DS #: 05232

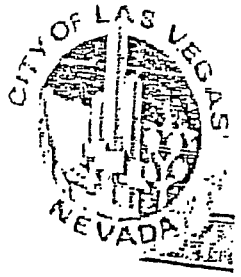
APN: 126-25-201-010

PROJECT: Centennial Heights Townhomes

SUBMITTAL: 1st

SCANNED BY/DATE:

CHECKED BY/DATE:



CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM			DATE: February 4, 2020
TO: **Land Development Services** Department of Building & Safety			FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT:	Drainage Study for:		**COPIES TO:**
Centennial Heights Townhomes			Horrocks Engineers
Cross Streets:	SWQ of Centennial Pkwy & Shaumber Road		Harmony Homes, LLC
File Number:	F:\Depot\DSMemos\DS5232A.doc		Bart Anderson, P.E., DevCo
Parcel Number:	126-25-201-010		CCRFCD
Zoning Action:	TMP-77575; VAC-77574; VAR-77573 & ZON-77572		
FEMA Flood Zone	YES	NO X	
Proposed Storm Drain	YES X	NO	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1st Submittal	12/30/2019	1/31/2019	See Comments Below	$400.00	3688174: $400
			TOTAL FEES (LDDRS):	**$400.00**	**----**

REMARKS:

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

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

1. Provide a copy of the zoning/planning conditions associated with this site (**TMP-77575; VAC-77574; VAR-77573 & ZON-77572**) with the next submittal to verify compliance with conditions. *Flood Control* will not issue conditional approval of the drainage study without the associated zoning/planning conditions (issued by the *City Council*). Any associated conditions of approval that revise the site drainage parameters will require that the drainage study be revised and resubmitted.
2. Sites with a grade difference of 2 feet above or below existing grades are required to have approval from the *City of Las Vegas Planning and Development Department.* The engineer must submit copies of the grading plans and detail sheet with a letter justifying the grade difference to the *City Planning Department* (229-6301). The engineer must provide *City Planning* approval with the next submittal.
3. The site is adjacent to or crosses an existing or proposed *Clark County Regional Flood Control District* (CCRFCD) master planned facility. Therefore, CCRFCD concurrence is required prior to final approval of the drainage study.

   Please note that effective March 15, 2019, the CCRFCD adopted new requirements for drainage study concurrence submittal. Follow the link below for specific guidance.

   http://gustfront.ccrfcd.org/LandDev/LandDev.aspx

4. The project proposes to build a temporary drainage facility (dirt channel with riprap at sections) along the west boundary of the subject site. Prior to final plan approval the developer must complete a maintenance and liability agreement for the interim drainage improvements (off-site channels) and post a minimum maintenance bond of $50,000 or 50-percent of the construction cost for the improvements, whichever is greater. The engineer must submit an estimate of the quantities for constructing the facility and an exhibit that adequately shows the location and limits of the drainage facility to *City of Las Vegas Flood Control* for approval. Once the drainage study is conditionally approved, the engineer should contact the City's Land Development Section (229-6371) to begin the agreement process.

   In order for the maintenance bond to be released in the future, a drainage update / letter will be required to justify that the offsite berms / channels are no longer necessary and can be removed.

5. The proposed channel to the west requires offsite grading. Obtain a notarized letter of permission for grading from the adjacent property owner prior to the final approval of the subject study.

6. The *Study* stated that the project will be developed in two phases. For *Phase 1 Improvements*, a separate set of plans must be provided to show the interim condition grading, ie, Phase 1 with full improvements and Phase 2 portion with rough graded plans. Provide as such in the next submittal.

7. **Figure 5 (Existing Offsite Condition Basin Map)**: The *Figure* shows a dirt access road in the *Centennial Parkway* alignment. However, the contour lines presented do not reflect a rough graded roadway at all. Without an access road, the basin boundary line along *Centennial* is not conclusive. Drainage from the north of *Centennial* indeed impacts the offsite basins such as OF-E1, OF-E2, OF-E3 etc base on the contour lines as shown. Address and resolve all pertinent drainage conditions maps in the next submittal.

8. **Figure 5 (Existing Offsite Condition Basin Map)**: The flow in Combination Point "CE8" in *Centennial Parkway* is not correct. The offsite basins north and west of ST-E1 are contributing basins too. Review and revise all pertinent drainage conditions maps accordingly.

9. **Figure 5**: The outflow from "GOAN 0044" in *Tropical Parkway* was missing and has not been addressed at all. Review and resolve in the next submittal.

10. **Figure 6 (Phase 1 Interim Condition Offsite Basin Map)** and **Figure 8 (Phase 2 Interim Condition Offsite Basin Map)**: Same comment for the access road in *Centennial Parkway*.

11. **Figure 6:** *Phase 1 Interim Condition Hydrologic Summary Table* on lists RTCI1D but is not shown on the exhibit or shown as a referenced flow or considered in the HEC-1. Clarify what this flow is, if it exists and how the flows were determined.

12. **Figure 6**: It is unclear where some of the values for sections are coming from, for example it appears that some basins have been prorated in the description of the summary table or given alternate values for an existing basin. For example, Sections 9C and 9D consider OP-D1(0.8) and OP-D1(1.2) respectively. Some of the descriptions appear to show values that have been subtracted while some show values that are being used instead of the full basin value. It is unclear how these values were determined and should be explained in the report and on the exhibit.

13. **Figure 6**: Phase I interim condition combination point CI1L is 119 cfs. However, the 36" RCP inlet is references to convey 86 cfs. Prove that the 119 cfs is in fact flowing through the development as stated here and is no flow is being diverted and impacting Phase I improvements.

14. **Figure 6**: All facility flows need to be checked for quality and accuracy. For example, it is listed that inlet DI4 intercepts 0.5 cfs and that the lateral pipe (P4) has 9 cfs in it.

15. **Figure 6**: The combination point at the end of the channel is covered by an elevation label. Fix overlap to clarify.

16. **Figures 6/7 (Phase 1 Interim Condition Onsite and Offsite Basin Map):** DI3 outlets into *Facility P3* which is shown on the exhibit as part of Phase 1 construction, but not listed on the *Drainage Facility Summary* table.
17. **Figures 6/7:** Cross Section 2 lists CU1H as a contributing basin, this basin does not exist on the exhibits and is not shown on the tables or the HEC-1s, revise to show correct basin names, or show the basin on the exhibit so that the half street flows for Section 2 can be confirmed.
18. **Figures 6/7:** Cross Section 8 is analyzed with 25 cfs but is sited as considering basin ON-D6 which has a 100-yr flow of 26 cfs. Explain the discrepancy or revise the calculations to consider all flow in the basin.
19. It is unclear where some of the values for sections are coming from, for example on **Figure 6** and **Figure 7** *Section 18* considers 7cfs from *Basin OF-E7*, but the basin has 59cfs. A majority of the flow from the basin should be flowing to the channel. If only some of the basin is entering the channel then a separate basin should be delineated to reflect that scenario.
20. **Figures 6/10**: It is unclear how the flows used to calculates inlets was determined, for example DI3 is analyzed for 11 cfs, however Cross Section 6 shows 19 cfs at that location in Phase I and 28 cfs at Phase II and for Ultimate. Clarify the inlet contributing flows for all inlets.
21. **Figure 10 (Ultimate Condition Offsite Basin Map)**: It is unclear how the offsite flow is being conveyed to combination point CUF. The combination points shown in the reference are not provided and the flow for each basin is shown, but never connected to a system or channel and appears to be impacting the park without mitigation, address and resolve.
22. **Figure 10**: The line weight of the local existing facilities is inconsistent on the exhibit and does not match the legend.
23. **Figure 10**: Label drop inlets more clearly. The current labels are very faint and hard to distinguish.
24. The *Study* states that the *Phase II Interim Condition* is the worst case scenario and has the highest peak flow rates (page 8-9), however the *Ultimate Condition* flow rates are in fact the highest and should therefore be the dictating design flows.
25. Provide an overall *Storm Drain Exhibit* with all proposed facilities and drop inlets labeled.
26. Provide an overall exhibit to show all proposed public drainage easements (privately maintained). It appears that all areas other than the buildings need to be drainage easements because of cross-lot drainage.
27. The rainfall depth for the 100 year shown on Table 2, 6-Hour Rainfall Depth, is 2.0 while it is shown as 2.2 on Figure 506. Update the values to match.
28. The street names shown on the Custom Soils Report do not match those on the Figure 1 Vicinity Map, confirm that this is the right location and update the street names on the exhibit so that the location can be confirmed.
29. Label the existing CCRFCD regional facility GOAN 0061 on the exhibits.
30. Label all regional facilities on all of the exhibits. For example, GOAN 0070 and GOAN 0044 are not labeled on the *Ultimate Condition Offsite Drainage Map*.
31. The report incorrectly identified different reference material, for example, Flow Master Reports are said to be Reference 5 in the report, but are actually the first section of Appendix B.
32. Label and provide numbering for all drop inlets on the grading plans.
33. Label on all grading plans and plan & profile sheets whether the onsite streets are PRIVATE or PUBLIC.

34. On all grading sheets, Pentagon 1, 2 and 3 all stated the same sort of easements without distinction. Review and revise accordingly.

35. **Sheet C.2.0**: There are floating FL elevation callouts that do not point to any swales or flow lines. Review and adjust so that all FL elevations are pointing to actual flow lines.

36. **Sheet C.2.2**: Address in the next submittal whether there are existing wall openings along the west property wall of the adjacent *Apartments* complex to accept the flows from the subject development into the existing concrete channel. It is not clear a proposed onsite storm drain between Lot 170 and Lot 171 will need a penetration of the existing wall? If yes, permission from the Apartments owner will be required prior to the final approval of the drainage study. Address and clarify in the next submittal.

37. All common areas such as for example, between Lots 222-217 and Lots 223-228 must be a designated public drainage easement to be privately maintained.

    Provide an overall plan to show the locations of all drainage easements in the next submittal.

38. **Sheet C.5.14 to Sheet C.5.21**: Regarding the outfall pipe in *Tropical Parkway*, address how in the future when "GOAN 0000" is extended to the west end of the site to be connected to the proposed 78"-RCP.

39. **Sheet C.5.21**: Provide a cut-off wall at the entrance of the proposed 78"-RCP.

40. **Sheet C.5.20**: Profile for *Storm Drain 4* has a floating label for an EX SS not shown in the profile. Also, check the line weights and colors for the storm drain for consistency and accuracy. The top of the pipe in *Storm Drain 4* is gray while the bottom is black. Gray is generally used for existing infrastructure.

41. Per the WSPG Model, the 78"-RCP mainline in *Tropical Parkway* has erosive 100-year velocity greater than 25 ft/s. Provide sacrificial concrete in the next submittal.

42. **Sheet C.5.21**: *Storm Drain 5* shows a thick gray line at the top of the channel, clarify/label what this line represents.

43. **Sheet C.6.1 (Detail Sheet 2)**: Detailed building grading, the lots to the north of the detail flow to a flowline located on top of a sidewalk. Sidewalks are not to function as concentrated flow locations. Review and revise accordingly.

44. Provide storm drain profiles for all proposed storm drain. Provide profile of the full proposed system along Tropical Parkway and for inlets DI3 and DI4.

45. An open culvert modeling method such as HY-8 is required for modeling headwater for the outletting culvert of the open channel. Appropriate freeboard must also be provided and shown at this location.

46. The proposed wrought iron fence must utilize RTC Uniform Standard Drawing 425.S1. Clearly label as such in all Construction Notes and pertinent details.

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
HDR/AYS

T/R/S: T19S/R59E/25
AREA F-25

HORROCKS ENGINEERS

1401 N. Green Valley Parkway, Ste. 160
Henderson, NV 89074
702-966-4063
www.horrocks.com

To: **City of Las Vegas**
Development Review
333 N Rancho Dr.
Las Vegas, NV 89106

From: **David Clark**

Date: December 23, 2019 **Transmittal**

Subject: **Technical Drainage Study for Centennial Heights Townhomes Park, (APN 126-25-201-010)**

The following items are: ☐ Requested

☒ Enclosed

☐ Sent Separately via Courier

No. of Copies	Description
2	Subject TDS
2	CD
2	Check #_____ ($400.00)
2	Improvements Plans (Rolled)

These data are submitted:

☒ For your review

_____
Signature

HORROCKS ENGINEERS

1401 N. Green Valley Parkway, Ste. 160
Henderson, NV 89074
702-966-4063
www.horrocks.com

To: **City of Las Vegas**
Development Review
333 N Rancho Dr.
Las Vegas, NV 89106

From: **David Clark**

Date: December 26, 2019 **Transmittal**

Subject: **Technical Drainage Study for Centennial Heights Townhomes Park, (APN 126-25-201-010)**

The following items are: ☐ Requested

☒ Enclosed

☐ Sent Separately via Courier

No. of Copies	Description
1	Subject TDS
1	CD
2	Check #_____ ($400.00)
1	Improvements Plans (Folded)

These data are submitted:

☒ For your review

_____
Signature

VOLUME 1: REPORT, APPENDIX A AND APPENDIX B

OF

TECHNICAL DRAINAGE STUDY

FOR

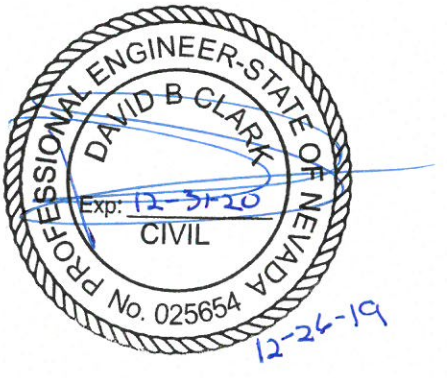
CENTENNIAL HEIGHTS TOWNHOMES

IN

CITY OF LAS VEGAS, NEVADA

PREPARED FOR

HARMONY HOMES, LLC
8912 Spanish Ridge Ave. Ste. 200
Las Vegas, NV, 89148
Ph. (702) 570-7240



DECEMBER 2019

HORROCKS ENGINEERS PROJECT NV-1949-1909

Horrocks Engineers
1401 N Green Valley Pkwy, Suite 160
Henderson, NV 89074
702.966.4063

HORROCKS
ENGINEERS

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: CENTENNIAL HEIGHTS TOWNHOMES Date: 12-26-2019

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

East/West: Centennial Pkwy

b) Section: 25 Township: 19S Range: 59E

c) APN : 126-25-201-010

Name of Owner: HARMONY HOMES, LLC

Telephone No.: 858.755.0499 Fax No.: E-Mail Address: blake@chaseconstruction@gmail.com

Address: 2620 W. Horizon Ridge Pkwy Henderson, NV 89052

Contact Person-Name: David B. Clark **Telephone No.:** 702.966.4063

*** E-Mail Address:** dclark@horrocks.com **Fax No.:**

Firm: Horrocks Engineers

Address: 1401 N Green Valley Pkwy, Suite 160 Henderson, NV 89014

Type of Land Development/Land Disturbance Process:

	Rezoning		Subdivision Map		Clearing and Grading Only
	Parcel Map	X	Planned Unit Development	X	Other (Please specify below)
	Large Parcel Map	X	Building Permit		OFFSITE ROADWAY/IMPROVEMENTS

1. Total Owned Land Area: At Site: 30+/- acres Being Developed/Disturbed: 30+/- acres
2. Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? ☐ **Yes**** ☒ **No**
3. Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? ☒ **Yes**** ☐ **No**
4. Proposed type of development (Residential, Commercial, Etc.): Residential - Townhomes
5. Approximate upstream land area which drains to the subject site: 155 acres
6. Has the site drainage been evaluated in the past? ☐ **YES** ☒ **NO** If yes, please identify documentation:
7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: The site discharges at 3 locations along eastern boundary of the northern half of the project site, and into the Tropical ROW at the southeast corner of the site
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.**

Local Entity File No.

Revision	Date

REFERENCE:

STANDARD FORM 1

Updated 05/01/2008

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

Project Name: CENTENNIAL HEIGHTS TOWNHOMES	Map ID:
Firm Name: Horrocks Engineers	Engineer: David B. Clark, P.E.
Address: 1401 N Green Valley Pkwy, Suite 160	
City: Henderson, State: NV Zip: 89074	
Phone Number: 702.966.4063	Fax Number:
Property Owner: HARMONY HOMES, LLC	
Address: 8912 Spanish Ridge Ave. Ste. 200	
City: Las Vegas State: NV Zip: 89148	

Reviewed By:	Date Received:	Date Accepted for Review:

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

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

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

I. GENERAL REQUIREMENT

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

II. MAPS AND EXHIBITS

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

REFERENCE:	**STANDARD FORM 2**

DRAINAGE SUBMITTAL CHECKLIST

II. MAPS AND EXHIBITS (Continued)

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

III. DRAINAGE PLAN

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

REFERENCE:	**STANDARD FORM 2**

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

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

REFERENCE:	**STANDARD FORM 2**

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

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

IV. HYDROLOGIC ANALYSIS

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

REFERENCE:	**STANDARD FORM 2**

DRAINAGE SUBMITTAL CHECKLIST

V. HYDRAULIC ANALYSIS

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

REFERENCE:	**STANDARD FORM 2**

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APPENDICES

Appendix A – Hydrologic Data and Calculations

Appendix B – Hydraulic Sections and Calculations

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Appendix D – Grading Plan; Plan/Profiles; Sections/Details

I. INTRODUCTION

Harmony Homes LLC proposes to develop a 30 +/-acres Centennial Heights Townhomes located south of Centennial Parkway, a 100 foot ROW street, west of Shaumber Road, and north of Tropical Parkway (Assessor Parcel Number 126-25-201-010). The site generally drains from the northwest to the southeast. The proposed site includes residential townhomes with 4-8 units per building, common areas, onsite roadways, and a future park along the Puli alignment. Offsite improvements include utilities, the path and grading for the future park along the Puli alignment and the half street improvements for Tropical Parkway and Centennial Parkway. This report presents the results of a technical drainage study consisting of hydrologic and hydraulic analysis and the proposed drainage facilities for the site development as required in the Clark County Regional Flood Control District (CCRFCD) Hydrologic Criteria and Design Manual (hereinafter referred to as, "The Manual") (Reference 1). The purpose of the report is:

- To identify and evaluate previous drainage studies in the surrounding area
- To identify the flood zone status of the property
- To identify the existing and developed regional facilities adjacent to the site
- To quantify the 10-yr and 100-yr peak runoff impacting the site, and
- To present the appropriate mitigation for conveying the peak flows under the Interim and Ultimate conditions through and around the development in accordance with local standards.

II. PROJECT LOCATION AND DESCRIPTION

The project is located in Section 25 Township 19 South, Range 59 East MDM in Clark County, Nevada. Refer to Figure 1 – Vicinity Map. Conditions surrounding the property are summarized in Table 1 below.

TABLE 1

Table 1 – Project Conditions

Frontage	Existing Condition	Proposed Condition	Notes
Site	Undeveloped	Residential Townhouse	
North	Developed – Residential	unchanged	Does not contributes flows to the project area.
East	Partially developed - Residential	Unchanged	Centennial Condos. Avanti Apartments BLM land borders the project site
South	Undeveloped	Unchanged	- Does not contribute flows to the project site
West	Undeveloped	Unchanged	- The land to the west is concurrently under design for residential development by others

The project site exists in a natural desert condition and generally flows from northwest to the southeast at a slope of approximately 5.0%. There is developed residential area (Centennial Condominiums) east of the north half of the project area. Centennial Parkway is partially developed adjacent to the project site. The parcel to the north of the project site is developed residential area and does not affect the project site. The parcel to the south of the project site is undeveloped and also does not have any flow contribution to the project site. The parcel to the west is currently undeveloped.

Upstream of the project site is the existing CCRFCD regional facility, a soil cement channel - GOAN 0070, which has a 100-year event peak flow of 1075 cfs flow. This channel intercept upstream

runoff. This flow is conveyed into the 364 ac-ft Ann Road Detention Basin and is discharged through GOAN 0044. The detention basin, GOAN 0061, is located west of the project site, south of Tropical Parkway.



FIGURE 1 – VICINITY MAP

FEMA FLOOD ZONE

The Federal Emergency Management Agency (FEMA), Flood Insurance Rate Map (FIRM) (Reference 2), Community Panel Numbers 32003C1750E, effective September 27, 2002, designates the project site as Zone 'X'. Zone 'X' is described as an area of minimum flood hazard. See Figure 2 in Appendix A for the most current panel being used in this study.

CCRFCD FACILITIES

The 2018 Las Vegas Valley Master Plan Update (Reference 3) (hereinafter referred to as the MPU) shows existing and proposed CCRFCD regional facilities. The CCRFCD proposed regional facility GOBW 0315 is 54" RCP, and runs west to east along the northern boundary of the project site. CCRFCD regional facilities GOAN 0044 and GOAN 0000 are existing and proposed CCRFCD regional facilities, respectively, and are specified as 54" RCP and convey a design flow of 157 cfs. The facilities flow from the detention basin outfall to the CC215 beltway facilities. The GOAN facilities are designed to convey the Ann Road Detention Basin discharge. It appears that the facilities were not designed to capture or convey additional flows not routed through the Ann Road Detention Basin (GOAN 0061) that originate north of Tropical Parkway. See Figure 3, MPU Figure F-16, in the appendix A for location with relation to the project site and the regional facilities.

III. METHODOLOGY

The methodology for hydrologic and hydraulic analyses used in this study are in compliance with the Manual. The drainage models use unit hydrograph modeling methodology per the Manual. The HEC-1 software package by USACE Water Resources Institute (Reference 4) as allowed per Clark County. Hydrologic methodologies used in this study are in accordance with Sections 500 and 600 of the Manual.

Hydraulic Methodology and Criteria

Hydraulic methodologies used in this study in accordance with the manual. Flowmaster (Reference 5) and WSPGW (Reference 6) has been used to assist in hydraulic calculations as well as nomographs and other aids included in the Manual. Excel spreadsheets have also been used for any other necessary calculations. Hydraulic calculations can be found in Appendix B.

Topographic Information

Topographic information for this project was gathered from sources including:

1. Aerial and field topographic survey completed by AEROTECH Mapping Inc,.
2. Two (2) foot contour data provided by Clark County circa 2016.

HEC-1 –

The U.S. Army Corps of Engineers *HEC-1 Flood Hydrograph Package* was used to determine the peak runoff values generated by the 10-year and 100-year, 6-hour storm event. The HEC-1 computer model has the ability to simulate the surface runoff response of a drainage basin to precipitation. The HEC-1 program represents the basin as an interconnected system of hydraulic components. Each component models an aspect of the rainfall runoff process within a portion of the entire basin. This basin portion is referred to as a sub-basin. The computed hydrographs of each sub-basin are then combined at the appropriate locations and a final discharge hydrograph is obtained.

Rainfall –

The project site is located outside of the limits for McCarran Airport Rainfall. Point precipitation values were selected from the NOAA atlas maps and adjusted as directed in the Manual, resulting in final rainfall depths of 1.74 inches and 3.15 inches in the 10- and 100-year storm events. The site encompasses less than 8 square miles, therefore the Storm Distribution Number Three (SDN No. 3) was used for the HEC-1 Model. Since the total watershed studied consists of approximately 30 acres, the rainfall depths were not adjusted for depth area.

Table 2
6-Hour Rainfall Depths

Year	Rainfall Depth	Adjustment Ratio	Adjusted Rainfall Depth	Percentage of 100 Year
10	1.40	1.24	1.74	0.55
100	2.0	1.43	3.15	1.00

Depth-Area Reduction Factor

DARFs were not used in this analysis as the drainage basins were too small.

Curve Numbers –

The soils for the drainage basins were determined using the digital map from the Las Vegas Valley Area, Nevada, Part of Clark County Soil Survey Area sourced from the Natural Resources Conservation Service [Reference 7]. The drainage basins have been delineated on the soils map to identify makeup of soils types. The drainage basins are comprised of soils classified as 190 and 400, which corresponds respectively to Hydrologic Soil Group A, and D. Soil descriptions, soils map, and associated soil properties/qualities are included in Appendix A. The Curve Numbers associated with the soils were determined using land use categories and methodology of the Manual.

Drainage Basins –

Drainage basins were identified by field observations, aerial photography, surveyed topography, 2-ft contour topography from Clark County OpenWeb and referenced plans. The offsite upstream basins that impact the project site are located to the west of the project site. Runoff further west of the site is collected and conveyed to the Ann Road Detention Basin and does not impact the western boundary of the project site. The Ann Road Detention basin which is located south of the soil cement channel ultimately accumulates all flows upstream of the offsite basin, and discharges the captured flow along the tropical parkways, and limits the flows that impact the project site. See Figure 4, W-Map in Appendix A. The basins are described in the applicable sections below for each drainage condition: Existing, Interim, and Ultimate depicted on exhibits in Appendix A.

Lag Time

Lag time (TLAG) is described as the time measured between the centroid of rainfall to the peak of the outflow hydrograph. It is a measure of the watershed's response time and is associated to basin length, slope, roughness characteristics, and land use.

Lag-times have been estimated by calculating the drainage basins' time of concentration, T_c. The time of concentration consists of two component times; the initial overland flow time, t_i, and the travel time for the flow within the gutter, swale, or channel, t_t. The equation for the time of concentration is as follows:

$$T_c = t_i + t_t$$

Where, $t_i = 1.8(1.1-K)L_O^{1/2}/S^{1/3}$

K = Flow Resistance Coefficient (K = 0.0132CN-0.39)
CN = Curve Number
L_O = Length of the Overland Flow

S = Average Basin Slope

And, $t_t = L/(60V)$

L = Length of Gutter/Channel (ft)
V = Flow Velocity (ft/s) – Velocity is calculated from the Manning's Equation with $Q = 0.6Q_T$, where Q_T = Total Discharge

Lag-times are estimated with the following equation: $TLAG = 0.6T_c$.

IV. Drainage Summary

General Description

The project site is impacted by offsite runoff from the west. In the north portion of the project site, there are existing local storm drains across the Centennial Condominiums that collect and convey both offsite and onsite runoff and discharges it into the undeveloped BLM parcel to the east. The southern portion of the project area generally flows from west to east.

Previous Drainage Studies

There were numerous Technical Drainage Studies that have been previously approved in the vicinity of the subject site. Although several studies were reviewed for general information, only the studies of which specific information was referenced are listed below. All reference material can be found in Appendix C.

Technical Drainage Study for Centennial Condominiums, DS 4217

The Technical Drainage Study for Centennial Condominiums (hereinafter referred to as the Condo Study) located east of the project site is an existing condominium development. Flows are generally travelling from west to east. The site includes a drainage easement along the western border of the Condo Site, a concrete u-channel that collects offsite flows and conveys them to drop inlets along the Condo Study site's western boundary. The offsite flows are conveyed through the site with 24-36" RCP storm drain and discharged at 3 locations along the Condos Study sites eastern boundary. The storm drain peak flows, storm drain profiles and onsite drainage are referenced for use in this study. See Appendix C for pertinent referenced material.

The Centennial Condominiums flow quantities and patterns have been accepted and referenced for use in this study as described above. For southern portion of our project area, below sections provides referenced information that has been considered in this study.

Shaumber Road Realignment

The Shaumber Road Realignment is located to the east of this project site. The realignment study has performed interim condition analysis focuses on the design of culvert crossings that would convey the 100-year interim flow. We have referenced the culvert sizes and flows through them which have been designed in Shaumber Road Realignment. Pertinent plan sheets have been included in Appendix C.

Final Submittal Calculation Workbook for Western Clark County 215 Bruce Woodbury Beltway – Craig Road to Hualapai Way

The Final Submittal Calculation Workbook for Western Clark County 215 Bruce Woodbury Beltway – Craig Road to Hualapai Way (Hereinafter referred to as Beltway Study) is located to the east of

Shaumber Road Realignment, and designed the GOBW regional facilities. The Beltway Study conducted hydrologic and hydraulic analysis of the upstream area of the GOBW site, including the project site. These designed local existing facilities ultimately discharges collected runoff into the now existing GOBW regional facilities. Our study has been referenced the pipe/culvert sizes and their flows designed by Interim CC 215 Beltway. See Appendix C for pertinent Study information and plan sheets.

The engineer has reviewed and accepted the referenced studies as described above, and are used in this study.

V. EXISTING CONDITIONS DRAINAGE

In the existing condition, offsite runoff impacts the project site from the west; which is undeveloped, natural desert and consists of multiple natural washes. The project site is also comprised of numerous natural washes, generally slopes from the northwest to the southeast and discharges from the project site to the east. Multiple washes converge north of the Tropical Parkway Alignment before crossing under Shaumber Road in a 10'x5' RCB culvert. See *Figure 5, Existing Offsite Conditions Basin Map,* for basin delineation, flow paths, and Flow Summary Table.

Runoff from the existing offsite street basin ST-E1 combines with the street basin ST-D2 at concentration point CE8. Concentration Point CE1 is located at inlets in the Condos Study site and combines runoff from the existing offsite basin OF-E1 and the existing onsite basin ON-E1. Concentration Point CE2 is located at inlets in the Condos Study site and combines runoff from the existing offsite basin OF-E2 and the existing onsite basin ON-E2. Concentration Point CE3 is located at inlets in the Condos Study site and combines runoff from the existing offsite basin OF-E3 and the existing onsite basin ON-E3. Concentration Point CE4 combines runoff from the existing offsite basin OF-E4 and the existing onsite basin ON-E4. Runoff at concentration points CE1, CE2, CE3, and CE4 is captured by inlets along the western border of the Condos Site Study and conveyed through the Condos Study Site. The Condos Study Site includes a public (privately maintained) drainage easement along its western border and a concrete U-channel to capture runoff and convey flows to the drop inlets.

Concentration Point CE5 combines runoff from the existing offsite basin OF-E5 and the existing onsite basin ON-E5. CE5 is located at the eastern border of the project site. Runoff from CE5 is captures and conveyed under Shaumber by the dual 38"x60" HERCP culverts. Concentration Point CE6 combines runoff from the existing offsite basin OF-E6 and the existing onsite basin ON-E6. CE6 is located at the eastern border of the project site. Concentration Point CE7 combines runoff from the existing offsite basin OF-E7 and the existing onsite basin ON-E7, and the discharge from Ann Road Detention Basin (157 cfs). CE7 is located at the eastern border of the project site. The runoff at CE6 and CE7 is combined and conveyed under Shaumber Road by the existing 10'X5' RCB culvert.

The flows discharged from the Ann Road Detection Basin (GOAN 0061) are conveyed across the Tropical Parkway alignment to the southwest of the project site, and then is conveyed along the southern boundary of the project site.

VI. PHASE 1 INTERIM CONDITION

The project is intended to be constructed in two (2) phases. The plans accompanying this study is the full grading plans. It is anticipated that a Phase 1 interim improvements will accompany Addendum #1. However, the TDS presents both Phases and includes Phase 1 Interim Condition, Phase 2 Interim Condition, and Ultimate condition.

In the Phase 1 interim condition, the south portion of project site is assumed to be developed and the north portion of project site and the offsite basins are assumed to be in the existing condition. Refer to *Figures 6* and *7* for the Offsite and Onsite Phase 1 Interim Basin Maps, for basin boundaries and flow paths. See Table 3 for a summary of peak flowrates for the 10 year and 100-year events.

The developed south portion of project site consists of townhome residential building including roadways with 30 feet ROW, driveways, landscaping as proposed within the project area. The Phase 2 portion of the site will remain in the existing condition. The Phase 2 area is not adversely affected by the construction of the Phase 1 portion of the site.

Runoff from the existing offsite street basin ST-E1 combines with the street basin ST-D2 at concentration point CI1P. Concentration Point CI1A is located at inlets in the Condos Study site and combines runoff from the existing offsite basin OF-E1 and the existing onsite basin ON-E1. Concentration Point CI1B is located at inlets in the Condos Study site and combines runoff from the existing offsite basin OF-E2 and the existing onsite basin ON-E2. Concentration Point CI1C combines runoff from the existing offsite basin OF-E3 and the existing onsite basin ON-E3. Concentration Point CI1D combines runoff from the existing offsite basin OF-E4 and the existing onsite basin ON-E4. CI1D and CI1C combine at inlets in the Condos Study Site at concentration point CI1L. The Condos site includes a drainage easement along its western border and concrete U-channel to capture and convey flows to the drop inlets.

The runoff from offsite existing basins OF-E5 and OF-E6 combine with the onsite park basins OP-D6 at concentration point CI1E. CI1E and the offsite existing basins OF-E7 combines with CI1E in the interim offsite channel at concentration point CI1F. The discharge from the Ann Road Detention Basin combines with CI1F at concentration point CI1G. Runoff from the onsite existing basin ONE5A and the onsite developed basin ON-D5 combine at CI1H. CI1H and CI1G combine in the Tropical Roadway alignment at concentration point CI1I. Runoff from onsite developed basins ON-D6 and ON-D7 combine with developed street basin ST-D3 and CI1K at concentration point CI71 located at the southeast corner of the project site. The runoff from offsite downstream basin OF-E8 combines with runoff conveyed from south of Tropical Parkway and CI1K at Shaumber Road at concentration point CI1Q.

The flows at CI1G are collected and conveyed in a 78" RCP under Tropical Parkway. Runoff from Street H and Street C are collected by DI3 and DI4 and conveyed into the Tropical mainline. A 5'x6' NDOT Type 2 drop inlet at the northwest corner of Tropical Parkway and Shaumber Road collects runoff and conveys it into the Tropical mainline before the mainline discharges east of Shaumber Road. The existing 10'X5' RCB culvert is to be removed.

VII. PHASE 2 INTERIM CONDITION

In the Phase 2 interim condition, the project site is assumed to be developed and the offsite basins are assumed to be in the existing condition. Refer to *Figures 8* and *9* for the Offsite and Onsite Phase 2 Interim Basin Maps, for basin boundaries and flow paths. See Table 3 for a summary of peak flowrates for the 10 year and 100-year events.

The developed south portion of project site consists of townhome residential building including roadways with 30 feet ROW, driveways, landscaping as proposed within the project area. In Phase 2, the northern portion of the site will be developed including the onsite park, and storm drain utilities in the northern portion of the site.

Runoff from the existing offsite street basin ST-E1 combines with the street basin ST-D2 at concentration point CI82.

Runoff from offsite basins OF-E1 and OF-E2 combine at concentration point CI2A in the offsite natural channel. Runoff from offsite basins OF-E3 combine with CI2A at concentration point CI2B in the offsite natural channel. Runoff from offsite basins OF-E4 combines with CI2B at concentration point CI2C. Runoff from offsite basins OF-E5 combines with CI2C at concentration point CI2D. Runoff from offsite basins OF-E6 combines with CI2D at concentration point CI2E. Runoff from offsite basins OF-E7 combines with CI2E at concentration point CI2F. The discharge from the Ann Road Detention Basin (157 cfs) combines with CI1F at CI2G at the 78' RCP pipe opening.

The Runoff from the park basin OP-D2 and the prorated subbasin E1A, E2A, E3A, E4A, and E5A are conveyed in a swale v- ditch just west of the proposed park in the Puli alignment along the Phase 2 area. This runoff is combine with the runoff from the park basin OP-D1 and the prorated subbasins E5A, E6A, E6B and E7A in the park swale along the Phase 1 area. These flows are washed through a riprap pad before draining into Tropical Parkway via a sidewalk underdrain.

The runoff from onsite developed basins ON-D1, ON-D2, and ON-D3 are combined at concentration point CI2L where a portion of the runoff is collected and conveyed into the 18" RCP storm drain. The bypass at CI2L is conveyed south and combines with the onsite developed basin ON-D4 at concentration point CI2M. At the intersection of Street H and Street G, there is a flow split where a portion of the flow is conveyed east (D2), and a portion of the flow is conveyed south (DIV2). Runoff from onsite basin ON-D5 is combine with the diverted flows in Street H at concentration point CI2H. CI2H combines with CI2I in Tropical Parkway. A portion of runoff is collected through a sump drop inlet at the south end of Street H. Pipe P3 and the surface flow enter the 78" RCP Tropical Mainline and the Tropical Parkway, respectively, through a proposed drainage easement.

The runoff from developed onsite basins ON-D1A, ON-D2A, ON-D3A, and ON-d4A are combined in Street G at concentration point CI2N. Runoff from developed onsite basinoN-D6 is combine with CI2N at CI2J at the southern end of Street C. Pipe P4 and the surface flow enter the 78" RCP Tropical Mainline and the Tropical Parkway, respectively, through a proposed drainage easement.

Runoff from onsite basin ON-D7, the street basin ST-D3 and CI2J combine at the project site boundary in Tropical Parkway at concentration point CI2K. The runoff from offsite downstream basin OF-E8 combines with runoff conveyed from south of Tropical Parkway and CI2K at Shaumber Road at concentration point CI2Q.

The flows at CI2G are collected and conveyed in a 78" RCP under Tropical Parkway. Runoff from Street H and Street C are collected by DI3 and DI4 and conveyed into the Tropical Mainline. A XX drop inlet at the northwest corner of Tropical Parkway and Shaumber Road collects runoff and conveys it into the Tropical Mainline before the mainline discharges east of Shaumber Road. The existing 10'X5' RCB culvert is to be removed.

VIII. ULTIMATE CONDITIONS

In the ultimate condition, both project site and offsite basins are assumed to be fully developed including Centennial Parkway and Tropical Parkway. The Ultimate conditions includes the alignment for thee future Sheep Mountain Parkway. The alignment is shown on the MPU and affects drainage patterns. The area the upstream area that impacts the project site is greatly reduced by construction of Sheep Mountain Parkway. Phase 2 Interim conditions is the worse

case scenario and includes the highest peak flowrates. Refer to Figure 10 Ultimate Basin Maps for basin boundaries and flow paths. See Table 3 for a summary of peak flowrates for the 10 year and 100-year events.

Runoff from the existing offsite street basin ST-E1 combines with the street basin ST-D2 at concentration point CU8.

Runoff from developed offsite basins OF-D1, OF-D2, OF-D3, OF-D4, OF-D5, OF-D6, and OF-D7 combine at concentration point CUF near the tropical Parkway alignment. Runoff from park basins OP-D2 and OP-D1 is conveyed to Tropical Parkway

The runoff from onsite developed basins ON-D1, ON-D2, and ON-D3 are combined at concentration point CUL where a portion of the runoff is collected and conveyed into the 18" RCP storm drain. The bypass at CUL is conveyed south and combines with the onsite developed basin ON-D4 at concentration point CUM. At the intersection of Street H and Street G, there is a flow split where a portion of the flow is conveyed east (D2), and a portion of the flow is conveyed south (DIV2). Runoff from onsite basin ON-D5 is combine with the diverted flows in Street H at concentration point CUH. CUH combines with CUI in Tropical Parkway. A portion of runoff is collected through a sump drop inlet at the south end of Street H. Pipe P3 and the surface flow enter the 78" RCP Tropical Mainline and the Tropical Parkway, respectively, through a proposed drainage easement.

Runoff from onsite basin ON-D7, the street basin ST-D3 and CUJ combine at the project site boundary in Tropical Parkway at concentration point CUK. The runoff from offsite downstream basin OF-E8 combines with runoff conveyed from south of Tropical Parkway and CUK at Shaumber Road at concentration point CUQ.

Onsite drop inlets and storm drain located at the southern ends of Streets H and C will collect and convey onsite runoff into the proposed 78" RCP storm drain in Tropical Parkway. In the ultimate condition.

IX. HYDRAULICS

Street Hydraulics -

Hydraulic calculations have been provided for all streets in the developed conditions. See Table 4 for a summary of results; calculations can be found in Appendix B. The location of the hydraulic cross sections can be found on Figures 6 and 7 for phase 1 interim and on figures 8 and 9 for phase 2 interim conditions. All street sections meet VxD and depth requirements for the 10-year and 100-year storm events.

In both Phase 1 and Phase 2 Interim conditions, Centennial Parkway and Tropical Parkways are designated as 100' and 80' ROW streets, respectively, and dry-lane criteria is required. Ten (10) Year Dry-lane requirements are met for Centennial Parkway (section 1) and Tropical Parkway (sections 2). Available dry lane width has been shown on the applicable cross-section calculations. Section 1 and Section 2 show the normal depth calculations for Centennial Parkway and Tropical Parkway, respectively. All onsite streets are of 30' ROW which do not require to meet dry lane criteria.

Normal depth calculations for Sections 3-8 show the normal depth street calculations for the proposed onsite private roadways including where proposed drop inlets are located. Section 5

and 7 are located at T-intersections and represent the worst case flows and slopes for the 'lateral' west-east oriented streets. The normal depth calculations are used for the finished floor analysis.

Interim Offsite Channel

Per a meeting with Harmony Homes, Olympia, Horrocks Engineers, Westwood Professionals and the City of Las Vegas, a naturally lined, interim channel was proposed within the Olympia property west of the Puli alignment to protect the project site in the interim conditions. The proposed channel was discussed and agreed upon as is proposed with this study. The intent is that the channel will protect the project site in the 10 and 100-year events and will be replaced with the development of the area upstream of the project site. The channel generally runs north to south between Centennial Parkway to Tropical Parkway. The channel is designed with a trapezoidal cross section and 3:1 side slopes. The bottom width of the channel widens as flows are collected so that the velocities remain below 5 fps and are considered non-erosive per the Manual. As a note for soil quantities, soil from the interim channel will be placed between the channel and the Puli alignment as additional embankment protection for the interim condition. The channel terminates at a 78" RCP storm drain opening in the Tropical Parkway Alignment. A permission to grade letter form the adjacent property owner is being sought and will be provided before drainage study approval.

Normal depth cross section 10-18 show that the channel will remain non-erosive through the channel. Normal depth calculations are provided to show that the concentrated flows entering the channel in existing washes do not overtop the east side slope of the channel. The calculations use a natural cross section and compare the specific energy to the side slope. The eastern side slope of the channel provide at least 1' of freeboard above the Specific Energy depth.

The Phase 1 interim condition proposes the channel only adjacent to the proposed phase 1 improvements. The Phase 2 portion of the site is not negatively affected by limiting the channel to only the area adjacent to the Phase 1 area. The runoff upstream of Phase 2 and in Phase 2 is not negatively affected by the construction of Phase 1. Note that the full drianag study grading plans are included with this submittal and phased improvement plans will accompany Addendum #1.

Park Swale –

There is a proposed v-ditch swale along the western edge of the proposed 40' park corridor located within the vacated Puli alignment. The swale is to be naturally lined, and will collect and convey they flows between the interim offsite channel and the proposed park improvements on the project site. The park design is intended to be a joint effort with the project site client, Harmony Homes and the adjacent owner, Olympia. The proposed improvements for this study includes the portion of the park that lies within the project sit boundaries. Normal Depth Cross Sections 9A-9D represent the swale at various locations in the Phase 1 and Phase 2 Interim conditions. The swale terminates at Tropical Parkway where the swale flows will be conveyed through a 5 foot riprap pad and through a sidewalk underdrain into Tropical Parkway. The swale is intended to be an interim solution until the area west of the project site is constructed. In the instance that the west half of the park is constructed (by others), the park will drain within local swales and other drainage features as designed by others. The swale side slopes vary with a maximum 3:1 side slope. See Appendix B for normal depth calculations and Figures 6 and 8 and Table 4 below for summary tables.

Tropical Parkway Storm Drain Facility –

The proposed mainline in Tropical Parkway is a 78" RCP that will collect flows upstream of the project site at the Tropical Parkway alignment. An equivalent RCB will be evaluated and may

replaced the 78" RCP in future addenda. The offsite flows include flows from offsite basins OF-E1 thru OF-E7 and the discharge from the Ann Road Detention Basin (157 cfs). The 78" RCP mainline will start in a 11' deep minimum riprap lined sump. This sump area is intended to be an interim condition facility. In the future, the 78" RCP will be extended with facilities designed by others.

The 78" RCP mainline will collect flows that are collected at the southern end the onsite Street H a and Street C. There is an existing 36" RCP that collects runoff south of Tropical Parkway and discharges into the existing 10'X5' RCB culvert under Shaumber Road. This will pipe will be intercepted and connected to the 78" RCP. There is a proposed drop inlet at the northwest corner of Tropical Parkway and Shaumber Road that collects upstream runoff and conveys the flows into the 78" RCP mainline.

The 78" RCP mainline discharges just east of Shaumber Road. The discharge point includes a headwall, a 10' foot concrete pad and riprap lined discharge channel. The flow continues east until it is intercepted by the 78" RCP stub provided with GOBW 0264. The area between will be graded as a 10' bottom width trapezoidal riprap lined channel. Here the flows are collected and conveyed into GOBW 0264.

The 78" RCP stub for facility GOBW 0264 does not meet the required HW/D =1.5 criteria. A 54" RCP stub is proposed to increase the collection (inlet control) capacity of GOBW 0264 near the 78" Stub. The mainline and laterals are modeled using WSPG. The 100-year HGL's are included on the plan and profile sheets. See Appendix B for WSPG models, riprap calculations, inlet control calculations etc.

The increased flows at the 78" RCP stub are generated from three (3) different sources. The first is the runoff that is diverted south to Tropical instead of through the site. (Upstream offsite basins). The second includes the Ann Road Detention Basin discharge (157 cfs) that was does not appear to be accounted for in the Beltway Study. The third is the 40 cfs generated south of Tropical Parkway that is conveyed south to the 10'X5' RCB culvert at Shaumber Road and Tropical Parkway instead of south as shown in the Beltway Study. The cumulative affect of these flows is an increase to 616 from the expected 328 cfs at the 78" RCP stub for GOBW 2064 in the pertinent studies. To mitigate this increase, the 54" RCP stub is proposed.

The increase flows collected at the Tropical alignment and GOBW 0264 does not have any negative affects on the hydraulic performance of the regional facility. A WSPG model of the affected WSPG facility sections is included in Appendix C. The resultant HGL is shown in Appendix B over a copy of the Beltway profile sheets, with the calculated revised flows.

Onsite Storm Drains –

In Phase 2 area, there are two (2) drop inlets proposed in Street H. The 10' Type CM2 drop inlets collect runoff in Street H and convey the flows into the adjacent drainage easement in the Condos Study site via an 18" RCP. The storm drain will drain into the side of the existing concrete U-channel that runs along the project boundary. This portion of the Condos Study Site conveys flows into drop inlets. The flows are then conveyed under the Condos Study site via 36" and 42" RCP before discharging east of the Condos Study Site. The proposed flows that the project site will discharge into the Condos Study Site is relatively small compared to the 86 cfs the Condos Study was designed to convey. The proposed design limits that flows discharged into the Condos Study site.

At the south end of Street H is a proposed 15' Type CM2 drop inlet, DI3, in a sump condition that collects a large portion of the 10-year peak discharge. The flows not collected by the drop

inlet will pond up and flow south into Tropical Parkway. There is a drainage easement to convey flows into Tropical Parkway.

At the south end of Street C is a proposed 10' Type CM2 drop inlet, DI4, in a sump condition that collects a large portion of the 10-year peak discharge. The flows not collected by the drop inlet will pond up and flow south into Tropical Parkway. There is a drainage easement to convey flows into Tropical Parkway.

WSPGW –

WSPGW was used to model the onsite and offsite storm drain including the Tropical Parkway, laterals and the revised flows in CCRFCD GOBW. HGLs lines are included on the pertinent plan and profile sheets. Appendix B shows hydraulic calculations of WSPGW storm drain systems.

Finished Floor Elevations –

The proposed finished floors include the floor levels of townhome buildings and include an analysis for each slab step of each building. The proposed finished floor elevation has been set at a minimum vertical distance above gutter flowline of at least twice the depth of flow in the gutter flowline (up to a maximum of 18 inches above the water surface elevation in the street), and the finished floors are set at a minimum of 6" above the adjacent top of curb per the Manual.

Easements

There is an existing 20" drainage easement along the western border of the Condos Study site that starts at the property boundary. There is an existing 80' roadway and drainage easement along the Puli roadway alignment. In lieu of the street, the City is requiring a linear park within the Puli alignment. The easements straddle the project site boundary and 40' of the roadway and drainage easement is located in the project site. There are existing drainage easements that surround the 10'x5' culvert entrance at the northwest corner of Tropical Parkway and Shaumber Road. Drop inlet DI5 and storm drain pipe P5 is proposed within this easement and the Tropical and Shaumber ROW. There is an existing easement at the 78" RCP stub for the GOBW 0264 facility.

There are three (3) proposed onsite drainage easements. Two are located in Phase 1 and the third is located in Phase 2. The first is located at the south end of Street H. There is a proposed 15' the CM2 drop inlet, DI2, in sag at the southern end of Street H. During a storm event, runoff will pond at the drop inlet and overtop and flow south to Tropical Parkway. The adjacent finished floors are set at least 18" above the weir elevation at the Drop inlet.

The second is located at the south end of Street C. There is a proposed 10' the CM2 drop inlet, DI3, in sag at the southern end of Street C. During a storm event, runoff will pond at the drop inlet and overtop and flow south to Tropical Parkway. The adjacent finished floors are set at least 18" above the weir elevation at the drop inlet.

The third proposed easement is located in Phase 2 and includes the storm drain, P2, which discharges into the Condos Study Site, and the existing drainage easement. P2 conveys flows captured by drop inlets DI1 and DI2 in Street H.

All of the private streets and onsite storm drain corridors will include public drainage easements to be privately maintained. No cross lot drainage within the project site is proposed.

X. SUMMARY TABLES

Table 3: Basin Summary

EXISTING CONDITION HYDROLOGIC SUMMARY				PHASE 1 INTERIM CONDITION HYDROLOGIC SUMMARY				PHASE 2 INTERIM CONDITION HYDROLOGIC SUMMARY				ULTIMATE CONDITION HYDROLOGIC SUMMARY			
Basin	Area (ac)	Q_{10} (cfs)	Q_{100} (cfs)	Basin	Area (ac)	Q_{10} (cfs)	Q_{100} (cfs)	Basin	Area (ac)	Q_{10} (cfs)	Q_{100} (cfs)	Basin	Area (ac)	Q_{10} (cfs)	Q_{100} (cfs)
CE1	-	9	24	CI1A	-	9	24	CI2A	-	11	28	CUF	-	133	273
CE2	-	10	24	CI1B	-	10	24	CI2B	-	23	56	CUG	-	291	435
CE3	-	13	32	CI1C	-	13	32	CI2C	-	52	139	CUH	-	12	28
CE4A	-	44	119	CI1D	-	31	87	CI2D	-	52	140	CUI	-	303	463
CE4	-	31	87	CI1E	-	16	49	CI2E	-	66	186	CUJ	-	15	37
CE5	-	2	12	CI1F	-	75	207	CI2F	-	125	344	CUK	-	320	506
CE6	-	18	60	CI1G	-	232	366	CI2G	-	284	506	CUL	-	11	23
CE7	-	60	162	CI1H	-	7	19	CI2H	-	12	28	CUM	-	8	19
CE8	-	2	5	CI1I	-	239	384	CI2I	-	292	531	CUN	-	3	6
OF-E1	4.60	5	13	CI1K	-	251	414	CI2J	-	15	37	CUP	-	9	18
OF-E2	6.12	7	16	CI1L	-	44	119	CI2K	-	309	569	D1*	-	6	11
OF-E3	10.78	11	28	CI1P	-	2	5	CI2L	-	11	23	D2*	-	3	8
OF-E4	40.00	29	83	CI1Q	-	292	459	CI2M	-	8	19	DIV1	-	5	12
OF-E5	2.94	<1	2	BASE	-	40	40	CI2N	-	3	6	DIV2	-	5	11
OF-E6	23.32	16	47	GOAN	-	157	157	CI2P	-	2	5	BASE	-	40	40
OF-E7	67.8	59	158	OF-E1	4.60	5	13	CI2Q	-	349	614	GOAN	-	157	157
OF-E8	4.37	1	5	OF-E2	6.12	7	16	D1*	-	6	11	CUQ	-	365	558
ON-E1	4.04	4	11	OF-E3	10.78	11	28	D2*	-	3	8	OF-D1	4.60	9	18
ON-E2	2.90	3	8	OF-E4	40.00	29	83	DIV1	-	5	12	OF-D2	6.12	12	23
ON-E3	1.44	2	4	OF-E5	2.94	<1	2	DIV2	-	5	11	OF-D3	10.78	19	37
ON-E4	1.62	2	4	OF-E6	23.32	16	47	BASE	-	40	40	OF-D4	22.00	32	66
ON-E5	7.26	2	10	OF-E7	67.8	59	158	GOAN	-	157	157	OF-D5	2.94	4	9
ON-E6	10.14	2	12	OF-E8	4.37	1	5	OF-E1	4.60	5	13	OF-D6	23.32	40	81
ON-E7	3.36	1	4	ON-E1	4.04	4	11	OF-E2	6.12	7	16	OF-D7	11.49	18	38
ST-E1	0.58	1	2	ON-E2	2.90	3	8	OF-E3	10.78	11	28	OF-D8	4.37	5	12
ST-D2	0.83	2	3	ON-E3	1.44	2	4	OF-E4	40.00	29	83	ON-D1	2.34	4	9
CE1= OF-E1 + ON-E1				ON-E4	1.62	2	4	OF-E5	2.94	<1	2	ON-D1A	0.56	1	2
CE2= OF-E2 + ON-E2				ON-D5	6.40	7	17	OF-E6	23.32	16	47	ON-D2	2.38	4	9
CE3= OF-E3 + ON-E3				ON-E5A	1.40	1	3	OF-E7	67.8	59	158	ON-D2A	0.48	1	2
CE4A = CE3 + CE4				ON-D6	10.26	10	26	OF-E8	4.37	1	5	ON-D3	1.53	3	6
CE4= OF-E4 + ON-E4				ON-D7	1.07	1	3	ON-D1	2.34	4	9	ON-D3A	0.27	<1	1
CE5= OF-E5 + ON-E5				OP-D1	1.02	1	2	ON-D1A	0.56	1	2	ON-D4	2.12	3	7
CE6= OF-E6 + ON-E6				RTCI1D	-	51	139	ON-D2	2.38	4	9	ON-D4A	0.34	1	1

EXISTING CONDITION HYDROLOGIC SUMMARY				PHASE 1 INTERIM CONDITION HYDROLOGIC SUMMARY				PHASE 2 INTERIM CONDITION HYDROLOGIC SUMMARY				ULTIMATE CONDITION HYDROLOGIC SUMMARY			
Basin	Area (ac)	Q_{10} (cfs)	Q_{100} (cfs)	Basin	Area (ac)	Q_{10} (cfs)	Q_{100} (cfs)	Basin	Area (ac)	Q_{10} (cfs)	Q_{100} (cfs)	Basin	Area (ac)	Q_{10} (cfs)	Q_{100} (cfs)
CE7= OF-E7 + ON-E7				ST-D2	0.83	2	3	ON-D2A	0.48	1	2	ON-D5	6.40	7	17
CE8 = ST-E1 + ST-D2				ST-D3	0.68	2	3	ON-D3	1.53	3	6	ON-D6	10.26	10	26
				ST-E1	0.58	1	2	ON-D3A	0.27	<1	1	ON-D7	1.07	1	3
				CI1A = OF-E1 + ON-E1				ON-D4	2.12	3	7	OP-D1	1.02	1	2
				CI1B = OF-E2 + ON-E2				ON-D4A	0.34	1	1	OP-D2	1.37	1	3
				CI1C = OF-E3 + ON-E3				ON-D5	6.40	7	17	ST-D1	3.59	8	14
				CI1D = OF-E4 + ON-E4				ON-D6	10.26	10	26	ST-D2	0.83	2	3
				CI1E = OF-E5 + OF-E6				ON-D7	1.07	1	3	ST-D3	0.68	2	3
				CI1F = CI1E + OF-E7				OP-D1	1.02	1	2	CUF = OF-D1 + OF-D2 + OF-D3 + OF-D4 + OF-D5 + OF-D6 + OF-D7			
				CI1G = CI1F + OP-D1 + GOAN				OP-D2	1.37	1	3				
				CI1H = ON-E5A + ON-D5				RTCI2D	-	51	139	CUG = CUF + OP-D1 + OP-D2 + GOAN			
				CI1I = CI1G + CI1H				ST-D2	0.83	2	3	CUH = DIV2 + ON-D5			
				CI1K = CI1I + ON-D6 + ON-D7 + ST-D3				ST-D3	0.68	2	3	CUI = CUG + CUH			
				CI1L = CI1C + CI1D				ST-E1	0.58	1	2	CUJ = CUN + ON-D6 + D2			
				CI1P = ST-E1 + ST-D2				CI2A = OF-E1 + OF-E2				CUK = CUI + CUJ + ON-D7 + ST-D3			
				CI1Q = CI1K + OF-E8 + BASE				CI2B = CI2A + OF-E3				CUL = ON-D1 + ON-D2 + ON-D3			
								CI2C = CI2B + OF-E4				CUM = DIV1 + ON-D4			
								CI2D = CI2C + OF-E5				CUN = ON-D1A + ON-D2A + ON-D3A + ON-D4A			
								CI2E = RTCI2D + OF-E6				CUP = ST-D1 = ST-D2			
								CI2F = CI2E + OF-E7				CUQ = CUK + OF-D8 + BASE			
								CI2G = CI2F + OP-D1 + OP-D2 + GOAN				DIV1 = CUL - D1			
								CI2H = DIV2 + ON-D5				DIV2 = CUM - D2			
								CI2I = CI2G + CI2H							
								CI2J = CI2N + ON-D6 + D2							
								CI2K = CI2I + CI2J + ON-D7 + ST-D3							
								CI2L = ON-D1 + ON-D2 + ON-D3							
								CI2M = DIV1 + ON-D4							
								CI2N = ON-D1A + ON-D2A + ON-D3A + ON-D4A							
								CI2P = ST-E1 + ST-D2							
								CI2Q = CI2K + OF-E8 + BASE							
								DIV1 = CI2L - D1							
								DIV2 = CI2M - D2							

Table 3A: Prorate Summary Table

PRORATE FLOW SUMMARY					
		For Q_{10} YR Flow		For Q_{100} YR Flow	
Basin	Area (acre)	Flow (cfs)	Flowrate (cfs/acre)	Flow (cfs)	Flowrate (cfs/acre)
OF-E1	4.6	5	1.09	13	2.83
OF-E2	6.12	7	1.14	16	2.61
OF-E3	10.78	11	1.02	28	2.60
OF-E4	40	29	0.73	83	2.08
OF-E5	2.94	1	0.34	2	0.68
OF-E6	23.32	16	0.69	47	2.02
OF-E7	67.8	59	0.87	158	2.33
ON-D4	2.12	3	1.41	7	3.3
ON-D5	6.4	-	-	17	2.64
ON-D6	10.26	-	-	26	2.53
E1A	0.31	0.34	1.09	0.88	2.83
E2A	0.23	0.26	1.14	0.60	2.61
E3A	0.15	0.15	1.02	0.39	2.60
E4A	0.19	0.14	0.73	0.39	2.08
E5A	0.19	0.06	0.34	0.13	0.68
E6A	0.25	0.17	0.69	0.50	2.02
E6B	0.33	0.23	0.69	0.67	2.02
E7A	0.15	0.13	0.87	0.35	2.33
ON-D4-P	0.43	0.61	1.41	1.42	3.3
ON-D5-P	1.11	-	-	2.90	2.64
ON-D6-P1	1.22	-	-	3.00	2.53
ON-D6-P2	1.05	-	-	2.66	2.53

Table 4: Normal Depth Summary Tables

STREET NORMAL DEPTH CALCULATION SUMMARY FOR INTERIM PHASE 1 CONDITION						
Cross Section	**Description**	**Q (cfs)**	**Slope (%)**	**Depth (ft)**	**Velocity (ft/s)**	**DxV**
Section1 FULL 100' R/W - 100 YR	CI1P	5	3.00	0.30	3.33	1.00
Section1 FULL 100' R/W-10 YR	CI1P	2	3.00	0.23	2.86	0.66
Section2 HALF 80' R/W -100 YR	(ST-D3) + (ON-D7) + (CU1H - 11) + ((ON-D6)-9) + (OP-D1) + E6A + E6B + E7A	34.6	3.85	0.59	6.38	3.76
Section2 HALF 80' R/W -10 YR	(ST-D3) + (ON-D7) + (CU1H - 11) + ((ON-D6)-9) + (OP-D1) + E6A + E6B + E7A	5.5	3.85	0.35	4.42	1.55
Section5 onsite @ON-D5 100 YR	ON-D5-P	2.9	2.20	0.27	2.67	0.72
Section6 onsite @ ON-D5 100YR	CI1H	19	1.78	0.44	3.82	1.68
Section7 onsite @ON-D6 100 YR	ON-D6-P1	3	2.20	0.27	2.69	0.73
Section8 onsite @ ON-D5 100 YR	ON-D6	25	2.20	0.46	4.54	2.09
Section19 onsite @ ON-D6 100 YR	ON-D6-P2	2.7	2.20	0.21	2.82	0.59

OFFSITE CHANNEL NORMAL DEPTH CALCULATION SUMMARY FOR INTERIM PHASE 1 CONDITION						
Cross Section	**Description**	**Q (cfs)**	**Slope (%)**	**Depth (ft)**	**Velocity (ft/s)**	**DxV**
Section15 INT Phase1	OF-E5 + OF-E6 (5)	7	2.10	0.07	1.51	0.11
Section16 INT Phase1	OF-E5 + OF-E6 (25)	27	2.10	0.15	2.41	0.36
Section17 INT Phase1	OF-E5 + OF-E6	49	2.10	0.20	2.90	0.58
Section18 INT Phase1	OF-E5 + OF-E6 + OF-E7 (7)	56	2.10	0.21	3.06	0.64

STREET NORMAL DEPTH CALCULATION SUMMARY FOR INTERIM PHASE 2 CONDITION						
Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
Section1 FULL 100' R/W - 100 YR	CI2P	5	3.00	0.30	3.33	1.00
Section1 FULL 100' R/W-10 YR	CI2P	2	3.00	0.23	2.86	0.66
Section2 HALF 80' R/W -100 YR	(ST-D3) + (ON-D7) + (CI2H - 11) + (CI2J - 9) + (OP-D1) + (OP-D2) + E1A + E2A + E3A + E4A + E5A + E6A + E6B + E7A	59.9	3.85	0.68	7.43	5.05
Section2 HALF 80' R/W -10 YR	(ST-D3) + (ON-D7) + (CI2H - 11) + (CI2J - 9) + (OP-D1) + (OP-D2) + E1A + E2A + E3A + E4A + E5A + E6A + E6B + E7A	13.8	3.85	0.45	5.46	2.46
Section3 onsite @ ON-D3 10 YR	CI2L	11	2.20	0.37	3.53	1.31
Section3 onsite @ ON-D3 100 YR	CI2L	23	2.20	0.45	4.39	1.98
Section4 HALF EAST onsite @ ON-D4 100 YR	D2	8	2.20	0.41	3.85	1.58
Section5 onsite @ON-D5 100 YR	ON-D5-P	2.9	2.20	0.27	2.67	0.72
Section6 onsite @ ON-D5 100YR	CI2H	28	1.78	0.48	4.46	2.14
Section7 onsite @ON-D6 100 YR	D2 + CI2N + ON-D6-P1	17	2.20	0.42	3.91	1.64
Section8 onsite @ ON-D5 100 YR	CI2J	37	2.20	0.51	5.31	2.71
Section19 onsite @ ON-D6 100 YR	ON-D6-P2	2.7	2.20	0.21	2.82	0.59

OFFSITE CHANNEL NORMAL DEPTH CALCULATION SUMMARY FOR INTERIM PHASE 2 CONDITION						
Cross Section	**Description**	**Q (cfs)**	**Slope (%)**	**Depth (ft)**	**Velocity (ft/s)**	**DxV**
Section10 INT Phase2	OF-E1	13	2.10	0.19	2.79	0.53
Section11 INT Phase2	CI2A	28	2.10	0.30	3.76	1.13
Section12 INT Phase2	CI2B	56	2.10	0.45	4.88	2.20
Section13 INT Phase2	CI2C	139	2.10	0.44	4.91	2.16
Section14 INT Phase2	CI2D	140	2.10	0.44	4.92	2.16
Section15 INT Phase2	CI2D + OF-E6 (5)	145	2.10	0.45	4.99	2.25
Section16 INT Phase2	CI2D + OF-E6 (25)	165	2.10	0.44	4.92	2.16
Section17 INT Phase2	CI2E	186	2.10	0.44	4.91	2.16
Section18 INT Phase2	CI2E + OF-E7 (7)	193	2.10	0.45	4.99	2.25

STREET NORMAL DEPTH CALCULATION SUMMARY FOR INTERIM PHASE 1 CONDITION						
Cross Section	**Description**	**Q (cfs)**	**Slope (%)**	**Depth (ft)**	**Velocity (ft/s)**	**DxV**
Section1 FULL 100' R/W - 100 YR	CI1P	5	3.00	0.30	3.33	1.00
Section1 FULL 100' R/W-10 YR	CI1P	2	3.00	0.23	2.86	0.66
Section2 HALF 80' R/W -100 YR	(ST-D3) + (ON-D7) + (CU1H - 11) + ((ON-D6)-9) + (OP-D1) + E6A + E6B + E7A	34.6	3.85	0.59	6.38	3.76
Section2 HALF 80' R/W -10 YR	(ST-D3) + (ON-D7) + (CU1H - 11) + ((ON-D6)-9) + (OP-D1) + E6A + E6B + E7A	5.5	3.85	0.35	4.42	1.55
Section5 onsite @ON-D5 100 YR	ON-D5-P	2.9	2.20	0.27	2.67	0.72
Section6 onsite @ ON-D5 100YR	CI1H	19	1.78	0.44	3.82	1.68
Section7 onsite @ON-D6 100 YR	ON-D6-P1	3	2.20	0.27	2.69	0.73
Section8 onsite @ ON-D5 100 YR	ON-D6	25	2.20	0.46	4.54	2.09
Section19 onsite @ ON-D6 100 YR	ON-D6-P2	2.7	2.20	0.21	2.82	0.59

XI. CONCLUSIONS & RECOMMENDATIONS

As detailed in this study, the Centennial Heights Townhomes is in compliance with the Manual. No adverse effects are expected either upstream or downstream of the subject site. Street criteria will be met. Proposed finished floor elevations are adequately a minimum vertical distance above the adjacent gutter flowline of at least twice the depth of flow up to a maximum of 18 inches above the water surface elevation in the street.

As a result of completing the analysis of the drainage conditions associated with the development Horrocks Engineers concludes the following:

1. The analysis used in this study is in compliance with the Clark County Regional Flood Control District Criteria.
2. The proposed project is not located within a FEMA flood zone.
3. Peak flows can be safely routed through and around the proposed development to return to the natural flow path in accordance with the criteria of the Manual

XII. REFERENCES

1. Clark County Regional Flood Control District's Hydrologic Criteria and Drainage Design Manual – Adopted August 12, 1999
2. FEMA: https://www.fema.gov/flood-insurance-rate-map-firm. Panel 32003C2565D, Effective Sep 27, 2002
3. 2018 Las Vegas Valley Flood Control Master Plan Update, ATKINS, 2018
4. Hydrologic Modeling System (HEC-1) U.S. Army Corps of Engineers Institute for Water Resources
5. Flowmaster Version 8i, Bentley Systems, Inc. Haestad Methods Solution Center, Watertown CT
6. https://help.innovyze.com/display/xps2016/Water+Surface+Pressure+Gradient+-+WSPG
7. Las Vegas Valley Area, Nevada, Part of Clark County Soil Survey Area sourced from the Natural Resources Conservation Service – Online Resource http://websoilssurvey.nrcs.sda.gov. Version 11, Sept 2016
8. Technical Drainage Study for Highland Ranch 19, HTE No: 15-28091, Cardno 2015.
9. Technical Drainage Study for Highland Ranch 22, HTE: 18-13232, Slater Hanifan Group 2018.
10. Technical Drainage Study for Highland Ranch 15, HTE: 17-42275, Slater Hanifan Group 2018.

APPENDIX A. Hydrologic Data and Calculations

Figure 2 – FIRMette Panel 32003C1750E

Figure 3 – 2018 MPU F-46 Map

Figure 3A – 2018 MPU F-46 Tables

Figure 4 – W Map (2018 MPU W-7)

Rainfall / Precipitation Data

Custom Soil Resource Report

Existing Basin Soils Map

Developed Basin Soils Map

Curve Number Calculations

Standard Form 4 (All Conditions)

Existing Condition HEC-1 Model

Phase 1 Interim Condition HEC-1 Model

Phase 2 Interim Condition HEC-1 Model

Ultimate Conditions HEC-1 Model

Figure 5 – Existing Offsite Basin Map

Figure 6 – Phase 1 Interim Offsite Basin Map

Figure 7 – Phase 1 Interim Onsite Basin Map

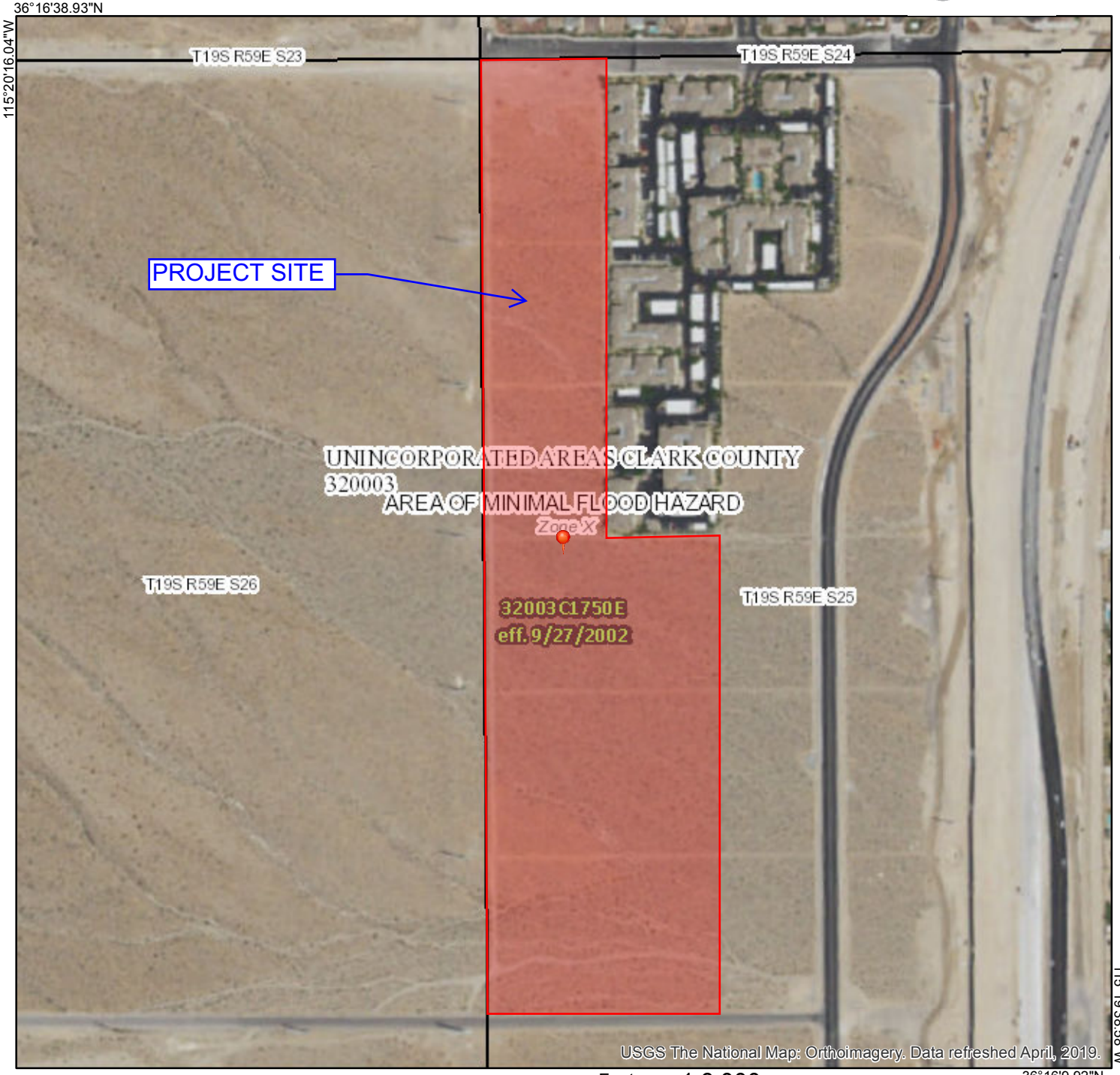
Figure 8 – Phase 2 Interim Offsite Basin Map

Figure 9 – Phase 2 Interim Onsite Basin Map

Figure 10 – Ultimate Offsite Basin Map

National Flood Hazard Layer FIRMette

FEMA



Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

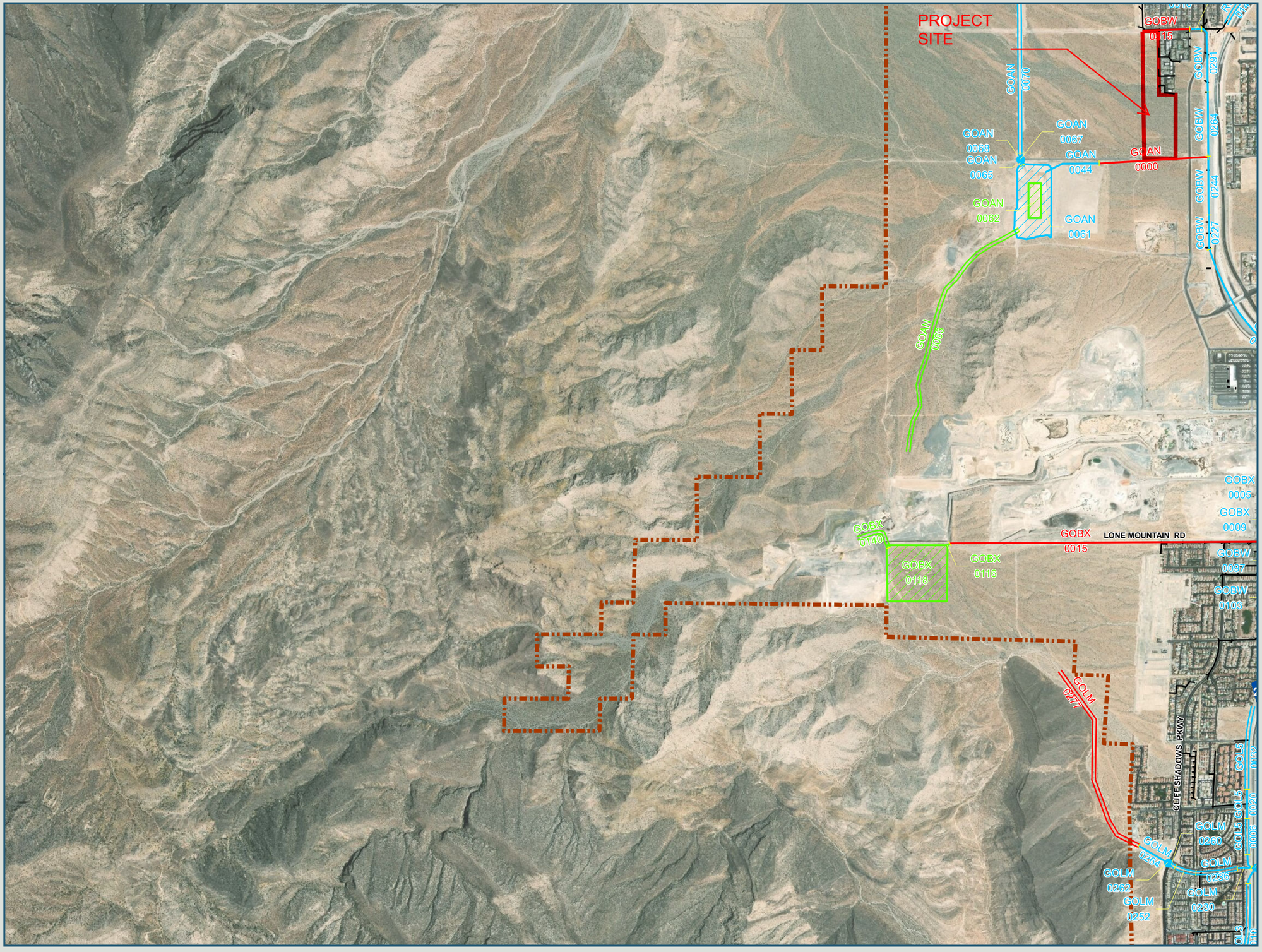
N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 9/12/2019 at 8:06:16 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.



REGIONAL FLOOD CONTROL DISTRICT

2018
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE

FIGURE F-16
FLOOD CONTROL FACILITIES

LEGEND

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

Remove & Replace/Parallel Facilities

Category A	Category B
Channel	Channel
Stormdrain	Stormdrain
Crossing	Crossing

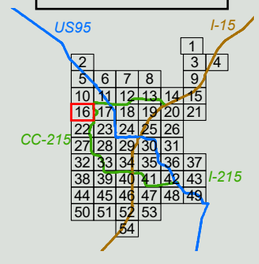
N

0 500 1,000 2,000 3,000
Feet

Scale: 1 inch = 2,000 feet

AerialSource:Esri World Imagery 2017

FIGURE 3



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ID / Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
GOAN		**GOWAN ANN ROAD DETENTION BASIN FACILITIES**						
0000	P	54" RCP	2279	157	CAM10DB	GOW3A	3.76	3.44
0044	E	54" RCP OUTLET	1153	157	CAM10DB	GOW3A	3.76	1.90
0059	E	25,181 CFS PMF SPILLWAY		25181	CAM10IN	GOW3A	3.76	
0061	E	364 AC-FT ANN ROAD DETENTION BASIN		5656	CAM10IN	GOW3A	3.76	
0062	P0	UPGRADE TO 439 AC-FT ANN ROAD DETENTION BASIN		5656	CAM10IN	GOW3A	3.76	
0063	P0	CONC CHNL 25'W 4.5'D 2:1 SS	5534	2108	CAM-10A	GOW3A	1.25	4.80
0065	E	SOIL CEMENT CHNL 20'W 7'D 0:1 SS	95	1075	CCAMDK3	GOW3A	0.66	3.98
0067	E	BRIDGE 20' X 6' @ TROPICAL	36	1075	CCAMDK3	GOW3A	0.66	3.98
0068	E	SOIL CEMENT CHNL 20'W 6'D 0:1 SS	112	1075	CCAMDK3	GOW3A	0.66	6.70
0070	E	SOIL CEMENT CHNL 10'W 4'-7'D 4:1 SS	3125	1075	CCAMDK3	GOW3A	0.66	3.00
0127	E	SOIL CEMENT CHNL 10'W 2'-6'D 4:1 SS	1292	578	CAMDK2	GOW3A	0.34	1.73
GOBW		**GOWAN BELTWAY WEST**						
0183	E	14' X 9' RCB	3414	3156	CHLBW1-C	GOW3A	5.83	1.77
0227	E	10' X 8' RCB	739	1823	CEFPOA2	GOW3A	4.94	2.78
0244	E	10' X 8' RCB	1225	1823	CEFPOA2	GOW3A	4.94	0.68
0264	E	9' X 8' RCB	1346	1210	CEFPOA1	GOW3A	0.78	1.00
0291	E	8' X 6' RCB	1309	783	CMNA2	GOW3A	0.49	1.70
0310	E	54" RCP	250	501	CDMNA3	GOW3A	0.30	4.73
0315	P	54" RCP	976	501	CDMNA3	GOW3A	0.30	4.00
GOBX		**GOWAN BOX CANYON**						
0015	P	66" RCP	6783	39	BOXDET	GOW3A	3.41	6.55
0115	P0	43,030 CFS PMF SPILLWAY		43030	BOXCANYO	GOW3A	3.41	
0116	P0	18" RCP OUTLET	100	39	BOXDET	GOW3A	3.41	
0118	P0	430 AC-FT BOX CANYON DETENTION BASIN		4303	BOXCANYON	GOW3A	3.41	
0140	P0	CONC CHNL 50'W 4.5'D 2:1 SS	900	4303	BOXCANYO	GOW3A	3.41	7.00
GOL3		**GOWAN LONE MOUNTAIN SYSTEM-BRANCH 3**						
0000	E	2: 10' X 10' RCBC @ BELTWAY	500	3713	CLMT5	GOW3A	7.83	3.39
0010	E	CONC CHNL 20'W 10'D 0:1 SS	3037	3277	CRCLMT1R	GOW3A	7.31	2.78
GOL5		**GOWAN LONE MOUNTAIN SYSTEM-BRANCH 5**						
0000	E	6' X 5' RCB	309	421	UVB2	GOW3A	0.33	7.69
0006	E	CONC CHNL 6'W 5'D 0:1 SS	740	421	UVB2	GOW3A	0.33	3.85
0020	E	6' X 5' RCBC @ ALEXANDER RD	615	421	UVB2	GOW3A	0.33	2.08
0032	E	CONC CHNL 6'W 5'D 0:1 SS	1756	421	UVB2	GOW3A	0.33	1.67
GOLM		**GOWAN LONE MOUNTAIN SYSTEM**						
0226	E	10' X 10' RCBC @ BELTWAY	246	2246	CUVB2	GOW3A	1.67	2.50
0230	E	10' X 10' RCB	290	1931	CLMT3	GOW3A	1.34	2.50
0236	E	CONC CHNL 15'W 8'D 0:1 SS	869	1931	CLMT3	GOW3A	1.34	3.69
0252	E	CONC CHNL 15'W 8.15'D 0:1 SS	455	1931	CLMT3	GOW3A	1.34	3.16
0260	E	TRANSITION STRUCTURE	124	1931	CLMT3	GOW3A	1.34	3.16
0262	E	16' X 9' RCAC @ CLIFF SHADOWS	80	1931	CLMT3	GOW3A	1.34	3.16
0264	E	16' X 7' RCAP	674	1931	CLMT3	GOW3A	1.34	4.00
0277	P	CONC CHNL 20'W 4.5'D 2:1 SS	4300	1931	CLMT3	GOW3A	1.34	5.00
RCBC		**RANCHO ROAD SYSTEM - BELTWAY CHANNEL**						
0140	E	CONC CHNL 10'W 5'D 0:1 SS	2155	475	CDMNA1	WEST3	0.43	1.65

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

FIGURE 3A

REGIONAL FLOOD CONTROL DISTRICT

2018 LAS VEGAS VALLEY FLOOD CONTROL MASTER PLAN UPDATE

FACILITY INVENTORY FIGURE F-16

LEGEND

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

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

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

Construction Features

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

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H:\2019\NV-1949-1909 Centennial Heights Townhomes\Project Data\03 Engineering\3.01 Drainage\01_TDS\Figure\NV-1826-1907_W-Map.dwg David Clark 11/19/2019 1:40 PM

1191

SHAUME

DORRELL LA

CDMNA3

CDMNA2

CAMDK2

CAMDK3

PROJECT AREA

CEN

1400

EFPOA1

TR

CAM-10B

DETCAM10

EFPOA1

EFPOA2

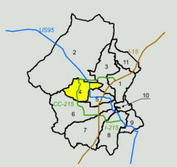
REGIONAL FLOOD CONTROL DISTRICT

2018 Las Vegas Valley Master Plan Update

Figure W-4
Gowan Watershed

Legend

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



N

Scale: 1 inch = 0.65 mile

0 0.325 0.65 1.3
Miles

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Louis Berger

HORRACKS ENGINEERS
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Henderson, NV 89074
(702) 966-4063
www.horrocks.com

OWNER:HARMONY HOMES, LLC

CITY: CITY OF LAS VEGAS, NEVADA

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

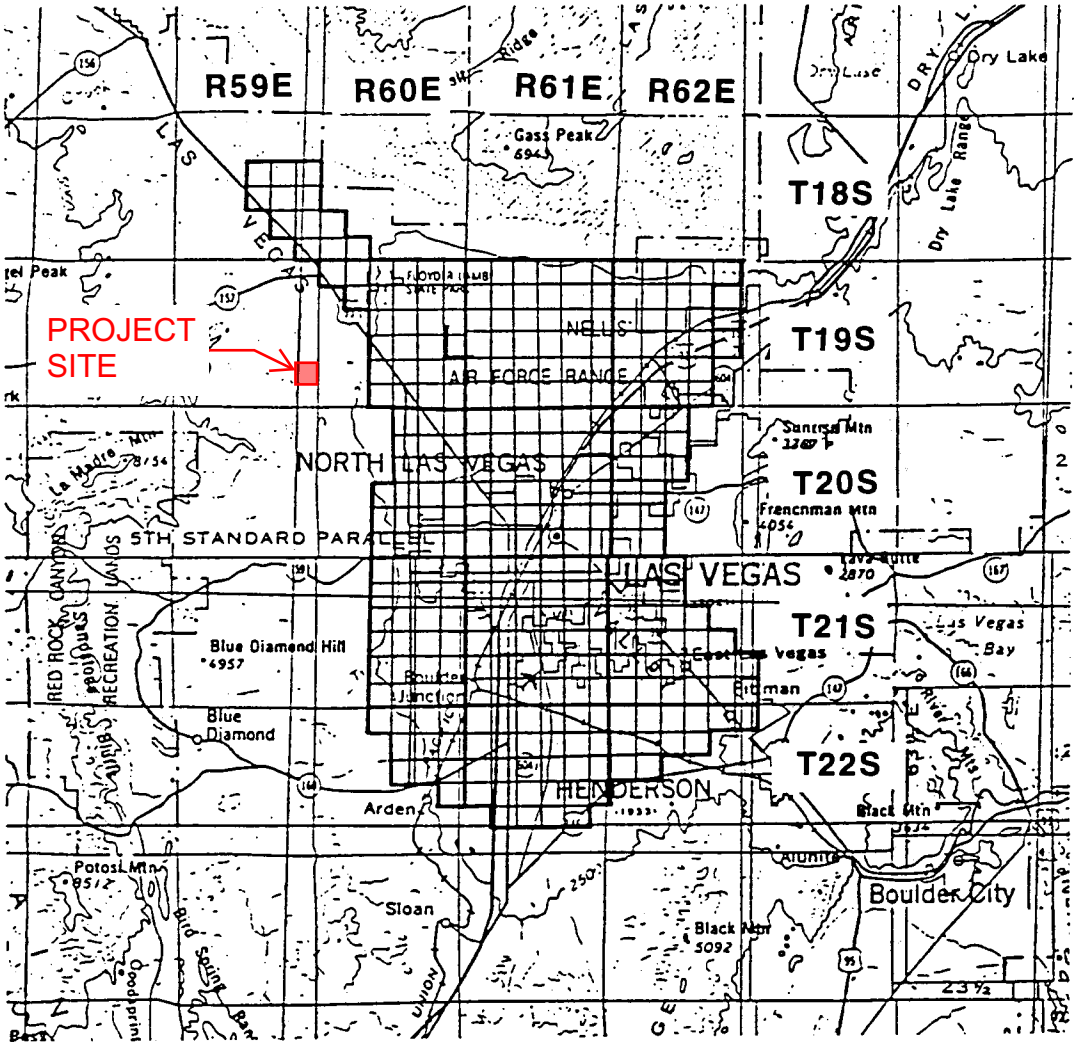
W-MAP

CENTENNIAL HEIGHTS TOWNHOMES

DRAWING INFO
DATE 11/19/19
SCALE
REV # | DATE
*SEE 2nd SHEET FOR LISTING
PROJ. NO:

4
PAGE

McCARRAN AIRPORT RAINFALL AREA



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

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

Revision	Date

WRC ENGINEERING

REFERENCE:
USACE, Los Angeles District, 1988

FIGURE 513

PRECIPITATION ADJUSTMENT RATIOS

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

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

Revision	Date

SIX-HOUR STORM DISTRIBUTIONS

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

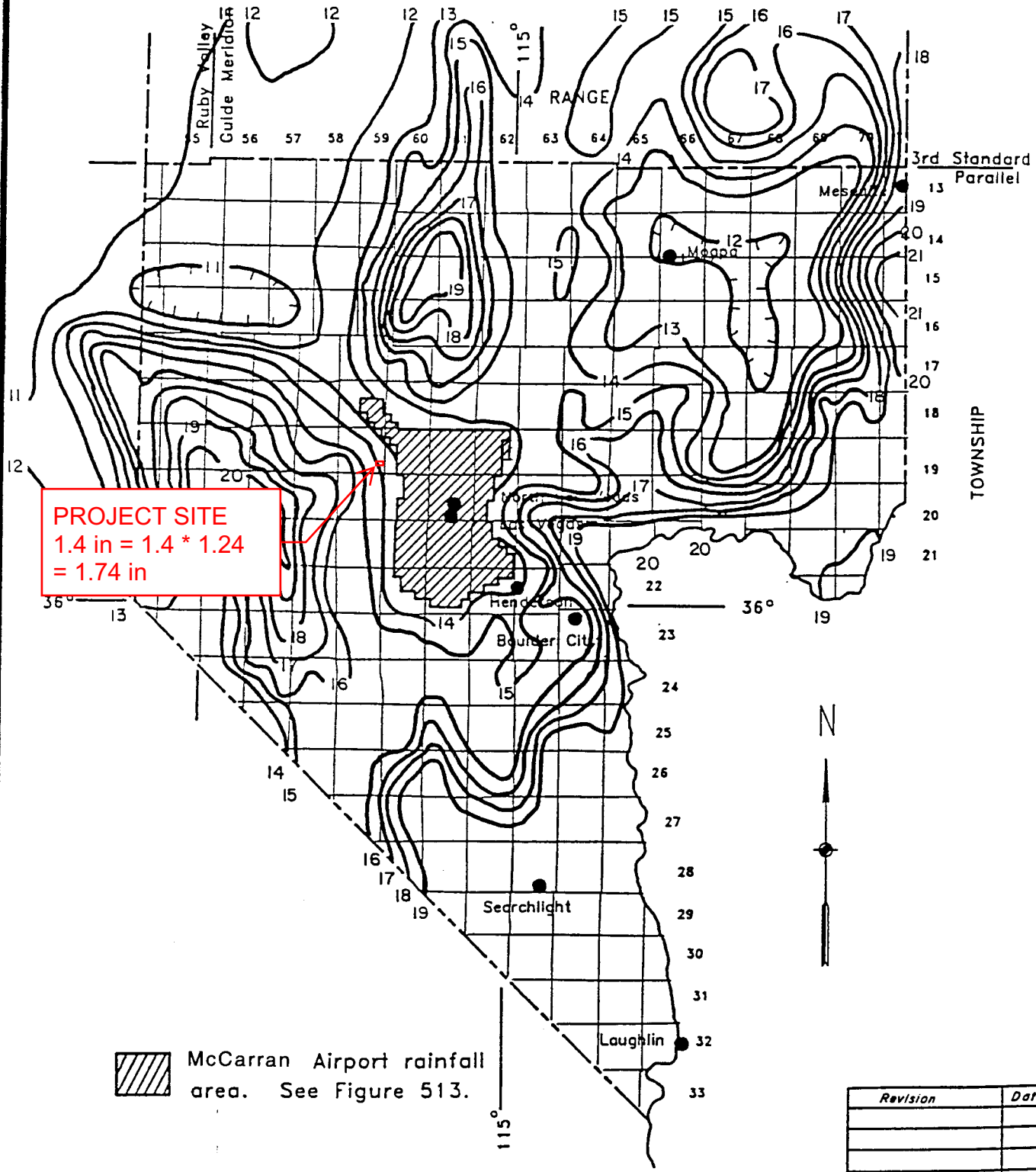
Notes:
1. For drainage areas less than 8 square miles in size, use SDN 3.
2. For drainage areas greater than or equal to 8 square miles and less than 12 square miles in size, use SDN 4.
3. For drainage areas greater than or equal to 12 square miles, use SDN 5.
4. A graphical representation of these values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

Revision	Date

REFERENCE:

TABLE 503

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



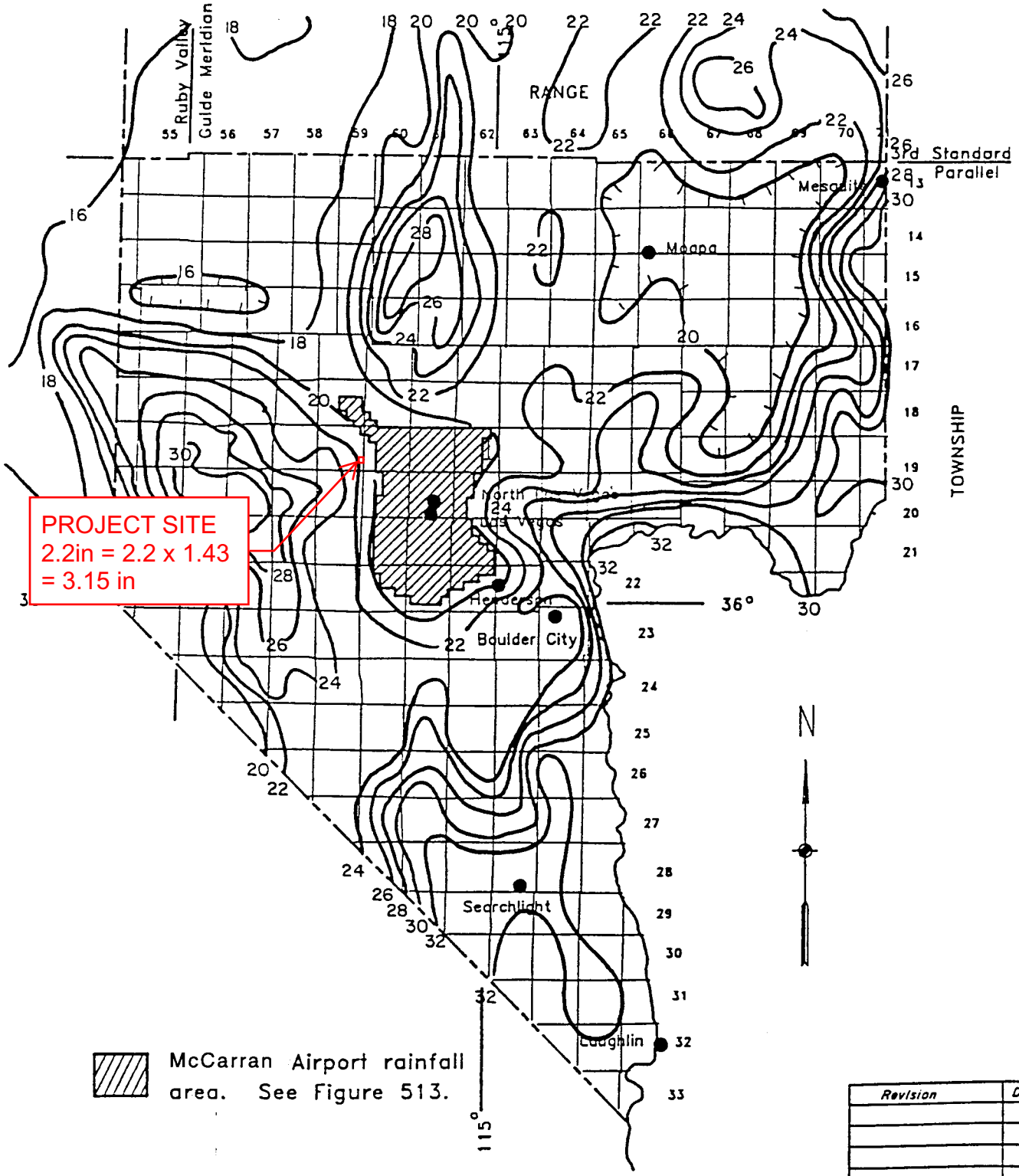
Revision	Date

WRC ENGINEERING

REFERENCE:
NOAA ATLAS 2, VOLUME VII NEVADA, 1973

FIGURE 503

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



Revision	Date

WRC ENGINEERING

REFERENCE:
NOAA ATLAS 2, VOLUME VII NEVADA, 1973

FIGURE 506

RUNOFF CURVE NUMBERS
(URBAN AREAS[1])

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

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

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

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

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

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

Revision	Date

RUNOFF CURVE NUMBERS
(SEMIARID RANGELANDS[1])

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

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

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

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

Revision	Date

RUNOFF CURVE NUMBERS - RESIDENTIAL DISTRICTS

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

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

Revision	Date

REFERENCE:

TABLE 602A

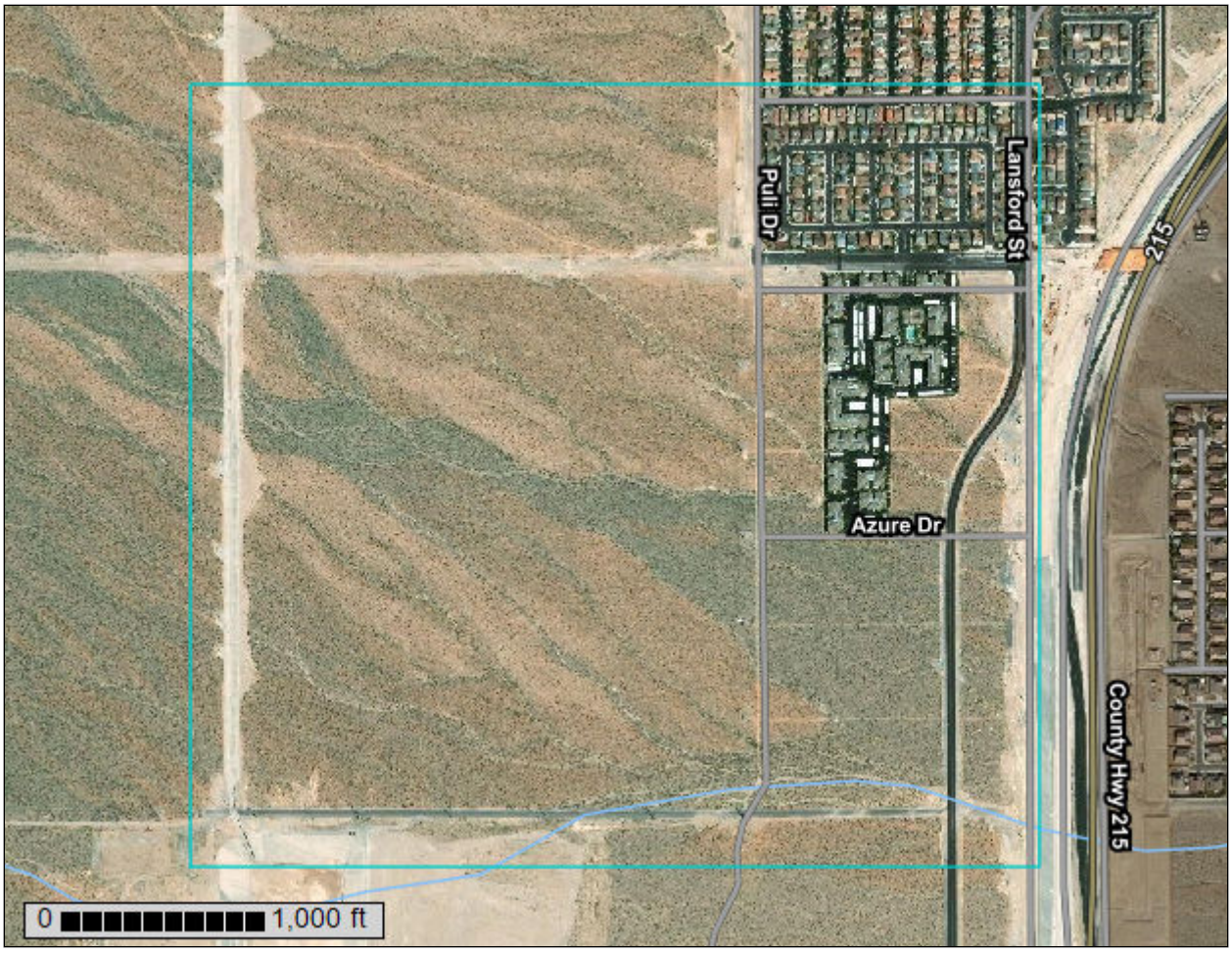
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

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



September 12, 2019

Custom Soil Resource Report
Soil Map



Map Scale: 1:9,870 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 100 200 400 600

Feet
0 450 900 1800 2700

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

Las Vegas Valley Area, Nevada, Part of Clark County

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

Map Unit Setting

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

Map Unit Composition

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

Description of Dalian

Setting

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

Typical profile

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

Properties and qualities

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

Interpretive groups

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

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

Map Unit Setting

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

Map Unit Composition

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

Description of Tencee

Setting

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

Typical profile

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

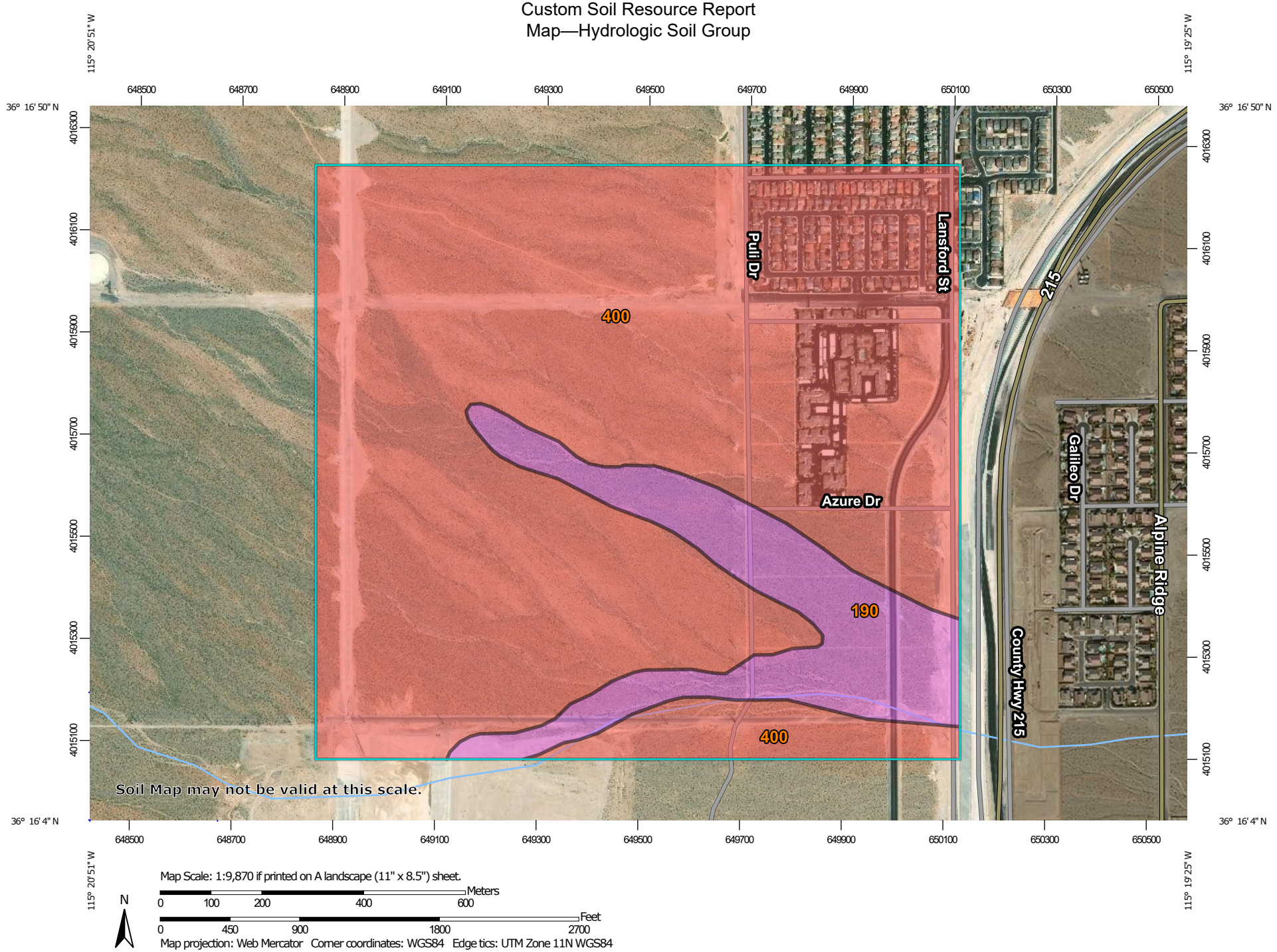
Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: 7 to 20 inches to petrocalcic
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 40 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 2.0
Available water storage in profile: Very low (about 1.0 inches)

Interpretive groups

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

Custom Soil Resource Report
Map—Hydrologic Soil Group



Map Scale: 1:9,870 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 100 200 400 600

Feet
0 450 900 1800 2700

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

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
190	Dalian very gravelly fine sandy loam, 2 to 4 percent slopes	A	49.1	13.4%
400	Tencee very gravelly fine sandy loam, 2 to 8 percent slopes	D	316.7	86.6%
Totals for Area of Interest			**365.8**	**100.0%**

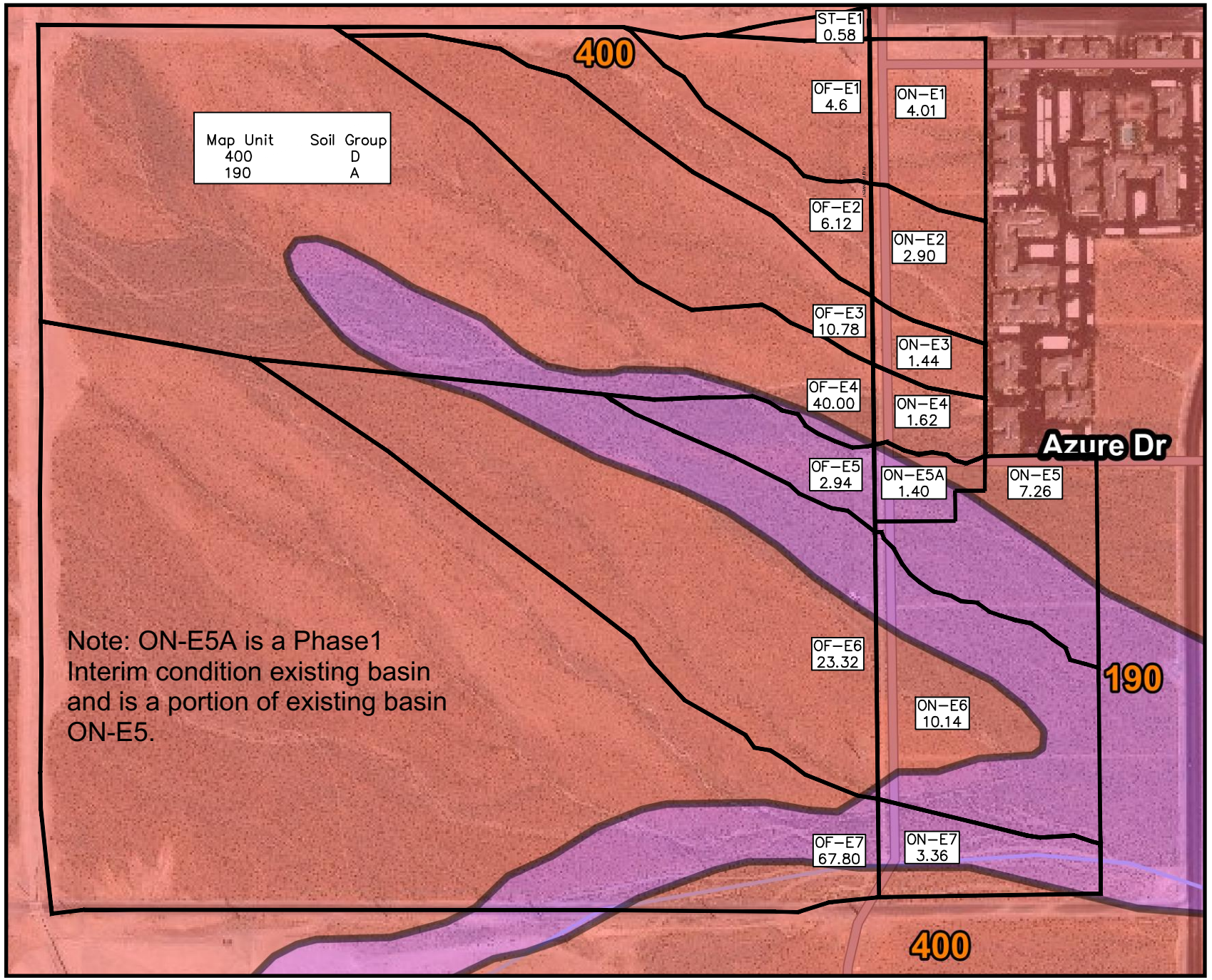
Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

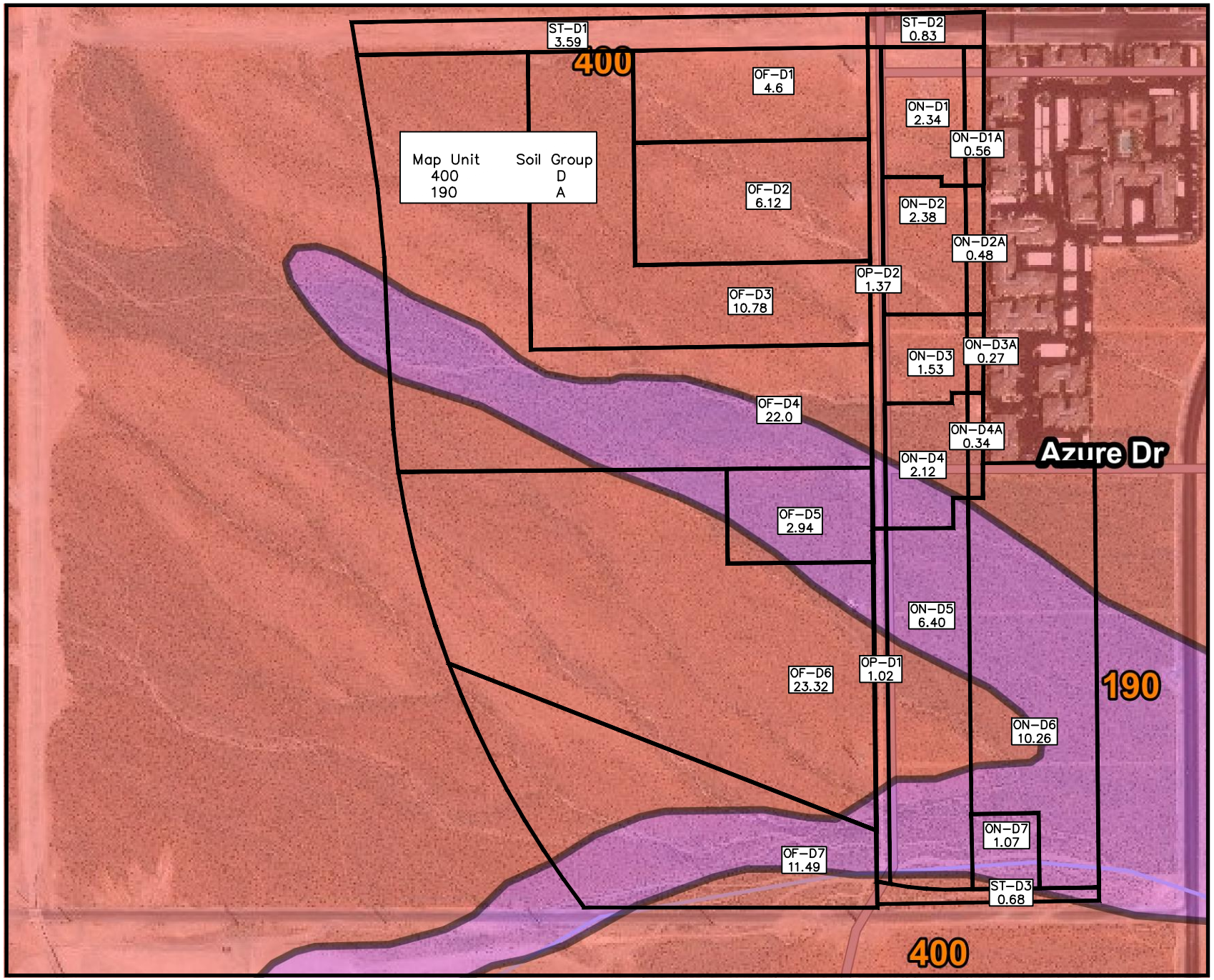
Tie-break Rule: Higher

Custom Soil Resource Report Map-
Hydrologic Soil Group



Existing Basin Soils Map
Centennial Heights Townhomes

Custom Soil Resource Report Map-
Hydrologic Soil Group



Developed Basin Soils Map
Centennial Heights Townhomes

HORROCKS ENGINEERS

Composite Curve Number Calculations

Proj. No: NV-1949-1909 **Project Name:** Centennial Heights TownHomes
Date: 12/20/2019 **Designed By:** dbc/sbl

Basin	Basin Area (ac)	Sub-region Cover Type	Sub-region Soil Type	Sub-region CN	Sub-region Area (ac)	Percent of Basin	Cumulative Percent	Area Weighted CN	Cumulative CN	Composite CN
EXISTING CONDITION										
OF-E1	4.60	Desert Shrub, Poor	D	88	4.60	100.0%	100.0%	88.0	88.0	88
OF-E2	6.12	Desert Shrub, Poor	D	88	6.12	100.0%	100.0%	88.0	88.0	88
OF-E3	10.78	Desert Shrub, Poor	D	88	10.78	100.0%	100.0%	88.0	88.0	88
OF-E4	40.00	Desert Shrub, Poor	D	88	35.75	89.4%	89.4%	78.7	78.7	
OF-E4	40.00	Desert Shrub, Poor	A	63	4.25	10.6%	100.0%	6.7	85.3	85
OF-E5	2.94	Desert Shrub, Poor	A	63	2.94	100.0%	100.0%	63.0	63.0	63
OF-E6	23.32	Desert Shrub, Poor	D	88	18.36	78.7%	78.7%	69.3	69	
OF-E6	23.32	Desert Shrub, Poor	A	63	4.96	21.3%	100.0%	13.4	82.7	83
OF-E7	67.80	Desert Shrub, Poor	D	88	63.05	93.0%	93.0%	81.8	81.8	
OF-E7	67.80	Desert Shrub, Poor	A	63	4.75	7.0%	100.0%	4.4	86.2	86
OF-E8	4.37	Desert Shrub, Poor	A	63	3.47	79.4%	79.4%	50.0	50.0	
OF-E8	4.37	Impervious	A	98	0.9	20.6%	100.0%	20.2	70.2	70
ON-E1	4.01	Desert Shrub, Poor	D	88	4.01	100.0%	100.0%	88.0	88.0	88
ON-E2	2.90	Desert Shrub, Poor	D	88	2.9	100.0%	100.0%	88.0	88.0	88
ON-E3	1.44	Desert Shrub, Poor	D	88	1.44	100.0%	100.0%	88.0	88.0	88
ON-E4	1.62	Desert Shrub, Poor	D	88	1.62	100.0%	100.0%	88.0	88.0	88
ON-E5	7.26	Desert Shrub, Poor	D	88	2.93	40.4%	40.4%	35.5	35.5	
ON-E5	7.26	Desert Shrub, Poor	A	63	4.33	59.6%	100.0%	37.6	73.1	73
ON-E5A	1.40	Desert Shrub, Poor	D	88	0.55	39.3%	39.3%	34.6	34.6	
ON-E5A	1.40	Desert Shrub, Poor	A	63	0.85	60.7%	100.0%	38.3	72.8	73
ON-E6	10.14	Desert Shrub, Poor	D	88	3.68	36.3%	36.3%	31.9	31.9	
ON-E6	10.14	Desert Shrub, Poor	A	63	6.46	63.7%	100.0%	40.1	72.1	72
ON-E7	3.36	Desert Shrub, Poor	D	88	0.99	29.5%	29.5%	25.9	25.9	
ON-E7	3.36	Desert Shrub, Poor	A	63	2.37	70.5%	100.0%	44.4	70.4	70
ST-E1	0.58	Desert Shrub, Poor	D	88	0.58	100.0%	100.0%	88.0	88.0	88

HORROCKS ENGINEERS

Basin	Basin Area (ac)	Sub-region Cover Type	Sub-region Soil Type	Sub-region CN	Sub-region Area (ac)	Percent of Basin	Cumulative Percent	Area Weighted CN	Cumulative CN	Composite CN
DEVELOPED CONDITION										
OF-D1	4.60	Commercial	D	95	4.60	100.0%	100.0%	95.0	95.0	95
OP-D1	1.02	Open Space, Poor	D	89	0.50	49.0%	49.0%	43.6	43.6	
OP-D1	1.02	Open Space, Poor	A	68	0.52	51.0%	100.0%	34.7	78.3	78
ON-D1	2.34	Industrial	D	94	2.34	100.0%	100.0%	94.0	94.0	94
ON-D1A	0.56	Industrial	D	94	0.56	100.0%	100.0%	94.0	94.0	94
OF-D2	6.12	Commercial	D	95	6.12	100.0%	100.0%	95.0	95.0	95
OP-D2	1.37	Open Space, Poor	D	89	1.13	82.5%	82.5%	73.4	73.4	
OP-D2	1.37	Open Space, Poor	A	68	0.24	17.5%	100.0%	11.9	85.3	85
ON-D2	2.38	Industrial	D	94	2.38	100.0%	100.0%	94.0	94.0	94
ON-D2A	0.48	Industrial	D	94	0.48	100.0%	100.0%	94.0	94.0	94
OF-D3	10.78	Commercial	D	95	10.78	100.0%	100.0%	95.0	95.0	95
ON-D3	1.53	Industrial	D	94	1.53	100.0%	100.0%	94.0	94.0	94
ON-D3A	0.27	Industrial	D	94	0.27	100.0%	100.0%	94.0	94.0	94
OF-D4	22.00	Commercial	D	95	15.18	69.0%	69.0%	65.6	65.6	
OF-D4	22.00	Commercial	A	89	6.82	31.0%	100.0%	27.6	93.1	93
ON-D4	2.12	Industrial	D	94	1.44	67.9%	67.9%	63.8	63.8	
ON-D4	2.12	Industrial	A	84	0.68	32.1%	100.0%	26.9	90.8	91
ON-D4A	0.34	Industrial	D	94	0.34	100.0%	100.0%	94.0	94.0	94
OF-D5	2.94	Commercial	D	95	0.35	11.9%	11.9%	11.3	11.3	
OF-D5	2.94	Commercial	A	89	2.59	88.1%	100.0%	78.4	89.7	90
ON-D5	6.40	Industrial	D	94	2.4	37.5%	37.5%	35.3	35.3	
ON-D5	6.40	Industrial	A	84	4.0	62.5%	100.0%	52.5	87.8	88
OF-D6	23.32	Commercial	D	95	22.67	97.2%	97.2%	92.4	92.4	
OF-D6	23.32	Commercial	A	89	0.65	2.8%	100.0%	2.5	94.8	95
ON-D6	10.26	Industrial	D	94	3.56	34.7%	34.7%	32.6	32.6	
ON-D6	10.26	Industrial	A	84	6.7	65.3%	100.0%	54.9	87.5	87
OF-D7	11.49	Commercial	D	95	7.63	66.4%	66.4%	63.1	63.1	
OF-D7	11.49	Commercial	A	89	3.86	33.6%	100.0%	29.9	93.0	93
OF-D8	4.37	Industrial	A	84	3.47	79.4%	79.4%	66.7	66.7	
OF-D8	4.37	Impervious	A	98	0.9	20.6%	100.0%	20.2	86.9	87
ON-D7	1.07	Industrial	A	84	1.07	100.0%	100.0%	84.0	84.0	84
ST-D1	3.59	Impervious	D	98	3.59	100.0%	100.0%	98.0	98.0	98
ST-D2	0.83	Impervious	D	98	0.83	100.0%	100.0%	98.0	98.0	98

ST-D3	0.68	Impervious	D	98	0.68	100.0%	100.0%	98.0	98.0	98

HORROCKS ENGINEERS

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL - STANDARD FORM 4

Horrocks Engineers | 1401 N. Green Valley Pkwy, Suite 160 | Henderson, NV, 89074

PROJECT NO.: NV-1949-1909 **PROJECT: CENTENNIAL HEIGHTS TOWNHOMES** **DATE : 12/20/2019 17:17**

CALCULATED BY: DBC/SBL

Sub-Basin Data					Initial/Overland Time (T_i)			Travel Time (T_t)					T_c	T_c Check (Urbanized Basins)		Final T_c	T_{lag}	Remarks
DESIG	CN	K	AREA (acres)	AREA (mi^2)	LENGTH (ft)	SLOPE (%)	T_i (min)	LENGTH (ft)	SLOPE (%)	V_1 (fps)	V_2 (fps)	T_t (min)	$T_c=T_i+T_t$ (min)	TOTAL (ft)	T_c (min)	T_c (min)	T_{lag} (hrs)	Remarks Precip 100/10
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
EXISTING CONDITION																		
OF-E1	88	0.7716	4.60	0.0072	210	5.7	4.8	600	5.8	3.57	7.10	2.6	7.4	N/A	N/A	7.36	0.100	3.15/1.76
OF-E2	88	0.7716	6.12	0.0096	350	6.0	6.1	1510	4.6	3.19	6.33	5.3	11.4	N/A	N/A	11.36	0.114	3.15/1.76
OF-E3	88	0.7716	10.78	0.0168	470	5.5	7.2	1490	4.8	3.23	6.42	5.2	12.4	N/A	N/A	12.40	0.124	3.15/1.76
OF-E4	85	0.732	40.00	0.0625	740	4.5	10.9	2370	4.1	3.01	5.98	8.0	18.9	N/A	N/A	18.93	0.189	3.15/1.76
OF-E5	63	0.4416	2.94	0.0046	200	5.0	9.8	690	4.3	3.09	6.13	3.2	13.0	N/A	N/A	13.02	0.130	3.15/1.76
OF-E6	83	0.7056	23.32	0.0364	700	5.4	10.7	1700	4.7	3.21	6.38	5.7	16.4	N/A	N/A	16.42	0.164	3.15/1.76
OF-E7	86	0.7452	67.8	0.1059	440	7.7	6.8	2730	4.3	3.08	6.11	8.8	15.6	N/A	N/A	15.56	0.156	3.15/1.76
OF-E8	70	0.534	4.37	0.0068	240	5.4	9.0	460	2.2	2.20	N/A	3.5	12.5	N/A	N/A	12.49	0.125	3.15/1.76
ON-E1	88	0.7716	4.04	0.0063	180	5.6	4.5	300	5.3	3.42	N/A	1.5	5.9	N/A	N/A	5.94	0.100	3.15/1.76
ON-E2	88	0.7716	2.90	0.0045	190	3.7	5.3	400	5.0	3.31	N/A	2.0	7.3	N/A	N/A	7.29	0.100	3.15/1.76
ON-E3	88	0.7716	1.44	0.0023	105	7.6	3.1	350	4.0	2.96	N/A	2.0	5.0	N/A	N/A	5.05	0.100	3.15/1.76
ON-E4	88	0.7716	1.62	0.0025	60	6.7	2.4	280	4.3	3.06	N/A	1.5	4.0	N/A	N/A	3.96	0.100	3.15/1.76
ON-E5	73	0.5736	7.26	0.0113	200	5.0	7.8	540	4.8	3.25	6.45	2.7	10.5	N/A	N/A	10.51	0.105	3.15/1.76
ON-E5A	73	0.5736	1.40	0.0022	200	2.5	9.9	145	6.9	3.89	N/A	0.6	10.5	N/A	N/A	10.49	0.105	3.15/1.76
ON-E6	72	0.5604	10.14	0.0158	320	3.8	11.2	775	3.9	2.91	5.78	3.7	14.8	N/A	N/A	14.84	0.148	3.15/1.76
ON-E7	70	0.534	3.36	0.0053	210	2.9	10.4	435	3.2	2.66	N/A	2.7	13.1	N/A	N/A	13.14	0.131	3.15/1.76
ST-E1	88	0.7716	0.58	0.0009	70	5.7	2.8	365	5.5	3.46	N/A	1.8	4.5	N/A	N/A	4.52	0.100	3.15/1.76
DEVELOPED CONDITION																		
OF-D1	95	0.864	4.60	0.0072	190	5.3	3.4	720	5.0	4.52	6.84	2.4	5.7	910	15.1	5.75	0.057	3.15/1.76
OP-D1	78	0.6396	1.02	0.0016	40	2.0	4.2	1080	1.5	2.47	3.75	5.9	10.1	1120.0	16.2	10.1	0.101	3.15/1.76
ON-D1	94	0.8508	2.34	0.0037	220	2.2	5.1	300	2.2	3.00	N/A	1.7	6.8	520.0	12.9	6.8	0.068	3.15/1.76
ON-D1A	94	0.8508	0.56	0.0009	55	7.3	1.7	500	1.6	2.56	N/A	3.3	5.0	555.0	13.1	5.0	0.050	3.15/1.76
OF-D2	95	0.864	6.12	0.0096	175	7.4	2.9	890	3.5	3.77	5.71	3.3	6.2	1065	15.9	6.23	0.062	3.15/1.76
OP-D2	85	0.732	1.37	0.0021	40	2.0	3.3	1465	2.2	2.99	4.54	6.3	9.7	1505.0	18.4	9.7	0.097	3.15/1.76
ON-D2	94	0.8508	2.38	0.0037	240	2.2	5.3	250	2.2	3.00	N/A	1.4	6.7	490.0	12.7	6.7	0.067	3.15/1.76
ON-D2A	94	0.8508	0.48	0.0008	55	5.5	1.9	370	2.2	2.97	N/A	2.1	4.0	425.0	12.4	4.0	0.050	3.15/1.76

HORROCKS ENGINEERS

Sub-Basin Data					Initial/Overland Time (T_i)			Travel Time (T_t)					T_c	T_c Check (Urbanized Basins)		Final T_c	T_{lag}	Remarks
DESIG	CN	K	AREA (acres)	AREA (mi^2)	LENGTH (ft)	SLOPE (%)	T_i (min)	LENGTH (ft)	SLOPE (%)	V_1 (fps)	V_2 (fps)	T_t (min)	$T_c=T_i+T_t$ (min)	TOTAL (ft)	T_c (min)	T_c (min)	T_{lag} (hrs)	Remarks Precip 100/10
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
OF-D3	95	0.864	10.78	0.0168	160	3.8	3.5	1720	3.7	3.90	5.90	5.6	9.0	1880	20.4	9.04	0.090	3.15/1.76
ON-D3	94	0.8508	1.53	0.0024	85	2.2	3.2	260	2.2	3.00	N/A	1.4	4.6	345.0	11.9	4.6	0.050	3.15/1.76
ON-D3A	94	0.8508	0.27	0.0004	55	1.8	2.7	210	0.5	1.39	N/A	2.5	5.2	265.0	11.5	5.2	0.052	3.15/1.76
OF-D4	93	0.8376	22.00	0.0344	315	4.4	5.1	2170	3.9	3.97	6.02	6.7	11.8	2485	23.8	11.82	0.118	3.15/1.76
ON-D4	91	0.8112	2.12	0.0033	225	2.2	6.0	310	2.2	3.00	N/A	1.7	7.7	535.0	13.0	7.7	0.077	3.15/1.76
ON-D4A	94	0.8508	0.34	0.0005	55	1.8	2.7	320	0.3	1.13	N/A	4.7	7.4	375.0	12.1	7.4	0.074	3.15/1.76
OF-D5	90	0.798	2.94	0.0046	200	3.0	5.3	510	3.3	3.69	5.59	2.3	7.6	710	13.9	7.62	0.076	3.15/1.76
ON-D5	88	0.7716	6.40	0.0100	220	2.2	6.7	980	1.78	2.69	4.08	5.1	11.8	1200.0	16.7	11.8	0.118	3.15/1.76
OF-D6	95	0.864	23.32	0.0364	225	4.4	3.9	1790	4.5	4.30	6.51	5.2	9.1	2015	21.2	9.12	0.091	3.15/1.76
ON-D6	87	0.7584	10.26	0.0160	320	2.2	8.5	1150	2.20	3.00	4.54	5.2	13.6	1470	18.2	13.64	0.136	3.15/1.76
OF-D7	93	0.8376	11.49	0.0180	231	6.1	3.9	1370	3.5	3.78	5.73	4.7	8.7	1601	18.9	8.67	0.087	3.15/1.76
ON-D7	84	0.7188	1.07	0.0017	150	3.9	5.3	225	2.10	2.93	N/A	1.3	6.6	375.0	12.1	6.6	0.066	3.15/1.76
OF-D8	87	0.7584	4.37	0.0068	240	5.4	5.4	460	2.2	3.00	N/A	2.6	8.0	700	13.9	7.99	0.080	3.15/1.76
ST-D1	98	0.9036	3.59	0.0056	50	2.0	2.0	1570	4.8	4.44	6.73	4.5	6.5	1620.0	19.0	6.5	0.065	3.15/1.76
ST-D2	98	0.9036	0.83	0.0013	50	2.0	2.0	350	3.70	3.89	N/A	1.5	3.5	400.0	12.2	3.5	0.050	3.15/1.76
ST-D3	98	0.9036	0.68	0.0011	40	2.0	1.8	600	3.85	3.96	6.00	2.4	4.2	640.0	13.6	4.2	0.050	3.15/1.76

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

REFERENCE: **CCRFCD HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL**

STANDARD FORM 4

HEC-1 EXISTING BASIN

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1****************************************                                  ****************************************
 *                                      *                                  *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                  *    U.S. ARMY CORPS OF ENGINEERS      *
 *               JUN   1998             *                                  *    HYDROLOGIC ENGINEERING CENTER     *
 *            VERSION 4.1               *                                  *          609 SECOND STREET           *
 *                                      *                                  *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   20DEC19  TIME  17:04:21  *                                  *           (916) 756-1104             *
 *                                      *                                  *                                      *
 ****************************************                                  ****************************************

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

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

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


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

                        *DIAGRAM
            1           ID
            2           ID      <><><><><><><><><><><><><><><><><><><><>
            3           ID        SHAUMBER & TROPICAL Pkwy
            4           ID        HYDROLOGIC MODEL
            5           ID        --------------------------
            6           ID
            7           ID        10-YR AND 100-YR STORM EVENT
            8           ID        --------------------------
            9           ID        HORROCKS ENGINEERING
           10           ID        EXISTING CONDITION
           11           ID        FILE: EX.DAT
           12           ID        PROJECT No: NV-1826-1907
           13           ID        DATE:  SEP 16 2019
           14           ID      <><><><><><><><><><><><><><><><><><><><>
           15           ID
           16           ID       ---> 6-HOUR / SDN 3 <---
           17           ID
           18           IT       5       0       0     300
           19           IO       5
           20           IN       5
           21           JR    PREC    0.55    1.00
                        *
           22           KK   OF-E1
           23           KM    OFFSITE FLOW AT NORTHWEST CORNER OF PROJECT SITE
           24           BA   .0072
           25           PB    3.15
           26           PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
           27           PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
           28           PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
           29           PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
           30           PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
           31           PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
           32           PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
           33           PC    .998    .999    1.00
           34           LS       0      88
           35           UD    .100
                        *
           36           KK   ON-E1
           37           BA   .0063
           38           LS       0      88
           39           UD    .100
                        *
           40           KK     CE1
           41           KM   COMBINES OFFISTE BASIN OF-E1 AND ONSITE BASIN ON-E1.
           42           HC       2
                        *
```



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

```
          43          KK   OF-E2
          44          BA   .0096
          45          LS       0      88
          46          UD   0.114
                      *

          47          KK   ON-E2
          48          BA   .0045
          49          LS       0      88
          50          UD   0.100
                      *

          51          KK     CE2
          52          KM   COMBINES OFFISTE BASIN OF-E2 AND ONSITE BASIN ON-E2.
          53          HC       2
                      *

          54          KK   OF-E3
          55          BA   .0168
          56          LS       0      88
          57          UD   0.124
                      *

          58          KK   ON-E3
          59          BA   .0023
          60          LS       0      88
          61          UD   0.100
                      *

          62          KK     CE3
          63          KM   COMBINES OFFISTE BASIN OF-E3 AND ONSITE BASIN ON-E3.
          64          HC       2
                      *

          65          KK   OF-E4
          66          BA   .0625
          67          LS       0      85
          68          UD   0.189
                      *

          69          KK   ON-E4
          70          BA   .0025
          71          LS       0      88
          72          UD   0.100
                      *

          73          KK     CE4
          74          KM   COMBINES OFFISTE BASIN OF-E4 AND ONSITE BASIN ON-E4.
          75          HC       2
                      *
1                                        HEC-1 INPUT                                          PAGE  3

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

          76          KK    CE4A
          77          KM   COMBINES BASINS CE4 AND CE3.
          78          HC       2
                      *

          79          KK   OF-E5
          80          BA   .0046
          81          LS       0      63
          82          UD   0.130
                      *

          83          KK   ON-E5
          84          BA   .0113
          85          LS       0      73
          86          UD   0.105
                      *

          87          KK     CE5
          88          KM   COMBINES OFFISTE BASIN OF-E5 AND ONSITE BASIN ON-E5.
          89          HC       2
                      *

          90          KK   OF-E6
          91          BA   .0364
          92          LS       0      83
          93          UD   0.164
                      *

          94          KK   ON-E6
          95          BA   .0158
          96          LS       0      72
          97          UD   0.148
                      *
```

```
             98          KK     CE6
             99          KM   COMBINES OFFISTE BASIN OF-E6 AND ONSITE BASIN ON-E6.
            100          HC       2
                         *

            101          KK   OF-E7
            102          BA   .1059
            103          LS       0      86
            104          UD   0.156
                         *

            105          KK   ON-E7
            106          BA   .0053
            107          LS       0      70
            108          UD   0.131
                         *
1                                              HEC-1 INPUT                                              PAGE  4

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


            109          KK     CE7
            110          KM   COMBINES OFFISTE BASIN OF-E7 AND ONSITE BASIN ON-E7.
            111          HC       2
                         *

            112          KK   ST-E1
            113          BA   .0009
            114          LS       0      88
            115          UD   0.100
                         *

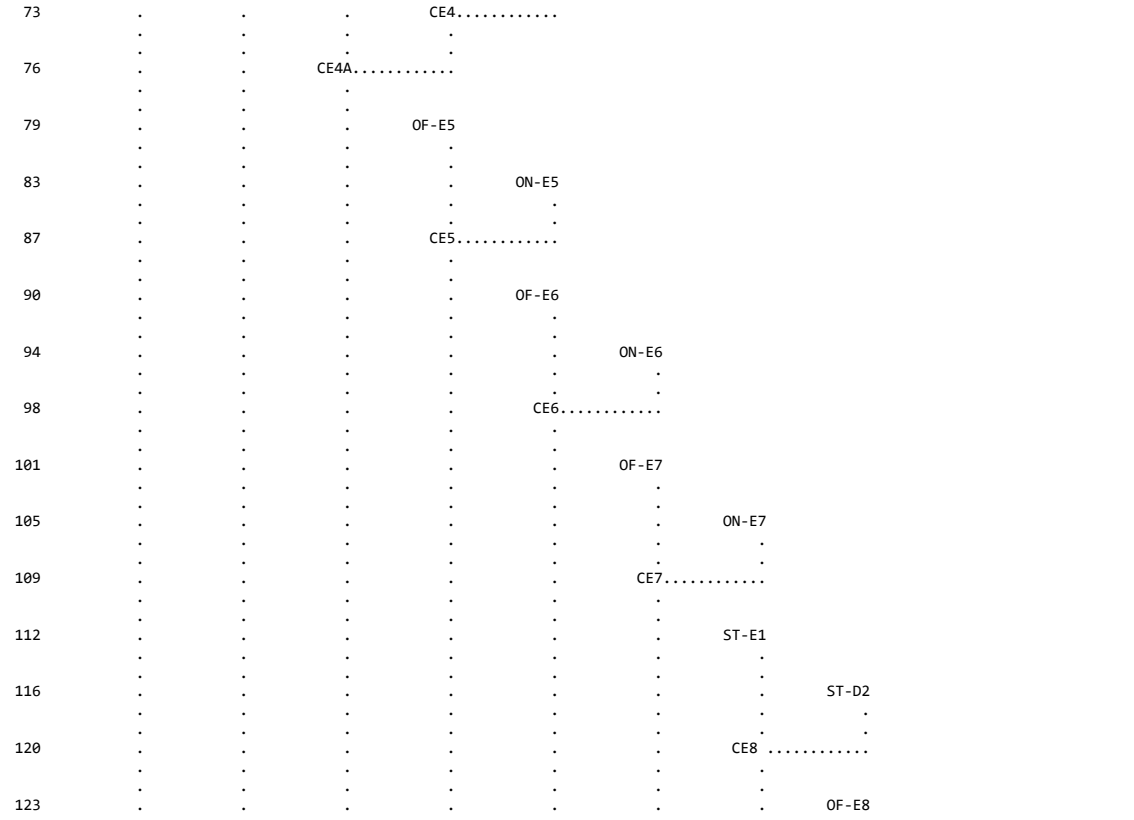
            116          KK   ST-D2
            117          BA   .0013
            118          LS       0      98
            119          UD   0.050
                         *

            120          KK    CE8
            121          KM   COMBINES OFFISTE BASIN ST-E8 AND ONSITE BASIN ST-E9.
            122          HC       2
                         *

            123          KK   OF-E8
            124          BA   .0068
            125          LS       0      70
            126          UD   0.125
                         *
                         *
                         *
            127          ZZ
1
                 SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

    22       OF-E1
                 .
                 .
    36           .       ON-E1
                 .           .
                 .           .
    40         CE1............
                 .
                 .
    43           .       OF-E2
                 .           .
                 .           .
    47           .           .       ON-E2
                 .           .           .
                 .           .           .
    51           .         CE2............
                 .           .
                 .           .
    54           .           .       OF-E3
                 .           .           .
                 .           .           .
    58           .           .           .       ON-E3
                 .           .           .           .
                 .           .           .           .
    62           .           .         CE3............
                 .           .           .
                 .           .           .
    65           .           .           .       OF-E4
                 .           .           .           .
                 .           .           .           .
    69           .           .           .           .       ON-E4
                 .           .           .           .           .
                 .           .           .           .           .
```



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************                    *****************************************
 *                                       *                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER      *
 *            VERSION 4.1                *                    *          609 SECOND STREET            *
 *                                       *                    *       DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   20DEC19  TIME  17:04:21   *                    *           (916) 756-1104              *
 *                                       *                    *                                       *
 *****************************************                    *****************************************
```

```
                          <><><><><><><><><><><><><><><><><><><><>
                            SHAUMBER & TROPICAL Pkwy
                            HYDROLOGIC MODEL
                            ---------------------------

                            10-YR AND 100-YR STORM EVENT
                            ---------------------------
                            HORROCKS ENGINEERING
                            EXISTING CONDITION
                            FILE: EX.DAT
                            PROJECT No: NV-1826-1907
                            DATE:  SEP 16 2019
                          <><><><><><><><><><><><><><><><><><><><>

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


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

     IT          HYDROGRAPH TIME DATA
                        NMIN           5  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1    0  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE      2    0  ENDING DATE
                      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
                     .55      1.00
1

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


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

 HYDROGRAPH AT
+                 OF-E1       .01     1   FLOW           5.      13.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                 ON-E1       .01     1   FLOW           4.      11.
                                           TIME         3.50     3.50

  2 COMBINED AT
+                   CE1       .01     1   FLOW           9.      24.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                 OF-E2       .01     1   FLOW           7.      16.
                                           TIME         3.58     3.58

 HYDROGRAPH AT
+                 ON-E2       .00     1   FLOW           3.       8.
                                           TIME         3.50     3.50

  2 COMBINED AT
+                   CE2       .01     1   FLOW          10.      24.
                                           TIME         3.58     3.50

 HYDROGRAPH AT
+                 OF-E3       .02     1   FLOW          11.      28.
                                           TIME         3.58     3.58

 HYDROGRAPH AT
+                 ON-E3       .00     1   FLOW           2.       4.
                                           TIME         3.50     3.50

  2 COMBINED AT
+                   CE3       .02     1   FLOW          13.      32.
                                           TIME         3.58     3.58

 HYDROGRAPH AT
+                 OF-E4       .06     1   FLOW          29.      83.
                                           TIME         3.67     3.58

 HYDROGRAPH AT
+                 ON-E4       .00     1   FLOW           2.       4.
                                           TIME         3.50     3.50

  2 COMBINED AT
+                   CE4       .06     1   FLOW          31.      87.
                                           TIME         3.58     3.58

  2 COMBINED AT
+                  CE4A       .08     1   FLOW          44.     119.
                                           TIME         3.58     3.58

 HYDROGRAPH AT
+                 OF-E5       .00     1   FLOW           0.       2.
                                           TIME         4.92     3.58

 HYDROGRAPH AT
+                 ON-E5       .01     1   FLOW           2.      10.
                                           TIME         3.58     3.58

  2 COMBINED AT
+                   CE5       .02     1   FLOW           2.      12.
```

```
                                        TIME         3.58     3.58

 HYDROGRAPH AT
+                 OF-E6       .04     1   FLOW          16.      47.
                                        TIME         3.58     3.58

 HYDROGRAPH AT
+                 ON-E6       .02     1   FLOW           2.      12.
                                        TIME         3.67     3.58

  2 COMBINED AT
+                   CE6       .05     1   FLOW          18.      60.
                                        TIME         3.58     3.58

 HYDROGRAPH AT
+                 OF-E7       .11     1   FLOW          59.     158.
                                        TIME         3.58     3.58

 HYDROGRAPH AT
+                 ON-E7       .01     1   FLOW           1.       4.
                                        TIME         3.67     3.58

  2 COMBINED AT
+                   CE7       .11     1   FLOW          60.     162.
                                        TIME         3.58     3.58

 HYDROGRAPH AT
+                 ST-E1       .00     1   FLOW           1.       2.
                                        TIME         3.50     3.50

 HYDROGRAPH AT
+                 ST-D2       .00     1   FLOW           2.       3.
                                        TIME         3.50     3.50

  2 COMBINED AT
+                  CE8        .00     1   FLOW           2.       5.
                                        TIME         3.50     3.50

 HYDROGRAPH AT
+                 OF-E8       .01     1   FLOW           1.       5.
                                        TIME         3.67     3.58


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

HEC-1 INTERIM PHASE 1

```
1*************************************                                  *************************************
 *                                   *                                  *                                   *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                              *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998           *                                  *    HYDROLOGIC ENGINEERING CENTER    *
 *            VERSION 4.1            *                                  *         609 SECOND STREET           *
 *                                   *                                  *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   22DEC19  TIME  18:01:56   *                              *          (916) 756-1104           *
 *                                   *                                  *                                   *
 *************************************                                  *************************************

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

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

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


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

                        *DIAGRAM
            1           ID
            2           ID      <><><><><><><><><><><><><><><><><><><><>
            3           ID        SHAUMBER & TROPICAL Pkwy
            4           ID        HYDROLOGIC MODEL
            5           ID        --------------------------
            6           ID
            7           ID        10-YR AND 100-YR STORM EVENT
            8           ID        --------------------------
            9           ID        HORROCKS ENGINEERING
           10           ID        PHASE 1 INTERIM CONDITION
           11           ID        FILE: INT PH1.DAT
           12           ID        PROJECT No: NV-1826-1907
           13           ID        DATE:  SEP 16 2019
           14           ID      <><><><><><><><><><><><><><><><><><><><>
           15           ID
           16           ID       ---> 6-HOUR / SDN 3 <---
           17           ID
           18           IT       5       0       0     300
           19           IO       5
           20           IN       5
           21           JR    PREC    0.55    1.00
                        *

           22           KK   OF-E1
           23           KM   STREET FLOW AT NORTHWEST CORNER OF PROJECT SITE
           24           BA   .0072
           25           PB    3.15
           26           PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
           27           PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
           28           PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
           29           PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
           30           PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
           31           PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
           32           PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
           33           PC    .998    .999   1.00
           34           LS       0      88
           35           UD    .100
                        *

           36           KK   ON-E1
           37           BA   .0063
           38           LS       0      88
           39           UD    .100
                        *

           40           KK    CI1A
           41           KM   COMBINES OFFISTE BASINS OF-E1 AND ON-E1.
           42           HC       2
                        *
```



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

```
                43          KK   OF-E2
                44          BA   .0096
                45          LS       0      88
                46          UD   0.114
                            *

                47          KK   ON-E2
                48          BA   .0045
                49          LS       0      88
                50          UD   0.100
                            *

                51          KK    CI1B
                52          KM   COMBINES OF-E2 AND ON-E2.
                53          HC       2
                            *

                54          KK   OF-E3
                55          BA   .0168
                56          LS       0      88
                57          UD   0.124
                            *

                58          KK   ON-E3
                59          BA   .0023
                60          LS       0      88
                61          UD   0.100
                            *

                62          KK    CI1C
                63          KM   COMBINES OF-E3 AND ON-E3.
                64          HC       2
                            *

                65          KK   OF-E4
                66          BA   .0625
                67          LS       0      85
                68          UD    .189
                            *

                69          KK   ON-E4
                70          BA   .0025
                71          LS       0      88
                72          UD   0.100
                            *

                73          KK    CI1D
                74          KM   COMBINES OF-E4 AND ON-E4.
                75          HC       2
                            *
1                                          HEC-1 INPUT                                                PAGE  3

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

                76          KK    CI1L
                77          KM   COMBINES CI1C AND CI1D.
                78          HC       2
                            *

                79          KK   OF-E5
                80          BA   .0046
                81          LS       0      63
                82          UD   0.130
                            *

                83          KK   OF-E6
                84          BA   .0364
                85          LS       0      83
                86          UD   0.164
                            *

                87          KK    CI1E
                88          KM   COMBINES OF-E5 AND OF-E6.
                89          HC       2
                            *

                90          KK   OF-E7
                91          BA   .1059
                92          LS       0      86
                93          UD   0.156
                            *

                94          KK    CI1F
                95          KM   COMBINES CI1E AND OF-E7.
                96          HC       2
                            *

                97          KK   OP-D1
```

```
  98          BA   .0016
  99          LS      0      78
 100          UD    .101
              *

 101          KK   GOAN
 102          BA   .0001
 103          BF     157
 104          LS      0      01
 105          UD   .0001
              *

 106          KK   DUMMY
 107          BA   .0001
 108          BF     .00
 109          LS      0      01
 110          UD   .0001
              *
```



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

 111          KK    CI1G
 112          KM   COMBINES CI1F, OP-D1, GOAN AND DUMMY.
 113          HC       4
              *

 114          KK  ON-E5A
 115          BA   .0022
 116          LS      0      73
 117          UD    .0105
              *

 118          KK   ON-D5
 119          BA   .0100
 120          LS      0      88
 121          UD    .118
              *

 122          KK    CI1H
 123          KM   COMBINES ON-E5A, ON-D5.
 124          HC       2
              *

 125          KK    CI1I
 126          KM   COMBINES CI1G, CI1H.
 127          HC       2
              *

 128          KK   ON-D6
 129          BA   .0160
 130          LS      0      87
 131          UD   0.136
              *

 132          KK   ON-D7
 133          BA   .0017
 134          LS      0      84
 135          UD   0.066
              *

 136          KK   ST-D3
 137          BA   .0011
 138          LS      0      98
 139          UD    .050
              *

 140          KK    CI1K
 141          KM   COMBINES CI1I, ON-D6, ON-D7, ST-D3.
 142          HC       4
              *
```



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

 143          KK   OF-E8
 144          BA   .0068
 145          LS      0      70
 146          UD   0.125
              *

 147          KK    BASE
 148          BA   .0001
 149          BF      40
 150          LS      0      01
 151          UD   .0001
              *

 152          KK   DUMMY
```

```
           153          BA   .0001
           154          BF     .00
           155          LS       0      01
           156          UD   .0001
                        *

           157          KK    CI1Q
           158          KM   COMBINES CI1K, OF-E8, BASE, AND DUMMY.
           159          HC       4
                        *

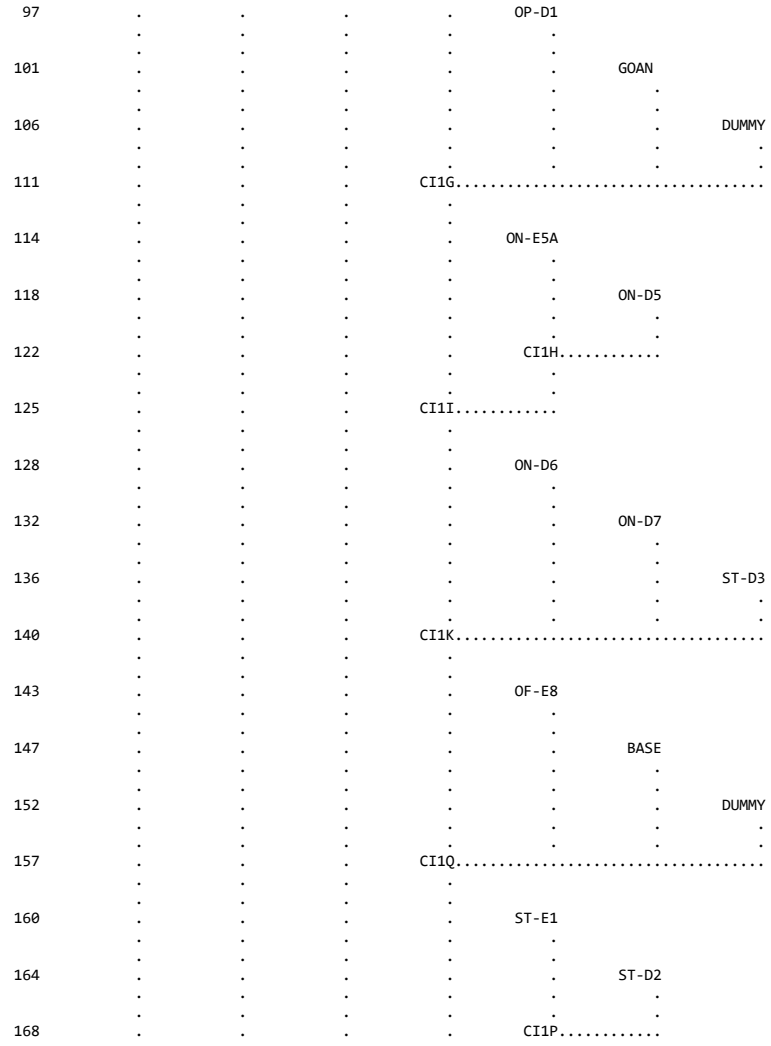
           160          KK   ST-E1
           161          BA   .0009
           162          LS       0      88
           163          UD   0.100
                        *

           164          KK   ST-D2
           165          BA   .0013
           166          LS       0      98
           167          UD   0.050
                        *

           168          KK    CI1P
           169          KM   COMBINES OFFISTE BASIN ST-E1 AND ONSITE BASIN ST-D2.
           170          HC       2
                        *
                        *
                        *
           171          ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

    22       OF-E1
                 .
                 .
    36           .       ON-E1
                 .           .
                 .           .
    40        CI1A............
                 .
                 .
    43           .       OF-E2
                 .           .
                 .           .
    47           .           .       ON-E2
                 .           .           .
                 .           .           .
    51           .        CI1B............
                 .           .
                 .           .
    54           .           .       OF-E3
                 .           .           .
                 .           .           .
    58           .           .           .       ON-E3
                 .           .           .           .
                 .           .           .           .
    62           .           .        CI1C............
                 .           .           .
                 .           .           .
    65           .           .           .       OF-E4
                 .           .           .           .
                 .           .           .           .
    69           .           .           .           .       ON-E4
                 .           .           .           .           .
                 .           .           .           .           .
    73           .           .           .        CI1D............
                 .           .           .           .
                 .           .           .           .
    76           .           .        CI1L............
                 .           .           .
                 .           .           .
    79           .           .           .       OF-E5
                 .           .           .           .
                 .           .           .           .
    83           .           .           .           .       OF-E6
                 .           .           .           .           .
                 .           .           .           .           .
    87           .           .           .        CI1E............
                 .           .           .           .
                 .           .           .           .
    90           .           .           .           .       OF-E7
                 .           .           .           .           .
                 .           .           .           .           .
    94           .           .           .        CI1F............
                 .           .           .           .
                 .           .           .           .
```



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*************************************
 *                                   *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *               JUN   1998              *
 *            VERSION 4.1                *
 *                                       *
 *  RUN DATE   22DEC19  TIME  18:01:56   *
 *                                       *
 *************************************
```

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

```
                          <><><><><><><><><><><><><><><><><><><><><><><><>
                            SHAUMBER & TROPICAL Pkwy
                            HYDROLOGIC MODEL
                            ---------------------------

                            10-YR AND 100-YR STORM EVENT
                            ---------------------------
                            HORROCKS ENGINEERING
                            PHASE 1 INTERIM CONDITION
                            FILE: INT PH1.DAT
                            PROJECT No: NV-1826-1907
                            DATE:  SEP 16 2019
                          <><><><><><><><><><><><><><><><><><><><><><><><>

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


  19 IO          OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
```

```
                    IPLOT           0  PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                     NMIN           5  MINUTES IN COMPUTATION INTERVAL
                    IDATE      1    0  STARTING DATE
                    ITIME         0000  STARTING TIME
                       NQ          300  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE      2    0  ENDING DATE
                   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
                 .55      1.00
1

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


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

 HYDROGRAPH AT
+                 OF-E1       .01     1   FLOW           5.      13.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                 ON-E1       .01     1   FLOW           4.      11.
                                           TIME         3.50     3.50

   2 COMBINED AT
+                  CI1A       .01     1   FLOW           9.      24.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                 OF-E2       .01     1   FLOW           7.      16.
                                           TIME         3.58     3.58

 HYDROGRAPH AT
+                 ON-E2       .00     1   FLOW           3.       8.
                                           TIME         3.50     3.50

   2 COMBINED AT
+                  CI1B       .01     1   FLOW          10.      24.
                                           TIME         3.58     3.50

 HYDROGRAPH AT
+                 OF-E3       .02     1   FLOW          11.      28.
                                           TIME         3.58     3.58

 HYDROGRAPH AT
+                 ON-E3       .00     1   FLOW           2.       4.
                                           TIME         3.50     3.50

   2 COMBINED AT
+                  CI1C       .02     1   FLOW          13.      32.
                                           TIME         3.58     3.58

 HYDROGRAPH AT
+                 OF-E4       .06     1   FLOW          29.      83.
                                           TIME         3.67     3.58

 HYDROGRAPH AT
+                 ON-E4       .00     1   FLOW           2.       4.
                                           TIME         3.50     3.50

   2 COMBINED AT
+                  CI1D       .06     1   FLOW          31.      87.
                                           TIME         3.58     3.58

   2 COMBINED AT
+                  CI1L       .08     1   FLOW          44.     119.
```

```
                                        TIME         3.58     3.58

 HYDROGRAPH AT
+                 OF-E5       .00     1   FLOW          0.       2.
                                        TIME         4.92     3.58

 HYDROGRAPH AT
+                 OF-E6       .04     1   FLOW         16.      47.
                                        TIME         3.58     3.58

  2 COMBINED AT
+                  CI1E       .04     1   FLOW         16.      49.
                                        TIME         3.58     3.58

 HYDROGRAPH AT
+                 OF-E7       .11     1   FLOW         59.     158.
                                        TIME         3.58     3.58

  2 COMBINED AT
+                  CI1F       .15     1   FLOW         75.     207.
                                        TIME         3.58     3.58

 HYDROGRAPH AT
+                 OP-D1       .00     1   FLOW          1.       2.
                                        TIME         3.58     3.50

 HYDROGRAPH AT
+                 GOAN        .00     1   FLOW        157.     157.
                                        TIME          .00      .00

 HYDROGRAPH AT
+                 DUMMY       .00     1   FLOW          0.       0.
                                        TIME          .00      .00

  4 COMBINED AT
+                  CI1G       .15     1   FLOW        232.     366.
                                        TIME         3.58     3.58

 HYDROGRAPH AT
+                ON-E5A       .00     1   FLOW          1.       3.
                                        TIME         3.50     3.50

 HYDROGRAPH AT
+                 ON-D5       .01     1   FLOW          7.      17.
                                        TIME         3.58     3.58

  2 COMBINED AT
+                  CI1H       .01     1   FLOW          7.      19.
                                        TIME         3.58     3.50

  2 COMBINED AT
+                  CI1I       .16     1   FLOW        239.     384.
                                        TIME         3.58     3.58

 HYDROGRAPH AT
+                 ON-D6       .02     1   FLOW         10.      26.
                                        TIME         3.58     3.58

 HYDROGRAPH AT
+                 ON-D7       .00     1   FLOW          1.       3.
                                        TIME         3.50     3.50

 HYDROGRAPH AT
+                 ST-D3       .00     1   FLOW          2.       3.
                                        TIME         3.50     3.50

  4 COMBINED AT
+                  CI1K       .18     1   FLOW        251.     414.
                                        TIME         3.58     3.58

 HYDROGRAPH AT
+                 OF-E8       .01     1   FLOW          1.       5.
                                        TIME         3.67     3.58

 HYDROGRAPH AT
+                  BASE       .00     1   FLOW         40.      40.
                                        TIME          .00      .00

 HYDROGRAPH AT
+                 DUMMY       .00     1   FLOW          0.       0.
                                        TIME          .00      .00

  4 COMBINED AT
+                  CI1Q       .19     1   FLOW        292.     459.
                                        TIME         3.58     3.58

 HYDROGRAPH AT
+                 ST-E1       .00     1   FLOW          1.       2.
                                        TIME         3.50     3.50

 HYDROGRAPH AT
```

```
+                 ST-D2       .00     1   FLOW           2.       3.
                                          TIME         3.50     3.50

  2 COMBINED AT
+                  CI1P       .00     1   FLOW           2.       5.
                                          TIME         3.50     3.50


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

HEC-1 INTERIM PHASE 2

```
1****************************************                                  ****************************************
 *                                      *                                  *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                  *    U.S. ARMY CORPS OF ENGINEERS      *
 *               JUN   1998             *                                  *    HYDROLOGIC ENGINEERING CENTER     *
 *            VERSION 4.1               *                                  *          609 SECOND STREET           *
 *                                      *                                  *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   20DEC19  TIME  17:09:26  *                                  *           (916) 756-1104             *
 *                                      *                                  *                                      *
 ****************************************                                  ****************************************

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

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

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


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

                        *DIAGRAM
            1           ID
            2           ID      <><><><><><><><><><><><><><><><><><><><>
            3           ID        SHAUMBER & TROPICAL Pkwy
            4           ID        HYDROLOGIC MODEL
            5           ID        --------------------------
            6           ID
            7           ID        10-YR AND 100-YR STORM EVENT
            8           ID        --------------------------
            9           ID        HORROCKS ENGINEERING
           10           ID        PHASE 2 INTERIM CONDITION
           11           ID        FILE: INT PH2.DAT
           12           ID        PROJECT No: NV-1826-1907
           13           ID        DATE:  SEP 16 2019
           14           ID      <><><><><><><><><><><><><><><><><><><><>
           15           ID
           16           ID       ---> 6-HOUR / SDN 3 <---
           17           ID
           18           IT       5       0       0     300
           19           IO       5
           20           IN       5
           21           JR    PREC    0.55    1.00
                        *

           22           KK   OF-E1
           23           KM   STREET FLOW AT NORTHWEST CORNER OF PROJECT SITE
           24           BA   .0072
           25           PB    3.15
           26           PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
           27           PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
           28           PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
           29           PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
           30           PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
           31           PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
           32           PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
           33           PC    .998    .999    1.00
           34           LS       0      88
           35           UD    .100
                        *

           36           KK   OF-E2
           37           BA   .0096
           38           LS       0      88
           39           UD   0.114
                        *

           40           KK    CI2A
           41           KM   COMBINES OFFISTE BASINS OF-E1 AND OF-E2.
           42           HC       2
                        *
```



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

```
                43          KK   OF-E3
                44          BA   .0168
                45          LS      0      88
                46          UD   0.124
                            *

                47          KK    CI2B
                48          KM   COMBINES CI2A AND OF-E3.
                49          HC       2
                            *

                50          KK   OF-E4
                51          BA   .0625
                52          LS       0      85
                53          UD    .189
                            *

                54          KK    CI2C
                55          KM   COMBINES CI2B AND OF-E4.
                56          HC       2
                            *

                57          KK   OF-E5
                58          BA   .0046
                59          LS       0      63
                60          UD   0.130
                            *

                61          KK    CI2D
                62          KM   COMBINES CI2C AND OF-E5.
                63          HC       2
                            *

                64          KK  RTCI2D
                65          KM   ROUTE CI2D THROUGH OF-E6
                66          RD    0850     .03    .013            TRAP
                            *

                67          KK   OF-E6
                68          BA   .0364
                69          LS       0      83
                70          UD   0.164
                            *

                71          KK    CI2E
                72          KM   COMBINES RTCI2D AND OF-E6.
                73          HC       2
                            *
1                                          HEC-1 INPUT                                          PAGE  3

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

                74          KK   OF-E7
                75          BA   .1059
                76          LS       0      86
                77          UD   0.156
                            *

                78          KK    CI2F
                79          KM   COMBINES CI2E AND OF-E7.
                80          HC       2
                            *

                81          KK   OP-D1
                82          BA   .0016
                83          LS       0      78
                84          UD    .101
                            *

                85          KK   OP-D2
                86          BA   .0021
                87          LS       0      85
                88          UD   0.097
                            *

                89          KK   GOAN
                90          BA   .0001
                91          BF     157
                92          LS       0      01
                93          UD   .0001
                            *

                94          KK   DUMMY
                95          BA   .0001
                96          BF     .00
                97          LS       0      01
                98          UD   .0001
                            *
```

```
 99          KK    CI2G
100          KM   COMBINES CI2F, OP-D1, OP-D2, GOAN AND DUMMY.
101          HC       5
             *

102          KK   ON-D1
103          BA   .0037
104          LS       0      94
105          UD    .068
             *

106          KK   ON-D2
107          BA   .0037
108          LS       0      94
109          UD   0.067
             *
1                                        HEC-1 INPUT                                          PAGE  4

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

110          KK   ON-D3
111          BA   .0024
112          LS       0      94
113          UD   0.050
             *

114          KK    CI2L
115          KM   COMBINES ONSITE BASINS ON-D1, ON-D2, AND ON-D3.
116          HC       3
             *

117          KK    DIV1
118          KM   DIVERSION (PROVIDE DISCRIPTION HERE, THIS IS A TYP. DIVERSION CARD)
119          KM   ('DT' IS NAME OF WHAT YOU ARE DIVERTING;'DI' IS THE TOTAL FLOW; THE 'DQ' CARD
120          DT      D1
121          DI      11     23
122          DQ       6     10
             *

123          KK   ON-D4
124          BA   .0033
125          LS       0      91
126          UD    .077
             *

127          KK    CI2M
128          KM   COMBINES DIV1 AND ON-D4.
129          HC       2
             *

130          KK    DIV2
131          KM   DIVERSION (PROVIDE DISCRIPTION HERE, THIS IS A TYP. DIVERSION CARD)
132          KM   ('DT' IS NAME OF WHAT YOU ARE DIVERTING;'DI' IS THE TOTAL FLOW; THE 'DQ' CARD
133          DT      D2
134          DI      08     19
135          DQ       3     08
             *

136          KK   ON-D5
137          BA   .0100
138          LS       0      88
139          UD    .118
             *

140          KK    CI2H
141          KM   COMBINES DIV2, ON-D5.
142          HC       2
             *
1                                        HEC-1 INPUT                                          PAGE  5

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

143          KK    CI2I
144          KM   COMBINES CI2G, CI2H.
145          HC       2
             *

146          KK  ON-D1A
147          BA   .0009
148          LS       0      94
149          UD    .050
             *

150          KK  ON-D2A
151          BA   .0008
152          LS       0      94
153          UD   0.050
             *
```

```
 154          KK  ON-D3A
 155          BA   .0004
 156          LS       0      94
 157          UD   0.052
              *

 158          KK  ON-D4A
 159          BA   .0005
 160          LS       0      94
 161          UD   0.074
              *

 162          KK    CI2N
 163          KM   COMBINES ON-D1A, ON-D2A, ON-D3A, ON-D4A.
 164          HC       4
              *

 165          KK   ON-D6
 166          BA   .0160
 167          LS       0      87
 168          UD   0.136
              *

 169          KK   RETD2
 170          KM   RETRIEVE D2 - (THIS CARD RETRIEVES THE DIVERTED FLOW)
 171          DR      D2
              *

 172          KK    CI2J
 173          KM   COMBINES CI2N, ON-D6 AND D2.
 174          HC       3
              *
1                                      HEC-1 INPUT                                          PAGE  6

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

 175          KK   ON-D7
 176          BA   .0017
 177          LS       0      84
 178          UD   0.066
              *

 179          KK   ST-D3
 180          BA   .0011
 181          LS       0      98
 182          UD    .050
              *

 183          KK    CI2K
 184          KM   COMBINES CI2I, CI2J, ON-D7, ST-D3.
 185          HC       4
              *

 186          KK   OF-E8
 187          BA   .0068
 188          LS       0      70
 189          UD   0.125
              *

 190          KK    BASE
 191          BA   .0001
 192          BF      40
 193          LS       0      01
 194          UD   .0001
              *

 195          KK   DUMMY
 196          BA   .0001
 197          BF     .00
 198          LS       0      01
 199          UD   .0001
              *

 200          KK    CI2Q
 201          KM   COMBINES CI2K, OF-E8, BASE, AND DUMMY.
 202          HC       4
              *

 203          KK   ST-E1
 204          BA   .0009
 205          LS       0      88
 206          UD   0.100
              *

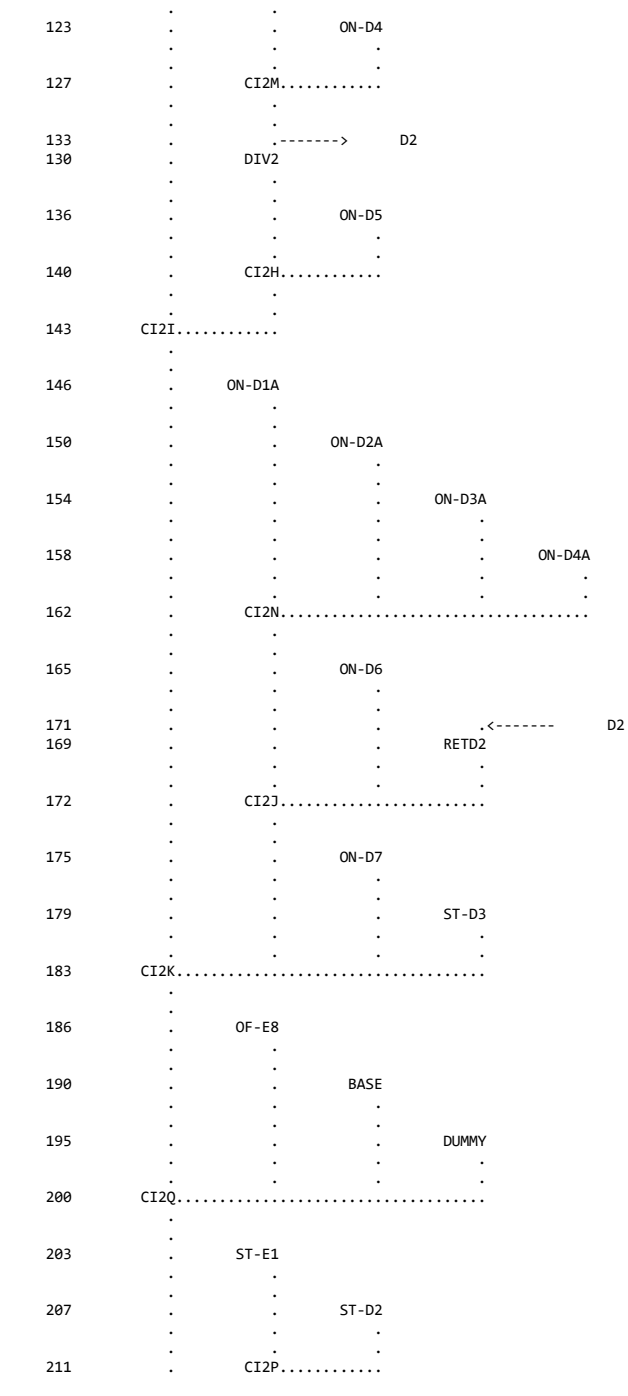
 207          KK   ST-D2
 208          BA   .0013
 209          LS       0      98
 210          UD   0.050
              *
```

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


           211          KK    CI2P
           212          KM   COMBINES OFFISTE BASIN ST-E1 AND ONSITE BASIN ST-D2.
           213          HC       2
                        *
                        *
                        *
           214          ZZ
1
               SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

    22       OF-E1
                .
                .
    36          .       OF-E2
                .           .
                .           .
    40        CI2A...........
                .
                .
    43          .       OF-E3
                .           .
                .           .
    47        CI2B...........
                .
                .
    50          .       OF-E4
                .           .
                .           .
    54        CI2C...........
                .
                .
    57          .       OF-E5
                .           .
                .           .
    61        CI2D...........
                V
                V
    64      RTCI2D
                .
                .
    67          .       OF-E6
                .           .
                .           .
    71        CI2E...........
                .
                .
    74          .       OF-E7
                .           .
                .           .
    78        CI2F...........
                .
                .
    81          .       OP-D1
                .           .
                .           .
    85          .           .       OP-D2
                .           .           .
                .           .           .
    89          .           .           .       GOAN
                .           .           .           .
                .           .           .           .
    94          .           .           .           .       DUMMY
                .           .           .           .           .
                .           .           .           .           .
    99        CI2G.............................................
                .
                .
   102          .       ON-D1
                .           .
                .           .
   106          .           .       ON-D2
                .           .           .
                .           .           .
   110          .           .           .       ON-D3
                .           .           .           .
                .           .           .           .
   114          .        CI2L........................
                .           .
                .           .
   120          .           .-------->      D1
   117          .       DIV1
                .           .
```



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

1**********

```
*                                   *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              JUN   1998           *
*            VERSION 4.1            *
*                                   *
*  RUN DATE   20DEC19  TIME  17:09:26   *
*                                   *
*************************************
```

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

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```
                              SHAUMBER & TROPICAL Pkwy
                              HYDROLOGIC MODEL
                              ----------------------------

                              10-YR AND 100-YR STORM EVENT
                              ----------------------------
                              HORROCKS ENGINEERING
                              PHASE 2 INTERIM CONDITION
                              FILE: INT PH2.DAT
                              PROJECT No: NV-1826-1907
                              DATE:  SEP 16 2019
                             <><><><><><><><><><><><><><><><><><><><>

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


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

      IT          HYDROGRAPH TIME DATA
                        NMIN           5  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1    0  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE      2    0  ENDING DATE
                      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
                      .55      1.00
1

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


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

 HYDROGRAPH AT
+                 OF-E1       .01     1   FLOW           5.      13.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                 OF-E2       .01     1   FLOW           7.      16.
                                           TIME         3.58     3.58

  2 COMBINED AT
+                  CI2A       .02     1   FLOW          11.      28.
                                           TIME         3.58     3.50

 HYDROGRAPH AT
+                 OF-E3       .02     1   FLOW          11.      28.
                                           TIME         3.58     3.58

  2 COMBINED AT
+                  CI2B       .03     1   FLOW          23.      56.
                                           TIME         3.58     3.58

 HYDROGRAPH AT
+                 OF-E4       .06     1   FLOW          29.      83.
                                           TIME         3.67     3.58

  2 COMBINED AT
+                  CI2C       .10     1   FLOW          52.     139.
                                           TIME         3.58     3.58

 HYDROGRAPH AT
+                 OF-E5       .00     1   FLOW           0.       2.
                                           TIME         4.92     3.58
```

```
  2 COMBINED AT
+                  CI2D       .10     1   FLOW          52.     140.
                                            TIME         3.58     3.58

 ROUTED TO
+                RTCI2D       .10     1   FLOW          51.     139.
                                            TIME         3.58     3.58

 HYDROGRAPH AT
+                  OF-E6      .04     1   FLOW          16.      47.
                                            TIME         3.58     3.58

  2 COMBINED AT
+                  CI2E       .14     1   FLOW          66.     186.
                                            TIME         3.58     3.58

 HYDROGRAPH AT
+                  OF-E7      .11     1   FLOW          59.     158.
                                            TIME         3.58     3.58

  2 COMBINED AT
+                  CI2F       .24     1   FLOW         125.     344.
                                            TIME         3.58     3.58

 HYDROGRAPH AT
+                  OP-D1      .00     1   FLOW           1.       2.
                                            TIME         3.58     3.50

 HYDROGRAPH AT
+                  OP-D2      .00     1   FLOW           1.       3.
                                            TIME         3.50     3.50

 HYDROGRAPH AT
+                  GOAN       .00     1   FLOW         157.     157.
                                            TIME          .00      .00

 HYDROGRAPH AT
+                  DUMMY      .00     1   FLOW           0.       0.
                                            TIME          .00      .00

  5 COMBINED AT
+                  CI2G       .25     1   FLOW         284.     506.
                                            TIME         3.58     3.58

 HYDROGRAPH AT
+                  ON-D1      .00     1   FLOW           4.       9.
                                            TIME         3.50     3.50

 HYDROGRAPH AT
+                  ON-D2      .00     1   FLOW           4.       9.
                                            TIME         3.50     3.50

 HYDROGRAPH AT
+                  ON-D3      .00     1   FLOW           3.       6.
                                            TIME         3.50     3.50

  3 COMBINED AT
+                  CI2L       .01     1   FLOW          11.      23.
                                            TIME         3.50     3.50

 DIVERSION TO
+                    D1       .01     1   FLOW           6.      11.
                                            TIME         3.50     3.50

 HYDROGRAPH AT
+                  DIV1       .01     1   FLOW           5.      12.
                                            TIME         3.50     3.50

 HYDROGRAPH AT
+                  ON-D4      .00     1   FLOW           3.       7.
                                            TIME         3.50     3.50

  2 COMBINED AT
+                  CI2M       .01     1   FLOW           8.      19.
                                            TIME         3.50     3.50

 DIVERSION TO
+                    D2       .01     1   FLOW           3.       8.
                                            TIME         3.50     3.50

 HYDROGRAPH AT
+                  DIV2       .01     1   FLOW           5.      11.
                                            TIME         3.50     3.50

 HYDROGRAPH AT
+                  ON-D5      .01     1   FLOW           7.      17.
                                            TIME         3.58     3.58

  2 COMBINED AT
+                  CI2H       .02     1   FLOW          12.      28.
                                            TIME         3.50     3.50
```

```
  2 COMBINED AT
+                   CI2I       .27     1   FLOW         292.     531.
                                           TIME         3.58     3.58

 HYDROGRAPH AT
+                  ON-D1A      .00     1   FLOW           1.       2.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                  ON-D2A      .00     1   FLOW           1.       2.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                  ON-D3A      .00     1   FLOW           0.       1.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                  ON-D4A      .00     1   FLOW           1.       1.
                                           TIME         3.50     3.50

  4 COMBINED AT
+                   CI2N       .00     1   FLOW           3.       6.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   ON-D6      .02     1   FLOW          10.      26.
                                           TIME         3.58     3.58

 HYDROGRAPH AT
+                   RETD2      .00     1   FLOW           3.       8.
                                           TIME         3.50     3.50

  3 COMBINED AT
+                   CI2J       .02     1   FLOW          15.      37.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   ON-D7      .00     1   FLOW           1.       3.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   ST-D3      .00     1   FLOW           2.       3.
                                           TIME         3.50     3.50

  4 COMBINED AT
+                   CI2K       .29     1   FLOW         309.     569.
                                           TIME         3.58     3.58

 HYDROGRAPH AT
+                   OF-E8      .01     1   FLOW           1.       5.
                                           TIME         3.67     3.58

 HYDROGRAPH AT
+                    BASE      .00     1   FLOW          40.      40.
                                           TIME          .00      .00

 HYDROGRAPH AT
+                   DUMMY      .00     1   FLOW           0.       0.
                                           TIME          .00      .00

  4 COMBINED AT
+                   CI2Q       .30     1   FLOW         349.     614.
                                           TIME         3.58     3.58

 HYDROGRAPH AT
+                   ST-E1      .00     1   FLOW           1.       2.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   ST-D2      .00     1   FLOW           2.       3.
                                           TIME         3.50     3.50

  2 COMBINED AT
+                   CI2P       .00     1   FLOW           2.       5.
                                           TIME         3.50     3.50
1
                                       SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                           (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                 INTERPOLATED TO
                                                                               COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                      PEAK                                    PEAK

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

          FOR PLAN = 1  RATIO=  .00
            RTCI2D  MANE          .84     51.68    216.03       .63      5.00     50.72    215.00         .63


 CONTINUITY SUMMARY (AC-FT) - INFLOW= .3382E+01 EXCESS= .0000E+00 OUTFLOW= .3382E+01 BASIN STORAGE= .1202E-03 PERCENT ERROR=    .0
```

```
          FOR PLAN = 1  RATIO=  .00
            RTCI2D  MANE          .66    139.96    215.69      1.74      5.00    138.54    215.00        1.74


CONTINUITY SUMMARY (AC-FT) - INFLOW= .9337E+01 EXCESS= .0000E+00 OUTFLOW= .9337E+01 BASIN STORAGE= .1150E-03 PERCENT ERROR=    .0



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

HEC-1 ULTIMATE

```
1*************************************                                  *************************************
 *                                   *                                  *                                   *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                              *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998           *                                  *    HYDROLOGIC ENGINEERING CENTER    *
 *            VERSION 4.1            *                                  *         609 SECOND STREET           *
 *                                   *                                  *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   20DEC19  TIME  17:12:41   *                              *          (916) 756-1104           *
 *                                   *                                  *                                   *
 *************************************                                  *************************************
```

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

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

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


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

                        *DIAGRAM
            1           ID
            2           ID      <><><><><><><><><><><><><><><><><><><><>
            3           ID        SHAUMBER & TROPICAL Pkwy
            4           ID        HYDROLOGIC MODEL
            5           ID        --------------------------
            6           ID
            7           ID        10-YR AND 100-YR STORM EVENT
            8           ID        --------------------------
            9           ID        HORROCKS ENGINEERING
           10           ID        ULTIMATE CONDITION
           11           ID        FILE: ULTIMATE.DAT
           12           ID        PROJECT No: NV-1826-1907
           13           ID        DATE:  SEP 16 2019
           14           ID      <><><><><><><><><><><><><><><><><><><><>
           15           ID
           16           ID       ---> 6-HOUR / SDN 3 <---
           17           ID
           18           IT       5       0       0     300
           19           IO       5
           20           IN       5
           21           JR    PREC    0.55    1.00
                        *
           22           KK   OF-D1
           23           KM   STREET FLOW AT NORTHWEST CORNER OF PROJECT SITE
           24           BA   .0072
           25           PB    3.15
           26           PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
           27           PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
           28           PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
           29           PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
           30           PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
           31           PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
           32           PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
           33           PC    .998    .999    1.00
           34           LS       0      95
           35           UD    .057
                        *
           36           KK   OF-D2
           37           BA   .0096
           38           LS       0      95
           39           UD   0.062
                        *
           40           KK   OF-D3
           41           BA   .0168
           42           LS       0      95
           43           UD   0.090
                        *
```

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

  44          KK   OF-D4
  45          BA   .0344
  46          LS      0      93
  47          UD   0.118
              *

  48          KK   OF-D5
  49          BA   .0046
  50          LS      0      90
  51          UD   0.076
              *

  52          KK   OF-D6
  53          BA   .0364
  54          LS      0      95
  55          UD   0.091
              *

  56          KK   OF-D7
  57          BA   .0180
  58          LS      0      93
  59          UD   0.087
              *

  60          KK     CUF
  61          KM   COMBINES OF-D1 TO OF-D7.
  62          HC      7
              *

  63          KK   OP-D1
  64          BA   .0016
  65          LS      0      78
  66          UD    .101
              *

  67          KK   OP-D2
  68          BA   .0021
  69          LS      0      85
  70          UD   0.097
              *

  71          KK   GOAN
  72          BA   .0001
  73          BF     157
  74          LS      0      01
  75          UD   .0001
              *

  76          KK   DUMMY
  77          BA   .0001
  78          BF     .00
  79          LS      0      01
  80          UD   .0001
              *
1                                        HEC-1 INPUT                                          PAGE  3

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

  81          KK     CUG
  82          KM   COMBINES CUF, OP-D1, OP-D2, GOAN AND DUMMY.
  83          HC      5
              *

  84          KK   ON-D1
  85          BA   .0037
  86          LS      0      94
  87          UD    .068
              *

  88          KK   ON-D2
  89          BA   .0037
  90          LS      0      94
  91          UD   0.067
              *

  92          KK   ON-D3
  93          BA   .0024
  94          LS      0      94
  95          UD   0.050
              *

  96          KK     CUL
  97          KM   COMBINES ONSITE BASINS ON-D1, ON-D2, AND ON-D3.
  98          HC      3
              *

  99          KK    DIV1
```

```
 100          KM   DIVERSION (PROVIDE DISCRIPTION HERE, THIS IS A TYP. DIVERSION CARD)
 101          KM   ('DT' IS NAME OF WHAT YOU ARE DIVERTING;'DI' IS THE TOTAL FLOW; THE 'DQ' CARD
 102          DT      D1
 103          DI      11     23
 104          DQ       6     10
              *

 105          KK   ON-D4
 106          BA   .0033
 107          LS       0      91
 108          UD    .077
              *

 109          KK     CUM
 110          KM   COMBINES DIV1 AND ON-D4.
 111          HC       2
              *

 112          KK    DIV2
 113          KM   DIVERSION (PROVIDE DISCRIPTION HERE, THIS IS A TYP. DIVERSION CARD)
 114          KM   ('DT' IS NAME OF WHAT YOU ARE DIVERTING;'DI' IS THE TOTAL FLOW; THE 'DQ' CARD
 115          DT      D2
 116          DI      08     19
 117          DQ       3     08
              *
1                                      HEC-1 INPUT                                          PAGE  4

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


 118          KK   ON-D5
 119          BA   .0100
 120          LS       0      88
 121          UD    .118
              *

 122          KK     CUH
 123          KM   COMBINES DIV2, ON-D5.
 124          HC       2
              *

 125          KK     CUI
 126          KM   COMBINES CUG AND CUH.
 127          HC       2
              *

 128          KK  ON-D1A
 129          BA   .0009
 130          LS       0      94
 131          UD    .050
              *

 132          KK  ON-D2A
 133          BA   .0008
 134          LS       0      94
 135          UD   0.050
              *

 136          KK  ON-D3A
 137          BA   .0004
 138          LS       0      94
 139          UD   0.052
              *

 140          KK  ON-D4A
 141          BA   .0005
 142          LS       0      94
 143          UD   0.074
              *

 144          KK     CUN
 145          KM   COMBINES ON-D1A, ON-D2A, ON-D3A, ON-D4A.
 146          HC       4
              *

 147          KK   ON-D6
 148          BA   .0160
 149          LS       0      87
 150          UD   0.136
              *
1                                      HEC-1 INPUT                                          PAGE  5

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


 151          KK   RETD2
 152          KM   RETRIEVE D2 - (THIS CARD RETRIEVES THE DIVERTED FLOW)
 153          DR      D2
              *

 154          KK     CUJ
```

```
            155          KM   COMBINES CUN, ON-D6 AND D2.
            156          HC       3
                         *

            157          KK   ON-D7
            158          BA   .0017
            159          LS       0      84
            160          UD   0.066
                         *

            161          KK   ST-D3
            162          BA   .0011
            163          LS       0      98
            164          UD    .050
                         *

            165          KK     CUK
            166          KM   COMBINES CUI, CUJ, ON-D7, ST-D3.
            167          HC       4
                         *

            168          KK   OF-D8
            169          BA   .0068
            170          LS       0      87
            171          UD   0.080
                         *

            172          KK    BASE
            173          BA   .0001
            174          BF      40
            175          LS       0      01
            176          UD   .0001
                         *

            177          KK   DUMMY
            178          BA   .0001
            179          BF     .00
            180          LS       0      01
            181          UD   .0001
                         *

            182          KK     CUQ
            183          KM   COMBINES CUK, OF-D8, BASE, AND DUMMY.
            184          HC       4
                         *
1                                                HEC-1 INPUT                                                PAGE  6

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


            185          KK   ST-D1
            186          BA   .0056
            187          LS       0      98
            188          UD   0.065
                         *

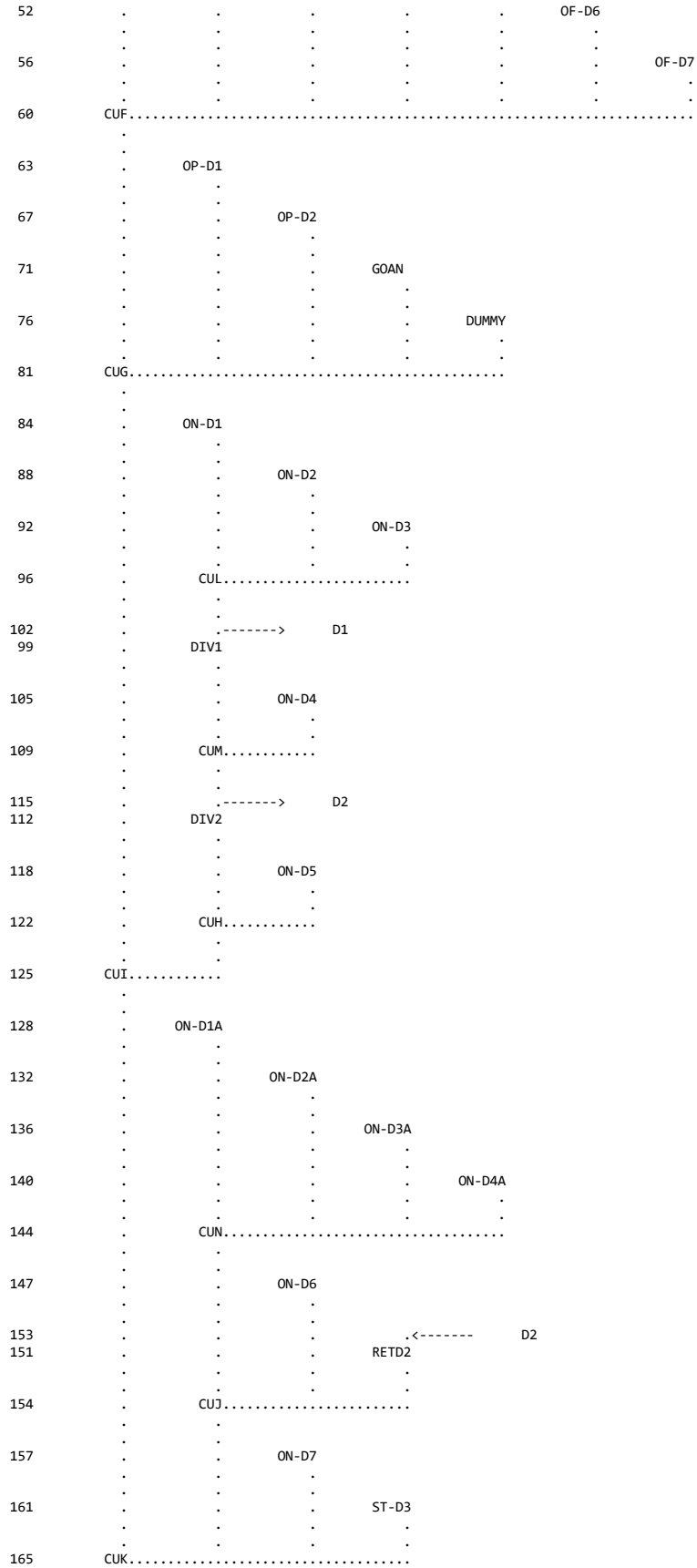
            189          KK   ST-D2
            190          BA   .0013
            191          LS       0      98
            192          UD   0.050
                         *

            193          KK     CUP
            194          KM   COMBINES OFFISTE BASIN ST-D1 AND ONSITE BASIN ST-D2.
            195          HC       2
                         *
                         *
                         *
            196          ZZ
1
                    SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

    22       OF-D1
                  .
                  .
    36            .       OF-D2
                  .           .
                  .           .
    40            .           .       OF-D3
                  .           .           .
                  .           .           .
    44            .           .           .       OF-D4
                  .           .           .           .
                  .           .           .           .
    48            .           .           .           .       OF-D5
                  .           .           .           .           .
                  .           .           .           .           .
```


OF-D6
OF-D7
CUF
OP-D1
OP-D2
GOAN
DUMMY
CUG
ON-D1
ON-D2
ON-D3
CUL
D1
DIV1
ON-D4
CUM
D2
DIV2
ON-D5
CUH
CUI
ON-D1A
ON-D2A
ON-D3A
ON-D4A
CUN
ON-D6
D2
RETD2
CUJ
ON-D7
ST-D3
CUK

```
                .
                .
   168          .       OF-D8
                .           .
                .           .
   172          .           .        BASE
                .           .           .
                .           .           .
   177          .           .           .       DUMMY
                .           .           .           .
                .           .           .           .
   182        CUQ.....................................
                .
                .
   185          .       ST-D1
                .           .
                .           .
   189          .           .       ST-D2
                .           .           .
                .           .           .
   193          .         CUP............

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************                                  ****************************************
 *                                      *                                  *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                  *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                                  *    HYDROLOGIC ENGINEERING CENTER     *
 *            VERSION 4.1               *                                  *          609 SECOND STREET           *
 *                                      *                                  *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   20DEC19  TIME  17:12:41  *                                  *           (916) 756-1104             *
 *                                      *                                  *                                      *
 ****************************************                                  ****************************************
```

<><><><><><><><><><><><><><><><><><><><>
SHAUMBER & TROPICAL Pkwy
HYDROLOGIC MODEL

10-YR AND 100-YR STORM EVENT

HORROCKS ENGINEERING
ULTIMATE CONDITION
FILE: ULTIMATE.DAT
PROJECT No: NV-1826-1907
DATE: SEP 16 2019
<><><><><><><><><><><><><><><><><><><><>

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

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

      IT          HYDROGRAPH TIME DATA
                        NMIN           5  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1    0  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE      2    0  ENDING DATE
                      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
                      .55      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
					.55	1.00
HYDROGRAPH AT						
+	OF-D1	.01	1	FLOW	9.	18.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	OF-D2	.01	1	FLOW	12.	23.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	OF-D3	.02	1	FLOW	19.	37.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	OF-D4	.03	1	FLOW	32.	66.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	OF-D5	.00	1	FLOW	4.	9.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	OF-D6	.04	1	FLOW	40.	81.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	OF-D7	.02	1	FLOW	18.	38.
				TIME	3.50	3.50
7 COMBINED AT						
+	CUF	.13	1	FLOW	133.	273.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	OP-D1	.00	1	FLOW	1.	2.
				TIME	3.58	3.50
HYDROGRAPH AT						
+	OP-D2	.00	1	FLOW	1.	3.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	GOAN	.00	1	FLOW	157.	157.
				TIME	.00	.00
HYDROGRAPH AT						
+	DUMMY	.00	1	FLOW	0.	0.
				TIME	.00	.00
5 COMBINED AT						
+	CUG	.13	1	FLOW	291.	435.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	ON-D1	.00	1	FLOW	4.	9.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	ON-D2	.00	1	FLOW	4.	9.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	ON-D3	.00	1	FLOW	3.	6.
				TIME	3.50	3.50
3 COMBINED AT						
+	CUL	.01	1	FLOW	11.	23.
				TIME	3.50	3.50
DIVERSION TO						
+	D1	.01	1	FLOW	6.	11.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DIV1	.01	1	FLOW	5.	12.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	ON-D4	.00	1	FLOW	3.	7.
				TIME	3.50	3.50
2 COMBINED AT						
+	CUM	.01	1	FLOW	8.	19.
				TIME	3.50	3.50

```
 DIVERSION TO
+                     D2       .01     1   FLOW          3.       8.
                                            TIME        3.50     3.50

 HYDROGRAPH AT
+                    DIV2      .01     1   FLOW          5.      11.
                                            TIME        3.50     3.50

 HYDROGRAPH AT
+                   ON-D5      .01     1   FLOW          7.      17.
                                            TIME        3.58     3.58

  2 COMBINED AT
+                     CUH      .02     1   FLOW         12.      28.
                                            TIME        3.50     3.50

  2 COMBINED AT
+                     CUI      .15     1   FLOW        303.     463.
                                            TIME        3.50     3.50

 HYDROGRAPH AT
+                  ON-D1A      .00     1   FLOW          1.       2.
                                            TIME        3.50     3.50

 HYDROGRAPH AT
+                  ON-D2A      .00     1   FLOW          1.       2.
                                            TIME        3.50     3.50

 HYDROGRAPH AT
+                  ON-D3A      .00     1   FLOW          0.       1.
                                            TIME        3.50     3.50

 HYDROGRAPH AT
+                  ON-D4A      .00     1   FLOW          1.       1.
                                            TIME        3.50     3.50

  4 COMBINED AT
+                     CUN      .00     1   FLOW          3.       6.
                                            TIME        3.50     3.50

 HYDROGRAPH AT
+                   ON-D6      .02     1   FLOW         10.      26.
                                            TIME        3.58     3.58

 HYDROGRAPH AT
+                  RETD2       .00     1   FLOW          3.       8.
                                            TIME        3.50     3.50

  3 COMBINED AT
+                     CUJ      .02     1   FLOW         15.      37.
                                            TIME        3.50     3.50

 HYDROGRAPH AT
+                   ON-D7      .00     1   FLOW          1.       3.
                                            TIME        3.50     3.50

 HYDROGRAPH AT
+                   ST-D3      .00     1   FLOW          2.       3.
                                            TIME        3.50     3.50

  4 COMBINED AT
+                     CUK      .18     1   FLOW        320.     506.
                                            TIME        3.50     3.50

 HYDROGRAPH AT
+                   OF-D8      .01     1   FLOW          5.      12.
                                            TIME        3.50     3.50

 HYDROGRAPH AT
+                    BASE      .00     1   FLOW         40.      40.
                                            TIME         .00      .00

 HYDROGRAPH AT
+                   DUMMY      .00     1   FLOW          0.       0.
                                            TIME         .00      .00

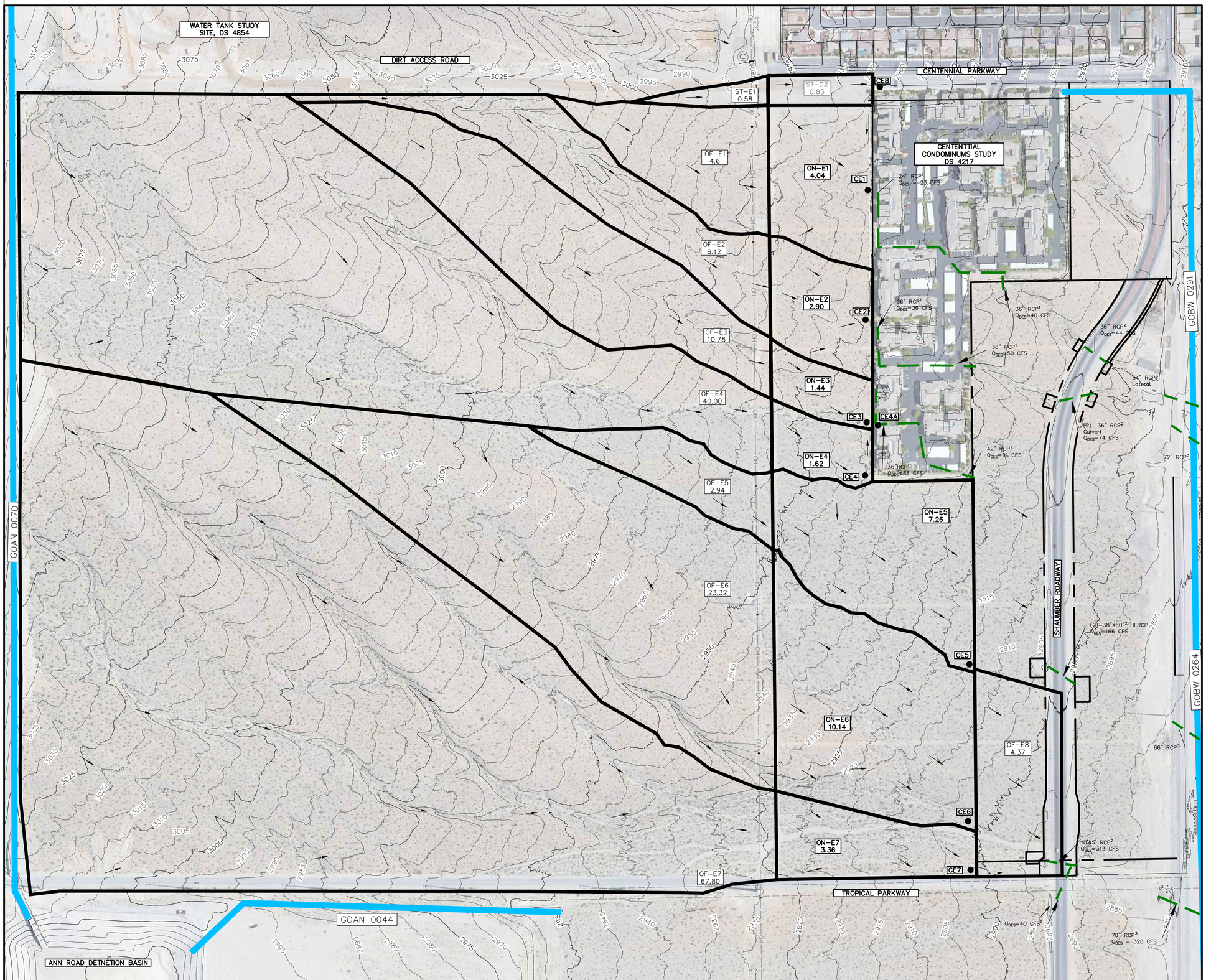
  4 COMBINED AT
+                     CUQ      .18     1   FLOW        365.     558.
                                            TIME        3.50     3.50

 HYDROGRAPH AT
+                   ST-D1      .01     1   FLOW          8.      14.
                                            TIME        3.50     3.50

 HYDROGRAPH AT
+                   ST-D2      .00     1   FLOW          2.       3.
                                            TIME        3.50     3.50

  2 COMBINED AT
+                     CUP      .01     1   FLOW          9.      18.
                                            TIME        3.50     3.50
```

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



EXISTING CONDITION HYDROLOGIC SUMMARY			
Basin	Area (acres)	Q_{10} (cfs)	Q_{100} (cfs)
CE1	-	9	24
CE2	-	10	24
CE3	-	13	32
CE4A	-	44	119
CE4	-	31	87
CE5	-	2	12
CE6	-	18	60
CE7	-	60	162
CE8	-	2	5
OF-E1	4.60	5	13
OF-E2	6.12	7	16
OF-E3	10.78	11	28
OF-E4	40.00	29	83
OF-E5	2.94	<1	2
OF-E6	23.32	16	47
OF-E7	67.8	59	158
OF-E8	4.37	1	5
ON-E1	4.04	4	11
ON-E2	2.90	3	8
ON-E3	1.44	2	4
ON-E4	1.62	2	4
ON-E5	7.26	2	10
ON-E6	10.14	2	12
ON-E7	3.36	1	4
ST-E1	0.58	1	2
ST-D2	0.83	2	3
CE1= OF-E1 + ON-E1			
CE2= OF-E2 + ON-E2			
CE3= OF-E3 + ON-E3			
CE4A = CE3 + CE4			
CE4= OF-E4 + ON-E4			
CE5= OF-E5 + ON-E5			
CE6= OF-E6 + ON-E6			
CE7= OF-E7 + ON-E7			
CE8 = ST-E1 + ST-D2			

NOTES
1. Refereced from the Centennial Condominious Study.
2. Facility size and flows are referenced from Shaumber Road Realignment Study
3. Facility size is referenced from 215 Bruce Woodbury Beltway-Craig Road Study

KEY:

- ON-D1 4.04 — BASIN NAME/AREA
- CE2 — CONCENTRATION POINT
- FLOW DIRECTION
- BASIN BOUNDARY
- EXISTING CCRFCD REG. FAC.
- LOCAL EXISTING FACILITY

SCALE: 1" = 150'

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DRAWING INFO
DATE 09/19/2019
DESIGNED MDP
DRAWN SS
CHECKED LMB
PROJECT NV-1949-1909

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HARMONY HOMES, LLC
CITY OF LAS VEGAS
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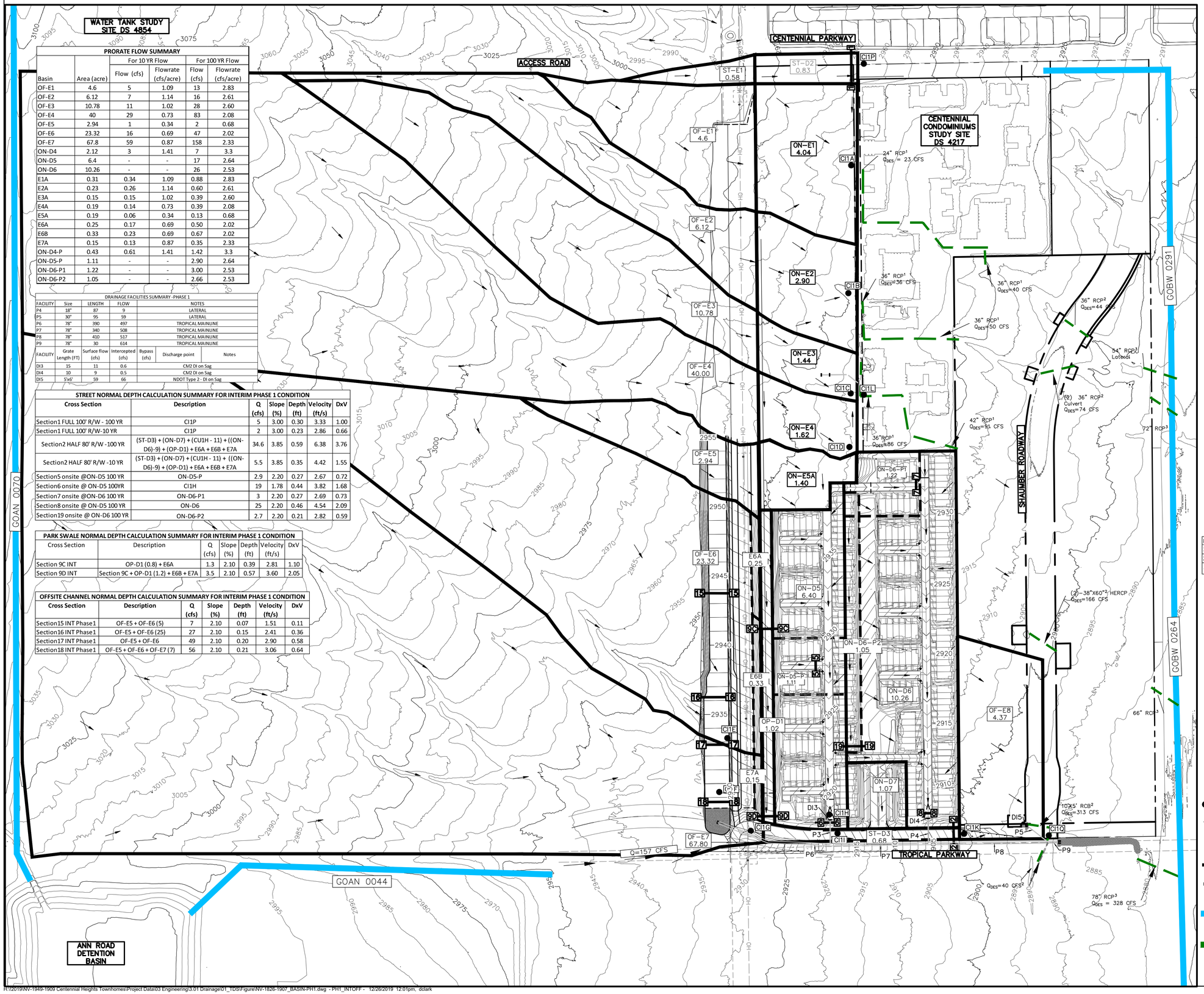
EXISTING OFFSITE CONDITION BASIN MAP

A PORTION OF APN# 126-25-201-010

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PRORATE FLOW SUMMARY

Basin	Area (acre)	For 10 YR Flow: Flow (cfs)	For 10 YR Flow: Flowrate (cfs/acre)	For 100 YR Flow: Flow (cfs)	For 100 YR Flow: Flowrate (cfs/acre)
OF-E1	4.6	5	1.09	13	2.83
OF-E2	6.12	7	1.14	16	2.61
OF-E3	10.78	11	1.02	28	2.60
OF-E4	40	29	0.73	83	2.08
OF-E5	2.94	1	0.34	2	0.68
OF-E6	23.32	16	0.69	47	2.02
OF-E7	67.8	59	0.87	158	2.33
ON-D4	2.12	3	1.41	7	3.3
ON-D5	6.4	-	-	17	2.64
ON-D6	10.26	-	-	26	2.53
E1A	0.31	0.34	1.09	0.88	2.83
E2A	0.23	0.26	1.14	0.60	2.61
E3A	0.15	0.15	1.02	0.39	2.60
E4A	0.19	0.14	0.73	0.39	2.08
E5A	0.19	0.06	0.34	0.13	0.68
E6A	0.25	0.17	0.69	0.50	2.02
E6B	0.33	0.23	0.69	0.67	2.02
E7A	0.15	0.13	0.87	0.35	2.33
ON-D4-P	0.43	0.61	1.41	1.42	3.3
ON-D5-P	1.11	-	-	2.90	2.64
ON-D6-P1	1.22	-	-	3.00	2.53
ON-D6-P2	1.05	-	-	2.66	2.53

DRAINAGE FACILITIES SUMMARY - PHASE 1

FACILITY	Size	LENGTH	FLOW	NOTES
P4	18"	87	9	LATERAL
P5	30"	95	59	LATERAL
P6	78"	390	497	TROPICAL MAINLINE
P7	78"	340	508	TROPICAL MAINLINE
P8	78"	410	517	TROPICAL MAINLINE
P9	78"	30	614	TROPICAL MAINLINE

FACILITY	Grate Length (FT)	Surface flow (cfs)	Intercepted (cfs)	Bypass (cfs)	Discharge point	Notes
DI3	15	11	0.6		CM2 DI on Sag	
DI4	10	9	0.5		CM2 DI on Sag	
DI5	5'x0'	59	66		NDOT Type 2 - DI on Sag	

STREET NORMAL DEPTH CALCULATION SUMMARY FOR INTERIM PHASE 1 CONDITION

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
Section1 FULL 100' R/W - 100 YR	CI1P	5	3.00	0.30	3.33	1.00
Section1 FULL 100' R/W-10 YR	CI1P	2	3.00	0.23	2.86	0.66
Section2 HALF 80' R/W -100 YR	(ST-D3) + (ON-D7) + (CU1H - 11) + ((ON-D6)-9) + (OP-D1) + E6A + E6B + E7A	34.6	3.85	0.59	6.38	3.76
Section2 HALF 80' R/W -10 YR	(ST-D3) + (ON-D7) + (CU1H - 11) + ((ON-D6)-9) + (OP-D1) + E6A + E6B + E7A	5.5	3.85	0.35	4.42	1.55
Section5 onsite @ON-D5 100 YR	ON-D5-P	2.9	2.20	0.27	2.67	0.72
Section6 onsite @ ON-D5 100YR	CI1H	19	1.78	0.44	3.82	1.68
Section7 onsite @ON-D6 100 YR	ON-D6-P1	3	2.20	0.27	2.69	0.73
Section8 onsite @ ON-D5 100 YR	ON-D6	25	2.20	0.46	4.54	2.09
Section19 onsite @ ON-D6 100 YR	ON-D6-P2	2.7	2.20	0.21	2.82	0.59

PARK SWALE NORMAL DEPTH CALCULATION SUMMARY FOR INTERIM PHASE 1 CONDITION

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
Section 9C INT	OP-D1 (0.8) + E6A	1.3	2.10	0.39	2.81	1.10
Section 9D INT	Section 9C + OP-D1 (1.2) + E6B + E7A	3.5	2.10	0.57	3.60	2.05

OFFSITE CHANNEL NORMAL DEPTH CALCULATION SUMMARY FOR INTERIM PHASE 1 CONDITION

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
Section15 INT Phase1	OF-E5 + OF-E6 (5)	7	2.10	0.07	1.51	0.11
Section16 INT Phase1	OF-E5 + OF-E6 (25)	27	2.10	0.15	2.41	0.36
Section17 INT Phase1	OF-E5 + OF-E6	49	2.10	0.20	2.90	0.58
Section18 INT Phase1	OF-E5 + OF-E6 + OF-E7 (7)	56	2.10	0.21	3.06	0.64

PHASE 1 INTERIM CONDITION HYDROLOGIC SUMMARY

Basin	Area (acres)	Q_{10} (cfs)	Q_{100} (cfs)
CI1A	-	9	24
CI1B	-	10	24
CI1C	-	13	32
CI1D	-	31	87
CI1E	-	16	49
CI1F	-	75	207
CI1G	-	232	366
CI1H	-	7	19
CI1I	-	239	384
CI1K	-	251	414
CI1L	-	44	119
CI1P	-	2	5
CI1Q	-	292	459
BASE	-	40	40
GOAN	-	157	157
OF-E1	4.60	5	13
OF-E2	6.12	7	16
OF-E3	10.78	11	28
OF-E4	40.00	29	83
OF-E5	2.94	<1	2
OF-E6	23.32	16	47
OF-E7	67.8	59	158
OF-E8	4.37	1	5
ON-E1	4.04	4	11
ON-E2	2.90	3	8
ON-E3	1.44	2	4
ON-E4	1.62	2	4
ON-D5	6.40	7	17
ON-E5A	1.40	1	3
ON-D6	10.26	10	26
ON-D7	1.07	1	3
OP-D1	1.02	1	2
RTCI1D	-	51	139
ST-D2	0.83	2	3
ST-D3	0.68	2	3
ST-E1	0.58	1	2

CI1A = OF-E1 + ON-E1
CI1B = OF-E2 + ON-E2
CI1C = OF-E3 + ON-E3
CI1D = OF-E4 + ON-E4
CI1E = OF-E5 + OF-E6
CI1F = CI1E + OF-E7
CI1G = CI1F + OP-D1 + GOAN
CI1H = ON-E5A + ON-D5
CI1I = CI1G + CI1H
CI1K = CI1I + ON-D6 + ON-D7 + ST-D3
CI1L = CI1C + CI1D
CI1P = ST-E1 + ST-D2
CI1Q = CI1K + OF-E8 + BASE

NOTES
1. Refereced from the Centennial Condominious Study.
2. Facility size and flows are referenced from Shaumber Road Realignment Study
3. Facility size is referenced from 215 Bruce Woodbury Beltway-Craig Road Study

0 150' 300'
SCALE: 1" = 150'

KEY:

- ON-D1 4.04 — BASIN NAME/AREA
- PRT 0.49 — PRORATE BASIN NAME/AREA
- CI11 — CONCENTRATION POINT
- FLOW DIRECTION
- 4—4 — CROSS SECTION
- BASIN BOUNDARY
- PRORATE BASIN BOUNDARY
- EXISTING CCRFCD REG. FAC.
- LOCAL EXISTING FACILITY

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DATE 09/19/2019
DESIGNED MDP
DRAWN SS
CHECKED LMB
PROJECT NV-1949-1909

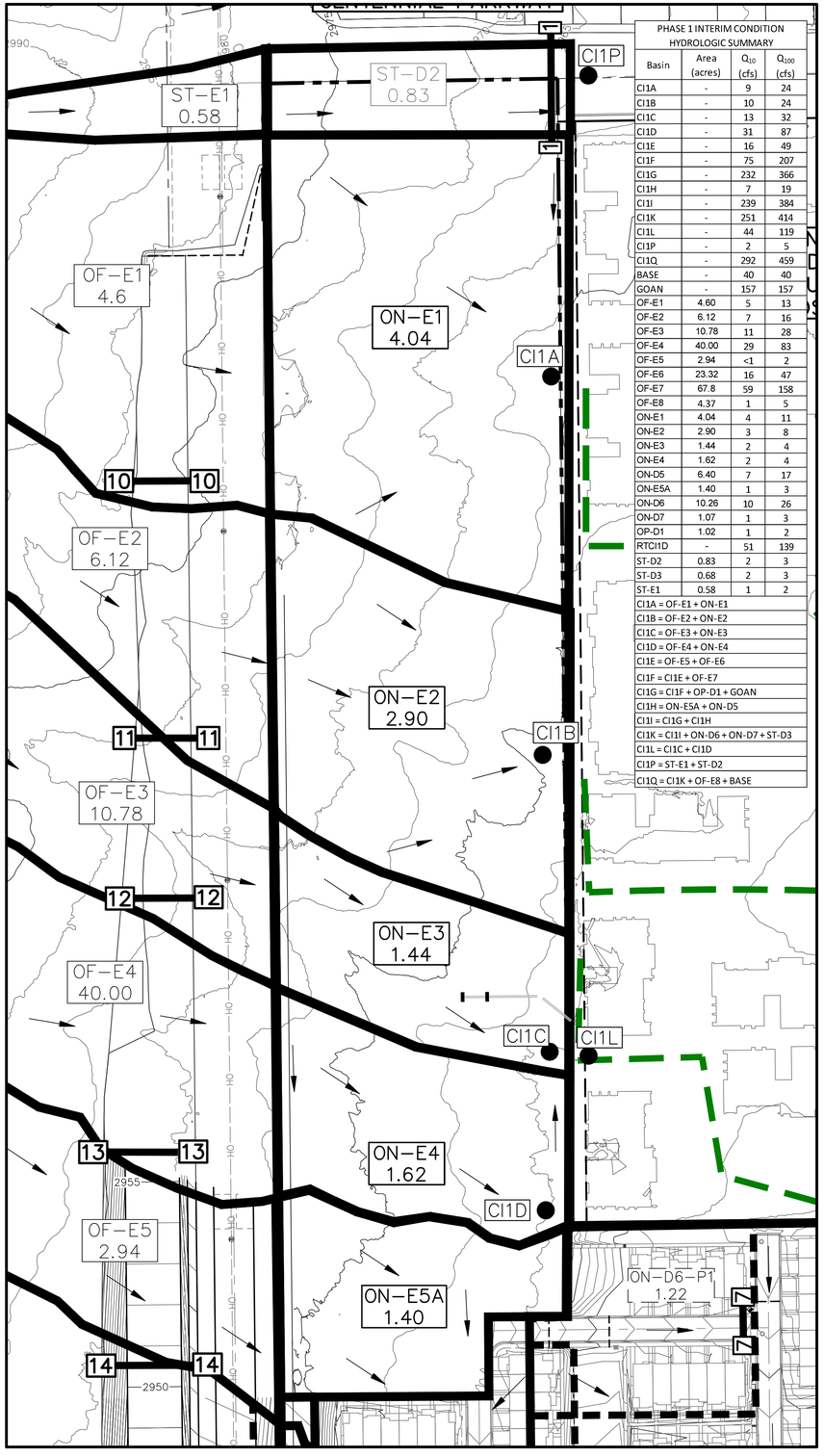
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CITY OF LAS VEGAS
NEVADA

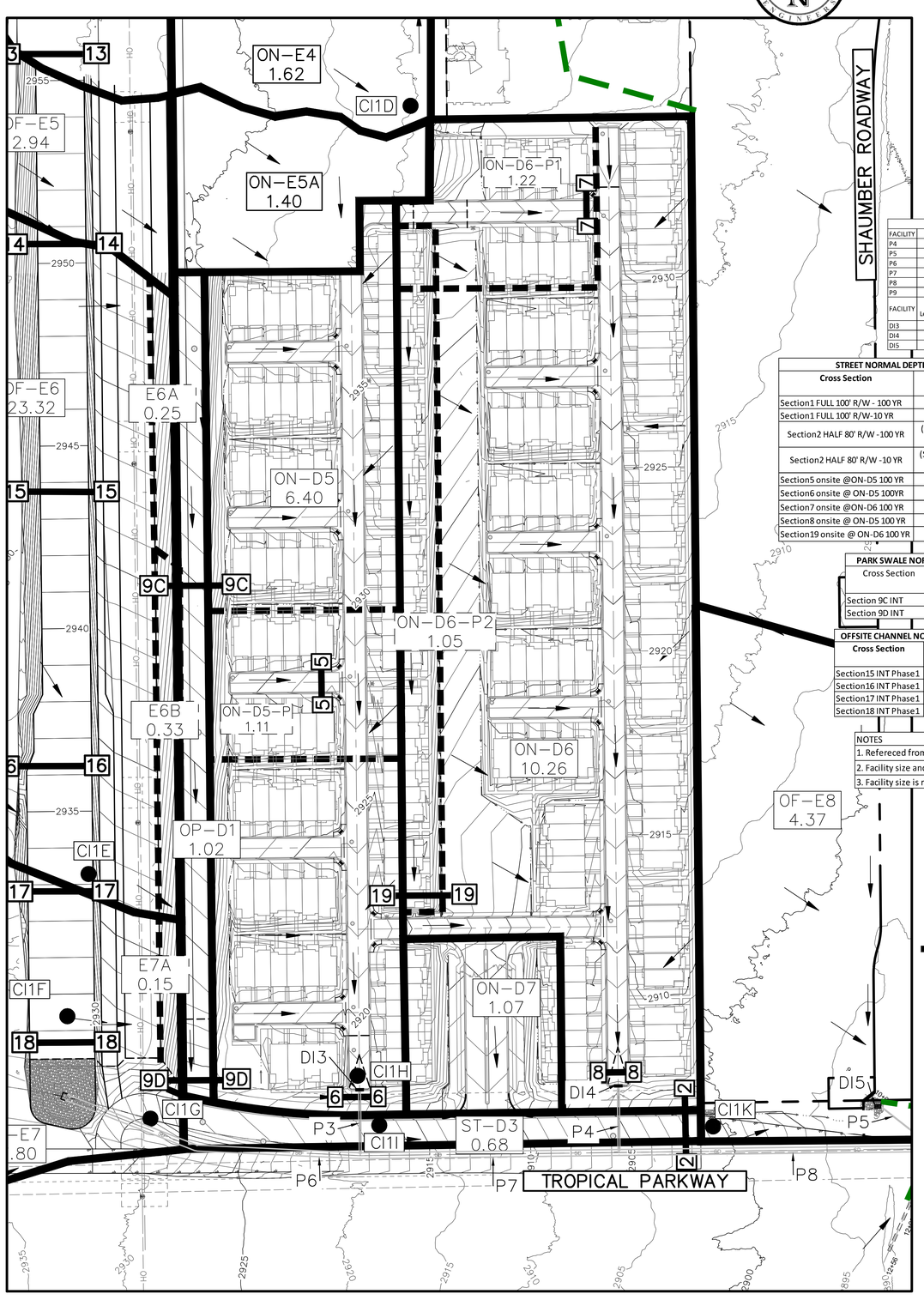
PHASE 1 INTERIM CONDITION OFFSITE BASIN MAP

A PORTION OF APN# 126-25-201-010

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PHASE 1 INTERIM CONDITION HYDROLOGIC SUMMARY			
Basin	Area (acres)	Q_{10} (cfs)	Q_{100} (cfs)
CI1A	-	9	24
CI1B	-	10	24
CI1C	-	13	32
CI1D	-	31	87
CI1E	-	16	49
CI1F	-	75	207
CI1G	-	232	366
CI1H	-	7	19
CI1I	-	239	384
CI1K	-	251	414
CI1L	-	44	119
CI1P	-	2	5
CI1Q	-	292	459
BASE	-	40	40
GOAN	-	157	157
OF-E1	4.60	5	13
OF-E2	6.12	7	16
OF-E3	10.78	11	28
OF-E4	40.00	29	83
OF-E5	2.94	<1	2
OF-E6	23.32	16	47
OF-E7	67.8	59	158
OF-E8	4.37	1	5
ON-E1	4.04	4	11
ON-E2	2.90	3	8
ON-E3	1.44	2	4
ON-E4	1.62	2	4
ON-D5	6.40	7	17
ON-E5A	1.40	1	3
ON-D6	10.26	10	26
ON-D7	1.07	1	3
OP-D1	1.02	1	2
RTCI1D	-	51	139
ST-D2	0.83	2	3
ST-D3	0.68	2	3
ST-E1	0.58	1	2

CI1A = OF-E1 + ON-E1
CI1B = OF-E2 + ON-E2
CI1C = OF-E3 + ON-E3
CI1D = OF-E4 + ON-E4
CI1E = OF-E5 + OF-E6
CI1F = CI1E + OF-E7
CI1G = CI1F + OP-D1 + GOAN
CI1H = ON-E5A + ON-D5
CI1I = CI1G + CI1H
CI1K = CI1I + ON-D6 + ON-D7 + ST-D3
CI1L = CI1C + CI1D
CI1P = ST-E1 + ST-D2
CI1Q = CI1K + OF-E8 + BASE

0 80' 160'
SCALE: 1" = 80'

PRORATE FLOW SUMMARY					
		For 10 YR Flow		For 100 YR Flow	
Basin	Area (acre)	Flow (cfs)	Flowrate (cfs/acre)	Flow (cfs)	Flowrate (cfs/acre)
OF-E1	4.6	5	1.09	13	2.83
OF-E2	6.12	7	1.14	16	2.61
OF-E3	10.78	11	1.02	28	2.60
OF-E4	40	29	0.73	83	2.08
OF-E5	2.94	1	0.34	2	0.68
OF-E6	23.32	16	0.69	47	2.02
OF-E7	67.8	59	0.87	158	2.33
ON-D4	2.12	3	1.41	7	3.3
ON-D5	6.4	-	-	17	2.64
ON-D6	10.26	-	-	26	2.53
E1A	0.31	0.34	1.09	0.88	2.83
E2A	0.23	0.26	1.14	0.60	2.61
E3A	0.15	0.15	1.02	0.39	2.60
E4A	0.19	0.14	0.73	0.39	2.08
E5A	0.19	0.06	0.34	0.13	0.68
E6A	0.25	0.17	0.69	0.50	2.02
E6B	0.33	0.23	0.69	0.67	2.02
E7A	0.15	0.13	0.87	0.35	2.33
ON-D4-P	0.43	0.61	1.41	1.42	3.3
ON-D5-P	1.11	-	-	2.90	2.64
ON-D6-P1	1.22	-	-	3.00	2.53
ON-D6-P2	1.05	-	-	2.66	2.53

DRAINAGE FACILITIES SUMMARY -PHASE 1				
FACILITY	Size	LENGTH	FLOW	NOTES
P4	18"	87	9	LATERAL
P5	30"	95	59	LATERAL
P6	78"	390	497	TROPICAL MAINLINE
P7	78"	340	508	TROPICAL MAINLINE
P8	78"	410	517	TROPICAL MAINLINE
P9	78"	30	614	TROPICAL MAINLINE

FACILITY	Grate Length (FT)	Surface flow (cfs)	Intercepted (cfs)	Bypass (cfs)	Discharge point	Notes
DI3	15	11	0.6			CM2 DI on Sag
DI4	10	9	0.5			CM2 DI on Sag
DI5	5'x6'	59	66			NDOT Type 2 - DI on Sag

STREET NORMAL DEPTH CALCULATION SUMMARY FOR INTERIM PHASE 1 CONDITION

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
Section1 FULL 100' R/W - 100 YR	CI1P	5	3.00	0.30	3.33	1.00
Section1 FULL 100' R/W-10 YR	CI1P	2	3.00	0.23	2.86	0.66
Section2 HALF 80' R/W -100 YR	(ST-D3) + (ON-D7) + (CU1H - 11) + ((ON-D6)-9) + (OP-D1) + E6A + E6B + E7A	34.6	3.85	0.59	6.38	3.76
Section2 HALF 80' R/W -10 YR	(ST-D3) + (ON-D7) + (CU1H - 11) + ((ON-D6)-9) + (OP-D1) + E6A + E6B + E7A	5.5	3.85	0.35	4.42	1.55
Section5 onsite @ON-D5 100 YR	ON-D5-P	2.9	2.20	0.27	2.67	0.72
Section6 onsite @ ON-D5 100YR	CI1H	19	1.78	0.44	3.82	1.68
Section7 onsite @ON-D6 100 YR	ON-D6-P1	3	2.20	0.27	2.69	0.73
Section8 onsite @ ON-D5 100 YR	ON-D6	25	2.20	0.46	4.54	2.09
Section19 onsite @ ON-D6 100 YR	ON-D6-P2	2.7	2.20	0.21	2.82	0.59

PARK SWALE NORMAL DEPTH CALCULATION SUMMARY FOR INTERIM PHASE 1 CONDITION

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
Section 9C INT	OP-D1 (0.8) + E6A	1.3	2.10	0.39	2.81	1.10
Section 9D INT	Section 9C + OP-D1 (1.2) + E6B + E7A	3.5	2.10	0.57	3.60	2.05

OFFSITE CHANNEL NORMAL DEPTH CALCULATION SUMMARY FOR INTERIM PHASE 1 CONDITION

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
Section15 INT Phase1	OF-E5 + OF-E6 (5)	7	2.10	0.07	1.51	0.11
Section16 INT Phase1	OF-E5 + OF-E6 (25)	27	2.10	0.15	2.41	0.36
Section17 INT Phase1	OF-E5 + OF-E6	49	2.10	0.20	2.90	0.58
Section18 INT Phase1	OF-E5 + OF-E6 + OF-E7 (7)	56	2.10	0.21	3.06	0.64

NOTES
1. Refereced from the Centennial Condominious Study.
2. Facility size and flows are referenced from Shaumber Road Realignment Study
3. Facility size is referenced from 215 Bruce Woodbury Beltway-Craig Road Study

KEY:

- ON-D1 / 4.04 — BASIN NAME/AREA
- PR1 / 0.49 — PRORATE BASIN NAME/AREA
- CI11 — CONCENTRATION POINT
- FLOW DIRECTION
- 4 — 4 — CROSS SECTION
- BASIN BOUNDARY
- PRORATE BASIN BOUNDARY
- EXISTING CCRFCD REG. FAC.
- LOCAL EXISTING FACILITY

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PHASE 1 INTERIM CONDITION ONSITE BASIN MAP

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PHASE 2 INTERIM CONDITION HYDROLOGIC SUMMARY			
Basin	Area (acres)	Q_{10} (cfs)	Q_{100} (cfs)
CI2A	-	11	28
CI2B	-	23	56
CI2C	-	52	139
CI2D	-	52	140
CI2E	-	66	186
CI2F	-	125	344
CI2G	-	284	506
CI2H	-	12	28
CI2I	-	292	531
CI2J	-	15	37
CI2K	-	309	569
CI2L	-	11	23
CI2M	-	8	19
CI2N	-	3	6
CI2P	-	2	5
CI2Q	-	349	614
D1*	-	6	11
D2*	-	3	8
DIV1	-	5	12
DIV2	-	5	11
BASE	-	40	40
GOAN	-	157	157
OF-E1	4.60	5	13
OF-E2	6.12	7	16
OF-E3	10.78	11	28
OF-E4	40.00	29	83
OF-E5	2.94	<1	2
OF-E6	23.32	16	47
OF-E7	67.8	59	158
OF-E8	4.37	1	5
ON-D1	2.34	4	9
ON-D1A	0.56	1	2
ON-D2	2.38	4	9
ON-D2A	0.48	1	2
ON-D3	1.53	3	6
ON-D3A	0.27	<1	1
ON-D4	2.12	3	7
ON-D4A	0.34	1	1
ON-D5	6.40	7	17
ON-D6	10.26	10	26
ON-D7	1.07	1	3
OP-D1	1.02	1	2
OP-D2	1.37	1	3
RTCI2D	-	51	139
ST-D2	0.83	2	3
ST-D3	0.68	2	3
ST-E1	0.58	1	2

CI2A = OF-E1 + OF-E2
CI2B = CI2A + OF-E3
CI2C = CI2B + OF-E4
CI2D = CI2C + OF-E5
CI2E = RTCI2D + OF-E6
CI2F = CI2E + OF-E7
CI2G = CI2F + OP-D1 + OP-D2 + GOAN
CI2H = DIV2 + ON-D5
CI2I = CI2G + CI2H
CI2J = CI2N + ON-D6 + D2
CI2K = CI2I + CI2J + ON-D7 + ST-D3
CI2L = ON-D1 + ON-D2 + ON-D3
CI2M = DIV1 + ON-D4
CI2N = ON-D1A + ON-D2A + ON-D3A + ON-D4A
CI2P = ST-E1 + ST-D2
CI2Q = CI2K + OF-E8 + BASE
DIV1 = CI2L - D1
DIV2 = CI2M - D2

PRORATE FLOW SUMMARY					
		For 10 YR Flow		or 100 YR Flo	
Basin	Area (acre)	Flow (cfs)	Flowrate (cfs/acre)	Flow (cfs)	Flo wrat
OF-E1	4.6	5	1.09	13	2.83
OF-E2	6.12	7	1.14	16	2.61
OF-E3	10.78	11	1.02	28	2.60
OF-E4	40	29	0.73	83	2.08
OF-E5	2.94	1	0.34	2	0.68
OF-E6	23.32	16	0.69	47	2.02
OF-E7	67.8	59	0.87	158	2.33
ON-D4	2.12	3	1.41	7	3.3
ON-D5	6.4	-	-	17	2.64
ON-D6	10.26	-	-	26	2.53
E1A	0.31	0.34	1.09	0.88	2.83
E2A	0.23	0.26	1.14	0.60	2.61
E3A	0.15	0.15	1.02	0.39	2.60
E4A	0.19	0.14	0.73	0.39	2.08
E5A	0.19	0.06	0.34	0.13	0.68
E6A	0.25	0.17	0.69	0.50	2.02
E6B	0.33	0.23	0.69	0.67	2.02
E7A	0.15	0.13	0.87	0.35	2.33
ON-D4-P	0.43	0.61	1.41	1.42	3.3
ON-D5-P	1.11	-	-	2.90	2.64
ON-D6-P1	1.22	-	-	3.00	2.53
ON-D6-P2	1.05	-	-	2.66	2.53

DRAINAGE FACILITIES SUMMARY -PHASE 2				
FACILITY	Size	LENGTH	FLOW	NOTES
P1	18"	30	5	-
P2	18"	105	10	-
P3	18"	86	11	LATERAL
P4	18"	87	9	LATERAL
P5	30"	95	59	LATERAL
P6	78"	390	497	TROPICAL MAINLINE
P7	78"	340	508	TROPICAL MAINLINE
P8	78"	410	517	TROPICAL MAINLINE
P9	78"	30	614	TROPICAL MAINLINE

FACILITY	Grate Length (FT)	Surface flow (cfs)	Intercepted (cfs)	Bypass (cfs)	Discharge point	Notes
DI1	10	12	5	7	Condos south	CM2 DI on Grate for Q_{100}
DI2	10	11	5	6	Condos south	CM2 DI on Grate for Q_{100}
DI1	10	6	3	3	Condos south	CM2 DI on Grate for Q_{10}
DI2	10	5	3	2	Condos south	CM2 DI on Grate for Q_{10}
DI3	15	11	0.6		CM2 DI on Sag	
DI4	10	9	0.5		CM2 DI on Sag	
DI5	5'x6'	59	66		NDOT Type 2 - DI on Sag	

STREET NORMAL DEPTH CALCULATION SUMMARY FOR INTERIM PHASE 2 CONDITION

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
Section1 FULL 100' R/W - 100 YR	CI2P	5	3.00	0.30	3.33	1.00
Section1 FULL 100' R/W -10 YR	CI2P	2	3.00	0.23	2.86	0.66
Section2 HALF 80' R/W -100 YR	(ST-D3) + (ON-D7) + (CI2H - 11) + (CI2J - 9) + (OP-D1) + (OP-D2) + E1A + E2A + E3A + E4A + E5A + E6A + E6B + E7A	59.9	3.85	0.68	7.43	5.05
Section2 HALF 80' R/W -10 YR	(ST-D3) + (ON-D7) + (CI2H - 11) + (CI2J - 9) + (OP-D1) + (OP-D2) + E1A + E2A + E3A + E4A + E5A + E6A + E6B + E7A	13.8	3.85	0.45	5.46	2.46
Section3 onsite @ ON-D3 10 YR	CI2L	11	2.20	0.37	3.53	1.31
Section3 onsite @ ON-D3 100 YR	CI2L	23	2.20	0.45	4.39	1.98
Section4 HALF EAST onsite @ ON-D4 100 YR	D2	8	2.20	0.41	3.85	1.58
Section5 onsite @ON-D5 100 YR	ON-D5-P	2.9	2.20	0.27	2.67	0.72
Section6 onsite @ ON-D5 100YR	CI2H	28	1.78	0.48	4.46	2.14
Section7 onsite @ON-D6 100 YR	D2 + CI2N + ON-D6-P1	17	2.20	0.42	3.91	1.64
Section8 onsite @ ON-D5 100 YR	CI2J	37	2.20	0.51	5.31	2.71
Section19 onsite @ ON-D6 100 YR	ON-D6-P2	2.7	2.20	0.21	2.82	0.59

PARK SWALE NORMAL DEPTH CALCULATION SUMMARY FOR INTERIM PHASE 2 CONDITION

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
Section 9A INT	OP-D2 (1.6) + E1A + E2A	3.1	2.98	0.51	3.98	2.03
Section 9B INT	Section 9A + OP-D2 (1.4) + E3A + E4A	5.3	1.42	0.72	3.45	2.48
Section 9C INT	Section 9B + OP-D1 (0.8) + E5A + E6A	6.7	2.10	0.73	4.23	3.09
Section 9D INT	Section 9C + OP-D1 (1.2) + E6B + E7A	8.9	2.10	0.81	4.54	3.68

OFFSITE CHANNEL NORMAL DEPTH CALCULATION SUMMARY FOR INTERIM PHASE 2 CONDITION

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
Section10:INT Phase2	OF-E1	13	2.10	0.19	2.79	0.53
Section11:INT Phase2	CI2A	28	2.10	0.30	3.76	1.13
Section12:INT Phase2	CI2B	56	2.10	0.45	4.88	2.20
Section13:INT Phase2	CI2C	139	2.10	0.44	4.91	2.16
Section14:INT Phase2	CI2D	140	2.10	0.44	4.92	2.16
Section15:INT Phase2	CI2D + OF-E6 (5)	145	2.10	0.45	4.99	2.25
Section16:INT Phase2	CI2D + OF-E6 (25)	165	2.10	0.44	4.92	2.16
Section17:INT Phase2	CI2E	186	2.10	0.44	4.91	2.16
Section18:INT Phase2	CI2E + OF-E7 (7)	193	2.10	0.45	4.99	2.25

NOTES
1. Refereced from the Centennial Condominious Study.
2. Facility size and flows are referenced from Shaumber Road Realignment Study
3. Facility size is referenced from 215 Bruce Woodbury Beltway-Craig Road Study
4. D1* is the sum of flow captured by drop inlets DI-1W and DI-1E in street H
5. D2* is Sum of DI-1E bypass flow and flow contributed by east side of ON-D4 in street H

KEY:

- ON-D1 / 4.04 — BASIN NAME/AREA
- PR1 / 0.49 — PRORATE BASIN NAME/AREA
- CI2 — CONCENTRATION POINT
- FLOW DIRECTION
- 4—4 — CROSS SECTION
- BASIN BOUNDARY
- PRORATE BASIN BOUNDARY
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PHASE 2 INTERIM CONDITION ONSITE BASIN MAP

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WATER TANK STUDY
SITE: DS 4854

PRORATE FLOW SUMMARY

Basin	Area (acre)	For 10 YR Flow: Flow (cfs)	For 10 YR Flow: Flowrate (cfs/acre)	For 100 YR Flow: Flow (cfs)	For 100 YR Flow: Flowrate
OF-E1	4.6	5	1.09	13	2.83
OF-E2	6.12	7	1.14	16	2.61
OF-E3	10.78	11	1.02	28	2.60
OF-E4	40	29	0.73	83	2.08
OF-E5	2.94	1	0.34	2	0.68
OF-E6	23.32	16	0.69	47	2.02
OF-E7	67.8	59	0.87	158	2.33
ON-D4	2.12	3	1.41	7	3.3
ON-D5	6.4	-	-	17	2.64
ON-D6	10.26	-	-	26	2.53
E1A	0.31	0.34	1.09	0.88	2.83
E2A	0.23	0.26	1.14	0.60	2.61
E3A	0.15	0.15	1.02	0.39	2.60
E4A	0.19	0.14	0.73	0.39	2.08
E5A	0.19	0.06	0.34	0.13	0.68
E6A	0.25	0.17	0.69	0.50	2.02
E6B	0.33	0.23	0.69	0.67	2.02
E7A	0.15	0.13	0.87	0.35	2.33
ON-D4-P	0.43	0.61	1.41	1.42	3.3
ON-D5-P	1.11	-	-	2.90	2.64
ON-D6-P1	1.22	-	-	3.00	2.53
ON-D6-P2	1.05	-	-	2.66	2.53

DRAINAGE FACILITIES SUMMARY -PHASE 2

FACILITY	Size	LENGTH	FLOW	NOTES
P1	18"	30	5	-
P2	18"	105	10	-
P3	18"	86	11	LATERAL
P4	18"	87	9	LATERAL
P5	30"	95	59	LATERAL
P6	78"	390	497	TROPICAL MAINLINE
P7	78"	340	508	TROPICAL MAINLINE
P8	78"	410	517	TROPICAL MAINLINE
P9	78"	30	614	TROPICAL MAINLINE

FACILITY	Grate Length (FT)	Surface flow (cfs)	Intercepted (cfs)	Bypass (cfs)	Discharge point	Notes
DI1	10	12	5	7	Condos south	CM2 DI on Grate for Q_{100}
DI2	10	11	5	6	Condos south	CM2 DI on Grate for Q_{100}
DI1	10	6	3	3	Condos south	CM2 DI on Grate for Q_{10}
DI2	10	5	3	2	Condos south	CM2 DI on Grate for Q_{10}
DI3	15	11	0.6		CM2 DI on Sag	
DI4	10	9	0.5		CM2 DI on Sag	
DI5	5'x6'	59	66		NDOT Type 2 - DI on Sag	

STREET NORMAL DEPTH CALCULATION SUMMARY FOR INTERIM PHASE 2 CONDITION

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
Section1 FULL 100' R/W - 100 YR	CI2P	5	3.00	0.30	3.33	1.00
Section1 FULL 100' R/W-10 YR	CI2P	2	3.00	0.23	2.86	0.66
Section2 HALF 80' R/W -100 YR	(ST-D3) + (ON-D7) + (CI2H - 11) + (CI2J - 9) + (OP-D1) + (OP-D2) + E1A + E2A + E3A + E4A + E5A + E6A + E6B + E7A	59.9	3.85	0.68	7.43	5.05
Section2 HALF 80' R/W -10 YR	(ST-D3) + (ON-D7) + (CI2H - 11) + (CI2J - 9) + (OP-D1) + (OP-D2) + E1A + E2A + E3A + E4A + E5A + E6A + E6B + E7A	13.8	3.85	0.45	5.46	2.46
Section3 onsite @ ON-D3 10 YR	CI2L	11	2.20	0.37	3.53	1.31
Section3 onsite @ ON-D3 100 YR	CI2L	23	2.20	0.45	4.39	1.98
Section4 HALF EAST onsite @ ON-D4 100 YR	D2	8	2.20	0.41	3.85	1.58
Section5 onsite @ON-D5 100 YR	ON-D5-P	2.9	2.20	0.27	2.67	0.72
Section6 onsite @ ON-D5 100YR	CI2H	28	1.78	0.48	4.46	2.14
Section7 onsite @ON-D6 100 YR	D2 + CI2N + ON-D6-P1	17	2.20	0.42	3.91	1.64
Section8 onsite @ ON-D5 100 YR	CI2J	37	2.20	0.51	5.31	2.71
Section19 onsite @ ON-D6 100 YR	ON-D6-P2	2.7	2.20	0.21	2.82	0.59

PARK SWALE NORMAL DEPTH CALCULATION SUMMARY FOR INTERIM PHASE 2 CONDITION

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
Section 9A INT	OP-D2 (1.6) + E1A + E2A	3.1	2.98	0.51	3.98	2.03
Section 9B INT	Section 9A + OP-D2 (1.4) + E3A + E4A	5.3	1.42	0.72	3.45	2.48
Section 9C INT	Section 9B + OP-D1 (0.8) + E5A + E6A	6.7	2.10	0.73	4.23	3.09
Section 9D INT	Section 9C + OP-D1 (1.2) + E6B + E7A	8.9	2.10	0.81	4.54	3.68

OFFSITE CHANNEL NORMAL DEPTH CALCULATION SUMMARY FOR INTERIM PHASE 2 CONDITION

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
Section10 INT Phase2	OF-E1	13	2.10	0.19	2.79	0.53
Section11 INT Phase2	CI2A	28	2.10	0.30	3.76	1.13
Section12 INT Phase2	CI2B	56	2.10	0.45	4.88	2.20
Section13 INT Phase2	CI2C	139	2.10	0.44	4.91	2.16
Section14 INT Phase2	CI2D	140	2.10	0.44	4.92	2.16
Section15 INT Phase2	CI2D + OF-E6 (5)	145	2.10	0.45	4.99	2.25
Section16 INT Phase2	CI2D + OF-E6 (25)	165	2.10	0.44	4.92	2.16
Section17 INT Phase2	CI2E	186	2.10	0.44	4.91	2.16
Section18 INT Phase2	CI2E + OF-E7 (7)	193	2.10	0.45	4.99	2.25

PHASE 2 INTERIM CONDITION HYDROLOGIC SUMMARY

Basin	Area (acres)	Q_{10} (cfs)	Q_{100} (cfs)
CI2A	-	11	28
CI2B	-	23	56
CI2C	-	52	139
CI2D	-	52	140
CI2E	-	66	186
CI2F	-	125	344
CI2G	-	284	506
CI2H	-	12	28
CI2I	-	292	531
CI2J	-	15	37
CI2K	-	309	569
CI2L	-	11	23
CI2M	-	8	19
CI2N	-	3	6
CI2P	-	2	5
CI2Q	-	349	614
D1*	-	6	11
D2*	-	3	8
DIV1	-	5	12
DIV2	-	5	11
BASE	-	40	40
GOAN	-	157	157
OF-E1	4.60	5	13
OF-E2	6.12	7	16
OF-E3	10.78	11	28
OF-E4	40.00	29	83
OF-E5	2.94	<1	2
OF-E6	23.32	16	47
OF-E7	67.8	59	158
OF-E8	4.37	1	5
ON-D1	2.34	4	9
ON-D1A	0.56	1	2
ON-D2	2.38	4	9
ON-D2A	0.48	1	2
ON-D3	1.53	3	6
ON-D3A	0.27	<1	1
ON-D4	2.12	3	7
ON-D4A	0.34	1	1
ON-D5	6.40	7	17
ON-D6	10.26	10	26
ON-D7	1.07	1	3
OP-D1	1.02	1	2
OP-D2	1.37	1	3
RTCI2D	-	51	139
ST-D2	0.83	2	3
ST-D3	0.68	2	3
ST-E1	0.58	1	2

CI2A = OF-E1 + OF-E2
CI2B = CI2A + OF-E3
CI2C = CI2B + OF-E4
CI2D = CI2C + OF-E5
CI2E = RTCI2D + OF-E6
CI2F = CI2E + OF-E7
CI2G = CI2F + OP-D1 + OP-D2 + GOAN
CI2H = DIV2 + ON-D5
CI2J = CI2G + CI2H
CI2J = CI2N + ON-D6 + D2
CI2K = CI2I + CI2J + ON-D7 + ST-D3
CI2L = ON-D1 + ON-D2 + ON-D3
CI2M = DIV1 + ON-D4
CI2N = ON-D1A + ON-D2A + ON-D3A + ON-D4A
CI2P = ST-E1 + ST-D2
CI2Q = CI2K + OF-E8 + BASE
DIV1 = CI2L - D1
DIV2 = CI2M - D2

NOTES
1. Refereced from the Centennial Condominious Study.
2. Facility size and flows are referenced from Shaumber Road Realignment Study
3. Facility size is referenced from 215 Bruce Woodbury Beltway-Craig Road Study.
4. D1* is the sum of flow captured by drop inlets DI-1W and DI-1E in street H
5. D2* is Sum of DI-1E bypass flow and flow contributed by east side of ON-D4 in street H

KEY:

- ON-D1 4.04 — BASIN NAME/AREA
- PR1 0.49 — PRORATE BASIN NAME/AREA
- CI2 — CONCENTRATION POINT
- FLOW DIRECTION
- 4—4 — CROSS SECTION
- BASIN BOUNDARY
- PRORATE BASIN BOUNDARY
- EXISTING CCRFCD REG. FAC.
- LOCAL EXISTING FACILITY

SCALE: 1" = 150'

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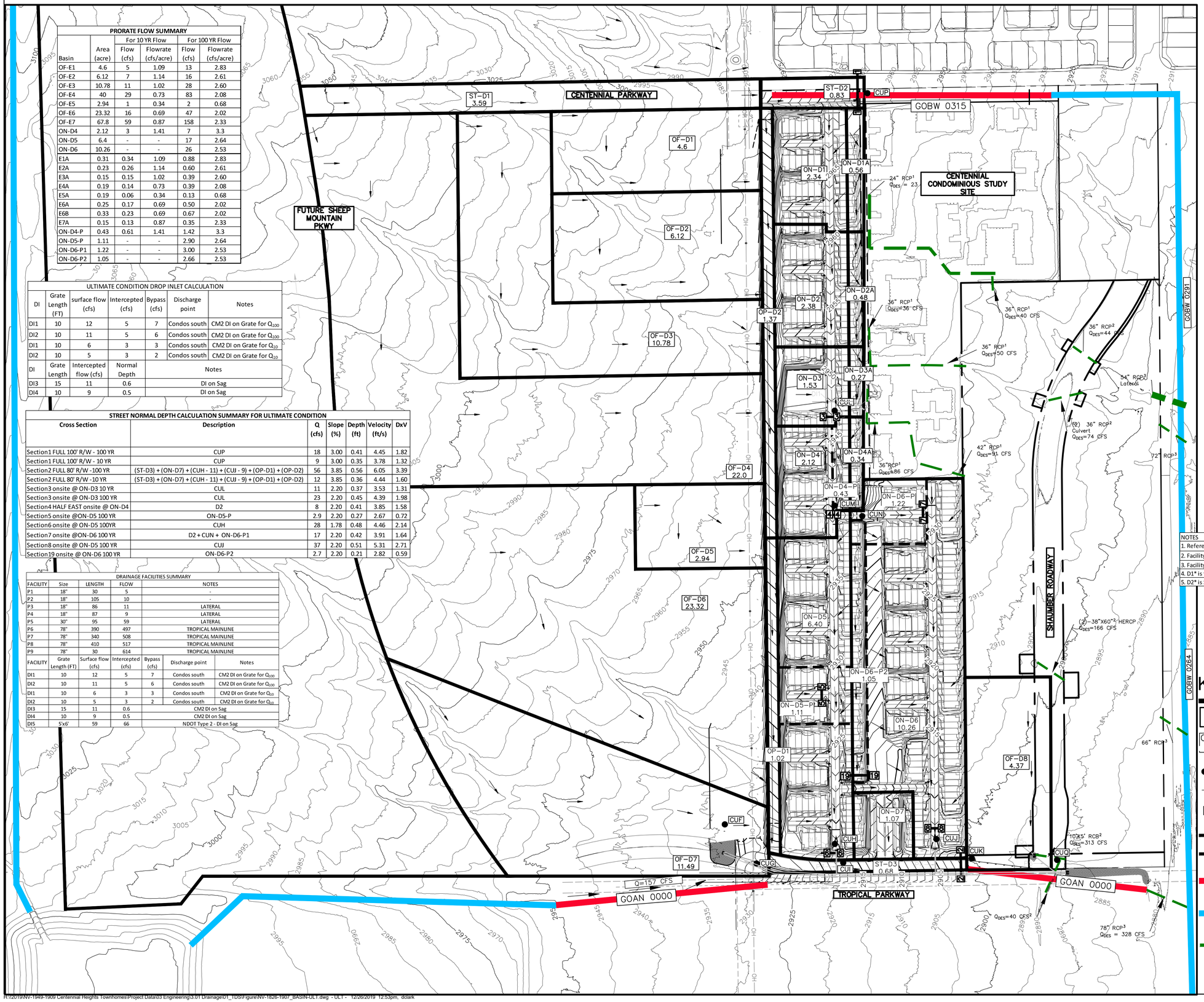
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PHASE 2 INTERIM CONDITION OFFSITE BASIN MAP
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PRORATE FLOW SUMMARY

Basin	Area (acre)	For 10 YR Flow: Flow (cfs)	For 10 YR Flow: Flowrate (cfs/acre)	For 100 YR Flow: Flow (cfs)	For 100 YR Flow: Flowrate (cfs/acre)
OF-E1	4.6	5	1.09	13	2.83
OF-E2	6.12	7	1.14	16	2.61
OF-E3	10.78	11	1.02	28	2.60
OF-E4	40	29	0.73	83	2.08
OF-E5	2.94	1	0.34	2	0.68
OF-E6	23.32	16	0.69	47	2.02
OF-E7	67.8	59	0.87	158	2.33
ON-D4	2.12	3	1.41	7	3.3
ON-D5	6.4	-	-	17	2.64
ON-D6	10.26	-	-	26	2.53
E1A	0.31	0.34	1.09	0.88	2.83
E2A	0.23	0.26	1.14	0.60	2.61
E3A	0.15	0.15	1.02	0.39	2.60
E4A	0.19	0.14	0.73	0.39	2.08
E5A	0.19	0.06	0.34	0.13	0.68
E6A	0.25	0.17	0.69	0.50	2.02
E6B	0.33	0.23	0.69	0.67	2.02
E7A	0.15	0.13	0.87	0.35	2.33
ON-D4-P	0.43	0.61	1.41	1.42	3.3
ON-D5-P	1.11	-	-	2.90	2.64
ON-D6-P1	1.22	-	-	3.00	2.53
ON-D6-P2	1.05	-	-	2.66	2.53

ULTIMATE CONDITION DROP INLET CALCULATION

DI	Grate Length (FT)	surface flow (cfs)	Intercepted (cfs)	Bypass (cfs)	Discharge point	Notes
DI1	10	12	5	7	Condos south	CM2 DI on Grate for Q_{100}
DI2	10	11	5	6	Condos south	CM2 DI on Grate for Q_{100}
DI1	10	6	3	3	Condos south	CM2 DI on Grate for Q_{10}
DI2	10	5	3	2	Condos south	CM2 DI on Grate for Q_{10}
DI	Grate Length	Intercepted flow (cfs)	Normal Depth	Notes		
DI3	15	11	0.6	DI on Sag		
DI4	10	9	0.5	DI on Sag		

STREET NORMAL DEPTH CALCULATION SUMMARY FOR ULTIMATE CONDITION

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
Section1 FULL 100' R/W - 100 YR	CUP	18	3.00	0.41	4.45	1.82
Section1 FULL 100' R/W - 10 YR	CUP	9	3.00	0.35	3.78	1.32
Section2 FULL 80' R/W -100 YR	(ST-D3) + (ON-D7) + (CUH - 11) + (CUI - 9) + (OP-D1) + (OP-D2)	56	3.85	0.56	6.05	3.39
Section2 FULL 80' R/W -10 YR	(ST-D3) + (ON-D7) + (CUH - 11) + (CUI - 9) + (OP-D1) + (OP-D2)	12	3.85	0.36	4.44	1.60
Section3 onsite @ ON-D3 10 YR	CUL	11	2.20	0.37	3.53	1.31
Section3 onsite @ ON-D3 100 YR	CUL	23	2.20	0.45	4.39	1.98
Section4 HALF EAST onsite @ ON-D4	D2	8	2.20	0.41	3.85	1.58
Section5 onsite @ON-D5 100 YR	ON-D5-P	2.9	2.20	0.27	2.67	0.72
Section6 onsite @ ON-D5 100YR	CUH	28	1.78	0.48	4.46	2.14
Section7 onsite @ON-D6 100 YR	D2 + CUN + ON-D6-P1	17	2.20	0.42	3.91	1.64
Section8 onsite @ ON-D5 100 YR	CUJ	37	2.20	0.51	5.31	2.71
Section19 onsite @ ON-D6 100 YR	ON-D6-P2	2.7	2.20	0.21	2.82	0.59

DRAINAGE FACILITIES SUMMARY

FACILITY	Size	LENGTH	FLOW	NOTES
P1	18"	30	5	-
P2	18"	105	10	-
P3	18"	86	11	LATERAL
P4	18"	87	9	LATERAL
P5	30"	95	59	LATERAL
P6	78"	390	497	TROPICAL MAINLINE
P7	78"	340	508	TROPICAL MAINLINE
P8	78"	410	517	TROPICAL MAINLINE
P9	78"	30	614	TROPICAL MAINLINE

FACILITY	Grate Length (FT)	Surface flow (cfs)	Intercepted (cfs)	Bypass (cfs)	Discharge point	Notes
DI1	10	12	5	7	Condos south	CM2 DI on Grate for Q_{100}
DI2	10	11	5	6	Condos south	CM2 DI on Grate for Q_{100}
DI1	10	6	3	3	Condos south	CM2 DI on Grate for Q_{10}
DI2	10	5	3	2	Condos south	CM2 DI on Grate for Q_{10}
DI3	15	11	0.6	CM2 DI on Sag		
DI4	10	9	0.5	CM2 DI on Sag		
DI5	5'x6'	59	66	NDOT Type 2 - DI on Sag		

ULTIMATE CONDITION HYDROLOGIC SUMMARY

Basin	Area (acres)	Q_{10} (cfs)	Q_{100} (cfs)
CUF	-	133	273
CUG	-	291	435
CUH	-	12	28
CUI	-	303	463
CUJ	-	15	37
CUK	-	320	506
CUL	-	11	23
CUM	-	8	19
CUN	-	3	6
CUP	-	9	18
D1*	-	6	11
D2*	-	3	8
DIV1	-	5	12
DIV2	-	5	11
BASE	-	40	40
GOAN	-	157	157
CUQ	-	365	558
OF-D1	4.60	9	18
OF-D2	6.12	12	23
OF-D3	10.78	19	37
OF-D4	22.00	32	66
OF-D5	2.94	4	9
OF-D6	23.32	40	81
OF-D7	11.49	18	38
OF-D8	4.37	5	12
ON-D1	2.34	4	9
ON-D1A	0.56	1	2
ON-D2	2.38	4	9
ON-D2A	0.48	1	2
ON-D3	1.53	3	6
ON-D3A	0.27	<1	1
ON-D4	2.12	3	7
ON-D4A	0.34	1	1
ON-D5	6.40	7	17
ON-D6	10.26	10	26
ON-D7	1.07	1	3
OP-D1	1.02	1	2
OP-D2	1.37	1	3
ST-D1	3.59	8	14
ST-D2	0.83	2	3
ST-D3	0.68	2	3

CUF = OF-D1 + OF-D2 + OF-D3 + OF-D4 + OF-D5 + OF-D6 + OF-D7

CUG = CUF + OP-D1 + OP-D2 + GOAN

CUH = DIV2 + ON-D5

CUI = CUG + CUH

CUJ = CUN + ON-D6 + D2

CUK = CUI + CUJ + ON-D7 + ST-D3

CUL = ON-D1 + ON-D2 + ON-D3

CUM = DIV1 + ON-D4

CUN = ON-D1A + ON-D2A + ON-D3A + ON-D4A

CUP = ST-D1 = ST-D2

CUQ = CUK + OF-D8 + BASE

DIV1 = CUL - D1

DIV2 = CUM - D2

NOTES
1. Refereced from the Centennial Condominious Study.
2. Facility size and flows are referenced from Shaumber Road Realignment Study
3. Facility size is referenced from 215 Bruce Woodbury Beltway-Craig Road Study
4. D1* is the sum of flow captured by drop inlets DI-1W and DI-1E in street H
5. D2* is Sum of DI-1E bypass flow and flow contributed by east side of ON-D4 in street H



KEY:

- ON-D1 / 4.04 — BASIN NAME/AREA
- ON-D4-P / 0.49 — PRORATE BASIN NAME/AREA
- CU2 — CONCENTRATION POINT
- FLOW DIRECTION
- 4 — 4 — CROSS SECTION
- BASIN BOUNDARY
- PRORATE BASIN BOUNDARY
- PROPOSED CCRFCD REG. FAC.
- EXISTING CCRFCD REG. FAC.
- LOCAL EXISTING FACILITY

HORROCKS ENGINEERS
1401 N. Green Valley Pkwy., Suite 160
Henderson, NV 89074
(702) 966-4063
www.horrocks.com

WARNING
0 1 2
IF THIS BAR DOES NOT MEASURE 2" THEN DRAWING IS NOT TO SCALE

REVISIONS
REV # | DATE

*SEE GENERAL NOTES SHEET

DRAWING INFO
DATE 09/19/2019
DESIGNED MDP
DRAWN SS
CHECKED LMB
PROJECT NV-1949-1909

CENTENNIAL HEIGHTS TOWNHOMES
HARMONY HOMES, LLC
CITY OF LAS VEGAS
NEVADA

ULTIMATE CONDITION OFFISTE BASIN MAP

A PORTION OF APN# 126-25-201-010

10
PAGE #

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APPENDIX B. Hydraulic Data and Calculations

Street Normal Depth Calculations for Interim Phase 1 condition

Street Normal Depth Calculations for Interim Phase 2 condition

Street Normal Depth Calculations for Ultimate condition

Drop Inlet Calculations

Storm Drain Inlet Control Nomographs

WSPG Models

Beltway Plans with Revised HGL

78” Discharge Calculations

Finish Floor Analysis

STREET NORMAL DEPTH CALCULATION FOR INTERIM PHASE 1 CONDITION

Section1 FULL 100' R/W - 10 YR-PH1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.00 %
Discharge	2.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+50.00	1.03
0+93.00	0.17
0+93.00	0.13
0+94.50	0.00
0+94.50	0.50
0+95.00	0.50
1+00.00	0.60

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.13)	0.013
(0+07.00, 0.13)	(1+00.00, 0.60)	0.016

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

Results	
Normal Depth	0.23 ft
Elevation Range	0.00 to 1.03 ft
Flow Area	0.7 ft²
Wetted Perimeter	9.83 ft
Hydraulic Radius	0.07 ft
Top Width	9.27 ft
Normal Depth	0.23 ft

Results	
Critical Depth	0.28 ft
Critical Slope	0.84 %
Velocity	2.86 ft/s
Velocity Head	0.13 ft
Specific Energy	0.36 ft
Froude Number	1.83
Flow Type	Supercritical

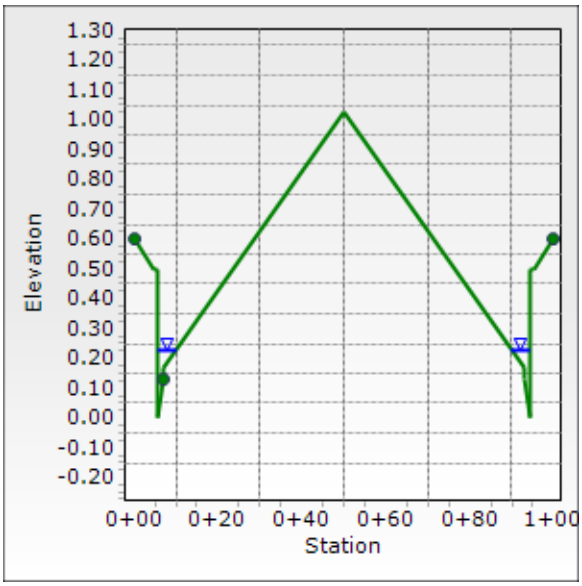
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Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.23 ft
Critical Depth	0.28 ft
Channel Slope	3.00 %
Critical Slope	0.84 %

Cross Section for Section1 FULL 100' R/W - 10 YR-PH1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.00 %
Normal Depth	0.23 ft
Discharge	2.00 cfs



Section1 FULL 100' R/W - 100 YR-PH1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.00 %
Discharge	5.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+50.00	1.03
0+93.00	0.17
0+93.00	0.13
0+94.50	0.00
0+94.50	0.50
0+95.00	0.50
1+00.00	0.60

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.13)	0.013
(0+07.00, 0.13)	(1+00.00, 0.60)	0.016

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

Results	
Normal Depth	0.30 ft
Elevation Range	0.00 to 1.03 ft
Flow Area	1.5 ft²
Wetted Perimeter	16.38 ft
Hydraulic Radius	0.09 ft
Top Width	15.69 ft
Normal Depth	0.30 ft

Results	
Critical Depth	0.35 ft
Critical Slope	0.77 %
Velocity	3.33 ft/s
Velocity Head	0.17 ft
Specific Energy	0.47 ft
Froude Number	1.90
Flow Type	Supercritical

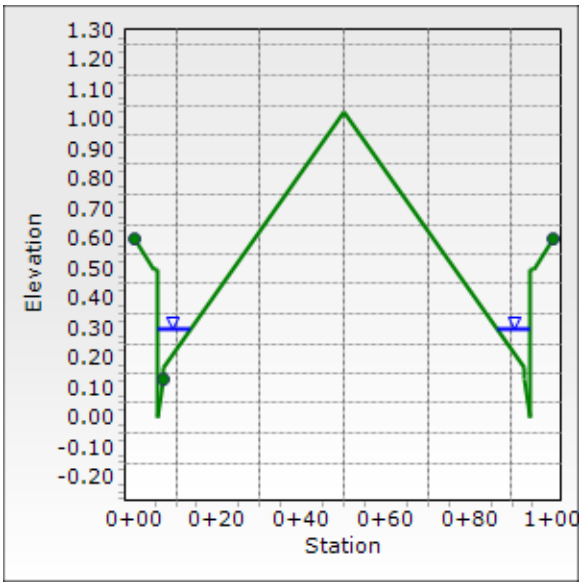
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Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.30 ft
Critical Depth	0.35 ft
Channel Slope	3.00 %
Critical Slope	0.77 %

Cross Section for Section1 FULL 100' R/W - 100 YR-PH1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.00 %
Normal Depth	0.30 ft
Discharge	5.00 cfs



Section2 HALF 80' R/W -10 YR-PH1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.85 %
Discharge	5.50 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+40.00	0.83
0+73.00	0.17
0+73.00	0.13
0+74.50	0.00
0+74.50	0.50
0+75.00	0.50
0+80.00	0.60

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+40.00, 0.83)	(0+73.00, 0.17)	0.016
(0+73.00, 0.17)	(0+80.00, 0.60)	0.013

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

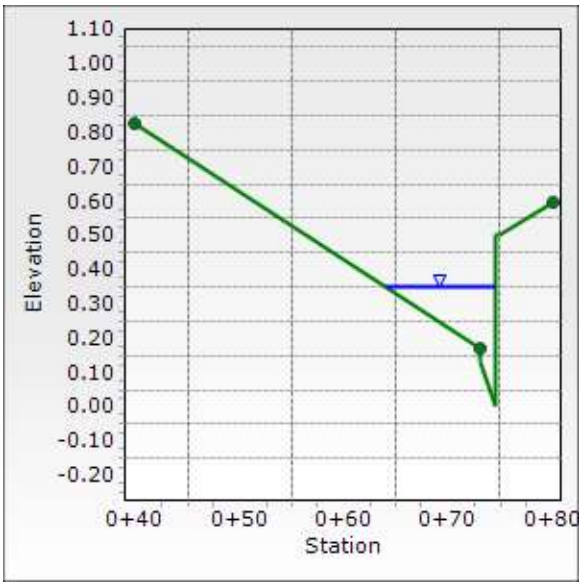
Results	
Normal Depth	0.35 ft
Elevation Range	0.00 to 0.83 ft
Flow Area	1.2 ft²
Wetted Perimeter	10.93 ft
Hydraulic Radius	0.11 ft
Top Width	10.53 ft
Normal Depth	0.35 ft
Critical Depth	0.44 ft
Critical Slope	0.67 %
Velocity	4.42 ft/s
Velocity Head	0.30 ft
Specific Energy	0.65 ft
Froude Number	2.27

Results	
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	0.35 ft
Critical Depth	0.44 ft
Channel Slope	3.85 %
Critical Slope	0.67 %

Cross Section for Section2 HALF 80' R/W -10 YR-PH1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.85 %
Normal Depth	0.35 ft
Discharge	5.50 cfs



Section2 HALF 80' R/W -100 YR-PH1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.85 %
Discharge	34.60 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+40.00	0.83
0+73.00	0.17
0+73.00	0.13
0+74.50	0.00
0+74.50	0.50
0+75.00	0.50
0+80.00	0.60

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+40.00, 0.83)	(0+73.00, 0.17)	0.016
(0+73.00, 0.17)	(0+80.00, 0.60)	0.013

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

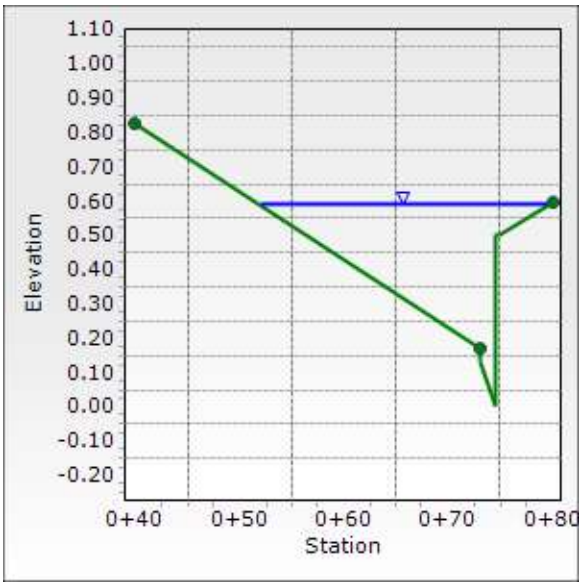
Results	
Normal Depth	0.59 ft
Elevation Range	0.00 to 0.83 ft
Flow Area	5.4 ft²
Wetted Perimeter	27.97 ft
Hydraulic Radius	0.19 ft
Top Width	27.41 ft
Normal Depth	0.59 ft
Critical Depth	0.76 ft
Critical Slope	0.52 %
Velocity	6.38 ft/s
Velocity Head	0.63 ft
Specific Energy	1.22 ft
Froude Number	2.53

Results	
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	0.59 ft
Critical Depth	0.76 ft
Channel Slope	3.85 %
Critical Slope	0.52 %

Cross Section for Section2 HALF 80' R/W -100 YR-PH1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.85 %
Normal Depth	0.59 ft
Discharge	34.60 cfs



Section5 onsite @ON-D5 100 YR-PH1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.20 %
Discharge	2.90 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.38
0+00.35	0.35
0+01.33	0.06
0+01.33	0.00
0+02.50	0.13
0+02.50	0.17
0+15.00	0.42
0+27.50	0.17
0+27.50	0.13
0+28.67	0.00
0+28.67	0.06
0+29.65	0.35
0+30.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.38)	(0+02.50, 0.13)	0.013
(0+02.50, 0.13)	(0+27.50, 0.13)	0.016
(0+27.50, 0.13)	(0+30.00, 0.38)	0.013

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

Results	
Normal Depth	0.27 ft
Elevation Range	0.00 to 0.42 ft
Flow Area	1.1 ft²
Wetted Perimeter	13.70 ft
Hydraulic Radius	0.08 ft
Top Width	13.42 ft

Results	
Normal Depth	0.27 ft
Critical Depth	0.30 ft
Critical Slope	0.75 %
Velocity	2.67 ft/s
Velocity Head	0.11 ft
Specific Energy	0.38 ft
Froude Number	1.66
Flow Type	Supercritical

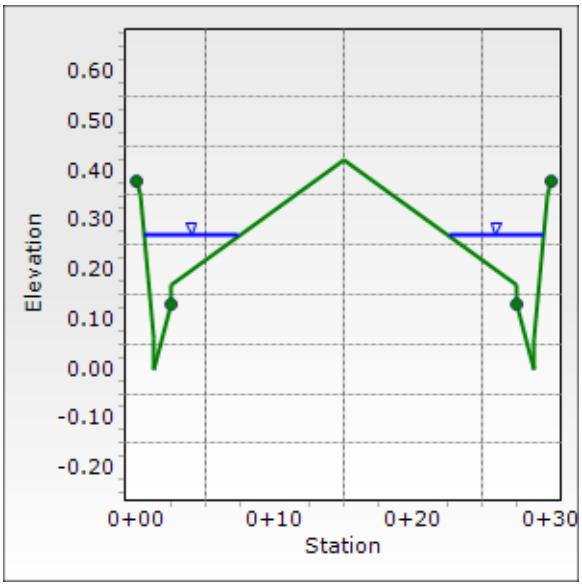
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Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.27 ft
Critical Depth	0.30 ft
Channel Slope	2.20 %
Critical Slope	0.75 %

Cross Section for Section5 onsite @ON-D5 100 YR-PH1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.20 %
Normal Depth	0.27 ft
Discharge	2.90 cfs



Section6 onsite @ ON-D5 100YR-PH1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.78 %
Discharge	19.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.38
0+00.35	0.35
0+01.33	0.06
0+01.33	0.00
0+02.50	0.13
0+02.50	0.17
0+15.00	0.42
0+27.50	0.17
0+27.50	0.13
0+28.67	0.00
0+28.67	0.06
0+29.65	0.35
0+30.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.38)	(0+02.50, 0.13)	0.013
(0+02.50, 0.13)	(0+27.50, 0.13)	0.016
(0+27.50, 0.13)	(0+30.00, 0.38)	0.013

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

Results	
Normal Depth	0.44 ft
Elevation Range	0.00 to 0.42 ft
Flow Area	5.0 ft²
Wetted Perimeter	30.42 ft
Hydraulic Radius	0.16 ft
Top Width	30.00 ft

Results	
Normal Depth	0.44 ft
Critical Depth	0.50 ft
Critical Slope	0.59 %
Velocity	3.82 ft/s
Velocity Head	0.23 ft
Specific Energy	0.67 ft
Froude Number	1.66
Flow Type	Supercritical

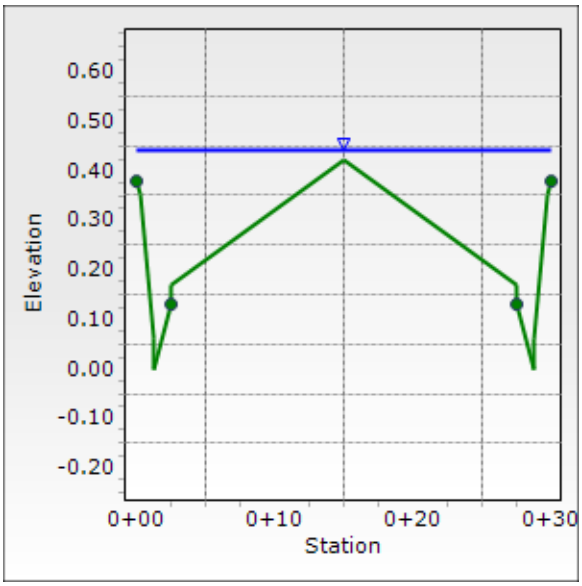
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Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.44 ft
Critical Depth	0.50 ft
Channel Slope	1.78 %
Critical Slope	0.59 %

Cross Section for Section6 onsite @ ON-D5 100YR-PH1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.78 %
Normal Depth	0.44 ft
Discharge	19.00 cfs



Section7 onsite @ON-D6 100 YR-PH1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.20 %
Discharge	3.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.38
0+00.35	0.35
0+01.33	0.06
0+01.33	0.00
0+02.50	0.13
0+02.50	0.17
0+15.00	0.42
0+27.50	0.17
0+27.50	0.13
0+28.67	0.00
0+28.67	0.06
0+29.65	0.35
0+30.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.38)	(0+02.50, 0.13)	0.013
(0+02.50, 0.13)	(0+27.50, 0.13)	0.016
(0+27.50, 0.13)	(0+30.00, 0.38)	0.013

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

Results	
Normal Depth	0.27 ft
Elevation Range	0.00 to 0.42 ft
Flow Area	1.1 ft²
Wetted Perimeter	13.94 ft
Hydraulic Radius	0.08 ft
Top Width	13.66 ft

Results	
Normal Depth	0.27 ft
Critical Depth	0.31 ft
Critical Slope	0.75 %
Velocity	2.69 ft/s
Velocity Head	0.11 ft
Specific Energy	0.38 ft
Froude Number	1.66
Flow Type	Supercritical

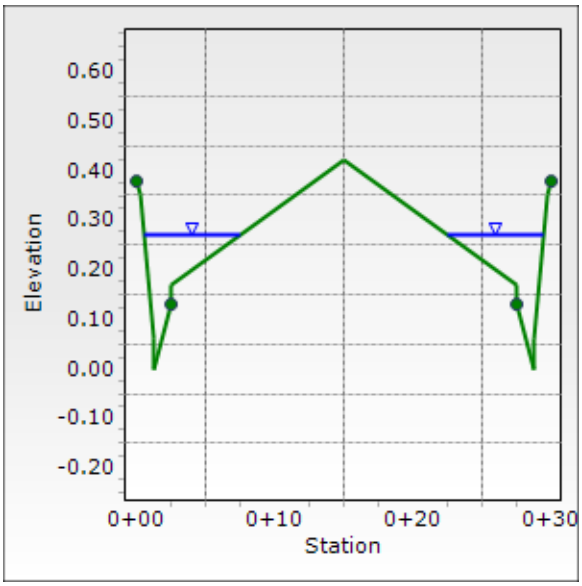
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Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.27 ft
Critical Depth	0.31 ft
Channel Slope	2.20 %
Critical Slope	0.75 %

Cross Section for Section7 onsite @ON-D6 100 YR-PH1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.20 %
Normal Depth	0.27 ft
Discharge	3.00 cfs



Section8 onsite @ ON-D5 100 YR-PH1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.20 %
Discharge	25.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.38
0+00.35	0.35
0+01.33	0.06
0+01.33	0.00
0+02.50	0.13
0+02.50	0.17
0+15.00	0.42
0+27.50	0.17
0+27.50	0.13
0+28.67	0.00
0+28.67	0.06
0+29.65	0.35
0+30.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.38)	(0+02.50, 0.13)	0.013
(0+02.50, 0.13)	(0+27.50, 0.13)	0.016
(0+27.50, 0.13)	(0+30.00, 0.38)	0.013

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

Results	
Normal Depth	0.46 ft
Elevation Range	0.00 to 0.42 ft
Flow Area	5.5 ft²
Wetted Perimeter	30.46 ft
Hydraulic Radius	0.18 ft
Top Width	30.00 ft

Results	
Normal Depth	0.46 ft
Critical Depth	0.55 ft
Critical Slope	0.55 %
Velocity	4.54 ft/s
Velocity Head	0.32 ft
Specific Energy	0.78 ft
Froude Number	1.87
Flow Type	Supercritical

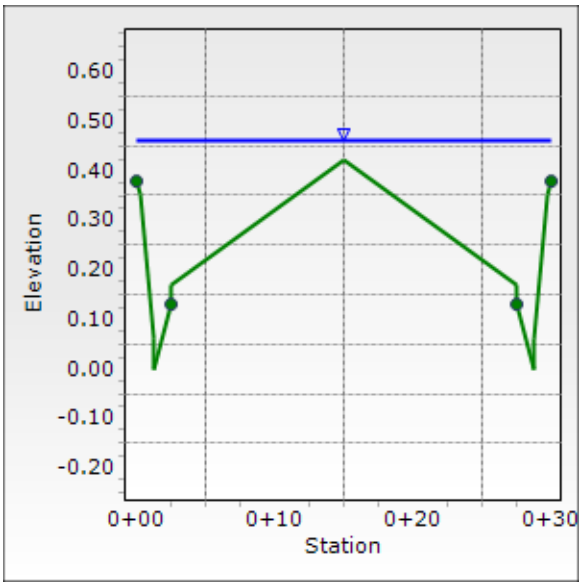
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Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.46 ft
Critical Depth	0.55 ft
Channel Slope	2.20 %
Critical Slope	0.55 %

Cross Section for Section8 onsite @ ON-D5 100 YR-PH1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.20 %
Normal Depth	0.46 ft
Discharge	25.00 cfs



Worksheet for Section 19 onsite @ ON-D6 100 YR-PH1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.20 %
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	4.00 ft
Discharge	2.70 cfs

Results	
Normal Depth	0.21 ft
Flow Area	1.0 ft²
Wetted Perimeter	5.31 ft
Hydraulic Radius	0.18 ft
Top Width	5.24 ft
Critical Depth	0.23 ft
Critical Slope	1.59 %
Velocity	2.82 ft/s
Velocity Head	0.12 ft
Specific Energy	0.33 ft
Froude Number	1.16
Flow Type	Supercritical

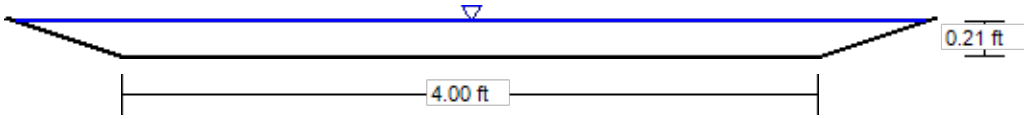
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Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

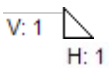
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.21 ft
Critical Depth	0.23 ft
Channel Slope	2.20 %
Critical Slope	1.59 %

Cross Section for Section 19 onsite @ ON-D6 100 YR-PH1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.20 %
Normal Depth	0.21 ft
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	4.00 ft
Discharge	2.70 cfs





PARK SWALE NORMAL DEPTH CALCULATION FOR INTERIM PHASE 1 CONDITION

Worksheet for Section 9C INT Phase1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	0.00 ft
Discharge	1.30 cfs

Results	
Normal Depth	0.39 ft
Flow Area	0.5 ft²
Wetted Perimeter	2.48 ft
Hydraulic Radius	0.19 ft
Top Width	2.36 ft
Critical Depth	0.41 ft
Critical Slope	1.66 %
Velocity	2.81 ft/s
Velocity Head	0.12 ft
Specific Energy	0.52 ft
Froude Number	1.12
Flow Type	Supercritical

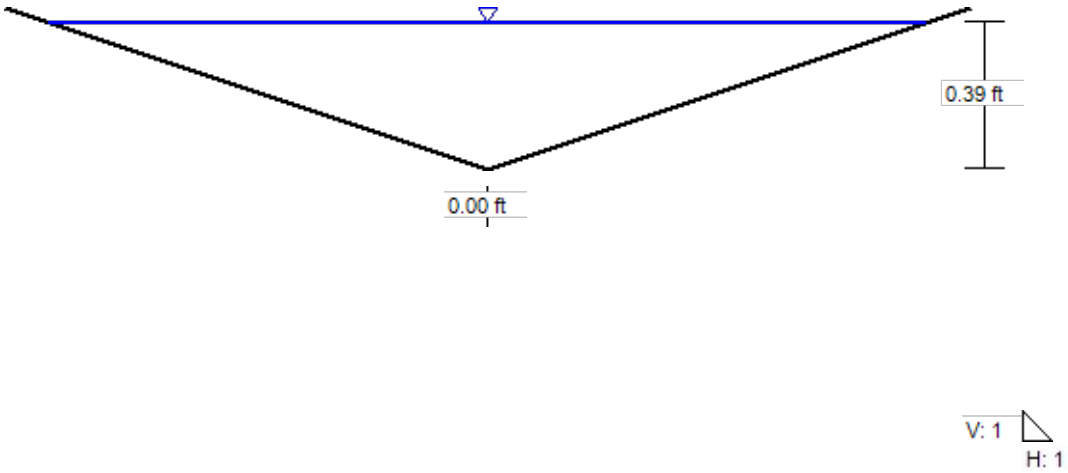
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Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.39 ft
Critical Depth	0.41 ft
Channel Slope	2.10 %
Critical Slope	1.66 %

Cross Section for Section 9C INT Phase1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Normal Depth	0.39 ft
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	0.00 ft
Discharge	1.30 cfs



Section 9D INT Phase1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	0.00 ft
Discharge	3.50 cfs

Results	
Normal Depth	0.57 ft
Flow Area	1.0 ft²
Wetted Perimeter	3.60 ft
Hydraulic Radius	0.27 ft
Top Width	3.42 ft
Critical Depth	0.61 ft
Critical Slope	1.45 %
Velocity	3.60 ft/s
Velocity Head	0.20 ft
Specific Energy	0.77 ft
Froude Number	1.19
Flow Type	Supercritical

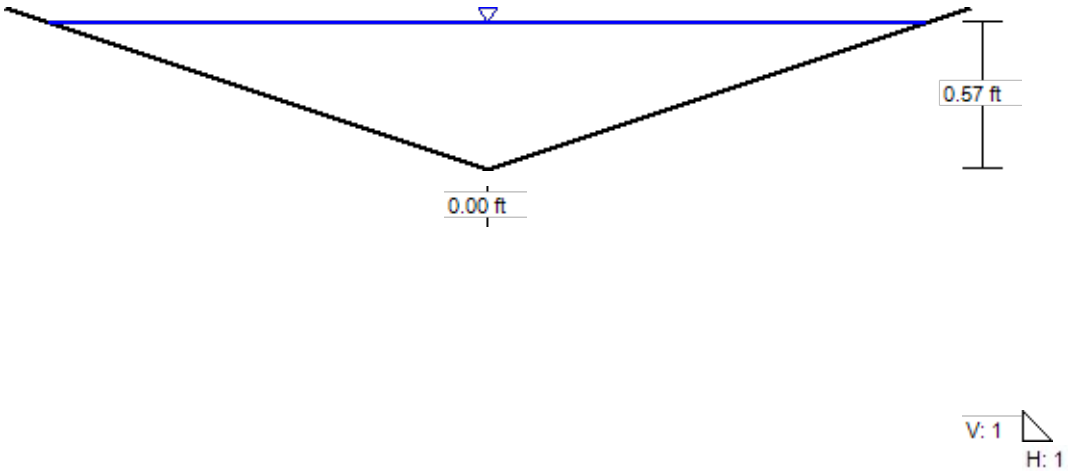
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Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.57 ft
Critical Depth	0.61 ft
Channel Slope	2.10 %
Critical Slope	1.45 %

Cross Section for Section 9D INT Phase1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Normal Depth	0.57 ft
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	0.00 ft
Discharge	3.50 cfs



OFFSITE CHANNEL NORMAL DEPTH CALCULATION FOR INTERIM PHASE 1 CONDITION

Section15 INT Phase1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	63.00 ft
Discharge	7.00 cfs

Results	
Normal Depth	0.07 ft
Flow Area	4.7 ft²
Wetted Perimeter	63.47 ft
Hydraulic Radius	0.07 ft
Top Width	63.44 ft
Critical Depth	0.07 ft
Critical Slope	2.18 %
Velocity	1.51 ft/s
Velocity Head	0.04 ft
Specific Energy	0.11 ft
Froude Number	0.98
Flow Type	Subcritical

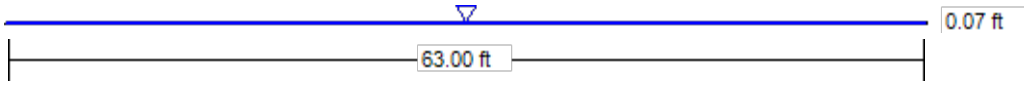
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

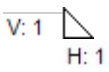
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.07 ft
Critical Depth	0.07 ft
Channel Slope	2.10 %
Critical Slope	2.18 %

Cross Section for Section15 INT Phase1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Normal Depth	0.07 ft
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	63.00 ft
Discharge	7.00 cfs





Section16 INT Phase1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	75.00 ft
Discharge	27.00 cfs

Results	
Normal Depth	0.15 ft
Flow Area	11.2 ft²
Wetted Perimeter	75.94 ft
Hydraulic Radius	0.15 ft
Top Width	75.89 ft
Critical Depth	0.16 ft
Critical Slope	1.69 %
Velocity	2.41 ft/s
Velocity Head	0.09 ft
Specific Energy	0.24 ft
Froude Number	1.11
Flow Type	Supercritical

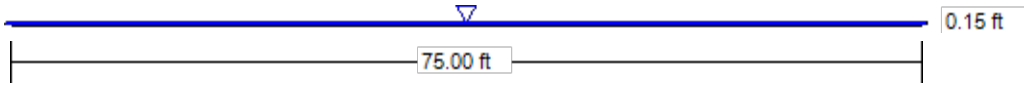
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

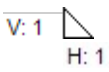
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.15 ft
Critical Depth	0.16 ft
Channel Slope	2.10 %
Critical Slope	1.69 %

Cross Section for Section16 INT Phase1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Normal Depth	0.15 ft
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	75.00 ft
Discharge	27.00 cfs





Section17 INT Phase1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	85.00 ft
Discharge	49.00 cfs

Results	
Normal Depth	0.20 ft
Flow Area	16.9 ft²
Wetted Perimeter	86.25 ft
Hydraulic Radius	0.20 ft
Top Width	86.18 ft
Critical Depth	0.22 ft
Critical Slope	1.52 %
Velocity	2.90 ft/s
Velocity Head	0.13 ft
Specific Energy	0.33 ft
Froude Number	1.15
Flow Type	Supercritical

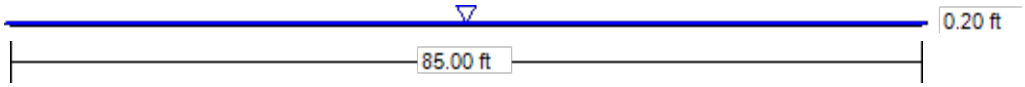
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

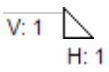
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.20 ft
Critical Depth	0.22 ft
Channel Slope	2.10 %
Critical Slope	1.52 %

Cross Section for Section17 INT Phase1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Normal Depth	0.20 ft
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	85.00 ft
Discharge	49.00 cfs





Section18 INT Phase1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	85.00 ft
Discharge	56.00 cfs

Results	
Normal Depth	0.21 ft
Flow Area	18.3 ft²
Wetted Perimeter	86.35 ft
Hydraulic Radius	0.21 ft
Top Width	86.28 ft
Critical Depth	0.24 ft
Critical Slope	1.48 %
Velocity	3.06 ft/s
Velocity Head	0.15 ft
Specific Energy	0.36 ft
Froude Number	1.17
Flow Type	Supercritical

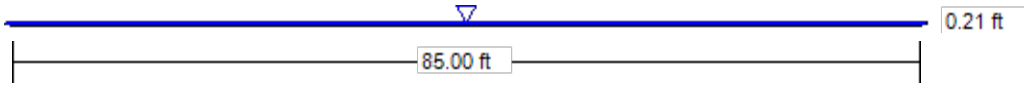
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

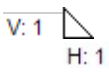
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.21 ft
Critical Depth	0.24 ft
Channel Slope	2.10 %
Critical Slope	1.48 %

Cross Section for Section18 INT Phase1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Normal Depth	0.21 ft
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	85.00 ft
Discharge	56.00 cfs





STREET NORMAL DEPTH CALCULATION FOR INTERIM PHASE 2 CONDITION

Section1 FULL 100' R/W - 10 YR-PH2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.00 %
Discharge	2.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+50.00	1.03
0+93.00	0.17
0+93.00	0.13
0+94.50	0.00
0+94.50	0.50
0+95.00	0.50
1+00.00	0.60

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.13)	0.013
(0+07.00, 0.13)	(1+00.00, 0.60)	0.016

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

Results	
Normal Depth	0.23 ft
Elevation Range	0.00 to 1.03 ft
Flow Area	0.7 ft²
Wetted Perimeter	9.83 ft
Hydraulic Radius	0.07 ft
Top Width	9.27 ft
Normal Depth	0.23 ft

Results	
Critical Depth	0.28 ft
Critical Slope	0.84 %
Velocity	2.86 ft/s
Velocity Head	0.13 ft
Specific Energy	0.36 ft
Froude Number	1.83
Flow Type	Supercritical

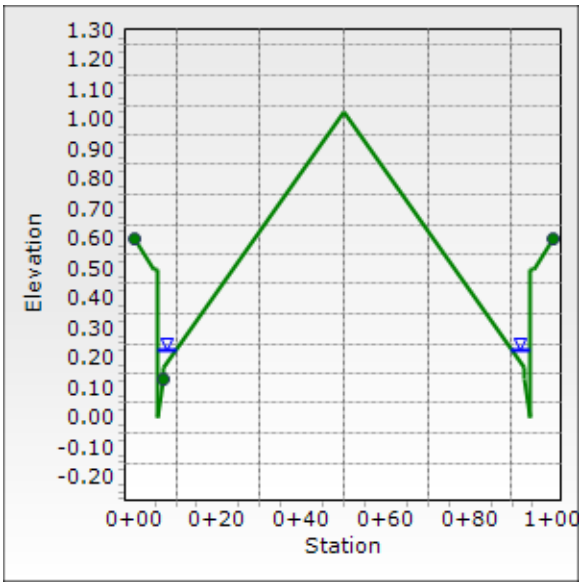
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.23 ft
Critical Depth	0.28 ft
Channel Slope	3.00 %
Critical Slope	0.84 %

Cross Section for Section1 FULL 100' R/W - 10 YR-PH2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.00 %
Normal Depth	0.23 ft
Discharge	2.00 cfs



Section1 FULL 100' R/W - 100 YR-PH2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.00 %
Discharge	5.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+50.00	1.03
0+93.00	0.17
0+93.00	0.13
0+94.50	0.00
0+94.50	0.50
0+95.00	0.50
1+00.00	0.60

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.13)	0.013
(0+07.00, 0.13)	(1+00.00, 0.60)	0.016

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

Results	
Normal Depth	0.30 ft
Elevation Range	0.00 to 1.03 ft
Flow Area	1.5 ft²
Wetted Perimeter	16.38 ft
Hydraulic Radius	0.09 ft
Top Width	15.69 ft
Normal Depth	0.30 ft

Results	
Critical Depth	0.35 ft
Critical Slope	0.77 %
Velocity	3.33 ft/s
Velocity Head	0.17 ft
Specific Energy	0.47 ft
Froude Number	1.90
Flow Type	Supercritical

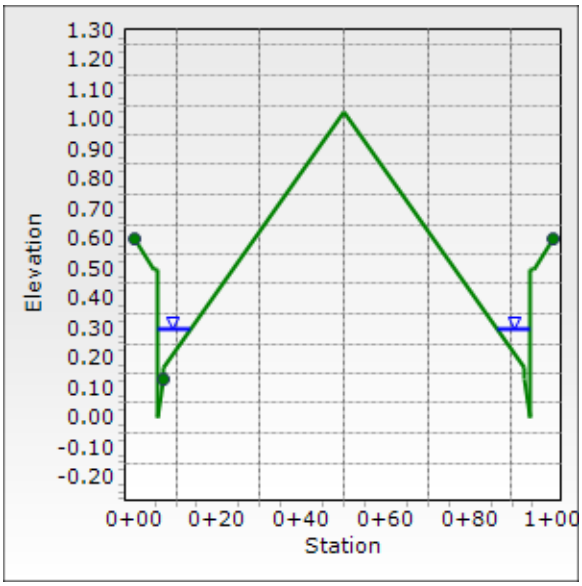
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Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.30 ft
Critical Depth	0.35 ft
Channel Slope	3.00 %
Critical Slope	0.77 %

Cross Section for Section1 FULL 100' R/W - 100 YR-PH2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.00 %
Normal Depth	0.30 ft
Discharge	5.00 cfs



Section2 HALF 80' R/W -10 YR-PH2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.85 %
Discharge	13.80 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+40.00	0.83
0+73.00	0.17
0+73.00	0.13
0+74.50	0.00
0+74.50	0.50
0+75.00	0.50
0+80.00	0.60

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+40.00, 0.83)	(0+73.00, 0.17)	0.016
(0+73.00, 0.17)	(0+80.00, 0.60)	0.013

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

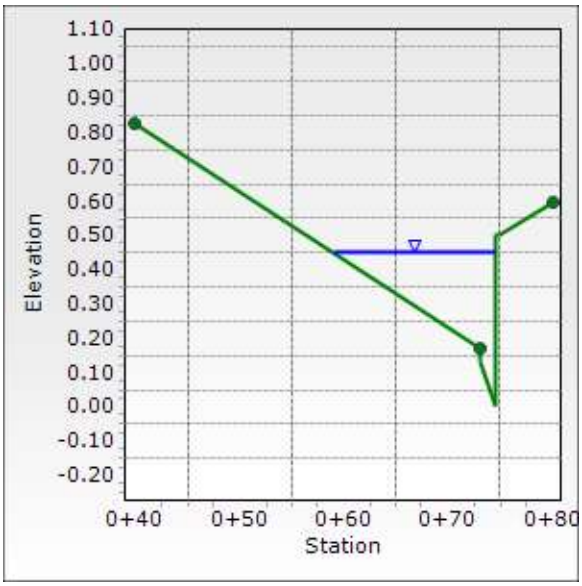
Results	
Normal Depth	0.45 ft
Elevation Range	0.00 to 0.83 ft
Flow Area	2.5 ft²
Wetted Perimeter	15.97 ft
Hydraulic Radius	0.16 ft
Top Width	15.47 ft
Normal Depth	0.45 ft
Critical Depth	0.59 ft
Critical Slope	0.63 %
Velocity	5.46 ft/s
Velocity Head	0.46 ft
Specific Energy	0.91 ft
Froude Number	2.38

Results	
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	0.45 ft
Critical Depth	0.59 ft
Channel Slope	3.85 %
Critical Slope	0.63 %

Cross Section for Section2 HALF 80' R/W -10 YR-PH2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.85 %
Normal Depth	0.45 ft
Discharge	13.80 cfs



Section2 HALF 80' R/W -100 YR-PH2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.85 %
Discharge	59.90 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+40.00	0.83
0+73.00	0.17
0+73.00	0.13
0+74.50	0.00
0+74.50	0.50
0+75.00	0.50
0+80.00	0.60

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+40.00, 0.83)	(0+73.00, 0.17)	0.016
(0+73.00, 0.17)	(0+80.00, 0.60)	0.013

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

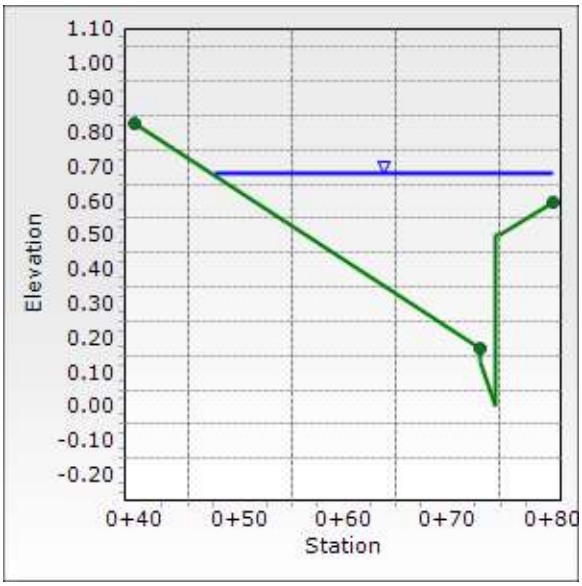
Results	
Normal Depth	0.68 ft
Elevation Range	0.00 to 0.83 ft
Flow Area	8.1 ft²
Wetted Perimeter	32.97 ft
Hydraulic Radius	0.24 ft
Top Width	32.34 ft
Normal Depth	0.68 ft
Critical Depth	0.90 ft
Critical Slope	0.48 %
Velocity	7.43 ft/s
Velocity Head	0.86 ft
Specific Energy	1.53 ft
Froude Number	2.62

Results	
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	0.68 ft
Critical Depth	0.90 ft
Channel Slope	3.85 %
Critical Slope	0.48 %

Cross Section for Section2 HALF 80' R/W -100 YR-PH2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.85 %
Normal Depth	0.68 ft
Discharge	59.90 cfs



Section3 onsite @ ON-D3 10 YR-PH2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.20 %
Discharge	11.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.38
0+00.35	0.35
0+01.33	0.06
0+01.33	0.00
0+02.50	0.13
0+02.50	0.17
0+15.00	0.42
0+27.50	0.17
0+27.50	0.13
0+28.67	0.00
0+28.67	0.06
0+29.65	0.35
0+30.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.38)	(0+02.50, 0.13)	0.013
(0+02.50, 0.13)	(0+27.50, 0.13)	0.016
(0+27.50, 0.13)	(0+30.00, 0.38)	0.013

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

Results	
Normal Depth	0.37 ft
Elevation Range	0.00 to 0.42 ft
Flow Area	3.1 ft²
Wetted Perimeter	25.45 ft
Hydraulic Radius	0.12 ft
Top Width	25.15 ft

Results	
Normal Depth	0.37 ft
Critical Depth	0.43 ft
Critical Slope	0.65 %
Velocity	3.53 ft/s
Velocity Head	0.19 ft
Specific Energy	0.57 ft
Froude Number	1.77
Flow Type	Supercritical

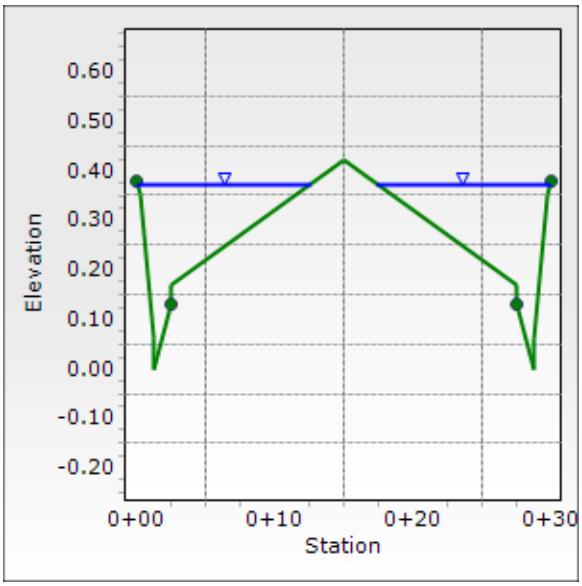
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.37 ft
Critical Depth	0.43 ft
Channel Slope	2.20 %
Critical Slope	0.65 %

Cross Section for Section3 onsite @ ON-D3 10 YR-PH2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.20 %
Normal Depth	0.37 ft
Discharge	11.00 cfs



Section3 onsite @ ON-D3 100 YR-PH2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.20 %
Discharge	23.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.38
0+00.35	0.35
0+01.33	0.06
0+01.33	0.00
0+02.50	0.13
0+02.50	0.17
0+15.00	0.42
0+27.50	0.17
0+27.50	0.13
0+28.67	0.00
0+28.67	0.06
0+29.65	0.35
0+30.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.38)	(0+02.50, 0.13)	0.013
(0+02.50, 0.13)	(0+27.50, 0.13)	0.016
(0+27.50, 0.13)	(0+30.00, 0.38)	0.013

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

Results	
Normal Depth	0.45 ft
Elevation Range	0.00 to 0.42 ft
Flow Area	5.2 ft²
Wetted Perimeter	30.44 ft
Hydraulic Radius	0.17 ft
Top Width	30.00 ft

Results	
Normal Depth	0.45 ft
Critical Depth	0.54 ft
Critical Slope	0.56 %
Velocity	4.39 ft/s
Velocity Head	0.30 ft
Specific Energy	0.75 ft
Froude Number	1.86
Flow Type	Supercritical

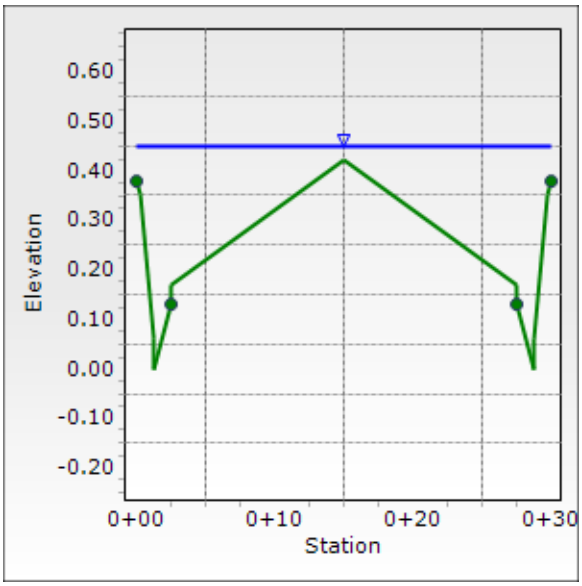
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Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.45 ft
Critical Depth	0.54 ft
Channel Slope	2.20 %
Critical Slope	0.56 %

Cross Section for Section3 onsite @ ON-D3 100 YR-PH2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.20 %
Normal Depth	0.45 ft
Discharge	23.00 cfs



Worksheet for Section4 HAFL EAST onsite @ ON-D4 100 YR-PH2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.20 %
Discharge	8.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+15.00	0.42
0+27.50	0.17
0+27.50	0.13
0+28.67	0.00
0+28.67	0.06
0+29.65	0.35
0+30.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+15.00, 0.42)	(0+27.50, 0.13)	0.016
(0+27.50, 0.13)	(0+30.00, 0.38)	0.013

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

Results	
Normal Depth	0.41 ft
Elevation Range	0.00 to 0.42 ft
Flow Area	2.1 ft²
Wetted Perimeter	14.74 ft
Hydraulic Radius	0.14 ft
Top Width	14.56 ft
Normal Depth	0.41 ft
Critical Depth	0.48 ft
Critical Slope	0.61 %
Velocity	3.85 ft/s
Velocity Head	0.23 ft
Specific Energy	0.64 ft
Froude Number	1.80

Worksheet for Section4 HAFL EAST onsite @ ON-D4 100 YR-PH2

Results	
Flow Type	Supercritical

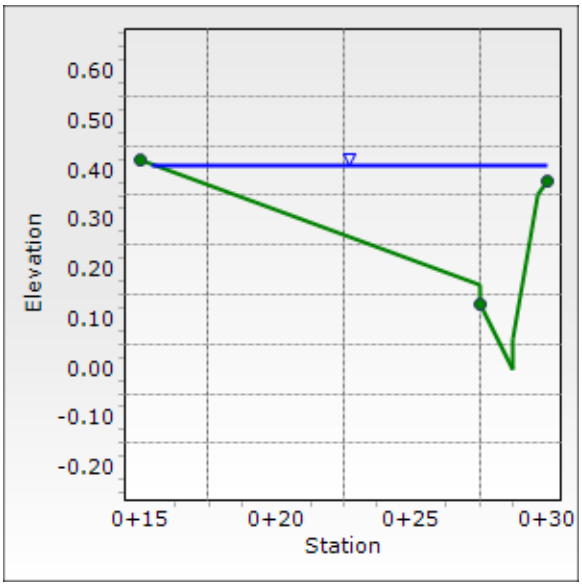
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Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.41 ft
Critical Depth	0.48 ft
Channel Slope	2.20 %
Critical Slope	0.61 %

Cross Section for Section4 HAFL EAST onsite @ ON-D4 100 YR-PH2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.20 %
Normal Depth	0.41 ft
Discharge	8.00 cfs



Section5 onsite @ON-D5 100 YR-PH2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.20 %
Discharge	2.90 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.38
0+00.35	0.35
0+01.33	0.06
0+01.33	0.00
0+02.50	0.13
0+02.50	0.17
0+15.00	0.42
0+27.50	0.17
0+27.50	0.13
0+28.67	0.00
0+28.67	0.06
0+29.65	0.35
0+30.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.38)	(0+02.50, 0.13)	0.013
(0+02.50, 0.13)	(0+27.50, 0.13)	0.016
(0+27.50, 0.13)	(0+30.00, 0.38)	0.013

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

Results	
Normal Depth	0.27 ft
Elevation Range	0.00 to 0.42 ft
Flow Area	1.1 ft²
Wetted Perimeter	13.70 ft
Hydraulic Radius	0.08 ft
Top Width	13.42 ft

Results	
Normal Depth	0.27 ft
Critical Depth	0.30 ft
Critical Slope	0.75 %
Velocity	2.67 ft/s
Velocity Head	0.11 ft
Specific Energy	0.38 ft
Froude Number	1.66
Flow Type	Supercritical

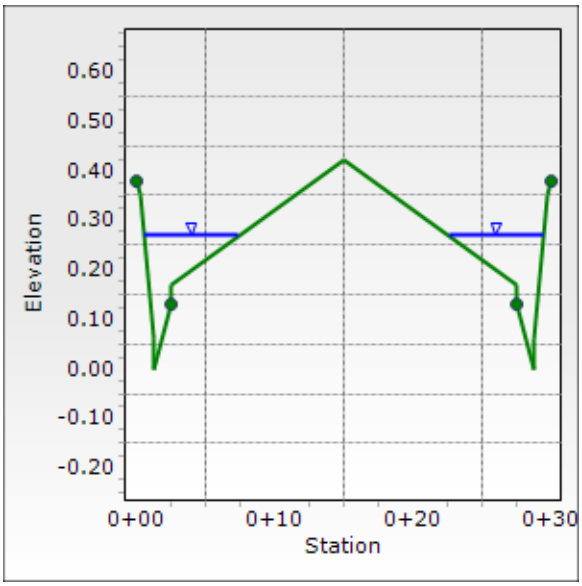
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Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.27 ft
Critical Depth	0.30 ft
Channel Slope	2.20 %
Critical Slope	0.75 %

Cross Section for Section5 onsite @ON-D5 100 YR-PH2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.20 %
Normal Depth	0.27 ft
Discharge	2.90 cfs



Section6 onsite @ ON-D5 100YR-PH2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.78 %
Discharge	28.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.38
0+00.35	0.35
0+01.33	0.06
0+01.33	0.00
0+02.50	0.13
0+02.50	0.17
0+15.00	0.42
0+27.50	0.17
0+27.50	0.13
0+28.67	0.00
0+28.67	0.06
0+29.65	0.35
0+30.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.38)	(0+02.50, 0.13)	0.013
(0+02.50, 0.13)	(0+27.50, 0.13)	0.016
(0+27.50, 0.13)	(0+30.00, 0.38)	0.013

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

Results	
Normal Depth	0.48 ft
Elevation Range	0.00 to 0.42 ft
Flow Area	6.3 ft²
Wetted Perimeter	30.51 ft
Hydraulic Radius	0.21 ft
Top Width	30.00 ft

Results	
Normal Depth	0.48 ft
Critical Depth	0.57 ft
Critical Slope	0.54 %
Velocity	4.46 ft/s
Velocity Head	0.31 ft
Specific Energy	0.79 ft
Froude Number	1.72
Flow Type	Supercritical

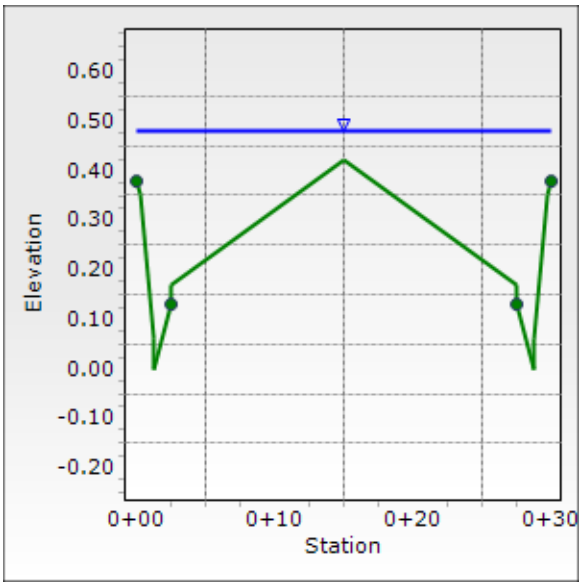
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Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.48 ft
Critical Depth	0.57 ft
Channel Slope	1.78 %
Critical Slope	0.54 %

Cross Section for Section6 onsite @ ON-D5 100YR-PH2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.78 %
Normal Depth	0.48 ft
Discharge	28.00 cfs



Section7 onsite @ON-D6 100 YR-PH2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.20 %
Discharge	17.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.38
0+00.35	0.35
0+01.33	0.06
0+01.33	0.00
0+02.50	0.13
0+02.50	0.17
0+15.00	0.42
0+27.50	0.17
0+27.50	0.13
0+28.67	0.00
0+28.67	0.06
0+29.65	0.35
0+30.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.38)	(0+02.50, 0.13)	0.013
(0+02.50, 0.13)	(0+27.50, 0.13)	0.016
(0+27.50, 0.13)	(0+30.00, 0.38)	0.013

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

Results	
Normal Depth	0.42 ft
Elevation Range	0.00 to 0.42 ft
Flow Area	4.4 ft²
Wetted Perimeter	30.16 ft
Hydraulic Radius	0.14 ft
Top Width	29.78 ft

Results	
Normal Depth	0.42 ft
Critical Depth	0.49 ft
Critical Slope	0.60 %
Velocity	3.91 ft/s
Velocity Head	0.24 ft
Specific Energy	0.66 ft
Froude Number	1.80
Flow Type	Supercritical

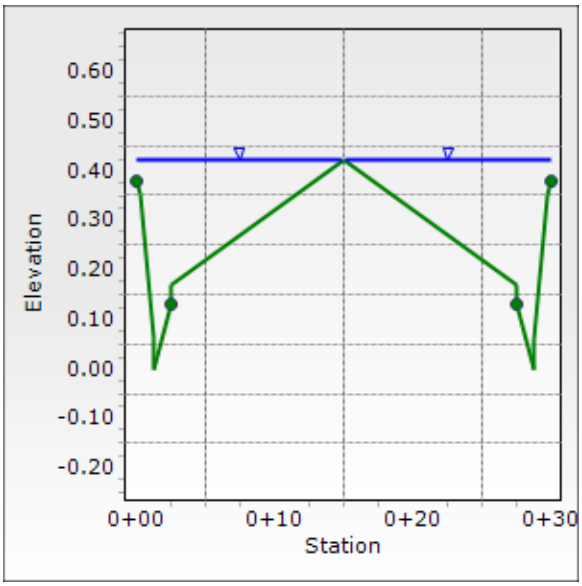
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Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.42 ft
Critical Depth	0.49 ft
Channel Slope	2.20 %
Critical Slope	0.60 %

Cross Section for Section7 onsite @ON-D6 100 YR-PH2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.20 %
Normal Depth	0.42 ft
Discharge	17.00 cfs



Section8 onsite @ ON-D5 100 YR-PH2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.20 %
Discharge	37.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.38
0+00.35	0.35
0+01.33	0.06
0+01.33	0.00
0+02.50	0.13
0+02.50	0.17
0+15.00	0.42
0+27.50	0.17
0+27.50	0.13
0+28.67	0.00
0+28.67	0.06
0+29.65	0.35
0+30.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.38)	(0+02.50, 0.13)	0.013
(0+02.50, 0.13)	(0+27.50, 0.13)	0.016
(0+27.50, 0.13)	(0+30.00, 0.38)	0.013

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

Results	
Normal Depth	0.51 ft
Elevation Range	0.00 to 0.42 ft
Flow Area	7.0 ft²
Wetted Perimeter	30.56 ft
Hydraulic Radius	0.23 ft
Top Width	30.00 ft

Results	
Normal Depth	0.51 ft
Critical Depth	0.63 ft
Critical Slope	0.51 %
Velocity	5.31 ft/s
Velocity Head	0.44 ft
Specific Energy	0.94 ft
Froude Number	1.94
Flow Type	Supercritical

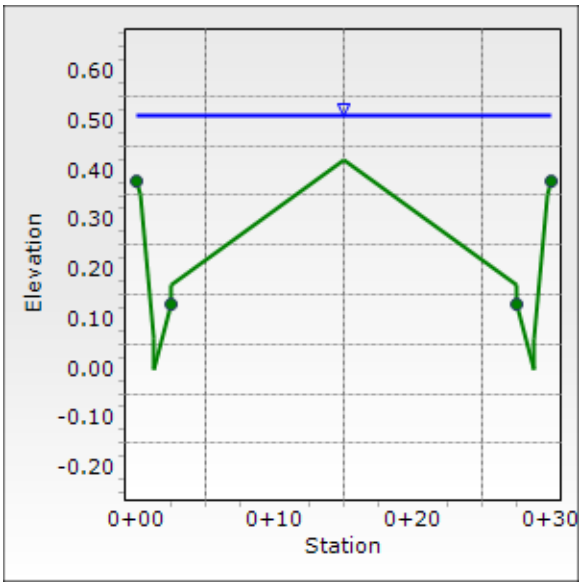
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.51 ft
Critical Depth	0.63 ft
Channel Slope	2.20 %
Critical Slope	0.51 %

Cross Section for Section8 onsite @ ON-D5 100 YR-PH2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.20 %
Normal Depth	0.51 ft
Discharge	37.00 cfs



Worksheet for Section 19 onsite @ ON-D6 100 YR-PH2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.20 %
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	4.00 ft
Discharge	2.70 cfs

Results	
Normal Depth	0.21 ft
Flow Area	1.0 ft²
Wetted Perimeter	5.31 ft
Hydraulic Radius	0.18 ft
Top Width	5.24 ft
Critical Depth	0.23 ft
Critical Slope	1.59 %
Velocity	2.82 ft/s
Velocity Head	0.12 ft
Specific Energy	0.33 ft
Froude Number	1.16
Flow Type	Supercritical

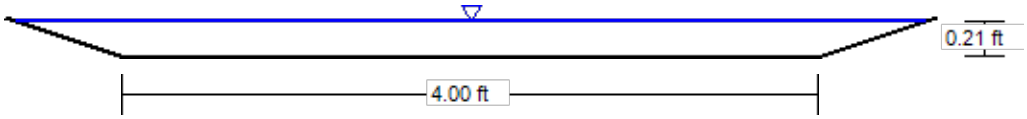
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Length	0.00 ft
Number Of Steps	0

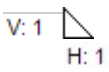
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Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.21 ft
Critical Depth	0.23 ft
Channel Slope	2.20 %
Critical Slope	1.59 %

Cross Section for Section 19 onsite @ ON-D6 100 YR-PH2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.20 %
Normal Depth	0.21 ft
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	4.00 ft
Discharge	2.70 cfs





PARK SWALE NORMAL DEPTH CALCULATION FOR INTERIM PHASE 2 CONDITION

Section 9A INT Phase2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.98 %
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	0.00 ft
Discharge	3.10 cfs

Results	
Normal Depth	0.51 ft
Flow Area	0.8 ft²
Wetted Perimeter	3.22 ft
Hydraulic Radius	0.24 ft
Top Width	3.06 ft
Critical Depth	0.58 ft
Critical Slope	1.47 %
Velocity	3.98 ft/s
Velocity Head	0.25 ft
Specific Energy	0.76 ft
Froude Number	1.39
Flow Type	Supercritical

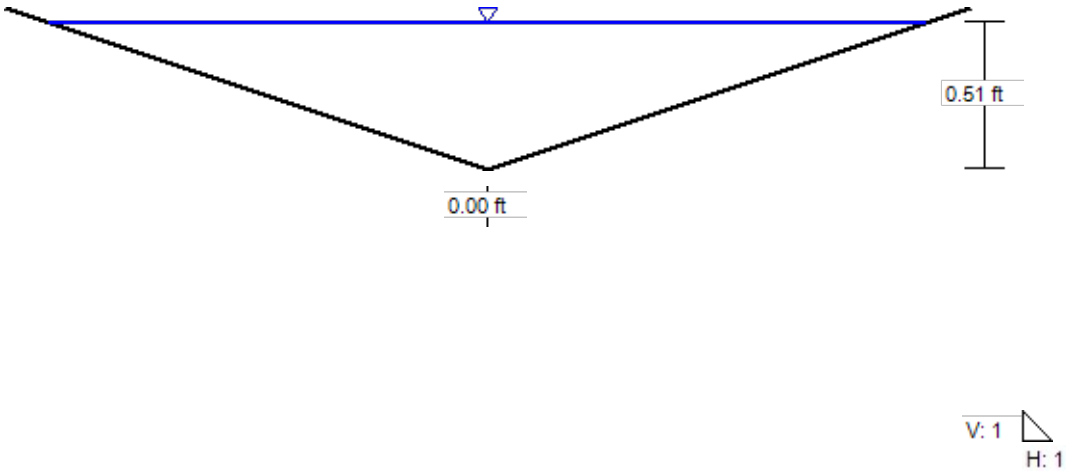
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Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.51 ft
Critical Depth	0.58 ft
Channel Slope	2.98 %
Critical Slope	1.47 %

Cross Section for Section 9A INT Phase2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.98 %
Normal Depth	0.51 ft
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	0.00 ft
Discharge	3.10 cfs



Section 9B INT Phase2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	1.42 %
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	0.00 ft
Discharge	5.30 cfs

Results	
Normal Depth	0.72 ft
Flow Area	1.5 ft²
Wetted Perimeter	4.53 ft
Hydraulic Radius	0.34 ft
Top Width	4.30 ft
Critical Depth	0.72 ft
Critical Slope	1.37 %
Velocity	3.45 ft/s
Velocity Head	0.18 ft
Specific Energy	0.90 ft
Froude Number	1.02
Flow Type	Supercritical

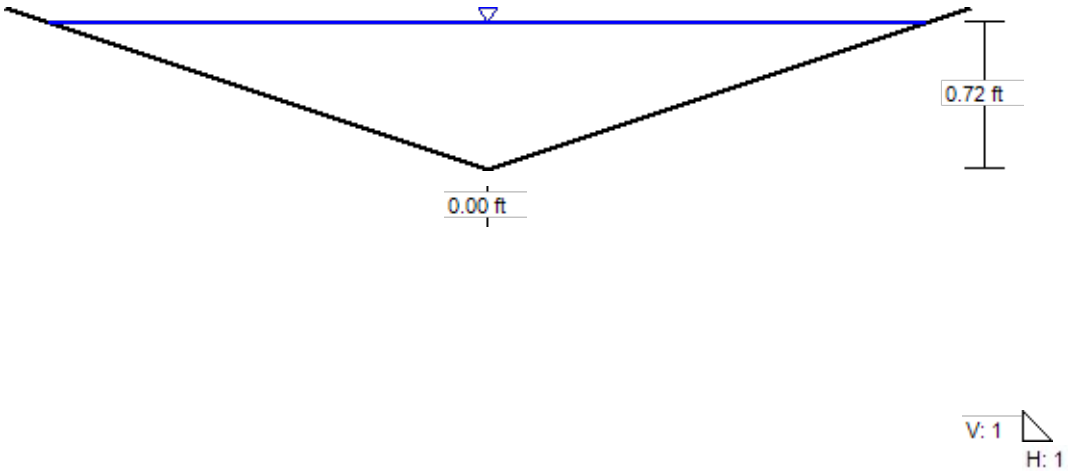
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Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.72 ft
Critical Depth	0.72 ft
Channel Slope	1.42 %
Critical Slope	1.37 %

Cross Section for Section 9B INT Phase2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	1.42 %
Normal Depth	0.72 ft
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	0.00 ft
Discharge	5.30 cfs



Section 9C INT Phase2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	0.00 ft
Discharge	6.70 cfs

Results	
Normal Depth	0.73 ft
Flow Area	1.6 ft²
Wetted Perimeter	4.59 ft
Hydraulic Radius	0.34 ft
Top Width	4.36 ft
Critical Depth	0.79 ft
Critical Slope	1.33 %
Velocity	4.23 ft/s
Velocity Head	0.28 ft
Specific Energy	1.00 ft
Froude Number	1.24
Flow Type	Supercritical

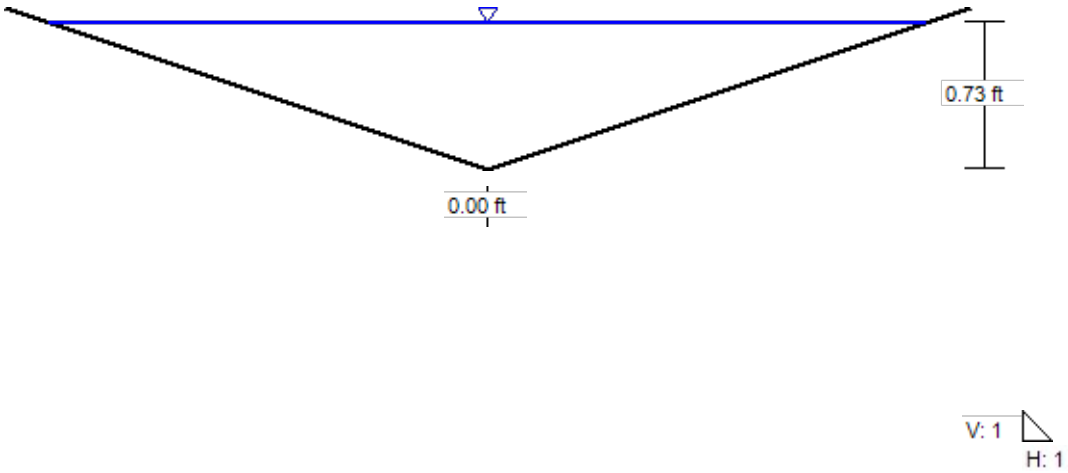
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Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.73 ft
Critical Depth	0.79 ft
Channel Slope	2.10 %
Critical Slope	1.33 %

Cross Section for Section 9C INT Phase2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Normal Depth	0.73 ft
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	0.00 ft
Discharge	6.70 cfs



Section 9D INT Phase2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	0.00 ft
Discharge	8.90 cfs

Results	
Normal Depth	0.81 ft
Flow Area	2.0 ft²
Wetted Perimeter	5.11 ft
Hydraulic Radius	0.38 ft
Top Width	4.85 ft
Critical Depth	0.89 ft
Critical Slope	1.28 %
Velocity	4.54 ft/s
Velocity Head	0.32 ft
Specific Energy	1.13 ft
Froude Number	1.26
Flow Type	Supercritical

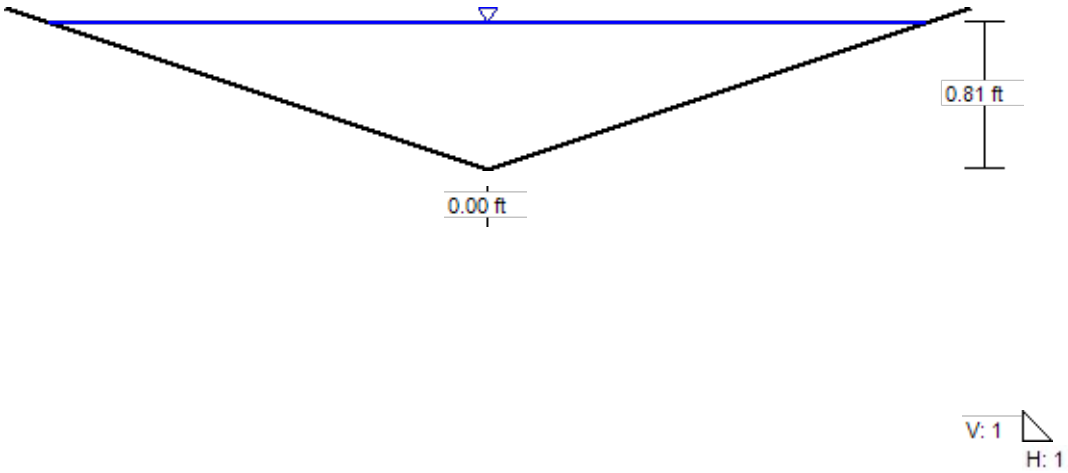
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.81 ft
Critical Depth	0.89 ft
Channel Slope	2.10 %
Critical Slope	1.28 %

Cross Section for Section 9D INT Phase2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Normal Depth	0.81 ft
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	0.00 ft
Discharge	8.90 cfs



OFFSITE CHANNEL NORMAL DEPTH CALCULATION FOR INTERIM PHASE 2 CONDITION

Section10 INT Phase2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	24.00 ft
Discharge	13.00 cfs

Results	
Normal Depth	0.19 ft
Flow Area	4.7 ft²
Wetted Perimeter	25.20 ft
Hydraulic Radius	0.18 ft
Top Width	25.14 ft
Critical Depth	0.21 ft
Critical Slope	1.56 %
Velocity	2.79 ft/s
Velocity Head	0.12 ft
Specific Energy	0.31 ft
Froude Number	1.14
Flow Type	Supercritical

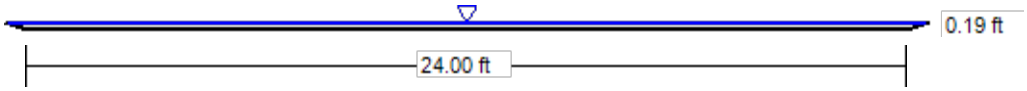
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Length	0.00 ft
Number Of Steps	0

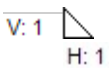
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.19 ft
Critical Depth	0.21 ft
Channel Slope	2.10 %
Critical Slope	1.56 %

Cross Section for Section10 INT Phase2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Normal Depth	0.19 ft
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	24.00 ft
Discharge	13.00 cfs





Section11 INT Phase2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	24.00 ft
Discharge	28.00 cfs

Results	
Normal Depth	0.30 ft
Flow Area	7.5 ft²
Wetted Perimeter	25.89 ft
Hydraulic Radius	0.29 ft
Top Width	25.80 ft
Critical Depth	0.34 ft
Critical Slope	1.33 %
Velocity	3.76 ft/s
Velocity Head	0.22 ft
Specific Energy	0.52 ft
Froude Number	1.23
Flow Type	Supercritical

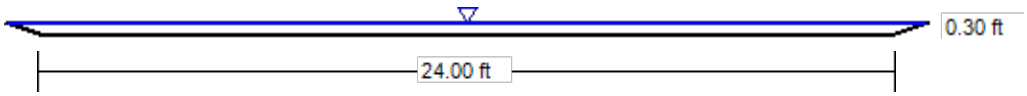
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

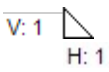
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.30 ft
Critical Depth	0.34 ft
Channel Slope	2.10 %
Critical Slope	1.33 %

Cross Section for Section11 INT Phase2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Normal Depth	0.30 ft
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	24.00 ft
Discharge	28.00 cfs





Section12 INT Phase2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	24.00 ft
Discharge	56.00 cfs

Results	
Normal Depth	0.45 ft
Flow Area	11.5 ft²
Wetted Perimeter	26.86 ft
Hydraulic Radius	0.43 ft
Top Width	26.71 ft
Critical Depth	0.54 ft
Critical Slope	1.15 %
Velocity	4.88 ft/s
Velocity Head	0.37 ft
Specific Energy	0.82 ft
Froude Number	1.31
Flow Type	Supercritical

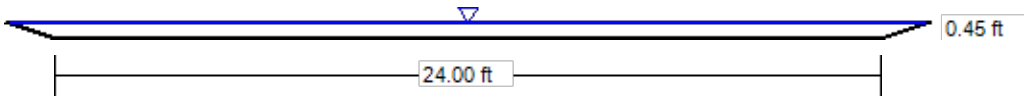
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

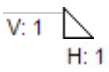
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.45 ft
Critical Depth	0.54 ft
Channel Slope	2.10 %
Critical Slope	1.15 %

Cross Section for Section12 INT Phase2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Normal Depth	0.45 ft
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	24.00 ft
Discharge	56.00 cfs





Section13 INT Phase2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	63.00 ft
Discharge	139.00 cfs

Results	
Normal Depth	0.44 ft
Flow Area	28.3 ft²
Wetted Perimeter	65.78 ft
Hydraulic Radius	0.43 ft
Top Width	65.64 ft
Critical Depth	0.53 ft
Critical Slope	1.14 %
Velocity	4.91 ft/s
Velocity Head	0.37 ft
Specific Energy	0.81 ft
Froude Number	1.32
Flow Type	Supercritical

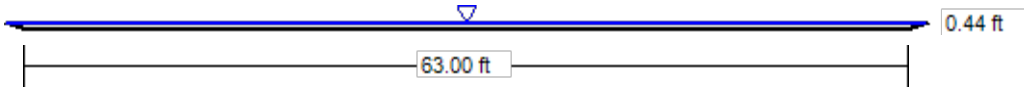
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Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

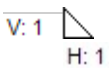
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.44 ft
Critical Depth	0.53 ft
Channel Slope	2.10 %
Critical Slope	1.14 %

Cross Section for Section13 INT Phase2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Normal Depth	0.44 ft
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	63.00 ft
Discharge	139.00 cfs





Section14 INT Phase2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	63.00 ft
Discharge	140.00 cfs

Results	
Normal Depth	0.44 ft
Flow Area	28.5 ft²
Wetted Perimeter	65.80 ft
Hydraulic Radius	0.43 ft
Top Width	65.65 ft
Critical Depth	0.53 ft
Critical Slope	1.14 %
Velocity	4.92 ft/s
Velocity Head	0.38 ft
Specific Energy	0.82 ft
Froude Number	1.32
Flow Type	Supercritical

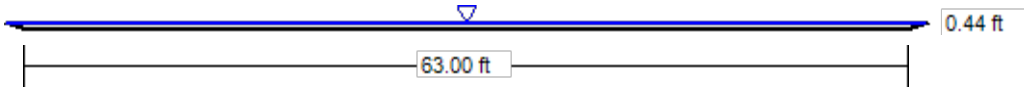
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

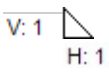
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.44 ft
Critical Depth	0.53 ft
Channel Slope	2.10 %
Critical Slope	1.14 %

Cross Section for Section14 INT Phase2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Normal Depth	0.44 ft
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	63.00 ft
Discharge	140.00 cfs





Section15 INT Phase2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	63.00 ft
Discharge	145.00 cfs

Results	
Normal Depth	0.45 ft
Flow Area	29.0 ft²
Wetted Perimeter	65.85 ft
Hydraulic Radius	0.44 ft
Top Width	65.71 ft
Critical Depth	0.54 ft
Critical Slope	1.13 %
Velocity	4.99 ft/s
Velocity Head	0.39 ft
Specific Energy	0.84 ft
Froude Number	1.32
Flow Type	Supercritical

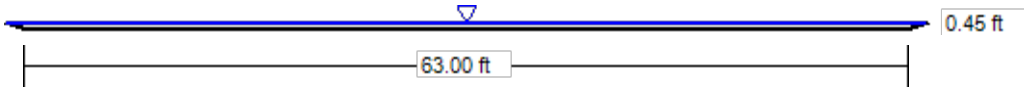
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

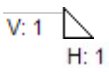
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.45 ft
Critical Depth	0.54 ft
Channel Slope	2.10 %
Critical Slope	1.13 %

Cross Section for Section15 INT Phase2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Normal Depth	0.45 ft
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	63.00 ft
Discharge	145.00 cfs





Section16 INT Phase2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	75.00 ft
Discharge	165.00 cfs

Results	
Normal Depth	0.44 ft
Flow Area	33.6 ft²
Wetted Perimeter	77.78 ft
Hydraulic Radius	0.43 ft
Top Width	77.64 ft
Critical Depth	0.53 ft
Critical Slope	1.14 %
Velocity	4.92 ft/s
Velocity Head	0.38 ft
Specific Energy	0.82 ft
Froude Number	1.32
Flow Type	Supercritical

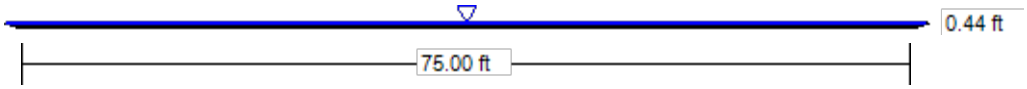
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

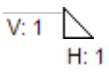
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.44 ft
Critical Depth	0.53 ft
Channel Slope	2.10 %
Critical Slope	1.14 %

Cross Section for Section16 INT Phase2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Normal Depth	0.44 ft
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	75.00 ft
Discharge	165.00 cfs





Section17 INT Phase2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	85.00 ft
Discharge	186.00 cfs

Results	
Normal Depth	0.44 ft
Flow Area	37.9 ft²
Wetted Perimeter	87.77 ft
Hydraulic Radius	0.43 ft
Top Width	87.63 ft
Critical Depth	0.53 ft
Critical Slope	1.14 %
Velocity	4.91 ft/s
Velocity Head	0.38 ft
Specific Energy	0.81 ft
Froude Number	1.32
Flow Type	Supercritical

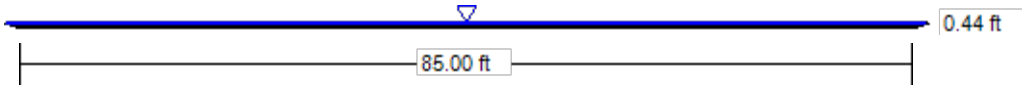
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Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

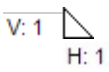
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.44 ft
Critical Depth	0.53 ft
Channel Slope	2.10 %
Critical Slope	1.14 %

Cross Section for Section17 INT Phase2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Normal Depth	0.44 ft
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	85.00 ft
Discharge	186.00 cfs





Section18 INT Phase2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	85.00 ft
Discharge	193.00 cfs

Results	
Normal Depth	0.45 ft
Flow Area	38.7 ft²
Wetted Perimeter	87.83 ft
Hydraulic Radius	0.44 ft
Top Width	87.69 ft
Critical Depth	0.54 ft
Critical Slope	1.13 %
Velocity	4.99 ft/s
Velocity Head	0.39 ft
Specific Energy	0.83 ft
Froude Number	1.32
Flow Type	Supercritical

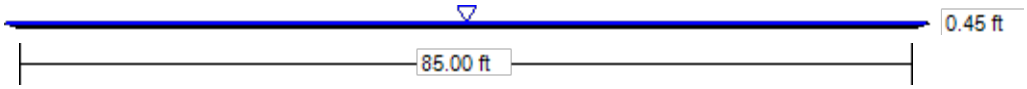
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

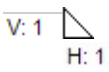
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.45 ft
Critical Depth	0.54 ft
Channel Slope	2.10 %
Critical Slope	1.13 %

Cross Section for Section18 INT Phase2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.10 %
Normal Depth	0.45 ft
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	85.00 ft
Discharge	193.00 cfs





STREET NORMAL DEPTH CALCULATION FOR ULTIMATE CONDITION

Section1 FULL 100' R/W - 10 YR-ULT

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.00 %
Discharge	9.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+50.00	1.03
0+93.00	0.17
0+93.00	0.13
0+94.50	0.00
0+94.50	0.50
0+95.00	0.50
1+00.00	0.60

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.13)	0.013
(0+07.00, 0.13)	(1+00.00, 0.60)	0.016

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

Results	
Normal Depth	0.35 ft
Elevation Range	0.00 to 1.03 ft
Flow Area	2.4 ft²
Wetted Perimeter	21.32 ft
Hydraulic Radius	0.11 ft
Top Width	20.54 ft
Normal Depth	0.35 ft

Results	
Critical Depth	0.42 ft
Critical Slope	0.71 %
Velocity	3.78 ft/s
Velocity Head	0.22 ft
Specific Energy	0.57 ft
Froude Number	1.96
Flow Type	Supercritical

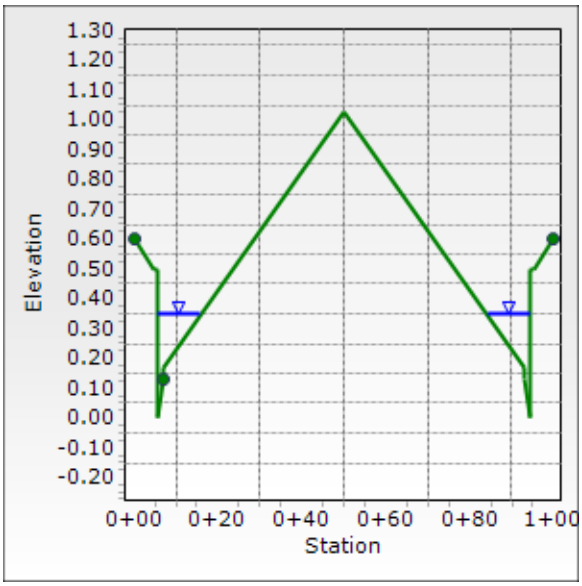
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.35 ft
Critical Depth	0.42 ft
Channel Slope	3.00 %
Critical Slope	0.71 %

Cross Section for Section1 FULL 100' R/W - 10 YR-ULT

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.00 %
Normal Depth	0.35 ft
Discharge	9.00 cfs



Section1 FULL 100' R/W - 100 YR-ULT

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.00 %
Discharge	18.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+50.00	1.03
0+93.00	0.17
0+93.00	0.13
0+94.50	0.00
0+94.50	0.50
0+95.00	0.50
1+00.00	0.60

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.13)	0.013
(0+07.00, 0.13)	(1+00.00, 0.60)	0.016

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

Results	
Normal Depth	0.41 ft
Elevation Range	0.00 to 1.03 ft
Flow Area	4.0 ft²
Wetted Perimeter	28.41 ft
Hydraulic Radius	0.14 ft
Top Width	27.49 ft
Normal Depth	0.41 ft

Results	
Critical Depth	0.52 ft
Critical Slope	0.66 %
Velocity	4.45 ft/s
Velocity Head	0.31 ft
Specific Energy	0.72 ft
Froude Number	2.04
Flow Type	Supercritical

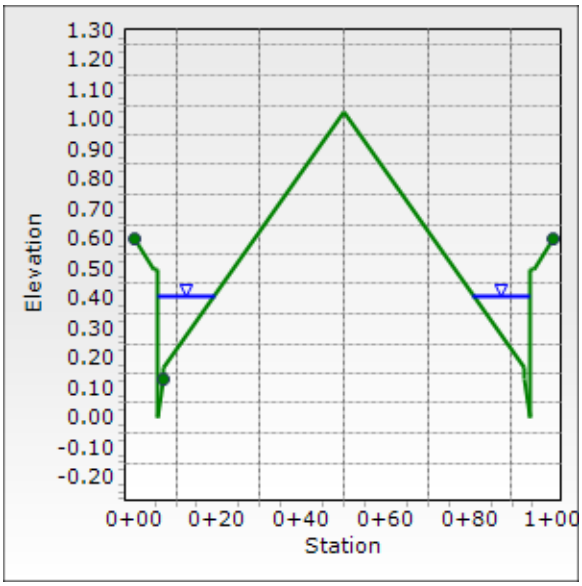
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Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.41 ft
Critical Depth	0.52 ft
Channel Slope	3.00 %
Critical Slope	0.66 %

Cross Section for Section1 FULL 100' R/W - 100 YR-ULT

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.00 %
Normal Depth	0.41 ft
Discharge	18.00 cfs



Section2 FULL 80' R/W -10 YR-ULT

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.85 %
Discharge	12.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+40.00	0.83
0+73.00	0.17
0+73.00	0.13
0+74.50	0.00
0+74.50	0.50
0+75.00	0.50
0+80.00	0.60

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.13)	0.013
(0+07.00, 0.13)	(0+80.00, 0.60)	0.016

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

Results	
Normal Depth	0.36 ft
Elevation Range	0.00 to 0.83 ft
Flow Area	2.7 ft²
Wetted Perimeter	22.87 ft
Hydraulic Radius	0.12 ft
Top Width	22.05 ft
Normal Depth	0.36 ft

Results	
Critical Depth	0.45 ft
Critical Slope	0.69 %
Velocity	4.44 ft/s
Velocity Head	0.31 ft
Specific Energy	0.67 ft
Froude Number	2.24
Flow Type	Supercritical

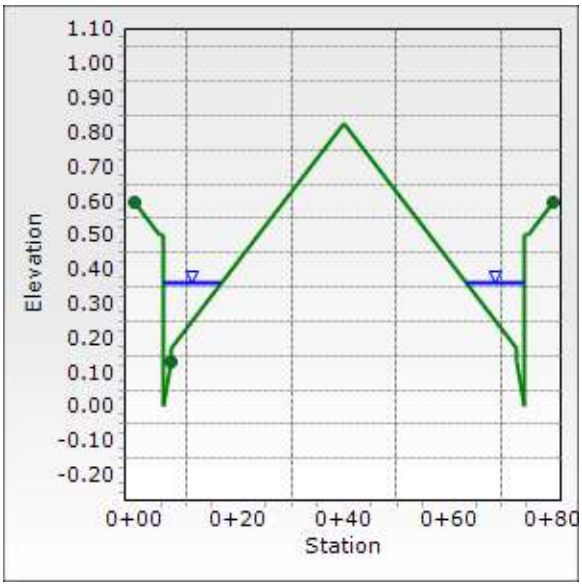
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Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.36 ft
Critical Depth	0.45 ft
Channel Slope	3.85 %
Critical Slope	0.69 %

Cross Section for Section2 FULL 80' R/W -10 YR-ULT

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.85 %
Normal Depth	0.36 ft
Discharge	12.00 cfs



Section2 FULL 80' R/W -100 YR-ULT

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.85 %
Discharge	56.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+40.00	0.83
0+73.00	0.17
0+73.00	0.13
0+74.50	0.00
0+74.50	0.50
0+75.00	0.50
0+80.00	0.60

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.13)	0.013
(0+07.00, 0.13)	(0+80.00, 0.60)	0.016

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

Results	
Normal Depth	0.56 ft
Elevation Range	0.00 to 0.83 ft
Flow Area	9.3 ft²
Wetted Perimeter	49.81 ft
Hydraulic Radius	0.19 ft
Top Width	48.71 ft
Normal Depth	0.56 ft

Results	
Critical Depth	0.72 ft
Critical Slope	0.57 %
Velocity	6.05 ft/s
Velocity Head	0.57 ft
Specific Energy	1.13 ft
Froude Number	2.45
Flow Type	Supercritical

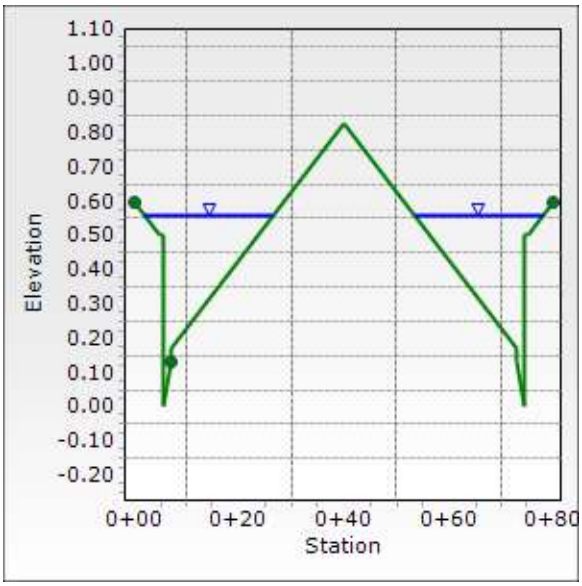
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Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.56 ft
Critical Depth	0.72 ft
Channel Slope	3.85 %
Critical Slope	0.57 %

Cross Section for Section2 FULL 80' R/W -100 YR-ULT

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.85 %
Normal Depth	0.56 ft
Discharge	56.00 cfs



Section3 onsite @ ON-D3 10 YR-ULT

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.20 %
Discharge	11.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.38
0+00.35	0.35
0+01.33	0.06
0+01.33	0.00
0+02.50	0.13
0+02.50	0.17
0+15.00	0.42
0+27.50	0.17
0+27.50	0.13
0+28.67	0.00
0+28.67	0.06
0+29.65	0.35
0+30.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.38)	(0+02.50, 0.13)	0.013
(0+02.50, 0.13)	(0+27.50, 0.13)	0.016
(0+27.50, 0.13)	(0+30.00, 0.38)	0.013

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

Results	
Normal Depth	0.37 ft
Elevation Range	0.00 to 0.42 ft
Flow Area	3.1 ft²
Wetted Perimeter	25.45 ft
Hydraulic Radius	0.12 ft
Top Width	25.15 ft

Results	
Normal Depth	0.37 ft
Critical Depth	0.43 ft
Critical Slope	0.65 %
Velocity	3.53 ft/s
Velocity Head	0.19 ft
Specific Energy	0.57 ft
Froude Number	1.77
Flow Type	Supercritical

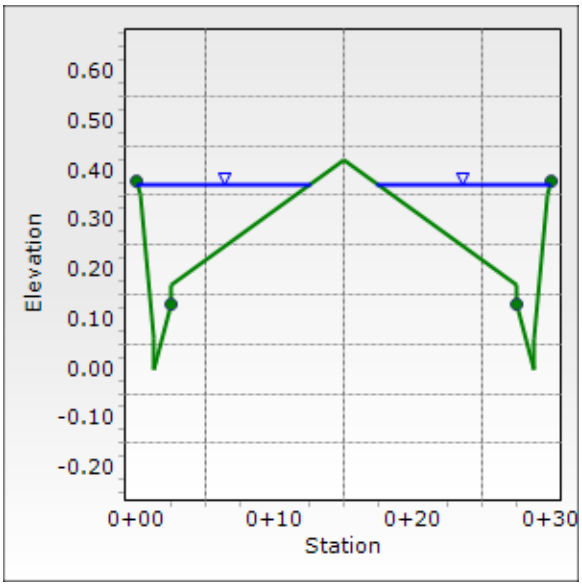
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.37 ft
Critical Depth	0.43 ft
Channel Slope	2.20 %
Critical Slope	0.65 %

Cross Section for Section3 onsite @ ON-D3 10 YR-ULT

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.20 %
Normal Depth	0.37 ft
Discharge	11.00 cfs



Section3 onsite @ ON-D3 100 YR-ULT

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.20 %
Discharge	23.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.38
0+00.35	0.35
0+01.33	0.06
0+01.33	0.00
0+02.50	0.13
0+02.50	0.17
0+15.00	0.42
0+27.50	0.17
0+27.50	0.13
0+28.67	0.00
0+28.67	0.06
0+29.65	0.35
0+30.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.38)	(0+02.50, 0.13)	0.013
(0+02.50, 0.13)	(0+27.50, 0.13)	0.016
(0+27.50, 0.13)	(0+30.00, 0.38)	0.013

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

Results	
Normal Depth	0.45 ft
Elevation Range	0.00 to 0.42 ft
Flow Area	5.2 ft²
Wetted Perimeter	30.44 ft
Hydraulic Radius	0.17 ft
Top Width	30.00 ft

Results	
Normal Depth	0.45 ft
Critical Depth	0.54 ft
Critical Slope	0.56 %
Velocity	4.39 ft/s
Velocity Head	0.30 ft
Specific Energy	0.75 ft
Froude Number	1.86
Flow Type	Supercritical

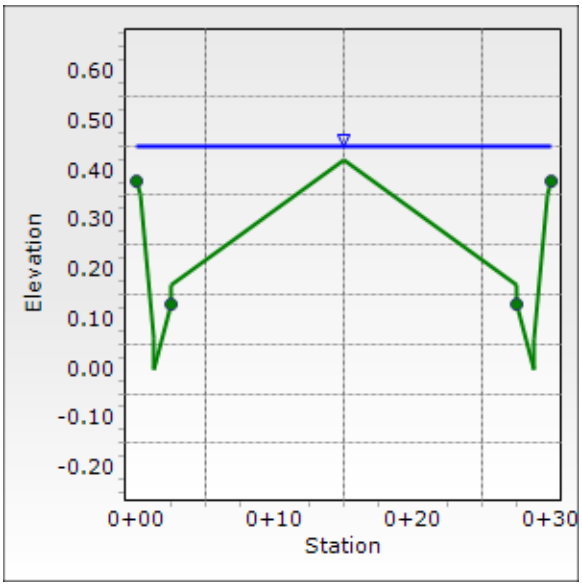
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.45 ft
Critical Depth	0.54 ft
Channel Slope	2.20 %
Critical Slope	0.56 %

Cross Section for Section3 onsite @ ON-D3 100 YR-ULT

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.20 %
Normal Depth	0.45 ft
Discharge	23.00 cfs



Worksheet for Section4 HAFL EAST onsite @ ON-D4 100 YR-ULT

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.20 %
Discharge	8.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+15.00	0.42
0+27.50	0.17
0+27.50	0.13
0+28.67	0.00
0+28.67	0.06
0+29.65	0.35
0+30.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+15.00, 0.42)	(0+27.50, 0.13)	0.016
(0+27.50, 0.13)	(0+30.00, 0.38)	0.013

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

Results	
Normal Depth	0.41 ft
Elevation Range	0.00 to 0.42 ft
Flow Area	2.1 ft²
Wetted Perimeter	14.74 ft
Hydraulic Radius	0.14 ft
Top Width	14.56 ft
Normal Depth	0.41 ft
Critical Depth	0.48 ft
Critical Slope	0.61 %
Velocity	3.85 ft/s
Velocity Head	0.23 ft
Specific Energy	0.64 ft
Froude Number	1.80

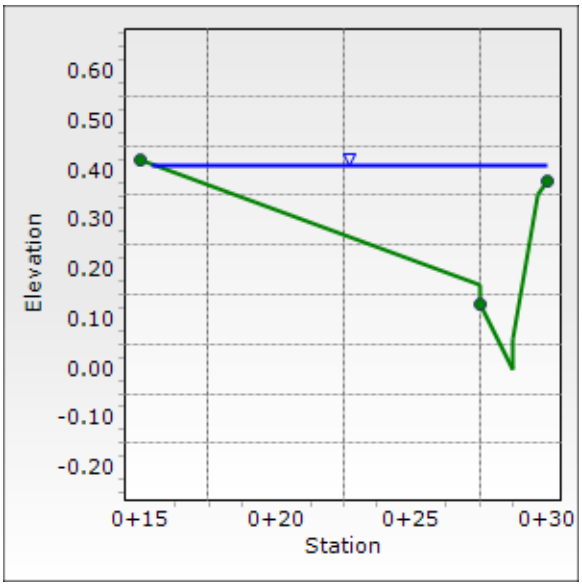
Worksheet for Section4 HAFL EAST onsite @ ON-D4 100 YR-ULT

Results	
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	0.41 ft
Critical Depth	0.48 ft
Channel Slope	2.20 %
Critical Slope	0.61 %

Cross Section for Section4 HAFL EAST onsite @ ON-D4 100 YR-ULT

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.20 %
Normal Depth	0.41 ft
Discharge	8.00 cfs



Section5 onsite @ON-D5 100 YR-ULT

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.20 %
Discharge	2.90 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.38
0+00.35	0.35
0+01.33	0.06
0+01.33	0.00
0+02.50	0.13
0+02.50	0.17
0+15.00	0.42
0+27.50	0.17
0+27.50	0.13
0+28.67	0.00
0+28.67	0.06
0+29.65	0.35
0+30.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.38)	(0+02.50, 0.13)	0.013
(0+02.50, 0.13)	(0+27.50, 0.13)	0.016
(0+27.50, 0.13)	(0+30.00, 0.38)	0.013

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

Results	
Normal Depth	0.27 ft
Elevation Range	0.00 to 0.42 ft
Flow Area	1.1 ft²
Wetted Perimeter	13.70 ft
Hydraulic Radius	0.08 ft
Top Width	13.42 ft

Results	
Normal Depth	0.27 ft
Critical Depth	0.30 ft
Critical Slope	0.75 %
Velocity	2.67 ft/s
Velocity Head	0.11 ft
Specific Energy	0.38 ft
Froude Number	1.66
Flow Type	Supercritical

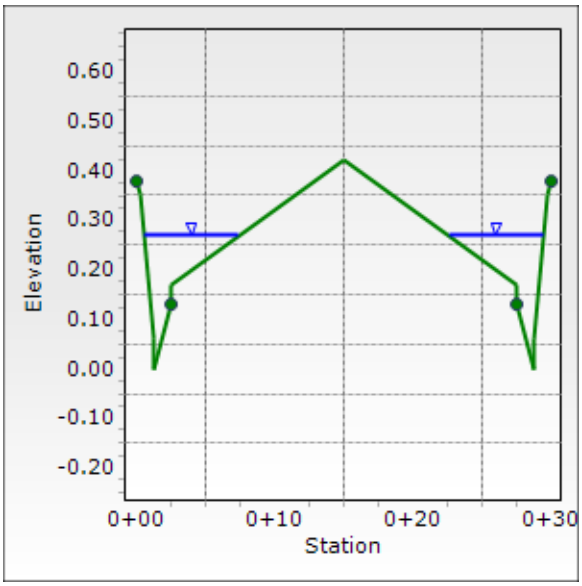
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Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.27 ft
Critical Depth	0.30 ft
Channel Slope	2.20 %
Critical Slope	0.75 %

Cross Section for Section5 onsite @ON-D5 100 YR-ULT

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.20 %
Normal Depth	0.27 ft
Discharge	2.90 cfs



Section6 onsite @ ON-D5 100YR-ULT

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.78 %
Discharge	28.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.38
0+00.35	0.35
0+01.33	0.06
0+01.33	0.00
0+02.50	0.13
0+02.50	0.17
0+15.00	0.42
0+27.50	0.17
0+27.50	0.13
0+28.67	0.00
0+28.67	0.06
0+29.65	0.35
0+30.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.38)	(0+02.50, 0.13)	0.013
(0+02.50, 0.13)	(0+27.50, 0.13)	0.016
(0+27.50, 0.13)	(0+30.00, 0.38)	0.013

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

Results	
Normal Depth	0.48 ft
Elevation Range	0.00 to 0.42 ft
Flow Area	6.3 ft²
Wetted Perimeter	30.51 ft
Hydraulic Radius	0.21 ft
Top Width	30.00 ft

Results	
Normal Depth	0.48 ft
Critical Depth	0.57 ft
Critical Slope	0.54 %
Velocity	4.46 ft/s
Velocity Head	0.31 ft
Specific Energy	0.79 ft
Froude Number	1.72
Flow Type	Supercritical

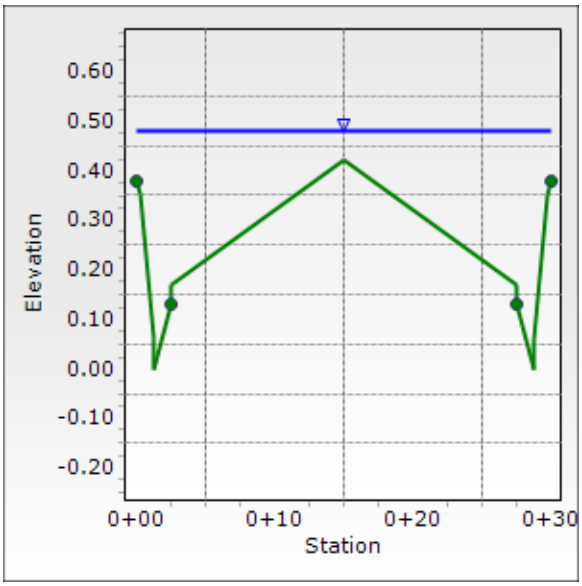
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.48 ft
Critical Depth	0.57 ft
Channel Slope	1.78 %
Critical Slope	0.54 %

Cross Section for Section6 onsite @ ON-D5 100YR-ULT

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.78 %
Normal Depth	0.48 ft
Discharge	28.00 cfs



Section7 onsite @ON-D6 100 YR-ULT

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.20 %
Discharge	17.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.38
0+00.35	0.35
0+01.33	0.06
0+01.33	0.00
0+02.50	0.13
0+02.50	0.17
0+15.00	0.42
0+27.50	0.17
0+27.50	0.13
0+28.67	0.00
0+28.67	0.06
0+29.65	0.35
0+30.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.38)	(0+02.50, 0.13)	0.013
(0+02.50, 0.13)	(0+27.50, 0.13)	0.016
(0+27.50, 0.13)	(0+30.00, 0.38)	0.013

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

Results	
Normal Depth	0.42 ft
Elevation Range	0.00 to 0.42 ft
Flow Area	4.4 ft²
Wetted Perimeter	30.16 ft
Hydraulic Radius	0.14 ft
Top Width	29.78 ft

Results	
Normal Depth	0.42 ft
Critical Depth	0.49 ft
Critical Slope	0.60 %
Velocity	3.91 ft/s
Velocity Head	0.24 ft
Specific Energy	0.66 ft
Froude Number	1.80
Flow Type	Supercritical

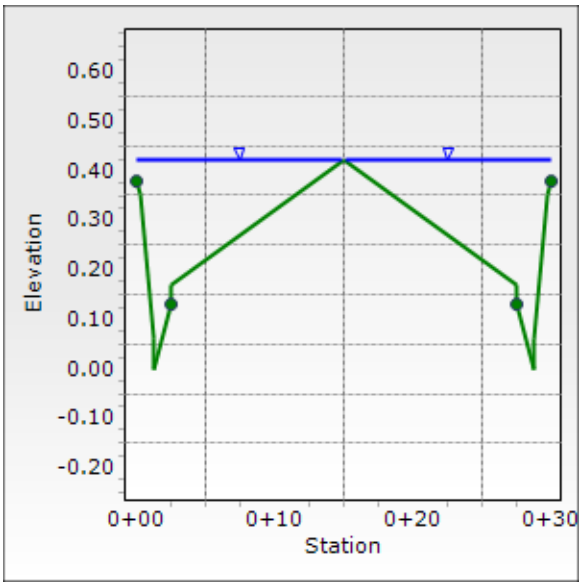
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Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.42 ft
Critical Depth	0.49 ft
Channel Slope	2.20 %
Critical Slope	0.60 %

Cross Section for Section7 onsite @ON-D6 100 YR-ULT

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.20 %
Normal Depth	0.42 ft
Discharge	17.00 cfs



Section8 onsite @ ON-D5 100 YR-ULT

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.20 %
Discharge	37.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.38
0+00.35	0.35
0+01.33	0.06
0+01.33	0.00
0+02.50	0.13
0+02.50	0.17
0+15.00	0.42
0+27.50	0.17
0+27.50	0.13
0+28.67	0.00
0+28.67	0.06
0+29.65	0.35
0+30.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.38)	(0+02.50, 0.13)	0.013
(0+02.50, 0.13)	(0+27.50, 0.13)	0.016
(0+27.50, 0.13)	(0+30.00, 0.38)	0.013

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

Results	
Normal Depth	0.51 ft
Elevation Range	0.00 to 0.42 ft
Flow Area	7.0 ft²
Wetted Perimeter	30.56 ft
Hydraulic Radius	0.23 ft
Top Width	30.00 ft

Results	
Normal Depth	0.51 ft
Critical Depth	0.63 ft
Critical Slope	0.51 %
Velocity	5.31 ft/s
Velocity Head	0.44 ft
Specific Energy	0.94 ft
Froude Number	1.94
Flow Type	Supercritical

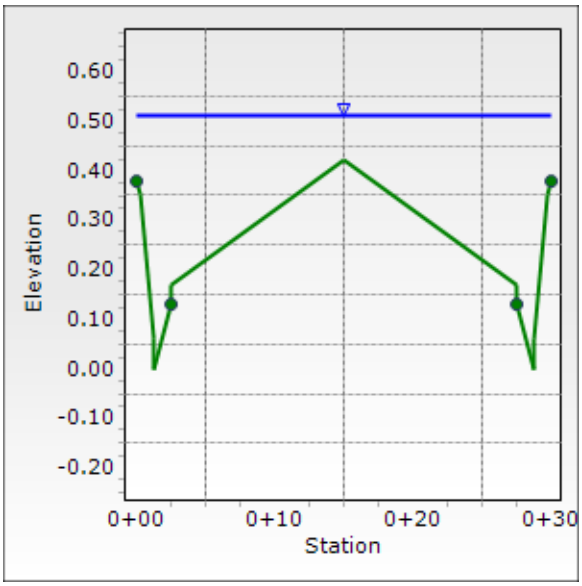
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	0.51 ft
Critical Depth	0.63 ft
Channel Slope	2.20 %
Critical Slope	0.51 %

Cross Section for Section8 onsite @ ON-D5 100 YR-ULT

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.20 %
Normal Depth	0.51 ft
Discharge	37.00 cfs



Worksheet for Section 19 onsite @ ON-D6 100 YR-ULT

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.20 %
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	4.00 ft
Discharge	2.70 cfs

Results	
Normal Depth	0.21 ft
Flow Area	1.0 ft²
Wetted Perimeter	5.31 ft
Hydraulic Radius	0.18 ft
Top Width	5.24 ft
Critical Depth	0.23 ft
Critical Slope	1.59 %
Velocity	2.82 ft/s
Velocity Head	0.12 ft
Specific Energy	0.33 ft
Froude Number	1.16
Flow Type	Supercritical

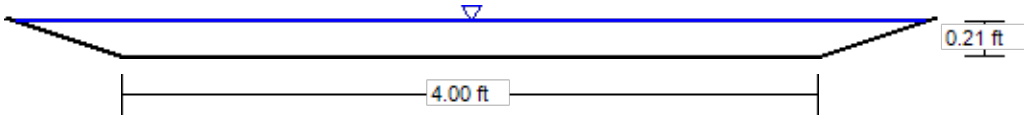
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

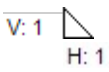
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.21 ft
Critical Depth	0.23 ft
Channel Slope	2.20 %
Critical Slope	1.59 %

Cross Section for Section 19 onsite @ ON-D6 100 YR-ULT

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.025
Channel Slope	2.20 %
Normal Depth	0.21 ft
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	4.00 ft
Discharge	2.70 cfs





DROP INLET CALCULATION

DI3 10' CM2 in Sag PH1

Project Description	
Solve For	Spread

Input Data	
Discharge	11.00 cfs
Gutter Width	1.50 ft
Gutter Cross Slope	8.33 %
Road Cross Slope	2.00 %
Local Depression	2.0 in
Local Depression Width	18.0 in
Grate Width	1.50 ft
Grate Length	6.25 ft
Grate Type	P-50 mm (P-1 -7/8")
Clogging	0.0 %
Curb Opening Length	7.50 ft
Opening Height	0.50 ft
Curb Throat Type	Horizontal
Throat Incline Angle	90.00 degrees

Options	
Calculation Option	Use Both

Results	
Spread	20.45 ft
Depth	0.50 ft
Gutter Depression	1.1 in
Total Depression	3.1 in
Open Grate Area	8.4 ft²
Active Grate Weir Length	9.25 ft

DI4 10' CM2 in Sag PH1

Project Description	
Solve For	Spread

Input Data	
Discharge	9.00 cfs
Gutter Width	1.50 ft
Gutter Cross Slope	8.33 %
Road Cross Slope	2.00 %
Local Depression	2.0 in
Local Depression Width	18.0 in
Grate Width	1.50 ft
Grate Length	3.75 ft
Grate Type	P-50 mm (P-1 -7/8")
Clogging	0.0 %
Curb Opening Length	5.00 ft
Opening Height	0.50 ft
Curb Throat Type	Horizontal
Throat Incline Angle	90.00 degrees

Options	
Calculation Option	Use Both

Results	
Spread	20.37 ft
Depth	0.50 ft
Gutter Depression	1.1 in
Total Depression	3.1 in
Open Grate Area	5.1 ft²
Active Grate Weir Length	6.75 ft

DI1 10' CM2 in Grade 10YR-PH2

Project Description	
Solve For	Efficiency

Input Data	
Discharge	6.00 cfs
Slope	2.20 %
Gutter Width	1.50 ft
Gutter Cross Slope	8.33 %
Road Cross Slope	2.00 %
Roughness Coefficient	0.016
Local Depression	2.0 in
Local Depression Width	18.0 in
Grate Width	1.50 ft
Grate Length	3.75 ft
Grate Type	P-50 mm (P-1 -7/8")
Clogging	0.0 %
Curb Opening Length	5.00 ft

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results	
Efficiency	56.06 %
Intercepted Flow	3.36 cfs
Bypass Flow	2.64 cfs
Spread	11.68 ft
Depth	0.33 ft
Flow Area	1.4 ft²
Gutter Depression	1.1 in
Total Depression	3.1 in
Velocity	4.18 ft/s
Splash Over Velocity	11.14 ft/s
Frontal Flow Factor	1.00
Side Flow Factor	0.17
Grate Flow Ratio	0.383
Equivalent Cross Slope	8.68 %
Active Grate Length	3.75 ft
Length Factor	0.06
Total Interception Length	21.00 ft

Messages

Messages	
Messages	Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

DI2 10' CM2 in Grade 10YR-PH2

Project Description	
Solve For	Efficiency

Input Data	
Discharge	5.00 cfs
Slope	2.20 %
Gutter Width	1.50 ft
Gutter Cross Slope	8.33 %
Road Cross Slope	2.00 %
Roughness Coefficient	0.016
Local Depression	2.0 in
Local Depression Width	18.0 in
Grate Width	1.50 ft
Grate Length	3.75 ft
Grate Type	P-50 mm (P-1 -7/8")
Clogging	0.0 %
Curb Opening Length	5.00 ft

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results	
Efficiency	59.62 %
Intercepted Flow	2.98 cfs
Bypass Flow	2.02 cfs
Spread	10.83 ft
Depth	0.31 ft
Flow Area	1.2 ft²
Gutter Depression	1.1 in
Total Depression	3.1 in
Velocity	4.02 ft/s
Splash Over Velocity	11.14 ft/s
Frontal Flow Factor	1.00
Side Flow Factor	0.19
Grate Flow Ratio	0.412
Equivalent Cross Slope	9.19 %
Active Grate Length	3.75 ft
Length Factor	0.07
Total Interception Length	18.79 ft

Messages

Messages	
Messages	Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

DI1 10' CM2 in Grade 100 YR-PH2

Project Description	
Solve For	Efficiency

Input Data	
Discharge	12.00 cfs
Slope	2.20 %
Gutter Width	1.50 ft
Gutter Cross Slope	8.33 %
Road Cross Slope	2.00 %
Roughness Coefficient	0.016
Local Depression	2.0 in
Local Depression Width	18.0 in
Grate Width	1.50 ft
Grate Length	3.75 ft
Grate Type	P-50 mm (P-1 -7/8")
Clogging	0.0 %
Curb Opening Length	5.00 ft

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results	
Efficiency	43.82 %
Intercepted Flow	5.26 cfs
Bypass Flow	6.74 cfs
Spread	15.42 ft
Depth	0.40 ft
Flow Area	2.4 ft²
Gutter Depression	1.1 in
Total Depression	3.1 in
Velocity	4.90 ft/s
Splash Over Velocity	11.14 ft/s
Frontal Flow Factor	1.00
Side Flow Factor	0.14
Grate Flow Ratio	0.288
Equivalent Cross Slope	7.03 %
Active Grate Length	3.75 ft
Length Factor	0.04
Total Interception Length	31.88 ft

Messages

Messages	
Messages	Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

DI2 10' CM2 in Grade 100YR-PH2

Project Description	
Solve For	Efficiency

Input Data	
Discharge	11.00 cfs
Slope	2.20 %
Gutter Width	1.50 ft
Gutter Cross Slope	8.33 %
Road Cross Slope	2.00 %
Roughness Coefficient	0.016
Local Depression	2.0 in
Local Depression Width	18.0 in
Grate Width	1.50 ft
Grate Length	3.75 ft
Grate Type	P-50 mm (P-1 -7/8")
Clogging	0.0 %
Curb Opening Length	5.00 ft

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results	
Efficiency	45.24 %
Intercepted Flow	4.98 cfs
Bypass Flow	6.02 cfs
Spread	14.89 ft
Depth	0.39 ft
Flow Area	2.3 ft²
Gutter Depression	1.1 in
Total Depression	3.1 in
Velocity	4.80 ft/s
Splash Over Velocity	11.14 ft/s
Frontal Flow Factor	1.00
Side Flow Factor	0.14
Grate Flow Ratio	0.299
Equivalent Cross Slope	7.21 %
Active Grate Length	3.75 ft
Length Factor	0.04
Total Interception Length	30.26 ft

Messages

Messages		
Messages	Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).	

DI3 10' CM2 in Sag PH2

Project Description	
Solve For	Spread

Input Data	
Discharge	11.00 cfs
Gutter Width	1.50 ft
Gutter Cross Slope	8.33 %
Road Cross Slope	2.00 %
Local Depression	2.0 in
Local Depression Width	18.0 in
Grate Width	1.50 ft
Grate Length	6.25 ft
Grate Type	P-50 mm (P-1 -7/8")
Clogging	0.0 %
Curb Opening Length	7.50 ft
Opening Height	0.50 ft
Curb Throat Type	Horizontal
Throat Incline Angle	90.00 degrees

Options	
Calculation Option	Use Both

Results	
Spread	20.45 ft
Depth	0.50 ft
Gutter Depression	1.1 in
Total Depression	3.1 in
Open Grate Area	8.4 ft²
Active Grate Weir Length	9.25 ft

DI4 10' CM2 in Sag PH2

Project Description	
Solve For	Spread

Input Data	
Discharge	9.00 cfs
Gutter Width	1.50 ft
Gutter Cross Slope	8.33 %
Road Cross Slope	2.00 %
Local Depression	2.0 in
Local Depression Width	18.0 in
Grate Width	1.50 ft
Grate Length	3.75 ft
Grate Type	P-50 mm (P-1 -7/8")
Clogging	0.0 %
Curb Opening Length	5.00 ft
Opening Height	0.50 ft
Curb Throat Type	Horizontal
Throat Incline Angle	90.00 degrees

Options	
Calculation Option	Use Both

Results	
Spread	20.37 ft
Depth	0.50 ft
Gutter Depression	1.1 in
Total Depression	3.1 in
Open Grate Area	5.1 ft²
Active Grate Weir Length	6.75 ft

DI1 10' CM2 in Grade 10YR-ULT

Project Description	
Solve For	Efficiency

Input Data	
Discharge	6.00 cfs
Slope	2.20 %
Gutter Width	1.50 ft
Gutter Cross Slope	8.33 %
Road Cross Slope	2.00 %
Roughness Coefficient	0.016
Local Depression	2.0 in
Local Depression Width	18.0 in
Grate Width	1.50 ft
Grate Length	3.75 ft
Grate Type	P-50 mm (P-1 -7/8")
Clogging	0.0 %
Curb Opening Length	5.00 ft

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results	
Efficiency	56.06 %
Intercepted Flow	3.36 cfs
Bypass Flow	2.64 cfs
Spread	11.68 ft
Depth	0.33 ft
Flow Area	1.4 ft²
Gutter Depression	1.1 in
Total Depression	3.1 in
Velocity	4.18 ft/s
Splash Over Velocity	11.14 ft/s
Frontal Flow Factor	1.00
Side Flow Factor	0.17
Grate Flow Ratio	0.383
Equivalent Cross Slope	8.68 %
Active Grate Length	3.75 ft
Length Factor	0.06
Total Interception Length	21.00 ft

Messages

Messages		
Messages	Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).	

DI2 10' CM2 in Grade 10YR-ULT

Project Description	
Solve For	Efficiency

Input Data	
Discharge	5.00 cfs
Slope	2.20 %
Gutter Width	1.50 ft
Gutter Cross Slope	8.33 %
Road Cross Slope	2.00 %
Roughness Coefficient	0.016
Local Depression	2.0 in
Local Depression Width	18.0 in
Grate Width	1.50 ft
Grate Length	3.75 ft
Grate Type	P-50 mm (P-1 -7/8")
Clogging	0.0 %
Curb Opening Length	5.00 ft

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results	
Efficiency	59.62 %
Intercepted Flow	2.98 cfs
Bypass Flow	2.02 cfs
Spread	10.83 ft
Depth	0.31 ft
Flow Area	1.2 ft²
Gutter Depression	1.1 in
Total Depression	3.1 in
Velocity	4.02 ft/s
Splash Over Velocity	11.14 ft/s
Frontal Flow Factor	1.00
Side Flow Factor	0.19
Grate Flow Ratio	0.412
Equivalent Cross Slope	9.19 %
Active Grate Length	3.75 ft
Length Factor	0.07
Total Interception Length	18.79 ft

Messages

Messages	
Messages	Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

DI1 10' CM2 in Grade 100 YR-ULT

Project Description	
Solve For	Efficiency

Input Data	
Discharge	12.00 cfs
Slope	2.20 %
Gutter Width	1.50 ft
Gutter Cross Slope	8.33 %
Road Cross Slope	2.00 %
Roughness Coefficient	0.016
Local Depression	2.0 in
Local Depression Width	18.0 in
Grate Width	1.50 ft
Grate Length	3.75 ft
Grate Type	P-50 mm (P-1 -7/8")
Clogging	0.0 %
Curb Opening Length	5.00 ft

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results	
Efficiency	43.82 %
Intercepted Flow	5.26 cfs
Bypass Flow	6.74 cfs
Spread	15.42 ft
Depth	0.40 ft
Flow Area	2.4 ft²
Gutter Depression	1.1 in
Total Depression	3.1 in
Velocity	4.90 ft/s
Splash Over Velocity	11.14 ft/s
Frontal Flow Factor	1.00
Side Flow Factor	0.14
Grate Flow Ratio	0.288
Equivalent Cross Slope	7.03 %
Active Grate Length	3.75 ft
Length Factor	0.04
Total Interception Length	31.88 ft

Messages

Messages	
Messages	Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

DI2 10' CM2 in Grade 100YR-ULT

Project Description	
Solve For	Efficiency

Input Data	
Discharge	11.00 cfs
Slope	2.20 %
Gutter Width	1.50 ft
Gutter Cross Slope	8.33 %
Road Cross Slope	2.00 %
Roughness Coefficient	0.016
Local Depression	2.0 in
Local Depression Width	18.0 in
Grate Width	1.50 ft
Grate Length	3.75 ft
Grate Type	P-50 mm (P-1 -7/8")
Clogging	0.0 %
Curb Opening Length	5.00 ft

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results	
Efficiency	45.24 %
Intercepted Flow	4.98 cfs
Bypass Flow	6.02 cfs
Spread	14.89 ft
Depth	0.39 ft
Flow Area	2.3 ft²
Gutter Depression	1.1 in
Total Depression	3.1 in
Velocity	4.80 ft/s
Splash Over Velocity	11.14 ft/s
Frontal Flow Factor	1.00
Side Flow Factor	0.14
Grate Flow Ratio	0.299
Equivalent Cross Slope	7.21 %
Active Grate Length	3.75 ft
Length Factor	0.04
Total Interception Length	30.26 ft

Messages

Messages		
Messages	Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).	

DI3 10' CM2 in Sag ULT

Project Description	
Solve For	Spread

Input Data	
Discharge	11.00 cfs
Gutter Width	1.50 ft
Gutter Cross Slope	8.33 %
Road Cross Slope	2.00 %
Local Depression	2.0 in
Local Depression Width	18.0 in
Grate Width	1.50 ft
Grate Length	6.25 ft
Grate Type	P-50 mm (P-1 -7/8")
Clogging	0.0 %
Curb Opening Length	7.50 ft
Opening Height	0.50 ft
Curb Throat Type	Horizontal
Throat Incline Angle	90.00 degrees

Options	
Calculation Option	Use Both

Results	
Spread	20.45 ft
Depth	0.50 ft
Gutter Depression	1.1 in
Total Depression	3.1 in
Open Grate Area	8.4 ft²
Active Grate Weir Length	9.25 ft

DI4 10' CM2 in Sag ULT

Project Description	
Solve For	Spread

Input Data	
Discharge	9.00 cfs
Gutter Width	1.50 ft
Gutter Cross Slope	8.33 %
Road Cross Slope	2.00 %
Local Depression	2.0 in
Local Depression Width	18.0 in
Grate Width	1.50 ft
Grate Length	3.75 ft
Grate Type	P-50 mm (P-1 -7/8")
Clogging	0.0 %
Curb Opening Length	5.00 ft
Opening Height	0.50 ft
Curb Throat Type	Horizontal
Throat Incline Angle	90.00 degrees

Options	
Calculation Option	Use Both

Results	
Spread	20.37 ft
Depth	0.50 ft
Gutter Depression	1.1 in
Total Depression	3.1 in
Open Grate Area	5.1 ft²
Active Grate Weir Length	6.75 ft

Worksheet for DI5 NDOT Type II Grate Inlet

Project Description	
Solve For	Spread

Input Data	
Discharge	66.00 cfs
Gutter Width	5.00 ft
Gutter Cross Slope	8.33 %
Road Cross Slope	2.00 %
Grate Width	5.00 ft
Grate Length	6.00 ft
Local Depression	2.0 in
Local Depression Width	18.0 in
Grate Type	P-50 mm (P-1 -7/8")
Clogging	50.0 %

Results	
Spread	77.58 ft
Depth	1.87 ft
Gutter Depression	3.8 in
Total Depression	5.8 in
Open Grate Area	13.5 ft²
Active Grate Weir Length	11.00 ft

Worksheet for Weir at Section 6

Project Description	
Solve For	Headwater Elevation

Input Data	
Discharge	17.00 cfs
Crest Elevation	100.00 ft
Tailwater Elevation	100.00 ft
Weir Coefficient	3.10 ft^(1/2)/s
Crest Length	30.00 ft
Number Of Contractions	0

Results	
Headwater Elevation	100.32 ft
Headwater Height Above Crest	0.32 ft
Tailwater Height Above Crest	0.00 ft
Flow Area	9.7 ft²
Velocity	1.76 ft/s
Wetted Perimeter	30.64 ft
Top Width	30.00 ft

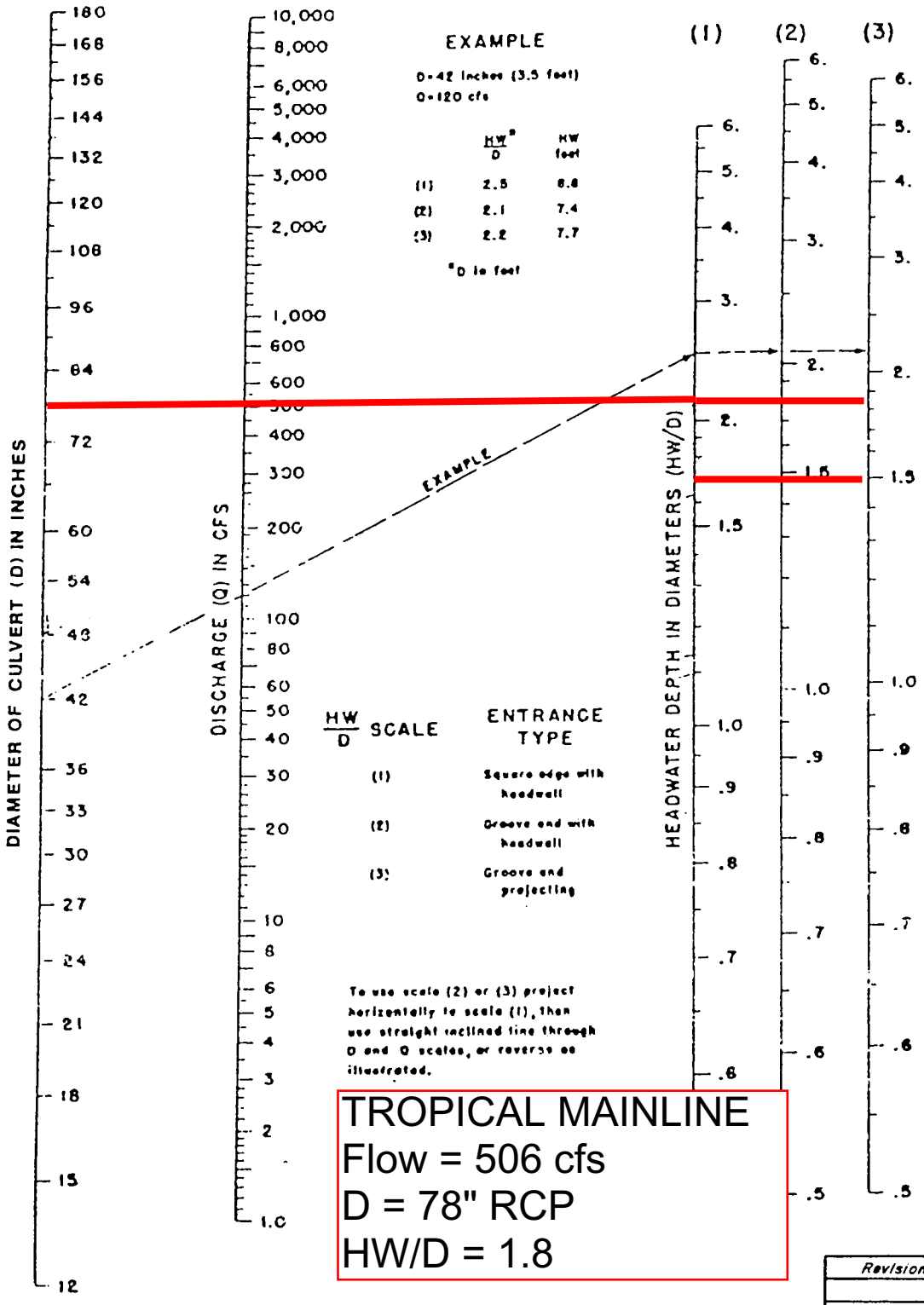
Weir at Section 8

Project Description	
Solve For	Headwater Elevation

Input Data	
Discharge	28.00 cfs
Crest Elevation	100.00 ft
Tailwater Elevation	100.00 ft
Weir Coefficient	3.10 ft^(1/2)/s
Crest Length	30.00 ft
Number Of Contractions	0

Results	
Headwater Elevation	100.45 ft
Headwater Height Above Crest	0.45 ft
Tailwater Height Above Crest	0.00 ft
Flow Area	13.5 ft²
Velocity	2.08 ft/s
Wetted Perimeter	30.90 ft
Top Width	30.00 ft

NOMOGRAPH – INLET CONTROL RCP



TROPICAL MAINLINE
Flow = 506 cfs
D = 78" RCP
HW/D = 1.8

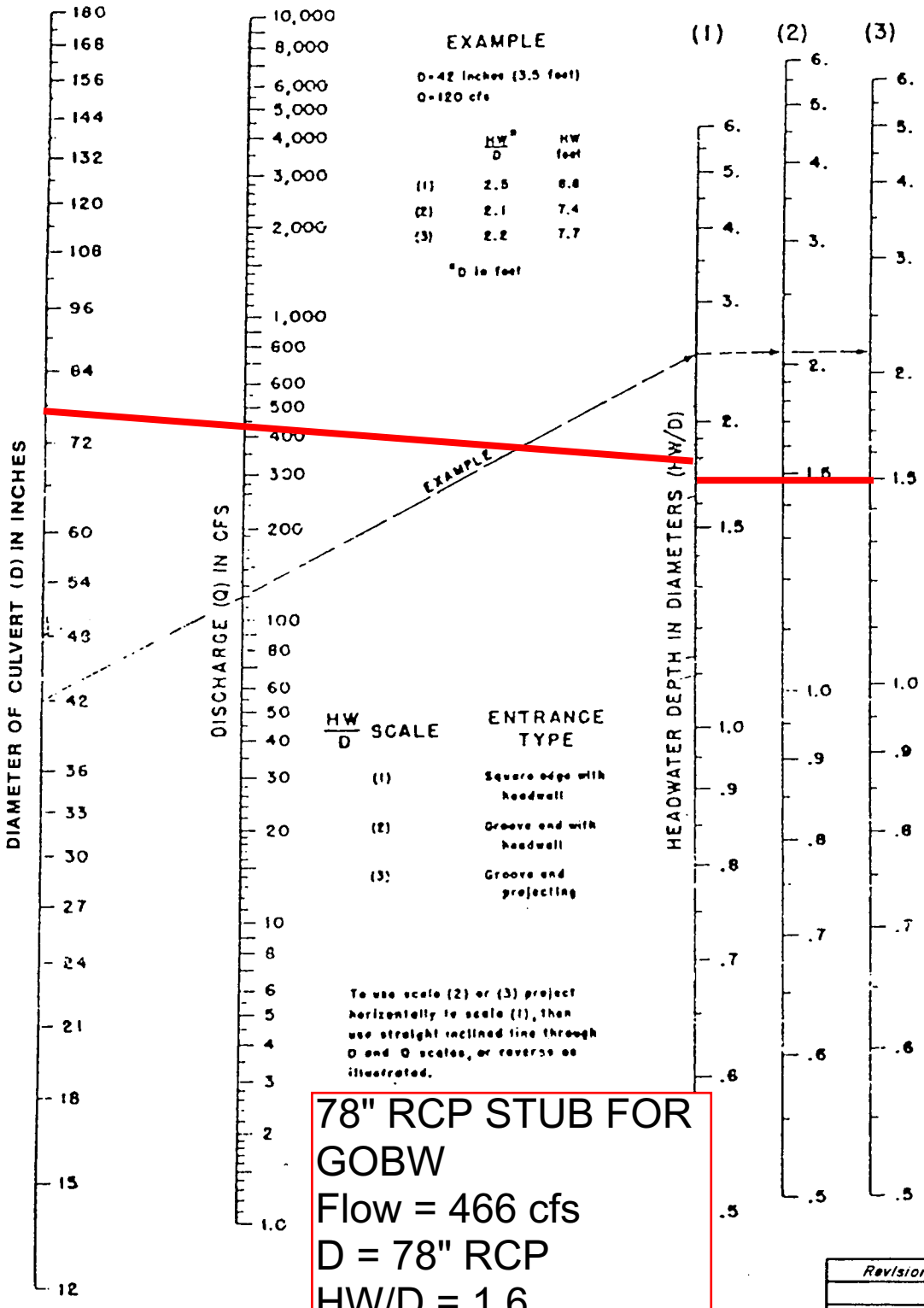
Revision	Date

WRC ENGINEERING

REFERENCE:
USDOT, FHWA, HDS, No. 5, 1985

FIGURE 1005

NOMOGRAPH – INLET CONTROL RCP



78" RCP STUB FOR GOBW
Flow = 466 cfs
D = 78" RCP
HW/D = 1.6

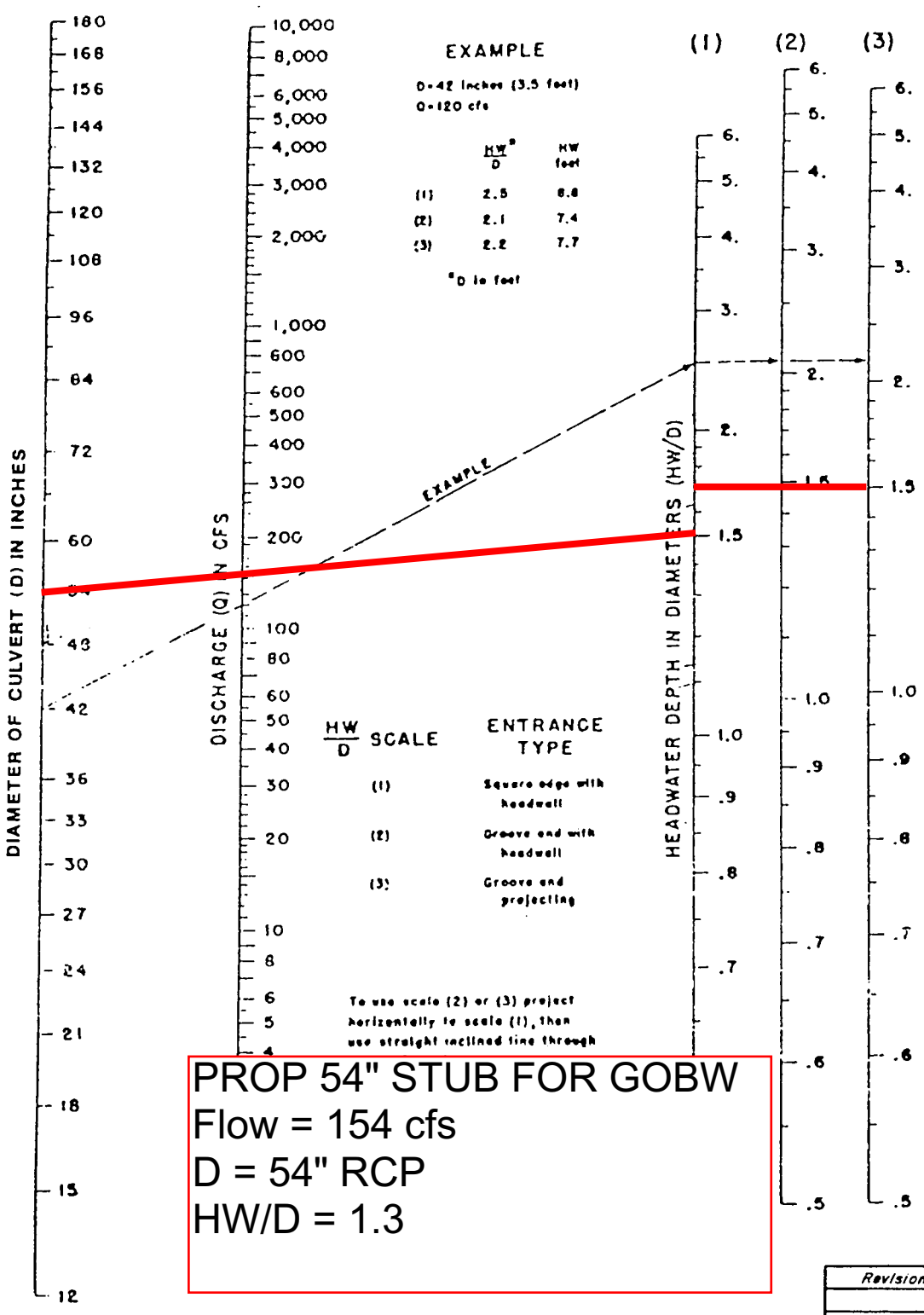
Revision	Date

WRC ENGINEERING

REFERENCE: USDOT, FHWA, HDS, No. 5, 1985

FIGURE 1005

NOMOGRAPH – INLET CONTROL RCP



PROP 54" STUB FOR GOBW
Flow = 154 cfs
D = 54" RCP
HW/D = 1.3

Revision	Date

WRC ENGINEERING

REFERENCE:
USDOT, FHWA, HDS, No. 5, 1985

FIGURE 1005

Worksheet for Downstream Channel-Concrete Bottom

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.60 %
Discharge	616.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	5.00
0+15.00	0.00
0+25.00	0.00
0+40.00	5.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 5.00)	(0+15.00, 0.00)	0.035
(0+15.00, 0.00)	(0+25.00, 0.00)	0.013
(0+25.00, 0.00)	(0+40.00, 5.00)	0.035

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	4.01 ft
Elevation Range	0.00 to 5.00 ft
Flow Area	88.4 ft²
Wetted Perimeter	35.38 ft
Hydraulic Radius	2.50 ft
Top Width	34.08 ft
Normal Depth	4.01 ft
Critical Depth	3.49 ft
Critical Slope	1.07 %
Velocity	6.96 ft/s
Velocity Head	0.75 ft
Specific Energy	4.77 ft
Froude Number	0.76
Flow Type	Subcritical

Worksheet for Downstream Channel-Concrete Bottom

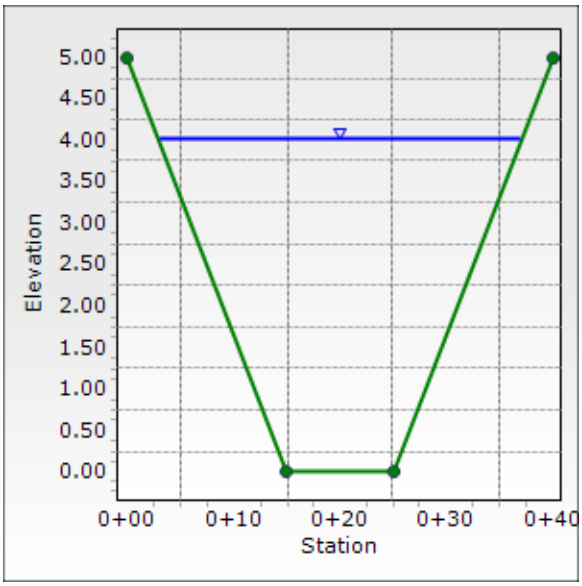
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	4.01 ft
Critical Depth	3.49 ft
Channel Slope	0.60 %
Critical Slope	1.07 %

Cross Section for Downstream Channel-Concrete Bottom

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.60 %
Normal Depth	4.01 ft
Discharge	616.00 cfs



Worksheet for Downstream Channel

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.60	%
Discharge	616.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	5.00
0+15.00	0.00
0+25.00	0.00
0+40.00	5.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 5.00)	(0+15.00, 0.00)	0.035
(0+15.00, 0.00)	(0+25.00, 0.00)	0.035
(0+25.00, 0.00)	(0+40.00, 5.00)	0.035

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	4.29	ft
Elevation Range	0.00 to 5.00	ft
Flow Area	98.0	ft²
Wetted Perimeter	37.12	ft
Hydraulic Radius	2.64	ft
Top Width	35.73	ft
Normal Depth	4.29	ft
Critical Depth	3.49	ft
Critical Slope	1.42	%
Velocity	6.28	ft/s
Velocity Head	0.61	ft
Specific Energy	4.90	ft
Froude Number	0.67	
Flow Type	Subcritical	

Worksheet for Downstream Channel

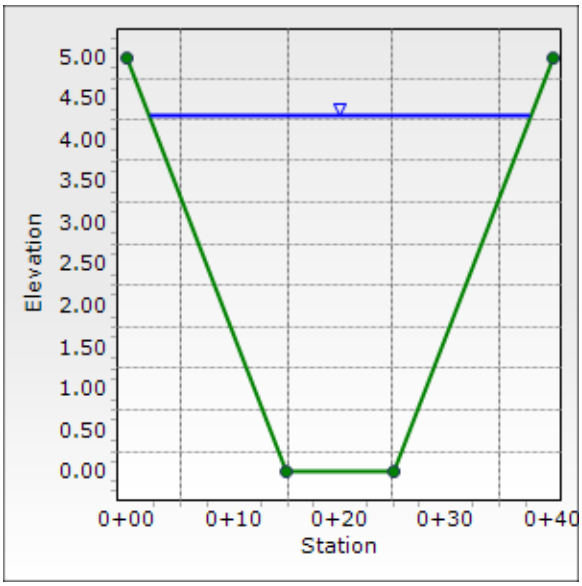
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	4.29 ft
Critical Depth	3.49 ft
Channel Slope	0.60 %
Critical Slope	1.42 %

Cross Section for Downstream Channel

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.60 %
Normal Depth	4.29 ft
Discharge	616.00 cfs



WSPGW For GOBW

```
                                                    GOBW
T1 CENTENNIAL HEIGHTS TOWNHOMES
T2 GOBW ANALYSIS
T3 HORROCKS ENGINEERS DECEMBER 2019
SO 178989.9802842.660  1                          2847.500
JX 179229.8602849.350  1  4   .013    8.000         2850.820        -45.0 00.0    .000
JX 179368.8802854.180  1  5   .013  196.000         2854.180        -45.0 00.0    .000
R  179648.9102860.960  1      .013                                +0.0000 +0.0000 0
JX 180678.1102867.140  1  6   .013  466.000         2868.140        -45.0 00.0    .000
JX 180693.1102867.230  1  7   .013  150.000         2870.140        -45.0 00.0    .000
R  180778.9102867.740  1      .013                                +0.0000 +0.0000 0
TS 180853.9102869.110  1      .013
R  180873.9102869.230  2      .013                                +0.0000 +0.0000 0
R  181150.0002870.890  2      .013                                +0.0000 +0.0000 0
JX 181215.8302871.614  2  5   .013   61.000         2873.110        -45.0 00.0    .000
JX 182178.3302882.202  2  8   .013    6.000         2886.160        -45.0 00.0    .000
R  182200.0002882.400  3      .013                                +0.0000 +0.0000 0
R  182220.0002883.310  3      .013                                +0.0000 +0.0000 0
JX 182383.0002885.040  3  7   .013   80.000         2887.090        -45.0 00.0    .000
R  182450.0002886.800  3      .013                                +0.0000 +0.0000 0
SH 182450.0002886.800  3      .013                                +0.0000 +0.0000 0
CD   1  3   0    .000  10.000   08.000 0.000 0.000  .000
CD   2  3   0    .000  09.000   08.000 0.000 0.000  .000
CD   3  3   0    .000  08.000   06.000 0.000 0.000  .000
CD   4  4   1    .000  1.5000   00.000 0.000 0.000  .000
CD   5  4   1    .000  6.0000   00.000 0.000 0.000  .000
CD   6  4   1    .000  6.5000   00.000 0.000 0.000  .000
CD   7  4   1    .000  4.5000   00.000 0.000 0.000  .000
CD   8  4   1    .000  5.5000   00.000 0.000 0.000  .000
Q           425.000  1.0
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WSPGW For GOBW

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS) / SF Ave	Vel Head / HF	Energy Grd.El. / SE Dpth	Super Elev / Froude N	Critical Depth / Norm Dp	Flow Top Width	Height/Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
						WARNING - Junction Analysis - Large Lateral Flow(s)								
178990.000	2842.660	5.955	2848.615	1392.00	29.22	13.26	2861.87	.00	9.80	8.00	10.000	8.000	.00	0 .0
JUNCT STR	.0279				.0173	4.16	5.96	2.11	.013		.00	.00	BOX	
179229.900	2849.350	6.840	2856.190	1384.00	25.29	9.93	2866.12	.00	9.76	8.00	10.000	8.000	.00	0 .0
JUNCT STR	.0347				.0156	2.17	6.84	1.70	.013		.00	.00	BOX	
179368.900	2854.180	5.653	2859.833	1188.00	26.27	10.72	2870.55	.00	8.81	8.00	10.000	8.000	.00	0 .0
JUNCT STR	.0347				.0170	.00	5.65	1.95	.013		.00	.00	BOX	
179368.900	2854.180	5.653	2859.833	1188.00	26.27	10.72	2870.55	.00	8.81	8.00	10.000	8.000	.00	0 .0
30.922	.0242				.0167	.51	5.65	1.95	4.92	.013		.00	.00	BOX
179399.800	2854.929	5.739	2860.668	1188.00	25.87	10.40	2871.06	.00	8.81	8.00	10.000	8.000	.00	0 .0
75.484	.0242				.0154	1.16	5.74	1.90	4.92	.013		.00	.00	BOX
179475.300	2856.756	6.019	2862.776	1188.00	24.67	9.45	2872.23	.00	8.81	8.00	10.000	8.000	.00	0 .0
53.531	.0242				.0137	.73	6.02	1.77	4.92	.013		.00	.00	BOX
179528.800	2858.052	6.313	2864.365	1188.00	23.52	8.59	2872.96	.00	8.81	8.00	10.000	8.000	.00	0 .0
39.063	.0242				.0121	.47	6.31	1.65	4.92	.013		.00	.00	BOX
179567.900	2858.998	6.621	2865.620	1188.00	22.43	7.81	2873.43	.00	8.81	8.00	10.000	8.000	.00	0 .0
28.734	.0242				.0107	.31	6.62	1.54	4.92	.013		.00	.00	BOX

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
179596.600	2859.694	6.945	2866.638	1188.00	21.38	7.10	2873.74	.00	8.81	8.00	10.000	8.000	.00	0 .0
20.906	.0242					.0095	.20	6.94	1.43	4.92	.013	.00	.00	BOX
179617.500	2860.200	7.283	2867.483	1188.00	20.39	6.45	2873.94	.00	8.81	8.00	10.000	8.000	.00	0 .0
14.703	.0242					.0085	.12	7.28	1.33	4.92	.013	.00	.00	BOX
179632.200	2860.556	7.639	2868.195	1188.00	19.44	5.87	2874.06	.00	8.81	8.00	10.000	8.000	.00	0 .0
9.641	.0242					.0075	.07	7.64	1.24	4.92	.013	.00	.00	BOX
179641.800	2860.789	8.012	2868.801	1188.00	18.54	5.33	2874.14	.00	8.81	8.00	10.000	8.000	.00	0 .0
5.375	.0242					.0067	.04	8.01	1.15	4.92	.013	.00	.00	BOX
179647.200	2860.919	8.403	2869.322	1188.00	17.67	4.85	2874.17	.00	8.81	8.00	10.000	8.000	.00	0 .0
1.688	.0242					.0060	.01	8.40	1.07	4.92	.013	.00	.00	BOX
179648.900	2860.960	8.814	2869.774	1188.00	16.85	4.41	2874.18	.00	8.81	8.00	10.000	8.000	.00	0 .0
JUNCT STR	.0060					.0017	1.71	8.81	1.00		.013	.00	.00	BOX
180678.100	2867.140	9.683	2876.823	722.00	9.32	1.35	2878.17	.00	6.33	8.00	10.000	8.000	.00	0 .0
JUNCT STR	.0060					.0013	.02	9.68	.53		.013	.00	.00	BOX
		---------- WARNING - Flow depth near top of box conduit ----------												
180693.100	2867.230	10.262	2877.492	572.00	7.15	.79	2878.29	.00	5.42	8.00	10.000	8.000	.00	0 .0
56.969	.0059					.0013	.08	10.26	.40	4.82	.013	.00	.00	BOX

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

180750.100	2867.569	10.000	2877.569	572.00	7.15	.79	2878.36	.00	5.42	8.00	10.000	8.000	.00	0 .0
28.828	.0059					.0010	.03	10.00	.40	4.82	.013		.00	BOX
180778.900	2867.740	9.828	2877.568	572.00	7.27	.82	2878.39	.00	5.42	8.00	10.000	8.000	.00	0 .0
TRANS STR	.0183					.0010	.08	9.83	.41		.013		.00	BOX

---------- WARNING - Flow depth near top of box conduit ----------

180853.900	2869.110	8.286	2877.396	572.00	8.63	1.16	2878.55	.00	5.42	8.00	9.000	8.000	.00	0 .0
20.000	.0060					.0015	.03	8.29	.53	4.80	.013		.00	BOX

---------- WARNING - Flow depth near top of box conduit ----------

180873.900	2869.230	8.162	2877.392	572.00	8.76	1.19	2878.58	.00	5.42	8.00	9.000	8.000	.00	0 .0
60.047	.0060					.0016	.09	8.16	.54	4.80	.013		.00	BOX

---------- WARNING - Flow depth near top of box conduit ----------

180934.000	2869.591	7.782	2877.373	572.00	9.19	1.31	2878.68	.00	5.42	8.00	9.000	8.000	.00	0 .0
55.906	.0060					.0018	.10	7.78	.58	4.80	.013		.00	BOX
180989.900	2869.927	7.420	2877.347	572.00	9.64	1.44	2878.79	.00	5.42	8.00	9.000	8.000	.00	0 .0
51.578	.0060					.0020	.10	7.42	.62	4.80	.013		.00	BOX

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
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
181041.400	2870.237	7.074	2877.312	572.00	10.11	1.59	2878.90	.00	5.42	8.00	9.000	8.000	.00	0 .0
46.953	.0060					.0022	.11	7.07	.67	4.80	.013		.00	BOX
181088.400	2870.520	6.745	2877.265	572.00	10.60	1.74	2879.01	.00	5.42	8.00	9.000	8.000	.00	0 .0
37.719	.0060					.0025	.10	6.75	.72	4.80	.013		.00	BOX
181126.100	2870.746	6.463	2877.209	572.00	11.06	1.90	2879.11	.00	5.42	8.00	9.000	8.000	.00	0 .0
HYDRAULIC JUMP														

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
L/Elem	Ch Slope				SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch	
181126.100	2870.746	4.485	2875.231	572.00	15.94	3.95	2879.18	.00	5.42	8.00	9.000	8.000	.00	0 .0
23.891	.0060				.0072	.17	4.48	1.33	4.80	.013		.00	.00	BOX
181150.000	2870.890	4.458	2875.348	572.00	16.04	3.99	2879.34	.00	5.42	8.00	9.000	8.000	.00	0 .0
JUNCT STR	.0110				.0103	.68	4.46	1.34		.013		.00	.00	BOX
181215.800	2871.614	3.264	2874.878	511.00	19.57	5.95	2880.82	.00	5.02	8.00	9.000	8.000	.00	0 .0
JUNCT STR	.0110				.0092	8.89	3.26	1.91		.013		.00	.00	BOX
182178.300	2882.202	4.656	2886.858	505.00	18.08	5.07	2891.93	.00	6.04	6.00	8.000	6.000	.00	0 .0
21.672	.0091				.0113	.25	4.66	1.48	5.05	.013		.00	.00	BOX
182200.000	2882.400	4.616	2887.016	505.00	18.23	5.16	2892.18	.00	6.04	6.00	8.000	6.000	.00	0 .0
4.609	.0455				.0110	.05	4.62	1.50	2.72	.013		.00	.00	BOX
182204.600	2882.609	4.756	2887.365	505.00	17.70	4.86	2892.23	.00	6.04	6.00	8.000	6.000	.00	0 .0
5.922	.0455				.0100	.06	4.76	1.43	2.72	.013		.00	.00	BOX

Program Package Serial Number: 7294

WATER SURFACE PROFILE LISTING Date:12-22-2019 Time:10:46:51

CENTENNIAL HEIGHTS TOWNHOMES

GOBW ANALYSIS

HORROCKS ENGINEERS DECEMBER 2019

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
L/Elem	Ch Slope				SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch	
182210.500	2882.879	4.988	2887.866	505.00	16.88	4.42	2892.29	.00	6.04	6.00	8.000	6.000	.00	0 .0
4.328	.0455				.0089	.04	4.99	1.33	2.72	.013		.00	.00	BOX
182214.900	2883.076	5.231	2888.307	505.00	16.09	4.02	2892.33	.00	6.04	6.00	8.000	6.000	.00	0 .0
2.922	.0455				.0079	.02	5.23	1.24	2.72	.013		.00	.00	BOX
182217.800	2883.209	5.486	2888.696	505.00	15.34	3.65	2892.35	.00	6.04	6.00	8.000	6.000	.00	0 .0
1.672	.0455				.0070	.01	5.49	1.15	2.72	.013		.00	.00	BOX
182219.500	2883.285	5.754	2889.040	505.00	14.63	3.32	2892.36	.00	6.04	6.00	8.000	6.000	.00	0 .0

.547	.0455				.0063	.00	5.75	1.07	2.72	.013	.00	.00	BOX	
182220.000	2883.310	6.036	2889.346	505.00	13.94	3.02	2892.37	.00	6.04	6.00	8.000	6.000	.00	0 .0
JUNCT STR	.0106						6.04	1.00		.013	.00	.00	BOX	
182383.000	2885.040	3.829	2888.869	425.00	18.50	5.31	2894.18	.00	5.38	6.00	8.000	6.000	.00	0 .0
JUNCT STR	.0106				.0131	.00	3.83	1.67		.013	.00	.00	BOX	
182383.000	2885.040	3.829	2888.869	425.00	18.50	5.31	2894.18	.00	5.38	6.00	8.000	6.000	.00	0 .0
3.141	.0263				.0130	.04	3.83	1.67	2.94	.013	.00	.00	BOX	
182386.200	2885.123	3.853	2888.976	425.00	18.38	5.25	2894.22	.00	5.38	6.00	8.000	6.000	.00	0 .0
20.453	.0263				.0121	.25	3.85	1.65	2.94	.013	.00	.00	BOX	
182406.600	2885.660	4.041	2889.701	425.00	17.53	4.77	2894.47	.00	5.38	6.00	8.000	6.000	.00	0 .0
15.219	.0263				.0107	.16	4.04	1.54	2.94	.013	.00	.00	BOX	

Program Package Serial Number: 7294

WATER SURFACE PROFILE LISTING Date:12-22-2019 Time:10:46:51

CENTENNIAL HEIGHTS TOWNHOMES
GOBW ANALYSIS
HORROCKS ENGINEERS DECEMBER 2019

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
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
182421.800	2886.060	4.239	2890.298	425.00	16.71	4.34	2894.63	.00	5.38	6.00	8.000	6.000	.00	0 .0
11.172	.0263				.0095	.11	4.24	1.43	2.94	.013	.00	.00	BOX	
182433.000	2886.353	4.445	2890.799	425.00	15.93	3.94	2894.74	.00	5.38	6.00	8.000	6.000	.00	0 .0
7.922	.0263				.0084	.07	4.45	1.33	2.94	.013	.00	.00	BOX	
182440.900	2886.562	4.662	2891.224	425.00	15.19	3.58	2894.81	.00	5.38	6.00	8.000	6.000	.00	0 .0
5.219	.0263				.0075	.04	4.66	1.24	2.94	.013	.00	.00	BOX	
182446.200	2886.699	4.890	2891.589	425.00	14.49	3.26	2894.85	.00	5.38	6.00	8.000	6.000	.00	0 .0
2.922	.0263				.0066	.02	4.89	1.15	2.94	.013	.00	.00	BOX	
182449.100	2886.776	5.129	2891.904	425.00	13.81	2.96	2894.87	.00	5.38	6.00	8.000	6.000	.00	0 .0

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                                                                GOBW
        -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-      -|-     -|-     -|-     |-
      .922    .0263                                          .0059      .01     5.13    1.07    2.94    .013       .00   .00  BOX
         |         |        |         |         |              |         |       |       |       |       |       |       |      |
182450.000  2886.800    5.380  2892.180    425.00   13.17    2.69  2894.87     .00    5.38     6.00    8.000    6.000   .00   0   .0
        -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-      -|-     -|-     -|-     |-
♠
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WSPGW For PIPE 3

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T1 CENTENNIAL HEIGHTS TOWNHOMES
T2 P3 - 18-INCH RCP LATERAL PIPE
T3 HORROCKS ENGINEERS NOVEMBER 2019
SO  -3575.7502905.750  1                        2909.547
R   -3489.6202910.060  1      .013                              +0.0000 +0.0000 0
SH  -3489.6202910.060  1      .013                              +0.0000 +0.0000 0
CD   1  4   1    .000  1.5000   00.000 0.000 0.000  .000
CD   2  4   1    .000  2.0000   00.000 0.000 0.000  .000
CD   3  4   1    .000  2.5000   00.000 0.000 0.000  .000
CD   4  4   1    .000  3.0000   00.000 0.000 0.000  .000
CD   5  4   1    .000  3.5000   00.000 0.000 0.000  .000
CD   6  4   1    .000  4.0000   00.000 0.000 0.000  .000
CD   7  4   1    .000  4.5000   00.000 0.000 0.000  .000
CD   8  4   1    .000  5.0000   00.000 0.000 0.000  .000
CD   9  4   1    .000  5.5000   00.000 0.000 0.000  .000
CD  10  4   1    .000  6.0000   00.000 0.000 0.000  .000
CD  11  3   0    .000  10.000   06.000 0.000 0.000  .000
Q            11.000  1.0
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Program Package Serial Number: 7294

WATER SURFACE PROFILE LISTING Date:12-23-2019 Time:10:27:37

CENTENNIAL HEIGHTS TOWNHOMES

P3 - 18-INCH RCP LATERAL PIPE

HORROCKS ENGINEERS NOVEMBER 2019

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
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
-3575.750	2905.750	3.797	2909.547	11.00	6.22	.60	2910.15	.00	1.27	.00	1.500	.000	.00	1 .0
46.274	.0500					.0110	.51	3.80	.00	.72	.013	.00	.00	PIPE
-3529.476	2908.066	1.987	2910.053	11.00	6.22	.60	2910.65	.00	1.27	.00	1.500	.000	.00	1 .0
HYDRAULIC JUMP														
-3529.476	2908.066	.790	2908.856	11.00	11.65	2.11	2910.96	.00	1.27	1.50	1.500	.000	.00	1 .0
1.673	.0500					.0368	.06	.79	2.59	.72	.013	.00	.00	PIPE
-3527.803	2908.149	.790	2908.939	11.00	11.65	2.11	2911.05	.00	1.27	1.50	1.500	.000	.00	1 .0
10.439	.0500					.0346	.36	.79	2.59	.72	.013	.00	.00	PIPE
-3517.365	2908.671	.821	2909.492	11.00	11.11	1.92	2911.41	.00	1.27	1.49	1.500	.000	.00	1 .0
7.277	.0500					.0306	.22	.82	2.40	.72	.013	.00	.00	PIPE
-3510.087	2909.036	.854	2909.889	11.00	10.59	1.74	2911.63	.00	1.27	1.49	1.500	.000	.00	1 .0
5.391	.0500					.0270	.15	.85	2.23	.72	.013	.00	.00	PIPE
-3504.696	2909.305	.888	2910.193	11.00	10.10	1.58	2911.78	.00	1.27	1.47	1.500	.000	.00	1 .0
4.122	.0500					.0239	.10	.89	2.07	.72	.013	.00	.00	PIPE
-3500.574	2909.512	.924	2910.436	11.00	9.63	1.44	2911.88	.00	1.27	1.46	1.500	.000	.00	1 .0
3.200	.0500					.0212	.07	.92	1.92	.72	.013	.00	.00	PIPE
-3497.374	2909.672	.962	2910.634	11.00	9.18	1.31	2911.94	.00	1.27	1.44	1.500	.000	.00	1 .0
2.496	.0500					.0188	.05	.96	1.77	.72	.013	.00	.00	PIPE

Program Package Serial Number: 7294

WATER SURFACE PROFILE LISTING Date:12-23-2019 Time:10:27:37

CENTENNIAL HEIGHTS TOWNHOMES

P3 - 18-INCH RCP LATERAL PIPE

HORROCKS ENGINEERS NOVEMBER 2019

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
-3494.878	2909.797	1.003	2910.800	11.00	8.76	1.19	2911.99	.00	1.27	1.41	1.500	.000	.00	1 .0
1.926	.0500					.0167	.03	1.00	1.64	.72	.013	.00	.00	PIPE
-3492.952	2909.893	1.047	2910.941	11.00	8.35	1.08	2912.02	.00	1.27	1.38	1.500	.000	.00	1 .0
1.448	.0500					.0149	.02	1.05	1.50	.72	.013	.00	.00	PIPE
-3491.504	2909.966	1.095	2911.061	11.00	7.96	.98	2912.04	.00	1.27	1.33	1.500	.000	.00	1 .0
1.028	.0500					.0133	.01	1.09	1.38	.72	.013	.00	.00	PIPE
-3490.476	2910.017	1.147	2911.164	11.00	7.59	.89	2912.06	.00	1.27	1.27	1.500	.000	.00	1 .0
.631	.0500					.0120	.01	1.15	1.25	.72	.013	.00	.00	PIPE
-3489.845	2910.049	1.204	2911.253	11.00	7.24	.81	2912.07	.00	1.27	1.19	1.500	.000	.00	1 .0
.225	.0500					.0109	.00	1.20	1.13	.72	.013	.00	.00	PIPE
-3489.620	2910.060	1.270	2911.330	11.00	6.89	.74	2912.07	.00	1.27	1.08	1.500	.000	.00	1 .0

WSPGW For PIPE 4

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T1 CENTENNIAL HEIGHTS TOWNHOMES
T2 P4 - 18-INCH RCP LATERAL PIPE
T3 HORROCKS ENGINEERS NOVEMBER 2019
SO  -2337.5402892.730  1                        2896.105
R   -2250.4302897.090  1      .013                              +0.0000 +0.0000 0
SH  -2250.4302897.090  1      .013                              +0.0000 +0.0000 0
CD   1  4   1    .000  1.5000   00.000 0.000 0.000  .000
CD   2  4   1    .000  2.0000   00.000 0.000 0.000  .000
CD   3  4   1    .000  2.5000   00.000 0.000 0.000  .000
CD   4  4   1    .000  3.0000   00.000 0.000 0.000  .000
CD   5  4   1    .000  3.5000   00.000 0.000 0.000  .000
CD   6  4   1    .000  4.0000   00.000 0.000 0.000  .000
CD   7  4   1    .000  4.5000   00.000 0.000 0.000  .000
CD   8  4   1    .000  5.0000   00.000 0.000 0.000  .000
CD   9  4   1    .000  5.5000   00.000 0.000 0.000  .000
CD  10  4   1    .000  6.0000   00.000 0.000 0.000  .000
CD  11  3   0    .000  10.000   06.000 0.000 0.000  .000
Q            09.000  1.0
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Program Package Serial Number: 7294

WATER SURFACE PROFILE LISTING Date:12-23-2019 Time:10:52:14

CENTENNIAL HEIGHTS TOWNHOMES

P4 - 18-INCH RCP LATERAL PIPE

HORROCKS ENGINEERS NOVEMBER 2019

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
L/Elem	Ch Slope				SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch	
-2337.540	2892.730	3.375	2896.105	9.00	5.09	.40	2896.51	.00	1.16	.00	1.500	.000	.00	1 .0
34.397	.0501					.0073	.25	3.38	.00	.64	.013	.00	.00	PIPE
-2303.143	2894.452	1.905	2896.357	9.00	5.09	.40	2896.76	.00	1.16	.00	1.500	.000	.00	1 .0
HYDRAULIC JUMP														
-2303.143	2894.452	.687	2895.138	9.00	11.41	2.02	2897.16	.00	1.16	1.49	1.500	.000	.00	1 .0
8.386	.0501					.0398	.33	.69	2.77	.64	.013	.00	.00	PIPE
-2294.757	2894.871	.687	2895.558	9.00	11.41	2.02	2897.58	.00	1.16	1.49	1.500	.000	.00	1 .0
12.504	.0501					.0374	.47	.69	2.77	.64	.013	.00	.00	PIPE
-2282.252	2895.497	.712	2896.210	9.00	10.88	1.84	2898.05	.00	1.16	1.50	1.500	.000	.00	1 .0
8.173	.0501					.0329	.27	.71	2.58	.64	.013	.00	.00	PIPE
-2274.079	2895.906	.739	2896.646	9.00	10.37	1.67	2898.32	.00	1.16	1.50	1.500	.000	.00	1 .0
5.869	.0501					.0290	.17	.74	2.40	.64	.013	.00	.00	PIPE
-2268.211	2896.200	.768	2896.968	9.00	9.89	1.52	2898.49	.00	1.16	1.50	1.500	.000	.00	1 .0
4.423	.0501					.0255	.11	.77	2.24	.64	.013	.00	.00	PIPE
-2263.787	2896.422	.797	2897.219	9.00	9.43	1.38	2898.60	.00	1.16	1.50	1.500	.000	.00	1 .0
3.425	.0501					.0225	.08	.80	2.08	.64	.013	.00	.00	PIPE
-2260.363	2896.593	.828	2897.421	9.00	8.99	1.26	2898.68	.00	1.16	1.49	1.500	.000	.00	1 .0
2.691	.0501					.0199	.05	.83	1.93	.64	.013	.00	.00	PIPE

Program Package Serial Number: 7294

WATER SURFACE PROFILE LISTING Date:12-23-2019 Time:10:52:14

CENTENNIAL HEIGHTS TOWNHOMES

P4 - 18-INCH RCP LATERAL PIPE

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS) / SF Ave	Vel Head / HF	Energy Grd.El. / SE Dpth	Super Elev / Froude N	Critical Depth / Norm Dp	Flow Top Width / "N"	Height/Dia.-FT / X-Fall	Base Wt or I.D. / ZR	ZL	No Wth Prs/Pip / Type Ch
-2257.672	2896.728	.861	2897.589	9.00	8.57	1.14	2898.73	.00	1.16	1.48	1.500	.000	.00	1 .0
2.128	.0501					.0176	.04	.86	1.80	.64	.013	.00	.00	PIPE
-2255.544	2896.834	.896	2897.730	9.00	8.17	1.04	2898.77	.00	1.16	1.47	1.500	.000	.00	1 .0
1.666	.0501					.0155	.03	.90	1.66	.64	.013	.00	.00	PIPE
-2253.877	2896.918	.933	2897.850	9.00	7.79	.94	2898.79	.00	1.16	1.45	1.500	.000	.00	1 .0
1.288	.0501					.0138	.02	.93	1.54	.64	.013	.00	.00	PIPE
-2252.589	2896.982	.972	2897.954	9.00	7.43	.86	2898.81	.00	1.16	1.43	1.500	.000	.00	1 .0
.958	.0501					.0122	.01	.97	1.42	.64	.013	.00	.00	PIPE
-2251.631	2897.030	1.013	2898.043	9.00	7.08	.78	2898.82	.00	1.16	1.40	1.500	.000	.00	1 .0
.668	.0501					.0109	.01	1.01	1.31	.64	.013	.00	.00	PIPE
-2250.964	2897.063	1.058	2898.122	9.00	6.75	.71	2898.83	.00	1.16	1.37	1.500	.000	.00	1 .0
.397	.0501					.0097	.00	1.06	1.21	.64	.013	.00	.00	PIPE
-2250.567	2897.083	1.107	2898.190	9.00	6.44	.64	2898.83	.00	1.16	1.32	1.500	.000	.00	1 .0
.137	.0501					.0087	.00	1.11	1.10	.64	.013	.00	.00	PIPE
-2250.430	2897.090	1.160	2898.250	9.00	6.14	.58	2898.83	.00	1.16	1.26	1.500	.000	.00	1 .0

WSPGW For PIPE 5

```
T1 CENTENNIAL HEIGHTS TOWNHOMES
T2 P5 - 30-INCH RCP LATERAL PIPE
T3 HORROCKS ENGINEERS NOVEMBER 2019
SO  -1093.9002880.200  3                         2883.695
R   -1000.0002883.020  3      .013                              +0.0000 +0.0000 0
SH  -1000.0002883.020  3      .013                              +0.0000 +0.0000 0
CD   1  4   1    .000  1.5000   00.000 0.000 0.000  .000
CD   2  4   1    .000  2.0000   00.000 0.000 0.000  .000
CD   3  4   1    .000  2.5000   00.000 0.000 0.000  .000
CD   4  4   1    .000  3.0000   00.000 0.000 0.000  .000
CD   5  4   1    .000  3.5000   00.000 0.000 0.000  .000
CD   6  4   1    .000  4.0000   00.000 0.000 0.000  .000
CD   7  4   1    .000  4.5000   00.000 0.000 0.000  .000
CD   8  4   1    .000  5.0000   00.000 0.000 0.000  .000
CD   9  4   1    .000  5.5000   00.000 0.000 0.000  .000
CD  10  4   1    .000  6.0000   00.000 0.000 0.000  .000
CD  11  3   0    .000  10.000   06.000 0.000 0.000  .000
Q            59.000  1.0
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Program Package Serial Number: 7294

WATER SURFACE PROFILE LISTING Date:12-23-2019 Time:10:42:32

CENTENNIAL HEIGHTS TOWNHOMES
P5 - 30-INCH RCP LATERAL PIPE
HORROCKS ENGINEERS NOVEMBER 2019

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
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
-1093.900	2880.200	3.495	2883.695	59.00	12.02	2.24	2885.94	.00	2.39	.00	2.500	.000	.00	1 .0
93.900	.0300					.0207	1.94	3.50	.00	1.74	.013	.00	.00	PIPE
-1000.000	2883.020	2.618	2885.638	59.00	12.02	2.24	2887.88	.00	2.39	.00	2.500	.000	.00	1 .0

WSPGW For TROPICAL MAINLINE

```
T1 CENTENNIAL HEIGHTS TOWNHOMES
T2 SD5 - TROPICAL MAINLINE
T3 HORROCKS ENGINEERS NOVEMBER 2019
SO  -2176.4902879.770 10                        2886.270
R   -2146.9502880.000 10      .013                                +0.0000 +0.0000 0
JX  -2140.9502880.200 10  3  4.013   59.000   40.0002883.0202881.892-39.0 65.0  -2.865
R   -1735.9802892.530 10      .013                                +0.0000 +0.0000 0
JX  -1729.9802892.730 10  1   .013   09.000         2897.503         90.0         .000
R   -1398.7002905.550 10      .013                                +0.0000 +0.0000 0
JX  -1392.7002905.750 10  1   .013   11.000         2910.460         90.0         .000
R   -1185.0002910.240 10      .013                                +0.0000 +0.0000 0
R   -1179.0002910.440 10      .013                                -19.000 +0.0000 1
R   -1000.0002916.740 10      .013                                +0.0000 +0.0000 0
SH  -1000.0002916.740 10      .013                                 +0.000 +0.0000 0
CD   1  4   1    .000  1.5000   00.000 0.000 0.000  .000
CD   2  4   1    .000  2.0000   00.000 0.000 0.000  .000
CD   3  4   1    .000  2.5000   00.000 0.000 0.000  .000
CD   4  4   1    .000  3.0000   00.000 0.000 0.000  .000
CD   5  4   1    .000  3.5000   00.000 0.000 0.000  .000
CD   6  4   1    .000  4.0000   00.000 0.000 0.000  .000
CD   7  4   1    .000  4.5000   00.000 0.000 0.000  .000
CD   8  4   1    .000  5.0000   00.000 0.000 0.000  .000
CD   9  4   1    .000  5.5000   00.000 0.000 0.000  .000
CD  10  4   1    .000  6.5000   00.000 0.000 0.000  .000
Q           497.000  1.0
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Program Package Serial Number: 7294

WATER SURFACE PROFILE LISTING Date:12-23-2019 Time:10:44: 9

CENTENNIAL HEIGHTS TOWNHOMES
SD5 - TROPICAL MAINLINE
HORROCKS ENGINEERS NOVEMBER 2019

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
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
-2176.490	2879.770	4.218	2883.988	616.00	27.03	11.35	2895.33	.00	6.16	6.21	6.500	.000	.00	1 .0
29.540	.0078					.0251	.74	4.22	2.49	6.50	.013	.00	.00	PIPE
-2146.950	2880.000	4.124	2884.124	616.00	27.74	11.95	2896.08	1.25	6.16	6.26	6.500	.000	.00	1 .0
JUNCT STR	.0333					.0282	.17	5.37	2.60		.013	.00	.00	PIPE
-2140.950	2880.200	3.495	2883.695	517.00	28.43	12.55	2896.25	.00	5.89	6.48	6.500	.000	.00	1 .0
404.970	.0304					.0307	12.44	3.50	2.99	3.50	.013	.00	.00	PIPE
-1735.980	2892.530	3.481	2896.011	517.00	28.57	12.68	2908.69	.00	5.89	6.48	6.500	.000	.00	1 .0
JUNCT STR	.0333					.0320	.19	3.48	3.01		.013	.00	.00	PIPE
-1729.980	2892.730	3.375	2896.105	508.00	29.19	13.23	2909.33	.00	5.85	6.50	6.500	.000	.00	1 .0
12.358	.0387					.0329	.41	3.38	3.14	3.22	.013	.00	.00	PIPE
-1717.622	2893.208	3.383	2896.591	508.00	29.10	13.15	2909.74	.00	5.85	6.49	6.500	.000	.00	1 .0
135.961	.0387					.0309	4.20	3.38	3.13	3.22	.013	.00	.00	PIPE
-1581.661	2898.470	3.514	2901.984	508.00	27.75	11.95	2913.94	.00	5.85	6.48	6.500	.000	.00	1 .0
82.760	.0387					.0272	2.25	3.51	2.91	3.22	.013	.00	.00	PIPE
-1498.902	2901.672	3.653	2905.325	508.00	26.46	10.87	2916.19	.00	5.85	6.45	6.500	.000	.00	1 .0
57.516	.0387					.0241	1.38	3.65	2.70	3.22	.013	.00	.00	PIPE
-1441.386	2903.898	3.798	2907.697	508.00	25.22	9.88	2917.58	.00	5.85	6.41	6.500	.000	.00	1 .0
42.686	.0387					.0213	.91	3.80	2.51	3.22	.013	.00	.00	PIPE

Program Package Serial Number: 7294

WATER SURFACE PROFILE LISTING Date:12-23-2019 Time:10:44: 9

CENTENNIAL HEIGHTS TOWNHOMES
SD5 - TROPICAL MAINLINE

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS) / SF Ave	Vel Head / HF	Energy Grd.El. / SE Dpth	Super Elev / Froude N	Critical Depth / Norm Dp	Flow Top Width / "N"	Height/ Dia.-FT / X-Fall	Base Wt or I.D. / ZR	ZL	No Wth Prs/Pip / Type Ch
-1398.700	2905.550	3.953	2909.502	508.00	24.05	8.98	2918.48	.00	5.85	6.35	6.500	.000	.00	1 .0
JUNCT STR	.0333				.0208	.12	3.95	2.32		.013		.00	.00	PIPE
-1392.700	2905.750	3.797	2909.547	497.00	24.69	9.46	2919.01	.00	5.81	6.41	6.500	.000	.00	1 .0
207.700	.0216				.0216	4.49	3.80	2.45	3.80	.013		.00	.00	PIPE
-1185.000	2910.240	3.797	2914.037	497.00	24.69	9.46	2923.50	6.50	5.81	6.41	6.500	.000	.00	1 .0
6.000	.0333				.0215	.13	6.50	2.45	3.32	.013		.00	.00	PIPE
-1179.000	2910.440	3.811	2914.251	497.00	24.58	9.38	2923.63	.00	5.81	6.40	6.500	.000	.00	1 .0
8.900	.0352				.0212	.19	3.81	2.44	3.27	.013		.00	.00	PIPE
-1170.100	2910.753	3.837	2914.590	497.00	24.38	9.23	2923.82	.00	5.81	6.39	6.500	.000	.00	1 .0
44.158	.0352				.0197	.87	3.84	2.41	3.27	.013		.00	.00	PIPE
-1125.942	2912.307	3.993	2916.301	497.00	23.25	8.39	2924.69	.00	5.81	6.33	6.500	.000	.00	1 .0
33.694	.0352				.0175	.59	3.99	2.23	3.27	.013		.00	.00	PIPE
-1092.248	2913.493	4.159	2917.652	497.00	22.16	7.63	2925.28	.00	5.81	6.24	6.500	.000	.00	1 .0
26.243	.0352				.0155	.41	4.16	2.06	3.27	.013		.00	.00	PIPE
-1066.004	2914.417	4.336	2918.753	497.00	21.13	6.93	2925.69	.00	5.81	6.13	6.500	.000	.00	1 .0
20.604	.0352				.0138	.28	4.34	1.90	3.27	.013		.00	.00	PIPE
-1045.400	2915.142	4.526	2919.667	497.00	20.15	6.30	2925.97	.00	5.81	5.98	6.500	.000	.00	1 .0
16.106	.0352				.0123	.20	4.53	1.75	3.27	.013		.00	.00	PIPE

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

L/Elem	Ch Slope				SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
-1029.294	2915.709	4.730	2920.439	497.00	19.21	5.73	2926.17	.00	5.81	5.79	6.500	.000	.00	1	.0
12.331	.0352				.0110	.14	4.73	1.60	3.27	.013	.00	.00	PIPE		
-1016.963	2916.143	4.953	2921.096	497.00	18.32	5.21	2926.31	.00	5.81	5.54	6.500	.000	.00	1	.0
8.989	.0352				.0099	.09	4.95	1.46	3.27	.013	.00	.00	PIPE		
-1007.974	2916.459	5.200	2921.659	497.00	17.47	4.74	2926.40	.00	5.81	5.20	6.500	.000	.00	1	.0
5.777	.0352				.0090	.05	5.20	1.32	3.27	.013	.00	.00	PIPE		
-1002.197	2916.663	5.479	2922.141	497.00	16.65	4.31	2926.45	.00	5.81	4.73	6.500	.000	.00	1	.0
2.197	.0352				.0083	.02	5.48	1.17	3.27	.013	.00	.00	PIPE		
-1000.000	2916.740	5.812	2922.552	497.00	15.88	3.91	2926.47	.00	5.81	4.00	6.500	.000	.00	1	.0

WSPGW For STREET H

```
T1 CENTENNIAL HEIGHTS TOWNHOMES
T2 ST-H MAINLINE - 18-INCH RCP
T3 HORROCKS ENGINEERS NOVEMBER 2019
SO  -1351.8302939.220  1                         2940.700
R   -1310.1302939.330  1      .013                              +0.0000 +0.0000 0
R   -1304.1302939.530  1      .013                             +39.0000 +0.0000 1
R   -1247.1202939.680  1      .013                              +0.0000 +0.0000 0
WE  -1247.1202939.680 11      .013
R   -1245.3702939.680 11      .013                              +0.0000 +0.0000 0
JX  -1245.3702939.680 11  1   .013   05.000         2939.680         90.0         .000
R   -1243.6202939.680 11      .013                              +0.0000 +0.0000 0
WX  -1243.6202939.680  1      .013
R   -1218.6402939.760  1      .013                              +0.0000 +0.0000 0
WE  -1218.6402939.760  1      .013
SH  -1218.6402939.760  1      .013                              +0.0000 +0.0000 0
CD   1  4   1    .000  1.5000   00.000 0.000 0.000  .000
CD   2  4   1    .000  2.0000   00.000 0.000 0.000  .000
CD   3  4   1    .000  2.5000   00.000 0.000 0.000  .000
CD   4  4   1    .000  3.0000   00.000 0.000 0.000  .000
CD   5  4   1    .000  3.5000   00.000 0.000 0.000  .000
CD   6  4   1    .000  4.0000   00.000 0.000 0.000  .000
CD   7  4   1    .000  4.5000   00.000 0.000 0.000  .000
CD   8  4   1    .000  5.0000   00.000 0.000 0.000  .000
CD   9  4   1    .000  5.5000   00.000 0.000 0.000  .000
CD  10  4   1    .000  6.0000   00.000 0.000 0.000  .000
CD  11  3   0    .000  10.000   06.000 0.000 0.000  .000
Q           5.00  1.0
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Program Package Serial Number: 7294

WATER SURFACE PROFILE LISTING Date:12-18-2019 Time: 7: 1:39

CENTENNIAL HEIGHTS TOWNHOMES
ST-H MAINLINE - 18-INCH RCP
HORROCKS ENGINEERS NOVEMBER 2019

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
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
-1351.830	2939.220	1.480	2940.700	10.00	5.67	.50	2941.20	.00	1.22	.34	1.500	.000	.00	1 .0
3.052	.0026					.0083	.03	1.48	.44	1.50	.013	.00	.00	PIPE
-1348.778	2939.228	1.500	2940.728	10.00	5.66	.50	2941.23	.00	1.22	.00	1.500	.000	.00	1 .0
38.648	.0026					.0088	.34	1.50	.00	1.50	.013	.00	.00	PIPE
-1310.130	2939.330	1.748	2941.078	10.00	5.66	.50	2941.58	.00	1.22	.00	1.500	.000	.00	1 .0
6.000	.0333					.0091	.05	.00	.00	.77	.013	.00	.00	PIPE
-1304.130	2939.530	1.693	2941.223	10.00	5.66	.50	2941.72	.00	1.22	.00	1.500	.000	.00	1 .0
57.010	.0026					.0091	.52	1.69	.00	1.50	.013	.00	.00	PIPE
-1247.120	2939.680	2.060	2941.740	10.00	5.66	.50	2942.24	.00	1.22	.00	1.500	.000	.00	1 .0
WALL	ENTRANCE													
-1247.120	2939.680	2.557	2942.237	10.00	.65	.01	2942.24	.00	.44	6.00	10.000	6.000	.00	0 .0
1.750	.0000					.0000	.00	2.56	.07	.00	.013	.00	.00	BOX
JUNCT STR	.0000					.0000	.00	2.56	.07		.013	.00	.00	BOX
-1245.370	2939.680	2.568	2942.248	5.00	.32	.00	2942.25	.00	.28	6.00	10.000	6.000	.00	0 .0
1.750	.0000					.0000	.00	2.57	.04	.00	.013	.00	.00	BOX
-1243.620	2939.680	2.569	2942.249	5.00	.32	.00	2942.25	.00	.28	6.00	10.000	6.000	.00	0 .0
WALL	EXIT													

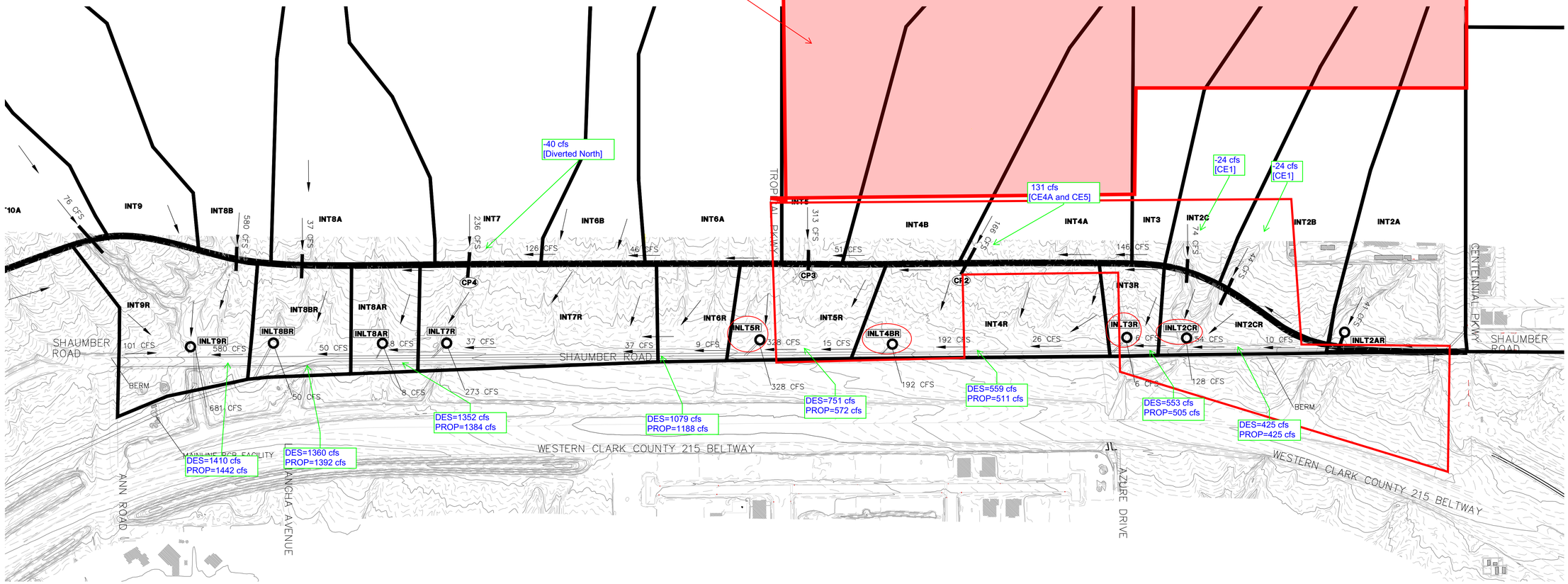
Program Package Serial Number: 7294

WATER SURFACE PROFILE LISTING Date:12-18-2019 Time: 7: 1:39

CENTENNIAL HEIGHTS TOWNHOMES
ST-H MAINLINE - 18-INCH RCP
HORROCKS ENGINEERS NOVEMBER 2019

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

Station	Elev	(FT)	Elev	(CFS)	(FPS)	Head	Grd.El.	Elev	Depth	Width	Dia.-FT or I.D.	ZL	Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
-1243.620	2939.680	2.569	2942.249	5.00	2.83	.12	2942.37	.00	.86	.00	1.500	.000	.00	1 .0
24.980	.0032					.0023	.06	2.57	.00	1.05	.013	.00	.00	PIPE
WALL	ENTRANCE													
-1218.640	2939.760	2.546	2942.306	5.00	2.83	.12	2942.43	.00	.86	.00	1.500	.000	.00	0 .0



WESTERN BELTWAY TRAIL INTERIM CONDITIONS SUBBASIN SUMMARY			
Basin	Area (acres)	Q_{100} (cfs)	100YR cfs/acre
INT2A*	12.3	40	3.26
INT2B*	14.8	44	2.98
INT2C*	28.7	74	2.58
INT3*	61.6	146	2.37
INT4A*	9.9	23	2.32
CP2*	-	166	-
DETCAM10*	29.8	98	3.29
INT4B*	25.3	51	2.01
INT5*	94.7	219	2.31
CP3*	-	313	-
INT6A*	17.8	46	2.58
INT6B*	31.9	80	2.51
INT7*	63.6	158	2.49
CP4*	-	236	-
INT8A*	13.2	37	2.80
INT8B*	106.8	314	2.94
INT9*	85.7	266	3.10
CP5*	-	578	-
INT10A*	28.8	76	2.64
INT2CR**	3.1	10	3.23
INT3R**	1.9	6	3.23
INT4R**	7.9	26	3.23
INT5R**	4.6	15	3.23
INT6R**	2.7	9	3.23
INT7R**	8.7	28	3.23
INT8AR**	2.6	8	3.23
INT8BR**	3.9	13	3.23
INT9R**	7.6	25	3.23

*Basin Referenced from CH2MHill July 2014 Shaumber Road Realignment
**100-yr cfs/acre calculated from hydrology of GCW 90% Design August 2008

RIP RAP HOLE SUMMARY						
Rip Rap Hole Location	Facility Size	Interim Conditions		Interim Headwater (ft)	Ultimate Conditions*	
		Q100 (cfs)	Tributary Basins		Q100 (cfs)	Tributary Basins
INLT2A	36" RCP	41	INT2A*	3.6		
INLT2CR	54" RCP	128	INT2B* + INT2C* + INT2CR**	6.0	275	EFPOA3* + EFPOA3R**
INLT3R - Azure Dr.	72" RCP	6	INT3R**	0.8		
INLT4BR	66" RCP	192	CP2* (INT3 + INT4A) + INT4R**	7.9	271	CP2* (EFPOA4**) + EFPOA4R**
INLT5R - Tropical prkwy.	78" RCP	328	CP3* (INT4B + INT5 + CAM10DB) + INT5R**	8.8		
INLT7R	72" RCP	270	CP4* (INT6A + INT6B + INT7) + INT6R** + INT7R**	7.9	50	EFPOA5R**
INLT8AR	18" RCP	8	INT8AR**	1.8		
INLT8BR - La Mancha Ave.	7'x7' RCB	50	INT8A* + INT8BR**	1.9	545	CP3* (EFPOA1 + EFPOA2 + EFPOA5)*
INLT9R	8'x7' RCB	681	INT8B* + INT9* + INT10A* + INT9R**	12.5	970	CP4* (EFPOB1*** + EFPOB2)* + EFPOB1R**

*Basin reference from CH2MHill July 2014 Shaumber Road realignment Centennial Parkwat to Washburn Road

BERM CALCULATIONS											
Berm Location	Start Station	End Station	Slope %	Berm Impacting Discharge (cfs)	Depth (ft)	Velocity (fps)	Froude Number	Freeboard (ft)	Total Req'd Berm Height (ft)	Berm Height (ft)	Req'd Rip Rap Size (d50 in inches)
INT2AR	1829+50	1830+50	2.22	1	0.2	2.0	1.07	1.0	1.2	2.0	Mulch
INT2CR*	1825+75	1829+50	0.85	10	0.6	2.6	0.80	1.0	1.6	2.0	Mulch
INT2CR*	1823+60	1825+75	0.85	54	1.2	4.5	0.91	1.0	2.2	2.5	Mulch
INT3R	1821+90	1823+60	0.85	6	0.5	2.1	0.76	1.0	1.5	2.0	Mulch
INT4BR	1813+73.5	1821+90	1.32	26	0.8	4.1	1.05	1.1	1.9	2.0	Mulch
INT4BR	1811+75	1813+73.5	1.32	192	2.0	7.2	1.12	1.2	3.2	3.5	6
INT5R	1809+35	1811+75	0.54	15	0.8	2.6	0.67	1.0	1.8	2.0	Mulch
INT5R	1806+40	1809+35	0.54	328	3.2	6.0	0.74	1.1	4.2	4.5	6
INT6R	1804+75	1806+40	0.47	9	0.6	3.3	0.59	1.0	1.6	2.0	Mulch
INT7R*	1794+20.5	1804+75	0.47	37	1.1	3.3	0.67	1.0	2.1	2.5	Mulch
INT8AR	1791+60	1794+20.5	0.56	8	0.6	2.1	0.64	1.0	1.6	2.0	Mulch
INT8BR	1787+30	1791+60	0.47	50	1.3	3.6	0.69	1.0	2.3	2.5	Mulch
INT9R*	1785+25	1787+30	1.00	580	3.6	8.8	1.02	1.3	4.9	5.0	6
INT9R*	1781+90	1785+25	1.00	101	1.6	5.5	0.96	1.0	2.6	3.0	6

*Revised: Due to topography of basins. Full flow of subbasins does not impact berm

Freeboard — Subcritical: Fb = 0.5 + vel^2 / 2G; Supercritical: Fb = 1 + 0.025 * vel (d)^0.333

Rip Rap Sizing — d50=((vel*S^0.17)/(3*(Sg-1)))^2

LEGEND

- DRAINAGE SUBBASIN
- (CP4) CONCENTRATION POINT
- INT5R SUBBASIN NAME
- RIP RAP SUMP INFLOW LOCATION
- INLT3R RIP RAP SUMP INLET NAME
- FLOW DIRECTION
- 328 CFS FLOW QUANTITY
- 328 CFS CULVERT AND BERM FLOWS

% COMPLETE

DATE:
GCW APP
DATE
AGEN APP
DATE
DESCRIPTION
REV
DATE

PROJECT NO.

DRAWN:
CHECK:
PLOT DATE: 10-29-14
PLOT TIME: 14:23:38

G.C. WALLACE COMPANIES
ENGINEERS | PLANNERS | SURVEYORS
1555 S. RAINBOW BLVD - LAS VEGAS, NV 89146
T: 702.804.2000 - F: 702.804.2299 - GCWALLACE.COM
LAS VEGAS

F:\Projects\450\451-002-001\Dwg\Hydro\Figures\140902\Fig8-140820.dwg
David Clark

WESTERN SEGMENT OF THE LAS VEGAS BELTWAY
CRAIG ROAD TO HUALAPAI WAY
INTERIM CONDITIONS BASIN MAP
SHAUMBER TRAIL

DRAWING
FIG 8
SHT OF SHTS

LD #:

gc-24.56.dwg 070203.jpr

HTE: 00-00000

F:\Projects\400\451-002-001\Dwg\Hydro\Improv\WB_SD2016.dwg 8-28-14 10:53:49 bdoane

SCALE: HORIZ. – 1" = 50'
VERT. – 1" = 5'

– SEE SHEET RSD19 FOR CONTINUATION

– SEE SHEET RSD21 FOR CONTINUATION

STA 781+53.79 ℄ OLD ANN ROAD ALIGNMENT
PVI STA = 1781+89.19
PVI ELEV = 2883.84
PVI STA = 1782+88.90
PVI ELEV = 2883.05
PVI STA = 1784+75
PVI ELEV = 2878.97
PVI STA = 1785+25
PVI ELEV = 2880.20
PVI STA = 1787+30
PVI ELEV = 2875.41
PVI STA = 1787+80
PVI ELEV = 2873.15
STA 1788+10.83 ℄ INTERSECTION
PVI STA = 1788+60.85
PVI ELEV = 2874.00
STA 1790+00–13.00' RT. (7 RSD57)
SDMH
TMH=2849.8±
PVI STA = 1791+60
PVI ELEV = 2876.23
PVI STA = 1792+10
PVI ELEV = 2876.29
PVI STA = 1793+70.50
PVI ELEV = 2876.66
STA 1794+00 13.00' RT (7 RSD57)
SDMH
TMH=2876.5±

-0.79% -2.19% 2.45% -2.34% -4.52% 1.05% 0.75% 0.12% 0.23% -2.23%

MATCH PROFILE GRADE SEE RAODWAY SHEETS

FG AT SHAUMBER ℄

EG AT CENTERLINE OF PRECAST RCB

FG AT CENTERLINE OF RCB

EX TEL TO BE RELOCATED
EX UGE TO BE RELOCATED
EX TEL TO BE RELOCATED

EX 24" SD TO BE REMOVED
EX 24" SD TO BE REMOVED
EX 24" SD TO BE REMOVED

EX 18" SD TO BE REMOVED
EX 18" SD TO BE REMOVED

STA 784+50 5' RT (7 RSD57)
SDMH
TMH=2851.3±

STA 786+50 5' RT (7 RSD57)
SDMH
TMH=2847.7±

10'x8' PRECAST RCB ~ 548.86 LF
Q100=1,410 CFS

10'x8' PRECAST RCB~58.98 LF

20' TRANSITION

HGL

2.75%

24.73 FL

58.98 FL

NOTE: SEE SD SHEETS FOR STORM DRAIN CROSSINGS AT RCB

14'x9' PRECAST RCB ~ 405.44 LF
Q100=1,955 CFS

7.78%

2.78%

14'x9' PRECAST RCB ~ 450.00 LF
Q100=2,925 CFS

1.05%

HGL WITH REVISED FLOWS

"GBWC" STA 781+00.00 (1 RSD57)
60" X 38" HERCP
INV=2825.17

"GBWC" STA 782+12.99 (1 RSD57)
18" RCP
INV=2830.00

"GBWC" STA 784+51.53 (1 RSD57)
(1 RSD43) 7'x7' RCB
INV=2829.41
QULT=970 CFS

"GBWC" STA 785+50.00
GRADE BREAK
INV=2829.45

"GBWC" STA 786+23.98 (1 RSD57)
18" RCP
INV=2833.00

"GBWC" STA 787+45.72 (2 RSD43) 7'x7' RCB
INV=2836.26
QULT=545 CFS

"GBWC" STA 789+08.99
END 14'x9' PRECAST RCB
BEGIN 20' TRANSITION
INV=2839.42
EQUATION STATION
"GBWC" STA 789+28.99=
"GBWC" STA. 789+31.00' PC
END 20' TRANSITION
BEGIN 10'X8' PRECAST RCB
INV=2941.02

MATCH LINE – RCB STA 789+89.98–
SHAUMBER ROAD STA 1789+89.98–16.00' RT.
PT
INV=2942.66

STA 1792+29.86 – 11.00' RT (3 RSD57) (1 RSD43) 72" RCP
INV=2850.82
QULT=0 CFS

STA 1793+68.88 – 11.00' RT (1 RSD57) (4 RSD43) 72" RCP
INV=2854.18
QULT=50 CFS

781+00 782+00 783+00 784+00 785+00 786+00 787+00 788+00 789+00 790+00 1791+00 1792+00 1793+00 1794+00 1795+00

2890 2880 2870 2860 2850 2840 2830

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Call 811 or 1-800-227-2600

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

REV. NO.	DATE	DESCRIPTION	APPROVED

CLARK COUNTY NEVADA

WESTERN CLARK COUNTY 215 BRUCE WOODBURY BELTWAY - CRAIG ROAD TO HUALAPAI WAY

"GBWC" PROFILE

STA 781+00.00 TO STA 1795+00.00

CLARK COUNTY, NEVADA, DEPARTMENT OF PUBLIC WORKS

PROFESSIONAL ENGINEER – REGISTERED – STATE OF NEVADA – No. 15577 – PRINT – TODD W. WOLKOW – Date 08/28/2014 – NOT VALID WITHOUT SIGNATURE AND SEAL

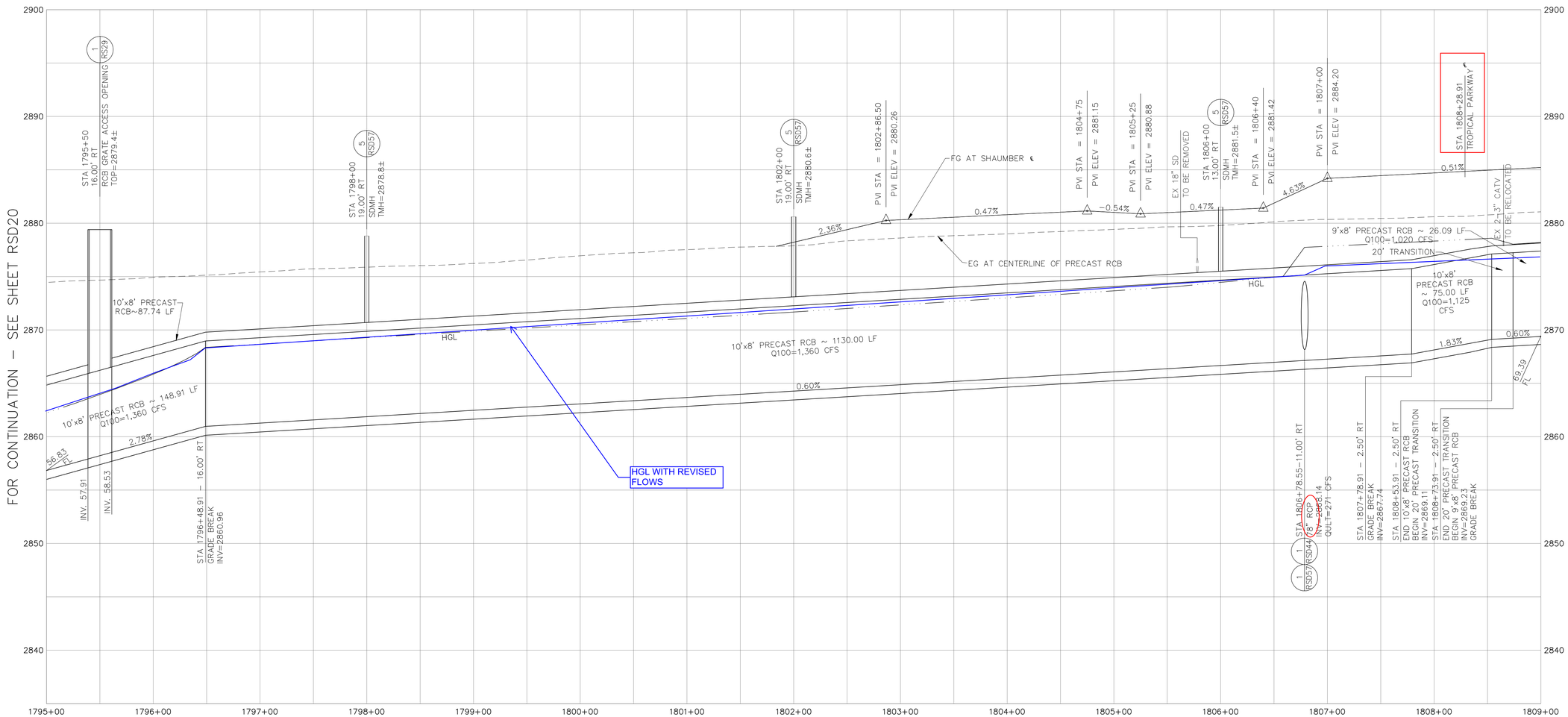
PROJECT No: 451.002.001 DRAWN BY:
DESIGNED BY: CHECKED BY:
APPROVED BY

G. C. WALLACE COMPANIES
ENGINEERS | PLANNERS | SURVEYORS
1555 S. RAINBOW BOULEVARD · LAS VEGAS, NV 89146
T: 702.804.2000 · F: 702.804.2299 · GCWALLACE.COM

SCALE
HORIZ: AS SHOWN
VERT: AS SHOWN
FIELD BOOK

DRAWING NO. RSD20
SHT. OF

F:\Projects\400\451-002-001\Dwg\Hydro\improv\WB_SD21.dwg 8-28-14 10:54:02 bdoone



50 0 50 100
SCALE FEET

SCALE: HORIZ. – 1" = 50'
VERT. – 1" = 5'

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REV. NO.	DATE	DESCRIPTION	APPROVED

CLARK COUNTY NEVADA

WESTERN CLARK COUNTY 215 BRUCE WOODBURY BELTWAY - CRAIG ROAD TO HUALAPAI WAY

"GBWC" PROFILE

STA 1795+00.00 TO STA 1809+00.00

CLARK COUNTY, NEVADA, DEPARTMENT OF PUBLIC WORKS

PROFESSIONAL ENGINEER – BRENT T. YORK – No. 15571 – STATE OF NEVADA

PROJECT No: 451.002.001 DRAWN BY:
DESIGNED BY: CHECKED BY:
APPROVED BY

G. C. WALLACE COMPANIES
ENGINEERS | PLANNERS | SURVEYORS
1555 S. RAINBOW BOULEVARD · LAS VEGAS, NV 89146
T: 702.804.2000 · F: 702.804.2299 · GCWALLACE.COM

SCALE
HORIZ: AS SHOWN
VERT: AS SHOWN
FIELD BOOK

DRAWING NO.
RSD21
SHT. OF

FOR CONTINUATION – SEE SHEET RSD21

FOR CONTINUATION – SEE SHEET RSD23

PVI STA = 1809+35
PVI ELEV = 2885.40
PVI STA = 1809+85
PVI ELEV = 2883.17
STA 1810+00
13.50' RT
SDMH
TMH=2883.5±
(5) (RSD57)
PVI STA = 1811+37.40
PVI ELEV = 2884.00
PVI STA = 1811+75
PVI ELEV = 2884.33
PVI STA = 1812+25
PVI ELEV = 2886.49
PVI STA = 1812+75
PVI ELEV = 2888.13
STA 1814+00
13.50' RT
SDMH
TMH=2887.9±
(5) (RSD57)
STA 1815+50
16.00' RT
RCB GRATE ACCESS OPENING
TOP=2890.0±
(1) (RSD29)
STA 1818+00
13.50' RT
SDMH
TMH=2893.0±
(5) (RSD57)
PVI STA = 1819+07.09
PVI ELEV = 2895.00
STA 1821+64.44
AZURE AVENUE
EX 18" SD
TO BE REMOVED
STA 1822+00
5.50' RT
SDMH
TMH=2896.2±
(5) (RSD57)
PVI STA = 1823+10
PVI ELEV = 2897.45
EX 24" SD
TO BE REMOVED
EX 24" SD
TO BE REMOVED
EX 24" SD
TO BE REMOVED

4.46%
0.54%
0.88%
4.32%
3.28%
-0.52%
2.93%
0.85%
1.06%
10.0%
1.10%
0.60%

FG AT SHAUMBER ℄
EG AT CENTERLINE OF PRECAST RCB
20' TRANSITION
HGL
8'x6' PRECAST RCB ~ 280.00 LF
Q100=814 CFS
9'x8' PRECAST RCB ~ 638.83 LF
Q100=1,089 CFS
9'x8' PRECAST RCB ~ 388.83 LF
Q100=1,089 CFS
9'x8' PRECAST RCB ~ 250.00 LF
Q100=1,089 CFS
HGL WITH REVISED FLOWS

INV. 75.15
INV. 75.42

69.39
FL

STA 1811+50.00 – 16.00' RT
GRADE BREAK
INV=2870.89

(1) (RSD57) (2) (RSD44) 42" RCP
STA 1812+15.83–11.50' RT
INV=2873.11
QULT=0 CFS

(1) (RSD57) (4) (RSD44) 42" RCP
STA 1821+78.33–12.00' RT
INV=2883.16
QULT=275 CFS

STA 1822+00.00–16.00' RT
END 9'x8' PRECAST RCB
BEGIN 20' PRECAST TRANSITION
INV=2882.40

STA 1822+20.00–16.00' RT
END 20' PRECAST TRANSITION
BEGIN 8'x6' PRECAST RCB
INV=2883.31

(1) (RSD57) (1) (RSD45) 42" RCP
STA 1823+83.00–12.00' RT
INV=2887.09
QULT=0 CFS

2910
2900
2890
2880
2870
2860
2850

1809+00 1810+00 1811+00 1812+00 1813+00 1814+00 1815+00 1816+00 1817+00 1818+00 1819+00 1820+00 1821+00 1822+00 1823+00 1824+00

50 0 50 100
SCALE FEET

SCALE: HORIZ. – 1" = 50'
VERT. – 1" = 5'

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REV. NO.	DATE	DESCRIPTION	APPROVED

CLARK COUNTY NEVADA

WESTERN CLARK COUNTY 215 BRUCE WOODBURY BELTWAY - CRAIG ROAD TO HUALAPAI WAY

"GBWC" PROFILE

STA 1809+00.00 TO STA 1824+50.00

CLARK COUNTY, NEVADA, DEPARTMENT OF PUBLIC WORKS

PROFESSIONAL ENGINEER BRANT T. YOKOYAMA No. 15879 STATE OF NEVADA

PROJECT No: 451.002.001 DRAWN BY:
DESIGNED BY: CHECKED BY:
APPROVED BY

G. C. WALLACE COMPANIES
ENGINEERS | PLANNERS | SURVEYORS
1555 S. RAINBOW BOULEVARD · LAS VEGAS, NV 89146
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SCALE
HORIZ: AS SHOWN
VERT: AS SHOWN
FIELD BOOK

DRAWING NO.
RSD22
SHT. OF

HORROCKS ENGINEERS

Rip Rap Calculations for Open Channels

Project Name: Centennial Heights Townhomes
Proj. Number: NV-1949-1909
Cross Streets: Centennial and Shaumber
Designed By: DBC
Date: 12/23/2019

Input Data

Velocity (ft/s) = 7.43
Slope (ft/ft) = 0.039
Spec. Gravity = 2.5
(2.5 min)

Rip Rap Size

d_{50} (in) = 10.81

Use d_{50} (in) = 11
Thickness (in) = 22

Mannings Coefficient

n = 0.039

$$V = 3\,(d_{50})^{0.5}\,(S_s - 1)/S^{0.17}$$

$$n = 0.0395\,(d_{50})^{1/6}$$

Reference:
Hydrologic Criteria and Drainage Design Manual, CCRFCD, Aug. 1999
Section 705.4.6 and equations 732 and 734

HORROCKS ENGINEERS

FINISHED FLOOR ANALYSIS

Project Number	NV-1949-1909	**Project Name:**	CENTENNIAL HEIGHTS TOWNHOMES
Date:	12/23/2019	**Designed By:**	DBC

FF Check

Bldg #	FF Elev.	TC Elev.	Flow Depth	WSE	Freeboard	Criteria Met	Bldg #	FF Elev.	TC Elev.	Flow Depth	WSE	Freeboard	Criteria Met
1	8.55	7.01	0.51	7.14	1.41	YES	43	32.17	30.29	0.51	30.42	1.75	YES
2	8.55	7.47	0.51	7.60	0.95	NO	44	32.17	30.75	0.51	30.88	1.29	YES
3	9.30	7.94	0.51	8.07	1.23	YES	45	32.92	31.21	0.51	31.34	1.58	YES
4	9.30	8.50	0.51	8.63	0.67	NO	46	32.92	31.68	0.51	31.81	1.11	YES
5	11.15	9.51	0.51	9.64	1.51	YES	47	33.67	32.04	0.51	32.17	1.50	YES
6	11.15	9.97	0.51	10.10	1.05	YES	48	33.67	32.25	0.51	32.38	1.29	YES
7	11.95	10.43	0.51	10.56	1.39	YES	49	34.42	32.46	0.51	32.59	1.83	YES
8	11.95	10.89	0.51	11.02	0.93	NO	50	34.52	33.42	0.51	33.55	0.97	NO
9	12.70	11.35	0.51	11.48	1.22	YES	51	33.40	31.70	0.42	31.74	1.66	YES
10	12.70	11.92	0.51	12.05	0.65	NO	52	33.40	32.16	0.42	32.20	1.20	YES
11	14.81	12.92	0.51	13.05	1.76	YES	53	34.15	32.62	0.42	32.66	1.49	YES
12	14.81	13.39	0.51	13.52	1.29	YES	54	34.15	33.08	0.42	33.12	1.03	YES
13	15.56	13.85	0.51	13.98	1.58	YES	55	34.90	33.54	0.42	33.58	1.32	YES
14	15.56	14.31	0.51	14.44	1.12	YES	56	34.90	34.11	0.42	34.15	0.75	NO
15	16.31	14.77	0.51	14.90	1.41	YES	57	34.99	34.11	0.42	34.15	0.84	YES
16	16.31	15.23	0.51	15.36	0.95	NO	58	34.99	33.54	0.42	33.58	1.41	YES
17	17.06	15.70	0.51	15.83	1.23	YES	59	34.24	33.08	0.42	33.12	1.12	YES
18	17.06	16.26	0.51	16.39	0.67	NO	60	34.24	32.62	0.42	32.66	1.58	YES
19	19.15	17.27	0.51	17.40	1.75	YES	61	33.49	32.16	0.42	32.20	1.29	YES
20	19.15	17.73	0.51	17.86	1.29	YES	62	33.49	31.70	0.42	31.74	1.75	YES
21	19.90	18.19	0.51	18.32	1.58	YES	63	29.66	27.46	0.27	27.35	2.31	YES
22	19.90	18.65	0.51	18.78	1.12	YES	64	29.66	27.92	0.27	27.81	1.85	YES
23	20.65	19.11	0.51	19.24	1.41	YES	65	30.41	28.38	0.27	28.27	2.14	YES
24	20.65	19.58	0.51	19.71	0.94	NO	66	30.41	28.84	0.27	28.73	1.68	YES
25	21.40	20.04	0.51	20.17	1.23	YES	67	31.16	29.30	0.27	29.19	1.97	YES
26	21.40	20.60	0.51	20.73	0.67	NO	68	31.16	29.37	0.27	29.26	1.90	YES
27	23.49	21.61	0.51	21.74	1.75	YES	69	30.25	29.37	0.27	29.26	0.99	YES
28	23.49	22.07	0.51	22.20	1.29	YES	70	30.25	28.80	0.27	28.69	1.56	YES
29	24.24	22.53	0.51	22.66	1.58	YES	71	29.50	28.34	0.27	28.23	1.27	YES
30	24.24	22.99	0.51	23.12	1.12	YES	72	29.50	27.88	0.27	27.77	1.73	YES
31	24.99	23.45	0.51	23.58	1.41	YES	73	28.75	27.42	0.27	27.31	1.44	YES
32	24.99	23.92	0.51	24.05	0.94	NO	74	28.75	26.96	0.27	26.85	1.90	YES
33	25.74	24.38	0.51	24.51	1.23	YES	75	24.92	22.72	0.27	22.61	2.31	YES
34	25.74	24.94	0.51	25.07	0.67	NO	76	24.92	23.18	0.27	23.07	1.85	YES
35	27.83	25.95	0.51	26.08	1.75	YES	77	25.76	23.64	0.27	23.53	2.23	YES
36	27.83	26.41	0.51	26.54	1.29	YES	78	25.76	24.10	0.27	23.99	1.77	YES
37	28.58	26.87	0.51	27.00	1.58	YES	79	26.42	24.56	0.27	24.45	1.97	YES
38	28.58	27.33	0.51	27.46	1.12	YES	80	26.42	24.63	0.27	24.52	1.90	YES
39	29.33	27.80	0.51	27.93	1.40	YES	81	25.51	24.63	0.27	24.52	0.99	YES
40	29.33	28.26	0.51	28.39	0.94	NO	82	25.51	24.06	0.27	23.95	1.56	YES
41	30.08	28.72	0.51	28.85	1.23	YES	83	24.76	23.60	0.27	23.49	1.27	YES
42	30.08	29.28	0.51	29.41	0.67	NO	Notes:						

FINISHED FLOOR ANALYSIS

Project Number NV-1949-1909 | **Project Name:** CENTENNIAL HEIGHTS TOWNHOMES

Date: 12/23/2019 | **Designed By:** DBC

FF Check

Bldg #	FF Elev.	TC Elev.	Flow Depth	WSE	Freeboard	Criteria Met	Bldg #	FF Elev.	TC Elev.	Flow Depth	WSE	Freeboard	Criteria Met
84	24.76	23.14	0.27	23.03	1.73	YES	126	26.56	25.59	0.48	25.69	0.87	NO
85	24.01	22.68	0.27	22.57	1.44	YES	127	27.31	25.98	0.48	26.08	1.23	YES
86	24.01	22.22	0.27	22.11	1.90	YES	128	27.31	26.37	0.48	26.47	0.84	NO
87	20.18	17.98	0.27	17.87	2.31	YES	129	28.06	26.76	0.48	26.86	1.20	YES
88	20.18	18.44	0.27	18.33	1.85	YES	130	28.06	27.15	0.48	27.25	0.81	NO
89	20.93	18.90	0.27	18.79	2.14	YES	131	28.81	27.54	0.48	27.64	1.17	YES
90	20.93	19.36	0.27	19.25	1.68	YES	132	28.81	28.01	0.48	28.11	0.70	NO
91	21.68	19.82	0.27	19.71	1.97	YES	133	30.21	28.85	0.48	28.95	1.26	YES
92	21.68	19.89	0.27	19.78	1.90	YES	134	30.21	29.24	0.48	29.34	0.87	NO
93	20.77	19.89	0.27	19.78	0.99	YES	135	30.96	29.63	0.48	29.73	1.23	YES
94	20.77	19.32	0.27	19.21	1.56	YES	136	30.96	30.02	0.48	30.12	0.84	NO
95	20.02	18.86	0.27	18.75	1.27	YES	137	31.71	30.41	0.48	30.51	1.20	YES
96	20.02	18.40	0.27	18.29	1.73	YES	138	31.71	30.80	0.48	30.90	0.81	NO
97	19.27	17.94	0.27	17.83	1.44	YES	139	32.46	31.19	0.48	31.29	1.17	YES
98	19.27	17.48	0.27	17.37	1.90	YES	140	32.46	31.66	0.48	31.76	0.70	NO
99	15.17	14.39	0.51	14.52	0.65	NO	141	33.86	32.50	0.48	32.60	1.26	YES
100	15.17	13.82	0.51	13.95	1.22	YES	142	33.86	32.89	0.48	32.99	0.87	NO
101	15.17	13.36	0.51	13.49	1.68	YES	143	34.61	33.28	0.48	33.38	1.23	YES
102	15.17	12.90	0.51	13.03	2.14	YES	144	34.61	33.67	0.48	33.77	0.84	NO
103	13.67	12.44	0.51	12.57	1.10	YES	145	35.36	34.06	0.48	34.16	1.20	YES
104	13.67	11.97	0.51	12.10	1.57	YES	146	35.36	34.45	0.48	34.55	0.81	NO
105	11.09	13.56	0.51	13.69	-2.60	NO	147	36.11	34.84	0.48	34.94	1.17	YES
106	11.09	9.74	0.51	9.87	1.22	YES	148	36.11	35.31	0.48	35.41	0.70	NO
107	10.34	9.28	0.51	9.41	0.93	NO	149	37.51	36.15	0.48	36.25	1.26	YES
108	10.34	8.82	0.51	8.95	1.39	YES	150	37.51	36.46	0.48	36.56	0.95	NO
109	9.59	8.36	0.51	8.49	1.10	YES	151	38.26	36.93	0.48	37.03	1.23	YES
110	9.59	7.90	0.51	8.03	1.56	YES	152	38.26	37.32	0.48	37.42	0.84	NO
111	8.84	7.43	0.51	7.56	1.28	YES	153	39.01	37.71	0.48	37.81	1.20	YES
112	8.84	6.97	0.51	7.10	1.74	YES	154	39.01	38.10	0.48	38.20	0.81	NO
113	21.00	18.90	0.48	19.00	2.00	YES	155	39.76	38.49	0.48	38.59	1.17	YES
114	21.00	19.29	0.48	19.39	1.61	YES	156	39.76	37.74	0.48	37.84	1.92	YES
115	21.75	19.68	0.48	19.78	1.97	YES	157	42.25	40.56	0.41	40.59	1.66	YES
116	21.75	20.07	0.48	20.17	1.58	YES	158	42.25	41.02	0.41	41.05	1.20	YES
117	22.50	20.46	0.48	20.56	1.94	YES	159	43.00	41.48	0.41	41.51	1.49	YES
118	22.50	20.85	0.48	20.95	1.55	YES	160	43.00	41.94	0.41	41.97	1.03	YES
119	23.25	21.23	0.48	21.33	1.92	YES	161	43.75	42.41	0.41	42.44	1.31	YES
120	23.25	21.55	0.48	21.65	1.60	YES	162	43.75	42.97	0.41	43.00	0.75	NO
121	24.46	23.11	0.48	23.21	1.25	YES	163	45.85	43.97	0.41	44.00	1.85	YES
122	24.46	23.50	0.48	23.60	0.86	NO	164	45.85	44.44	0.41	44.47	1.38	YES
123	25.21	23.89	0.48	23.99	1.22	YES	165	46.60	44.90	0.41	44.93	1.67	YES
124	25.21	24.36	0.48	24.46	0.75	NO	166	46.60	45.38	0.41	45.41	1.19	YES
125	26.56	25.20	0.48	25.30	1.26	YES	Notes:						

FINISHED FLOOR ANALYSIS

Project Number NV-1949-1909 | **Project Name:** CENTENNIAL HEIGHTS TOWNHOMES

Date: 12/23/2019 | **Designed By:** DBC

FF Check

Bldg #	FF Elev.	TC Elev.	Flow Depth	WSE	Freeboard	Criteria Met	Bldg #	FF Elev.	TC Elev.	Flow Depth	WSE	Freeboard	Criteria Met
167	47.35	45.82	0.41	45.85	1.50	YES	211	70.60	68.40	0.27	68.29	2.31	YES
168	47.35	46.28	0.41	46.31	1.04	YES	212	70.60	68.86	0.27	68.75	1.85	YES
169	48.10	46.75	0.41	46.78	1.32	YES	213	71.35	69.32	0.27	69.21	2.14	YES
170	48.10	47.31	0.41	47.34	0.76	NO	214	71.35	69.78	0.27	69.67	1.68	YES
171	50.58	48.71	0.45	48.78	1.80	YES	215	72.10	70.24	0.27	70.13	1.97	YES
172	50.58	49.17	0.45	49.24	1.34	YES	216	72.10	70.31	0.27	70.20	1.90	YES
173	51.73	49.64	0.45	49.71	2.02	YES	217	69.69	67.90	0.27	67.79	1.90	YES
174	51.73	50.10	0.45	50.17	1.56	YES	218	69.69	68.36	0.27	68.25	1.44	YES
175	52.08	50.56	0.45	50.63	1.45	YES	219	70.40	68.82	0.27	68.71	1.69	YES
176	52.08	51.02	0.45	51.09	0.99	YES	220	70.40	69.26	0.27	69.15	1.25	YES
177	52.83	51.48	0.45	51.55	1.28	YES	221	71.19	69.74	0.27	69.63	1.56	YES
178	52.83	52.05	0.45	52.12	0.71	NO	222	71.19	70.31	0.27	70.20	0.99	YES
179	54.42	53.05	0.45	53.12	1.30	YES	223	67.36	65.53	0.27	65.42	1.94	YES
180	54.42	53.52	0.45	53.59	0.83	NO	224	67.36	65.50	0.27	65.39	1.97	YES
181	55.67	53.98	0.45	54.05	1.62	YES	225	66.61	65.04	0.27	64.93	1.68	YES
182	55.67	54.44	0.45	54.51	1.16	YES	226	66.61	64.58	0.27	64.47	2.14	YES
183	56.42	54.90	0.45	54.97	1.45	YES	227	65.85	64.12	0.27	64.01	1.84	YES
184	56.42	55.36	0.45	55.43	0.99	YES	228	65.85	63.66	0.27	63.55	2.30	YES
185	57.17	55.83	0.45	55.90	1.27	YES	229	64.95	63.16	0.27	63.05	1.90	YES
186	57.17	56.39	0.45	56.46	0.71	NO	230	64.95	63.62	0.27	63.51	1.44	YES
187	59.27	57.40	0.45	57.47	1.80	YES	231	65.70	64.08	0.27	63.97	1.73	YES
188	59.27	57.86	0.45	57.93	1.34	YES	232	65.70	64.54	0.27	64.43	1.27	YES
189	60.02	58.32	0.45	58.39	1.63	YES	233	66.45	65.00	0.27	64.89	1.56	YES
190	60.02	58.78	0.45	58.85	1.17	YES	234	66.45	65.53	0.27	65.42	1.03	YES
191	60.77	59.24	0.45	59.31	1.46	YES	235	62.62	60.83	0.27	60.72	1.90	YES
192	60.77	59.71	0.45	59.78	0.99	YES	236	62.62	60.76	0.27	60.65	1.97	YES
193	61.52	60.17	0.45	60.24	1.28	YES	237	61.87	60.30	0.27	60.19	1.68	YES
194	61.52	60.73	0.45	60.80	0.72	NO	238	61.87	59.84	0.27	59.73	2.14	YES
195	64.00	62.13	0.45	62.20	1.80	YES	239	61.12	59.38	0.27	59.27	1.85	YES
196	64.00	62.59	0.45	62.66	1.34	YES	240	61.12	58.92	0.27	58.81	2.31	YES
197	64.75	63.06	0.45	63.13	1.62	YES	241	60.21	58.42	0.27	58.31	1.90	YES
198	64.75	63.52	0.45	63.59	1.16	YES	242	60.21	58.88	0.27	58.77	1.44	YES
199	65.50	63.98	0.45	64.05	1.45	YES	243	60.96	59.34	0.27	59.23	1.73	YES
200	65.50	64.44	0.45	64.51	0.99	YES	244	60.96	59.80	0.27	59.69	1.27	YES
201	66.25	64.94	0.45	65.01	1.24	YES	245	61.71	60.26	0.27	60.15	1.56	YES
202	66.25	65.47	0.45	65.54	0.71	NO	246	61.71	60.83	0.27	60.72	0.99	YES
203	68.00	66.47	0.45	66.54	1.46	YES	247	57.88	56.09	0.27	55.98	1.90	YES
204	68.00	66.94	0.45	67.01	0.99	YES	248	57.88	56.02	0.27	55.91	1.97	YES
205	68.75	67.40	0.45	67.47	1.28	YES	249	57.13	55.56	0.27	55.45	1.68	YES
206	68.75	67.96	0.45	68.03	0.72	NO	Notes:						

FINISHED FLOOR ANALYSIS

Project Number NV-1949-1909 | **Project Name:** CENTENNIAL HEIGHTS TOWNHOMES

Date: 12/23/2019 | **Designed By:** DBC

FF Check

Bldg #	FF Elev.	TC Elev.	Flow Depth	WSE	Freeboard	Criteria Met
250	57.13	55.10	0.27	54.99	2.14	YES
251	56.38	54.64	0.27	54.53	1.85	YES
252	56.38	54.18	0.27	54.07	2.31	YES
253	55.47	53.68	0.27	53.57	1.90	YES
254	55.47	54.14	0.27	54.03	1.44	YES
255	56.22	54.60	0.27	54.49	1.73	YES
256	56.22	55.06	0.27	54.95	1.27	YES
257	56.97	55.52	0.27	55.41	1.56	YES
258	56.97	56.06	0.27	55.95	1.02	YES
259	49.58	47.91	0.27	47.80	1.78	YES
260	49.58	47.71	0.27	47.60	1.98	YES
261	48.83	47.25	0.27	47.14	1.69	YES
262	48.83	46.79	0.27	46.68	2.15	YES
263	48.08	46.33	0.27	46.22	1.86	YES
264	48.08	45.87	0.27	45.76	2.32	YES
265	47.16	45.37	0.27	45.26	1.90	YES
266	47.16	45.83	0.27	45.72	1.44	YES
267	47.91	46.29	0.27	46.18	1.73	YES
268	47.91	46.75	0.27	46.64	1.27	YES
269	48.66	47.21	0.27	47.10	1.56	YES
270	48.66	47.91	0.27	47.80	0.86	YES
271	44.83	43.04	0.27	42.93	1.90	YES
272	44.83	42.97	0.27	42.86	1.97	YES
273	44.08	42.91	0.27	42.80	1.28	YES
274	44.08	42.05	0.27	41.94	2.14	YES
275	43.33	41.59	0.27	41.48	1.85	YES
276	43.33	41.13	0.27	41.02	2.31	YES
277	42.42	40.63	0.27	40.52	1.90	YES
278	42.42	41.09	0.27	40.98	1.44	YES
279	43.17	41.55	0.27	41.44	1.73	YES
280	43.17	42.01	0.27	41.90	1.27	YES
281	43.92	42.47	0.27	42.36	1.56	YES
282	43.92	43.04	0.27	42.93	0.99	YES
283	40.72	38.93	0.27	38.82	1.90	YES
284	40.72	38.86	0.27	38.75	1.97	YES
285	39.97	38.40	0.27	38.29	1.68	YES
286	39.97	37.94	0.27	37.83	2.14	YES
287	39.22	37.48	0.27	37.37	1.85	YES
288	39.22	37.02	0.27	36.91	2.31	YES
289	38.31	36.52	0.27	36.41	1.90	YES
290	38.31	36.98	0.27	36.87	1.44	YES
291	39.06	37.44	0.27	37.33	1.73	YES
292	39.06	37.90	0.27	37.79	1.27	YES
293	39.81	38.36	0.27	38.25	1.56	YES
294	39.81	39.93	0.27	39.82	-0.01	NO
295	36.74	34.95	0.27	34.84	1.90	YES
296	36.74	34.88	0.27	34.77	1.97	YES
297	35.99	34.42	0.27	34.31	1.68	YES
298	35.99	33.96	0.27	33.85	2.14	YES
299	35.24	33.50	0.27	33.39	1.85	YES
300	35.24	33.04	0.27	32.93	2.31	YES
301	34.33	32.54	0.27	32.43	1.90	YES
302	34.33	33.00	0.27	32.89	1.44	YES
303	35.08	33.46	0.27	33.35	1.73	YES
304	35.08	33.92	0.27	33.81	1.27	YES
305	35.83	34.38	0.27	34.27	1.56	YES
306	35.83	34.95	0.27	34.84	0.99	YES
307	32.75	30.96	0.27	30.85	1.90	YES
308	32.75	30.89	0.27	30.78	1.97	YES
309	32.00	30.43	0.27	30.32	1.68	YES
310	32.00	29.97	0.27	29.86	2.14	YES
311	31.25	29.51	0.27	29.40	1.85	YES
312	31.25	29.05	0.27	28.94	2.31	YES
313	30.34	28.55	0.27	28.44	1.90	YES
314	30.34	29.01	0.27	28.90	1.44	YES
315	31.09	29.47	0.27	29.36	1.73	YES
316	31.09	29.93	0.27	29.82	1.27	YES
317	31.84	30.39	0.27	30.28	1.56	YES
318	31.84	30.96	0.27	30.85	0.99	YES
319	28.77	26.98	0.27	26.87	1.90	YES
320	28.77	26.91	0.27	26.80	1.97	YES
321	28.02	26.45	0.27	26.34	1.68	YES
322	28.02	25.99	0.27	25.88	2.14	YES
323	27.27	25.53	0.27	25.42	1.85	YES
324	27.27	25.07	0.27	24.96	2.31	YES
325	26.36	24.57	0.27	24.46	1.90	YES
326	26.36	25.03	0.27	24.92	1.44	YES
327	27.11	25.49	0.27	25.38	1.73	YES
328	27.11	25.95	0.27	25.84	1.27	YES
329	27.86	26.41	0.27	26.30	1.56	YES
330	27.86	26.98	0.27	26.87	0.99	YES
331	24.78	22.99	0.27	22.88	1.90	YES
332	24.78	22.92	0.27	22.81	1.97	YES

Notes:

FINISHED FLOOR ANALYSIS

Project Number	NV-1949-1909	**Project Name:**	CENTENNIAL HEIGHTS TOWNHOMES
Date:	12/23/2019	**Designed By:**	DBC

FF Check

Bldg #	FF Elev.	TC Elev.	Flow Depth	WSE	Freeboard	Criteria Met
333	24.03	22.46	0.27	22.35	1.68	YES
334	24.03	22.00	0.27	21.89	2.14	YES
335	23.28	21.54	0.27	21.43	1.85	YES
336	23.28	21.08	0.27	20.97	2.31	YES
337	23.47	22.06	0.27	21.95	1.52	YES
338	23.47	21.50	0.27	21.39	2.08	YES
339	22.72	21.01	0.27	20.90	1.82	YES
340	22.72	20.58	0.27	20.47	2.25	YES

Bldg #	FF Elev.	TC Elev.	Flow Depth	WSE	Freeboard	Criteria Met

VOLUME 2: APPENDIX C AND GRADING PLANS

OF

TECHNICAL DRAINAGE STUDY

FOR

CENTENNIAL HEIGHTS TOWNHOMES

IN

CITY OF LAS VEGAS, NEVADA

PREPARED FOR

HARMONY HOMES, LLC
8912 Spanish Ridge Ave. Ste. 200
Las Vegas, NV, 89148
Ph. (702) 570-7240

DECEMBER 2019

HORROCKS ENGINEERS PROJECT NV-1949-1909

Horrocks Engineers
1401 N Green Valley Pkwy, Suite 160
Henderson, NV 89074
702.966.4063

HORROCKS
ENGINEERS

APPENDIX C. Reference Material

Technical Drainage Study for Centennial Condominiums

Technical Drainage Study for Shaumber Road Realignment

Technical Drainage Study for Western Clark County 215 Bruce Woodbury Beltway – Craig Road to Hualapai Way



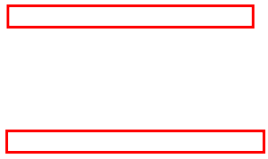
SD1 AND SD2

SD3

SD4



























DEPARTMENT OF PUBLIC WORKS

MAYOR :

CAROLYN G. GOODMAN

CITY COUNCIL :

STAVROS S. ANTHONY, MAYOR PRO TEM

LOIS TARKANIAN

STEVEN D. ROSS

RICKI Y. BARLOW

BOB COFFIN

BOB BEERS

CITY MANAGER :

ELIZABETH N. FRETWELL

DIRECTOR OF PUBLIC WORKS :

DAVID N. BOWERS, P.E., P.T.O.E.

CITY ENGINEER :

ALLEN E. PAVELKA, P.E.

SHAUMBER ROAD REALIGNMENT
CENTENNIAL PKWY
TO
WASHBURN RD

BID# : 15.45398

FUNDED BY:
REGIONAL TRANSPORTATION COMMISSION
MOTOR VEHICLE FUEL TAX

REVIEWED BY:

CLV City Engineer — 01/20/15 Date

CLV Project Manager — 1/20/15 Date

CLV City Traffic Engineer — 1-20-15 Date

CLV Construction Management — 1-20-15 Date

Regional Transportation Commission of So. Nevada — 12-18-14 Date

Las Vegas Valley Water District — 12/23/14 Date
ENGINEERING SERVICES MANAGER
PROJECT # 122987
SHEETS G1, G2, G3, G4, R1, R2, R3, RD1, RD2, RD8, RD9, RD10, DT-6, DT-7, DT-8, SD1, SD2, SD5, SD6, SD9

NV Energy - Distribution — 12/19/14 Date
NV ENERGY ACKNOWLEDGES THAT WE HAVE RECEIVED YOUR PLANS AND WILL PROVIDE SERVICE TO ALL ELECTRICAL NEEDS ASSOCIATED WITH THIS PROJECT. NV ENERGY RESERVES THE RIGHT TO ADDRESS ANY EXISTING OR FUTURE CONFLICTS ONCE THE FINAL DESIGN IS COMPLETED. THE NEW SERVICE AND THE RESOLUTION OF ANY CONFLICTS WILL BE ACCOMPLISHED PURSUANT TO THE NEVADA PUBLIC UTILITY COMMISSION'S RULES AND REGULATIONS.

NV Energy - Transmission — 12/19/14 Date

Southwest Gas Corporation — 12/19/14 Date

Central Telephone Company, d/b/a CenturyLink — 12/19/14 Date
THE AFFIXED CENTURYLINK NEVADA APPROVAL DOES NOT ASSUME OR GUARANTEE LIABILITY FOR KNOWN OR UNKNOWN CONFLICTS WITH EXISTING OR PROPOSED IMPROVEMENTS. RESOLUTION OF ANY CONFLICT WILL BE ACCOMPLISHED PURSUANT TO LOCAL ORDINANCES, NEVADA REVISED STATUTES AND/OR PUBLIC UTILITY COMMISSION STANDARD REGULATIONS.

Cox Communications Las Vegas Inc. — 12/19/14 Date

THE SIGNATURE ABOVE ACKNOWLEDGES THAT THE UTILITY COMPANY REPRESENTATIVE HAS REVIEWED THE PLANS, AND THAT TO THE BEST OF HIS OR HER KNOWLEDGE THE UTILITY LINES ARE SHOWN IN THE CORRECT LOCATIONS AND ARE THE CORRECT SIZES. WHILE SUCH DATA HAS BEEN COLLECTED WITH REASONABLE CARE, THERE IS NO EXPRESSED OR IMPLIED GUARANTEE THAT THE LOCATIONS ARE EXACT. THE CONTRACTOR SHALL BEAR THE RESPONSIBILITY OF OBTAINING THE ACTUAL FIELD LOCATIONS.

THE SIGNATURE ABOVE FURTHER ACKNOWLEDGES THAT THE UTILITY COMPANY DOES NOT ANTICIPATE CONSTRUCTION OR MAINTENANCE IN THE PROJECT AREA FOR FIVE (5) YEARS IN CONFORMANCE WITH THE CLV NO-CUT POLICY.

HANSEN NO. 45398

REVISIONS

NO.	DATE	DESCRIPTION	APP'D
6			
5			
4			
3			
2			
1			

DEPARTMENT OF PUBLIC WORKS
CAPITAL PROJECT MANAGEMENT

CITY ENGINEER: ALLEN E. PAVELKA, P.E.
PROGRAM MANAGER: JEREMY LEAVITT, P.E.
DESIGNED BY:
DRAWN BY: B. MAHAN
CHECKED BY: J. GRIEST
APPROVED BY: J. GRIEST

CH2MHILL
2485 VILLAGE VIEW DRIVE, SUITE 300
HENDERSON, NEVADA 89074
PHONE 702-369-4175, FAX 702-369-1107

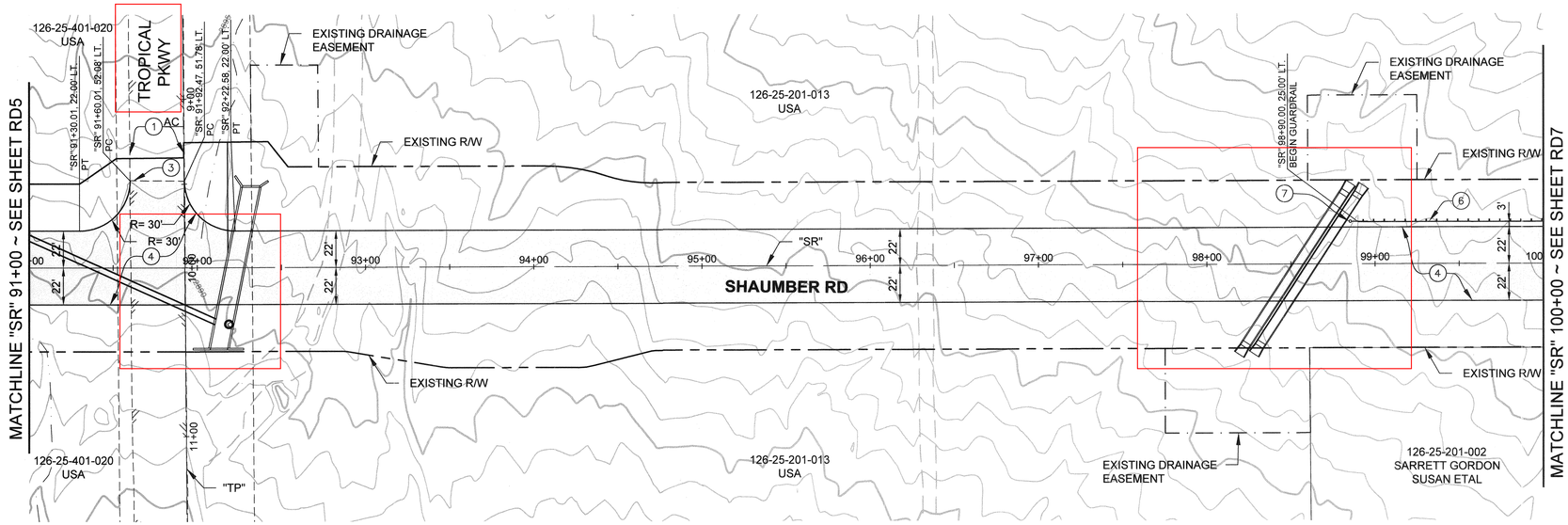
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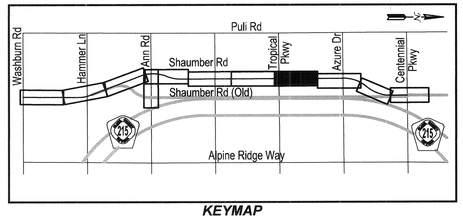
TITLE: SHAUMBER ROAD REALIGNMENT CENTENNIAL PKWY TO WASHBURN RD

PROFESSIONAL ENGINEER - STATE OF NEVADA
JEFFREY N. GRIEST
EXP. 06/30/15
CIVIL
No. 17150
12-17-14

SHEET: 1 of 52
DATE December 16, 2014
DRAWING NO. 107V6351
BID NO. 15.45398

458949-Cover Sheet.dwg





KEYMAP

40' 0 20' 40' 80'
Scale In Feet

LEGEND:

AREA OF NEW AC PAVEMENT
(SEE ROADWAY TYPICAL SECTIONS)

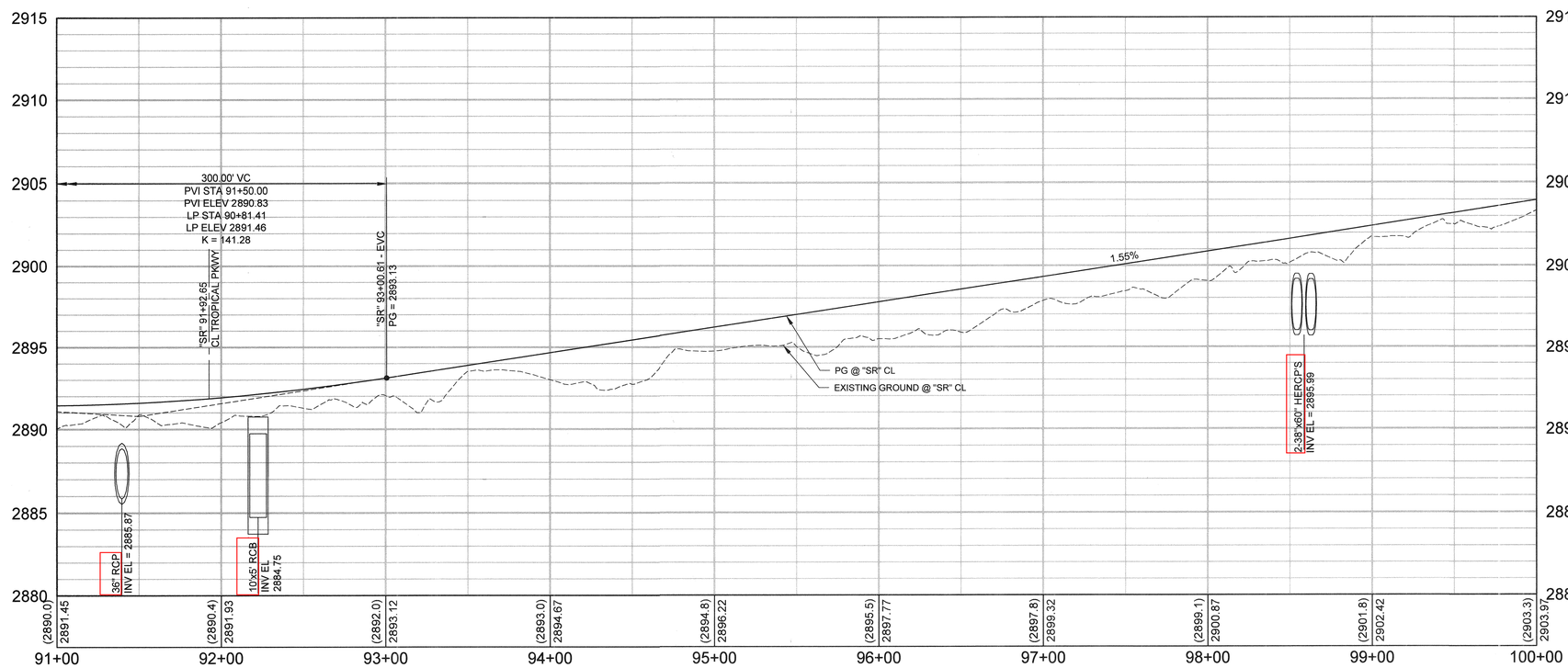
CONSTRUCTION NOTES

1. PROTECT IN PLACE
3. SAWCUT & MATCH EXISTING
4. CONSTRUCT PAVEMENT SECTION No. 1 (SEE SHEET TY5)
6. INSTALL GUARDRAIL PER NDOT STD. DWG. No. R-8.1.1
7. INSTALL GUARDRAIL TRAILING END ANCHOR PER NDOT STD. DWG. No. R-8.2.2

FOR GRADING & DRAINAGE SEE SHEET SD4

FOR STRIPING & SIGNING SEE SHEET ST4

FOR INTERSECTION GRADING DETAILS SEE SHEET DT3



458949--Roadway.dwg

FAST Call before you UnderGround 1-702-432-5300 FREEWAY AND ARTERIAL SYSTEM OF TRANSPORTATION

AVOID OVERHEAD POWER LINE CONTACT. IT'S COSTLY. Call before you Overhead 1-702-227-2929 NV ENERGY ENVIRONMENT AND SAFETY SERVICES DEPARTMENT

Call before you Dig AVOID CUTTING UNDERGROUND UTILITY LINES. IT'S COSTLY. Call 811

HANSEN NO. 45398

REVISIONS

NO.	DATE	DESCRIPTION	APPD
6			
5			
4			
3			
2			
1			

DEPARTMENT OF PUBLIC WORKS
CAPITAL PROJECT MANAGEMENT

CITY ENGINEER: ALLEN E. PAVELKA, P.E.
PROGRAM MANAGER: JEREMY LEAVITT, P.E.
DESIGNED BY: B. MAHAN
DRAWN BY: F. PAULLO
CHECKED BY: J. GRIEST
APPROVED BY: J. GRIEST

CH2MHILL®
2485 VILLAGE VIEW DRIVE, SUITE 350
HENDERSON, NEVADA 89074
PHONE 702-384-8115 FAX 702-384-1107

CITY OF LAS VEGAS NEVADA

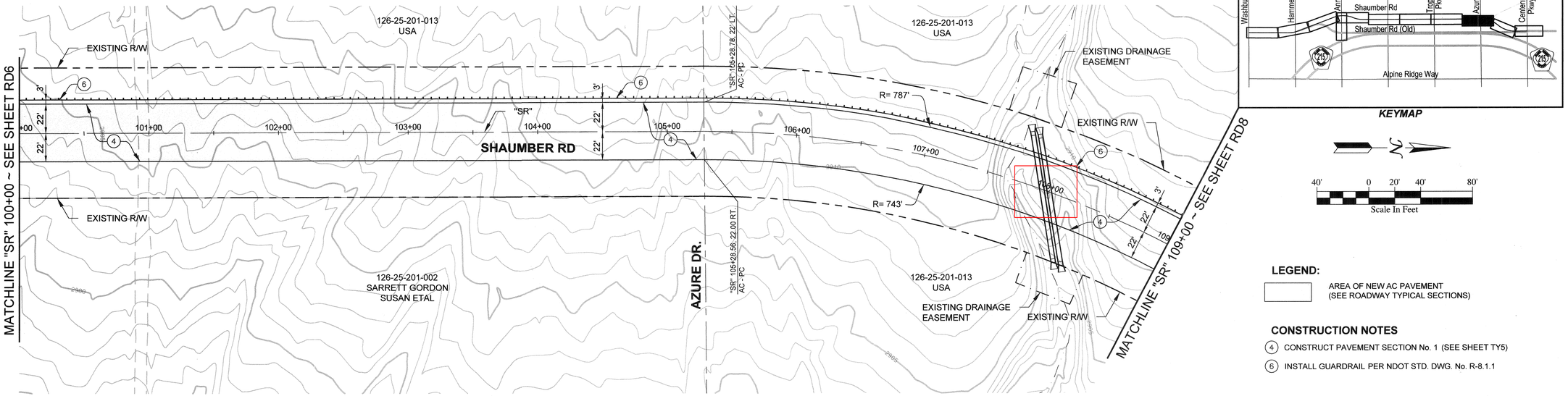
SHEET: ROADWAY PLAN & PROFILE "SR" 91+00 TO "SR" 100+00

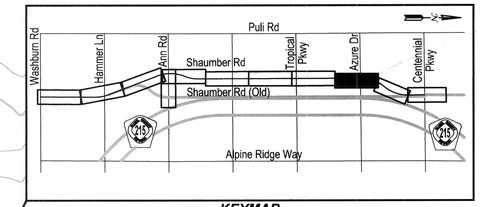
TITLE: SHAUMBER ROAD REALIGNMENT CENTENNIAL PKWY TO WASHBURN RD

PROFESSIONAL ENGINEER - STATE OF NEVADA
JEFFREY N. GRIEST
EXP. 06/30/15
CIVIL
No. 17156

SHEET: **RD6**
22 of 52
DATE January 7, 2015
DRAWING NO. 107V6351

BID NO. 15-45398





KEYMAP

40' 0 20' 40' 80'
Scale In Feet

LEGEND:

AREA OF NEW AC PAVEMENT
(SEE ROADWAY TYPICAL SECTIONS)

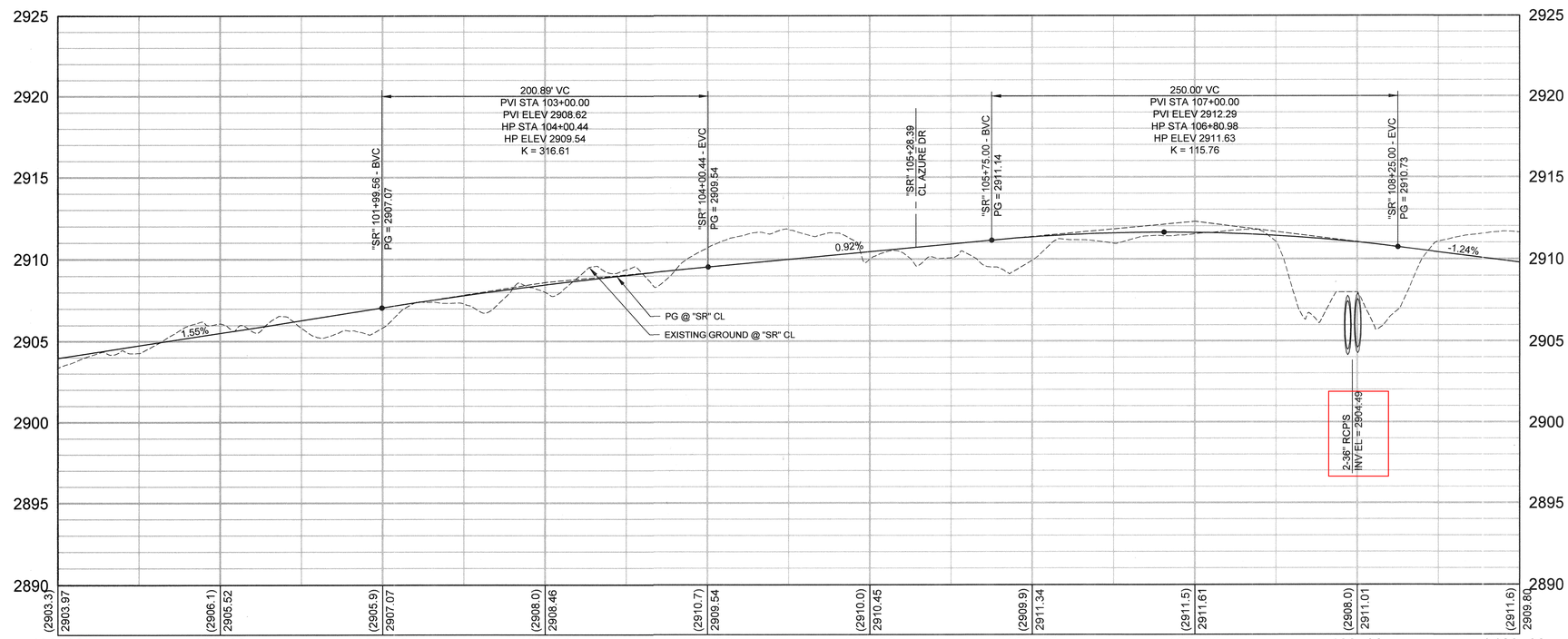
CONSTRUCTION NOTES

(4) CONSTRUCT PAVEMENT SECTION No. 1 (SEE SHEET TY5)

(6) INSTALL GUARDRAIL PER NDOT STD. DWG. No. R-8.1.1

FOR GRADING & DRAINAGE SEE SHEETS SD4

FOR STRIPING & SIGNING SEE SHEET ST4



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HANSEN NO. 45398

REVISIONS

NO.	DATE	DESCRIPTION	APP'D
6			
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DEPARTMENT OF PUBLIC WORKS
CAPITAL PROJECT MANAGEMENT

ALLEN E. PAVELKA, P.E.
JEREMY LEAVITT, P.E.
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2485 VILLAGE VIEW DRIVE, SUITE 350
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PHONE 702-388-8175 FAX 702-388-1107

CITY ENGINEER:
PROGRAM MANAGER: B. MAHAN
DESIGNED BY: F. PAULLO
DRAWN BY: J. GRIEST
CHECKED BY: J. GRIEST
APPROVED BY: J. GRIEST

SHEET: ROADWAY PLAN & PROFILE "SR" 100+00 TO "SR" 109+00

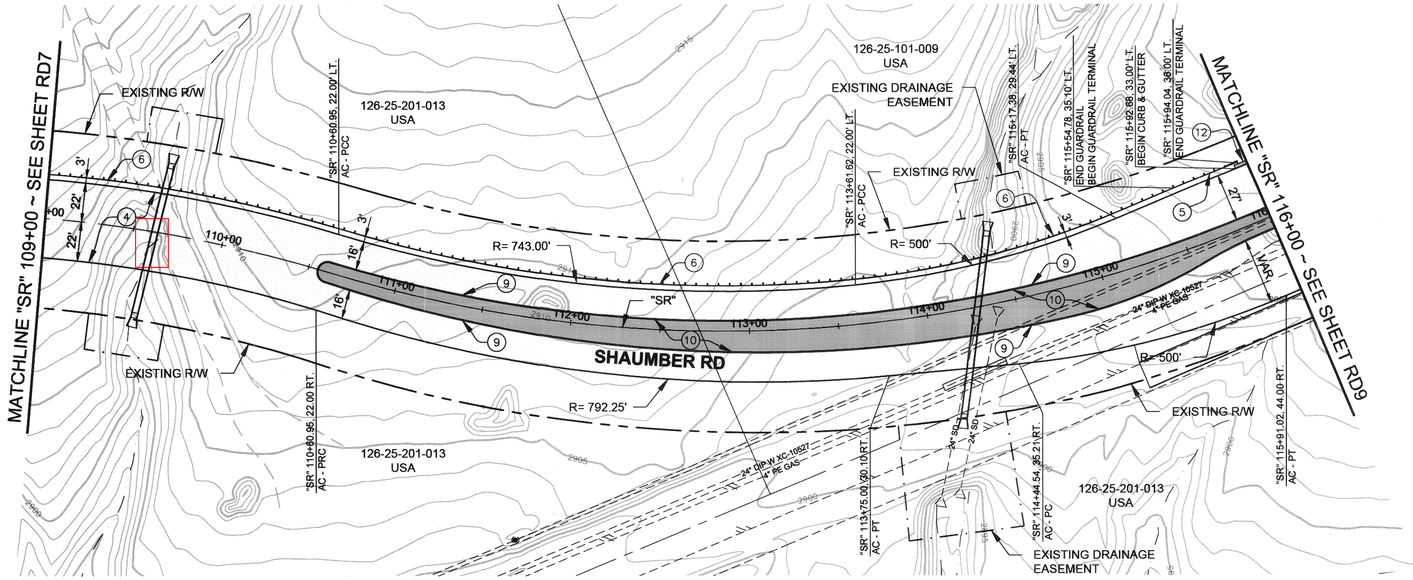
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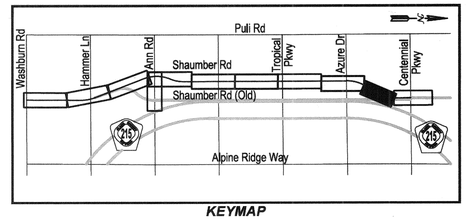
PROFESSIONAL ENGINEER - STATE OF NEVADA
JEFFREY N. GRIEST
EXP. 06/30/15
CIVIL
No. 17156
1-7-15

SHEET: **RD7**
23 of 52
DATE January 7, 2015
DRAWING NO. 107V6351

BID NO. 15-45398

458849—Roadway.dwg





KEYMAP

40' 0 20' 40' 80'
Scale In Feet

LEGEND:

AREA OF NEW AC PAVEMENT (SEE ROADWAY TYPICAL SECTIONS)

AREA OF NEW CONCRETE MEDIAN ISLAND (SEE SHEET TY3 & TY5)

CONSTRUCTION NOTES

(4) CONSTRUCT PAVEMENT SECTION No. 1 (SEE SHEET TY5)

(5) INSTALL TANGENTIAL GUARDRAIL TERMINAL (METHOD A) PER NDOT STD. DWG. No. R-8.2.2

(6) INSTALL GUARDRAIL PER NDOT STD. DWG. No. R-8.1.1

(9) CONSTRUCT TYPE "A" MEDIAN ISLAND CURB PER USDCCA STD. DWG. No. 219

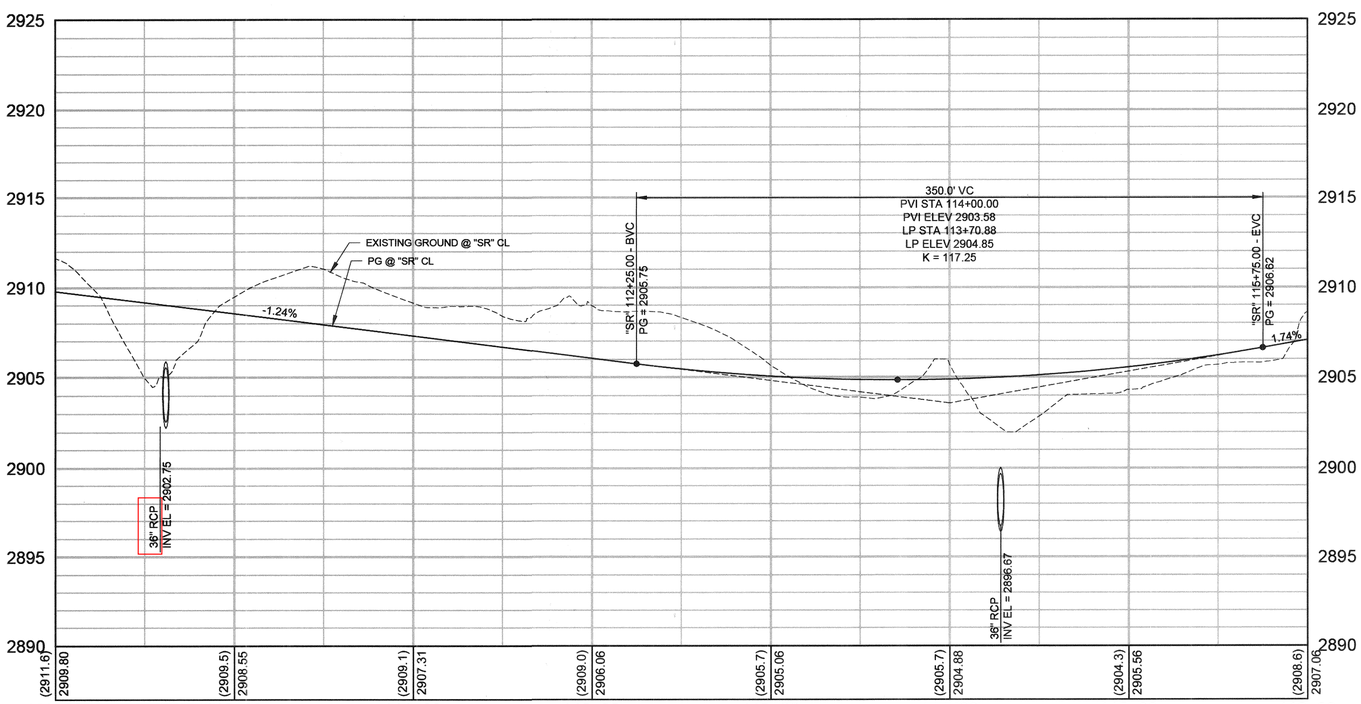
(10) CONSTRUCT GRAVEL MEDIAN ISLAND TREATMENT (SEE SPECIFICATIONS)

(12) CONSTRUCT TYPE "L" CURB & GUTTER PER USDCCA STD. DWG. No. 216

FOR GRADING & DRAINAGE SEE SHEET SD5

FOR STRIPING & SIGNING SEE SHEET ST5

FOR MEDIAN ISLAND GEOMETRICS SEE SHEET DT1



APPROVED FOR CONSTRUCTION
Las Vegas Valley Water District Engineering Services Manager
Date 12/23/14 Project No. 122987

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NO.	DATE	DESCRIPTION	APPD
8			
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DEPARTMENT OF PUBLIC WORKS
CAPITAL PROJECT MANAGEMENT

CITY ENGINEER: ALLEN E. PAVELKA, P.E.
PROGRAM MANAGER: JEREMY LEAVITT, P.E.
DESIGNED BY: B. MAHAN
DRAWN BY: F. PAULLO
CHECKED BY: J. GRIEST
APPROVED BY: J. GRIEST

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PHONE 702-938-1175 FAX 702-938-1107

CITY OF LAS VEGAS NEVADA

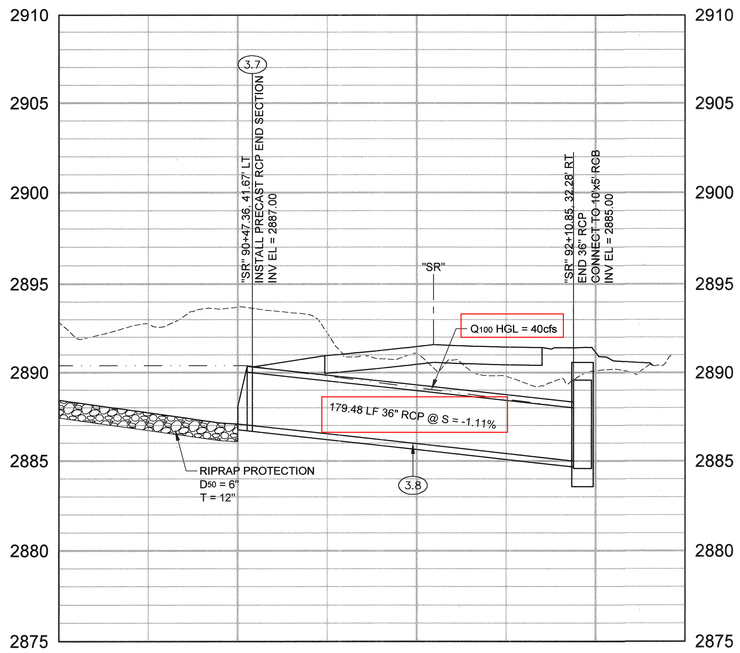
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TITLE: SHAUMBER ROAD REALIGNMENT CENTENNIAL PKWY TO WASHBURN RD

PROFESSIONAL ENGINEER-STATE OF NEVADA
JEFFREY N. GRIEST
EXP. 06/30/15
CIVIL
No. 17156
12-23-14

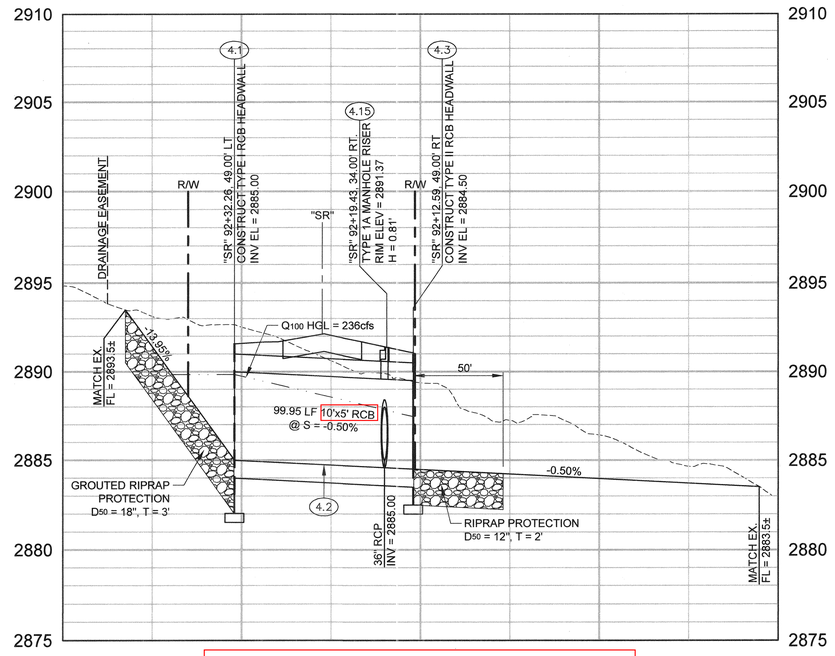
SHEET: **RD8**
24 of 52
DATE December 17, 2014
DRAWING NO. 107V6351
BID NO. 15-45398

458949--Roadway.dwg



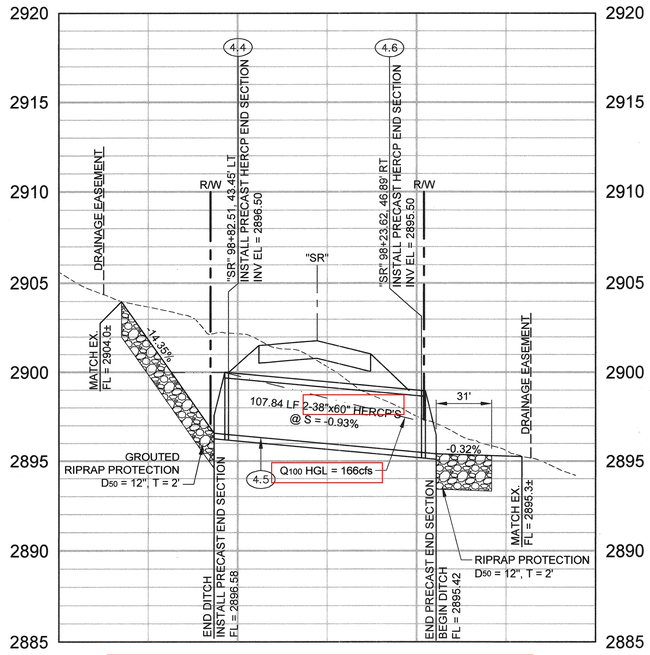
CULVERT STORM DRAIN @ "SR" 91+50

(SEE SHEET SD3)



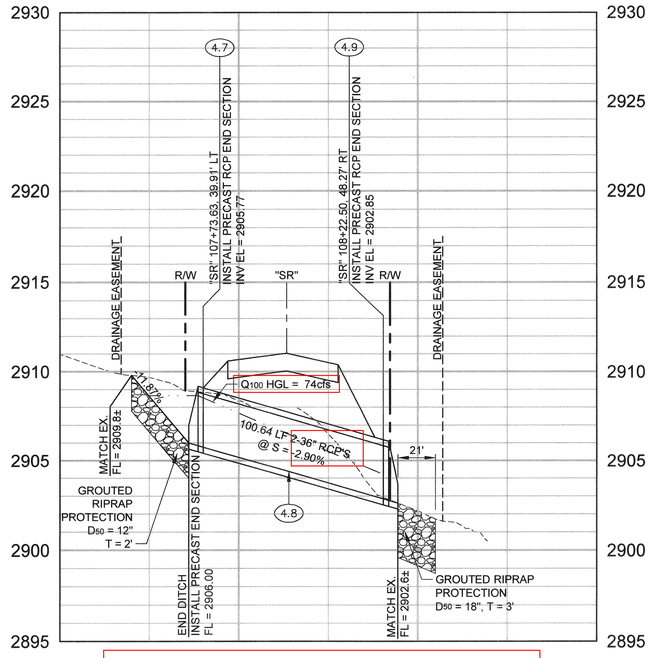
CULVERT STORM DRAIN @ "SR" 92+25

(SEE SHEET SD4)



CULVERT STORM DRAIN @ "SR" 98+50

(SEE SHEET SD4)



CULVERT STORM DRAIN @ "SR" 108+00

(SEE SHEET SD4)

40' 0 20' 40' 80'

Scale In Feet

NOTES

1. ALL PIPES SHALL BE CLASS III, UNLESS NOTED OTHERWISE.

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DEPARTMENT OF PUBLIC WORKS
CAPITAL PROJECT MANAGEMENT

CITY ENGINEER: ALLEN E. PAVELKA, P.E.
PROGRAM MANAGER: JEREMY LEAVITT, P.E.
DESIGNED BY: M. SCHWAB
DRAWN BY: B. MAHAN
CHECKED BY: J. GRIEST
APPROVED BY: J. GRIEST

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HENDERSON, NEVADA 89074
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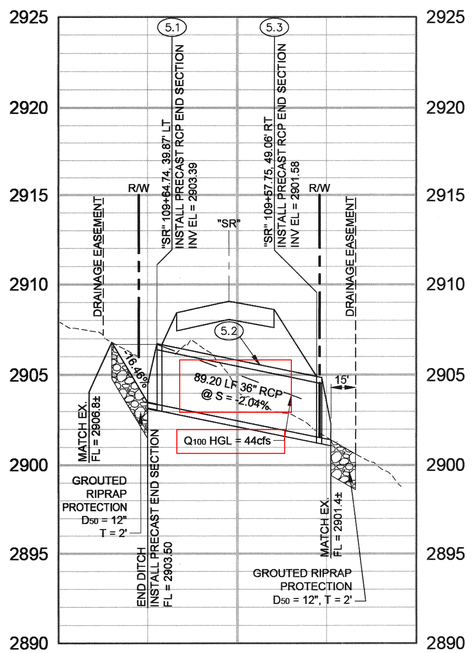
SHEET: CULVERT STORM DRAIN PROFILE

TITLE: SHAUMBER ROAD REALIGNMENT
CENTENNIAL PKWY TO WASHBURN RD

PROFESSIONAL ENGINEER-STATE OF NEVADA
JEFFREY N. GRIEST
EXP. 06/30/15
CIVIL
No. 17156
1-7-15

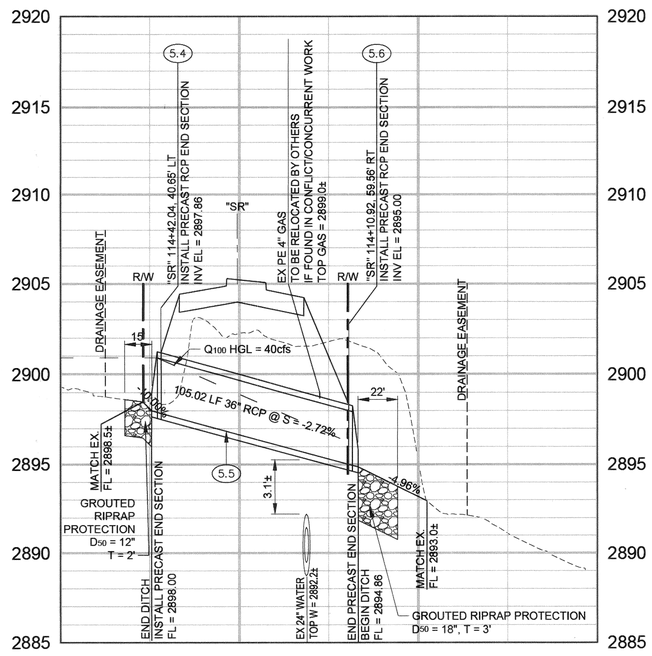
SHEET: **SD8**
45 of 52
DATE January 7, 2015
DRAWING NO. 107V6351
BID NO. 15-45398

458849-Storm Drain.dwg



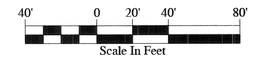
CULVERT STORM DRAIN @ "SR" 109+50

(SEE SHEET SD5)



CULVERT STORM DRAIN @ "SR" 114+50

(SEE SHEET SD5)



NOTES

1. ALL PIPES SHALL BE CLASS III, UNLESS NOTED OTHERWISE.
2. CONTRACTOR SHALL VERIFY VERTICAL SEPARATION BETWEEN PROPOSED STORM DRAIN AND EXISTING WATER LINE AND NOTIFY ENGINEER IF LESS THAN 12" VERTICAL SEPARATION IS FOUND.

APPROVED FOR CONSTRUCTION
Las Vegas Valley Water District Engineering Services Manager
Date 12/23/14 Project No. 122987

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HANSEN NO. 45398

458949--Storm Drain.dwg

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DEPARTMENT OF PUBLIC WORKS
CAPITAL PROJECT MANAGEMENT
CITY ENGINEER: ALLEN E. PAVELKA, P.E.
CONSTRUCTION MANAGER: JEREMY LEVITT, P.E.

DESIGNED BY:	M. SCHWAB
DRAWN BY:	B. MAHAN
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APPROVED BY:	J. GRIEST

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CITY OF LAS VEGAS NEVADA

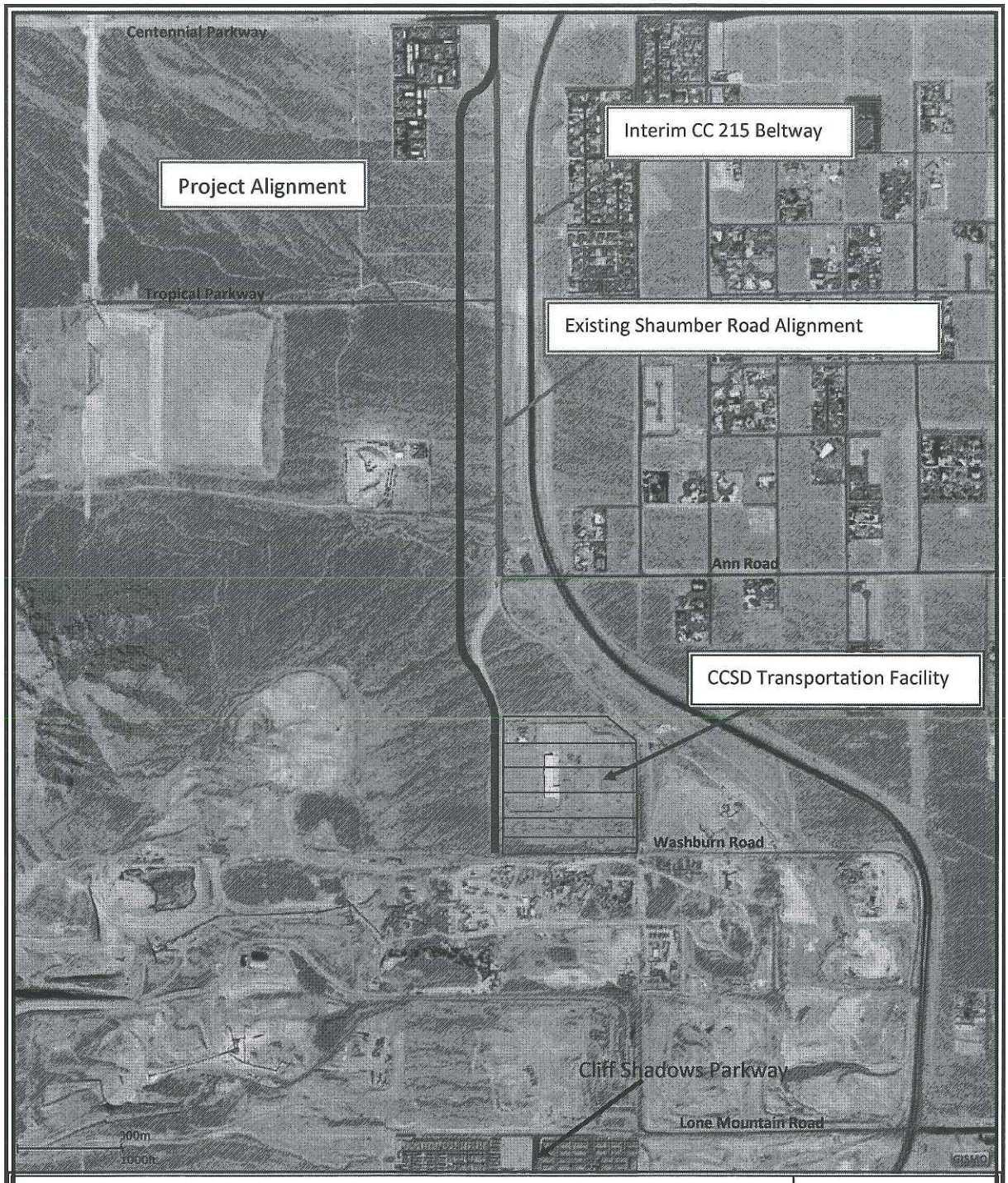
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TITLE: SHAUMBER ROAD REALIGNMENT
CENTENNIAL PKWY TO WASHBURN RD

PROFESSIONAL ENGINEER-STATE OF NEVADA
JEFFREY N. GRIEST
EXP. 06/30/15
CIVIL
No. 17166
12-23-14

SHEET: **SD9**
46 of 52
DATE December 17, 2014
DRAWING NO. 107V6351

BID NO. 15-45398



Project Area Map

Shaumber Road Realignment Project

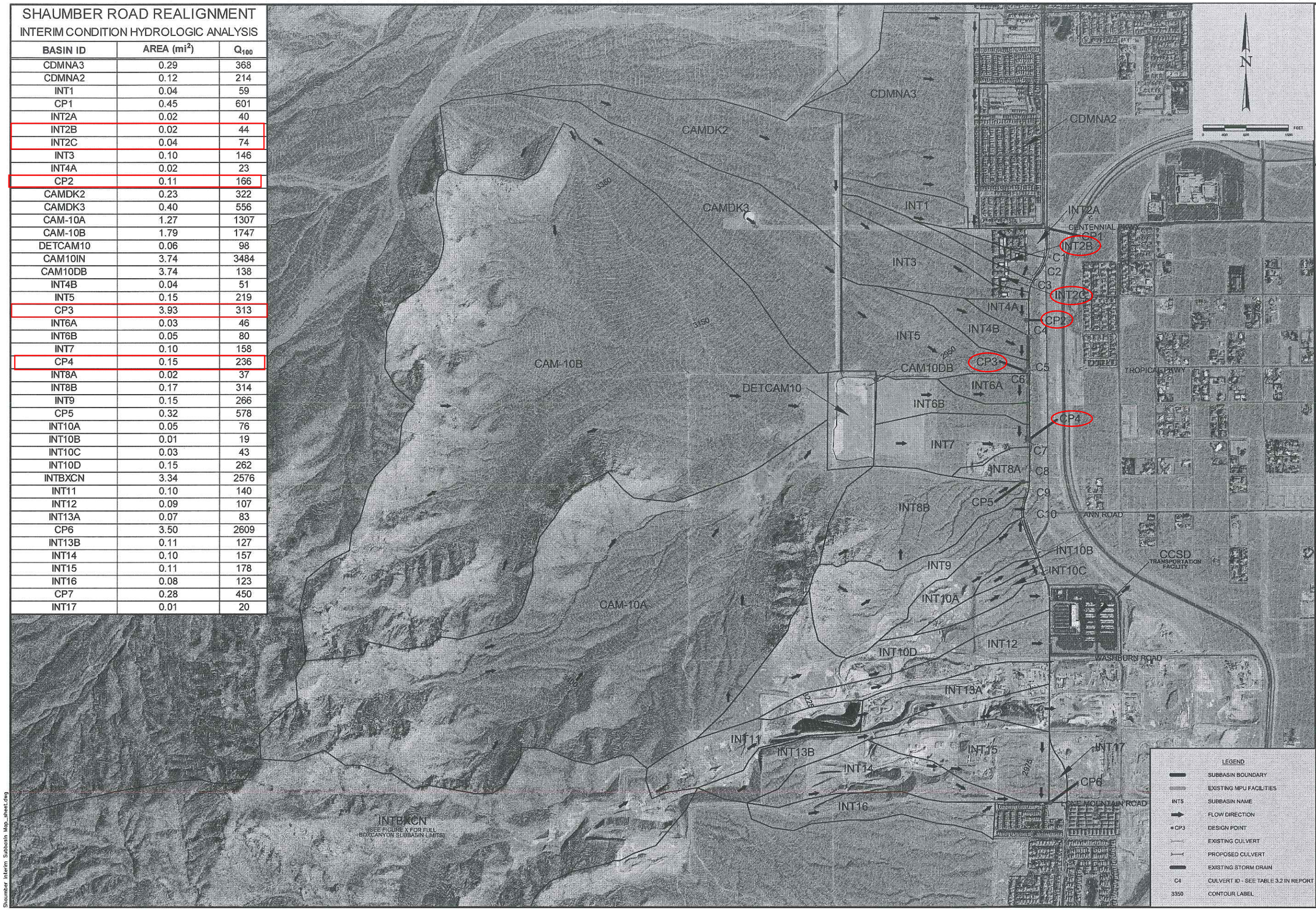
Centennial Parkway to Washburn Road

Figure 2
07/2014

CH2MHILL

SHAUMBER ROAD REALIGNMENT
INTERIM CONDITION HYDROLOGIC ANALYSIS

BASIN ID	AREA (mi^2)	Q_{100}
CDMNA3	0.29	368
CDMNA2	0.12	214
INT1	0.04	59
CP1	0.45	601
INT2A	0.02	40
INT2B	0.02	44
INT2C	0.04	74
INT3	0.10	146
INT4A	0.02	23
CP2	0.11	166
CAMDK2	0.23	322
CAMDK3	0.40	556
CAM-10A	1.27	1307
CAM-10B	1.79	1747
DETCAM10	0.06	98
CAM10IN	3.74	3484
CAM10DB	3.74	138
INT4B	0.04	51
INT5	0.15	219
CP3	3.93	313
INT6A	0.03	46
INT6B	0.05	80
INT7	0.10	158
CP4	0.15	236
INT8A	0.02	37
INT8B	0.17	314
INT9	0.15	266
CP5	0.32	578
INT10A	0.05	76
INT10B	0.01	19
INT10C	0.03	43
INT10D	0.15	262
INTBXCN	3.34	2576
INT11	0.10	140
INT12	0.09	107
INT13A	0.07	83
CP6	3.50	2609
INT13B	0.11	127
INT14	0.10	157
INT15	0.11	178
INT16	0.08	123
CP7	0.28	450
INT17	0.01	20



REVISIONS

NO.	DATE	DESCRIPTION	APPD

DEPARTMENT OF PUBLIC WORKS
CAPITAL PROJECT MANAGEMENT
CITY OF LAS VEGAS NEVADA

CITY ENGINEER: DAVID N. BOWERS, P.E.
PROGRAM MANAGER: JEREMY LEAVITT, P.E.
DESIGNED BY: MS
DRAWN BY: SB
CHECKED BY: JG
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HENDERSON, NEVADA 89074
PHONE (702) 987-7474 FAX (702) 369-1167

SHEET: SHAUMBER ROAD REALIGNMENT CENTENNIAL PKWY TO WASHBURN RD

TITLE: INTERIM CONDITION SUBBASIN MAP

DRAFT

SHEET: FIGURE 3 of

DATE 07/21/2014

DRAWING NO.

BID NO.

Shaumber Interim Subbasin Map_sheet.dwg

TABLE 3.1 – INTERIM CONDITION ROADSIDE DITCHES (continued)

LOCATION	HEC-1 NODE	FLOW (cfs)	SLOPE (%)	VELOCITY (FT/S)	DITCH LINING	FLOW DEPTH (FT)	DITCH DESIGN DEPTH (FT)
"SR" 86+00 - 82+00 to C7	INT6B	80	0.69	4.52	RIPRAP	2.97	3.20
"SR" 82+00 - 78+85 to C7	CP4	236	0.69	5.93	RIPRAP	4.46	4.50
"SR" 78+50 - 73+83 to C8	INT8A	6	0.69	2.92	EARTHEN	1.01	2.50
"SR" 70+75 – 73+83 to C8	INT8A	20	0.71	3.98	EARTHEN	1.58	2.50
"SR" 65+00 - 69+50 to C9	INT9	266	3.50	11.23	RIPRAP	3.44	3.55
"SR" 59+25 - 64+17 to C10	INT10A	76	0.50	3.96	RIPRAP	3.10	3.30

Note: See Figure 3, Interim Condition Subbasin Map for culvert locations

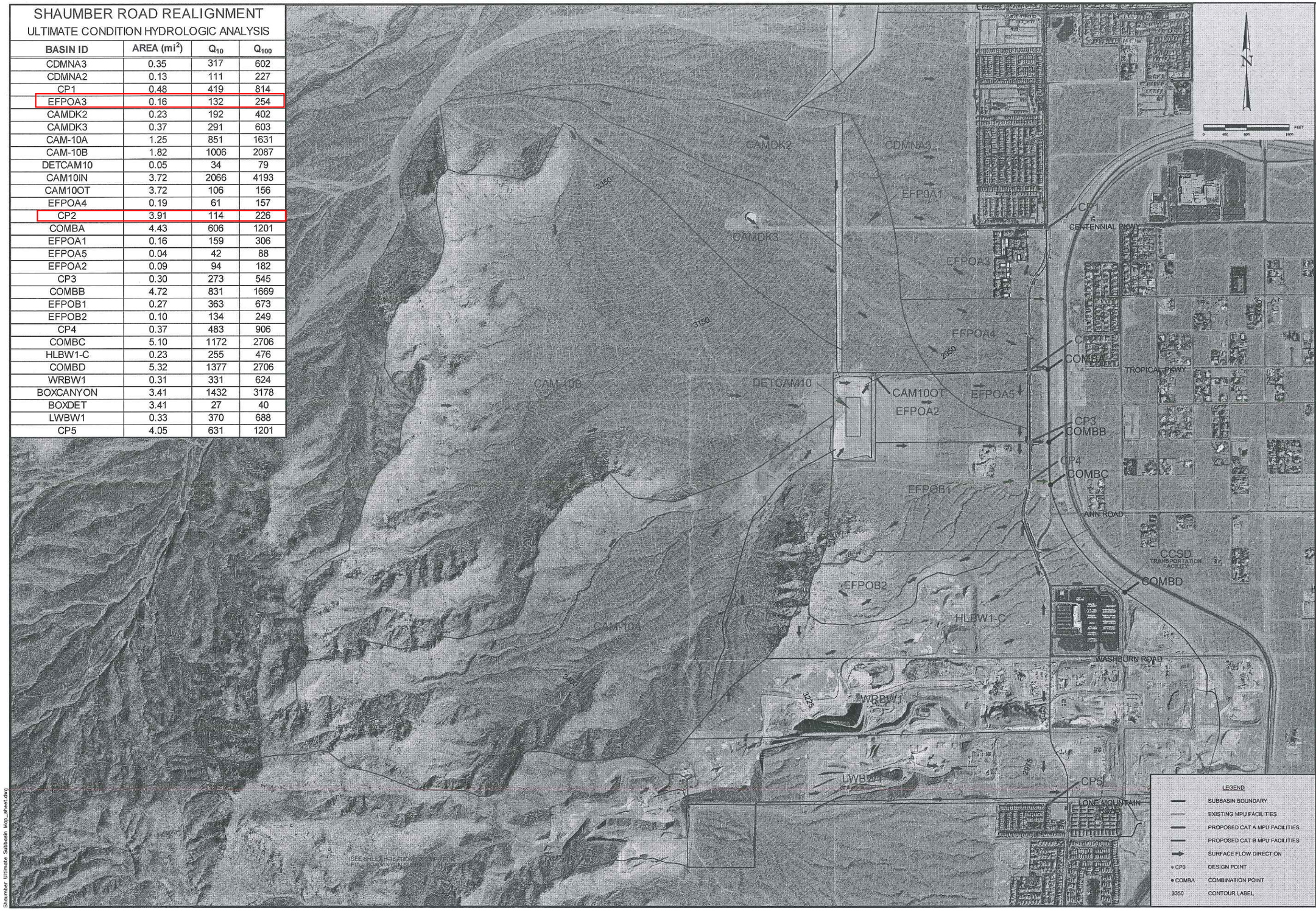
HY-8 version 7.30, a software program distributed by the Federal Highway Administration (FHWA), was used to design the interim condition culverts. Reinforced Concrete Pipe (RCP) culverts and Reinforced Concrete Box (RCB) culverts are both included in the culvert design. Culvert ID profiles, C1-C10, for the interim roadway can be found on SD6-SD8 of the plan sheets, and are included in Appendix B-1. See Table 3.2 – *Interim Condition Culverts.* Refer to Appendix B-1 for all HY-8 culvert calculations.

TABLE 3.2 – INTERIM CONDITION CULVERTS

APPROXIMATE STATION	DESIGN POINT	CULVERT ID	DESIGN FLOW (cfs)	CULVERT SIZE
114+50	INT2A	C1	40	(1) 36" RCP
109+50	INT2B	C2	44	(1) 36" RCP
108+00	INT2C	C3	74	(2) 36" RCP
98+50	CP2	C4	166	(2) 38"x60" HERCP
92+25	CP3	C5	313	10'x5' RCB
91+50	INT6A	C6	46	(1) 36" RCP
78+50	CP4	C7	236	8'x5' RCB
73+75	INT8A	C8	37	(1) 30" RCP
69+75	CP5	C9	578	12'x6' RCB
64+60	INT10A	C10	76	(1) 48" RCP
56+25	INT10B	-	19	(2) 24" RCP*

SHAUMBER ROAD REALIGNMENT
ULTIMATE CONDITION HYDROLOGIC ANALYSIS

BASIN ID	AREA (mi^2)	Q_{10}	Q_{100}
CDMNA3	0.35	317	602
CDMNA2	0.13	111	227
CP1	0.48	419	814
EFPOA3	0.16	132	254
CAMDK2	0.23	192	402
CAMDK3	0.37	291	603
CAM-10A	1.25	851	1631
CAM-10B	1.82	1006	2087
DETCAM10	0.05	34	79
CAM10IN	3.72	2066	4193
CAM10OT	3.72	106	156
EFPOA4	0.19	61	157
CP2	3.91	114	226
COMBA	4.43	606	1201
EFPOA1	0.16	159	306
EFPOA5	0.04	42	88
EFPOA2	0.09	94	182
CP3	0.30	273	545
COMBB	4.72	831	1669
EFPOB1	0.27	363	673
EFPOB2	0.10	134	249
CP4	0.37	483	906
COMBC	5.10	1172	2706
HLBW1-C	0.23	255	476
COMBD	5.32	1377	2706
WRBW1	0.31	331	624
BOXCANYON	3.41	1432	3178
BOXDET	3.41	27	40
LWBW1	0.33	370	688
CP5	4.05	631	1201



REVISIONS

NO.	DATE	DESCRIPTION	APPD

DEPARTMENT OF PUBLIC WORKS
CAPITAL PROJECT MANAGEMENT

CITY ENGINEER: JEREMY LEAVITT, PE
PROGRAM MANAGER:
DESIGNED BY: MS
DRAWN BY: SB
CHECKED BY: JG
APPROVED BY:

CH2MHILL®
2485 VILLAGE VIEW DRIVE, SUITE 350
HENDERSON, NEVADA 89074
PHONE 702-968-2100 FAX 702-369-1107

SHEET: SHAUMBER ROAD REALIGNMENT
CENTENNIAL PKWY TO WASHBURN RD

TITLE: ULTIMATE CONDITION
SUBBASIN MAP

DRAFT

SHEET: FIGURE 4
of
DATE 07/21/2014
DRAWING NO.

BID NO.

Shaumber Ultimate Subbasin Map_sheet.dwg

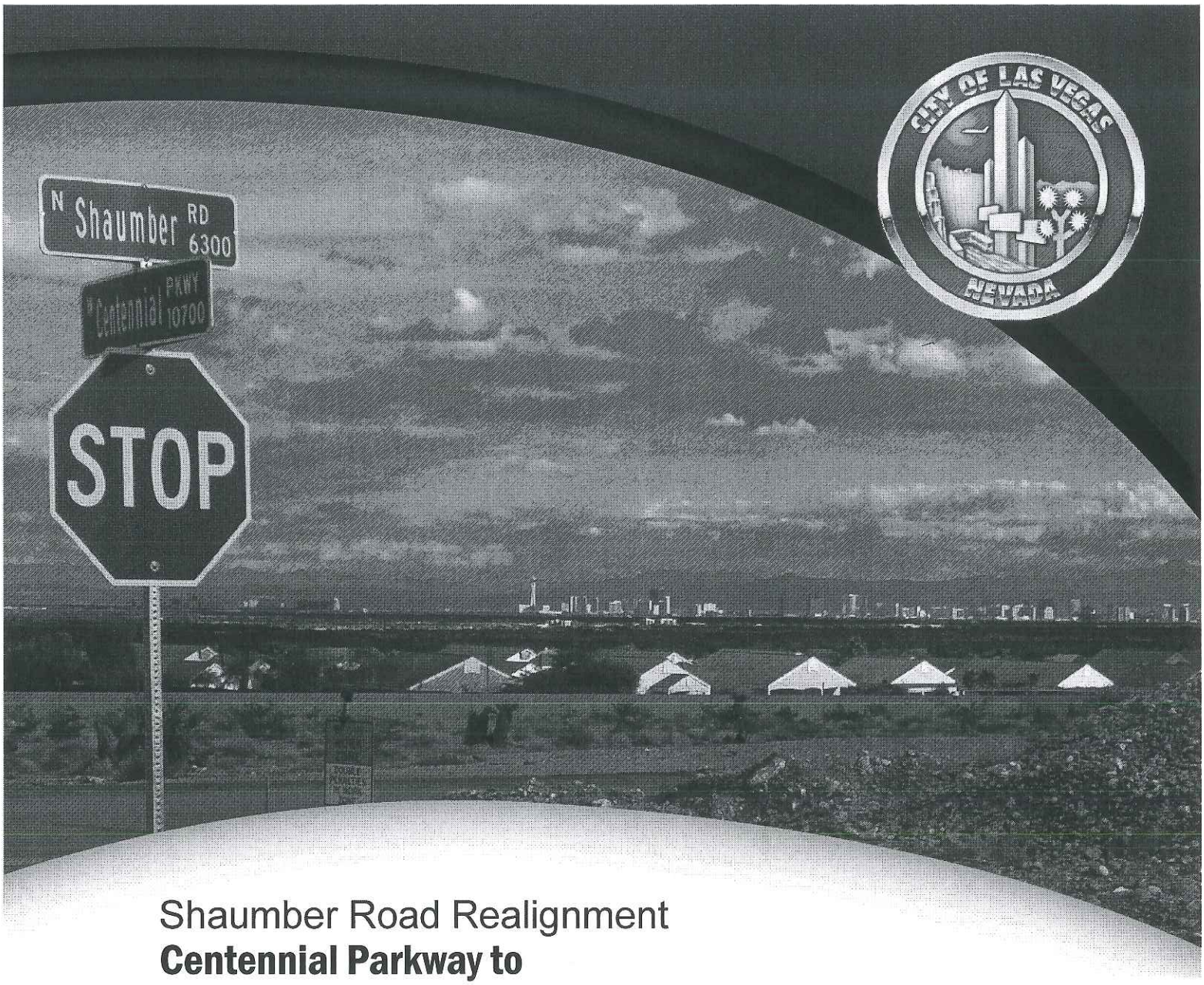
2.2 ULTIMATE CONDITION HYDROLOGIC ANALYSIS

The ultimate condition hydrologic analysis has been updated from the previous Alternative Alignments Design Memorandum, submitted January 2013. Subbasins have been re-delineated to account for the future Sheep Mountain Parkway. The 10-year storm event was analyzed in order to perform preliminary sizing for a future local facility in Shaumber Road that will convey 10-year storm flows east to the MPU facility located in the existing Shaumber Road alignment. Six design points were established along Shaumber Road where flow will be conveyed east to the proposed MPU facility. The design points are located at: 1) Centennial Parkway/Shaumber Road, CP1; 2) Azure Drive/Shaumber Road, EFPOA3; 3) Tropical Parkway/Shaumber Road, CP2; 4) El Campo Grande Avenue/Shaumber Road, CP3; 5) La Mancha Avenue/Shaumber Road, CP4; and 6) Hammer Lane/Shaumber Road, HLBW1-C. 10-year and 100-year storm event HEC-1 models can be found in Appendix A-4.2 and A-4.3, respectively. See Figure 4 – *Ultimate Condition Subbasin Map.*

The ultimate condition subbasins are based on 2008 MPU analysis and reflect the future conditions of the watershed. Future land use consists of mostly very high density residential, with some parks, golf courses, some public facility residential land use, and a small amount of open desert with desert shrub vegetative cover to the west of the project site. Subbasin curve numbers for the tributary area in the developed condition are generally in the nineties. Updated calculations for the ultimate condition curve numbers can be found in Appendix A-3.2. Ultimate condition flow rates for specified design points can be found in Table 2.2.

TABLE 2.2 – ULTIMATE CONDITION FLOW RATE VALUES

LOCATION	HEC-1 NODE	10-YR FLOW (cfs)	100-YR FLOW (cfs)	AREA (mi^2)
Centennial Parkway and Shaumber Road	CP1	419	814	0.48
Azure Drive and Shaumber Road	EFPOA3	132	254	0.16
Tropical Parkway and Shaumber Road	CP2	114	226	3.91
El Camp Grande Avenue and Shaumber Road	CP3	273	545	0.30
La Mancha Avenue and Shaumber Road	CP4	483	906	0.37
Hammer Lane and Shaumber Road	HLBW1-C	255	476	0.23



Shaumber Road Realignment

Centennial Parkway to

Washburn Road

Calculation Notebook

Appendix A-4.1

100-Year HEC-1 Model SDN3 (Interim)

Hansen #45398

```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *               JUN   1998              *
 *            VERSION 4.1                *
 *                                       *
 *  RUN DATE   30JUN14  TIME  15:19:03   *
 *                                       *
 *****************************************

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

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

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

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

1                                        HEC-1 INPUT                                    PAGE  1

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

                    *DIAGRAM
 *** FREE ***
               1    ID    SHAUMBER ROAD DRAINAGE
               2    ID    DRAINAGE IMPACT IN INTERIM CONDITION DEVELOPMENT
               3    ID    INPUT FILE = SHAUMINT.DAT
               4    ID    LAST MODIFIED = JUNE 2014
               5    ID    DESIGN STORM = 100-YEAR 6-HOUR STORM
               6    ID    STORM DISTRIBUTION = SDN3
               7    ID    MODELED BY = CH2M HILL (MICHAEL SCHWAB, E.I.)
               8    ID
               9    ID    REFERENCED HYDROLOGIC MODELS:
              10    ID    LONE MOUNTAIN/BELTWAY DETENTION BASINS AND GOWAN BELTWAY WEST CHANNEL, 90% (
              11    ID    CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT 2008 MASTER PLAN UPDATE
              12    ID    CITY OF LAS VEGAS CITY WIDE HYDROLOGY ANALYSIS (PBS&J 1997)
              13    ID    NORTHWEST NEIGHBORHOOD STUDY PHASE 1 (PBS&J 1997)
              14    ID    RESPONSE TO COMMENTS ON THE 2006 SUMMERLIN WEST PLANNING AREA FLOOD
              15    ID    CONTROL MASTER PLAN UPDATE (G.C. WALLACE 2006)
              16    ID    3RD RESPONSE TO COMMENTS ON THE 2006 SUMMERLIN WEST PLANNING AREA FLOOD
              17    ID    CONTROL MASTER PLAN UPDATE (G.C. WALLACE 2006)
              18    ID    SUPPLEMENT FOR THE 2006 SUMMERLIN WEST PLANNING AREA FLOOD CONTROL
              19    ID    MASTER PLAN UPDATE (G.C. WALLACE 2006)
              20    ID    GOWAN OUTFALL - LONE MOUNTAIN BRANCH PRELIMINARY DESIGN REPORT
              21    ID    (G.C. WALLACE 2007)
              22    ID    LONE MOUNTAIN WESTERN BELTWAY DETENTION BASIN PARAMETERS (RECEIVED
              23    ID    FROM G.C. WALLACE ON JANUARY 31, 2008)
              24    ID    US 95/RANCHO FIS RESTUDY (PBS&J 1998)
              25    ID    JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:
              26    ID
              27    ID                          AREA    DARF
              28    ID                          SQ. MI.
              29    ID                          0-0.5   0.99
              30    ID                          0.5-1   0.975
              31    ID                          1-2     0.95
              32    ID                          2-3     0.925
              33    ID                          3-4     0.915
              34    ID                          4-5     0.908
              35    ID                          5-6     0.903
              36    ID                          6-7     0.895
              37    ID                          7-8     0.885
              38    ID
              39    ID  JR CARD RATIOS REPRESENT DEPTH-AREA REDUCTION FACTORS (DARF'S)
              40    ID
              41    IT       5       0       0     100
              42    IO       5       0       0
              43    IN       5       0       0
              44    JR    PREC    0.99   0.975    0.95   0.925   0.915   0.908   0.903   0.895   0.885
                    *
              45    KK  CDMNA3
              46    BA   0.290
              47    PB    3.21
              48    PC   0.000   0.020   0.057   0.070   0.087   0.108   0.124   0.130   0.130   0.130
              49    PC   0.130   0.130   0.130   0.133   0.140   0.142   0.148   0.158   0.172   0.181
              50    PC   0.190   0.197   0.199   0.200   0.201   0.204   0.214   0.229   0.241   0.249
              51    PC   0.251   0.256   0.270   0.278   0.281   0.283   0.295   0.322   0.352   0.409
1                                        HEC-1 INPUT                                    PAGE  2

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

```
 52          PC   0.499   0.590   0.710   0.744   0.781   0.812   0.819   0.835   0.851   0.856
 53          PC   0.860   0.868   0.876   0.888   0.910   0.926   0.937   0.950   0.970   0.976
 54          PC   0.982   0.985   0.987   0.989   0.990   0.993   0.993   0.994   0.995   0.998
 55          PC   0.998   0.999   1.000
 56          LS       0    86.9
 57          UD   0.263
             *

 58          KK    INT1
 59          BA  0.0361
 60          PB    3.22
 61          LS       0    86.9
 62          UD   0.115
             *

 63          KK   COMBA
 64          KM  COMBINE INT1 AND CDMNA3
 65          KM  CENTENNIAL AND PULI DR
 66          HC       2
             *

 67          KK  RCOMBA
 68          KM  ROUTE COMBA TO CMNA2
 69          KM  FACILITY = GOWAN BELTWAY WEST
 70          KM  FACILITY ID-MILE = GOBW 0315
 71          KM  LINING = RCB
 72          RD    1615    0.01   0.015       0    TRAP      10       0
             *

 73          KK  CDMNA2
 74          BA  0.1240
 75          PB    3.18
 76          LS       0    92.4
 77          UD   0.188
             *

 78          KK     CP1
 79          KM  COMBINE COMBA AND CDMNA2
 80          KM  CENTENNIAL AND SHAUMBER
 81          HC       2
             *

 82          KK   INT2A
 83          BA  0.0192
 84          PB    3.19
 85          LS       0    90.7
 86          UD   0.075
             *

 87          KK   INT2B
 88          BA  0.0231
 89          PB    3.19
 90          LS       0    89.3
 91          UD   0.092
             *
```



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

 92          KK   INT2C
 93          BA  0.0449
 94          PB    3.19
 95          LS       0    87.7
 96          UD   0.133
             *

 97          KK   COMBB
 98          KM  COMBINE INT2A, INT2B, AND INT2C
 99          KM  COMBINE EAST OF SHAUMBER TO CLEAN UP MODEL
100          HC       3
             *

101          KK    INT3
102          BA  0.0963
103          PB    3.23
104          LS       0    85.8
105          UD   0.154
             *

106          KK   RINT3
107          KM  ROUTE INT3 TO CP2
108          KM  ROUTE IN ROADSIDE DITCH
109          RD     563    0.01   0.015       0    TRAP       5       0
             *

110          KK   INT4A
111          BA  0.0157
112          PB    3.25
113          LS       0    82.0
114          UD   0.087
             *

115          KK     CP2
116          KM  COMBINE INT4A AND RINT3
```

```
          117          KM  SOUTH OF CENTENNIAL CONDOS
          118          HC       2
                       *

          119          KK   COMBC
          120          KM  COMBINE CP1, COMBB, AND CP2
          121          KM  COMBINE EAST OF SHAUMBER TO CLEAN UP MODEL
          122          HC       3
                       *

          123          KK  CAMDK2
          124          BA  0.2275
          125          PB    3.28
          126          LS       0    86.9
          127          UD   0.207
                       *
1                                        HEC-1 INPUT                                        PAGE  4

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

          128          KK RCAMDK2
          129          KM  ROUTE RCAMDK2 TO CAMDK3 ALONG COLLECTOR DIKE
          130          KM  FACILITY = GOWAN ANN ROAD DETENTION BASIN FACILITIES
          131          KM  FACILITY # = GOAN 0065, 0067, 0068, 0070
          132          KM  LINING = SOIL CEMENT
          133          RD    1400  0.0321   0.025       0    TRAP      10       4
                       *

          134          KK  CAMDK3
          135          BA  0.3977
          136          PB    3.32
          137          LS       0    87.1
          138          UD   0.235
                       *

          139          KK CCAMDK3
          140          KM  COMBINE RCAMDK2 AND CAMDK3
          141          HC       2
                       *

          142          KK CAM-10A
          143          BA   1.269
          144          PB    3.41
          145          LS       0    87.4
          146          UD   0.452
                       *

          147          KK CAM-10B
          148          BA   1.792
          149          PB    3.39
          150          LS       0    87.4
          151          UD   0.468
                       *

          152          KKDETCAM10
          153          BA  0.0575
          154          PB   3.294
          155          LS       0    86.9
          156          UD   0.109
                       *

          157          KK CAM10IN
          158          KM  COMBINE CCAMDK3, CAM-10A, CAM-10B AND DETCAM10
          159          KM  TOTAL INFLOW TO CAM10 DETENTION BASIN
          160          HC       4
                       *

          161          KK CAM10DB
          162          KM  DETENTION BASIN PARAMETERS FROM 2008 MPU BY PBS&J
          163          KM  FACILITY = GOWAN ANN ROAD DETENTION BASIN FACILITIES
          164          KM  FACILITY # = GOAN 0058
          165          KM  STORAGE VOLUME = 429.52 AC-FT (BERGER 5-05 VOLUME = 364 AC-FT; 18% INCREASE)
          166          KM  OUTLET = 33" ORIFICE WITH 54" RCP
          167          KM  100-YEAR DISCHARGE = 156 CFS
1                                        HEC-1 INPUT                                        PAGE  5

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

          168          KM  SPILLWAY LENGTH = 1360 FT
          169          KM  SPILLWAY HEIGHT = 27.7 FT
          170          KM  SPILLWAY CREST ELEVATION = 3000'
          171          KM  SPILLWAY TYPE =
          172          KM  PMF DISCHARGE = 24,614 CFS
          173          KM  TOP OF EMBANKMENT ELEVATION = 3004.5'
          174          KM  INFORMATION TAKEN FROM "ANN ROAD (CAM-10) DETENTION BASIN PLANS"
          175          KM  BY THE LOUIS BERGER GROUP (5-05)
          176          RS       1    STOR      -1
                       *        0       0       0    0.67    3.33    8.33   26.67   43.33     110       2
                       *      280   347.2     364     396
          177          SV    0.00    0.00    0.00    0.79    3.93    9.83   31.47   51.13  129.80  236.00
          178          SV  330.40  409.70  429.52  467.28
          179          SE  2972.6  2973.8  2974.5  2975.0  2976.0  2976.7  2978.8  2980.0  2985.0  2990.0
          180          SE  2995.0  2999.0  3000.0  3003.4
          181          SQ    0.00    6.67   17.78   27.78   45.56   54.44   64.44   82.22   93.33  117.78
          182          SQ  138.39  156.00  160.40   24614
```

```
                *
 183            KK  RCAM10
 184            KM  ROUTE CAM10 OUTFALL TO OUTLET OF PIPE
 185            RD    1086    .019   0.013       0    CIRC     4.0
                *
 186            KK  RCAM10
 187            KM  ROUTE CAM10 OUTFALL OVERLAND TO TROPICAL
 188            RD    1728    0.01   0.015       0    TRAP      25       0
                *
 189            KK   INT4B
 190            BA  0.0393
 191            PB    3.25
 192            LS       0    80.8
 193            UD   0.141
                *
 194            KK  RINT4B
 195            KM  ROUTE INT4B TO CP3
 196            KM  ROUTE IN ROADSIDE DITCH
 197            RD     631    0.01   0.015       0    TRAP       5       0
                *
 198            KK    INT5
 199            BA  0.1479
 200            PB    3.26
 201            LS       0    85.3
 202            UD   0.164
                *
 203            KK     CP3
 204            KM   COMBINE CAM10 OUTFALL, INT5, AND INT4B
 205            KM  SHAUMBER AND TROPICAL
 206            HC       3
                *
1                                       HEC-1 INPUT                                                    PAGE  6

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

 207            KK   COMBD
 208            KM   COMBINE COMBC AND CP3
 209            KM   COMBINE EAST OF SHAUMBER TO CLEAN UP MODEL
 210            HC       2
                *
 211            KK   INT6A
 212            BA  0.0278
 213            PB    3.25
 214            LS       0    86.6
 215            UD   0.110
                *
 216            KK   INT6B
 217            BA  0.0498
 218            PB    3.25
 219            LS       0    86.6
 220            UD   0.146
                *
 221            KK  RINT6B
 222            KM  ROUTE INT6 TO CP4
 223            KM  ROUTE IN ROADSIDE DITCH
 224            RD     682    0.01   0.015       0    TRAP       5       0
                *
 225            KK    INT7
 226            BA  0.0993
 227            PB    3.25
 228            LS       0    86.0
 229            UD   0.137
                *
 230            KK     CP4
 231            KM   COMBINE RINT6 AND INT7
 232            KM  SHAUMBER AND EL CAMPO GRANDE
 233            HC       2
                *
 234            KK   INT8A
 235            BA  0.0207
 236            PB    3.29
 237            LS       0    87.0
 238            UD   0.100
                *
 239            KK   COMBE
 240            KM   COMBINE COMBD, INT6A, INT8A, AND CP4
 241            KM   COMBINE EAST OF SHAUMBER TO CLEAN UP MODEL
 242            HC       4
                *
1                                       HEC-1 INPUT                                                    PAGE  7

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

```
243          KK    INT9
244          BA  0.1519
245          PB    3.29
246          LS       0    87.1
247          UD   0.102
             *

248          KK   RINT9
249          KM  ROUTE INT9 TO CP5
250          KM  ROUTE IN ROADSIDE DITCH
251          RD      76    0.01   0.015       0    TRAP       5       0
             *

252          KK   INT8B
253          BA  0.1668
254          PB    3.29
255          LS       0    87.0
256          UD   0.084
             *

257          KK     CP5
258          KM   COMBINE RINT9 AND INT8B
259          KM  SHAUMBER AND LA MANCHA
260          HC       2
             *

261          KK  INT10A
262          BA  0.0450
263          PB    3.30
264          LS       0    86.9
265          UD   0.123
             *

266          KK  INT10B
267          BA  0.0099
268          PB    3.30
269          LS       0    86.9
270          UD   0.075
             *

271          KK  INT10C
272          BA  0.0253
273          PB    3.30
274          LS       0    87.0
275          UD   0.131
             *

276          KK  INT10D
277          BA  0.1549
278          PB    3.30
279          LS       0    87.0
280          UD   0.131
             *
```



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

281          KK   COMBF
282          KM   COMBINE COMBE, CP5, INT10A, INT10B, INT10C AND INT10D
283          KM   COMBINE EAST OF SHAUMBER TO CLEAN UP MODEL
284          HC       6
             *

285          KK   INT12
286          BA  0.0860
287          PB    3.30
288          LS       0    81.4
289          UD   0.177
             *

290          KK INTBXCN
291          BA   3.335
292          PB    3.30
293          LS       0   87.31
294          UD   0.608
             *

295          KK   INT11
296          BA  0.0958
297          PB    3.30
298          LS       0    83.2
299          UD   0.141
             *

300          KK  CINT11
301          KM   COMBINE INTBXCN AND INT11
302          HC       2
             *

303          KK RCINT11
304          KM  ROUTE CINT11 TO CP6
305          RD    3591    0.01   0.015       0    TRAP      25       0
             *
```

```
          306          KK  INT13A
          307          BA  0.0712
          308          PB    3.23
          309          LS       0    78.6
          310          UD   0.140
                       *

          311          KK     CP6
          312          KM   COMBINE CINT11 AND INT13A
          313          KM  SHAUMBER AND SOUTH OF WASHBURN
          314          HC       2
                       *
1                                                HEC-1 INPUT                                                PAGE  9

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

          315          KK   COMBG
          316          KM   COMBINE COMBF, CP6 AND INT12
          317          KM   COMBINE EAST OF SHAUMBER TO CLEAN UP MODEL
          318          HC       3
                       *

          319          KK  INT13B
          320          BA  0.1054
          321          PB    3.23
          322          LS       0    82.8
          323          UD   0.198
                       *

          324          KK   INT14
          325          BA  0.0992
          326          PB    3.23
          327          LS       0    86.9
          328          UD   0.153
                       *

          329          KK  RINT14
          330          KM  ROUTE INT14 TO CP7
          331          KM  ROUTE INT11 OVERLAND
          332          RD     657    0.01   0.015       0    TRAP      25       0
                       *

          333          KK   INT16
          334          BA  0.0756
          335          PB    3.23
          336          LS       0    86.9
          337          UD   0.138
                       *

          338          KK  RINT16
          339          KM  ROUTE INT16 TO CP7
          340          KM  ROUTE INT11 OVERLAND
          341          RD     973    0.01   0.015       0    TRAP      25       0
                       *

          342          KK   INT15
          343          BA  0.1084
          344          PB    3.23
          345          LS       0    86.9
          346          UD   0.112
                       *

          347          KK     CP7
          348          KM   COMBINE INT14, INT15 AND INT16
          349          HC       3
                       *
1                                                HEC-1 INPUT                                                PAGE 10

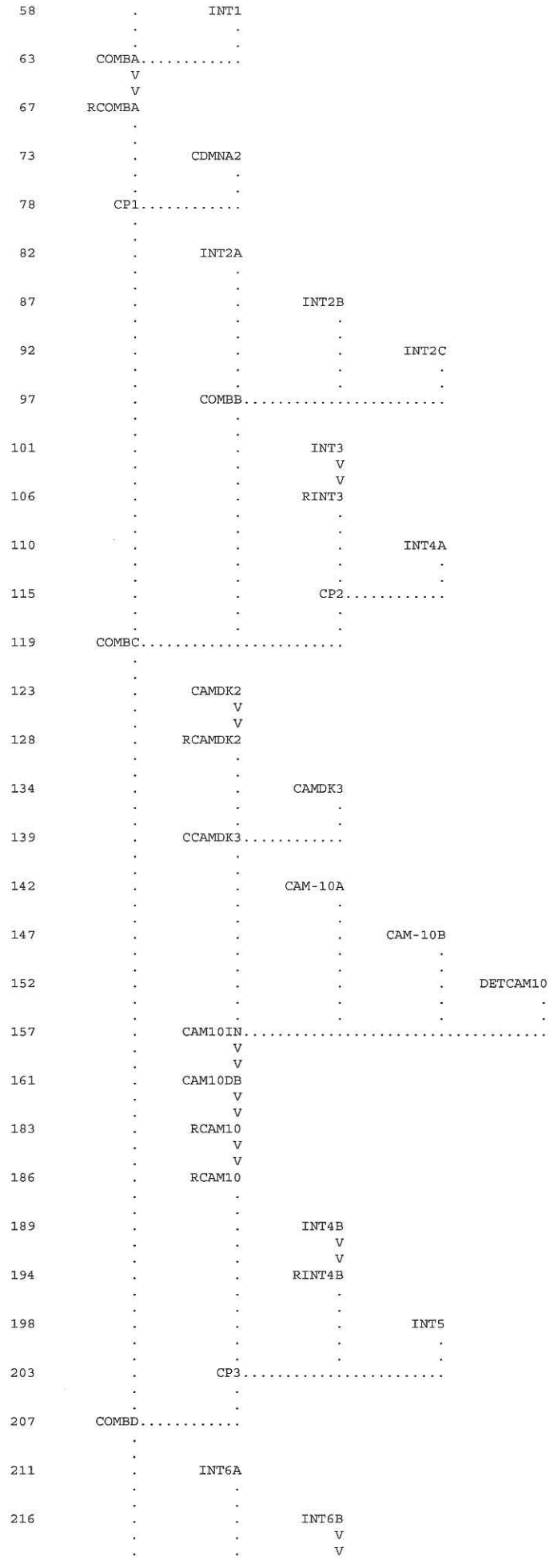
        LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

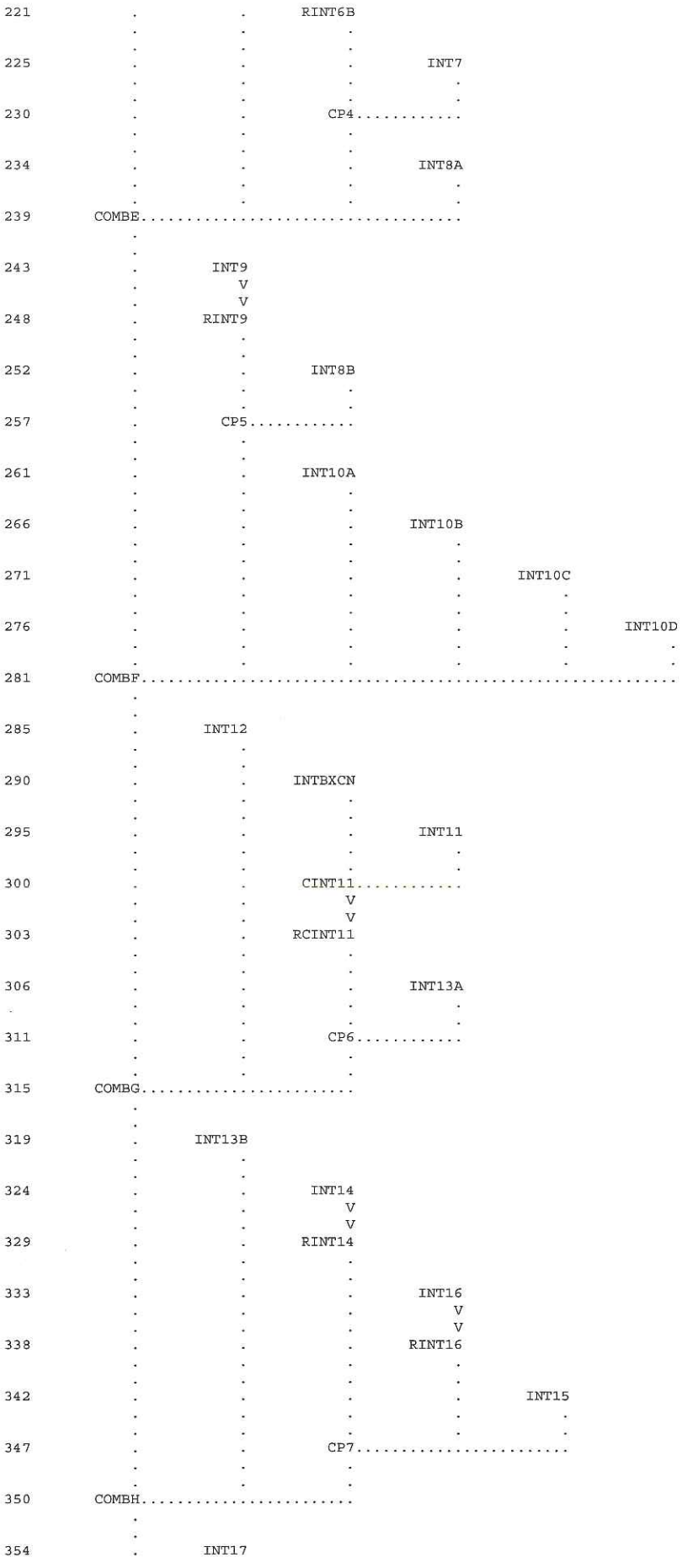
          350          KK   COMBH
          351          KM   COMBINE COMBG, INT13B, AND CP7
          352          KM   COMBINE EAST OF SHAUMBER TO CLEAN UP MODEL
          353          HC       3
                       *

          354          KK   INT17
          355          BA  0.0103
          356          PB    3.23
          357          LS       0    86.9
          358          UD   0.070
                       *
          359          ZZ
1
               SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE       (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

     45      CDMNA3
                  .
                  .
```


58 INT1
63 COMBA
67 RCOMBA
73 CDMNA2
78 CP1
82 INT2A
87 INT2B
92 INT2C
97 COMBB
101 INT3
106 RINT3
110 INT4A
115 CP2
119 COMBC
123 CAMDK2
128 RCAMDK2
134 CAMDK3
139 CCAMDK3
142 CAM-10A
147 CAM-10B
152 DETCAM10
157 CAM10IN
161 CAM10DB
183 RCAM10
186 RCAM10
189 INT4B
194 RINT4B
198 INT5
203 CP3
207 COMBD
211 INT6A
216 INT6B



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

1**********

*

* FLOOD HYDROGRAPH PACKAGE (HEC-1) *

*

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* U.S. ARMY CORPS OF ENGINEERS *

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*              JUN   1998              *                                    *    HYDROLOGIC ENGINEERING CENTER    *
*           VERSION 4.1                *                                    *         609 SECOND STREET           *
*                                      *                                    *       DAVIS, CALIFORNIA 95616       *
*  RUN DATE   30JUN14  TIME  15:19:03  *                                    *          (916) 756-1104             *
*                                      *                                    *                                     *
****************************************                                    ***************************************
```

SHAUMBER ROAD DRAINAGE
DRAINAGE IMPACT IN INTERIM CONDITION DEVELOPMENT
INPUT FILE = SHAUMINT.DAT
LAST MODIFIED = JUNE 2014
DESIGN STORM = 100-YEAR 6-HOUR STORM
STORM DISTRIBUTION = SDN3
MODELED BY = CH2M HILL (MICHAEL SCHWAB, E.I.)

REFERENCED HYDROLOGIC MODELS:
LONE MOUNTAIN/BELTWAY DETENTION BASINS AND GOWAN BELTWAY WEST CHANNEL, 90% (
CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT 2008 MASTER PLAN UPDATE
CITY OF LAS VEGAS CITY WIDE HYDROLOGY ANALYSIS (PBS&J 1997)
NORTHWEST NEIGHBORHOOD STUDY PHASE 1 (PBS&J 1997)
RESPONSE TO COMMENTS ON THE 2006 SUMMERLIN WEST PLANNING AREA FLOOD
CONTROL MASTER PLAN UPDATE (G.C. WALLACE 2006)
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MASTER PLAN UPDATE (G.C. WALLACE 2006)
GOWAN OUTFALL - LONE MOUNTAIN BRANCH PRELIMINARY DESIGN REPORT
(G.C. WALLACE 2007)
LONE MOUNTAIN WESTERN BELTWAY DETENTION BASIN PARAMETERS (RECEIVED
FROM G.C. WALLACE ON JANUARY 31, 2008)
US 95/RANCHO FIS RESTUDY (PBS&J 1998)
JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:

AREA SQ. MI.	DARF
0-0.5	0.99
0.5-1	0.975
1-2	0.95
2-3	0.925
3-4	0.915
4-5	0.908
5-6	0.903
6-7	0.895
7-8	0.885

JR CARD RATIOS REPRESENT DEPTH-AREA REDUCTION FACTORS (DARF'S)

```
  42 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         100  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      1    0  ENDING DATE
                     NDTIME        0815  ENDING TIME
                     ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL     .08 HOURS
                       TOTAL TIME BASE    8.25 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
                     .99       .98       .95       .93       .92       .91       .90       .89       .88
1

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


                                                                          RATIOS APPLIED TO PRECIPITATION
 OPERATION       STATION      AREA     PLAN            RATIO 1  RATIO 2  RATIO 3  RATIO 4  RATIO 5  RATIO 6  RATIO 7  RATIO 8  RATIO 9
                                                          .99      .98      .95      .93      .92      .91      .90      .89      .88

 HYDROGRAPH AT
```

+	CDMNA3	.29	1	FLOW	369.	361.	348.	334.	329.	325.	323.	319.	313.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT													
+	INT1	.04	1	FLOW	59.	58.	56.	54.	53.	52.	52.	51.	51.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT													
+	COMBA	.33	1	FLOW	412.	403.	389.	374.	368.	364.	361.	356.	350.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
ROUTED TO													
+	RCOMBA	.33	1	FLOW	407.	398.	384.	369.	363.	359.	356.	352.	346.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT													
+	CDMNA2	.12	1	FLOW	214.	210.	203.	197.	194.	192.	191.	189.	186.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT													
+	CP1	.45	1	FLOW	608.	595.	576.	554.	546.	540.	536.	530.	521.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT													
+	INT2A	.02	1	FLOW	40.	40.	38.	37.	37.	36.	36.	36.	35.
				TIME	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
HYDROGRAPH AT													
+	INT2B	.02	1	FLOW	44.	43.	41.	40.	39.	39.	39.	38.	38.
				TIME	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
HYDROGRAPH AT													
+	INT2C	.04	1	FLOW	74.	73.	70.	67.	66.	66.	65.	64.	63.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
3 COMBINED AT													
+	COMBB	.09	1	FLOW	152.	149.	144.	139.	137.	135.	134.	133.	131.
				TIME	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
HYDROGRAPH AT													
+	INT3	.10	1	FLOW	146.	143.	138.	133.	130.	129.	128.	126.	124.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
ROUTED TO													
+	RINT3	.10	1	FLOW	145.	142.	136.	131.	129.	128.	126.	125.	122.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT													
+	INT4A	.02	1	FLOW	24.	23.	22.	21.	21.	21.	20.	20.	20.
				TIME	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
2 COMBINED AT													
+	CP2	.11	1	FLOW	166.	162.	156.	150.	148.	146.	144.	142.	140.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
3 COMBINED AT													
+	COMBC	.65	1	FLOW	894.	875.	844.	812.	800.	791.	785.	775.	763.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT													
+	CAMDK2	.23	1	FLOW	322.	315.	304.	293.	288.	285.	283.	279.	275.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
ROUTED TO													
+	RCAMDK2	.23	1	FLOW	321.	315.	303.	291.	287.	283.	282.	278.	273.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT													
+	CAMDK3	.40	1	FLOW	561.	549.	529.	510.	502.	496.	492.	486.	478.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
2 COMBINED AT													
+	CCAMDK3	.63	1	FLOW	881.	864.	832.	801.	789.	780.	774.	764.	752.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT													
+	CAM-10A	1.27	1	FLOW	1366.	1337.	1290.	1243.	1224.	1211.	1201.	1186.	1168.
				TIME	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92
HYDROGRAPH AT													
+	CAM-10B	1.79	1	FLOW	1882.	1842.	1777.	1712.	1685.	1667.	1654.	1633.	1607.
				TIME	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92
HYDROGRAPH AT													
+	DETCAM10	.06	1	FLOW	98.	96.	92.	89.	87.	86.	86.	84.	83.
				TIME	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
4 COMBINED AT													
+	CAM10IN	3.74	1	FLOW	3906.	3824.	3688.	3551.	3497.	3459.	3432.	3388.	3334.
				TIME	3.83	3.83	3.83	3.83	3.83	3.83	3.83	3.83	3.83
ROUTED TO													
+	CAM10DB	3.74	1	FLOW	147.	145.	142.	139.	138.	137.	137.	136.	134.
				TIME	6.17	6.17	6.17	6.17	6.17	6.17	6.17	6.17	6.17

** PEAK STAGES IN FEET **

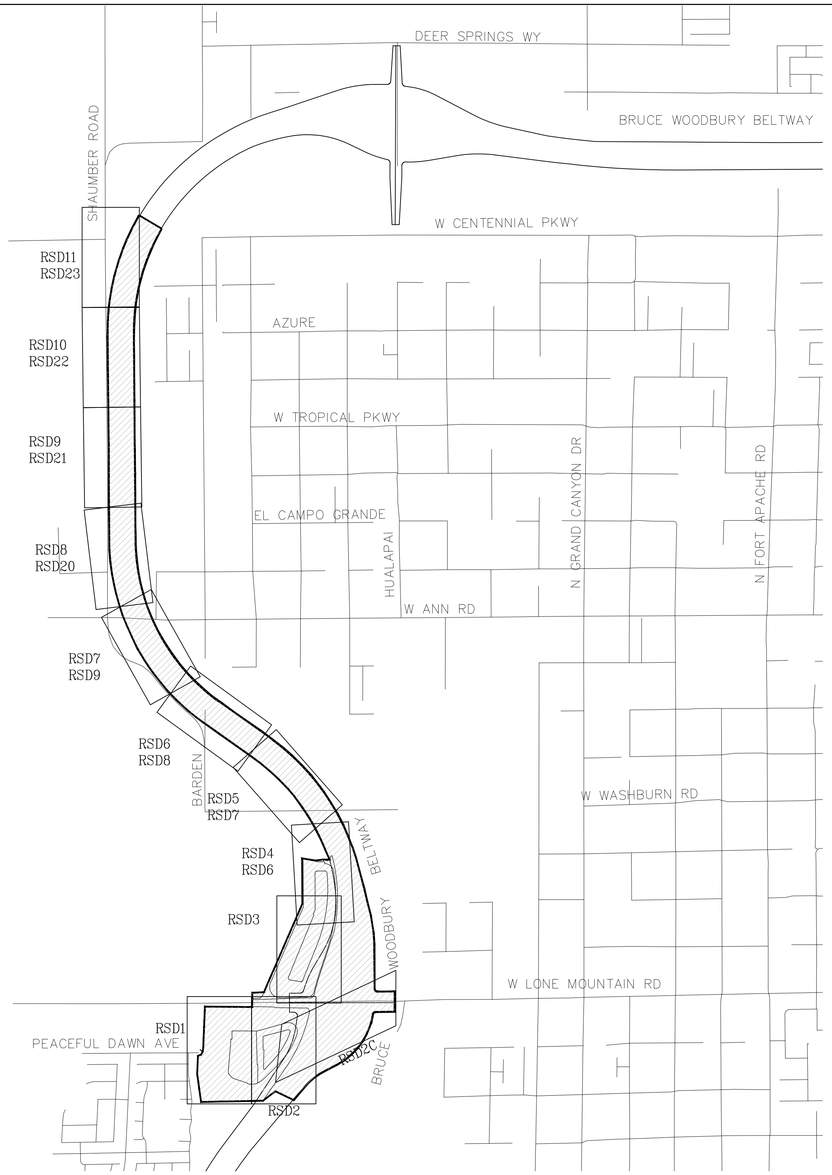
			1	STAGE	2997.02	2996.60	2995.89	2995.18	2994.90	2994.69	2994.55	2994.31	2994.02
				TIME	6.17	6.17	6.17	6.17	6.17	6.17	6.17	6.17	6.17
ROUTED TO													
+	RCAM10	3.74	1	FLOW	147.	145.	142.	139.	138.	137.	137.	136.	134.
				TIME	6.17	6.17	6.17	6.17	6.17	6.17	6.17	6.17	6.17
ROUTED TO													
+	RCAM10	3.74	1	FLOW	147.	145.	142.	139.	138.	137.	137.	136.	134.
				TIME	6.25	6.25	6.25	6.25	6.17	6.25	6.17	6.17	6.17
HYDROGRAPH AT													
+	INT4B	.04	1	FLOW	51.	49.	47.	45.	44.	44.	43.	43.	42.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
ROUTED TO													
+	RINT4B	.04	1	FLOW	50.	49.	46.	44.	43.	43.	43.	42.	41.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT													
+	INT5	.15	1	FLOW	219.	214.	206.	198.	195.	193.	191.	188.	185.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
3 COMBINED AT													
+	CP3	3.93	1	FLOW	352.	344.	332.	320.	315.	312.	309.	305.	301.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT													
+	COMBD	4.58	1	FLOW	1246.	1219.	1176.	1132.	1115.	1103.	1094.	1080.	1063.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT													
+	INT6A	.03	1	FLOW	46.	45.	43.	41.	41.	40.	40.	40.	39.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT													
+	INT6B	.05	1	FLOW	80.	78.	75.	72.	71.	71.	70.	69.	68.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
ROUTED TO													
+	RINT6B	.05	1	FLOW	79.	77.	74.	71.	70.	69.	69.	68.	67.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT													
+	INT7	.10	1	FLOW	158.	154.	149.	143.	141.	139.	138.	136.	134.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT													
+	CP4	.15	1	FLOW	236.	231.	223.	214.	211.	209.	207.	204.	201.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT													
+	INT8A	.02	1	FLOW	37.	36.	34.	33.	33.	32.	32.	32.	31.
				TIME	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
4 COMBINED AT													
+	COMBE	4.78	1	FLOW	1563.	1529.	1475.	1419.	1398.	1382.	1372.	1354.	1333.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT													
+	INT9	.15	1	FLOW	267.	261.	252.	242.	239.	236.	234.	231.	227.
				TIME	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
ROUTED TO													
+	RINT9	.15	1	FLOW	266.	260.	251.	242.	238.	235.	234.	231.	227.
				TIME	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
HYDROGRAPH AT													
+	INT8B	.17	1	FLOW	314.	307.	296.	285.	281.	278.	276.	272.	268.
				TIME	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
2 COMBINED AT													
+	CP5	.32	1	FLOW	580.	568.	547.	527.	519.	513.	509.	503.	494.
				TIME	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
HYDROGRAPH AT													
+	INT10A	.05	1	FLOW	76.	75.	72.	69.	68.	68.	67.	66.	65.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT													
+	INT10B	.01	1	FLOW	19.	19.	18.	18.	17.	17.	17.	17.	16.
				TIME	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
HYDROGRAPH AT													
+	INT10C	.03	1	FLOW	43.	42.	40.	39.	38.	38.	38.	37.	37.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT													
+	INT10D	.15	1	FLOW	262.	256.	247.	238.	235.	232.	230.	227.	224.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
6 COMBINED AT													
+	COMBF	5.33	1	FLOW	2479.	2426.	2341.	2254.	2220.	2196.	2179.	2151.	2118.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT													

+	INT12	.09	1	FLOW	107.	104.	100.	96.	94.	93.	92.	90.	89.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT													
+	INTBXCN	3.34	1	FLOW	2873.	2812.	2711.	2610.	2570.	2542.	2522.	2490.	2449.
				TIME	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08
HYDROGRAPH AT													
+	INT11	.10	1	FLOW	140.	136.	131.	126.	123.	122.	121.	119.	117.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT													
+	CINT11	3.43	1	FLOW	2903.	2842.	2740.	2638.	2597.	2569.	2548.	2516.	2475.
				TIME	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08
ROUTED TO													
+	RCINT11	3.43	1	FLOW	2899.	2838.	2736.	2634.	2593.	2563.	2544.	2510.	2470.
				TIME	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08
HYDROGRAPH AT													
+	INT13A	.07	1	FLOW	83.	80.	77.	73.	72.	71.	70.	69.	67.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT													
+	CP6	3.50	1	FLOW	2918.	2857.	2754.	2651.	2609.	2580.	2560.	2526.	2486.
				TIME	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08
3 COMBINED AT													
+	COMBG	8.92	1	FLOW	3865.	3782.	3643.	3504.	3449.	3410.	3383.	3339.	3283.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
HYDROGRAPH AT													
+	INT13B	.11	1	FLOW	127.	123.	118.	113.	111.	110.	109.	107.	105.
				TIME	3.58	3.58	3.58	3.58	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT													
+	INT14	.10	1	FLOW	157.	154.	148.	143.	141.	139.	138.	136.	134.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
ROUTED TO													
+	RINT14	.10	1	FLOW	154.	150.	145.	139.	137.	136.	135.	133.	131.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT													
+	INT16	.08	1	FLOW	123.	120.	116.	112.	110.	109.	108.	106.	105.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
ROUTED TO													
+	RINT16	.08	1	FLOW	119.	117.	112.	108.	107.	105.	104.	103.	101.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT													
+	INT15	.11	1	FLOW	178.	175.	168.	162.	160.	158.	157.	155.	152.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
3 COMBINED AT													
+	CP7	.28	1	FLOW	451.	441.	425.	409.	404.	399.	396.	390.	384.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
3 COMBINED AT													
+	COMBH	9.31	1	FLOW	4433.	4332.	4167.	4002.	3935.	3890.	3856.	3805.	3738.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT													
+	INT17	.01	1	FLOW	20.	19.	19.	18.	18.	18.	17.	17.	17.
				TIME	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50

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

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RS21 SDLM–6 JUNCTION BOX AT STA 18+15.08
RS22 SDLM–6 JUNCTION BOX AT STA 25+21.95
RS23 SDLM–4 CONCRETE CHANNEL CHUTE/GROUTED RIPRAP CHUTE STA 10+00.00 TO STA 13+95.83
RS24 SDLM–5 AND SDLF–NDB–1 INLET/OUTFALL STRUCTURE AT STA 10+00.00
RS25 "SDNDB–B3" NORTH BASIN TRANSITION/INLET STRUCTURE
RS26 SDNDB–B3 NORTH BASIN STILLING BASIN STRUCTURE AT STA 22+87.12
RS27 GBWC CONFLUENCE STRUCTURE STA 759+90.59 TO STA 760+69.59
RS28 MODIFIED TYPE "CM" DROP INLET DETAILS FOR "H" > 8'–0"
RS29 RCB GRATE ACCESS OPENING, PLAN AND ELEVATION
RS30 ACCESS OPENING INTO RCB BELOW GRATE SUPPORT BERM AND GRATE DETAILS
RS31 "SDNDB–B3" NORTH BASIN TRANSITION/INLET STRUCTURE SECTIONS AND DETAILS
RS32 CONCRETE RETAINING WALL DETAILS



APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT LVVWD PROJECT #107164 DATE

REV. NO.	DATE	DESCRIPTION	APPROVED

CLARK COUNTY NEVADA

WESTERN CLARK COUNTY 215 BRUCE WOODBURY BELTWAY - CRAIG ROAD TO HUALAPAI WAY

REGIONAL FLOOD CONTROL IMPROVEMENTS

INDEX OF DRAWINGS, KEY MAP AND LOCATION MAP

CLARK COUNTY, NEVADA, DEPARTMENT OF PUBLIC WORKS

REGISTERED PROFESSIONAL ENGINEER STATE OF NEVADA No. 13577 ROBERT E. YOKUM Exp. 06/30/2015 CIVIL

G. C. WALLACE COMPANIES
ENGINEERS | PLANNERS | SURVEYORS
1555 S. RAINBOW BOULEVARD - LAS VEGAS, NV 89146
T: 702.804.2000 - F: 702.804.2299 - GCWALLACE.COM

PROJECT No: 451.002.001 DRAWN BY:
DESIGNED BY: CHECKED BY:
APPROVED BY

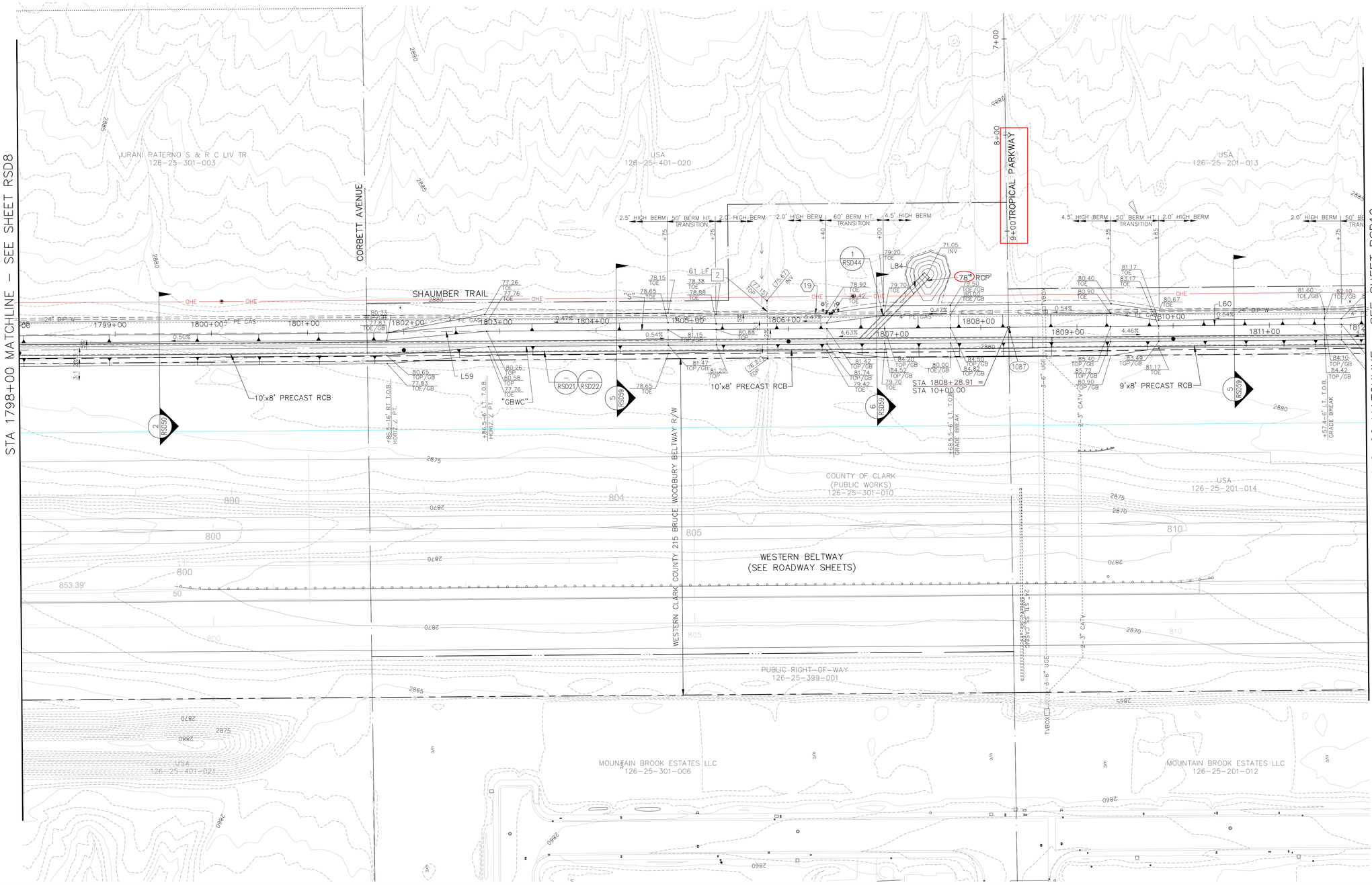
SCALE
HORIZ: NONE
VERT: NONE
FIELD BOOK

DRAWING NO. RG1

SHT. OF

STA 1798+00 MATCHLINE – SEE SHEET RSD8

STA 1812+00 MATCHLINE – SEE SHEET RSD10



SCALE 1" = 50'

NORTH

50 0 50 100

SCALE FEET

NOTE:
SEE SHEET RG5-RG6 FOR LINE, CURVE AND COORDINATE CALL-OUTS FOR ALL ALIGNMENTS AND POINT NUMBERS.
SEE SHEET RG2 FOR CONSTRUCTION AND REMOVAL NOTES.

DISCLAIMER NOTE

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WESTERN CLARK COUNTY 215 BRUCE WOODBURY BELTWAY - CRAIG ROAD TO HUALAPAI WAY

GRADING AND DRAINAGE PLAN

STA 1798+00.00 TO STA 1812+00.00

CLARK COUNTY, NEVADA, DEPARTMENT OF PUBLIC WORKS

PROFESSIONAL ENGINEER — REGISTERED — STATE OF NEVADA — No. 15577 — PRINT — YOKUM — Exp. 06/30/2015 — NOT VALID UNLESS SIGNED

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SCALE
HORIZ: AS SHOWN
VERT: NONE
FIELD BOOK

DRAWING NO.
RSD9

SHT. OF

F:\Projects\400\451-002-001\Dwg\Hydro\Improv\WB_SD10.dwg 9-29-14 13:43:09 bdoane

STA 1812+00.00 MATCHLINE – SEE SHEET RSD9

STA 1826+00.00 MATCHLINE – SEE SHEET RSD11

NORTH

SCALE = 1" = 50'

50 0 50 100

SCALE FEET

NOTE:
SEE SHEET RG5–RG6 FOR LINE, CURVE AND COORDINATE CALL–OUTS FOR ALL ALIGNMENTS AND POINT NUMBERS.
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REV. NO.	DATE	DESCRIPTION	APPROVED

CLARK COUNTY NEVADA

WESTERN CLARK COUNTY 215 BRUCE WOODBURY BELTWAY - CRAIG ROAD TO HUALAPAI WAY

GRADING AND DRAINAGE PLAN

STA 1812+00.00 TO STA 1826+00.00

CLARK COUNTY, NEVADA, DEPARTMENT OF PUBLIC WORKS

PROFESSIONAL ENGINEER — BRANT T. YOKUM — No. 15475 — STATE OF NEVADA — 09/30/2014

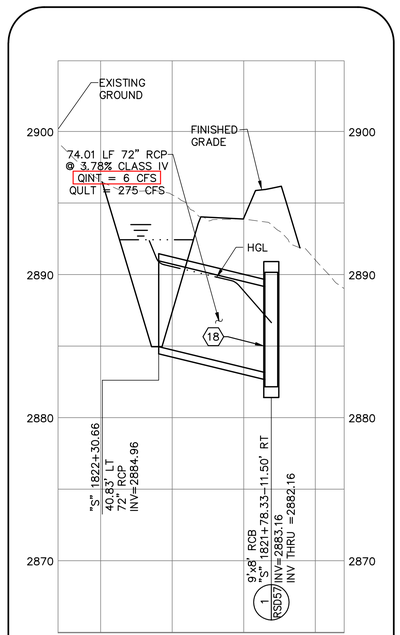
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SCALE
HORIZ: AS SHOWN
VERT: NONE
FIELD BOOK

DRAWING NO. RSD10

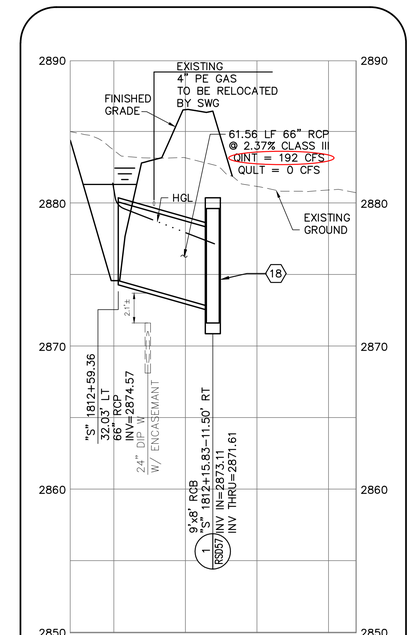
SHT. OF



72" RCP LATERAL ("S" 1821+78.33) 4 RSD44

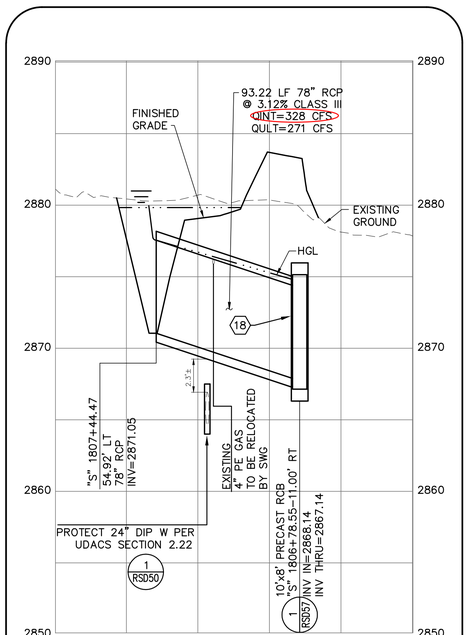
SCALE: HORIZ. 1" = 50'
VERT. 1" = 5'

NOT USED



66" RCP LATERAL ("S" 1812+15.83) 2 RSD44

SCALE: HORIZ. 1" = 50'
VERT. 1" = 5'



78" RCP LATERAL ("S" 1806+78.55) 1 RSD44

SCALE: HORIZ. 1" = 50'
VERT. 1" = 5'

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REV. NO.	DATE	DESCRIPTION	APPROVED

CLARK COUNTY NEVADA

WESTERN CLARK COUNTY 215 BRUCE WOODBURY BELTWAY - CRAIG ROAD TO HUALAPAI WAY
LATERALS

CLARK COUNTY, NEVADA, DEPARTMENT OF PUBLIC WORKS

PROFESSIONAL ENGINEER — BRIAN K. YOKLEY — No. 13429 — STATE OF NEVADA

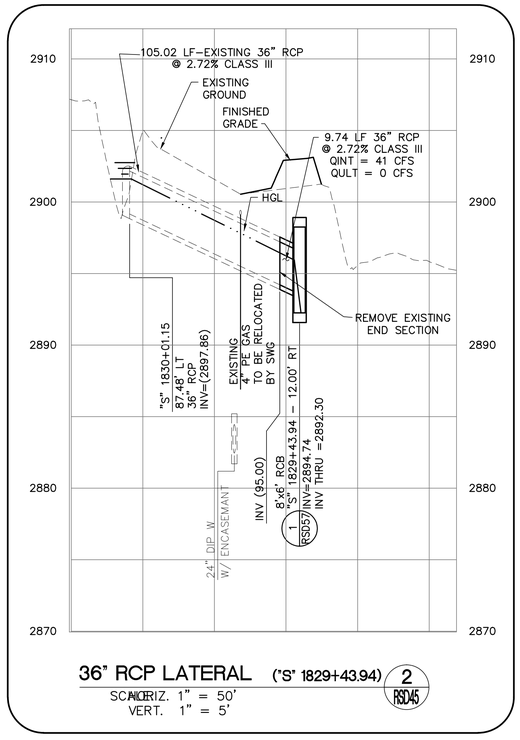
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SCALE
HORIZ: 1"=50'
VERT: 1"=5'
FIELD BOOK

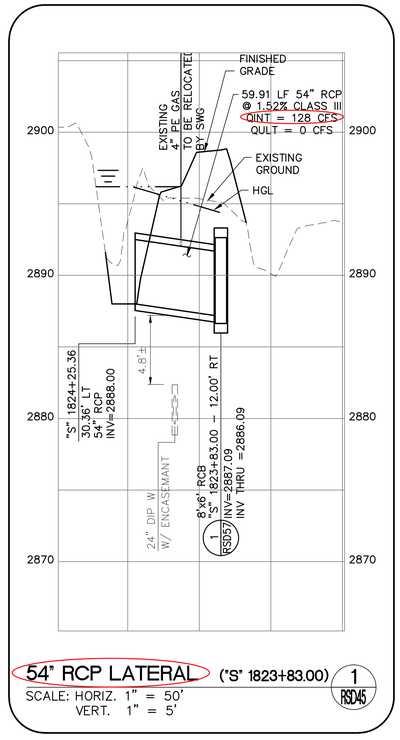
DRAWING NO.
RSD44

SHT. OF



36" RCP LATERAL ("S" 1829+43.94) 2 RSD45

SCALE: HORIZ. 1" = 50'
VERT. 1" = 5'



54" RCP LATERAL ("S" 1823+83.00) 1 RSD45

SCALE: HORIZ. 1" = 50'
VERT. 1" = 5'

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REV. NO.	DATE	DESCRIPTION	APPROVED

CLARK COUNTY NEVADA

WESTERN CLARK COUNTY 215 BRUCE WOODBURY BELTWAY - CRAIG ROAD TO HUALAPAI WAY
LATERALS

CLARK COUNTY, NEVADA, DEPARTMENT OF PUBLIC WORKS

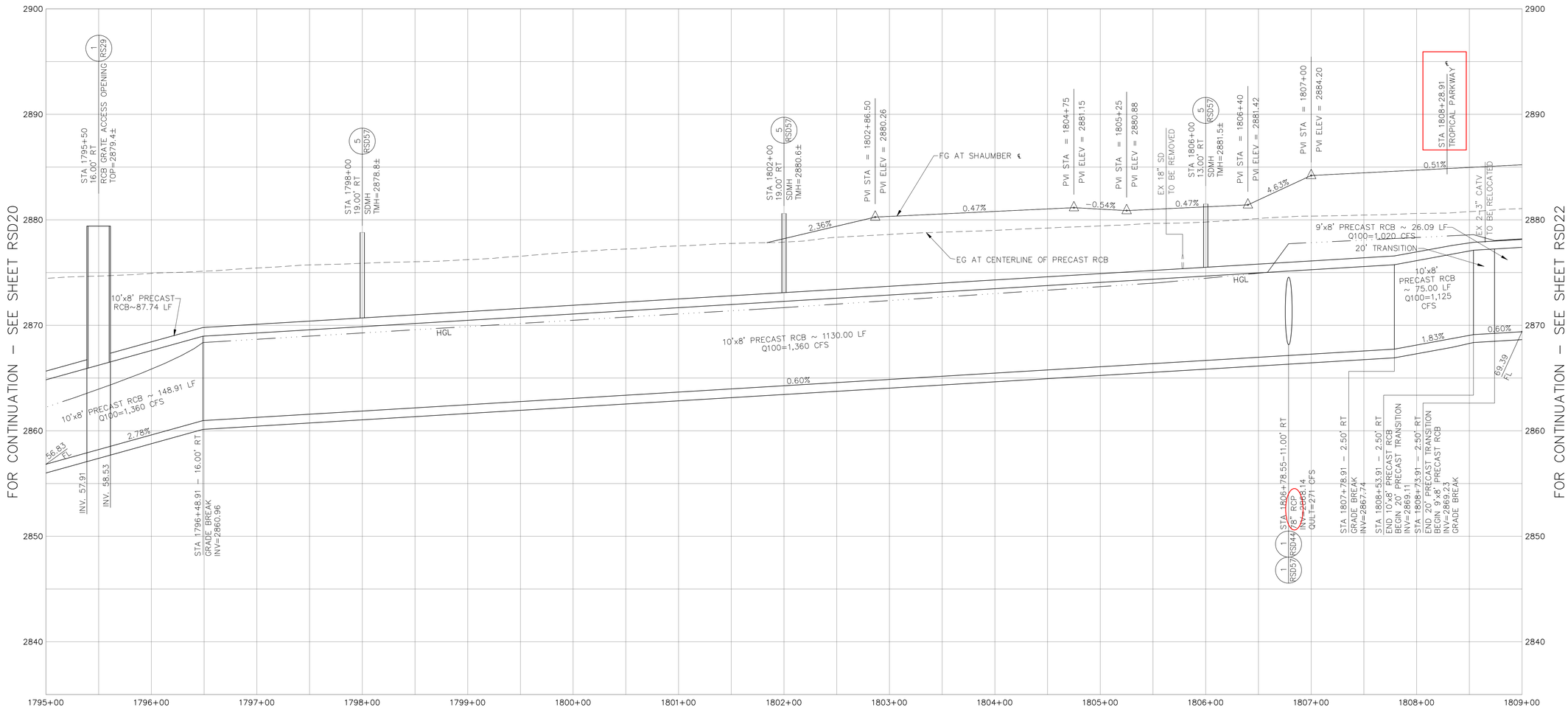
PROFESSIONAL ENGINEER — BRIANT TOKUDA — No. 15257 — STATE OF NEVADA

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SCALE
HORIZ: 1"=50'
VERT: 1"=5'
FIELD BOOK

DRAWING NO. RSD45
SHT. OF



SCALE: 50 0 50 100 FEET

SCALE: HORIZ. – 1" = 50'
VERT. – 1" = 5'

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REV. NO.	DATE	DESCRIPTION	APPROVED

WESTERN CLARK COUNTY 215 BRUCE WOODBURY BELTWAY - CRAIG ROAD TO HUALAPAI WAY

"GBWC" PROFILE

STA 1795+00.00 TO STA 1809+00.00

CLARK COUNTY, NEVADA, DEPARTMENT OF PUBLIC WORKS

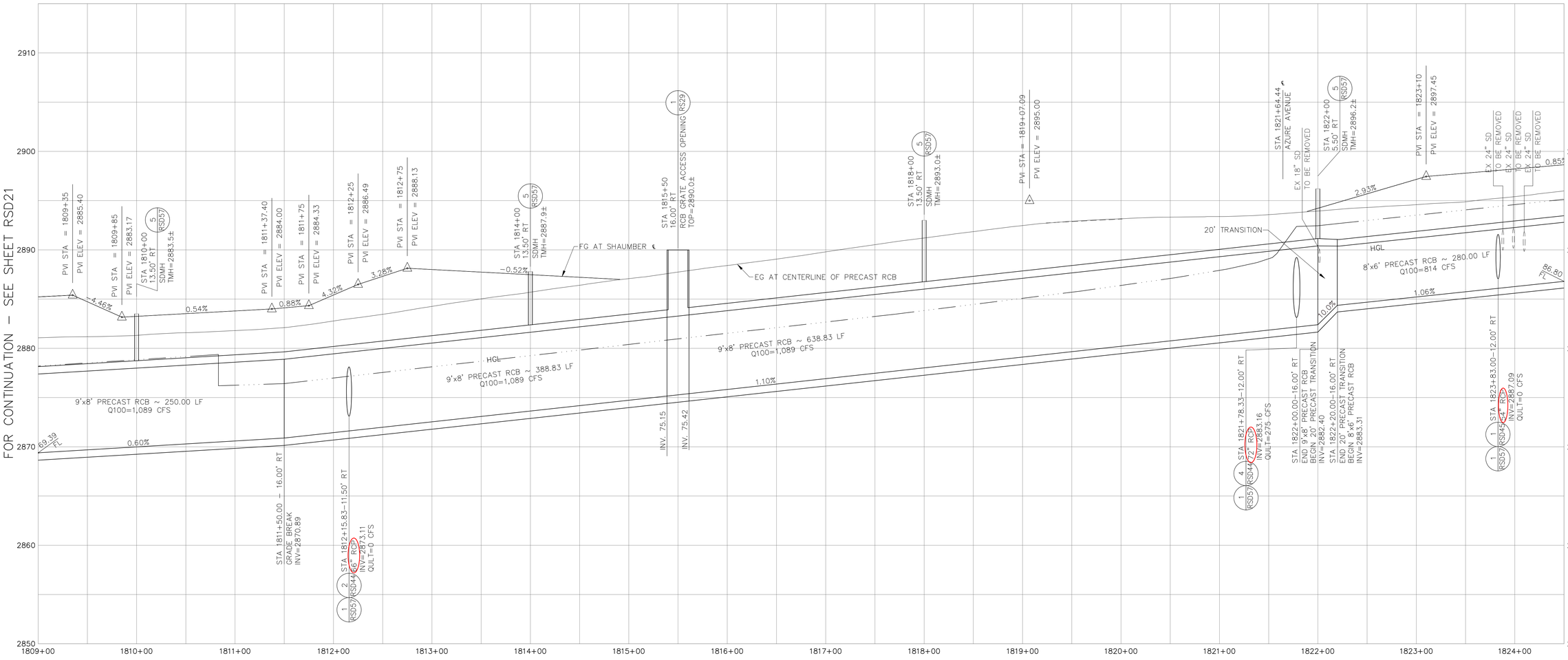
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SCALE
HORIZ: AS SHOWN
VERT: AS SHOWN
FIELD BOOK

DRAWING NO.
RSD21
SHT. OF

FOR CONTINUATION – SEE SHEET RSD21



FOR CONTINUATION – SEE SHEET RSD23

50 0 50 100
SCALE FEET

SCALE: HORIZ. – 1" = 50'
VERT. – 1" = 5'

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REV. NO.	DATE	DESCRIPTION	APPROVED

WESTERN CLARK COUNTY 215 BRUCE WOODBURY BELTWAY - CRAIG ROAD TO HUALAPAI WAY

"GBWC" PROFILE

STA 1809+00.00 TO STA 1824+50.00

CLARK COUNTY, NEVADA, DEPARTMENT OF PUBLIC WORKS

PROFESSIONAL ENGINEER
ROBERT L. WITTIG
VINCENT LARKIN
YOKOM
No. 15872
STATE OF NEVADA
08/28/2014
REGISTERED
PROFESSIONAL
ENGINEER
No. 15872
STATE OF WASHINGTON

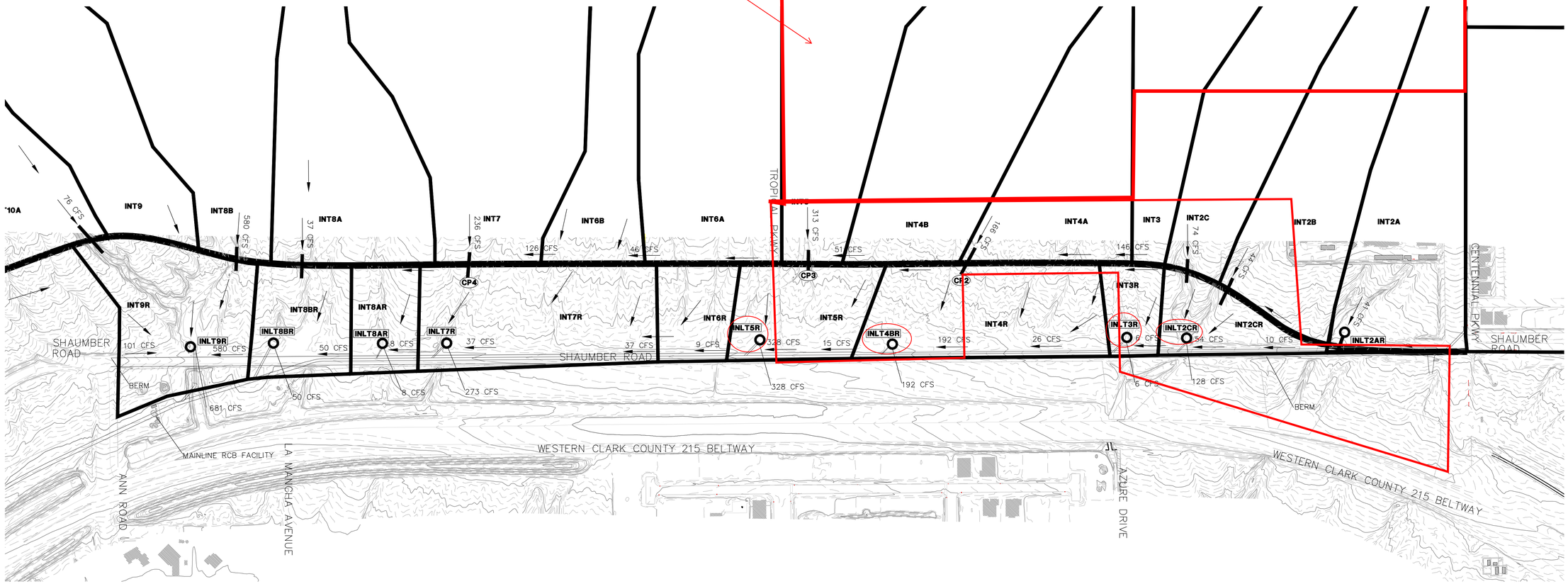
PROJECT No: 451.002.001 DRAWN BY:
DESIGNED BY: CHECKED BY:
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SCALE
HORIZ: AS SHOWN
VERT: AS SHOWN
FIELD BOOK

DRAWING NO.
RSD22
SHT. OF

PROJECT SITE



WESTERN BELTWAY TRAIL INTERIM CONDITIONS SUBBASIN SUMMARY			
Basin	Area (acres)	Q_{100} (cfs)	100YR cfs/acre
INT2A*	12.3	40	3.26
INT2B*	14.8	44	2.98
INT2C*	28.7	74	2.58
INT3*	61.6	146	2.37
INT4A*	9.9	23	2.32
CP2*	-	166	-
DETCAM10*	29.8	98	3.29
INT4B*	25.3	51	2.01
INT5*	94.7	219	2.31
CP3*	-	313	-
INT6A*	17.8	46	2.58
INT6B*	31.9	80	2.51
INT7*	63.6	158	2.49
CP4*	-	236	-
INT8A*	13.2	37	2.80
INT8B*	106.8	314	2.94
INT9*	85.7	266	3.10
CP5*	-	578	-
INT10A*	28.8	76	2.64
INT2CR**	3.1	10	3.23
INT3R**	1.9	6	3.23
INT4R**	7.9	26	3.23
INT5R**	4.6	15	3.23
INT6R**	2.7	9	3.23
INT7R**	8.7	28	3.23
INT8AR**	2.6	8	3.23
INT8BR**	3.9	13	3.23
INT9R**	7.6	25	3.23

*Basin Referenced from CH2MHill July 2014 Shaumber Road Realignment
**100-yr cfs/acre calculated from hydrology of GCW 90% Design August 2008

RIP RAP HOLE SUMMARY						
Rip Rap Hole Location	Facility Size	Interim Conditions		Interim Headwater (ft)	Ultimate Conditions*	
		Q100 (cfs)	Tributary Basins		Q100 (cfs)	Tributary Basins
INLT2A	36" RCP	41	INT2A*	3.6		
INLT2CR	54" RCP	128	INT2B* + INT2C* + INT2CR**	6.0	275	EFPOA3* + EFPOA3R**
INLT3R - Azure Dr.	72" RCP	6	INT3R**	0.8		
INLT4BR	66" RCP	192	CP2* (INT3 + INT4A) + INT4R**	7.9	271	CP2* (EFPOA4**) + EFPOA4R**
INLT5R - Tropical prkwy.	78" RCP	328	CP3* (INT4B + INT5 + CAM10DB) + INT5R**	8.8		
INLT7R	72" RCP	270	CP4* (INT6A + INT6B + INT7) + INT6R** + INT7R**	7.9	50	EFPOA5R**
INLT8AR	18" RCP	8	INT8AR**	1.8		
INLT8BR - La Mancha Ave.	7'x7' RCB	50	INT8A* + INT8BR**	1.9	545	CP3* (EFPOA1 + EFPOA2 + EFPOA5)*
INLT9R	8'x7' RCB	681	INT8B* + INT9* + INT10A* + INT9R**	12.5	970	CP4* (EFPOB1*** + EFPOB2)* + EFPOB1R**

*Basin reference from CH2MHill July 2014 Shaumber Road realignment Centennial Parkwat to Washburn Road

BERM CALCULATIONS											
Berm Location	Start Station	End Station	Slope %	Berm Impacting Discharge (cfs)	Depth (ft)	Velocity (fps)	Froude Number	Freeboard (ft)	Total Req'd Berm Height (ft)	Berm Height (ft)	Req'd Rip Rap Size (d50 in inches)
INT2AR	1829+50	1830+50	2.22	1	0.2	2.0	1.07	1.0	1.2	2.0	Mulch
INT2CR*	1825+75	1829+50	0.85	10	0.6	2.6	0.80	1.0	1.6	2.0	Mulch
INT2CR*	1823+60	1825+75	0.85	54	1.2	4.5	0.91	1.0	2.2	2.5	Mulch
INT3R	1821+90	1823+60	0.85	6	0.5	2.1	0.76	1.0	1.5	2.0	Mulch
INT4BR	1813+73.5	1821+90	1.32	26	0.8	4.1	1.05	1.1	1.9	2.0	Mulch
INT4BR	1811+75	1813+73.5	1.32	192	2.0	7.2	1.12	1.2	3.2	3.5	6
INT5R	1809+35	1811+75	0.54	15	0.8	2.6	0.67	1.0	1.8	2.0	Mulch
INT5R	1806+40	1809+35	0.54	328	3.2	6.0	0.74	1.1	4.2	4.5	6
INT6R	1804+75	1806+40	0.47	9	0.6	3.3	0.59	1.0	1.6	2.0	Mulch
INT7R*	1794+20.5	1804+75	0.47	37	1.1	3.3	0.67	1.0	2.1	2.5	Mulch
INT8AR	1791+60	1794+20.5	0.56	8	0.6	2.1	0.64	1.0	1.6	2.0	Mulch
INT8BR	1787+30	1791+60	0.47	50	1.3	3.6	0.69	1.0	2.3	2.5	Mulch
INT9R*	1785+25	1787+30	1.00	580	3.6	8.8	1.02	1.3	4.9	5.0	6
INT9R*	1781+90	1785+25	1.00	101	1.6	5.5	0.96	1.0	2.6	3.0	6

*Revised: Due to topography of basins. Full flow of subbasins does not impact berm

Freeboard — Subcritical: Fb = 0.5 + vel^2 / 2G
Supercritical: Fb = 1 + 0.025 * vel (d)^0.333

Rip Rap Sizing — d50=((vel*S^0.17)/(3*(Sg-1)))^2

LEGEND

- DRAINAGE SUBBASIN
- (CP4) CONCENTRATION POINT
- INT5R SUBBASIN NAME
- RIP RAP SUMP INFLOW LOCATION
- INLT3R RIP RAP SUMP INLET NAME
- FLOW DIRECTION
- 328 CFS FLOW QUANTITY
- 328 CFS CULVERT AND BERM FLOWS

% COMPLETE

DATE:
CGW APP
DATE
AGEN APP
DATE
DESCRIPTION
REV
DATE

PROJECT NO.

DRAWN:
CHECK:
PLOT DATE: 10-29-14
PLOT TIME: 14:23:38

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LAS VEGAS

F:\Projects\450\451-002-001\Dwg\Hydro\Figures\140902\Fig8-140820.dwg
David Clark

WESTERN SEGMENT OF THE LAS VEGAS BELTWAY
CRAIG ROAD TO HUALAPAI WAY
INTERIM CONDITIONS BASIN MAP
SHAUMBER TRAIL

DRAWING
FIG 8
SHT OF SHTS

LD #:

gc-24.56.dwg 070203.jpr

HTE: 00-00000

INLET FLOWS- INTERIM					
INLET NAME	Inlet Station	CH2M Basin Q [cfs]	East Shaumber Q [cfs]	Q Total [cfs]	Basins
INLT2AR	1829+43	41	0	41	INT2A*
INLT2CR	1823+83	118	10	128	INT2B* + INT2C* + INT2CR**
INLT3R	1821+78	0	6	6	INT3R**
INLT4BR	1812+15	166	26	192	CP2* (INT3 + INT4A) + INT4R**
INLT5R	1806+78	313	15	328	CP3* (INT4B + INT5 + CAM10DB) + INT5R**
INLT7R	1793+69	236	37	270	CP4* (INT6A + INT6B + INT7) + INT6R** + INT7R**
INLT8AR	1792+30	0	8	8	INT8AR**
INLT8BR	787+45	37	13	50	INT8A* + INT8BR**
INLT9R	784+51	656	25	681	INT8B* + INT9* + INT10A* + INT9R**

*Basin reference from CH2MHill July 2014 Shaumber Road realignment Centennial Parkwat to Washburn Road Calculation Workbook

**Basin created in area between the old and new Shaumber Road alignments. Hydrology prorated from CH2MHill July 2014 Shaumber Road realignment Centennial Parkwat to Washburn Road Calculation Workbook

PROJECT SITE

GRAPHIC SCALE
200 0 100 200
(IN FEET)
1 inch = 200 ft.

NORTH

EFPOB1

EFPOA2

EFPOA5

EFPOA4

EFPOA3

906 CFS

545 CFS

226 CFS

254 CFS

TROPICAL PKWY

CENTENNIAL PKWY

SHAUMBER ROAD

CP4

CP3

CP2

EFPOA5R

EFPOA4R

EFPOA3R

INLT9R

INLT8BR

INLT8AR

INLT7R

INLT5R

INLT4BR

INLT3R

INLT2CR

INLT2AR

BERM

OLD SHAUMBER ROAD LOCATION

EFPOB1R

970 CFS

545 CFS

0 CFS

50 CFS

271 CFS

275 CFS

WESTERN CLARK COUNTY 215 BELTWAY

ANN ROAD

LA MANCHA AVENUE

AZURE DRIVE

WESTERN BELTWAY TRAIL
ULTIMATE CONDITIONS SUBBASIN SUMMARY

Basin	Area (acres)	Q_{100} (cfs)	100YR cfs/acre
EFPOA3*	80.7	254	3.15
EFPOA4*	68.4	157	2.29
CP2*	-	226	-
EFPOA1*	103.4	306	2.96
EFPOA2*	57.3	182	3.17
EFPOA5*	28.4	88	3.10
CP3*	-	545	-
EFPOB1*	173.3	673	3.88
EFPOB2*	65.2	249	3.82
CP4*	-	906	-
EFPOA3R**	6.7	21	3.15
EFPOA4R**	14.3	45	3.15
EFPOA5R**	16.0	50	3.15
EFPOB1R**	20.3	64	3.15

*Referenced from CH2MHill July 2014 Shaumber Road Realignment
**100-yr cfs/acre calculated from hydrology of GCW 90% Design August 2008

RIP RAP HOLE SUMMARY

Rip Rap Hole Location	Facility Size	Interim Conditions Q100 (cfs)	Interim Conditions Tributary Basins	Interim Headwater (ft)	Ultimate Conditions* Q100 (cfs)	Ultimate Conditions* Tributary Basins
INLT2A	36" RCP	41	INT2A*	3.6	275	EFPOA3* + EFPOA3R**
INLT2CR	54" RCP	128	INT2B* + INT2C* + INT2CR**	6.0		
INLT3R - Azure Dr.	72" RCP	6	INT3R**	0.8	271	CP2* (EFPOA4**) + EFPOA4R**
INLT4BR	66" RCP	192	CP2* (INT3 + INT4A) + INT4R**	7.9		
INLT5R - Tropical prkwy.	78" RCP	328	CP3* (INT4B + INT5 + CAM10DB) + INT5R**	8.8		
INLT7R	72" RCP	270	CP4* (INT6A + INT6B + INT7) + INT6R** + INT7R**	7.9	50	EFPOA5R**
INLT8AR	18" RCP	8	INT8AR**	1.8		
INLT8BR - La Mancha Ave.	7'x7' RCB	50	INT8A* + INT8BR**	1.9	545	CP3* (EFPOA1 + EFPOA2 + EFPOA5)*
INLT9R	8'x7' RCB	681	INT8B* + INT9* + INT10A* + INT9R**	12.5	970	CP4* (EFPOB1*** + EFPOB2)* + EFPOB1R**

*Basin reference from CH2MHill July 2014 Shaumber Road realignment Centennial Parkwat to Washbum Road

BERM CALCULATIONS

Berm Location	Start Station	End Station	Slope %	Berm Impacting Discharge (cfs)	Depth (ft)	Velocity (fps)	Froude Number	Freeboard (ft)	Total Req'd Berm Height (ft)	Berm Height (ft)	Req'd Rip Rap Size (d50 in inches)
INT2AR	1829+50	1830+50	2.22	1	0.2	2.0	1.07	1.0	1.2	2.0	Mulch
INT2CR*	1825+75	1829+50	0.85	10	0.6	2.6	0.80	1.0	1.6	2.0	Mulch
INT2CR*	1823+60	1825+75	0.85	54	1.2	4.5	0.91	1.0	2.2	2.5	Mulch
INT3R	1821+90	1823+60	0.85	6	0.5	2.1	0.76	1.0	1.5	2.0	Mulch
INT4BR	1813+73.5	1821+90	1.32	26	0.8	4.1	1.05	1.1	1.9	2.0	Mulch
INT4BR	1811+75	1813+73.5	1.32	192	2.0	7.2	1.12	1.2	3.2	3.5	6
INT5R	1809+35	1811+75	0.54	15	0.8	2.6	0.67	1.0	1.8	2.0	Mulch
INT5R	1806+40	1809+35	0.54	328	3.2	6.0	0.74	1.1	4.2	4.5	6
INT6R	1804+75	1806+40	0.47	9	0.6	3.3	0.59	1.0	1.6	2.0	Mulch
INT7R*	1794+20.5	1804+75	0.47	37	1.1	3.3	0.67	1.0	2.1	2.5	Mulch
INT8AR	1791+60	1794+20.5	0.56	8	0.6	2.1	0.64	1.0	1.6	2.0	Mulch
INT8BR	1787+30	1791+60	0.47	50	1.3	3.6	0.69	1.0	2.3	2.5	Mulch
INT9R*	1785+25	1787+30	1.00	580	3.6	8.8	1.02	1.3	4.9	5.0	6
INT9R*	1781+90	1785+25	1.00	101	1.6	5.5	0.96	1.0	2.6	3.0	6

*Revised: Due to topography of basins. Full flow of subbasins does not impact berm
Freeboard Subcritical: Fb = 0.5 + vel^2 / 2G
Supercritical: Fb = 1 + 0.025 * vel (d)^0.333
Rip Rap Sizing d50=((vel^S^0.17)/(3*(Sg-1)))^2

LEGEND

- ULTIMATE DRAINAGE BASIN
- (CP4) CONCENTRATION POINT
- EFPO ULTIMATE BASIN NAME
- O RIP RAP SUMP INFLOW LOCATION
- INLT3R RIP RAP SUMP INLET NAME
- FLOW DIRECTION
- 328 CFS FLOW QUANTITY

% COMPLETE

DATE:

DESCRIPTION	DATE	AGEN. APP	DATE	GCW APP	DATE

REV | DATE

PROJECT NO.

DESIGN:
DRAWN:
CHECK:
PLOT DATE: 10-29-14
PLOT TIME: 14:26:53

G.C. WALLACE COMPANIES
ENGINEERS | PLANNERS | SURVEYORS
1555 S. RAINBOW BLVD. LAS VEGAS, NV 89146
T: 702.804.2000 F: 702.804.2299 GCWALLACE.COM
LAS VEGAS

F:\Projects\400\451-002-001\Dwg\Hydro\Figures\140902\Fig9-140920.dwg
David Clark

WESTERN SEGMENT OF THE LAS VEGAS BELTWAY
CRAIG ROAD TO HUALAPAI WAY
ULTIMATE CONDITIONS BASIN MAP
SHAUMBER TRAIL

DRAWING
FIG 9
SHT OF SHTS

LID #:
HTE: 00-00000

gc-2435.dwg 070203.prv

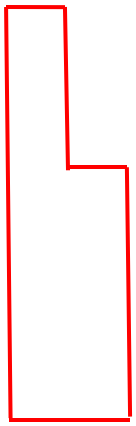
INLET FLOWS - ULTIMATE					
Inlet Name	Inlet Station	CH2MHill Basin Q [cfs]	East Shaumber Q [cfs]	Q Total [cfs]	Basins
INLT2AR	1829+43	254	21	275	EFPOA3* + EFPOA3R**
INLT2CR	1823+83				
INLT3R	1821+78				
INLT4BR	1812+15	226	45	271	CP2* (EFPOA4**) + EFPOA4R**
INLT5R	1806+78				
INLT7R	1793+69	0	50	50	EFPOA5R**
INLT8AR	1792+30				
INLT8BR	787+45	545	50	595	CP3* (EFPOA1 + EFPOA2 + EFPOA5)*
INLT9R	784+51	906	64	970	CP4* (EFPOB1*** + EFPOB2)* + EFPOB1R**

*Basin reference from CH2MHill July 2014 Shaumber Road realignment Centennial Parkwat to Washburn Road Calculation Workbook

**Created in Area between the old and new Shaumber Road alignments. Hydrology prorated from CH2MHill July 2014 Shaumber Road realignment Centennial Parkwat to Washburn Road Calculation Workbook

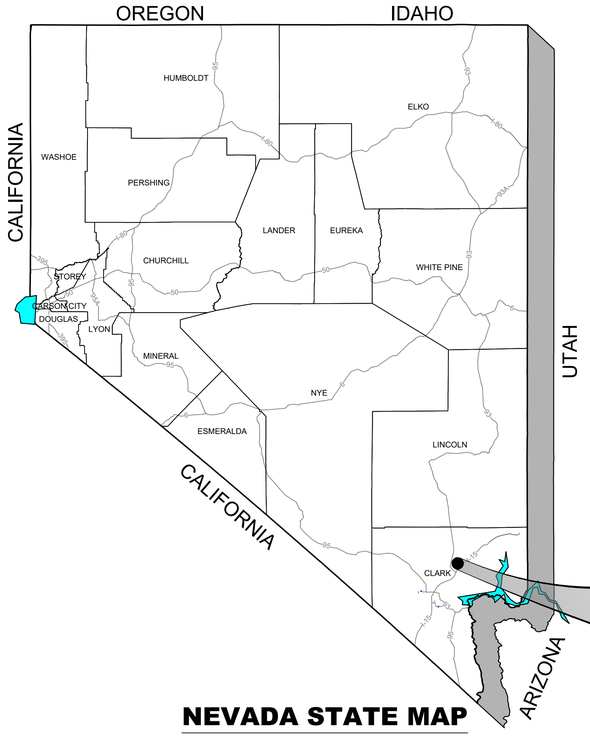
***EFPBO1 not shown on Figure 9

APPENDIX D. Grading Plan / Plan-Profiles / Sections-Details

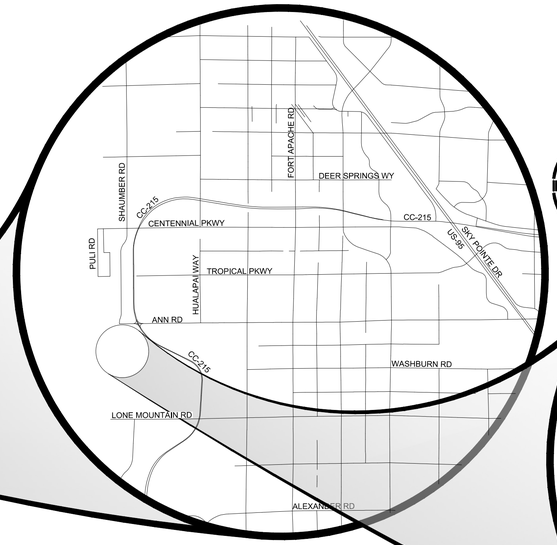


CENTENNIAL HEIGHTS TOWNHOMES

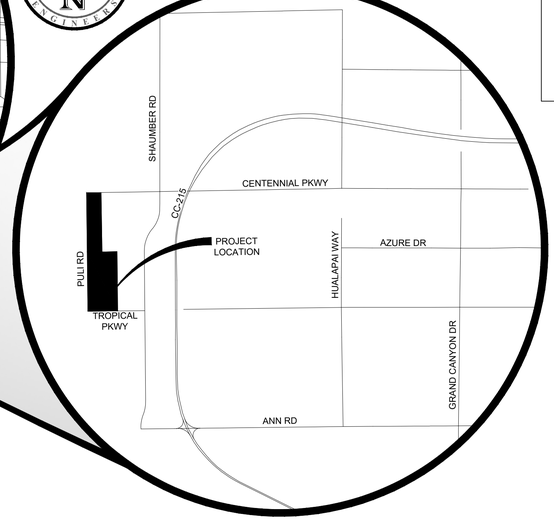
located in
CITY OF LAS VEGAS
APN # 126-25-201-010



NEVADA STATE MAP



VICINITY MAP



PROJECT SITE

OWNER:

HARMONY HOMES
8912 SPANISH RIDGE AVE, STE 200
LAS VEGAS, NV 89148
PHONE: (702)570-7213
CONTACT: MATT ROSENBERG
EMAIL: MROSENBERG@HARMONYHOMES.COM

DEVELOPER:

HARMONY HOMES
8912 SPANISH RIDGE AVE, STE 200
LAS VEGAS, NV 89148
PHONE: (702)570-7213
CONTACT: MATT ROSENBERG
EMAIL: MROSENBERG@HARMONYHOMES.COM

ENGINEER:

HORROCKS ENGINEERS
1401 N. GREEN VALLEY PKWY., STE 160
HENDERSON, NV 89074
PHONE: (702)966-4063
CONTACT: LARRY BITTON, P.E.
EMAIL: LARRYB@HORROCKS.COM

UTILITY CONTACTS

WATER
LAS VEGAS VALLEY WATER DISTRICT
1001 S. VALLEY VIEW BLVD.
LAS VEGAS, NV 89107
(702) 870-2011

POWER
NEVADA ENERGY
7155 LINDELL RD.
LAS VEGAS, NV 89118
(702) 402-8400

NATURAL GAS
SOUTHWEST GAS CORPORATION
6355 SHATZ ST.
LAS VEGAS, NV 89115
(877) 860-6020

SEWER
CITY OF LAS VEGAS
333 N. RANCHO DR.
LAS VEGAS, NV 89106
(702) 229-6301

TELEPHONE
CENTURY LINK
2340 E. TROPICANA AVE.
LAS VEGAS, NV 89119
(877) 862-9343

CATV SERVICE
COX COMMUNICATIONS
819 E. OGDEN AVE.
LAS VEGAS, NV 89010
(702) 883-4000

EARTHWORKS

CUT: _____ CY
FILL: _____ CY
NET: _____ (FILL)

ESTIMATED QUANTITY FROM EXISTING TO FINISHED GRADES.
PER SOILS REPORT BY _____, PROJECT #_____, DATED _____

FLOOD ZONE:

THIS SITE IS LOCATED IN A ZONE 'X', AREAS OUTSIDE OF THE 0.2% ANNUAL CHANCE FLOODPLAIN AND PARTIALLY IN A SHADED ZONE 'X', AREAS OF 0.2% ANNUAL CHANCE FLOOD; AREAS OF 1% ANNUAL CHANCE FLOOD WITH AVERAGE DEPTHS OF LESS THAN 1 FOOT OR WITH DRAINAGE AREAS LESS THAN 1 SQUARE MILE; AND AREAS PROTECTED BY LEVEES FROM 1% ANNUAL CHANCE OF FLOOD PER THE FLOOD INSURANCE RATE MAP COMMUNITY PANEL 32003C2565F, CLARK COUNTY, NEVADA DATED NOVEMBER 16, 2011, REVISED TO REFLECT LOMR DATED OCTOBER 18, 2018.

BENCHMARK

RIVET & PLATE IN CONCRETE CYLINDER 60 FEET WEST OF MAINWAL AND AZURE

ELEVATION (meters) 901.13
ELEVATION (feet) 2,956.44
NAVD 88

BASIS OF BEARING

NORTH 00°37'29" WEST, BEING THE WEST LINE OF THE NORTHWEST QUARTER (NW1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.M.,CLARK COUNTY, NEVADA, AS SHOWN ON THE PLAT OF CONSTELLATION ESTATES, RECORDED IN BOOK 102, PAGE 92, OFFICIAL RECORDS, CLARK COUNTY, NEVADA.

LEGAL DESCRIPTION:

A PORTION OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.D., CITY OF LAS VEGAS, CLARK COUNTY, NEVADA, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

THE WEST HALF (W 1/2) OF THE WEST HALF (W 1/2) OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.M., TOGETHER WITH:

THE WEST HALF (W 1/2) OF THE SOUTHWEST QUARTER (SW 1/4) OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.M.

Call before you AVOID CUTTING UNDERGROUND UTILITY LINES. IT'S COSTLY. Call 811 1-800-227-2600

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

FAST Call before you UnderGround 1-702-432-5300 FREEWAY AND ARTERIAL SYSTEM OF TRANSPORTATION

Sheet List Table

Sheet Number	Sheet Title
01	COVER SHEET
02	NOTES
03	LEGEND & ABBREVIATIONS
04	GRADING PLAN I
05	GRADING PLAN II
06	GRADING PLAN III
07	GRADING PLAN IV
08	GRADING PLAN V
09	GRADING PLAN VI
10	GRADING PLAN VII
11	ST A PLAN & PROFILE (STA 9+50 TO STA 13+50)
12	ST B PLAN & PROFILE (STA 9+75 TO STA 14+00)
13	ST C PLAN & PROFILE (STA 16+00 TO STA 23+50)
14	ST C PLAN & PROFILE (STA 9+50 TO STA 17+00)
15	ST D, E, & F PLAN & PROFILE (STA 9+75 TO STA 12+00)
16	ST G PLAN & PROFILE (STA 9+50 TO STA 13+50)
17	ST H PLAN & PROFILE (STA 28+50 TO STA 36+00)
18	ST H PLAN & PROFILE (STA 21+50 TO STA 29+00)
19	ST H PLAN & PROFILE (STA 15+00 TO STA 22+50)
20	ST H PLAN & PROFILE (STA 9+00 TO STA 15+50)
21	ST I, J, & K PLAN & PROFILE (STA 9+75 TO STA 12+00)
22	ST L, M & N PLAN & PROFILE (STA 9+75 TO STA 12+00)
23	ST O, P & Q PLAN & PROFILE (STA 9+75 TO STA 12+00)
24	ST R PLAN & PROFILE (STA 9+75 TO STA 12+0)
25	TROPICAL PKWY PLAN & PROFILE (STA 5+00 TO 9+50)
26	TROPICAL PKWY PLAN & PROFILE (STA 9+00 TO STA 13+50)
27	CHANNEL 1 (STA 11+00-18+50)
28	CHANNEL 1 (STA 17+50-25+00)
29	CHANNEL 1 (STA 14+00-32+00)
30	CHANNEL 1 (STA 31+50-38+00)
31	STORM DRAIN 3 (STA 9+50-12+00)
32	STORM DRAIN 5 (STA 10+00-15+50)
33	STORM DRAIN 5 (STA 14+50 TO 22+50)
34	DETAILS SHEET 1
35	DETAIL SHEET 2

SITE DATA

APN NUMBER:	124-25-201-010
GROSS AREA:	31.02± ACRES
ZONING:	R-TH
TOTAL COMMON LOT COUNT:	2 LOTS
TOTAL RESIDENTIAL LOT COUNT:	340 LOTS
TOTAL DENSITY:	10.83 DU/AC
MINIMUM LOT SIZE (REQUIRED):	1,600 SF
MINIMUM LOT SIZE (PROVIDED):	1,663 SF
MAXIMUM LOT SIZE:	2,567 SF
COVERAGE RATIO:	32.7%
GUEST PARKING SPACES:	63 (56 REQUIRED)

UTILITY DISCLAIMER NOTE:

EXISTING UTILITY LOCATIONS SHOWN HEREIN ARE APPROXIMATE ONLY. IT SHALL BE AT THE CONTRACTORS RESPONSIBILITY TO DETERMINE THE EACT VERTICAL AND HORIZONTAL LOCATION OF ALL EXISTIING UNDERGROUND UTILITIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN HEREON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR UTILITIES NOT SHOWN IN THEIR PROPPER LOCATIONS.

NOTE:

FOR ALL REFERENCES TO FINAL MAP #_____ SHOWN THROUGHOUT THIS SET OF PLANS, SEE PLAT BOOK ___ PAGE ___.

AREA OF DISTURBANCE:

XXXX ONSITE (PRIVATE)
XXXX OFFSITE (PUBLIC)

APPROVALS

_____ DATE
CITY OF LAS VEGAS FIRE DEPARTMENT

_____ DATE
MIKE JANSEN
CITY ENGINEER - CITY OF LAS VEGAS
APPROVAL OF THESE PLANS BY THE CITY ENGINEER IS LIMITED TO THOSE IMPROVEMENTS CONSTRUCTED IN THE DEDICATED RIGHT-OF-WAY, AND/OR DEDICATED EASEMENTS. THIS APPROVAL DOES NOT AUTHORIZE CONSTRUCTION OF ANY IMPROVEMENTS THAT DEVIATE FROM ADOPTED STANDARDS AND/OR SPECIFICATIONS EXCEPT THOSE SPECIFICALLY LISTED UNDER DEVIATIONS FROM STANDARDS. THE ENGINEER SHALL RESOLVE ANY DEVIATION OTHER THAN THOSE LISTED IN DEVIATIONS FROM STANDARD IN FAVOR OF THE UNIFORM STANDARD DRAWINGS AND SPECIFICATIONS, CLARK COUNTY AREA, NEVADA.

_____ DATE
SOUTHWEST GAS CORPORATION

_____ DATE
COX COMMUNICATIONS LAS VEGAS, INC

_____ DATE
CENTRAL TELEPHONE COMPANY DBA CENTURY LINK
THE CENTURY LINK APPROVAL DOES NOT ASSUME OR GUARANTEE LIABILITY FOR KNOWN OR UNKNOWN CONFLICTS WITH EXISTING OR PROPOSED IMPROVEMENTS. RESOLUTION OF ANY CONFLICT WILL BE ACCOMPLISHED PURSUANT TO LOCAL ORDINANCES, NEVADA REVISED STATUTES AND/OR PUBLIC UTILITY COMMISSION RULES AND REGULATIONS.

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

_____ DATE
LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER
(PROJECT# _____), SHEETS: _____

HORROCKS ENGINEERS
1401 N. Green Valley Pkwy., Suite 160
Henderson, NV 89074
(702) 966-4063
www.horrocks.com

WARNING
IF THIS BAR DOES NOT MEASURE 2" THEN DRAWING IS NOT TO SCALE
0 1 2

REVISIONS
REV # | DATE
*SEE GENERAL NOTES SHEET

DRAWING INFO
DATE 12/23/19
DESIGNED SS
DRAWN PMP
CHECKED AD
PROJECT NV-1949-1909

PROFESSIONAL ENGINEER—STATE OF NEVADA
LARRY M. BITTON
EXP. 12-31-20
CIVIL
No. 01159

CENTENNIAL HEIGHTS TOWNHOMES
CITY OF LAS VEGAS, NEVADA
COVER SHEET

C.0.0
PAGE 01

CITY OF LAS VEGAS GENERAL NOTES

1. ALL CONSTRUCTION AND MATERIALS SHALL BE IN ACCORDANCE WITH THE "UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION OFF-SITE IMPROVEMENTS, CLARK COUNTY AREA NEVADA", LATEST ISSUE; THE "UNIFORM STANDARD DRAWINGS FOR PUBLIC WORKS CONSTRUCTION, CLARK COUNTY AREA NEVADA", LATEST REVISED EDITION; THE "SUMMERLIN IMPROVEMENT STANDARDS" FOR WORK IN THE SUMMERLIN AREA; AND OTHER APPLICABLE APPROVED STANDARDS ISSUED BY THE CONTROLLING AGENCY; THE UNIFORM BUILDING CODE; AND ALL LOCAL CITY CODES AND ORDINANCES APPLICABLE, EXCEPT AS NOTED ON THIS SHEET AS "DEVIATIONS FROM STANDARDS".

2. THE EXISTENCE AND LOCATION OF ANY OVERHEAD OR UNDERGROUND UTILITY LINES, PIPES, OR STRUCTURES SHOWN ON THESE PLANS ARE OBTAINED BY A RESEARCH OF THE AVAILABLE RECORDS. EXISTING UTILITIES AS SHOWN FROM CLV PLANS LIBRARY ARE APPROXIMATE AND FOR RECORD PURPOSES. EXISTING UTILITIES ARE LOCATED ON PLANS ONLY FOR THE CONVENIENCE OF THE CONTRACTOR. EXISTING UTILITY SERVICE LATERALS MAY NOT BE SHOWN ON THE PLANS. THE CONTRACTOR SHALL, AT HIS OWN EXPENSE, LOCATE ALL UNDERGROUND AND OVERHEAD INTERFERENCE'S WHICH MAY AFFECT HIS OPERATION DURING CONSTRUCTION AND SHALL TAKE ALL NECESSARY PRECAUTIONS TO AVOID DAMAGE TO SAME. THE CONTRACTOR SHALL USE EXTREME CAUTION WHEN WORKING NEAR OVERHEAD UTILITIES SO AS TO SAFELY PROTECT ALL PERSONNEL AND EQUIPMENT, AND SHALL BE RESPONSIBLE FOR ALL COST AND LIABILITY IN CONNECTION THEREWITH.

3. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT EXISTING UTILITY LINES, STRUCTURES AND STREET IMPROVEMENTS WHICH ARE TO REMAIN IN PLACE, FREE FROM DAMAGE, AND ALL SUCH IMPROVEMENTS OR STRUCTURES DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED OR REPLACED SATISFACTORY TO THE CITY ENGINEER AND OWNING UTILITY COMPANY AT THE EXPENSE OF THE CONTRACTOR.

4. ALL CONSTRUCTION SHALL BE AS SHOWN ON THESE PLANS, ANY REVISIONS SHALL HAVE THE PRIOR WRITTEN APPROVAL OF THE CITY ENGINEER.

5. TYPE V CEMENT SHALL BE USED IN ALL OFF-SITE CONCRETE WORK. CONCRETE TO BE 3000 P.S.I. MINIMUM @ 28 DAYS. MIX DESIGNS TO BE APPROVED BY THE CITY, PRIOR TO THE USE ON THE PROJECT.

6. PERMITS ARE REQUIRED FOR ANY WORK IN THE PUBLIC RIGHT-OF-WAY. THE CONTRACTOR SHALL SECURE ALL PERMITS AND INSPECTIONS REQUIRED FOR THIS CONSTRUCTION.

7. EXPANSION JOINTS REQUIRED, MAXIMUM EVERY 300' IN EXTRUDED-TYPE CURB.

8. AC PAVEMENT TO BE ONE-HALF INCH (½") ABOVE LIP OF ALL GUTTERS AFTER COMPACTION, EXCEPT AT SIDEWALK RAMPS AND CROSS GUTTERS.

9. CURB AND GUTTER FOUND TO BE UNACCEPTABLE TO THE CITY OF LAS VEGAS SHALL BE REMOVED AND REPLACED PER STANDARD DRAWING 216.

10. SIDEWALK RAMPS SHALL BE CONSTRUCTED IN EACH QUADRANT OF AN INTERSECTION PER STANDARD DRAWING 235. EXACT LOCATION OF RAMPS MAY BE ADJUSTED IN THE FIELD BY A CITY INSPECTOR.

11. CONTRACTOR SHALL PROVIDE ALL NECESSARY HORIZONTAL AND VERTICAL TRANSITIONS BETWEEN NEW CONSTRUCTION AND EXISTING SURFACES TO PROVIDE FOR PROPER DRAINAGE AND FOR INGRESS AND EGRESS TO NEW CONSTRUCTION. THE EXTENT OF THE TRANSITIONS TO BE AS SHOWN ON PLANS.

12. ALL GRADING WORK SHALL CONFORM TO THE SOILS REPORT AS PREPARED BY THE (COMPANY , REPORT #, DATE) APPROVED BY THE CITY ENGINEER, AND AS SHOWN ON THESE PLANS.

13. EXACT LOCATION OF ALL SAWCUT LINES MAY BE ADJUSTED OR DETERMINED IN THE FIELD BY A CITY OF LAS VEGAS ENGINEER IF LOCATION ON PLANS IS NOT CLEARLY SHOWN, OR EXISTING PAVEMENT CONDITION REQUIRES RELOCATIONS.

14. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONS NECESSARY TO PROTECT EXISTING PERMANENT SURVEY MONUMENTS. ANY MONUMENTS DISTURBED SHALL BE REPLACED AND ADJUSTED PER AVAILABLE RECORDS IN ACCORDANCE WITH N.R.S. STATUTE NO. 625.380 & CITY OF LAS VEGAS TITLE 18, APPENDIX D.

15. UTILITY COMPANY METER BOXES, MANHOLE LIDS, VALVE COVERS, ETC., SHALL BE LOCATED OUT OF DRIVEWAYS, DRIVEWAY APRONS, FLOWLINES, AND CROSS GUTTERS UNLESS WRITTEN APPROVAL IS GRANTED BY THE UTILITY COMPANY AND THE CITY ENGINEER.

WALL NOTES:

16. ALL WALLS, NEW OR EXISTING, ARE ONLY SHOWN ON CIVIL PLANS FOR THE PURPOSE OF REVIEWING GRADING RELATIONSHIPS; FLOOD CONTROL AND SIGHT DISTANCE AT INTERSECTIONS. NEW WALLS REQUIRE A SEPARATE PERMIT AND INSPECTION BY THE BUILDING DEPARTMENT.

17. ASPHALT MIX DESIGN MUST BE SUBMITTED AND APPROVED BY THE CITY ENGINEER PRIOR TO THE PLACEMENT OF ASPHALT WITHIN CITY RIGHT OF WAY.

18. CONTRACTOR SHALL ADJUST ALL NEW AND EXISTING INLETS, VALVE BOXES, MANHOLE RIMS, AND SEWER CLEAN OUTS, ETC. TO FINISH GRADE AS APPLICABLE WHETHER OR NOT THEY ARE SHOWN ON THE PLANS.

19. MATERIALS, HANDLING AND PLACEMENT OF PORTLAND CEMENT CONCRETE SHALL BE IN ACCORDANCE WITH APPLICABLE SECTIONS OF NDOT OR THE CLARK COUNTY AREA SPECIFICATIONS (AS APPLICABLE) AND THE PLANS AND DETAILS SHOWN HEREON.

20. WHEN INSTALLING UNDERGROUND FACILITIES THAT REQUIRE UNDERGROUND LOCATING DEVICES SUCH AS MARKER BALLS, LOCATING RIBBON, ETC, THE CONTRACTOR SHALL PROVIDE WRITTEN DOCUMENTATION TO OFFSITE INSPECTION AND TESTING CERTIFYING THAT ALL DEVICES HAVE BEEN PLACED AND VERIFIED TO BE IN GOOD WORKING CONDITION PRIOR TO THE CONSTRUCTION OF ANY ROAD BASE.

21. SANITARY SEWER AND STORM DRAIN FINAL LOCATION MAP(S) SHALL BE PROVIDED TO THE CITY AND APPROVED PRIOR TO ACCEPTANCE OF FACILITY VIDEO INSPECTION. THE MAP(S) SHALL INCLUDE THE HORIZONTAL AND VERTICAL (INVERT) LOCATION OF PUBLIC SEWER MANHOLES, STORM DRAIN MANHOLES AND TRANSITION STRUCTURES, STORM DRAIN LATERALS AT THE CONNECTION TO THE STORM DRAIN MAIN AND AT THE CONNECTION TO A DROP INLET, THE CONNECTION OF SEWER SERVICE LATERALS TO THE SEWER MAIN AND WHERE THE SEWER SERVICE LATERALS EXIT THE PUBLIC RIGHT-OF-WAY, AND STORM DRAIN MAIN ALIGNMENT, INCLUDING DEFLECTION POINTS. THE LOCATION SHALL BE DESCRIBED BY COORDINATES WHICH SHALL BE BASED ON THE OFFICIAL HORIZONTAL AND VERTICAL CONTROL NETWORKS OF THE CITY OF LAS VEGAS. FINAL LOCATION MAPS MUST BE SEALED AND CERTIFIED BY A NEVADA PROFESSIONAL LAND SURVEYOR TO HAVE POSITIONAL CERTAINTIES OF ± 0.09 METERS (± 0.3 FEET) HORIZONTALLY AND VERTICALLY. A SEPARATE ELECTRONIC COMMA DELIMITED FILE FOR THE SANITARY SEWER AND STORM DRAIN COORDINATES SHALL ALSO ACCOMPANY THE SANITARY SEWER AND STORM DRAIN FINAL LOCATION MAP(S).

OR

SANITARY SEWER AND STORM DRAIN FACILITIES SHOWN ON THESE PLANS SHALL BE USED TO MEET THE REQUIREMENTS OF NRS 455 AND SHALL SHOW AT A MINIMUM THE HORIZONTAL AND VERTICAL (INVERT) LOCATION OF PUBLIC SEWER MANHOLES, STORM DRAIN MANHOLES, STORM DRAIN LATERALS AT THE CONNECTION TO THE STORM DRAIN MAIN AND AT THE CONNECTION TO A DROP INLET, AND THE CONNECTION OF SEWER SERVICE LATERALS TO THE SEWER MAIN AND WHERE THE SEWER SERVICE LATERALS EXIT THE PUBLIC RIGHT-OF-WAY. ANY DEVIATIONS FROM THE INFORMATION SHOWN SHALL BE NOTED AND SUBMITTED AS A REVISION TO THE PLANS AND APPROVED PRIOR TO ACCEPTANCE OF FACILITY VIDEO INSPECTION.

22. CCTV VIDEO INSPECTION IS REQUIRED FOR ALL SEWER AND STORM DRAINS. THE CCTV VIDEO INSPECTIONS NEED TO BE PERFORMED PER THE DESIGN AND CONSTRUCTION STANDARDS FOR WASTEWATER COLLECTION SYSTEMS LATEST EDITION.

23. A SEPARATE BORING PERMIT IS REQUIRED FOR ALL BORING ACTIVITIES.

CITY OF LAS VEGAS GRADING NOTES

1. IN THE EVENT THAT ANY UNFORESEEN CONDITIONS NOT COVERED BY THESE NOTES ARE ENCOUNTERED DURING GRADING OPERATIONS, THE OWNER/ENGINEER SHALL BE IMMEDIATELY NOTIFIED FOR DIRECTION.

2. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO PERFORM ALL NECESSARY CUTS AND FILLS WITHIN THE LIMITS OF THIS PROJECT AND THE RELATED OFF-SITE WORK, SO AS TO GENERATE THE DESIRED SUBGRADE, FINISH GRADES AND SLOPES SHOWN.

3. CONTRACTOR SHALL TAKE FULL RESPONSIBILITY FOR ALL EXCAVATION. ADEQUATE SHORING SHALL BE DESIGNED AND PROVIDED BY THE CONTRACTOR TO PREVENT UNDERMINING OF ANY ADJACENT FEATURES OR FACILITIES AND/OR CAVING OF THE EXCAVATION.

4. THE CONTRACTOR IS WARNED THAT AN EARTHWORK BALANCE WAS NOT NECESSARILY THE INTENT OF THIS PROJECT. ANY ADDITIONAL MATERIAL REQUIRED OR LEFTOVER MATERIAL FOLLOWING EARTHWORK OPERATIONS BECOMES THE RESPONSIBILITY OF THE CONTRACTOR.

5. THE GRADING CONTRACTOR IS RESPONSIBLE TO COORDINATE WITH THE OWNER TO PROVIDE FOR THE REQUIREMENTS OF THE PROJECT STORM WATER POLLUTION PREVENTION PLAN (SWPPP) AND ASSOCIATED PERMIT.

6. CONTRACTOR SHALL GRADE TO THE LINES AND ELEVATIONS SHOWN ON THE PLANS WITHIN THE FOLLOWING HORIZONTAL AND VERTICAL TOLERANCES AND DEGREES OF COMPACTION, IN THE AREAS INDICATED:

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

COMPACTION TESTING WILL BE PERFORMED BY THE OWNER OR HIS REPRESENTATIVE.

7. ALL CUT AND FILL SLOPES SHALL BE PROTECTED UNTIL EFFECTIVE EROSION CONTROL HAS BEEN ESTABLISHED.

8. THE USE OF POTABLE WATER WITHOUT A SPECIAL PERMIT FOR BUILDING OR CONSTRUCTION PURPOSES INCLUDING CONSOLIDATION OF BACKFILL OR DUST CONTROL IS PROHIBITED. THE CONTRACTOR SHALL OBTAIN ALL NECESSARY PERMITS FOR CONSTRUCTION WATER.

9. THE CONTRACTOR SHALL MAINTAIN THE STREETS, SIDEWALKS AND ALL OTHER PUBLIC RIGHT-OF-WAY IN A CLEAN, SAFE AND USABLE CONDITION. ALL SPILLS OF SOIL, ROCK OR CONSTRUCTION DEBRIS SHALL BE PROMPTLY REMOVED FROM THE PUBLICLY OWNED PROPERTY DURING CONSTRUCTION AND UPON COMPLETION OF THE PROJECT. ALL ADJACENT PROPERTY, PRIVATE OR PUBLIC SHALL BE MAINTAINED IN A CLEAN, SAFE AND USABLE CONDITION.

10. IN THE EVENT THAT ANY TEMPORARY CONSTRUCTION ITEM IS REQUIRED THAT IS NOT SHOWN ON THESE DRAWINGS, THE OWNER AGREES TO PROVIDE AND INSTALL SUCH ITEM AT HIS OWN EXPENSE AND AT THE DIRECTION OF THE CITY ENGINEER. TEMPORARY CONSTRUCTION INCLUDES DITCHES, BERMS, ROAD SIGNS AND BARRICADES, ETC.

CITY OF LAS VEAGS TRAFFIC NOTES

1. ALL CONSTRUCTION SIGNING, BARRICADING, AND TRAFFIC DELINEATION SHALL CONFORM TO THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES", LATEST EDITION.

2. THE STREET SIGN CONTRACTOR SHALL OBTAIN STREET NAMES AND BLOCK NUMBERING FROM THE PLANNING DEPARTMENT PRIOR TO CONSTRUCTION.

3. BEFORE ANY WORK IS STARTED IN THE RIGHT-OF-WAY, THE CONTRACTOR SHALL INSTALL ALL ADVANCE WARNING SIGNS FOR THE CONSTRUCTION ZONE. THE CONTRACTOR SHALL INSTALL TEMPORARY STOP SIGNS AT ALL NEW STREET ENCROACHMENTS INTO EXISTING CITY STREETS WHERE WARRANTED IMMEDIATELY AFTER FIRST GRADING WORK IS ACCOMPLISHED, AND SHALL MAINTAIN SAID SIGNS UNTIL PERMANENT SIGNS ARE INSTALLED.

4. WHEN A DESIGNATED "SAFE ROUTE TO SCHOOL" IS ENCROACHED UPON BY A CONSTRUCTION WORK ZONE AND PUBLIC WORKS STAFF IDENTIFIES A NEED FOR STUDENTS TO BE ASSISTED IN THE SAFE CROSSING THROUGH THAT WORK ZONE, THE CONTRACTOR SHALL BE REQUIRED TO PROVIDE A QUALIFIED "CROSSING GUARD". THE GUARD SHALL BE PRESENT FOR THE FULL DURATION OF TIME THAT CHILDREN ARE LIKELY TO BE PRESENT.

5. IF THE IMPROVEMENTS NECESSITATE THE OBLITERATION, TEMPORARY OBSTRUCTION, TEMPORARY REMOVAL OR RELOCATION OF ANY EXISTING TRAFFIC PAVEMENT MARKING, SUCH PAVEMENT MARKING SHALL BE RESTORED OR REPLACED WITH LIKE MATERIALS TO THE SATISFACTION OF THE CITY TRAFFIC ENGINEER.

6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING AND INSTALLING ALL PERMANENT SIGNS SHOWN ON THE PLANS. ALL NEW TRAFFIC SIGNS SHALL BE FABRICATED WITH DIAMOND GRADE VIP CLASS 6 REFLECTIVE SHEETING OR APPROVED EQUAL. ALL NEW TRAFFIC SIGNS, EXCEPT STREETNAME AND SCHOOL SPEED LIMIT SIGNS, SHALL HAVE 3M SERIES 1160 OR APPROVED EQUIVALENT ANTI-GRAFFITI PROTECTIVE OVERLAY FILM; SCHOOL ZONE SIGNS SHALL HAVE 3M SERIES 1150 ANTI-GRAFFITI PROTECTIVE OVERLAY FILM. STREET NAME SIGNS SHALL CONFORM IN THEIR ENTIRETY TO CURRENT CITY STANDARDS. ALL OTHER SIGNS SHALL BE STANDARD SIZE UNLESS OTHERWISE SPECIFIED ON THE PLANS. ALL SIGN POSTS SHALL BE INSTALLED IN ACCORDANCE WITH THE CURRENT CITY STANDARDS.

7. WHEN A PROPOSED STREET LIGHT STANDARD IS LOCATED WITHIN FIVE (5') FEET OF ANY PROPOSED SIGN SHOWN ON THE PLANS TO BE MOUNTED ON A SIGNPOST, THE SIGN SHALL BE MOUNTED ON THE STREET LIGHT STANDARD AND THE SIGNPOST SHALL BE ELIMINATED.

8. ALL PERMANENT TRAFFIC CONTROL DEVICES CALLED FOR HEREON SHALL BE IN PLACE AND IN FINAL POSITION PRIOR TO ALLOWING ANY PUBLIC TRAFFIC ONTO THE PORTIONS OF THE ROAD(S) BEING IMPROVED HERE UNDER, REGARDLESS OF THE STATUS OF COMPLETION OF PAVING OR OTHER OFF-SITE IMPROVEMENTS CALLED FOR BY THESE PLANS.

9. STREET SIGNS AND STOPS SIGNS SHALL BE INSTALLED PER CITY STANDARD SPECIFICATIONS FOR PLACEMENT OF STREET NAME SIGNS.

10. THE CONTRACTOR SHALL PROVIDE ALL NECESSARY TRAFFIC CONTROL DEVICES AND FLAGGERS TO INSURE THE SAFETY OF THE PUBLIC IN OR AROUND THE WORK AREA. THE CONTRACTOR SHALL HAVE A CERTIFIED ATSSA TRAFFIC CONTROL TECHNICIAN OR IMSA WORK ZONE SAFETY SPECIALIST SET UP, MAINTAIN AND/OR REMOVE ALL TRAFFIC CONTROL DEVICES IN THE CITY OF LAS VEGAS RIGHT OF WAY.

11. WORK IN PUBLIC STREETS, ONCE BEGUN, SHALL BE EXPEDITED TO COMPLETION SO AS TO PROVIDE MINIMUM INCONVENIENCE TO ADJACENT PROPERTY OWNERS AND TO THE TRAVELING PUBLIC.

12. THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING CITIZENS AREA TRANSIT (C.A.T.) IF THE CONSTRUCTION INTERRUPTS OR RELOCATES A BUS STOP OR HAS AN ADVERSE EFFECT ON BUS SERVICE ON THAT STREET TO ARRANGE FOR TEMPORARY RELOCATION OF STOP.

13. GUARDS SHALL BE OBTAINED BY CONTACTING THE METROPOLITAN POLICE DEPARTMENT SPECIAL EVENTS UNIT (PHONE # 828-3442) WHO WILL PROVIDE OFFICERS PROPERLY TRAINED IN TRAFFIC CONTROL. FEES FOR THE USE OF THESE OFFICERS SHALL BE SET BY METRO AND WILL BE PAID BY THE CONTRACTOR. THE CONTRACTOR IS RESPONSIBLE FOR ALL ARRANGEMENTS WITH METRO.

14. ANY WORK WITHIN 300' OF A SIGNALIZED INTERSECTION WILL BE NIGHT WORK, UNLESS OTHERWISE DIRECTED BY THE CITY OF LAS VEGAS TRAFFIC ENGINEER.

15. THE CONTRACTOR SHALL CONTACT THE TRAFFIC ENGINEERING DIVISION (TRANSPORTATION SECTION) THROUGH THE PROJECT'S OFFSITE INSPECTOR PRIOR TO INITIATING PAVING TO RECEIVE DIRECTION FOR ANY PERMANENT OR TEMPORARY MODIFICATIONS TO THE APPROVED DRAWINGS REGARDING FINAL PAVEMENT TRANSITIONS, MARKINGS AND SIGNING THAT ARE REQUIRED TO MATCH ADJACENT ROADWAY SEGMENTS. THE CONTRACTOR SHALL PROVIDE A DRAWING FOR APPROVAL BY THE TRAFFIC ENGINEERING DIVISION DEPICTING ANY ADJUSTMENTS TO THE FINAL PAVEMENT MARKINGS AND SIGNAGE, WHICH MAY INCLUDE OMITTING, ADDING OR MODIFYING PAVEMENT MARKINGS AND TRAFFIC CONTROL SIGNS SUCH THAT ADEQUATE TRANSITIONS AND LANE TERMINATIONS BETWEEN ADJACENT ROADWAY SEGMENTS ARE CONSTRUCTED

CITY OF LAS VEGAS STREETLIGHT NOTES

1. ALL STREET LIGHTING INSTALLATIONS SHALL BE IN ACCORDANCE WITH THE STREET LIGHTING PLANS, THE "UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION OFF-SITE IMPROVEMENTS, CLARK COUNTY AREA, NEVADA", LATEST REVISION, AND THE "UNIFORM STANDARD DRAWINGS FOR PUBLIC WORKS CONSTRUCTION OFF-SITE IMPROVEMENTS, CLARK COUNTY AREA, NEVADA", LATEST REVISION, AND ANY ADOPTED SPECIAL AREA STANDARDS.

2. NO DEVIATION OF STREET LIGHT, PULL BOX, CONDUITS (ETC.) LOCATIONS SHALL BE PERMITTED WITHOUT WRITTEN APPROVAL OF TRAFFIC ENGINEERING AND THE CITY ENGINEER.

3. ALL EXISTING STREET LIGHTING SHALL REMAIN OPERATIONAL DURING CONSTRUCTION.

4. ALL STREET LIGHTING CONDUITS STUB SHALL HAVE AT LEAST ONE GREEN #8 THW WIRE INSTALLED, AS TRACER WIRE. WHEN "EMPTY" CONDUIT IS COMPLETELY INSTALLED FROM PB TO PB, IT SHALL HAVE MINIMUM OF 2 #4 AND 1 #8 THW WIRE WITH THE ENDS TAPED OR "SAFE OFF" PRIOR TO FINAL INSPECTION.

5. ANY STRUCTURE SUCH AS BLOCK WALLS, CHAIN LINK FENCES, RETAINING WALLS, ETC., SHALL LEAVE A MINIMUM CLEARANCE IN ACCORDANCE WITH THE USD NO. 320A.

6. AS-BUILT DRAWINGS SHALL BE SUPPLIED TO THE TEFO PRIOR TO ANY PRE-FINAL INSPECTION. THE AS- BUILT DRAWING NEEDS TO BE STAMPED AS-BUILT AND SIGNED BY THE PREPARER.

7. SERVICE POINT SHALL BE COORDINATED WITH NV ENERGY COMPANY, AND WHEREVER POSSIBLE, BE LOCATED NEAR THE CENTER OF THE CIRCUIT. SERVICE POINTS SHALL BE SHOWN ON THE CIVIL PLANS.

8. IT SHALL BE ASSUMED THAT IN THE ABSENCE OF AN EXISTING, WORKABLE CIRCUIT TO ATTACH TO, ALL INSTALLATIONS SHALL REQUIRE A NEW SERVICE FOR OPERATION OF THE CIRCUIT.

9. WHEREVER THERE IS AN OVERHEAD UTILITY THAT MAY CONFLICT WITH THE INSTALLATION OF STREET LIGHTING CIRCUITS AND/OR POLES, THESE CONFLICTS MUST BE RESOLVED BETWEEN THE DEVELOPER AND THE UTILITIES INVOLVED, AT NO EXPENSE TO THE CITY OF LAS VEGAS, BEFORE STREETLIGHT BASES ARE INSTALLED.

10. THE CONTRACTOR SHALL FURNISH COMPLETE SERVICE TO TRANSFORMERS AND CONTROL SYSTEMS IF REQUIRED ON PLANS.

11. THE DEVELOPER/OWNER WILL BE REQUIRED TO SUPPLY POWER TO ALL NEW PUBLIC STREET LIGHTS INSTALLED UNDER THIS DESIGN, PRIOR TO BOND RELEASE OR PROJECT COMPLETION. THE DEVELOPER/OWNER WILL BE RESPONSIBLE FOR ALL ITEMS ASSOCIATED WITH THE INSTALLATION, CONSTRUCTION, ENERGIZING, MAINTENANCE AND OPERATIONAL COST OF SAID STREET LIGHTS PRIOR TO PROJECT COMPLETION. REFER TO THE PLAN FOR ANY NEW SERVICE REQUIREMENTS. THE TRANSFER OF OWNERSHIP FROM THE DEVELOPER/OWNER TO THE CITY OF LAS VEGAS FOR ALL NEW PUBLIC STREET LIGHT/S AND/OR SERVICE/S INSTALLED UNDER THIS PLAN DESIGN WILL BE IN CONJUNCTION WITH THIS PROJECT COMPLETION. COORDINATE ALL MAINTENANCE AND OPERATIONAL TRANSFERS WITH THE CITY OF LAS VEGAS TRAFFIC ENGINEERING DEPARTMENT (TEFO) AT (702) 229-6331.

STORMWATER MANAGEMENT NOTES

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

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

3. TEMPORARY OR PERMANENT STABILIZATION PRACTICES WILL BE INSTALLED ON DISTURBED AREAS AS SOON AS PRACTICABLE AND NO LATER THAN 14 DAYS AFTER THE CONSTRUCTION ACTIVITY IN THAT PORTION OF THE SITE HAS TEMPORARILY OR PERMANENTLY CEASED. SOME EXCEPTIONS MAY APPLY, REFER TO THE NEVADA STORMWATER GENERAL PERMIT FOR CONSTRUCTION ACTIVITY NVR 100000, SECTION III.A.5.

4. AT A MINIMUM, THE CONSTRACTOR OR HIS AGENT SHALL INSPECT ALL DISTURBED AREAS, AREAS USED FOR STORAGE OF MATERIALS AND EQUIPMENT THAT ARE EXPOSED TO PRECIPITATION, VEHICLE ENTRANCE AND EXIT LOCATIONS AND ALL BMPS WEEKLY, AND WITHIN 24 HOURS AFTER A RAIN EVENT OF 0.5 INCHES OR MORE. THE CONTRACTOR OR HIS AGENT SHALL UPDATE OR MODIFY THE STORMWATER POLLUTION PREVENTION PLAN AS NECESSARY. SOME EXCEPTIONS TO WEEKLY INSPECTIONS MAY APPLY, SUCH AS SUSPENSION OF LAND DISTURBANCE ACTIVITIES. REFER TO THE NEVADA STORMWATER GENERAL PERMIT FOR CONSTRUCTION ACTIVITY NVR 100000, SECTION III.A.12.

5. ACCUMULATED SEDIMENT IN BMPS SHALL BE REMOVED WITHIN SEVEN DAYS AFTER A STORMWATER RUNOFF EVENT OR PRIOR TO THE NEXT ANTICIPATED STORM EVENT, WHICHEVER IS EARLIER. SEDIMENT MUST BE REMOVED WHEN BMP CAPACITY HAS BEEN REDUCED BY 50 PERCENT OR MORE.

SOUTHERN NEVADA - SOUTHWEST GAS CORPORATION GENERAL NOTES

1. IN THE EVENT OF A NATURAL GAS EMERGENCIES CALL 911 AND 1-877-860-6020.

2. THERE SHALL BE A MINIMUM HORIZONTAL AND VERTICAL CLEARANCE OF 12-INCHES BETWEEN NATURAL GAS FACILITIES AND ANY UNDERGROUND FACILITIES AND/OR STRUCTURES, INCLUDING BUT NOT LIMITED TO WATER, SEWER, STORM DRAIN, COMMUNICATIONS, AND ELECTRIC.

3. FOR VALVE ADJUSTMENT CONTACT 702-668-6107 48 HOURS PRIOR TO CONSTRUCTION.

4. IN THE EVENT OF A NATURAL GAS CONFLICT WITH PROPOSED UTILITIES AND/OR STRUCTURES CONTACT 702-365-2099.

5. FOR STAND BY CONTACT 702-400-1789

CITY OF LAS VEGAS FIRE PREVENTION NOTES

1. ALL WORK SHALL BE DONE IN STRICT ACCORDANCE WITH THE LAS VEGAS FIRE AND RESCUE ADOPTED FIRE CODE ORDINANCE # 6325 FOR HYDRANT SPECIFICATIONS AND HYDRANT INSTALLATION SPECIFICATIONS.

2. ONLY FIRE HYDRANTS THAT ARE ON THE LAS VEGAS VALLEY WATER DISTRICT'S - **APPROVED PRODUCTS LIST** ARE ALLOWED TO BE INSTALLED.

3. A PERMIT IS REQUIRED FROM LAS VEGAS FIRE AND RESCUE FOR THE INSTALLATION OF ON-SITE WATER LINES AND FIRE HYDRANTS. THE PERMIT AND CONTRACTORS MATERIAL TEST CERTIFICATE FOR UNDERGROUND PIPING FORM SHALL BE OBTAINED FROM THE FIRE PROTECTION ENGINEER *BEFORE* COMMENCEMENT OF WORK. [IFC § 105.7.12]

4. ON ANY RESIDENTIAL OR COMMERCIAL INSTALLATIONS, FIRE HYDRANTS SHALL BE INSTALLED AND FIRE APPARATUS ACCESS ROADS SHALL BE MAINTAINED *BEFORE* COMMENCEMENT OF ANY COMBUSTIBLE CONSTRUCTION. ALL FIRE HYDRANTS SHALL BE IN GOOD WORKING ORDE AND SHALL BE CAPABLE OF DELIVERING THE REQUIRED FIRE FLOW. [IFC § 3310, § 3312]

5. TO IDENTIFY THE FIRE HYDRANT LOCATIONS, THE CONTRACTOR SHALL PLACE A BLUE REFLECTIVE MARKER AT THE CENTER LINE OF THE STREET ADJACENT TO THE FIRE HYDRANTS. [IFC § 507.5.7.3]

6. ALL UNDERGROUND INSPECTIONS, PRESSURE AND FLUSH VERIFICATIONS OF ALL FIRE HYDRANTS AND FIRE LINES, SHALL BE CONDUCTED
BEFORE COVERING THE LINES. CENTER LOADING IS ACCEPTABLE FOR THE HYDRO TESTS WITH PRIOR FIRE PREVENTION APPROVAL. [IFC § 106.3]

7. ALL ON-SITE UNDERGROUND WATER MAINS AND MATERIALS SHALL BE U.L. LISTED, A.W.W.A APPROVED AND SHALL BE RATED FOR THE APPROPRIATE WORKING PRESSURE. [IFC § 507.2.1, NFPA 24]

8. PAINTING OF CURBS, FIRE HYDRANTS, PADS, PROTECTION OF FIRE HYDRANTS FROM PHYSICAL DAMAGE, AND ALL OTHER WORK NECESSARY PER PLANS SHALL BE COMPLETED BEFORE APPROVAL BY LAS VEGAS FIRE AND RESCUE, FIRE PREVENTION DIVISION. [IFC § 507]

9. PRIVATE HYDRANTS SHALL BE PAINTED RED. [IFC § 507.5.7.1]

10. PRIOR TO THE FINAL OCCUPANCY ,A FIRE FLOW TEST SHALL BE WITNESSED BY LAS VEGAS FIRE AND RESCUE, FIRE PREVENTION DIVISION TO VERIFY AVAILABILITY OF THE REQUIRED FIRE FLOW. [IFC § 507]

11. FIRE HYDRANT SPACING SHALL BE AS FOLLOWS: [IFC § C102]
- RESIDENTIAL - 500 FT UNSPRINKLERED; 600 FT SPRINKLERED.
- COMMERCIAL - 300 FT UNSPRINKLERED; 400 FT SPRINKLERED.

12. WHERE THE WATER MAINS ARE EXTENDED ALONG STREETS OR NEW STREETS ARE INSTALLED WHERE FIRE HYDRANTS ARE NOT NEEDED FOR PROTECTION OF THE STRUCTURES, FIRE HYDRANTS SHALL BE INSTALLED AT A MAXIMUM OF 1000 FT SPACING, TO PROVIDE FOR TRANSPORTATION HAZARDS. WHERE STREETS ARE PROVIDED WITH MEDIAN DIVIDERS OR HAVE FOUR (4) OR MORE TRAFFIC LANES AND HAVE A TRAFFIC COUNT OF MORE THAN 30,000 PER DAY, HYDRANTS ARE REQUIRED ON EACH SIDE OF THE STREET SPACED AT 500 FT ON AN ALTERNATING BASIS. [IFC § C102.8]

13. NO FIRE HYDRANTS SHALL BE LOCATED WITHIN THE RADIUS OF A CUL-DE-SAC OR WITHIN 20 FT OF THE PERIMETER OF THE RADIUS OF THE CUL-DE-SAC.

14. NO FIRE HYDRANTS SHALL BE LOCATED WITHIN 6 FT OF ANY CURB RETURN, DRIVEWAY, POWER POLE, STREETLIGHT OR ANY OTHER OBSTRUCTION. [IFC § C102.12]

15. A MAXIMUM DISTANCE FROM A FIRE HYDRANT TO A ONE-TWO FAMILY DWELLING SHALL NOT EXCEED 300 FT, AS MEASURED BY AN APPROVED ROUTE. [IFC § C102.4]

16. THE MAXIMUM DISTANCE FROM A FIRE HYDRANT TO A FIRE DEPARTMENT CONNECTION (FDC) SHALL NOT EXCEED 100 FT, AS MEASURED BY AN APPROVED ROUTE. [IFC § C102.7]

17. THE MAXIMUM DISTANCE FROM A HYDRANT TO THE END OF A DEAD-END STREET SHALL NOT EXCEED 200 FT. [IFC § C102.6]

18. TWO (2) SOURCES OF SUPPLY ARE REQUIRED WHENEVER THERE IS 4 OR MORE FIRE HYDRANTS/SPRINKLER LEAD-INS ARE INSTALLED ON A SINGLE SYSTEM. SECTIONAL CONTROL VALVES SHALL BE INSTALLED SO THAT NO MORE THAN 2 FIRE HYDRANTS CAN BE OUT OF SERVICE DUE TO A BREAK IN A WATER MAIN. [IFC § C104]

19. ALL FIRE APPARATUS ACCESS ROADS SHALL BE PAVED TO PROVIDE ALL-WEATHER DRIVING CAPABILITIES, AND SHALL BE DESIGNED AND MAINTAINED TO SUPPORT THE IMPOSED LOADS OF THE FIRE APPARATUS. [IFC § 503.2.3]

20. THE GRADIENT FOR THE FIRE APPARATUS ACCESS ROADS SHALL NOT EXCEED 12%. ANGLES OF APPROACH AND ANGLES OF DEPARTURE SHALL NOT EXCEED 6% FOR 25 FT PRIOR TO OR AFTER THE GRADE CHANGE. ADJACENT TO THE STRUCTURES GRADIENT S

SEWER

EXISTING	PROPOSED
UNKNOWN	ss
4" ss	4" SS
6" ss	6" SS
8" ss	8" SS
10" ss	10" SS
12" ss	12" SS
LATERAL	

POWER

EXISTING		PROPOSED
	OVERHEAD	OH OH OH
ABC ABC	3-PHASE	ABC ABC ABC
AB AB	2-PHASE (AB)	AB AB AB
AC AC	2-PHASE (AC)	AC AC AC
BC BC	2-PHASE (BC)	BC BC BC
A A A	1-PHASE (A)	A A A
B B B	1-PHASE (B)	B B B
C C C	1-PHASE (C)	C C C

HATCH PATTERNS

- BUILDING / PAD
- CONCRETE SIDEWALK / FLATWORK
- LANDSCAPE AREAS / GRASS
- ADA ACCESS RAMP TRUNCATED DOMES
- RIPRAP
- 3" ASPHALT PAVEMENT OVER 6" TYPE II BASE (ONSITE)
- SIGHT VISIBILITY ZONE

STANDARD SYMBOLS

EXISTING		PROPOSED
s	SEWER MANHOLE	S
sd	STORM DRAIN MANHOLE	SD
w	WATER MANHOLE	W
e	ELECTRICAL MANHOLE	E
t	TELEPHONE MANHOLE	T
fo	FIBER OPTIC MANHOLE	FO
ir	IRRIGATION MANHOLE	IR
g	GAS MANHOLE	G
tv	CABLE TV MANHOLE	TV
	STORM DRAIN CATCH BASIN	
ir	IRRIGATION BOX	IR
jb	ELECTRICAL JUNCTION BOX	JB
e	ELECTRICAL BOX	E
t	TELEPHONE BOX	T
tv	CABLE TV BOX	TV
fo	FIBER OPTIC BOX	FO
w	WATER METER	
g	GAS METER	G
	GATE VALVE	
	BUTTERFLY VALVE	
	PRESSURE REDUCING VALVE	
	FIRE HYDRANT	
PIV	POST INDICATOR VALVE	PIV
pp	ELECTRICAL POWER POLE	PP
	STREET LIGHT	
	SIGN (SINGLE POLE)	
	SIGN (2 POLE)	
	SIGN (3 POLE)	

ABBREVIATIONS

Aban	- Abandon
AIP	- Abandoned in Place
Agg	- Aggregate
Alt	- Alternate
A	- Anode, Gas
ACP	- Asbestos Cement Pipe
AC	- Asphaltic Concrete
Ave	- Avenue
BC	- Back of Curb
BCR	- Back of Curb Radius
BVC	- Beginning of Vertical Curve
BM	- Bench Mark
Bdry Line	- Boundary Line
CATV	- Cable Television
C-C	- Center to Center
℄	- Centerline
CBC	- City of Boulder City
CLV	- City of Las Vegas
COH	- City of Henderson
CM	- City of Mesquite
CNLV	- City of North Las Vegas
CC	- Clark County
CCSD	- Clark County Sanitation District
CO	- Clean Out, Sewer
Comm	- Commercial
Conc, PCC	- Concrete
Const	- Construction or Construct
Cor	- Corner
CMP	- Corrugated Metal Pipe
CSAP	- Corrugated Steel Arch Pipe
CSP	- Corrugated Steel Pipe
C&G	- Curb and Gutter
CIP	- Cast Iron Pipe
Col	- Column
Cu Yd, CY	- Cubic Yard
Cu Ft, CF	- Cubic Feet
Culv	- Culvert
CF	- Curb Face
Dept	- Department
Dia	- Diameter
Dwy	- Driveway
DI	- Drop Inlet
Esmt	- Easement
E/o	- East of
EP	- Edge of Pavement
EO	- Edge of Oil
E	- Electric
EM	- Electric Meter
Elev	- Elevation
Embk	- Embankment
ECR	- End of Curb Return
EC	- End of Curve
EBS	- Cathode Protection Bond Station
ETS	- Cathode Protection Test Station
EVC	- End of Vertical Curve
Exist	- Existing
Ft	- Feet or Foot
FG	- Finish Grade
FA	- Fire Alarm
FH	- Fire Hydrant
℄	- Flow Line
Galv	- Galvanized
GM	- Gas Meter
GR	- Gas Pressure Regulator
PL-G	- Plastic Gas
S-G	- Steel Gas
GB	- Grade Break
Gut	- Gutter
Hdwl	- Headwall
In	- Inch
INT	- Intersection
INV	- Invert
ISL	- Island
JB	- Junction Box
LOC	- Length of Curb
Lt	- Left
LF	- Linear Feet
LVVWD	- Las Vegas Valley Water District
MH	- Manhole
Max	- Maximum
Min	- Minimum
Mon	- Monolithic
N/o	- North of
NTS	- Not to Scale
OC	- On Center
OG	- Open-Graded Pavement, Original Ground
Pvmt	- Pavement
PI	- Point of Intersection
PRC	- Point of Reverse Curve
PC	- Point of Curve
PT	- Point of Tangency
PCC	- Point of Compound Curve
PCC, Conc	- Portland Cement Concrete
PP	- Power Pole
P	- Power
℄	- Property Line
Prop	- Proposed
PB	- Pull Box
RP	- Radius Point
R	- Radius
RR	- Railroad
Reinf	- Reinforced
RC	- Reinforced Concrete
RCB	- Reinforced Concrete Box
RCP	- Reinforced Concrete Pipe
Reloc	- Relocate
RT	- Right
R/W	- Right-of-way
RD	- Road
SS	- Sanitary Sewer
Sht	- Sheet
S/o	- South of
SW	- Sidewalk
SQ FT, SF	- Square foot
SQ YD, SY	- Square yard
Sta	- Station
SHP	- Steel Highpressure Pipe
SD	- Storm Drain
STD	- Standard
Struct	- Structural or Structure
Surv	- Survey
SL	- Streetlight
T	- Telephone
Temp	- Temporary
TBA	- To Be Adjusted
TBR	- To Be Removed
TC	- Top of Curb
TP	- Top of Pipe
TS	- Traffic Signal
TSI	- Traffic Signal Interconnect
Trans	- Transition
Typ	- Typical
UG	- Underground
Var	- Variable
Vert	- Vertical
VC	- Vertical Curve
VG	- Valley Gutter
VCP	- Vitrified Clay Pipe
W	- Water
WM	- Water Meter
W/o	- West of
Yd	- Yard

STORM DRAIN

EXISTING	PROPOSED
UNKNOWN	SD
10" sd	10" SD
12" sd	12" SD
15" sd	15" SD
18" sd	18" SD
24" sd	24" SD
30" sd	30" SD
36" sd	36" SD
LAND	

COMMUNICATIONS

EXISTING		PROPOSED
t	TELEPHONE	T
TV TV TV	TV	TV TV TV TV
fo	FIBER	FO
fo fo	FIBER	FO
bfo bfo	FIBER	BFO
ctv ctv	CABLE TV	BFO
com	COMM	COM

SURFACE FEATURES

- PROPERTY BOUNDARY
- RIGHT OF WAY LINE
- PARCEL LINE
- CURB & GUTTER
- EASEMENT LINE
- 4000 EXISTING MAJOR CONTOURS
- 4002 EXISTING MINOR CONTOURS
- 4000 MAJOR CONTOURS
- 4002 MINOR CONTOURS
- ROCK WALL
- PERIMETER/RETAINING WALL
- CONCRETE WALL
- CONSTRUCTION FENCE
- BARB WIRE FENCE
- CHAIN LINK FENCE
- WROUGHT IRON FENCE
- DECORATIVE FENCE
- EXISTING RAILROAD TRACKS
- EXISTING EDGE OF PAVEMENT
- EDGE OF PAVEMENT
- SAWCUT LINE
- CENTERLINE

CONSTRUCTION KEYNOTE TAGS

G1	OR	G9 GRADING PLAN
01	OR	35 SITE PLAN
36	OR	50 WATER
51	OR	65 SEWER
66	OR	80 STORM
81	OR	90 DOCUMENT REFERENCE
A	OR	Z STREETLIGHT / SIGNAGE

GAS

EXISTING		PROPOSED
2" g	GAS	2" G
HPG HPG	HIGH PRESS	HPG HPG HPG
	SERVICE "Y"	

WATER

EXISTING	PROPOSED
UNKNOWN	W
1" w	1" W
2" w	2" W
4" w	4" W
6" w	6" W
8" w	8" W
10" w	10" W
12" w	12" W
14" w	14" W

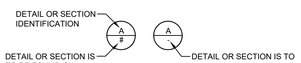
IRRIGATION

EXISTING	PROPOSED
UNKNOWN	IRR
1" irr	1" IRR
2" irr	2" IRR
4" irr	4" IRR
6" irr	6" IRR
8" irr	8" IRR

MISCELLANEOUS

EXISTING		PROPOSED
sig	SIGNAL	SIG

DETAIL REFERENCE



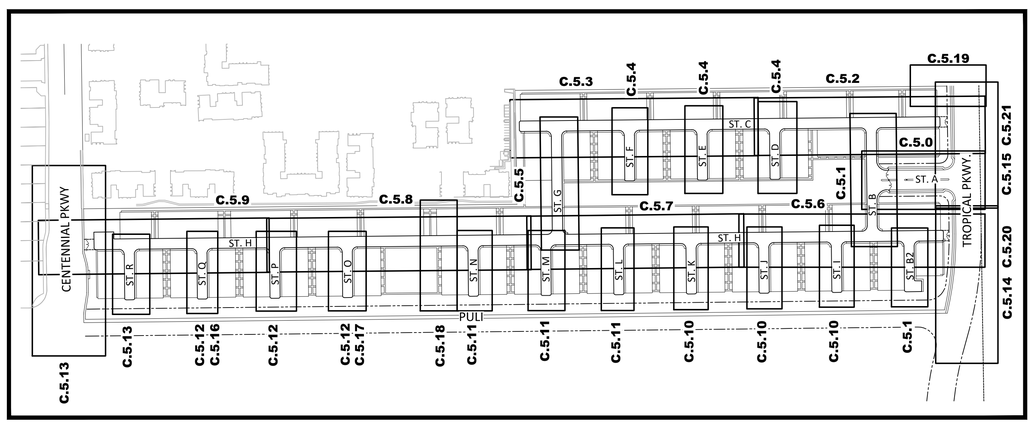
X CURVE DATA
A = XX°XX'XX"
R = XXX.XXX'
L = XXX.XXX'
T = XXX.XXX
P.I. STA. XX+X.XXX
N = XXXXX.XXXX
E = XXXXX.XXXX

NOTES:
1. XXXXX.
2. XXXXX.
3. XXXXX.

MATCHLINE STA XX+XX.XX
SEE PAGE X.X.X

X / - **DETAIL NAME**
SCALE: NTS

KEY MAP
N.T.S.



CALLOUTS

PAD= XX.XX
FF = XX.XX — PROPOSED BUILDING PAD ELEVATION / PROPOSED BUILDING FINISHED FLOOR ELEVATION

FF = — EXISTING BUILDING FINISHED FLOOR ELEVATION

XXX:85.00 — PROPOSED SPOT ELEVATION (@ TBC, TOA, TOC, FG, FL)

XXX:(85.00) — EXISTING SPOT ELEVATION (@ TBC, TOA, TOC, FG, FL)

APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES

PROJECT NO. _____ FIRST APPROVAL DATE: _____
LVVWD APPROVED FIRE FLOW 1500 GPM AT 20 PSI RESIDENTIAL

LVVWD APPROVAL IS VALID FOR ONE (1) YEAR FROM SIGNATURE DATE. IF CONSTRUCTION IS NOT STARTED, PLANS **MUST** BE RESUBMITTED FOR REVIEW AND APPROVAL.

HORROCKS ENGINEERS
1401 N. Green Valley Pkwy., Suite 160
Henderson, NV 89074
(702) 966-4063
www.horrocks.com

WARNING
IF THIS BAR DOES NOT MEASURE 2" THEN DRAWING IS NOT TO SCALE
0 1 2

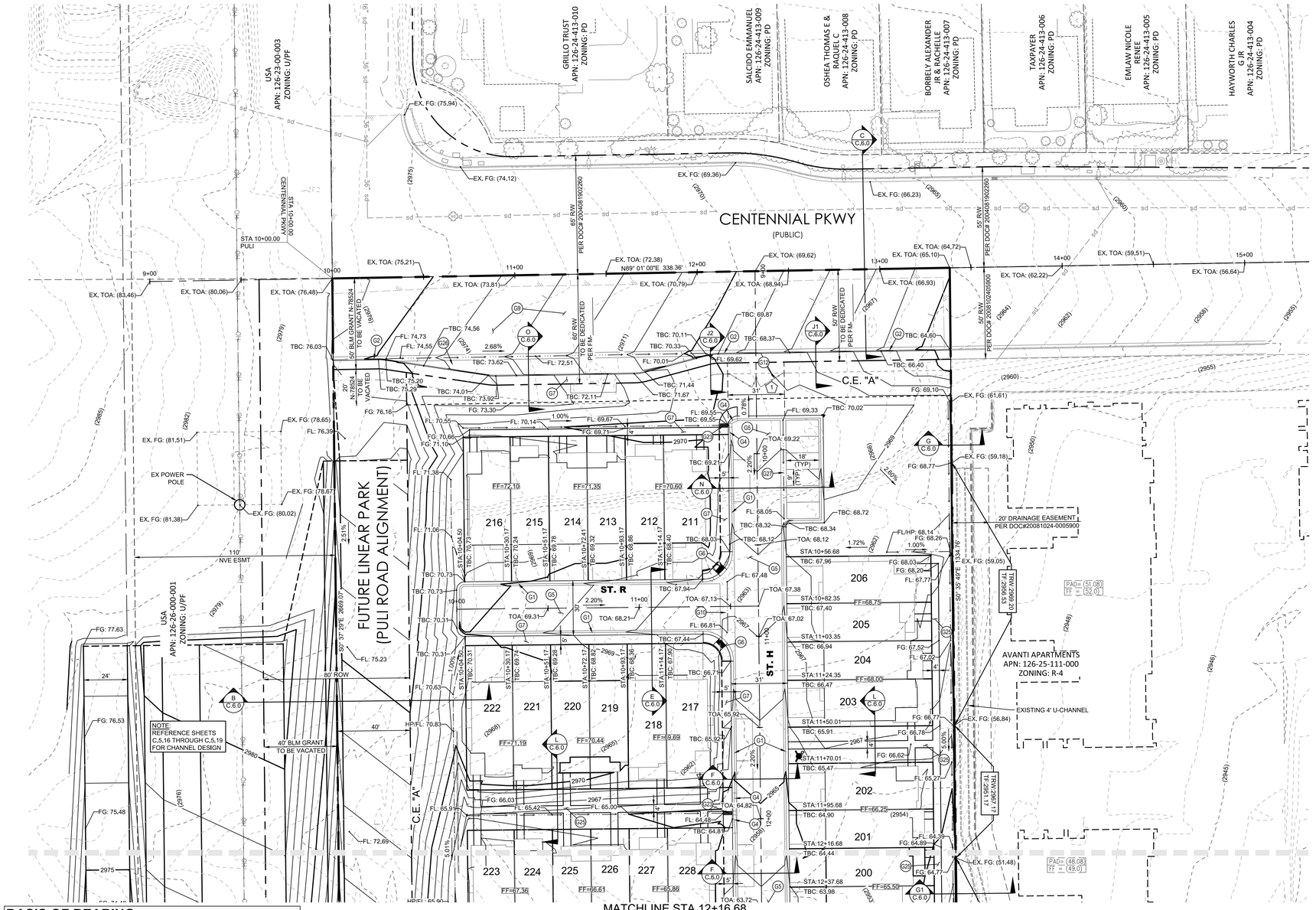
REVISIONS
REV # | DATE
*SEE GENERAL NOTES SHEET

DRAWING INFO
DATE 12/23/19
DESIGNED SS
DRAWN PMP
CHECKED AD
PROJECT NV-1949-1909

PROFESSIONAL ENGINEER—STATE OF NEVADA
LARRY M. BITTON
EXP. 12-31-20
CIVIL
No. 01159

CENTENNIAL HEIGHTS TOWNHOMES
CITY OF LAS VEGAS, NEVADA
LEGEND & ABBREVIATIONS
126-25-201-010

C.0.2
PAGE 03



0 30' 60'
SCALE: 1" = 30'

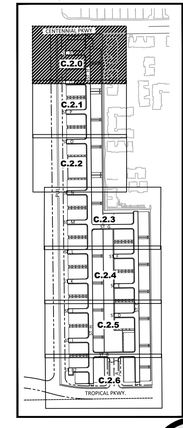
GRADING KEY NOTES:

G1 CONSTRUCT 30" ROLL CURB PER CCAUSD #217.2 S1
G2 CONSTRUCT "L" TYPE CURB PER CCAUSD #216
G3 CONSTRUCT "A" TYPE CURB PER CCAUSD #219
G4 CONSTRUCT 10' TRANSITION FROM "L" TYPE CURB TO ROLL CURB PER DETAIL "1" ON SHEET C.6.0
G5 CONSTRUCT 2" AC PAVEMENT OVER 4" TYPE II AGG BASE REFERENCE GEOTECHNICAL REPORT
G6 CONSTRUCT SIDEWALK RAMP "CASE I" PER CCAUSD #235
G7 CONSTRUCT 5" CONCRETE SIDEWALK PER CCAUSD #234
G8 CONSTRUCT 4" AC PAVEMENT OVER 4" TYPE II AGG BASE
G9 CONSTRUCT 5.5" AC PAVEMENT OVER 6" TYPE II AGG BASE
G10 CONSTRUCT 8' CONCRETE VALLEY GUTTER PER CCAUSD #228
G11 SAWCUT, TRENCH, BACKFILL, AND ASPHALT PATCH PER CCAUSD 500.3, 500.4, 500.5 & 503 (PATCH DIMENSIONS TO BE DETERMINED IN THE FIELD) PROPOSED SAWCUT TO BE AT LANE LINE
G12 INSTALL WROUGHT IRON GATE
G13 INSTALL 60" TYPE II-SD STORM DRAIN MANHOLE PER CCAUSD #401 & 405.2
G14 CONSTRUCT HEADWALL PER NDOT STANDARDS
G15 INSTALL 60" TYPE II-SD STORM DRAIN MANHOLE WITH GRATE PER CCAUSD #401 & 405.2
G17 EXISTING TO REMAIN. PROTECT IN PLACE.
G18 INSTALL LANDSCAPING PER LANDSCAPE PLAN BY OTHERS
G19 CONSTRUCT 5'X5' CONCRETE SIDEWALK PAD PER CCAUSD #234 FOR ADA TURNAROUND
G20 CONSTRUCT 24.0' WIDE CURB OPENING PER DETAIL "CC" ON SHEET C.6.0
G21 INSTALL BUBBLER STRUCTURE W/ (13) 2' GRATES, L=26', W=5', D=TBD
G22 CONSTRUCT DROP INLET TYPE "CM2" PER CCAUSD #412.1 & 421 W/ (3) 2.5' GRATES, L=10', D=TBD
G23 CONSTRUCT SIDEWALK DRAIN PER CCAUSD #236
G24 INSTALL RIP-RAP D50=6",T=12" SUBGRADE @ 90% COMPACTION
G25 CONSTRUCT 4" CONCRETE SIDEWALK PER CCAUSD #234
G26 CONSTRUCT BUS TURNOUT PER CCAUSD #234.1
G27 CONSTRUCT 3' CONCRETE VALLEY GUTTER PER CCAUSD #228

EASEMENT KEY NOTES:

1 31' PUBLIC EMERGENCY ACCESS & UTILITY EASEMENT TO BE PRIVATELY MAINTAINED. PER FINAL MAP.
2 31' PUBLIC EMERGENCY ACCESS & UTILITY EASEMENT TO BE PRIVATELY MAINTAINED. PER FINAL MAP.
3 31' PUBLIC EMERGENCY ACCESS & UTILITY EASEMENT TO BE PRIVATELY MAINTAINED. PER FINAL MAP.

KEY MAP
N.T.S.



BASIS OF BEARING

NORTH 00°37'29" WEST, BEING THE WEST LINE OF THE NORTHWEST QUARTER (NW1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.M.,CLARK COUNTY, NEVADA, AS SHOWN ON THE PLAT OF CONSTELLATION ESTATES, RECORDED IN BOOK 102, PAGE 92, OFFICIAL RECORDS, CLARK COUNTY, NEVADA.

LEGAL DESCRIPTION:

A PORTION OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.D., CITY OF LAS VEGAS, CLARK COUNTY, NEVADA, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

THE WEST HALF (W 1/2) OF THE WEST HALF (W 1/2) OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.M., TOGETHER WITH:

THE WEST HALF (W 1/2) OF THE SOUTHWEST QUARTER (SW 1/4) OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.M.

Call before you dig
AVOID CUTTING UNDERGROUND UTILITY LINES. IT'S COSTLY.
Call 811 or 1-800-227-2600

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

FAST
Call before you UnderGround
1-702-432-5300
FREEWAY AND ARTERIAL SYSTEM OF TRANSPORTATION

BENCHMARK

RIVET & PLATE IN CONCRETE CYLINDER 60 FEET WEST OF MAINWAL AND AZURE

ELEVATION (meters) 901.13
ELEVATION (feet) 2,956.44
NAVD 88

FLOOD ZONE:

THIS SITE IS LOCATED IN A ZONE 'X', AREAS OUTSIDE OF THE 0.2% ANNUAL CHANCE FLOODPLAIN AND PARTIALLY IN A SHADED ZONE 'X', AREAS OF 0.2% ANNUAL CHANCE FLOOD; AREAS OF 1% ANNUAL CHANCE FLOOD WITH AVERAGE DEPTHS OF LESS THAN 1 FOOT OR WITH DRAINAGE AREAS LESS THAN 1 SQUARE MILE; AND AREAS PROTECTED BY LEVEES FROM 1% ANNUAL CHANCE OF FLOOD PER THE FLOOD INSURANCE RATE MAP COMMUNITY PANEL 32003C1750E, CLARK COUNTY, NEVADA DATED NOVEMBER 16, 2011, REVISED TO REFLECT LOMR DATED OCTOBER 18, 2018.

SIGHT VISIBILITY ZONE PER CCAUSD# 201.2 (TYP)

SIGHT VISIBILITY ZONE NOTE:

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

DETAILED GRADING NOTE:

FOR DETAILED GRADING AROUND BUILDINGS REF. DETAIL "2" ON SHEET C.6.1

NOTE:

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

NOTE:

ADD 2900' TO GRADING ELEVATIONS SHOWN HEREON TO ADJUST THEM TO THE ASSOCIATED DATUM. FINISHED GRADE CONTOURS ARE APPROXIMATE. REFER TO SPOT ELEVATION GRADE TAGS FOR CONSTRUCTION STAKING PURPOSES.

ENGINEER'S NOTES:

1. CONTRACTOR IS RESPONSIBLE FOR EROSION AND DUST CONTROL, AND STORMWATER MANAGEMENT DURING CONSTRUCTION.
2. SEE HORIZONTAL CONTROL PLAN FOR EXACT PROPERTY LINE DIMENSIONS
3. ENGINEER TO BE NOTIFIED IMMEDIATELY OF ANY DISCREPANCIES BETWEEN THESE PLANS AND FIELD CONDITIONS.
4. THESE PLANS SHALL NOT IN PART, OR IN WHOLE, BE USED FOR CONSTRUCTION UNTIL APPROVED AND SIGNED BY GOVERNING AGENCIES.
5. ALL GRADING SHALL CONFORM TO SOILS REPORT RECOMMENDATIONS.
6. DURING CONSTRUCTION, SURVEYORS AND CONTRACTORS MUST VERIFY THAT ALL STREETS AND LOTS HAVE POSITIVE DRAINAGE. SAME MUST UTILIZE AT LEAST THREE GRADES ON VERTICAL TANGENTS TO VERIFY SLOPES.
7. SOILS REPORT NOTE:
   GRADING SHALL BE IN ACCORDANCE WITH SOILS REPORT
   PREPARED BY: _____
   PROJECT NO.: _____
   DATE: _____
8. CUT/FILL ESTIMATES (PUBLIC AND PRIVATE):
   FROM EXISTING TO FINISH GRADE ELEVATIONS
   NET CUT: _____
   NET FILL: _____
   TOTAL: _____
9. FLOOR SECTION ASSUMES 5" SLAB OVER MIN. 8.5" TYPE II. CONTRACTOR TO VERIFY WITH STRUCTURAL PLANS AND GEOTECHNICAL ENGINEER.

EARTHWORKS

CUT: _____ CY
FILL: _____ CY
NET: _____ (FILL)

ESTIMATED QUANTITY FROM EXISTING TO FINISHED GRADES.
PER SOILS REPORT BY _____., PROJECT #_____, DATED _____

AREA OF DISTURBANCE

ONSITE: _____
OFFSITE: _____

DRAINAGE CERTIFICATION:

THIS SET OF IMPROVEMENT PLANS IS CERTIFIED TO CONFORM TO THE REQUIREMENTS OF THE APPROVED DRAINAGE STUDY.
DS# _____.

LARRY BITTON, P.E. NO. 010159 DATE

HORROCKS ENGINEERS
1401 N. Green Valley Pkwy., Suite 160
Henderson, NV 89074
(702) 966-4063
www.horrocks.com

WARNING
0 1 2
IF THIS BAR DOES NOT MEASURE 2" THEN DRAWING IS NOT TO SCALE

REVISIONS
REV # | DATE
*SEE GENERAL NOTES SHEET

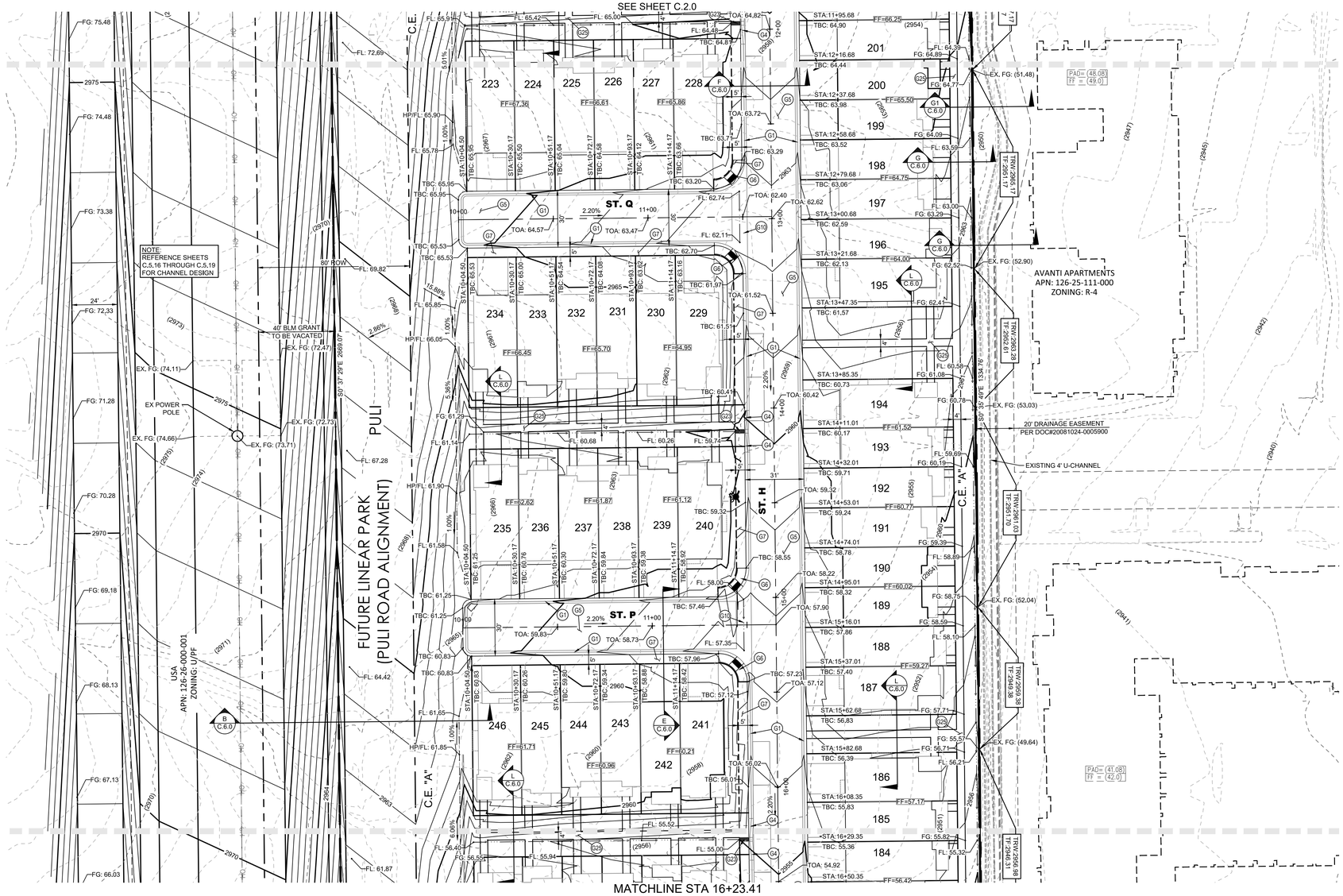
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DATE 12/23/19
DESIGNED SS
DRAWN PMP
CHECKED AD
PROJECT NV-1949-1909

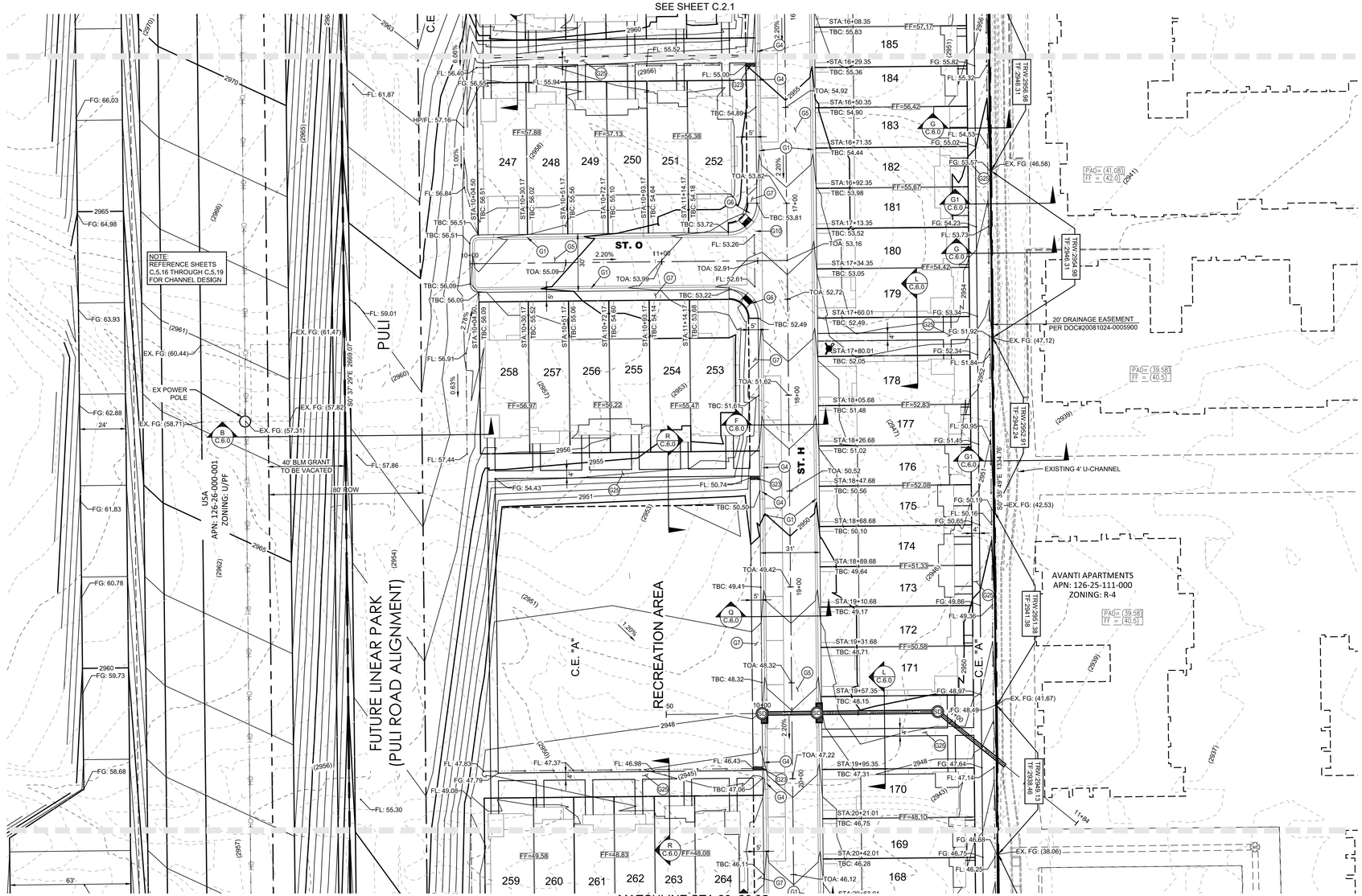
PROFESSIONAL ENGINEER—STATE OF NEVADA
LARRY M. BITTON
EXP. 12-31-20
CIVIL
No. 010159

CENTENNIAL HEIGHTS TOWNHOMES
TECHNICAL DRAINAGE STUDY
CITY OF LAS VEGAS, NEVADA
GRADING PLAN I
126-25-201-010

C.2.0

PAGE 04


MATCHLINE STA 12+16.68
SEE SHEET C.2.0
MATCHLINE STA 16+23.41
SEE SHEET C.2.2
ST. Q
ST. H
ST. P
C.E. "A"
FUTURE LINEAR PARK
(PULI ROAD ALIGNMENT)
PULI
AVANTI APARTMENTS
APN: 126-25-111-000
ZONING: R-4
USA
APN: 126-26-000-001
ZONING: U/PF
NOTE
REFERENCE SHEETS C.5.16 THROUGH C.5.19 FOR CHANNEL DESIGN
80' ROW
24'
40' BLM GRANT TO BE VACATED
EX. FG: (72.47)
EX. FG: (74.11)
EX POWER POLE
EX. FG: (74.66)
EX. FG: (72.73)
EX. FG: (73.71)
EX. FG: (53.03)
EX. FG: (52.90)
EX. FG: (52.04)
EX. FG: (49.64)
20' DRAINAGE EASEMENT PER DOC#20081024-0005900
EXISTING 4' U-CHANNEL
PAD= 48.08
FF = 49.0
PAD= (41.08)
FF = (42.0)
TBC: 64.90
FF=66.25
TBC: 64.44
FF=65.50
TBC: 63.98
TBC: 63.52
FF=64.75
TBC: 63.06
TBC: 62.59
FF=64.00
TBC: 62.13
TBC: 61.57
FF=61.52
TBC: 60.17
TBC: 59.71
FF=60.77
TBC: 59.24
FF=60.02
TBC: 58.32
TBC: 57.40
FF=59.27
TBC: 56.83
FF=57.17
TBC: 55.83
TBC: 55.36
FF=56.42
TBC: 54.89
FF=55.67
TBC: 54.42
FF=54.92
TBC: 53.95
FF=54.17
TBC: 53.48
FF=53.42
TBC: 52.92
FF=52.67
TBC: 52.45
FF=51.92
TBC: 51.98
FF=51.17
TBC: 51.51
FF=50.42
TBC: 51.04
FF=49.67
TBC: 50.57
FF=48.92
TBC: 50.10
FF=48.17
TBC: 49.63
FF=47.42
TBC: 49.16
FF=46.67
TBC: 48.69
FF=45.92
TBC: 48.22
FF=45.17
TBC: 47.75
FF=44.42
TBC: 47.28
FF=43.67
TBC: 46.81
FF=42.92
TBC: 46.34
FF=42.17
TBC: 45.87
FF=41.42
TBC: 45.40
FF=40.67
TBC: 44.93
FF=39.92
TBC: 44.46
FF=39.17
TBC: 43.99
FF=38.42
TBC: 43.52
FF=37.67
TBC: 43.05
FF=36.92
TBC: 42.58
FF=36.17
TBC: 42.11
FF=35.42
TBC: 41.64
FF=34.67
TBC: 41.17
FF=33.92
TBC: 40.70
FF=33.17
TBC: 40.23
FF=32.42
TBC: 39.76
FF=31.67
TBC: 39.29
FF=30.92
TBC: 38.82
FF=30.17
TBC: 38.35
FF=29.42
TBC: 37.88
FF=28.67
TBC: 37.41
FF=27.92
TBC: 36.94
FF=27.17
TBC: 36.47
FF=26.42
TBC: 36.00
FF=25.67
TBC: 35.53
FF=24.92
TBC: 35.06
FF=24.17
TBC: 34.59
FF=23.42
TBC: 34.12
FF=22.67
TBC: 33.65
FF=21.92
TBC: 33.18
FF=21.17
TBC: 32.71
FF=20.42
TBC: 32.24
FF=19.67
TBC: 31.77
FF=18.92
TBC: 31.30
FF=18.17
TBC: 30.83
FF=17.42
TBC: 30.36
FF=16.67
TBC: 29.89
FF=15.92
TBC: 29.42
FF=15.17
TBC: 28.95
FF=14.42
TBC: 28.48
FF=13.67
TBC: 28.01
FF=12.92
TBC: 27.54
FF=12.17
TBC: 27.07
FF=11.42
TBC: 26.60
FF=10.67
TBC: 26.13
FF=9.92
TBC: 25.66
FF=9.17
TBC: 25.19
FF=8.42
TBC: 24.72
FF=7.67
TBC: 24.25
FF=6.92
TBC: 23.78
FF=6.17
TBC: 23.31
FF=5.42
TBC: 22.84
FF=4.67
TBC: 22.37
FF=3.92
TBC: 21.90
FF=3.17
TBC: 21.43
FF=2.42
TBC: 20.96
FF=1.67
TBC: 20.49
FF=0.92
TBC: 20.02
FF=0.17
TBC: 19.55
FF=-0.58
TBC: 19.08
FF=-1.33
TBC: 18.61
FF=-2.08
TBC: 18.14
FF=-2.83
TBC: 17.67
FF=-3.58
TBC: 17.20
FF=-4.33
TBC: 16.73
FF=-5.08
TBC: 16.26
FF=-5.83
TBC: 15.79
FF=-6.58
TBC: 15.32
FF=-7.33
TBC: 14.85
FF=-8.08
TBC: 14.38
FF=-8.83
TBC: 13.91
FF=-9.58
TBC: 13.44
FF=-10.33
TBC: 12.97
FF=-11.08
TBC: 12.50
FF=-11.83
TBC: 12.03
FF=-12.58
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TBC: 10.15
FF=-15.58
TBC: 9.68
FF=-16.33
TBC: 9.21
FF=-17.08
TBC: 8.74
FF=-17.83
TBC: 8.27
FF=-18.58
TBC: 7.80
FF=-19.33
TBC: 7.33
FF=-20.08
TBC: 6.86
FF=-20.83
TBC: 6.39
FF=-21.58
TBC: 5.92
FF=-22.33
TBC: 5.45
FF=-23.08
TBC: 4.98
FF=-23.83
TBC: 4.51
FF=-24.58
TBC: 4.04
FF=-25.33
TBC: 3.57
FF=-26.08
TBC: 3.10
FF=-26.83
TBC: 2.63
FF=-27.58
TBC: 2.16
FF=-28.33
TBC: 1.69
FF=-29.08
TBC: 1.22
FF=-29.83
TBC: 0.75
FF=-30.58
TBC: 0.28
FF=-31.33
TBC: -0.19
FF=-32.08
TBC: -0.66
FF=-32.83
TBC: -1.13
FF=-33.58
TBC: -1.60
FF=-34.33
TBC: -2.07
FF=-35.08
TBC: -2.54
FF=-35.83
TBC: -3.01
FF=-36.58
TBC: -3.48
FF=-37.33
TBC: -3.95
FF=-38.08
TBC: -4.42
FF=-38.83
TBC: -4.89
FF=-39.58
TBC: -5.36
FF=-40.33
TBC: -5.83





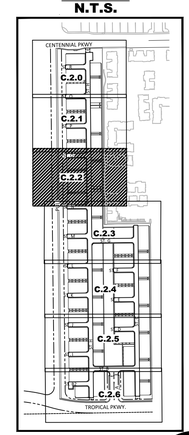
GRADING KEY NOTES:

(G1) CONSTRUCT 30" ROLL CURB PER CCAUSD #217.2.S1
(G2) CONSTRUCT "L" TYPE CURB PER CCAUSD #216
(G3) CONSTRUCT "A" TYPE CURB PER CCAUSD #219
(G4) CONSTRUCT 10' TRANSITION FROM "L" TYPE CURB TO ROLL CURB PER DETAIL "1" ON SHEET C.6.0
(G5) CONSTRUCT 2" AC PAVEMENT OVER 4" TYPE II AGG BASE REFERENCE GEOTECHNICAL REPORT
(G6) CONSTRUCT SIDEWALK RAMP "CASE I" PER CCAUSD #235
(G7) CONSTRUCT 5" CONCRETE SIDEWALK PER CCAUSD #234
(G8) CONSTRUCT 4" AC PAVEMENT OVER 4" TYPE II AGG BASE
(G9) CONSTRUCT 5.5" AC PAVEMENT OVER 6" TYPE II AGG BASE
(G10) CONSTRUCT 8' CONCRETE VALLEY GUTTER PER CCAUSD #228
(G11) SAWCUT, TRENCH, BACKFILL, AND ASPHALT PATCH PER CCAUSD 500.3, 500.4, 500.5 & 503 (PATCH DIMENSIONS TO BE DETERMINED IN THE FIELD) PROPOSED SAWCUT TO BE AT LANE LINE
(G12) INSTALL WROUGHT IRON GATE
(G13) INSTALL 60" TYPE II-SD STORM DRAIN MANHOLE PER CCAUSD #401 & 405.2
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(G15) INSTALL 60" TYPE II-SD STORM DRAIN MANHOLE WITH GRATE PER CCAUSD #401 & 405.2
(G17) EXISTING TO REMAIN. PROTECT IN PLACE.
(G18) INSTALL LANDSCAPING PER LANDSCAPE PLAN BY OTHERS
(G19) CONSTRUCT 5'X5' CONCRETE SIDEWALK PAD PER CCAUSD #234 FOR ADA TURNAROUND
(G20) CONSTRUCT 24.0' WIDE CURB OPENING PER DETAIL "CC" ON SHEET C.6.0
(G21) INSTALL BUBBLER STRUCTURE W/ (13) 2' GRATES, L=26', W=5', D=TBD
(G22) CONSTRUCT DROP INLET TYPE "CM2" PER CCAUSD #412.1 & 421 W/ (3) 2.5' GRATES, L=10', D=TBD
(G23) CONSTRUCT SIDEWALK DRAIN PER CCAUSD #236
(G24) INSTALL RIP-RAP D50=6",T=12" SUBGRADE @ 90% COMPACTION
(G25) CONSTRUCT 4" CONCRETE SIDEWALK PER CCAUSD #234
(G26) CONSTRUCT BUS TURNOUT PER CCAUSD #234.1
(G27) CONSTRUCT 3' CONCRETE VALLEY GUTTER PER CCAUSD #228

EASEMENT KEY NOTES:

(1) 31' PUBLIC EMERGENCY ACCESS & UTILITY EASEMENT TO BE PRIVATELY MAINTAINED. PER FINAL MAP.
(2) 31' PUBLIC EMERGENCY ACCESS & UTILITY EASEMENT TO BE PRIVATELY MAINTAINED. PER FINAL MAP.
(3) 31' PUBLIC EMERGENCY ACCESS & UTILITY EASEMENT TO BE PRIVATELY MAINTAINED. PER FINAL MAP.

KEY MAP
N.T.S.



BASIS OF BEARING

NORTH 00°37'29" WEST, BEING THE WEST LINE OF THE NORTHWEST QUARTER (NW1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.M.,CLARK COUNTY, NEVADA, AS SHOWN ON THE PLAT OF CONSTELLATION ESTATES, RECORDED IN BOOK 102, PAGE 92, OFFICIAL RECORDS, CLARK COUNTY, NEVADA.

LEGAL DESCRIPTION:

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THE WEST HALF (W 1/2) OF THE WEST HALF (W 1/2) OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.M., TOGETHER WITH:

THE WEST HALF (W 1/2) OF THE SOUTHWEST QUARTER (SW 1/4) OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.M.

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

FAST
Call before you
UnderGround
1-702-432-5300
FREEWAY AND ARTERIAL SYSTEM OF TRANSPORTATION

BENCHMARK

RIVET & PLATE IN CONCRETE CYLINDER 60 FEET WEST OF MAINWAL AND AZURE

ELEVATION (meters) 901.13
ELEVATION (feet) 2,956.44
NAVD 88

FLOOD ZONE:

THIS SITE IS LOCATED IN A ZONE 'X', AREAS OUTSIDE OF THE 0.2% ANNUAL CHANCE FLOODPLAIN AND PARTIALLY IN A SHADED ZONE 'X', AREAS OF 0.2% ANNUAL CHANCE FLOOD; AREAS OF 1% ANNUAL CHANCE FLOOD WITH AVERAGE DEPTHS OF LESS THAN 1 FOOT OR WITH DRAINAGE AREAS LESS THAN 1 SQUARE MILE; AND AREAS PROTECTED BY LEVEES FROM 1% ANNUAL CHANCE OF FLOOD PER THE FLOOD INSURANCE RATE MAP COMMUNITY PANEL 32003C1750E, CLARK COUNTY, NEVADA DATED NOVEMBER 16, 2011, REVISED TO REFLECT LOMR DATED OCTOBER 18, 2018.

SIGHT VISIBILITY ZONE PER CCAUSD# 201.2 (TYP)

SIGHT VISIBILITY ZONE NOTE:

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

DETAILED GRADING NOTE:
FOR DETAILED GRADING AROUND BUILDINGS REF. DETAIL "2" ON SHEET C.6.1

NOTE:
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NOTE:
ADD 2900' TO GRADING ELEVATIONS SHOWN HEREON TO ADJUST THEM TO THE ASSOCIATED DATUM. FINISHED GRADE CONTOURS ARE APPROXIMATE. REFER TO SPOT ELEVATION GRADE TAGS FOR CONSTRUCTION STAKING PURPOSES.

ENGINEER'S NOTES:

1. CONTRACTOR IS RESPONSIBLE FOR EROSION AND DUST CONTROL, AND STORMWATER MANAGEMENT DURING CONSTRUCTION.
2. SEE HORIZONTAL CONTROL PLAN FOR EXACT PROPERTY LINE DIMENSIONS
3. ENGINEER TO BE NOTIFIED IMMEDIATELY OF ANY DISCREPANCIES BETWEEN THESE PLANS AND FIELD CONDITIONS.
4. THESE PLANS SHALL NOT IN PART, OR IN WHOLE, BE USED FOR CONSTRUCTION UNTIL APPROVED AND SIGNED BY GOVERNING AGENCIES.
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7. SOILS REPORT NOTE:
   GRADING SHALL BE IN ACCORDANCE WITH SOILS REPORT
   PREPARED BY: _____
   PROJECT NO.: _____
   DATE:
8. CUT/FILL ESTIMATES (PUBLIC AND PRIVATE):
   FROM EXISTING TO FINISH GRADE ELEVATIONS
   NET CUT: _____
   NET FILL: _____
   TOTAL:
9. FLOOR SECTION ASSUMES 5" SLAB OVER MIN. 8.5" TYPE II. CONTRACTOR TO VERIFY WITH STRUCTURAL PLANS AND GEOTECHNICAL ENGINEER.

EARTHWORKS

CUT: _____ CY
FILL: _____ CY
NET: _____ (FILL)

ESTIMATED QUANTITY FROM EXISTING TO FINISHED GRADES. PER SOILS REPORT BY _____., PROJECT #_____, DATED _____

AREA OF DISTURBANCE

ONSITE: _____

OFFSITE: _____

DRAINAGE CERTIFICATION:

THIS SET OF IMPROVEMENT PLANS IS CERTIFIED TO CONFORM TO THE REQUIREMENTS OF THE APPROVED DRAINAGE STUDY.
DS# _____.

LARRY BITTON, P.E. NO. 010159 DATE

HORROCKS ENGINEERS
1401 N. Green Valley Pkwy., Suite 160
Henderson, NV 89074
(702) 966-4063
www.horrocks.com

WARNING
IF THIS BAR DOES NOT MEASURE 2" THEN DRAWING IS NOT TO SCALE
0 1 2

REVISIONS
REV # | DATE
*SEE GENERAL NOTES SHEET

DRAWING INFO
DATE 12/23/19
DESIGNED SS
DRAWN PMP
CHECKED AD
PROJECT NV-1949-1909

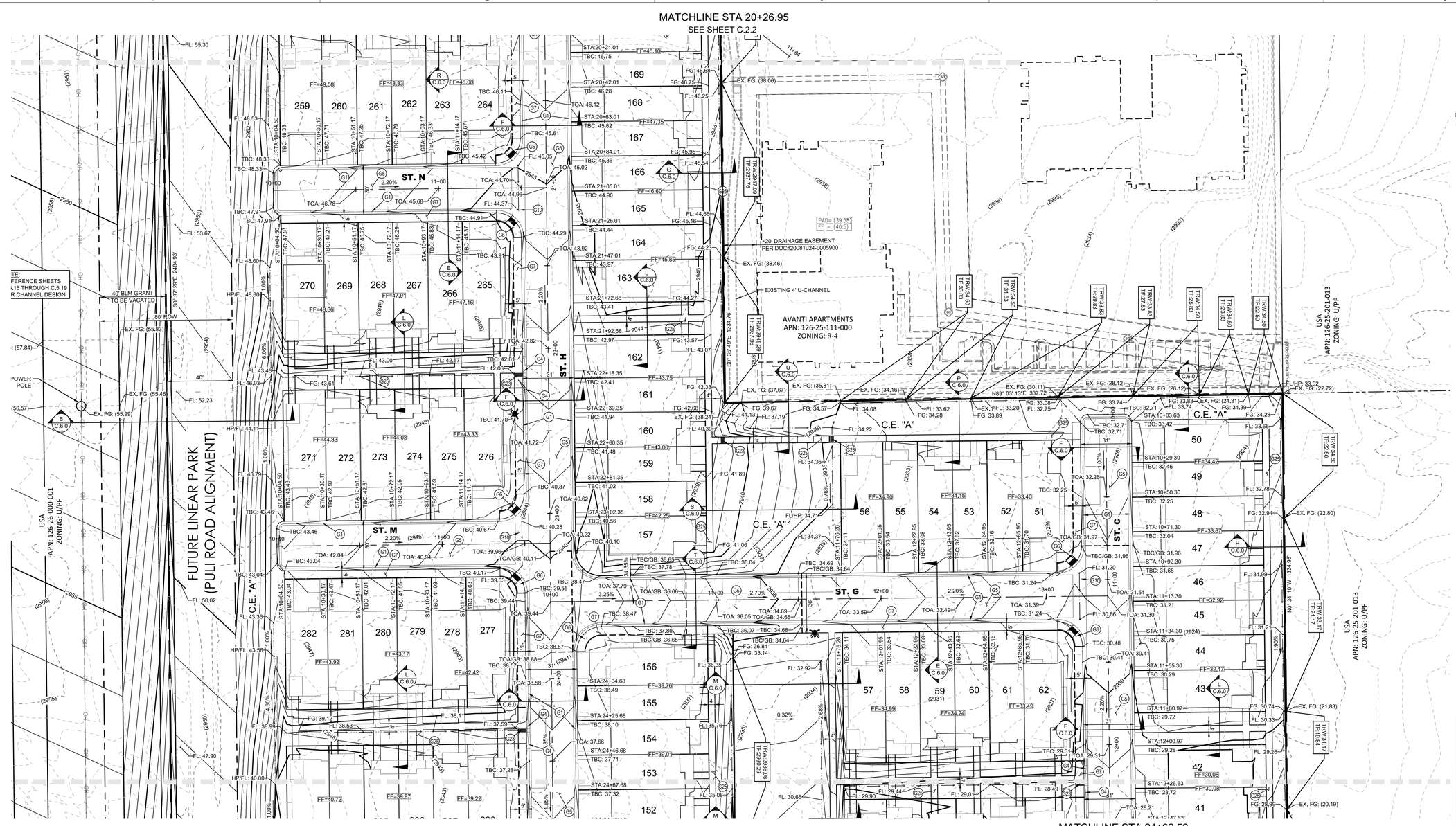
PROFESSIONAL ENGINEER—STATE OF NEVADA
LARRY M. BITTON
EXP. 12-31-20
CIVIL
No. 010159

CENTENNIAL HEIGHTS TOWNHOMES
TECHNICAL DRAINAGE STUDY
CITY OF LAS VEGAS, NEVADA

GRADING PLAN III
126-25-201-010

C.2.2

C:\Users\heather.dominguez\appdata\local\temp\AcPublish_5816\NV-1949-1909_C.2.0_GRD.dwg - C.2.2 - 12/23/2019 01:22pm, heather.dominguez



BASIS OF BEARING

NORTH 00°37'29" WEST, BEING THE WEST LINE OF THE NORTHWEST QUARTER (NW1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.M.,CLARK COUNTY, NEVADA, AS SHOWN ON THE PLAT OF CONSTELLATION ESTATES, RECORDED IN BOOK 102, PAGE 92, OFFICIAL RECORDS, CLARK COUNTY, NEVADA.

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FREEWAY AND ARTERIAL SYSTEM OF TRANSPORTATION

BENCHMARK

RIVET & PLATE IN CONCRETE CYLINDER 60 FEET WEST OF MAINWAL AND AZURE

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NAVD 88

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AREA OF DISTURBANCE

ONSITE: _____

OFFSITE: _____

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   PREPARED BY: _____
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   DATE: _____
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   NET FILL: _____
   TOTAL: _____
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- G3 CONSTRUCT "A" TYPE CURB PER CCAUSD #219
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- G6 CONSTRUCT SIDEWALK RAMP "CASE I" PER CCAUSD #235
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- G18 INSTALL LANDSCAPING PER LANDSCAPE PLAN BY OTHERS
- G19 CONSTRUCT 5'X5' CONCRETE SIDEWALK PAD PER CCAUSD #234 FOR ADA TURNAROUND
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SIGHT VISIBILITY ZONE PER CCAUSD# 201.2 (TYP)

EASEMENT KEY NOTES:

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3. 31' PUBLIC EMERGENCY ACCESS & UTILITY EASEMENT TO BE PRIVATELY MAINTAINED. PER FINAL MAP.

EARTHWORKS

CUT: _____ CY
FILL: _____ CY
NET: _____ (FILL)

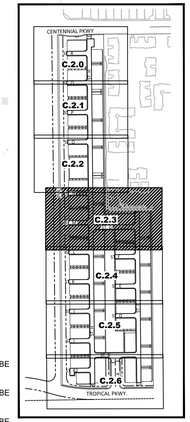
ESTIMATED QUANTITY FROM EXISTING TO FINISHED GRADES.
PER SOILS REPORT BY _____., PROJECT #_____, DATED _____

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DS# _____.

LARRY BITTON, P.E. NO. 010159 DATE

KEY MAP
N.T.S.



HORROCKS ENGINEERS
1401 N. Green Valley Pkwy., Suite 160
Henderson, NV 89074
(702) 966-4063
www.horrocks.com

WARNING
IF THIS BAR DOES NOT MEASURE 2" THEN DRAWING IS NOT TO SCALE

REVISIONS
REV # | DATE
*SEE GENERAL NOTES SHEET

DRAWING INFO
DATE 12/23/19
DESIGNED SS
DRAWN PMP
CHECKED AD
PROJECT NV-1949-1909

PROFESSIONAL ENGINEER—STATE OF NEVADA
LARRY M. BITTON
EXP. 12-31-20
CIVIL
No. 010159

CENTENNIAL HEIGHTS TOWNHOMES
TECHNICAL DRAINAGE STUDY
CITY OF LAS VEGAS, NEVADA

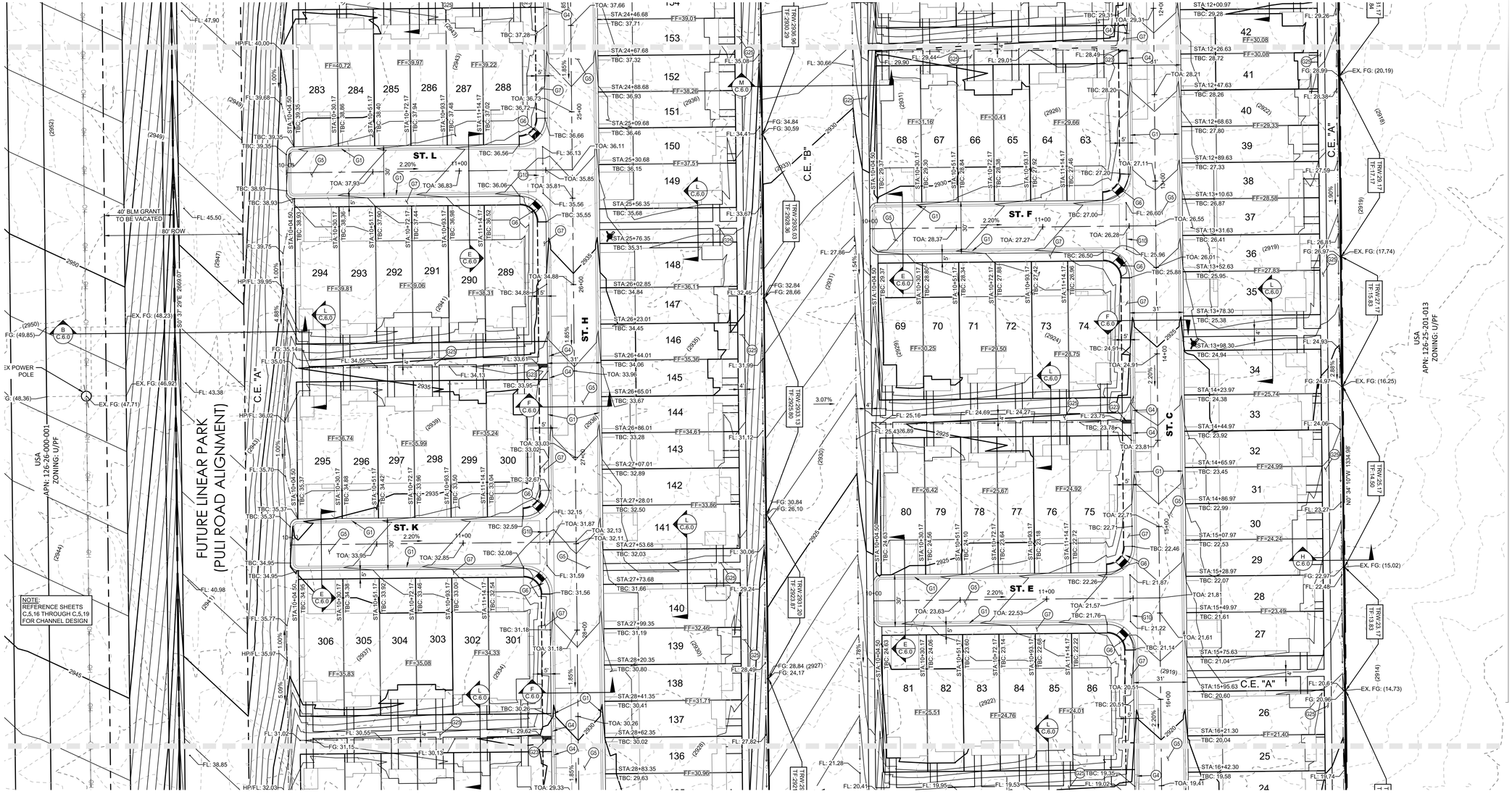
GRADING PLAN IV
126-25-201-010

C.2.3

PAGE 07

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MATCHLINE STA 24+62.52
SEE SHEET C.2.3



MATCHLINE STA 28+67.14
SEE SHEET C.2.5

BASIS OF BEARING

NORTH 00°37'29" WEST, BEING THE WEST LINE OF THE NORTHWEST QUARTER (NW1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.M.,CLARK COUNTY, NEVADA, AS SHOWN ON THE PLAT OF CONSTELLATION ESTATES, RECORDED IN BOOK 102, PAGE 92, OFFICIAL RECORDS, CLARK COUNTY, NEVADA.

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RIVET & PLATE IN CONCRETE CYLINDER 60 FEET WEST OF MAINWAL AND AZURE

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G20 CONSTRUCT 24.0' WIDE CURB OPENING PER DETAIL "CC" ON SHEET C.6.0
G21 INSTALL BUBBLER STRUCTURE W/ (13) 2' GRATES, L=26', W=5', D=TBD
G22 CONSTRUCT DROP INLET TYPE "CM2" PER CCAUSD #412.1 & 421 W/ (3) 2.5' GRATES, L=10', D=TBD
G23 CONSTRUCT SIDEWALK DRAIN PER CCAUSD #236
G24 INSTALL RIP-RAP D50=6",T=12" SUBGRADE @ 90% COMPACTION
G25 CONSTRUCT 4" CONCRETE SIDEWALK PER CCAUSD #234
G26 CONSTRUCT BUS TURNOUT PER CCAUSD #234.1
G27 CONSTRUCT 3' CONCRETE VALLEY GUTTER PER CCAUSD #228

SIGHT VISIBILITY ZONE PER CCAUSD# 201.2 (TYP)

EASEMENT KEY NOTES:

1. 31' PUBLIC EMERGENCY ACCESS & UTILITY EASEMENT TO BE PRIVATELY MAINTAINED. PER FINAL MAP.
2. 31' PUBLIC EMERGENCY ACCESS & UTILITY EASEMENT TO BE PRIVATELY MAINTAINED. PER FINAL MAP.
3. 31' PUBLIC EMERGENCY ACCESS & UTILITY EASEMENT TO BE PRIVATELY MAINTAINED. PER FINAL MAP.

DRAINAGE CERTIFICATION:

THIS SET OF IMPROVEMENT PLANS IS CERTIFIED TO CONFORM TO THE REQUIREMENTS OF THE APPROVED DRAINAGE STUDY.
DS# _____.

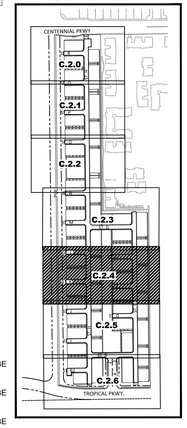
LARRY BITTON, P.E. NO. 010159 DATE

EARTHWORKS

CUT: _____ CY
FILL: _____ CY
NET: _____ (FILL)

ESTIMATED QUANTITY FROM EXISTING TO FINISHED GRADES.
PER SOILS REPORT BY _____, PROJECT #_____, DATED _____

KEY MAP
N.T.S.



HORROCKS ENGINEERS
1401 N. Green Valley Pkwy., Suite 160
Henderson, NV 89074
(702) 966-4063
www.horrocks.com

SCALE: 1" = 30'

WARNING
IF THIS BAR DOES NOT MEASURE 2" THEN DRAWING IS NOT TO SCALE

REVISIONS		
REV #	DATE	
1		

*SEE GENERAL NOTES SHEET

DRAWING INFO	
DATE	12/23/19
DESIGNED	SS
DRAWN	PMP
CHECKED	AD
PROJECT	NV-1949-1909

PROFESSIONAL ENGINEER—STATE OF NEVADA
LARRY M. BITTON
EXP. 12-31-20
CIVIL
No. 010159

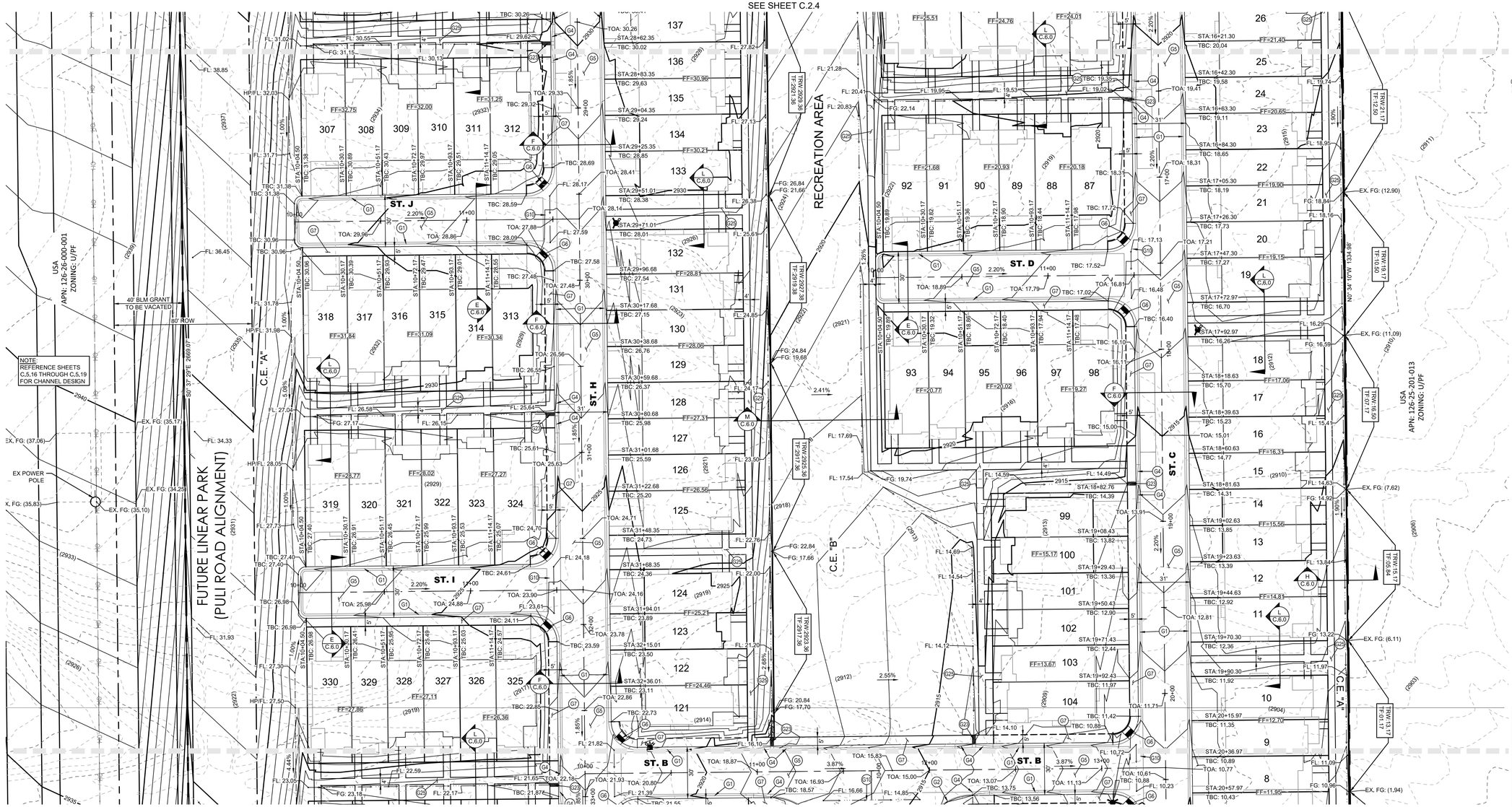
CENTENNIAL HEIGHTS TOWNHOMES
TECHNICAL DRAINAGE STUDY
CITY OF LAS VEGAS, NEVADA

GRADING PLAN V

126-25-201-010

C.2.4

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0 30' 60'
SCALE: 1" = 30'

HORROCKS ENGINEERS
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WARNING
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REVISIONS		
REV #	DATE	

*SEE GENERAL NOTES SHEET

DRAWING INFO	
DATE	12/23/19
DESIGNED	SS
DRAWN	PMP
CHECKED	AD
PROJECT	NV-1949-1909

PROFESSIONAL ENGINEER—STATE OF NEVADA
LARRY M. BITTON
EXP. 12-31-20
CIVIL
No. 010159

CENTENNIAL HEIGHTS TOWNHOMES
TECHNICAL DRAINAGE STUDY
CITY OF LAS VEGAS, NEVADA

GRADING PLAN VI

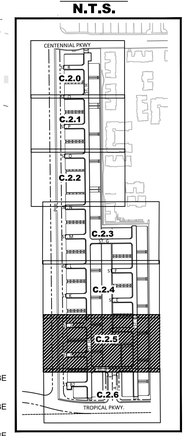
126-25-201-010

EARTHWORKS

CUT: _____ CY
FILL: _____ CY
NET: _____ (FILL)

ESTIMATED QUANTITY FROM EXISTING TO FINISHED GRADES.
PER SOILS REPORT BY _____, PROJECT #_____, DATED _____

KEY MAP
N.T.S.



BASIS OF BEARING

NORTH 00°37'29" WEST, BEING THE WEST LINE OF THE NORTHWEST QUARTER (NW1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.M.,CLARK COUNTY, NEVADA, AS SHOWN ON THE PLAT OF CONSTELLATION ESTATES, RECORDED IN BOOK 102, PAGE 92, OFFICIAL RECORDS, CLARK COUNTY, NEVADA.

LEGAL DESCRIPTION:

A PORTION OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.D., CITY OF LAS VEGAS, CLARK COUNTY, NEVADA, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

THE WEST HALF (W 1/2) OF THE WEST HALF (W 1/2) OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.M., TOGETHER WITH:

THE WEST HALF (W 1/2) OF THE SOUTHWEST QUARTER (SW 1/4) OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.M.

Call before you Dig
AVOID CUTTING UNDERGROUND UTILITY LINES, IT'S COSTLY.
Call 811 or 1-800-227-2600

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

FAST
Call before you UnderGround
1-702-432-5300
FREEWAY AND ARTERIAL SYSTEM OF TRANSPORTATION

BENCHMARK

RIVET & PLATE IN CONCRETE CYLINDER 60 FEET WEST OF MAINWAL AND AZURE

ELEVATION (meters) 901.13
ELEVATION (feet) 2,956.44
NAVD 88

SIGHT VISIBILITY ZONE NOTE:

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

FLOOD ZONE:

THIS SITE IS LOCATED IN A ZONE 'X', AREAS OUTSIDE OF THE 0.2% ANNUAL CHANCE FLOODPLAIN AND PARTIALLY IN A SHADED ZONE 'X', AREAS OF 0.2% ANNUAL CHANCE FLOOD; AREAS OF 1% ANNUAL CHANCE FLOOD WITH AVERAGE DEPTHS OF LESS THAN 1 FOOT OR WITH DRAINAGE AREAS LESS THAN 1 SQUARE MILE; AND AREAS PROTECTED BY LEVEES FROM 1% ANNUAL CHANCE OF FLOOD PER THE FLOOD INSURANCE RATE MAP COMMUNITY PANEL 32003C1750E, CLARK COUNTY, NEVADA DATED NOVEMBER 16, 2011, REVISED TO REFLECT LOMR DATED OCTOBER 18, 2018.

DETAILED GRADING NOTE:
FOR DETAILED GRADING AROUND BUILDINGS REF. DETAIL "2" ON SHEET C.6.1

NOTE:
ALL PRIVATE STREETS ARE P.U.E., PUBLIC SEWER EASEMENTS AND PUBLIC DRAINAGE EASEMENTS TO BE PRIVATELY MAINTAINED BY THE HOA.

AREA OF DISTURBANCE

ONSITE: _____

OFFSITE: _____

NOTE:
ADD 2900' TO GRADING ELEVATIONS SHOWN HEREON TO ADJUST THEM TO THE ASSOCIATED DATUM.
FINISHED GRADE CONTOURS ARE APPROXIMATE. REFER TO SPOT ELEVATION GRADE TAGS FOR CONSTRUCTION STAKING PURPOSES.

ENGINEER'S NOTES:

1. CONTRACTOR IS RESPONSIBLE FOR EROSION AND DUST CONTROL, AND STORMWATER MANAGEMENT DURING CONSTRUCTION.
2. SEE HORIZONTAL CONTROL PLAN FOR EXACT PROPERTY LINE DIMENSIONS
3. ENGINEER TO BE NOTIFIED IMMEDIATELY OF ANY DISCREPANCIES BETWEEN THESE PLANS AND FIELD CONDITIONS.
4. THESE PLANS SHALL NOT IN PART, OR IN WHOLE, BE USED FOR CONSTRUCTION UNTIL APPROVED AND SIGNED BY GOVERNING AGENCIES.
5. ALL GRADING SHALL CONFORM TO SOILS REPORT RECOMMENDATIONS.
6. DURING CONSTRUCTION, SURVEYORS AND CONTRACTORS MUST VERIFY THAT ALL STREETS AND LOTS HAVE POSITIVE DRAINAGE. SAME MUST UTILIZE AT LEAST THREE GRADES ON VERTICAL TANGENTS TO VERIFY SLOPES.
7. SOILS REPORT NOTE:
   GRADING SHALL BE IN ACCORDANCE WITH SOILS REPORT
   PREPARED BY: _____
   PROJECT NO.: _____
   DATE: _____
8. CUT/FILL ESTIMATES (PUBLIC AND PRIVATE):
   FROM EXISTING TO FINISH GRADE ELEVATIONS
   NET CUT: _____
   NET FILL: _____
   TOTAL: _____
9. FLOOR SECTION ASSUMES 5" SLAB OVER MIN. 8.5" TYPE II. CONTRACTOR TO VERIFY WITH STRUCTURAL PLANS AND GEOTECHNICAL ENGINEER.

GRADING KEY NOTES:

G1 CONSTRUCT 30" ROLL CURB PER CCAUSD #217.2.S1
G2 CONSTRUCT "L" TYPE CURB PER CCAUSD #216
G3 CONSTRUCT "A" TYPE CURB PER CCAUSD #219
G4 CONSTRUCT 10' TRANSITION FROM "L" TYPE CURB TO ROLL CURB PER DETAIL "1" ON SHEET C.6.0
G5 CONSTRUCT 2" AC PAVEMENT OVER 4" TYPE II AGG BASE REFERENCE GEOTECHNICAL REPORT
G6 CONSTRUCT SIDEWALK RAMP "CASE I" PER CCAUSD #235
G7 CONSTRUCT 5" CONCRETE SIDEWALK PER CCAUSD #234
G8 CONSTRUCT 4" AC PAVEMENT OVER 4" TYPE II AGG BASE
G9 CONSTRUCT 5.5" AC PAVEMENT OVER 6" TYPE II AGG BASE
G10 CONSTRUCT 8' CONCRETE VALLEY GUTTER PER CCAUSD #228
G11 SAWCUT, TRENCH, BACKFILL, AND ASPHALT PATCH PER CCAUSD 500.3, 500.4, 500.5 & 503 (PATCH DIMENSIONS TO BE DETERMINED IN THE FIELD) PROPOSED SAWCUT TO BE AT LANE LINE
G12 INSTALL WROUGHT IRON GATE
G13 INSTALL 60" TYPE II-SD STORM DRAIN MANHOLE PER CCAUSD #401 & 405.2
G14 CONSTRUCT HEADWALL PER NDOT STANDARDS
G15 INSTALL 60" TYPE II-SD STORM DRAIN MANHOLE WITH GRATE PER CCAUSD #401 & 405.2
G17 EXISTING TO REMAIN. PROTECT IN PLACE.
G18 INSTALL LANDSCAPING PER LANDSCAPE PLAN BY OTHERS
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G20 CONSTRUCT 24.0' WIDE CURB OPENING PER DETAIL "CC" ON SHEET C.6.0
G21 INSTALL BUBBLER STRUCTURE W/ (13) 2' GRATES, L=26', W=5', D=TBD
G22 CONSTRUCT DROP INLET TYPE "CM2" PER CCAUSD #412.1 & 421 W/ (3) 2.5' GRATES, L=10', D=TBD
G23 CONSTRUCT SIDEWALK DRAIN PER CCAUSD #236
G24 INSTALL RIP-RAP D50=6",T=12" SUBGRADE @ 90% COMPACTION
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G26 CONSTRUCT BUS TURNOUT PER CCAUSD #234.1
G27 CONSTRUCT 3' CONCRETE VALLEY GUTTER PER CCAUSD #228

SIGHT VISIBILITY ZONE PER CCAUSD# 201.2 (TYP)

EASEMENT KEY NOTES:

1. 31' PUBLIC EMERGENCY ACCESS & UTILITY EASEMENT TO BE PRIVATELY MAINTAINED. PER FINAL MAP.
2. 31' PUBLIC EMERGENCY ACCESS & UTILITY EASEMENT TO BE PRIVATELY MAINTAINED. PER FINAL MAP.
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DRAINAGE CERTIFICATION:

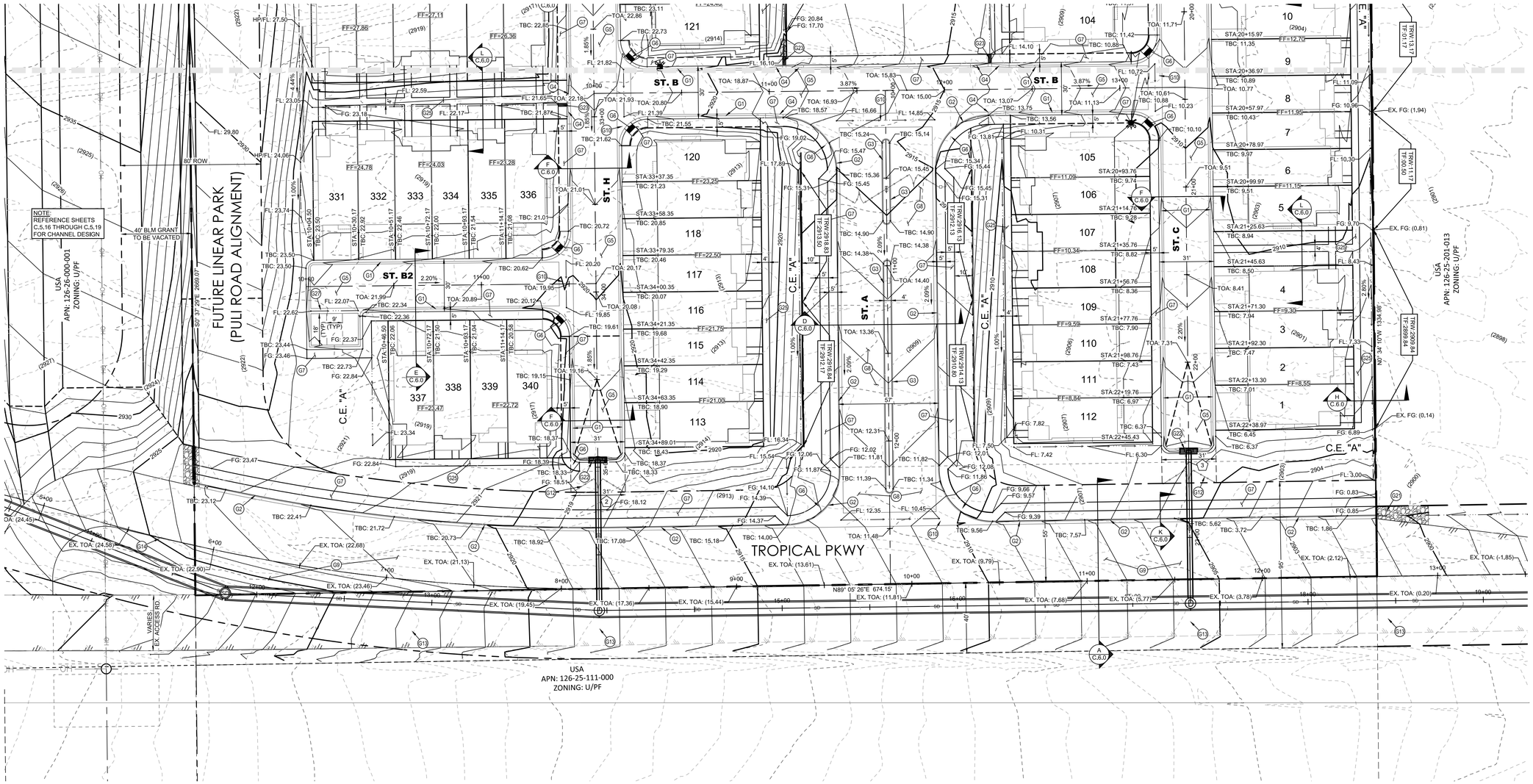
THIS SET OF IMPROVEMENT PLANS IS CERTIFIED TO CONFORM TO THE REQUIREMENTS OF THE APPROVED DRAINAGE STUDY.
DS# _____.

LARRY BITTON, P.E. NO. 010159 DATE

C.2.5

C:\Users\heather.dominguez\appdata\local\temp\AcPublish_5816\NV-1949-1909_C.2.0_GRD.dwg - C.2.5 - 12/23/2019 01:22pm, heather.dominguez

MATCHLINE STA 32+73.48
SEE SHEET C.2.5





HORROCKS ENGINEERS
1401 N. Green Valley Pkwy., Suite 160
Henderson, NV 89074
(702) 966-4063
www.horrocks.com

WARNING
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0 1 2

REVISIONS		
REV #	DATE	

*SEE GENERAL NOTES SHEET

DRAWING INFO	
DATE	12/23/19
DESIGNED	SS
DRAWN	PMP
CHECKED	AD
PROJECT	NV-1949-1909

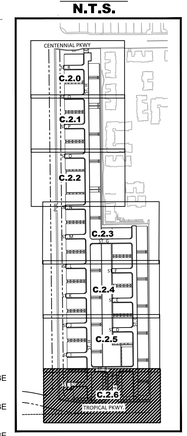
PROFESSIONAL ENGINEER—STATE OF NEVADA
LARRY M. BITTON
EXP. 12-31-20
CIVIL
No. 010159

EARTHWORKS

CUT: _____ CY
FILL: _____ CY
NET: _____ (FILL)

ESTIMATED QUANTITY FROM EXISTING TO FINISHED GRADES.
PER SOILS REPORT BY _____, PROJECT #_____, DATED _____

KEY MAP
N.T.S.



CENTENNIAL HEIGHTS TOWNHOMES
TECHNICAL DRAINAGE STUDY
CITY OF LAS VEGAS, NEVADA

GRADING PLAN VII

126-25-201-010

BASIS OF BEARING

NORTH 00°37'29" WEST, BEING THE WEST LINE OF THE NORTHWEST QUARTER (NW1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.M.,CLARK COUNTY, NEVADA, AS SHOWN ON THE PLAT OF CONSTELLATION ESTATES, RECORDED IN BOOK 102, PAGE 92, OFFICIAL RECORDS, CLARK COUNTY, NEVADA.

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Call 811 or 1-800-227-2600

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

FAST
Call before you UnderGround
1-702-432-5300
FREEWAY AND ARTERIAL SYSTEM OF TRANSPORTATION

BENCHMARK

RIVET & PLATE IN CONCRETE CYLINDER 60 FEET WEST OF MAINWAL AND AZURE

ELEVATION (meters) 901.13
ELEVATION (feet) 2,956.44
NAVD 88

SIGHT VISIBILITY ZONE NOTE:

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FOR DETAILED GRADING AROUND BUILDINGS REF. DETAIL "2" ON SHEET C.6.1

NOTE:
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AREA OF DISTURBANCE

ONSITE: _____

OFFSITE: _____

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G12	INSTALL WROUGHT IRON GATE
G13	INSTALL 60" TYPE II-SD STORM DRAIN MANHOLE PER CCAUSD #401 & 405.2
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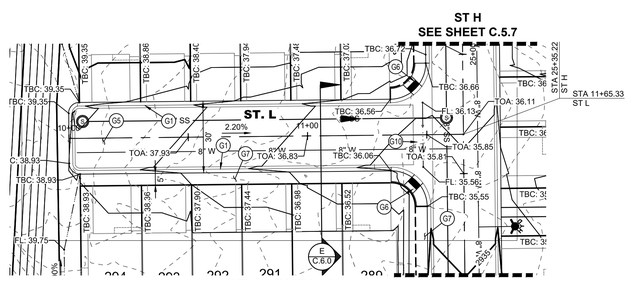
DRAINAGE CERTIFICATION:

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DS# _____ .

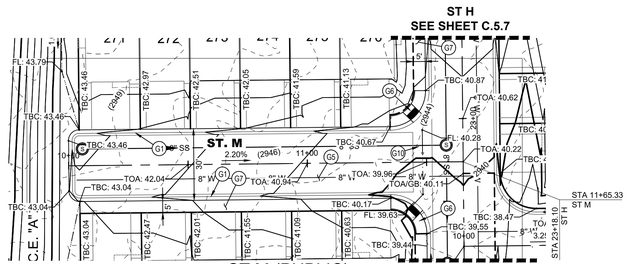
LARRY BITTON, P.E. NO. 010159 DATE

C.2.6

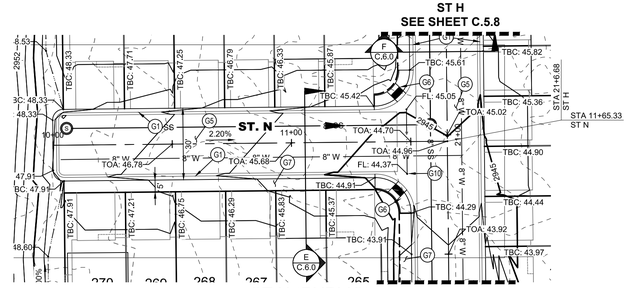
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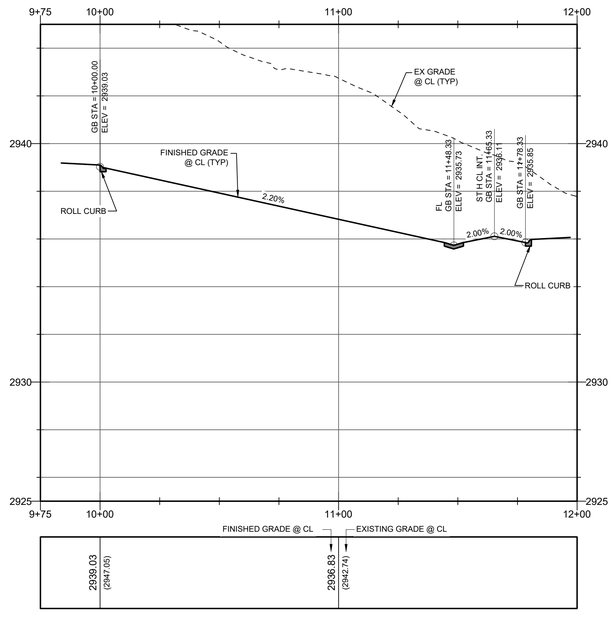
ST L (PUBLIC)
PLAN VIEW
(STA. 9+75 TO 12+00)



ST M (PUBLIC)
PLAN VIEW
(STA. 9+75 TO 12+00)

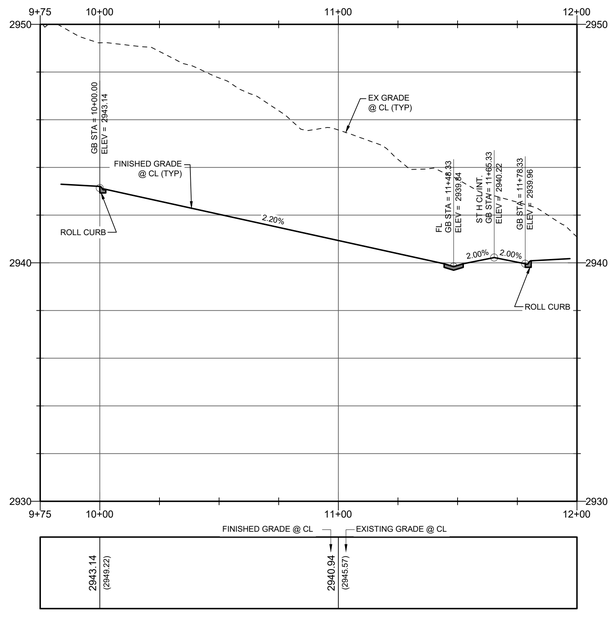


ST N (PUBLIC)
PLAN VIEW
(STA. 9+75 TO 12+00)



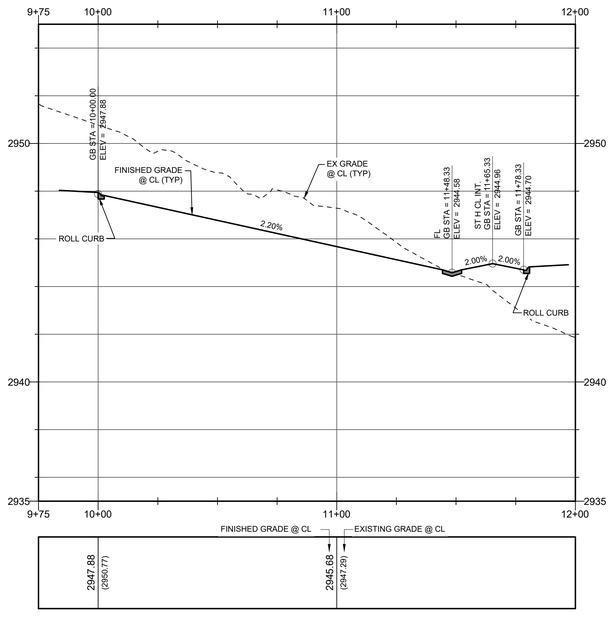
ST L (PUBLIC)
PPROFILE VIEW
(STA. 9+75 TO 12+00)

SCALE: 1" = 30' H
SCALE: 1" = 3' V



ST M (PUBLIC)
PPROFILE VIEW
(STA. 9+75 TO 12+00)

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SCALE: 1" = 3' V



ST N (PUBLIC)
PPROFILE VIEW
(STA. 9+75 TO 12+00)

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NOTE:
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BENCHMARK

RIVET & PLATE IN CONCRETE CYLINDER 60 FEET WEST OF MAINWAL AND AZURE

ELEVATION (meters) 901.13
ELEVATION (feet) 2,956.44
NAVD 88

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APPROVED FOR CONSTRUCTION

SOUTHWEST GAS CORPORATION DATE

APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES

PROJECT NO. _____ FIRST APPROVAL DATE: _____
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HORROCKS ENGINEERS
1401 N. Green Valley Pkwy., Suite 160
Henderson, NV 89074
(702) 966-4063
www.horrocks.com

HORROCKS ENGINEERS

0 30' 60'
SCALE: 1" = 30'

WARNING
0 1 2
IF THIS BAR DOES NOT MEASURE 2" THEN DRAWING IS NOT TO SCALE

REVISIONS
REV # | DATE

*SEE GENERAL NOTES SHEET

DRAWING INFO
DATE 12/23/19
DESIGNED SS
DRAWN PMP
CHECKED AD
PROJECT NV-1949-1909

PROFESSIONAL ENGINEER-STATE OF NEVADA
LARRY M. BITTON
EXP. 12-31-20
CIVIL
No. 0159

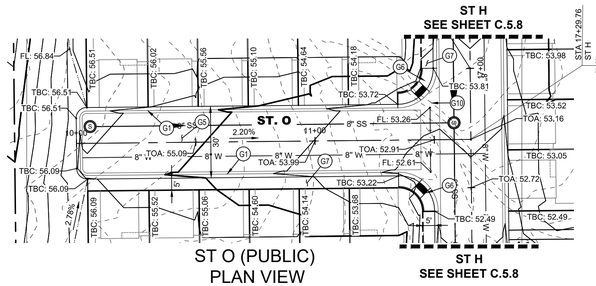
CENTENNIAL HEIGHTS TOWNHOMES
TECHNICAL DRAINAGE STUDY
CITY OF LAS VEGAS, NEVADA

ST L, M & N PLAN & PROFILE (STA 9+75 TO STA 12+00)

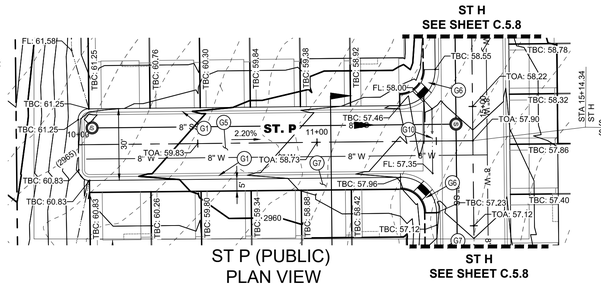
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PAGE 22

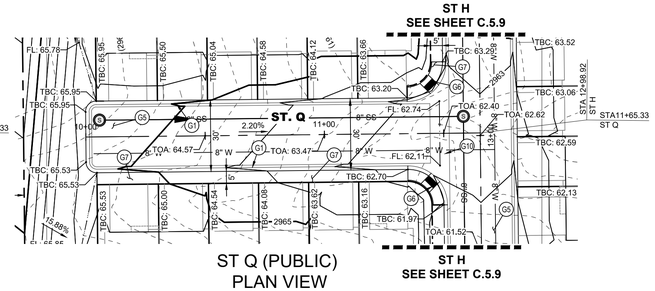
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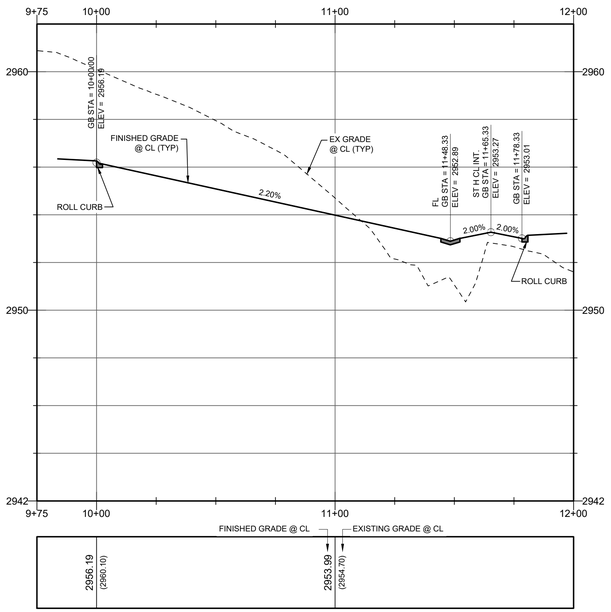
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ST P (PUBLIC)
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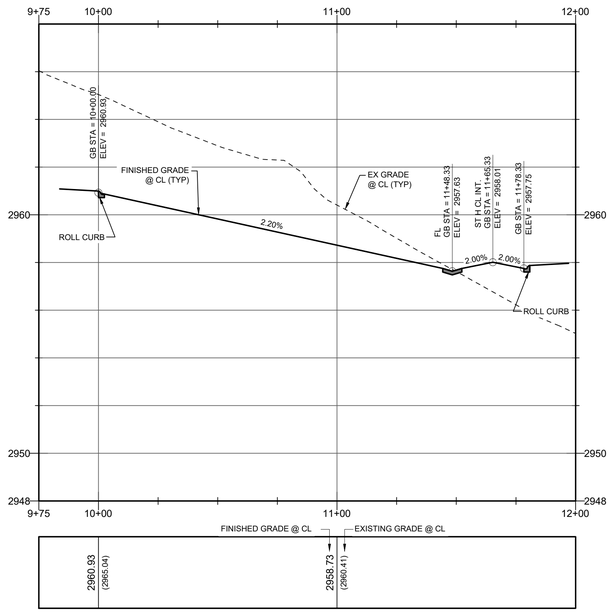


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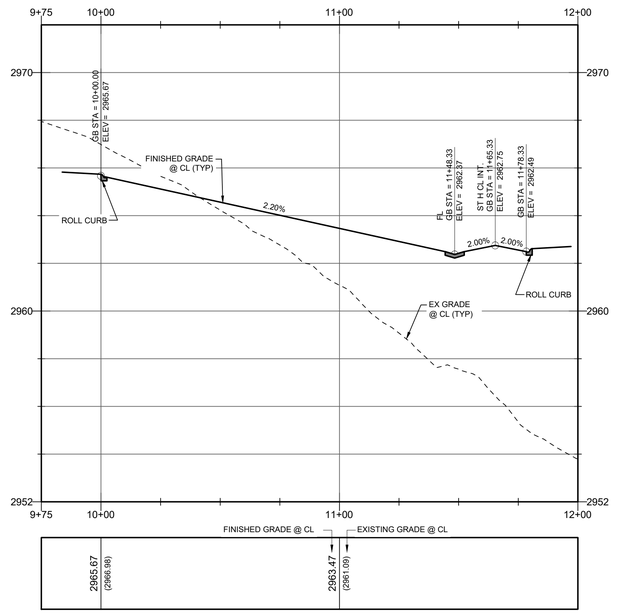
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REVISIONS
REV # | DATE

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DESIGNED SS
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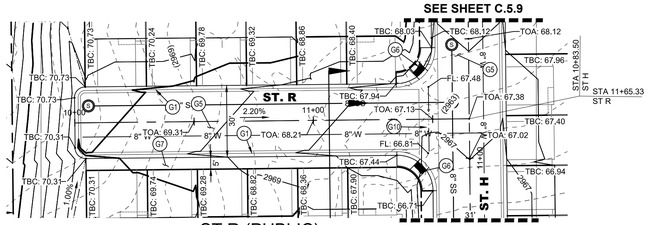
PROFESSIONAL ENGINEER—STATE OF NEVADA
LARRY M. BITTON
EXP. 12-31-20
CIVIL
No. 01159

CENTENNIAL HEIGHTS TOWNHOMES
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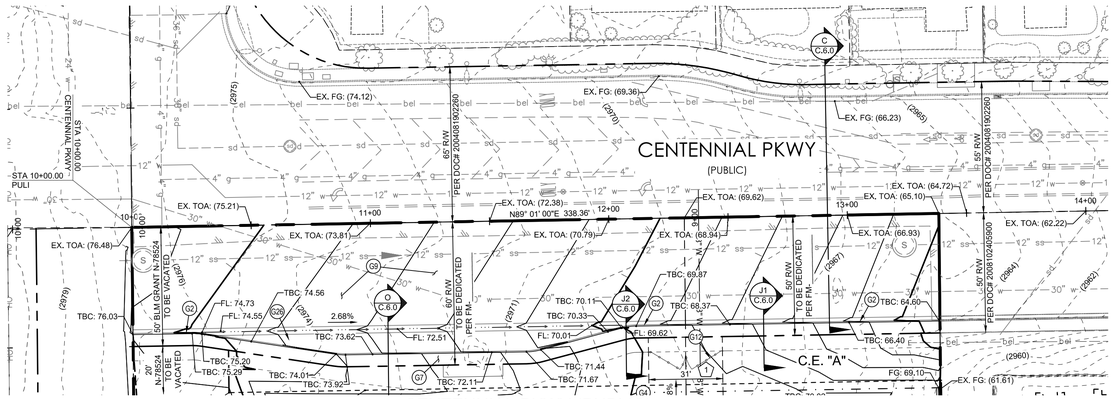
ST O, P & Q PLAN & PROFILE (STA 9+75 TO STA 12+00)

C.5.12

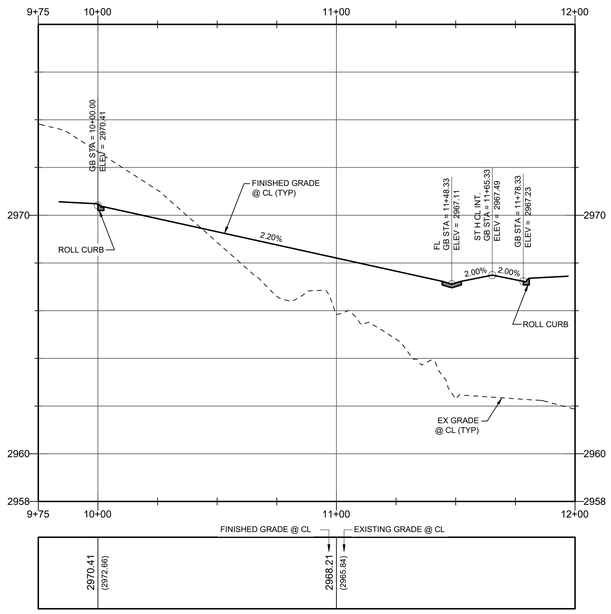
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ST R (PUBLIC)
PLAN VIEW
(STA. 9+50 TO 12+00)



CENTENNIAL PKWY (PUBLIC)
PLAN VIEW
(STA. 10+50 TO 13+50)



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FREEWAY AND ARTERIAL SYSTEM OF TRANSPORTATION

BASIS OF BEARING

NORTH 00°37'29" WEST, BEING THE WEST LINE OF THE NORTHWEST QUARTER (NW1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.M.,CLARK COUNTY, NEVADA, AS SHOWN ON THE PLAT OF CONSTELLATION ESTATES, RECORDED IN BOOK 102, PAGE 92, OFFICIAL RECORDS, CLARK COUNTY, NEVADA.

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DEPTH OF COVER DURING CONSTRUCTION:

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NOTE:
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FINISHED GRADE CONTOURS ARE APPROXIMATE. REFER TO SPOT ELEVATION GRADE TAGS FOR CONSTRUCTION STAKING PURPOSES.

BENCHMARK

RIVET & PLATE IN CONCRETE CYLINDER 60 FEET WEST OF MAINWAL AND AZURE

ELEVATION (meters) 901.13
ELEVATION (feet) 2,956.44
NAVD 88

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ENGINEER'S NOTES:

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7. FLOOR SECTION ASSUMES 5" SLAB OVER MIN. 8.5" TYPE II. CONTRACTOR TO VERIFY WITH STRUCTURAL PLANS AND GEOTECHNICAL ENGINEER.

APPROVED FOR CONSTRUCTION

SOUTHWEST GAS CORPORATION DATE

APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES

PROJECT NO. _____ FIRST APPROVAL DATE: _____
LVVWD APPROVED FIRE FLOW 1500 GPM AT 20 PSI RESIDENTIAL

LVVWD APPROVAL IS VALID FOR ONE (1) YEAR FROM SIGNATURE DATE. IF CONSTRUCTION IS NOT STARTED, PLANS **MUST** BE RESUBMITTED FOR REVIEW AND APPROVAL.

HORROCKS ENGINEERS
1401 N. Green Valley Pkwy., Suite 160
Henderson, NV 89074
(702) 966-4063
www.horrocks.com

SCALE: 1" = 30'

WARNING
IF THIS BAR DOES NOT MEASURE 2" THEN DRAWING IS NOT TO SCALE

REVISIONS
REV # | DATE

*SEE GENERAL NOTES SHEET

DRAWING INFO
DATE 12/23/19
DESIGNED SS
DRAWN PMP
CHECKED AD
PROJECT NV-1949-1909

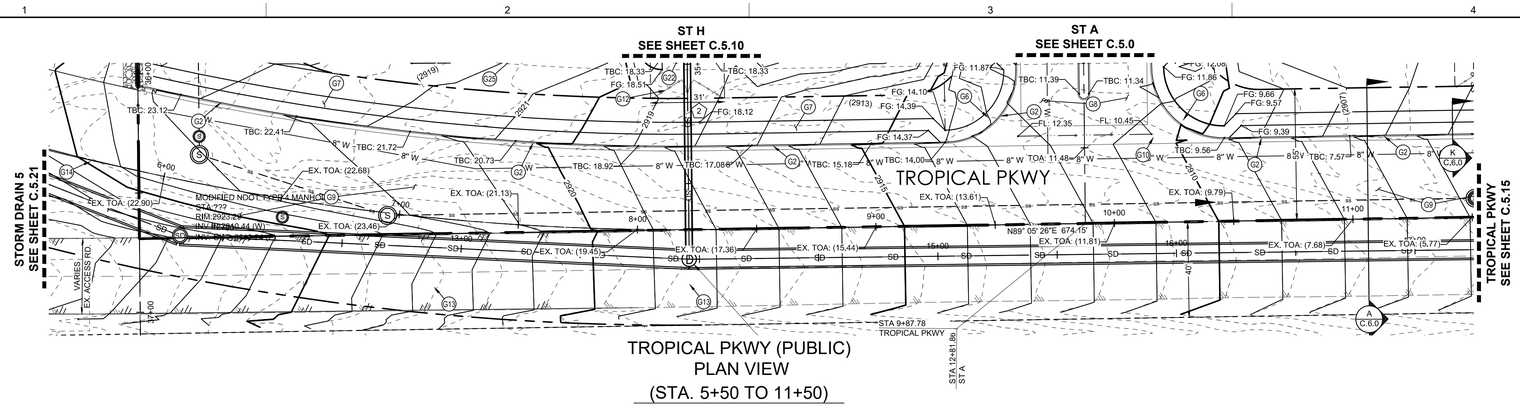
PROFESSIONAL ENGINEER-STATE OF NEVADA
LARRY M. BITTON
EXP. 12-31-20
CIVIL
No. 0059

CENTENNIAL HEIGHTS TOWNHOMES
TECHNICAL DRAINAGE STUDY
CITY OF LAS VEGAS, NEVADA

ST R PLAN & PROFILE (STA 9+75 TO STA 12+0)
CENTENNIAL PKWY PLAN & PROFILE (STA 10+50 TO 13+50)

C.5.13

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TROPICAL PKWY (PUBLIC)
PLAN VIEW
(STA. 5+50 TO 11+50)

TROPICAL PKWY (PUBLIC)
PLAN VIEW
(STA. 5+50 TO 11+50)

SCALE: 1" = 30' H
SCALE: 1" = 3' V

LEGAL DESCRIPTION:

A PORTION OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.D., CITY OF LAS VEGAS, CLARK COUNTY, NEVADA, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

THE WEST HALF (W 1/2) OF THE WEST HALF (W 1/2) OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.M., TOGETHER WITH:

THE WEST HALF (W 1/2) OF THE SOUTHWEST QUARTER (SW 1/4) OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.M.

Call before you dig
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BASIS OF BEARING

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- (G3) CONSTRUCT "A" TYPE CURB PER CCAUSD #219
- (G4) CONSTRUCT 10' TRANSITION FROM "L" TYPE CURB TO ROLL CURB PER DETAIL "1" ON SHEET C.6.0
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- (G10) CONSTRUCT 8' CONCRETE VALLEY GUTTER PER CCAUSD #228
- (G11) SAWCUT, TRENCH, BACKFILL, AND ASPHALT PATCH PER CCAUSD 500.3, 500.4, 500.5 & 503 (PATCH DIMENSIONS TO BE DETERMINED IN THE FIELD) PROPOSED SAWCUT TO BE AT LANE LINE
- (G12) INSTALL WROUGHT IRON GATE
- (G13) INSTALL 60" TYPE II-SD STORM DRAIN MANHOLE PER CCAUSD #401 & 405.2
- (G14) CONSTRUCT HEADWALL PER NDOT STANDARDS
- (G15) INSTALL 60" TYPE II-SD STORM DRAIN MANHOLE WITH GRATE PER CCAUSD #401 & 405.2
- (G17) EXISTING TO REMAIN. PROTECT IN PLACE.
- (G18) INSTALL LANDSCAPING PER LANDSCAPE PLAN BY OTHERS
- (G19) CONSTRUCT 5'X5' CONCRETE SIDEWALK PAD PER CCAUSD #234 FOR ADA TURNAROUND
- (G20) CONSTRUCT 24.0' WIDE CURB OPENING PER DETAIL "CC" ON SHEET C.6.0
- (G21) INSTALL BUBBLER STRUCTURE W/ (13) 2' GRATES, L=26', W=5', D=TBD
- (G22) CONSTRUCT DROP INLET TYPE "CM2" PER CCAUSD #412.1 & 421 W/ (3) 2.5' GRATES, L=10', D=TBD
- (G23) CONSTRUCT SIDEWALK DRAIN PER CCAUSD #236
- (G24) INSTALL RIP-RAP D50=6",T=12" SUBGRADE @ 90% COMPACTION
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APPROVED FOR CONSTRUCTION

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APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES

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REVISIONS		
REV #	DATE	
1		

*SEE GENERAL NOTES SHEET

DRAWING INFO	
DATE	12/23/19
DESIGNED	SS
DRAWN	PMP
CHECKED	AD
PROJECT	NV-1949-1909

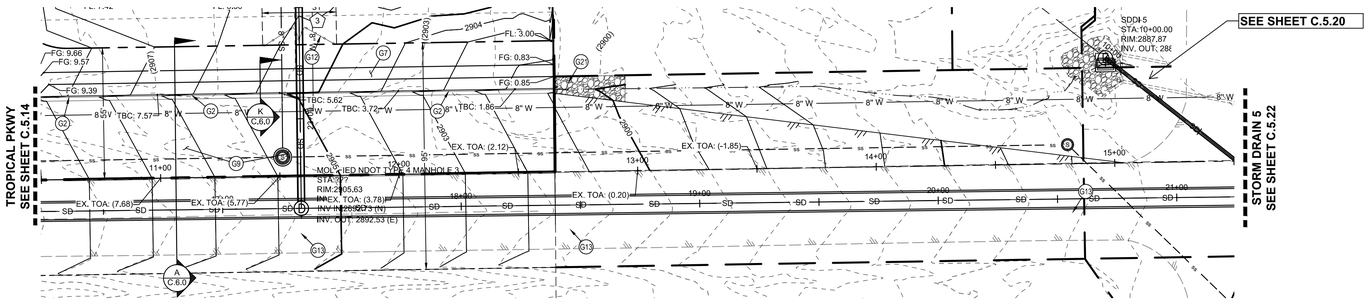
PROFESSIONAL ENGINEER—STATE OF NEVADA
LARRY M. BITTON
EXP. 12-31-20
CIVIL
No. 01059

CENTENNIAL HEIGHTS TOWNHOMES
TECHNICAL DRAINAGE STUDY
CITY OF LAS VEGAS, NEVADA

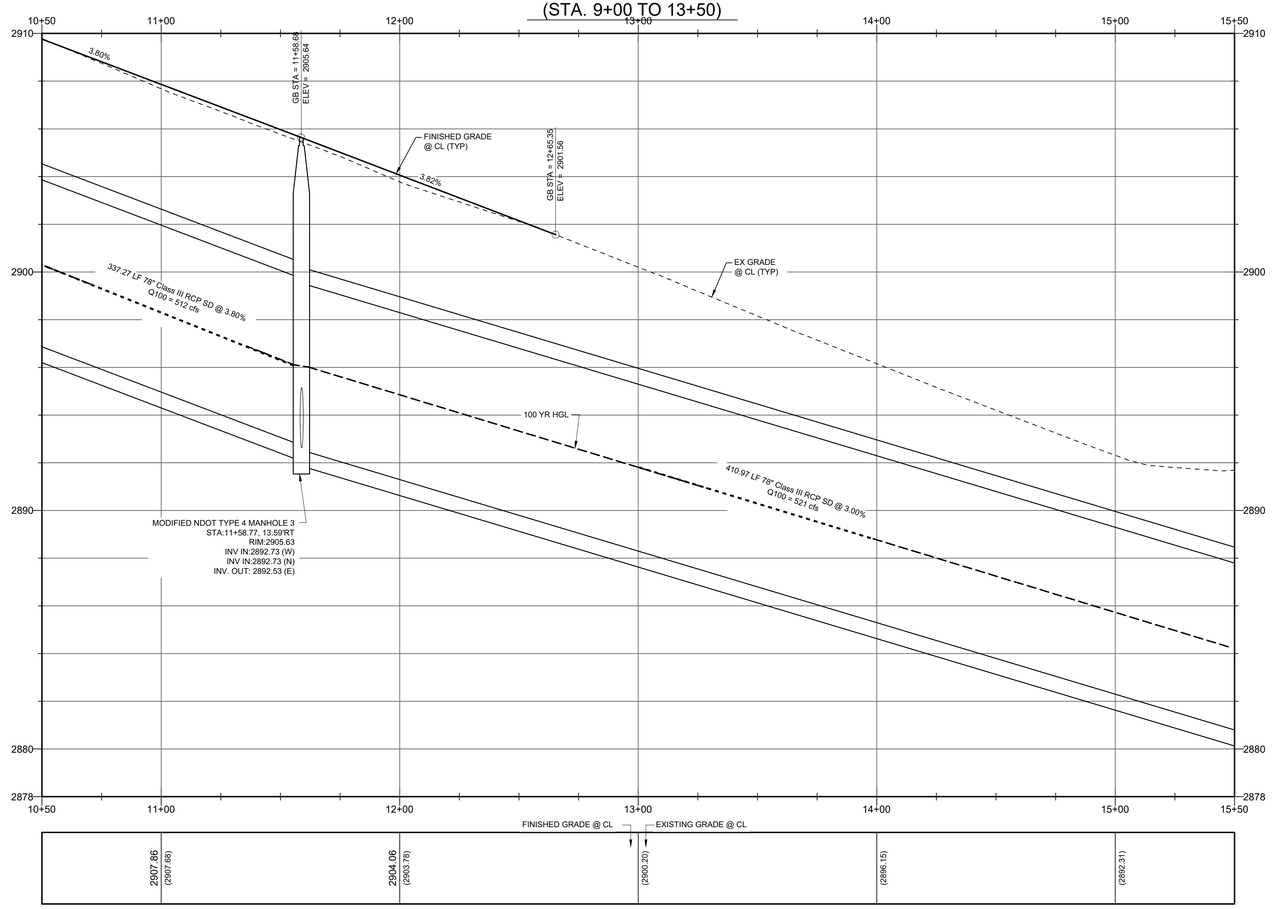
TROPICAL PKWY PLAN & PROFILE (STA 5+00 TO 9+50)

C.5.14

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TROPICAL PKWY (PUBLIC)
PLAN VIEW
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LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES

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0 30' 60'
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0 1 2
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REVISIONS
REV # | DATE
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DRAWING INFO
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DESIGNED SS
DRAWN PMP
CHECKED AD
PROJECT NV-1949-1909

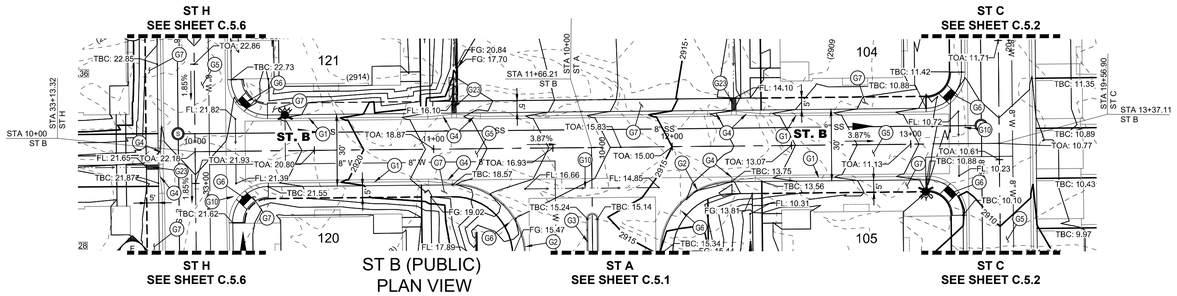
PROFESSIONAL ENGINEER-STATE OF NEVADA
LARRY M. BITTON
EXP. 12-31-20
CIVIL
No. 0159

CENTENNIAL HEIGHTS TOWNHOMES
TECHNICAL DRAINAGE STUDY
CITY OF LAS VEGAS, NEVADA

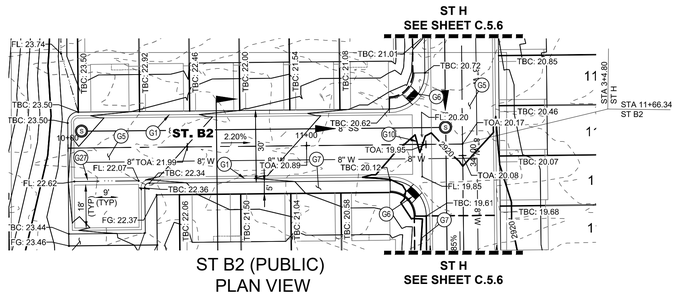
TROPICAL PKWY PLAN & PROFILE (STA 9+00 TO STA 13+50)

C.5.15

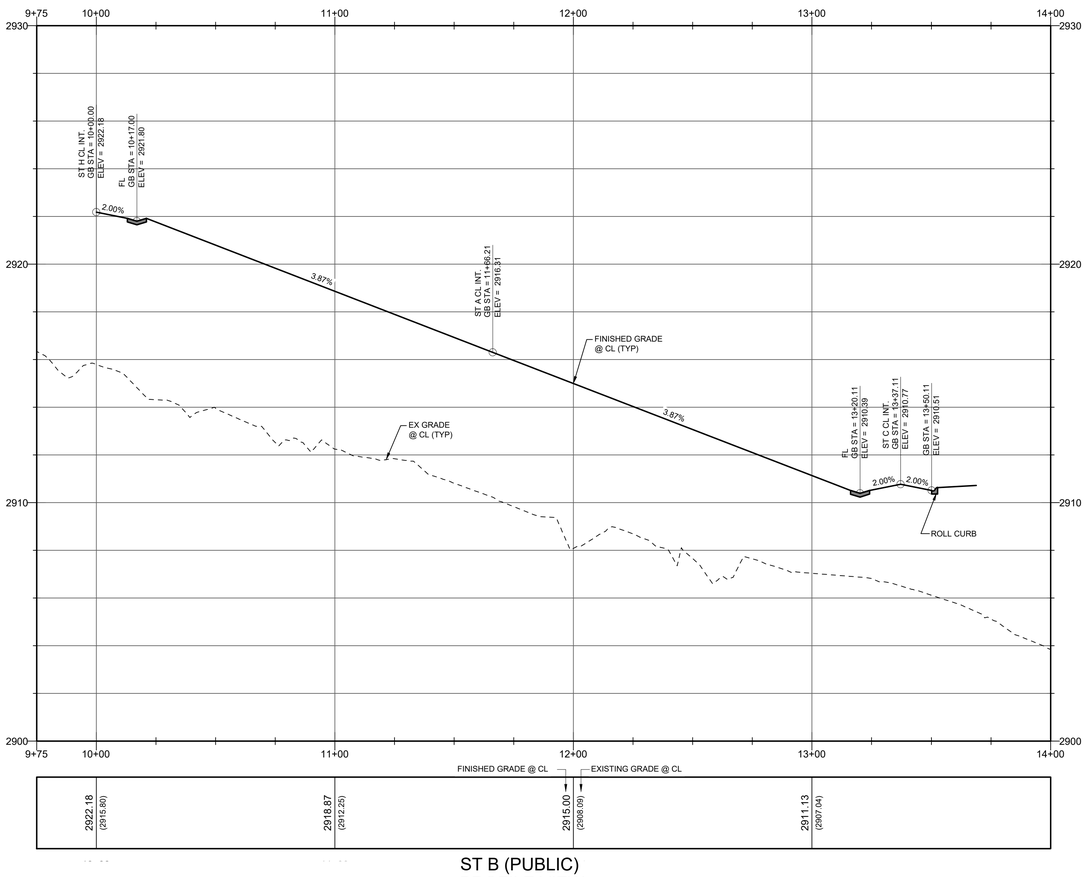
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ST B (PUBLIC)
PLAN VIEW
(STA. 9+75 TO 14+00)

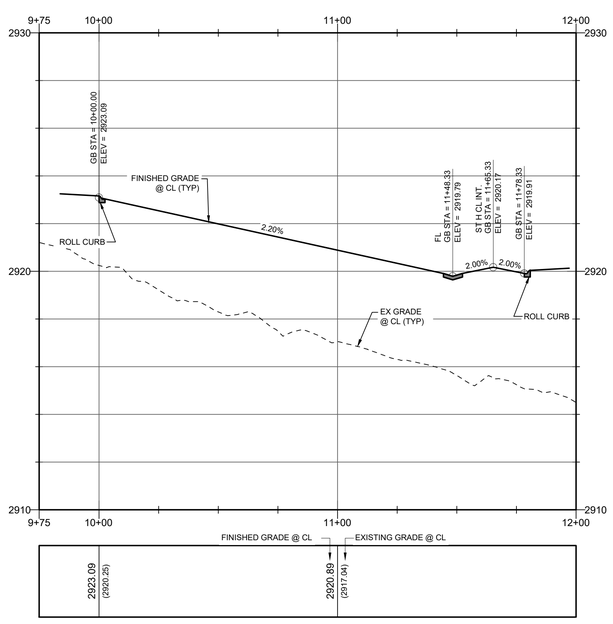


ST B2 (PUBLIC)
PLAN VIEW
(STA. 9+75 TO 12+00)



ST B (PUBLIC)
PROFILE VIEW
(STA. 9+75 TO 14+00)

SCALE: 1" = 30' H
SCALE: 1" = 3' V



ST B2 (PUBLIC)
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- (G11) SAWCUT, TRENCH, BACKFILL, AND ASPHALT PATCH PER CCAUSD 500.3, 500.4, 500.5 & 503 (PATCH DIMENSIONS TO BE DETERMINED IN THE FIELD) PROPOSED SAWCUT TO BE AT LANE LINE
- (G12) INSTALL WROUGHT IRON GATE
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- (G15) INSTALL 60" TYPE II-SD STORM DRAIN MANHOLE WITH GRATE PER CCAUSD #401 & 405.2
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- (G19) CONSTRUCT 5'X5' CONCRETE SIDEWALK PAD PER CCAUSD #234 FOR ADA TURNAROUND
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A PORTION OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.D., CITY OF LAS VEGAS, CLARK COUNTY, NEVADA, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

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THE WEST HALF (W 1/2) OF THE SOUTHWEST QUARTER (SW 1/4) OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.M.

BASIS OF BEARING

NORTH 00°37'29" WEST, BEING THE WEST LINE OF THE NORTHWEST QUARTER (NW1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.M.,CLARK COUNTY, NEVADA, AS SHOWN ON THE PLAT OF CONSTELLATION ESTATES, RECORDED IN BOOK 102, PAGE 92, OFFICIAL RECORDS, CLARK COUNTY, NEVADA.

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FINISHED GRADE CONTOURS ARE APPROXIMATE. REFER TO SPOT ELEVATION GRADE TAGS FOR CONSTRUCTION STAKING PURPOSES.

BENCHMARK

RIVET & PLATE IN CONCRETE CYLINDER 60 FEET WEST OF MAINWAL AND AZURE

ELEVATION (meters) 901.13
ELEVATION (feet) 2,956.44
NAVD 88

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FREEWAY AND ARTERIAL SYSTEM OF TRANSPORTATION

APPROVED FOR CONSTRUCTION

SOUTHWEST GAS CORPORATION DATE

APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES

PROJECT NO. _____ FIRST APPROVAL DATE: _____
LVVWD APPROVED FIRE FLOW 1500 GPM AT 20 PSI RESIDENTIAL

LVVWD APPROVAL IS VALID FOR ONE (1) YEAR FROM SIGNATURE DATE. IF CONSTRUCTION IS NOT STARTED, PLANS **MUST** BE RESUBMITTED FOR REVIEW AND APPROVAL.

HORROCKS ENGINEERS
1401 N. Green Valley Pkwy., Suite 160
Henderson, NV 89074
(702) 966-4063
www.horrocks.com

HORROCKS ENGINEERS

0 30' 60'
SCALE: 1" = 30'

WARNING
0 1 2
IF THIS BAR DOES NOT MEASURE 2" THEN DRAWING IS NOT TO SCALE

REVISIONS
REV # | DATE

*SEE GENERAL NOTES SHEET

DRAWING INFO
DATE 12/23/19
DESIGNED SS
DRAWN PMP
CHECKED AD
PROJECT NV-1949-1909

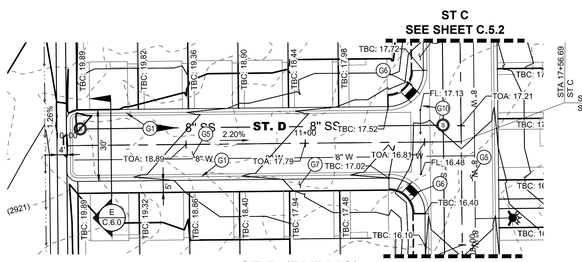
PROFESSIONAL ENGINEER-STATE OF NEVADA
LARRY M. BITTON
EXP. 12-31-20
CIVIL
No. 01159

CENTENNIAL HEIGHTS TOWNHOMES
TECHNICAL DRAINAGE STUDY
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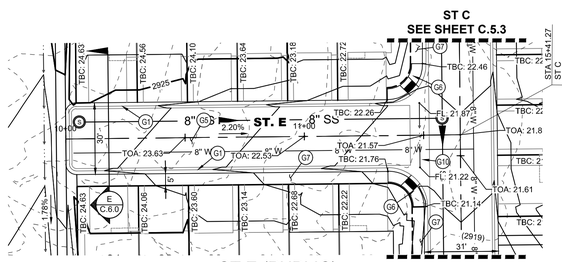
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ST B2 PLAN & PROFILE (STA 10+00 TO 11+65.33)

C.5.1

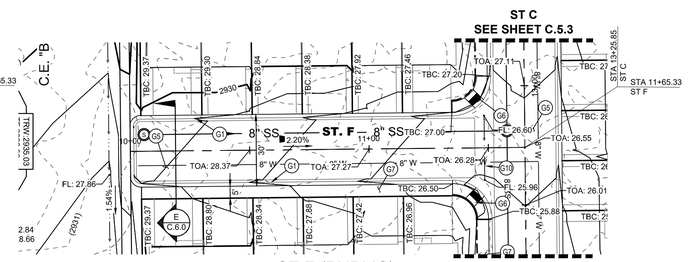
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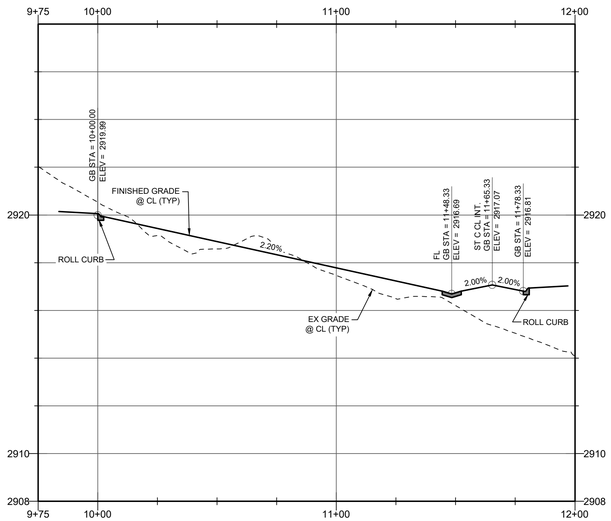
ST D (PUBLIC)
PLAN VIEW
(STA. 9+75 TO 12+00)

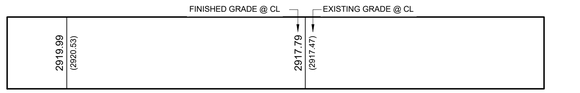


ST E (PUBLIC)
PLAN VIEW
(STA. 9+75 TO 12+00)

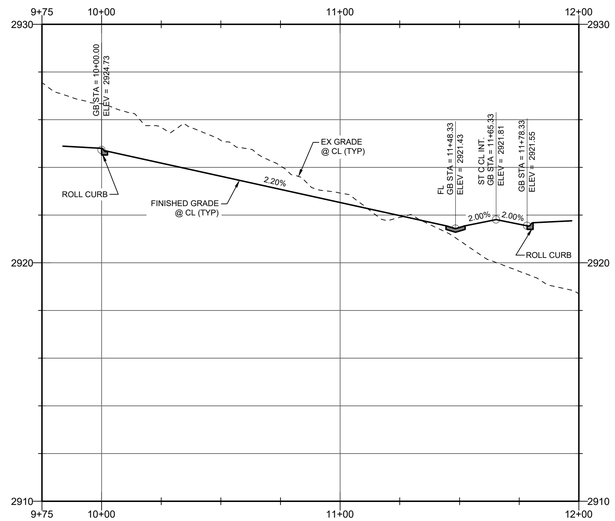


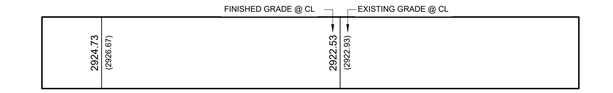
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PLAN VIEW
(STA. 9+75 TO 12+00)



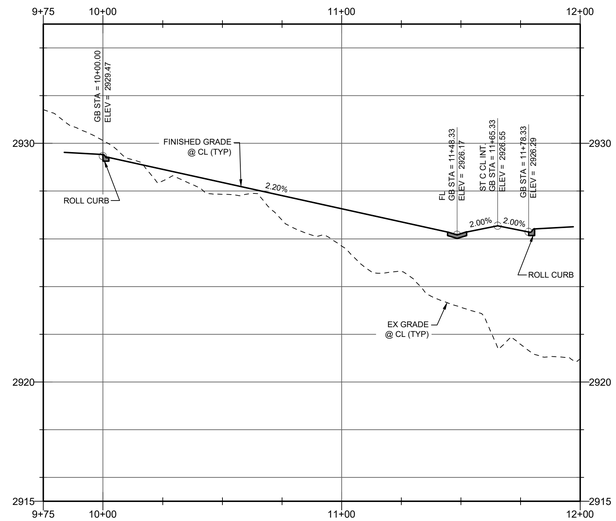


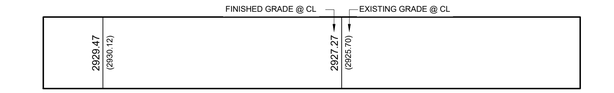
ST D (PUBLIC)
PROFILE VIEW
(STA. 9+75 TO 12+00)
SCALE: 1" = 30' H
SCALE: 1" = 3' V





ST E (PUBLIC)
PROFILE VIEW
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SCALE: 1" = 30' H
SCALE: 1" = 3' V





ST F (PUBLIC)
PROFILE VIEW
(STA. 9+75 TO 12+00)
SCALE: 1" = 30' H
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(G6) CONSTRUCT SIDEWALK RAMP "CASE I" PER CCAUSD #235
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APPROVED FOR CONSTRUCTION

SOUTHWEST GAS CORPORATION DATE

APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES

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SCALE: 1" = 30'

WARNING
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REVISIONS
REV # | DATE

*SEE GENERAL NOTES SHEET

DRAWING INFO
DATE 12/23/19
DESIGNED SS
DRAWN PMP
CHECKED AD
PROJECT NV-1949-1909

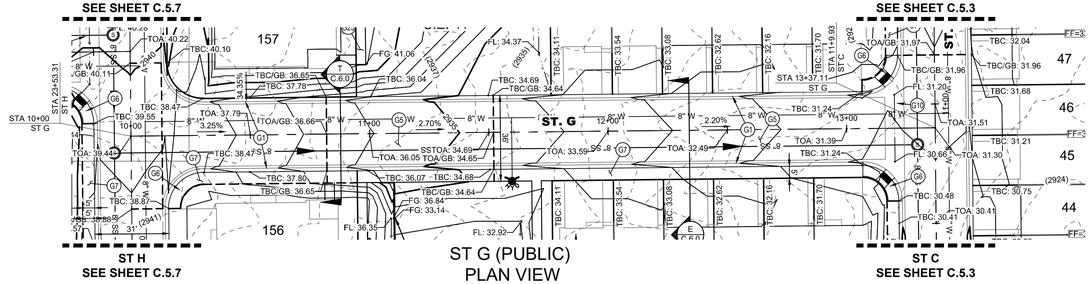
PROFESSIONAL ENGINEER—STATE OF NEVADA
LARRY M. BITTON
EXP. 12-31-20
CIVIL
No. 010159

CENTENNIAL HEIGHTS TOWNHOMES
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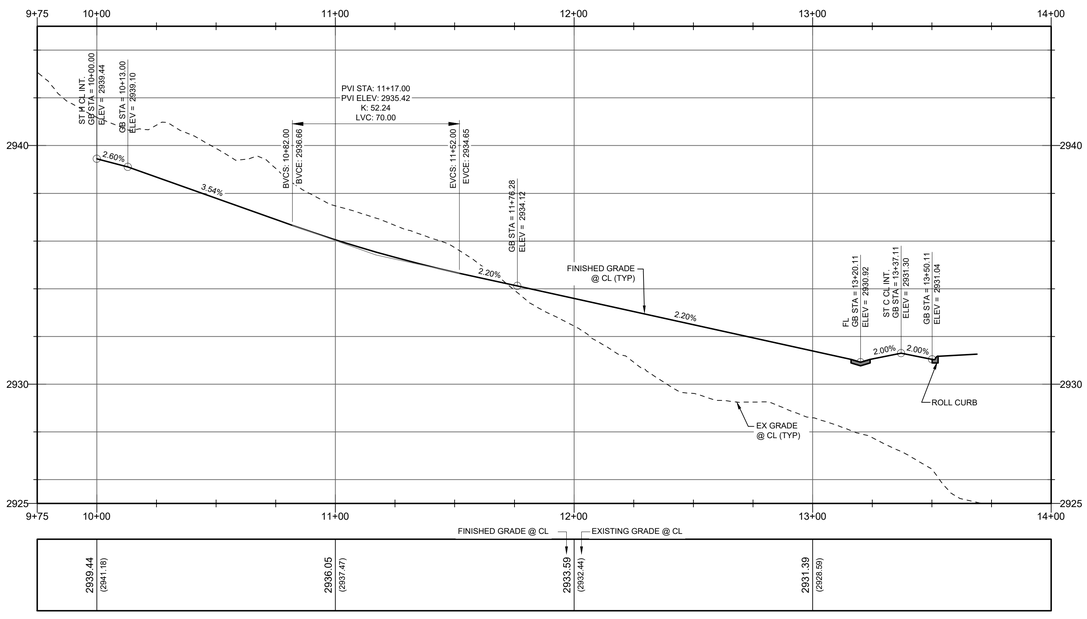
ST D, E, & F PLAN & PROFILE (STA 9+75 TO STA 12+00)

C.5.4

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ST G (PUBLIC)
PLAN VIEW
(STA. 9+50 TO 13+50)



ST G (PUBLIC)
PROFILE VIEW
(STA. 9+50 TO 13+50)
SCALE: 1" = 30' H
SCALE: 1" = 3' V

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BENCHMARK

RIVET & PLATE IN CONCRETE CYLINDER 60 FEET WEST OF MAINWAL AND AZURE

ELEVATION (meters) 901.13
ELEVATION (feet) 2,956.44
NAVD 88

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APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES

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www.horrocks.com

SCALE: 1" = 30'

WARNING
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REVISIONS
REV # | DATE
*SEE GENERAL NOTES SHEET

DRAWING INFO
DATE 12/23/19
DESIGNED SS
DRAWN PMP
CHECKED AD
PROJECT NV-1949-1909

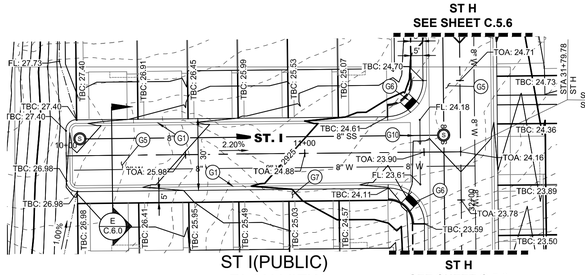
PROFESSIONAL ENGINEER—STATE OF NEVADA
LARRY M. BITTON
EXP. 12-31-20
CIVIL
No. 01159

CENTENNIAL HEIGHTS TOWNHOMES
TECHNICAL DRAINAGE STUDY
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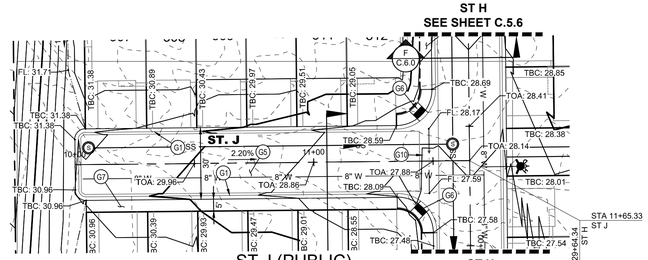
ST G PLAN & PROFILE (STA 9+50 TO STA 13+50)

C.5.5

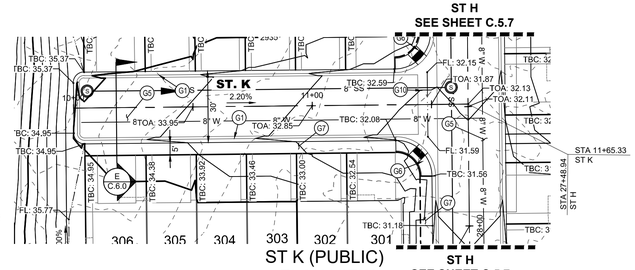
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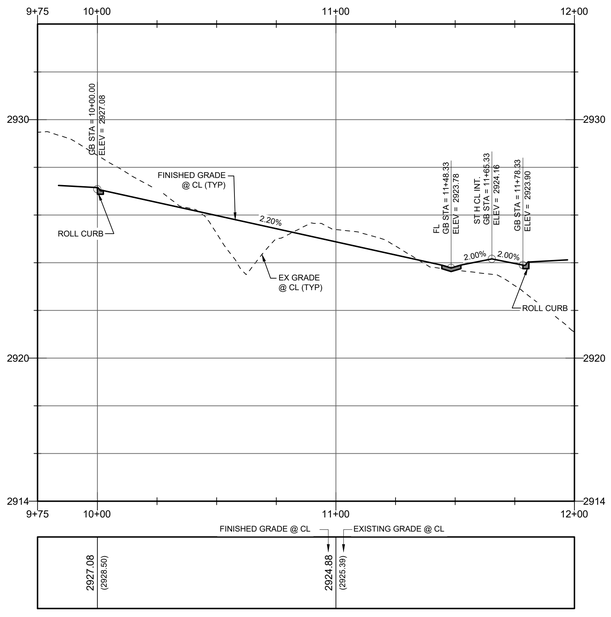
ST I(PUBLIC)
PLAN VIEW
(STA. 9+75 TO 12+00)



ST J (PUBLIC)
PLAN VIEW
(STA. 9+75 TO 12+00)

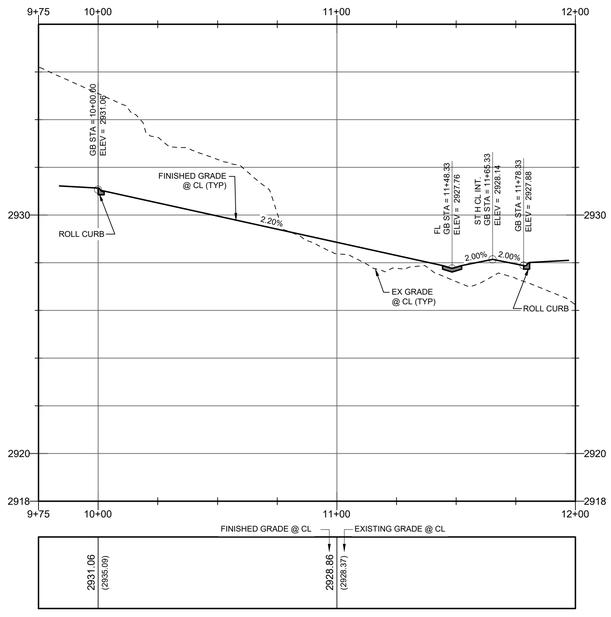


ST K (PUBLIC)
PLAN VIEW
(STA. 9+75 TO 12+00)



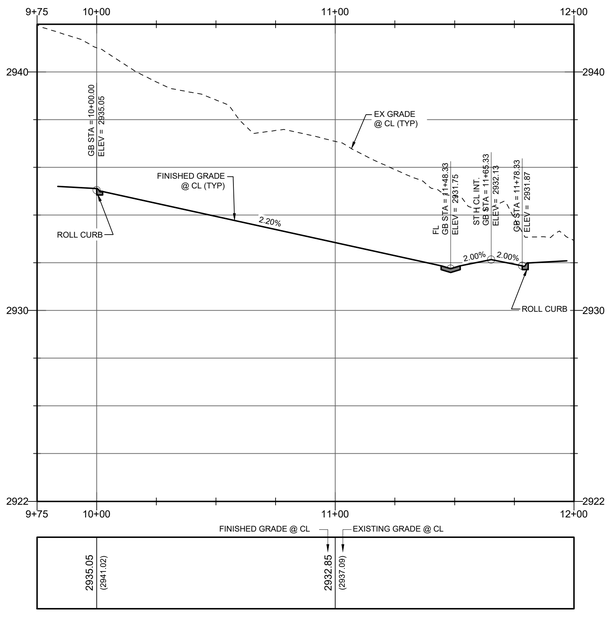
ST I (PUBLIC)
PPROFILE VIEW
(STA. 9+75 TO 12+00)

SCALE: 1" = 30' H
SCALE: 1" = 3' V



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- G3 CONSTRUCT "A" TYPE CURB PER CCAUSD #219
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- G9 CONSTRUCT 5.5" AC PAVEMENT OVER 6" TYPE II AGG BASE
- S10 CONSTRUCT 8' CONCRETE VALLEY GUTTER PER CCAUSD #228
- S11 SAWCUT, TRENCH, BACKFILL, AND ASPHALT PATCH PER CCAUSD 500.3, 500.4, 500.5 & 503 (PATCH DIMENSIONS TO BE DETERMINED IN THE FIELD) PROPOSED SAWCUT TO BE AT LANE LINE
- S12 INSTALL WROUGHT IRON GATE
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- S14 CONSTRUCT HEADWALL PER NDOT STANDARDS
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- S17 EXISTING TO REMAIN. PROTECT IN PLACE.
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FREEWAY AND ARTERIAL SYSTEM OF TRANSPORTATION

BASIS OF BEARING

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REVISIONS
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DRAWING INFO
DATE 12/23/19
DESIGNED SS
DRAWN PMP
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PROJECT NV-1949-1909

PROFESSIONAL ENGINEER—STATE OF NEVADA
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EXP. 12-31-20
CIVIL
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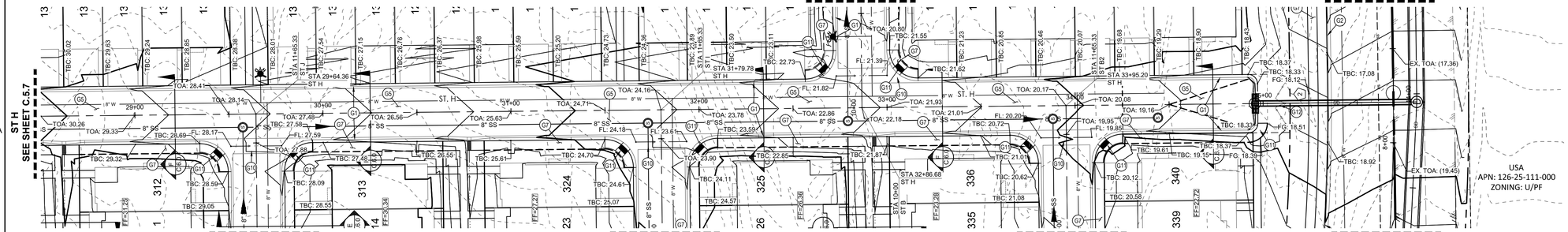
CENTENNIAL HEIGHTS TOWNHOMES
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ST I, J, & K PLAN & PROFILE (STA 9+75 TO STA 12+00)

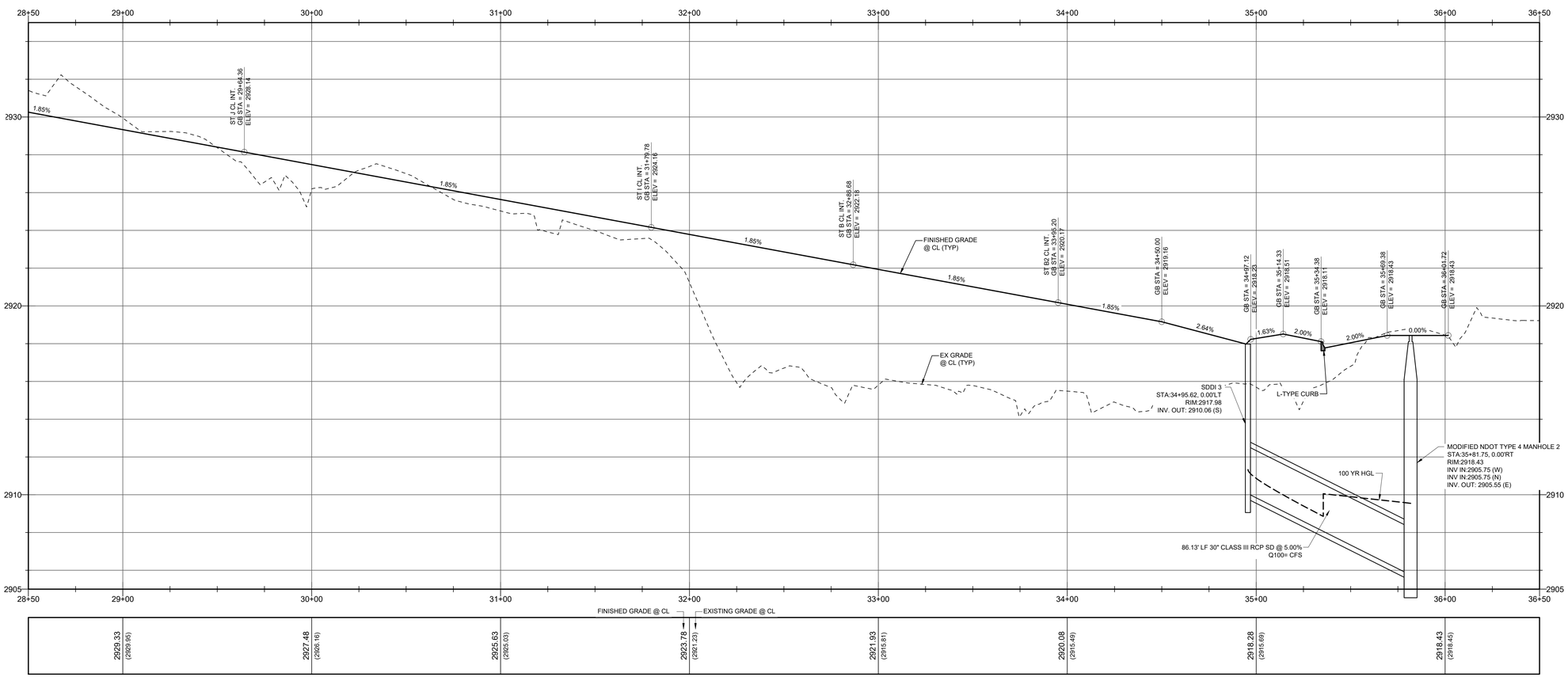
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ST H (PUBLIC)
PLAN VIEW
(STA. 28+50 TO 36+00)



ST H (PUBLIC)
PROFILE VIEW
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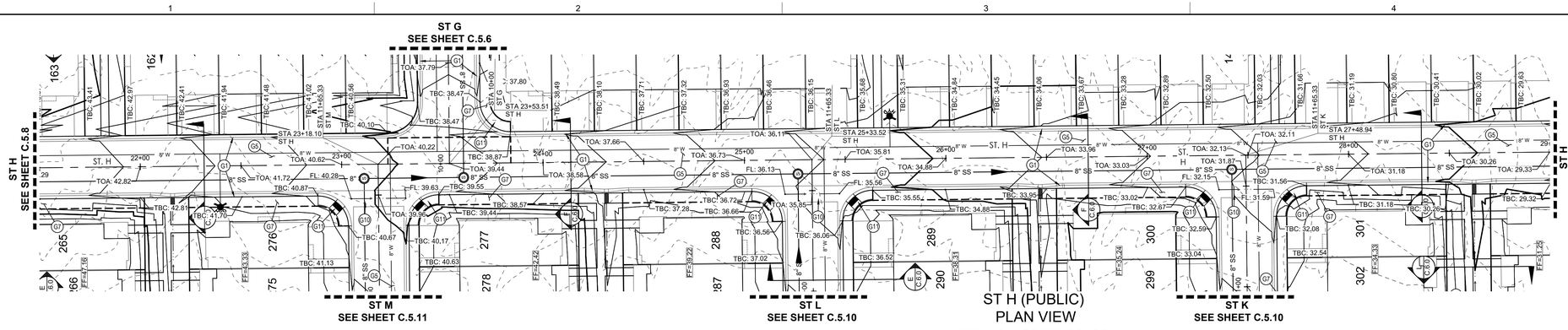
PROFESSIONAL ENGINEER-STATE OF NEVADA
LARRY M. BITTON
EXP. 12-31-20
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CENTENNIAL HEIGHTS TOWNHOMES
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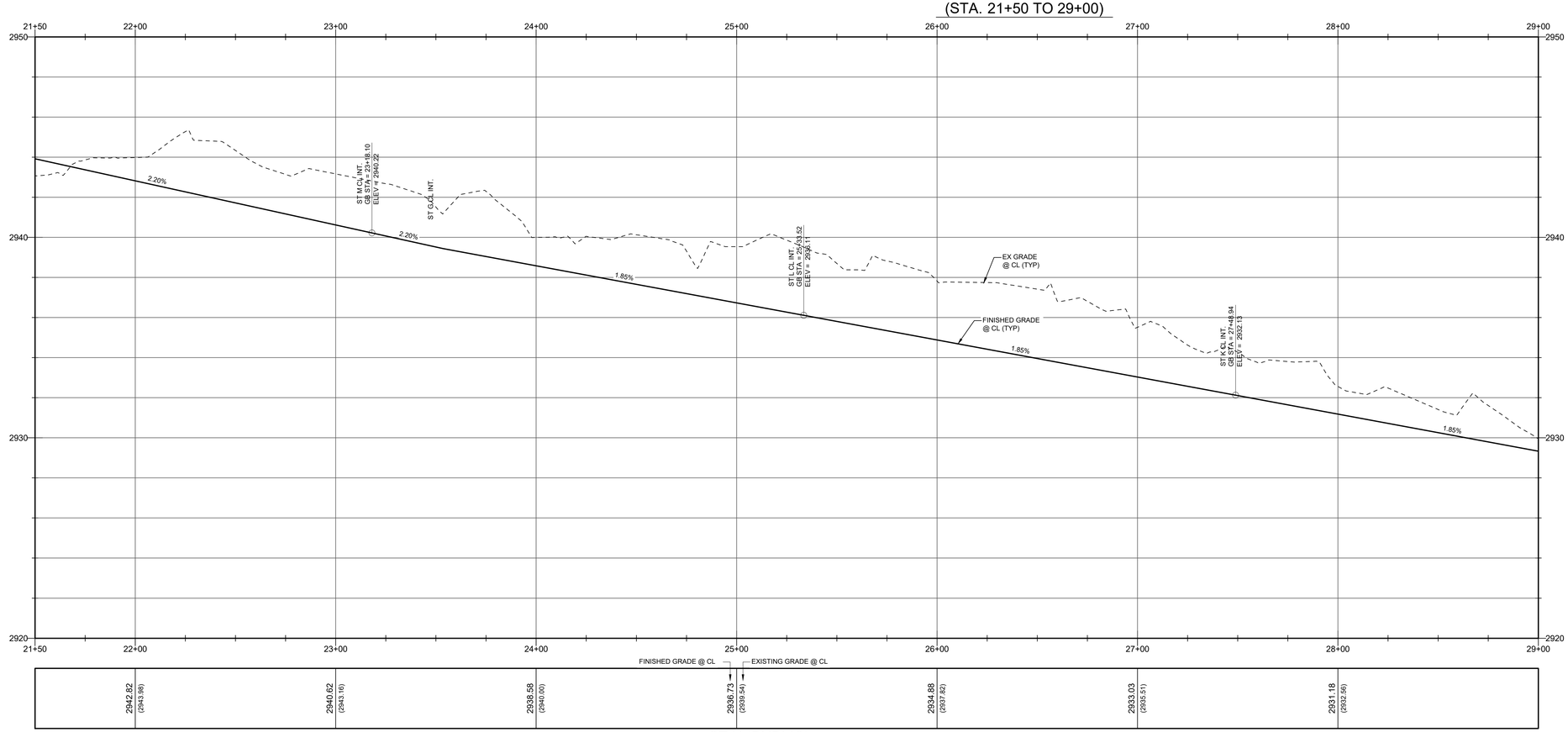
ST H PLAN & PROFILE (STA 28+50 TO STA 36+00)

C.5.6

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ST H (PUBLIC)
PLAN VIEW
(STA. 21+50 TO 29+00)



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APPROVED FOR CONSTRUCTION

SOUTHWEST GAS CORPORATION DATE

APPROVED FOR CONSTRUCTION

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REVISIONS
REV # | DATE

*SEE GENERAL NOTES SHEET

DRAWING INFO
DATE 12/23/19
DESIGNED SS
DRAWN PMP
CHECKED AD
PROJECT NV-1949-1909

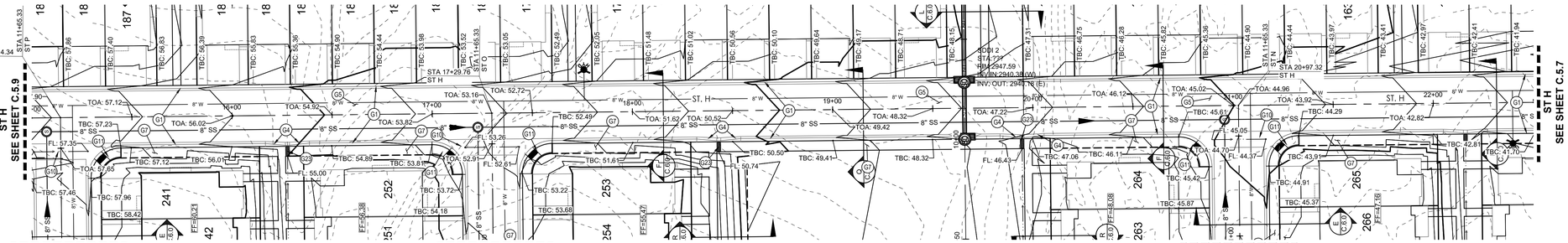
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LARRY M. BITTON
EXP. 12-31-20
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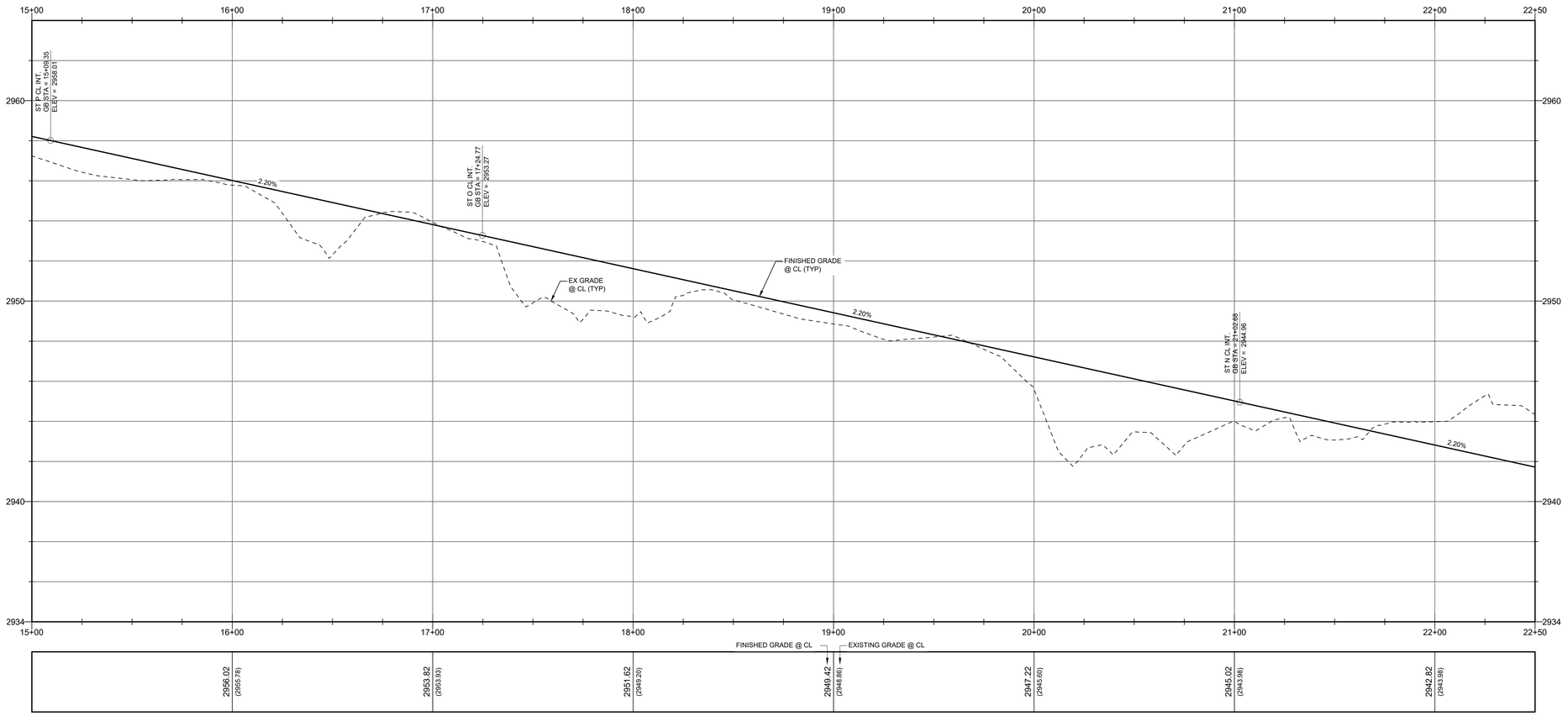
ST H PLAN & PROFILE (STA 21+50 TO STA 29+00)

C.5.7

H:\!2019\NV-1949-1909 Centennial Heights Townhomes\Project Data\02 CAD\2.03 Sheet Files\NV-1949-1909_C.5.0_PNP_NS2.dwg - C.5.7 - 12/23/2019 01:29pm, shayans



ST H (PUBLIC)
PLAN VIEW
(STA. 15+00 TO 22+50)



ST H (PUBLIC)
PROFILE VIEW
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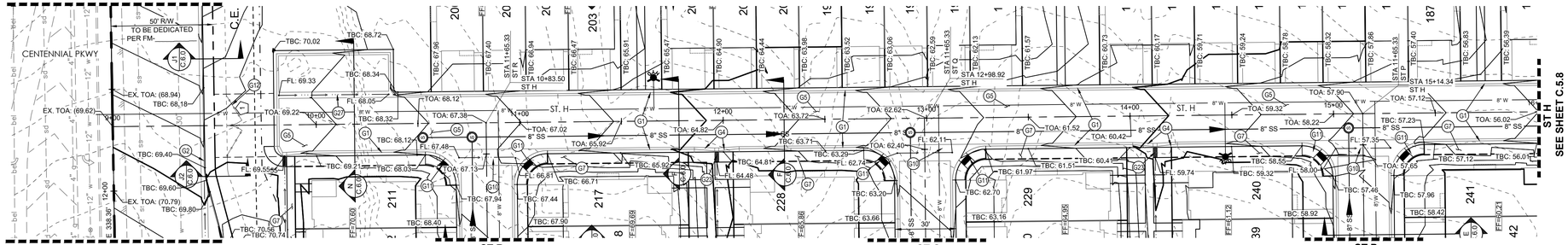
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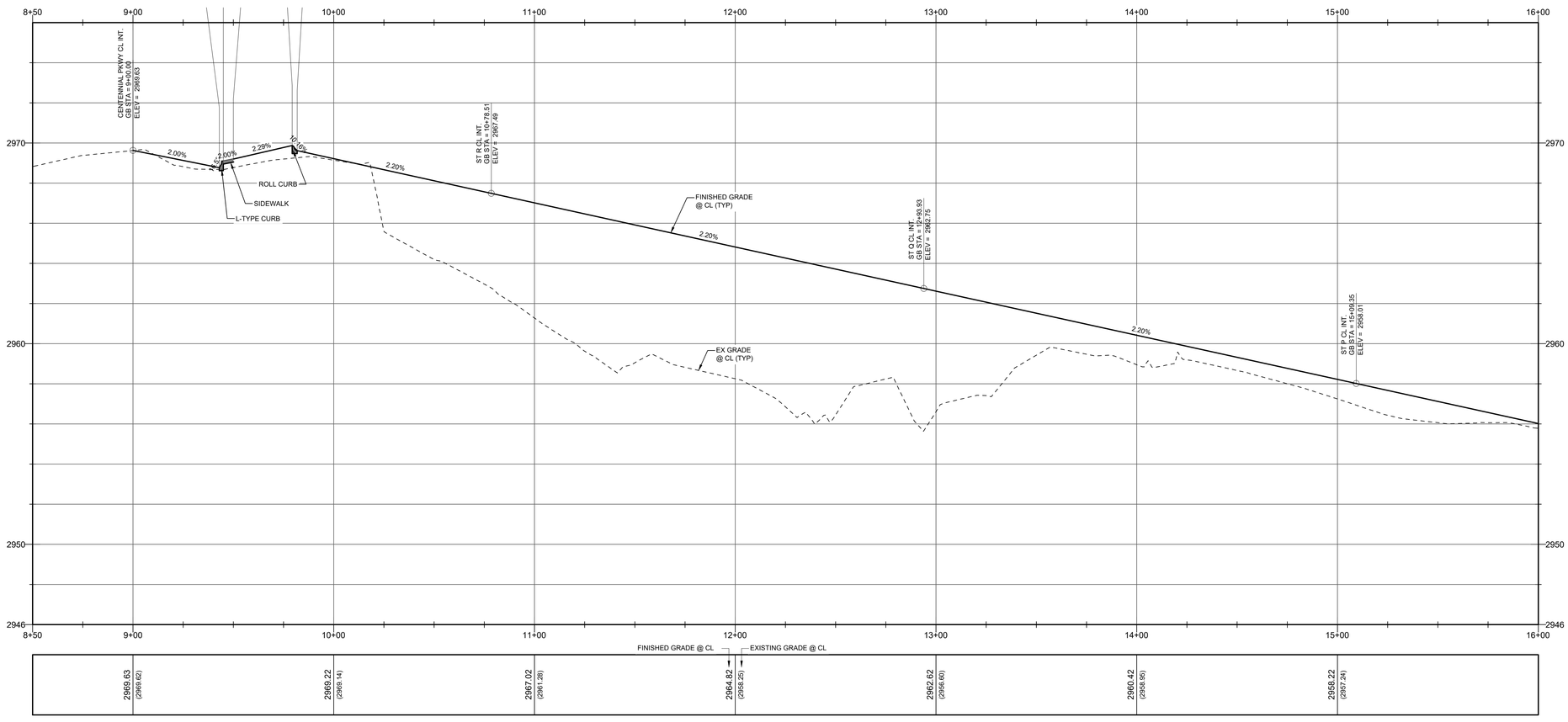
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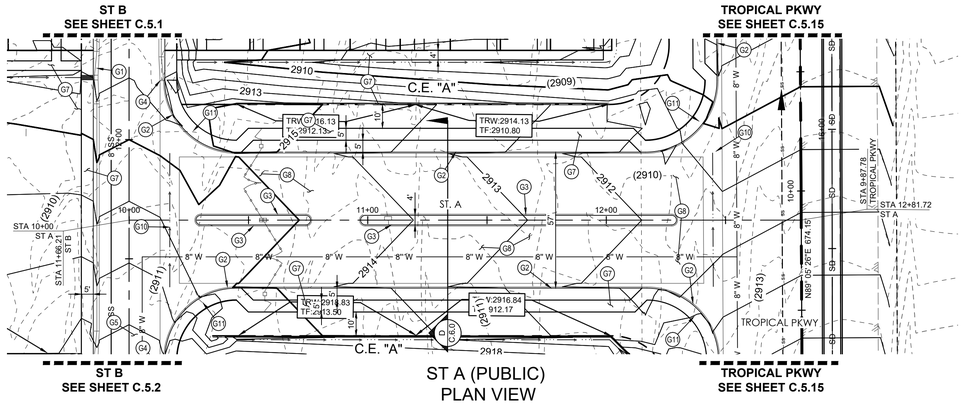
PROFESSIONAL ENGINEER-STATE OF NEVADA
LARRY M. BITTON
EXP. 12-31-20
CIVIL
No. 010159

CENTENNIAL HEIGHTS TOWNHOMES
TECHNICAL DRAINAGE STUDY
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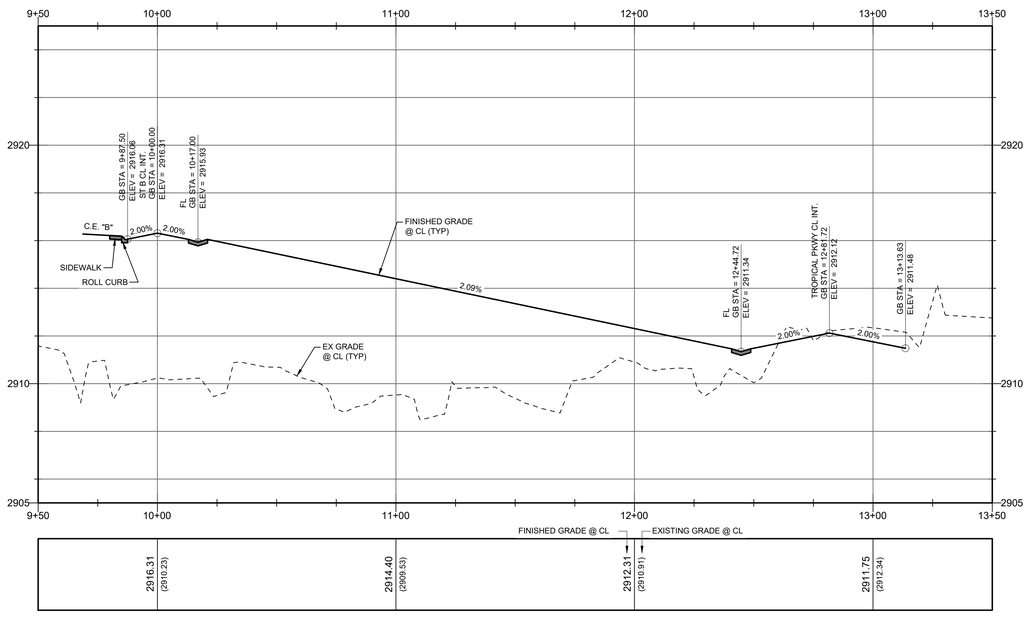
ST H PLAN & PROFILE (STA 9+00 TO STA 15+50)

C.5.9

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ST A (PUBLIC)
PLAN VIEW
(STA. 9+50 TO 13+50)



ST A (PUBLIC)
PROFILE VIEW
(STA. 9+50 TO 13+50)

SCALE: 1" = 30' H
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APPROVED FOR CONSTRUCTION

SOUTHWEST GAS CORPORATION DATE

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0 30' 60'
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0 1 2

REVISIONS
REV # | DATE

*SEE GENERAL NOTES SHEET

DRAWING INFO
DATE 12/23/19
DESIGNED SS
DRAWN PMP
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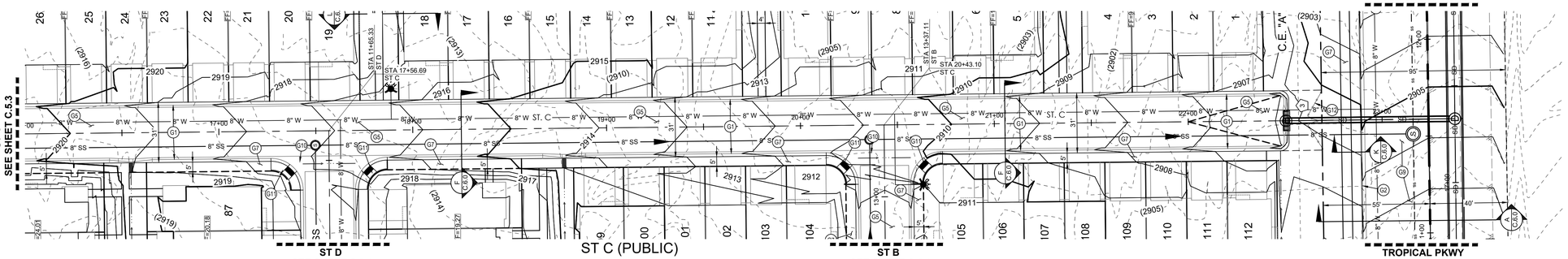
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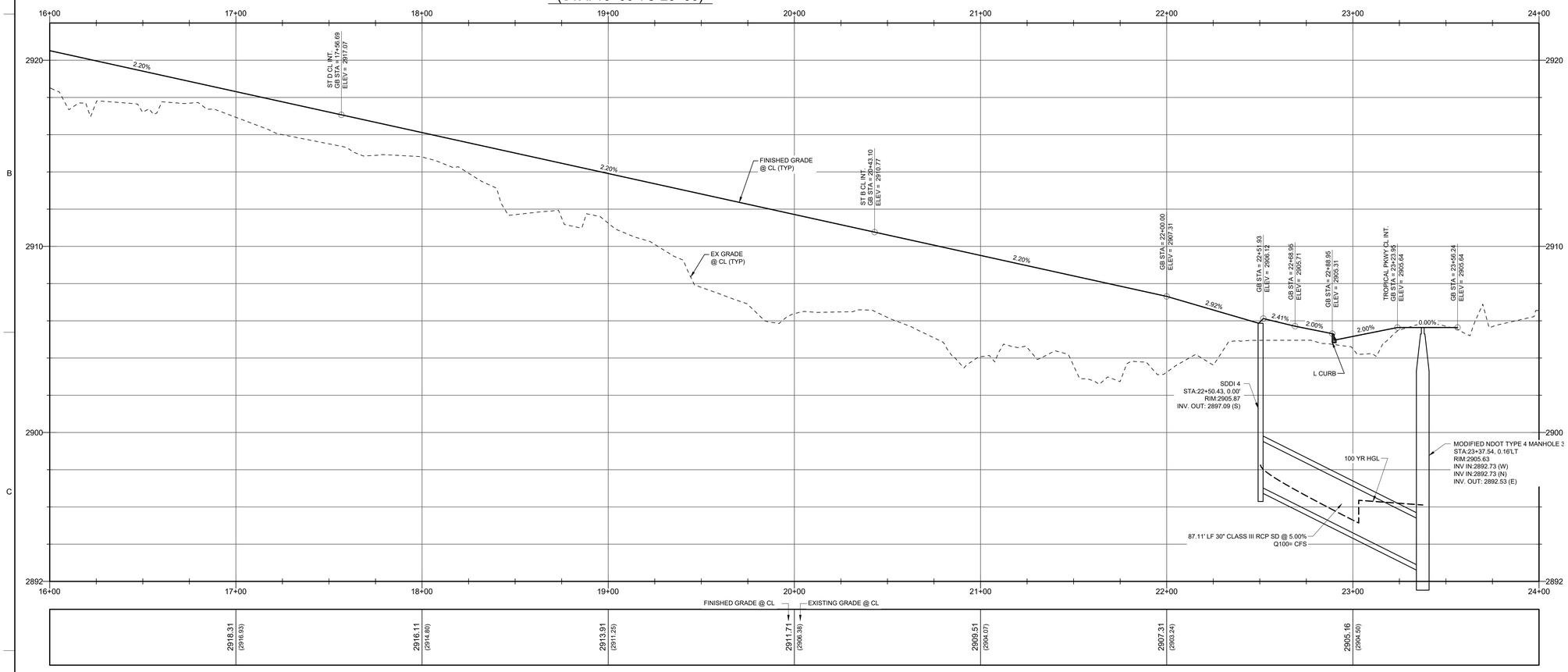
ST A PLAN & PROFILE (STA 9+50 TO STA 13+50)

C.5.0

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PLAN VIEW
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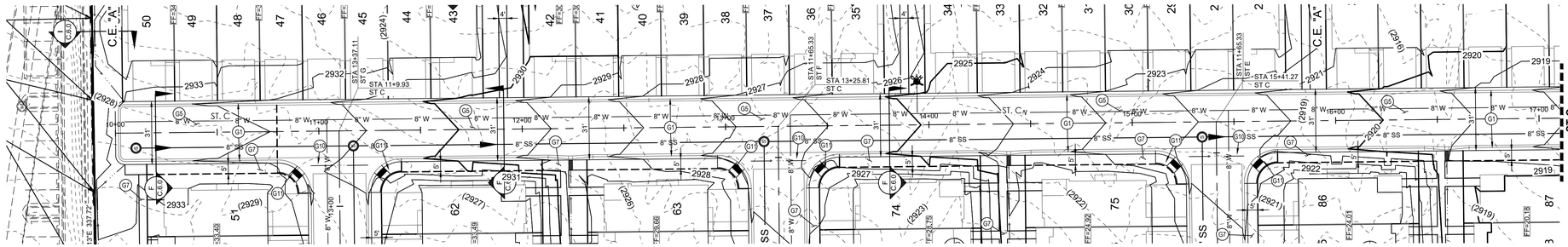
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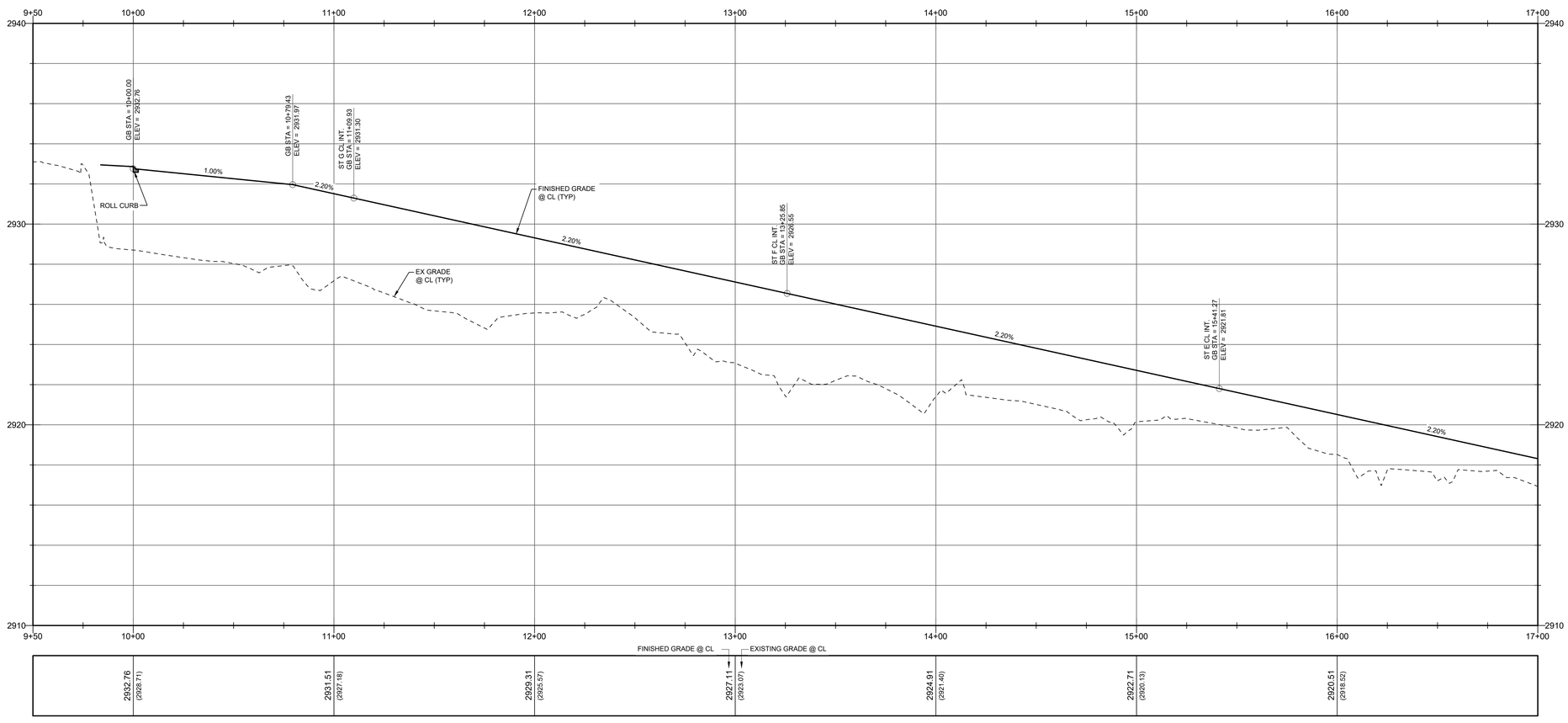
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APPROVED FOR CONSTRUCTION

SOUTHWEST GAS CORPORATION DATE

APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES

PROJECT NO. _____ FIRST APPROVAL DATE: _____
LVVWD APPROVED FIRE FLOW 1500 GPM AT 20 PSI RESIDENTIAL

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HORROCKS ENGINEERS
1401 N. Green Valley Pkwy., Suite 160
Henderson, NV 89074
(702) 966-4063
www.horrocks.com

SCALE: 1" = 30'

WARNING
IF THIS BAR DOES NOT MEASURE 2" THEN DRAWING IS NOT TO SCALE

REVISIONS
REV # | DATE

*SEE GENERAL NOTES SHEET

DRAWING INFO
DATE 12/23/19
DESIGNED SS
DRAWN PMP
CHECKED AD
PROJECT NV-1949-1909

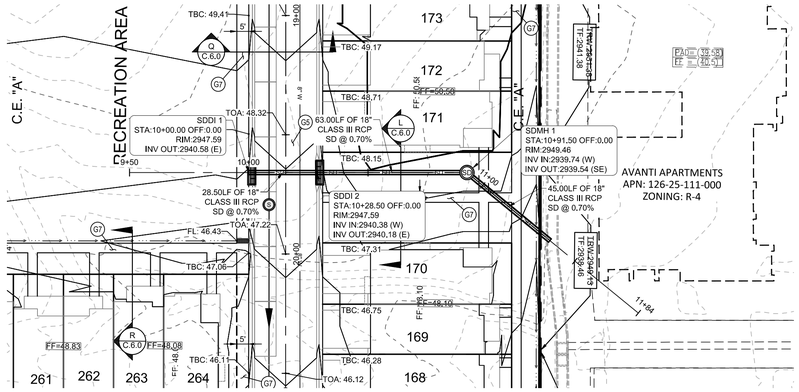
PROFESSIONAL ENGINEER-STATE OF NEVADA
LARRY M. BITTON
EXP. 12-31-20
CIVIL
No. 01159

CENTENNIAL HEIGHTS TOWNHOMES
TECHNICAL DRAINAGE STUDY
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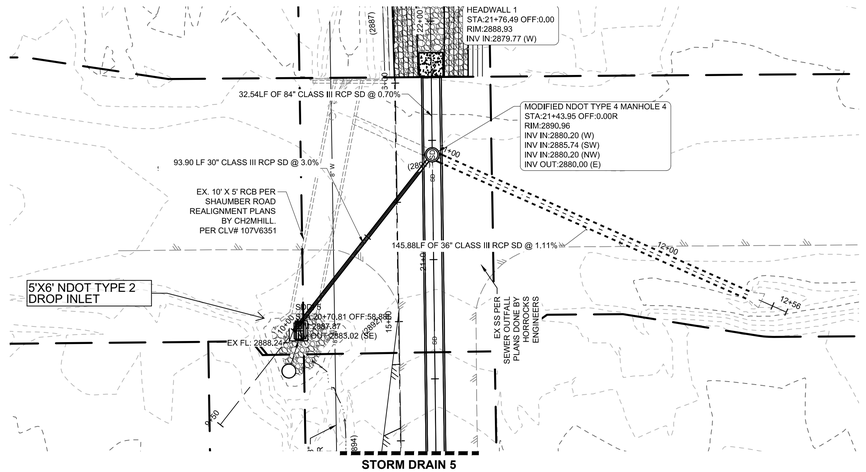
ST C PLAN & PROFILE (STA 9+50 TO STA 17+00)

C.5.3

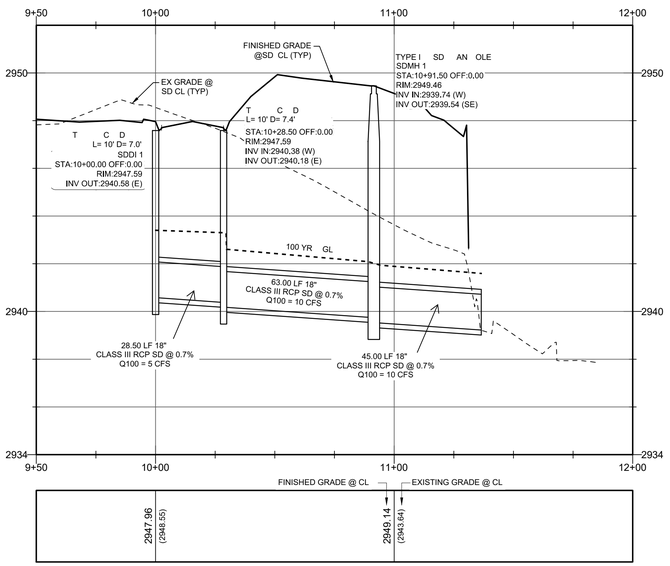
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STORM DRAIN 3 (PUBLIC)
PLAN VIEW
(STA. 9+50 TO 12+00)



STORM DRAIN 4 (PUBLIC)
PLAN VIEW
(STA. 9+50 TO 12+50)



STORM DRAIN 3 (PUBLIC)
PROFILE VIEW
(STA. 9+50 TO 12+00)

SCALE: 1" = 30' H
SCALE: 1" = 3' V

STORM DRAIN 4 (PUBLIC)
PROFILE VIEW
(STA. 9+50 TO 12+50)

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- (G10) CONSTRUCT 8' CONCRETE VALLEY GUTTER PER CCAUSD #228
- (G11) SAWCUT, TRENCH, BACKFILL, AND ASPHALT PATCH PER CCAUSD 500.3, 500.4, 500.5 & 503 (PATCH DIMENSIONS TO BE DETERMINED IN THE FIELD) PROPOSED SAWCUT TO BE AT LANE LINE
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- (G27) CONSTRUCT 3' CONCRETE VALLEY GUTTER PER CCAUSD #228

LEGAL DESCRIPTION:

A PORTION OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.D., CITY OF LAS VEGAS, CLARK COUNTY, NEVADA, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

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NORTH 00°37'29" WEST, BEING THE WEST LINE OF THE NORTHWEST QUARTER (NW1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.M.,CLARK COUNTY, NEVADA, AS SHOWN ON THE PLAT OF CONSTELLATION ESTATES, RECORDED IN BOOK 102, PAGE 92, OFFICIAL RECORDS, CLARK COUNTY, NEVADA.

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RIVET & PLATE IN CONCRETE CYLINDER 60 FEET WEST OF MAINWAL AND AZURE

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ELEVATION (feet) 2,956.44
NAVD 88

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LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES

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REVISIONS
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DRAWING INFO
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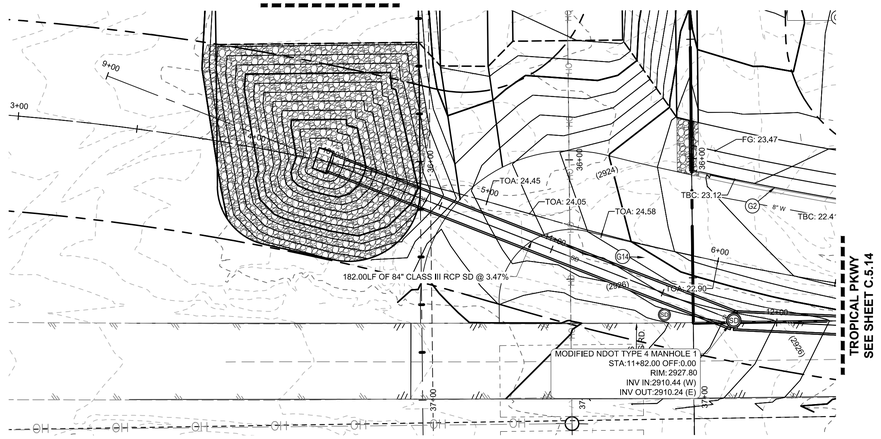
PROFESSIONAL ENGINEER—STATE OF NEVADA
LARRY M. BITTON
EXP. 12-31-20
CIVIL
No. 01059

CENTENNIAL HEIGHTS TOWNHOMES
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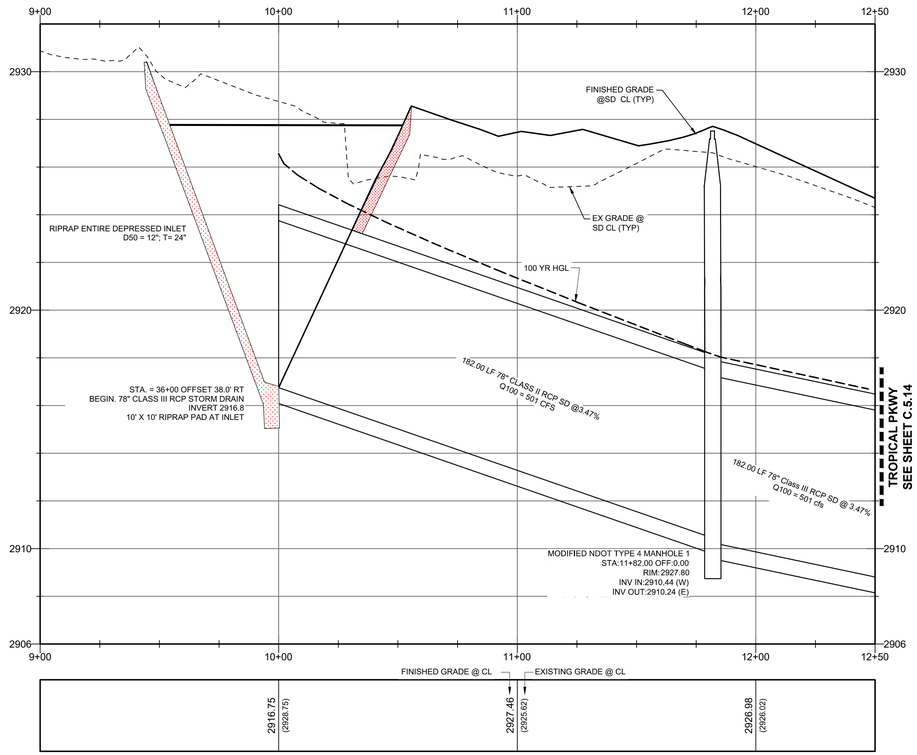
STORM DRAIN 3 (STA 9+50-12+00)

C.5.20

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STORM DRAIN 5 (PUBLIC)
PLAN VIEW
(STA. 9+00 TO 12+50)



STORM DRAIN 5 (PUBLIC)
PROFILE VIEW
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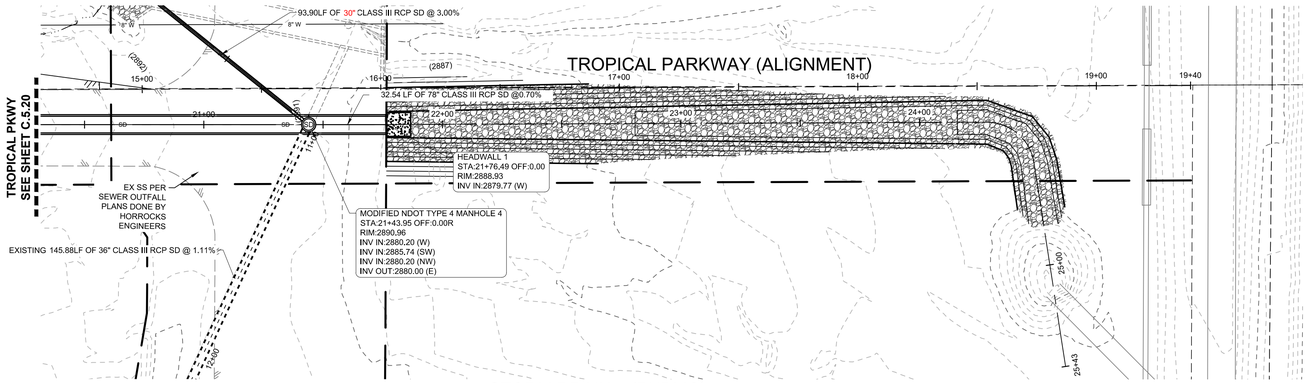
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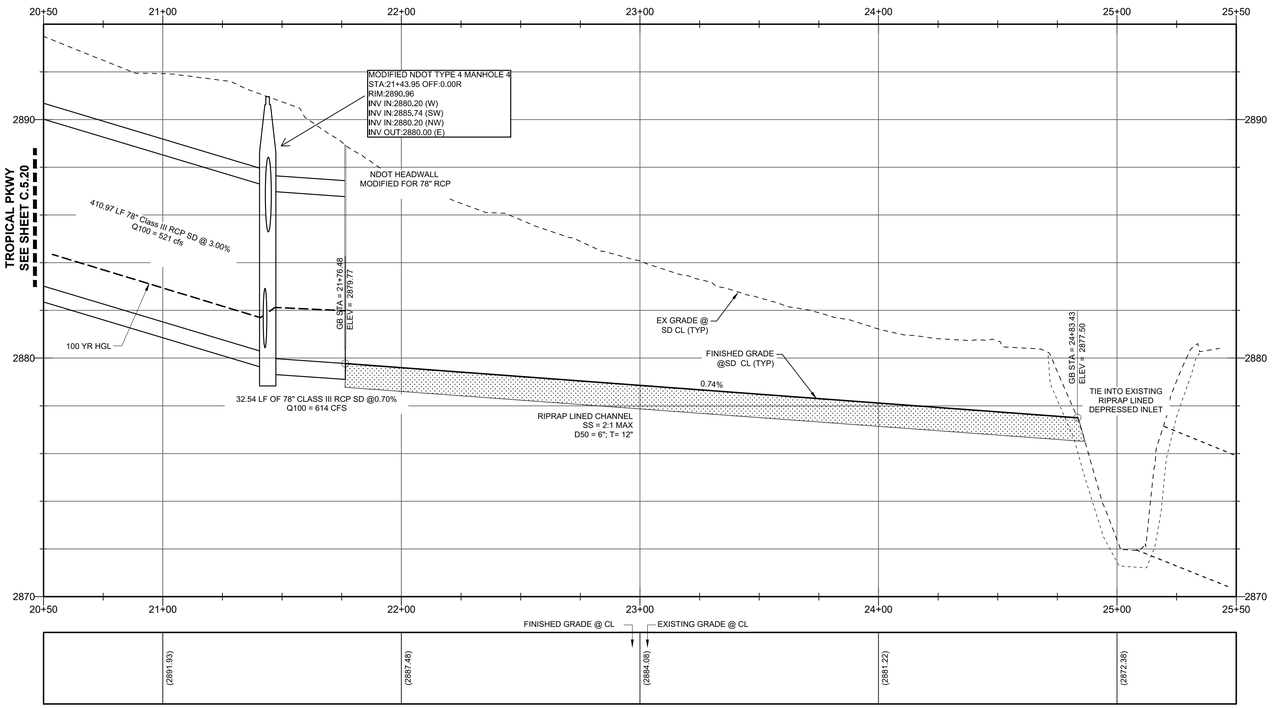
STORM DRAIN 5 (STA 10+00-15+50)

C.5.21

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STORM DRAIN 5 (PUBLIC)
PLAN VIEW
(STA. 20+50 TO 25+50)



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FAST
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FREEWAY AND ARTERIAL SYSTEM OF TRANSPORTATION

BASIS OF BEARING

NORTH 00°37'29" WEST, BEING THE WEST LINE OF THE NORTHWEST QUARTER (NW1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.M.,CLARK COUNTY, NEVADA, AS SHOWN ON THE PLAT OF CONSTELLATION ESTATES, RECORDED IN BOOK 102, PAGE 92, OFFICIAL RECORDS, CLARK COUNTY, NEVADA.

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BENCHMARK

RIVET & PLATE IN CONCRETE CYLINDER 60 FEET WEST OF MAINWAL AND AZURE

ELEVATION (meters) 901.13
ELEVATION (feet) 2,956.44
NAVD 88

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APPROVED FOR CONSTRUCTION

SOUTHWEST GAS CORPORATION DATE

APPROVED FOR CONSTRUCTION

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(702) 966-4063
www.horrocks.com

SCALE: 1" = 30'

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REVISIONS
REV # | DATE
*SEE GENERAL NOTES SHEET

DRAWING INFO
DATE 12/23/19
DESIGNED SS
DRAWN PMP
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PROJECT NV-1949-1909

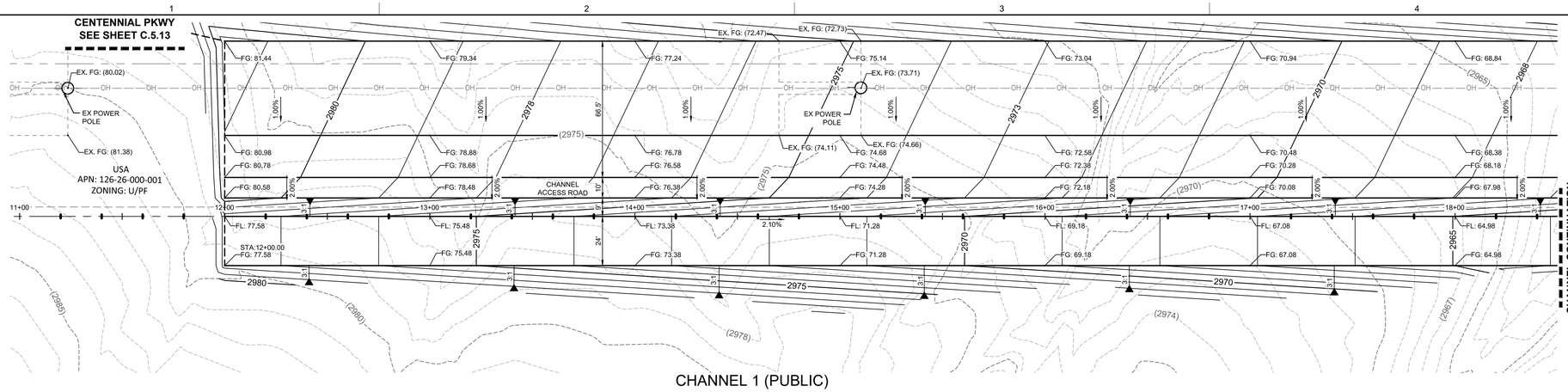
PROFESSIONAL ENGINEER-STATE OF NEVADA
LARRY M. BITTON
EXP. 12-31-20
CIVIL
No. 0159

CENTENNIAL HEIGHTS TOWNHOMES
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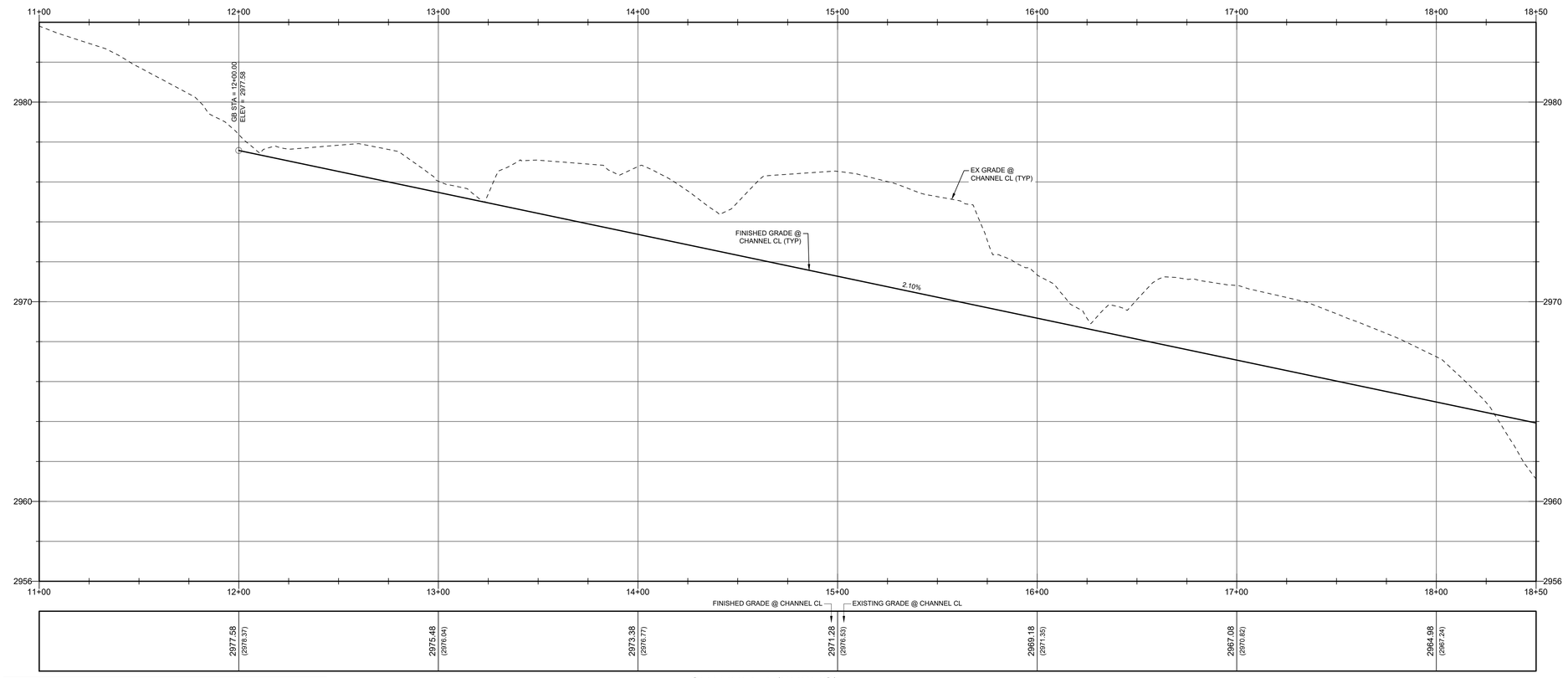
STORM DRAIN 5 (STA 14+50 TO 22+50)

C.5.22

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CHANNEL 1 (PUBLIC)
PLAN VIEW
(STA. 12+00 TO 18+50)



CHANNEL 1 (PUBLIC)
PROFILE VIEW
(STA. 12+00 TO 18+50)
SCALE: 1" = 30' H
SCALE: 1" = 3' V

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- G21 INSTALL BUBBLER STRUCTURE W/ (13) 2' GRATES, L=26', W=5', D=TBD
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APPROVED FOR CONSTRUCTION

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DRAWING INFO
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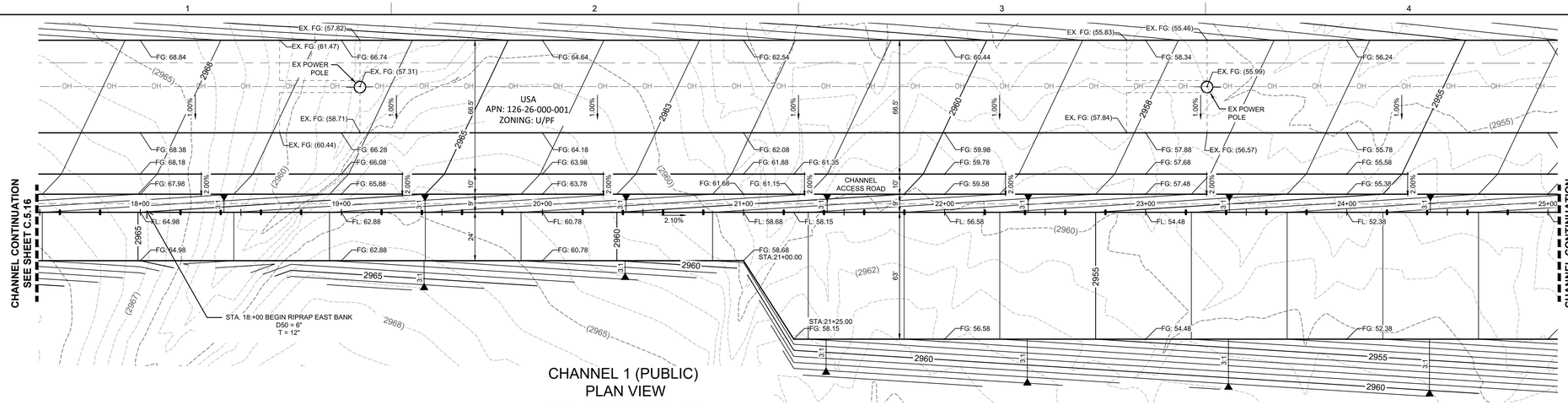
PROFESSIONAL ENGINEER—STATE OF NEVADA
LARRY M. BITTON
EXP. 12-31-20
CIVIL
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CENTENNIAL HEIGHTS TOWNHOMES
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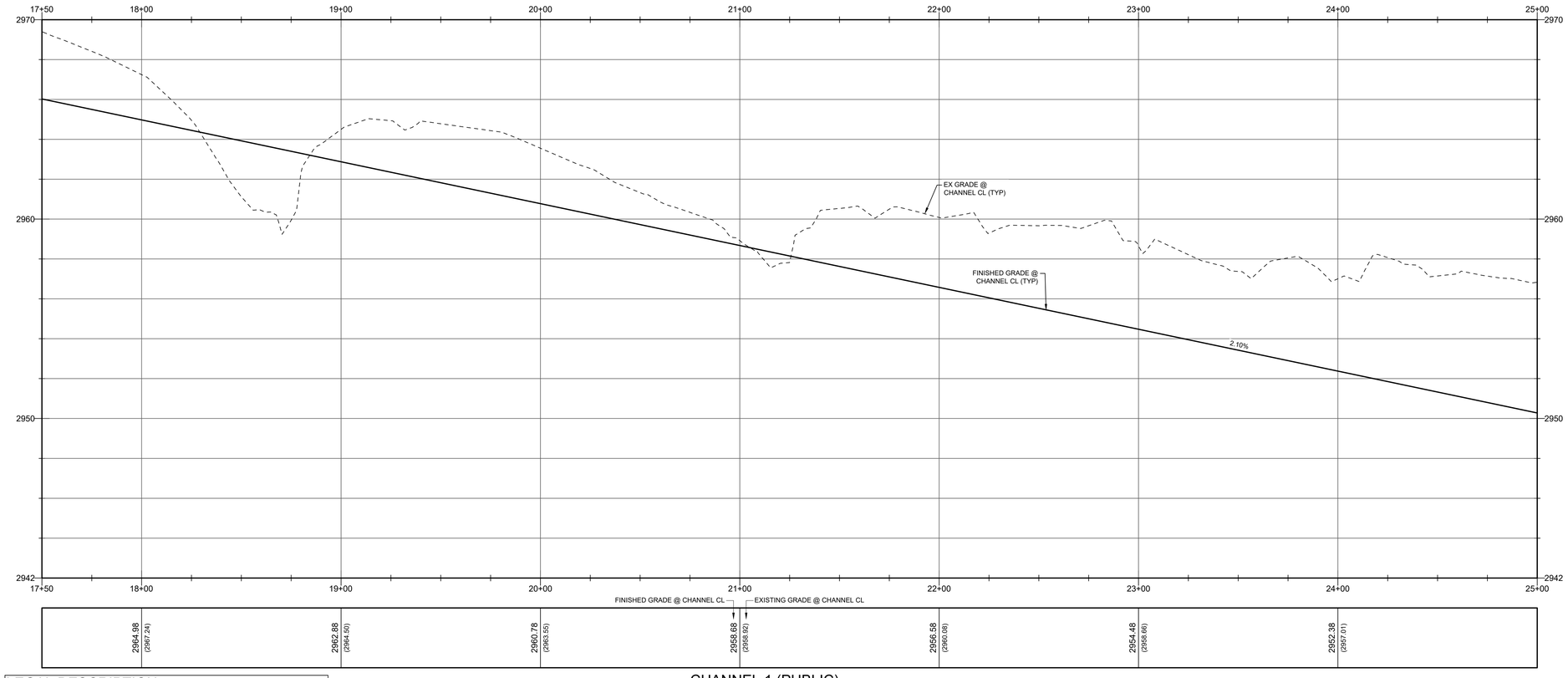
CHANNEL 1 (STA 11+00-18+50)

C.5.16

H:\!2019\NV-1949-1909 Centennial Heights Townhomes\Project Data\02 CAD\2.03 Sheet Files\NV-1949-1909_C.5.0_PNP_SD.dwg - C.5.16 - 12/23/2019 01:25pm, heather.dominguez



CHANNEL 1 (PUBLIC)
PLAN VIEW
(STA. 17+50 TO 25+00)



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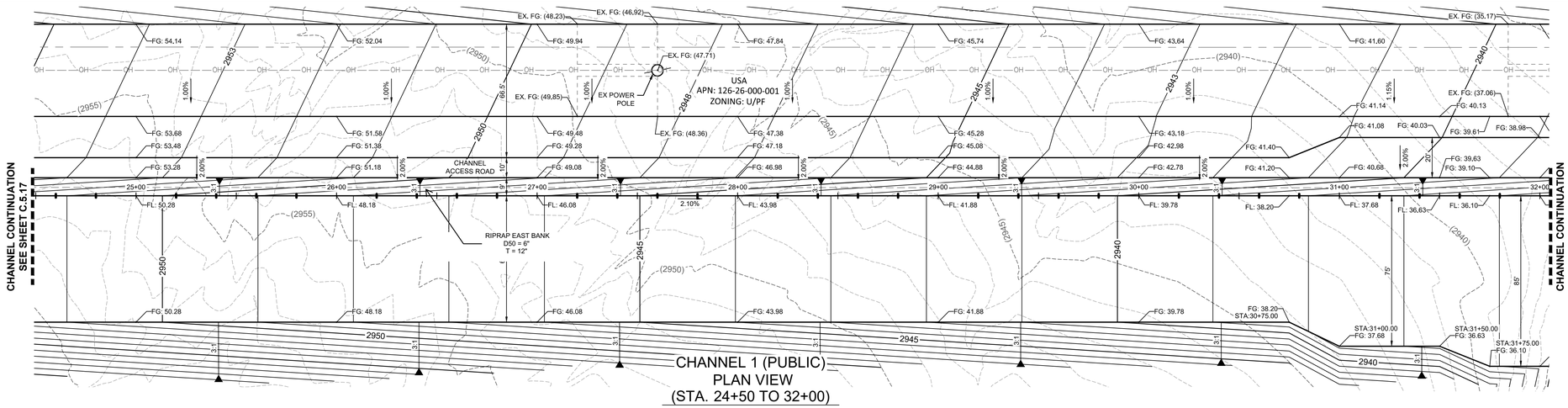
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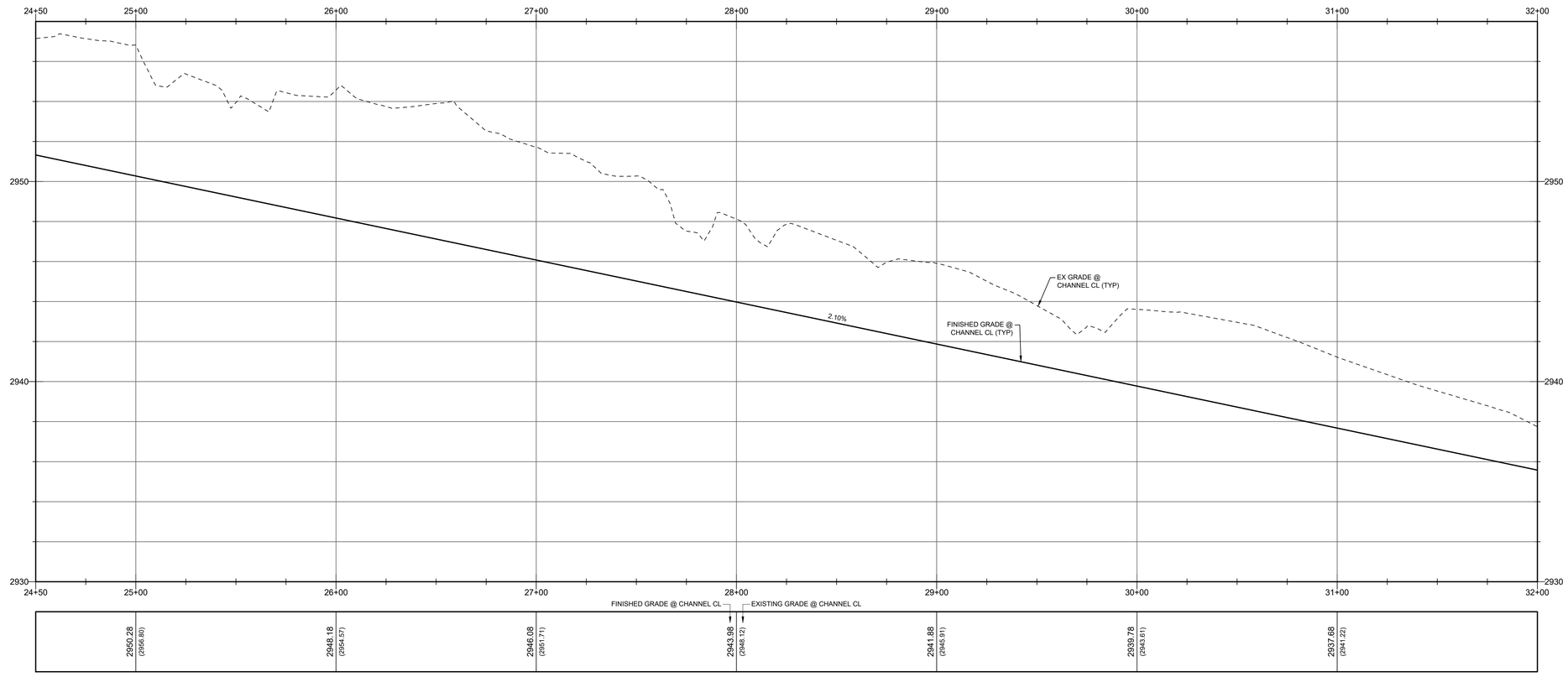
CENTENNIAL HEIGHTS TOWNHOMES
TECHNICAL DRAINAGE STUDY
CITY OF LAS VEGAS, NEVADA

CHANNEL 1 (STA 17+50-25+00)

C.5.17



CHANNEL 1 (PUBLIC)
PLAN VIEW
(STA. 24+50 TO 32+00)



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- G24 INSTALL RIP-RAP D50=6",T=12" SUBGRADE @ 90% COMPACTION
- G25 CONSTRUCT 4" CONCRETE SIDEWALK PER CCAUSD #234
- G26 CONSTRUCT BUS TURNOUT PER CCAUSD #234.1
- G27 CONSTRUCT 3' CONCRETE VALLEY GUTTER PER CCAUSD #228

LEGAL DESCRIPTION:

A PORTION OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.D., CITY OF LAS VEGAS, CLARK COUNTY, NEVADA, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

THE WEST HALF (W 1/2) OF THE WEST HALF (W 1/2) OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.M., TOGETHER WITH:

THE WEST HALF (W 1/2) OF THE SOUTHWEST QUARTER (SW 1/4) OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.M.

Call before you DIG
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Call 811 OR 1-800-227-2600

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

FAST
Call before you UnderGround
1-702-432-5300
FREEWAY AND ARTERIAL SYSTEM OF TRANSPORTATION

BASIS OF BEARING

NORTH 00°37'29" WEST, BEING THE WEST LINE OF THE NORTHWEST QUARTER (NW1/4) OF SECTION 25, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.M.,CLARK COUNTY, NEVADA, AS SHOWN ON THE PLAT OF CONSTELLATION ESTATES, RECORDED IN BOOK 102, PAGE 92, OFFICIAL RECORDS, CLARK COUNTY, NEVADA.

FLOOD ZONE:

THIS SITE IS LOCATED IN A ZONE 'X', AREAS OUTSIDE OF THE 0.2% ANNUAL CHANCE FLOODPLAIN AND PARTIALLY IN A SHADED ZONE 'X', AREAS OF 0.2% ANNUAL CHANCE FLOOD; AREAS OF 1% ANNUAL CHANCE FLOOD WITH AVERAGE DEPTHS OF LESS THAN 1 FOOT OR WITH DRAINAGE AREAS LESS THAN 1 SQUARE MILE; AND AREAS PROTECTED BY LEVEES FROM 1% ANNUAL CHANCE OF FLOOD PER THE FLOOD INSURANCE RATE MAP COMMUNITY PANEL 32003C1750E, CLARK COUNTY, NEVADA DATED NOVEMBER 16, 2011, REVISED TO REFLECT LOMR DATED OCTOBER 18, 2018.

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NOTE:
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BENCHMARK

RIVET & PLATE IN CONCRETE CYLINDER 60 FEET WEST OF MAINWAL AND AZURE

ELEVATION (meters) 901.13
ELEVATION (feet) 2,956.44
NAVD 88

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APPROVED FOR CONSTRUCTION

SOUTHWEST GAS CORPORATION DATE

APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES

PROJECT NO. _____ FIRST APPROVAL DATE: _____
LVVWD APPROVED FIRE FLOW 1500 GPM AT 20 PSI RESIDENTIAL

LVVWD APPROVAL IS VALID FOR ONE (1) YEAR FROM SIGNATURE DATE. IF CONSTRUCTION IS NOT STARTED, PLANS **MUST** BE RESUBMITTED FOR REVIEW AND APPROVAL.

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1401 N. Green Valley Pkwy., Suite 160
Henderson, NV 89074
(702) 966-4063
www.horrocks.com

SCALE: 1" = 30'

WARNING
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REVISIONS
REV # | DATE

*SEE GENERAL NOTES SHEET

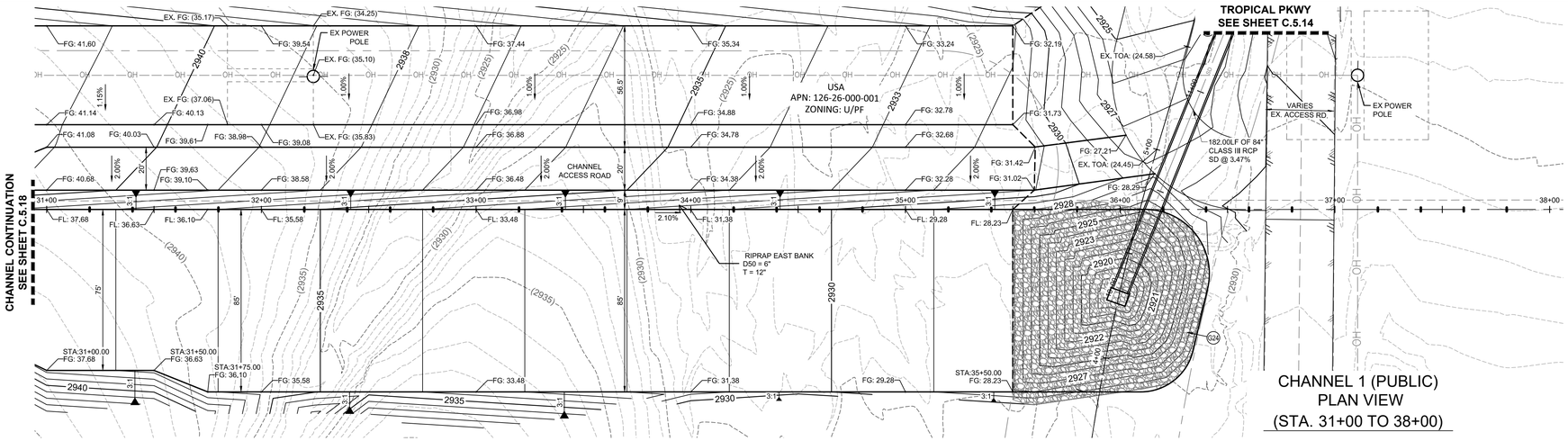
DRAWING INFO
DATE 12/23/19
DESIGNED SS
DRAWN PMP
CHECKED AD
PROJECT NV-1949-1909

PROFESSIONAL ENGINEER-STATE OF NEVADA
LARRY M. BITTON
EXP. 12-31-20
CIVIL
No. 0159

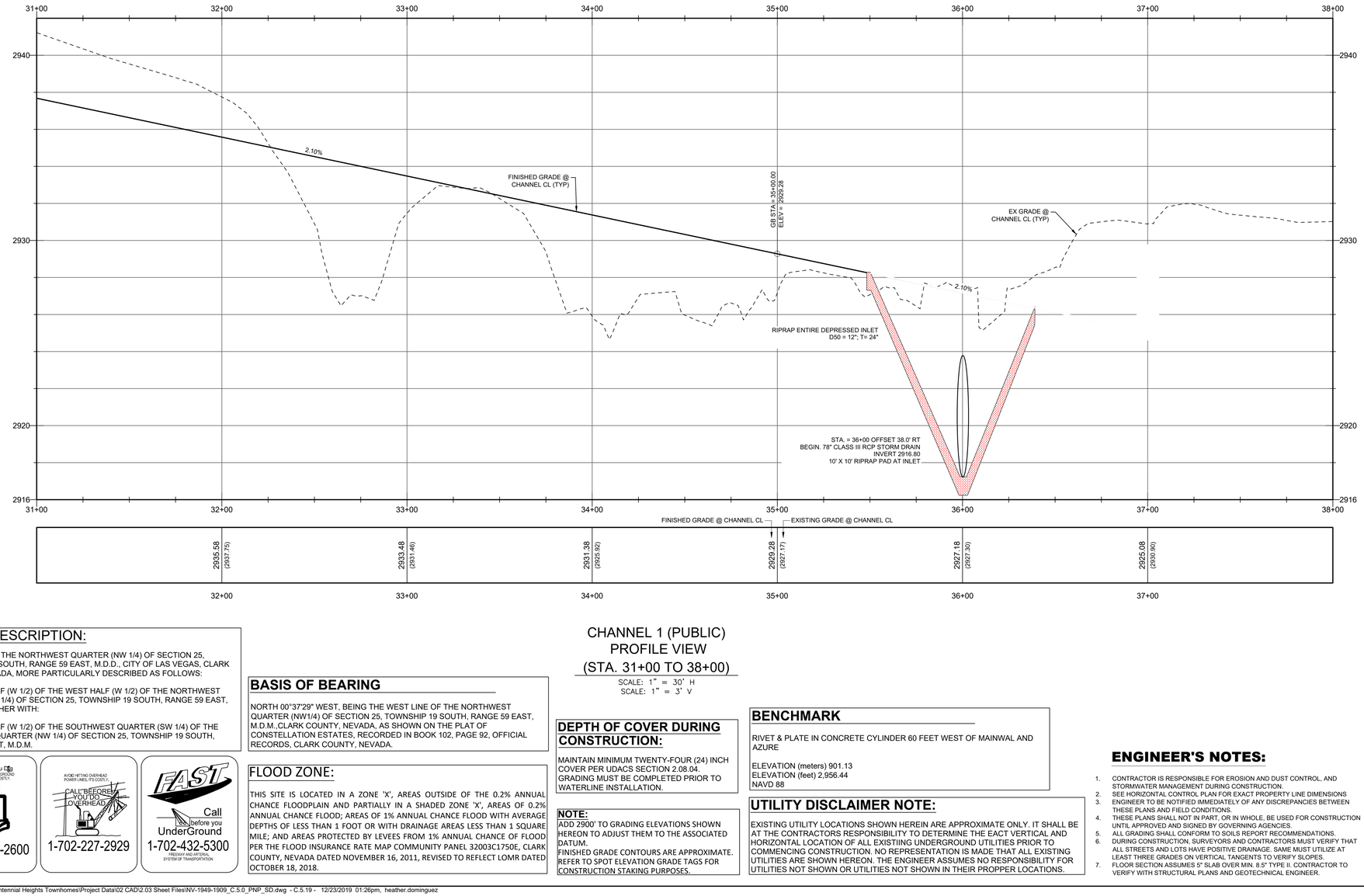
CENTENNIAL HEIGHTS TOWNHOMES
TECHNICAL DRAINAGE STUDY
CITY OF LAS VEGAS, NEVADA

CHANNEL 1 (STA 14+00-32+00)

C.5.18



CHANNEL 1 (PUBLIC) PLAN VIEW (STA. 31+00 TO 38+00)



CHANNEL 1 (PUBLIC) PROFILE VIEW (STA. 31+00 TO 38+00)

SCALE: 1" = 30' H
SCALE: 1" = 3' V

GRADING KEY NOTES:

- G1 CONSTRUCT 30" ROLL CURB PER CCAUSD #217.2,S1
- G2 CONSTRUCT "L" TYPE CURB PER CCAUSD #216
- G3 CONSTRUCT "A" TYPE CURB PER CCAUSD #219
- G4 CONSTRUCT 10' TRANSITION FROM "L" TYPE CURB TO ROLL CURB PER DETAIL "1" ON SHEET C.6.0
- G5 CONSTRUCT 2" AC PAVEMENT OVER 4" TYPE II AGG BASE REFERENCE GEOTECHNICAL REPORT
- G6 CONSTRUCT SIDEWALK RAMP "CASE I" PER CCAUSD #235
- G7 CONSTRUCT 5" CONCRETE SIDEWALK PER CCAUSD #234
- G8 CONSTRUCT 4" AC PAVEMENT OVER 4" TYPE II AGG BASE
- G9 CONSTRUCT 5.5" AC PAVEMENT OVER 6" TYPE II AGG BASE
- G10 CONSTRUCT 8' CONCRETE VALLEY GUTTER PER CCAUSD #228
- G11 SAWCUT, TRENCH, BACKFILL, AND ASPHALT PATCH PER CCAUSD 500.3, 500.4, 500.5 & 503 (PATCH DIMENSIONS TO BE DETERMINED IN THE FIELD) PROPOSED SAWCUT TO BE AT LANE LINE
- G12 INSTALL WROUGHT IRON GATE
- G13 INSTALL 60" TYPE II-SD STORM DRAIN MANHOLE PER CCAUSD #401 & 405.2
- G14 CONSTRUCT HEADWALL PER NDOT STANDARDS
- G15 INSTALL 60" TYPE II-SD STORM DRAIN MANHOLE WITH GRATE PER CCAUSD #401 & 405.2
- G17 EXISTING TO REMAIN. PROTECT IN PLACE.
- G18 INSTALL LANDSCAPING PER LANDSCAPE PLAN BY OTHERS
- G19 CONSTRUCT 5'X5' CONCRETE SIDEWALK PAD PER CCAUSD #234 FOR ADA TURNAROUND
- G20 CONSTRUCT 24.0' WIDE CURB OPENING PER DETAIL "CC" ON SHEET C.6.0
- G21 INSTALL BUBBLER STRUCTURE W/ (13) 2' GRATES, L=26', W=5', D=TBD
- G22 CONSTRUCT DROP INLET TYPE "CM2" PER CCAUSD #412.1 & 421 W/ (3) 2.5' GRATES, L=10', D=TBD
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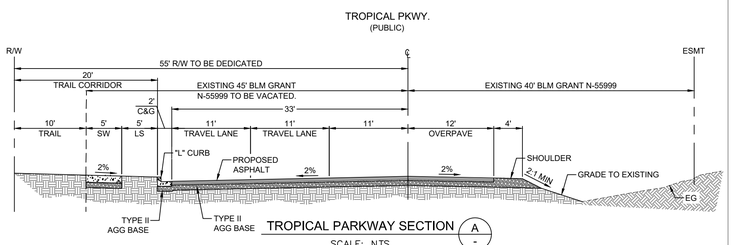
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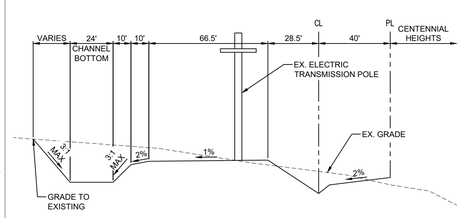
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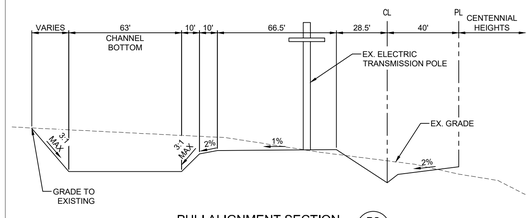
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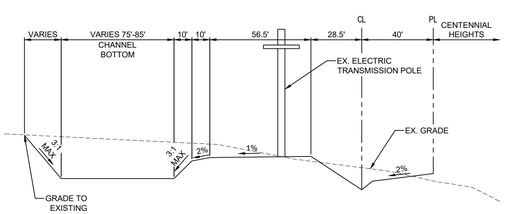
TROPICAL PARKWAY SECTION (A)
SCALE: NTS
(REFERENCE CCAUSD #205 & 208)



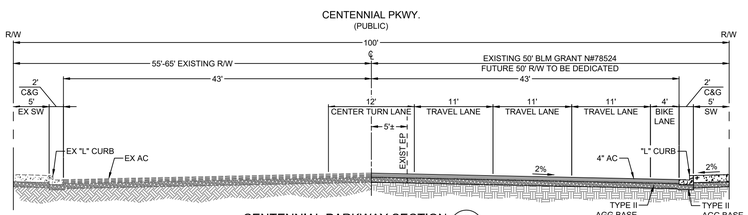
PULI ALIGNMENT SECTION (B1)
SCALE: NTS



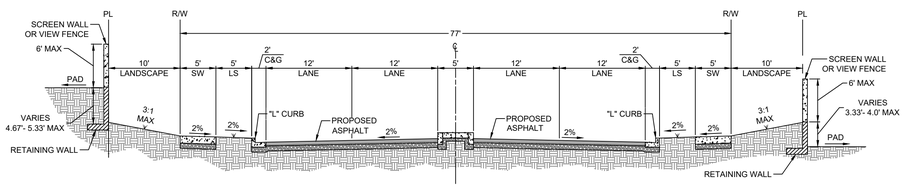
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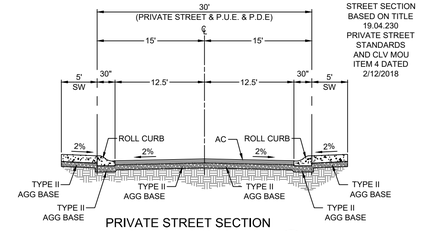
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SCALE: NTS



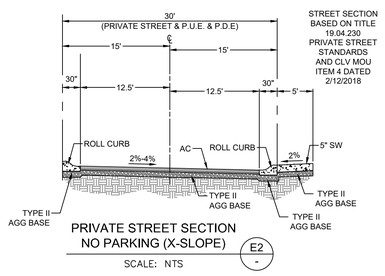
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SCALE: NTS
(REFERENCE CCAUSD #202 & 208)



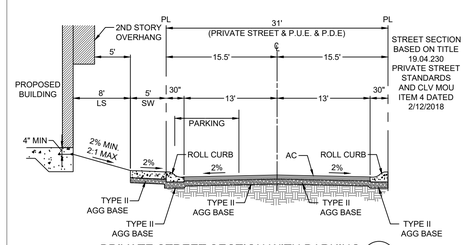
ENTRY DRIVE SECTION (D)
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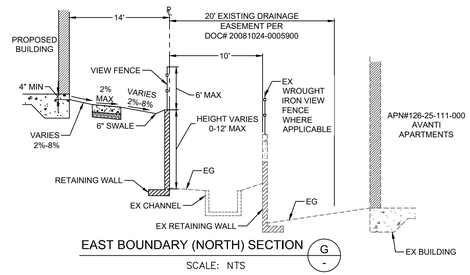
PRIVATE STREET SECTION
NO PARKING (CROWN) (E1)
SCALE: NTS



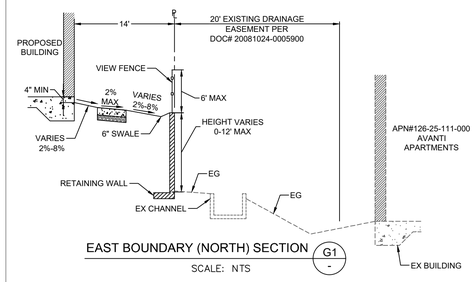
PRIVATE STREET SECTION
NO PARKING (X-SLOPE) (E2)
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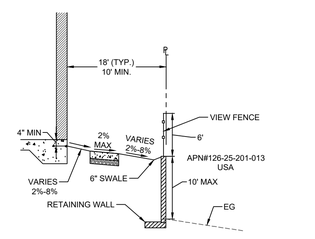
PRIVATE STREET SECTION WITH PARKING (F)
SCALE: NTS



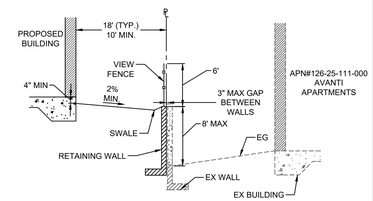
EAST BOUNDARY (NORTH) SECTION (G)
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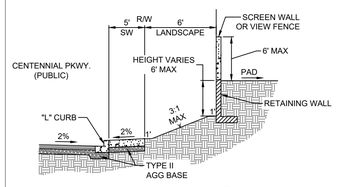
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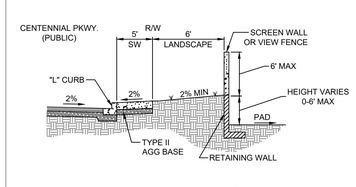
EAST BOUNDARY (SOUTH) SECTION (H)
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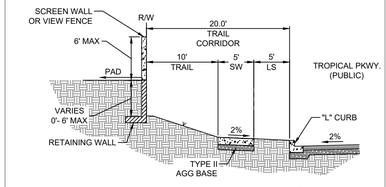
AVANTI APARTMENTS - SOUTH
BOUNDARY (I)
SCALE: NTS



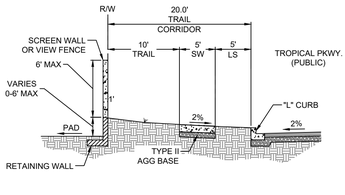
CENTENNIAL WALL SECTION (J1)
SCALE: NTS



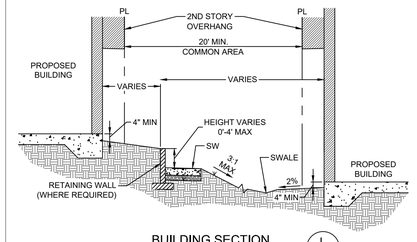
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SCALE: NTS



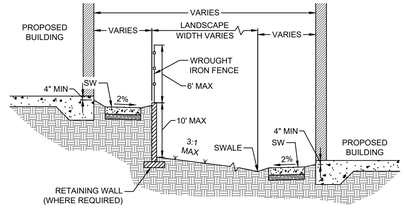
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SCALE: NTS



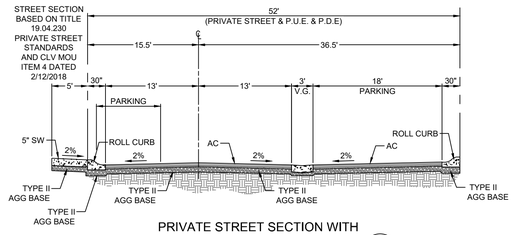
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SCALE: NTS



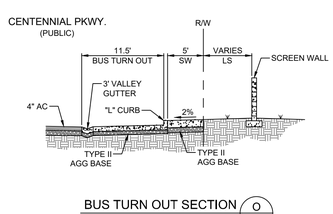
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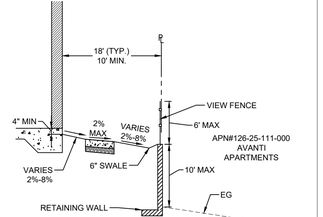
ONSITE GREENBELT SECTION (M)
SCALE: NTS



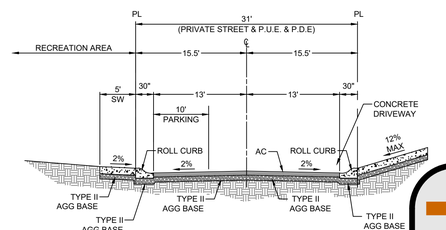
PRIVATE STREET SECTION WITH
ADDITIONAL PARKING (N)
SCALE: NTS



BUS TURN OUT SECTION (O)
SCALE: NTS



NORTH BOUNDARY (WEST) SECTION (P)
SCALE: NTS



STREET "H" AT RECREATION AREA (Q)
SCALE: NTS

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DRAWING INFO
DATE 12/23/19
DESIGNED SS
DRAWN PMP
CHECKED AD
PROJECT NV-1949-1909

PROFESSIONAL ENGINEER-STATE OF NEVADA
LARRY M. BITTON
EXP. 12-31-20
CIVIL
No. 010159

CENTENNIAL HEIGHTS TOWNHOMES
TECHNICAL DRAINAGE STUDY
CITY OF LAS VEGAS, NEVADA

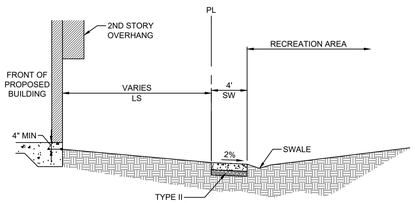
DETAILS SHEET 1

126-25-201-010

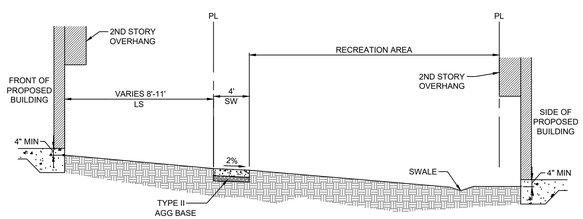
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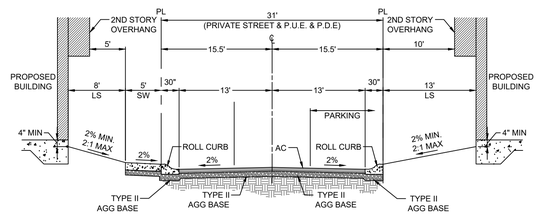
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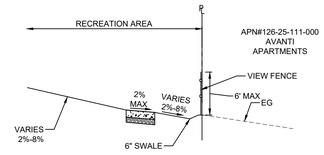
FRONTING RECREATION AREA (R)
SCALE: NTS



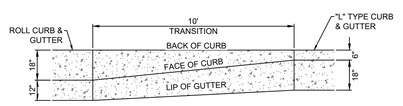
COMMON AREA ADJACENT BUILDINGS (S)
SCALE: NTS



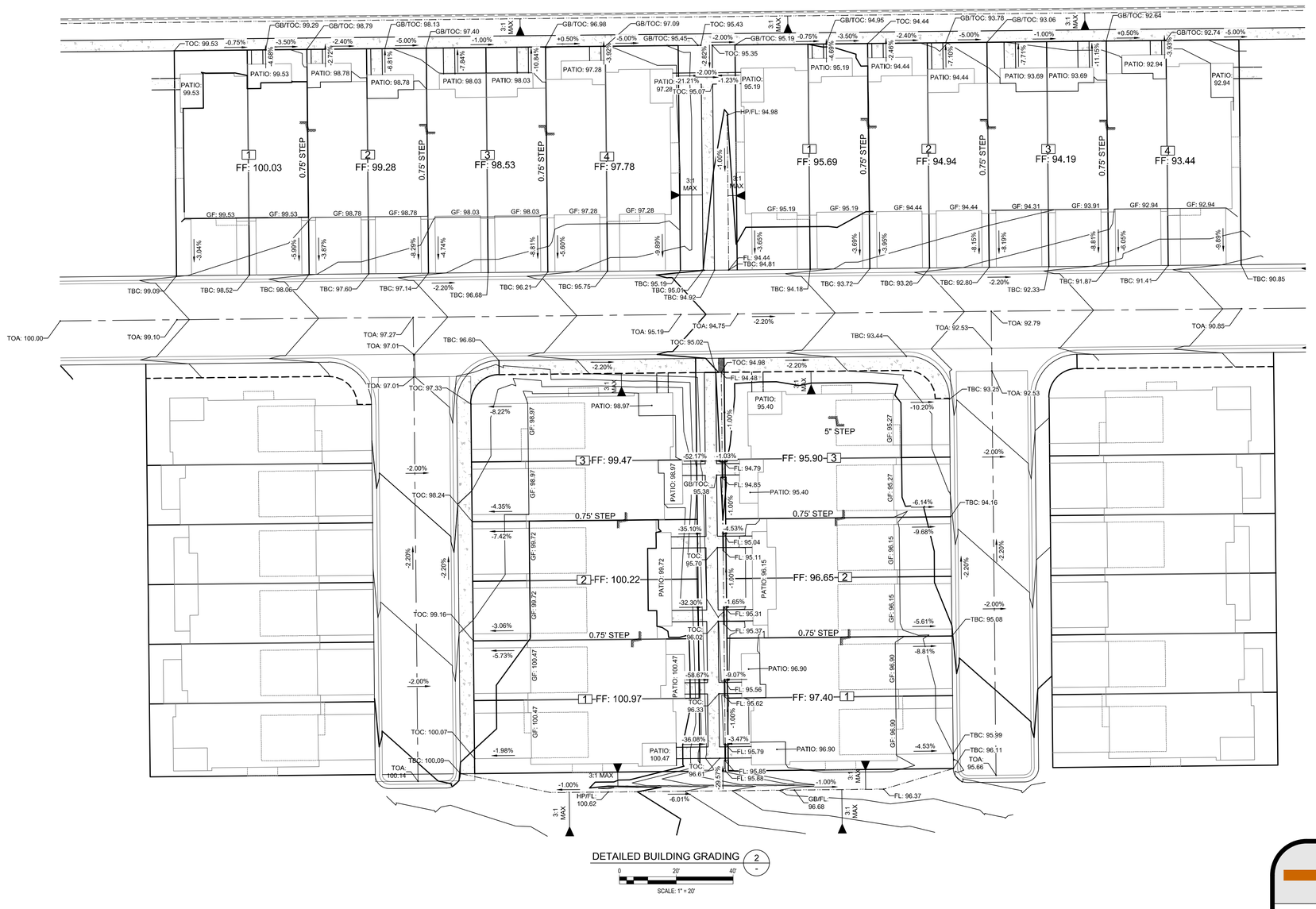
PRIVATE STREET SECTION WITH PARKING (T)
SCALE: NTS



NORTH BOUNDARY (WEST) SECTION WITHOUT RETAINING WALL (U)
SCALE: NTS



10' CURB TRANSITION (1)
SCALE: NTS



DETAILED BUILDING GRADING (2)
0 20' 40
SCALE: 1" = 20'

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PROJECT	NV-1949-1909

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CIVIL
No. 01059

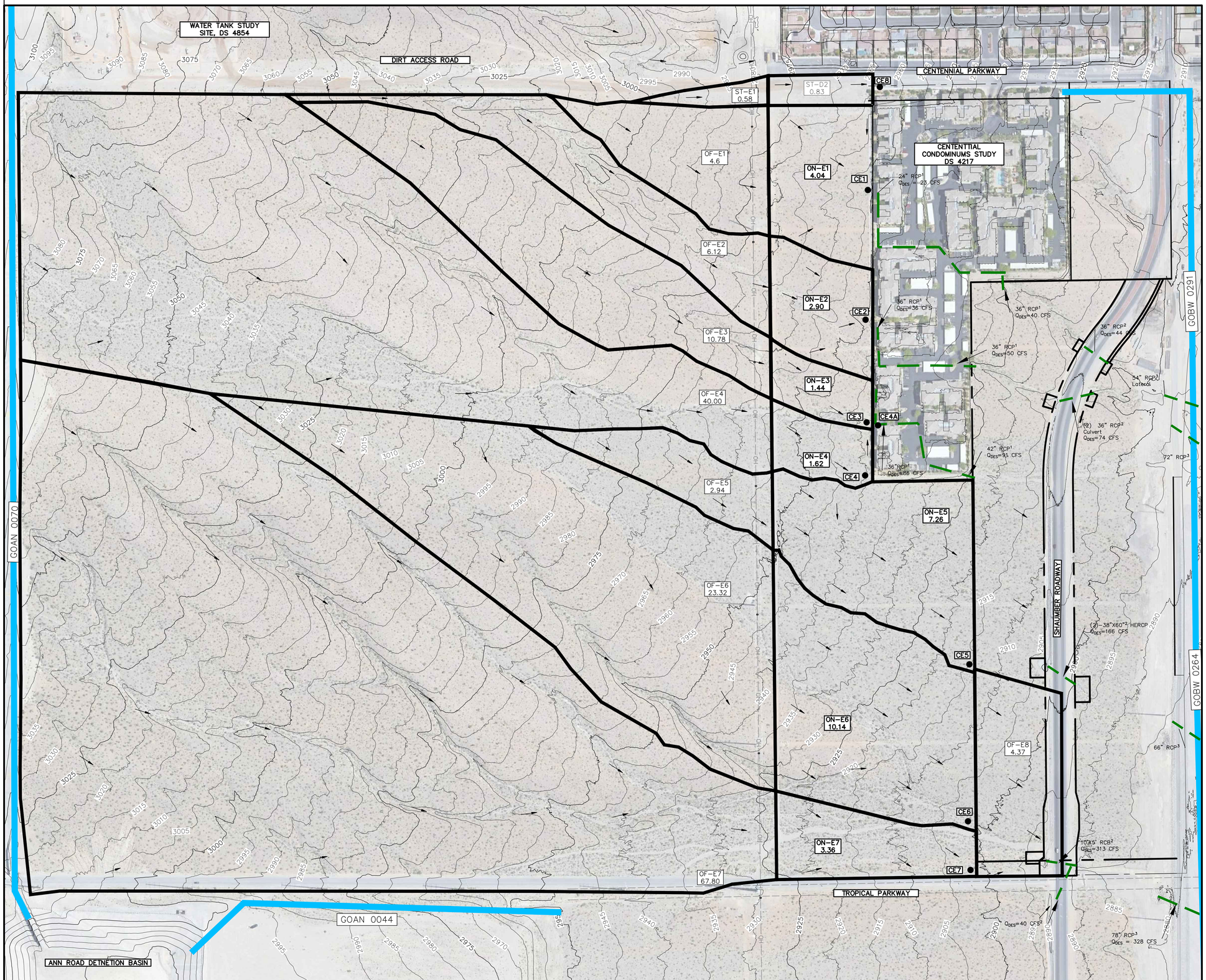
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DETAIL SHEET 2

126-25-201-010

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EXISTING CONDITION HYDROLOGIC SUMMARY			
Basin	Area (acres)	Q_{10} (cfs)	Q_{100} (cfs)
CE1	-	9	24
CE2	-	10	24
CE3	-	13	32
CE4A	-	44	119
CE4	-	31	87
CE5	-	2	12
CE6	-	18	60
CE7	-	60	162
CE8	-	2	5
OF-E1	4.60	5	13
OF-E2	6.12	7	16
OF-E3	10.78	11	28
OF-E4	40.00	29	83
OF-E5	2.94	<1	2
OF-E6	23.32	16	47
OF-E7	67.8	59	158
OF-E8	4.37	1	5
ON-E1	4.04	4	11
ON-E2	2.90	3	8
ON-E3	1.44	2	4
ON-E4	1.62	2	4
ON-E5	7.26	2	10
ON-E6	10.14	2	12
ON-E7	3.36	1	4
ST-E1	0.58	1	2
ST-D2	0.83	2	3
CE1= OF-E1 + ON-E1			
CE2= OF-E2 + ON-E2			
CE3= OF-E3 + ON-E3			
CE4A = CE3 + CE4			
CE4= OF-E4 + ON-E4			
CE5= OF-E5 + ON-E5			
CE6= OF-E6 + ON-E6			
CE7= OF-E7 + ON-E7			
CE8 = ST-E1 + ST-D2			

NOTES
1. Refereced from the Centennial Condominious Study.
2. Facility size and flows are referenced from Shaumber Road Realignment Study
3. Facility size is referenced from 215 Bruce Woodbury Beltway-Craig Road Study

KEY:

- ON-D1 4.04 — BASIN NAME/AREA
- CE2 — CONCENTRATION POINT
- FLOW DIRECTION
- BASIN BOUNDARY
- EXISTING CCRFCD REG. FAC.
- LOCAL EXISTING FACILITY

SCALE: 1" = 150'

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CITY OF LAS VEGAS
NEVADA

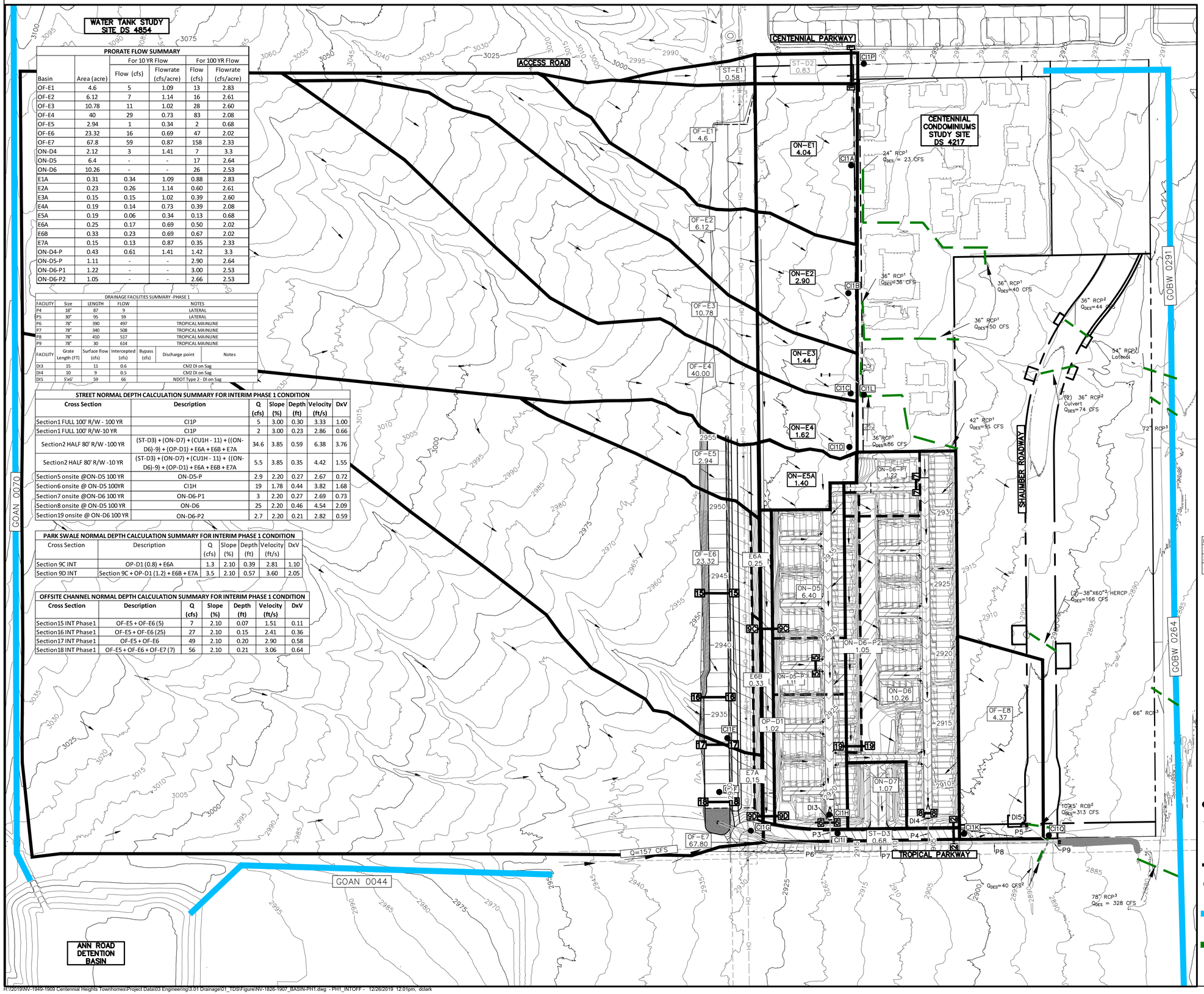
EXISTING OFFSITE CONDITION BASIN MAP

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PAGE #

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PRORATE FLOW SUMMARY

Basin	Area (acre)	For 10 YR Flow: Flow (cfs)	For 10 YR Flow: Flowrate (cfs/acre)	For 100 YR Flow: Flow (cfs)	For 100 YR Flow: Flowrate (cfs/acre)
OF-E1	4.6	5	1.09	13	2.83
OF-E2	6.12	7	1.14	16	2.61
OF-E3	10.78	11	1.02	28	2.60
OF-E4	40	29	0.73	83	2.08
OF-E5	2.94	1	0.34	2	0.68
OF-E6	23.32	16	0.69	47	2.02
OF-E7	67.8	59	0.87	158	2.33
ON-D4	2.12	3	1.41	7	3.3
ON-D5	6.4	-	-	17	2.64
ON-D6	10.26	-	-	26	2.53
E1A	0.31	0.34	1.09	0.88	2.83
E2A	0.23	0.26	1.14	0.60	2.61
E3A	0.15	0.15	1.02	0.39	2.60
E4A	0.19	0.14	0.73	0.39	2.08
E5A	0.19	0.06	0.34	0.13	0.68
E6A	0.25	0.17	0.69	0.50	2.02
E6B	0.33	0.23	0.69	0.67	2.02
E7A	0.15	0.13	0.87	0.35	2.33
ON-D4-P	0.43	0.61	1.41	1.42	3.3
ON-D5-P	1.11	-	-	2.90	2.64
ON-D6-P1	1.22	-	-	3.00	2.53
ON-D6-P2	1.05	-	-	2.66	2.53

DRAINAGE FACILITIES SUMMARY - PHASE 1

FACILITY	Size	LENGTH	FLOW	NOTES
P4	18"	87	9	LATERAL
P5	30"	95	59	LATERAL
P6	78"	390	497	TROPICAL MAINLINE
P7	78"	340	508	TROPICAL MAINLINE
P8	78"	410	517	TROPICAL MAINLINE
P9	78"	30	614	TROPICAL MAINLINE

FACILITY	Grate Length (FT)	Surface flow (cfs)	Intercepted (cfs)	Bypass (cfs)	Discharge point	Notes
DI3	15	11	0.6		CM2 DI on Sag	
DI4	10	9	0.5		CM2 DI on Sag	
DI5	5'x0'	59	66		NDOT Type 2 - DI on Sag	

STREET NORMAL DEPTH CALCULATION SUMMARY FOR INTERIM PHASE 1 CONDITION

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
Section1 FULL 100' R/W - 100 YR	CI1P	5	3.00	0.30	3.33	1.00
Section1 FULL 100' R/W-10 YR	CI1P	2	3.00	0.23	2.86	0.66
Section2 HALF 80' R/W -100 YR	(ST-D3) + (ON-D7) + (CU1H - 11) + ((ON-D6)-9) + (OP-D1) + E6A + E6B + E7A	34.6	3.85	0.59	6.38	3.76
Section2 HALF 80' R/W -10 YR	(ST-D3) + (ON-D7) + (CU1H - 11) + ((ON-D6)-9) + (OP-D1) + E6A + E6B + E7A	5.5	3.85	0.35	4.42	1.55
Section5 onsite @ON-D5 100 YR	ON-D5-P	2.9	2.20	0.27	2.67	0.72
Section6 onsite @ ON-D5 100YR	CI1H	19	1.78	0.44	3.82	1.68
Section7 onsite @ON-D6 100 YR	ON-D6-P1	3	2.20	0.27	2.69	0.73
Section8 onsite @ ON-D5 100 YR	ON-D6	25	2.20	0.46	4.54	2.09
Section19 onsite @ ON-D6 100 YR	ON-D6-P2	2.7	2.20	0.21	2.82	0.59

PARK SWALE NORMAL DEPTH CALCULATION SUMMARY FOR INTERIM PHASE 1 CONDITION

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
Section 9C INT	OP-D1 (0.8) + E6A	1.3	2.10	0.39	2.81	1.10
Section 9D INT	Section 9C + OP-D1 (1.2) + E6B + E7A	3.5	2.10	0.57	3.60	2.05

OFFSITE CHANNEL NORMAL DEPTH CALCULATION SUMMARY FOR INTERIM PHASE 1 CONDITION

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
Section15 INT Phase1	OF-E5 + OF-E6 (5)	7	2.10	0.07	1.51	0.11
Section16 INT Phase1	OF-E5 + OF-E6 (25)	27	2.10	0.15	2.41	0.36
Section17 INT Phase1	OF-E5 + OF-E6	49	2.10	0.20	2.90	0.58
Section18 INT Phase1	OF-E5 + OF-E6 + OF-E7 (7)	56	2.10	0.21	3.06	0.64

PHASE 1 INTERIM CONDITION HYDROLOGIC SUMMARY

Basin	Area (acres)	Q_{10} (cfs)	Q_{100} (cfs)
CI1A	-	9	24
CI1B	-	10	24
CI1C	-	13	32
CI1D	-	31	87
CI1E	-	16	49
CI1F	-	75	207
CI1G	-	232	366
CI1H	-	7	19
CI1I	-	239	384
CI1K	-	251	414
CI1L	-	44	119
CI1P	-	2	5
CI1Q	-	292	459
BASE	-	40	40
GOAN	-	157	157
OF-E1	4.60	5	13
OF-E2	6.12	7	16
OF-E3	10.78	11	28
OF-E4	40.00	29	83
OF-E5	2.94	<1	2
OF-E6	23.32	16	47
OF-E7	67.8	59	158
OF-E8	4.37	1	5
ON-E1	4.04	4	11
ON-E2	2.90	3	8
ON-E3	1.44	2	4
ON-E4	1.62	2	4
ON-D5	6.40	7	17
ON-E5A	1.40	1	3
ON-D6	10.26	10	26
ON-D7	1.07	1	3
OP-D1	1.02	1	2
RTCI1D	-	51	139
ST-D2	0.83	2	3
ST-D3	0.68	2	3
ST-E1	0.58	1	2

CI1A = OF-E1 + ON-E1
CI1B = OF-E2 + ON-E2
CI1C = OF-E3 + ON-E3
CI1D = OF-E4 + ON-E4
CI1E = OF-E5 + OF-E6
CI1F = CI1E + OF-E7
CI1G = CI1F + OP-D1 + GOAN
CI1H = ON-E5A + ON-D5
CI1I = CI1G + CI1H
CI1K = CI1I + ON-D6 + ON-D7 + ST-D3
CI1L = CI1C + CI1D
CI1P = ST-E1 + ST-D2
CI1Q = CI1K + OF-E8 + BASE

NOTES
1. Refereced from the Centennial Condominious Study.
2. Facility size and flows are referenced from Shaumber Road Realignment Study
3. Facility size is referenced from 215 Bruce Woodbury Beltway-Craig Road Study

0 150' 300'
SCALE: 1" = 150'

KEY:

- ON-D1 4.04 — BASIN NAME/AREA
- PRT 0.49 — PRORATE BASIN NAME/AREA
- CI11 — CONCENTRATION POINT
- FLOW DIRECTION
- 4—4 — CROSS SECTION
- BASIN BOUNDARY
- PRORATE BASIN BOUNDARY
- EXISTING CCRFCD REG. FAC.
- LOCAL EXISTING FACILITY

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PROJECT NV-1949-1909

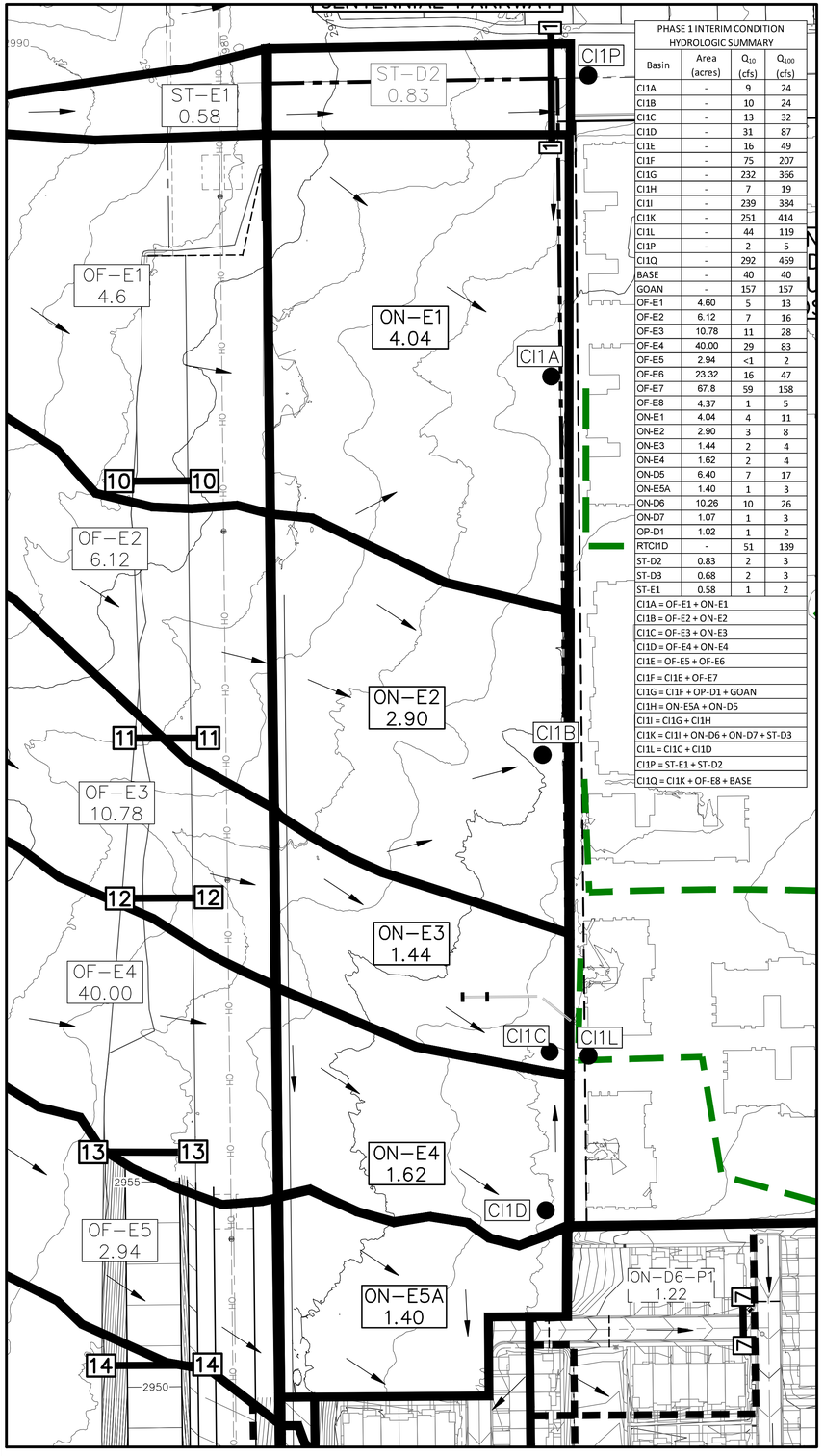
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HARMONY HOMES, LLC
CITY OF LAS VEGAS
NEVADA

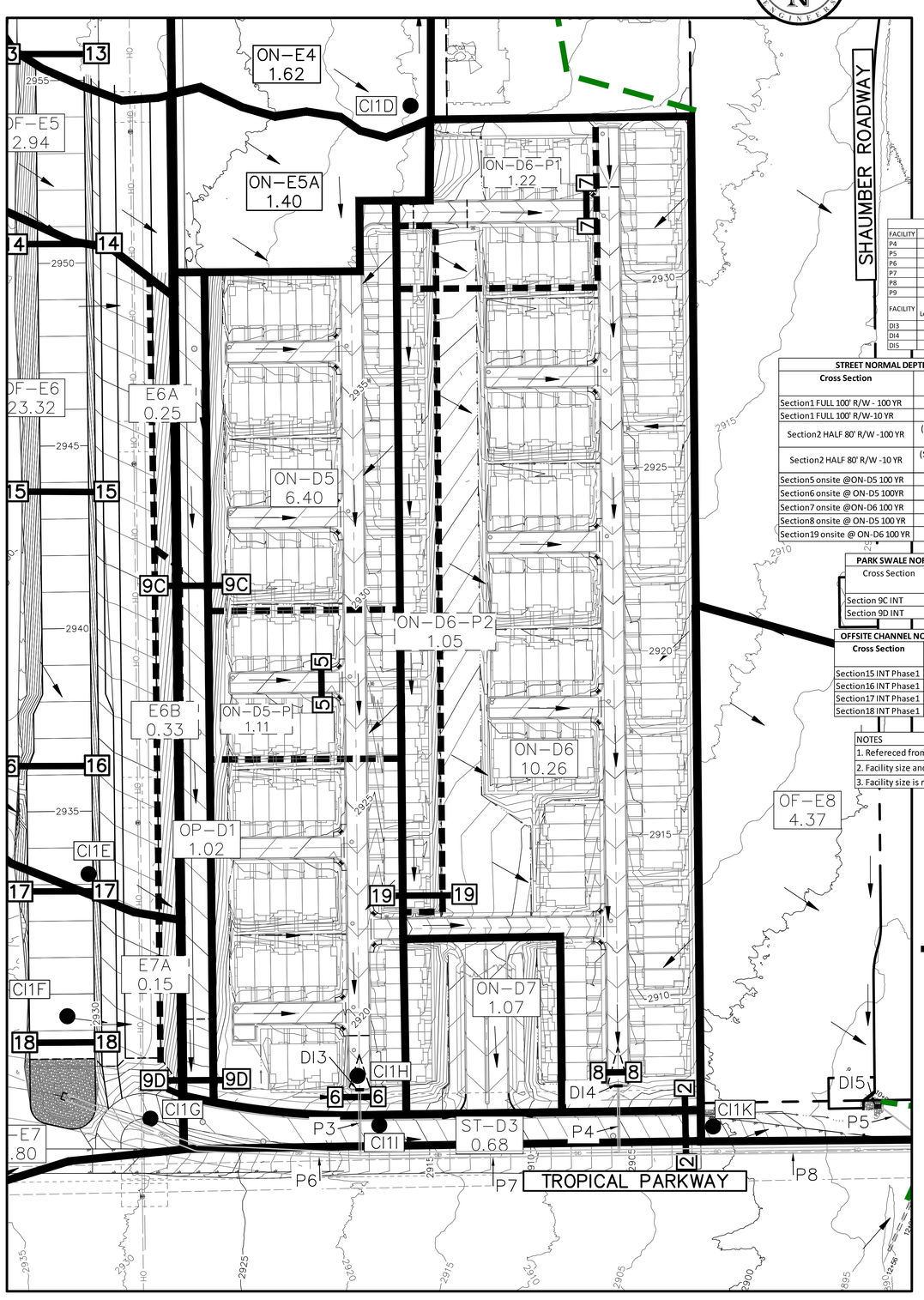
PHASE 1 INTERIM CONDITION OFFSITE BASIN MAP

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PHASE 1 INTERIM CONDITION HYDROLOGIC SUMMARY			
Basin	Area (acres)	Q_{10} (cfs)	Q_{100} (cfs)
CI1A	-	9	24
CI1B	-	10	24
CI1C	-	13	32
CI1D	-	31	87
CI1E	-	16	49
CI1F	-	75	207
CI1G	-	232	366
CI1H	-	7	19
CI1I	-	239	384
CI1K	-	251	414
CI1L	-	44	119
CI1P	-	2	5
CI1Q	-	292	459
BASE	-	40	40
GOAN	-	157	157
OF-E1	4.60	5	13
OF-E2	6.12	7	16
OF-E3	10.78	11	28
OF-E4	40.00	29	83
OF-E5	2.94	<1	2
OF-E6	23.32	16	47
OF-E7	67.8	59	158
OF-E8	4.37	1	5
ON-E1	4.04	4	11
ON-E2	2.90	3	8
ON-E3	1.44	2	4
ON-E4	1.62	2	4
ON-D5	6.40	7	17
ON-E5A	1.40	1	3
ON-D6	10.26	10	26
ON-D7	1.07	1	3
OP-D1	1.02	1	2
RTCI1D	-	51	139
ST-D2	0.83	2	3
ST-D3	0.68	2	3
ST-E1	0.58	1	2

CI1A = OF-E1 + ON-E1
CI1B = OF-E2 + ON-E2
CI1C = OF-E3 + ON-E3
CI1D = OF-E4 + ON-E4
CI1E = OF-E5 + OF-E6
CI1F = CI1E + OF-E7
CI1G = CI1F + OP-D1 + GOAN
CI1H = ON-E5A + ON-D5
CI1I = CI1G + CI1H
CI1K = CI1I + ON-D6 + ON-D7 + ST-D3
CI1L = CI1C + CI1D
CI1P = ST-E1 + ST-D2
CI1Q = CI1K + OF-E8 + BASE

0 80' 160'
SCALE: 1" = 80'

PRORATE FLOW SUMMARY					
		For 10 YR Flow		For 100 YR Flow	
Basin	Area (acre)	Flow (cfs)	Flowrate (cfs/acre)	Flow (cfs)	Flowrate (cfs/acre)
OF-E1	4.6	5	1.09	13	2.83
OF-E2	6.12	7	1.14	16	2.61
OF-E3	10.78	11	1.02	28	2.60
OF-E4	40	29	0.73	83	2.08
OF-E5	2.94	1	0.34	2	0.68
OF-E6	23.32	16	0.69	47	2.02
OF-E7	67.8	59	0.87	158	2.33
ON-D4	2.12	3	1.41	7	3.3
ON-D5	6.4	-	-	17	2.64
ON-D6	10.26	-	-	26	2.53
E1A	0.31	0.34	1.09	0.88	2.83
E2A	0.23	0.26	1.14	0.60	2.61
E3A	0.15	0.15	1.02	0.39	2.60
E4A	0.19	0.14	0.73	0.39	2.08
E5A	0.19	0.06	0.34	0.13	0.68
E6A	0.25	0.17	0.69	0.50	2.02
E6B	0.33	0.23	0.69	0.67	2.02
E7A	0.15	0.13	0.87	0.35	2.33
ON-D4-P	0.43	0.61	1.41	1.42	3.3
ON-D5-P	1.11	-	-	2.90	2.64
ON-D6-P1	1.22	-	-	3.00	2.53
ON-D6-P2	1.05	-	-	2.66	2.53

DRAINAGE FACILITIES SUMMARY -PHASE 1				
FACILITY	Size	LENGTH	FLOW	NOTES
P4	18"	87	9	LATERAL
P5	30"	95	59	LATERAL
P6	78"	390	497	TROPICAL MAINLINE
P7	78"	340	508	TROPICAL MAINLINE
P8	78"	410	517	TROPICAL MAINLINE
P9	78"	30	614	TROPICAL MAINLINE

FACILITY	Grate Length (FT)	Surface flow (cfs)	Intercepted (cfs)	Bypass (cfs)	Discharge point	Notes
DI3	15	11	0.6			CM2 DI on Sag
DI4	10	9	0.5			CM2 DI on Sag
DI5	5'x6'	59	66			NDOT Type 2 - DI on Sag

STREET NORMAL DEPTH CALCULATION SUMMARY FOR INTERIM PHASE 1 CONDITION

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
Section1 FULL 100' R/W - 100 YR	CI1P	5	3.00	0.30	3.33	1.00
Section1 FULL 100' R/W-10 YR	CI1P	2	3.00	0.23	2.86	0.66
Section2 HALF 80' R/W -100 YR	(ST-D3) + (ON-D7) + (CU1H - 11) + ((ON-D6)-9) + (OP-D1) + E6A + E6B + E7A	34.6	3.85	0.59	6.38	3.76
Section2 HALF 80' R/W -10 YR	(ST-D3) + (ON-D7) + (CU1H - 11) + ((ON-D6)-9) + (OP-D1) + E6A + E6B + E7A	5.5	3.85	0.35	4.42	1.55
Section5 onsite @ON-D5 100 YR	ON-D5-P	2.9	2.20	0.27	2.67	0.72
Section6 onsite @ ON-D5 100YR	CI1H	19	1.78	0.44	3.82	1.68
Section7 onsite @ON-D6 100 YR	ON-D6-P1	3	2.20	0.27	2.69	0.73
Section8 onsite @ ON-D5 100 YR	ON-D6	25	2.20	0.46	4.54	2.09
Section19 onsite @ ON-D6 100 YR	ON-D6-P2	2.7	2.20	0.21	2.82	0.59

PARK SWALE NORMAL DEPTH CALCULATION SUMMARY FOR INTERIM PHASE 1 CONDITION

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
Section 9C INT	OP-D1 (0.8) + E6A	1.3	2.10	0.39	2.81	1.10
Section 9D INT	Section 9C + OP-D1 (1.2) + E6B + E7A	3.5	2.10	0.57	3.60	2.05

OFFSITE CHANNEL NORMAL DEPTH CALCULATION SUMMARY FOR INTERIM PHASE 1 CONDITION

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
Section15 INT Phase1	OF-E5 + OF-E6 (5)	7	2.10	0.07	1.51	0.11
Section16 INT Phase1	OF-E5 + OF-E6 (25)	27	2.10	0.15	2.41	0.36
Section17 INT Phase1	OF-E5 + OF-E6	49	2.10	0.20	2.90	0.58
Section18 INT Phase1	OF-E5 + OF-E6 + OF-E7 (7)	56	2.10	0.21	3.06	0.64

NOTES
1. Refereced from the Centennial Condominious Study.
2. Facility size and flows are referenced from Shaumber Road Realignment Study
3. Facility size is referenced from 215 Bruce Woodbury Beltway-Craig Road Study

KEY:

- ON-D1 / 4.04 — BASIN NAME/AREA
- PR1 / 0.49 — PRORATE BASIN NAME/AREA
- CI11 — CONCENTRATION POINT
- FLOW DIRECTION
- 4 — 4 — CROSS SECTION
- BASIN BOUNDARY
- PRORATE BASIN BOUNDARY
- EXISTING CCRFCD REG. FAC.
- LOCAL EXISTING FACILITY

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PROJECT NV-1949-1909

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PHASE 1 INTERIM CONDITION ONSITE BASIN MAP

A PORTION OF APN# 126-25-201-010

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WATER TANK STUDY
SITE: DS 4854

PRORATE FLOW SUMMARY

Basin	Area (acre)	For 10 YR Flow: Flow (cfs)	For 10 YR Flow: Flowrate (cfs/acre)	For 100 YR Flow: Flow (cfs)	For 100 YR Flow: Flowrate
OF-E1	4.6	5	1.09	13	2.83
OF-E2	6.12	7	1.14	16	2.61
OF-E3	10.78	11	1.02	28	2.60
OF-E4	40	29	0.73	83	2.08
OF-E5	2.94	1	0.34	2	0.68
OF-E6	23.32	16	0.69	47	2.02
OF-E7	67.8	59	0.87	158	2.33
ON-D4	2.12	3	1.41	7	3.3
ON-D5	6.4	-	-	17	2.64
ON-D6	10.26	-	-	26	2.53
E1A	0.31	0.34	1.09	0.88	2.83
E2A	0.23	0.26	1.14	0.60	2.61
E3A	0.15	0.15	1.02	0.39	2.60
E4A	0.19	0.14	0.73	0.39	2.08
E5A	0.19	0.06	0.34	0.13	0.68
E6A	0.25	0.17	0.69	0.50	2.02
E6B	0.33	0.23	0.69	0.67	2.02
E7A	0.15	0.13	0.87	0.35	2.33
ON-D4-P	0.43	0.61	1.41	1.42	3.3
ON-D5-P	1.11	-	-	2.90	2.64
ON-D6-P1	1.22	-	-	3.00	2.53
ON-D6-P2	1.05	-	-	2.66	2.53

DRAINAGE FACILITIES SUMMARY -PHASE 2

FACILITY	Size	LENGTH	FLOW	NOTES
P1	18"	30	5	-
P2	18"	105	10	-
P3	18"	86	11	LATERAL
P4	18"	87	9	LATERAL
P5	30"	95	59	LATERAL
P6	78"	390	497	TROPICAL MAINLINE
P7	78"	340	508	TROPICAL MAINLINE
P8	78"	410	517	TROPICAL MAINLINE
P9	78"	30	614	TROPICAL MAINLINE

FACILITY	Grate Length (FT)	Surface flow (cfs)	Intercepted (cfs)	Bypass (cfs)	Discharge point	Notes
DI1	10	12	5	7	Condos south	CM2 DI on Grate for Q_{100}
DI2	10	11	5	6	Condos south	CM2 DI on Grate for Q_{100}
DI1	10	6	3	3	Condos south	CM2 DI on Grate for Q_{10}
DI2	10	5	3	2	Condos south	CM2 DI on Grate for Q_{10}
DI3	15	11	0.6		CM2 DI on Sag	
DI4	10	9	0.5		CM2 DI on Sag	
DI5	5'x6'	59	66		NDOT Type 2 - DI on Sag	

STREET NORMAL DEPTH CALCULATION SUMMARY FOR INTERIM PHASE 2 CONDITION

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
Section1 FULL 100' R/W - 100 YR	CI2P	5	3.00	0.30	3.33	1.00
Section1 FULL 100' R/W-10 YR	CI2P	2	3.00	0.23	2.86	0.66
Section2 HALF 80' R/W -100 YR	(ST-D3) + (ON-D7) + (CI2H - 11) + (CI2J - 9) + (OP-D1) + (OP-D2) + E1A + E2A + E3A + E4A + E5A + E6A + E6B + E7A	59.9	3.85	0.68	7.43	5.05
Section2 HALF 80' R/W -10 YR	(ST-D3) + (ON-D7) + (CI2H - 11) + (CI2J - 9) + (OP-D1) + (OP-D2) + E1A + E2A + E3A + E4A + E5A + E6A + E6B + E7A	13.8	3.85	0.45	5.46	2.46
Section3 onsite @ ON-D3 10 YR	CI2L	11	2.20	0.37	3.53	1.31
Section3 onsite @ ON-D3 100 YR	CI2L	23	2.20	0.45	4.39	1.98
Section4 HALF EAST onsite @ ON-D4 100 YR	D2	8	2.20	0.41	3.85	1.58
Section5 onsite @ON-D5 100 YR	ON-D5-P	2.9	2.20	0.27	2.67	0.72
Section6 onsite @ ON-D5 100YR	CI2H	28	1.78	0.48	4.46	2.14
Section7 onsite @ON-D6 100 YR	D2 + CI2N + ON-D6-P1	17	2.20	0.42	3.91	1.64
Section8 onsite @ ON-D5 100 YR	CI2J	37	2.20	0.51	5.31	2.71
Section19 onsite @ ON-D6 100 YR	ON-D6-P2	2.7	2.20	0.21	2.82	0.59

PARK SWALE NORMAL DEPTH CALCULATION SUMMARY FOR INTERIM PHASE 2 CONDITION

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
Section 9A INT	OP-D2 (1.6) + E1A + E2A	3.1	2.98	0.51	3.98	2.03
Section 9B INT	Section 9A + OP-D2 (1.4) + E3A + E4A	5.3	1.42	0.72	3.45	2.48
Section 9C INT	Section 9B + OP-D1 (0.8) + E5A + E6A	6.7	2.10	0.73	4.23	3.09
Section 9D INT	Section 9C + OP-D1 (1.2) + E6B + E7A	8.9	2.10	0.81	4.54	3.68

OFFSITE CHANNEL NORMAL DEPTH CALCULATION SUMMARY FOR INTERIM PHASE 2 CONDITION

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
Section10 INT Phase2	OF-E1	13	2.10	0.19	2.79	0.53
Section11 INT Phase2	CI2A	28	2.10	0.30	3.76	1.13
Section12 INT Phase2	CI2B	56	2.10	0.45	4.88	2.20
Section13 INT Phase2	CI2C	139	2.10	0.44	4.91	2.16
Section14 INT Phase2	CI2D	140	2.10	0.44	4.92	2.16
Section15 INT Phase2	CI2D + OF-E6 (5)	145	2.10	0.45	4.99	2.25
Section16 INT Phase2	CI2D + OF-E6 (25)	165	2.10	0.44	4.92	2.16
Section17 INT Phase2	CI2E	186	2.10	0.44	4.91	2.16
Section18 INT Phase2	CI2E + OF-E7 (7)	193	2.10	0.45	4.99	2.25

PHASE 2 INTERIM CONDITION HYDROLOGIC SUMMARY

Basin	Area (acres)	Q_{10} (cfs)	Q_{100} (cfs)
CI2A	-	11	28
CI2B	-	23	56
CI2C	-	52	139
CI2D	-	52	140
CI2E	-	66	186
CI2F	-	125	344
CI2G	-	284	506
CI2H	-	12	28
CI2I	-	292	531
CI2J	-	15	37
CI2K	-	309	569
CI2L	-	11	23
CI2M	-	8	19
CI2N	-	3	6
CI2P	-	2	5
CI2Q	-	349	614
D1*	-	6	11
D2*	-	3	8
DIV1	-	5	12
DIV2	-	5	11
BASE	-	40	40
GOAN	-	157	157
OF-E1	4.60	5	13
OF-E2	6.12	7	16
OF-E3	10.78	11	28
OF-E4	40.00	29	83
OF-E5	2.94	<1	2
OF-E6	23.32	16	47
OF-E7	67.8	59	158
OF-E8	4.37	1	5
ON-D1	2.34	4	9
ON-D1A	0.56	1	2
ON-D2	2.38	4	9
ON-D2A	0.48	1	2
ON-D3	1.53	3	6
ON-D3A	0.27	<1	1
ON-D4	2.12	3	7
ON-D4A	0.34	1	1
ON-D5	6.40	7	17
ON-D6	10.26	10	26
ON-D7	1.07	1	3
OP-D1	1.02	1	2
OP-D2	1.37	1	3
RTCI2D	-	51	139
ST-D2	0.83	2	3
ST-D3	0.68	2	3
ST-E1	0.58	1	2

CI2A = OF-E1 + OF-E2
CI2B = CI2A + OF-E3
CI2C = CI2B + OF-E4
CI2D = CI2C + OF-E5
CI2E = RTCI2D + OF-E6
CI2F = CI2E + OF-E7
CI2G = CI2F + OP-D1 + OP-D2 + GOAN
CI2H = DIV2 + ON-D5
CI2J = CI2G + CI2H
CI2J = CI2N + ON-D6 + D2
CI2K = CI2I + CI2J + ON-D7 + ST-D3
CI2L = ON-D1 + ON-D2 + ON-D3
CI2M = DIV1 + ON-D4
CI2N = ON-D1A + ON-D2A + ON-D3A + ON-D4A
CI2P = ST-E1 + ST-D2
CI2Q = CI2K + OF-E8 + BASE
DIV1 = CI2L - D1
DIV2 = CI2M - D2

NOTES
1. Refereced from the Centennial Condominious Study.
2. Facility size and flows are referenced from Shaumber Road Realignment Study
3. Facility size is referenced from 215 Bruce Woodbury Beltway-Craig Road Study.
4. D1* is the sum of flow captured by drop inlets DI-1W and DI-1E in street H
5. D2* is Sum of DI-1E bypass flow and flow contributed by east side of ON-D4 in street H

KEY:

- ON-D1 4.04 — BASIN NAME/AREA
- PR1 0.49 — PRORATE BASIN NAME/AREA
- CI2 — CONCENTRATION POINT
- FLOW DIRECTION
- 4—4 — CROSS SECTION
- BASIN BOUNDARY
- PRORATE BASIN BOUNDARY
- EXISTING CCRFCD REG. FAC.
- LOCAL EXISTING FACILITY

SCALE: 1" = 150'

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PHASE 2 INTERIM CONDITION OFFSITE BASIN MAP
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PHASE 2 INTERIM CONDITION HYDROLOGIC SUMMARY			
Basin	Area (acres)	Q_{10} (cfs)	Q_{100} (cfs)
CI2A	-	11	28
CI2B	-	23	56
CI2C	-	52	139
CI2D	-	52	140
CI2E	-	66	186
CI2F	-	125	344
CI2G	-	284	506
CI2H	-	12	28
CI2I	-	292	531
CI2J	-	15	37
CI2K	-	309	569
CI2L	-	11	23
CI2M	-	8	19
CI2N	-	3	6
CI2P	-	2	5
CI2Q	-	349	614
D1*	-	6	11
D2*	-	3	8
DIV1	-	5	12
DIV2	-	5	11
BASE	-	40	40
GOAN	-	157	157
OF-E1	4.60	5	13
OF-E2	6.12	7	16
OF-E3	10.78	11	28
OF-E4	40.00	29	83
OF-E5	2.94	<1	2
OF-E6	23.32	16	47
OF-E7	67.8	59	158
OF-E8	4.37	1	5
ON-D1	2.34	4	9
ON-D1A	0.56	1	2
ON-D2	2.38	4	9
ON-D2A	0.48	1	2
ON-D3	1.53	3	6
ON-D3A	0.27	<1	1
ON-D4	2.12	3	7
ON-D4A	0.34	1	1
ON-D5	6.40	7	17
ON-D6	10.26	10	26
ON-D7	1.07	1	3
OP-D1	1.02	1	2
OP-D2	1.37	1	3
RTCI2D	-	51	139
ST-D2	0.83	2	3
ST-D3	0.68	2	3
ST-E1	0.58	1	2

CI2A = OF-E1 + OF-E2
CI2B = CI2A + OF-E3
CI2C = CI2B + OF-E4
CI2D = CI2C + OF-E5
CI2E = RTCI2D + OF-E6
CI2F = CI2E + OF-E7
CI2G = CI2F + OP-D1 + OP-D2 + GOAN
CI2H = DIV2 + ON-D5
CI2I = CI2G + CI2H
CI2J = CI2N + ON-D6 + D2
CI2K = CI2I + CI2J + ON-D7 + ST-D3
CI2L = ON-D1 + ON-D2 + ON-D3
CI2M = DIV1 + ON-D4
CI2N = ON-D1A + ON-D2A + ON-D3A + ON-D4A
CI2P = ST-E1 + ST-D2
CI2Q = CI2K + OF-E8 + BASE
DIV1 = CI2L - D1
DIV2 = CI2M - D2

PRORATE FLOW SUMMARY					
		For 10 YR Flow		or 100 YR Flo	
Basin	Area (acre)	Flow (cfs)	Flowrate (cfs/acre)	Flow (cfs)	Flo wrat
OF-E1	4.6	5	1.09	13	2.83
OF-E2	6.12	7	1.14	16	2.61
OF-E3	10.78	11	1.02	28	2.60
OF-E4	40	29	0.73	83	2.08
OF-E5	2.94	1	0.34	2	0.68
OF-E6	23.32	16	0.69	47	2.02
OF-E7	67.8	59	0.87	158	2.33
ON-D4	2.12	3	1.41	7	3.3
ON-D5	6.4	-	-	17	2.64
ON-D6	10.26	-	-	26	2.53
E1A	0.31	0.34	1.09	0.88	2.83
E2A	0.23	0.26	1.14	0.60	2.61
E3A	0.15	0.15	1.02	0.39	2.60
E4A	0.19	0.14	0.73	0.39	2.08
E5A	0.19	0.06	0.34	0.13	0.68
E6A	0.25	0.17	0.69	0.50	2.02
E6B	0.33	0.23	0.69	0.67	2.02
E7A	0.15	0.13	0.87	0.35	2.33
ON-D4-P	0.43	0.61	1.41	1.42	3.3
ON-D5-P	1.11	-	-	2.90	2.64
ON-D6-P1	1.22	-	-	3.00	2.53
ON-D6-P2	1.05	-	-	2.66	2.53

DRAINAGE FACILITIES SUMMARY -PHASE 2				
FACILITY	Size	LENGTH	FLOW	NOTES
P1	18"	30	5	-
P2	18"	105	10	-
P3	18"	86	11	LATERAL
P4	18"	87	9	LATERAL
P5	30"	95	59	LATERAL
P6	78"	390	497	TROPICAL MAINLINE
P7	78"	340	508	TROPICAL MAINLINE
P8	78"	410	517	TROPICAL MAINLINE
P9	78"	30	614	TROPICAL MAINLINE

FACILITY	Grate Length (FT)	Surface flow (cfs)	Intercepted (cfs)	Bypass (cfs)	Discharge point	Notes
DI1	10	12	5	7	Condos south	CM2 DI on Grate for Q_{100}
DI2	10	11	5	6	Condos south	CM2 DI on Grate for Q_{100}
DI1	10	6	3	3	Condos south	CM2 DI on Grate for Q_{10}
DI2	10	5	3	2	Condos south	CM2 DI on Grate for Q_{10}
DI3	15	11	0.6		CM2 DI on Sag	
DI4	10	9	0.5		CM2 DI on Sag	
DI5	5'x6'	59	66		NDOT Type 2 - DI on Sag	

STREET NORMAL DEPTH CALCULATION SUMMARY FOR INTERIM PHASE 2 CONDITION

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
Section1 FULL 100' R/W - 100 YR	CI2P	5	3.00	0.30	3.33	1.00
Section1 FULL 100' R/W -10 YR	CI2P	2	3.00	0.23	2.86	0.66
Section2 HALF 80' R/W -100 YR	(ST-D3) + (ON-D7) + (CI2H - 11) + (CI2J - 9) + (OP-D1) + (OP-D2) + E1A + E2A + E3A + E4A + E5A + E6A + E6B + E7A	59.9	3.85	0.68	7.43	5.05
Section2 HALF 80' R/W -10 YR	(ST-D3) + (ON-D7) + (CI2H - 11) + (CI2J - 9) + (OP-D1) + (OP-D2) + E1A + E2A + E3A + E4A + E5A + E6A + E6B + E7A	13.8	3.85	0.45	5.46	2.46
Section3 onsite @ ON-D3 10 YR	CI2L	11	2.20	0.37	3.53	1.31
Section3 onsite @ ON-D3 100 YR	CI2L	23	2.20	0.45	4.39	1.98
Section4 HALF EAST onsite @ ON-D4 100 YR	D2	8	2.20	0.41	3.85	1.58
Section5 onsite @ON-D5 100 YR	ON-D5-P	2.9	2.20	0.27	2.67	0.72
Section6 onsite @ ON-D5 100YR	CI2H	28	1.78	0.48	4.46	2.14
Section7 onsite @ON-D6 100 YR	D2 + CI2N + ON-D6-P1	17	2.20	0.42	3.91	1.64
Section8 onsite @ ON-D5 100 YR	CI2J	37	2.20	0.51	5.31	2.71
Section19 onsite @ ON-D6 100 YR	ON-D6-P2	2.7	2.20	0.21	2.82	0.59

PARK SWALE NORMAL DEPTH CALCULATION SUMMARY FOR INTERIM PHASE 2 CONDITION

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
Section 9A INT	OP-D2 (1.6) + E1A + E2A	3.1	2.98	0.51	3.98	2.03
Section 9B INT	Section 9A + OP-D2 (1.4) + E3A + E4A	5.3	1.42	0.72	3.45	2.48
Section 9C INT	Section 9B + OP-D1 (0.8) + E5A + E6A	6.7	2.10	0.73	4.23	3.09
Section 9D INT	Section 9C + OP-D1 (1.2) + E6B + E7A	8.9	2.10	0.81	4.54	3.68

OFFSITE CHANNEL NORMAL DEPTH CALCULATION SUMMARY FOR INTERIM PHASE 2 CONDITION

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
Section10:INT Phase2	OF-E1	13	2.10	0.19	2.79	0.53
Section11:INT Phase2	CI2A	28	2.10	0.30	3.76	1.13
Section12:INT Phase2	CI2B	56	2.10	0.45	4.88	2.20
Section13:INT Phase2	CI2C	139	2.10	0.44	4.91	2.16
Section14:INT Phase2	CI2D	140	2.10	0.44	4.92	2.16
Section15:INT Phase2	CI2D + OF-E6 (5)	145	2.10	0.45	4.99	2.25
Section16:INT Phase2	CI2D + OF-E6 (25)	165	2.10	0.44	4.92	2.16
Section17:INT Phase2	CI2E	186	2.10	0.44	4.91	2.16
Section18:INT Phase2	CI2E + OF-E7 (7)	193	2.10	0.45	4.99	2.25

NOTES
1. Refereced from the Centennial Condominious Study.
2. Facility size and flows are referenced from Shaumber Road Realignment Study
3. Facility size is referenced from 215 Bruce Woodbury Beltway-Craig Road Study
4. D1* is the sum of flow captured by drop inlets DI-1W and DI-1E in street H
5. D2* is Sum of DI-1E bypass flow and flow contributed by east side of ON-D4 in street H

KEY:

- ON-D1 / 4.04 — BASIN NAME/AREA
- PR1 / 0.49 — PRORATE BASIN NAME/AREA
- CI2 — CONCENTRATION POINT
- FLOW DIRECTION
- 4—4 — CROSS SECTION
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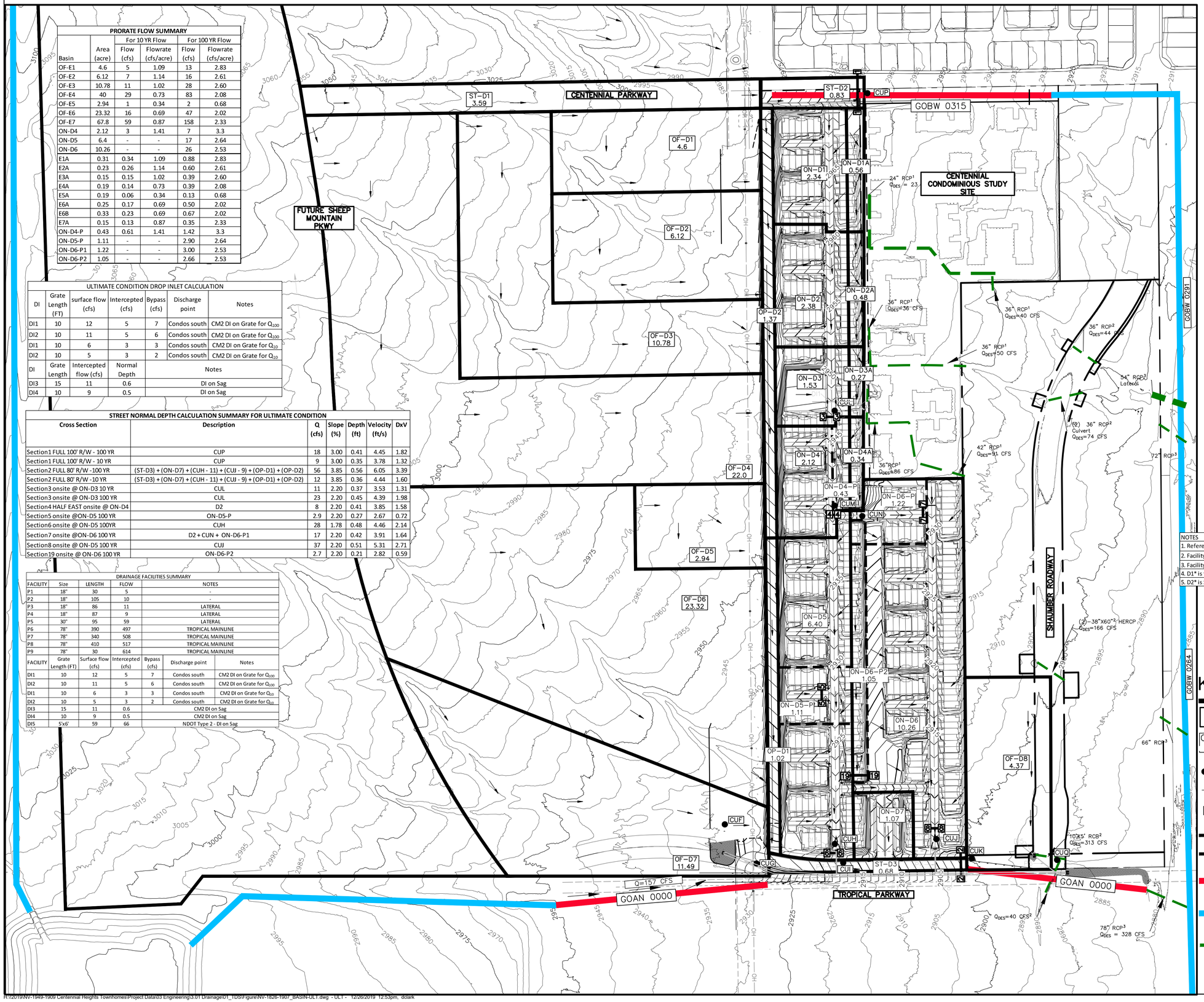
PHASE 2 INTERIM CONDITION ONSITE BASIN MAP

A PORTION OF APN# 126-25-201-010

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PRORATE FLOW SUMMARY

Basin	Area (acre)	For 10 YR Flow: Flow (cfs)	For 10 YR Flow: Flowrate (cfs/acre)	For 100 YR Flow: Flow (cfs)	For 100 YR Flow: Flowrate (cfs/acre)
OF-E1	4.6	5	1.09	13	2.83
OF-E2	6.12	7	1.14	16	2.61
OF-E3	10.78	11	1.02	28	2.60
OF-E4	40	29	0.73	83	2.08
OF-E5	2.94	1	0.34	2	0.68
OF-E6	23.32	16	0.69	47	2.02
OF-E7	67.8	59	0.87	158	2.33
ON-D4	2.12	3	1.41	7	3.3
ON-D5	6.4	-	-	17	2.64
ON-D6	10.26	-	-	26	2.53
E1A	0.31	0.34	1.09	0.88	2.83
E2A	0.23	0.26	1.14	0.60	2.61
E3A	0.15	0.15	1.02	0.39	2.60
E4A	0.19	0.14	0.73	0.39	2.08
E5A	0.19	0.06	0.34	0.13	0.68
E6A	0.25	0.17	0.69	0.50	2.02
E6B	0.33	0.23	0.69	0.67	2.02
E7A	0.15	0.13	0.87	0.35	2.33
ON-D4-P	0.43	0.61	1.41	1.42	3.3
ON-D5-P	1.11	-	-	2.90	2.64
ON-D6-P1	1.22	-	-	3.00	2.53
ON-D6-P2	1.05	-	-	2.66	2.53

ULTIMATE CONDITION DROP INLET CALCULATION

DI	Grate Length (FT)	surface flow (cfs)	Intercepted (cfs)	Bypass (cfs)	Discharge point	Notes
DI1	10	12	5	7	Condos south	CM2 DI on Grate for Q_{100}
DI2	10	11	5	6	Condos south	CM2 DI on Grate for Q_{100}
DI1	10	6	3	3	Condos south	CM2 DI on Grate for Q_{10}
DI2	10	5	3	2	Condos south	CM2 DI on Grate for Q_{10}
DI	Grate Length	Intercepted flow (cfs)	Normal Depth	Notes		
DI3	15	11	0.6	DI on Sag		
DI4	10	9	0.5	DI on Sag		

STREET NORMAL DEPTH CALCULATION SUMMARY FOR ULTIMATE CONDITION

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
Section1 FULL 100' R/W - 100 YR	CUP	18	3.00	0.41	4.45	1.82
Section1 FULL 100' R/W - 10 YR	CUP	9	3.00	0.35	3.78	1.32
Section2 FULL 80' R/W -100 YR	(ST-D3) + (ON-D7) + (CUH - 11) + (CUI - 9) + (OP-D1) + (OP-D2)	56	3.85	0.56	6.05	3.39
Section2 FULL 80' R/W -10 YR	(ST-D3) + (ON-D7) + (CUH - 11) + (CUI - 9) + (OP-D1) + (OP-D2)	12	3.85	0.36	4.44	1.60
Section3 onsite @ ON-D3 10 YR	CUL	11	2.20	0.37	3.53	1.31
Section3 onsite @ ON-D3 100 YR	CUL	23	2.20	0.45	4.39	1.98
Section4 HALF EAST onsite @ ON-D4	D2	8	2.20	0.41	3.85	1.58
Section5 onsite @ON-D5 100 YR	ON-D5-P	2.9	2.20	0.27	2.67	0.72
Section6 onsite @ ON-D5 100YR	CUH	28	1.78	0.48	4.46	2.14
Section7 onsite @ON-D6 100 YR	D2 + CUN + ON-D6-P1	17	2.20	0.42	3.91	1.64
Section8 onsite @ ON-D5 100 YR	CUJ	37	2.20	0.51	5.31	2.71
Section19 onsite @ ON-D6 100 YR	ON-D6-P2	2.7	2.20	0.21	2.82	0.59

DRAINAGE FACILITIES SUMMARY

FACILITY	Size	LENGTH	FLOW	NOTES
P1	18"	30	5	-
P2	18"	105	10	-
P3	18"	86	11	LATERAL
P4	18"	87	9	LATERAL
P5	30"	95	59	LATERAL
P6	78"	390	497	TROPICAL MAINLINE
P7	78"	340	508	TROPICAL MAINLINE
P8	78"	410	517	TROPICAL MAINLINE
P9	78"	30	614	TROPICAL MAINLINE

FACILITY	Grate Length (FT)	Surface flow (cfs)	Intercepted (cfs)	Bypass (cfs)	Discharge point	Notes
DI1	10	12	5	7	Condos south	CM2 DI on Grate for Q_{100}
DI2	10	11	5	6	Condos south	CM2 DI on Grate for Q_{100}
DI1	10	6	3	3	Condos south	CM2 DI on Grate for Q_{10}
DI2	10	5	3	2	Condos south	CM2 DI on Grate for Q_{10}
DI3	15	11	0.6	CM2 DI on Sag		
DI4	10	9	0.5	CM2 DI on Sag		
DI5	5'x6'	59	66	NDOT Type 2 - DI on Sag		

ULTIMATE CONDITION HYDROLOGIC SUMMARY

Basin	Area (acres)	Q_{10} (cfs)	Q_{100} (cfs)
CUF	-	133	273
CUG	-	291	435
CUH	-	12	28
CUI	-	303	463
CUJ	-	15	37
CUK	-	320	506
CUL	-	11	23
CUM	-	8	19
CUN	-	3	6
CUP	-	9	18
D1*	-	6	11
D2*	-	3	8
DIV1	-	5	12
DIV2	-	5	11
BASE	-	40	40
GOAN	-	157	157
CUQ	-	365	558
OF-D1	4.60	9	18
OF-D2	6.12	12	23
OF-D3	10.78	19	37
OF-D4	22.00	32	66
OF-D5	2.94	4	9
OF-D6	23.32	40	81
OF-D7	11.49	18	38
OF-D8	4.37	5	12
ON-D1	2.34	4	9
ON-D1A	0.56	1	2
ON-D2	2.38	4	9
ON-D2A	0.48	1	2
ON-D3	1.53	3	6
ON-D3A	0.27	<1	1
ON-D4	2.12	3	7
ON-D4A	0.34	1	1
ON-D5	6.40	7	17
ON-D6	10.26	10	26
ON-D7	1.07	1	3
OP-D1	1.02	1	2
OP-D2	1.37	1	3
ST-D1	3.59	8	14
ST-D2	0.83	2	3
ST-D3	0.68	2	3

CUF = OF-D1 + OF-D2 + OF-D3 + OF-D4 + OF-D5 + OF-D6 + OF-D7

CUG = CUF + OP-D1 + OP-D2 + GOAN

CUH = DIV2 + ON-D5

CUI = CUG + CUH

CUJ = CUN + ON-D6 + D2

CUK = CUI + CUJ + ON-D7 + ST-D3

CUL = ON-D1 + ON-D2 + ON-D3

CUM = DIV1 + ON-D4

CUN = ON-D1A + ON-D2A + ON-D3A + ON-D4A

CUP = ST-D1 = ST-D2

CUQ = CUK + OF-D8 + BASE

DIV1 = CUL - D1

DIV2 = CUM - D2

NOTES
1. Refereced from the Centennial Condominious Study.
2. Facility size and flows are referenced from Shaumber Road Realignment Study
3. Facility size is referenced from 215 Bruce Woodbury Beltway-Craig Road Study
4. D1* is the sum of flow captured by drop inlets DI-1W and DI-1E in street H
5. D2* is Sum of DI-1E bypass flow and flow contributed by east side of ON-D4 in street H

KEY:

- ON-D1 4.04 — BASIN NAME/AREA
- ON-D4-P 0.49 — PRORATE BASIN NAME/AREA
- CU2 — CONCENTRATION POINT
- FLOW DIRECTION
- 4 — 4 — CROSS SECTION
- BASIN BOUNDARY
- PRORATE BASIN BOUNDARY
- PROPOSED CCRFCD REG. FAC.
- EXISTING CCRFCD REG. FAC.
- LOCAL EXISTING FACILITY

SCALE: 1" = 150'

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WARNING
IF THIS BAR DOES NOT MEASURE 2" THEN DRAWING IS NOT TO SCALE

REVISIONS
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*SEE GENERAL NOTES SHEET

DRAWING INFO
DATE 09/19/2019
DESIGNED MDP
DRAWN SS
CHECKED LMB
PROJECT NV-1949-1909

CENTENNIAL HEIGHTS TOWNHOMES
HARMONY HOMES, LLC
CITY OF LAS VEGAS
NEVADA

ULTIMATE CONDITION OFFISTE BASIN MAP

A PORTION OF APN# 126-25-201-010

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