

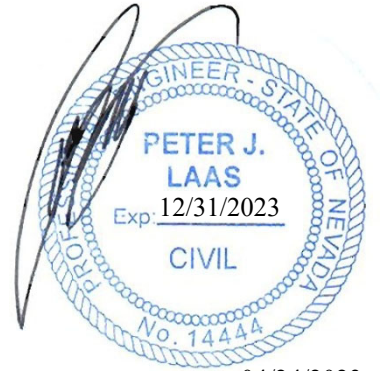
TECHNICAL DRAINAGE STUDY
FOR
BLIND CENTER OF NEVADA

W.O. #CD-2306

April 24, 2023

Prepared for:

Creative Design Architecture, INC
1855 Village Center Circle
Las Vegas, NV 89134
Phone: (702) 256-6663
Fax: (702) 255-4396
Email: rami@cdarch.com



04/24/2023

Prepared by:

Impulse

Civil Engineering & Planning

7485 West Azure Avenue, Suite 226
Las Vegas, NV 89130
Phone: 702-815-0720 · Fax: 702-478-8535

$$I = \int F \cdot dt$$



Civil Engineering



Land Planning



Flood Control



Utilities

April 24, 2023

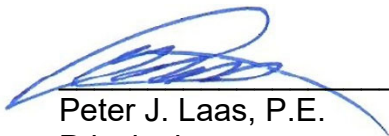
City of Las Vegas
Public Works – Flood Control
495 S Main Street
Las Vegas, NV 89101

**Re: *Technical Drainage Study*
 *BLIND CENTER OF NEVADA***

Submitted for your approval is the ***Technical Drainage Study for Blind Center of Nevada*** a proposed 4.48 acre apartment development. The site is affected by a FEMA Special Flood Hazard Area Shaded Zone X according to FEMA FIRM Map 32003C2170F, and is adjacent to an existing Clark County Regional Flood Control District (CCRFCD) Master Planned Facilities (WAPR-0000 and LVWH-0305) according to the CCRFCD Master Plan Update, Figure F-25. So CCRFCD concurrence should be required.

If you have any questions or require additional information, please call me at (702) 853-6702.

Sincerely,
IMPULSE CIVIL ENGINEERING



Peter J. Laas, P.E.
Principal

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Blind Center of Nevada Date: 04/24/2023

Location of Development: a) Descriptive (Cross Streets) North/South: Classic Car Lane
East/West: Washington Avenue

b) Section: 26 Township: 20 South Range: 61 East

c) APN : 139-26-201-013

Name of Owner: Blind Center of Nevada, INC c/o Creative Design Architecture, INC

Telephone No.: (702) 256-6663 Fax No.: (702) 255-4396 E-Mail Address: rami@cdarch.com

Address: 1855 Village Center Circle, Las Vegas, NV 89134

Contact Person-Name: Peter Laas Telephone No.: 702-815-0720

* E-Mail Address: plaas@ImpulseCivil.net Fax No.: 702-478-8535

Firm: Impulse Civil Engineering

Address: 7485 West Azure Avenue, Suite 226, Las Vegas NV 89130

Type of Land Development/Land Disturbance Process:

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

1. Total Owned Land Area: At Site: 4.48 AC+- Being Developed/Disturbed: 4.48 AC+-

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

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

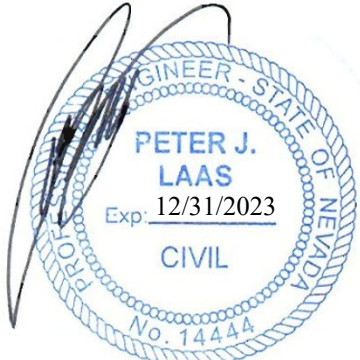
4. Proposed type of development (Residential, Commercial, Etc.): Residential

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

6. Has the site drainage been evaluated in the past? ☐ YES ☒ NO If yes, please identify documentation: We could not find a study for the site

7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: West to Classic Car Lane, South to Washington Avenue, and northeast to existing wall openings

8. Briefly describe your proposed schedule for the subject project: As soon as possible

 04/24/2023 Engineer's Seal	Submit this form as part of the required drainage study to the local entity which has jurisdiction over the subject property. This form may provide sufficient information to serve as the Conceptual Drainage Study. *New Required Field **Review and concurrence of the Clark County Regional Flood Control District is required. <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 60%;"></td> <td style="width: 20%; text-align: center;">Revision</td> <td style="width: 20%; text-align: center;">Date</td> </tr> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> </tr> </table> DS- _____ Local Entity File No. _____		Revision	Date									
	Revision	Date											
REFERENCE: $I = \int F \cdot dt$	STANDARD FORM 1												

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL																										
DRAINAGE SUBMITTAL CHECKLIST																										
Project Name: Blind Center of Nevada	Map ID:																									
Firm Name: Impulse Civil Engineering	Engineer: Peter Laas, P.E.																									
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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 <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%; text-align: center;">Yes</td> <td style="width: 10%; text-align: center;">No</td> <td></td> </tr> <tr> <td style="text-align: center;"><u> X </u></td> <td style="text-align: center;"><u> </u></td> <td>Design Manual Standard Form 1 with the engineer's seal and signature.</td> </tr> <tr> <td style="text-align: center;"><u> X </u></td> <td style="text-align: center;"><u> </u></td> <td>Design Manual Standard Form 4.</td> </tr> <tr> <td style="text-align: center;"><u> X </u></td> <td style="text-align: center;"><u> </u></td> <td>2 copies of the 24" x 36" Drainage Plan.</td> </tr> <tr> <td style="text-align: center;"><u> </u></td> <td style="text-align: center;"><u> X </u></td> <td>A notarized letter from the adjacent property owner(s) allowing off-site grading or discharge.</td> </tr> </table> II. MAPS AND EXHIBITS <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%; text-align: center;">Yes</td> <td style="width: 10%; text-align: center;">No</td> <td></td> </tr> <tr> <td style="text-align: center;"><u> X </u></td> <td style="text-align: center;"><u> </u></td> <td>A copy of a current Flood Insurance Rate Map (FIRM) with the site delineated.</td> </tr> <tr> <td style="text-align: center;"><u> X </u></td> <td style="text-align: center;"><u> </u></td> <td>A copy of the current CCRFCD Master Plan Update Figure, (F-x), for Flood Control Facilities and Environmental areas with the site delineated.</td> </tr> </table>			Yes	No		<u> X </u>	<u> </u>	Design Manual Standard Form 1 with the engineer's seal and signature.	<u> X </u>	<u> </u>	Design Manual Standard Form 4 .	<u> X </u>	<u> </u>	2 copies of the 24" x 36" Drainage Plan.	<u> </u>	<u> X </u>	A notarized letter from the adjacent property owner(s) allowing off-site grading or discharge.	Yes	No		<u> X </u>	<u> </u>	A copy of a current Flood Insurance Rate Map (FIRM) with the site delineated.	<u> X </u>	<u> </u>	A copy of the current CCRFCD Master Plan Update Figure, (F-x), for Flood Control Facilities and Environmental areas with the site delineated.
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REFERENCE:		STANDARD FORM 2																								

$$I = \int F \cdot dt$$

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

II. MAPS AND EXHIBITS (Continued)

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

III. DRAINAGE PLAN

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

REFERENCE:

STANDARD FORM 2

$$I = \int F \cdot dt$$

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

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

REFERENCE:

STANDARD FORM 2

$$I = \int F \cdot dt$$

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes No

- ☐ ☒ For areas in Zone A, AE, AH, and AO, base flood elevations (BFEs) must be shown for each lot; BFEs may be listed on each lot, or in a table. Finish floor elevations must be a minimum of 18 inches above BFE.
- ☐ ☒ Appropriately elevated "humps" 6 inches above the 100 year water surface elevation at site accesses where the intent is to protect the site from the Q₁₀₀ flows.
- ☒ ☐ Street slopes for perimeter and interior streets. The minimum slope is 0.4 percent.
- ☐ ☒ Location and detail of best management practice (BMP) for parking lots and low impact development (LID) (if required).

IV. HYDROLOGIC ANALYSIS

Yes No

- ☒ ☐ Appropriate soil information and Soils Map for existing and future conditions with subbasins and property delineated.
- ☒ ☐ Input and output information for existing conditions from computer models (HEC-1 or TR-55). The flow routing diagram must be provided with HEC-1 models.
- ☒ ☐ Input and output information for future conditions from computer models (HEC-1 or TR-55). The flow routing diagram must be provided with HEC-1 models.
- ☒ ☐ Use of correct precipitation values in and around the McCarran Airport rainfall area.
- ☒ ☐ A discussion in the text of the hydrologic analysis justifying subbasin boundaries and cutoffs, supporting assumptions, and calculations.
- ☒ ☐ A summary table of stormwater flows showing basin area, Q₁₀ and Q₁₀₀ for both individual basins and combined basin flows, where applicable.
- ☒ ☐ Copies of supporting technical information referenced from a previously approved study and a statement accepting these results.
- ☒ ☐ On-site facilities must perpetuate flows through or around the site without significantly impacting adjacent property owners in accordance with current Nevada Drainage Law.
- ☐ ☒ Calculation for impervious area for parking lots and LIDs (if required).

REFERENCE:

STANDARD FORM 2

$$I = \int F \cdot dt$$

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

V. HYDRAULIC ANALYSIS

Yes No

- | | | |
|--------------|--------------|--|
| _____ | <u> X </u> | Flow split calculations and supporting documentation or reference for the method of flow split calculations used. |
| <u> X </u> | _____ | Normal depth street flow calculations and cross section diagrams for all interior and perimeter streets. Provide "d x v" products for the Q ₁₀₀ and Q ₁₀ flows representing the worst case for interior and all perimeter streets. Q ₁₀₀ d x v ≤ 8. Q ₁₀ d x v ≤ 6 and 12 foot dry lane for rights-of-way ≥ 80 feet. Calculations must be labeled by street name as indicated on the Grading Plan. |
| <u> X </u> | _____ | A summary table of interior and exterior street capacity calculations showing the street name, Q ₁₀₀ flow, slope, depth of flow, velocity and depth times velocity product and streets needing to meet 12 foot dry lane criteria. |
| <u> X </u> | _____ | Appropriate hydraulic calculations for block wall openings assuming a 50 percent vertical clogging factor. (Assume the lower half of the opening is plugged.) |
| <u> X </u> | _____ | 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. |
| <u> X </u> | _____ | 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. |
| _____ | <u> X </u> | <p>A complete water surface profile analysis (HEC-2, HEC-RAS, etc.) for channel flows and FEMA Zone A flood zones.</p> <ul style="list-style-type: none"> • Field survey data. • Input and output information. • Plotted cross-sections based on survey with proper encroachments. • A map showing the location of the cross-sections. • Analysis of both sub and super-critical flow segments. • A summary table and a discussion of the results in the text of the report. |
| _____ | <u> X </u> | Provide a 50 percent clogging factor in the capacity calculation for drop inlets. |
| _____ | <u> X </u> | Hydraulic calculations for culverts and storm drains. D-Load calculations must be provided for storm drain pipes in public rights-of-way, including headwater pool inundation. |
| <u> X </u> | _____ | The mitigation of nuisance water, both during construction and in the fully developed condition, must be addressed. |
| _____ | <u> X </u> | Provide BMP type, size and supporting calculations for parking lots and LIDs (if required). |

REFERENCE:

STANDARD FORM 2

$$I = \int F \cdot dt$$



CITY OF LAS VEGAS

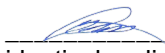
MINIMUM DRAINAGE STUDY CRITERIA STANDARD FORM 2 CHECKLIST SUPPLEMENT

(Revised 5/18/11)

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

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

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

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

$$I = \int F \cdot dt$$

CITY OF LAS VEGAS MINIMUM DRAINAGE STUDY CRITERIA CHECKLIST

II. GRADING PLAN INFORMATION		
Yes	No	
	N/A	Proposed on-site and off-site storm drains and other flood control facilities with plan and profile sheets for public storm drains showing the class of pipe, (Class III, IV, V, etc.), design hydraulic grade line, (HGL) and 100 year storm flow. A public drainage easement must be provided over on-site storm drains conveying off-site flows. An overflow path must be provided over all storm drains.
X		All existing and "to be constructed" walls with cross-sections showing wall type, (e.g. block wall, retaining wall, flood wall, etc.), with limits clearly defined, adjacent ground elevations. Wall heights must meet current ordinances and in no case exceed 14 feet above the adjacent property.
X		Street slopes for both interior and perimeter streets. Note: The minimum slope for a roadway is 0.4 percent, a minimum 18-inch storm drain must be provided where minimum slopes cannot be met.
X		Back of lot elevations and lot drainage pattern for all lots including common lots.
	N/A	Sites with a grade difference two feet above or below existing ground are required to have approval from City of Las Vegas Current Planning. Current Planning approval is required prior to final approval of the drainage study.
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.

$$I = \int F \cdot dt$$

CITY OF LAS VEGAS MINIMUM DRAINAGE STUDY CRITERIA CHECKLIST

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.

$$I = \int F \cdot dt$$

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1.0 GENERAL LOCATION AND DEVELOPMENT DESCRIPTION

1.1 Scope

The purpose of this report is to provide detailed hydrologic and hydraulic analyses for the proposed apartment development on parcel 139-26-201-013, generally located at the northwest corner of the existing Bruce Street and Washington Avenue intersection (just west of APN: 139-26-201-014), and to provide appropriate drainage mitigation recommendations. This report will address the existing, interim, and ultimate conditions which affect the onsite and off-site drainage. The criteria set forth in the Clark County Regional Flood Control District "Hydrologic Criteria and Drainage Design Manual" (CCRFCD Manual), was used as the technical basis for this study.

1.2 Location

The proposed Blind Center of Nevada development is located within the City of Las Vegas, Nevada, the site is generally located at the northwest corner of the existing Bruce Street and Washington Avenue intersection (just west of APN: 139-26-201-014), as shown in Figures 1 and 2. The site is bounded by the once Roger's Classic Car Museum to the north, the existing Fraternal Order of Eagles to the east, the existing Cashman Field and parking lot to the south (across existing Washington Avenue), and the existing Grant Sawyer State Office Building and parking lot to the west (across existing Classic Cars Lane).

1.3 Description of Property

The project site consists of approximately 4.48 acres of newly graded land. The site was a small church at the southwest corner of the property but the remainder of the property has been used for construction staging for equipment and debris. The site is currently cleared with the exception of a cell tower on the north property line. The topography is relatively flat with a slope of approximately 1.3% to the northeast.

BLIND CENTER OF NEVADA

APN: 139-26-201-013

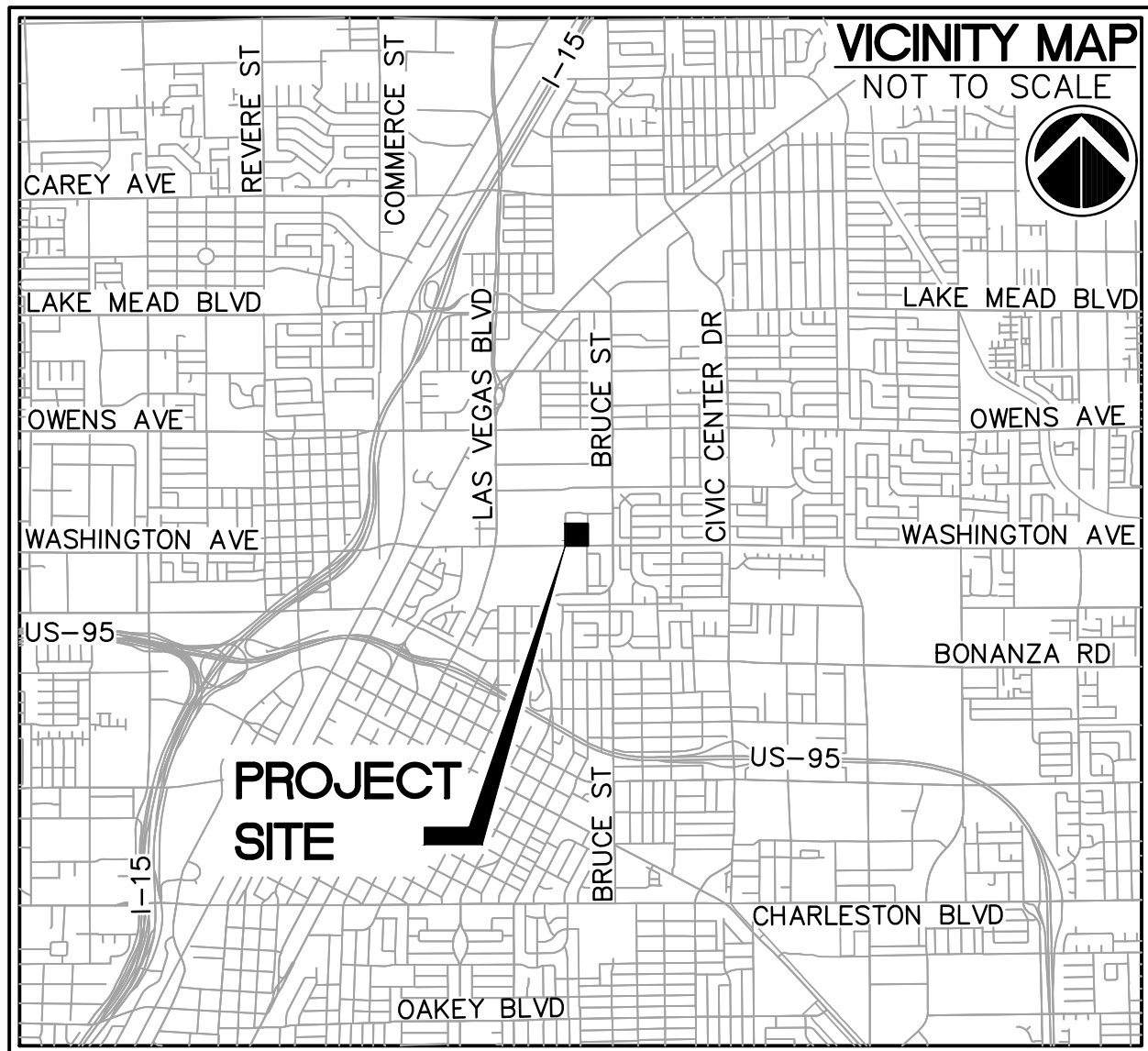


FIGURE 1

VICINITY MAP
NOT TO SCALE



Impulse

Civil Engineering & Planning

PLANNERS • CIVIL ENGINEERS

7485 WEST AZURE DRIVE, SUITE 226 • LAS VEGAS, NEVADA 89130 • (702) 308-7115

$$I = \int F \cdot dt$$

BLIND CENTER OF NEVADA

APN: 139-26-201-013

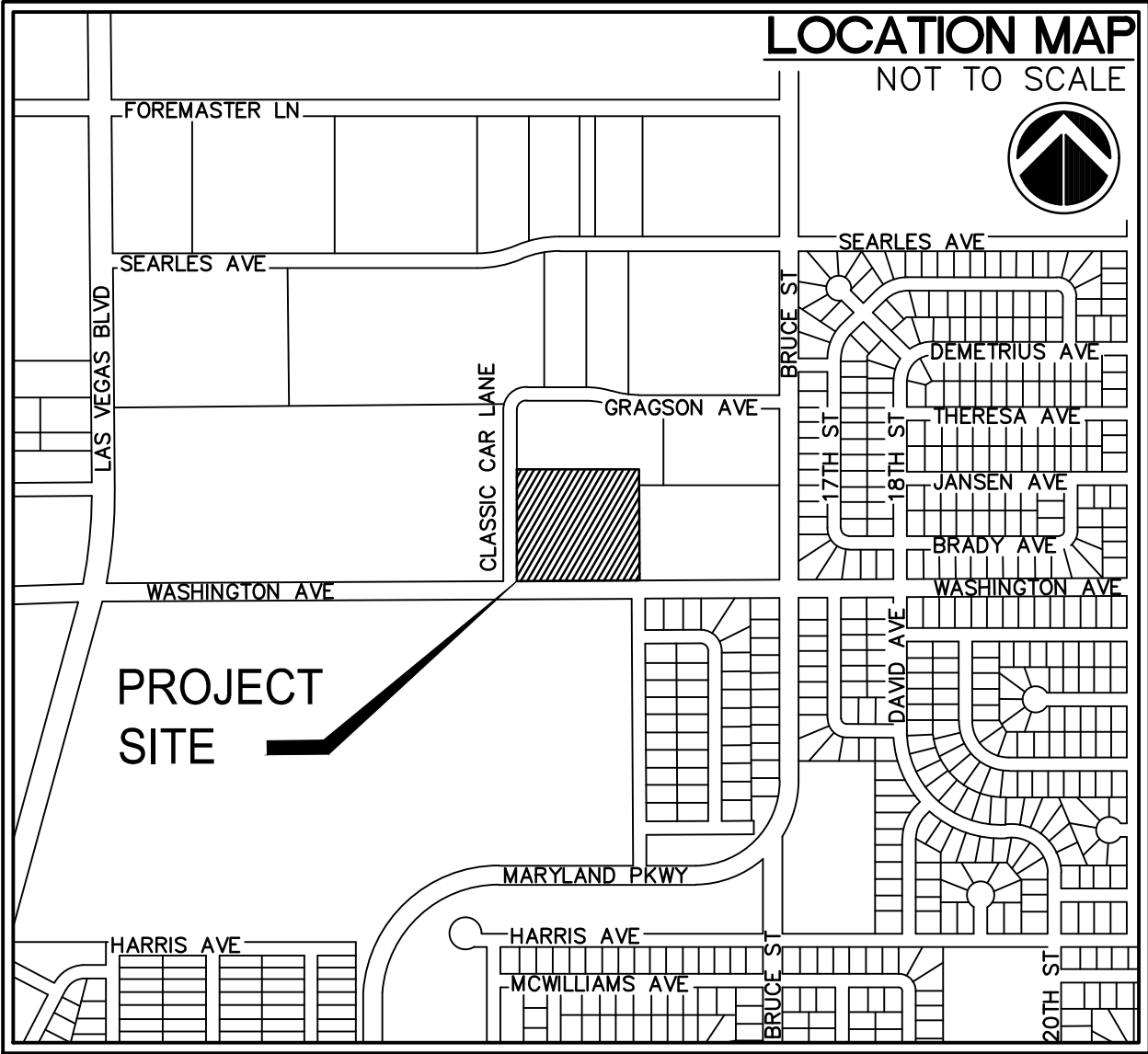


FIGURE 2
LOCATION MAP
NOT TO SCALE



Impulse
Civil Engineering & Planning

PLANNERS • CIVIL ENGINEERS
7485 WEST AZURE DRIVE, SUITE 226 • LAS VEGAS, NEVADA 89130 • (702) 308-7115

$$I = \int F \cdot dt$$

2.0 DRAINAGE BASIN DESCRIPTION

2.1 Off-site Drainage Description

The general drainage pattern for this portion of valley is to the east. Historic offsite runoff has been eliminated with the construction of the CCRFCD facilities in Washington Avenue. Facility WAPR 0000 is a 12'x8' RCB completed in 2001 and facility LVWH 0305 is a parallel 12'x8' RCB completed in 2002. The City of Las Vegas Central Neighborhood Flood Control Master Plan, 2005 Figure F-4 shows that all historic runoff is captured by CCRFCD Facilities WAPR 0000 and LVWH 0305. The City of Las Vegas City Wide Hydrology Study Update, 1997 Figure H-14 shows an ultimate flow rate of 3656 cfs and Figure F-14 shows that WAPR 0000 has a capacity of 2,000 cfs and LVWH 0305 has a 2,000 cfs capacity. As a result, there is no offsite runoff that impacts the site. All of the recent drainage studies in the area confirm this deduction.

2.2 Existing Onsite Drainage Description

The general drainage pattern for the site is to the northeast. In the existing condition, the site drains north east into the existing storage facility located at the southeast corner of Gragson Avenue and Classic Car Lane. There are existing wall openings to accept the flow from the site. A small portion of the old church site drains to Washington Avenue and Classic Car Lane and the existing cell site drains to Classic Car Lane but the remainder of the site drains north east. The site is broken into three basins in the existing condition. The following discussion describes the basin characteristics:

Basin EX1 is the 0.32 acre portion of the site that currently drains to Washington Avenue and is treated as newly graded. Basin EX2 is the 0.40 acre portion of the site that currently drains to Classic Car Lane and is treated as newly graded. Basin EX3 is the 3.69 ac portion of the site that drains to the northeast through wall openings and is treated as newly graded. The existing condition basin map may be found in the map pocket at the rear of this study as Figure 3.

2.3 Interim/Ultimate Onsite Drainage Description

In the interim/ultimate condition, the offsite area was treated the same as for the existing condition and only the site is developed. The design of the site redistributes the site runoff slightly. Basin PR1 is the 1.43 acre portion of the developed site that drains to Washington Avenue and is treated as pervious & impervious. Basin PR2 is the 0.12 acre portion of the developed site that drains to Classic Car Lane and is treated as pervious & impervious. Basin PR3 is the 2.86 acre portion of the developed site that drains to the wall openings and is treated as pervious & impervious. The interim/ultimate condition basin map that may be found in the map pocket at the rear of this study as Figure 4.

2.4 FEMA Flood Hazard Zone

The Special Flood Hazard Areas for Clark County, Nevada are outlined in the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM), dated November 16, 2011. The site is affected by a designated Special Flood Hazard Area (SFHA) Shaded Zone X as shown on Figure 5, which is a replication of Community Panel No. 32003C2170F. A Shaded Zone X is an area determined to be areas of 0.2% annual chance flood.

2.5 Regional Flood Control Master Plan Update

The site is adjacent to an existing regional facility (WAPR-0000) as shown on Figure 6 which is a replication of Figure F-25 in the 2018 Clark County Regional Flood Control District Flood Control Master Plan Update for the Las Vegas Valley. Facilities WAPR-0000 and LVWH-0305is are existing parallel 12'x8' RCBs running along Washington Avenue.

2.6 Previous Drainage Studies

The site has not been studied in the past. The following studies have been reviewed and are being referenced for pertinent information which may be found in Appendix D at the rear of this report:

- *City of Las Vegas Central Neighborhood Flood Control Mater Plan*, by PBS&J, dated March 2005. This study is referenced to show that offsite runoff is contained within existing CCRFCD facilities.
- *City of Las Vegas Flood Control Facilities Inventory and City Wide Hydrology Analysis*, by PBS&J, dated December 1997. This study is referenced to show that offsite runoff is contained within existing CCRFCD facilities.
- *Sunbelt Storage Gragson & Fantasy Lane*, by Summit Engineering, dated January 2002, (DS 3066). This study is referenced for comparison purposes for the runoff anticipated in the drainage easement along the south side of their site from our site.
- *Blind Center of Nevada*, by Balova Engineering, dated November 2005, (DS 4768). This study is referenced for comparison purposes for the runoff anticipated in the drainage easement along the south side of the Sunbelt Storage site from our site. We also are referencing this study for the flow in Classic Car Lane.

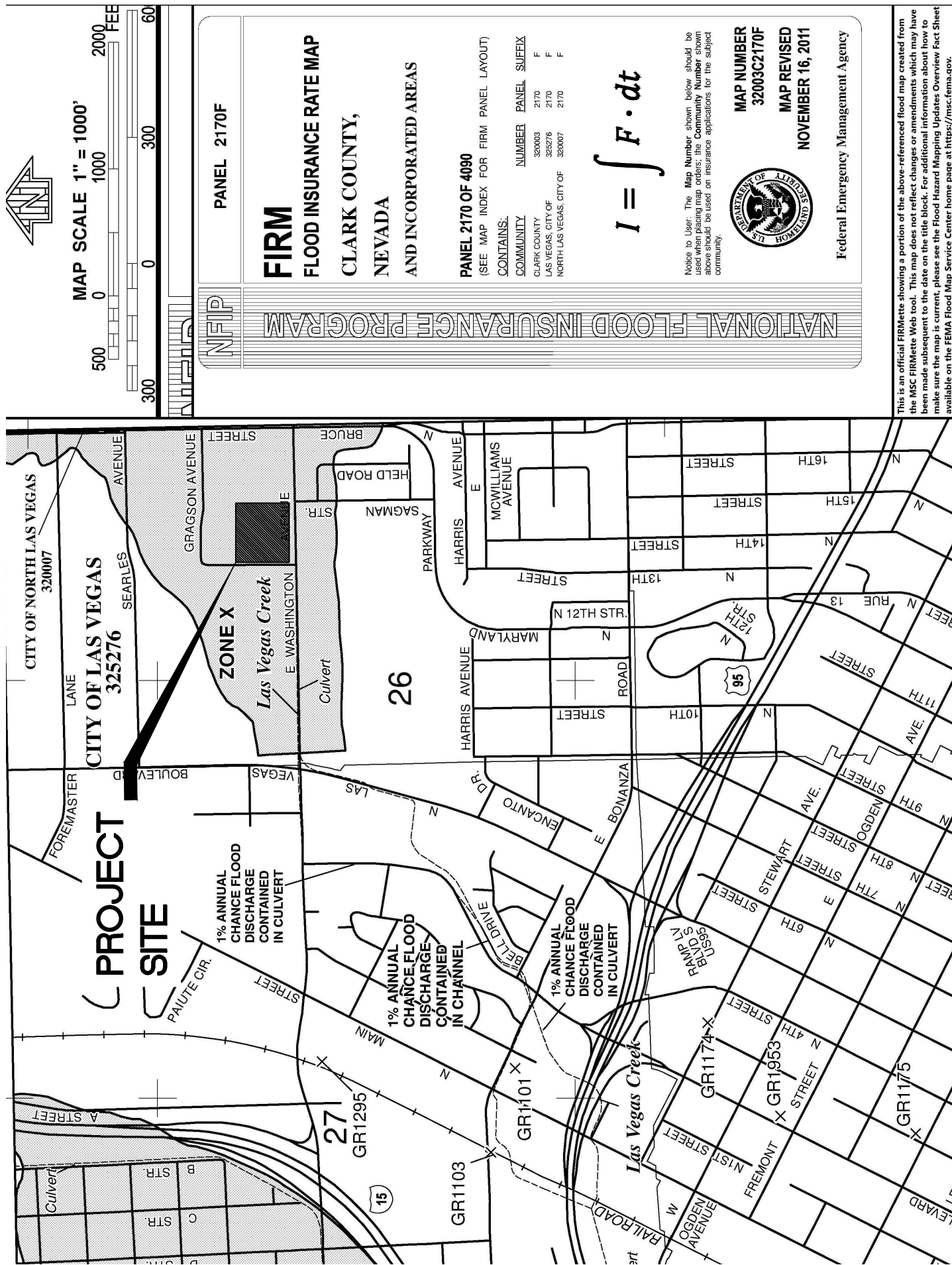


FIGURE 5

3.0 HYDROLOGIC/HYDRAULIC METHODOLOGY

3.1 General

The project site is to be developed into an apartment building. The grading of the site will provide positive drainage through the site without creating a negative impact to neighboring properties and the site itself. The natural drainage patterns were maintained as close as possible.

3.2 Compliance with Regulations and Adopted Plans

The hydrologic parameter calculations for the local on-site basins are included in Appendix A. The hydrologic analyses for the existing and developed conditions are included in Appendix B. The hydraulic calculations for the proposed improvements are included in Appendix C. All calculations presented in this report are in accordance with the CCRFCD Manual.

3.3 Hydrologic Criteria

The watershed was modeled using the storm network computation capabilities of the U. S. Army Corps of Engineer's HEC-1 Flood Hydrograph computer model. The HEC-1 computer program has a wide range of capabilities in modeling gauged and un-gauged watersheds, with most of the latest techniques for simulating precipitation, rainfall distribution, runoff losses due to soil absorption, transpiration, evaporation and surface impoundment, flood routing, flow diversions and splits. Since the study watershed is un-gauged, the analysis used to model the runoff incorporated

the Soil Conservation Service (SCS) unit hydrograph method to develop a hypothetical flood hydrograph. The CCRFCD Manual was used to establish the point precipitation values, rainfall distribution (SDN 3), and depth area reduction factors. The point precipitation values were established from the NOAA precipitation Frequency Atlas (1973). The NOAA precipitation values were then adjusted by the recommended correction factors to develop point rainfall depths for storm events that best simulate the hydrologic area. The point precipitation values are shown in Table 1 for the six-hour duration storm event. The six-hour storm has been selected in accordance with the CCRFCD Manual.

TABLE 1 Depth-Duration-Frequency Values	
Return Period (year)	Precipitation (in)
10	1.58
100	2.77

The site is within the McCarran rainfall area, so the precipitation adjustment ratios are not applied. A depth area reduction factor was not applied to the rainfall values so the DARF = 1.00. Precipitation calculations are located in Appendix A.

The curve numbers were developed based on vegetation, soils group information, land use, and antecedent soil moisture conditions in accordance with the standard methods of the Soil Conservation Service (SCS). The curve numbers were adjusted accordingly to reflect the existing and developed conditions of the site.

The soils information was obtained from the United States Department of Agriculture Natural Resources Conservation Service Soil Survey dated August 22, 2014. It should be noted that the entire area is in map unit symbol 341 which is Paradise Silt Loam and is classified as hydrologic soil group B. Curve numbers are based on the hydrologic soil group and the values provided in the Manual on Table 602. Excerpts from the 2018 Master Plan Update are provided at the request of CCRFCD Staff. Curve number calculations and the excerpts from the 2018 Master Plan Update may be found in Appendix A at the rear of this report.

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

$$L = 0.6 T_c$$

$$T_c = \frac{L_{ws}}{3600 \cdot V} + T_i$$

where: L_{ws} = Hydraulic length

V = Average velocity

T_i = Initial flow time

Average velocities for estimating travel time for surface flow were used to develop a time of concentration. Flow characteristics may be separated into three general categories: initial overland, shallow concentrated, and channelized. To determine initial flow times, the equation $T_i = 1.8 (1.1-K) L^{1/2}/S^{1/3}$ was used as outlined in the CCRFCD Manual. To determine shallow concentrated flow velocities and channelized flow velocities, the equations published in the CCRFCD Manual were utilized. The computations are included on the Standard Form 4. The results are shown on a version of Standard Form 4 and may be found in Appendix A.

3.4 Facility Design Calculations

Normal depth calculations were performed for areas of interest for the existing, interim, and ultimate conditions. All normal depth calculations may be found in Appendix C. The flow in Classic Car Lane is referenced based on the discussion in Section 2.1 of this study. The flow in Washington Avenue is based on site contribution. The flow to the wall openings is also based on site contribution.

The flow depth onsite is below the top of curb. The finished floor elevation is more than twice the depth of flow. In Classic Car Lane, we specifically performed normal depth calculations at the entrances. The north entrance achieves a depth of flow of 0.33 and the top of curb high points provides the necessary 6-inch freeboard. The south entrance achieves a depth of flow of 0.32 and the top of curb high points provides the necessary 6-inch freeboard. In Washington Avenue, we specifically performed a normal depth calculation at the exit and the depth of flow is 0.34-feet. The site drains out of this exit and the necessary 6-inch freeboard is provided before the gates.

The site drains to BMP swales located at the northeast corner and southeast corner of the site. Nuisance runoff is not anticipated but should it occur, it will drain to the BMP swales.

4.0 RESULTS

The flow rates developed by this report are shown in Table 2. The development of the site does not substantially increase any of the adjacent flow rates.

TABLE 2 Summary of Flows		
BASIN	Existing (10yr/100yr) (cfs)	Developed (10 yr/100yr) (cfs)
EX1	<1 / 1	- / -
EX2	<1 / 1	- / -
EX3	3 / 8	- / -
PR1	- / -	2 / 4
PR2	- / -	<1 / <1
PR3	- / -	3 / 7
Classic Car Lane	1.61 / 2.31	1.61 / 2.31
Washington Avenue	1 / 1	2 / 4

Table 3 summarizes the normal depth sections analyzed. All sections meet the velocity-depth product requirements and dry lane requirements.

TABLE 3 Interim/Ultimate Condition Normal Depth Sections									
Street Name	Q ₁₀ (cfs)	V ₁₀ (ft/s)	d ₁₀ (ft)	V ₁₀ * d ₁₀	Q ₁₀₀ (cfs)	V ₁₀₀ (ft/s)	d ₁₀₀ (ft)	V ₁₀₀ * d ₁₀₀	Dry Lane (ft)
Classic Car Lane	1.61	2.21	0.29	0.64	2.31	2.40	0.32	0.77	N/A
Washington Avenue	2.00	2.55	0.30	0.77	4.00	2.98	0.36	1.07	29.50
Wall Openings	3.00	2.45	0.31	0.76	7.00	3.32	0.53	1.76	N/A
North Drive Aisle	3.00	1.74	0.22	0.38	7.00	2.19	0.28	0.61	N/A
West Drive Aisle	3.00	1.17	0.24	0.28	7.00	1.52	0.30	0.46	N/A
East Drive Aisle	3.00	2.12	0.35	0.74	7.00	2.60	0.43	1.12	N/A

5.0 CONCLUSIONS AND RECOMMENDATIONS

1. The site is located within a Special Flood Hazard Area Shaded Zone X. CCRFCD concurrence should not be required prior to final signature on the improvement plans.
2. The development of this site will impact on the Clark County Regional Flood Control District Flood Control Master Plan Update. The site is adjacent to a CCRFCD facility. CCRFCD concurrence should be required.
3. The finished floor elevations were established as follows:
 - Six inches above the highest adjacent top of curb per CCRFCD HCDDM 304.4.E.1. $91.04 + 0.5 = 91.54 < \mathbf{91.6}$ so the FF meets criteria.
 - Finished floor elevations for buildings adjacent to public drainage easements are a minimum of 18 inches above the Q-100 weir or submerged weir elevation, whichever is greater. This is not applicable.
 - Finished floor elevation calculations include allowances for super elevations on curves and velocity head (head loss) for tee intersections. This is not applicable.
4. The grading plan is included in the pocket in the back of this report.
5. The design of this project does not negatively impact adjacent or downstream properties.

6.0 REFERENCES

"2018 Las Vegas Valley Flood Control Master Plan Update", September 2018.
Clark County Regional Flood Control District

"Drainage of Highway Pavements," U. S. Department of Transportation, Federal
Highway Administration, March 1984.

"HEC-1 Flood Hydrograph Package" Revised January 1985. U.S. Army Corps of
Engineers.

"Hydrologic Criteria and Drainage Design Manual", dated 1999. Clark County
Regional Flood Control District.

"Improvement Standards," Department of Public Works, Clark County, Nevada,
1993.

"Soil Survey of Las Vegas Valley Area, Nevada, Part of Clark County" dated
August 2014. U.S. Department of Agriculture, Soil Conservation Service.

"Urban Hydrology for Small Watersheds", June 1986, U.S. Department of
Agriculture, Soil Conservation Service, Technical Release 55, TR-55.

City of Las Vegas Central Neighborhood Flood Control Master Plan, by PBS&J, dated
March 2005.

City of Las Vegas Flood Control Facilities Inventory and City Wide Hydrology Analysis,
by PBS&J, dated December 1997.

Sunbelt Storage Gragson & Fantasy Lane, by Summit Engineering, dated January 2002,
(DS 3066).

Blind Center of Nevada, by Balova Engineering, dated November 2005, (DS 4768).

APPENDIX A

Hydrologic Parameter Development

$$I = \int F \cdot dt$$

ASSESSOR'S PARCELS - CLARK COUNTY, NV.
Briana Johnson - Assessor

BOOK

T20S R61E

SECTION

26

MAP

S 2 NW 4

139-26-2

MAP LEGEND

PARCEL BOUNDARY

SUB BOUNDARY

PM/D BOUNDARY

ROAD EASEMENT

MATCH / LEADER LINE

HISTORIC LOT LINE

HISTORIC SUB BOUNDARY

HISTORIC PM/D BOUNDARY

SECTION LINE

CONDOMINIUM UNIT

AIR SPACE PCL

RIGHT OF WAY PCL

SUB-SURFACE PCL

SUB-LOT LINE

BLOCK NUMBER

LOT NUMBER

GOV. LOT NUMBER

001 ROAD PARCEL NUMBER

001 PARCEL NUMBER

1.00 ACREAGE

202 PARCEL SUB/SEQ NUMBER

PB 24-45 PLAT RECORDING NUMBER

5 BLOCK NUMBER

5 LOT NUMBER

GL5 GOV. LOT NUMBER

Scale: 1" = 200'

Rev: 1/8/2019

NOTES

This map is for assessment use only and does NOT represent a survey.

No liability is assumed for the accuracy of the data delineated herein. Information on roads and other non-assessed parcels may be obtained from the Road Document Listing in the Assessor's Office.

This map is compiled from official records, including surveys and deeds, but only contains the information required for assessment. See the recorded documents for more detailed legal information.

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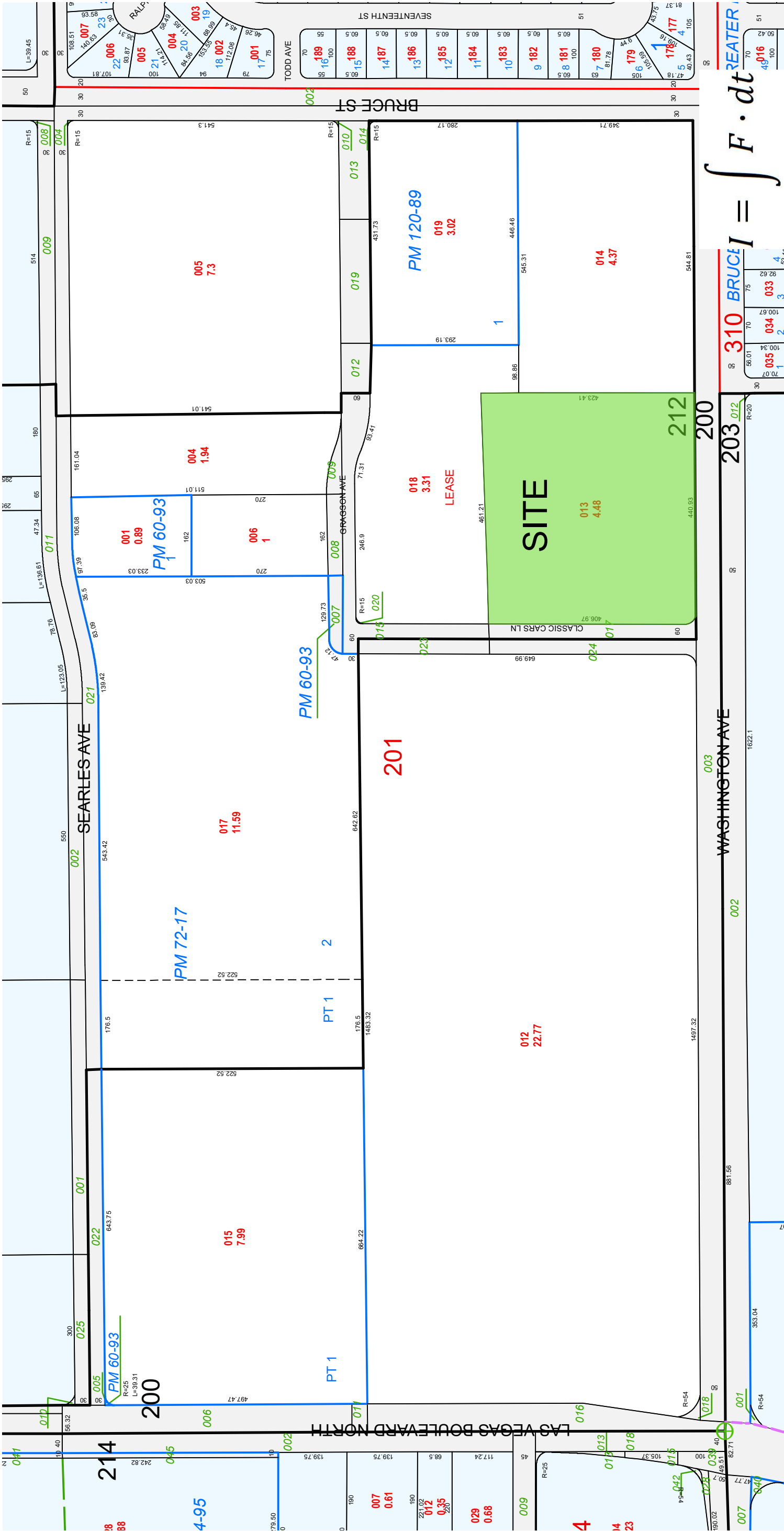
USE THIS SCALE(FEET) WHEN MAP REDUCED FROM 11X17 ORIGINAL

CLARK COUNTY

NEVADA

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

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



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Calc By: PJL
Date: 4/18/2023

[illegible]

Calc By: PJL
Date: 4/18/2023

[illegible]

$$I = \int F \cdot dt$$

Rainfall Calculation - In McCarren Study Area			
10-year		100-year	
From Table 505		From Table 505	
$P_{10} =$	1.58	$P_{100} =$	2.77
From Table 501		From Table 501	
$PAR_{10} =$	1	$PAR_{100} =$	1
From Table 502		From Table 502	
$DARF =$	1	$DARF =$	1
$PB_{10} =$	1.58	$PB_{100} =$	2.77

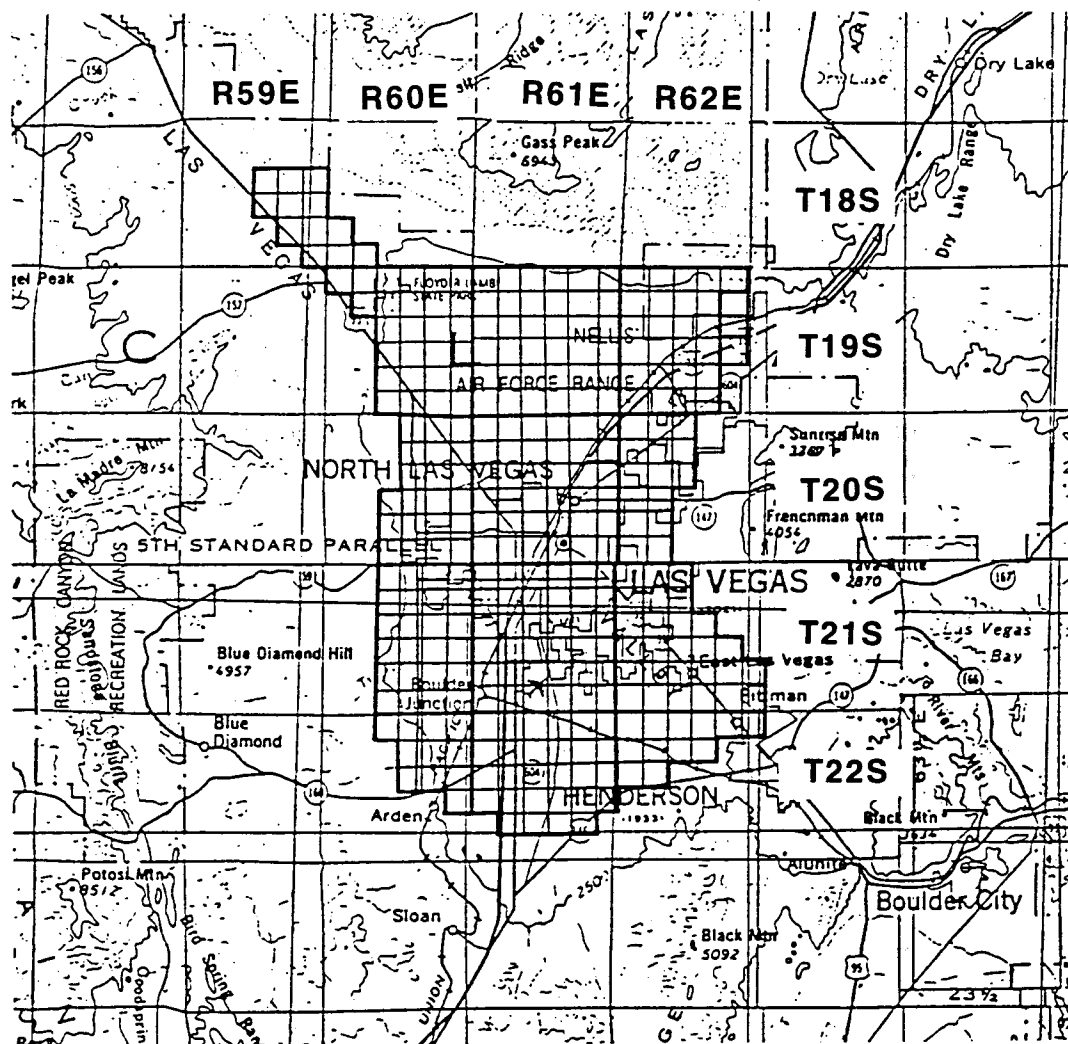
JR Card Calculaiton

JR = $PB_{10} / PB_{100} =$

0.57

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

McCARRAN AIRPORT RAINFALL AREA



TOWNSHIP RANGE SECTIONS

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

TOWNSHIP RANGE SECTIONS

20 South	62 East	4-9,16-20,29-32
21 South	60 East	1-4,9-16,21-28,33-36
21 South	61 East	ALL SECTIONS
21 South	62 East	4-9,15-23, 25-36
22 South	60 East	1-4,10-15,24
22 South	61 East	1-24,26-29
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.

$$I = \int F \cdot dt$$

Revision	Date

WRC
ENGINEERING

REFERENCE:

USACE, Los Angeles District, 1988

FIGURE 513

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

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

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

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

$$I = \int F \cdot dt$$

Revision	Date

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

TIME-INTENSITY-FREQUENCY VALUES FOR McCARRAN AIRPORT RAINFALL AREA (IN INCHES PER HOUR)

TIME (min)	RECURRENCE INTERVAL					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
5	1.80	3.24	4.20	5.52	6.48	7.56
10	1.50	2.64	3.42	4.44	5.34	6.12
15	1.32	2.28	2.96	3.88	4.60	5.28
30	0.88	1.56	2.02	2.62	3.10	3.58
60	0.52	0.89	1.15	1.50	1.78	2.06

- NOTE: 1. Refer to Figure 513 for a description and drawing of the area included in the McCarran Airport Rainfall Area.
2. Table 501 adjustments not required.

$$I = \int F \cdot dt$$

Revision	Date

**WRC
ENGINEERING**

REFERENCE:

USACE, Los Angeles District, 1988

TABLE 506

PRECIPITATION ADJUSTMENT RATIOS

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

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

$$I = \int F \cdot dt$$

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

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

SIX-HOUR STORM DISTRIBUTIONS

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

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

$$I = \int F \cdot dt$$

Revision	Date

REFERENCE:

TABLE 503

SIX HOUR DEPTH-AREA REDUCTION FACTORS

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

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

$$I = \int F \cdot dt$$

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

Company Name:	Impulse Civil Engineering	Existing Condition
File Name:	P:\Clients\Creative Design\Blind Center of NV\Hydrology\Impulse-STD4-blind center.XLS\Soils-EX	
Project Number:	CD-2306	

Calc By: PJJ
Date: 4/18/2023

100-Year Rainfall =	2.77 (in.)
Depth Area Reduction Factor =	1.00
Adjusted 100-Year Rainfall =	2.77 (in.)

- * From Tbl. 505 (x1.0) or Fig. 506 (x1.43)
- * From Tbl. 502
- * PB card

10-Year Rainfall =	1.58 (in.)	* From Tbl. 505 (x1.0) or Fig. 503 (x1.24)
Depth Area Reduction Factor =	1.00	
Adjusted 10-Year Rainfall =	1.58 (in.)	

$$JR_{10} = 0.57$$
[illegible]

[illegible]

$$I = \int F \cdot dt$$

Interim/Ultimate Condition

				TOTAL
PR1	Area	%		62112.33
IMPERVIOUS	B	35,710.30	57.49%	98 w
OPEN SPACE	B	26,402.03	42.51%	79

Composite CN = 89.92

				TOTAL
PR2	Area	%		5217.24
IMPERVIOUS	B	2,964.47	56.82%	98
OPEN SPACE	B	2,252.77	43.18%	79

Composite CN = 89.80

				TOTAL
PR3	Area	%		124375.26
IMPERVIOUS	A	82,874.99	66.63%	98
OPEN SPACE	A	41,500.26	33.37%	79

Composite CN = 91.66

RUNOFF CURVE NUMBERS (SEMIARID RANGELANDS¹)

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

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

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

Fair: 30 to 70% ground cover.

Good: >70% ground cover.

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

$$I = \int F \cdot dt$$

Revision	Date

RUNOFF CURVE NUMBERS (URBAN AREAS¹)

Cover description		Curve numbers for hydrologic soil group—			
Cover type and hydrologic condition	Average percent impervious area ²	A	B	C	D
<i>Fully developed urban areas (vegetation established)</i>					
Open space (lawns, parks, golf courses, cemeteries, etc.): ³					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved: curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved: open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) ⁴ ...		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					

See Table 602A

Developing urban areas

Newly graded areas (pervious areas only, no vegetation) ⁵	77	86	91	94
--	----	----	----	----

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

2 The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system. Impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using Figure 603.

3 CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

4 Composite CN's for natural desert landscaping should be computed using Figure 603 based on the impervious area percentage (CN #98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

5 Composite CN's to use for the design of temporary measures during grading and construction should be computed using Figure 603 based on the degree of development impervious area percentage) and the CN's for the newly graded pervious areas.

$$I = \int F \cdot dt$$

Revision	Date

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

Blind Center of Nevada

$$I = \int F \cdot dt$$



Preface

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

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

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

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

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

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

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How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

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

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

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

Custom Soil Resource Report

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

Soil Map

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

Custom Soil Resource Report Soil Map



Custom Soil Resource Report

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features

 Blowout

 Borrow Pit

 Clay Spot

 Closed Depression

 Gravel Pit

 Gravelly Spot

 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water

 Perennial Water

 Rock Outcrop

 Saline Spot

 Sandy Spot

 Severely Eroded Spot

 Sinkhole

 Slide or Slip

 Sodic Spot

 Spoil Area

 Stony Spot

 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

Water Features

 Streams and Canals

Transportation

 Rails

 Interstate Highways

 US Routes

 Major Roads

 Local Roads

Background

 Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Las Vegas Valley Area, Nevada, Part of Clark County
Survey Area Data: Version 18, Sep 2, 2022

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

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

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

MAP LEGEND

MAP INFORMATION

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
341	Paradise silt loam	7.2	100.0%
Totals for Area of Interest		7.2	100.0%

Map Unit Descriptions

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

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

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

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

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

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

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

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

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

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

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

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

Las Vegas Valley Area, Nevada, Part of Clark County

341—Paradise silt loam

Map Unit Setting

National map unit symbol: hrbx
Elevation: 1,800 to 2,100 feet
Mean annual precipitation: 4 to 6 inches
Mean annual air temperature: 64 to 68 degrees F
Frost-free period: 240 to 260 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Paradise

Setting

Landform: Alluvial flats
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium

Typical profile

H1 - 0 to 10 inches: silt loam
H2 - 10 to 39 inches: loam
H3 - 39 to 61 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.57 to 1.98 in/hr)
Depth to water table: About 36 to 60 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Gypsum, maximum content: 5 percent
Maximum salinity: Moderately saline to strongly saline (8.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum: 12.0
Available water supply, 0 to 60 inches: High (about 10.5 inches)

Interpretive groups

Land capability classification (irrigated): 4w
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: B
Ecological site: R030XY023NV - SALINE MEADOW
Hydric soil rating: No

Soil Information for All Uses

Soil Reports

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

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

Water Features

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

Hydrologic Soil Group and Surface Runoff

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

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

The four hydrologic soil groups are:

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

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

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

Custom Soil Resource Report

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

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

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

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

Report—Hydrologic Soil Group and Surface Runoff

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

Hydrologic Soil Group and Surface Runoff—Las Vegas Valley Area, Nevada, Part of Clark County			
Map symbol and soil name	Pct. of map unit	Surface Runoff	Hydrologic Soil Group
341—Paradise silt loam			
Paradise	100	Low	B

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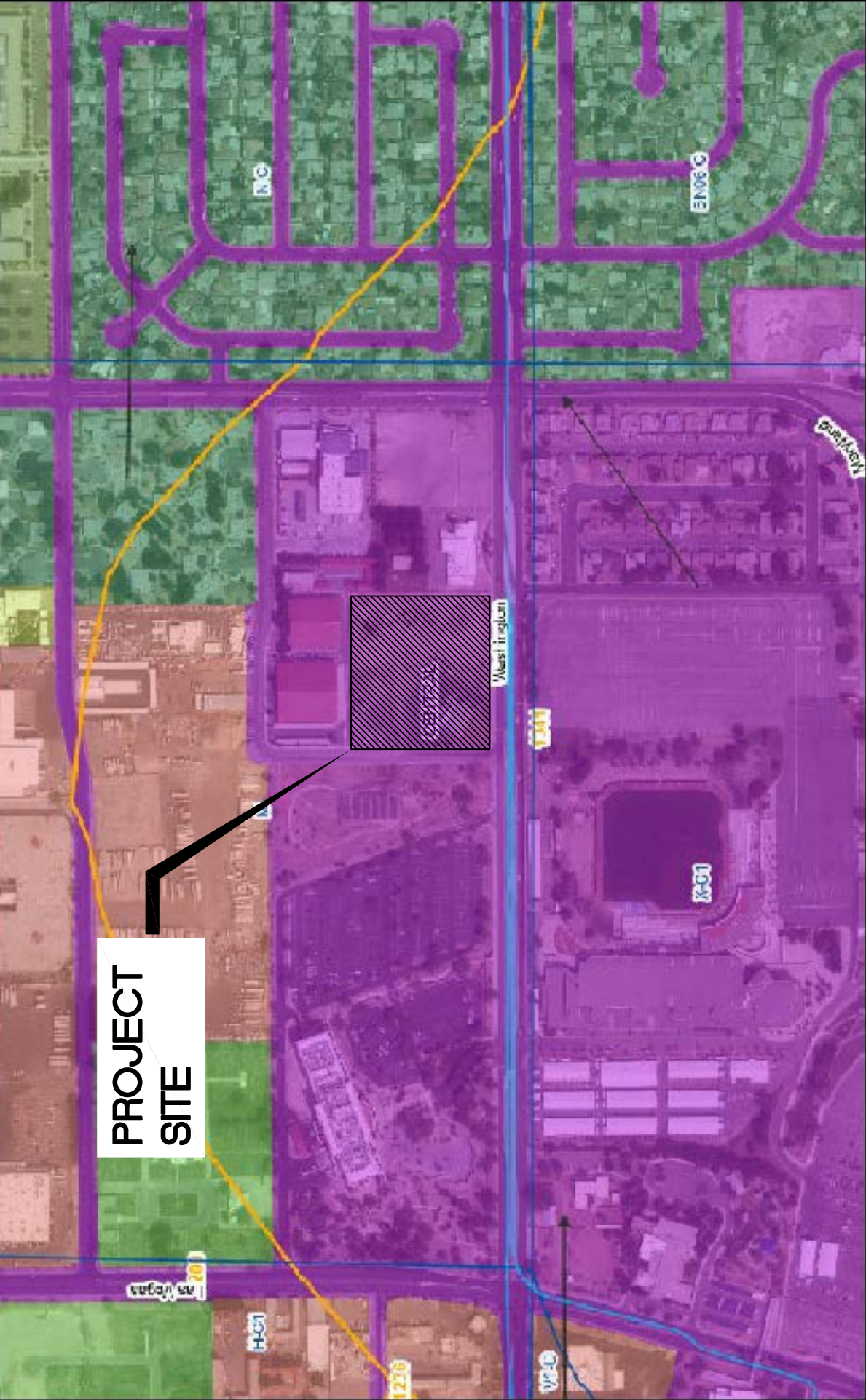
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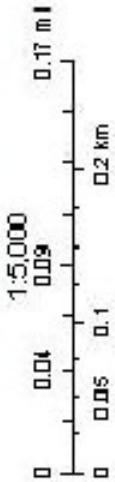
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February 20, 2023



WMAP $I = \int F \cdot dt$

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 --->	CN --->	CN --->	CN --->		63	47	57	60	62	74	84	89	92	86	92	71	30
						77	66	73	74	76	83	89	93	94	91	94	81	30
						85	77	82	83	84	88	92	95	95	93	95	87	30
						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																		
%	%	%	%	%	%													
1301	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
1302	35	20	0	45	0	77.0	67.0	73.0	75.0	76.0	83.0	89.0	93.0	94.0	91.0	94.0	82.0	30.0
1305	5	0	35	60	0	86.0	79.0	83.0	84.0	85.0	89.0	93.0	95.0	96.0	94.0	96.0	88.0	30.0
1307	10	0	30	60	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	96.0	93.0	96.0	87.0	30.0
1313	8	68	0	24	0	79.0	68.0	75.0	76.0	78.0	84.0	90.0	93.0	94.0	91.0	94.0	82.0	30.0
1314	80	5	0	15	0	67.0	53.0	62.0	65.0	67.0	77.0	86.0	91.0	92.0	88.0	92.0	74.0	30.0
1320	0	2	0	83	15	88.0	83.0	87.0	87.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0
1323	0	0	0	85	15	88.0	84.0	87.0	88.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	91.0	30.0
1325	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
1326	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
1340	9	0	0	71	20	86.0	81.0	85.0	85.0	86.0	90.0	93.0	95.0	96.0	94.0	96.0	89.0	30.0
1341	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
1342	0	7	0	78	15	88.0	83.0	86.0	87.0	87.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0
1360	15	0	0	35	50	85.0	81.0	84.0	85.0	86.0	90.0	93.0	95.0	96.0	94.0	96.0	89.0	30.0
1380	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
1390	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
1400	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
1415	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
1417	5	0	55	10	30	86.0	80.0	84.0	85.0	86.0	89.0	93.0	95.0	96.0	94.0	96.0	89.0	30.0
1419	35	0	55	10	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
1440	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
1450	1	0	0	89	10	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
1484	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
1500	60	0	0	35	5	73.0	61.0	69.0	71.0	73.0	81.0	88.0	92.0	93.0	89.0	93.0	79.0	30.0
1501	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
1502	60	0	0	40	0	73.0	61.0	69.0	71.0	72.0	80.0	88.0	92.0	93.0	89.0	93.0	79.0	30.0
1505	55	0	0	40	5	74.0	63.0	70.0	72.0	74.0	81.0	88.0	92.0	94.0	90.0	94.0	80.0	30.0
1506	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
1508	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
1510	10	0	0	55	35	86.0	82.0	85.0	86.0	87.0	90.0	93.0	95.0	96.0	94.0	96.0	89.0	30.0
1540	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
1541	4	0	0	76	20	87.0	83.0	86.0	87.0	87.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0
1542	60	0	30	10	0	72.0	59.0	67.0	69.0	71.0	80.0	87.0	92.0	93.0	89.0	93.0	78.0	30.0
1545	60	0	10	30	0	73.0	60.0	68.0	70.0	72.0	80.0	88.0	92.0	93.0	89.0	93.0	78.0	30.0
1600	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
1605	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
1610	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
1615	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
1630	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
1635	7	0	5	63	25	87.0	82.0	85.0	86.0	87.0	90.0	94.0	95.0	96.0	94.0	96.0	89.0	30.0
1640	0	0	0	10	90	90.0	90.0	91.0	91.0	92.0	94.0	96.0	96.0	97.0	96.0	97.0	94.0	30.0
1645	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
1674	27	26	0	45	2	78.0	69.0	75.0	76.0	78.0	84.0	90.0	93.0	94.0	91.0	94.0	83.0	30.0
1700	0	0	3	93	4	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
1710	2	89	0	9	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
1731	10	2	0	88	0	85.0	79.0	83.0	84.0	85.0	89.0	93.0	95.0	96.0	94.0	96.0	88.0	30.0
1732	3	0	0	96	1	87.0	82.0	85.0	86.0	87.0	90.0	94.0	95.0	96.0	94.0	96.0	89.0	30.0
1753	0	8	0	90	2	87.0	81.0	85.0	86.0	87.0	90.0	93.0	95.0	96.0	94.0	96.0	89.0	30.0
1850	0	0	0	94	6	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
1853	0	0	0	85	15	88.0	84.0	87.0	88.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	91.0	30.0
1871	17	0	0	83	0	84.0	76.0	81.0	82.0	83.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1999	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



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 <u>Natural Desert Landscaping</u> (%)
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.

Central Watershed

2018 LAS VEGAS VALLEY FLOOD CONTROL MASTER PLAN UPDATE - COMPOSITE CURVE NUMBER BREAKDOWN											
WATERSHED	BASINID	LAND USE INDEX NUMBER	SOIL MAP UNIT #	SUBREGION CN	SUBREGION AREA (SQ FT)	SUBBASIN AREA (SQ FT)	PERCENT OF SUBBASIN	CUMULATIVE PERCENT	AREAL WEIGHTED CN	CUMULATIVE CN	COMPOSITE CN
Central	LM19	12	1236	87	1157247	7135489	16.2%	97.7%	14.11	86.53	
Central	LM19	12	1325	71	163173	7135489	2.3%	100.0%	1.62	88.16	88.2
Central	LM20-C	2	1236	77	626353	10685687	5.9%	5.9%	4.51	4.51	
Central	LM20-C	6	1236	88	3332301	10685687	31.2%	37.0%	27.44	31.96	
Central	LM20-C	6	1325	74	338093	10685687	3.2%	40.2%	2.34	34.30	
Central	LM20-C	6	1380	88	1480468	10685687	13.9%	54.1%	12.19	46.49	
Central	LM20-C	7	1236	92	2693636	10685687	25.2%	79.3%	23.19	69.68	
Central	LM20-C	7	1325	84	271512	10685687	2.5%	81.8%	2.13	71.82	
Central	LM20-C	7	1380	92	713941	10685687	6.7%	88.5%	6.15	77.96	
Central	LM20-C	8	1236	95	237975	10685687	2.2%	90.7%	2.12	80.08	
Central	LM20-C	8	1380	95	69742	10685687	0.7%	91.4%	0.62	80.70	
Central	LM20-C	9	1236	95	508027	10685687	4.8%	96.1%	4.52	85.21	
Central	LM20-C	9	1325	92	236774	10685687	2.2%	98.3%	2.04	87.25	
Central	LM20-C	9	1380	95	176863	10685687	1.7%	100.0%	1.57	88.83	88.8
Central	LVW01-C	1	1200	85	139306	6575470	2.1%	2.1%	1.80	1.80	
Central	LVW01-C	6	1200	88	4323408	6575470	65.8%	67.9%	57.86	59.66	
Central	LVW01-C	7	1200	92	1988015	6575470	30.2%	98.1%	27.82	87.48	
Central	LVW01-C	9	1200	95	12647	6575470	0.2%	98.3%	0.18	87.66	
Central	LVW01-C	12	1200	87	112094	6575470	1.7%	100.0%	1.48	89.14	89.1
Central	M	4	1200	83	2024729	7440037	27.2%	27.2%	22.59	22.59	
Central	M	4	1341	74	113712	7440037	1.5%	28.7%	1.13	23.72	
Central	M	6	1200	88	502191	7440037	6.7%	35.5%	5.94	29.66	
Central	M	6	1341	83	194822	7440037	2.6%	38.1%	2.17	31.83	
Central	M	7	1200	92	674266	7440037	9.1%	47.2%	8.34	40.17	
Central	M	7	1341	89	2137838	7440037	28.7%	75.9%	25.57	65.74	
Central	M	9	1200	95	1026549	7440037	13.8%	89.7%	13.11	78.85	
Central	M	9	1341	94	615466	7440037	8.3%	98.0%	7.78	86.63	
Central	M	10	1200	93	86141	7440037	1.2%	99.1%	1.08	87.70	
Central	M	12	1200	87	64324	7440037	0.9%	100.0%	0.75	88.46	88.5
Central	MEDB	2	1300	83	2614602	6398653	40.9%	40.9%	33.92	33.92	
Central	MEDB	2	1341	66	1815843	6398653	28.4%	69.2%	18.73	52.65	
Central	MEDB	2	1999	47	40385	6398653	0.6%	69.9%	0.30	52.94	
Central	MEDB	4	1300	87	230748	6398653	3.6%	73.5%	3.14	56.08	
Central	MEDB	4	1341	74	14	6398653	0.0%	73.5%	0.00	56.08	
Central	MEDB	7	1300	94	1079772	6398653	16.9%	90.4%	15.86	71.94	
Central	MEDB	7	1341	89	34569	6398653	0.5%	90.9%	0.48	72.42	
Central	MEDB	7	1615	92	253822	6398653	4.0%	94.9%	3.65	76.07	
Central	MEDB	7	1999	84	313706	6398653	4.9%	99.8%	4.12	80.19	
Central	MEDB	9	1615	95	15194	6398653	0.2%	100.0%	0.23	80.42	80.4
Central	N-C	6	1200	88	2278141	7357242	31.0%	31.0%	27.25	27.25	
Central	N-C	6	1341	83	144344	7357242	2.0%	32.9%	1.63	28.88	
Central	N-C	7	1200	92	2724062	7357242	37.0%	70.0%	34.06	62.94	
Central	N-C	7	1341	89	135389	7357242	1.8%	71.8%	1.64	64.58	
Central	N-C	9	1200	95	612302	7357242	8.3%	80.1%	7.91	72.48	
Central	N-C	12	1200	87	1463004	7357242	19.9%	100.0%	17.30	89.79	89.8
Central	NEL06-C	2	1236	77	196428	8997747	2.2%	2.2%	1.68	1.68	
Central	NEL06-C	6	1236	88	2109842	8997747	23.4%	25.6%	20.63	22.32	
Central	NEL06-C	6	1282	88	1809977	8997747	20.1%	45.7%	17.70	40.02	
Central	NEL06-C	7	1200	92	194161	8997747	2.2%	47.9%	1.99	42.00	
Central	NEL06-C	7	1236	92	1018247	8997747	11.3%	59.2%	10.41	52.41	
Central	NEL06-C	7	1282	92	1383066	8997747	15.4%	74.6%	14.14	66.56	
Central	NEL06-C	9	1200	95	36542	8997747	0.4%	75.0%	0.39	66.94	
Central	NEL06-C	9	1282	95	1637857	8997747	18.2%	93.2%	17.29	84.23	
Central	NEL06-C	12	1236	87	552209	8997747	6.1%	99.3%	5.34	89.57	
Central	NEL06-C	12	1282	87	59419	8997747	0.7%	100.0%	0.57	90.15	90.1
Central	OG011A-C	2	1152	83	132081	8726108	1.5%	1.5%	1.26	1.26	
Central	OG011A-C	2	1240	83	485520	8726108	5.6%	7.1%	4.62	5.87	
Central	OG011A-C	2	1264	47	233186	8726108	2.7%	9.7%	1.26	7.13	
Central	OG011A-C	6	1152	91	489832	8726108	5.6%	15.4%	5.11	12.24	
Central	OG011A-C	6	1240	91	273977	8726108	3.1%	18.5%	2.86	15.10	
Central	OG011A-C	6	1264	74	3264455	8726108	37.4%	55.9%	27.68	42.78	
Central	OG011A-C	6	1610	88	292226	8726108	3.3%	59.3%	2.95	45.73	
Central	OG011A-C	7	1152	94	223129	8726108	2.6%	61.8%	2.40	48.13	
Central	OG011A-C	7	1240	94	165253	8726108	1.9%	63.7%	1.78	49.91	
Central	OG011A-C	7	1264	84	1586754	8726108	18.2%	81.9%	15.27	65.18	
Central	OG011A-C	7	1610	92	351893	8726108	4.0%	85.9%	3.71	68.89	
Central	OG011A-C	8	1240	96	1280	8726108	0.0%	85.9%	0.01	68.91	
Central	OG011A-C	8	1264	89	766160	8726108	8.8%	94.7%	7.81	76.72	
Central	OG011A-C	8	1610	95	152605	8726108	1.7%	96.5%	1.66	78.38	
Central	OG011A-C	9	1240	96	140	8726108	0.0%	96.5%	0.00	78.39	
Central	OG011A-C	9	1264	92	732	8726108	0.0%	96.5%	0.01	78.39	
Central	OG011A-C	9	1610	95	306884	8726108	3.5%	100.0%	3.34	81.73	81.7
Central	OG011AC2	2	1240	83	520306	3338035	15.6%	15.6%	12.94	12.94	
Central	OG011AC2	6	1240	91	749260	3338035	22.4%	38.0%	20.43	33.36	
Central	OG011AC2	6	1264	74	15100	3338035	0.5%	38.5%	0.33	33.70	
Central	OG011AC2	7	1240	94	792204	3338035	23.7%	62.2%	22.31	56.01	
Central	OG011AC2	7	1264	84	21396	3338035	0.6%	62.9%	0.54	56.55	
Central	OG011AC2	8	1240	96	1126735	3338035	33.8%	96.6%	32.40	88.95	
Central	OG011AC2	9	1240	96	113033	3338035	3.4%	100.0%	3.25	92.20	92.2
Central	OG02-C	2	1152	83	69143	8864192	0.8%	0.8%	0.65	0.65	
Central	OG02-C	2	1264	47	190	8864192	0.0%	0.8%	0.00	0.65	
Central	OG02-C	2	1610	77	315051	8864192	3.6%	4.3%	2.74	3.39	
Central	OG02-C	6	1152	91	2696966	8864192	30.4%	34.8%	27.69	31.07	
Central	OG02-C	6	1264	74	21125	8864192	0.2%	35.0%	0.18	31.25	
Central	OG02-C	6	1610	88	13644	8864192	0.2%	35.2%	0.14	31.38	
Central	OG02-C	7	1152	94	1630103	8864192	18.4%	53.5%	17.29	48.67	

APPENDIX B

Hydrologic Analyses

$$I = \int F \cdot dt$$

HYDROLOGIC ANALYSIS

Existing Condition

$$I = \int F \cdot dt$$

$$I = \int F \cdot dt$$

Blind Center of Nevada

[illegible]

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

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

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

NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY, DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION

KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

LINE	ID	1	2	3	4	5	6	7	8	9	10
1	ID										
2	ID										
3	ID			BLIND CENTER OF NEVADA							
4	ID			Input = blindex.hc1							
5	ID			EXISTING CONDITIONS							
6	ID			WATERSHED ANALYSIS							
7	ID			SDN-3 6 HOUR STORM							
8	ID										
9	ID			JR = 1.58/2.77 = 0.57	10 year						
10	ID			JR = 2.77/2.77 = 1.00	100 year						
11	ID										
12	ID			Engineer = IMPULSE CIVIL ENGINEERING							
13	ID			Client = CREATIVE DESIGN ARCHITECTURE							
14	ID										
15	ID										
16	ID										
				*DIAGRAM							
17	IT	5	0	0	300						
18	IO	5	0	0							
19	IN	5	0	0							
20	JR	PREC	0.57	1.00							
21	KK	EX1									
22	BA	0.0005									
23	PB	2.77									
24	PC	0	.02	.057	.07	.087	.108	.124	.13	.13	.13
25	PC	.13	.13	.13	.133	.14	.142	.148	.158	.172	.181

26	PC	.19	.197	.199	.2	.201	.204	.214	.229	.241	.249
27	PC	.251	.256	.27	.278	.281	.283	.295	.322	.352	.409
28	PC	.499	.59	.71	.744	.781	.812	.819	.835	.851	.856
29	PC	.86	.868	.876	.888	.91	.926	.937	.95	.97	.976
30	PC	.982	.985	.987	.989	.99	.993	.993	.994	.995	.998
31	PC	.998	.999	1							
32	LS	0	86.0								
33	UD	.1000									
	*										
34	KK	EX2									
35	BA	0.0006									
36	LS	0	86.0								
37	UD	.1000									
	*										
38	KK	EX3									
39	BA	0.0058									
40	LS	0	86.0								
41	UD	.1199									
	*										
42	ZZ										

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT

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

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

21	EX1		
	.		
	.		
34	.	EX2	
	.	.	
	.	.	
38	.	.	EX3

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```

*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* SEPTEMBER 1990
* VERSION 4.0
*
* RUN DATE 04/18/2023 TIME 10:55:12
*

```

```

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

```

```

%%
%% BLIND CENTER OF NEVADA
%%
%% Input = blindex.hc1
%%
%% EXISTING CONDITIONS
%%
%% WATERSHED ANALYSIS
%%
%% SDN-3 6 HOUR STORM
%%
%%
%% JR = 1.58/2.77 = 0.57 10 year
%% JR = 2.77/2.77 = 1.00 100 year
%%
%% Engineer = IMPULSE CIVIL ENGINEERING
%% Client = CREATIVE DESIGN ARCHITECTURE
%%

```

18 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
100	0.0023
200	0.0046
300	0.0069
400	0.0092
500	0.0115
600	0.0138
700	0.0161
800	0.0184
900	0.0207
1000	0.0230
1100	0.0253
1200	0.0276
1300	0.0299
1400	0.0322
1500	0.0345
1600	0.0368
1700	0.0391
1800	0.0414
1900	0.0437
2000	0.0460
2100	0.0483
2200	0.0506
2300	0.0529
2400	0.0552
2500	0.0575
2600	0.0598
2700	0.0621
2800	0.0644
2900	0.0667
3000	0.0690
3100	0.0713
3200	0.0736
3300	0.0759
3400	0.0782
3500	0.0805
3600	0.0828
3700	0.0851
3800	0.0874
3900	0.0897
4000	0.0920
4100	0.0943
4200	0.0966
4300	0.0989
4400	0.1012
4500	0.1035
4600	0.1058
4700	0.1081
4800	0.1104
4900	0.1127
5000	0.1150
5100	0.1173
5200	0.1196
5300	0.1219
5400	0.1242
5500	0.1265
5600	0.1288
5700	0.1311
5800	0.1334
5900	0.1357
6000	0.1380
6100	0.1403
6200	0.1426
6300	0.1449
6400	0.1472
6500	0.1495
6600	0.1518
6700	0.1541
6800	0.1564
6900	0.1587
7000	0.1610
7100	0.1633
7200	0.1656
7300	0.1679
7400	0.1702
7500	0.1725
7600	0.1748
7700	0.1771
7800	0.1794
7900	0.1817
8000	0.1840
8100	0.1863
8200	0.1886
8300	0.1909
8400	0.1932
8500	0.1955
8600	0.1978
8700	0.2001
8800	0.2024
8900	0.2047
9000	0.2070
9100	0.2093
9200	0.2116
9300	0.2139
9400	0.2162
9500	0.2185
9600	0.2208
9700	0.2231
9800	0.2254
9900	0.2277
10000	0.2300

TEMPERATURE	DEGREES FAHRENHEIT
10	50
20	68
30	86
40	104
50	122
60	140
70	158
80	176
90	194
100	212

JP MULTI-PLAN OPTION

NPLAN	1	NUMBER OF PLANS
-------	---	-----------------

JR MULTI-RATIO OPTION

RATIOS OF PRECIPITATION

.57	1.00
-----	------

1

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS

FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES

TIME TO PEAK IN HOURS

RATIOS APPLIED TO PRECIPITATION

RATIO 1	RATIO 2
1	1
2	1
3	1
4	1
5	1
6	1
7	1
8	1
9	1
10	1
11	1
12	1
13	1
14	1
15	1
16	1
17	1
18	1
19	1
20	1
21	1
22	1
23	1
24	1
25	1
26	1
27	1
28	1
29	1
30	1
31	1
32	1
33	1
34	1
35	1
36	1
37	1
38	1
39	1
40	1
41	1
42	1
43	1
44	1
45	1
46	1
47	1
48	1
49	1
50	1
51	1
52	1
53	1
54	1
55	1
56	1
57	1
58	1
59	1
60	1
61	1
62	1
63	1
64	1
65	1
66	1
67	1
68	1
69	1
70	1
71	1
72	1
73	1
74	1
75	1
76	1
77	1
78	1
79	1
80	1
81	1
82	1
83	1
84	1
85	1
86	1
87	1
88	1
89	1
90	1
91	1
92	1
93	1
94	1
95	1
96	1
97	1
98	1
99	1
100	1

.57	1.00
-----	------

HYDROGRAPH AT

+	EX1	.00	1	FLOW	0.	1.
				TIME	3.50	3.50

HYDROGRAPH AT

+	EX2	.00	1	FLOW	0.	1.
				TIME	3.50	3.50

HYDROGRAPH AT

+	EX3	.01	1	FLOW	3.	8.
				TIME	3.58	3.58

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

HYDROLOGIC ANALYSIS

Interim/Ultimate Condition

$$I = \int F \cdot dt$$

$$I = \int F \cdot dt$$

Blind Center of Nevada

[illegible]

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

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

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

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

NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY, DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION

KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

LINE	ID	1	2	3	4	5	6	7	8	9	10
1	ID										
2	ID										
3	ID	%%			BLIND CENTER OF NEVADA				%%		
4	ID	%%			Input = blindpr.hc1				%%		
5	ID	%%			INTERIM/ULTIMATE CONDITIONS				%%		
6	ID	%%			WATERSHED ANALYSIS				%%		
7	ID	%%			SDN-3 6 HOUR STORM				%%		
8	ID	%%							%%		
9	ID	%%			JR = 1.58/2.77 = 0.57	10 year			%%		
10	ID	%%			JR = 2.77/2.77 = 1.00	100 year			%%		
11	ID	%%							%%		
12	ID	%%			Engineer = IMPULSE CIVIL ENGINEERING				%%		
13	ID	%%			Client = CREATIVE DESIGN ARCHITECTURE				%%		
14	ID										
15	ID										
16	ID										
	*DIAGRAM										
17	IT	5		0		0	300				
18	IO	5		0		0					
19	IN	5		0		0					
20	JR	PREC		0.57		1.00					
21	KK	PR1									
22	BA	0.0022									
23	PB	2.77									
24	PC	0		.02	.057	.07	.087	.108	.124	.13	.13

25	PC	.13	.13	.13	.133	.14	.142	.148	.158	.172	.181
26	PC	.19	.197	.199	.2	.201	.204	.214	.229	.241	.249
27	PC	.251	.256	.27	.278	.281	.283	.295	.322	.352	.409
28	PC	.499	.59	.71	.744	.781	.812	.819	.835	.851	.856
29	PC	.86	.868	.876	.888	.91	.926	.937	.95	.97	.976
30	PC	.982	.985	.987	.989	.99	.993	.993	.994	.995	.998
31	PC	.998	.999	1							
32	LS	0	89.92								
33	UD	.0699									

*

34	KK	PR2	
35	BA	0.0002	
36	LS	0	89.80
37	UD	.0531	

*

38	KK	PR3	
39	BA	0.0045	
40	LS	0	91.66
41	UD	.1222	

*

42 ZZ

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT

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

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

21	PR1		
.			
.			
34	.	PR2	
.	.		
.	.		
38	.	.	PR3

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* SEPTEMBER 1990 *
* VERSION 4.0 *
* RUN DATE 04/18/2023 TIME 10:57:46 *

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

%% BLIND CENTER OF NEVADA %%
%% Input = blindpr.hc1 %%
%% INTERIM/ULTIMATE CONDITIONS %%
%% WATERSHED ANALYSIS %%
%% SDN-3 6 HOUR STORM %%
%% JR = 1.58/2.77 = 0.57 10 year %%
%% JR = 2.77/2.77 = 1.00 100 year %%
%% Engineer = IMPULSE CIVIL ENGINEERING %%
%% Client = CREATIVE DESIGN ARCHITECTURE %%

18 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	
.57	1.00

1

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS

 FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES

 TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION	
				RATIO 1	RATIO 2
				.57	1.00
HYDROGRAPH AT					
+	PR1	.00	1	FLOW	2.
				TIME	3.50
HYDROGRAPH AT					
+	PR2	.00	1	FLOW	0.
				TIME	3.50
HYDROGRAPH AT					
+	PR3	.00	1	FLOW	3.
				TIME	3.58

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

APPENDIX C

Hydraulic Analyses

$$I = \int F \cdot dt$$

HYDRAULIC ANALYSIS

Existing Condition

$$I = \int F \cdot dt$$

Blind Center of Nevada Existing Condition Street Flow Calculations

[illegible]

Dry Lane Calculations:

For 80-foot Right of Way:

For 100-foot Right of Way:

$$\text{Dry Lane} = ((\text{Crown} - d_{10}) / \text{Cross Slope}) - (\text{Center Turn Lane} / 2)$$
Dry Lane = $((0.83 - d_{10}) / .02) - 7$

$$\text{Dry Lane} = ((1.03 - d_{10}) / .02) - 7$$

*

Flow in Classic Car Lane is referenced from the Blind Center of Nevada DS 4768 + EX2

Flow in Washington Avenue is EX1

Flow at wall openings is EX3

Classic Car Lane 10-year
Worksheet for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	Classic Car Lane
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

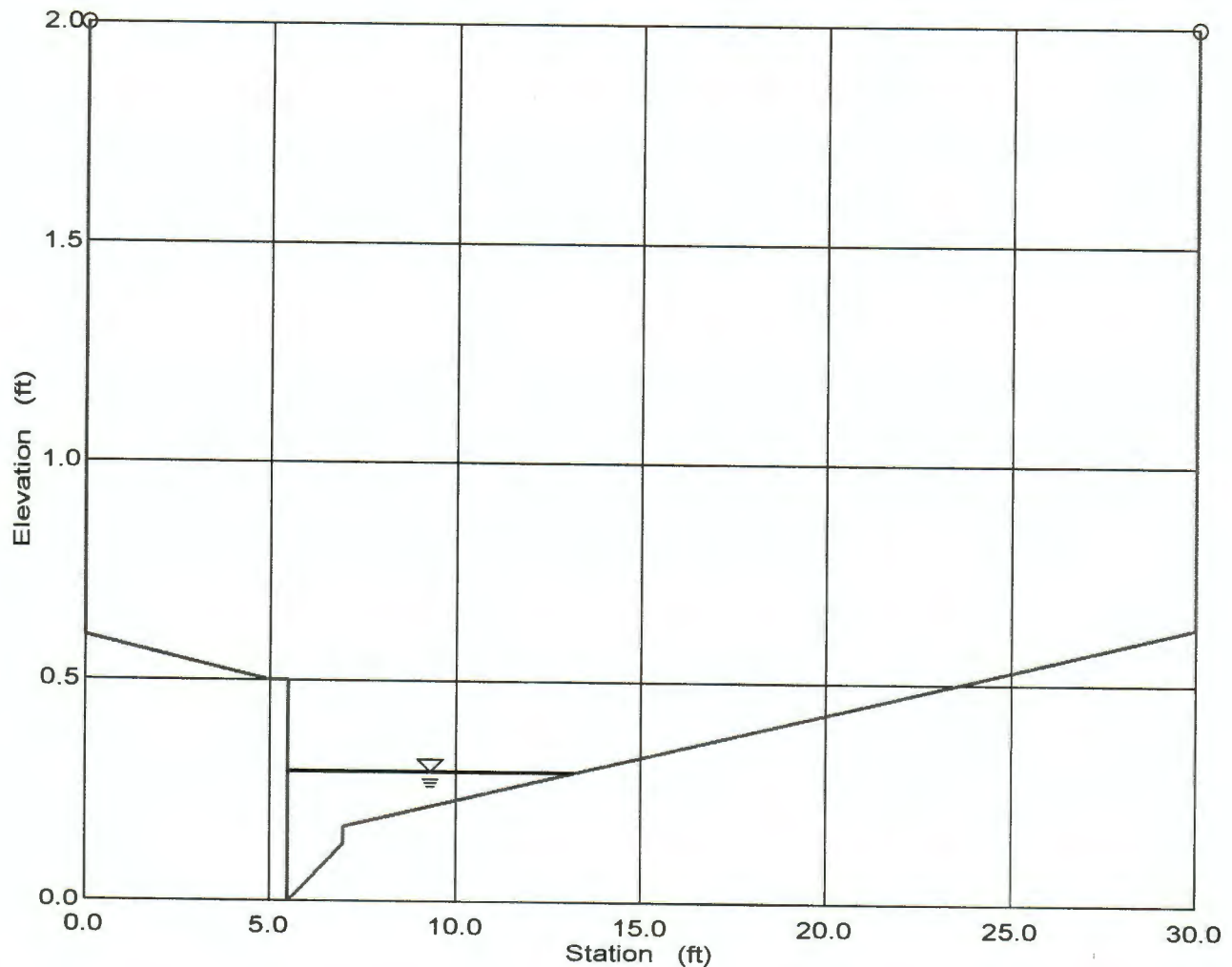
Input Data				
Channel Slope		0.014000 ft/ft		
Elevation range: 0.00 ft to 2.00 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	2.00	0.00	30.00	0.016
0.00	0.60			
5.00	0.50			
5.50	0.50			
5.50	0.00			
7.00	0.13			
7.00	0.17			
30.00	0.63			
30.00	2.00			
Discharge	1.61	cfs		

Results		
Wtd. Mannings Coefficient	0.016	
Water Surface Elevation	0.29	ft
Flow Area	0.73	ft ²
Wetted Perimeter	8.03	ft
Top Width	7.69	ft
Height	0.29	ft
Critical Depth	0.31	ft
Critical Slope	0.008422	ft/ft
Velocity	2.21	ft/s
Velocity Head	0.08	ft
Specific Energy	0.37	ft
Froude Number	1.27	
Flow is supercritical.		

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	Classic Car Lane
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.016
Channel Slope	0.014000 ft/ft
Water Surface Elevation	0.29 ft
Discharge	1.61 cfs



Classic Car Lane 100-year
Worksheet for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	Classic Car Lane
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

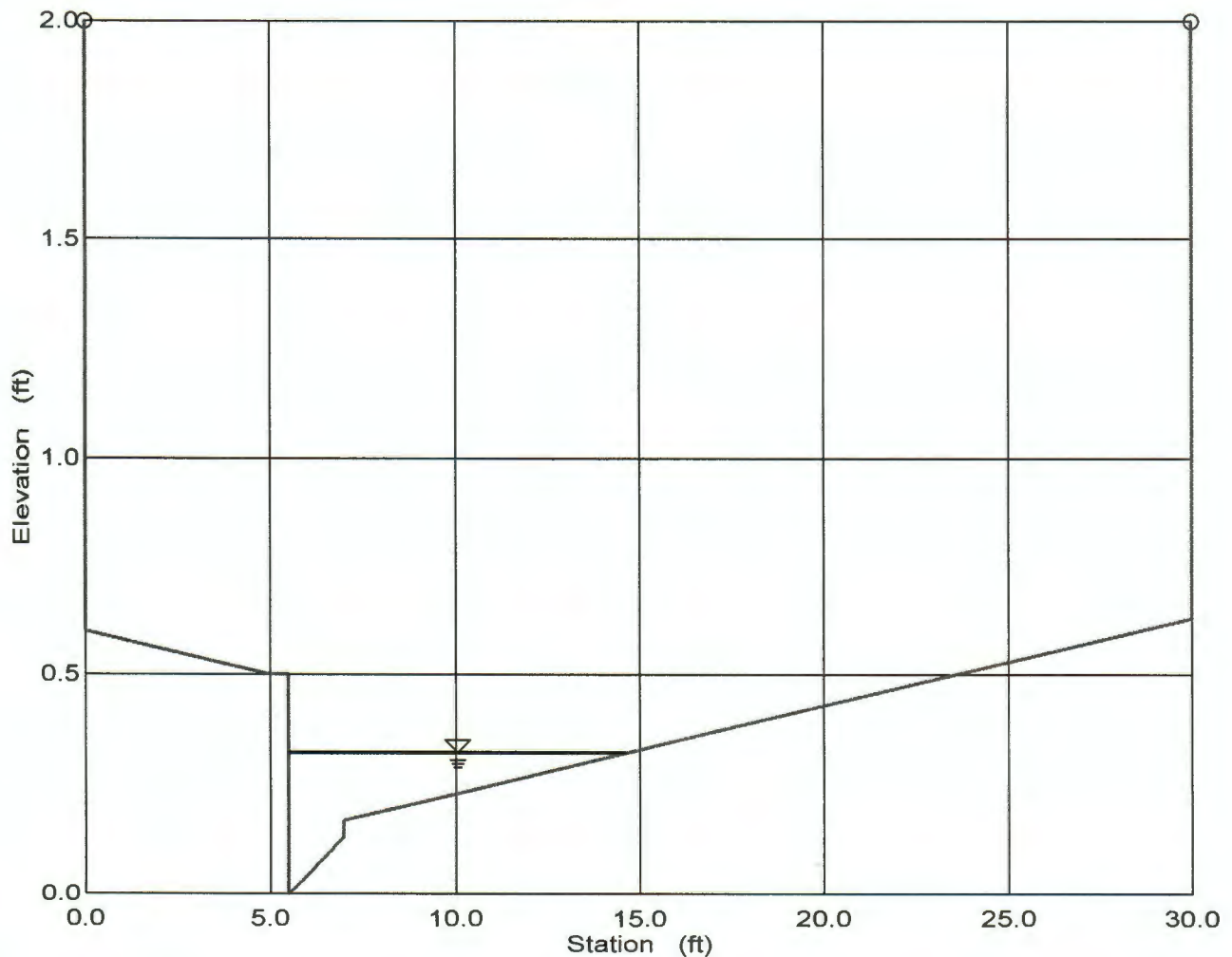
Input Data				
Channel Slope		0.014000 ft/ft		
Elevation range: 0.00 ft to 2.00 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	2.00	0.00	30.00	0.016
0.00	0.60			
5.00	0.50			
5.50	0.50			
5.50	0.00			
7.00	0.13			
7.00	0.17			
30.00	0.63			
30.00	2.00			
Discharge	2.31	cfs		

Results		
Wtd. Mannings Coefficient	0.016	
Water Surface Elevation	0.32	ft
Flow Area	0.96	ft ²
Wetted Perimeter	9.48	ft
Top Width	9.11	ft
Height	0.32	ft
Critical Depth	0.35	ft
Critical Slope	0.008040	ft/ft
Velocity	2.40	ft/s
Velocity Head	0.09	ft
Specific Energy	0.41	ft
Froude Number	1.30	
Flow is supercritical.		

Cross Section Cross Section for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	Classic Car Lane
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.016
Channel Slope	0.014000 ft/ft
Water Surface Elevation	0.32 ft
Discharge	2.31 cfs



Washington Avenue 10/100-year
Worksheet for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	Washington Avenue
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

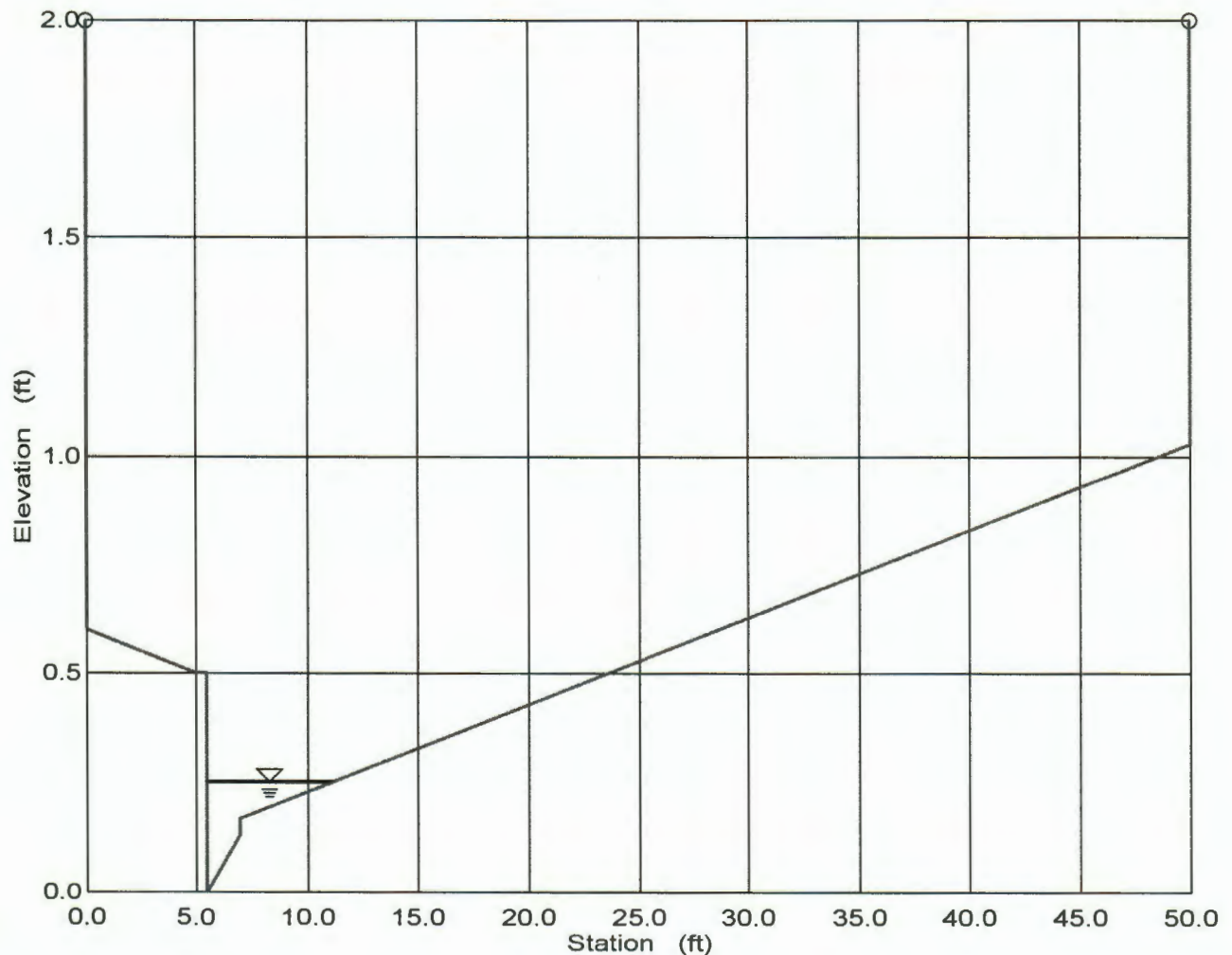
Input Data				
Channel Slope	0.017900 ft/ft			
Elevation range: 0.00 ft to 2.00 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	2.00	0.00	50.00	0.016
0.00	0.60			
5.00	0.50			
5.50	0.50			
5.50	0.00			
7.00	0.13			
7.00	0.17			
50.00	1.03			
50.00	2.00			
Discharge	1.00	cfs		

Results		
Wtd. Mannings Coefficient	0.016	
Water Surface Elevation	0.25	ft
Flow Area	0.45	ft ²
Wetted Perimeter	5.90	ft
Top Width	5.60	ft
Height	0.25	ft
Critical Depth	0.28	ft
Critical Slope	0.008930	ft/ft
Velocity	2.23	ft/s
Velocity Head	0.08	ft
Specific Energy	0.33	ft
Froude Number	1.39	
Flow is supercritical.		

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	Washington Avenue
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.016
Channel Slope	0.017900 ft/ft
Water Surface Elevation	0.25 ft
Discharge	1.00 cfs



Wall Opening 10-year
Worksheet for Rectangular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	Wall Opening
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

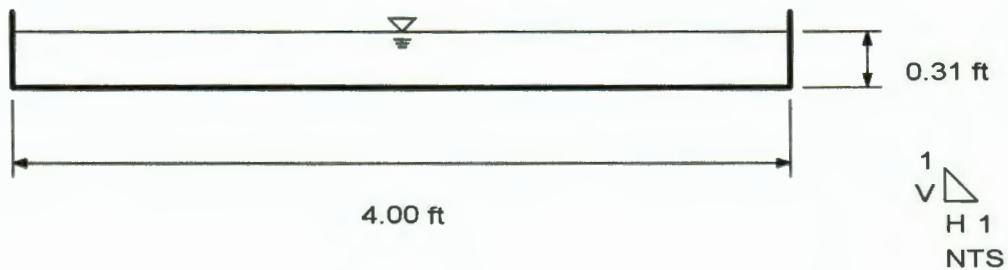
Input Data	
Mannings Coefficient	0.025
Channel Slope	0.010000 ft/ft
Bottom Width	4.00 ft
Discharge	3.00 cfs

Results	
Depth	0.31 ft
Flow Area	1.22 ft ²
Wetted Perimeter	4.61 ft
Top Width	4.00 ft
Critical Depth	0.26 ft
Critical Slope	0.016800 ft/ft
Velocity	2.45 ft/s
Velocity Head	0.09 ft
Specific Energy	0.40 ft
Froude Number	0.78
Flow is subcritical.	

Cross Section
Cross Section for Rectangular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	Wall Opening
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.025
Channel Slope	0.010000 ft/ft
Depth	0.31 ft
Bottom Width	4.00 ft
Discharge	3.00 cfs



Wall Opening 100-year
Worksheet for Rectangular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	Wall Opening
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

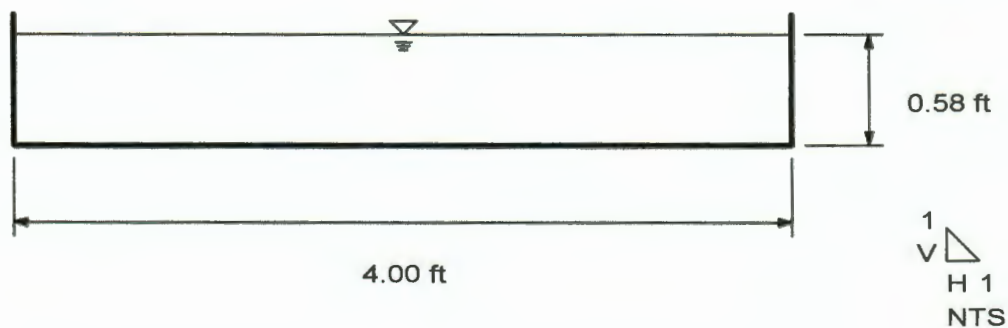
Input Data	
Mannings Coefficient	0.025
Channel Slope	0.010000 ft/ft
Bottom Width	4.00 ft
Discharge	8.00 cfs

Results	
Depth	0.58 ft
Flow Area	2.30 ft ²
Wetted Perimeter	5.15 ft
Top Width	4.00 ft
Critical Depth	0.50 ft
Critical Slope	0.015453 ft/ft
Velocity	3.47 ft/s
Velocity Head	0.19 ft
Specific Energy	0.76 ft
Froude Number	0.81
Flow is subcritical.	

Cross Section
Cross Section for Rectangular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	Wall Opening
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.025
Channel Slope	0.010000 ft/ft
Depth	0.58 ft
Bottom Width	4.00 ft
Discharge	8.00 cfs



HYDRAULIC ANALYSIS

Interim/Ultimate Condition

$$I = \int F \cdot dt$$

$$I = \int F \cdot dt$$

Blind Center of Nevada

Interim Condition Street Flow Calculations

Street Name	Slope (%)	R.O.W. Width (ft)	Q ₁₀ (cfs)	V ₁₀ (ft/s)	d ₁₀ (ft)	V ₁₀ * d ₁₀	Q ₁₀₀ (cfs)	V ₁₀₀ (ft/s)	d ₁₀₀ (ft)	V ₁₀₀ * d ₁₀₀	Dry Lane (ft)
Classic Car Lane *	1.40	60	1.61	2.21	0.29	0.64	2.31	2.40	0.32	0.77	N/A
Washington Avenue **	1.79	100	2.00	2.55	0.30	0.77	4.00	2.98	0.36	1.07	29.50
Wall Openings ***	1.00	N/A	3.00	2.45	0.31	0.76	7.00	3.32	0.53	1.76	N/A
North Drive Aisle	1.00	N/A	3.00	1.74	0.22	0.38	7.00	2.19	0.28	0.61	N/A
West Drive Aisle	0.40	N/A	3.00	1.17	0.24	0.28	7.00	1.52	0.30	0.46	N/A
East Drive Aisle	1.00	N/A	3.00	2.12	0.35	0.74	7.00	2.60	0.43	1.12	N/A
Dry Lane Calculations:											
For 80-foot Right of Way:											
For 100-foot Right of Way:											
Dry Lane = ((Crown - d ₁₀) / Cross Slope)-(Center Turn Lane / 2)											
Dry Lane = ((0.83 - d ₁₀) / .02) - 7											
Dry Lane = ((1.03 - d ₁₀) / .02) - 7											

*

Flow in Classic Car Lane is referenced from the Blind Center of Nevada DS 4768 + PR2

**

Flow in Washington Avenue is PR1

Flow at wall openings is PR3

Classic Car Lane 10-year
Worksheet for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	Classic Car Lane
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

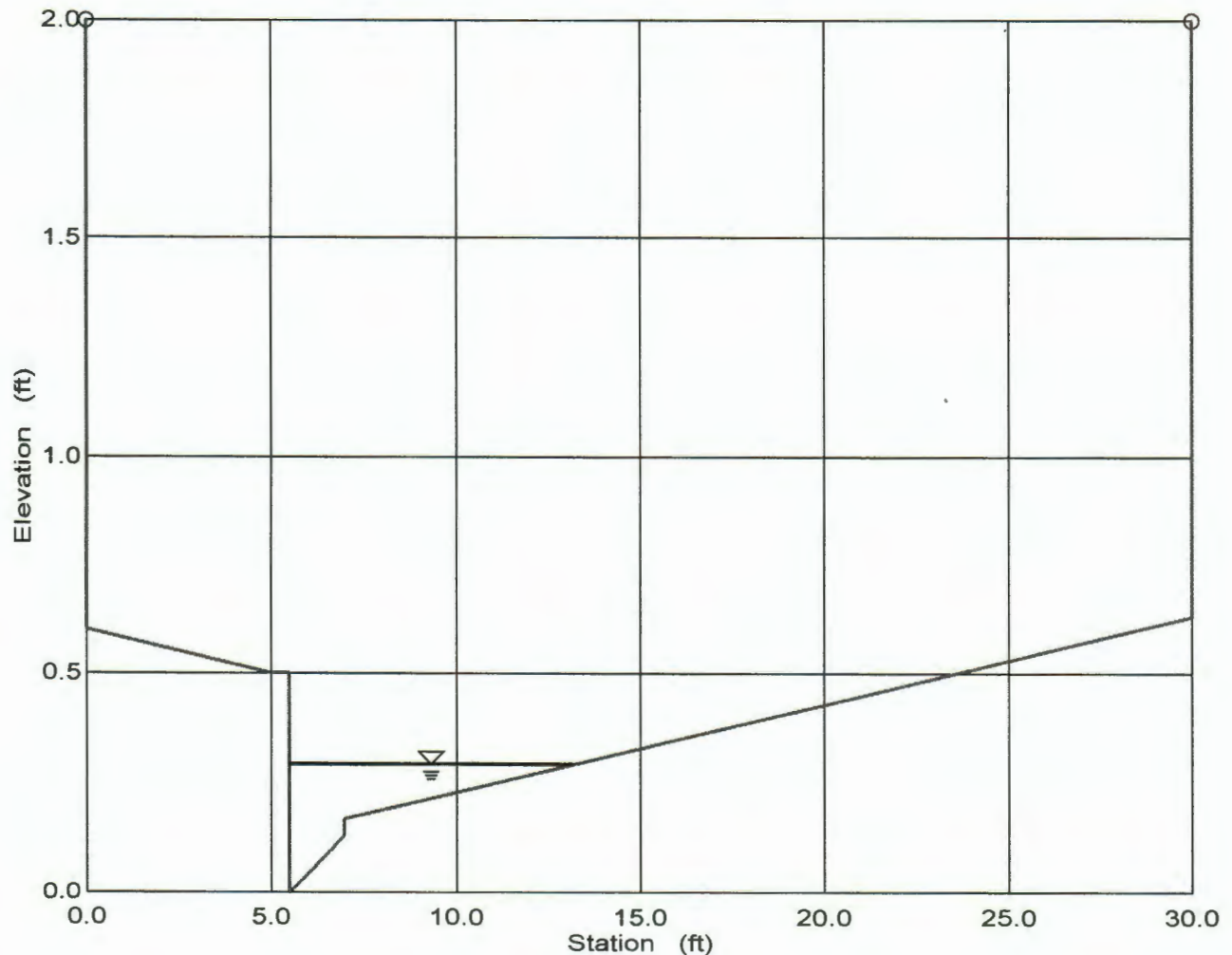
Input Data				
Channel Slope	0.014000 ft/ft			
Elevation range: 0.00 ft to 2.00 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	2.00	0.00	30.00	0.016
0.00	0.60			
5.00	0.50			
5.50	0.50			
5.50	0.00			
7.00	0.13			
7.00	0.17			
30.00	0.63			
30.00	2.00			
Discharge	1.61	cfs		

Results		
Wtd. Mannings Coefficient	0.016	
Water Surface Elevation	0.29	ft
Flow Area	0.73	ft ²
Wetted Perimeter	8.03	ft
Top Width	7.69	ft
Height	0.29	ft
Critical Depth	0.31	ft
Critical Slope	0.008422	ft/ft
Velocity	2.21	ft/s
Velocity Head	0.08	ft
Specific Energy	0.37	ft
Froude Number	1.27	
Flow is supercritical.		

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	Classic Car Lane
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.016
Channel Slope	0.014000 ft/ft
Water Surface Elevation	0.29 ft
Discharge	1.61 cfs



Classic Car Lane 100-year
Worksheet for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	Classic Car Lane
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data				
Channel Slope	0.014000 ft/ft			
Elevation range: 0.00 ft to 2.00 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	2.00	0.00	30.00	0.016
0.00	0.60			
5.00	0.50			
5.50	0.50			
5.50	0.00			
7.00	0.13			
7.00	0.17			
30.00	0.63			
30.00	2.00			
Discharge	2.31	cfs		

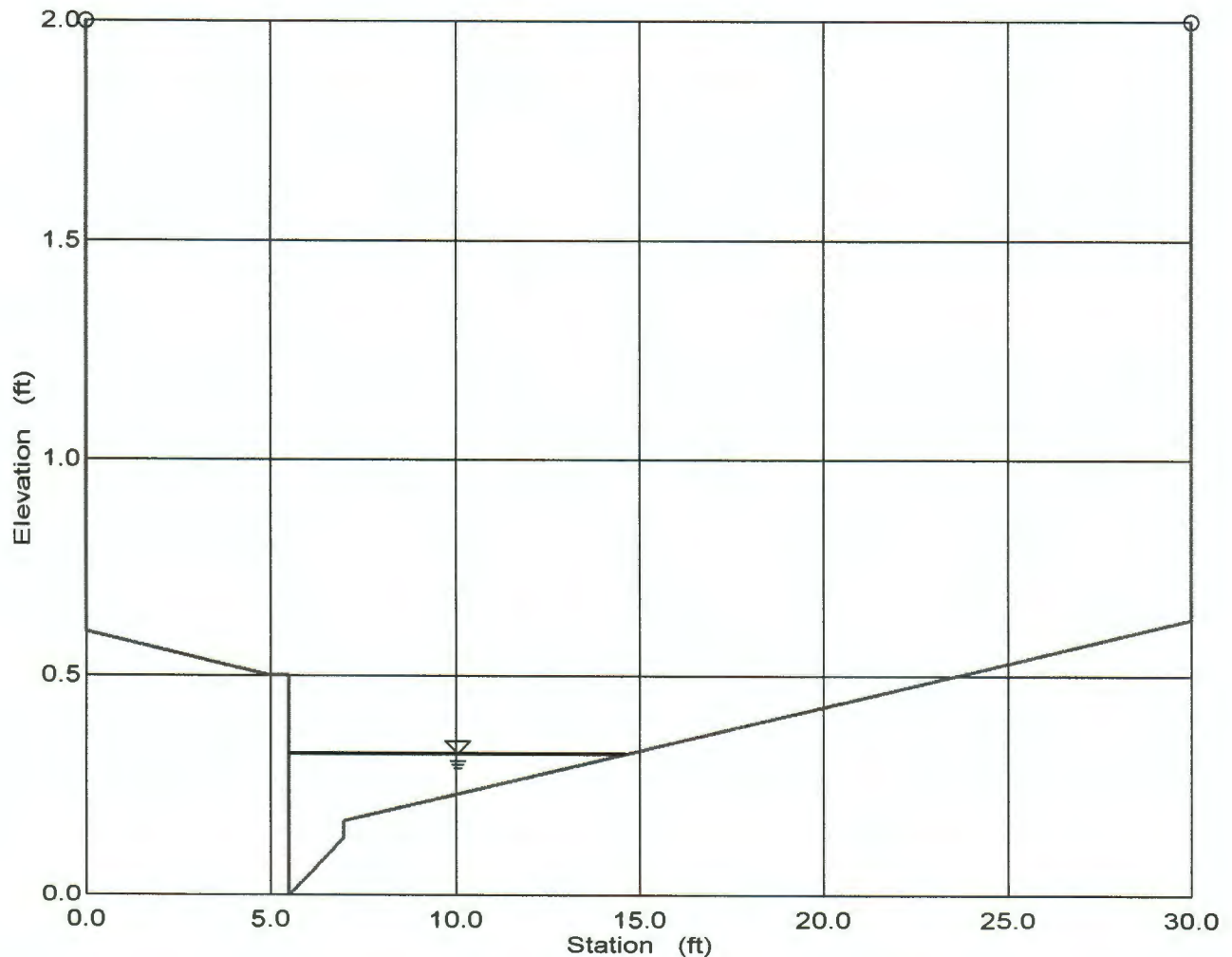
Results		
Wtd. Mannings Coefficient	0.016	
Water Surface Elevation	0.32	ft
Flow Area	0.96	ft ²
Wetted Perimeter	9.48	ft
Top Width	9.11	ft
Height	0.32	ft
Critical Depth	0.35	ft
Critical Slope	0.008040	ft/ft
Velocity	2.40	ft/s
Velocity Head	0.09	ft
Specific Energy	0.41	ft
Froude Number	1.30	
Flow is supercritical.		

Cross Section

Cross Section for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	Classic Car Lane
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.016
Channel Slope	0.014000 ft/ft
Water Surface Elevation	0.32 ft
Discharge	2.31 cfs



Washington Avenue 10-year
Worksheet for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	Washington Avenue
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

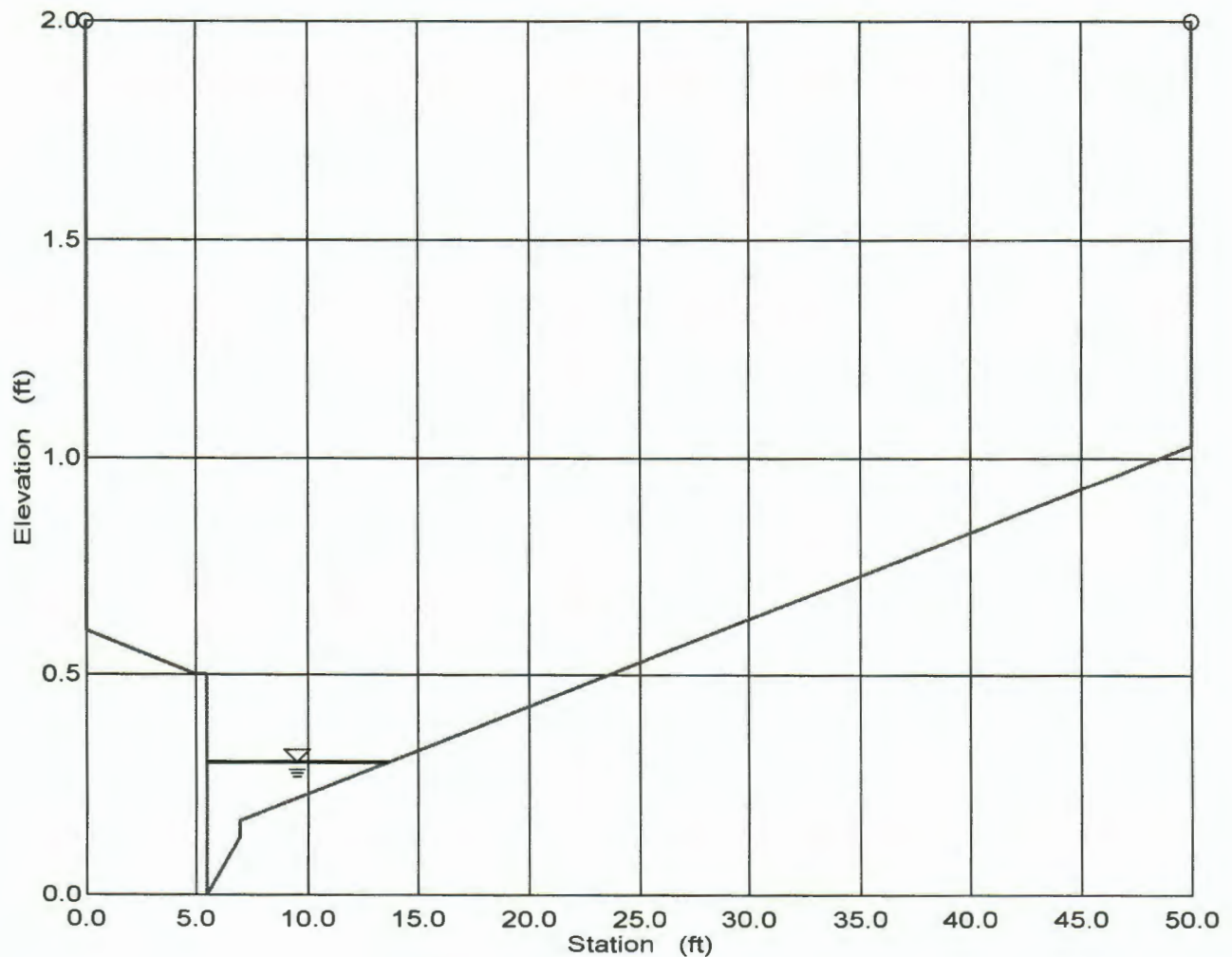
Input Data				
Channel Slope		0.017900 ft/ft		
Elevation range: 0.00 ft to 2.00 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	2.00	0.00	50.00	0.016
0.00	0.60			
5.00	0.50			
5.50	0.50			
5.50	0.00			
7.00	0.13			
7.00	0.17			
50.00	1.03			
50.00	2.00			
Discharge	2.00	cfs		

Results		
Wtd. Mannings Coefficient	0.016	
Water Surface Elevation	0.30	ft
Flow Area	0.78	ft ²
Wetted Perimeter	8.40	ft
Top Width	8.05	ft
Height	0.30	ft
Critical Depth	0.33	ft
Critical Slope	0.008191	ft/ft
Velocity	2.55	ft/s
Velocity Head	0.10	ft
Specific Energy	0.40	ft
Froude Number	1.44	
Flow is supercritical.		

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	Washington Avenue
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.016
Channel Slope	0.017900 ft/ft
Water Surface Elevation	0.30 ft
Discharge	2.00 cfs



Washington Avenue 100-year
Worksheet for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	Washington Avenue
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

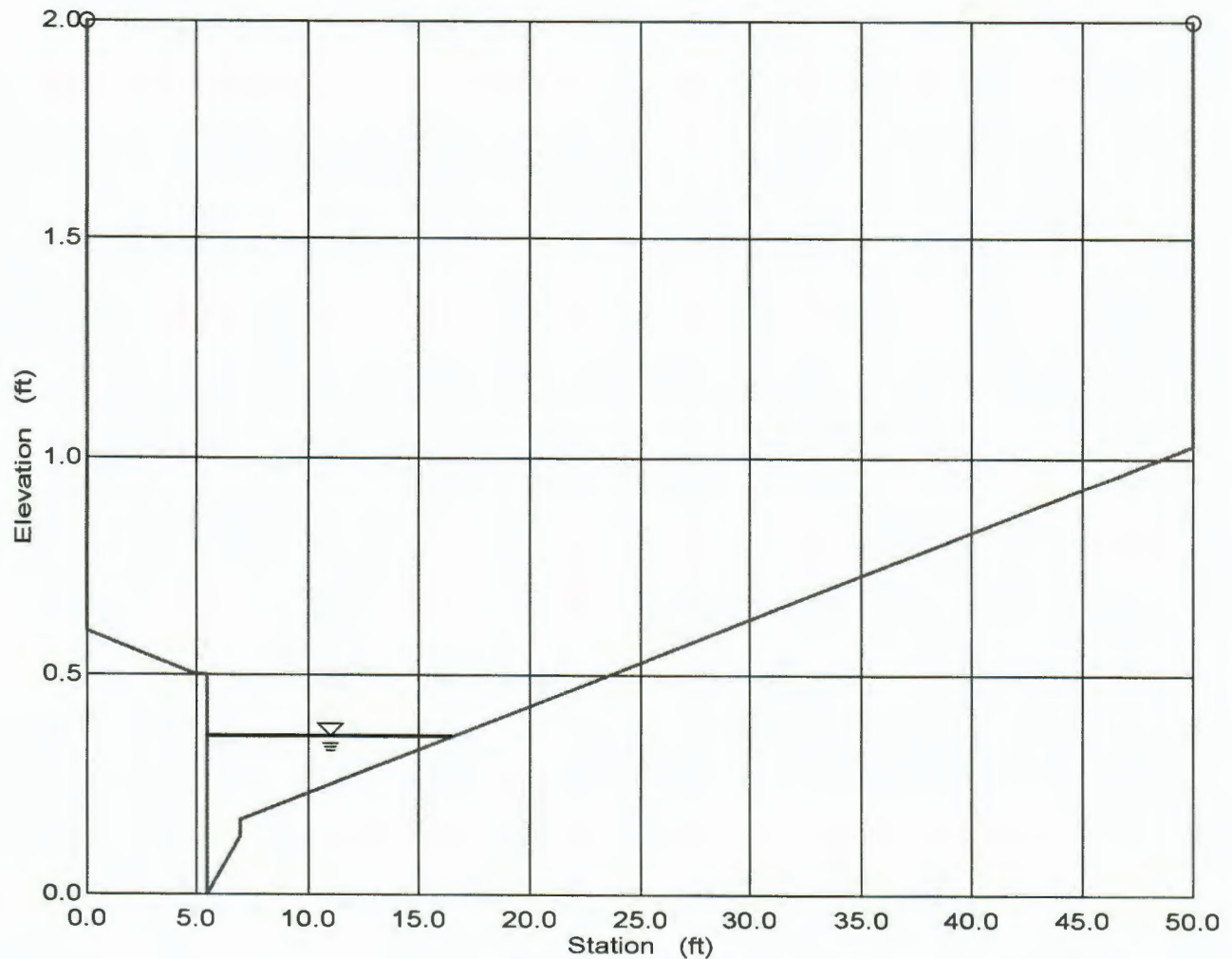
Input Data				
Channel Slope	0.017900 ft/ft			
Elevation range: 0.00 ft to 2.00 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	2.00	0.00	50.00	0.016
0.00	0.60			
5.00	0.50			
5.50	0.50			
5.50	0.00			
7.00	0.13			
7.00	0.17			
50.00	1.03			
50.00	2.00			
Discharge	4.00	cfs		

Results		
Wtd. Mannings Coefficient	0.016	
Water Surface Elevation	0.36	ft
Flow Area	1.34	ft ²
Wetted Perimeter	11.39	ft
Top Width	10.98	ft
Height	0.36	ft
Critical Depth	0.40	ft
Critical Slope	0.007479	ft/ft
Velocity	2.98	ft/s
Velocity Head	0.14	ft
Specific Energy	0.50	ft
Froude Number	1.51	
Flow is supercritical.		

Cross Section Cross Section for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	Washington Avenue
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.016
Channel Slope	0.017900 ft/ft
Water Surface Elevation	0.36 ft
Discharge	4.00 cfs



Wall Opening 10-year
Worksheet for Rectangular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	Wall Opening
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

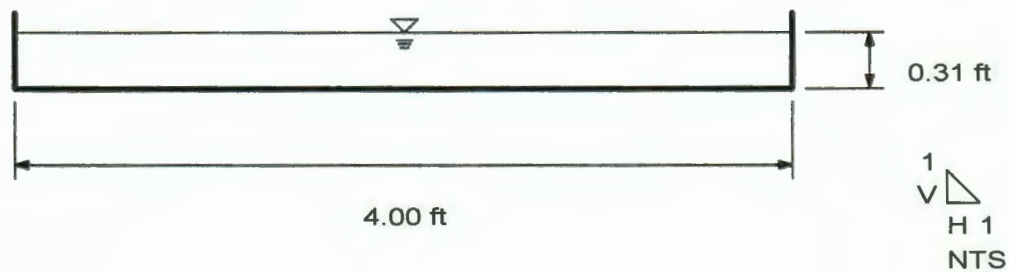
Input Data		
Mannings Coefficient	0.025	
Channel Slope	0.010000	ft/ft
Bottom Width	4.00	ft
Discharge	3.00	cfs

Results		
Depth	0.31	ft
Flow Area	1.22	ft ²
Wetted Perimeter	4.61	ft
Top Width	4.00	ft
Critical Depth	0.26	ft
Critical Slope	0.016800	ft/ft
Velocity	2.45	ft/s
Velocity Head	0.09	ft
Specific Energy	0.40	ft
Froude Number	0.78	
Flow is subcritical.		

Cross Section
Cross Section for Rectangular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	Wall Opening
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.025
Channel Slope	0.010000 ft/ft
Depth	0.31 ft
Bottom Width	4.00 ft
Discharge	3.00 cfs



Wall Opening 100-year
Worksheet for Rectangular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	Wall Opening
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

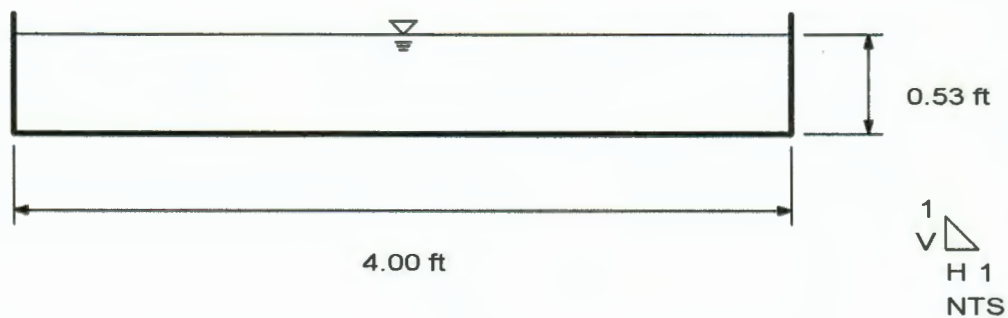
Input Data		
Mannings Coefficient	0.025	
Channel Slope	0.010000	ft/ft
Bottom Width	4.00	ft
Discharge	7.00	cfs

Results		
Depth	0.53	ft
Flow Area	2.11	ft ²
Wetted Perimeter	5.05	ft
Top Width	4.00	ft
Critical Depth	0.46	ft
Critical Slope	0.015558	ft/ft
Velocity	3.32	ft/s
Velocity Head	0.17	ft
Specific Energy	0.70	ft
Froude Number	0.81	
Flow is subcritical.		

Cross Section
Cross Section for Rectangular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	Wall Opening
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.025
Channel Slope	0.010000 ft/ft
Depth	0.53 ft
Bottom Width	4.00 ft
Discharge	7.00 cfs



North Drive Aisle 10-year
Worksheet for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	North Drive Aisle
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

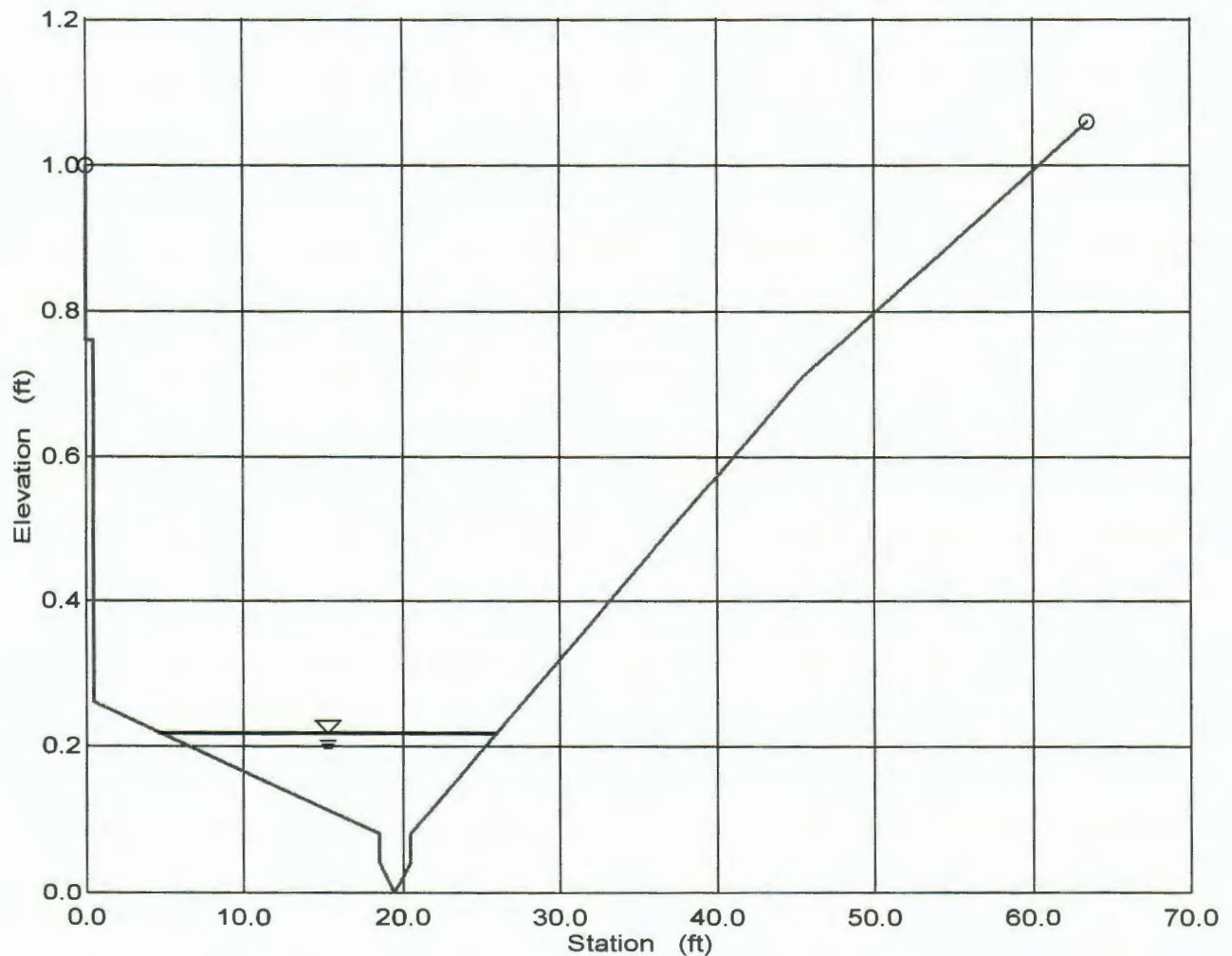
Input Data				
Channel Slope	0.010000 ft/ft			
Elevation range: 0.00 ft to 1.06 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	1.00	0.00	63.50	0.016
0.00	0.76			
0.50	0.76			
0.50	0.26			
18.50	0.08			
18.50	0.04			
19.50	0.00			
20.50	0.04			
20.50	0.08			
45.50	0.71			
63.50	1.06			
Discharge	3.00	cfs		

Results		
Wtd. Mannings Coefficient	0.016	
Water Surface Elevation	0.22	ft
Flow Area	1.73	ft ²
Wetted Perimeter	21.37	ft
Top Width	21.29	ft
Height	0.22	ft
Critical Depth	0.22	ft
Critical Slope	0.008580	ft/ft
Velocity	1.74	ft/s
Velocity Head	0.05	ft
Specific Energy	0.26	ft
Froude Number	1.07	
Flow is supercritical.		

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	North Drive Aisle
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.016
Channel Slope	0.010000 ft/ft
Water Surface Elevation	0.22 ft
Discharge	3.00 cfs



North Drive Aisle 100-year
Worksheet for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	North Drive Aisle
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

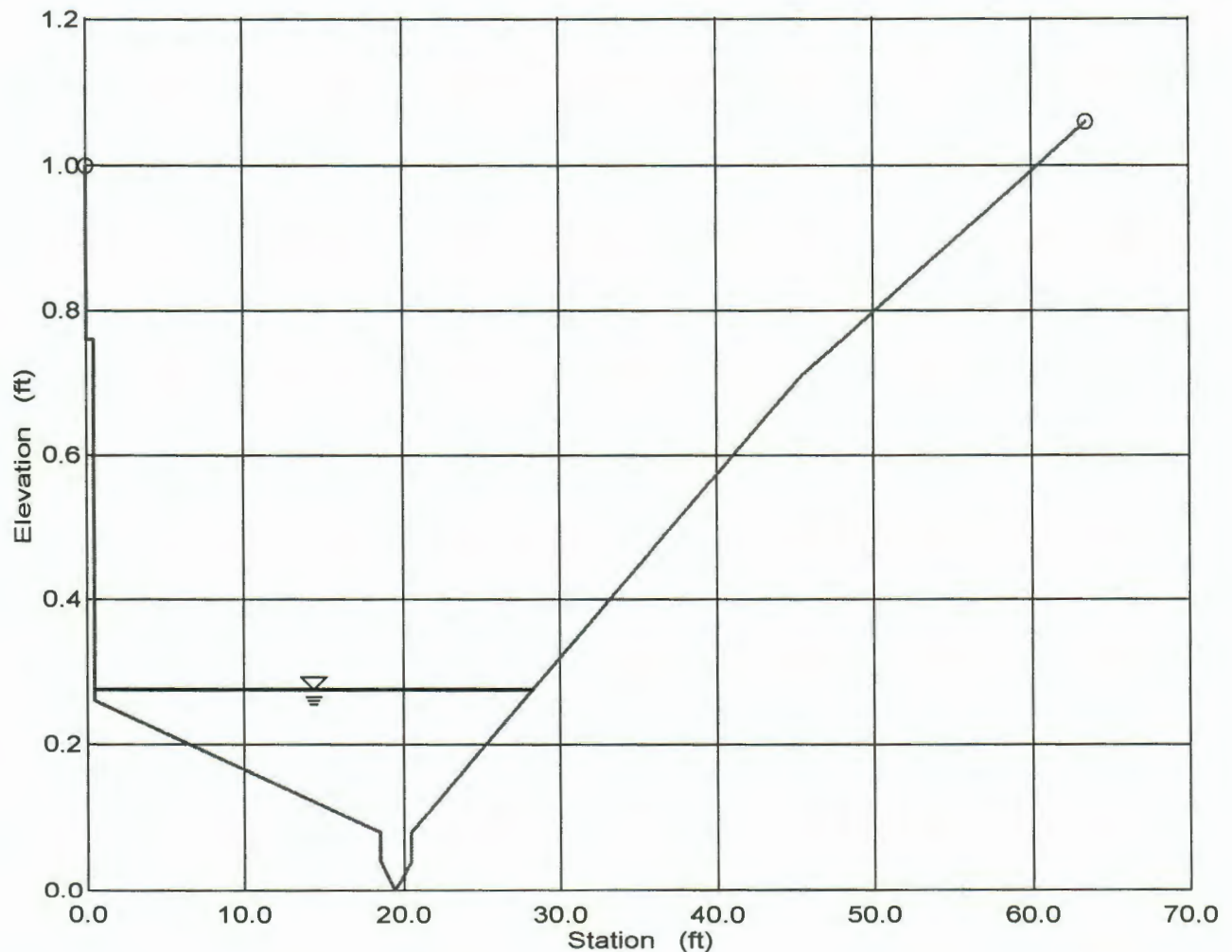
Input Data				
Channel Slope	0.010000 ft/ft			
Elevation range: 0.00 ft to 1.06 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	1.00	0.00	63.50	0.016
0.00	0.76			
0.50	0.76			
0.50	0.26			
18.50	0.08			
18.50	0.04			
19.50	0.00			
20.50	0.04			
20.50	0.08			
45.50	0.71			
63.50	1.06			
Discharge	7.00	cfs		

Results		
Wtd. Mannings Coefficient	0.016	
Water Surface Elevation	0.28	ft
Flow Area	3.20	ft ²
Wetted Perimeter	27.90	ft
Top Width	27.80	ft
Height	0.28	ft
Critical Depth	0.29	ft
Critical Slope	0.007520	ft/ft
Velocity	2.19	ft/s
Velocity Head	0.07	ft
Specific Energy	0.35	ft
Froude Number	1.14	
Flow is supercritical.		

Cross Section Cross Section for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	North Drive Aisle
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.016
Channel Slope	0.010000 ft/ft
Water Surface Elevation	0.28 ft
Discharge	7.00 cfs



West Drive Aisle 10-year
Worksheet for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	West Drive Aisle
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

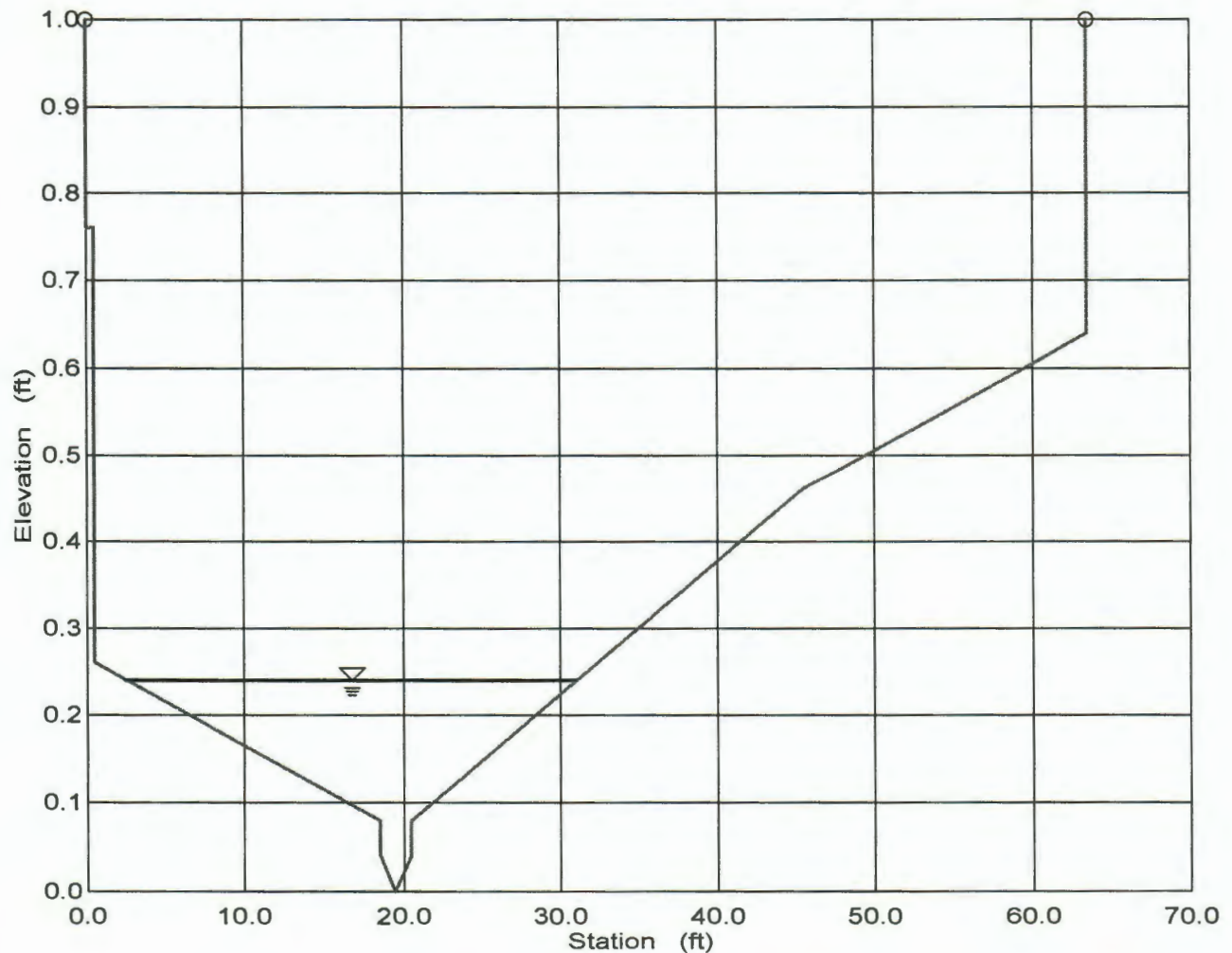
Input Data				
Channel Slope		0.004000 ft/ft		
Elevation range: 0.00 ft to 1.00 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	1.00	0.00	63.50	0.016
0.00	0.76			
0.50	0.76			
0.50	0.26			
18.50	0.08			
18.50	0.04			
19.50	0.00			
20.50	0.04			
20.50	0.08			
45.50	0.46			
63.50	0.64			
63.50	1.00			
Discharge	3.00	cfs		

Results		
Wtd. Mannings Coefficient	0.016	
Water Surface Elevation	0.24	ft
Flow Area	2.55	ft ²
Wetted Perimeter	28.56	ft
Top Width	28.48	ft
Height	0.24	ft
Critical Depth	0.21	ft
Critical Slope	0.008775	ft/ft
Velocity	1.17	ft/s
Velocity Head	0.02	ft
Specific Energy	0.26	ft
Froude Number	0.69	
Flow is subcritical.		

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	West Drive Aisle
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.016
Channel Slope	0.004000 ft/ft
Water Surface Elevation	0.24 ft
Discharge	3.00 cfs



West Drive Aisle 100-year
Worksheet for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	West Drive Aisle
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

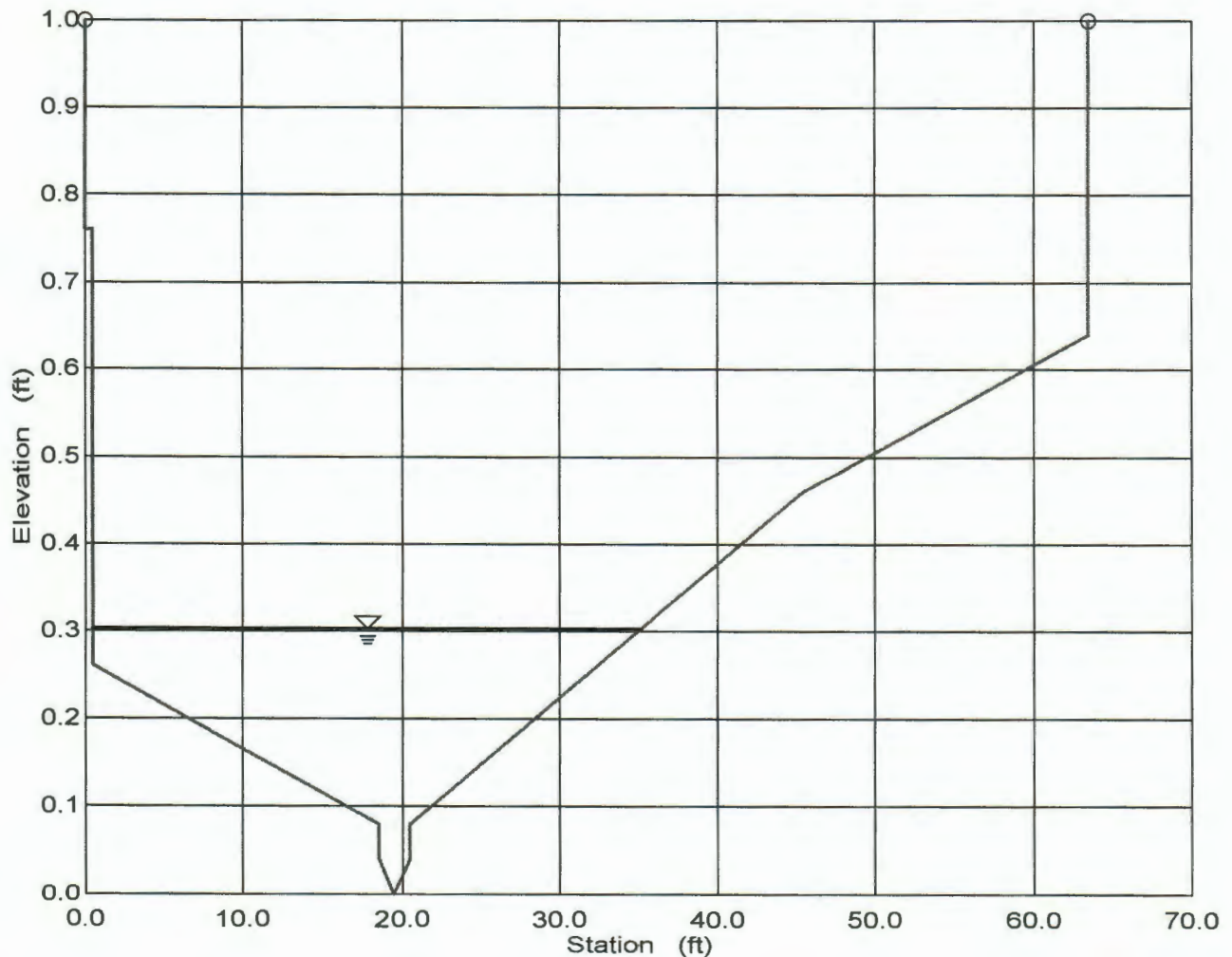
Input Data				
Channel Slope	0.004000 ft/ft			
Elevation range: 0.00 ft to 1.00 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	1.00	0.00	63.50	0.016
0.00	0.76			
0.50	0.76			
0.50	0.26			
18.50	0.08			
18.50	0.04			
19.50	0.00			
20.50	0.04			
20.50	0.08			
45.50	0.46			
63.50	0.64			
63.50	1.00			
Discharge	7.00	cfs		

Results		
Wtd. Mannings Coefficient	0.016	
Water Surface Elevation	0.30	ft
Flow Area	4.60	ft ²
Wetted Perimeter	34.80	ft
Top Width	34.67	ft
Height	0.30	ft
Critical Depth	0.28	ft
Critical Slope	0.007768	ft/ft
Velocity	1.52	ft/s
Velocity Head	0.04	ft
Specific Energy	0.34	ft
Froude Number	0.74	
Flow is subcritical.		

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	West Drive Aisle
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.016
Channel Slope	0.004000 ft/ft
Water Surface Elevation	0.30 ft
Discharge	7.00 cfs



East Drive Aisle 10-year
Worksheet for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	East Drive Aisle
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data				
Channel Slope		0.010000 ft/ft		
Elevation range: 0.00 ft to 2.00 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	2.00	0.00	44.00	0.016
0.00	0.50			
0.50	0.50			
0.50	0.00			
2.00	0.13			
2.00	0.17			
44.00	0.85			
44.00	2.00			
Discharge	3.00	cfs		

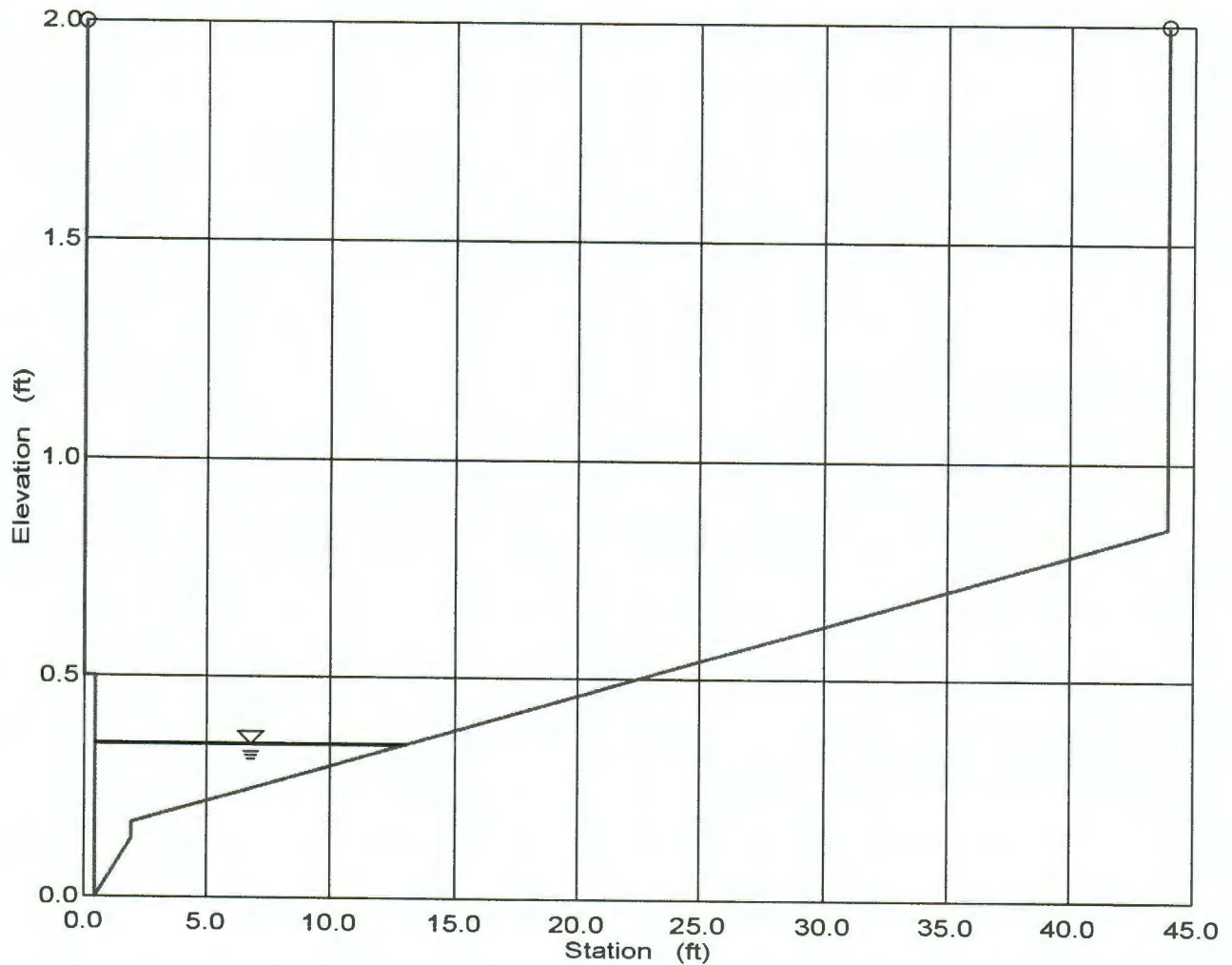
Results		
Wtd. Mannings Coefficient	0.016	
Water Surface Elevation	0.35	ft
Flow Area	1.41	ft ²
Wetted Perimeter	12.94	ft
Top Width	12.55	ft
Height	0.35	ft
Critical Depth	0.36	ft
Critical Slope	0.007937	ft/ft
Velocity	2.12	ft/s
Velocity Head	0.07	ft
Specific Energy	0.42	ft
Froude Number	1.11	
Flow is supercritical.		

Cross Section

Cross Section for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	East Drive Aisle
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.016
Channel Slope	0.010000 ft/ft
Water Surface Elevation	0.35 ft
Discharge	3.00 cfs



East Drive Aisle 100-year
Worksheet for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	East Drive Aisle
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

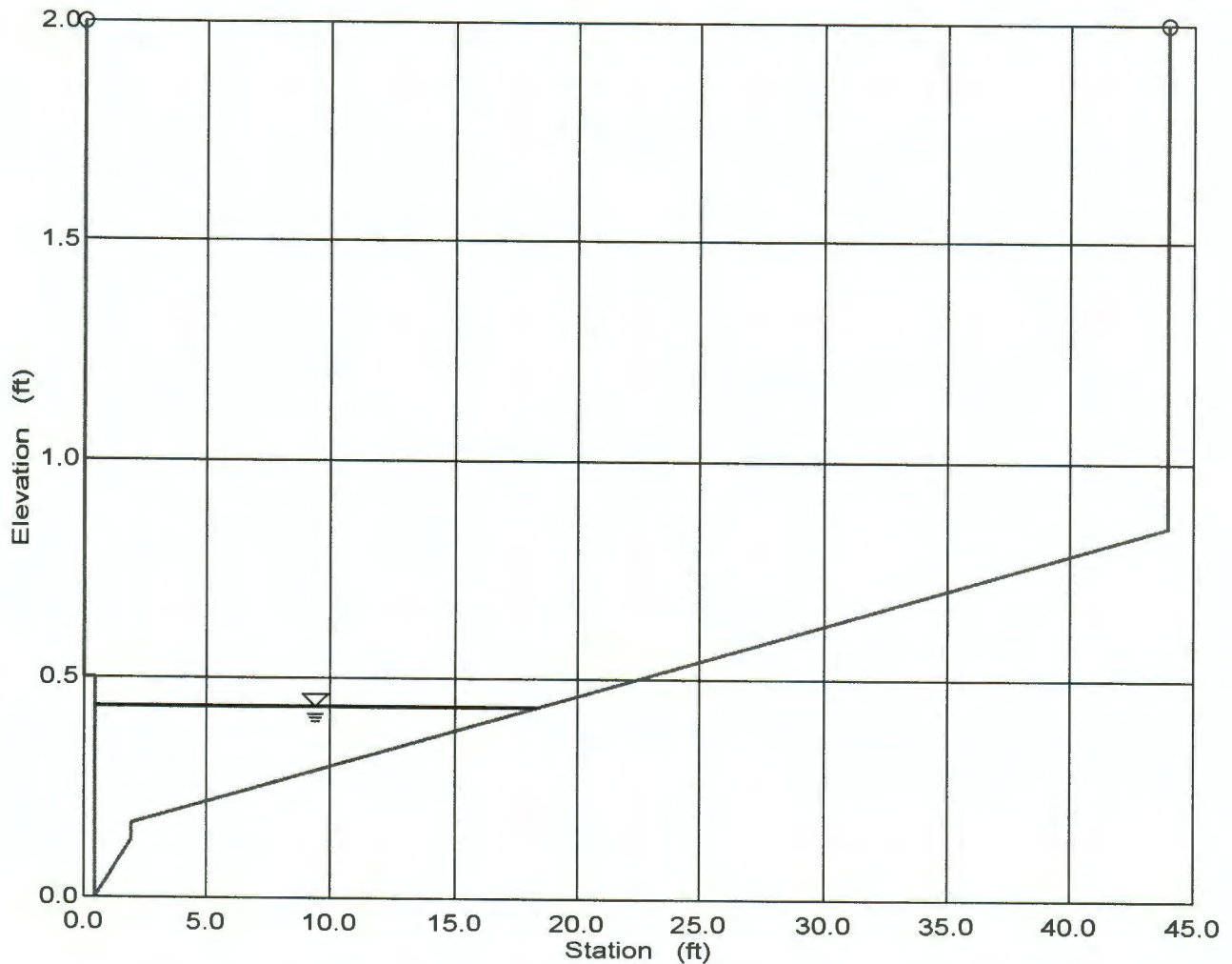
Input Data				
Channel Slope		0.010000 ft/ft		
Elevation range: 0.00 ft to 2.00 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	2.00	0.00	44.00	0.016
0.00	0.50			
0.50	0.50			
0.50	0.00			
2.00	0.13			
2.00	0.17			
44.00	0.85			
44.00	2.00			
Discharge	7.00	cfs		

Results		
Wtd. Mannings Coefficient	0.016	
Water Surface Elevation	0.43	ft
Flow Area	2.70	ft ²
Wetted Perimeter	18.26	ft
Top Width	17.78	ft
Height	0.43	ft
Critical Depth	0.45	ft
Critical Slope	0.007094	ft/ft
Velocity	2.60	ft/s
Velocity Head	0.10	ft
Specific Energy	0.54	ft
Froude Number	1.17	
Flow is supercritical.		

Cross Section Cross Section for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	East Drive Aisle
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.016
Channel Slope	0.010000 ft/ft
Water Surface Elevation	0.43 ft
Discharge	7.00 cfs



Classic Car Lane 100-year North Driveway
Worksheet for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	Classic Car Lane
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

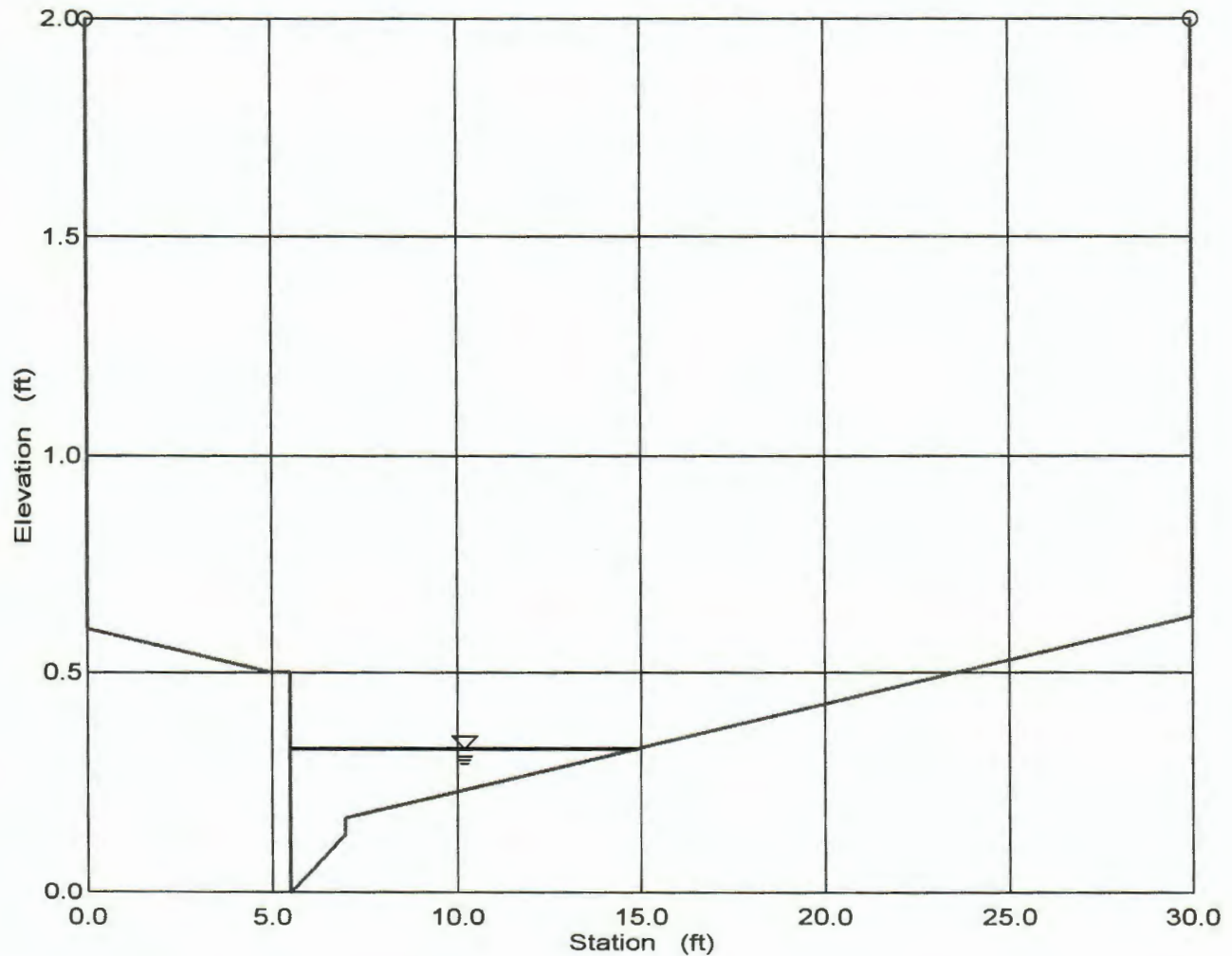
Input Data				
Channel Slope	0.012100 ft/ft			
Elevation range: 0.00 ft to 2.00 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	2.00	0.00	30.00	0.016
0.00	0.60			
5.00	0.50			
5.50	0.50			
5.50	0.00			
7.00	0.13			
7.00	0.17			
30.00	0.63			
30.00	2.00			
Discharge	2.31	cfs		

Results		
Wtd. Mannings Coefficient	0.016	
Water Surface Elevation	0.33	ft
Flow Area	1.02	ft ²
Wetted Perimeter	9.79	ft
Top Width	9.41	ft
Height	0.33	ft
Critical Depth	0.35	ft
Critical Slope	0.008040	ft/ft
Velocity	2.26	ft/s
Velocity Head	0.08	ft
Specific Energy	0.41	ft
Froude Number	1.21	
Flow is supercritical.		

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	Classic Car Lane
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.016
Channel Slope	0.012100 ft/ft
Water Surface Elevation	0.33 ft
Discharge	2.31 cfs



Classic Car Lane 100-year South Driveway
Worksheet for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	Classic Car Lane
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

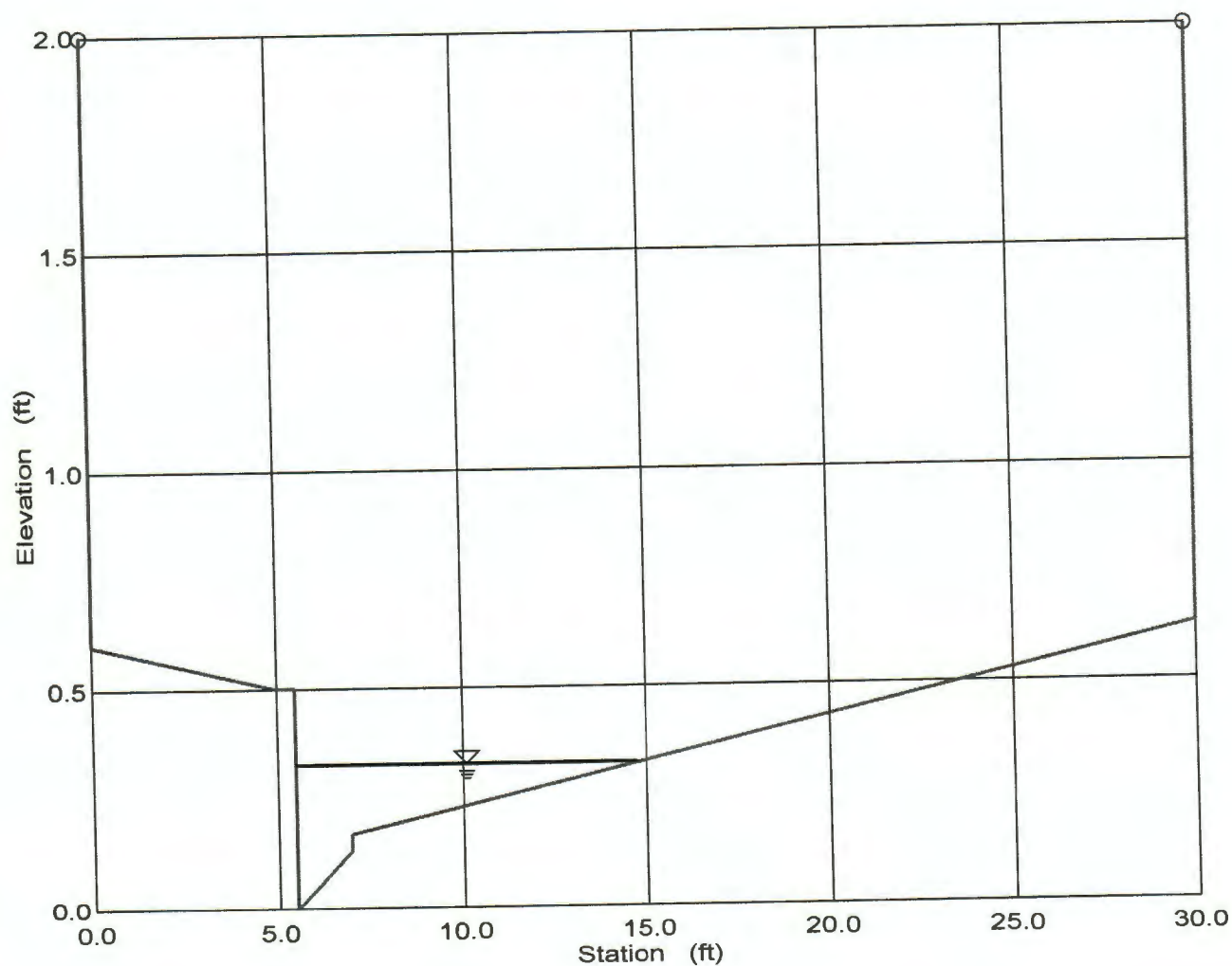
Input Data				
Channel Slope		0.013200 ft/ft		
Elevation range: 0.00 ft to 2.00 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	2.00	0.00	30.00	0.016
0.00	0.60			
5.00	0.50			
5.50	0.50			
5.50	0.00			
7.00	0.13			
7.00	0.17			
30.00	0.63			
30.00	2.00			
Discharge	2.31	cfs		

Results		
Wtd. Mannings Coefficient	0.016	
Water Surface Elevation	0.32	ft
Flow Area	0.99	ft ²
Wetted Perimeter	9.60	ft
Top Width	9.23	ft
Height	0.32	ft
Critical Depth	0.35	ft
Critical Slope	0.008040	ft/ft
Velocity	2.34	ft/s
Velocity Head	0.09	ft
Specific Energy	0.41	ft
Froude Number	1.26	
Flow is supercritical.		

Cross Section Cross Section for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	Classic Car Lane
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.016
Channel Slope	0.013200 ft/ft
Water Surface Elevation	0.32 ft
Discharge	2.31 cfs



Washington Avenue 100-year Driveway
Worksheet for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	Washington Avenue
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

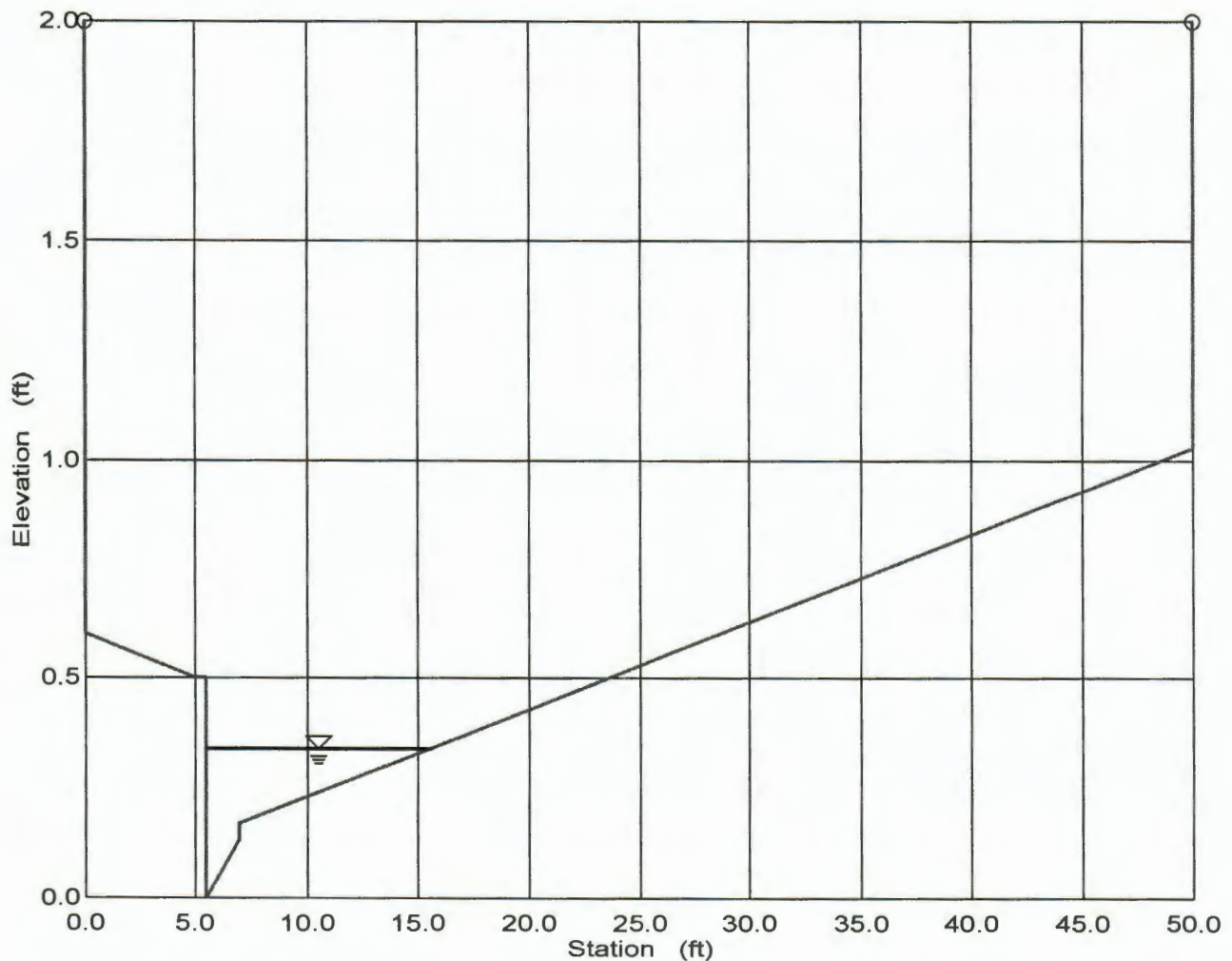
Input Data				
Channel Slope	0.027400 ft/ft			
Elevation range: 0.00 ft to 2.00 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	2.00	0.00	50.00	0.016
0.00	0.60			
5.00	0.50			
5.50	0.50			
5.50	0.00			
7.00	0.13			
7.00	0.17			
50.00	1.03			
50.00	2.00			
Discharge	4.00	cfs		

Results		
Wtd. Mannings Coefficient	0.016	
Water Surface Elevation	0.34	ft
Flow Area	1.14	ft ²
Wetted Perimeter	10.40	ft
Top Width	10.01	ft
Height	0.34	ft
Critical Depth	0.40	ft
Critical Slope	0.007478	ft/ft
Velocity	3.52	ft/s
Velocity Head	0.19	ft
Specific Energy	0.53	ft
Froude Number	1.84	
Flow is supercritical.		

Cross Section Cross Section for Irregular Channel

Project Description	
Project File	c:\hydrology\haestad\fmw\blind.fm2
Worksheet	Washington Avenue
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.016
Channel Slope	0.027400 ft/ft
Water Surface Elevation	0.34 ft
Discharge	4.00 cfs



Impulse

$$I = \int F \cdot dt$$

Civil Engineering & Planning

7485 West Azure Drive, Suite 226, Las Vegas, NV 89130

PROJECT: Blind Center of Nevada

Date: 4/21/2023

Job#: CD-2306

Task: Parking Lot BMP Analysis

Sheet 1 of 1

Plaas@ImpulseCivil.net

F: 702-478-8535

P: 702-815-0720

Parking lot area		121,549.76 SF	
	A=	2.79 AC	
Category	Large		
D ₂ =	0.72 in	Ratio =	1.00
D ₈₅ =	=0.32 *1.25 =	0.32 in	
Calculate BMP Design Peak Discharge			
		Qp/A=1.5042*D ₈₅ - 0.0066	
		Qp/A=	0.47 cfs/ac
Adjustment for Qp/A Relative to 90% Average Percent Impervious			
	Calculated % Impervious =	80.00%	
		Qp=Qp/A*(0.0059 %Imp + 0.4688)	
		Qp=	0.22 cfs/ac
	Total Flow =	0.63 cfs	
Calculate Design Volume Runoff			
	Vol/A (90%) = 0.0887 * D ₈₅ + 0.0057 =	0.03	
	Vol =	0.095 ac-ft	
	Vol =	4143 cf	
Treatment Required by Category			
Low	0%		
Medium	75%		
High	75%		
	Vol =	3107 cf	
Use a BMP swale			

Section 1500

Structural Best Management Practices

1501 INTRODUCTION

Presented in this section are design criteria for structural Best Management Practices (BMPs) for the control of surface water quality in Las Vegas Valley. These BMPs have been identified as having potential effectiveness in Las Vegas Valley based on the types of water quality conditions expected in this area, and on documented BMP performance in other areas. Criteria for the following BMPs are presented:

- Parking Lot Low Impact Development (LID)
- General Low Impact Development (LID)
 - Disconnected Impervious Areas
 - Landscape Swale
 - Depressed Medians
 - Depressed Landscaping
 - Buffer Strip
 - Pervious Overflow Parking
 - Sand / Media Filters
 - Oil / Water Separators
 - Oil / Grit Separators
 - On-Site Water Quality Basin
 - Infiltration Trench

There are currently no federal, state or local stormwater regulations which require the installation of specific water quality features in most new or existing developments in the Las Vegas Valley. The exception is new and redeveloped non-residential sites larger than 1.0 acre, for which low impact development (LID) measures are required by the Storm Water Management Plan. LID measures for sites smaller than 1 acre are encouraged for developers desiring to mitigate the impacts of urban development on surface water resources in the Las Vegas Valley.

There are three general categories of conditions for which urban stormwater quality management practices may be applied: (1) existing urban development; (2) new urban development and substantial redevelopment; and (3) construction activity. The BMPs in this section are primarily applicable to areas of new urban development, where land is available to devote to installations of this type and where design flexibility exists. In certain cases, these structural BMPs may be effective in retrofitting existing developed areas to control water quality problems. However, it is generally more cost-effective to rely on nonstructural BMPs (e.g., source controls, housekeeping practices, public education, and employee training) in these applications. BMPs related to construction activity are primarily directed toward erosion control. This issue

1502 Parking Lot LID Measures

1502.1 Description

Low impact development (LID) measures can be used for managing runoff from areas of new development and significant redevelopment (NDSR). LID measures must be applied to parking lots for all new non-residential sites of 1 acre and larger in the Las Vegas Valley. For the purpose of LID measures, a parking lot is defined as all of the impervious area outside the building footprint. Parking lot LID policies and design criteria are discussed in more detail in Proposed Parking Lot Low Impact Development Program for Las Vegas Valley, Las Vegas Valley Stormwater Quality Management Committee, February 2013.

1502.2 Design Criteria

Parking lot designs must be submitted to local entities with the technical drainage study required by Municipal code. A list of accepted parking lot BMPs that can be used in the Las Vegas Valley is provided in Table 1501.

BMP requirements shall adhere to this manual. A stepped approach to determine whether a parking lot is categorized as small, medium or large for the purpose of determining required BMPs is shown below. Any project site that is less than 1 acre in size is categorized as small; parking lot size is not a factor in determining required BMPs for small sites. For project sites that are greater than or equal to 1 acre, the parking lot size is used to determine if the category is medium or large. Sites having parking lots that are less than or equal to 1 acre are categorized as medium. Sites with parking lots greater than 1 acre are categorized as large.

<u>Total Site Size</u>	<u>Parking Lot Size</u>	<u>Parking Lot Category</u>
< 1 acre	Not Applicable	Small
≥ 1 acre	≤ 1 acre	Medium
≥ 1 acre	> 1 acre	Large

Once the parking lot category is determined, the BMP requirements for the parking lot design can be determined as shown in Table 1502. BMP requirements are more stringent as the parking lot size increases.

The designer may choose how to meet the parking lot BMP design requirements depending on specific site characteristics. In order to maximize the water quality benefit of the parking lot BMPs, the designer is encouraged to locate BMPs to capture runoff from portions of the site with the highest potential to generate pollutants.

There are no specific BMP requirements for small parking lots; however, the designer is encouraged to install any of the BMPs that are listed for parking lots in the medium or large categories.

For the Medium parking lot category, the design requirements consist of disconnecting impervious areas for at least 75 percent of the parking lot area from the onsite drainage network. This may be accomplished by directing runoff to pervious areas such as landscaping, depressed medians, parking strips, or stormwater retention basins. The design criteria are based on meeting the accepted minimum standards for the BMPs selected. The designer may choose to install a treatment BMP listed in the Large parking lot category.

* For the Large parking lot category, treatment BMPs are required to treat stormwater runoff from at least 75 percent of the parking lot. Because typical site drainage layouts must account for application of flood control criteria, treatment BMPs may need to be sized to accommodate runoff from the contributing building area as well. BMPs are to be sized for the 85th percentile storm, and hydrologic and hydraulic calculations are required to be submitted for the BMP design.

The requirement to treat 75 percent of the parking lot area, either through disconnecting impervious areas or installing treatment devices, recognizes that grading and other site conditions will prevent directing all site runoff to some type of BMP. However, designers are encouraged to exceed the minimum standard when this can be done cost effectively in order to maximize the potential water quality benefits of the BMP system.

LID measures that are incorporated in the parking lot design should be planned during the site design process. Certain LID measures, including depressed medians, islands, and rock-lined swales, help to disconnect impervious areas and remove suspended particles in the stormwater runoff, prior to connection to the MS4. Parking Lot BMPs can be integrated into perimeter landscaped areas (e.g., buffers) and interior landscaped areas (e.g., medians) required by local development standards whenever possible. When incorporated into landscaping features, tributary areas to individual BMPs should be kept to less than 0.5 acres whenever possible, and should never exceed 1.0 acre.

Figure 1501 through Figure 1503, provide ideas on how parking lots can be designed to comply with the water quality regulations. The designer is required to comply with the planning code for the municipality in which the site is located. The conceptual layouts incorporate general planning requirements, however, specific planning requirements such as those for landscape buffers are determined based in part on the adjacent property. The conceptual layouts are designed to represent a commercial property that is approximately 5 acres in size, with the total parking lot area of approximately 3.3 acres.

Figure 1501, Conceptual Layout 1, represents a parking lot that can be designed so that the runoff can be directed towards the perimeter landscape buffer areas that incorporate a landscaped swale. These swales are designed as rock or xeriscaped swales to convey runoff to a low point, which discharges either directly to the MS4 or to a main drainage pipe and then into the MS4.

Figure 1502, Conceptual Layout 2, represents a parking lot that is not designed to direct all runoff towards swales installed in the perimeter landscape buffer areas. One example could be that the adjacent right-of-way at this area is higher in elevation than the onsite grade. In order to still use the landscape swale BMP, the Developer could use swales in depressed medians within the site, combined with perimeter swales where feasible.

Treatment control devices rather than BMP swales may be used, however, the amount of parking lot area required to be treated would need to be calculated.

Figure 1503, Conceptual Layout 3, shows a conceptual level layout for this scenario, which relies on a combination of modular pavers, sand/oil separators, and underground detention to provide treatment for at least 75 percent of the parking lot area. To size the treatment control BMPs, the approaches described in section 1502.3 should be used. Note that for treatment devices, hydraulic sizing may need to account for the contribution of runoff from building areas draining through the parking lot.

1502.3 Water Quality Design Storm

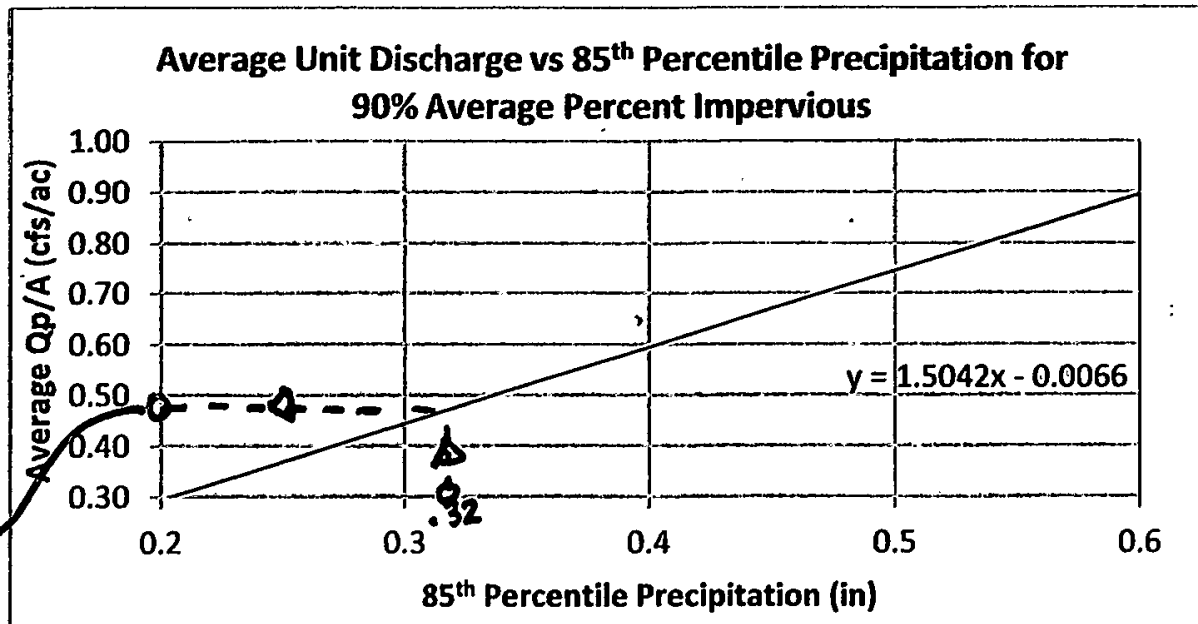
This section describes the steps to be followed to determine the design hydrology for sizing parking lot BMPs in the Las Vegas Valley.

- 1. Determine BMP Design Precipitation - 85th Percentile Rainfall Depth
- a. Locate site on CCRFCD Design Rainfall Map for 2-year, 6-hour storm
 - b. Determine the adjusted 2-year rainfall depth (D_2) for site, per CCRFCD methods
 - c. Compute ratio of D_2 site to D_2 for the McCarran Airport Area
 - d. Compute 85th percentile rainfall depth (D_{85}) as $0.32 \times D_2$ ratio (0.32 is D_{85} for McCarran Area)

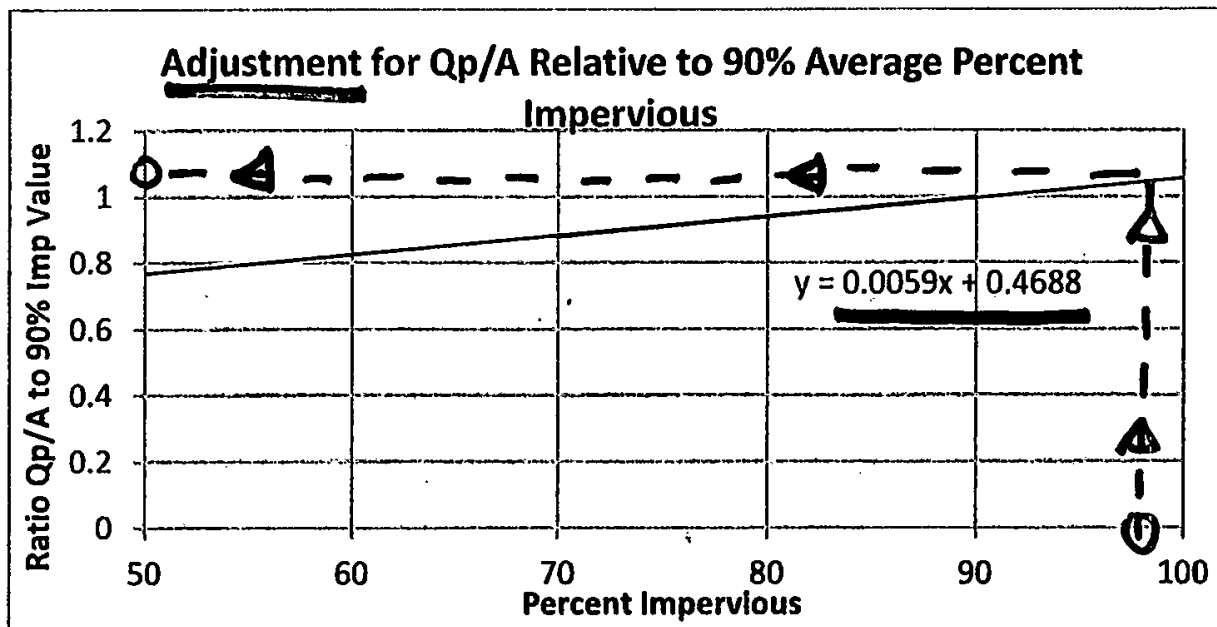
D_{85}

- 2. Calculate BMP Design Peak Discharge
- a. Use the following chart or regression equation to calculate the unit discharge (Q_p/A) for the 90 percent average percent impervious area condition based on the D_{85} value.

Q_p / area



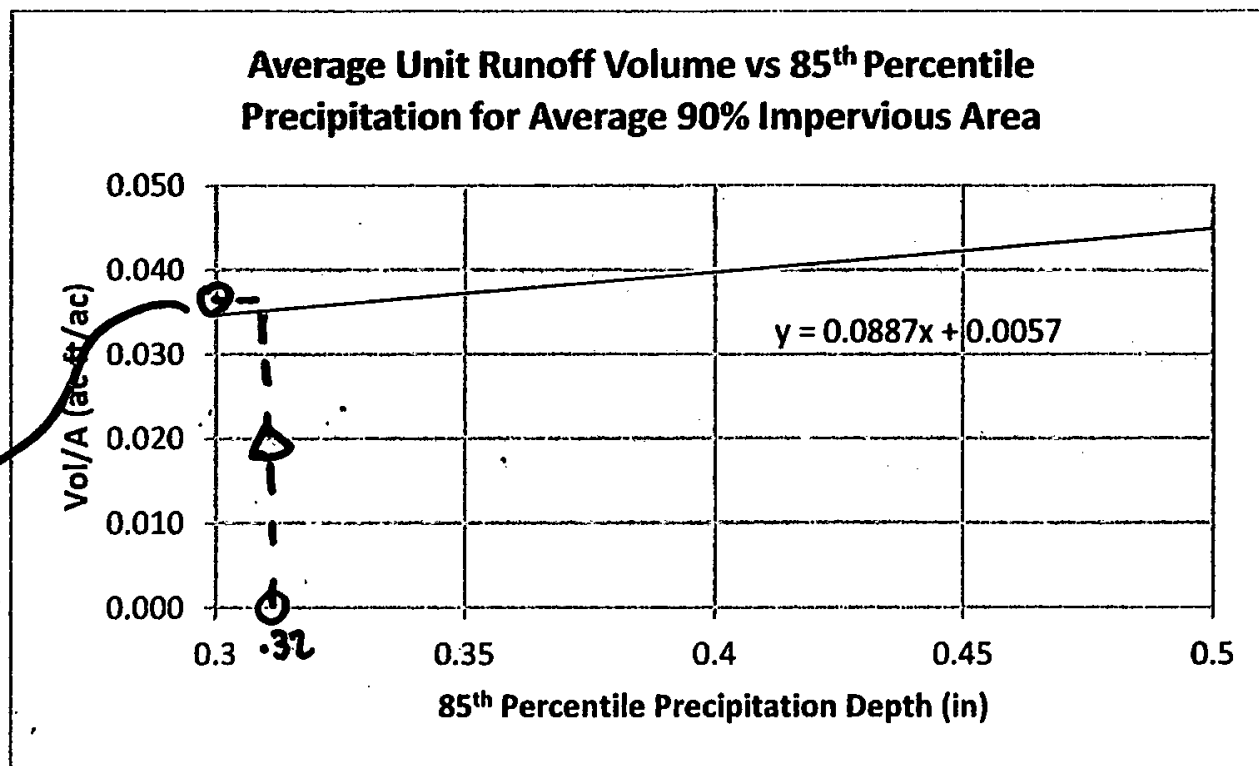
- b. Use the following chart or regression equation to calculate the unit discharge for the site based on the actual percent impervious area of the parking lot and associated landscaped areas.



- c. Calculate the peak design discharge in cfs as $Q_P = Q_P/A \times A$ where Q_P/A is from step (2b) and A is in acres.

3. Calculate BMP Design Runoff Volume

- a. Use the following chart or regression equation to calculate the unit runoff volume (Vol/A) for the 90 percent impervious condition based on the D_{85} value.



- b. Use the chart or regression equation in step (2b) to calculate the unit runoff volume for the site based on the actual average percent impervious area of the parking lot and associated landscaped areas.
- c. Calculate the design runoff volume in acre-feet as $Vol = Vol/A \times A$ where Vol/A is from step (3b) and A is in acres

Sample Calculation

Given: New Commercial Center in Summerlin area

Site Area = 100 acres

D₂ site / D₂ McCarran Area = 1.25

percent impervious area = 85% (parking lot and associated landscaped area)

1. Determine BMP Design Precipitation - 85th Percentile Rainfall Depth (D₈₅)

$$D_{85} = 1.25 \times 0.32 = 0.40 \text{ inches}$$

2. Calculate BMP Design Discharge

$$Q_P/A (90\%) = 1.5042 \times (0.40) + 0.0066 = 0.60$$

Find Adjustment factor for percent impervious

$$Q_P/A = 0.60 \times [(0.0059[85]) + 0.4688] = 0.58$$

$$Q_P = 0.58 \times 100 \text{ acres} = 58 \text{ cfs}$$

3. Calculate BMP Design Runoff Volume

$$\text{Vol/A (90\%)} = 0.0887 \times 0.40 + 0.0057 = 0.04$$

$$\text{Vol/A} = 0.04 \times (0.0059 \times [85] + 0.4688) = 0.04; \text{Vol} = 0.04 \times 100 \text{ acres} = 4.0 \text{ ac-ft.}$$

1503 LOW IMPACT DEVELOPMENT (LID) ←

1503.1 Description

LID measures can be used for managing runoff from areas of new development and significant redevelopment (NDSR). LIDs consist of a variety of site planning and site design measures or practices to minimize the impact of individual urban developments on stormwater quality and quantity. Developers proposing the use of measures that rely on infiltration to dispose of stormwater must perform studies to demonstrate that infiltration will be effective and will not adversely affect groundwater or downstream surface water quality. LID measures determined to be feasible for use in the Las Vegas Valley NDSR program can be found in **Table 1503**.

The BMPs presented in this section can be utilized for sites complying with the Parking Lot LID program or other site designs requiring BMPs. These BMPs are recommendations and the designer is not limited to the BMPs in this section. The designer is encouraged to contact the local entity when alternative BMPs are considered for use.

1503.2 Water Quality Benefits

Managing site runoff can significantly reduce the amount of pollutants conveyed to receiving waters. By incorporating the LID measures described below into site planning, runoff water quality can be improved by using simple technologies, employing basic practices, and educating those present on the site. Reducing pollutants in site runoff can reduce the need for downstream treatment to meet water quality goals.

1503.3 Disconnected Impervious Areas

1503.3.1 Description

This BMP consists of disconnecting impervious areas from downstream storm drainage infrastructure. Any surface in the landscape that cannot effectively absorb or infiltrate rainfall is an impervious area. This includes driveways, roads, parking lots, rooftops, and sidewalks. On natural landscapes, rainfall is absorbed into the soil and vegetation which naturally slows down, spreads out, and soaks up precipitation and runoff. A stable supply of groundwater is provided from water percolating into the soil, and the runoff is naturally filtered of impurities before it reaches creeks, streams, rivers, and bays.

The amount of impervious cover increases as areas become more developed. Natural filter systems are no longer in place to intercept the runoff which has serious implications for water quality and flood control. Typical pollutants in runoff from impervious areas include oil, litter, sediment, bacteria and in some cases, herbicides and pesticides.

1503.3.2 Water Quality Benefits

Concentrations and loads of the following pollutants are typically reduced by the LID BMP described in this section:

- Trace metals
- Hydrocarbons
- Litter

1503.3.3 Applications

This BMP applies to all urban areas. A beneficial way of mitigating stormwater runoff from impervious areas is to direct the runoff from parking lots and roads to pervious and vegetated soils.

1503.3.4 Limitations

Limitations may occur in areas with poor soils, where infiltration would not occur or could exacerbate groundwater quality problems. Limitations may also occur in ultra-urban areas where the site has no pervious area, including but not limited to high density areas.

1503.3.5 Design Criteria

Ways to mitigate the stormwater runoff by disconnecting impervious areas include:

- Breaking up flow directions from paved surfaces – Impervious surfaces are designed to allow stormwater to run off in a dispersed manner in several directions. The drainage off impervious surfaces is directed onto adjacent vegetated soil and not onto other pavements or into storm sewers.
- Minimize directly connected impervious areas - The impact of impervious surfaces is reduced by minimizing directly connected impervious areas, directing runoff from the impervious areas to pervious areas and/or small depressions, and in the process disconnecting hydrologic flow paths.
- Locating impervious surfaces to drain to natural systems - Existing zones of vegetation, from forested zones to scrub vegetation, are used

for management of stormwater runoff, often with some sort of landforming to achieve volume control. The scale of this technique can vary from microcontrol by redirecting sidewalk and driveway runoff to adjacent vegetation to conveyance of runoff from larger impervious surfaces to natural areas on the development site.

1503.3.6 Maintenance

Sweep impervious areas regularly to collect loose particles and litter. Wipe up spills with rags and other absorbent material immediately, but do not hose down the area to a storm drain. Pervious areas receiving runoff should be cleared regularly of litter and accumulated sediment.

1503.4 Landscape Swale

1503.4.1 Description of Facility

The purpose of the swale is to settle out sediment, which has the potential to have urban pollutants bound to the particulate matter. The required length of the swale to settle out particulate pollutants is dependent on multiple factors, including velocity, characteristics of the stormwater, characteristics of the swale, and length of the swale. For the Parking Lot LID program, sizing of swales will be based on minimizing the slope of the swale to minimize the swale length and flow velocities. Xeriscaped or rock swales can be sized using the standard sizing requirements, as shown in Section 1503.4.5.

Runoff from any impervious areas on a developed site can be directed to swales, including parking lots, roof tops, parking covers, etc. The swales can be installed either within the parking lot area or at the perimeter of the site.

1503.4.2 Water Quality Benefits

Concentrations and loads of the following pollutants are typically reduced by the LID BMP described in this section:

- 
- Sediment
 - Total Phosphorus
 - Trace Metals
 - Hydrocarbons

Estimated pollutant removal efficiencies for vegetated landscape swales are given below. Pollutant removal efficiencies for rock lined or xeriscaped swales are expected to be lower.

<u>Pollutant</u>	<u>Removal Efficiency</u>
→ TSS	77%
Total Phosphorus	8%
Total Nitrogen	67%
Trace Metals	83-90%

Source: CASQA New Development and Redevelopment Handbook, 2003

1503.4.3 Applications

Landscape swales are typically located in parks, parkways, private landscaped areas, or in development buffers, and can also be used as pre-treatment devices for other structural treatment controls. They are primarily used as stormwater conveyance systems; however they are limited in their ability to mitigate large storms. Landscape swales are best utilized in low to moderate sloped areas as an alternative to ditches and curb and gutter drainage.

1503.4.4 Limitations

The effectiveness of landscape swales is decreased by compacted soils, frozen ground conditions, short grass heights, steep slopes, large storm events, high discharge rates, high velocities, and a short runoff contact time. Landscape swales also require a sufficient amount of available land area and they may not be appropriate for industrial sites or locations where spills may occur. In areas where burrowing animals are abundant, landscape swales may not perform effectively. Additionally, the infiltration rates of local soils can limit the application of landscape swales, unless underdrains are installed. Another possible issue is the formation of mosquito breeding habitat if water does not drain or infiltrate.

1503.4.5 Design Criteria

<u>Tributary Area (ac)</u>	<u>Swale Slope</u>	<u>Minimum Swale Length (ft)</u>	<u>Size of Swale</u>
≤ 0.5	≤ 1%	30	9" deep maximum, 6 ft wide at top average, 4ft wide at top minimum, 4:1 side slope
0.5 - 1.0	≤ 1%	40	9" deep maximum, 6 ft wide at top average, 4ft wide at top minimum, 4:1 side slope

Minimum criteria for sizing landscaped swales for parking lot BMPs using xeriscaped surface treatments are provided below. Sizing was based on minimizing flow velocities and maximizing flow paths to encourage settlement of sediment.

BMP swales should be as long as practically feasible to provide as much treatment as possible. The minimum length is 30 ft for tributary areas up to 0.5 acres, and 40 ft for tributary areas of up to 1.0 acre. When incorporating swales into landscaping features, tributary areas to individual BMPs should be kept to less than 0.5 acre whenever possible, and should never exceed 1.0 acre unless hydrologic and hydraulic calculations are provided. BMP swales should have a minimum average top width of 6 ft, with a minimum top width at any point of 4 ft and a maximum flow depth of 9 inches for water quality flows (approximately 2-yr storm). When combined with a larger flood control facility these dimensions should apply to the portion of the swale carrying low flows. When lined with rock, landscaped swale BMPs should have a minimum rock size of 3-inch D₅₀. When combined with a larger flood control facility, rock lining should be sized based on the anticipated flood velocities in the facility.

The Developer may propose to use an alternative size swale, if supporting calculations are submitted.

1503.4.6 Maintenance

Remove any sediment or debris build-up when the depths exceed 3 inches. Inspect for pools of standing water. At regular intervals, re-grade to restore design grade and re-vegetate.

Use of heavy equipment for mowing and removing plants/debris should be avoided to minimize soil compaction. Disturbed areas should be stabilized with seed and mulch, or rock lining, as necessary.

If a spill occurs and hazardous materials contaminate soils in the swales, the affected areas should be removed immediately and disposed of in a manner that complies with federal and state regulations. The swale soils and materials should be replaced as soon as possible.

1503.5 Depressed Median

1503.5.1 Description of Facility

Medians come in the depressed or raised form, or are made flush with the surface of the carriageways. Only the depressed medians are discussed in this section.

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

ACCEPTED PARKING LOT BMPs IN THE LAS VEGAS VALLEY

[illegible]

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

PARKING LOT BMP DESIGN REQUIREMENTS BY PARKING LOT CATEGORY

[illegible]

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

FEASIBLE LID MEASURES IN THE LAS VEGAS VALLEY NDSR PROGRAM

[illegible]

APPENDIX D

References

$$I = \int F \cdot dt$$

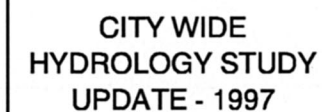
Reference Information



City of Las Vegas City Wide Hydrology Study Update

1997

$$I = \int F \cdot dt$$



●→ FLOW ARROW

(FLOWS IN CFS)

NOTE:

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

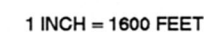


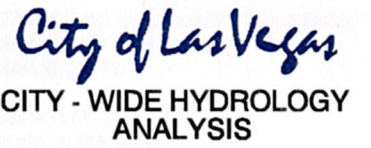
FIGURE H-14

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

$$I = \int F \cdot dt$$



PHOTO DATE: APRIL 1996



LEGEND

- FIGURE F-14

$$I = \int F \cdot dt$$

1999 CITY OF LAS VEGAS
FLOOD CONTROL FACILITY
INVENTORY UPDATE

LEGEND

REGIONAL STREAM NAME DESIGNATOR AAB
PARENT STREAM NAME
STREAM NAME

REGIONAL ID / RIVER MILE 0000
DISTANCE ABOVE
CONFLUENCE WITH PARENT STREAM
MILES
TENTHS OF A MILE

LOCAL STREAM NAME DESIGNATOR AAB

LOCAL ID NUMBER 000

EXISTING FACILITY E

PROPOSED OR MODIFIED FACILITY P
CONTINGENCY LEVEL:
MASTER PLAN P1
FACILITY PLAN P2
PRELIMINARY DESIGN P3
DESIGN P4

BOTTOM WIDTH W

DEPTH D

SIDE SLOPE, H:V SS

CORRUGATED METAL PIPE CMP
CULVERT

CORRUGATED METAL ARCH CMAP
PIPE CULVERT

REINFORCED CONCRETE BOX RCB

RCB CULVERT RCBC

REINFORCED CONCRETE PIPE RCP

RCP CULVERT RCPC

REINFORCED CONCRETE ARCH PIPE CULVERT RCACP

GENERAL COMMENT G1

FACILITY SPECIFIC COMMENT S1

PUBLIC DRAINAGE EASEMENT PDE

NOTES:

FLOW = 100 YEAR DESIGN FLOW
(REGIONAL FACILITIES)
FLOW = FACILITY CAPACITY
(LOCAL FACILITIES)

FLOOD CONTROL FACILITIES
INVENTORY

SHEET F-14

PBS&J, INC

ID	No.	Facility	Plan No.	Facility Description	Fac Length	Slope (%)	Flow (cfs)
4ST	100	E	107-V2288	18" RCP (Culvert to Bridge)	3,453	0.25	5
4ST	200	E	107-V2288	18" RCP (Culvert to Street)	672	0.25	5
ALT	015	E	70% Ala Plans	60" RCP	1,478	1.00	280
ALT	020	E	70% Ala Plans	24" RCP	836	0.50	139
ALT	025	E	70% Ala Plans	30" RCP	1,299	0.50	102
ALT	027	E	70% Ala Plans	30" RCP	138	0.50	47
ALT	029	E	70% Ala Plans	30" RCP	78	0.50	28
ALT	031	E	70% Ala Plans	24" RCP	893	0.35	7
ALT	033	E	70% Ala Plans	18" RCP	635	0.35	6
ALT	035	E	107-V2771	8" PVC	600		
ALT	036	E	107-V1584	Chnl V-Ditch	531	12	
BNZ	113	E	107-V1515	12" PVC	2,490		
BNZ	120	E	HWY BK L-1, L-5	36" RCP	150	2.340	37
BNZ	130	E	327-V16 HWY BK L-5	2" x 11" RCBC	150		
BNZ	140	E	327-V16 HWY BK L-1, L-5	18" RCP	524		
BNZ	150	E	327-V104	12" RCP	362	0.50	2
BRI	002	E	307-V704	18" RCP	842	0.50	6
BRI	003	E	307-V704	18" RCP	460		
CAS	000	E	Delta Index	36" RCP	320	41	
CAS	010	E	Delta Index	30" RCP	100	4	
CAS	020	E	Delta Index	24" RCP	180	23	
CAS	030	E	Delta Index	18" RCP	400	11	
CAS	040	E	Delta Index	18" RCP	620	11	
CAS	050	E	Delta Index	18" RCP	180	11	
CAS	060	E	Delta Index	18" RCP	240	11	
CAS	070	E	Delta Index	18" RCP	140	23	
CAS	080	E	Delta Index	18" RCP	60	11	
CAS	090	E	Delta Index	18" RCP	5,580	75	
CHN	009	E	107-V8298	32" RCP	678		
CHN	070	E	107-V1832	12" PVC	471	30	
CHN	071	E	327-V162W11, 107V-1801	24" VCP	1,837		
CHN	080	E	327-V121	18" VCP	400		
CHN	120	E	327-V21	18" VCP	873	7	
CHN	140	E	107-V742/107V-397	12" RCP	417		
CHN	145	E	327-V742	18" RCP	200	11	
CHN	150	E	327-V742	18" RCP	480	17	
CHN	160	E	327-V21	15" VCP	440	10	
CHN	180	E	327-V21	15" VCP	480	10	
CHN	190	E	327-V21	15" VCP	1,340	14	
CHN	210	E	107-V8298	32" RCP	713	11	
CHN	220	E	107-V731	18" RCP	606	10	
CHN	230	E	107-V8298	36" RCP	1,084		
CHN	240	E	107-V8298	42" RCP	3,036	101	
CHN	241	E	327-V120	Conc Chnl 9W STD 1.5:1 SS	1,275		
CHN	270	E	107-V258	42" RCP	338		
CHN	280	E	107-V258	24" RCP	878	23	
CHN	295	E	107-V258	8" PVC	87	0.50	1
CHN	300	E	107-V258	24" RCP	6,480	10	
CHN	310	E	107-V1278	18" RCP	535	5	
CHN	311	E	107-V2408	24" RCP	710		
CHN	312	E	107-V2408	12" RCP	126	0.30	2
CHN	313	E	107-V2408	8" PVC	100	0.30	1
COM	510	E	107-V2008	12" RCP	86	0.25	2
COM	518	E	107-V2008	18" RCP	883	0.25	2
CSN	010	E	327-V238	18" RCP	65	0.10	25
CSN	020	E	327-V238	12" PVC	1,400	5	
CSN	030	E	327-V238	18" PVC	367	0.86	9
FMT	000	E	107-V2224	12" PVC	253	0.97	4
FMT	005	E	107-V2224	18" RCP	130	1.00	9
FMT	007	E	107-V2224	18" RCP	130	1.00	9
FMT	008	E	107-V2224	12" PVC	67	0.51	3
FMT	010	E	107-V2224	12" PVC	310	0.75	3
FMT	012	E	107-V2224	12" PVC	463	0.75	17
FST	010	E	327-V240	18" RCP	50	3.98	20
I-15	111	E	HWY BK L-3	8' x 3' RCBC	390	0.25	170
I-15	112	E	HWY BK L-3	Conc Chnl 6W 2:1 SS	550	0.12	
I-15	113	E	HWY BK L-3	24" RCP	238	0.40	12
I-15	120	E	107-V800	18" RCP	351		
I-15	121	E	107-V793	8' x 3' RCBC	80		
I-15	130	E	327-V119	36" x 60" RCP	1,435		
I-15	133	E	HWY BK L-3	18" RCP	80	0.40	6
I-15	134	E	HWY BK L-3	24" RCP	557		
I-15	140	E	107-V4229	18" RCP	690	0.40	3
I-15	140	E	107-V4229	36" RCP	440		
I-15	170	E	107-V4229	24" RCP	220		
I-15	180	E	107-V4229	48" RCP	510		
I-15	186	E	107-V4229	5' x 4' RCBC	1,015		
I-15	188	E	107-V4229	11' x 4' RCBC	405		
I-15	190	E	107-V4229	8' x 4' RCBC	1,445		
I-15	192	E	107-V4229	4' x 6' RCBC	940		
I-15	194	E	107-V4229	42" RCP	520		
I-15	198	E	107-V4229	11' x 4' RCBC	2,445		
I-15	198	E	107-V4229	12' x 4' RCBC	4,100		
I-15	200	E	107-V4229	48" RCP	505		
I-15	202	E	107-V4229	4' x 4' RCBC	520		
I-15	204	E	107-V4229	8' x 4' RCBC	725		
I-15	208	E	107-V4229	7' x 4' RCBC	228		
I-15	208	E	107-V4229	8' x 4' RCBC	435		
I-15	210	E	107-V4229	12' x 4' RCBC	690		
I-15	214	E	HWY BK L-14 Vol 1 SD-2	24" RCP (800 mm)	70	7.00	80
I-15	216	E	HWY BK L-14 Vol 1 SD-2	Conc Chnl 6' W 9' D 2400mm/225mm	384	0.25	811
I-15	218	E	HWY BK L-14 Vol 1 SD-3	Conc V Ditch 4' W (1200mm)	433		
I-15	220	E	HWY BK L-14 Vol 1 SD-4	18" RCP (450mm)	968	0.25	10
I-15	222	E	HWY BK L-14 Vol 1 SD-4	18" RCP (450mm)	213	0.86	10
I-15	224	E	HWY BK L-14 Vol 1 SD-4	18" RCP (450mm)	108	16.50	43
I-15	226	E	HWY BK L-14 Vol 1 SD-4	24" RCP (600 mm)	108	11.70	77
I-15	228	E	HWY BK L-14 Vol 1 SD-4	18" RCP (450mm)	72	75.90	91
I-15	230	E	HWY BK L-14 Vol 1 SD-4	18" RCP (450mm)	158	24.60	52
I-15	232	E	HWY BK L-14 Vol 1 SD-13	24" RCP (600 mm)	88	4.30	87
I-15	234	E	HWY BK L-14 Vol 1 SD-13	18" RCP (450mm)	294	2.10	15
I-15	236	E	HWY BK L-14 Vol 1 SD-4	18" RCP (450mm)	473	0.50	7
I-15	238	E	HWY BK L-14 Vol 1 SD-11	18" RCP (450mm)	124	1.50	13
I-15	240	E	HWY BK L-14 Vol 1 SD-11	48" RCP (1200mm)	543	1.00	11
I-15	242	E	HWY BK L-14 Vol 1 SD-6	18" RCP (450mm)	267		
I-15	244	E	HWY BK L-14 Vol 1 SD-6	36" RCP (900mm)	491	0.35	38
I-15	246	E	HWY BK L-14 Vol 1 SD-6	18" RCP (450mm)	43	1.50	13
I-15	248	E	HWY BK L-14 Vol 1 SD-6	24" RCP (600 mm)	408	0.30	12
I-15	250	E	HWY BK L-14 Vol 1 SD-13	18" RCP (450mm)	97	0.25	5
I-15	252	E	HWY BK L-14 Vol 1 SD-13	18" RCP (450mm)	187	3.00	18
I-15	254	E	HWY BK L-14 Vol 1 SD-9	Skotch Drain	556		
I-15	256	E	HWY BK L-14 Vol 1 SD-6	18" RCP (450mm)	48	0.50	7
I-15	258	E	HWY BK L-14 Vol 1 SD-6	18" RCP (450mm)	146	2.30	16
I-15	260	E	HWY BK L-14 Vol 1 SD-6	18" RCP (450mm)	151	0.50	23
I-15	262	E	HWY BK L-14 Vol 1 SD-6	24" RCP (600 mm)	623	1.76	30
I-15	264	E	HWY BK L-14 Vol 1 SD-6	18" RCP (450mm)	140	0.50	7
I-15	266	E	HWY BK L-14 Vol 1 SD-6	42" RCP (1050mm)	131	0.25	50
I-15	268	E	HWY BK L-14 Vol 1 SD-6	42" RCP (1050mm)	896	2.00	142
I-15	270	E	HWY BK L-14 Vol 1 SD-6	18" RCP (450mm)	110	0.50	7
I-15	271	E	HWY BK L-14 Vol 1 SD-6	30" RCP (750mm)	133	1.31	47
I-15	273	E	HWY BK L-14 Vol 1 SD-6	18" RCP (450mm)	133	1.15	11
I-15	274	E	HWY BK L-14 Vol 1 SD-6	18" RCP (450mm)	172	1.00	11
I-15	276	E	HWY BK L-14 Vol 1 SD-6	18" RCP (450mm)	5	0.25	5
I-15	278	E	HWY BK L-14 Vol 1 SD-6	18" RCP (450mm)	228	13.00	38
I-15	280	E	HWY BK L-14 Vol 1 SD-6	8' x 6' RCBC	480		
I-15	280	E	HWY BK L-14 Vol 1 SD-6	8' x 3' RCBC	378		
I-15	300	E	HWY BK L-14 Vol 1 SD-6	8' x 3' RCBC	357		
I-15	310	E	I-15 IRRD	12" PVC	1,070		
I-15	315	E	HWY BK L-7	30" RCP	645		
I-15	320	E	HWY BK L-10	42" RCP	600		
I-15	330	E	HWY BK L-10	54" RCP	263		
I-15	340	E	HWY BK L-7A	8' x 3' RCBC	280		
I-15	350	E	HWY BK L-7A	8' x 3' RCBC	180		
I-15	360	E	HWY BK L-7A	2" 24" RCP Culverts	71		
I-15	361	E	NDOT # 1538	36" RCP	225		
I-15	362	E	NDOT # 1538	36" RCP	225		
I-15	363	E	NDOT # 1538	36" RCP	225		
I-15	364	E	NDOT # 1538	36" RCP	225		

ID	No.	Facility	Plan No.	Facility Description	Fac Length	Slope (%)	Flow (cfs)
LOCAL FACILITIES							
LVB	080	E	327-V	15" RCP	379		
LVB	100	E	HWY BK L-5	24" RCP	2,750		23
LVB	121	E	HWY BK L-5	10" CMP	240		2
LVB	122	E	HWY BK L-5	18" CMP	90		11
LVB	123	E	HWY BK L-5	24" CMP	2,424		23
LVB	124	E	HWY BK L-5	24" CMP	1,750		23
LVB	127	E	HWY BK L-5	18" RCP	740		10
LVB	128	E	HWY BK L-5	24" RCP	1,000		19
LVB	129	E	HWY BK L-5	53" x 34" RCP	1,875		13
LVB	130	E	HWY BK L-5	48" RCP	4,050		144
LVB	131	E	107-V589	18" Semi-Circle RCP	280		1
LVB	132	E	107-V589	18" Semi-Circle RCP	225		1
LVB	133	E	107-V589	18" Semi-Circle RCP	283		1
LVB	134	E	107-V589	18" Semi-Circle RCP	185		7
LVB	135	E	107-V589	18" Semi-Circle RCP	165		7
LVB	136	E	327-V158A / 107-V061	18" RCP	1,575		3
LVB	137	E	327-V158A	12" RCP	207		3
LVB	138	E	307-V514	10" VCP	267		2
LVB	139	E	327-V158A	12" RCP	1,062		3
LVB	140	E	HWY BK L-5	15" RCP	319		6
LVB	145	E	327-V155	12" x 8" RCBC	61		250
LVB	146	E	HWY BK L-1A	60" RCP	380		
LVB	151	E	107-V2105	6" PVC	170		1.00
LVB	152	E	107-V2105	6" PVC	170		1.00
LVB	153	E	107-V2105	6" PVC	122		0.50
LVB	154	E	107-V2105	6" CL 50 PVC Force Main	122		0.30
LVB	155	E	107-V2105	12" PVC	525		36
LVB	156	E	107-V1558	18" RCP	600		36
LVB	157	E	107-V1558	18" RCP	761		40
LVB	158	E	HWY BK L-5	18" RCP	761		40
LVB	190	E	HWY BK L-5	24" RCP	486		8
LVP	100	E	350-V2	18" RCP	1,037		6
LVP	119	E	350-V2	18" RCP	1,078	0.40	6
LVP	120	E	107-4578-3	24" PDE	1,037		6
MLK	000	E	107-V058A	24" RCP	500		
MLK	003	E	107-V058A	18" RCP	180		
MLK	005	E	HWY BK L-1	8" X 3" RCBC	228		68
MLK	007	E	707A-ANA-PHena	36" x 60" RCP	969	0.25	72
MLK	010	E	327-1001/107-V058A	36" x 60" RCP	100		110
MLK	011	E	327-1001/107-V058A	48" RCP	1,224		12
MLK	030	E	327-100	48" RCP	1,134		12
MLK	035	E	107-V1737	18" RCP	436		100
MLK	040	E	107-V058A	18" RCP	1,077		100
MLK	050	E	107-V1433	18" RCP	150		11
MLK	051	E	HWY BK L-1A Vol 1 SD-14	18" RCP (450mm)	150		10
MLK	055	E	HWY BK L-1A Vol 1 SD-14	24" RCP (600mm)	240		130
MLK	058	E	HWY BK L-1A Vol 1 SD-14	24" RCP (600mm)	54		162
MLK	064	E	HWY BK L-1A Vol 1 SD-14	24" RCP (600mm)	272		30
MLK	065	E	107-V058A	24" RCP	560		50
MLK	068	E	HWY BK L-1A Vol 1 SD-14	24" RCP (600mm)	54		162
MLK	071	E	HWY BK L-1A Vol 1 SD-14	24" RCP (600mm)	67		183
MLK	075	E	HWY BK L-1A Vol 1 SD-14	24" RCP (600mm)	47		103
MLK	080	E	107-V058A	36" RCP	3,361		4
MLK	090	E	107-V058A	18" RCP	1,780		4
MNS	000	E	HWY BK M-2	18" CMP	4,000		4
MNS	010	E	107-V2010	Conc Chnl 12W 4D 11 SS	3,330		698
MNS	020	E	107-V2010	Storm Water Pumping Station	655		19
MNS	021	E	107-V2011	24" RCP	855		19
MNS	022	E	107-V2011	24" RCP	855		19
MNS	023	E	107-V2011	24" RCP	855		19
MNS	029	E	107-V1540	24" CMP	855		19
MNS	030	E	107-V2011	42" RCP	120	0.83	37
MNS	031	E	107-V2011	42" RCP	120		37
MNS	032	E	107-V2011	2" x 45" x 27" RCP	136	0.30	88
MNS	035	E	107-V2011	7" x 48" RCP	344	0.30	135
MNS	036	E	107-V2011	7" x 48" RCP	344	0.25	94
MNS	040	E	107-V2011	7" x 48" RCP	385	0.25	123
MNS	041	E	HWY BK L-1	2" x 45" x 27" RCP	450	0.30	171
MNS	070	E	HWY BK L-1	2" x 10 x 2.5 RCBC	120		240
MNS	080	E	Field Check	21" RCP	1,590		16
MNS	090	E	Field Check	21" RCP	1,590		16
MRY	000	E	107-V7968	24" RCP	1,125		23
MRY	000	E	107-V7968	12" RCP	1,275		4
OKG	146	E	Bk 1 Shd 18-23	30" RCP	1,200		16
OKG	150	E	HWY BK L-1	30" RCP	4,722		18
OKG	151	E	107-V1025	30" RCP	189		30
OKG	153	E	HWY BK L-1A Vol 1 SD-14	24" RCP (450mm)	522	1.20	12
OKG	157	E	HWY BK L-1A Vol 1 SD-14	24" RCP (600mm)	354	1.80	29
OKG	160	E	HWY BK L-1A Vol 1 SD-14	24" RCP (600mm)	669	2.50	25
OKG	163	E	HWY BK L-1A Vol 1 SD-14	24" RCP (600mm)	513	0.50	7
OWS	060	E	107-V708	18" RCP	12,086		7
OWS	140	E	107-V767	18" RCP	9,090		11
OWS	200	E	107-V020	12" RCP	1,422		3
PMT	010	E	327-V239	4" Pressure PVC	1,475		
RAN	001	E	107-V531	18" Elliptical RCP	154		7
RAN	007	E	107-V1208A	18" RCP	860		35
RAN	050	E	107-V068	48" x 78" RCP	263	0.33	5
RAN	051	E	Field Check	30" RCP	375		280
RAN	052	E	Field Check	30" RCP	860		41
RAN	060	E	107-V068	HWY BK L-2	1,500		88
RAN	070	E	107-V068	HWY BK L-2	1,500		88
RAN	080	E	107-V1698	HWY BK L-2	42" RCP	3,078	12
RAN	090	E	107-V1698	HWY BK L-2	42" RCP	3,078	12
RAN	110	E	107-V1698	HWY BK L-2	42" RCP	690	142
RAN	111	E	107-V1698	HWY BK L-2	42" x 22" RCP	101	29
RAN	112	E	HWY BK L-2	42" RCP	3,394		12
STW	100	E	HWY BK L-515	36" RCP	9,300		67
STW	136	E	HWY BK L-1	18" RCP	3,565		6
STW	140	E	327-V241	18" PVC	420		40
STW	145	E	107-V2288	18" PVC	174		40
STW	150	E	107-V2288	18" PVC	27	0.40	7
STW	151	E	107-V1894	18" PVC	223		50
VBV	111	E	107-V1673	24" RCP	154		12
VBV	112	E	Pancrete 107-0203	Conc Chnl 0.9 P 3.5W 4.1 SS	100		115
VBV	120	E	107-V928	14" x 23" RCP	200		16
VBV	121	E	107-V1156	12" x 20" RCP	267		360
VBV	130	E	F10, 1.2 Boyle Eng	12" x 5" RCBC	100		210
VBV	131	E	107-V1156	12" x 20" RCP	116		118
VBV	150	E	107-V1156	4" x 8" RCBC	1,022		368
VBV	160	E	107-V1137	8" x 6" RCBC	1,224	0.50	462
WAS	200	E	HWY BK W-1	30" RCP	964		67
WAS	210	E	HWY BK W-1	42" RCP	807		41
WAS	220	E	HWY BK W-1	42" RCP	67		48
WAS	230	E	HWY BK W-1	18" RCP	490		16
WAS	240	E	107-V708	18" RCP	218		17
WAS	300	E	107-V1772	18" RCP	4,088		11

Reference Information



City of Las Vegas Central Neighborhood Flood Control

Master Plan 2005

$$I = \int F \cdot dt$$

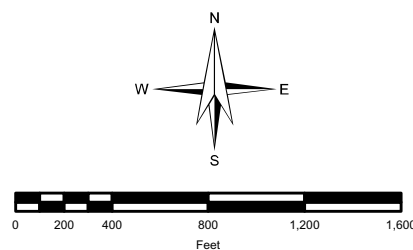
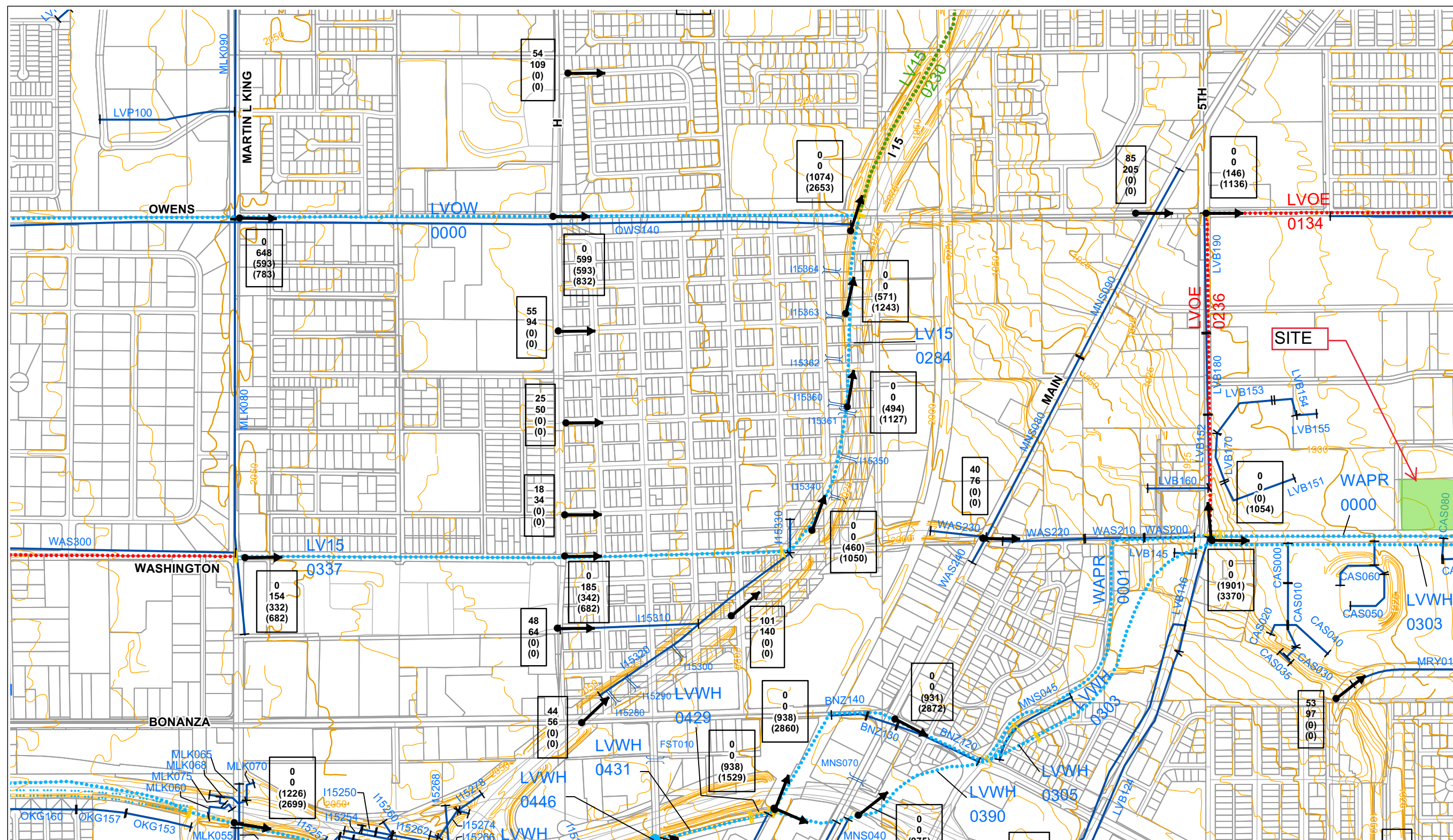


CENTRAL NEIGHBORHOOD FLOOD CONTROL MASTER PLAN

LEGEND

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

FIGURE F-4



SCALE: 1 inch = 800 feet

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

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

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

$$I = \int F \cdot dt$$

	Durango	Rainbow	Decatur	Tonopah	5th	Pecos
Lake Mead				1	2	
Washington				3	4	5
Charleston	7	8	9	10	11	12
Sahara	13	14	15	16	17	
Desert Inn		18	19			

FUTURE DRAINAGE CONDITIONS



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

Reference Information

Blind Center of Nevada (DS 4768)

$$I = \int F \cdot dt$$

TECHNICAL DRAINAGE STUDY

Prepared for:
Blind Center of Nevada
1001 N. Bruce Street
Las Vegas, NV 89101

Prepared by:

BALOVA ENGINEERING
6130 ELTON AVENUE
LAS VEGAS, NV 89107
TEL 702-216-0330

11/02/2015

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM		DATE: January 7, 2016
TO: Land Development Services Department of Building & Safety		FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT:	Drainage Study for: Blind Center of Nevada	
Cross Streets:	SWC of Bruce Street & Gragson Avenue	
File Number:	F:\Depot\DSMemos\DS4768B.doc	
Parcel Number:	139-26-201-010 & 139-26-201-011	
Zoning Action:	SDR-60891; SUP-61367 & PMP-61335	
FEMA Flood Zone	YES	NO X
Proposed Storm Drain	YES	NO X
COPIES TO:		Balova Engineering
		Blind Center of Nevada
		Bart Anderson, P.E., DevCo

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1 st Submittal	11/12/2015	12/2/2015	Not Approved	\$400.00	422512: \$400
2 nd Submittal	12/22/2015	1/7/2016	See Comments Below	\$400.00	427297: \$400
			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

ays

T/R/S: T20S/R61E/26
AREA M-26

Table 1 Peak Flows for Offsite and Onsite Basins

Basin	Area (acres)	10-year Q (cfs)	100-year Q (cfs)
EXISTING			
XOFF1 (Existing Off-Site Drainage Basin)	3.3	1.4	3.63
XOFF2 (Existing Off-Site Drainage Basin - Bruce)	0.46	0.79	1.46
XOFF3 (Existing Off-Site Drainage Basin - Gragson)	0.31	0.68	1.15
XOFF4 (Existing Off-Site Drainage Basin)	0.7	1.14	2.23
XOFF5 (Existing Off-Site Drainage Basin – Classic Cars Lane)	0.46	0.61	1.31
XOFF9 (Existing Off-Site Drainage Basin - HUD)	1.6	0.59	2.21
XOFF10 (Existing Off-Site Drainage Basin – Gragson North Half)	0.4	0.9	1.51
XON1 (Existing On-Site Drainage Basin)	1.5	2.44	4.78
XON2 (Existing On-Site Drainage Basin)	1.5	1.46	3.23
PROPOSED			
DON1 (Proposed On-Site Drainage Basin)	0.67	1.1	2.15
DON2 (Proposed On-Site Drainage Basin)	0.34	0.55	1.08

Basin	Area (acres)	10-year Q (cfs)	100-year Q (cfs)
DON3 (Proposed On-Site Drainage Basin)	0.39	0.64	1.25
DON4 (Proposed On-site Drainage Basin)	0.67	1.1	2.15
DON5 (Proposed On-site Drainage Basin)	0.95	1.54	3.03

Source: TR-55 Calculations (Appendix A)

Table 2 Street Flow Capacity (proposed)

	Slope (%)	Q 100 (cfs)	Depth of Flow (ft)	Velocity (fps)
Gragson Avenue	1.63	43.04	0.58	4.11
Bruce Street (half)	0.6	12.60	0.58	2.48

Source: FlowMaster Calculations (Appendix B)

IV. Conclusions and Recommendations

According to the Manual:

The finished floor shall be set at a vertical distance above the gutter flowline of at least twice the Q100 depth of flow in the gutter flowline up to a maximum of 18 inches above the water surface elevation in the street.

CLV: Minimum finish floor elevation is 6 inches above highest adjacent top of curb elevation.

The building was designed with a stepped slab with an 18" step. A portion of the building along the north side will be flood protected as shown. The min finish floor elevation has been set to meet the requirements in respect to Bruce Street, however it does not meet the criteria in respect to Gragson Avenue. In order to mitigate the requirement, we are proposing a landscape berm along the street frontage on Gragson. In addition, the driveway has been 'humped' to prevent any offsite flows from entering the site.

The following recommendations are provided to facilitate safety, both public and private, for the proposed development:

STREET FLOW SUMMARY

STREET NAME	RIGHT-OF-WAY WIDTH (ft)	HYDRAULIC CROSS SECTION IDENTIFIER	100-YEAR FLOW (Q100) (cfs)	100-YEAR VELOCITY (V) (fps)	100-YEAR FLOW DEPTH (D) (ft)	100-YEAR DEPTH VELOCITY PRODUCT (VxD)
GRAGSON AVENUE	60	A	43.04	4.11	0.58	2.38
BRUCE STREET	80	B	12.60	2.48	0.58	1.43

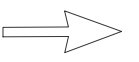
STREET NAME	RIGHT-OF-WAY WIDTH (ft)	HYDRAULIC CROSS SECTION IDENTIFIER	10-YEAR FLOW (Q100) (cfs)	10-YEAR VELOCITY (V) (fps)	10-YEAR FLOW DEPTH (D) (ft)	10-YEAR DEPTH VELOCITY PRODUCT (VxD)	10-YEAR DRY LANE WIDTH (ft)
GRAGSON AVENUE	60	A	19.42	3.60	0.46	1.66	—
BRUCE STREET	80	B	6.02	2.20	0.46	1.01	yes

FLOW RATES

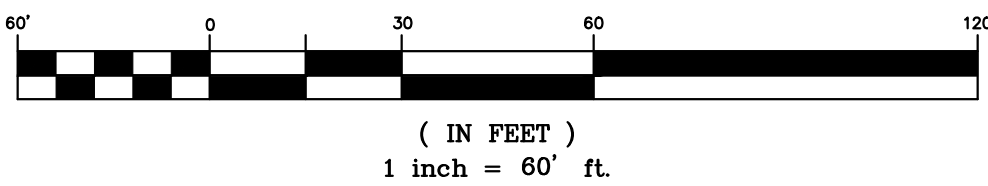
BASIN	AREA	SLOPE	LENGTH	Q10/Q100
DON1	0.67 ac	1.7%	240 ft	1.10/2.15 cfs
DON2	0.34 ac	1.7%	150 ft	0.55/1.08 cfs
DON3	0.39 ac	1.7%	200 ft	0.64/1.25 cfs
DON4	0.67 ac	1.7%	150 ft	1.10/2.15 cfs
DON5	0.95 ac	1.7%	400 ft	1.54/3.03 cfs

LEGEND

XX/XX CFS Q10/Q100

-  FLOWMASTER CROSS SECTION
- * per CLV DS# 3066 (A-CAB)
- ** per CLV DS# 4562 (SUNBELT)
- *** per CLV DS# 1563 (STATE BLDG)
-  FLOW ARROW

GRAPHIC SCALE

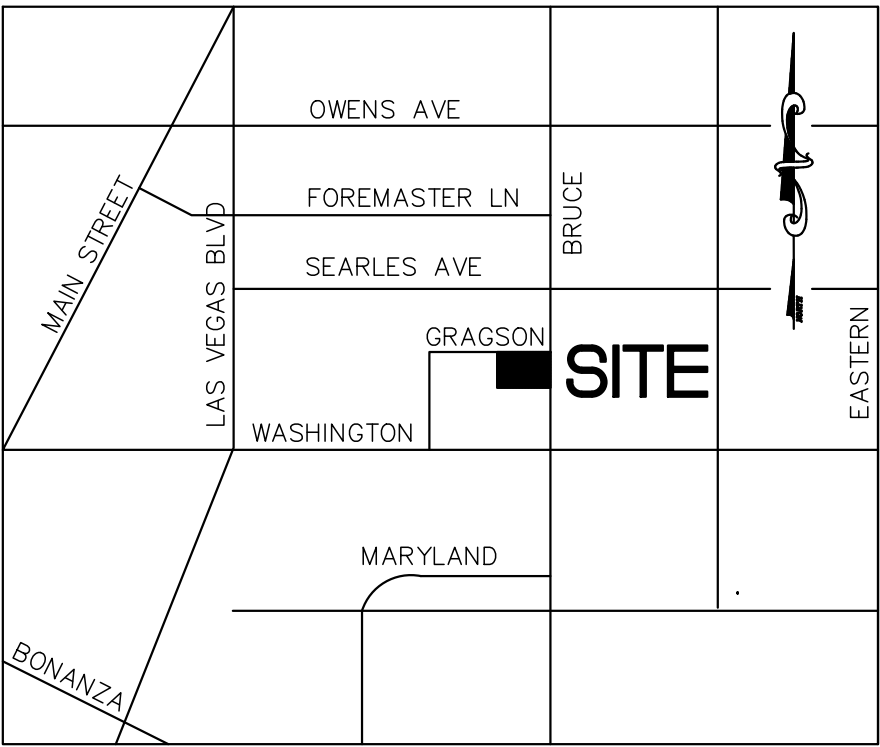


SEARLES AVENUE

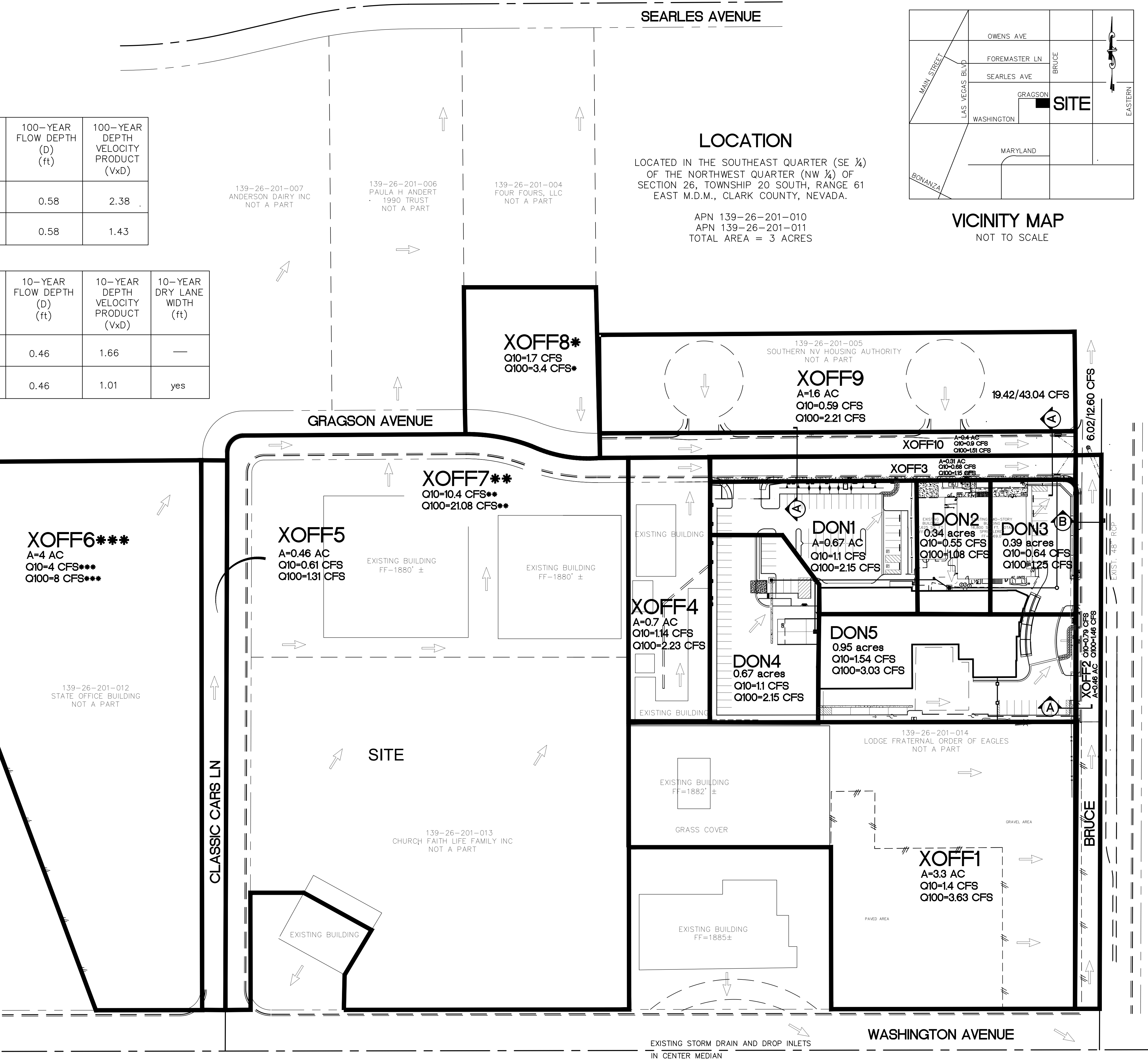
LOCATION

LOCATED IN THE SOUTHEAST QUARTER (SE ¼) OF THE NORTHWEST QUARTER (NW ¼) OF SECTION 26, TOWNSHIP 20 SOUTH, RANGE 61 EAST M.D.M., CLARK COUNTY, NEVADA.

APN 139-26-201-010
APN 139-26-201-011
TOTAL AREA = 3 ACRES



VICINITY MAP
NOT TO SCALE



SOUTHERN NEVADA SIGHTLESS
DRAINAGE BASIN MAP
DEVELOPED CONDITIONS

DESIGNED BY : PB
CHECKED BY : PB
DATE : 11/15/16
JOB # : 15-000
APN :
SECT 26 T 20S R 61E
SCALE : HORIZ 1" = 80'

SHEET #
D2
2 OF 2

BALOVA ENGINEERING
6130 ELTON AVENUE
LAS VEGAS, NV 89107
702-682-1706 TEL

1001 N. BRUCE STREET
LAS VEGAS, NV 89101

REV. DATE: BY: REVISION:
THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND REPORT ANY ERRORS TO THE ENGINEER PRIOR TO COMMENCING WORK. ALL DRAWINGS, SPECIFICATIONS AND COPIES THEREOF FURNISHED BY THE ENGINEER ARE AND SHALL REMAIN THE PROPERTY OF THE ENGINEER. NO PART OF THESE DRAWINGS OR SPECIFICATIONS SHALL BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE WRITTEN PERMISSION OF THE ENGINEER. THESE PLANS ARE TO BE CONSIDERED PRELIMINARY AND USED AT THE OWNER'S RISK. CONTRACTORS RISK.

Reference Information

Sunbelt Storage at Gragson & Fantasy Lane (DS 3066)

$$I = \int F \cdot dt$$

CITY OF LAS VEGAS		DATE:	
INTER-OFFICE MEMORANDUM		October 1, 2004 <i>AMS</i>	
TO: Land Development Services Department of Public Works		FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works	
SUBJECT:		COPIES TO:	
Technical Drainage Study for:		Summit Engineering	
Sunbelt Storage @ Gragson & Fantasy – Update #2 for Phase II		Sunbelt Communications	
Cross Streets: Gragson Avenue and Fantasy Lane		Bart Anderson, P.E. DevCo	
FILE NO. F:\Depot\DSMEMOS\DS3066F.doc			
Parcel Number: 139-26-201-018			
Zoning Action: SDR 4073			
FEMA Flood Zone	YES	No	X
Proposed Storm Drain	YES	No	X

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Trn. #
1 st Submittal	1/23/2002	2/5/2002	Not Acceptable	\$250.00	---
2 nd Submittal	2/20/2002	2/27/2002	Acceptable	\$250.00	---
3 rd Submittal	11/13/2002	11/26/2002	Not Acceptable	\$250.00	94705: \$250
4 th Submittal	12/31/2002	1/14/2003	Acceptable	\$250.00	96800: \$250
5 th Submittal	7/12/2004	7/26/2004	Not Acceptable	\$100.00	6753: \$100
6 th Submittal	9/1 & 10/1/2004	10/1/2004	See Comments Below	\$400.00	8959: \$400
			TOTAL FEES (LDDRS):	\$1,500.00	---

REMARKS:

5th & 6th Submittals: Update and Addendum for Phase II improvements.

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

X	is acceptable in concept subject to conformance to all City standards and the following conditions.
	must be resubmitted or supplemented including the following:
	must have Clark County Regional Flood Control District concurrence

1. Show the size of the "Wall Opening Detail". The minimum size of a wall opening is 48"x16".
2. Previous comment to provide the necessary transitional grading for roadway construction still has not been fully addressed. Note that the existing contours and the proposed edge of paving do not match. Therefore transitional grading must be provided.

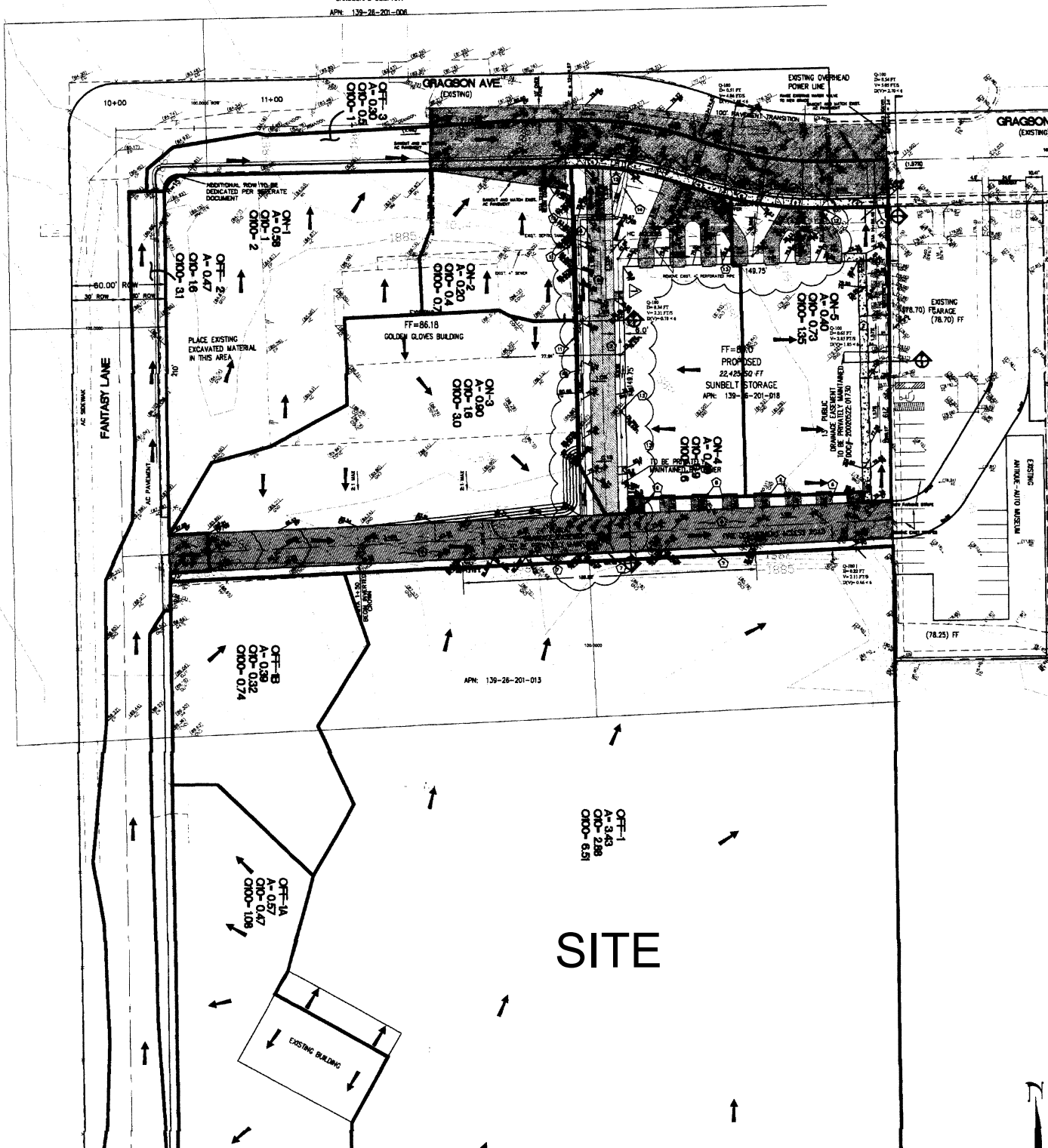
NOTE: Any future changes to the proposed design (or design assumptions) as outlined in the approved drainage study and attached preliminary grading plan which affect drainage must be addressed in a Drainage Study Amendment and accepted by the City of Las Vegas Flood Control Section. Additionally, conditional 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
B&H/ays/PBJ

T/R/S: T20S/R61E/26
AREA M-26

LANDSCAPE COMPANY
APN: 139-26-201-006



RAW EARTHWORK QUANTITIES

BENCHMARK

CURVE TABLE			
No.	Radius	Length	Tangent

EXISTING
PROPOSED
RIGHT
EDGE
CONTOUR
CURB

SITE