

TECHNICAL DRAINAGE STUDY

FOR

CAPROCK HOSPITAL

City of Las Vegas, Nevada

JUNE 2017

Prepared By:



Rietz Consulting, Inc.

3060 E. Post Road, Suite #110; Las Vegas, Nevada 89120

Phone: 702-521-3355 Fax: 702-212-3693

Prepared For:

CAPROCK Emergency Holdings, LLC

One Momentum Blvd. #100

College Station, Texas 77845

Phone: 702-528-2322

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL
DRAINAGE STUDY INFORMATION FORM

Name of Development: Technical Drainage Study for Caprock Hospital Date: June 2017
Location of Development: a) Descriptive (Cross Streets) North/South: Durango
East/West: Oso Blanca
b) Section: 17 Township: 19S Range: 60E
c) APN: 125-17-701-001

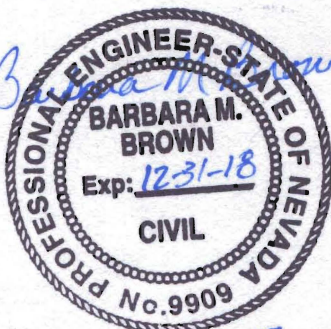
Name of Owner: NORTHWEST 95 LLC (Owner) -Caprock Emergency Holdings, LLC (Developer) - SH4 Development, LLC (Developer)
Telephone No.: 702.528.2322 Fax No.: _____ E-Mail Address: stuart@sh4development.com
Address: One Momentum Blvc. #100, College Station, TX 77845

Contact Person-Name: Eric Rietz Telephone No.: 702.521.3355
* E-Mail Address: Eric.rietz@gmail.com Fax No.: _____
Firm: Rietz Consulting, Inc.
Address: 3060 East Post Road, #110, Las Vegas, NV 89120

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		medical building development

1. Total Owned Land Area: At Site: 15.78ac Being Developed/Disturbed: 2.79 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.): Commercial
5. Approximate upstream land area which drains to the subject site: 20acres
6. Has the site drainage been evaluated in the past? ☐ YES ☒ NO If yes, please identify documentation: _____
7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: _____
Discharge to NDOT right-of-way ditch to the southeast.
8. Briefly describe your proposed schedule for the subject project: ASAP



Engineer's Seal

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

***New Required Field**

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

Revision	Date

Local Entity File No. _____

REFERENCE:

STANDARD FORM 1



Department of Public Works

Development Review Division • Drainage Study Team

500 S Grand Central Pky | Box 554000 | Las Vegas NV 89155-4000
(702) 455-4600 | Fax (702) 388-2550
www.ClarkCountyNV.gov/PubWorks

DRAINAGE STUDY MINIMUM CRITERIA CHECKLIST

Project Name: Technical Drainage Study for Caprock Hospital
Engineer: Eric Rietz, P.E. Company : Rietz Consulting
Address: 3060 East Post Road, #110,
City: Las Vegas State: NV Zip: 89120
E-mail: eric.rietz@gmail.com
Phone Number: 702.521.3355 Fax Number: _____
Property Owner: Caprock Emergency Holdings, L L C
Address: One Momentum Blvd. #100,
City: College Station, State: TX Zip: 77845
Phone Number: 702.528.2322 Fax Number: NA
E-mail: Stuart@sh4development.com

The following information is intended as a guide to the engineer for providing the minimum information required for a Technical Drainage Study submittal prior to the County performing a review. The engineer will remain responsible to ensure the Technical Drainage Study is prepared within the guidelines as set forth in the Clark County Regional Flood Control District (CCRFCD) *Hydrologic Criteria and Drainage Design Manual* (Design Manual).

This document is intended as an aid in preparing Technical Drainage Studies for Clark County. 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, and exhibits which may be necessary to properly evaluate the intended land use.

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

DRAINAGE STUDY MINIMUM CRITERIA CHECKLIST

I. GENERAL REQUIREMENT

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

II. DRAINAGE PLAN INFORMATION

Yes	No	
X		Sheet size: 24" x 36"
X		Minimum Scale: 1" = 50'
X		Project Name
X		Vicinity Map
X		Revision Box
X		North Arrow and Bar Scale
X		Professional Engineer's signature, seal, and date
X		Engineer's/Consultant's address and phone number
X		Elevation Datum and Benchmark
X		Legend for symbols and abbreviations
X		Cut/fill scarps, where applicable
X		Street Names, Grades, and Widths
X		Spot grades for top of curbs and street crowns at lot lines, grad breaks, and along curb returns
X		Existing contours encompassing the site and 100 feet beyond with spot elevations for important, excess of 100 feet where appropriate
X		Minimum finish floor elevations
X		Typical street sections
X		Proposed contours or spot elevations in sufficient detail to exhibit intended drainage patterns and slopes
X		Property lines
X		Right-of-way lines and widths, existing and proposed
X		Existing improvements and their elevations
X		Delineation of proposed onsite drainage basins indicating area and 10-year and 100- year storm peak flows at basin concentration points
X		Drainage flow direction with Q100 and V100
X		Cross-sectional detail for channels, including cutoff wall locations

Yes	No	
X		Existing and proposed drainage easements and widths shown with sufficient detail
X		Existing and proposed drainage easements and widths shown with sufficient detail
X		Location and detail of existing, proposed, and future block wall openings
N/A		Detail of flood walls illustrating depth of flow, proposed grouting height, etc.
X		Retaining wall locations
X		Building and/or lot numbers
X		Alignment of all existing, proposed, or future Regional Facilities adjacent to the site
N/A		Limits of existing floodplain based on current FIRM
N/A		For areas in Zone A, AE, AH, and AO, base flood elevations (BFEs) must be shown for each lot; BFEs may be listed on each lot, or in a table

III. HYDROLOGIC ANALYSIS

Yes	No	
X		Appropriate soil information
X		Input and output information for computer models (HEC-1 or TR-55). The flow routing diagram must be provided with HEC-1 models
X		Use of correct precipitation values in and outside the McCarran Airport rainfalls area
X		A discussion in the text of the hydrologic analysis justifying basin boundaries and cutoffs, supporting assumptions and calculations
X		A summary table of stormwater flows showing basin area, Q10 and Q100 for both individual basins and combined basin flows where applicable
X		Copies of supporting technical information referenced from a previously approved study and a comment accepting these flows
X		On-site facilities must perpetuate flows through or around the site without significantly impacting adjacent property owners

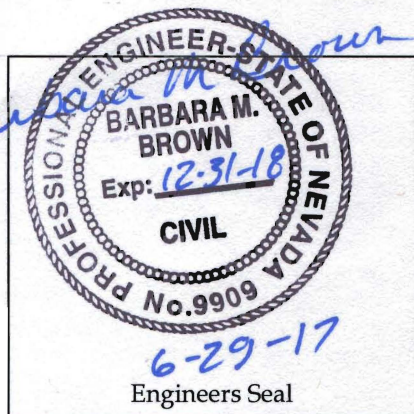
IV. HYDRAULIC ANALYSIS

Yes	No	
N/A		Flow split calculations and supporting documentation for the method of flow split calculations used
X		Normal depth street flow calculations and cross sections for all interior and perimeter streets (address dry lane criteria)
X		Provide depth x velocity "D x V" products for flows in interior and exterior streets $Q_{10}(D \times V \leq 6)$ $Q_{100}(D \times V \leq 8)$
N/A		Appropriate hydraulic calculations for block wall opening assuming a 50% vertical clogging factor (Assume the lower half of the opening is plugged)
X		Appropriate hydraulic calculations at drainage easement entrance and discharge locations to set first floor elevations. Hydraulic calculations must include submerged weir, superelevation and tee intersection losses where appropriate
X		Provide necessary freeboard requirements to set the finished floor elevations
X		On-site facilities must perpetuate flows through or around the site without significantly impacting adjacent property owners

Yes	No	
		A complete water surface profile analysis (HEC-2, WSPG, etc.) for channel flows and FEMA Zone A flood zones
N/A		· 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 supercritical flow segments · A summary table and a discussion of the results in the text of the report
N/A		Provide a 50% clogging factor in the capacity calculation for drop inlets
N/A		Hydraulic calculations for culverts and storm drains

V. MAPS AND EXHIBITS

Yes	No	
X		A Flood Insurance Rate Map (FIRM) with the site delineated
X		The CCRFCD Master Plan Update Figures (F&H) with the site delineated
X		A soils map with the site and the upstream sub-basins delineated
X		Off-site drainage basin map for existing, interim and future conditions showing the basin boundaries, concentration points, existing topo and flows in cfs
X		On-site drainage basin map for existing and proposed conditions showing the basin boundaries, concentration points, existing topo and flows in cfs
X		Vicinity Map with local and major cross streets identified



Submitted By: _____

Date: _____

Table of Contents

LIST OF APPENDICES 2

1. INTRODUCTION 3

1.1 PROJECT OVERVIEW & STUDY PURPOSE3

1.2 SITE DESCRIPTION3

1.3 FEMA FLOOD ZONE DESIGNATION4

1.4 MASTER-PLANNING INFORMATION4

1.5 SOILS DATA.....4

1.6 REFERENCE STUDIES5

2. METHODOLOGY 7

2.1 COMPLIANCE.....7

2.2 HYDROLOGIC MODELING.....7

2.3 HYDRAULIC MODELING7

3. EXISTING CONDITIONS DRAINAGE 9

3.1 ON-SITE EXISTING CONDITIONS.....9

3.3 OFFSITE EXISTING CONDITIONS9

4. DEVELOPED CONDITIONS DRAINAGE 10

4.1 ONSITE DEVELOPED CONDITIONS10

4.2 OFFSITE DEVELOPED CONDITIONS10

4.3 DEVELOPED CONDITIONS NORMAL DEPTH STREET FLOWS10

4.4 DEVELOPED CONDITIONS NORMAL DEPTH ONSITE FLOWS11

5. CONCLUSIONS & RECOMMENDATIONS 12

7. REFERENCES 13

LIST OF APPENDICES

Figures

Figure 1 – Vicinity Map

Figure 2 – Location Map

Figure 3 – Existing Conditions Drainage Map

Figure 4 – Developed Conditions Drainage Map

Current Zoning Conditions

Supporting Documents

Hydrology

Hydraulics

Reference Material

Grading Plans

1. INTRODUCTION

1.1 Project Overview & Study Purpose

The purpose of this Technical Drainage Study for Capstone Hospital is to address drainage and grading design of the proposed 2.79-acre medical development. The development is located in the northwest portion of the Las Vegas Valley, in the City of Las Vegas, Nevada.

This Technical Drainage Study was prepared in accordance with criteria specified in the *Clark County Regional Flood Control District (CCRFCD) Hydrologic Criteria and Drainage Design Manual* (latest update), which is referred to in this document as the "*Drainage Manual*". All pertinent reference material and calculations are presented in the Appendix of this report.

Waters of the United States. Many of the dry streams of the southwestern United States have been found to be jurisdictional Waters of the United States (WOUS) which requires special permitting from the United States Army Corps of Engineers (USACE) to commence grading/construction. The purpose of this Technical Drainage Study was only to provide concurrence with local drainage criteria as stated above. The scope of this Technical Drainage Study does not include an assessment of Jurisdictional WOUS for the subject property and therefore does not address special permitting that may be required by the USACE.

1.2 Site Description

The subject site is located specifically in the North Half (N 2) of the Southeast Quarter (SE 4) of Section 17, Township 19South (T19S) Range 60 East (R60E), on the northeast corner of Durango Drive and Oso Blanca Road. The subject site is currently undeveloped, and exists partially in a natural desert terrain condition, with areas of previous grading along the southern and western boundaries.

The subject site is basically located within frontage loop roads of the US95/Durango Drive interchange. The subject site lies significantly lower than the bordering streets of Durango Drive and Oso Blanca Road, as well as the southbound onramp to US-95, which borders the subject site on the northeast, and is up to 19 feet higher than the subject site.

The site is bound by North Durango Drive (120-foot right-of-way) on the west, which is currently fully improved with pavement, sidewalk, curb and gutter, and street lighting. North Durango Drive is located along an embankment leading to the overpass of the US-95 at the subject site. There are two existing culvert crossings of the Durango Drive embankment upstream of the subject site, which discharge runoff flow toward the site.

The subject site is bordered by Oso Blanca Road on the south, from which the site will be accessed. Oso Blanca Road at the subject site is currently not specified as roadway right-of-way, but is part of a larger parcel, on which the adjacent park and ride RTC facility is located to the south of the road area. Oso Blanca Road at the subject site is currently fully improved, lacking only sidewalk on the north side (site side) of the street. It is likely that there will be overflow parking for the park and ride facility extending to the north side (site side) of Oso Blanca Road in the future. There is an existing local storm drain system located in Oso Blanca Road at the subject site.

The site is bordered on the north and northeast by embankments and other NDOT right-of-way associated with the US-95/Durango Drive interchange. See *Figure 1, Vicinity Map*, and *Figure 2, Location Map* in the Appendix of this report.

1.3 FEMA Flood Zone Designation

The subject site is not located within a Federal Emergency Management Association Special Flood Hazard Zone. According to FEMA FIRM Panel 32003C1745F, dated September 27, 2002, the subject site is in a "Zone X" which applies to "Areas determined to be outside the 0.2% annual chance floodplain". The associated FEMA Map Panel has been annotated and included in the appendix of this report.

1.4 Master-Planning Information

CCRFCFCD MPU

The subject site is bordered by NDOT right-of-way along the US-95. *CCRFCFCD Las Vegas Valley Flood Control Master Plan Update* (MPU, updated 2013) shows that the US-95 right-of-way is planned for CCRFCFCD regional facility CN95 0068, which is a planned triple-barrel 8'x7' RCB, having a peak 100-yr, 6-hour flow rate of 3216 cfs. The facility is currently under design, and is cited under reference #6 below. This report will require review and approval from the CCRFCFCD. The appropriate figures from the CCRFCFCD MPU have been annotated and included in the appendix of this report.

City of Las Vegas Northwest Neighborhood Study Phase 2

The subject site is located within exhibit E-12 (existing conditions) and F-12(future conditions) of the *City of Las Vegas Northwest Neighborhood Study Phase 2 (CLVNNSP2)*. These exhibits have been copied, annotated and included in the appendix of the subject report. It is noted that the *CLVNNSP2* is a study prepared in 1998, and therefore is somewhat outdated by more recent hydrology. There was no specific information cited from the *CLVNNSP2* for use in the subject report.

1.5 Soils Data

A soils report was downloaded from the USCS Web Soil Survey site, in order to determine the most current rating for Hydrologic Soils Groups (HSG) for the watershed studied in the subject study. The report results in HSG "A" (soil symbol 191) and "PITS" (soil symbol 610) for the watersheds studied in the subject study. Since there is no specific HSG assigned to areas with HSG "PITS", it was found to be most feasible to assume that those areas are HSG "C", since it would have a higher potential runoff, and is also what other previous studies have assumed, including the 2008 MPU hydrologic study.

For areas from the website resulting in HSG "A", these same areas have been studied in the past with HSG "B" which is also more conservative than HSG "A". HSG "B" is the same as that used in the 2008 MPU hydrologic study. Hence soils with symbol 191 were assumed to have HSG "B". Portions of the downloaded soils report have been printed, annotated and included in the Appendix of this report.

Curve numbers were selected from the *Drainage Manual* as directed, using the land usage and hydrologic condition of each basin studied, for input to the HEC1 hydrologic model. The curve numbers were selected so that they would concur with the referenced material as much as possible.

1.6 Reference Studies

There were several approved drainage studies on file in the vicinity of the subject site. Some studies were referenced for specific information, while others were reviewed for general information. Each study was reviewed and found to be reasonable and acceptable for reference. A summary of information from each of the reviewed studies are as follows:

1. **Technical Drainage Study for Town Center Assemblage Severance Access Road by GC Wallace, Inc., August 2002, City of Las Vegas #DS3164.**

Perused for general information only.

The *TDS for Town Center Assemblage Severance Access Road* was created for construction of an access road along the Severance Lane alignment from Fort Apache Road, to Oso Blanca Road. The study was reviewed for general information; however, more recent studies, which also reference the Severance Access Road study, are more accurate for updated hydrology and nothing specific was referenced from it.

2. **Technical Drainage Study for Remington Commercial VIII (AKA Update to Durango and 95 Commercial), by Baughman & Turner, Inc., March 2014 City of Las Vegas #DS4660.**

Perused for general information only.

The *Technical Drainage Study for Remington Commercial VIII* was prepared for the commercial parcel located to the west of the subject site, adjacent across Durango Drive. The study was later updated; hence, only the updates which were applicable were referenced for use in the subject study (see references below).

3. **Technical Drainage Study for Remington Commercial VIII (AKA Update to Durango and 95 Commercial or Storage One at 7422 Oso Blanca), by Baughman & Turner, Inc., March 2014, City of Las Vegas #DS4719.**

Perused for general information only.

The *TDS for Remington* was prepared for the commercial development, known as the update to that study for Storage One, was prepared for the northern end of the adjacent site to the west of the subject site. That area drained to the northern parts of the interchange and therefore the Storage One update was not necessarily applicable to the subject site, and was not referenced for anything specific.

4. **Technical Drainage Study for Remington Commercial VIII (AKA Update to Durango and 95 Commercial), by Baughman & Turner, Inc., November 2015 - City of Las Vegas #DS4743.**

Specific data are referenced.

The *Technical Drainage Study for Remington Commercial VIII* was referenced for use to determine the amount of runoff which impacts the subject site through the existing 6' x 3' RCB at the western boundary of the subject site. The 6'x3' RCB passes runoff flow underneath the Durango Drive alignment, discharging just upstream of the subject site. The peak flow rates of 15 cfs/144 cfs in the 10- and 100-year, 6-hour storm events, respectively, were referenced directly for use in the subject study. It is noted that once the regional MPU

facility is constructed in Farm Road as well as the upstream reach of the Centennial Channel facility, which is planned for the US 95 alignment is constructed, peak flow rates to the culvert in question are reduced, likely to around 84 cfs in the 100-year event. Hence the adoption of the 144 cfs in the 100-year storm event is the most conservative estimate of flow impacting the subject site and is used for design.

5. **Technical Drainage Study for Centennial Hills Transit Center and Park and Ride, by TCUPP & Associates, April 2009 - City of Las Vegas #DS4356.**

Specific data are referenced.

The *Technical Drainage Study for Centennial Hills Transit Center and Park and Ride* was prepared for the site adjacent to, and directly south of the subject site, which is a public project. The public site includes the roadway right-of-way of Oso Blanca Road, extending parking areas to the north of said road, adjacent to the subject site. The study states that there is a 30-inch storm drain pipe in Oso Blanca Road, which is approximately 100 feet south of the subject site, but from which the site takes access from. The 30-inch storm drain is said to have a peak flow rate of 52 cfs in the 10-year storm. In addition, the normal depth flow calculations of 4 cfs (100-yr) in the north side (site side) of Oso Blanca Road was referenced directly from the study, even though the site does not necessarily front on the street. The 10-year flow in the street is also taken to be negligible. These data are referenced directly from the Park and Ride study.

6. **Technical Drainage Study for Centennial Parkway Channel West, US95, 215 to Durango, by CH2M, (Pre-final)February 2017.**

Specific data are referenced.

The *Technical Drainage Study for Centennial Parkway Channel West*, was prepared for a future regional MPU facility, which is located adjacent to the subject site, running from northwest to southeast along the west side of the US 95 embankment. The study is in support of preliminary construction drawings, which show drainage improvements just downstream of the subject site. The improvements are collection systems for the proposed MPU facility.

The channel drawings show connection of the storm drain facility in Oso Blanca Road along the southern boundary of the subject site, to the proposed MPU facility. The storm drain is shown to have a 10-year peak flow rate of 52 cfs (the same as in the *Park and Ride* study).

The drawings also show a berm and channel- type collection grading upstream of a 48-inch diameter pipe, which will collect 84 cfs and connect it to the future MPU facility. It is noted that the peak flow rates specified in the study for the MPU facility are based on ultimate conditions, which means that upstream facilities are already in place, such as the MPU facility which is planned for the Farm Road alignment upstream of the subject site. It is understood that currently, there is 144 cfs discharged upstream of the subject site from the 6'x3' RCB upstream of the subject site, which is tributary to the proposed 48" pipe. Since implementation of facilities upstream will reduce the quantity of runoff to the existing 6'x3' RCB (to about 84 cfs), the interim conditions data presents the worst case for the 100-year peak flow rate estimate at the subject site.

2. METHODOLOGY

2.1 Compliance

The methodologies utilized in the preparation of this study are in compliance with the *Drainage Manual* (latest update).

2.2 Hydrologic Modeling

Modeling: The SCS Unit Hydrograph Method (SCS Method) was utilized to determine peak flow rates. The SCS Method utilizes precipitation, drainage area, curve number and lag time parameters to determine peak flow rates. The SCS Method routine within the U.S. Army Corp of Engineers *HEC1* was utilized to model the drainage sub-basins analyzed by this study.

Precipitation: The site is not located within the McCarran Rainfall Area, per *Drainage Manual* Figure 513. The precipitation values utilized in the HEC-1 models, were referenced from *Technical Drainage Study for Remington Commercial VIII* as 1.60" and 2.86" for the 10-year and 100-year storm events, respectively. SDN 3 design storm from Table 503 in the *Drainage Manual* has been used for the less than 1-mile square drainage area. Reference tables and figures from the *Drainage Manual* are included in the Appendix.

Curve Number: The SCS curve number loss rate methodology was utilized to approximate infiltration for the drainage sub-basins. As discussed in section 1.5 above, although most current soils data shows the area, having soils Map Unit 191, as HSG "A", the HSG "B" was chosen for all the areas studied in the subject report. This is a more conservative approach, since it will likely result in higher runoff rates. In addition, both referenced studies also used HSG "B" in their analysis.

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

2.3 Hydraulic Modeling

Street Flow: Normal depth street flow for Oso Blanca Road was referenced from Technical Drainage Study for Centennial Transit Center Park & Ride, where surface flow characteristics are given, as well as storm drain flow along the subject site. It is noted that the subject site does not necessarily front on Oso Blanca Road, since public property extends north of the actual street at the subject site.

Drop Inlet Sizing: Sizing for the grated drop inlet at the west end of the subject site was calculated with Flowmaster by Bentley Systems Methods, assuming 50 % clogging of the grate.

Storm Drain Flow: A storm drain system is proposed with the subject site, which will connect at the existing 6'x3' RCB, which currently lies under the embankment for Durango Drive, which

borders on the western boundary of the subject site. The Storm drain will convey the flow from the existing RCB, underneath the subject site's improvements, to discharge back to the surface at the downstream end of the site, where it flows historically. The system includes a junction (grated inlet at the top) with an existing small lateral which will pick up minor flows from the west end of the site.

The 100-year peak flow rate in the system is referenced directly from the Technical Drainage Study for Remington Commercial VIII as 144 cfs. It is noted that the 144 cfs peak flow rate is not additive with the small hydrograph from the western end of the subject site (DN1). Hence they are not combined in the storm drain system.

Storm drain flow is modeled using the WSPG computer program. Calculations are included in the appendix and summarized on the plan and profile sheets of the design drawings.

Hydraulic Sections: Onsite hydraulic sections are analyzed by calculating normal depth flow in the 100-year storm event with Flowmaster by Bentley Systems Methods.

3. EXISTING CONDITIONS DRAINAGE

3.1 On-site Existing Conditions

Referring to *Figure 3, Existing Conditions Drainage Map*, the subject site is undeveloped and covered with natural desert terrain, having typical scrub brush and creosote vegetation that is native to southern Nevada. The subject site is located within the road embankments of the Durango/95 interchange. The subject site drains to the southeast at a slope of approximately 3.5 %.

There is an existing 6'x3' reinforced concrete box (RCB) which lies to the west of and upstream of the subject site. The culvert drains underneath the embankment for Durango Drive along the western boundary of the subject site. The RCB has a (referenced) peak flow rate of 144 cfs in the 100-year storm event. There is a secondary pipe near the culvert, which has inlets up above it for street area nuisance flow. Flow from the RCB and the other minor pipe discharge runoff flow just west of the subject site, into runoff basin EX1. Runoff flow from basin EX1, along with the flow from the RCB and pipe combine with flow from basin PNR at point CP1. At point CP1, it is currently discharged along the US95 embankment to the southeast. However, for clarity in the subject study, the basin is shown to drain to the northeast, along a future berm, which will be constructed with the MPU facility along the US95. Flow from basin EXOFN will combine with flow from point CP1 at point CP3. Point CP3 is located at the future opening to the MPU system which is planned along the US95 highway.

To summarize, in existing conditions in this subject study, runoff flow from all basins studied is combined at point CP3, where it will enter a future 48" pipe and flow into the MPU facility in the future.

3.3 Offsite Existing Conditions

Again referring to *Figure 3, Existing Conditions Drainage Basins*, the subject site is not necessarily bound by Oso Blanca Road on the south, since the public property extends northerly beyond the actual street improvements. There is an existing storm drain pipe in Oso Blanca Road near the subject site. The storm drain system is cited from the *TDS for Centennial Hills Transit Center Park and Ride* to be a 10-year storm drain system, having a peak flow rate of 52 cfs. This storm drain is a 30-inch diameter pipe, and is intended to drain into the MPU facility in the future. The same drainage study is referenced for surface street flows in Oso Blanca Road near the subject site.

The only other runoff flow from offsite are the two culverts which discharge runoff flow just west of the property line of the subject site. The main culvert is an existing 6'x3' RCB, which is cited to have peak flow rates of 15 cfs and 144 cfs in the 10- and 100-year storm events respectively. This information is cited from the *TDS for Remington Commercial VIII*.

4. DEVELOPED CONDITIONS DRAINAGE

4.1 Onsite Developed Conditions

Since there are no changes to the impacts from offsite assuming developed conditions, there was no need to analyze interim conditions. The developed conditions analysis creates the most conservative analysis for drainage design of the subject site.

Referring to *Figure 4, Developed Conditions Drainage Map*, the subject site becomes developed with the micro hospital building and appurtenant improvements. Runoff flow from the existing 6'x3' RCB is captured into the storm drain system by attachment of a new RCB just west of the subject site. Runoff from the existing smaller culvert, which drains nuisance flow from Durango Drive is also attached to the storm drain system. Runoff flow from area D1 is collected into the storm drain system at the western boundary of the subject site in a grated inlet. Runoff flow from the storm drain system is discharged at the downstream end (east end) of the subject site, where it combines with flow from the undeveloped offsite basin DOFN at point CP2.

Runoff flow from area PNR1 crosses the access road by a small bleeder-size pipe, where it flows through basin PNR2 and combines with flow from basins D2 and D3 at point CP1. At point CP1, runoff flow would follow the future berm and collection area to the MPU facility and flow northerly, combining with flow from point CP2 at point CP3. At point CP3, runoff flow would enter the future MPU system by way of an opening to a 48" storm drain pipe.

4.2 Offsite Developed Conditions

Again referring to *Figure 4, Developed Conditions Drainage Map*, the subject site is not necessarily bound by Oso Blanca Road on the south, since the public property extends northerly beyond the actual street improvements. There is an existing storm drain pipe in Oso Blanca Road near the subject site. The storm drain system is cited from the *TDS for Centennial Hills Transit Center Park and Ride* to be a 10-year storm drain system, having a peak flow rate of 52 cfs. This storm drain is a 30-inch diameter pipe, and is intended to drain into the MPU facility in the future. The same drainage study is referenced for surface street flows in Oso Blanca Road near the subject site.

The only other runoff flow from offsite are the two culverts which discharge runoff flow just west of the property line of the subject site. The main culvert is an existing 6'x3' RCB, which is cited to have peak flow rates of 15 cfs and 144 cfs in the 10- and 100-year storm events respectively. This information is cited from the *TDS for Remington Commercial VIII*.

4.3 Developed Conditions Normal Depth Street Flows

Normal depth flow calculations in the adjacent streets have been analyzed to demonstrate conformance to the criteria set forth in the *Drainage Manual*. Developed conditions street flows were referenced directly from the *TDS for Remington Commercial VIII*. Street calculations are summarized on *Figure 4, Developed Conditions Drainage Map*.

It is possible that the finished floor elevation of the proposed building may need an administrative waiver of the street depth criterion since the building is not much higher in elevation than Oso Blanca Road (and much lower than the NDOT improvements).

4.4 Developed Conditions Normal Depth Onsite Flows

Normal depth flow calculations in the onsite drainage pathways have been analyzed to demonstrate conformance to the criteria set forth in the *Drainage Manual*. Calculations were made at the worst-case position for onsite flows at flow Section A. Future conditions onsite normal depth calculations are summarized on *Figure 4, Developed Conditions Drainage Map*.

4.5 Lower Impact Development

Proposed grading design incorporates features intended to conform to section 1500 of the *Drainage Manual*; most specifically the table at the top of page 1516 of the *Drainage Manual*. Impervious areas, pavement and roofs, drain through landscape areas / BMP swales prior to discharge into the public right-of-way. Onsite areas each drain to separate BMP landscape swales before entering public right-of-way.

4.6 Inlet Calculations

The grated inlet was sized using the Bentley FlowMaster, which is in concurrence with the HEC22 method. Calculations are included in the appendix and are all hydraulic calculations are summarized on *Figure 4, Developed Conditions Drainage Map*.

5. CONCLUSIONS & RECOMMENDATIONS

This study and improvement drawings complies with the drainage laws and regulations set forth by the City of Las Vegas and the Clark County Regional Flood Control District.

Development of this site is not expected to have a negative drainage impact on any upstream or downstream properties.

The site is adequately protected from flood damage caused by a 100-year flood or less, as specified by the *CCRFGD Hydrologic Criteria and Drainage Design Manual*.

This site is not within a Special Flood Hazard Zone as designated by FEMA.

The site discharges nuisance runoff flow into BMP drainage swales before discharging to public rights-of-way.

7. REFERENCES

1. **Hydrologic Criteria and Drainage Design Manual**. Clark County Regional Flood Control District, 1990.
2. **USCS Web soil survey <http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>**
3. **FlowMaster Version 5.13**, dated 1994-1995. Prepared by Bentley Systems Inc.

REFERENCED DRAINAGE STUDIES:

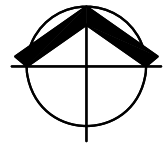
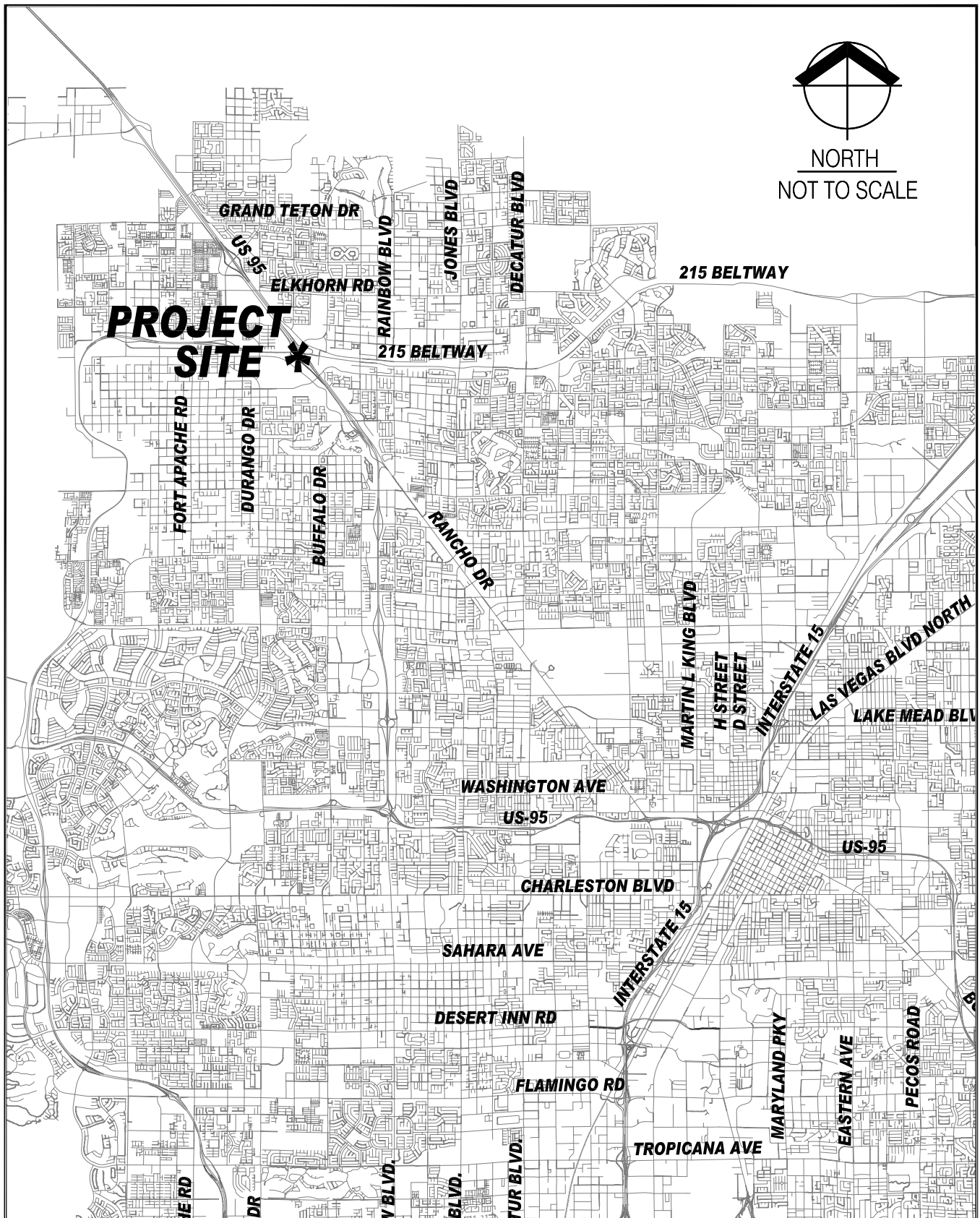
4. **Technical Drainage Study for Remington Commercial VIII (AKA Update to Durango and 95 Commercial)**, by Baughman & Turner, Inc., November 2015 - City of Las Vegas #DS4743.
5. **Technical Drainage Study for Centennial Hills Transit Center and Park and Ride**, by TCUPP & Associates, April 2009 - City of Las Vegas #DS4356.
6. **Technical Drainage Study for Centennial Parkway Channel West, US95, 215 to Durango**, by CH2M, (Pre-final)February 2017.



APPENDIX



FIGURES



NORTH
NOT TO SCALE

**PROJECT
SITE ***

RIETZ
CONSULTING INC.

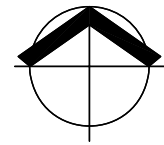
3060 E. POST ROAD, #110
LAS VEGAS, NEVADA 89120
PH: 702.521.3355
FX: 702.891.5397

CAPROCK HOSPITAL

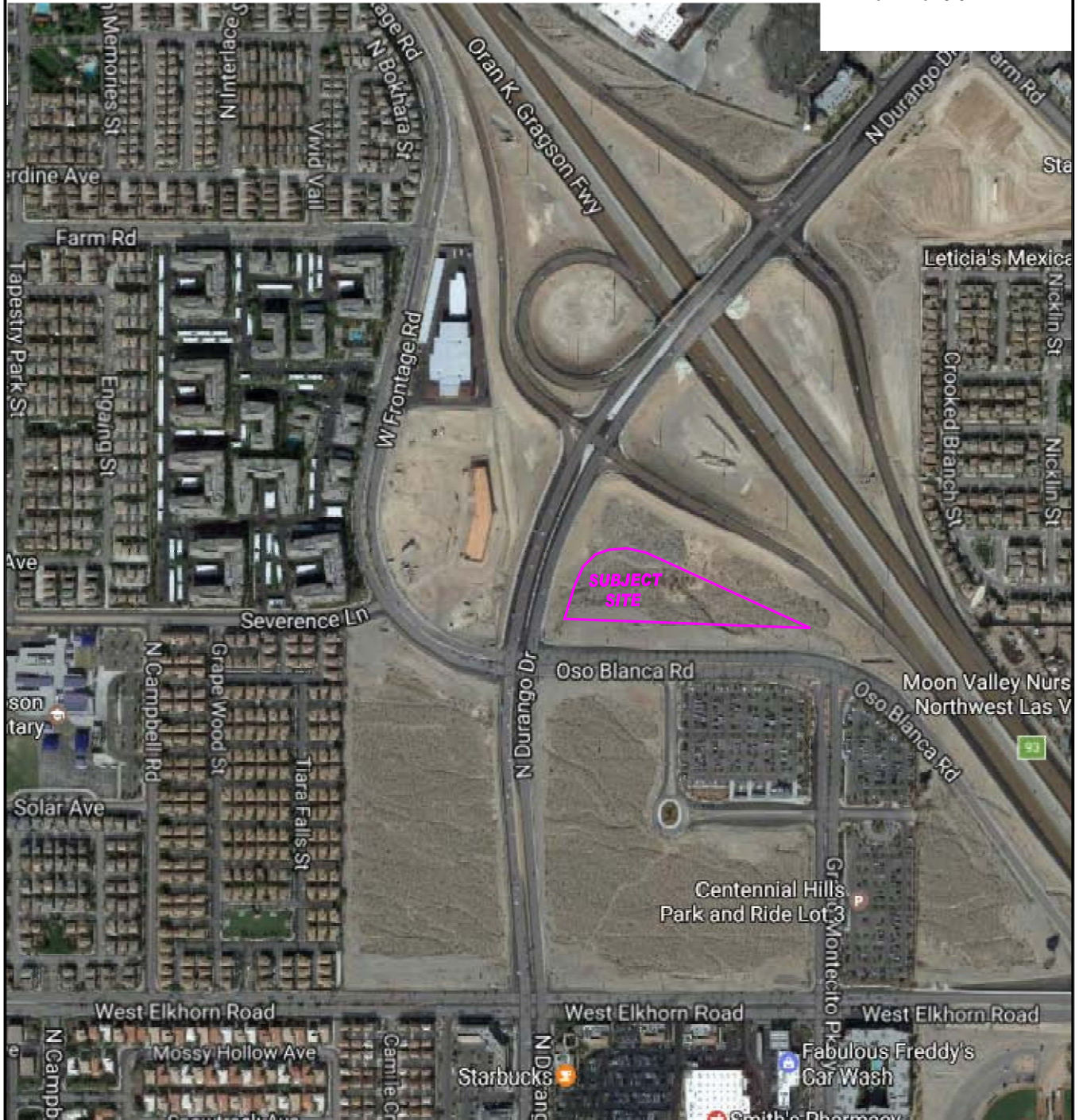
VICINITY MAP

FIGURE

1



NORTH
NOT TO SCALE



RIETZ
CONSULTING INC.

3060 E. POST ROAD, #110
LAS VEGAS, NEVADA 89120
PH: 702.521.3355
FX: 702.891.5397

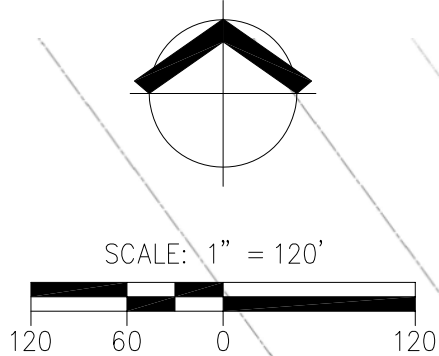
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LOCATION MAP

FIGURE

2

NORMAL DEPTH FLOW CALCULATIONS					
HYDRAULIC SECTION	SLOPE, %	Q ₁₀ / Q ₁₀₀ CFS	D ₁₀ / D ₁₀₀ , FEET	V ₁₀ / V ₁₀₀ , FPS	V ₁₀ * D ₁₀ / V ₁₀₀ * D ₁₀₀
*1 - Oso Blanca Road	2.93	NA / 4	NA / 0.33	NA / 3.6	NA / 1.3
6/28/2017					
*Half-street calculation referenced from TDS for Centennial Hills Transit Center, Park & Ride, DS 4356, 2009.					



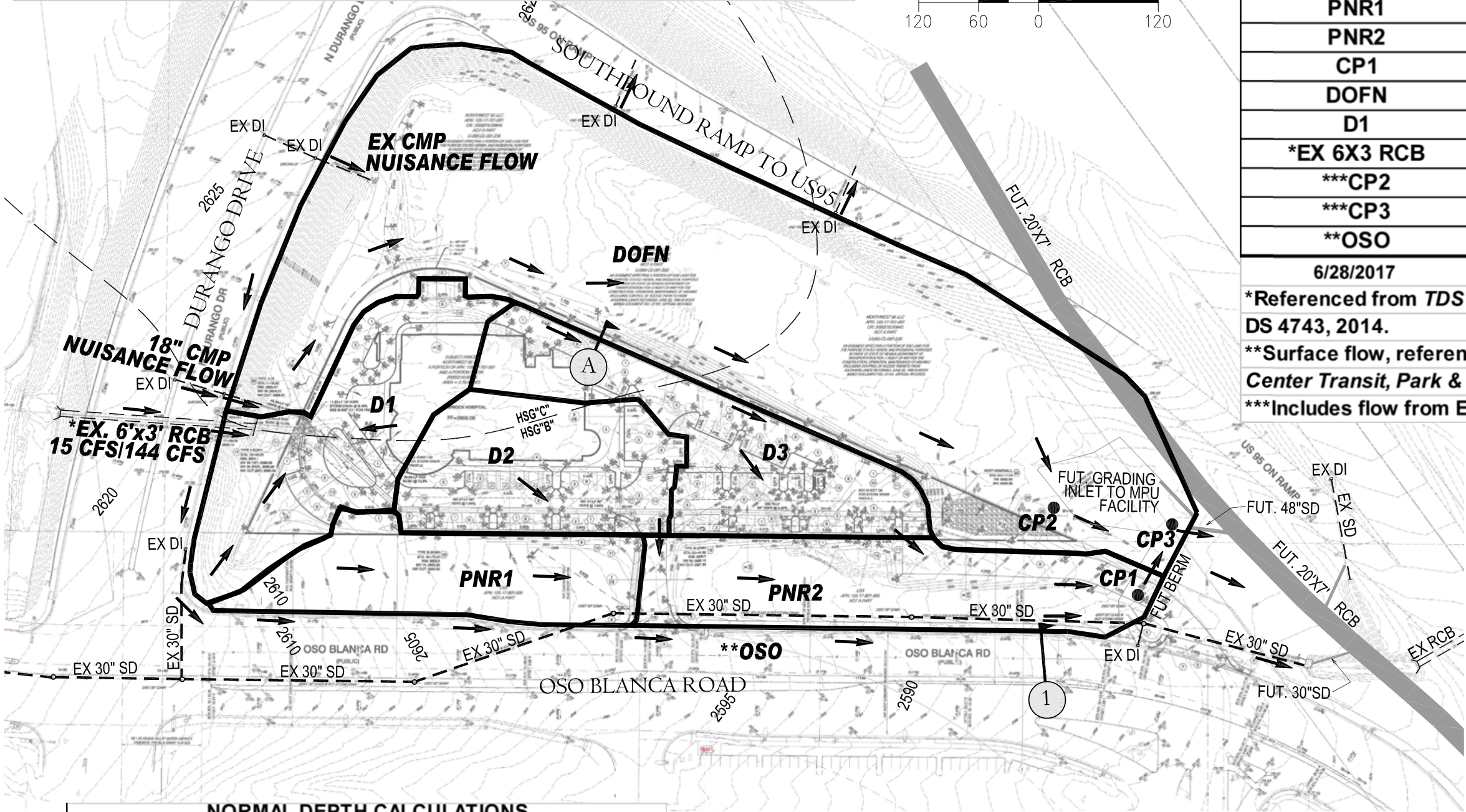
SUMMARY OF PEAK FLOW RATES DEVELOPED CONDITIONS			
CONC. POINT/ DRAINAGE AREA	AREA, ACRES	PEAK FLOW, CFS	
		10-YR	100-YR
D2	0.81	1	3
D3	0.93	2	3
PNR1	0.77	<1	1
PNR2	1.01	1	2
CP1		4	9
DOFN		3	9
D1	1.03	2	3
*EX 6X3 RCB		15	144
***CP2		19	156
***CP3		23	165
**OSO		<1	4

6/28/2017

*Referenced from TDS for Remington Commercial VIII, DS 4743, 2014.

**Surface flow, referenced from TDS for Centennial Hills Center Transit, Park & Ride, DS 4356, 2009.

***Includes flow from EX6X3 RCB



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

NORMAL DEPTH CALCULATIONS					
HYDRAULIC SECTION LABEL	DESCRIPTION	SLOPE, PERCENT	Q ₁₀₀ CFS	D ₁₀₀ FEET	V ₁₀₀ FPS
A	Onsite Gutter, worst case	1.00	3	0.33	2.0

RIETZ
CONSULTING INC.
3060 E. POST ROAD, #110
LAS VEGAS, NEVADA 89120
PH: 702.521.3355
FX: 702.891.5397

CAPROCK HOSPITAL
DEVELOPED CONDITIONS
DRAINAGE MAP

FIGURE
4



CURRENT ZONING CONDITIONS



**LAS VEGAS
CITY COUNCIL**

Carolyn G. Goodman
Mayor

Steven D. Ross
Mayor Pro Tem
Lois Tarkanian
Ricki Y. Barlow
Stavros S. Anthony
Bob Coffin
Bob Beers

Elizabeth N. Fretwell
City Manager

**DEPARTMENT OF
PLANNING**

Thomas A. Perrigo
Director

DEVELOPMENT
SERVICES CENTER
333 N. RANCHO DRIVE
3RD FLOOR
LAS VEGAS, NV 89106
702.229.6301
702.474.0352 | FAX
TTY 711

   
cityoflasvegas
lasvegasnevada.gov

June 14, 2017

Northwest 95 LLC
3455 Cliff Shadows Pkwy.
Las Vegas, Nevada 89129

**RE: SDR-70240 [PRJ-70056] - SITE DEVELOPMENT PLAN REVIEW
PLANNING COMMISSION MEETING OF JUNE 13, 2017**

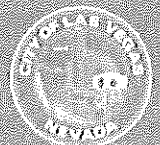
Dear Applicant:

Your request for a Site Development Plan Review FOR A PROPOSED TWO-STORY, 28,118 SQUARE-FOOT HOSPITAL WITH A WAIVER TO ALLOW A FOUR-FOOT LANDSCAPE BUFFER ALONG A PORTION OF THE SOUTH PROJECT BOUNDARY WHERE EIGHT FEET IS REQUIRED on a 2.79-acre portion of 15.78 acres at the northeast corner of Oso Blanca Road and Durango Drive (APN 125-17-701-001), T-C (Town Center) Zone [SC-TC (Service Commercial - Town Center Special Land Use Designation), Ward 6 (Ross) [PRJ-70056], was considered by the Planning Commission on June 13, 2017.

The Planning Commission voted to **APPROVE** your request, subject to the following:

Planning

1. Conformance to the Conditions of Approval for Rezoning (Z-0076-98).
2. This approval shall be void two years from the date of final approval, unless exercised pursuant to the provisions of LVMC Title 19.16. An Extension of Time may be filed for consideration by the City of Las Vegas.
3. All development shall be in conformance with the site plan, landscape plan, and building elevations, date stamped 04/27/17, except as amended by conditions herein.
4. A Waiver from Title 19.08.040 is hereby approved, to allow a four-foot perimeter landscape buffer along the south property line where eight feet is required.
5. All necessary building permits shall be obtained and final inspections shall be completed in compliance with Title 19 and all codes as required by the Department of Building and Safety.



6. These Conditions of Approval shall be affixed to the cover sheet of any plan set submitted for building permit.
7. A technical landscape plan, signed and sealed by a Registered Architect, Landscape Architect, Residential Designer or Civil Engineer, must be submitted prior to or at the same time application is made for a building permit. A permanent underground sprinkler system is required, and shall be permanently maintained in a satisfactory manner; the landscape plan shall include irrigation specifications. Installed landscaping shall not impede visibility of any traffic control device. The technical landscape plan shall indicate a row of 24-inch box Chinese Pistache trees (or similar drought tolerant trees) and four five-gallon shrubs per tree in the space between rockery walls along the northern development boundary.
8. A fully operational fire protection system, including fire apparatus roads, fire hydrants and water supply, shall be installed and shall be functioning prior to construction of any combustible structures.
9. All City Code requirements and design standards of all City Departments must be satisfied, except as modified herein.

Public Works

10. Assessor's Parcel Number (APN) 125-17-801-005 is owned by the Bureau of Land Management (BLM) and the City has a BLM grant (N-73902) for roadway, sewer, drainage, access, and landscaping within this parcel. Prior to approval of construction drawings for this site, obtain the necessary easements or provide proof of legal rights to construct improvements on BLM property not covered by the City's BLM grant.
11. Construct a paved vehicular and pedestrian access from Oso Blanca Road to this site crossing Assessor's Parcel Number (APN) 125-17-801-005 concurrent with onsite development activities.
12. All private improvements and landscaping installed with this project shall be situated and maintained so as to not create sight visibility obstructions for vehicular traffic at all development access drives and abutting street intersections.
13. Meet with the Sanitary Sewer Planning Section of the Department of Public Works to determine an acceptable connection point to the 24-inch diameter sewer interceptor in Durango Drive. Comply with the recommendations of the Sanitary Sewer Planning Section.

SDR-70240 [PRJ-70056] - Page Four
June 14, 2017

For additional information on appeals or review requests submitted please access <http://www.lasvegasnevada.gov/CheckStatus/DevelopmentApp.htm>, or contact the Department of Planning and Development at 702.229.6301 after **June 26, 2017**. No building permits or business licenses related to these items shall be issued prior to the expiration of the required ten day waiting period, or until any filed appeal is resolved pursuant to LVMC Title 19.18.

Sincerely,



Steve Gebeke, AICP
Planning Supervisor
Case Planning Division

SG:nl

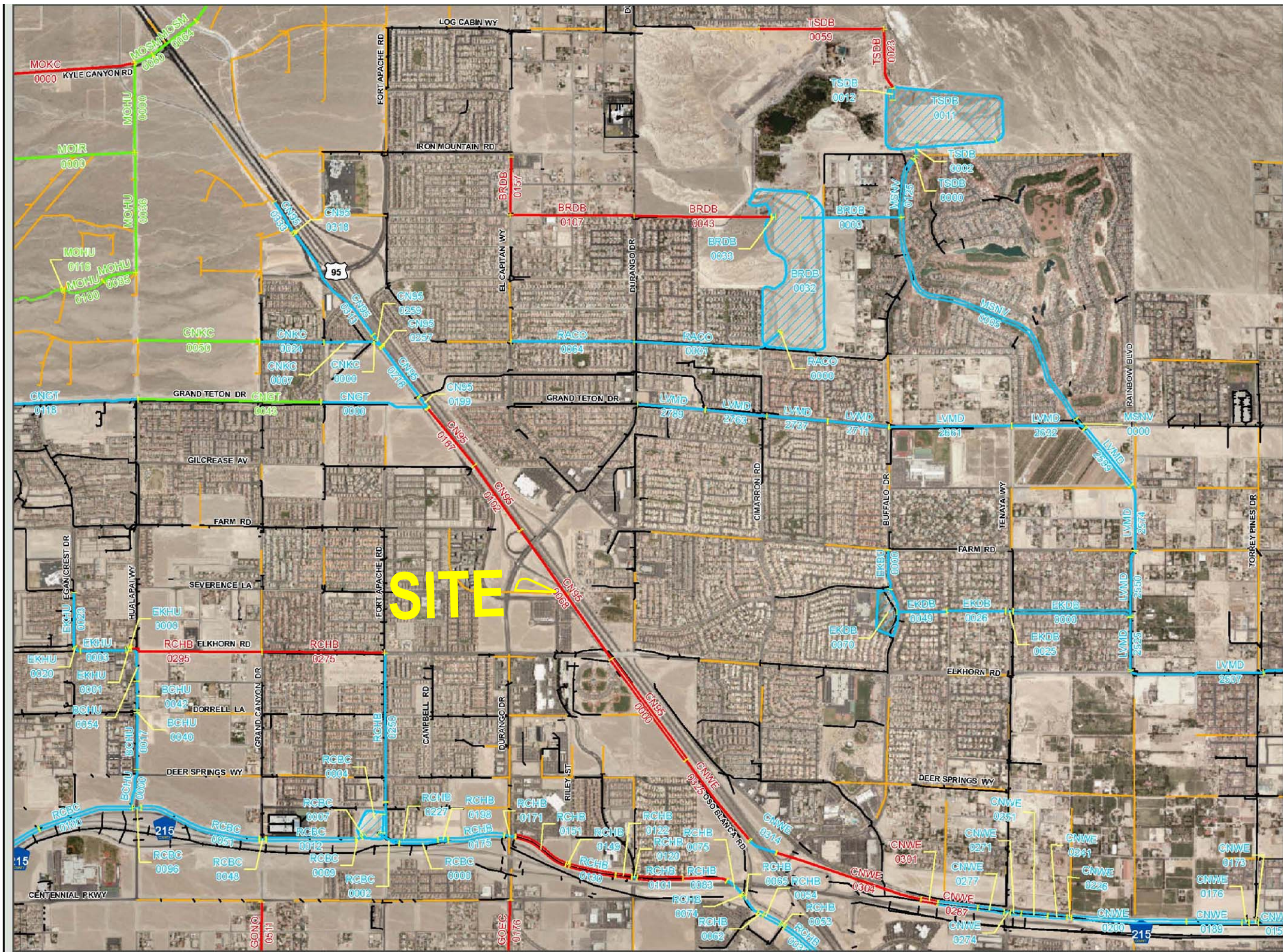
cc:

Mr. Marcos Rosales
Caprock Emergency Holdings LLC
One Moment Blvd., Ste. 100
College Station, Texas 77845

Mr. Geroge Garcia
G.C. Garcia, Inc.
1055 Whitney Ranch Dr., Ste. 210
Henderson, Nevada 89014



SUPPORTING DOCUMENTS



2013
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE

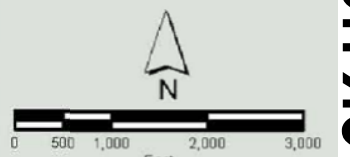
FIGURE F- 13
FLOOD CONTROL FACILITIES

LEGEND

- Ultimate Development Boundary
- Existing Facilities
- Category A Proposed Facilities
- Category B Proposed Facilities
- Local Existing Facilities
- Local Proposed Facilities
- Detention Basin

- Stormdrain
- Lined Channel
- Unlined Channel
- Levee/Dike
- Natural Wash/Floodway
- ID-Mile Separator

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



Refer to Figure G-2 for Aerial Source(s)

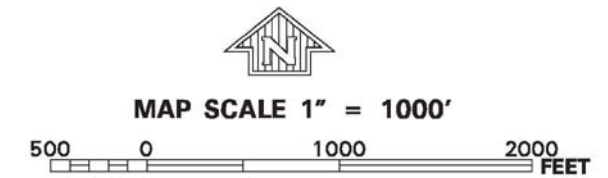
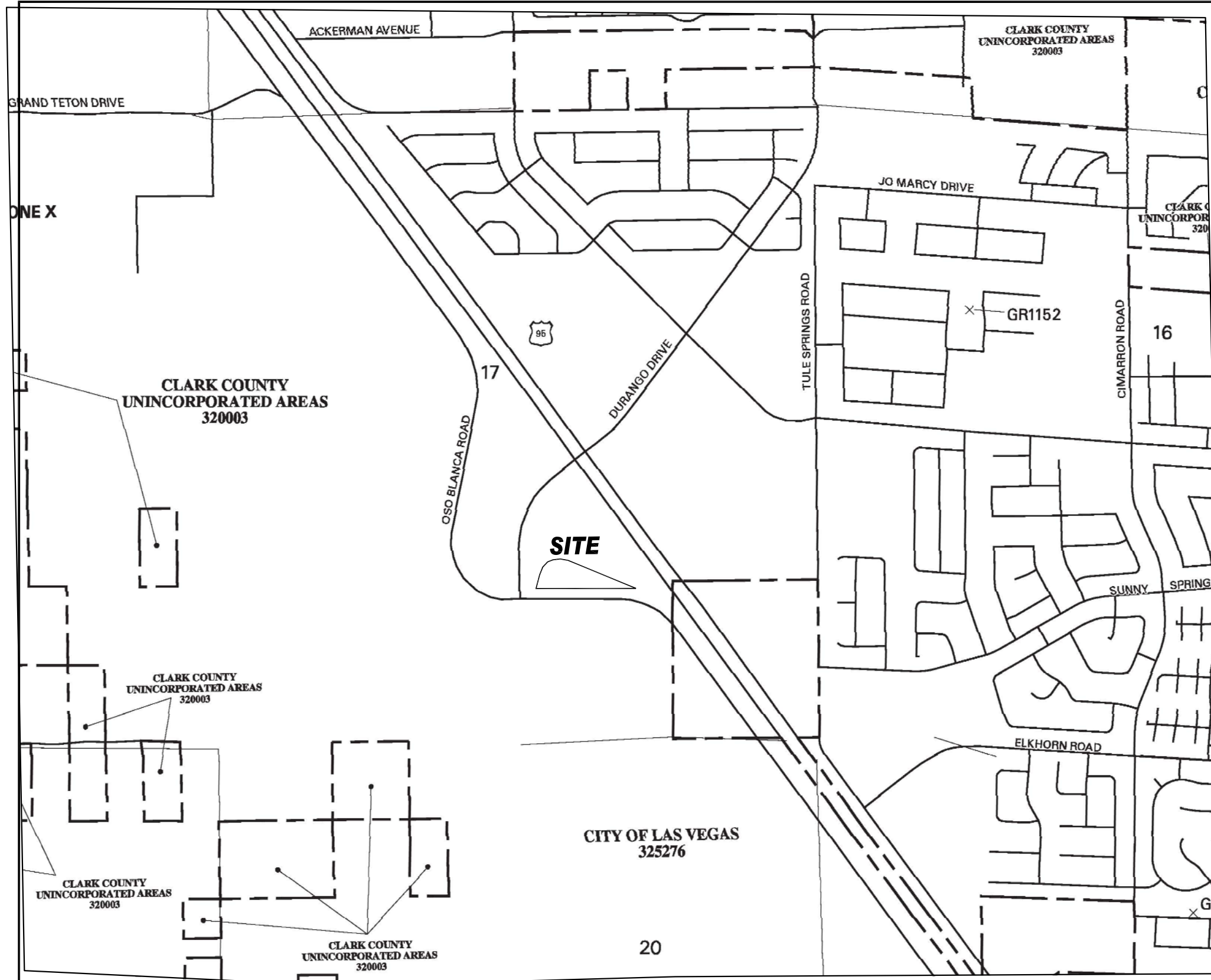


CAPROCK HOSPITAL APN 125-17-701-001

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
BCHU		BELTWAY CHANNEL - HUALAPAI						
0000	E	12' X 5' RCAP	853	501	CBA3-C	WEST3	0.84	1.11
0017	E	8' X 5' RCAP	1216	501	CBA3-C	WEST3	0.84	1.33
0040	E	66" RCP	60	222	DNW26-C	WEST3	0.51	1.04
0042	E	60" RCP	615	222	DNW26-C	WEST3	0.51	1.42
0054	E	54" RCP	770	222	DNW26-C	WEST3	0.51	1.23
BRDB		BRENT DRAINAGE SYSTEM						
0000	E	36" RCP with 18" Orifice Plate	2170	37	BRDB	WEST3	2.48	0.40
0031	E	45,080 cfs PMF Spillway		45080	CBRDB	WEST3	2.48	
0032	E	450 ac-ft South Environmental Enhancement Area		1902	CBRDB	WEST3	2.48	
0033	E	Energy Dissipator	100	957	CNW113-C	WEST3	1.58	
0043	P1	8' X 6' RCB	2920	957	CNW113-C	WEST3	1.58	2.10
0107	P1	8' X 6' RCB	2660	957	CNW113-C	WEST3	1.58	2.40
0157	P1	12' X 6' RCB	1260	741	CNW96-C	WEST3	0.95	0.25
CN95		CENTENNIAL PKWY CHANNEL WEST / U.S 95 BRANCH						
0000	P1	Conc Chnl 22"W 10"D 0:1 SS	2690	3340	CNWBB3-C	WEST3	3.36	2.17
0068	P1	3: 8' X 7" RCB	3380	3216	CNW103-C	WEST3	3.05	2.12
0102	P1	3: 8' X 6" RCB	1710	2888	2CNW89-C	WEST3	2.66	2.09
0167	P1	2: 10' X 6' RCB	1580	2160	2CNW71-E	WEST3	1.64	1.50
0199	E	2: 10' X 6' RCB	320	1423	2CNW72-C	WEST3	1.14	0.82
0218	E	15' X 9' RCB	1127	1423	2CNW72-C	WEST3	1.14	0.82
0257	E	Transition Structure	59	1423	2CNW72-C	WEST3	1.14	0.77
0259	E	15' X 9' RCB	290	653	CNW74-C	WEST3	0.44	0.77
0313	E	10' X 6' RCB	2680	653	CNW74-C	WEST3	0.44	2.50
0318	E	Transition Structure	60	653	CNW74-C	WEST3	0.44	1.50
0333	E	5' X 5' RCB	670	339	NW62-S	WEST3	0.22	1.50
CNGT		CENTENNIAL PKWY CHANNEL WEST / GRAND TETON BRANCH						
0000	E	10' X 5' RCB	2376	600	CNW71-E	WEST3	0.47	2.58
0043	P0	6' X 6' RCB	3980	600	CNW71-E	WEST3	0.47	3.00
0118	E	6' X 5' RCAP	5472	363	KYLEDET*	KYLEDB	57.73	3.72
CNKC		CENTENNIAL PKWY CHANNEL WEST / KYLE CANYON BRANCH						
0000	E	12' X 4' RCB	377	999	CNW72-C	WEST3	0.71	4.58
0007	E	10' X 5' RCB	874	999	CNW72-C	WEST3	0.71	3.28
0024	E	8' X 5' RCB	1385	999	CNW72-C	WEST3	0.71	2.40
0050	P0	84" RCP	2610	854	CNW72-C	WEST3	0.71	3.60
CNWE		CENTENNIAL PKWY CHANNEL WEST						
0150	E	Conc Chnl 40"W 9.5"D 0:1 SS	2279	4233	CNW3B3-C	WEST3	5.64	0.42
0173	E	3: 18' X 8' RCBC @ Torrey Pines	200	4233	CNW3B3-C	WEST3	5.64	0.42
0176	E	Conc Chnl 40"W 9"D 0:1 SS	150	4233	CNW3B3-C	WEST3	5.64	0.41
0189	E	Conc Chnl 36"W 10"D 0:1 SS	1200	4067	CNW2D4-C	WEST3	5.15	0.42
0200	E	Conc Chnl 36"W 9"D 0:1 SS	2470	4067	CNW2D4-C	WEST3	5.15	1.00
0226	E	2: 18' X 8.5' RCBC @ Rio Vista	100	4067	CNW2D4-C	WEST3	5.15	0.51
0241	E	Conc Chnl 36"W 9.5"D 0:1 SS	405	3951	CNW2D3-C	WEST3	4.65	0.51
0251	E	Conc Chnl 36"W 9"D 0:1 SS	575	3951	CNW2D3-C	WEST3	4.65	0.51
0271	E	Conc Chnl 32"W 10"D 0:1 SS	229	3951	CNW2D3-C	WEST3	4.65	0.51
0274	E	32' X 10' RCBC @ Tenaya	142	3951	CNW2D3-C	WEST3	4.65	0.51
0277	E	Conc Chnl 32"W 9"D 0:1 SS	579	3951	CNW2D3-C	WEST3	4.65	0.64
0287	E	Conc Chnl 13"W 10"D 2:1 SS	605	3593	CNW2B2-C	WEST3	3.84	1.19
0301	P2	Conc Chnl 32"W 10"D 0:1 SS	235	3593	CNW2B2-C	WEST3	3.84	1.19
0304	P2	32' X 10' RCB	3259	3593	CNW2B2-C	WEST3	3.84	1.79
0314	E	22' X 7' RCB	785	3593	CNW2B2-C	WEST3	3.84	1.79
0325	P1	32' X 10' RCB	2200	3593	CNW2B2-C	WEST3	3.84	1.75
EKBU		ELKHORN SPRINGS AND BUFFALO						
0000	E	60" RCP	1046	375	NW134-C	WEST3	0.46	1.00
EKDB		ELKHORN SPRINGS DETENTION BASIN						
0000	E	Grass Chnl 15"W 5.8"D 3.5:1 SS	2575	238	CNW150-C	WEST3	1.41	0.39
0025	E	4' X 3' RCB	160	120	ELKBASIN	WEST3	0.84	0.50
0026	E	48" RCP	1270	120	ELKBASIN	WEST3	0.84	1.23
0049	E	60" RCP	1095	120	ELKBASIN	WEST3	0.84	0.13
0070	E	48 ac-ft Elkhorn Springs Detention Basin		629	CNW133-C	WEST3	0.84	
ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
EKHU		ELKHORN AND HUALAPAI						
0000	E	6' X 5' RCB Overflow Structure	48	638	CNW26-C	WEST3	0.51	0.91
0001	E	6' X 5' RCAP	72	638	CNW26-C	WEST3	0.51	0.91
0003	E	6' X 4' RCAP	980	638	CNW26-C	WEST3	0.51	3.61
0020	E	6' X 5' RCAP	150	638	CNW26-C	WEST3	0.51	3.61
0023	E	8' X 5' RCAP	1200	638	CNW26-C	WEST3	0.51	0.90
GOEC		GOWAN NORTH - EL CAPITAN BRANCH						
0176	P1	78" RCP	1320	363	CCPFR-C	ALLGOW3	0.46	1.15
GONO		GOWAN NORTH SYSTEM						
0511	P1	7' X 6' RCB	1320	546	CCPHW-C	ALLGOW3	0.60	1.14
LVMD		LAS VEGAS WASH - MIDDLE						
2490	E	2: 13' X 7' RCB	2555	2278	CNW168-C	CWEST3	4.69	0.40
2507	E	2: 13' X 9' RCB	2831	2278	CNW168-C	CWEST3	4.69	0.36
2525	E	24' X 8' RCB	1140	1913	CNW159-C	CWEST3	3.91	0.40
2550	E	24' X 8' RCB	1445	1664	CD161-C	CWEST3	3.41	0.40
2574	E	24' X 8' RCB	1430	1664	CD161-C	CWEST3	3.41	0.40
2599	E	Conc Chnl 24"W 7"D 2:1 SS	1577	1585	CNW162-C	CWEST3	3.08	0.50
2632	E	18' X 5' RCB	1580	968	CNW138-C	WEST3	1.16	0.46
2661	E	18' X 5' RCB	2640	968	CNW138-C	WEST3	1.16	0.46
2711	E	10' X 5' RCB	1320	968	CNW138-C	WEST3	1.16	1.54
2737	E	10' X 5' RCB	1320	818	CNW139-C	WEST3	0.93	2.22
2763	E	6' X 5' RCB	1320	818	CNW139-C	WEST3	0.93	1.79
2789	E	6' X 5' RCB	1470	818	CNW139-C	WEST3	0.93	2.17
MOHU		MOCCASIN - HUALAPAI BRANCH						
0000	P0	14' X 8' RCB	1920	761	2CNW45-N	LOWER3	2.10	0.50
0036	P0	10' X 8' RCB	2590	368	CNW45-N	LOWER3	1.15	0.50
0085	P0	72" RCP	790	368	CNW45-N	LOWER3	1.15	3.00
0100	P0	Natural Wash	850	65	DMODB1	LOWER3	0.81	3.00
0116	P0	60" RCPC	12	65	DMODB1	LOWER3	0.81	3.00
0118	P0	Natural Wash	3485	65	DMODB1	LOWER3	0.81	3.00
MOIR		MOCCASIN - IRON MOUNTAIN BRANCH						
0000	P0	66" RCP	2770	446	2CNW33-C	LOWER3	1.76	3.60
MOKK		MOCCASIN AND KYLE CANYON						
0000	P1	11' X 8' RCB	5450	2662	CNW35-C	LOWER3	2.69	3.40
MOSM		MOCCASIN AND SHEEP MOUNTAIN PARKWAY						
0000	P0	14' X 9' RCB	3370	3778	CNW64-C	LOWER3	5.32	2.40
0064	P0	14' X 8' RCB	880	3505	CNW50-C	LOWER3	4.99	3.00
0080	P0	14' X 8' RCB	710	3325	2CNW35-C	LOWER3	4.80	3.00
MSNV		MOUNTAIN SPA/VISTA RANCH						
0000	E	6: 12' X 5' RCBC @ Grand Teton	273	679	CNW163-C	CWEST3	1.67	0.40
0005	E	Grass Chnl 100"W 4.5"D 10:1 SS	6325	679	CNW163-C	CWEST3	1.67	0.40
0125	E	Grass Chnl 100"W 4.5"D 10:1 SS	1300	116	CNW147E	WEST3	1.54	0.40
RACO		RACEL STREET COLLECTOR						
0000	E	96" RCP Baffled Energy Dissipator	54	497	CNW111S	WEST3	0.55	4.20
0001	E	78" RCP	3245	497	CNW111S	WEST3	0.55	2.46
0064	E	78" RCP	2650	423	DNW111S	WEST3	0.44	2.09
RCBC		RANCHO ROAD SYSTEM - BELTWAY CHANNEL						
0000	E	6' X 5' RCB	1062	222	FADB	WEST3	1.60	1.04
0002	E	54" RCP Outlet with 41" Orifice	503	222	FADB	WEST3	1.60	2.38
0003	E	2,341 cfs PMF Spillway		2341	FADBIN	WEST3	1.60	
0004	E	76 ac-ft Fort Apache Detention Basin		1255	FADBIN	WEST3	1.60	
0007	E	Energy Dissipator	100	1255	FADBIN	WEST3	1.60	
0009	E	12' X 6' RCBC @ Fort Apache Detention Basin	133	1255	FADBIN	WEST3	1.60	1.79
0012	E	Conc Chnl 12"W 6'-7"D 0:1 SS	1937	1255	FADBIN	WEST3	1.60	3.15
0048	E	12' X 6' RCBC @ Grand Canyon	140	1040	CMNA1	WEST3	1.32	3.15
0051	E	Conc Chnl 12"W 6'-8"D 0:1 SS	2660	1040	CMNA1	WEST3	1.32	3.44
0096	E	1: 10' X 6' and 1: 6' X 6' RCBC @ Hualapai Way	190	1040	CMNA1	WEST3	1.32	1.93
0100	E	Conc Chnl 12"W 5.5"D 0:1 SS	2085	598	CDMNA1	WEST3	0.48	2.88
0140	E	Conc Chnl 10"W 5"D 0:1 SS	2155	598	CDMNA1	WEST3	0.48	1.65
ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
RCHB		RANCHO ROAD SYSTEM - BELTWAY						
0034	E	Conc Chnl 21"W 8'D 0:1 SS	1000	2631	CNW1C-W	WEST3	4.68	1.19
0053	E	2: 12' X 8' RCBC @ South Ramp Connector	85	2304	CDW1C1	WEST3	4.31	1.40
0054	E	Conc Chnl 21"W 8'D 0:1 SS	432	2304	CDW1C1	WEST3	4.31	1.51
0062	E	Transition Structure	130	2304	CDW1C1	WEST3	4.31	1.51
0065	E	24' X 7' RCB	480	2304	CDW1C1	WEST3	4.31	0.30
0074	E	24' X 6' RCB	50	2226	CNWBC6-C	WEST3	4.17	0.30
0075	E	20' X 6' RCBC @ Beltway	428	2226	CNWBC6-C	WEST3	4.17	2.81
0083	P1	20' X 6' RCB	950	2226	CNWBC6-C	WEST3	4.17	2.49
0101	P1	Conc Chnl 20"W 7'D 0:1 SS	980	2226	CNWBC6-C	WEST3	4.17	2.38
0120	E	20' X 6' RCBC @ Grand Montecito	120	2226	CNWBC6-C	WEST3	4.17	1.00
0122	P1	Conc Chnl 16'-20"W 6'D 0:1 SS	350	2226	CNWBC6-C	WEST3	4.17	1.84
0130	P1	Conc Chnl 16"W 6'D 0:1 SS	1012	2226	CNWBC6-C	WEST3	4.17	2.67
0149	P1	Conc Chnl 16"W 6'-7"D 0:1 SS	87	1888	CNWBC3	WEST3	3.75	2.27
0151	P1	Conc Chnl 16"W 7'D 0:1 SS	1255	1888	CNWBC3	WEST3	3.75	2.65
0171	E	16' X 6' RCBC @ El Capitan Way	234	1888	CNWBC3	WEST3	3.75	1.75
0175	E	Conc Chnl 14"W 7'D 0:1 SS	1220	1888	CNWBC3	WEST3	3.75	2.93
0198	E	Conc Chnl 14"W 7'D 0:1 SS	225	1402	CNWBA6-C	WEST3	3.61	2.93
0227	E	12' X 6' RCB	1885	1402	CNWBA6-C	WEST3	3.61	1.02
0250	E	12' X 6' RCB	3200	1402	CNWBA6-C	WEST3	3.61	1.00
0275	P1	7' X 6' RCB	2650	973	CNW66-C	WEST3	1.75	3.30
0295	P1	7' X 6' RCB	2875	973	CNW66-C	WEST3	1.75	3.30
TSDB		TULE SPRINGS DRAINAGE SYSTEM						
0000	E	2: 10' X 4' RCBC @ Echo Grande	100	26	TULEDB	WEST3	1.35	1.04
0002	E	36" RCP with 22" Orifice Plate	320	26	TULEDB	WEST3	1.35	0.33
0010	E	14,013 cfs PMF Spillway		14013	CTULEDB	WEST3	1.35	
0011	E	117 ac-ft North Environmental Enhancement Area		804	CTULEDB	WEST3	1.35	
0012	E	Energy Dissipator	260	376	CNW148-C	WEST3	0.52	
0023	P1	84" RCP	1320	376	CNW148-C	WEST3	0.52	0.80
0059	P1	78" RCP	2640	376	CNW148-C	WEST3	0.52	1.03

* The HEC-1 node shown identifies the controlling concentration point for the associated facility and is located upstream of this facility due to decreasing peak flow with increasing tributary area caused by storm distribution transitions, depth area reduction factors, or attenuation of flow from routing.

** As-built or design slopes were used when available. All other slopes are based on existing topography. The user should verify the facility slope listed prior to performing any facility specific analysis.



NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1745 E

FIRM

FLOOD INSURANCE RATE MAP

CLARK COUNTY,
NEVADA AND
INCORPORATED AREAS

PANEL 1745 OF 4090

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

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

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

MAP NUMBER
32003C1745 E

MAP REVISED:
SEPTEMBER 27, 2002

Federal Emergency Management Agency

RIETZ
CONSULTING INC.
3060 E. POST ROAD, #110
LAS VEGAS, NEVADA 89120
PH: 702.521.3355
FX: 702.891.5397

CAPROCK HOSPITAL

FEMA MAP
PANEL 1745

FIGURE
FIRM

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.

MAP LEGEND

PARCEL BOUNDARY

SUB BOUNDARY

PM/LD BOUNDARY

ROAD EASEMENT

MATCH / LEADER LINE

HISTORIC LOT LINE

HISTORIC SUB BOUNDARY

HISTORIC PM/LD BOUNDARY

SECTION LINE

CONDOMINIUM UNIT

AIR SPACE PCL

RIGHT OF WAY PCL

SUB-SURFACE PCL

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

BOOK

T19S R60E

SEC

17

MAP

N 2 SE 4

125-17-7

099

100

101

126

125

124

137

138

139

Scale: 1" = 200'

Rev: 7/2/2013

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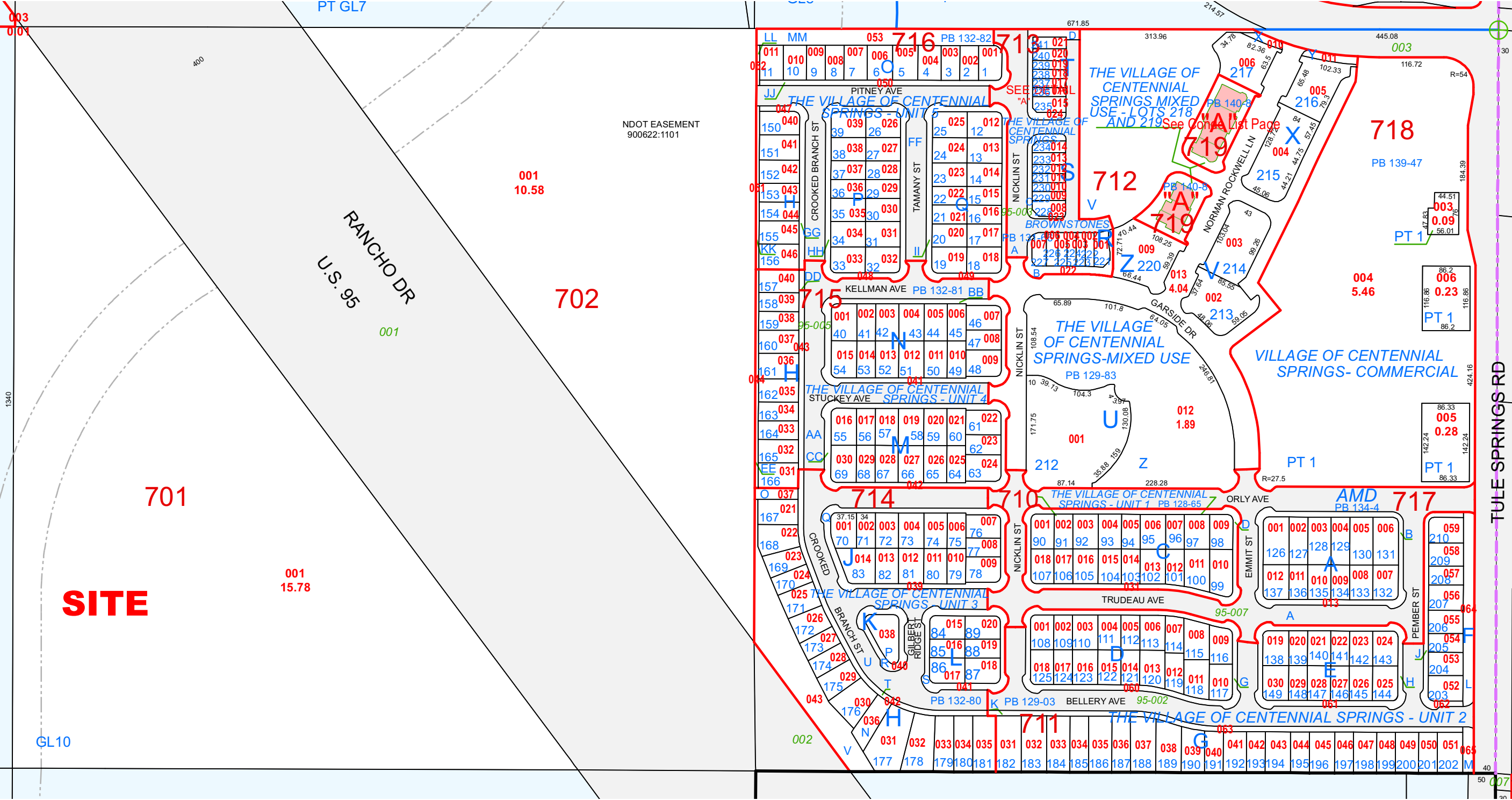
5

1

CLARK COUNTY

ASSESSOR

NEVADA





NORTHWEST
NEIGHBORHOOD
STUDY
PHASE 2

LEGEND

- SUB-BASIN BOUNDARY
- FLOW ARROW
- 250 10-YEAR STREET FLOW
500 100-YEAR STREET FLOW
300 10-YEAR FACILITY FLOW
800 100-YEAR FACILITY FLOW
(FLOWS IN CFS)

- BWJS Basin-ID
(13 / 59) Contributing flow
from the basin (cfs)

PHOTO DATE: SEPTEMBER 1998

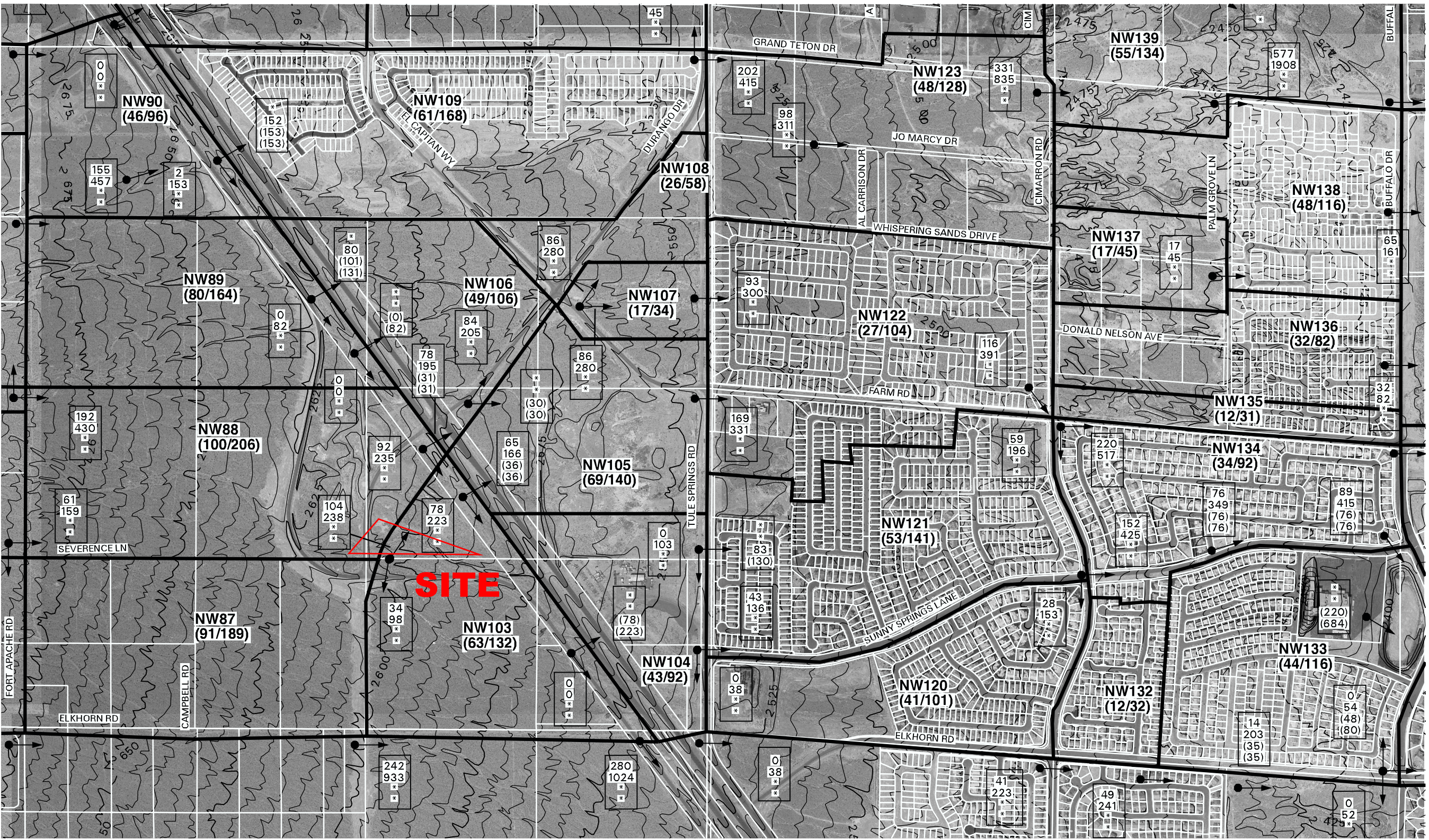
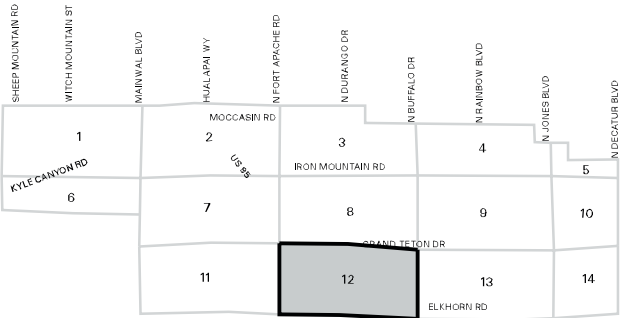


FIGURE E-12

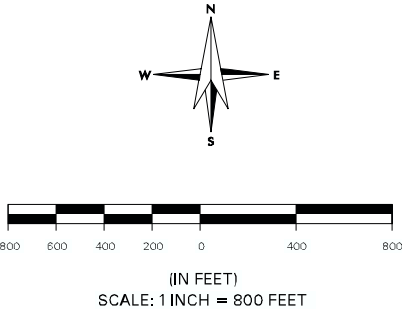
EXISTING DRAINAGE CONDITIONS

PBSI
ENGINEERING PLANNING GIS SURVEYING CONSTRUCTION SERVICES

901 North Green Valley Parkway, Suite 100
Henderson, Nevada 89014-6139
Phone: 702/263-7275
Fax: 702/263-7200



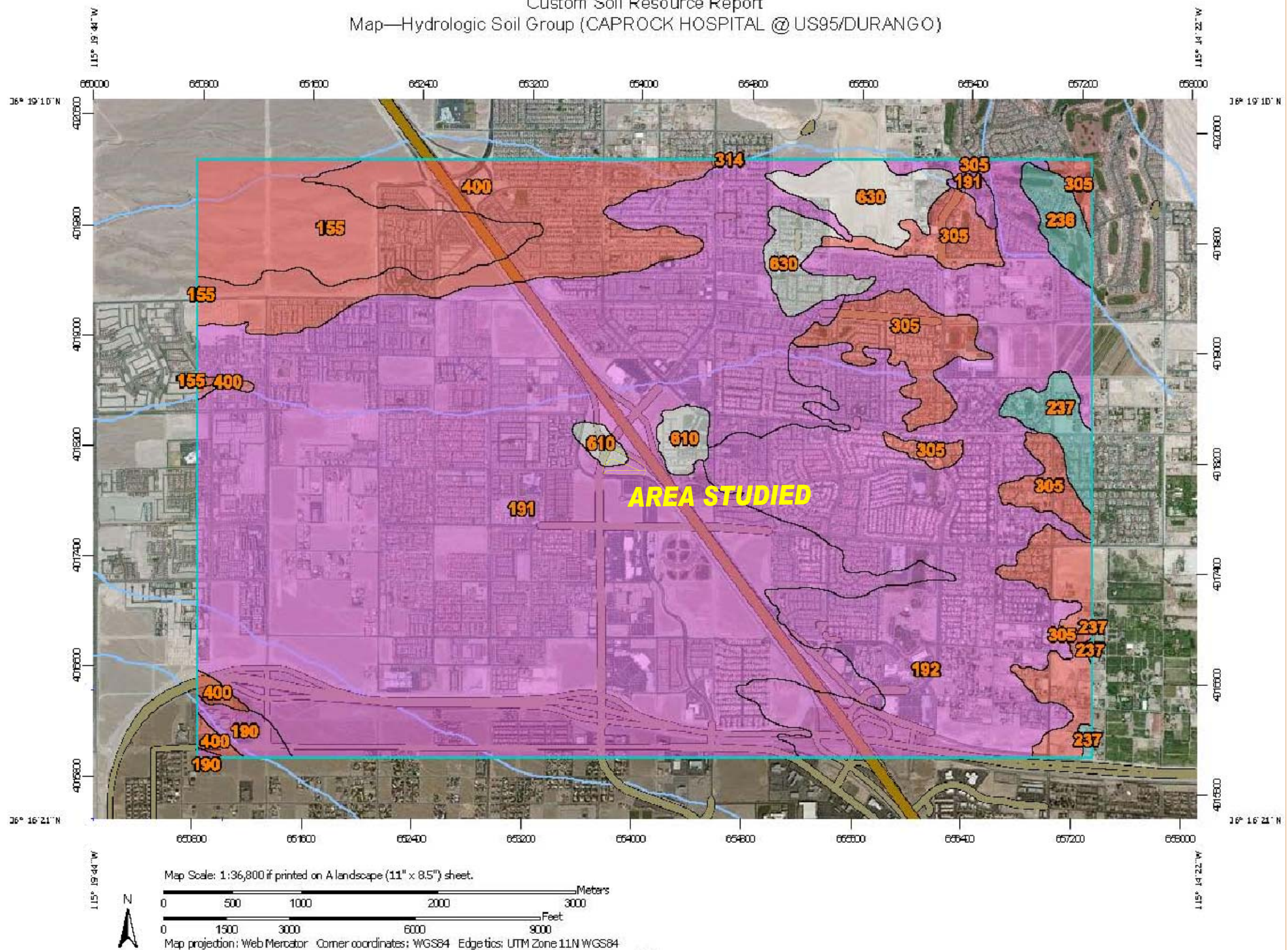
NOTE:
Existing conditions are based on future
CN values with only existing local and
CCRFCD facilities in place





HYDROLOGY

Custom Soil Resource Report
Map—Hydrologic Soil Group (CAPROCK HOSPITAL @ US95/DURANGO)



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Rating Polygons

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Lines

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Points

 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available

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.

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 11, Sep 16, 2016

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

Date(s) aerial images were photographed: May 7, 2011—Feb 25, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

**Table—Hydrologic Soil Group (CAPROCK HOSPITAL @ US95/
DURANGO)**

Hydrologic Soil Group— Summary by Map Unit — Las Vegas Valley Area, Nevada, Part of Clark County (NV788)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
155	Cave gravelly fine sandy loam, 4 to 15 percent slopes	D	371.9	5.3%
190	Dalian very gravelly fine sandy loam, 2 to 4 percent slopes	A	41.4	0.6%
191	Dalian very cobbly fine sandy loam, 2 to 8 percent slopes	A	3,717.6	53.0%
192	Dalian-McCullough complex, 0 to 4 percent slopes	A	1,530.5	21.8%
236	Glencarb very fine sandy loam, saline	C	60.2	0.9%
237	Glencarb very fine sandy loam, hardpan substratum	C	75.3	1.1%
305	Las Vegas-DeStazo complex, 0 to 2 percent slopes	D	452.7	6.5%
314	Weiser-Wechech association	A	0.0	0.0%
400	Tencee very gravelly fine sandy loam, 2 to 8 percent slopes	D	510.1	7.3%
610	Pits, gravel		58.0	0.8%
630	Badland		193.7	2.8%
Totals for Area of Interest			7,011.4	100.0%

**Rating Options—Hydrologic Soil Group (CAPROCK HOSPITAL @
US95/DURANGO)***Aggregation Method: Dominant Component**Component Percent Cutoff: None Specified**Tie-break Rule: Higher*

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.

Revision	Date

RUNOFF CURVE NUMBERS (SEMIARID RANGELANDS¹)

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

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

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

Fair: 30 to 70% ground cover.

Good: >70% ground cover.

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

Revision	Date

CURVE NUMBER DETERMINATION*

CAPROCK HOSPITAL

6/21/2017

BY B.BROWN

BASIN	HYDROLOGIC SOIL GROUP	LAND USE	CURVE NUMBER	PERCENT OF TOTAL	FINAL CN	REMARKS
PNR, PNR1	B	DESERT SHRUB	77	100	77	Table 602, 4 of 4 Semiarid Rangeland
EXOFN	C	DESERT SHRUB	85	40	85	Table 602, 4 of 4 Semiarid Rangeland
	ANY	EMBANKMENT	95	25		ASSUME CN 95 FOR MINIMAL INFILTRATION Table 602, 4 of 4
	B	DESERT SHRUB	77	35		Semiarid Rangeland
EX1	C	DESERT SHRUB	85	35	82	Table 602, 4 of 4 Semiarid Rangeland
	ANY	EMBANKMENT	95	10		ASSUME CN 95 FOR MINIMAL INFILTRATION Table 602, 4 of 4
	B	DESERT SHRUB	77	55		Semiarid Rangeland
PNR2	B	DESERT SHRUB	77	85	80	Table 602, 4 of 4 Semiarid Rangeland
	ANY	PAVEMENT	98	15		Table 602, 1 of 4 Urban districts
DOFN	C	DESERT SHRUB	85	40	82	Table 602, 4 of 4 Semiarid Rangeland
	ANY	EMBANKMENT	95	10		ASSUME CN 95 FOR MINIMAL INFILTRATION Table 602, 4 of 4
	B	DESERT SHRUB	77	50		Semiarid Rangeland
D1	C	COMMERCIAL & BUSINESS	94	40	93	Table 602, 1 of 4 Urban districts
	ANY	EMBANKMENT	95	10		ASSUME CN 95 FOR MINIMAL INFILTRATION Table 602, 1 of 4
	B	COMMERCIAL & BUSINESS	92	50		Urban districts
D2	B	COMMERCIAL & BUSINESS	92	85	92	Table 602, 1 of 4 Urban districts
	C	COMMERCIAL & BUSINESS	94	15		Table 602, 1 of 4 Urban districts
D3	B	COMMERCIAL & BUSINESS	92	70	93	Table 602, 1 of 4 Urban districts
	C	COMMERCIAL & BUSINESS	94	30		Table 602, 1 of 4 Urban districts

*Based on Clark County Regional Flood Control District Hydrologic Criteria and Drainage Design Manual, Latest update.

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL - STANDARD FORM 4

Momentum Engineers, Ltd.

6101 Kings Brook Ct.
Las Vegas NV 89149

Sub-Basin Data					Initial/Overland Time (T _i)			Travel Time (T _t)					T _c	T _c Check (Urbanized Basins)		Final T _c	T _{lag}	Remarks
DESIG (1)	CN (2)	K (3)	AREA (acres) (4)	AREA (mi ²) (5)	LENGTH (ft) (6)	SLOPE (%) (7)	T _i (min) (8)	LENGTH (ft) (9)	SLOPE (%) (10)	V ₁ (fps) (11)	V ₂ (fps) (12)	T _t (min) (13)	T _c =T _i +T _t (min) (14)	TOTAL (ft) (15)	T _c (min) (16)	T _c (min) (17)	T _{lag} (hrs) (18)	Remarks (19)
DEVELOPED CONDITION																		
D1	93	0.84	1.03	0.0016	50	1.0	3.3	70	0.50	1.43	N/A	0.8	4.2	120	10.7	4.16	0.050	
D2	92	0.82	0.81	0.0013	50	1.0	3.5	250	0.60	1.56	N/A	2.7	6.2	300	11.7	6.17	0.062	
D3	93	0.84	0.93	0.0015	50	1.0	3.3	360	2.90	3.44	N/A	1.7	5.1	410	12.3	5.08	0.051	
UNDEVELOPED CONDITION																		
PNR	77	0.63	1.82	0.0028	100	4.1	5.3	850	3.80	2.89	5.73	3.9	9.2	N/A	N/A	9.2	0.100	
EXOFN	85	0.73	4.47	0.0070	100	5.0	3.9	860	3.10	2.61	5.18	4.4	8.2	N/A	N/A	8.2	0.100	
EX1	82	0.69	3.16	0.0049	100	4.3	4.5	690	3.60	2.81	5.58	3.5	8.0	N/A	N/A	8.0	0.100	
DOFN	82	0.69	4.83	0.0075	100	5.0	4.3	950	2.30	2.24	4.46	5.4	9.7	N/A	N/A	9.7	0.100	
PNR1	77	0.63	0.77	0.0012	100	4.1	5.3	190	3.20	2.65	N/A	1.2	6.5	N/A	N/A	6.5	0.100	
PNR2	80	0.67	1.01	0.0016	100	3.8	5.0	405	3.80	2.89	N/A	2.3	7.3	N/A	N/A	7.3	0.100	

$T_i=(1.8(1.1-K)L^{1/2})/(S^{1/3})$ $T_c=T_i+T_t$ $K=0.0132(CN)-.39$ $T_{fan} = 0.6T_c$		Travel Time Velocity Formulas		All basins over one square mile are calculated by the equation $T_{lag}=20Kn(L \cdot L_c/S^{0.5})^{0.33}$ (See Worksheet).
		Existing	Developed	
		$V_1 = 14.8 \cdot (S/100)^{1/2}$	$V_1 = 20.2 \cdot (S/100)^{1/2}$	
		$V_2 = 29.4 \cdot (S/100)^{1/2}$	$V_2 = 30.6 \cdot (S/100)^{1/2}$	
For the travel time (T_i) calculations,	V_1 applies to the first 500 feet of travel distance;			
V_2 applies to the remaining travel distance.				

REFERENCE:	CCRFCD HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL	STANDARD FORM 4
------------	---	-----------------


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1*****
*
*   FLOOD HYDROGRAPH PACKAGE   (HEC-1)
*         JUN   1998
*         VERSION 4.1
*
*   RUN DATE   21JUN17   TIME  13:31:00
*
*****

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

```

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

```

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

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

1

HEC-1 INPUT

PAGE 1

```

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

      *DIAGRAM
1         ID
2         ID      EXISTING AND DEVELOPED CONDITIONS MODEL
3         ID      CAPROCK HOSPITAL
4         ID      MOMENTUM ENGINEERS FOR RIETZ CONSULTING - B BROWN
5         ID
6         ID
7         ID      6-HOUR STORM DISTRIBUTION #3
8         ID      10- AND 100-YEAR STORM EVENTS
9         ID      NO REDUCTION FOR DEPTH AREA
10        ID      NO HYDROGRAPH ROUTING LOSSES
11        ID
12        IT      5      0      0      300
13        IO      5      0      0
14        IN      5      0      0
15        JR      PREC   0.564      1

16        KK      EXOFN
17        KM      ~~~~~~BEGIN EXISTING CONDITIONS ANALYSIS~~~~~
18        BA      .0070
19        PB      2.86
20        KM      SDN #3

```

21	PC	0.000	0.020	0.057	0.070	0.087	0.108	0.124	0.130	0.130	0.130
22	PC	0.130	0.130	0.130	0.133	0.140	0.142	0.148	0.158	0.172	0.181
23	PC	0.190	0.197	0.199	0.200	0.201	0.204	0.214	0.229	0.241	0.249
24	PC	0.251	0.256	0.270	0.278	0.281	0.283	0.295	0.322	0.352	0.409
25	PC	0.499	0.590	0.710	0.744	0.781	0.812	0.819	0.835	0.851	0.856
26	PC	0.860	0.868	0.876	0.888	0.910	0.926	0.937	0.950	0.970	0.976
27	PC	0.982	0.985	0.987	0.989	0.990	0.993	0.993	0.994	0.995	0.998
28	PC	0.998	0.999	1.000							
29	LS	0	85								
30	UD	0.100									
	*										

31	KK	EX1									
32	BA	.0049									
33	LS	0	82								
34	UD	0.100									
	*										

35	KK	PNR									
36	BA	.0028									
37	LS	0	77								
38	UD	0.100									
	*										

39	KK	CP1									
40	KM										
41	HC	2									
	*										

ADD 15 / 144 TO INCLUDE RCB FLOW AT THIS POINT

HEC-1 INPUT

PAGE 2

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

42	KK	CP3									
43	KM										
44	HC	2									
	*										

ADD 15 / 144 TO INCLUDE RCB FLOW AT THIS POINT

45	KK	D2									
46	KM										
47	BA	.0013									
48	LS	0	92								
49	UD	0.0620									
	*										

~~~~~BEGIN DEVELOPED CONDITIONS ANALYSIS~~~~~

|    |    |       |    |  |  |  |  |  |  |  |  |
|----|----|-------|----|--|--|--|--|--|--|--|--|
| 50 | KK | D3    |    |  |  |  |  |  |  |  |  |
| 51 | BA | .0015 |    |  |  |  |  |  |  |  |  |
| 52 | LS | 0     | 93 |  |  |  |  |  |  |  |  |
| 53 | UD | 0.051 |    |  |  |  |  |  |  |  |  |
|    | *  |       |    |  |  |  |  |  |  |  |  |

|    |    |       |    |  |  |  |  |  |  |  |  |
|----|----|-------|----|--|--|--|--|--|--|--|--|
| 54 | KK | PNR1  |    |  |  |  |  |  |  |  |  |
| 55 | BA | .0012 |    |  |  |  |  |  |  |  |  |
| 56 | LS | 0     | 77 |  |  |  |  |  |  |  |  |
| 57 | UD | 0.100 |    |  |  |  |  |  |  |  |  |
|    | *  |       |    |  |  |  |  |  |  |  |  |

|    |    |       |    |  |  |  |  |  |  |  |  |
|----|----|-------|----|--|--|--|--|--|--|--|--|
| 58 | KK | PNR2  |    |  |  |  |  |  |  |  |  |
| 59 | BA | .0016 |    |  |  |  |  |  |  |  |  |
| 60 | LS | 0     | 80 |  |  |  |  |  |  |  |  |

|    |    |       |    |
|----|----|-------|----|
| 61 | UD | 0.100 |    |
|    | *  |       |    |
| 62 | KK | CP1   |    |
| 63 | HC | 4     |    |
|    | *  |       |    |
| 64 | KK | DOFN  |    |
| 65 | BA | .0075 |    |
| 66 | LS | 0     | 82 |
| 67 | UD | 0.100 |    |
|    | *  |       |    |
| 68 | KK | D1    |    |
| 69 | BA | .0016 |    |
| 70 | LS | 0     | 93 |
| 71 | UD | 0.050 |    |
|    | *  |       |    |
| 72 | KK | CP2   |    |
| 73 | KM |       |    |
| 74 | HC | 2     |    |
|    | *  |       |    |

ADD 15 / 144 TO INCLUDE SD FLOW AT THIS POINT

HEC-1 INPUT

PAGE 3

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

|    |    |     |
|----|----|-----|
| 75 | KK | CP3 |
| 76 | KM |     |
| 77 | HC | 2   |
|    | *  |     |
| 78 | ZZ |     |

ADD 15 / 144 TO INCLUDE SD FLOW AT THIS POINT

# SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

|    |       |          |     |
|----|-------|----------|-----|
| 16 | EXOEN |          |     |
|    | .     |          |     |
| 31 | .     | EX1      |     |
|    | .     | .        |     |
| 35 | .     | .        | PNR |
|    | .     | .        | .   |
| 39 | .     | CP1..... |     |
|    | .     | .        |     |
| 42 | .     | CP3..... |     |
|    | .     | .        |     |
| 45 | .     | D2       |     |
|    | .     | .        |     |
| 50 | .     | .        | D3  |
|    | .     | .        | .   |



```

54      .      .      .      PNR1
      .      .      .      .
58      .      .      .      .      PNR2
      .      .      .      .
62      .      CP1.....
      .      .
64      .      .      DOFN
      .      .      .
68      .      .      .      D1
      .      .      .      .
72      .      .      CP2.....
      .      .      .
75      .      CP3.....

```

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

```

1*****
*
*   FLOOD HYDROGRAPH PACKAGE (HEC-1)
*       JUN 1998
*   VERSION 4.1
*
*   RUN DATE 21JUN17 TIME 13:31:00
*
*****

```

```

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

```

EXISTING AND DEVELOPED CONDITIONS MODEL  
 CAPROCK HOSPITAL  
 MOMENTUM ENGINEERS FOR RIETZ CONSULTING - B BROWN

6-HOUR STORM DISTRIBUTION #3  
 10- AND 100-YEAR STORM EVENTS  
 NO REDUCTION FOR DEPTH AREA  
 NO HYDROGRAPH ROUTING LOSSES

```

13 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  
.56 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 |
|               |         |      |      |      | .56                             | 1.00    |
| HYDROGRAPH AT |         |      |      |      |                                 |         |
| +             | EXOFN   | .01  | 1    | FLOW | 3.                              | 9.      |
|               |         |      |      | TIME | 3.58                            | 3.50    |
| HYDROGRAPH AT |         |      |      |      |                                 |         |
| +             | EX1     | .00  | 1    | FLOW | 2.                              | 6.      |
|               |         |      |      | TIME | 3.58                            | 3.50    |
| HYDROGRAPH AT |         |      |      |      |                                 |         |
| +             | PNR     | .00  | 1    | FLOW | 1.                              | 3.      |
|               |         |      |      | TIME | 3.58                            | 3.58    |
| 2 COMBINED AT |         |      |      |      |                                 |         |
| +             | CP1     | .01  | 1    | FLOW | 3.                              | 8.      |
|               |         |      |      | TIME | 3.58                            | 3.50    |
| 2 COMBINED AT |         |      |      |      |                                 |         |
| +             | CP3     | .01  | 1    | FLOW | 6.                              | 18.     |
|               |         |      |      | TIME | 3.58                            | 3.50    |
| HYDROGRAPH AT |         |      |      |      |                                 |         |
| +             | D2      | .00  | 1    | FLOW | 1.                              | 3.      |
|               |         |      |      | TIME | 3.50                            | 3.50    |
| HYDROGRAPH AT |         |      |      |      |                                 |         |
| +             | D3      | .00  | 1    | FLOW | 2.                              | 3.      |
|               |         |      |      | TIME | 3.50                            | 3.50    |
| HYDROGRAPH AT |         |      |      |      |                                 |         |

$$+ 15 / 144 = 18 / 152$$

$$+ 15 / 144 = 21 / 162$$

|               |  |      |     |   |              |            |             |
|---------------|--|------|-----|---|--------------|------------|-------------|
| +             |  | PNR1 | .00 | 1 | FLOW<br>TIME | 0.<br>3.58 | 1.<br>3.58  |
| HYDROGRAPH AT |  |      |     |   |              |            |             |
| +             |  | PNR2 | .00 | 1 | FLOW<br>TIME | 1.<br>3.58 | 2.<br>3.50  |
| 4 COMBINED AT |  |      |     |   |              |            |             |
| +             |  | CP1  | .01 | 1 | FLOW<br>TIME | 4.<br>3.50 | 9.<br>3.50  |
| HYDROGRAPH AT |  |      |     |   |              |            |             |
| +             |  | DOFN | .01 | 1 | FLOW<br>TIME | 3.<br>3.58 | 9.<br>3.50  |
| HYDROGRAPH AT |  |      |     |   |              |            |             |
| +             |  | D1   | .00 | 1 | FLOW<br>TIME | 2.<br>3.50 | 3.<br>3.50  |
| 2 COMBINED AT |  |      |     |   |              |            |             |
| +             |  | CP2  | .01 | 1 | FLOW<br>TIME | 4.<br>3.50 | 12.<br>3.50 |
| 2 COMBINED AT |  |      |     |   |              |            |             |
| +             |  | CP3  | .01 | 1 | FLOW<br>TIME | 8.<br>3.50 | 21.<br>3.50 |

$$+ 15 / 144 = 19 / 156$$

$$+ 15 / 144 = 23 / 165$$

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





---

## HYDRAULICS

## Project Description

## Input Data

## Results

|                          |      |     |
|--------------------------|------|-----|
| Spread                   | 2.55 | ft  |
| Depth                    | 0.24 | ft  |
| Wetted Perimeter         | 2.98 | ft  |
| Top Width                | 2.55 | ft  |
| Open Grate Area          | 2.81 | ft² |
| Active Grate Weir Length | 7.50 | ft  |

## Cross Section for grate inlet

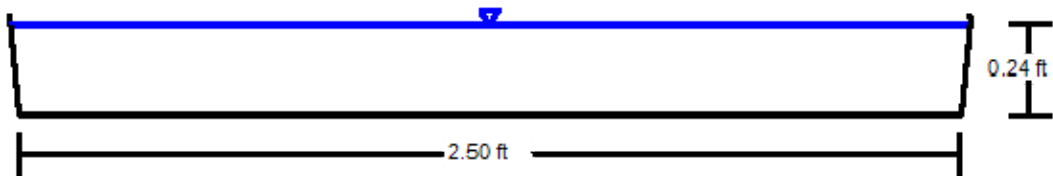
### Project Description

Solve For Spread

### Input Data

|                        |                    |                    |
|------------------------|--------------------|--------------------|
| Discharge              | 3.00               | ft <sup>3</sup> /s |
| Spread                 | 2.55               | ft                 |
| Left Side Slope        | 0.10               | ft/ft (H:V)        |
| Right Side Slope       | 0.10               | ft/ft (H:V)        |
| Bottom Width           | 2.50               | ft                 |
| Grate Width            | 2.50               | ft                 |
| Grate Length           | 2.50               | ft                 |
| Local Depression       | 0.25               | in                 |
| Local Depression Width | 2.50               | ft                 |
| Grate Type             | P-50 mm (P-1-7/8") |                    |
| Clogging               | 50.00              | %                  |

### Cross Section Image



V: 1  
H: 1



## Worksheet for Sec A onsite gutter 100yr worst case

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                                              0.01000    ft/ft  
Discharge                                                3.00    ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+28.00      | 0.47           |
| 0+53.00      | 0.17           |
| 0+53.00      | 0.13           |
| 0+54.50      | 0.00           |
| 0+54.50      | 0.50           |
| 0+55.00      | 0.50           |
| 0+55.00      | 2.50           |

### Roughness Segment Definitions

| Start Station   | Ending Station  | Roughness Coefficient |
|-----------------|-----------------|-----------------------|
| (0+28.00, 0.47) | (0+55.00, 2.50) | 0.016                 |

### Options

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

### Results

Normal Depth                                              0.33    ft  
Elevation Range                                              0.00 to 2.50 ft  
Flow Area                                                      1.52    ft<sup>2</sup>  
Wetted Perimeter                                              15.53    ft  
Hydraulic Radius                                              0.10    ft  
Top Width                                                      15.15    ft

---

**Worksheet for Sec A onsite gutter 100yr worst case**

---

**Results**

|                 |               |       |
|-----------------|---------------|-------|
| Normal Depth    | 0.33          | ft    |
| Critical Depth  | 0.34          | ft    |
| Critical Slope  | 0.00820       | ft/ft |
| Velocity        | 1.97          | ft/s  |
| Velocity Head   | 0.06          | ft    |
| Specific Energy | 0.39          | ft    |
| Froude Number   | 1.10          |       |
| Flow Type       | Supercritical |       |

**GVF Input Data**

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

**GVF Output Data**

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.33     | ft    |
| Critical Depth      | 0.34     | ft    |
| Channel Slope       | 0.01000  | ft/ft |
| Critical Slope      | 0.00820  | ft/ft |

---

## ***Cross Section for Sec A onsite gutter 100yr worst case***

---

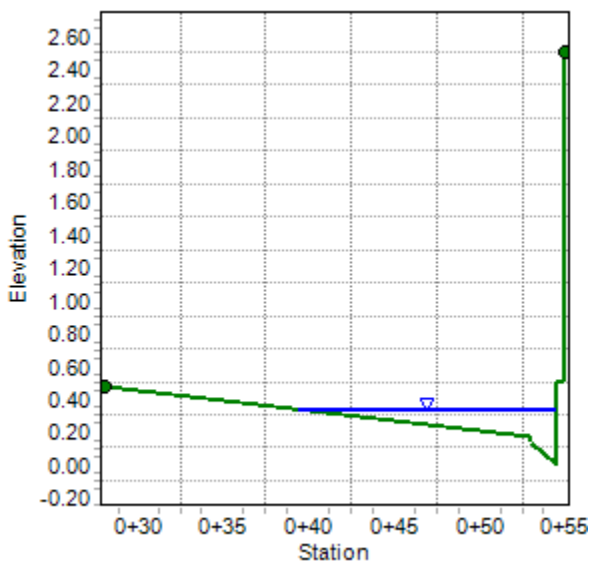
### Project Description

|                 |                 |
|-----------------|-----------------|
| Friction Method | Manning Formula |
| Solve For       | Normal Depth    |

### Input Data

|               |         |                    |
|---------------|---------|--------------------|
| Channel Slope | 0.01000 | ft/ft              |
| Normal Depth  | 0.33    | ft                 |
| Discharge     | 3.00    | ft <sup>3</sup> /s |

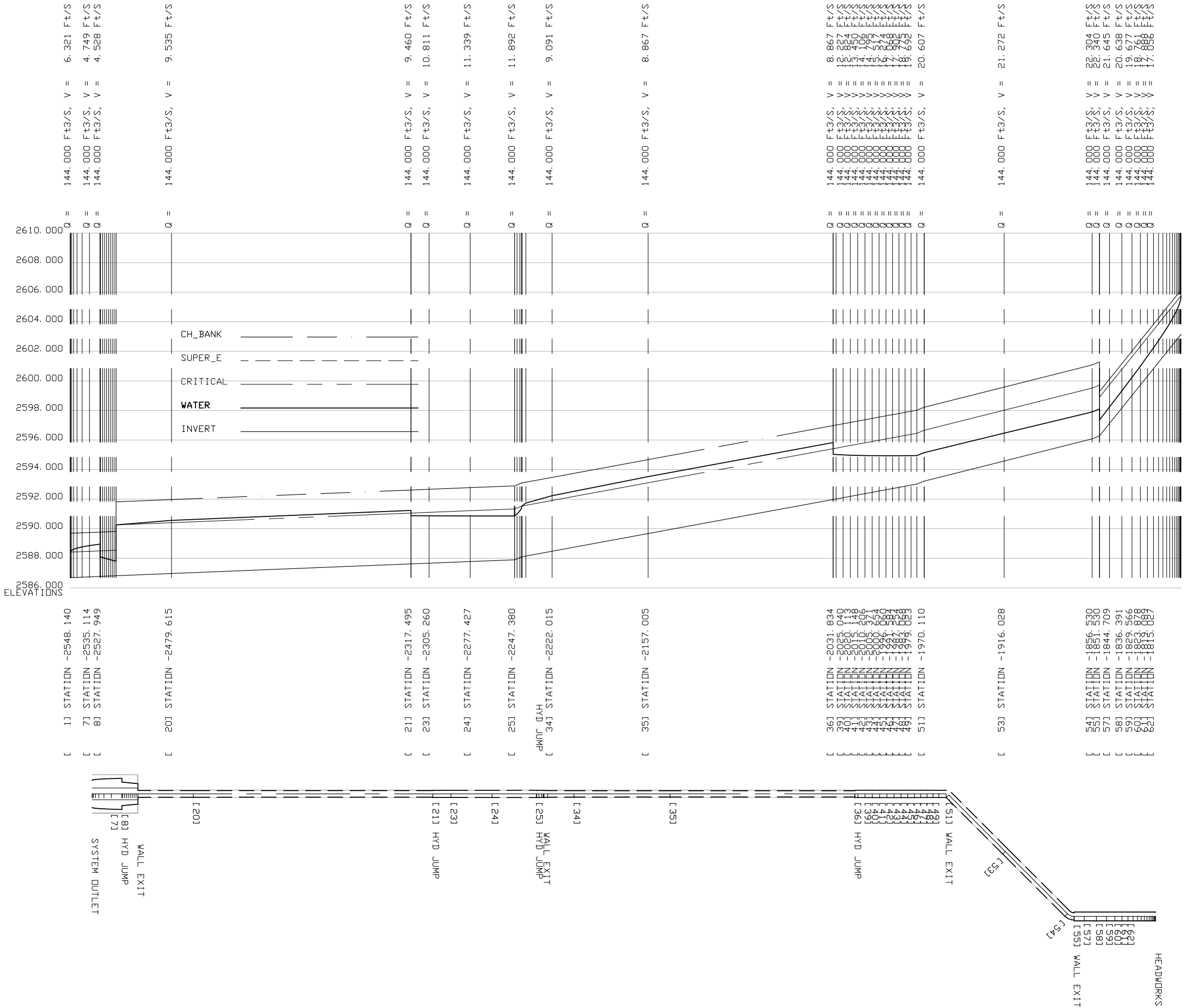
### Cross Section Image





WATER SURFACE PRESSURE GRADIENT ANALYSIS (PLAN & PROFILE)

OSO.WSW



CAPROCK HOSPITAL STORM DRAIN

| 1       |                | 2               | 3                | 4                   | 5               | 6            | 7    |           |                    |                    |                   |                  |                    |       |       |                    |                    |                   |                          |          |  |  |  |
|---------|----------------|-----------------|------------------|---------------------|-----------------|--------------|------|-----------|--------------------|--------------------|-------------------|------------------|--------------------|-------|-------|--------------------|--------------------|-------------------|--------------------------|----------|--|--|--|
| [ No. ] | TYPE OPERATION | STATION<br>(FT) | INV ELEV<br>(FT) | WATER LEVEL<br>(FT) | CHAN HT<br>(FT) | TYPE CHANNEL | "N"  | #PIER/PIP | FLOW RATE<br>(CFS) | VELOCITY<br>(FT/S) | TOP WIDTH<br>(FT) | CHAN WDT<br>(FT) | PIER WIDTH<br>(FT) | ZL    | ZR    | SUPEL RT B<br>(FT) | SUPEL LT B<br>(FT) | CRIT DPTH<br>(FT) | RADIUS/⟨PT<br>(FT OR ⟨ ) | RMKS     |  |  |  |
| [ 1 ]   | SYSTEM OUTLET  | -2548.140       | 2586.690         | 1.728               | 3.000           | TRAPEZOIDAL  | .040 | 0         | 144.000            | 6.321              | 18.368            | 8.000            | .000               | 3.000 | 3.000 | .000               | .000               | 1.728             | .000                     |          |  |  |  |
| [ 2 ]   | REACH          | -2547.931       | 2586.691         | 1.788               | 3.000           | TRAPEZOIDAL  | .040 | 0         | 144.000            | 6.027              | 18.728            | 8.000            | .000               | 3.000 | 3.000 | .000               | .000               | 1.728             | .000                     |          |  |  |  |
| [ 3 ]   | REACH          | -2547.208       | 2586.694         | 1.849               | 3.000           | TRAPEZOIDAL  | .040 | 0         | 144.000            | 5.746              | 19.098            | 8.000            | .000               | 3.000 | 3.000 | .000               | .000               | 1.728             | .000                     |          |  |  |  |
| [ 4 ]   | REACH          | -2545.817       | 2586.700         | 1.913               | 3.000           | TRAPEZOIDAL  | .040 | 0         | 144.000            | 5.479              | 19.478            | 8.000            | .000               | 3.000 | 3.000 | .000               | .000               | 1.728             | .000                     |          |  |  |  |
| [ 5 ]   | REACH          | -2543.550       | 2586.709         | 1.979               | 3.000           | TRAPEZOIDAL  | .040 | 0         | 144.000            | 5.224              | 19.869            | 8.000            | .000               | 3.000 | 3.000 | .000               | .000               | 1.728             | .000                     |          |  |  |  |
| [ 6 ]   | REACH          | -2540.119       | 2586.724         | 2.045               | 3.000           | TRAPEZOIDAL  | .040 | 0         | 144.000            | 4.981              | 20.272            | 8.000            | .000               | 3.000 | 3.000 | .000               | .000               | 1.728             | .000                     |          |  |  |  |
| [ 7 ]   | REACH          | -2535.114       | 2586.745         | 2.114               | 3.000           | TRAPEZOIDAL  | .040 | 0         | 144.000            | 4.749              | 20.685            | 8.000            | .000               | 3.000 | 3.000 | .000               | .000               | 1.728             | .000                     |          |  |  |  |
| [ 8 ]   | HYD JUMP       | -2527.949       | 2586.775         | 2.185               | 3.000           | TRAPEZOIDAL  | .040 | 0         | 144.000            | 4.528              | 21.110            | 8.000            | .000               | 3.000 | 3.000 | .000               | .000               | 1.728             | .000                     | HYD JUMP |  |  |  |
| [ 9 ]   | REACH          | -2527.949       | 2586.775         | 1.328               | 3.000           | TRAPEZOIDAL  | .040 | 0         | 144.000            | 9.044              | 15.970            | 8.000            | .000               | 3.000 | 3.000 | .000               | .000               | 1.728             | .000                     |          |  |  |  |
| [ 10 ]  | REACH          | -2527.580       | 2586.776         | 1.318               | 3.000           | TRAPEZOIDAL  | .040 | 0         | 144.000            | 9.136              | 15.910            | 8.000            | .000               | 3.000 | 3.000 | .000               | .000               | 1.728             | .000                     |          |  |  |  |
| [ 11 ]  | REACH          | -2526.278       | 2586.781         | 1.272               | 3.000           | TRAPEZOIDAL  | .040 | 0         | 144.000            | 9.582              | 15.631            | 8.000            | .000               | 3.000 | 3.000 | .000               | .000               | 1.728             | .000                     |          |  |  |  |
| [ 12 ]  | REACH          | -2524.955       | 2586.787         | 1.227               | 3.000           | TRAPEZOIDAL  | .040 | 0         | 144.000            | 10.050             | 15.360            | 8.000            | .000               | 3.000 | 3.000 | .000               | .000               | 1.728             | .000                     |          |  |  |  |
| [ 13 ]  | REACH          | -2523.623       | 2586.793         | 1.183               | 3.000           | TRAPEZOIDAL  | .040 | 0         | 144.000            | 10.541             | 15.098            | 8.000            | .000               | 3.000 | 3.000 | .000               | .000               | 1.728             | .000                     |          |  |  |  |
| [ 14 ]  | REACH          | -2522.293       | 2586.798         | 1.141               | 3.000           | TRAPEZOIDAL  | .040 | 0         | 144.000            | 11.055             | 14.843            | 8.000            | .000               | 3.000 | 3.000 | .000               | .000               | 1.728             | .000                     |          |  |  |  |
| [ 15 ]  | REACH          | -2520.974       | 2586.804         | 1.099               | 3.000           | TRAPEZOIDAL  | .040 | 0         | 144.000            | 11.595             | 14.596            | 8.000            | .000               | 3.000 | 3.000 | .000               | .000               | 1.728             | .000                     |          |  |  |  |
| [ 16 ]  | REACH          | -2519.672       | 2586.809         | 1.060               | 3.000           | TRAPEZOIDAL  | .040 | 0         | 144.000            | 12.161             | 14.356            | 8.000            | .000               | 3.000 | 3.000 | .000               | .000               | 1.728             | .000                     |          |  |  |  |
| [ 17 ]  | REACH          | -2518.393       | 2586.815         | 1.020               | 3.000           | TRAPEZOIDAL  | .040 | 0         | 144.000            | 12.754             | 14.124            | 8.000            | .000               | 3.000 | 3.000 | .000               | .000               | 1.728             | .000                     |          |  |  |  |
| [ 18 ]  | REACH          | -2517.140       | 2586.820         | .983                | 3.000           | TRAPEZOIDAL  | .013 | 0         | 144.000            | 13.377             | 13.899            | 8.000            | .000               | 3.000 | 3.000 | .000               | .000               | 1.728             | .000                     |          |  |  |  |
| [ 19 ]  | WALL EXIT      | -2517.140       | 2586.820         | 3.439               | 5.000           | PIPE         | .013 | 0         | 144.000            | 10.001             | 4.634             | 5.000            | .000               | .000  | .000  | .000               | .000               | 3.439             | .000                     |          |  |  |  |
| [ 20 ]  | REACH          | -2479.615       | 2586.970         | 3.592               | 5.000           | PIPE         | .013 | 0         | 144.000            | 9.535              | 4.498             | 5.000            | .000               | .000  | .000  | .000               | .000               | 3.439             | .000                     |          |  |  |  |
| [ 21 ]  | HYD JUMP       | -2317.495       | 2587.619         | 3.620               | 5.000           | PIPE         | .013 | 0         | 144.000            | 9.460              | 4.471             | 5.000            | .000               | .000  | .000  | .000               | .000               | 3.439             | .000                     | HYD JUMP |  |  |  |
| [ 22 ]  | REACH          | -2317.495       | 2587.619         | 3.265               | 5.000           | PIPE         | .013 | 0         | 144.000            | 10.604             | 4.760             | 5.000            | .000               | .000  | .000  | .000               | .000               | 3.439             | .000                     |          |  |  |  |
| [ 23 ]  | REACH          | -2305.260       | 2587.668         | 3.210               | 5.000           | PIPE         | .013 | 0         | 144.000            | 10.811             | 4.794             | 5.000            | .000               | .000  | .000  | .000               | .000               | 3.439             | .000                     |          |  |  |  |
| [ 24 ]  | REACH          | -2277.427       | 2587.780         | 3.081               | 5.000           | PIPE         | .013 | 0         | 144.000            | 11.339             | 4.863             | 5.000            | .000               | .000  | .000  | .000               | .000               | 3.439             | .000                     |          |  |  |  |
| [ 25 ]  | HYD JUMP       | -2247.380       | 2587.900         | 2.961               | 5.000           | PIPE         | .013 | 0         | 144.000            | 11.892             | 4.914             | 5.000            | .000               | .000  | .000  | .000               | .000               | 3.439             | .000                     | HYD JUMP |  |  |  |
| [ 26 ]  | HYD JUMP       | -2247.380       | 2587.900         | 3.620               | 5.000           | PIPE         | .014 | 0         | 144.000            | 9.460              | 4.471             | 5.000            | .000               | .000  | .000  | .000               | .000               | 3.439             | .000                     | HYD JUMP |  |  |  |
| [ 27 ]  | REACH          | -2247.380       | 2587.900         | 2.961               | 5.000           | PIPE         | .014 | 0         | 144.000            | 11.890             | 4.914             | 5.000            | .000               | .000  | .000  | .000               | .000               | 3.439             | .000                     |          |  |  |  |
| [ 28 ]  | REACH          | -2245.758       | 2587.965         | 3.036               | 5.000           | PIPE         | .014 | 0         | 144.000            | 11.541             | 4.884             | 5.000            | .000               | .000  | .000  | .000               | .000               | 3.439             | .000                     |          |  |  |  |
| [ 29 ]  | REACH          | -2243.842       | 2588.042         | 3.161               | 5.000           | PIPE         | .014 | 0         | 144.000            | 11.004             | 4.822             | 5.000            | .000               | .000  | .000  | .000               | .000               | 3.439             | .000                     |          |  |  |  |
| [ 30 ]  | REACH          | -2242.746       | 2588.085         | 3.296               | 5.000           | PIPE         | .014 | 0         | 144.000            | 10.492             | 4.740             | 5.000            | .000               | .000  | .000  | .000               | .000               | 3.439             | .000                     |          |  |  |  |
| [ 31 ]  | REACH          | -2242.380       | 2588.100         | 3.439               | 5.000           | PIPE         | .030 | 0         | 144.000            | 10.001             | 4.634             | 5.000            | .000               | .000  | .000  | .000               | .000               | 3.439             | .000                     |          |  |  |  |
| [ 32 ]  | WALL EXIT      | -2242.380       | 2588.100         | 3.439               | 5.000           | PIPE         | .030 | 0         | 144.000            | 10.001             | 4.634             | 5.000            | .000               | .000  | .000  | .000               | .000               | 3.439             | .000                     |          |  |  |  |
| [ 33 ]  | REACH          | -2239.775       | 2588.148         | 3.592               | 5.000           | PIPE         | .030 | 0         | 144.000            | 9.535              | 4.498             | 5.000            | .000               | .000  | .000  | .000               | .000               | 3.439             | .000                     |          |  |  |  |
| [ 34 ]  | REACH          | -2222.015       | 2588.475         | 3.759               | 5.000           | PIPE         | .030 | 0         | 144.000            | 9.091              | 4.320             | 5.000            | .000               | .000  | .000  | .000               | .000               | 3.439             | .000                     |          |  |  |  |
| [ 35 ]  | REACH          | -2157.005       | 2589.672         | 3.854               | 5.000           | PIPE         | .030 | 0         | 144.000            | 8.867              | 4.203             | 5.000            | .000               | .000  | .000  | .000               | .000               | 3.439             | .000                     |          |  |  |  |
| [ 36 ]  | HYD JUMP       | -2031.834       | 2591.976         | 3.854               | 5.000           | PIPE         | .030 | 0         | 144.000            | 8.867              | 4.203             | 5.000            | .000               | .000  | .000  | .000               | .000               | 3.439             | .000                     | HYD JUMP |  |  |  |
| [ 37 ]  | REACH          | -2031.834       | 2591.976         | 3.060               | 5.000           | PIPE         | .030 | 0         | 144.000            | 11.435             | 4.873             | 5.000            | .000               | .000  | .000  | .000               | .000               | 3.439             | .000                     |          |  |  |  |
| [ 38 ]  | REACH          | -2029.837       | 2592.012         | 3.010               | 5.000           | PIPE         | .030 | 0         | 144.000            | 11.658             | 4.895             | 5.000            | .0                 |       |       |                    |                    |                   |                          |          |  |  |  |

| T1 | CAPROCK HOSPITAL STORM DRAIN                                        |      |    |       |   |       |   |       |   |       |   |     |   |  |   | 0        |        |  |  |  |  |
|----|---------------------------------------------------------------------|------|----|-------|---|-------|---|-------|---|-------|---|-----|---|--|---|----------|--------|--|--|--|--|
| T2 | 1                                                                   |      | 2  |       | 3 |       | 4 |       | 5 |       | 6 |     | 7 |  | 8 |          | 9      |  |  |  |  |
| T3 | 4567890123456789012345678901234567890123456789012345678901234567890 |      |    |       |   |       |   |       |   |       |   |     |   |  |   |          |        |  |  |  |  |
| SO | -2548.1402586.690                                                   | 2    |    |       |   |       |   |       |   |       |   |     |   |  |   | 2586.690 |        |  |  |  |  |
| R  | -2517.1402586.820                                                   | 2    |    | .040  |   |       |   |       |   |       |   |     |   |  |   | .000     | .000   |  |  |  |  |
| WX | -2517.1402586.820                                                   | 3    |    |       |   |       |   |       |   |       |   |     |   |  |   |          |        |  |  |  |  |
| R  | -2247.3802587.900                                                   | 3    |    | .013  |   |       |   |       |   |       |   |     |   |  |   | .000     | .000   |  |  |  |  |
| WE | -2247.3802587.900                                                   | 3    |    | .20   |   |       |   |       |   |       |   |     |   |  |   |          |        |  |  |  |  |
| R  | -2242.3802588.100                                                   | 3    |    | .014  |   |       |   |       |   |       |   |     |   |  |   | .000     | .000   |  |  |  |  |
| WX | -2242.3802588.100                                                   | 3    |    |       |   |       |   |       |   |       |   |     |   |  |   |          |        |  |  |  |  |
| R  | -1975.1102593.020                                                   | 3    |    | .030  |   |       |   |       |   |       |   |     |   |  |   | .000     | 000    |  |  |  |  |
| WE | -1975.1102593.020                                                   | 3    |    | .20   |   |       |   |       |   |       |   |     |   |  |   |          |        |  |  |  |  |
| R  | -1970.1102593.220                                                   | 3    |    | .014  |   |       |   |       |   |       |   |     |   |  |   | .000     | 45.000 |  |  |  |  |
| WX | -1970.1102593.220                                                   | 3    |    |       |   |       |   |       |   |       |   |     |   |  |   |          |        |  |  |  |  |
| R  | -1856.5302596.080                                                   | 3    |    | .013  |   |       |   |       |   |       |   |     |   |  |   | .000     | .000   |  |  |  |  |
| WE | -1856.5302596.080                                                   | 3    |    | .20   |   |       |   |       |   |       |   |     |   |  |   |          |        |  |  |  |  |
| R  | -1851.5302596.280                                                   | 3    |    | .014  |   |       |   |       |   |       |   |     |   |  |   | -45.000  | .000   |  |  |  |  |
| WX | -1851.5302596.280                                                   | 1    |    |       |   |       |   |       |   |       |   |     |   |  |   |          |        |  |  |  |  |
| R  | -1796.3402603.150                                                   | 1    |    | .014  |   |       |   |       |   |       |   |     |   |  |   | .000     | .000   |  |  |  |  |
| SH | -1796.3402603.150                                                   | 1    |    |       |   |       |   |       |   |       |   |     |   |  |   | 2603.150 |        |  |  |  |  |
| CD | 1 3 0                                                               | .000 |    | 3.000 |   | 6.000 |   | .000  |   | .000  |   | .00 |   |  |   |          |        |  |  |  |  |
| CD | 2 1 0                                                               | .000 |    | 3.000 |   | 8.000 |   | 3.000 |   | 3.000 |   | .00 |   |  |   |          |        |  |  |  |  |
| CD | 3 4 0                                                               | .000 |    | 5.000 |   | .000  |   | .000  |   | .000  |   | .00 |   |  |   |          |        |  |  |  |  |
| CD | 4 4 0                                                               | .000 |    | 2.000 |   | .000  |   | .000  |   | .000  |   | .00 |   |  |   |          |        |  |  |  |  |
| CD | 5 4 2                                                               | .000 |    | 3.000 |   | .000  |   | .000  |   | .000  |   | .00 |   |  |   |          |        |  |  |  |  |
| Q  | 144.000                                                             |      | .0 |       |   |       |   |       |   |       |   |     |   |  |   |          |        |  |  |  |  |



## WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING

PAGE 1

| CARD<br>CODE | SECT<br>NO | CHN<br>TYPE | NO OF<br>PIER/PIP | AVE<br>WIDTH | PIER<br>DIAMETER | HEIGHT 1<br>WIDTH | BASE<br>WIDTH | ZL    | ZR  | INV<br>DROP | Y(1) | Y(2) | Y(3) | Y(4) | Y(5) | Y(6) | Y(7) | Y(8) | Y(9) | Y(10) |
|--------------|------------|-------------|-------------------|--------------|------------------|-------------------|---------------|-------|-----|-------------|------|------|------|------|------|------|------|------|------|-------|
| CD           | 1          | 3           | 0                 | .000         | 3.000            | 6.000             | .000          | .000  | .00 |             |      |      |      |      |      |      |      |      |      |       |
| CD           | 2          | 1           | 0                 | .000         | 3.000            | 8.000             | 3.000         | 3.000 | .00 |             |      |      |      |      |      |      |      |      |      |       |
| CD           | 3          | 4           | 0                 |              | 5.000            |                   |               |       |     |             |      |      |      |      |      |      |      |      |      |       |
| CD           | 4          | 4           | 0                 |              | 2.000            |                   |               |       |     |             |      |      |      |      |      |      |      |      |      |       |
| CD           | 5          | 4           | 2                 |              | 3.000            |                   |               |       |     |             |      |      |      |      |      |      |      |      |      |       |

W S P G W

PAGE NO 1

## WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -

CAPROCK HOSPITAL STORM DRAIN

HEADING LINE NO 2 IS -

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
|---|---|---|---|---|---|---|

HEADING LINE NO 3 IS -

4567890123456789012345678901234567890123456789012345678901234567

W S P G W

PAGE NO 2

## WATER SURFACE PROFILE - ELEMENT CARD LISTING

| ELEMENT NO | 1 IS A  | SYSTEM OUTLET | * * * | U/S DATA | STATION   | INVERT   | SECT | W S ELEV |      |        |       |        |       |  |  |  |  |  |  |  |
|------------|---------|---------------|-------|----------|-----------|----------|------|----------|------|--------|-------|--------|-------|--|--|--|--|--|--|--|
|            |         |               |       |          | -2548.140 | 2586.690 | 2    | 2586.690 |      |        |       |        |       |  |  |  |  |  |  |  |
| ELEMENT NO | 2 IS A  | REACH         | * * * | U/S DATA | STATION   | INVERT   | SECT |          | N    | RADIUS | ANGLE | ANG PT | MAN H |  |  |  |  |  |  |  |
|            |         |               |       |          | -2517.140 | 2586.820 | 2    |          | .040 | .000   | .000  | .000   | 0     |  |  |  |  |  |  |  |
| ELEMENT NO | 3 IS A  | WALL EXIT     | * * * | U/S DATA | STATION   | INVERT   | SECT |          |      |        |       |        |       |  |  |  |  |  |  |  |
|            |         |               |       |          | -2517.140 | 2586.820 | 3    |          |      |        |       |        |       |  |  |  |  |  |  |  |
| ELEMENT NO | 4 IS A  | REACH         | * * * | U/S DATA | STATION   | INVERT   | SECT |          | N    | RADIUS | ANGLE | ANG PT | MAN H |  |  |  |  |  |  |  |
|            |         |               |       |          | -2247.380 | 2587.900 | 3    |          | .013 | .000   | .000  | .000   | 0     |  |  |  |  |  |  |  |
| ELEMENT NO | 5 IS A  | WALL ENTRANCE | * * * | U/S DATA | STATION   | INVERT   | SECT |          | FP   |        |       |        |       |  |  |  |  |  |  |  |
|            |         |               |       |          | -2247.380 | 2587.900 | 3    |          | .200 |        |       |        |       |  |  |  |  |  |  |  |
| ELEMENT NO | 6 IS A  | REACH         | * * * | U/S DATA | STATION   | INVERT   | SECT |          | N    | RADIUS | ANGLE | ANG PT | MAN H |  |  |  |  |  |  |  |
|            |         |               |       |          | -2242.380 | 2588.100 | 3    |          | .014 | .000   | .000  | .000   | 0     |  |  |  |  |  |  |  |
| ELEMENT NO | 7 IS A  | WALL EXIT     | * * * | U/S DATA | STATION   | INVERT   | SECT |          |      |        |       |        |       |  |  |  |  |  |  |  |
|            |         |               |       |          | -2242.380 | 2588.100 | 3    |          |      |        |       |        |       |  |  |  |  |  |  |  |
| ELEMENT NO | 8 IS A  | REACH         | * * * | U/S DATA | STATION   | INVERT   | SECT |          | N    | RADIUS | ANGLE | ANG PT | MAN H |  |  |  |  |  |  |  |
|            |         |               |       |          | -1975.110 | 2593.020 | 3    |          | .030 | .000   | .000  | .000   | 0     |  |  |  |  |  |  |  |
| ELEMENT NO | 9 IS A  | WALL ENTRANCE | * * * | U/S DATA | STATION   | INVERT   | SECT |          | FP   |        |       |        |       |  |  |  |  |  |  |  |
|            |         |               |       |          | -1975.110 | 2593.020 | 3    |          | .200 |        |       |        |       |  |  |  |  |  |  |  |
| ELEMENT NO | 10 IS A | REACH         | * * * | U/S DATA | STATION   | INVERT   | SECT |          | N    | RADIUS | ANGLE | ANG PT | MAN H |  |  |  |  |  |  |  |
|            |         |               |       |          | -1970.110 | 2593.220 | 3    |          | .014 | .000   | .000  | 45.000 | 0     |  |  |  |  |  |  |  |
| ELEMENT NO | 11 IS A | WALL EXIT     | * * * | U/S DATA | STATION   | INVERT   | SECT |          |      |        |       |        |       |  |  |  |  |  |  |  |
|            |         |               |       |          | -1970.110 | 2593.220 | 3    |          |      |        |       |        |       |  |  |  |  |  |  |  |
| ELEMENT NO | 12 IS A | REACH         | * * * | U/S DATA | STATION   | INVERT   | SECT |          | N    | RADIUS | ANGLE | ANG PT | MAN H |  |  |  |  |  |  |  |
|            |         |               |       |          | -1856.530 | 2596.080 | 3    |          | .013 | .000   | .000  | .000   | 0     |  |  |  |  |  |  |  |
| ELEMENT NO | 13 IS A | WALL ENTRANCE | * * * | U/S DATA | STATION   | INVERT   | SECT |          | FP   |        |       |        |       |  |  |  |  |  |  |  |
|            |         |               |       |          | -1856.530 | 2596.080 | 3    |          | .200 |        |       |        |       |  |  |  |  |  |  |  |

W S P G W

PAGE NO 3

WATER SURFACE PROFILE - ELEMENT CARD LISTING

|            |    |    |   |                  |           |          |      |      |   |          |         |        |       |
|------------|----|----|---|------------------|-----------|----------|------|------|---|----------|---------|--------|-------|
| ELEMENT NO | 14 | IS | A | REACH            | *         | *        | *    |      |   |          |         |        |       |
|            |    |    |   | U/S DATA         | STATION   | INVERT   | SECT | N    |   | RADIUS   | ANGLE   | ANG PT | MAN H |
|            |    |    |   |                  | -1851.530 | 2596.280 | 3    | .014 |   | 6.366    | -45.000 | .000   | 0     |
| ELEMENT NO | 15 | IS | A | WALL EXIT        | *         |          | *    |      |   |          |         |        |       |
|            |    |    |   | U/S DATA         | STATION   | INVERT   | SECT |      |   |          |         |        |       |
|            |    |    |   |                  | -1851.530 | 2596.280 | 1    |      |   |          |         |        |       |
| ELEMENT NO | 16 | IS | A | REACH            | *         | *        | *    |      |   |          |         |        |       |
|            |    |    |   | U/S DATA         | STATION   | INVERT   | SECT | N    |   | RADIUS   | ANGLE   | ANG PT | MAN H |
|            |    |    |   |                  | -1796.340 | 2603.150 | 1    | .014 |   | .000     | .000    | .000   | 0     |
| ELEMENT NO | 17 | IS | A | SYSTEM HEADWORKS |           |          | *    |      | * |          |         |        |       |
|            |    |    |   | U/S DATA         | STATION   | INVERT   | SECT |      |   | W S ELEV |         |        |       |
|            |    |    |   |                  | -1796.340 | 2603.150 | 1    |      |   | 2603.150 |         |        |       |

Program Package Serial Number: 1604

## WATER SURFACE PROFILE LISTING

Date: 6-20-2017 Time:12:23:51

## CAPROCK HOSPITAL STORM DRAIN

1 2 3 4 5 6 7  
456789012345678901234567890123456789012345678901234567890123

| *****          |             |            |            |         |           |          |                |            |                |                |                |                 |       |                | ***** |  |
|----------------|-------------|------------|------------|---------|-----------|----------|----------------|------------|----------------|----------------|----------------|-----------------|-------|----------------|-------|--|
| Station        | Invert Elev | Depth (FT) | Water Elev | Q (CFS) | Vel (FPS) | Vel Head | Energy Grd.El. | Super Elev | Critical Depth | Flow Top Width | Height/Dia.-FT | Base Wt/or I.D. | ZL    | No Wth Prs/Pip |       |  |
| I/Elem         | Ch Slope    |            |            |         |           | SF Ave   | HF             | SE Dpth    | Froude N       | Norm Dp        | "N"            | X-Fall          | ZR    | Type Ch        |       |  |
| *****          | *****       | *****      | *****      | *****   | *****     | *****    | *****          | *****      | *****          | *****          | *****          | *****           | ***** | *****          |       |  |
| -2548.140      | 2586.690    | 1.728      | 2588.418   | 144.00  | 6.32      | .62      | 2589.04        | .00        | 1.73           | 18.37          | 3.000          | 8.000           | 3.00  | 0 .0           |       |  |
|                |             |            |            |         |           |          |                |            |                |                |                |                 |       |                |       |  |
| .209           | .0042       |            |            |         |           | .0212    | .00            | 1.73       | 1.00           | 2.64           | .040           | .00             | 3.00  | TRAP           |       |  |
| -2547.931      | 2586.691    | 1.788      | 2588.479   | 144.00  | 6.03      | .56      | 2589.04        | .00        | 1.73           | 18.73          | 3.000          | 8.000           | 3.00  | 0 .0           |       |  |
|                |             |            |            |         |           |          |                |            |                |                |                |                 |       |                |       |  |
| .723           | .0042       |            |            |         |           | .0186    | .01            | 1.79       | .94            | 2.64           | .040           | .00             | 3.00  | TRAP           |       |  |
| -2547.208      | 2586.694    | 1.850      | 2588.543   | 144.00  | 5.75      | .51      | 2589.06        | .00        | 1.73           | 19.10          | 3.000          | 8.000           | 3.00  | 0 .0           |       |  |
|                |             |            |            |         |           |          |                |            |                |                |                |                 |       |                |       |  |
| 1.391          | .0042       |            |            |         |           | .0163    | .02            | 1.85       | .88            | 2.64           | .040           | .00             | 3.00  | TRAP           |       |  |
| -2545.817      | 2586.700    | 1.913      | 2588.613   | 144.00  | 5.48      | .47      | 2589.08        | .00        | 1.73           | 19.48          | 3.000          | 8.000           | 3.00  | 0 .0           |       |  |
|                |             |            |            |         |           |          |                |            |                |                |                |                 |       |                |       |  |
| 2.267          | .0042       |            |            |         |           | .0143    | .03            | 1.91       | .83            | 2.64           | .040           | .00             | 3.00  | TRAP           |       |  |
| -2543.550      | 2586.709    | 1.978      | 2588.688   | 144.00  | 5.22      | .42      | 2589.11        | .00        | 1.73           | 19.87          | 3.000          | 8.000           | 3.00  | 0 .0           |       |  |
|                |             |            |            |         |           |          |                |            |                |                |                |                 |       |                |       |  |
| 3.431          | .0042       |            |            |         |           | .0125    | .04            | 1.98       | .78            | 2.64           | .040           | .00             | 3.00  | TRAP           |       |  |
| -2540.119      | 2586.724    | 2.045      | 2588.769   | 144.00  | 4.98      | .39      | 2589.15        | .00        | 1.73           | 20.27          | 3.000          | 8.000           | 3.00  | 0 .0           |       |  |
|                |             |            |            |         |           |          |                |            |                |                |                |                 |       |                |       |  |
| 5.006          | .0042       |            |            |         |           | .0110    | .05            | 2.05       | .73            | 2.64           | .040           | .00             | 3.00  | TRAP           |       |  |
| -2535.114      | 2586.745    | 2.114      | 2588.859   | 144.00  | 4.75      | .35      | 2589.21        | .00        | 1.73           | 20.69          | 3.000          | 8.000           | 3.00  | 0 .0           |       |  |
|                |             |            |            |         |           |          |                |            |                |                |                |                 |       |                |       |  |
| 7.165          | .0042       |            |            |         |           | .0096    | .07            | 2.11       | .69            | 2.64           | .040           | .00             | 3.00  | TRAP           |       |  |
| -2527.949      | 2586.775    | 2.185      | 2588.960   | 144.00  | 4.53      | .32      | 2589.28        | .00        | 1.73           | 21.11          | 3.000          | 8.000           | 3.00  | 0 .0           |       |  |
|                |             |            |            |         |           |          |                |            |                |                |                |                 |       |                |       |  |
| HYDRAULIC JUMP |             |            |            |         |           |          |                |            |                |                |                |                 |       |                |       |  |
| -2527.949      | 2586.775    | 1.328      | 2588.103   | 144.00  | 9.04      | 1.27     | 2589.37        | .00        | 1.73           | 15.97          | 3.000          | 8.000           | 3.00  | 0 .0           |       |  |
|                |             |            |            |         |           |          |                |            |                |                |                |                 |       |                |       |  |
| .369           | .0042       |            |            |         |           | .0626    | .02            | 1.33       | 1.60           | 2.64           | .040           | .00             | 3.00  | TRAP           |       |  |

W S P G W - CIVILDESIGN Version 14.06

Program Package Serial Number: 1604

## WATER SURFACE PROFILE LISTING

Date: 6-20-2017 Time:12:23:51

CAPROCK HOSPITAL STORM DRAIN

[illegible][illegible]

|           |          |       |          |        |       |       |         |      |      |       |       |       |      |      |    |
|-----------|----------|-------|----------|--------|-------|-------|---------|------|------|-------|-------|-------|------|------|----|
| -2527.580 | 2586.776 | 1.318 | 2588.094 | 144.00 | 9.14  | 1.30  | 2589.39 | .00  | 1.73 | 15.91 | 3.000 | 8.000 | 3.00 | 0    | .0 |
| -         | -        | -     | -        | -      | -     | -     | -       | -    | -    | -     | -     | -     | -    | -    | -  |
| 1.302     | .0042    |       |          |        |       | .0680 | .09     | 1.32 | 1.62 | 2.64  | .040  | .00   | 3.00 | TRAP |    |
| -2526.278 | 2586.781 | 1.272 | 2588.053 | 144.00 | 9.58  | 1.43  | 2589.48 | .00  | 1.73 | 15.63 | 3.000 | 8.000 | 3.00 | 0    | .0 |
| -         | -        | -     | -        | -      | -     | -     | -       | -    | -    | -     | -     | -     | -    | -    | -  |
| 1.323     | .0042    |       |          |        |       | .0778 | .10     | 1.27 | 1.72 | 2.64  | .040  | .00   | 3.00 | TRAP |    |
| -2524.955 | 2586.787 | 1.227 | 2588.014 | 144.00 | 10.05 | 1.57  | 2589.58 | .00  | 1.73 | 15.36 | 3.000 | 8.000 | 3.00 | 0    | .0 |
| -         | -        | -     | -        | -      | -     | -     | -       | -    | -    | -     | -     | -     | -    | -    | -  |
| 1.332     | .0042    |       |          |        |       | .0891 | .12     | 1.23 | 1.83 | 2.64  | .040  | .00   | 3.00 | TRAP |    |
| -2523.623 | 2586.793 | 1.183 | 2587.976 | 144.00 | 10.54 | 1.73  | 2589.70 | .00  | 1.73 | 15.10 | 3.000 | 8.000 | 3.00 | 0    | .0 |
| -         | -        | -     | -        | -      | -     | -     | -       | -    | -    | -     | -     | -     | -    | -    | -  |
| 1.330     | .0042    |       |          |        |       | .1020 | .14     | 1.18 | 1.95 | 2.64  | .040  | .00   | 3.00 | TRAP |    |
| -2522.293 | 2586.798 | 1.140 | 2587.939 | 144.00 | 11.06 | 1.90  | 2589.84 | .00  | 1.73 | 14.84 | 3.000 | 8.000 | 3.00 | 0    | .0 |
| -         | -        | -     | -        | -      | -     | -     | -       | -    | -    | -     | -     | -     | -    | -    | -  |
| 1.319     | .0042    |       |          |        |       | .1168 | .15     | 1.14 | 2.08 | 2.64  | .040  | .00   | 3.00 | TRAP |    |
| -2520.974 | 2586.804 | 1.099 | 2587.903 | 144.00 | 11.59 | 2.09  | 2589.99 | .00  | 1.73 | 14.60 | 3.000 | 8.000 | 3.00 | 0    | .0 |
| -         | -        | -     | -        | -      | -     | -     | -       | -    | -    | -     | -     | -     | -    | -    | -  |
| 1.302     | .0042    |       |          |        |       | .1339 | .17     | 1.10 | 2.22 | 2.64  | .040  | .00   | 3.00 | TRAP |    |
| -2519.672 | 2586.809 | 1.059 | 2587.869 | 144.00 | 12.16 | 2.30  | 2590.17 | .00  | 1.73 | 14.36 | 3.000 | 8.000 | 3.00 | 0    | .0 |
| -         | -        | -     | -        | -      | -     | -     | -       | -    | -    | -     | -     | -     | -    | -    | -  |
| 1.280     | .0042    |       |          |        |       | .1534 | .20     | 1.06 | 2.36 | 2.64  | .040  | .00   | 3.00 | TRAP |    |
| -2518.393 | 2586.815 | 1.021 | 2587.835 | 144.00 | 12.75 | 2.53  | 2590.36 | .00  | 1.73 | 14.12 | 3.000 | 8.000 | 3.00 | 0    | .0 |
| -         | -        | -     | -        | -      | -     | -     | -       | -    | -    | -     | -     | -     | -    | -    | -  |
| 1.253     | .0042    |       |          |        |       | .1759 | .22     | 1.02 | 2.51 | 2.64  | .040  | .00   | 3.00 | TRAP |    |
| -2517.140 | 2586.820 | .983  | 2587.803 | 144.00 | 13.38 | 2.78  | 2590.58 | .00  | 1.73 | 13.90 | 3.000 | 8.000 | 3.00 | 0    | .0 |
| -         | -        | -     | -        | -      | -     | -     | -       | -    | -    | -     | -     | -     | -    | -    | -  |

WALL EXIT

FILE: OSO.WSW

W S P G W - CIVILDESIGN Version 14.06

PAGE 3

Program Package Serial Number: 1604

WATER SURFACE PROFILE LISTING

Date: 6-20-2017 Time:12:23:51

CAPROCK HOSPITAL STORM DRAIN

1 2 3 4 5 6 7  
456789012345678901234567890123456789012345678901234567890123

| Station   | Invert Elev | Depth (FT) | Water Elev | Q (CFS) | Vel (FPS) | Vel Head | Energy Grd.El. | Super Elev | Critical Depth | Flow Top Width | Height/ft | Base Wt/ft | No ZL | Wth Prs/Pip |
|-----------|-------------|------------|------------|---------|-----------|----------|----------------|------------|----------------|----------------|-----------|------------|-------|-------------|
| -2517.140 | 2586.820    | 3.439      | 2590.259   | 144.00  | 10.00     | 1.55     | 2591.81        | .00        | 3.44           | 4.63           | 5.000     | .000       | .00   | 0 .0        |
|           | 37.525      | .0040      |            |         |           | .0043    | .16            | 3.44       | 1.00           | 3.62           | .013      | .00        | .00   | PIPE        |
| -2479.615 | 2586.970    | 3.592      | 2590.562   | 144.00  | 9.54      | 1.41     | 2591.97        | .00        | 3.44           | 4.50           | 5.000     | .000       | .00   | 0 .0        |
|           | 162.120     | .0040      |            |         |           | .0040    | .65            | 3.59       | .92            | 3.62           | .013      | .00        | .00   | PIPE        |
| -2317.495 | 2587.619    | 3.620      | 2591.239   | 144.00  | 9.46      | 1.39     | 2592.63        | .00        | 3.44           | 4.47           | 5.000     | .000       | .00   | 0 .0        |

HYDRAULIC JUMP



|                |          |       |          |        |       |       |         |      |      |      |       |      |     |      |     |
|----------------|----------|-------|----------|--------|-------|-------|---------|------|------|------|-------|------|-----|------|-----|
| -2317.495      | 2587.619 | 3.265 | 2590.884 | 144.00 | 10.60 | 1.75  | 2592.63 | .00  | 3.44 | 4.76 | 5.000 | .000 | .00 | 0    | .0  |
| - -            | - -      | - -   | - -      | - -    | - -   | - -   | - -     | - -  | - -  | - -  | - -   | - -  | - - | - -  | - - |
| 12.235         | .0040    |       |          |        |       | .0054 | .07     | 3.26 | 1.11 | 3.62 | .013  | .00  | .00 | PIPE |     |
| -2305.260      | 2587.668 | 3.210 | 2590.878 | 144.00 | 10.81 | 1.81  | 2592.69 | .00  | 3.44 | 4.79 | 5.000 | .000 | .00 | 0    | .0  |
| - -            | - -      | - -   | - -      | - -    | - -   | - -   | - -     | - -  | - -  | - -  | - -   | - -  | - - | - -  | - - |
| 27.833         | .0040    |       |          |        |       | .0059 | .16     | 3.21 | 1.14 | 3.62 | .013  | .00  | .00 | PIPE |     |
| -2277.427      | 2587.780 | 3.081 | 2590.861 | 144.00 | 11.34 | 2.00  | 2592.86 | .00  | 3.44 | 4.86 | 5.000 | .000 | .00 | 0    | .0  |
| - -            | - -      | - -   | - -      | - -    | - -   | - -   | - -     | - -  | - -  | - -  | - -   | - -  | - - | - -  | - - |
| 30.047         | .0040    |       |          |        |       | .0066 | .20     | 3.08 | 1.24 | 3.62 | .013  | .00  | .00 | PIPE |     |
| -2247.380      | 2587.900 | 2.961 | 2590.861 | 144.00 | 11.89 | 2.20  | 2593.06 | .00  | 3.44 | 4.91 | 5.000 | .000 | .00 | 0    | .0  |
| - -            | - -      | - -   | - -      | - -    | - -   | - -   | - -     | - -  | - -  | - -  | - -   | - -  | - - | - -  | - - |
| HYDRAULIC DROP |          |       |          |        |       |       |         |      |      |      |       |      |     |      |     |
| -2247.380      | 2587.900 | 3.620 | 2591.520 | 144.00 | 9.46  | 1.39  | 2592.91 | .00  | 3.44 | 4.47 | 5.000 | .000 | .00 | 0    | .0  |
| - -            | - -      | - -   | - -      | - -    | - -   | - -   | - -     | - -  | - -  | - -  | - -   | - -  | - - | - -  | - - |
| HYDRAULIC JUMP |          |       |          |        |       |       |         |      |      |      |       |      |     |      |     |
| -2247.380      | 2587.900 | 2.961 | 2590.861 | 144.00 | 11.89 | 2.20  | 2593.06 | .00  | 3.44 | 4.91 | 5.000 | .000 | .00 | 0    | .0  |
| - -            | - -      | - -   | - -      | - -    | - -   | - -   | - -     | - -  | - -  | - -  | - -   | - -  | - - | - -  | - - |
| 1.622          | .0400    |       |          |        |       | .0079 | .01     | 2.96 | 1.33 | 1.87 | .014  | .00  | .00 | PIPE |     |

FILE: OSO.WSW  
 W S P G W - CIVILDESIGN Version 14.06  
 Program Package Serial Number: 1604  
 WATER SURFACE PROFILE LISTING  
 CAPROCK HOSPITAL STORM DRAIN  
 Date: 6-20-2017 Time:12:23:51  
 PAGE 4

| Station   | Invert Elev | Depth (FT) | Water Elev | Q (CFS) | Vel (FPS) | Vel Head | Energy Grd.El. | Super Elev | Critical Depth | Flow Top Width | Height/ Base Wt | No Wth | ZL      | Prs/Pip |     |
|-----------|-------------|------------|------------|---------|-----------|----------|----------------|------------|----------------|----------------|-----------------|--------|---------|---------|-----|
| L/Elem    | Ch Slope    |            |            |         | SF Ave    | HF       | SE Dpth        | Froude N   | Norm Dp        | "N"            | X-Fall          | ZR     | Type Ch |         |     |
| -2245.758 | 2587.965    | 3.036      | 2591.001   | 144.00  | 11.54     | 2.07     | 2593.07        | .00        | 3.44           | 4.88           | 5.000           | .000   | .00     | 0       | .0  |
| - -       | - -         | - -        | - -        | - -     | - -       | - -      | - -            | - -        | - -            | - -            | - -             | - -    | - -     | - -     | - - |
| 1.916     | .0400       |            |            |         |           | .0071    | .01            | 3.04       | 1.27           | 1.87           | .014            | .00    | .00     | PIPE    |     |
| -2243.842 | 2588.042    | 3.161      | 2591.203   | 144.00  | 11.00     | 1.88     | 2593.08        | .00        | 3.44           | 4.82           | 5.000           | .000   | .00     | 0       | .0  |
| - -       | - -         | - -        | - -        | - -     | - -       | - -      | - -            | - -        | - -            | - -            | - -             | - -    | - -     | - -     | - - |
| 1.096     | .0400       |            |            |         |           | .0063    | .01            | 3.16       | 1.18           | 1.87           | .014            | .00    | .00     | PIPE    |     |
| -2242.746 | 2588.085    | 3.295      | 2591.381   | 144.00  | 10.49     | 1.71     | 2593.09        | .00        | 3.44           | 4.74           | 5.000           | .000   | .00     | 0       | .0  |
| - -       | - -         | - -        | - -        | - -     | - -       | - -      | - -            | - -        | - -            | - -            | - -             | - -    | - -     | - -     | - - |
| .366      | .0400       |            |            |         |           | .0056    | .00            | 3.30       | 1.09           | 1.87           | .014            | .00    | .00     | PIPE    |     |
| -2242.380 | 2588.100    | 3.439      | 2591.539   | 144.00  | 10.00     | 1.55     | 2593.09        | .00        | 3.44           | 4.63           | 5.000           | .000   | .00     | 0       | .0  |
| - -       | - -         | - -        | - -        | - -     | - -       | - -      | - -            | - -        | - -            | - -            | - -             | - -    | - -     | - -     | - - |
| WALL EXIT |             |            |            |         |           |          |                |            |                |                |                 |        |         |         |     |
| -2242.380 | 2588.100    | 3.439      | 2591.539   | 144.00  | 10.00     | 1.55     | 2593.09        | .00        | 3.44           | 4.63           | 5.000           | .000   | .00     | 0       | .0  |
| - -       | - -         | - -        | - -        | - -     | - -       | - -      | - -            | - -        | - -            | - -            | - -             | - -    | - -     | - -     | - - |
| 2.605     | .0184       |            |            |         |           | .0230    | .06            | 3.44       | 1.00           | 3.85           | .030            | .00    | .00     | PIPE    |     |
| -2239.775 | 2588.148    | 3.592      | 2591.740   | 144.00  | 9.54      | 1.41     | 2593.15        | .00        | 3.44           | 4.50           | 5.000           | .000   | .00     | 0       | .0  |
| - -       | - -         | - -        | - -        | - -     | - -       | - -      | - -            | - -        | - -            | - -            | - -             | - -    | - -     | - -     | - - |
| 17.760    | .0184       |            |            |         |           | .0206    | .37            | 3.59       | .92            | 3.85           | .030            | .00    | .00     | PIPE    |     |

|           |          |       |          |        |      |       |         |      |      |      |       |      |     |      |     |
|-----------|----------|-------|----------|--------|------|-------|---------|------|------|------|-------|------|-----|------|-----|
| -2222.015 | 2588.475 | 3.759 | 2592.234 | 144.00 | 9.09 | 1.28  | 2593.52 | .00  | 3.44 | 4.32 | 5.000 | .000 | .00 | 0    | .0  |
| - -       | - -      | - -   | - -      | - -    | - -  | - -   | - -     | - -  | - -  | - -  | - -   | - -  | - - | - -  | - - |
| 65.010    | .0184    |       |          |        |      | .0189 | 1.23    | 3.76 | .84  | 3.85 | .030  | .00  | .00 | PIPE |     |
| -2157.005 | 2589.672 | 3.854 | 2593.526 | 144.00 | 8.87 | 1.22  | 2594.75 | .00  | 3.44 | 4.20 | 5.000 | .000 | .00 | 0    | .0  |
| - -       | - -      | - -   | - -      | - -    | - -  | - -   | - -     | - -  | - -  | - -  | - -   | - -  | - - | - -  | - - |
| 125.171   | .0184    |       |          |        |      | .0184 | 2.30    | 3.85 | .79  | 3.85 | .030  | .00  | .00 | PIPE |     |
| -2031.834 | 2591.976 | 3.854 | 2595.830 | 144.00 | 8.87 | 1.22  | 2597.05 | .00  | 3.44 | 4.20 | 5.000 | .000 | .00 | 0    | .0  |
| - -       | - -      | - -   | - -      | - -    | - -  | - -   | - -     | - -  | - -  | - -  | - -   | - -  | - - | - -  | - - |

HYDRAULIC JUMP

FILE: OSO.WSW

W S P G W - CIVILDESIGN Version 14.06  
Program Package Serial Number: 1604

PAGE 5

WATER SURFACE PROFILE LISTING

Date: 6-20-2017 Time:12:23:51

CAPROCK HOSPITAL STORM DRAIN

| 1         | 2           | 3          | 4          | 5       | 6         | 7        |                |            |                |                |                |                 |       |            |       |       |       |
|-----------|-------------|------------|------------|---------|-----------|----------|----------------|------------|----------------|----------------|----------------|-----------------|-------|------------|-------|-------|-------|
| Station   | Invert Elev | Depth (FT) | Water Elev | Q (CFS) | Vel (FPS) | Vel Head | Energy Grd.El. | Super Elev | Critical Depth | Flow Top Width | Height/Dia.-FT | Base Wt/or I.D. | ZL    | No Prs/Pip | Wth   |       |       |
| L/Elem    | Ch Slope    |            |            |         |           | SF Ave   | HF             | SE Dpth    | Froude N       | Norm Dp        | "N"            | X-Fall          | ZR    | Type       | Ch    |       |       |
| *****     | *****       | *****      | *****      | *****   | *****     | *****    | *****          | *****      | *****          | *****          | *****          | *****           | ***** | *****      | ***** | ***** | ***** |
| -2031.834 | 2591.976    | 3.060      | 2595.036   | 144.00  | 11.43     | 2.03     | 2597.07        | .00        | 3.44           | 4.87           | 5.000          | .000            | .00   | 0          | .0    |       |       |
| - -       | - -         | - -        | - -        | - -     | - -       | - -      | - -            | - -        | - -            | - -            | - -            | - -             | - -   | - -        | - -   | - -   |       |
| 1.997     | .0184       |            |            |         |           | .0348    | .07            | 3.06       | 1.25           | 3.85           | .030           | .00             | .00   | PIPE       |       |       |       |
| -2029.837 | 2592.012    | 3.010      | 2595.022   | 144.00  | 11.66     | 2.11     | 2597.13        | .00        | 3.44           | 4.89           | 5.000          | .000            | .00   | 0          | .0    |       |       |
| - -       | - -         | - -        | - -        | - -     | - -       | - -      | - -            | - -        | - -            | - -            | - -            | - -             | - -   | - -        | - -   | - -   |       |
| 4.798     | .0184       |            |            |         |           | .0380    | .18            | 3.01       | 1.29           | 3.85           | .030           | .00             | .00   | PIPE       |       |       |       |
| -2025.040 | 2592.101    | 2.893      | 2594.994   | 144.00  | 12.23     | 2.32     | 2597.32        | .00        | 3.44           | 4.94           | 5.000          | .000            | .00   | 0          | .0    |       |       |
| - -       | - -         | - -        | - -        | - -     | - -       | - -      | - -            | - -        | - -            | - -            | - -            | - -             | - -   | - -        | - -   | - -   |       |
| 4.927     | .0184       |            |            |         |           | .0430    | .21            | 2.89       | 1.40           | 3.85           | .030           | .00             | .00   | PIPE       |       |       |       |
| -2020.113 | 2592.191    | 2.782      | 2594.973   | 144.00  | 12.82     | 2.55     | 2597.53        | .00        | 3.44           | 4.97           | 5.000          | .000            | .00   | 0          | .0    |       |       |
| - -       | - -         | - -        | - -        | - -     | - -       | - -      | - -            | - -        | - -            | - -            | - -            | - -             | - -   | - -        | - -   | - -   |       |
| 4.964     | .0184       |            |            |         |           | .0487    | .24            | 2.78       | 1.50           | 3.85           | .030           | .00             | .00   | PIPE       |       |       |       |
| -2015.148 | 2592.283    | 2.677      | 2594.960   | 144.00  | 13.45     | 2.81     | 2597.77        | .00        | 3.44           | 4.99           | 5.000          | .000            | .00   | 0          | .0    |       |       |
| - -       | - -         | - -        | - -        | - -     | - -       | - -      | - -            | - -        | - -            | - -            | - -            | - -             | - -   | - -        | - -   | - -   |       |
| 4.942     | .0184       |            |            |         |           | .0552    | .27            | 2.68       | 1.62           | 3.85           | .030           | .00             | .00   | PIPE       |       |       |       |
| -2010.206 | 2592.374    | 2.578      | 2594.952   | 144.00  | 14.11     | 3.09     | 2598.04        | .00        | 3.44           | 5.00           | 5.000          | .000            | .00   | 0          | .0    |       |       |
| - -       | - -         | - -        | - -        | - -     | - -       | - -      | - -            | - -        | - -            | - -            | - -            | - -             | - -   | - -        | - -   | - -   |       |
| 4.835     | .0184       |            |            |         |           | .0627    | .30            | 2.58       | 1.74           | 3.85           | .030           | .00             | .00   | PIPE       |       |       |       |
| -2005.371 | 2592.463    | 2.483      | 2594.946   | 144.00  | 14.79     | 3.40     | 2598.34        | .00        | 3.44           | 5.00           | 5.000          | .000            | .00   | 0          | .0    |       |       |
| - -       | - -         | - -        | - -        | - -     | - -       | - -      | - -            | - -        | - -            | - -            | - -            | - -             | - -   | - -        | - -   | - -   |       |
| 4.718     | .0184       |            |            |         |           | .0712    | .34            | 2.48       | 1.87           | 3.85           | .030           | .00             | .00   | PIPE       |       |       |       |
| -2000.654 | 2592.550    | 2.392      | 2594.942   | 144.00  | 15.52     | 3.74     | 2598.68        | .00        | 3.44           | 5.00           | 5.000          | .000            | .00   | 0          | .0    |       |       |
| - -       | - -         | - -        | - -        | - -     | - -       | - -      | - -            | - -        | - -            | - -            | - -            | - -             | - -   | - -        | - -   | - -   |       |
| 4.593     | .0184       |            |            |         |           | .0809    | .37            | 2.39       | 2.01           | 3.85           | .030           | .00             | .00   | PIPE       |       |       |       |
| -1996.060 | 2592.634    | 2.305      | 2594.939   | 144.00  | 16.27     | 4.11     | 2599.05        | .00        | 3.44           | 4.98           | 5.000          | .000            | .00   | 0          | .0    |       |       |
| - -       | - -         | - -        | - -        | - -     | - -       | - -      | - -            | - -        | - -            | - -            | - -            | - -             | - -   | - -        | - -   | - -   |       |
| 4.477     | .0184       |            |            |         |           | .0920    | .41            | 2.31       | 2.15           | 3.85           | .030           | .00             | .00   | PIPE       |       |       |       |

# WATER SURFACE PROFILE LISTING

Date: 6-20-2017 Time:12:23:51

## CAPROCK HOSPITAL STORM DRAIN

**1                  2                  3                  4                  5                  6                  7**

**456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123**

| Station   | Invert Elev | Depth (FT) | Water Elev | Q (CFS) | Vel (FPS) | Vel Head | Energy Grd.El. | Super Elev | Critical Depth | Flow Top Width | Height/Dia.-FT | Base Wt/I.D. | No ZL | Wth Prs/Pip |
|-----------|-------------|------------|------------|---------|-----------|----------|----------------|------------|----------------|----------------|----------------|--------------|-------|-------------|
| L/Elem    | Ch Slope    |            |            |         |           | SF Ave   | HF             | SE Dpth    | Froude N       | Norm Dp        | "N"            | X-Fall       | ZR    | Type Ch     |
| -1991.584 | 2592.717    | 2.223      | 2594.940   | 144.00  | 17.07     | 4.52     | 2599.46        | .00        | 3.44           | 4.97           | 5.000          | .000         | .00   | 0 .0        |
| 4.329     | .0184       |            |            |         |           | .1047    | .45            | 2.22       | 2.31           | 3.85           | .030           | .00          | .00   | PIPE        |
| -1987.254 | 2592.796    | 2.144      | 2594.940   | 144.00  | 17.90     | 4.98     | 2599.92        | .00        | 3.44           | 4.95           | 5.000          | .000         | .00   | 0 .0        |
| 4.186     | .0184       |            |            |         |           | .1191    | .50            | 2.14       | 2.47           | 3.85           | .030           | .00          | .00   | PIPE        |
| -1983.068 | 2592.874    | 2.068      | 2594.942   | 144.00  | 18.78     | 5.47     | 2600.42        | .00        | 3.44           | 4.92           | 5.000          | .000         | .00   | 0 .0        |
| 4.045     | .0184       |            |            |         |           | .1357    | .55            | 2.07       | 2.65           | 3.85           | .030           | .00          | .00   | PIPE        |
| -1979.023 | 2592.948    | 1.995      | 2594.943   | 144.00  | 19.69     | 6.02     | 2600.96        | .00        | 3.44           | 4.90           | 5.000          | .000         | .00   | 0 .0        |
| 3.913     | .0184       |            |            |         |           | .1546    | .60            | 2.00       | 2.84           | 3.85           | .030           | .00          | .00   | PIPE        |
| -1975.110 | 2593.020    | 1.927      | 2594.947   | 144.00  | 20.64     | 6.62     | 2601.56        | .00        | 3.44           | 4.87           | 5.000          | .000         | .00   | 0 .0        |
| 5.000     | .0400       |            |            |         |           | .0357    | .18            | 1.93       | 3.04           | 1.87           | .014           | .00          | .00   | PIPE        |
| -1970.110 | 2593.220    | 1.929      | 2595.149   | 144.00  | 20.61     | 6.59     | 2601.74        | .00        | 3.44           | 4.87           | 5.000          | .000         | .00   | 0 .0        |
| WALL EXIT |             |            |            |         |           |          |                |            |                |                |                |              |       |             |
| -1970.110 | 2593.220    | 1.928      | 2595.148   | 144.00  | 20.62     | 6.60     | 2601.75        | .00        | 3.44           | 4.87           | 5.000          | .000         | .00   | 0 .0        |
| 54.082    | .0252       |            |            |         |           | .0322    | 1.74           | 1.93       | 3.03           | 2.04           | .013           | .00          | .00   | PIPE        |
| -1916.028 | 2594.582    | 1.884      | 2596.466   | 144.00  | 21.27     | 7.03     | 2603.49        | .00        | 3.44           | 4.85           | 5.000          | .000         | .00   | 0 .0        |
| 59.498    | .0252       |            |            |         |           | .0359    | 2.14           | 1.88       | 3.17           | 2.04           | .013           | .00          | .00   | PIPE        |
| -1856.530 | 2596.080    | 1.819      | 2597.899   | 144.00  | 22.30     | 7.72     | 2605.62        | 5.00       | 3.44           | 4.81           | 5.000          | .000         | .00   | 0 .0        |
| 5.000     | .0400       |            |            |         |           | .0444    | .22            | 5.00       | 3.39           | 1.87           | .014           | .00          | .00   | PIPE        |

Program Package Serial Number: 1604

## WATER SURFACE PROFILE LISTING

Date: 6-20-2017 Time:12:23:51

## CAPROCK HOSPITAL STORM DRAIN

|             |            |            |            |            |            |            |
|-------------|------------|------------|------------|------------|------------|------------|
| 1           | 2          | 3          | 4          | 5          | 6          | 7          |
| 45678901234 | 5678901234 | 5678901234 | 5678901234 | 5678901234 | 5678901234 | 5678901234 |

| Station | Invert Elev | Depth (FT) | Water Elev | Q (CFS) | Val (EPS) | Val Head | Energy Grd.El. | Super Elev | Critical Depth | Flow Top | Height/Dia. | Base Wt/or I.D. | No Wth ZL | No Wth Prs/Pip |
|---------|-------------|------------|------------|---------|-----------|----------|----------------|------------|----------------|----------|-------------|-----------------|-----------|----------------|
| L/Elem  | Ch Slope    |            |            |         |           | SF Ave   | HF             | SE Dpth    | Froude N       | Norm Dp  | "N"         | X-Fall          | ZR        | Type Ch        |

|           |          |       |          |        |       |       |         |      |      |      |       |       |     |     |     |
|-----------|----------|-------|----------|--------|-------|-------|---------|------|------|------|-------|-------|-----|-----|-----|
| -1851.530 | 2596.280 | 1.817 | 2598.097 | 144.00 | 22.34 | 7.75  | 2605.85 | .00  | 3.44 | 4.81 | 5.000 | .000  | .00 | 0   | .0  |
| - -       | - -      | - -   | - -      | - -    | - -   | - -   | - -     | - -  | - -  | - -  | - -   | - -   | - - | - - | - - |
| WALL EXIT |          |       |          |        |       |       |         |      |      |      |       |       |     |     |     |
| -1851.530 | 2596.280 | 1.074 | 2597.354 | 144.00 | 22.36 | 7.76  | 2605.11 | .00  | 2.62 | 6.00 | 3.000 | 6.000 | .00 | 0   | .0  |
| - -       | - -      | - -   | - -      | - -    | - -   | - -   | - -     | - -  | - -  | - -  | - -   | - -   | - - | - - | - - |
| 6.821     | .1245    |       |          |        |       | .0579 | .39     | 1.07 | 3.80 | .85  | .014  | .00   | .00 | BOX |     |
| -1844.709 | 2597.129 | 1.109 | 2598.238 | 144.00 | 21.64 | 7.27  | 2605.51 | .00  | 2.62 | 6.00 | 3.000 | 6.000 | .00 | 0   | .0  |
| - -       | - -      | - -   | - -      | - -    | - -   | - -   | - -     | - -  | - -  | - -  | - -   | - -   | - - | - - | - - |
| 8.318     | .1245    |       |          |        |       | .0515 | .43     | 1.11 | 3.62 | .85  | .014  | .00   | .00 | BOX |     |
| -1836.391 | 2598.165 | 1.163 | 2599.328 | 144.00 | 20.64 | 6.61  | 2605.94 | .00  | 2.62 | 6.00 | 3.000 | 6.000 | .00 | 0   | .0  |
| - -       | - -      | - -   | - -      | - -    | - -   | - -   | - -     | - -  | - -  | - -  | - -   | - -   | - - | - - | - - |
| 6.825     | .1245    |       |          |        |       | .0447 | .31     | 1.16 | 3.37 | .85  | .014  | .00   | .00 | BOX |     |
| -1829.566 | 2599.014 | 1.220 | 2600.234 | 144.00 | 19.68 | 6.01  | 2606.25 | .00  | 2.62 | 6.00 | 3.000 | 6.000 | .00 | 0   | .0  |
| - -       | - -      | - -   | - -      | - -    | - -   | - -   | - -     | - -  | - -  | - -  | - -   | - -   | - - | - - | - - |
| 5.688     | .1245    |       |          |        |       | .0388 | .22     | 1.22 | 3.14 | .85  | .014  | .00   | .00 | BOX |     |
| -1823.878 | 2599.722 | 1.279 | 2601.002 | 144.00 | 18.76 | 5.47  | 2606.47 | .00  | 2.62 | 6.00 | 3.000 | 6.000 | .00 | 0   | .0  |
| - -       | - -      | - -   | - -      | - -    | - -   | - -   | - -     | - -  | - -  | - -  | - -   | - -   | - - | - - | - - |
| 4.790     | .1245    |       |          |        |       | .0338 | .16     | 1.28 | 2.92 | .85  | .014  | .00   | .00 | BOX |     |
| -1819.089 | 2600.319 | 1.342 | 2601.660 | 144.00 | 17.89 | 4.97  | 2606.63 | .00  | 2.62 | 6.00 | 3.000 | 6.000 | .00 | 0   | .0  |
| - -       | - -      | - -   | - -      | - -    | - -   | - -   | - -     | - -  | - -  | - -  | - -   | - -   | - - | - - | - - |
| 4.062     | .1245    |       |          |        |       | .0294 | .12     | 1.34 | 2.72 | .85  | .014  | .00   | .00 | BOX |     |
| -1815.027 | 2600.824 | 1.407 | 2602.231 | 144.00 | 17.06 | 4.52  | 2606.75 | .00  | 2.62 | 6.00 | 3.000 | 6.000 | .00 | 0   | .0  |
| - -       | - -      | - -   | - -      | - -    | - -   | - -   | - -     | - -  | - -  | - -  | - -   | - -   | - - | - - | - - |
| 3.458     | .1245    |       |          |        |       | .0256 | .09     | 1.41 | 2.53 | .85  | .014  | .00   | .00 | BOX |     |
| -1811.569 | 2601.255 | 1.476 | 2602.730 | 144.00 | 16.26 | 4.11  | 2606.84 | .00  | 2.62 | 6.00 | 3.000 | 6.000 | .00 | 0   | .0  |
| - -       | - -      | - -   | - -      | - -    | - -   | - -   | - -     | - -  | - -  | - -  | - -   | - -   | - - | - - | - - |
| 2.948     | .1245    |       |          |        |       | .0223 | .07     | 1.48 | 2.36 | .85  | .014  | .00   | .00 | BOX |     |

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W S P G W - CIVILDESIGN Version 14.06

PAGE 8

Program Package Serial Number: 1604

# WATER SURFACE PROFILE LISTING

Date: 6-20-2017 Time:12:23:51

## CAPROCK HOSPITAL STORM DRAIN

1 2 3 4 5 6 7  
456789012345678901234567890123456789012345678901234567890123

| Station   | Invert Elev | Depth (FT) | Water Elev | Q (CFS) | Vel (FPS) | Vel Head | Energy Grd.El. | Super Elev | Critical Depth | Flow Top Width | Height/ Dia.-FT | Base Wt/ or I.D. | No ZL | Wth Prs/Pip |
|-----------|-------------|------------|------------|---------|-----------|----------|----------------|------------|----------------|----------------|-----------------|------------------|-------|-------------|
| L/Elem    | Ch Slope    |            |            |         |           | SF Ave   | HF             | SE Dpth    | Froude N       | Norm Dp        | "N"             | X-Fall           | ZR    | Type Ch     |
| -1808.621 | 2601.622    | 1.548      | 2603.169   | 144.00  | 15.51     | 3.73     | 2606.90        | .00        | 2.62           | 6.00           | 3.000           | 6.000            | .00   | 0 .0        |
| - -       | - -         | - -        | - -        | - -     | - -       | - -      | - -            | - -        | - -            | - -            | - -             | - -              | - -   | - -         |
| 2.511     | .1245       |            |            |         |           | .0194    | .05            | 1.55       | 2.20           | .85            | .014            | .00              | .00   | BOX         |
| -1806.109 | 2601.934    | 1.623      | 2603.557   | 144.00  | 14.78     | 3.39     | 2606.95        | .00        | 2.62           | 6.00           | 3.000           | 6.000            | .00   | 0 .0        |
| - -       | - -         | - -        | - -        | - -     | - -       | - -      | - -            | - -        | - -            | - -            | - -             | - -              | - -   | - -         |
| 2.132     | .1245       |            |            |         |           | .0169    | .04            | 1.62       | 2.04           | .85            | .014            | .00              | .00   | BOX         |
| -1803.977 | 2602.199    | 1.703      | 2603.902   | 144.00  | 14.10     | 3.09     | 2606.99        | .00        | 2.62           | 6.00           | 3.000           | 6.000            | .00   | 0 .0        |
| - -       | - -         | - -        | - -        | - -     | - -       | - -      | - -            | - -        | - -            | - -            | - -             | - -              | - -   | - -         |
| 1.800     | .1245       |            |            |         |           | .0148    | .03            | 1.70       | 1.90           | .85            | .014            | .00              | .00   | BOX         |



|           |          |       |          |        |       |       |         |      |      |      |       |       |     |     |     |
|-----------|----------|-------|----------|--------|-------|-------|---------|------|------|------|-------|-------|-----|-----|-----|
| -1802.177 | 2602.423 | 1.786 | 2604.209 | 144.00 | 13.44 | 2.80  | 2607.01 | .00  | 2.62 | 6.00 | 3.000 | 6.000 | .00 | 0   | .0  |
| - -       | - -      | - -   | - -      | - -    | - -   | - -   | - -     | - -  | - -  | - -  | - -   | - -   | - - | - - | - - |
| 1.504     | .1245    |       |          |        |       | .0129 | .02     | 1.79 | 1.77 | .85  | .014  | .00   | .00 | BOX |     |
| -1800.673 | 2602.611 | 1.873 | 2604.483 | 144.00 | 12.81 | 2.55  | 2607.03 | .00  | 2.62 | 6.00 | 3.000 | 6.000 | .00 | 0   | .0  |
| - -       | - -      | - -   | - -      | - -    | - -   | - -   | - -     | - -  | - -  | - -  | - -   | - -   | - - | - - | - - |
| 1.240     | .1245    |       |          |        |       | .0113 | .01     | 1.87 | 1.65 | .85  | .014  | .00   | .00 | BOX |     |
| -1799.433 | 2602.765 | 1.964 | 2604.729 | 144.00 | 12.22 | 2.32  | 2607.05 | .00  | 2.62 | 6.00 | 3.000 | 6.000 | .00 | 0   | .0  |
| - -       | - -      | - -   | - -      | - -    | - -   | - -   | - -     | - -  | - -  | - -  | - -   | - -   | - - | - - | - - |
| 1.002     | .1245    |       |          |        |       | .0099 | .01     | 1.96 | 1.54 | .85  | .014  | .00   | .00 | BOX |     |
| -1798.431 | 2602.890 | 2.060 | 2604.950 | 144.00 | 11.65 | 2.11  | 2607.06 | .00  | 2.62 | 6.00 | 3.000 | 6.000 | .00 | 0   | .0  |
| - -       | - -      | - -   | - -      | - -    | - -   | - -   | - -     | - -  | - -  | - -  | - -   | - -   | - - | - - | - - |
| .786      | .1245    |       |          |        |       | .0087 | .01     | 2.06 | 1.43 | .85  | .014  | .00   | .00 | BOX |     |
| -1797.645 | 2602.988 | 2.161 | 2605.148 | 144.00 | 11.11 | 1.92  | 2607.06 | .00  | 2.62 | 6.00 | 3.000 | 6.000 | .00 | 0   | .0  |
| - -       | - -      | - -   | - -      | - -    | - -   | - -   | - -     | - -  | - -  | - -  | - -   | - -   | - - | - - | - - |
| .588      | .1245    |       |          |        |       | .0076 | .00     | 2.16 | 1.33 | .85  | .014  | .00   | .00 | BOX |     |
| -1797.057 | 2603.061 | 2.266 | 2605.327 | 144.00 | 10.59 | 1.74  | 2607.07 | .00  | 2.62 | 6.00 | 3.000 | 6.000 | .00 | 0   | .0  |
| - -       | - -      | - -   | - -      | - -    | - -   | - -   | - -     | - -  | - -  | - -  | - -   | - -   | - - | - - | - - |
| .405      | .1245    |       |          |        |       | .0066 | .00     | 2.27 | 1.24 | .85  | .014  | .00   | .00 | BOX |     |

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W S P G W - CIVILDESIGN Version 14.06

PAGE 9

Program Package Serial Number: 1604

# WATER SURFACE PROFILE LISTING

Date: 6-20-2017 Time:12:23:51

## CAPROCK HOSPITAL STORM DRAIN

1 2 3 4 5 6 7  
456789012345678901234567890123456789012345678901234567890123

| Station   | Invert Elev | Depth (FT) | Water Elev | Q (CFS) | Vel (FPS) | Vel Head | Energy Grd.El. | Super Elev | Critical Depth | Flow Top Width | Height/ Base Wt | No Wth     |     |     |     |
|-----------|-------------|------------|------------|---------|-----------|----------|----------------|------------|----------------|----------------|-----------------|------------|-----|-----|-----|
| L/Elem    | Ch Slope    |            |            |         |           | SF Ave   | HF             | SE Dpth    | Froude N       | Norm Dp        | "N" X-Fall      | ZR Type Ch |     |     |     |
| -1796.652 | 2603.111    | 2.377      | 2605.488   | 144.00  | 10.10     | 1.58     | 2607.07        | .00        | 2.62           | 6.00           | 3.000           | 6.000      | .00 | 0   | .0  |
| - -       | - -         | - -        | - -        | - -     | - -       | - -      | - -            | - -        | - -            | - -            | - -             | - -        | - - | - - | - - |
| .235      | .1245       |            |            |         |           | .0058    | .00            | 2.38       | 1.15           | .85            | .014            | .00        | .00 | BOX |     |
| -1796.417 | 2603.140    | 2.493      | 2605.633   | 144.00  | 9.63      | 1.44     | 2607.07        | .00        | 2.62           | 6.00           | 3.000           | 6.000      | .00 | 0   | .0  |
| - -       | - -         | - -        | - -        | - -     | - -       | - -      | - -            | - -        | - -            | - -            | - -             | - -        | - - | - - | - - |
| .077      | .1245       |            |            |         |           | .0051    | .00            | 2.49       | 1.07           | .85            | .014            | .00        | .00 | BOX |     |
| -1796.340 | 2603.150    | 2.616      | 2605.765   | 144.00  | 9.18      | 1.31     | 2607.07        | .00        | 2.62           | 6.00           | 3.000           | 6.000      | .00 | 0   | .0  |
| - -       | - -         | - -        | - -        | - -     | - -       | - -      | - -            | - -        | - -            | - -            | - -             | - -        | - - | - - | - - |

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WATER SURFACE PRESSURE GRADIENT ANALYSIS (PLAN & PROFILE)  
OS02.WSW

Program Package Serial Number: 1604

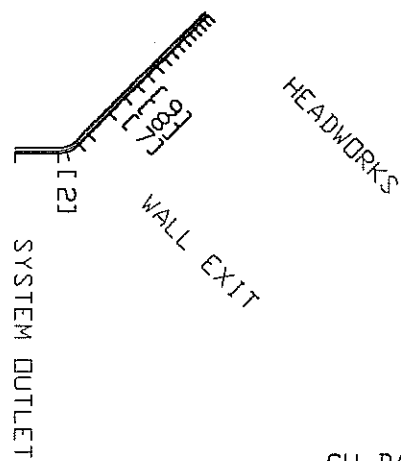
Date: 6-21-2017 Time: 3:39:49 File: DS02.WSW

CAPROCK HOSPITAL STORM DRAIN LATERAL PIPE

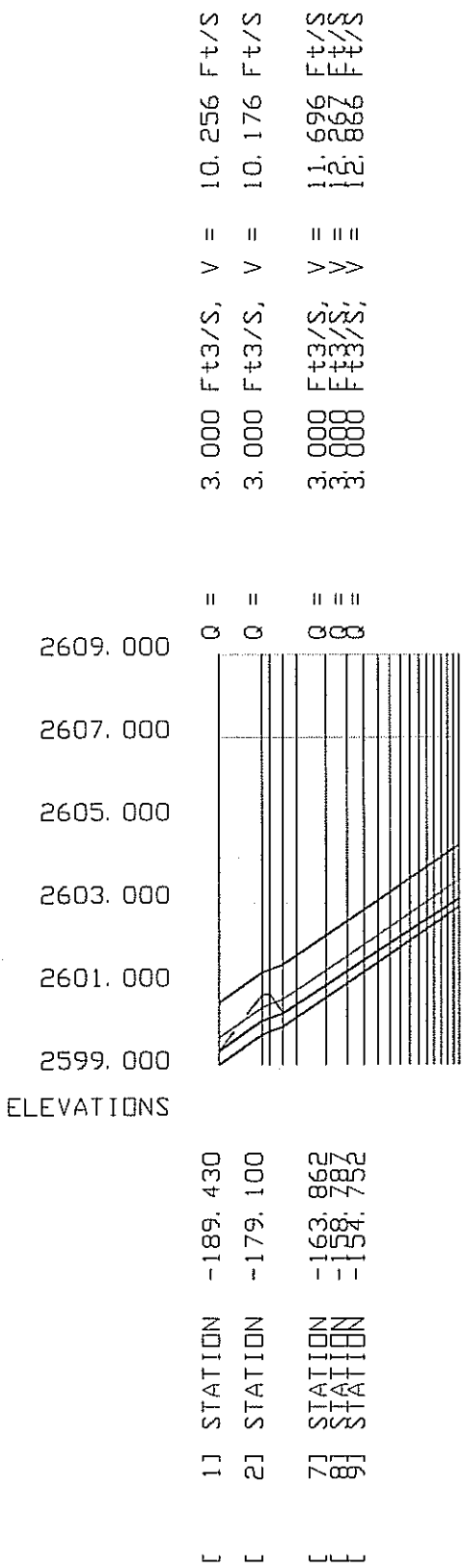
| 45678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123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|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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# WATER SURFACE PRESSURE GRADIENT ANALYSIS (PLAN & PROFILE)

## OS02.WSW



|          |           |           |           |
|----------|-----------|-----------|-----------|
| CH_BANK  | _____     | _____     | _____     |
| SUPER_E  | - - - - - | - - - - - | - - - - - |
| CRITICAL | _____     | _____     | _____     |
| WATER    | _____     | _____     | _____     |
| INVERT   | _____     | _____     | _____     |



|     |                                                                                         |   |   |      |           |       |       |       |         |  |      |
|-----|-----------------------------------------------------------------------------------------|---|---|------|-----------|-------|-------|-------|---------|--|------|
| T1  | CAPROCK HOSPITAL STORM DRAIN LATERAL PIPE                                               |   |   |      |           |       |       |       |         |  | 0    |
| T2  | 1                                                                                       | 2 | 3 | 4    | 5         | 6     | 7     | 8     |         |  | 9    |
| T3  | 456789012345678901234567890123456789012345678901234567890123456789012345678901234567890 |   |   |      |           |       |       |       |         |  |      |
| SO  | -189.4302599.080 4                                                                      |   |   |      | 2598.0970 |       |       |       |         |  |      |
| REM | ABOVE HGL TAKEN FROM OSO.WSW OUTPUT STA -18+510                                         |   |   |      |           |       |       |       |         |  |      |
| R   | -179.1002599.810 4                                                                      |   |   |      | .013      |       |       |       | .000    |  | .000 |
| WE  | -179.1002599.810 4                                                                      |   |   |      | .20       |       |       |       |         |  |      |
| R   | -174.1002600.010 4                                                                      |   |   |      | .014      |       |       |       | -45.000 |  | .000 |
| WX  | -174.1002600.010 4                                                                      |   |   |      |           |       |       |       |         |  |      |
| R   | -131.6702602.900 4                                                                      |   |   |      | .013      |       |       |       | .000    |  | 000  |
| SH  | -131.6702602.900 1                                                                      |   |   |      | 2602.900  |       |       |       |         |  |      |
| CD  | 1                                                                                       | 3 | 0 | .000 | 3.000     | 6.000 | .000  | .000  | .00     |  |      |
| CD  | 2                                                                                       | 1 | 0 | .000 | 3.000     | 8.000 | 3.000 | 3.000 | .00     |  |      |
| CD  | 3                                                                                       | 4 | 0 | .000 | 5.000     | .000  | .000  | .000  | .00     |  |      |
| CD  | 4                                                                                       | 4 | 0 | .000 | 1.500     | .000  | .000  | .000  | .00     |  |      |
| CD  | 5                                                                                       | 4 | 2 | .000 | 3.000     | .000  | .000  | .000  | .00     |  |      |
| Q   | 144.000                                                                                 |   |   | .0   |           |       |       |       |         |  |      |



## WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING

PAGE 1

| CARD CODE | SECT NO | CHN TYPE | NO OF PIER/PIP | AVE PIER WIDTH | HEIGHT 1 DIAMETER | BASE WIDTH | ZL    | ZR    | INV DROP | Y(1) | Y(2) | Y(3) | Y(4) | Y(5) | Y(6) | Y(7) | Y(8) | Y(9) | Y(10) |
|-----------|---------|----------|----------------|----------------|-------------------|------------|-------|-------|----------|------|------|------|------|------|------|------|------|------|-------|
| CD        | 1       | 3        | 0              | .000           | 3.000             | 6.000      | .000  | .000  | .00      |      |      |      |      |      |      |      |      |      |       |
| CD        | 2       | 1        | 0              | .000           | 3.000             | 8.000      | 3.000 | 3.000 | .00      |      |      |      |      |      |      |      |      |      |       |
| CD        | 3       | 4        | 0              |                | 5.000             |            |       |       |          |      |      |      |      |      |      |      |      |      |       |
| CD        | 4       | 4        | 0              |                | 1.500             |            |       |       |          |      |      |      |      |      |      |      |      |      |       |
| CD        | 5       | 4        | 2              |                | 3.000             |            |       |       |          |      |      |      |      |      |      |      |      |      |       |

W S P G W

PAGE NO 1

## WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -

CAPROCK HOSPITAL STORM DRAIN LATERAL PIPE

HEADING LINE NO 2 IS -

1 2 3 4 5 6 7

HEADING LINE NO 3 IS -

4567890123456789012345678901234567890123456789012345678901234567

W S P G W

PAGE NO 2

## WATER SURFACE PROFILE - ELEMENT CARD LISTING

| ELEMENT NO                                                                                  | DESCRIPTION           | U/S DATA | STATION  | INVERT   | SECT | W S ELEV | RADIUS | ANGLE | ANG PT  | MAN H  |
|---------------------------------------------------------------------------------------------|-----------------------|----------|----------|----------|------|----------|--------|-------|---------|--------|
| 1                                                                                           | IS A SYSTEM OUTLET    |          |          |          |      |          |        |       |         |        |
|                                                                                             |                       |          | -189.430 | 2599.080 | 4    | 2598.097 |        |       |         |        |
| REMARKS: ABOVE HGL TAKEN FROM OSO.WSW OUTPUT STA -18+510                                    |                       |          |          |          |      |          |        |       |         |        |
| 2                                                                                           | IS A REACH            |          |          |          |      |          |        |       |         |        |
|                                                                                             |                       |          | -179.100 | 2599.810 | 4    |          | .013   | .000  | .000    | .000 0 |
| 3                                                                                           | IS A WALL ENTRANCE    |          |          |          |      |          |        |       |         |        |
|                                                                                             |                       |          | -179.100 | 2599.810 | 4    |          | .200   |       |         |        |
| 4                                                                                           | IS A REACH            |          |          |          |      |          |        |       |         |        |
|                                                                                             |                       |          | -174.100 | 2600.010 | 4    |          | .014   | 6.366 | -45.000 | .000 0 |
| 5                                                                                           | IS A WALL EXIT        |          |          |          |      |          |        |       |         |        |
|                                                                                             |                       |          | -174.100 | 2600.010 | 4    |          |        |       |         |        |
| 6                                                                                           | IS A REACH            |          |          |          |      |          |        |       |         |        |
|                                                                                             |                       |          | -131.670 | 2602.900 | 4    |          | .013   | .000  | .000    | .000 0 |
| WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS |                       |          |          |          |      |          |        |       |         |        |
| 7                                                                                           | IS A SYSTEM HEADWORKS |          |          |          |      |          |        |       |         |        |
|                                                                                             |                       |          | -131.670 | 2602.900 | 1    | 2602.900 |        |       |         |        |

Program Package Serial Number: 1604

# WATER SURFACE PROFILE LISTING

Date: 6-21-2017 Time: 3:39:49

CAPROCK HOSPITAL STORM DRAIN LATERAL PIPE

[illegible]

| *****     |             |            |            |         |           |          |                |            |                |          |                 |        |        |         | ***** |  |
|-----------|-------------|------------|------------|---------|-----------|----------|----------------|------------|----------------|----------|-----------------|--------|--------|---------|-------|--|
| Station   | Invert Elev | Depth (FT) | Water Elev | Q (CFS) | Vel (FPS) | Vel Head | Energy Grd.El. | Super Elev | Critical Depth | Flow Top | Height/ Base Wt | ZL     | No Wth | Prs/Pip |       |  |
| L/Elem    | Ch Slope    |            |            |         |           | SF Ave   | HF             | SE Dpth    | Froude N       | Norm Dp  | "N"             | X-Fall | ZR     | Type Ch |       |  |
| *****     | *****       | *****      | *****      | *****   | *****     | *****    | *****          | *****      | *****          | *****    | *****           | *****  | *****  | *****   |       |  |
| -189.430  | 2599.080    | .333       | 2599.414   | 3.00    | 10.26     | 1.63     | 2601.05        | .00        | .66            | 1.25     | 1.500           | .000   | .00    | 0 0.0   |       |  |
| -         | -           | -          | -          | -       | -         | -        | -              | -          | -              | -        | -               | -      | -      | -       |       |  |
| 10.330    | .0707       |            |            |         |           | .0691    | .71            | .33        | 3.73           | .33      | .013            | .00    | .00    | PIPE    |       |  |
| -179.100  | 2599.810    | .335       | 2600.145   | 3.00    | 10.18     | 1.61     | 2601.75        | .63        | .66            | 1.25     | 1.500           | .000   | .00    | 0 0.0   |       |  |
| -         | -           | -          | -          | -       | -         | -        | -              | -          | -              | -        | -               | -      | -      | -       |       |  |
| 1.835     | .0400       |            |            |         |           | .0813    | .15            | .97        | 3.69           | .40      | .014            | .00    | .00    | PIPE    |       |  |
| -177.265  | 2599.884    | .329       | 2600.213   | 3.00    | 10.41     | 1.68     | 2601.90        | .66        | .66            | 1.24     | 1.500           | .000   | .00    | 0 0.0   |       |  |
| -         | -           | -          | -          | -       | -         | -        | -              | -          | -              | -        | -               | -      | -      | -       |       |  |
| 3.165     | .0400       |            |            |         |           | .0900    | .28            | .99        | 3.81           | .40      | .014            | .00    | .00    | PIPE    |       |  |
| -174.100  | 2600.010    | .319       | 2600.329   | 3.00    | 10.92     | 1.85     | 2602.18        | .00        | .66            | 1.23     | 1.500           | .000   | .00    | 0 0.0   |       |  |
| -         | -           | -          | -          | -       | -         | -        | -              | -          | -              | -        | -               | -      | -      | -       |       |  |
| WALL EXIT |             |            |            |         |           |          |                |            |                |          |                 |        |        |         |       |  |
| -174.100  | 2600.010    | .318       | 2600.328   | 3.00    | 10.98     | 1.87     | 2602.20        | .00        | .66            | 1.23     | 1.500           | .000   | .00    | 0 0.0   |       |  |
| -         | -           | -          | -          | -       | -         | -        | -              | -          | -              | -        | -               | -      | -      | -       |       |  |
| 3.259     | .0681       |            |            |         |           | .0861    | .28            | .32        | 4.10           | .34      | .013            | .00    | .00    | PIPE    |       |  |
| -170.841  | 2600.232    | .314       | 2600.546   | 3.00    | 11.15     | 1.93     | 2602.48        | .00        | .66            | 1.22     | 1.500           | .000   | .00    | 0 0.0   |       |  |
| -         | -           | -          | -          | -       | -         | -        | -              | -          | -              | -        | -               | -      | -      | -       |       |  |
| 6.979     | .0681       |            |            |         |           | .0943    | .66            | .31        | 4.19           | .34      | .013            | .00    | .00    | PIPE    |       |  |
| -163.862  | 2600.707    | .304       | 2601.011   | 3.00    | 11.70     | 2.12     | 2603.14        | .00        | .66            | 1.21     | 1.500           | .000   | .00    | 0 0.0   |       |  |
| -         | -           | -          | -          | -       | -         | -        | -              | -          | -              | -        | -               | -      | -      | -       |       |  |
| 5.074     | .0681       |            |            |         |           | .1080    | .55            | .30        | 4.47           | .34      | .013            | .00    | .00    | PIPE    |       |  |
| -158.787  | 2601.053    | .294       | 2601.347   | 3.00    | 12.27     | 2.34     | 2603.68        | .00        | .66            | 1.19     | 1.500           | .000   | .00    | 0 0.0   |       |  |
| -         | -           | -          | -          | -       | -         | -        | -              | -          | -              | -        | -               | -      | -      | -       |       |  |
| 4.035     | .0681       |            |            |         |           | .1235    | .50            | .29        | 4.77           | .34      | .013            | .00    | .00    | PIPE    |       |  |
| -154.752  | 2601.328    | .284       | 2601.612   | 3.00    | 12.87     | 2.57     | 2604.18        | .00        | .66            | 1.18     | 1.500           | .000   | .00    | 0 0.0   |       |  |
| -         | -           | -          | -          | -       | -         | -        | -              | -          | -              | -        | -               | -      | -      | -       |       |  |
| 3.385     | .0681       |            |            |         |           | .1414    | .48            | .28        | 5.09           | .34      | .013            | .00    | .00    | PIPE    |       |  |

W S P G W - CIVILDESIGN Version 14.06

Program Package Serial Number: 1604

## WATER SURFACE PROFILE LISTING

Date: 6-21-2017 Time: 3:39:49

CAPROCK HOSPITAL STORM DRAIN LATERAL PIPE

| 1           | 2           | 3           | 4           | 5           | 6           | 7                                   |
|-------------|-------------|-------------|-------------|-------------|-------------|-------------------------------------|
| 45678901234 | 56789012345 | 67890123456 | 78901234567 | 89012345678 | 90123456789 | 01234567890123456789012345678901234 |

| Station | Invert Elev | Depth (FT) | Water Elev | Q (CFS) | Vel (FPS) | Vel Head | Energy Grd.El. | Super Elev | Critical Depth | Flow Top Width | Height/Dia.-FT | Base Wt/Or I.D. | ZL | No Wth Prs/Pip |
|---------|-------------|------------|------------|---------|-----------|----------|----------------|------------|----------------|----------------|----------------|-----------------|----|----------------|
| I/Elem  | Ch Slope    |            |            |         |           | SF Ave   | HF             | SE Dpth    | Froude N       | Norm Dp        | "N"            | X-Fall          | ZR | Type Ch        |

FILE: OSO2.WSW

W S P G W - CIVILDESIGN Version 14.06

Program Package Serial Number: 1604

WATER SURFACE PROFILE LISTING

Date: 6-21-2017 Time: 3:39:49

PAGE 3

CAPROCK HOSPITAL STORM DRAIN LATERAL PIPE

|                                                                        |   |   |   |   |   |   |
|------------------------------------------------------------------------|---|---|---|---|---|---|
| 1                                                                      | 2 | 3 | 4 | 5 | 6 | 7 |
| 4567890123456789012345678901234567890123456789012345678901234567890123 |   |   |   |   |   |   |





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## REFERENCE MATERIAL



**TECHNICAL DRAINAGE STUDY UPDATE  
REMINGTON COMMERCIAL VIII  
(DURANGO & 95 COMMERCIAL)  
SECTION 17, TOWNSHIP 19 SOUTH, RANGE 60 EAST  
CITY OF LAS VEGAS, NEVADA**

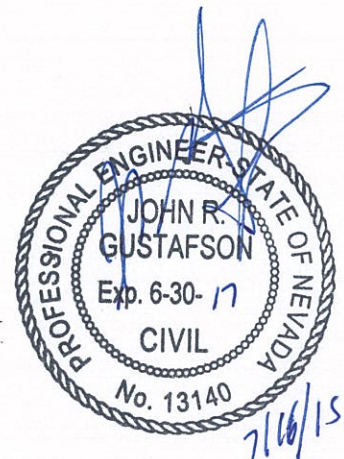
July 16, 2015

**PREPARED FOR:**

**REMINGTON COMMERCIAL DEVELOPMENT**  
5920 SOUTH RAINBOW BLVD, SUITE 11  
LAS VEGAS, NEVADA 89118

**PREPARED BY:**

**BAUGHMAN & TURNER, INC.**  
1210 HINSON STREET  
LAS VEGAS, NEVADA 89102



|                                                                            |                                                                                                |                                                                                                   |
|----------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| <b>CITY OF LAS VEGAS<br/>INTER-OFFICE MEMORANDUM</b>                       |                                                                                                | <b>DATE:</b><br>November 4, 2015                                                                  |
| <b>TO:</b><br>Land Development Services<br>Department of Building & Safety |                                                                                                | <b>FROM:</b><br>Albert Sung, P.E.<br>Flood Control Project Engineer<br>Department of Public Works |
| <b>SUBJECT:</b>                                                            | Drainage Study for:<br><b>Remington Commercial VIII</b><br>(Update to Durango & 95 Commercial) | <b>COPIES TO:</b><br>Baughman & Turner, Inc.                                                      |
| <b>Cross Streets:</b>                                                      | NEC of Oso Blanca Road & Severance Lane                                                        | Remington Commercial VIII, LLC                                                                    |
| <b>File Number:</b>                                                        | F:\Depot\DSMemos\DS4743C.doc                                                                   | Bart Anderson, P.E., DevCo                                                                        |
| <b>Parcel Number:</b>                                                      | 125-17-301-012                                                                                 | NDOT                                                                                              |
| <b>Zoning Action:</b>                                                      | TMP-59501; SDR-58128; SUP-58125;<br>SUP-58126 & SUP-58127                                      |                                                                                                   |
| <b>FEMA Flood Zone</b>                                                     | YES                                                                                            | NO <b>X</b>                                                                                       |
| <b>Proposed Storm Drain</b>                                                | YES                                                                                            | NO <b>X</b>                                                                                       |

| HISTORY                    | DATE RECEIVED | DATE REVIEWED | COMMENTS               | REVIEW FEES     | FEES PAID<br>Payment Trn # |
|----------------------------|---------------|---------------|------------------------|-----------------|----------------------------|
| 1 <sup>st</sup> Submittal  | 7/21/2015     | 8/5/2015      | Not Approved           | \$400.00        | 407591: \$400              |
| 2 <sup>nd</sup> Submittal  | 8/17/2015     | 8/31/2015     | Conditionally Approved | \$400.00        | 410428: \$400              |
| NDOT                       | 11/4/2015     | 11/4/2015     | Concurrence Received   | N/C             | N/C                        |
| <b>TOTAL FEES (LDDRS):</b> |               |               |                        | <b>\$800.00</b> | <b>----</b>                |

#### REMARKS:

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

|          |                                                                                                |
|----------|------------------------------------------------------------------------------------------------|
| <b>X</b> | 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 NDOT concurrence.                                         |

1. The project proposes to construct facilities and/or increase flows within *Nevada Department of Transportation* (NDOT) right-of-way. The engineer must contact NDOT for encroachment permit for the proposed project.

**NOTE:** Any future changes to the proposed design (or design assumptions) as outlined in the approved drainage study and attached preliminary grading plan which affect drainage must be addressed in a Drainage Study Update and accepted by the *City of Las Vegas Flood Control Section*. Additionally, conditional acceptance of a drainage study is valid for a period of one (1) year. If the proposed construction has not been completed in that time period, the *City of Las Vegas* reserves the right to require additional conditions and/or submission and acceptance of a complete drainage study update prior to further construction of a project.

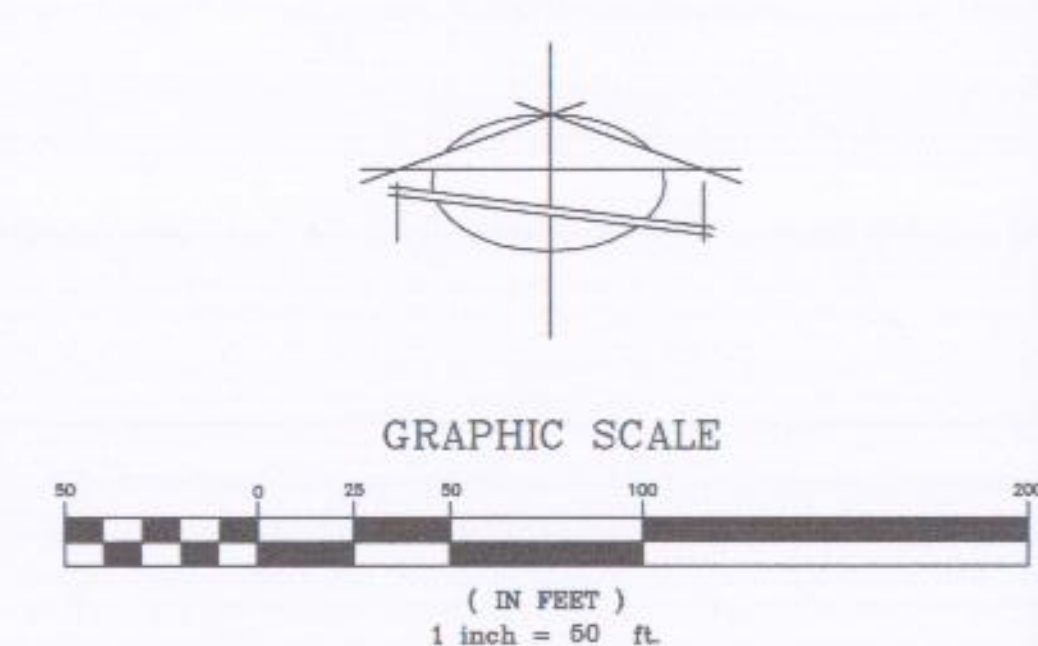
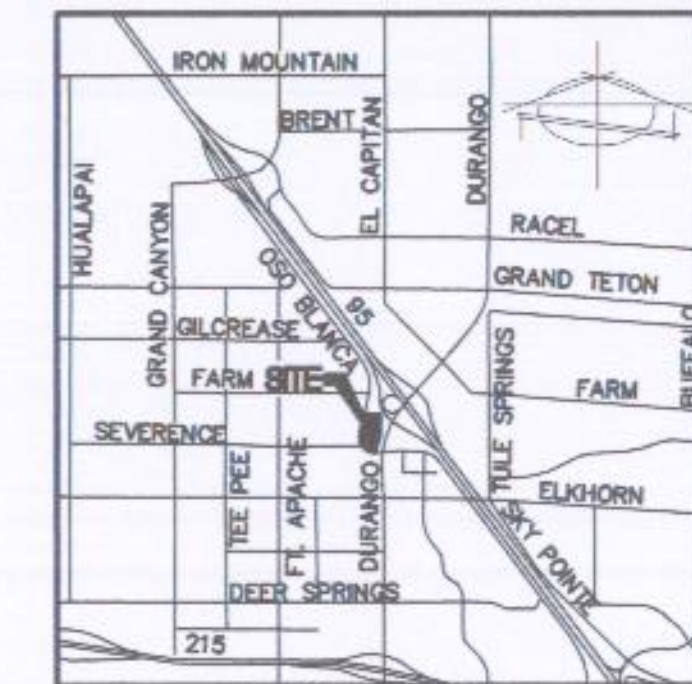
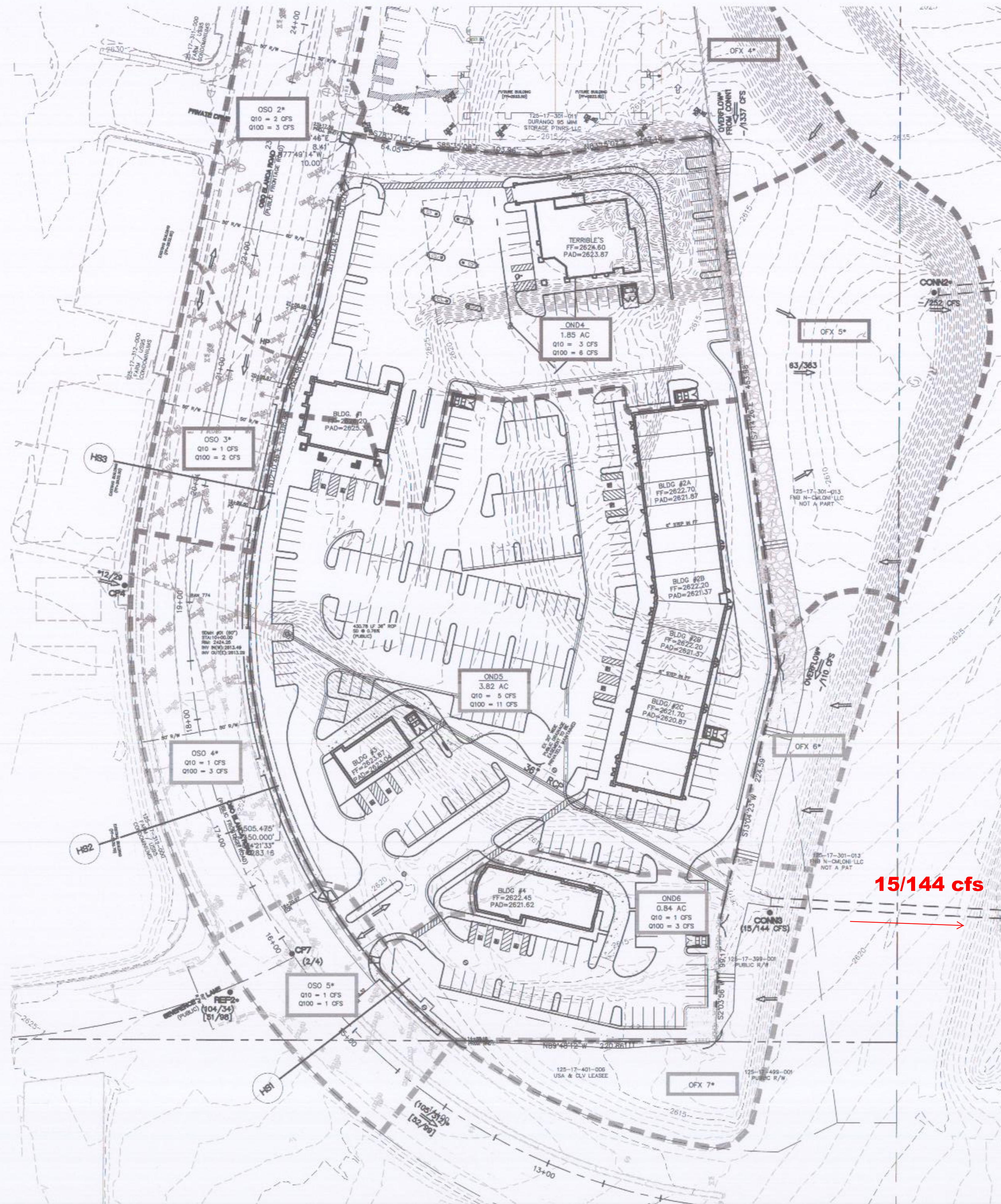
**NOTE:** Please be advised that all land surface area disturbances over 1 acre or any area adjacent to a water way must submit to the *Nevada Division of Environmental Protection* a "Notice of Intent" to discharge that certifies a stormwater pollution prevention plan has been developed and is maintained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

#### END OF REMARKS

ays

T/R/S: T19S/R60E/17  
AREA G-17





- DRAINAGE LEGEND**
- PROPERTY LINE
  - LOT LINE
  - STREET CENTERLINE
  - PROPOSED WALL
  - EXISTING WALL
  - PROPOSED "L" CURB & GUTTER
  - EXISTING "L" CURB & GUTTER
  - EXISTING CONTOUR LINES
  - PROPOSED CONTOUR LINES
  - EXISTING EDGE OF PAVEMENT
  - SAW CUT AND REMOVE EXISTING ASPHALT
  - PROPOSED ELEVATION & LOCATION
  - EXISTING ELEVATION & LOCATION
  - PROPOSED GRADE
  - EXISTING DRAINAGE FLOW
  - CENTERLINE
  - TOP OF CURB
  - EDGE OF PAVEMENT
  - FINISHED GRADE
  - GRADE BREAK
  - FINISHED FLOOR
  - HIGHPOINT
  - ASPHALTIC CONCRETE
  - BLANKET THICKNESS
  - DRAINAGE BASIN BOUNDARY
  - COMBINATION POINT
  - BASIN NAME & FLOW DATA
  - DIRECTION OF FLOWS
  - STREET CAPACITY SECTION

**Peak Flow Summary**

| Basin   | Area (acres) | 10-year Flow (cfs) | 100-year Flow (cfs) |
|---------|--------------|--------------------|---------------------|
| OND1**  | 0.77         | <1                 | <1                  |
| OPX1*   | 0.96         | <1                 | <1                  |
| OPX2*   | 0.36         | <1                 | 1                   |
| OND2**  | 0.95         | 2                  | 3                   |
| OND3**  | 0.89         | 2                  | 3                   |
| OND3A** | 0.59         | 1                  | 2                   |
| OND4    | 1.85         | 3                  | 6                   |
| OND5    | 3.85         | 5                  | 11                  |
| OPX3*   | 0.34         | <1                 | 1                   |
| OPX4*   | 0.25         | <1                 | 1                   |
| OPX5*   | 1.62         | 2                  | 4                   |
| OND6    | 0.84         | 1                  | 3                   |
| OPX7*   | 0.65         | <1                 | 1                   |
| OSO2*   | 0.80         | 2                  | 3                   |
| OSO3*   | 0.50         | 1                  | 2                   |
| OSO4*   | 0.70         | 1                  | 3                   |
| OSO5*   | 0.33         | 1                  | 1                   |
| REF2*   | -            | 104                | 311                 |
| CP-4*   | -            | 12                 | 29                  |

**CONCENTRATION POINT SUMMARY**

| CONCENTRATION POINT | Q10 (CFS) | Q100 (CFS) |
|---------------------|-----------|------------|
| CON1                | 34        | 544**      |
| CON2                | 3         | 362        |
| CON3                | 15        | 144        |

**Street Capacity Summary**

| Location                   | Q (cfs) | D (ft) | V (fps) | D x V | Remarks                                                                    |
|----------------------------|---------|--------|---------|-------|----------------------------------------------------------------------------|
| H51 Oso Blanca - West Side | 200     | 1.21   | 7.18    | 8.69  | Flow is carried on the west side. Vd < 8 is met; D less than 2 ft. is met. |
| H51 Oso Blanca - East Side | 111     | 0.98   | 5.64    | 5.53  | Vd < 8 is met; D less than 2 ft. is met.                                   |
| H52 Oso Blanca             | 4       | 0.35   | 1.59    | 0.56  | Vd < 8 is met; D less than 2 ft. is met.                                   |
| H53 Oso Blanca             | 2       | 0.30   | 1.33    | 0.40  | Vd < 8 is met; D less than 2 ft. is met.                                   |

**10-Year Flow**

| Location                   | Q (cfs) | D (ft) | V (fps) | D x V | Remarks                                                                                  |
|----------------------------|---------|--------|---------|-------|------------------------------------------------------------------------------------------|
| H51 Oso Blanca - West Side | 104     | 1.00   | 5.09    | 5.09  | Flow is contained on west side. Vd < 8 is met; D less than 1; dry lane met on east side. |
| H52 Oso Blanca             | 2       | 0.29   | 1.38    | 0.40  | Flow is carried in Street Vd < 8 is met; D less than 1; dry lane met.                    |
| H53 Oso Blanca             | 1       | 0.25   | 1.18    | 0.30  | Vd < 8 is met; D less than 1; dry lane is met.                                           |

**BOX CULVERT FLOW**

| BOX    | Q100 (CFS) |
|--------|------------|
| NORTH  | 207        |
| MIDDLE | 252        |
| SOUTH  | 144        |

**DISCLAIMER NOTE**

UTILITY LOCATIONS SHOWN HEREON ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT HORIZONTAL AND VERTICAL LOCATION OF ALL EXISTING UNDERGROUND AND OVERHEAD UTILITIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN HEREON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR UTILITIES NOT SHOWN IN THEIR PROPER LOCATION.

Call before you Dig

Avoid cutting underground utility lines. It's costly.

Call

OR

1-800-227-2600

AVOID HITTING OVERHEAD POWER LINES. IT'S COSTLY.

CALL BEFORE YOU DIG OVER-HEAD

1-702-227-2929

**FAST**

Call before you UnderGround

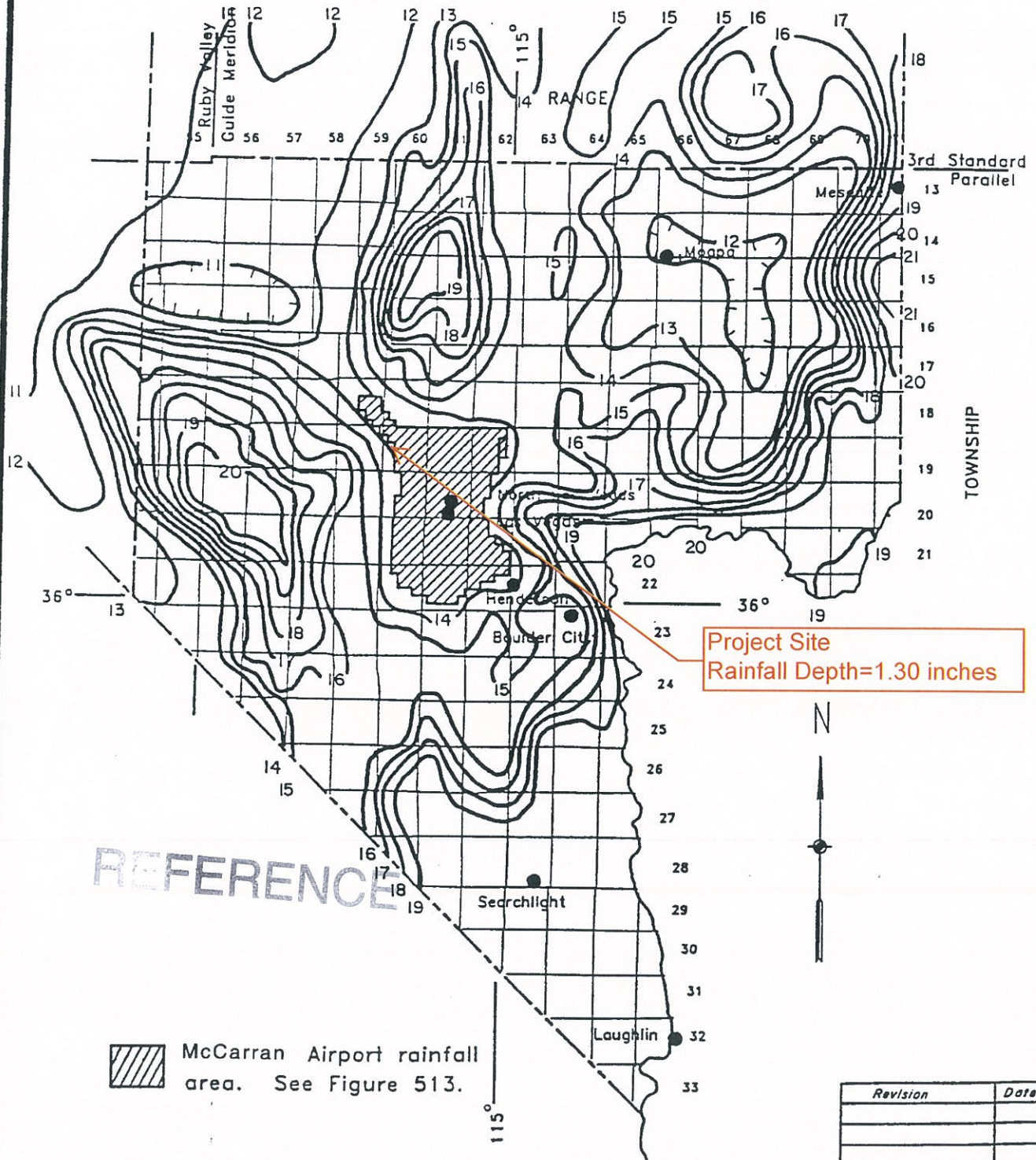
1-702-432-5300

FREEDOM AND ARTERIAL SYSTEM OF TRANSPORTATION



# HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

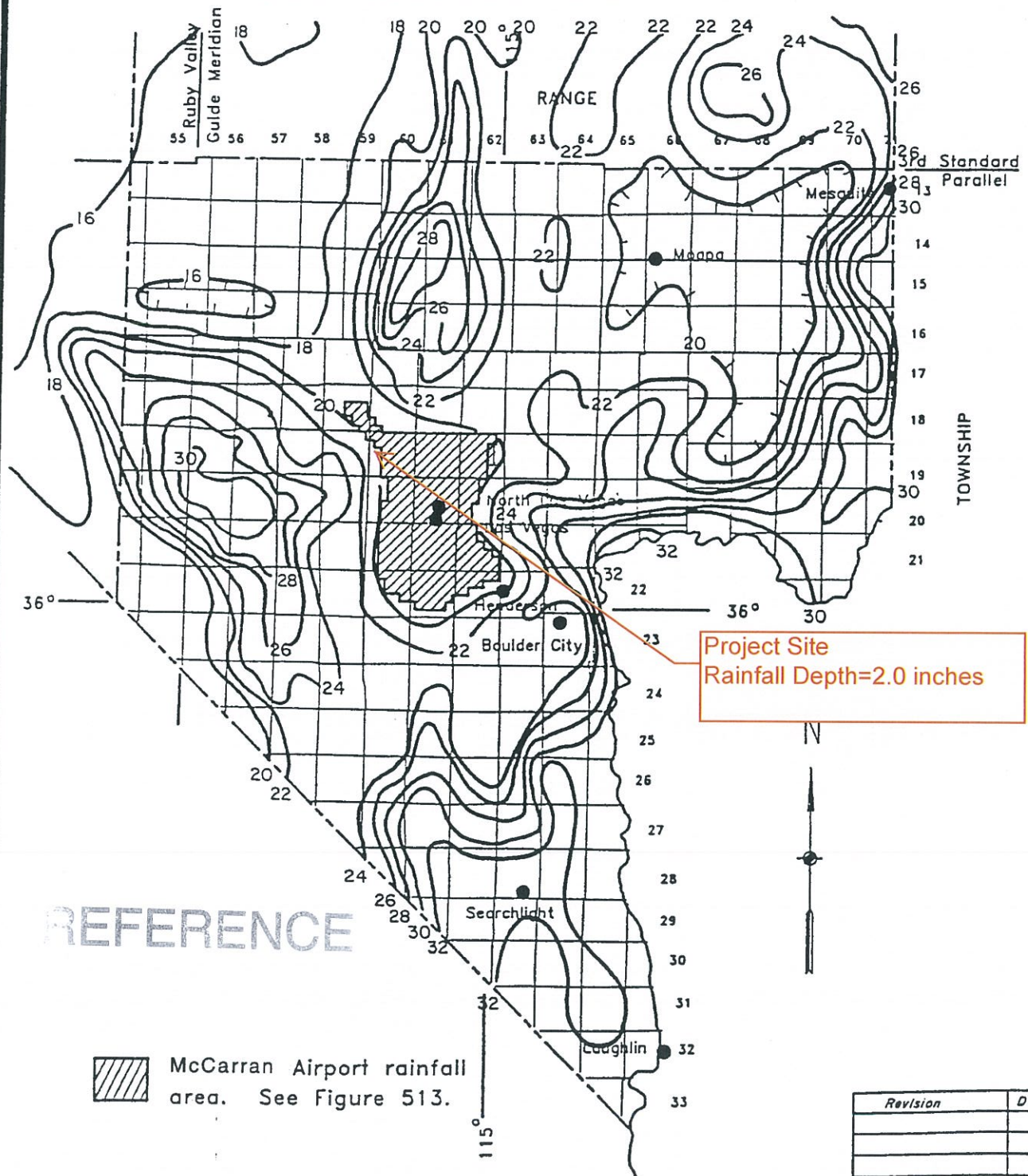
## RAINFALL DEPTH-DURATION-FREQUENCY 10-YEAR, 6-HOUR (DEPTHS IN TENTHS OF INCHES)





# HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

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



| Revision | Date |
|----------|------|
|          |      |
|          |      |
|          |      |
|          |      |

```

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JUN 1998
* VERSION 4.1
*
* RUN DATE 15JUL15 TIME 13:32:08
*
*****

```

```

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

```

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

```

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

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

1 HEC-1 INPUT PAGE 1

```

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
*DIAGRAM
1 ID
2 ID Durango & 95 Commercial
3 ID Developed Condition
4 ID
5 ID File u:\pam \HEC-1\REM95DV\HC1
6 ID
7 IT 5 360
8 IO 5
9 IN 5
10 JR PREC 0.564 1.0
* *****
* Developed Conditions *
* *****

11 KK OND1
12 BA 0.0002
13 PB 2.86
14 PC 0.00 2 5.7 7 8.7 10.8 12.4 13 13 13
15 PC 13 13 13 13.3 14 14.2 14.8 15.8 17.2 18.1
16 PC 19 19.7 19.7 20.1 20.1 20.4 21.4 22.9 24.1 24.9
17 PC 25.1 25.6 27 27.8 28.1 28.3 29.5 32.2 35.2 40.9
18 PC 49.9 59 71 74.4 78.1 81.2 81.9 83.5 85.1 85.6
19 PC 86 86.8 87.6 88.8 91 92.6 93.7 95 97 97.6
20 PC 98.2 98.5 98.7 98.9 99 99.3 99.3 99.4 99.5 99.8
21 PC 99.8 99.9 100
22 LS 92.0
23 UD 0.0500

24 KK OFX1
25 BA 0.0001
26 LS 77
27 UD 0.0500

28 KK OFX2
29 BA 0.0006
30 LS 77
31 UD 0.050

32 KK OND3
33 BA .0014
34 LS 94
35 UD 0.05

36 KK OND2
37 BA .0015
38 LS 93
39 UD 0.05

40 KK CON1
41 HC 5

```

1 HEC-1 INPUT PAGE 2

```

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
42 KK OND3A
43 BA .0009
44 LS 94
45 UD 0.05

```

|    |    |        |      |
|----|----|--------|------|
| 46 | KK | OND4   |      |
| 47 | BA | 0.0029 |      |
| 48 | LS |        | 94   |
| 49 | UD | 0.0650 |      |
|    |    |        |      |
| 50 | KK | OND5   |      |
| 51 | BA | 0.0060 |      |
| 52 | LS |        | 93   |
| 53 | UD | 0.100  |      |
|    |    |        |      |
| 54 | KK | OFX3   |      |
| 55 | BA | .0005  |      |
| 56 | LS |        | 85   |
| 57 | UD | 0.118  |      |
|    |    |        |      |
| 58 | KK | OFX4   |      |
| 59 | BA | .0004  |      |
| 60 | LS |        | 85   |
| 61 | UD | 0.05   |      |
|    |    |        |      |
| 62 | KK | OFX5   |      |
| 63 | BA | .0025  |      |
| 64 | LS |        | 85   |
| 65 | UD | 0.05   |      |
|    |    |        |      |
| 66 | KK | CON2   |      |
| 67 | HC | 5      |      |
|    |    |        |      |
| 68 | KK | OND6   |      |
| 69 | BA | .0013  |      |
| 70 | LS |        | 92   |
| 71 | UD | 0.055  |      |
|    |    |        |      |
| 72 | KK | OFX6   |      |
| 73 | BA | .0005  |      |
| 74 | LS |        | 82.5 |
| 75 | UD | 0.05   |      |
|    |    |        |      |
| 76 | KK | OFX7   |      |
| 77 | BA | .0010  |      |
| 78 | LS |        | 77   |
| 79 | UD | 0.063  |      |
|    |    |        |      |
| 80 | KK | CON3   |      |
| 81 | HC | 3      |      |

1

HEC-1 INPUT

PAGE 3

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

|    |    |       |      |
|----|----|-------|------|
| 82 | KK | OFD1  |      |
| 83 | BA | .0006 |      |
| 84 | LS |       | 93.5 |
| 85 | UD | 0.063 |      |
|    |    |       |      |
| 86 | KK | OFD2  |      |
| 87 | BA | .0002 |      |
| 88 | LS |       | 92   |
| 89 | UD | 0.052 |      |
| 90 | ZZ |       |      |

1

# SCHEMATIC DIAGRAM OF STREAM NETWORK

| INPUT<br>LINE | (V) ROUTING   | (--->) DIVERSION OR PUMP FLOW            |
|---------------|---------------|------------------------------------------|
| NO.           | (.) CONNECTOR | (<---) RETURN OF DIVERTED OR PUMPED FLOW |
| 11            | OND1          |                                          |
|               | .             |                                          |
| 24            | .             | OFX1                                     |
|               | .             |                                          |
| 28            | .             | .                                        |
|               | .             | OFX2                                     |
|               | .             | .                                        |
| 32            | .             | .                                        |
|               | .             | OND3                                     |
|               | .             | .                                        |
| 36            | .             | .                                        |
|               | .             | OND2                                     |
|               | .             | .                                        |
| 40            | CON1.....     |                                          |
|               | .             |                                          |
| 42            | .             | OND3A                                    |
|               | .             | .                                        |
| 46            | .             | .                                        |
|               | .             | OND4                                     |
|               | .             | .                                        |
| 50            | .             | .                                        |
|               | .             | OND5                                     |
|               | .             | .                                        |
| 54            | .             | .                                        |
|               | .             | OFX3                                     |
|               | .             | .                                        |



|                    |       |     |   |              |             |             |
|--------------------|-------|-----|---|--------------|-------------|-------------|
| HYDROGRAPH AT<br>+ | OFX2  | .00 | 1 | FLOW<br>TIME | 0.<br>3.50  | 1.<br>3.50  |
| HYDROGRAPH AT<br>+ | OND3  | .00 | 1 | FLOW<br>TIME | 2.<br>3.50  | 3.<br>3.50  |
| HYDROGRAPH AT<br>+ | OND2  | .00 | 1 | FLOW<br>TIME | 2.<br>3.50  | 3.<br>3.50  |
| 5 COMBINED AT<br>+ | CON1  | .00 | 1 | FLOW<br>TIME | 4.<br>3.50  | 8.<br>3.50  |
| HYDROGRAPH AT<br>+ | OND3A | .00 | 1 | FLOW<br>TIME | 1.<br>3.50  | 2.<br>3.50  |
| HYDROGRAPH AT<br>+ | OND4  | .00 | 1 | FLOW<br>TIME | 3.<br>3.50  | 6.<br>3.50  |
| HYDROGRAPH AT<br>+ | OND5  | .01 | 1 | FLOW<br>TIME | 5.<br>3.50  | 11.<br>3.50 |
| HYDROGRAPH AT<br>+ | OFX3  | .00 | 1 | FLOW<br>TIME | 0.<br>3.58  | 1.<br>3.58  |
| HYDROGRAPH AT<br>+ | OFX4  | .00 | 1 | FLOW<br>TIME | 0.<br>3.50  | 1.<br>3.50  |
| HYDROGRAPH AT<br>+ | OFX5  | .00 | 1 | FLOW<br>TIME | 2.<br>3.50  | 4.<br>3.50  |
| 5 COMBINED AT<br>+ | CON2  | .01 | 1 | FLOW<br>TIME | 10.<br>3.50 | 23.<br>3.50 |
| HYDROGRAPH AT<br>+ | OND6  | .00 | 1 | FLOW<br>TIME | 1.<br>3.50  | 3.<br>3.50  |
| HYDROGRAPH AT<br>+ | OFX6  | .00 | 1 | FLOW<br>TIME | 0.<br>3.50  | 1.<br>3.50  |
| HYDROGRAPH AT<br>+ | OFX7  | .00 | 1 | FLOW<br>TIME | 0.<br>3.50  | 1.<br>3.50  |
| 3 COMBINED AT<br>+ | CON3  | .00 | 1 | FLOW<br>TIME | 2.<br>3.50  | 5.<br>3.50  |
| HYDROGRAPH AT<br>+ | OED1  | .00 | 1 | FLOW<br>TIME | 1.<br>3.50  | 1.<br>3.50  |
| HYDROGRAPH AT<br>+ | OED2  | .00 | 1 | FLOW<br>TIME | 0.<br>3.50  | 0.<br>3.50  |

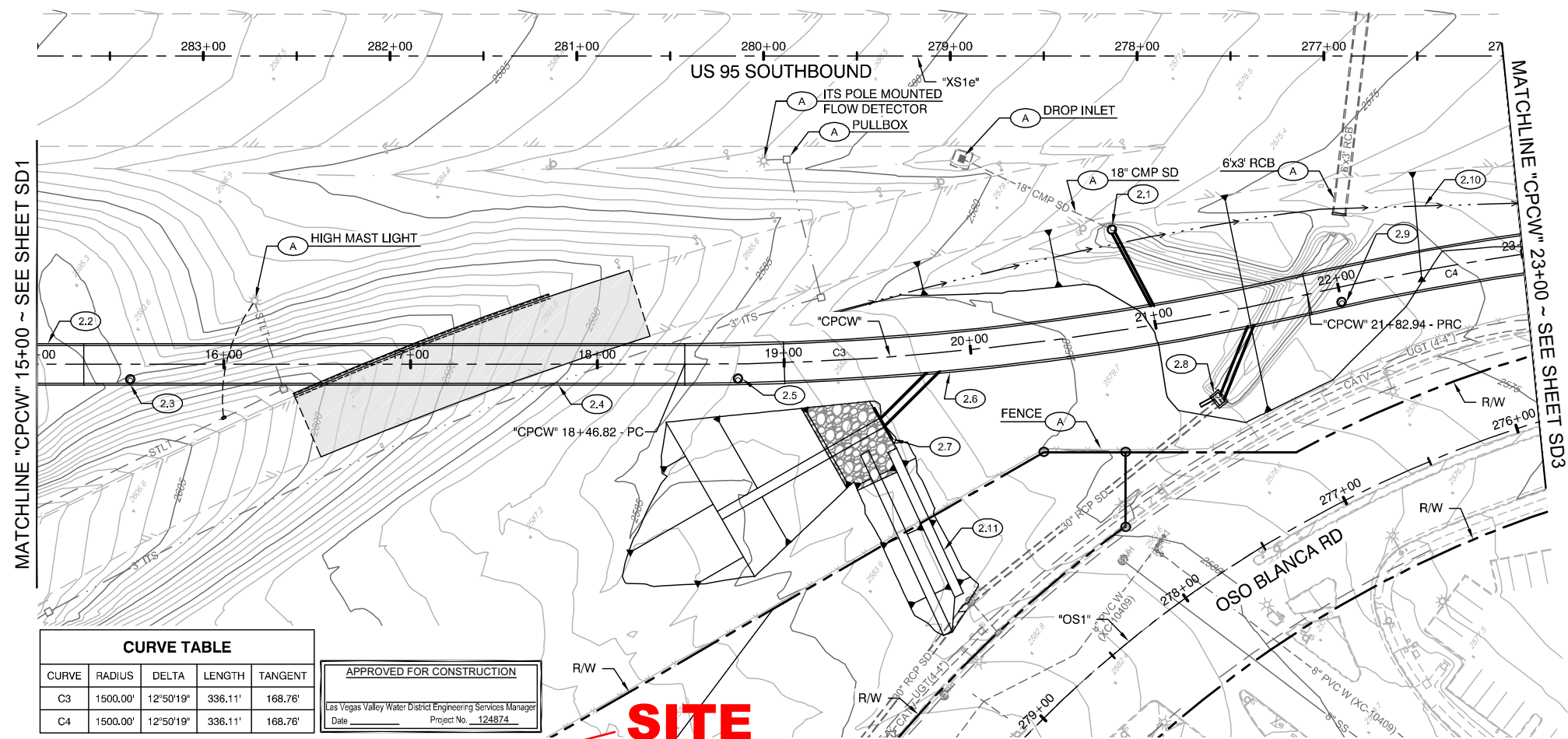
(544 cfs w/flows from farm)

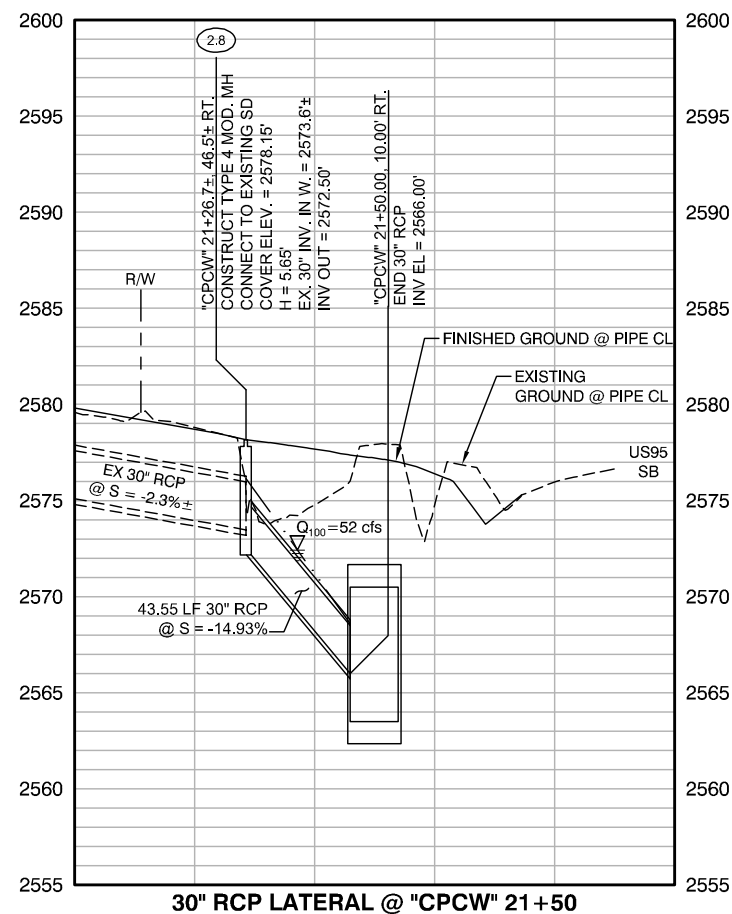
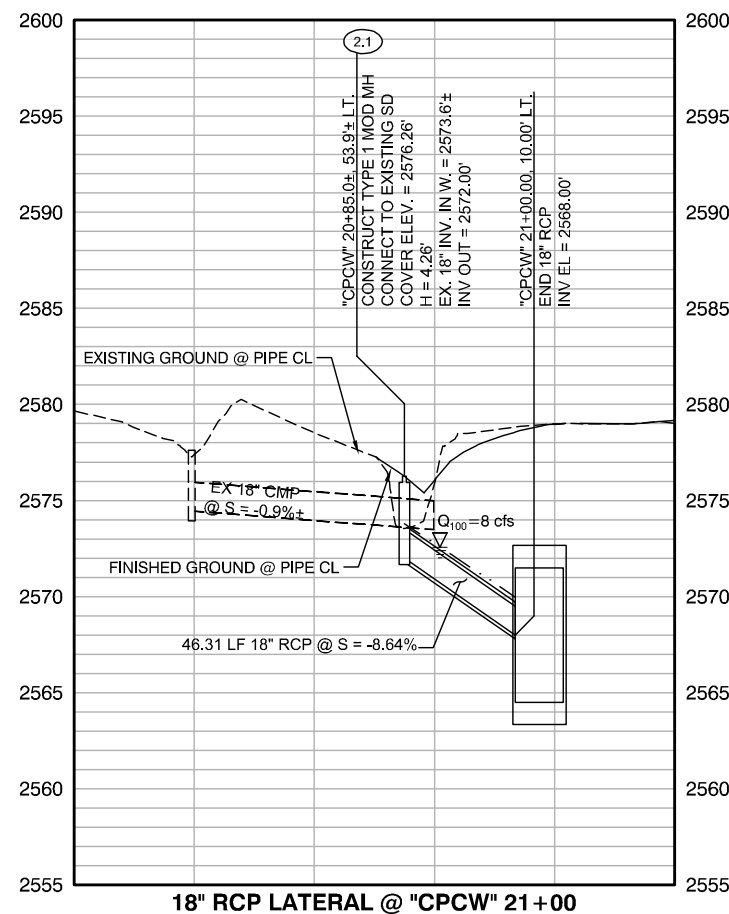
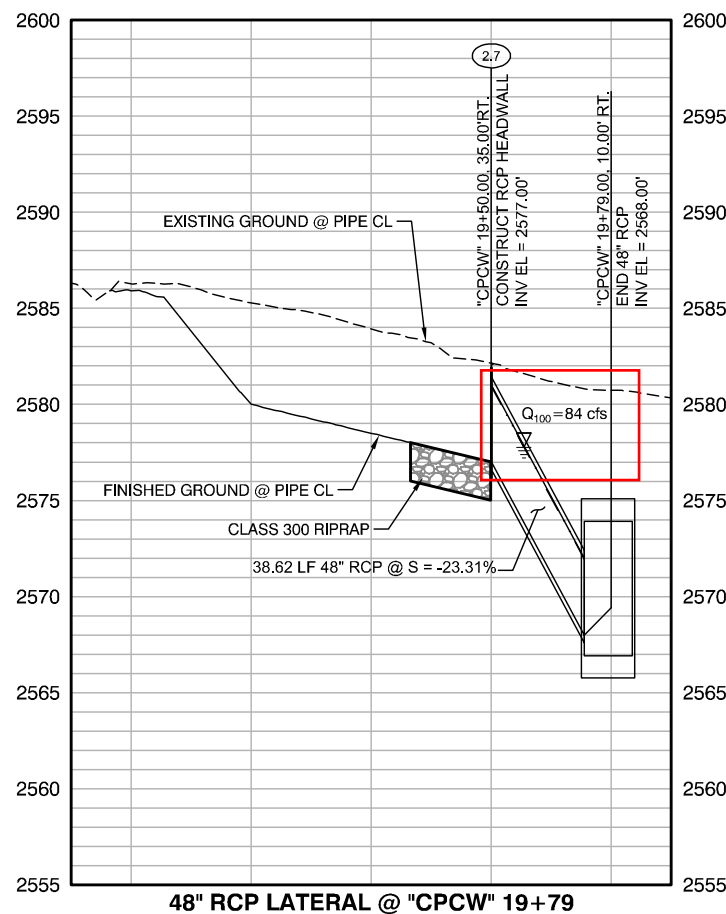
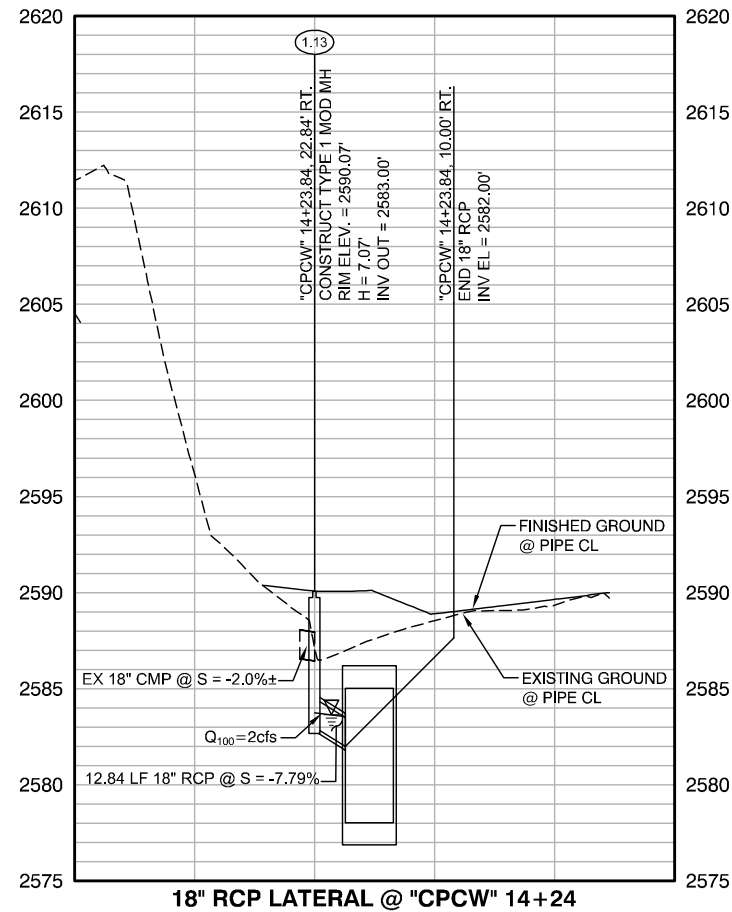
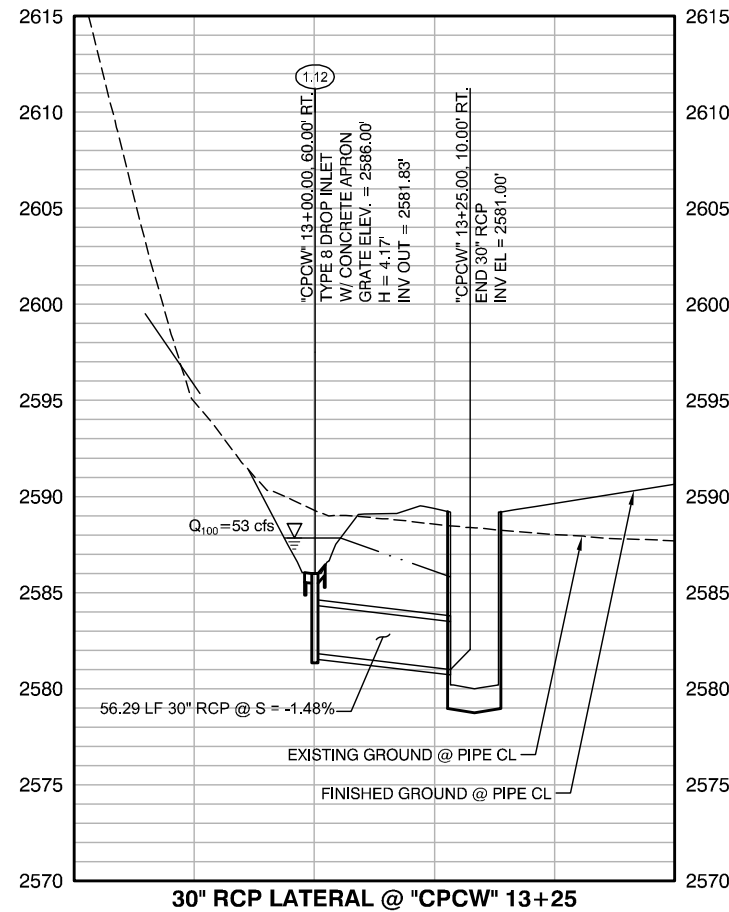
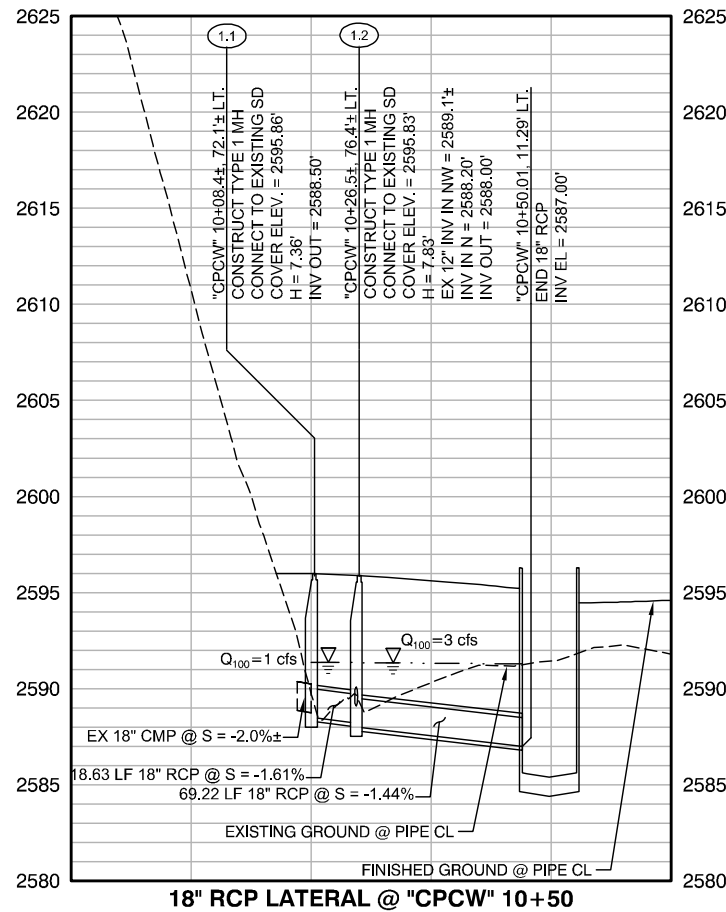
(362 cfs w/flows from overflow)

(144 cfs w/flows from overflow & reference)

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

**REF. FLOWS @**  
**EX 6X3 RCB=**  
**15/144**





| CALL BEFORE CONSTRUCTION  |                                    |                        |
|---------------------------|------------------------------------|------------------------|
| BEFORE YOU DIG            | USA NORTH                          | 811 OR<br>800-227-2600 |
| BEFORE YOU<br>UNDERGROUND | F.A.S.T.                           | 702-432-5300           |
|                           | CLARK COUNTY TRAFFIC<br>OPERATIONS | 702-455-7511           |
| BEFORE YOU<br>OVERHEAD    | CITY OF LAS VEGAS<br>T.E.F.O.      | 702-229-6611           |
|                           | NV ENERGY                          | 702-227-2929           |

|                         |  |                                                         |  |
|-------------------------|--|---------------------------------------------------------|--|
| TITLE                   |  | CENTENNIAL PARKWAY CHANNEL WEST<br>US95, 215 TO DURANGO |  |
| SHEET                   |  | DRAINAGE LATERAL PROFILES                               |  |
| PREPARED BY:            |  | CITY OF LAS VEGAS                                       |  |
| DESIGNED BY: B. MAHAN   |  | DRAWN BY: G. SHEARER                                    |  |
| CHECKED BY: J. GRIEST   |  | SUBMITTAL STAGE:<br>PRE-FINAL<br>PRELIMINARY            |  |
| DATE: November 14, 2016 |  | H# 60222                                                |  |
| NO. DATE                |  | 5                                                       |  |
| NO. DATE                |  | 4                                                       |  |
| NO. DATE                |  | 3                                                       |  |
| NO. DATE                |  | 2                                                       |  |
| NO. DATE                |  | 1                                                       |  |
| NO. DATE                |  | REVISIONS                                               |  |

PREPARED BY:

**CH2M**

2485 VILLAGE VIEW DRIVE, SUITE 350  
HENDERSON, NEVADA 89074  
PHONE: 702-369-6175  
FAX: 702-369-1107



**Technical Drainage Study  
for  
Centennial Hills Transit Center and  
Park and Ride**

*Rec'd: 4/8/09*

*DS 4356*

*G-17*

*N/C*

**April 6, 2009**

**Prepared for:**

**Regional Transportation Commission of Southern Nevada  
600 S. Grand Central Parkway, Suite 350  
Las Vegas, NV 89106-4512**

**Prepared by:**



**TCupp & Associates  
2470 St. Rose Parkway, Suite 105  
Henderson, NV 89074  
Phone: (702) 982-2139 Fax: (702) 982-2146**

|                                                                                                       |                                          |                                                                                                                                                                                       |
|-------------------------------------------------------------------------------------------------------|------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CITY OF LAS VEGAS</b>                                                                              |                                          | <b>DATE:</b>                                                                                                                                                                          |
| <b>INTER-OFFICE MEMORANDUM</b>                                                                        |                                          | April 14, 2009                                                                                                                                                                        |
| <b>TO:</b><br>Land Development Services<br>Department of Public Works                                 |                                          | <b>FROM:</b><br>Albert Sung, P.E. <br>Flood Control Project Engineer<br>Department of Public Works |
| <b>SUBJECT:</b> Drainage Study for:<br><b>CENTENNIAL HILLS TRANSIT CENTER<br/>AND PARK &amp; RIDE</b> |                                          | <b>COPIES TO:</b><br>TCupp & Associates                                                                                                                                               |
| <b>Cross Streets:</b>                                                                                 | NEC of Durango Drive & Elkhorn Boulevard | RTC of Southern Nevada                                                                                                                                                                |
| <b>File Number:</b>                                                                                   | F:\Depot\DSMemos\DS4356B.doc             | Bart Anderson, P.E., DevCo                                                                                                                                                            |
| <b>Parcel Number:</b>                                                                                 | 125-17-801-004                           | NDOT                                                                                                                                                                                  |
| <b>Zoning Action:</b>                                                                                 | SDR-32155                                |                                                                                                                                                                                       |
| <b>FEMA Flood Zone</b>                                                                                | YES NO <b>X</b>                          |                                                                                                                                                                                       |
| <b>Proposed Storm Drain</b>                                                                           | YES <b>X</b> NO                          |                                                                                                                                                                                       |

| HISTORY                                | DATE RECEIVED | DATE REVIEWED | COMMENTS                   | REVIEW FEES     | FEES PAID Transaction # |
|----------------------------------------|---------------|---------------|----------------------------|-----------------|-------------------------|
| 1 <sup>st</sup> Submittal              | 3/2/2009      | 3/13/2009     | Not Approved               | \$400.00        | Paid: \$400             |
| 2 <sup>nd</sup> Submittal (Supplement) | 4/8/2009      | 4/13/2009     | See Comments Below         | N/C             | N/C                     |
|                                        |               |               | <b>TOTAL FEES (LDDRS):</b> | <b>\$400.00</b> | <b>----</b>             |

#### REMARKS:

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

|          |                                                                                                   |
|----------|---------------------------------------------------------------------------------------------------|
|          | is approved subject to conformance to all City standards and the following conditions:            |
|          | 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 Department of Development Services concurrence. |
| <b>X</b> | is conditionally approved subject to NDOT concurrence.                                            |

- The project proposes to construct facilities and/or increase flows within *Nevada Department of Transportation* (NDOT) right-of-way (*Oso Blanca Avenue*). The engineer must contact NDOT for encroachment permit for the proposed project.
- Provide a rip-rap transition between the 30-inch RCP Flared End Section and the existing graded channel. Extend the rip-rap a minimum of 15-feet downstream. Extend the rip-rap transition to a depth equal to the pipe diameter. Include a rip-rap detail showing the size, depth, geofabric & Type II base.
- Revise the 30-inch storm drain profile stationing and call outs on the grading plan Sheet C2.02 and Profile Sheet C5.11 to revise stationing, inlet type and manhole locations. Extend the profile to the east to show the extent of grading and the rip-rap at the outlet.
- Revise the 30-inch storm drain profile to reflect the removal of the existing storm drain manhole at the connection to the existing storm drain near Station 12+53.
- The 30-inch RCP storm drain appears to conflict with the proposed traffic signal pole shown near Station 20+60. Review and revise accordingly.

6. Revise the length of the 412A inlet to reflect the 2.5-foot increments.
7. Provide rip-rap pads at the eastern terminus of Ace Boulevard as a transition between the existing ground and the proposed roadway improvements. Include a rip-rap pad detail showing the size, depth, geofabric & Type II base.
8. Revise the roadway swale west of Grand Montecito Parkway to match the drainage study calculations which show a 1% slope.
9. Provide a profile of the 18-inch storm drain connecting into the existing drop inlet at the northwest corner of Grand Montecito Parkway and Elkhorn Road.
10. Provide additional grading information for the south side of the Ace Boulevard & Deuce Avenue intersection. Extend the Grading Plan to show the extent of the proposed grading.
11. Provide ditch, street and curb slope information on the Grading Plans. Verify that the ditch slope matches the provided calculations shown in the drainage study.
12. Provide additional grading information at the roadway intersections and at the end of roadway improvements.
13. Provide additional grading information for the graded swale located west of Deuce Avenue, near Station 12+00.
14. Label the size of the existing drainage facilities and the CLV Drawing #.
15. include the drainage Study # (DS 4356) in the drainage certification note.
16. Show the new location of the NDOT chain link fencing and provide an access gate for storm drain maintenance.
17. Revise the Plan Name to reflect the new project title, CENTENNIAL HILLS TRANSIT CENTER AND PARK & RIDE.
18. Provide a detail sheet with typical cross sections, necessary details and roadway sections. Include a detail of the proposed 3' x 3' Jensen inlet.
19. Complete the Storm Drain Construction Note call-outs to reflect detail locations.

**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.

**NOTES:** This drainage study assumes that the project will be constructed in one phase. If improvement plans are submitted to break the project into separate phases, a drainage study update will be required for each phase addressing the interim condition.

**END OF REMARKS**  
ays

T/R/S: T19S/R60E/17  
AREA G-17



## NORTH SIDE OSO BLANCA

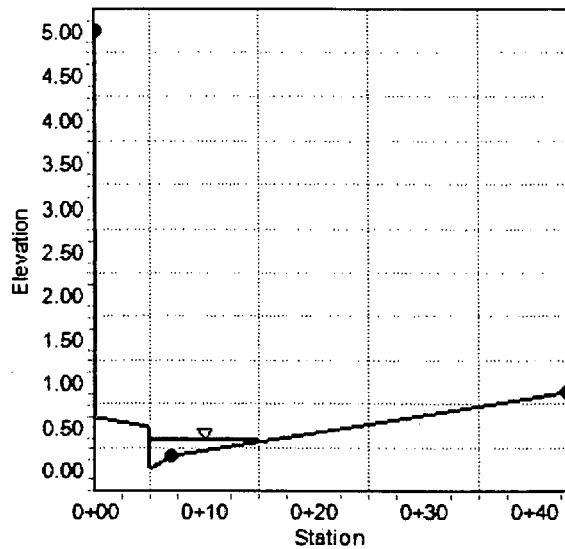
### Project Description

Friction Method                      Manning Formula  
Solve For                                Normal Depth

### Input Data

Channel Slope                                              0.02930    ft/ft  
Normal Depth                                              0.33    ft  
Discharge                                                      4.00    ft<sup>3</sup>/s

### Cross Section Image



$$VD = 1.32$$

## NORTH SIDE OSO BLANCA

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                              0.02930    ft/ft  
Discharge                                    4.00    ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00         | 5.00           |
| 0+00         | 0.60           |
| 0+05         | 0.50           |
| 0+05         | 0.00           |
| 0+07         | 0.17           |
| 0+43         | 0.89           |

### Roughness Segment Definitions

| Start Station | Ending Station | Roughness Coefficient |
|---------------|----------------|-----------------------|
| (0+00, 5.00)  | (0+07, 0.17)   | 0.013                 |
| (0+07, 0.17)  | (0+43, 0.89)   | 0.017                 |

### Options

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

### Results

Normal Depth                              0.33    ft  
Elevation Range                              0.00 to 5.00 ft  
Flow Area                                    1.12    ft<sup>2</sup>  
Wetted Perimeter                              10.27    ft  
Hydraulic Radius                              0.11    ft  
Top Width                                    9.94    ft

TCUPP @ ASSOCIATES

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## NORTH SIDE OSO BLANCA

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### Results

|                 |               |       |
|-----------------|---------------|-------|
| Normal Depth    | 0.33          | ft    |
| Critical Depth  | 0.39          | ft    |
| Critical Slope  | 0.00761       | ft/ft |
| Velocity        | 3.58          | ft/s  |
| Velocity Head   | 0.20          | ft    |
| Specific Energy | 0.53          | ft    |
| Froude Number   | 1.88          |       |
| Flow Type       | Supercritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.33     | ft    |
| Critical Depth      | 0.39     | ft    |
| Channel Slope       | 0.02930  | ft/ft |
| Critical Slope      | 0.00761  | ft/ft |

## GRAND MONTECITO NORTH OF PRIVATE DRIVE

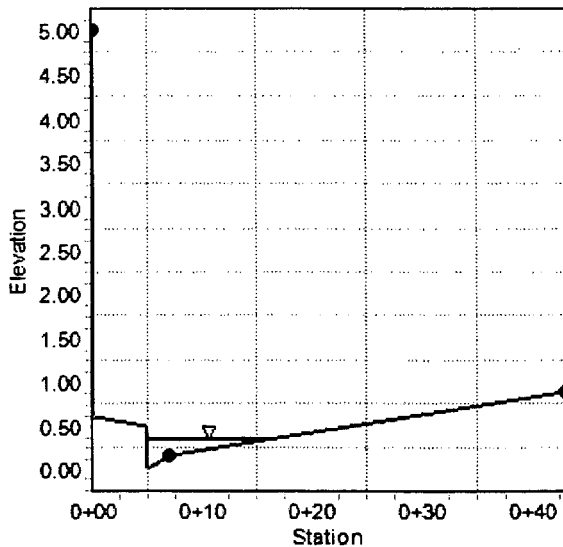
### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                              0.01000    ft/ft  
Normal Depth                              0.35    ft  
Discharge                                  3.00    ft<sup>3</sup>/s

### Cross Section Image



$$VD = 1.05$$



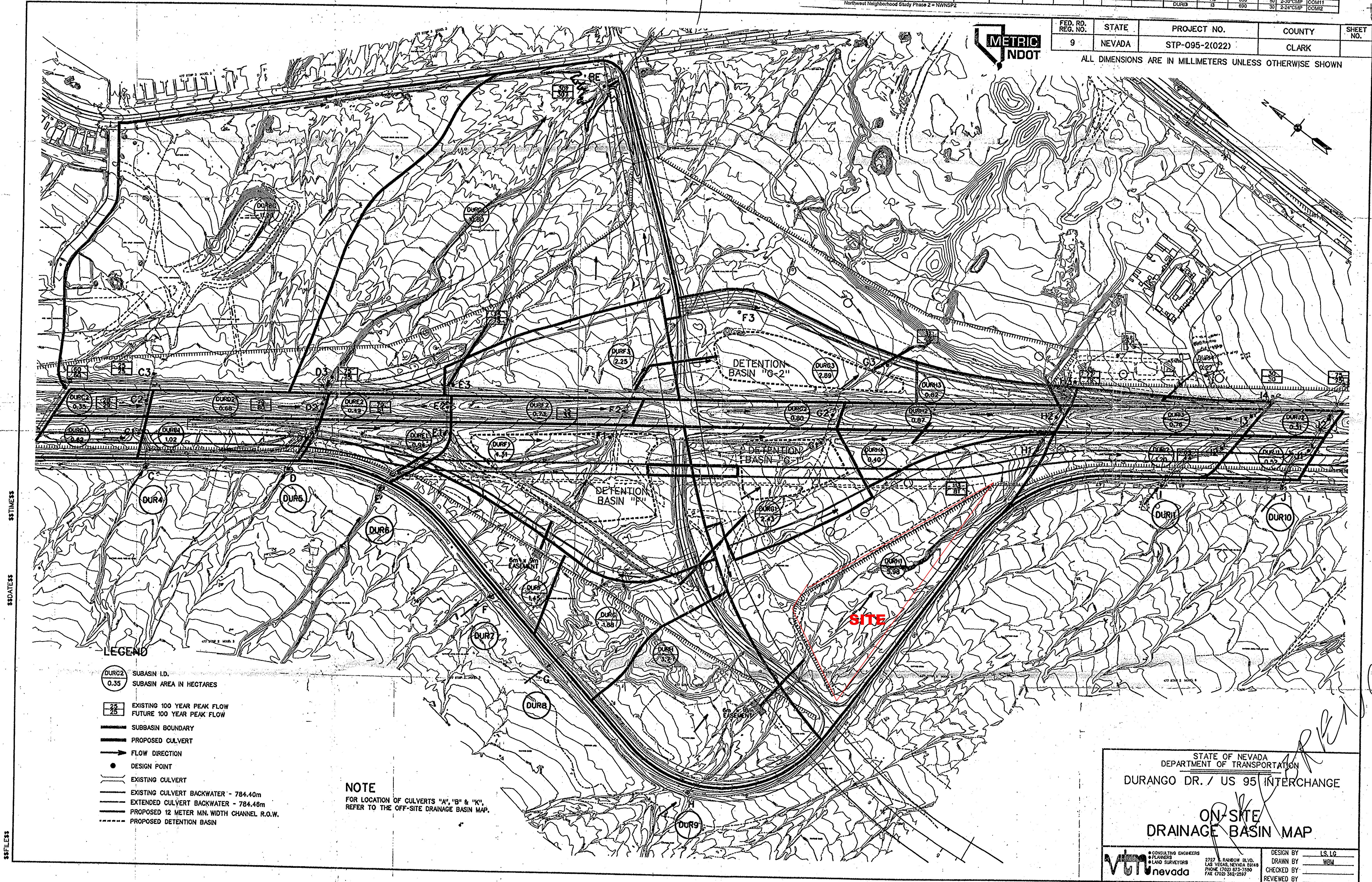
| VTN HEC-1    | VTN-Exhibit  | NWNSP2       | 100-Yr | Contributing | VTN HEC-1    | VTN-Exhibit  | NWNSP2       | 100-Yr | Contributing | VTN HEC-1    | VTN-Exhibit  | NWNSP2       | 100-Yr | Contributing | VTN HEC-1    | VTN-Exhibit  | NWNSP2       | 100-Yr | Contributing |
|--------------|--------------|--------------|--------|--------------|--------------|--------------|--------------|--------|--------------|--------------|--------------|--------------|--------|--------------|--------------|--------------|--------------|--------|--------------|
| Culvert Name | Culvert Name | Culvert Name | Flow   | Basin        | Culvert Name | Culvert Name | Culvert Name | Flow   | Basin        | Culvert Name | Culvert Name | Culvert Name | Flow   | Basin        | Culvert Name | Culvert Name | Culvert Name | Flow   | Basin        |
| DUR02        | A            | 780          | 12     | 24" CMP      | DUR02        | A            | 780          | 12     | 24" CMP      | DUR02        | A            | 780          | 12     | 24" CMP      | DUR02        | A            | 780          | 12     | 24" CMP      |
| DUR03        | B            | 778          | 60     | 24" CMP      | DUR03        | B            | 778          | 60     | 24" CMP      | DUR03        | B            | 778          | 60     | 24" CMP      | DUR03        | B            | 778          | 60     | 24" CMP      |
| DUR04        | C            | 768          | 25     | 30" CMP      | DUR04        | C            | 768          | 25     | 30" CMP      | DUR04        | C            | 768          | 25     | 30" CMP      | DUR04        | C            | 768          | 25     | 30" CMP      |
| DUR05        | D            | 762          | 75     | 6"X3' RCB    | DUR05        | D            | 762          | 75     | 6"X3' RCB    | DUR05        | D            | 762          | 75     | 6"X3' RCB    | DUR05        | D            | 762          | 75     | 6"X3' RCB    |
| DUR06        | E            | 764          | 75     | 6"X3' RCB    | DUR06        | E            | 764          | 75     | 6"X3' RCB    | DUR06        | E            | 764          | 75     | 6"X3' RCB    | DUR06        | E            | 764          | 75     | 6"X3' RCB    |
| DUR07        | F            | 748          | 25     | 30" CMP      | DUR07        | F            | 748          | 25     | 30" CMP      | DUR07        | F            | 748          | 25     | 30" CMP      | DUR07        | F            | 748          | 25     | 30" CMP      |
| DUR08        | G            | 744          | 25     | 30" CMP      | DUR08        | G            | 744          | 25     | 30" CMP      | DUR08        | G            | 744          | 25     | 30" CMP      | DUR08        | G            | 744          | 25     | 30" CMP      |
| DUR09        | H            | 742          | 75     | 6"X3' RCB    | DUR09        | H            | 742          | 75     | 6"X3' RCB    | DUR09        | H            | 742          | 75     | 6"X3' RCB    | DUR09        | H            | 742          | 75     | 6"X3' RCB    |
| DUR10        | I            | 740          | 30     | 24" CMP      | DUR10        | I            | 740          | 30     | 24" CMP      | DUR10        | I            | 740          | 30     | 24" CMP      | DUR10        | I            | 740          | 30     | 24" CMP      |
| DUR11        | J            | 740          | 75     | 6"X3' RCB    | DUR11        | J            | 740          | 75     | 6"X3' RCB    | DUR11        | J            | 740          | 75     | 6"X3' RCB    | DUR11        | J            | 740          | 75     | 6"X3' RCB    |
| DUR12        | K            | 740          | 50     | 24" CMP      | DUR12        | K            | 740          | 50     | 24" CMP      | DUR12        | K            | 740          | 50     | 24" CMP      | DUR12        | K            | 740          | 50     | 24" CMP      |

Northwest Neighborhood Study Phase 2 - NWNSP2



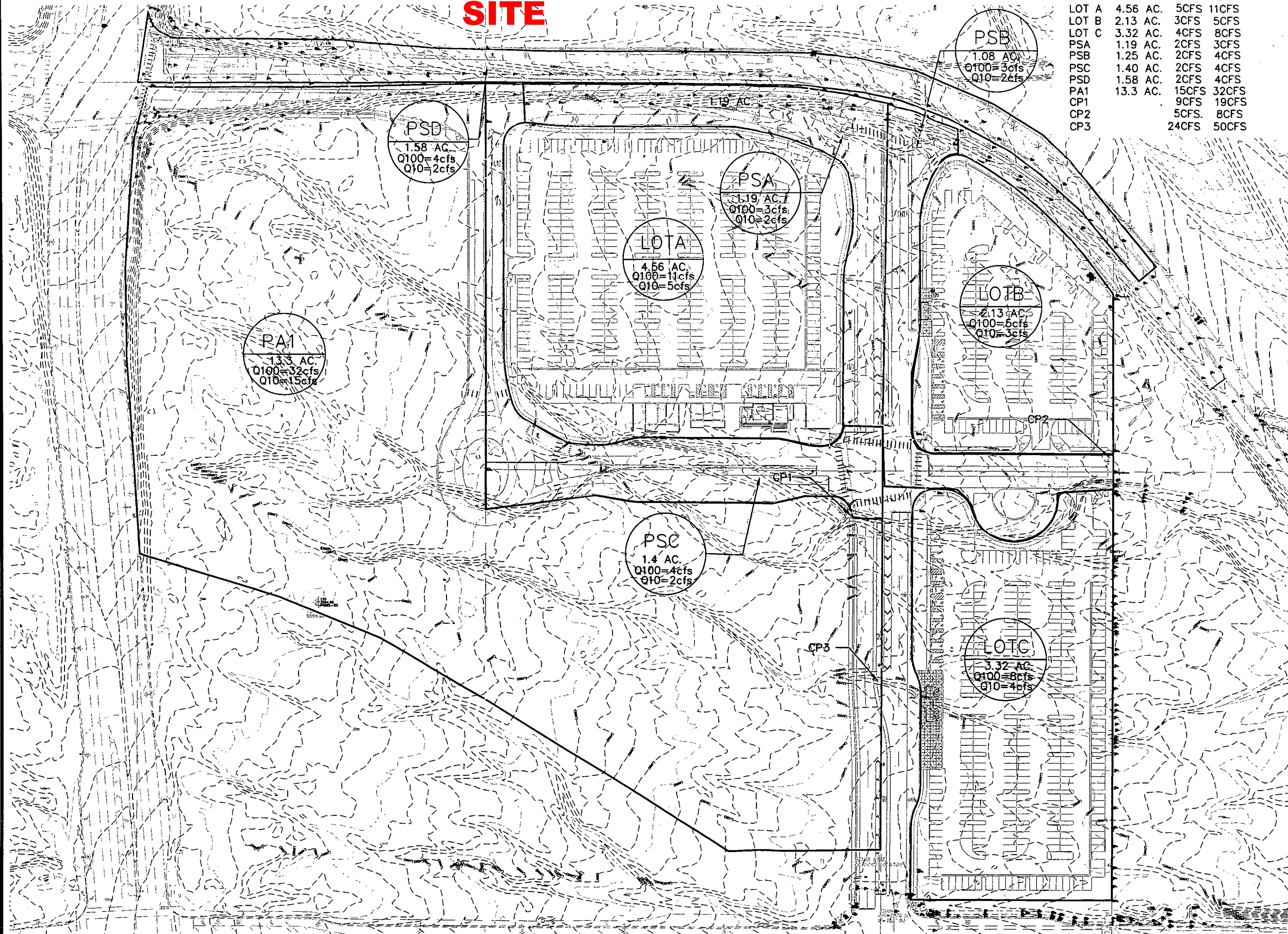
| FED. RD. REG. NO. | STATE  | PROJECT NO.    | COUNTY | SHEET NO. |
|-------------------|--------|----------------|--------|-----------|
| 9                 | NEVADA | STP-095-2(022) | CLARK  |           |

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN





**SITE**



|       |          |       |       |
|-------|----------|-------|-------|
| LOT A | 4.56 AC. | 5CFS  | 11CFS |
| LOT B | 2.13 AC. | 3CFS  | 5CFS  |
| LOT C | 3.32 AC. | 4CFS  | 8CFS  |
| PSA   | 1.19 AC. | 2CFS  | 3CFS  |
| PSB   | 1.25 AC. | 2CFS  | 4CFS  |
| PSC   | 1.40 AC. | 2CFS  | 4CFS  |
| PSD   | 1.58 AC. | 2CFS  | 4CFS  |
| PA1   | 13.3 AC. | 15CFS | 32CFS |
| CP1   |          | 9CFS  | 19CFS |
| CP2   |          | 5CFS  | 8CFS  |
| CP3   |          | 24CFS | 50CFS |

|                                                      |  |                    |  |                   |  |                                                                                            |  |              |  |              |  |             |  |
|------------------------------------------------------|--|--------------------|--|-------------------|--|--------------------------------------------------------------------------------------------|--|--------------|--|--------------|--|-------------|--|
| DRAWN BY: _____                                      |  | DESIGNED BY: _____ |  | CHECKED BY: _____ |  | PROJECT NO: _____                                                                          |  | SCALE: _____ |  | HORIZ. _____ |  | VERT. _____ |  |
| 60%                                                  |  |                    |  |                   |  |                                                                                            |  |              |  |              |  |             |  |
| SHEET                                                |  |                    |  |                   |  |                                                                                            |  |              |  |              |  |             |  |
| OF 22 SHEETS                                         |  |                    |  |                   |  |                                                                                            |  |              |  |              |  |             |  |
| DRAWING NO.                                          |  |                    |  |                   |  |                                                                                            |  |              |  |              |  |             |  |
| PROPOSED BASIN MAP                                   |  |                    |  |                   |  | REGIONAL TRANSPORTATION COMMISSION<br>600 S. GRAND CENTRAL PARKWAY<br>Las Vegas, NV        |  |              |  |              |  |             |  |
| CENTENNIAL HILLS TRANSIT<br>CENTER AND PARK AND RIDE |  |                    |  |                   |  | TCUPP<br>2470 St. Rose Parkway<br>Henderson, NV 89074<br>(702) 982-2339 Fax (702) 982-2446 |  |              |  |              |  |             |  |

## Oso Blanca mh#1-mh#2

### Project Description

|                 |                 |
|-----------------|-----------------|
| Friction Method | Manning Formula |
| Solve For       | Normal Depth    |

### Input Data

|                       |         |       |
|-----------------------|---------|-------|
| Roughness Coefficient | 0.013   |       |
| Channel Slope         | 0.03140 | ft/ft |
| Diameter              | 2.50    | ft    |
| Discharge             | 52.00   | ft³/s |

### Results

|                   |               |       |
|-------------------|---------------|-------|
| Normal Depth      | 1.56          | ft    |
| Flow Area         | 3.23          | ft²   |
| Wetted Perimeter  | 4.56          | ft    |
| Hydraulic Radius  | 0.71          | ft    |
| Top Width         | 2.42          | ft    |
| Critical Depth    | 2.32          | ft    |
| Percent Full      | 62.6          | %     |
| Critical Slope    | 0.01391       | ft/ft |
| Velocity          | 16.09         | ft/s  |
| Velocity Head     | 4.03          | ft    |
| Specific Energy   | 5.59          | ft    |
| Froude Number     | 2.46          |       |
| Maximum Discharge | 78.18         | ft³/s |
| Discharge Full    | 72.68         | ft³/s |
| Slope Full        | 0.01607       | ft/ft |
| Flow Type         | SuperCritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                             |          |      |
|-----------------------------|----------|------|
| Upstream Depth              | 0.00     | ft   |
| Profile Description         |          |      |
| Profile Headloss            | 0.00     | ft   |
| Average End Depth Over Rise | 0.00     | %    |
| Normal Depth Over Rise      | 62.56    | %    |
| Downstream Velocity         | Infinity | ft/s |

TCUPP @ ASSOCIATES

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## Oso Blanca mh#1-mh#2

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### GVF Output Data

|                   |          |       |
|-------------------|----------|-------|
| Upstream Velocity | Infinity | ft/s  |
| Normal Depth      | 1.56     | ft    |
| Critical Depth    | 2.32     | ft    |
| Channel Slope     | 0.03140  | ft/ft |
| Critical Slope    | 0.01391  | ft/ft |



## Oso Blanca MH#3-MN#4

### Project Description

|                 |                 |
|-----------------|-----------------|
| Friction Method | Manning Formula |
| Solve For       | Normal Depth    |

### Input Data

|                       |         |       |
|-----------------------|---------|-------|
| Roughness Coefficient | 0.013   |       |
| Channel Slope         | 0.02780 | ft/ft |
| Diameter              | 2.50    | ft    |
| Discharge             | 52.00   | ft³/s |

### Results

|                   |               |       |
|-------------------|---------------|-------|
| Normal Depth      | 1.63          | ft    |
| Flow Area         | 3.39          | ft²   |
| Wetted Perimeter  | 4.70          | ft    |
| Hydraulic Radius  | 0.72          | ft    |
| Top Width         | 2.38          | ft    |
| Critical Depth    | 2.32          | ft    |
| Percent Full      | 65.2          | %     |
| Critical Slope    | 0.01391       | ft/ft |
| Velocity          | 15.33         | ft/s  |
| Velocity Head     | 3.65          | ft    |
| Specific Energy   | 5.28          | ft    |
| Froude Number     | 2.26          |       |
| Maximum Discharge | 73.56         | ft³/s |
| Discharge Full    | 68.39         | ft³/s |
| Slope Full        | 0.01607       | ft/ft |
| Flow Type         | SuperCritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                             |          |      |
|-----------------------------|----------|------|
| Upstream Depth              | 0.00     | ft   |
| Profile Description         |          |      |
| Profile Headloss            | 0.00     | ft   |
| Average End Depth Over Rise | 0.00     | %    |
| Normal Depth Over Rise      | 65.25    | %    |
| Downstream Velocity         | Infinity | ft/s |

TCUPP @ ASSOCIATES

---

## Oso Blanca MH#3-MN#4

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### GVF Output Data

|                   |          |       |
|-------------------|----------|-------|
| Upstream Velocity | Infinity | ft/s  |
| Normal Depth      | 1.63     | ft    |
| Critical Depth    | 2.32     | ft    |
| Channel Slope     | 0.02780  | ft/ft |
| Critical Slope    | 0.01391  | ft/ft |

## Oso Blanca MH#4-End

### Project Description

|                 |                 |
|-----------------|-----------------|
| Friction Method | Manning Formula |
| Solve For       | Normal Depth    |

### Input Data

|                       |         |                    |
|-----------------------|---------|--------------------|
| Roughness Coefficient | 0.013   |                    |
| Channel Slope         | 0.02460 | ft/ft              |
| Diameter              | 2.50    | ft                 |
| Discharge             | 52.00   | ft <sup>3</sup> /s |

### Results

|                   |               |                    |
|-------------------|---------------|--------------------|
| Normal Depth      | 1.70          | ft                 |
| Flow Area         | 3.56          | ft <sup>2</sup>    |
| Wetted Perimeter  | 4.86          | ft                 |
| Hydraulic Radius  | 0.73          | ft                 |
| Top Width         | 2.33          | ft                 |
| Critical Depth    | 2.32          | ft                 |
| Percent Full      | 68.2          | %                  |
| Critical Slope    | 0.01391       | ft/ft              |
| Velocity          | 14.59         | ft/s               |
| Velocity Head     | 3.31          | ft                 |
| Specific Energy   | 5.01          | ft                 |
| Froude Number     | 2.08          |                    |
| Maximum Discharge | 69.20         | ft <sup>3</sup> /s |
| Discharge Full    | 64.33         | ft <sup>3</sup> /s |
| Slope Full        | 0.01607       | ft/ft              |
| Flow Type         | SuperCritical |                    |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                             |          |      |
|-----------------------------|----------|------|
| Upstream Depth              | 0.00     | ft   |
| Profile Description         |          |      |
| Profile Headloss            | 0.00     | ft   |
| Average End Depth Over Rise | 0.00     | %    |
| Normal Depth Over Rise      | 68.18    | %    |
| Downstream Velocity         | Infinity | ft/s |

TCUPP @ ASSOCIATES



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## Oso Blanca MH#4-End

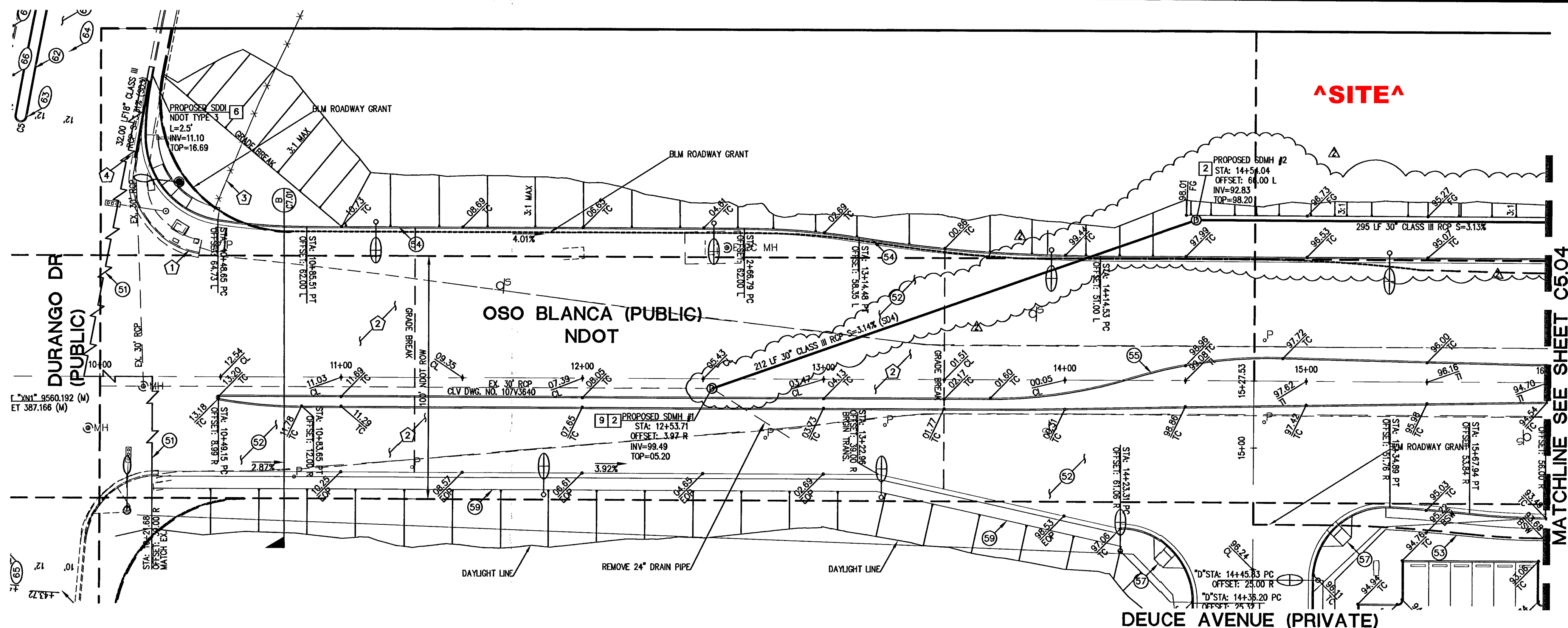
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### GVF Output Data

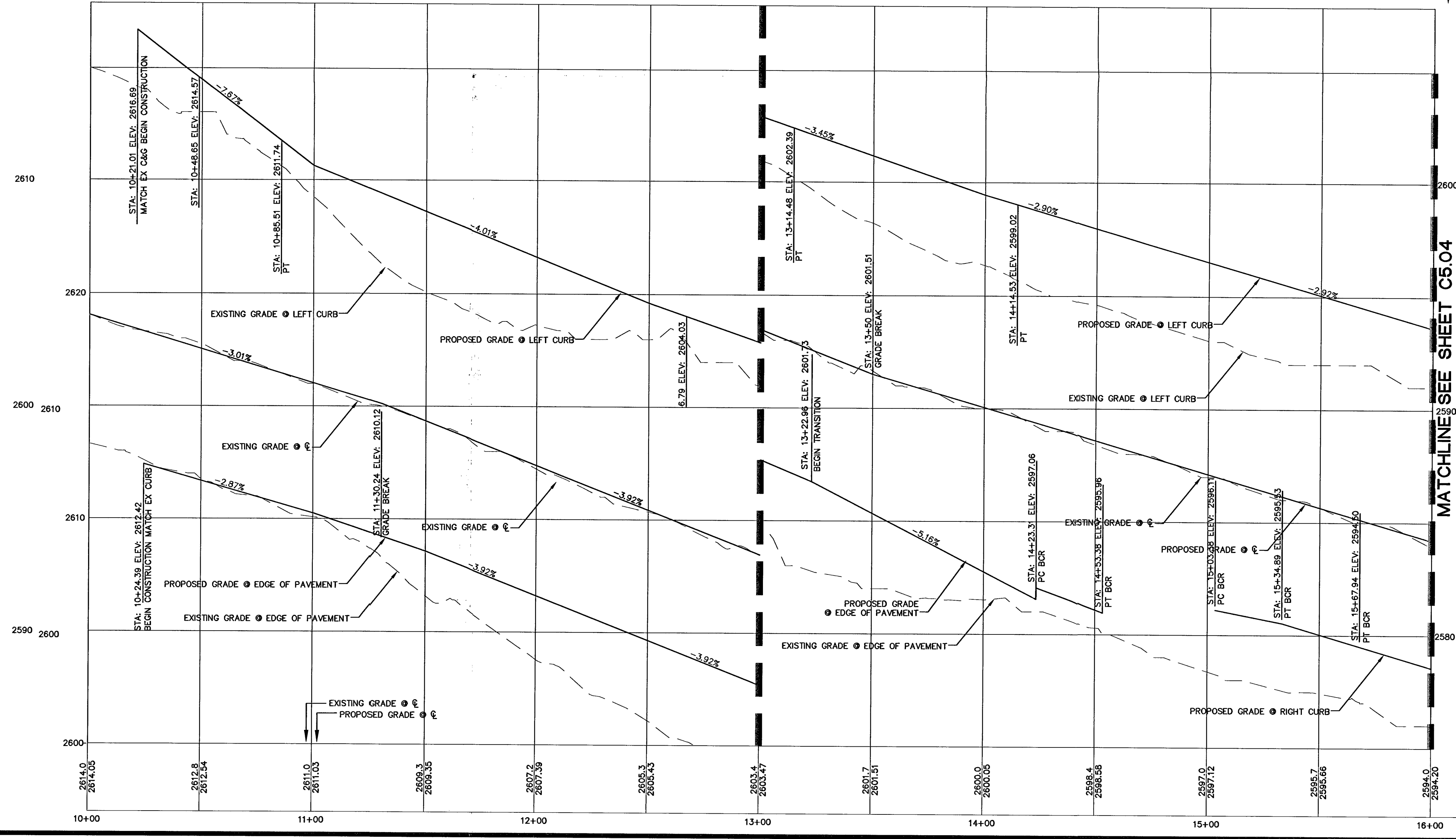
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|                   |          |       |
|-------------------|----------|-------|
| Upstream Velocity | Infinity | ft/s  |
| Normal Depth      | 1.70     | ft    |
| Critical Depth    | 2.32     | ft    |
| Channel Slope     | 0.02460  | ft/ft |
| Critical Slope    | 0.01391  | ft/ft |





LEFT CURB  
CENTER LINE  
RIGHT CURB



MATCHLINE SEE SHEET C5.04

MATCHLINE SEE SHEET C5.04

**SAFETY ALERT**

Call Before You Overhead

1-702-227-2929

811

Know what's below. Call before you dig.

1-702-227-6811

811 UNDERGROUND SERVICE ALERT (USA)

**ON-SITE STORM DRAIN CONSTRUCTION NOTES:**

1. NOT ALL NOTES USED ON THIS SHEET -

2. INSTALL 60" TYPE I STORM DRAIN MANHOLE PER CCAUSD No. 403 W/ CONC. COLLAR PER CCAUSD No. 408. REFER TO CCAUSD No. 409 FOR MANHOLE COVER & RING.

3. INSTALL 36" 36" JENSEN PRECAST DROP INLET MODEL No. D13636 W/ H-20 TRAFFIC RATED FRAME & GRATE (OR OWNER APPROVED EQUIVALENT). SEE DETAIL 7 SHEET C7.01.

4. INSTALL ROP FLARED END SECTION PER NDOT STD R-2.31

5. INSTALL 2.5' DROP INLET WITH ONE GRATE PER CCAUSD No. 412A.

6. INSTALL NDOT TYPE 3 DROP INLET PER NDOT DETAIL STD R-4.2.3.

7. INSTALL 15" ROP RAP D60-10" THICKNESS=20" W/ GEOTEXTILE & 6" TYPE II PER DETAIL 4 SHEET C7.01.

8. INSTALL 7'X7' ROP RAP PAD D50-4" THICK PER DETAIL 5 ON SHEET C7.01.

9. REMOVE EXISTING 30" CAP AND INSTALL NEW MANHOLE.

10. INSTALL NDOT TYPE 10 INLET PER NDOT STD R-4.2.5. INTERCEPT EXISTING 18" ROP. REMOVE 18" WEST OF ROP.

**DEMOLITION NOTES:**

1. NOT ALL NOTES USED ON THIS SHEET -

2. REMOVE EXISTING CURB, GUTTER, AND SIDEWALK.

3. REMOVE EXISTING PAVEMENT.

4. REMOVE EXISTING FENCE.

5. REMOVE EXISTING DROP INLET.

6. REMOVE EXISTING DROP INLET. BACKFILL WITH CLSM AND PATCH AC.

**OFF-SITE TRAFFIC CONTROL NOTES:**

1. ALL CONSTRUCTION TO BE DONE IN ACCORDANCE WITH "CLARK COUNTY AREA UNIFORM STANDARD DRAWINGS (C.C.A.U.S.D.)" LATEST EDITION AND/OR REGULATING ENTITY HAVING JURISDICTION.

2. NOT ALL NOTES USED ON THIS SHEET -

3. INSTALL YELLOW MEDIAN NOSE MARKING AND REFLECTIVE PAINT PER USA NO. 248.

4. INSTALL RAISED PAVEMENT MARKERS (TYPE 4 LANE LINE) PER USD NO. 244A.

5. INSTALL 2' WIDE, WHITE PAINTED STOP BAR.

6. INSTALL COLD POLYMER PAVEMENT SYMBOL AS SHOWN.

7. INSTALL RAISED PAVEMENT MARKERS (ADDED LEFT/RIGHT TURN LANE) PER USD NO. 246.

8. INSTALL 6" WIDE, WHITE REFLECTIVE PAINT.

**CURVE TABLE**

| CURVE | LENGTH  | RADIUS   | DELTA      | TANGENT  |
|-------|---------|----------|------------|----------|
| C1    | 618.48' | 1957.00' | 18°06'26"  | 311.83'  |
| C2    | 54.52'  | 150.50'  | 20°45'17"  | 27.56'   |
| C3    | 62.83'  | 149.50'  | 24°14'52"  | 31.89'   |
| C4    | 587.57' | 1959.00' | 18°36'00"  | 285.79'  |
| C5    | 3.14'   | 1.00'    | 180°00'00" | INFINITE |

**ON-SITE CONSTRUCTION**

1 inch = 30 ft.

**NOTES:**

1. ALL CONSTRUCTION TO BE DONE IN ACCORDANCE WITH "CLARK COUNTY AREA UNIFORM STANDARD DRAWINGS (C.C.A.U.S.D.)" LATEST EDITION, TOWN CENTER DEVELOPMENT STANDARDS, AND/OR REGULATING ENTITY HAVING JURISDICTION.

2. NOT ALL NOTES USED ON THIS SHEET -

3. CONSTRUCT ASPHALT PAVEMENT PER DETAIL 1 ON SHEET C7.01.

4. CONSTRUCT CONCRETE SIDEWALK PER CCAUSD No. 234.

5. CONSTRUCT "A" TYPE CURB PER DETAIL 3 ON SHEET C7.01.

6. INSTALL 2" VALLEY GUTTER PER DETAIL 2 ON SHEET C7.01.

7. LANDSCAPE AREA. SEE LANDSCAPE ARCH. PLANS.

8. INSTALL 0" CURB PER DETAIL 6 ON SHEET C7.01.

9. TRASH ENCLOSURE PER ARCHITECTURAL PLANS.

**OFF-SITE CONSTRUCTION NOTES:**

1. ALL CONSTRUCTION TO BE DONE IN ACCORDANCE WITH "CLARK COUNTY AREA UNIFORM STANDARD DRAWINGS (C.C.A.U.S.D.)" LATEST EDITION AND/OR REGULATING ENTITY HAVING JURISDICTION.

2. NOT ALL NOTES USED ON THIS SHEET -

3. SAWCUT & MATCH EX. GRADE.

4. CONSTRUCT ASPHALT PAVEMENT PER DETAIL 1 ON SHEET C7.01.

5. CONSTRUCT CONCRETE SIDEWALK PER CCAUSD No. 234.

6. CONSTRUCT "L" TYPE CURB PER CCAUSD No. 216.

7. CONSTRUCT "A" TYPE MEDIAN CURB PER CCAUSD No. 219.

8. CONSTRUCT SIDEWALK UNDERDRAIN PER DETAIL 1 ON SHEET C7.02 AND CCAUSD No. 238.

9. CONSTRUCT HANDICAP RAMP PER CCAUSD No. 235 CASE II A&B-8' UNLESS OTHERWISE NOTED AND PER TOWN CENTER FIGURE 14 & 25.

10. CONSTRUCT 8' CROSS GUTTER PER CCAUSD No. 228.

11. CONSTRUCT TEMPORARY AC SIDEWALK.

12. CONSTRUCT TRUCK RING PER DETAIL 8 ON SHEET C7.01.

13. CONSTRUCT NDOT FREEWAY FENCE PER NDOT STD. DWG.R-6.3.2.1

14. CONSTRUCT TACK ON MEDIAN CURB.

15. MILL AND REAPPLY OPEN GRADE WITHIN LIMITS OF NEW STRIPING.

16. CONSTRUCT CONCRETE IN AMENITY ZONE PER TOWN CENTER FIGURE 14.

17. CONSTRUCT CONCRETE BUS TURNOUT PER CCAUSD No. 234.1

**GRADING AND GEOTECHNICAL NOTES:**

1. CONTRACTOR TO ENSURE POSITIVE DRAINAGE. NO PONDING ALLOWED.

2. CONTRACTOR TO BE FAMILIAR WITH ALL RECOMMENDATIONS OUTLINED IN THE PROJECT GEOTECHNICAL REPORT, INCLUDING BUT NOT LIMITED TO EXCAVATION, GRADING & COMPACTION. REFER TO THE REPORT PREPARED BY: DUPONT ENGINEERING DEI NO. 08-0476 DATED OCTOBER 17, 2008.

3. SLOPES 4:1 OR STEEPER AND FINE-GRAINED MATERIALS THAT HAVE BEEN DISTURBED (SANDY AND SILTY MATERIALS) SHOULD BE PROTECTED WITH BURLAP OR OTHER EROSION CONTROL FABRIC/MATERIAL, UNLESS OTHERWISE SPECIFIED BY LANDSCAPE DRAWINGS & SPECIFICATIONS OR THE PROJECT SOILS REPORT RECOMMENDATIONS.

4. CONTRACTOR SHALL NOTIFY ENGINEER WITHIN 24 HOURS OF OMISSIONS AND/OR ERRORS DISCOVERED ON PLANS. ENGINEER WILL NOT BE RESPONSIBLE FOR ANY "CORRECTIVE" WORK DONE BY OTHERS.

**CROSSING/SEPARATION NOTE:**

ALL SEWER/STORM DRAINS CROSSING WATER LINES MUST CONFORM TO SECTION 2.15 OF UNIFORM DESIGN AND CONSTRUCTION STANDARD FOR WATER DISTRIBUTION SYSTEMS (UDMS) FOR WATER & STORM DRAIN CROSSING AND CLEARANCES.

MINIMUM SEPARATION BETWEEN FIRE SYSTEMS AND DOMESTIC WATER MAINS SHALL BE SIX (6) FEET HORIZONTALLY FROM EXTERIOR PIPE WALLS & EIGHTEEN (18) INCHES VERTICALLY. MINIMUM SEPARATION FROM SEWER LINES SHALL BE TEN (10) FEET HORIZONTALLY.

**BENCHMARK**

RIVET AND ALUMINUM PLATE IN TOP OF SOUTH END OF HEADWALL ON THE WEST SIDE OF WEST FRONTAGE ROAD +/- 400 FEET NORTH OF ELKHORN AT MILE POST 88.4 CITY OF LAS VEGAS NO. BLV90 175ES ELEVATION BEING 618.436 METERS OR 2555.61 FEET, OR 778.9500 METERS. NAVD 88

**BASIS OF BEARING**

NORTH 89°42'36" WEST BEING THE CENTER LINE OF ELKHORN ROAD, BEARING PRODUCED USING LEICA 1200 GPS AND CITY OF LAS VEGAS BASE STATION.

**FLOOD ZONE NOTE**

THE SUBJECT PROPERTY IS COVERED BY A FLOOD INSURANCE RATE MAP (FIRM) FOR THE CLARK COUNTY, NEVADA AND UNINCORPORATED AREAS, COMMUNITY PANEL NUMBER 320030745E, EFFECTIVE DATE: SEPT. 27, 2002. REVIEW OF THE FIRM INDICATES THAT THE SITE IS LOCATED WITHIN A FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) DESIGNATED ZONE "X".

**SIGHT VISIBILITY ZONE**

NOTE:

1. NO PROPOSED IMPROVEMENTS OVER 24" IN HEIGHT ALLOWED IN SIGHT VISIBILITY ZONES EXCEPT TRAFFIC CONTROL DEVICES. REFER TO CCAUSD No. 234.1

This grading plan is a part of drainage study # 4356 which was received on 9/3/09 and approved on 9/13/09. Page 6 of 14

**REGIONAL TRANSPORTATION COMMISSION**

600 S. GRAND CENTRAL PARKWAY  
Las Vegas, NV

**PLAN AND PROFILE**

**CENTENNIAL HILLS TRANSIT CENTER AND PARK AND RIDE**

**DESIGNED BY:** TAC

**CHECKED BY:** TAC

**PROJECT NO.:**

**SCALE:** 1"=30' HORIZ. 1"=5' VERT.

**SHEET C5.03**

**16 OF 59 SHEETS**

**DRAWING NO.:**

**REVISION**

2470 St. Rose Parkway  
Henderson, NV 89074  
(702) 982-2189 Fax (702) 982-2146

**TCUPP**

**ENGINEER**

**TERRY A. CURRY**

**CIVIL**

**NO. 5074**



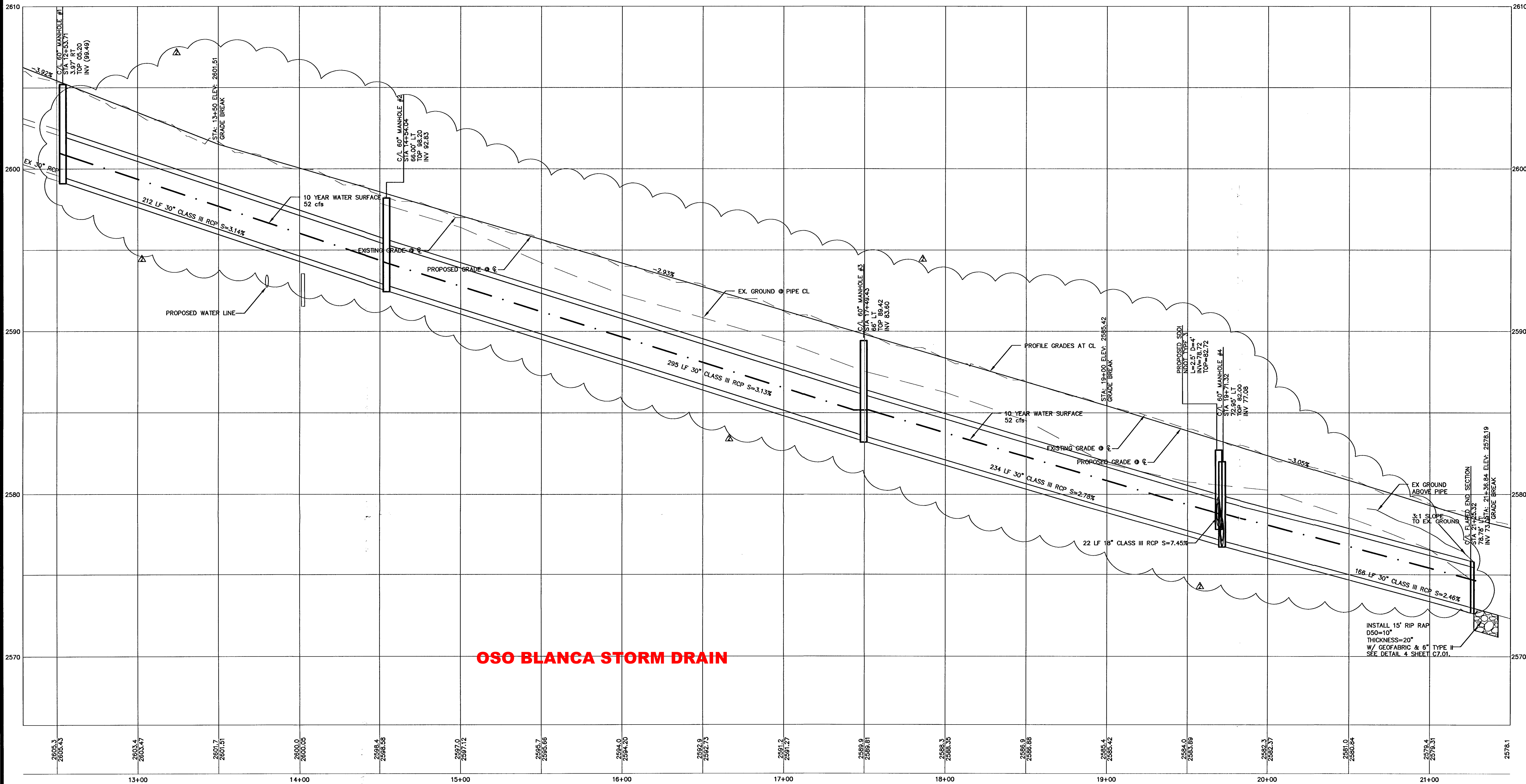








OSO BLANCA STORM DRAIN



This grading plan is a part of drainage study # 4356 which was received on 9/3/09 and approved on 01/03/2009 Page 12 of 14

|                                                                                                                |  |                     |  |                    |  |              |  |
|----------------------------------------------------------------------------------------------------------------|--|---------------------|--|--------------------|--|--------------|--|
| DRAWN BY:<br>TAC                                                                                               |  | DESIGNED BY:<br>TAC |  | CHECKED BY:<br>TAC |  | PROJECT NO.: |  |
| SCALE: 1"=30'                                                                                                  |  | HORIZ.:             |  | VERT.:             |  |              |  |
| <b>REGIONAL TRANSPORTATION COMMISSION</b><br>600 S. GRAND CENTRAL PARKWAY<br>Las Vegas, NV                     |  |                     |  |                    |  |              |  |
| <b>OSO BLANCA STORM DRAIN</b><br>PROFILE                                                                       |  |                     |  |                    |  |              |  |
| <b>CENTENNIAL HILLS TRANSIT</b><br>CENTER AND PARK AND RIDE                                                    |  |                     |  |                    |  |              |  |
| 2470 St. Rose Parkway<br>Henderson, NV 89074<br>(702) 982-2339 Fax (702) 982-2146                              |  |                     |  |                    |  |              |  |
| <b>TCUPP</b><br>TERRY A. CUPP<br>REGISTERED PROFESSIONAL ENGINEER-STATE OF NEVADA<br>No. 5074<br>EXP. 12/31/10 |  |                     |  |                    |  |              |  |
| SHEET<br>C5.11<br>22 of 69 SHEETS<br>DRAWING NO.                                                               |  |                     |  |                    |  |              |  |
| REV. DATE BY REVISION                                                                                          |  |                     |  |                    |  |              |  |



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## GRADING PLANS