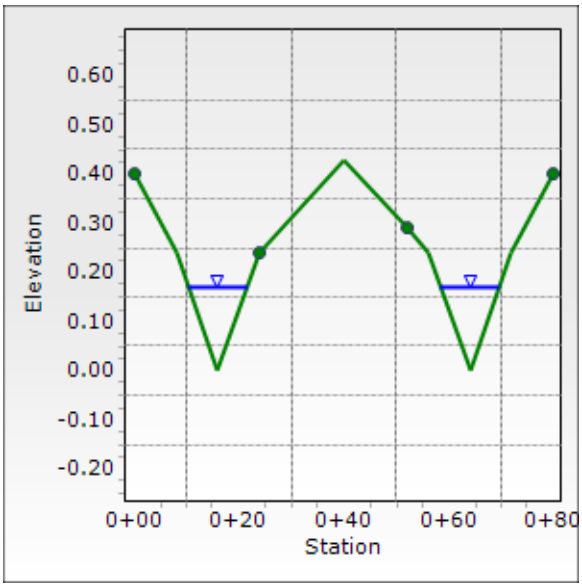
Messages:

Flow is divided.

Cross Section for FS2S-Grand Canyon (80' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Normal Depth	0.17 ft
Discharge	2.50 cfs



Worksheet for FS3E-Washburn (60' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.00 %
Discharge	7.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.22
0+02.00	0.18
0+08.00	0.00
0+14.00	0.18
0+30.00	0.50
0+46.00	0.18
0+52.00	0.00
0+58.00	0.18
0+60.00	0.22

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.22)	(0+14.00, 0.18)	0.025
(0+14.00, 0.18)	(0+46.00, 0.18)	0.016
(0+46.00, 0.18)	(0+60.00, 0.22)	0.025

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	0.024
Elevation	0.21 ft
Elevation Range	0.00 to 0.50 ft
Flow Area	3.06 ft²
Wetted Perimeter	30.61 ft
Hydraulic Radius	0.10 ft
Top Width	30.60 ft
Normal Depth	0.21 ft
Critical Depth	0.23 ft

Worksheet for FS3E-Washburn (60' ROW)-10

Results	
Critical Slope	1.78 %
Velocity	2.29 ft/s
Velocity Head	0.08 ft
Specific Energy	0.29 ft
Froude Number	1.275
Flow Type	Supercritical

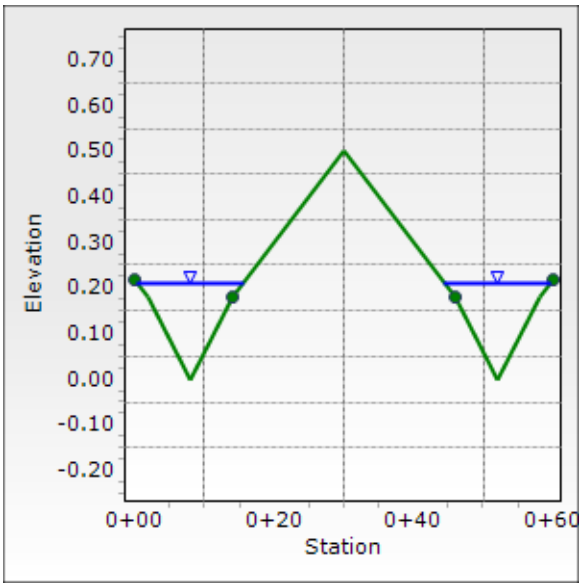
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.21 ft
Critical Depth	0.23 ft
Channel Slope	3.00 %
Critical Slope	1.78 %

Cross Section for FS3E-Washburn (60' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.00 %
Normal Depth	0.21 ft
Discharge	7.00 cfs



Worksheet for FS3S-Grand Canyon (80' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Discharge	4.50 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.40
0+08.00	0.24
0+16.00	0.00
0+24.00	0.24
0+28.00	0.32
0+40.00	0.56
0+52.00	0.32
0+56.00	0.24
0+64.00	0.00
0+72.00	0.24
0+80.00	0.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.40)	(0+28.00, 0.32)	0.025
(0+28.00, 0.32)	(0+52.00, 0.32)	0.016
(0+52.00, 0.32)	(0+80.00, 0.40)	0.025

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	0.025
Elevation	0.21 ft
Elevation Range	0.00 to 0.56 ft
Flow Area	3.06 ft²
Wetted Perimeter	28.57 ft
Hydraulic Radius	0.11 ft
Top Width	28.56 ft

Worksheet for FS3S-Grand Canyon (80' ROW)-10

Results	
Normal Depth	0.21 ft
Critical Depth	0.20 ft
Critical Slope	1.98 %
Velocity	1.47 ft/s
Velocity Head	0.03 ft
Specific Energy	0.25 ft
Froude Number	0.792
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	1.20 %
Critical Slope	1.98 %

Worksheet for FS3S-Grand Canyon (80' ROW)-10

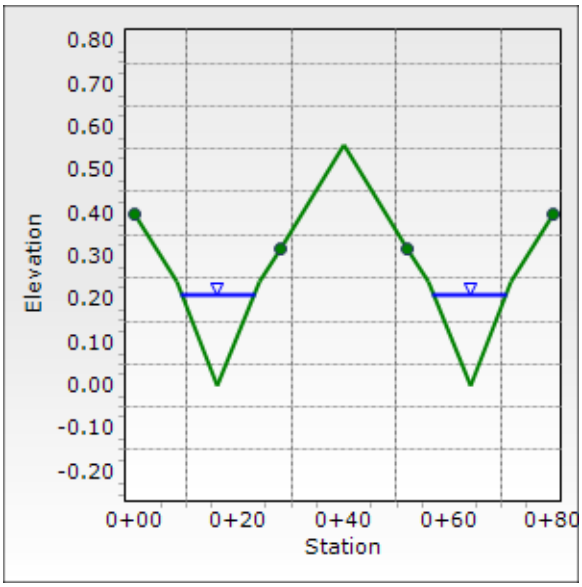
Messages:

Flow is divided.

Cross Section for FS3S-Grand Canyon (80' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Normal Depth	0.21 ft
Discharge	4.50 cfs



Worksheet for FS4E-Rosada (60' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.77 %
Discharge	4.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.22
0+02.00	0.18
0+08.00	0.00
0+14.00	0.18
0+30.00	0.50
0+46.00	0.18
0+52.00	0.00
0+58.00	0.18
0+60.00	0.22

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.22)	(0+14.00, 0.18)	0.025
(0+14.00, 0.18)	(0+46.00, 0.18)	0.016
(0+46.00, 0.18)	(0+60.00, 0.22)	0.025

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	0.025
Elevation	0.17 ft
Elevation Range	0.00 to 0.50 ft
Flow Area	1.82 ft²
Wetted Perimeter	22.06 ft
Hydraulic Radius	0.08 ft
Top Width	22.05 ft
Normal Depth	0.17 ft
Critical Depth	0.19 ft

Worksheet for FS4E-Rosada (60' ROW)-10

Results	
Critical Slope	2.02 %
Velocity	2.19 ft/s
Velocity Head	0.07 ft
Specific Energy	0.24 ft
Froude Number	1.346
Flow Type	Supercritical

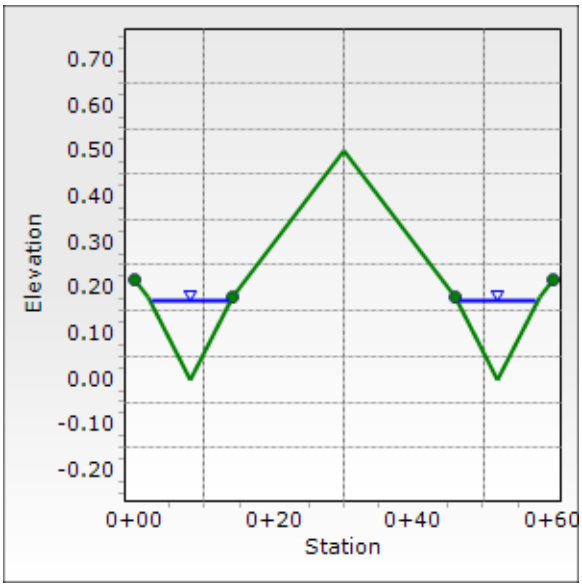
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.17 ft
Critical Depth	0.19 ft
Channel Slope	3.77 %
Critical Slope	2.02 %

Cross Section for FS4E-Rosada (60' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.77 %
Normal Depth	0.17 ft
Discharge	4.00 cfs



Worksheet for FS4S-Grand Canyon (80' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.02 %
Discharge	2.50 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.40
0+08.00	0.24
0+16.00	0.00
0+24.00	0.24
0+28.00	0.32
0+40.00	0.56
0+52.00	0.32
0+56.00	0.24
0+64.00	0.00
0+72.00	0.24
0+80.00	0.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.40)	(0+28.00, 0.32)	0.025
(0+28.00, 0.32)	(0+52.00, 0.32)	0.016
(0+52.00, 0.32)	(0+80.00, 0.40)	0.025

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	0.18 ft
Roughness Coefficient	0.025
Elevation	0.18 ft
Elevation Range	0.00 to 0.56 ft
Flow Area	2.09 ft²
Wetted Perimeter	23.62 ft
Hydraulic Radius	0.09 ft
Top Width	23.61 ft

Worksheet for FS4S-Grand Canyon (80' ROW)-10

Results	
Normal Depth	0.18 ft
Critical Depth	0.15 ft
Critical Slope	2.14 %
Velocity	1.20 ft/s
Velocity Head	0.02 ft
Specific Energy	0.20 ft
Froude Number	0.709
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	0.18 ft
Critical Depth	0.15 ft
Channel Slope	1.02 %
Critical Slope	2.14 %

Worksheet for FS4S-Grand Canyon (80' ROW)-10

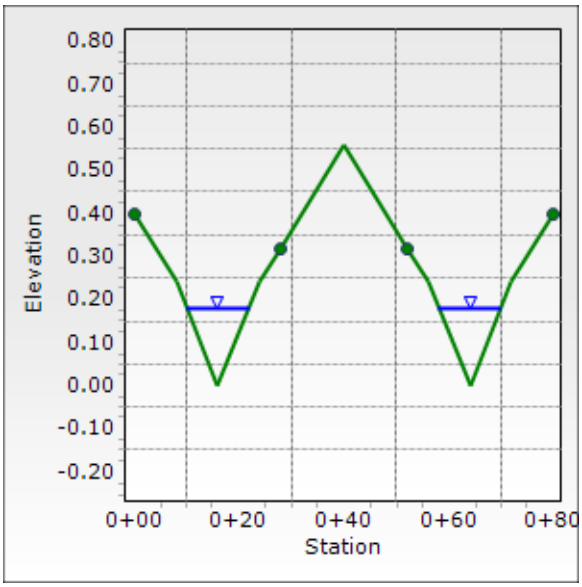
Messages:

Flow is divided.

Cross Section for FS4S-Grand Canyon (80' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.02 %
Normal Depth	0.18 ft
Discharge	2.50 cfs



Developed Condition Flow Split Computations – 100 Yr

Worksheet for FS2E-Fisher (60' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.20 %
Discharge	58.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.22
0+02.00	0.18
0+08.00	0.00
0+14.00	0.18
0+30.00	0.50
0+46.00	0.18
0+52.00	0.00
0+58.00	0.18
0+60.00	0.22

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.22)	(0+14.00, 0.18)	0.025
(0+14.00, 0.18)	(0+46.00, 0.18)	0.016
(0+46.00, 0.18)	(0+60.00, 0.22)	0.025

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	0.43 ft
Roughness Coefficient	0.021
Elevation	0.43 ft
Elevation Range	0.00 to 0.50 ft
Flow Area	12.35 ft²
Wetted Perimeter	53.71 ft
Hydraulic Radius	0.23 ft
Top Width	53.27 ft
Normal Depth	0.43 ft
Critical Depth	0.54 ft

Worksheet for FS2E-Fisher (60' ROW)-100

Results	
Critical Slope	0.99 %
Velocity	4.70 ft/s
Velocity Head	0.34 ft
Specific Energy	0.78 ft
Froude Number	1.720
Flow Type	Supercritical

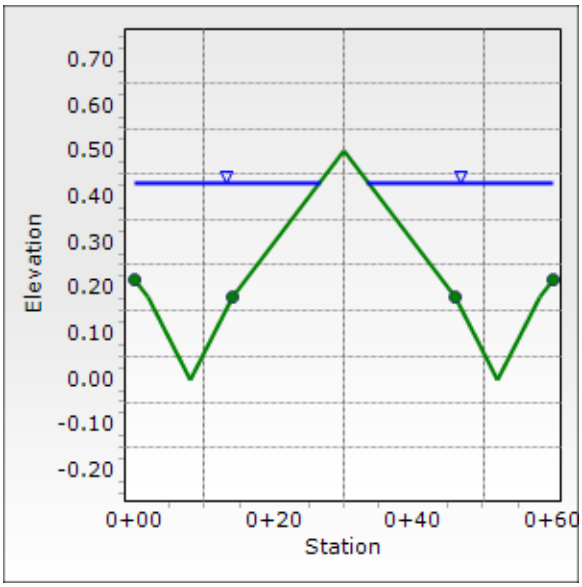
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.43 ft
Critical Depth	0.54 ft
Channel Slope	3.20 %
Critical Slope	0.99 %

Cross Section for FS2E-Fisher (60' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.20 %
Normal Depth	0.43 ft
Discharge	58.00 cfs



Worksheet for FS2S-Grand Canyon (80' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Discharge	37.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.40
0+08.00	0.24
0+16.00	0.00
0+24.00	0.24
0+40.00	0.43
0+52.00	0.29
0+56.00	0.24
0+64.00	0.00
0+72.00	0.24
0+80.00	0.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.40)	(0+24.00, 0.24)	0.025
(0+24.00, 0.24)	(0+52.00, 0.29)	0.016
(0+52.00, 0.29)	(0+80.00, 0.40)	0.025

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	0.44 ft
Roughness Coefficient	0.022
Elevation	0.44 ft
Elevation Range	0.00 to 0.43 ft
Flow Area	15.27 ft²
Wetted Perimeter	80.09 ft
Hydraulic Radius	0.19 ft
Top Width	80.00 ft
Normal Depth	0.44 ft

Worksheet for FS2S-Grand Canyon (80' ROW)-100

Results	
Critical Depth	0.43 ft
Critical Slope	1.26 %
Velocity	2.42 ft/s
Velocity Head	0.09 ft
Specific Energy	0.53 ft
Froude Number	0.978
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	0.44 ft
Critical Depth	0.43 ft
Channel Slope	1.20 %
Critical Slope	1.26 %

Worksheet for FS2S-Grand Canyon (80' ROW)-100

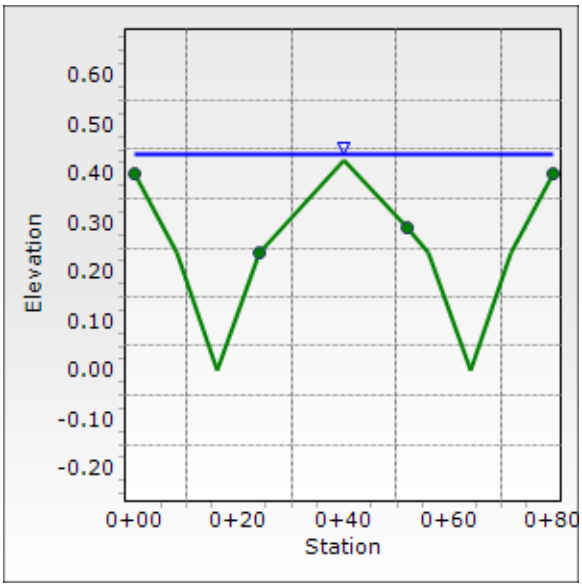
Messages:

Water Surface Elevation exceeds lowest end station by 0.0371036696329095ft.

Cross Section for FS2S-Grand Canyon (80' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Normal Depth	0.44 ft
Discharge	37.00 cfs



Worksheet for FS3E-Washburn (60' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.00 %
Discharge	65.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.22
0+02.00	0.18
0+08.00	0.00
0+14.00	0.18
0+30.00	0.50
0+46.00	0.18
0+52.00	0.00
0+58.00	0.18
0+60.00	0.22

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.22)	(0+14.00, 0.18)	0.025
(0+14.00, 0.18)	(0+46.00, 0.18)	0.016
(0+46.00, 0.18)	(0+60.00, 0.22)	0.025

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	0.46 ft
Roughness Coefficient	0.021
Elevation	0.46 ft
Elevation Range	0.00 to 0.50 ft
Flow Area	13.64 ft²
Wetted Perimeter	56.13 ft
Hydraulic Radius	0.24 ft
Top Width	55.64 ft
Normal Depth	0.46 ft
Critical Depth	0.56 ft

Worksheet for FS3E-Washburn (60' ROW)-100

Results	
Critical Slope	0.95 %
Velocity	4.76 ft/s
Velocity Head	0.35 ft
Specific Energy	0.81 ft
Froude Number	1.697
Flow Type	Supercritical

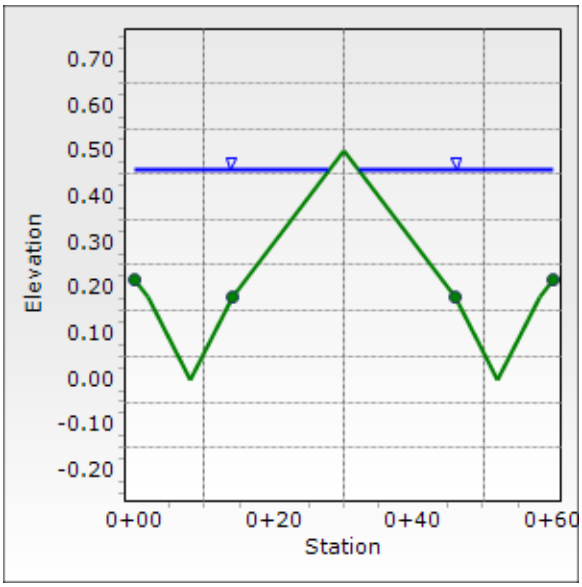
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.46 ft
Critical Depth	0.56 ft
Channel Slope	3.00 %
Critical Slope	0.95 %

Cross Section for FS3E-Washburn (60' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.00 %
Normal Depth	0.46 ft
Discharge	65.00 cfs



Worksheet for FS3S-Grand Canyon (80' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Discharge	38.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.40
0+08.00	0.24
0+16.00	0.00
0+24.00	0.24
0+28.00	0.32
0+40.00	0.56
0+52.00	0.32
0+56.00	0.24
0+64.00	0.00
0+72.00	0.24
0+80.00	0.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.40)	(0+28.00, 0.32)	0.025
(0+28.00, 0.32)	(0+52.00, 0.32)	0.016
(0+52.00, 0.32)	(0+80.00, 0.40)	0.025

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	0.45 ft
Roughness Coefficient	0.024
Elevation	0.45 ft
Elevation Range	0.00 to 0.56 ft
Flow Area	15.16 ft²
Wetted Perimeter	69.58 ft
Hydraulic Radius	0.22 ft
Top Width	69.45 ft

Worksheet for FS3S-Grand Canyon (80' ROW)-100

Results	
Normal Depth	0.45 ft
Critical Depth	0.45 ft
Critical Slope	1.36 %
Velocity	2.51 ft/s
Velocity Head	0.10 ft
Specific Energy	0.55 ft
Froude Number	0.946
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	0.45 ft
Critical Depth	0.45 ft
Channel Slope	1.20 %
Critical Slope	1.36 %

Worksheet for FS3S-Grand Canyon (80' ROW)-100

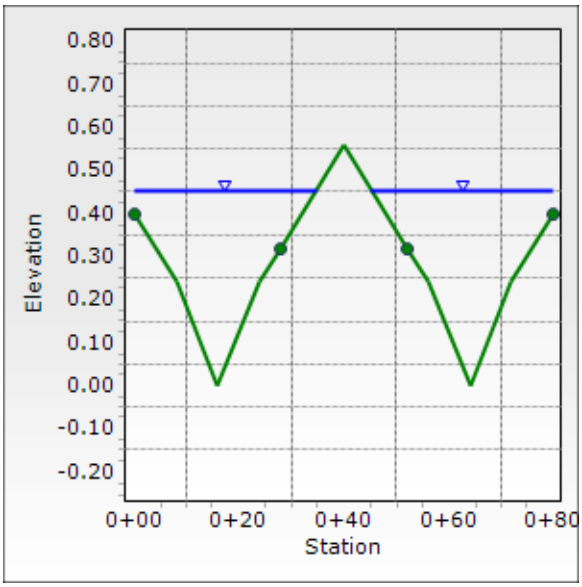
Messages:

Water Surface Elevation exceeds lowest end station by 0.0545027324609083ft. Flow is divided.

Cross Section for FS3S-Grand Canyon (80' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Normal Depth	0.45 ft
Discharge	38.00 cfs



Worksheet for FS4E-Rosada (60' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.77 %
Discharge	46.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.22
0+02.00	0.18
0+08.00	0.00
0+14.00	0.18
0+30.00	0.50
0+46.00	0.18
0+52.00	0.00
0+58.00	0.18
0+60.00	0.22

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.22)	(0+14.00, 0.18)	0.025
(0+14.00, 0.18)	(0+46.00, 0.18)	0.016
(0+46.00, 0.18)	(0+60.00, 0.22)	0.025

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	0.39 ft
Roughness Coefficient	0.022
Elevation	0.39 ft
Elevation Range	0.00 to 0.50 ft
Flow Area	9.97 ft²
Wetted Perimeter	48.95 ft
Hydraulic Radius	0.20 ft
Top Width	48.60 ft
Normal Depth	0.39 ft
Critical Depth	0.49 ft

Worksheet for FS4E-Rosada (60' ROW)-100

Results	
Critical Slope	1.08 %
Velocity	4.61 ft/s
Velocity Head	0.33 ft
Specific Energy	0.72 ft
Froude Number	1.796
Flow Type	Supercritical

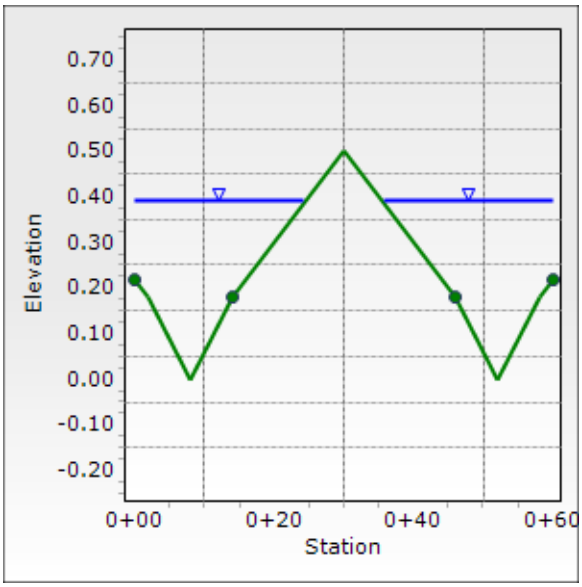
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.39 ft
Critical Depth	0.49 ft
Channel Slope	3.77 %
Critical Slope	1.08 %

Cross Section for FS4E-Rosada (60' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.77 %
Normal Depth	0.39 ft
Discharge	46.00 cfs



Worksheet for FS4S-Grand Canyon (80' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.02 %
Discharge	22.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.40
0+08.00	0.24
0+16.00	0.00
0+24.00	0.24
0+28.00	0.32
0+40.00	0.56
0+52.00	0.32
0+56.00	0.24
0+64.00	0.00
0+72.00	0.24
0+80.00	0.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.40)	(0+28.00, 0.32)	0.025
(0+28.00, 0.32)	(0+52.00, 0.32)	0.016
(0+52.00, 0.32)	(0+80.00, 0.40)	0.025

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	0.39 ft
Roughness Coefficient	0.024
Elevation	0.39 ft
Elevation Range	0.00 to 0.56 ft
Flow Area	11.19 ft²
Wetted Perimeter	62.99 ft
Hydraulic Radius	0.18 ft
Top Width	62.97 ft

Worksheet for FS4S-Grand Canyon (80' ROW)-100

Results	
Normal Depth	0.39 ft
Critical Depth	0.37 ft
Critical Slope	1.54 %
Velocity	1.97 ft/s
Velocity Head	0.06 ft
Specific Energy	0.45 ft
Froude Number	0.822
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	0.39 ft
Critical Depth	0.37 ft
Channel Slope	1.02 %
Critical Slope	1.54 %

Worksheet for FS4S-Grand Canyon (80' ROW)-100

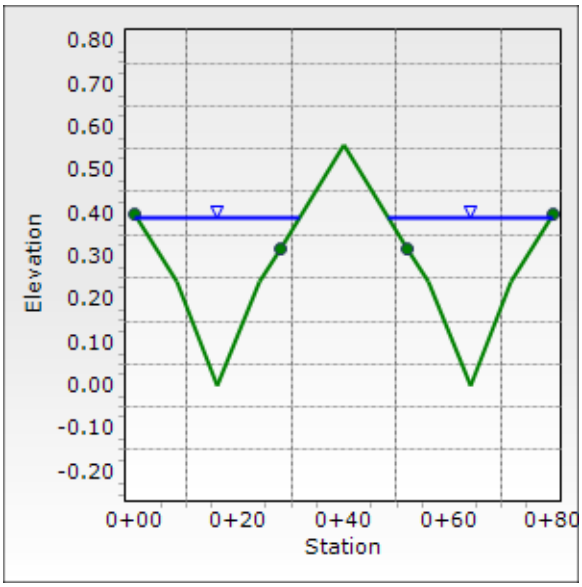
Messages:

Flow is divided.

Cross Section for FS4S-Grand Canyon (80' ROW)-100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.02 %
Normal Depth	0.39 ft
Discharge	22.00 cfs



Developed Condition Flow Split Computations – 10 Yr

Worksheet for FS2E-Fisher (60' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.20 %
Discharge	4.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.22
0+02.00	0.18
0+08.00	0.00
0+14.00	0.18
0+30.00	0.50
0+46.00	0.18
0+52.00	0.00
0+58.00	0.18
0+60.00	0.22

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.22)	(0+14.00, 0.18)	0.025
(0+14.00, 0.18)	(0+46.00, 0.18)	0.016
(0+46.00, 0.18)	(0+60.00, 0.22)	0.025

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	0.025
Elevation	0.17 ft
Elevation Range	0.00 to 0.50 ft
Flow Area	1.94 ft²
Wetted Perimeter	22.74 ft
Hydraulic Radius	0.09 ft
Top Width	22.73 ft
Normal Depth	0.17 ft
Critical Depth	0.19 ft

Worksheet for FS2E-Fisher (60' ROW)-10

Results	
Critical Slope	2.02 %
Velocity	2.06 ft/s
Velocity Head	0.07 ft
Specific Energy	0.24 ft
Froude Number	1.247
Flow Type	Supercritical

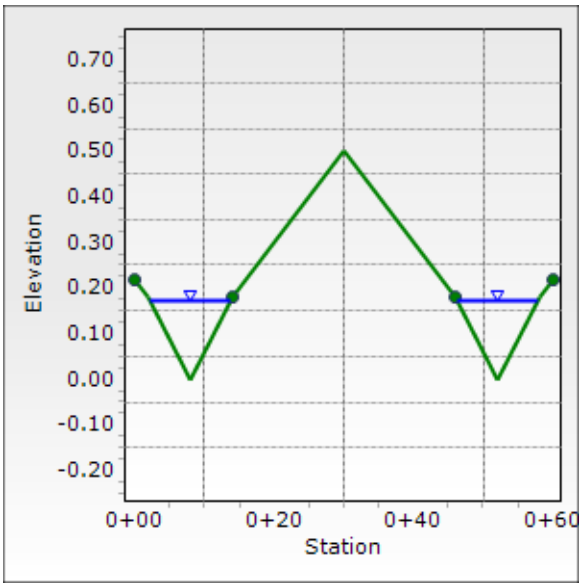
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.17 ft
Critical Depth	0.19 ft
Channel Slope	3.20 %
Critical Slope	2.02 %

Cross Section for FS2E-Fisher (60' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.20 %
Normal Depth	0.17 ft
Discharge	4.00 cfs



Worksheet for FS2S-Grand Canyon (80' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Discharge	2.50 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.40
0+08.00	0.24
0+16.00	0.00
0+24.00	0.24
0+40.00	0.43
0+52.00	0.29
0+56.00	0.24
0+64.00	0.00
0+72.00	0.24
0+80.00	0.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.40)	(0+24.00, 0.24)	0.025
(0+24.00, 0.24)	(0+52.00, 0.29)	0.016
(0+52.00, 0.29)	(0+80.00, 0.40)	0.025

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	0.025
Elevation	0.17 ft
Elevation Range	0.00 to 0.43 ft
Flow Area	1.97 ft²
Wetted Perimeter	22.94 ft
Hydraulic Radius	0.09 ft
Top Width	22.93 ft
Normal Depth	0.17 ft

Worksheet for FS2S-Grand Canyon (80' ROW)-10

Results	
Critical Depth	0.15 ft
Critical Slope	2.14 %
Velocity	1.27 ft/s
Velocity Head	0.02 ft
Specific Energy	0.20 ft
Froude Number	0.762
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	0.17 ft
Critical Depth	0.15 ft
Channel Slope	1.20 %
Critical Slope	2.14 %

Worksheet for FS2S-Grand Canyon (80' ROW)-10

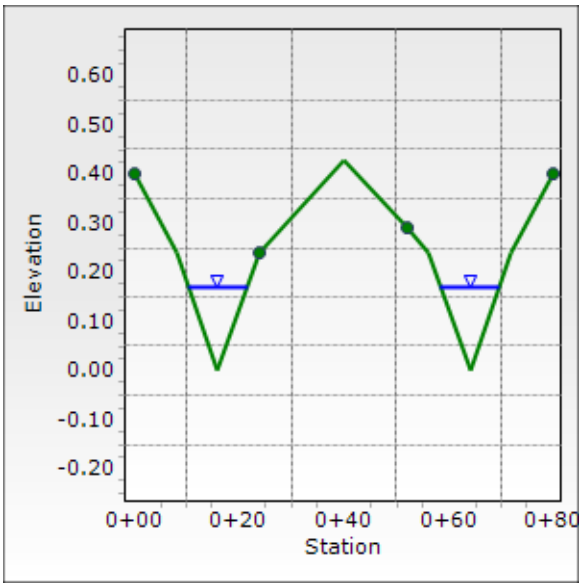
Messages:

Flow is divided.

Cross Section for FS2S-Grand Canyon (80' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Normal Depth	0.17 ft
Discharge	2.50 cfs



Worksheet for FS3E-Washburn (60' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.00 %
Discharge	7.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.22
0+02.00	0.18
0+08.00	0.00
0+14.00	0.18
0+30.00	0.50
0+46.00	0.18
0+52.00	0.00
0+58.00	0.18
0+60.00	0.22

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.22)	(0+14.00, 0.18)	0.025
(0+14.00, 0.18)	(0+46.00, 0.18)	0.016
(0+46.00, 0.18)	(0+60.00, 0.22)	0.025

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	0.024
Elevation	0.21 ft
Elevation Range	0.00 to 0.50 ft
Flow Area	3.06 ft²
Wetted Perimeter	30.61 ft
Hydraulic Radius	0.10 ft
Top Width	30.60 ft
Normal Depth	0.21 ft
Critical Depth	0.23 ft

Worksheet for FS3E-Washburn (60' ROW)-10

Results	
Critical Slope	1.78 %
Velocity	2.29 ft/s
Velocity Head	0.08 ft
Specific Energy	0.29 ft
Froude Number	1.275
Flow Type	Supercritical

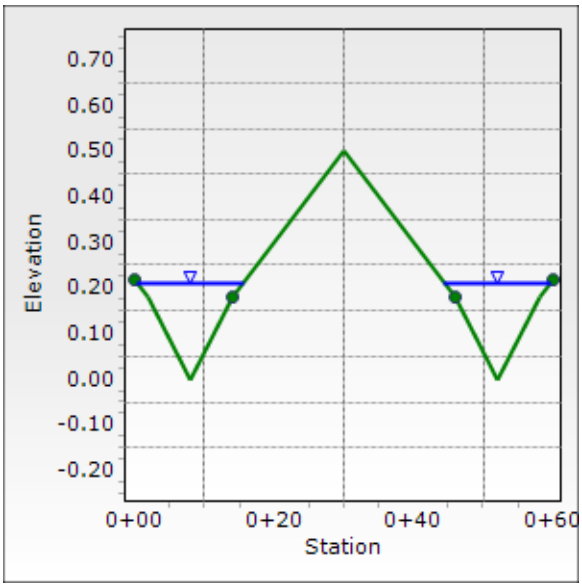
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.21 ft
Critical Depth	0.23 ft
Channel Slope	3.00 %
Critical Slope	1.78 %

Cross Section for FS3E-Washburn (60' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.00 %
Normal Depth	0.21 ft
Discharge	7.00 cfs



Worksheet for FS3S-Grand Canyon (80' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Discharge	4.50 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.40
0+08.00	0.24
0+16.00	0.00
0+24.00	0.24
0+28.00	0.32
0+40.00	0.56
0+52.00	0.32
0+56.00	0.24
0+64.00	0.00
0+72.00	0.24
0+80.00	0.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.40)	(0+28.00, 0.32)	0.025
(0+28.00, 0.32)	(0+52.00, 0.32)	0.016
(0+52.00, 0.32)	(0+80.00, 0.40)	0.025

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	0.025
Elevation	0.21 ft
Elevation Range	0.00 to 0.56 ft
Flow Area	3.06 ft²
Wetted Perimeter	28.57 ft
Hydraulic Radius	0.11 ft
Top Width	28.56 ft

Worksheet for FS3S-Grand Canyon (80' ROW)-10

Results	
Normal Depth	0.21 ft
Critical Depth	0.20 ft
Critical Slope	1.98 %
Velocity	1.47 ft/s
Velocity Head	0.03 ft
Specific Energy	0.25 ft
Froude Number	0.792
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	1.20 %
Critical Slope	1.98 %

Worksheet for FS3S-Grand Canyon (80' ROW)-10

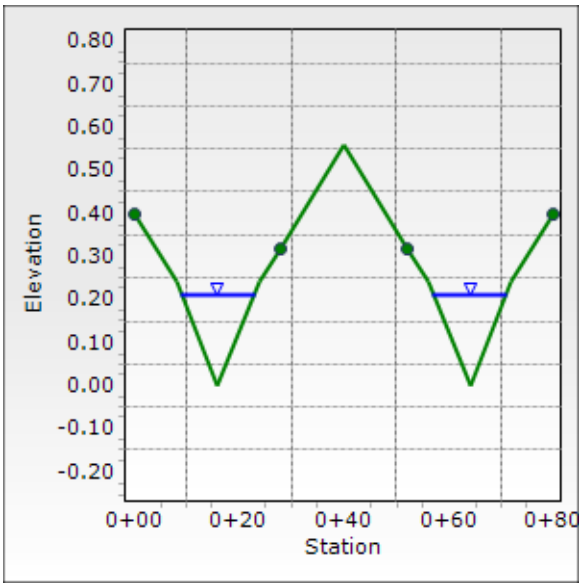
Messages:

Flow is divided.

Cross Section for FS3S-Grand Canyon (80' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Normal Depth	0.21 ft
Discharge	4.50 cfs



Worksheet for FS4E-Rosada (60' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.77 %
Discharge	4.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.22
0+02.00	0.18
0+08.00	0.00
0+14.00	0.18
0+30.00	0.50
0+46.00	0.18
0+52.00	0.00
0+58.00	0.18
0+60.00	0.22

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.22)	(0+14.00, 0.18)	0.025
(0+14.00, 0.18)	(0+46.00, 0.18)	0.016
(0+46.00, 0.18)	(0+60.00, 0.22)	0.025

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	0.025
Elevation	0.17 ft
Elevation Range	0.00 to 0.50 ft
Flow Area	1.82 ft²
Wetted Perimeter	22.06 ft
Hydraulic Radius	0.08 ft
Top Width	22.05 ft
Normal Depth	0.17 ft
Critical Depth	0.19 ft

Worksheet for FS4E-Rosada (60' ROW)-10

Results	
Critical Slope	2.02 %
Velocity	2.19 ft/s
Velocity Head	0.07 ft
Specific Energy	0.24 ft
Froude Number	1.346
Flow Type	Supercritical

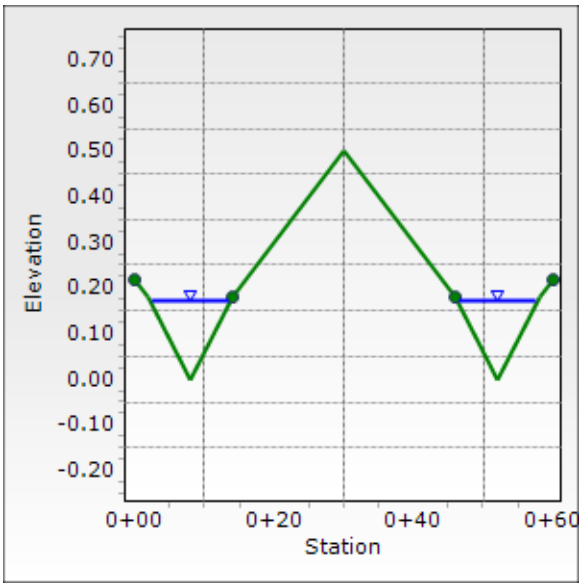
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.17 ft
Critical Depth	0.19 ft
Channel Slope	3.77 %
Critical Slope	2.02 %

Cross Section for FS4E-Rosada (60' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.77 %
Normal Depth	0.17 ft
Discharge	4.00 cfs



Worksheet for FS4S-Grand Canyon (80' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.02 %
Discharge	2.50 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.40
0+08.00	0.24
0+16.00	0.00
0+24.00	0.24
0+28.00	0.32
0+40.00	0.56
0+52.00	0.32
0+56.00	0.24
0+64.00	0.00
0+72.00	0.24
0+80.00	0.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.40)	(0+28.00, 0.32)	0.025
(0+28.00, 0.32)	(0+52.00, 0.32)	0.016
(0+52.00, 0.32)	(0+80.00, 0.40)	0.025

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	0.18 ft
Roughness Coefficient	0.025
Elevation	0.18 ft
Elevation Range	0.00 to 0.56 ft
Flow Area	2.09 ft²
Wetted Perimeter	23.62 ft
Hydraulic Radius	0.09 ft
Top Width	23.61 ft

Worksheet for FS4S-Grand Canyon (80' ROW)-10

Results	
Normal Depth	0.18 ft
Critical Depth	0.15 ft
Critical Slope	2.14 %
Velocity	1.20 ft/s
Velocity Head	0.02 ft
Specific Energy	0.20 ft
Froude Number	0.709
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	0.18 ft
Critical Depth	0.15 ft
Channel Slope	1.02 %
Critical Slope	2.14 %

Worksheet for FS4S-Grand Canyon (80' ROW)-10

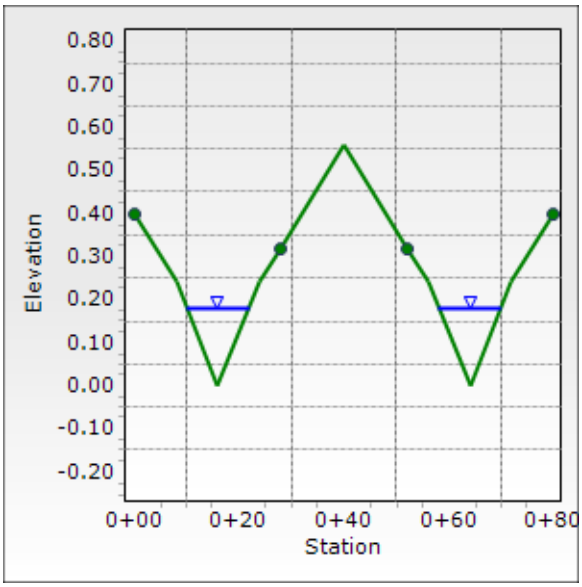
Messages:

Flow is divided.

Cross Section for FS4S-Grand Canyon (80' ROW)-10

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.02 %
Normal Depth	0.18 ft
Discharge	2.50 cfs



Perimeter Street Flow Computations – 100-Yr

ES1 min% Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.80 %
Discharge	6.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.58
0+04.00	0.50
0+07.00	0.00
0+10.00	0.50
0+14.00	0.58
0+30.00	0.90
0+46.00	0.58
0+50.00	0.50
0+53.00	0.00
0+56.00	0.50
0+60.00	0.58

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.58)	(0+14.00, 0.58)	0.022
(0+14.00, 0.58)	(0+46.00, 0.58)	0.016
(0+46.00, 0.58)	(0+60.00, 0.58)	0.022

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	0.022
Elevation	0.47 ft
Elevation Range	0.00 to 0.90 ft
Flow Area	2.6 ft²
Wetted Perimeter	11.40 ft
Hydraulic Radius	0.23 ft
Top Width	11.25 ft

ES1 min% Report

Results	
Normal Depth	0.47 ft
Critical Depth	0.43 ft
Critical Slope	1.19 %
Velocity	2.28 ft/s
Velocity Head	0.08 ft
Specific Energy	0.55 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	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.47 ft
Critical Depth	0.43 ft
Channel Slope	0.80 %
Critical Slope	1.19 %

ES1 min% Report

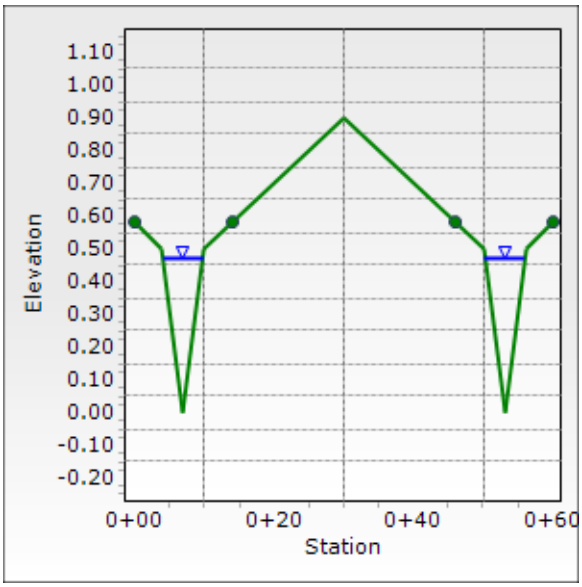
Messages:

Flow is divided.

ES1 min% Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.80 %
Normal Depth	0.47 ft
Discharge	6.0 cfs



ES1 max% Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.48 %
Discharge	6.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.58
0+04.00	0.50
0+07.00	0.00
0+10.00	0.50
0+14.00	0.58
0+30.00	0.90
0+46.00	0.58
0+50.00	0.50
0+53.00	0.00
0+56.00	0.50
0+60.00	0.58

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.58)	(0+14.00, 0.58)	0.022
(0+14.00, 0.58)	(0+46.00, 0.58)	0.016
(0+46.00, 0.58)	(0+60.00, 0.58)	0.022

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	0.42 ft
Roughness Coefficient	0.022
Elevation	0.42 ft
Elevation Range	0.00 to 0.90 ft
Flow Area	2.1 ft²
Wetted Perimeter	10.16 ft
Hydraulic Radius	0.21 ft
Top Width	10.02 ft

ES1 max% Report

Results	
Normal Depth	0.42 ft
Critical Depth	0.43 ft
Critical Slope	1.19 %
Velocity	2.87 ft/s
Velocity Head	0.13 ft
Specific Energy	0.55 ft
Froude Number	1.107
Flow Type	Supercritical

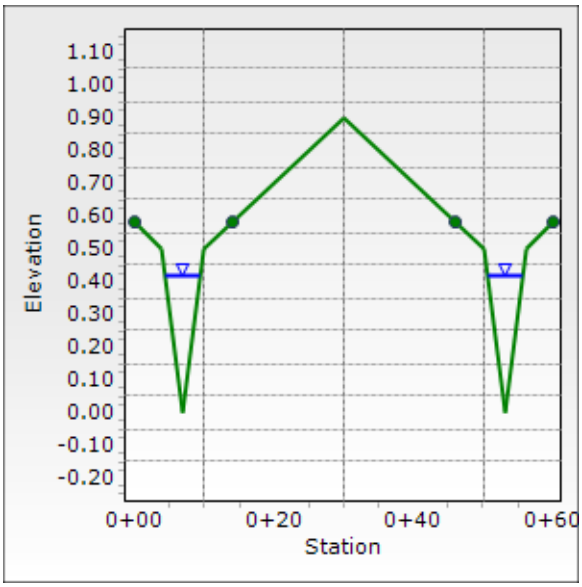
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.42 ft
Critical Depth	0.43 ft
Channel Slope	1.48 %
Critical Slope	1.19 %

ES1 max% Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.48 %
Normal Depth	0.42 ft
Discharge	6.0 cfs



HP 100 yr min% Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.60 %
Discharge	41.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.24
0+09.00	0.06
0+12.00	0.00
0+15.00	0.06
0+40.00	0.56
0+65.00	0.06
0+68.00	0.00
0+71.00	0.06
0+80.00	0.24

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.24)	(0+09.00, 0.06)	0.016
(0+09.00, 0.06)	(0+15.00, 0.06)	0.022
(0+15.00, 0.06)	(0+65.00, 0.06)	0.016
(0+65.00, 0.06)	(0+80.00, 0.24)	0.022

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	0.43 ft
Roughness Coefficient	0.018
Elevation	0.43 ft
Elevation Range	0.00 to 0.56 ft
Flow Area	16.4 ft²
Wetted Perimeter	67.03 ft
Hydraulic Radius	0.25 ft
Top Width	66.64 ft
Normal Depth	0.43 ft

HP 100 yr min% Report

Results	
Critical Depth	0.40 ft
Critical Slope	0.78 %
Velocity	2.49 ft/s
Velocity Head	0.10 ft
Specific Energy	0.52 ft
Froude Number	0.885
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.43 ft
Critical Depth	0.40 ft
Channel Slope	0.60 %
Critical Slope	0.78 %

HP 100 yr min% Report

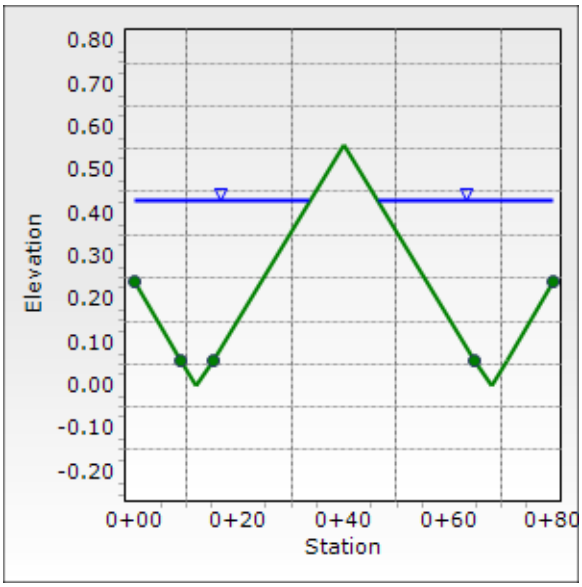
Messages:

Water Surface Elevation exceeds lowest end station by 0.186398523165213ft. Flow is divided.

HP 100 yr min% Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

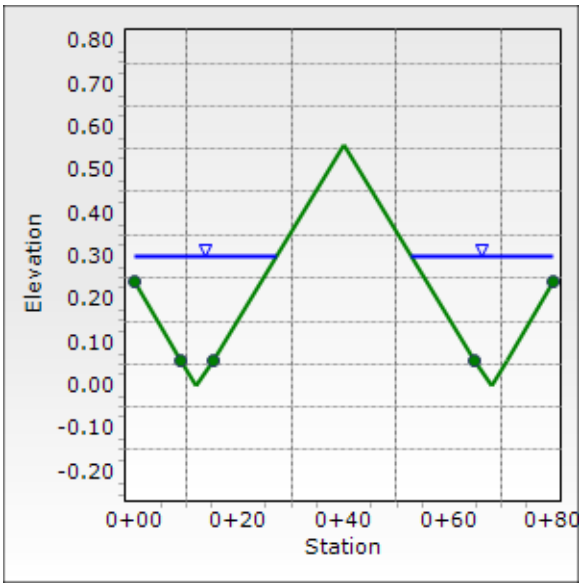
Input Data	
Channel Slope	0.60 %
Normal Depth	0.43 ft
Discharge	41.0 cfs



HP 100 yr max% Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.50 %
Normal Depth	0.30 ft
Discharge	41.0 cfs



HP 100 yr max% Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.50 %
Discharge	41.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.24
0+09.00	0.06
0+12.00	0.00
0+15.00	0.06
0+40.00	0.56
0+65.00	0.06
0+68.00	0.00
0+71.00	0.06
0+80.00	0.24

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.24)	(0+09.00, 0.06)	0.016
(0+09.00, 0.06)	(0+15.00, 0.06)	0.022
(0+15.00, 0.06)	(0+65.00, 0.06)	0.016
(0+65.00, 0.06)	(0+80.00, 0.24)	0.022

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	0.30 ft
Roughness Coefficient	0.019
Elevation	0.30 ft
Elevation Range	0.00 to 0.56 ft
Flow Area	9.1 ft²
Wetted Perimeter	54.57 ft
Hydraulic Radius	0.17 ft
Top Width	54.43 ft
Normal Depth	0.30 ft

HP 100 yr max% Report

Results	
Critical Depth	0.40 ft
Critical Slope	0.82 %
Velocity	4.53 ft/s
Velocity Head	0.32 ft
Specific Energy	0.62 ft
Froude Number	1.958
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.30 ft
Critical Depth	0.40 ft
Channel Slope	3.50 %
Critical Slope	0.82 %

FA Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	4.50 %
Discharge	90.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.58
0+04.00	0.50
0+07.00	0.00
0+10.00	0.50
0+14.00	0.54
0+30.00	0.82
0+46.00	0.58
0+50.00	0.50
0+53.00	0.00
0+56.00	0.50
0+60.00	0.58

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.58)	(0+14.00, 0.54)	0.022
(0+14.00, 0.54)	(0+46.00, 0.58)	0.016
(0+46.00, 0.58)	(0+60.00, 0.58)	0.022

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	0.79 ft
Roughness Coefficient	0.019
Elevation	0.79 ft
Elevation Range	0.00 to 0.82 ft
Flow Area	14.0 ft²
Wetted Perimeter	57.37 ft
Hydraulic Radius	0.24 ft
Top Width	56.77 ft

FA Report

Results	
Normal Depth	0.79 ft
Critical Depth	0.97 ft
Critical Slope	0.74 %
Velocity	6.41 ft/s
Velocity Head	0.64 ft
Specific Energy	1.43 ft
Froude Number	2.273
Flow Type	Supercritical

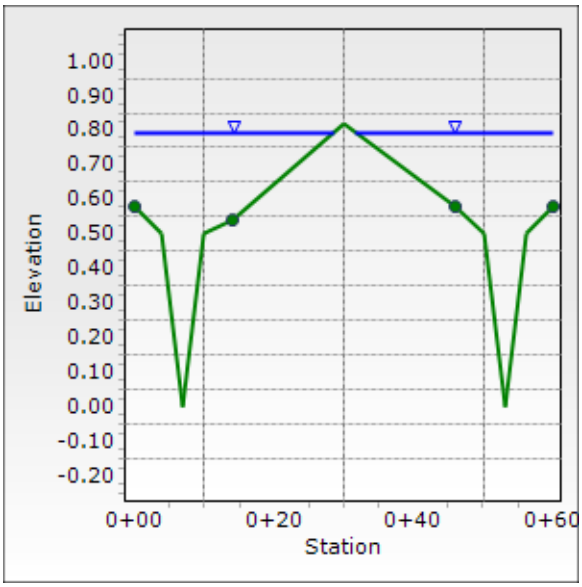
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.79 ft
Critical Depth	0.97 ft
Channel Slope	4.50 %
Critical Slope	0.74 %

FA Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	4.50 %
Normal Depth	0.79 ft
Discharge	90.0 cfs



GC1 100 yr Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Discharge	44.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.68
0+09.00	0.50
0+12.00	0.00
0+15.00	0.50
0+24.00	0.68
0+40.00	1.00
0+56.00	0.68
0+65.00	0.50
0+68.00	0.00
0+71.00	0.50
0+80.00	0.68

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.68)	(0+24.00, 0.68)	0.022
(0+24.00, 0.68)	(0+56.00, 0.68)	0.016
(0+56.00, 0.68)	(0+80.00, 0.68)	0.022

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	0.79 ft
Roughness Coefficient	0.021
Elevation	0.79 ft
Elevation Range	0.00 to 1.00 ft
Flow Area	14.6 ft²
Wetted Perimeter	59.87 ft
Hydraulic Radius	0.24 ft
Top Width	59.46 ft

GC1 100 yr Report

Results	
Normal Depth	0.79 ft
Critical Depth	0.81 ft
Critical Slope	1.02 %
Velocity	3.02 ft/s
Velocity Head	0.14 ft
Specific Energy	0.94 ft
Froude Number	1.077
Flow Type	Supercritical

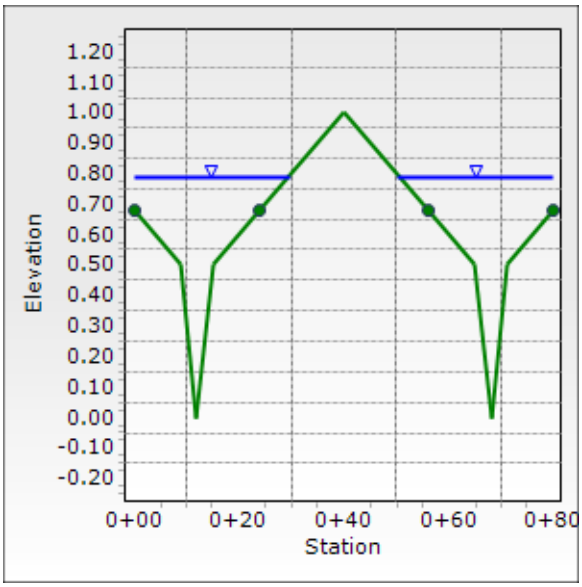
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.79 ft
Critical Depth	0.81 ft
Channel Slope	1.20 %
Critical Slope	1.02 %

GC1 100 yr Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Normal Depth	0.79 ft
Discharge	44.0 cfs



WB min% Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.50 %
Discharge	19.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.22
0+08.00	0.06
0+11.00	0.00
0+14.00	0.06
0+30.00	0.38
0+46.00	0.06
0+49.00	0.00
0+52.00	0.06
0+60.00	0.22

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.22)	(0+14.00, 0.06)	0.022
(0+14.00, 0.06)	(0+46.00, 0.06)	0.016
(0+46.00, 0.06)	(0+60.00, 0.22)	0.022

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	0.25 ft
Roughness Coefficient	0.020
Elevation	0.25 ft
Elevation Range	0.00 to 0.38 ft
Flow Area	6.2 ft²
Wetted Perimeter	47.03 ft
Hydraulic Radius	0.13 ft
Top Width	46.96 ft
Normal Depth	0.25 ft
Critical Depth	0.29 ft

WB min% Report

Results	
Critical Slope	1.05 %
Velocity	3.07 ft/s
Velocity Head	0.15 ft
Specific Energy	0.40 ft
Froude Number	1.492
Flow Type	Supercritical

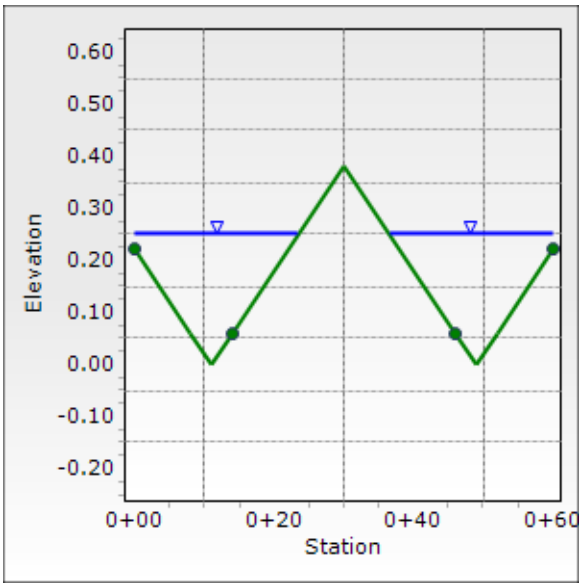
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.25 ft
Critical Depth	0.29 ft
Channel Slope	2.50 %
Critical Slope	1.05 %

WB min% Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.50 %
Normal Depth	0.25 ft
Discharge	19.0 cfs



WB max% Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	10.74 %
Discharge	19.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.22
0+08.00	0.06
0+11.00	0.00
0+14.00	0.06
0+30.00	0.38
0+46.00	0.06
0+49.00	0.00
0+52.00	0.06
0+60.00	0.22

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.22)	(0+14.00, 0.06)	0.022
(0+14.00, 0.06)	(0+46.00, 0.06)	0.016
(0+46.00, 0.06)	(0+60.00, 0.22)	0.022

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	0.020
Elevation	0.19 ft
Elevation Range	0.00 to 0.38 ft
Flow Area	3.7 ft²
Wetted Perimeter	38.61 ft
Hydraulic Radius	0.10 ft
Top Width	38.60 ft
Normal Depth	0.19 ft
Critical Depth	0.29 ft

WB max% Report

Results	
Critical Slope	1.09 %
Velocity	5.10 ft/s
Velocity Head	0.40 ft
Specific Energy	0.60 ft
Froude Number	2.894
Flow Type	Supercritical

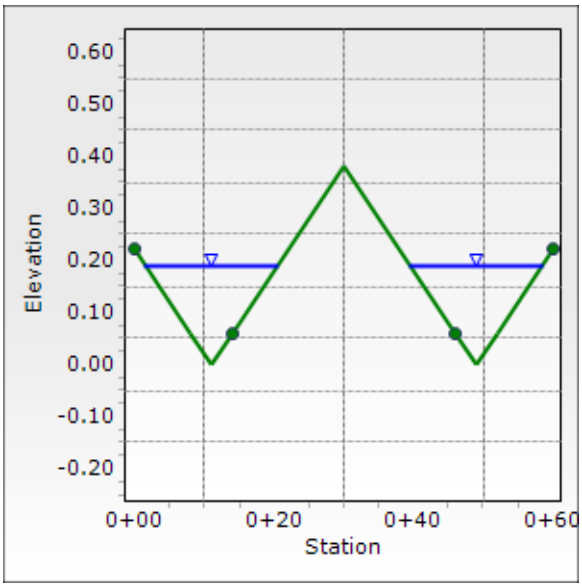
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.19 ft
Critical Depth	0.29 ft
Channel Slope	10.74 %
Critical Slope	1.09 %

WB max% Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	10.74 %
Normal Depth	0.19 ft
Discharge	19.0 cfs



ES2 Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.70 %
Discharge	16.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.28
0+14.00	0.00
0+17.00	0.06
0+33.00	0.38
0+49.00	0.06
0+52.00	0.00
0+55.00	0.06
0+63.00	0.22

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.28)	(0+17.00, 0.06)	0.022
(0+17.00, 0.06)	(0+49.00, 0.06)	0.016
(0+49.00, 0.06)	(0+63.00, 0.22)	0.022

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	0.30 ft
Roughness Coefficient	0.020
Elevation	0.30 ft
Elevation Range	0.00 to 0.38 ft
Flow Area	8.7 ft²
Wetted Perimeter	54.79 ft
Hydraulic Radius	0.16 ft
Top Width	54.69 ft
Normal Depth	0.30 ft
Critical Depth	0.27 ft
Critical Slope	1.08 %

ES2 Report

Results	
Velocity	1.85 ft/s
Velocity Head	0.05 ft
Specific Energy	0.35 ft
Froude Number	0.819
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.30 ft
Critical Depth	0.27 ft
Channel Slope	0.70 %
Critical Slope	1.08 %

ES2 Report

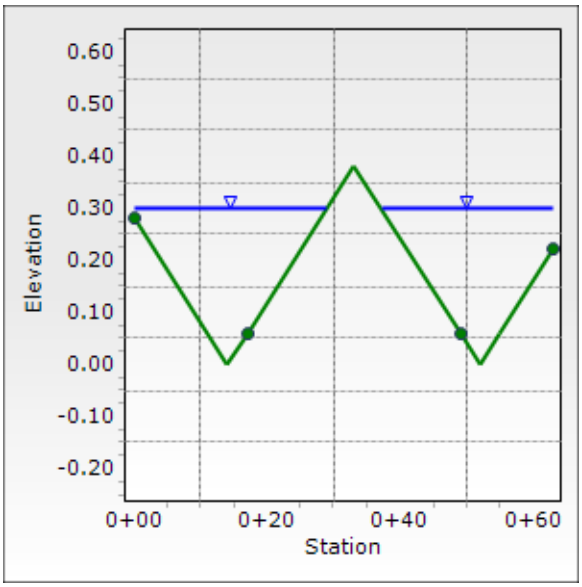
Messages:

Water Surface Elevation exceeds lowest end station by 0.0769000000000001ft. Flow is divided.

ES2 Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.70 %
Normal Depth	0.30 ft
Discharge	16.0 cfs



RW min% Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.90 %
Discharge	38.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.58
0+04.00	0.50
0+07.00	0.00
0+10.00	0.50
0+14.00	0.58
0+30.00	0.90
0+46.00	0.58
0+51.50	0.50
0+54.50	0.00
0+57.50	0.50
0+63.00	0.61

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.58)	(0+14.00, 0.58)	0.022
(0+14.00, 0.58)	(0+63.00, 0.61)	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	0.66 ft
Roughness Coefficient	0.018
Elevation	0.66 ft
Elevation Range	0.00 to 0.90 ft
Flow Area	7.3 ft²
Wetted Perimeter	38.90 ft
Hydraulic Radius	0.19 ft
Top Width	38.60 ft
Normal Depth	0.66 ft

RW min% Report

Results	
Critical Depth	0.79 ft
Critical Slope	0.79 %
Velocity	5.22 ft/s
Velocity Head	0.42 ft
Specific Energy	1.08 ft
Froude Number	2.117
Flow Type	Supercritical

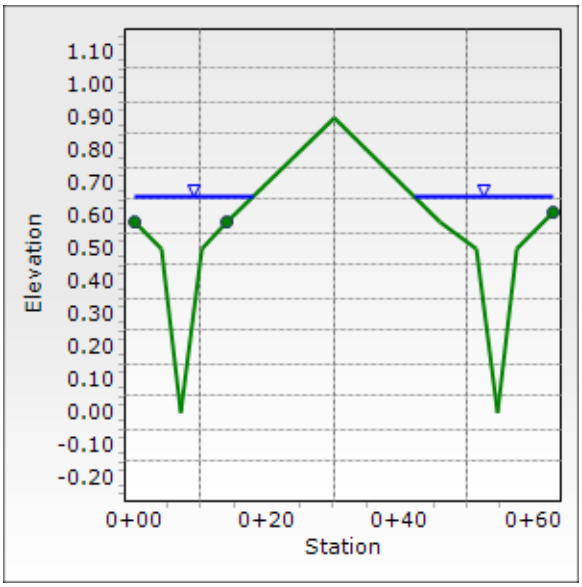
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.66 ft
Critical Depth	0.79 ft
Channel Slope	3.90 %
Critical Slope	0.79 %

RW min% Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.90 %
Normal Depth	0.66 ft
Discharge	38.0 cfs



RW max% Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	6.50 %
Discharge	38.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.58
0+04.00	0.50
0+07.00	0.00
0+10.00	0.50
0+14.00	0.58
0+30.00	0.90
0+46.00	0.58
0+51.50	0.50
0+54.50	0.00
0+57.50	0.50
0+63.00	0.61

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.58)	(0+10.00, 0.50)	0.022
(0+10.00, 0.50)	(0+46.00, 0.58)	0.016
(0+46.00, 0.58)	(0+63.00, 0.61)	0.022

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	0.64 ft
Roughness Coefficient	0.021
Elevation	0.64 ft
Elevation Range	0.00 to 0.90 ft
Flow Area	6.5 ft²
Wetted Perimeter	36.90 ft
Hydraulic Radius	0.18 ft
Top Width	36.64 ft

RW max% Report

Results	
Normal Depth	0.64 ft
Critical Depth	0.79 ft
Critical Slope	0.99 %
Velocity	5.80 ft/s
Velocity Head	0.52 ft
Specific Energy	1.16 ft
Froude Number	2.421
Flow Type	Supercritical

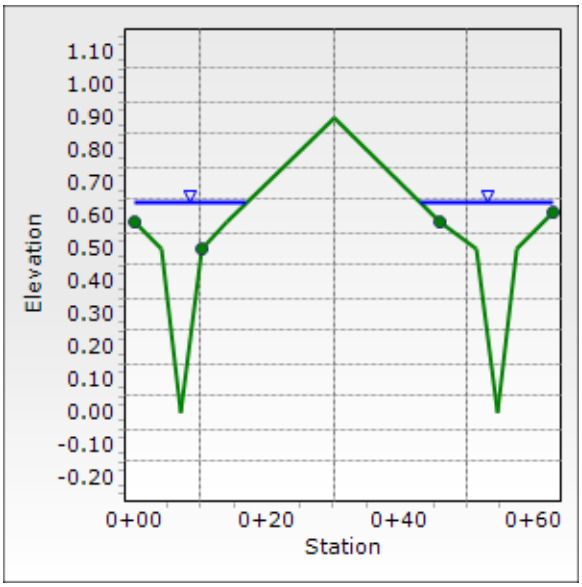
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.64 ft
Critical Depth	0.79 ft
Channel Slope	6.50 %
Critical Slope	0.99 %

RW max% Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	6.50 %
Normal Depth	0.64 ft
Discharge	38.0 cfs



GC2 100 yr Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Discharge	52.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.68
0+09.00	0.50
0+12.00	0.00
0+15.00	0.50
0+24.00	0.68
0+40.00	1.00
0+56.00	0.68
0+65.00	0.50
0+68.00	0.00
0+71.00	0.50
0+80.00	0.68

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.68)	(0+24.00, 0.68)	0.022
(0+24.00, 0.68)	(0+56.00, 0.68)	0.016
(0+56.00, 0.68)	(0+80.00, 0.68)	0.022

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	0.82 ft
Roughness Coefficient	0.021
Elevation	0.82 ft
Elevation Range	0.00 to 1.00 ft
Flow Area	16.3 ft²
Wetted Perimeter	62.78 ft
Hydraulic Radius	0.26 ft
Top Width	62.32 ft

GC2 100 yr Report

Results	
Normal Depth	0.82 ft
Critical Depth	0.84 ft
Critical Slope	0.98 %
Velocity	3.19 ft/s
Velocity Head	0.16 ft
Specific Energy	0.98 ft
Froude Number	1.100
Flow Type	Supercritical

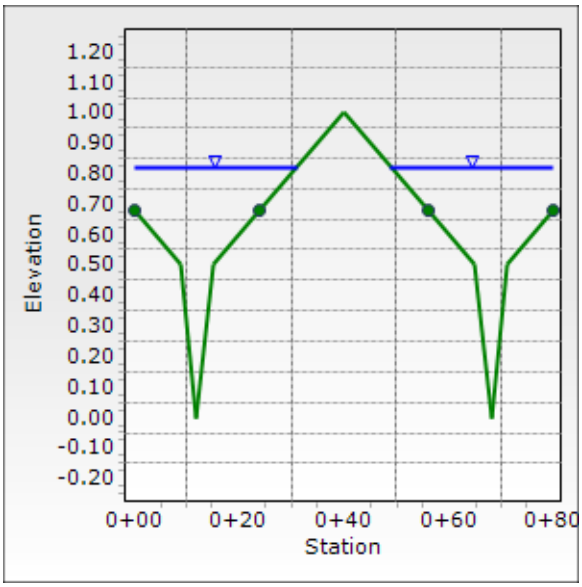
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.82 ft
Critical Depth	0.84 ft
Channel Slope	1.20 %
Critical Slope	0.98 %

GC2 100 yr Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Normal Depth	0.82 ft
Discharge	52.0 cfs



LW1 Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	5.00 %
Discharge	11.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.58
0+04.00	0.50
0+07.00	0.00
0+10.00	0.50
0+14.00	0.58
0+30.00	0.90
0+53.00	0.44
0+55.00	0.42
0+57.50	0.00
0+60.00	0.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.58)	(0+14.00, 0.58)	0.022
(0+14.00, 0.58)	(0+53.00, 0.44)	0.016
(0+53.00, 0.44)	(0+60.00, 0.50)	0.022

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	0.44 ft
Roughness Coefficient	0.022
Elevation	0.44 ft
Elevation Range	0.00 to 0.90 ft
Flow Area	2.2 ft²
Wetted Perimeter	12.15 ft
Hydraulic Radius	0.18 ft
Top Width	12.00 ft
Normal Depth	0.44 ft

LW1 Report

Results	
Critical Depth	0.57 ft
Critical Slope	1.28 %
Velocity	4.90 ft/s
Velocity Head	0.37 ft
Specific Energy	0.81 ft
Froude Number	1.999
Flow Type	Supercritical

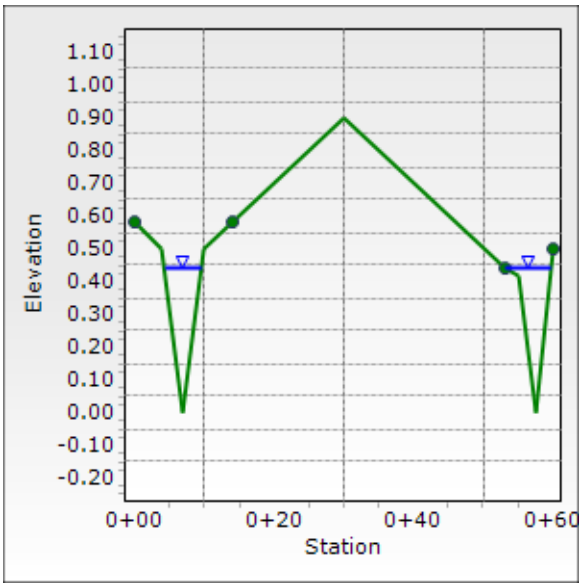
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.44 ft
Critical Depth	0.57 ft
Channel Slope	5.00 %
Critical Slope	1.28 %

LW1 Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	5.00 %
Normal Depth	0.44 ft
Discharge	11.0 cfs



LW2 Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	4.25 %
Discharge	25.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.58
0+04.00	0.50
0+07.00	0.00
0+10.00	0.50
0+14.00	0.58
0+30.00	0.90
0+53.00	0.44
0+53.00	0.40
0+54.50	0.27
0+54.50	0.77
0+55.00	0.77
0+60.00	0.87

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.58)	(0+14.00, 0.58)	0.022
(0+14.00, 0.58)	(0+53.00, 0.44)	0.016
(0+53.00, 0.44)	(0+60.00, 0.87)	0.013

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	0.65 ft
Roughness Coefficient	0.019
Elevation	0.65 ft
Elevation Range	0.00 to 0.90 ft
Flow Area	5.1 ft²
Wetted Perimeter	30.44 ft
Hydraulic Radius	0.17 ft

LW2 Report

Results	
Top Width	29.85 ft
Normal Depth	0.65 ft
Critical Depth	0.77 ft
Critical Slope	0.88 %
Velocity	4.92 ft/s
Velocity Head	0.38 ft
Specific Energy	1.03 ft
Froude Number	2.102
Flow Type	Supercritical

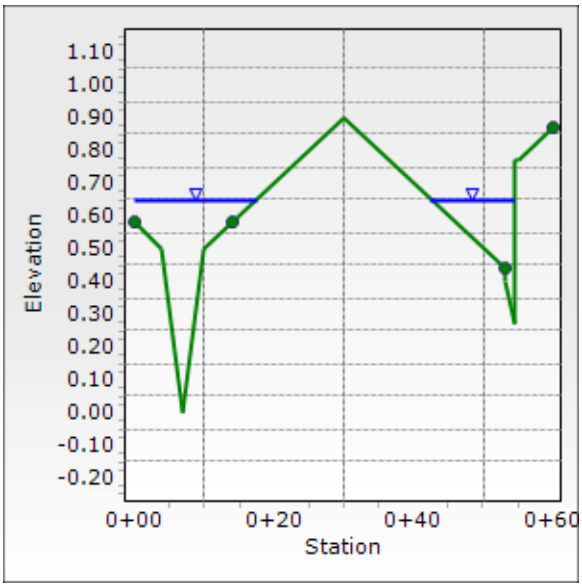
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.65 ft
Critical Depth	0.77 ft
Channel Slope	4.25 %
Critical Slope	0.88 %

LW2 Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	4.25 %
Normal Depth	0.65 ft
Discharge	25.0 cfs



GC3 100 yr Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Discharge	34.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.68
0+09.00	0.50
0+12.00	0.00
0+15.00	0.50
0+24.00	0.68
0+40.00	1.00
0+56.00	0.68
0+65.00	0.50
0+68.00	0.00
0+71.00	0.50
0+80.00	0.68

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.68)	(0+24.00, 0.68)	0.022
(0+24.00, 0.68)	(0+56.00, 0.68)	0.016
(0+56.00, 0.68)	(0+80.00, 0.68)	0.022

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	0.021
Elevation	0.75 ft
Elevation Range	0.00 to 1.00 ft
Flow Area	12.2 ft²
Wetted Perimeter	55.73 ft
Hydraulic Radius	0.22 ft
Top Width	55.41 ft

GC3 100 yr Report

Results	
Normal Depth	0.75 ft
Critical Depth	0.76 ft
Critical Slope	1.10 %
Velocity	2.78 ft/s
Velocity Head	0.12 ft
Specific Energy	0.87 ft
Froude Number	1.043
Flow Type	Supercritical

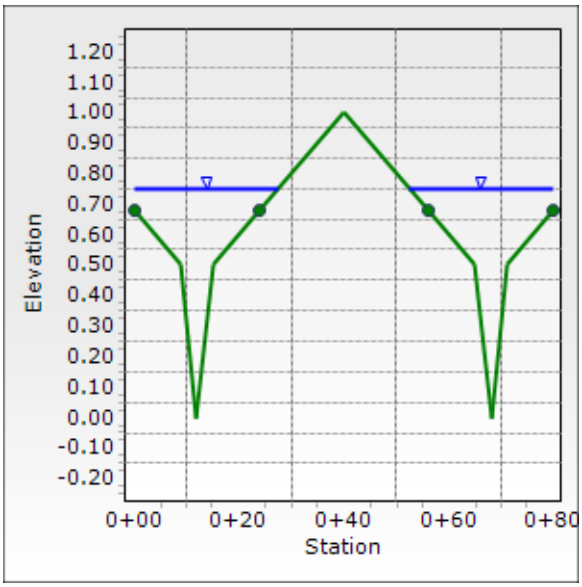
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.75 ft
Critical Depth	0.76 ft
Channel Slope	1.20 %
Critical Slope	1.10 %

GC3 100 yr Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Normal Depth	0.75 ft
Discharge	34.0 cfs



Perimeter Street Flow Computations – 10-Yr

HP 10 yr min% Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.60 %
Discharge	7.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.24
0+09.00	0.06
0+12.00	0.00
0+15.00	0.06
0+40.00	0.56
0+65.00	0.06
0+68.00	0.00
0+71.00	0.06
0+80.00	0.24

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.24)	(0+09.00, 0.06)	0.016
(0+09.00, 0.06)	(0+15.00, 0.06)	0.022
(0+15.00, 0.06)	(0+65.00, 0.06)	0.016
(0+65.00, 0.06)	(0+80.00, 0.24)	0.022

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	0.019
Elevation	0.22 ft
Elevation Range	0.00 to 0.56 ft
Flow Area	5.0 ft²
Wetted Perimeter	44.61 ft
Hydraulic Radius	0.11 ft
Top Width	44.60 ft
Normal Depth	0.22 ft

HP 10 yr min% Report

Results	
Critical Depth	0.20 ft
Critical Slope	1.13 %
Velocity	1.41 ft/s
Velocity Head	0.03 ft
Specific Energy	0.25 ft
Froude Number	0.743
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.22 ft
Critical Depth	0.20 ft
Channel Slope	0.60 %
Critical Slope	1.13 %

HP 10 yr min% Report

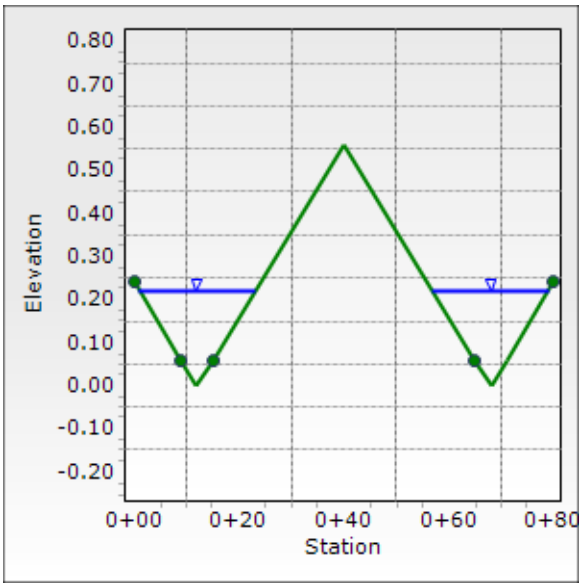
Messages:

Flow is divided.

HP 10 yr min% Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.60 %
Normal Depth	0.22 ft
Discharge	7.0 cfs



HP 10 yr max% Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.50 %
Discharge	7.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.24
0+09.00	0.06
0+12.00	0.00
0+15.00	0.06
0+40.00	0.56
0+65.00	0.06
0+68.00	0.00
0+71.00	0.06
0+80.00	0.24

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.24)	(0+09.00, 0.06)	0.016
(0+09.00, 0.06)	(0+15.00, 0.06)	0.022
(0+15.00, 0.06)	(0+65.00, 0.06)	0.016
(0+65.00, 0.06)	(0+80.00, 0.24)	0.022

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	0.16 ft
Roughness Coefficient	0.019
Elevation	0.16 ft
Elevation Range	0.00 to 0.56 ft
Flow Area	2.6 ft²
Wetted Perimeter	32.39 ft
Hydraulic Radius	0.08 ft
Top Width	32.38 ft
Normal Depth	0.16 ft

HP 10 yr max% Report

Results	
Critical Depth	0.20 ft
Critical Slope	1.19 %
Velocity	2.67 ft/s
Velocity Head	0.11 ft
Specific Energy	0.27 ft
Froude Number	1.655
Flow Type	Supercritical

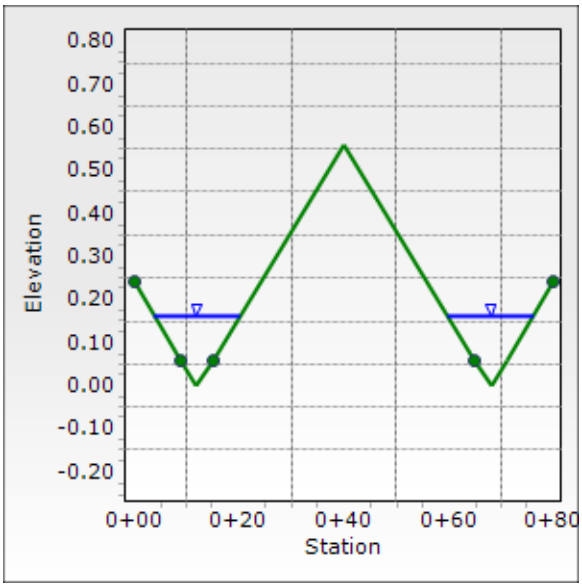
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.16 ft
Critical Depth	0.20 ft
Channel Slope	3.50 %
Critical Slope	1.19 %

HP 10 yr max% Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.50 %
Normal Depth	0.16 ft
Discharge	7.0 cfs



GC1 10 yr Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Discharge	5.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.68
0+09.00	0.50
0+12.00	0.00
0+15.00	0.50
0+24.00	0.68
0+40.00	1.00
0+56.00	0.68
0+65.00	0.50
0+68.00	0.00
0+71.00	0.50
0+80.00	0.68

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.68)	(0+24.00, 0.68)	0.022
(0+24.00, 0.68)	(0+56.00, 0.68)	0.016
(0+56.00, 0.68)	(0+80.00, 0.68)	0.022

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	0.41 ft
Roughness Coefficient	0.022
Elevation	0.41 ft
Elevation Range	0.00 to 1.00 ft
Flow Area	2.0 ft²
Wetted Perimeter	9.87 ft
Hydraulic Radius	0.20 ft
Top Width	9.73 ft

GC1 10 yr Report

Results	
Normal Depth	0.41 ft
Critical Depth	0.40 ft
Critical Slope	1.22 %
Velocity	2.53 ft/s
Velocity Head	0.10 ft
Specific Energy	0.51 ft
Froude Number	0.992
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.41 ft
Critical Depth	0.40 ft
Channel Slope	1.20 %
Critical Slope	1.22 %

GC1 10 yr Report

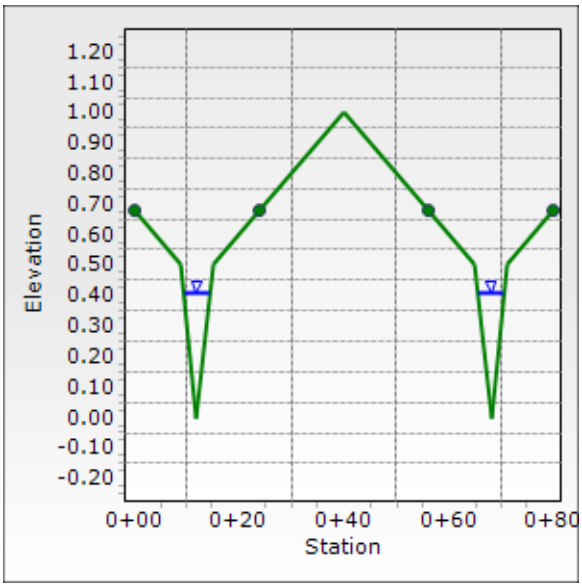
Messages:

Flow is divided.

GC1 10 yr Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Normal Depth	0.41 ft
Discharge	5.0 cfs



GC2 10 yr Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Discharge	7.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.68
0+09.00	0.50
0+12.00	0.00
0+15.00	0.50
0+24.00	0.68
0+40.00	1.00
0+56.00	0.68
0+65.00	0.50
0+68.00	0.00
0+71.00	0.50
0+80.00	0.68

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.68)	(0+24.00, 0.68)	0.022
(0+24.00, 0.68)	(0+56.00, 0.68)	0.016
(0+56.00, 0.68)	(0+80.00, 0.68)	0.022

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	0.46 ft
Roughness Coefficient	0.022
Elevation	0.46 ft
Elevation Range	0.00 to 1.00 ft
Flow Area	2.5 ft²
Wetted Perimeter	11.20 ft
Hydraulic Radius	0.23 ft
Top Width	11.05 ft

GC2 10 yr Report

Results	
Normal Depth	0.46 ft
Critical Depth	0.46 ft
Critical Slope	1.17 %
Velocity	2.75 ft/s
Velocity Head	0.12 ft
Specific Energy	0.58 ft
Froude Number	1.011
Flow Type	Supercritical

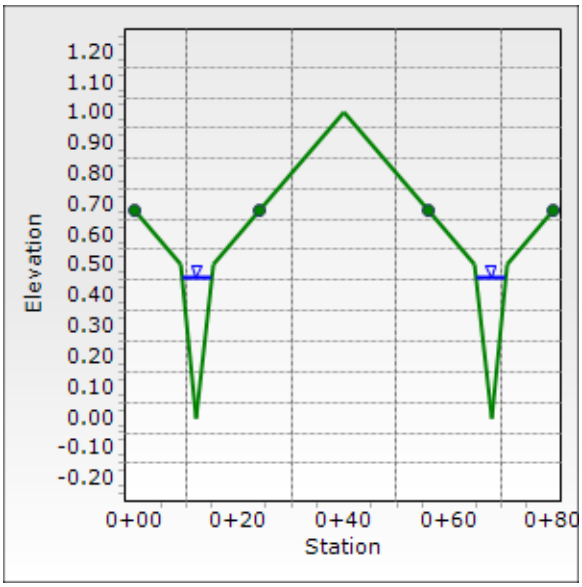
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.46 ft
Critical Depth	0.46 ft
Channel Slope	1.20 %
Critical Slope	1.17 %

GC2 10 yr Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Normal Depth	0.46 ft
Discharge	7.0 cfs



GC3 10 yr Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Discharge	4.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.68
0+09.00	0.50
0+12.00	0.00
0+15.00	0.50
0+24.00	0.68
0+40.00	1.00
0+56.00	0.68
0+65.00	0.50
0+68.00	0.00
0+71.00	0.50
0+80.00	0.68

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.68)	(0+24.00, 0.68)	0.022
(0+24.00, 0.68)	(0+56.00, 0.68)	0.016
(0+56.00, 0.68)	(0+80.00, 0.68)	0.022

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	0.37 ft
Roughness Coefficient	0.022
Elevation	0.37 ft
Elevation Range	0.00 to 1.00 ft
Flow Area	1.7 ft²
Wetted Perimeter	9.08 ft
Hydraulic Radius	0.18 ft
Top Width	8.95 ft

GC3 10 yr Report

Results	
Normal Depth	0.37 ft
Critical Depth	0.37 ft
Critical Slope	1.26 %
Velocity	2.40 ft/s
Velocity Head	0.09 ft
Specific Energy	0.46 ft
Froude Number	0.978
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.37 ft
Critical Depth	0.37 ft
Channel Slope	1.20 %
Critical Slope	1.26 %

GC3 10 yr Report

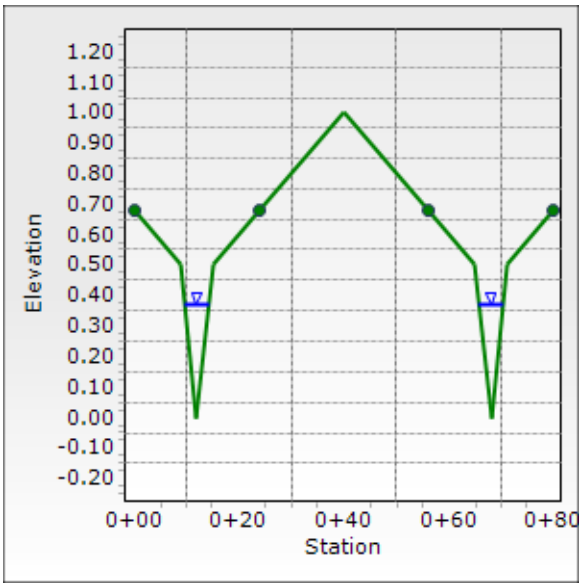
Messages:

Flow is divided.

GC3 10 yr Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.20 %
Normal Depth	0.37 ft
Discharge	4.0 cfs



Interior Street Flow Computations – 100-Yr

1 min% Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.01 %
Discharge	5.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.38
0+00.38	0.38
0+01.50	0.00
0+02.50	0.08
0+02.50	0.12
0+15.50	0.38
0+28.50	0.12
0+28.50	0.08
0+29.50	0.00
0+30.62	0.38
0+31.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.38)	(0+31.00, 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	0.30 ft
Roughness Coefficient	0.016
Elevation	0.30 ft
Elevation Range	0.00 to 0.38 ft
Flow Area	2.4 ft²
Wetted Perimeter	21.70 ft
Hydraulic Radius	0.11 ft
Top Width	21.52 ft
Normal Depth	0.30 ft
Critical Depth	0.31 ft

1 min% Report

Results	
Critical Slope	0.78 %
Velocity	2.12 ft/s
Velocity Head	0.07 ft
Specific Energy	0.37 ft
Froude Number	1.132
Flow Type	Supercritical

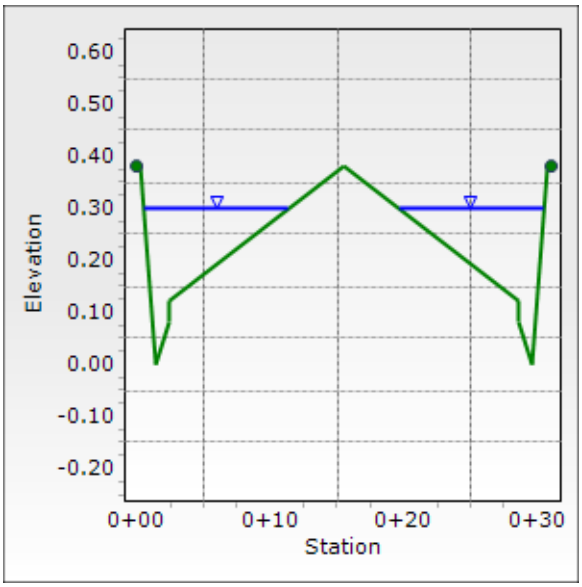
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.30 ft
Critical Depth	0.31 ft
Channel Slope	1.01 %
Critical Slope	0.78 %

1 min% Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.01 %
Normal Depth	0.30 ft
Discharge	5.0 cfs



1 max% Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	4.50 %
Discharge	5.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.38
0+00.38	0.38
0+01.50	0.00
0+02.50	0.08
0+02.50	0.12
0+15.50	0.38
0+28.50	0.12
0+28.50	0.08
0+29.50	0.00
0+30.62	0.38
0+31.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.38)	(0+31.00, 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	0.24 ft
Roughness Coefficient	0.016
Elevation	0.24 ft
Elevation Range	0.00 to 0.38 ft
Flow Area	1.3 ft²
Wetted Perimeter	15.85 ft
Hydraulic Radius	0.08 ft
Top Width	15.68 ft
Normal Depth	0.24 ft
Critical Depth	0.31 ft

1 max% Report

Results	
Critical Slope	0.78 %
Velocity	3.76 ft/s
Velocity Head	0.22 ft
Specific Energy	0.46 ft
Froude Number	2.279
Flow Type	Supercritical

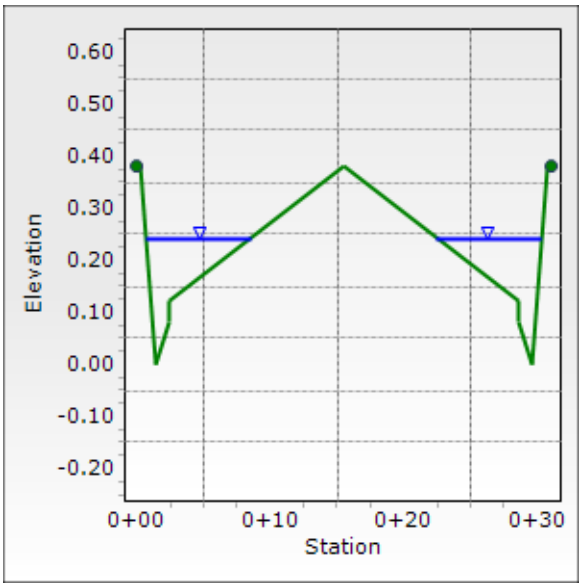
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.24 ft
Critical Depth	0.31 ft
Channel Slope	4.50 %
Critical Slope	0.78 %

1 max% Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	4.50 %
Normal Depth	0.24 ft
Discharge	5.0 cfs



2 min% Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.70 %
Discharge	66.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.38
0+00.38	0.38
0+01.50	0.00
0+02.50	0.08
0+02.50	0.12
0+15.50	0.38
0+28.50	0.12
0+28.50	0.08
0+29.50	0.00
0+30.62	0.38
0+31.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.38)	(0+31.00, 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	0.70 ft
Roughness Coefficient	0.016
Elevation	0.70 ft
Elevation Range	0.00 to 0.38 ft
Flow Area	14.4 ft²
Wetted Perimeter	31.86 ft
Hydraulic Radius	0.45 ft
Top Width	31.00 ft
Normal Depth	0.70 ft
Critical Depth	0.76 ft

2 min% Report

Results	
Critical Slope	0.48 %
Velocity	4.58 ft/s
Velocity Head	0.33 ft
Specific Energy	1.03 ft
Froude Number	1.185
Flow Type	Supercritical

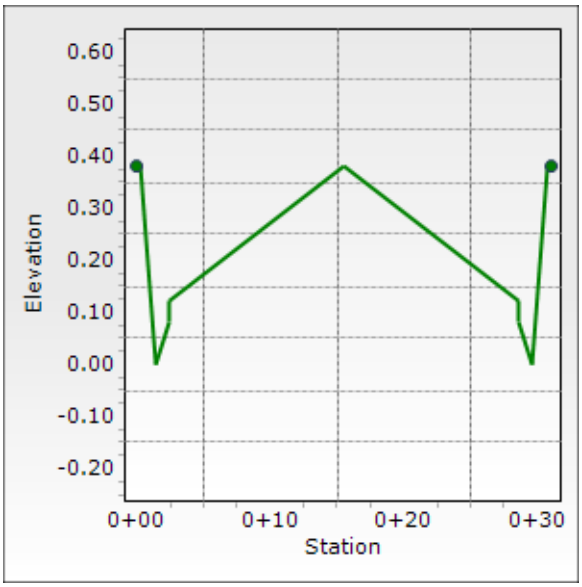
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.70 ft
Critical Depth	0.76 ft
Channel Slope	0.70 %
Critical Slope	0.48 %

2 min% Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.70 %
Normal Depth	0.70 ft
Discharge	66.0 cfs



2 max% Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	5.38 %
Discharge	66.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.38
0+00.38	0.38
0+01.50	0.00
0+02.50	0.08
0+02.50	0.12
0+15.50	0.38
0+28.50	0.12
0+28.50	0.08
0+29.50	0.00
0+30.62	0.38
0+31.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.38)	(0+31.00, 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	0.49 ft
Roughness Coefficient	0.016
Elevation	0.49 ft
Elevation Range	0.00 to 0.38 ft
Flow Area	7.8 ft²
Wetted Perimeter	31.43 ft
Hydraulic Radius	0.25 ft
Top Width	31.00 ft
Normal Depth	0.49 ft
Critical Depth	0.76 ft

2 max% Report

Results	
Critical Slope	0.48 %
Velocity	8.49 ft/s
Velocity Head	1.12 ft
Specific Energy	1.61 ft
Froude Number	2.990
Flow Type	Supercritical

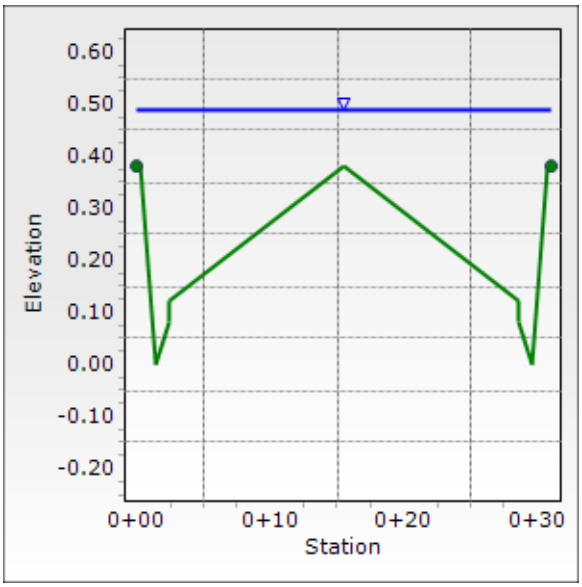
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.49 ft
Critical Depth	0.76 ft
Channel Slope	5.38 %
Critical Slope	0.48 %

2 max% Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	5.38 %
Normal Depth	0.49 ft
Discharge	66.0 cfs



3 min% Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.70 %
Discharge	23.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.38
0+00.38	0.38
0+01.50	0.00
0+02.50	0.08
0+02.50	0.12
0+15.50	0.38
0+28.50	0.12
0+28.50	0.08
0+29.50	0.00
0+30.62	0.38
0+31.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.38)	(0+31.00, 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	0.48 ft
Roughness Coefficient	0.016
Elevation	0.48 ft
Elevation Range	0.00 to 0.38 ft
Flow Area	7.6 ft²
Wetted Perimeter	31.42 ft
Hydraulic Radius	0.24 ft
Top Width	31.00 ft
Normal Depth	0.48 ft
Critical Depth	0.49 ft

3 min% Report

Results	
Critical Slope	0.60 %
Velocity	3.02 ft/s
Velocity Head	0.14 ft
Specific Energy	0.62 ft
Froude Number	1.075
Flow Type	Supercritical

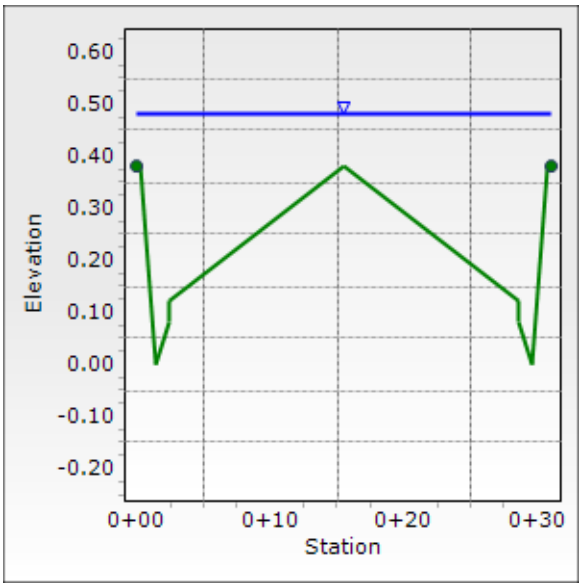
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.48 ft
Critical Depth	0.49 ft
Channel Slope	0.70 %
Critical Slope	0.60 %

3 min% Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.70 %
Normal Depth	0.48 ft
Discharge	23.0 cfs



3 max% Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	5.10 %
Discharge	23.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.38
0+00.38	0.38
0+01.50	0.00
0+02.50	0.08
0+02.50	0.12
0+15.50	0.38
0+28.50	0.12
0+28.50	0.08
0+29.50	0.00
0+30.62	0.38
0+31.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.38)	(0+31.00, 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	0.37 ft
Roughness Coefficient	0.016
Elevation	0.37 ft
Elevation Range	0.00 to 0.38 ft
Flow Area	4.1 ft²
Wetted Perimeter	28.91 ft
Hydraulic Radius	0.14 ft
Top Width	28.69 ft
Normal Depth	0.37 ft
Critical Depth	0.49 ft

3 max% Report

Results	
Critical Slope	0.60 %
Velocity	5.67 ft/s
Velocity Head	0.50 ft
Specific Energy	0.87 ft
Froude Number	2.660
Flow Type	Supercritical

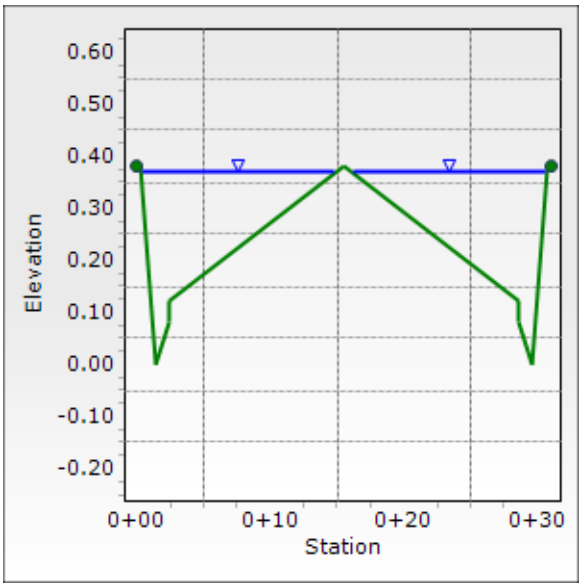
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.37 ft
Critical Depth	0.49 ft
Channel Slope	5.10 %
Critical Slope	0.60 %

3 max% Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	5.10 %
Normal Depth	0.37 ft
Discharge	23.0 cfs



4 Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.26 %
Discharge	5.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.38
0+00.38	0.38
0+01.50	0.00
0+02.50	0.08
0+02.50	0.12
0+22.50	0.52
0+42.50	0.12
0+42.50	0.08
0+43.50	0.00
0+44.62	0.38
0+45.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.38)	(0+45.00, 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	0.29 ft
Roughness Coefficient	0.016
Elevation	0.29 ft
Elevation Range	0.00 to 0.52 ft
Flow Area	2.2 ft²
Wetted Perimeter	20.76 ft
Hydraulic Radius	0.10 ft
Top Width	20.57 ft
Normal Depth	0.29 ft
Critical Depth	0.31 ft

4 Report

Results	
Critical Slope	0.78 %
Velocity	2.31 ft/s
Velocity Head	0.08 ft
Specific Energy	0.37 ft
Froude Number	1.254
Flow Type	Supercritical

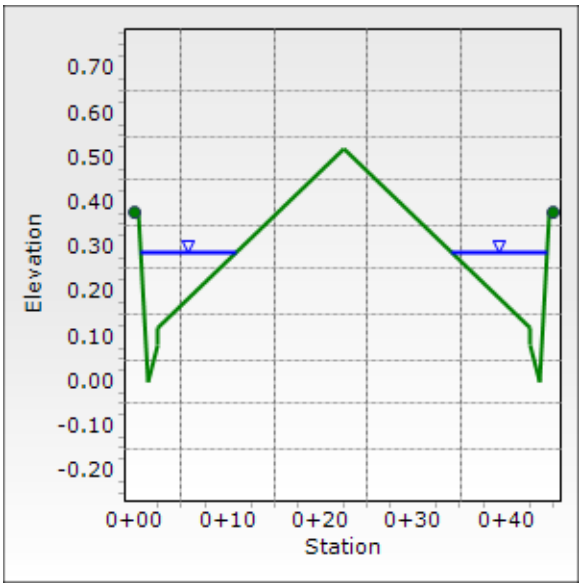
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.29 ft
Critical Depth	0.31 ft
Channel Slope	1.26 %
Critical Slope	0.78 %

4 Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.26 %
Normal Depth	0.29 ft
Discharge	5.0 cfs



5 Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.98 %
Discharge	5.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.38
0+00.38	0.38
0+01.50	0.00
0+02.50	0.08
0+02.50	0.12
0+15.50	0.38
0+28.50	0.12
0+28.50	0.08
0+29.50	0.00
0+30.62	0.38
0+31.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.38)	(0+31.00, 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 0.38 ft
Flow Area	1.8 ft²
Wetted Perimeter	18.86 ft
Hydraulic Radius	0.10 ft
Top Width	18.68 ft
Normal Depth	0.27 ft
Critical Depth	0.31 ft

5 Report

Results	
Critical Slope	0.78 %
Velocity	2.75 ft/s
Velocity Head	0.12 ft
Specific Energy	0.39 ft
Froude Number	1.557
Flow Type	Supercritical

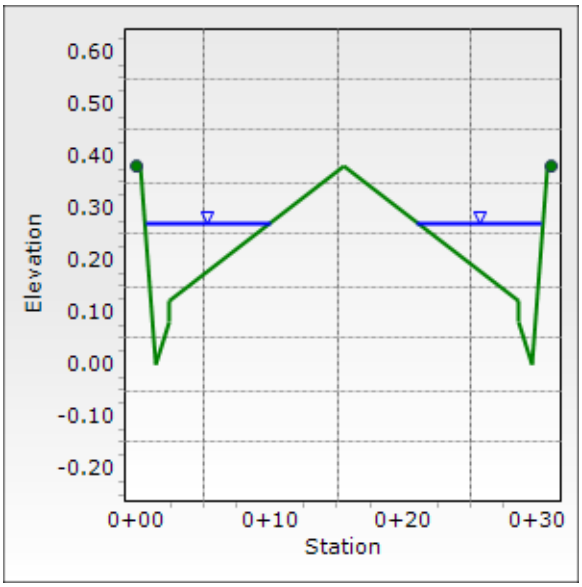
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.27 ft
Critical Depth	0.31 ft
Channel Slope	1.98 %
Critical Slope	0.78 %

5 Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.98 %
Normal Depth	0.27 ft
Discharge	5.0 cfs



6 min% Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.60 %
Discharge	10.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.38
0+00.38	0.38
0+01.50	0.00
0+02.50	0.08
0+02.50	0.12
0+15.50	0.38
0+28.50	0.12
0+28.50	0.08
0+29.50	0.00
0+30.62	0.38
0+31.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.38)	(0+31.00, 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	0.39 ft
Roughness Coefficient	0.016
Elevation	0.39 ft
Elevation Range	0.00 to 0.38 ft
Flow Area	4.8 ft²
Wetted Perimeter	31.24 ft
Hydraulic Radius	0.15 ft
Top Width	31.00 ft
Normal Depth	0.39 ft
Critical Depth	0.38 ft

6 min% Report

Results	
Critical Slope	0.71 %
Velocity	2.07 ft/s
Velocity Head	0.07 ft
Specific Energy	0.46 ft
Froude Number	0.926
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.39 ft
Critical Depth	0.38 ft
Channel Slope	0.60 %
Critical Slope	0.71 %

6 min% Report

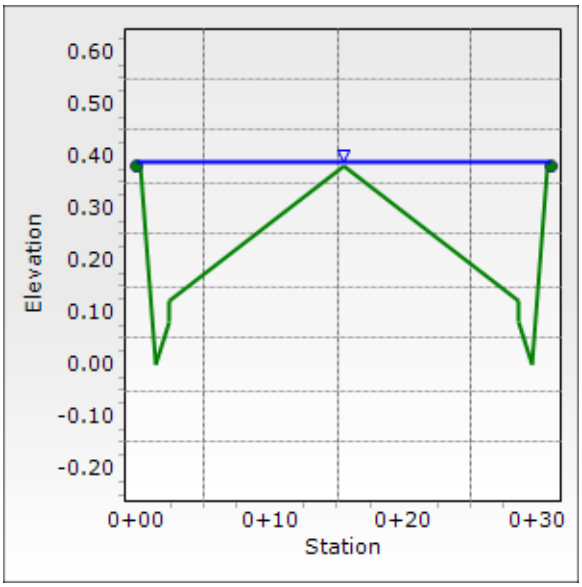
Messages:

Water Surface Elevation exceeds lowest end station by 0.0109411956183066ft.

6 min% Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.60 %
Normal Depth	0.39 ft
Discharge	10.0 cfs



6 max% Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	4.50 %
Discharge	10.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.38
0+00.38	0.38
0+01.50	0.00
0+02.50	0.08
0+02.50	0.12
0+15.50	0.38
0+28.50	0.12
0+28.50	0.08
0+29.50	0.00
0+30.62	0.38
0+31.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.38)	(0+31.00, 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	0.29 ft
Roughness Coefficient	0.016
Elevation	0.29 ft
Elevation Range	0.00 to 0.38 ft
Flow Area	2.3 ft²
Wetted Perimeter	21.22 ft
Hydraulic Radius	0.11 ft
Top Width	21.03 ft
Normal Depth	0.29 ft
Critical Depth	0.38 ft

6 max% Report

Results	
Critical Slope	0.71 %
Velocity	4.43 ft/s
Velocity Head	0.31 ft
Specific Energy	0.60 ft
Froude Number	2.385
Flow Type	Supercritical

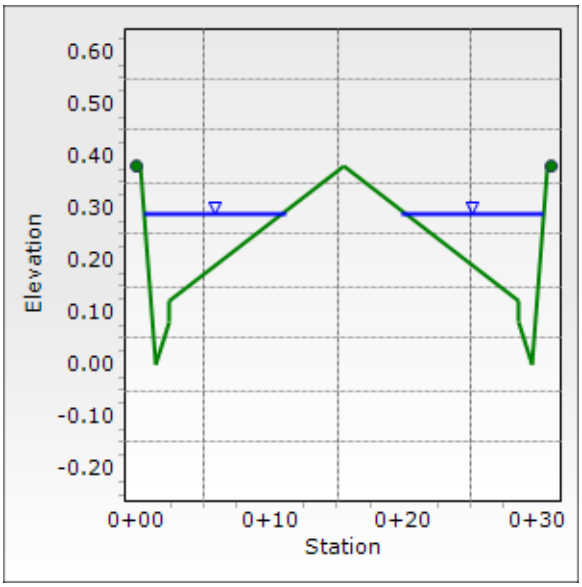
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.29 ft
Critical Depth	0.38 ft
Channel Slope	4.50 %
Critical Slope	0.71 %

6 max% Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	4.50 %
Normal Depth	0.29 ft
Discharge	10.0 cfs



7 Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.75 %
Discharge	5.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.38
0+00.38	0.38
0+01.50	0.00
0+02.50	0.08
0+02.50	0.12
0+15.50	0.38
0+28.50	0.12
0+28.50	0.08
0+29.50	0.00
0+30.62	0.38
0+31.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.38)	(0+31.00, 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	0.28 ft
Roughness Coefficient	0.016
Elevation	0.28 ft
Elevation Range	0.00 to 0.38 ft
Flow Area	1.9 ft²
Wetted Perimeter	19.36 ft
Hydraulic Radius	0.10 ft
Top Width	19.18 ft
Normal Depth	0.28 ft
Critical Depth	0.31 ft

7 Report

Results	
Critical Slope	0.78 %
Velocity	2.63 ft/s
Velocity Head	0.11 ft
Specific Energy	0.38 ft
Froude Number	1.469
Flow Type	Supercritical

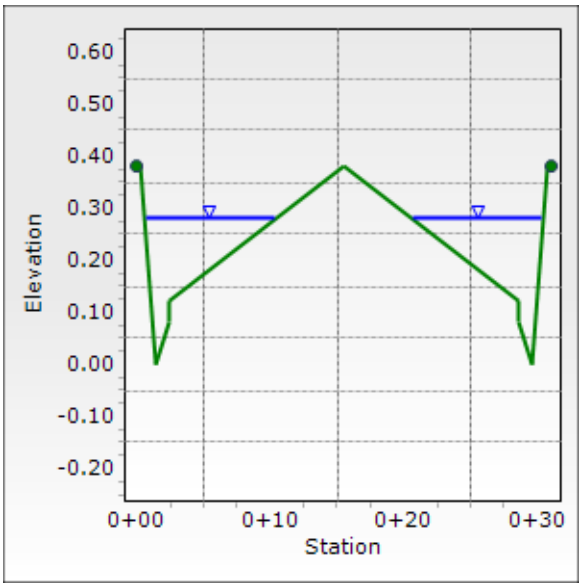
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.28 ft
Critical Depth	0.31 ft
Channel Slope	1.75 %
Critical Slope	0.78 %

7 Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.75 %
Normal Depth	0.28 ft
Discharge	5.0 cfs



LaMadre Street Flow Comparison

La Madre East of Jensen (Existing) Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.90 %
Discharge	17.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.58
0+04.00	0.50
0+07.00	0.00
0+10.00	0.50
0+14.00	0.58
0+30.00	0.90
0+46.00	0.58
0+50.00	0.50
0+53.00	0.00
0+56.00	0.50
0+60.00	0.58

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.58)	(0+14.00, 0.58)	0.022
(0+14.00, 0.58)	(0+46.00, 0.58)	0.016
(0+46.00, 0.58)	(0+60.00, 0.58)	0.022

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

Results	
Normal Depth	0.57 ft
Roughness Coefficient	0.022
Elevation	0.57 ft
Elevation Range	0.00 to 0.90 ft
Flow Area	4.2 ft²
Wetted Perimeter	25.18 ft
Hydraulic Radius	0.17 ft
Top Width	25.01 ft

La Madre East of Jensen (Existing) Report

Results	
Normal Depth	0.57 ft
Critical Depth	0.65 ft
Critical Slope	1.23 %
Velocity	4.04 ft/s
Velocity Head	0.25 ft
Specific Energy	0.82 ft
Froude Number	1.739
Flow Type	Supercritical

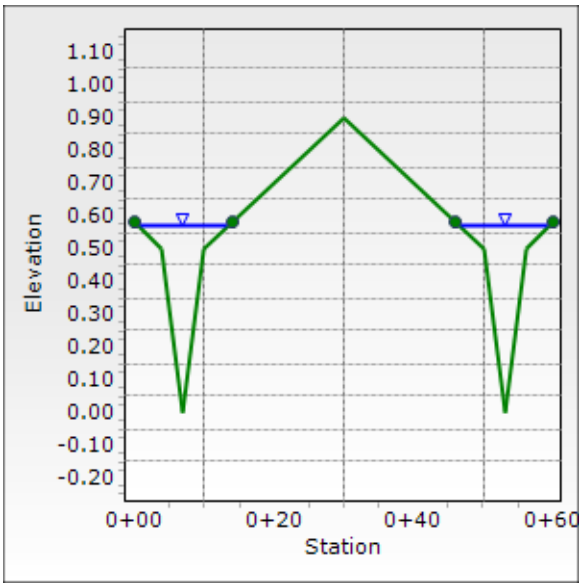
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.57 ft
Critical Depth	0.65 ft
Channel Slope	3.90 %
Critical Slope	1.23 %

La Madre East of Jensen (Existing) Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.90 %
Normal Depth	0.57 ft
Discharge	17.0 cfs



La Madre East of Jensen (Interim) Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.90 %
Discharge	21.0 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.58
0+04.00	0.50
0+07.00	0.00
0+10.00	0.50
0+14.00	0.58
0+30.00	0.90
0+46.00	0.58
0+50.00	0.50
0+53.00	0.00
0+56.00	0.50
0+60.00	0.58

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.58)	(0+14.00, 0.58)	0.022
(0+14.00, 0.58)	(0+46.00, 0.58)	0.016
(0+46.00, 0.58)	(0+60.00, 0.58)	0.022

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	0.022
Elevation	0.60 ft
Elevation Range	0.00 to 0.90 ft
Flow Area	5.1 ft²
Wetted Perimeter	29.80 ft
Hydraulic Radius	0.17 ft
Top Width	29.60 ft

La Madre East of Jensen (Interim) Report

Results	
Normal Depth	0.60 ft
Critical Depth	0.68 ft
Critical Slope	1.17 %
Velocity	4.15 ft/s
Velocity Head	0.27 ft
Specific Energy	0.86 ft
Froude Number	1.769
Flow Type	Supercritical

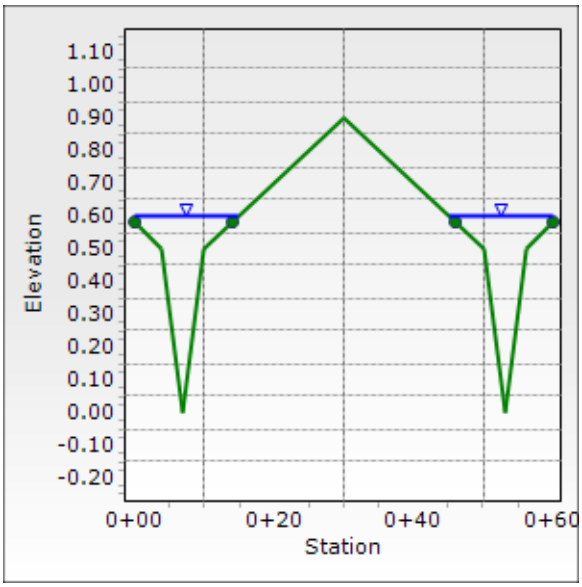
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.60 ft
Critical Depth	0.68 ft
Channel Slope	3.90 %
Critical Slope	1.17 %

La Madre East of Jensen (Interim) Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.90 %
Normal Depth	0.60 ft
Discharge	21.0 cfs



Temporary Ditch Computations

Worksheet for TD1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.037
Channel Slope	4.50 %
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	5.00 ft
Discharge	41.00 cfs

Results	
Normal Depth	0.86 ft
Flow Area	6.6 ft²
Wetted Perimeter	10.5 ft
Hydraulic Radius	0.63 ft
Top Width	10.19 ft
Critical Depth	1.03 ft
Critical Slope	2.29 %
Velocity	6.24 ft/s
Velocity Head	0.61 ft
Specific Energy	1.47 ft
Froude Number	1.370
Flow Type	Supercritical

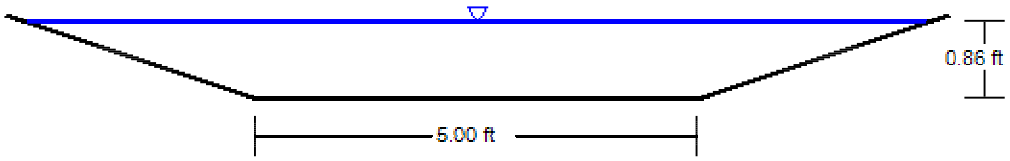
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.0 ft
Number Of Steps	0

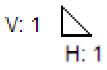
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.86 ft
Critical Depth	1.03 ft
Channel Slope	4.50 %
Critical Slope	2.29 %

Cross Section for TD1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.037
Channel Slope	4.50 %
Normal Depth	0.86 ft
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	5.00 ft
Discharge	41.00 cfs





Westwood

Rip Rap Sizing Computation

Project Name & Number: LEN2206 Grand Canyon & Washburn
Date: 3/24/2023
By: CRW

Location: Section TD1

Known Information: **Reference:**

Rip Rap protection at

V =	Velocity (fps)	6.24	WSPG Hydraulic / Flowmaster Calculations
S_g =	Specific Gravity of Rock (typ=2.5)	2.5	Use Typical
s =	Longitudinal Channel Slope (ft/ft)	0.045	Grading Plan

Solve For:

d_{50} = 0.67 ft - Average Rock Size

d_{50} = 8 in - Average Rock Size
Thickness = 16 in - Thickness of Rip Rap protection
Manning's 'n' = 0.037 - Roughness Coefficient

Equations:

Based upon a Stable Channel Lining

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

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

Recommendations:

* Provide 8-in Riprap

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

Worksheet for TD2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	3.20 %
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	7.00 ft
Discharge	15.00 cfs

Results	
Normal Depth	0.37 ft
Flow Area	3.0 ft²
Wetted Perimeter	9.3 ft
Hydraulic Radius	0.32 ft
Top Width	9.22 ft
Critical Depth	0.49 ft
Critical Slope	1.25 %
Velocity	4.99 ft/s
Velocity Head	0.39 ft
Specific Energy	0.76 ft
Froude Number	1.542
Flow Type	Supercritical

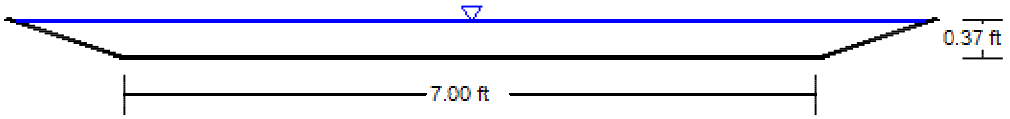
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.0 ft
Number Of Steps	0

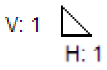
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.37 ft
Critical Depth	0.49 ft
Channel Slope	3.20 %
Critical Slope	1.25 %

Cross Section for TD2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	3.20 %
Normal Depth	0.37 ft
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	7.00 ft
Discharge	15.00 cfs





Worksheet for TD3

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.40 %
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	7.00 ft
Discharge	16.00 cfs

Results	
Normal Depth	0.42 ft
Flow Area	3.4 ft²
Wetted Perimeter	9.6 ft
Hydraulic Radius	0.36 ft
Top Width	9.51 ft
Critical Depth	0.51 ft
Critical Slope	1.23 %
Velocity	4.64 ft/s
Velocity Head	0.33 ft
Specific Energy	0.75 ft
Froude Number	1.358
Flow Type	Supercritical

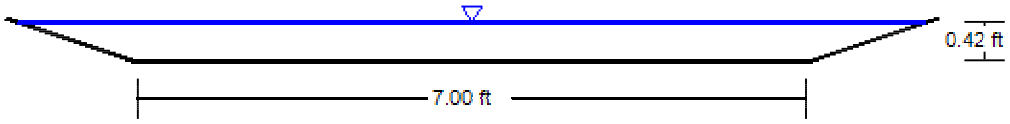
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.0 ft
Number Of Steps	0

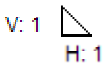
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.42 ft
Critical Depth	0.51 ft
Channel Slope	2.40 %
Critical Slope	1.23 %

Cross Section for TD3

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.40 %
Normal Depth	0.42 ft
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	7.00 ft
Discharge	16.00 cfs





Drainage Easement Computations

Worksheet for DE1 - Normal Depth @ 1.80%

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.80 %
Discharge	66.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.0	1.00
0+00.0	0.20
0+10.0	0.00
0+20.0	0.20
0+20.0	1.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 1.00)	(0+20.0, 1.00)	0.013

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	0.50 ft
Roughness Coefficient	0.013
Elevation	0.50 ft
Elevation Range	0.0 to 1.0 ft
Flow Area	8.1 ft²
Wetted Perimeter	20.6 ft
Hydraulic Radius	0.39 ft
Top Width	20.00 ft
Normal Depth	0.50 ft
Critical Depth	0.80 ft
Critical Slope	0.30 %
Velocity	8.20 ft/s
Velocity Head	1.04 ft
Specific Energy	1.55 ft
Froude Number	2.278
Flow Type	Supercritical

Worksheet for DE1 - Normal Depth @ 1.80%

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.0 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	0.50 ft
Critical Depth	0.80 ft
Channel Slope	1.80 %
Critical Slope	0.30 %

Worksheet for DE1 - Normal Depth @ 1.80%

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.80 %
Discharge	66.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.0	1.00
0+00.0	0.20
0+10.0	0.00
0+20.0	0.20
0+20.0	1.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 1.00)	(0+20.0, 1.00)	0.013

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	0.50 ft
Roughness Coefficient	0.013
Elevation	0.50 ft
Elevation Range	0.0 to 1.0 ft
Flow Area	8.1 ft²
Wetted Perimeter	20.6 ft
Hydraulic Radius	0.39 ft
Top Width	20.00 ft
Normal Depth	0.50 ft
Critical Depth	0.80 ft
Critical Slope	0.30 %
Velocity	8.20 ft/s
Velocity Head	1.04 ft
Specific Energy	1.55 ft
Froude Number	2.278
Flow Type	Supercritical

Worksheet for DE1 - Normal Depth @ 1.80%

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.0 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	0.50 ft
Critical Depth	0.80 ft
Channel Slope	1.80 %
Critical Slope	0.30 %

DE1 - Weir Report

Project Description	
Solve For	Headwater Elevation

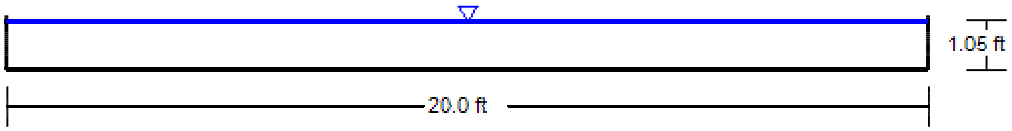
Input Data	
Discharge	66.00 cfs
Crest Elevation	0.00 ft
Tailwater Elevation	0.50 ft
Crest Surface Type	Paved
Crest Breadth	0.50 ft
Crest Length	20.0 ft

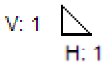
Results	
Headwater Elevation	1.05 ft
Headwater Height Above Crest	1.05 ft
Tailwater Height Above Crest	0.50 ft
Weir Coefficient	3.09 ft^(1/2)/s
Submergence Factor	1.000
Adjusted Weir Coefficient	3.09 ft^(1/2)/s
Flow Area	20.9 ft²
Velocity	3.16 ft/s
Wetted Perimeter	22.1 ft
Top Width	20.00 ft

DE1 - Weir Section

Project Description	
Solve For	Headwater Elevation

Input Data	
Discharge	66.00 cfs
Headwater Elevation	1.05 ft
Crest Elevation	0.00 ft
Tailwater Elevation	0.50 ft
Crest Surface Type	Paved
Crest Breadth	0.50 ft
Crest Length	20.0 ft





DE2 - Normal Depth @ 0.50% Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.50 %
Discharge	5.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.0	1.00
0+00.0	0.10
0+05.0	0.00
0+10.0	0.10
0+10.0	1.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 1.00)	(0+10.0, 1.00)	0.013

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	0.24 ft
Roughness Coefficient	0.013
Elevation	0.24 ft
Elevation Range	0.0 to 1.0 ft
Flow Area	1.9 ft²
Wetted Perimeter	10.3 ft
Hydraulic Radius	0.18 ft
Top Width	10.00 ft
Normal Depth	0.24 ft
Critical Depth	0.25 ft
Critical Slope	0.44 %
Velocity	2.63 ft/s
Velocity Head	0.11 ft
Specific Energy	0.35 ft
Froude Number	1.063
Flow Type	Supercritical

DE2 - Normal Depth @ 0.50% Report

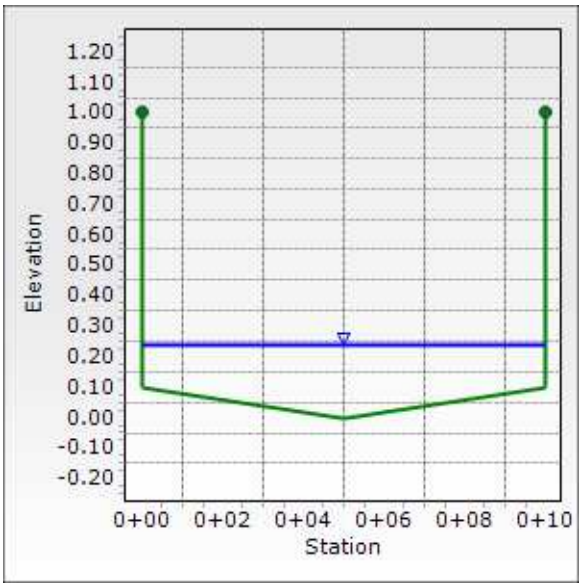
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.0 ft
Number Of Steps	0

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	0.24 ft
Critical Depth	0.25 ft
Channel Slope	0.50 %
Critical Slope	0.44 %

DE2 - Normal Depth @ 0.50% Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.50 %
Normal Depth	0.24 ft
Discharge	5.00 cfs



DE2 - Normal Depth @18.90% Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	18.90 %
Discharge	5.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.0	1.00
0+00.0	0.10
0+05.0	0.00
0+10.0	0.10
0+10.0	1.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 1.00)	(0+10.0, 1.00)	0.013

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	0.11 ft
Roughness Coefficient	0.013
Elevation	0.11 ft
Elevation Range	0.0 to 1.0 ft
Flow Area	0.6 ft²
Wetted Perimeter	10.0 ft
Hydraulic Radius	0.06 ft
Top Width	10.00 ft
Normal Depth	0.11 ft
Critical Depth	0.25 ft
Critical Slope	0.44 %
Velocity	7.89 ft/s
Velocity Head	0.97 ft
Specific Energy	1.08 ft
Froude Number	5.527
Flow Type	Supercritical

DE2 - Normal Depth @18.90% Report

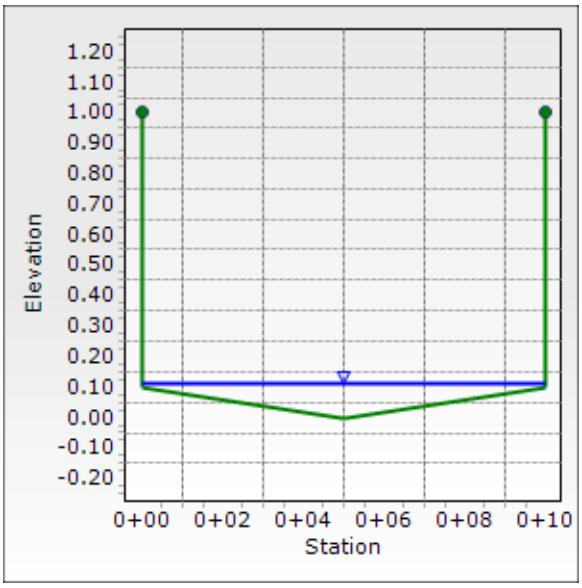
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.0 ft
Number Of Steps	0

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	0.11 ft
Critical Depth	0.25 ft
Channel Slope	18.90 %
Critical Slope	0.44 %

DE2 - Normal Depth @18.90% Sections

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	18.90 %
Normal Depth	0.11 ft
Discharge	5.00 cfs



DE2 - Weir Report

Project Description	
Solve For	Headwater Elevation

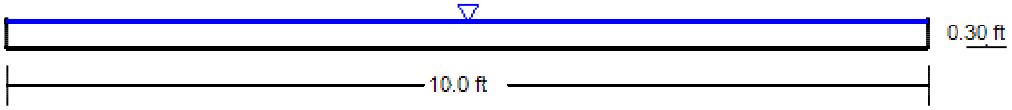
Input Data	
Discharge	5.00 cfs
Crest Elevation	0.00 ft
Tailwater Elevation	0.11 ft
Crest Surface Type	Paved
Crest Breadth	0.50 ft
Crest Length	10.0 ft

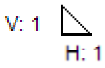
Results	
Headwater Elevation	0.30 ft
Headwater Height Above Crest	0.30 ft
Tailwater Height Above Crest	0.11 ft
Weir Coefficient	3.09 ft^(1/2)/s
Submergence Factor	1.000
Adjusted Weir Coefficient	3.09 ft^(1/2)/s
Flow Area	3.0 ft²
Velocity	1.68 ft/s
Wetted Perimeter	10.6 ft
Top Width	10.00 ft

DE2 - Weir Section

Project Description	
Solve For	Headwater Elevation

Input Data	
Discharge	5.00 cfs
Headwater Elevation	0.30 ft
Crest Elevation	0.00 ft
Tailwater Elevation	0.11 ft
Crest Surface Type	Paved
Crest Breadth	0.50 ft
Crest Length	10.0 ft





DE3 - Normal Depth @ 1.00% Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.00 %
Discharge	4.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.0	0.50
0+09.5	0.00
0+09.5	0.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 0.50)	(0+09.5, 0.50)	0.013

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	0.35 ft
Roughness Coefficient	0.013
Elevation	0.35 ft
Elevation Range	0.0 to 0.5 ft
Flow Area	1.2 ft²
Wetted Perimeter	7.0 ft
Hydraulic Radius	0.17 ft
Top Width	6.64 ft
Normal Depth	0.35 ft
Critical Depth	0.41 ft
Critical Slope	0.45 %
Velocity	3.45 ft/s
Velocity Head	0.18 ft
Specific Energy	0.53 ft
Froude Number	1.455
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft

DE3 - Normal Depth @ 1.00% Report

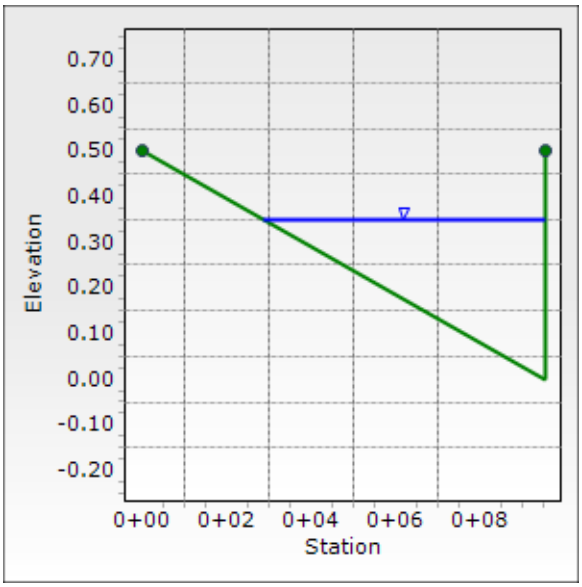
GVF Input Data	
Length	0.0 ft
Number Of Steps	0

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	0.35 ft
Critical Depth	0.41 ft
Channel Slope	1.00 %
Critical Slope	0.45 %

DE3 - Normal Depth @ 1.00% Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.00 %
Normal Depth	0.35 ft
Discharge	4.00 cfs



DE4 - Normal Depth @ 0.50% Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.50 %
Discharge	4.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.0	0.50
0+09.5	0.00
0+09.5	0.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 0.50)	(0+09.5, 0.50)	0.013

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	0.40 ft
Roughness Coefficient	0.013
Elevation	0.40 ft
Elevation Range	0.0 to 0.5 ft
Flow Area	1.5 ft²
Wetted Perimeter	8.0 ft
Hydraulic Radius	0.19 ft
Top Width	7.56 ft
Normal Depth	0.40 ft
Critical Depth	0.41 ft
Critical Slope	0.45 %
Velocity	2.66 ft/s
Velocity Head	0.11 ft
Specific Energy	0.51 ft
Froude Number	1.052
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft

DE4 - Normal Depth @ 0.50% Report

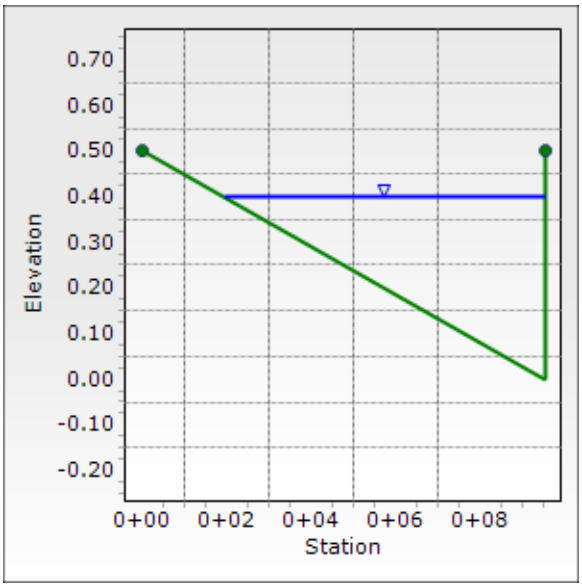
GVF Input Data	
Length	0.0 ft
Number Of Steps	0

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	0.40 ft
Critical Depth	0.41 ft
Channel Slope	0.50 %
Critical Slope	0.45 %

DE4 - Normal Depth @ 0.50% Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.50 %
Normal Depth	0.40 ft
Discharge	4.00 cfs



DE5 - Normal Depth @ 1.58% Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.58 %
Discharge	8.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.0	1.00
0+00.0	0.10
0+05.0	0.00
0+10.0	0.10
0+10.0	1.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 1.00)	(0+10.0, 1.00)	0.013

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	0.23 ft
Roughness Coefficient	0.013
Elevation	0.23 ft
Elevation Range	0.0 to 1.0 ft
Flow Area	1.8 ft²
Wetted Perimeter	10.3 ft
Hydraulic Radius	0.17 ft
Top Width	10.00 ft
Normal Depth	0.23 ft
Critical Depth	0.32 ft
Critical Slope	0.40 %
Velocity	4.48 ft/s
Velocity Head	0.31 ft
Specific Energy	0.54 ft
Froude Number	1.871
Flow Type	Supercritical

DE5 - Normal Depth @ 1.58% Report

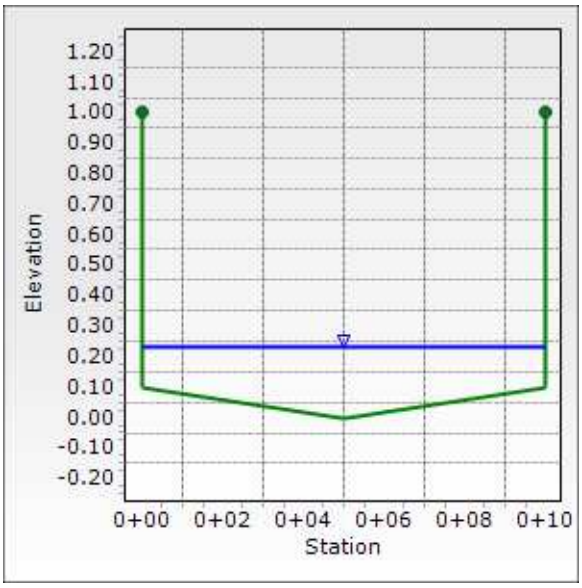
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.0 ft
Number Of Steps	0

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	0.23 ft
Critical Depth	0.32 ft
Channel Slope	1.58 %
Critical Slope	0.40 %

DE5 - Normal Depth @ 1.58% Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.58 %
Normal Depth	0.23 ft
Discharge	8.00 cfs



DE5 - Weir Report

Project Description	
Solve For	Headwater Elevation

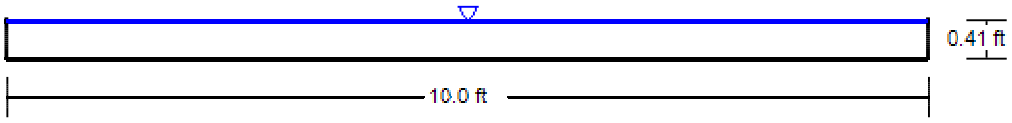
Input Data	
Discharge	8.00 cfs
Crest Elevation	0.00 ft
Tailwater Elevation	0.23 ft
Crest Surface Type	Paved
Crest Breadth	0.50 ft
Crest Length	10.0 ft

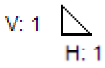
Results	
Headwater Elevation	0.41 ft
Headwater Height Above Crest	0.41 ft
Tailwater Height Above Crest	0.23 ft
Weir Coefficient	3.09 ft^(1/2)/s
Submergence Factor	1.000
Adjusted Weir Coefficient	3.09 ft^(1/2)/s
Flow Area	4.1 ft²
Velocity	1.97 ft/s
Wetted Perimeter	10.8 ft
Top Width	10.00 ft

DE5 - Weir Section

Project Description	
Solve For	Headwater Elevation

Input Data	
Discharge	8.00 cfs
Headwater Elevation	0.41 ft
Crest Elevation	0.00 ft
Tailwater Elevation	0.23 ft
Crest Surface Type	Paved
Crest Breadth	0.50 ft
Crest Length	10.0 ft





DE6 - Normal Depth @ 0.50% Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.50 %
Discharge	10.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.0	1.00
0+00.0	0.00
0+10.0	0.00
0+10.0	1.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 1.00)	(0+10.0, 1.00)	0.013

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	0.29 ft
Roughness Coefficient	0.013
Elevation	0.29 ft
Elevation Range	0.0 to 1.0 ft
Flow Area	2.9 ft²
Wetted Perimeter	10.6 ft
Hydraulic Radius	0.28 ft
Top Width	10.00 ft
Normal Depth	0.29 ft
Critical Depth	0.31 ft
Critical Slope	0.39 %
Velocity	3.43 ft/s
Velocity Head	0.18 ft
Specific Energy	0.47 ft
Froude Number	1.118
Flow Type	Supercritical

GVF Input Data

DE6 - Normal Depth @ 0.50% Report

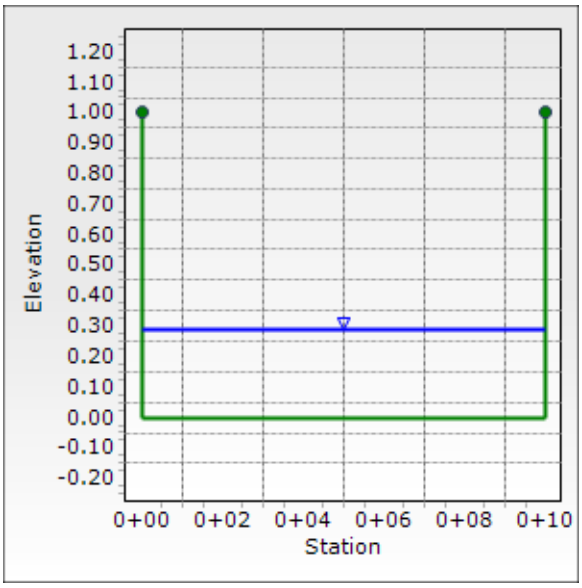
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.0 ft
Number Of Steps	0

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	0.29 ft
Critical Depth	0.31 ft
Channel Slope	0.50 %
Critical Slope	0.39 %

DE6 - Normal Depth @ 0.50% Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.50 %
Normal Depth	0.29 ft
Discharge	10.00 cfs



DE6 - Weir Report

Project Description	
Solve For	Headwater Elevation

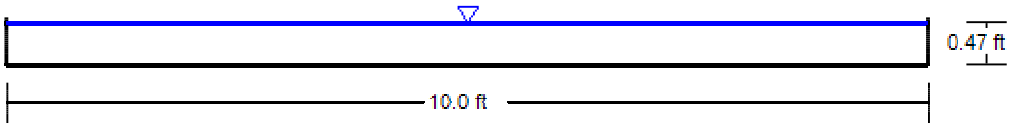
Input Data	
Discharge	10.00 cfs
Crest Elevation	0.00 ft
Tailwater Elevation	0.29 ft
Crest Surface Type	Paved
Crest Breadth	0.50 ft
Crest Length	10.0 ft

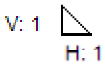
Results	
Headwater Elevation	0.47 ft
Headwater Height Above Crest	0.47 ft
Tailwater Height Above Crest	0.29 ft
Weir Coefficient	3.09 ft^(1/2)/s
Submergence Factor	1.000
Adjusted Weir Coefficient	3.09 ft^(1/2)/s
Flow Area	4.7 ft²
Velocity	2.12 ft/s
Wetted Perimeter	10.9 ft
Top Width	10.00 ft

DE6 - Weir Section

Project Description	
Solve For	Headwater Elevation

Input Data	
Discharge	10.00 cfs
Headwater Elevation	0.47 ft
Crest Elevation	0.00 ft
Tailwater Elevation	0.29 ft
Crest Surface Type	Paved
Crest Breadth	0.50 ft
Crest Length	10.0 ft





DE7 - Normal Depth @ 0.50% Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.50 %
Discharge	5.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.0	1.00
0+00.0	0.10
0+05.0	0.00
0+10.0	0.10
0+10.0	1.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 1.00)	(0+10.0, 1.00)	0.013

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	0.24 ft
Roughness Coefficient	0.013
Elevation	0.24 ft
Elevation Range	0.0 to 1.0 ft
Flow Area	1.9 ft²
Wetted Perimeter	10.3 ft
Hydraulic Radius	0.18 ft
Top Width	10.00 ft
Normal Depth	0.24 ft
Critical Depth	0.25 ft
Critical Slope	0.44 %
Velocity	2.63 ft/s
Velocity Head	0.11 ft
Specific Energy	0.35 ft
Froude Number	1.063
Flow Type	Supercritical

DE7 - Normal Depth @ 0.50% Report

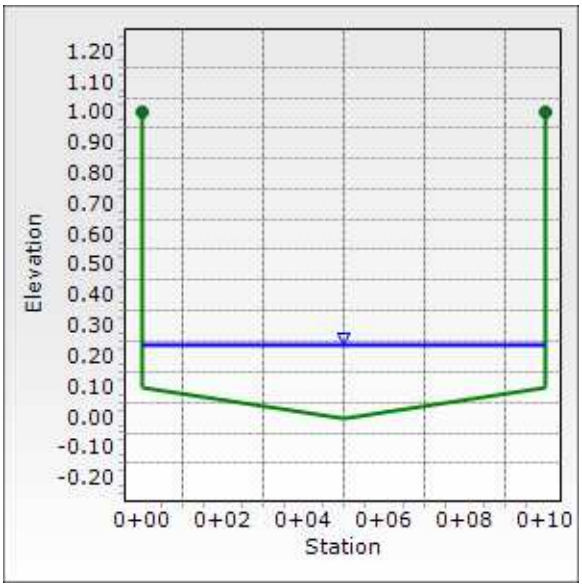
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.0 ft
Number Of Steps	0

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	0.24 ft
Critical Depth	0.25 ft
Channel Slope	0.50 %
Critical Slope	0.44 %

DE7 - Normal Depth @ 0.50% Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.50 %
Normal Depth	0.24 ft
Discharge	5.00 cfs



DE7 - Normal Depth @ 3.58% Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.58 %
Discharge	5.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.0	1.00
0+00.0	0.10
0+05.0	0.00
0+10.0	0.10
0+10.0	1.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 1.00)	(0+10.0, 1.00)	0.013

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	0.16 ft
Roughness Coefficient	0.013
Elevation	0.16 ft
Elevation Range	0.0 to 1.0 ft
Flow Area	1.1 ft²
Wetted Perimeter	10.1 ft
Hydraulic Radius	0.10 ft
Top Width	10.00 ft
Normal Depth	0.16 ft
Critical Depth	0.25 ft
Critical Slope	0.44 %
Velocity	4.76 ft/s
Velocity Head	0.35 ft
Specific Energy	0.51 ft
Froude Number	2.590
Flow Type	Supercritical

DE7 - Normal Depth @ 3.58% Report

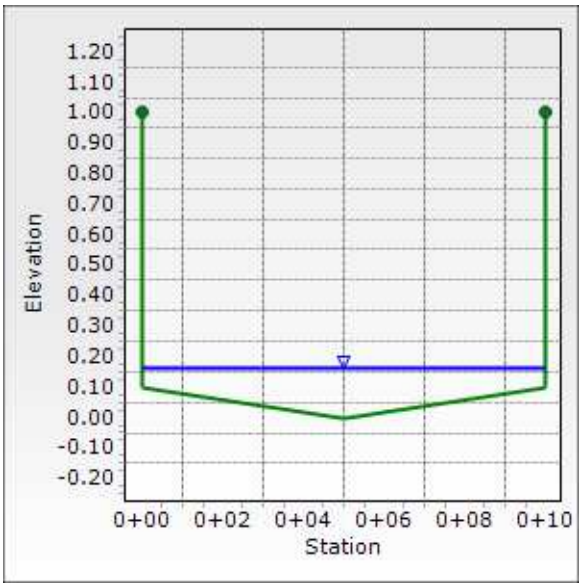
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.0 ft
Number Of Steps	0

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	0.16 ft
Critical Depth	0.25 ft
Channel Slope	3.58 %
Critical Slope	0.44 %

DE7 - Normal Depth @ 3.58% Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.58 %
Normal Depth	0.16 ft
Discharge	5.00 cfs



DE7 - Weir Report

Project Description	
Solve For	Headwater Elevation

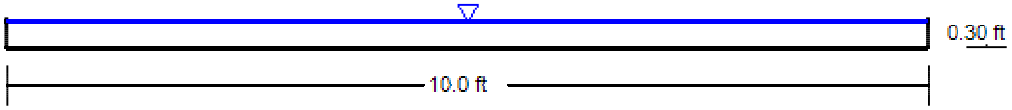
Input Data	
Discharge	5.00 cfs
Crest Elevation	0.00 ft
Tailwater Elevation	0.16 ft
Crest Surface Type	Paved
Crest Breadth	0.50 ft
Crest Length	10.0 ft

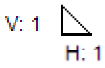
Results	
Headwater Elevation	0.30 ft
Headwater Height Above Crest	0.30 ft
Tailwater Height Above Crest	0.16 ft
Weir Coefficient	3.09 ft^(1/2)/s
Submergence Factor	1.000
Adjusted Weir Coefficient	3.09 ft^(1/2)/s
Flow Area	3.0 ft²
Velocity	1.68 ft/s
Wetted Perimeter	10.6 ft
Top Width	10.00 ft

DE7 - Weir Section

Project Description	
Solve For	Headwater Elevation

Input Data	
Discharge	5.00 cfs
Headwater Elevation	0.30 ft
Crest Elevation	0.00 ft
Tailwater Elevation	0.16 ft
Crest Surface Type	Paved
Crest Breadth	0.50 ft
Crest Length	10.0 ft





DE8 - Normal Depth @ 2.50% Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.50 %
Discharge	41.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.0	1.00
0+00.0	0.00
0+05.0	0.00
0+19.5	0.00
0+19.5	1.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 1.00)	(0+19.5, 1.00)	0.013

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	0.28 ft
Roughness Coefficient	0.013
Elevation	0.28 ft
Elevation Range	0.0 to 1.0 ft
Flow Area	5.4 ft²
Wetted Perimeter	20.1 ft
Hydraulic Radius	0.27 ft
Top Width	19.50 ft
Normal Depth	0.28 ft
Critical Depth	0.52 ft
Critical Slope	0.33 %
Velocity	7.56 ft/s
Velocity Head	0.89 ft
Specific Energy	1.17 ft
Froude Number	2.528
Flow Type	Supercritical

DE8 - Normal Depth @ 2.50% Report

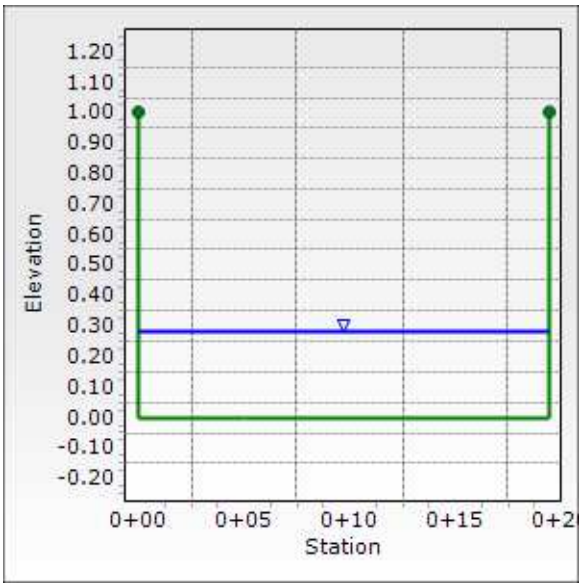
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.0 ft
Number Of Steps	0

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	0.28 ft
Critical Depth	0.52 ft
Channel Slope	2.50 %
Critical Slope	0.33 %

DE8 - Normal Depth @ 2.50% Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.50 %
Normal Depth	0.28 ft
Discharge	41.00 cfs



DE8 - Normal Depth @ 3.40% Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.40 %
Discharge	41.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.0	1.00
0+00.0	0.00
0+05.0	0.00
0+19.0	0.00
0+19.0	1.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 1.00)	(0+19.0, 1.00)	0.013

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	0.26 ft
Roughness Coefficient	0.013
Elevation	0.26 ft
Elevation Range	0.0 to 1.0 ft
Flow Area	4.9 ft²
Wetted Perimeter	19.5 ft
Hydraulic Radius	0.25 ft
Top Width	19.00 ft
Normal Depth	0.26 ft
Critical Depth	0.53 ft
Critical Slope	0.33 %
Velocity	8.39 ft/s
Velocity Head	1.09 ft
Specific Energy	1.35 ft
Froude Number	2.914
Flow Type	Supercritical

DE8 - Normal Depth @ 3.40% Report

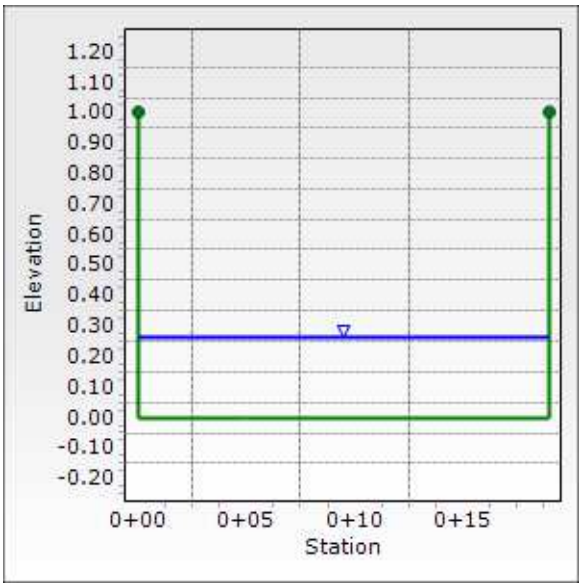
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.0 ft
Number Of Steps	0

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	0.26 ft
Critical Depth	0.53 ft
Channel Slope	3.40 %
Critical Slope	0.33 %

DE8 - Normal Depth @ 3.40% Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.40 %
Normal Depth	0.26 ft
Discharge	41.00 cfs



DE8 - Normal Depth @ 3.70% Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.70 %
Discharge	41.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.0	1.00
0+00.0	0.00
0+05.0	0.00
0+11.0	0.00
0+11.0	1.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 1.00)	(0+11.0, 1.00)	0.013

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	0.35 ft
Roughness Coefficient	0.013
Elevation	0.35 ft
Elevation Range	0.0 to 1.0 ft
Flow Area	3.9 ft²
Wetted Perimeter	11.7 ft
Hydraulic Radius	0.33 ft
Top Width	11.00 ft
Normal Depth	0.35 ft
Critical Depth	0.76 ft
Critical Slope	0.32 %
Velocity	10.55 ft/s
Velocity Head	1.73 ft
Specific Energy	2.08 ft
Froude Number	3.128
Flow Type	Supercritical

DE8 - Normal Depth @ 3.70% Report

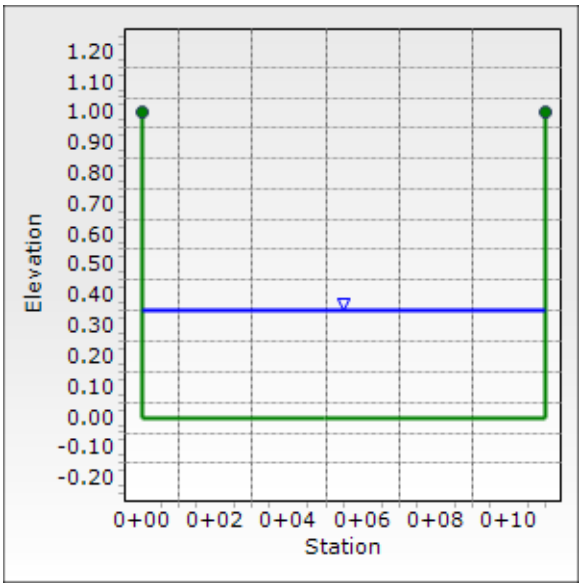
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.0 ft
Number Of Steps	0

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	0.35 ft
Critical Depth	0.76 ft
Channel Slope	3.70 %
Critical Slope	0.32 %

DE8 - Normal Depth @ 3.70% Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.70 %
Normal Depth	0.35 ft
Discharge	41.00 cfs



DE8 - Weir Report

Project Description	
Solve For	Headwater Elevation

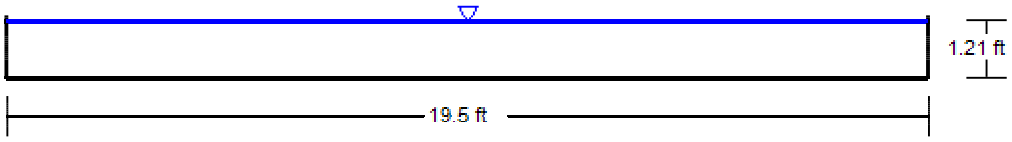
Input Data	
Discharge	41.00 cfs
Crest Elevation	0.00 ft
Tailwater Elevation	1.17 ft
Crest Surface Type	Paved
Crest Breadth	0.50 ft
Crest Length	19.5 ft

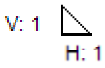
Results	
Headwater Elevation	1.21 ft
Headwater Height Above Crest	1.21 ft
Tailwater Height Above Crest	1.17 ft
Weir Coefficient	3.09 ft^(1/2)/s
Submergence Factor	0.512
Adjusted Weir Coefficient	1.58 ft^(1/2)/s
Flow Area	23.6 ft²
Velocity	1.74 ft/s
Wetted Perimeter	21.9 ft
Top Width	19.50 ft

DE8 - Weir Section

Project Description	
Solve For	Headwater Elevation

Input Data	
Discharge	41.00 cfs
Headwater Elevation	1.21 ft
Crest Elevation	0.00 ft
Tailwater Elevation	1.17 ft
Crest Surface Type	Paved
Crest Breadth	0.50 ft
Crest Length	19.5 ft





DE9 - Normal Depth @ 2.40% Report

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.40 %
Discharge	16.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.0	1.00
0+00.0	0.00
0+09.0	0.00
0+09.0	1.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 1.00)	(0+09.0, 1.00)	0.013

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	0.26 ft
Roughness Coefficient	0.013
Elevation	0.26 ft
Elevation Range	0.0 to 1.0 ft
Flow Area	2.3 ft²
Wetted Perimeter	9.5 ft
Hydraulic Radius	0.24 ft
Top Width	9.00 ft
Normal Depth	0.26 ft
Critical Depth	0.46 ft
Critical Slope	0.36 %
Velocity	6.91 ft/s
Velocity Head	0.74 ft
Specific Energy	1.00 ft
Froude Number	2.401
Flow Type	Supercritical

GVF Input Data

DE9 - Normal Depth @ 2.40% Report

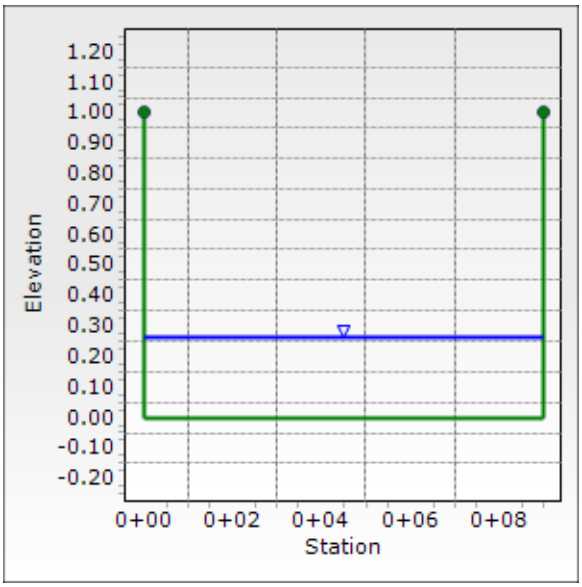
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.0 ft
Number Of Steps	0

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	0.26 ft
Critical Depth	0.46 ft
Channel Slope	2.40 %
Critical Slope	0.36 %

DE9 - Normal Depth @ 2.40% Section

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.40 %
Normal Depth	0.26 ft
Discharge	16.00 cfs



DE9 - Weir Report

Project Description	
Solve For	Headwater Elevation

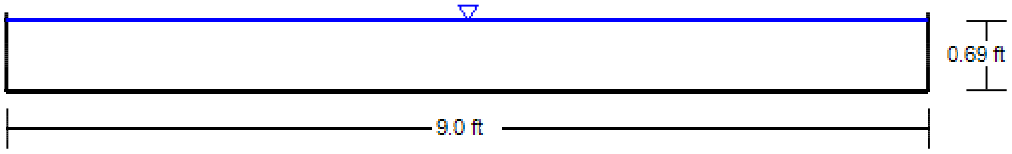
Input Data	
Discharge	16.00 cfs
Crest Elevation	0.00 ft
Tailwater Elevation	0.26 ft
Crest Surface Type	Paved
Crest Breadth	0.50 ft
Crest Length	9.0 ft

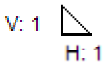
Results	
Headwater Elevation	0.69 ft
Headwater Height Above Crest	0.69 ft
Tailwater Height Above Crest	0.26 ft
Weir Coefficient	3.09 ft^(1/2)/s
Submergence Factor	1.000
Adjusted Weir Coefficient	3.09 ft^(1/2)/s
Flow Area	6.2 ft²
Velocity	2.57 ft/s
Wetted Perimeter	10.4 ft
Top Width	9.00 ft

DE9 - Weir Section

Project Description	
Solve For	Headwater Elevation

Input Data	
Discharge	16.00 cfs
Headwater Elevation	0.69 ft
Crest Elevation	0.00 ft
Tailwater Elevation	0.26 ft
Crest Surface Type	Paved
Crest Breadth	0.50 ft
Crest Length	9.0 ft





APPENDIX D

Storm Drain Analyses

Inlet Sizing Computations

Grate Inlet Sizing Computation

Project Name & Number: Grand Canyon & Washburn, LEN2206
Date: March 2023
By: KC

Westwood

Notes:

Facility ID:	Future SDDI#1a
Drainage Condition:	Proposed
Source of Flow:	Q100= 1/4 * CP2.1
Inlet Type:	NDOT Type 2
Inlet Size:	5'x6'

Known Information:

Q =	Flow (cfs)	21.0
W =	Width of Grate (ft)	5.00
L =	Length of Grate (ft)	6.00
D =	Diameter of Circle (in)	
Cf =	Clogging Factor (%)	50

Weir Conditions:

$$HW = (Q/(Cw*Pc))^{2/3}$$

Cw =	Weir Coefficient	3.00
P =	Perimeter of grate (ft)	22.0
Pc =	Perimeter (w/clogging) (ft)	11.0
HW =	Headwater depth (ft)	0.74

Orifice Conditions:

$$HW = (Q/(Co*Ac))^2/2*g$$

Co =	Orifice Coefficient	0.65
Ag =	Grate Area (ft^2)	30.00
Gf =	Grate Opening Factor	0.60
Ac =	Grate Open Area (w/ clogging) (ft^2)	9.00
g =	Gravity (fps)	32.20
HW =	Headwater depth (ft)	0.20

Output:

Worst Case Scenario Occurs Under Weir Conditions

Headwater Depth = 0.74 ft with grate

Average Grate Elevation	**2,330.42**
Headwater Elevation	**2,331.16**

Target Headwater Elevation = 2331.71

Grate Inlet Sizing Computation

Project Name & Number: Grand Canyon & Washburn, LEN2206
Date: March 2023
By: KC

Westwood

Notes:

Facility ID:	Future SDDI#1b
Drainage Condition:	Proposed
Source of Flow:	Q100= 1/4 * CP2.1
Inlet Type:	NDOT Type 2
Inlet Size:	5'x6'

Known Information:

Q =	Flow (cfs)	21.0
W =	Width of Grate (ft)	5.00
L =	Length of Grate (ft)	6.00
D =	Diameter of Circle (in)	
Cf =	Clogging Factor (%)	50

Weir Conditions:

$$HW = (Q/(Cw*Pc))^{2/3}$$

Cw =	Weir Coefficient	3.00
P =	Perimeter of grate (ft)	22.0
Pc =	Perimeter (w/clogging) (ft)	11.0
HW =	Headwater depth (ft)	0.74

Orifice Conditions:

$$HW = (Q/(Co*Ac))^2/2*g$$

Co =	Orifice Coefficient	0.65
Ag =	Grate Area (ft^2)	30.00
Gf =	Grate Opening Factor	0.60
Ac =	Grate Open Area (w/ clogging) (ft^2)	9.00
g =	Gravity (fps)	32.20
HW =	Headwater depth (ft)	0.20

Output:

Worst Case Scenario Occurs Under Weir Conditions

Headwater Depth = 0.74 ft with grate

Average Grate Elevation	**2,330.42**
Headwater Elevation	**2,331.16**

Target Headwater Elevation = 2331.71

Grate Inlet Sizing Computation

Project Name & Number: Grand Canyon & Washburn, LEN2206
Date: March 2023
By: KC

Westwood

Notes:

Facility ID:	Future SDDI#2
Drainage Condition:	Proposed
Source of Flow:	Q100= BAS2E + SBAS7P(I)
Inlet Type:	NDOT Type 2
Inlet Size:	5'x6'

Known Information:

Q =	Flow (cfs)	33.0
W =	Width of Grate (ft)	5.00
L =	Length of Grate (ft)	6.00
D =	Diameter of Circle (in)	
Cf =	Clogging Factor (%)	50

Weir Conditions:

$$HW = (Q/(Cw*Pc))^{2/3}$$

Cw =	Weir Coefficient	3.00
P =	Perimeter of grate (ft)	22.0
Pc =	Perimeter (w/clogging) (ft)	11.0
HW =	Headwater depth (ft)	1.00

Orifice Conditions:

$$HW = (Q/(Co*Ac))^2/2*g$$

Co =	Orifice Coefficient	0.65
Ag =	Grate Area (ft^2)	30.00
Gf =	Grate Opening Factor	0.60
Ac =	Grate Open Area (w/ clogging) (ft^2)	9.00
g =	Gravity (fps)	32.20
HW =	Headwater depth (ft)	0.49

Output:

Worst Case Scenario Occurs Under Weir Conditions

Headwater Depth = 1.00 ft with grate

Average Grate Elevation	**2,330.42**
Headwater Elevation	**2,331.42**

Target Headwater Elevation = 2331.71

Grate Inlet Sizing Computation

Project Name & Number: Grand Canyon & Washburn, LEN2206
Date: March 2023
By: KC

Westwood

Notes:

Facility ID:	Future SDDI#3
Drainage Condition:	Proposed
Source of Flow:	Q100= SBAS7P(J) + SDDI#2 Bypass
Inlet Type:	NDOT Type 2
Inlet Size:	5'x6'

Known Information:

Q =	Flow (cfs)	29.0
W =	Width of Grate (ft)	5.00
L =	Length of Grate (ft)	6.00
D =	Diameter of Circle (in)	
Cf =	Clogging Factor (%)	50

Weir Conditions:

$$HW = (Q/(Cw*Pc))^{2/3}$$

Cw =	Weir Coefficient	3.00
P =	Perimeter of grate (ft)	22.0
Pc =	Perimeter (w/clogging) (ft)	11.0
HW =	Headwater depth (ft)	0.92

Orifice Conditions:

$$HW = (Q/(Co*Ac))^2/2*g$$

Co =	Orifice Coefficient	0.65
Ag =	Grate Area (ft^2)	30.00
Gf =	Grate Opening Factor	0.60
Ac =	Grate Open Area (w/ clogging) (ft^2)	9.00
g =	Gravity (fps)	32.20
HW =	Headwater depth (ft)	0.38

Output:

Worst Case Scenario Occurs Under Weir Conditions

Headwater Depth = 0.92 ft with grate

Average Grate Elevation	**2,330.42**
Headwater Elevation	**2,331.34**

Target Headwater Elevation = 2331.71

Grate Inlet Sizing Computation

Project Name & Number: Grand Canyon & Washburn, LEN2206
Date: March 2023
By: KC

Westwood

Notes:

Facility ID:	Future SDDI#4
Drainage Condition:	Proposed
Source of Flow:	Q100= SBAS7P(K)
Inlet Type:	NDOT Type 2
Inlet Size:	2.5'x2'

Known Information:

Q =	Flow (cfs)	4.0
W =	Width of Grate (ft)	2.50
L =	Length of Grate (ft)	2.00
D =	Diameter of Circle (in)	
Cf =	Clogging Factor (%)	50

Weir Conditions:

$$HW = (Q/(Cw*Pc))^{2/3}$$

Cw =	Weir Coefficient	3.00
P =	Perimeter of grate (ft)	9.0
Pc =	Perimeter (w/clogging) (ft)	4.5
HW =	Headwater depth (ft)	0.44

Orifice Conditions:

$$HW = (Q/(Co*Ac))^2/2*g$$

Co =	Orifice Coefficient	0.65
Ag =	Grate Area (ft^2)	5.00
Gf =	Grate Opening Factor	0.60
Ac =	Grate Open Area (w/ clogging) (ft^2)	1.50
g =	Gravity (fps)	32.20
HW =	Headwater depth (ft)	0.26

Output:

Worst Case Scenario Occurs Under Weir Conditions

Headwater Depth = 0.44 ft with grate

Average Grate Elevation	**2,330.38**
Headwater Elevation	**2,330.82**

Target Headwater Elevation = 2331.71

Grate Inlet Sizing Computation

Project Name & Number: Grand Canyon & Washburn, LEN2206
Date: March 2023
By: KC

Westwood

Notes:

Facility ID:	Future SDDI#5 & SDDI#6
Drainage Condition:	Proposed
Source of Flow:	Q100= 1/2 * CP4.1
Inlet Type:	NDOT Type 2
Inlet Size:	5'x6'

Known Information:

Q =	Flow (cfs)	15.0
W =	Width of Grate (ft)	5.00
L =	Length of Grate (ft)	6.00
D =	Diameter of Circle (in)	
Cf =	Clogging Factor (%)	50

Weir Conditions:

$$HW = (Q/(Cw*Pc))^{2/3}$$

Cw =	Weir Coefficient	3.00
P =	Perimeter of grate (ft)	22.0
Pc =	Perimeter (w/clogging) (ft)	11.0
HW =	Headwater depth (ft)	0.59

Orifice Conditions:

$$HW = (Q/(Co*Ac))^2/2*g$$

Co =	Orifice Coefficient	0.65
Ag =	Grate Area (ft^2)	30.00
Gf =	Grate Opening Factor	0.60
Ac =	Grate Open Area (w/ clogging) (ft^2)	9.00
g =	Gravity (fps)	32.20
HW =	Headwater depth (ft)	0.10

Output:

Worst Case Scenario Occurs Under Weir Conditions

Headwater Depth = 0.59 ft with grate

Average Grate Elevation	**2,330.42**
Headwater Elevation	**2,331.01**

Target Headwater Elevation = 2331.71

Grate Inlet Sizing Computation

Project Name & Number: Grand Canyon & Washburn, LEN2206
Date: March 2023
By: KC

Westwood

Notes:

Facility ID:	Future SDDI#7
Drainage Condition:	Proposed
Source of Flow:	Q100= Basin BAS11I
Inlet Type:	NDOT Type 2
Inlet Size:	3'x2'

Known Information:

Q =	Flow (cfs)	5.0
W =	Width of Grate (ft)	3.00
L =	Length of Grate (ft)	2.00
D =	Diameter of Circle (in)	
Cf =	Clogging Factor (%)	50

Weir Conditions:

$$HW = (Q/(Cw*Pc))^{2/3}$$

Cw =	Weir Coefficient	3.00
P =	Perimeter of grate (ft)	10.0
Pc =	Perimeter (w/clogging) (ft)	5.0
HW =	Headwater depth (ft)	0.48

Orifice Conditions:

$$HW = (Q/(Co*Ac))^2/2*g$$

Co =	Orifice Coefficient	0.65
Ag =	Grate Area (ft^2)	6.00
Gf =	Grate Opening Factor	0.60
Ac =	Grate Open Area (w/ clogging) (ft^2)	1.80
g =	Gravity (fps)	32.20
HW =	Headwater depth (ft)	0.28

Output:

Worst Case Scenario Occurs Under Weir Conditions

Headwater Depth = 0.48 ft with grate

Average Grate Elevation	**2,330.38**
Headwater Elevation	**2,330.86**

Target Headwater Elevation = 2331.71

Grate Inlet Sizing Computation

Project Name & Number: Grand Canyon & Washburn, LEN2206
Date: March 2023
By: KC

Westwood

Notes:

Facility ID:	Future SDDI#8
Drainage Condition:	Proposed
Source of Flow:	Q100= 1/2 * CP5.1
Inlet Type:	NDOT Type 2
Inlet Size:	5'x6'

Known Information:

Q =	Flow (cfs)	13.0
W =	Width of Grate (ft)	5.00
L =	Length of Grate (ft)	6.00
D =	Diameter of Circle (in)	
Cf =	Clogging Factor (%)	50

Weir Conditions:

$$HW = (Q/(Cw*Pc))^{2/3}$$

Cw =	Weir Coefficient	3.00
P =	Perimeter of grate (ft)	22.0
Pc =	Perimeter (w/clogging) (ft)	11.0
HW =	Headwater depth (ft)	0.54

Orifice Conditions:

$$HW = (Q/(Co*Ac))^2/2*g$$

Co =	Orifice Coefficient	0.65
Ag =	Grate Area (ft^2)	30.00
Gf =	Grate Opening Factor	0.60
Ac =	Grate Open Area (w/ clogging) (ft^2)	9.00
g =	Gravity (fps)	32.20
HW =	Headwater depth (ft)	0.08

Output:

Worst Case Scenario Occurs Under Weir Conditions

Headwater Depth = 0.54 ft with grate

Average Grate Elevation	**2,330.42**
Headwater Elevation	**2,330.96**

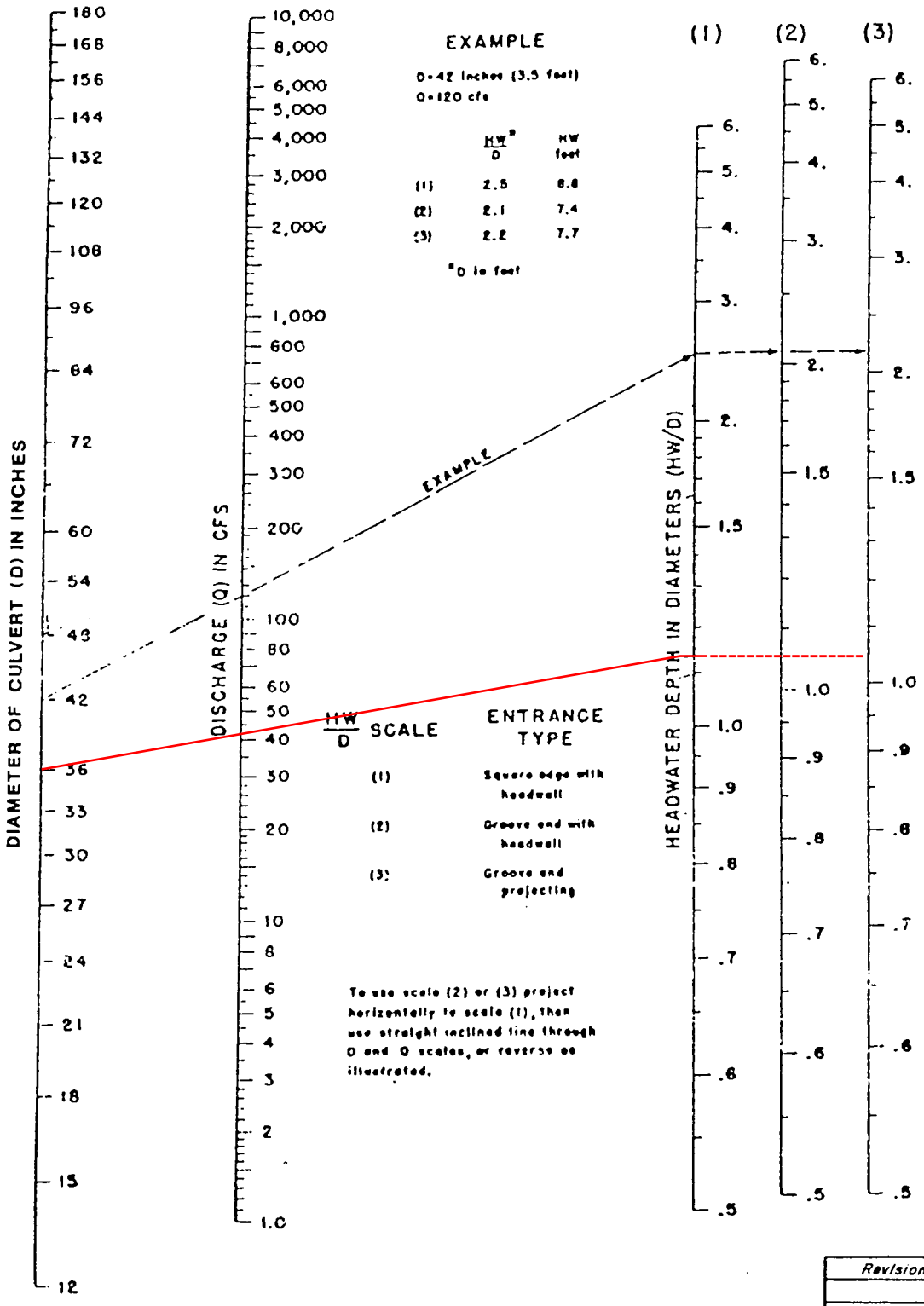
Target Headwater Elevation = 2331.71

Inlet Control Nomographs

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

NOMOGRAPH – INLET CONTROL RCP

FACILITY F1: Q=42 CFS



HW/D	1.13
D	36
HW	3.4

Revision	Date

WRC ENGINEERING

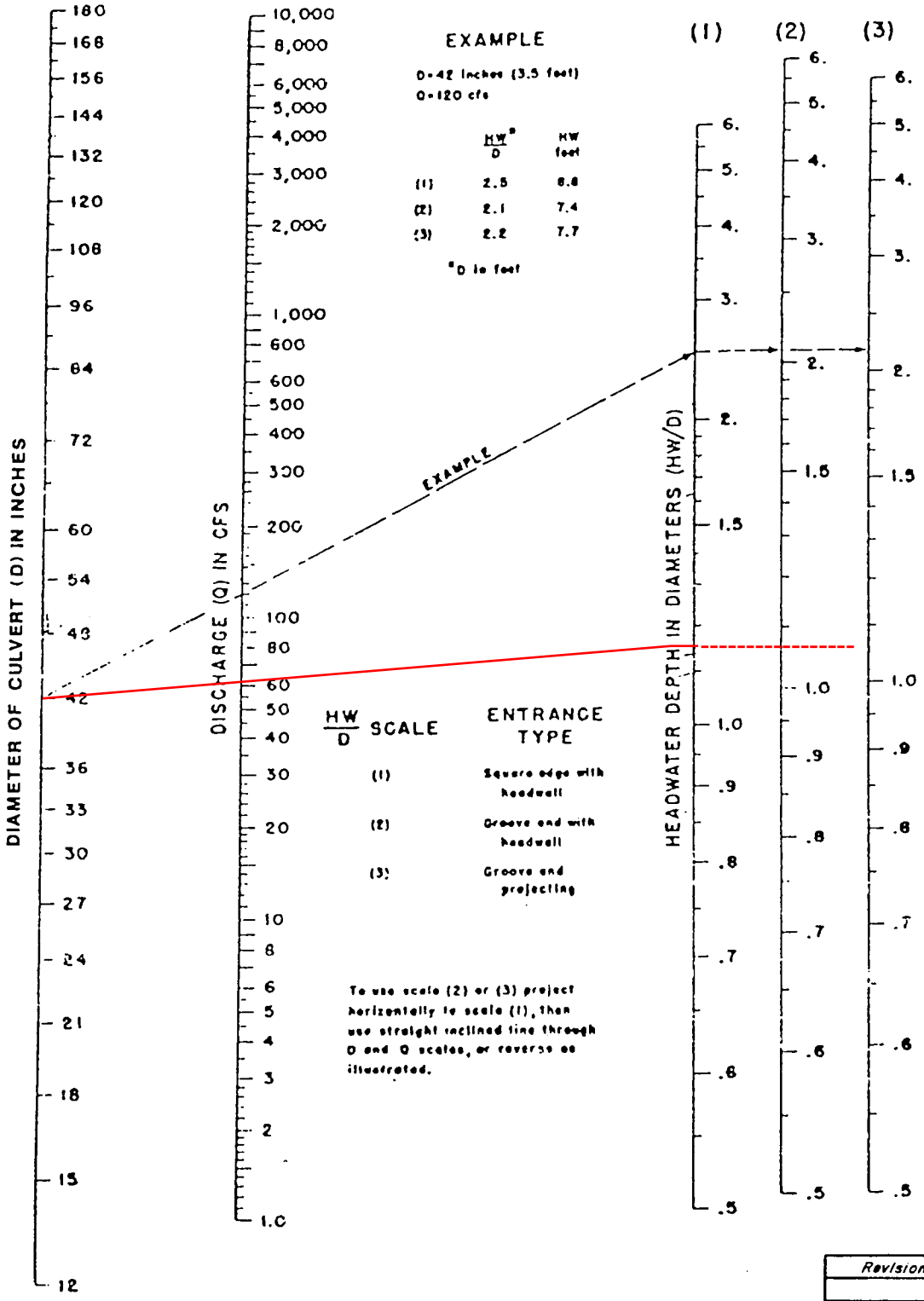
REFERENCE: USDOT, FHWA, HDS, No. 5, 1985

FIGURE 1005

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

NOMOGRAPH – INLET CONTROL RCP

FACILITY F2: Q=62 CFS



HW/D 1.16

D 42

HW 4.1

Revision	Date

WRC ENGINEERING

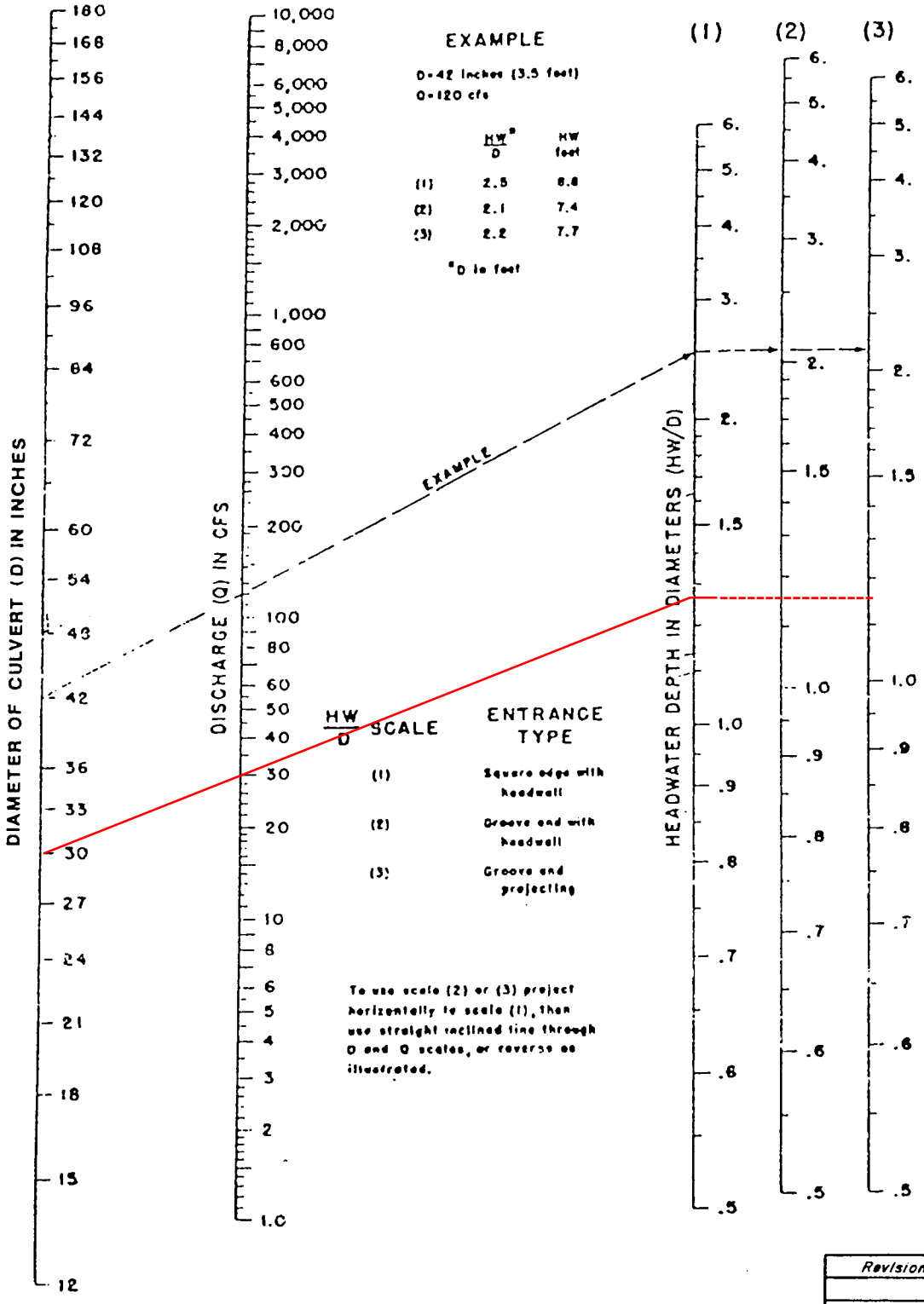
REFERENCE: USDOT, FHWA, HDS, No. 5, 1985

FIGURE 1005

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

NOMOGRAPH – INLET CONTROL RCP

FACILITY F3: Q=30 CFS



Revision	Date

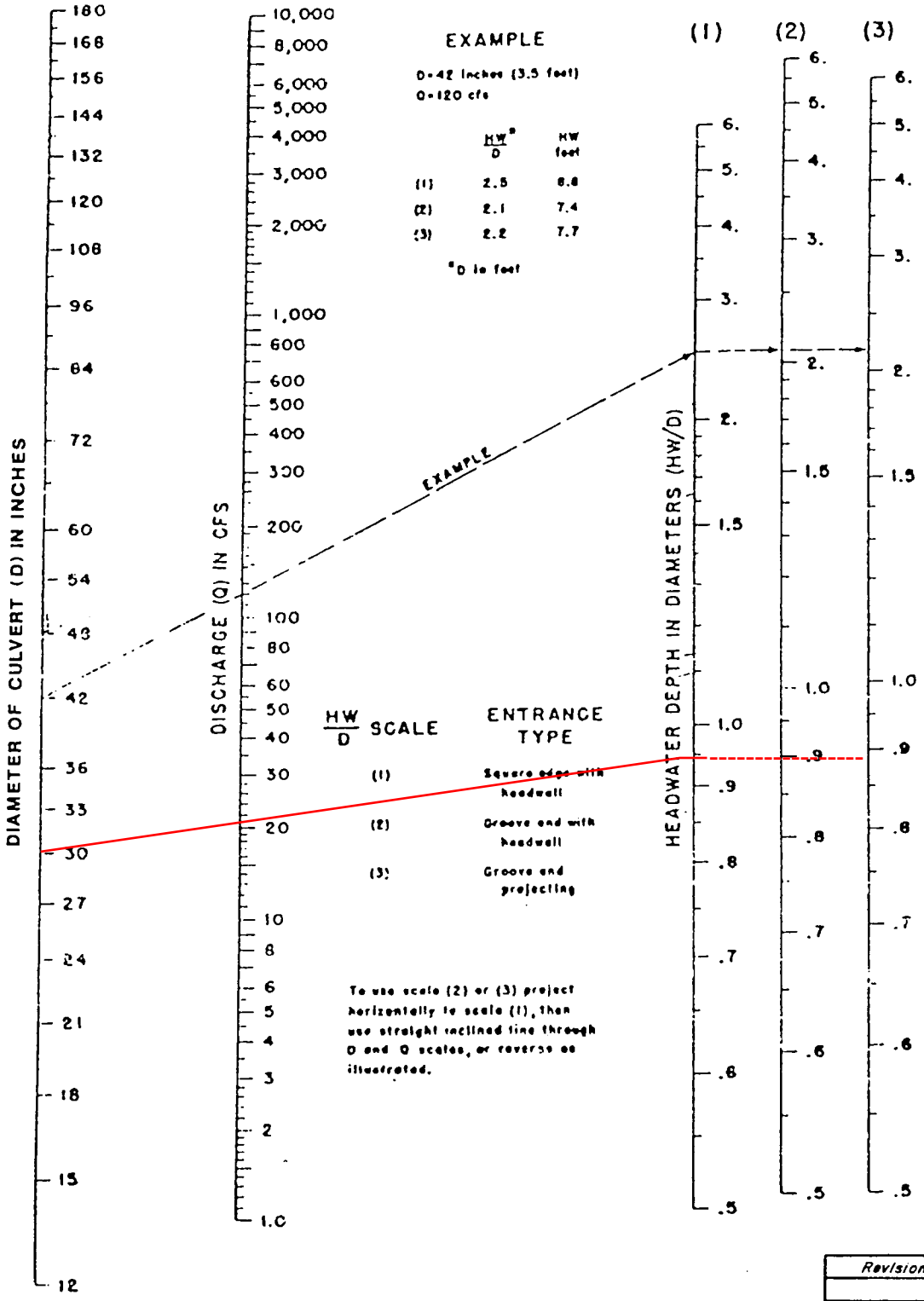
WRC ENGINEERING

REFERENCE: USDOT, FHWA, HDS, No. 5, 1985

FIGURE 1005

NOMOGRAPH – INLET CONTROL RCP

FACILITY FDI1a: Q=21 CFS



HW/D	0.94
D	30
HW	2.4

Revision	Date

WRC ENGINEERING

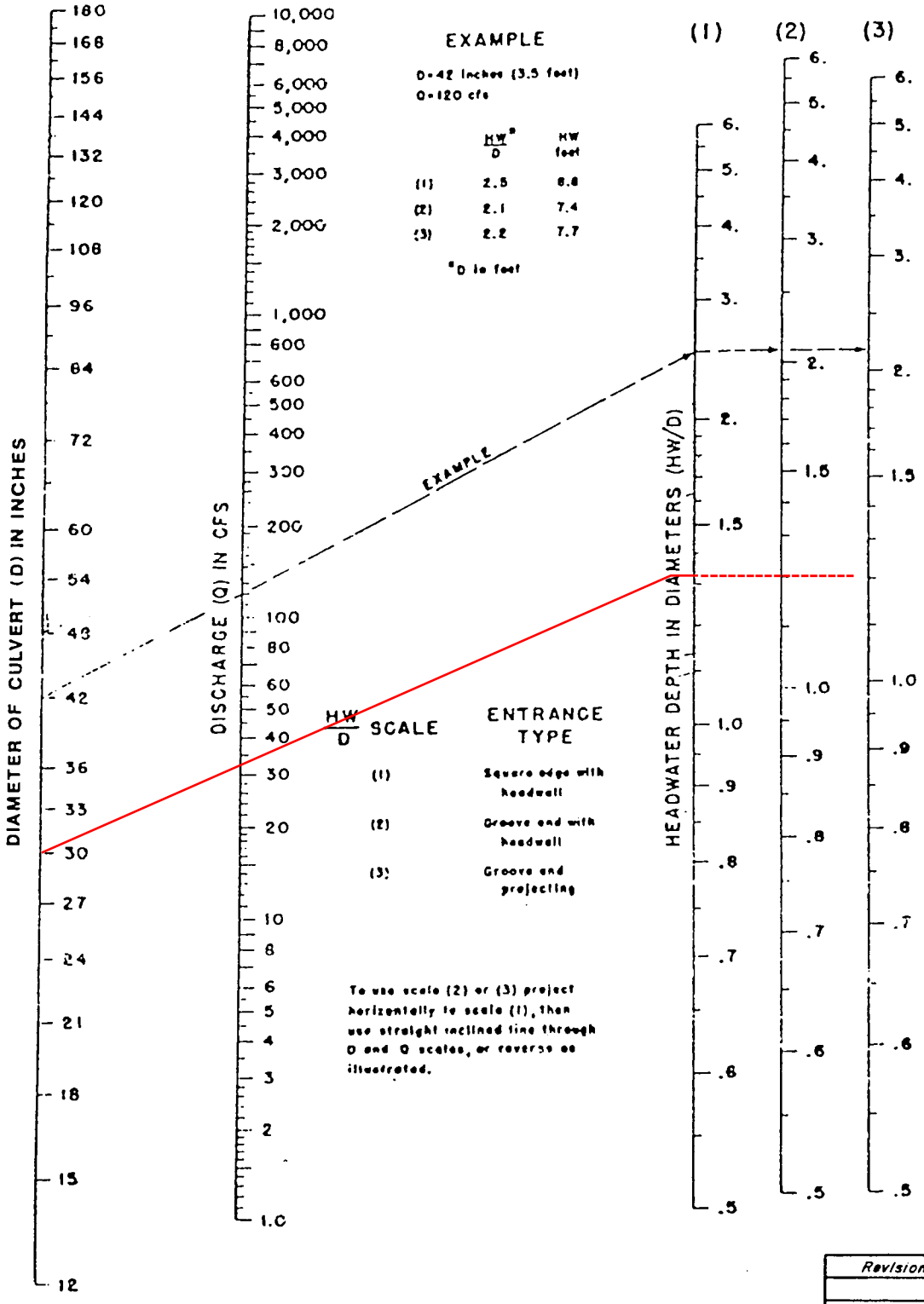
REFERENCE:
USDOT, FHWA, HDS, No. 5, 1985

FIGURE 1005

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

NOMOGRAPH – INLET CONTROL RCP

FACILITY FDI2: Q=33 CFS



HW/D	1.32
D	30
HW	3.3

Revision	Date

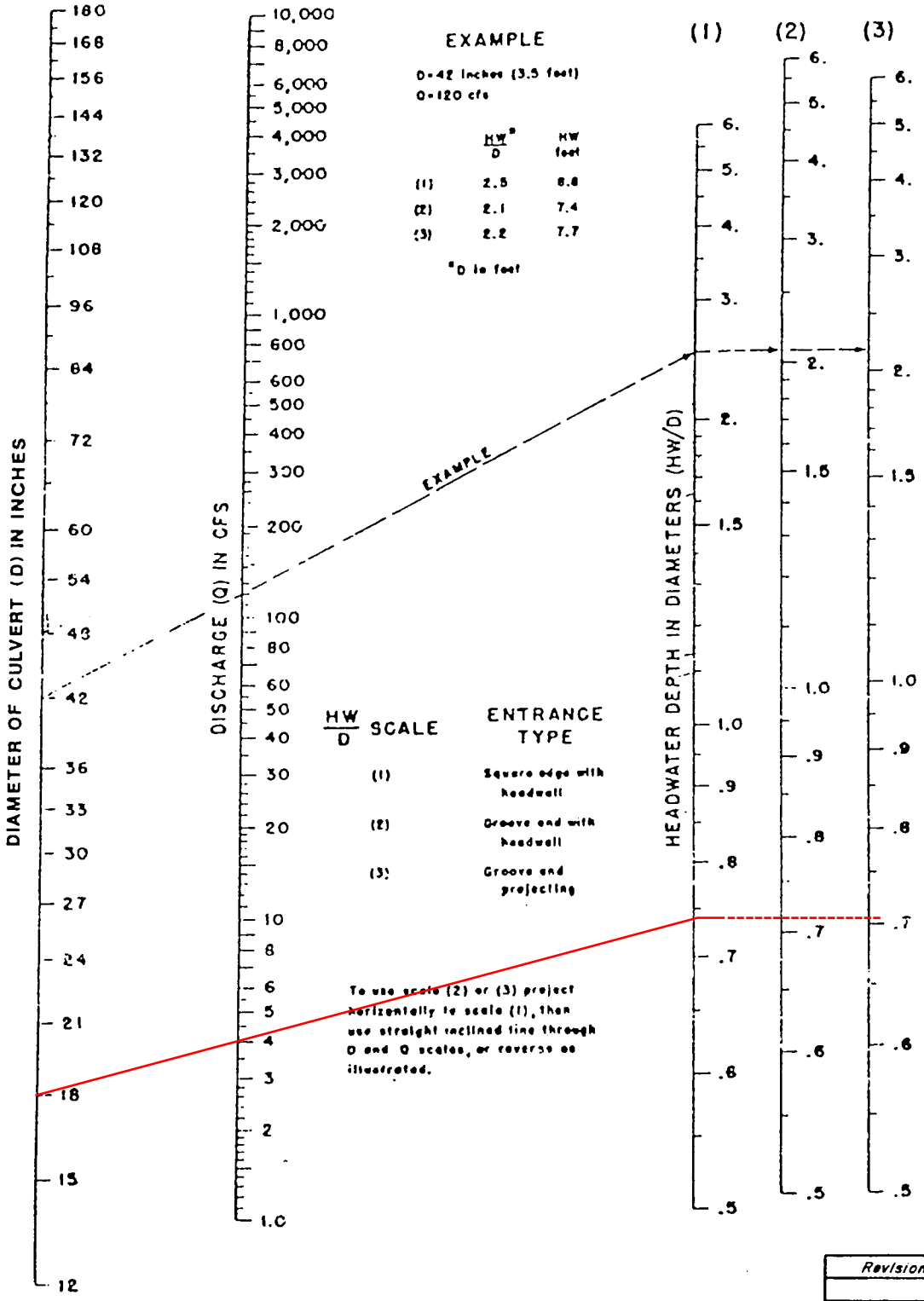
WRC ENGINEERING

REFERENCE: USDOT, FHWA, HDS, No. 5, 1985

FIGURE 1005

NOMOGRAPH – INLET CONTROL RCP

FACILITY FDI4: Q=4 CFS



HW/D	.74
D	18
HW	1.1

Revision	Date

WRC ENGINEERING

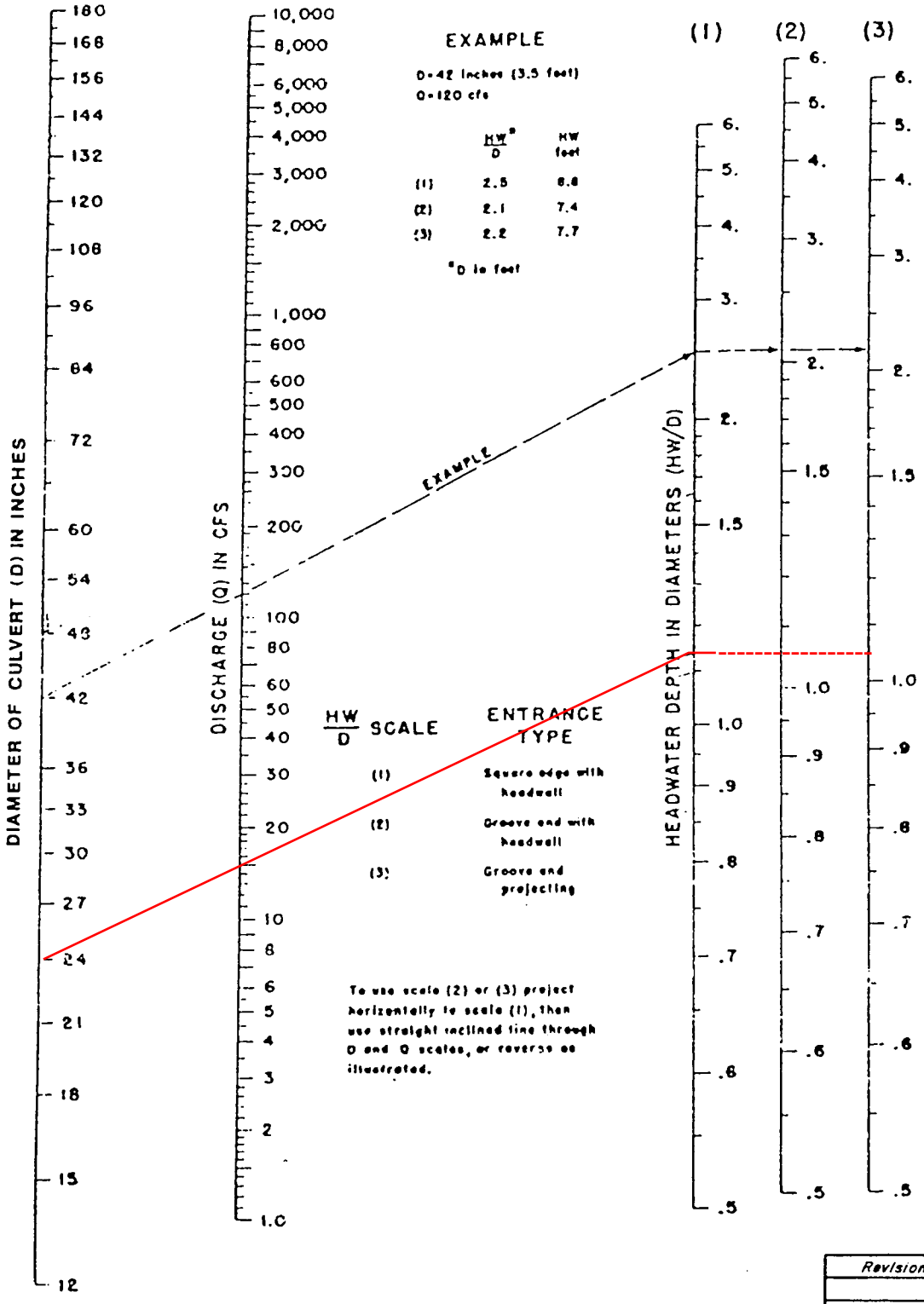
REFERENCE:
USDOT, FHWA, HDS, No. 5, 1985

FIGURE 1005

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

NOMOGRAPH – INLET CONTROL RCP

FACILITY FDI5: Q=15 CFS



Revision	Date

WRC ENGINEERING

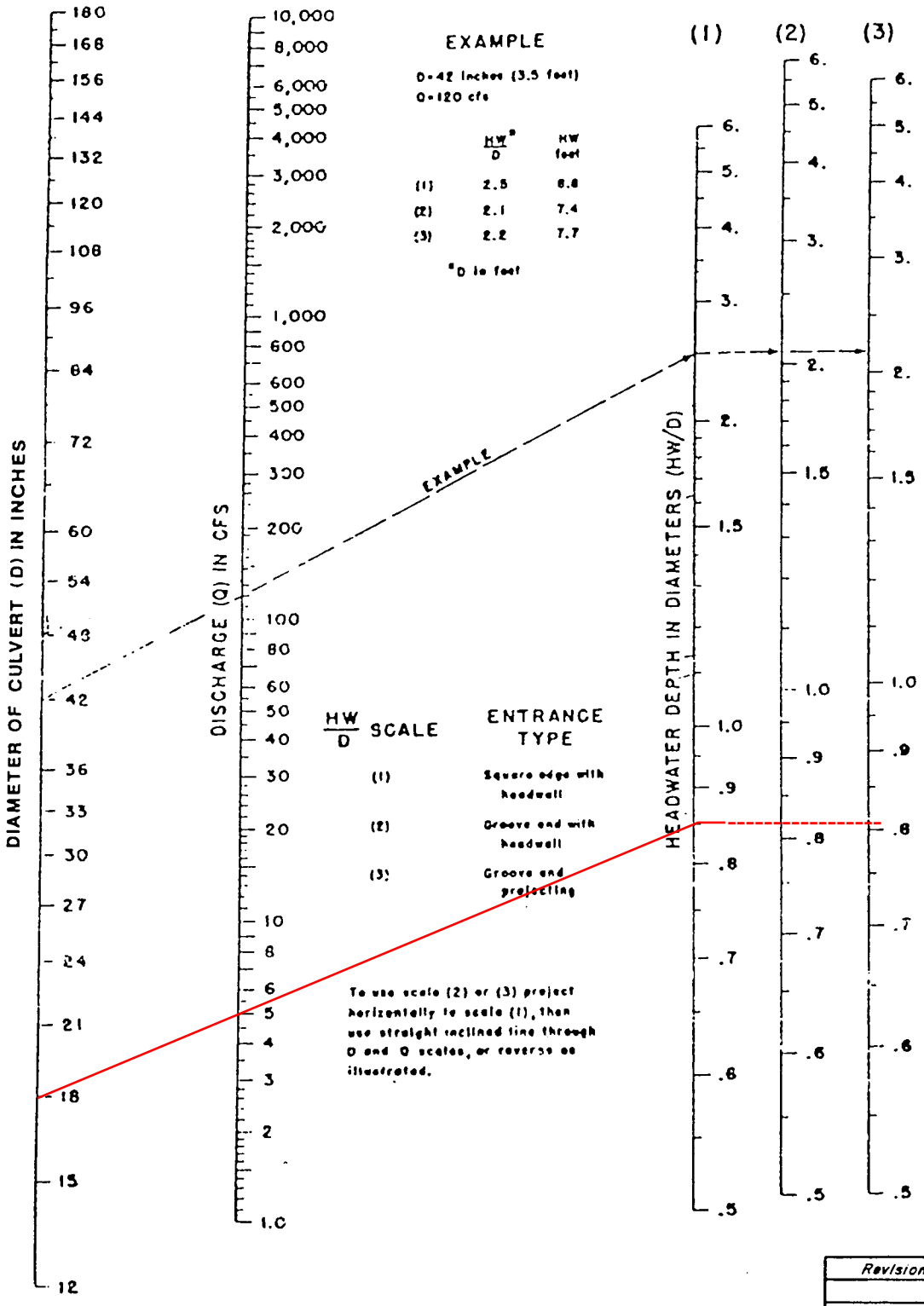
REFERENCE:
USDOT, FHWA, HDS, No. 5, 1985

FIGURE 1005

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

NOMOGRAPH – INLET CONTROL RCP

FACILITY FDI7: Q=5 CFS



HW/D	0.85
D	18
HW	1.3

Revision	Date

WRC ENGINEERING

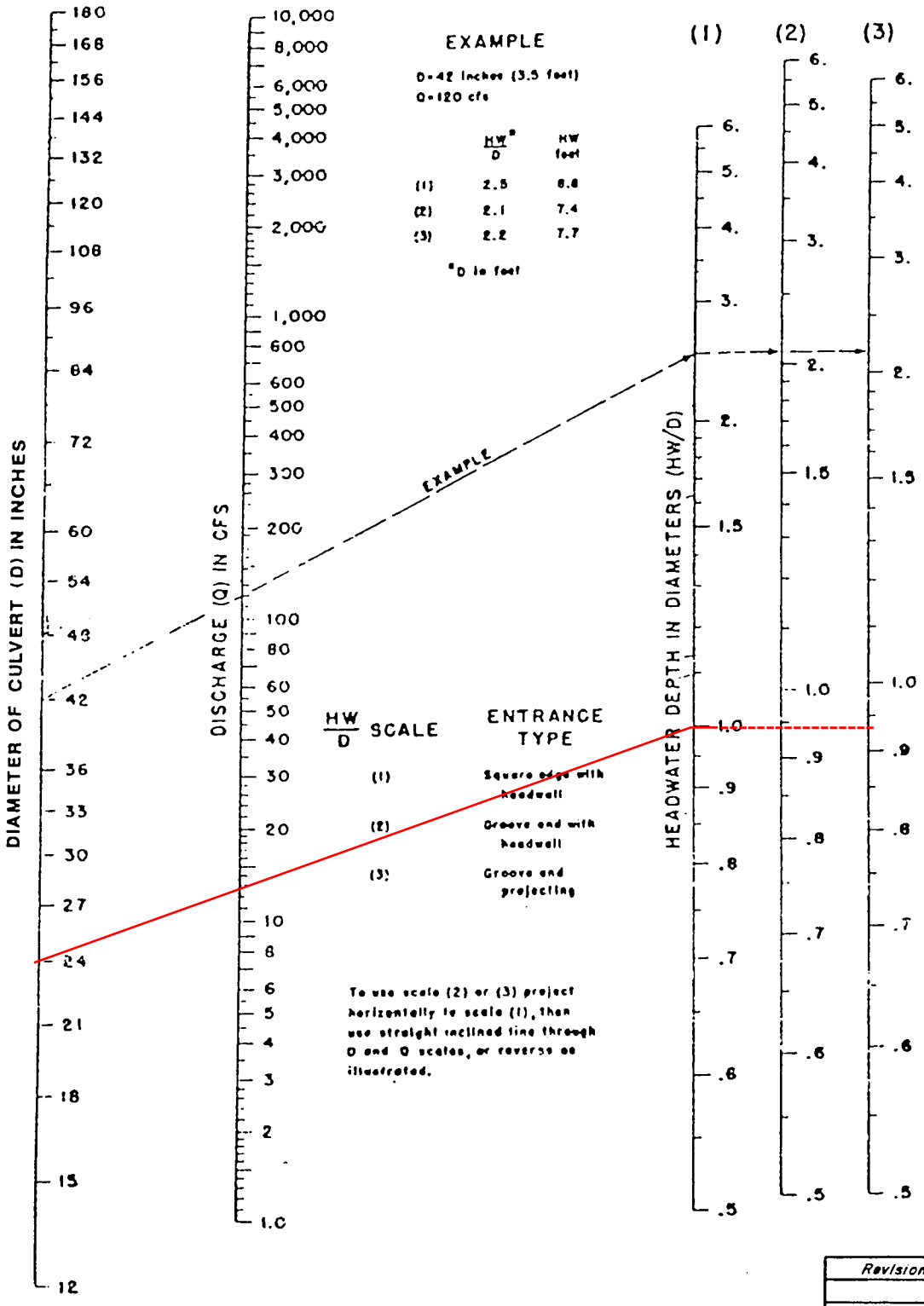
REFERENCE:
USDOT, FHWA, HDS, No. 5, 1985

FIGURE 1005

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

NOMOGRAPH – INLET CONTROL RCP

FACILITY FDI8: Q=13 CFS



HW/D 1.0

D 24

HW 2.0

Revision	Date

WRC ENGINEERING

REFERENCE: USDOT, FHWA, HDS, No. 5, 1985

FIGURE 1005

Lateral Sizing Computations

Worksheet for F1 Lateral

Project Description	
Friction Method	Manning Formula
Solve For	Full Flow Diameter

Input Data	
Roughness Coefficient	0.013
Channel Slope	1.00 %
Normal Depth	2.52 ft
Diameter	30.3 in
Discharge	42.0 cfs

Results	
Diameter	30.3 in
Normal Depth	2.52 ft
Flow Area	5.0 ft²
Wetted Perimeter	7.92 ft
Hydraulic Radius	0.63 ft
Top Width	0.00 ft
Critical Depth	2.17 ft
Percent Full	100.00 %
Critical Slope	0.92 %
Velocity	8.41 ft/s
Velocity Head	1.10 ft
Specific Energy	3.62 ft
Froude Number	(N/A)
Maximum Discharge	45.2 cfs
Discharge Full	42.0 cfs
Slope Full	1.00 %
Flow Type	Undefined

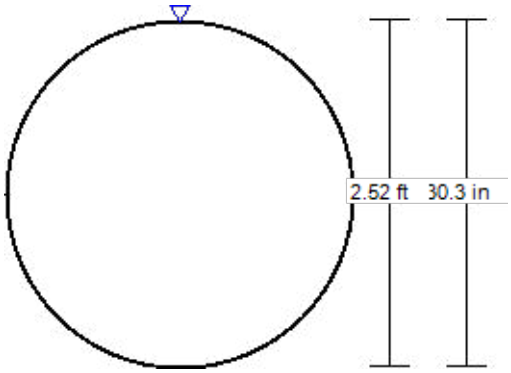
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

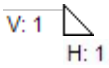
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.00 %
Normal Depth Over Rise	100.00 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	2.52 ft
Critical Depth	2.17 ft
Channel Slope	1.00 %
Critical Slope	0.92 %

Cross Section for F1 Lateral

Project Description	
Friction Method	Manning Formula
Solve For	Full Flow Diameter

Input Data	
Roughness Coefficient	0.013
Channel Slope	1.00 %
Normal Depth	2.52 ft
Diameter	30.3 in
Discharge	42.0 cfs





Worksheet for F2 Lateral

Project Description	
Friction Method	Manning Formula
Solve For	Full Flow Diameter

Input Data	
Roughness Coefficient	0.013
Channel Slope	1.00 %
Normal Depth	2.92 ft
Diameter	35.0 in
Discharge	62.0 cfs

Results	
Diameter	35.0 in
Normal Depth	2.92 ft
Flow Area	6.7 ft²
Wetted Perimeter	9.17 ft
Hydraulic Radius	0.73 ft
Top Width	0.00 ft
Critical Depth	2.54 ft
Percent Full	100.00 %
Critical Slope	0.91 %
Velocity	9.26 ft/s
Velocity Head	1.33 ft
Specific Energy	4.25 ft
Froude Number	(N/A)
Maximum Discharge	66.7 cfs
Discharge Full	62.0 cfs
Slope Full	1.00 %
Flow Type	Undefined

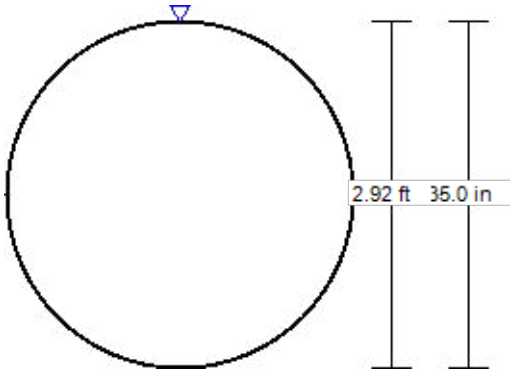
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

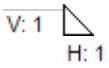
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.00 %
Normal Depth Over Rise	100.00 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	2.92 ft
Critical Depth	2.54 ft
Channel Slope	1.00 %
Critical Slope	0.91 %

Cross Section for F2 Lateral

Project Description	
Friction Method	Manning Formula
Solve For	Full Flow Diameter

Input Data	
Roughness Coefficient	0.013
Channel Slope	1.00 %
Normal Depth	2.92 ft
Diameter	35.0 in
Discharge	62.0 cfs





Worksheet for F3 Lateral

Project Description	
Friction Method	Manning Formula
Solve For	Full Flow Diameter

Input Data	
Roughness Coefficient	0.013
Channel Slope	1.00 %
Normal Depth	2.22 ft
Diameter	26.7 in
Discharge	30.0 cfs

Results	
Diameter	26.7 in
Normal Depth	2.22 ft
Flow Area	3.9 ft²
Wetted Perimeter	6.98 ft
Hydraulic Radius	0.56 ft
Top Width	0.00 ft
Critical Depth	1.90 ft
Percent Full	100.00 %
Critical Slope	0.94 %
Velocity	7.73 ft/s
Velocity Head	0.93 ft
Specific Energy	3.15 ft
Froude Number	(N/A)
Maximum Discharge	32.3 cfs
Discharge Full	30.0 cfs
Slope Full	1.00 %
Flow Type	Undefined

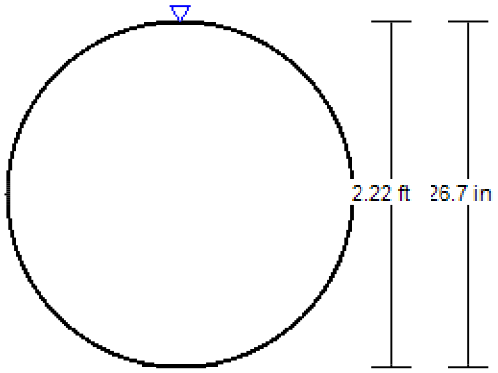
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.00 %
Normal Depth Over Rise	100.00 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	2.22 ft
Critical Depth	1.90 ft
Channel Slope	1.00 %
Critical Slope	0.94 %

Cross Section for F3 Lateral

Project Description	
Friction Method	Manning Formula
Solve For	Full Flow Diameter

Input Data	
Roughness Coefficient	0.013
Channel Slope	1.00 %
Normal Depth	2.22 ft
Diameter	26.7 in
Discharge	30.0 cfs



V: 1
H: 1

Worksheet for FDI1a Lateral

Project Description	
Friction Method	Manning Formula
Solve For	Full Flow Diameter

Input Data	
Roughness Coefficient	0.013
Channel Slope	1.00 %
Normal Depth	1.94 ft
Diameter	23.3 in
Discharge	21.0 cfs

Results	
Diameter	23.3 in
Normal Depth	1.94 ft
Flow Area	3.0 ft²
Wetted Perimeter	6.11 ft
Hydraulic Radius	0.49 ft
Top Width	0.00 ft
Critical Depth	1.65 ft
Percent Full	100.00 %
Critical Slope	0.95 %
Velocity	7.07 ft/s
Velocity Head	0.78 ft
Specific Energy	2.72 ft
Froude Number	(N/A)
Maximum Discharge	22.6 cfs
Discharge Full	21.0 cfs
Slope Full	1.00 %
Flow Type	Undefined

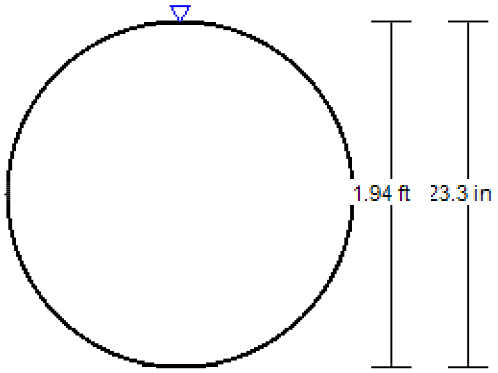
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

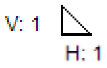
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.00 %
Normal Depth Over Rise	100.00 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.94 ft
Critical Depth	1.65 ft
Channel Slope	1.00 %
Critical Slope	0.95 %

Cross Section for FDI1a Lateral

Project Description	
Friction Method	Manning Formula
Solve For	Full Flow Diameter

Input Data	
Roughness Coefficient	0.013
Channel Slope	1.00 %
Normal Depth	1.94 ft
Diameter	23.3 in
Discharge	21.0 cfs





Worksheet for FDI2 Lateral

Project Description	
Friction Method	Manning Formula
Solve For	Full Flow Diameter

Input Data	
Roughness Coefficient	0.013
Channel Slope	3.50 %
Normal Depth	1.82 ft
Diameter	21.9 in
Discharge	33.0 cfs

Results	
Diameter	21.9 in
Normal Depth	1.82 ft
Flow Area	2.6 ft²
Wetted Perimeter	5.72 ft
Hydraulic Radius	0.46 ft
Top Width	0.00 ft
Critical Depth	1.78 ft
Percent Full	100.00 %
Critical Slope	3.13 %
Velocity	12.66 ft/s
Velocity Head	2.49 ft
Specific Energy	4.31 ft
Froude Number	(N/A)
Maximum Discharge	35.5 cfs
Discharge Full	33.0 cfs
Slope Full	3.50 %
Flow Type	Undefined

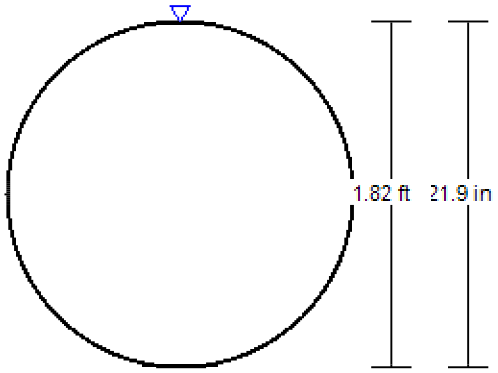
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

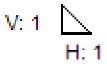
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.00 %
Normal Depth Over Rise	100.00 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.82 ft
Critical Depth	1.78 ft
Channel Slope	3.50 %
Critical Slope	3.13 %

Cross Section for FDI2 Lateral

Project Description	
Friction Method	Manning Formula
Solve For	Full Flow Diameter

Input Data	
Roughness Coefficient	0.013
Channel Slope	3.50 %
Normal Depth	1.82 ft
Diameter	21.9 in
Discharge	33.0 cfs





Worksheet for FDI4 Lateral

Project Description	
Friction Method	Manning Formula
Solve For	Full Flow Diameter

Input Data	
Roughness Coefficient	0.013
Channel Slope	1.00 %
Normal Depth	1.04 ft
Diameter	12.5 in
Discharge	4.0 cfs

Results	
Diameter	12.5 in
Normal Depth	1.04 ft
Flow Area	0.9 ft²
Wetted Perimeter	3.28 ft
Hydraulic Radius	0.26 ft
Top Width	0.00 ft
Critical Depth	0.84 ft
Percent Full	100.00 %
Critical Slope	1.03 %
Velocity	4.67 ft/s
Velocity Head	0.34 ft
Specific Energy	1.38 ft
Froude Number	(N/A)
Maximum Discharge	4.3 cfs
Discharge Full	4.0 cfs
Slope Full	1.00 %
Flow Type	Undefined

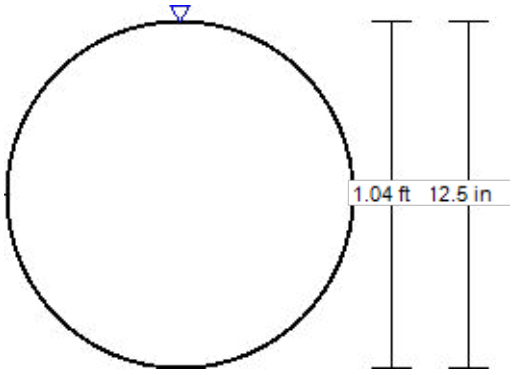
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

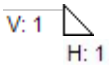
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.00 %
Normal Depth Over Rise	100.00 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.04 ft
Critical Depth	0.84 ft
Channel Slope	1.00 %
Critical Slope	1.03 %

Cross Section for FDI4 Lateral

Project Description	
Friction Method	Manning Formula
Solve For	Full Flow Diameter

Input Data	
Roughness Coefficient	0.013
Channel Slope	1.00 %
Normal Depth	1.04 ft
Diameter	12.5 in
Discharge	4.0 cfs





Worksheet for FDI5 Lateral

Project Description	
Friction Method	Manning Formula
Solve For	Full Flow Diameter

Input Data	
Roughness Coefficient	0.013
Channel Slope	1.75 %
Normal Depth	1.54 ft
Diameter	18.5 in
Discharge	15.0 cfs

Results	
Diameter	18.5 in
Normal Depth	1.54 ft
Flow Area	1.9 ft²
Wetted Perimeter	4.85 ft
Hydraulic Radius	0.39 ft
Top Width	0.00 ft
Critical Depth	1.42 ft
Percent Full	100.00 %
Critical Slope	1.52 %
Velocity	8.01 ft/s
Velocity Head	1.00 ft
Specific Energy	2.54 ft
Froude Number	(N/A)
Maximum Discharge	16.1 cfs
Discharge Full	15.0 cfs
Slope Full	1.75 %
Flow Type	Undefined

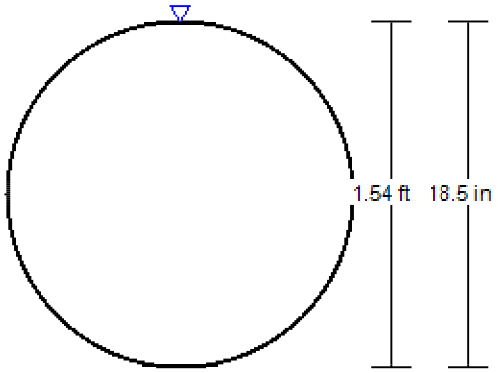
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

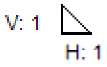
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.00 %
Normal Depth Over Rise	100.00 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.54 ft
Critical Depth	1.42 ft
Channel Slope	1.75 %
Critical Slope	1.52 %

Cross Section for FDI5 Lateral

Project Description	
Friction Method	Manning Formula
Solve For	Full Flow Diameter

Input Data	
Roughness Coefficient	0.013
Channel Slope	1.75 %
Normal Depth	1.54 ft
Diameter	18.5 in
Discharge	15.0 cfs





Worksheet for FDI7 Lateral

Project Description	
Friction Method	Manning Formula
Solve For	Full Flow Diameter

Input Data	
Roughness Coefficient	0.010
Channel Slope	1.00 %
Normal Depth	1.03 ft
Diameter	12.3 in
Discharge	5.0 cfs

Results	
Diameter	12.3 in
Normal Depth	1.03 ft
Flow Area	0.8 ft²
Wetted Perimeter	3.23 ft
Hydraulic Radius	0.26 ft
Top Width	0.00 ft
Critical Depth	0.92 ft
Percent Full	100.00 %
Critical Slope	0.88 %
Velocity	6.01 ft/s
Velocity Head	0.56 ft
Specific Energy	1.59 ft
Froude Number	(N/A)
Maximum Discharge	5.4 cfs
Discharge Full	5.0 cfs
Slope Full	1.00 %
Flow Type	Undefined

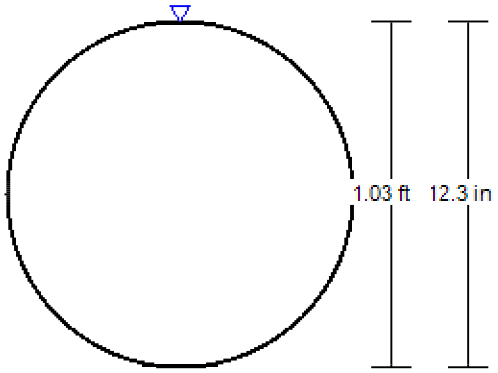
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

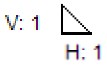
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.00 %
Normal Depth Over Rise	100.00 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.03 ft
Critical Depth	0.92 ft
Channel Slope	1.00 %
Critical Slope	0.88 %

Cross Section for FDI7 Lateral

Project Description	
Friction Method	Manning Formula
Solve For	Full Flow Diameter

Input Data	
Roughness Coefficient	0.010
Channel Slope	1.00 %
Normal Depth	1.03 ft
Diameter	12.3 in
Discharge	5.0 cfs





Worksheet for FDI8 Lateral

Project Description	
Friction Method	Manning Formula
Solve For	Full Flow Diameter

Input Data	
Roughness Coefficient	0.010
Channel Slope	1.00 %
Normal Depth	1.47 ft
Diameter	17.7 in
Discharge	13.0 cfs

Results	
Diameter	17.7 in
Normal Depth	1.47 ft
Flow Area	1.7 ft²
Wetted Perimeter	4.63 ft
Hydraulic Radius	0.37 ft
Top Width	0.00 ft
Critical Depth	1.35 ft
Percent Full	100.00 %
Critical Slope	0.87 %
Velocity	7.63 ft/s
Velocity Head	0.91 ft
Specific Energy	2.38 ft
Froude Number	(N/A)
Maximum Discharge	14.0 cfs
Discharge Full	13.0 cfs
Slope Full	1.00 %
Flow Type	Undefined

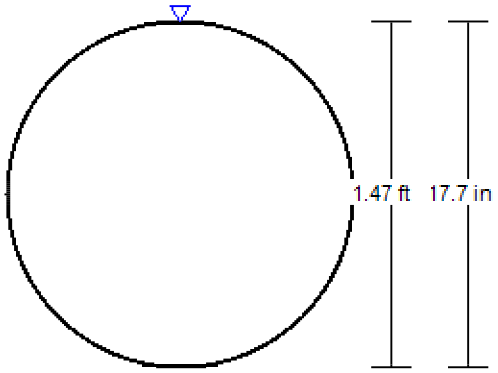
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

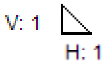
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.00 %
Normal Depth Over Rise	100.00 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.47 ft
Critical Depth	1.35 ft
Channel Slope	1.00 %
Critical Slope	0.87 %

Cross Section for FDI8 Lateral

Project Description	
Friction Method	Manning Formula
Solve For	Full Flow Diameter

Input Data	
Roughness Coefficient	0.010
Channel Slope	1.00 %
Normal Depth	1.47 ft
Diameter	17.7 in
Discharge	13.0 cfs





APPENDIX E

Finished Floor Analysis

Grand Canyon & Washburn FINISHED FLOOR - CITY OF LAS VEGAS JURISDICTION										
INPUT INFORMATION					FINISHED FLOORS					NOTES
Lot Number	Hydraulic Section Utilized	T/C[1] (ft)	F/L[2] (ft)	D_{100} (ft)	Flowline $F.F._{.min}$[3] (ft)	T/C + 6" $F.F._{.min}$[4] (ft)	$F.F._{.Design}$ (ft)	Flowline Check	T/C + 6" Check	See References on Last Sheet
1	2	2691.38	2691.00	0.7	2692.40	2691.88	2693.6	OK	OK	
2	2	2704.00	2703.62	0.7	2705.02	2704.50	2706.1	OK	OK	
3	2	2706.36	2705.98	0.7	2707.38	2706.86	2708.5	OK	OK	
4	2	2706.36	2705.98	0.7	2707.38	2706.86	2708.5	OK	OK	
5	2	2702.91	2702.53	0.7	2703.93	2703.41	2705.0	OK	OK	
6	2	2696.97	2696.59	0.7	2697.99	2697.47	2699.1	OK	OK	
7	1	2695.96	2695.58	0.3	2696.18	2696.46	2698.1	OK	OK	
8	1	2701.90	2701.52	0.3	2702.12	2702.40	2704.0	OK	OK	
9	1	2706.31	2705.93	0.3	2706.53	2706.81	2708.5	OK	OK	
10	1	2706.31	2705.93	0.3	2706.53	2706.81	2708.5	OK	OK	
11	1	2701.90	2701.52	0.3	2702.12	2702.40	2704.0	OK	OK	
12	1	2695.96	2695.58	0.3	2696.18	2696.46	2698.1	OK	OK	
13	1	2697.17	2696.79	0.3	2697.39	2697.67	2699.3	OK	OK	
14	1	2702.45	2702.07	0.3	2702.67	2702.95	2704.6	OK	OK	
15	1	2706.37	2705.99	0.3	2706.59	2706.87	2708.6	OK	OK	
16	1	2706.37	2705.99	0.3	2706.59	2706.87	2708.6	OK	OK	
17	1	2702.45	2702.07	0.3	2702.67	2702.95	2704.6	OK	OK	
18	1	2697.17	2696.79	0.3	2697.39	2697.67	2699.3	OK	OK	
19	1	2692.97	2692.59	0.3	2693.19	2693.47	2696.7	OK	OK	
20	1	2691.89	2691.51	0.3	2692.11	2692.39	2694.4	OK	OK	
21	1	2690.71	2690.33	0.3	2690.93	2691.21	2692.9	OK	OK	
22	1	2691.13	2690.75	0.3	2691.35	2691.63	2693.3	OK	OK	
23	1	2692.80	2692.42	0.3	2693.02	2693.30	2694.9	OK	OK	
24	2	2692.66	2692.28	0.7	2693.68	2693.16	2694.8	OK	OK	
25	2	2691.70	2691.32	0.7	2692.72	2692.20	2693.9	OK	OK	
26	2	2676.99	2676.61	0.7	2678.01	2677.49	2678.9	OK	OK	
27	2	2677.70	2677.32	0.7	2678.72	2678.20	2680.6	OK	OK	
28	2	2677.70	2677.32	0.7	2678.72	2678.20	2680.8	OK	OK	
29	2	2676.99	2676.61	0.7	2678.01	2677.49	2678.9	OK	OK	
30	2	2661.30	2660.92	0.7	2662.32	2661.80	2663.5	OK	OK	
31	2	2662.26	2661.88	0.7	2663.28	2662.76	2665.3	OK	OK	
32	2	2662.26	2661.88	0.7	2663.28	2662.76	2665.3	OK	OK	

Grand Canyon & Washburn FINISHED FLOOR - CITY OF LAS VEGAS JURISDICTION										
INPUT INFORMATION					FINISHED FLOORS					NOTES
Lot Number	Hydraulic Section Utilized	T/C[1] (ft)	F/L[2] (ft)	D_{100} (ft)	Flowline $F.F._{.min}$[3] (ft)	T/C + 6" $F.F._{.min}$[4] (ft)	$F.F._{.Design}$ (ft)	Flowline Check	T/C + 6" Check	See References on Last Sheet
33	2	2661.30	2660.92	0.7	2662.32	2661.80	2663.5	OK	OK	
34	2	2647.26	2646.88	0.7	2648.28	2647.76	2649.4	OK	OK	
35	2	2648.71	2648.33	0.7	2649.73	2649.21	2651.9	OK	OK	
36	2	2648.71	2648.33	0.7	2649.73	2649.21	2651.9	OK	OK	
37	2	2647.26	2646.88	0.7	2648.28	2647.76	2649.4	OK	OK	
38	2	2636.23	2635.85	0.7	2637.25	2636.73	2638.4	OK	OK	
39	2	2637.60	2637.22	0.7	2638.62	2638.10	2640.5	OK	OK	
40	2	2637.60	2637.22	0.7	2638.62	2638.10	2640.5	OK	OK	
41	2	2636.26	2635.88	0.7	2637.28	2636.76	2638.5	OK	OK	
42	2	2629.12	2628.74	0.7	2630.14	2629.62	2631.3	OK	OK	
43	2	2621.15	2620.77	0.7	2622.17	2621.65	2623.3	OK	OK	
44	2	2621.88	2621.50	0.7	2622.90	2622.38	2625.5	OK	OK	
45	2	2621.88	2621.50	0.7	2622.90	2622.38	2625.5	OK	OK	
46	2	2621.10	2620.72	0.7	2622.12	2621.60	2623.3	OK	OK	
47	2	2619.59	2619.21	0.7	2620.61	2620.09	2621.6	OK	OK	
48	2	2624.23	2623.85	0.7	2625.25	2624.73	2626.4	OK	OK	
49	2	2628.90	2628.52	0.7	2629.92	2629.40	2631.1	OK	OK	
50	2	2633.50	2633.12	0.7	2634.52	2634.00	2636.2	OK	OK	
51	2	2639.22	2638.84	0.7	2640.24	2639.72	2641.3	OK	OK	
52	2	2642.35	2641.97	0.7	2643.37	2642.85	2644.6	OK	OK	
53	2	2646.52	2646.14	0.7	2647.54	2647.02	2648.7	OK	OK	
54	2	2652.06	2651.68	0.7	2653.08	2652.56	2654.2	OK	OK	
55	2	2657.61	2657.23	0.7	2658.63	2658.11	2659.8	OK	OK	
56	2	2663.42	2663.04	0.7	2664.44	2663.92	2665.6	OK	OK	
57	2	2669.36	2668.98	0.7	2670.38	2669.86	2671.5	OK	OK	
58	2	2675.31	2674.93	0.7	2676.33	2675.81	2677.5	OK	OK	
59	2	2681.25	2680.87	0.7	2682.27	2681.75	2683.4	OK	OK	
60	2	2687.19	2686.81	0.7	2688.21	2687.69	2689.3	OK	OK	
61	2	2693.70	2693.32	0.7	2694.72	2694.20	2696.8	OK	OK	
62	2	2702.99	2702.61	0.7	2704.01	2703.49	2702.8	CHECK	CHECK	It is OK, lot is near HP with negligable Q

Grand Canyon & Washburn FINISHED FLOOR - CITY OF LAS VEGAS JURISDICTION										
INPUT INFORMATION					FINISHED FLOORS					NOTES
Lot Number	Hydraulic Section Utilized	T/C[1] (ft)	F/L[2] (ft)	D_{100} (ft)	Flowline $F.F._{.min}$[3] (ft)	T/C + 6" $F.F._{.min}$[4] (ft)	$F.F._{.Design}$ (ft)	Flowline Check	T/C + 6" Check	See References on Last Sheet
63	WB	2688.76	2688.76	0.25	2689.26	2689.26	2690.9	OK	OK	
64	WB	2683.31	2683.31	0.25	2683.81	2683.81	2685.6	OK	OK	
65	WB	2676.57	2676.57	0.25	2677.07	2677.07	2678.9	OK	OK	
66	WB	2669.84	2669.84	0.25	2670.34	2670.34	2672.2	OK	OK	
67	WB	2663.03	2663.03	0.25	2663.53	2663.53	2665.4	OK	OK	
68	WB	2657.06	2657.06	0.25	2657.56	2657.56	2659.4	OK	OK	
69	WB	2651.18	2651.18	0.25	2651.68	2651.68	2653.5	OK	OK	
70	WB	2645.30	2645.30	0.25	2645.80	2645.80	2647.6	OK	OK	
71	WB	2640.28	2640.28	0.25	2640.78	2640.78	2642.6	OK	OK	
72	WB	2636.51	2636.51	0.25	2637.01	2637.01	2638.9	OK	OK	
73	WB	2630.61	2630.61	0.25	2631.11	2631.11	2632.9	OK	OK	
74	WB	2625.41	2625.41	0.25	2625.91	2625.91	2627.8	OK	OK	
75	2	2618.04	2617.66	0.7	2619.06	2618.54	2620.2	OK	OK	
76	2	2618.12	2617.74	0.7	2619.14	2618.62	2620.3	OK	OK	
77	2	2708.24	2707.86	0.7	2709.26	2708.74	2710.4	OK	OK	
78	ES2	2682.90	2682.90	0.3	2683.50	2683.40	2685.1	OK	OK	
79	ES2	2683.50	2683.50	0.3	2684.10	2684.00	2685.7	OK	OK	
80	ES2	2684.09	2684.09	0.3	2684.69	2684.59	2686.3	OK	OK	
81	ES2	2684.74	2684.74	0.3	2685.34	2685.24	2686.9	OK	OK	
82	RW	2672.45	2672.45	0.66	2673.77	2672.95	2674.9	OK	OK	
83	RW	2666.00	2666.00	0.66	2667.32	2666.50	2668.2	OK	OK	
84	3	2662.69	2662.31	0.48	2663.27	2663.19	2666.0	OK	OK	
85	3	2659.06	2658.68	0.48	2659.64	2659.56	2662.5	OK	OK	
86	3	2653.35	2652.97	0.48	2653.93	2653.85	2656.8	OK	OK	
87	3	2645.10	2644.72	0.48	2645.68	2645.60	2647.3	OK	OK	
88	3	2645.80	2645.42	0.48	2646.38	2646.30	2648.0	OK	OK	
89	3	2647.05	2646.67	0.48	2647.63	2647.55	2649.3	OK	OK	
90	3	2647.05	2646.67	0.48	2647.63	2647.55	2649.3	OK	OK	
91	3	2645.72	2645.34	0.48	2646.30	2646.22	2647.9	OK	OK	
92	3 @ 5.1%	2669.79	2669.41	0.37	2670.15	2670.29	2670.3	OK	OK	
93	3	2668.40	2668.02	0.48	2668.98	2668.90	2671.7	OK	OK	
94	3	2676.79	2676.41	0.48	2677.37	2677.29	2680.0	OK	OK	

Grand Canyon & Washburn FINISHED FLOOR - CITY OF LAS VEGAS JURISDICTION										
INPUT INFORMATION					FINISHED FLOORS					NOTES
Lot Number	Hydraulic Section Utilized	T/C[1] (ft)	F/L[2] (ft)	D_{100} (ft)	Flowline $F.F._{.min}$[3] (ft)	T/C + 6" $F.F._{.min}$[4] (ft)	$F.F._{.Design}$ (ft)	Flowline Check	T/C + 6" Check	See References on Last Sheet
95	WB	2671.57	2671.57	0.25	2672.07	2672.07	2673.3	OK	OK	
96	WB	2665.96	2665.96	0.25	2666.46	2666.46	2668.1	OK	OK	
97	WB	2660.70	2660.70	0.25	2661.20	2661.20	2663.0	OK	OK	
98	WB	2655.98	2655.98	0.25	2656.48	2656.48	2658.3	OK	OK	
99	WB	2651.26	2651.26	0.25	2651.76	2651.76	2653.6	OK	OK	
100	WB	2646.54	2646.54	0.25	2647.04	2647.04	2648.9	OK	OK	
101	WB	2641.82	2641.82	0.25	2642.32	2642.32	2644.2	OK	OK	
102	WB	2638.79	2638.79	0.25	2639.29	2639.29	2641.1	OK	OK	
103	WB	2635.76	2635.76	0.25	2636.26	2636.26	2638.1	OK	OK	
104	4	2633.58	2633.20	0.29	2633.78	2634.08	2635.7	OK	OK	
105	4	2632.08	2631.70	0.29	2632.28	2632.58	2634.4	OK	OK	
106	4	2630.83	2630.45	0.29	2631.03	2631.33	2633.1	OK	OK	
107	4	2629.58	2629.20	0.29	2629.78	2630.08	2631.8	OK	OK	
108	RW	2638.28	2638.28	0.66	2639.60	2638.78	2640.0	OK	OK	
109	RW	2633.80	2633.80	0.66	2635.12	2634.30	2635.9	OK	OK	
110	6	2627.12	2626.74	0.39	2627.52	2627.62	2629.4	OK	OK	
111	6	2634.47	2634.09	0.39	2634.87	2634.97	2636.8	OK	OK	
112	6	2631.38	2631.00	0.39	2631.78	2631.88	2633.5	OK	OK	
113	4	2629.22	2628.84	0.29	2629.42	2629.72	2631.7	OK	OK	
114	4	2630.42	2630.04	0.29	2630.62	2630.92	2632.8	OK	OK	
115	4	2631.68	2631.30	0.29	2631.88	2632.18	2634.0	OK	OK	
116	4	2632.93	2632.55	0.29	2633.13	2633.43	2635.3	OK	OK	
117	4	2633.94	2633.56	0.29	2634.14	2634.44	2636.3	OK	OK	
118	4	2633.94	2633.56	0.29	2634.14	2634.44	2636.2	OK	OK	
119	5	2619.94	2619.56	0.27	2620.10	2620.44	2622.1	OK	OK	
120	5	2619.94	2619.56	0.27	2620.10	2620.44	2622.1	OK	OK	
121	5	2618.43	2618.05	0.27	2618.59	2618.93	2620.6	OK	OK	
122	5	2616.45	2616.07	0.27	2616.61	2616.95	2618.6	OK	OK	
123	5	2614.47	2614.09	0.27	2614.63	2614.97	2616.6	OK	OK	
124	5	2612.49	2612.11	0.27	2612.65	2612.99	2614.6	OK	OK	
125	7	2608.51	2608.13	0.28	2608.69	2609.01	2610.6	OK	OK	
126	7	2606.37	2605.99	0.28	2606.55	2606.87	2609.4	OK	OK	

Grand Canyon & Washburn
FINISHED FLOOR - CITY OF LAS VEGAS JURISDICTION

INPUT INFORMATION					FINISHED FLOORS					NOTES
Lot Number	Hydraulic Section Utilized	T/C[1] (ft)	F/L[2] (ft)	D_{100} (ft)	Flowline $F.F._{.min}$[3] (ft)	T/C + 6" $F.F._{.min}$[4] (ft)	$F.F._{.Design}$ (ft)	Flowline Check	T/C + 6" Check	See References on Last Sheet
127	7	2605.52	2605.14	0.28	2605.70	2606.02	2607.2	OK	OK	
128	7	2610.19	2609.81	0.28	2610.37	2610.69	2612.4	OK	OK	
129	7	2611.75	2611.37	0.28	2611.93	2612.25	2613.9	OK	OK	
130	5	2611.75	2611.37	0.27	2611.91	2612.25	2613.9	OK	OK	
131	5	2612.49	2612.11	0.27	2612.65	2612.99	2614.6	OK	OK	
132	5	2614.47	2614.09	0.27	2614.63	2614.97	2616.6	OK	OK	
133	5	2616.45	2616.07	0.27	2616.61	2616.95	2618.6	OK	OK	
134	5	2618.43	2618.05	0.27	2618.59	2618.93	2620.6	OK	OK	
135	5	2619.94	2619.56	0.27	2620.10	2620.44	2622.1	OK	OK	
136	5	2619.94	2619.56	0.27	2620.10	2620.44	2622.1	OK	OK	

Where:

1: Top of Curb at High Side of Lot

2: TC-0.38 (For Roll Curb), TC-0.5 (For L Curb)

3: Minimum Allowable Finished Floor Elevation above flowline elevation @ high side of lot = (2 x D_{100}) + F/L

4: City of Las Vegas minimum allowable finished floor elevation = T.C. @ high side of lot + 6-inches

5: These lots have an adjacent solid grouted wall that protects the FF.

City of Las Vegas Finished Floor Criteria:

-The finished floor shall be set a vertical distance above the gutter flowline of at least twice the depth of flow in the gutter flowline up to a maximum of 18 inches above the WSEL in the street. Per HCDDM, Section 304.4.

-The finished floor shall be set a vertical distance of at least 6-inches above the highest adjacent top of curb. Per HCDDM, Section 1602.

Supplemental Finish Floor Checks

Drainage Easements Check

Lot Number	High TC/FL[1]	Section	Flow Depth[2]	Min FF[3]	Design FF	Check	Solid Grout	Notes
3	2706.44	DE8	1.21	2709.15	2708.50	CHECK	Yes	3-courses of solid grouting
4	2712.30	DE8	1.21	2715.01	2708.50	CHECK	Yes	3-courses of solid grouting
21	2689.03	DE7	0.30	2690.83	2692.90	OK	No	
22	2689.03	DE7	0.30	2690.83	2693.30	OK	No	
75	2616.67	DE1	1.05	2619.22	2620.20	OK	No	
76	2616.67	DE1	1.05	2619.22	2620.30	OK	No	
78	2681.77	DE9	0.69	2683.96	2685.10	OK	No	
94	2677.24	DE9	0.69	2679.43	2680.00	OK	No	
108	2638.27	DE3	0.35	2640.12	2640.00	CHECK	Yes	3-courses of solid grouting
110	2636.03	DE3	0.35	2637.88	2629.40	CHECK	Yes	3-courses of solid grouting
111	2635.99	DE4	0.40	2637.89	2636.80	CHECK	Yes	3-courses of solid grouting
111	2634.73	DE5	0.41	2636.64	2636.80	OK	No	
127	2604.36	DE2	0.30	2606.16	2607.20	OK	No	

1: High TC/FL is at the high side of the drainage easement flowline or the highest TC adjacent to the easement if flow is weiring over the curb.

2: Flow depth is either normal depth or weir depth (whichever is higher).

3: Min FF is the High TC/FL plus the Flow Depth plus 18 inches.

4: D = Available depth from drainage easement FL to drainage easement edge

5: Assumed 8" tall courses.

Supplemental Finish Floor Checks

Adjacent/Perimeter Street Check

Lot Number	Street	High TC[1]	High FL[2]	Section	Flow Depth[3]	Min FF[4]	Design FF	Check	Solid Grout	FG[5]	# of Solid Grout Courses[6]	Notes
1	Ember Light Ct	2698.06	2697.68	2	0.70	2699.08	2693.6	CHECK	Yes	2698.06	2	
1	Moonlit Haze Dr	2700.09	2699.71	2	0.70	2701.11	2693.6	CHECK	Yes	2700.09	2	*
2	Moonlit Haze Dr	2702.52	2702.14	2	0.70	2703.54	2706.1	OK	No		-	
3	Hualapai Way	2716.20	2716.20	HP	0.43	2717.06	2708.5	CHECK	Yes	2716.80	1	
6	Eclipsed Moon St	2692.80	2692.42	2	0.70	2693.82	2699.1	OK	No		-	
7	Eclipsed Moon St	2692.80	2692.42	1	0.30	2693.02	2698.1	OK	No		-	
9	Hualapai Way	2715.22	2715.22	HP	0.43	2716.08	2708.5	CHECK	Yes	2715.82	1	*
10	Hualapai Way	2716.90	2716.90	HP	0.43	2717.76	2708.5	CHECK	Yes	2717.50	1	*
12	Eclipsed Moon St	2690.26	2689.88	1	0.30	2690.48	2698.1	OK	No		-	
13	Eclipsed Moon St	2692.17	2691.79	1	0.30	2692.39	2699.3	OK	No		-	
15	Hualapai Way	2715.52	2715.52	HP	0.43	2716.38	2708.6	CHECK	Yes	2716.12	1	*
16	Hualapai Way	2714.72	2714.72	HP	0.43	2715.58	2708.6	CHECK	Yes	2715.32	1	*
19	Eula St	2688.80	2688.80	ES1	0.47	2689.74	2696.7	OK	No		-	
20	Eula St	2686.60	2686.60	ES1	0.47	2687.54	2694.4	OK	No		-	
21	Eula St	2684.39	2684.39	ES1	0.47	2685.33	2692.9	OK	No		-	
22	Eula St	2682.72	2682.72	ES1	0.47	2683.66	2693.3	OK	No		-	
23	Eula St	2681.68	2681.68	ES1	0.47	2682.62	2694.9	OK	No		-	
25	Moonlit Haze Dr	2689.38	2689.00	2	0.70	2690.40	2693.9	OK	No		-	
26	Moonlit Haze Dr	2683.64	2683.26	2	0.70	2684.66	2678.9	CHECK	Yes	2683.64	2	
27	Fisher Ave	2681.20	2681.20	FA	0.79	2682.78	2680.6	CHECK	Yes	2681.26	3	
28	Fisher Ave	2677.50	2677.50	FA	0.79	2679.08	2680.8	OK	No		-	
29	Moonlit Haze Dr	2674.03	2673.65	2	0.70	2675.05	2678.9	OK	No		-	
30	Moonlit Haze Dr	2662.55	2662.17	2	0.70	2663.57	2663.5	CHECK	Yes	2662.65	2	
31	Fisher Ave	2696.50	2696.50	FA	0.79	2698.08	2665.3	CHECK	Yes	2696.60	3	
32	Fisher Ave	2662.00	2662.00	FA	0.79	2663.58	2665.3	OK	No		-	
33	Moonlit Haze Dr	2657.98	2657.60	2	0.70	2659.00	2663.5	OK	No		-	
34	Moonlit Haze Dr	2651.90	2651.52	2	0.70	2652.92	2649.4	CHECK	Yes	2652.00	2	
35	Fisher Ave	2656.50	2656.50	FA	0.79	2658.08	2651.9	CHECK	Yes	2656.60	3	
36	Fisher Ave	2650.90	2650.90	FA	0.79	2652.48	2651.9	CHECK	Yes	2651.00	3	
37	Moonlit Haze Dr	2643.46	2643.08	2	0.70	2644.48	2649.4	OK	No		-	
38	Moonlit Haze Dr	2639.83	2639.45	2	0.70	2640.85	2638.4	CHECK	Yes	2639.93	2	
39	Fisher Ave	2644.50	2644.50	FA	0.79	2646.08	2640.5	CHECK	Yes	2644.60	3	
40	Fisher Ave	2637.90	2637.90	FA	0.79	2639.48	2640.5	OK	No		-	
41	Moonlit Haze Dr	2633.50	2633.12	2	0.70	2634.52	2638.5	OK	No		-	
43	Moonlit Haze Dr	2624.27	2623.89	2	0.70	2625.29	2623.3	CHECK	Yes	2624.37	2	

Supplemental Finish Floor Checks												
44	Fisher Ave	2629.90	2629.90	FA	0.79	2631.48	2625.5	CHECK	Yes	2630.00	3	
45	Fisher Ave	2622.60	2622.60	FA	0.79	2624.18	2625.5	OK	No		-	
45	Grand Canyon Dr	2615.23	2615.23	GC1	0.79	2616.81	2625.5	OK	No		-	
46	Grand Canyon Dr	2614.00	2614.00	GC1	0.79	2615.58	2623.3	OK	No		-	
47	Grand Canyon Dr	2611.98	2611.98	GC1	0.79	2613.56	2621.6	OK	No		-	
48	Golden Twlight Ct	2619.24	2618.86	2	0.70	2620.26	2626.4	OK	No		-	
50	Sparkling Moon St	2635.74	2635.36	2	0.70	2636.76	2636.2	CHECK	Yes	2635.84	2	*
51	Sparkling Moon St	2635.74	2635.36	2	0.70	2636.76	2641.3	OK	No		-	
62	Ember Skies Dr	2706.89	2706.51	2	0.70	2707.91	2702.8	CHECK	Yes	2706.99	2	*
72	Sparkling Moon St	2634.51	2634.13	2	0.70	2635.53	2638.9	OK	No		-	
73	Sparkling Moon St	2634.51	2634.13	2	0.70	2635.53	2632.9	CHECK	Yes	2634.61	2	*
75	Washburn	2620.38	2620.38	WB	0.25	2620.88	2620.2	CHECK	Yes	2620.48	1	
76	Washburn	2614.80	2614.80	WB	0.25	2615.30	2620.3	OK	No		-	
76	Grand Canyon Dr	2611.40	2611.40	WB	0.25	2611.90	2620.3	OK	No		-	
77	Hualapai Way	2724.42	2724.42	HP	0.43	2725.28	2710.4	CHECK	Yes	2725.02	1	
77	Washburn	2723.36	2723.36	WB	0.25	2723.86	2710.4	CHECK	Yes	2723.46	1	
81	Rosada Way	2682.85	2682.85	RW	0.66	2684.17	2686.9	OK	No		-	
84	Rosada Way	2661.33	2661.33	RW	0.66	2662.65	2666.0	OK	No		-	
85	Rosada Way	2657.71	2657.71	RW	0.66	2659.03	2662.5	OK	No		-	
86	Rosada Way	2653.41	2653.41	RW	0.66	2654.73	2656.8	OK	No		-	
86	Ember Astro Ct	2644.15	2643.77	3	0.48	2644.73	2656.8	OK	No		-	
91	Nightly Shine Pl	2657.00	2656.62	3	0.48	2657.58	2647.9	CHECK	Yes	2657.10	1	*
95	Nightly Shine Pl	2676.01	2675.63	3	0.48	2676.59	2673.3	CHECK	Yes	2676.11	1	*
103	Sparkling Moon St	2633.94	2633.56	4	0.29	2634.14	2638.1	OK	No		-	
107	Rosada Way	2633.55	2633.55	RW	0.66	2634.87	2631.8	CHECK	Yes	2634.05	2	
109	Sparkling Moon St	2629.60	2629.22	6	0.39	2630.00	2635.9	OK	No		-	
110	Sparkling Moon St	2634.84	2634.46	6	0.39	2635.24	2629.4	CHECK	Yes	2634.94	1	
111	La Madre Way	2636.78	2636.78	LW1	0.44	2637.66	2636.8	CHECK	Yes	2637.28	1	
112	La Madre Way	2630.18	2630.18	LW1	0.44	2631.06	2633.5	OK	No		-	
113	Rosada Way	2624.35	2624.35	RW	0.66	2625.67	2631.7	OK	No		-	
118	Washburn	2630.36	2630.36	WB	0.25	2630.86	2636.2	OK	No		-	
119	Washburn	2624.10	2624.10	WB	0.25	2624.60	2622.1	CHECK	Yes	2624.30	1	
124	Rosada Way	2617.44	2617.44	RW	0.66	2618.76	2614.6	CHECK	Yes	2617.94	2	
126	La Madre Way	2607.22	2607.22	LW2	0.65	2608.52	2609.4	OK	No		-	
127	La Madre Way	2599.11	2599.11	LW2	0.65	2600.41	2607.2	OK	No		-	
127	Grand Canyon Dr	2599.21	2599.21	GC3	0.75	2600.71	2607.2	OK	No		-	
128	Dusk Skyscrape St	2609.12	2608.74	7	0.28	2609.30	2612.4	OK	No		-	
128	Grand Canyon Dr	2599.02	2599.02	GC3	0.75	2600.52	2612.4	OK	No		-	
129	Grand Canyon Dr	2599.97	2599.97	GC3	0.75	2601.47	2613.9	OK	No		-	
130	Rosada Way	2608.17	2608.17	RW	0.66	2609.49	2613.9	OK	No		-	
130	Grand Canyon Dr	2600.30	2600.30	GC3	0.75	2601.80	2613.9	OK	No		-	
131	Rosada Way	2609.15	2609.15	RW	0.66	2610.47	2614.6	OK	No		-	
131	Grand Canyon Dr	2602.93	2602.93	GC2	0.82	2604.57	2614.6	OK	No		-	

Supplemental Finish Floor Checks

132	Grand Canyon Dr	2603.74	2603.74	GC2	0.82	2605.38	2616.6	OK	No		-	
133	Grand Canyon Dr	2604.54	2604.54	GC2	0.82	2606.18	2618.6	OK	No		-	
134	Grand Canyon Dr	2605.75	2605.75	GC2	0.82	2607.39	2620.6	OK	No		-	
135	Grand Canyon Dr	2606.96	2606.96	GC2	0.82	2608.60	2622.1	OK	No		-	
136	Grand Canyon Dr	2607.12	2607.12	GC2	0.82	2608.76	2622.1	OK	No		-	

1: High TC is the elevation at the high side of the adjacent perimeter street

2: 0.38-ft is subtracted from the High TC to obain the High FL elevation

3: Flow depth is the normal depth in adjacent perimeter street

4: Min FF is the High FL plus twice the depth of flow.

5: FG = finished grade elevation at top of scarp in landscape/common element.

6: Assumed 8" tall courses.

NOTES:

* Located at a high point. Therefore, flow rate is negligable and solid grouting is not necessary.

** 2x the flow depth is contained by the FG. Therefore, solid grouting is not necessary.

*** Substantial elevation difference between lot and adjacent/perimeter roadway. Therefore, detailed lot assessment is not needed nor provided. Solid grouting is not necessary.

**** n/a

Supplemental Finish Floor Checks

Specific Energy Check for Fronting Lots

Lot Number	High Elevation or TC	High FL[2]	Section	Specific Energy[3]	Min FF[4]	Design FF	Check
19	2692.97	2692.59	1-SE	0.46	2693.05	2696.70	OK
20	2691.89	2691.51	1-SE	0.46	2691.97	2694.40	OK
22	2689.58	2689.20	1-SE	0.46	2689.66	2693.30	OK
24	2692.66	2692.28	2-SE	1.61	2693.89	2694.80	OK
25	2691.70	2691.32	2-SE	1.61	2692.93	2693.90	OK
53	2646.52	2646.14	2-SE	1.61	2647.75	2648.70	OK
56	2663.42	2663.04	2-SE	1.61	2664.65	2665.60	OK
58	2675.31	2674.93	2-SE	1.61	2676.54	2677.50	OK
59	2681.25	2680.87	2-SE	1.61	2682.48	2683.40	OK
61	2693.70	2693.32	2-SE	1.61	2694.93	2696.80	OK
125	2608.51	2608.13	7-SE	0.38	2608.51	2610.60	OK

1: High TC is the elevation at the high side of the adjacent perimeter street

2: 0.38-ft is subtracted from the High TC to obain the High FL elevation for internal curb

3: Specific energy depth is taken from FlowMaster calculation for street directing flow toward lot.

4: Min FF is the High FL plus the specific energy depth.

Specific Energy Check for Adjacent/Perimeter Street

Lot Number	Street	High Elevation or TC	High FL[2]	Section	Specific Energy[3]	Min FF[4]	Design FF	Check	Solid Grout	FG[5]	# of Solid Grout Courses[6]	Notes
27	Eula	2681.28	2681.28	ES1-SE	0.55	2681.83	2680.60	CHECK	Yes	2681	1	

1: High TC is the elevation at the high side of the adjacent perimeter street

2: 0.38-ft is subtracted from the High TC to obain the High FL elevation for internal curb

3: Specific energy depth is taken from FlowMaster calculation for street directing flow toward lot.

4: Min FF is the High FL plus the specific energy depth.

5: FG = finished grade elevation at top of scarp in landscape/common element.

6: Assumed 8" tall courses.

NOTES:

* Depth of specific energy is contained by the FG. Therefore, solid grouting is not necessary.

APPENDIX F

Reference Material
Technical Drainage Study for Ann Road & Hualapai Way
(PW21-16399)

Approval Letters

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 Approval Letter

LTR
PW21-16399

Date: October 18, 2021
Firm: Kimley-Horn
Engineer: Michael E. Schwab, P.E.
Address: 6671 Las Vegas Boulevard, Suite 320, Las Vegas, NV 89119
Phone: (702) 790-0206
Fax: (702)
E-mail: Michael.schwab@kimley-horn.com

Subject: Technical Drainage Study for Ann Road & Hualapai (Estrella Park)
Location: SEC of Ann Rd & Hualapai
APN: 125-31-101-001
Sec, Township, Range: S31, T19S, R60E
Flood Zone & Panel: Zone X, 1745E & 1750E, Dated September 27, 2002
Application Number: PW21-16399

Submittals	Date Received	Date Returned	Reviewer	Miscellaneous
Concurrence/Technical	08/02/2021	08/23/2021	BC	
Addendum 1	09/01/2021	09/27/2021	BC	
Supplement	10/07/2021	10/18/2021	BC	

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

BOARD OF COUNTY COMMISSIONERS
MARILYN KIRKPATRICK, Chair • JAMES B. GIBSON, Vice Chair
JUSTIN C. JONES • WILLIAM MCCURDY II • ROSS MILLER • 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 "**Estrella Park**", grading plan sheets CV, NT, LQ, GD0 thru GD3, GD5, GD6, PP1 thru PP8, PP10, PP11, and DT, signed and sealed by Eric Hopkins, P.E., on August 30, 2021 and grading plan sheets GD4, XS1, and PP9 signed and sealed by Eric Hopkins, P.E., on October 5, 2021.

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.
X	The grading plan will be reviewed by the Building Office Operations Division to ensure compliance with the ADA access requirements. Revisions to the grading plan may be required if the site accessibility design does not comply with the requirements set forth in the Accessibility Chapter of the Clark County Building Code.
X	The plans show work is proposed outside of the project boundary. Notarized written permission must be obtained **prior to grading plan approval.**
X	Right-of-way dedication must be verified.
	Any previously approved drainage easements that are not being used must be vacated.
	Per *Regional Flood Control District policies and Procedures manual, Section VIII. D. 13. Uniform Regulations for the Control of Drainage*, the Engineer of Record shall provide As-Built plans or record drawings to the District after completion and final inspection of such privately installed flood control facilities that have regional flood control significance.
	Structural calculations are required. The structural calculations, plans, and details must be approved prior to "Offsite" submittal and prior to CCRFCD submittal, if applicable.
X	Plan revisions can be found on the red-lined plans and must be addressed.
	Prepare drainage easement documents as shown on the grading plans.

Additional Conditions:

1. 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 August 2, 2021. In addition, the County has received the City of Las Vegas acceptance letter dated July 22, 2021 for the Technical Drainage Study (File# DS5439C).

2. 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.

3. Any improvements not depicted on the above-mentioned grading plans or in the comment above may require an Update to this Technical Drainage Study.

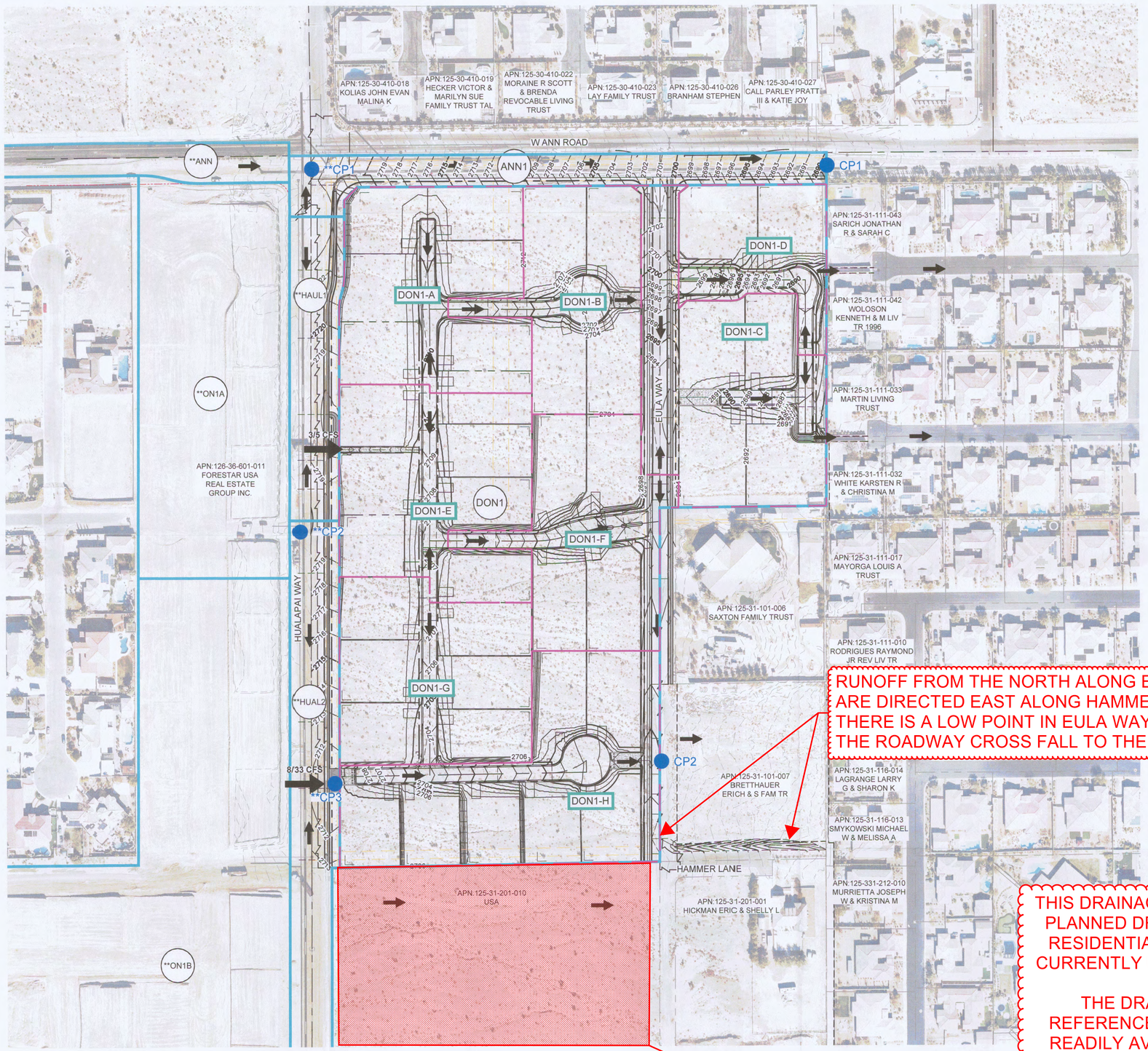
The County's review is solely based on the information submitted by the Engineer of Record. The County's review is strictly limited to compliance with minimum County Codes and Standards. The Engineer of Record is responsible for researching and addressing situations that may require designs above and 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

Referenced Drainage Exhibits



NORTH

GRAPHIC SCALE IN FEET
0 50 100 200
1" = 100'

LEGEND

- XXX — BASIN ID
- XXX — PRORATED BASIN ID
- BASIN BOUNDARY
- PRORATED BASIN BOUNDARY
- FUTURE CCRFCD REGIONAL FACILITY
- EXITING DRAINAGE FACILITY
- FLOW ARROW
- CPX — CONCENTRATION POINT

Ann & Hualapai
ULTIMATE FLOW SUMMARY TABLE

BASIN ID/ COMB. PT.	BASIN AREA (ac)	10-YR FLOW (cfs)	100-YR FLOW (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	11
CP2	-	11	47

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

ULTIMATE CONDITION PRORATED FLOW SUMMARY			
Ultimate Onsites			
SUBBASIN	Q_{100} (cfs)	AREA (ac)	CFS/ACRE
DON1	11	22.5	0.49
Ultimate Onsite Prorated Basins			
SUBBASIN	Q_{100} (cfs)	AREA (ac)	CFS/ACRE
DON1-A	1.5	3.0	0.49
DON1-B	1.0	2.3	0.49
DON1-C	1.5	3.3	0.49
DON1-D	1.0	1.5	0.49
DON1-E	1.5	3.1	0.49
DON1-F	1.0	2.6	0.49
DON1-G	1.5	2.8	0.49
DON1-H	2.0	3.9	0.49
TOTAL	11.0	22.5	NA

THIS DRAINAGE MAP ADDRESSES THE PLANNED DRAINAGE PATTERN OF A RESIDENTIAL SUBDIVISION THAT IS CURRENTLY UNDER CONSTRUCTION.

THE DRAINAGE PATTERN IS REFERENCED TO SUPERCEED THE READILY AVAILABLE TOPOGRAPHY USED FOR THIS AREA.

CLV#:

No.	REVISIONS	DATE	BY

Kimley»Horn
© 2021 KIMLEY-HORN AND ASSOCIATES, INC.
6671 LAS VEGAS BOULEVARD S., SUITE 320, LAS VEGAS, NV 89119
PHONE: 702-862-3600
WWW.KIMLEY-HORN.COM

KHA PROJECT 291400024
DATE 08/30/2021
SCALE AS SHOWN
DESIGNED BY MS
DRAWN BY DH
CHECKED BY MS

ULTIMATE CONDITION DRAINAGE MAP

ANN ROAD AND HUALAPAI WAY

PREPARED FOR RICHMOND HOMES

CITY OF LAS VEGAS NEVADA

ULT

Plotted By: Martinez, Elizabeth Sheet Set: Kho Layout: ULT August 30, 2021 01:27:27pm K:\LAV_Civil\291400024 - Ann and Hualapai\Reports\DRAINAGE\09_CCRFW_ADD\Figures\Figure ULT.dwg
This document, together with the concepts and designs presented herein, as an instrument of service, is intended only for the specific purpose and client for which it was prepared. Reuse of and improper reliance on this document without written authorization and adaptation by Kimley-Horn and Associates, Inc. and by Kimley-Horn and Associates, Inc.

APPENDIX G

Reference Material
Technical Drainage Study for Ann and 215 Phase 1
(DS 5211)

Approval Letters

CITY OF LAS VEGAS **INTER-OFFICE MEMORANDUM**				**DATE:** **November 18, 2021**
TO: **Land Development Services** Department of Building & Safety				**FROM:** Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT:	Drainage Study for: **Ann and 215 – Phase 1 - Update**			**COPIES TO:** Westwood Professionals
Cross Streets:	NWC of Hualapai Way & Washburn Road			Upgrowth NV Partners, LLC
File Number:	F:\Depot\DSMemos\DS5211G.doc			Bart Anderson, P.E., DevCo
Parcel Number:	126-36-601-009			CCPW
Zoning Action:	TMP-77682; VAR-77645 thru VAR-77681			
FEMA Flood Zone	YES	NO	**X**	
Proposed Storm Drain	YES	NO	**X**	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1st Submittal	10/30/2019	12/5/2019	Not Approved	$400.00	3627886: $400
2nd Submittal	12/24/2019	1/18/2019	Not Approved	$400.00	3685399: $400
3rd Submittal	1/27/2020	2/18/2020	Conditional Approval	N/C	N/C
4th Submittal & Supplement	6/11/2020 & 6/25/2020	6/25/2020	Conditional Approval	$400.00	3879574: $400
5th Submittal	8/31/2021	9/14/2021	Not Approved	$100.00	4432146: $100
6th Submittal	9/21/2021	9/30/2021	Conditional Approval	N/C	N/C
7th Submittal (CCPW)	11/17/2021	11/18/2021	See Comments Below	N/C	N/C
			TOTAL FEES (LDDRS):	**$1,300.00**	**----**

REMARKS:

7th Submittal: CCPW Concurrence received

5th & 6th Submittals: Update & Supplement to revise the width of drainage easement at Stephens Avenue and Ruffian Road

4th Submittal: Response to CCPW Comments

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

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

1. The *Ann Road* storm drain is owned by the *Clark County*. Obtain pertinent permits from the *Clark County Public Works Department* for the proposed lateral and drop inlet connection prior to the final approval of the improvement plans.

2. The project proposes to build temporary drainage facility such as berms and swales in various locations for the flood protection of ***Phase 1 Development*** and the adjacent *County* residences. Prior to final plan approval the developer must complete a maintenance and liability agreement for the interim drainage improvements and post a minimum maintenance bond of $50,000 or 50-percent of the construction cost for the improvements, whichever is greater. The engineer must submit an estimate of the quantities for constructing the facility and an exhibit that adequately shows the location and limits of the drainage facility to *City of Las Vegas Flood Control* for approval. Once the drainage study is conditionally approved, the engineer should contact the City's Land Development Section (229-6371) to begin the agreement process.

   In order for the maintenance bond to be released in the future, a drainage update / letter will be required to justify that the offsite berms / channels are no longer necessary and can be removed.

NOTE: Any future changes to the proposed design (or design assumptions) as outlined in the approved drainage study and attached preliminary grading plan which affect drainage must be addressed in a Drainage Study Update and accepted by the *City of Las Vegas Flood Control Section*. Additionally, conditional acceptance of a drainage study is valid for a period of one (1) year. If the proposed construction has not been completed in that time period, the *City of Las Vegas* reserves the right to require additional conditions and/or submission and acceptance of a complete drainage study update prior to further construction of a project.

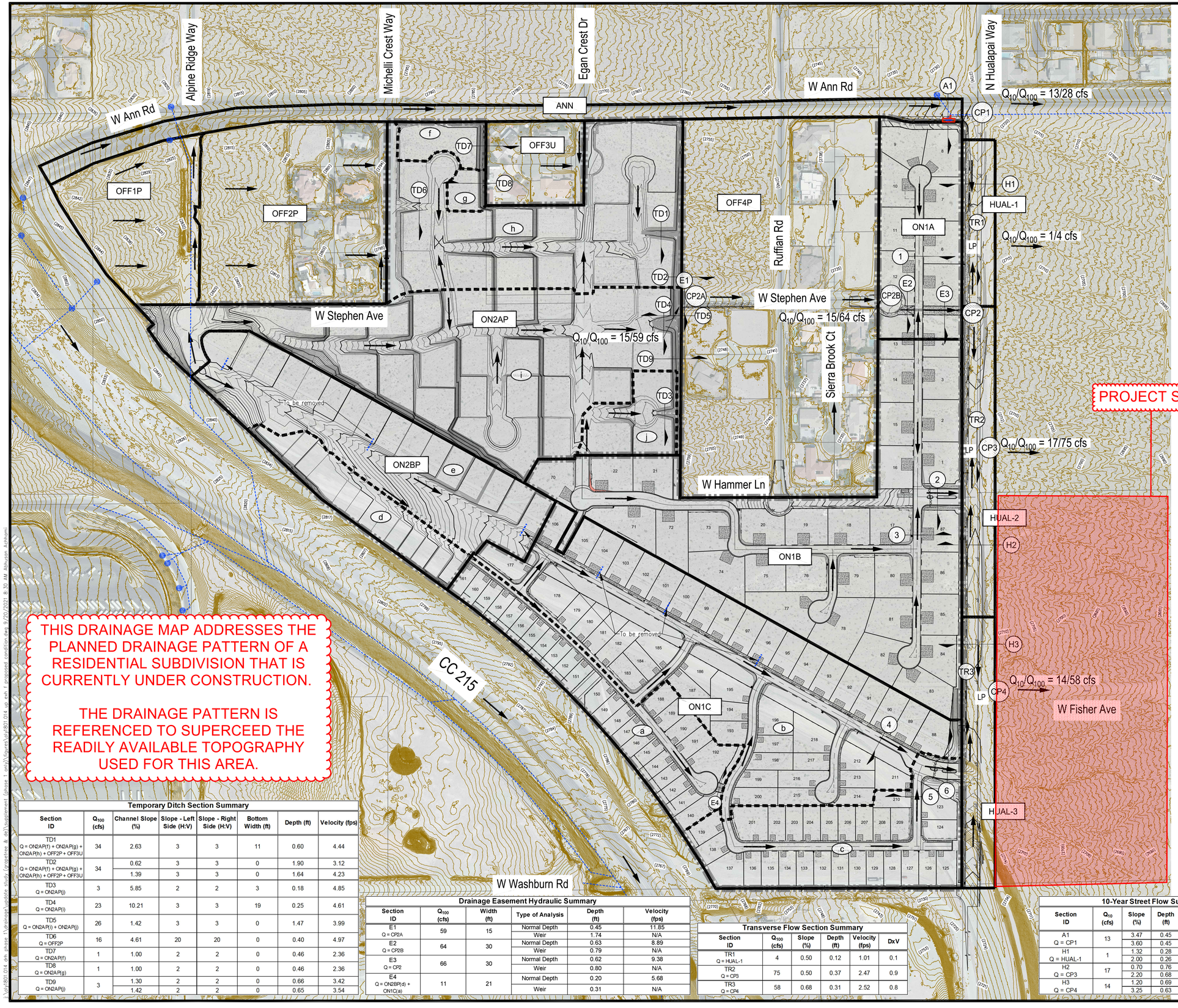
NOTE: Please be advised that all land surface area disturbances over 1 acre or any area adjacent to a water way must submit to the *Nevada Division of Environmental Protection* a "Notice of Intent" to discharge that certifies a stormwater pollution prevention plan has been developed and is maintained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

END OF REMARKS

ays

T/R/S: T19S/R59E/36
AREA F36

Referenced Drainage Exhibits



THIS DRAINAGE MAP ADDRESSES THE PLANNED DRAINAGE PATTERN OF A RESIDENTIAL SUBDIVISION THAT IS CURRENTLY UNDER CONSTRUCTION.

THE DRAINAGE PATTERN IS REFERENCED TO SUPERCEED THE READILY AVAILABLE TOPOGRAPHY USED FOR THIS AREA.

LEGEND

- BASIN BOUNDARY
- PHASE BOUNDARY
- EXISTING FACILITY
- SUBBASIN BOUNDARY
- PROPOSED DRAINAGE FACILITY
- ID — BASIN ID
- (ID) — SUBBASIN ID
- (ID) — CONCENTRATION POINT ID
- FLOW DIRECTION
- (ID) — 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 Q = OFF1P + ANN	N/A	28	13
CP2A Q = OFF2P + OFF3U + ON2AP	N/A	59	15
CP2B Q = CP2A + OFF4P	N/A	64	15
CP2 Q = CP2B + ON1A	N/A	66	15
CP3 Q = CP2 + ON1B + HUAL-2	N/A	75	17
CP4 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	**Q_{100} (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 Q = ON1A	1	1.29	0.22	1.85	0.4
2 Q = ON1B	5	2.00	0.34	2.78	0.9
		5.24	0.30	4.07	1.2
3 Q = ON1B	5	1.14	0.33	2.30	0.8
		5.61	0.27	4.32	1.2
4 Q = ON2BP + ON1C(a) + ON1C(b)	45	1.89	0.55	5.41	3.0
		6.41	0.47	7.81	3.7
5 Q = ON1C(c)	9	2.00	0.36	3.25	1.2
		7.25	0.31	5.38	1.7
6 Q = ON2BP + ON1C	54	3.20	0.59	6.21	3.7
A1 Q = CP1	28	3.47	0.58	5.42	3.1
		3.60	0.58	5.50	3.2
H1 Q = HUAL-1	4	1.32	0.48	2.95	1.4
		2.20	0.43	3.58	1.5
H2 Q = CP3	75	0.70	1.07	4.30	4.6
		2.20	0.93	6.29	5.8
H3 Q = CP4	58	1.20	0.95	4.70	4.5
		3.25	0.84	6.73	5.7

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 Q = ON2AP(f) + ON2AP(g) + ON2AP(h) + OFF2P + OFF3U	34	2.63	3	3	11	0.60	4.44
TD2 Q = ON2AP(f) + ON2AP(g) + ON2AP(h) + OFF2P + OFF3U	34	0.62	3	3	0	1.90	3.12
		1.39	3	3	0	1.64	4.23
TD3 Q = ON2AP(j)	3	5.85	2	2	3	0.18	4.85
TD4 Q = ON2AP(i)	23	10.21	3	3	19	0.25	4.61
TD5 Q = ON2AP(i) + ON2AP(j)	26	1.42	3	3	0	1.47	3.99
TD6 Q = OFF2P	16	4.61	20	20	0	0.40	4.97
TD7 Q = ON2AP(f)	1	1.00	2	2	0	0.46	2.36
TD8 Q = ON2AP(g)	1	1.00	2	2	0	0.46	2.36
TD9 Q = ON2AP(j)	3	1.30	2	2	0	0.66	3.42
		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 Q = CP2A	59	15	Normal Depth	0.45	11.85
			Weir	1.74	N/A
E2 Q = CP2B	64	30	Normal Depth	0.63	8.89
			Weir	0.79	N/A
E3 Q = CP2	66	30	Normal Depth	0.62	9.38
			Weir	0.80	N/A
E4 Q = ON2BP(d) + ON1C(a)	11	21	Normal Depth	0.20	5.68
			Weir	0.31	N/A

Transverse Flow Section Summary

Section ID	Q_{100} (cfs)	Slope (%)	Depth (ft)	Velocity (fps)	DxV
TR1 Q = HUAL-1	4	0.50	0.12	1.01	0.1
TR2 Q = CP3	75	0.50	0.37	2.47	0.9
TR3 Q = CP4	58	0.68	0.31	2.52	0.8

10-Year Street Flow Summary

Section ID	Q_{10} (cfs)	Slope (%)	Depth (ft)	Velocity (fps)	DxV	Dry Lane (ft)
A1 Q = CP1	13	3.47	0.45	5.15	2.32	42.00
		3.60	0.45	5.22	2.35	42.00
H1 Q = HUAL-1	1	1.32	0.28	2.08	0.58	25.00
		2.00	0.26	2.52	0.66	25.00
H2 Q = CP3	17	0.70	0.76	2.73	2.07	12.00
		2.20	0.68	4.09	2.78	16.00
H3 Q = CP4	14	1.20	0.69	3.12	2.15	15.50
		3.25	0.63	4.61	2.90	18.50

Westwood
5725 W. Badura Ave.
Suite 100
Las Vegas, NV 89118
Phone (702) 284-5300
westwoodps.com
Westwood Professional Services, Inc.

NO.	DESCRIPTION	DATE	BY	APP. DATE	APP.

UPGROWTH NV PARTNERS, LLC

ANN & 215 PHASE 1

PROPOSED CONDITION DRAINAGE MAP

DATE: SEP 2021

DRAFTER: AA

DESIGNER: AA

CHECKED: KC

PROJECT NO.
OLY1801.014

EXHIBIT F

SHEET 1 OF 1

SCALE – 1"=150' FEET

J:\oly\1801.014 drh phase 1\drainage\update study (grapetree & dr)\supplement (phase 1 only)\figures\oly1801.014 up exh f proposed condition.dwg 9/20/2021 8:30 AM Ashuson Ashkhami

APPENDIX H

Reference Material
Technical Drainage Study for Park & Hammer Residential
(PW21-17227)

Approval Letters

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

PW21-17227
LTR

Drainage Study Approval Letter

Date: October 25, 2021
Firm: Taney Engineering
Engineer: Janelle Klein, P.E.
Address: 6030 S. Jones Boulevard, Las Vegas, NV 89118
Phone: (702) 362-8844
Fax: (702) 362-5233
E-mail: janellek@taneycorp.com

Subject: Technical Drainage Study Concurrence for Park and Hammer
Location: SWC of Hammer Lane and Park Street
APN: 125-31-601-001, -002
Sec, Township, Range: S31, T19S, R60E
Flood Zone & Panel: Zone X, 1745E, Dated September 27, 2002
Application Number: PW21-17227

Submittals	Date Received	Date Returned	Reviewer	Miscellaneous
Technical	08/30/2021	09/20/2021	EC	
Addendum 1	08/30/2021	09/20/2021	EC	
Addendum 2	08/30/2021	09/20/2021	EC	
Addendum 3	08/30/2021	09/20/2021	EC	
Supplement	10/06/2021	10/25/2021	EC	Addressed drainage easement

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

BOARD OF COUNTY COMMISSIONERS
MARILYN KIRKPATRICK, Chair • JAMES B. GIBSON, Vice Chair
JUSTIN C. JONES • WILLIAM MCCURDY II • ROSS MILLER • 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 "**Park & Hammer (Sierra)**", grading plan sheets C1, C2, C3, G1, G2, G3, G4, PP1, PP2, PP3, PP4, PP5, PP6 and PP7 signed and sealed by Robert D. Cunningham, P.E., on October 4, 2021 and grading plan sheet GD1 signed and sealed by Robert D. Cunningham, P.E. on October 5, 2021.

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.**
	Right-of-way dedication must be verified.
	Any previously approved drainage easements that are not being used must be vacated.
	Per *Regional Flood Control District policies and Procedures manual, Section VIII. D. 13. Uniform Regulations for the Control of Drainage*, the Engineer of Record shall provide As-Built plans or record drawings to the District after completion and final inspection of such privately installed flood control facilities that have regional flood control significance.
	Structural calculations are required. The structural calculations, plans, and details must be approved prior to "Offsite" submittal and prior to CCRFCD submittal, if applicable.
X	Plan revisions can be found on the red-lined plans and must be addressed.
	Prepare drainage easement documents as shown on the grading plans.

Additional Conditions:

1. Based on the wall and drainage agreement between Pushing 30, LLC and Albert Faccinto Jr. (owner of parcel 125-31-601-038) positive drainage to the northeast corner of parcel 125-31-601-038 should be provided throughout the drainage easement. See redlines on sheet G4 for clarification.

2. 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 August 30, 2021. In addition, the County has received the City of Las Vegas acceptance letter dated August 25, 2021 for the Technical Drainage Study (DS5424D).

3. 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.

4. There is a waterline and sanitary sewer that is being constructed within Clark County ROW and paving on Hammer and Park. Therefore, the engineer must submit to CCPW for offsite plan review and permits.

5. Provide Clark County signature blocks and notes on plans.

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

Ernie Corn, P.E.
Senior Civil Engineer
Development Review
ernie.corn@ClarkCountyNV.gov

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

Referenced Drainage Exhibits

TANEY ENGINEERING
6030 S. JONES BOULEVARD
LAS VEGAS, NV 89118
(702) 362-8844 FAX: (702) 362-5233

Ultimate Condition			
Basin	Area (acres)	Q_{10} (cfs)	Q_{100} (cfs)
CP1		35	128
CP2		32	101
CP3		58	234
CP4		69	275
DIV1		31	99
DIV2		54	212
DIV3		4	29
DIV4		3	16
ULON1		<1	2
ULON2	0.30	<1	1
FH	0.30	1	1
GC	0.42	1	2
HM	0.24	1	1
OFX1	2.13	<1	1
ULOF2	1.85	<1	1
PK	0.19	<1	1
REF1		21	79
REF2		64	236
REF3		14	44

Cross Section Summary Ultimate Conditon

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
A - Grand Canyon Dr 10yr	DIV3+GC+1/4(OFX4)	4	1.4	0.27	1.61	0.43
A - Grand Canyon Dr 100yr	DIV3+GC+1/4(OFX4)	34	1.4	0.53	2.73	1.45
B - Hammer Lane 100yr	CP2	101	3.3	0.77	5.54	4.27
C - Park Street 100yr	DIV4+ULON1+ULON2+PK	21	1.5	0.51	2.90	1.48
D - Fisher Ave 100yr	DIV2+FH	213	3.3	0.96	7.23	6.94
E - Interior Street 100yr	ULON1	2	2.94	0.21	2.67	0.56
F - Interior Street 100yr	ULON2	1	4.26	0.17	2.86	0.49

NOTE THAT THESE FLOW RATES ARE REFERENCED FROM A PROJECT WERE FLOWS NORTH OF ANN RD CROSS AN ROAD.

PROJECT SITE

HAMMER LANE

FISHER AVENUE

GRAND CANYON DRIVE

PARK STREET

CP1
35/128 CFS

*REF1
21/79 CFS

**REF2
64/236 CFS

CP4
69/275 CFS

DIV1
31/99 CFS

DIV2
54/212 CFS

DIV3
4/29 CFS

DIV4
3/16 CFS

15/63 CFS

CP2
32/101 CFS

29/85 CFS

CP3
58/234 CFS

ULOF2
1.85
<1/1 CFS

HM
0.24
1/1 CFS

ULON1
4.00
<1/2 CFS

ULON2
2.07
<1/1 CFS

PK
0.19
<1/1 CFS

GC
0.42
1/2 CFS

OFX1
2.13
<1/1 CFS

FH
0.30
1/1 CFS

ANTICIPATED FLOW RATE HEADING EAST IN FISHER FROM GRAND CANYON

ANTICIPATED FLOW RATE HEADING SOUTH IN GRAND CANYON FROM FISHER

*REF1 FORM HTE #10-18993 FOR ANN AND GRAND CANYON RESIDENTIAL

**REF2 FORM HTE #10-18993 FOR ANN AND GRAND CANYON RESIDENTIAL

***APPROX. 1/4 (OFX4) DRAINS TO GRAND CANYON DRIVE AND 3/4 (OFX4) DRAIN TO FISHER AVEN INCLUDED IN REF2

SCALE: 1" = 50'

DRAINAGE LEGEND

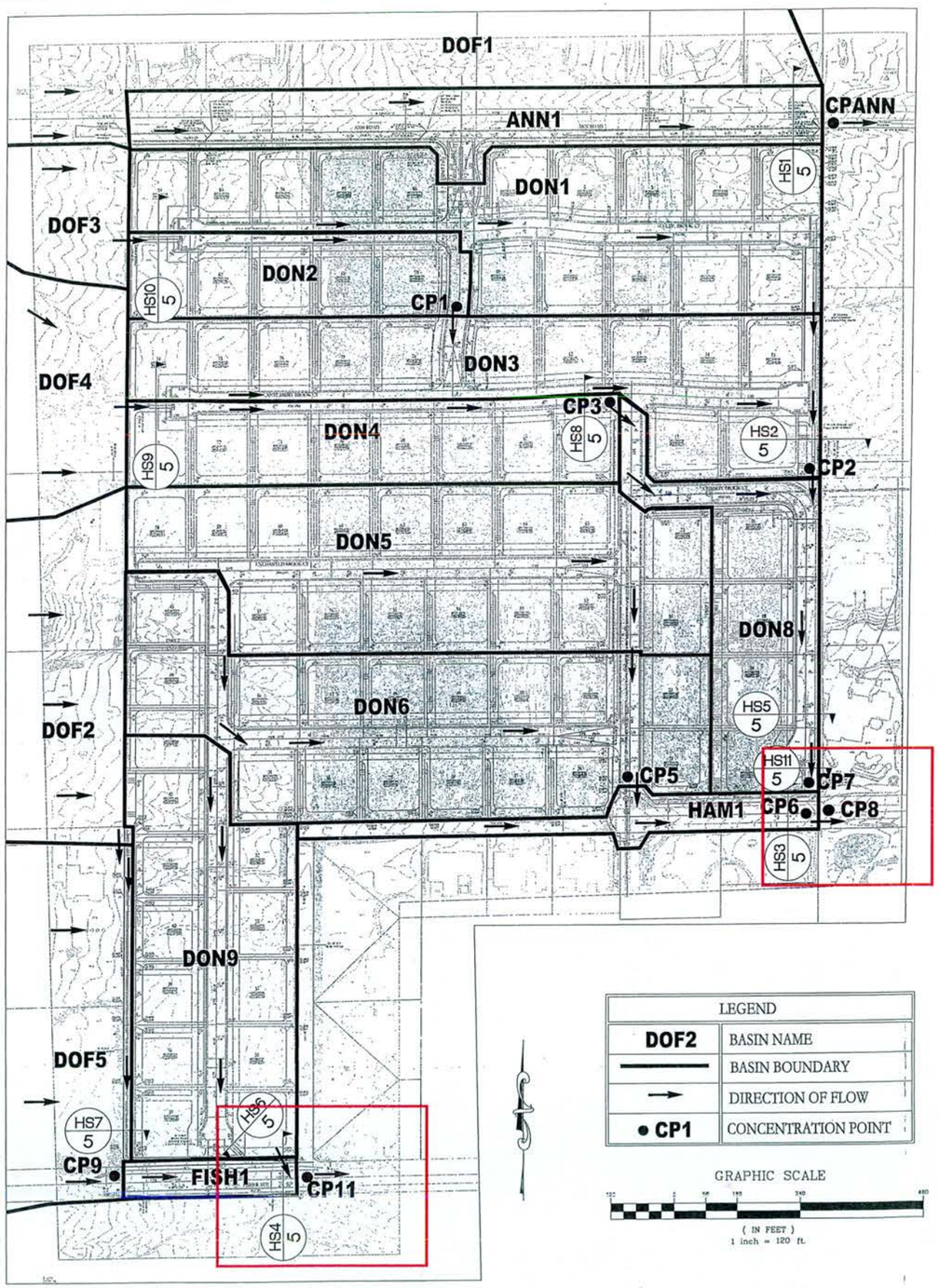
XOF1 / XXX	BASIN IDENTIFICATION / BASIN AREA (ACRES)
C1	BASIN BOUNDARY / CONCENTRATION POINT
	FLOW PATH
A	PROJECT SITE / CROSS SECTION
XX/XXX (XX/XXX)	10-YR/100-YR FLOW (CFS) / REFERENCE FLOW (CFS)

DATE: 6.25.2021
JOBNO: PNN_20005

EST. 2000

ULTIMATE CONDITION PARK AND HAMMER

FIGURE 7



FOR EXTENTS OF OFFSITE BASINS SEE FIGURE 4

LEGEND	
DOF2	BASIN NAME
———	BASIN BOUNDARY
→	DIRECTION OF FLOW
• CP1	CONCENTRATION POINT

GRAPHIC SCALE

(IN FEET)
1 inch = 120 ft.

SUMMARY OF FLOW RATES
FUTURE CONDITIONS

CONC. POINT/ DRAINAGE AREA	AREA, ACRES	PEAK FLOW, CFS 10-YR	PEAK FLOW, CFS 100-YR	NOTES
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	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)

THIS DRAINAGE MAP IS REFERENCED BY THE PW 21-17227 PROJECT

FUTURE CONDITIONS ONSITE DRAINAGE BASINS

TANEY ENGINEERING
6030 JONES BLVD SUITE #100
LAS VEGAS, NV 89118
(702) 362-8844 FAX:(702) 362-5233

FIGURE 5

WILLIAM LYON HOMES
ANN + GRAND CANYON

APPENDIX I

Reference Material
Technical Drainage Study for Grand Canyon & Rosada
(DS 4924)

Approval Letters

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM				DATE: January 25, 2018
TO: **Land Development Services** Department of Building & Safety				FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT:	Drainage Study for: **Grand Canyon and Rosada**			**COPIES TO:** GCW Engineers / Surveyors
Cross Streets:	Grand Canyon Drive and Rosada Way			Touchstone Living
File Number:	F:\Depot\DSMemos\DS4924C.doc			Bart Anderson, P.E., DevCo
Parcel Number:	125-31-701-005			CCPW
Zoning Action:	TMP-71297			
FEMA Flood Zone	YES	NO	X	
Proposed Storm Drain	YES	NO	X	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1st Submittal	10/5/2017	10/19/2017	Not Approved	$400.00	490480: $400
2nd Submittal	11/15/2017	12/5/2017	Conditional Approval	$400.00	491505: $400
CCPW	1/25/2018	1/25/2018	Concurrence Recv'd	N/C	N/C
			TOTAL FEES (LDDRS):	**$800.00**	**----**

REMARKS:

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

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

NOTE: Any future changes to the proposed design (or design assumptions) as outlined in the approved drainage study and attached preliminary grading plan which affect drainage must be addressed in a Drainage Study Update and accepted by the *City of Las Vegas Flood Control Section*. Additionally, conditional acceptance of a drainage study is valid for a period of one (1) year. If the proposed construction has not been completed in that time period, the *City of Las Vegas* reserves the right to require additional conditions and/or submission and acceptance of a complete drainage study update prior to further construction of a project.

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

END OF REMARKS
WSP/AYS

T/R/S: T19S/R60E/S31
AREA G-31

Rec'd: 1/25/18

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 Approval Letter

Date: January 10, 2018
Firm: GCW, Inc.
Engineer: Steve Jones, P.E.
Address: 1555 S. Rainbow Boulevard, Las Vegas, NV 89146
Phone: (702) 804-2000
Fax: (702) 804-2297
E-mail: sjones@gcwengineering.com

Subject: Technical Drainage Study for Grand Canyon & Rosada
Location: North of Rosada and Park Street intersection
APN: 125-31-701-005
Sec, Township, Range: S31, T19S, R60E
Flood Zone & Panel: Zone X, 1745E, dated September 27, 2002
Application Number: PW17-56751

Submittals	Date Received	Date Returned	Reviewer	Miscellaneous
Technical/Add 1	12/13/2017	01/09/2018	BC	
Plans	01/10/2018	01/10/2018	BC	

The above-referenced project is located within the **City of Las Vegas** adjacent to Clark County unincorporated areas. The study was submitted to Clark County for concurrence on December 13, 2017. In addition, the County has received the City of Las Vegas acceptance letter dated December 5, 2017 for the Technical Drainage Study (DS4924).

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
STEVE SISOLAK, Chairman • CHRIS GIUNCHIGLIANI, Vice Chair
SUSAN BRAGER • LARRY BROWN • JAMES B. GIBSON • MARILYN KIRKPATRICK • LAWRENCE WEEKLY
YOLANDA T. KING, County Manager

The County concurs with the acceptance of this Drainage Study by the City of Las Vegas. Please note that the County's review of this development is limited to drainage issues significant to Clark County unincorporated areas. The site shall be graded with respect to drainage as shown on "**Grand Canyon and Rosada**", improvement plan sheets C1 thru C4, G1, G2, D1, and D2, signed and sealed by Hao A. Nguyen, P.E., on November 13, 2017, and improvement plan sheets P1 thru P8, signed and sealed by Hao A. Nguyen, P.E., on January 9, 2018.

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.
	Per *Regional Flood Control District policies and Procedures manual, Section VIII. D. 13. Uniform Regulations for the Control of Drainage*, the Engineer of Record shall provide As-Built plans or record drawings to the District after completion and final inspection of such privately installed flood control facilities that have regional flood control significance.
	Structural calculations are required. The structural calculations, plans, and details must be approved prior to "Offsite" submittal and prior to CCRFCD submittal, if applicable.
X	Plan revisions can be found on the red-lined plans and must be addressed.
	Prepare drainage easement documents as shown on the grading plans.

Additional Conditions:

1. Provide cutoff wall along edge of placed asphalt for Washburn and Rosada, which is maintained by Clark County Public works.

2. Revise grading plan to accurately label all existing patent easements.

3. Revise note sheet to include Clark County Public Works standard notes and traffic notes.

4. Any improvements not depicted on the above mentioned grading plans may require an Update to this Technical Drainage Study.

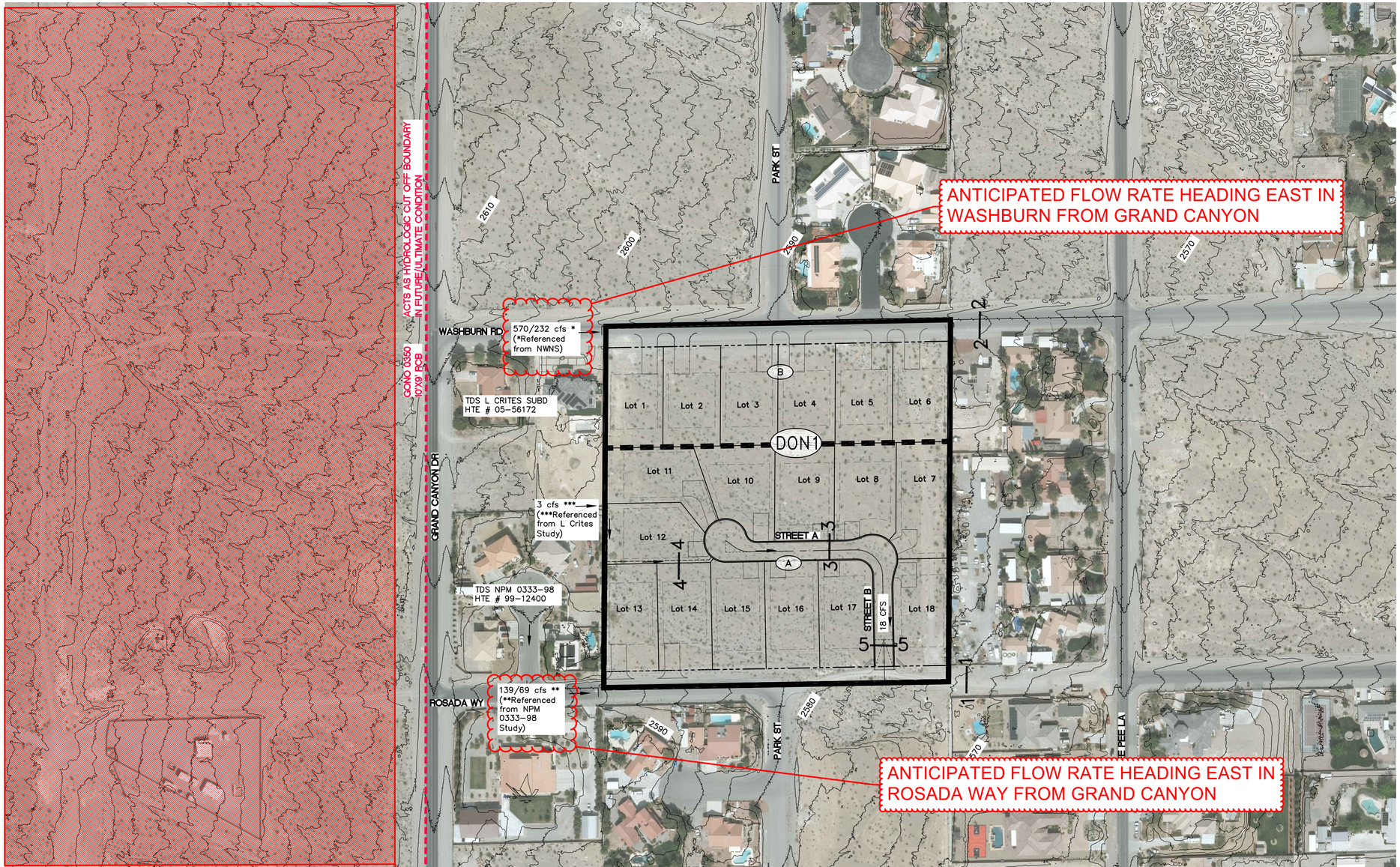
The County's review is solely based on the information submitted by the Engineer of Record. The County's review is strictly limited to compliance with minimum County Codes and Standards. The Engineer of Record is responsible for researching and addressing situations that may require designs above and 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.
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

Referenced Drainage Exhibits



NORTH

GRAPHIC SCALE

100 0 50 100

(IN FEET)

1 inch = 100 ft.

LEGEND

- SUBBASIN BOUNDARY
- DON1 — SUBBASIN DESIGNATION
- COND14 — CONCENTRATION POINT
- FLOW DIRECTION
- PRORATED SUBBASIN BOUNDARY
- A — SUBBASIN DESIGNATION
- FUTURE REGIONAL FACILITY

Note:
Site lies within 'A' soil; However, 'D' soil utilized in analysis for conservative purposes

PROPOSED CONDITION SUBBASIN FLOW RATE SUMMARY

Subbasin ID	Area (acres)	Q_{100} (cfs)	Q_{10} (cfs)
DON1	10.0	22	7

100-YR PROPOSED CONDITION PRORATED FLOW SUMMARY

Proposed Basins			
Subbasin*	Q_{100} (cfs)	Area (acres)	cfs/acre
DON1	22	10.0	2.20
Proposed Prorated Basins			
Subbasin*	Q_{100} (cfs)	Area (acres)	cfs/acre
A	15	6.6	2.20
B	7	3.4	2.20
TOTAL	22	10.0	2.20

10-YR PROPOSED CONDITION PRORATED FLOW SUMMARY

Proposed Basins			
Subbasin*	Q_{10} (cfs)	Area (acres)	cfs/acre
DON1	7	10.0	0.70
Proposed Prorated Basins			
Subbasin*	Q_{10} (cfs)	Area (acres)	cfs/acre
A	5	6.6	0.70
B	2	3.4	0.70
TOTAL	7	10.0	0.70

10-YEAR STREET FLOW CHARACTERISTICS

Location	Slope (%)	Q_{10} (cfs)	Depth (ft)	Velocity (ft/s)	D*V	Tributary
1-1: Rosada	2.6	76	1.07	5.32	5.7	** (69) + A (5) + *** (2)
2-2: Washburn	3.0	234	1.33	8.43	11.2	* (232) + B (2)

* Referenced from the CLV NWNS
*** Referenced from the L Crites Study

100-YEAR STREET FLOW CHARACTERISTICS PROPOSED CONDITIONS

Location	Slope (%)	Q_{100} (cfs)	Depth (ft)	Velocity (ft/s)	D*V	Tributary
1-1: Rosada	2.6	157	1.23	7.0	8.5	** (139) + A (15) + *** (3)
2-2: Washburn	3.0	577	1.70	12.0	20.4	* (570) + B (7)
3-3: Street A/ Street B	0.5	18	0.45	2.3	1.0	A (15) + *** (3)
4-4: Drainage Easement	1.0	3	0.22	3.5	N/A	*** (3)
5-5: Street B (before T-Intersection)	2.4	18	0.37	3.7	N/A	A (15) + *** (3)

* Referenced from the CLV NWNS
** Referenced from the NPM 0333-98 Study
*** Referenced from the L Crites Study

DATE: | GCW APP | DATE | AGEN APP | DATE | DESCRIPTION | REV | DATE

PROJECT NO. 767-605
DESIGN: GYT
DRAWN: GYT
CHECK:
PLOT DATE: 11-13-17
PLOT TIME: 16:21:40

GCW ENGINEERS \ SURVEYORS
1555 S. RAINBOW BLVD.
LAS VEGAS, NV 89146
T: 702.804.2000
F: 702.804.2299
gcwengineering.com

F:\Projects\300\398-A833\Division\Fet\Figures\RTC\FIGURE6.dwg
Nelson Boggs

TOUCHSTONE LIVING

GRAND CANYON AND ROSADA

PROPOSED CONDITIONS BASIN MAP

DRAWING
FIG 6
1 OF 1 SHTS

APPENDIX J

Reference Material
Technical Drainage Study for Park Meadows
(PW19-15982)

Approval Letters

Department of Public Works

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

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

LTR

PW19-15982

Drainage Study Approval Letter

Date: October 30, 2019
Firm: Per4mance Engineering
Engineer: Ray Fredericksen, P.E.
Address: 4525 W. Hacienda Avenue, Suite 190, Las Vegas, NV 89118
Phone: (702) 569-9770
Fax:
E-mail: rayf@per4mancelv.com

Subject: Technical Drainage Study for Park Meadows
Location: SEC of Rosada Way & Park Street
APN: 125-31-701-011
Sec, Township, Range: S31, T19S, R60E
Flood Zone & Panel: Zone X, 1745E, dated September 27, 2002
Application Number: PW19-15982

Submittals	Date Received	Date Returned	Reviewer	Miscellaneous
Technical	07/31/2019	08/19/2019	EC	
Addendum 1	09/04/2019	09/24/2019	EC	
Supplement	10/16/2019	10/30/2019	EC	Revised grading plans, FF's were lowered by 0.20ft

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

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 "**Park Meadows**" grading plan sheet GP-1, GP-2, and DT-1, signed and sealed by Ray F. Fredericksen, P.E., on October 7, 2019.

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.
X	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 on another property. Notarized written permission must be obtained **prior to** plan approval. A grading permit must be obtained from Building Dept prior to grading.
X	Right-of-way dedication must be verified.
	Any previously approved drainage easements that are not being used must be vacated.
	Per *Regional Flood Control District policies and Procedures manual, Section VIII. D. 13. Uniform Regulations for the Control of Drainage*, the Engineer of Record shall provide As-Built plans or record drawings to the District after completion and final inspection of such privately installed flood control facilities that have regional flood control significance.
	Structural calculations are required. The structural calculations, plans, and details must be approved prior to "Offsite" submittal and prior to CCRFCD submittal, if applicable.
X	Plan revisions can be found on the red-lined plans and must be addressed.
X	Prepare drainage easement documents as shown on the grading plans.

Additional Conditions:

1. Any improvements not depicted on the above mentioned grading plans may require an Update to this Technical Drainage Study.

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.

Ernie Corn, E.I.
Associate Engineer
Development Review
Ernie.corn@ClarkCountyNV.gov

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

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM				DATE: October 28, 2019
TO: **Land Development Services** Department of Building & Safety				FROM: Jennifer Shinn, P.E. Flood Control, Engr. Associate Department of Public Works
SUBJECT:	Drainage Study for: **Park Meadows Residential** (Project in Clark County for City of Las Vegas Concurrence)			COPIES TO: Per4mance Consulting Engineering
Cross Streets:	SEC of Brent Lane & Lutts Street			Marrero Louis/Pinnacle Homes
File Number:	F:\Depot\DSMemos\DS5202A.doc			Bart Anderson, P.E., DevCo
Parcel Number:	125-31-701-011			CCPW
Zoning Action:	N/A			
FEMA Flood Zone	YES	NO	X	
Proposed Storm Drain	YES	NO	X	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1st Submittal	10/14/2019	10/28/2019	See Comments Below	$400.00	3608857: $400
			TOTAL FEES (LDDRS):	**$400.00**	**----**

REMARKS:

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

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

City of Las Vegas Flood Control staff has reviewed the Technical Drainage Study, including the Addendum for the subject development "***Park Meadows***" within the jurisdiction of ***Clark County***. ***City of Las Vegas*** concurs with the acceptance of the drainage study by the ***Clark County Public Works Department***. The review of this project was limited to issues of flood control significance to the ***City of Las Vegas***.

NOTE: Any future changes to the proposed design (or design assumptions) as outlined in the approved drainage study and attached preliminary grading plan which affect drainage must be addressed in a Drainage Study Update and accepted by the *City of Las Vegas Flood Control Section*. Additionally, conditional acceptance of a drainage study is valid for a period of one (1) year. If the proposed construction has not been completed in that time period, the *City of Las Vegas* reserves the right to require additional conditions and/or submission and acceptance of a complete drainage study update prior to further construction of a project.

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

END OF REMARKS
jks

T/R/S: T19S/R60E/31
AREA G-31

Referenced Drainage Exhibits

PROJECT SITE

NO FLOW SPLIT CONSIDERATON

ANTICIPATED FLOW RATE HEADING EAST IN ROSADA WAY (OFF1)

OFF1

OFF5

OFF2

OFF3

OFF4

ONX1

ONX2

*DON1a

AREA ANALYZED BY AND REFERENCED FROM THE TDS FOR GRAND CANYON & ROSADA (DS4924 & PW17-5675). SEE REFERENCED FIGURE 6.

AREA ANALYZED BY AND REFERENCED FROM THE TDS FOR CHRISTIAN & SHARI GRIMES (HTE 08-8698). SEE REFERENCED FIGURES 5B & 5C.

Existing Condition Flow Rate Summary

Basin/Concentration Point ID	Area (ac)	Q_{10} (cfs)	Q_{100} (cfs)
OFF1	58.54	2	26
ONX1	1.07	<1	<1
**DON1a	-	5	18
CP1 (OFF1+OND1+**DON1a)	-	7	44
*CPA	-	27	110
OFF2	2.50	<1	1
OFF3	2.57	<1	2
OFF4	1.99	<1	1
OFF5	27.86	1	14
ONX2	3.93	<1	2
CP2 (*CPA+OFF2+OFF3+OFF4+OFF5+ONX2)	-	28	129

*Referenced from the Christian & Shari Grimes Study (HTE#08-8698)
**Referenced from the Grand Canyon & Rosada Study (DS4924 & PW17-5675)

Proposed Condition Flow Rate Summary

Basin/Concentration Point ID	Area (ac)	Q_{10} (cfs)	Q_{100} (cfs)
OFF1	58.54	2	26
OND1	1.67	<1	<1
**DON1a	-	5	18
CP1 (OFF1+OND1+**DON1a)	-	7	44
*CPA	-	27	110
OFF2	2.50	<1	1
OFF3	2.57	<1	2
OFF4	1.99	<1	1
OFF5	27.86	1	14
OND2	3.33	<1	<1
CP2 (*CPA+OFF2+OFF3+OFF4+OFF5+OND2)	-	28	127

*Referenced from the Christian & Shari Grimes Study (HTE #08-8698)
**Referenced from the Grand Canyon & Rosada Study (DS4924 & PW17-5675)

Ultimate Condition Flow Rate Summary

Basin/Concentration Point ID	Area (ac)	Q_{10} (cfs)	Q_{100} (cfs)
OFF1	58.54	<1	11
OND1	1.67	<1	<1
**DON1a	-	5	18
CP1 (OFF1+OND1+**DON1a)	-	5	29
*CPA	-	11	79
OFF2	2.50	<1	1
OFF3	2.57	<1	<1
OFF4	1.99	<1	<1
OFF5	27.86	<1	4
OND2	3.33	<1	<1
CP2 (*CPA+OFF2+OFF3+OFF4+OND2)	-	11	85

*Referenced from the Christian & Shari Grimes Study (HTE #08-8698)
**Referenced from the Grand Canyon & Rosada Study (DS4924 & PW17-5675)

GRAPHIC SCALE

400 0 200 400 800 1600

(IN FEET)
1 inch = 400 ft.

LEGEND

- DRAINAGE BASIN LINE
- PRORATED BASIN LINE
- EXISTING STORM DRAIN
- FLOW DIRECTION ARROW
- FLOW CROSS-SECTION
- xx/xx cfs (xx/xx cfs) 10-YR/100-YR FLOWS 10-YR/100-YR SD FLOWS
- DRAINAGE BASIN NAME
- PRORATED BASIN NAME
- REFERENCED BASIN NAME
- CONCENTRATION POINT
- REF CONCENTRATION POINT

NORTH

SHEET DR1 1 OF 2

PARK MEADOWS

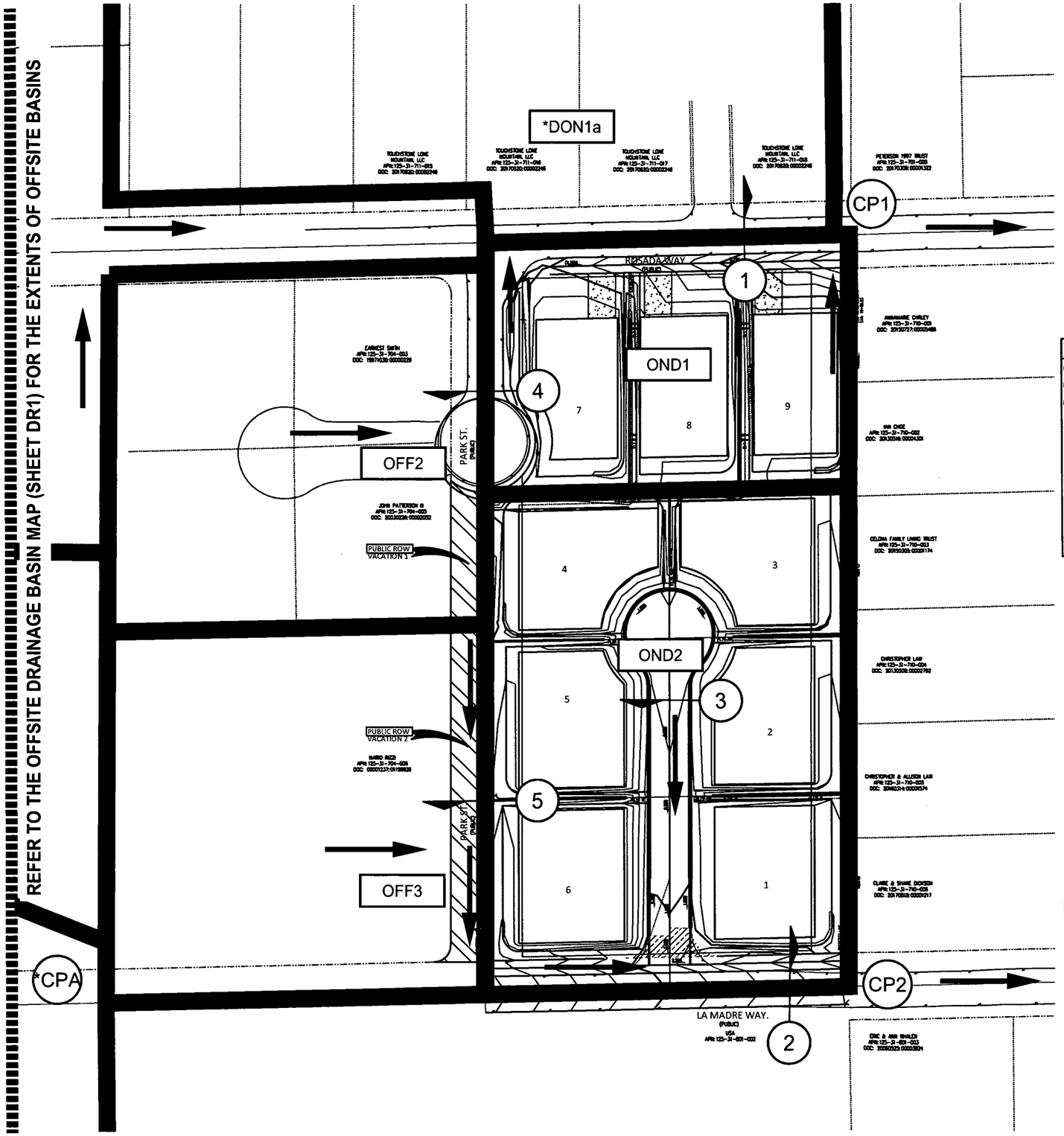
CLARK COUNTY NEVADA

Sheet: EXISTING/DEVELOPED CONDITION OFFSITE DRAINAGE BASIN MAP

PROJECT No. 19-0030
SCALE 1"=400'
DATE AUGUST 2019
DRAWN BY BTF

PERFORMANCE
4525 W. HACIENDA AVENUE, STE 1, LAS VEGAS, NEVADA 89118
TEL: (702)669-9770 EMAIL: RAYF@PERAMANCELV.COM

REFER TO THE OFFSITE DRAINAGE BASIN MAP (SHEET DR1) FOR THE EXTENTS OF OFFSITE BASINS



NORTH

GRAPHIC SCALE

300 0 150 300 600 1200

(IN FEET)
1 inch = 300 ft.

LEGEND

- DRAINAGE BASIN LINE
- PRORATED BASIN LINE
- EXISTING STORM DRAIN
- FLOW DIRECTION ARROW
- FLOW CROSS-SECTION
- xx/xx cfs — 10-YR/100-YR FLOWS
- (xx/xx cfs) — 10-YR/100-YR SD FLOWS
- DRAINAGE BASIN NAME
- PRORATED BASIN NAME
- REFERENCED BASIN NAME
- CONCENTRATION POINT
- REF CONCENTRATION POINT

Proposed Condition Flow Rate Summary

Basin/Concentration Point ID	Area (ac)	Q_{10} (cfs)	Q_{100} (cfs)
OFF1	58.54	2 ✓	26 ✓
OND1	1.67	<1	<1
**DON1a	-	5	18
CP1 (OFF1+OND1+**DON1a)	-	7 ✓	44 ✓
*CPA	-	27	110
OFF2	2.50	<1	1
OFF3	2.57	<1	2
OFF4	1.99	<1	1
OFF5	27.86	1 ✓	14 ✓
OND2	3.33	<1	<1
CP2 (*CPA+OFF2+OFF3+OFF4+OFF5+OND2)	-	28 ✓	127 ✓

*Referenced from the Christian & Shari Grimes Study (HTE #06-8698)
**Referenced from the Grand Canyon & Rosada Study (DS4924 & PW17-5675)

Ultimate Condition Flow Rate Summary

Basin/Concentration Point ID	Area (ac)	Q_{10} (cfs)	Q_{100} (cfs)
OFF1	58.54	<1	11
OND1	1.67	<1	<1
**DON1a	-	5	18
CP1 (OFF1+OND1+**DON1a)	-	5	29
*CPA	-	11	79
OFF2	2.50	<1	1
OFF3	2.57	<1	<1
OFF4	1.99	<1	<1
OFF5	27.86	<1	4
OND2	3.33	<1	<1
CP2 (*CPA+OFF2+OFF3+OFF4+OND2)	-	11	85

*Referenced from the Christian & Shari Grimes Study (HTE #06-8698)
**Referenced from the Grand Canyon & Rosada Study (DS4924 & PW17-5675)

Developed Condition Street Flow Summary - 100-Year

Cross Section	Slope (%)	Flow Rate (cfs)	Depth (ft)	Velocity (fps)	DxV	Dry Lane (ft)
1	2.70	44	0.44	4.39	1.93	N/A
(Q = CP1)	3.79		0.41	4.91	2.01	
2	2.30	127	0.63	6.22	3.92	N/A
(Q = CP2)	3.00		0.60	6.75	4.05	
3 (Q = OND1)	0.50	1	0.24	1.06	0.25	N/A
4 (Q = OFF2)	0.70	1	0.15	0.88	0.13	N/A
5 (Q = OFF2+OFF3+OFF4)	1.50	4	0.33	3.78	1.25	N/A

SHEET DR2 2 OF 2

PARK MEADOWS NEVADA

CLARK COUNTY

DEVELOPED CONDITION ONSITE DRAINAGE BASIN MAP

PROJECT No. 19-0050
SCALE 1"=300'
DATE AUGUST 2019
SHEET:
DRAWN BY RFF

PERFORMANCE ENGINEERING
4525 W. HACIENDA AVENUE STE 1, LAS VEGAS, NEVADA 89118
TEL: (702)589-9770 EMAIL: RAYF@PER4MANCELV.COM

APPENDIX K

Reference Material
Technical Drainage Study Update for Morley Properties
(PW18-1227)

Approval Letters

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 Approval Letter

LTR
PW18-12727

Date: June 19, 2018
Firm: Dwyer Engineering
Engineer: David A. Dwyer, P.E.
Address: 7310 Smoke Ranch Road, Suite E, Las Vegas, NV, 89128
Phone: (702) 254-2200
Fax: (702) 254-2236
E-mail: ddwyer@dwyerengineering.com

Subject: Update #1 for Morley Properties (MSM 0042-17)
Location: SWC of Eula and Rosada
APN: 125-31-301-004
Sec, Township, Range: S31, T19S, R60E
Flood Zone & Panel: Zone X, 1750E, Dated September 27, 2002
Application Number: PW18-12727

Submittals	Date Received	Date Returned	Reviewer	Miscellaneous
Update	04/05/2018	05/07/2018	BC	
Addendum 1	05/30/2018	06/19/2018	BC	

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

BOARD OF COUNTY COMMISSIONERS
STEVE SISOLAK, Chairman • CHRIS GIUNCHIGLIANI, Vice Chair
SUSAN BRAGER • LARRY BROWN • JAMES B. GIBSON • MARILYN KIRKPATRICK • LAWRENCE WEEKLY
YOLANDA T. KING, County Manager

The referenced **Technical Drainage Study Update** 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.

This update is to revise site grading, including revisions from CMU block walls to 2'x6'x5' concrete blocks. The previously approved Technical Drainage Study is PW17-32411-DS.

The site shall be graded with respect to drainage as shown on "**Morely Grading (MSM-0042-17)**", grading plan sheets 1, 2, 3, 4, 5, and 6, signed and sealed by David A. Dwyer, P.E., on May 29, 2018.

Check appropriate conditions

X	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).
X	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.
X	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 on another property. Notarized written permission must be obtained **prior to** plan approval. A grading permit must be obtained from Building Dept prior to grading.
X	Right-of-way dedication must be verified.
	Any previously approved drainage easements that are not being used must be vacated.
	Per *Regional Flood Control District policies and Procedures manual, Section VIII. D. 13. Uniform Regulations for the Control of Drainage*, the Engineer of Record shall provide As-Built plans or record drawings to the District after completion and final inspection of such privately installed flood control facilities that have regional flood control significance.
	Structural calculations are required. The structural calculations, plans, and details must be approved prior to "Offsite" submittal and prior to CCRFCD submittal, if applicable.
X	Plan revisions can be found on the red-lined plans and must be addressed.
X	Prepare drainage easement documents as shown on the grading plans.

Additional Conditions:

1. It appears the site design proposes excess fill and does not comply with Title 30.32-040-9. A design review is required for the excess fill. This application does not appear to have been submitted at the time of review.

2. It is noted that the portion of the proposed roadway improvements in Eula that is east of centerline is located within BLM property. A BLM grant will be necessary for this proposed work.

3. An updated geotechnical report will be required. The plans specify the geotechnical report is dated May 8, 2017 at the time of review.

4. Any improvements not depicted on the above mentioned grading plans will require an Update to this Technical Drainage Study.

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 Engineer
Development Review
Brian.Churchill@ClarkCountyNV.gov

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

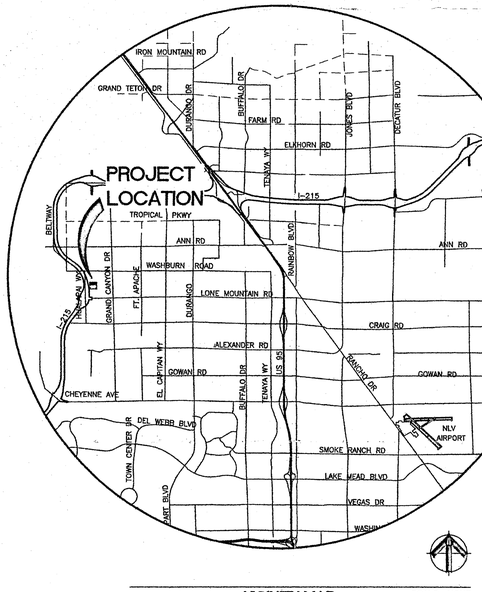
Referenced Plan Sheets

MORLEY PROPERTIES (MSM-0042-17)

EULA ST. AND ROSADA ST.
CLARK COUNTY, NEVADA
APN: 125-31-301-004

LEGEND

- ROADWAY CENTERLINE
- PROPERTY LINE / ROW LINE
- PROPOSED BUILDING FOOTPRINT
- PROPOSED SETBACK LINE
- PROPOSED WALL
- PROPOSED STRIPING
- PROPOSED EDGE OF PAVEMENT
- EXISTING EDGE OF PAVEMENT
- PROPOSED FENCE
- EXISTING 1' CONTOURS
- EXISTING 5' CONTOURS
- EXISTING FLOWLINE
- PROPOSED FLOWLINE
- PROPOSED GRADE BREAK LINE
- PROPOSED DRAIN PIPE
- EXISTING ELEC. VAULT
- EXISTING SIGN / PROPOSED SIGN
- CONCRETE PAVING
- COMPACTED TYPE II DRIVEWAY
- NEW AC PAVEMENT
- EXISTING AC PAVEMENT
- PROPOSED D(50)=6" RIP-RAP
- PROPOSED PRIVATE DRNG. ESMT PRIVATELY MAINTAINED
- PROPOSED SIGHT VISIBILITY ZONE
- PROPOSED DROP INLET
- EXISTING GRADE (TL 4.30)
- PROPOSED GRADE TL 4.30
- PROPOSED SLOPE 0.4%
- USBLM 14' WIDE EQUESTRIAN RIGHT OF WAY PER N-86681
- USBLM 33' WIDE PATENT RESERVATION PER PATENT NO.1217656



VICINITY MAP SCALE: NONE
T19S/ R60E/ SEC 31

ABBREVIATIONS

AC	ASPHALTIC CONCRETE
AB	AGGREGATE BASE
BRW	BOTTOM RETAINING WALL (NO TOP OF FOOTER)
BVC	BEGIN VERTICAL CURVE
CC	CLARK COUNTY
CCAUSD	CLARK COUNTY AREA UNIFORM STANDARD DRAWING
CL	CENTERLINE
CLV	CITY OF LAS VEGAS
CONC	CONCRETE
EG	EXISTING GROUND
EP	EDGE OF PAVEMENT
ESI	EMPIRE STRUCTURAL INC. (STRUCTURAL ENGINEER)
ESMT	EASEMENT
EVC	END VERTICAL CURVE
EX	EXISTING
FF	FINISH FLOOR
FG	FINISH GRADE
FL	FLOWLINE
FS	FINISHED SURFACE
GB	GRADE BREAK
GFF	GARAGE FINISHED FLOOR
HP	HIGH POINT
INST.	INSTRUMENT
INV	INVERT
LP	LOW POINT
L/S	LANDSCAPE
LT	LEFT
NAP	NOT A PART
NTS	NOT TO SCALE
OFF	OFFSET
PL	PROPERTY LINE
ROW	RIGHT OF WAY
RT	RIGHT
S	SLOPE
SB	SETBACK LINE
STA	STATION
TF	TOP OF FOOTER
TFEN	TOP OF FENCE
TRW	TOP OF RETAINING WALL
TW	TOP OF WALL
TYP	TYPICAL
VAC	VACATED
VC	VERTICAL CURVE
WI	WROUGHT IRON

OWNER/DEVELOPER

COREY MORLEY
8001 ROXBURGH CASTLE AVENUE
LAS VEGAS, NV. 89117
TEL: (702) 348-7071

CIVIL ENGINEER

DWYER ENGINEERING INC.
7310 SMOKE RANCH ROAD; SUITE E
LAS VEGAS, NV, 89128
TEL: 702-254-2200
FAX: 702-254-2236

INDEX OF SHEETS

1. COVER SHEET
2. GENERAL NOTES SHEET
3. GRADING PLAN
4. PLAN AND PROFILE – ROSADA STREET
5. PLAN AND PROFILE – EULA STREET
6. SECTIONS AND DETAILS
7. TRAFFIC CONTROL PLAN SHEET

APPROVALS

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

CENTRAL TELEPHONE COMPANY DBA CENTURY LINK DATE

"THE AFFIXED CENTURY LINK 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."

BASIS OF BEARINGS:

NORTH 89°51'25" EAST, BEING THE NORTH LINE OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 36, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.M., CLARK COUNTY, NEVADA AS SHOWN IN FILE 191 OF SURVEYS, PAGE 61 IN THE OFFICE OF THE CLARK COUNTY, NEVADA RECORDER.

BENCHMARK:

CLARK COUNTY VERTICAL CONTROL v.2003
BENCHMARK No. 1C9031C4
A RIVET AND SQUARE ALUMINUM PLATE IN A 4' X 4' CONCRETE ELECTRIC PAD (#AA314)
45' SOUTH AND 100' EAST OF GRAND CANYON DRIVE AND WASHBURN ROAD.
NAVD88 ELEVATION 794.785 METERS (2607.56 FEET)

LEGAL DESCRIPTION

BEING LOT 1 OF THAT CERTAIN LAND DIVISION AS RECORDED IN BOOK 900726 AS DOCUMENT NO. 00705 AND ALSO BEING A PORTION OF THE NORTH HALF (N 1/2) OF GOVERNMENT LOT 16 IN SECTION 31, AND ALSO BEING A PORTION OF THE NORTHEAST QUARTER (NE 1/4) THE SOUTHWEST QUARTER (SW 1/4) OF THE NORTHWEST QUARTER (NW 1/4) OF THE SOUTHWEST QUARTER (SW 1/4) OF SECTION 31, TOWNSHIP 19 SOUTH RANGE 60 EAST, M.D.M. OF CLARK COUNTY, NEVADA OFFICIAL RECORDS.

NOTE:

"PRE-DEVELOPEMENT MEETING WITH DEPARTMENT OF PUBLIC WORKS DEVELOPMENT REVIEW DIVISION, OFF-SITE INSPECTOR IS REQUIRED. PLEASE CONTACT THE INSPECTOR AT 702-455-4610".

DEVIATIONS FROM STANDARDS

NONE

SOILS REPORT NOTE:

ALL GRADING SHALL CONFORM TO THE SOIL REPORT:
ENGINEER: GEOTEK RESIDENTIAL LLC
DATE: MAY 8, 2017
JOB NUMBER: 13496-LVR

Update - must be less than 1 year old

FAST Call before you UnderGround 1-702-432-5800 FREEWAY AND ARTERIAL SYSTEM OF TRANSPORTATION

CALL BEFORE YOU DIG AVOID CUTTING UNDERGROUND UTILITY LINES. IT'S COSTLY. CALL 811 OR 1-800-227-2600

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

Job No.
FILE No.

REUSE OF DOCUMENTS
THIS DOCUMENT, AND THE IDEAS AND DESIGNS INCORPORATED HEREIN, AS AN INSTRUMENT OF PROFESSIONAL SERVICE, IS THE PROPERTY OF DWYER ENGINEERING INC. AND SHALL NOT BE USED, IN THE WHOLE OR IN PART, FOR ANY OTHER PROJECT WITHOUT THE WRITTEN AUTHORIZATION OF DWYER ENGINEERING, INC.

APPROVED

REVISIONS		
NO.	DATE	DESCRIPTION

DWYER ENGINEERING INC.
CIVIL ENGINEERS
LAND SURVEYORS
7310 SMOKE RANCH ROAD, SUITE E
LAS VEGAS, NEVADA 89128
WATER RIGHTS
LAND USE PLANNING
PHONE: (702) 254-2200
FAX: (702) 254-2236

COVER SHEET
MSM-0042-17 MORLEY PROPERTIES
EULA ST. AND ROSADA ST.
CLARK COUNTY, NEVADA
A.P.N. 125-31-301-004

JOB No.	16177
DATE:	05/23/18
VERT. SCALE:	N/A
HORIZ. SCALE:	N/A
DRAWN BY:	JGR
CHECKED BY:	DAD

SHEET 1 of 7

PW# 17-56740

Approved 8-28-18 22223

SOILS REPORT NOTE:

ALL GRADING SHALL CONFORM TO THE SOIL REPORT:
ENGINEER: GEOTEK RESIDENTIAL, LLC
DATE: MAY 8, 2017
JOB NUMBER: 13496-LVR

FLOOD ZONE NOTE

ACCORDING TO THE FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) FLOOD INSURANCE RATE MAP (FIRM) COMMUNITY-PANEL NUMBER 32003C1750E, REVISED SEPTEMBER 27, 2002. THE SITE IS LOCATED WITHIN A ZONE 'X'. A ZONE 'X' IS DEFINED BY FEMA AS AN AREA OUTSIDE THE 0.2% ANNUAL CHANCE FLOOD PLAIN.

EARTHWORK QUANTITIES

OFF-SITE

IMPORT	155 CY
EXPORT	671 CY
EXPORT	516 CY

ON-SITE

IMPORT	6974 CY
EXPORT	3072 CY
IMPORT	3902 CY

TOTAL

IMPORT	4418 CY

SVZ NOTE

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

PAVEMENT SECTION NOTE:

ALL AGGREGATE BASES SHALL BE COMPACTED PER GEOTCHNICAL REPORT HTE# 18- PRELIMINARY PAVEMENT SECTIONS SHALL BE VERIFIED WITH THE FINAL PAVEMENT SECTION RECOMMENDATION REPORT (MPSR) PRIOR TO CONSTRCTION. IF FINAL PAVMENT SECTIONS ARE DIFFERENT. A REVISION TO THE IMPROVMENT PLANS WILL BE REQUIRED.

NOTE:

THE LOCATION OF UNDERGROUND UTILITIES SHOWN HEREON HAS BEEN DETERMINED FROM SURFACE EVIDENCE OF THEIR EXISTENCE OR FROM VERY LIMITED INFORMATION OBTAINED FROM THE UTILITY COMPANIES AND FROM CLARK COUNTY. THE ENGINEER ACCEPTS NO LIABILITY FOR THE EXISTENCE OR NONEXISTENCE OF UTILITY LINES. CONTRACTORS AND OTHERS USING THIS MAP MUST CONFIRM THE LOCATION OF UNDERGROUND LINES OR STRUCTURES WITH THE UTILITY COMPANIES PRIOR TO COMMENCING ANY EXCAVATION. SOUTHWEST GAS CORPORATION STAND BY CONTACT No. IS (702-400-1789).

STORMWATER MANAGEMENT NOTES:

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

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

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

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

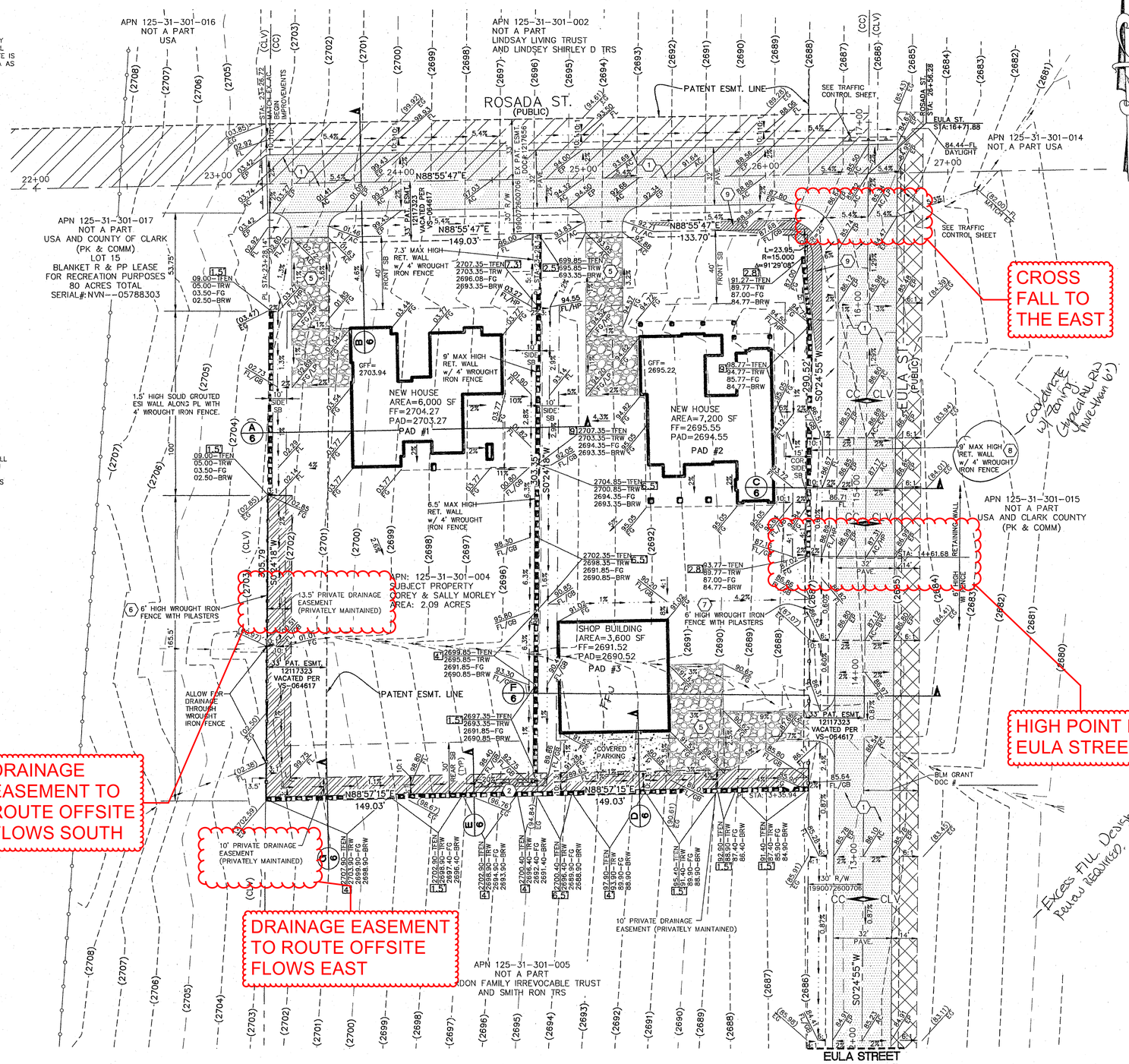
5.) ACCUMULATED SEDIMENT IN BMPs SHALL BE REMOVED WITHIN SEVEN DAYS AFTER A STORMWATER RUNOFF EVENT OR PRIOR TO THE NEXT ANTICIPATED STORM EVENT, WHICHEVER IS EARLIER. SEDIMENT MUST BE REMOVED WHEN BMP DESIGN CAPACITY HAS BEEN REDUCED BY 50 PERCENT OR MORE.

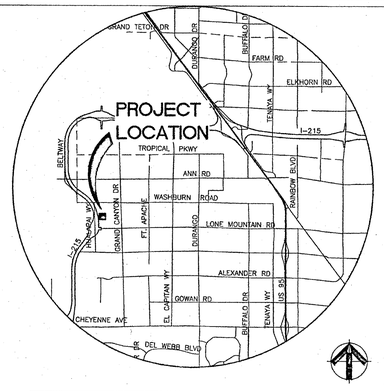
BASIS OF BEARINGS:

NORTH 89°51'25" EAST, BEING THE NORTH LINE OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 36, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.M., CLARK COUNTY, NEVADA AS SHOWN IN FILE 191 OF SURVEYS, PAGE 61 IN THE OFFICE OF THE CLARK COUNTY, NEVADA RECORDER. BENCHMARK IS VERIFIED BY PROFESSIONAL LAND SURVEYOR AND CORRECT AS OF 08/22/17.

BENCHMARK:

CLARK COUNTY VERTICAL CONTROL v.2003
BENCHMARK No. 1C90314
A RIVET AND SQUARE ALUMINUM PLATE IN A 4' X 4' CONCRETE ELECTRIC PAD (#AA314) 45' SOUTH AND 100' EAST OF GRAND CANYON DRIVE AND WASHBURN ROAD.
NAVD88 ELEVATION 794.785 METERS (2607.56 FEET)





VICINITY MAP

T19S/ R60E/ SEC 31

SCALE: NONE

GRAPHIC SCALE

30 0 15 30 60 120

(IN FEET)
1 inch = 30 ft.

SEE SHEET #1 FOR LEGEND AND ABBREVIATIONS

CONSTRUCTION NOTES:

		QUANTITIES
1	INSTALL 3" AC PAVEMENT PER CCAUSD No. 209 AND THIS PAVEMENT SECTION. SEE SHEET 7 FOR STRIPING. TYPICAL OFFSITE PAVEMENT SECTION N.T.S. ENGINEER: GEOTEK RESIDENTIAL, LLC DATE: MAY 8, 2017 JOB NUMBER: 13496-LVR FOG SEAL 3" ASPHALT CONCRETE 4" TYPE II A.B. AT 95% MAX. DENSITY	3,791 SY (PUBLIC) 421 CY (PUBLIC)
2	INSTALL D(50)=6" RIP-RAP 1' THICK, 4' WIDE ALONG FLOWLINE.	6 CY (PRIVATE)
3	NOT USED.	
4	NOT USED.	
5	CONSTRUCT COMPACTED TYPE II GRAVEL DRIVEWAY.	770 SY (PRIVATE)
6	CONSTRUCT 6' HIGH WROUGHT IRON FENCE WITH 6' PILASTERS ALONG THE INSIDE OF THE WEST PROPERTY LINE.	166 LF (PRIVATE)
7	CONSTRUCT 6' HIGH WROUGHT IRON FENCE WITH 6' PILASTERS ALONG THE INSIDE OF THE EAST PROPERTY LINE. START STA=13+35.94, END STA=14+61.68 (EULA ST. ALIGNMENT)	126 LF (PRIVATE)
8	CONSTRUCT 9' HIGH (MAX) RETAINING WALL WITH A 4' WROUGHT IRON FENCE ON TOP OF WALL. SEE ESI WALL DETAIL ON SHEET 6. START STA=14+61.68, END STA=16+25.70 (EULA ST. ALIGNMENT)	164 LF (PRIVATE)
9	SIGHT VISIBILITY ZONE PER CCAUSD 201.2 AND PER SVZ NOTE THIS SHEET. SEE TRAFFIC PLAN SHEET FOR DIMENSIONS.	

BLM EASEMENT LEGEND

USBLM 14' WIDE EQUESTRIAN RIGHT OF WAY PER N-86681

USBLM 33' WIDE PATENT RESERVATION PER PATENT NO.1217656

ENGINEERS CERTIFICATION:

I CERTIFY THAT THIS GRADING PLAN CONFORMS TO THE APPROVED DRAINAGE STUDY. (PW17-32411-DS) & (PW18-12727)

ACCEPTED
CLARK COUNTY PUBLIC WORKS
DEVELOPMENT REVIEW

BY _____

ACCEPTANCE OF THESE PLANS SHALL NOT BE CONSTRUED TO BE A PERMIT FOR OR APPROVAL OF ANY VIOLATION OF ANY OF THE PROVISIONS OR THE STATE OR COUNTY LAWS AND/OR SPECIFICATIONS.

FAST — Call before you UnderGround 1-702-432-5300 (FREEWAY AND NATIONAL SYSTEM OF TRANSPORTATION)

CALL BEFORE YOU DIG — AVOID CUTTING UNDERGROUND UTILITY LINES, IT'S COSTLY. CALL 811 or 1-800-227-2600

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

Job No.
FILE No.

REUSE OF DOCUMENTS

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APPROVED

REVISIONS

NO.	DESCRIPTION	DATE

PROFESSIONAL ENGINEER — STATE OF NEVADA — DAVID A. DWYER — No. 9166 — Exp. 6/30/19 — CIVIL

STAMP

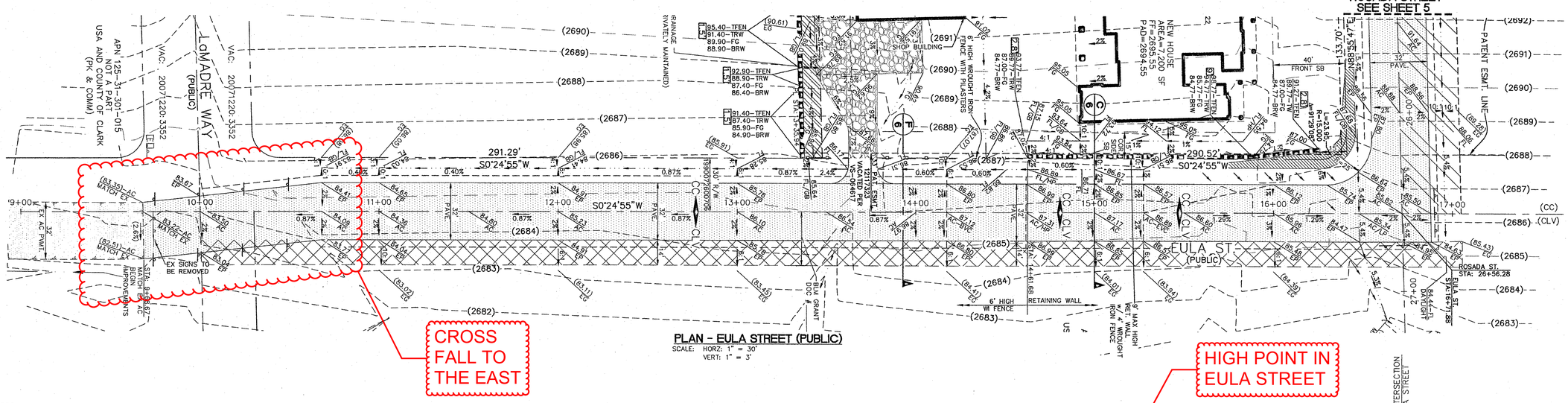
DWYER ENGINEERING INC.
CIVIL ENGINEERS — WATER RIGHTS
LAND SURVEYORS — LAND USE PLANNING
7210 SMOKE RANCH RD., SUITE E — (702) 254-2200
LAS VEGAS, NEVADA 89128 — fax: (702) 254-2258

GRADING PLAN
MSM-00342-17 MORLEY PROPERTIES
EULA ST. AND ROSADA ST.
CLARK COUNTY, NEVADA
A.P.N. 125-31-301-004

JOB No.	16177
DATE:	05/23/18
VERT. SCALE:	N/A
HORIZ. SCALE:	1"=30'
DRAWN BY:	JGR
CHECKED BY:	DAD

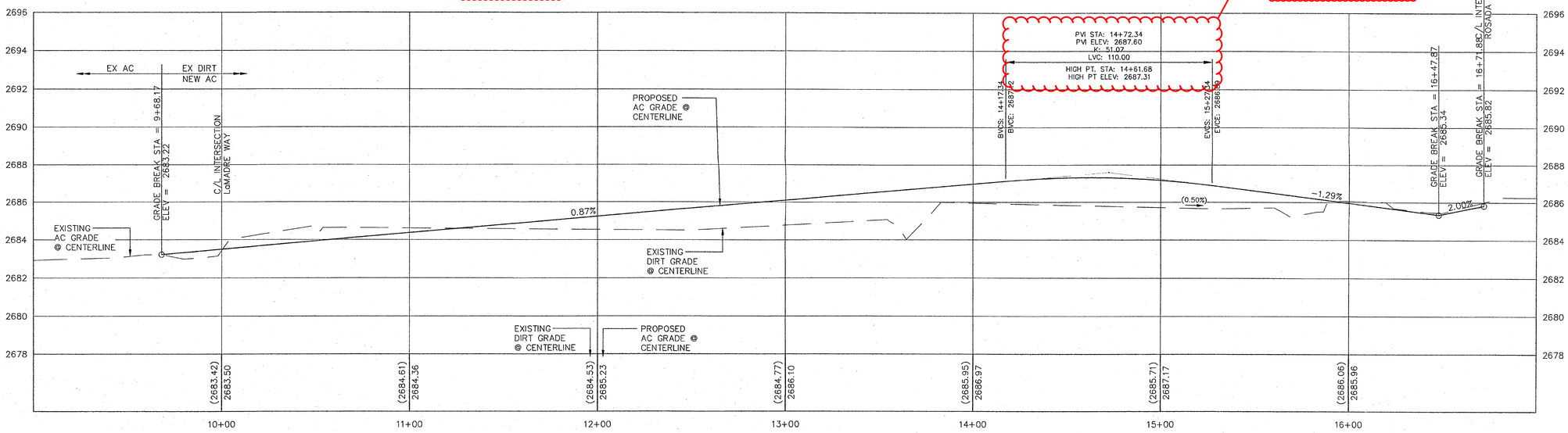
SHEET 3 of 7

PW# 17-56740



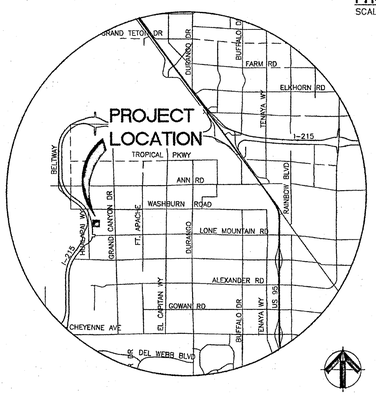
PLAN - EULA STREET (PUBLIC)

SCALE: HORZ: 1" = 30'
VERT: 1" = 3'



PROFILE - EULA STREET (PUBLIC)

SCALE: HORZ: 1" = 30'
VERT: 1" = 3'



VICINITY MAP

T19S/ R60E/ SEC 31

SCALE: NONE

BASIS OF BEARINGS:

NORTH 89°51'25" EAST, BEING THE NORTH LINE OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 31, TOWNSHIP 19 SOUTH, RANGE 60 EAST, M.D.M., CLARK COUNTY, NEVADA AS SHOWN IN FILE 191 OF SURVEYS, PAGE 61 IN THE OFFICE OF THE CLARK COUNTY, NEVADA RECORDER.

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A RIVET AND SQUARE ALUMINUM PLATE IN A 4' X 4' CONCRETE ELECTRIC PAD (#AA314) 45' SOUTH AND 100' EAST OF GRAND CANYON DRIVE AND WASHBURN ROAD.
NAVD88 ELEVATION 794.785 METERS (2607.56 FEET)

MAGNETIC

GRAPHIC SCALE

30 0 15 30 60 120

(IN FEET)
1 inch = 30 ft.

SEE SHEET #1 FOR LEGEND AND ABBREVIATIONS

ACCEPTED
CLARK COUNTY PUBLIC WORKS
DEVELOPMENT REVIEW

BY _____

ACCEPTANCE OF THESE PLANS SHALL NOT BE CONSTRUED TO BE A PERMIT FOR OR APPROVAL OF ANY VIOLATION OF ANY OF THE PROVISIONS OR THE STATE OR COUNTY LAWS AND/OR SPECIFICATIONS.

FAST Call before you UnderGround 1-702-432-5300 FREEWAY AND ARTERIAL SYSTEM OF TRANSPORTATION

CALL BEFORE YOU DIG AVOID CUTTING UNDERGROUND UTILITY LINES. IT'S COSTLY. CALL 811 OR 1-800-227-2600

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

Job No.
FILE No.

REUSE OF DOCUMENTS
THIS DOCUMENT, AND THE IDEAS AND DESIGN INCORPORATED HEREIN, AS AN INSTRUMENT OF PROFESSIONAL SERVICE, IS THE PROPERTY OF DWYER ENGINEERING, INC. AND IS NOT TO BE USED, IN THE WHOLE OR IN PART, FOR ANY OTHER PROJECT WITHOUT THE WRITTEN AUTHORIZATION OF DWYER ENGINEERING, INC.

APPROVED

REVISIONS

NO.	DESCRIPTION	DATE

STATE OF NEVADA
DAVID A. DWYER
No. 7785
Exp. 6/30/19
CIVIL
PROFESSIONAL ENGINEER
STAMP

DWYER ENGINEERING, INC.
CIVIL ENGINEERS
LAND SURVEYORS
7310 SMOKE RANCH RD., SUITE E
LAS VEGAS, NEVADA 89128
LAND PLANNERS
(702) 254-2290
fax: (702) 254-2256

PLAN AND PROFILE - EULA STREET
MSM-0042-17 MORLEY PROPERTIES
EULA ST. AND ROSADA ST.

A.P.N. 125-31-301-004
CLARK COUNTY, NEVADA

JOB No.	16177
DATE:	05/23/18
VERT. SCALE:	1"=3'
HORIZ. SCALE:	1"=30'
DRAWN BY:	JGR
CHECKED BY:	DAD
SHEET	5 of 7

PW# 17-56740

APPENDIX L

Reference Material
Technical Drainage Study for MSM 19-600022
(PW19-14561)

Approval Letters

Department of Public Works

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

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

LTR

Drainage Study Approval Letter PW19-14561

Date: October 10, 2019
Firm: Infinity Engineering
Engineer: Chi-Ying Seto, P.E.
Address: 3157 N. Rainbow Blvd, Suite 534; Las Vegas NV 89108
Phone: (702) 379-8812
Fax: (702) 974-0297
E-mail:

Subject: Technical Drainage Study for MSM 19-600022
Location: NWC of La Madre and Eula
APN: 125-31-301-005
Sec, Township, Range: S31, T19S, R60E
Flood Zone & Panel: Zone X, 1750E, dated September 27, 2002
Application Number: PW19-14561

Submittals	Date Received	Date Returned	Reviewer	Miscellaneous
Technical	06/05/2019	06/27/2019	BC	
Addendum 1	08/16/2019	09/12/2019	EC	
Supplement	10/03/2019	10/10/2019	EC	

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

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 "**MSM 19-600022**", grading plan sheet CV1 and GN1, signed and sealed by Chi-Ying Seto, P.E., on August 15, 2019 and grading plan sheet GR1 and DT1, signed and sealed by Chi-Ying, P.E. on October 2, 2019.

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.
X	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 on another property. Notarized written permission must be obtained **prior to** plan approval. A grading permit must be obtained from Building Dept prior to grading.
	Right-of-way dedication must be verified.
X	Any previously approved drainage easements that are not being used must be vacated.
	Per *Regional Flood Control District policies and Procedures manual, Section VIII. D. 13. Uniform Regulations for the Control of Drainage*, the Engineer of Record shall provide As-Built plans or record drawings to the District after completion and final inspection of such privately installed flood control facilities that have regional flood control significance.
	Structural calculations are required. The structural calculations, plans, and details must be approved prior to "Offsite" submittal and prior to CCRFCD submittal, if applicable.
X	Plan revisions can be found on the red-lined plans and must be addressed.
X	Prepare drainage easement documents as shown on the grading plans.

Additional Conditions:

1. Any improvements not depicted on the above mentioned grading plans may require an Update to this Technical Drainage Study.

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.

Ernie Corn, E.I.
Associate Engineer
Development Review
Ernie.corn@ClarkCountyNV.gov

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

Referenced Plan Sheets

GRADING PLAN

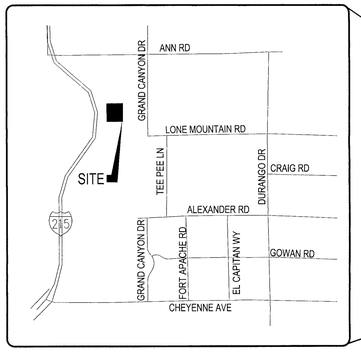
FOR

MSM 19-60022

A RESIDENTIAL LOT

LYING WITHIN THE SOUTHWEST QUARTER (SW1/4) OF SECTION 31,
TOWNSHIP 19 SOUTH, RANGE 60 EAST, M.D.M, CLARK COUNTY, NEVADA

APN: 125-31-301-005





VICINITY MAP

N.T.S

SHEET INDEX

SHEET NUMBER	SHEET TITLE
1 (CV1)	COVER SHEET
2 (GN1)	GENERAL NOTES SHEET
3 (GR1)	GRADING PLAN
4 (DT1)	DETAIL SHEET

PROJECT INFORMATION

APN: 140-28-211-022
PARCEL ACREAGE: 0.73 ACRES

PRIMARY STRUCTURE
1ST FLOOR LIVING: 1341 SF
2ND FLOOR LIVING: N/A SF
BASEMENT: N/A
GARAGE: 407 SF
ENTRY: 93 SF
GROSS AREA: 1841 SF

ACCESSORY STRUCTURE
1ST FLOOR LIVING: N/A
GARAGE: N/A

OWNER INFORMATION

OWNER NAME: SCHNEIDER BRIAN AND SCHNEIDER COLLIN
SITE ADDRESS:
OWNER ADDRESS: 8341 E. REDFIELD RD., SCOTTSDALE, AZ 85260
CONTACT TELEPHONE:
CONTACT EMAIL:

ZONING & LAND USE INFORMATION

CURRENT ZONING: R-E (RURAL ESTATES RESIDENTIAL)
OVERLAY DISTRICT: RNP I
PLANNED LANDUSE: RNP (RURAL NEIGHBORHOOD PRESERVATION)

R-E SETBACKS:

FRONT: 40'
INTERIOR SIDE: 10'
SIDE STREET: 10'
REAR: 30'

NOTES TO CONTRACTOR

1. THE CONTRACTOR AGREES THAT IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, THE CONTRACTOR SHALL BE REQUIRED TO ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THE PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY, THAT THIS REQUIREMENT SHALL BE MADE TO APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS, AND THE CONTRACTOR FURTHER AGREES TO DEFEND, INDEMNIFY AND HOLD DESIGN PROFESSIONALS HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF DESIGN PROFESSIONAL. THE CONTRACTOR SHALL VERIFY ALL CONDITIONS AND DIMENSIONS AND SHALL REPORT ALL DISCREPANCIES TO THE ENGINEER PRIOR TO THE COMMENCEMENT OF WORK. THE EXISTENCE AND APPROXIMATE LOCATION OF ANY UNDERGROUND FACILITIES SHOWN HEREON WERE OBTAINED FROM A SEARCH OF AVAILABLE RECORDS. THERE MAY, HOWEVER, BE EXISTING UTILITIES NOT SHOWN ON THE PLANS. THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO PROTECT THE UTILITIES AND/OR STRUCTURES SHOWN HEREON AND ANY OTHERS NOT OF RECORD OR NOT SHOWN ON THESE PLANS.
2. THE CONTRACTOR IS RESPONSIBLE FOR DUST AND EROSION CONTROL DURING THE CONSTRUCTION OF THE PROJECT.
3. 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.

FAST
Call before you UnderGround
1-702-432-5300
FREEWAY AND ARTERIAL SYSTEM OF TRANSPORTATION

CALL BEFORE YOU D G
AVOID CUTTING UNDERGROUND UTILITY LINES. IT'S COSTLY.
CALL 811
OR
1-800-227-2600

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

COX COMMUNICATIONS LAS VEGAS INC. DATE

SOUTHWEST GAS CORPORATION DATE

CENTRAL TELEPHONE COMPANY, DBA CENTURY LINK DATE

THE AFFIXED CENTRAL TELEPHONE COMPANY, DBA CENTURY LINK 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.

NEVADA POWER COMPANY DATE

NEVADA POWER COMPANY ACKNOWLEDGES THAT WE HAVE RECEIVED YOUR PLANS AND WILL PROVIDE SERVICE TO ALL ELECTRICAL NEEDS ASSOCIATED WITH THIS PROJECT. NEVADA POWER COMPANY 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.

REV. # | REV. DATE | REV. BY | REVISION DESCRIPTION:

MHP LIMITED
6440 Sky Pointe Drive #140-385
Las Vegas, NV 89131
TEL: (702) 803-6223

INFINITY ENGINEERING PROJECT NO.: 19-1000
DATE: 7/19
CHECKED BY: CYS
DATE: 7/19
DESIGNED BY: CYS
DATE: 7/19
DRAWN BY: CYS

INFINITY ENGINEERING LLC
4276 SPRING MOUNTAIN RD #200
LAS VEGAS, NEVADA 89102
TEL: (702) 827-1414
FAX: (702) 827-1413
WWW.INFINITYENGR.COM

Infinity Engineering

SHEET TITLE: COVER SHEET

MSM 19-600022
CLARK COUNTY, NV

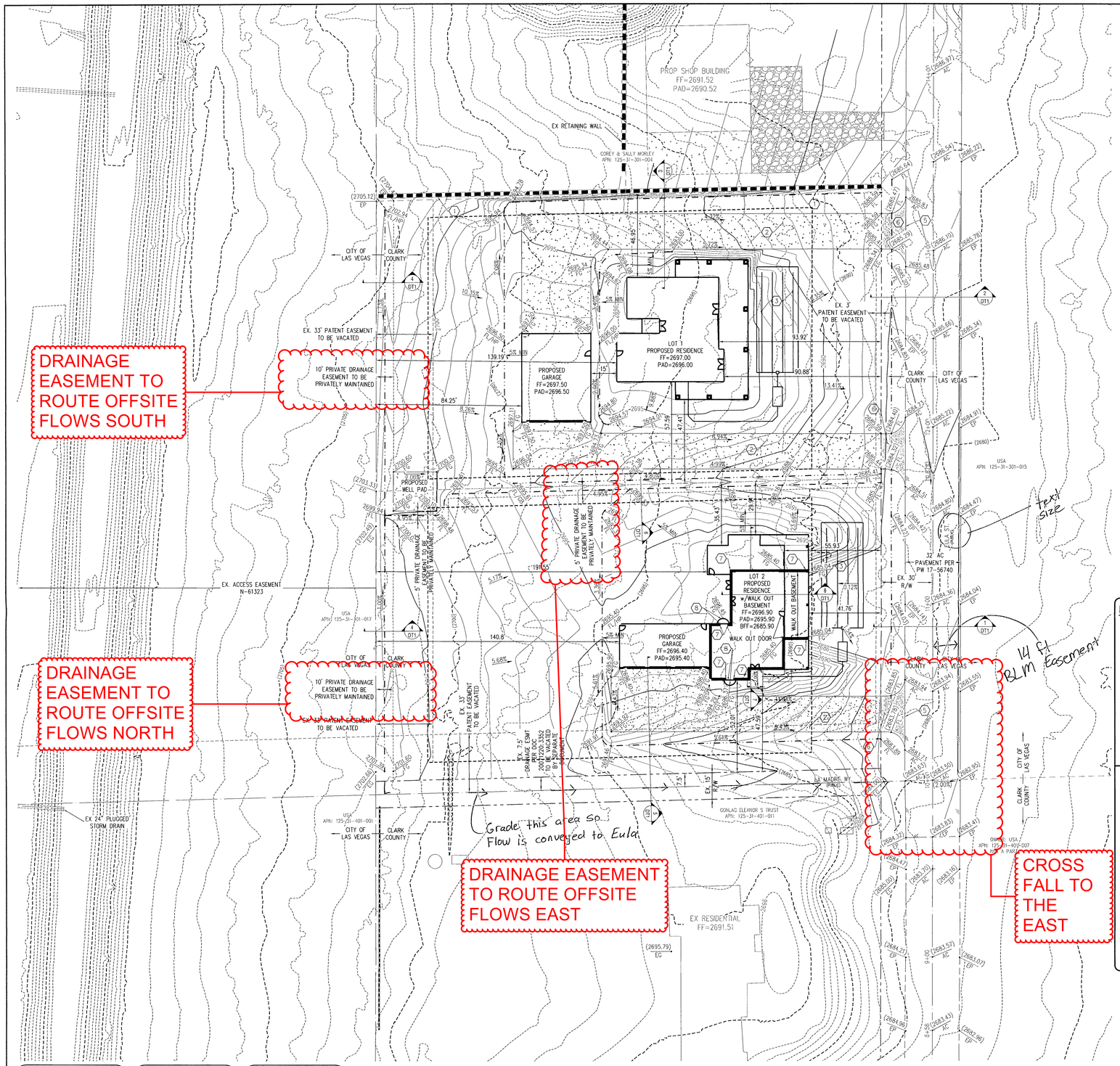
SEAL
PROFESSIONAL ENGINEER
CHI-YING SETO
Exp: 6-30-20
CIVIL
No. 21472
STATE OF NEVADA
5/15/19

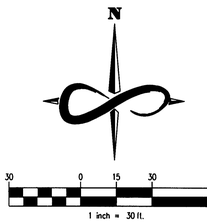
SHEET CV1
1 OF 4

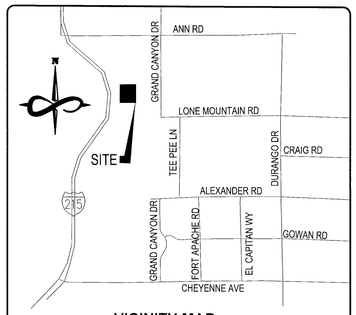
PW19-14561

APPLANS

PW19-14561







VICINITY MAP
NOT TO SCALE

GRADING NOTES

1. EXISTING RETAINING WALL TO REMAIN, DO NOT DISTURB
2. CONSTRUCT AC DRIVEWAY PER DETAIL "B" ON SHEET DT1 OR ARCHITECTURAL PLANS FOR SPECIAL PAVING
3. PROPOSED SEPTIC SYSTEM AND LEACH FIELD TO BE INSTALLED BY OTHERS
4. PROPOSED WELL BY TO BE INSTALLED BY OTHERS
5. TIE INTO EXISTING PAVEMENT
6. CONSTRUCT AC DRIVEWAY PER DETAIL "A" ON SHEET DT1
7. LIMITS OF PROPOSED BASEMENT
8. PROP WINDOW WITH WINDOW WELL. PROVIDE POSITIVE DRIAINAGE AWAY FROM WINDOW WELL

LEGEND

- PROPERTY LINE
- ADJACENT PROPERTY LINE
- RIGHT OF WAY
- ROADWAY CENTERLINE
- EXISTING FENCE
- EXISTING C.M.U. BLOCK WALL
- SETBACK LINE
- EDGE OF PAVEMENT
- PROPOSED 1' CONTOUR
- XXXX — PROPOSED 5' CONTOUR
- EXISTING 1' CONTOUR
- (XXXX) — EXISTING 5' CONTOUR
- FLOWLINE / SWALE
- EXISTING FIRE HYDRANT
- EXISTING SANITARY SEWER MH
- EP — EDGE OF PAVEMENT
- FL — FLOWLINE
- FG — FINISHED GRADE
- FF — FINISHED FLOOR
- APN — ASSESSOR'S PARCEL NUMBER
- CONC — CONCRETE
- FH — FIRE HYDRANT
- R/W — RIGHT OF WAY
- OR: — OFFICIAL RECORDS
- CONCRETE DRIVEWAY/SIDEWALK
- AC PAVING

NOTES TO CONTRACTOR

1. THE CONTRACTOR AGREES THAT IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, THE CONTRACTOR SHALL BE REQUIRED TO ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THE PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY, THAT THIS REQUIREMENT SHALL BE MADE TO APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS, AND THE CONTRACTOR FURTHER AGREES TO DEFEND, INDEMNIFY AND HOLD DESIGN PROFESSIONALS HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF DESIGN PROFESSIONAL. THE CONTRACTOR SHALL VERIFY ALL CONDITIONS AND DIMENSIONS AND SHALL REPORT ALL DISCREPANCIES TO THE ENGINEER PRIOR TO THE COMMENCEMENT OF WORK. THE EXISTENCE AND APPROXIMATE LOCATION OF ANY UNDERGROUND FACILITIES SHOWN HEREON WERE OBTAINED FROM A SEARCH OF AVAILABLE RECORDS. THERE MAY, HOWEVER, BE EXISTING UTILITIES NOT SHOWN ON THE PLANS. THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO PROTECT THE UTILITIES AND/OR STRUCTURES SHOWN HEREON AND ANY OTHERS NOT OF RECORD OR NOT SHOWN ON THESE PLANS.
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STORM WATER POLLUTION STANDARD PLAN NOTES

1. THE OWNER, SITE DEVELOPER, CONTRACTOR, AND/OR THEIR AUTHORIZED AGENTS SHALL EACH DAY REMOVE ALL SEDIMENT, MUD, CONSTRUCTION DEBRIS, OR OTHER POTENTIAL POLLUTANTS THAT MAY HAVE BEEN DISCHARGED TO, OR ACCUMULATED IN, THE PUBLIC RIGHTS OF WAY OF CLARK COUNTY AS A RESULT OF CONSTRUCTION ACTIVITIES ASSOCIATED WITH THIS SITE DEVELOPMENT OR CONSTRUCTION PROJECT. SUCH MATERIALS SHALL BE PREVENTED FROM ENTERING THE STORM SEWER SYSTEM.
2. ADDITIONAL CONSTRUCTION SITE DISCHARGE BEST MANAGEMENT PRACTICES MAY BE REQUIRED OF THE OWNER AND HIS OR HER AGENTS DUE TO UNFORESEEN EROSION PROBLEMS OR IF THE SUBMITTED PLAN DOES NOT MEET THE PERFORMANCE STANDARDS SPECIFIED IN CLARK COUNTY TITLE 24.40 AND THE LAS VEGAS VALLEY CONSTRUCTION SITE BMP GUIDANCE MANUAL.
3. TEMPORARY OR PERMANENT STABILIZATION PRACTICES WILL BE INSTALLED ON DISTURBED AREAS AS SOON AS PRACTICABLE AND NO LATER THAN 14 DAYS AFTER THE CONSTRUCTION ACTIVITY IN THAT PORTION OF THE SITE HAS TEMPORARILY OR PERMANENTLY CEASED. SOME EXCEPTIONS MAY APPLY; REFER TO THE NEVADA STORMWATER GENERAL PERMIT FOR CONSTRUCTION ACTIVITY NVR100000, SECTION III.A.5.
4. AT A MINIMUM, THE CONTRACTOR OR HIS AGENT SHALL INSPECT ALL DISTURBED AREAS, AREAS USED FOR STORAGE OF MATERIALS AND EQUIPMENT THAT ARE EXPOSED TO PRECIPITATION, VEHICLE ENTRANCE AND EXIT LOCATIONS, AND ALL BMPS WEEKLY, AND WITHIN 24 HOURS AFTER ANY RAIN EVENT OF 0.5 INCHES OR MORE. THE CONTRACTOR OR HIS AGENT SHALL UPDATE OR MODIFY THE STORMWATER POLLUTION PREVENTION PLAN AS NECESSARY. SOME EXCEPTIONS TO WEEKLY INSPECTIONS MAY APPLY, SUCH AS SUSPENSION OF LAND DISTURBANCE ACTIVITIES. REFER TO THE NEVADA STORMWATER GENERAL PERMIT FOR CONSTRUCTION ACTIVITY NVR100000, SECTION III.A.12.
5. ACCUMULATED SEDIMENT IN BMPS SHALL BE REMOVED WITHIN SEVEN DAYS AFTER A STORMWATER RUNOFF EVENT OR PRIOR TO THE NEXT ANTICIPATED STORM EVENT, WHICHEVER IS EARLIER. SEDIMENT MUST BE REMOVED WHEN BMP DESIGN CAPACITY HAS BEEN REDUCED BY 50 PERCENT OR MORE.

GEOTECHNICAL REPORT

GEOTEK RESIDENTIAL, LLC
6835 SOUTH ESCONDIDO STREET, SUITE B
LAS VEGAS, NV 89119
TEL: (702) 897-1424
FAX: (702) 897-2213
JOB NO: 14758-LVR
DATE: APRIL 22, 2019

FLOOD ZONE INFORMATION

THE SUBJECT SITE IS LOCATED WITHIN FEMA ZONE "X" AS SHOWN ON F.I.R.M. FLOOD INSURANCE RATE MAP COMMUNITY PANEL NUMBER 1750E, MAP REVISED SEPTEMBER 27, 2002. ZONE X IS DEFINED BY FEMA AS AREA OF 0.2% ANNUAL CHANCE FLOOD; AREA 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.

I CERTIFY THAT THIS GRADING PLAN IS IN CONFORMANCE WITH THE APPROVED DRAINAGE STUDY ON FILE AT CLARK COUNTY FOR THIS PROJECT. (PW 19-14561).

CHI-YING SETO, P.E. No. 21422 — DATE

CLARK COUNTY DEPARTMENT OF PUBLIC WORKS
DEVELOPMENT REVIEW

ACCEPTANCE OF PLANS FOR FILING

BY: _____

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

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

BENCHMARK

BENCH ID: SLV9936C4

DESCRIPTION: CITY OF LAS VEGAS RIVET AND PLATE IN TOP OF TRANSFORMER PAD 170' EAST OF WASHBURN ROAD AND ALPINE RIDGE WAY.

ELEVATION: 874.793 METERS
2,870.05 FEET (U.S. SURVEY FEET) NAVD88 v.2018

LEGAL DESCRIPTION

THE SOUTH HALF (S 1/2) OF GOVERNMENT LOT SIXTEEN (16) IN SECTION 31, TOWNSHIP 19 SOUTH, RANGE 60 EAST, M.D.B. AND M., ALSO KNOWN AS THE SOUTHEAST QUARTER (SE 1/4) OF THE SOUTHWEST QUARTER (SW 1/4) OF THE NORTHWEST QUARTER (NW 1/4) OF THE SOUTHWEST QUARTER (SW 1/4) OF SECTION 31; EXCEPTING THEREFROM THAT PORTION OF LAND AS CONVEYED TO CLARK COUNTY FOR ROAD PURPOSES BY DEED RECORDED JULY 26, 1990 IN BOOK 900726 AS DOCUMENT NO. 00706 OF OFFICIAL RECORDS, CLARK COUNTY, NEVADA. BEING FURTHER DESCRIBED AS LOT 2 OF THAT CERTAIN CERTIFICATE OF LAND DIVISION RECORDED JULY 26, 1990 AT BOOK 900726 AS DOCUMENT NO. 00705 OF OFFICIAL RECORDS, CLARK COUNTY, NEVADA.

APN: 125-31-301-005

BASIS OF BEARINGS

NORTH 88°32'05" WEST, BEING THE NORTH LINE OF THE NORTHEAST QUARTER (NE 1/4) OF THE SOUTHWEST QUARTER (SW 1/4) OF SECTION 31, TOWNSHIP 19 SOUTH, RANGE 60 EAST, M.D.M., CLARK COUNTY, NEVADA, AS SHOWN BY MAP THEREOF IN FILE 206 PAGE 53 OF SURVEYS IN THE CLARK COUNTY RECORDER'S OFFICE, NEVADA.

SURVEY MONUMENTATION

OWNER RESPONSIBLE TO PROVIDE SURVEY MONUMENTATION AS SHOWN ON THE PLANS (IF APPLICABLE) AND TO REPLACE ALL SURVEY MONUMENTATION THAT ARE DAMAGED, DISTURBED, DESTROYED, OR OBSCURED DURING CONSTRUCTION OR AS REQUESTED BY THE GOVERNING AGENCIES.

FAST — Call before you UnderGround — 1-702-432-5300 — FREEWAY AND ARTERIAL SYSTEM OF TRANSPORTATION

CALL BEFORE YOU DIG — AVOID CUTTING UNDERGROUND UTILITY LINES. IT'S COSTLY. CALL 811 OR 1-800-227-2600

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

REV. #	REV. DATE:	REV. BY:	REVISION DESCRIPTION:

MHP LIMITED
6440 Sky Pointe Drive #140-385
Las Vegas, NV 89151
TEL: (702) 803-6223

INFINITY ENGINEERING PROJECT NO.: 19-1000

DRAWN BY:	DATE:	DESIGNED BY:	DATE:	CHECKED BY:	DATE:
CYS	7/19	CYS	7/19	CYS	7/19

INFINITY ENGINEERING LLC
4276 SPRING MOUNTAIN RD #200
LAS VEGAS, NEVADA 89102
TEL: (702) 827-1414
FAX: (702) 827-1413
WWW.INFINITYENGR.COM

Infinity Engineering

GRADING PLAN

MSM 19-600022
CLARK COUNTY, NV

SEAL — PROFESSIONAL ENGINEER — STATE OF NEVADA — CHI-YING SETO — Exp: 6-30-20 — CIVIL — No. 21422 — 10/1/19

SHEET GR1
3 OF 4

PW19-14561

APPENDIX M

Reference Material
Technical Drainage Study for Infante – 2 Lots
(PW18-11461)

Approval Letters

LTR PW18-11461

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 Approval Letter

Date: March 22, 2018
Firm: ACG Design
Engineer: Randolph A Skorpinski, P.E.
Address: 4310 Cameron St., Las Vegas, NV 89144
Phone: (702) 569-9157
Fax: n/a
E-mail: RSkorpinski@acg.design

Subject: Technical Drainage Study for Infante 2-Lot Residential MSM 17-600097
Location: SWC of West La Madre Way and North Jensen Street
APN: 125-31-401-004
Sec, Township, Range: S31, T19S, R60E
Flood Zone & Panel: Zone X, 1745E, Dated September 27, 2002
Application Number: PW18-11461UP

Submittals	Date Received	Date Returned	Reviewer	Miscellaneous
Update	02/26/2018	03/22/2018	PR	

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

BOARD OF COUNTY COMMISSIONERS
STEVE SISOLAK, Chairman • CHRIS GIUNCHIGLIANI, Vice Chair
SUSAN BRAGER • LARRY BROWN • JAMES B. GIBSON • MARILYN KIRKPATRICK • LAWRENCE WEEKLY
YOLANDA T. KING, County Manager

The referenced **Technical Drainage Study Update** 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.

This update is to reduce the number of lots in the subdivision from 3 to 2. The previously approved Technical Drainage Studies are: 16-43375 and 17-36053UP.

The site shall be graded with respect to drainage as shown on "**Infante - 2 Lot Residential MSM 17-600097**", grading plan sheets C-1, C-2, C-3, C-05, C7, and C-8, signed and sealed by Randolph A. Skorpinski, P.E., on February 16, 2018.

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.
X	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 on another property. Notarized written permission must be obtained **prior to** plan approval. A grading permit must be obtained from Building Dept prior to grading.
X	Right-of-way dedication must be verified.
	Any previously approved drainage easements that are not being used must be vacated.
	Per *Regional Flood Control District policies and Procedures manual, Section VIII. D. 13. Uniform Regulations for the Control of Drainage*, the Engineer of Record shall provide As-Built plans or record drawings to the District after completion and final inspection of such privately installed flood control facilities that have regional flood control significance.
	Structural calculations are required. The structural calculations, plans, and details must be approved prior to "Offsite" submittal and prior to CCRFCD submittal, if applicable.
X	Plan revisions can be found on the red-lined plans and must be addressed.
X	Prepare drainage easement documents as shown on the grading plans.

Additional Conditions:

1. There appears to be an MSM (17-600097) still pending for the parcel. While there do not appear to be any preliminary conditions that would alter the design, and zoning conditions issued that require changes to the grading plan may require an Update to this Technical Drainage Study.

2. Any improvements not depicted on the above mentioned grading plans may require an Update to this Technical Drainage Study.

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.

Patrick Robinson, P.E.
Senior Civil Engineer
Development Review
Patrick.Robinson@ClarkCountyNV.gov

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

Referenced Drainage Exhibits

GRAPHIC SCALE
60 0 30 60 120
(IN FEET)
1" = 60'

N

FLOW CHARACTERISTICS – DEVELOPED CONDITION (10 YEAR)					
SECTION NUMBER	SLOPE (%)	Q_{10} (cfs)	DEPTH (ft)	VELOCITY (ft/s)	D*V
6A	4.89	2	0.16	3.71	0.59

FLOW CHARACTERISTICS – DEVELOPED CONDITION (100 YEAR)					
SECTION NUMBER	SLOPE (%)	Q_{100} (cfs)	DEPTH (ft)	VELOCITY (ft/s)	D*V
6B	4.89	16	0.30	5.97	1.79
7	0.25	1	0.23	0.72	0.17

LEGEND

OFF1 — SUBBASIN BOUNDARY
1 — SUBBASIN NAME
(2555) — FLOW DIRECTION
FLOWMASTER SECTION
EXISTING CONTOURS

ANTICIPATED FLOW RATE IN LA MADRE AT JENSEN

SUMMARY OF DEVELOPED CONDITIONS			
BASIN NAME	AREA (AC)	Q_{10} (CFS)	Q_{100} (CFS)
ON2	2.05	<1	<1
OFF4	2.25	<1	<1
DOFF2*	14.50	2	16
OFF5	0.21	<1	<1

* REFERENCED FROM HYDROLOGY STUDY FOR MOUNTAIN VISTA, SECTION 31, TOWNSHIP 19 SOUTH, RANGE 60 EAST BY BAUGHMAN & TURNER (HTE#05-10097)

PROJECT SITE

DOFF2*

OFF4

ON2

OFF5

Conquistador Street

APPROVAL

REV.	DESCRIPTION	APRVD. BY	DATE

REVISIONS

INFANTE - 2 LOT RESIDENTIAL (MSM 17-600097)

DEVELOPED CONDITIONS
APN: 125-31-401-004
SW CORNER W. LA MADRE WAY & N. JENSEN ST.
LAS VEGAS, NEVADA 89149

ACG DESIGN
4310 CAMERON ST., SUITE 12-A
LAS VEGAS, NEVADA 89103
OFFICE: 702.448.8737
WEBSITE: WWW.ACGDESIGN

ENGINEER'S SEAL
PROFESSIONAL ENGINEER
RANDOLPH A. SKORPINSKI
EXP: 06-30-18
CIVIL
No. 14965
STATE OF NEVADA
FEB 16 2018

DATE:	02/14/18
PROJ. NO:	160236
DRAWN BY:	ARB
CHECKED BY:	RAS
SCALE:	AS NOTED
JURISDICTION:	CLARK COUNTY

DRAWING NUMBER:
FIG 7
SHEET - OF 8

AGENCY NUMBER:
HTE # 16-57573

APPENDIX N

Reference Material

Technical Drainage Study for Cristian & Shari Grimes Residence

(PW07-42495)

Approval Letters

LTR

W

REGIONAL FLOOD CONTROL DISTRICT

Gale Wm. Fraser, II, P.E.
General Manager/Chief Engineer

BOARD OF DIRECTORS

Larry Brown
Chairman
City of Las Vegas

Chip Maxfield
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David Bennett
City of Mesquite

Robert L. Eliason
City of North Las Vegas

Mayor Oscar Goodman
City of Las Vegas

Andy Hafen
City of Henderson

Mayor Roger Tobler
City of Boulder City

Bruce L. Woodbury
Clark County

December 3, 2007

Mr. Layne Weber, P.E.
Department of Development Services
500 S. Grand Central Parkway
Las Vegas, NV 89155

DISTRICT CONCURRENCE: UPDATE TO CHRISTIAN & SHARI GRIMES RESIDENCE (HTE #07-42495UP) (RFCD No. 07-7508)

Dear Mr. Weber:

Clark County Regional Flood Control District (District) reviewed Technical Drainage Study dated October 9, 2007 for above-mentioned project as submitted by KEN NICHOLSON. In addition, District is in receipt of the Conditional Letter of Acceptance from Department of Development Services dated November 1, 2007.

District concurs with acceptance of this Technical Drainage Study by Department of Development Services.

District's review of this project was limited to issues of Regional Flood Control Significance as defined in *Uniform Regulations for the Control of Drainage.*

Please be aware that as additional information becomes available and/or restudies of Flood Insurance Studies are performed, information submitted by KEN NICHOLSON may be superseded. Compliance with regulatory elements and design standards specified in *Uniform Regulations for the Control of Drainage* does not imply a guarantee that properties will be free from flooding or flood damage. The District, its officials, or employees assume no liability for information, data, or conclusions presented by consulting engineers. We, therefore, make no warranties, either expressed or implied, in conducting this review.

GALE WM. FRASER, II, P.E.
General Manager/Chief Engineer

BY: _____
Abigail Mayrena, P.E.
Senior Engineer

_____
Andrew R. Trelease, P.E., CFM
Principal Civil Engineer

AM:ART:ph

c: Lambdin Lauvao, P.E., KEN NICHOLSON

P:\Letters and Memos\Local Drainage\Land Development & Drainage\Concurrence Letters\2007\Dec07\19-60-31.KNE.doc

600 S. Grand Central Parkway, Suite 300 • Las Vegas, Nevada 89106-4511
(702) 455-3139 • FAX: (702) 455-3870
Website: *http://www.regionalflood.org*

Department of Development Services

500 S Grand Central Pky 1st Fl • Box 551799 • Las Vegas NV 89155-1799

(702) 455-4600 • Fax (702) 388-2550

Ronald L. Lynn, Director/Building Official

Dean Friedli	Greg Franklin	Robert Thompson
Assistant Director	Assistant Director	Assistant Director
Administrative Division	Building Division	Civil Engineering Division

Drainage Study Approval Letter

Date: November 1, 2007
Firm: Ken Nicholson - Engineer
Engineer: Kenneth F. Nicholson, P.E.
Address: 2155 Mohawk Street, Las Vegas, NV 89146
Phone: (702) 437-2591
Fax:
E-mail:

Subject: Technical Drainage Study Update for Grimes Residence
Location: SEC Grand Canyon Drive and La Madre Way
APN: 125-31-801-001
Sec, Township, Range: Sec 31, T19S, R60E
Flood Zone & Panel: Zone X, 1745, Revised 9/27/02
Application Tracking #: 07-42495UP

HTE07-42495CDD

Submittals	Date Received	Date Returned	Clark Co. Reviewer	WILLDAN Reviewer	Misc.
Update	10/16/07	11/01/07	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	Adjacent to or Impacts NDOT Facility
	Clark County Public Works	Impacts a CCPW Facility
	US Army Corp of Engineers	Impacts a USACOE Facility
X	Clark County Regional Flood Control District	Adjacent to or Impacts CCRFCD MPU Facility or in a SFHA

BOARD OF COUNTY COMMISSIONERS
RORY REID, Chairman • CHIP MAXFIELD, Vice-Chairman
SUSAN BRAGER • TOM COLLINS • CHRIS GIUNCHIGLIANI • LAWRENCE WEEKLY • BRUCE L. WOODBURY
VIRGINIA VALENTINE, P.E., County Manager

The referenced **Technical Drainage Study Update** 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 purpose of this update is to remove the curb, gutter and sidewalk along Grand Canyon Drive and replace the 4-foot Type C drop inlet with a Beehive inlet. The original technical drainage study, HTE# 06-8498, was approved on October 17, 2006.

The site shall be graded with respect to drainage as shown on "Christian & Shari Grimes", grading plan sheets 1 through 5, signed and sealed by Kenneth F. Nicholson, P.E., on October 4, 2007.

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 Clark County Civil Engineering Division Plan Check prior to the issuance of Certificates of Occupancy for those structures.
X	Mylars of the grading plan must be submitted to the Clark County Civil Engineering Division 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 Development Services Civil Engineering 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.
	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.
X	Plan revisions can be found on the red-lined plans and must be addressed prior to offsite submittal.

Additional Conditions:

1. All other conditions and facilities, as stipulated in the previously approved letters (mentioned above), still apply.

2. An update is required for any improvements not shown on the above mentioned grading plans.

3. Provide a bondable quantities list of drainage/flood control facilities on the plans.

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

By _____

Glenn S. Hale, P.E.
Senior Civil Engineer
Department of Development Services
Civil Engineering Division

cc: Grimes
Andrew Trelease, RFCD
Development File

Referenced Drainage Exhibits

PROJECT SITE

NO FLOW SPLIT CONSIDERATON

ANTICIPATED FLOW IN GRAND CANYON NORTH OF LA MADRE

OLD BELTWAY ALIGNMENT

ANTICIPATED FLOW AT GRAND CANYON AND LA MADRE FROM THE NORTHWEST

ANTICIPATED FLOW IN LA MADRE WEST OF GRAND CANYON

EXOFF4* A=9.1 acres

EOFF5* A=10.1 acres

EXOFF3* A=21.6 acres

EXOFF2* A=14.5 acres

OFFE1 A=4.82 acres

DON4* A=0.50 ac

OND1 A=2.50 ac

CP1

CP1A

CP2

CPB

CPA

EX. MOUNTAIN VISTA SEE REFERENCED FIGURE 6 FOR ONSITE PATTERNS

FISHER AVE

GRAND CANYON DR

TEE PEE LN

ROSADA WAY

PARK ST

LA MADRE WAY

VERDE WAY

LONE MOUNTAIN RD

I-215 BELTWAY

EULA ST

CONQUISTADOR ST

JENSEN ST

GRAPHIC SCALE

0 200 400 800

1" = 400'

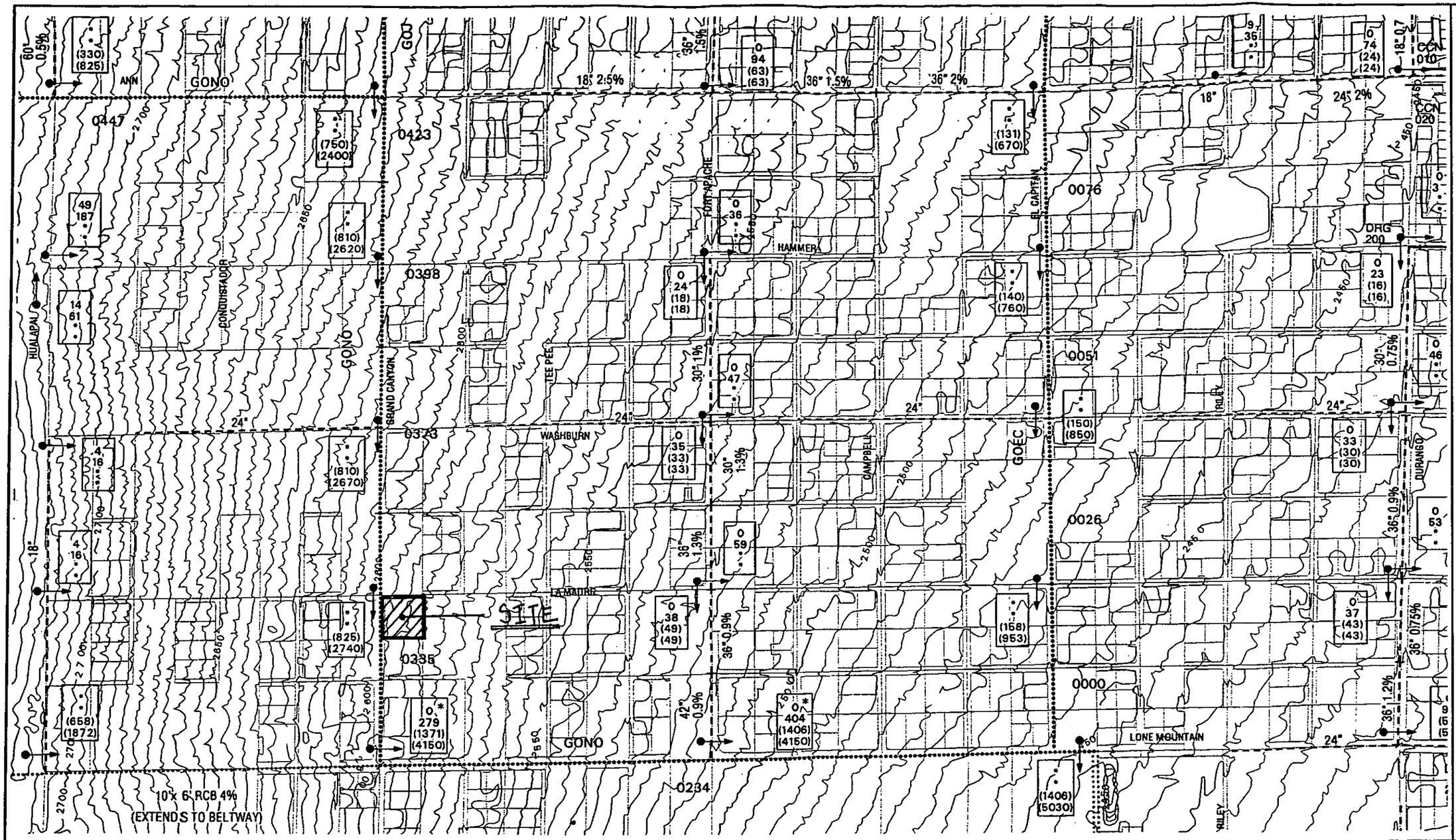
INTERIM CONDITION		
HEC-1 ANALYSIS PEAK FLOW SUMMARY		
BASIN NAME / COMBINED POINT	10-YEAR FLOW (cfs)	100-YEAR FLOW (cfs)
EOFF5	4	17
EXOFF4	7	30
CP1A	11	45
EXOFF3	8	31
EXOFF2	7	24
CP1	14	55
DON4	0	1
CP2	25	100
OND1	1	5
CPB	25	103
OFFE1	2	7
CPA	27	110

LEGEND

- ONSITE BASIN BOUNDARY
- OFFSITE BASIN BOUNDARY
- OND1 BASIN NAME
- CP1A ● COMBINATION POINT
- → DIRECTION OF FLOW
- EOFF1* REFERENCED BASINS FROM MOUNTAIN VISTA DRAINAGE STUDY

REFERENCE

INTERIM CONDITION BASIN MAP	FIGURE 5B
TECHNICAL DRAINAGE STUDY CHRISTIAN & SHARI GRIMES APN 125-31-801-001	



CITY OF LAS VEGAS NEVADA

NORTHWEST NEIGHBORHOOD STUDY

LEGEND

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

FIGURE F-7

800 600 400 200 0 400 800

(IN FEET)

SCALE: 1 INCH = 800 FEET

FLOW ARROW

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

(FLOWS IN CFS)

NOTE:

Ultimate drainage conditions are based on future CN values with all flood control facilities in place

* The capacity of the proposed regional facility is based on the "1996 Clark County Regional Flood Control Master Plan Update for the Las Vegas Valley." The facility may need to be enlarged in final design.

HUALAPAI	FT. APACHE	DURANGO	BUFFALO	RAINBOW	JONES	DECATUR	
1		2		3			ELKHORN
4		5		6			CENTENNIAL
7		8		9			ANN
10		11		12			LONE MOUNTAIN
				13	14		ALEXANDER
				15	16		CHEYENNE
				17	18		SMOKE RANCH

FUTURE DRAINAGE CONDITIONS

POST, BUCKLEY, SCHUH & JERNIGAN, INC.

ENGINEERING PLANNING SURVEYING GIS

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

CITY OF LAS VEGAS NEVADA

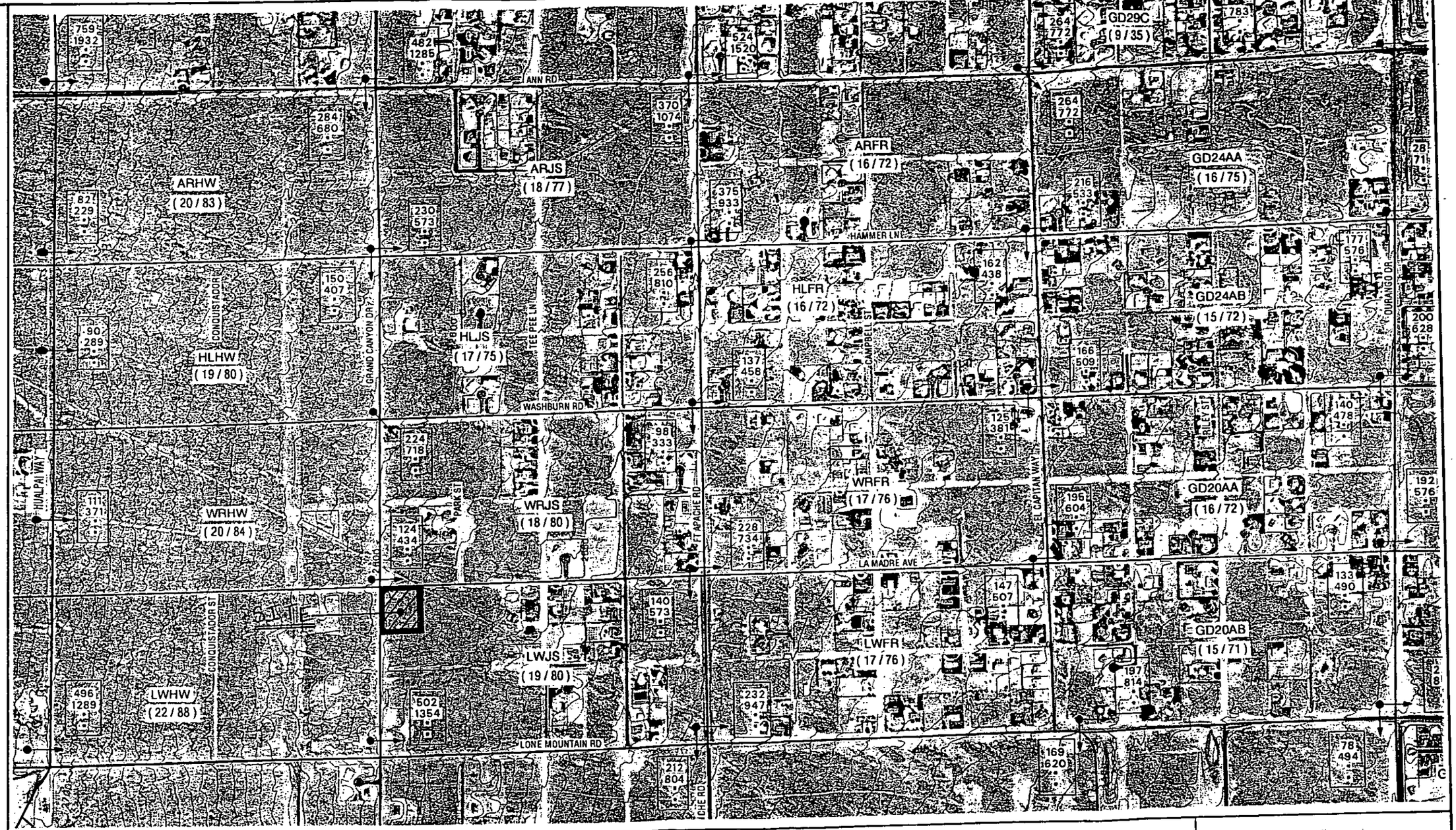
NORTHWEST NEIGHBORHOOD STUDY

LEGEND

- SUB-BASIN BOUNDARY
- FLOW ARROW
- 250 | 10-YEAR STREET FLOW
- 500 | 100-YEAR STREET FLOW
- 300 | 10-YEAR FACILITY FLOW
- 800 | 100-YEAR FACILITY FLOW
- (FLOWS IN CFS)
- BWJS — Basin-ID
- (13 / 59) — Contributing flow (10-Year / 100-Year) from the basin (cfs)

PHOTO DATE: APRIL 1996

FIGURE E-7



EXISTING DRAINAGE CONDITIONS

HUALAPAI	FT. APACHE	DURANGO	BUFFALO	RAINBOW	JONES	DECATUR	
1		2		3			EUCHORN
4		5		6			CENTENNIAL
7		8		9			ANN
10		11		12			LONE MOUNTAIN
		13		14			ALEXANDER
		15		16			CHEYENNE
		17		18			SMOKE RANCH

NOTE:
Existing conditions are based on future CN values with only existinig local and CCRFCD facilities in place

N W E S

800 600 400 200 0 400 800

(IN FEET)

SCALE: 1 INCH = 800 FEET

PBS&J POST, BUCKLEY, SCHUH & JERNIGAN, INC.

ENGINEERING PLANNING SURVEYING GIS

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

APPENDIX O

Zoning & Planning Conditions

LAS VEGAS CITY COUNCIL

CAROLYN G. GOODMAN
Mayor

BRIAN KNUDSEN
Mayor Pro Tem

CEDRIC CREAR
VICTORIA SEAMAN
OLIVIA DIAZ
FRANCIS ALLEN-PALENSKE
NANCY E. BRUNE

JORGE CERVANTES
City Manager

DEPARTMENT OF
COMMUNITY DEVELOPMENT

SETH T. FLOYD
DIRECTOR

CITY HALL
495 S. MAIN ST.
1ST FLOOR
LAS VEGAS, NV 89101

702.229.6301 | VOICE
702.464.2545 | FAX
711 | TTY

cityoflasvegas | lasvegasnevada.gov

FEBRUARY 15, 2023

Dave Cornoyer
Greystone Nevada LLC
9275 West Russell Road Suite 400
Las Vegas, Nevada 89147

RE: 22-0666-GPA1, 22-0666-VAR1 THROUGH VAR29, 22-0666-VAR31 THROUGH 22-0666-VAR33, 22-0666-VAC1 AND 22-0666-TMP1 CITY COUNCIL MEETING OF FEBRUARY 15, 2023

Dear Applicant:

The City Council at a regular meeting held on ***February 15, 2023*** voted to ***APPROVE*** the following Land Use Entitlement project requests on 90.10 acres at the northwest corner of La Madre Way and Grand Canyon Drive (APNs 125-31-201-010 and 125-31-301-014), R-E (Residence Estates) Zone, Ward 4 (Allen-Palenske).

22-0666-VAR1 - VARIANCE - TO ALLOW A 30-FOOT FRONT YARD SETBACK WHERE 50 FEET IS REQUIRED FOR LOT 63

22-0666-VAR2 - VARIANCE - TO ALLOW A 30-FOOT FRONT YARD SETBACK WHERE 50 FEET IS REQUIRED FOR LOT 64

22-0666-VAR3 - VARIANCE - TO ALLOW A 30-FOOT FRONT YARD SETBACK WHERE 50 FEET IS REQUIRED FOR LOT 65

22-0666-VAR4 - VARIANCE - TO ALLOW A 30-FOOT FRONT YARD SETBACK WHERE 50 FEET IS REQUIRED FOR LOT 66

22-0666-VAR5 - VARIANCE - TO ALLOW A 30-FOOT FRONT YARD SETBACK WHERE 50 FEET IS REQUIRED FOR LOT 67

22-0666-VAR6 - VARIANCE - TO ALLOW A 30-FOOT FRONT YARD SETBACK WHERE 50 FEET IS REQUIRED FOR LOT 68

22-0666-VAR7 - VARIANCE - TO ALLOW A 30-FOOT FRONT YARD SETBACK WHERE 50 FEET IS REQUIRED FOR LOT 69

22-0666-VAR8 - VARIANCE - TO ALLOW A 30-FOOT FRONT YARD SETBACK WHERE 50 FEET IS REQUIRED FOR LOT 70

22-0666-VAR9 - VARIANCE - TO ALLOW A 30-FOOT FRONT YARD SETBACK WHERE 50 FEET IS REQUIRED FOR LOT 71

22-0666-VAR10 - VARIANCE - TO ALLOW A 30-FOOT FRONT YARD SETBACK WHERE 50 FEET IS REQUIRED FOR LOT 72

22-0666-VAR11 - VARIANCE - TO ALLOW A 30-FOOT FRONT YARD SETBACK WHERE 50 FEET IS REQUIRED FOR LOT 73

22-0666-VAR12 - VARIANCE - TO ALLOW A 30-FOOT FRONT YARD SETBACK WHERE 50 FEET IS REQUIRED FOR LOT 74

22-0666-VAR13 - VARIANCE - TO ALLOW A 30-FOOT FRONT YARD SETBACK WHERE 50 FEET IS REQUIRED FOR LOT 78

22-0666-VAR14 - VARIANCE - TO ALLOW A 30-FOOT FRONT YARD SETBACK WHERE 50 FEET IS REQUIRED FOR LOT 79

22-0666-VAR15 - VARIANCE - TO ALLOW A 30-FOOT FRONT YARD SETBACK WHERE 50 FEET IS REQUIRED FOR LOT 80

22-0666-VAR16 - VARIANCE - TO ALLOW A 30-FOOT FRONT YARD SETBACK WHERE 50 FEET IS REQUIRED FOR LOT 81

22-0666-VAR17 - VARIANCE - TO ALLOW A 30-FOOT FRONT YARD SETBACK WHERE 50 FEET IS REQUIRED FOR LOT 82

22-0666-VAR18 - VARIANCE - TO ALLOW A 30-FOOT FRONT YARD SETBACK WHERE 50 FEET IS REQUIRED FOR LOT 83

22-0666-VAR19 - VARIANCE - TO ALLOW A 30-FOOT FRONT YARD SETBACK WHERE 50 FEET IS REQUIRED FOR LOT 95

22-0666-VAR20 - VARIANCE - TO ALLOW A 30-FOOT FRONT YARD SETBACK WHERE 50 FEET IS REQUIRED FOR LOT 96

22-0666-VAR21 - VARIANCE - TO ALLOW A 30-FOOT FRONT YARD SETBACK WHERE 50 FEET IS REQUIRED FOR LOT 97

22-0666-VAR22 - VARIANCE - TO ALLOW A 30-FOOT FRONT YARD SETBACK WHERE 50 FEET IS REQUIRED FOR LOT 98

22-0666-VAR23 - VARIANCE - TO ALLOW A 30-FOOT FRONT YARD SETBACK WHERE 50 FEET IS REQUIRED FOR LOT 99

22-0666-VAR24 - VARIANCE - TO ALLOW A 30-FOOT FRONT YARD SETBACK WHERE 50 FEET IS REQUIRED FOR LOT 100

22-0666-VAR25 - VARIANCE - TO ALLOW A 30-FOOT FRONT YARD SETBACK WHERE 50 FEET IS REQUIRED FOR LOT 101

22-0666-VAR26 - VARIANCE - TO ALLOW A 30-FOOT FRONT YARD SETBACK WHERE 50 FEET IS REQUIRED FOR LOT 102

22-0666-VAR27 - VARIANCE - TO ALLOW A 30-FOOT FRONT YARD SETBACK WHERE 50 FEET IS REQUIRED FOR LOT 103

22-0666-VAR28 - VARIANCE - TO ALLOW A 30-FOOT FRONT YARD SETBACK WHERE 50 FEET IS REQUIRED FOR LOT 108

22-0666-VAR29 - VARIANCE - TO ALLOW A 30-FOOT FRONT YARD SETBACK WHERE 50 FEET IS REQUIRED FOR LOT 109

22-0666-VAR31 - VARIANCE - TO ALLOW A PROPOSED EIGHT-FOOT TALL PERIMETER RETAINING WALL WHERE SIX FEET IS ALLOWED AND AN OVERALL PROPOSED PERIMETER WALL/FENCE HEIGHT OF 14 FEET WHERE 12 FEET IS ALLOWED

22-0666-VAR32 - VARIANCE - TO ALLOW NO OFFSITE IMPROVEMENTS IN GRAND CANYON DRIVE, WASHBURN ROAD, ROSADA WAY, LA MADRE WAY, FISHER AVENUE, EULA STREET AND HUALAPAI WAY WHERE SUCH ARE REQUIRED, INCLUDING STREETLIGHTS, CURBS, GUTTERS AND SIDEWALKS

22-0666-VAR33 - VARIANCE - TO ALLOW A MODIFIED SHARED USE AND EQUESTRIAN TRAIL DESIGN ALONG PORTIONS OF HUALAPAI WAY AND THE NV ENERGY EASEMENT; TO ALLOW PRIVATE STREETS WITHOUT A GATE TO NOT MEET PUBLIC STREET STANDARDS WHERE SUCH ARE REQUIRED; AND TO ALLOW A STUB STREET TERMINATION WHERE A CUL-DE-SAC OR HAMMERHEAD IS REQUIRED

22-0666-VAC1 - VACATION - PETITION TO VACATE PORTIONS OF BUREAU OF LAND MANAGEMENT RIGHT-OF-WAY GRANTS TO THE CITY OF LAS VEGAS

22-0666-TMP1 - TENTATIVE MAP - GRAND CANYON AND WASHBURN - FOR A 136-LOT SINGLE-FAMILY RESIDENTIAL SUBDIVISION

This approval is subject to the following conditions:

22-0666-GPA1 is approved with no conditions.

22-0666-VAR1 CONDITIONS:

Planning

1. A Variance is hereby approved to allow a 30-foot front yard setback where 50 feet is required for Lot 63 on the proposed Tentative Map (22-0666-TMP1) related to this request.

2. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

3. This approval shall be void four 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.

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.

22-0666-VAR2 CONDITIONS:

Planning

1. A Variance is hereby approved to allow a 30-foot front yard setback where 50 feet is required for Lot 64 on the proposed Tentative Map (22-0666-TMP1) related to this request.

2. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

3. This approval shall be void four 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.

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.

22-0666-VAR3 CONDITIONS:

Planning

1. A Variance is hereby approved to allow a 30-foot front yard setback where 50 feet is required for Lot 65 on the proposed Tentative Map (22-0666-TMP1) related to this request.

2. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

3. This approval shall be void four 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.

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.

22-0666-VAR4 CONDITIONS:

Planning

1. A Variance is hereby approved to allow a 30-foot front yard setback where 50 feet is required for Lot 66 on the proposed Tentative Map (22-0666-TMP1) related to this request.

2. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

3. This approval shall be void four 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.

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.

22-0666-VAR5 CONDITIONS:

Planning

1. A Variance is hereby approved to allow a 30-foot front yard setback where 50 feet is required for Lot 67 on the proposed Tentative Map (22-0666-TMP1) related to this request.

2. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

3. This approval shall be void four 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.

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.

22-0666-VAR6 CONDITIONS:

Planning

1. A Variance is hereby approved to allow a 30-foot front yard setback where 50 feet is required for Lot 68 on the proposed Tentative Map (22-0666-TMP1) related to this request.

2. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

3. This approval shall be void four 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.

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.

22-0666-VAR7 CONDITIONS:

Planning

1. A Variance is hereby approved to allow a 30-foot front yard setback where 50 feet is required for Lot 69 on the proposed Tentative Map (22-0666-TMP1) related to this request.

2. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

3. This approval shall be void four 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.

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.

22-0666-VAR8 CONDITIONS:

Planning

1. A Variance is hereby approved to allow a 30-foot front yard setback where 50 feet is required for Lot 70 on the proposed Tentative Map (22-0666-TMP1) related to this request.

2. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

3. This approval shall be void four 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.

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.

22-0666-VAR9 CONDITIONS:

Planning

1. A Variance is hereby approved to allow a 30-foot front yard setback where 50 feet is required for Lot 71 on the proposed Tentative Map (22-0666-TMP1) related to this request.

2. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

3. This approval shall be void four 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.

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.

22-0666-VAR10 CONDITIONS:

Planning

1. A Variance is hereby approved to allow a 30-foot front yard setback where 50 feet is required for Lot 72 on the proposed Tentative Map (22-0666-TMP1) related to this request.

2. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

3. This approval shall be void four 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.

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.

22-0666-VAR11 CONDITIONS:

Planning

1. A Variance is hereby approved to allow a 30-foot front yard setback where 50 feet is required for Lot 73 on the proposed Tentative Map (22-0666-TMP1) related to this request.

2. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

3. This approval shall be void four 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.

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.

22-0666-VAR12 CONDITIONS:

Planning

1. A Variance is hereby approved to allow a 30-foot front yard setback where 50 feet is required for Lot 74 on the proposed Tentative Map (22-0666-TMP1) related to this request.

2. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

3. This approval shall be void four 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.

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.

22-0666-VAR13 CONDITIONS:

Planning

1. A Variance is hereby approved to allow a 30-foot front yard setback where 50 feet is required for Lot 78 on the proposed Tentative Map (22-0666-TMP1) related to this request.

2. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

3. This approval shall be void four 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.

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.

22-0666-VAR14 CONDITIONS:

Planning

1. A Variance is hereby approved to allow a 30-foot front yard setback where 50 feet is required for Lot 79 on the proposed Tentative Map (22-0666-TMP1) related to this request.

2. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

3. This approval shall be void four 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.

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.

22-0666-VAR15 CONDITIONS:

Planning

1. A Variance is hereby approved to allow a 30-foot front yard setback where 50 feet is required for Lot 80 on the proposed Tentative Map (22-0666-TMP1) related to this request.

2. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

3. This approval shall be void four 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.

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.

22-0666-VAR16 CONDITIONS:

Planning

1. A Variance is hereby approved to allow a 30-foot front yard setback where 50 feet is required for Lot 81 on the proposed Tentative Map (22-0666-TMP1) related to this request.

2. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

3. This approval shall be void four 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.

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.

22-0666-VAR17 CONDITIONS:

Planning

1. A Variance is hereby approved to allow a 30-foot front yard setback where 50 feet is required for Lot 82 on the proposed Tentative Map (22-0666-TMP1) related to this request.

2. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

3. This approval shall be void four 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.

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.

22-0666-VAR18 CONDITIONS:

Planning

1. A Variance is hereby approved to allow a 30-foot front yard setback where 50 feet is required for Lot 83 on the proposed Tentative Map (22-0666-TMP1) related to this request.

2. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

3. This approval shall be void four 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.

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.

22-0666-VAR19 CONDITIONS:

Planning

1. A Variance is hereby approved to allow a 30-foot front yard setback where 50 feet is required for Lot 95 on the proposed Tentative Map (22-0666-TMP1) related to this request.

2. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

3. This approval shall be void four 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.

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.

22-0666-VAR20 CONDITIONS:

Planning

1. A Variance is hereby approved to allow a 30-foot front yard setback where 50 feet is required for Lot 96 on the proposed Tentative Map (22-0666-TMP1) related to this request.

2. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

3. This approval shall be void four 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.

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.

22-0666-VAR21 CONDITIONS:

Planning

1. A Variance is hereby approved to allow a 30-foot front yard setback where 50 feet is required for Lot 97 on the proposed Tentative Map (22-0666-TMP1) related to this request.

2. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

3. This approval shall be void four 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.

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.

22-0666-VAR22 CONDITIONS:

Planning

1. A Variance is hereby approved to allow a 30-foot front yard setback where 50 feet is required for Lot 98 on the proposed Tentative Map (22-0666-TMP1) related to this request.

2. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

3. This approval shall be void four 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.

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.

22-0666-VAR23 CONDITIONS:

Planning

1. A Variance is hereby approved to allow a 30-foot front yard setback where 50 feet is required for Lot 99 on the proposed Tentative Map (22-0666-TMP1) related to this request.

2. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

3. This approval shall be void four 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.

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.

22-0666-VAR24 CONDITIONS:

Planning

1. A Variance is hereby approved to allow a 30-foot front yard setback where 50 feet is required for Lot 100 on the proposed Tentative Map (22-0666-TMP1) related to this request.

2. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

3. This approval shall be void four 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.

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.

22-0666-VAR25 CONDITIONS:

Planning

1. A Variance is hereby approved to allow a 30-foot front yard setback where 50 feet is required for Lot 101 on the proposed Tentative Map (22-0666-TMP1) related to this request.

2. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

3. This approval shall be void four 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.

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.

22-0666-VAR26 CONDITIONS:

Planning

1. A Variance is hereby approved to allow a 30-foot front yard setback where 50 feet is required for Lot 102 on the proposed Tentative Map (22-0666-TMP1) related to this request.

2. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

3. This approval shall be void four 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.

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.

22-0666-VAR27 CONDITIONS:

Planning

1. A Variance is hereby approved to allow a 30-foot front yard setback where 50 feet is required for Lot 103 on the proposed Tentative Map (22-0666-TMP1) related to this request.

2. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

3. This approval shall be void four 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.

5. These Conditions of Approval shall be affixed to the cover sheet of any plan set submitted for building permit.

22-0666-VAR28 CONDITIONS:

Planning

1. A Variance is hereby approved to allow a 30-foot front yard setback where 50 feet is required for Lot 108 on the proposed Tentative Map (22-0666-TMP1) related to this request.

2. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

3. This approval shall be void four 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.

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.

22-0666-VAR29 CONDITIONS:

Planning

1. A Variance is hereby approved to allow a 30-foot front yard setback where 50 feet is required for Lot 109 on the proposed Tentative Map (22-0666-TMP1) related to this request.

2. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

3. This approval shall be void four 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.

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.

22-0666-VAR31 CONDITIONS:

Planning

1. A Variance is hereby approved to allow eight-foot tall retaining walls along the portions of the site perimeter as shown on the perimeter wall exhibit date stamped 12/01/22 where six feet is the maximum allowed, and to allow overall proposed perimeter wall/fence height of 14 feet where 12 feet is the maximum allowed.

2. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

3. This approval shall be void four 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.

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.

7. A three-foot minimum view fence shall be included on perimeter walls exceeding 12 feet in total height.

22-0666-VAR32 CONDITIONS:

Planning

1. A Variance is hereby approved to allow no offsite improvements in Grand Canyon Drive, Washburn Road, Rosada Way, La Madre Way, Fisher Avenue, Eula Street and Hualapai Way where such are required, including streetlights, curbs, gutter and sidewalks.

2. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for Variances (22-0666-VAR1 through VAR29, VAR31 and VAR33), a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

3. This approval shall be void four 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.

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 all deferred improvements on Grand Canyon Drive and Hualapai Way and 50% of the City's bond estimate costs for all deferred improvements on Washburn Road, Rosada Way, La Madre Way, Fisher Avenue and Eula Street based on the Regional Transportation Commission's (RTC) rural standards (244.10 and 244.11). If all RTC standards are followed, no deferral contribution is required.

8. Sign a Covenant Running with Land agreement for the possible future installation of half-street improvements per urban Standards (including curb and gutter, sidewalks, streetlighting, permanent paving and possibly fire hydrants and sewers) on Grand Canyon Drive, Washburn Road, Rosada Way, La Madre Way, Fisher Avenue, 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 issuance of permits or the recordation of a Final Map for this site, whichever may occur first.

22-0666-VAR33 CONDITIONS:

Planning

1. A Variance is hereby approved to allow no amenity zones in the proposed Shared Use Trail and Equestrian Trail along Hualapai Way and along Nightly Shine Place (a private street as shown on the proposed Tentative Map (22-0666-TMP1) where a five-foot minimum amenity zone is required.

2. A Variance is hereby approved to allow no equestrian path in the trail section required within the NV Energy easement from Hualapai Way southeasterly approximately 385 feet where a 10-foot minimum equestrian path is required.

3. A Variance is hereby approved to allow private streets without a gate to not meet public street standards where such is required; and to allow a stub street termination where a cul-de-sac or hammerhead is required.

4. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for a Petition to Vacate (22-0666-VAC1) and Tentative Map (22-0666-TMP1) shall be required, if approved.

5. This approval shall be void four 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.

6. 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.

7. These Conditions of Approval shall be affixed to the cover sheet of any plan set submitted for building permit.

8. All City Code requirements and design standards of all City departments must be satisfied, except as modified herein.

22-0666-VAC1 CONDITIONS:

1. The limits of this Petition of Vacation shall be defined as the Bureau of Land Management Grants generally located on Assessor Parcel Numbers (APNs) #125-31-201-010 and 125-31-301-014.

2. This Petition of Vacation shall record prior to and concurrent with the recordation of a Final Map for 22-0666-TMP1.

3. A Drainage Plan and Technical Drainage Study must be submitted to and approved by the Department of Public Works prior to the recordation of the Order of Vacation for this application. Appropriate drainage easements shall be reserved if recommended by the approved Drainage Plan/Study. The drainage study required by 22-0666-TMP1 may be used to satisfy this requirement provided that it addresses the area to be vacated.

4. All public improvements, if any, adjacent to and in conflict with this vacation application are to be modified, as necessary, at the applicant's expense prior to the recordation of an Order of Vacation.

5. Reservation of easements for the facilities of the various utility companies together with reasonable ingress thereto and egress there from shall be provided if required.

6. All development shall be in conformance with code requirements and design standards of all City Departments.

7. The Order of Vacation shall not be recorded until all of the conditions of approval have been met provided, however, that conditions requiring modification of public improvements may be fulfilled for purposes of recordation by providing sufficient security for the performance thereof in accordance with the Subdivision Ordinance of the City of Las Vegas. City Staff is empowered to modify this application if necessary because of technical concerns or because of other related review actions as long as current City right-of-way requirements are still complied with and the intent of the vacation application is not changed. If applicable, a five foot wide easement for public streetlight and fire hydrant purposes shall be retained on all vacation actions abutting public street corridors that will remain dedicated and available for public use. Also, if applicable and where needed, public easement corridors and sight visibility or other easements that would/should cross any right-of-way or easement being vacated must be retained.

8. If the Order of Vacation is not recorded within four (4) years after approval by the City of Las Vegas or an Extension of Time is not granted by the Planning Director, then approval will terminate and a new petition must be submitted.

22-0666-TMP1 CONDITIONS:

Planning

1. A technical landscape plan, signed and sealed by a Registered Architect, Landscape Architect, Residential Designer or Civil Engineer, must be submitted prior to or at the same time as submittal of a Final Map. A permanent underground sprinkler system is required, and shall be permanently maintained in a satisfactory manner; the landscape plan shall include irrigation specifications. Installed landscaping shall not impede visibility of any traffic control device. The technical landscape plan shall include the following changes from the conceptual landscape plan:
   a. Indicate trees and shrubs within the provided perimeter landscape buffers in conformance to Title 19.06.040 requirements.
   b. Within the amenity zone located in the trail segments within the NV Energy easement common areas, provide flowering shrubs not to exceed five feet in height at maturity at intervals not exceeding 20 feet.

2. 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.

3. Approval of a General Plan Amendment (22-0666-GPA1) and approval of and conformance to the Conditions of Approval for Variances (22-0666-VAR1 through VAR29 and VAR31, VAR32 and VAR33) and a Petition to Vacate (22-0666-VAC1) shall be required, if approved.

4. Street names must be provided in accordance with the City's Street Naming Regulations.

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. Prior to and concurrent with the recordation of a Final Map for this site, a Petition of Vacation, such as 22-0666-VAC1, shall be recorded to eliminate the Bureau of Land Management Grants in conflict with this proposed site. If 22-0666-VAC1 is not approved, then this Tentative Map shall be null and void and a new Tentative Map shall be submitted for review.

9. Dedicate 30 feet or 60 feet for Washburn Road and Rosada Way, as appropriate, 40 feet for Grand Canyon Drive and Hualapai Way, 30 feet for Fisher Avenue, Eula Street between Hammer and Fisher Avenue (with an associated knuckle at the intersection of Fisher and Eula), and Eula Street between Washburn Road and Rosada Way. All trails outside the public right-of-way shall be granted as either Shared Use Trail Easements, Equestrian Trail Easements, or a combination of both as appropriate. Additionally, dedicate all intersection radii for public streets to match Title 13.12.

10. Unless otherwise allowed by the City Engineer, submit all required documentation and support materials to the Right of Way Section of the Department of Public Works for a Bureau of Land Management (BLM) Road, Sewer, and Drainage Grant application to obtain a grant for the south side of Rosada Way on Assessor's Parcel #125-31-301-015 prior to constructing improvements on the BLM parcel. Civil Plans may be approved without the grant being authorized; however no construction on Assessor's Parcel #125-31-301-015 may occur until the grant is authorized by BLM and recorded by the Right-of-Way section of the Department of Public Works. The developer must submit the BLM application to the City for review prior to submitting to BLM for authorization. If the BLM Grant application is submitted, but no activity has occurred toward obtaining the grant within one year of the submittal of the BLM application, the City will make best efforts to contact the applicant and request a project status report; however if a project status cannot be determined, the City may withdraw the grant application. If the City withdraws the application, a brand new grant application will be required when it is determined that efforts are being made toward obtaining the grant. Additionally, the applicant must accept responsibility for all stipulations required by the BLM in the offer of the grant made to the City. The off-site improvement agreement must include a section addressing the acceptance of the BLM grant stipulations prior to the City's acceptance of the BLM grant.

11. Private streets must be granted and labeled on the Final Map for this site as Public Utility Easements (P.U.E.), Public Sewer Easements, and Public Drainage Easements to be privately maintained by the Homeowner's Association.

12. Grant a minimum 20-foot wide Public Sewer Easement to be privately maintained for the public sewer within Common Element between Lots 46 and 47 and between Lots 127 and 128.

13. Where required, construct full street improvements on Washburn Road and Rosada Way along with half-street improvements on Grand Canyon Drive, Hualapai Way, Eula Street, Fisher Avenue, La Madre Way, Washburn Road and Rosada Way per Standard Drawings 244.10 and 244.11 including appropriate transition and overpaving on these streets adjacent to this site concurrent with development of this site, except as amended herein. Improvements on Hualapai Way shall match existing improvements immediately to the north. Extend all required underground utilities, such as electrical, telephone, etc., located within public rights-of-way, past the boundaries of this site prior to construction of hard surfacing (asphalt or concrete). All existing paving damaged or removed by this development shall be restored at its original location and to its original width concurrent with development of this site.

14. All City of Las Vegas maintained underground infrastructure shall meet standard minimum horizontal separations, unless otherwise approved by the City Engineer.

15. Horizontal clearances between the proposed Public Sewer and existing Kern River Gas must meet standard separations acceptable to both The City of Las Vegas and Kern River Gas. Provide written verification of such acceptable clearances prior to submittal of construction drawings.

16. No walls, signs, lights, parking area, buildings or other structures, or permanent landscaping having a mature height of greater than three feet shall be placed anywhere in any public sewer easement or in the vehicle ingress or egress pathways to such easements.

17. All landscaping and private improvements installed with this project 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.

18. Submit a License Agreement for landscaping and private improvements in the public rights-of-way, if any, prior to the issuance of permits for these improvements. If requested by the City, the applicant shall remove property encroaching in the public right-of-way at the applicant's expense pursuant to the terms of the City's License Agreement. The installation and maintenance of all private improvements in the public right of way shall be the responsibility of the applicant and any successors in interest to the property and assigns pursuant to the terms of the License Agreement. Coordinate all requirements for the License Agreement with the Land Development Section of the Department of Building and Safety (702-229-4836).

19. A Traffic Impact Analysis must be submitted to and approved by the Department of Public Works prior to the issuance of any building or grading permits, submittal of any construction drawings or the recordation of a Map subdividing this site, whichever may occur first. Comply with the recommendations of the approved Traffic Impact Analysis prior to occupancy of the site. The Traffic Impact Analysis shall include a pedestrian circulation/access plan to identify nearby pedestrian attractors and recommend measures to accommodate pedestrians, such as but not limited to pedestrian access, crosswalk, pedestrian activated flashers and temporary sidewalks. The Traffic Impact Analysis shall also include a section addressing Standard Drawings #234.1 #234.2 and #234.3 to determine additional right-of-way requirements for bus turnouts adjacent to this site, if any; dedicate all areas recommended by the approved Traffic Impact Analysis. All additional rights of way required by Standard Drawing #201.1 for exclusive right turn lanes and dual left turn lanes shall be dedicated prior to or concurrent with the commencement of on site development activities unless specifically noted as not required in the approved Traffic Impact Analysis. Phased compliance will be allowed if recommended by the approved Traffic Impact Analysis. No recommendation of the approved Traffic Impact Analysis, nor compliance therewith, shall be deemed to modify or eliminate any condition of approval imposed by the Planning Commission or the City Council on the development of this site.

20. 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.

21. As per Unified Development Code (UDC) 19.16.060.G, all requirements must be complied with or such future compliance must be guaranteed by an approved performance security method in accordance with UDC sections 19.02.130.

22. 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.

The Notice of Final Action was filed with the Las Vegas City Clerk on February 16, 2023.

Sincerely,

Seth T. Floyd
Director of Community Development

STF:PL:nl

cc:

Tanya Steadham
Westwood Professional Services
5725 Badura Avenue Suite 100
Las Vegas, Nevada 89118

APPENDIX P

Improvement Plans