BARGHAUSEN

November 20, 2023

Albert Y. Sung, P.E.
City of Las Vegas
Public Works Department
495 S. Main Street
Las Vegas, NV 89101

RE: Drainage Study Update
Dutch Bros Coffee – NV3014
8570 Lake Mead Boulevard, Las Vegas, Nevada 89128
Our Job No. 22625

Dear Albert:

This letter has been provided to confirm that the proposed Dutch Bros Coffee development is consistent with the South Shores Center Drainage Study prepared by G.C. Wallace Inc, dated March 13, 1991. Enclosed are the following documents for your review:

1. One (1) set of the Grading Plans

2. One (1) copy of the South Shores Center Drainage Study prepared by G.C. Wallace, dated March 13, 1991

3. One (1) copy of the Hydrology Study Update to the South Shore Center Drainage Study prepared by Pyramid Rock Engineering, dated May 3, 1994

This project is subjected to the development standards set forth by the City of Las Vegas. G.C. Wallace, Inc. prepared a Drainage Study to address drainage conditions for the overall development of the South Shores Center, of which this project is a part of. Per the study, stormwater will be sheet flowed through the site and onto N. Harbor Island Drive. The Dutch Bros Coffee site is located within sub-area B3 per the attached South Shores Center Drainage Study.

The project proposes the development of approximately 0.87 acres, featuring a Dutch Bros Coffee commercial building with a 950-square-foot footprint. A significant portion of the site is designated for paved vehicular parking and drive areas, complemented by landscaping that includes a large central area along with buffers on the west and north ends of the site. The proposed conditions prioritize minimizing impervious areas to the greatest extent possible, while introducing pervious areas to mitigate stormwater runoff. The project also proposes to widen Rampart Boulevard to provide a bus turnout. There will be no changes to the current drainage pattern on Rampart Boulevard because of the widening.

The building's roof is designed to channel water to downspouts, which then connect to 2-inch PVC storm pipes embedded in the sidewalk. These pipes will discharge water into a drive aisle or landscaping, and the runoff will subsequently sheet flow to the adjacent lots.

The graded paved parking and maneuvering areas are designed to direct stormwater via sheet flow to the southeastern end of the site. At the southwestern corner, the proposed curb elevation is currently higher than the proposed building elevation, gradually dropping as it moves northward. To ensure proper drainage away from the building, a 2-foot stem/flood wall is proposed along the back of the sidewalk. This construction will facilitate drainage away from the building in the event of a flood. See the attached Grading Plan for a detailed description of the proposed curb, wall, and building elevations.

Consistent with the existing conditions and proposed overall development, drainage is planned to sheet flow towards the southeastern corner of the site, directing water into the adjacent parking lot and ultimately onto N. Harbor Island Drive. In addition, the project proposes to reduce the amount of impervious area on-site, which further reduces the stormwater runoff.

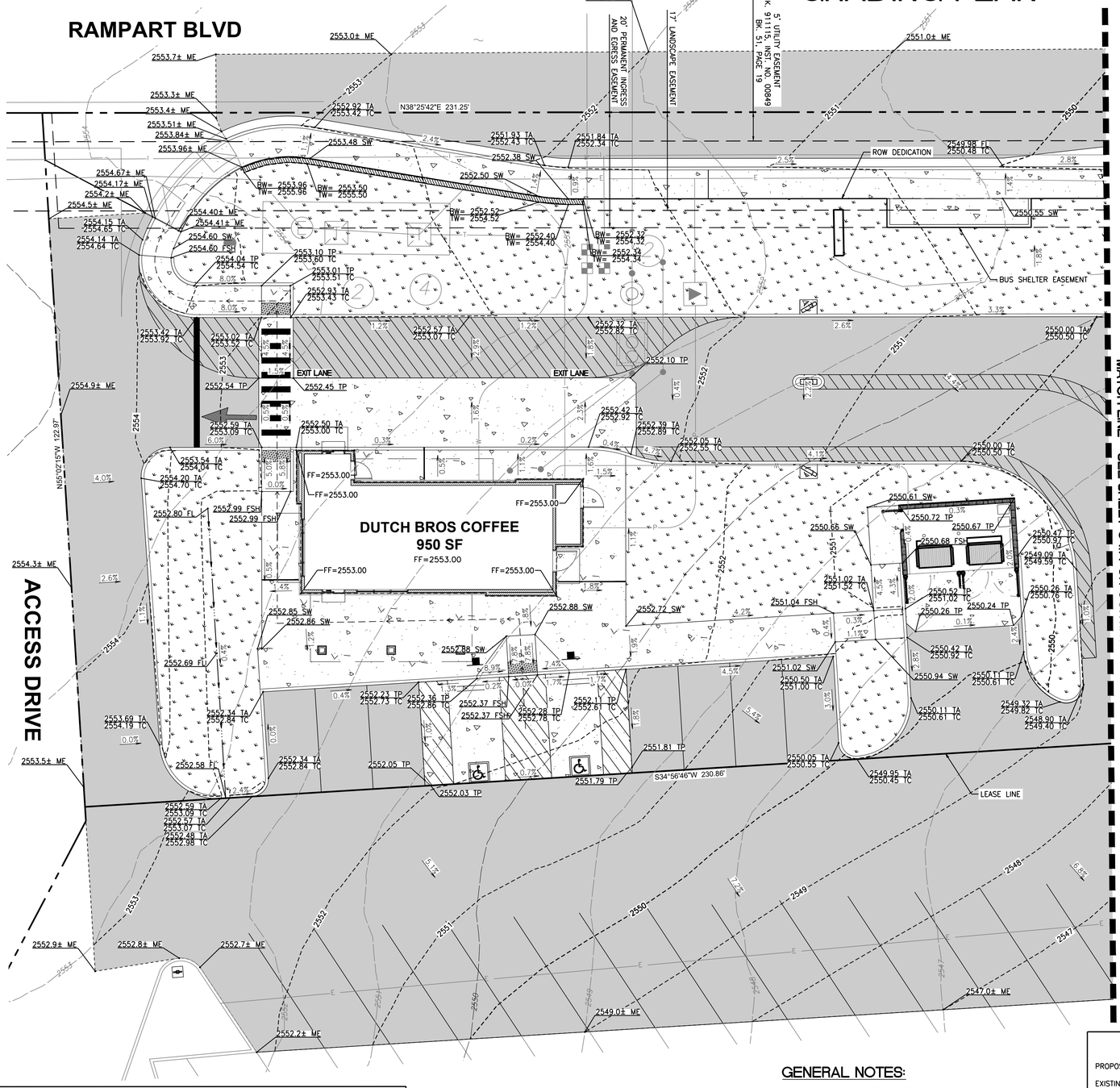
If you have questions or need additional information, please do not hesitate to contact me at this office.

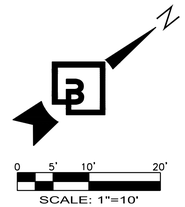
Sincerely,

Hal P. Grubb, P.E.
Director of Engineering Services

HPG/sr
22625c.001
enc: As Noted

DUTCH BROS COFFEE - NV-0314 - LAS VEGAS, NV
GRADING PLAN





GEOTECHNICAL RECOMMENDATIONS

THE FOLLOWING NOTES HAVE BEEN REFERENCED FROM THE REPORT TITLED "GEOTECHNICAL ENGINEERING REPORT" DATED APRIL 21, 2023, PREPARED BY TERRACON CONSULTANTS. REFER TO THE COMPLETE REPORTS FOR ALL EARTHWORK REQUIREMENTS.

SOILS:
BASED ON THE CLARK COUNTY EXPANSIVE SOILS GUIDELINES MAP, THE SITE IS LOCATED IN A LOW EXPANSION POTENTIAL AREA (0% - 4%). BASED ON THE CLARK COUNTY SOILS GUIDELINES MAP, THE SITE IS LOCATED IN A SPECIAL GEOTECHNICAL CONSIDERATION AREA DESIGNATED FOR SUBSIDENCE AND 2,000 FOOT COMPACTION OR SEISMIC FAULT BUFFER ZONE (INCLUDES 90% OF MAPPED FISSURES).

GROUNDWATER:

GROUNDWATER WAS NOT OBSERVED IN THE BOREHOLES WHILE DRILLING, OR FOR THE SHORT DURATION THE BORINGS COULD REMAIN OPEN. GROUNDWATER WAS NOT ENCOUNTERED IN THE BORINGS PERFORMED. BASED ON DATA COLLECTED FROM A GROUNDWATER DOMESTIC WELL APPROXIMATELY 7,950 FT NORTHEAST OF THE PROJECT SITE, THE ANTICIPATED DEPTH TO GROUNDWATER AT THE SUBJECT SITE IS GREATER THAN 100 FEET BELOW GROUND SURFACE. THEREFORE, TERRACON DOES NOT ANTICIPATE GROUNDWATER WILL IMPACT CONSTRUCTION OF THE PROJECT

SITE PREPARATION

ALL UNSUITABLE MATERIAL SHOULD BE REMOVED FROM THE CONSTRUCTION AREAS. THIS SHOULD INCLUDE ALL DEBRIS, UNCONTROLLED FILL, EXISTING PAVEMENT, AND OTHER DELETERIOUS MATERIALS FROM WITHIN THE AREA OF THE PROPOSED CONSTRUCTION. IF UNDERGROUND FACILITIES ARE ENCOUNTERED DURING SITE CLEARING, SUCH FEATURES SHALL BE REMOVED, AND THE EXCAVATION THOROUGHLY CLEANED AND PROPERLY BACKFILLED. EXCAVATIONS SHOULD BE OBSERVED BY THE GEOTECHNICAL ENGINEER PRIOR TO BACKFILL PLACEMENT.

FOLLOWING THE REQUIRED REMOVALS, THE EXPOSED NATIVE SOILS SHOULD BE SCARIFIED TO AT LEAST 8 INCHES, MOISTURE CONDITIONED, AND COMPACTED IN ACCORDANCE WITH THE FILL COMPACTION REQUIREMENTS PROVIDED IN THIS REPORT. ON-SITE SOILS MAY BE REUSED AS ENGINEERED FILL, PROVIDED THEY MEET THE MATERIAL REQUIREMENTS FOR ON-SITE SOILS DESCRIBED IN FILL MATERIAL TYPES.

OVERSIZED MATERIALS:

APPARENT COBBLES, BOULDERS, AND CEMENTED DEPOSITS WERE ENCOUNTERED IN OUR BORINGS. COBBLES AND BOULDERS EXCAVATED GREATER THAN 6 INCHES IN NOMINAL SIZE, UNEARTHED BY EXCAVATIONS OR GRADING OPERATIONS, SHOULD BE CONSIDERED OVERSIZED AND SHOULD BE REMOVED AND DISPOSED OF OFF-SITE OR CRUSHED TO MEET THE RECOMMENDATIONS FOR ENGINEERED FILL.

FILL MATERIAL AND COMPACTION:

REFER TO GEOTECHNICAL REPORT PREPARED BY TERRACON FOR FULL LIST OF ALLOWED FILL MATERIAL. FILL COMPACTION SHALL FOLLOW THE BELOW REQUIREMENTS.

- MAXIMUM LEFT THICKNESS: 9 INCHES OR LESS IN LOOSE THICKNESS WHEN HEAVY, SELF-PROPELLED COMPACTION EQUIPMENT IS USED. 4 TO 6 INCHES IN LOOSE THICKNESS WHEN HAND-GUIDED EQUIPMENT (I.E. JUMPING JACK OR PLATE COMPACTOR) IS USE.
- MINIMUM COMPACTION: 95% OF MAXIMUM DRY DENSITY AS DETERMINED BY THE MODIFIED PROCTOR TEST ASTM D1557. UTILITY TRENCH BACKFILL: 90% OF MAXIMUM DRY DENSITY AS DETERMINED BY THE MODIFIED PROCTOR TEST ASTM D1557.
- WATER CONTENT RANGE: COARSE GRAINED MATERIAL: WITHIN ± 3% WITHIN THE RANGE OF OPTIMUM MOISTURE CONTENT FOR GRANULAR MATERIAL.

LAS VEGAS GRADING NOTES:

1. IN THE EVENT THAT ANY UNFORESEEN CONDITIONS NOT COVERED BY THESE NOTES ARE ENCOUNTERED DURING GRADING OPERATIONS, THE OWNER/ENGINEER SHALL BE IMMEDIATELY NOTIFIED FOR DIRECTION.
2. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO PERFORM ALL NECESSARY CUTS AND FILLS WITHIN THE LIMITS OF THIS PROJECT AND THE RELATED OFF-SITE WORK, SO AS TO GENERATE THE DESIRED SUBGRADE, FINISH GRADES AND SLOPES SHOWN.
3. CONTRACTOR SHALL TAKE FULL RESPONSIBILITY FOR ALL EXCAVATION. ADEQUATE SHORING SHALL BE DESIGNED AND PROVIDED BY THE CONTRACTOR TO PREVENT UNDERMINING OF ANY ADJACENT FEATURES OR FACILITIES AND/OR CAVING OF THE EXCAVATION.
4. THE CONTRACTOR IS WARNED THAT AN EARTHWORK BALANCE WAS NOT NECESSARILY THE INTENT OF THIS PROJECT. ANY ADDITIONAL MATERIAL REQUIRED OR LEFTOVER MATERIAL FOLLOWING EARTHWORK OPERATIONS BECOMES THE RESPONSIBILITY OF THE CONTRACTOR.
5. THE GRADING CONTRACTOR IS RESPONSIBLE TO COORDINATE WITH THE OWNER TO PROVIDE FOR THE REQUIREMENTS OF THE PROJECT STORM WATER POLLUTION PREVENTION PLAN (SWPPP) AND ASSOCIATED PERMIT.
6. CONTRACTOR SHALL GRADE TO THE LINES AND ELEVATIONS SHOWN ON THE PLANS WITHIN THE FOLLOWING HORIZONTAL AND VERTICAL TOLERANCES AND DEGREES OF COMPACTION, IN THE AREAS INDICATED:

	HORIZONTAL	VERTICAL	COMPACTION
PAVEMENT AREA SUBGRADE	0.1'+	+0.0' TO -0.1'	SEE SOILS REPORT
ENGINEERED FILL	0.5'+	+0.1' TO -0.1'	SEE SOILS REPORT

   COMPACTION TESTING WILL BE PERFORMED BY THE OWNER OR HIS REPRESENTATIVE.
7. ALL CUT AND FILL SLOPES SHALL BE PROTECTED UNTIL EFFECTIVE EROSION CONTROL HAS BEEN ESTABLISHED.
8. THE USE OF POTABLE WATER WITHOUT A SPECIAL PERMIT FOR BUILDING OR CONSTRUCTION PURPOSES INCLUDING CONSOLIDATION OF BACKFILL OR DUST CONTROL IS PROHIBITED. THE CONTRACTOR SHALL OBTAIN ALL NECESSARY PERMITS FOR CONSTRUCTION WATER.
9. THE CONTRACTOR SHALL MAINTAIN THE STREETS, SIDEWALKS AND ALL OTHER PUBLIC RIGHT-OF-WAY IN A CLEAN, SAFE AND USABLE CONDITION. ALL SPILLS OF SOIL, ROCK OR CONSTRUCTION DEBRIS SHALL BE PROMPTLY REMOVED FROM THE PUBLICLY OWNED PROPERTY DURING CONSTRUCTION AND UPON COMPLETION OF THE PROJECT. ALL ADJACENT PROPERTY, PRIVATE OR PUBLIC SHALL BE MAINTAINED IN A CLEAN, SAFE AND USABLE CONDITION.
10. IN THE EVENT THAT ANY TEMPORARY CONSTRUCTION ITEM IS REQUIRED THAT IS NOT SHOWN ON THESE DRAWINGS, THE OWNER AGREES TO PROVIDE AND INSTALL SUCH ITEM AT HIS OWN EXPENSE AND AT THE DIRECTION OF THE CITY ENGINEER. TEMPORARY CONSTRUCTION INCLUDES DITCHES, BERMS, ROAD SIGNS AND BARRICADES, ETC.

GRADING NOTES:

1. ALL SPOT ELEVATIONS SHOWN ARE TO FINISH SURFACE (TOP OF ASPHALT OR TOP OF CONCRETE PAVEMENT, NOT TOP OF CURB/SIDEWALK) UNLESS OTHERWISE NOTED. (TC = TOP OF CONCRETE SIDEWALK/CURB, ME = MATCH EXISTING ELEVATIONS, FC = FLUSH CURB, FL = FLOW LINE, GB = GRADE BREAK)
2. CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING ALL PROPOSED GRADES IN RELATIONSHIP TO SURVEYED BASIS OF ELEVATION.
3. FILL MATERIAL AND COMPACTION SHALL CONFORM TO THE GEOTECHNICAL REPORT AND THE CITY OF LAS VEGAS REQUIREMENTS.
4. CONTRACTOR TO PROTECT AND MAINTAIN EROSION CONTROL FACILITIES DURING GRADING OPERATIONS.
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8. CONTRACTOR TO ORDER LOCATES AND FIELD VERIFY ALL UTILITIES PRIOR TO CONSTRUCTION TO ENSURE THAT UTILITY CONFLICTS DO NOT EXIST. CONTRACTOR TO REVIEW UTILITY ASBUILTS IN ORDER TO VERIFY EXISTING UTILITY LOCATIONS. CONTRACTOR SHALL POTHOLE ALL POTENTIAL UTILITY CONFLICTS PRIOR TO CONSTRUCTION. NOTIFY BARGHAUSEN CONSULTING ENGINEERS, INC. OF ANY CONFLICTS.

UTILITY PROTECTION NOTE:

APPROXIMATE LOCATION OF EXISTING UTILITIES ARE SHOWN ON THESE PLANS. CONTRACTOR TO COORDINATE WITH PURVEYORS AND USE EXTREME CAUTION WHEN EXCAVATING ON-SITE, UNTIL EXISTING GAS AND POWER SERVICE LOCATIONS ARE CONFIRMED. CONTRACTOR TO ORDER INDEPENDENT UTILITY LOCATES (INCLUDING GAS AND POWER) FOR THE FULL SCOPE OF WORK PRIOR TO CONSTRUCTION OR ANY GROUND DISTURBING ACTIVITIES.

UTILITY CONFLICT NOTE:

THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE LOCATION, DIMENSION, AND DEPTH OF ALL EXISTING UTILITIES WHETHER SHOWN ON THESE PLANS OR NOT BY POTHOLING THE UTILITIES AND SURVEYING THE HORIZONTAL AND VERTICAL LOCATION PRIOR TO CONSTRUCTION. THIS SHALL INCLUDE CALLING UTILITY LOCATE AT 811 AND THEN POTHOLING ALL OF THE EXISTING UTILITIES AT LOCATIONS OF NEW UTILITY CROSSINGS TO PHYSICALLY VERIFY WHETHER OR NOT CONFLICTS EXIST. LOCATIONS OF SAID UTILITIES AS SHOWN ON THESE PLANS ARE BASED UPON THE UNVERIFIED PUBLIC INFORMATION AND ARE SUBJECT TO VARIATION. IF CONFLICTS SHOULD OCCUR, THE CONTRACTOR SHALL NOTIFY BARGHAUSEN CONSULTING ENGINEERS, INC. TO RESOLVE ALL PROBLEMS PRIOR TO PROCEEDING WITH CONSTRUCTION.

ACCESSIBLE PATH OF TRAVEL NOTE:

WALKWAYS ALONG ACCESSIBLE ROUTES OF TRAVEL SHALL BE CONTINUOUSLY ACCESSIBLE, A MINIMUM 36" IN WIDTH, HAVE A MAXIMUM 1.5% CROSS SLOPE, AND SHALL HAVE RAMPS COMPLYING WITH ADA STANDARDS (SECTION 405) WHERE NECESSARY TO CHANGE ELEVATION AT A LONGITUDINAL SLOPE EXCEEDING 5% (1:20).

⚠ - UTILITY POTHOLING NOTE:

THE CIRCLED LOCATIONS ARE REQUIRED TO BE POTHOLED TO VERIFY VERTICAL AND HORIZONTAL LOCATION OF EXISTING UTILITY AND/OR POTENTIAL CONFLICTS WITH EXISTING UTILITIES. POTHOLING SHALL OCCUR PRIOR TO CONSTRUCTION ACTIVITIES.

GENERAL NOTES:

1. ALL GRADING AND PUBLIC IMPROVEMENTS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE PROVISIONS OF THE CURRENT CITY ORDINANCE AND STANDARD PLANS. THE GRADING AND IMPROVEMENTS ARE SUBJECT TO THE OBSERVATION AND APPROVAL OF THE ENGINEERING DIVISION.
2. ALL UTILITY STRUCTURES EXPOSED TO TRAFFIC SHALL BE TRAFFIC RATED INCLUDING STRUCTURE, LID, ETC.
3. ALL UTILITY STRUCTURES WITH LIDS EXPOSED TO PEDESTRIAN TRAFFIC SHALL BE BE SLIP RESISTANT IN ACCORDANCE WITH ACCESSIBILITY REQUIREMENTS.
4. PROVIDE ALL INCIDENTAL FITTINGS, BENDS, WYES, TEES, COUPLINGS, GASKETS, ETC. REQUIRED TO CONSTRUCT THE INFRASTRUCTURE DEPICTED.
5. ALL TRENCHING SHALL CONFORM TO THE REQUIREMENTS OF THE APPLICABLE PURVEYOR.
6. PROVIDE MARKING TAPE AND LOCATE WIRE WITH ALL TRENCH INSTALLATIONS.

GRADING LEGEND:

PROPOSED CONTOUR	30
EXISTING CONTOUR	30
PROPOSED RIDGE LINE	RIDGE
PROPOSED GRADE BREAK	GB
SWALE FLOWLINE	
PROPOSED GRADING SLOPE	1.00%
SPOT ELEVATION	30.01
FLUSH ELEVATION	30.01 FSH
MATCH EXISTING ELEVATION	30.01± ME
TOP OF PAVEMENT/TOP OF CURB	30.01 TA / 30.51 TC
FLOW/GUTTER LINE/TOP OF CURB	30.01 FL / 30.51 TC

Title: GRADING PLAN
8570 WEST LAKE MEAD BOULEVARD
LAS VEGAS, NV 89128

For: DUTCH BROS

HAL P. GRUBB
Exp. 6/30/2025
CIVIL
NO 027232
STATE OF NEVADA
PROFESSIONAL ENGINEER
11/20/2023

Scale: Horizontal 1" = 10' Vertical N.A.
Designed NRN Drawn NRN Checked MTL Approved HPG Date 11/17/23

Barghausen Consulting Engineers, Inc.
18215 72nd Avenue South
Kent, WA 98032
425.251.6222
barghausen.com

Job Number 22625
Sheet C40
2018 DB Franchising USA, LLC

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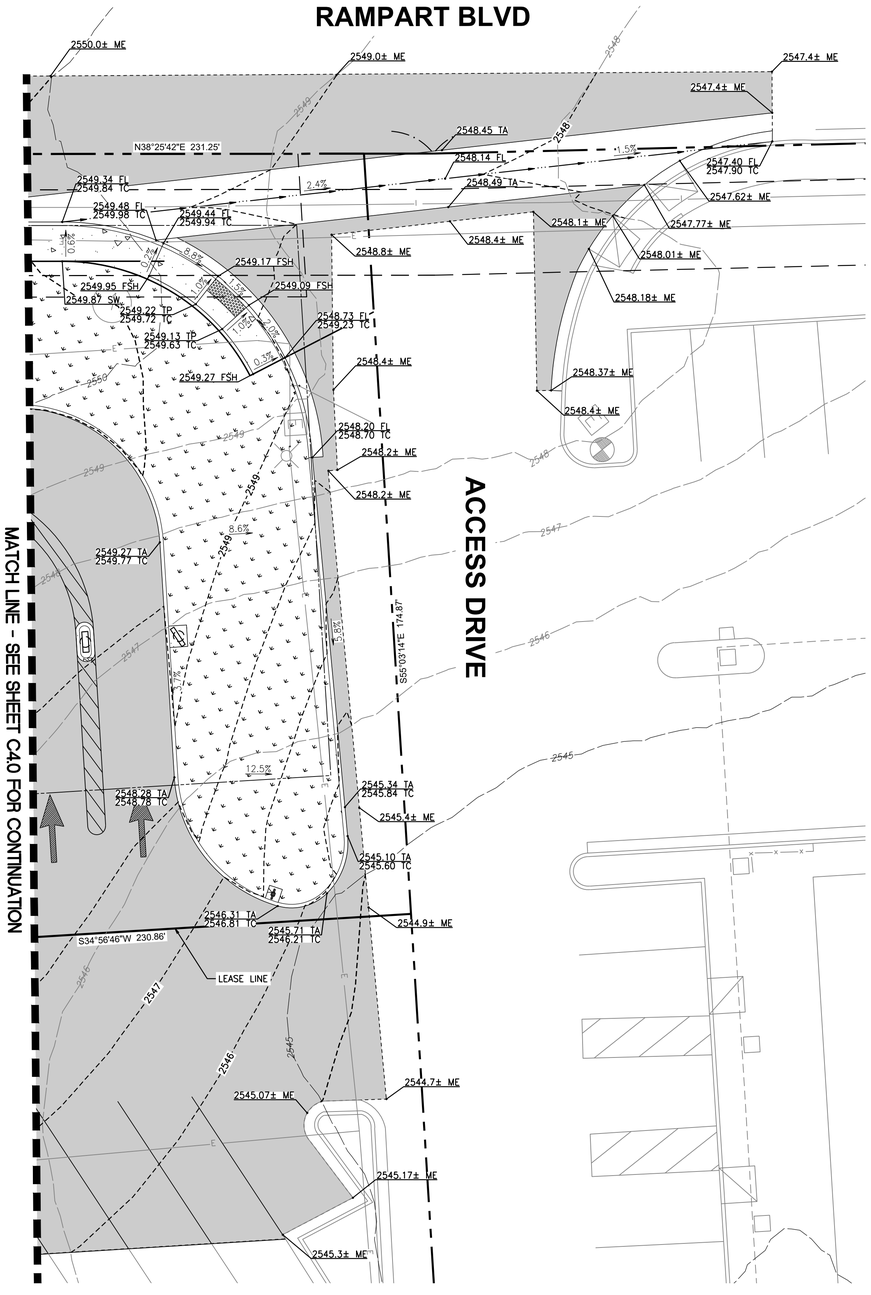
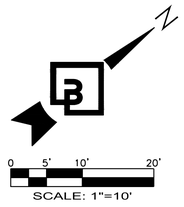
Know what's **below.**
Call before you dig.
Dial 811

DUTCH BROS COFFEE - NV-0314 - LAS VEGAS, NV
GRADING PLAN





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Title:
GRADING PLAN
8570 WEST LAKE MEAD BOULEVARD
LAS VEGAS, NV 89128

For:
DUTCH BROS

PROFESSIONAL ENGINEER - STATE OF NEVADA
HAL P. GRUBB
Exp. 6/30/2025
CIVIL
NO. 027232
11/20/2023

Scale: Horizontal 1" = 10' Vertical N.A.

Designed MRN Drawn MRN Checked MTL Approved HPG Date 11/17/23

Barghausen
Consulting Engineers, Inc.
18215 72nd Avenue South
Kent, WA 98032
425.251.6222
barghausen.com

Job Number 22625

Sheet C41
2019 DB Franchising USA, LLC

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INDEX 1107

PN 138-20-521-002

PROJECT South Shores Center

SUBMITTAL 1st submittal - Drainage Study


scanning.doc

CITY OF LAS VEGAS

INTER-OFFICE MEMORANDUM

DATE: March 13, 1991

TO:

Kent Nash
Land Development Division
Department of Public Works

FROM: RLT

T. Chiatovich, PE
Chief Flood Control
Dept. Public Works

SUBJECT:

South Shores Center Drainage Study

File No. DS676A
Date of Engineer's Stamp: 03/05/91
Date Received by City: 03/07/91

COPIES TO:

G. C. Wallace

John McNellis, PE
Charles Kajkowski, PE

REMARKS:

1st Submittal

The drainage study for the subject project has been reviewed and

_____ is acceptable in concept subject to the following conditions:

__X__ must be resubmitted or supplemented.

1. There was no depth of flow given for Lake Mead Boulevard. A flow depth must be presented in the resubmittal so as to facilitate proper review of this report.

2. All entrances off of Lake Harbor, Lake Mead and Rampart must be humped at least 6-inches above the adjacent 100-year water surface elevation.

END OF REMARKS
dbm

T/R/S: L21
Z-3-89

676
L-21
Rec'd
3/7/91

SOUTH SHORES CENTER
DRAINAGE STUDY

MARCH 1991

671.002

Prepared for:

Las Vegas Rampart RPR Assoc. III
21235 Hawthorne Blvd.
Suite 200
Torrance, CA 90503
213/540-4475

Prepared by:

G. C. Wallace, Inc.
1555 South Rainbow Boulevard
Las Vegas, Nevada 89102

G.C. WALLACE, INC.
Engineering/Architecture

G.C. WALLACE, P.E.
TERRILL B. ADAMS
CALVIN L. BLACK, P.E.
JAMES A. DUDDLESTEN, P.E.
DAVID HUCKLE, P.E.
JACK H. MITCHELL, P.E.
MICHAEL D. ROSS, P.E.
RONALD R. THOMAS

CHRISTOPHER W. ANDERSON, P.E.
L. STEVEN ANDERSON, P.E.
MICHAEL J. CSIZMADIA, P.E.
MICHAEL S. KOIZUMI, P.E.
DAN STUART DAVIS, ARCHITECT
C. RUSSELL DAVIS, P.E.
HOWARD L. HARRIS, P.E.
MARC A. LEMOINE
SCOTT R. PLUMMER, P.E.
HOWARD K. VANDER MEER, P.E.
MARIE RAINWATER

JIM BAKKEDAHL, P.E.
RICHARD G. CLARKE
R. GUY DOTY, P.L.S.
DOUGLAS M. HANKEL
DONALD A. HASELHOFF, P.E.
ROBERT J. HERMAN
MICHAEL L. IVES, ASLA
KRISTOFER D. KORPI
MARVIN W. MAIZE
JOHN R. TOBIN, P.E.
SAUNDRA L. VANCE, CCS
STEVEN L. YOUNGBERG, P.L.S.

671.002

March 5, 1991

City of Las Vegas
400 East Stewart Avenue
Las Vegas, Nevada 89101

Attention: Mr. Tom Chiatovich, P.E.
Chief of Flood Control

Subject: **South Shores Center Drainage Study**

Gentlemen:

G. C. Wallace is please to submit two copies of the referenced drainage study for your review and approval.

If you have any questions or if we may be of any further assistance, please do not hesitate to call us at 702-363-1200.

Very truly yours,

G. C. Wallace, Inc.

Noel C. Laughlin
Senior Designer

Calvin L. Black
Senior Vice President

Enclosure

NCL:vms

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: South Shores Center Date: March 5, 1991

Location of Development: a) Descriptive Northeast corner of Rampart Blvd. & Lake Mead Blvd
b) Sect. 20&21 Twn. 20 Rng. 60

Name of Owner: Las Vegas/Rampart RPR Associates, III Assessors Parcel No:

Contact Person-Name: Calvin L. Black Noel C. Laughlin Telephone No: 702-363-1200

Firm: G. C. Wallace, Inc.

Address: 1555 South Rainbow Boulevard

Las Vegas, Nevada 89102

Type of Land Development/Land Disturbance Process:

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

1. Total Owned Land Area: At Site: 20AC Being Developed/Disturbed: 14AC
2. Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? YES* (NO)
3. Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? YES* (NO)
4. Proposed type of development (Residential, Commercial, Etc.)? Commercial
5. Approximate upstream land area which drains to the subject site?
6. Has the site drainage been evaluated in the past? (YES) NO. If yes, please identify documentation: "A.G. Rentals, Inc. South Shores Development Drainage Study" G.C. Wallace, "R.A. Homes Westlake Drainage Study", G.C. Wallace
7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: Site Runoff discharged onto Harbor Island Drive
8. Briefly describe your proposed schedule for the subject project: Begin Construction as soon as possible.

REGISTERED PROFESSIONAL ENGINEER STATE OF NEVADA
CALVIN L. BLACK
CIVIL
No. 4525
Engineer's Seal 3-5-91

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.

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

Revision	Date

Local Entity File No.

REFERENCE:

STANDARD FORM 1

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

Scope

The purpose of this report is to provide hydrologic and hydraulic analysis for the proposed commercial development at South Shores Center. Proposed conditions relating to site drainage will be addressed in this report. This report will be a supplement to "A & G Rentals, Inc. South Shores Development Drainage Study," dated January 4, 1989. (Reference 1.)

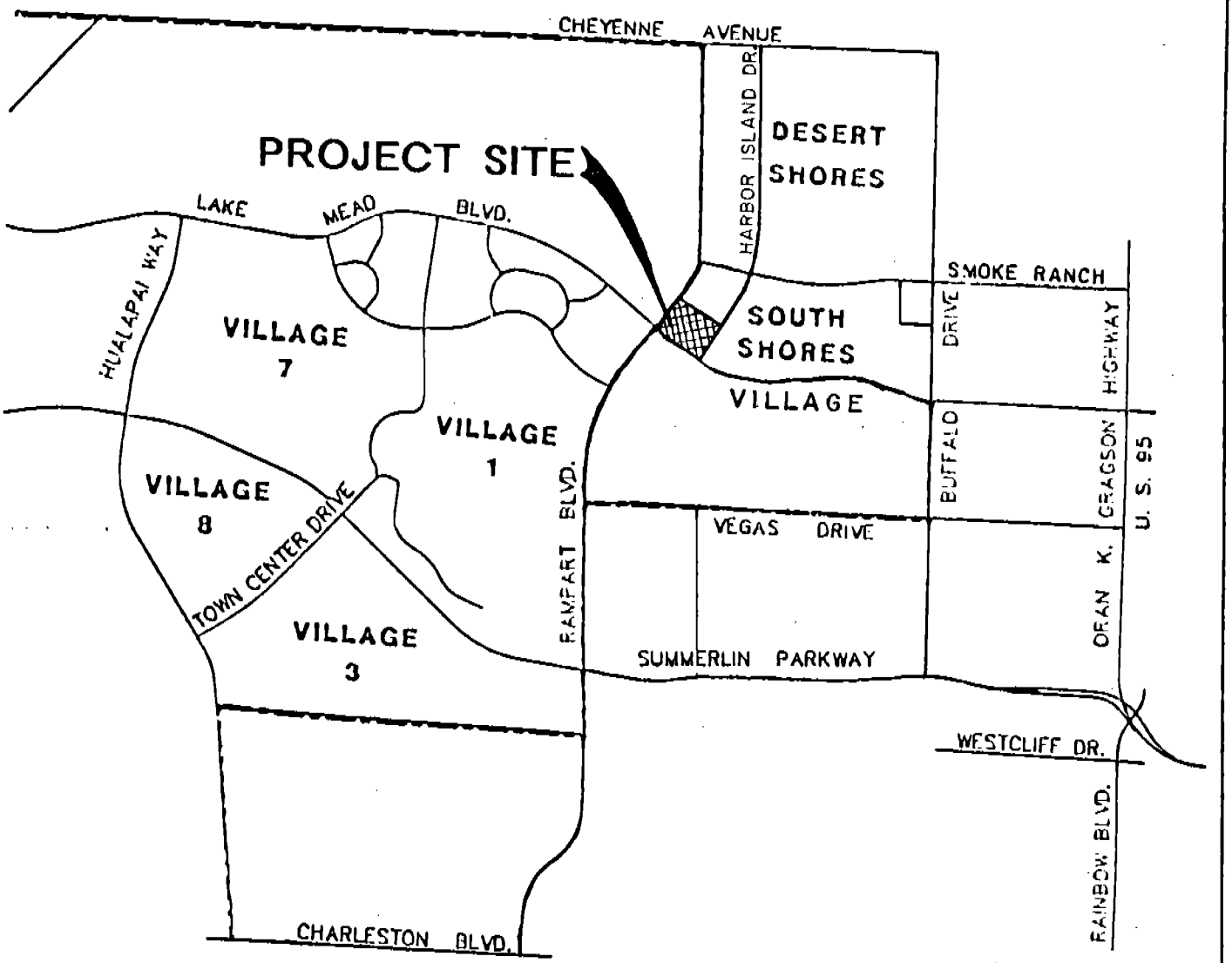
Location

This parcel is located within Section 20 and Section 21, Township 20 South, Range 60 East, M.D.M. South Shores Center is located in the southwest corner of South Shores Development. The site is bounded by Rampart Boulevard on the west, Lake Mead Boulevard on the south, Harbor Island Drive on the east, and by existing residential developments within South Shores to the north (see Figure 1).

EXISTING CONDITIONS

The project site is roughly rectangular in shape and consists of approximately 20 acres. The project site is proposed to be a commercial development. Under existing site conditions, the land is barren desert with sparse vegetation and slopes from the southwest to the northeast at approximately 2.2%. Numerous mounds of fill dirt are present in the northeast corner of the site.

It is beyond the scope of this report to analyze the historical on-site and off-site drainage characteristics of the project site since this parcel lies within a master planned area. The predevelopment drainage conditions were addressed in the "Husite



NORTH

SOUTH SHORES CENTER

FIGURE NO. 1 VICINITY MAP

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Engineering/Architecture
1555 SOUTH RAINBOW BLVD./LAS VEGAS, NEVADA 89102

Master Drainage Plan" dated April 1987 (Reference 2), "R.A. Homes Westlake Estates Drainage Study" dated August 1987 (Reference 3), "Sun City Summerlin Supplemental Drainage Study Unit No. 17, 18, 19, and 20" dated June 1989 (Reference 7)," and "Summerlin Village 1 South Drainage Study," revised October 1, 1989 (Reference 8).

FLOOD PLAIN INFORMATION

The Special Flood Hazard Area for the unincorporated portions of Clark County, Nevada are outlined in the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM), dated September 29, 1989. The project site was determined not be located in a designated Special Flood Hazard Zone after review of Community Panel 320003 100B (see Figure 2).

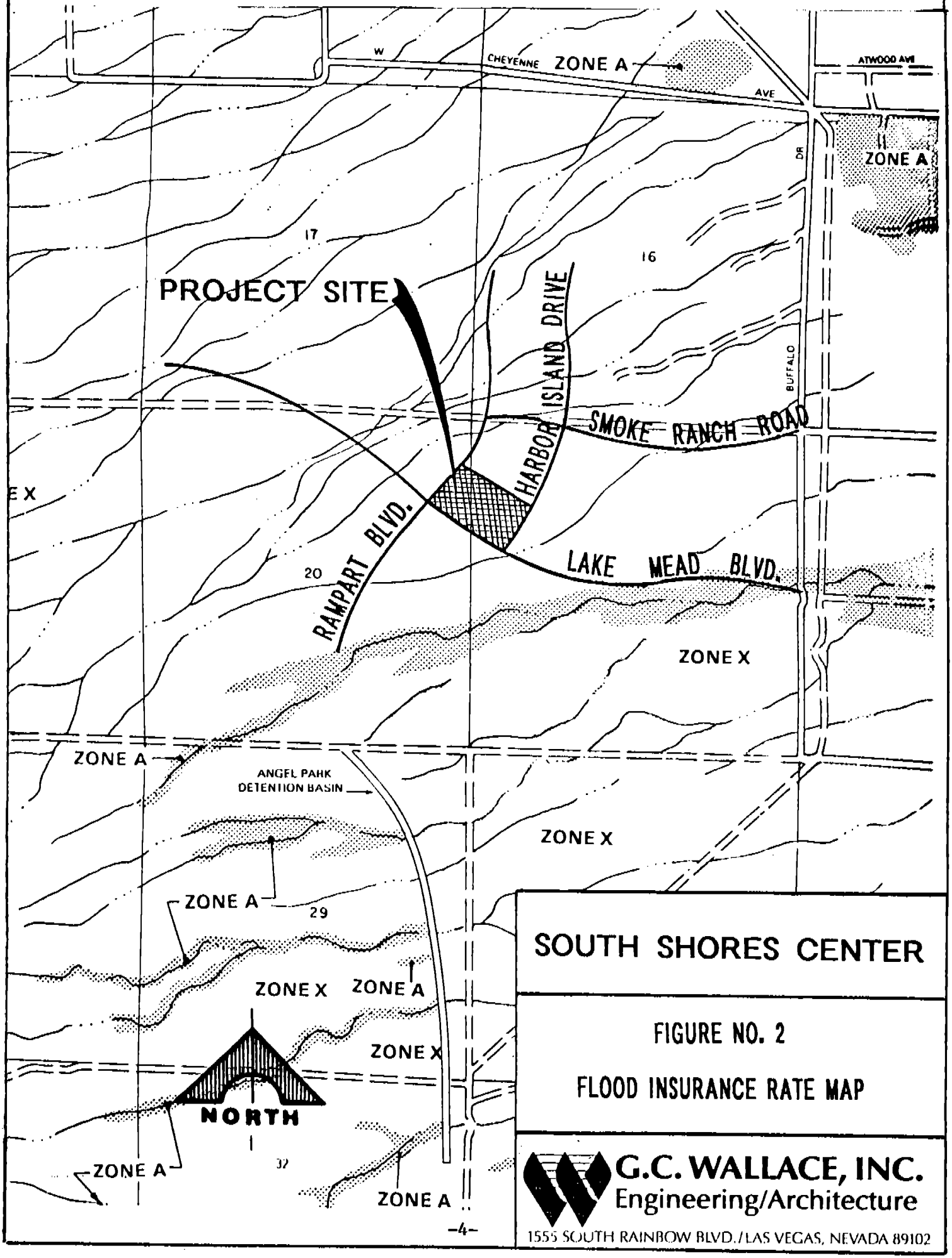
REGIONAL FLOOD CONTROL

The development of South Shores Center is in compliance with the Clark County Regional Flood Control Master Plan (Reference 4), R.A. Homes Westlake Estates Drainage Study (Reference 3), and South Shores Development Drainage Study (Reference 1).

PROPOSED CONDITIONS

The project site, as previously mentioned, is to be a commercial development of approximately 20 acres. The initial development of the site will include two large clusters of buildings, a large paved parking area and associated traffic access points. Future development will include small commercial building and associated parking areas along Lake Mead Boulevard.

A 5.8 acre portion of the site, roughly the eastern 1/3 of the project site currently has no proposed development plans. Runoff calculations were performed for the project site under



SOUTH SHORES CENTER

FIGURE NO. 2

FLOOD INSURANCE RATE MAP

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proposed and ultimate conditions. Ultimate conditions assume commercial development on the entire project site and will yield the most conservative runoff values.

As per "Sun City Summerlin Supplemental Drainage Study, Units No. 17, 18, 19 and 20," dated June 5, 1989 (Reference 7), the east side of Rampart Boulevard adjacent to the project site carries 30 cfs at a depth of 0.61 feet during the 100-year storm event. Therefore each traffic access driveway along Rampart Boulevard is recommended to have a hump height equal to the depth associated with twice the 100-year storm flow. The recommended minimum hump height from flow line of the valley gutter to flow line of the hump should be 0.72 feet. Street capacity calculations are enclosed in Appendix B.

Runoff generated on-site will be routed through the parking areas and will be directed to the northeast corner of the property. On-site flows will be discharged on to Harbor Island Drive. This drainage pattern is in agreement with the drainage study for the overall South Shores development area (Reference 1).

HYDROLOGY AND HYDRAULICS

Methodology

Model Description - The watershed was modeled using the generalized storm network, computation capabilities of the Army Corps of Engineer's HEC-1 Flood Hydrograph computer model (Reference 5). The HEC-1 computer program has a wide range of capabilities in modeling gaged and ungaged watersheds, with most of the latest techniques for simulating precipitation, rainfall distribution, runoff losses due to soil absorption, transpiration, evaporation and surface impoundment, flood routing, flow diversions and splits. Since the study watershed is ungaged, the analysis used to model the runoff incorporated

the Soil Conservation Service (SCS) Unit Hydrograph Method to develop a hypothetical flood hydrograph (Reference 6).

Precipitation - The location for South Shores Center falls within the McCarran Airport Rainfall Area. The McCarran Airport Rainfall Area is presented in Figure 513 of the Manual. Table 505 of the Manual was used to establish rainfall depth-duration-frequency values. Table 1 lists the point precipitation values for the 6-hour duration storm event. The 6-hour storm event has been selected to remain consistent with the guidelines set forth in the Manual. Figure 513 and Table 505 from the Manual are included in the Appendix.

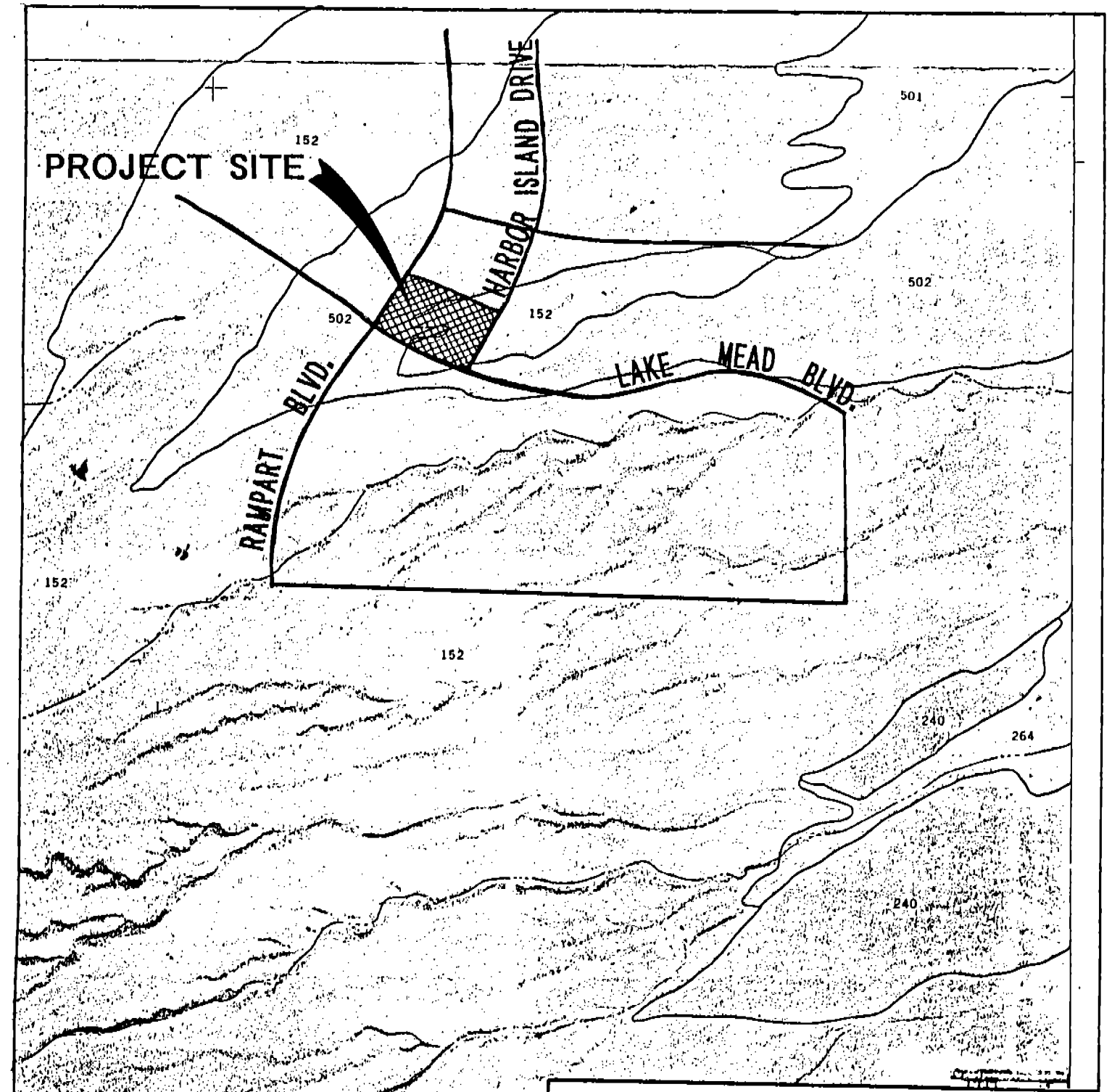
TABLE 1
Point Precipitation Values

	Inches (6-hour duration)	
	10-Year	100-Year
Point Precipitation	1.58	2.77

Drainage Areas - The drainage areas were determined with the use of preliminary grading plans of the site, field investigations and existing drainage studies. A planimeter was used to determine the basin areas.

Curve Numbers/Soil Types - The curve numbers were developed based on vegetation, soils group information, land use, and antecedent soil moisture conditions in accordance with the standard methods of the SCS. The curve numbers were determined from Table 602 of the Manual.

The soils information was obtained from the SCS Soil Survey of the Las Vegas Valley Area. This survey delineates families of soil types and the hydrologic soil group of each family. Figure 3 shows the project location on the soil map of the area. An examination of this map shows that the watershed consists of "B"



SOUTH SHORES CENTER

FIGURE NO. 3 SOIL MAP

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Engineering/Architecture
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and "D" type soils. These soils are estimated to have a medium to high runoff potential. A curve number of 98 was used for the proposed commercially developed area. The undeveloped portion of the project site will have a curve number of 88.

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

$$Lag = 0.6\ Tc$$

$$Tc = Tt + Ti$$

$$Tc = \frac{LwS}{3600V} + \frac{1.8(1.1-K)L_o^{\frac{1}{2}}}{S^{\frac{1}{3}}}$$

where: t_t = Travel time
t_i = Initial time
LWS = Hydraulic length
V = Travel time velocity
K = Flow resistance coefficient (.0132 Cn - .39)
L_o = Length of overland flow (ft.)
S = Average basin slope (%)

Average velocities for estimating travel time for surface flow were used to develop a time of concentration. Travel time velocity was determined from Figure 602 of the Manual (Reference 6).

Table 2 summarizes the specific drainage basin characteristics used in the SCS Unit Hydrograph Method.

TABLE 2

DRAINAGE BASIN SUMMARY

Basin	Area (Sq.Mi.)	Cn	Length (ft)	Slope (%)	Avg.Vel. (fps)	Lag (Hrs)
B1	0.0044	98	570	2.0	2.7	0.082
B2 (1)	0.009	88	270	1.0	2.0	0.128
(2)	0.009	98	270	1.0	2.0	0.086
B3	0.0036	98	470	0.5	1.4	0.119
B4	0.0047	98	350	0.5	1.4	0.107
B5	0.0028	98	250	1.0	2.0	0.068
B6	0.0061	98	570	2.0	2.7	0.114
B6 (cont)			270	0.5	1.4	

(1) Undeveloped

(2) Developed

See Figure 4 for basin locations.

RUNOFF CALCULATIONS

Peak runoff rates for the basins were calculated using the SCS Unit Hydrograph Method. Calculated runoff values for 10-year and 100-year storm event for each basin are listed in Table 3.

TABLE 3

PEAK RUNOFF RATES

Basin	10-Year	100-Year
B1	5	9
B2 (1)	5	13
(2)	10	19
B3	4	7
B4	5	9
B5	3	6
B6	6	12

(1) Undeveloped

(2) Developed

The peak flows generated in each basin were routed through the site using the Kinematic Wave routing. The peak runoff discharged onto Harbor Island Drive was calculated to be 59 cfs. The peak runoff discharged on Harbor Island Drive does not exceed the runoff estimate of 63 cfs for the project site established in drainage study for the overall South Shores development (Reference 1). See Figure 4 for the drainage pattern for the proposed development. The HEC-1 run for the proposed development is enclosed in Appendix A.

The aforementioned flow of 59 cfs generated on the project site will outlet onto Harbor Island Drive. The flow will continue to flow in a northerly direction on Harbor Island Drive until its confluence with the Cheyenne Channel.

The on-site flow values and off-site routing of flows to the Cheyenne Channel are in agreement with the drainage study performed for the overall South Shores development to which this report is a supplement (Reference 1).

CONCLUSIONS AND RECOMMENDATIONS

1. To insure that no off-site flows enter the site, 0.72 foot humps from flow line to flow line are recommended for entry roads along Rampart Boulevard.

2. The on-site flows can be safely conveyed through the development and outlet into Harbor Island Drive as shown in Figure No. 4. The discharge from the site (59 cfs) does not exceed the storm flow estimated in the overall South Shores Drainage Study.

3. The site does not lie within a Special Flood Hazard Zone.

4. The development of this site does not conflict with previous drainage studies performed for the South Shores area, the overall Summerlin area, or the CCRFCD Master Plan, and will serve to enhance the drainage pattern for the South Shores area.

5. It is recommended that a supplemental drainage study be performed when the conceptual development plan for Basin B2 is available.

6. The methods used to calculate the storm runoff generated on the project site are conservative in nature and are in compliance with the Manual.

REFERENCES

1. "A & G Rentals, Inc. South Shores Development Drainage Study," dated January 4, 1989. G. C. Wallace, Inc.

2. "Husite Master Drainage Plan," dated April 1987. G. C. Wallace, Inc.

3. "R.A. Homes Westlake Estates Drainage Study," dated August 1987. G. C. Wallace, Inc.

4. "Clark County Regional Flood Control District Comprehensive Flood Control Master Plan," dated October 1986. J.M. Montgomery Consulting Engineers, Inc.

5. "HEC-1 Flood Hydrograph Package," dated September 1981, Revised January 1985. U.S. Army Corps of Engineers.

6. "Clark County Regional Flood Control District Hydrologic Criteria and Drainage Design Manual," dated October 1990.

7. "Sun City Summerlin Supplemental Drainage Study Units No. 17, 18, 19 and 20," dated June 5, 1989. G. C. Wallace, Inc.

8. "Summerlin Village 1 South Drainage Study," dated June 9, 1989, revised October 1989. G. C. Wallace, Inc.

APPENDIX A

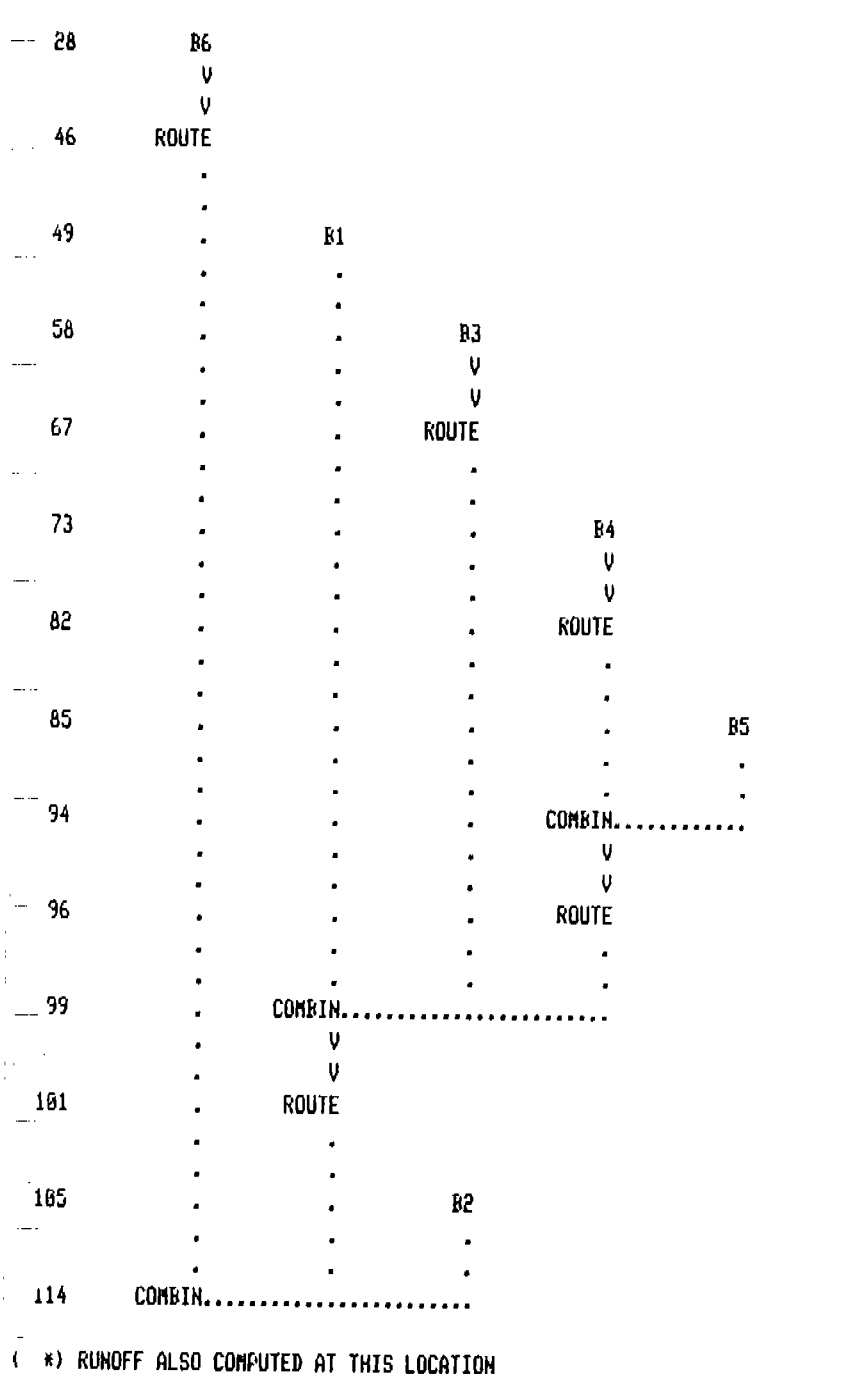
-HEC-1 COMPUTER PRINTOUTS AND BACK UP INFORMATION

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

          *DIAGRAM
    1     ID   ************************************************************
    2     ID   * ..................................................... *
    3     ID   * :                SOUTH SHORES CENTER                : *
    4     ID   * :                PROPOSED CONDITIONS                : *
    5     ID   * :...................................................: *
    6     ID   * :            RETURN PERIOD_ _10 AND 100  YEAR       : *
    7     ID   * :            DISTRIBUTUION_ _ _ _ _ _ _6-HOUR       : *
    8     ID   * :            PROJECT NO_ _ _ _ _ _ _ _671.002       : *
    9     ID   * :            FILENAME_ _ _ _ _ _ _ _ SHORE.H1       : *
   10     ID   * :            DATE_ _ _ _ _ _ _ _ OCT 19, 1990       : *
   11     ID   * :            MODELED BY_ _ _ _ _ JERRY PRUITT       : *
   12     ID   * :...................................................: *
   13     ID   ************************************************************
   14     ID   *  1.  THE POINT PRECIPITATION VALUE FROM NOAA ATLAS 2 WAS    *
   15     ID   *      FOUND TO BE 2.77 FOR THE 100-YEAR, 6-HOUR STORM.       *
   16     ID   ************************************************************
   17     ID   *  2.  THE PROPOSED DEVELOPMENT AREA WILL CONSIST OF          *
   18     ID   *      COMMERCIAL BUILDINGS AND PARKING LOTS.                 *
   19     ID   ************************************************************
   20     ID   *  3.  CURVE NUMBER (CN) AND LAND USE INFORMATION            *
   21     ID   *      (PARKING LOTS, STREETS, AND ROOF TOPS).....CN=98       *
   22     ID   *      (UNDEVELOPED LANDSCAPE).....................CN=88       *
   23     ID   ************************************************************
   24     IT      5       0       0     300
   25     ID      5       0
   26     IN      5       0       0
   27     JR    PREC   .5704   1.000

   28     KK      B6
   29     KM   AREA.....(AC)... 3.93
   30     KM   LENGTH....(FT)... 570             270
   31     KM   SLOPE.....(%).... 2.0             0.5
   32     KM   VELOCITY..(FPS).. 2.7             1.4
   33     KM   LAG TIME..(HR)... .114
   34     BA   .0061
   35     PB    2.77
   36     PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
   37     PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
   38     PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
   39     PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
   40     PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
   41     PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
   42     PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
   43     PC    .998    .999   1.00
   44     LS       0      98
   45     UD    .114

   46     KK   ROUTE      B6
   47     KM   ROUTE B6 TO PT.3
   48     RK     700     .02     .02       0    TRAP       0      10
```

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

  49      KK     B1
  50      KM   AREA.....(AC)... 2.84
  51      KM   LENGTH....(FT)... 570
  52      KM   SLOPE.....(%).... 2.0
  53      KM   VELOCITY..(FPS).. 2.7
  54      KM   LAG TIME..(HR)... .082
  55      BA   .0044
  56      LS      0      98
  57      UD    .082

  58      KK     B3
  59      KM   AREA.....(AC)... 2.28
  60      KM   LENGTH....(FT)... 470
  61      KM   SLOPE.....(%).... 0.5
  62      KM   VELOCITY..(FPS).. 1.4
  63      KM   LAG TIME..(HR)... .119
  64      BA   .0036
  65      LS      0      98
  66      UD    .119

  67      KK   ROUTE  B3
  68      KM  ROUTE B3 TO PT.2
  69      RK     280     1.0    .016       0    TRAP       0      50
  70      RK     100     .60    .016       0    TRAP       0      50
  71      RK     150     2.0    .016       0    TRAP       0      50
  72      RK     120     1.0    .016       0    TRAP       0      50

  73      KK     B4
  74      KM   AREA.....(AC)... 3.00
  75      KM   LENGTH....(FT)... 350
  76      KM   SLOPE.....(%).... 0.5
  77      KM   VELOCITY..(FPS).. 1.4
  78      KM   LAG TIME..(HR)... .107
  79      BA   .0047
  80      LS      0      98
  81      UD    .107

  82      KK   ROUTE      B4
  83      KM  ROUTE B4 TO PT.1
  84      RK     100     .01    .016       0    TRAP       0      50

  85      KK     B5
  86      KM   AREA.....(AC)... 1.77
  87      KM   LENGTH....(FT)... 250
  88      KM   SLOPE.....(%).... 1.0
  89      KM   VELOCITY..(FPS).. 2.0
  90      KM   LAG TIME..(HR)... .068
  91      BA   .0028
  92      LS      0      98
  93      UD    .068
```

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

  94      KK  COMBINE B4 & B5
  95      HC       2

  96      KK   ROUTE  B4 & B5
  97      KM  ROUTE TO PT.2
  98      RK     160     .01     .02       0    TRAP       0      10

  99      KK  COMBINE B1,B3,B4,&B5
 100      HC       3

 101      KK   ROUTE  B1,B3,B4,&B5
 102      KM  ROUTE TO PT.3
 103      RK     235   .0362     .02       0    TRAP       0      10
 104      RK     225   .0157     .02       0    TRAP       0      10

 105      KK      B2
 106      KM   AREA......(AC)... 5.76
 107      KM   LENGTH....(FT)... 270
 108      KM   SLOPE.....(%).... 1.0
 109      KM   VELOCITY..(FPS).. 2.0
 110      KM   LAG TIME..(HR)... .128
 111      BA    .009
 112      LS       0      88
 113      UD    .128

 114      KK  COMBINE B1,B2,B3,B4,B5,&B6
 115      HC       3
 116      ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK



(*) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
**************************************************************
* ..........................................................  *
* :                SOUTH SHORES CENTER                     :  *
* :                PROPOSED CONDITIONS                     :  *
* :........................................................:  *
* :            RETURN PERIOD_ _10 AND 100  YEAR            :  *
* :            DISTRIBUTUION_ _ _ _ _ _ _6-HOUR            :  *
* :            PROJECT NO_ _ _ _ _ _ _ _671.002            :  *
* :            FILENAME_ _ _ _ _ _ _ _ SHORE.H1            :  *
* :            DATE_ _ _ _ _ _ _ _ OCT 19, 1990            :  *
* :            MODELED BY_ _ _ _ _ JERRY PRUITT            :  *
* :........................................................:  *
**************************************************************
*  1.  THE POINT PRECIPITATION VALUE FROM NOAA ATLAS 2 WAS     *
*      FOUND TO BE 2.77 FOR THE 100-YEAR, 6-HOUR STORM.       *
**************************************************************
*  2.  THE PROPOSED DEVELOPMENT AREA WILL CONSIST OF          *
*      COMMERCIAL BUILDINGS AND PARKING LOTS.                 *
**************************************************************
*  3.  CURVE NUMBER (CN) AND LAND USE INFORMATION             *
*      (PARKING LOTS, STREETS, AND ROOF TOPS).....CN=98       *
*      (UNDEVELOPED LANDSCAPE)....................CN=88       *
**************************************************************

 25 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

               COMPUTATION INTERVAL     .00 HOURS
                   TOTAL TIME BASE   24.92 HOURS

       ENGLISH UNITS

    JP         MULTI-PLAN OPTION
                   NPLAN          1  NUMBER OF PLANS

    JR         MULTI-RATIO OPTION
                  RATIOS OF PRECIPITATION
                  .57      1.00

WARNING *** TIME INTERVAL IS GREATER THAN .29*LAG

WARNING *** TIME INTERVAL IS GREATER THAN .29*LAG

WARNING *** TIME INTERVAL IS GREATER THAN .29*LAG

WARNING *** TIME INTERVAL IS GREATER THAN .29*LAG
```

ARNING *** TIME INTERVAL IS GREATER THAN .29*LAG

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

					RATIOS APPLIED TO PRECIPITATION	
ERATION	STATION	AREA	PLAN		RATIO 1	RATIO 2
					.57	1.00
DROGRAPH AT	B6	.01	1	FLOW	6.	12.
				TIME	3.50	3.50
UTED TO	ROUTE	.01	1	FLOW	6.	11.
				TIME	3.58	3.58
DROGRAPH AT	B1	.00	1	FLOW	5.	9.
				TIME	3.50	3.50
HYDROGRAPH AT	B3	.00	1	FLOW	4.	7.
				TIME	3.50	3.50
ROUTED TO	ROUTE	.00	1	FLOW	4.	7.
				TIME	3.58	3.50
HYDROGRAPH AT	B4	.00	1	FLOW	5.	9.
				TIME	3.50	3.50
ROUTED TO	ROUTE	.00	1	FLOW	5.	9.
				TIME	3.50	3.50
DROGRAPH AT	B5	.00	1	FLOW	3.	6.
				TIME	3.50	3.50
COMBINED AT	COMBIN	.01	1	FLOW	8.	15.
				TIME	3.50	3.50
JTED TO	ROUTE	.01	1	FLOW	8.	15.
				TIME	3.50	3.50
COMBINED AT	COMBIN	.02	1	FLOW	17.	31.
				TIME	3.50	3.50
TED TO	ROUTE	.02	1	FLOW	17.	30.
				TIME	3.50	3.50
DROGRAPH AT	B2	.01	1	FLOW	5.	13.
				TIME	3.58	3.58
3 COMBINED AT	COMBIN	.03	1	FLOW	27.	52.
				TIME	3.58	3.50

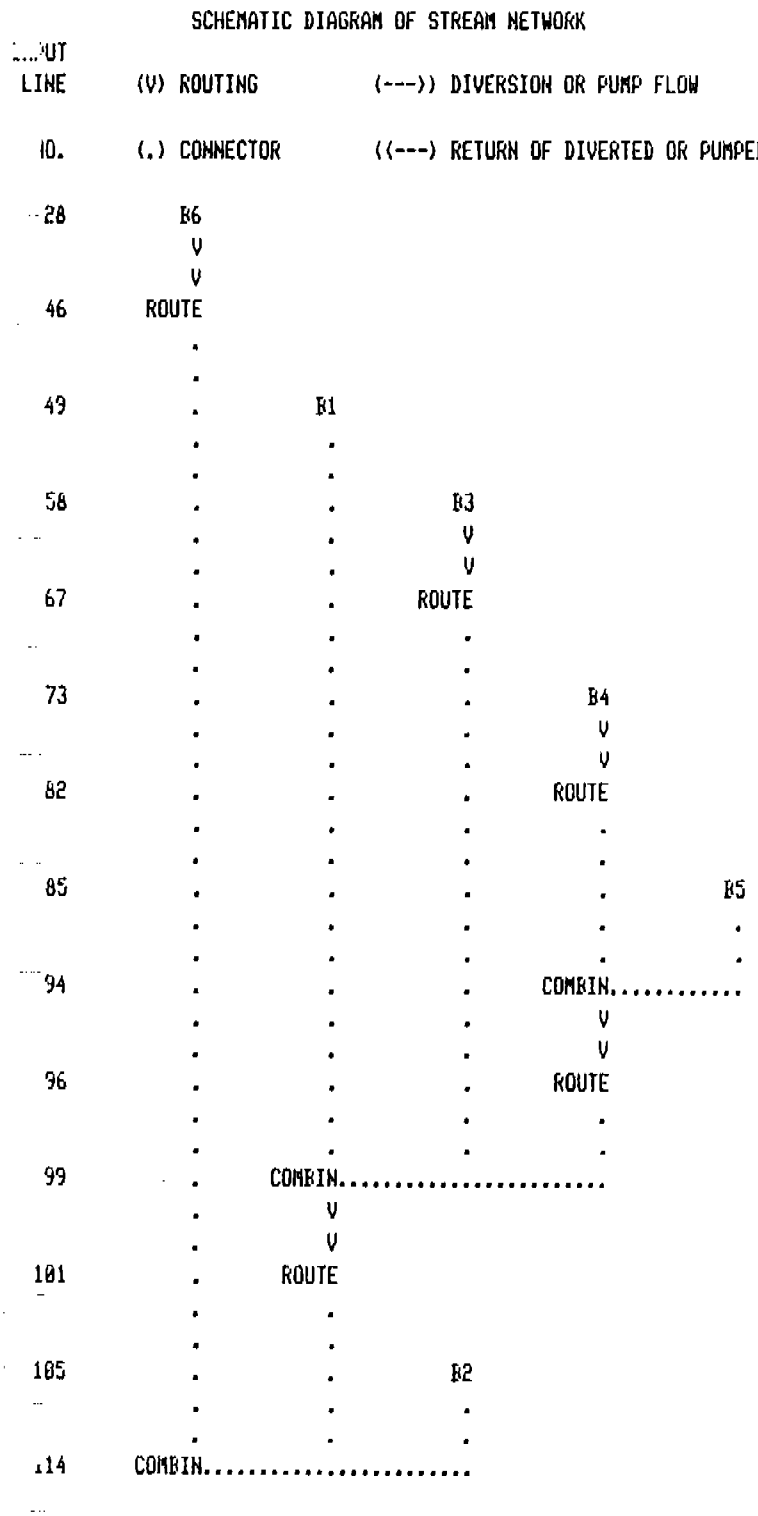
* NORMAL END OF HEC-1 ***

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

          *DIAGRAM
    1     ID   ************************************************************
    2     ID   * ..................................................... *
    3     ID   * :                SOUTH SHORES CENTER                : *
    4     ID   * :                ULTIMATE CONDITIONS                : *
    5     ID   * :...................................................: *
    6     ID   * :            RETURN PERIOD_ _10 AND 100  YEAR       : *
    7     ID   * :            DISTRIBUTUION_ _ _ _ _ _ _6-HOUR       : *
    8     ID   * :            PROJECT NO_ _ _ _ _ _ _ _671.002       : *
    9     ID   * :            FILENAME_ _ _ _ _ _ _ _ SHOR1.H1       : *
   10     ID   * :            DATE_ _ _ _ _ _ _ _ OCT 19, 1990       : *
   11     ID   * :            MODELED BY_ _ _ _ _ JERRY PRUITT       : *
   12     ID   * :...................................................: *
   13     ID   ************************************************************
   14     ID   *  1.  THE POINT PRECIPITATION VALUE FROM NOAA ATLAS 2 WAS    *
   15     ID   *      FOUND TO BE 2.77 FOR THE 100-YEAR, 6-HOUR STORM.       *
   16     ID   ************************************************************
   17     ID   *  2.  THE PROPOSED DEVELOPMENT AREA WILL CONSIST OF          *
   18     ID   *      COMMERCIAL BUILDINGS AND PARKING LOTS.                 *
   19     ID   ************************************************************
   20     ID   *  3.  CURVE NUMBER (CN) AND LAND USE INFORMATION            *
   21     ID   *      (PARKING LOTS, STREETS, AND ROOF TOPS).....CN=98       *
   22     ID   *      (UNDEVELOPED LANDSCAPE).....................CN=88       *
   23     ID   ************************************************************
   24     IT       5       0       0     300
   25     IO       5       0
   26     IN       5       0       0
   27     JR    PREC   .5704   1.000

   28     KK      B6
   29     KM   AREA.....(AC)... 3.93
   30     KM   LENGTH....(FT)... 570             270
   31     KM   SLOPE.....(%).... 2.0             0.5
   32     KM   VELOCITY..(FPS).. 2.7             1.4
   33     KM   LAG TIME..(HR)... .114
   34     BA   .0061
   35     PB    2.77
   36     PC   .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
   37     PC   .130    .130    .130    .133    .140    .142    .148    .156    .172    .181
   38     PC   .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
   39     PC   .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
   40     PC   .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
   41     PC   .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
   42     PC   .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
   43     PC   .998    .999    1.00
   44     LS      0      98
   45     UD   .114

   46     KK  ROUTE      B6
   47     KM  ROUTE B6 TO PT.3
   48     RK     850     .02    .016       0    TRAP       0      50
```

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

  49      KK     B1
  50      KM   AREA.....(AC)... 2.84
  51      KM   LENGTH....(FT)... 570
  52      KM   SLOPE.....(%).... 2.0
  53      KM   VELOCITY..(FPS).. 2.7
  54      KM   LAG TIME..(HR)... .082
  55      BA   .0044
  56      LS      0      98
  57      UD    .082

  58      KK     B3
  59      KM   AREA.....(AC)... 2.28
  60      KM   LENGTH....(FT)... 470
  61      KM   SLOPE.....(%).... 0.5
  62      KM   VELOCITY..(FPS).. 1.4
  63      KM   LAG TIME..(HR)... .119
  64      BA   .0036
  65      LS      0      98
  66      UD    .119

  67      KK   ROUTE  B3
  68      KM  ROUTE B3 TO PT.2
  69      RK     280     1.0    .016       0    TRAP       0      50
  70      RK     100     .60    .016       0    TRAP       0      50
  71      RK     150     2.0    .016       0    TRAP       0      50
  72      RK     120     1.0    .016       0    TRAP       0      50

  73      KK     B4
  74      KM   AREA.....(AC)... 3.00
  75      KM   LENGTH....(FT)... 350
  76      KM   SLOPE.....(%).... 0.5
  77      KM   VELOCITY..(FPS).. 1.4
  78      KM   LAG TIME..(HR)... .107
  79      BA   .0047
  80      LS      0      98
  81      UD    .107

  82      KK   ROUTE      B4
  83      KM  ROUTE B4 TO PT.1
  84      RK     100     .01    .016       0    TRAP       0      50

  85      KK     B5
  86      KM   AREA.....(AC)... 1.77
  87      KM   LENGTH....(FT)... 250
  88      KM   SLOPE.....(%).... 1.0
  89      KM   VELOCITY..(FPS).. 2.0
  90      KM   LAG TIME..(HR)... .068
  91      BA   .0028
  92      LS      0      98
  93      UD    .068
```

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

  94      KK  COMBINE B4 & B5
  95      HC       2

  96      KK   ROUTE  B4 & B5
  97      KM  ROUTE TO PT.2
  98      RK     160     .01     .02       0    TRAP       0      10

  99      KK  COMBINE B1,B3,B4,&B5
 100      HC       3

 101      KK   ROUTE  B1,B3,B4,&B5
 102      KM  ROUTE TO PT.3
 103      RK     235   .0362     .02       0    TRAP       0      10
 104      RK     225   .0157     .02       0    TRAP       0      10

 105      KK      B2
 106      KM   AREA......(AC)... 5.76
 107      KM   LENGTH....(FT)... 270
 108      KM   SLOPE.....(%).... 1.0
 109      KM   VELOCITY..(FPS).. 2.0
 110      KM   LAG TIME..(HR)... .086
 111      BA    .009
 112      LS       0      98
 113      UD    .086

 114      KK  COMBINE B1,B2,B3,B4,B5,&B6
 115      HC       3
 116      ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK



(*) RUNOFF ALSO COMPUTED AT THIS LOCATION

****

FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985
U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
****

```
*****************************************************************
* ............................................................. *
* :                  SOUTH SHORES CENTER                      : *
* :                  ULTIMATE CONDITIONS                      : *
* :...........................................................: *
* :              RETURN PERIOD_ _10 AND 100  YEAR             : *
* :              DISTRIBUTUION_ _ _ _ _ _ _6-HOUR             : *
* :              PROJECT NO_ _ _ _ _ _ _ _671.002             : *
* :              FILENAME_ _ _ _ _ _ _ _ SHOR1.H1             : *
* :              DATE_ _ _ _ _ _ _ _ OCT 19, 1990             : *
* :              MODELED BY_ _ _ _ _ JERRY PRUITT             : *
* :...........................................................: *
*****************************************************************
*  1.  THE POINT PRECIPITATION VALUE FROM NOAA ATLAS 2 WAS      *
*      FOUND TO BE 2.77 FOR THE 100-YEAR, 6-HOUR STORM.        *
*****************************************************************
*  2.  THE PROPOSED DEVELOPMENT AREA WILL CONSIST OF           *
*      COMMERCIAL BUILDINGS AND PARKING LOTS.                  *
*****************************************************************
*  3.  CURVE NUMBER (CN) AND LAND USE INFORMATION              *
*      (PARKING LOTS, STREETS, AND ROOF TOPS).....CN=98        *
*      (UNDEVELOPED LANDSCAPE)....................CN=88        *
*****************************************************************
```

```
 5 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

               COMPUTATION INTERVAL      .08 HOURS
                   TOTAL TIME BASE   24.92 HOURS

      ENGLISH UNITS

   JP         MULTI-PLAN OPTION
                  NPLAN          1  NUMBER OF PLANS

   JR         MULTI-RATIO OPTION
                 RATIOS OF PRECIPITATION
                 .57      1.00

WARNING *** TIME INTERVAL IS GREATER THAN .29*LAG

WA...ING *** TIME INTERVAL IS GREATER THAN .29*LAG

WA ING *** TIME INTERVAL IS GREATER THAN .29*LAG

WARNING *** TIME INTERVAL IS GREATER THAN .29*LAG
```

RNING *** TIME INTERVAL IS GREATER THAN .29*LAG

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

					RATIOS APPLIED TO PRECIPITATION	
C RATION	STATION	AREA	PLAN		RATIO 1	RATIO 2
					.57	1.00
H ROGRAPH AT	B6	.01	1	FLOW	6.	12.
				TIME	3.50	3.50
R TED TO	ROUTE	.01	1	FLOW	6.	11.
				TIME	3.58	3.58
H ROGRAPH AT	B1	.00	1	FLOW	5.	9.
				TIME	3.50	3.50
HYDROGRAPH AT	B3	.00	1	FLOW	4.	7.
				TIME	3.50	3.50
ROUTED TO	ROUTE	.00	1	FLOW	4.	7.
				TIME	3.58	3.50
HYDROGRAPH AT	B4	.00	1	FLOW	5.	9.
				TIME	3.50	3.50
RouTED TO	ROUTE	.00	1	FLOW	5.	9.
				TIME	3.50	3.50
H ROGRAPH AT	B5	.00	1	FLOW	3.	6.
				TIME	3.50	3.50
COMBINED AT	COMBIN	.01	1	FLOW	8.	15.
				TIME	3.50	3.50
R TED TO	ROUTE	.01	1	FLOW	8.	15.
				TIME	3.50	3.50
COMBINED AT	COMBIN	.02	1	FLOW	17.	31.
				TIME	3.50	3.50
R TED TO	ROUTE	.02	1	FLOW	17.	30.
				TIME	3.50	3.50
HYDROGRAPH AT	B2	.01	1	FLOW	10.	19.
				TIME	3.50	3.50
3 COMBINED AT	COMBIN	.03	1	FLOW	32.	59.
				TIME	3.50	3.50

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

G.C. WALLACE, INC.

DATE _____ SUBJECT _____ SHEET NO._____ OF_____

BY_____ JOB NO._____

DRAINAGE BASIN SUMMARY

BASIN		AREA	CN	LENGTH	SLOPE	AVG. VEL.	LAG
B1		0.0044	98	570	2.0	2.7	0.082
B2	(1)	0.009	88	270	1.0	2.0	0.128
	(2)	0.009	98	270	1.0	2.0	0.086
B3		0.0036	98	470	0.5	1.4	0.119
B4		0.0047	98	350	0.5	1.4	0.107
B5		0.0028	98	250	1.0	2.0	0.068
B6		0.0061	98	570 270	2.0 0.5	2.7 1.4	0.114

(1) UNDEVELOPED

(2) DEVELOPED

G.C. WALLACE, INC.

DATE 10/24/90 SUBJECT South Shores SHEET NO. ____ OF ____

BY JEP JOB NO. 671.002

PEAK RUNOFF

BASIN	10-YEAR (CFS)	100-YEAR (CFS)
B1	5	9
B2 (1)	5	13
(2)	10	19
B3	4	7
B4	5	9
B5	3	6
B6	6	12

(1) UNDEVELOPED
(2) DEVELOPED

G.C. WALLACE, INC.

DATE 10/19/90 SUBJECT South Shores SHEET NO. 7 OF

BY JEP JOB NO. 671.002

SCS UNIT HYDROGRAPH METHOD

BASIN B1 :

CURVE NUMBER (CN): CN = 98 (TABLE 602)

AREA: A = 2.84 ACRES = 0.0044 mi²

LAG TIME:

$LAG = 0.6\,t_c$

$t_c = t_i + t_t$

$t_i = 1.9(1.1-K)L_o^{1/2}/S^{1/3}$

$K = 0.0132\,CN - 0.39 = 0.9036$

$L_o = 180$ ft

$S = 1\%$

$t_i = 4.7$ MIN ; $t_t = 3.5$ MIN (PAGE 1)

$t_c = 4.7$ MIN + 3.5 MIN = 8.2 MIN

LAG = 0.082 HR

G.C. WALLACE, INC.

DATE 10/19/90 SUBJECT South Shores SHEET NO. 8 OF
BY JEP JOB NO. 671.002

BASIN B2 :

CURVE NUMBER (CN) : CN = 88 (UNDEVELOPED)
CN = 98 (DEVELOPED)

AREA : A = 5.76 ACRES = 0.009 mi²

LAG TIME :

$LAG = 0.6\, t_c$

$t_c = t_i + t_t$

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

K = 0.7716 (UNDEVELOPED)
K = 0.9036 (DEVELOPED)
L = 500 ft
S = 2%

t_i = 10.5 MIN ; t_t = 2.3 MIN ; t_i = 6.3 MIN

t_c = 12.8 MIN (UNDEVELOPED)
t_c = 8.6 MIN (DEVELOPED)

LAG = 0.128 HR (UNDEVELOPED)
LAG = 0.086 HR (DEVELOPED)

G.C. WALLACE, INC.

DATE 10/19/90 SUBJECT SOUTH SHORES SHEET NO. 9 OF

BY JEP JOB NO. 671.002

BASIN B3 :

CURVE NUMBER : CN = 98

AREA : A = 2.28 ACRES = 0.0036 mi^2

LAG TIME : LAG = 0.6 t_c

$t_c = t_i + t_t$

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

$K = 0.9036$

$L_o = 500 ft$

$S = 2\%$

$t_i = 6.3$ MIN ; $t_t = 5.6$ MIN

$t_c = 6.3$ MIN + 5.6 MIN = 11.9 MIN

LAG = 0.119 HR

G.C. WALLACE, INC.

DATE 10/19/96 SUBJECT SOUTH SHORES SHEET NO. 10 OF

BY JEP JOB NO. 671.002

BASIN B4 :

CURVE NUMBER : CN = 98

AREA : A = 3.00 ACRES = 0.0047 mi^2

LAG TIME :

$$LAG = 0.6\, t_c$$

$$t_c = t_i + t_t$$

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

$K = 0.9036$

$L_o = 500$ ft

$S = 1.8\%$

$t_i = 6.5$ MIN ; $t_t = 4.2$ MIN

$t_c = 6.5$ MIN + 4.2 MIN = 10.7 MIN

LAG = 0.107 HR

G.C. WALLACE, INC.

DATE 10/19/90 SUBJECT South Shores SHEET NO. 4 OF _____

BY JEP JOB NO. 671.002

BASIN B5 :

CURVE NUMBER : CN = 98

AREA : A = 1.77 ACRES = 0.0028 mi^2

LAG TIME :

$LAG = 0.6\, t_c$

$t_c = t_i + t_t$

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

$K = 0.9036$

$L = 180$ ft

$S = 1\%$

$t_i = 4.7$ MIN, $t_t = 2.1$ MIN

$t_c = 4.7$ MIN + 2.1 MIN = 6.8 MIN

LAG = 0.068 HR

G.C. WALLACE, INC.

DATE 10/19/90 SUBJECT SOUTH SHORES SHEET NO. 12 OF
BY JEP JOB NO. 671.002

BASIN B6 :

CURVE NUMBER : CN = 98

AREA : A = 3.93 ACRES = 0.0061 mi²

LAG TIME :

$LAG = 0.6\ t_c$

$t_c = t_i + t_t$

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

$K = 0.9036$

$L_o = 280$ ft

$S = 2\%$

$t_i = 4.7$ MIN ; $t_t = 6.7$ MIN

$t_c = 4.7$ MIN + 6.7 MIN = 11.4 MIN

$LAG = 0.114$ HR

G.C. WALLACE, INC.

DATE 10/22/90
BY JFP

SUBJECT SOUTH SHORES

SHEET NO. ____ OF ____
JOB NO. 671.002

WEIR BETWEEN BUILDINGS:

$$Q = CLH^{3/2}$$

$$H = \left(\frac{Q}{CL}\right)^{2/3}$$

ASSUMPTIONS:

$Q = 17.3$ cfs (RATIONAL METHOD)
$C = 3.0$
$L = 28$ ft

$$H = \left(\frac{(17.3)}{(3.0)(28)}\right)^{2/3} = 0.35 \text{ ft.}$$

W.S. EL. = 41.68' + .35' = 42.03'

F.F. = 42.00'

$Q = 9$ cfs (SCS UNIT HYDROGRAPH METHOD)
$C = 3.0$
$L = 28$ ft

$$H = \left(\frac{(9)}{(3.0)(28)}\right)^{2/3} = 0.23 \text{ ft}$$

W.S. EL. = 41.68' + .23' = 41.91'

DEPTH-DURATION-FREQUENCY VALUES FOR McCARRAN AIRPORT RAINFALL AREA

(IN INCHES)

	RECURRENCE INTERVAL					
TIME	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.

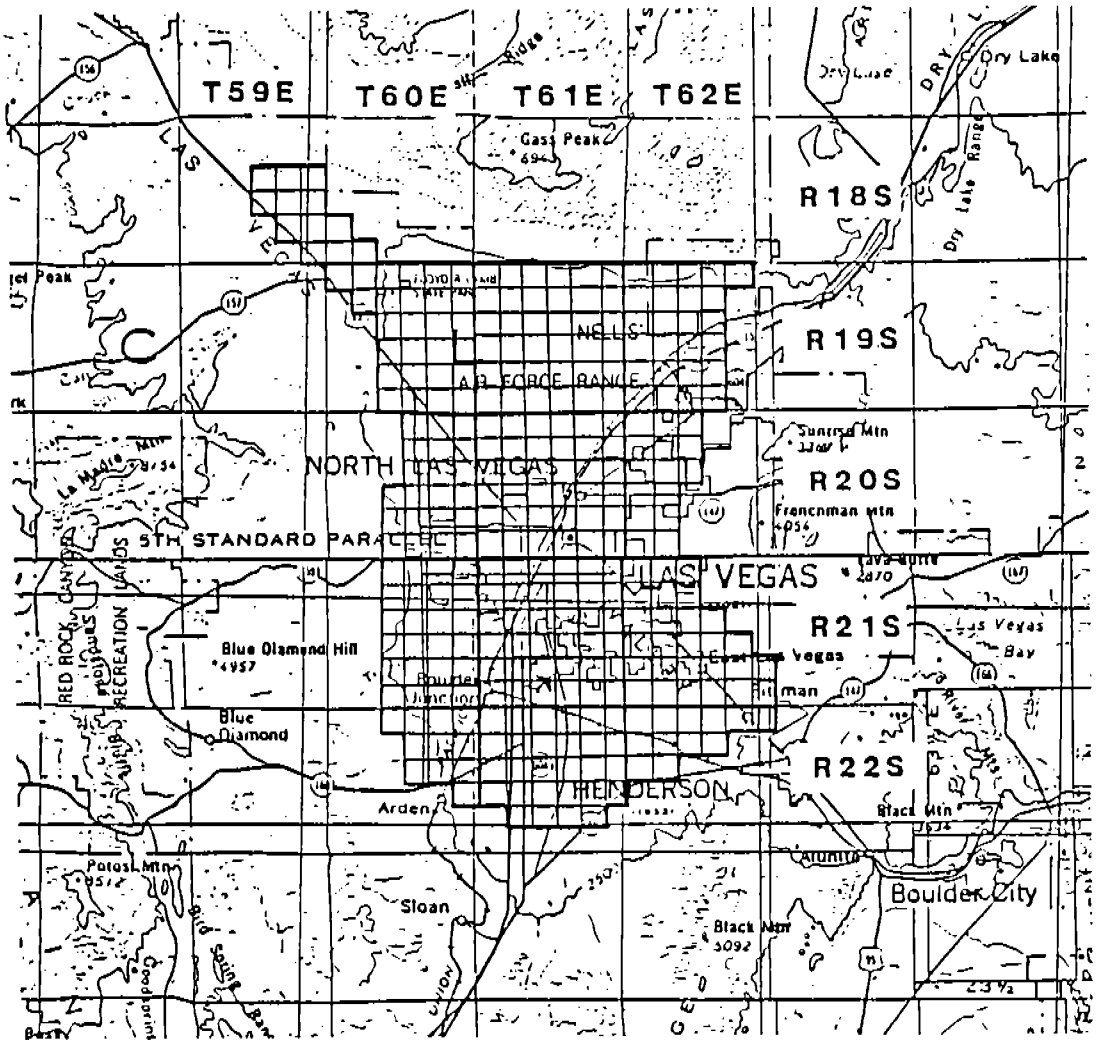
2. The 24 hour values presented above are for use with TR-55 only.

3. Table 501 adjustments not required.

Revision	Date

WRC ENGINEERING	REFERENCE: USACE, Los Angeles District, 1988	TABLE 505

McCARRAN AIRPORT RAINFALL AREA



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

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

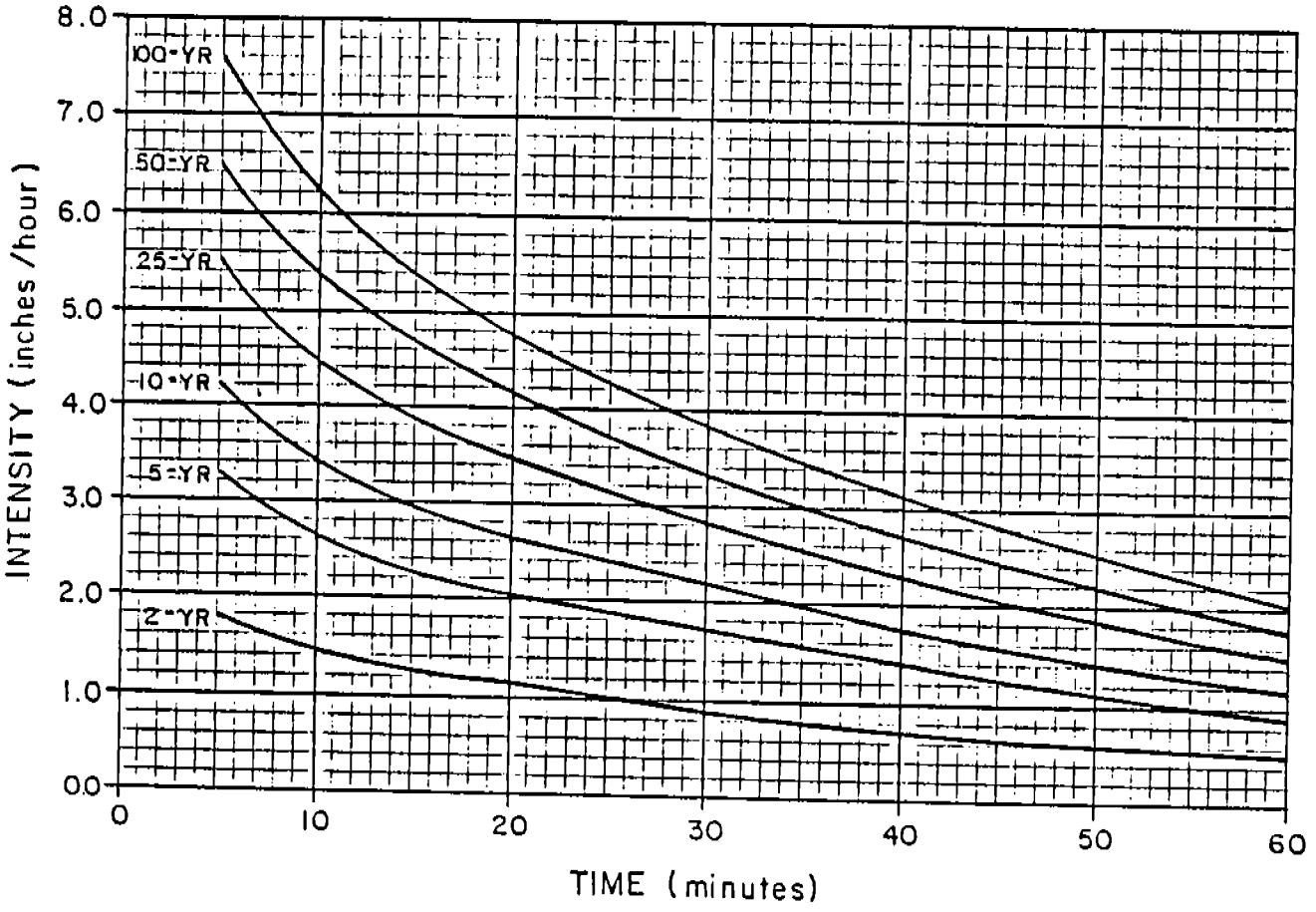
Revision	Date

WRC ENGINEERING

REFERENCE:
USACE, Los Angeles District, 1988

FIGURE 513

TIME-INTENSITY-FREQUENCY CURVES FOR McCARRAN AIRPORT RAINFALL AREA



NOTE: 1. Refer to Table 506 for tabulation of Time-Intensity-Frequency Values.

Revision	Date

WRC ENGINEERING	REFERENCE: USACE, Los Angeles District, 1988	FIGURE 517

RUNOFF CURVE NUMBERS
(URBAN AREAS[1])

Cover description		Curve numbers for hydrologic soil group—			
Cover type and hydrologic condition	Average percent impervious area[2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.)[3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only)[4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)[5]		77	86	91	94

[1]Average runoff condition, and $I_a = 0.2S$.
[2]The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 603
[3]CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.
[4]Composite CN's for natural desert landscaping should be computed using figure 603 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.
[5]Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 603 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Revision	Date

APPENDIX B

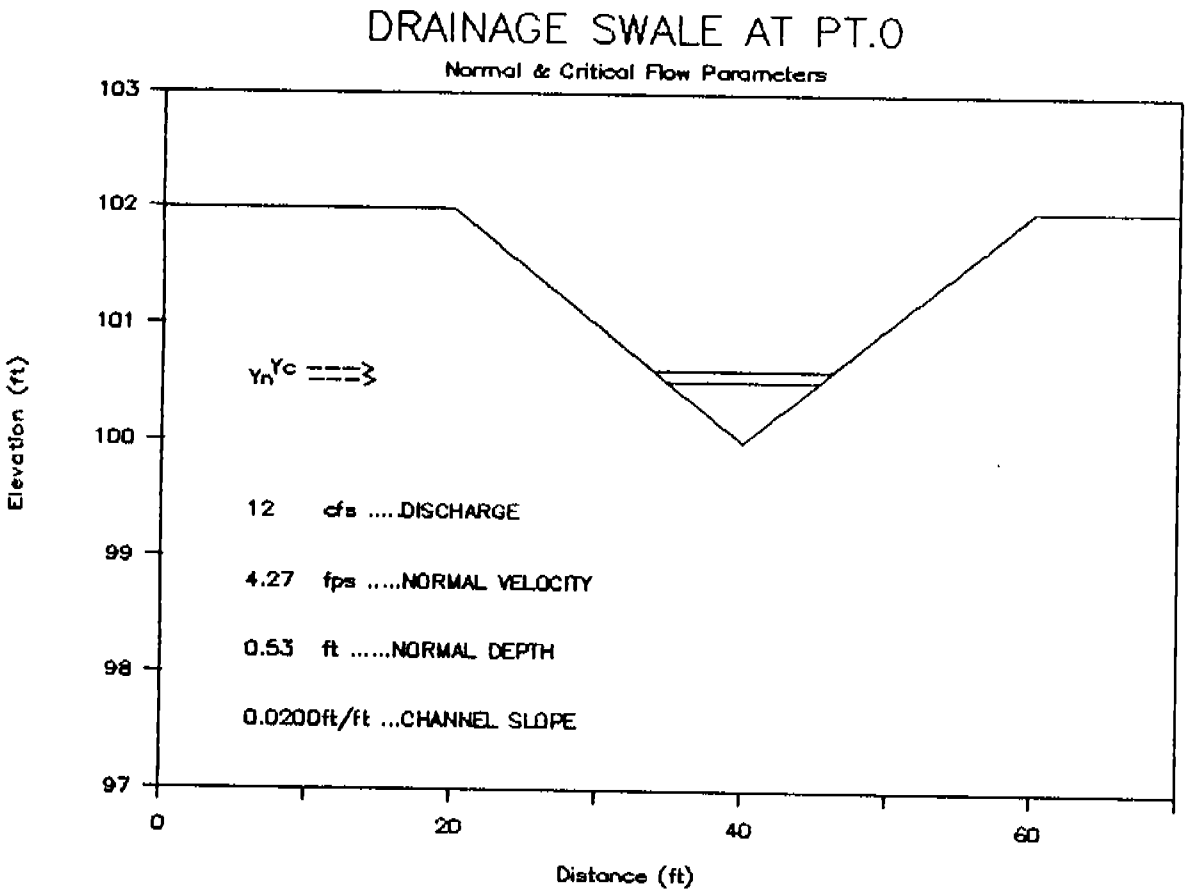
-STREET FLOW CALCULATIONS

T R A P E Z O I D A L C H A N N E L

Normal depth and critical depth parameters

DRAINAGE SWALE AT PT.0

Input variables:		Output variables:	
Discharge	12 cfs	Normal depth	0.53 ft
Channel slope	0.02000 ft/ft	Normal velocity	4.27 fps
Manning's n	0.020	Froude number	1.46
Bottom width	0 ft	Critical depth	0.62 ft
Left side slope	10 H:1	Critical velocity	3.12 fps
Right side slope	10 H:1	Critical slope	0.008

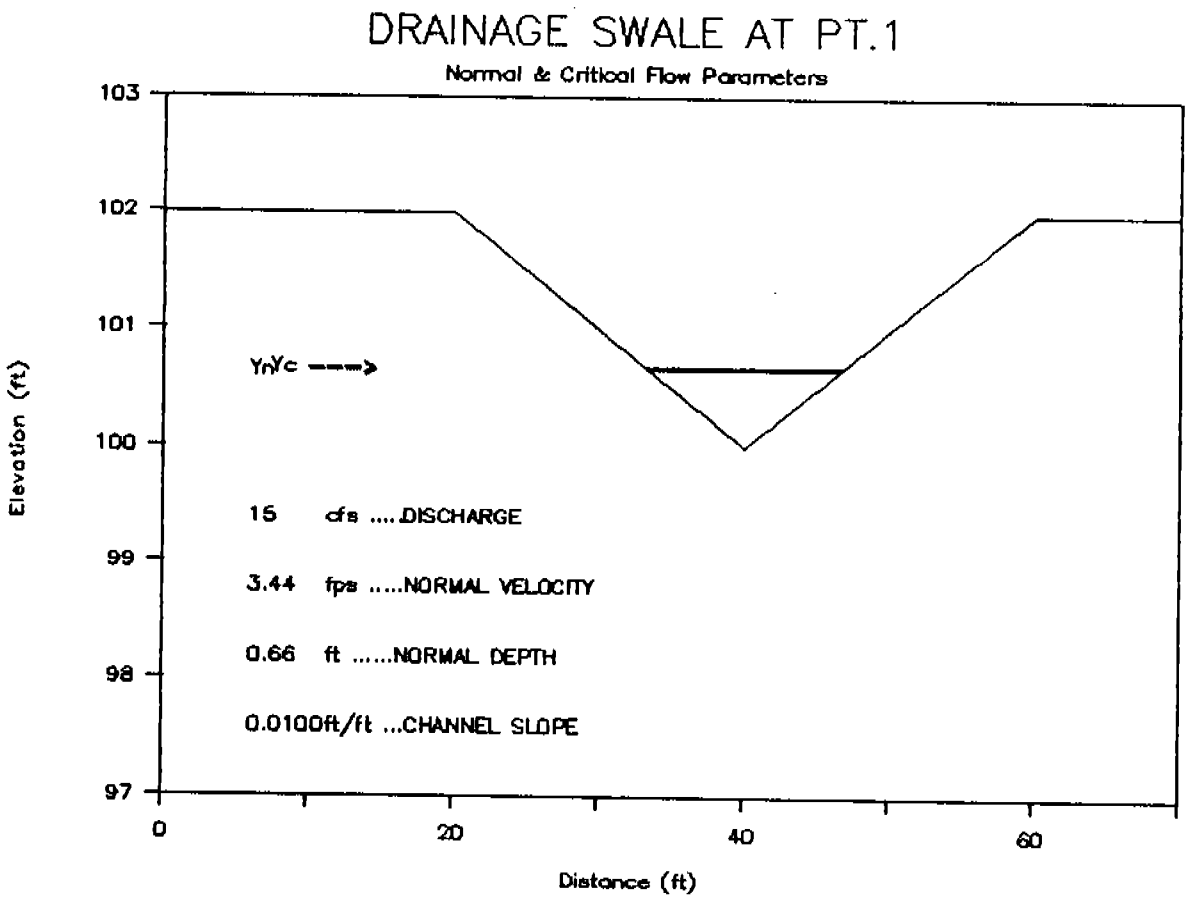


T R A P E Z O I D A L C H A N N E L

Normal depth and critical depth parameters

DRAINAGE SWALE AT PT.1

Input variables:		Output variables:	
Discharge	15 cfs	Normal depth	0.66 ft
Channel slope	0.01000 ft/ft	Normal velocity	3.44 fps
Manning's n	0.020	Froude number	1.06
Bottom width	0 ft	Critical depth	0.68 ft
Left side slope	10 H:1	Critical velocity	3.24 fps
Right side slope	10 H:1	Critical slope	0.008

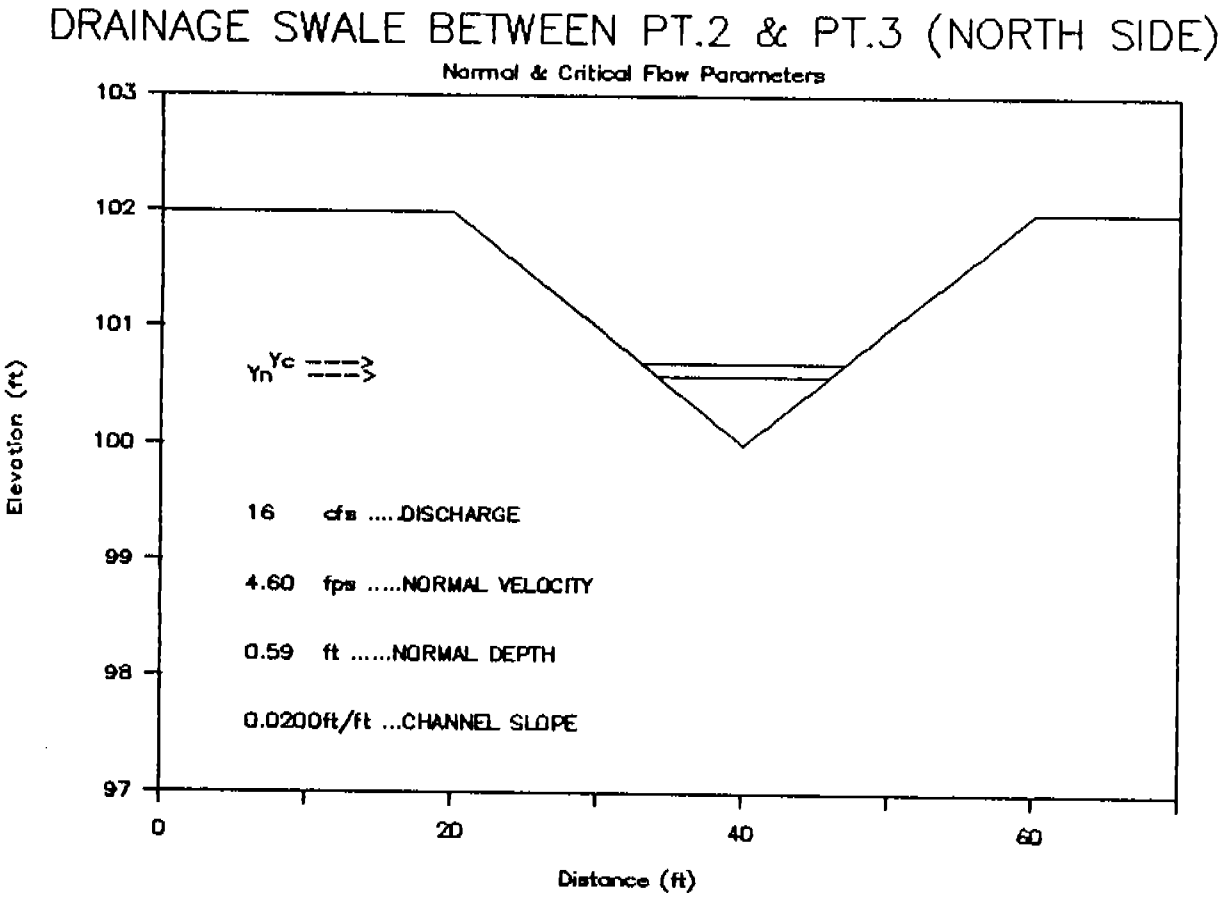


T R A P E Z O I D A L C H A N N E L

Normal depth and critical depth parameters

DRAINAGE SWALE BETWEEN PT.2 & PT.3 (NORTH SIDE)

Input variables:		Output variables:	
Discharge	16 cfs	Normal depth	0.59 ft
Channel slope	0.02000 ft/ft	Normal velocity	4.60 fps
Manning's n	0.020	Froude number	1.49
Bottom width	0 ft	Critical depth	0.70 ft
Left side slope	10 H:1	Critical velocity	3.27 fps
Right side slope	10 H:1	Critical slope	0.008

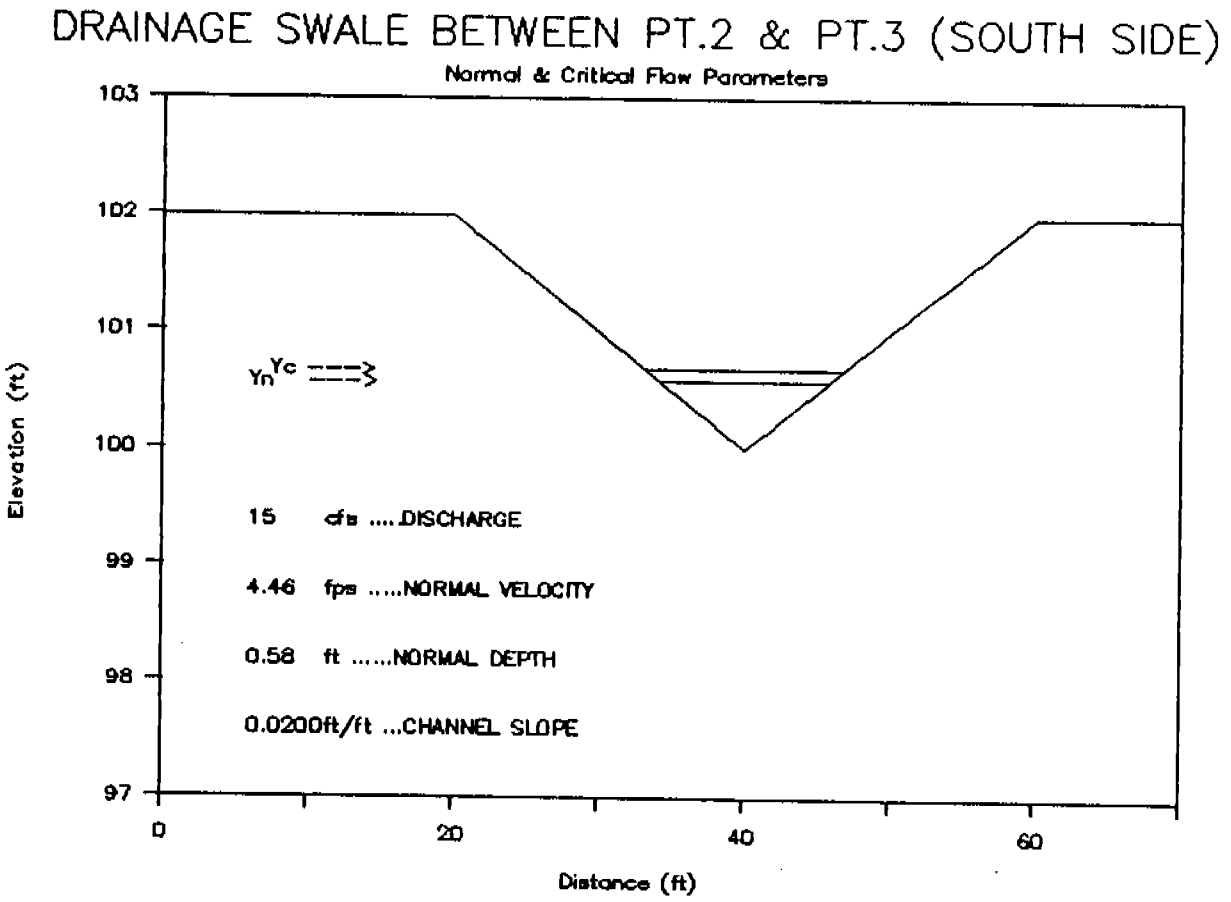


T R A P E Z O I D A L C H A N N E L

Normal depth and critical depth parameters

DRAINAGE SWALE BETWEEN PT.2 & PT.3 (SOUTH SIDE)

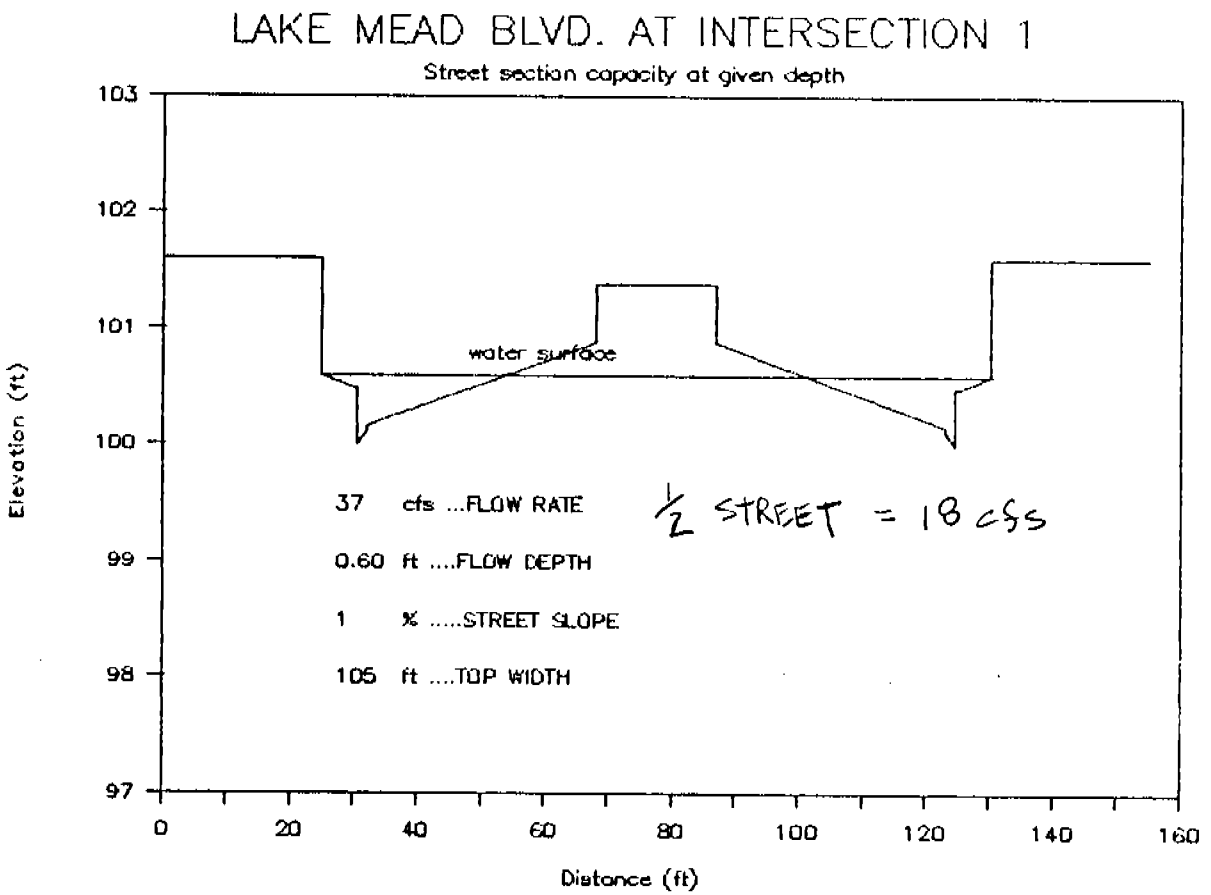
Input variables:		Output variables:	
Discharge	15 cfs	Normal depth	0.58 ft
Channel slope	0.02000 ft/ft	Normal velocity	4.46 fps
Manning's n	0.020	Froude number	1.46
Bottom width	0 ft	Critical depth	0.68 ft
Left side slope	10 H:1	Critical velocity	3.24 fps
Right side slope	10 H:1	Critical slope	0.008



S T R E E T F L O W S

Manning's Equation for flow capacity in a street section.
LAKE MEAD BLVD. AT INTERSECTION 1

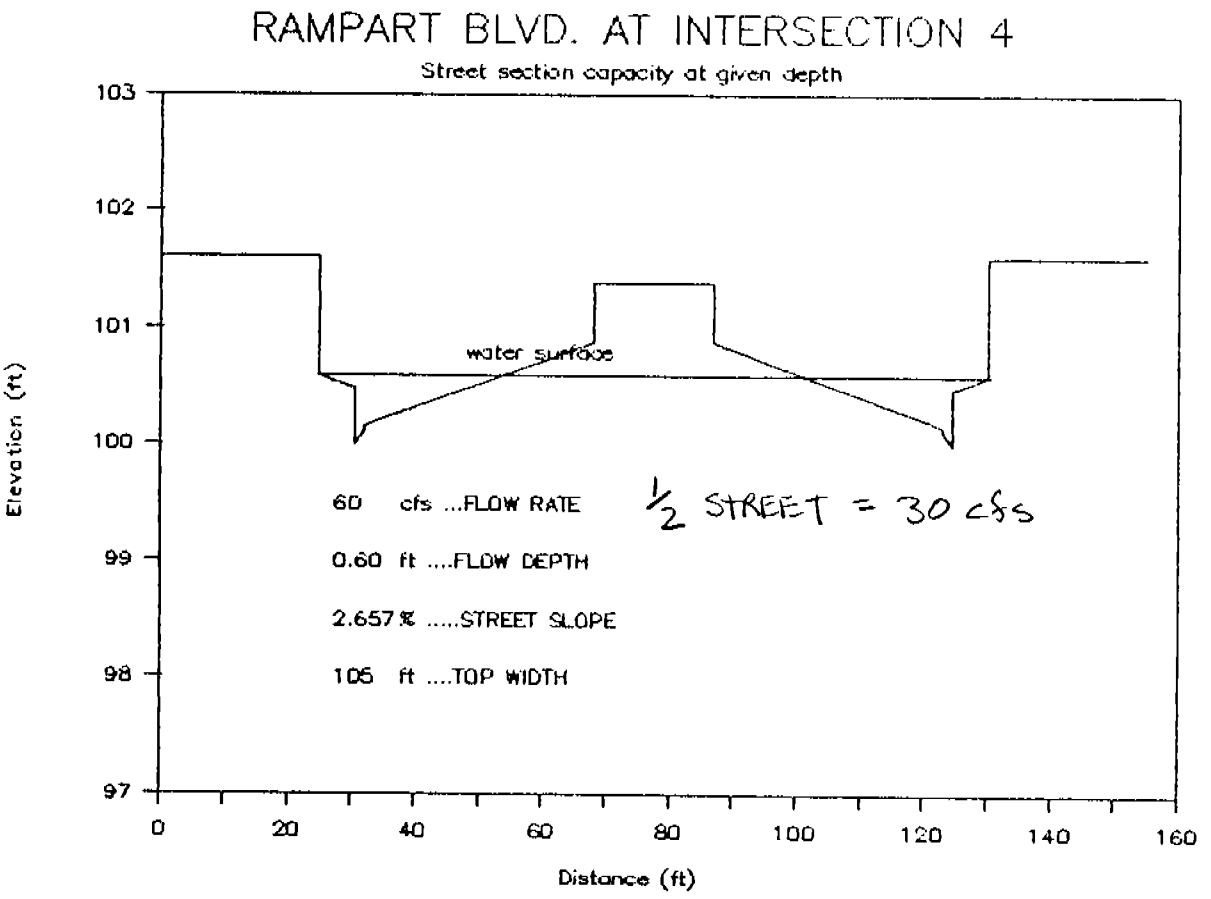
Input variables:		Output variables:	
Flow depth, d	0.60 ft	Capacity at d	36.65 cfs
Road width	95.0 ft	Velocity	3.2 fps
Crown height	0.09 ft	Top width	105.0 ft
Street slope	1.00 %		
Sidewalk width	5.0 ft	CAPACITY:	
Curb height	6 in	@ top of curb	20.6 cfs
Median width	18.7 ft	@ back of walk	36.6 cfs
Rt back of walk	100.0 %		
Lt back of walk	100.0 %	Manning's n	0.016



S T R E E T F L O W S

Manning's Equation for flow capacity in a street section.
RAMPART BLVD. AT INTERSECTION 4

Input variables:		Output variables:	
Flow depth, d	0.60 ft	Capacity at d	59.74 cfs
Road width	95.0 ft	Velocity	5.2 fps
Crown height	0.89 ft	Top width	105.0 ft
Street slope	2.66 %		
Sidewalk width	5.0 ft	CAPACITY:	
Curb height	6 in	@ top of curb	33.6 cfs
Median width	18.7 ft	@ back of walk	59.7 cfs
Rt back of walk	100.0 %		
Lt back of walk	100.0 %	Manning's n	0.016

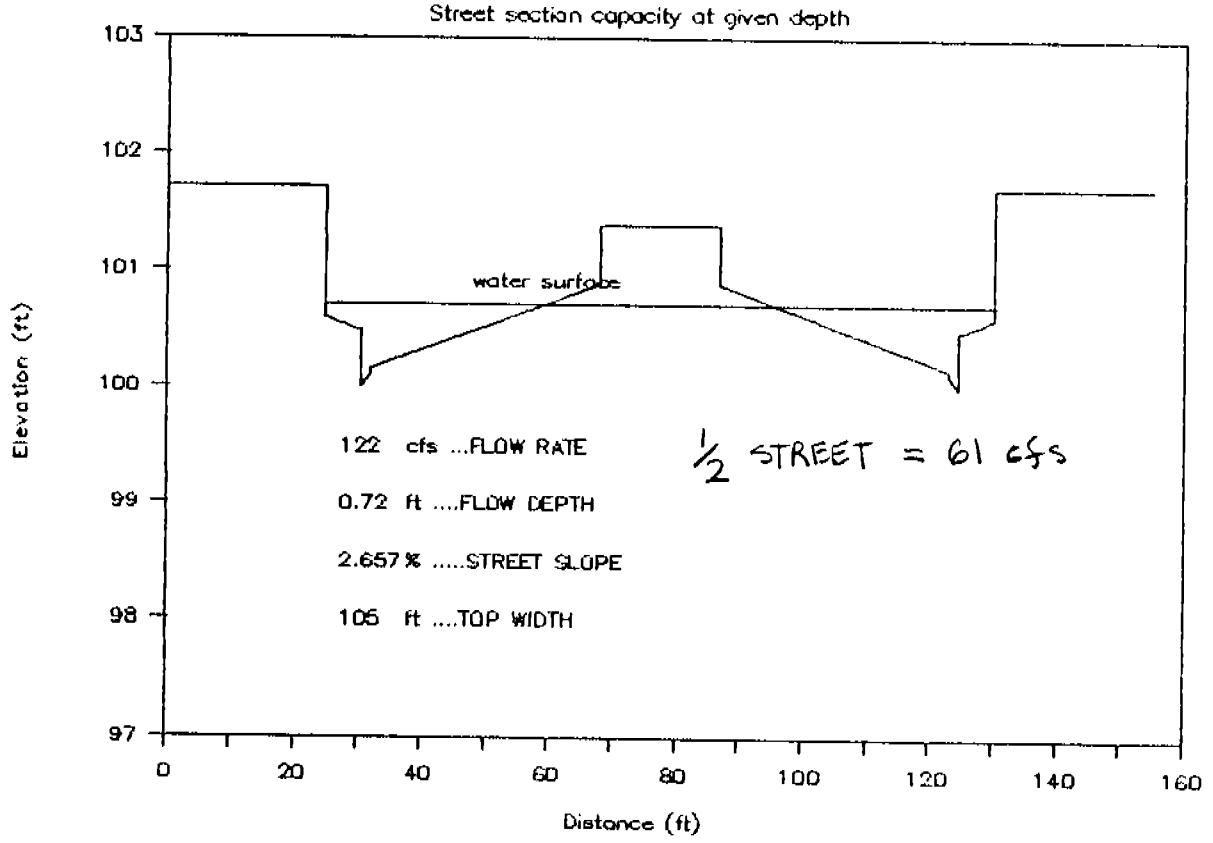


S T R E E T F L O W S

Manning's Equation for flow capacity in a street section.
DEPTH AT TWICE THE FLOW RATE ON RAMPART FOR HUMP DESIGN

Input variables:		Output variables:	
Flow depth, d	0.72 ft	Capacity at d	122.15 cfs
Road width	95.0 ft	Velocity	6.4 fps
Crown height	0.83 ft	Top width	105.0 ft
Street slope	2.66 %		
Sidewalk width	5.0 ft	CAPACITY:	
Curb height	6 in	@ top of curb	33.6 cfs
Median width	18.7 ft	@ back of walk	59.7 cfs
Rt back of walk	100.0 %		
Lt back of walk	100.0 %	Manning's n	0.016

DEPTH AT TWICE THE FLOW RATE ON RAMPART FOR HUMP DESIGN



B O X C U L V E R T

Inlet control and outlet control parameters

2'X6" UNDERPASS

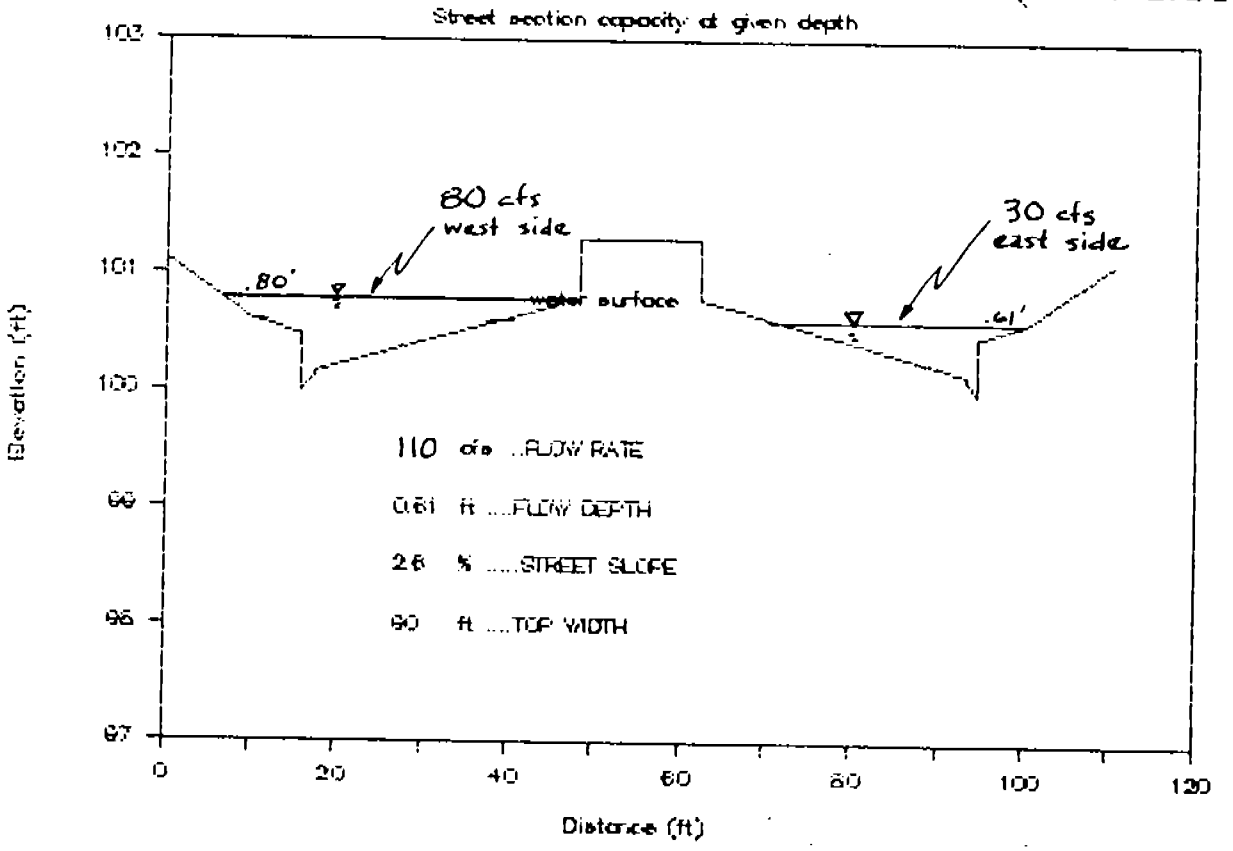
Box height	0.5 ft	INLET CTRL HWo:	
Box width	2.0 ft	tapered throat	0.85 ft
Number of boxes	2	45 degree bevels	1.06 ft
Slope	0.01170 ft/ft	sq edge headwall	1.16 ft
Manning's n	0.015	OUTLET CTRL HWo	1.18 ft
Culvert length	50 ft	Velocity	4.5 fps
Discharge	9 cfs	Critical depth	0.54 ft

S T R E E T F L O W S

Manning's Equation for flow capacity in a street section.
Rampart Blvd -- Lake Mead to Del Webb (east side)

Input variables:		Output variables:	
Flow depth, d	0.61 ft	Capacity at d	58.35 cfs
Road width	80.0 ft	Velocity	4.9 fps
Crown height	0.80 ft	Top width	90.4 ft
Street slope	2.60 %		
Sidewalk width	5.0 ft	CAPACITY:	
Curb height	6 in	@ top of curb	30.8 cfs
Median width	14.0 ft	@ back of walk	54.6 cfs
Rt back of walk	5.0 %		
Lt back of walk	5.0 %	Manning's n	0.017

Rampart Blvd -- Lake Mead to Del Webb (east side)



*FROM "SUN CITY SUMMERLIN SUPPLEMENTAL DRAINAGE STUDY UNITS No. 17, 18, 19, and 20," DATED JUNE 5, 1989. G.C. WALLACE, INC.

The presence of the grass-lined swale adjacent to the west side of Rampart Boulevard will require the construction of a retaining wall structure for flood protection extending the entire length between Lake Mead Boulevard and the Cheyenne Channel. The flood wall would range in height from 3 feet to 5 feet. In addition, a 12-inch PVC storm drain under the swale was also proposed for nuisance water.

An analysis of the above scenario proved to be economically unacceptable. Therefore, a more workable option was evaluated that proved more feasible. This option includes the construction of a 36-inch storm drain in place of the grass-lined swale from Lake Mead Boulevard to Del Webb Boulevard and a 48-inch storm drain from Del Webb Boulevard to the Cheyenne Channel. The grass-lined slope from the back of sidewalk to the Rampart Boulevard right-of-way will be 20 horizontal to 1 vertical (20:1) for a distance of 17.5 feet.

The 100-year storm flow generated at point LM1 on Lake Mead Boulevard from the Summerlin Village 1 area directly impacts Rampart Boulevard and the 36-inch storm drain. The 36-inch storm drain on a 2.6% slope has a capacity of approximately 115 cfs. The 100-year peak discharge at point LM1 using the most recent preliminary layout for Village 1 was calculated as 225 cfs. Therefore, approximately 110 cfs will remain in the street section at a depth of 0.80 feet with a velocity of 6.3 fps on the west side and 0.61 feet with a velocity of 4.9 fps on the east side of Rampart Boulevard.

Due to local inflow from areas A1 to A15, the 100-year peak flow on Rampart Boulevard at Del Webb Boulevard was calculated as 318 cfs. At this point, the slope transitions from 2.6% to 1.1% to the Cheyenne Channel. The capacity of the 48-inch RCP in this section was calculated as 163 cfs leaving approximately 155 cfs in the street section flowing at a depth of 0.88 feet with a velocity of 4.7 fps. The full 10-year flow will be carried in the storm drain system.

676

INDEX 1110

PN 138-20-521-002

PROJECT South Shores Center

SUBMITTAL 4th Submittal - Updated Study
Addendum 1

canning.doc

CITY OF LAS VEGAS	DATE:
INTER-OFFICE MEMORANDUM	May 3, 1994

TO:	FROM:
Kent Nash Land Development Services Department of Public Works	T. Chiatovich, P.E. Chief Flood Control Dept. Public Works
SUBJECT:	**COPIES TO:**
South Shore Center Drainage Study Update Z-03-89 File No. DS676D Date of Engineer's Stamp: 04/07/94 Date Received by City: 04/11/94	Pyramid Rock Eng. John McNellis, P.E.

HISTORY:

1st Submittal	03/13/91 - Not Acceptable
2nd Submittal	05/09/91 - Acceptable
3rd Submittal	04/05/94 - Not Acceptable
4th Submittal	05/03/94 - (See Comments Below)

REMARKS:

4th Submittal (Updated Study Addendum)

The drainage study for the subject project has been reviewed and

__X__ is acceptable in concept subject to the following conditions:

_____ must be resubmitted or supplemented.

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 addendum and accepted by CLV Flood Control. Additionally, conditional acceptance of a drainage study is valid for a period of one (1) year from date of issuance. 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.

1. The concrete swale in the 5-foot drainage easement must be a minimum thickness of 6-inches with # 4's 12" O. C.

END OF REMARKS T/R/S: L21
dbm Z-3-89

#676
L-21
Z-3-89

PYRAMID ROCK ENGINEERING

2950 E. FLAMINGO, SUITE E-8 LAS VEGAS, NV 89121 (702) 892-0599

April 7, 1994

City of Las Vegas
Department of Public Works
400 East Stewart
Las Vegas, Nevada 89101

Attention: Roger Bailey
Land Development

Regarding: Hydrology Study Update to the South Shore Center Drainage Study
Addendum 1

This letter has been prepared as an addendum to the Drainage Study Update for South Shore Commercial Center.

In the City of Las Vegas inter - office memorandum dated April 5, 1994, concerns were expressed by the City of Las Vegas. We will address those concerns as outlined below:

COMMENT 1A. The Engineer must account for flows that are designed to be conveyed through this portion of the commercial site per the original G. C. Wallace report. Point 'O' appears to receive 12 cfs from off-site Basin B6 that must be conveyed through the site since it is a low spot and it appears that water presently ponds at this location.

RESPONSE: The original study update by P.R.E. Engineering showed Basin B6 flowing around the developed site and through Basin B2 to the northeast corner of the project. An on-site inspection showed a small ponding area adjacent to the east boundary of Basin B4. To mitigate this ponding a portion of the existing asphalt will be removed in the area of the ponding. This area will be regraded to shift the flow line so no ponding occurs (see the revised Grading Plan).

The flows from Wallace's point 'O' and Basin B4 will be routed north and than east across Basin B2 as was analyzed in the original study. This flow path is shown on the revised Drainage Plan included as part of this addendum.

COMMENT 1B. Additionally, it appears from a field visit that off-site Basin B5 will also impact the site. Though the Wallace plan did not show flow from off-site Basin B5 being conveyed through the site a flow depth and flow cross-section must be provided along the west boundary of the site. The HEC-1 analysis must be adjusted to show flow from the west (or specific reference to the previous analysis, including xeroxes, provided).

RESPONSE: The original P.R.E. study update analyzed the proposed sites. We used the flow values from the Wallace study for the developed sites. P.R.E. reviewed the Wallace study and found their analysis to be acceptable.

The Wallace study routed all the flows from the commercial subdivision to the northeast corner of the site. Basin B5 was routed through P.R.E.'s Basin B3. However, the flows from Basin B5 ultimately end up in the North Entrance Road. The Wallace Study calls for 31 cfs to flow in this North Entrance Road. This 31 cfs includes the flows from Basin B5.

The current routing of Wallace's Basin B5 is shown on the revised Drainage Plan included as part of this addendum. A cross section and flow depth of the North Entrance Road is also included with this addendum.

COMMENT 2. The grading plan must show at least 100 feet of the existing South Shore Commercial Center with topo.

RESPONSE: The existing topo is shown on the revised Grading Plan included as part of this addendum.

COMMENT 3. Flow depth calculations (whether calculated by the current engineer or referenced) must be provided and discussed for Lake Mead Boulevard, Harbor Island Drive and all on-site concentration points.

RESPONSE: The required calculations are included as part of this addendum.

COMMENT 4. Developed conditions for the entire site must be analyzed with a HEC-1 model. Basin 2 and Basin 3 are presently only analyzed as undeveloped.

RESPONSE: A revised HEC-1 model with developed Basins B2 and B3 is included as part of this addendum.

COMMENT 5. The minimum width for a private drainage easement is 10-feet. Part of the easement ("Section A") can be overflow over curb and through the parking area but no obstructions above curb height will not be allowed. Additionally, a cross-section must be provided through the 2-foot wide concrete swale ("Detail No.1") showing adjacent overflow capacity. Under sidewalk drains are required for any concentrated drainage that is discharged at a sidewalk.

RESPONSE: The easement along the north boundary line of lots 15, 16 and 17 is primarily for utilities. A drainage way for the commercial subdivision will be included in the parking agreement.

The 2-foot concrete swale detail is redrawn to show maximum landscape heights on each side of the swale. The new detail is shown on the revised Grading Plan included as part of this addendum.

COMMENT 6. The minimum elevation difference between the pad grade and finished floor must be stated on the grading plan for the future pads.

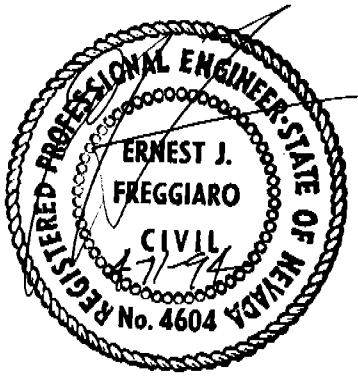
RESPONSE: The elevation difference is called out on the revised Grading Plan included as part of this addendum.

We trust that our responses have addressed your concerns. If there are any questions please do not hesitate to call.

Respectfully,
P.R.E. Engineering

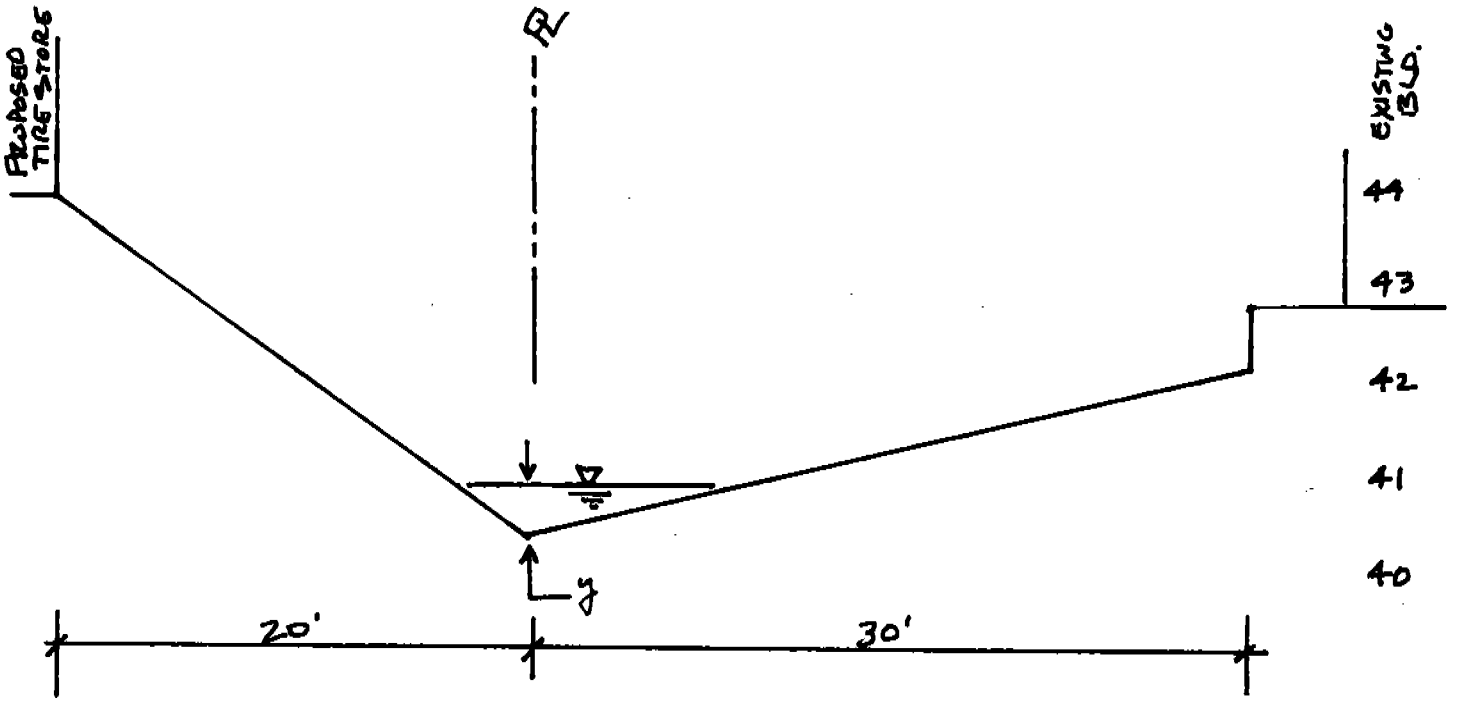
Ernest Freggiaro, P.E.

Phillip Regeski, EIT



PYRAMID ROCK ENGINEERING

2950 E. FLAMINGO, SUITE E-8 LAS VEGAS, NV 89121 (702) 892-0599



SECTION A-A INTERIOR STREET
Q100 = 13 CFS
N = 0.016
SLOPE = 0.0105

MANNINGS EQUATION

$$Q = \frac{1.49}{n} A R^{.66} S^{.5}$$

Y (ft)	A (sq ft)	P (ft)	R (A/P)	Q (cfs)	V (ft/sec)
0.5	3.00	12.3	0.244	11.3	3.8
1.0	11.5	23.1	0.498	69.2	

PYRAMID ROCK ENGINEERING

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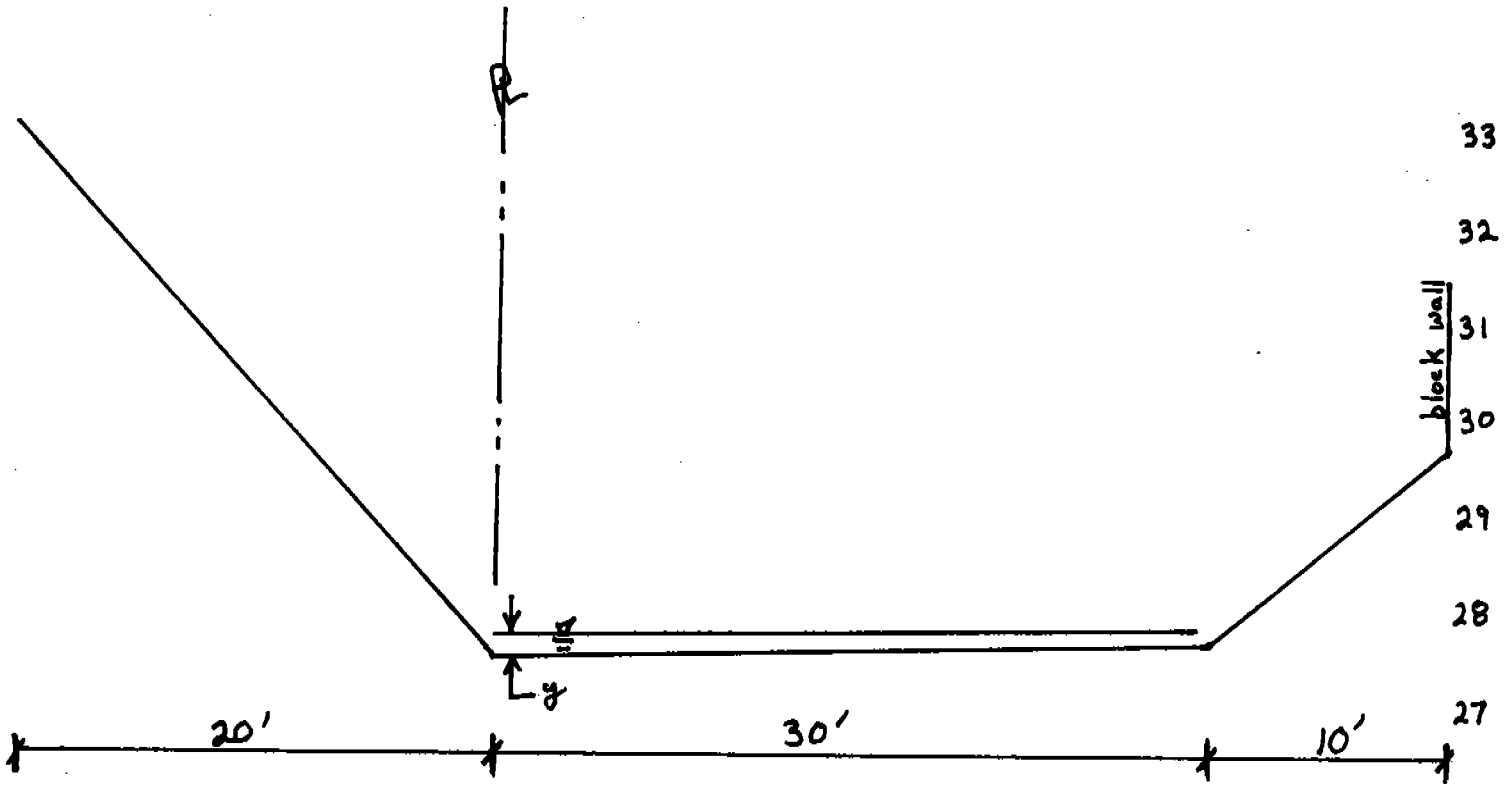


Existing Parcel 12 Existing North Entrance Road Existing Berm

NORTH ENTRANCE STREET SECTION B-B
Q100 = 31 CFS
N = 0.016
SLOPE = 0.018

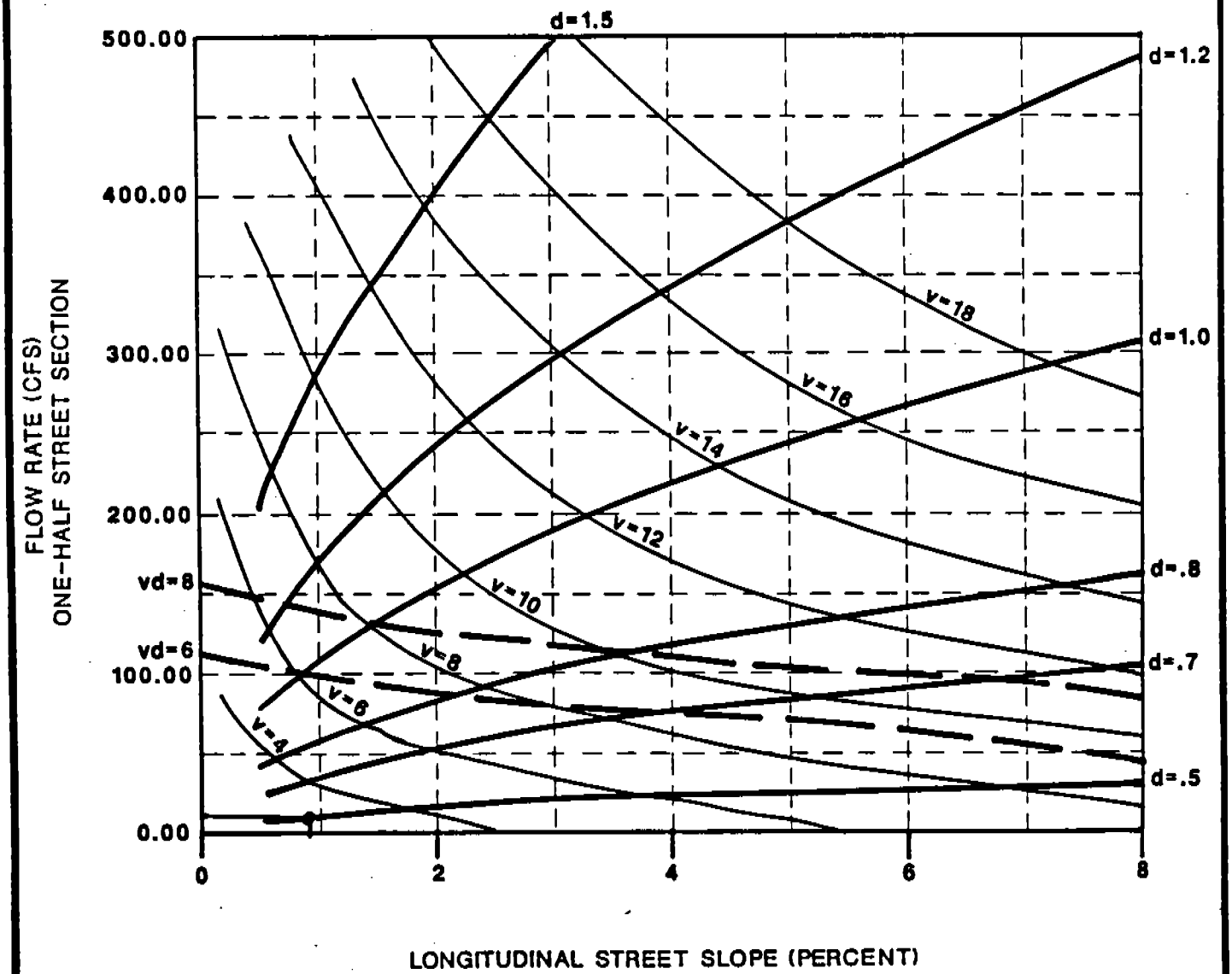
MANNINGS EQUATION

$$Q = \frac{1.49}{n} A R^{.66} S^{.5}$$

Y (ft)	A (sq ft)	P (ft)	R (A/P)	Q (cfs)	V (ft/sec)
0.5	14.9	32.5	0.459	111.3	
0.25	7.5	32.1	0.234	35.9	4.8

STREET CAPACITY CURVES
51 FOOT ROW

HARBOR ISLAND DRIVE
Q100 = 12 cfs
SLOPE = 0.009
FLOW DEPTH IS 0.5 ft
VELOCITY IS LESS THAN 4 ft/sec



EXPLANATION

v velocity (feet per second)

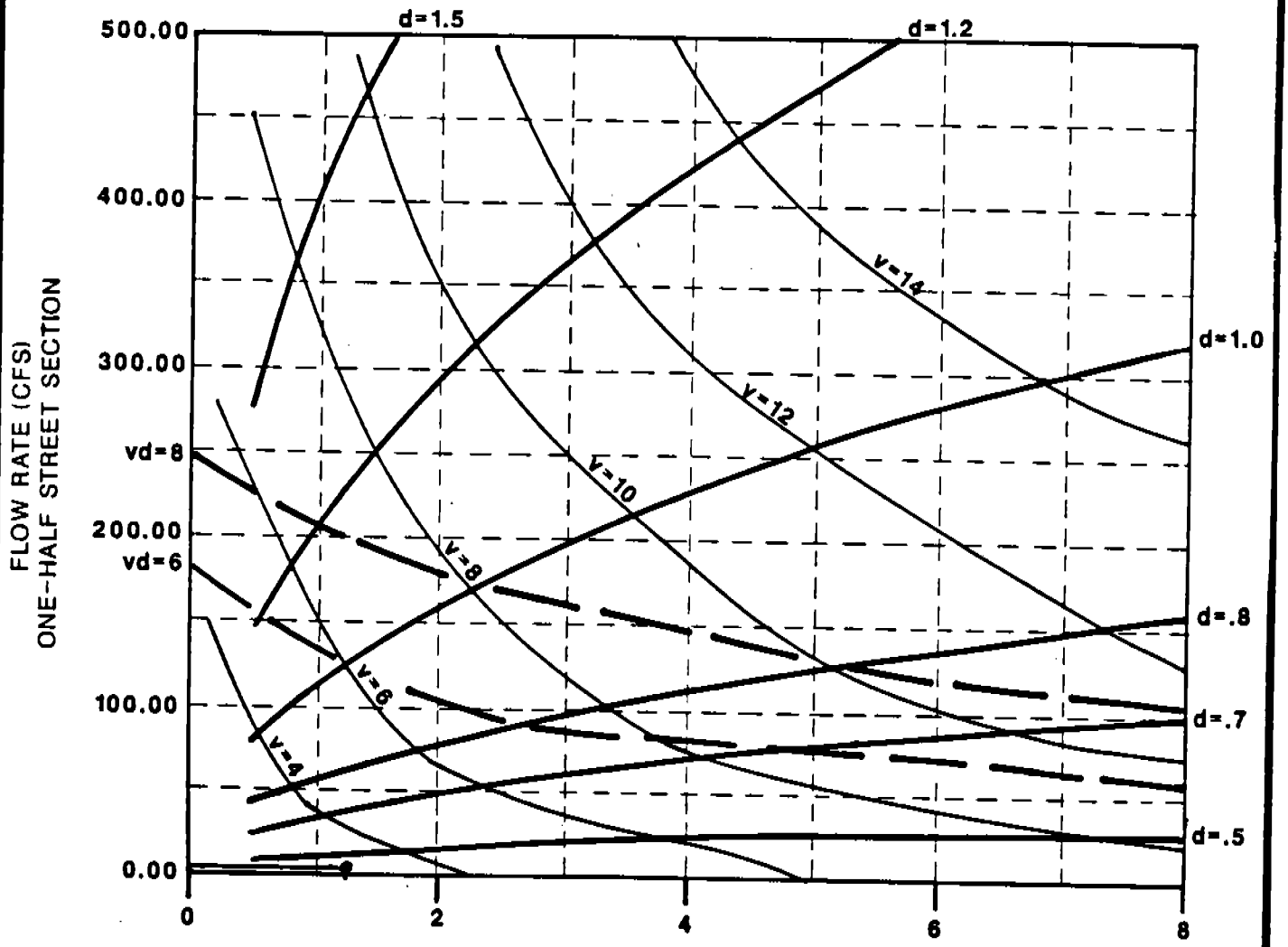
d depth (feet)

Revision	Date

WRC ENGINEERING	REFERENCE:	FIGURE 906

STREET CAPACITY CURVES
100 FOOT ROW

LAKE MEAD BLVD.
Q100 = 4 cfs
SLOPE = 0.012
FLOW DEPTH IS LESS THAN 0.5 ft
VELOCITY IS LESS THAN 4 ft/sec



EXPLANATION

v velocity (feet per second)

d depth (feet)

Revision	Date

WRC ENGINEERING	REFERENCE:	FIGURE 909

BASIN AREA < 1 MI.^{2}

Basin B2 & B3 Developed

SUB-BASIN DATA			SHEET FLOW: INITIAL/OVERLAND TIME (Ti)			SHALLOW CONC. FLOW: TRAVEL TIME (Tt)				CHANNEL FLOW: MANNING'S EQUATION $V = \frac{1.49}{n} S^{0.5} R^{0.66}$								TOTAL Tc	Tc CHECK (URBANIZED BASINS)		FINAL Tc	T_{lag}
DESIG: (1)	K / CN (2)	AREA Ac. (3)	LENGTH Ft. (4)	SLOPE % (5)	Ti Min. (6)	LENGTH Ft. (7)	SLOPE % (8)	VEL. FPS (9)	Tt Min. (10)	n	SLOPE Ft/Ft	AREA Sq Ft	P Ft	R A/P	VEL. FPS	LENGTH Ft.	Ttc Min.	Ti+Tt+Ttc Min.	TOTAL LENGTH Ft. (11)	Tc=(L/180)+10 Min. (12)	Min. (13)	T_{lag}(HR)= 0.6Tc/60
B1	0.8576 / 93	2.1	100	3.8	3.03	490	2.1	3.0	2.72									5.8	590	13.3	5.8	0.058
B2	0.8641 / 95	1.5	200	3.6	3.9	160	3.0	3.5	0.8									4.7	360	12.0	4.7	0.047
B3	0.8641 / 95	1.2	200	2.7	4.3	200	2.5	3.2	1.0									5.3	400	12.2	5.3	0.053
B4	0.8640 / 95	0.3	260	2.1	5.35													5.3	260	11.4	5.3	0.053
	/																					
	/																					
	/																					
	/																					

BASIN AREA < 1 MI.^{2}

DESIG.	K_n	L_c (mi.)	L (mi.)	S (ft/mi.)	T_{LAG} (hr.)

FINAL T_{LAG}

BASIN No.															
MINIMUM T_{LAG} (hr.)															

$Tt = L / ((60) V)$

$Ttc + L / ((60) V)$

$Ti = 1.8 (1.1 - K) L^{.5} / S^{0.33}$

$T_{LAG} = 20K_n (L L_c / S^{0.5})^{0.33}$

SHEET No.
TABLE No.

TIME OF CONCENTRATION

PRI

TIME-CON

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*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*      BY THE COE IN FEBRUARY 1981      *
*           REVISED 02 AUG 88           *
*                                       *
*  RUN DATE  04/07/1994  TIME  12:22:59 *
*                                       *
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*************************************
*                                   *
*     DODSON AND ASSOCIATES, INC.   *
*   HYDROLOGIST AND CIVIL ENGINEERS *
*      7015 W TIDWELL SUITE 107     *
*        HOUSTON, TEXAS  77092      *
*           (713) 895-8322          *
*                                   *
*************************************
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X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
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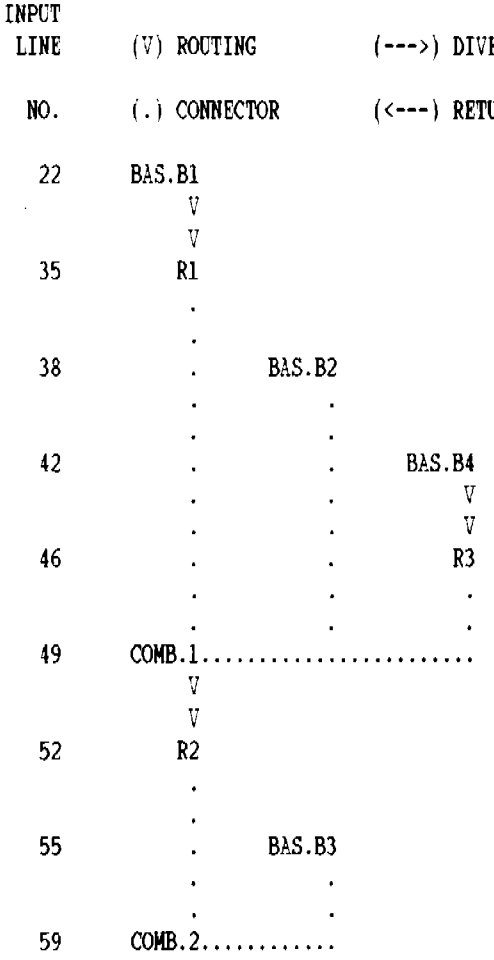
THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

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

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

  1       ID       *********************************************
  2       ID              SOUTH SHORE COMMERCIAL CENTER - DEVELOPED
  3       ID              PARCELS 12, 14, 15, 16 AND 17
  4       ID              PRE ENGINEERING
  5       ID              FEBRUARY 26, 1994
  6       ID              REVIEWED AND APPROVED BY ERNEST FREGGIARO P.E.
  7       ID              PARCELS 12 AND 14 ARE DEVELOPED
  8       ID
  9       ID
 10       ID
 11       ID
 12       ID        ***********************************************
 13       ID              RATIO 1=100 YEAR STORM EVENT
 14       ID              RATIO 2=10 YEAR STORM EVENT
 15       ID              McCARRAN RAINFALL DATA USED
 16       ID              HEC1 FILE: SS-DEV1.IH1
 17       ID       *******************************************
          *DIAGRAM
 18       IT       5       0       0     300
 19       IO       5       0       0
 20       IN       5       0       0
 21       JR    PREC     1.0   0.570
          *

 22       KK  BAS.B1
 23       BA  0.0033
 24       PB    2.77
 25       PC     0.0   0.020   0.057   0.070   0.087   0.108   0.124   0.130   0.130   0.130
 26       PC   0.130   0.130   0.130   0.133   0.140   0.142   0.148   0.158   0.172   0.181
 27       PC   0.190   0.197   0.199   0.200   0.201   0.204   0.214   0.229   0.241   0.249
 28       PC   0.251   0.256   0.270   0.278   0.281   0.283   0.295   0.322   0.352   0.409
 29       PC   0.499   0.590   0.710   0.744   0.781   0.812   0.819   0.835   0.851   0.856
 30       PC   0.860   0.868   0.876   0.888   0.910   0.926   0.937   0.950   0.970   0.976
 31       PC   0.982   0.985   0.987   0.989   0.990   0.993   0.993   0.994   0.995   0.998
 32       PC   0.998   0.999   1.000
 33       LS       0      93       0
 34       UD   0.058
          *

 35       KK      R1
 36       KM  ROUTE BASINS B1 TO BASIN B2
 37       RK     220  0.0235   0.016       0    TRAP       0      50
          *

 38       KK  BAS.B2
 39       BA  0.0023
 40       LS       0      95       0
 41       UD   0.047
          *
```

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

  42      KK  BAS.B4
  43      BA  0.0005
  44      LS       0      95       0
  45      UD   0.053
          *

  46      KK      R3
  47      KM  ROUTE BASIN B4 TO BASIN B3
  48      RK     420   0.036   0.026       0    TRAP       0      50
          *

  49      KK  COMB.1
  50      KM  COMBINE BASINS B1 AND B2
  51      HC       3
          *

  52      KK      R2
  53      KM  ROUTE BASINS B1 AND B2 AND B4 TO B3
  54      RK     190  0.0094   0.016       0    TRAP       0      50
          *

  55      KK  BAS.B3
  56      BA  0.0018
  57      LS       0      95       0
  58      UD   0.085
          *

  59      KK  COMB.2
  60      KM  COMBINE ALL BASINS
  61      HC       2
  62      ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*      BY THE COE IN FEBRUARY 1981      *
*           REVISED 02 AUG 88           *
*                                       *
*  RUN DATE  04/07/1994  TIME  12:22:59 *
*                                       *
*****************************************
```

```
*************************************
*                                   *
*     DODSON AND ASSOCIATES, INC.   *
*   HYDROLOGIST AND CIVIL ENGINEERS *
*      7015 W TIDWELL SUITE 107     *
*         HOUSTON, TEXAS  77092     *
*           (713) 895-8322          *
*                                   *
*************************************
```

```
*********************************************
      SOUTH SHORE COMMERCIAL CENTER - DEVELOPED
      PARCELS 12, 14, 15, 16 AND 17
      PRE ENGINEERING
      FEBRUARY 26, 1994
      REVIEWED AND APPROVED BY ERNEST FREGGIARO P.E.
      PARCELS 12 AND 14 ARE DEVELOPED
```

```
*********************************************
      RATIO 1=100 YEAR STORM EVENT
      RATIO 2=10 YEAR STORM EVENT
      McCARRAN RAINFALL DATA USED
      HEC1 FILE: SS-DEV1.IH1
*****************************************
```

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

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

           COMPUTATION INTERVAL     .08 HOURS
               TOTAL TIME BASE   24.92 HOURS

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

   JP        MULTI-PLAN OPTION
                NPLAN           1  NUMBER OF PLANS
   JR        MULTI-RATIO OPTION
              RATIOS OF PRECIPITATION
             1.00       .57
```

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

					RATIOS APPLIED TO PRECIPITATION	
OPERATION	STATION	AREA	PLAN		RATIO 1	RATIO 2
					1.00	.57
HYDROGRAPH AT	BAS.B1	.00	1	FLOW	7.	3.
				TIME	3.50	3.50
ROUTED TO	R1	.00	1	FLOW	7.	3.
				TIME	3.50	3.50
HYDROGRAPH AT	BAS.B2	.00	1	FLOW	5.	3.
				TIME	3.50	3.50
HYDROGRAPH AT	BAS.B4	.00	1	FLOW	1.	1.
				TIME	3.50	3.50
ROUTED TO	R3	.00	1	FLOW	1.	0.
				TIME	3.50	3.50
3 COMBINED AT	COMB.1	.01	1	FLOW	13.	6.
				TIME	3.50	3.50
ROUTED TO	R2	.01	1	FLOW	12.	6.
				TIME	3.50	3.50
HYDROGRAPH AT	BAS.B3	.00	1	FLOW	4.	2.
				TIME	3.50	3.50
2 COMBINED AT	COMB.2	.01	1	FLOW	16.	8.
				TIME	3.50	3.50

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

CITY OF LAS VEGAS | **DATE:**

INTER-OFFICE MEMORANDUM | April 5, 1994

TO:	**FROM:**
Kent Nash Land Development Services Department of Public Works	Mas for T. Chiatovich, PE Chief Flood Control Dept. Public Works
SUBJECT:	**COPIES TO:**
South Shore Center Drainage Study Update Z-03-89 File No. DS676C Date of Engineer's Stamp: 03/02/94 Date Received by City: 03/02/94	Pyramid Rock Eng. Charles Kajkowski, PE John McNellis, PE

HISTORY:

1st Submittal	03/13/91 - Not Acceptable
2nd Submittal	05/09/91 - Acceptable
3rd Submittal	04/05/94 - (See Comments Below)

REMARKS:

3rd Submittal (Updated Study)

The drainage study for the subject project has been reviewed and

_____ is acceptable in concept subject to the following conditions:

__X__ must be resubmitted or supplemented.

1. The Engineer must account for flows that are designed to be conveyed through this portion of the commercial site per the original G. C. Wallace report. Point C appears to receive 12 cfs from offsite Basin B6 that must be conveyed through the site since it is a low spot and it appears that water presently ponds at this location. Additionally, it appears from a field visit that offsite Basin B5 will also impact the site. Though the Wallace plan did not show flow from offsite Basin B5 being conveyed through the site a flow depth and flow cross-section must be provided along the west boundary of the site. The HEC-1 analysis must be adjusted to show flow from the west (or specific reference to the previous analysis, including Xeroxes, provided).

2. The grading plan must show at least 100 feet of the existing South Shores Commercial Center with topo.

3. Flow depth calculations (whether calculated by the current engineer or referenced) must be provided and discussed for Lake Mead Boulevard, Harbor Island Drive and all onsite concentration points.

4. Developed conditions for the entire site must be analyzed with a HEC-1 model. Basin 2 and Basin 3 are presently only analyzed as undeveloped.

5. The minimum width for a private drainage easement is 10-feet. Part of the easement ("Section A") can be overflow over curb and through the parking area but no obstructions above curb height will not be allowed. Additionally, a cross-section must be provided through the 2-foot wide concrete swale ("Detail No.1") showing adjacent overflow capacity. Under sidewalk drains are required for any concentrated drainage that is discharged at a sidewalk.

6. The minimum elevation difference between the pad grade and finished floor must be stated on the grading plan for the future pads.

END OF REMARKS

T/R/S: L21
Z-3-89

dbm