

DS #: 4543

APN: 124-30-204-008

PROJECT: TROPICAL PKWY - CENTENNIAL PKWY
ROADWAY IMPROVEMENTS (CNLV)

SUBMITTAL: 1ST

SCANNED BY/DATE: _____

CHECKED BY/DATE: _____



CITY OF LAS VEGAS		DATE:
INTER-OFFICE MEMORANDUM		January 19, 2012
TO: Land Development Services Department of Public Works		FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT:	Drainage Study for:	COPIES TO:
	Tropical Pkwy / Centennial Pkwy – Roadway Improvements (Project in CNLV for CLV Concurrence)	Slater Hanifan Group
Cross Streets:	Decatur Boulevard & Tropical Parkway	M Grape LLC
File Number:	F:\Depot\DSMemos\DS4543A.doc	Bart Anderson, P.E., DevCo
Parcel Number:	124-30-204-008	CNLV
Zoning Action:	N/A	
FEMA Flood Zone	YES	NO X
Proposed Storm Drain	YES	NO X

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1 st Submittal	1/9/2012	1/19/2012	See Comments Below	\$400.00	270598: \$400
TOTAL FEES (LDDRS):				\$400.00	----

REMARKS:

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

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

City of Las Vegas Flood Control staff has reviewed the Technical Drainage Study, including the Response to Comments of the subject study. *City of Las Vegas* concurs with the acceptance of the drainage study by the *Development and Flood Control Division* of the *City of North Las Vegas*. The review of this project was limited to issues of flood control significance to the *City of Las Vegas*.

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

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

END OF REMARKS

ays

T/R/S: T19S/R61E/30
AREA H-30

Mayor
Shari L. Buck

Council Members
Robert L. Eliason
Anita G. Wood
Pamela A. Goynes-Brown
Wade W. Wagner



City Manager
Timothy R. Hacker

Your Community of Choice

PUBLIC WORKS – DEVELOPMENT AND FLOOD CONTROL
2250 Las Vegas Boulevard, North, Suite 200 • North Las Vegas, Nevada 89030
Telephone: (702) 633-1200 • Fax: (702) 649-4696 • TDD: (800) 326-6868
www.cityofnorthlasvegas.com

January 4, 2012

Ray Fredricksen, P.E.
Slater Hanifan Group
5740 S. Arville St. #216
Las Vegas, NV 89118

Re: Addendum to the Technical Drainage Study for Tropical Parkway/Centennial Parkway Roadway Improvements
CNLV No. 43988

Dear Mr. Fredricksen:

Staff has reviewed the above referenced study, dated December 19, 2011, and found it to meet the minimum accepted standards for a technical drainage study. NOTE that there were grading plan items that were not fully addressed and will need to be completed with the Civil Plan review process. This acceptance is contingent upon the following conditions:

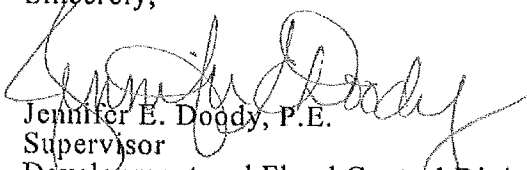
1. Concurrence must be obtained by the City of Las Vegas due to the proposed improvements proximity to the jurisdictional boundary.

Please be advised that all land surface area disturbances over 1 acre and/or adjacent to a water way must submit a "Notice of Intent" to discharge to the Nevada Division of Environmental Protection, which certifies that a stormwater pollution prevention plan has been developed and is maintained on site. For more information, including forms and applications, see <http://ndep.nv.gov/bwpc/storm01.htm>.

Acceptance of this drainage study does not imply approval of the grading plan or the structural calculations associated with the drainage for this site. A detailed review of the grading plan is performed by staff during the improvement plan review process.

The City assumes no responsibility for the information, data, and conclusions presented in this report. If you have any questions concerning this matter, please contact me at 633-1223.

Sincerely,


Jennifer E. Doody, P.E.
Supervisor
Development and Flood Control Division

Albert Sung

From: Ray Fredericksen [rfredericksen@shg-inc.com]
Sent: Monday, January 09, 2012 1:52 PM
To: Albert Sung
Subject: Tropical/Centennial Pkwy TDS
Attachments: 43988 TROP CENT IMP APPROVAL.pdf

Albert,

Attached is the approval letter from the City of North Las Vegas.

If any questions arise during your review please feel free to contact me. I am always available.

Ray Fredericksen, P.E.
Project Manager
Cell: (702) 569-9770

SLATER HANIFAN GROUP
"The Benchmark of Our Profession."

LAS VEGAS
5740 S. ARVILLE STREET #216
LAS VEGAS, NEVADA 89118
PHONE: (702) 284-5300
FAX: (702) 284-5399
www.shg-inc.com

PHOENIX
11801 N. TATUM BLVD. #124
PHOENIX, ARIZONA 85028
PHONE: (602) 687-9664
FAX: (602) 687-9693

Any files contained within are to be used for information ONLY. Accuracy and/or design information to be verified from approved original plans. Use of electronic media is at the sole risk of the user.

Mayor
Shari L. Buck

Council Members
Robert L. Eliason
Anita G. Wood
Pamela A. Goynes-Brown
Wade W. Wagner



City Manager
Timothy R. Hacker

Your Community of Choice

Community Services and Development Department - Frank Fiori, Director

2240 Civic Center Drive, Suite 210 • North Las Vegas, Nevada 89030
Telephone: (702) 633-1537 • Fax: (702) 649-6091 • TDD: (800) 326-6868
www.cityofnorthlasvegas.com

October 17, 2011

George Garcia
G.C. Garcia, Inc.
1711 Whitney Mesa Drive Suite 110
Henderson, NV 89014

RE: SPR-11-11 (43720) LVAC @ TROPICAL & DECATUR. An application submitted by Las Vegas Racquetball Club, Inc. DBA Las Vegas Athletic Club on behalf of M Grape LLC, property owner, for a site plan review in a C-2, General Commercial District to allow a commercial/retail center with approximately 89,000 square feet for a health and exercise center and retail uses. The property is located at the northeast corner of Tropical Parkway and Decatur Boulevard. The Assessor's Parcel Numbers are 124-30-204-001, 124-30-204-002 and a portion of 124-30-204-005.

Dear Mr. Garcia:

The Planning Commission, at its meeting of October 12, 2011, approved SPR-11-11 subject to the following conditions:

1. Unless expressly authorized through a variance, waiver or another method, development shall comply with all applicable codes and ordinances.
2. Development shall generally conform to the site plan as submitted.
3. The proposed development shall comply with the Commercial Development Standards and Design Guidelines with the following exceptions:
 - a. The width of perimeter landscaping shall be provided as shown on the revised site plan dated October 5, 2011.
 - b. Provide six (6) foot wide landscape diamonds for every three (3) parking spaces in every row of parking in lieu of landscaping being provided between the parking rows of every other double row of parking.
4. LED wall signs shall be prohibited unless otherwise approved through another appropriate method.

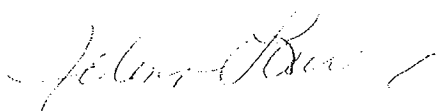
5. The ultimate design of Tropical Parkway and Centennial Parkway, including but not limited to, lane widths, number of lanes, median island locations and widths, is subject to review by the City of North Las Vegas Traffic Engineer during the civil improvement plan review process and shall comply with the *Master Plan of Streets and Highways*.
6. Dedication and construction of the following streets and/or half streets is required per the *Master Plan of Streets and Highways* and *City of North Las Vegas Municipal Code* section 16.24.100:
 - a. Rice Avenue
 - b. Decatur Boulevard
 - c. Tropical Parkway
 - d. Centennial Parkway
7. The Rice Avenue / Montgomery Street knuckle shall be constructed per *Clark County Area Uniform Standard Drawing* number 211.
8. The developer is required to construct a raised median within Tropical Parkway, Rice Avenue and Centennial Parkway. The median shall be constructed per *Clark County Area Uniform Standard Drawing* numbers 218 and 219 "A" type island curb and shall be treated per Public Works Department standards and requirements.
9. The revised site plan (dated 10/05/11) is proposing to modify the existing median island within Tropical Parkway, west of River Landing Street; consequently, the civil improvement plans must show the proposed median island modification as well, otherwise this site plan will need to be modified to accommodate the existing median which may subsequently result in a reduction of parking.
10. The flow of incoming traffic is obstructed at the mid-block entrance on Tropical Parkway opposite River Landing Street. To remedy this situation, the first three parking stalls shall be eliminated and the proposed landscaped island shall be extended north and west to channel the flow of incoming traffic.
11. Approval of a traffic study is required prior to submittal of the civil improvement plans.
12. The driveway on Decatur Boulevard is limited to right in, right out only.
13. If not already existing, the civil improvement plans for the project shall include schedule 40 PVC fiber optic conduit along Decatur Boulevard.
14. Commercial driveways are to be constructed in accordance with *Clark County Area Uniform Standard Drawing* numbers 222A and 225, with minimum widths of 32 feet as measured from lip of gutter to lip of gutter.
15. The property owner is required to grant a roadway easement for commercial driveway(s).

16. The property owner is required to grant a public pedestrian access easement for sidewalk located within a common element, or on private property, when that sidewalk is providing public access adjacent to the right-of-way.
17. A revocable encroachment permit for landscaping within the public right of way is required.
18. The property owner is required to sign a restrictive covenant for utilities.
19. All Nevada Energy easements, appurtenances, lines and poles must be shown and shall be located entirely within the perimeter landscape area of this development. New distribution lines or existing distribution lines being adjusted or relocated, shall be placed underground.
20. Approval of a drainage study is required prior to submittal of the civil improvement plans.
21. City of Las Vegas concurrence with the results of the drainage study is required prior to approval of the civil improvement plans.
22. All known geologic hazards, such as fault lines and/or fissures, shall be shown on the civil improvement plans submitted to the Department of Public Works. Subsequent identification of additional hazards may substantially alter the original site plan.
23. The public street geometrics, saw-cut lines and thickness of the pavement sections will be determined by the Department of Public Works.

The decision of the Planning Commission is final unless appealed within seven days of the date action was taken, in writing, to the City Clerk at which time a public hearing will be scheduled before the City Council.

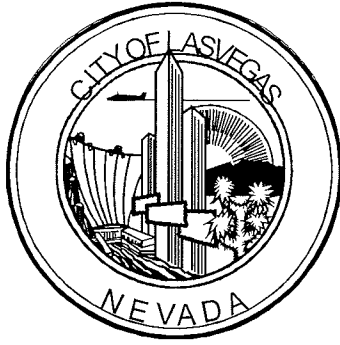
Should you have questions regarding this application, please contact Marc Jordan, Planning Manager at (702) 633-1545.

Sincerely,



Jo Ann Lawrence
Community Development Department

cc: Marc Jordan, Planning Manager



CITY OF LAS VEGAS

MINIMUM DRAINAGE STUDY CRITERIA STANDARD FORM 2 CHECKLIST SUPPLEMENT

(Revised 5/18/11)

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

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

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

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

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

CITY OF LAS VEGAS MINIMUM DRAINAGE STUDY CRITERIA CHECKLIST

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

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

CITY OF LAS VEGAS MINIMUM DRAINAGE STUDY CRITERIA CHECKLIST

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

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

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

TRANSMITTAL

To: City of Las Vegas
751 N. Rancho
Las Vegas, NV 89106
Flood Control

Date: January 9, 2011

Project No.: MGL1101-000

From: Ray Fredericksen

Subject: Tropical Parkway Realignment

CC: _____
CC: _____
CC: _____

CC: _____
CC: _____
CC: _____

Transmitting Via:

- ☐ Mail
☒ Messenger / MDS
☐ Federal Express
☐ Pickup

For:

- ☒ Review & Comment
☐ Per your Request
☐ Information/File

Acknowledgement of Receipt:

- ☐ Not Required
☒ Acknowledgement Required

Received By: _____
Date: _____ Time: _____

Copies	Description
1	Technical Drainage Study
1	Fee – Check in the amount of \$400.00
1	CD with PDFs of studies

Comments:

Signed: _____
Ray Fredericksen, Project Manager

Please, notify us at (702) 284-5300 if there are any problems receiving this transmission.

**TECHNICAL DRAINAGE STUDY
TROPICAL PKWY/CENTENNIAL PKWY
ROADWAY IMPROVEMENTS**
City of North Las Vegas, Nevada

Job No.: MGL1101-000
Date: November 2011

Prepared By:
Slater Hanifan Group, Inc.
5740 S. Arville Street, Suite 216
Las Vegas, Nevada 89118
Phone: 702-284-5300 • Fax: 702-284-5399

Prepared For:
Bentar Development
3030 S. Durango Drive
Las Vegas, Nevada 89117
Phone: 702-366-1605 • Fax: 702-387-1008



Ray Fredericksen, P.E.
NV Professional Engineer No. 17471

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Tropical Pkwy/Centennial Pkwy Roadway Improvements Date: October 19, 2011

Location of Development: a) Descriptive (Cross Streets) North/South: Centennial Parkway

East/West: Tropical Parkway

b) Section: 30 Township: 19 Range: 61

c) APN: 124-30-204-008

Name of Owner: M Grape LLC

Telephone No.: _____ Fax No.: _____ E-Mail Address: _____

Address: 2460 Professional Court, Suite 120

Contact Person-Name: Ray Fredericksen, P.E. Telephone No.: 702-284-5300

* E-Mail Address: rfredericksen@shg-inc.com Fax No.: 702-284-5399

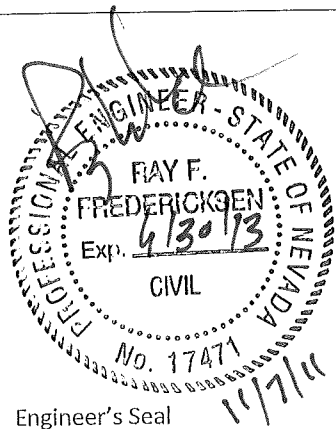
Firm: Slater Hanifan Group

Address: 5740 S. Arville Street #216, Las Vegas, NV 89118

Type of Land Development/Land Disturbance Process:

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

- Total Owned Land Area: At Site: 2.1 Ac Being Developed/Disturbed: 2.1 AC
- Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? ☐ Yes** ☒ No
- Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? ☐ Yes** ☒ No
- Proposed type of development (Residential, Commercial, Etc.): Roadway Improvements
- Approximate upstream land area which drains to the subject site: 10 acres
- Has the site drainage been evaluated in the past? ☒ YES ☐ NO If yes, please identify documentation: Offsites - Twilight North
- If known, please briefly identify the proposed discharge point(s) of runoff from the site: East in Tropical Parkway to existing storm water improvements
- Briefly describe your proposed schedule for the subject project: As soon as possible



Engineer's Seal

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

*New Required Field

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

		Revision	Date
Local Entity File No. _____			

REFERENCE:

STANDARD FORM 1



DEPARTMENT OF PUBLIC WORKS

Drainage Study Checklist

Background

The City of North Las Vegas strives to provide the development community with adequate information to ensure the successful completion of any project in the City. To aid in the submittal of a complete, thorough drainage study, the following checklist has been compiled to assist the design engineer. This checklist focuses on requirements specific to the City of North Las Vegas. When preparing a drainage study, the engineer will still be required to adhere to all local criterion and guidelines as set forth in the Clark County Regional Flood Control District (CCRFCD) *Hydrologic Criteria and Drainage Design Manual (HCDDM)* and the *Uniform Standard Drawings for Public Works' Construction Off-site Improvements* for Clark County Area, Nevada. In order to have a complete drainage study for submittal to the City, this checklist must be completed, signed, and stamped by the engineer in responsible charge for the completion of the drainage. Incomplete submittals will not be accepted at the front counter.

Checklist

Provide N/A to an item that is not applicable for the subject site.

I. General Requirement		
Yes	No	
✓		Ensure that the new Standard Form 1 and 2 are utilized for all incoming drainage study submittals. The form can be acquired from the CCRFCD's website at http://www.ccrfcd.org/engineering.htm .
✓		Ensure that the new 2008 CCRFCD's Master Plan Update (MPU) is utilized for all incoming drainage study submittals. Both the Flood Control Facilities and Facility Inventory Maps must be included with the drainage study. Please contact CCRFCD at 685-0000 to acquire the information.
		A copy of the approved zoning/planning conditions associated with this site must be included with the initial submittal to verify compliance with conditions.
N/A		If offsite grading is anticipated, a notarized permission letter to construct from the property owner is required prior to the approval of this technical drainage study.
N/A		If the site is proposing to increase or concentrate storm flow and/or nuisance flows onto the adjacent property. A notarized permission letter to accept from the property owner is required prior to the approval of this technical drainage study.
✓		The City of North Las Vegas (CNLV) does not allow valley gutters to be constructed across streets with right-of-way widths of 80 feet or greater.
✓		Provide map pockets in the back of the drainage study in order to keep the improvement plans with the study.
N/A		The project proposes to construct facilities and/or discharge flows within Nevada Department of Transportation (NDOT) right of way. The engineer must contact NDOT for an encroachment permit for the proposed project and it must be received prior to approval of the improvement plans. NOTE: NDOT does not allow for development to increase the 100-year flow rate into their ROW - onsite detention may be required.

N/A		Where right-of-way does not exist, a roadway or drainage easement must be obtained from the adjacent property owner(s) prior to improvement plans approval. Roadway and drainage easement dedication documentation must be processed through the CNLV Real Property Services Division. For more information, please contact Lorena Candelario at 633-2396.
✓		This report serves as a master drainage study for the site. A separate technical drainage study will be required by the City of North Las Vegas upon development of areas shown on the conceptual site plan. Each technical drainage study should provide more detailed design information, including final grading plans with corresponding drainage facility details, hydraulic design calculations, etc.
N/A		When submitting flow split analysis for a site, staff suggests using the Pima County flow split calculations. Make sure to provide all supporting documents.
✓		Ensure that the longitudinal slope used to calculate the 100-year flow depth for a given street matches with the slope indicated on the grading plans.
N/A		The City of North Las Vegas (CNLV) is a member of the Community Rating System, which requires Base Flood Elevations (BFE's) to be indicated for any structures located within a Special Flood Hazard Area (SFHA) Zone A, AO, AE, etc.. Please indicate the extent of the effective regulatory SFHA on the grading plan and show the BFE's of the affected lots.
N/A		If a site is adjacent to a future Clark County Regional Flood Control Facility, the developer is required to construct drop inlets at the site's discharge point along the alignment, which will collect 100% of the site's 100-year discharge.
N/A		If the proposed development is required to construct flood control facilities that are depicted on the Clark County Regional Flood Control District's Master Plan Update, structural drawings must be submitted with the drainage study for review and approval by the City of North Las Vegas prior to submitting to CCRFCD for concurrence.
✓		The City of North Las Vegas North Neighborhood Flood Control Master Plan (NNFCMP) has established centerline intersection grades with corresponding street slopes. Please ensure that the street intersection designs are compatible with the NNFCMP.
N/A		For rectangular shaped culverts, the minimum shall be 6 feet in height and 5 feet in width.
N/A		The City of North Las Vegas requires that all local drainage facilities identified on the North Neighborhood Flood Control Master Plan (NNFCMP) to be constructed by the developer for the full frontage of the site.
N/A		This property is adjacent to Unincorporated Clark County. Please note that a copy of this study and any addenda must be submitted to Clark County Development Services for their review and concurrence.
✓		This property is adjacent to the City of Las Vegas. Please note that a copy of this study and any addenda must be submitted to City of Las Vegas for their review and concurrence.
N/A		Side lot easement for all residential development will need to meet all the requirements as set forth in the City of North Las Vegas Municipal Code under Title 17.24.210.D.4.

N/A		"Arizona" style crossing is not permitted within CNLV right-of-way. Culvert crossings, sized to convey the 100-year flow without any backwater effects, must be designed to convey the flow back to its historical path.
✓		The minimum pipe diameter to be constructed within public drainage easement or right-of-way shall be 18-inch in reinforced concrete pipe. HDPE pipes are allowed with the caveat that it must be slurry back fill.
N/A		Backwater ponding limits that extend outside of the public right-of-way shall be delineated on the grading plans and a public drainage easement or right-of-way be obtained from the property owner. Roadway and drainage easement dedication documentation must be processed through the CNLV Real Property Services Division. For more information, please contact Lorena Candelario at 633-2396.
✓		When referencing other drainage studies, all relevant information such as approval letters, drainage basin maps, HEC-1 analyses, details, plans, etc. must be included with the study. The material being referenced should be highlighted in some manner to indicate what is being referenced.

II. Grading Plan Information

Yes	No	
✓		24"X36" copies of Grading Plans including Detail Sheets. Additionally, Plan and Profile sheets must be provided for all public offsite streets and/or storm drain/channel system improvements. The information provided in profile shall include: stationing, length, slope, size, discharge (Q100), material, class of pipe (Class III, IV, V, etc.), hydraulic grade line, inlet locations, finished grade over the pipe and etc.
✓		On a 100' right-of-way street, the developer is required to build their half of the street, the median island, and one lane on the opposite side of the median. Additionally, the median island will be required to be landscaped.
N/A		Alignment of all existing, proposed, or future Regional Flood Control Facilities adjacent to the site must be shown on the grading plans.
✓		Appropriate elevated "humps" 6 inches above the 100-year water surface elevation at all driveways location where the intent is to protect the site from the Q100 flows.
✓		Erosion protection must be provided at the upstream and downstream terminus of all public roadway improvements.
✓		Landscape berms used to protect property from flows in the adjacent streets must meet the criterium of being twice the depth of flow above the adjacent flowline up to 18 inches above the adjacent water surface.
N/A		Temporary pavements used to satisfy Clark County PM-10 requirements cannot be used to establish centerline grades for any proposed streets. All proposed street improvements must be designed per the Uniform Standard Drawings for Public Works Construction, Offsite Improvements, Clark County Area, Nevada.
✓		Show cross sections along all project boundaries showing the elevational relationship, property line, and any existing or proposed walls.
N/A		Verify all finished floor elevations of the proposed development meet Section 304.4 of the HCDDM.

✓		All onsite drainage swale must maintain a minimum of 1% slope. If < 1% is anticipated, concrete valley gutter is required.
✓		Proposed on-site and off-site storm drains and other flood control facilities with plan and profile sheets for public storm drains showing the class of pipe, (Class III, IV, V, etc.), utilities conflict (if any), design hydraulic grade line (HGL) and the 100 year storm flow. A public drainage easement must be provided over on-site storm drains conveying the off-site flows.
✓		Identify all adjacent parcels with the appropriate assessor parcel number and ownership information.
✓		The Engineer must show existing and proposed development at least 100-feet beyond the project site limits. Finished floor elevations of existing buildings, centerline grades, centerline slopes, and top of existing curb elevations must be shown. Reference all adjacent existing improvements with a CNLV Project #. Ensure that it matches with the approved civil plans.
✓		Make every effort to provide plan sheets that are clean and clear to review. Be sure to eliminate superimposed text.
✓		Due to air quality regulations, all proposed streets must maintain a total of 32' asphalt area. For instance, a 60' half-street improvements will require an additional of 9-foot of overpaving from the centerline.
✓		Full intersection designs abutting the proposed development must be provided to ensure that all quadrants of the intersection will drain properly.
✓		Provide slopes of driveway fronting all public right-of-ways. Per CNLV Fire Code, the angles of approach and angles of departure must not exceed 6%.
✓		For commercial and industrial developments, landscape areas are not allowed to sheet flow over the sidewalk. Provide flow lines with grades and sidewalk under drains for all landscape areas draining to the streets.

III. Hydrologic and Hydraulic Analyzes		
Yes	No	
✓		Verify that the street capacity calculations for "ABC" and "XYZ" streets were completed for the worst case scenario for both water surface elevation and velocity (flattest and steepest slopes). In the interim condition, provide street capacity calculations for the 100-year event. In the ultimate condition, provide street capacity calculations for the 10-year and 100-year events.
✓		For 100-year street flows with depths greater than 0.6' and velocities higher than 5 fps, erosion resistant landscaping or pony walls at the back of sidewalk (to the height of the flow in the street) must be provided.
N/A		If a CNLV modified 60' standard street section with offset sidewalk is to be proposed with the development. Ensure that the Flowmaster calculations and improvement drawings are reflected with the correct cross section.
✓		For 80' and greater streets, if a median island is proposed with the site, ensure that the street capacity calculations are reflected with a median island.

✓		For 80' and greater streets, the actual 12' dry lane determination must be shown on the Q10 street capacity calculations. CNLV only requires this criterion to be met in the FUTURE condition. Please note that the dual left turn lane and center median island cannot be used to satisfy the 12' dry lane criterion. Therefore, a minimum of 19' on each half of the street must be achieved for the entire stretch of the site.
✓		All drainage studies for sites located within the North Neighborhood Flood Control Master Plan (NNFCMP) area must analyze four (4) separate conditions. a. A pure existing condition analysis that quantifies the amount of flow impacting the site in the existing condition. This condition has existing improvements and curve numbers for both onsite and offsite basins. Offsite basins should generally follow contours or existing development drainage patterns. b. An interim condition, where the offsite basins are the same as in the pure existing condition and the onsite basins are developed. The flows in this condition are modeled in the proposed half-streets being constructed with the development and homes/buildings must be at or above the WSE in the street. c. The NNFCMP existing condition flows are analyzed assuming a full street section, the CCRFCD street flow criterion does not need to be met, and the adjacent finished floor elevations must be above the associated WSE. d. The NNFCMP future condition flows are analyzed assuming a full street section, all CCRFCD street flow criteria must be met, and the finished floor elevations must have the required freeboard above the associated WSE.
N/A		For parcels impacted by a FEMA Special Flood Hazard Area, analyses of the floodzone, utilizing the FEMA effective flowrate must be completed for both pre- and post-development cases. The post-development analysis must tie into the effective SFHA in both width and water surface elevation.
✓		For proposed storm drain connecting into other existing storm drain system, supporting documents must be provided for the beginning HGL used in the hydraulic modeling.
N/A		For the purpose of establishing adequate finished floor elevations for those structures adjacent to the proposed drainage easement, the City requires that submerged weir calculations are submitted. As the sidewalks at the upstream entrance of the drainage easement will effectively act as a broad-crested weir with a submerged tailwater, the water surface elevations at the easement entrances must be calculated as such.
✓		The engineer must provide inlet control nomograph (see HCDDM) calculations for all proposed drop inlets to ensure that the storm sewer will have the capacity to convey the anticipated 100-year peak flow.
✓		The CNLV requires that all drop inlet sizing to be performed with the HEC-22 software which can be acquired from the Federal Highway Administration's website at http://www.fhwa.dot.gov/engineering/hydraulics/software.cfm
N/A		Concrete headwalls are required at the inlet and outlet of all culvert installations. Flare end sections are acceptable for culvert less than 30-inch.
N/A		Erosion protection and/or cut off walls may be required at the upstream and downstream of a culvert.

✓		For the ease of maintainability and constructability, all storm drain pipes must be designed with a soffit to soffit connections.
✓		Swales that are designed to carry the 100-year flow must maintain a minimum freeboard of six inches above the depth of flow. Provide hydraulic calculations for verification.
✓		The soil's map must include both the off-site and on-site sub-basin delineations for all drainage conditions.

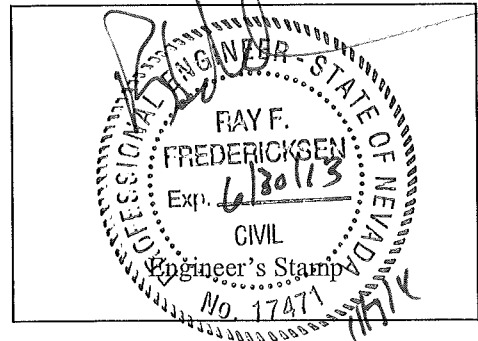
IV. Local Entity Criteria - City of North Las Vegas - HCDDM Section 1603

Yes	No	
N/A		Within the interior streets of a residential subdivision, the depth times velocity for the major storm event shall be less than or equal to 6.
N/A		When downstream storm sewer facilities are not available, the City of North Las Vegas requires bubbler laterals for the conveyance of storm water under streets with right-of-way widths greater than or equal to 80 feet. The bubbler laterals must consist of a minimum 18-inch diameter reinforced concrete pipe. To accommodate the draining of the bubbler system prior to future downstream extension of the storm sewer system, a minimum 6-inch diameter PVC pipe must be daylighted downstream.
N/A		The City of North Las Vegas does not permit the construction of permanent structures within a Federal Emergency Management Agency (FEMA) designated Special Flood Hazard Area (SFHA). Under this policy, any developer/builder proposing to place structures within a SFHA must meet the following requirements prior to the issuance of various permits and certificates-of-occupancy: a. Grading and off-site construction permits may be issued by the CNLV Department of Public Works once the improvement plans and drainage study have been approved and a copy of the completed Conditional Letter of Map Revision (CLOMR) application has been submitted to FEMA for processing. b. Building permits can be issued once a favorable CLOMR has been obtained from FEMA. c. Certificates-of-occupancy can be issued once a Letter of Map Revision (LOMR) has been obtained from FEMA.
✓		The City of North Las Vegas requires that stormwater drop inlet signage be affixed to any installed drop inlets. The plaque must read "Don't pollute - drains to Lake Mead" in English and Spanish. CNLV Quality Control/Offsite inspectors will verify that the signs are properly installed.
✓		A minimum longitudinal street slope of 0.4 percent (0.004 ft/ft) shall be used. If the Engineer can demonstrate, to the satisfaction and approval of the City Engineer, severe topographic constraints or other mitigating factors, the design of streets with slopes less than 0.4 percent may be permitted.
N/A		Side lot drainage easements are generally discouraged unless the engineer can demonstrate design constraints that render alternative site layout and drainage facility design options as impossible or impractical.
N/A		All wall openings must be designed to pass the 100-year storm event flows using the assumption that the bottom 50% of the openings are obstructed.

N/A	When a storm drain system is proposed at a sump area, a non-damaging emergency surface flow path must be provided to convey the 100-year flows. Adjacent finished floor elevations must be adequately protected.
N/A	For any ground-mounted air-conditioning pad that encroaches to within three (3) feet of a property line, the engineer must indicate on the plot plans how lot drainage will be accommodated beneath the pad. This can include, but is not limited to, the placement of a 4-inch diameter PVC pipe, with the inlet and outlet inverts of the pipe constructed to correspond with the flow line of the obstructed lot drainage swale.

Ray Frederickson

Engineer in Responsible Charge Name (Printed)



Approved by CNLV Development and Flood Control

Date

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

Project Name: Tropical Pkwy & Centennial Pkwy Roadway Impr.		Map ID:
Firm Name: Slater Hanifan Group (SHG)		Ray Fredericksen, P.E.
Address: 5740 S. Arville St., Suite 216		
City: Las Vegas	State: Nevada	Zip: 89118
Phone Number: 702-284-5300	Fax Number: 702-284-5399	
Property Owner: M Grape LLC		
2460 Professional Court, Suite 120		
City: Las Vegas	State: NV	Zip: 89118
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.
	n/a	Design Manual Standard Form 4 .
x		2 copies of the 24" x 36" Drainage Plan.
	n/a	A notarized letter from the adjacent property owner(s) allowing off-site grading or discharge.

Reference:	STANDARD FORM 2
------------	-----------------

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

II. MAPS AND EXHIBITS

Yes	No	
☒	☐	A copy of a current Flood Insurance Rate Map (FIRM) with the site delineated.
☒	☐	A copy of the current CCRFCD Master Plan Update Figure, (F-x), for Flood Control Facilities and Environmental areas with the site delineated.
☒	☐	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.
☒	☐	Vicinity Map with local and major cross streets identified and a north arrow.
☒	☐	Off-site drainage basin maps for existing, interim and future conditions showing the existing topography, basin boundaries, concentration points, and flows in cfs.

III. DRAINAGE PLAN

Yes	No	
☒	☐	Sheet size: 24" x 36" sealed by a registered engineer in the State of Nevada.
☒	☐	Minimum scale: 1" = 60'.
☒	☐	Project name.
☒	☐	Vicinity Map with local and major cross streets.
☒	☐	Revision box.
☒	☐	North arrow and bar scale.
☒	☐	Engineer's/consultant's address and phone number.
☒	☐	Elevation datum and benchmark.
☒	☐	Legend for symbols and abbreviations.
☒	☐	Cut/fill scarps, where applicable.
☒	☐	Street names, grades, widths.
☒	☐	Proposed future and existing spot grades for top of curbs and street crowns at lot lines, grade breaks, and along curb returns on both sides of the street.

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
☒	☐	Existing contours encompassing the site and 100 feet beyond with spot elevations for important locations, where appropriate.
☐	☐	n/a Minimum finish floor elevations with top-of-curb elevations at upstream end of lot.
☐	☐	n/a Proposed typical street sections.
☐	☐	n/a Streets with off-set crowns.
☒	☐	Proposed contours or spot elevations in sufficient detail to exhibit intended drainage patterns and slopes.
☒	☐	Property lines.
☒	☐	Right-of-way lines and widths, existing and proposed.
☒	☐	Existing improvements and their elevations.
☒	☐	Delineation of proposed on-site drainage basins indicating area and 10-year and 100-year storm peak flows at basin concentration points.
☒	☐	Concentration points and drainage flow direction with Q_{100} and V_{100} and D_{100} in streets.
☒	☐	Cumulative flows, velocity, and direction of flow at upstream and downstream ends of site for the 10-year and 100-year flows.
☒	☐	Location and cross-section of street capacity calculations.
☐	☐	n/a Cross-sectional detail for channels, including cutoff wall locations.
☒	☐	Existing and proposed drainage facilities, appurtenances, and connections (i.e., sidewalk, ditches, swales, storm drain systems, unimproved and improved channels, and culverts, etc.) stating size, material, shape, and slope with plan and profile and HGL calculations.
☒	☐	Existing and proposed drainage easements and widths shown with sufficient detail. A cross sectional detail must be provided that shows appropriate lining and reinforcement.
☐	☐	n/a Location and detail of existing, proposed, and future block wall openings. Minimum size is 16"x48". Wrought iron gate is required for flows > 10 cfs.
☐	☐	n/a Location and detail of flood walls illustrating depth of flow, proposed grouting height, etc.

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes No

 n/a 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.

 n/a Alignment of all existing, proposed, or future Regional Facilities adjacent to the site.

x Limits of existing floodplain based on current FIRM or best available information; limits of proposed floodplains based on best available information.

 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.

 n/a Street slopes for perimeter and interior streets. The minimum slope is 0.4 percent.

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 storm water flows showing basin area, Q_{10} and Q_{100} for both individual basins and combined basin flows, where acceptable.

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.

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

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. $Q_{100} \text{ d x v} \leq 8$. $Q_{10} \text{ d x v} \leq 6$ and 12 foot dry lane for rights-of-way ≥ 80 feet. Calculations must be labeled by street name as indicated on the Grading Plan.
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.)
	n/a	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.
	n/a	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, which ever 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.

REFERENCE:

STANDARD FORM 2

TABLE OF CONTENTS

1	INTRODUCTION	1
	1.1 Project Overview & Study Purpose.....	1
	1.2 Site Description.....	1
	1.3 FEMA Flood Zone Designation	1
	1.4 CCRFCD Facility Information.....	1
	1.5 2002 NNFCMP Information.....	2
	1.6 Reference Studies	2
2	METHODOLOGY	3
	2.1 Compliance	3
	2.2 Hydrologic Modeling	3
	2.3 Hydraulic Modeling	4
3	EXISTING DRAINAGE CONDITION.....	4
	3.1 Discussion of Existing Drainage Condition.....	4
	3.2 Discussion of Existing Condition Drainage Patterns.....	4
	3.3 Summary of Existing Condition Flows	5
	3.4 Summary of Existing Condition Street Flows.....	6
4	INTERIM DRAINAGE CONDITION	6
	4.1 Definition of Interim Condition.....	6
	4.2 Discussion of Interim Condition Drainage Patterns.....	6
	4.3 Summary of Interim Condition Flows	7
	4.4 Summary of Interim Condition Street Flows	8
	4.5 Summary of Interim Condition Recommended Facilities.....	8
5	FUTURE DRAINAGE CONDITION.....	8
	5.1 Definition of Future Condition.....	8
	5.2 Discussion of Future Condition Drainage Patterns.....	9
	5.3 Summary of Future Condition Flows	9
	5.4 Summary of Future Condition Street Flows	10
	5.5 Summary of Future Condition Recommended Facilities.....	11
6	CONCLUSIONS & RECOMMENDATIONS	11
7	REFERENCES	12

TABLES

TABLE 1: SUMMARY OF EXISTING CONDITION FLOW RATES	5
TABLE 1A: SUMMARY OF EXISTING CONDITION 10-YEAR STREET FLOW HYDRAULICS	6
TABLE 1B: SUMMARY OF EXISTING CONDITION 100-YEAR STREET FLOW HYDRAULICS	6
TABLE 2: SUMMARY OF INTERIM CONDITION FLOW RATES	7
TABLE 3: INTERIM CONDITION COMPARISON – THIS STUDY VS. TWILIGHT STUDY.....	7
TABLE 3A: SUMMARY OF INTERIM CONDITION 10-YEAR STREET FLOW HYDRAULICS	8
TABLE 3B: SUMMARY OF INTERIM CONDITION 100-YEAR STREET FLOW HYDRAULICS	8
TABLE 4: SUMMARY OF FUTURE CONDITION FLOW RATES	9
TABLE 5: FUTURE CONDITION COMPARISON – THIS STUDY VS. TWILIGHT STUDY.....	10
TABLE 6: SUMMARY OF FUTURE CONDITION 10-YEAR STREET FLOW HYDRAULICS	10
TABLE 7: SUMMARY OF FUTURE CONDITION 100-YEAR STREET FLOW HYDRAULICS	10
TABLE 8: SUMMARY OF DROP INLET HYDRAULICS	11

LIST OF APPENDICES

Appendix A Drainage Exhibits

- Exhibit A – Location Map
- Exhibit B – FEMA FIRM Panel Map
- Exhibit C – CCRFCD 2008 MPU H Map
- Exhibit D – CCRFCD 2008 MPU F Map
- Exhibit E – Existing Condition Drainage Map
- Exhibit F – Interim Condition Drainage Map
- Exhibit G – Future Condition Drainage Map

Appendix B Hydrologic Analyses

- Precipitation, Curve Number & Lag Time Data
- Existing Condition HEC-1 Model
- Interim Condition HEC-1 Model
- Future Condition HEC-1 Model

Appendix C Hydraulic Analyses

- 10-Year Street Flow Computations
- 100-Year Street Flow Computations
- Drop Inlet Computations
- Future Condition WSPG Model

Appendix D Reference Material

- Technical Drainage Study for Twilight at Riverwalk Ranch, by SHG*
- Approval Letters
 - Ultimate Condition Drainage Map
 - Ultimate Condition WSPG Model

Appendix E Reference Material

- Technical Drainage Study for High Noon at Riverwalk Ranch, by SHG*
- Approval Letters
 - Ultimate Condition Drainage Map
 - Hydrologic Parameters
 -

Appendix F Reference Material

- Technical Drainage Study for Tropical/Decatur C-Store, by Kimley Horn*
- Approval Letters
 - Ultimate Condition Drainage Map
 - Hydrologic Parameters

Appendix G Reference Material

- 1999 City of Las Vegas Northwest Neighborhood Study, by PBS&J*
- Figure E-6
 - Figure F-6

Appendix H Reference Material

- 2002 City of North Las Vegas North Neighborhood Study, by PBS&J*
- Figure E-9
 - Figure F-9

Appendix I Improvement Plans

1 INTRODUCTION

1.1 Project Overview & Study Purpose

Bentar Development is proposing to develop the adjacent roadways to the future commercial development located at the northeast corner of the Decatur Boulevard and Tropical Parkway intersection (hereafter referred to in this study as the project site). An area of approximately ± 2.1 acre of roadway improvements is proposed and identified as *Tropical Parkway/Centennial Parkway Improvements* (hereafter referred to in this study as Offsite Improvements). The Offsite Improvements is located within the City of North Las Vegas, Nevada. Associated with the Offsite Improvements is the re-alignment of Centennial Parkway and Tropical Parkway. The proposed improvements also include half street improvements to Rice Avenue, Decatur Boulevard, Tropical Parkway, and Centennial Parkway. Note that the west half Decatur Boulevard is located within the City of Las Vegas, Nevada.

The purpose of this study is to provide a detailed hydrologic and hydraulic analysis for the project site in order to protect the property from onsite and offsite runoff in accordance with local storm water criteria. This study will also provide an inventory of existing storm water facilities in the vicinity as well as provide recommendations for site specific facilities necessary to control runoff impacting the project site.

1.2 Site Description

The project site is bounded by Rice Avenue and undeveloped land to the north, to the east is Centennial Parkway and an existing residential development, to the south is Tropical Parkway and an existing residential development, and to the west is Decatur Boulevard and an existing commercial development. The Offsite Improvements are located within APNs 124-30-299-001, 124-30-299-013, 124-30-299-006, 124-30-299-014, and 124-30-299-015.

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

1.3 FEMA Flood Zone Designation

The future commercial development and Offsite Improvements are located on Flood Insurance Rate Map (FIRM) Panel 32003C1765E, dated September 27, 2002. The site is currently located within a FEMA designated Zone X. A Zone X is described as an area determined to be outside the 0.2% annual chance flood. Exhibit B, identifying the site on the current FIRM Panel, has been included in Appendix A for your reference.

1.4 CCRFCD Facility Information

Per the 2008 CCRFCD MPU (Reference 1), the project site and the Offsite Improvements are not adjacent to nor is it crossed by any existing or future CCRFCD facility. The site has been identified on the current 2008 CCRFCD MPU Figures H-20 and F-20, identified as Exhibits C and D, respectively. The exhibits are included in Appendix A for your reference.

1.5 2002 NNFCMP Information

The project site and the Offsite Improvements are located within the City of North Las Vegas 2002 North Neighborhood Flood Control Master Plan (2002 NNFCMP). The flows crossing Decatur Boulevard shown on the 2002 NNFCMP are based on the City of Las Vegas' 1999 Northwest Neighborhood Study (1999 NNS). The flows shown in the two exhibits mentioned do not match. Improvements west of Decatur have effectively cut off flows and routed them into the existing storm drain in Decatur.

The flow rates at the Decatur/Rice have changed with the development along the west side of Decatur and the construction of the regional facility in Decatur Blvd. The master plan flows shown east in Rice have been captured in the Decatur storm drain by upstream properties from the developments west of Decatur Boulevard and the Beltway along with the construction of the storm drain in Decatur Boulevard. In fact, there is a high point designed in Rice just east of Decatur which ensures storm water does not flow east in Rice.

The site has been identified on the 2002 NNFCMP Figures E-9 and F-9, included in Appendix H for your reference. Additionally, the site has been identified on the 1999 NNS Figures E-6 and F-6, included in Appendix G for your reference.

1.6 Reference Studies

The following existing approved drainage studies have been utilized in the preparation of this study. The studies identified below have been reviewed and determined acceptable for reference.

Technical Drainage Study for Twilight at Riverwalk Ranch (hereafter referred to as the Twilight Study) prepared by Slater Hanifan Group, CNLV No. 19767 analyzed the interim condition drainage pattern and flow rates to the Centennial Parkway and Tropical Parkway intersection. Additionally, this study designed the storm drain facility in Tropical Parkway from Centennial Parkway to the CCRFCD facility. Relevant reference material from the Twilight/Manor Update has been included in Appendix D. The following were specifically referenced from the Unit 5 Study.

- The HGL at SDMH #6 (WSPG Station 1012.55), 2253.22-ft.
- The flow rate to be collected into the storm drain system by SDMH #6, 31 cfs.

Technical Drainage Study for High Noon at Riverwalk Ranch (hereafter referred to as the High Noon Study) prepared by Slater Hanifan Group, CNLV No. 20768 analyzed the interim condition drainage pattern and flow rates of the High Noon development. Relevant reference material from the High Noon Study has been included in Appendix E. The following were specifically referenced from the High Noon Study.

- The drainage pattern of the High Noon development.
- The hydrologic parameters of Basins DEC4, RH.4D, RH.5D and RH.6D.

Technical Drainage Study for Tropical/Decatur C-Store (hereafter referred to as the C-Store Study) prepared by Kimley Horn and Associates, CNLV No. 43005 analyzed the ultimate condition drainage pattern and flow rates of the C-Store development directly west of the proposed project. Relevant reference material from the C-Store Study has

been included in Appendix F. The following were specifically referenced from the C-Store Study.

- The drainage pattern of the C-Store development.
- The hydrologic parameters of Basin 005.

2 METHODOLOGY

2.1 Compliance

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

2.2 Hydrologic Modeling

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

Precipitation: The site is located inside of the McCarran Rainfall Area. The precipitation values utilized in the HEC-1 model are 1.58 and 2.77 inches for the 10-year and 100-year storm events, respectively. Additionally, since the drainage area is less than 8 square miles, the SDN 3 design storm distribution referenced from Table 503 of the CCRFCD Manual was used, and has been included in Appendix B.

Curve Number: The SCS curve number loss rate methodology has been utilized to approximate infiltration for the drainage basins. The soils information for the site has been obtained from *Soil Survey of Las Vegas Valley Area Nevada*, United States Department of Agriculture, Soil Conservation Service (Soil Survey, Reference 2). Per the Soil Survey, the project site and Offsite Improvements lies within Soil Type 301 and 305. Soil Type 301 has a composite makeup of 5% Hydrologic Soil Group (HSG) B and 95% HSG D. Soil Type 305 has a composite makeup of 5% HSG A, 30% HSG B, 5% HSG C and 60% HSG D.

The Offsite Improvements consist of proposed roadway. Therefore, per CCRFCD Manual Table 602A, a curve number associated with "roadway" has been selected for the proposed roadway development. For drainage areas that are undisturbed, a curve number associated with "desert shrub in poor condition" has been selected from CCRFCD Manual Table 602. For basins that consist of commercial development, a "commercial" curve number has been selected from the CCRFCD Manual. Due to the composite makeup of the soil in which development is proposed on, composite curve numbers have been utilized in this study's hydrologic analysis. All composite curve number computations, CCRFCD Manual curve number tables and soil data have been included in Appendix B.

Lag Time: The lag time is defined as the time measured from the center of mass of effective rainfall to the time to peak of the outflow hydrograph. The lag time is related to the time of concentration as 0.6 times the time of concentration. The time of concentration

is defined as the time required for runoff to flow from the hydraulically most distant point of a basin to the outlet point of the basin. Standard Form 4, as outlined in the CCRFCD Manual, was utilized to determine the lag times for basins modeled. A copy of the lag time computations is included in Appendix B.

2.3 Hydraulic Modeling

Street Flow: Street flow is analyzed utilizing the Flowmaster Version 7.0 software by Haestad Methods. In accordance with the CCRFCD Manual, the velocity times depth factor ($v \times d$) for street flow for the 10-year storm event must be less than or equal to 6 with a maximum depth of 1 foot. The velocity times depth factor ($v \times d$) for street flow for the 100-year storm event must be less than or equal to 8 with a maximum depth of 2 feet. Additionally, street capacity calculations are performed for the flattest and steepest slopes. Erosion protection landscaping or a pony wall at the back of sidewalk is required should the 100-year street flow depth exceed 0.5-ft in depth and consist of a velocity greater than 5 fps. For 80-ft and greater right-of-ways, a 12-ft dry lane (not utilizing the center turning lane) must be provided in the 10-year storm event.

Storm Drain and Drop Inlets: The hydraulic gradient line (HGL) for storm drain flows is determined by utilizing the Water Surface and Pressure gradient (WSPG) Hydraulic Analysis System software by the Los Angeles County Department of Public Works. Per CCRFCD Manual criteria, the HGL in the storm drain shall be 1-ft or greater below the finished grade above the pipe and the flow velocities shall be limited to 25 ft/s.

Drop inlets are designed using a spreadsheet which utilizes equations taken from Section 805 of the CCRFCD Manual. Additionally, an inlet nomograph calculation is performed for each drop inlet to ensure the drop inlet structure has capacity to convey the design flow rate.

3 EXISTING DRAINAGE CONDITION

3.1 Discussion of Existing Drainage Condition

Refer to Exhibit E, included in Appendix A, for a detailed illustration of the existing condition drainage patterns for the Offsite Improvements. In the existing condition, the project site is undeveloped (or in this case existing half street asphalt improvements) and the offsite improvements are undeveloped (consisting of natural terrain). Offsite basins are described as the currently exist.

3.2 Discussion of Existing Condition Drainage Patterns

Refer to Exhibit E, included in Appendix A, for a detailed illustration of the existing condition drainage patterns for the Offsite Improvements. Twelve (12) basins are delineated for the existing condition: Basins DEC4, DEC3 are offsite flows which combine at the intersection of Decatur and Tropical at CP.E1, these flows combine with the 2002 NNFCMP flows as well as basin 005 (from reference study from Kimley Horn for the Convenience Store) at CP.E2. Offsite flows from basins ON.1E and ON.2E combine with TROP1 at CP.E3. Offsite basins from the existing High Noon development RH.5D and RH.6D combine at CP.D6 then combine with RH.4D and CENT2 in Centennial Pkwy with

CENT4 at combination point CP.D7. All of the above mentioned basins then combine at CP.E5 for a total flow combination at the intersection of Centennial Pkwy at Tropical Pkwy. Basins OF.2E and RIC1 combine at concentration point CP.D7. Inclusive of flows from NNFCMP.

3.3 Summary of Existing Condition Flows

Existing condition flow rates, as determined by HEC-1 Analysis, have been summarized below in Table 1. Refer to Appendix B for the HEC-1 Analysis.

Table 1: Summary of Existing Condition Flow Rates		
Basin / Concentration Point	Q ₁₀₀ (cfs)	Q ₁₀ (cfs)
DEC.4	6	3
DEC.3	2	1
CP.E1 (intersection of Tropical & Decatur)	8	5
005* (from Kimley Horn study for C-Store)	5	3
CP.E2 (includes 2002 NNFCMP) Q = DEC.4 + DEC.3+005+NNFCMP	280	69
TROP.1	6	3
ON.1E	3	1
ON.2E	14	5
CP.E3 Q = CP.E2+TROP.1+ON.1E+ON.2E	302	78
RH.5D (from Twilight at Riverwalk)	5	2
RH.6D (from Twilight at Riverwalk)	8	4
CP.D6 Q = RH.5D+RH.6D	13	6
RH.4D (from Twilight at Riverwalk)	1	<0.5
CENT2 (from Twilight at Riverwalk)	5	3
CENT4	<1	<1
CP.D7 Q = CP.D6+RH.4D+CENT2+CENT4	20	10
CP.E5 Q = CP.E3+CP.D7	320	87
OF.2E	14	5
RIC1	3	2
CP.E8 Q = OF.2E + RIC1	17	6

3.4 Summary of Existing Condition Street Flows

Table 1a: Summary of Existing Condition 10-Year Street Flow Hydraulics						
Street Section ID	Q ₁₀ (cfs)	Slope (%)	Velocity, V (ft/s)	Depth, D (ft)	VxD	Dry Lane (ft)
Section A-A <i>Tropical Parkway</i>	69	0.70	4.44	0.82	3.6	14.0
Section B-B <i>Q = CP.E3</i>	78	0.60	4.17	0.70	2.9	0.0
Section C-C <i>Q = CP.E1</i>	4	0.60	1.52	0.32	0.5	10.5
Section D-D <i>Q = RIC1</i>	38	0.61	2.84	0.74	2.1	N/A
Section E-E <i>Q = CP.D7</i>	10	0.43	2.57	0.49	1.3	0.0

Table 1b: Summary of Existing Condition 100-Year Street Flow Hydraulics					
Street Section ID	Q ₁₀₀ (cfs)	Slope (%)	Velocity, V (ft/s)	Depth, D (ft)	DxV
Section A-A	280	0.70	6.15	1.26	7.7
Section B-B	302	0.60	7.25	1.28	9.3
Section C-C	8	0.60	1.87	0.40	0.7
Section D-D	118	0.61	3.94	1.03	4.1
Section E-E	20	0.43	3.37	0.63	2.1

4 INTERIM DRAINAGE CONDITION

4.1 Definition of Interim Condition

The interim condition considers the Offsite Improvements complete. The project site (proposed roadways) and offsite basin remains as described in the existing condition.

4.2 Discussion of Interim Condition Drainage Patterns

Refer to Exhibit I, included in Appendix A, for a detailed illustration of the interim condition drainage patterns for the Offsite Improvements. Twelve (12) basins are delineated for the interim condition: The Interim condition follows the same flow summary as the existing condition, the only changes are to basin sizes as some of the previous off-site basins have now become part of the Offsite Improvements as summarized in the table below, for example ON.2I is now smaller than ON.2E in the existing condition while TROP1 has grown in the interim condition. The majority of the basins still combine at the intersection of Centennial Pkwy at Tropical Parkway, CP.15.

4.3 Summary of Interim Condition Flows

Interim condition flow rates, as determined by HEC-1 analysis, have been summarized below in Table 2. Refer to Appendix B for the HEC-1 analysis.

Table 2: Summary of Interim Condition Flow Rates		
Basin / Concentration Point	Q₁₀₀ (cfs)	Q₁₀ (cfs)
DEC.4	6	3
DEC.3	2	1
CP.I1 (inter. of Tropical & Decatur +NNFCMP)	275	67
005* (from Kimley Horn study for C-Store)	5	3
CP.I2 (includes 2002 NNFCMP) Q = DEC.4 + DEC.3+005+NNFCMP	280	69
TROP.1	8	4
ON.1I	3	1
ON.2I	13	4
CP.I3 Q = CP.I2+TROP.1+ON.1I+ON.2I	302	78
RH.5D (from Twilight at Riverwalk)	5	2
RH.6D (from Twilight at Riverwalk)	8	4
CP.D6 Q = RH.5D+RH.6D	13	6
RH.4D (from Twilight at Riverwalk)	1	<0.5
CENT2 (from Twilight at Riverwalk)	5	3
CENT4	<1	<1
CP.D7 Q = CP.D6+RH.4D+CENT2+CENT4	21	10
CP.I5 Q = CP.I3+CP.D7	321	88
OF.2I	14	5
RIC1	3	2
CP.I8 Q = OF.2I + RIC1	17	6

Table 3 below summarizes the flow rates generated by the Offsite Improvements in comparison to the flow rates established in the Twilight Study. Relevant reference material from the Twilight Study has been included in Appendix D.

Table 3: Interim Condition Comparison – This Study vs. Twilight Study				
Location	Concentration Point ID	Q_{100/10} (cfs)	Concentration Point ID	Q_{100/10} (cfs)
Intersection of Centennial Pkwy & Tropical Pkwy	CP.I5	290/57	CP.D6	241/16

4.4 Summary of Interim Condition Street Flows

Street flow hydraulic computations have been analyzed utilizing the larger future condition flow rates. In the interim condition, flow is generated by the undeveloped project site, whereas in the future condition, the project site is developed and drains to Tropical Parkway. Therefore, refer to Section 5.4 of this report for a detailed discussion of street flow hydraulic characteristics.

Table 3a: Summary of Interim Condition 10-Year Street Flow Hydraulics						
Street Section ID	Q ₁₀ (cfs)	Slope (%)	Velocity, V (ft/s)	Depth, D (ft)	VxD	Dry Lane (ft)
Section A-A <i>Tropical Parkway</i>	69.0	0.70	3.72	0.83	3.1	14.0
Section B-B <i>Q = CP.13</i>	78	0.60	3.41	0.88	3.0	11.5
Section C-C <i>Q = CP.11</i>	5	0.60	2.31	0.42	1.0	23.5
Section D-D <i>Q = RIC1</i>	2	0.61	1.62	0.32	0.5	N/A
Section E-E <i>Q = CP.D7</i>	10	0.43	2.01	0.45	0.9	22.20

Table 3b: Summary of Interim Condition 100-Year Street Flow Hydraulics					
Street Section ID	Q ₁₀₀ (cfs)	Slope (%)	Velocity, V (ft/s)	Depth, D (ft)	DxV
Section A-A	280	0.70	5.26	1.22	6.4
Section B-B	302	0.60	4.86	1.28	6.2
Section C-C	8	0.60	2.52	0.49	1.2
Section D-D	3	0.61	1.62	0.32	0.5
Section E-E	21	0.43	2.24	0.56	1.3

4.5 Summary of Interim Condition Recommended Facilities

Drop Inlets: As discussed in Section 4.4 of this report, the future condition flows conveyed in streets are considered equal to or larger than interim condition flows. Thereby, the drop inlets proposed by the Offsite Improvements have been designed utilizing the future condition flow rates for conservative purposes. Refer to Section 5.5 of this report for a detailed discussion regarding the design of proposed drop inlets.

Storm Drain: Similarly, the storm drain has been designed utilizing the larger future condition flow rates collected by the proposed drop inlets. Refer to Section 5.5 of this report for a detailed discussion regarding the design of proposed storm drain.

The future condition assumes that the Offsite Improvements and the project site are fully developed. Offsite basins are also fully developed. The drainage pattern for the project site discussed in this study is only conceptual. Note that an update to this drainage study will technically address the project site development.

5.2 Discussion of Future Condition Drainage Patterns

Refer to Exhibit F, included in Appendix A, for a detailed illustration of the future condition drainage patterns for the Offsite Improvements.

5.3 Summary of Future Condition Flows

Future condition flow rates, as determined by HEC-1 analysis, have been summarized below in Table 4. Refer to Appendix B for the HEC-1 analysis.

Table 4: Summary of Future Condition Flow Rates		
Basin / Concentration Point	Q₁₀₀ (cfs)	Q₁₀ (cfs)
DEC.4	6	3
DEC.3	2	1
CP.D1 (inter. of Tropical & Decatur +NNFCMP)	231	5
005* (from Kimley Horn study for C-Store)	5	3
CP.D2 (includes 2002 NNFCMP) Q = DEC.4 + DEC.3+005+NNFCMP	236	7
TROP.1	8	4
ON.1D	5	3
ON.2D	22	12
CP.D3 Q = CP.D2+TROP.1+ON.1D+ON.2D	269	26
RH.5D (from Twilight at Riverwalk)	5	2
RH.6D (from Twilight at Riverwalk)	8	4
CP.D6 Q = RH.5D+RH.6D	13	6
RH.4D (from Twilight at Riverwalk)	1	<0.5
CENT2 (from Twilight at Riverwalk)	5	3
CENT4	<1	<1
CP.D7 Q = CP.D6+RH.4D+CENT2+CENT4	21	10
CP.D5 Q = CP.D3+CP.D7	288	35
OF.2D	24	13
RIC1	3	2
CP.D8 Q = OF.2D + RIC1	26	15

Table 5 below summarizes the flow rates generated in the future condition to the Centennial Parkway and Tropical Parkway intersection in comparison to the flow rates established in the Twilight Study. Relevant reference material from the Twilight Study has been included in Appendix D.

Table 5 below summarizes the flow rates generated in the future condition to the Centennial Parkway and Tropical Parkway intersection in comparison to the flow rates established in the Twilight Study. Relevant reference material from the Twilight Study has been included in Appendix D.

Table 5: Future Condition Comparison – This Study vs. Twilight Study				
Location	Concentration Point ID	Q _{100/10} (cfs)	Concentration Point ID	Q _{100/10} (cfs)
Intersection of Centennial Pkwy & Tropical Pkwy	CP.D5	257/35	CP.D6	234/31

Upon inspection of Table 5, development of Decatur/Tropical/Centennial offsite improvements results in flow exceeding the allowable discharge to the intersection previously established in the Twilight at Riverwalk TDS. The above mentioned flows exclude the 31 cfs captured by the proposed drop inlets and conveyed to the existing storm drain system in Tropical Pkwy east of Centennial Pkwy. reasons:

5.4 Summary of Future Condition Street Flows

A summary of the street flow hydraulic characteristics is provided in Table 6 and 7 below, and the computations have been included in Appendix C. Refer to Exhibit F provided in Appendix B for cross section locations. Note that only the worst case flows (interim or ultimate condition) are analyzed and reported in the table.

Table 6: Summary of Future Condition 10-Year Street Flow Hydraulics						
Street Section ID	Q ₁₀ (cfs)	Slope (%)	Velocity, V (ft/s)	Depth, D (ft)	VxD	Dry Lane (ft)
Section A-A Tropical Parkway	7	0.70	2.33	0.37	0.9	14.5
Section B-B Q = CP.D3	26	0.60	2.60	0.58	1.5	22.5
Section C-C Q = CP.D1	5	0.60	2.31	0.42	1.0	23.5
Section D-D Q = RIC1	2	0.61	1.49	0.29	0.4	N/A
Section E-E Q = CP.D7	10	0.43	2.01	0.45	0.9	22.0

Table 7: Summary of Future Condition 100-Year Street Flow Hydraulics					
Street Section ID	Q ₁₀₀ (cfs)	Slope (%)	Velocity, V (ft/s)	Depth, D (ft)	DxV
Section A-A	236	0.70	4.78	1.07	5.1
Section B-B	269	0.60	4.80	1.14	5.5
Section C-C	8	0.60	2.52	0.49	1.2
Section D-D	3	0.61	1.62	0.32	0.5
Section E-E	21	0.43	2.24	0.56	1.3

5.5 Summary of Future Condition Recommended Facilities

Refer to Exhibit H, included in Appendix A, for a detailed illustration of the flood control facilities proposed by the Offsite Improvements.

Drop Inlets: A total of two (2) drop inlets have been proposed by the Offsite Improvements. Table 8 below summarizes the hydraulic characteristics of the proposed drop inlets and the drop inlet computations which have been included in Appendix C.

Table 8: Summary of Drop Inlet Hydraulics							
Drop Inlet No.	Length (ft)	Type	On-Grade or Sump	Street Section ID	Q _{APPROACHING} (cfs)	Q _{COLLECTED} (cfs)	Q _{BYPASS} (cfs)
1	12	Mod C	Sump	E	26	26	0
2	3	Mod C	On-Grade	½ E	10	6	4

Drop Inlet No. 1 has been designed to allow for the maximum amount of flow to be captured in a sump condition; storm water flow from Tropical Pkwy will drain around the curb to the low point, in addition ½ street flows from Centennial Parkway will be captured in this 12-ft Modified Type C drop inlet.

Drop Inlet No. 2 has been designed to allow flow to bypass the drop inlet. This inlet is proposed to pick up nuisance flow as previously designed with the Twilight at Riverwalk improvements. All bypass flow will simply discharge east in Tropical Pkwy where storm water improvements are already in place.

Storm Drain: The storm drain flow hydraulic characteristics satisfy CCRFCD Manual criteria set forth in Section 2.3 of this report. The HGLs for the proposed storm drain, as determined by FlowMaster analyses included in Appendix C, have been drawn on the associated storm drain profile sheets included in Appendix H. Note that only the storm drain proposed by the Offsite Improvements has been hydraulically analyzed by FlowMaster and previously by WSPG in this study. A future drainage study update will hydraulically analyze any future storm drain improvements to be constructed by the project site. In addition, the starting HGL utilized in the WSPG analyses has been referenced from the Twilight Study.

6 CONCLUSIONS & RECOMMENDATIONS

1. The project site and the Offsite Improvements are not located within a FEMA designated SFHA. Therefore, FEMA acceptance and CCRFCD concurrence is not required.
2. The project site and Offsite Improvements are not adjacent to an existing or future planned CCRFCD regional facility, per the 2008 MPU. Therefore, CCRFCD concurrence is not required.
3. The drainage pattern for the project site discussed in this study is only conceptual. A future update to this drainage study will technically address the project site development.
4. No buildings are being proposed with this study.

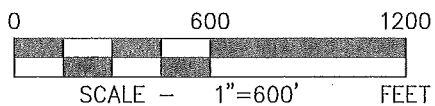
5. The runoff generated by development of the project site and Offsite Improvements are similar to the flow established by the Twilight Study. Therefore, no negative impacts occur to downstream property or facilities as a result of the development of the project site or Offsite Improvements.
6. Flows collected and conveyed in proposed drop inlet and storm drain improvements satisfy CCRFCD Manual criteria.
7. The grading plan, profile and detail sheets included in Appendix H of this study support the drainage patterns, conclusions and/or recommendations detailed in this study.

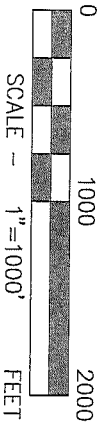
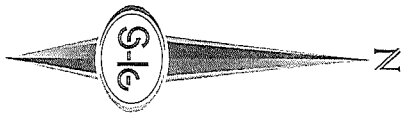
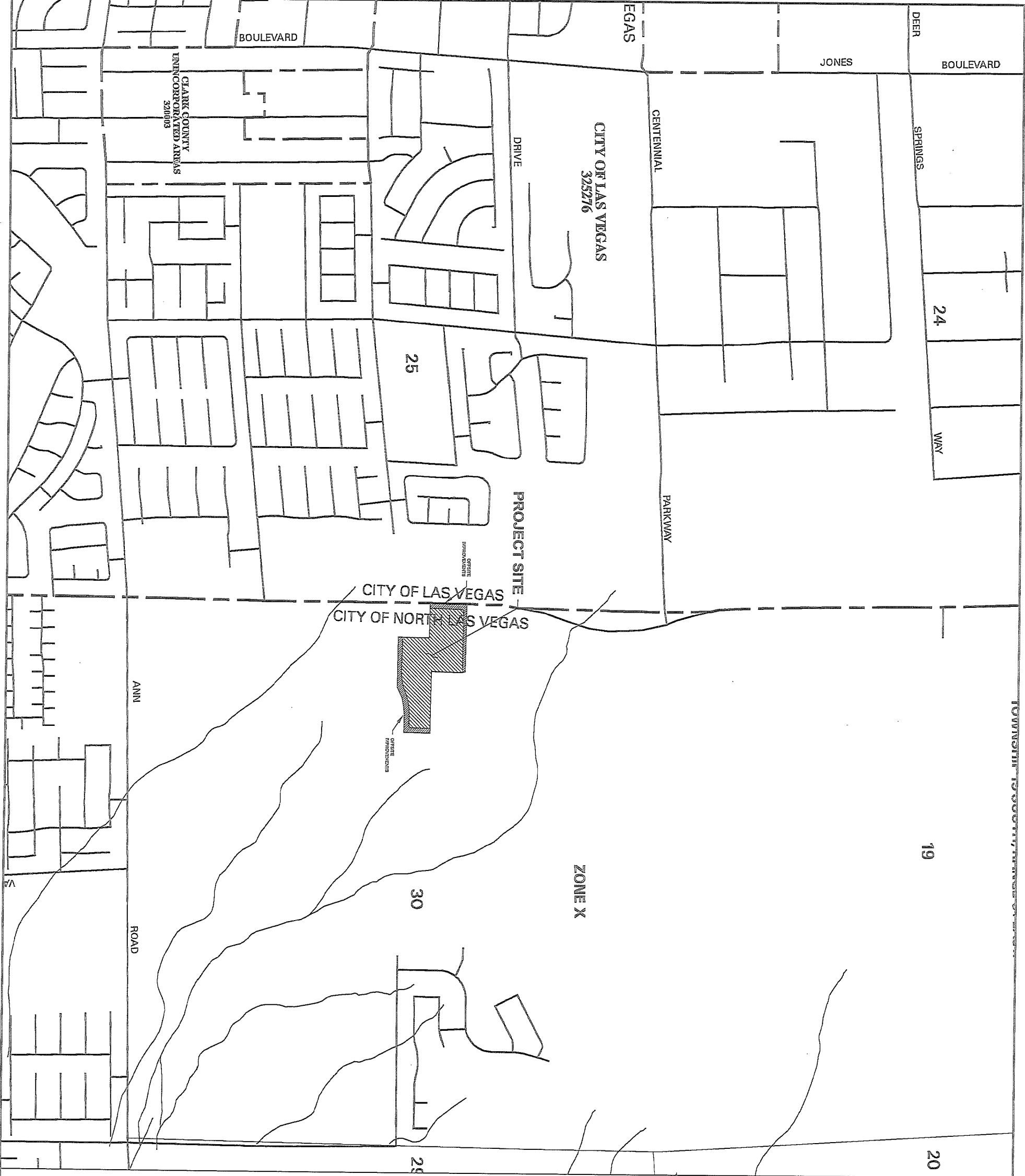
7 REFERENCES

1. *CCRFCD 2008 Clark County Las Vegas Valley Master Plan Update*. PBS&J, 2010.
2. *Hydrologic Criteria and Drainage Design Manual*. Clark County Regional Flood Control District, 1990.
3. *Soil Survey of Las Vegas Valley Area Nevada*, United States Department of Agriculture, Soil Conservation Service.
4. *Technical Drainage Study for Twilight at Riverwalk Ranch*. Slater Hanifan Group, March 2005.
5. *Technical Drainage Study for High Noon at Riverwalk Ranch*. Slater Hanifan Group, April 2005.
6. *Technical Drainage Study for Tropical/Decatur Convenience Store*, Kimley Horn and Associates, 2011.

APPENDIX A

Drainage Exhibits





PANEL 1765 E

FIRM

FLOOD INSURANCE RATE MAP

CLARK COUNTY,
NEVADA AND
INCORPORATED AREAS

PANEL 1765 OF 4090

SEE MAP INDEX FOR FIRM PANEL LAYOUT

COPIES:

COMMITTEE	NUMBER	PANEL	SHEET
NORTH LAS VEGAS CITY OF	30037	1765	E
LAS VEGAS CITY OF	30038	1765	E
UNINCORPORATED AREAS	30039	1765	E

MAP NUMBER
3200361765 E

MAP REVISED:
SEPTEMBER 27, 2002

Federal Emergency Management Agency

NO.	DESCRIPTION	DATE	BY	APP. DATE	APP.

S-16

SLATER HANIFAN GROUP

CONSULTING ENGINEERS & PLANNERS

5740 S. ARVILLE STREET #216, LAS VEGAS, NV 89116

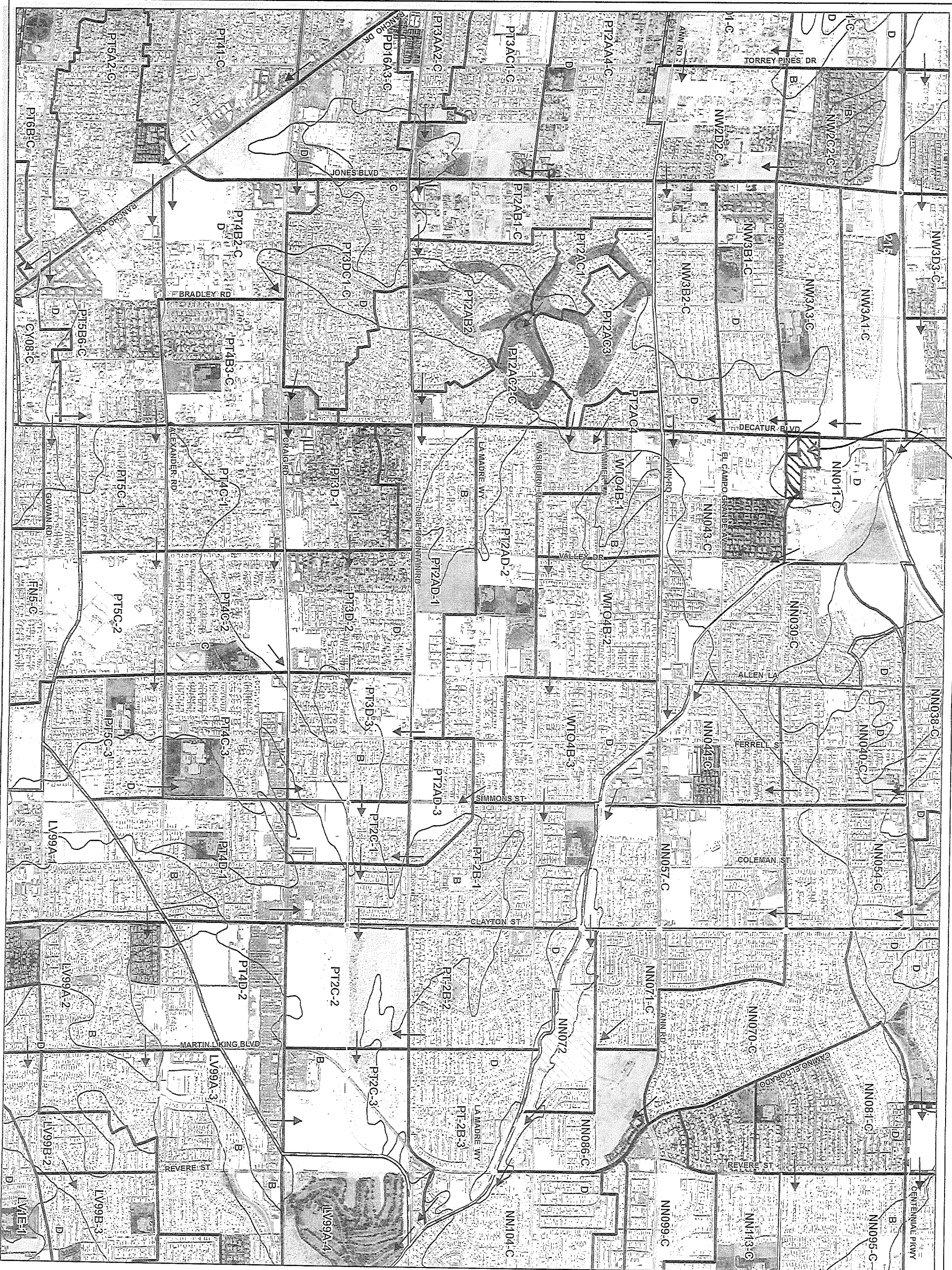
PHONE (702) 284-5300 FAX (702) 284-5399

TROPICAL/CENTENNIAL ROADWAY REALIGNMENT

FEMA FIRM PANEL

EXHIBIT B

SITE



2008

LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE
FIGURE H-20

HYDROLOGIC SUMMARY

LEGEND

- Ultimate Development Boundary
- Watershed Boundary
- Subbasin Boundary
- Drought Ordinance Boundary
- Flow Arrows

Flood Control Facilities

- Existing Facilities
- Category A Proposed Facilities
- Category B Proposed Facilities
- Category A Remove & Replace/Parallel Facilities
- Category B Remove & Replace/Parallel Facilities

Hydrologic Soil Groups

- A Low Runoff Potential
- B Moderately Low Runoff Potential
- C Moderately High Runoff Potential
- D High Runoff Potential/Rock Outcrops

Typical Land Use

- 1 Undeveloped Land, Open Desert
- 2 Parks, Golf Courses
- 3 Rural
- 4/14* Low Density Residential
- 5/15* Medium Density Residential
- 6/16* High Density Residential
- 7/17* Public Facility, Residential
- 8/18* Very High Density Residential
- 9/19* Commercial, Retail, Casino, High Rise Condominiums
- 10/20* Light Industrial
- 11/21* Heavy Industrial
- 12/22* Schools
- 13 Lakes



Scale: 1 inch = 2,000 feet
Refer to Figure G-2 for Aerial Source(s)

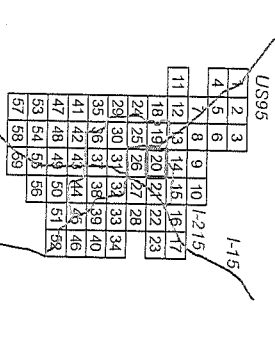
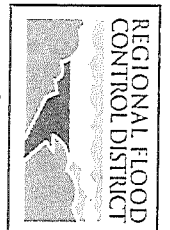
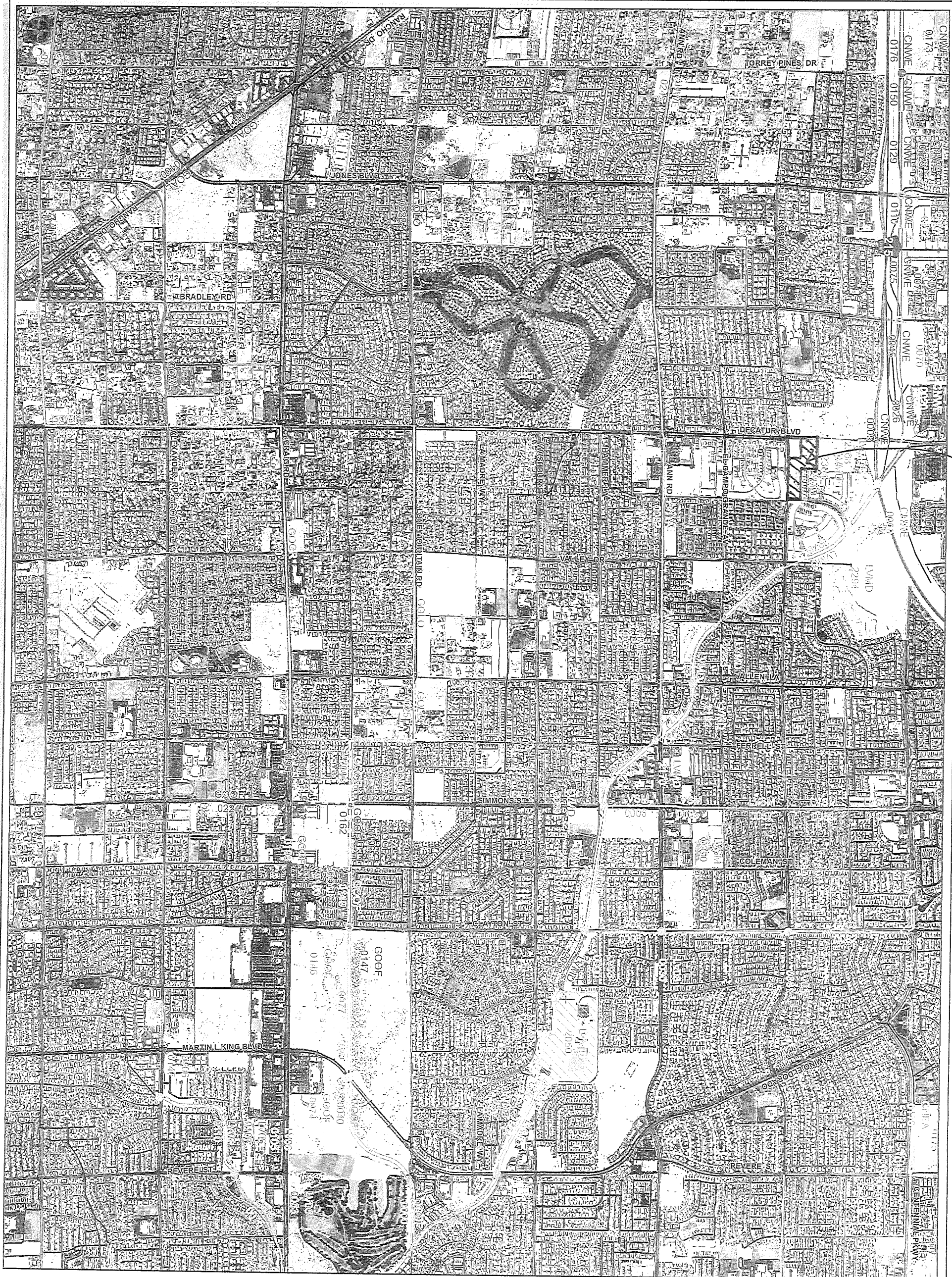


Exhibit C

SITE

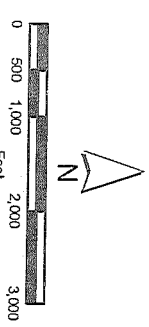


2008
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE
FIGURE F-20

FLOOD CONTROL FACILITIES

LEGEND

- Ultimate Development Boundary
- Existing Facilities
- Category A Proposed Facilities
- Category B Proposed Facilities
- Local Existing Facilities
- Local Proposed Facilities
- Detention Basin
- Culvert or Bridge Crossing
- Stormdrain
- Lined Channel
- Unlined Channel
- Levee/Dike
- Natural Wash/Floodway
- 1/2-Mile Separator
- Remove & Replace/Parallel Facilities
- Category A
- Category B
- Channel
- Stormdrain
- Crossing
- Stormdrain
- Crossing



Scale: 1 inch = 2,000 feet
Refer to Figure G-2 for Aerial Source(s)

US95

4	2	3
5	6	
7	8	9
11	12	13
14	15	16
17	18	19
20	21	22
23	24	25
26	27	28
29	30	31
32	33	34
35	36	37
38	39	40
41	42	43
44	45	46
47	48	49
50	51	52
53	54	55
56	57	58
59		

I-15



Exhibit D

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mt)	Channel Slope (%)**
0000	E	ANN ROAD CHANNEL WEST	1400	2214	CNNM3-C	CWES13	3.41	0.66
0007	E	14' X 12' RCB	203	2214	CNNM3-C	CWES13	3.41	0.77
0031	E	12' X 10' RCB	2392	2214	CNNM3-C	CWES13	3.41	1.40
0076	E	16' X 8' RCB	360	2214	CNNM3-C	CWES13	3.41	0.93
0082	E	12' X 11' RCB	2217	1947	CNNM3-C	CWES13	2.99	0.71
0122	E	12' X 10' RCB	280	1947	CNNM3-C	CWES13	2.99	0.71
0127	E	10' X 8' RCB	1450	1947	CNNM3-C	CWES13	2.99	2.55
0157	E	10' X 8' RCB	1112	1257	CNNM3-C	CWES13	1.95	1.13
0177	E	12' X 10' RCB	2197	1257	CNNM3-C	CWES13	1.95	0.39
0232	E	12' X 8' RCB	714	1257	CNNM3-C	CWES13	1.95	0.43
0245	E	10' X 9' RCB	1721	993	CNNM3-C	CWES13	6.84	0.80
0279	E	10' X 8' RCB	553	749	CNNM3-C	CWES13	6.37	0.80
0290	E	8' X 8' RCB	2050	749	CNNM3-C	CWES13	6.37	0.70
CNEA	E	CENTENNIAL PKWY CHANNEL EAST						
0123	E	14' X 6' RCB	1656	1457	CNNM3-C	WEST13	1.67	0.92
0153	E	14' X 6' RCB	1125	1457	CNNM3-C	WEST13	1.67	1.34
0175	E	15' X 6' RCB	125	1174	CNNM3-C	WEST13	1.35	5.66
0176	E	15' X 6' RCB	540	1174	CNNM3-C	WEST13	1.35	0.70
CNWE	E	CENTENNIAL PKWY CHANNEL WEST						
0000	E	2-27' X 10' RCB @ Bellway	235	4465	CNNM3-C	WEST13	6.41	1.51
0005	P2	2-27' X 10' RCB	764	4465	CNNM3-C	WEST13	6.41	1.10
0020	E	2-27' X 10' RCB @ Bechtel	310	4465	CNNM3-C	WEST13	6.41	2.58
0026	P2	2-27' X 10' RCB	1006	4465	CNNM3-C	WEST13	6.41	0.59
0045	P2	Cone Chnl 56W 10D 0.1 SS	1404	4465	CNNM3-C	WEST13	6.41	0.59
0070	E	27' X 10' RCB @ Bradley	155	2233	CNNM3-C	WEST13	6.41	0.40
0071	P2	Add 1: 27' X 10' RCB @ Bradley	155	2233	CNNM3-C	WEST13	6.41	0.40
0075	P2	Cone Chnl 56W 10D 0.1 SS	1915	4465	CNNM3-C	WEST13	6.41	0.40
0110	P2	2-27' X 10' RCB	650	4465	CNNM3-C	WEST13	6.41	0.40
0122	E	27' X 10' RCB @ Jones	122	2191	CNNM3-C	WEST13	6.15	0.40
0123	P2	Add 1: 27' X 10' RCB @ Jones	122	2191	CNNM3-C	WEST13	6.15	0.40
0139	P2	2-27' X 10' RCB	1865	4465	CNNM3-C	WEST13	6.15	0.40
0150	P2	Cone Chnl 42W 10D 0.1 SS	720	4233	CNNM3-C	WEST13	5.64	0.40
0173	P2	42' X 10' RCB @ Torrey Pines	190	4233	CNNM3-C	WEST13	5.64	0.40
0178	P2	Cone Chnl 32W 12D 0.1 SS	765	4233	CNNM3-C	WEST13	5.64	0.40
0189	P2	Cone Chnl 32W 10D 0.1 SS	1845	4067	CNNM3-C	WEST13	5.15	0.54
GOA2	P1	GOWAN OUTFALL - ALEXANDER BRANCH						
0000	P1	8' X 8' RCB	2281	523	CPT14-C	ALLGOW3	0.61	0.90
GOAL	P1	GOWAN OUTFALL - ALEXANDER ROAD FACILITIES						
0000	P1	10' X 9' RCB	5280	1461	CPT14-C	ALLGOW3	3.23	1.00
0100	P1	10' X 8' RCB	540	1297	CPT14-C	ALLGOW3	2.89	1.00
0111	P1	10' X 8' RCB	3000	880	CPT282	ALLGOW3	2.28	0.83
0169	P1	10' X 8' RCB	4200	880	CPT282	ALLGOW3	2.28	0.50
GOCL	P1	GOWAN OUTFALL - CLAYTON BRANCH						
0000	P1	9' X 8' RCB	6785	814	CPT28-1	ALLGOW3	1.11	0.61
GOOR	E	GOWAN OUTFALL - CRAIG ROAD						
0000	E	Cone Chnl 20W 6D 2.1 SS	1380	3101	CPT3D-3	ALLGOW3	5.78	1.30
0022	E	2-8' X 8' RCB	3000	1120	CPT3D-2	ALLGOW3	1.75	0.50
0080	E	120' RCP	5880	995	CPT4C-1	ALLGOW3	1.50	0.50
0180	E	114' RCP	350	238	PT4B3-C	ALLGOW3	0.28	0.30
0201	E	96' RCP	1080	238	PT4B3-C	ALLGOW3	0.28	0.35
GOLO	E	GOWAN OUTFALL - LONE MTN. ROAD BRANCH						
0000	E	72' RCP	1370	308	CPT2AD-1	ALLGOW3	3.28	0.53
0001	E	13' X 8' RCB	1433	1433	CPT2AD-1	ALLGOW3	3.28	0.45
0025	E	16' X 8' RCB	1464	1741	CPT2AD-1	ALLGOW3	3.28	0.39
0052	E	16' X 8' RCB	2564	1741	CPT2AD-1	ALLGOW3	3.28	0.42
0100	E	16' X 8' RCB	2732	1605	C2AC2-C	ALLGOW3	2.96	0.71
0152	P1	10' X 10' RCB	700	1605	C2AC2-C	ALLGOW3	2.96	0.71
0165	P1	10' X 8' RCB	3300	1415	CPT2AB2	ALLGOW3	2.59	1.21
0228	P1	10' X 8' RCB	1300	1244	C2AB1C	ALLGOW3	2.31	1.00
0253	P1	10' X 8' RCB	1200	989	CPT3AC1	ALLGOW3	2.10	1.25

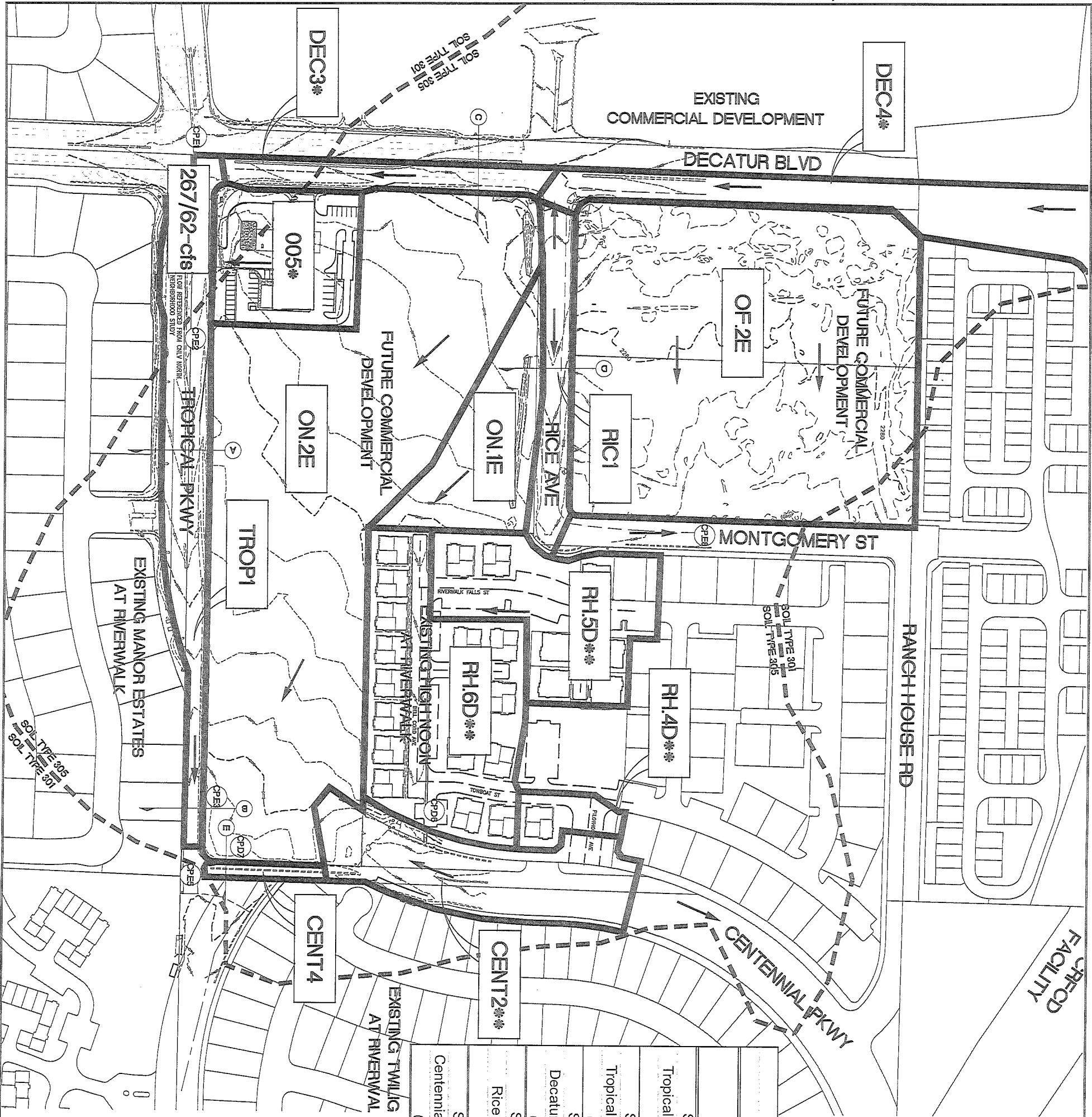
* The HEC-1 node shown identifies the controlling concentration point for the associated facility and is located upstream of this facility due to storm distribution transitions, depth area reduction factors, or attenuation of flow from routing.

** 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).

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mt)	Channel Slope (%)**
GOLO	P1	GOWAN OUTFALL - LONE MTN. ROAD BRANCH	3000	590	CPT3AA2	ALLGOW3	1.16	0.77
GOOF	E	GOWAN OUTFALL FACILITIES						
0000	E	Cone Chnl 20W 7D 2.1 SS	2500	5233	CPT2B-3	GWSSC	14.66	1.25
0040	E	Cone Chnl 20W 7D 2.1 SS	1900	5058	CPT2D1+	GWSSC	11.84	0.60
0074	E	2-16' X 7' RCB @ Camino Al Norte	131	5058	CPT2D1+	GWSSC	11.84	1.30
0077	E	Cone Chnl 20W 7D 2.1 SS	3157	5058	CPT2D1+	GWSSC	11.84	1.40
0146	E	3-12' X 4' RCB @ Clayton	150	1044	CPT2C1+	GWSSC	11.84	1.33
0149	E	Cone Chnl 20W 7D 2.1 SS	1228	5058	CPT2D1	GWSSC	11.84	1.33
0150	E	Cone Chnl 20W 7D 2.1 SS	612	4772	CPT2D1	GWSSC	10.86	1.13
0161	E	Cone Chnl 20W 7D 2.1 SS	625	4772	CPT2D1	GWSSC	10.86	1.13
0162	P3	Confluence Structure (Replaces GOOF0161)	625	4772	CPT2D1	GWSSC	10.86	0.90
0166	P3	37.66' X 5.66' Bridge @ Simmons (Replaces GOOF0162)	120	3101	CPT3D-3	ALLGOW3	5.78	0.90
0197	E	3-12' X 6' RCB @ Simmons (Replaces GOOF0166)	120	3101	CPT3D-3	ALLGOW3	5.78	0.90
0198	E	14' X 6' RCB	1344	1561	CPT4C-3	GWSSC	5.85	0.41
0199	P3	Add 1: 24' X 6' RCB	2745	2745	CPT4C-3	GWSSC	5.85	0.40
0224	P3	1-16' X 8' RCB and 1: 14' X 6' RCB	515	2582	CPT5C-3	GWSSC	5.59	0.40
0275	P3	1-16' X 8' RCB and 1: 14' X 6' RCB	2582	2582	CPT5C-3	GWSSC	5.59	0.40
0285	P1	2-14' X 8' RCB	2650	2582	CPT5C-3	GWSSC	5.59	0.45
0325	P1	2-14' X 8' RCB	2550	2458	CPT5C-2	GWSSC	5.36	0.37
0427	P1	2-12' X 8' RCB	2375	2375	CPT5C-1	GWSSC	5.17	0.55
0465	E	90' RCP	1510	630	DGOW2A	GWSSC	1.38	0.47
0486	E	8' X 5' RCB	1160	630	DGOW2A	GWSSC	1.38	0.47
0511	E	8' X 5' RCB	8390	689	CPT6B-C	GWSSC	1.08	0.50
LV03	E	CLAYTON STREET CHANNEL						
0000	E	33' X 16' RCB @ Hammer	400	1044	CNNM3-C	WEST13	1.22	0.42
0006	E	Cone Chnl 9W 9.4D 1.51 SS	1300	1044	CNNM3-C	WEST13	1.22	0.42
0030	E	2-9' X 7' RCB @ Ann	120	1044	CNNM3-C	WEST13	1.22	0.42
0031	E	Cone Chnl 8W 8.1D 1.51 SS	2800	757	CNNM3-C	WEST13	0.81	0.40
0081	E	2-10' X 7' RCB @ Topical	100	757	CNNM3-C	WEST13	0.81	0.42
0082	E	Cone Chnl 7W 7.1D 1.51 SS	2444	757	CNNM3-C	WEST13	0.81	2.80
0128	E	Cone Chnl 7W 7.1D 1.51 SS	167	257	1/2NNM3-C	WEST13	0.55	2.80
0129	E	2-10' X 6' RCB	801	257	1/2NNM3-C	WEST13	0.55	1.60
0131	E	10' X 6' RCB	665	257	1/2NNM3-C	WEST13	0.55	1.28
LV05	E	WESTERN TRIBUTARY AT ALEXANDER RD						
0131	E	Cone Chnl 28W 3D 3.1 SS	1300	567	CLV9B-3	WEST13	0.64	0.76
LV06	E	WESTERN TRIBUTARY AT CRAIG RD						
0053	E	16' X 6' RCB	782	1080	CLV9A-3	WEST13	1.31	1.55
0063	E	14' X 6' RCB	526	1080	CLV9A-3	WEST13	1.31	1.88
0075	E	12' X 6' RCB	1808	1080	CLV9A-3	WEST13	1.31	0.72
0105	E	2-8' X 6' RCB @ Revere	158	1080	CLV9A-3	WEST13	1.31	1.71
0107	E	Cone Chnl 17.3W 6D 0.1 SS	140	1080	CLV9A-3	WEST13	1.31	3.79
0110	E	Cone Chnl 12W 5.5D 2.1 SS	2451	1080	CLV9A-3	WEST13	1.31	0.87
0147	E	12' X 6' RCB @ Alexander	150	629	CLV9A-2	WEST13	0.74	1.16
LV07	E	LAS VEGAS WASH - MIDDLE						
1877	E	Cone Chnl 30W 10D 1.1 SS	1570	6423	CNNM3-C	WEST13	44.33	1.10
1905	E	Cone Chnl 12W 10D 1.631 SS	2440	3245	CNNM3-C	WEST13	29.30	1.00
1933	E	2-24' X 10' RCB @ Camino Al Norte	145	3245	CNNM3-C	WEST13	29.30	0.94
1954	E	Cone Chnl 32W 7D 2.1 SS	1587	3245	CNNM3-C	WEST13	29.30	0.99
1984	E	Transition Structure	550	3221	LOWEROB	CWES15	19.67	0.98
2048	E	68,000 cfs PWF Spillway	68000	3221	LOWEROB	CWES15	19.67	
2049	E	4-7' X 7' RCB Outlet	200	3221	LOWEROB	CWES15	19.67	
2050	E	700 ac-ft Lower Las Vegas Wash Detention Basin	6728	6636	LOWEROB	CWES15	19.26	3.11
2052	P1	Cone Chnl 50W 6D 0.1 SS	240	6636	20057-C	CWES15	19.26	0.15
2053	P1	Cone Chnl 60W 12D 0.1 SS	680	6636	20057-C	CWES15	19.26	0.15
2054	P1	Cone Chnl 80W 12D 0.1 SS	280	6636	20057-C	CWES15	19.26	11.97
2055	P1	Cone Chnl 60W 12D 0.1 SS	165	6636	20057-C	CWES15	19.26	0.15
2060	E	4-12.75' X 16' RCB @ Clayton	144	6171	20044-C	CWES15	18.06	0.15
2061	E	Cone Chnl 54W 16D 0.1 SS	425	6171	20044-C	CWES15	18.06	0.15

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mt)	Channel Slope (%)**
LV08		LAS VEGAS WASH - MIDDLE						
2682	E	Cone Chnl 54W 9D 0.1 SS	1200	6171	20044-C	CWES15	18.06	1.35
2689	E	Cone Chnl 54W 9.5D 0.1 SS	608	6171	20044-C	CWES15	18.06	0.50
2124	E	2-28.5' X 10' RCB @ Simmons	110	6046	20043-C	CLVMD5	15.94	0.50
2125	E	Cone Chnl 54W 9D 0.1 SS	1571	6046	20043-C	CLVMD5	15.94	0.77
2170	E	4-12' X 10' RCB @ Ann Road	500	6046	20043-C	CLVMD5	15.94	1.42
2172	E	Cone Chnl 50W 10D 0.1 SS	1289	5734	20304-C*	CLVMD4	11.98	1.15
2192	E	2-24.5' X 10' RCB @ Allen	110	5734	20304-C*	CLVMD4	11.98	1.15
2197	E	Cone Chnl 50W 10D 0.1 SS	1385	5734	20304-C*	CLVMD4	11.98	1.37
2223	E	50' X 10' RCB @ El Campo Grande	275	5734	20304-C*	CLVMD4	11.98	1.83
2266	E	2-24.5' X 10' RCB @ El Campo Grande	1600	5734	20304-C*	CLVMD4	11.98	1.83
2276	E	Cone Chnl 50D 10D 0.1 SS	575	5734	20304-C*	CLVMD4	11.98	1.04
2294	E	2-24.5' X 10' RCB @ Ranchhouse	985	5734	20304-C*	CLVMD4	11.98	1.04
2300	E	Transition Structure	292	5734	20304-C	CLVMD4	11.98	1.50
2304	E	Cone Chnl 70W 10D 0.1 SS	200	5734	20304-C	CLVMD4	11.98	1.50
2308	E	Confluence Structure	220	5734	20304-C	CLVMD4	11.98	1.50
2322	P2	2-24.5' X 10' RCB	480	5734	20304-C	CLVMD4	11.98	1.50
2324	P2	2-14' X 8' RCB	1200	3317	CWES13	CWES13	6.88	1.50
			5485	3317	CWES13	CWES13	6.88	0.40
LV5A		LAS VEGAS WASH-SIMMONS						
0000	E	12' X 8' RCB	195	790	CNN044-C	WES13	0.81	0.63
0006	E	11' X 6' RCB	1005	790	CNN044-C	WES13	0.81	0.30
0025	E	10' X 6' RCB	1310	780	CNN044-C	WES13	0.81	0.44
0050	E	9' X 6' RCB	387	530	CNN040-C	WES13	0.53	0.60
0057	E	8' X 6' RCB	1113	530	CNN040-C	WES13	0.53	0.54
0084	E	72' RCP	292	530	CNN040-C	WES13	0.53	1.49
0089	E	60' RCP	1069	235	CNN08-C	WES13	0.24	2.04
0109	E	48' RCP	2003	235	CNN08-C	WES13	0.24	1.91
TRE4		TROPICAL ROAD CHANNEL EAST						
0104	E	66' RCP	2700	447	CNN095-C	WES13	0.57	2.10



Flow Summary				
Existing Condition				
Subbasin ID	Area (ac)	Q ₁₀ (cfs)	Q ₁₀₀ (cfs)	
DEC.4	2.19	3	6	
DEC.3	0.76	1	2	
CP.E1	N/A	5	8	
005*	1.55	3	5	
CP.E2	N/A	69	280	INCLUDES North Neighborhood flows
TROP1	2.05	3	6	
ON.1E	1.54	1	3	
ON.2E	9.7	5	14	
CP.E3	N/A	78	302	INCLUDES North Neighborhood flows
RH.5D**	2.07	2	5	
RH.6D**	3.17	4	8	
CP.D6*	N/A	6	13	
RH.4D**	0.34	<0.5	1	
CENT2**	1.65	3	5	
CENT4	0.14	<1	<1	
CP.D7	N/A	10	20	
CP.E5	N/A	87	320	INCLUDES North Neighborhood flows
OF.2E	8.64	5	14	
RIC1	0.9	2	3	
CP.E8	N/A	6	17	

*Referenced from the Tropical Oceanic Commerce Store Proposed Condition Analysis, by K&J from
**Referenced from the Twp Right at Riverwalk Ranch Upland Condition Analysis, by SHG

Perimeter Street Flow Summary

Existing Condition						
Section	Slope (%)	Q ₁₀₀ (cfs)	Depth (ft)	Velocity (fps)	VxD	Dry Lane Q ₁₀ (cfs) Width (ft)
SECTION A Tropical Pkwy (100' ROW) (Q = CP.E2)	0.70	280.0	1.26	6.15	7.7	69.0 14.00
SECTION B Tropical Pkwy (100' ROW) (Q = CP.E3)	0.60	302.0	1.28	7.25	9.3	78.0 0.00
SECTION C Decatur Blvd (100' ROW) (Q = CP.E1)	0.60	8.0	0.40	1.87	0.7	4.0 10.5
SECTION D Rice Ave (60' ROW) (Q = RIC1)	0.61	118.0	1.03	3.94	4.1	38.0 n/a
SECTION E Centennial Pkwy (100' ROW) (Q = CP.D7)	0.43	20.0	0.63	3.37	2.1	10.0 0.0

LEGEND

BASIN BOUNDARY

BASIN ID

FLOW DIRECTION

CONCENTRATION POINT

SOIL BOUNDARY

FLOWMASTER SECTION

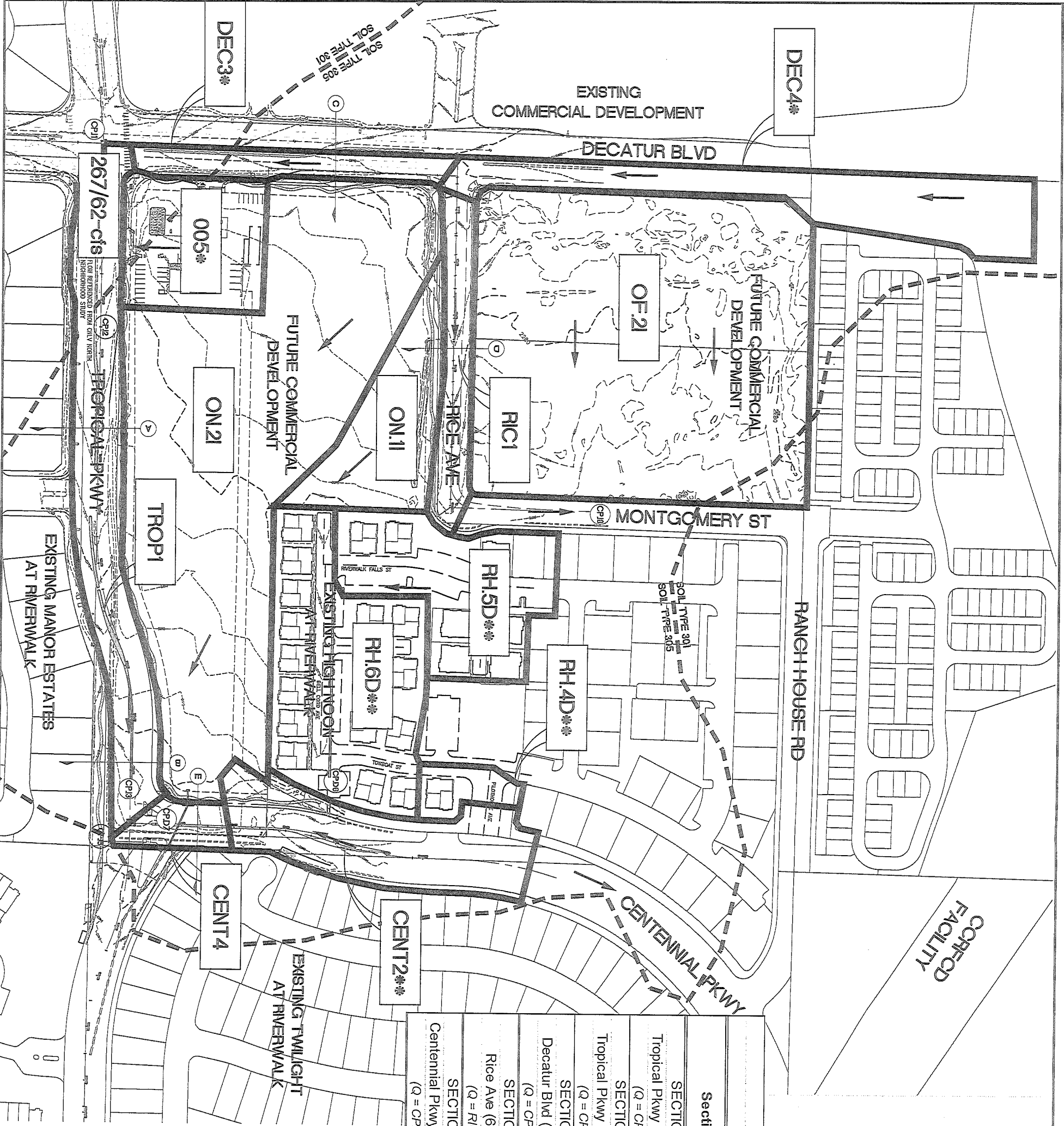
M GRAPE LLC

TROPICAL PARKWAY REALIGNMENT
EXISTING CONDITION BASIN MAP

NO.	DESCRIPTION	DATE	BY	APP. DATE	APP.

SLATER HANIFAN GROUP
CONSULTING ENGINEERS & PLANNERS
5740 S. ARVILLE STREET #216, LAS VEGAS, NV 89118
PHONE (702) 284-5300 FAX (702) 284-5399

DATE: 9/23/11
DRAFTER: RFF
DESIGNER: RFF
CHECKED: RFF
PROJECT NO.
MGL1101.000
EXHIBIT E
SHEET 1 OF 3



Flow Summary					
Interim Condition					
Subbasin ID	Area (ac)	Q ₁₀₀ (cfs)	Q ₁₀ (cfs)	Q ₂ (cfs)	
DEC4	2.19	3	2	6	
DEC3	0.76	1	1	2	
CP11	N/A	67	275		INCLUDES North Neighborhood flows
005*	1.55	3	5		
CP12	N/A	69	280		INCLUDES North Neighborhood flows
TROP1	2.69	4	8		
ON11	1.54	1	3		
ON21	8.64	4	13		
CP18	N/A	78	302		INCLUDES North Neighborhood flows
RH5D**	2.07	2	5		
RH6D**	3.17	4	8		
CP16	N/A	6	13		
RH4D**	0.34	<0.5	1		
CENT2**	1.65	3	5		
CENT4	0.39	<1	<1		
CP17	N/A	10	21		
CP15	N/A	89	321		INCLUDES North Neighborhood flows
OF21	8.64	5	14		
RIC1	0.9	2	3		
CP18	N/A	6	17		

Perimeter Street Flow Summary						
Interim Condition						
Section	Slope (%)	Q ₁₀₀ (cfs)	Depth (ft)	Velocity (fps)	V _{xD} (cfs)	Dry Lane Width (ft)
SECTION A Tropical Pkwy (100' ROW) (Q = CP12)	0.70	280.0	1.22	5.26	6.4	69.0
SECTION B Tropical Pkwy (100' ROW) (Q = CP13)	0.60	302.0	1.28	4.86	6.2	78.0
SECTION C Decatur Blvd (100' ROW) (Q = CP17)	0.60	8.0	0.49	2.52	1.2	5.0
SECTION D Rice Ave (60' ROW) (Q = RIC1)	0.61	3.0	0.32	1.62	0.5	2.0
SECTION E Centennial Pkwy (100' ROW) (Q = CP17)	0.43	21.0	0.56	2.24	1.3	10.0
						22.0

ON-D1

PT1

000

BASIN BOUNDARY

BASIN ID

FLOW DIRECTION

CONCENTRATION POINT

SOIL BOUNDARY

FLOWMASTER SECTION

0 200 400

SCALE - 1"=200'

FEET

M GRAPE LLC

TROPICAL PARKWAY REALIGNMENT
INTERIM CONDITION BASIN MAP

NO.	DESCRIPTION	DATE	BY	APP. DATE	APP.

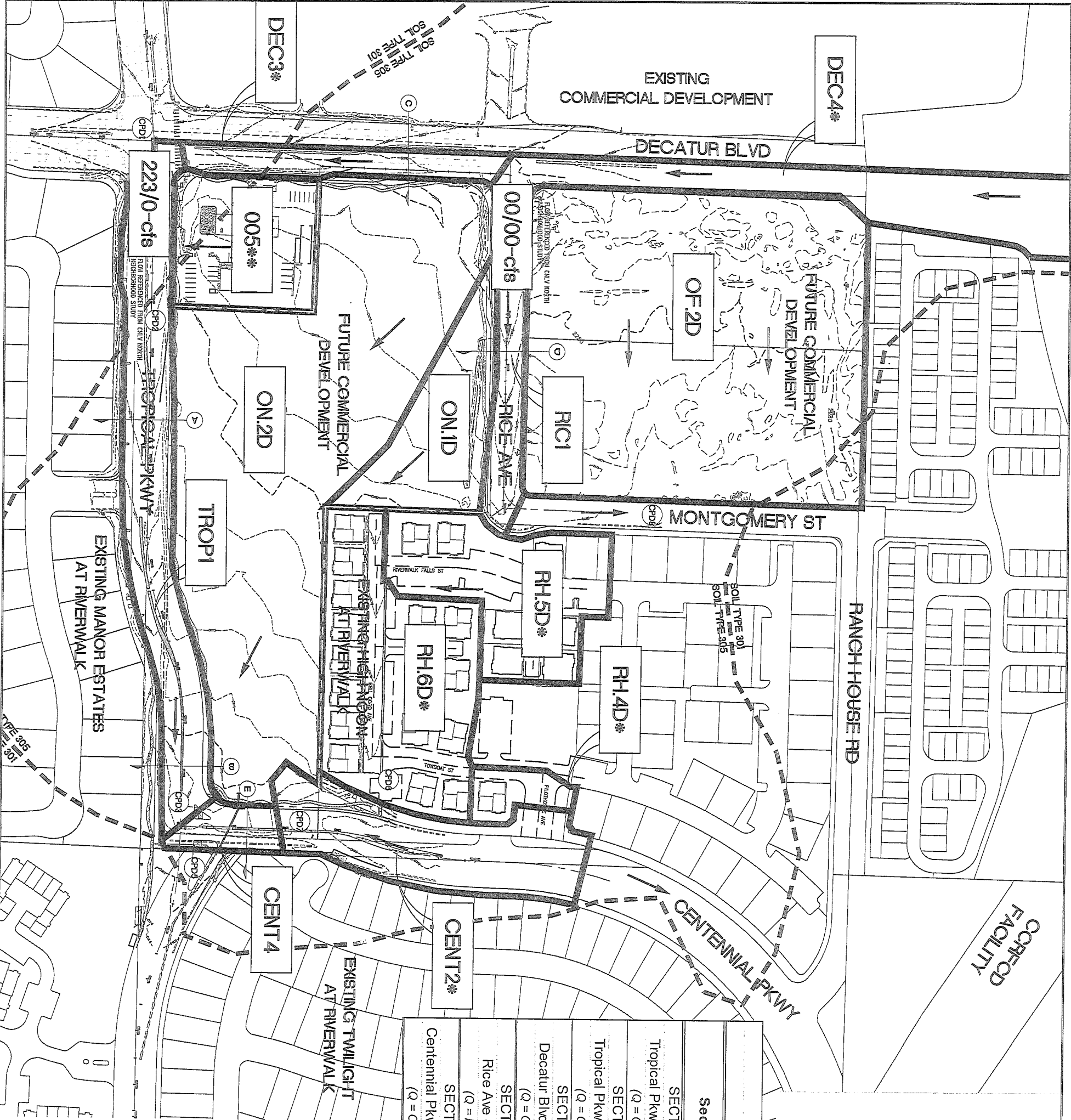
S-I-G

SLATER HANIFAN GROUP

CONSULTING ENGINEERS & PLANNERS

5740 S. ARVILLE STREET #216, LAS VEGAS, NV 89118
PHONE (702) 284-5300 FAX (702) 284-5399

DATE: 9/23/11
DRAFTER: RFF
DESIGNER: RFF
CHECKED: RFF
PROJECT NO.
MGL1101.000
EXHIBIT F
SHEET 2 OF 3



Flow Summary Proposed Condition					
Subbasin ID	Area (ac)	Q ₁₀₀ (cfs)	Q ₁₀ (cfs)	Q ₁₀₀ (cfs)	Q ₁₀ (cfs)
DEC.4	2.19	0.76	1	3	6
DEC.3	2.19	0.76	1	3	6
CP.D1	N/A	N/A	5	5	231
005*	1.55	3	3	5	5
CP.D2	N/A	7	7	236	
TROP1	2.69	4	4	8	
ON.1D	1.54	3	3	5	
ON.2D	8.64	12	22	22	
CP.D3	N/A	26	26	269	
RH.5D**	2.07	2	2	5	
RH.6D**	3.17	4	4	8	
CP.D5*	6	6	13	13	
RH.4D**	0.34	<0.5	1	1	
CENT2**	1.65	3	5	5	
CENT4	0.38	<1	<1	<1	
CP.D7	N/A	10	10	21	
CP.D5	N/A	36	36	288	
RIC1	0.9	2	3	3	
OF.2D	8.64	13	24	24	
CP.D8	N/A	15	15	28	

INCLUDES North Neighborhood flows

INCLUDES North Neighborhood flows

INCLUDES North Neighborhood flows

*Referenced from the Tropical/Decatur Confluence Slope Proposed Condition Analysis, by Keny Item

**Referenced from the Twilight at River at Ranch Ultimate Condition Analysis, by SPS

Perimeter Street Flow Summary Future Condition						
Section	Slope (%)	Q ₁₀₀ (cfs)	Depth (ft)	Velocity (fps)	VxD	Q ₁₀ (cfs)
SECTION A Tropical Pkwy (100' ROW) (Q = CP.D2)	0.70	236.0	1.07	4.78	5.1	7.0
SECTION B Tropical Pkwy (100' ROW) (Q = CP.D3)	0.60	269.0	1.14	4.80	5.5	26.0
SECTION C Decatur Blvd (100' ROW) (Q = CP.D1)	0.60	8.0	0.49	2.52	1.2	5.0
SECTION D Rice Ave (60' ROW) (Q = RIC1)	0.61	3.0	0.32	1.62	0.5	2.0
SECTION E Centennial Pkwy (100' ROW) (Q = CP.D7)	0.43	21.0	0.56	2.24	1.3	10.0
						22.0



0 200 400
SCALE - 1"=200'
FEET

LEGEND

BASIN BOUNDARY

BASIN ID

FLOW DIRECTION

CONCENTRATION POINT

SOIL BOUNDARY

FLOWMASTER SECTION

M GRAPE, LLC.

TROPICAL PARKWAY REALIGNMENT
FUTURE CONDITION BASIN MAP

NO.	DESCRIPTION	DATE	BY	APP. DATE	APP.



**SLATER
HANIFAN
GROUP**

CONSULTING ENGINEERS & PLANNERS

5740 S. ARVILLE STREET #216, LAS VEGAS, NV 89118
PHONE (702) 284-5300 FAX (702) 284-5399

DATE: 9/23/11
DRAFTER: RFF
DESIGNER: RFF
CHECKED: RFF
PROJECT NO:
MGL1101.000
EXHIBIT G
SHEET 3 OF 3

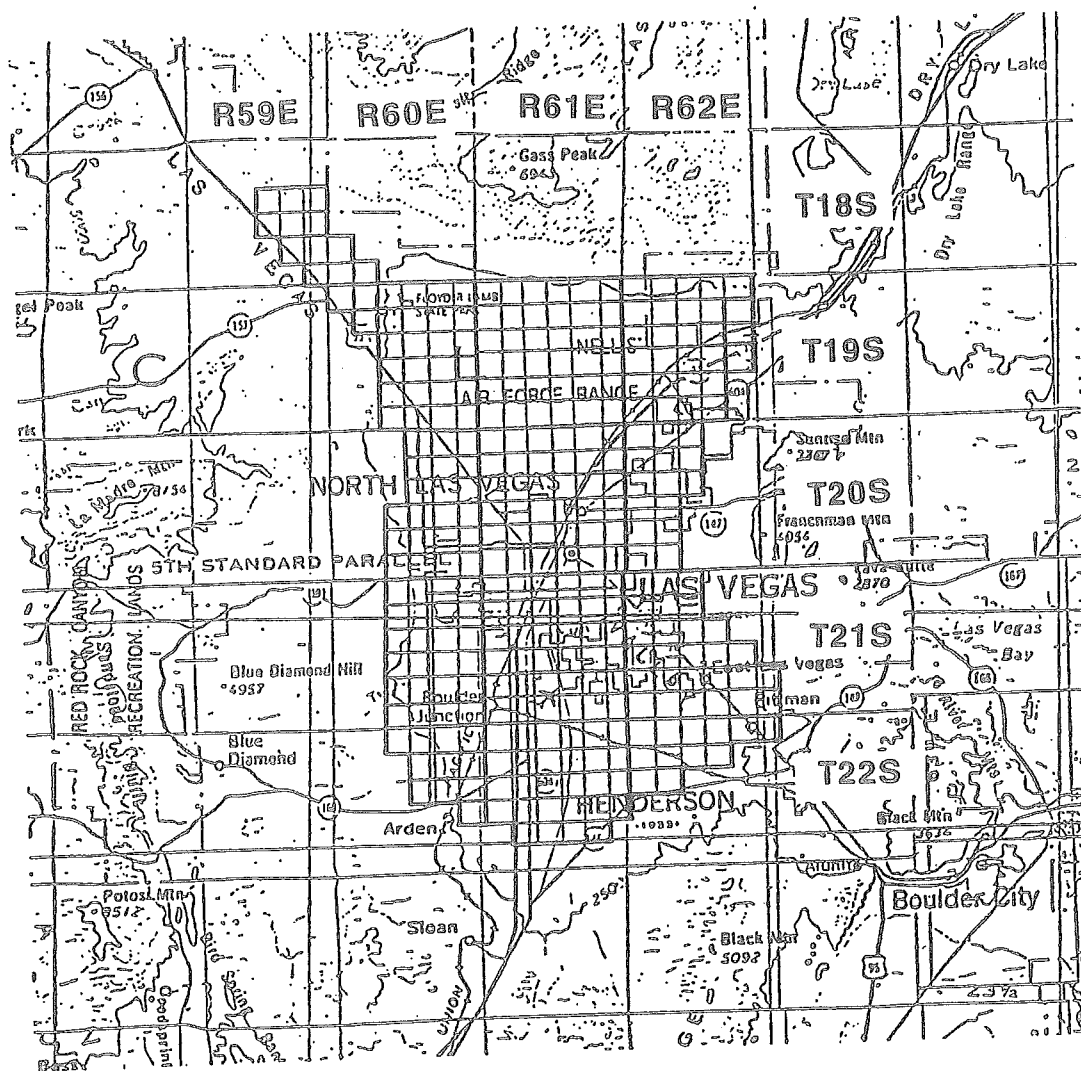
APPENDIX B

Hydrologic Analysis

Precipitation and Curve Number Data

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

McCARRAN AIRPORT RAINFALL AREA



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

Notes:

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

REFERENCE:

USACE, Los Angeles District, 1988

FIGURE 513

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

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

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

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

Revision	Date

high-intensity storms. Channeling and deposition are common along streambanks. This soil is strongly affected by salts.

This unit is used mainly as habitat for desert wildlife and for recreation. It is also used for urban development.

The main limitation for construction of dwellings is the hazard of flooding. Dikes and channels that have outlets for floodwater can be used to protect buildings from flooding. Some areas of this unit may be subject to salt heaving because of the expansion of sodium sulfate salts. This action may cause concrete slab floors, driveways, and sidewalks to crack. Removal of the sodium sulfate salts by mechanical means, deep leaching, or chemical treatment can alleviate this problem. Sodium sulfate in the soil can induce electrochemical action that corrodes concrete. This limitation can be overcome by using cement that is resistant to sulfate corrosion.

The main limitation for septic tank absorption fields is restricted permeability of the soil. Using long absorption lines and backfilling the trench with sandy material help to compensate for the restricted permeability.

This unit is limited for roads because of limited ability of the soil to support a load and because of the presence of sodium sulfate salts. Roads and streets should be designed to compensate for the instability of the soil. Local roads and streets may require a special base to avoid damage from the expansion of sodium sulfate salts.

The main limitations for lawns and landscaping are excessive soluble salts in the soil. Because of the content of sodium sulfate and other salts in the soil, salt-tolerant plants should be selected. Content of toxic salts can be reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil.

This map unit is in capability subclasses VIw, irrigated, and VIIw, nonirrigated. It is in horticultural group 5.

300—Las Vegas gravelly fine sandy loam, 0 to 2 percent slopes. This shallow, well drained soil is on basin floor remnants. It formed in alluvium derived dominantly from limestone and dolomite.

Typically, about 25 percent of the surface is covered with a desert pavement of hardpan fragments and pebbles. The surface layer is very pale brown gravelly fine sandy loam about 1 inch thick. The upper 6 inches of the underlying material is very pale brown fine sandy loam, and the next 4 inches is very pale brown gravelly sandy clay loam. A white, indurated, lime-cemented hardpan is at a depth of about 11 inches. Depth to the hardpan ranges from 3 to 14 inches.

Included in this unit are about 5 percent Destazo soils, 0 to 4 percent slopes, and 5 percent Grapevine soils, 0 to 4 percent slopes, on erosional fan remnants. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Las Vegas soil is moderately slow above the hardpan. Available water capacity is very low. Effective rooting depth is 3 to 14 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is subject to rare periods of flooding during prolonged, high-intensity storms. Channeling and deposition are common along streambanks.

This unit is used mainly as habitat for desert wildlife and for recreation. It is also used for urban development.

The main limitations for construction of dwellings are the hazard of flooding and the limited depth to the hardpan. Dikes and channels that have outlets for floodwater can be used to protect buildings from flooding. Excavation for building sites is limited by the hardpan. Heavy equipment is needed for excavation.

The main limitation for septic tank absorption fields is the limited depth to the hardpan. Special design of septic tank absorption fields is needed. Excavation is limited by the hardpan. Heavy equipment is needed for excavation.

This unit is limited for roads because of the limited depth to the hardpan. Roads should be designed to minimize cuts. Heavy equipment is needed for excavation.

The main limitation for lawns and landscaping is the limited depth to the hardpan. It is difficult to establish plants in areas where the pan is exposed. Mulching and fertilizing cut areas help to establish plants. Lawn grasses, shrubs, and trees that are not sensitive to lime-induced chlorosis are well suited to use in landscaping. Annual applications of iron chelates reduce the effects of chlorosis.

This map unit is in capability subclass VIIs, nonirrigated, and in horticultural group 6.



301—Las Vegas gravelly fine sandy loam, 2 to 4 percent slopes. This shallow, well drained soil is on deeply dissected basin floor remnants. It formed in alluvium derived dominantly from limestone and dolomite.

Typically, about 30 percent of the surface is covered with a desert pavement of hardpan fragments and pebbles. The surface layer is very pale brown gravelly fine sandy loam about 1 inch thick. The upper 6 inches of the underlying material is very pale brown fine sandy loam, and the next 4 inches is very pale brown gravelly sandy clay loam. A white, indurated, lime-cemented hardpan is at a depth of about 11 inches. Depth to the hardpan ranges from 3 to 14 inches.

Included in this unit is about 5 percent Destazo soils, 8 to 15 percent slopes, on side slopes of erosional fan remnants.

Permeability of the Las Vegas soil is moderately slow above the hardpan. Available water capacity is very low. Effective rooting depth is 3 to 14 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is subject to rare periods of

flooding during prolonged, high-intensity storms. Channeling and deposition are common along streambanks.

This unit is used as habitat for desert wildlife and for recreation.

This unit is limited for roads because of the depth to an indurated hardpan and the dendritic pattern of straight-walled channels that are 5 to 20 feet deep. Roads should be designed to minimize cuts. Heavy equipment is needed for excavation. Roads that cross the deep channels require bridging or deep cuts and fills and large culverts.

This map unit is in capability subclass VII, nonirrigated, and in horticultural group 6.

302—Las Vegas-McCarran-Grapevine complex, 0 to 4 percent slopes. This map unit is on basin floor remnants.

This unit is 40 percent Las Vegas gravelly fine sandy loam, 0 to 4 percent slopes; 25 percent McCarran fine sandy loam, 0 to 4 percent slopes, eroded; and 20 percent Grapevine very fine sandy loam, 0 to 4 percent slopes. The Las Vegas soil is on summits, the McCarran soil is on foot slopes, and the Grapevine soil is on shoulders of basin floor remnants. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are about 5 percent areas of Badland; 5 percent Bluepoint soils on small sand sheets; and 5 percent Bracken soils on pediment remnants. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Las Vegas soil is shallow and well drained. It formed in alluvium derived from limestone and lacustrine sediment. Typically, the surface layer is very pale brown gravelly fine sandy loam about 1 inch thick. The upper 6 inches of the underlying material is very pale brown fine sandy loam, and the next 4 inches is very pale brown gravelly sandy clay loam. A white, indurated, lime-cemented hardpan is at a depth of about 11 inches. Depth to the hardpan ranges from 3 to 14 inches.

Permeability of the Las Vegas soil is moderately slow above the hardpan. Available water capacity is very low. Effective rooting depth is 3 to 14 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is subject to rare periods of flooding during prolonged, high-intensity storms. Channeling and deposition are common along streambanks.

The McCarran soil is very deep and well drained. It formed in alluvium derived from limestone, sandstone, and gypsiferous sediment. Typically, the surface layer is pink fine sandy loam about 5 inches thick. The underlying material is pink sandy loam and loam to a depth of 60 inches. Most of the subsurface layers are weakly cemented with lime and gypsum.

Permeability of the McCarran soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is subject to rare periods of flooding during prolonged, high-intensity storms. Channeling and deposition are common along streambanks. This soil is slightly affected by salts to a depth of 5 inches, and it is moderately affected by salts below this depth.

The Grapevine soil is very deep and well drained. It formed in alluvium derived from various kinds of rock that have a high content of gypsiferous material. Typically, the surface layer is pink very fine sandy loam about 10 inches thick. The underlying material to a depth of 60 inches or more is pink, stratified fine sandy loam to clay loam.

Permeability of the Grapevine soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is subject to rare periods of flooding during prolonged, high-intensity storms. Channeling and deposition are common along streambanks. The soil is slightly affected by salts below a depth of 10 inches.

This unit is used mainly as habitat for desert wildlife and for recreation. It is also used for urban development.

The main limitations for construction of dwellings are the hazard of flooding on all soils and the depth to the hardpan in the Las Vegas soil. Dikes and channels that have outlets for floodwater can be used to protect buildings from flooding. Excavation for building sites is limited by the hardpan. Heavy equipment is needed for excavation. Gypsum in the McCarran and Grapevine soils can induce electrochemical action that corrodes concrete. This limitation can be overcome by using cement that is resistant to sulfate corrosion. Subsidence caused by the dissolution of gypsum in the McCarran soil can be prevented by using foundation drains, gutters, and downspouts that discharge directly into the sewer system.

The main limitations for septic tank absorption fields are depth to the hardpan in the Las Vegas soil and the restricted permeability of the McCarran soil. Excavation is limited by the hardpan. Special design of septic tank absorption fields is needed. Using long absorption lines and backfilling the trench with sandy material help to compensate for the restricted permeability.

The Las Vegas soil is limited for roads because of the depth to the hardpan. Roads should be designed to minimize cuts. Heavy equipment is needed for excavation.

The main limitations for lawns and landscaping are depth to the hardpan in the Las Vegas soil and excess soluble salts in the McCarran soil. It is difficult to establish plants in areas where the pan is exposed. Mulching and fertilizing cut areas help to establish

plants. Because of the content of gypsum and other salts in the soil, salt-tolerant plants should be selected. Excessive irrigation can dissolve gypsum in the soil and cause subsidence. Lawn grasses, shrubs, and trees that are not sensitive to lime-induced chlorosis are well suited to use in landscaping. Annual applications of iron chelates reduce the effects of chlorosis.

This map unit is in capability subclass VII_s, nonirrigated. The Las Vegas soil is in horticultural group 6, the McCarran soil is in horticultural group 4, and the Grapevine soil is in horticultural group 2.

X-305—Las Vegas-Destazo complex, 0 to 2 percent slopes. This map unit is on relict alluvial flats.

This unit is 60 percent Las Vegas gravelly fine sandy loam, 0 to 2 percent slopes, and 25 percent Destazo fine sandy loam, 0 to 2 percent slopes. These soils are in a random pattern on a relict surface and are topographically indistinguishable. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are about 5 percent Bluepoint soils on small sand sheets, 5 percent Glencarb soils on recent alluvial flats, and 5 percent Skyhaven soils on the relict alluvial flats. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Las Vegas soil is shallow and well drained. It formed in alluvium derived dominantly from limestone, dolomite, and some lacustrine sediment that has a high content of lime. Typically, about 25 percent of the surface is covered with a desert pavement of hardpan fragments and pebbles. The surface layer is very pale brown gravelly fine sandy loam about 2 inches thick. The upper 6 inches of the underlying material is very pale brown fine sandy loam, and the next 4 inches is very pale brown gravelly sandy clay loam and gravelly loam. An indurated, lime-cemented hardpan is at a depth of about 12 inches. Depth to the hardpan ranges from 3 to 14 inches.

Permeability of the Las Vegas soil is moderately slow above the hardpan. Available water capacity is very low. Effective rooting depth is 3 to 14 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is subject to rare periods of flooding during prolonged, high-intensity storms. Channeling and deposition are common along streambanks.

The Destazo soil is very deep and well drained. It formed in alluvium derived dominantly from limestone, dolomite, and sediment that has a high content of lime. Typically, about 25 percent of the surface is covered with a desert pavement of pebbles and lime nodules. The surface layer is very pale brown fine sandy loam about 11 inches thick. The upper 40 inches of the underlying material is stratified very pale brown to white very gravelly to extremely gravelly sandy clay loam,

averaging very gravelly sandy clay loam, and the lower part to a depth of 62 inches is light brown sandy loam.

Permeability of the Destazo soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is subject to rare periods of flooding during prolonged, high-intensity storms. Channeling and deposition are common along streambanks.

This unit is used mainly as habitat for desert wildlife and for recreation. It is also used for urban development.

The main limitations for construction of dwellings are the hazard of flooding and the limited depth to the hardpan in the Las Vegas soil. Dikes and channels that have outlets for floodwater can be used to protect buildings from flooding. Excavation for building sites is limited by the hardpan. Heavy equipment is needed for excavation.

The main limitations for septic tank absorption fields are the limited depth to the hardpan in the Las Vegas soil and the restricted permeability of the Destazo soil. Special design of septic tank absorption fields is needed. Heavy equipment is needed for excavation. Using long absorption lines and backfilling the trench with sandy material help to compensate for the restricted permeability.

This unit is limited for roads because of the limited depth to the hardpan in the Las Vegas soil. Roads should be designed to minimize cuts. Heavy equipment is needed for excavation.

The main limitations for lawns and landscaping are the limited depth to the hardpan in the Las Vegas soil and the moderate available water capacity of the Destazo soil. It is difficult to establish plants in areas where the pan is exposed. Mulching and fertilizing cut areas help to establish plants. Frequent irrigation of lawns, gardens, and most other plantings is needed because of the limited available water capacity of the soil. Lawn grasses, shrubs, and trees that are not sensitive to lime-induced chlorosis are well suited to use in landscaping. Annual applications of iron chelates reduce the effects of chlorosis.

This map unit is in capability subclass VII_s, nonirrigated. The Las Vegas soil is in horticultural group 6, and the Destazo soil is in horticultural group 2.

307—Las Vegas-Skyhaven complex, 0 to 4 percent slopes. This map unit is on relict alluvial flats.

This unit is 60 percent Las Vegas gravelly fine sandy loam, 0 to 4 percent slopes, and 30 percent Skyhaven very fine sandy loam, 0 to 4 percent slopes. The Las Vegas and Skyhaven soils are in a random pattern on relict alluvial flats and are topographically indistinguishable. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Existing Condition HEC-1 Model

The logo for S-I-G Group, featuring the letters 'S', 'I', and 'G' in a large, bold, sans-serif font, with a vertical line separating 'I' from 'G'. Below this, the word 'GROUP' is written in a smaller, all-caps, sans-serif font.

CONSULTING ENGINEERS & PLANNERS

Description: MGL1101-000

File Name: MGL1101-000 Standard Form 4

Bv: RFF

Date: Sep-11

[illegible]

Soil & Curve Number Computation

Project Name: Tropical Pkwy

Date: 9/22/2011

File Name: MGL1101-000

By: RFF

Reference:

Exhibit G
SCS Soil Data

Data:

Soil Type & Description	A	B	C	D
301 Las Vegas gravelly fine sandy loam, 2 to 4 percent slopes	0%	5%	0%	95%
305 Las Vegas-Destazo complex, 0 to 2 percent slopes	5%	30%	5%	60%

Land Use	A	B	C	D
Desert Shrub (poor)	63	77	85	88
Commercial	89	92	94	95
Roadway	98	98	98	98

BASIN ID	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP				LAND USE CN				SUBAREA ACRES	CALCULATED CN
				A	B	C	D	A	B	C	D		
OF_2E	301	3.5%	Desert Shrub (poor)	0%	5%	0%	95%	63	77	85	88	0.30	3.03
	305	96.5%	Desert Shrub (poor)	5%	30%	5%	60%	63	77	85	88	8.35	80.41
TOTAL PERCENT			100.0%					TOTAL AREA				8.65	83.44

BASIN ID	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP				LAND USE CN				SUBAREA ACRES	CALCULATED CN
				A	B	C	D	A	B	C	D		
ON_1E	305	100.0%	Desert Shrub (poor)	5%	30%	5%	60%	63	77	85	88	1.54	83.30
	TOTAL AREA												83.30
TOTAL PERCENT			100.0%									1.54	83.30

BASIN ID	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP				LAND USE CN				SUBAREA ACRES	CALCULATED CN
				A	B	C	D	A	B	C	D		
ON_2E	305	100.0%	Desert Shrub (poor)	5%	30%	5%	60%	63	77	85	88	10.00	83.30
	TOTAL AREA												83.30
TOTAL PERCENT			100.0%									10.00	83.30

BASIN ID	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP				LAND USE CN				SUBAREA ACRES	CALCULATED CN
				A	B	C	D	A	B	C	D		
DEC_5	305	30.3%	Roadway	5%	30%	5%	60%	98	98	98	98	0.23	29.66
	301	69.7%	Roadway	0%	5%	0%	95%	98	98	98	98	0.53	68.34
TOTAL PERCENT			30.3%					TOTAL AREA				0.76	98.00

BASIN ID	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP				LAND USE CN				SUBAREA ACRES	CALCULATED CN
				A	B	C	D	A	B	C	D		
TROP_1	301	28.8%	Roadway	0%	5%	0%	95%	98	98	98	98	0.59	28.20
	305	71.2%	Roadway	5%	30%	5%	60%	98	98	98	98	1.46	69.80
TOTAL PERCENT			100.0%					TOTAL AREA				2.05	98.00

BASIN ID	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP				LAND USE CN				SUBAREA ACRES	CALCULATED CN
				A	B	C	D	A	B	C	D		
CENT_2	305	100.0%	Roadway	5%	30%	5%	60%	98	98	98	98	0.14	98.00
	TOTAL AREA												98.00
TOTAL PERCENT			100.0%									0.14	98.00

BASIN ID	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP				LAND USE CN				SUBAREA ACRES	CALCULATED CN
				A	B	C	D	A	B	C	D		
RICE-1	305	100.0%	Roadway	5%	30%	5%	60%	98	98	98	98	0.90	98.00
	TOTAL AREA												98.00
TOTAL PERCENT			100.0%									0.90	98.00

EXISTING.OUT

 * FLOOD HYDROGRAPH PACKAGE (HEC-1) *
 * JUN 1998 *
 * VERSION 4.1 *
 * RUN DATE 23SEP11 TIME 14:22:36 *

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

```

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

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.
 THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
 THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
 NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
 DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
 KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

HEC-1 INPUT

PAGE 1

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

*DIAGRAM
 1 ID PROJECT NAME
 2 ID TECHNICAL DRAINAGE STUDY
 3 ID EXISTING CONDITION
 4 ID
 5 ID RETURN PERIOD ----- 10- AND 100-YEAR
 6 ID DISTRIBUTION ----- 6-HOUR SDN3
 7 ID PROJECT NO. ----- MGL1101.000
 8 ID FILENAME ----- EXISTING.H1
 9 ID DATE ----- SEPTEMBER 2011
 10 ID MODELED BY ----- SLATER HANIFAN GROUP
 11 ID
 12 ID SIX HOUR DEPTH-AREA REDUCTION FACTORS
 13 ID DRAINAGE AREA (MIA^2) DARF
 14 ID 100-YR 0.990
 15 ID 10-YR 0.570
 16 ID
 17 IT 5 0 0 300
 18 IO 5 0 0
 19 IN 5 0 0
 20 JR PREC 0.990 0.570
 *

21 KK DEC4
 22 BA .0034
 23 PB 2.77
 24 PC 0 0.020 0.057 0.070 0.087 0.108 0.124 0.130 0.130 0.130
 25 PC 0.130 0.130 0.130 0.133 0.140 0.142 0.148 0.158 0.172 0.181
 26 PC 0.190 0.197 0.199 0.200 0.201 0.204 0.214 0.229 0.241 0.249
 27 PC 0.251 0.256 0.270 0.278 0.281 0.283 0.295 0.322 0.352 0.409
 28 PC 0.499 0.590 0.710 0.744 0.781 0.812 0.819 0.835 0.851 0.856
 29 PC 0.860 0.868 0.876 0.888 0.910 0.926 0.937 0.950 0.970 0.976
 30 PC 0.982 0.985 0.987 0.989 0.990 0.993 0.993 0.994 0.995 0.998
 31 PC 0.998 0.999 1.000
 32 LS 0 98.0
 33 UD 0.136
 *

34 KK DEC3
 35 BA .0012
 36 LS 0 98.0
 37 UD 0.100
 *

38 KK CP.E1
 39 KM COMBINATION POINT AT INTERSECTION DECATUR & TROPICAL
 40 HC 2
 *

41 KK .005
 42 BA .0024
 43 LS 0 98.0
 44 UD 0.100
 *

HEC-1 INPUT

PAGE 2

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

45 KK CP.E2
 46 KM COMBINATION POINT EAST OF C-STORE IN TROPICAL
 47 HC 2
 *

48 KK TROP1
 49 BA .0032
 50 LS 0 98.0
 51 UD 0.139

EXISTING.OUT

```

*
52      KK      ON1E
53      BA      .0024
54      LS      0      83.3
55      UD      0.100
*
56      KK      ON2E
57      BA      .0152
58      LS      0      83.3
59      UD      0.212
*
60      KK      CP.E3
61      KM      COMBINATION POINT JUST W OF CENT PKWY IN TROPICAL
62      HC      4
*
63      KK      RH.5D
64      KM      BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
65      BA      .0032
66      LS      0      91.0
67      UD      0.098
*
68      KK      RH.6D
69      KM      BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
70      BA      .0050
71      LS      0      91.0
72      UD      0.107
*
73      KK      CP.D6
74      KM      COMBINATION POINT AT INTERSECTION TWILIGHT
75      KM      COMBINATION POINT REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
76      HC      2
*
77      KK      RH.4D
78      BA      .0005
79      LS      0      91.0
80      UD      0.069
*

```

HEC-1 INPUT

PAGE 3

1

```

LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
81      KK      CENT2
82      KM      BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
83      BA      .0026
84      LS      0      98.0
85      UD      0.082
*
86      KK      CENT4
87      BA      .0002
88      LS      0      98.0
89      UD      0.100
*
90      KK      CP.D7
91      KM      COMBINATION POINT NORTH OF INTERSECTION OF CENT PKWY IN TROPICAL
92      HC      4
*
93      KK      CP.E5
94      KM      COMBINATION POINT AT INTERSECTION OF CENT PKWY IN TROPICAL
95      HC      2
*
96      KK      OF.2E
97      KM      OFFSITE BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
98      BA      .0135
99      LS      0      83.4
100     UD      0.166
*
101     KK      RIC1
102     BA      .0014
103     LS      0      98.0
104     UD      0.100
*
105     KK      CP.E8
106     KM      COMBINATION POINT IN RICE
107     HC      2
*
108     ZZ

```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

```

INPUT LINE      (V) ROUTING      (--->) DIVERSION OR PUMP FLOW
NO.      (.) CONNECTOR      (<---) RETURN OF DIVERTED OR PUMPED FLOW
21      DEC4
.
.
34      .      DEC3
.
.
38      CP.E1.....
.
.

```

EXISTING.OUT

```

41      .      005
45      CP.E2.....
48      .      TROP1
52      .      .      ON1E
56      .      .      .      ON2E
60      CP.E3.....
63      .      RH.5D
68      .      .      RH.6D
73      .      CP.D6.....
77      .      .      RH.4D
81      .      .      .      CENT2
86      .      .      .      .      CENT4
90      .      CP.D7.....
93      CP.E5.....
96      .      OF.2E
101     .      .      RIC1
105     .      CP.E8.....

```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
 1*****
 * FLOOD HYDROGRAPH PACKAGE (HEC-1)
 * JUN 1998
 * VERSION 4.1
 * RUN DATE 23SEP11 TIME 14:22:36
 *

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

PROJECT NAME
 TECHNICAL DRAINAGE STUDY
 EXISTING CONDITION
 RETURN PERIOD ----- 10- AND 100-YEAR
 DISTRIBUTION ----- 6-HOUR SDN3
 PROJECT NO. ----- MGL1101.000
 FILENAME ----- EXISTING.H1
 DATE ----- SEPTEMBER 2011
 MODELED BY ----- SLATER HANIFAN GROUP

SIX HOUR DEPTH-AREA REDUCTION FACTORS
 DRAINAGE AREA (MI^2) DARF
 100-YR 0.990
 10-YR 0.570

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

COMPUTATION INTERVAL .08 HOURS
 TOTAL TIME BASE 24.92 HOURS

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

EXISTING.OUT

TEMPERATURE DEGREES FAHRENHEIT

JP MULTI-PLAN OPTION
NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
RATIOS OF PRECIPITATION
.99 .57

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 .99	RATIO 2 .57
HYDROGRAPH AT +	DEC4	.00	1	FLOW TIME	6. 3.58	3. 3.58
HYDROGRAPH AT +	DEC3	.00	1	FLOW TIME	2. 3.50	1. 3.50
2 COMBINED AT +	CP.E1	.00	1	FLOW TIME	8. 3.58	5. 3.58
HYDROGRAPH AT +	005	.00	1	FLOW TIME	5. 3.50	3. 3.50
2 COMBINED AT +	CP.E2	.01	1	FLOW TIME	13. 3.50	7. 3.50
HYDROGRAPH AT +	TROP1	.00	1	FLOW TIME	6. 3.58	3. 3.58
HYDROGRAPH AT +	ON1E	.00	1	FLOW TIME	3. 3.50	1. 3.58
HYDROGRAPH AT +	ON2E	.02	1	FLOW TIME	14. 3.67	5. 3.67
4 COMBINED AT +	CP.E3	.03	1	FLOW TIME	35. 3.58	16. 3.58
HYDROGRAPH AT +	RH.5D	.00	1	FLOW TIME	5. 3.50	2. 3.50
HYDROGRAPH AT +	RH.6D	.00	1	FLOW TIME	8. 3.50	4. 3.50
2 COMBINED AT +	CP.D6	.01	1	FLOW TIME	13. 3.50	6. 3.50
HYDROGRAPH AT +	RH.4D	.00	1	FLOW TIME	1. 3.50	0. 3.50
HYDROGRAPH AT +	CENT2	.00	1	FLOW TIME	5. 3.50	3. 3.50
HYDROGRAPH AT +	CENT4	.00	1	FLOW TIME	0. 3.50	0. 3.50
4 COMBINED AT +	CP.D7	.01	1	FLOW TIME	20. 3.50	10. 3.50
2 COMBINED AT +	CP.E5	.04	1	FLOW TIME	53. 3.58	25. 3.58
HYDROGRAPH AT +	OF.2E	.01	1	FLOW TIME	14. 3.58	5. 3.58
HYDROGRAPH AT +	RIC1	.00	1	FLOW TIME	3. 3.50	2. 3.50
2 COMBINED AT +	CP.E8	.01	1	FLOW TIME	17. 3.58	6. 3.58

Plus 267/62 → 280/69

Plus 267/62 → 302/78

Plus 267/62 → 320/87

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

Interim Condition HEC-1 Model

The logo for G-I Group, featuring the letters 'G-I' in a large, bold, sans-serif font, with 'GROUP' in a smaller, all-caps, sans-serif font to the right.

Project Name: TROPICAL PKWY REALIGNMENT

Description: MGL1101-000

File Name: MGL1101-000 Standard Form 4

By: RFF

Date: Sep-11

[illegible]

INTERIM.OUT

1*****
 * FLOOD HYDROGRAPH PACKAGE (HEC-1) *
 * JUN 1998 *
 * VERSION 4.1 *
 * RUN DATE 23SEP11 TIME 14:23:10 *

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

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.
 THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
 THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
 NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE, SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
 DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
 KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

PAGE 1

1

HEC-1 INPUT

LINE	ID	1	2	3	4	5	6	7	8	9	10
1	ID	*DIAGRAM									
2	ID	PROJECT NAME									
3	ID	TECHNICAL DRAINAGE STUDY									
4	ID	EXISTING CONDITION									
5	ID	RETURN PERIOD ----- 10- AND 100-YEAR									
6	ID	DISTRIBUTION ----- 6-HOUR SDN3									
7	ID	PROJECT NO. ----- MGL1101.000									
8	ID	FILENAME ----- INTERIM.H1									
9	ID	DATE ----- SEPTEMBER 2011									
10	ID	MODELED BY ----- SLATER HANIFAN GROUP									
11	ID	SIX HOUR DEPTH-AREA REDUCTION FACTORS									
12	ID	DRAINAGE AREA (MIA2) DARF									
13	ID	100-YR 0.990									
14	ID	10-YR 0.570									
15	ID										
16	ID	5	0	0	300						
17	IT	5	0	0							
18	IO	5	0	0							
19	IN										
20	JR	PREC	0.990	0.570							
21	KK	DEC4									
22	BA	.0034									
23	PB	2.77									
24	PC	0	0.020	0.057	0.070	0.087	0.108	0.124	0.130	0.130	
25	PC	0.130	0.130	0.130	0.133	0.140	0.142	0.148	0.158	0.172	
26	PC	0.190	0.197	0.199	0.200	0.201	0.204	0.214	0.229	0.241	
27	PC	0.251	0.256	0.270	0.278	0.281	0.283	0.295	0.322	0.352	
28	PC	0.499	0.590	0.710	0.744	0.781	0.812	0.819	0.835	0.851	
29	PC	0.860	0.868	0.876	0.888	0.910	0.926	0.937	0.950	0.970	
30	PC	0.982	0.985	0.987	0.989	0.990	0.993	0.993	0.994	0.995	
31	PC	0.998	0.999	1.000							
32	LS	0	98.0								
33	UD	0.136									
34	KK	DEC3									
35	BA	.0012									
36	LS	0	98.0								
37	UD	0.100									
38	KK	CP.I1									
39	KM	COMBINATION POINT AT INTERSECTION DECATUR & TROPICAL									
40	HC	2									
41	KK	.005									
42	BA	.0024									
43	LS	0	98.0								
44	UD	0.100									

PAGE 2

1

HEC-1 INPUT

LINE	ID	1	2	3	4	5	6	7	8	9	10
45	KK	CP.I2									
46	KM	COMBINATION POINT EAST OF C-STORE IN TROPICAL									
47	HC	2									
48	KK	TROP1									
49	BA	.0042									
50	LS	0	98.0								
51	UD	0.140									

INTERIM.OUT

```

*
52      KK  ON1I
53      BA  .0024
54      LS      0      83.3
55      UD  0.100
      *

56      KK  ON2I
57      BA  .0135
58      LS      0      83.3
59      UD  0.212
      *

60      KK  CP.I3
61      KM  COMBINATION POINT JUST W OF CENT PKWY IN TROPICAL
62      HC      4
      *

63      KK  RH.5D
64      KM  BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
65      BA  .0032
66      LS      0      91.0
67      UD  0.098
      *

68      KK  RH.6D
69      KM  BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
70      BA  .0050
71      LS      0      91.0
72      UD  0.107
      *

73      KK  CP.D6
74      KM  COMBINATION POINT AT INTERSECTION TWILIGHT
75      KM  COMBINATION POINT REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
76      HC      2
      *

77      KK  RH.4D
78      BA  .0005
79      LS      0      91.0
80      UD  0.069
      *

```

PAGE 3

HEC-1 INPUT

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

```

81      KK  CENT2
82      KM  BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
83      BA  .0026
84      LS      0      98.0
85      UD  0.082
      *

86      KK  CENT4
87      BA  .0006
88      LS      0      98.0
89      UD  0.100
      *

90      KK  CP.D7
91      KM  COMBINATION POINT NORTH OF INTERSECTION OF CENT PKWY IN TROPICAL
92      HC      4
      *

93      KK  CP.I5
94      KM  COMBINATION POINT AT INTERSECTION OF CENT PKWY IN TROPICAL
95      HC      2
      *

96      KK  OF.2I
97      KM  OFFSITE BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
98      BA  .0135
99      LS      0      83.4
100     UD  0.166
      *

101     KK  RIC1
102     BA  .0014
103     LS      0      98.0
104     UD  0.100
      *

105     KK  CP.I8
106     KM  COMBINATION POINT IN RICE
107     HC      2
      *

108     ZZ

```

SCHEMATIC DIAGRAM OF STREAM NETWORK

1
INPUT
LINE (V) ROUTING (--->) DIVERSION OR PUMP FLOW
NO. (.) CONNECTOR (<---) RETURN OF DIVERTED OR PUMPED FLOW

```

21      DEC4
      .
34      .      DEC3
      .
38      CP.I1.....
      .

```

INTERIM.OUT

```

41      .      005
45      CP.I2.....
48      .      TROP1
52      .      .      ON1I
56      .      .      .      ON2I
60      CP.I3.....
63      .      RH.5D
68      .      .      RH.6D
73      .      CP.D6.....
77      .      .      RH.4D
81      .      .      .      CENT2
86      .      .      .      .      CENT4
90      .      CP.D7.....
93      CP.I5.....
96      .      OF.2I
101     .      .      RIC1
105     .      CP.I8.....
  
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```

1*****
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
*   JUN 1998
*   VERSION 4.1
* RUN DATE 23SEP11 TIME 14:23:10
*****
  
```

```

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

```

PROJECT NAME
TECHNICAL DRAINAGE STUDY
EXISTING CONDITION

RETURN PERIOD ----- 10- AND 100-YEAR
DISTRIBUTION ----- 6-HOUR SDN3
PROJECT NO. ----- MGL1101.000
FILENAME ----- EXISTING.H1
DATE ----- SEPTEMBER 2011
MODELED BY ----- SLATER HANIFAN GROUP
  
```

```

SIX HOUR DEPTH-AREA REDUCTION FACTORS
DRAINAGE AREA (MIA2)      DARF
100-YR                    0.990
10-YR                     0.570
  
```

```

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

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

          COMPUTATION INTERVAL      .08 HOURS
          TOTAL TIME BASE      24.92 HOURS
  
```

```

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

TEMPERATURE DEGREES FAHRENHEIT INTERIM.OUT
 JP MULTI-PLAN OPTION 1 NUMBER OF PLANS
 JR MULTI-RATIO OPTION
 RATIOS OF PRECIPITATION
 .99 .57

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	FLOW TIME	RATIOS APPLIED TO PRECIPITATION	
					RATIO 1 .99	RATIO 2 .57
HYDROGRAPH AT +	DEC4	.00	1	6. 3.58	3. 3.58	
HYDROGRAPH AT +	DEC3	.00	1	2. 3.50	1. 3.50	
2 COMBINED AT +	CP.I1	.00	1	8. 3.58	5. 3.58	plus 267/62 → 275/67
HYDROGRAPH AT +	005	.00	1	5. 3.50	3. 3.50	
2 COMBINED AT +	CP.I2	.01	1	13. 3.50	7. 3.50	plus 267/62 → 280/69
HYDROGRAPH AT +	TROP1	.00	1	8. 3.58	4. 3.58	
HYDROGRAPH AT +	ON1I	.00	1	3. 3.50	1. 3.58	
HYDROGRAPH AT +	ON2I	.01	1	13. 3.67	4. 3.67	
4 COMBINED AT +	CP.I3	.03	1	35. 3.58	16. 3.58	plus 267/62 → 302/78
HYDROGRAPH AT +	RH.5D	.00	1	5. 3.50	2. 3.50	
HYDROGRAPH AT +	RH.6D	.00	1	8. 3.50	4. 3.50	
2 COMBINED AT +	CP.D6	.01	1	13. 3.50	6. 3.50	
HYDROGRAPH AT +	RH.4D	.00	1	1. 3.50	0. 3.50	
HYDROGRAPH AT +	CENT2	.00	1	5. 3.50	3. 3.50	
HYDROGRAPH AT +	CENT4	.00	1	1. 3.50	1. 3.50	
4 COMBINED AT +	CP.D7	.01	1	21. 3.50	10. 3.50	
2 COMBINED AT +	CP.I5	.04	1	54. 3.58	26. 3.58	plus 267/62 → 321/88
HYDROGRAPH AT +	OF.2I	.01	1	14. 3.58	5. 3.58	
HYDROGRAPH AT +	RIC1	.00	1	3. 3.50	2. 3.50	
2 COMBINED AT +	CP.I8	.01	1	17. 3.58	6. 3.58	

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

Future Condition HEC-1 Model

**SLATER
HANIFAN
GROUP**

Project Name: TROPICAL PKWY REALIGNMENT

Description: MGL1101-000

File Name: MGL1101-000 Standard Form 4

BV: RFF

Date: Sep-11

[illegible]

DEVELOPED.OUT

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

1*****
 * FLOOD HYDROGRAPH PACKAGE (HEC-1) *
 * JUN 1998 *
 * VERSION 4.1 *
 * RUN DATE 23SEP11 TIME 15:02:32 *

```

      X  X  XXXXXX  XXXXX  X
      X  X  X      X      XX
      X  X  X      X      X
      XXXXXX XXXX  X      XXXXX
      X  X  X      X      X
      X  X  X      X      X
      X  X  XXXXXX  XXXXX  XXX
  
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.
 THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
 THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
 NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE, SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
 DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
 KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

PAGE 1

1

HEC-1 INPUT

LINE	ID	1	2	3	4	5	6	7	8	9	10
1	ID	*DIAGRAM									
2	ID	PROJECT NAME									
3	ID	TECHNICAL DRAINAGE STUDY									
4	ID	EXISTING CONDITION									
5	ID	RETURN PERIOD ----- 10- AND 100-YEAR									
6	ID	DISTRIBUTION ----- 6-HOUR SDN3									
7	ID	PROJECT NO. ----- MGL1101.000									
8	ID	FILENAME ----- DEVELOPED.H1									
9	ID	DATE ----- SEPTEMBER 2011									
10	ID	MODELED BY ----- SLATER HANIFAN GROUP									
11	ID	SIX HOUR DEPTH-AREA REDUCTION FACTORS									
12	ID	DRAINAGE AREA (MIA2) DARF									
13	ID	100-YR 0.990									
14	ID	10-YR 0.570									
15	ID										
16	ID	5	0	0	300						
17	IT	5	0	0							
18	IO	5	0	0							
19	IN	5	0	0							
20	JR	PREC	0.990	0.570							
21	KK	DEC4									
22	BA	.0034									
23	PB	2.77									
24	PC	0	0.020	0.057	0.070	0.087	0.108	0.124	0.130	0.130	
25	PC	0.130	0.130	0.130	0.133	0.140	0.142	0.148	0.158	0.172	
26	PC	0.190	0.197	0.199	0.200	0.201	0.204	0.214	0.229	0.241	
27	PC	0.251	0.256	0.270	0.278	0.281	0.283	0.295	0.322	0.352	
28	PC	0.499	0.590	0.710	0.744	0.781	0.812	0.819	0.835	0.851	
29	PC	0.860	0.868	0.876	0.888	0.910	0.926	0.937	0.950	0.970	
30	PC	0.982	0.985	0.987	0.989	0.990	0.993	0.993	0.994	0.995	
31	PC	0.998	0.999	1.000							
32	LS	0	98.0								
33	UD	0.136									
34	KK	DEC3									
35	BA	.0012									
36	LS	0	98.0								
37	UD	0.100									
38	KK	CP.D1									
39	KM	COMBINATION POINT AT INTERSECTION DECATUR & TROPICAL									
40	HC	2									
41	KK	.005									
42	BA	.0024									
43	LS	0	98.0								
44	UD	0.100									

PAGE 2

1

HEC-1 INPUT

LINE	ID	1	2	3	4	5	6	7	8	9	10
45	KK	CP.D2									
46	KM	COMBINATION POINT EAST OF C-STORE IN TROPICAL									
47	HC	2									
48	KK	TROP1									
49	BA	.0042									
50	LS	0	98.0								
51	UD	0.140									

Page 1

DEVELOPED.OUT

```

*
52      KK  ONID
53      BA  .0024
54      LS      0      98.0
55      UD  0.100
      *

56      KK  ON2D
57      BA  .0135
58      LS      0      98.0
59      UD  0.212
      *

60      KK  CP.D3
61      KM  COMBINATION POINT JUST W OF CENT PKWY IN TROPICAL
62      HC      4
      *

63      KK  RH.5D
64      KM  BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
65      BA  .0032
66      LS      0      91.0
67      UD  0.098
      *

68      KK  RH.6D
69      KM  BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
70      BA  .0050
71      LS      0      91.0
72      UD  0.107
      *

73      KK  CP.D6
74      KM  COMBINATION POINT AT INTERSECTION TWILIGHT
75      KM  COMBINATION POINT REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
76      HC      2
      *

77      KK  RH.4D
78      BA  .0005
79      LS      0      91.0
80      UD  0.069
      *

```

PAGE 3

HEC-1 INPUT

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

```

LINE
81      KK  CENT2
82      KM  BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
83      BA  .0026
84      LS      0      98.0
85      UD  0.082
      *

86      KK  CENT4
87      BA  .0006
88      LS      0      98.0
89      UD  0.100
      *

90      KK  CP.D7
91      KM  COMBINATION POINT NORTH OF INTERSECTION OF CENT PKWY IN TROPICAL
92      HC      4
      *

93      KK  CP.D5
94      KM  COMBINATION POINT AT INTERSECTION OF CENT PKWY IN TROPICAL
95      HC      2
      *

96      KK  OF.2D
97      KM  OFFSITE BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
98      BA  .0135
99      LS      0      98.0
100     UD  0.166
      *

101     KK  RIC1
102     BA  .0014
103     LS      0      98.0
104     UD  0.100
      *

105     KK  CP.D8
106     KM  COMBINATION POINT IN RICE
107     HC      2
      *

108     ZZ

```

1 SCHEMATIC DIAGRAM OF STREAM NETWORK

```

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

21      DEC4
      .
34      .      DEC3
      .
38      CP.D1.....
      .

```

DEVELOPED.OUT

```

41      .      005
45      CP.D2.....
48      .      TROP1
52      .      .      ON1D
56      .      .      ON2D
60      CP.D3.....
63      .      RH.5D
68      .      .      RH.6D
73      .      CP.D6.....
77      .      .      RH.4D
81      .      .      .      CENT2
86      .      .      .      .      CENT4
90      .      CP.D7.....
93      CP.D5.....
96      .      OF.2D
101     .      .      RIC1
105     .      CP.D8.....
  
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
 1*****
 * FLOOD HYDROGRAPH PACKAGE (HEC-1) *
 * JUN 1998 *
 * VERSION 4.1 *
 * RUN DATE 23SEP11 TIME 15:02:32 *

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

PROJECT NAME
 TECHNICAL DRAINAGE STUDY
 EXISTING CONDITION
 RETURN PERIOD ----- 10- AND 100-YEAR
 DISTRIBUTION ----- 6-HOUR SDN3
 PROJECT NO. ----- MGL1101.000
 FILENAME ----- DEVELOPED.H1
 DATE ----- SEPTEMBER 2011
 MODELED BY ----- SLATER HANIFAN GROUP

SIX HOUR DEPTH-AREA REDUCTION FACTORS
 DRAINAGE AREA (MI^2) DARF
 100-YR 0.990
 10-YR 0.570

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

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

TEMPERATURE	DEGREES FAHRENHEIT
MULTI-PLAN OPTION NPLAN	1 NUMBER OF PLANS

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 .99	RATIO 2 .57
HYDROGRAPH AT +	DEC4	.00	1 FLOW TIME	6. 3.58	3. 3.58
HYDROGRAPH AT +	DEC3	.00	1 FLOW TIME	2. 3.50	1. 3.50
2 COMBINED AT +	CP.D1	.00	1 FLOW TIME	8. 3.58	5. 3.58
HYDROGRAPH AT +	005	.00	1 FLOW TIME	5. 3.50	3. 3.50
2 COMBINED AT +	CP.D2	.01	1 FLOW TIME	13. 3.50	7. 3.50
HYDROGRAPH AT +	TROP1	.00	1 FLOW TIME	8. 3.58	4. 3.58
HYDROGRAPH AT +	ON1D	.00	1 FLOW TIME	5. 3.50	3. 3.50
HYDROGRAPH AT +	ON2D	.01	1 FLOW TIME	22. 3.58	12. 3.58
4 COMBINED AT +	CP.D3	.03	1 FLOW TIME	46. 3.58	26. 3.58
HYDROGRAPH AT +	RH.5D	.00	1 FLOW TIME	5. 3.50	2. 3.50
HYDROGRAPH AT +	RH.6D	.00	1 FLOW TIME	8. 3.50	4. 3.50
2 COMBINED AT +	CP.D6	.01	1 FLOW TIME	13. 3.50	6. 3.50
HYDROGRAPH AT +	RH.4D	.00	1 FLOW TIME	1. 3.50	0. 3.50
HYDROGRAPH AT +	CENT2	.00	1 FLOW TIME	5. 3.50	3. 3.50
HYDROGRAPH AT +	CENT4	.00	1 FLOW TIME	1. 3.50	1. 3.50
4 COMBINED AT +	CP.D7	.01	1 FLOW TIME	21. 3.50	10. 3.50
2 COMBINED AT +	CP.D5	.04	1 FLOW TIME	65. 3.58	35. 3.58
HYDROGRAPH AT +	OF.2D	.01	1 FLOW TIME	24. 3.58	13. 3.58
HYDROGRAPH AT +	RIC1	.00	1 FLOW TIME	3. 3.50	2. 3.50
2 COMBINED AT +	CP.D8	.01	1 FLOW TIME	26. 3.58	15. 3.58

Pos $223/0 \rightarrow 231/5$

plus 223/0 $\rightarrow$ 236/7

p/05 223/0 $\rightarrow$ 269/26

plus $223/0 \rightarrow 288/35$

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

APPENDIX C

Hydraulic Analysis

Street Flow Computations

Tropical Pkwy Q10 EX Sec A Worksheet for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec A Q10 EX
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.70 %
Discharge	69.00 cfs

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

Results	
Mannings Coefficient	0.013
Water Surface Elevation	72.16 ft
Elevation Range	71.34 to 73.95
Flow Area	15.5 ft ²
Wetted Perimeter	48.83 ft
Top Width	48.23 ft
Actual Depth	0.82 ft
Critical Elevation	72.25 ft
Critical Slope	0.35 %
Velocity	4.44 ft/s
Velocity Head	0.31 ft
Specific Energy	72.46 ft
Froude Number	1.38
Flow Type	Supercritical

$$V \times D$$

$$4.44 \times 0.82 = 3.6$$

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+13.00	0.034
0+13.00	0+26.00	0.016
0+26.00	0+39.50	0.013
0+39.50	0+40.00	0.016
0+40.00	0+83.00	0.013
0+83.00	0+95.00	0.022

Day Lane

$$72.44 - 72.16 = 14'$$

$$0.02$$

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	73.95
0+08.00	71.72
0+13.00	72.09
0+26.00	72.44
0+26.00	72.78

Tropical Pkwy Q10 EX Sec A **Worksheet for Irregular Channel**

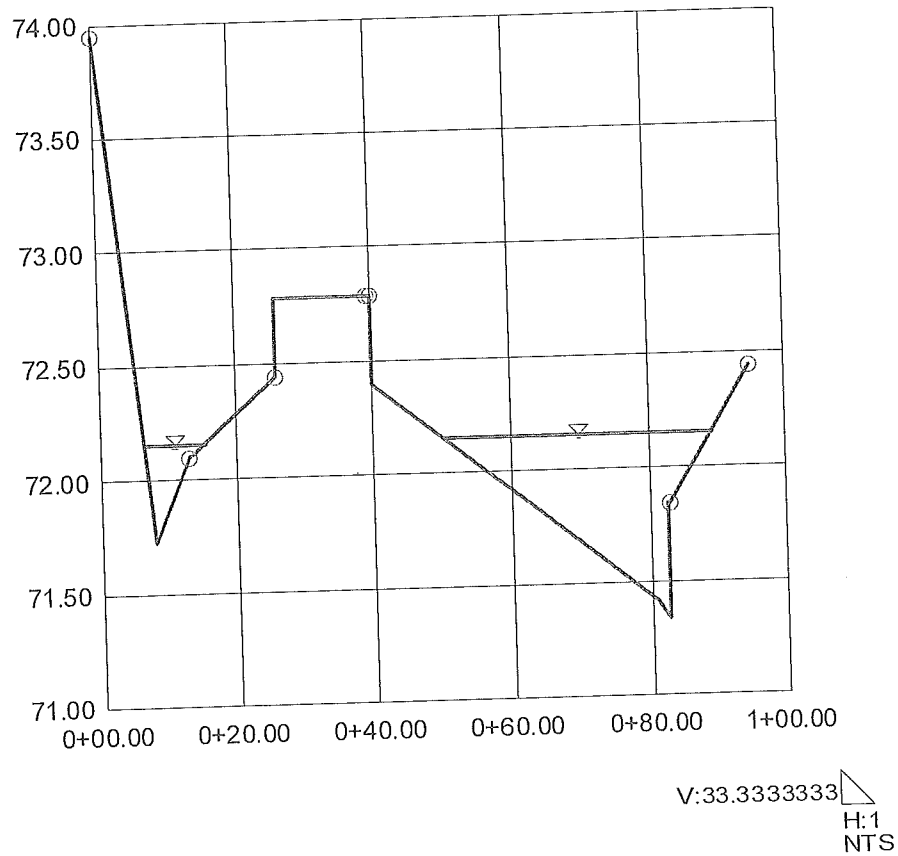
Natural Channel Points	
Station (ft)	Elevation (ft)
0+26.50	72.78
0+39.50	72.78
0+40.00	72.78
0+40.00	72.40
0+81.00	71.41
0+82.50	71.34
0+82.50	71.84
0+83.00	71.84
0+95.00	72.44

Tropical Pkwy Q10 Ex Sec A

Cross Section for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec A Q10 EX
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.013
Channel Slope	0.70 %
Water Surface Elevation	72.16 ft
Elevation Range	71.34 to 73.95
Discharge	69.00 cfs



Tropical Pkwy Q100 EX Sec A Worksheet for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec A Q100 EX
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.70 %
Discharge	280.00 cfs

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

Results	
Mannings Coefficient	0.014
Water Surface Elevation	72.60 ft
Elevation Range	71.34 to 73.95
Flow Area	45.5 ft ²
Wetted Perimeter	77.35 ft
Top Width	76.16 ft
Actual Depth	1.26 ft
Critical Elevation	72.79 ft
Critical Slope	0.34 %
Velocity	6.15 ft/s
Velocity Head	0.59 ft
Specific Energy	73.19 ft
Froude Number	1.40
Flow Type	Supercritical

Calculation Messages:
Water elevation exceeds lowest end station by 0.16109587 ft.
Flow is divided.

$$\frac{V \times D}{6.15 \times 1.26 = 7.75 \text{ ok}}$$

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+13.00	0.034
0+13.00	0+26.00	0.016
0+26.00	0+39.50	0.013
0+39.50	0+40.00	0.016
0+40.00	0+83.00	0.013
0+83.00	0+95.00	0.022

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	73.95
0+08.00	71.72
0+13.00	72.09
0+26.00	72.44

Tropical Pkwy Q100 EX Sec A **Worksheet for Irregular Channel**

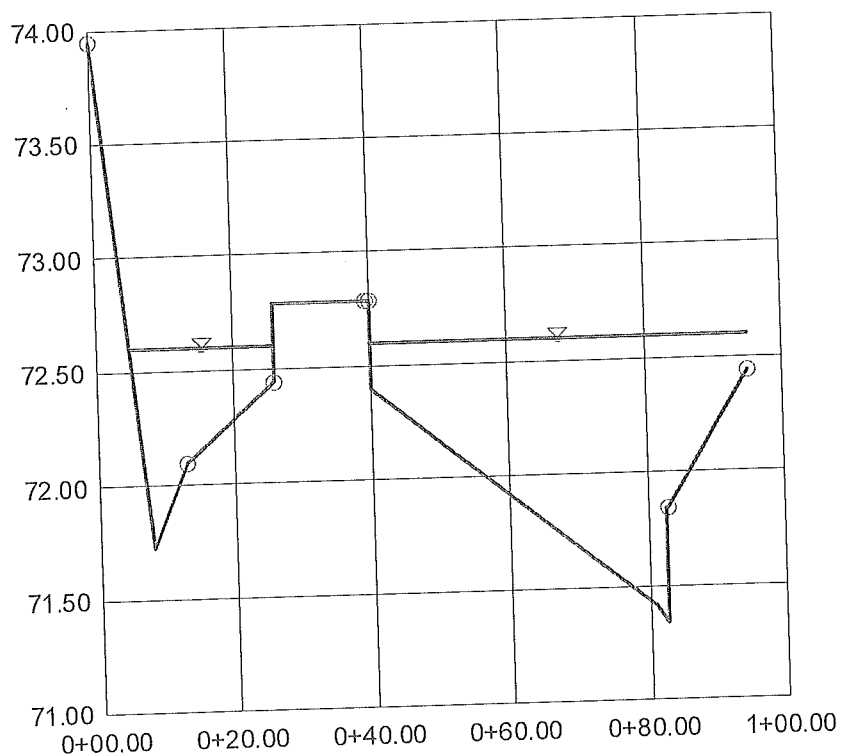
Natural Channel Points	
Station (ft)	Elevation (ft)
0+26.00	72.78
0+26.50	72.78
0+39.50	72.78
0+40.00	72.78
0+40.00	72.40
0+81.00	71.41
0+82.50	71.34
0+82.50	71.84
0+83.00	71.84
0+95.00	72.44

Tropical Pkwy Q100 Ex Sec A

Cross Section for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec A Q100 EX
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.014
Channel Slope	0.70 %
Water Surface Elevation	72.60 ft
Elevation Range	71.34 to 73.95
Discharge	280.00 cfs



V:33.3333333
H:1
NTS

Tropical Pkwy Sec B Q10 EX Worksheet for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec B Q1O EX
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.60 %
Discharge	78.00 cfs

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

Results	
Mannings Coefficient	0.018
Water Surface Elevation	66.91 ft
Elevation Range	66.21 to 67.02
Flow Area	18.7 ft ²
Wetted Perimeter	36.53 ft
Top Width	35.98 ft
Actual Depth	0.70 ft
Critical Elevation	66.92 ft
Critical Slope	0.58 %
Velocity	4.17 ft/s
Velocity Head	0.27 ft
Specific Energy	67.18 ft
Froude Number	1.02
Flow Type	Supercritical

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+04.00	0.022
0+04.00	0+29.50	0.016
0+29.50	0+30.00	0.013
0+30.00	0+40.00	0.022

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	67.02
0+04.00	66.30
0+18.00	66.21
0+29.50	66.25
0+29.50	66.74
0+30.00	66.74
0+40.00	67.00

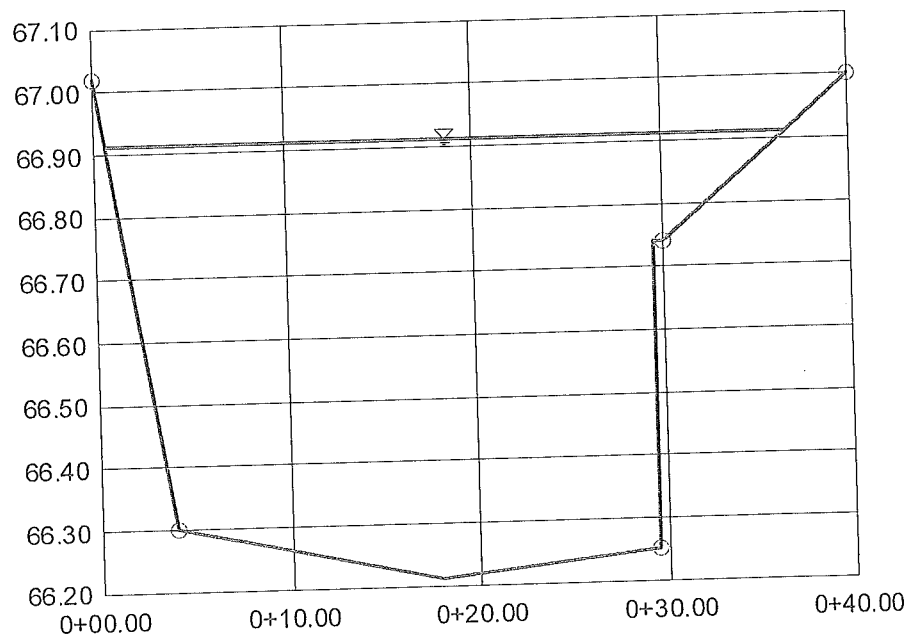
By Lane
66.71 - 66.30
5,02

Tropical Pkwy Sec B Q10 EX

Cross Section for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec B Q10 EX
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.018
Channel Slope	0.60 %
Water Surface Elevation	66.91 ft
Elevation Range	66.21 to 67.02
Discharge	78.00 cfs



V:33.3333333
H:1
NTS

Tropical Pkwy Sec B Q100 EX Worksheet for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec B Q100 EX
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.60 %
Discharge	302.00 cfs

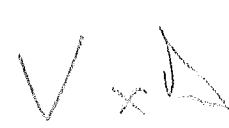
Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results	
Mannings Coefficient	0.016
Water Surface Elevation	67.49 ft
Elevation Range	66.21 to 67.02
Flow Area	41.7 ft ²
Wetted Perimeter	41.52 ft
Top Width	40.00 ft
Actual Depth	1.28 ft
Critical Elevation	67.66 ft
Critical Slope	0.37 %
Velocity	7.25 ft/s
Velocity Head	0.82 ft
Specific Energy	68.31 ft
Froude Number	1.25
Flow Type	Supercritical

Calculation Messages:
Water elevation exceeds lowest end station by 0.49015261 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+04.00	0.022
0+04.00	0+29.50	0.016
0+29.50	0+30.00	0.013
0+30.00	0+40.00	0.022

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	67.02
0+04.00	66.30
0+18.00	66.21
0+29.50	66.25
0+29.50	66.74
0+30.00	66.74
0+40.00	67.00



$$7.25 \times 1.28 = 9.3 \text{ ok}$$

Tropical Pkwy Sec B Q100 EX

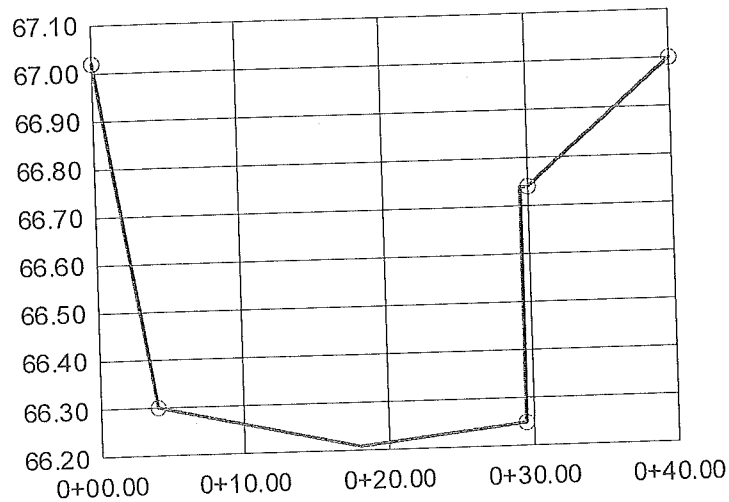
Cross Section for Irregular Channel

Project Description

Worksheet	Tropical Parkway Sec B Q100 EX
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data

Mannings Coefficient	0.016
Channel Slope	0.60 %
Water Surface Elevation	67.49 ft
Elevation Range	66.21 to 67.02
Discharge	302.00 cfs



V:33.3333333
H:1
NTS

Decatur Blvd Q10 EX Sec C

Worksheet for Irregular Channel

Project Description

Worksheet	Decatur Boulevard Q10 EX Sec C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data

Channel Slope	0.60 %
Discharge	4.00 cfs

Options

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

Results

Mannings Coefficient	0.021
Water Surface Elevation	77.70 ft
Elevation Range	77.38 to 81.53
Flow Area	2.6 ft ²
Wetted Perimeter	17.69 ft
Top Width	17.64 ft
Actual Depth	0.32 ft
Critical Elevation	77.66 ft
Critical Slope	1.32 %
Velocity	1.52 ft/s
Velocity Head	0.04 ft
Specific Energy	77.74 ft
Froude Number	0.69
Flow Type	Subcritical

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+00.50	0.013
0+00.50	0+25.00	0.016
0+25.00	0+43.00	0.033

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	78.41
0+00.50	78.41
0+00.50	77.91
0+25.00	77.48
0+29.00	77.38
0+43.00	81.53

Day Lane

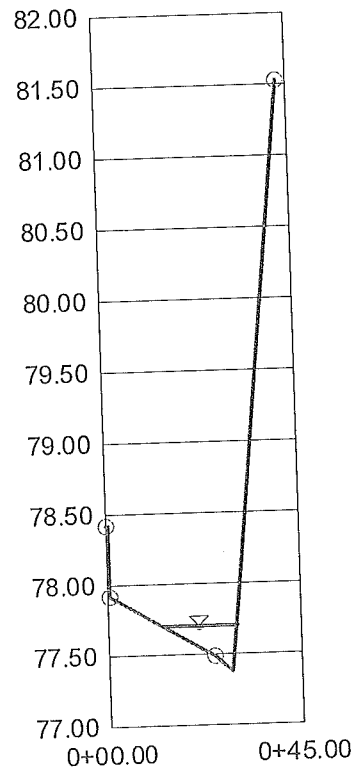
$$\frac{77.91 - 77.7}{0.02} = 10.5'$$

Decatur Blvd Q10 Ex Sec C

Cross Section for Irregular Channel

Project Description	
Worksheet	Decatur Boulevard Q10 EX Sec C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.021
Channel Slope	0.60 %
Water Surface Elevation	77.70 ft
Elevation Range	77.38 to 81.53
Discharge	4.00 cfs



V:33.3333333
H:1
NTS

Decatur Blvd Q100 EX Sec C

Worksheet for Irregular Channel

Project Description	
Worksheet	Decatur Boulevard Q100 EX Sec C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.60 %
Discharge	8.00 cfs

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

Results	
Mannings Coefficient	0.020
Water Surface Elevation	77.78 ft
Elevation Range	77.38 to 81.53
Flow Area	4.3 ft ²
Wetted Perimeter	22.64 ft
Top Width	22.58 ft
Actual Depth	0.40 ft
Critical Elevation	77.74 ft
Critical Slope	1.09 %
Velocity	1.87 ft/s
Velocity Head	0.05 ft
Specific Energy	77.84 ft
Froude Number	0.76
Flow Type	Subcritical

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+00.50	0.013
0+00.50	0+25.00	0.016
0+25.00	0+43.00	0.033

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	78.41
0+00.50	78.41
0+00.50	77.91
0+25.00	77.48
0+29.00	77.38
0+43.00	81.53

$$V \times D$$

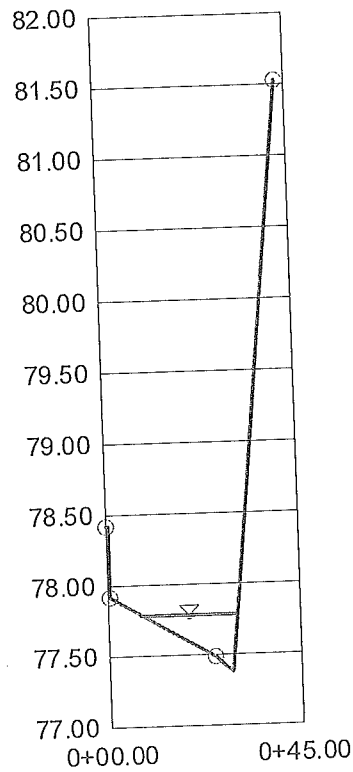
$$1.87 \times 0.40 = 0.748$$

Decatur Blvd Q100 Ex Sec C

Cross Section for Irregular Channel

Project Description	
Worksheet	Decatur Boulevard Q100 EX Sec C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.020
Channel Slope	0.60 %
Water Surface Elevation	77.78 ft
Elevation Range	77.38 to 81.53
Discharge	8.00 cfs



V:33.333333
H:1
NTS

Rice EX Q10

Worksheet for Irregular Channel

Project Description	
Worksheet	Rice Q10 EX
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.61 %
Discharge	38.00 cfs

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

Results	
Mannings Coefficient	0.017
Water Surface Elevation	81.71 ft
Elevation Range	80.97 to 84.00
Flow Area	13.4 ft ²
Wetted Perimeter	48.19 ft
Top Width	46.71 ft
Actual Depth	0.74 ft
Critical Elevation	80.97 ft
Critical Slope	0.00 %
Velocity	2.84 ft/s
Velocity Head	0.13 ft
Specific Energy	81.84 ft
Froude Number	0.94
Flow Type	Subcritical

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+10.00	0.022
0+10.00	0+50.00	0.016
0+50.00	0+60.00	0.022

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	83.97
0+00.00	80.97
0+05.00	81.17
0+10.00	81.51
0+30.00	81.83
0+50.00	81.42
0+60.00	81.00
0+60.00	84.00

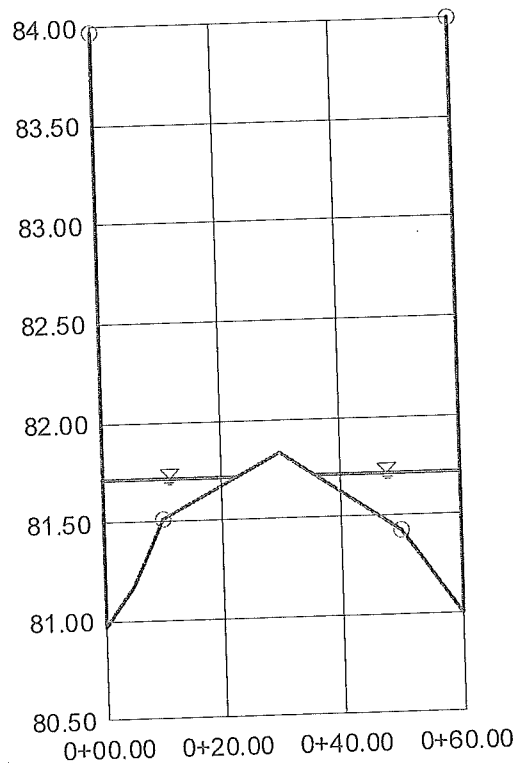
Day Lane
N/A 60' Road

Rice Q10 EX

Cross Section for Irregular Channel

Project Description	
Worksheet	Rice Q10 EX
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.017
Channel Slope	0.61 %
Water Surface Elevation	81.71 ft
Elevation Range	80.97 to 84.00
Discharge	38.00 cfs



V:33.3333333
H:1
NTS

Rice EX Q100

Worksheet for Irregular Channel

Project Description	
Worksheet	Rice Q100 EX
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.61 %
Discharge	118.00 cfs

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

Results	
Mannings Coefficient	0.018
Water Surface Elevation	82.00 ft
Elevation Range	80.97 to 84.00
Flow Area	29.9 ft ²
Wetted Perimeter	62.06 ft
Top Width	60.00 ft
Actual Depth	1.03 ft
Critical Elevation	80.97 ft
Critical Slope	0.00 %
Velocity	3.94 ft/s
Velocity Head	0.24 ft
Specific Energy	82.24 ft
Froude Number	0.98
Flow Type	Subcritical

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+10.00	0.022
0+10.00	0+50.00	0.016
0+50.00	0+60.00	0.022

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	83.97
0+00.00	80.97
0+05.00	81.17
0+10.00	81.51
0+30.00	81.83
0+50.00	81.42
0+60.00	81.00
0+60.00	84.00

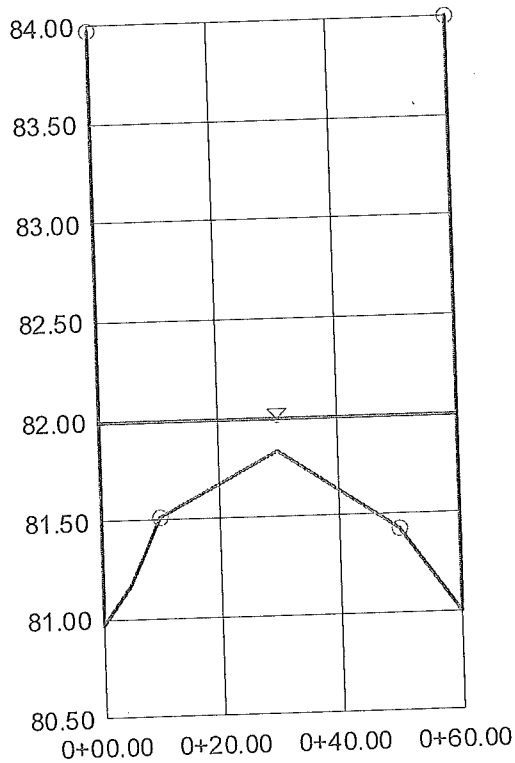
$$V \times D$$

$$3.94 \times 1.03 = 4.1 \text{ ft}^2$$

Rice Q100 EX

Cross Section for Irregular Channel

Project Description	
Worksheet	Rice Q100 EX
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth
Section Data	
Mannings Coefficient	0.018
Channel Slope	0.61 %
Water Surface Elevation	82.00 ft
Elevation Range	80.97 to 84.00
Discharge	118.00 cfs



V:33.3333333
H:1
NTS

Centennial Pkwy Sec E Q10 EX **Worksheet for Irregular Channel**

Project Description	
Worksheet	Centennial Parkway Sec E Q10 EX
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.43 %
Discharge	10.00 cfs

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

Results	
Mannings Coefficient	0.016
Water Surface Elevation	66.00 ft
Elevation Range	65.51 to 67.00
Flow Area	3.9 ft ²
Wetted Perimeter	14.21 ft
Top Width	14.00 ft
Actual Depth	0.49 ft
Critical Elevation	65.97 ft
Critical Slope	0.60 %
Velocity	2.57 ft/s
Velocity Head	0.10 ft
Specific Energy	66.10 ft
Froude Number	0.86
Flow Type	Subcritical

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+04.00	0.022
0+04.00	0+04.50	0.013
0+04.50	0+18.50	0.016
0+18.50	0+19.00	0.013

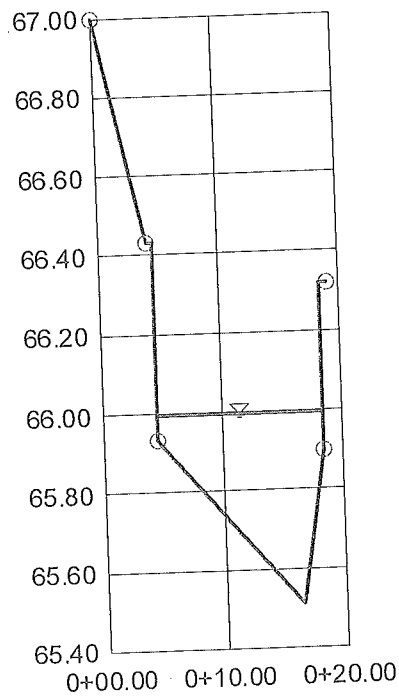
Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	67.00
0+04.00	66.43
0+04.50	66.43
0+04.50	65.93
0+16.50	65.51
0+18.50	65.90
0+18.50	66.32
0+19.00	66.32

By Lane
 66.0 - 65.93 = 0.07
 0.02

Centennial Pkwy Sec E Q10 EX **Cross Section for Irregular Channel**

Project Description	
Worksheet	Centennial Parkway Sec E Q10 EX
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.016
Channel Slope	0.43 %
Water Surface Elevation	66.00 ft
Elevation Range	65.51 to 67.00
Discharge	10.00 cfs



V:33.3333333
H:1
NTS

Centennial Pkwy Sec E Q100 EX Worksheet for Irregular Channel

Project Description	
Worksheet	Centennial Parkway Sec E Q100 EX
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.43 %
Discharge	20.00 cfs

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

Results	
Mannings Coefficient	0.016
Water Surface Elevation	66.14 ft
Elevation Range	65.51 to 67.00
Flow Area	5.9 ft ²
Wetted Perimeter	14.50 ft
Top Width	14.00 ft
Actual Depth	0.63 ft
Critical Elevation	65.51 ft
Critical Slope	0.00 %
Velocity	3.37 ft/s
Velocity Head	0.18 ft
Specific Energy	66.32 ft
Froude Number	0.91
Flow Type	Subcritical

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+04.00	0.022
0+04.00	0+04.50	0.013
0+04.50	0+18.50	0.016
0+18.50	0+19.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	67.00
0+04.00	66.43
0+04.50	66.43
0+04.50	65.93
0+16.50	65.51
0+18.50	65.90
0+18.50	66.32
0+19.00	66.32

$V \times D$

$3.37 \times 0.63 = 2.1$

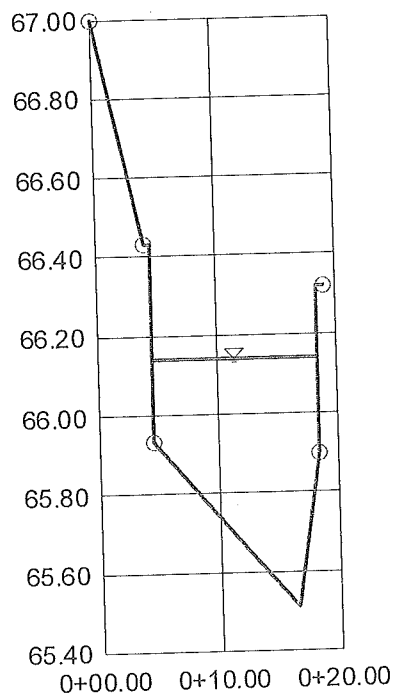
Centennial Pkwy Sec E Q100 EX **Cross Section for Irregular Channel**

Project Description

Worksheet	Centennial Parkway Sec E Q100 EX
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data

Mannings Coefficient	0.016
Channel Slope	0.43 %
Water Surface Elevation	66.14 ft
Elevation Range	65.51 to 67.00
Discharge	20.00 cfs



V:33.3333333
H:1
NTS

Interim Street Flow

Tropical Pkwy Q10 INT Worksheet for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec A Q10 INT
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.70 %
Discharge	69.00 cfs

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

Results	
Mannings Coefficient	0.015
Water Surface Elevation	71.80 ft
Elevation Range	70.97 to 72.46
Flow Area	18.5 ft ²
Wetted Perimeter	64.50 ft
Top Width	63.25 ft
Actual Depth	0.83 ft
Critical Elevation	71.86 ft
Critical Slope	0.47 %
Velocity	3.72 ft/s
Velocity Head	0.22 ft
Specific Energy	72.02 ft
Froude Number	1.21
Flow Type	Supercritical

Calculation Messages:

Flow is divided.

Water elevation exceeds lowest end station by 0.2548734 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.013
0+07.00	0+49.00	0.016
0+49.00	0+53.00	0.013
0+53.00	0+89.00	0.016
0+89.00	0+91.00	0.013
0+91.00	1+05.00	0.022

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	71.55
0+05.00	71.44
0+05.50	71.44
0+05.50	70.97

Dry Lane
72.08 - 71.80 = 0.28
0.02

Tropical Pkwy Q10 INT Worksheet for Irregular Channel

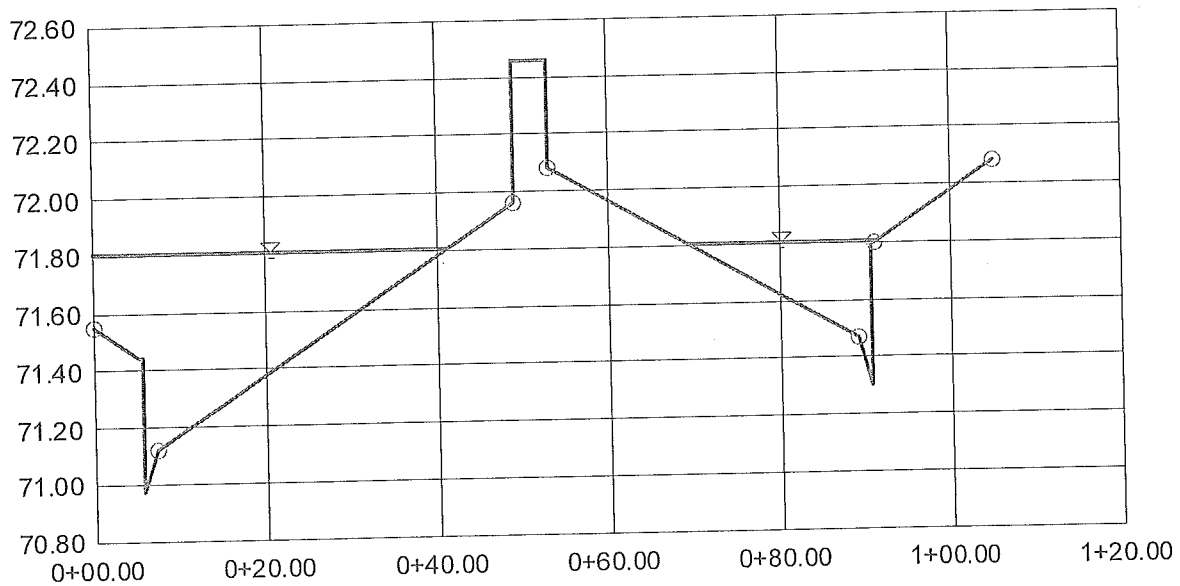
Natural Channel Points	
Station (ft)	Elevation (ft)
0+07.00	71.12
0+49.00	71.96
0+49.00	72.46
0+53.00	72.46
0+53.00	72.08
0+89.00	71.47
0+90.50	71.30
0+90.50	71.80
0+91.00	71.80
1+05.00	72.08

Tropical Pkwy Q10 INT

Cross Section for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec A Q10 INT
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.015
Channel Slope	0.70 %
Water Surface Elevation	71.80 ft
Elevation Range	70.97 to 72.46
Discharge	69.00 cfs



V:33.3333333
H:1
NTS

Tropical Pkwy Q100 INT Worksheet for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec A Q100 INT
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.70 %
Discharge	280.00 cfs

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

Results	
Mannings Coefficient	0.015
Water Surface Elevation	72.19 ft
Elevation Range	70.97 to 72.46
Flow Area	53.2 ft²
Wetted Perimeter	103.11 ft
Top Width	101.00 ft
Actual Depth	1.22 ft
Critical Elevation	72.29 ft
Critical Slope	0.41 %
Velocity	5.26 ft/s
Velocity Head	0.43 ft
Specific Energy	72.63 ft
Froude Number	1.28
Flow Type	Supercritical

$$\frac{V \times D}{5.26 \times 1.22 = 6.40 \text{ ok}}$$

Calculation Messages:
Flow is divided.
Water elevation exceeds lowest end station by 0.64498856 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.013
0+07.00	0+49.00	0.016
0+49.00	0+53.00	0.013
0+53.00	0+89.00	0.016
0+89.00	0+91.00	0.013
0+91.00	1+05.00	0.022

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	71.55
0+05.00	71.44
0+05.50	71.44
0+05.50	70.97

Tropical Pkwy Q100 INT
Worksheet for Irregular Channel

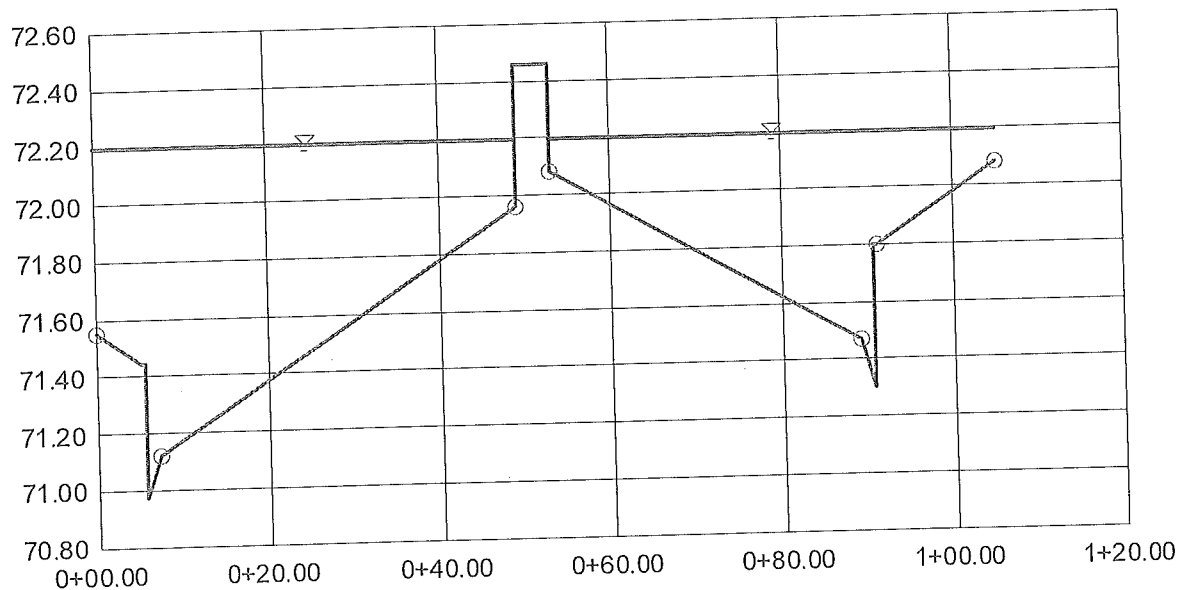
Natural Channel Points	
Station (ft)	Elevation (ft)
0+07.00	71.12
0+49.00	71.96
0+49.00	72.46
0+53.00	72.46
0+53.00	72.08
0+89.00	71.47
0+90.50	71.30
0+90.50	71.80
0+91.00	71.80
1+05.00	72.08

Tropical Pkwy Q100 INT

Cross Section for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec A Q100 INT
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.015
Channel Slope	0.70 %
Water Surface Elevation	72.19 ft
Elevation Range	70.97 to 72.46
Discharge	280.00 cfs



V:33.333333
H:1
NTS

Tropical Pkwy Q10 INT Sec B Worksheet for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec B Q10 INT
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.60 %
Discharge	78.00 cfs

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

Results	
Mannings Coefficient	0.015
Water Surface Elevation	67.46 ft
Elevation Range	66.58 to 69.50
Flow Area	22.9 ft ²
Wetted Perimeter	76.30 ft
Top Width	75.25 ft
Actual Depth	0.88 ft
Critical Elevation	67.48 ft
Critical Slope	0.50 %
Velocity	3.41 ft/s
Velocity Head	0.18 ft
Specific Energy	67.64 ft
Froude Number	1.09
Flow Type	Supercritical

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+25.00	0.022
0+25.00	0+27.00	0.013
0+27.00	0+74.00	0.016
0+74.00	0+77.00	0.013
0+77.00	1+13.00	0.016
1+13.00	1+15.00	0.013
1+15.00	1+30.00	0.022

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	68.00
0+25.00	67.08
0+25.50	67.08
0+25.50	66.58

Dry Lane
67.69 - 67.46 = 11.5'
0.02

Tropical Pkwy Q10 INT Sec B **Worksheet for Irregular Channel**

Natural Channel Points	
Station (ft)	Elevation (ft)
0+27.00	66.75
0+74.00	67.69
0+74.00	68.19
0+77.00	68.19
0+77.00	67.69
1+13.00	66.97
1+14.50	66.80
1+14.50	67.30
1+15.00	67.30
1+30.00	69.50

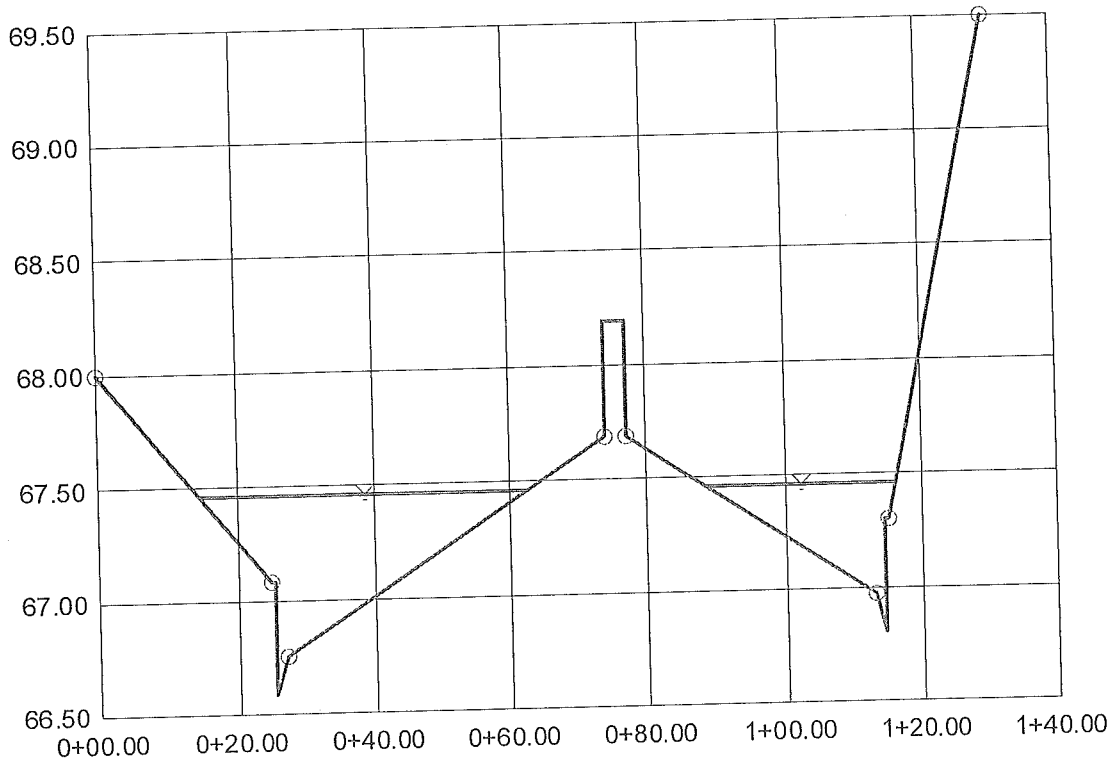
Tropical Pkwy Q10 INT Sec B **Cross Section for Irregular Channel**

Project Description

Worksheet	Tropical Parkway Sec B Q10 INT
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data

Mannings Coefficient	0.015
Channel Slope	0.60 %
Water Surface Elevation	67.46 ft
Elevation Range	66.58 to 69.50
Discharge	78.00 cfs



V:33.3333333
H:1
NTS

Tropical Pkwy Q100 INT Sec B Worksheet for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec B Q100 INT
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.60 %
Discharge	302.00 cfs

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

Results	
Mannings Coefficient	0.016
Water Surface Elevation	67.86 ft
Elevation Range	66.58 to 69.50
Flow Area	62.1 ft ²
Wetted Perimeter	113.36 ft
Top Width	111.93 ft
Actual Depth	1.28 ft
Critical Elevation	67.91 ft
Critical Slope	0.44 %
Velocity	4.86 ft/s
Velocity Head	0.37 ft
Specific Energy	68.22 ft
Froude Number	1.15
Flow Type	Supercritical

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+25.00	0.022
0+25.00	0+27.00	0.013
0+27.00	0+74.00	0.016
0+74.00	0+77.00	0.013
0+77.00	1+13.00	0.016
1+13.00	1+15.00	0.013
1+15.00	1+30.00	0.022

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	68.00
0+25.00	67.08
0+25.50	67.08
0+25.50	66.58

$V \times d$

$4.86 \times 1.28 = 6.22$

Tropical Pkwy Q100 INT Sec B **Worksheet for Irregular Channel**

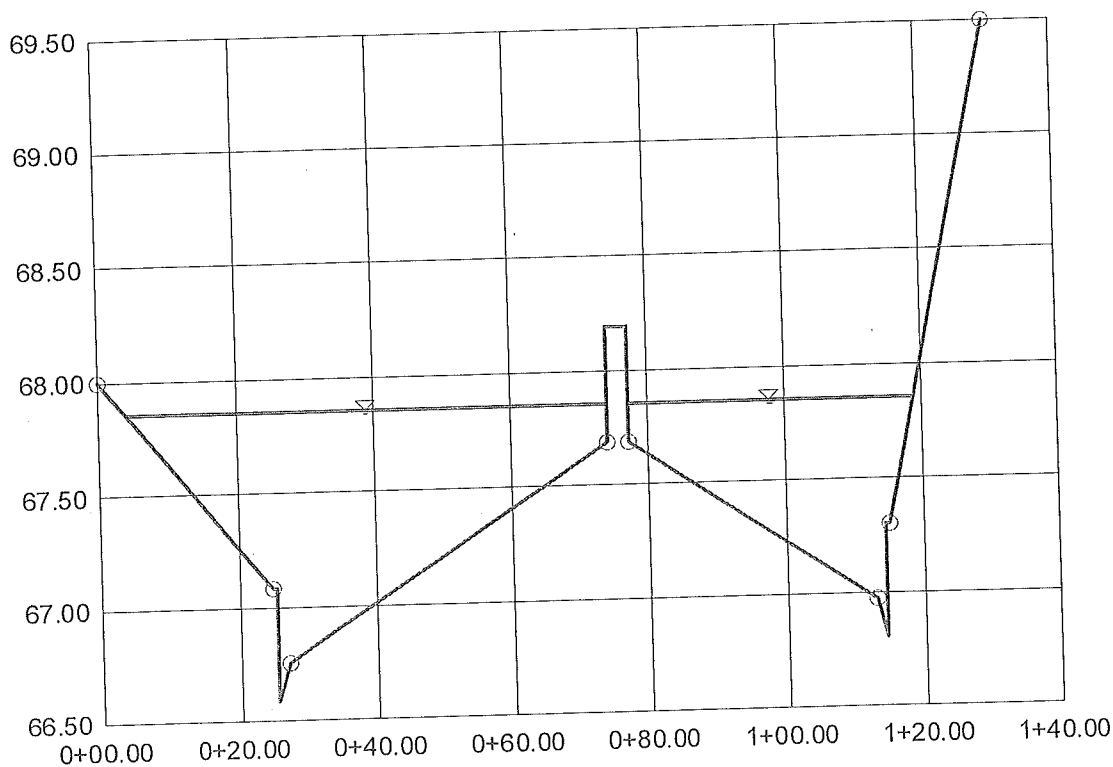
Natural Channel Points	
Station (ft)	Elevation (ft)
0+27.00	66.75
0+74.00	67.69
0+74.00	68.19
0+77.00	68.19
0+77.00	67.69
1+13.00	66.97
1+14.50	66.80
1+14.50	67.30
1+15.00	67.30
1+30.00	69.50

Tropical Pkwy Q100 INT Sec B

Cross Section for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec B Q100 INT
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.016
Channel Slope	0.60 %
Water Surface Elevation	67.86 ft
Elevation Range	66.58 to 69.50
Discharge	302.00 cfs



V:33.3333333
H:1
NTS

Decatur Blvd Q10 INT Sec C Worksheet for Irregular Channel

Project Description	
Worksheet	Decatur Boulevard Q10 INT Sec C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.60 %
Discharge	5.00 cfs

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

Results	
Mannings Coefficient	0.014
Water Surface Elevation	0.42 ft
Elevation Range	0.00 to 1.03
Flow Area	2.2 ft ²
Wetted Perimeter	14.72 ft
Top Width	14.25 ft
Actual Depth	0.42 ft
Critical Elevation	0.43 ft
Critical Slope	0.55 %
Velocity	2.31 ft/s
Velocity Head	0.08 ft
Specific Energy	0.51 ft
Froude Number	1.04
Flow Type	Supercritical

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+05.00	0.022
0+05.00	0+07.00	0.013
0+07.00	0+50.00	0.016

Natural Channel Points	
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

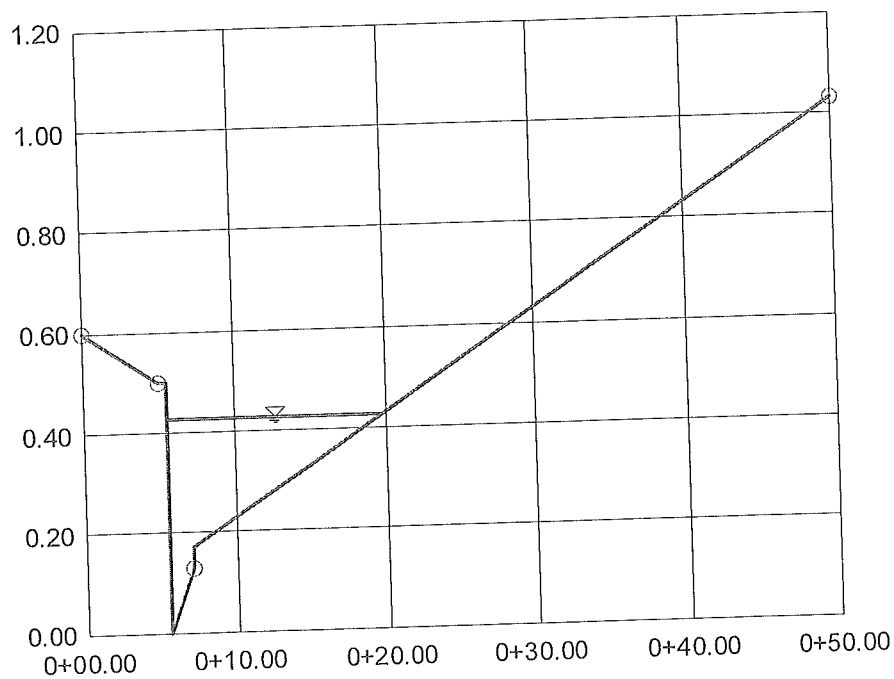
By Lane
 $1.03 - 0.42 = 0.61$
 $0.61 \times 30.5' = 18.6' \approx 19'$
 $0.42 \times 23.5' = 9.9' \approx 10'$

Decatur Blvd Q10 Int Sec C

Cross Section for Irregular Channel

Project Description	
Worksheet	Decatur Boulevard Q10 INT Sec C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.014
Channel Slope	0.60 %
Water Surface Elevation	0.42 ft
Elevation Range	0.00 to 1.03
Discharge	5.00 cfs



V:33.333333
H:1
NTS

Decatur Blvd Q100 INTSec C Worksheet for Irregular Channel

Project Description	
Worksheet	Decatur Boulevard Q100 INT Sec C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.60 %
Discharge	8.00 cfs

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

Results	
Mannings Coefficient	0.014
Water Surface Elevation	0.49 ft
Elevation Range	0.00 to 1.03
Flow Area	3.2 ft ²
Wetted Perimeter	17.99 ft
Top Width	17.45 ft
Actual Depth	0.49 ft
Critical Elevation	0.50 ft
Critical Slope	0.55 %
Velocity	2.52 ft/s
Velocity Head	0.10 ft
Specific Energy	0.59 ft
Froude Number	1.04
Flow Type	Supercritical

$$\checkmark \times \Delta$$

$$2.52 \times 0.49 = 1.2$$

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+05.00	0.022
0+05.00	0+07.00	0.013
0+07.00	0+50.00	0.016

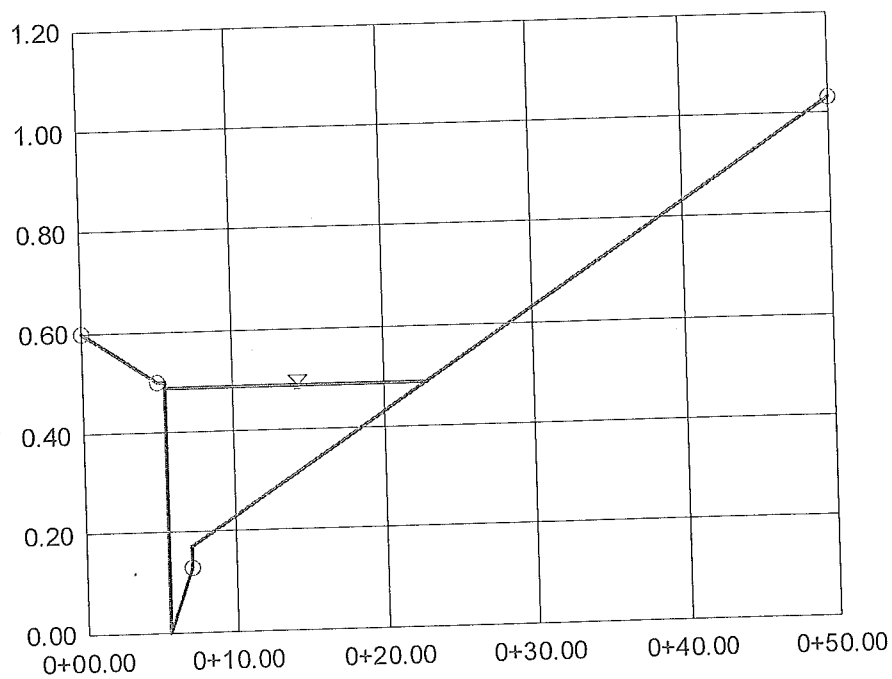
Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+50.00	1.03

Decatur Blvd Q100 Int Sec C

Cross Section for Irregular Channel

Project Description	
Worksheet	Decatur Boulevard Q100 INT Sec C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.014
Channel Slope	0.60 %
Water Surface Elevation	0.49 ft
Elevation Range	0.00 to 1.03
Discharge	8.00 cfs



V:33.3333333
H:1
NTS

Rice Ave Q10 INT Sec D

Worksheet for Irregular Channel

Project Description	
Worksheet	Rice Avenue Q10 INT Sec D
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.61 %
Discharge	2.00 cfs

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

Results	
Mannings Coefficient	0.015
Water Surface Elevation	0.29 ft
Elevation Range	0.00 to 0.63
Flow Area	1.3 ft ²
Wetted Perimeter	15.28 ft
Top Width	14.61 ft
Actual Depth	0.29 ft
Critical Elevation	0.28 ft
Critical Slope	0.81 %
Velocity	1.49 ft/s
Velocity Head	0.03 ft
Specific Energy	0.32 ft
Froude Number	0.87
Flow Type	Subcritical

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.013
0+07.00	0+53.00	0.016
0+53.00	0+60.00	0.013

Natural Channel Points	
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+30.00	0.63
0+53.00	0.17

Dry Lane
N/A

Rice Ave Q10 INT Sec D
Worksheet for Irregular Channel

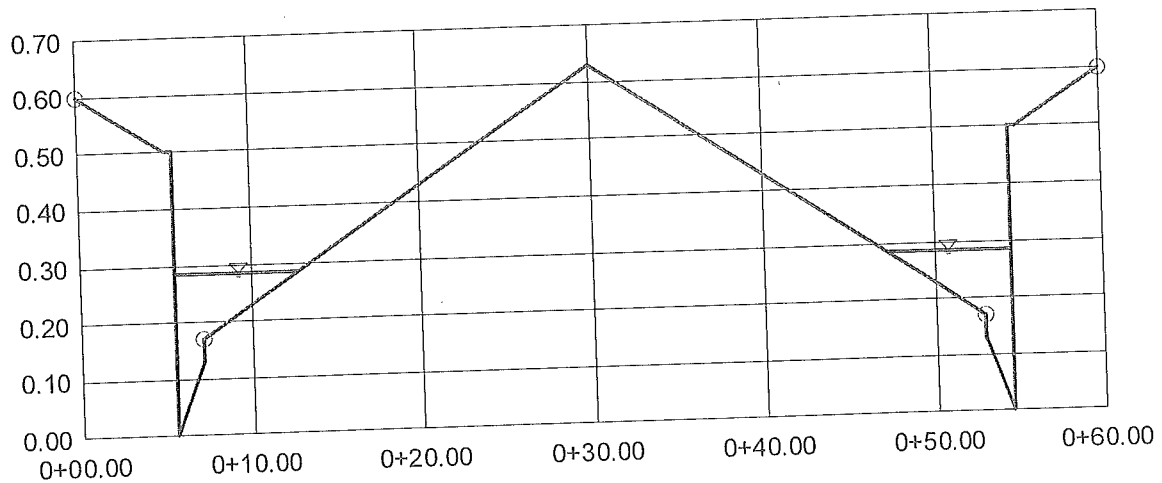
Natural Channel Points	
Station (ft)	Elevation (ft)
0+53.00	0.13
0+54.50	0.00
0+54.50	0.50
0+55.00	0.50
0+60.00	0.60

Rice Ave Q10 INT Sec D

Cross Section for Irregular Channel

Project Description	
Worksheet	Rice Avenue Q10 INT Sec D
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.015
Channel Slope	0.61 %
Water Surface Elevation	0.29 ft
Elevation Range	0.00 to 0.63
Discharge	2.00 cfs



V:33.3333333
H:1
NTS

Rice Ave Q100 INT Sec D

Worksheet for Irregular Channel

Project Description	
Worksheet	Rice Avenue Q100 INT Sec D
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.61 %
Discharge	3.00 cfs

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

Results	
Mannings Coefficient	0.015
Water Surface Elevation	0.32 ft
Elevation Range	0.00 to 0.63
Flow Area	1.9 ft ²
Wetted Perimeter	18.51 ft
Top Width	17.78 ft
Actual Depth	0.32 ft
Critical Elevation	0.31 ft
Critical Slope	0.79 %
Velocity	1.62 ft/s
Velocity Head	0.04 ft
Specific Energy	0.36 ft
Froude Number	0.89
Flow Type	Subcritical

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.013
0+07.00	0+53.00	0.016
0+53.00	0+60.00	0.013

Natural Channel Points	
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+30.00	0.63
0+53.00	0.17

$V \times D$

$1.62 \times 0.32 = 0.50$

Rice Ave Q100 INT Sec D
Worksheet for Irregular Channel

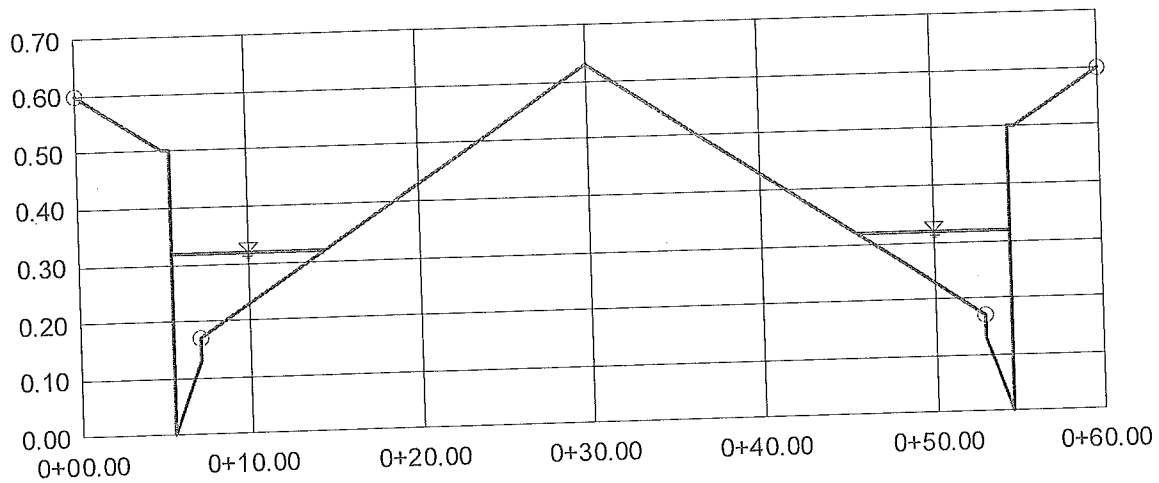
Natural Channel Points	
Station (ft)	Elevation (ft)
0+53.00	0.13
0+54.50	0.00
0+54.50	0.50
0+55.00	0.50
0+60.00	0.60

RICE Q100 INT Sec D

Cross Section for Irregular Channel

Project Description	
Worksheet	Rice Avenue Q100 INT Sec D
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.015
Channel Slope	0.61 %
Water Surface Elevation	0.32 ft
Elevation Range	0.00 to 0.63
Discharge	3.00 cfs



V:33.3333333
H:1
NTS

Centennial Pkwy Q10 Int Sec E Worksheet for Irregular Channel

Project Description	
Worksheet	Centennial Parkway Q10 Int Sec E
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.43 %
Discharge	10.00 cfs

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

Results	
Mannings Coefficient	0.014
Water Surface Elevation	0.45 ft
Elevation Range	0.00 to 1.03
Flow Area	5.0 ft ²
Wetted Perimeter	31.64 ft
Top Width	30.65 ft
Actual Depth	0.45 ft
Critical Elevation	0.43 ft
Critical Slope	0.56 %
Velocity	2.01 ft/s
Velocity Head	0.06 ft
Specific Energy	0.51 ft
Froude Number	0.88
Flow Type	Subcritical

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+05.00	0.022
0+05.00	0+07.00	0.013
0+07.00	0+93.00	0.016
0+93.00	0+95.00	0.013
0+95.00	1+00.00	0.022

Natural Channel Points	
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

Day Lane
1.03 - 0.45 = 0.58
0.06
0.58 - 0.06 = 0.52

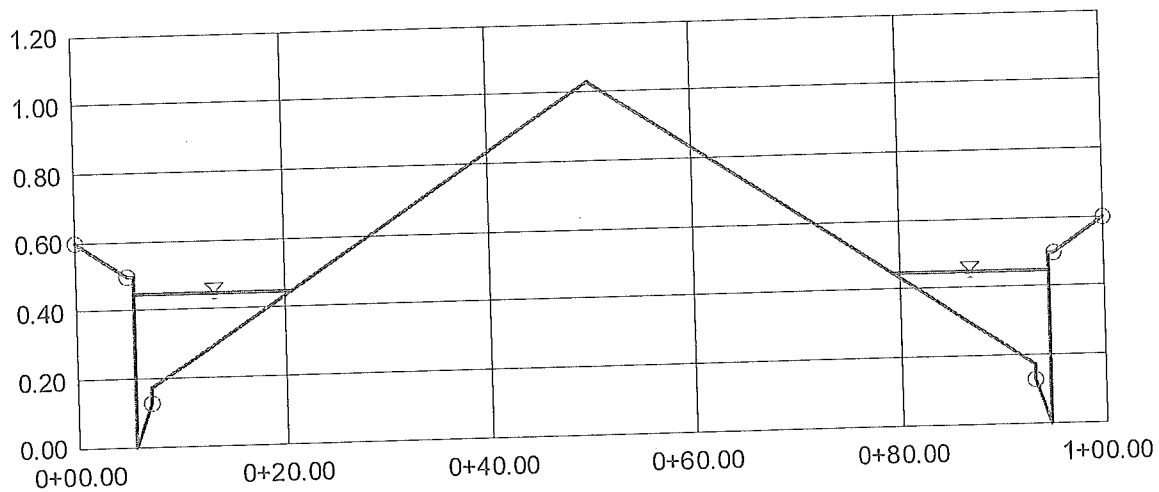
Centennial Pkwy Q10 Int Sec E
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
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

Centennial Pkwy Q10 Int Sec E **Cross Section for Irregular Channel**

Project Description	
Worksheet	Centennial Parkway Q10 Int Sec E
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.014
Channel Slope	0.43 %
Water Surface Elevation	0.45 ft
Elevation Range	0.00 to 1.03
Discharge	10.00 cfs



V:33.3333333
H:1
NTS

Centennial Pkwy Q100 Int Sec E Worksheet for Irregular Channel

Project Description	
Worksheet	Centennial Parkway Q100 Int Sec E
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.43 %
Discharge	21.00 cfs

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

Results	
Mannings Coefficient	0.014
Water Surface Elevation	0.56 ft
Elevation Range	0.00 to 1.03
Flow Area	9.4 ft ²
Wetted Perimeter	50.23 ft
Top Width	49.13 ft
Actual Depth	0.56 ft
Critical Elevation	0.54 ft
Critical Slope	0.53 %
Velocity	2.24 ft/s
Velocity Head	0.08 ft
Specific Energy	0.64 ft
Froude Number	0.91
Flow Type	Subcritical

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+05.00	0.022
0+05.00	0+07.00	0.013
0+07.00	0+93.00	0.016
0+93.00	0+95.00	0.013
0+95.00	1+00.00	0.022

Natural Channel Points	
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

$$V \times d$$

$$2.24 \times 0.56 = 1.3$$

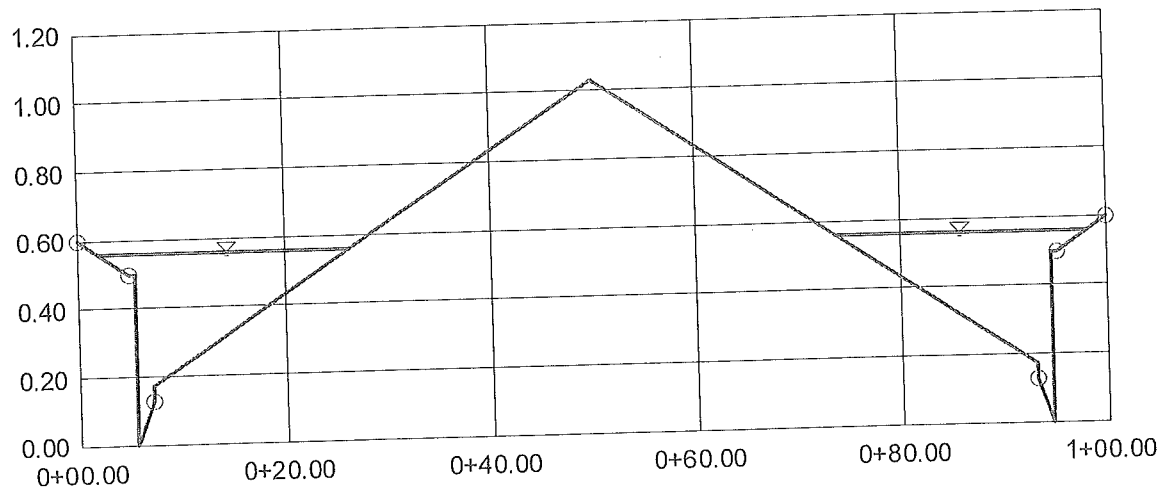
Centennial Pkwy Q100 Int Sec E Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
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

Centennial Pkwy Q100 Int Sec E **Cross Section for Irregular Channel**

Project Description	
Worksheet	Centennial Parkway Q100 Int Sec E
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.014
Channel Slope	0.43 %
Water Surface Elevation	0.56 ft
Elevation Range	0.00 to 1.03
Discharge	21.00 cfs



V:33.333333
H:1
NTS

Future Street Flow

Tropical Pkwy Q10 Dev Sec A Worksheet for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec A Q10 DEV
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.70 %
Discharge	7.00 cfs

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

Results	
Mannings Coefficient	0.013
Water Surface Elevation	0.37 ft
Elevation Range	0.00 to 1.03
Flow Area	3.0 ft ²
Wetted Perimeter	24.23 ft
Top Width	23.39 ft
Actual Depth	0.37 ft
Critical Elevation	0.39 ft
Critical Slope	0.52 %
Velocity	2.33 ft/s
Velocity Head	0.08 ft
Specific Energy	0.46 ft
Froude Number	1.15
Flow Type	Supercritical

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+05.00	0.022
0+05.00	0+07.00	0.013
0+07.00	0+93.00	0.016
0+93.00	0+95.00	0.013
0+95.00	1+00.00	0.022

Natural Channel Points	
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

Day Lane
0.66 - 0.37
0.02
14.5' ok

**Tropical Pkwy Q10 Dev
Worksheet for Irregular Channel**

Natural Channel Points	
Station (ft)	Elevation (ft)
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

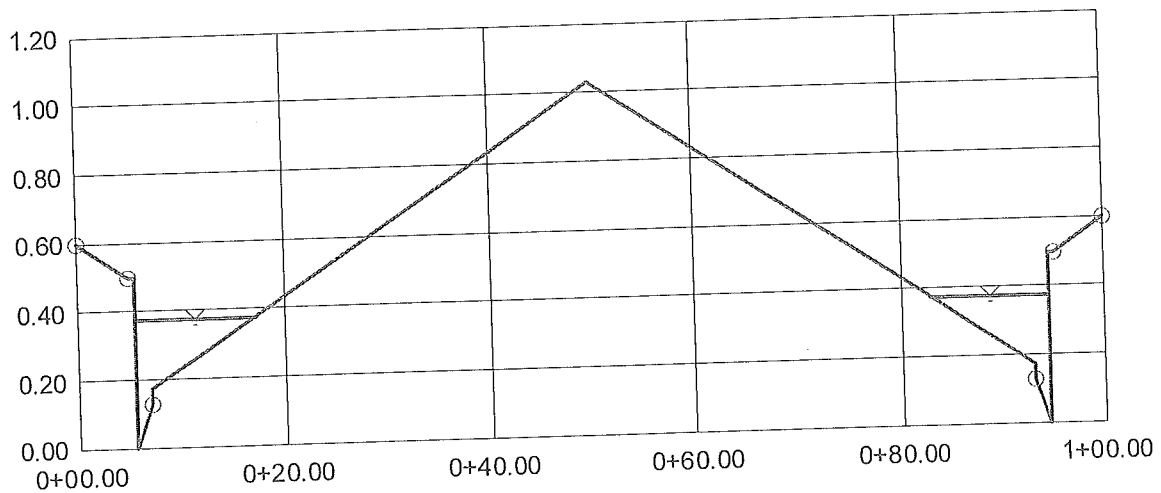
Tropical Pkwy Q10 Dev Cross Section for Irregular Channel

Project Description

Worksheet	Tropical Parkway Sec A Q10 DEV
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data

Mannings Coefficient	0.013
Channel Slope	0.70 %
Water Surface Elevation	0.37 ft
Elevation Range	0.00 to 1.03
Discharge	7.00 cfs



V:33.333333

H:1
NTS

Tropical Pkwy Q100 Dev Sec A Worksheet for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec A Q100 DEV
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.70 %
Discharge	236.00 cfs

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

Results	
Mannings Coefficient	0.016
Water Surface Elevation	1.07 ft
Elevation Range	0.00 to 1.03
Flow Area	49.3 ft ²
Wetted Perimeter	102.05 ft
Top Width	100.00 ft
Actual Depth	1.07 ft
Critical Elevation	1.14 ft
Critical Slope	0.47 %
Velocity	4.78 ft/s
Velocity Head	0.36 ft
Specific Energy	1.43 ft
Froude Number	1.20
Flow Type	Supercritical

$V \times D$

$4.78 \times 1.07 = 5.11 \text{ ft}^2$

Calculation Messages:
Water elevation exceeds lowest end station by 0.47124569 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+05.00	0.022
0+05.00	0+07.00	0.013
0+07.00	0+93.00	0.016
0+93.00	0+95.00	0.013
0+95.00	1+00.00	0.022

Natural Channel Points	
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

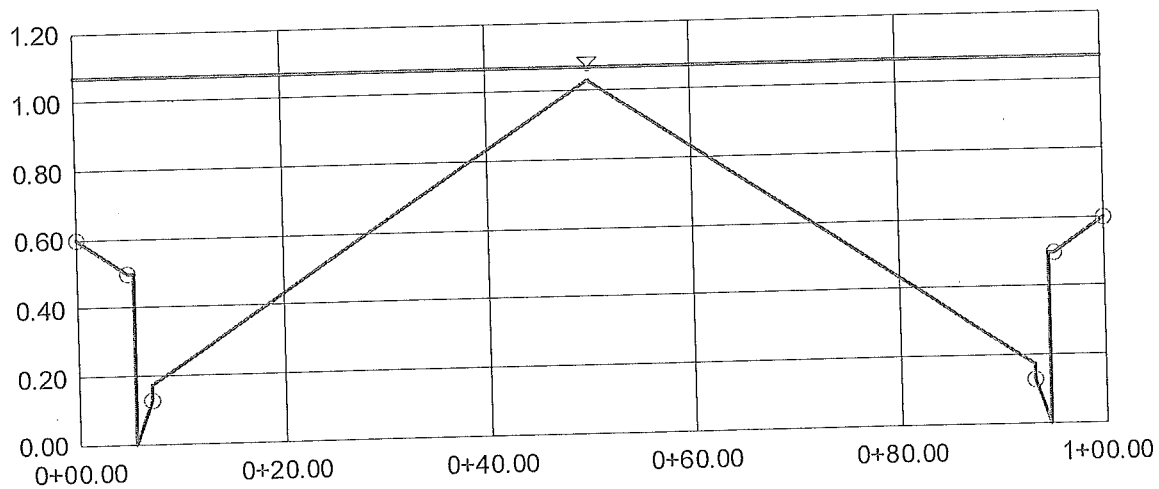
Tropical Pkwy Q100 Dev Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
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

Tropical Pkwy Q100 Dev Cross Section for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec A Q100 DEV
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.016
Channel Slope	0.70 %
Water Surface Elevation	1.07 ft
Elevation Range	0.00 to 1.03
Discharge	236.00 cfs



V:33.3333333
H:1
NTS

Tropical Pkwy Sec B Q10 DEV Worksheet for Irregular Channel

Project Description	
Worksheet	Tropical Q10 DEV Sec B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.60 %
Discharge	26.00 cfs

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

Results	
Mannings Coefficient	0.014
Water Surface Elevation	0.58 ft
Elevation Range	0.00 to 1.03
Flow Area	10.0 ft ²
Wetted Perimeter	53.71 ft
Top Width	53.07 ft
Actual Depth	0.58 ft
Critical Elevation	0.59 ft
Critical Slope	0.53 %
Velocity	2.60 ft/s
Velocity Head	0.11 ft
Specific Energy	0.69 ft
Froude Number	1.06
Flow Type	Supercritical

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+05.00	0.022
0+05.00	0+07.00	0.013
0+07.00	0+93.00	0.016
0+93.00	0+95.00	0.013
0+95.00	1+00.00	0.022

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+07.00	0.13
0+07.00	0.17
0+50.00	1.03

Dry Lane
1.03 - 0.58 = 22.5'
0.02

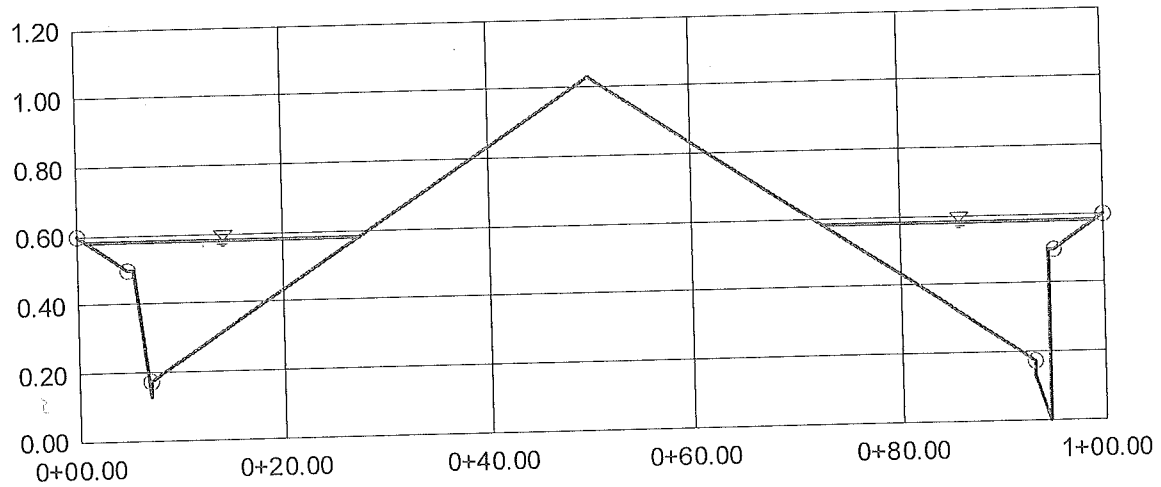
Tropical Pkwy Sec B Q10 DEV **Worksheet for Irregular Channel**

Natural Channel Points	
Station (ft)	Elevation (ft)
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

Tropical Pkwy Sec B Q10 DEV Cross Section for Irregular Channel

Project Description	
Worksheet	Tropical Q10 DEV Sec B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.014
Channel Slope	0.60 %
Water Surface Elevation	0.58 ft
Elevation Range	0.00 to 1.03
Discharge	26.00 cfs



V:33.3333333
H:1
NTS

Tropical Pkwy Sec B Q100 DEV Worksheet for Irregular Channel

Project Description	
Worksheet	Tropical Q100 DEV Sec B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.60 %
Discharge	269.00 cfs

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

Results	
Mannings Coefficient	0.016
Water Surface Elevation	1.14 ft
Elevation Range	0.00 to 1.03
Flow Area	56.0 ft ²
Wetted Perimeter	101.73 ft
Top Width	100.00 ft
Actual Depth	1.14 ft
Critical Elevation	1.19 ft
Critical Slope	0.46 %
Velocity	4.80 ft/s
Velocity Head	0.36 ft
Specific Energy	1.50 ft
Froude Number	1.13
Flow Type	Supercritical

Calculation Messages:
Water elevation exceeds lowest end station by 0.54206592 ft.

$$\frac{V \times \Delta}{4.8 \times 1.14} = 5.5$$

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+05.00	0.022
0+05.00	0+07.00	0.013
0+07.00	0+93.00	0.016
0+93.00	0+95.00	0.013
0+95.00	1+00.00	0.022

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+07.00	0.13
0+07.00	0.17
0+50.00	1.03

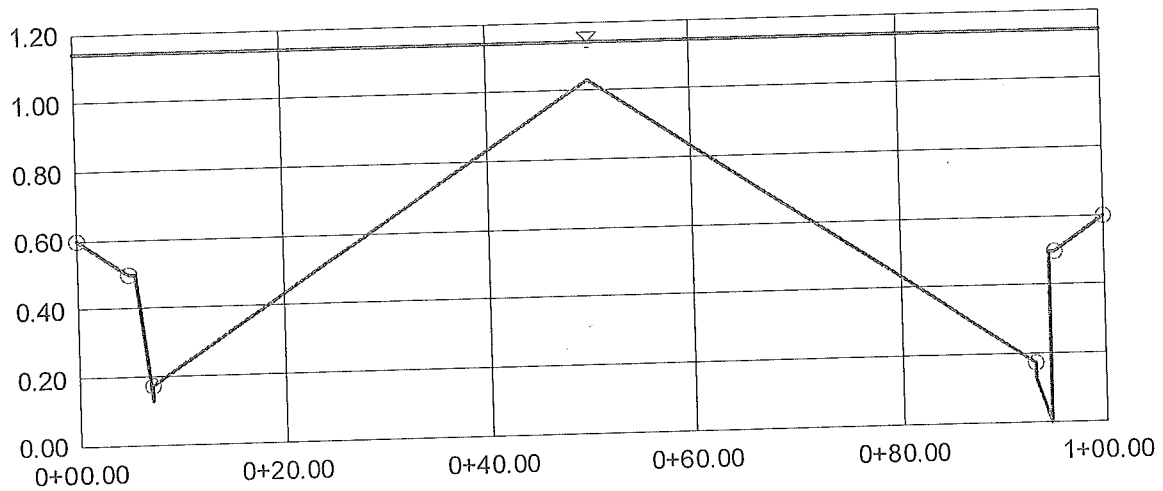
Tropical Pkwy Sec B Q100 DEV Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
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

Tropical Pkwy Sec B Q100 DEV Cross Section for Irregular Channel

Project Description	
Worksheet	Tropical Q100 DEV Sec B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.016
Channel Slope	0.60 %
Water Surface Elevation	1.14 ft
Elevation Range	0.00 to 1.03
Discharge	269.00 cfs



V:33.3333333
H:1
NTS

Decatur Blvd Q10 Dev Sec C Worksheet for Irregular Channel

Project Description	
Worksheet	Decatur Boulevard Q10 Sec C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.60 %
Discharge	5.00 cfs

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

Results	
Mannings Coefficient	0.014
Water Surface Elevation	0.42 ft
Elevation Range	0.00 to 1.03
Flow Area	2.2 ft ²
Wetted Perimeter	14.72 ft
Top Width	14.25 ft
Actual Depth	0.42 ft
Critical Elevation	0.43 ft
Critical Slope	0.55 %
Velocity	2.31 ft/s
Velocity Head	0.08 ft
Specific Energy	0.51 ft
Froude Number	1.04
Flow Type	Supercritical

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+05.00	0.022
0+05.00	0+07.00	0.013
0+07.00	0+50.00	0.016

Natural Channel Points	
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

Dry Lane
 $1103 \div 0.112 = 30.5'$
 0.02
 $= 23.5'$

Decatur Blvd Q10 Dev Sec C

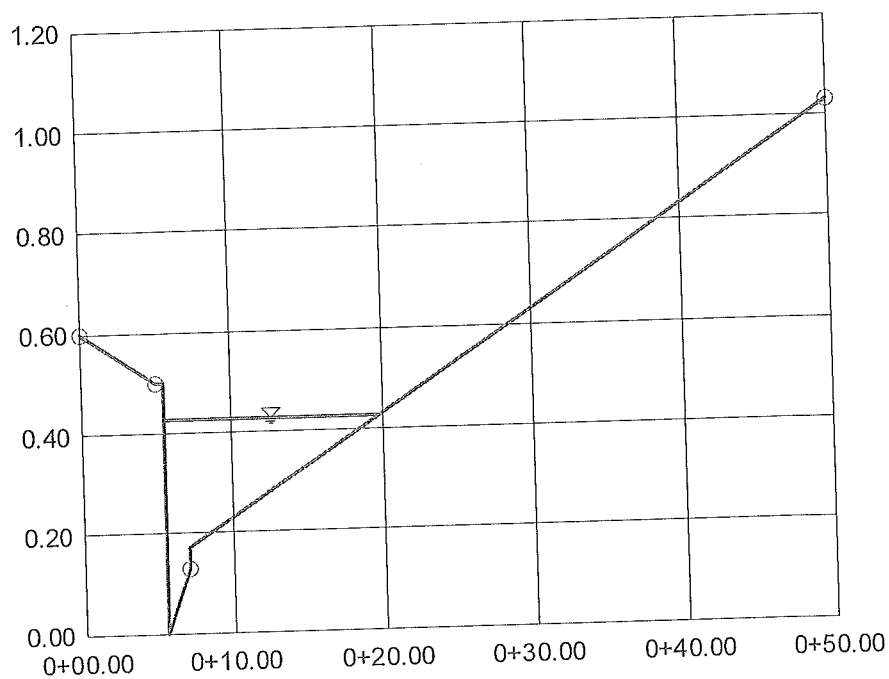
Cross Section for Irregular Channel

Project Description

Worksheet	Decatur Boulevard Q10 Sec C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data

Mannings Coefficient	0.014
Channel Slope	0.60 %
Water Surface Elevation	0.42 ft
Elevation Range	0.00 to 1.03
Discharge	5.00 cfs



V:33.333333
H:1
NTS

Decatur Blvd Q100 Dev Sec C Worksheet for Irregular Channel

Project Description	
Worksheet	Decatur Boulevard Q100 Sec C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.60 %
Discharge	8.00 cfs

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

Results	
Mannings Coefficient	0.014
Water Surface Elevation	0.49 ft
Elevation Range	0.00 to 1.03
Flow Area	3.2 ft ²
Wetted Perimeter	17.99 ft
Top Width	17.45 ft
Actual Depth	0.49 ft
Critical Elevation	0.50 ft
Critical Slope	0.55 %
Velocity	2.52 ft/s
Velocity Head	0.10 ft
Specific Energy	0.59 ft
Froude Number	1.04
Flow Type	Supercritical

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+05.00	0.022
0+05.00	0+07.00	0.013
0+07.00	0+50.00	0.016

Natural Channel Points	
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

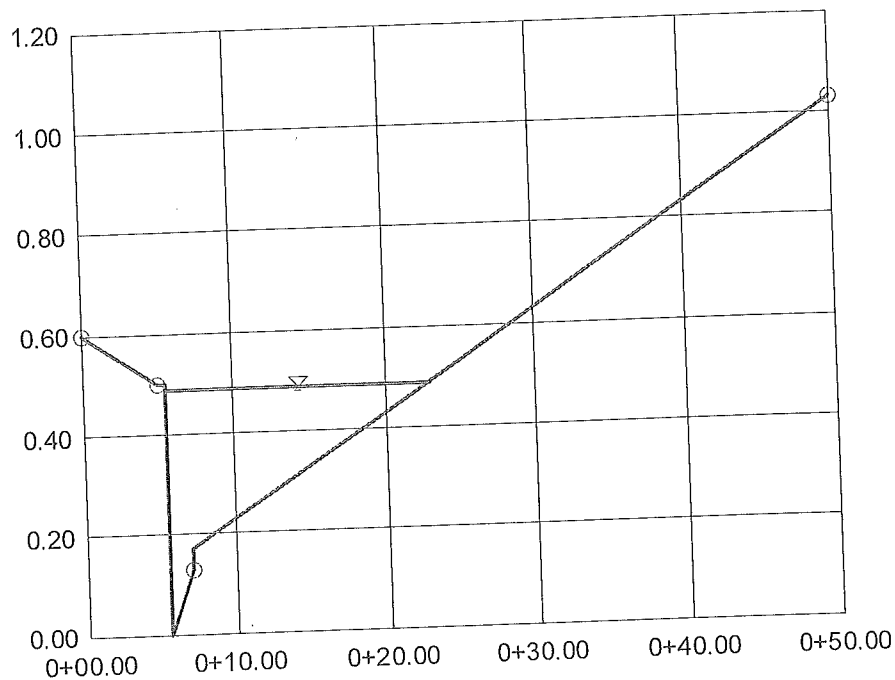
$V = 2.52$
 $2.52 \times 0.0149 = 1.70 - k$

Decatur Blvd Q100 Dev Sec C

Cross Section for Irregular Channel

Project Description	
Worksheet	Decatur Boulevard Q100 Sec C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.014
Channel Slope	0.60 %
Water Surface Elevation	0.49 ft
Elevation Range	0.00 to 1.03
Discharge	8.00 cfs



V:33.333333
H:1
NTS

Rice DEV Q10

Worksheet for Irregular Channel

Project Description	
Worksheet	Rice Q10 DEV
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.61 %
Discharge	2.00 cfs

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

Results	
Mannings Coefficient	0.015
Water Surface Elevation	0.29 ft
Elevation Range	0.00 to 0.63
Flow Area	1.3 ft ²
Wetted Perimeter	15.28 ft
Top Width	14.61 ft
Actual Depth	0.29 ft
Critical Elevation	0.28 ft
Critical Slope	0.81 %
Velocity	1.49 ft/s
Velocity Head	0.03 ft
Specific Energy	0.32 ft
Froude Number	0.87
Flow Type	Subcritical

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.013
0+07.00	0+53.00	0.016
0+53.00	0+60.00	0.013

Natural Channel Points	
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+30.00	0.63
0+53.00	0.17

Dry Lane

$$0.63 - 0.29 = 0.34$$

0.34

N/A 60' Low

Rice DEV Q10
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+53.00	0.13
0+54.50	0.00
0+54.50	0.50
0+55.00	0.50
0+60.00	0.60

Rice DEV Q10

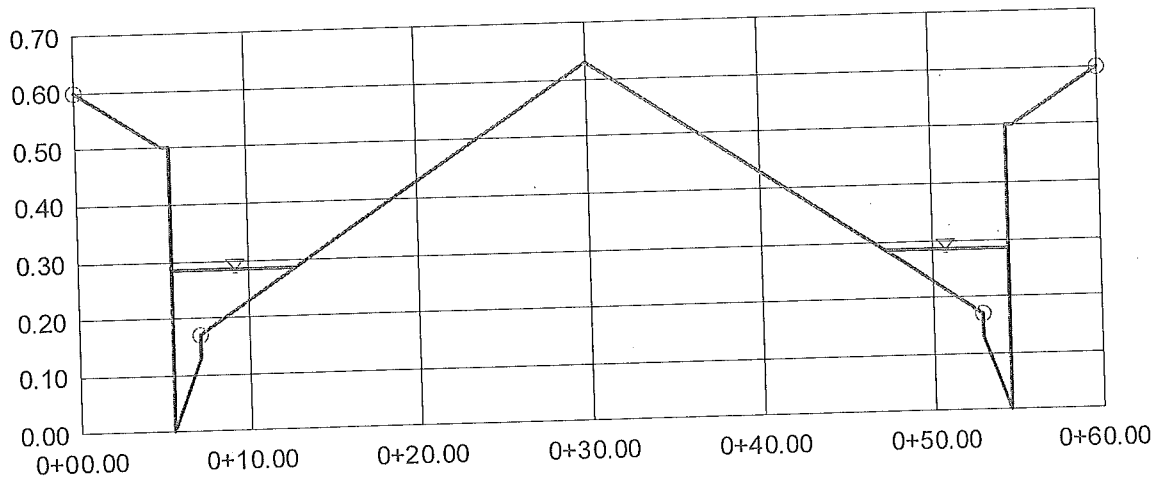
Cross Section for Irregular Channel

Project Description

Worksheet	Rice Q10 DEV
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data

Mannings Coefficient	0.015
Channel Slope	0.61 %
Water Surface Elevation	0.29 ft
Elevation Range	0.00 to 0.63
Discharge	2.00 cfs



V:33.333333

H:1
NTS

Rice DEV Q100

Worksheet for Irregular Channel

Project Description	
Worksheet	Rice Q100 DEV
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.61 %
Discharge	3.00 cfs

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

Results	
Mannings Coefficient	0.015
Water Surface Elevation	0.32 ft
Elevation Range	0.00 to 0.63
Flow Area	1.9 ft ²
Wetted Perimeter	18.51 ft
Top Width	17.78 ft
Actual Depth	0.32 ft
Critical Elevation	0.31 ft
Critical Slope	0.79 %
Velocity	1.62 ft/s
Velocity Head	0.04 ft
Specific Energy	0.36 ft
Froude Number	0.89
Flow Type	Subcritical

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.013
0+07.00	0+53.00	0.016
0+53.00	0+60.00	0.013

Natural Channel Points	
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+30.00	0.63
0+53.00	0.17

$V \times D$
 $1.62 \times 0.32 = 0.5 \text{ ok}$

Rice DEV Q100
Worksheet for Irregular Channel

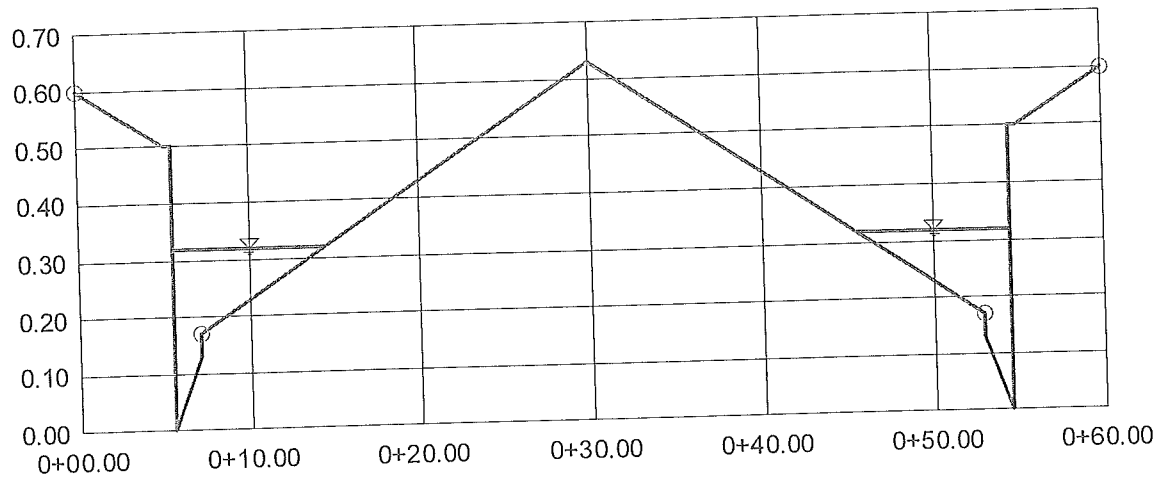
Natural Channel Points	
Station (ft)	Elevation (ft)
0+53.00	0.13
0+54.50	0.00
0+54.50	0.50
0+55.00	0.50
0+60.00	0.60

Rice DEV Q100

Cross Section for Irregular Channel

Project Description	
Worksheet	Rice Q100 DEV
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.015
Channel Slope	0.61 %
Water Surface Elevation	0.32 ft
Elevation Range	0.00 to 0.63
Discharge	3.00 cfs



V:33.3333333
H:1
NTS

Centennial Pkwy Sec E Q10 DEV Worksheet for Irregular Channel

Project Description	
Worksheet	CENT Q10 DEV SEC E
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.43 %
Discharge	10.00 cfs

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

Results	
Mannings Coefficient	0.014
Water Surface Elevation	0.45 ft
Elevation Range	0.00 to 1.03
Flow Area	5.0 ft ²
Wetted Perimeter	31.70 ft
Top Width	30.71 ft
Actual Depth	0.45 ft
Critical Elevation	0.43 ft
Critical Slope	0.57 %
Velocity	2.01 ft/s
Velocity Head	0.06 ft
Specific Energy	0.51 ft
Froude Number	0.88
Flow Type	Subcritical

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+05.00	0.022
0+05.00	0+07.00	0.013
0+07.00	0+93.00	0.016
0+93.00	0+95.00	0.013
0+95.00	1+00.00	0.022

Natural Channel Points	
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

Dry Lane
1.03 - 0.45
0.02
29'-7"
22'
2

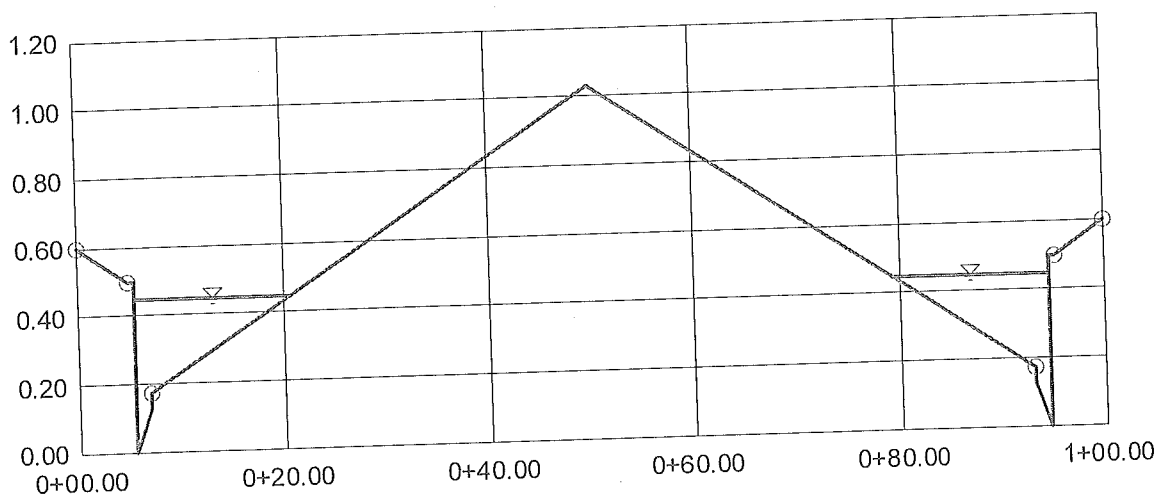
Centennial Pkwy Sec E Q10 DEV Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
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

Centennial Pkwy Sec E Q10 DEV **Cross Section for Irregular Channel**

Project Description	
Worksheet	CENT Q10 DEV SEC E
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.014
Channel Slope	0.43 %
Water Surface Elevation	0.45 ft
Elevation Range	0.00 to 1.03
Discharge	10.00 cfs



V:33.3333333
H:1
NTS

Centennial Pkwy Sec E Q100 DEV Worksheet for Irregular Channel

Project Description

Worksheet	CENT Q100 DEV SEC E
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data

Channel Slope	0.43 %
Discharge	21.00 cfs

Options

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

Results

Mannings Coefficient	0.014
Water Surface Elevation	0.56 ft
Elevation Range	0.00 to 1.03
Flow Area	9.4 ft ²
Wetted Perimeter	50.28 ft
Top Width	49.18 ft
Actual Depth	0.56 ft
Critical Elevation	0.54 ft
Critical Slope	0.53 %
Velocity	2.24 ft/s
Velocity Head	0.08 ft
Specific Energy	0.64 ft
Froude Number	0.90
Flow Type	Subcritical

$$\frac{V \times D}{2.24 \times 0.56} = 1.3$$

Calculation Messages:
Flow is divided.

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+05.00	0.022
0+05.00	0+07.00	0.013
0+07.00	0+93.00	0.016
0+93.00	0+95.00	0.013
0+95.00	1+00.00	0.022

Natural Channel Points

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

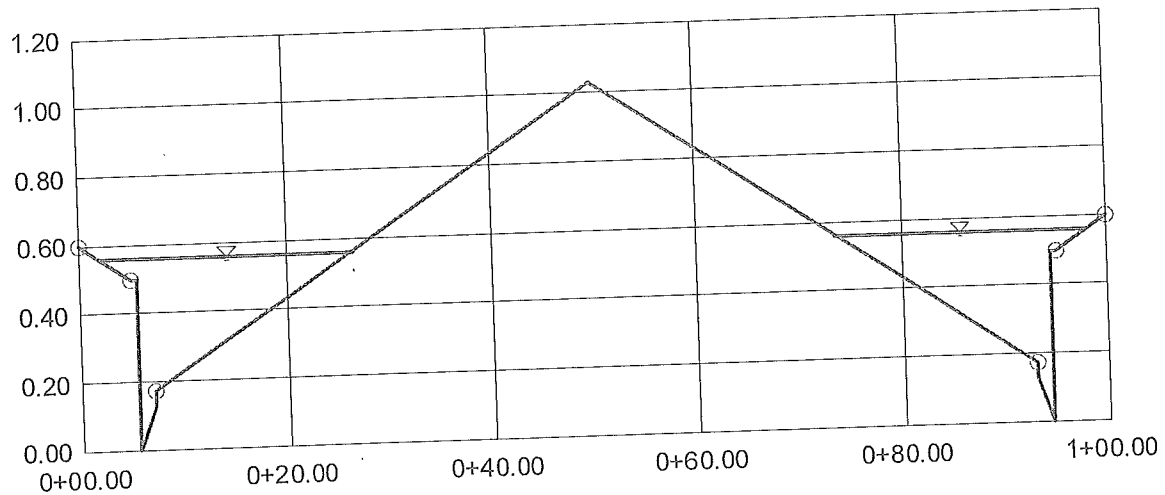
Centennial Pkwy Sec E Q100 DEV Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
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

Centennial Pkwy Sec E Q100 DEV **Cross Section for Irregular Channel**

Project Description	
Worksheet	CENT Q100 DEV SEC E
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.014
Channel Slope	0.43 %
Water Surface Elevation	0.56 ft
Elevation Range	0.00 to 1.03
Discharge	21.00 cfs



V:33.3333333
H:1
NTS

Drop Inlet Computations

Project:	TROPICAL & CENTENNIAL	
Title:	Mod. Type 'C' Drop Inlet (SUMP)	
Subtitle:	12-ft Drop Inlet	
By:	RFF	
Date:	10/19/2011	

Input:	Variable:	Input:
Depth at Inlet (ft)	D	0.67
Grate Width (ft)	W	1.50
Length of Grate (ft)	L_g	12.00
Length of Curb Opening (ft)	L_c	12.00
Height of Curb Opening (ft)	H	0.547
Weir Coef. - Curb Opening	W_c	2.3
Weir Coef. - Grate	W_g	3.0
Orifice Coef.	O_c	0.67
Grate Coef.	G_c	0.60
Clogging Factor - Grate (%)	CF_g	50
Clogging Factor - Curb (%)	CF_c	50

Output (Grate):	Equation:	Output (Grate):
Effective Weir Length (ft)	$2*W+L_g$	15.00
Adjusted Effective Weir Length (ft)	$2*(1-CF_g/100)*W+(1-CF_g/100)*L_g$	7.50
Grate Open Area (sf)	$W*L_g$	18.00
Adjusted Grate Open Area (sf)	Grate Open Area * $G_c*(1-CF_g/100)$	5.40
Controlling Flow Type (weir/orifice)	If $D < 1.792*(Adj. \text{ Grate Open Area}/Adj. \text{ Eff. Length})$ use weir, else orifice	weir
Intercepted Flow (cfs)	weir: $W_g*(Adj. \text{ Eff. Weir Length})*D^{1.5}$ orifice: $O_c*(Adj. \text{ Grate Open Area})*(64.4*D)^{0.5}$	12.3

Output (Curb):	Equation:	Output (Curb):
Effective Weir Length (ft)	$L+1.8*W$	14.70
Adjusted Effective Weir Length (ft)	$L+1.8(1-CF_c/100)*W$	13.41
Curb Open Area (sf)	$L*H$	6.56
Adjusted Curb Open Area (sf)	Curb Open Area * $(1-CF_c/100)$	3.28
Controlling Flow Type (weir/orifice)	If $D < H$, weir, else orifice	orifice
Intercepted Flow (cfs)	weir: $W_c*(Adj. \text{ Eff. Weir Length})*D^{1.5}$ orifice: $O_c*(Adj. \text{ Curb Open Area})*(64.4*(D-H/2))^{0.5}$	14.40

Output (Combination):		Output (Combination):
Total Intercepted Flow (cfs)	Intercepted (Grate) + Intercepted (Curb)	26.7

Project:		TROPICAL & CENTENNIAL
Title:		Mod. Type C Drop Inlet (Continuous Grade)
Subtitle:		3-ft Drop Inlet
By:		RFF
Date:		10/19/2011
Input:	Variable:	Input:
Street Flow (cfs)	Q	21.0
Longitudinal Slope (ft/ft)	S _o	0.0090
Manning's Coefficient	n	0.016
Street Flow Velocity (fps)	V	2.39
Street Flow Depth (ft)	D	0.55
Street Cross Slope (ft/ft)	S _x	0.02
Grate Width (ft)	W	1.5
Grate Depression (in)	D _g	2.0
Length of Grate (ft)	L _g	3.0
Length of Curb Opening (ft)	L _c	3.00
Clogging Factor - Grate (%)	CF _g	50%
Clogging Factor - Curb (%)	CF _c	50%
Effective Grate Length (ft)	L _{ge}	1.5
Effective Curb Opening Length (ft)	L _{ce}	1.50
Output (Grate):	Equation:	Output (Grate):
¹ R _f - Frontal Flow Factor	1-0.09*(V-V _x) if V>V _x ; else Frontal Flow Factor=1	1.00
² V _o - Splash Over Velocity (fps)	V _x =p+q*L _g -r*L _{ge} ² +sy*L _{ge} ³ ; where p=0.30,q=4.85,r=1.31,sy=0.15 (for Vane Grate)	5.13
¹ E - Grate Flow Ratio	Frontal Flow/Side Flow	0.20
² Q _w - Frontal Flow (cfs)	Q _w = Q[1-(1-(W/T)) ^{2.67}]	4.11
¹ Q _s - Side Flow (cfs)	Q _s = Q-Q _w	16.9
T - Side Flow Spread (ft)	(D-D _g)/S _x	19.17
¹ R _s - Side Flow Factor	1/(1+(0.15*V ^{1.8})/(S _x *L _{ge} ^{2.3}))	0.07
¹ Q _{gi} - Intercepted Flow (cfs)	(R _f *E+R _s *(1-E))*Q	5.2
Output (Curb):	Equation:	Output (Curb):
¹ S _e - Equivalent Cross Slope (ft/ft)	S _x +S _g *E	0.042
Q _{sx} - Remaining Flow After Grate Interception (cfs)	Q-Q _{gi}	15.780
S _g - Gutter Cross Slope (ft/ft)	D _g /W	0.111
¹ L _i - Effective Interception Length (ft)	0.60*Q _{sx} ^{0.42} *S _o ^{0.30} *(1/n*S _e) ^{0.6}	37.40
¹ Q _{ci} - Intercepted Flow (cfs)	(1-(1-L _{ce} /L _i) ^{1.8})*Q _{sx} or Q _{sx} if L _i is less than L _{ce}	1.1
Output (Combination):		Output (Combination):
Total Intercepted Flow (cfs)	Intercepted (Grate) + Intercepted (Curb)	6.3

¹ Formula referenced from the CCRFCD Manual

² Formula referenced from FHWA Urban Drainage Design Manual (HEC-22)

FlowMaster Storm Drain
Worksheets

12" INCH PIPE IN CENT

Worksheet for Circular Channel

Project Description

Worksheet	24" CENT
Flow Element	Circular Chann
Method	Manning's Forr
Solve For	Channel Depth

Input Data

Mannings Coeff	0.013
Channel Slope	3.00 %
Diameter	12.0 in
Discharge	6.00 cfs

Results

Depth	0.80 ft
Flow Area	0.7 ft ²
Wetted Perime	2.20 ft
Top Width	0.00 ft
Critical Depth	0.96 ft
Percent Full	79.6 %
Critical Slope	2.46 %
Velocity	8.95 ft/s
Velocity Head	1.25 ft
Specific Energ	2.04 ft
Froude Numbe	1.73
Maximum Disc	6.64 cfs
Discharge Full	6.17 cfs
Slope Full	2.84 %
Flow Type	Supercritical

24" INCH PIPE ACROSS CENT

Worksheet for Circular Channel

Project Description

Worksheet	24" CENT
Flow Element	Circular Chann
Method	Manning's Forr
Solve For	Channel Depth

Input Data

Mannings Coeff	0.013
Channel Slope	3.00 %
Diameter	24.0 in
Discharge	26.00 cfs

Results

Depth	1.19 ft
Flow Area	1.9 ft ²
Wetted Perime	3.52 ft
Top Width	0.00 ft
Critical Depth	1.79 ft
Percent Full	59.5 %
Critical Slope	1.17 %
Velocity	13.34 ft/s
Velocity Head	2.76 ft
Specific Energ	3.96 ft
Froude Numbe	2.36
Maximum Disc	42.15 cfs
Discharge Full	39.18 cfs
Slope Full	1.32 %
Flow Type	Supercritical

APPENDIX D

Reference Material
Twilight at Riverwalk

TECHNICAL DRAINAGE STUDY RESPONSE TO COMMENTS

Twilight at Riverwalk Ranch
City of North Las Vegas, Clark County, Nevada

Job No.: DRH0409.003
Date: March 2005

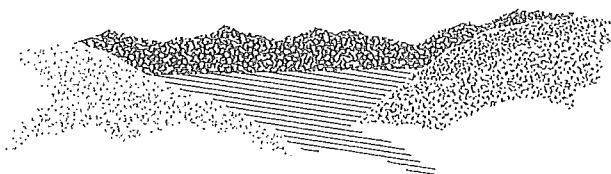
Prepared By:
Slater Hanifan Group, Inc.
5740 S. Arville Street, Suite 216
Las Vegas, Nevada 89118
Phone: 702-284-5300 • Fax: 702-284-5399

Prepared For:
D.R. Horton, Inc.
3513 East Russell Road, Suite D
Las Vegas, Nevada 89120
Phone: 702-435-8585 • Fax: 702-638-4719

Mark J. Failla
NV Professional Engineer No. 14566

Assisted by: Justin D. Stoker, E.I.

RECEIVED

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

Gale Wm. Fraser, II, P.E.
General Manager/Chief
Engineer

BOARD OF DIRECTORS

Larry Brown
Chairman
City of Las Vegas

Chip Maxfield
Vice-Chairman
Clark County

Shari Buck
City of North Las Vegas

Andy Hafen
City of Henderson

Michael Mack
City of Las Vegas

Mayor Bill Nicholas
City of Mesquite

Roger Tobler
City of Boulder City

Bruce L. Woodbury
Clark County

May 23, 2005

Mr. Stephen E. Casmus, P.E.
City of North Las Vegas Public Works
2266 Civic Center Drive
North Las Vegas, NV 89030

DISTRICT CONCURRENCE: TWILIGHT AT RIVERWALK RANCH
(CNLV NO. 19767) (RFCD NO. 6318)

Dear Mr. Casmus:

Clark County Regional Flood Control District (District) reviewed Technical Drainage Study dated March 7, 2005 and Addendum No. 1 dated March 23, 2005, for the above-mentioned project as submitted by Slater Hanifan, Group. In addition, District is in receipt of the Conditional Letter of Acceptance from City of North Las Vegas Public Works dated March 30, 2005.

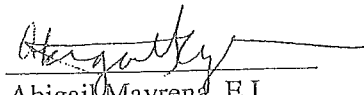
District concurs with acceptance of this Technical Drainage Study by City of North Las Vegas Public Works.

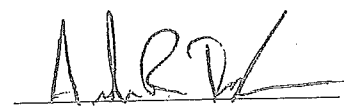
District's review of this project was limited to issues of Regional Flood Control Significance as defined in *Uniform Regulations for the Control of Drainage*.

Please be aware that as additional information becomes available and/or restudies of Flood Insurance Studies are performed, information submitted by Slater Hanifan, Group may be superseded. Compliance with regulatory elements and design standards specified in *Uniform Regulations for the Control of Drainage* does not imply a guarantee that properties will be free from flooding or flood damage. The District, its officials, or employees assume no liability for information, data, or conclusions presented by consulting engineers. We, therefore, make no warranties, either expressed or implied, in conducting this review.

GALE WM. FRASER, II, P.E.
General Manager/Chief Engineer

BY:

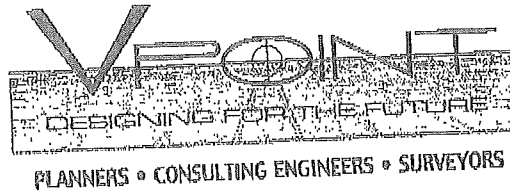

Abigail Mayrena, E.I.
Associate Engineer


Andrew R. Trelease, P.E.
Senior Civil Engineer

AM:ART:css

c: Mark J. Failla, P.E., Slater Hanifan, Group

File: 19-61-30.SLA



March 30, 2005

Post-It® Fax Note	7671	Date	3/30/05	# of pages	3
To	Mark Failla	From	SCasmus		
Co./Dept	SHG	Co.	CNLV		
Phone #	284-5300	Phone #	633-1912		
Fax #	284-5399	Fax #	649-4626		

Mark J. Failla, P.E.
 Slater Hanifan Group, Inc.
 5740 S. Arville, Suite 216
 Las Vegas, NV 89120

RE: Technical Drainage Study for Twilight at Riverwalk Ranch
 CNLV No. 19767

Dear Mr. Failla:

VPoint has received and reviewed *Addendum #1* to the above referenced drainage study dated March 23, 2005 and has found the study to meet the minimum accepted standards for a technical drainage study with the following condition: Per Steve Casmus at Development and Flood Control for the City of North Las Vegas, the requested deviation from the City of North Las Vegas North Neighborhood Flood Control Master Plan regarding elevations and grades on Tropical Parkway will require specific CNLV approval.

Concurrence must be obtained from the Clark County Regional Flood Control District due to the proposed proximity to Regional Flood Control Facilities.

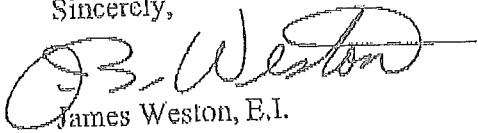
Please be advised that land surface disturbances over one (1) acre must submit to the Nevada Department of Environmental Protection a "Notice of Intent" to discharge, which certifies that a storm water pollution prevention plan has been developed and is maintained on the site for inclusion in the Storm Water General Permit No. NVR100000. A phased construction unit 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.

Acceptance of this study does not imply approval of the grading plan associated with the drainage for this site. A detailed review of the grading plan is performed by the City of North Las Vegas staff during the improvement plan review process. The review process does not relieve the design engineer of the responsibility to provide correct and safe drainage design or the developer to properly construct the designed facilities. The City and VPoint assume no liability for the information, data,

Mark J. Failla, P.E.
Twilight at Riverwalk Ranch, CNLV# 19767
Page 2 of 3
March 30, 2005

and conclusions presented in this technical drainage study. Should you have any questions regarding any comments, please contact the City of North Las Vegas at (702) 633-1200.

Sincerely,

A handwritten signature in cursive script, appearing to read "J. Weston", written in dark ink.

James Weston, E.I.

VPoint

cc: Lenny Badger

DATE: 3/18/2005
TIME: 9:48

F0515P
WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING

PAGE 1

CARD CODE	SECT NO	CHN TYPE	NO OF PIERS	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)
CD	1	4			4.00														
CD	2	4			2.00														
CD	3	4			3.00														
CD	4	4			2.50														
CD	5	4			1.50														

F 0 5 1 5 P

PAGE NO 3

WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -

TWILIGHT AT RIVERWALK RANCH BY DR HORTON

HEADING LINE NO 2 IS -

SLATER HANIFAN GROUP, INC. - MAR 18, 2005

HEADING LINE NO 3 IS -

TROPICAL PWKY CONNECTION TO REGIONAL CHANNEL

F 0 5 1 5 P

PAGE NO 2

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO	1	IS A SYSTEM OUTLET	U/S DATA	STATION	INVERT	SECT	W S ELEV										
				0.00	2231.01	1	2235.00										
ELEMENT NO	2	IS A REACH	U/S DATA	STATION	INVERT	SECT	RADIUS	ANGLE	ANG PT	MAN H							
				21.21	2231.78	1	0.013	0.00	0.00	21.00	1						
ELEMENT NO	3	IS A JUNCTION	U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4		
				145.00	2236.28	1	1	0	0.014	130.0	0.0	2236.28	0.00	45.00	0.00		
ELEMENT NO	4	IS A JUNCTION	U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4		
				317.24	2239.00	3	4	0	0.014	32.0	0.0	2240.00	0.00	45.00	0.00		
ELEMENT NO	5	IS A JUNCTION	U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4		
				701.89	2245.20	4	5	0	0.013	11.0	0.0	2245.70	0.00	90.00	0.00		
ELEMENT NO	6	IS A JUNCTION	U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4		
				919.73	2250.67	4	5	0	0.013	1.0	0.0	2251.17	0.00	45.00	0.00		
ELEMENT NO	7	IS A REACH	U/S DATA	STATION	INVERT	SECT			N					RADIUS	ANGLE	ANG PT	MAN H
				1012.55	2251.60	4			0.013					0.00	0.00	12.00	1
ELEMENT NO	8	IS A REACH	U/S DATA	STATION	INVERT	SECT			N					RADIUS	ANGLE	ANG PT	MAN H
				1272.55	2254.20	4			0.013					0.00	0.00	18.00	1
ELEMENT NO	9	IS A REACH	U/S DATA	STATION	INVERT	SECT			N					RADIUS	ANGLE	ANG PT	MAN H
				1442.55	2255.90	4			0.013					0.00	0.00	9.00	1
ELEMENT NO	10	IS A JUNCTION	U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4		
				1546.42	2256.94	4	5	5	0.013	1.5	3.0	2.00	2257.44	80.00	80.00		

WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS

ELEMENT NO	11	IS A SYSTEM HEADWORKS	U/S DATA	STATION	INVERT	SECT	W S ELEV
				1652.33	2258.00	2	0.00

NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING
** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC

LICENSEE: SLATER HANIFAN GROUP

F0515P

PAGE 1

WATER SURFACE PROFILE LISTING

TWILIGHT AT RIVERWALK RANCH BY DR HORTON
SLATER HANIFAN GROUP, INC. - MAR 18, 2005
TROPICAL PWKY CONNECTION TO REGIONAL CHANNEL

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH		ZR		
0.00	2231.01	3.381	2234.391	205.0	18.10	5.084	2239.475	0.00	3.860	4.00	0.00	0.00	0	0.00
13.77	0.03630					.018694	0.26			2.582		0.00		
13.77	2231.51	3.573	2235.083	205.0	17.30	4.649	2239.732	0.00	3.860	4.00	0.00	0.00	0	0.00
7.44	0.03630					.017933	0.13			2.582		0.00		
21.21	2231.78	3.860	2235.640	205.0	16.50	4.225	2239.865	0.00	3.860	4.00	0.00	0.00	0	0.00
JUNCT STR	0.03635											0.00		
145.00	2236.28	2.585	2238.865	75.0	8.73	1.184	2240.049	0.00	2.621	4.00	0.00	0.00	0	0.00
JUNCT STR	0.01579					.006099	1.05					0.00		
317.24	2239.00	2.136	2241.136	43.0	7.99	0.991	2242.127	0.00	2.136	3.00	0.00	0.00	0	0.00
JUNCT STR	0.01612											0.00		
701.89	2245.20	1.195	2246.395	32.0	13.81	2.959	2249.354	0.00	1.927	2.50	0.00	0.00	0	0.00
JUNCT STR	0.02511					.019220	4.19					0.00		
919.73	2250.67	1.621	2252.291	31.0	9.20	1.316	2253.607	0.00	1.897	2.50	0.00	0.00	0	0.00
59.88	0.01002					.010054	0.60			1.621		0.00		
979.61	2251.27	1.621	2252.891	31.0	9.20	1.316	2254.207	0.00	1.897	2.50	0.00	0.00	0	0.00
32.94	0.01002					.010045	0.33			1.621		0.00		
1012.55	2251.60	1.622	2253.222	31.0	9.20	1.314	2254.536	0.00	1.897	2.50	0.00	0.00	0	0.00
260.00	0.01000					.010036	2.61			1.622		0.00		
1272.55	2254.20	1.622	2255.822	31.0	9.20	1.314	2257.136	0.00	1.897	2.50	0.00	0.00	0	0.00
13.31	0.01000					.010036	0.13			1.622		0.00		
1285.86	2254.33	1.622	2255.955	31.0	9.20	1.314	2257.269	0.00	1.897	2.50	0.00	0.00	0	0.00
106.12	0.01000					.009711	1.03			1.622		0.00		
1391.98	2255.39	1.660	2257.054	31.0	8.95	1.245	2258.299	0.00	1.897	2.50	0.00	0.00	0	0.00
35.68	0.01000					.008874	0.32			1.622		0.00		
1427.66	2255.75	1.733	2257.484	31.0	8.54	1.132	2258.616	0.00	1.897	2.50	0.00	0.00	0	0.00
11.93	0.01000					.007914	0.09			1.622		0.00		
1439.59	2255.87	1.811	2257.681	31.0	8.14	1.029	2258.710	0.00	1.897	2.50	0.00	0.00	0	0.00
2.96	0.01000					.007078	0.02			1.622		0.00		
1442.55	2255.90	1.897	2257.797	31.0	7.76	0.935	2258.732	0.00	1.897	2.50	0.00	0.00	0	0.00
JUNCT STR	0.01001					.005600	0.58					0.00		
1546.42	2256.94	1.968	2258.908	26.5	6.39	0.635	2259.543	0.00	1.755	2.50	0.00	0.00	0	0.00
JUNCT STR	0.01001					.005216	0.00					0.00		
1652.33	2258.00	1.968	2259.968	26.5	8.46	1.112	2261.080	0.00	1.798	2.00	0.00	0.00	0	0.00

SDMH #6

TWILIGHT AT RIVERWALK RANCH BY DR HORTON
SLATER HANIFAN GROUP, INC. -- MAR 18, 2005
TROPICAL PWKY CONNECTION TO REGIONAL CHANNEL

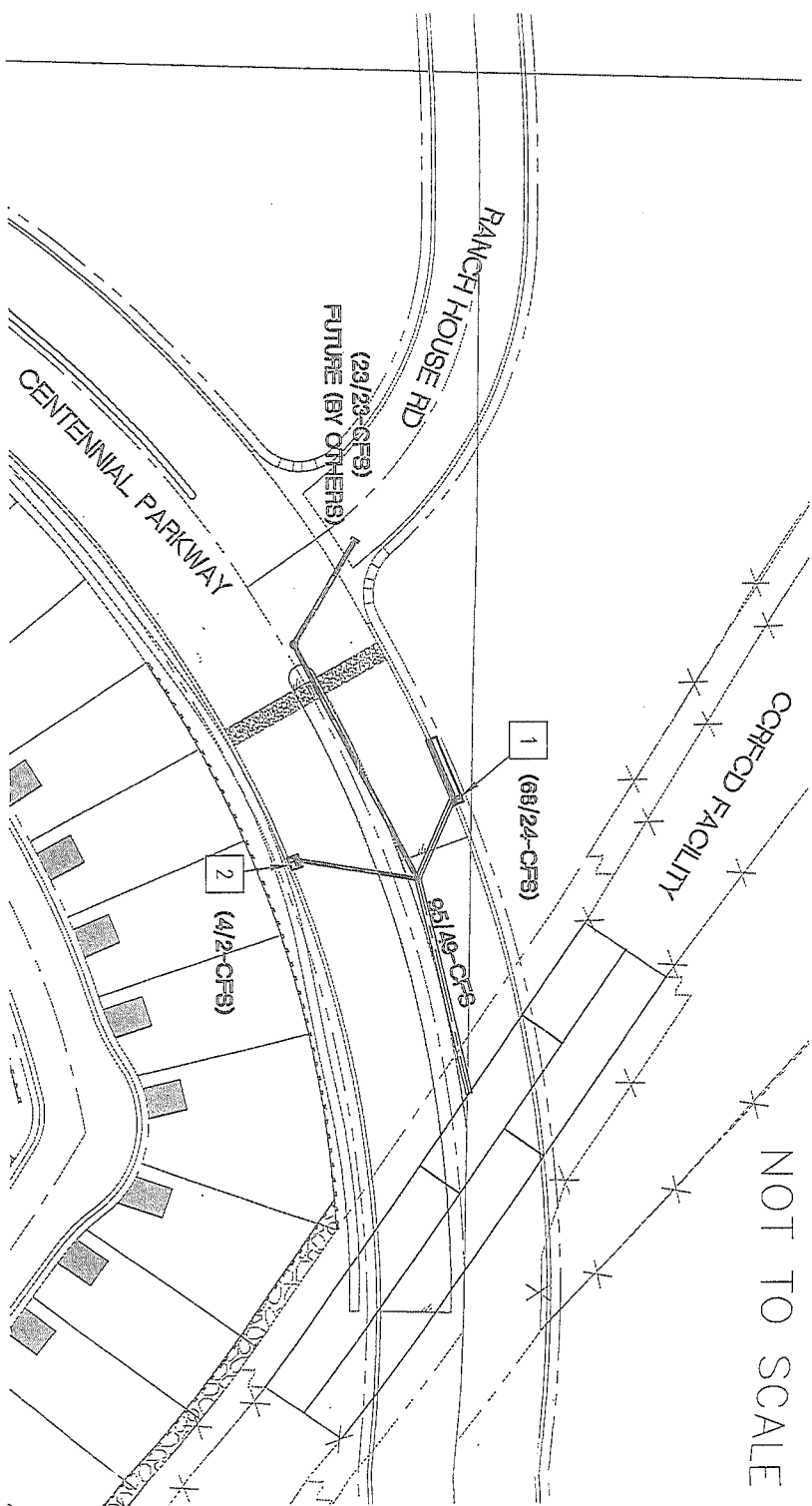
2231.01	2234.02	2237.02	2240.03	2243.04	2246.05	2249.05	2252.06	2255.07	2258.07	2261.08
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

NOTES

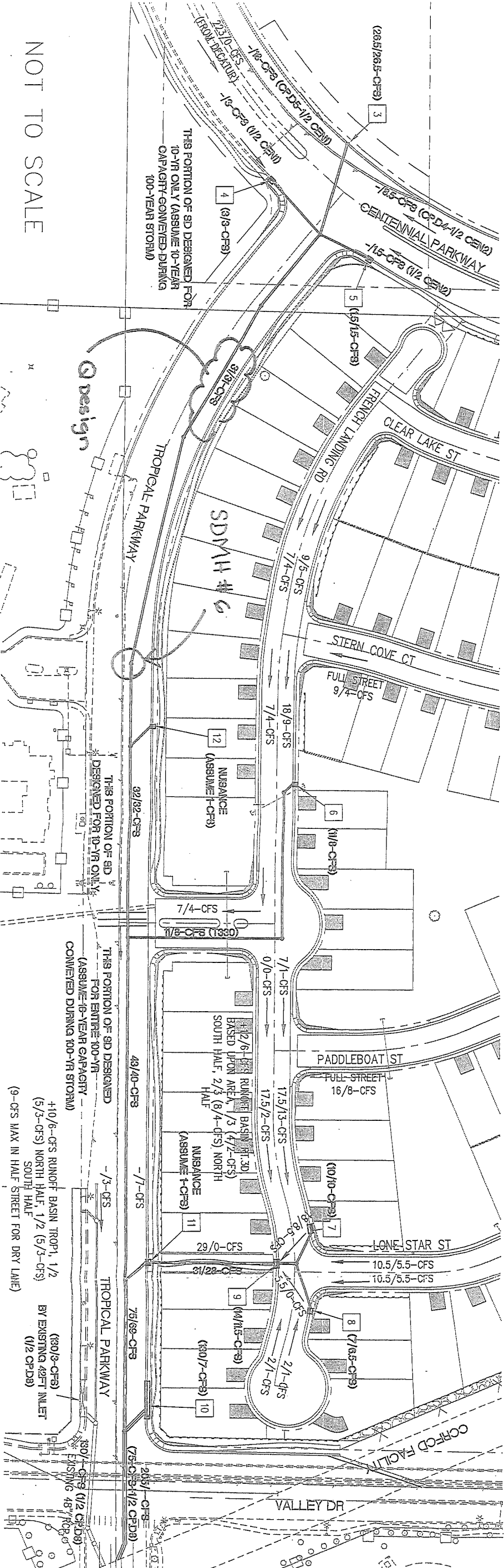
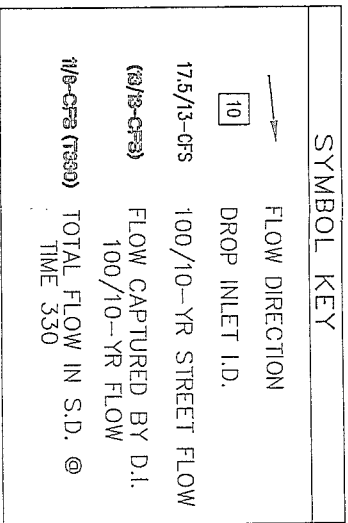
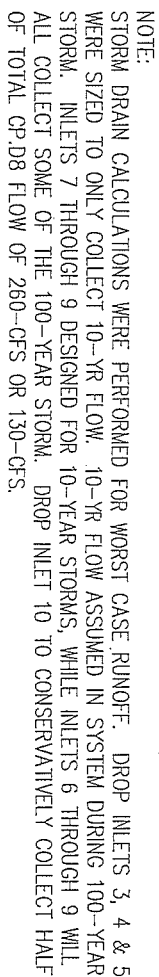
1. GLOSSARY

1. GLOSSARY
I = INVERT ELEVATION
C = CRITICAL DEPTH
W = WATER SURFACE ELEVATION
H = HEIGHT OF CHANNEL
E = ENERGY GRADE LINE
X = CURVES CROSSING OVER
B = BRIDGE ENTRANCE OR EXIT
Y = WALL ENTRANCE OR EXIT
FOR POINTS AT A JUNCTION

2. STATIONS FOR POINTS AT A JUMP MAY NOT BE PLOTTED EXACTLY



DROP INLET AND LATERAL SUMMARY TABLE				
D.I. #	DROP INLET DESCRIPTION	LATERAL SIZE (IN)	Q100 COLLECTED (CFS)	Q10 COLLECTED (CFS)
1	36-FT MOD. TYPE C (12 GRATES)	36	68	24
2	6-FT MOD. TYPE C (2 GRATES)	18	4	2
3	NDOT TYPE 2A	24	-	26.5
4	6-FT MOD. TYPE C (2 GRATES)	18	-	3
5	6-FT MOD. TYPE C (2 GRATES)	18	-	1.5
6	4-FT TYPE C (1 GRATE)	18	11	8
7	9-FT MOD. TYPE C (3 GRATES)	18	10	10
8	6-FT MOD. TYPE C (2 GRATES)	18	7	6.5
9	9-FT MOD. TYPE C (3 GRATES)	30	14	11.5
10	42-FT MOD. TYPE C (14 GRATES)	48	130	7
11	4-FT TYPE C (1 GRATE)	NA	NUIS.	NUIS.
12	4-FT TYPE C (1 GRATE)	18	NUIS.	NUIS.



APPENDIX E

Reference Material
High Noon at Riverwalk

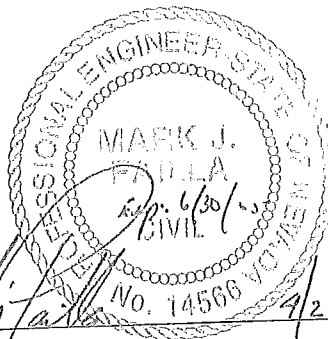
TECHNICAL DRAINAGE STUDY

High Noon at Riverwalk Ranch
City of North Las Vegas, Clark County, Nevada

Job No.: DRH0409.004
Date: April 2005

Prepared By:
Slater Hanifan Group, Inc.
5740 S. Arville Street, Suite 216
Las Vegas, Nevada 89118
Phone: 702-284-5300 • Fax: 702-284-5399

Prepared For:
D.R. Horton, Inc.
3513 East Russell Road, Suite D
Las Vegas, Nevada 89120
Phone: 702-435-8585 • Fax: 702-638-4719

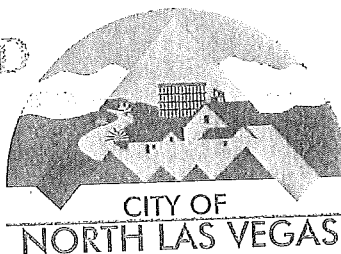

Mark J. Failla
NV Professional Engineer No. 14566

Assisted By: Justin Stoker, E.I.

Mayor
Michael L. Montandon

Council Members
William E. Robinson
Stephanie S. Smith
Shari Buck
Robert L. Eliason

RECEIVED



City Manager
Gregory E. Rose

Assistant City Manager
Dan Tarwater

Your Community of Choice
Public Works Department - Development & Flood Control
2266 Civic Center Drive • North Las Vegas, Nevada 89030
Telephone: (702) 633-1200 • Fax: (702) 649-4696
www.cityofnorthlasvegas.com

June 15, 2005

Mark J. Failla, PE
Slater Hanifan Group, Inc.
5740 South Arville Street, Suite 216
Las Vegas, NV 89118

Re: Addendum to the Technical Drainage Study for High Noon at Riverwalk Ranch
CNLV No. 20768; SHG No. DRH0409.004

Dear Mr. Failla:

Staff has reviewed the above referenced study, dated June 9, 2005, and found it to meet the minimum accepted standards for a technical drainage study.

Please be advised that all land surface area disturbances over 1 acre and/or adjacent to a water way must submit a "Notice of Intent" to discharge to the Nevada Division of Environmental Protection, which certifies that a stormwater pollution prevention plan has been developed and is maintained on site. For more information, including forms and applications, see <http://ndep.nv.gov/bwpc/storm01.htm>.

Acceptance of this drainage study does not imply approval of the grading plan or the structural calculations associated with the drainage for this site. A detailed review of the grading plan is performed by staff during the improvement plan review process.

The City assumes no responsibility for the information, data, and conclusions presented in this report. If you have any questions concerning this matter, please contact me at 633-2088.

Sincerely,

Jennifer E. Doody, PE CFM
Senior Engineer
Development and Flood Control Division

SLATER
HANIFAN
GROUP

CONSULTING ENGINEERS & PLANNERS

Project Name:	High Noon at Riverwalk Ranch
Description:	Proposed Conditions
File Name:	

Company: SHG, Inc
By: Justin Stoker, El
Date: 04/14/05

[illegible]



ULTING ENGINEERS & PLANNERS

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

TIME OF CONCENTRATION

Company: SHG, Inc
By: Justin Stoker, EI
Date: 03/02/05

Project Name: Twilight at Riverwalk Ranch
Description: All Conditions
File Name:

SIG:	DEV/JEX (D or E)	SUB-BASIN DATA			INITIAL / OVERLAND TIME (Ti)			TRAVEL TIME (Tt)				Tc			Tc Check			Tag
		CN	K	AREA Ac	AREA Mi ²	INITIAL LENGTH Feet	SLOPE %	Ti Min	TRAVEL LENGTH Feet	SLOPE %	V1 FPS	V2 FPS	Tt Min	Tc Calc.	Tc Check	Total Length Feet	Tc Check	Tag Hours
1E	E	85	0.7320	24.80	0.0388	500	0.7	16.98	1135	2.2	2.20	4.36	6.22	22.90	22.90	700	22.90	0.229
2E	E	87	0.7584	8.34	0.0130	250	1.0	9.72	700	2.6	2.38	4.74	4.20	13.92	13.92	700	13.92	0.139
1E	E	87	0.7584	29.62	0.0463	500	1.1	13.32	900	1.1	1.55	3.08	7.53	20.85	20.85	900	20.85	0.208
2E	E	85	0.7320	12.43	0.0194	500	1.0	14.81	825	1.0	1.48	2.94	7.47	22.28	22.28	825	22.28	0.223
1D	D	95	0.8640	3.29	0.0051	150	1.00	5.20	550	0.6	1.56	2.37	5.68	10.88	10.88	550	10.88	0.109
2D	D	95	0.8640	3.13	0.0049	150	1.00	5.20	500	0.5	1.43	2.16	5.83	11.04	11.04	500	11.04	0.110
3D	D	95	0.8640	4.14	0.0065	150	1.00	5.20	760	1.4	2.35	3.56	4.77	9.97	9.97	760	9.97	0.100
4D	D	95	0.8640	5.60	0.0088	150	1.00	5.20	940	1.1	2.12	3.21	6.22	11.42	11.42	940	11.42	0.114
5D	D	95	0.8640	8.05	0.0126	150	1.00	5.20	1690	1.0	2.02	3.06	10.61	15.81	15.81	1690	15.81	0.158
6D	D	95	0.8640	1.26	0.0020	150	1.00	5.20	200	1.0	2.02	3.06	11.65	16.85	16.85	200	16.85	0.168
7D	D	95	0.8640	2.23	0.0035	150	1.00	5.20	610	2.1	2.93	4.43	3.26	8.46	8.46	610	8.46	0.085
8D	D	95	0.9036	1.65	0.0026	15	2.00	1.09	660	0.5	1.43	2.16	7.07	8.15	8.15	660	8.15	0.082
9D	D	98	0.9036	2.15	0.0034	15	2.00	1.09	890	1.3	2.30	3.49	5.48	16.57	16.57	890	16.57	0.164
10D	D	98	0.9036	3.36	0.0053	15	2.00	1.09	1455	1.0	2.02	3.06	9.33	10.41	10.41	1455	10.41	0.104
11D	D	98	0.9036	0.87	0.0034	420	1.00	13.58	0	1.0	1.48	2.94	0.00	13.58	13.58	0	13.58	0.136
12D	D	85	0.7320	12.45	0.0195	500	1.00	14.81	2200	1.0	1.74	2.63	15.27	30.08	30.08	2200	30.08	0.301
13D	D	98	0.9036	2.00	0.0031	15	2.00	1.09	900	0.7	1.74	2.63	7.33	8.42	8.42	900	8.42	0.084
14D	D	94	0.8508	11.03	0.0172	100	2.00	3.56	1300	0.7	1.69	2.56	10.14	13.70	13.70	1300	13.70	0.137
15D	D	94	0.8508	8.67	0.0135	100	2.00	3.56	1000	0.5	1.43	2.16	9.69	13.25	13.25	1000	13.25	0.132
16D	D	95	0.8640	12.02	0.0188	100	2.00	3.56	1500	1.0	2.02	3.06	9.57	12.94	12.94	1500	12.94	0.129
17D	D	96	0.8772	0.87	0.0014	420	1.00	8.22	0	1.0	2.02	3.06	0.00	8.22	8.22	0	8.22	0.082
18D	D	92	0.8244	6.91	0.0108	140	1.00	5.87	1080	0.8	1.81	2.74	8.14	14.01	14.01	1080	14.01	0.140
19D	D	91	0.8112	6.75	0.0105	140	1.00	6.15	1000	0.8	1.81	2.74	7.66	13.81	13.81	1000	13.81	0.138
20D	D	98	0.9036	3.47	0.0054	15	2.00	1.09	1400	0.5	1.43	2.16	12.77	13.85	13.85	1400	13.85	0.139
21D	D	98	0.9036	3.21	0.0050	15	2.00	1.09	1150	0.7	1.74	2.63	8.91	10.00	10.00	1150	10.00	0.100
22D	D	98	0.9036	0.88	0.0014	15	2.00	1.09	700	0.7	1.69	2.56	6.23	7.32	7.32	700	7.32	0.073
23D	D	98	0.9036	2.12	0.0033	15	2.00	1.09	1115	4.0	4.04	6.12	3.74	4.82	4.82	1115	4.82	0.048

For Existing Conditions: $V2 = 29.4 * (S/100)^{0.5}$
For Developed Conditions: $V2 = 30.6 * (S/100)^{0.5}$
 $Tc = (L/180) + 10$
 $Tag = (0.6 * Tc) / 60$
Min Tag = 0.05

For Existing Conditions: $V1 = 14.8 * (S/100)^{0.5}$
For Developed Conditions: $V1 = 20.2 * (S/100)^{0.5}$
 $Tt = L / (60 * V)$
 $Tc = Tt + Tt$
Total L = Initial L + Travel L

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

STANDARD FORM 4

REFERENCE:

SCALE: 1" = 200'

F E E T

[illegible]

**S-I-G SLATER
HANIFAN
GROUP**
CONSULTING ENGINEERS & PLANNERS
5740 S. ARVILLE STREET #216, LAS VEGAS, NV 89118
PHONE (702) 284-5300 FAX (702) 284-5399

HIGH NOON AT RIVERWALK RANCH

DRAINAGE BASIN MAP ULTIMATE CONDITIONS

SYMBOL KEY	
	DRAINAGE SUBBASIN
	COMBINATION POINT
	SUBBASIN BOUNDARY
	FLOW DIRECTION
	CROSS SECTION

*BASINS REFERENCED FROM TWILIGHT AT RIVERWALK RANCH

DATE:	04/15/05
DRAFTER:	JDS
DESIGNER:	JDS
CHECKED:	MJF
PROJECT NO.	DRH0409-004

APPENDIX F

Reference Material
Tropical/Decatur C-Store

CITY OF LAS VEGAS		DATE:	
INTER-OFFICE MEMORANDUM		May 31, 2011 <i>AMS</i>	
TO: Land Development Services Department of Public Works		FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works	
SUBJECT: Drainage Study for: Tropical and Decatur Convenience Store (Project in CNLV for CLV Concurrence)		COPIES TO: Kimley Horn & Associates	
Cross Streets:	NEC of Tropical Parkway & Decatur Blvd.	M Grape LLC	
File Number:	F:\Depot\DSMemos\DS4530A.doc	Bart Anderson, P.E., DevCo	
Parcel Number:	124-30-204-005		
Zoning Action:	N/A		
FEMA Flood Zone	YES	NO	X
Proposed Storm Drain	YES	NO	X

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Transaction #
1 st Submittal & Supplement	5/10/2011 & 5/25/2011	5/31/2011	See Comments Below	\$400.00	168553: \$400
			TOTAL FEES (LDDRS):		-----

REMARKS:

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

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

City of Las Vegas Flood Control staff has reviewed the Technical Drainage Study and Addendum #1 for the subject project. City of Las Vegas concurs with the acceptance of the drainage study by the City of North Las Vegas Public Works Department. The review of this project was limited to issues of flood control significance to the City of Las Vegas.

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

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

In an effort to increase administrative efficiency, the City of Las Vegas Public Works will be requiring all soils report, drainage study and traffic impact analysis submittals to be accompanied by an electronic copy of the submittal. Electronic documents must be submitted with one original hard copy of the study. Electronic documents should be on a universal computer-readable digital output replicating your submittal to be used for archival or display purposes. This may be more than one file if necessary. An Indexed Portable Document Format (PDF) or Print Ready CAD file formats with a minimum of 300dpi are the desired formats, but provided it is a high quality digitized replication of the submittal, other formats may be acceptable. If figures are in color, they must be scanned in color and saved as a separate file. The new submittal requirements will become effective on July 1, 2011. If there are any questions regarding these new requirements, please contact Robert Welch in the Flood Section at (702) 229-2177 or Rick Schroder in Traffic Engineering at (702) 229-6327.

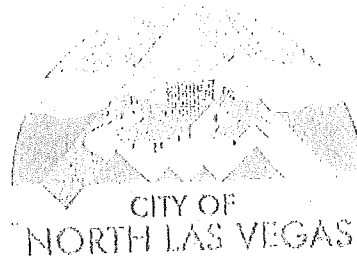
END OF REMARKS
ays

T/R/S: T19S/R61E/30
AREA H-30

Mayor
Shari L. Buck

Council Members
William E. Robinson
Robert L. Eliason
Anita G. Wood
Richard J. Cherchio

Acting City Manager
Maryann Ustick



Your Community of Choice

Community Development Department - Frank Fiori, Director
2240 Civic Center Drive, Suite 210 • North Las Vegas, Nevada 89030
Telephone: (702) 633-1537 • Fax: (702) 649-6091 • TDD: (800) 326-6868
www.cityofnorthlasvegas.com

February 15, 2011

George Garcia
G.C. Garcia, Inc.
1711 Whitney Mesa Drive Suite 110
Henderson, NV 89014

RE: UN-09-11 (42342) ARCO @ TROPICAL & DECATUR. An application submitted by M Grape LLC, property owner, for a special use permit in a C-2, General Commercial District to allow a convenience food store with gas pumps. The property is located at the northeast corner of Decatur Boulevard & Tropical Parkway. The Assessor's Parcel Number is 124-30-204-005.

Dear Mr. Garcia:

This letter is to correct the approval letter dated February 10, 2011.

The Planning Commission, at its meeting of February 9, 2011, approved UN-09-11 with the following conditions:

1. That, unless expressly authorized through a variance, waiver or another approved method, this development shall comply with all applicable codes and ordinances, including but not limited to all attached departmental memoranda.
2. The development of this site shall be in compliance with the Commercial Development Standards and Design Guidelines, with the exception of the following:
 - a. The convenience food store and car wash building is not required to be located at the front setback lines nearest to the intersection of Decatur Boulevard and Tropical Parkway and the gas pumps may be located between the building and Decatur Boulevard, generally as shown on the submitted site plan.
3. The building elevations for the convenience food store shall be revised to identify:
 - a. a consistent wainscot that shall be provided on each side of each structure;
 - b. a cornice that architecturally embellishes each side of each structure. Pre-finished galvanized metal flashing shall not be considered an acceptable cornice;
 - c. all down-spouts shall be within the building or otherwise fully concealed by architectural embellishments.
4. The special use permit is site-specific and non-transferable.

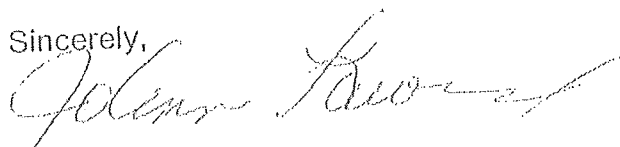
5. The gas canopy shall be designed and constructed to include wainscoting around the columns, and a cornice element that matches the convenience food store building. The canopy shall also use similar materials and colors of the primary building.
6. All signage (i.e., freestanding, wall, etc.) for this site shall be in compliance with the requirements set forth in Title 17. With the exception that the canopy signage shall be permitted to have a maximum of 75% coverage on each elevation to include the colored stripes and logo only. No signage identified on the site plan, primary structure, and/or canopy is implied to be or otherwise approved with this application.
7. The gas canopy lighting shall be directed downward through the use of shielding or recessed lighting.
8. All canvas-type awnings shall be Sunbrella material, or similar. No back-lit awnings are allowed.
9. All access to the roof shall be from within the building. Exterior roof ladders are prohibited.
10. The "Air and Water Station" (#7 in the legend) shall be relocated such that it (1) is not within a required landscape area; (2) would not impede vehicular movements (e.g., fueling trucks); and (3) would be away from the public rights-of-way.
11. Direct pedestrian access shall be provided as shown on the revised site plan dated 2/8/2011.
12. A landscape berm or decorative screen wall shall be provided between the adjacent rights-of-way (Tropical Parkway and Decatur Boulevard) and the on-site driving surface. In any area not wide enough for a landscape berm, a decorative screen wall shall be provided. The berm and/or wall shall measure three feet above the adjacent on-site paved surface. Openings in the berm or wall shall only be permitted to allow for pedestrian accessways from the sidewalk to the primary customer entrance.
13. The submitted site plan shall be revised to satisfy the landscape requirements in the following areas:
 - a. The row of parking facing Decatur Boulevard adjacent to the northern property line shall include a six foot wide landscape island at both ends of the row of 15 parking spaces, which may result in additional modifications if that row is to include the proposed 500-gallon propane tank and vacuum;
 - b. the landscape island at the west end of the row of parking adjacent to the north side of the car wash does not identify a 24" box tree;
 - c. the landscape island at the north end of the row of parking adjacent to the west side of the c-store does not identify a 24" box tree;
 - d. the landscape island at the south end of the row of parking adjacent to the west side of the c-store does not identify a 24" box tree;
 - e. the row of parking facing the south side of the c-store shall include a landscape island at both ends of the row, which may result in additional modifications if the trash enclosure is not relocated;
 - f. The row of parking facing Tropical Parkway adjacent to the southern property line shall include a six foot wide landscape island at both ends of the row of 15 parking spaces;
 - g. all required landscaping including, but not limited to, the planters/landscape pots adjacent to the west side of the c-store are required to be linked to the site's automatic drip irrigation system.

14. Commercial driveways are to be designed and constructed in accordance with *Uniform Standard Drawings for Public Works' Construction Off-Site Improvements* Drawing Numbers 222A and 225, with minimum widths of 32 feet as measured from lip of gutter to lip of gutter.
15. The size and number of driveways and their locations are subject to review and approval by the Department of Public Works. Conformance may require modifications to the site.
16. The applicant shall submit an application (AMP) to amend the *Master Plan of Streets & Highways* to formally change the alignment of the Centennial Parkway/Tropical Parkway intersection; additionally, the property owner shall complete a parcel map concurrently with the civil improvement plans.
17. The public street geometrics, width of over-pave and thickness of the pavement sections will be determined by the Department of Public Works.
18. All known geologic hazards shall be shown on the site plan and the civil improvement plans. Subsequent identification of additional hazards may substantially alter the original site plan.
19. The property owner is required to grant a roadway easement for commercial driveway(s).
20. The property owner is required to grant a pedestrian access easement for sidewalk located within a common element, or on private property, when that sidewalk is providing public access adjacent to the right-of-way.
21. A revocable encroachment permit for landscaping within the public right of way may be required.
22. All Nevada Energy easements, appurtenances, lines and poles must be shown and shall be located entirely within the perimeter landscape area of this development. New distribution lines or existing distribution lines being adjusted or relocated, shall be placed underground.
23. Prior to the installation of any subgrade street improvements, all required underground utilities (i.e. telephone, power, water, etc.) located within public rights-of-way, shall be extended a minimum of ten (10) feet beyond the project boundary.
24. A cross access easement with adjacent parcels 124-30-204-001 and 124-30-204-002 shall be provided prior to approval of the civil improvement plans.

The decision of the Planning Commission is final unless appealed within seven days of the date action was taken, in writing, to the City Clerk at which time a public hearing will be scheduled before the City Council.

Should you have questions regarding this application, please contact Bob Hoyes, Planner at (702) 633-1872.

Sincerely,



Jo Ann Lawrence
Community Development Department

cc: Bob Hoyes, Planner

Technical Drainage Study

Tropical/Decatur Convenience Store

Prepared for:

M Grape, LLC

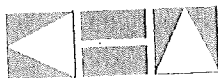
2460 Professional Court, Suite 120
Las Vegas, NV 89128

Prepared by:

Kimley-Horn and Associates, Inc.

2080 East Flamingo Road
Suite 210
Las Vegas, NV 89119-5178

Copyright © 2011 Kimley-Horn and Associates, Inc.
March 2011
KHA Project #092253005



Kimley-Horn
and Associates, Inc.



Kinley-Horn
and Associates, Inc.

Existing

Calculated by LSM Date 2/16/2011
Checked by _____ Date _____

Modified Rational Method

Tropical/Decatur Convenience Store

KHA Project No. 092583005

10-Year Storm Event															
Sub-Basin Data			Initial/Overland Time			Travel Time				t _c Check		10-Year Event			
		Area [ac]	Length [ft]	Slope [%]	t _b [min]	Length [ft]	Slope [%]	Velocity ^c [fps]	t _d [min]	Total Length [ft]	t _c =(L/180)*10 [min]	Final t _c [min]	Intensity ^f [in/hr]	Runoff Coefficient, C ₁₀ ^g	Q ₁₀ ^h [cfs]
Name	K ^a	0.25	1.55	50	1.0%	10.8	390	1.0%	2	3.3	440	12.4	3.2	0.25	0.6
005															

100-Year Storm Event															
Sub-Basin Data				Initial/Overland Time			Travel Time				t _c Check		100-Year Event		
Name	K ^a	Area [ac]	Length [ft]	Slope [%]	t _b [min]	Length [ft]	Slope [%]	Velocity ^c [fps]	t _d [min]	Total Length [ft]	t _c =(L/180)*10 [min]	Final t _c [min]	Intensity ^f [in/hr]	Runoff Coefficient, C ₁₀₀ ^g	Q ₁₀₀ ^h [cfs]
005	0.25	1.55	50	1.0%	10.8	390	1.0%	2	3.3	440	12.4	12.4	5.7	0.5	2.2

Notes:

^a K = C₁₀, 10-year runoff coefficient, from Table 601

^b t_b = 1.8(1-K)^{1/2}L^{1/3} equation 602, can also use Figure 601

^c Determined from Figure 602

^d t_d = L/60V where V is determined from Figure 602

^e Final t_c is the minimum of t_b + t_d and t_c (Minimum t_c for urban area is 5 minutes)

^f If in McCarran Airport Rainfall Data area, intensity is determined from Figure 517, if outside area, follow procedures in Section 507

^g Determined from Table 601

^h Q = KCIA, where K = 0.5

Proposed

Modified Rational Method

Tropical/Decatur Convenience Store

KHA Project No. 092583005

Calculated by ZRS Date 2/2/2011
Checked by LSM Date 2/2/2011

10-Year Storm Event				Travel Time				t _c Check		10-Year Event		
Sub-Basin Data		Initial/Overland Time		Length		Slope		t _i ^b		t _c		Runoff Coefficient, C ₁₀₀ ^g
Name	K ^a	Area [ac]	Length [ft]	Slope [%]	Length [ft]	Slope [%]	Velocity ^c [fps]	t ^d [min]	Total Length [ft]	t _c =(L/180)*10 [min]	Final t _e [min]	
005	0.75	1.55	50	1.5%	400	1.0%	2.0	3.3	450	12.5	7.2	0.75

100-Year Storm Event				Travel Time				t _c Check		100-Year Event		
Sub-Basin Data		Initial/Overland Time		Length		Slope		t _i ^b		t _c		Runoff Coefficient, C ₁₀₀ ^g
Name	K ^a	Area [ac]	Length [ft]	Slope [%]	Length [ft]	Slope [%]	Velocity ^c [fps]	t ^d [min]	Total Length [ft]	t _c =(L/180)*10 [min]	Final t _e [min]	
005	0.75	1.55	50	1.5%	400	1.0%	2.0	3.3	450	12.5	7.2	0.83

Notes:

^a K = C₁₀, 10-year runoff coefficient, from Table 601

^b t_i = 1.8(1.1-K)^{1/2}/S^{1/3} equation 602, can also use Figure 601

^c Determined from Figure 602

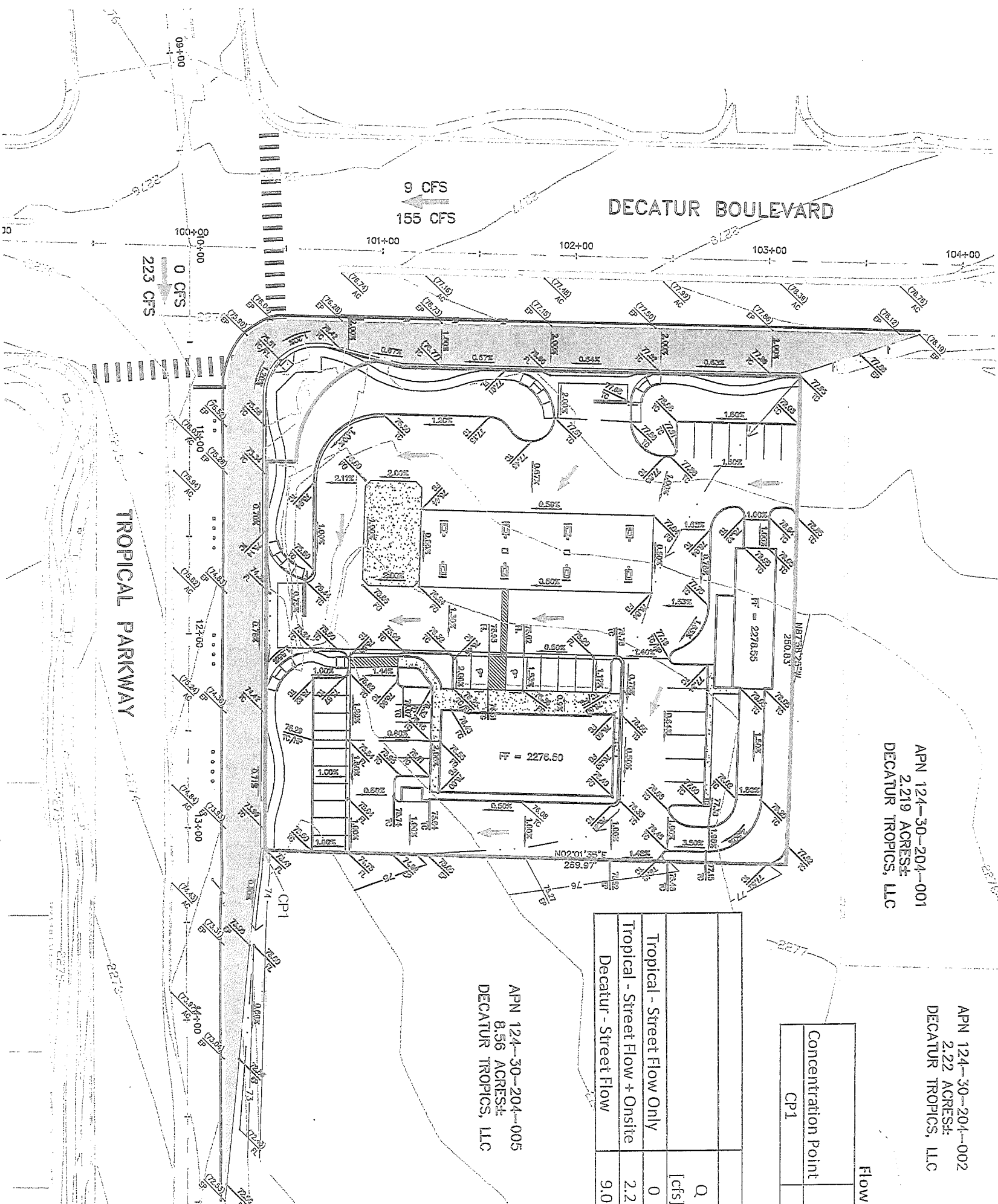
^d t_c = L/60V where V is determined from Figure 602

^e Final t_e is the minimum of t_i + t_c and t_c (Minimum t_c for urban area is 5 minutes)

^f If in McCarran Airport Rainfall Data area, intensity is determined from Figure 517, if outside area, follow procedures in Section 507

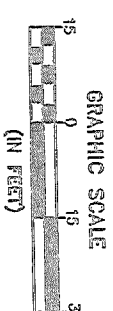
^g Determined from Table 601

^h Q = KCIA, where K = 0.5



	Area	Q_{410}	Q_{4100}
Concentration Point	[ac]	[cfs]	[cfs]
CP1	1.55	2.2	4.4

Flow Summary



	10-yr				100-yr			
	Q	d	V	dxV	Q	d	V	dxV
	[cfs]	[ft]	[ft/s]	[ft ² /s]	[cfs]	[ft]	[ft/s]	[ft ² /s]
Tropical - Street Flow Only	0	0	0	0	223	1.06	5.22	5.53
Tropical - Street Flow + Onsite	2.2	0.26	1.76	0.46	227.4	1.07	5.26	5.63
Decatur - Street Flow	9.0	0.41	2.57	1.05	155	1.02	4.57	4.66

APN 124-30-204-005
8.56 ACRE±
DECATUR TROPICS, LLC

LEGEND

-
- The map displays a topographic area with a grid of elevation contours ranging from 100 to 150 feet. A dashed line indicates the 'SUBBASIN BOUNDARY'. A solid line with arrows shows the 'SUBBASIN FLOW PATH', originating from the upper left and moving towards the lower right. A thick, solid line represents the 'PROPOSED BUILDING OUTLINE', located in the lower right portion of the map. A legend in the bottom right corner identifies the symbols: a dashed line for 'SUBBASIN BOUNDARY', a solid line with arrows for 'SUBBASIN FLOW PATH', a thick solid line for 'PROPOSED BUILDING OUTLINE', and a line with cross-ticks for 'DIRECTION OF RUNOFF'. Two flow events are specified: '10-YR FLOW' and '100-YR FLOW', both indicated by arrows pointing towards the building outline.

BENCHMARK

CITY OF NORTH LAS VEGAS BENCHMARK NLV9025E4

A RIVET AND 2" ROUND ALUMINUM DISK, LOCATED APPROXIMATELY 18 FEET SOUTH OF THE SOUTHWEST BCR AT THE INTERSECTION OF TROPICAL PARKWAY AND DECATUR BLVD.

ELEVATION = 2275.79 FEET (NAVD 88)

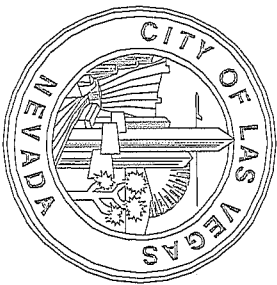
EXHIBIT d: NNECMP FUTURE CONDITIONS DRAINAGE MAP



APPENDIX G

Reference Material

City of Las Vegas Northwest Neighborhood Study



NORTHWEST NEIGHBORHOOD STUDY

LEGEND

— SUB-BASIN BOUNDARY

— FLOW ARROW

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

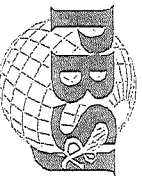
(FLOWS IN CFS)

BWJS $\leftrightarrow$ Basin-ID
(13 / 59) $\leftrightarrow$ Contributing flow
(10-Year / 100-Year)
from the basin (cfs)

PHOTO DATE: APRIL 1996

FIGURE E-6

EXISTING DRAINAGE CONDITIONS



**POST,
BUCKLEY,
SCHUH &
JERNIGAN, INC.**

ENGINEERING PLANNING SURVEYING GIS
901, N. Green Valley Pkwy., Ste 100, Henderson NV 89014
Phone: (702) 263-7275 Fax: (702) 263-7200

1	2	3	ELKHORN
4	5	6	DECATUR
7	8	9	JONES
10	11	12	RAINBOW
			BUFFALO
			DURANGO
			FT. APACHE
			HUALPAPI

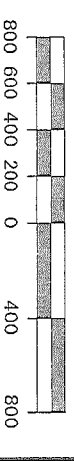
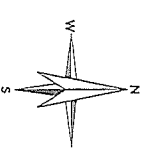
13	14	ALEXANDER
15	16	CHEVERIE
17	18	STONE MARCH

101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----



NOTE:

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



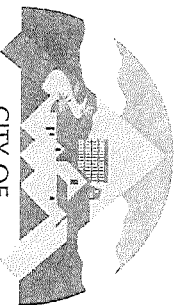
SCALE: 1 INCH = 800 FEET

REVISED SEPTEMBER 1999

APPENDIX H

Reference Material

CNLV North Neighborhood Study



CITY OF
NORTH LAS VEGAS
**NORTH
NEIGHBORHOOD
STUDY**

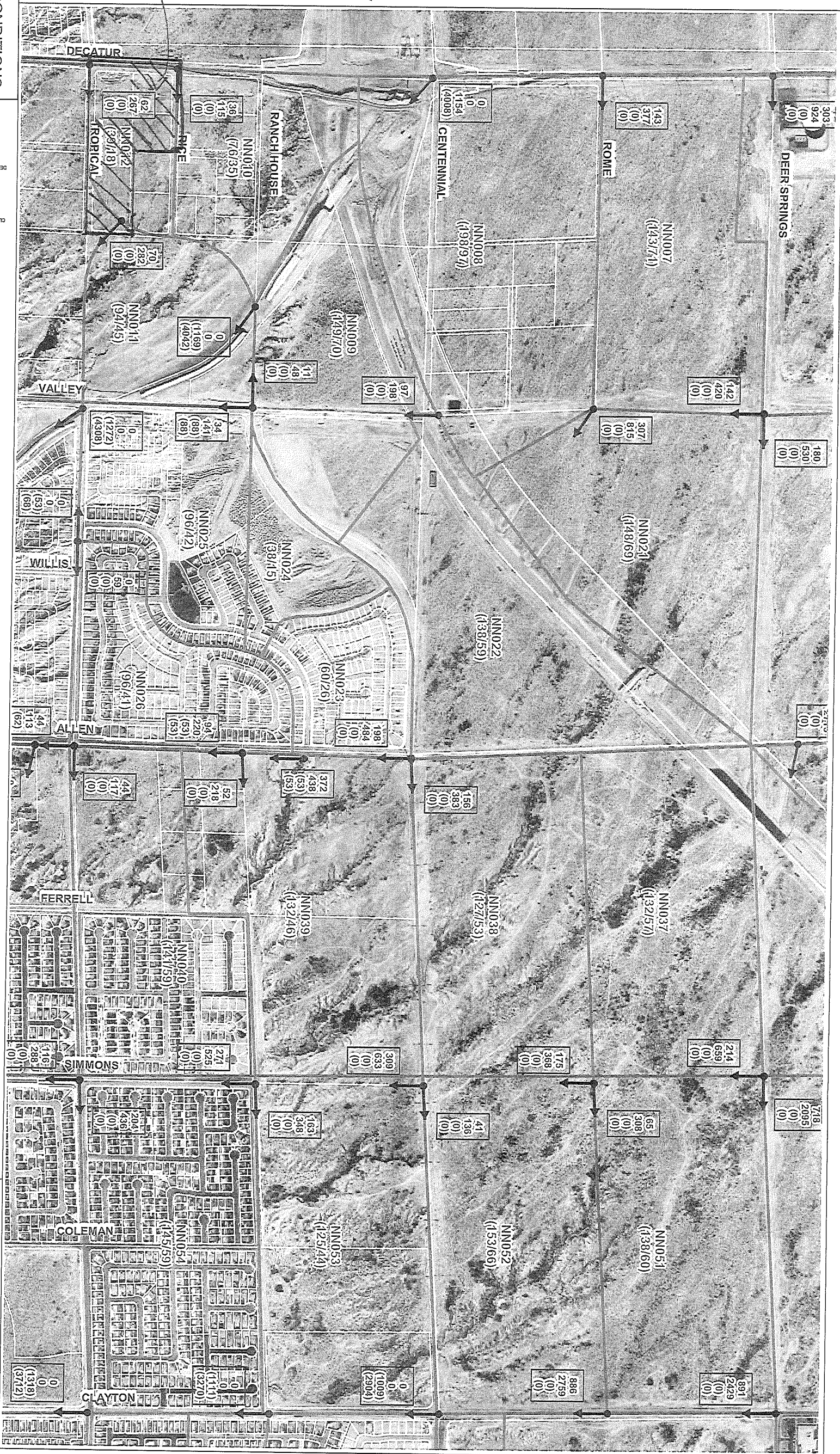
LEGEND

- Sub-basin Boundary
- NN100 Basin ID
- (100yr./10yr.) Contributing flow from the basin (cfs)
- Flow Arrow
- 250 10-Year Street Flow
- 500 100-Year Street Flow
- 300 10-Year Facility Flow
- 800 100-Year Facility Flow
- (Flows in CFS)
- Flows with asterisks represent non-street, non-facility flows.

PHOTO DATE: OCTOBER 2001

*Proposed
Site*
FIGURE E-9

EXISTING DRAINAGE CONDITIONS



PBS&J
901 N Green Valley Pkwy, Suite 100
Henderson, Nevada 89074-7105
Phone: 702/263-1725
Fax: 702/263-1700

The Consultant of Choice

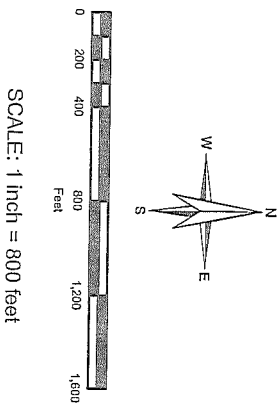
HOBBE	DECATUR				PECCOS	NELLIS
	CLAYTON	ST	PECCOS	NELLIS		
1	2	3	4			
5	6	7	8			
9	10	11	12			
13	14	15	16			

HOBBE	DECATUR				PECCOS	NELLIS
	CLAYTON	ST	PECCOS	NELLIS		
1	2	3	4			
5	6	7	8			
9	10	11	12			
13	14	15	16			

HOBBE	DECATUR				PECCOS	NELLIS
	CLAYTON	ST	PECCOS	NELLIS		
1	2	3	4			
5	6	7	8			
9	10	11	12			
13	14	15	16			

HOBBE	DECATUR				PECCOS	NELLIS
	CLAYTON	ST	PECCOS	NELLIS		
1	2	3	4			
5	6	7	8			
9	10	11	12			
13	14	15	16			

NOTE:
Existing conditions are based on future CN values with only existing local and CCRFCD facilities in place.
(X) - Existing condition flow not determined for this facility.



CITY OF
NORTH LAS VEGAS
**NORTH
NEIGHBORHOOD
STUDY**

- LEGEND**
- Existing Regional Basin
 - Proposed Regional Basin
 - Existing Regional Culvert
 - Existing Regional Bridge
 - Proposed Regional Culvert
 - Proposed Regional Bridge
 - Existing Regional Pipeline
 - Proposed Regional Pipeline
 - Existing Regional Channel
 - Proposed Regional Channel
 - Existing Regional Dike
 - Proposed Regional Dike
 - Existing Local Pipeline
 - Proposed Local Pipeline

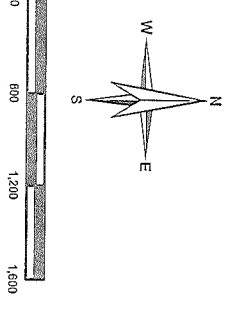
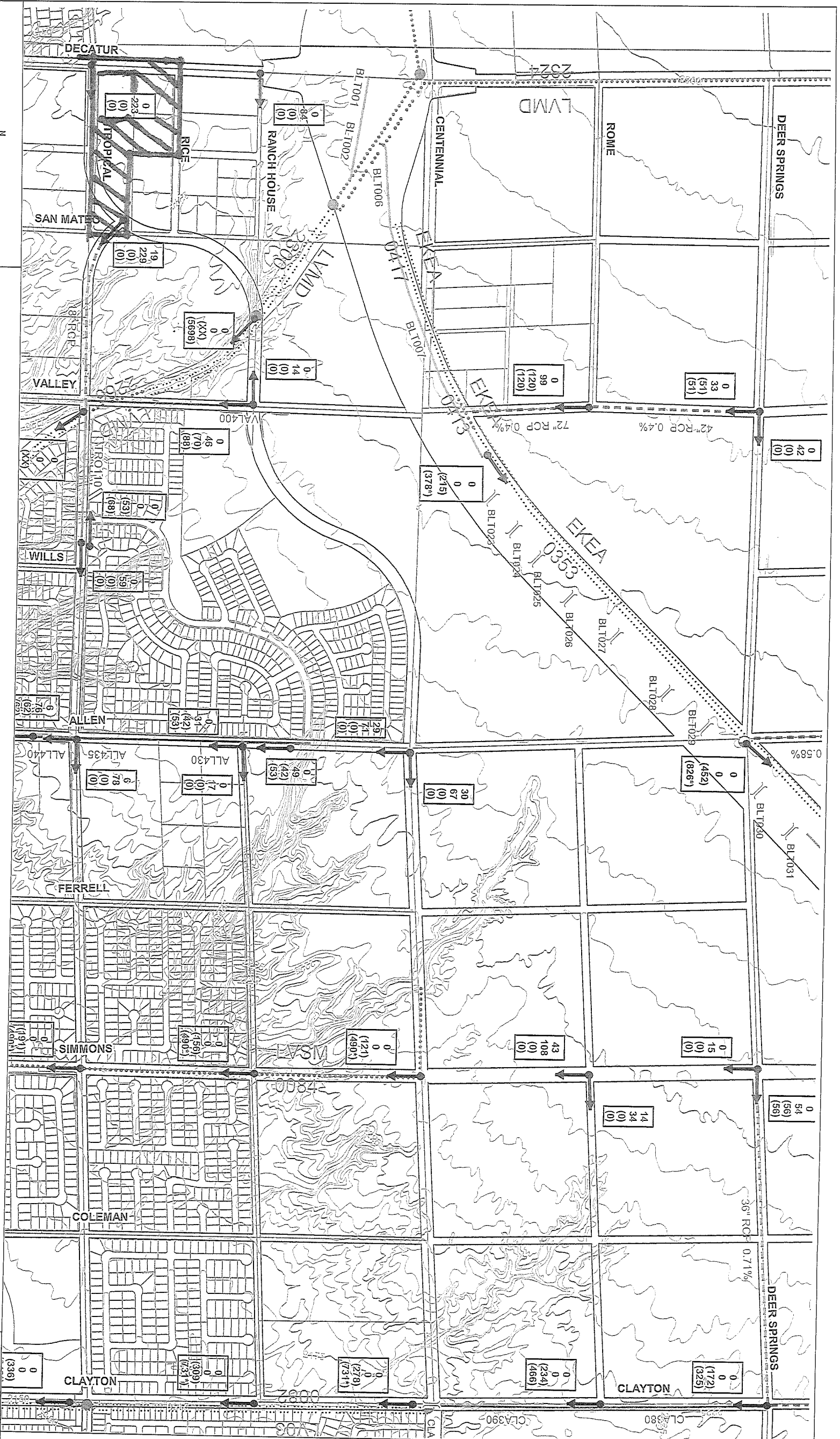
FIGURE F-9

FUTURE DRAINAGE CONDITIONS

DECATUR	CLAYTON	SH	REDS	NEILLS
1	2	3	4	
5	6	7	8	
9	10	11	12	
13	14	15	16	
17	18			

DECATUR
CLAYTON
SH
REDS
NEILLS

PBS&J
901 N Green Valley Pkwy, Suite 100
Henderson, Nevada 89044-7105
Phone: 702/263-7275
Fax: 702/263-7200
The Consultant of Choice



Flow Arrow

250
500
100-Year Street Flow
100-Year Facility Flow
100-Year Facility Flow
(800)

(Flows in CFS)

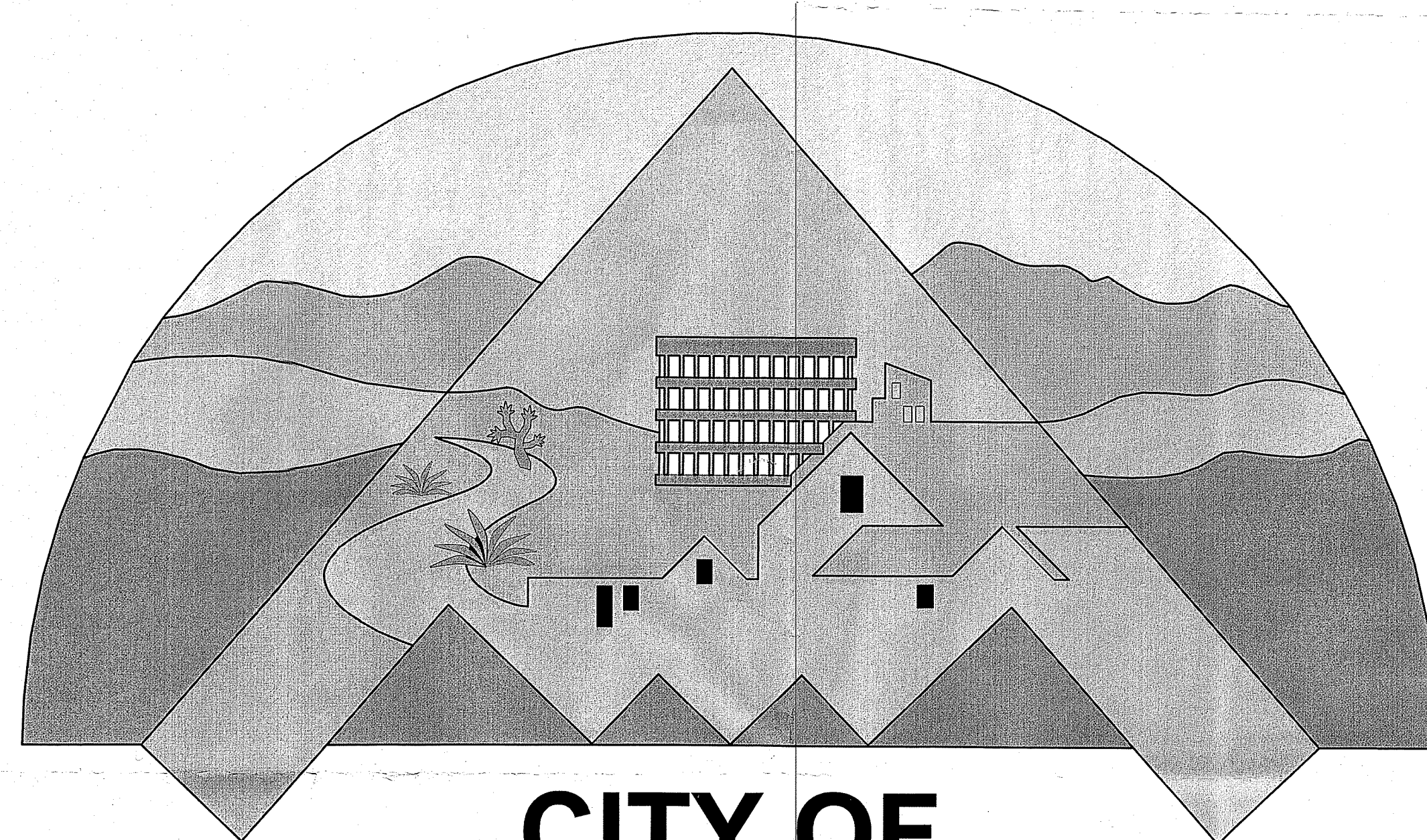
North Valley 1,905
Acre Study Area

NOTE:
Ultimate drainage conditions are based on future CN values with all flood control facilities in place.
100 Year Facility Flows with an asterisk (*) are flows from the Clark County Regional Flood Control District's 2002 Master Plan Update for the Las Vegas Valley.
(XX) - 10-year future flow not determined for this master planned facility.

APPENDIX I

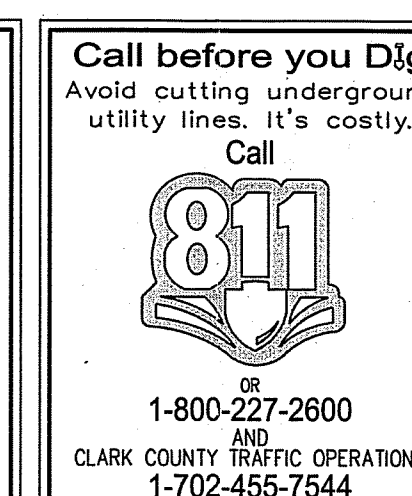
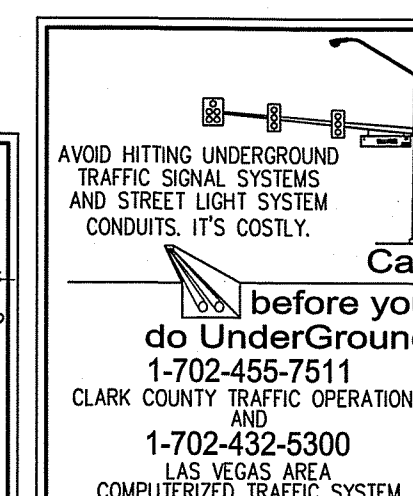
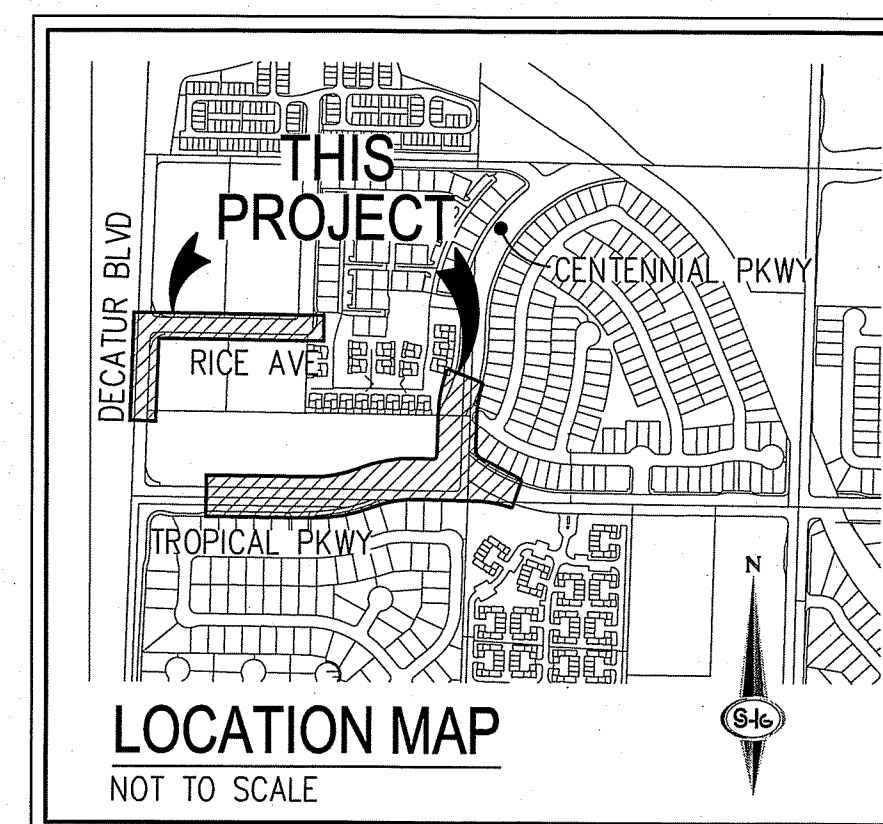
Grading Plans, Profiles and Details

IMPROVEMENT PLANS FOR TROPICAL PKWY AND CENTENNIAL PKWY ROADWAY IMPROVEMENTS



CITY OF NORTH LAS VEGAS

SHEET INDEX		
NUMBER	SHEET	DESCRIPTION
1	C-1	COVER SHEET
2	C-2	GENERAL NOTES AND QUANTITIES
3	P-1	PLAN AND PROFILE - RICE AVE
4	P-2	PLAN AND PROFILE - CENTENNIAL PKWY
5	P-3	PLAN AND PROFILE - TROPICAL PKWY
6	P-4	PLAN AND PROFILE - TROPICAL PKWY
7	P-5	PLAN AND PROFILE - DECATUR BLVD
8	P-6	PLAN AND PROFILE - STORM DRAIN LATERALS
9	D-1	SECTIONS AND DETAILS
10	T-1	TRAFFIC PLAN - RICE AND DECATUR
11	T-2	TRAFFIC PLAN - TROPICAL PKWY
12	T-3	TRAFFIC PLAN - CENTENNIAL PKWY
13	DM-1	DEMOLITION PLAN I
14	DM-2	DEMOLITION PLAN II



LEGAL DESCRIPTION
LYING WITHIN PORTION OF THE SOUTHWEST QUARTER (SW 1/4) OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 30, TOWNSHIP 19 SOUTH, RANGE 61 EAST, M.D.M. CITY OF NORTH LAS VEGAS, CLARK COUNTY, NEVADA

BASIS OF BEARING
BEING THE CENTERLINE OF DECATUR BOULEVARD NORTH 02°01'35" EAST BETWEEN TROPICAL PARKWAY AND RICE AVENUE, AS SHOWN ON PLAT MAP BOOK 140 PAGE 42 AS RECORDED IN THE OFFICIAL RECORDS OF CLARK COUNTY, NEVADA ON JUNE 25, 2008.

BENCHMARK
????

FLOOD ZONE
THE PROJECT IS LOCATED ON THE CURRENT FEMA FIRM PANEL MAP 32003C1765E REVISED SEPTEMBER 27, 2002. THE PROJECT SITE IS LOCATED WITHIN FEMA FLOOD ZONE X, AN AREA DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN.

DEVELOPER M GRAPE LLC 2480 PROFESSIONAL COURT #120 LAS VEGAS, NV 89128-0832 PH (702) 839-0050 FAX (702) 839-0060	ENGINEER SLATER HANIFAN GROUP 5740 S. ARVILLE, SUITE 216 LAS VEGAS, NV 89118-3071 PH (702) 284-5300
GEOTECH ENGINEER XXX XXX XXX	

UTILITY SERVICE BY

WATER	CITY OF NORTH LAS VEGAS
SEWER	CITY OF NORTH LAS VEGAS
GARBAGE	REPUBLIC SERVICES OF NEVADA
POWER	NV ENERGY
TELEPHONE	CENTURYLINK
NATURAL GAS	SOUTHWEST GAS COMPANY

APPROVALS:

DR. QIONG LIU, P.E., PTOE
DIRECTOR, PUBLIC WORKS DEPARTMENT

JENNIFER DOODY, P.E.
MANAGER, DEVELOPMENT AND FLOOD CONTROL DIVISION

LORENA CANDELARIO, SR/VA
MANAGER, REAL PROPERTY SERVICES DIVISION

UTILITIES DEPARTMENT - ENGINEERING SERVICES DIVISION
APPROVAL OF THESE PLANS SHALL NOT BE CONSTRUED TO BE A PERMIT FOR CONSTRUCTION, A COMMITMENT TO SUPPLY WATER AND/OR SEWER SERVICE, OR AN APPROVAL OF ANY VIOLATION OF ONLY WATER AND/OR SEWER SERVICE RULES AND REGULATIONS OR DESIGN AND CONSTRUCTION STANDARDS.

ISMAEL GARZA, P.E., PTOE
CNLY TRAFFIC ENGINEER

ONLY FIRE DEPARTMENT

NV ENERGY

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

SOUTHWEST GAS CORPORATION

CENTURYLINK

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

SLATER
HANIFAN
GROUP

SE
CIVIL ENGINEERS & PLANNERS

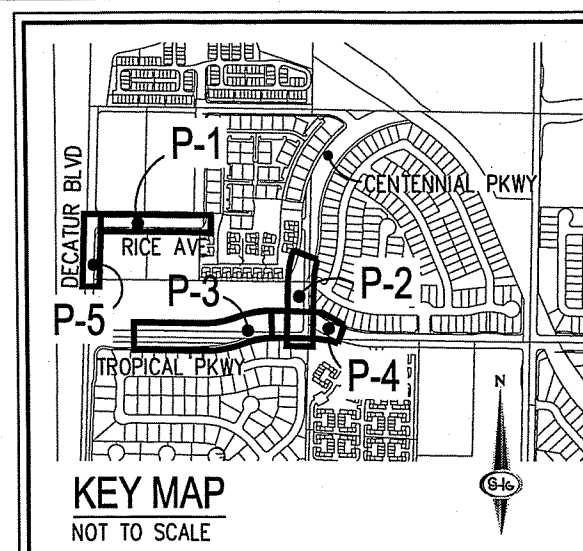
APP. DATE
DATE BY
DESCRIPTION
NO.

CITY OF NORTH LAS VEGAS, NV

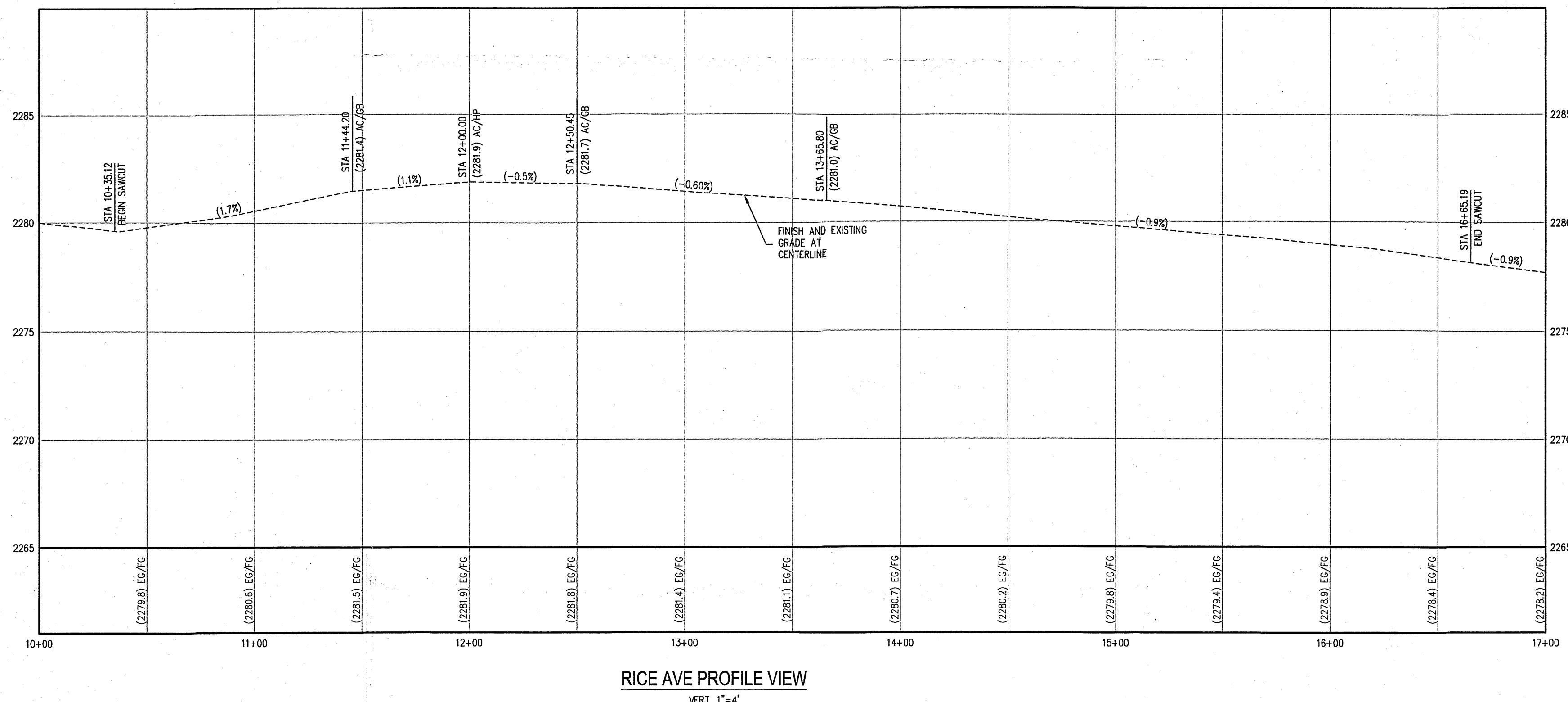
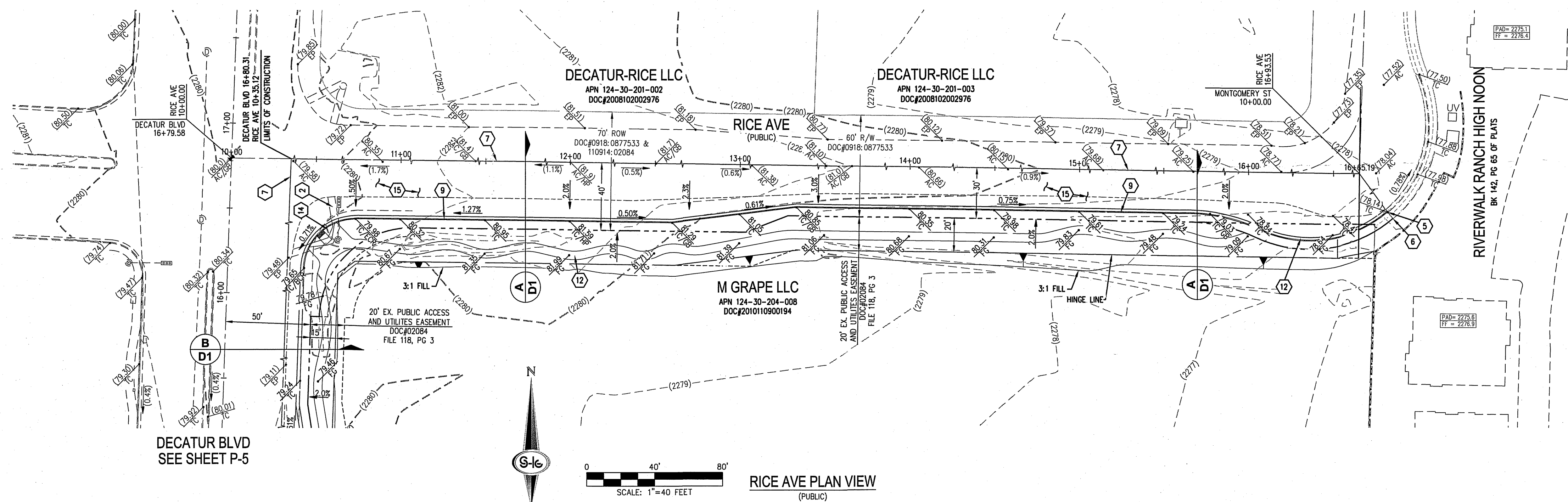
M GRAPE LLC

IMPROVEMENT PLANS FOR TROPICAL PKWY
AND CENTENNIAL PKWY ROADWAY IMPROVEMENTS

DATE: 10/19/11
DRAFTER: BC
DESIGNER: BC
CHECKED: RF
PROJECT NO.
MGL1101.1
RAY F. FREDERICKSE
Exp. 06/30/13
CIVIL
No. 17471
C-1
SHEET 1 OF



S-I-G **SLATER**
HANIFAN
GROUP
CONSULTING ENGINEERS & PLANNERS
5740 S. ARVILLE STREET #216, LAS VEGAS, NV 89118
PHONE (702) 284-5300 FAX (702) 284-5399



- ## GRADING NOTES

- 1 EXISTING CURB TO BE REMOVED
- 2 EXISTING SIDEWALK TO BE REMOVED
- 3 EXISTING VALLEY GUTTER TO BE REMOVED
- 4 EXISTING PAVEMENT TO BE REMOVED
- 5 SAWCUT AND MATCH EXISTING CURB
- 6 SAWCUT AND MATCH EXISTING SIDEWALK
- 7 SAWCUT AND MATCH EXISTING PAVEMENT
- 8 SAWCUT AND MATCH EXISTING CONCRETE PAD
- 9 INSTALL "L" TYPE CURB AND GUTTER PER CCAUSD #216
- 10 INSTALL TACK-ON ISLAND PER CCAUSD #220.1.SI
- 11 INSTALL "A" TYPE CURB PER CCAUSD #219
- 12 INSTALL 5' WIDE CONCRETE SIDEWALK (4" THICK OVER 6" TYPE 2 AGGREGATE BASE) PER CCAUSD #234
- 13 INSTALL ADA COMPLIANT ARMOR TILE TRUNCATED DOMES
- 14 INSTALL SIDEWALK RAMP USING ARMOR TILE TRUNCATED DOMES PER CCAUSD NO. 235
- 15 INSTALL ____ ASPHALT PAVEMENT OVER ____ TYPE II AGGREGATE BASE
- 16 SEE DETAIL 3 ON SHEET D-1
- 17 INSTALL MOD. TYPE "C" DROP INLET WITH 3' MIN. CURB TRANSITION PER CCAUSD #412.1 AND 421 (SEE PROFILE SHEET P-5 FOR SIZE AND GRATES)
- 18 EXISTING CAST VULV TO BE RELOCATED (BY OTHERS)
- 19 EXISTING SERVICE PEDESTAL TO BE RELOCATED (BY OTHERS)
- 20 EXISTING CATV BOX. ADJUST TO FINISH GRADE
- 21 EXISTING CONCRETE FLUME. EXTEND AND TIE TO "L" TYPE CURB
- 22 INSTALL ____ CONCRETE PAD OVER ____ TYPE II AGGREGATE BASE
- 23 EXIST. TIE MANHOLE. ADJUST TO FINISH GRADE

SEE SHEET C-2 FOR LEGEND, GENERAL NOTES, AND QUANTITIES

- ### LEGEND

- | | |
|--|--------------------------|
| | ROADWAY CENTERLINE |
| | RIGHT-OF-WAY |
| | PROPERTY LINE |
| | CURB AND GUTTER |
| | EXISTING CURB AND GUTTER |
| | FLOWLINE |
| | EDGE OF PAVEMENT (EP) |
| | SAWCUT LINE |
| | PROPOSED ELEVATION |
| | EXISTING ELEVATION |
| | EXISTING CONTOUR (5-FT) |
| | EXISTING CONTOUR (1-FT) |
| | SCARP |
| | STREETLIGHT |
| | OR |
| | EXISTING STREETLIGHT |
| | MATCH LINE |

NOTICE TO CONTRACTOR

-QUANTITIES SHOWN ARE ESTIMATES ONLY AND ARE INTENDED TO ILLUSTRATE SCOPE OF WORK. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE EXACT QUANTITIES INVOLVED.

-EXISTING UTILITY LOCATIONS SHOWN HEREIN ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT VERTICAL AND HORIZONTAL LOCATION OF ALL EXISTING UNDERGROUND UTILITIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN/HEREON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR UTILITIES NOT SHOWN IN THEIR PROPER LOCATIONS. CALL BEFORE YOU DIG: (800) 227-2600

CERTIFICATION

THIS PLAN COMPLIES WITH THE APPROVED DRAINAGE STUDY APPLICATION # CNLV No. _____, ON FILE WITH THE CITY OF NORTH LAS VEGAS.

DATE _____ RAY F. FREDERICKSEN _____

CITY OF NORTH LAS VEGAS
UTILITIES DEPARTMENT

UTILITIES DEPARTMENT- ENGINEERING SERVICES DIVISION DATE: _____

APPROVAL OF THESE PLANS SHALL NOT BE CONSTRUED TO BE A PERMIT CONSTRUCTION, A COMMITMENT TO SUPPLY WATER AND/OR SEWER SERVICE OR APPROVAL OF ANY VIOLATION OF CNLV WATER AND/OR SEWER SERVICE REGULATIONS OR DESIGN AND CONSTRUCTION STANDARDS.

APPROVALS:

JENNIFER DOODY, P.E.
MANAGER, DEVELOPMENT AND FLOOD CONTROL DIVISION

ISMAEL GARZA, P.E., PTOE
CNLY TRAFFIC ENGINEER

CITY OF NORTH LAS VEGAS UTILITY
DEPARTMENT DISCLAIMER

A STATEMENT OF UNDERSTANDING BETWEEN THE CITY OF NORTH LAS VEGAS
UTILITY DEPARTMENT (CITY) AND ANY AND ALL SUBSEQUENT USERS OF
INFORMATION CONTAINED HEREFROM:

THE PLANS AND SUPPORTING INFORMATION IS FURNISHED BY THE CITY, AND IS ACCEPTED/USED BY THE RECIPIENT WITH THE UNDERSTANDING THAT THE CITY MAKES NO WARRANTIES, EXPRESS OR IMPLIED, CONCERNING THE ACCURACY, COMPLETENESS, RELIABILITY, OR SUITABILITY OF SAID PLANS OR ANY SUPPORTING DATA AND FURTHER UNDERSTANDS THAT ALL USERS ARE ACTING AT THEIR OWN RISK. THE CITY SHALL BE UNDER NO LIABILITY WHATSOEVER RESULTING FROM ANY USE OF THIS INFORMATION.

THIS INFORMATION SHOULD NOT BE RELIED UPON AS THE SOLE BASIS FOR EXISTING WATER AND/OR SEWER LOCATIONS. THE ENGINEER SHALL CHECK AND VERIFY ALL DIMENSIONS AND LOCATIONS OF EXISTING UTILITIES.

CONTACT CNLV UTILITIES @ 633-1277 24 HOURS PRIOR TO BEGINNING
ANY WORK FOR SCHEDULING INSPECTIONS AND APPROVALS.

LEGAL DESCRIPTION

LYING WITHIN PORTION OF THE SOUTHWEST QUARTER (SW 1/4) OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 30, TOWNSHIP 19 SOUTH, RANGE 61 EAST, M.D.M. CITY OF NORTH LAS VEGAS, CLARK COUNTY, NEVADA

BASIS OF BEARING

BEING THE CENTERLINE OF DECATUR BOULEVARD NORTH 02°01'35" EAST BETWEEN TROPICAL PARKWAY AND RICE AVENUE, AS SHOWN ON PLAT MAP BOOK 140 PAGE 42 AS RECORDED IN THE OFFICIAL RECORDS OF CLARK COUNTY, NEVADA ON JUNE 25, 2008.

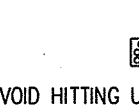
BENCHMARK

???

Call before you Dig
Avoid cutting underground utility lines. It's costly.

Call
811

OR
1-800-227-2600
AND
CLARK COUNTY TRAFFIC OPERATIONS
1-702-455-7544



AVOID HITTING UNDERGROUND
TRAFFIC SIGNAL SYSTEMS
AND STREET LIGHT SYSTEM
CONDUITS. IT'S COSTLY.

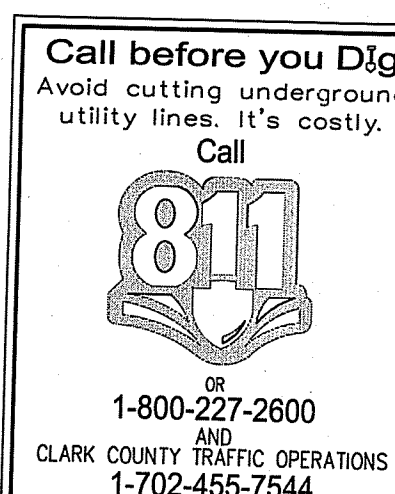
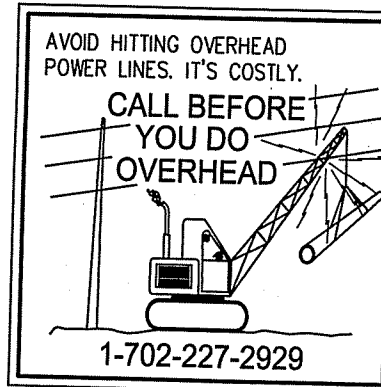
Call
before you
do UnderGround
1-702-455-7511
CLARK COUNTY TRAFFIC OPERATIONS
AND
1-702-432-5300
LAS VEGAS AREA
COMPUTERIZED TRAFFIC SYSTEM



AVOID HITTING OVERHEAD
POWER LINES. IT'S COSTLY.
**CALL BEFORE
YOU DO
OVERHEAD**
1-702-227-2929

\\mg1101-000\dwg\improv\mg1101-000 p1.dwg 11/8/2011 4:01 PM Ray Fredericksen

11/28/2011 4:02 PM Ray.Friedricksen



LEGAL DESCRIPTION
LYING WITHIN PORTION OF THE SOUTHWEST QUARTER (SW 1/4) OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 30, TOWNSHIP 19 SOUTH, RANGE 61 EAST, M.D.M. CITY OF NORTH LAS VEGAS, CLARK COUNTY, NEVADA

BASIS OF BEARING
BEING THE CENTERLINE OF DECATUR BOULEVARD NORTH 0201°35' EAST BETWEEN TROPICAL PARKWAY AND RICE AVENUE, AS SHOWN ON PLAT MAP BOOK 140 PAGE 42 AS RECORDED IN THE OFFICIAL RECORDS OF CLARK COUNTY, NEVADA ON JUNE 25, 2008.

BENCHMARK
????

CITY OF NORTH LAS VEGAS UTILITY DEPARTMENT DISCLAIMER

A STATEMENT OF UNDERSTANDING BETWEEN THE CITY OF NORTH LAS VEGAS UTILITY DEPARTMENT (CITY) AND ANY AND ALL SUBSEQUENT USERS OF INFORMATION CONTAINED HEREOF:

THE PLANS AND SUPPORTING INFORMATION IS FURNISHED BY THE CITY, AND IS ACCEPTED/USED BY THE RECIPIENT WITH THE UNDERSTANDING THAT THE CITY MAKES NO WARRANTIES, EXPRESS OR IMPLIED, CONCERNING THE ACCURACY, COMPLETENESS, RELIABILITY, OR SUITABILITY OF SAID PLANS OR ANY SUPPORTING DATA AND FURTHER UNDERSTANDS THAT ALL USERS ARE ACTING AT THEIR OWN RISK. THE CITY SHALL BE UNDER NO LIABILITY WHATSOEVER RESULTING FROM ANY USE OF THIS INFORMATION.

THIS INFORMATION SHOULD NOT BE RELIED UPON AS THE SOLE BASIS FOR EXISTING WATER AND/OR SEWER LOCATIONS. THE ENGINEER SHALL CHECK AND VERIFY ALL DIMENSIONS AND LOCATIONS OF EXISTING UTILITIES.

CONTACT ONLY UTILITIES @ 633-1277 24 HOURS PRIOR TO BEGINNING ANY WORK FOR SCHEDULING INSPECTIONS AND APPROVALS.

DISCLAIMER NOTE:

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

NOTICE TO CONTRACTOR

-QUANTITIES SHOWN ARE ESTIMATES ONLY AND ARE INTENDED TO ILLUSTRATE SCOPE OF WORK. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE EXACT QUANTITIES INVOLVED.

-EXISTING UTILITY LOCATIONS SHOWN HEREIN ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT VERTICAL AND HORIZONTAL LOCATION OF ALL EXISTING UNDERGROUND UTILITIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN HEREON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR UTILITIES NOT SHOWN IN THEIR PROPER LOCATIONS. CALL BEFORE YOU DIG. (800) 227-2600

CITY OF NORTH LAS VEGAS UTILITIES DEPARTMENT

UTILITIES DEPARTMENT- ENGINEERING SERVICES DIVISION DATE: _____

APPROVAL OF THESE PLANS SHALL NOT BE CONSTRUED TO BE A PERMIT FOR CONSTRUCTION, A COMMITMENT TO SUPPLY WATER AND/OR SEWER SERVICE, OR AN APPROVAL OF ANY VIOLATION OF ONLY WATER AND/OR SEWER SERVICE RULES AND REGULATIONS OR DESIGN AND CONSTRUCTION STANDARDS.

CERTIFICATION

THIS PLAN COMPLIES WITH THE APPROVED DRAINAGE STUDY APPLICATION # ONLY NO. _____ ON FILE WITH THE CITY OF NORTH LAS VEGAS.

DATE _____ RAY F. FREDERICKSEN

APPROVALS:

JENNIFER DODDY, P.E. DATE _____
MANAGER, DEVELOPMENT AND FLOOD CONTROL DIVISION

ISMAEL GARZA, P.E., PTOE DATE _____
ONLY TRAFFIC ENGINEER

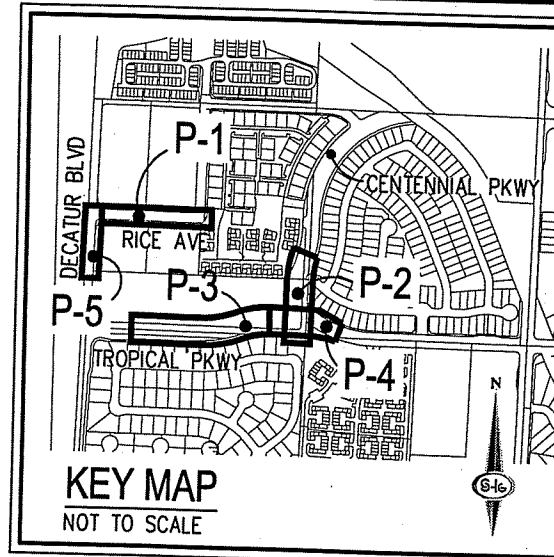
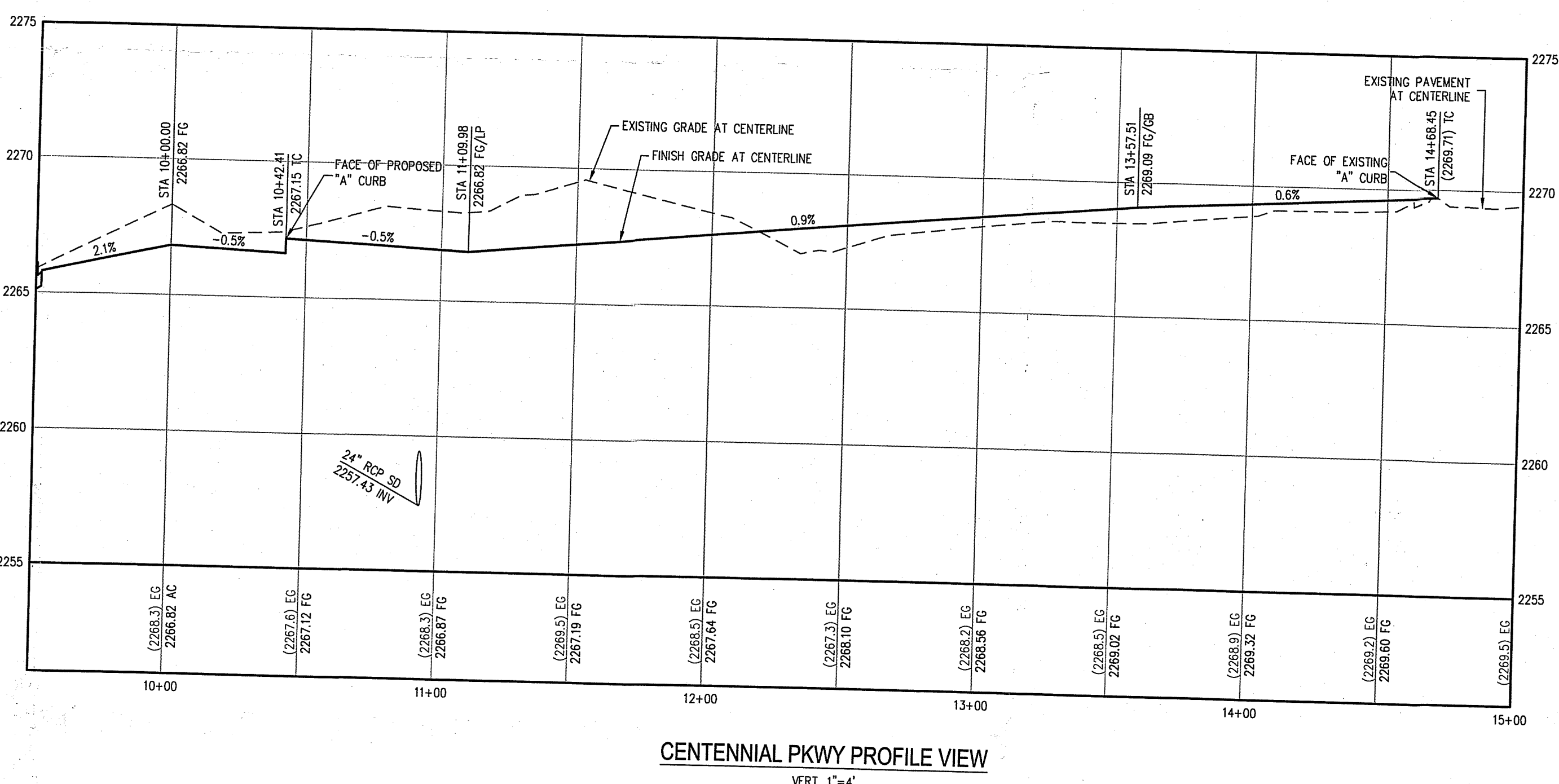
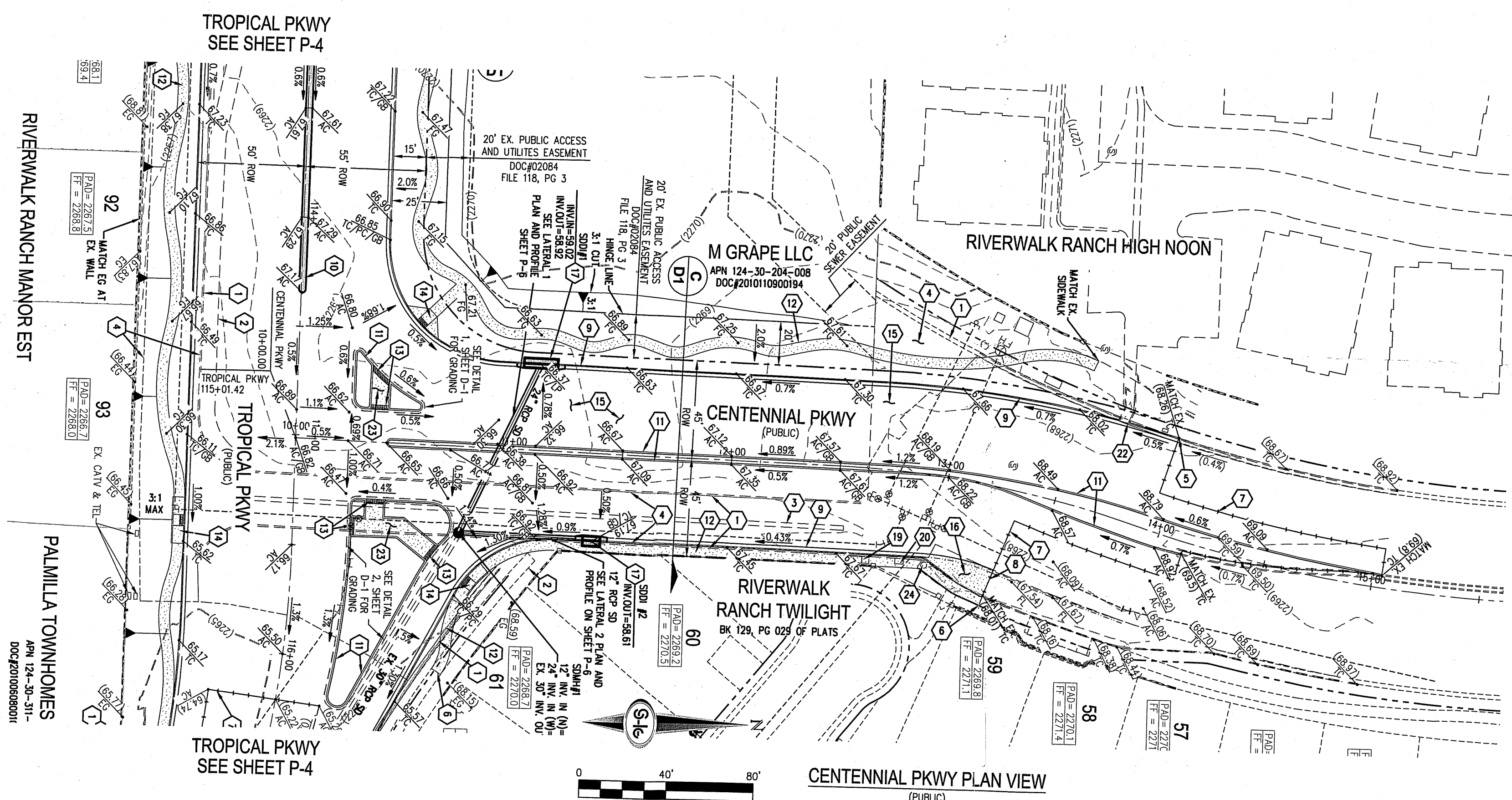
LEGEND

- ROADWAY CENTERLINE
- RIGHT-OF-WAY
- PROPERTY LINE
- CURB AND GUTTER
- EXISTING CURB AND GUTTER
- FLOWLINE
- EDGE OF PAVEMENT (EP)
- SAWCUT LINE
- PROPOSED ELEVATION
- EXISTING ELEVATION
- EXISTING CONTOUR (5-FT)
- EXISTING CONTOUR (1-FT)
- SCARP
- STREETLIGHT
- EXISTING STREETLIGHT
- MATCH LINE

GRADING NOTES

- EXISTING CURB TO BE REMOVED
- EXISTING SIDEWALK TO BE REMOVED
- EXISTING VALLEY GUTTER TO BE REMOVED
- EXISTING PAVEMENT TO BE REMOVED
- SAWCUT AND MATCH EXISTING CURB
- SAWCUT AND MATCH EXISTING SIDEWALK
- SAWCUT AND MATCH EXISTING PAVEMENT
- SAWCUT AND MATCH EXISTING CONCRETE PAD
- INSTALL "L" TYPE CURB AND GUTTER PER CCAUSD #216
- INSTALL TACK-ON ISLAND PER CCAUSD #220.1.SI
- INSTALL "A" TYPE CURB PER CCAUSD #219
- INSTALL 5' WIDE CONCRETE SIDEWALK (4" THICK OVER 6" TYPE 2 AGGREGATE BASE) PER CCAUSD #234
- INSTALL ADA COMPLIANT ARMOR TILE TRUNCATED DOMES
- INSTALL SIDEWALK RAMP USING ARMOR TILE TRUNCATED DOMES PER CCAUSD NO. 235
- INSTALL ASPHALT PAVEMENT OVER TYPE II AGGREGATE BASE
- SEE DETAIL 3 ON SHEET D-1
- INSTALL MOD. TYPE "C" DROP INLET WITH 3" MIN. CURB TRANSITION PER CCAUSD #412.1 AND 421 (SEE PROFILE SHEET P-5 FOR SIZE AND GRATES)
- EXISTING CATV VAULT TO BE RELOCATED (BY OTHERS)
- EXISTING SERVICE PEDESTAL TO BE RELOCATED (BY OTHERS)
- EXISTING CATV BOX. ADJUST TO FINISH GRADE
- EXISTING CONCRETE FLUME. EXTEND AND TIE TO "L" TYPE CURB
- INSTALL CONCRETE PAD OVER TYPE II AGGREGATE BASE
- EXISTING TEL MANHOLE. ADJUST TO FINISH GRADE

SEE SHEET C-2 FOR LEGEND, GENERAL NOTES, AND QUANTITIES



SLATER HANFAN GROUP
CONSULTING ENGINEERS & PLANNERS
5740 S. ARVILLE STREET #216, LAS VEGAS, NV 89118
PHONE (702) 284-5300 FAX (702) 284-5399

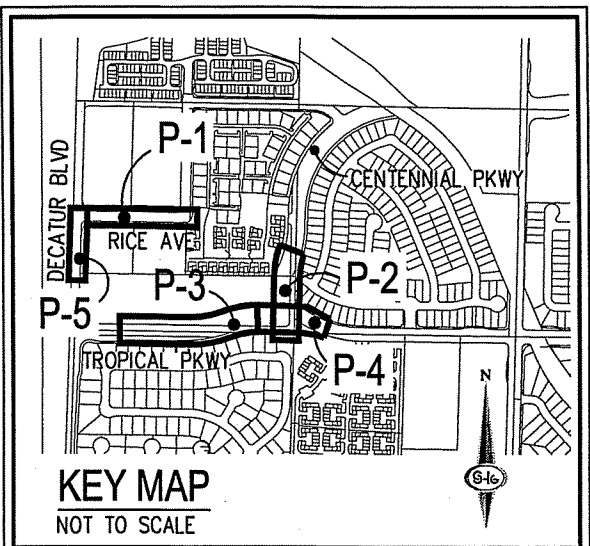
M GRAPE LLC
CITY OF NORTH LAS VEGAS, NV

IMPROVEMENT PLANS FOR TROPICAL PKWY AND CENTENNIAL PKWY ROADWAY IMPROVEMENTS
PLAN AND PROFILE - CENTENNIAL PKWY

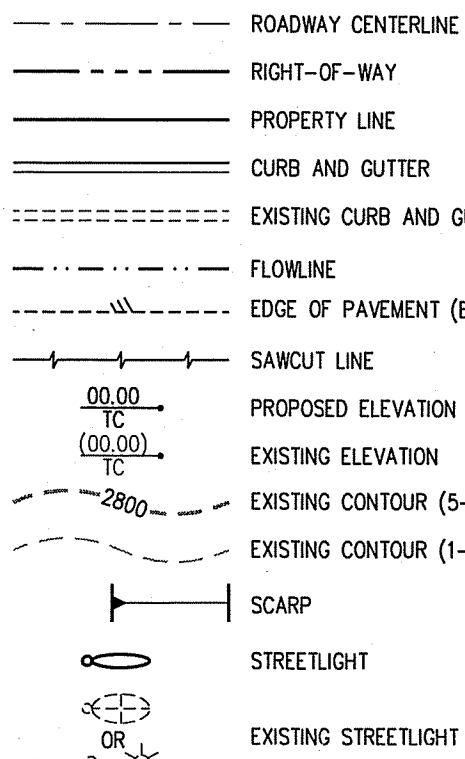
DATE: 10/19/11
DRAFTER: BC
DESIGNER: BC
CHECKED: RF
PROJECT NO. MGL1101.000

RAY F. FREDERICKSEN
REGISTERED PROFESSIONAL ENGINEER - CIVIL
No. 17471
Exp. 06/30/13

P-2
SHEET 4 OF 14



- 1 EXISTING CURB TO BE REMOVED
- 2 EXISTING SIDEWALK TO BE REMOVED
- 3 EXISTING VALLEY GUTTER TO BE REMOVED
- 4 EXISTING PAVEMENT TO BE REMOVED
- 5 SAWCUT AND MATCH EXISTING CURB
- 6 SAWCUT AND MATCH EXISTING SIDEWALK
- 7 SAWCUT AND MATCH EXISTING PAVEMENT
- 8 SAWCUT AND MATCH EXISTING CONCRETE PAD
- 9 INSTALL "L" TYPE CURB AND GUTTER PER CCAUSD #216
- 10 INSTALL TACK-ON ISLAND PER CCAUSD #220.1.S)
- 11 INSTALL "X" TYPE CURB PER CCAUSD #219
- 12 INSTALL 5' WIDE CONCRETE SIDEWALK ("4" OVER 6" TYPE 2 AGGREGATE BASE) PER CCAUSD #234
- 13 INSTALL ADA COMPLIANT ARMOR TILE TRUNCATED DOMES
- 14 INSTALL SIDEWALK RAMP USING ARMOR TILE TRUNCATED DOMES PER CCAUSD NO. 235
- 15 INSTALL ____ ASPHALT PAVEMENT OVER ____ TYPE II AGGREGATE BASE
- 16 SEE DETAIL 3 ON SHEET D-1
- 17 INSTALL MOD. TYPE "C" DROP INLET WITH 3' MIN. CURB TRANSITION PER CCAUSD #412.1 AND 421 (SEE PROFILE SHEET P-5 FOR SIZE AND GRATES)
- 18 EXISTING CATV VAULT TO BE RELOCATED (BY OTHERS)
- 19 EXISTING SERVICE PEDAESTAL TO BE RELOCATED (BY OTHERS)
- 20 EXISTING CATV BOX, ADJUST TO FINISH GRADE
- 21 EXISTING CONCRETE FLUME, EXTEND AND TIE TO "L" TYPE CURB
- 22 INSTALL ____ CONCRETE PAD OVER ____ TYPE I AGGREGATE BASE
- 23 EXISTING TIE MANHOLE, ADJUST TO FINISH GRADE

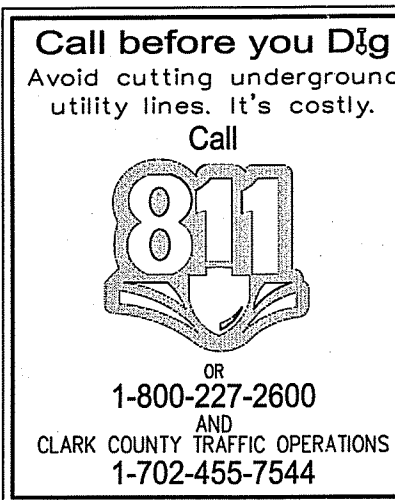
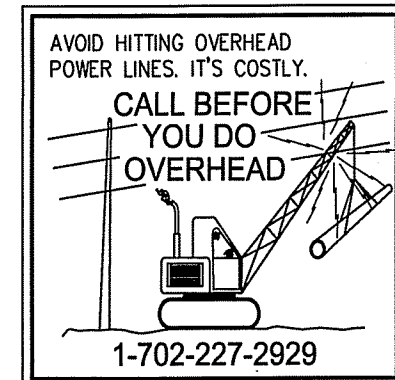


VERT. 1"=4'

SHEET 5 OF 14

i:\mg1101-000\dwg\improv\mg1101-000 p1.dwg 11/8/2011 4:02 PM Ray Fredericksen

11/9/2011 4:03 PM Ray.Fredrickson
11/9/2011 4:03 PM Ray.Fredrickson
11/9/2011 4:03 PM Ray.Fredrickson



LEGAL DESCRIPTION
LYING WITHIN PORTION OF THE SOUTHWEST QUARTER (SW 1/4) OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 30, TOWNSHIP 19 SOUTH, RANGE 61 EAST, M.D.M. CITY OF NORTH LAS VEGAS, CLARK COUNTY, NEVADA

BASIS OF BEARING
BEING THE CENTERLINE OF DECATUR BOULEVARD NORTH 02°01'35" EAST BETWEEN TROPICAL PARKWAY AND RICE AVENUE, AS SHOWN ON PLAT MAP BOOK 140 PAGE 42 AS RECORDED IN THE OFFICIAL RECORDS OF CLARK COUNTY, NEVADA ON JUNE 25, 2008.

BENCHMARK
????

CITY OF NORTH LAS VEGAS UTILITY DEPARTMENT DISCLAIMER

A STATEMENT OF UNDERSTANDING BETWEEN THE CITY OF NORTH LAS VEGAS UTILITY DEPARTMENT (CITY) AND ANY AND ALL SUBSEQUENT USERS OF INFORMATION CONTAINED HEREFROM:

THE PLANS AND SUPPORTING INFORMATION IS FURNISHED BY THE CITY, AND IS ACCEPTED/USED BY THE RECIPIENT WITH THE UNDERSTANDING THAT THE CITY MAKES NO WARRANTIES, EXPRESS OR IMPLIED, CONCERNING THE ACCURACY, COMPLETENESS, RELIABILITY, OR SUITABILITY OF SAID PLANS OR ANY SUPPORTING DATA AND FURTHER UNDERSTANDS THAT ALL USERS ARE ACTING AT THEIR OWN RISK. THE CITY SHALL BE UNDER NO LIABILITY WHATSOEVER RESULTING FROM ANY USE OF THIS INFORMATION.

THIS INFORMATION SHOULD NOT BE RELIED UPON AS THE SOLE BASIS FOR EXISTING WATER AND/OR SEWER LOCATIONS. THE ENGINEER SHALL CHECK AND VERIFY ALL DIMENSIONS AND LOCATIONS OF EXISTING UTILITIES.

CONTACT ONLY UTILITIES @ 633-1277 24 HOURS PRIOR TO BEGINNING ANY WORK FOR SCHEDULING INSPECTIONS AND APPROVALS.

DISCLAIMER NOTE:

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

NOTICE TO CONTRACTOR

-QUANTITIES SHOWN ARE ESTIMATES ONLY AND ARE INTENDED TO ILLUSTRATE SCOPE OF WORK. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE EXACT QUANTITIES INVOLVED.
-EXISTING UTILITY LOCATIONS SHOWN HEREIN ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT VERTICAL AND HORIZONTAL LOCATION OF ALL EXISTING UNDERGROUND UTILITIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN HEREON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR UTILITIES NOT SHOWN IN THEIR PROPER LOCATIONS. CALL BEFORE YOU DIG: (800) 227-2800

CITY OF NORTH LAS VEGAS UTILITIES DEPARTMENT

UTILITIES DEPARTMENT- ENGINEERING SERVICES DIVISION DATE: _____

APPROVAL OF THESE PLANS SHALL NOT BE CONSTRUED TO BE A PERMIT FOR CONSTRUCTION, A COMMITMENT TO SUPPLY WATER AND/OR SEWER SERVICE, OR AN APPROVAL OF ANY VIOLATION OF ONLY WATER AND/OR SEWER SERVICE RULES AND REGULATIONS OR DESIGN AND CONSTRUCTION STANDARDS.

CERTIFICATION

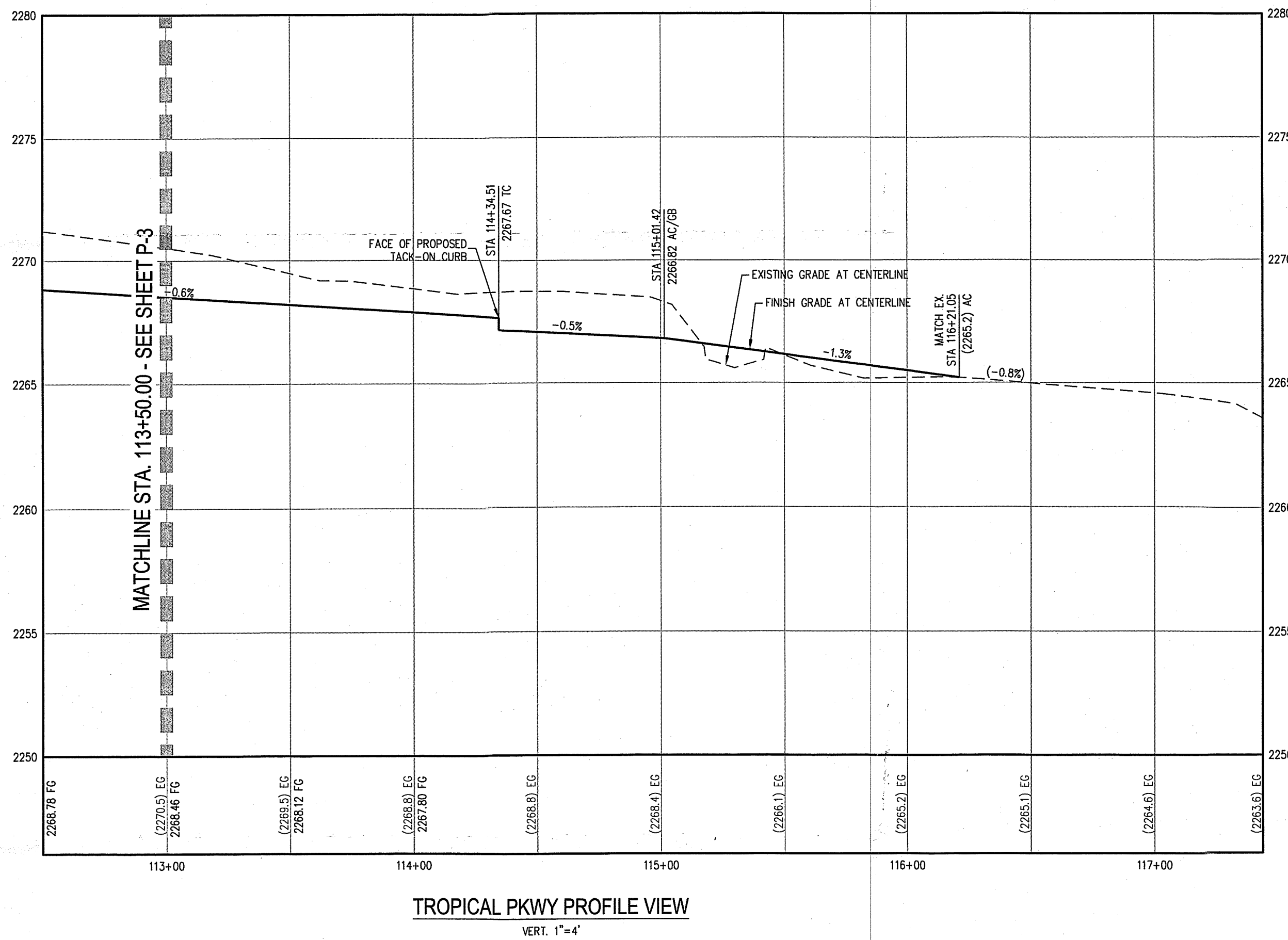
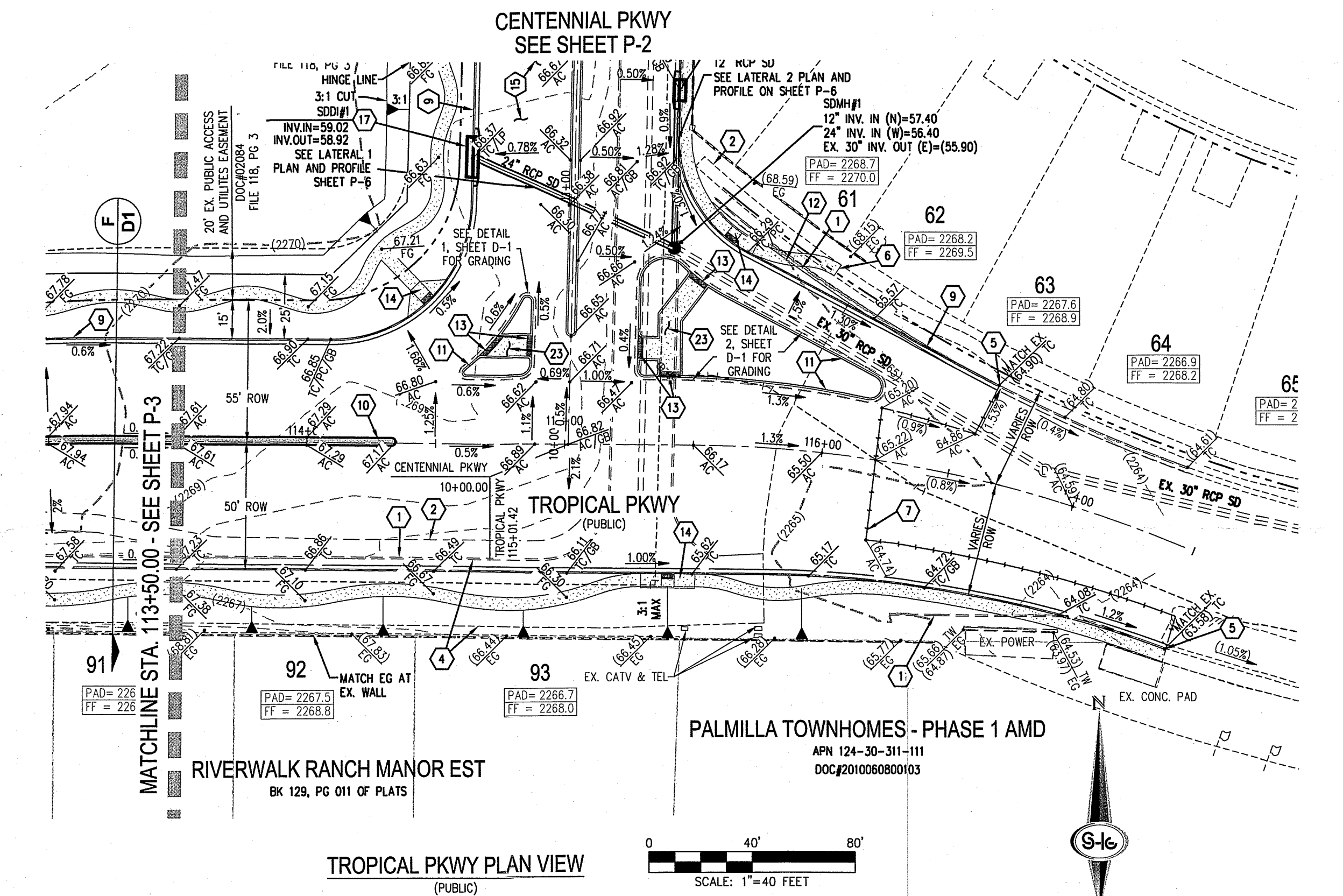
THIS PLAN COMPLIES WITH THE APPROVED DRAINAGE STUDY APPLICATION # ONLY NO. _____ ON FILE WITH THE CITY OF NORTH LAS VEGAS.

DATE _____ RAY F. FREDRICKSEN

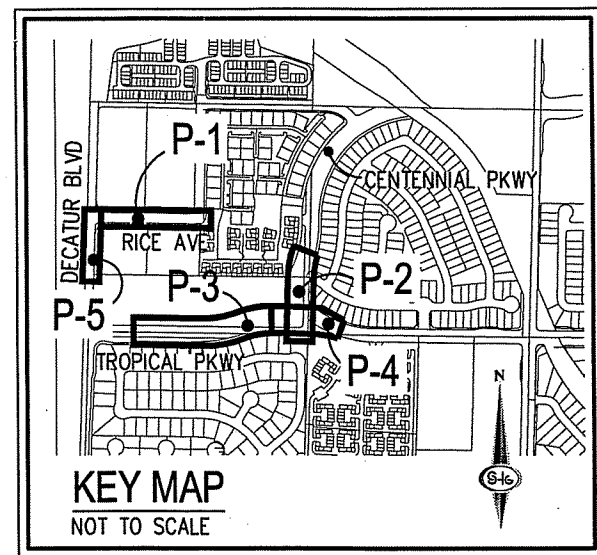
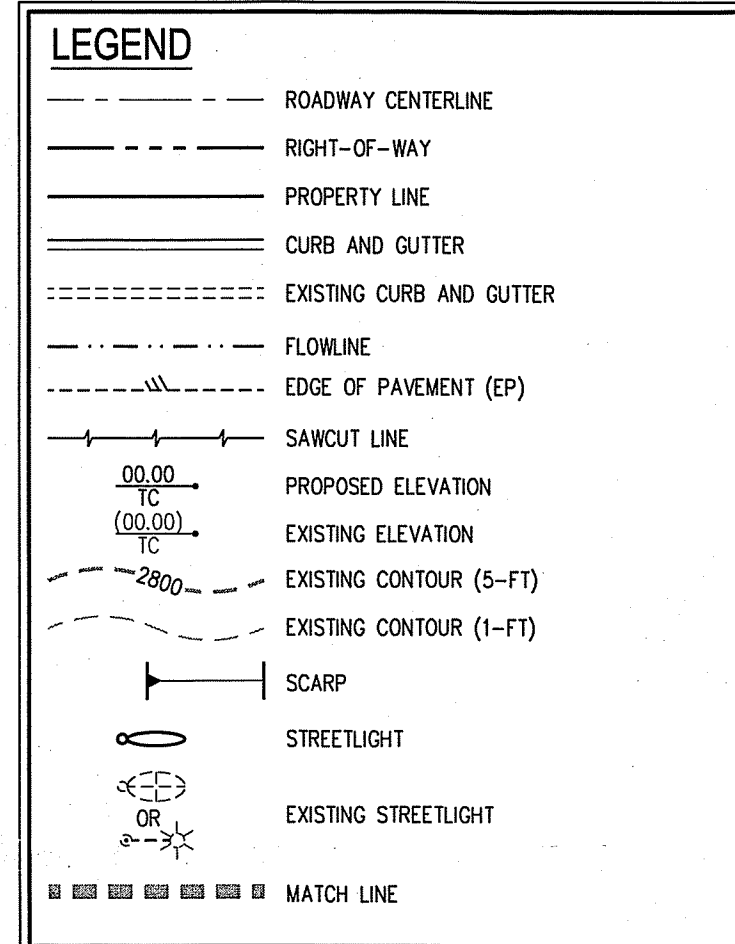
APPROVALS:

JENNIFER DODDY, P.E. DATE _____
MANAGER, DEVELOPMENT AND FLOOD CONTROL DIVISION

ISMAEL GARZA, P.E., PTOE DATE _____
ONLY TRAFFIC ENGINEER



- GRADING NOTES**
- EXISTING CURB TO BE REMOVED
 - EXISTING SIDEWALK TO BE REMOVED
 - EXISTING VALLEY GUTTER TO BE REMOVED
 - EXISTING PAVEMENT TO BE REMOVED
 - SAWCUT AND MATCH EXISTING CURB
 - SAWCUT AND MATCH EXISTING SIDEWALK
 - SAWCUT AND MATCH EXISTING PAVEMENT
 - SAWCUT AND MATCH EXISTING CONCRETE PAD
 - INSTALL "L" TYPE CURB AND GUTTER PER CCAUSD #216
 - INSTALL TACK-ON ISLAND PER CCAUSD #220.1.SI
 - INSTALL "A" TYPE CURB PER CCAUSD #219
 - INSTALL 5' WIDE CONCRETE SIDEWALK (4" THICK OVER 6" TYPE 2 AGGREGATE BASE) PER CCAUSD #234
 - INSTALL ADA COMPLIANT ARMOR TILE TRUNCATED DOMES
 - INSTALL SIDEWALK RAMP USING ARMOR TILE TRUNCATED DOMES PER CCAUSD NO. 235
 - INSTALL ASPHALT PAVEMENT OVER TYPE II AGGREGATE BASE
 - SEE DETAIL 3 ON SHEET D-1
 - INSTALL MOD. TYPE "C" DROP INLET WITH 3" MIN. CURB TRANSITION PER CCAUSD #412.1 AND 421 (SEE PROFILE SHEET P-5 FOR SIZE AND GRATES)
 - EXISTING CATV VAULT TO BE RELOCATED (BY OTHERS)
 - EXISTING SERVICE PEDESTAL TO BE RELOCATED (BY OTHERS)
 - EXISTING CATV BOX. ADJUST TO FINISH GRADE
 - EXISTING CONCRETE FLUME. EXTEND AND TIE TO "L" TYPE CURB
 - INSTALL CONCRETE PAD OVER TYPE II AGGREGATE BASE
 - EXISTING TEL MANHOLE. ADJUST TO FINISH GRADE
- SEE SHEET C-2 FOR LEGEND, GENERAL NOTES, AND QUANTITIES



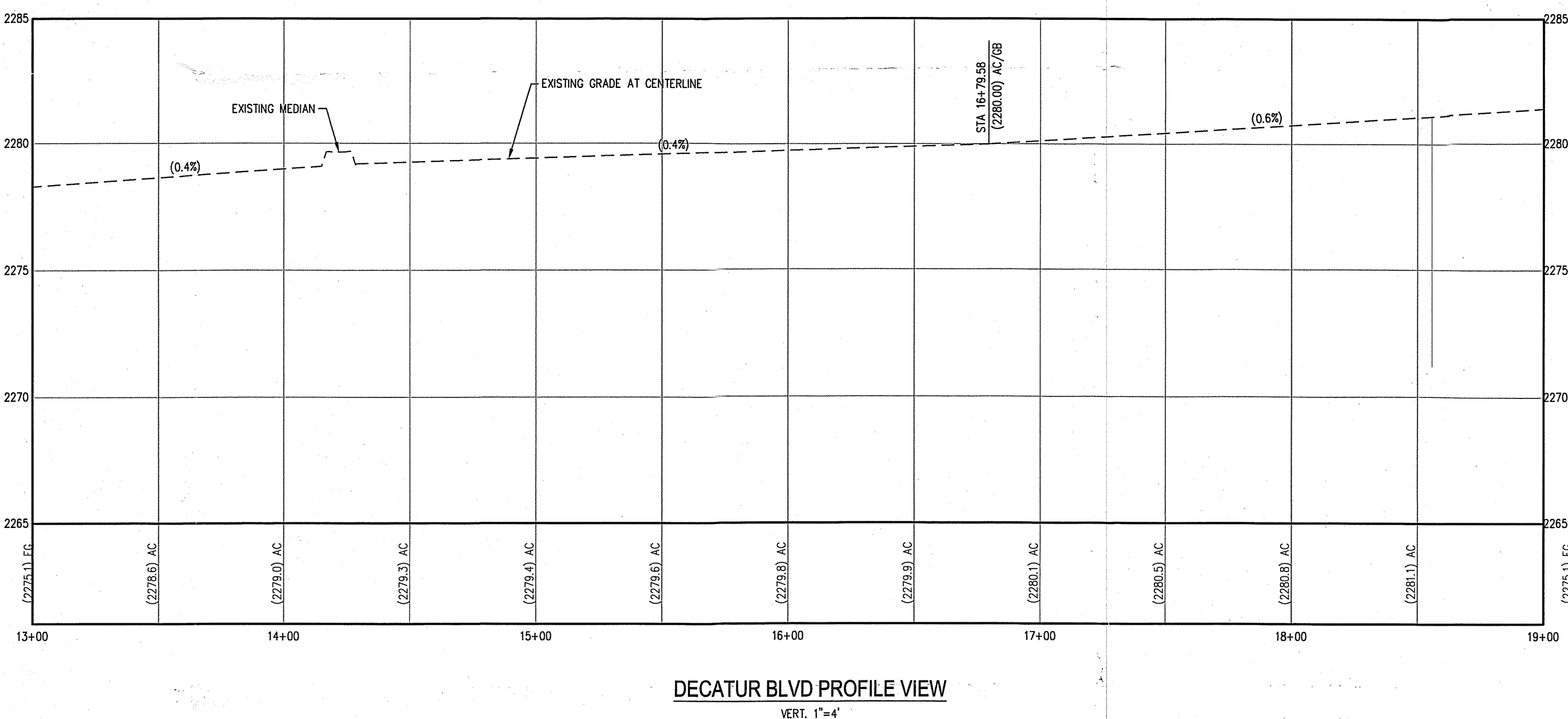
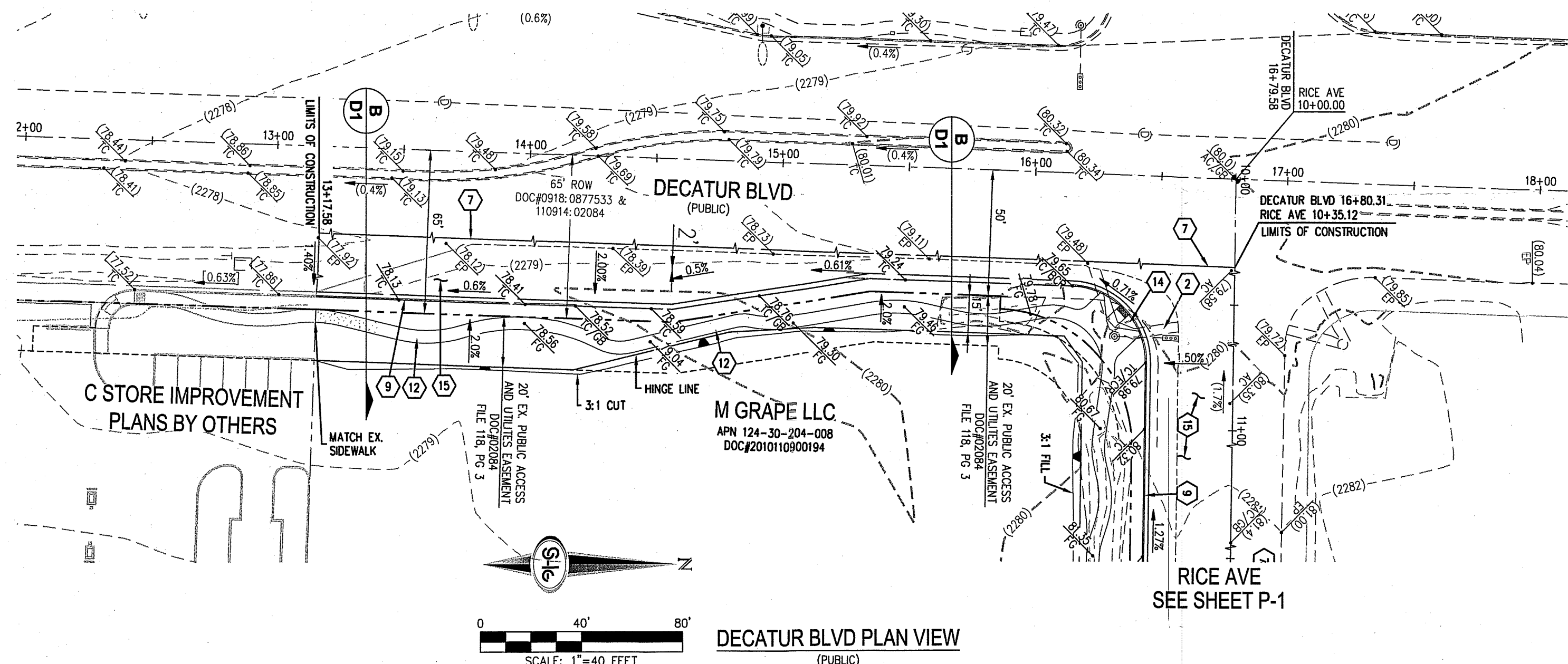
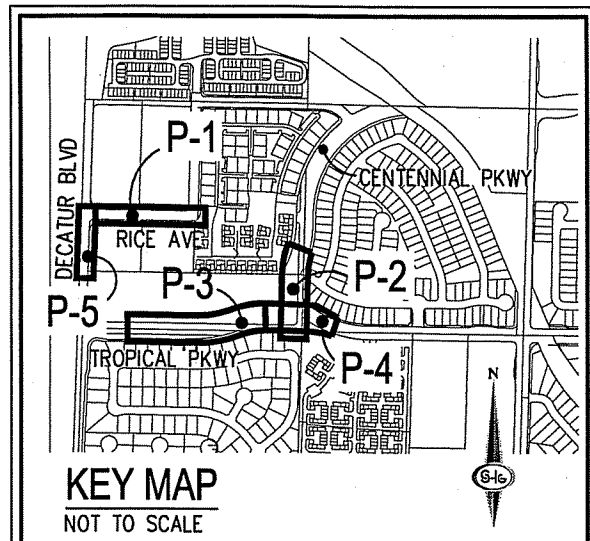
SLATER HANIFAN GROUP
CONSULTING ENGINEERS & PLANNERS
5740 S. ARVILLE STREET #216, LAS VEGAS, NV 89118
PHONE (702) 284-5300 FAX (702) 284-5399

M GRAPE LLC

IMPROVEMENT PLANS FOR TROPICAL PKWY AND CENTENNIAL PKWY ROADWAY IMPROVEMENTS PLAN AND PROFILE - TROPICAL PKWY

DATE: 10/19/11
DRAFTER: BC
DESIGNER: BC
CHECKED: RF
PROJECT NO. **MGL1101.000**

P-4
SHEET 6 OF 14



- GRADING NOTES**
- EXISTING CURB TO BE REMOVED
 - EXISTING SIDEWALK TO BE REMOVED
 - EXISTING VALLEY GUTTER TO BE REMOVED
 - EXISTING PAVEMENT TO BE REMOVED
 - SAWCUT AND MATCH EXISTING CURB
 - SAWCUT AND MATCH EXISTING SIDEWALK
 - SAWCUT AND MATCH EXISTING PAVEMENT
 - SAWCUT AND MATCH EXISTING CONCRETE PAD
 - INSTALL "L" TYPE CURB AND GUTTER PER CCAUSD #216
 - INSTALL TACK-ON ISLAND PER CCAUSD #220.1.SI
 - INSTALL "A" TYPE CURB PER CCAUSD #219
 - INSTALL 5" WIDE CONCRETE SIDEWALK (4" THICK OVER 6" TYPE 2 AGGREGATE BASE) PER CCAUSD #234
 - INSTALL ADA COMPLIANT ARMOR TILE TRUNCATED DOMES
 - INSTALL SIDEWALK RAMP USING ARMOR TILE TRUNCATED DOMES PER CCAUSD NO. 235
 - INSTALL ASPHALT PAVEMENT OVER TYPE II AGGREGATE BASE
 - SEE DETAIL 3 ON SHEET D-1
 - INSTALL MOD. TYPE "C" DROP INLET WITH 3" MIN. CURB TRANSITION PER CCAUSD #412.1 AND 421 (SEE PROFILE SHEET P-5 FOR SIZE AND GRATES)
 - EXISTING CATV VAULT TO BE RELOCATED (BY OTHERS)
 - EXISTING SERVICE PEDESTAL TO BE RELOCATED (BY OTHERS)
 - EXISTING CATV BOX, ADJUST TO FINISH GRADE
 - EXISTING CONCRETE FLUME, EXTEND AND TIE TO "L" TYPE CURB
 - INSTALL CONCRETE PAD OVER TYPE II AGGREGATE BASE
 - EXISTING TEL MANHOLE, ADJUST TO FINISH GRADE
- SEE SHEET C-2 FOR LEGEND, GENERAL NOTES, AND QUANTITIES

- LEGEND**
- ROADWAY CENTERLINE
 - RIGHT-OF-WAY
 - PROPERTY LINE
 - CURB AND GUTTER
 - EXISTING CURB AND GUTTER
 - FLOWLINE
 - EDGE OF PAVEMENT (EP)
 - SAWCUT LINE
 - PROPOSED ELEVATION
 - EXISTING ELEVATION
 - EXISTING CONTOUR (5-FT)
 - EXISTING CONTOUR (1-FT)
 - SCARP
 - STREETLIGHT
 - EXISTING STREETLIGHT
 - MATCH LINE

NOTICE TO CONTRACTOR

QUANTITIES SHOWN ARE ESTIMATES ONLY AND ARE INTENDED TO ILLUSTRATE SCOPE OF WORK. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE EXACT QUANTITIES INVOLVED.

EXISTING UTILITY LOCATIONS SHOWN HEREIN ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT VERTICAL AND HORIZONTAL LOCATION OF ALL EXISTING UNDERGROUND UTILITIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN HEREON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR UTILITIES NOT SHOWN IN THEIR PROPER LOCATIONS. CALL BEFORE YOU DIG: (800) 227-2600

CERTIFICATION

THIS PLAN COMPLIES WITH THE APPROVED DRAINAGE STUDY APPLICATION # ONLY No. _____ ON FILE WITH THE CITY OF NORTH LAS VEGAS.

DATE _____ RAY F. FREDERICKSEN

CITY OF NORTH LAS VEGAS UTILITIES DEPARTMENT

UTILITIES DEPARTMENT- ENGINEERING SERVICES DIVISION DATE _____

APPROVAL OF THESE PLANS SHALL NOT BE CONSTRUED TO BE A PERMIT FOR CONSTRUCTION. A COMMITMENT TO SUPPLY WATER AND/OR SEWER SERVICE, OR AN APPROVAL OF ANY VIOLATION OF ONLY WATER AND/OR SEWER SERVICE RULES AND REGULATIONS OR DESIGN AND CONSTRUCTION STANDARDS.

APPROVALS:

JENNIFER DOODY, P.E., MANAGER, DEVELOPMENT AND FLOOD CONTROL DIVISION DATE _____

ISMAEL GARZA, P.E., PTCE ONLY TRAFFIC ENGINEER DATE _____

CITY OF NORTH LAS VEGAS UTILITY DEPARTMENT DISCLAIMER

A STATEMENT OF UNDERSTANDING BETWEEN THE CITY OF NORTH LAS VEGAS UTILITY DEPARTMENT (CITY) AND ANY AND ALL SUBSEQUENT USERS OF INFORMATION CONTAINED HEREFROM:

THE PLANS AND SUPPORTING INFORMATION IS FURNISHED BY THE CITY, AND IS ACCEPTED/USED BY THE RECIPIENT WITH THE UNDERSTANDING THAT THE CITY MAKES NO WARRANTIES, EXPRESS OR IMPLIED, CONCERNING THE ACCURACY, COMPLETENESS, RELIABILITY, OR SUITABILITY OF SAID PLANS OR ANY SUPPORTING DATA AND FURTHER UNDERSTANDS THAT ALL USERS ARE ACTING AT THEIR OWN RISK. THE CITY SHALL BE UNDER NO LIABILITY WHATSOEVER RESULTING FROM ANY USE OF THIS INFORMATION.

THIS INFORMATION SHOULD NOT BE RELIED UPON AS THE SOLE BASIS FOR EXISTING WATER AND/OR SEWER LOCATIONS. THE ENGINEER SHALL CHECK AND VERIFY ALL DIMENSIONS AND LOCATIONS OF EXISTING UTILITIES.

CONTACT ONLY UTILITIES @ 633-1277 24 HOURS PRIOR TO BEGINNING ANY WORK FOR SCHEDULING INSPECTIONS AND APPROVALS.

LEGAL DESCRIPTION

LYING WITHIN PORTION OF THE SOUTHWEST QUARTER (SW 1/4) OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 30, TOWNSHIP 19 SOUTH, RANGE 61 EAST, M.D.M. CITY OF NORTH LAS VEGAS, CLARK COUNTY, NEVADA

BASIS OF BEARING

BEING THE CENTERLINE OF DECATUR BOULEVARD NORTH 02°01'35" EAST BETWEEN TROPICAL PARKWAY AND RICE AVENUE, AS SHOWN ON PLAT MAP BOOK 140 PAGE 42 AS RECORDED IN THE OFFICIAL RECORDS OF CLARK COUNTY, NEVADA ON JUNE 25, 2008.

BENCHMARK

????

Call before you Dig

Avoid cutting underground utility lines. It's costly.

Call **811**

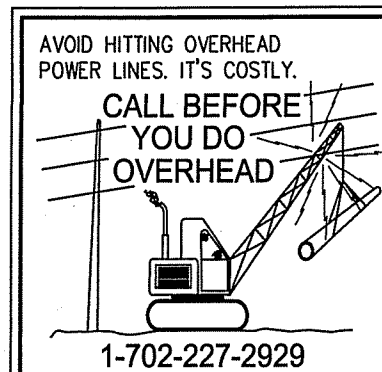
1-800-227-2600

CLARK COUNTY TRAFFIC OPERATIONS

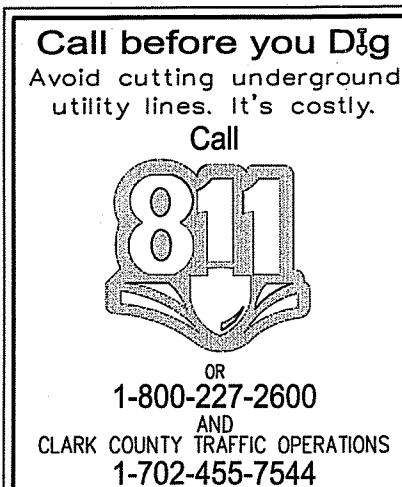
1-702-455-7511

1-702-432-5300

LAS VEGAS AREA COMPUTERIZED TRAFFIC SYSTEM



17/8/2011 4:03 PM Roy.Fredricksen



LEGAL DESCRIPTION
LYING WITHIN PORTION OF THE SOUTHWEST QUARTER (SW 1/4) OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 30, TOWNSHIP 19 SOUTH, RANGE 61 EAST, M.D.M. CITY OF NORTH LAS VEGAS, CLARK COUNTY, NEVADA

BASIS OF BEARING
BEING THE CENTERLINE OF DECATUR BOULEVARD NORTH 02°01'35" EAST BETWEEN TROPICAL PARKWAY AND RICE AVENUE, AS SHOWN ON PLAT MAP BOOK 140 PAGE 42 AS RECORDED IN THE OFFICIAL RECORDS OF CLARK COUNTY, NEVADA ON JUNE 25, 2008.

BENCHMARK
????

CITY OF NORTH LAS VEGAS UTILITY DEPARTMENT DISCLAIMER

A STATEMENT OF UNDERSTANDING BETWEEN THE CITY OF NORTH LAS VEGAS UTILITY DEPARTMENT (CITY) AND ANY AND ALL SUBSEQUENT USERS OF INFORMATION CONTAINED HEREFROM:

THE PLANS AND SUPPORTING INFORMATION IS FURNISHED BY THE CITY, AND IS ACCEPTED/USED BY THE RECIPIENT WITH THE UNDERSTANDING THAT THE CITY MAKES NO WARRANTIES, EXPRESS OR IMPLIED, CONCERNING THE ACCURACY, COMPLETENESS, RELIABILITY, OR SUITABILITY OF SAID PLANS OR ANY SUPPORTING DATA AND FURTHER UNDERSTANDS THAT ALL USERS ARE ACTING AT THEIR OWN RISK. THE CITY SHALL BE UNDER NO LIABILITY WHATSOEVER RESULTING FROM ANY USE OF THIS INFORMATION.

THIS INFORMATION SHOULD NOT BE RELIED UPON AS THE SOLE BASIS FOR EXISTING WATER AND/OR SEWER LOCATIONS. THE ENGINEER SHALL CHECK AND VERIFY ALL DIMENSIONS AND LOCATIONS OF EXISTING UTILITIES.

CONTACT ONLY UTILITIES @ 633-1277 24 HOURS PRIOR TO BEGINNING ANY WORK FOR SCHEDULING INSPECTIONS AND APPROVALS.

DISCLAIMER NOTE:

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

NOTICE TO CONTRACTOR

-QUANTITIES SHOWN ARE ESTIMATES ONLY AND ARE INTENDED TO ILLUSTRATE SCOPE OF WORK. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE EXACT QUANTITIES INVOLVED.
-EXISTING UTILITY LOCATIONS SHOWN HEREIN ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT VERTICAL AND HORIZONTAL LOCATION OF ALL EXISTING UNDERGROUND UTILITIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN HEREON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR UTILITIES NOT SHOWN IN THEIR PROPER LOCATIONS. CALL BEFORE YOU DIG: (800) 227-2600

CITY OF NORTH LAS VEGAS UTILITIES DEPARTMENT

UTILITIES DEPARTMENT- ENGINEERING SERVICES DIVISION DATE:
APPROVAL OF THESE PLANS SHALL NOT BE CONSTRUED TO BE A PERMIT FOR CONSTRUCTION, A COMMITMENT TO SUPPLY WATER AND/OR SEWER SERVICE, OR AN APPROVAL OF ANY VIOLATION OF ONLY WATER AND/OR SEWER SERVICE RULES AND REGULATIONS OR DESIGN AND CONSTRUCTION STANDARDS.

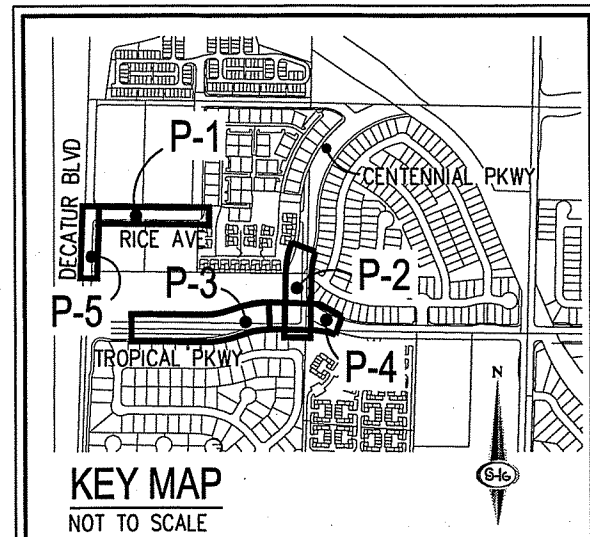
CERTIFICATION

THIS PLAN COMPLIES WITH THE APPROVED DRAINAGE STUDY APPLICATION # ONLY NO. _____ ON FILE WITH THE CITY OF NORTH LAS VEGAS.

DATE _____ RAY F. FREDERICKSEN

APPROVALS:

JENNIFER DOODY, P.E. DATE _____
MANAGER, DEVELOPMENT AND FLOOD CONTROL DIVISION
ISMAEL GARZA, P.E., PTOE DATE _____
ONLY TRAFFIC ENGINEER



GRADING NOTES

- EXISTING CURB TO BE REMOVED
- EXISTING SIDEWALK TO BE REMOVED
- EXISTING VALLEY GUTTER TO BE REMOVED
- EXISTING PAVEMENT TO BE REMOVED
- SAWCUT AND MATCH EXISTING CURB
- SAWCUT AND MATCH EXISTING SIDEWALK
- SAWCUT AND MATCH EXISTING PAVEMENT
- SAWCUT AND MATCH EXISTING CONCRETE PAD
- INSTALL "L" TYPE CURB AND GUTTER PER CCAUSD #216
- INSTALL TACK-ON ISLAND PER CCAUSD #220.1.SI
- INSTALL "A" TYPE CURB PER CCAUSD #219
- INSTALL 5' WIDE CONCRETE SIDEWALK (4" THICK OVER 6" TYPE 2 AGGREGATE BASE) PER CCAUSD #234
- INSTALL ADA COMPLIANT ARMOR TILE TRUNCATED DOMES
- INSTALL SIDEWALK RAMP USING ARMOR TILE TRUNCATED DOMES PER CCAUSD NO. 235
- INSTALL _____ ASPHALT PAVEMENT OVER _____ TYPE II AGGREGATE BASE
- SEE DETAIL 3 ON SHEET D-1
- INSTALL MOD. TYPE "C" DROP INLET WITH 3" MIN. CURB TRANSITION PER CCAUSD #412.1 AND 421 (SEE PROFILE SHEET P-5 FOR SIZE AND GRATES)
- EXISTING CATV VAULT TO BE RELOCATED (BY OTHERS)
- EXISTING SERVICE PEDESTAL TO BE RELOCATED (BY OTHERS)
- EXISTING CATV BOX. ADJUST TO FINISH GRADE
- EXISTING CONCRETE FLUME. EXTEND AND TIE TO "L" TYPE CURB
- INSTALL _____ CONCRETE PAD OVER _____ TYPE II AGGREGATE BASE
- EXISTING TEL MANHOLE. ADJUST TO FINISH GRADE

SEE SHEET C-2 FOR LEGEND, GENERAL NOTES, AND QUANTITIES

LEGEND

- ROADWAY CENTERLINE
- RIGHT-OF-WAY
- PROPERTY LINE
- CURB AND GUTTER
- EXISTING CURB AND GUTTER
- FLOWLINE
- EDGE OF PAVEMENT (EP)
- SAWCUT LINE
- PROPOSED ELEVATION
- EXISTING ELEVATION
- EXISTING CONTOUR (5-FT)
- EXISTING CONTOUR (1-FT)
- SCARP
- STREETLIGHT
- EXISTING STREETLIGHT
- MATCH LINE

CITY OF NORTH LAS VEGAS, NV

M GRAPE LLC

IMPROVEMENT PLANS FOR TROPICAL PKWY AND CENTENNIAL PKWY ROADWAY IMPROVEMENTS PLAN AND PROFILE - STORM DRAIN LATERALS

639
571
R61

DATE: 10/19/11

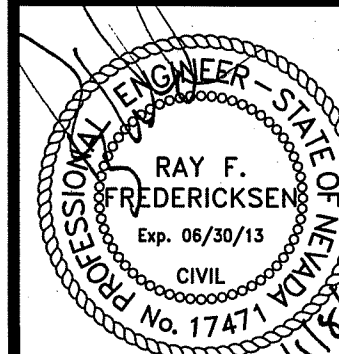
DRAFTER: BC

DESIGNER: BC

CHECKED: RF

PROJECT NO.

MGL1101.000



P-6

SHEET 8 OF 14

SLATER HANIFAN GROUP
CONSULTING ENGINEERS & PLANNERS
5740 S. ARVILLE STREET #216, LAS VEGAS, NV 89118
PHONE (702) 284-5300 FAX (702) 284-5399

