City of Las Vegas
TRANSMITTAL

February 5, 2007
Hansen No. 06-11273

To:	**From:**
Cheri Edelman, P.E. – Assistant City Engineer *(Revised Plans)* John O'Connell, P.E. – Construction Management *(PDR)* Rob Welch, P.E. – Flood Control *(PDR)* John Day, P.E. – Sanitation *(PDR)* Ed Byrge – Right-of-Way *(Revised Plans)* Greg McDermott, P.E. – Roadway Planning *(Revised Plans)* Alan Riekki, P.L.S. – Survey *(Revised Plans)* John Ridilla, P.E. – Traffic Engineering *(PDR)* Jerry Walker, P.E. – Field Operations *(Revised Plans)*	Rosa Cortez, P.E. City Engineer Division Engineering Design Section
Subject: Oakey Storm Drain – Birch to Cahlan, Supplemental Information to the Preliminary Design Report	**Copies to:** File

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Oakey Storm Drain – Birch to Cahlan, 30% Supplemental Information	1	

REMARKS: Please review the **30% Supplemental Information** and return with comments to **Rosa Cortez** in Engineering Design by **February 20, 2007**.

If you have any questions, please call Rosa at 229-6264.

BY: Fernando Fine
TITLE: Senior Engineering Technician

400 E. STEWART AVE · LAS VEGAS · NEVADA 89101-2986
(702) 229-6011 · (702) 386-9108 (TDD)

PDR Addendum – Section and Appendix List

The following Sections of the PDR are to be completely replaced:

Executive Summary
Section 1 – Introduction
Section 2 – Existing Conditions
Section 3 – Utilities
Section 4 – Topographic Mapping and Surveying
Section 5 – Hydrologic Analysis
Section 6 – Hydraulic Analysis
Section 8 – Preliminary Design
Section 9 – Opinion of Probable Construction Cost
Section 10 – Permits
Section 11 – Constructability

The following Appendices of the PDR are to be completely replaced:

Appendix D: List of Projects Reviewed
Appendix F: Hydrologic Analysis
Appendix H: Hydraulic Analysis
Appendix I: Preliminary Plans

The following Appendices of the PDR have additional sheets being added or replaced:

Appendix A: Meeting Minutes
Appendix H: Replace the two sample 8.5 x 11 exhibits with new (enclosed)
Appendix J: Correspondence with utility Companies

The following Appendices are new and should be added to the PDR:

Appendix K: Supporting Documents and Reference Material
Appendix L: Potholing Data

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Table of Contents

Executive Summary

Section 1: Introduction

- 1.1 Project Description
- 1.2 Design Criteria
- 1.3 Purpose
- 1.4 Coordination Meetings

Vicinity Map

Section 2: Existing Conditions

- 2.1 Existing Watershed Conditions
- 2.2 Alignment Description
- 2.3 Data Collection
- 2.4 Existing Drainage Facilities
- 2.5 Existing Roadway

Section 3: Utilities

- 3.1 Utility Data Collection

Section 4: Topographic Mapping and Surveying

- 4.1 Control Survey
- 4.2 Design Surveys
- 4.3 Horizontal Control Plan
- 4.4 Right of Way Needs and Easements

Section 5: Hydrologic Analysis

- 5.1 Limits of Study
- 5.2 Previous Hydrologic Studies
- 5.3 Hydrologic Procedure
  - 5.3.1 Design Storm
  - 5.3.2 Precipitation
  - 5.3.3 Storm Distribution
  - 5.3.4 Depth-Area Reduction Factors
  - 5.3.5 Subbasin Delineation
  - 5.3.6 Land Use
  - 5.3.7 Soils
  - 5.3.8 Curve Numbers
  - 5.3.9 Lag Times

5.3.10 Routing
5.3.11 Concentration Points
5.4 Project Models
5.4.1 Big Basin Model
5.4.2 Small Basin Model

Section 6: Hydraulic Analysis

6.1 Hydraulic Criteria
6.2 Street Flow Evaluation and Proposed Drop Inlet
6.3 Flow in Upstream Streets
6.4 Oakey Storm Drain
6.5 Conclusions and Recommendations

Section 7: Geotechnical Analysis

Section 8: Preliminary Design

8.1 Design Criteria
8.2 Alignment Discussion
8.3 Preliminary Design
8.4 Construction Drawing Sheets
8.5 Supplemental General Conditions and Technical Specifications

Section 9: Opinion of Probable Construction Cost

9.1 Construction Cost

Section 10: Permits

10.1 State/Local Permit Matrix

Section 11: Constructability

11.1 Constructability Issues

Appendix A: Meeting Minutes
Appendix B: FEMA Firm Map
Appendix C: Project Photos
Appendix D: List of Projects Reviewed
Appendix E: Draft Geotechnical Exploration Report
Appendix F: Hydrologic Analysis
Appendix G: Hydraulic Analysis
Appendix H: Right-Of-Way Exhibits
Appendix I: Preliminary Plans
Appendix J: Correspondence with Utility Companies

Appendix K: Supporting Documents and Reference Material
Appendix L: Potholing Data

Executive Summary

The City of Las Vegas authorized HDR to perform engineering services for the Oakey Storm Drain Extension – Birch to Cahlan project. This project includes design of approximately 3,000 feet of regional storm drain and associated facilities. This also includes full depth pavement replacement over the proposed storm drain and facilities trench.

This report summarizes the preliminary design efforts for the Oakey Storm Drain Extension – Birch to Cahlan project. The preliminary design phase includes a review of existing conditions, site investigations, preliminary hydrologic and hydraulic analyses, facility sizing, utility coordination, surveying, preliminary design plan preparation, and development of preliminary construction of cost estimate.

The following project design activities have been completed to date for the Preliminary Design Report;

- Project Baseline and control surveys
- Aerial mapping and one-foot contour topography
- Review of record plans for existing storm water improvements in the project corridor
- Incorporation of most existing utility information into the project base map.
- Completion of preliminary watershed hydrologic analysis for the 100-year 6-hour storm event
- Completion of preliminary hydraulic analysis for the 100-year 6-hour storm event
- Preliminary geotechnical report outlining soil and groundwater conditions
- Development of preliminary plan and profile design drawings
- Development of a preliminary construction cost estimate
- Development of a list of probable construction permits required for the project

The proposed storm drain facilities for the project are sized to convey peak design discharge from the upstream end of the street section. The preliminary plans propose approximately 900 feet of 5' x 5' reinforced box culvert (RCB), 850 feet of 8' x 6' RCB and 1250 feet of 8' x 7' RCB along Oakey Boulevard between Cahlan Drive and Birch Street.

The preliminary construction cost estimate for the proposed improvements is presented in Section 9 of the Preliminary Design Report (PDR). The preliminary estimated construction cost is $7,934,834. The quantities for the major storm drain are based upon preliminary plan quantities. The estimated quantities for the inlets, lateral pipes, utility adjustments and/or relocations and other construction related items are based on engineering judgment. The construction quantities will be refined as the design process

progresses. An updated construction cost estimate will be provided with each design submittal.

Preliminary geotechnical analysis indicates a large amount of water within the project limits that will probably require 'dewatering' by the contractor. Rough estimates put this in excess of $1,500,000 over and above the construction cost. In addition, further work is being performed by the geotechnical sub-consultant to develop a dewatering plan and specifications for this work

The primary storm drain trench does not require any easements based on the work to date on the PDR. In some project areas, the storm drain inlets may require temporary and permanent easements.

Section 1
Introduction

This report addresses the preliminary design and preparation of Contract Drawings, Special Provisions and reports for the Oakey Storm Drain Extension – Birch to Cahlan for collection and conveyance of storm flows into the existing Oakey Storm Drain at Birch which discharges into the Freeway Channel system along Interstate 15. The project location is shown in the Vicinity Map enclosed in this section.

1.1 Project Description

The project entails construction of approximately 3,000 feet of storm drain conveyance facilities, which include (1) the proposed Oakey Storm Drain Extension – Birch to Cahlan; (2) connecting an existing bubbler storm drain system in Oakey at Rancho into the proposed Regional Facility; (3) design of drop inlets on Rancho at the Oakey/Rancho Intersection; (4) design of drop inlets on Cahlan at the Oakey/Cahlan intersection; (5) design of drop inlets at all other locations as needed; and (6) other design elements as needed to complete this project.

The proposed Oakey Storm Drain Extension – Birch to Cahlan Street is a Regional Flood Control facility, approximately 3,000 feet long, which is designated as FWOK 0020 in the Clark County Regional Flood Control District's (CCRFCD) 2002 Las Vegas Valley Flood Control Master Plan Update (MPU). The proposed Oakey Storm Drain Extension – Birch to Cahlan will tie into the existing Oakey Storm Drain at Birch Street which will discharge into the I-15 Freeway Channel.

1.2 Design Criteria

The design shall conform to the standards published in the latest edition of the *Uniform Standard Drawings and Specifications for Public Works' Construction Off-Site Improvements, Clark County Area Nevada* as adopted by the City of Las Vegas. The design criteria for the following agencies will also be adhered to: Clark County Regional Flood Control District (CCRFCD); City of Las Vegas (sanitary sewer, traffic, flood control, etc.); Nevada Department of Transportation (NDOT); Las Vegas Valley Water District (LVVWD); and other local utility providers.

Specific design references to be used on this project include the following:
(The latest versions/current editions will be used)

- *A Policy on Geometric Design of Highways and Streets (AASHTO)*
- *Uniform Standard Specifications for Public Works' Construction, Off-Site Improvements, Clark County Area, Nevada*

- *Uniform Standard Drawings for Public Works' Construction, Off-Site Improvements, Clark County Area, Nevada*, Volume 1 and Volume II
- *Nevada Department of Transportation (NDOT) Standard Plans for Road and Bridge Construction*
- *NDOT Standard Specifications for Road and Bridge Construction*
- *Manual of Uniform Traffic Control Devices*
- *Clark County Regional Flood Control District's Hydrologic Criteria and Drainage Design Manual*
- *2002 Las Vegas Valley Flood Control Master Plan Update (MPU)*
- *Central Neighborhood Flood Control Master Plan, Volumes I & II, March 2005*
- *Las Vegas Valley Water District Rules and Regulations*
- *Uniform Design and Construction Standards for Water Distribution Systems, Clark County, Nevada*
- *Design and Construction Standards for Wastewater Collection Systems, Southern Nevada*
- *Other Applicable Design Standards*

1.3 Purpose

The purpose of this Preliminary Design Report (PDR) is to summarize the findings of the preliminary design phase. The preliminary design phase includes:

- Reviewing the following studies in conjunction with the development of the hydrologic model:

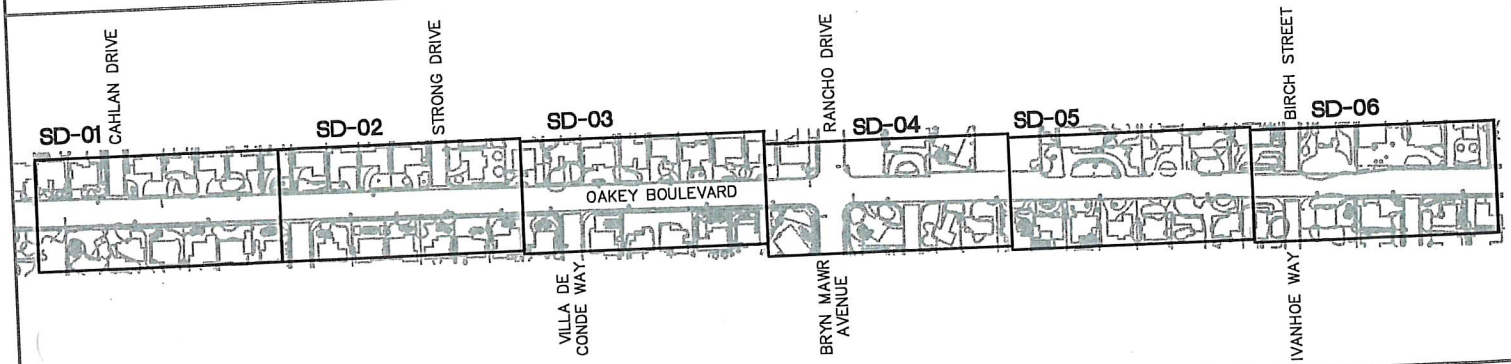
    A. 2002 Clark County Regional Flood Control District Las Vegas Valley Flood Control Master Plan Update.
    B. 2005 City of Las Vegas Central Neighborhood Flood Control Master Plan, Volumes I & II.
    C. Oakey Meadows Storm Drain and Street Rehabilitation Project Revised Preliminary Design Report and other related reports prepared by PBS&J and currently under review at the City of Las Vegas.

D. Previous drainage studies for the Project Site and surrounding offsite areas and drainage studies currently under review at the City of Las Vegas.

- Performing preliminary hydrologic and hydraulic analysis to determine design flows and compare the same with the design flows generated by the MPU;
- Determining preliminary facility sizes;
- Determining the viability of the proposed storm drain alignment;
- Providing a preliminary geotechnical review;
- Performing field surveys;
- Coordinating with affected utility companies to identify conflicts.

1.4 Coordination Meetings

During the preliminary design phase, regular meetings were held with the City of Las Vegas staff and other interested parties. **Appendix A** includes meeting minutes and other pertinent project correspondence.



VICINITY MAP

NTS

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Section 2
Existing Conditions

This section describes the existing conditions of the upstream watershed and Project alignment, data collection activities, and existing drainage facilities.

2.1 Existing Watershed Conditions

The area that drains to the Project is located within the Central Watershed as depicted in the 2002 Clark County Regional Flood Control District (CCRFCD) Las Vegas Valley Flood Control Master Plan Update (2002 MPU) and within the 2005 City of Las Vegas Central Neighborhood Study (CNS) area. The majority of the watershed is between Oakey Boulevard and Sahara Avenue. The watershed limit of the Project to the east is Birch Street. Small portions of the watershed are along the north side of Oakey Boulevard. On the west, the Oakey Meadows Storm Drain System is currently under design by PBS&J. The proposed Oakey Meadows Storm Drain System alignment is slightly different from the 2002 MPU alignment (see Figure 5.1 in Section 5). As directed by the City, the Oakey Meadows Storm Drain System is considered the cutoff of the watershed on the west. The area upstream of the Oakey Meadows Storm Drain System is excluded from the study area.

The watershed of the Project is a fully developed urban area with residential land use only. The slope of the watershed is generally from west to east at about 2%. Streets are currently the primary drainage facilities.

The watershed and Project area lie in a Zone X, Non-Special Flood Hazard Area (areas determined to be outside the 0.2% annual chance floodplain). The Flood Insurance Rate Map (FIRM) panel pertaining to this area is 32003C2170 E, revised September 27, 2002. Panel 32003C2170 E with the Project Location shown is printed in **Appendix B**.

2.2 Alignment Description

The proposed Oakey Storm Drain follows a west-east alignment along Oakey Boulevard from Cahlan Drive to Birch Street and ties into the existing segment of Oakey Storm Drain at Birch Street. The proposed storm drain alignment is located five feet south of the roadway centerline. A detailed account of alignment selection is provi□ in Section 8.

2.3 Data Collection

Plans and Reports from several data sources have been reviewed. The majority of these documents are improvement plans provided by the City for roads, storm drains, or other utilities. Table D-1 (**Appendix D**) shows which plans have been reviewed and incorporated into the preliminary design and hydrologic analysis.

The three important documents reviewed are: *2002 Clark County Regional Flood Control District Las Vegas Valley Flood Control Master Plan Update (2002 MPU); 2005 City of Las Vegas Central Neighborhood Flood Control Master Plan*; and *City of Las Vegas, I-15 Freeway Channel – Ivanhoe Way to Alta Drive Pre-Design Report, May 1999.*

Available previous drainage studies provided by the City for individual developments within the watershed, such as residential sub-divisions and commercial sites, were also reviewed.

In addition, HDR coordinated with PBS&J, design engineer of the Oakey Meadows Storm Drain System, for the latest alignment of the Oakey Meadows Storm Drain System. HDR will continue coordinating with PBS&J through the process of design.

2.4 Existing Drainage Facilities

Streets are currently the primary drainage facilities within the project watershed. There are no existing regional flood control facilities within the project limit. Local facility includes a storm drain-bubbler system at the intersection of Oakey Boulevard and Rancho Drive. This drain-bubbler system intercepts minor flows from southwest and northwest corners of the intersection and bubble out to the street just east of the intersection. East of the project site is the existing segment of the Oakey Storm Drain (Facility FWOK 0000). The proposed Oakey Storm Drain segment (Facility FWOK 0020) is an extension of the existing segment. The existing segment of Oakey Storm Drain from Birch Street to I-15 is a lateral of the I-15 Freeway Channel. The existing segment consists of a 10'×8' Reinforced Concrete Box (RCB). The proposed segment will tie into the existing segment at Birch Street.

The existing Oakey Storm Drain ("Oakey Lateral" in Parsons Brinckerhoff's study) east of Birch was designed by Parsons Brinckerhoff as a portion of the I-15 Freeway Channel. The study was done in May 1999. The study did not reflect the 2002 MPU which added the Oakey Meadows Storm Drain System to collect runoff upstream of the project area and convey the flows to the Meadows Detention Basin. The drainage area in Parsons Brinckerhoff's study is larger that that in the 2002 MPU and the design is therefore conservative. Review of the hydraulic study for I-15 Freeway Channel shows that the design flow for the existing Oakey Storm Drain was 1,240 cfs. The study also indicated that the flow in this existing storm drain is in supercritical flow condition with an average depth of 6.9 feet. A series of existing drop inlets along both sides of the street intercept the flows and drain to the storm drain through lateral pipes. The first two drop inlets are located just west of Birch Street. Copies of related materials from Parsons study are included in **Appendix K.**

West of the project site, a regional facility, Oakey Meadows Storm Drain System, is currently under design. The proposed Oakey Meadows Storm Drain System alignment is slightly different from the 2002 MPU alignment (See Figure 5.1). As directed by the City, the Oakey Meadows Storm Drain System is considered the cutoff of the watershed

on the west. Therefore, the Oakey Meadows Storm Drain System is considered an existing drainage facility in this study.

There are also local drainage facilities in the watershed of the project. The El Camino Storm Drain System diverts flows from Valley View Boulevard and El Camino Avenue to Sahara. The El Camino Storm Drain System consists of drop inlets to pick up flows from the low point at the intersection of Valley View and La Pasada. The plan and profiles for the existing El Camino Storm Drain System are included in **Appendix K.**

Another small local storm drain system exists at the intersection of Valley View and Oakey and extends south to El Cortez. This system collects nuisance flows from the low point at the northwest corner of the Valley View and El Cortez intersection and from the northwest corner of Valley View and Oakey intersection. This system bubbles out to Oakey just east of the intersection of Oakey and Valley View. See grading plans for Valley View included in **Appendix K**.

2.5 Existing Roadway

Oakey Boulevard is 64 feet wide (back of curb to back of curb) between Cahlan Drive and Rancho Drive. Oakey Boulevard varies from 55 feet to 64 feet wide (back of curb on the south side to edge of pavement/back of curb) between Rancho Drive and Birch Street and has 4 lanes (two in each direction). The street pavement is asphalt concrete. There are left turn lanes at all four legs of the intersection of Oakey Boulevard and Rancho Drive.

Oakey Boulevard (Cahlan Drive to Rancho Drive)

The street has 2 foot curb and gutter on both sides of the roadway. Both sides of the road have sidewalks. There are several single houses on the north side with driveways. The south side has no residential access other than the side roads. The local roads, Rambla Court and Villa De Conte Way provide access to the residential housing subdivision.

Oakey Boulevard (Rancho Drive to Birch Street)

The street has a curb on the south side of the roadway. The south side of the street also has gutter intermittently. The north side of the street also has curb and gutter intermittently. There is no sidewalk on either side of the roadway. There are several single houses on the south side with driveways. The north side has a couple of residential accesses. Bryn Mawr Avenue provides access to the residential housing subdivision.

Section 3
Utilities

3.1 Utility Data Collection

This section discusses the utility research, coordination and preliminary locations of utilities to date. The project alignment is located in an established residential neighborhood. Utility research included reviewing plans provided by the City of Las Vegas. Information is also being sought from various utilities. Some utilities have provided plans depicting location of their utilities. A preliminary set of potholing has been completed and the results are included in **Appendix L**. Utility conflicts and potential relocations/adjustments will be analyzed in greater detail for the future submittals after receipt and analysis of additional utility potholing data and analysis of information obtained from all the utility companies.

The following utilities and agencies have been contacted:

Kinder Morgan Pipeline
Time Warner Telecom
Nevada Power Company (Distribution)
Southern Nevada Water Authority (SNWA)
Southwest Gas Corporation
Las Vegas Valley Water District (LVVWD)
Verizon Business
City of Las Vegas
Level 3 Communications
Embarq Communications
Cox Communications
Clark County Water Reclamation District
RTC Utility Coordination Website

All the utilities listed below are shown on plans SD-01 to SD-06 (**Appendix I**).

Intersection of Oakey Boulevard centerline and Cahlan Drive (N/S)

- Existing 8-inch waterline along Cahlan Drive.

Oakey Boulevard centerline (Cahlan Drive to Rambla Court) (E/W)

- Existing 8-inch waterline on the north side of Oakey Boulevard centerline
- Existing 27-inch sanitary sewer on the north side of Oakey Boulevard centerline.
- Existing 6-inch sanitary sewer on the north side of Oakey Boulevard centerline.

- Existing 8-inch sanitary sewer on the south side of Oakey Boulevard centerline.
- Existing 18-inch waterline on the south side of Oakey Boulevard centerline.

Intersection of Oakey Boulevard and Rambla Court (N/S)

- Existing 8-inch sanitary sewer along Rambla Court.
- Existing 2-inch gas on the along Rambla Court.

Oakey Boulevard (Rambla Court to Strong Drive) (E/W)

- Existing 2-inch gas on the north side of Oakey Boulevard centerline.
- Existing 8-inch waterline on the north side of Oakey Boulevard centerline.
- Existing 27-inch sanitary sewer on the north side of Oakey Boulevard centerline.
- Existing 6-inch sanitary sewer on the north side of Oakey Boulevard centerline.
- Existing 8-inch sanitary sewer on the south side of Oakey Boulevard centerline.
- Existing 18-inch waterline on the south side of Oakey Boulevard centerline.

Intersection of Oakey Boulevard and Strong Drive (N/S)

- Existing 8-inch waterline along Strong Drive.
- Existing 8-inch sanitary sewer along Strong Drive.

Oakey Boulevard (Strong Drive to Villa De Conde Way) (E/W)

- Existing 30-inch sanitary sewer on the north side of Oakey Boulevard centerline.
- Existing 12-inch sanitary sewer on the south side of Oakey Boulevard centerline.
- Existing 18-inch waterline on the south side of Oakey Boulevard centerline.

Intersection of Oakey Boulevard and Villa De Conde Way (N/S)

- Existing 2-inch gas along Villa De Conde Way.

Oakey Boulevard (Villa De Conde Way to Rancho Drive) (E/W)

- Existing 2-inch gas on the north side of Oakey Boulevard centerline.
- Existing 30-inch sanitary sewer on the north side of Oakey Boulevard centerline.
- Existing 12-inch sanitary sewer on the south side of Oakey Boulevard centerline.

- Existing 18-inch waterline on the south side of Oakey Boulevard centerline.

Intersection of Oakey Boulevard and Rancho Drive (N/S)

- Existing 8-inch waterline on the west side of Rancho Drive.
- Existing 18-inch waterline on the west side of Rancho Drive.
- Existing 10-inch sanitary sewer on the west side of Rancho Drive.
- Existing 36-inch waterline on the east side of Rancho Drive, north side of Oakey Blvd. only.
- Existing 8-inch waterline on the east side of Rancho Drive.
- Existing 4-inch gas on the east side of Rancho Drive.
- Existing Telephone line on the east side of Rancho Drive.
- Existing 6-inch sanitary sewer on the northwest of Oakey Blvd/Rancho Dr intersection. (NW/SE)
- Existing 8-inch waterline on the north side of Oakey Boulevard centerline. (E/W)
- Existing 18-inch RCP storm drain on the south side of Oakey Boulevard centerline. (E/W & N/S)
- Existing 18-inch and 24-inch RCP storm drain on the north side of Oakey Boulevard centerline. (E/W & N/S)

Oakey Boulevard (Rancho Drive to Bryn Mawr Avenue) (E/W)

- Existing 36-inch waterline on the north side of Oakey Boulevard centerline.
- Existing 48-inch sanitary sewer on the north side of Oakey Boulevard centerline.
- Existing 2-inch gas on the south side of Oakey Boulevard centerline.
- Existing 10-inch sanitary sewer on the south side of Oakey Boulevard centerline.
- Existing 8-inch waterline on the south side of Oakey Boulevard centerline.

Intersection of Oakey Boulevard and Bryn Mawr Avenue (N/S)

- Existing 8-inch waterline on the west side of Bryn Mawr Street.
- Existing 8-inch sanitary sewer on the east side of Bryn Mawr Street.
- Existing 2-inch gas on the east side of Bryn Mawr Street.

Oakey Boulevard (Bryn Mawr Avenue to Birch Street) (E/W)

- Existing 36-inch waterline on the north side of Oakey Boulevard centerline.
- Existing 48-inch sanitary sewer on the north side of Oakey Boulevard centerline.
- Existing 2-inch gas on the south side of Oakey Boulevard centerline.

- Existing 10-inch sanitary sewer on the south side of Oakey Boulevard centerline.
- Existing 6-inch waterline on the south side of Oakey Boulevard centerline.

Intersection of Oakey Boulevard and Birch Street (N/S)

- Existing 10-inch sanitary sewer along the centerline of Birch Street.
- Existing 6-inch waterline on the east side of Birch Street.
- Existing 2-inch gas on the east side of Birch Street.

The preliminary location of the storm sewer is five feet south of Oakey Boulevard centerline. This conflicts with the sewer line (8"/10"/12" dia.) located approximately 9.5 feet south of the Oakey Boulevard centerline. There are a few other potential utility conflicts noted. A detailed account of alignment selection is provided in Section 8.

Section 4
Topographic Mapping and Surveying

4.1 Control Survey

All aerial mapping and design survey for the Project were performed by subconsultants, AeroTech Mapping and Horizon Survey, respectively.

Control surveys for the project include aerial panels and establishing a coordinate system. The control survey is tied to the City's established horizontal and vertical control network utilizing control information provided by the City. Existing monuments within the project limits are tied into this control network. Horizon Survey has established roadway alignments from control information found in the field and record information.

4.2 Design Surveys

All aerial mapping and Digital Terrain Model (DTM) was produced from aerials flown at an altitude to produce 1 inch to 40 feet horizontal scale with one-foot contour intervals per National Mapping Accuracy Standards. One-foot interval contours were developed utilizing a digital terrain program and the aerial mapping. Topographic surveys of existing features were completed in the field to supplement aerial mapping. Specifically these tasks included, but were not limited to, the following:

1. Existing surveys, parcel maps, ownership records, and the records as necessary were researched to obtain needed data in preparation of all existing rights-of-way and easements and control drawings.

2. Panel locations for control in obtaining aerial topography were set. Topographic mapping was developed at 1″ = 40′ horizontal with a contour interval of 1 foot, based upon a published City benchmark.

3. Both horizontal and vertical control for the Project including preparation of a horizontal control drawing sealed by a Nevada Professional Land Surveyor were prepared to identify, as a minimum, horizontal and vertical control points, Project alignment centerline indicating bearings, distances and control point coordinates.

4. Project coordinate system was established.

5. Survey is in state plane coordinates (horizontal) and NAVD 88 (vertical).

6. Field survey was conducted to identify and locate existing street improvements as necessary to supplement aerial topography. Field survey data was collected along the storm drain facility alignment, including but not limited to existing edge of pavement, drop inlet locations and invert elevations, manhole lids and invert elevations, and gutter flow line, top of curb, back of sidewalk elevations, water valves, visible surface utilities and pothole hubs. Field survey shots were obtained at 25-foot intervals along the top of curbs, street centerline, edges of driveways, sanitary sewer inverts and curb returns. Field survey were extended a minimum of 100 feet for minor street intersections and 150 feet for major street intersections beyond curb returns of adjacent street.

4.3 Horizontal Control Plan

A horizontal control plan showing ties to existing monumentation, centerline bearings and distances, project benchmarks, etc. stamped by a Nevada Professional Land Surveyor (PLS) is included in **Appendix I**.

4.4 Right-of-Way Needs and Easements

The project alignment is primarily within the existing street right-of-way. Consultant has prepared 24″ x 36″ exhibit, at a 1″ = 100′ scale, that shows schematically the project and identifies all existing right-of-way and existing easements. In addition, Consultant has provided a sample format of right-of-way legal descriptions and Authorization to Enter Property (AEP) exhibit format for review. These exhibits and sample formats have been included in **Appendix H**.

Section 5
Hydrologic Analysis

The hydrologic analysis in this section includes modeling existing and future condition storms for events with 10- and 100-year recurrence intervals. However, the watershed is fully developed and therefore changes in the flow rates between existing and future conditions are negligible. In addition, there are no proposed storm drain facilities in the upstream watershed that would change the drainage patterns and significantly change peak flows impacting the project alignment. The ultimate or future condition is essentially the same as the existing condition in terms of the hydrologic analysis, Therefore an existing condition model is not necessary and is not included in this report. The 100-year HEC-1 model from the 2005 City of Las Vegas Central Neighborhood Study (CNS) was used as the base model and was modified based on field investigations and data collected for the Project. The 100-year future condition model from the 2005 Central Neighborhood Study is based on the 2002 Clark County Regional Flood Control District (CCRFCD) Las Vegas Valley Flood Control Master Plan Update (2002 MPU). The hydrologic methodology used is in accordance with the CCRFCD Hydrologic Criteria and Drainage Design Manual (HCDDM), dated August 12, 1999.

5.1 Limits of Study

The area that drains to the Project is located within the Central Watershed as depicted in the 2002 MPU. The majority of the watershed is between Oakey Boulevard and Sahara Avenue. The watershed limit to the east is Birch Street. Small portions of the watershed are along the north side of Oakey Boulevard. On the west, the Oakey Meadows Storm Drain System is currently under design. The proposed Oakey Meadows Storm Drain System alignment is slightly different from the 2002 MPU alignment (See Fig. 5.1). As directed by the City, the Oakey Meadows Storm Drain System is considered the cutoff of the watershed on the west. The area upstream of the Oakey Meadows Storm Drain System is therefore excluded from the study area.

5.2 Previous Hydrologic Studies

As part of the engineering services performed, HDR obtained and reviewed previous hydrologic and hydraulic reports and studies prepared for areas surrounding, tributary to, or adjacent to this project site. Table 5.1 below listed the reports and studies reviewed during the preparation of this report. Excerpts from these studies were included in Appendix K.

Table 5.1 Previous Studies		
1	2005 City of Las Vegas Central Neighborhood Study (CNS)	March 2005
2	2002 Clark County Regional Flood Control District Las Vegas Valley Flood Control Master Plan Update (2002 MPU).	September 2002
4	Oakey Meadows Storm Drain and Street Rehabilitation Project Preliminary Design Report – By PBS&J.	October 2004
5	City of Las Vegas, I-15 Freeway Channel – Ivanhoe Way to Alta Drive Pre-Design Report - by Parsons Brinkerhoff.	May 1999
6	Technical Drainage Study for Sahara/Rancho Office Park-by The Keith Companies	July 11, 2000
7	Addendum#1 to The Technical Drainage Study for Sahara/Rancho Office Park- by The Keith Companies	September 5, 2000
8	Addendum#2 to The Technical Drainage Study for Sahara/Rancho Office Park- by The Keith Companies	September 25, 2000
9	Update to The Technical Drainage Study for Sahara/Rancho Office Park- by The Keith Companies	January 8, 2002
10	Addendum #1 to The Update to The Technical Drainage Study for Sahara/Rancho Office Park- by The Keith Companies	March 21, 2002
11	Supplement to Addendum #1 to The Update to The Technical Drainage Study for Sahara/Rancho Office Park- by The Keith Companies	April 15, 2002
12	Sahara Pavilion North-Taco Cabana Pad- by Baughman and Turner, Inc.	January 22, 1992
13	Sahara Pavilion North-Taco Cabana Pad (2nd Submittal)- by Baughman and Turner, Inc.	February 20, 1992
14	Update to The Technical Drainage Study for The Sahara Avenue/Valley View Boulevard Commercial Subdivision (Parcel J-Blockbuster Video)- by PBS&J	February 1996
15	Update to The Technical Drainage Study for The Sahara Avenue/Valley View Boulevard Commercial Subdivision (Parcel J-Blockbuster Video) (2nd Submittal)- by PBS&J	July 1996

16	Hydrology Study, Section 04, Township 21 South, Range 61 East, City of Las Vegas, Nevada- by Baughman and Turner, Inc.	December 29, 1992
17	Hydrology Study for Romano's Macaroni Grill- by Dunnam Civil Engineers, Inc.	March 4, 1994
18	Hydrology Study for Sahara/Richfield-by VTN	July 30, 1993
19	Addendum #1 to The Hydrology Study for Sahara/Richfield-by VTN	September 29, 1993
20	Hydrology Study for Parcel 030-630-063- by VTN	April 2, 1993
21	Addendum #1 to The Hydrology Study for Parcel 030-630-063- by VTN	April 26, 1993
22	Hydrology Study for Parcel 030-630-063 (3rd Submittal)- by VTN	August 1993
23	Technical Drainage Study for Indian Hills Apartments, Sahara Avenue & Arville Street- by MEA Consulting Engineers	February 1988
24	Addendum to Drainage Study for Cashman Court Subdivision- by E.J. Wojcik Engineering	April 8, 1986
25	Drainage Study Nevada Financial Center- by G.C. Wallace, Inc.	July 29, 1986

5.3 Hydrologic Procedure

5.3.1 Design Storm

The rainfall values used for hydrologic modeling are intended to produce runoff discharges for events with 100-year recurrence intervals. The 100-year recurrence interval is defined as having a 1.0 percent chance of being equaled in any given year.

In accordance with the HCDDM, the 100-year recurrence interval storms are based on a single event storm with a six-hour duration.

5.3.2 Precipitation

The project site is located in Section 4 and Section 5 of Township 21 South, Range 61 East, and Section 6 of Township 22 South, Range 61 East M.D.M., in Las Vegas, Nevada. The project site and its drainage basins lie within the McCarran Rainfall Area as delineated in the Manual. The point precipitation values were obtained from Figures 503 and 506 of the Manual. The 10- and 100-year, 6-hour rainfall depths are 1.58 inches and 2.77 inches, respectively.

The Manual also identifies a methodology to determine which storm distribution to employ. There are three design storm distributions, labeled SDN 3, SDN 4, and SDN 5. For drainage areas less than 8 square miles in size, use SDN 3. For drainage areas greater than or equal to 8 and less than 12 square miles in size, use SDN 4. For drainage areas greater than or equal to 12 square miles in size, use SDN 5.

Precipitation information is included in **Appendix F**.

5.3.3 Storm Distribution

The time distribution of the rainfall is in accordance with the HCDDM. The manual specifies storm distributions established by the Los Angeles District of the Corps of Engineers. The tributary watershed delineated for this study is less than eight square miles and therefore Storm Distribution 3 (SDN3) is used. See **Appendix F** for Storm distribution.

5.3.4 Depth-Area Reduction Factors

Point precipitation values are adjusted by applying Depth Area Reduction Factors (DARFs). The DARF decreases the point rainfall values to represent an average depth of rainfall over the entire storm area, the larger the storm area the lower the average rainfall (See **Appendix F**). However, the total tributary area is comparatively small (0.9 square miles). City of Las Vegas requested that a value of 1.0 for DARF be used (no area reduction).

5.3.5 Subbasin Delineations

The offsite drainage subbasins and flow patterns were determined from the 5-foot contour topographic for Clark County generated by the Clark County GIS Management Office. The 2005 Central Neighborhood Study (CNS) 100-year model was used as the base model for this study. The 100-year CNS subbasins were modified as a result of intensive data gathering and field investigations. This resulted in more detailed delineations along the Oakey storm drain alignment where subbasins were broken down into smaller subbasins to provide a higher frequency of concentration points for evaluation of storm drain sizes and facilitate the analysis of drop inlets and laterals to be developed in the next phase of the project design. The Oakey Meadows Storm Drain System is a cutoff on the west.

The subbasin delineations are shown in Figure 5.1 and Figure 5.2.

5.3.6 Land Use

The watershed of the Project is a fully developed urban area consisting primarily of single and multi-family residences. There are only sparse commercial and public parcels. Parcel maps for the subject watershed are included in **Appendix F.**

5.3.7 Soils

The SCS (Soil Conservation Service) methodology divides soils into four hydrological groups as defined below:

A. High infiltration rate, low runoff potential
B. Moderate infiltration rate, moderately low runoff potential
C. Slow infiltration rate, moderately high runoff potential
D. Very slow infiltration rate, high runoff potential

The study area is covered by the SCS Soil Survey for the Las Vegas Valley (1985 and 1995). The soil survey includes maps that show soil types and provides a table relating hydrologic soil group to SCS soil type.

The information was compiled in a GIS (Geographic Information System) format and map was generated (from 2002 MPU) that displays the soil classifications and the hydrologic soil groups for the study area (see **Appendix F**, Soil Exhibit).

5.3.8 Curve Numbers

The runoff curve number is an empirical measurement of the soils capacity for runoff. The soil type coverage along with the type of development greatly influences the CN value. The CN value is inversely proportional to the infiltration rate. The higher the CN value the lower the infiltration rate which, in turn, results in the higher potential for runoff.

Soils information and land use data are combined together to determine a CN for each subbasin. As presented in the Soils Exhibit, there are two types of soils in the subject watershed: Soil Unit 300 and Soil Unit 390. The hydrologic soil group (HSG) for Soil Unit 300 is "D". The hydrologic soil group (HSG) for Soil Unit 390 is "C". For further information regarding the aforementioned soil type, please refer to the SCS *Soil Survey of Las Vegas Valley Area Nevada* (Reference 4). Curve numbers were determined from the appropriate columns of Tables 602 and 602A of the *Manual*.

The curve number calculations for use in the HEC-1 models for this study are included in **Appendix F.**

5.3.9 Lag Times

All subbasins within the Oakey Meadows Watershed are less than 1 square mile. For subbasins less that 1 square mile, the time of concentration (velocity method) is used to compute lag time. This method is explained below:

Time of Concentration Method

For drainage basins with less than one square mile, the time of concentration is calculated as follows:

$Tc = Ti + Tt$

Where: Tc = Time of concentration (minutes)
Ti = Initial, inlet or overland flow time (minutes)
Tt = Travel time in the ditch, gutter, etc. (minutes)

The lag time for basins less than one square mile is calculated as follows:

$$T\ lag = 0.6Tc \text{ (hours)}$$

Initial flow time is calculated as follows:

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

Where: Ti = Initial overland flow time (minutes)
K = 0.0132 * CN – 0.39
CN= Curve Number
Lo = Length of overland flow (max.500 ft)
S = Average basin slope (percent)

Travel time is calculated as follows:

$$Tt = 500/(60\ V1) + (Lt-500)/(60\ V2)$$

Where:

Tt = Travel time (minutes)
Lt = Travel length (feet)

V1 = Average velocity of flow for the first 500 feet of travel distance (ft/s)
V2 = Average velocity of flow for the remaining travel distance (ft/s)

V1 and V2 are calculated as follows:

$V1 = C1 * (S/100)^{1/2}$
$V2 = C2 * (S/100)^{1/2}$

Where:
C1 = 20.2 for developed areas and 14.8 for undeveloped areas
C2 = 30.6 for developed areas and 29.4 for undeveloped areas
S = Average slope for the flow path (percent)

In urbanized areas, the time of concentration calculated above should not exceed the time of concentration calculated by the following equation:

$$Tc = (L / 180) + 10$$

Where:
Tc = Time of concentration at the first design point in an urban watershed (min)
L = Watershed length (ft)

The smaller of the two calculations for time of concentration will control. Minimum Tc for any watershed is limited to 5 minutes.

5.3.10 Routing

In this study all routing were either through improved channels, streets or storm drains and therefore only Muskingum-Cunge method for routing is used.

Muskingum-Cunge routing requires the following input parameters: roughness, coefficient, base width, side-slope, slope, and reach length.

5.3.11 Concentration Points

Subbasins were combined using concentration points. These concentration points were inserted into the HEC-1 Project model to obtain peak flow rates. Several concentration points were located along the intersection of the proposed storm drain alignment and cross streets in order to have good estimates of design flows that will be used to sized collection facilities such as drop inlets. Figure 5.1 and Figure 5.2 summarize the location of the combination points within the study area.

5.4 Project Models

Two HEC-1 models are developed for overall design purposes, one model would be used to size the main line facility and the other used to size the drop inlets. A model used for main lines would typically have larger subbasin delineations than a model used to size

drop inlets and would estimate a lower overall design discharge. Below are descriptions for the two models.

5.4.1 Big Basin Model

The first model, Big Basin Model, is developed to size the main line storm drain. The drainage basins are shown in Figure 5.1. As stated above, the proposed Oakey Meadows Storm Drain System to the west of the project site is the cutoff for the drainage basins to the west. The project site and the upstream offsite subbasins are fully developed urban area with primarily residential land use. The majority of the watershed contributing to the project site is located south of Oakey Boulevard. Only small areas north of Oakey drain to the project site. The overall area slopes in an easterly direction. Streets are currently the primary drainage facilities.

Subbasin OFF1 will drain through Subbasin OFF2 and combine flow from OFF2 at the intersection of Valley View and El Camino (concentration point CP1). This combined flow will split at the intersection based on the grading of the two streets. A portion of the flow will be intercepted by Valley View and drain north. The remaining will continue east along El Camino Avenue. The flow split is evaluated using Pima County Method. Three different incoming flows (100, 200 and 300 cfs) were evaluated for flow split. Calculations and the resulting split rating table were included in **Appendix F**. The split rating table was then input into the HEC-1 model.

The split flow to north from CP1 will combine flow from OFF3 at Valley view and La Pasada (concentration point CP2). Review of the Grading Plan for Valley View Boulevard (see **Appendix K**) shows that CP2 is at a sump point. Valley View Boulevard from Sahara Avenue to La Pasada Avenue is sloping northerly at a slope of 0.4%. Valley View Boulevard goes up after La Pasada and then slopes down towards El Cortez with a high point between La Pasada and El Cortez. The high point is about 0.5 feet lower than the flow line at El Camino intersection. An existing storm drain system, the local facility Valley View Storm Drain, will divert out a portion of the flow from this sump to Sahara. The Valley View Storm Drain starts at La Pasada and goes south along Valley View until El Camino where it turns east and continues along El Camino alignment. The storm drain turns south again at Spanish Oaks Drive and continues along Spanish Oaks alignment until it outlets to the existing storm drain at Sahara Avenue. The diversion is limited by the size of the storm drain. The storm drain consists of 30" and 36" RCPs. The capacity of the storm drain is governed by the smaller pipe. The full flow capacity is about 38 cfs (30" RCP at 0.85%), see **Appendix F** for FlowMaster calculations. This is the maximum flow which can be diverted out by the Valley View Storm Drain. The remaining flow of CP2 will accumulate in the sump until it overtops the high point north of CP2 and flow north along Valley View to El Cortez (concentration point CP3).

Subbasin OFF4 will drain through Subbasin OFF5 to concentration point CP3. Flows from Subbsins OFF4 and OFF5 will combine with flow from CP2 at concentration point CP3. The combined flow will be conveyed east through Subbasin OFF6 and combine

(Figure 5.1 Big Basin Map & Small Basin Map)

flow from OFF6. The combined flow will drain to Oakey at Campbell Drive (concentration point CP4).

Subbasin OFF7 will drain east along Oakey Boulevard to Campbell Drive (concentration point CP4). The flow will combine with flow from Subbsins OFF8 before Campbell Drive. The combined flow will then combine flow from Campbell Drive south of Oakey Boulevard at Campbell Drive intersection (concentration point CP4). This flow will drain east along Oakey Boulevard and combine with flow from Subbasin OFF9 at concentration point CP5 (just west of Cahlan Avenue). The combined flow will drain to the proposed Oakey Storm Drain at Cahlan Avenue.

Subbasin OFF10 north of Oakey Boulevard will drain to the proposed Oakey Storm Drain at Strong Drive and combine with flow from CP5 at Strong Drive.

The split flow to east from CP1 will combine flow from Subbasin OFF11. The combined flow will be conveyed east along El Camino Avenue until Spanish Oaks Drive (concentration point CP6) where the flow will split. A portion of the flow will drain north to the Spanish Oaks community. The remaining will drain south along Spanish Oaks Drive to Sahara Avenue. Based on the grading of El Camino Avenue and Spanish Oaks Drive and a joint field visit by HDR and City of Las Vegas, it was agreed by both parties that approximately 40% of the flow will drain north to the Spanish Oaks community and the remaining 60% will drain south to Sahara Avenue.

The split flow to north from CP6 will be routed through Subbasin OFF12 and combine flow from OFF12 at concentration point CP7. The combined flow will drain east through a wall opening to Subbasin OFF13 and be routed through OFF13. Flow from CP7 will combine with flow from OFF13 and drain to the proposed Oakey Storm Drain at Villa De Conde Way (concentration point CP9).

Flow from Subbasin OFF14 will drain to the proposed Oakey Storm Drain at Rancho Drive (concentration point CP10) and combine with flow from CP9.

Flow from Subbasin OFF15 east of Rancho Drive will drain to the proposed Oakey Storm Drain at Birch Street (concentration point CP11) and combine with flow from CP10.

Basin parameters including area, rainfall and curve numbers were calculated in GIS using the latest data available. Subbasin properties are summarized in **Appendix F**, Standard Form 4. These parameters include subbasin area, weighted curve number and lag time. All the data was complied into an HEC-1 input file. The HEC-1 model output is included in **Appendix F**.

Table 5.2 summarizes the computed 10-year and 100-year flows.

Table 5.2 Summary of Peak Flows – Big Basin Model			
Subbasin/ Concentration Point	**Area (acre)**	**Q_{10} (cfs)**	**Q_{100} (cfs)**
OFF1	62.71	67	138
OFF2	64.93	56	120
OFF3	23.11	26	56
OFF4	16.19	14	32
OFF5	20.63	23	50
OFF6	46.42	48	106
OFF7	23.05	22	48
OFF8	7.67	9	20
OFF9	14.05	17	40
OFF10	46.71	25	66
OFF11	17.96	22	45
OFF12	77.80	74	161
OFF13	39.99	20	59
OFF14	87.20	42	113
OFF15	25.16	12	37
CP1	-	123	255
CP1N	-	55	111
CP1E	-	68	143
CP2	-	68	142
CP3	-	54	167
CP4A	-	76	252
CP4B	-	29	64
CP4	-	99	314
CP5	-	113	334
CP6	-	81	173
CP6N	-	32	69
CP6S	-	48	104
CP7	-	90	213
CP8	-	136	397
CP9A	-	108	271
CP9	-	243	668
CP10	-	281	775
CP11	-	288	803

(1) See Figure 5.1

5.4.2 Small Basin Model

The second model, Small Basin Model, is developed to size the drop inlets and lateral pipes. The drainage basins are shown in Figure 5.2. The Small Basin Map was created based on the Big Basin Map. Some basins were broken into smaller basins and additional concentration points were added to accommodate design of drop inlets.

Calculations for the Small Basin Model were included in Appendix F. Table 5.23 summarizes the computed 10-year and 100-year flows.

Table 5.3 Summary of Peak Flows – Small Basin Model

Subbasin/ Concentration Point	Area (acre)	Q_{10} (cfs)	Q_{100} (cfs)
OFF1	62.71	67	138
OFF2	64.93	56	120
OFF3	23.11	26	56
OFF4	16.19	14	32
OFF5	20.63	23	50
OFF6	46.42	48	106
OFF7	23.05	22	48
OFF8	7.67	9	20
OFF9A	8.28	9	19
OFF9B	5.77	6	14
OFF10A	39.19	23	62
OFF10B	4.68	4	10
OFF10C	2.84	2	5
OFF11	17.96	22	45
OFF12	77.80	74	161
OFF13	39.99	20	59
OFF14A	15.30	8	23
OFF14B	3.54	2	6
OFF14C	4.61	3	8
OFF14D	63.75	47	104
OFF15A	8.74	4	12
OFF15B	16.42	8	25
CP1	-	123	255
CP1N	-	55	111
CP1E	-	68	143
CP2	-	67	142
CP2N	-	30	104
CP2S	-	38	38

CP3	-	54	167
CP4A	-	76	252
CP4B	-	29	64
CP4	-	99	314
CP5A	-	104	322
CP5	-	109	329
CP6	-	81	173
CP6N	-	32	69
CP6S	-	48	104
CP7	-	90	213
CP8	-	132	391
CP9A	-	108	271
CP9	-	239	659
CP10	-	295	790
CP11	-	303	819

(2) See Figure 5.2

The Small Basin Model provides flows where drop inlets may be needed. However, the total flow at each concentration point increases slightly. This phenomena is an inherit problem with HEC-1. In other words, if a model used to size inlets was applied for main line design, the resulting system would be unreasonably large and costly. The main line storm drain should be sized based on the Big Basin Model as stated above.

Section 6
Hydraulic Analysis

This section describes the methodology of the preliminary hydraulic analysis and presents the results of preliminary facility sizing.

6.1 Hydraulic Criteria

The hydraulic analysis and hydraulic criteria are in accordance with the CCRFCD's Hydrologic Criteria and Drainage Design Manual.

In this preliminary study, all drop inlets are assumed to be Type D inlet with same length of grate and curb opening. All drop inlets are assumed to be 20 ft long. The interception rate is estimated at 2 cfs per foot, per City of Las Vegas. Using a 50% clogging factor, the effective length is about 13 ft (per CCRFCD, the effective length is two thirds (2/3) of the total length). Detailed designs and calculations for drop inlets and laterals will be provided in the 70% design.

Hydraulic calculations for storm drain system were performed using the Windows version of computer program Water Surface Pressure Gradient (WSPG). The reader is referred to **Appendix G** – Hydraulic Calculations for further details on the full development of the onsite storm drain system.

Drainage systems for Clark County arterial and collector roadways consist of major and minor systems. Minor systems consist mainly of inlets and storm drain networks designed for the 10-year storm event. Major systems are designed for the 100-year storm event and include regional flood control facilities, natural washes, streets, and storm drain networks and inlets designed to intercept the 100-year storm runoff.

CCRFCD criteria for the storm water carrying capacity of an 80-ft and wider arterial, such as Oakey Boulevard, is as follows:

Minor Storm (10-year event):

- Maintain a 12 ft dry lane in each direction.
- The depth of flow at intersections with other streets with right-of-way widths greater than or equal to 80 ft shall be curb height or less.
- The product of the flow depth (ft) in the gutter flow line times the average velocity (fps) shall be less or equal to 6. ($D_{10} \times V_{avg\ 10} \leq 6$)

Major Storm (100-year event):

- The product of the flow depth (ft) in the gutter flow line times the average velocity (fps) shall be less or equal to 8. (D_{100} x $V_{avg\ 100} \leq 8$)
- The depth of flow (ft) in the gutter flow line shall be less than or equal to 2 ft. ($D_{100} \leq 2$)
- The transverse street flow on through traffic streets shall be at a depth less than or equal to 1 ft and a depth time velocity less that or equal to 8.

In addition to the above street capacity, the following hydraulic criteria are also used to design the facilities for pavement drainage:

- A 50% clogging factor will be used for all drop inlets per City of Las Vegas design criteria.
- The minimum slope for the storm drain is 0.25 percent.
- The minimum diameter for storm drain laterals shall be 18 inches.
- The minimum box for storm drain shall be 5-feet by 5-feet.
- The Hydraulic Grade Line (HGL) for storm drain will be a minimum of 1.5 feet below grade.

Hydraulic calculations for street flows were performed using the Haestad Methods FlowMaster computer software.

6.2 Street Flow Capacity and Proposed Drop Inlets

The carrying capacity of a street section is determined by both the CCRFCD criteria as stated in Section 6.1 and the street geometry such as longitudinal slope, cross slope, as well as the surface roughness. Where flows exceed the street capacity, the excessive flow will drain to the storm drain through drop inlets and lateral pipes. Street flow capacity along Oakey Boulevard from Cahlan to Birch was evaluated at each concentration point. Table 6.1 below summarizes the results of street flow capacity calculations. See **Appendix G** for cross section locations and hydraulic calculations using FlowMaster.

Seven street cross sections are evaluated along Oakey and one on Rancho south of the intersection. Section 1-1 illustrates the geometry and hydraulics of Oakey Boulevard just west of Cahlan Drive. Oakey Boulevard has a right-of-way of 80 feet. The roadway width from curb to curb is 68 feet. The roadway is crowned with a cross slope of 2%. There are two travel lanes in each direction. No median or let turn lane exists within this section of Oakey Boulevard. To have a 12 ft dry lane in each direction the flow depth should not exceed 0.53 ft. The longitudinal slope of Oakey Boulevard at Cahlan is approximately 1.2%. The Manning's roughness coefficient for pavement will be equal to 0.016. Using FlowMaster, the street capacity at depth 0.53 ft is 32.7 cfs. Considering flow mainly comes from the south side of the street, the half street capacity is 16.3 cfs. The criteria also require that for 10-year flow the product of flow depth and velocity be less or equal to 6 ($V \times D \leq 6$). In addition, the depth of flow should not exceed the curb height (0.50 ft) at major intersections (ROW width greater than or equal to 80 ft). Table

6.1 shows the value of V×D is1.8 at the above capacity. The street flow capacity for 100-year flow is also more governed by the product of flow depth and velocity than other factors. The design criteria require the product of depth and velocity less than or equal to 8 for the 100-year flow. Using FlowMaster, when the flow in the street is 373 cfs, the flow depth and velocity are1.09 ft and 7.37 fps, respectively, and the value of V×D is 8.0. Therefore, the capacity of Oakey Boulevard at Cahlan for 100-year storm is 373 cfs. Similarly, capacities at other locations can be calculated. The results are summarized in Table 6.1. It should be noted that at Rancho intersection, a major intersection, the flow depth in both streets (Sections 5-5, 6-6 and 7-7) should be less than or equal to 0.50 ft for 10-year storm and 1.00 ft for 100-year storm.

The 10- and 100-year flows to Oakey at Cahlan are 113 cfs and 334 cfs, respectively. The 100-year flow is less than the street capacity. The 10-year flow exceeds the street capacity. Therefore, the street has the capacity to convey the 100-year storm, but can not maintain a dry lane during a 10-year storm at this location. Therefore, drop inlets are needed at Cahlan to intercept the flow and drain to the proposed storm drain. As stated in Section 6.1, all drop inlets are assumed to be Type D inlet with same length of grate and curb opening. All drop inlets are assumed to be 20 ft long. The interception rate is estimated at 2 cfs per foot. Using a 50% clogging factor, the effective length is about 13 ft (per CCRFCD, the effective length is two thirds (2/3) of the total length). The interception by each inlet is then 26 cfs. Four drop inlets are proposed with two on each side of the street. The total interception capacity of four inlets is estimated to be 104 cfs. During a 100-year storm, some bypass flow will be conveyed by the street to the next interception. 36" RCP's are proposed for the laterals. The full flow capacity of a 36" RCP at slope 1.0% is 66.7 cfs (see FlowMaster calculations included in **Appendix G**). Detailed designs and calculations for drop inlets and laterals will be provided in the 70% design.

The 10- and 100-year flows from Subbasin OFF10A are 23 cfs and 62 cfs, respectively. This flow will drain to Oakey Boulevard from Strong Drive. Oakey Boulevard at Strong Drive is comparatively flat with a longitudinal slope of 0.8%. Using FlowMaster, the half street capacity at depth 0.53 ft is 13.3 cfs. Two drop inlets are proposed in Strong Drive just north of Oakey Boulevard with one on each side of the street. The total interception capacity of two inlets is estimated to be 52 cfs.

Flow to Oakey Boulevard from Villa De Conde Way should also be intercepted before reaching Oakey. The 10- and 100-year flows from Villa De Conde Way (CP 9A) are 108 cfs and 271 cfs, respectively. The longitudinal slope of Oakey Boulevard at Villa De Conde Way is approximately 1.3%. Using FlowMaster, the half street capacity at depth 0.53 ft is 34.0 cfs. Four drop inlets are proposed in Strong Drive just south of Oakey Boulevard with two on each side of the street. The total estimated interception capacity of the two inlets is estimated to be 104 cfs. Two 48" RCP laterals are proposed to convey the flows intercepted by the drop inlets to the main storm drain. The full flow capacity of a 48"RCP at slope 1.0% is 143.6 cfs (See FlowMaster calculations included in **Appendix G**).

Table 6.1 Street Capacity

Cross-Section*	Station	Slope (%)	10-Year Flow Capacity (One Dry Lane)					100-Year Flow Capacity (VxD≤8)			
			Depth D(ft)	Velocity V(fps)	D×V	Discharge (Half Steet) (cfs)	Discharge (Full Street) (cfs)	Depth D(ft)	Velocity V(fps)	D×V	Discharge (cfs)
1-1	38+50	1.2	0.53	3.45	1.8	16.3	32.7	1.09	7.37	8.0	373
2-2	40+50	1.2	0.53	3.45	1.8	16.3	32.7	1.09	7.37	8.0	373
3-3	48+50	0.8	0.53	2.82	1.5	13.3	26.7	1.19	6.68	8.0	396
4-4	52+00	1.3	0.53	3.59	1.9	17.0	34.0	1.07	7.51	8.0	368
5-5	56+75	1.5	0.50	3.87	1.9	15.8	31.6	1.00	7.50	7.5	328
6-6	58+50	0.6	0.50	2.45	1.2	10.0	20.0	1.00	4.74	4.7	207
7-7	9+00**	0.9	0.50	3.00	1.5	12.2	24.4	1.00	5.81	5.8	254
8-8	69+50	0.6	0.53	2.44	1.3	11.6	23.1	1.29	6.21	8.0	416

*See Cross Section Location Map in Appendix G
** Rancho Station

Two drop inlets are proposed in Oakey Boulevard just west of Rancho intersection with one on each side of the street. These two inlets will intercept the bypass flows from upstream drop inlets and the small flows from Subbasin 14B and Subbasin 14C. The total interception capacity of two inlets is estimated to be 52 cfs.

Subbasin OFF14A will drain to Oakey Boulevard from north through Rancho Drive. The 10- and 100-year flows from Subbasin OFF14A are 8 cfs and 23 cfs, respectively. A drop inlet is proposed on the west side of Rancho Drive just north of the intersection. The estimated interception capacity of one inlet is 26 cfs.

Subbasin OFF14D will drain to Oakey Boulevard from south through Rancho Drive. The 10- and 100-year flows from Subbasin OFF14D are 47 cfs and 104 cfs, respectively. Four drop inlets are proposed in Rancho Drive just south of Oakey Boulevard with two on each side of the street. The total estimated interception capacity of the four inlets is estimated to be 104 cfs. Two 48" RCP laterals are proposed to convey the flows intercepted by the drop inlets to the main storm drain. The full flow capacity of a 48"RCP at slope 1% is 66.7 cfs as stated above.

Subbasin OFF15 will drain to Oakey Boulevard east of Rancho intersection. The 10- and 100-year flows from Subbasin OFF15 are 12 cfs and 37 cfs, respectively. Both flows are far below the street capacity. In addition, there are existing drop inlets before and after Birch street. Therefore, no additional inlet is proposed east of Rancho intersection.

6.3 Flow in Upstream Streets

From analysis above, it is known that Oakey Boulevard at Cahlan Avenue meets the VxD criteria for 100- year flow, but does not meet the dry lane criteria for 10-year storm. Street flow in Oakey Boulevard was evaluated further upstream. A large amount of flow drains to Oakey Boulevard from south at Campbell Drive. Oakey Boulevard is steep at Campbell intersection with a longitudinal slope of 4.03% (see Grading Plans included in Appendix K). The flows to the intersection are 99 cfs for the 10-year storm event and 317 cfs for the 100-year storm event. Section A1-A1 is located just east of Campbell (See **Appendix G** for cross section locations). Using FlowMaster computer software, the flow depth and velocity at Section A1-A1 for the 10-year storm are 0.62 ft and 6.82 fps, respectively. The product of depth and velocity is then 4.2 which meets the design criteria ($V \times D < 6$). However, the water spreads over almost the entire roadway cross section and does not meet the dry lane requirement for the 10-year flow. For the 100-year storm, the flow depth and velocity are 0.85 ft and 9.92 fps, respectively. The product of depth and velocity is 8.4. The design criteria require the product of depth and velocity less than 8 for the 100-year flow. Therefore, both 10- and 100-year flows exceeds the capacity of the street at Campbell. Flow needs to be intercepted at Campbell before drains to Oakey. The flows in Oakey before the intersection are 29 cfs for the 10-year storm event and 64 cfs for the 100-year storm event. Section A2-A2 is located just west of Campbell. Using FlowMaster computer software, the flow depth and velocity at Section A2-A2 for the 10-year storm are 0.42 ft and 5.5 fps, respectively. The product of depth and velocity is then 2.3 which meets the design criteria ($V \times D < 6$). The flow depth

and velocity at Section A2-A2 for the 100-year storm are 0.54 ft and 6.37 fps, respectively. The product of depth and velocity is then 3.4 which meets the design criteria ($V \times D < 8$).

Three other locations in the upstream watershed were also evaluated. Section B-B is located in Calle De El Cortez (Casa Grande) Avenue within the Spanish Oaks community just west of Campbell. Section C-C is located in El Cortez Avenue just east of Valley View Boulevard intersection. Section D-D is located in El Camino Avenue just west of Valley View intersection. Results of FlowMaster calculations are listed in Table 6.2. Results show that flows in these three locations meet the 100-year DxV criteria. However, the flow depth at Section D-D exceeds 1.00 ft which does not meet the design criteria (less than or equal to 1 ft at major cross street). The results also show that all 10-year flow depths exceed the curb height (0.5 ft). However, these three locations are all in small street with Right-of-Way less than 80 feet. The curb height flow depth criteria does not apply.

Table 6.2 summarizes the results of the above street evaluations. Calculations are included in Appendix G.

Table 6.2 Flow in Upstream Streets

Section*	Slope (%)	10-Year Flow				100-Year Flow			
		Discharge (cfs)	Depth D(ft)	Velocity V(fps)	D×V	Discharge (cfs)	Depth D(ft)	Velocity (fps)	D×V
A1-A1	4.03	99	0.62	6.82	4.2	314	0.85	9.92	8.4
A2-A2	4.03	29	0.42	5.50	2.3	64	0.54	6.37	3.4
B-B	3.29	76	0.59	5.98	3.5	252	0.82	9.57	7.8
C-C	1.859	54	0.58	4.45	2.6	167	0.79	6.84	5.4
D-D	0.58	123	0.86	4.27	3.7	255	1.13	5.69	6.4

*See Cross Section Location Map in Appendix G

6.4 Oakey Storm Drain

The Oakey Storm Drain is proposed to intercept and convey flows from the 10-year and 100-year design storm impacting Oakey Boulevard from Cahlan Drive to Birch Street. The proposed storm drain consists of 8-foot wide by 7-foot high reinforced concrete pipe (8′x7′ RCB) from Birch to Rancho. The box ties into the existing 10′ x 8′ at Birch through a 15-foot long transition. The proposed storm drain consists of 8′x6′ RCB from Rancho Drive to Strong Drive, and 5′x5′ RCB from Strong Drive to Cahlan Drive. The proposed facilities are shown on Figure 6.1. Details can be found on the Pre-Final plan sheets included in Appendix I.

MASON
BURTON
BRYANT
EATON
CAMPBELL
COLANTHE
GILMARY
CAHLAN
STRONG
BUEHLER
WESTLUND
LLEWELLYN
LAURIE
KARLI
EDGEWOOD
PARK
WESTWOOD
WALDMAN
CRESCENT
PINE
BIRCH
BANNIE
SILVER
FUTURE 48" RCP
5' X 5' RCB
8' X 6' RCB
8' X 7' RCB
EX. 10' X 8' RCB
OAKEY
CALLE DE EL CORTEZ
SERAFINA
VALMORA
BERNARDO
PLAZA DE ERNESTO
PLAZA DE RAFAEL
PLAZA DE MONTE
CALLE DE ESPANA
PLAZA DEL CERRO
CALLE DE LAREDO
CALLE DEL ALONDRA
PLAZA DEL GRANDE
CALLE DE NUEVO
PLAZA DE ROSA
RICHFIELD
EL CAMINO
RAMBLA
LA SOLANA
MORA
BAYO
ADRA
ZAFRA
FULANO
REALEZA
CALANDA
VILLA DE CONDE
CALLITA
TARRASO
SIDONIA
MIRAFLORES
NACO
LOURDES
ALIA
PASEO DEL PRADO
DE OSMA
EL CORTEZ
RANCHO
BONNIE BRAE
BRYN MAWR
INVERNESS
KIRKLAND
GLEN HEATHER
IVANHOE
KILTIE
LOCH LOMOND
RAMP I15 S SAHARA W
N
W
E
S
0
225
450
900
Feet
Legend
Ex. Facilities
Proposed Facilities
Future Facilities
Connection Points
Oakey Storm Drain
FIGURE 6.1
FACILITY MAP
HDR

The proposed Oakey Storm Drain segment (Facility FWOK 0020) is an extension of the existing Oakey Storm Drain segment (Facility FWOK 0000). The existing segment of Oakey Storm Drain from Birch Street to I-15 is a lateral of the I-15 Freeway Channel. The existing segment consists of a 10'x8' RCB. The proposed segment will tie into the existing segment at Birch Street. The existing storm drain starts at just west of Birch Street and goes east along Oakey Boulevard until I-15 where it ties to the I-15 Freeway Channel. Review of the hydraulic study for I-15 Freeway Channel shows that the design flow for the existing Oakey Storm Drain was 1,240 cfs. The study also indicated that the flow in this existing storm drain is in supercritical flow condition with an average depth of 6.9 feet. With the 100-year flow of 803 cfs, the normal depth is 5.0 feet and Froude Number 1.3 (see **Appendix G**). The flow in the storm drain is still supercritical flow and will not affect the flow in the proposed storm drain.

As discussed above, street flow does not meet the design criteria at Campbell. Per meeting with City of Las Vegas, the Oakey Storm Drain is recommended to be extended west to Campbell in the future.

The proposed storm drain was modeled with the WSPG program. The WSPG output is included in **Appendix G**. The 100-year peak flows from the Big Basin Model in Section 5 are used to size the storm drain. At this preliminary design, flows at each concentration point are assumed to all drain to the storm drain. This assumption is on the conservative side of design. As will be discussed below, a 48" RCP extension is assumed for the Oakey Storm Drain from Cahlan Drive to Campbell Drive. A flow of 150 cfs is assumed to be conveyed through this extension.

The HGL for 100-year storm is shown in the profile, see **Appendix I.**

6.5 Conclusions and Recommendations

Based on the above analysis, it is recommended that the Oakey Storm Drain be extended west along Oakey Boulevard to Campbell Drive to intercept flows from Campbell before reaching Oakey. A 48" RCP is proposed for this extension. The capacity of a 48" RCP at slope 1.2% is 157 cfs (see **Appendix G**). In the above WSPG calculations, a150 cfs was assumed to be conveyed to Cahlan through the 48" RCP. A 20" long 48" RCP stub out is proposed with the design. Before the 48" RCP is constructed, the Oakey Storm Drain system will not work the proposed way. In addition, flows in most portion of the 5'x5' RCB segment from Cahlan to Strong is open flow. Box size may be further reduced. However, City of Las Vegas requires a minimum size of 5'x5' for box. Any size smaller should use RCP. The storm system will be further refined in 70% design.

Section 8
Preliminary Design

This section describes the project design criteria, recommended alignment, preliminary design and a list of anticipated construction drawings and specification sections.

8.1 Design Criteria

The storm drain design is based on CCRFCD criteria specified in HCDDM Section 800. Design criteria include:

- Conveyance of the 100 year flow
- Minimum cover over storm sewer of 18 " from the top of pavement (modified)
- Minimum Slope of 0.25 percent
- Maximum velocity of 25 fps
- Minimum velocity of 3 fps
- Manning's "n" value of 0.013 for RCB and RCP
- Sizing & Spacing of inlets based upon interception rate of 50 percent
- Maximum manhole spacing of 400 feet

8.2 Alignment Discussion

The proposed storm sewer will tie into the existing 10' x 8' reinforced concrete box. This is located 1.5 meters (approx. 5 feet) south of the centerline of Oakey Boulevard.

The main issue governing the alignment of the proposed storm sewer is the location of various utilities. The alignment will be located such that there is minimal relocation/disruption of existing utilities.

The best fit for the alignment is between two sanitary sewer lines on Oakey Boulevard. The first sanitary sewer line varies from 27 inch diameter pipe at Cahlan Drive to 48" diameter pipe at birch street. This sanitary sewer line is located approximately 15 feet north of the centerline of the roadway between stations 39+00 and 49+00. Then the pipe centerline transitions from a distance of 15 feet to five feet from the centerline of the roadway, between stations 49+00 to 51+50. From station 51+50 to the end of the project the distance between the centerline of the roadway and the pipe is approximately 5 feet. .

The second sewer line varies from 12" diameter at Cahlan drive to 10" at Birch Street. The centerline of this pipe is approximately 9.5 feet south of the centerline of the roadway. The space between these two sewer line gives the widest opening along the entire stretch of the project, to place the proposed storm sewer.

Other alignment locations were considered, One is located north of the 27"/30"/48" sanitary sewer line. The other one is south of the 12"/10" sanitary sewer line. Both of these were rejected, since both alignments do not satisfy the minimum horizontal clearance criteria for waterlines and sewers. Minimum horizontal clearance between water line and sewer is five feet, per Las Vegas Valley Water District, Uniform Design and Construction Standards (UDACS).

During the preliminary design phase, numerous tasks have been undertaken to facilitate the project design. These tasks include:

- Project Control Surveys
- Aerial Mapping of project limits with 1-foot contours
- Field surveyed topographic data
- Obtained/Requested utility information from several sources
- Conducted field visits to review existing conditions along Project alignment
- Prepared project base maps with survey and utilities information\
- Initiated preliminary hydrologic and hydraulic analysis of storm drain system
- Prepared a preliminary plan and profile for the storm drain size and alignment
- Initiated potholing of existing utilities

Based on the work completed on the project to date for the PDR, no issues were discovered that would disqualify the selected alignment and require changes. Based on the number of existing utilities within the project limits, any alignment would require relocations/adjustments of utilities. A preliminary set of potholing has been completed and the results are included in **Appendix L.** Utility conflicts and potential relocations/adjustments will be analyzed in greater detail for the future submittals after receipt and analysis of additional utility potholing data and analysis of information obtained from all the utility companies.

8.3 Preliminary Design

The preliminary design plans are included in **Appendix I.**

8.4 Construction Drawing Sheets

The following lists the anticipated sheets for the project:

Sheet No.	Sheet Description
1	Cover Sheet
2-3	General Notes, Sheet Index & Legend
4-7	Horizontal Control Plan

8-8	Typical Sections/Trench Detail
9-14	Storm Sewer Plan and Profile sheets
15-18	Lateral Profiles
19-25	Drainage Details
26-31	Utility Plans
31-37	Relocation Sheets
38-41	Miscellaneous Sheets

8.5 Supplemental General Conditions and Technical Specifications

The anticipated Project Special Provisions will include the following technical sections, with appropriate project-specific modifications, from the *Clark County Uniform Standard Specifications for Public Works Construction for Off-Site Improvements.*

Specification Number	**Specification Title**
Section 201	CLEARING AND GRUBBING
Section 202	REMOVAL OF STRUCTURES AND OBSTRUCTIONS
Section 603	REINFORCED CONCRETE PIPE, C.I.P AND PRE-CAST REINFORCED CONCRETE BOX SECTIONS
Section 609	CATCH BASINS, MANHOLES AND INLETS
Section 613	CONCRETE CURB, WALK, GUTTERS, DRIVEWAYS AND ALLEY INTERSECTIONS
Section 624	ACCOMMODATIONS FOR PUBLIC TRAFFIC
Section 625	CONSTRUCTION SIGNS
Section 626	FINAL CLEANUP
Section 627	PERMANENT SIGNS
Section 628	PAINTING TRAFFIC STRIPING, PAVEMENT MARKINGS AND CURB MARKINGS
Section 629	WATER DISTRIBUTION FACILITIES
Section 630	SANITARY SEWERS
Section 631	STREET NAME SIGNS
Section 633	PAVEMENT MARKERS
Section 634	TEMPORARY PAVEMENT STRIPING TAPE
Section 637	POLLUTION CONTROL

Section 9
Opinion of Probable Construction Cost

9.1 Construction Cost

This section provides the project construction cost estimate at the 30% completion level. The construction cost estimate is based on the best available information from the preliminary plans and historical construction cost information. The quantities for the major storm drain system and street rehabilitation are based on the preliminary plan quantities. Estimated quantities for connecting side drains, local inlets, utility adjustments, and other related construction work items are based on engineering judgment. As the project proceeds through the design process, the estimated construction cost will be refined through better site condition information and more detailed design.

Table 9-1 Construction Cost Estimate of the Oakey Storm Drain at the 30% Completion Level

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
200.01	Mobilization and Demobilization (approx. 6%)	1	L.S.	$500,000	$500,000
202.01	Remove Sidewalk	1,000	S.F.	$4.00	$4,000
202.02	Remove Curb and Gutter	1,000	L.F.	$5.00	$5,000
502.01	5' X 5' RCB	900	L.F.	$900.00	$810,000
502.02	8' X 6' RCB	850	L.F.	$1,100.00	$935,000
502.03	8' X 7' RCB	1,250	L.F.	$1,200.00	$1,500,000
603.01	24" RCP	240	L.F.	$135.00	$32,400
603.02	36" RCP	640	L.F.	$195.00	$124,800
603.02	48" RCP	340	L.F.	$200.00	$68,000
609.02	Type "CM" Drop Inlet (L = 20-Feet)	17	EA	$17,000.00	$289,000
613.01	Type "L" Curb and Gutter	1,000	L.F.	$15.00	$15,000
613.02	Concrete Sidewalk	1,000	S.F.	$5.00	$5,000
624.01	Traffic Control and Maintenance	1	L.S.	$250,000.00	$250,000
628.01	Type I Film "ONLY"	5	EA	$200.00	$1,000
628.02	Type I Film (ARROW)	12	EA	$190.00	$2,280
628.03	Type II Film for Crosswalks and Stop Bars	640	S.F.	$4.00	$2,560
628.04	Type II Film for Forced Right Turn Lane (8-Inch)	1,000	L.F.	$3.00	$3,000
628.05	White Painted Pavement Marking (4-Inch)	3,000	L.F.	$0.25	$750
629.01	Adjust Water Valve Box to Final Grade	10	EA	$600.00	$6,000
629.02	Relocate Water Meter	1	L.S.	$10,000.00	$10,000
630.01	Adjust Sanitary Sewer Manhole Grade Rings to Final Grade	20	EA	$900.00	$18,000
633.01	Non-Reflective Pavement Markers	1,500	EA	$2.00	$3,000
633.02	Reflective Pavement Markers	500	EA	$3.00	$1,500
	Utility Relocations - 2" Gas	1,150	L.F.	$20.00	$23,000
	Utility Relocations - Water Service lines	3,000	LF	$20.00	$60,000

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	Utility Relocations - 6" Sanitary Sewer	860	L.F.	$50.00	$43,000
	Utility Relocations - 8" Sanitary Sewer	1,950	L.F.	$60.00	$117,000
	Utility Relocations - 10" Sanitary Sewer	1,420	L.F.	$80.00	$113,600
	Utility Relocations - 12" Sanitary Sewer	900	L.F.	$100.00	$90,000
	Utility Relocations - Sanitary Sewer Manhole	23	EA	$4,000.00	$92,000
	Utility Relocations - Sanitary Sewer Laterals	5,000	LF	$50.00	$250,000
637.01	Temporary Dust Control	1	L.S.	$25,000.00	$25,000
637.03	Dewatering	1	L.S.	$1,500,000.00	$1,500,000
				SUBTOTAL:	$6,899,890
		15% CONTINGENCY:			$1,034,984
				TOTAL:	$7,934,874

ASSUMPTIONS:
The cost of RCB and RCP is all inclusive (Excavation, Backfill, Vertical trench support, Concrete, steel etc. and includes full depth pavement replacement over the storm drain and utility relocation trenches.)
Utility relocations are based on the location of the drainage structure 5 feet south of the roadway centerline.
Water Service Line relocation - 50 at 60 feet apiece
Sanitary Lines (Lateral) adjustments - 50 at 100 feet
Electrical and Cable relocations, if any, are assumed to be performed by the respective utilities

Section 10
Permits

10.1 State/Local Permit Matrix

It is anticipated that several permits are required during the design and construction phase for the project. Table 10-1 below shows the anticipated permits required.

Table 10-1 Oakey Storm Drain – State/Local Permit Matrix

ISSUING AGENCY/CONTACT:	PERMIT:	REGULATED ACTIVITY	PROJECT PHASE COORDINATION	RESPONSIBILITY	FEE ($)	STATUS & REMARKS
City of Las Vegas Dept of Public Works 420 North 4th Street Las Vegas, Nevada 89101 Valerie Flock Ph: (702) 229-6740	Construction: Excavation and Grading Permits Traffic Barricade Plan Approval	On-Site Grading Work within City Right-of-Way Site Disturbance	Construction Phase Contractor will prepare a project description outlining areas of possible impact	Contractor	Percentage of construction costs to be determined at 90% Design Phase	Contractor will submit traffic barricade plans prior to approval of the permit
Clark County Health District Air Pollution Enforcement 625 Shadow Lane PO Box 4426 Las Vegas, Nevada 89127 Ph: (702) 385-1291 Fax: (702) 383-1433	Dust Control Permit	Required for any construction activity to limit particulate (PM10) pollution	Construction Phase Contractor will prepare and submit upon issuance of the Notice to Proceed, the permit application	Contractor	$28 per acre of disturbance	
	Various Location Permit	Operation of standby electrical generator	Owner of the facility or contractor shall provide a description of impacting activities	Contractor	$236 application fee	
	Sand & Gravel Processing Permit	Materials processing plant	Construction Phase Contractor will prepare a project description outlining areas of possible impact	Contractor	$157 application fee + # of emmision units x $112, + # of tons of emmision x $28, + annual fee depending on size of units	

ISSUING AGENCY/CONTACT:	PERMIT:	REGULATED ACTIVITY	PROJECT PHASE COORDINATION	RESPONSIBILITY	FEE ($)	STATUS & REMARKS
State of Nevada Division of Enviromental Protection, Bureau of Water Pollution Control 333 West Nye Lane Carson City, Nevada 89710 Ph: (775) 687-5875	Construction Site NPDES General Stormwater Permit and Pollution Prevention Plan (Storm Water temporary Discharge Permit)	Required for any construction site disturbance exceeding 5 acres	Construction Phase	Contractor	$250 application fee	Contractor to agree to permit terms
State of NevadaDivision of Water Resources555 E. Washington AvenueSuite 4200Las Vegas, Nevada 89101Ph: (702) 486-2770Fax: (702) 486-2781	Waiver for Dewatering Wells, Monitoring Wells, and/or Test Wells	Groundwater	Construction Phase	Contractor	Undetermined at this time	
State of Nevada Division of Transportation 123 E. Washington Avenue Las Vegas, Nevada 89125 Herbert Champion Ph: (702) 385-6509	ROW Encroachment Permit Traffic Barricade Plan (SR 589)-Sahara Avenue (SR 159)-Charleston Blvd.	Construction activities within NDOT Right-of-Way	90% Design HDR will prepare documantation and perform filed investigations for the permit. Application and Professional Engineer-signed and stamed design drawings will be submitted at the 100% Design Phase	HDR	$200 application fee	NDOT requires final drawings for review

Section 11
Constructability

11.1 Constructability Issues

This section discusses issues regarding construction of the storm drain system along Oakey Boulevard. The project alignment is located in an established residential neighborhood. The project corridor crosses one major street with high traffic volumes, Rancho Drive. The project corridor contains several water, sanitary sewer, gas and other underground and overhead utility lines. All the utility lines that have been researched to date are listed in Section 3 of the PDR.

The following issues regarding constructability have been preliminarily reviewed,

- Traffic control for through traffic and access to local residences
- Excavation and trenching requirements along the project corridor due to variable soil, water table and depth of construction
- Protection of existing utilities, temporary adjustments and maintenance of utilities for adjacent residences along the corridor.
- Relocation and permanent adjustment of existing utilities in conflict with the new storm drain system
- Public protection from the construction work zone
- Site access and staging areas for construction
- Providing environmental and safety precautions during construction
- Reducing public inconvenience during construction
- Providing temporary and permanent easements as required

A detailed geotechnical analysis has been conducted along the project alignment. The detailed report will provide soil borings and groundwater investigations to define the existing soil classifications and groundwater conditions to depths below the required trench excavation at intervals along the project alignment. This information will assist the construction contractor to evaluate the methods to accomplish the required trench excavation and backfill for storm drain installation. A draft preliminary geotechnical report is included in **Appendix E.** Oakey storm drain dewatering evaluation is also being conducted.

The following construction management items are proposed for future design consideration:

- Construction work through most of the intersections to be performed at night or by means of continuous work through a weekend for each intersection

  Major Intersection:
  Oakey Boulevard and Rancho Drive

Minor Intersections:
Oakey Boulevard and Cahlan Drive
Oakey Boulevard and Rambla Court
Oakey Boulevard and Strong Drive
Oakey Boulevard and Ville De Condi Way
Oakey Boulevard and Bryn Mawr Avenue
Oakey Boulevard and Birch Street

- Pre-cast reinforced concrete box sections will be used except for transition structures

- Project specifications will require the construction contractor to produce a Traffic Maintenance Plan prepared and sealed by a Nevada Professional Engineer for review and acceptance by the City prior to each construction phase to maintain acceptable traffic control throughout project work.

- Project specifications will specify the general requirements for traffic control and maintenance of access to adjacent homes and businesses. Street and lane closure limitations shall establish the space and time limitation for closure of specific work areas.

The discussion is conducted in segments:

Cahlan Drive to Rancho Drive:

The project includes a 20 foot stub out for a 48" RCP at the beginning of the project. A 5' x 5' RCB follows the 48" RCP for 900 feet. The 5' x 5' RCB transitions into an 8' x 6' RCB for the next 850 feet. The transition structure is 10 feet long. All these storm drains are located five feet south of Oakey Boulevard centerline. This alignment requires the relocation of 8"/12" sanitary sewer line located south of the roadway centerline.

The 8' x 6' RCB transitions into an 8' x 7' RCB approximately 170 feet west of the intersection of Oakey Boulevard and Rancho Drive. The transition length is 10 feet.

Further, twelve 20 foot wide curb inlets including four grate inlets in the gutter are proposed. Once the location of the lateral storm drain pipes are finalized the points of utility conflicts will be defined.

Intersection of Rambla Court and Oakey Boulevard:

The 8" sanitary sewer along Oakey will be relocated approximately five feet south of its current location. This will require the 8" sanitary sewer along Rambla Court to be shortened in length and a new manhole will also be required at the intersection of these two sanitary sewer lines a few feet south of the current location.

The 2" gas line along Rambla Court is to remain in place during construction.

Intersection of Strong Drive and Oakey Boulevard:

The 8" sanitary sewer along Oakey will be relocated approximately five feet south of its current location. This will require the 8" sanitary sewer line along Strong Drive to be lengthened and a new manhole will also be required at the intersection of these two sanitary sewer lines a few feet south of the current location.

The 8" waterline along Strong Drive is to remain in place during construction.

Intersection of Oakey Boulevard and Rancho Drive:

Five 20 foot wide curb inlets including four grate inlets in the gutter are proposed. The project alignment through the intersection has utility conflicts with two 8" water lines and a 10" sanitary sewer line. The lateral storm drain pipes will conflict with these utilities. The waterlines along Oakey and Rancho will remain in place during construction of lateral pipes. The 4" gas line along Rancho will be relocated.

A sanitary sewer junction structure is present at the intersection and its exact location is unknown at this point. This has the potential to impact the proposed alignment. Additional information through research and/or survey is required to accurately locate this structure. Relocating the proposed storm drain alignment further south from its current locations violates the horizontal clearance requirement for the 18" waterline located south of the proposed storm drain alignment. An exception from LVVWD will be required along with relocation and encasement of waterline, if the LVVWD criteria for horizontal clearance between sewer and waterline is not met.

Intersection of Bryn Mawr Avenue and Oakey Boulevard:

The 10" sanitary sewer along Oakey will be relocated a feet south of its current location. This will require the 8" sanitary sewer line along Bryn Mawr Avenue to be shortened and a new manhole will also be required at the intersection of these two sanitary sewer lines a few feet south of the current location.

The 8" waterline along Bryn Mawr Avenue is to remain in place during construction.

Rancho Drive to Birch Street:

This segment includes an 8' x 7' RCB storm drain located five feet south of Oakey Boulevard centerline. The length of the 8' x 7' RCB is 1250 feet. The 8' x 7' RCB transitions into the existing 10' x 8' RCB approximately 60 feet west of the intersection of Oakey Boulevard and Birch Street. The transition length is 15 feet.

This alignment requires the relocation of a 10" sanitary sewer line located south of the roadway centerline. The 4 "/2" gas line along Oakey will be relocated.

Appendix A - Meeting Minutes

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Meeting Notes

Subject: Meeting Notes - Progress Meeting #4 DRAFT	
Client: City of Las Vegas	
Project: Oakey Storm Drain - Birch to Cahlan	Project No: (Hansen No.) 06-11273
Meeting Date: 1/11/2007	Meeting Location: Dept. of Public Works - CE Small Conf. Room
Notes by: Tom Craig	

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Attendees:

Rosa Cortez, City of Las Vegas – Design	**702-229-6264**	**rcortez@LasVegasNevada.GOV**
Peter Jackson, City of Las Vegas – Flood Control	**702-229-5266**	**pjackson@LasVegasNevada.GOV**
Tim Parks, City of Las Vegas – Sewer	**702-229-2178**	**tparks@LasVegasNevada.GOV**
Todd Myers, Clark County Reg. Flood Control	**702-455-3139**	**tmyers@ccrfcd.org**
Tom Craig, HDR Engineering	**702-938-6062**	**thomas.craig@hdrinc.com**
Mark Forest, HDR Engineering	**775-337-4710**	**mark.forest@hdrinc.com**
Huagao Tan, HDR Engineering	**702-938-6062**	**huagao.tan@hdrinc.com**

Purpose of Meeting:

The purpose of the Progress Meeting was to discuss the 30% submittal comments and PDR Drainage Addendum submittal.

Introductions –

Exchange of Information - Tom Craig/HDR provided Agenda and a sign-in-sheet.

Topics of Discussion:

Sanitary/Utilities -

Tim Parks/CLV discussed 30% Sanitary/Utilities comments and requested that HDR provide a list of plans that have been received to Rosa Cortez/CLV. This would allow CLV to determine what information has been provided and what additional information is to be provided to HDR. Tom Craig/HDR indicated that the 'general' Potholing (approximately 35 locations) was done to locate utility mainlines and laterals. At such time the final drainage system alignment along with lateral locations is determined, additional potholing may be necessary. It was also indicated that letters have been sent to the majority of the Utility Agencies who have facilities within the project limits requesting additional information.

Drainage -

1. Watershed

- Tom/HDR introduced Mark Forest, HDR senior hydraulic engineer and regional director of water resources.
- The north boundary of watershed was first discussed. Peter talked about the flood complaints from the neighborhood north of Oakey between Campbell and Strong. HDR showed street flow directions from field visit. Additional drainage areas should be inluded in the watershed. . HDR showed new boundaries on the north side.
- The west boundary of watershed was discussed. The local drop inlet within the apartment complex northwest of Arville and Sahara and the storm drain to Sahara should be ignored due to its small size and capacity. More drainage areas west of Cameron should be inluded in the watershed.

- Local storm drain system along Valley View and El Camino to Sahara should be included. Full flow capacity of the storm drains should be considered for maximum flow diversion.
- Peter pointed out a drainage easement existed on the east boundary between Subbasin OFF2 and Subbasin OFF3. A portion of OFF2 may drain to OFF3.
- Peter pointed out the Apartment Complex at northeast cornor of Valley View and El Camino drains to Sahara.

2. Design Criteria

- 100-year, 6-hour storm. Product of flow depth and velocity in street less than 8.
- 10-year storm should also be included in the HEC-1 model. and one dry lane in each direction of the street should also be checked.
- Size main storm drain based on big basin HEC-1 model and drop inlets based on small basin model.

3. Drop Inlets

- CLV prefers Type DM drop inlet. Grate and curb opening should have same length, maximum 20 feet. Neenah vane grates are prefered.
- FlowMaster should be used in hydraulic calculations for drop inlets. A 50% clogging factor should be applied to drop inlets. However, it is recommended not to utilize the clogging factor in the FlowMaster Program. The ultimate design length of the drop inlet should include the additional length required to account for the 50% that is clogged; not twice of the calculated length.

4. Laterals

- 90 degrees or slightly less than 90 degree angle between lateral and main storm drain may be used.

5. Main Storm Drain

- Box size may be reduced depending upon hydraulic calculations. Box size may vary along the alignment.
- Flow in box can be pressurized. HGL should be 1.5 feet below roadway pavement.

6. Manholes

- Maximum space for manholes 400 feet.
- Use 30 inch lid for manholes.

7. Recommendation of Storm Drain Extention

- HDR should give recommendation of storm drain extension to the west of Cahlan where the street flow criteria is not met (DxV < 8). Hydrology/Hydraulics needs to be included in the Supplemental Information to the PDR. CCRFCD needs the results to support Master Plan Amendment, if required. Preliminary plan and profile of the extention are needed in the Supplemental Information to the PDR.

Comments from CLV and CCRFCD were discussed

Various comments on the PDR were made regarding Drainage. In general, the PBS&J alignment and basin map along with any HEC-1 backup material should be included. Regarding the plan and profile sheets, Hydraulic Gradelines, slopes and lengths of pipes are to be shown.

Tom Craig/HDR indicated all work was in process and that HDR Hydrology/Hydraulics engineers were in contact with PBS&J and all information would be shown as requested.

Roadway -

It was stressed by Rosa Cortez/CLV that the only paving to be done with this project is patching of pavement removed for the drainage trunkline and laterals.

Geotechnical –

Rosa Cortez/CLV enquired as to when the Geotechnical subconsultant would be submitting a Draft Memorandum pertaining to Dewatering within the project limits. In addition, the following concerns were expressed regarding dewatering and recommendation expected within the report.

Environmental concerns – is ground water contaminated or not and how will it be removed from the site.

RCB or RCP – would joints be sealed or would infiltration of ground water be allowed. Peter Jackson/CLV expressed a preference of having the joints sealed.

Buoyancy of the RCB or RCP – recommendations to prevent the facilities from floating or moving.

Loss of fines under and around RCB or RCP – provisions to prevent this from happening must be made if this is deemed and issue.

Tom Craig/HDR indicated that he would check status on the memorandum and would pass along the above concerns and direct the Geotech subconsultant to make recommendation as necessary.

Action Items:

- HDR to provide a list of utility plans to Rosa Cortez/CLV that have been received.
- CLV to review provided utility plan list and provide additional plans as necessary.
- HDR to make appropriate revisions as discussed above to the Supplemental Information to the PDR and supporting data.
- HDR to submit Supplemental Information to the PDR on January 29, 2007.

Pending Items:

- Valerie Flock/CLV – to verify Permitting with NDOT for work at Rancho/Oakey intersection. – An Encroachment Permit is not required for the Rancho/Oakey intersection.
- Valerie Flock/CLV – to verify that wherever we are proposing improvements on Rancho is not in NDOT ROW. – Rancho Drive at Oakey Boulevard is not maintained by NDOT.
- Rob Welch/CLV – will be requesting a change to the Ten Year Plan to change construction date to 2007/2008 – Rob will maintain the original Ten-Year Plan construction date of 2008/2009.

Appendix D - List of Plans Reviewed

Location	Type	Year	Project Name	Engineer	Sheet No.	CLV Sheet No.
Oakey and Orangewood (Rancho)	w	1955	Oakey Boulevard Feeder	Montgomery Engineers of Nevada	J-4 of 28	
Oakey and Ivanhoe	w	1964	Glen Heather Estates	Kraemer Engineering Company	1	
Oakey and Rancho	w	1965	St.Louis - Campbell Transmission Main	Montgomery Engineers of Nevada	8 of 16	
Oakey and Wyoming	w	1965	St.Louis - Campbell Transmission Main	Montgomery Engineers of Nevada	7 of 16	
Oakey and Campbell	ss	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	9 of 65	307-V563
Oakey and Bronken	ss	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	8 of 65	307-V563
Oakey and Cahlan	ss	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	7 of 65	307-V563
Oakey and Strong	ss	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	6 of 65	307-V563
Oakey and Rancho	ss	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	5 of 65	307-V563
Oakey and Birch	ss	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	4 of 65	307-V563
Oakey and Birch	u	1999	I-15 Freeway Channel - Utility Relocation	Parsons Brinckerhoff	C-1	327-V254
Oakey and Birch	sd	1999	I-15 Freeway Channel - Construction Plan and Profile	Parsons Brinckerhoff	U-3	327-V254
Oakey and Birch	w	2002	Oakey Boulevard Main Extension	Las Vegas Valley Water District	C-676	
Clark County	w	2002	Las Vegas Valley Flood Control Master Plan Update	PBS&J, G.C.Wallace, Louis Berger Group	H-12, F-12	
Oakey and Campbell	r	2003	Oakey Boulevard Overlay Plan	Harris & Associates	C-4	
Oakey and Cahlan	r	2003	Oakey Boulevard Overlay Plan	Harris & Associates	C-5	
Oakey Boulevard	d	2003	Oakey Boulevard Overlay Plan - Construction Details	Harris & Associates	C-6	
Oakey and Rancho	r	2004	Rancho Drive: Sahara Av to Charleston Blvd Improvement Plan	City of Las Vegas	4 OF 12	
Oakey and Rancho	r	2004	Rancho Drive: Sahara Av to Charleston Blvd Traffic Delineation	City of Las Vegas	7 OF 12	
Oakey and Rancho	r	2004	Rancho Drive: Sahara Av to Charleston Blvd Interconnect	City of Las Vegas	10 OF 12	
Oakey and Rancho	d	2004	Rancho Drive: Sahara Av to Charleston Blvd Interconnect Details	City of Las Vegas	12 OF 12	
Oakey and Rancho	w	2005	162-04-SW	Las Vegas Valley Water District	162-04-SW	
Oakey and Rancho	w	2005	162-04-NW	Las Vegas Valley Water District	162-04-NW	
Oakey and Rancho	w	2005	162-04-SE	Las Vegas Valley Water District	162-04-SE	
Oakey and Rancho	w	2005	162-04-NE	Las Vegas Valley Water District	162-04-NE	
Central Neighborhood	w	2005	Flood Control Master Plan Vol. II	PBS&J	E-15, F-15,	
Las Solano Way	SS	1977	Rancho Bonito Estates - Unit No. 1	VTN	9 of 13	307y-2555-1
Oakey Boulevard Trunk	SS					307-v185
Rancho/Benito Relief Sewer	SS	1990	Rancho/Benito Relief Sewer	Alpha Engineering		307-V664
Oakey and Rancho	SS	1990	Rancho/Benito Relief Sewer	Alpha Engineering	2 of 3	
Oakey	SS	1954	Sewers Glen Heather Estates Subdivision 1	Karsten Bronken, Consulting Engineer		307y-1540-1
Oakey and Gilmary	SS	1962	McNeil Estates Unit No. 2 Sewer Plan and Profile	Western Engineers	2 of 2	307y-2095-2
Colantyhe Avenue	SS	1962	McNeil Estates Unit No. 2 Sewer Plan and Profile	Western Engineers	1 or 1	307y-2095-1
Oakey Blvd and Villa de Conde	SS	1978	Rancho Bonito Estates - Unit 2 Master Sewer Plan	VTN	7 or 11	307-2555-2
Adra Ct and Zafra Court	SS	1978	Rancho Bonito Estates - Unit 2 Sewer Plan and Profile	VTN	9 of 11	307y-2555-2
Oakey and Rambla	SS	1977	Rancho Bonito Estates - Unit No. 1 Sewer Plan and Profile	VTN	8 of 13	307Y-2555-1
Mora Lane and offsite	SS	1977	Rancho Bonito Estates - Unit 1	VTN	10 of 13	307y-2555-1
Mora Lane and offsite	SS	1977	Rancho Bonito Estates - Unit 1	VTN	10 of 13	307y-2555-1
Mora Lane and Bayo Court	SS	1977	Rancho Bonito Estates - Unit No. 1 Sewer Plan and Profile	VTN	4 of 13	307y-2555-1
Westwood Village Sewer & Water Details	SS	1963	Westwood Village Sewer & Water Details Tract 2	Beam, Inc.	11 of 13	307y-3330-2
Oakey and Westwood	SS	1979	Sahara - Oakey Sewer Interceptor	G.C.Wallace	3 of 65	307-v563
Oakey and Westwood	SS	1980	Sahara - Oakey Sewer Interceptor	G.C.Wallace	4 of 65	307-v563
Oakey Blvd	SS	1981	Sahara - Oakey Sewer Interceptor	G.C.Wallace	5 of 65	307-v563
Oakey Blvd	SS	1982	Sahara - Oakey Sewer Interceptor	G.C.Wallace	6 of 65	304-v563
Oakey Blvd	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	7 of 65	307-v563
Oakey Blvd	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	9 of 65	307-v563
Oakey Blvd	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	12 of 65	307-V563
Oakey Blvd	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	13 of 65	307-V563
Oakey Blvd	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	15 of 65	307-V563
Oakey Blvd	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	16 of 65	307-V563
Oakey Blvd	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	18 of 65	307-V563
Oakey Blvd	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	19 of 65	307-V563
O'Bannon	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	23 of 65	307-V563

Location	Type	Year	Project Name	Engineer	Sheet No.	CLV Sheet No.
O'Bannon	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	24 of 65	307-V563
O'Bannon	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	25 of 65	307-V563
Sahara Avenue and Torrey Pines Drive	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	29 of 65	307-v563
Sahara Avenue	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	30 of 65	307-V563
Sahara Avenue	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	31 of 65	307-V563
Sahara Avenue and Montessouri Street	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	33 of 65	307-V563
Sahara and Belcastro Street	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	34 of 65	307-V563
Sahara and Tenaya Street	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	35 of 65	307-V563
Sahara and Pioneer Way	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	36 of 65	307-V563
Sahara and Tioga Way	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	37 of 65	307-V563
Sahara and Buffalo Drive	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	38 of 65	307-V563
Sahara Avenue	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	39 of 65	307-V563
Sahara Avenue	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	40 of 65	307-V563
Sahara and Cimarron Road	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	41 of 65	307-V563
Sahara Avenue	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	42 of 65	307-V563
Durango Drive	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	44 of 65	307-V563
Durango Drive	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	45 of 65	307-V563
Durango Drive	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	46 of 65	307-V563
Durango Drive	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	47 of 65	307-V563
	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	48 of 65	307-V563
	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	49 of 65	307-V563
	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	50 of 65	307-V563
	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	51 of 65	307-V563
	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	52 of 65	307-V563
	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	53 of 65	307-V563
	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	54 of 65	307-V563
	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	55 of 65	307-V563
	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	56 of 65	307-V563
Rancho Drive and Oakey	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	58 of 65	307-V563
Rancho Drive and Cresent	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	59 of 65	307-V563
Rancho Drive and Edgewood	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	60 of 65	307-V563
Rancho Drive and Rancho Lane	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	62 of 65	307-V563
Rancho Drive and Palomino	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	63 of 65	307-V563
Rancho Drive and Alta	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	64 of 65	307-V563
Rancho Drive	SS	1977	McNeil Park - Streets and Sewers	Karsten Bronken, Consulting Engineer		307y-2100-1
Oakey and Cahlan	SS	1962	McNeil Estates Unit No. 2 Sewer Plan	Western Engineers	1 of 2	307y-2095-2
La Solana Way	SS	1976	Rancho Bonito Estates - Unit No. 2 Sewer Plan and Profile	VTN	8 of 11	307y-2555-2
Rancho Drive and Westwood	SS	1963	Westwood Village Tract 2 - Sewer Plan & Profile	Beam, Inc.	9 of 13	307y-3330-2
Westlund Drive	SS	1963	Westwood Village Tract 2 - Sewer Plan & Profile	Beam, Inc.	10 of 13	307y-3330-2
Rancho Drive and El Cortez	SS	1963	Westwood Village Tract 2 - Sewer Line Plan	Beam, Inc.	8 of 13	307y-3330-2
Oakey	SS	1999	I-15 Freeway Channel - Utility Relocation (Oakey Blvd)	Parsons Brinckerhoff	U-3	327-v254
Torrey Pines and O'Bannon	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	27 of 65	307-V563
O'Bannon Drive	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	26 of 65	307-V563
O'Bannon Drive	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	22 of 65	307-V563
O'Bannon Drive	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	21 of 65	307-V563
O'Bannon and Edmond	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	20 of 65	307-V563
Oakey and Decatur	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	17 of 65	307-V563
Oakey and Arville	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	14 of 65	307-V563
Oakey and Valley View	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	11 of 65	307-V563
Oakey and Cashman Drive	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	10 of 65	307-V563
Oakey and Devonshire Street	SS	1983	Sahara - Oakey Sewer Interceptor	G.C.Wallace	8 of 65	307-V563

Type: d-details, r-roadway, sd-storm drain, ss-sewer, w - water, u- utility

Appendix F

Hydrology

Precipitation Information

Soils Map

Curve Numbers (CN's)

Flow Split (Valley View and El Camino)

Capacity of Valley View Storm Drain

HEC-1 Models

PRECIPITATION INFORMATION

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

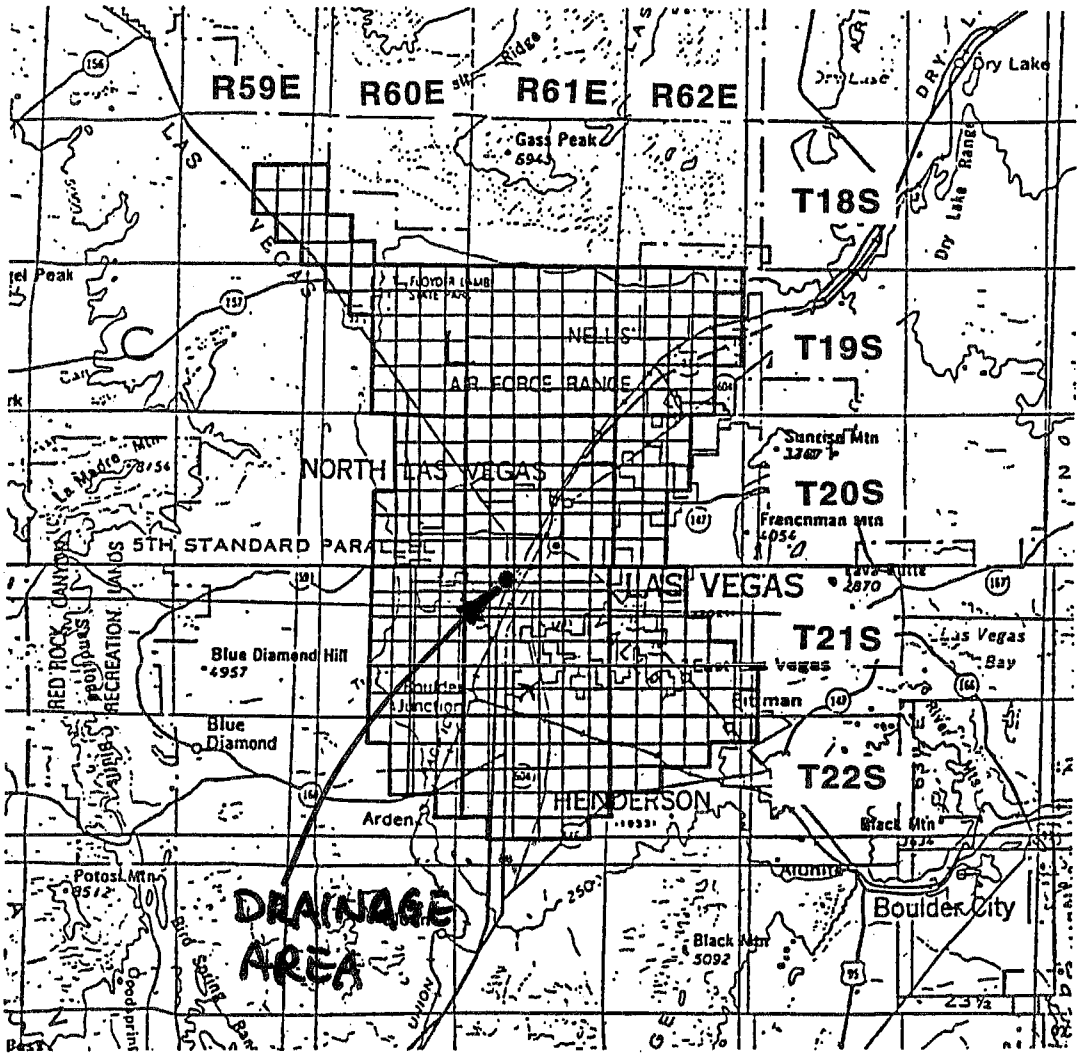
NOTE: 1. Refer to Figure 513 for a description and drawing of the area included in the McCarran Airport Rainfall Area.

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

3. Table 501 adjustments not required.

Revision	Date

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.

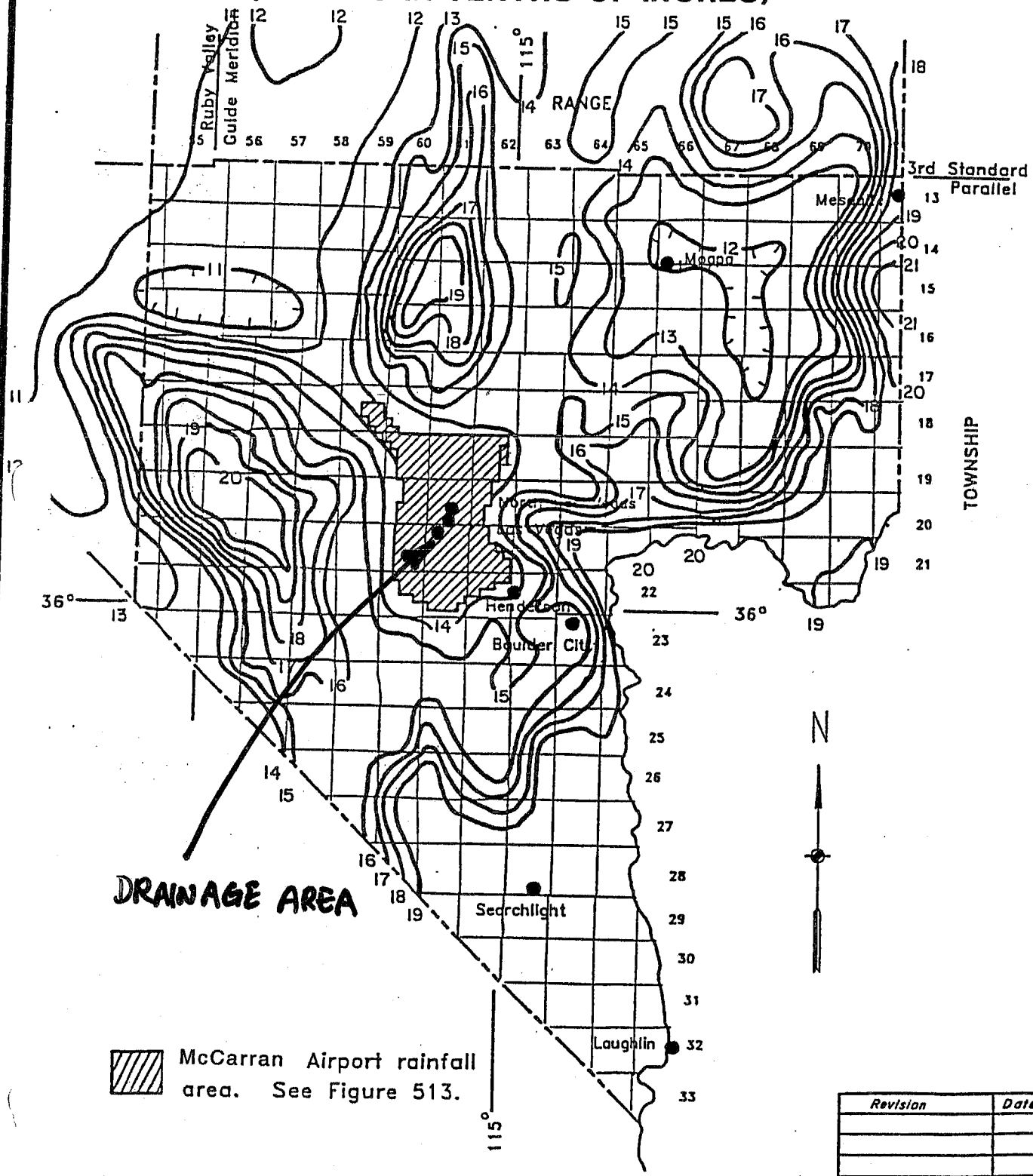
Revision	Date

WRC ENGINEERING

REFERENCE:
USACE, Los Angeles District, 1988

FIGURE 513

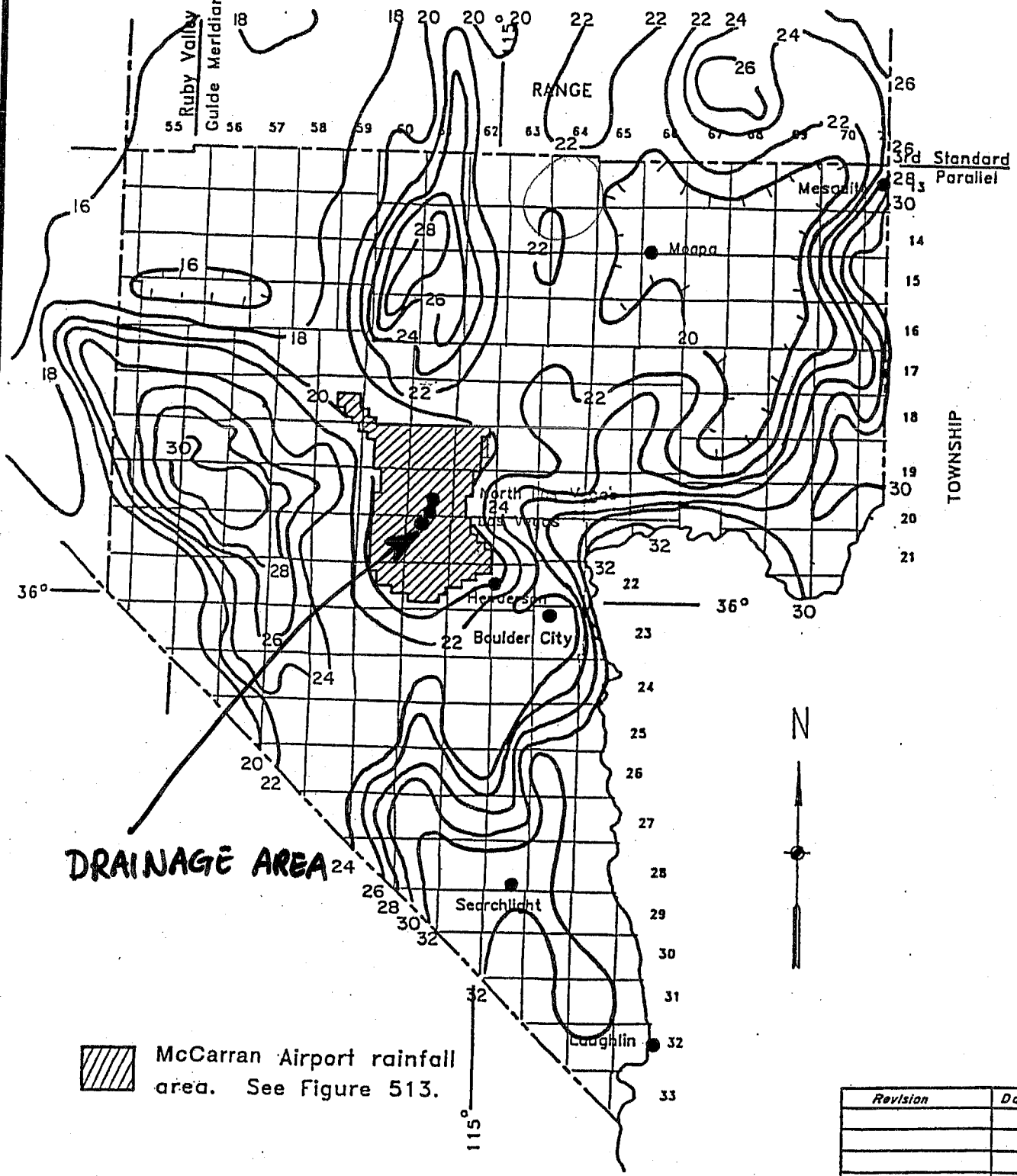
RAINFALL DEPTH-DURATION-FREQUENCY
10-YEAR, 6-HOUR
(DEPTHS IN TENTHS OF INCHES)



Revision	Date

WRC ENGINEERING	REFERENCE: NOAA ATLAS 2, VOLUME VII NEVADA, 1973	FIGURE 503

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



McCarran Airport rainfall area. See Figure 513.

Revision	Date

WRC ENGINEERING

REFERENCE:
NOAA ATLAS 2, VOLUME VII NEVADA, 1973

FIGURE 506

SIX HOUR DEPTH-AREA REDUCTION FACTORS

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

NOTES: 1. A graphical representation of these factors is presented in Figure 514.

2. Consult with the local entity and/or the CCRFCD for guidance in using the Depth-Area Reduction Factors for drainage areas greater than 200 square miles.

Revision	Date

SIX-HOUR STORM DISTRIBUTIONS

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

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

Revision	Date

REFERENCE:

TABLE 503

SOILS MAP

Oakey Storm Drain (Big Basin Model) Soils Exhibit

OFF1
OFF2
OFF3
OFF4
OFF5
OFF6
OFF7
OFF8
OFF9
OFF10
OFF11
OFF12
OFF13
OFF14
OFF15

N
W E
S

0 500 1,000 2,000 Feet

Legend

Oakey Sub-Basins **Soils**

- A
- B
- C
- D

HDR

Oakey Storm Drain (Small Basin Model) Soils Exhibit

OFF1
OFF2
OFF3
OFF4
OFF5
OFF6
OFF7
OFF8
OFF9 A
OFF9 B
OFF10A
OFF10B
OFF10C
OFF11
OFF12
OFF13
OFF14A
OFF14B
OFF14C
OFF14D
OFF15A
OFF15B

N
W E
S

0 500 1,000 2,000 Feet

Legend

Oakey Sub-Basins

Soils

- A
- B
- C
- D

HDR

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

TIME OF CONCENTRATION

HDR, Inc.
File: SF4.XLS

Oakey Storm Drain - Big Basin Model
(Ultimate Conditions)

BY: HT
DATE: 2/1/2007

SUB-BASIN DATA						INITIAL / OVERLAND TIME (Ti)			TRAVEL TIME (Tt)					Tc	Tc Check	Tlag	REMARKS
DESIG: (1)	DEV./EX. (D or E)	CN	K (2)	AREA Ac (3)	AREA Mi^2	INITIAL LENGTH Feet (4)	SLOPE % (5)	Ti Min (6)	TRAVEL LENGTH Feet (7)	SLOPE % (8)	V1 VELOCITY FPS (9a)	V2 VELOCITY FPS (9b)	Tt Min (10)	Min (13)	Min (14)	Tlag= 0.6Tc/60 Hours	RAINFALL Q100/Q10 Inches
OFF1	D	93.4	0.8429	62.71	0.0980	385	1.0	9.1	2650	1.32	2.3	3.5	13.8	22.9	26.9	0.229	2.77/1.58
OFF2	D	92.0	0.8244	64.93	0.1015	140	1.0	5.9	3600	0.42	1.3	2.0	32.5	38.4	30.8	0.308	2.77/1.58
OFF3	D	91.0	0.8112	23.11	0.0361	110	1.0	5.5	1520	2.47	3.2	4.8	6.2	11.6	19.1	0.116	2.77/1.58
OFF4	D	91.0	0.8112	16.19	0.0253	120	1.0	5.7	2930	0.85	1.9	2.8	18.8	24.5	26.9	0.245	2.77/1.58
OFF5	D	91.0	0.8112	20.63	0.0322	100	1.0	5.2	1420	1.41	2.4	3.6	7.7	12.9	18.4	0.129	2.77/1.58
OFF6	D	91.0	0.8112	46.42	0.0725	120	1.0	5.7	2555	1.86	2.8	4.2	11.2	16.9	24.9	0.169	2.77/1.58
OFF7	D	91.7	0.8204	23.05	0.0360	790	1.0	14.1	1360	1.47	2.4	3.7	7.3	21.4	21.9	0.214	2.77/1.58
OFF8	D	92.2	0.8270	7.67	0.0120	40	2.0	2.5	2110	2.13	2.9	4.5	8.8	11.3	21.9	0.113	2.77/1.58
OFF9	D	89.7	0.7940	18.67	0.0292	110	1.0	5.8	1665	0.75	1.8	2.7	12.1	17.9	19.9	0.179	2.77/1.58
OFF10	D	86.3	0.7492	41.89	0.0655	110	1.0	6.6	3670	1.16	2.2	3.3	19.9	26.5	31.0	0.265	2.77/1.58
OFF11	D	94.0	0.8508	17.96	0.0281	50	1.0	3.2	2050	0.73	1.7	2.6	14.7	17.9	21.7	0.179	2.77/1.58
OFF12	D	91.5	0.8178	77.80	0.1216	140	1.0	6.0	3550	1.62	2.6	3.9	16.3	22.3	30.5	0.223	2.77/1.58
OFF13	D	83.8	0.7162	39.99	0.0625	150	1.0	8.5	2410	0.62	1.6	2.4	18.4	26.9	24.2	0.242	2.77/1.58
OFF14	D	85.8	0.7426	87.20	0.1363	220	1.0	9.5	4900	0.92	1.9	2.9	29.3	38.9	38.4	0.384	2.77/1.58
OFF15	D	82.6	0.7003	25.16	0.0393	140	1.0	8.5	1820	0.80	1.8	2.7	12.7	21.2	20.9	0.209	2.77/1.58
			Total	166.94	0.896												

Tc = Ti + Tt Tlag = 0.6 Tc
Ti = 1.8 (1.1 - K) L^1/2 / S^1/3
K = 0.0132 (CN) - 0.39
Tc Check = L/180+10

For the travel time (Tt) calculations,
V1 applies to the first 500 feet of travel distance;
V2 applies to the remaining travel distance.

Existing V1 = 14.8*(S/100)^1/2 Developed V1 = 20.2*(S/100)^1/2
Existing V2 = 29.4*(S/100)^1/2 Developed V2 = 30.6*(S/100)^1/2

REFERENCE :

STANDARD FORM 4

CURVE NUMBERS (CN'S)

RUNOFF CURVE NUMBERS
(URBAN AREAS[1])

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

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

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

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

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

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

Revision	Date

RUNOFF CURVE NUMBERS - RESIDENTIAL DISTRICTS

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

1 Lot size should represent the size of the average lot and not the gross acreage divided by the number of lots.

2 Actual percent impervious value should be compared to selected land use type.

3 In cases where average residential lots are smaller than 6,000 sq ft, commercial/business/industrial land use should be used.

Revision	Date

REFERENCE:

TABLE 602A

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 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 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

Because of the content of gypsum and other salts in the soil, salt-tolerant plants should be selected for lawns and landscaping. Because of the underlying hardpan, deep cuts should be avoided on this 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 subclasses IIIs, irrigated, and VIIs, nonirrigated. It is in horticultural group 6.

390—Spring clay loam. This very deep, moderately well drained soil is on alluvial flats. It formed in gypsiferous lacustrine sediment. Slope is 0 to 2 percent.

Typically, the surface layer is pale brown clay loam about 5 inches thick. The underlying material to a depth of 60 inches or more is stratified, light brown to pink silt loam to silty clay, averaging silty clay loam, and contains many gypsum crystals.

Included in this unit are about 10 percent Land soils on alluvial flats and 5 percent Las Vegas soils on relict alluvial flats. Included areas make up about 15 percent of the total acreage.

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

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

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. Gypsum 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. 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 Spring soil is limited for roads because of limited ability to support a load. Roads and streets should be designed to compensate for the instability of the soil.

The main limitation for lawns and landscaping is the excess soluble salts in the soil. Intensive management is required to reduce the salinity and maintain soil productivity. Excess salts in the soil can be flushed out sing heavy periodic applications of water. Because e content of gypsum and other salts in the soil, salt-tolerant plants should be selected.

This map unit is in capability subclasses VIs, irrigated, and VIIs, nonirrigated. It is in horticultural group 4.

400—Tencee very gravelly fine sandy loam, 2 to 8 percent slopes. This shallow, well drained soil is on erosional fan remnants. It formed in alluvium derived dominantly from limestone and dolomite.

Typically, 75 percent of the surface is covered with a well developed desert pavement of pebbles. There is a dark desert varnish on the exposed surfaces of the rock fragments. The surface layer is light brown very gravelly fine sandy loam about 5 inches thick. The next layer is light brown very gravelly fine sandy loam and very gravelly sandy loam and is weakly cemented with lime to a depth of about 15 inches. An indurated, lime-cemented hardpan is at a depth of about 15 inches. Depth to the hardpan ranges from 7 to 20 inches.

Included in this unit are small areas of Dalian soils on side slopes of fan remnants and on inset fans. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Tencee soil is moderate above the hardpan. Available water capacity is very low. Effective rooting depth is 7 to 20 inches. Runoff is medium, and the hazard of water erosion is slight. The hazard of soil blowing is moderate if the surface is disturbed.

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

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

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

415—Aztec very gravelly sandy loam, 2 to 8 percent slopes. This very deep, well drained soil is on erosional fan remnants. It formed in alluvium derived from various kinds of rock.

Typically, 80 percent of the surface is covered with pebbles. The surface layer is light yellowish brown very gravelly sandy loam about 2 inches thick. The underlying material to a depth of 63 inches is stratified, light yellowish brown, light brown, and light reddish brown very gravelly sandy loam to extremely gravelly loamy coarse sand with weak, continuous gypsum cementation in some layers.

Included in this unit are about 5 percent Bracken soils on pediment remnants, 5 percent Rock outcrop on isolated ridges, and 5 percent Caliza soils on erosional fan remnants. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Aztec soil is moderately slow. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight. The hazard of soil blowing is high

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding		High water table		Bedrock		Cemented pan		Risk of corrosion	
		Frequency	Months	Depth	Months	Depth	Thickness	Depth	Hardness	Uncoated steel	Concrete
				Ft		In		In			
270---------- Land	B	Rare---------	---	3.5-6.0	Mar-Sep	>60	---	---	---	High-------	High.
278---------- Land	D	Rare---------	---	1.5-3.0	Jan-Dec	>60	---	---	---	High-------	High.
282---------- Land	C	Rare---------	---	3.0-3.5	Jan-Dec	>60	---	---	---	High-------	High.
300, 301---------- Las Vegas	D	Rare---------	---	>6.0	---	>60	---	3-14	Thick	High-------	High.
302*:											
Las Vegas---------	D	Rare---------	---	>6.0	---	>60	---	3-14	Thick	High-------	High.
McCarran----------	B	Rare---------	---	>6.0	---	>60	---	---	---	High-------	High.
Grapevine---------	B	Rare---------	---	>6.0	---	>60	---	---	---	High-------	High.
305*:											
Las Vegas---------	D	Rare---------	---	>6.0	---	>60	---	3-14	Thick	High-------	High.
Destazo-----------	B	Rare---------	---	>6.0	---	>60	---	---	---	High-------	High.
307*:											
Las Vegas---------	D	Rare---------	---	>6.0	---	>60	---	3-14	Thick	High-------	High.
Skyhaven----------	C	Rare---------	---	>6.0	---	>60	---	24-40	Thick	High-------	High.
325, 326---------- McCarran	B	Rare---------	---	>6.0	---	>60	---	---	---	High-------	High.
341---------- Paradise	C	Rare---------	---	3.0-5.0	Dec-Mar	>60	---	---	---	High-------	Low.
360*:											
Rock outcrop.											
St. Thomas--------	D	None---------	---	>6.0	---	4-20	Hard	---	---	High-------	Low.
380---------- Skyhaven	C	Rare---------	---	>6.0	---	>60	---	24-40	Thick	High-------	High.
390---------- Spring	C	Rare---------	---	>6.0	---	>60	---	---	---	High-------	High.
400---------- Tencee	D	None---------	---	>6.0	---	>60	---	7-20	Thick	High-------	Low.
415---------- Aztec	B	None---------	---	>6.0	---	>60	---	---	---	High-------	High.
417*:											
Aztec----------	B	None---------	---	>6.0	---	>60	---	---	---	High-------	High.
Rock outcrop.											
418*:											
Aztec----------	B	None---------	---	>6.0	---	>60	---	---	---	High-------	High.
Nickel----------	B	None---------	---	>6.0	---	40-60	Hard	---	---	High-------	Low.
Knob Hill---------	B	None---------	---	>6.0	---	>60	---	---	---	High-------	Low.

See footnote at end of table.

FLOW SPLIT

(VALLEY VIEW AND EL CAMINO)

Summary of Flow Split

Incoming Flow in Main Street (cfs)	Lateral Flow into Side Street (cfs)	Remaining Flow in Main Street (cfs)
100	45	55
200	88	112
300	131	169

natural contributing watersheds; and increased by fifty percent (i.e., multiplied by 1.5) for substantially paved contributing watersheds, which are generally found in-residential, commercial, and industrial developments.

The required inlet headwater, *HW*, can either be assumed to be some fraction of the height *(D)* of the flow-through wall openings; or it can be set equal to or greater than same, provided that the resulting ponding depth is less than one foot, does not affect all-weather access; and does not adversely affect nearby buildings, roadways, or parking areas, nor affect the future development of same.

12.6 Computation of Flow Splits at Intersections

It is not uncommon in urbanized areas for runoff being conveyed in streets to be either augmented or diminished in quantity by flows entering or departing at street intersections. The evaluation of converging flows can be done by adding either the two contributing hydrographs or the two flood peaks, dependent upon the comparative lag times of the flood peaks. The evaluation of flow splits at intersections may be evaluated by use of Equation 12.3 below.

$$Q_L = 0.042 \left(\frac{Q_m^{0.93} W_{ss}^{0.85}}{S_m^{0.41} W_m^{0.79}} \right) \qquad (12.3)$$

Where:

Q_L = Lateral flow into the side street, in cubic feet per second;
Q_m = Main street flow measured between the curbs, in cubic feet per second;
S_m = Longitudinal slope of the main street, in feet per foot;
W_m = Width of the main street, in feet; and,
W_{ss} = Width of the side street, in feet.

When applying Equation 12.3, the following items must be taken into consideration:

1. If the main street has an inverted crown, or if the side street has been crested to impede flow, Q_m should be calculated as only that portion of the total discharge flowing above the elevation of the crest (see Figure 12.1).

2. If flow extends beyond the curbs, Q_m should be only that portion of the total discharge which would be flowing between the curbs. Equation 12.4, below, is then used to calculate the maximum amount of "overbank" flow which will also turn and flow down the side street. Note that if Q_o calculated from Equation 12.4 is positive and is greater than the actual overbank flow, it should be assumed that *all* of the actual overbank flow turns and flows down the side street. Also, if Q_o calculated from Equation 12.4 becomes negative, it should be assumed that *no* overbank flow turns and flows down the side street.

$$Q_o = 46.8 y_o W_{oo} S_s^{0.5} - Q_L \quad (12.4)$$

Where:

Q_o = Overbank flow intercepted by the side street, in cubic feet per second;

y_o = Average depth of overbank flow intercepted by the side street, in feet;

S_s = Longitudinal slope of the side street, in feet/foot; and,

All other terms are defined in Equation 12.3.

3. If Q_L is calculated to be greater than Q_m, Q_L shall be set equal to Q_m.

4. Specific site conditions, such as walls, buildings, etc., which may affect flow characteristics at the intersection, must be carefully considered before applying Equation 12.1.

EXAMPLE 12.1: SPLIT FLOW AT AN INTERSECTION

A flow split must be calculated at the intersection shown on Figure 12.2. A hydrologic analysis determined that the 100-year peak discharge at a point just south of the intersection is 400 cfs. Street A slopes downward and to the north at *0.005* ft/ft, and street B slopes downward and to the west at *0.005* ft/ft. For the purposes of this example, it will be assumed that no flow enters the intersection via street B. It is also known, from the results of a hydraulic analysis, that at a flow of 400 cfs, 300 cfs will be flowing between the curbs (Q_m), 40 cfs will be flowing outside of the curb to the west (Q_{LOB}) at an average depth of one foot, and 60 cfs will be flowing outside of the curb to the east (Q_{ROB}) at this same depth. Q_L is then calculated, to the nearest cfs, from Equation 12.3 as follows:

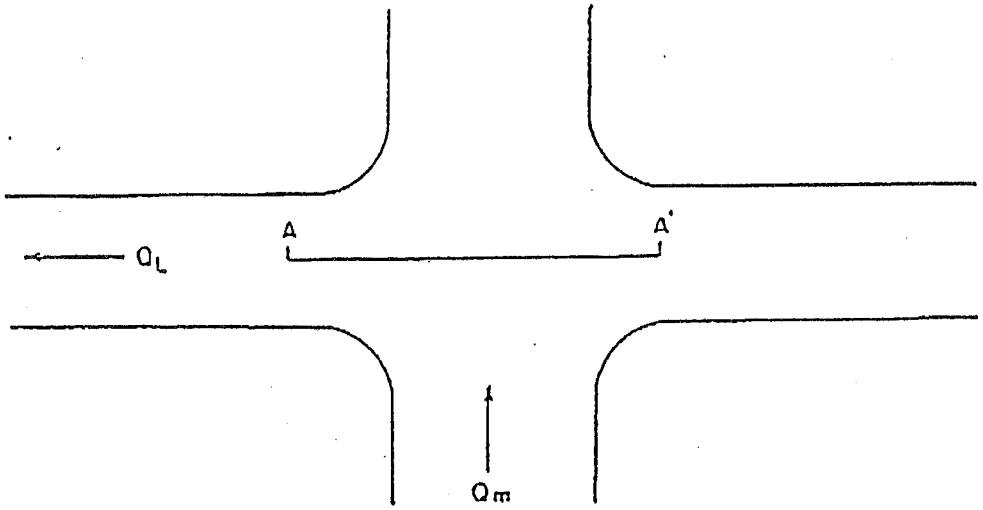
$$Q_L = 0.042 \left[\frac{(300)^{0.93} (24)^{0.86}}{(0.005)^{0.41} (48)^{0.79}} \right] = 52 \text{ cfs}$$

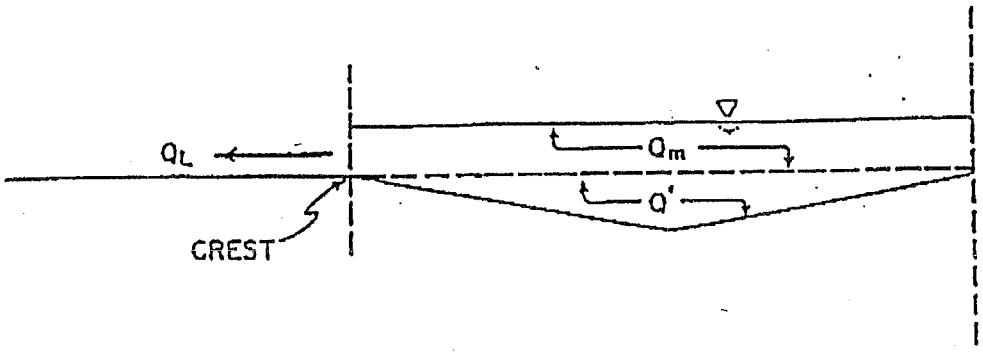
The maximum amount of flow from the left overbank which can flow west on street B is calculated, to the nearest cfs, from Equation 12.4 as follows:

$$Q_o = 46.8(1)(24)(0.005)^{0.5} - 52 = 27 \text{ cfs}$$

Therefore, the total side flow into street B is calculated to be:

$$Q_L + Q_o = 52 + 27 = 79 \text{ cfs}$$



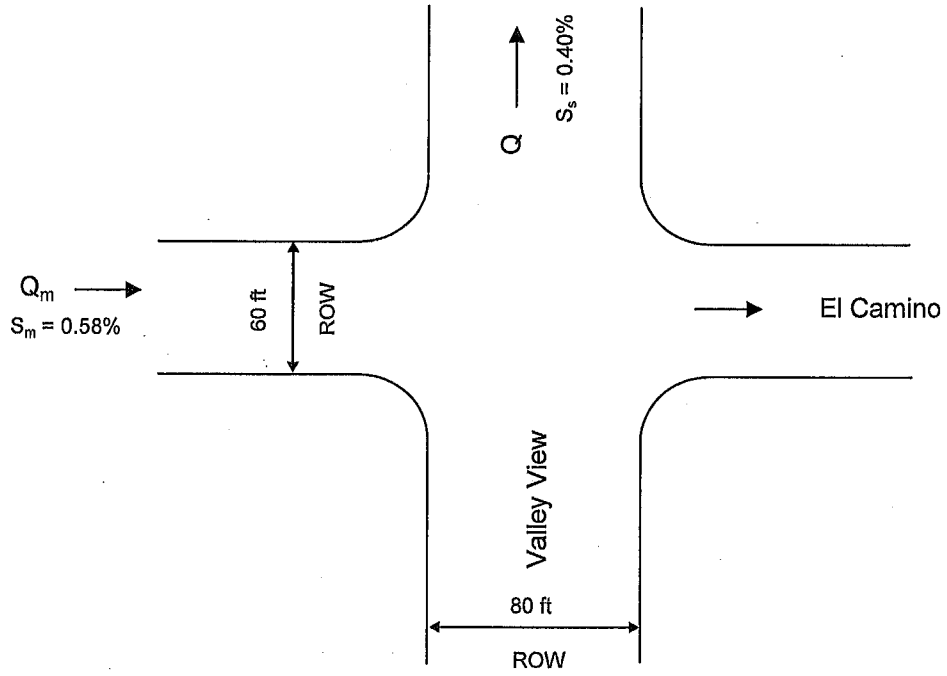


SECTION A-A'

TOTAL DISCHARGE IN MAIN STREET EQUALS $Q_m + Q'$. Q_m (AS USED IN EQUATION 12.3) IS ONLY THAT PORTION OF THE TOTAL DISCHARGE ABOVE THE ELEVATION OF THE CREST OF THE SIDE STREET.

FIGURE 12.1
DEFINITION SKETCH FOR COMPUTING Q_m IN AN INVERTED—CROWN STREET

Flow Split at El Camino and Valley View



Estimate flow split by Pima County method:

$$Q_L = 0.042\left(\frac{Q_m^{0.93} W_{ss}^{0.86}}{S_m^{0.41} W_m^{0.79}}\right)$$

(Eq. (12.3), Pima County Drainage Manual)

Where:

Q_L = Lateral flow into the side street, in cubic feet per second;
Q_m = Main street flow measured between the curbs, in cubic feet per second;
S_m = Longitudinal slope of the main street, in feet per foot;
W_m = Width of the main street, in feet; and,
W_{ss} = Width of the side street, in feet.

Overbank Flow intercepted by side street

$$Q_0 = 46.8 y_0 W_{ss} S_s^{0.5} - Q_L$$

(Eq. (12.4), Pima County Drainage Manual)

Where:

Q_o = Overbank flow intercepted by the side street, in cubic feet per second;
y_o = Average depth of overbank flow intercepted by the side street, in feet;

S_s = Longitudinal slope of the side street, in feet per foot; and, all other terms are defined above.

Street widths and slopes

W_m = 60 ft
S_m = 0.58%
W_{ss} = 80 ft
S_s = 0.40%

Total flow in main street (El Camino)

Q = 100 cfs

The depth of flow in the street (measured from gutter) can be obtained from FlowMaster

y = 0.80 ft (see FlowMaster)

and the depth of overbank flow is

y_{o1} = y - 0.50 = 0.30 ft (Curb height 0.50 ft)

The average depth of overbank flow is

y_o = y - 0.55 = 0.25 ft (Curb height 0.50 ft, 5 ft sidewalk at slope 2%, in average, sidewalk is 0.55 ft above gutter flow line)

The Overbank Flow in main street can be calculated with FlowMaster (use depth y_{o1})

Q_{mo} = 10.4 cfs (see FlowMaster)

Therefore, the main street flow between the curbs is

$Q_m = Q - 2Q_0$ = 79.2 cfs

Lateral flow into the side street (Valley View) is

$$Q_L = 0.042\left(\frac{Q_m^{0.93} W_{ss}^{0.86}}{S_m^{0.41} W_m^{0.79}}\right) = 34.5 \text{ cfs}$$

Overbank flow intercepted by side street calculated with Eq. (12.4) is

$$Q_0 = 46.8 y_0 W_{ss} S_s^{0.5} - Q_L = 24.7 \text{ cfs}$$

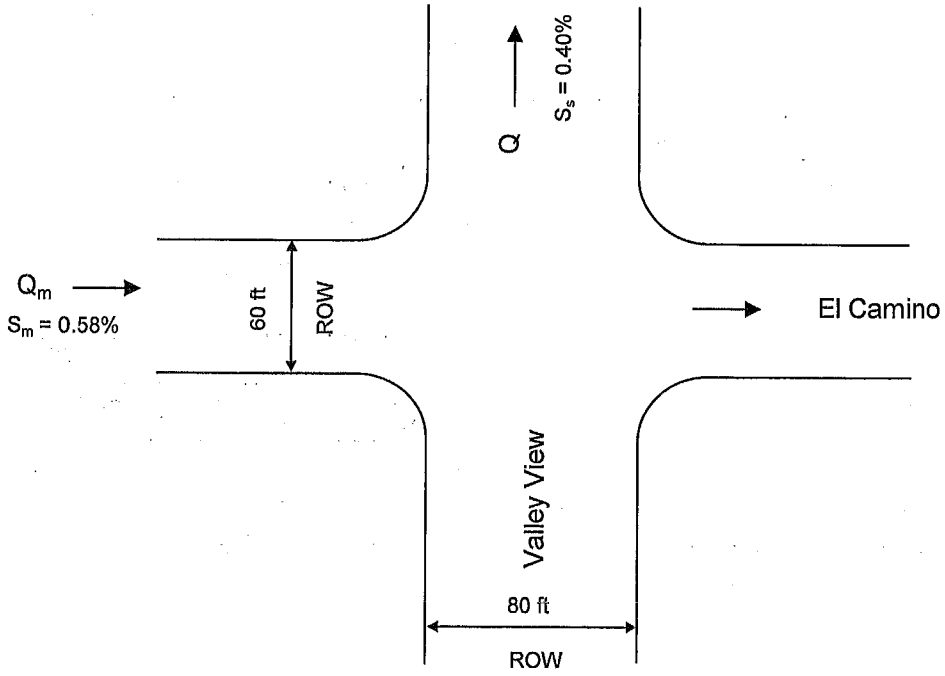
The overbank flow intercepted by the side street should not be more than the overbank flow in the main street, therefore

$Q_o = \min(Q_{mo}, Q_o)$ = 10.4 cfs

Therefore, the total side flow into Valley View is calculated to be:

$Q_L + Q_o =$ 45 cfs

Flow Split at El Camino and Valley View



Estimate flow split by Pima County method:

$$Q_L = 0.042\left(\frac{Q_m^{0.93} W_{ss}^{0.86}}{S_m^{0.41} W_m^{0.79}}\right)$$

(Eq. (12.3), Pima County Drainage Manual)

Where:

Q_L = Lateral flow into the side street, in cubic feet per second;
Q_m = Main street flow measured between the curbs, in cubic feet per second;
S_m = Longitudinal slope of the main street, in feet per foot;
W_m = Width of the main street, in feet; and,
W_{ss} = Width of the side street, in feet.

Overbank Flow intercepted by side street

$$Q_0 = 46.8 y_0 W_{ss} S_s^{0.5} - Q_L$$

(Eq. (12.4), Pima County Drainage Manual)

Where:

Q_o = Overbank flow intercepted by the side street, in cubic feet per second;
y_o = Average depth of overbank flow intercepted by the side street, in feet;

S_s = Longitudinal slope of the side street, in feet per foot; and, all other terms are defined above.

Street widths and slopes

W_m = 60 ft
S_m = 0.58%
W_{ss} = 80 ft
S_s = 0.40%

Total flow in main street (El Camino)

Q = 200 cfs

The depth of flow in the street (measured from gutter) can be obtained from FlowMaster

y = 1.03 ft (see FlowMaster)

and the depth of overbank flow is

$y_{o1} = y - 0.50$ = 0.53 ft (Curb height 0.50 ft)

The average depth of overbank flow is

$y_o = y - 0.55$ = 0.48 ft (Curb height 0.50 ft, 5 ft sidewalk at slope 2%, in average, sidewalk is 0.55 ft above gutter flow line)

The Overbank Flow in main street can be calculated with FlowMaster (use depth y_{o1})

Q_{mo} = 29.3 cfs (see FlowMaster)

Therefore, the main street flow between the curbs is

$Q_m = Q - 2Q_0$ = 141.4 cfs

Lateral flow into the side street (Valley View) is

$$Q_L = 0.042\left(\frac{Q_m^{0.93} W_{ss}^{0.86}}{S_m^{0.41} W_m^{0.79}}\right) = 59.2 \text{ cfs}$$

Overbank flow intercepted by side street calculated with Eq. (12.4) is

$$Q_0 = 46.8 y_0 W_{ss} S_s^{0.5} - Q_L = 54.5 \text{ cfs}$$

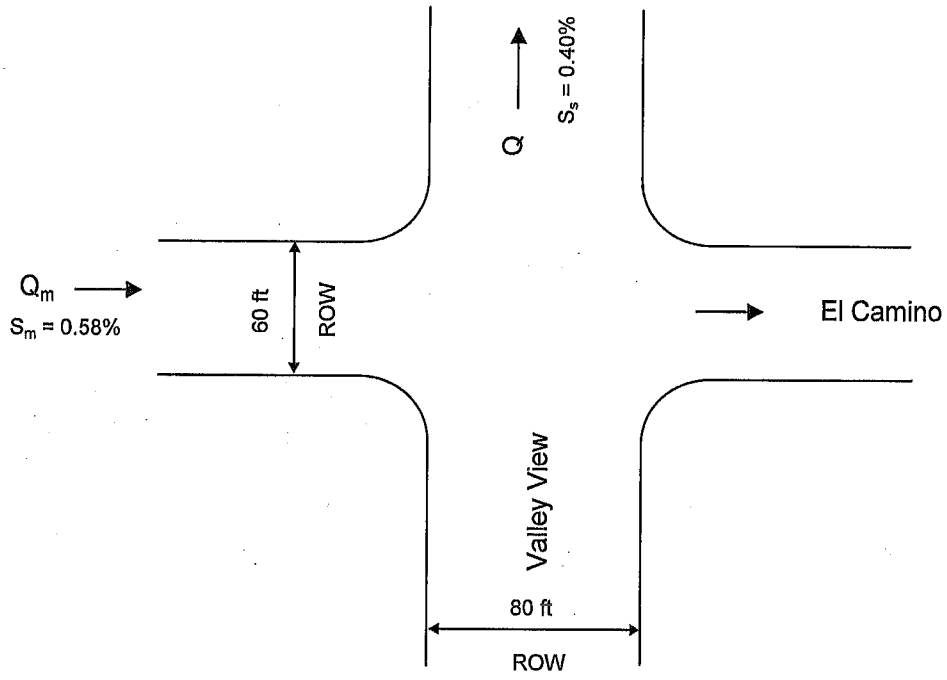
The overbank flow intercepted by the side street should not be more than the overbank flow in the main street, therefore

$Q_o = \min(Q_{mo}, Q_o)$ = 29.3 cfs

Therefore, the total side flow into Valley View is calculated to be:

$Q_L + Q_o =$ 88 cfs

Flow Split at El Camino and Valley View



Estimate flow split by Pima County method:

$$Q_L = 0.042\left(\frac{Q_m^{0.93} W_{ss}^{0.86}}{S_m^{0.41} W_m^{0.79}}\right)$$

(Eq. (12.3), Pima County Drainage Manual)

Where:

Q_L = Lateral flow into the side street, in cubic feet per second;
Q_m = Main street flow measured between the curbs, in cubic feet per second;
S_m = Longitudinal slope of the main street, in feet per foot;
W_m = Width of the main street, in feet; and,
W_{ss} = Width of the side street, in feet.

Overbank Flow intercepted by side street

$$Q_0 = 46.8 y_0 W_{ss} S_s^{0.5} - Q_L$$

(Eq. (12.4), Pima County Drainage Manual)

Where:

Q_o = Overbank flow intercepted by the side street, in cubic feet per second;
y_o = Average depth of overbank flow intercepted by the side street, in feet;

S_s = Longitudinal slope of the side street, in feet per foot; and, all other terms are defined above.

Street widths and slopes

W_m = 60 ft
S_m = 0.58%
W_{ss} = 80 ft
S_s = 0.40%

Total flow in main street (El Camino)

Q = 300 cfs

The depth of flow in the street (measured from gutter) can be obtained from FlowMaster

y = 1.20 ft (see FlowMaster)

and the depth of overbank flow is

y_{o1} = y - 0.50 = 0.70 ft (Curb height 0.50 ft)

The average depth of overbank flow is

y_o = y - 0.55 = 0.65 ft (Curb height 0.50 ft, 5 ft sidewalk at slope 2%, in average, sidewalk is 0.55 ft above gutter flow line)

The Overbank Flow in main street can be calculated with FlowMaster (use depth y_{o1})

Q_{mo} = 46.8 cfs (see FlowMaster)

Therefore, the main street flow between the curbs is

$Q_m = Q - 2Q_0$ = 206.4 cfs

Lateral flow into the side street (Valley View) is

$$Q_L = 0.042\left(\frac{Q_m^{0.93} W_{ss}^{0.86}}{S_m^{0.41} W_m^{0.79}}\right) = 84.1 \text{ cfs}$$

Overbank flow intercepted by side street calculated with Eq. (12.4) is

$$Q_0 = 46.8 y_0 W_{ss} S_s^{0.5} - Q_L = 69.8 \text{ cfs}$$

The overbank flow intercepted by the side street should not be more than the overbank flow in the main street, therefore

$Q_o = \min(Q_{mo}, Q_o)$ = 46.8 cfs

Therefore, the total side flow into Valley View is calculated to be:

$Q_L + Q_o =$ 131 cfs

El Camino
Worksheet for Irregular Channel

Project Description	
Worksheet	El Camino
Flow Element	Irregular Chan
Method	Manning's For
Solve For	Channel Depth

Input Data		
Channel Sl	005800	ft/ft
Discharge	100.0	cfs

Options	
Current Roughness Meth	oved Lotter's Method
Open Channel Weighting	oved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	0.80	ft
Elevation Range	0.00 to 0.60	
Flow Area	25.4	ft²
Wetted Perimeter	61.43	ft
Top Width	60.00	ft
Actual Depth	0.80	ft
Critical Elevation	0.82	ft
Critical Slope	0.005064	ft/ft
Velocity	3.93	ft/s
Velocity Head	0.24	ft
Specific Energy	1.04	ft
Froude Number	1.06	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.20491853 ft.

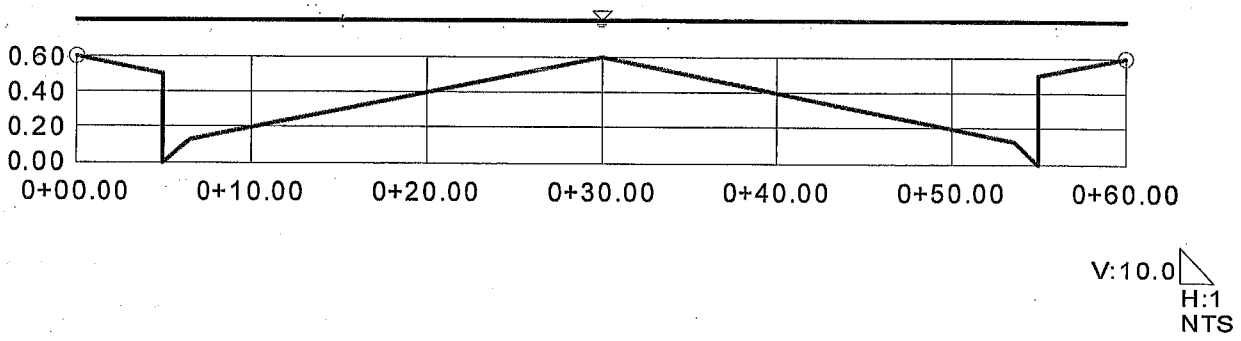
Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+60.00	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.00	0.00
0+06.50	0.13
0+30.00	0.60
0+53.50	0.13
0+55.00	0.00
0+55.00	0.50
0+60.00	0.60

El Camino
Cross Section for Irregular Channel

Project Description	
Worksheet	El Camino
Flow Element	Irregular Chani
Method	Manning's For
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.016	
Channel Slope	0.005800	ft/ft
Water Surface Elev	0.80	ft
Elevation Range	.00 to 0.60	
Discharge	100.00	cfs



ElCaminoOverBank
Worksheet for Irregular Channel

Project Description	
Worksheet	ElCaminoOver
Flow Element	Irregular Chan
Method	Manning's For
Solve For	Discharge

Input Data		
Channel Slope	058000	ft/ft
Water Surface Elev	0.30	ft

Options	
Current Roughness Meth	oved Lotter's Method
Open Channel Weighting	oved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coeffic	0.016	
Elevation Range	0.00 to 0.10	
Discharge	10.4	cfs
Flow Area	1.3	ft²
Wetted Perimete	5.50	ft
Top Width	5.00	ft
Actual Depth	0.30	ft
Critical Elevation	0.56	ft
Critical Slope	0.005975	ft/ft
Velocity	8.33	ft/s
Velocity Head	1.08	ft
Specific Energy	1.38	ft
Froude Number	2.94	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.3 ft.

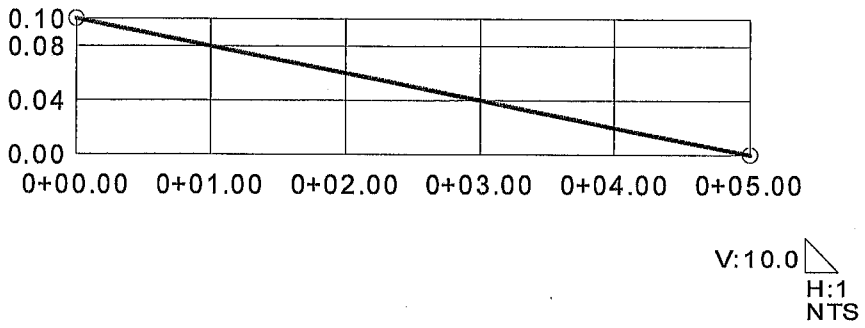
Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+05.00	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.10
0+05.00	0.00

ElCaminoOverBank
Cross Section for Irregular Channel

Project Description	
Worksheet	ElCaminoOver
Flow Element	Irregular Chan
Method	Manning's For
Solve For	Discharge

Section Data		
Mannings Coefficie	0.016	
Channel Slope	0.058000	ft/ft
Water Surface Elev	0.30	ft
Elevation Range	.00 to 0.10	
Discharge	10.4	cfs



El Camino
Worksheet for Irregular Channel

Project Description	
Worksheet	El Camino
Flow Element	Irregular Chan
Method	Manning's For
Solve For	Channel Depth

Input Data		
Channel Sl	005800	ft/ft
Discharge	200.0	cfs

Options	
Current Roughness Meth	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	1.03	ft
Elevation Range	0.00 to 0.60	
Flow Area	38.7	ft²
Wetted Perimeter	61.87	ft
Top Width	60.00	ft
Actual Depth	1.03	ft
Critical Elevation	1.08	ft
Critical Slope	0.004384	ft/ft
Velocity	5.17	ft/s
Velocity Head	0.42	ft
Specific Energy	1.44	ft
Froude Number	1.14	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.42546983 ft.

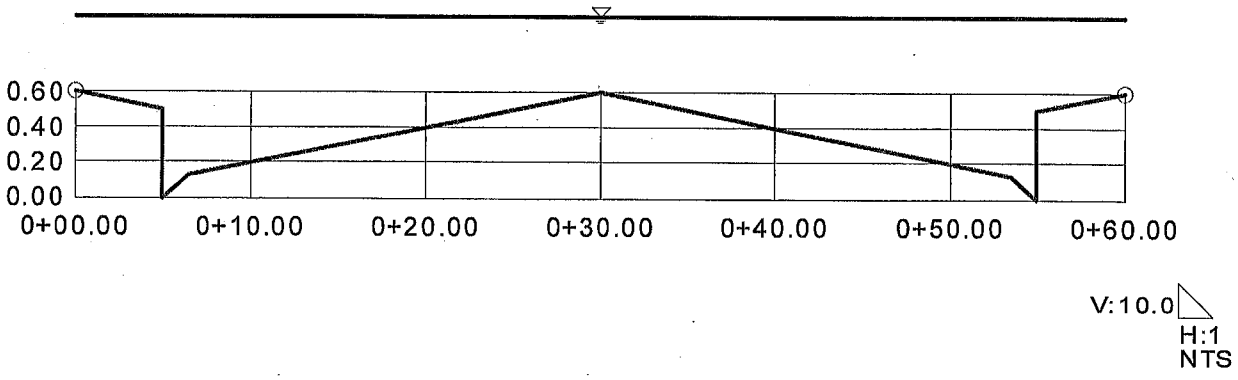
Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+60.00	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.00	0.00
0+06.50	0.13
0+30.00	0.60
0+53.50	0.13
0+55.00	0.00
0+55.00	0.50
0+60.00	0.60

El Camino
Cross Section for Irregular Channel

Project Description	
Worksheet	El Camino
Flow Element	Irregular Chan
Method	Manning's For
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.016	
Channel Slope	0.005800	ft/ft
Water Surface Elev	1.03	ft
Elevation Range	.00 to 0.60	
Discharge	200.0	cfs



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HDR Engineering Inc
37 Brookside Road Waterbury, CT 06708 USA +1-203-755-1666

ElCaminoOverBank
Worksheet for Irregular Channel

Project Description	
Worksheet	ElCaminoOver
Flow Element	Irregular Chan
Method	Manning's For
Solve For	Discharge

Input Data		
Channel Slope	058000	ft/ft
Water Surface Elev	0.53	ft

Options	
Current Roughness Meth	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coeffic	0.016	
Elevation Range	0.00 to 0.10	
Discharge	29.3	cfs
Flow Area	2.4	ft²
Wetted Perimeter	5.96	ft
Top Width	5.00	ft
Actual Depth	0.53	ft
Critical Elevation	1.07	ft
Critical Slope	0.005851	ft/ft
Velocity	12.20	ft/s
Velocity Head	2.31	ft
Specific Energy	2.84	ft
Froude Number	3.10	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.53 ft.

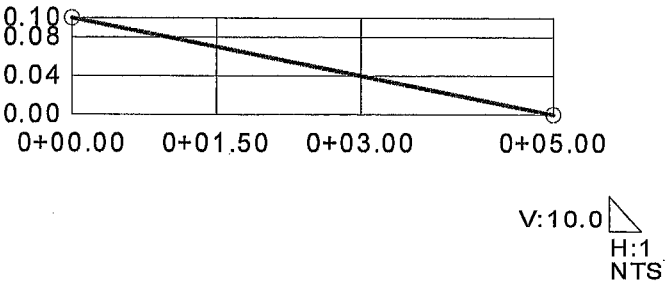
Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+05.00	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.10
0+05.00	0.00

ElCaminoOverBank
Cross Section for Irregular Channel

Project Description	
Worksheet	ElCaminoOver
Flow Element	Irregular Chan
Method	Manning's For
Solve For	Discharge

Section Data		
Mannings Coefficie	0.016	
Channel Slope	0.058000	ft/ft
Water Surface Elev	0.53	ft
Elevation Range	.00 to 0.10	
Discharge	29.3	cfs



El Camino
Worksheet for Irregular Channel

Project Description	
Worksheet	El Camino
Flow Element	Irregular Chan
Method	Manning's For
Solve For	Channel Depth

Input Data		
Channel Sl	005800	ft/ft
Discharge	300.0	cfs

Options	
Current Roughness Meth	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	1.20	ft
Elevation Range	0.00 to 0.60	
Flow Area	49.4	ft²
Wetted Perimeter	62.23	ft
Top Width	60.00	ft
Actual Depth	1.20	ft
Critical Elevation	1.30	ft
Critical Slope	0.004044	ft/ft
Velocity	6.07	ft/s
Velocity Head	0.57	ft
Specific Energy	1.78	ft
Froude Number	1.18	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.60492214 ft.

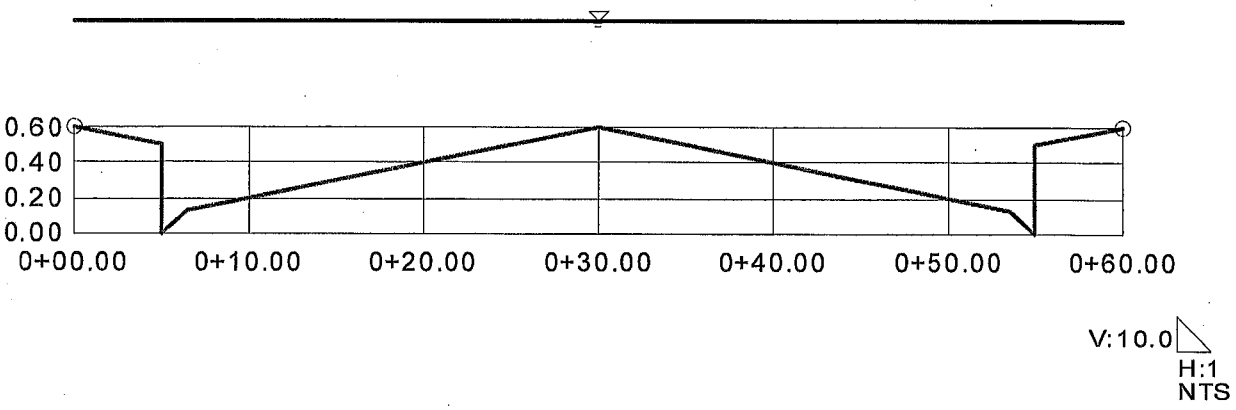
Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+60.00	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.00	0.00
0+06.50	0.13
0+30.00	0.60
0+53.50	0.13
0+55.00	0.00
0+55.00	0.50
0+60.00	0.60

El Camino
Cross Section for Irregular Channel

Project Description	
Worksheet	El Camino
Flow Element	Irregular Chan
Method	Manning's For
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.016	
Channel Slope	0.005800	ft/ft
Water Surface Elev	1.20	ft
Elevation Range	.00 to 0.60	
Discharge	300.0	cfs



ElCaminoOverBank
Worksheet for Irregular Channel

Project Description	
Worksheet	ElCaminoOver
Flow Element	Irregular Chani
Method	Manning's For
Solve For	Discharge

Input Data		
Channel Slope	058000	ft/ft
Water Surface Elev	0.70	ft

Options	
Current Roughness Metho	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coeffic	0.016	
Elevation Range	0.00 to 0.10	
Discharge	46.8	cfs
Flow Area	3.2	ft²
Wetted Perimeter	6.30	ft
Top Width	5.00	ft
Actual Depth	0.70	ft
Critical Elevation	1.45	ft
Critical Slope	0.006032	ft/ft
Velocity	14.38	ft/s
Velocity Head	3.22	ft
Specific Energy	3.92	ft
Froude Number	3.15	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.7 ft.

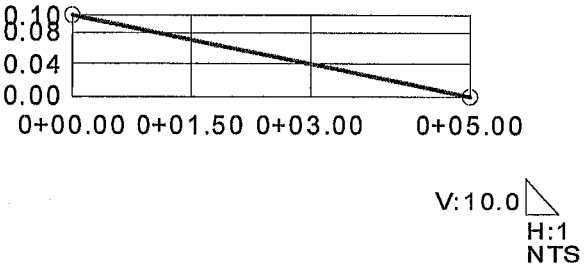
Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+05.00	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.10
0+05.00	0.00

ElCaminoOverBank
Cross Section for Irregular Channel

Project Description	
Worksheet	ElCaminoOver
Flow Element	Irregular Chan
Method	Manning's For
Solve For	Discharge

Section Data		
Mannings Coefficie	0.016	
Channel Slope	0.058000	ft/ft
Water Surface Elev	0.70	ft
Elevation Range	.00 to 0.10	
Discharge	46.8	cfs



CAPACITY OF
VALLEY VIEW STORM DRAIN

Capacity of Valley View Storm Drain (30" RCP @ 0.85)
Worksheet for Circular Channel

Project Description	
Worksheet	Capacity of Valley View Storm Drain (30" R
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

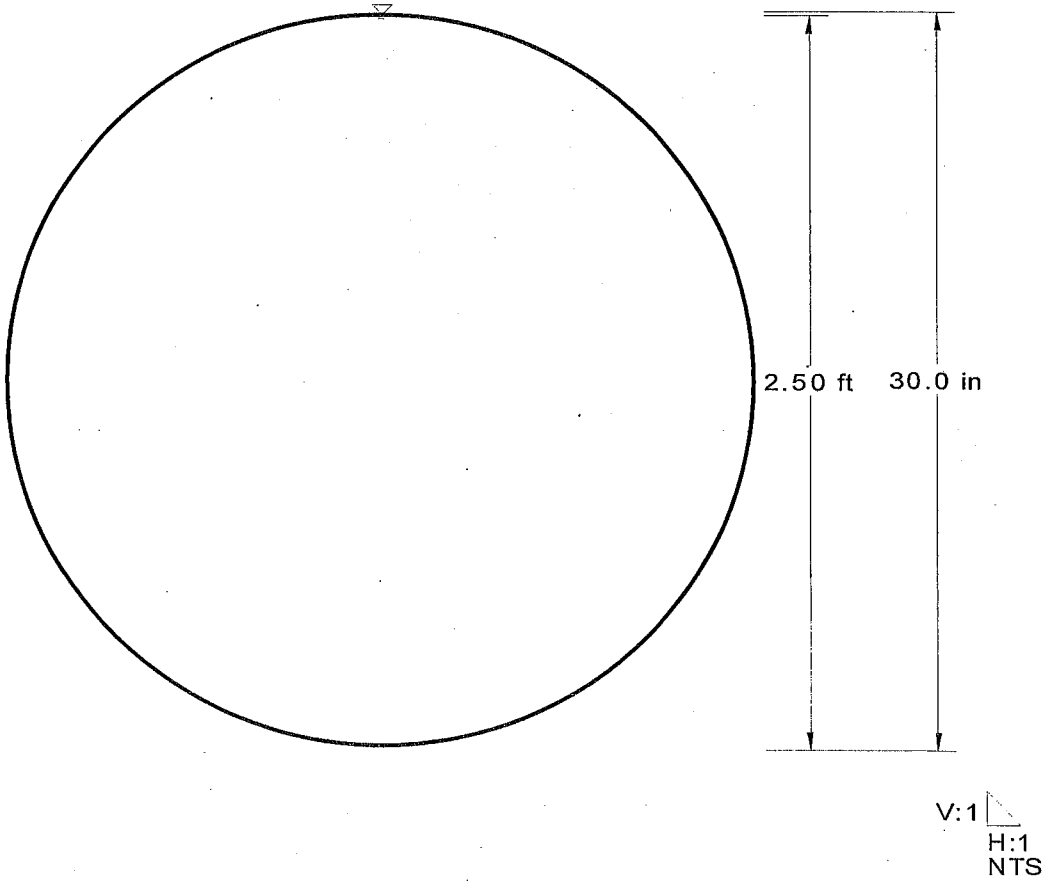
Input Data		
Mannings Coeffic	0.013	
Channel Slope	0.85	%
Diameter	30.0	in

Results		
Depth	2.50	ft
Discharge	37.8	cfs
Flow Area	4.9	ft²
Wetted Perime	7.85	ft
Top Width	0.00	ft
Critical Depth	2.08	ft
Percent Full	100.0	%
Critical Slope	0.83	%
Velocity	7.70	ft/s
Velocity Head	0.92	ft
Specific Energy	3.42	ft
Froude Numbe	0.00	
Maximum Disc	40.7	cfs
Discharge Full	37.8	cfs
Slope Full	0.85	%
Flow Type	N/A	

Capacity of Valley View Storm Drain (30" RCP @ 0.85)
Cross Section for Circular Channel

Project Description	
Worksheet	Capacity of Valley View Storm Drain (30" R
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

Section Data		
Mannings Coeffic	0.013	
Channel Slope	0.85	%
Depth	2.50	ft
Diameter	30.0	in
Discharge	37.8	cfs



HEC-1 MODELS

Big Basin Model

Computation

Project	Oakey Storm Drain - Birch to Cahlan	Computed	MC
Subject	Curve Numbers	Checked	
Task	Big Basin Model	Sheet	1 of 2

Date 2/1/2007

Date

Subbasin Compositive Curve Numbers (CN)

Subbasin	Soil Unit	HSG	Area (acre)	Land Use	CN	A*CN	Composite CN
OFF1	300	D	12.1	High Density Residential	91	1102.0	
			26.4	Multi Family	93	2450.6	
			24.2	Commercial, Office	95	2299.0	
	TOTAL		62.7			5851.6	93.4
OFF2	300	D	48.7	High Density Residential	91	4427.2	
			16.3	Commercial, Office	95	1550.4	
	TOTAL		65.0			5977.6	92.0
OFF3	300	D	23.1	High Density Residential	91	2103.0	
	TOTAL		23.1			2103.0	91.0
OFF4	300	D	16.2	High Density Residential	91	1473.3	
	TOTAL		16.2			1473.3	91.0
OFF5	300	D	20.6	High Density Residential	91	1877.3	
	TOTAL		20.6			1877.3	91.0
OFF6	300	D	46.4	High Density Residential	91	4224.2	
	TOTAL		46.4			4224.2	91.0
OFF7	300	D	10.3	High Density Residential	90	923.4	
			12.8	Multi Family	93	1191.3	
	TOTAL		23.1			2114.7	91.7
OFF8	300	D	2.4	High Density Residential	91	218.9	
			2.5	Medium Density Residential	87	218.6	
			2.8	Road	98	269.6	
	TOTAL		7.7			707.2	92.2

Computation

Project	Oakey Storm Drain - Birch to Cahlan	Computed	MC
Subject	Curve Numbers	Checked	
Task	Big Basin Model	Sheet	2

Date	2/1/2007						
Date							
Of	2						

OFF9	300	D	12.9	High Density Residential	90	1161.0	
			5.8	Park (Poor Condition)	89	513.5	
	TOTAL		18.7			1674.5	89.7
OFF10	300	D	18.8	High Density Residential	88	1656.2	
	390	C	23.1	High Density Residential	85	1961.0	
	TOTAL		41.9			3617.1	86.3
OFF11	300	D	9.3	Multi Family	93	861.2	
			8.7	Commercial, Office	95	826.5	
	TOTAL		18.0			1687.7	94.0
OFF12	300	D	58.2	High Density Residential	91	5294.4	
			19.6	Multi Family	93	1824.7	
	TOTAL		77.8			7119.0	91.5
OFF13	300	D	7.7	High Density Residential	87	671.6	
	390	C	32.3	High Density Residential	83	2678.4	
	TOTAL		40.0			3350.1	83.8
OFF14	300	D	36.9	High Density Residential	91	3357.9	
	390	C	50.3	High Density Residential	82	4121.3	
	TOTAL		87.2			7479.2	85.8
OFF15	390	C	16.3	High Density Residential	83	1349.6	
			8.9	Medium Density Residential	82	729.0	
	TOTAL		25.2			2078.6	82.6

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              JUN  1998                *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   01FEB07  TIME  16:57:34   *
*                                       *
*****************************************
```

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

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

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

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


```
         LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
                   *DIAGRAM
*** FREE ***
              1    ID  ***************************************************************************
              2    ID  * ..................................................................... *
              3    ID  * :                                                                   : *
              4    ID  * :                          OAKEY STORM DRAIN                        : *
              5    ID  * :                       (DEVELOPED CONDITIONS)                      : *
              6    ID  * :                                                                   : *
              7    ID  * :...................................................................: *
              8    ID  * :                RETURN PERIOD_ _ _ _ _ _10- AND 100-YEAR           : *
              9    ID  * :                DISTRIBUTION_ _ _ _ _ _ 6-HOUR, SDN3               : *
             10    ID  * :                PROJECT NO_ _ _ _ _ _ _ _                          : *
             11    ID  * :                FILENAME_ _ _ _ _ _ _ _ BIGBASIN.DAT               : *
             12    ID  * :                DATE_ _ _ _ _ _ _ _ _ _ 2/1/2007                   : *
             13    ID  * :                BY_ _ _ _ _ _ _ _ _ _ _ HDR                        : *
             14    ID  * :...................................................................: *
             15    ID  *                                                                     *
             16    ID  ***************************************************************************
             17    ID
             18    ID
             19    IT      5       0       0     300
             20    IO      5
             21    IN      5
                   *
             22    JR    PREC    1.00    0.57
                   *
             23    KK    OFF1
             24    BA   .0980
             25    PB    2.77
             26    PC   0.000   0.020   0.057   0.070   0.087   0.108   0.124   0.130   0.130   0.130
             27    PC   0.130   0.130   0.130   0.133   0.140   0.142   0.148   0.158   0.172   0.181
             28    PC   0.190   0.197   0.199   0.200   0.201   0.204   0.214   0.229   0.241   0.249
             29    PC   0.251   0.256   0.270   0.278   0.281   0.283   0.295   0.322   0.352   0.409
             30    PC   0.499   0.590   0.710   0.744   0.781   0.812   0.819   0.835   0.851   0.856
             31    PC   0.860   0.868   0.876   0.888   0.910   0.926   0.937   0.950   0.970   0.976
             32    PC   0.982   0.985   0.987   0.989   0.990   0.993   0.993   0.994   0.995   0.998
             33    PC   0.998   0.999   1.000
             34    LS       0    93.4
             35    UD   0.229
                   *
             36    KK   ROFF1
             37    KM   ROUTE OFF1 THROUGH OFF2 TO CP1
             38    KM   INTERSECTION OF EL CAMINO AND VALLEY VIEW
             39    RD    2860  0.0094   0.016       0    TRAP      50       0
                   *
             40    KK    OFF2
             41    BA   .1015
             42    LS       0    92.0
             43    UD   0.308
                   *
```



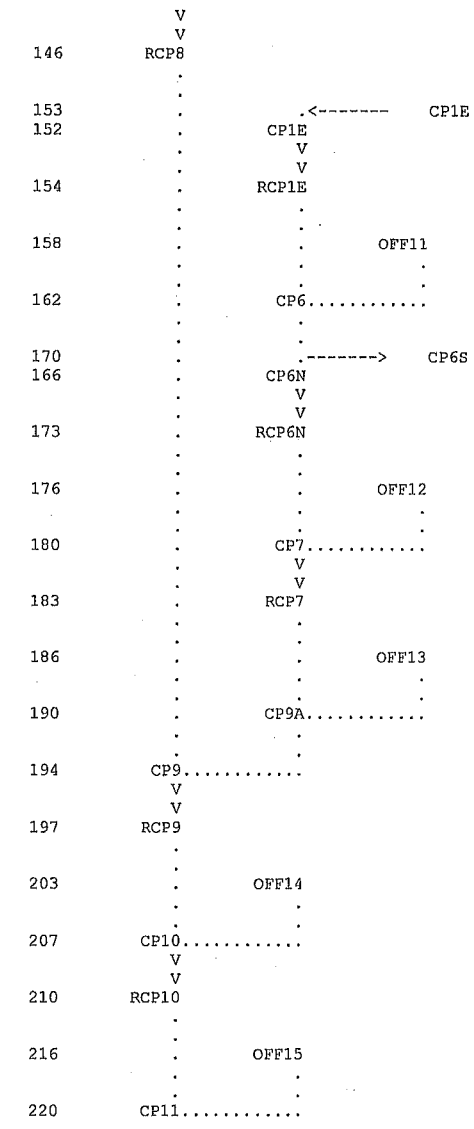
```
         LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
```

```
 44          KK     CP1
 45          KM   COMBINE ROFF1 AND OFF2
 46          KM   INTERSECTION OF EL CAMINO AND VALLEY VIEW
 47          HC       2
             *

 48          KK    CP1N
 49          KM   REMAINING FLOW EAST TO OFF4
 50          KM   AFTER FLOW SPLIT AT EL CAMINO AND VALLEYVIEW
 51          DT    CP1E
 52          DI       0     100     200     300
 53          DQ       0      55     112     169
             *

 54          KK   RCP1N
 55          KM   ROUTE CP1N ALONG VALLEY VIEW TO CP2
 56          KM   INTERSECTION OF EL CAMINO AND SPANISH OAKS
 57          RD     520  0.0040   0.016       0    TRAP      80       0
             *

 58          KK    OFF3
 59          BA   .0361
 60          LS       0    91.0
 61          UD   0.116
             *

 62          KK     CP2
 63          KM   COMBINE RCP1N AND OFF3
 64          KM   vALLEY VIEW AND LA PASADA
 65          HC       2
             *

 66          KK    CP2N
 67          KM   DIVERT OUT FLOW TO EL CAMINO STORM DRAIN SYSTEM
 68          KM   FULL FLOW CAPACITY IS 38 CFS (30" RCP @ 0.85%)
 69          DT    CP2S
 70          DI       0      10      20      38      50     100     200
 71          DQ       0      10      20      38      38      38      38
             *

 72          KK   RCP2N
 73          KM   ROUTE CP2N ALONG VALLEY VIEW TO CP3
 74          KM   INTERSECTION OF VALLEY VIEW AND EL CORTEZ
 75          RD     930  0.0040   0.016       0    TRAP      80       0
             *

 76          KK    OFF4
 77          BA   .0253
 78          LS       0    91.0
 79          UD   0.245
             *

1                                        HEC-1 INPUT                                        PAGE  3

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

 80          KK   ROFF4
 81          KM   ROUTE OFF4 THROUGH OFF5 TO CP3
 82          RD    1450  0.0069   0.016       0    TRAP      50       0
             *

 83          KK    OFF5
 84          BA   .0322
 85          LS       0    91.0
 86          UD   0.129
             *

 87          KK     CP3
 88          KM   COMBINE RCP2N, ROFF4 AND OFF5
 89          KM   vALLEY VIEW AND LA PASADA
 90          HC       3
             *

 91          KK    RCP3
 92          KM   ROUTE CP3 THROUGH OFF6 TO CP4A
 93          RD    2580  0.0174   0.016       0    TRAP      50       0
             *

 94          KK    OFF6
 95          BA   .0725
 96          LS       0    91.0
 97          UD   0.169
             *

 98          KK    CP4A
 99          KM   COMBINE RCP3 AND OFF6
100          KM   CAMPBELL JUST SOUTH OF OAKEY
101          HC       2
             *

102          KK    OFF7
103          BA   .0360
104          LS       0    91.7
105          UD   0.214
```

```
                *
  106           KK   ROFF7
  107           KM   ROUTE OFF7 ALONG OAKEY TO CP4B
  108           RD    650  0.0120   0.016       0    TRAP      80       0
                *

  109           KK    OFF8
  110           BA   .0120
  111           LS       0    92.2
  112           UD   0.113
                *
1                                        HEC-1 INPUT                                        PAGE  4

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

  113           KK    CP4B
  114           KM   COMBINE ROFF7 AND OFF8
  115           KM   OAKEY JUST WEST OF CAMPBELL
  116           HC       2
                *

  117           KK     CP4
  118           KM   COMBINE CP4A AND CP4B
  119           KM   INTERSECTION OF OAKEY AND CAMPBELL
  120           HC       2
                *

  121           KK    RCP4
  122           KM   ROUTE CP4 ALONG OAKEY TO CP5
  123           RD    1170  0.0130   0.016       0    TRAP      80       0
                *

  124           KK    OFF9
  125           BA   .0292
  126           LS       0    89.7
  127           UD   0.179
                *

  128           KK     CP5
  129           KM   COMBINE RCP4 AND OFF9
  130           KM   OAKEY JUST WEST OF CAHLAN
  131           HC       2
                *

  132           KK    RCP5
  133           KM   ROUTE CP5 ALONG OAKEY STORM DRAIN TO CP8
  134           KM   FACILITY = OAKEY DRAIN
  135           KM   FACILITY # = FWOK 0020
  136           KM   LINING = RCB
  137           RD     950  0.0150   0.015       0    TRAP       6       0
                *

  138           KK   OFF10
  139           BA   .0655
  140           LS       0    86.3
  141           UD   0.265
                *

  142           KK     CP8
  143           KM   COMBINE RCP5 AND OFF10
  144           KM   OAKEY AT STRONG
  145           HC       2
                *
1                                        HEC-1 INPUT                                        PAGE  5

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

  146           KK    RCP8
  147           KM   ROUTE CP8 ALONG OAKEY STORM DRAIN TO CP9
  148           KM   FACILITY = OAKEY DRAIN
  149           KM   FACILITY # = FWOK 0020
  150           KM   LINING = RCB
  151           RD     320  0.0100   0.015       0    TRAP       8       0
                *

  152           KK    CP1E
  153           DR    CP1E
                *

  154           KK   RCP1E
  155           KM   ROUTE CP1E THROUGH OFF11 TO CP6
  156           KM   INTERSECTION OF EL CAMINO AND SPANISH OAKS
  157           RD    1580  0.0125   0.016       0    TRAP      50       0
                *

  158           KK   OFF11
  159           BA   .0281
  160           LS       0    94.0
  161           UD   0.179
                *

  162           KK     CP6
```

```
 163          KM   COMBINE RCP1E AND OFF11
 164          KM   INTERSECTION OF EL CAMINO AND SPANISH OAKS
 165          HC       2
              *

 166          KK    CP6N
 167          KM   FLOW SPLIT AT EL CAMINO AND SPANISH OAKS
 168          KM   CLV AGREED 40% FLOW NORTH TO SPANISH COMMUNITY (OFF14)
 169          KM   AND 60% FLOW SOUTH TO SAHARA
 170          DT    CP6S
 171          DI       0     100     200     400
 172          DQ       0      60     120     240
              *

 173          KK   RCP6N
 174          KM   ROUTE CP6N THROUGH OFF12 TO CP7
 175          RD    2570  0.0187   0.016       0    TRAP      50       0
              *

 176          KK   OFF12
 177          BA   .1216
 178          LS       0    91.5
 179          UD   0.223
              *
1                                        HEC-1 INPUT                                        PAGE  6

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

 180          KK     CP7
 181          KM   COMBINE RCP6N AND OFF12
 182          HC       2
              *

 183          KK    RCP7
 184          KM   ROUTE CP7 THROUGH OFF13 TO CP9A
 185          RD    2340  0.0064   0.016       0    TRAP      50       0
              *

 186          KK   OFF13
 187          BA   .0625
 188          LS       0    83.8
 189          UD   0.242
              *

 190          KK    CP9A
 191          KM   COMBINE RCP7 AND OFF13
 192          KM   VILLA DE CONDE JUST SOUTH OF OAKEY
 193          HC       2
              *

 194          KK     CP9
 195          KM   COMBINE RCP8 AND CP9A
 196          HC       2
              *

 197          KK    RCP9
 198          KM   ROUTE CP9 ALONG OAKEY STORM DRAIN TO CP10
 199          KM   FACILITY = OAKEY DRAIN
 200          KM   FACILITY # = FWOK 0020
 201          KM   LINING = RCB
 202          RD     650  0.0100   0.015       0    TRAP       8       0
              *

 203          KK   OFF14
 204          BA   .1363
 205          LS       0    85.8
 206          UD   0.384
              *

 207          KK    CP10
 208          KM   COMBINE RCP9 AND OFF14
 209          HC       2
              *

 210          KK   RCP10
 211          KM   ROUTE CP10 ALONG OAKEY STORM DRAIN TO CP11
 212          KM   FACILITY = OAKEY DRAIN
 213          KM   FACILITY # = FWOK 0020
 214          KM   LINING = RCB
 215          RD    1130  0.0100   0.015       0    TRAP       8       0
              *
1                                        HEC-1 INPUT                                        PAGE  7

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

 216          KK   OFF15
 217          BA   .0393
 218          LS       0    82.6
 219          UD   0.209
              *

 220          KK    CP11
 221          KM  COMBINE RCP10 AND OFF14
```

```
            222           HC        2
                          *
                          *
            223           ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING           (--->) DIVERSION OR PUMP FLOW

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

    23        OFF1
                V
                V
    36        ROFF1
                .
                .
    40          .         OFF2
                .            .
                .            .
    44          CP1............
                .
                .
    51          .-------->    CP1E
    48        CP1N
                V
                V
    54        RCP1N
                .
                .
    58          .         OFF3
                .            .
                .            .
    62          CP2............
                .
                .
    69          .-------->    CP2S
    66        CP2N
                V
                V
    72        RCP2N
                .
                .
    76          .         OFF4
                .            V
                .            V
    80          .        ROFF4
                .            .
                .            .
    83          .            .         OFF5
                .            .            .
                .            .            .
    87          CP3.........................
                V
                V
    91        RCP3
                .
                .
    94          .         OFF6
                .            .
                .            .
    98        CP4A............
                .
                .
   102          .         OFF7
                .            V
                .            V
   106          .        ROFF7
                .            .
                .            .
   109          .            .         OFF8
                .            .            .
                .            .            .
   113          .         CP4B............
                .            .
                .            .
   117          CP4............
                V
                V
   121        RCP4
                .
                .
   124          .         OFF9
                .            .
                .            .
   128          CP5............
                V
                V
   132        RCP5
                .
                .
   138          .        OFF10
                .            .
                .            .
   142          CP8............
```



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              JUN   1998               *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   01FEB07  TIME  16:57:34   *
*                                       *
*****************************************
```

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

```
*************************************************************************
* ..................................................................... *
* :                                                                   : *
* :                          OAKEY STORM DRAIN                        : *
* :                       (DEVELOPED CONDITIONS)                      : *
* :                                                                   : *
* :...................................................................: *
* :               RETURN PERIOD_ _ _ _ _ _10- AND 100-YEAR            : *
* :               DISTRIBUTION_ _ _ _ _ _ 6-HOUR, SDN3                : *
* :               PROJECT NO_ _ _ _ _ _ _ _                           : *
* :               FILENAME_ _ _ _ _ _ _ _ BIGBASIN.DAT                : *
* :               DATE_ _ _ _ _ _ _ _ _ _ 2/1/2007                    : *
* :               BY_ _ _ _ _ _ _ _ _ _ _ HDR                         : *
* :...................................................................: *
*                                                                       *
*************************************************************************
```

```
                    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
1

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

                                                                                  RATIOS APPLIED TO PRECIPITATION
 OPERATION       STATION      AREA     PLAN                 RATIO 1  RATIO 2
                                                                1.00      .57

 HYDROGRAPH AT
+                  OFF1        .10      1   FLOW              138.      67.
                                             TIME             3.67     3.67

 ROUTED TO
+                  ROFF1       .10      1   FLOW              134.      67.
                                             TIME             3.75     3.75

 HYDROGRAPH AT
+                  OFF2        .10      1   FLOW              120.      56.
                                             TIME             3.75     3.75

   2 COMBINED AT
+                   CP1        .20      1   FLOW              255.     123.
                                             TIME             3.75     3.75

 DIVERSION TO
+                  CP1E        .20      1   FLOW              143.      68.
                                             TIME             3.75     3.75

 HYDROGRAPH AT
+                  CP1N        .20      1   FLOW              111.      55.
                                             TIME             3.75     3.75

 ROUTED TO
+                  RCP1N       .20      1   FLOW              110.      54.
                                             TIME             3.75     3.83

 HYDROGRAPH AT
+                  OFF3        .04      1   FLOW               56.      26.
                                             TIME             3.58     3.58

   2 COMBINED AT
+                   CP2        .24      1   FLOW              142.      68.
                                             TIME             3.67     3.75

 DIVERSION TO
+                  CP2S        .24      1   FLOW               38.      38.
                                             TIME             3.33     3.50

 HYDROGRAPH AT
+                  CP2N        .24      1   FLOW              104.      30.
                                             TIME             3.67     3.75

 ROUTED TO
+                  RCP2N       .24      1   FLOW              103.      29.
                                             TIME             3.75     3.83

 HYDROGRAPH AT
+                  OFF4        .03      1   FLOW               32.      14.
                                             TIME             3.67     3.67

 ROUTED TO
```

+	ROFF4	.03	1	FLOW	31.	14.
				TIME	3.75	3.83
HYDROGRAPH AT						
+	OFF5	.03	1	FLOW	50.	23.
				TIME	3.58	3.58
3 COMBINED AT						
+	CP3	.29	1	FLOW	167.	54.
				TIME	3.67	3.83
ROUTED TO						
+	RCP3	.29	1	FLOW	165.	56.
				TIME	3.75	3.92
HYDROGRAPH AT						
+	OFF6	.07	1	FLOW	106.	48.
				TIME	3.58	3.58
2 COMBINED AT						
+	CP4A	.37	1	FLOW	252.	76.
				TIME	3.67	3.92
HYDROGRAPH AT						
+	OFF7	.04	1	FLOW	48.	22.
				TIME	3.67	3.67
ROUTED TO						
+	ROFF7	.04	1	FLOW	48.	22.
				TIME	3.67	3.67
HYDROGRAPH AT						
+	OFF8	.01	1	FLOW	20.	9.
				TIME	3.50	3.58
2 COMBINED AT						
+	CP4B	.05	1	FLOW	64.	29.
				TIME	3.58	3.67
2 COMBINED AT						
+	CP4	.41	1	FLOW	314.	99.
				TIME	3.67	3.67
ROUTED TO						
+	RCP4	.41	1	FLOW	303.	97.
				TIME	3.75	3.75
HYDROGRAPH AT						
+	OFF9	.03	1	FLOW	40.	17.
				TIME	3.58	3.58
2 COMBINED AT						
+	CP5	.44	1	FLOW	334.	113.
				TIME	3.67	3.67
ROUTED TO						
+	RCP5	.44	1	FLOW	333.	111.
				TIME	3.75	3.75
HYDROGRAPH AT						
+	OFF10	.07	1	FLOW	66.	25.
				TIME	3.67	3.75
2 COMBINED AT						
+	CP8	.51	1	FLOW	397.	136.
				TIME	3.75	3.75
ROUTED TO						
+	RCP8	.51	1	FLOW	397.	136.
				TIME	3.75	3.75
HYDROGRAPH AT						
+	CP1E	.00	1	FLOW	143.	68.
				TIME	3.75	3.75
ROUTED TO						
+	RCP1E	.00	1	FLOW	140.	68.
				TIME	3.75	3.83
HYDROGRAPH AT						
+	OFF11	.03	1	FLOW	45.	22.
				TIME	3.58	3.58
2 COMBINED AT						
+	CP6	.03	1	FLOW	173.	81.
				TIME	3.75	3.83
DIVERSION TO						
+	CP6S	.03	1	FLOW	104.	48.
				TIME	3.75	3.83
HYDROGRAPH AT						
+	CP6N	.03	1	FLOW	69.	32.
				TIME	3.75	3.83

ROUTED TO

+	RCP6N	.03	1	FLOW	69.	33.
				TIME	3.83	3.92

HYDROGRAPH AT

+	OFF12	.12	1	FLOW	161.	74.
				TIME	3.67	3.67

2 COMBINED AT

+	CP7	.15	1	FLOW	213.	90.
				TIME	3.67	3.75

ROUTED TO

+	RCP7	.15	1	FLOW	215.	90.
				TIME	3.75	3.83

HYDROGRAPH AT

+	OFF13	.06	1	FLOW	59.	20.
				TIME	3.67	3.67

2 COMBINED AT

+	CP9A	.21	1	FLOW	271.	108.
				TIME	3.75	3.83

2 COMBINED AT

+	CP9	.72	1	FLOW	668.	243.
				TIME	3.75	3.75

ROUTED TO

+	RCP9	.72	1	FLOW	666.	241.
				TIME	3.75	3.75

HYDROGRAPH AT

+	OFF14	.14	1	FLOW	113.	42.
				TIME	3.83	3.83

2 COMBINED AT

+	CP10	.86	1	FLOW	775.	281.
				TIME	3.75	3.75

ROUTED TO

+	RCP10	.86	1	FLOW	771.	278.
				TIME	3.75	3.83

HYDROGRAPH AT

+	OFF15	.04	1	FLOW	37.	12.
				TIME	3.67	3.67

2 COMBINED AT

+	CP11	.90	1	FLOW	803.	288.
				TIME	3.75	3.75

1

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	INTERPOLATED TO COMPUTATION INTERVAL DT	PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
FOR PLAN = 1 RATIO= .00									
ROFF1	MANE	4.75	136.67	223.25	2.07	5.00	134.32	225.00	2.07

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1082E+02 EXCESS= .0000E+00 OUTFLOW= .1084E+02 BASIN STORAGE= .5649E-02 PERCENT ERROR= -.2

FOR PLAN = 1 RATIO= .00									
ROFF1	MANE	5.00	67.46	225.00	.97	5.00	67.46	225.00	.97

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5038E+01 EXCESS= .0000E+00 OUTFLOW= .5049E+01 BASIN STORAGE= .5539E-02 PERCENT ERROR= -.3

FOR PLAN = 1 RATIO= .00									
RCP1N	MANE	2.07	109.98	226.04	.89	5.00	109.90	225.00	.89

CONTINUITY SUMMARY (AC-FT) - INFLOW= .9503E+01 EXCESS= .0000E+00 OUTFLOW= .9503E+01 BASIN STORAGE= .1682E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RCP1N	MANE	2.75	54.18	228.29	.41	5.00	53.63	230.00	.41

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4381E+01 EXCESS= .0000E+00 OUTFLOW= .4381E+01 BASIN STORAGE= .1555E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RCP2N	MANE	1.25	103.77	223.75	.38	5.00	103.47	225.00	.38

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4718E+01 EXCESS= .0000E+00 OUTFLOW= .4721E+01 BASIN STORAGE= .2714E-02 PERCENT ERROR= -.1

```
          FOR PLAN = 1  RATIO=  .00
             RCP2N  MANE          1.50     29.20    229.50       .07       5.00     29.11    230.00         .07

CONTINUITY SUMMARY (AC-FT) - INFLOW= .8731E+00 EXCESS= .0000E+00 OUTFLOW= .8782E+00 BASIN STORAGE= .3411E-02 PERCENT ERROR=  -1.0

          FOR PLAN = 1  RATIO=  .00
             ROFF4  MANE          4.75     31.34    223.25      1.86       5.00     31.20    225.00        1.86

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2504E+01 EXCESS= .0000E+00 OUTFLOW= .2508E+01 BASIN STORAGE= .3513E-02 PERCENT ERROR=   -.3

          FOR PLAN = 1  RATIO=  .00
             ROFF4  MANE          5.00     14.31    230.00       .81       5.00     14.31    230.00         .81

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1086E+01 EXCESS= .0000E+00 OUTFLOW= .1088E+01 BASIN STORAGE= .3152E-02 PERCENT ERROR=   -.5

          FOR PLAN = 1  RATIO=  .00
              RCP3  MANE          4.67    166.46    223.94       .67       5.00    165.47    225.00         .67

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1043E+02 EXCESS= .0000E+00 OUTFLOW= .1044E+02 BASIN STORAGE= .4003E-02 PERCENT ERROR=   -.2

          FOR PLAN = 1  RATIO=  .00
              RCP3  MANE          5.00     56.20    235.00       .21       5.00     56.20    235.00         .21

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3315E+01 EXCESS= .0000E+00 OUTFLOW= .3320E+01 BASIN STORAGE= .4313E-02 PERCENT ERROR=   -.3

          FOR PLAN = 1  RATIO=  .00
             ROFF7  MANE          2.60     48.47    218.61      1.92       5.00     48.33    220.00        1.91

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3680E+01 EXCESS= .0000E+00 OUTFLOW= .3682E+01 BASIN STORAGE= .1400E-02 PERCENT ERROR=   -.1

          FOR PLAN = 1  RATIO=  .00
             ROFF7  MANE          3.54     22.27    223.06       .85       5.00     22.14    220.00         .85

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1629E+01 EXCESS= .0000E+00 OUTFLOW= .1630E+01 BASIN STORAGE= .1714E-02 PERCENT ERROR=   -.2

          FOR PLAN = 1  RATIO=  .00
              RCP4  MANE          2.17    311.03    223.01      1.02       5.00    302.85    225.00        1.02

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2252E+02 EXCESS= .0000E+00 OUTFLOW= .2253E+02 BASIN STORAGE= .2856E-02 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
              RCP4  MANE          3.44     98.62    223.45       .39       5.00     97.24    225.00         .39

CONTINUITY SUMMARY (AC-FT) - INFLOW= .8624E+01 EXCESS= .0000E+00 OUTFLOW= .8627E+01 BASIN STORAGE= .2861E-02 PERCENT ERROR=   -.1

          FOR PLAN = 1  RATIO=  .00
              RCP5  MANE           .56    334.52    220.90      1.07       5.00    332.93    225.00        1.07

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2524E+02 EXCESS= .0000E+00 OUTFLOW= .2524E+02 BASIN STORAGE= .6585E-03 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
              RCP5  MANE           .87    112.89    221.48       .41       5.00    111.05    225.00         .41

CONTINUITY SUMMARY (AC-FT) - INFLOW= .9768E+01 EXCESS= .0000E+00 OUTFLOW= .9768E+01 BASIN STORAGE= .6872E-03 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
              RCP8  MANE           .22    397.24    224.84      1.12       5.00    397.19    225.00        1.12

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3046E+02 EXCESS= .0000E+00 OUTFLOW= .3046E+02 BASIN STORAGE= .2743E-03 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
              RCP8  MANE           .34    135.93    224.94       .43       5.00    135.91    225.00         .43

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1173E+02 EXCESS= .0000E+00 OUTFLOW= .1173E+02 BASIN STORAGE= .2788E-03 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
             RCP1E  MANE          3.36    142.27    228.25     -1.00       5.00    140.31    225.00       -1.00
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          FOR PLAN = 1  RATIO=  .00
             RCP1E  MANE          4.51     67.93    230.15     -1.00      5.00     67.82    230.00       -1.00


          FOR PLAN = 1  RATIO=  .00
             RCP6N  MANE          5.00     69.10    230.00      4.02      5.00     69.10    230.00        4.02

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6018E+01 EXCESS= .0000E+00 OUTFLOW= .6024E+01 BASIN STORAGE= .5218E-02 PERCENT ERROR=   -.2

          FOR PLAN = 1  RATIO=  .00
             RCP6N  MANE          5.00     32.59    235.00      1.84      5.00     32.59    235.00        1.84

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2760E+01 EXCESS= .0000E+00 OUTFLOW= .2763E+01 BASIN STORAGE= .5105E-02 PERCENT ERROR=   -.3

          FOR PLAN = 1  RATIO=  .00
              RCP7  MANE          5.00    215.05    225.00      2.30      5.00    215.05    225.00        2.30

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1835E+02 EXCESS= .0000E+00 OUTFLOW= .1837E+02 BASIN STORAGE= .5693E-02 PERCENT ERROR=   -.1

          FOR PLAN = 1  RATIO=  .00
              RCP7  MANE          5.00     90.40    230.00      1.03      5.00     90.40    230.00        1.03

CONTINUITY SUMMARY (AC-FT) - INFLOW= .8183E+01 EXCESS= .0000E+00 OUTFLOW= .8191E+01 BASIN STORAGE= .4866E-02 PERCENT ERROR=   -.2

          FOR PLAN = 1  RATIO=  .00
              RCP9  MANE           .37    666.39    225.17      1.39      5.00    665.89    225.00        1.39

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5322E+02 EXCESS= .0000E+00 OUTFLOW= .5322E+02 BASIN STORAGE= .5514E-03 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
              RCP9  MANE           .55    242.48    225.82       .56      5.00    241.48    225.00         .56

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2144E+02 EXCESS= .0000E+00 OUTFLOW= .2144E+02 BASIN STORAGE= .5718E-03 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
             RCP10  MANE           .60    772.96    225.71      1.40      5.00    770.81    225.00        1.40

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6382E+02 EXCESS= .0000E+00 OUTFLOW= .6382E+02 BASIN STORAGE= .9824E-03 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
             RCP10  MANE           .91    280.66    226.48       .55      5.00    278.07    230.00         .56

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2536E+02 EXCESS= .0000E+00 OUTFLOW= .2536E+02 BASIN STORAGE= .1006E-02 PERCENT ERROR=    .0


*** NORMAL END OF HEC-1 ***
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Small Basin Model

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

TIME OF CONCENTRATION

HDR, Inc.
File: SF4.XLS

Oakey Storm Drain - Small Basin Model
(Ultimate Conditions)

BY: HT
DATE: 2/1/2007

SUB-BASIN DATA						INITIAL / OVERLAND TIME (Ti)			TRAVEL TIME (Tt)					Tc	Tc Check	Tlag	REMARKS
DESIG: (1)	DEV./EX. (D or E)	CN	K (2)	AREA Ac (3)	AREA Mi^2	INITIAL LENGTH Feet (4)	SLOPE % (5)	Ti Min (6)	TRAVEL LENGTH Feet (7)	SLOPE % (8)	V1 VELOCITY FPS (9a)	V2 VELOCITY FPS (9b)	Tt Min (10)	Min (13)	Min (14)	Tlag= 0.6Tc/60 Hours	RAINFALL Q100/Q10 Inches
OFF1	D	93.4	0.8429	62.71	0.0980	385	1.0	9.1	2650	1.32	2.3	3.5	13.8	22.9	26.9	0.229	2.77/1.58
OFF2	D	92.0	0.8244	64.93	0.1015	140	1.0	5.9	3600	0.42	1.3	2.0	32.5	38.4	30.8	0.308	2.77/1.58
OFF3	D	91.0	0.8112	23.11	0.0361	110	1.0	5.5	1520	2.47	3.2	4.8	6.2	11.6	19.1	0.116	2.77/1.58
OFF4	D	91.0	0.8112	16.19	0.0253	120	1.0	5.7	2930	0.85	1.9	2.8	18.8	24.5	26.9	0.245	2.77/1.58
OFF5	D	91.0	0.8112	20.63	0.0322	100	1.0	5.2	1420	1.41	2.4	3.6	7.7	12.9	18.4	0.129	2.77/1.58
OFF6	D	91.0	0.8112	46.42	0.0725	120	1.0	5.7	2555	1.86	2.8	4.2	11.2	16.9	24.9	0.169	2.77/1.58
OFF7	D	91.7	0.8204	23.05	0.0360	790	1.0	14.1	1360	1.47	2.4	3.7	7.3	21.4	21.9	0.214	2.77/1.58
OFF8	D	92.2	0.8270	7.67	0.0120	40	2.0	2.5	2110	2.13	2.9	4.5	8.8	11.3	21.9	0.113	2.77/1.58
OFF9A	D	90.0	0.7980	8.28	0.0129	110	1.0	5.7	840	0.60	1.6	2.4	7.7	13.4	15.3	0.134	2.77/1.58
OFF9B	D	89.0	0.7848	5.77	0.0090	135	1.0	6.6	460	1.09	2.1	3.2	3.6	10.2	13.3	0.102	2.77/1.58
OFF10A	D	86.4	0.7505	39.19	0.0612	110	1.0	6.6	3670	1.16	2.2	3.3	19.9	26.5	31.0	0.265	2.77/1.58
OFF10B	D	87.6	0.7663	4.68	0.0073	130	1.0	6.8	1300	1.54	2.5	3.8	6.8	13.7	17.9	0.137	2.77/1.58
OFF10C	D	85.0	0.7320	2.84	0.0044	130	1.0	7.6	810	1.23	2.2	3.4	5.2	12.8	15.2	0.128	2.77/1.58
OFF11	D	94.0	0.8508	17.96	0.0281	50	1.0	3.2	2050	0.73	1.7	2.6	14.7	17.9	21.7	0.179	2.77/1.58
OFF12	D	91.5	0.8178	77.80	0.1216	140	1.0	6.0	3550	1.62	2.6	3.9	16.3	22.3	30.5	0.223	2.77/1.58
OFF13	D	83.8	0.7162	39.99	0.0625	150	1.0	8.5	2410	0.62	1.6	2.4	18.4	26.9	24.2	0.242	2.77/1.58
OFF14A	D	83.0	0.7056	15.30	0.0239	200	1.0	10.0	1660	0.60	1.6	2.4	13.5	23.5	20.3	0.203	2.77/1.58
OFF14B	D	83.0	0.7056	3.54	0.0055	160	1.0	9.0	775	1.29	2.3	3.5	5.0	13.9	15.2	0.139	2.77/1.58
OFF14C	D	83.0	0.7056	4.61	0.0072	140	1.0	8.4	645	1.55	2.5	3.8	3.9	12.3	14.4	0.123	2.77/1.58
OFF14D	D	91.3	0.8152	63.75	0.0996	215	1.0	7.5	4750	0.68	1.7	2.5	33.0	40.5	37.6	0.376	2.77/1.58
OFF15A	D	82.0	0.6924	8.74	0.0137	410	1.0	14.9	1580	0.32	1.1	1.7	17.8	32.6	21.1	0.211	2.77/1.58
OFF15B	D	83.0	0.7056	16.42	0.0257	130	1.0	8.1	1760	0.85	1.9	2.8	11.9	20.0	20.5	0.200	2.77/1.58
				Total	0.896												

Tc = Ti + Tt Tlag = 0.6 Tc
Ti = 1.8 (1.1 - K) L^1/2 / S^1/3
K = 0.0132 (CN) - 0.39
Tc Check = L/180+10

For the travel time (Tt) calculations,
V1 applies to the first 500 feet of travel distance;
V2 applies to the remaining travel distance.

Existing V1 = 14.8*(S/100)^1/2 Developed V1 = 20.2*(S/100)^1/2
Existing V2 = 29.4*(S/100)^1/2 Developed V2 = 30.6*(S/100)^1/2

REFERENCE :

STANDARD FORM 4

Computation

Project	Oakey Storm Drain - Birch to Cahlan
Subject	Curve Numbers
Task	Small Basin Model

Computed	MC	Date	2/1/2007
Checked		Date	
Sheet	1	of	3

Subbasin Compositive Curve Numbers (CN)

Subbasin	Soil Unit	HSG	Area (acre)	Land Use	CN	A*CN	Composite CN
OFF1	300	D	12.1	High Density Residential	91	1102.0	
			26.4	Multi Family	93	2450.6	
			24.2	Commercial, Office	95	2299.0	
	TOTAL		62.7			5851.6	93.4
OFF2	300	D	48.7	High Density Residential	91	4427.2	
			16.3	Commercial, Office	95	1550.4	
	TOTAL		65.0			5977.6	92.0
OFF3	300	D	23.1	High Density Residential	91	2103.0	
	TOTAL		23.1			2103.0	91.0
OFF4	300	D	16.2	High Density Residential	91	1473.3	
	TOTAL		16.2			1473.3	91.0
OFF5	300	D	20.6	High Density Residential	91	1877.3	
	TOTAL		20.6			1877.3	91.0
OFF6	300	D	46.4	High Density Residential	91	4224.2	
	TOTAL		46.4			4224.2	91.0
OFF7	300	D	10.3	High Density Residential	90	923.4	
			12.8	Multi Family	93	1191.3	
	TOTAL		23.1			2114.7	91.7
OFF8	300	D	2.4	High Density Residential	91	218.9	
			2.5	Medium Density Residential	87	218.6	
			2.8	Road	98	269.6	
	TOTAL		7.7			707.2	92.2

Computation

Project	Oakey Storm Drain - Birch to Cahlan
Subject	Curve Numbers
Task	Small Basin Model

Computed	MC	Date	2/1/2007
Checked		Date	
Sheet	2	of	3

OFF9A	300	D	8.3	High Density Residential	90	745.2	
	TOTAL		8.3			745.2	90.0
OFF9B	300	D	5.8	Park (Poor Condition)	89	513.5	
	TOTAL		5.8			513.5	89.0
OFF10A	300	D	18.9	High Density Residential	88	1663.2	
	390	C	20.3	High Density Residential	85	1724.7	
	TOTAL		39.2			3387.9	86.4
OFF10B	300	D	4.0	High Density Residential	88	354.6	
	390	C	0.7	High Density Residential	85	55.3	
	TOTAL		4.7			409.9	87.6
OFF10C	390	C	2.8	High Density Residential	85	241.4	
	TOTAL		2.8			241.4	85.0
OFF11	300	D	9.3	Multi Family	93	861.2	
			8.7	Commercial, Office	95	826.5	
	TOTAL		18.0			1687.7	94.0
OFF12	300	D	58.2	High Density Residential	91	5294.4	
			19.6	Multi Family	93	1824.7	
	TOTAL		77.8			7119.0	91.5
OFF13	300	D	7.7	High Density Residential	87	671.6	
	390	C	32.3	High Density Residential	83	2678.4	
	TOTAL		40.0			3350.1	83.8
OFF14A	390	C	15.3	High Density Residential	83	1269.9	
	TOTAL		15.3			1269.9	83.0
OFF14B	390	C	3.5	High Density Residential	83	293.8	
	TOTAL		3.5			293.8	83.0

Computation

Project	Oakey Storm Drain - Birch to Cahlan
Subject	Curve Numbers
Task	Small Basin Model

Computed	MC	Date	2/1/2007
Checked		Date	
Sheet	3	of	3

OFF14C	390	C	4.6	High Density Residential	83	382.6	
	TOTAL		4.6			382.6	83.0
OFF14D	300	D	19.0	High Density Residential	91	1726.3	
			18.2	Commercial, Office	95	1724.3	
	390	C	26.7	High Density Residential	89	2371.9	
	TOTAL		63.8			5822.4	91.3
OFF15A	390	C	8.8	Medium Density Residential	82	720.0	
	TOTAL		8.8			720.0	82.0
OFF15B	390	C	16.4	High Density Residential	83	1362.9	
	TOTAL		16.4			1362.9	83.0

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1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              JUN  1998                *
*           VERSION 4.1                 *
*                                       *
*  RUN DATE   01FEB07  TIME  11:48:50   *
*                                       *
*****************************************
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*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
*****************************************
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X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X                X
XXXXXXX  XXXX     X        XXXXX   X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX           XXX
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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
                    *DIAGRAM
*** FREE ***
               1    ID   ********************************************************************************
               2    ID   * ..................................................................... *
               3    ID   * :                                                                   : *
               4    ID   * :                          OAKEY STORM DRAIN                        : *
               5    ID   * :                        (DEVELOPED CONDITIONS)                     : *
               6    ID   * :                                                                   : *
               7    ID   * :...................................................................: *
               8    ID   * :              RETURN PERIOD_ _ _ _ _ _10- AND 100-YEAR             : *
               9    ID   * :              DISTRIBUTION_ _ _ _ _ _ 6-HOUR, SDN3                 : *
              10    ID   * :              PROJECT NO_ _ _ _ _ _ _ _                            : *
              11    ID   * :              FILENAME_ _ _ _ _ _ _ _ SMLBASIN.DAT                 : *
              12    ID   * :              DATE_ _ _ _ _ _ _ _ _ _ 2/1/2007                     : *
              13    ID   * :              BY_ _ _ _ _ _ _ _ _ _ _ HDR                          : *
              14    ID   * :...................................................................: *
              15    ID   *                                                                      *
              16    ID   ********************************************************************************
              17    ID
              18    ID
              19    IT       5       0       0     300
              20    IO       5
              21    IN       5
                    *
              22    JR    PREC    1.00    0.57
                    *

              23    KK    OFF1
              24    BA   .0980
              25    PB    2.77
              26    PC   0.000   0.020   0.057   0.070   0.087   0.108   0.124   0.130   0.130   0.130
              27    PC   0.130   0.130   0.130   0.133   0.140   0.142   0.148   0.158   0.172   0.181
              28    PC   0.190   0.197   0.199   0.200   0.201   0.204   0.214   0.229   0.241   0.249
              29    PC   0.251   0.256   0.270   0.278   0.281   0.283   0.295   0.322   0.352   0.409
              30    PC   0.499   0.590   0.710   0.744   0.781   0.812   0.819   0.835   0.851   0.856
              31    PC   0.860   0.868   0.876   0.888   0.910   0.926   0.937   0.950   0.970   0.976
              32    PC   0.982   0.985   0.987   0.989   0.990   0.993   0.993   0.994   0.995   0.998
              33    PC   0.998   0.999   1.000
              34    LS       0    93.4
              35    UD   0.229
                    *

              36    KK   ROFF1
              37    KM   ROUTE OFF1 THROUGH OFF2 TO CP1
              38    KM   INTERSECTION OF EL CAMINO AND VALLEY VIEW
              39    RD    2860  0.0094   0.016       0    TRAP      50       0
                    *

              40    KK    OFF2
              41    BA   .1015
              42    LS       0    92.0
              43    UD   0.308
                    *
```



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

```
   44          KK     CP1
   45          KM   COMBINE ROFF1 AND OFF2
   46          KM   INTERSECTION OF EL CAMINO AND VALLEY VIEW
   47          HC        2
               *

   48          KK    CP1N
   49          KM   REMAINING FLOW EAST TO OFF4
   50          KM   AFTER FLOW SPLIT AT EL CAMINO AND VALLEYVIEW
   51          DT    CP1E
   52          DI        0      100      200      300
   53          DQ        0       55      112      169
               *

   54          KK   RCP1N
   55          KM   ROUTE CP1N ALONG VALLEY VIEW TO CP2
   56          KM   INTERSECTION OF EL CAMINO AND SPANISH OAKS
   57          RD     520  0.0040   0.016        0    TRAP       80        0
               *

   58          KK    OFF3
   59          BA   .0361
   60          LS        0    91.0
   61          UD   0.116
               *

   62          KK     CP2
   63          KM   COMBINE RCP1N AND OFF3
   64          KM   vALLEY VIEW AND LA PASADA
   65          HC        2
               *

   66          KK    CP2N
   67          KM   DIVERT OUT FLOW TO EL CAMINO STORM DRAIN SYSTEM
   68          KM   FULL FLOW CAPACITY IS 38 CFS (30" RCP @ 0.85%)
   69          DT    CP2S
   70          DI        0       10       20       38       50      100      200
   71          DQ        0       10       20       38       38       38       38
               *

   72          KK   RCP2N
   73          KM   ROUTE CP2N ALONG VALLEY VIEW TO CP3
   74          KM   INTERSECTION OF VALLEY VIEW AND EL CORTEZ
   75          RD     930  0.0040   0.016        0    TRAP       80        0
               *

   76          KK    OFF4
   77          BA   .0253
   78          LS        0    91.0
   79          UD   0.245
               *
1                                          HEC-1 INPUT                                          PAGE  3

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

   80          KK   ROFF4
   81          KM   ROUTE OFF4 THROUGH OFF5 TO CP3
   82          RD    1450  0.0069   0.016        0    TRAP       50        0
               *

   83          KK    OFF5
   84          BA   .0322
   85          LS        0    91.0
   86          UD   0.129
               *

   87          KK     CP3
   88          KM   COMBINE RCP2N, ROFF4 AND OFF5
   89          KM   vALLEY VIEW AND LA PASADA
   90          HC        3
               *

   91          KK    RCP3
   92          KM   ROUTE CP3 THROUGH OFF6 TO CP4A
   93          RD    2580  0.0174   0.016        0    TRAP       50        0
               *

   94          KK    OFF6
   95          BA   .0725
   96          LS        0    91.0
   97          UD   0.169
               *

   98          KK    CP4A
   99          KM   COMBINE RCP3 AND OFF6
  100          KM   CAMPBELL JUST SOUTH OF OAKEY
  101          HC        2
               *

  102          KK    OFF7
  103          BA   .0360
  104          LS        0    91.7
  105          UD   0.214
```

```
                *
  106           KK   ROFF7
  107           KM   ROUTE OFF7 ALONG OAKEY TO CP4B
  108           RD     650  0.0120   0.016       0    TRAP      80       0
                *
  109           KK    OFF8
  110           BA   .0120
  111           LS       0    92.2
  112           UD   0.113
                *
1                                        HEC-1 INPUT                                        PAGE  4

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

  113           KK    CP4B
  114           KM   COMBINE ROFF7 AND OFF8
  115           KM   OAKEY JUST WEST OF CAMPBELL
  116           HC       2
                *
  117           KK     CP4
  118           KM   COMBINE CP4A AND CP4B
  119           KM   INTERSECTION OF OAKEY AND CAMPBELL
  120           HC       2
                *
  121           KK    RCP4
  122           KM   ROUTE CP4 ALONG OAKEY TO CP5A
  123           RD     560  0.0180   0.016       0    TRAP      80       0
                *
  124           KK   OFF9A
  125           BA   .0129
  126           LS       0    90.0
  127           UD   0.134
                *
  128           KK    CP5A
  129           KM   COMBINE RCP4 AND OFF9A
  130           HC       2
                *
  131           KK   RCP5A
  132           KM   ROUTE CP5A ALONG OAKEY TO CP5
  133           RD     620  0.0097   0.016       0    TRAP      80       0
                *
  134           KK   OFF9B
  135           BA   .0090
  136           LS       0    89.0
  137           UD   0.102
                *
  138           KK  OFF10B
  139           BA   .0073
  140           LS       0    87.6
  141           UD   0.137
                *
  142           KK     CP5
  143           KM   COMBINE RCP5A, OFF9B AND OFF10B
  144           KM   OAKEY AT CAHLAN
  145           HC       3
                *
1                                        HEC-1 INPUT                                        PAGE  5

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

  146           KK    RCP5
  147           KM   ROUTE CP5 ALONG OAKEY STORM DRAIN TO CP8
  148           KM   FACILITY = OAKEY DRAIN
  149           KM   FACILITY # = FWOK 0020
  150           KM   LINING = RCB
  151           RD     950  0.0150   0.015       0    TRAP       6       0
                *
  152           KK  OFF10A
  153           BA   .0612
  154           LS       0    86.4
  155           UD   0.265
                *
  156           KK  OFF10C
  157           BA   .0044
  158           LS       0    85.0
  159           UD   0.128
                *
  160           KK     CP8
  161           KM   COMBINE RCP5, OFF10A AND OFF10C
  162           KM   OAKEY AT STRONG
```

```
 163          HC       3
              *

 164          KK  ROFF11
 165          KM   ROUTE CP8 ALONG OAKEY STORM DRAIN TO CP9
 166          KM   FACILITY = OAKEY DRAIN
 167          KM   FACILITY # = FWOK 0020
 168          KM   LINING = RCB
 169          RD     320  0.0100   0.015       0    TRAP       8       0
              *

 170          KK    CP1E
 171          DR    CP1E
              *

 172          KK   RCP1E
 173          KM   ROUTE CP1E THROUGH OFF11 TO CP6
 174          KM   INTERSECTION OF EL CAMINO AND SPANISH OAKS
 175          RD    1580  0.0125   0.016       0    TRAP      50       0
              *

 176          KK   OFF11
 177          BA   .0281
 178          LS       0    94.0
 179          UD   0.179
              *
1                                        HEC-1 INPUT                                        PAGE  6

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

 180          KK     CP6
 181          KM   COMBINE RCP1E AND OFF11
 182          KM   INTERSECTION OF EL CAMINO AND SPANISH OAKS
 183          HC       2
              *

 184          KK    CP6N
 185          KM   FLOW SPLIT AT EL CAMINO AND SPANISH OAKS
 186          KM   CLV AGREED 40% FLOW NORTH TO SPANISH COMMUNITY (OFF14)
 187          KM   AND 60% FLOW SOUTH TO SAHARA
 188          DT    CP6S
 189          DI       0     100     200     400
 190          DQ       0      60     120     240
              *

 191          KK   RCP6N
 192          KM   ROUTE CP6N THROUGH OFF12 TO CP7
 193          RD    2570  0.0187   0.016       0    TRAP      50       0
              *

 194          KK   OFF12
 195          BA   .1216
 196          LS       0    91.5
 197          UD   0.223
              *

 198          KK     CP7
 199          KM   COMBINE RCP6N AND OFF12
 200          HC       2
              *

 201          KK    RCP7
 202          KM   ROUTE CP7 THROUGH OFF13 TO CP9
 203          RD    2340  0.0064   0.016       0    TRAP      50       0
              *

 204          KK   OFF13
 205          BA   .0625
 206          LS       0    83.8
 207          UD   0.242
              *

 208          KK    CP9A
 209          KM   COMBINE RCP7 AND OFF13
 210          KM   VILLA DE CONDE JUST SOUTH OF OAKEY
 211          HC       2
              *

 212          KK     CP9
 213          KM   COMBINE RCP8 AND CP9A
 214          HC       2
              *
1                                        HEC-1 INPUT                                        PAGE  7

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

 215          KK    RCP9
 216          KM   ROUTE CP9 ALONG OAKEY STORM DRAIN TO CP10
 217          KM   FACILITY = OAKEY DRAIN
 218          KM   FACILITY # = FWOK 0020
 219          KM   LINING = RCB
 220          RD     650  0.0100   0.015       0    TRAP       8       0
              *
```

```
          221          KK  OFF14A
          222          BA   .0239
          223          LS        0    83.0
          224          UD   0.203
                       *

          225          KK  OFF14B
          226          BA   .0055
          227          LS        0    83.0
          228          UD   0.139
                       *

          229          KK  OFF14C
          230          BA   .0072
          231          LS        0    83.0
          232          UD   0.123
                       *

          233          KK  OFF14D
          234          BA   .0996
          235          LS        0    91.3
          236          UD   0.376
                       *

          237          KK    CP10
          238          KM   COMBINE RCP9 AND OFF14A, OFF14B, OFF14C AND OFF14D
          239          KM   INTERSECTION OF OAKEY AND RANCHO
          240          HC        5
                       *

          241          KK   RCP10
          242          KM   ROUTE CP10 ALONG OAKEY STORM DRAIN TO CP11
          243          KM   FACILITY = OAKEY DRAIN
          244          KM   FACILITY # = FWOK 0020
          245          KM   LINING = RCB
          246          RD    1130  0.0100   0.015       0    TRAP       8       0
                       *

          247          KK  OFF15A
          248          BA   .0137
          249          LS        0    82.0
          250          UD   0.211
                       *
1                                                  HEC-1 INPUT                                                  PAGE  8

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

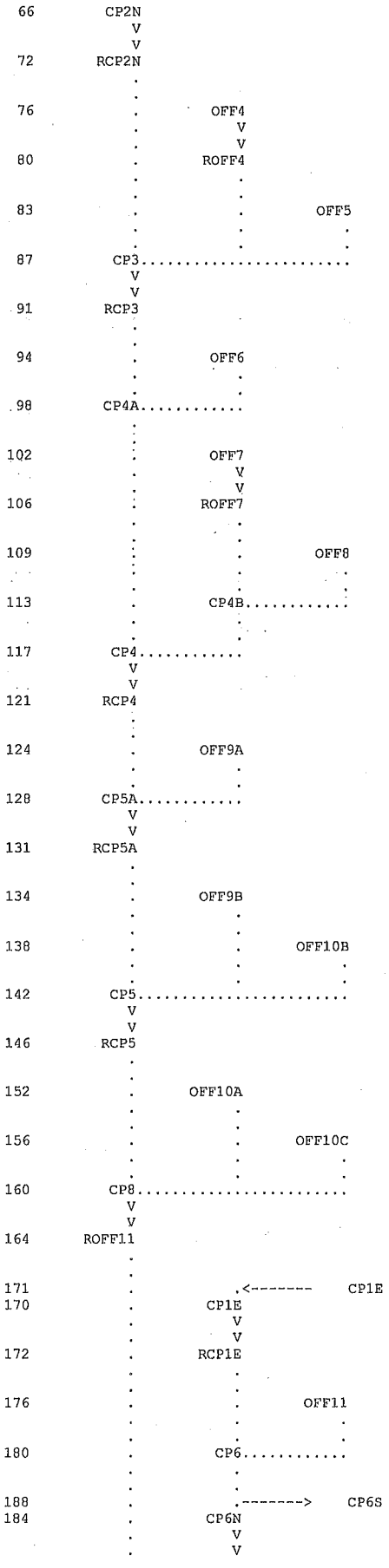
          251          KK  OFF15B
          252          BA   .0257
          253          LS        0    83.0
          254          UD   0.200
                       *

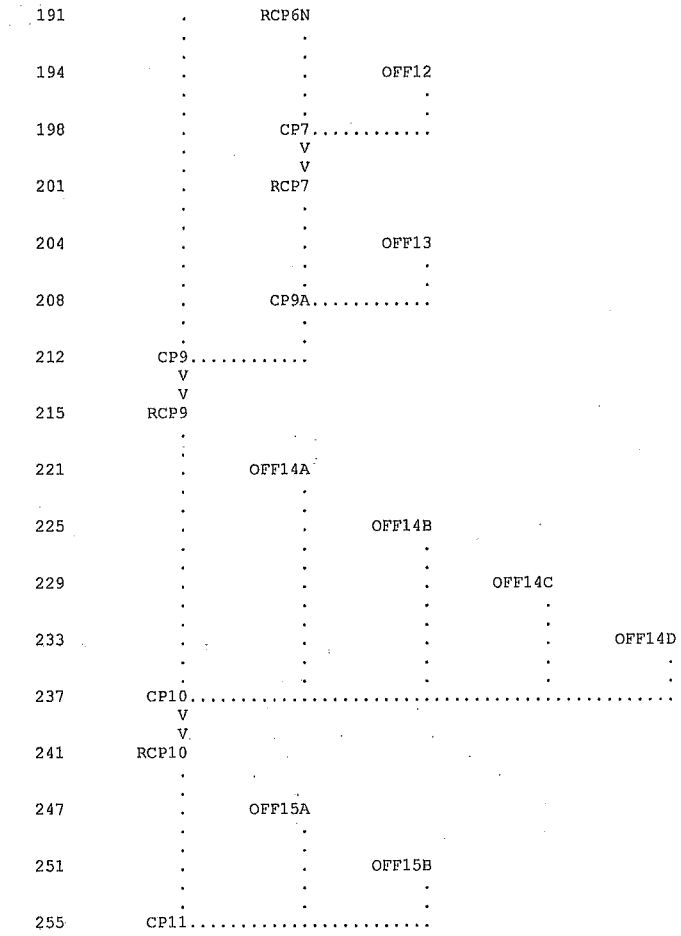
          255          KK    CP11
          256          KM   COMBINE RCP10, OFF15A AND OFF15B
          257          KM   OAKEY AT BIRCH
          258          HC        3
                       *
                       *
          259          ZZ
1
              SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

    23        OFF1
                V
                V
    36        ROFF1
                .
                .
    40          .        OFF2
                .          .
                .          .
    44         CP1.............
                .
                .
    51          .-------->    CP1E
    48         CP1N
                V
                V
    54        RCP1N
                .
                .
    58          .        OFF3
                .          .
                .          .
    62         CP2.............
                .
                .
    69          .-------->    CP2S
```


66 CP2N
72 RCP2N
76 OFF4
80 ROFF4
83 OFF5
87 CP3
91 RCP3
94 OFF6
98 CP4A
102 OFF7
106 ROFF7
109 OFF8
113 CP4B
117 CP4
121 RCP4
124 OFF9A
128 CP5A
131 RCP5A
134 OFF9B
138 OFF10B
142 CP5
146 RCP5
152 OFF10A
156 OFF10C
160 CP8
164 ROFF11
171 CP1E
170 CP1E
172 RCP1E
176 OFF11
180 CP6
188 CP6S
184 CP6N



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              JUN  1998                *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   01FEB07  TIME  11:48:50   *
*                                       *
*****************************************
```

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

```
*******************************************************************************
* ........................................................................... *
* :                                                                         : *
* :                          OAKEY STORM DRAIN                              : *
* :                       (DEVELOPED CONDITIONS)                            : *
* :                                                                         : *
* :.........................................................................: *
* :                RETURN PERIOD_ _ _ _ _10- AND 100-YEAR                   : *
* :                DISTRIBUTION_ _ _ _ _ _6-HOUR, SDN3                      : *
* :                PROJECT NO_ _ _ _ _ _ _                                  : *
* :                FILENAME_ _ _ _ _ _ _ _SMLBASIN.DAT                      : *
* :                DATE_ _ _ _ _ _ _ _ _ _2/1/2007                          : *
* :                BY_ _ _ _ _ _ _ _ _ _ _HDR                               : *
* :.........................................................................: *
*                                                                             *
*******************************************************************************
```

```
 20 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
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 1.00	RATIO 2 .57
HYDROGRAPH AT						
+	OFF1	.10	1	FLOW	138.	67.
				TIME	3.67	3.67
ROUTED TO						
+	ROFF1	.10	1	FLOW	134.	67.
				TIME	3.75	3.75
HYDROGRAPH AT						
+	OFF2	.10	1	FLOW	120.	56.
				TIME	3.75	3.75
2 COMBINED AT						
+	CP1	.20	1	FLOW	255.	123.
				TIME	3.75	3.75
DIVERSION TO						
+	CP1E	.20	1	FLOW	143.	68.
				TIME	3.75	3.75
HYDROGRAPH AT						
+	CP1N	.20	1	FLOW	111.	55.
				TIME	3.75	3.75
ROUTED TO						
+	RCP1N	.20	1	FLOW	110.	54.
				TIME	3.75	3.83
HYDROGRAPH AT						
+	OFF3	.04	1	FLOW	56.	26.
				TIME	3.58	3.58
2 COMBINED AT						
+	CP2	.24	1	FLOW	142.	68.
				TIME	3.67	3.75
DIVERSION TO						
+	CP2S	.24	1	FLOW	38.	38.
				TIME	3.33	3.50
HYDROGRAPH AT						
+	CP2N	.24	1	FLOW	104.	30.
				TIME	3.67	3.75
ROUTED TO						
+	RCP2N	.24	1	FLOW	103.	29.
				TIME	3.75	3.83
HYDROGRAPH AT						
+	OFF4	.03	1	FLOW	32.	14.
				TIME	3.67	3.67
ROUTED TO						
+	ROFF4	.03	1	FLOW	31.	14.
				TIME	3.75	3.83
HYDROGRAPH AT						
+	OFF5	.03	1	FLOW	50.	23.
				TIME	3.58	3.58
3 COMBINED AT						
+	CP3	.29	1	FLOW	167.	54.
				TIME	3.67	3.83

ROUTED TO						
+	RCP3	.29	1	FLOW	165.	56.
				TIME	3.75	3.92
HYDROGRAPH AT						
+	OFF6	.07	1	FLOW	106.	48.
				TIME	3.58	3.58
2 COMBINED AT						
+	CP4A	.37	1	FLOW	252.	76.
				TIME	3.67	3.92
HYDROGRAPH AT						
+	OFF7	.04	1	FLOW	48.	22.
				TIME	3.67	3.67
ROUTED TO						
+	ROFF7	.04	1	FLOW	48.	22.
				TIME	3.67	3.67
HYDROGRAPH AT						
+	OFF8	.01	1	FLOW	20.	9.
				TIME	3.50	3.58
2 COMBINED AT						
+	CP4B	.05	1	FLOW	64.	29.
				TIME	3.58	3.67
2 COMBINED AT						
+	CP4	.41	1	FLOW	314.	99.
				TIME	3.67	3.67
ROUTED TO						
+	RCP4	.41	1	FLOW	307.	97.
				TIME	3.67	3.67
HYDROGRAPH AT						
+	OFF9A	.01	1	FLOW	19.	9.
				TIME	3.58	3.58
2 COMBINED AT						
+	CP5A	.43	1	FLOW	322.	104.
				TIME	3.67	3.67
ROUTED TO						
+	RCP5A	.43	1	FLOW	312.	102.
				TIME	3.67	3.67
HYDROGRAPH AT						
+	OFF9B	.01	1	FLOW	14.	6.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	OFF10B	.01	1	FLOW	10.	4.
				TIME	3.58	3.58
3 COMBINED AT						
+	CP5	.44	1	FLOW	329.	109.
				TIME	3.67	3.67
ROUTED TO						
+	RCP5	.44	1	FLOW	325.	108.
				TIME	3.75	3.75
HYDROGRAPH AT						
+	OFF10A	.06	1	FLOW	62.	23.
				TIME	3.67	3.75
HYDROGRAPH AT						
+	OFF10C	.00	1	FLOW	5.	2.
				TIME	3.58	3.58
3 COMBINED AT						
+	CP8	.51	1	FLOW	391.	132.
				TIME	3.67	3.67
ROUTED TO						
+	ROFF11	.51	1	FLOW	389.	132.
				TIME	3.67	3.75
HYDROGRAPH AT						
+	CP1E	.00	1	FLOW	143.	68.
				TIME	3.75	3.75
ROUTED TO						
+	RCP1E	.00	1	FLOW	140.	68.
				TIME	3.75	3.83
HYDROGRAPH AT						
+	OFF11	.03	1	FLOW	45.	22.
				TIME	3.58	3.58
2 COMBINED AT						
+	CP6	.03	1	FLOW	173.	81.

				TIME	3.75	3.83
DIVERSION TO						
+	CP6S	.03	1	FLOW	104.	48.
				TIME	3.75	3.83
HYDROGRAPH AT						
+	CP6N	.03	1	FLOW	69.	32.
				TIME	3.75	3.83
ROUTED TO						
+	RCP6N	.03	1	FLOW	69.	33.
				TIME	3.83	3.92
HYDROGRAPH AT						
+	OFF12	.12	1	FLOW	161.	74.
				TIME	3.67	3.67
2 COMBINED AT						
+	CP7	.15	1	FLOW	213.	90.
				TIME	3.67	3.75
ROUTED TO						
+	RCP7	.15	1	FLOW	215.	90.
				TIME	3.75	3.83
HYDROGRAPH AT						
+	OFF13	.06	1	FLOW	59.	20.
				TIME	3.67	3.67
2 COMBINED AT						
+	CP9A	.21	1	FLOW	271.	108.
				TIME	3.75	3.83
2 COMBINED AT						
+	CP9	.72	1	FLOW	659.	239.
				TIME	3.75	3.75
ROUTED TO						
+	RCP9	.72	1	FLOW	658.	238.
				TIME	3.75	3.75
HYDROGRAPH AT						
+	OFF14A	.02	1	FLOW	23.	8.
				TIME	3.67	3.67
HYDROGRAPH AT						
+	OFF14B	.01	1	FLOW	6.	2.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	OFF14C	.01	1	FLOW	8.	3.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	OFF14D	.10	1	FLOW	104.	47.
				TIME	3.83	3.83
5 COMBINED AT						
+	CP10	.86	1	FLOW	790.	295.
				TIME	3.75	3.75
ROUTED TO						
+	RCP10	.86	1	FLOW	787.	291.
				TIME	3.75	3.75
HYDROGRAPH AT						
+	OFF15A	.01	1	FLOW	12.	4.
				TIME	3.67	3.67
HYDROGRAPH AT						
+	OFF15B	.03	1	FLOW	25.	8.
				TIME	3.67	3.67
3 COMBINED AT						
+	CP11	.90	1	FLOW	819.	303.
				TIME	3.75	3.75

1

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	INTERPOLATED TO COMPUTATION INTERVAL DT	PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
FOR PLAN = 1 RATIO= .00									
ROFF1	MANE	4.75	136.67	223.25	2.07	5.00	134.32	225.00	2.07

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1082E+02 EXCESS= .0000E+00 OUTFLOW= .1084E+02 BASIN STORAGE= .5649E-02 PERCENT ERROR= -.2

FOR PLAN = 1 RATIO= .00

```
          ROFF1  MANE          5.00     67.46    225.00       .97      5.00     67.46    225.00         .97

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5038E+01 EXCESS= .0000E+00 OUTFLOW= .5049E+01 BASIN STORAGE= .5539E-02 PERCENT ERROR=   -.3

       FOR PLAN = 1  RATIO=  .00
          RCP1N  MANE          2.07    109.98    226.04       .89      5.00    109.90    225.00         .89

CONTINUITY SUMMARY (AC-FT) - INFLOW= .9503E+01 EXCESS= .0000E+00 OUTFLOW= .9503E+01 BASIN STORAGE= .1682E-02 PERCENT ERROR=    .0

       FOR PLAN = 1  RATIO=  .00
          RCP1N  MANE          2.75     54.18    228.29       .41      5.00     53.63    230.00         .41

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4381E+01 EXCESS= .0000E+00 OUTFLOW= .4381E+01 BASIN STORAGE= .1555E-02 PERCENT ERROR=    .0

       FOR PLAN = 1  RATIO=  .00
          RCP2N  MANE          1.25    103.77    223.75       .38      5.00    103.47    225.00         .38

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4718E+01 EXCESS= .0000E+00 OUTFLOW= .4721E+01 BASIN STORAGE= .2714E-02 PERCENT ERROR=   -.1

       FOR PLAN = 1  RATIO=  .00
          RCP2N  MANE          1.50     29.20    229.50       .07      5.00     29.11    230.00         .07

CONTINUITY SUMMARY (AC-FT) - INFLOW= .8731E+00 EXCESS= .0000E+00 OUTFLOW= .8782E+00 BASIN STORAGE= .3411E-02 PERCENT ERROR=  -1.0

       FOR PLAN = 1  RATIO=  .00
          ROFF4  MANE          4.75     31.34    223.25      1.86      5.00     31.20    225.00        1.86

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2504E+01 EXCESS= .0000E+00 OUTFLOW= .2508E+01 BASIN STORAGE= .3513E-02 PERCENT ERROR=   -.3

       FOR PLAN = 1  RATIO=  .00
          ROFF4  MANE          5.00     14.31    230.00       .81      5.00     14.31    230.00         .81

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1086E+01 EXCESS= .0000E+00 OUTFLOW= .1088E+01 BASIN STORAGE= .3152E-02 PERCENT ERROR=   -.5

       FOR PLAN = 1  RATIO=  .00
           RCP3  MANE          4.67    166.46    223.94       .67      5.00    165.47    225.00         .67

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1043E+02 EXCESS= .0000E+00 OUTFLOW= .1044E+02 BASIN STORAGE= .4003E-02 PERCENT ERROR=   -.2

       FOR PLAN = 1  RATIO=  .00
           RCP3  MANE          5.00     56.20    235.00       .21      5.00     56.20    235.00         .21

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3315E+01 EXCESS= .0000E+00 OUTFLOW= .3320E+01 BASIN STORAGE= .4313E-02 PERCENT ERROR=   -.3

       FOR PLAN = 1  RATIO=  .00
          ROFF7  MANE          2.60     48.47    218.61      1.92      5.00     48.33    220.00        1.91

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3680E+01 EXCESS= .0000E+00 OUTFLOW= .3682E+01 BASIN STORAGE= .1400E-02 PERCENT ERROR=   -.1

       FOR PLAN = 1  RATIO=  .00
          ROFF7  MANE          3.54     22.27    223.06       .85      5.00     22.14    220.00         .85

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1629E+01 EXCESS= .0000E+00 OUTFLOW= .1630E+01 BASIN STORAGE= .1714E-02 PERCENT ERROR=   -.2

       FOR PLAN = 1  RATIO=  .00
           RCP4  MANE           .94    313.17    220.88      1.02      5.00    306.99    220.00        1.02

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2253E+02 EXCESS= .0000E+00 OUTFLOW= .2253E+02 BASIN STORAGE= .1067E-02 PERCENT ERROR=    .0

       FOR PLAN = 1  RATIO=  .00
           RCP4  MANE          1.49     98.53    220.87       .39      5.00     97.33    220.00         .39

CONTINUITY SUMMARY (AC-FT) - INFLOW= .8625E+01 EXCESS= .0000E+00 OUTFLOW= .8625E+01 BASIN STORAGE= .1159E-02 PERCENT ERROR=    .0

       FOR PLAN = 1  RATIO=  .00
          RCP5A  MANE          1.24    320.99    221.86      1.05      5.00    312.36    220.00        1.05

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2377E+02 EXCESS= .0000E+00 OUTFLOW= .2377E+02 BASIN STORAGE= .1382E-02 PERCENT ERROR=    .0
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          FOR PLAN = 1  RATIO=  .00
             RCP5A  MANE         1.95    104.01    221.94       .40      5.00    101.86    220.00         .40

CONTINUITY SUMMARY (AC-FT) - INFLOW= .9144E+01 EXCESS= .0000E+00 OUTFLOW= .9145E+01 BASIN STORAGE= .1372E-02 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
             RCP5  MANE          .56    329.28    221.08      1.07      5.00    325.27    225.00        1.07

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2522E+02 EXCESS= .0000E+00 OUTFLOW= .2522E+02 BASIN STORAGE= .6319E-03 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
             RCP5  MANE          .88    109.11    221.04       .41      5.00    107.60    225.00         .41

CONTINUITY SUMMARY (AC-FT) - INFLOW= .9714E+01 EXCESS= .0000E+00 OUTFLOW= .9714E+01 BASIN STORAGE= .6888E-03 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
             ROFF11  MANE          .22    391.19    220.41      1.12      5.00    389.07    220.00        1.12

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3046E+02 EXCESS= .0000E+00 OUTFLOW= .3046E+02 BASIN STORAGE= .2781E-03 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
             ROFF11  MANE          .35    132.56    220.70       .43      5.00    132.33    225.00         .43

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1168E+02 EXCESS= .0000E+00 OUTFLOW= .1168E+02 BASIN STORAGE= .2718E-03 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
             RCP1E  MANE         3.36    142.27    228.25     -1.00      5.00    140.31    225.00       -1.00


          FOR PLAN = 1  RATIO=  .00
             RCP1E  MANE         4.51     67.93    230.15     -1.00      5.00     67.82    230.00       -1.00


          FOR PLAN = 1  RATIO=  .00
             RCP6N  MANE         5.00     69.10    230.00      4.02      5.00     69.10    230.00        4.02

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6018E+01 EXCESS= .0000E+00 OUTFLOW= .6024E+01 BASIN STORAGE= .5218E-02 PERCENT ERROR=   -.2

          FOR PLAN = 1  RATIO=  .00
             RCP6N  MANE         5.00     32.59    235.00      1.84      5.00     32.59    235.00        1.84

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2760E+01 EXCESS= .0000E+00 OUTFLOW= .2763E+01 BASIN STORAGE= .5105E-02 PERCENT ERROR=   -.3

          FOR PLAN = 1  RATIO=  .00
             RCP7  MANE          5.00    215.05    225.00      2.30      5.00    215.05    225.00        2.30

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1835E+02 EXCESS= .0000E+00 OUTFLOW= .1837E+02 BASIN STORAGE= .5693E-02 PERCENT ERROR=   -.1

          FOR PLAN = 1  RATIO=  .00
             RCP7  MANE          5.00     90.40    230.00      1.03      5.00     90.40    230.00        1.03

CONTINUITY SUMMARY (AC-FT) - INFLOW= .8183E+01 EXCESS= .0000E+00 OUTFLOW= .8191E+01 BASIN STORAGE= .4866E-02 PERCENT ERROR=   -.2

          FOR PLAN = 1  RATIO=  .00
             RCP9  MANE          .37    658.31    225.18      1.38      5.00    657.95    225.00        1.39

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5322E+02 EXCESS= .0000E+00 OUTFLOW= .5322E+02 BASIN STORAGE= .5655E-03 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
             RCP9  MANE          .56    239.14    225.50       .56      5.00    238.09    225.00         .56

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2139E+02 EXCESS= .0000E+00 OUTFLOW= .2139E+02 BASIN STORAGE= .5539E-03 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
             RCP10  MANE         .60    787.79    225.20      1.44      5.00    786.88    225.00        1.44

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6572E+02 EXCESS= .0000E+00 OUTFLOW= .6572E+02 BASIN STORAGE= .1015E-02 PERCENT ERROR=    .0
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          FOR PLAN = 1   RATIO=   .00
             RCP10  MANE          .89     293.96     225.74        .58       5.00     291.41     225.00          .58

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2661E+02 EXCESS= .0000E+00 OUTFLOW= .2661E+02 BASIN STORAGE= .9797E-03 PERCENT ERROR=     .0


*** NORMAL END OF HEC-1 ***
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Appendix G

Hydraulic Calculations

Street Capacity

Flow in Upstream Streets

Flow in RCP'S

Flow in Existing 10'x8' RCB

WSPG

Street Capacity

XS 1-1 (Oakey just west of Cahlan) 10-yr Flow
Worksheet for Irregular Channel

Project Description	
Worksheet	XS 1-1 (Oakey just west of Cahlan) 1
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Sl	012000	ft/ft
Discharge	113.0	cfs

Options	
Current Roughness Meth	oved Lotter's Method
Open Channel Weighting	oved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	0.76	ft
Elevation Range	0.00 to 0.77	
Flow Area	24.5	ft²
Wetted Perimeter	80.21	ft
Top Width	78.92	ft
Actual Depth	0.76	ft
Critical Elevation	0.85	ft
Critical Slope	0.005202	ft/ft
Velocity	4.61	ft/s
Velocity Head	0.33	ft
Specific Energy	1.09	ft
Froude Number	1.46	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.13416401 ft.
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+80.00	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.63
0+06.00	0.50
0+06.50	0.50
0+06.50	0.00
0+08.00	0.13
0+40.00	0.77
0+72.00	0.13
0+73.50	0.00
0+73.50	0.50

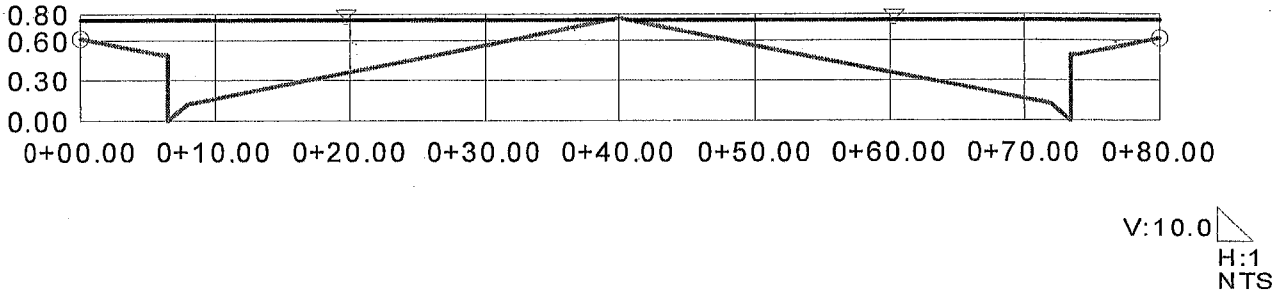
XS 1-1 (Oakey just west of Cahlan) 10-yr Flow
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+74.00	0.50
0+80.00	0.63

XS 1-1 (Oakey just west of Cahlan) 10-yr Flow
Cross Section for Irregular Channel

Project Description	
Worksheet	XS 1-1 (Oakey just west of Cahlan) 1
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficien	0.016	
Channel Slope	0.012000	ft/ft
Water Surface Elev	0.76	ft
Elevation Range	.00 to 0.77	
Discharge	113.0	cfs



XS 1-1 (Oakey just west of Cahlan) 100-yr Flow
Worksheet for Irregular Channel

Project Description	
Worksheet	XS 1-1 (Oakey just west of Cahlan) 10
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slc	1.20 %
Discharge	334.0 cfs

Options	
Current Roughness Methc	oved Lotter's Method
Open Channel Weighting	oved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	1.04	ft
Elevation Range	0.00 to 0.77	
Flow Area	47.3	ft²
Wetted Perimeter	81.87	ft
Top Width	80.00	ft
Actual Depth	1.04	ft
Critical Elevation	1.27	ft
Critical Slope	0.41	%
Velocity	7.06	ft/s
Velocity Head	0.77	ft
Specific Energy	1.82	ft
Froude Number	1.62	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.41951278 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+80.00	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.63
0+06.00	0.50
0+06.50	0.50
0+06.50	0.00
0+08.00	0.13
0+40.00	0.77
0+72.00	0.13
0+73.50	0.00
0+73.50	0.50
0+74.00	0.50

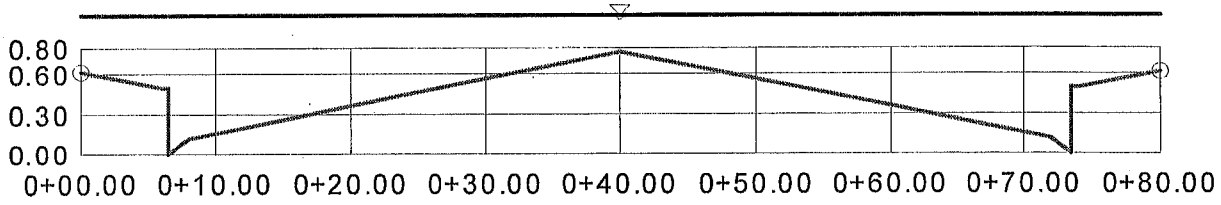
XS 1-1 (Oakey just west of Cahlan) 100-yr Flow
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+80.00	0.63

XS 1-1 (Oakey just west of Cahlan) 100-yr Flow
Cross Section for Irregular Channel

Project Description	
Worksheet	XS 1-1 (Oakey just west of Cahlan) 10
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.016	
Channel Slope	1.20	%
Water Surface Elev	1.04	ft
Elevation Range	.00 to 0.77	
Discharge	334.0	cfs



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Capacity of Oakey @ Cahlan (1.2%)
Worksheet for Irregular Channel

Project Description	
Worksheet	Capacity of Oakey @ Cahla
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Channel Slope	012000	ft/ft
Water Surface Elev	0.53	ft

Options	
Current Roughness Metho	oved Lotter's Method
Open Channel Weighting	oved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coeffic	0.016	
Elevation Range	0.00 to 0.77	
Discharge	32.7	cfs
Flow Area	9.5	ft²
Wetted Perimeter	47.90	ft
Top Width	46.88	ft
Actual Depth	0.53	ft
Critical Elevation	0.59	ft
Critical Slope	0.006379	ft/ft
Velocity	3.45	ft/s
Velocity Head	0.19	ft
Specific Energy	0.72	ft
Froude Number	1.35	
Flow Type	Supercritical	

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+80.00	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.63
0+06.00	0.50
0+06.50	0.50
0+06.50	0.00
0+08.00	0.13
0+40.00	0.77
0+72.00	0.13
0+73.50	0.00
0+73.50	0.50
0+74.00	0.50

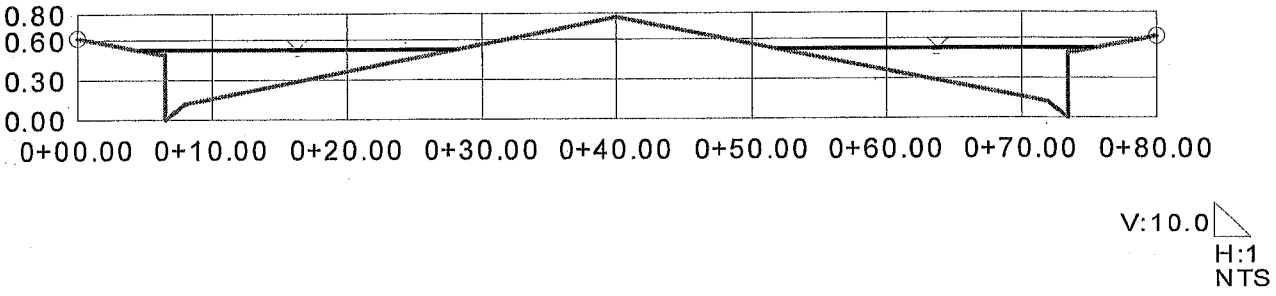
Capacity of Oakey @ Cahlan (1.2%)
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+80.00	0.63

Capacity of Oakey @ Cahlan (1.2%)
Cross Section for Irregular Channel

Project Description	
Worksheet	Capacity of Oakey @ Cahla
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

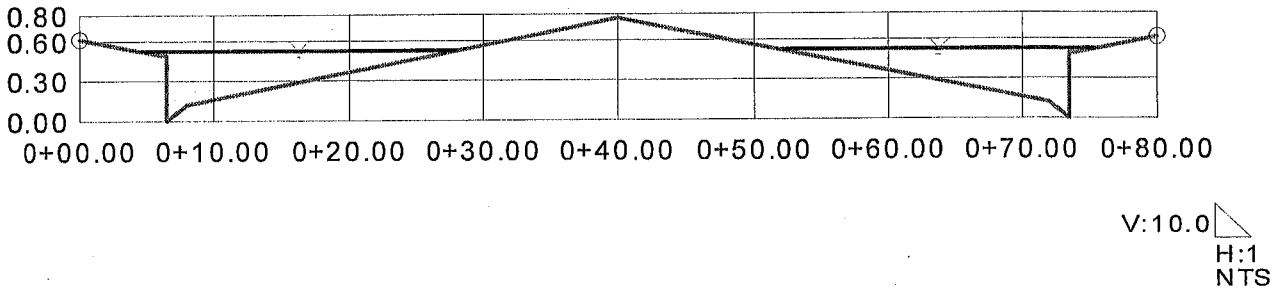
Section Data		
Mannings Coefficier	0.016	
Channel Slope	0.012000	ft/ft
Water Surface Elev	0.53	ft
Elevation Range	.00 to 0.77	
Discharge	32.7	cfs



XS 1-1 Capacity (10-yr Flow)
Cross Section for Irregular Channel

Project Description	
Worksheet	XS 1-1 Capacity (10-yr
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Mannings Coefficier	0.016	
Channel Slope	1.20	%
Water Surface Elev	0.53	ft
Elevation Range	.00 to 0.77	
Discharge	32.7	cfs



XS 1-1 Capacity (10-yr Flow)
Worksheet for Irregular Channel

Project Description	
Worksheet	XS 1-1 Capacity (10-yr
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Channel Slope	1.20	%
Water Surface Elev	0.53	ft

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

Results		
Mannings Coeffic	0.016	
Elevation Range	0.00 to 0.77	
Discharge	32.7	cfs
Flow Area	9.5	ft²
Wetted Perimeter	47.90	ft
Top Width	46.88	ft
Actual Depth	0.53	ft
Critical Elevation	0.59	ft
Critical Slope	0.64	%
Velocity	3.45	ft/s
Velocity Head	0.19	ft
Specific Energy	0.72	ft
Froude Number	1.35	
Flow Type	Supercritical	

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+80.00	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.63
0+06.00	0.50
0+06.50	0.50
0+06.50	0.00
0+08.00	0.13
0+40.00	0.77
0+72.00	0.13
0+73.50	0.00
0+73.50	0.50
0+74.00	0.50

XS 1-1 Capacity (10-yr Flow)
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+80.00	0.63

XS 1-1 Capacity (100-yr Flow)
Worksheet for Irregular Channel

Project Description	
Worksheet	XS 1-1 Capacity (100-yr
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Sl	1.20	%
Discharge	373.0	cfs

Options	
Current Roughness Metho	oved Lotter's Method
Open Channel Weighting	oved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	1.09	ft
Elevation Range	0.00 to 0.77	
Flow Area	50.6	ft²
Wetted Perimeter	81.95	ft
Top Width	80.00	ft
Actual Depth	1.09	ft
Critical Elevation	1.33	ft
Critical Slope	0.41	%
Velocity	7.37	ft/s
Velocity Head	0.85	ft
Specific Energy	1.93	ft
Froude Number	1.64	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.46028254 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+80.00	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.63
0+06.00	0.50
0+06.50	0.50
0+06.50	0.00
0+08.00	0.13
0+40.00	0.77
0+72.00	0.13
0+73.50	0.00
0+73.50	0.50
0+74.00	0.50

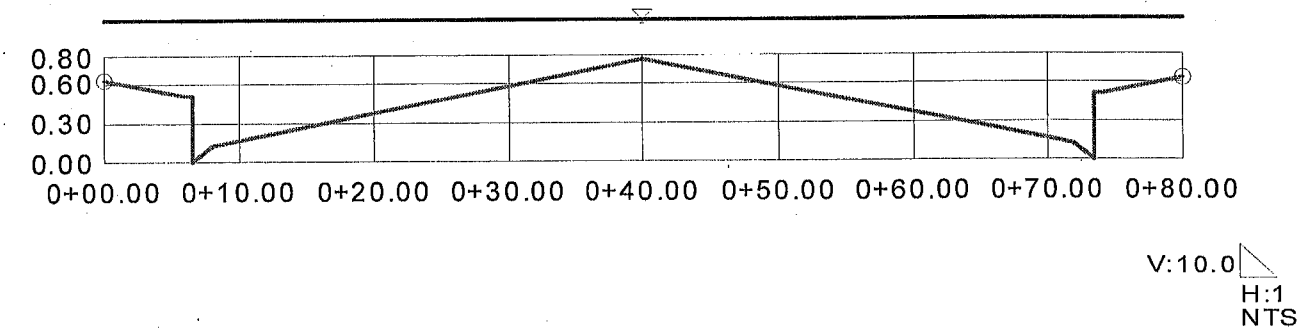
XS 1-1 Capacity (100-yr Flow)
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+80.00	0.63

XS 1-1 Capacity (100-yr Flow)
Cross Section for Irregular Channel

Project Description	
Worksheet	XS 1-1 Capacity (100-yr
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.016	
Channel Slope	1.20	%
Water Surface Elev.	1.09	ft
Elevation Range	.00 to 0.77	
Discharge	373.0	cfs



XS 3-3 Capacity (10-yr Flow)
Worksheet for Irregular Channel

Project Description	
Worksheet	XS 3-3 Capacity (10-yr
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Channel Slope	0.80	%
Water Surface Elev	0.53	ft

Options	
Current Roughness Metho	oved Lotter's Method
Open Channel Weighting	oved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coeffic	0.016	
Elevation Range	0.00 to 0.77	
Discharge	26.7	cfs
Flow Area	9.5	ft²
Wetted Perimeter	47.90	ft
Top Width	46.88	ft
Actual Depth	0.53	ft
Critical Elevation	0.55	ft
Critical Slope	0.65	%
Velocity	2.82	ft/s
Velocity Head	0.12	ft
Specific Energy	0.65	ft
Froude Number	1.11	
Flow Type	Supercritical	

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+80.00	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.63
0+06.00	0.50
0+06.50	0.50
0+06.50	0.00
0+08.00	0.13
0+40.00	0.77
0+72.00	0.13
0+73.50	0.00
0+73.50	0.50
0+74.00	0.50

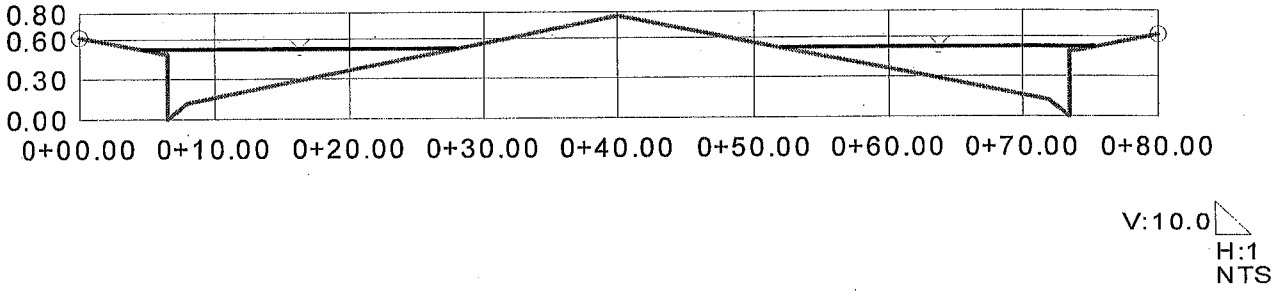
XS 3-3 Capacity (10-yr Flow)
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+80.00	0.63

XS 3-3 Capacity (10-yr Flow)
Cross Section for Irregular Channel

Project Description	
Worksheet	XS 3-3 Capacity (10-yr
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Mannings Coefficier	0.016	
Channel Slope	0.80	%
Water Surface Elev.	0.53	ft
Elevation Range	.00 to 0.77	
Discharge	26.7	cfs



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XS 3-3 Capacity (100-yr Flow)
Worksheet for Irregular Channel

Project Description	
Worksheet	XS 3-3 Capacity (100-yr
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Sl	0.80	%
Discharge	396.0	cfs

Options	
Current Roughness Metho	oved Lotter's Method
Open Channel Weighting	oved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	1.19	ft
Elevation Range	0.00 to 0.77	
Flow Area	59.3	ft²
Wetted Perimeter	82.16	ft
Top Width	80.00	ft
Actual Depth	1.19	ft
Critical Elevation	1.37	ft
Critical Slope	0.40	%
Velocity	6.68	ft/s
Velocity Head	0.69	ft
Specific Energy	1.89	ft
Froude Number	1.37	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.56894591 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+80.00	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.63
0+06.00	0.50
0+06.50	0.50
0+06.50	0.00
0+08.00	0.13
0+40.00	0.77
0+72.00	0.13
0+73.50	0.00
0+73.50	0.50
0+74.00	0.50

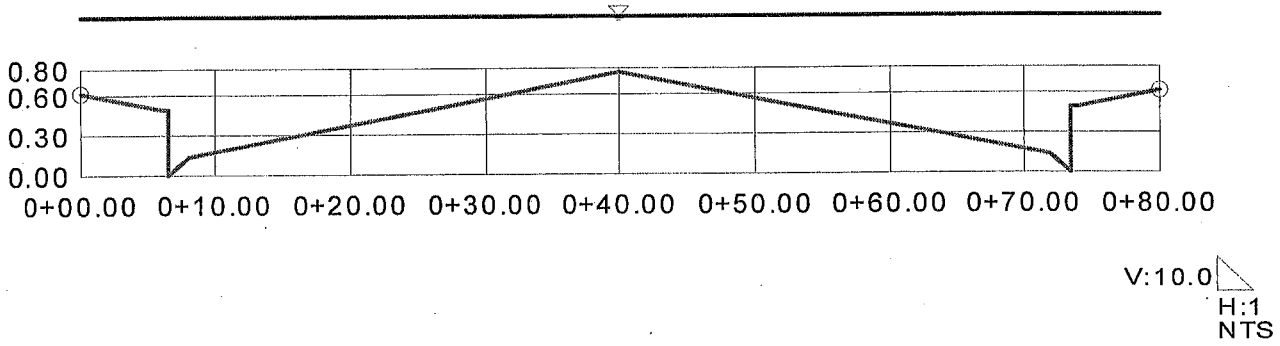
XS 3-3 Capacity (100-yr Flow)
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+80.00	0.63

XS 3-3 Capacity (100-yr Flow)
Cross Section for Irregular Channel

Project Description	
Worksheet	XS 3-3 Capacity (100-yr
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficier	0.016	
Channel Slope	0.80	%
Water Surface Elev.	1.19	ft
Elevation Range	.00 to 0.77	
Discharge	396.0	cfs



XS 4-4 Capacity (10-yr Flow)
Worksheet for Irregular Channel

Project Description	
Worksheet	XS 4-4 Capacity (10-yr
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Channel Slope	1.30	%
Water Surface Elev	0.53	ft

Options	
Current Roughness Metho	oved Lotter's Method
Open Channel Weighting	oved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coeffic	0.016	
Elevation Range	0.00 to 0.77	
Discharge	34.0	cfs
Flow Area	9.5	ft²
Wetted Perimeter	47.90	ft
Top Width	46.88	ft
Actual Depth	0.53	ft
Critical Elevation	0.59	ft
Critical Slope	0.63	%
Velocity	3.59	ft/s
Velocity Head	0.20	ft
Specific Energy	0.73	ft
Froude Number	1.41	
Flow Type	Supercritical	

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+80.00	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.63
0+06.00	0.50
0+06.50	0.50
0+06.50	0.00
0+08.00	0.13
0+40.00	0.77
0+72.00	0.13
0+73.50	0.00
0+73.50	0.50
0+74.00	0.50

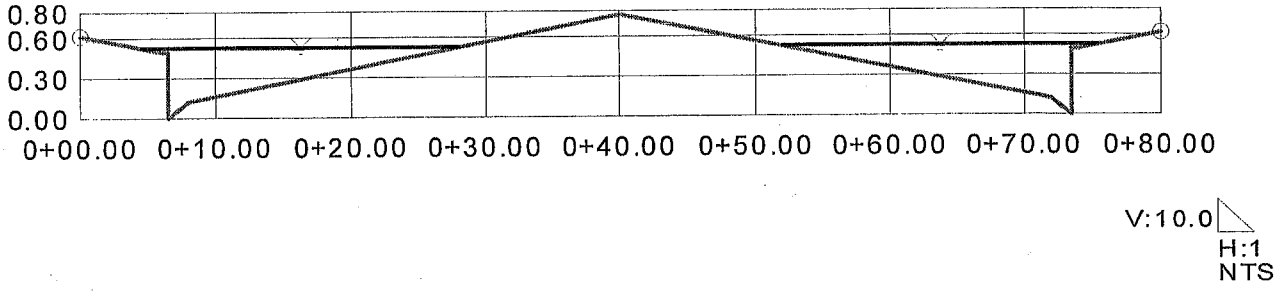
XS 4-4 Capacity (10-yr Flow)
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+80.00	0.63

XS 4-4 Capacity (10-yr Flow)
Cross Section for Irregular Channel

Project Description	
Worksheet	XS 4-4 Capacity (10-yr
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Mannings Coefficie	0.016	
Channel Slope	1.30	%
Water Surface Elev	0.53	ft
Elevation Range	.00 to 0.77	
Discharge	34.0	cfs



XS 4-4 Capacity (100-yr Flow)
Worksheet for Irregular Channel

Project Description	
Worksheet	XS 4-4 Capacity (100-yr
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Sl	1.30 %
Discharge	368.0 cfs

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

Results		
Mannings Coefficie	0.016	
Water Surface Elev	1.07	ft
Elevation Range	0.00 to 0.77	
Flow Area	49.0	ft²
Wetted Perimeter	81.91	ft
Top Width	80.00	ft
Actual Depth	1.07	ft
Critical Elevation	1.32	ft
Critical Slope	0.41	%
Velocity	7.51	ft/s
Velocity Head	0.88	ft
Specific Energy	1.94	ft
Froude Number	1.69	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.44018445 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+80.00	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.63
0+06.00	0.50
0+06.50	0.50
0+06.50	0.00
0+08.00	0.13
0+40.00	0.77
0+72.00	0.13
0+73.50	0.00
0+73.50	0.50
0+74.00	0.50

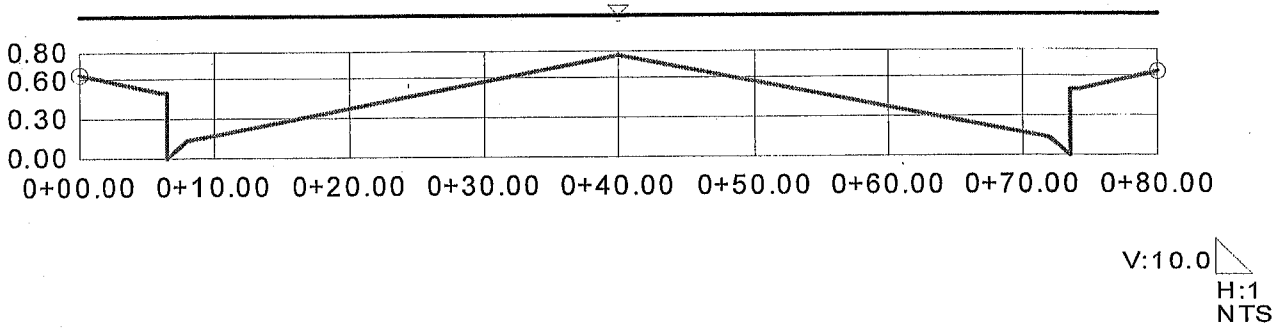
XS 4-4 Capacity (100-yr Flow)
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+80.00	0.63

XS 4-4 Capacity (100-yr Flow)
Cross Section for Irregular Channel

Project Description	
Worksheet	XS 4-4 Capacity (100-yr
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.016	
Channel Slope	1.30	%
Water Surface Elev	1.07	ft
Elevation Range	.00 to 0.77	
Discharge	368.0	cfs



XS 5-5 Capacity (10-yr Flow)
Worksheet for Irregular Channel

Project Description	
Worksheet	XS 5-5 Capacity (10-yr
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Channel Slope	1.50	%
Water Surface Elev	0.50	ft

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

Results		
Mannings Coeffic	0.016	
Elevation Range	0.00 to 0.77	
Discharge	31.6	cfs
Flow Area	8.1	ft²
Wetted Perimeter	41.02	ft
Top Width	40.00	ft
Actual Depth	0.50	ft
Critical Elevation	0.58	ft
Critical Slope	0.64	%
Velocity	3.87	ft/s
Velocity Head	0.23	ft
Specific Energy	0.73	ft
Froude Number	1.51	
Flow Type	Supercritical	

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+80.00	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.63
0+06.00	0.50
0+06.50	0.50
0+06.50	0.00
0+08.00	0.13
0+40.00	0.77
0+72.00	0.13
0+73.50	0.00
0+73.50	0.50
0+74.00	0.50

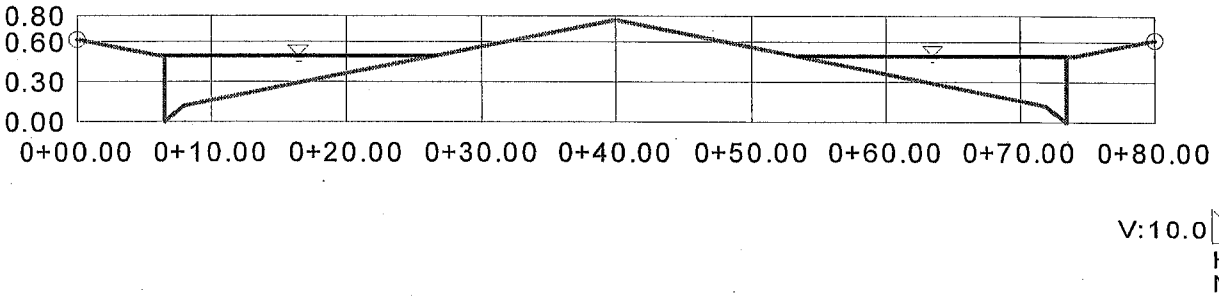
XS 5-5 Capacity (10-yr Flow)
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+80.00	0.63

XS 5-5 Capacity (10-yr Flow)
Cross Section for Irregular Channel

Project Description	
Worksheet	XS 5-5 Capacity (10-yr
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Mannings Coefficie	0.016	
Channel Slope	1.50	%
Water Surface Elev	0.50	ft
Elevation Range	.00 to 0.77	
Discharge	31.6	cfs



XS 5-5 Capacity (100-yr Flow)
Worksheet for Irregular Channel

Project Description	
Worksheet	XS 5-5 Capacity (100-yr
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Channel Slope	1.50	%
Water Surface Elev	1.00	ft

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

Results		
Mannings Coeffic	0.016	
Elevation Range	0.00 to 0.77	
Discharge	328.0	cfs
Flow Area	43.8	ft²
Wetted Perimeter	81.78	ft
Top Width	80.00	ft
Actual Depth	1.00	ft
Critical Elevation	1.26	ft
Critical Slope	0.42	%
Velocity	7.50	ft/s
Velocity Head	0.87	ft
Specific Energy	1.87	ft
Froude Number	1.79	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.375 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+80.00	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.63
0+06.00	0.50
0+06.50	0.50
0+06.50	0.00
0+08.00	0.13
0+40.00	0.77
0+72.00	0.13
0+73.50	0.00
0+73.50	0.50
0+74.00	0.50

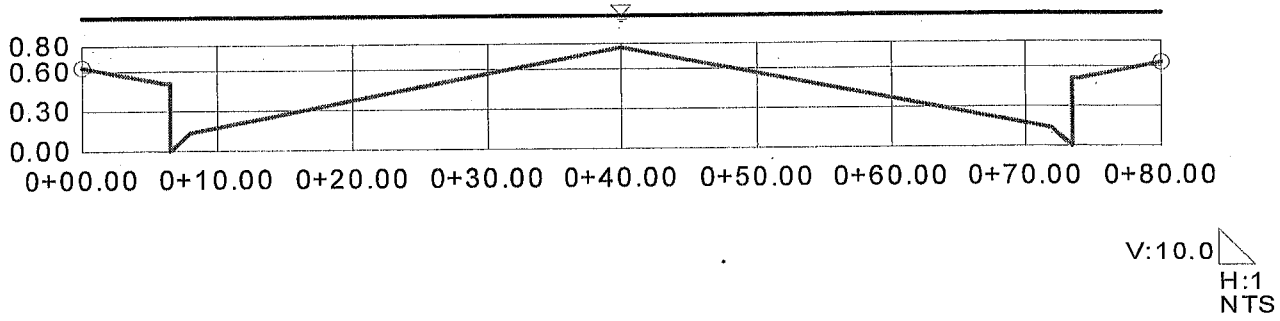
XS 5-5 Capacity (100-yr Flow)
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+80.00	0.63

XS 5-5 Capacity (100-yr Flow)
Cross Section for Irregular Channel

Project Description	
Worksheet	XS 5-5 Capacity (100-yr
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data	
Mannings Coefficier	0.016
Channel Slope	1.50 %
Water Surface Elev	1.00 ft
Elevation Range	.00 to 0.77
Discharge	328.0 cfs



XS 6-6 Capacity (10-yr Flow)
Worksheet for Irregular Channel

Project Description	
Worksheet	XS 6-6 Capacity (10-yr
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Channel Slope	0.60	%
Water Surface Elev	0.50	ft

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

Results		
Mannings Coeffic	0.016	
Elevation Range	.00 to 0.77	
Discharge	20.0	cfs
Flow Area	8.1	ft²
Wetted Perimeter	41.02	ft
Top Width	40.00	ft
Actual Depth	0.50	ft
Critical Elevation	0.49	ft
Critical Slope	0.66	%
Velocity	2.45	ft/s
Velocity Head	0.09	ft
Specific Energy	0.59	ft
Froude Number	0.96	
Flow Type	Subcritical	

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+80.00	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.63
0+06.00	0.50
0+06.50	0.50
0+06.50	0.00
0+08.00	0.13
0+40.00	0.77
0+72.00	0.13
0+73.50	0.00
0+73.50	0.50
0+74.00	0.50

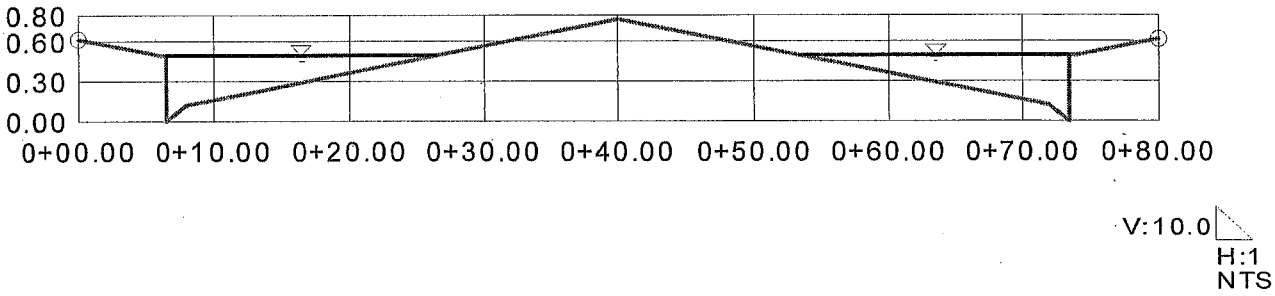
XS 6-6 Capacity (10-yr Flow)
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+80.00	0.63

XS 6-6 Capacity (10-yr Flow)
Cross Section for Irregular Channel

Project Description	
Worksheet	XS 6-6 Capacity (10-yr
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Mannings Coefficier	0.016	
Channel Slope	0.60	%
Water Surface Elev.	0.50	ft
Elevation Range	.00 to 0.77	
Discharge	20.0	cfs



XS 6-6 Capacity (100-yr Flow)
Worksheet for Irregular Channel

Project Description	
Worksheet	XS 6-6 Capacity (100-yr
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Channel Slope	0.60	%
Water Surface Elev	1.00	ft

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

Results		
Mannings Coeffic	0.016	
Elevation Range	0.00 to 0.77	
Discharge	207.4	cfs
Flow Area	43.8	ft²
Wetted Perimeter	81.78	ft
Top Width	80.00	ft
Actual Depth	1.00	ft
Critical Elevation	1.05	ft
Critical Slope	0.46	%
Velocity	4.74	ft/s
Velocity Head	0.35	ft
Specific Energy	1.35	ft
Froude Number	1.13	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.375 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+80.00	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.63
0+06.00	0.50
0+06.50	0.50
0+06.50	0.00
0+08.00	0.13
0+40.00	0.77
0+72.00	0.13
0+73.50	0.00
0+73.50	0.50
0+74.00	0.50

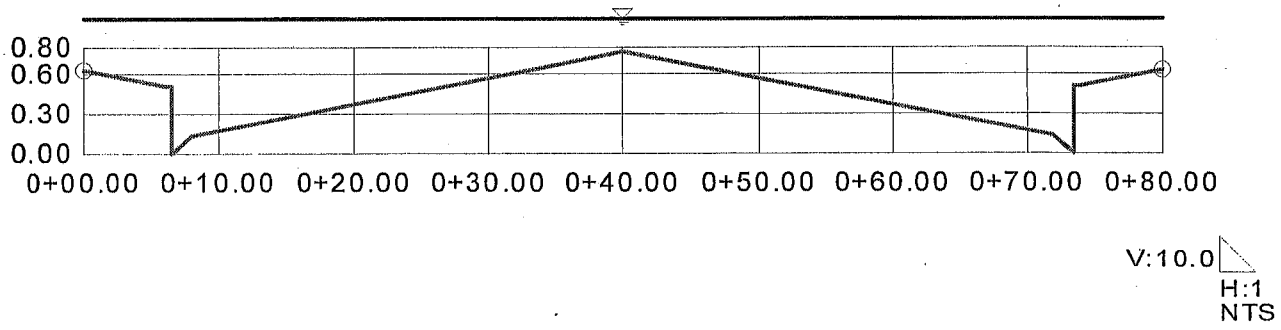
XS 6-6 Capacity (100-yr Flow)
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+80.00	0.63

XS 6-6 Capacity (100-yr Flow)
Cross Section for Irregular Channel

Project Description	
Worksheet	XS 6-6 Capacity (100-yr
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Mannings Coefficier	0.016	
Channel Slope	0.60	%
Water Surface Elev	1.00	ft
Elevation Range	.00 to 0.77	
Discharge	207.4	cfs



XS 7-7 Capacity (10-yr Flow)
Worksheet for Irregular Channel

Project Description	
Worksheet	XS 7-7 Capacity (10-yr
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Channel Slope	0.90	%
Water Surface Elev	0.50	ft

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

Results		
Mannings Coeffic	0.016	
Elevation Range	0.00 to 0.77	
Discharge	24.4	cfs
Flow Area	8.1	ft²
Wetted Perimeter	41.02	ft
Top Width	40.00	ft
Actual Depth	0.50	ft
Critical Elevation	0.53	ft
Critical Slope	0.65	%
Velocity	3.00	ft/s
Velocity Head	0.14	ft
Specific Energy	0.64	ft
Froude Number	1.17	
Flow Type	Supercritical	

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+80.00	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.63
0+06.00	0.50
0+06.50	0.50
0+06.50	0.00
0+08.00	0.13
0+40.00	0.77
0+72.00	0.13
0+73.50	0.00
0+73.50	0.50
0+74.00	0.50

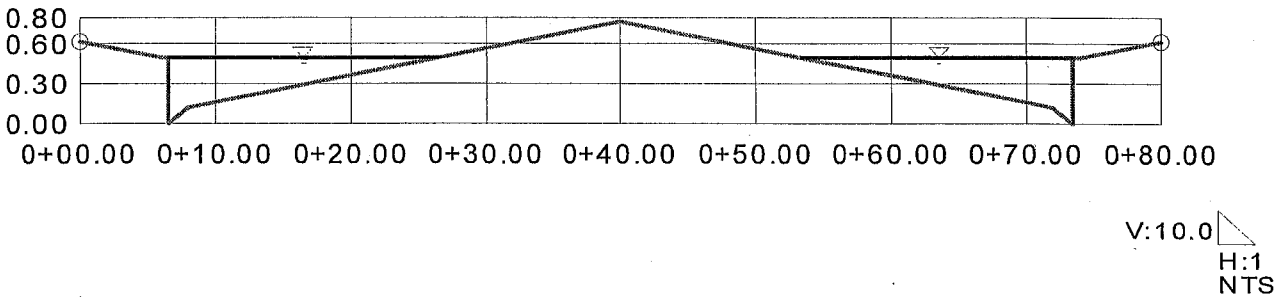
XS 7-7 Capacity (10-yr Flow)
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+80.00	0.63

XS 7-7 Capacity (10-yr Flow)
Cross Section for Irregular Channel

Project Description	
Worksheet	XS 7-7 Capacity (10-yr
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Mannings Coefficie	0.016	
Channel Slope	0.90	%
Water Surface Elev	0.50	ft
Elevation Range	.00 to 0.77	
Discharge	24.4	cfs



XS 7-7 Capacity (100-yr Flow)
Worksheet for Irregular Channel

Project Description	
Worksheet	XS 7-7 Capacity (100-yr
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Channel Slope	0.90	%
Water Surface Elev	1.00	ft

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

Results		
Mannings Coeffic	0.016	
Elevation Range	0.00 to 0.77	
Discharge	254.1	cfs
Flow Area	43.8	ft²
Wetted Perimeter	81.78	ft
Top Width	80.00	ft
Actual Depth	1.00	ft
Critical Elevation	1.13	ft
Critical Slope	0.44	%
Velocity	5.81	ft/s
Velocity Head	0.52	ft
Specific Energy	1.52	ft
Froude Number	1.38	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.375 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+80.00	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.63
0+06.00	0.50
0+06.50	0.50
0+06.50	0.00
0+08.00	0.13
0+40.00	0.77
0+72.00	0.13
0+73.50	0.00
0+73.50	0.50
0+74.00	0.50

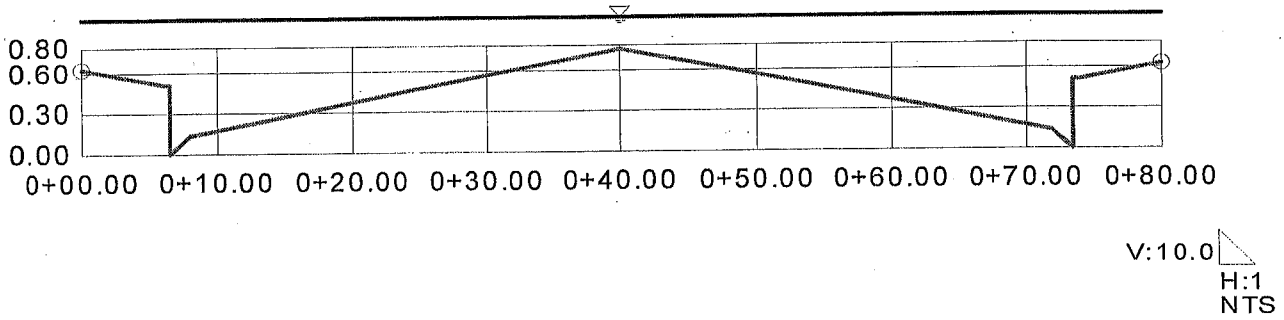
XS 7-7 Capacity (100-yr Flow)
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+80.00	0.63

XS 7-7 Capacity (100-yr Flow)
Cross Section for Irregular Channel

Project Description	
Worksheet	XS 7-7 Capacity (100-yr
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Mannings Coefficier	0.016	
Channel Slope	0.90	%
Water Surface Elev	1.00	ft
Elevation Range	.00 to 0.77	
Discharge	254.1	cfs



XS 8-8 Capacity (10-yr Flow)
Worksheet for Irregular Channel

Project Description	
Worksheet	XS 8-8 Capacity (10-yr
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Channel Slope	0.60	%
Water Surface Elev	0.53	ft

Options	
Current Roughness Metho	oved Lotter's Method
Open Channel Weighting	oved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coeffic	0.016	
Elevation Range	.00 to 0.77	
Discharge	23.1	cfs
Flow Area	9.5	ft²
Wetted Perimeter	47.90	ft
Top Width	46.88	ft
Actual Depth	0.53	ft
Critical Elevation	0.52	ft
Critical Slope	0.66	%
Velocity	2.44	ft/s
Velocity Head	0.09	ft
Specific Energy	0.62	ft
Froude Number	0.96	
Flow Type	Subcritical	

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+80.00	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.63
0+06.00	0.50
0+06.50	0.50
0+06.50	0.00
0+08.00	0.13
0+40.00	0.77
0+72.00	0.13
0+73.50	0.00
0+73.50	0.50
0+74.00	0.50

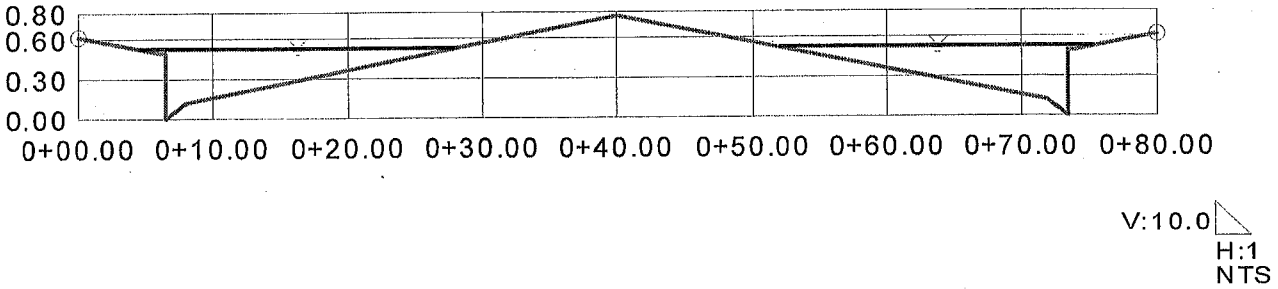
XS 8-8 Capacity (10-yr Flow)
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+80.00	0.63

XS 8-8 Capacity (10-yr Flow)
Cross Section for Irregular Channel

Project Description	
Worksheet	XS 8-8 Capacity (10-yr
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Mannings Coefficier	0.016	
Channel Slope	0.60	%
Water Surface Elev	0.53	ft
Elevation Range	.00 to 0.77	
Discharge	23.1	cfs



XS 8-8 Capacity (100-yr Flow)
Worksheet for Irregular Channel

Project Description	
Worksheet	XS 8-8 Capacity (100-yr
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Sl	0.60	%
Discharge	416.0	cfs

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

Results		
Mannings Coefficie	0.016	
Water Surface Elev	1.29	ft
Elevation Range	0.00 to 0.77	
Flow Area	66.6	ft²
Wetted Perimeter	82.35	ft
Top Width	80.00	ft
Actual Depth	1.29	ft
Critical Elevation	1.40	ft
Critical Slope	0.40	%
Velocity	6.25	ft/s
Velocity Head	0.61	ft
Specific Energy	1.89	ft
Froude Number	1.21	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.66070323 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+80.00	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.63
0+06.00	0.50
0+06.50	0.50
0+06.50	0.00
0+08.00	0.13
0+40.00	0.77
0+72.00	0.13
0+73.50	0.00
0+73.50	0.50
0+74.00	0.50

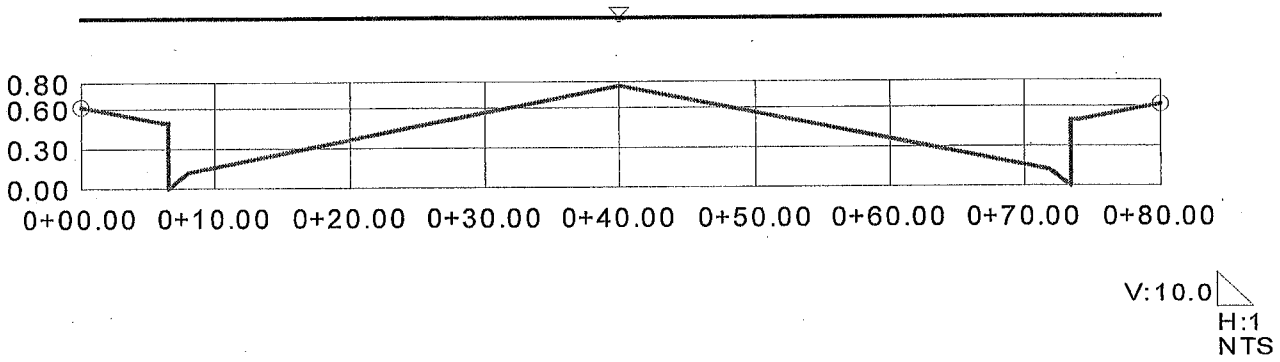
XS 8-8 Capacity (100-yr Flow)
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+80.00	0.63

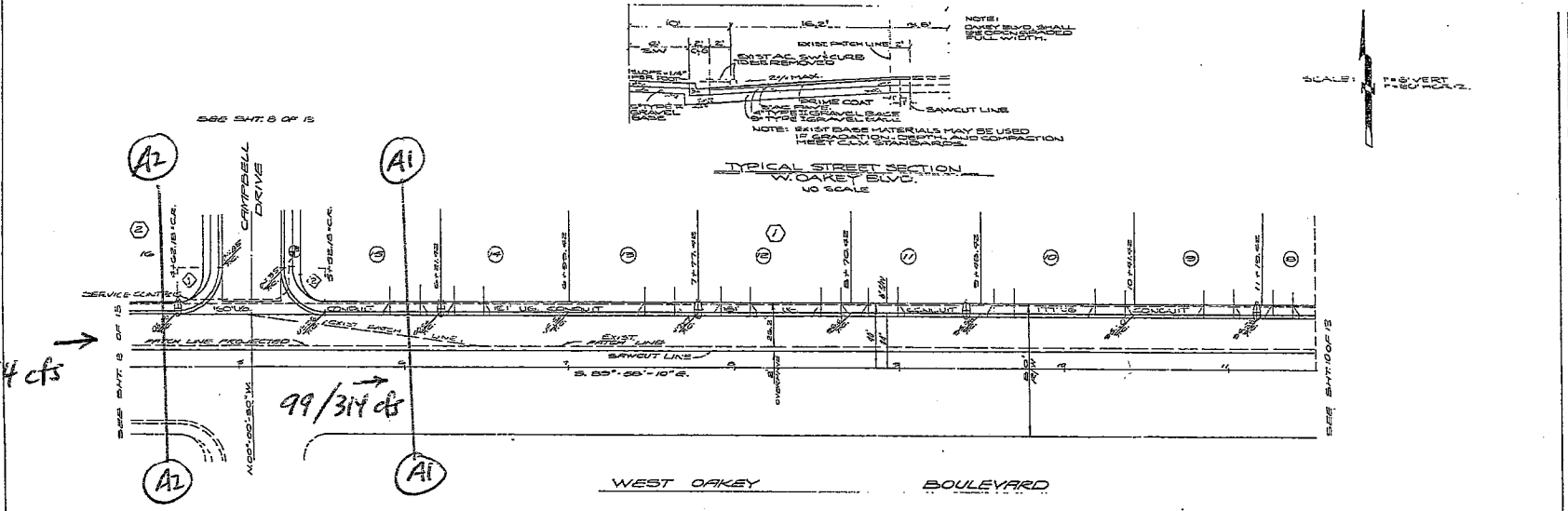
XS 8-8 Capacity (100-yr Flow)
Cross Section for Irregular Channel

Project Description	
Worksheet	XS 8-8 Capacity (100-yr
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficier	0.016	
Channel Slope	0.60	%
Water Surface Elev	1.29	ft
Elevation Range	.00 to 0.77	
Discharge	416.0	cfs



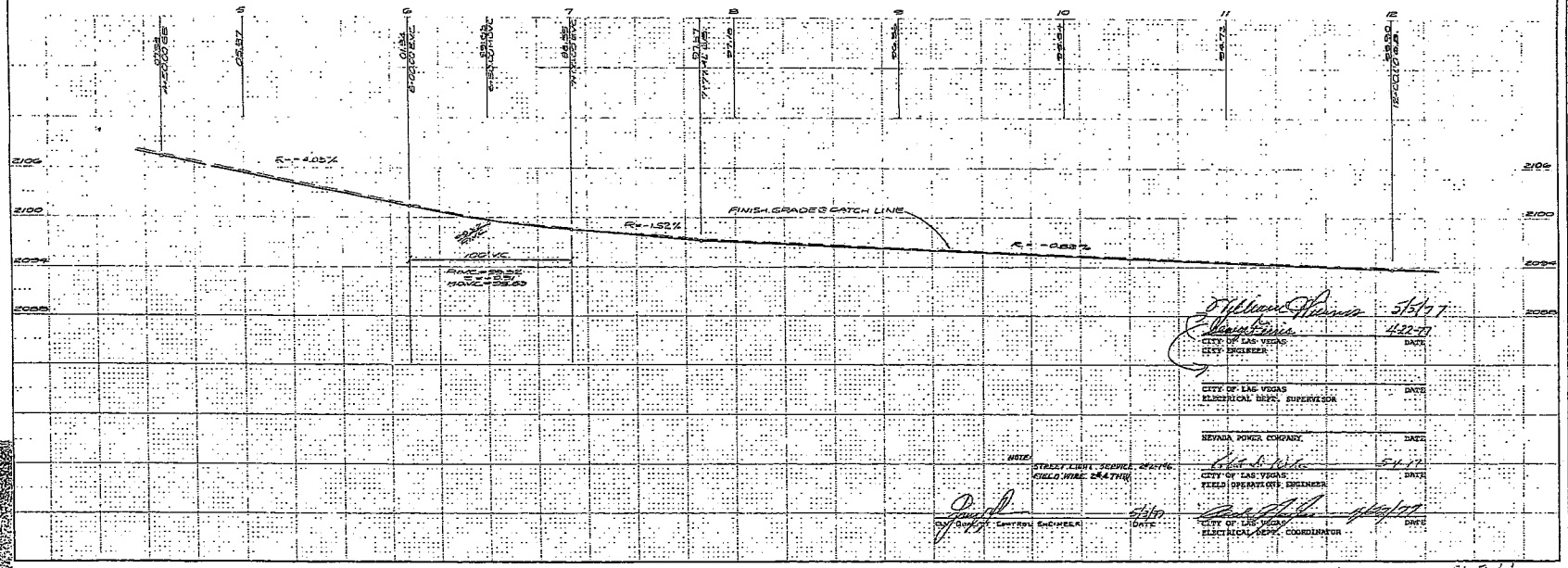
Flows in Upstream Streets



29/64 cfs

TYPICAL STREET SECTION
W. OAKEY BLVD.
NO SCALE

SCALE: 1"=8' VERT. 1"=50' HOR.



5/5/77
4-22-77
CITY OF LAS VEGAS
CITY ENGINEER
DATE

CITY OF LAS VEGAS
ELECTRICAL DEPT. SUPERVISOR
DATE

NEVADA POWER COMPANY
DATE

NOTE:
STREET LIGHT JUNCTION BOXES
FIELD WIRE LEATHER
5-11-77
CITY OF LAS VEGAS
FIELD OPERATIONS ENGINEER
DATE

5/5/77
CITY OF LAS VEGAS
ELECTRICAL DEPT. COORDINATOR
DATE

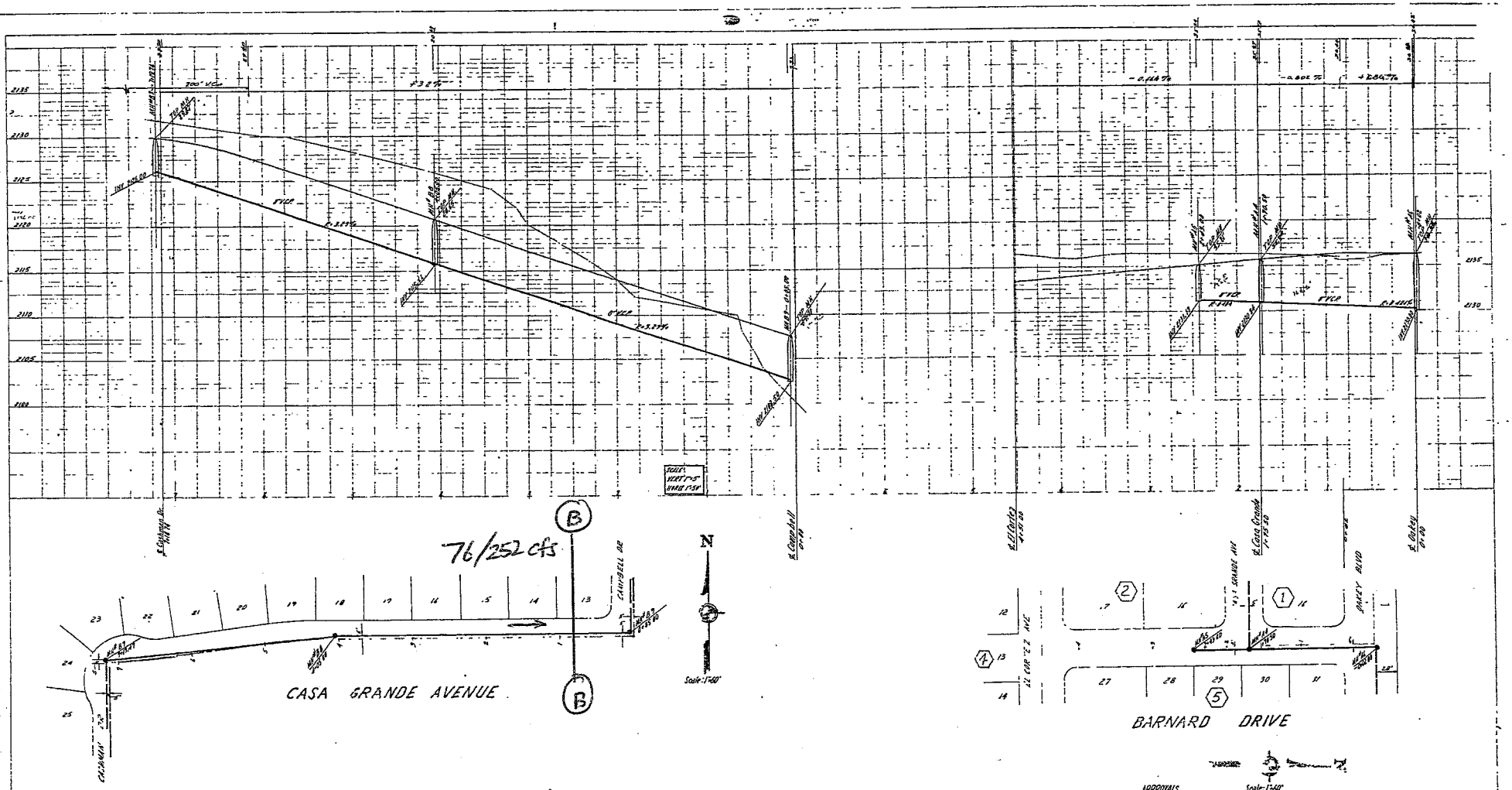
CITY TRAFFIC CONTROL ENGINEER
DATE

SJA
SPARKS, NEVADA
LAS VEGAS, NEVADA
SEATTLE, WASHINGTON
incorporated
ENGINEERS/PLANNERS
ARCHITECTS

McNEIL MANOR TRACT-3
B.J.A. DEVELOPMENT OF NEVADA
STREET IMPROVEMENTS
WEST OAKEY BOULEVARD
LAS VEGAS, NEVADA

JOB NO. 2-015-001-76(3)
DESIGNED HOLT
DRAWN MS
CHKD. WDJ
CHECKED
DATE MARCH, 1977
SHEET NO. 9
9 OF 13 SHEETS

1079-2110-3



APPROVALS

City Engineer — Date 6-17-63

Sanitation Dept — Date 6-4-63

ENGINEER

Chas D Mercer RCE No 4135

BUSINESS ENGINEERING ARCHITECTURE MANAGEMENT, INC.

WESTWOOD VILLAGE

SEWER PLAN & PROFILE

UNIT 1

IKALI 1

beam, inc.

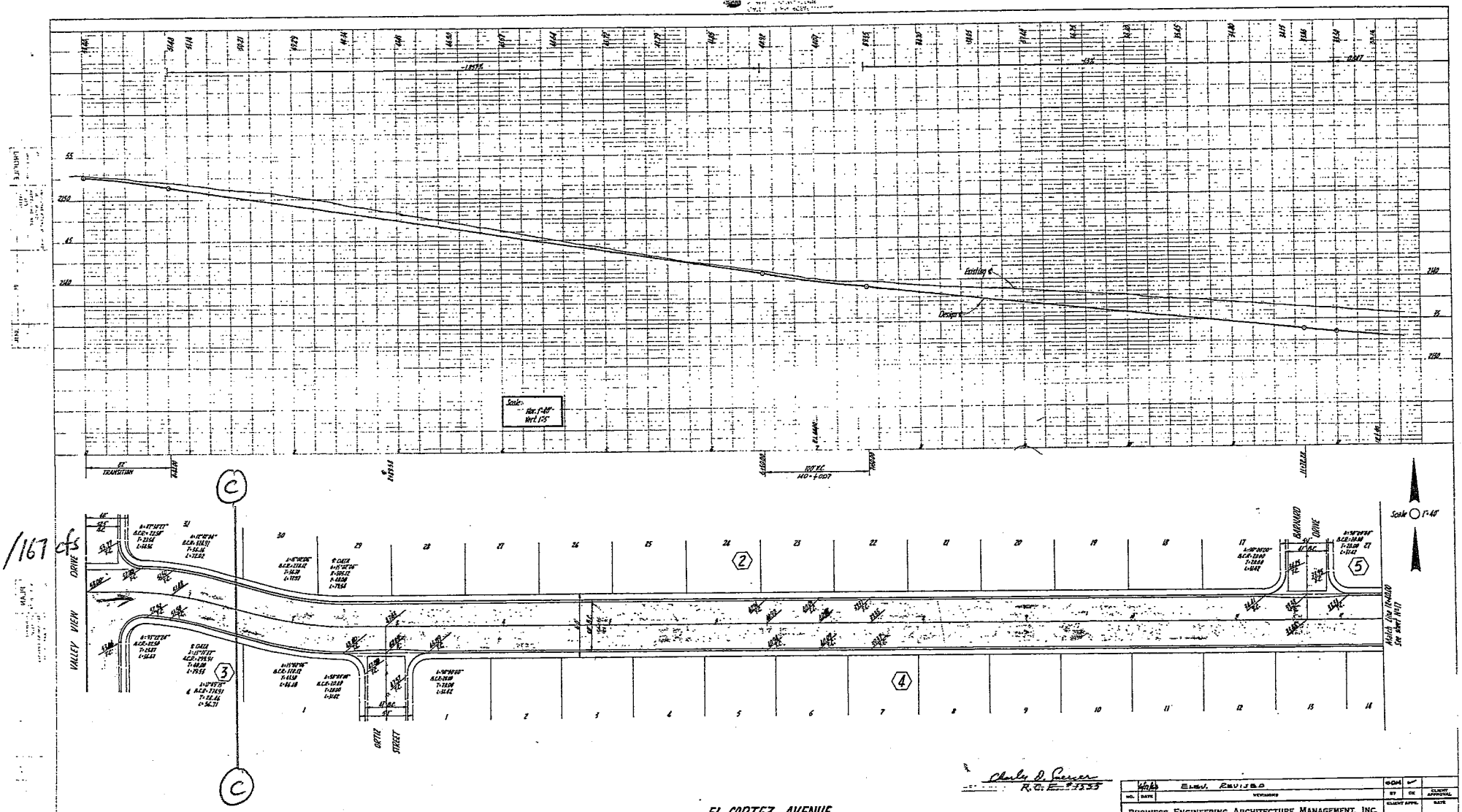
DRAWING NO WV-PP-SE-1

Casa Grande Ave 0+00 to 9+14.47 — Barnard Dr. -0+02 to 4+51.00

304-3330

6729

39-35



54/167 cfs

Charles D. Spencer
R.C.E. #3353

NO.	DATE	REVISIONS	BY	CK	CLIENT APPROVAL
		E.W.U. REVISED			

BUSINESS ENGINEERING ARCHITECTURE MANAGEMENT, INC.
LAS VEGAS, NEVADA — ALBUQUERQUE, NEW MEXICO

WESTWOOD VILLAGE
STREET PLAN & PROFILE
TRACT 1 — UNIT 1

DRAWING NO. WVPP-ST-2
SHEET 16 OF 23

beam, inc.

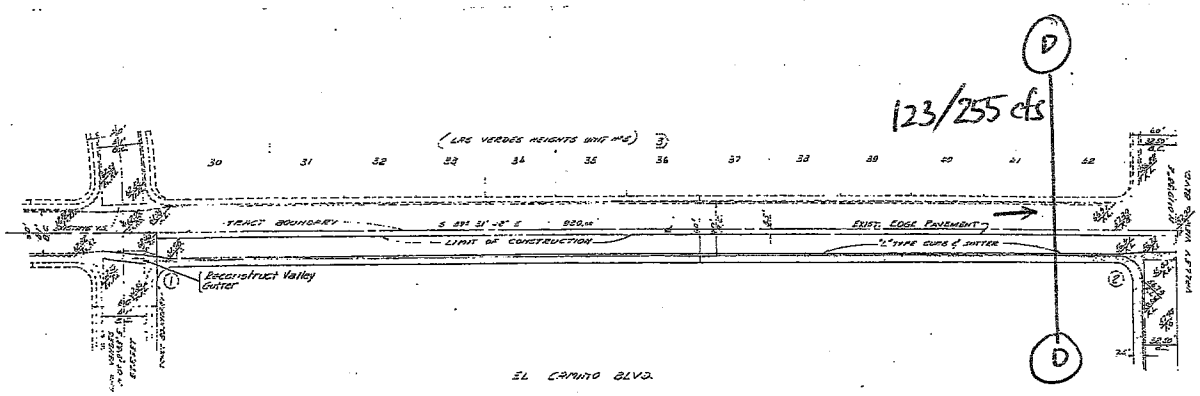
CITY ENG — 6-13-63 DATE

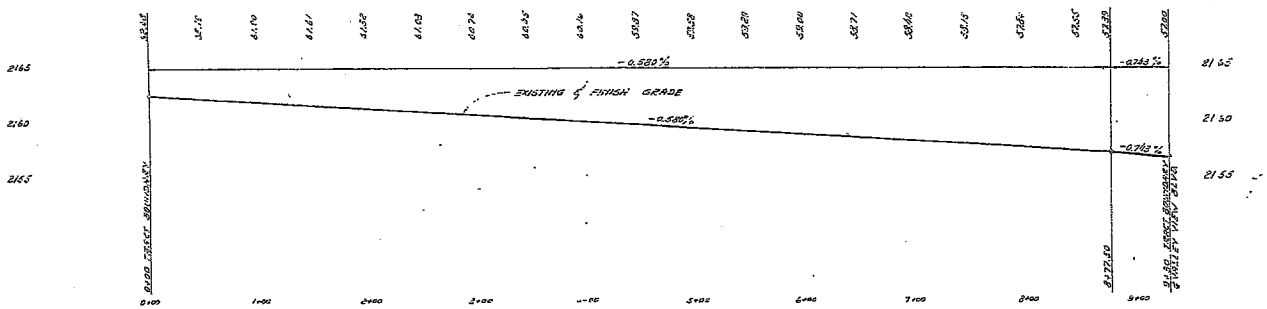
6-13-63

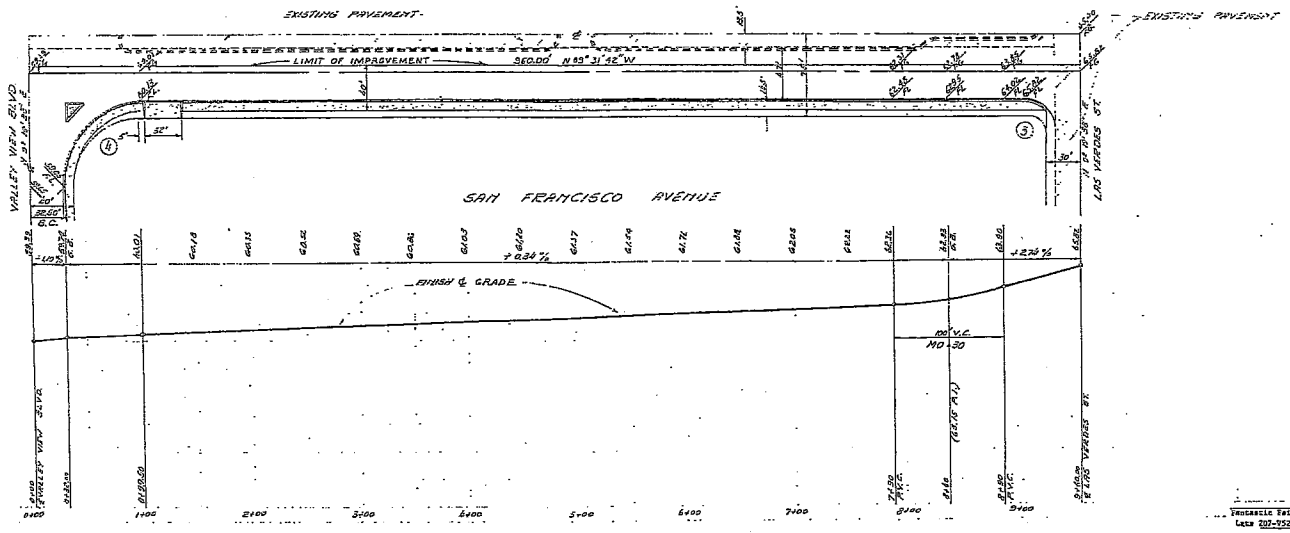
El Cortez 0.00 to 12+10

10TY-3330-1

123/255 cfs







HORIZ. SCALE 1" = 50'
VERT. SCALE 1" = 5'

APPROVALS

CITY ENGINEER — DATE 5/16/72

FIELD ENGINEER — DATE 7-24-72

REV.	DATE	DESCRIPTION	BY	APP'D
A	5-16-72	LOWERED & GRADE SAN FRANCISCO AVE.		

LAS VERDES HEIGHTS
COMMERCIAL PROPERTY

STREET PLAN & PROFILE

DESIGNED C.G.
DRAWN E.S.
CHECKED

WESTERN ENGINEERS, INC.
LAS VEGAS: NEVADA

SHEET 3 OF 3

APPROVED — DATE 7-24-72

Pentascle Pete (now WONDERWORLD)
Lots 207-952, Sewer 307-9299, Water 565-51

107-72/72
3-4-1

XS A1-A1 (Oakey just east of Campbell) 10-yr Flow
Worksheet for Irregular Channel

Project Description	
Worksheet	XS A1-A1 (Oakey just east of Campbell)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Sl	040300	ft/ft
Discharge	99.0	cfs

Options	
Current Roughness Metho	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	0.62	ft
Elevation Range	0.00 to 0.77	
Flow Area	14.5	ft²
Wetted Perimeter	65.66	ft
Top Width	64.64	ft
Actual Depth	0.62	ft
Critical Elevation	0.82	ft
Critical Slope	0.005364	ft/ft
Velocity	6.82	ft/s
Velocity Head	0.72	ft
Specific Energy	1.34	ft
Froude Number	2.54	
Flow Type	Supercritical	

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+80.00	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.63
0+06.00	0.50
0+06.50	0.50
0+06.50	0.00
0+08.00	0.13
0+40.00	0.77
0+72.00	0.13
0+73.50	0.00
0+73.50	0.50
0+74.00	0.50

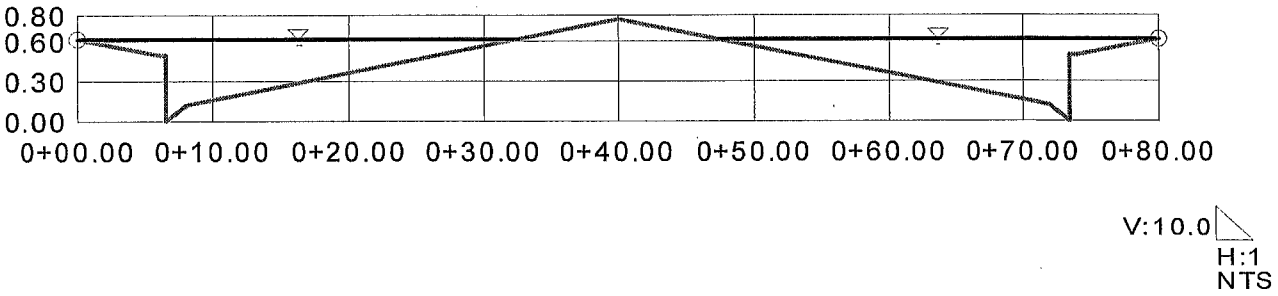
XS A1-A1 (Oakey just east of Campbell) 10-yr Flow
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+80.00	0.63

XS A1-A1 (Oakey just east of Campbell) 10-yr Flow
Cross Section for Irregular Channel

Project Description	
Worksheet	XS A1-A1 (Oakey just east of Campbell)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficier	0.016	
Channel Slope	0.040300	ft/ft
Water Surface Elev.	0.62	ft
Elevation Range	.00 to 0.77	
Discharge	99.0	cfs



XS A1-A1 (Oakey just east of Campbell) 100-yr Flow
Worksheet for Irregular Channel

Project Description	
Worksheet	XS A1-A1 (Oakey just east of Campbell)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Sl	040300	ft/ft
Discharge	314.0	cfs

Options	
Current Roughness Metho	oved Lotter's Method
Open Channel Weighting	oved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	0.85	ft
Elevation Range	0.00 to 0.77	
Flow Area	31.6	ft²
Wetted Perimeter	81.47	ft
Top Width	80.00	ft
Actual Depth	0.85	ft
Critical Elevation	1.24	ft
Critical Slope	0.004200	ft/ft
Velocity	9.92	ft/s
Velocity Head	1.53	ft
Specific Energy	2.38	ft
Froude Number	2.78	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.22357332 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+80.00	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.63
0+06.00	0.50
0+06.50	0.50
0+06.50	0.00
0+08.00	0.13
0+40.00	0.77
0+72.00	0.13
0+73.50	0.00
0+73.50	0.50
0+74.00	0.50

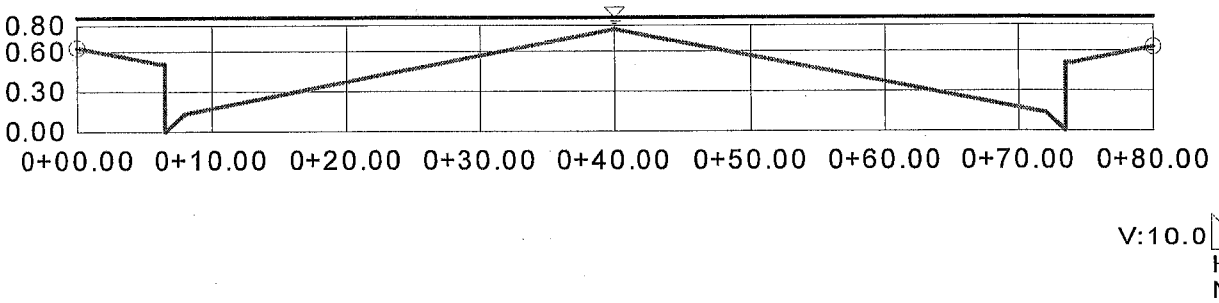
XS A1-A1 (Oakey just east of Campbell) 100-yr Flow
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+80.00	0.63

XS A1-A1 (Oakey just east of Campbell) 100-yr Flow
Cross Section for Irregular Channel

Project Description	
Worksheet	XS A1-A1 (Oakey just east of Campbell)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficier	0.016	
Channel Slope	0.040300	ft/ft
Water Surface Elev	0.85	ft
Elevation Range	.00 to 0.77	
Discharge	314.0	cfs



A2-A2 (Oakey just west of Campbell) 10-yr Flow
Worksheet for Irregular Channel

Project Description	
Worksheet	A2-A2 (Oakey just west of Campbell)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Sl	040300	ft/ft
Discharge	29.0	cfs

Options	
Current Roughness Metho	oved Lotter's Method
Open Channel Weighting	oved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	0.42	ft
Elevation Range	0.00 to 0.77	
Flow Area	5.3	ft²
Wetted Perimeter	32.86	ft
Top Width	32.00	ft
Actual Depth	0.42	ft
Critical Elevation	0.56	ft
Critical Slope	0.006449	ft/ft
Velocity	5.50	ft/s
Velocity Head	0.47	ft
Specific Energy	0.89	ft
Froude Number	2.39	
Flow Type	Supercritical	

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+80.00	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.63
0+06.00	0.50
0+06.50	0.50
0+06.50	0.00
0+08.00	0.13
0+40.00	0.77
0+72.00	0.13
0+73.50	0.00
0+73.50	0.50
0+74.00	0.50

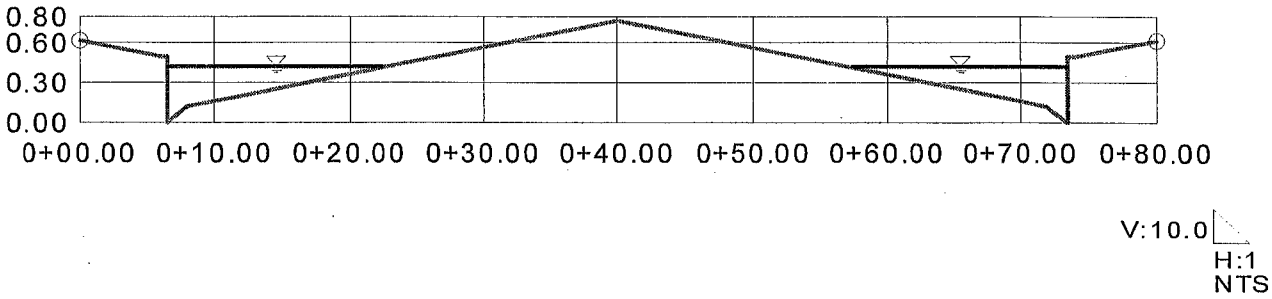
A2-A2 (Oakey just west of Campbell) 10-yr Flow
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+80.00	0.63

A2-A2 (Oakey just west of Campbell) 10-yr Flow
Cross Section for Irregular Channel

Project Description	
Worksheet	A2-A2 (Oakey just west of Campbell)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficier	0.016	
Channel Slope	0.040300	ft/ft
Water Surface Elev	0.42	ft
Elevation Range	.00 to 0.77	
Discharge	29.0	cfs



A2-A2 (Oakey just west of Campbell) 100-yr Flow
Worksheet for Irregular Channel

Project Description	
Worksheet	A2-A2 (Oakey just west of Campbell) 1
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Sl	040300	ft/ft
Discharge	64.0	cfs

Options	
Current Roughness Metho	oved Lotter's Method
Open Channel Weighting	oved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	0.54	ft
Elevation Range	0.00 to 0.77	
Flow Area	10.0	ft²
Wetted Perimeter	50.24	ft
Top Width	49.22	ft
Actual Depth	0.54	ft
Critical Elevation	0.72	ft
Critical Slope	0.005801	ft/ft
Velocity	6.37	ft/s
Velocity Head	0.63	ft
Specific Energy	1.17	ft
Froude Number	2.49	
Flow Type	Supercritical	

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+80.00	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.63
0+06.00	0.50
0+06.50	0.50
0+06.50	0.00
0+08.00	0.13
0+40.00	0.77
0+72.00	0.13
0+73.50	0.00
0+73.50	0.50
0+74.00	0.50

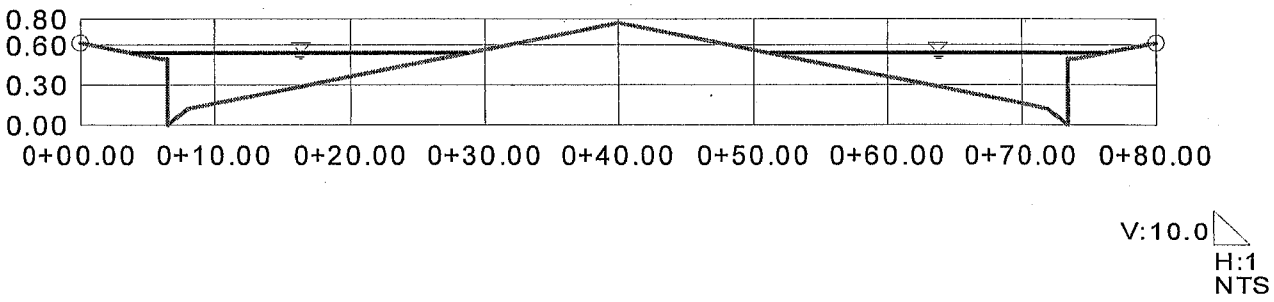
A2-A2 (Oakey just west of Campbell) 100-yr Flow
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+80.00	0.63

A2-A2 (Oakey just west of Campbell) 100-yr Flow
Cross Section for Irregular Channel

Project Description	
Worksheet	A2-A2 (Oakey just west of Campbell) 1
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficiel	0.016	
Channel Slope	0.040300	ft/ft
Water Surface Elev	0.54	ft
Elevation Range	.00 to 0.77	
Discharge	64.0	cfs



XS B-B (Calle De El Cortez just west of Campbell) 10-yr Flow Worksheet for Irregular Channel

Project Description	
Worksheet	XS B-B (Calle De El Cortez just west of Campbell
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Sl	032900	ft/ft
Discharge	76.0	cfs

Options	
Current Roughness Metho	oved Lotter's Method
Open Channel Weighting	oved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	0.59	ft
Elevation Range	0.00 to 0.60	
Flow Area	12.7	ft²
Wetted Perimeter	60.13	ft
Top Width	59.11	ft
Actual Depth	0.59	ft
Critical Elevation	0.75	ft
Critical Slope	0.005350	ft/ft
Velocity	5.98	ft/s
Velocity Head	0.56	ft
Specific Energy	1.15	ft
Froude Number	2.27	
Flow Type	Supercritical	

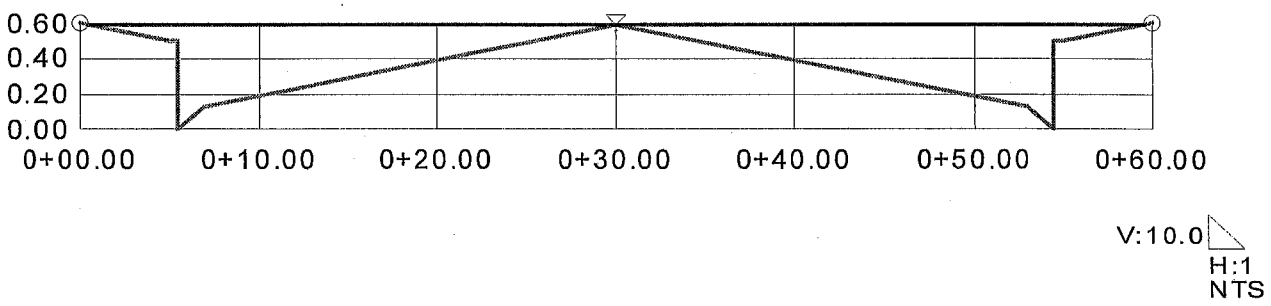
Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+60.00	0.016

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+30.00	0.59
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

XS B-B (Calle De El Cortez just west of Campbell) 10-yr Flow
Cross Section for Irregular Channel

Project Description	
Worksheet	XS B-B (Calle De El Cortez just west of Campbell
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficiel	0.016	
Channel Slope	0.032900	ft/ft
Water Surface Elev	0.59	ft
Elevation Range	.00 to 0.60	
Discharge	76.0	cfs



XS B-B (Calle De El Cortez just west of Campbell) 100-yr Flow
Worksheet for Irregular Channel

Project Description	
Worksheet	XS B-B (Calle De El Cortez just west of Campbell)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Sl	032900	ft/ft
Discharge	252.0	cfs

Options	
Current Roughness Metho	oved Lotter's Method
Open Channel Weighting	oved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	0.82	ft
Elevation Range	0.00 to 0.60	
Flow Area	26.3	ft²
Wetted Perimeter	61.46	ft
Top Width	60.00	ft
Actual Depth	0.82	ft
Critical Elevation	1.20	ft
Critical Slope	0.004185	ft/ft
Velocity	9.57	ft/s
Velocity Head	1.42	ft
Specific Energy	2.24	ft
Froude Number	2.55	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.21802166 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+60.00	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+30.00	0.59
0+53.00	0.13
0+54.50	0.00
0+54.50	0.50
0+55.00	0.50

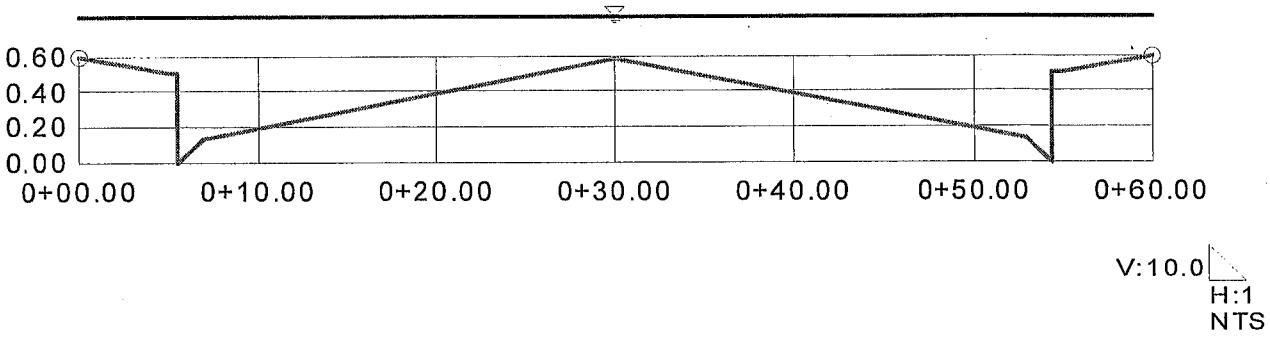
XS B-B (Calle De El Cortez just west of Campbell) 100-yr Flow
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+60.00	0.60

XS B-B (Calle De El Cortez just west of Campbell) 100-yr Flow
Cross Section for Irregular Channel

Project Description	
Worksheet	XS B-B (Calle De El Cortez just west of Campbell)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.016	
Channel Slope	0.032900	ft/ft
Water Surface Elev	0.82	ft
Elevation Range	.00 to 0.60	
Discharge	252.0	cfs



XS C-C (El Cortez just east of Valley View) 10-yr Flow
Worksheet for Irregular Channel

Project Description	
Worksheet	XS C-C (El Cortez just east of Valley View) 1
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Sl	018590	ft/ft
Discharge	54.0	cfs

Options	
Current Roughness Metho	oved Lotter's Method
Open Channel Weighting	oved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	0.58	ft
Elevation Range	0.00 to 0.60	
Flow Area	12.1	ft²
Wetted Perimeter	58.25	ft
Top Width	57.23	ft
Actual Depth	0.58	ft
Critical Elevation	0.67	ft
Critical Slope	0.005759	ft/ft
Velocity	4.45	ft/s
Velocity Head	0.31	ft
Specific Energy	0.89	ft
Froude Number	1.70	
Flow Type	Supercritical	

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+60.00	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+30.00	0.59
0+53.00	0.13
0+54.50	0.00
0+54.50	0.50
0+55.00	0.50

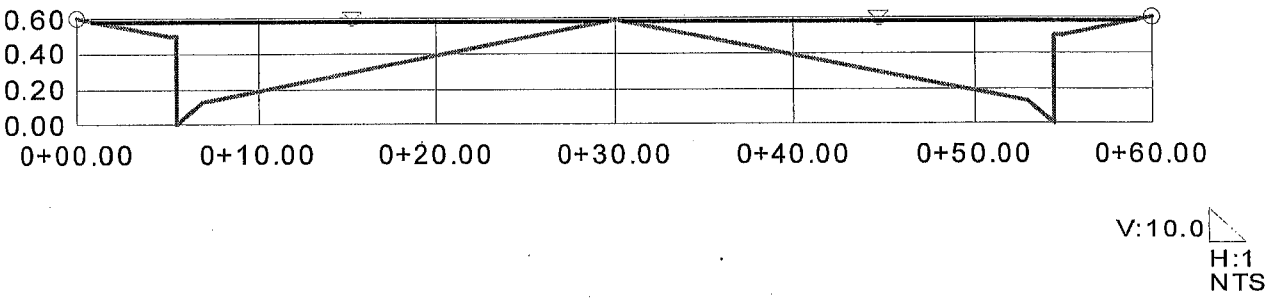
XS C-C (El Cortez just east of Valley View) 10-yr Flow
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+60.00	0.60

XS C-C (El Cortez just east of Valley View) 10-yr Flow
Cross Section for Irregular Channel

Project Description	
Worksheet	XS C-C (El Cortez just east of Valley View) 1
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficier	0.016	
Channel Slope	0.018590	ft/ft
Water Surface Elev	0.58	ft
Elevation Range	.00 to 0.60	
Discharge	54.0	cfs



C-C (El Cortez just east of Valley View) 100-yr Flow
Worksheet for Irregular Channel

Project Description	
Worksheet	C-C (El Cortez just east of Valley View) 10(
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Sl(	018590	ft/ft
Discharge	167.0	cfs

Options	
Current Roughness Metho	oved Lotter's Method
Open Channel Weighting	oved Lotter's Method
Closed Channel Weightin(	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	0.79	ft
Elevation Range	0.00 to 0.60	
Flow Area	24.4	ft²
Wetted Perimeter	61.39	ft
Top Width	60.00	ft
Actual Depth	0.79	ft
Critical Elevation	1.00	ft
Critical Slope	0.004553	ft/ft
Velocity	6.84	ft/s
Velocity Head	0.73	ft
Specific Energy	1.51	ft
Froude Number	1.89	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.18589999 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+60.00	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+30.00	0.59
0+53.00	0.13
0+54.50	0.00
0+54.50	0.50
0+55.00	0.50

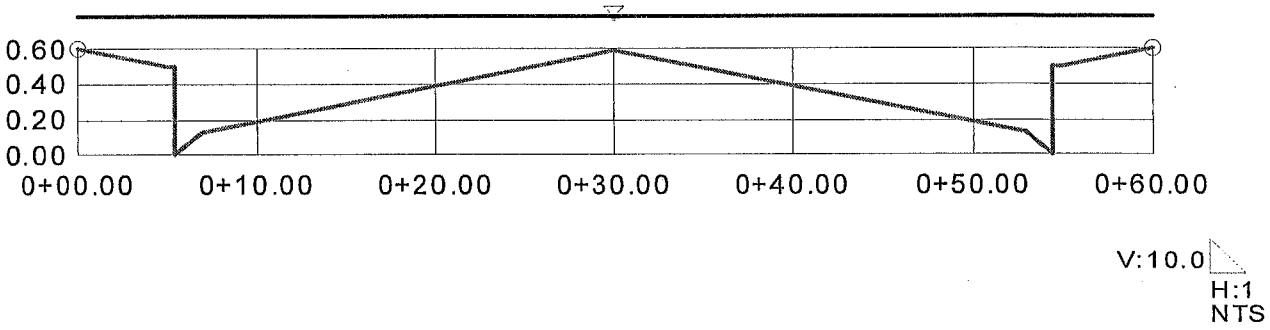
C-C (El Cortez just east of Valley View) 100-yr Flow
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+60.00	0.60

C-C (El Cortez just east of Valley View) 100-yr Flow
Cross Section for Irregular Channel

Project Description	
Worksheet	C-C (El Cortez just east of Valley View) 10(
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficier	0.016	
Channel Slope	0.018590	ft/ft
Water Surface Elev	0.79	ft
Elevation Range	.00 to 0.60	
Discharge	167.0	cfs



XS D-D (El Camino just west of Valley View) 10-yr Flow
Worksheet for Irregular Channel

Project Description	
Worksheet	XS D-D (El Camino just west of Valley View)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Sl	005800	ft/ft
Discharge	123.0	cfs

Options	
Current Roughness Metho	oved Lotter's Method
Open Channel Weighting	oved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	0.86	ft
Elevation Range	0.00 to 0.60	
Flow Area	28.8	ft²
Wetted Perimeter	61.54	ft
Top Width	60.00	ft
Actual Depth	0.86	ft
Critical Elevation	0.89	ft
Critical Slope	0.004846	ft/ft
Velocity	4.27	ft/s
Velocity Head	0.28	ft
Specific Energy	1.14	ft
Froude Number	1.09	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.25976493 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+60.00	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+30.00	0.59
0+53.00	0.13
0+54.50	0.00
0+54.50	0.50
0+55.00	0.50

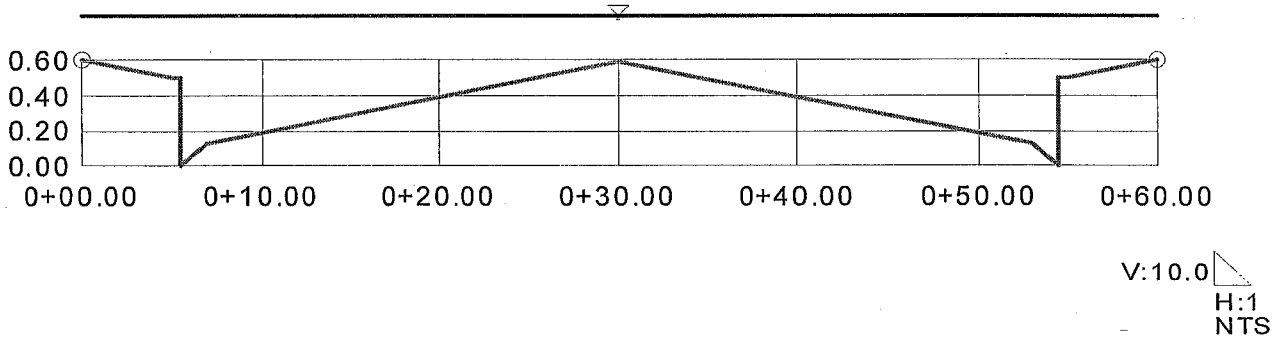
XS D-D (El Camino just west of Valley View) 10-yr Flow
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+60.00	0.60

XS D-D (El Camino just west of Valley View) 10-yr Flow
Cross Section for Irregular Channel

Project Description	
Worksheet	XS D-D (El Camino just west of Valley View)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficier	0.016	
Channel Slope	0.005800	ft/ft
Water Surface Elev	0.86	ft
Elevation Range	.00 to 0.60	
Discharge	123.0	cfs



XS D-D (El Camino just west of Valley View) 100-yr Flow
Worksheet for Irregular Channel

Project Description	
Worksheet	XS D-D (El Camino just west of Valley View)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Sl	005800	ft/ft
Discharge	255.0	cfs

Options	
Current Roughness Metho	oved Lotter's Method
Open Channel Weighting	oved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	1.13	ft
Elevation Range	0.00 to 0.60	
Flow Area	44.8	ft²
Wetted Perimeter	62.07	ft
Top Width	60.00	ft
Actual Depth	1.13	ft
Critical Elevation	1.20	ft
Critical Slope	0.004177	ft/ft
Velocity	5.69	ft/s
Velocity Head	0.50	ft
Specific Energy	1.63	ft
Froude Number	1.16	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.52601474 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+60.00	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+30.00	0.59
0+53.00	0.13
0+54.50	0.00
0+54.50	0.50
0+55.00	0.50

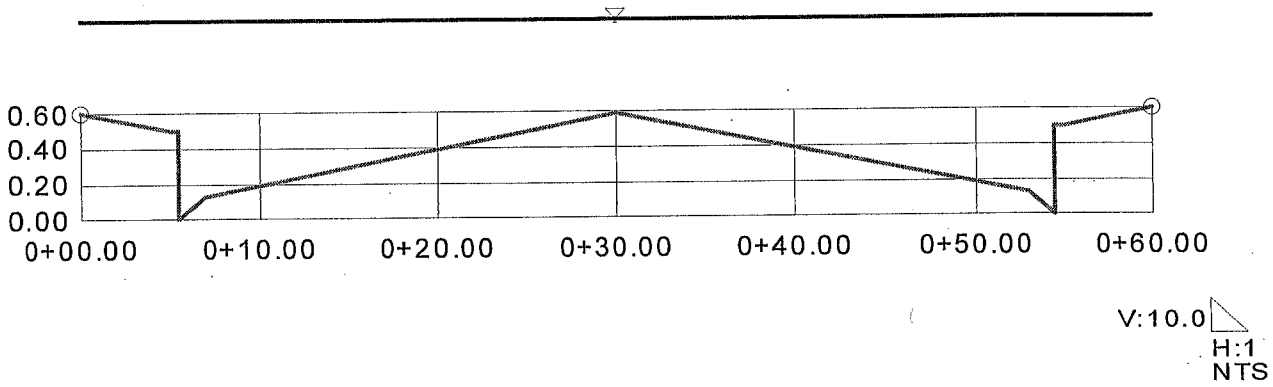
XS D-D (El Camino just west of Valley View) 100-yr Flow
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+60.00	0.60

XS D-D (El Camino just west of Valley View) 100-yr Flow
Cross Section for Irregular Channel

Project Description	
Worksheet	XS D-D (El Camino just west of Valley View)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficier	0.016	
Channel Slope	0.005800	ft/ft
Water Surface Elev	1.13	ft
Elevation Range	.00 to 0.60	
Discharge	255.0	cfs



Flow in RCP's

Capacity of 36" RCP @ 1.0%
Worksheet for Circular Channel

Project Description	
Worksheet	Capacity of 36" RCP @
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

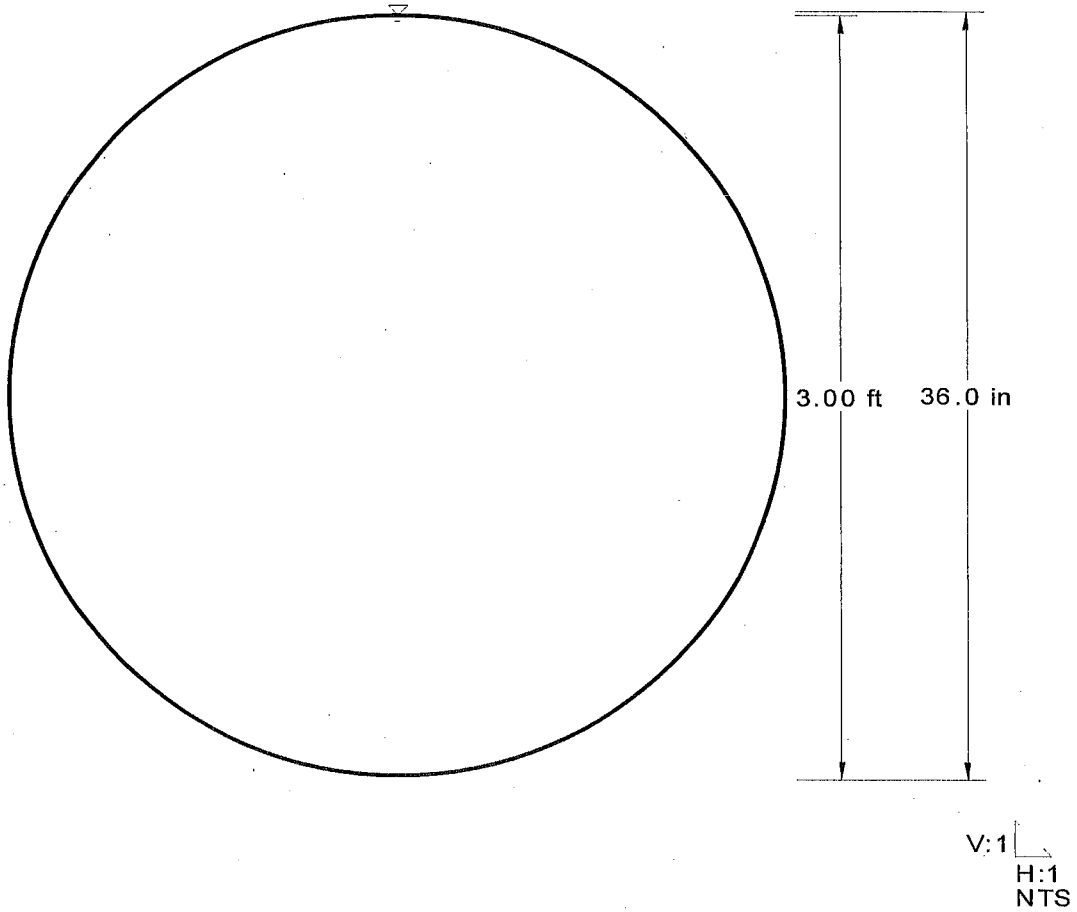
Input Data		
Mannings Coeffic	0.013	
Channel Slope	1.00	%
Diameter	36.0	in

Results		
Depth	3.00	ft
Discharge	66.7	cfs
Flow Area	7.1	ft²
Wetted Perime	9.42	ft
Top Width	0.00	ft
Critical Depth	2.61	ft
Percent Full	100.0	%
Critical Slope	0.91	%
Velocity	9.44	ft/s
Velocity Head	1.38	ft
Specific Energ	4.38	ft
Froude Numbe	0.00	
Maximum Disc	71.7	cfs
Discharge Full	66.7	cfs
Slope Full	1.00	%
Flow Type	N/A	

Capacity of 36" RCP @ 1.0%
Cross Section for Circular Channel

Project Description	
Worksheet	Capacity of 36" RCP @
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

Section Data		
Mannings Coeffic	0.013	
Channel Slope	1.00	%
Depth	3.00	ft
Diameter	36.0	in
Discharge	66.7	cfs



Capacity of 48" RCP @ 1.0%
Worksheet for Circular Channel

Project Description	
Worksheet	Capacity of 48" RCP @
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

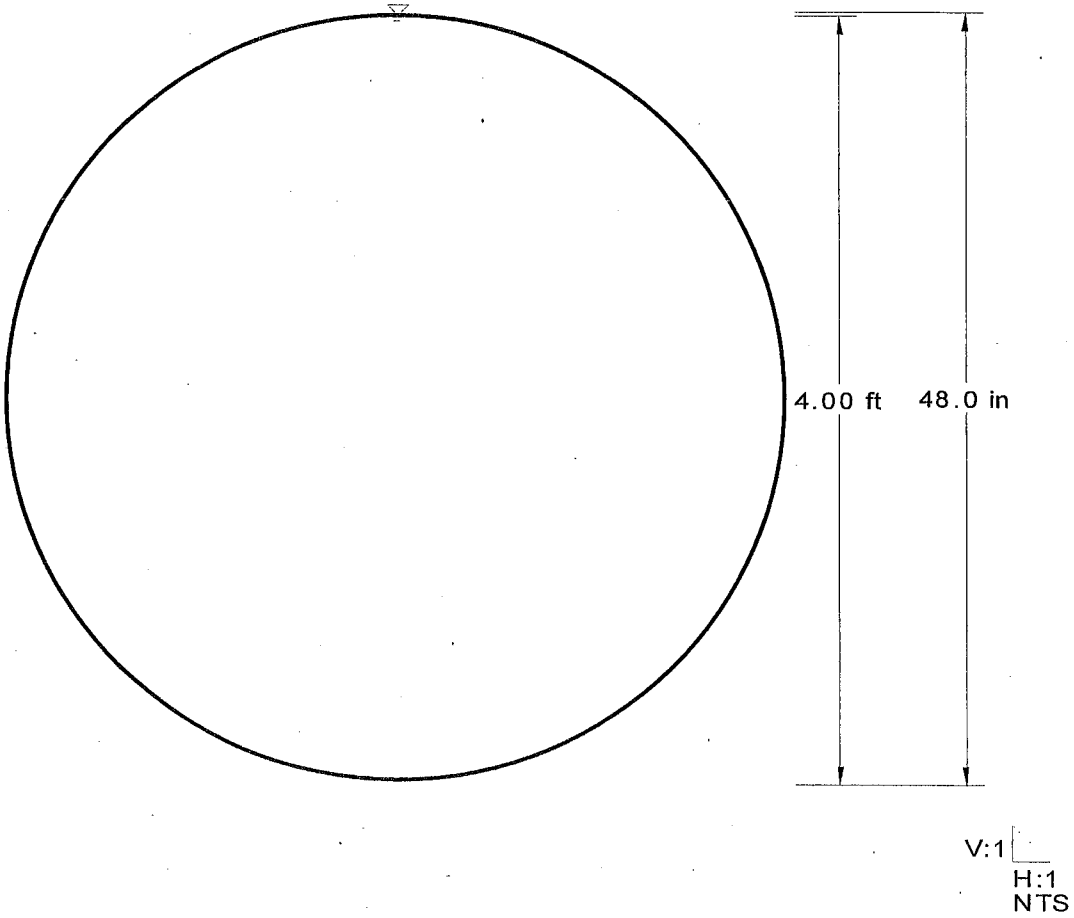
Input Data		
Mannings Coeffic	0.013	
Channel Slope	1.00	%
Diameter	48.0	in

Results		
Depth	4.00	ft
Discharge	143.6	cfs
Flow Area	12.6	ft²
Wetted Perime	12.57	ft
Top Width	0.00	ft
Critical Depth	3.54	ft
Percent Full	100.0	%
Critical Slope	0.89	%
Velocity	11.43	ft/s
Velocity Head	2.03	ft
Specific Energ	6.03	ft
Froude Numbe	0.00	
Maximum Disc	154.5	cfs
Discharge Full	143.6	cfs
Slope Full	1.00	%
Flow Type	N/A	

Capacity of 48" RCP @ 1.0%
Cross Section for Circular Channel

Project Description	
Worksheet	Capacity of 48" RCP @
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

Section Data		
Mannings Coeffic	0.013	
Channel Slope	1.00	%
Depth	4.00	ft
Diameter	48.0	in
Discharge	143.6	cfs



Flow in Existing 10'x8' RCB

10'x8' RCB @ 0.582% (1240 cfs)
Worksheet for Rectangular Channel

Project Description	
Worksheet	10'x8' RCB @ 0.582% (1:
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

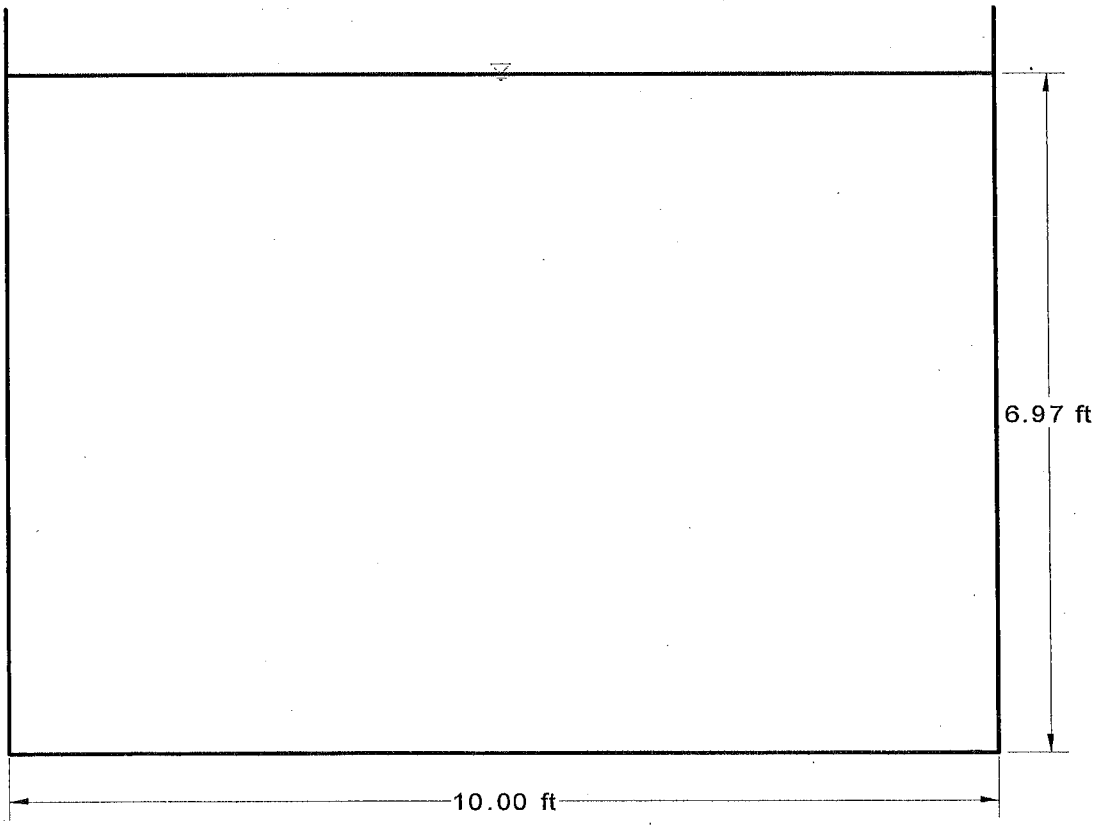
Input Data		
Mannings Coeffic	0.013	
Channel Slope	0.58	%
Bottom Width	10.00	ft
Discharge	1,240.0	cfs

Results		
Depth	6.97	ft
Flow Area	69.7	ft²
Wetted Perim	23.95	ft
Top Width	10.00	ft
Critical Depth	7.82	ft
Critical Slope	0.44	%
Velocity	17.78	ft/s
Velocity Head	4.91	ft
Specific Energ	11.89	ft
Froude Numb	1.19	
Flow Type	Supercritical	

10'x8' RCB @ 0.582% (1240 cfs)
Cross Section for Rectangular Channel

Project Description	
Worksheet	10'x8' RCB @ 0.582% (1:
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coeffic	0.013	
Channel Slope	0.58	%
Depth	6.97	ft
Bottom Width	10.00	ft
Discharge	1,240.0	cfs



10'x8' RCB @ 0.582% (803 cfs)
Worksheet for Rectangular Channel

Project Description	
Worksheet	10'x8' RCB @ 0.582% (8
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

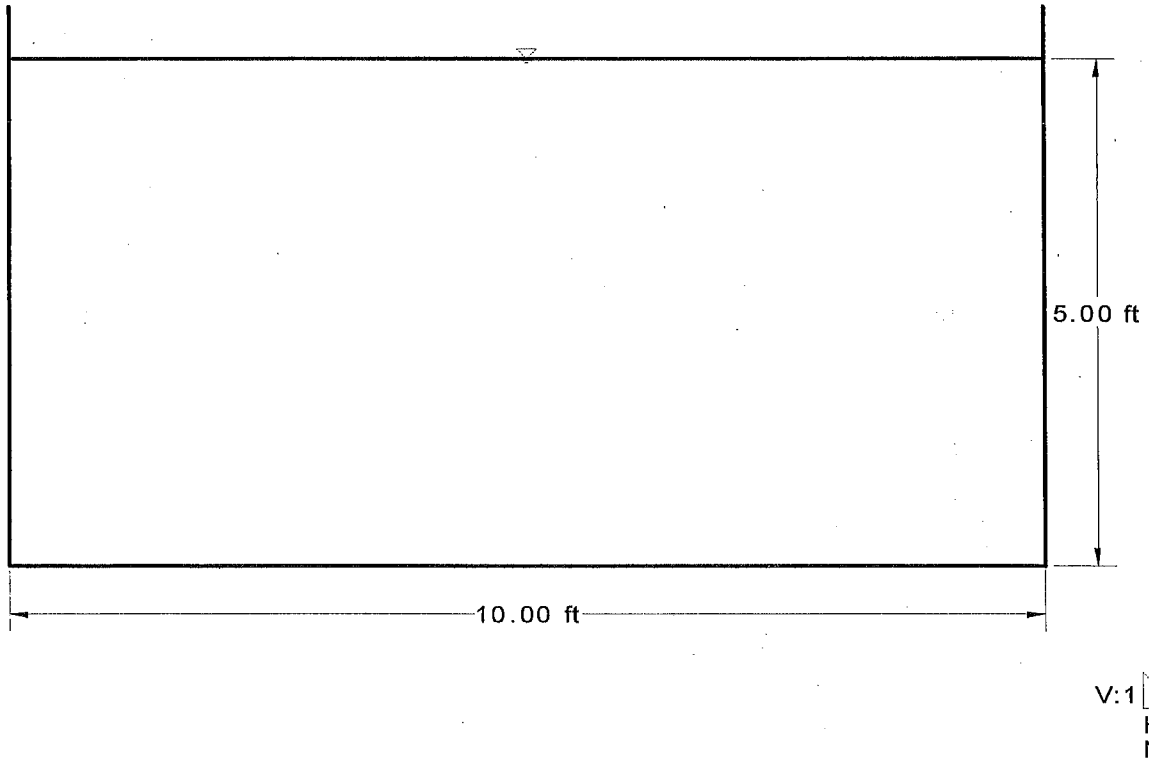
Input Data		
Mannings Coeffic	0.013	
Channel Slope	0.58	%
Bottom Width	10.00	ft
Discharge	303.0	cfs

Results		
Depth	5.00	ft
Flow Area	50.0	ft²
Wetted Perim	20.00	ft
Top Width	10.00	ft
Critical Depth	5.85	ft
Critical Slope	0.38	%
Velocity	16.06	ft/s
Velocity Head	4.01	ft
Specific Energ	9.01	ft
Froude Numb	1.27	
Flow Type	Supercritical	

10'x8' RCB @ 0.582% (803 cfs)
Cross Section for Rectangular Channel

Project Description	
Worksheet	10'x8' RCB @ 0.582% (8
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coeffic	0.013	
Channel Slope	0.58	%
Depth	5.00	ft
Bottom Width	10.00	ft
Discharge	303.0	cfs



WSPG

Program Package Serial Number: 1537

WATER SURFACE PROFILE LISTING Date: 2- 2-2007 Time: 9:52:42

OAKEY STORM DRAIN - BIRCH TO CAHLAN

FILE NAME: OAKEY.WSW

MODEL BY : HDR, DATE: 2/1/2007

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT or I.D.	Base Wt "N"	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	X-Fall	ZR	Type	Ch
-6821.150	2047.880	4.011	2051.892	775.00	19.32	5.80	2057.69	.00	5.71	10.00	8.000	10.000	.00	0 .0
TRANS STR	.0060					.0079	.12	4.01	1.70		.013	.00	.00	BOX
-6806.150	2047.970	6.080	2054.051	775.00	15.93	3.94	2057.99	.00	6.63	8.00	7.000	8.000	.00	0 .0
787.344	.0060					.0060	4.73	6.08	1.14	6.08	.013	.00	.00	BOX
-6018.806	2052.697	6.080	2058.777	775.00	15.93	3.94	2062.72	.00	6.63	8.00	7.000	8.000	.00	0 .0
192.090	.0060					.0057	1.10	6.08	1.14	6.08	.013	.00	.00	BOX
-5826.716	2053.850	6.321	2060.170	775.00	15.33	3.65	2063.82	.00	6.63	8.00	7.000	8.000	.00	0 .0
26.716	.0060					.0051	.14	6.32	1.07	6.08	.013	.00	.00	BOX
---------- WARNING - Flow depth near top of box conduit ----------														
-5800.000	2054.010	6.630	2060.640	775.00	14.61	3.32	2063.96	.00	6.63	8.00	7.000	8.000	.00	0 .0
JUNCT STR	.0060					.0057	.29	6.63	1.00		.013	.00	.00	BOX
---------- WARNING - Flow depth near top of box conduit ----------														
-5750.000	2054.310	7.549	2061.859	735.00	13.13	2.67	2064.53	.00	6.40	8.00	7.000	8.000	.00	0 .0
JUNCT STR	.0060					.0047	.24	7.55	.87		.013	.00	.00	BOX
-5700.000	2054.610	8.442	2063.052	668.00	11.93	2.21	2065.26	.00	6.01	8.00	7.000	8.000	.00	0 .0
100.000	.0060					.0047	.47	8.44	.79	5.41	.013	.00	.00	BOX

Program Package Serial Number: 1537

WATER SURFACE PROFILE LISTING Date: 2- 2-2007 Time: 9:52:42

OAKEY STORM DRAIN - BIRCH TO CAHLAN

FILE NAME: OAKEY.WSW

MODEL BY : HDR, DATE: 2/1/2007

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/Dia.-FT or I.D. / "N"	Base Wt / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
-5600.000	2055.210	8.316	2063.526	668.00	11.93	2.21	2065.74	.00	6.01	8.00	7.000	8.000	.00	0 .0
TRANS STR	.0100					.0047	.05	8.32	.79		.013	.00	.00	BOX
-5590.000	2055.310	7.638	2062.948	668.00	13.92	3.01	2065.95	.00	6.00	8.00	6.000	8.000	.00	0 .0
440.000	.0100					.0072	3.18	7.64	1.00	4.44	.013	.00	.00	BOX
-5150.000	2059.714	6.412	2066.126	668.00	13.92	3.01	2069.13	.00	6.00	8.00	6.000	8.000	.00	0 .0
JUNCT STR	.0100					.0026	.26	6.41	1.00		.013	.00	.00	BOX
-5050.000	2060.715	9.790	2070.505	397.00	8.27	1.06	2071.57	.00	4.24	8.00	6.000	8.000	.00	0 .0
200.000	.0100					.0026	.51	9.79	.60	3.02	.013	.00	.00	BOX
-4850.000	2062.717	8.299	2071.016	397.00	8.27	1.06	2072.08	.00	4.24	8.00	6.000	8.000	.00	0 .0
JUNCT STR	.0100					.0026	.26	8.30	.60		.013	.00	.00	BOX
-4750.000	2063.718	8.136	2071.854	334.00	6.96	.75	2072.61	.00	3.78	8.00	6.000	8.000	.00	0 .0
TRANS STR	.0142					.0018	.02	8.14	.50		.013	.00	.00	BOX
-4740.000	2063.860	6.733	2070.593	334.00	13.36	2.77	2073.36	.00	5.00	5.00	5.000	5.000	.00	0 .0
181.382	.0150					.0101	1.84	6.73	1.05	3.66	.013	.00	.00	BOX
-4558.618	2066.581	5.851	2072.432	334.00	13.36	2.77	2075.20	.00	5.00	5.00	5.000	5.000	.00	0 .0
HYDRAULIC JUMP														
-4558.618	2066.581	3.665	2070.246	334.00	18.23	5.16	2075.40	.00	5.00	5.00	5.000	5.000	.00	0 .0
311.461	.0150					.0145	4.53	3.67	1.68	3.66	.013	.00	.00	BOX

OAKEY STORM DRAIN - BIRCH TO CAHLAN
FILE NAME: OAKEY.WSW
MODEL BY : HDR, DATE: 2/1/2007

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT or I.D.	Base Wt "N"	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp		X-Fall	ZR	Type Ch
-4247.157	2071.253	3.756	2075.009	334.00	17.79	4.91	2079.92	.00	5.00	5.00	5.000	5.000	.00	0 .0
153.883	.0150					.0133	2.04	3.76	1.62	3.66	.013	.00	.00	BOX
-4093.274	2073.561	3.939	2077.500	334.00	16.96	4.47	2081.97	.00	5.00	5.00	5.000	5.000	.00	0 .0
66.500	.0150					.0118	.78	3.94	1.51	3.66	.013	.00	.00	BOX
-4026.774	2074.558	4.131	2078.690	334.00	16.17	4.06	2082.75	.00	5.00	5.00	5.000	5.000	.00	0 .0
36.882	.0150					.0105	.39	4.13	1.40	3.66	.013	.00	.00	BOX
-3989.892	2075.112	4.333	2079.445	334.00	15.42	3.69	2083.14	.00	5.00	5.00	5.000	5.000	.00	0 .0
21.723	.0150					.0093	.20	4.33	1.31	3.66	.013	.00	.00	BOX
-3968.169	2075.438	4.545	2079.982	334.00	14.70	3.35	2083.34	.00	5.00	5.00	5.000	5.000	.00	0 .0
12.339	.0150					.0083	.10	4.54	1.22	3.66	.013	.00	.00	BOX
		---------- WARNING - Flow depth near top of box conduit ----------												
-3955.830	2075.623	4.766	2080.389	334.00	14.01	3.05	2083.44	.00	5.00	5.00	5.000	5.000	.00	0 .0
5.830	.0150					.0073	.04	4.77	1.13	3.66	.013	.00	.00	BOX
		---------- WARNING - Flow depth near top of box conduit ----------												
-3950.000	2075.710	5.000	2080.710	334.00	13.36	2.77	2083.48	.00	5.00	5.00	5.000	5.000	.00	0 .0
JUNCT STR	.0105					.0089	.89	5.00	1.05		.013	.00	.00	BOX
		---------- WARNING - Flow depth near top of box conduit ----------												

Program Package Serial Number: 1537

WATER SURFACE PROFILE LISTING Date: 2- 2-2007 Time: 9:52:42

OAKEY STORM DRAIN - BIRCH TO CAHLAN

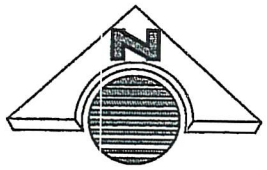
FILE NAME: OAKEY.WSW

MODEL BY : HDR, DATE: 2/1/2007

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT or I.D.	Base Wt ZL	ZR	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall		Type Ch
						WARNING - Junction Analysis - Change in Channel Type								
-3850.000	2076.760	9.258	2086.018	150.00	11.94	2.21	2088.23	.00	3.60	.00	4.000	.000	.00	1 .0
20.000	.0150					.0109	.22	9.26	.00	2.84	.013	.00	.00	PIPE
-3830.000	2077.060	9.176	2086.236	150.00	11.94	2.21	2088.45	.00	3.60	.00	4.000	.000	.00	1 .0

Appendix H - Right-Of-Way Exhibits

EXHIBIT 'B' TO ACCOMPANY LEGAL DESCRIPTION



SCALE: 1" = 400'

SAMPLE

APN:
161-35-305-001
CITY OF HENDERSON
991102:00710 O.R.

BOULDER HIGHWAY

PARCEL 2-A
FILE 87, PAGE 85
OF PARCEL MAPS
APN:
161-35-402-002
BOULDER HIGHWAY &
GIBSON INVESTMENT
20040406:02206
O.R.

GIBSON ROAD

PARCEL 2-B
FILE 87, PAGE 85
OF PARCEL MAPS
APN: 161-35-402-003
BOULDER HIGHWAY
HOLDING CO LLC
O.R.: 20010126:00599

GALLERIA DRIVE

GALLERIA DRIVE

1/4
35
2

34 | 35
3 | 2

EASEMENT DETAILS

HORIZON SURVEYS
2901 COVINGTON CROSS DRIVE, SUITE 120
LAS VEGAS, NEVADA 89144
PHONE: (702) 228-0366 FAX: (702) 228-0377

SHEET 1 OF 3

March 21, 2006
N. Hauge / S. Bazar

Exhibit 'A'

Explanation

This legal describes a temporary construction easement to be granted to the City of Henderson, generally located along the southerly right-of-way of Gibson Road from Galleria Drive to Boulder Highway.

Legal Description

A portion of Parcel 2-B as shown in File 87, Page 85 of Parcel Maps, on file at the Clark County, Nevada Recorder's Office, lying within the Southwest Quarter (SW 1/4) of Section 35, Township 21 South, Range 62 East, M.D.M., City of Henderson, Clark County, Nevada, described as follows:

Commencing at the southwest corner of said Section 35, being at the centerline intersection of Gibson Road and Galleria Drive; thence along the south line of said Section 35 and centerline of said Galleria Drive, North 89°11'56" East, 128.39 feet; thence departing said south Section line and street centerline North 00°48'04" West, 72.97 feet to the **Point of Beginning**, being the beginning of a non-tangent curve, concave to the northeast, having a radius of 40.00 feet, from which beginning the radius bears North 30°54'18" East; thence northwesterly along said curve, through a central angle of 80°01'57", an arc length of 55.87 feet to the beginning of a compound curve, concave to the southeast, having a radius of 788.00 feet, from which beginning the radius bears South 69°03'45" East; thence northeasterly along said curve, through a central angle of 16°57'40", an arc length of 233.27 feet to the beginning of a compound curve, concave to the southeast, having a radius of 966.53 feet, from which beginning the radius bears South 52°06'05" East; thence northeasterly along said curve, through a central angle of 10°38'40", an arc length of 179.56 feet to a point of non-tangency, to which a radial line bears North 41°27'26" West; thence North 48°45'25" East, 88.05 feet; thence North 50°52'00" East, 875.12 feet to the northeasterly boundary of said Parcel 2-B; thence along said northeasterly boundary South 42°43'17" East, 46.21 feet; thence departing said northeasterly boundary South 49°44'40" West, 1202.76 feet; thence South 23°28'56" West, 197.25 feet to the **Point of Beginning**.

Containing 71,581 square feet.

Basis of Bearing

South 42°43'22" East, being the bearing of the southwesterly right-of-way of Boulder Highway as shown in File 56, Page 35 of Surveys on file at the Clark County, Nevada Recorder's Office.

(See Exhibit 'B' attached hereto and by this reference made a part hereof)

End of description.

John Forsman, PLS
Professional Land Surveyor
Nevada License No. 10053

SAMPLE

Horizon Surveys
9901 Covington Cross Dr. • Suite 190 • Las Vegas, NV 89144 • (702)228-5066 • (702)228-0677 • www.horizonsurveys.com

Appendix I - Preliminary Plans

Appendix J – Correspondence with Utility Companies

SOUTHWEST GAS CORPORATION

LETTER OF TRANSMITTAL

TO: HDR Engineering, Inc. DATE: November 16, 2006

770 E. Warm Springs Rd. Suite 360

Las Vegas, NV 89119-4336 PHONE: (702) 938-6043

ATTN: Raj Hanumanthaiah, P.E. FRAN: ☒ NEW BUS: ☐

ENTITY: CLV PROJECT NAME: Oakey Storm Drain: Calhan Dr. to Birch St.

FORWARDING BY:	SUBMITTAL RECEIVED:	DATE SUBMITTAL RECEIVED:
Pick-up	Preliminary	November 6, 2006

NO. OF COPIES	DESCRIPTION
1	Please see the back of HDR Transmittal Letter

REMARKS: All Remarks checked below must be addressed prior to requesting signature.

- ☐ No SWG Facilities presently exist within the project area of the Civil Plans submitted.
- ☒ Attached to the set of Civil Plans are copies of the SWG Maps & As-builts showing the existing and/or proposed facilities within the project area. These SWG facilities must be shown on the Civil Plans.
- ☒ The Civil Plans have been "red-lined" to indicate the approximate location of the existing SWG Facilities. Please transfer the information to the updated Civil Plans.
- ☐ A note must be added near all High-Pressure Gas lines stating, "Caution: High-Pressure Gas!" All High-Pressure Gas crossings must be potholed and shown in Profile on the Civil Plans.
- ☐ 100% Civil Plans must be submitted for review prior to requesting signature.
- ☐ The Civil Plans have been reviewed and are ready for signature.

REQUIREMENTS: When requesting signatures, bring the most recent Transmittal, Redlines, all SWG Maps & As-builts listed above, and a Complete set of the 100% Civil Plans.

COMMENTS: All comments listed below must be addressed prior to requesting signature.
SWG currently maintains distribution main within the project limits. Please show these facilities on the next plan submittal. I will be your point of contact for this project, so please keep me informed of the design and construction schedule. I have included the SWG Signing Requirements. Please include all information listed in these requirements pertaining to this project. Thank you.

SIGNED: Robin Jenkins

Robin Jenkins E.I.
Engineer
Southern Nevada Division

Phone: (702) 365-2174
Fax: (702) 221-4116
Email: Robin.Jenkins@swgas.com

HDR | ONE COMPANY | *Many Solutions* SM

11/20/06
No CCWRD facilities
Work is in CLV

November 3, 2006

Christine Dudas,
Supervisor, Collection System Engineering
Clark County Water Reclamation District
5857 E. Flamingo Road
Las Vegas, Nevada 89122

Dear Ms. Dudas:

HDR Engineering, Inc. has been contracted by the City of Las Vegas Public Works (CLV) for the design of drainage improvements for **Oakey Boulevard, between Cahlan Drive and Birch Street. The project limit also includes Rancho Drive (1000 feet North and South of the intersection with Oakey Blvd.).** The project will include storm drain, lighting, signal, utility and roadway improvements.

The attached drawing shows the limits of the project. We are in the process of identifying the location of all existing utilities in the area. We request both **horizontal and vertical alignments of your existing and future facilities.**

If questions or problems arise in providing this information, or if it is ready to be picked up, please call Raj Hanumanthaiah (938-6043) or Kari Wadeson (938-6063). We will forward design submittals to you for review as the project progresses.

HDR Engineering looks forward to working with you on this project. Thank you in advance for your efforts. It would be helpful if we could receive any information you have by November 15, 2006.

RECEIVED
NOV 20 2006
ENGINEERING
CCWRD

Sincerely,

HDR Engineering, Inc.

Raj Hanumanthaiah, P.E.

Copy: Rosa Cortez (CLV), Project File

C:\Documents and Settings\ohahn\Local Settings\Temporary Internet Files\OLK169\CCWRD November2006.doc

HDR Engineering, Inc.
770 E Warm Springs Road
Suite 360
Las Vegas, NV 89119-4336
Phone: (702) 938-6000
Fax: (702) 938-6060
www.hdrinc.com

at&t

22311 Brookhurst Street Suite203
Huntington Beach Ca 92646

NO CONFLICT

November 14, 2006

HDR
Attn: Raj Hanumanthaiah
770 E. Warm Springs Road...Suite 360
Las Vegas, NV...89119-4336

Re: City of Las Vegas.....Drainage Imp...Oakey Blvd...

Dear Mr. Hanumanthaiah:

This is in response to your inquiry dated November 1, 2006 regarding the above referenced project.

After reviewing your location maps, please be advised that AT&T Network Services has no active facilities (transcontinental Fiber Optics Lines) within the vicinity of this project.

Thank you for notifying AT&T of the pending project referenced above. **PLEASE NOTE** that notification of future proposed work, performed in this vicinity should be directed to:

AT&T INQUIRIES
22311 Brookhurst Street, Suite 203
Huntington Beach, CA 92646

Should you have any questions or concerns regarding this project, please contact Stephen Shermoen at (714) 963-7964 or me at your earliest convenience.

Please Note

AT&T Drawings are Proprietary Information Pursuant to Company instructions–This Office does not distribute drawings for Pre–Planning and Design Engineering purposes.

Please contact your local City, County, Utility Notification Center or AT&T on Site Plant Protection workforce to determine prior to contacting AT&T Engineering. If you are referred to our office because of a possible conflict with AT&T lines, we will confirm and provide you with the appropriate drawings and pertinent information required to avoid a conflict with AT&T lines prior to the start of your construction project.

Sincerely,

Stephen Shermoen for
Rosemary Hamill
OSP Maintenance Engineer
(925) 944-8416

KINDER MORGAN
ENERGY PARTNERS, L.P.
SFPP, L.P.

SFPP, L.P.
Operating Partnership

December 5, 2006

ENG 4-2-1 (930)
Reference #06-771

Raj Hanumanthaiah, P.E.
HDR Engineering, Inc.
Suite 360
770 East Warm Springs Road
Las Vegas NV 89119-4336

Re: Drainage Improvement Design - Oakey Storm Drain Cahlan Drive to Birch Street

Dear Mr. Hanumanthaiah:

This letter is in response to your letter dated October 30, 2006, which we received on November 3, 2006.

Based on the information you have provided, Kinder Morgan has no conflict with this proposed project.

In the event the project scope changes, please resubmit your request.

Sincerely,

D. Sidorewicz

A. Dianne Sidorewicz CPS
Administrator
Engineering

T: Quinn\letters\421(930)\06-771

Southern Nevada
Water Authority

Departments of:
ENGINEERING
GROUNDWATER RESOURCES
SURFACE WATER RESOURCES
1900 E. Flamingo Road
Las Vegas, NV 89119

Main 702/862-3400
Fax 702/862-3470

RD OF DIRECTORS

Amanda M. Cyphers, Chair
Henderson Councilman

Rory Reid, Vice Chair
Clark County Commissioner

Andrea Anderson
Boulder City Councilman

Shari Buck
North Las Vegas Councilman

Lynette Boggs McDonald
Clark County Commissioner

Myrna Williams
Clark County Commissioner

Steve Wolfson
Las Vegas Councilman

Patricia Mulroy
General Manager

snwa.com

November 2, 2006

Raj Hanumanthaiah, PE
HDR Engineering, Inc.
770 E. Warm Springs Rd., Ste 360
Las Vegas, NV 89119

SUBJECT: OAKEY STORM DRAIN – CAHLAN DR TO BIRCH ST
DPR NO. 2005-0107B

We received the subject drawing on November 1, 2006. Based on review of the submitted drawings, the subject installation will not impact SNWA facilities. However, please resubmit plans should the job scope expand to areas other than location(s) shown in this submittal.

Should you have any questions, please contact me at 862-3459.

Sincerely,

Marie Green

Marie Green
Engineering Technician

MG/js

Attachment

Appendix K

Supporting Documents And Reference Material

Supporting Documents And Reference Material	
1	2005 City of Las Vegas Central Neighborhood Study (CNS). March 2005
2	2002 Clark County Regional Flood Control District Las Vegas Valley Flood Control Master Plan Update (2002 MPU). September 2002
3	Oakey Meadows Storm Drain Alignment – By PBS&J. January 2007
4	City of Las Vegas, I-15 Freeway Channel – Ivanhoe Way to Alta Drive Pre-Design Report - by Parsons Brinkerholf. May 1999
5	Rancho/Oakey Intersection Nuisance Water Drain. May 1986
6	Valley View Storm Drain – Phase 1, January 2000; Phase 2, October 2001
7	Valley View Boulevard Grading Plans. May 1974
8	Arville Street Rehabilitation. May 1990
9	West Oakey Boulevard Grading Plans. May 1977
10	El Camino Avenue Grading Plans. March 1966
11	El Cortez Avenue Grading Plans. June 1963
12	Casa Grande Avenue (Call De El Cortez) Grading Plans, June 1963
13	Spanish Oaks. 1974 - 1978
14	Technical Drainage Study for Sahara/Rancho Office Park-by The Keith Companies. July 11, 2000
15	Addendum#1 to The Technical Drainage Study for Sahara/Rancho Office Park- by The Keith Companies. September 5, 2000
16	Addendum#2 to The Technical Drainage Study for Sahara/Rancho Office Park- by The Keith Companies. September 25, 2000
17	Update to The Technical Drainage Study for Sahara/Rancho Office Park- by The Keith Companies. January 8, 2002
18	Addendum #1 to The Update to The Technical Drainage Study for Sahara/Rancho Office Park-by The Keith Companies. March 21, 2002
19	Supplement to Addendum #1 to The Update to The Technical Drainage Study for Sahara/Rancho Office Park- by The Keith Companies. April 15, 2002
20	Sahara Pavilion North-Taco Cabana Pad- by Baughman and Turner, Inc. January 22, 1992
21	Sahara Pavilion North-Taco Cabana Pad (2nd Submittal)- by Baughman and Turner, Inc. February 20, 1992
22	Update to The Technical Drainage Study for The Sahara Avenue/Valley View Boulevard Commercial Subdivision (Parcel J-Blockbuster Video)- by PBS&J. February 1996

23	Update to The Technical Drainage Study for The Sahara Avenue/Valley View Boulevard Commercial Subdivision (Parcel J-Blockbuster Video) (2nd Submittal)- by PBS&J. July 1996
24	Hydrology Study, Section 04, Township 21 South, Range 61 East, City of Las Vegas, Nevada- by Baughman and Turner, Inc. December 29, 1992
25	Hydrology Study for Romano's Macaroni Grill- by Dunnam Civil Engineers, Inc. March 4, 1994
26	Hydrology Study for Sahara/Richfield-by VTN. July 30, 1993
27	Addendum #1 to The Hydrology Study for Sahara/Richfield-by VTN. September 29, 1993
28	Hydrology Study for Parcel 030-630-063- by VTN. April 2, 1993
29	Addendum #1 to The Hydrology Study for Parcel 030-630-063- by VTN. April 26, 1993
30	Hydrology Study for Parcel 030-630-063 (3rd Submittal)- by VTN. August 1993
31	Technical Drainage Study for Indian Hills Apartments, Sahara Avenue & Arville Street- by MEA Consulting Engineers. February 1988
32	Addendum to Drainage Study for Cashman Court Subdivision- by E.J. Wojcik Engineering. April 8, 1986
33	Drainage Study Nevada Financial Center- by G.C. Wallace, Inc. July 29, 1986

City of Las Vegas

CENTRAL NEIGHBORHOOD FLOOD CONTROL MASTER PLAN

LEGEND

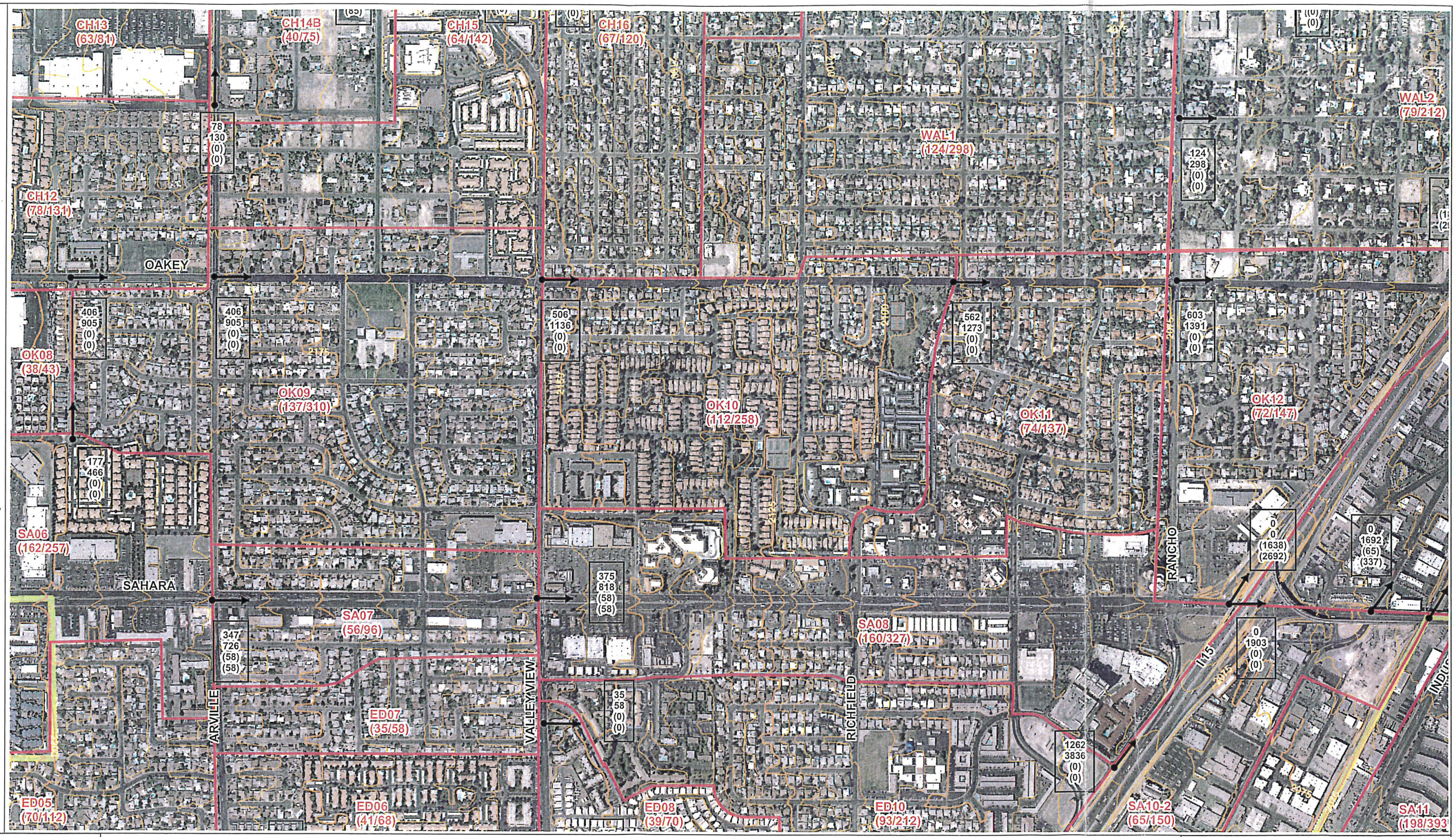
- Sub-basin Boundary
- LV12 — Basin ID
- (10yr./100yr.) — Contributing flow from the basin (cfs)
- Flow Arrow
- 250 / 500 / (300) / (800) — 10-Year Street Flow / 100-Year Street Flow / 10-Year Facility Flow / 100-Year Facility Flow

(Flows in CFS)

- Study Area Limit

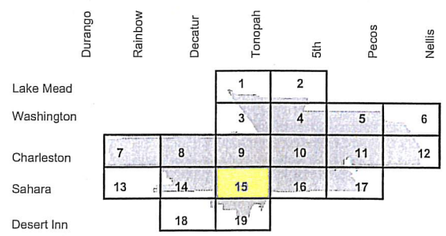
PHOTO DATE: SPRING 2004

FIGURE E-15



EXISTING DRAINAGE CONDITIONS

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



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

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

N
W E
S

0 200 400 800 1,200 1,600
Feet

SCALE: 1 inch = 800 feet

City of Las Vegas

CENTRAL NEIGHBORHOOD FLOOD CONTROL MASTER PLAN

LEGEND

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

FIGURE F-15

N
W E
S

0 200 400 800 1,200 1,600
Feet

SCALE: 1 inch = 800 feet

Flow Arrow

250	10-Year Street Flow
500	100-Year Street Flow
(300)	10-Year Facility Flow
(800)	100-Year Facility Flow

(Flows in CFS)

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

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

Durango Rainbow Decatur Tonopah 5th Pecos Nellis

Lake Mead
Washington
Charleston
Sahara
Desert Inn

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

FUTURE DRAINAGE CONDITIONS

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

City of Las Vegas

2004 CITY OF LAS VEGAS CENTRAL NEIGHBORHOOD FLOOD CONTROL MASTER PLAN

LEGEND

REGIONAL STREAM NAME DESIGNATOR	AABB
REGIONAL MILE	0000
LOCAL STREAM NAME DESIGNATOR	AAB
LOCAL ID NUMBER	000
EXISTING FACILITY	E
PROPOSED OR MODIFIED FACILITY	P
CONTINGENCY LEVEL:	
CATEGORY B	P0
MASTER PLAN	P1
PRELIMINARY DESIGN	P2
DESIGN	P3
BOTTOM WIDTH	W
DEPTH	D
SIDE SLOPE, H:V	SS
LEFT SIDE SLOPE H:V	LSS
RIGHT SIDE SLOPE H:V	RSS
CORRUGATED METAL ARCH PIPE CULVERT	CMAP
CORRUGATED METAL PIPE CULVERT	CMP
DUCTILE IRON PIPE	DIP
HIGH DENSITY POLYETHYLENE PIPE	HDPE
HELICAL ELLIPTICAL REINFORCED CONCRETE PIPE	HERCP
PUBLIC DRAINAGE EASEMENT	PDE
POLYVINYL CHLORIDE PIPE	PVC
REINFORCED CONCRETE BOX	RCB
REINFORCED CONCRETE BOX CULVERT	RCBC
REINFORCED CONCRETE ELLIPTICAL PIPE	RCEP
REINFORCED CONCRETE PIPE	RCP
REINFORCED CONCRETE PIPE ARCH	RCPA
REINFORCED CONCRETE PIPE CULVERT	RCPC
STORM SEWER PIPE	SSP
VITRIFIED CLAY PIPE	VCP

NOTES:
FLOW = 100 YEAR HEC-1 FLOW (REGIONAL FACILITIES)
FLOW = FACILITY CAPACITY (LOCAL FACILITIES)

FLOOD CONTROL FACILITIES INVENTORY

SHEET I - 10

PBS&J

F-14

ID	MILE	Status	Plan No.	Facility Description	Facility Length L (ft)	Channel Slope S (%)	Flow (cfs)
REGIONAL FACILITIES							
FLAMINGO WASH - LATERAL DRAIN (FLAMINGO / RAINBOW)							
FLLA	0369	E	2002 Master Plan Update	72" RCP	670	0.50	
FLLA	0379	E	2002 Master Plan Update	66" RCP	1320	0.50	
DECATUR DRAIN							
FWDE	0025	P1	2004 CNFCMP	10' X 8' RCB	1325	0.25	632
EXTENSION OF MEADOWS / CHARLESTON COLLECTION SYSTEM							
MECH	0108	E	731-55	30" RCP	11400	1.43	31
MECH	0310	E	731-55	24" RCP	860	1.43	31
MECH	0323	E	731-55	1: 15" Outlet Pipe	200		31
MECH	0324	E	731-55	180 ac-ft Oakey Detention Basin			1503
MECH	0334	E	731-55	11' X 6' RCB	142	0.50	530
MECH	0337	E	731-55	9' X 6' RCB	540	0.50	530
MECH	0338	E	731-55	10' X 8' RCB	2118	2.00	1072
MECH	0351	E	731-55	90" RCP	1393	0.50	530
MECH	0378	E	731-55	10' X 8' RCB	475	1.62	1072
MECH	0380	E	731-55	66" RCP	482	2.00	284
MECH	0390	E	731-55	83" X 53" RCP	32	0.80	284
MECH	0410	E	731-55	66" RCP	182	0.80	284
MECH	0420	E	731-55	66" RCP	1168	0.80	284
OAKEY/I-15 STORM DRAIN							
MEOK	0159	P1	2002 Master Plan Update	8' X 6' RCB	3900	1.25	733
MEOK	0170	P1	2002 Master Plan Update	6' X 6' RCB	1300	1.36	512
MEOK	0233	P1	2002 Master Plan Update	10' X 9' RCB	1300	0.15	553
LOCAL FACILITIES							
DCR	000	E	107-V1347	14" x 23" RCP	540	0.70	6
DCR	010	E	107-V1896	12" CMP	150	0.33	4
DCR	013	E	107-V1896	18" CMP	130		11
DCR	015	E	107-V1896	18" RCP	225		11
DCR	020	E	107-V1896	Conc Chnl 7'W 3'D 1:1 SS	480	0.25	463
DCR	030	E	107-V1993	48" RCP	1500	0.12	144
DLR	090	E	107-V2806	14"X 23" HERCP	224		
ELP	000	E		Unlined "V" ditch	800		257
JNS	000	E	107-V1591	18" RCP	2647		4
JNS	010	E	327-177	Unlined "V" ditch	269		257
OKY	070	E	107-V2247	54" RCP	4879	1.20	205
OKY	079	E	107-V2247	48" RCP	733	0.80	121
OKY	088	E	107-V2247	30" RCP	1229	1.93	54
OKY	089	E	107-V2247	24" RCP	1266	1.39	25
OKY	090	E	107-V2247	18" RCP	960	1.62	13
RNB	000	E	107-V1613	24" RCP	180		14
RNB	005	E	107-V2317	12" RCP	245		
RNB	010	E	107-V1749	54" RCP	342		206
RNB	011	E	107-Y4439	2: 42" RCP	170	5.77	418
RNB	012	E	107-Y4439	24" RCP	270	4.94	44
RNB	120	E	Hwy Bk R-6	60" RCP	230	5.35	522
RNB	130	E	107-V1663	36" RCP	260		94
RNB	140	E	Hwy Bk R-6	18" RCP	320	0.32	5
SAH	079	E	107-V1645	18" RCP	1334	0.40	6
SAH	080	E	107-V1645	18" RCP	674	0.20	4
SAH	085	E	107-V2346	18" RCP	130	0.50	6
SAH	086	E	107-V2346	12" PVC	98	0.75	3
SAH	087	E	107-V2346	18" RCP	167	1.02	9
SAH	090	E	HWY BK # S-4	24" RCP	4988		32
SAH	091	E	327-233	18" RCP	60		11
SAH	092	E	327-233	6" PVC	100		
SAH	110	E	HWY BK # S-4	18" RCP	4525		15
SAH	115	E	107-V2123	24" RCP	408	2.53	31
SAH	116	E	107-V2923	36" RCP	955	0.29	36
SAH	120	E	107V-1811	18" RCP	185		10
SAH	130	E	107-V2036	18" RCP	1296		14
SAH	135	E	107V-2036	18" RCP	1334	1.73	12

F-15

ID	MILE	Status	Plan No.	Facility Description	Facility Length L (ft)	Channel Slope S (%)	Flow (cfs)
REGIONAL FACILITIES							
BOULDER HIGHWAY, SAHARA AVENUE							
BHSA	0331	P1	2004 CNFCMP	2: 12' X 10' RCB	2000	1.00	4859
FREEWAY CHANNEL FROM DESERT INN TO EXPRESSWAY							
FW15	0125	E	327-V254	2: 10' X 8' RCB	1379	0.80	805
FW15	0150	E	327-V254	2: 10' X 8' RCB	1067	0.80	0
FW15	0175	E	327-V254	2: 10' X 8' RCB	985	0.75	0
FW15	0214	P1	2002 Master Plan Update	2: 12' X 10' RCB	1500	0.73	4156
FW15	0242	P1	2002 Master Plan Update	2: 12' X 9' RCB	1500	0.93	4023
OAKEY DRAIN							
FWOK	0000	E	327-V254	10' X 8' RCB	1300	0.62	805
FWOK	0020	P1	2002 Master Plan Update	10' X 7' RCB	2700	0.62	805
FREEWAY CHANNEL - SAHARA							
FWSA	0000	P1	2002 Master Plan Update	7' X 6' RCB	5700	1.49	593
FREEWAY CHANNEL BYPASS FACILITY							
FWUP	0100	E	327-V254	6' X 5' RCB	1400	0.56	221
EXTENSION OF MEADOWS / CHARLESTON COLLECTION SYSTEM							
MECH	0059	E	731-55	36" RCP	1280	0.42	43
MECH	0108	E	731-55	30" RCP	11400	1.43	31
OAKEY/I-15 STORM DRAIN							
MEOK	0063	P1	2002 Master Plan Update	12' X 8' RCB	5100	0.75	1433
MEOK	0159	P1	2002 Master Plan Update	8' X 6' RCB	3900	1.25	733
MEOK	0170	P1	2002 Master Plan Update	6' X 6' RCB	1300	1.36	512
LOCAL FACILITIES							
ELC	000	P	La Pasada DS	30" RCP	600	0.80	50
ELC	010	P	La Pasada DS	30" RCP	1500	1.50	25
ELC	020	P	La Pasada DS	36" RCP	700		
I15	091	E	HWY BK # I-2	24" RCP	150		30
I15	092	E	HWY BK # I-2	36" RCP	300		60
I15	093	E	HWY BK # I-2	24" CMP	150		30
I15	094	E	HWY BK # I-2	24" CMP	150		30
I15	096	E	HWY BK I-12	Riprap Chnl 10'W 2'D 2:1 SS	705	0.48	125
I15	097	E	HWY BK I-12	Riprap Chnl 10'W 2'D 2:1 SS	234	0.90	171
I15	098	E	HWY BK I-12	30" RCP	54	4.50	75
I15	099	E	HWY BK I-12	42" RCP	41	1.00	87
I15	100	E	HWY BK I-12	Riprap Chnl 10'W 8.3'D 2:1 SS	214	4.80	6709
I15	101	E	HWY BK I-12	10' X 4' RCBC	143	0.30	378
I15	102	E	HWY BK I-12	24" RCP	90	11.46	66
I15	103	E	HWY BK I-12	Riprap Chnl 10'W 6'D 2:1 SS	140	0.52	1104
I15	104	E	HWY BK I-12	24" RCP	70	0.24	10
I15	106	E	HWY BK I-12	Riprap/Conc Chnl 10'W 6'D 2:1 SS	1197	0.10	484
RAN	000	E	327-17G	18" RCP	85		11
RAN	001	E	107-V531	16" RCEP	154		7
RAN	006	E	107V-1286A	18" RCP	860		
RAN	007	E	107V-1286A	18" RCP	968	0.33	5
SAH	030	E	HWY BK # S-2	36" RCP	812		67
SAH	040	E	HWY BK # S-3	36" RCP	9975		58
SAH	045	E	107-V926	12" RCP	106		2
SAH	046	E	107-V926	18" RCP	200		5
SAH	070	E	107V-604C	30" RCP	1000		22
SAH	079	E	107-V1645	18" RCP	1334	0.40	6
SAH	090	E	HWY BK # S-4	24" RCP	4988		32
VVB	050	E	327-V224	24" RCP	752		18
VVB	060	E	327-V224	18" RCP	786		11
VVB	072	E	107-V604C	24" RCP	514		18
VVB	080	E	107-V926	19" X 30" RCP	68		30
VVB	085	E	107-V926	24" RCP	66	0.002	10
VVB	090	E	107-V1525	24" RCP	220		12
VVB	100	E	107-V926	18" RCP	432		7
VVB	101	E	107-V926	21" RCP	85	0.002	20
VVB	102	E	107-V926	30" RCP	60	0.01	41
VVB	103	E	107-V926	18" RCP	60	0.02	15
VVB	110	E	107-V1937	Conc Chnl 10'W 2.67'D 1:1 SS	600		633
VVB	111	E	107-V1937	24" RCP	100		12
VVB	112	E	Pentacore 707-0203	Conc Chnl 3.5'W 0.9'D 4:1 SS	45		115
VVB	120	E	107-V926	14" X 23" RCP	200		16
WYA	010	E	107Y-4453	12" PVC	133	0.35	2

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

2002 LAS VEGAS VALLEY FLOOD CONTROL MASTER PLAN UPDATE

LEGEND

- Ultimate Development Boundary
- Watershed Boundary
- ID — Subarea Boundary
- Flow Arrows

Flood Control Facilities

- Existing Facilities
- Proposed Facilities

Type — Hydrologic Soil Groups

- A — Low Runoff Potential
- B — Moderately Low Runoff Potential
- C — Moderately High Runoff Potential
- D — High Runoff Potential

Typical Land Use

1. Undeveloped Land, Open Desert
2. Parks, Golf Courses
3. Rural
4. Low Density Residential
5. Medium Density Residential
6. High Density Residential
7. Public Facility, Multi Family
8. Commercial, Office, Retail, Casino
9. Light Industrial
10. Heavy Industrial
11. Schools
12. Lakes

N W E S

0 1,000 2,000 3,000 4,000 5,000
Feet

SCALE: 1 inch = 3000 feet

US95 I-15 I-215

HYDROLOGIC SUBAREAS, LAND USE & SOILS

FIGURE H-12

PBS&J

G.C. WALLACE, INC.

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

2002
LAS VEGAS VALLEY FLOOD CONTROL MASTER PLAN UPDATE

LEGEND

- Ultimate Development Boundary
- Existing Facilities
- Category A Proposed Facilities
- Category B Proposed Facilities
- Local Existing Facilities
- Local Proposed Facilities
- Detention Basin
- Culvert
- Bridge
- Pipeline
- Lined Channel
- Unlined Channel
- Dike
- Natural Wash
- ID-Mile Separator

N
W E
S

0 1,000 2,000 3,000 4,000 5,000
Feet

SCALE: 1 inch = 3000 feet

US95 I-15 I-215

1	2		
3	4	5	6
7	8	9	10
11	12	13	14
15	16	17	18
19	20	21	22
23	24	25	26
27	28	29	

FLOOD CONTROL FACILITIES
FIGURE F-12

PBS&J

G.C. WALLACE, INC.

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
APDG		ANGEL PARK - DURANGO						
0000	E	84" RCP	2600	839	C38B	GW3SC	0.79	0.70
[illegible]	E	72" RCP	1901	374	38A	GW3SC	0.35	0.96
[illegible]D		ANGEL PARK - MIDDLE BRANCH						
0000	E	Natural Wash	1200	5780	C11A-3*	GW3SC	4.87	2.90
0027	E	1: 12' X 10' & 2: 12' X 2' RCBC	170	5780	C11A-3*	GW3SC	4.87	3.00
0030	E	Natural Wash	7000	5780	C11A-3*	GW3SC	4.87	3.00
APNO		ANGEL PARK NORTH						
0000	E	1400 ac-ft Angel Park Detention Basin		8623	ANGLPKDB	ALLGOW5	22.21	
0001	E	42" RCP Emergency Outlet	200	8623	ANGLPKDB	ALLGOW5	22.21	
0002	E	33" RCP Emergency Outlet	189	8623	ANGLPKDB	ALLGOW5	22.21	
0003	E	33" RCP Emergency Outlet	185	8623	ANGLPKDB	ALLGOW5	22.21	
0004	E	14' X 12' RCBC	380	1560	ANGLPKDB	ALLGOW5	22.21	1.00
0005	E	Natural Wash	1800	6743	CSF2-C	GW4SC	8.27	2.00
0012	E	3: 12' X 10' RCBC @ Rampart	220	6743	CSF2-C	GW4SC	8.27	1.00
0013	E	Natural Wash	1400	6743	CSF2-C	GW4SC	8.27	1.40
0015	E	2: 14' X 14' RCBC	150	6743	CSF2-C	GW4SC	8.27	1.00
APOF		ANGEL PARK OUTFALL						
0000	E	66" RCP	1297	451	CGD34AB	ALLGOW5	22.48	1.90
0015	E	60" RCP	5472	451	CGD34AB	ALLGOW5	22.48	2.20
0124	E	54" RCP	810	441	ANGLPKDB	ALLGOW5	22.21	2.50
APP1		ANGEL PARK - PECCOLE 1						
0000	E	2: 60" RCP	4430	435	PIC-B	GW3SC	0.44	2.40
APP2		ANGEL PARK - PECCOLE 2						
0000	E	Grass Chnl 10'W 5'D 2:1 SS	4773	1952	C57B-1	GW3SC	1.93	2.10
APSO		ANGEL PARK - SOUTH BRANCH						
0000	E	Natural Wash	2500	4425	CC57B-4	GW3SC	5.19	2.00
0020	E	2: 12' X 12' RCBC @ Rampart	350	4425	CC57B-4	GW3SC	5.19	1.80
0043	E	Natural Wash	500	4082	C57B-4	GW3SC	4.74	1.84
0067	E	Natural Wash	8300	2060	C57B-3	GW3SC	2.25	2.10
APSP		ANGEL PARK - SUMMERLIN PARKWAY						
0000	E	Concrete Chute Drop		2758	C3B-2B	GW3SC	2.67	3.00
0001	E	Unlined Chnl with Gabion Drops 20'W Depth Varies 2:1 SS	3750	2758	C3B-2B	GW3SC	2.67	3.00
BHSA		BOULDER HIGHWAY SAHARA AVENUE						
0289	P1	14' X 12' RCB	2300	3462	CSA11	SW3SC	7.76	0.87
0331	P1	12' X 12' RCB	2000	3152	CSA10-2	SW3SC	7.36	1.00
FLBF		FLAMINGO WASH - BUFFALO						
0278	E	90" RCP	2640	495	LF8	FLAM3SC	0.50	0.50
0328	E	54" RCP	660					0.30
FLLA		FLAMINGO WASH - LATERAL DRAIN (FLAMINGO/RAINBOW)						
0322	E	81" RCP	1370					0.50
0345	E	81" RCP	1340					0.50
0369	E	72" RCP	670					0.50
[illegible]	E	66" RCP	1320					0.50
[illegible]		FLAMINGO WASH - MONTESSOURI NORTH						
[illegible]000	E	78" RCP	1340					0.50
0025	E	72" RCP	1330					0.50
0050	E	66" RCP	500					0.50
0060	E	54" RCP	800					0.50
0075	E	48" RCP	30					0.50
FLSM		SPRING MOUNTAIN DRAIN						
0125	E	96" RCP	3040	748	CLF6N	FLAM3SC	0.87	0.80
0180	E	90" RCP	2350	523	LF5	FLAM3SC	0.49	0.50
FW15		FREEWAY CHANNEL FROM DESERT INN TO EXPRESSWAY						
0000	E	3: 12' X 10' RCB	2074	3366	CAL96	SW4SC	10.22	0.17
0010	E	3: 12' X 10' RCB	677	3366	CAL96	SW4SC	10.22	0.17
0038	E	3: 12' X 10' RCB	1893	3284	CCCH22	SW4SC	10.04	0.17
0050	E	3: 12' X 10' RCB	812	3284	CCCH22	SW4SC	10.04	0.17
0089	E	3: 12' X 10' RCB	922	2156	COK11-C	SW3SC	7.78	0.17
0100	E	3: 12' X 9' RCB	1669	2156	COK11-C	SW3SC	7.78	0.17
0125	E	2: 10' X 8' RCB	1379	2156	COK11-C	SW3SC	7.78	0.80
0150	E	2: 10' X 8' RCB	1067	1450	DCCSA08	SW3SC	6.88	0.80
0175	E	2: 10' X 8' RCB	985	1450	DCCSA08	SW3SC	6.88	0.75
0214	P1	2: 12' X 10' RCB	1500	3946	CED10-C	SW3SC	6.28	0.73
0242	P1	2: 12' X 9' RCB	1500	3835	CCPS08	SW3SC	6.06	0.93
0271	P1	2: 12' X 8' RCB	1700	2574	CRCPS06	SW3SC	4.20	0.59
FWCH		WEST CHARLESTON DRAINS						
0000	E	84" RCP	1600	1051	CCH22	SW3SC	1.54	0.93
0020	P1	2: 90" RCP	2200	1051	CCH22	SW3SC	1.54	0.68
FWOK		OAKEY DRAIN						
0000	E	10' X 8' RCB	1300	805	1COK11C	SW3SC	0.90	0.62
0020	P1	10' X 7' RCB	2700	805	1COK11C	SW3SC	0.90	0.62
FWR2		FREEWAY CHANNEL - RAILROAD CHANNEL						
0000	E	5' X 5' RCBC	310					1.60
0010	E	Conc Chnl 8'W 4'D 2:1 SS	50					0.95
0020	E	Earth Chnl 8'W 4'D 2:1 SS	600					0.95
FWRR		FREEWAY CHANNEL BYPASS FACILITY RR						
0000	E	48" RCP	35					1.22
0010	E	Conc Chnl 5'W 5'D 0:1 SS	215					1.22

[illegible]er	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
[illegible]R		LAS VEGASWASH - SMOKE RANCH						
[illegible]	E	66" RCP	4118	1126	CS	NW3SC	1.12	0.73
[illegible]	P1	10' X 8' RCB	4118	1126	CS	NW3SC	1.12	0.73
[illegible]	E	54" RCP	2587	1126	CS	NW3SC	1.12	0.58
[illegible]	P1	11' X 8' RCB	2587	1126	CS	NW3SC	1.12	0.58
[illegible]	E	30" RCP	581	651	CR2-C	NW3SC	0.55	0.86
[illegible]	P1	9' X 6' RCB	581	651	CR2-C	NW3SC	0.55	0.86
[illegible]	E	54" RCP	3000	651	CR2-C	NW3SC	0.55	1.41
[illegible]	P1	7' X 6' RCB	2700	651	CR2-C	NW3SC	0.55	1.41
[illegible]	E	14' X 8' RCB	750	2855	CB1-C	NW3SC	6.34	0.70
[illegible]	E	Conc Chnl 14'W 8'D 1.5:1 SS	2100	2855	CB1-C	NW3SC	6.34	0.52
[illegible]	E	14' X 8' RCB	550	2855	CB1-C	NW3SC	6.34	0.55
[illegible]	E	11' X 11' RCB	1800	2855	CB1-C	NW3SC	6.34	0.92
[illegible]	E	66" RCP	2000	1578	CSR05B	NW3SC	2.30	0.67
[illegible]	P1	10' X 10' RCB	2000	1578	CSR05B	NW3SC	2.3	0.75
[illegible]	E	60" RCP	2600	1432	CSR05D	NW3SC	1.94	1.14
[illegible]	P1	10' X 9' RCB	2640	1432	CSR05D	NW3SC	1.94	0.87
[illegible]	E	54" RCP	2600	1432	CSR05D	NW3SC	1.94	1.14
[illegible]	P1	10' X 8' RCB	2640	1432	CSR05D	NW3SC	1.94	1.25
[illegible]	P1	10' X 7' RCB	2600	1218	CSR02E-C	NW3SC	1.64	1.27
[illegible]	E	60" RCP	2770	191				0.54
[illegible]	P1	8' X 8' RCB	2640	741	CSR00A	NW3SC	1.01	0.57
[illegible]		MEADOWS ALTA						
[illegible]	E	Conc Chnl 8'W 11'D 1:1 SS	800	1345	CAL16-C	SW3SC	1.45	1.58
[illegible]	E	12' X 6' RCBC @ Red Sky	158	1345	CAL16-C	SW3SC	1.45	3.03
[illegible]	E	Conc Chnl 8'W 11'D 1:1 SS	317	1345	CAL16-C	SW3SC	1.45	3.03
[illegible]	E	72" RCP	2500	461	CAL08-C	SW3SC	0.77	1.94
[illegible]	E	60" RCP	5200	461	CAL08-C	SW3SC	0.77	2.81
[illegible]	E	36" RCP	2600	418	CAL01A	SW3SC	0.36	1.22
[illegible]		MEADOWS ALTA PARALLEL						
[illegible]	P1	8' X 6' RCB	8400	747	CAL09-C	SW3SC	0.87	1.25
[illegible]	P1	8' X 7' RCB	1100	507	CAL04-C	SW3SC	0.53	0.30
[illegible]		EXTENSION OF MEADOWS / CHARLESTON						
[illegible]	E	10' X 6' RCB	1109	820	CAL13-C	SW3SC	3.52	0.50
[illegible]	E	6' X 5' RCB	211	487	CAL13-C	SW3SC	3.52	1.16
[illegible]	E	78" RCP	475	565	CAL13-C	SW3SC	3.52	1.16
[illegible]	E	84" RCP	1267	424	CCH13-C	SW3SC	3.01	0.44
[illegible]	E	72" RCP	700	274	CCH13-C	SW3SC	3.01	0.42
[illegible]	E	36" RCP	1280	43	OAKEYOT	SW3SC	1.82	0.42
[illegible]	E	30" RCP	11400	31	OAKEYOT	SW3SC	1.82	1.43
[illegible]	E	24" RCP	860	31	OAKEYOT	SW3SC	1.82	1.43
[illegible]	E	15" RCP Outlet	200	31	OAKEYOT	SW3SC	1.82	
[illegible]	E	180 ac-ft Oakey Detention Basin		1503	OAKEYIN	SW3SC	1.82	
[illegible]	E	11' X 6' RCB	142	530	C5-OAK-C	SW3SC	0.51	0.50
[illegible]	E	9' X 6' RCB	540	530	C5-OAK-C	SW3SC	0.51	0.50
[illegible]	E	10' X 8' RCB	2118	1072	C3A-OAKC	SW3SC	1.31	2.00
[illegible]	E	90" RCP	1393	530	C5-OAK-C	SW3SC	0.51	0.50
[illegible]	E	10' X 8' RCB	475	1072	C3A-OAKC	SW3SC	1.31	2.00
[illegible]	E	66" RCP	482	284	3-HOLM-C	SW3SC	0.28	2.00
[illegible]	E	66" RCP	325	284	3-HOLM-C	SW3SC	0.28	3.08
[illegible]	E	83" X 53" RCP	32	284	3-HOLM-C	SW3SC	0.28	2.00
[illegible]	E	10' X 6' RCB	1853	850	C3-ELP-C	SW3SC	0.96	1.43
[illegible]	E	66" RCP	1244	284	3A-OAK-C	SW3SC	1.31	1.00
[illegible]	E	66" RCP	182	284	3-HOLM-C	SW3SC	0.28	2.00
[illegible]	E	66" RCP	1168	284	3-HOLM-C	SW3SC	0.28	2.00
[illegible]		MEADOWS - CHARLESTON						
[illegible]	P1	10' X 9' RCB	3200	1547	CCH13-C	SW3SC	1.49	1.09
[illegible]	P1	8' X 8' RCB	3300	1313	CCH10-C	SW3SC	1.20	1.82
[illegible]	P1	8' X 7' RCB	5200	1041	CCH09-C	SW3SC	0.91	1.64
[illegible]	P1	7' X 6' RCB	2700	676	CCH05-C	SW3SC	0.57	2.04
[illegible]		OAKEY/I-15 STORM DRAIN						
[illegible]	P1	3: 12' X 6' RCB	3300	2550	CAL13-C	SW3SC	3.42	0.61
[illegible]	P1	12' X 8' RCB	5100	1433	COK07-C	SW3SC	1.52	0.75
[illegible]	P1	8' X 6' RCB	3900	733	CCSA05	SW3SC	0.67	1.25
[illegible]	P1	6' X 6' RCB	1300	512	COK04-C	SW3SC	0.55	1.36
[illegible]	P1	10' X 9' RCB	1300	553	CSA05	SW3SC	0.50	0.15

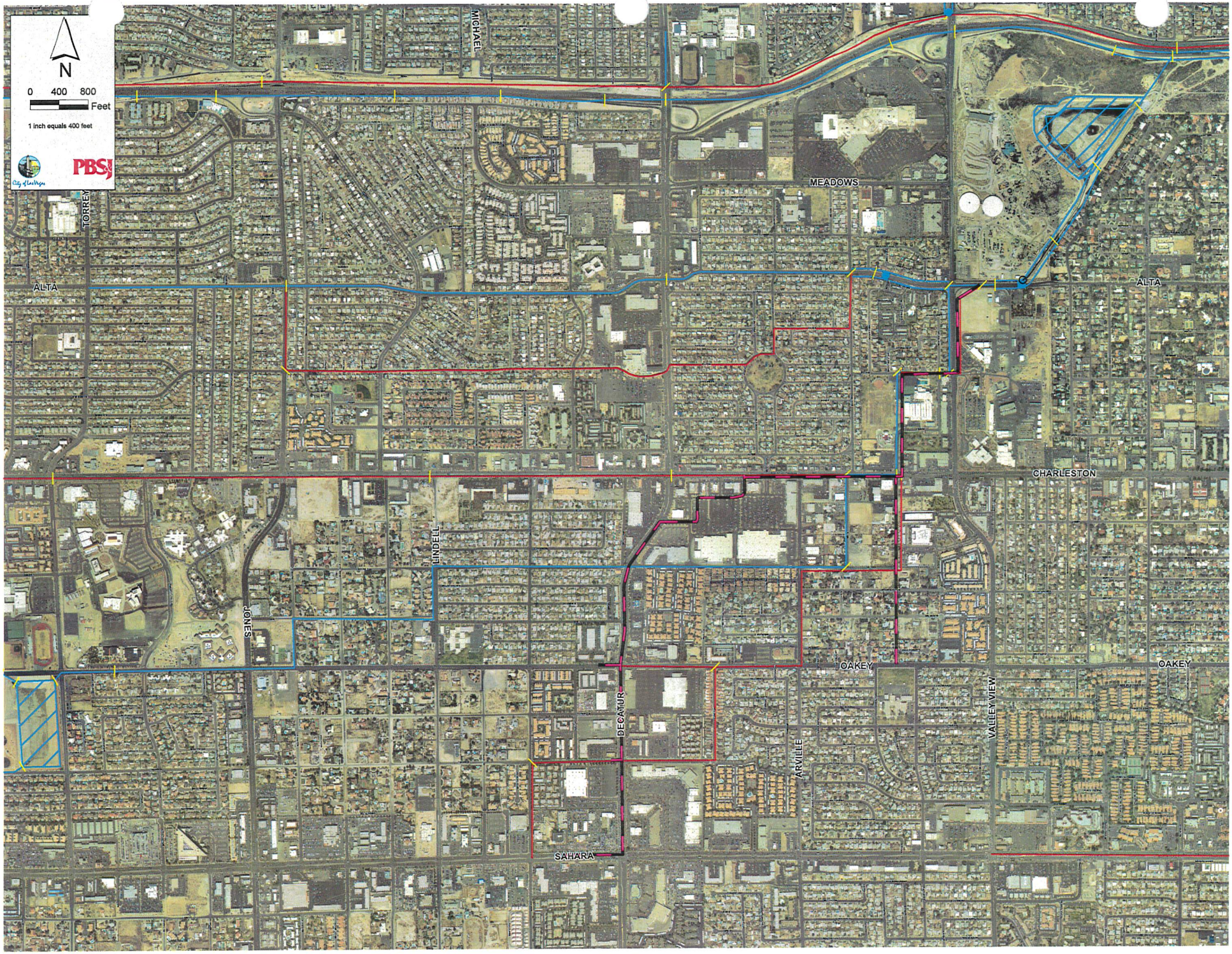
*The HEC-1 node shown identifies the controlling concentration point for the associated routing.
**As-built or design slopes were used when available. All other slopes are based on exis

REGIONAL FLOOD CONTROL DISTRICT

2002 LAS VEGAS VALLEY FLOOD CONTROL MASTER PLAN UPDATE FACILITY INVENTORY FIGURE F-12

e Box..... RCB
e Box Culvert..... RCBC
e Pipe..... RCP
e Pipe Culvert..... RCPC
..... SSP

PBS&J
G.C. WALLACE, INC.


N
0 400 800
Feet
1 inch equals 400 feet
PBS
MICHAEL
MEADOWS
TORREY
ALTA
ALTA
CHARLESTON
LINDELL
JONES
OAKEY
OAKEY
DECATUR
ARVILLE
VALLEY VIEW
SAHARA

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: I-15 Freeway Channel - Ivanhoe Way to Alta Drive Date: May 1999

Location of Development: a) Adjacent to I-15 between Sahara Avenue and Alta Drive
b) Sect. 4 Twn. 21S Rng. 61E

Name of Owner: City of Las Vegas Assessors Parcel No: N/A
Contact Person-Name: Mr. Marvin Stine Telephone No: (702) 433-6730

Firm: City of Las Vegas - Department of Public Works
Address: 400 E. Stewart Street
Las Vegas, Nevada 89101

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	X Regional Flood Control Facility

1. Total Owned Land Area: At Site: N/A Being Developed/Disturbed: N/A

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

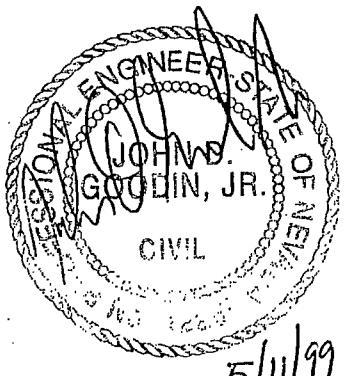
4. Proposed type of development (Residential, Commercial, Etc.)? CCRFCD Master Plan Facility

5. Approximate upstream land area which drains to the subject site? 12.00 sq. mi

6. Has the site drainage been evaluated in the past? (YES) NO If yes, please identify documentation: (1) Washington Avenue Conveyance System Improvements, July 1991

7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: Regional Flood Control Channel

8. Briefly describe your proposed schedule for the subject project: Construction expected to begin January 2000



Engineer's Seal

Submit this form as part of the require 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.

Local Entity File No.

Revision	Date

REFERENCE:

STANDARD FORM 1

to I-15 which will be relocated. There are no existing utilities located within this reach, except for power service to the billboards.

This reach of the I-15 Freeway Channel includes the interception of flows from an existing 8-foot by 3-foot RCB passing under the I-15 embankment at Pinto Lane. The east end of this culvert currently connects to an existing 48-inch storm pipe draining south to the Charleston Boulevard Underpass. Work by the CLV associated with another drainage project at Alta Drive requires the 8-foot by 3-foot RCB to remain functional. This is necessary to convey the 100-year flow to the I-15 Freeway Channel.

The hydraulic analysis indicates this reach is in a subcritical flow condition with an average depth of 2.6 meters.

4.2.2 Oakey Lateral

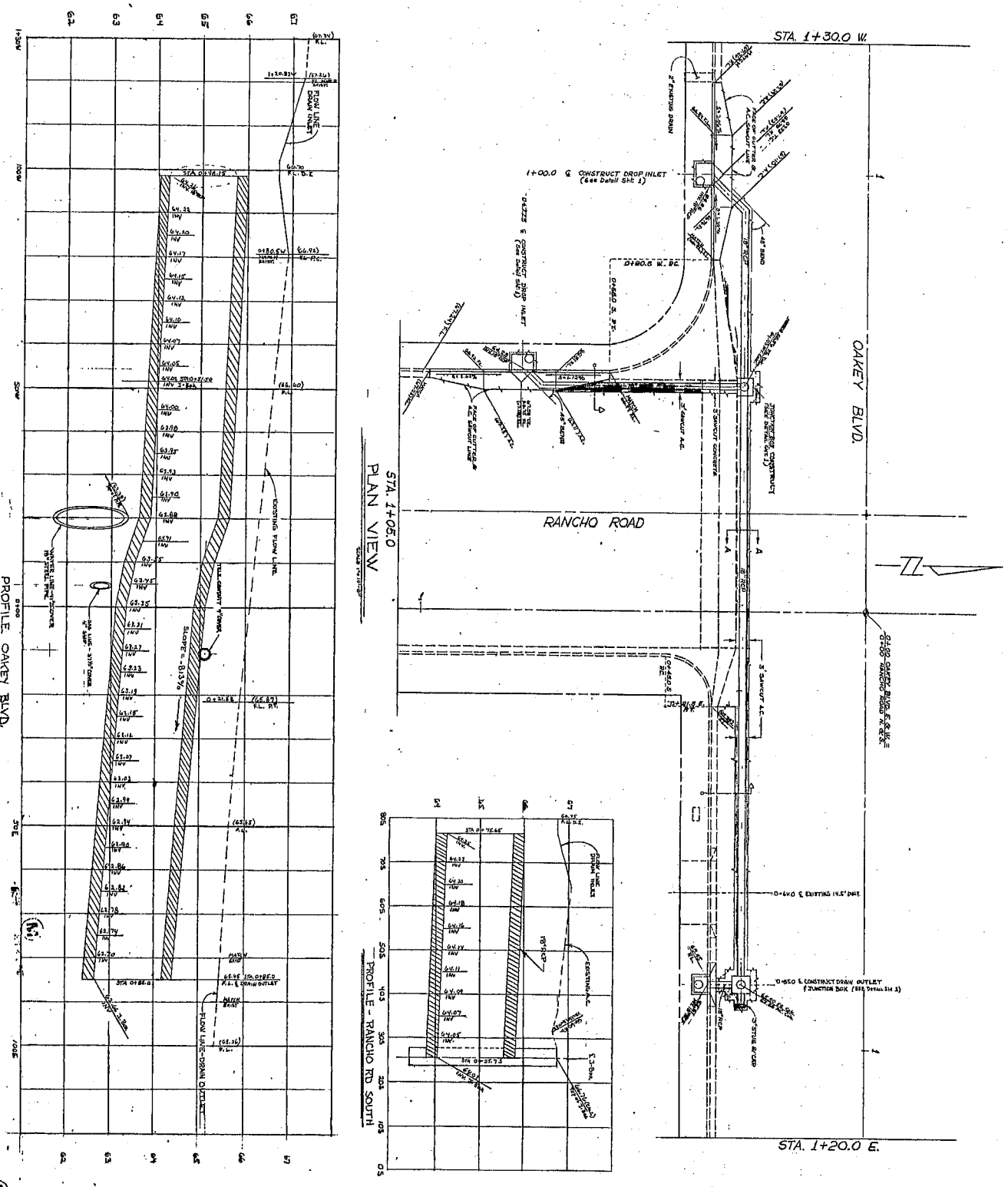
The Oakey Lateral is composed of one reach located from Birch Street to the I-15 Freeway Channel. This reach is to consist of a 3.0 meter by 2.4 meter RCB to convey 1,240 cfs. The hydraulic analysis indicates this reach is in super critical flow condition with an average depth of 2.1 meters.

The driving factor in locating the RCB alignment is the significant utilities in Oakey Boulevard. Existing utilities in the street include a 2-inch gas, a 36-inch water transmission pipe, a 54-inch sanitary sewer main, and a 10-inch sanitary sewer. In order to maintain required clearance from the water lines and to avoid removing and replacing extensive length of curb and gutter, the RCB will be placed adjacent to the 54-inch sanitary sewer pipe. The position of the Oakey Lateral is shown in Typical and Photograph 4.3. The 10-inch sanitary sewer will require relocation to the south of the proposed box. A new sanitary sewer will be needed to service the neighborhood north of Oakey Boulevard.

In April 1999, CCRFCD approved an amendment to the MPU for drainage improvements outlined in the Carter & Burgess Central Basin Hydrology Assessment of July 1998. The improvements include extending the Oakey Lateral from Birch Street to Cahlan Drive. In addition, the result of this work will reflect a new regional flood control facility to collect runoff upstream of the project area and convey the flows to the Meadows Detention Basin. The drainage area for the Oakey Basin as depicted in PB's pre-design report would be reduced, therefore reducing the runoff flow to the Oakey Lateral. PB compared the MPU 25-year runoff flows with the ultimate 100-year runoff flows and found the 25-year flow to be approximately 15 percent higher than the ultimate 100-year flow. Because the higher flow is more conservative, CLV has directed PB to design an inlet system in Oakey to collect the 25-year flow from the Oakey Basin.

4.2.3 Western Avenue Lateral

The purpose of this facility is to intercept the runoff flow from the Western Avenue Basin and transport the flow to the I-15 Freeway Channel at Wall Street. The Western Avenue Lateral is composed of the following four unique reaches:



Department of Public Services — Engineering Design Division		Scale (h) 1" = 10'	Scale (v) 1" = 1'-0"
RANCHO/OAKEY INTERSECTION NUISANCE WATER DRAIN	PLAN & PROFILE	Fld. bk. no. 79-9X	Date SEP. 80
		Design by C. KATKOWSKI	Drawn by G.S. NORATH

W.A. 2070

Revisions | Date

Drawing no. 12

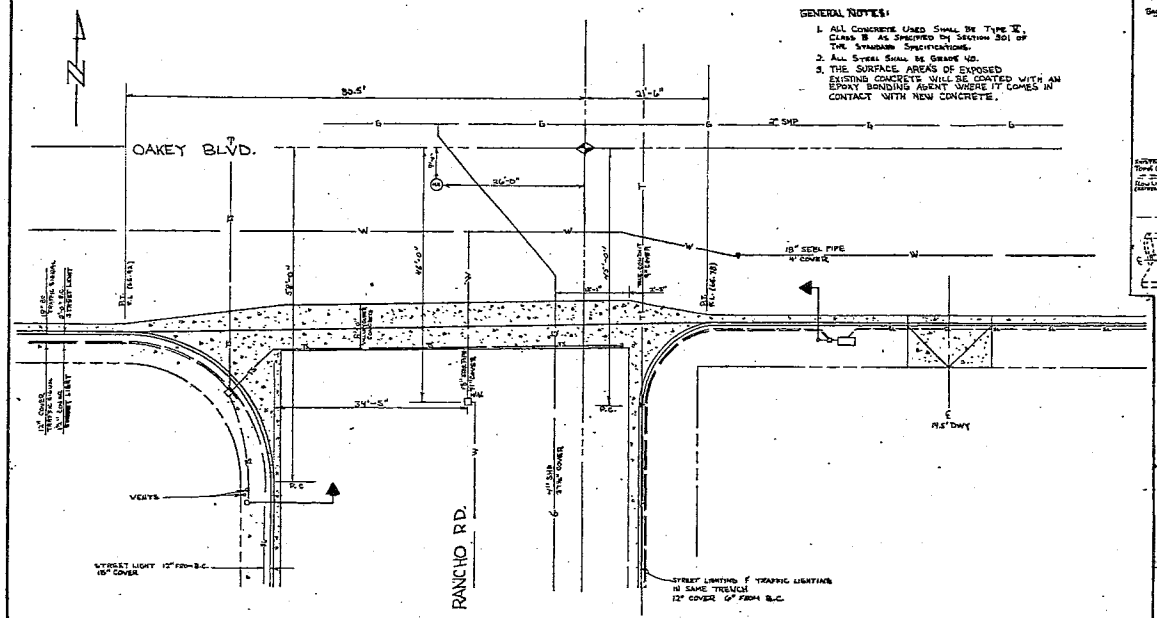
327-116

85-5-86

85-5-87

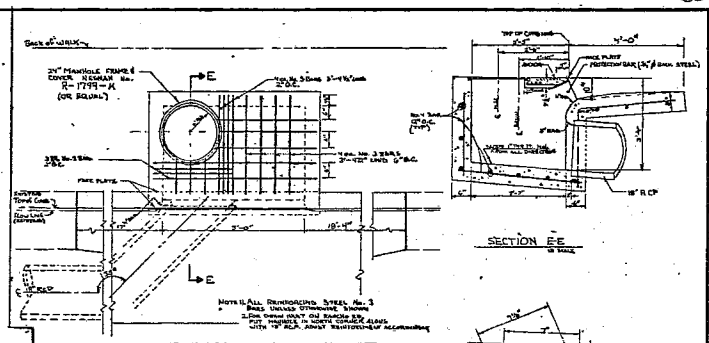
GENERAL NOTES:

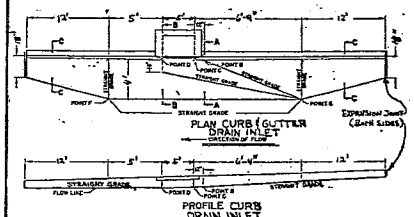
1. ALL CONCRETE USED SHALL BE TYPE II, CLASS B AS SPECIFIED BY SECTION 201 OF THE STANDARD SPECIFICATIONS.
2. ALL STEEL SHALL BE GRADE 40.
3. THE SURFACE AREAS OF EXPOSED EXISTING CONCRETE WILL BE COATED WITH AN EPOXY BONDING AGENT WHERE IT COMES IN CONTACT WITH NEW CONCRETE.



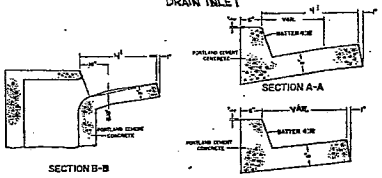
EXISTING PLAN

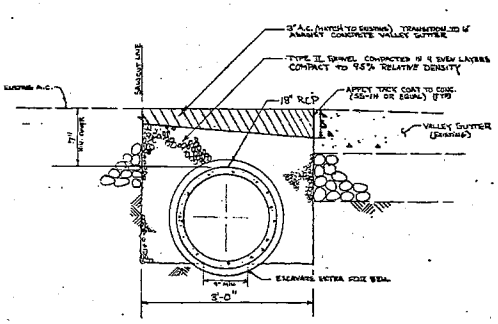
SCALE: 1" = 10'-0"





Note: 10" CURB FACE AT POINTS B, C, & D.





SECTION F-F

TYPICAL PIPE BED & BACKFILL

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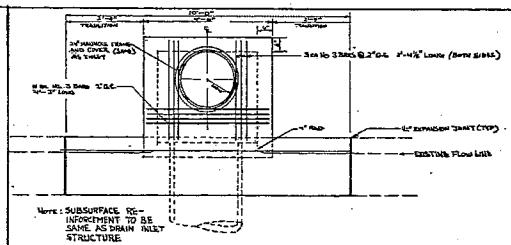

DRAIN OUTLET

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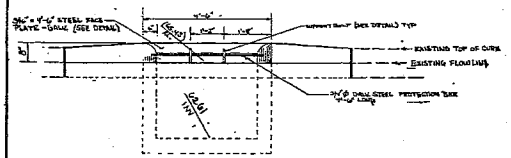

FRONT VIEW – DRAIN OUTLET

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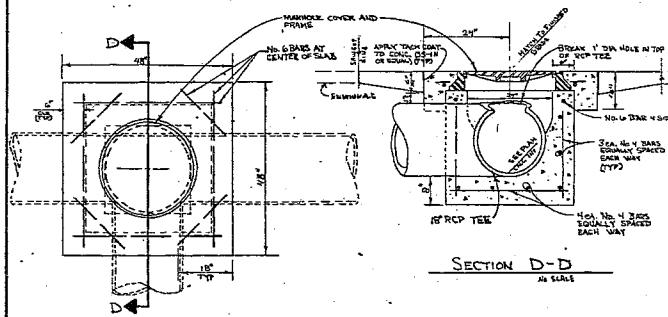


Junction Box

NO SCALE

Section D-D

NO SCALE

Department of Public Services — Engineering Design Division

RANCHO/OAKEY INTERSECTION
NUISANCE WATER DRAIN

EXISTING PLAN, INLET/OUTLET & J-BOX DETAILS

Scale (h) 1"=10'-0"	Scale (v) SAME	W.A. 3070
Fld. bk. no. 79-9X	Date SEPT 80	Drawn by N. R. HAMP
Design by C. KASYONSKI		

Note: Designed Per Indiana Construction.

Revisions	Date

Drawing no. 1/2

2490 JUN 27 1985

327-176

Call before you Dig. 1-800-227-2600 UNDERGROUND SERVICE ALERT (USA)

SAFETY ALERT
Call before you Overhead
593-6111
OVERHEAD SERVICE ALERT

BASIS:
S 00° ... ISING THE CENTERLINE OF VALLEY VIEW BLVD. AS SHOWN ON SPANISH OAKS 8 IN BOOK 22 PAGE 25 OF PLATS IN THE CLARK COUNTY RECORDERS OFFICE.

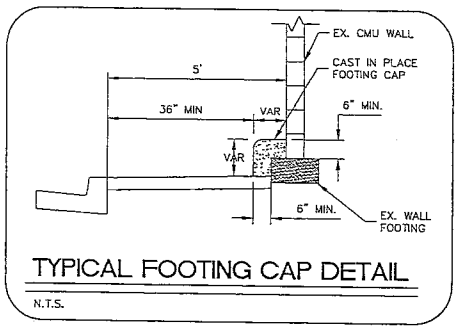
BENCH MARK
BRASS CAP WITH PUNCH MARK AND PLUG IN TOP OF CURB NORTHEAST RETURN SAHARA AND SPANISH OAKS
ELEV. 2131.809 NAVD 88

UTILITY DISCLAIMER

UTILITY LOCATIONS SHOWN HEREON ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTORS 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 AND THE CITY OF LAS VEGAS ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR UTILITIES NOT SHOWN IN THEIR PROPER LOCATION.

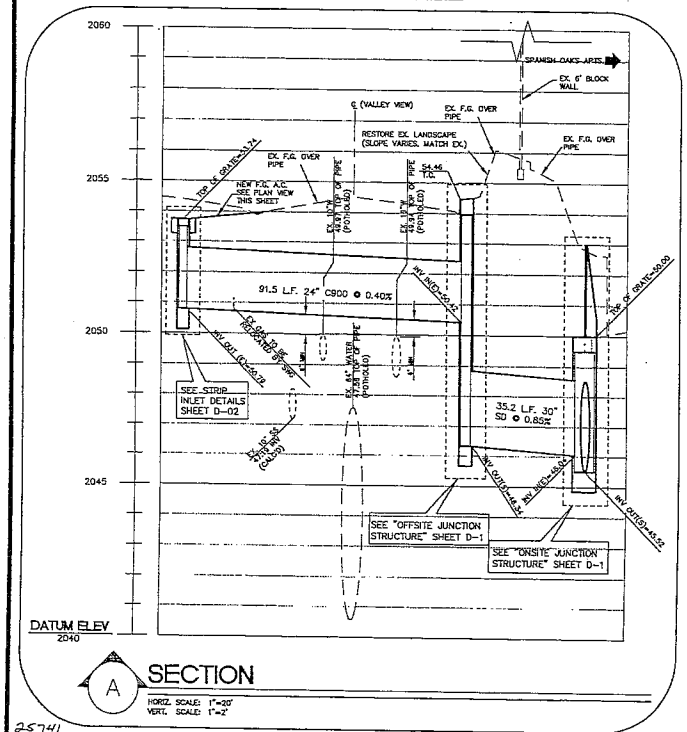
GENERAL NOTES

1. PIPE LENGTHS AND SLOPES ARE CALCULATED FROM CENTER OF MH TO CENTER OF MH OR TO INSIDE FRONT FACE OF DI.
2. DEPTH D FOR DROP INLETS (DI) IS AS DEFINED IN APPROPRIATE U.S.D. No.



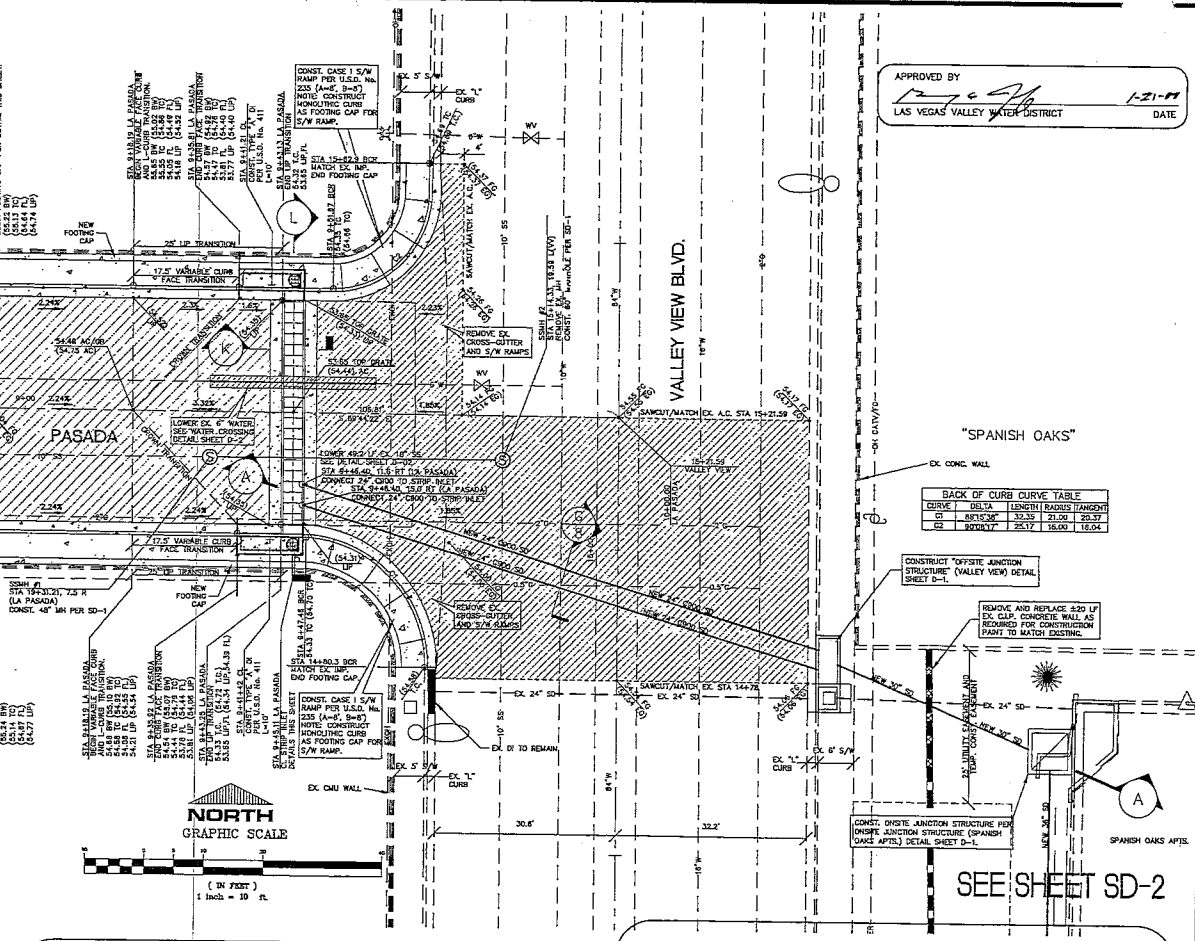
TYPICAL FOOTING CAP DETAIL

N.T.S.



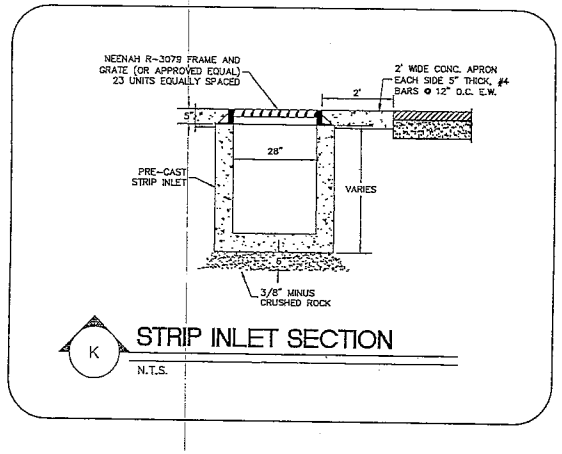
SECTION

HORIZ. SCALE: 1"=20'
VERT. SCALE: 1"=2'



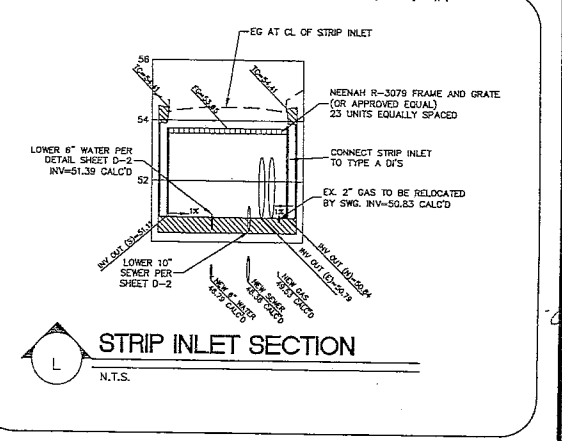
BACK OF CURB CURVE TABLE

CURVE	DELTA	LENGTH	RADIUS	TANGENT
C1	68°15'36"	32.35	21.00	20.37
C2	90°08'17"	25.17	16.00	16.04



STRIP INLET SECTION

N.T.S.



STRIP INLET SECTION

N.T.S.

REVISIONS			
NO.	DATE:	DESCRIPTION	APP'D

DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION

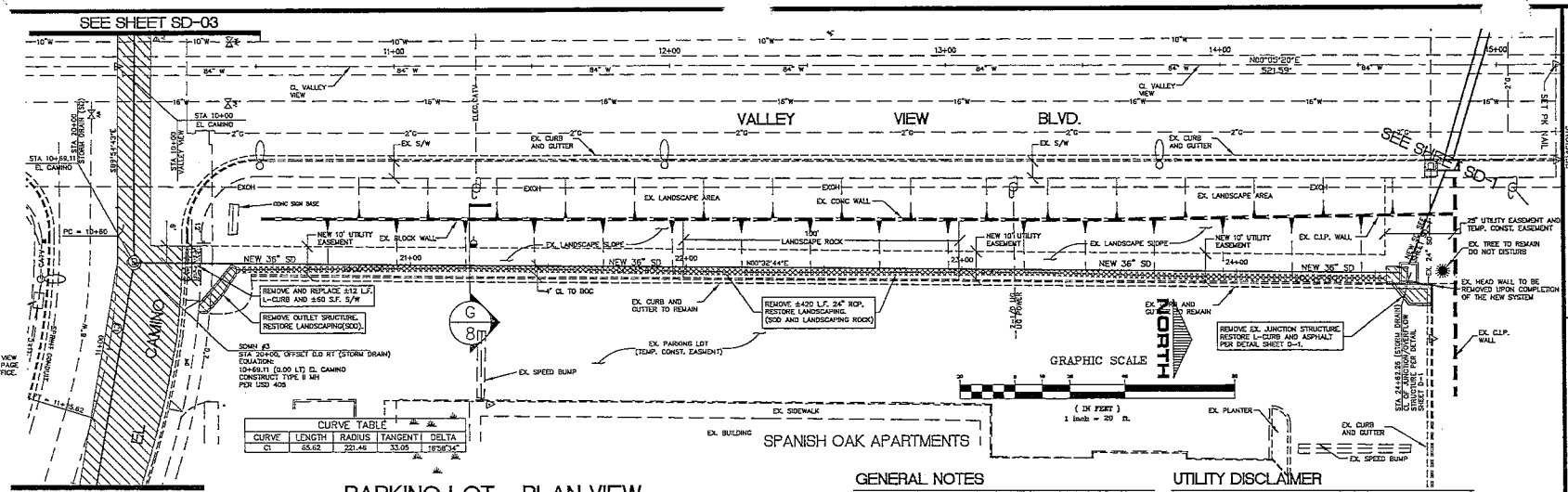
CITY ENGINEER: JERRY WALKER, P.E.(ACTING)
PROJECT MANAGER: ED NETTENSTROM, P.E.
DESIGNED BY: MAS
DRAWN BY: MAS/CSM
CHECKED BY:
HORIZONTAL SCALE: 1"=20'
VERTICAL SCALE: 1"=2'
DATE: 1/1/00

TITLE: VALLEY VIEW STORM DRAIN PHASE 1 - UPPER SYSTEM

SHEET: PLAN AND SECTION LA PASADA AT VALLEY VIEW

Sheet SD-1
3 of 9
DRAWING NO. 327-V259
BID# 00.1730.21

25741



Avoid cutting underground utility lines. It's costly.
Call before you Dig.
1-800-227-2600
UNDERGROUND SERVICE ALERT (USA)

SAFETY ALERT
Call before you Overhead
593-6111
OVERHEAD SERVICE ALERT

BASIS OF BEARING
S 00° 05' 17" W BEING THE CENTERLINE OF VALLEY VIEW BLVD, AS SHOWN ON SPANISH OAKS 8 IN BOOK 22 PAGE 25 OF PLATS IN THE CLARK COUNTY RECORDERS OFFICE.

BENCH MARK
BM# 7CI155SWS RIVET AND PLATE IN TOP OF CURB NORTHEAST RETURN SAHARA AND SPANISH OAKS
ELEV. 2131.809 NAVD 88

PARKING LOT - PLAN VIEW

HORIZ. SCALE: 1"=20'
VERT. SCALE: -

APPROVED BY
LAS VEGAS VALLEY WATER DISTRICT
DATE 1-21-10

GENERAL NOTES

1. PIPE LENGTHS AND SLOPES ARE CALCULATED FROM CENTER OF MH TO CENTER OF MH OR TO INSIDE FRONT FACE OF DI.
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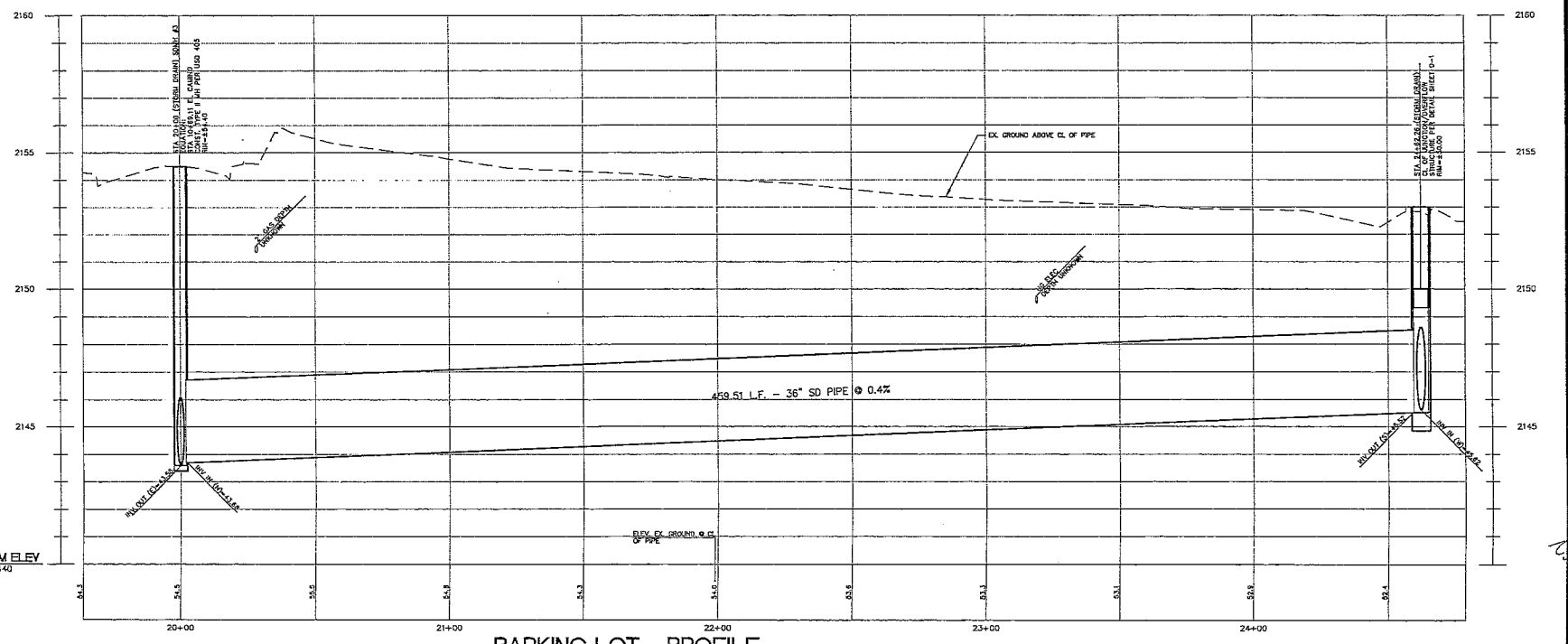


PARKING LOT - PROFILE

HORIZ. SCALE: 1"=20'
VERT. SCALE: 1"=2'

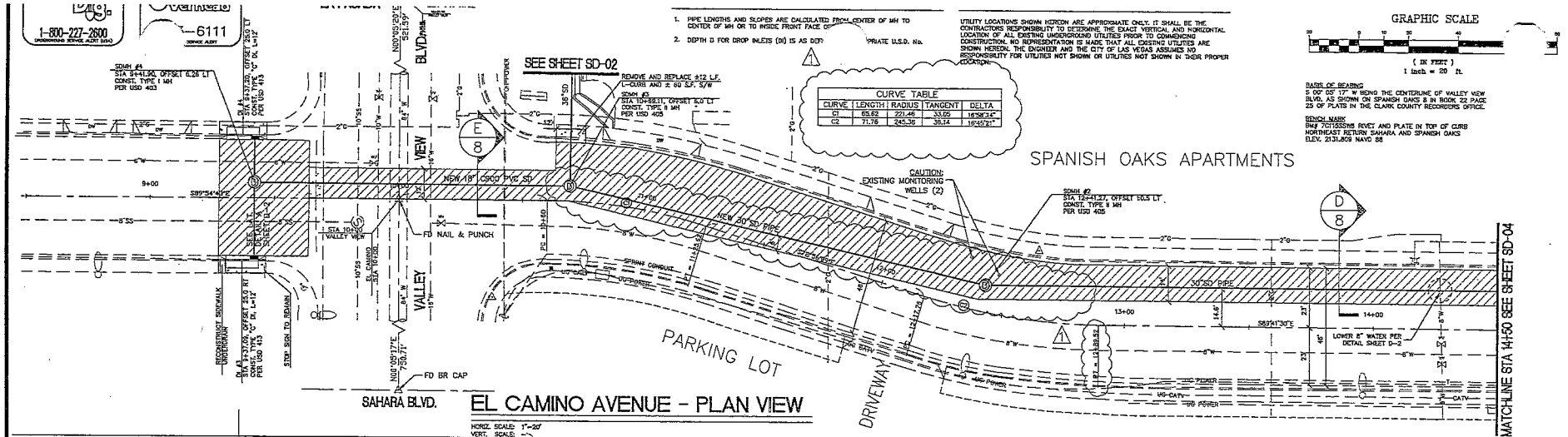
25742

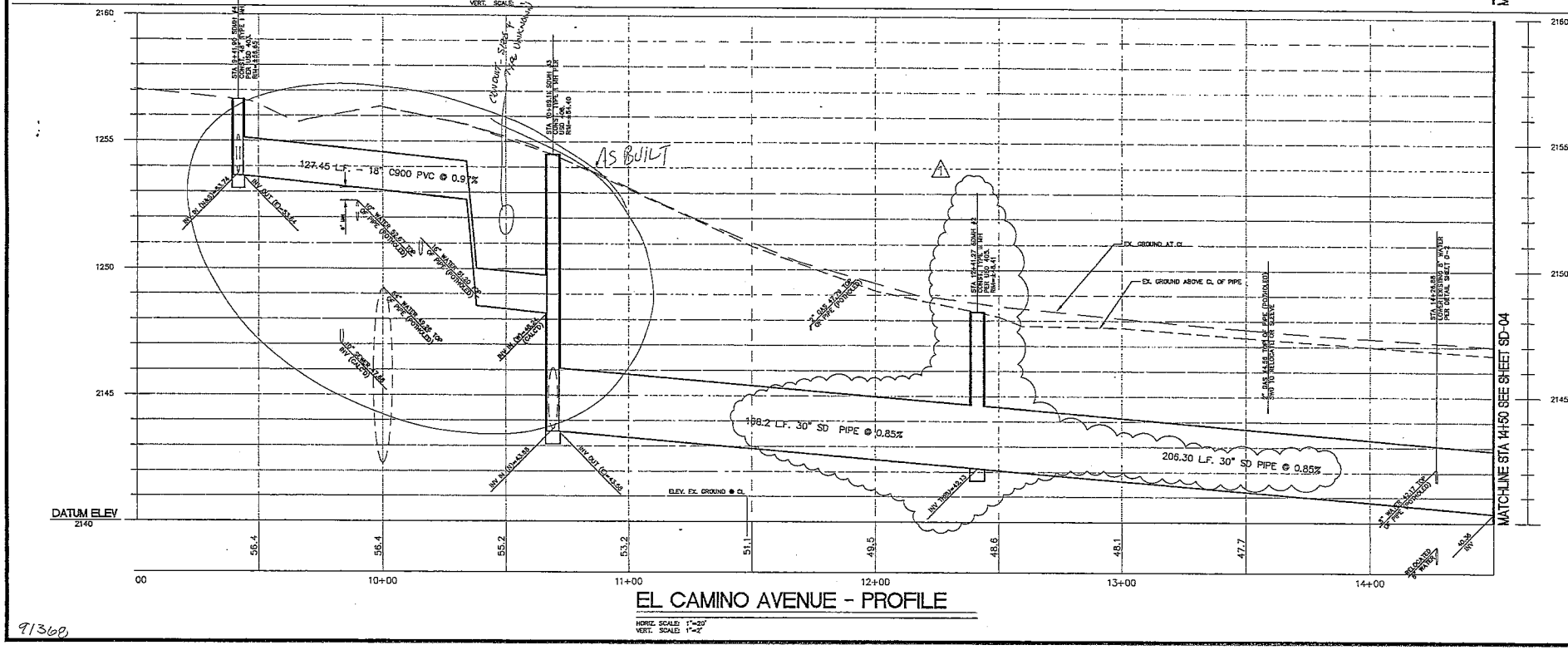
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION
CITY ENGINEER: JERRY WALKER, P.E.(ACTING)
PROJECT MANAGER: ED NETTENSTROM, P.E.
DESIGNED BY: MAS
DRAWN BY: MAS/FESM
CHECKED BY:
HORIZONTAL SCALE: 1"=20'
VERTICAL SCALE: 1"=2'
DATE: 1/1/00

NO.	DATE:	DESCRIPTION	APP'D
		REVISIONS	

TITLE: VALLEY VIEW STORM DRAIN PHASE 1 - UPPER SYSTEM
SHEET: PLAN AND PROFILE STATION 10+00 TO 15+00

Sheet SD-2
4 of 9
DRAWING NO. 327-V259
BID# 00.1730.21





DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION
CITY ENGINEER: CHARLES KAJKOWSKI JR., P.E.
PROJECT MANAGER: ED NETTENSTROM, P.E.
DESIGNED BY: MAS
HORIZONTAL SCALE: 1"=20'
VERTICAL SCALE: 1"=4'

TITLE: VALLEY VIEW STORM DRAIN PHASE 1 - UPPER SYSTEM
SHEET: PLAN AND PROFILE STATION 9+00 TO 14+50

Sheet SD-3
5 of 9
DRAWING NO. 327-V259
BID#: 00.1730

9/1360

Call before you Dig. 1-800-227-2600 (UNDERGROUND SERVICE ALERT (USA))

SAFETY ALERT

Call before you Overhead 593-6111 (OVERHEAD SERVICE ALERT)

GENERAL NOTES

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2. DEPTH D FOR DROP INLETS (DI) IS AS DEFINED IN APPROPRIATE U.S.D. No.

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NORTH
GRAPHIC SCALE
(IN FEET)
1 inch = 20 ft.

BASIS OF BEARING
S 00° 05' 17" W BEING THE CENTERLINE OF VALLEY VIEW BLVD. AS SHOWN ON SPANISH OAKS 8 IN BOOK 22 PAGE 25 OF PLATS IN THE CLARK COUNTY RECORDERS OFFICE.

BENCH MARK
BM# 20150SDMS RIVET AND PLATE IN TOP OF CURB NORTHEAST RETURN SAHARA AND SPANISH OAKS
ELEV. 2131.809 NAVD 88

SPANISH OAKS APARTMENTS

SPANISH OAKS SUBDIVISION

MATCHLINE STA 14+50 SEE SHEET SD-3

EX. 6' CMU WALL
EX. 6' PLANTER
EX. 2' CMU WALL

NEW 30" SD

NEW 8" PERFORATED DRAINAGE PIPE

PHASE I | PHASE II

END PROJECT PHASE I STA 19+80

FOUND REBAR

SPANISH OAKS DRIVE

EX. 6' PLANTER

PARKING LOT

PRIVATE DRIVE

BANK COMPLEX

EL CAMINO AVENUE - PLAN VIEW

HORIZ. SCALE: 1"=20'
VERT. SCALE: -

APPROVED BY
LAS VEGAS VALLEY WATER DISTRICT — DATE 1-21-00

EX. GROUND AT CL

EX. GROUND ABOVE CL OF PIPE

513.0 L.F. - 30" SD @ 0.85%

TEMPORARY INFILTRATION DRAIN

100 LF 8" PERFORATED HDPE DRAIN PIPE @ 0.85%

ELEV. EX. GROUND @ CL

DATUM ELEV 2135.00

EL CAMINO AVENUE - PROFILE

HORIZ. SCALE: 1"=20'
VERT. SCALE: 1"=2'

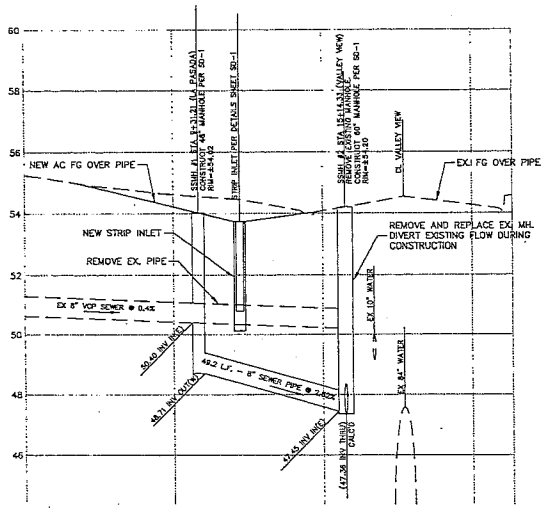
25744

NO.	DATE:	DESCRIPTION	APP'D
		REVISIONS	

DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION
ACTING CITY ENGINEER: JERRY WALKER, P.E.
ACTING ASSISTANT: ED MARTINOVICH, P.E.
DESIGNED BY: MAS
DRAWN BY: MAS/ESM
CHECKED BY:
HORIZONTAL SCALE: 1"=20'
VERTICAL SCALE: 1"=2'
DATE: 1/1/00

TITLE: VALLEY VIEW STORM DRAIN PHASE 1 - UPPER SYSTEM
SHEET: PLAN AND PROFILE STATION 14+50 TO 20+00

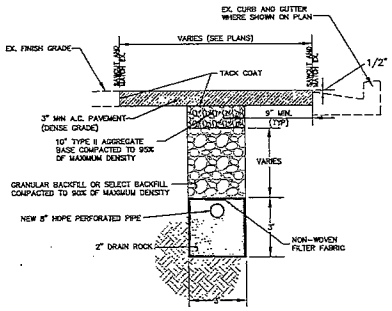
Sheet SD-4
6 of 9
DRAWING NO. 327-V259
BID# 00.1730.21



SEWER LOWERING

LA PASADA AT VALLEY VIEW

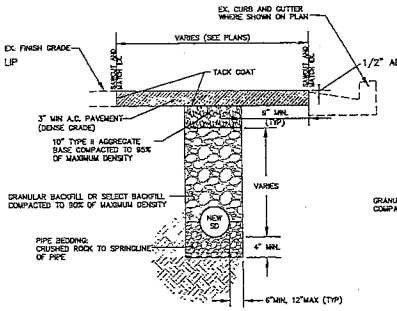
N.T.S.



EL CAMINO TEMPORARY UNDER DRAIN SECTION

8" DRAIN SECTION

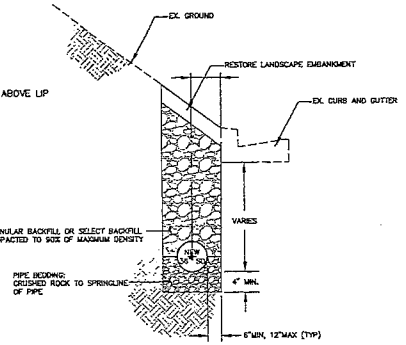
N.T.S.



EL CAMINO SECTION

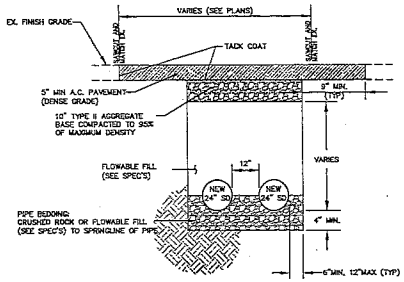
STORM DRAIN PIPE SECTION

N.T.S.



PARKING LOT SECTION

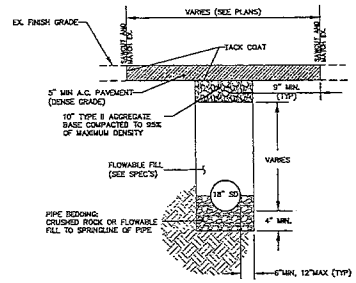
N.T.S.



VALLEY VIEW CROSSING

DUAL 24" PIPES AT LA PASADA

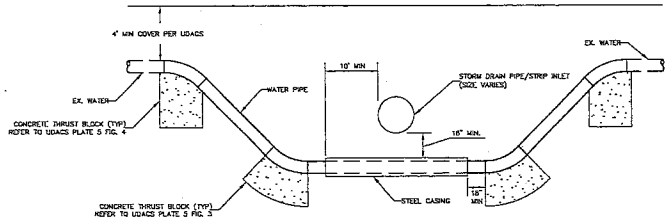
N.T.S.



VALLEY VIEW CROSSING

18" PIPE AT EL CAMINO

N.T.S.

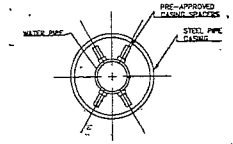


WHERE THE WATER LINE IS LESS THAN 18 INCHES OVER THE SEWER LINE, WHERE THE WATER LINE IS UNDER THE SEWER LINE, AND WHERE THE HORIZONTAL SEPARATION, AS REQUIRED BY THE WATER SUPPLY REGULATIONS, CANNOT BE MAINTAINED BECAUSE OF PHYSICAL OBSTRUCTIONS, THE WATER LINE SHALL BE PROTECTED BY CONSTRUCTION OF THE STORM/SEWER LINE AS FOLLOWS:

1. EXTRA HEAVY CAST IRON PIPE;
2. WATER SUPPLY QUALITY MATERIAL; OR
3. ENCASEMENT WITH FOUR INCHES, MINIMUM, OF CONCRETE OR SLEEVING WITH WATER SUPPLY QUALITY PIPE.

EACH OF THESE PROVISIONS SHALL ALSO BE EXTENDED FOR OTHER THAN 90 DEGREE CROSSINGS TO THE POINT AT WHICH THE TEN FOOT SEPARATION BETWEEN THE WATER AND SEWER LINES IS ACHIEVED (10/SINE OF CROSSING ANGLE)

TYPICAL CASING SECTION



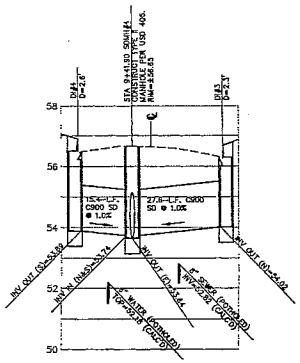
NOTES:

1. STEEL PIPE CASING SYMMETRICAL ABOUT WATER MAIN CENTERLINE.
2. PRE-APPROVED CASING SPACERS AND PRE-APPROVED END SEALS INSTALLED PER MANUFACTURER'S SPECIFICATIONS. (REDWOOD SKIDS NOT ALLOWED. UDACS SECTION 3.09 NOT APPLICABLE). USE A "CENTERED" CONFIGURATION AND PROVIDE THE MANUFACTURER WITH THE FOLLOWING:

*PIPE OD
*CASING ID
*CASING LENGTH

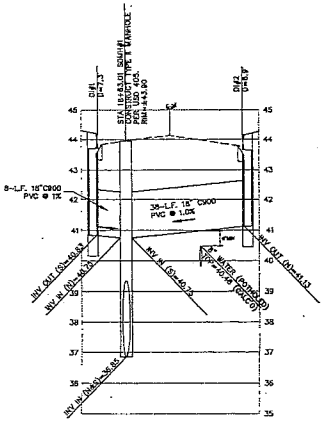
1. STEEL PIPE CASING SHALL BE FABRICATED FROM A MINIMUM 1/4" THICK STEEL PLATES CONFORMING TO THE REQUIREMENTS OF ASTM A285, GRADE B, C, OR D. ALL JOINTS SHALL BE WELDED. INTERIOR JOINTS SHALL BE GROUNDED TO A SMOOTH FINISH. ALL WELDING SHALL BE PERFORMED IN ACCORDANCE WITH AWWA C201, "AWWA STANDARD FOR FABRICATED ELECTRICALLY WELDED STEEL WATER PIPE." COATINGS FOR STEEL CASING ARE NOT REQUIRED.
2. PIPE CASING SHALL BE LAID TRUE TO LINE AND GRADE WITH NO BENDS OR CHANGES IN GRADE FOR THE FULL LENGTH OF THE CASING.
3. THE PIPE SHALL BE SUPPORTED AT EACH END WITH SPACERS. AFTER INSTALLATION OF THE PIPE, THE CASING SHALL BE SEALED AT BOTH ENDS WITH CASING END SEALS. DUCTILE IRON PIPE JOINTS INSIDE CASING ARE TO BE RESTRAINED.

WATER CROSSING DETAIL



LATERAL SECTION-DI'S 3+4

N.T.S.



LATERAL SECTION-DI'S 1+2

N.T.S.

APPROVED BY

LAS VEGAS VALLEY WATER DISTRICT — DATE 1-21-09

Call before you Dig. 1-800-227-2600

SAFETY ALERT

Call before you Overhead 593-6111

OVERHEAD SERVICE ALERT

REVISIONS

NO.	DATE	DESCRIPTION	APP'D

DEPARTMENT OF PUBLIC WORKS

ENGINEERING DESIGN SECTION

ACTING CITY ENGINEER: JERRY WALKER, P.E.
PROJECT MANAGERS: ED NETTENSTROM, P.E.

HORIZONTAL SCALE: 1"=20'
VERTICAL SCALE: 1"=2'
DESIGNED BY: MAS
DRAWN BY: MAS/ESM
CHECKED BY:
DATE: 1/1/00

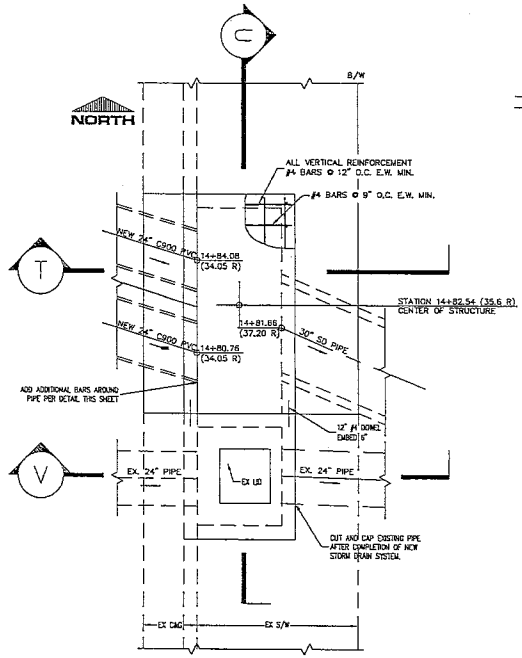
TITLE: VALLEY VIEW STORM DRAIN PHASE I-UPPER SYSTEM

SHEET: DETAILS

Sheet D-2
8 of 9
DRAWING NO. 327-V259

BID#: 00.1730.21

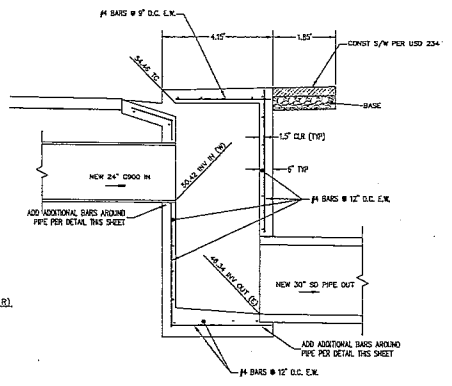
25746



PLAN VIEW

N.T.S.

NOTE:
CONSTRUCT TYPE "A" DI PER USD 411 AND DETAILS THIS SHEET.
ACCESS LID NOT SHOWN FOR CLARITY.



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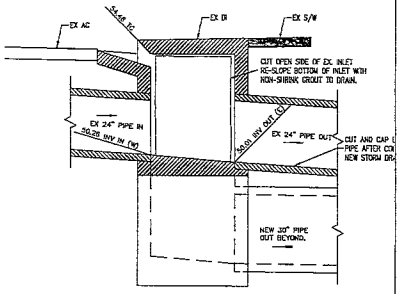
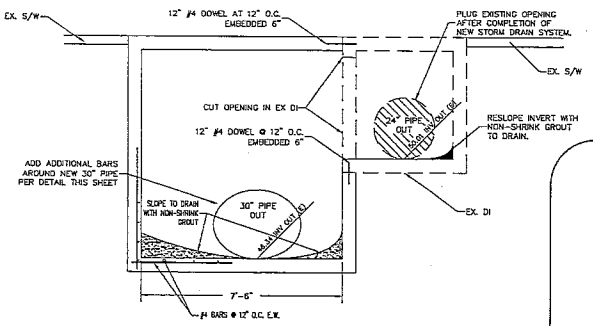
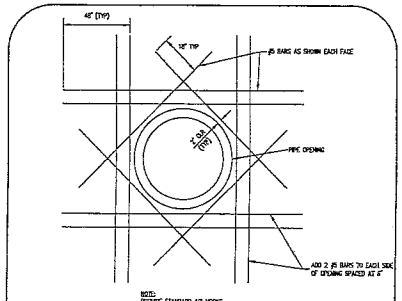




N.T.S.

OFFSITE JUNCTION STRUCTURE

N.T.S.



ADDITIONAL OPENING REINFORCEMENT

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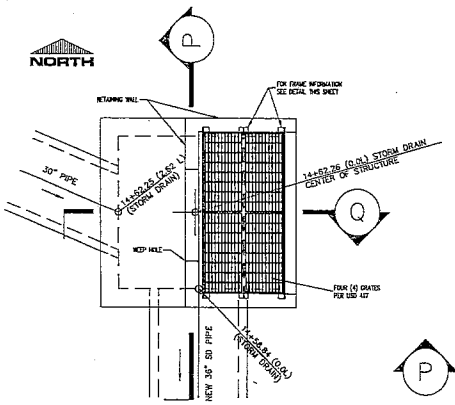

PLAN VIEW

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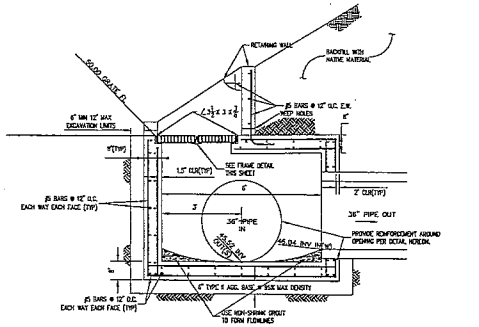

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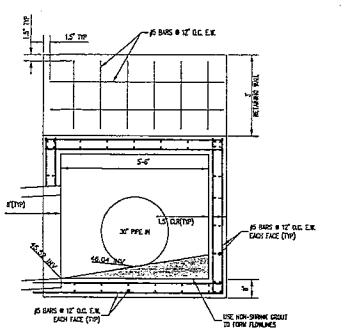

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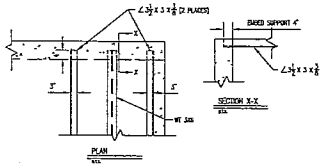

FRAME DETAIL

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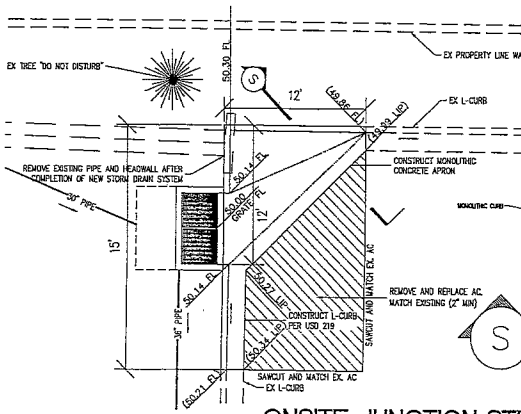

ONSITE JUNCTION STRUCTURE

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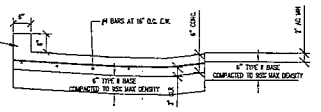


CONCRETE APRON SECTION

N.T.S.

Avoid cutting underground utility lines. It's costly.

Call before you Dig.
1-800-227-2600
UNDERGROUND SERVICE ALERT (USA)

SAFETY ALERT
Call before you Overhead
593-6111
OVERHEAD SERVICE ALERT

NO.	DATE:	DESCRIPTION	APP'D
		REVISIONS	

DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION

ACTING CITY ENGINEER: JERRY VANKER, P.E.
PROJECT MANAGER: ED NELTENSTRUM, P.E.
DESIGNED BY: MAS
DRAWN BY: MAS/ESM
CHECKED BY:
HORIZONTAL SCALE: 1"=20'
VERTICAL SCALE: 1"=2'
DATE: 1/1/00

TITLE: VALLEY VIEW STORM DRAIN PHASE I - UPPER SYSTEM
SHEET: DETAILS

Sheet D-1
7 of 9
DRAWING NO: 327-V259
BID# 00.1730.21

25745

Call before you Dig. 1-800-227-2600 UNDERGROUND SERVICE ALERT (USA)

SAFETY ALERT
Call before you Overhead 593-6111 OVERHEAD SERVICE ALERT

GENERAL NOTES

1. PIPE LENGTHS AND SLOPES ARE CALCULATED FROM CENTER OF MH TO CENTER OF MH OR TO INSIDE FRONT FACE OF DI.
2. DEPTH D FOR DROP INLETS (DI) IS AS DEFINED IN APPROPRIATE U.S.D. No. AND PER DETAIL SHEET D-1.

UTILITY DISCLAIMER

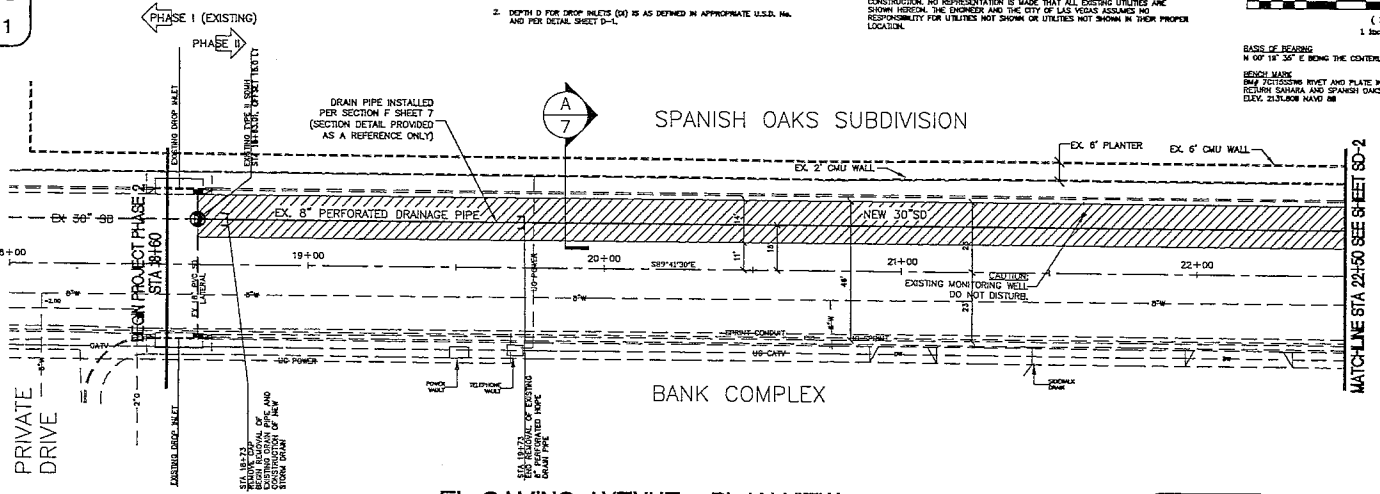
UTILITY LOCATIONS SHOWN HEREON ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO DETERMINE THE EXACT VERTICAL AND HORIZONTAL LOCATION OF ALL EXISTING UNDERGROUND UTILITIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN HEREON. THE ENGINEER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

NORTH
GRAPHIC SCALE
(IN FEET)
1 inch = 20 ft.

BASIS OF BEARING
N 00° 18' 35" E BEING THE CENTERLINE OF SPANISH OAKS DRIVE.

BENCH MARK
BM# 7GT03SWM RIVET AND PLATE IN TOP OF CURB NORTHEAST RETURN SAHARA AND SPANISH OAKS.
ELEV. 2131.80® NAVD 88

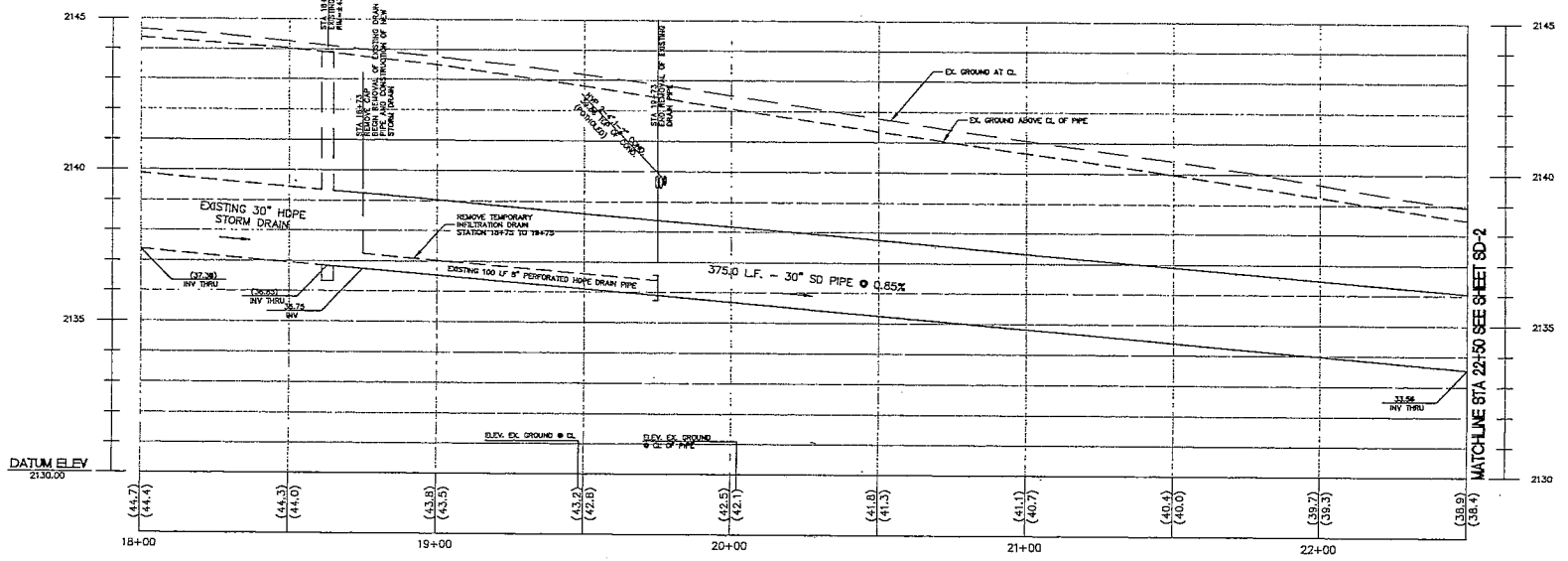
HATCH LEGEND
AC-PATCH



EL CAMINO AVENUE - PLAN VIEW

HORIZ. SCALE: 1"=20'
VERT. SCALE: -

APPROVED BY
LAS VEGAS VALLEY WATER DISTRICT
10/25/00
DATE



EL CAMINO AVENUE - PROFILE

HORIZ. SCALE: 1"=20'
VERT. SCALE: 1"=2'

25313

NO.	DATE	DESCRIPTION	APP'D
		REVISIONS	

DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION
CITY ENGINEER: CHARLES KAJKOWSKI, JR., P.E.
PROJECT MANAGER: ED NETTENSTROM, P.E.
DESIGNED BY: MAS
DRAWN BY: MAS
CHECKED BY: EDN
HORIZONTAL SCALE: 1"=20'
VERTICAL SCALE: 1"=2'
DATE: 10/12/00

TITLE: VALLEY VIEW STORM DRAIN PHASE 2 - LOWER SYSTEM
SHEET: PLAN AND PROFILE STA 18+00 TO 22+50

EDWARD C. NEDENSTROM CIVIL 12321 REGISTERED PROFESSIONAL ENGINEER STATE OF NEVADA

Sheet SD-1
3 of 7
DRAWING NO. 327-V262
BID# 01.1730.15

Call before you Dig. 1-800-227-2600 UNDERGROUND SERVICE ALERT (USA)

SAFETY ALERT
Call before you Overhead 593-6111 OVERHEAD SERVICE ALERT

GENERAL NOTES

1. PIPE LENGTHS AND SLOPES ARE CALCULATED FROM CENTER OF MH TO CENTER OF MH OR TO INSIDE FRONT FACE OF DI.
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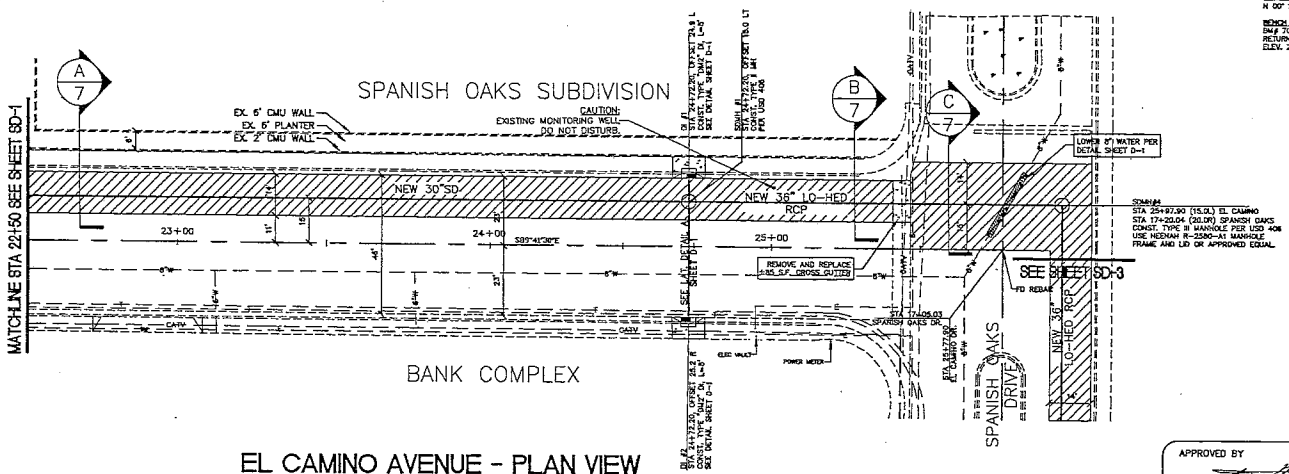
NORTH
GRAPHIC SCALE
(IN FEET)
1 inch = 20 ft.

BASIS OF BEARING
N 00° 19' 35" E BEING THE CENTERLINE OF SPANISH OAKS DRIVE.

BENCH MARK
DMJ 7C1103SWS RIVET AND PLATE IN TOP OF CURB NORTHEAST RETURN SAHARA AND SPANISH OAKS.
ELEV. 2131.808 NAVD 88

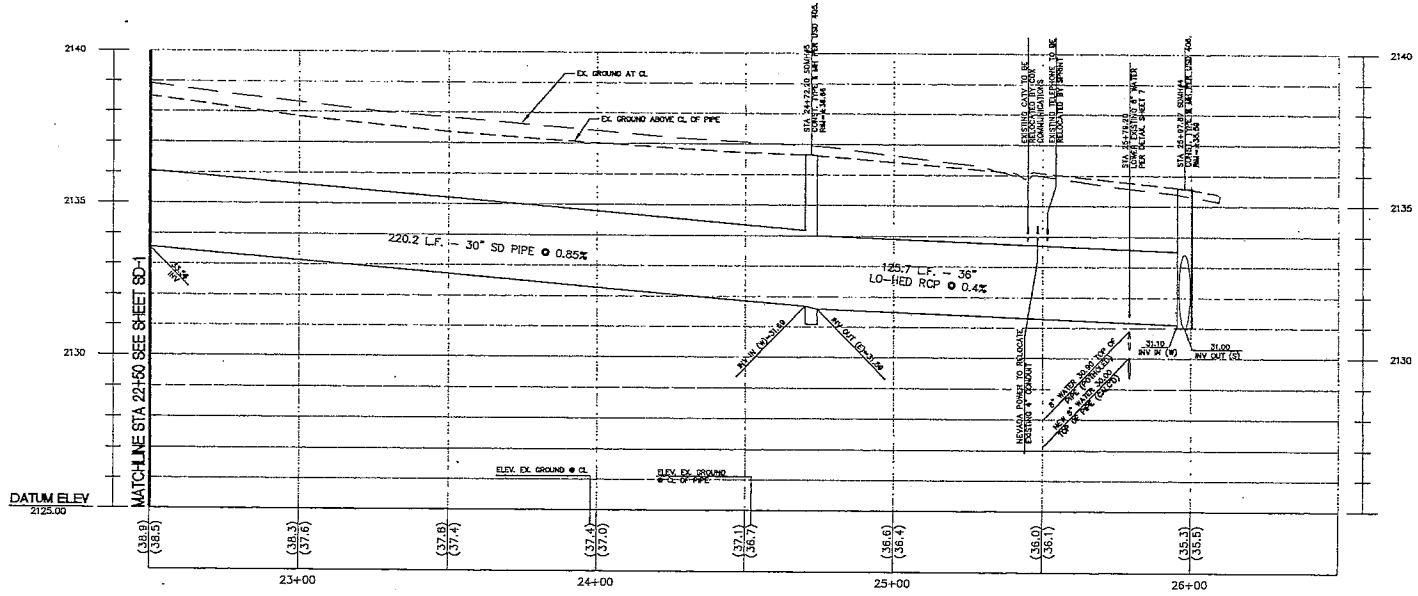
HATCH LEGEND
AC-PATCH



EL CAMINO AVENUE - PLAN VIEW

HORIZ. SCALE: 1"=20'
VERT. SCALE: -

APPROVED BY
LAS VEGAS VALLEY WATER DISTRICT DATE



EL CAMINO AVENUE - PROFILE

HORIZ. SCALE: 1"=20'
VERT. SCALE: 1"=2'

DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION
CITY ENGINEER: CHARLES KAJKOWSKI, JR., P.E.
PROJECT MANAGER: ED METTENSTROM, P.E.
DESIGNED BY: MAS
DRAWN BY: MAS
CHECKED BY: EDM
HORIZONTAL SCALE: 1"=20'
VERTICAL SCALE: 1"=2'
DATE: 09/27/00

NO.	DATE:	DESCRIPTION	APP'D
		REVISIONS	

TITLE: VALLEY VIEW STORM DRAIN PHASE 2 - LOWER SYSTEM
SHEET: PLAN AND PROFILE STA 22+50 TO 26+00

EDWARD D. METTENSTROM No. 3078 STATE OF NEVADA PROFESSIONAL ENGINEER

Sheet SD-2
4 of 7
DRAWING NO. 327-V262
BID# 01.1730.15

28314

Call before you Dig 1-800-227-2600 (UNDERGROUND SERVICE ALERT (USA))

SAFETY ALERT
Call before you Overhead 593-6111 (OVERHEAD SERVICE ALERT)

GENERAL NOTES

1. PIPE LENGTHS AND SLOPES ARE CALCULATED FROM CENTER OF MH TO CENTER OF MH OR TO INSIDE FRONT FACE OF DI.
2. DEPTH D FOR DROP INLETS (DI) IS AS DEFINED IN APPROPRIATE U.S.D. No. AND DETAILS SHEET D-1.

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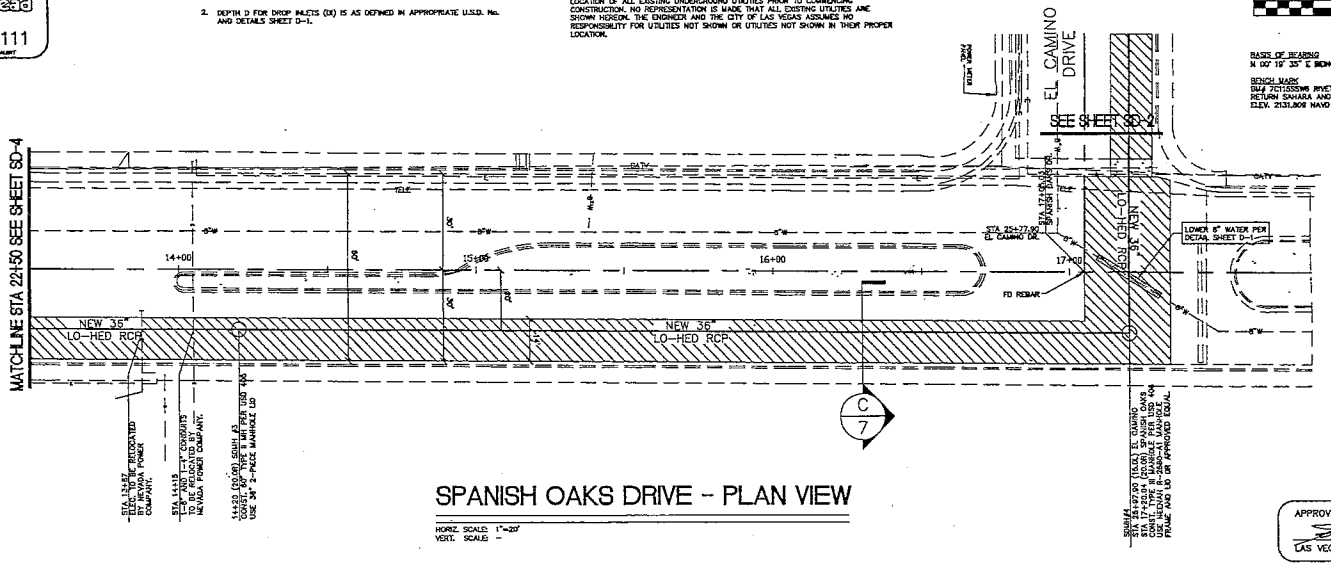
NORTH
GRAPHIC SCALE
(IN FEET)
1 inch = 20 ft.

BASIS OF BEARING
N 00° 19' 35" E BEING THE CENTERLINE OF SPANISH OAKS DRIVE.

BENCH MARK
BLM 2C11355WB RIVET AND PLATE IN TOP OF CURB NORTHEAST RETURN SAHARA AND SPANISH OAKS.
ELEV. 2131.808 NAVD 88

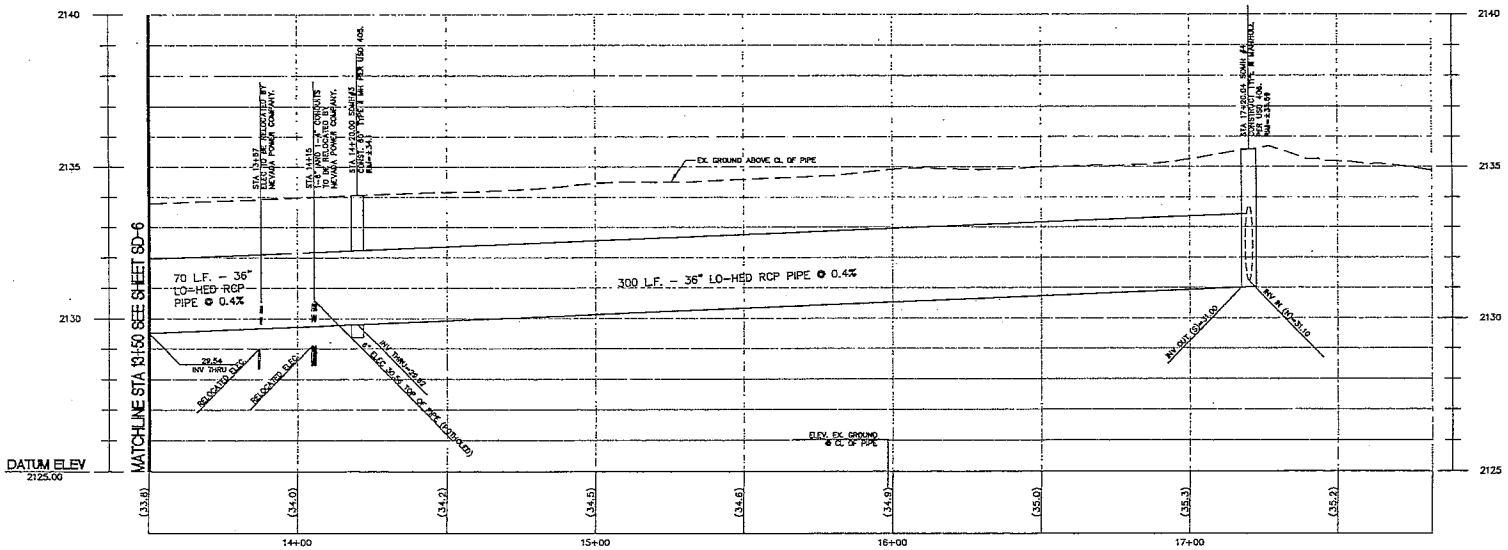
HATCH LEGEND
AC-PATCH



SPANISH OAKS DRIVE - PLAN VIEW

HORIZ. SCALE: 1"=20'
VERT. SCALE: -

APPROVED BY
LAS VEGAS VALLEY WATER DISTRICT — DATE 10/25/00



SPANISH OAKS DRIVE - PROFILE

HORIZ. SCALE: 1"=20'
VERT. SCALE: 1"=2'

28315

REVISIONS

NO.	DATE:	DESCRIPTION	APP'D

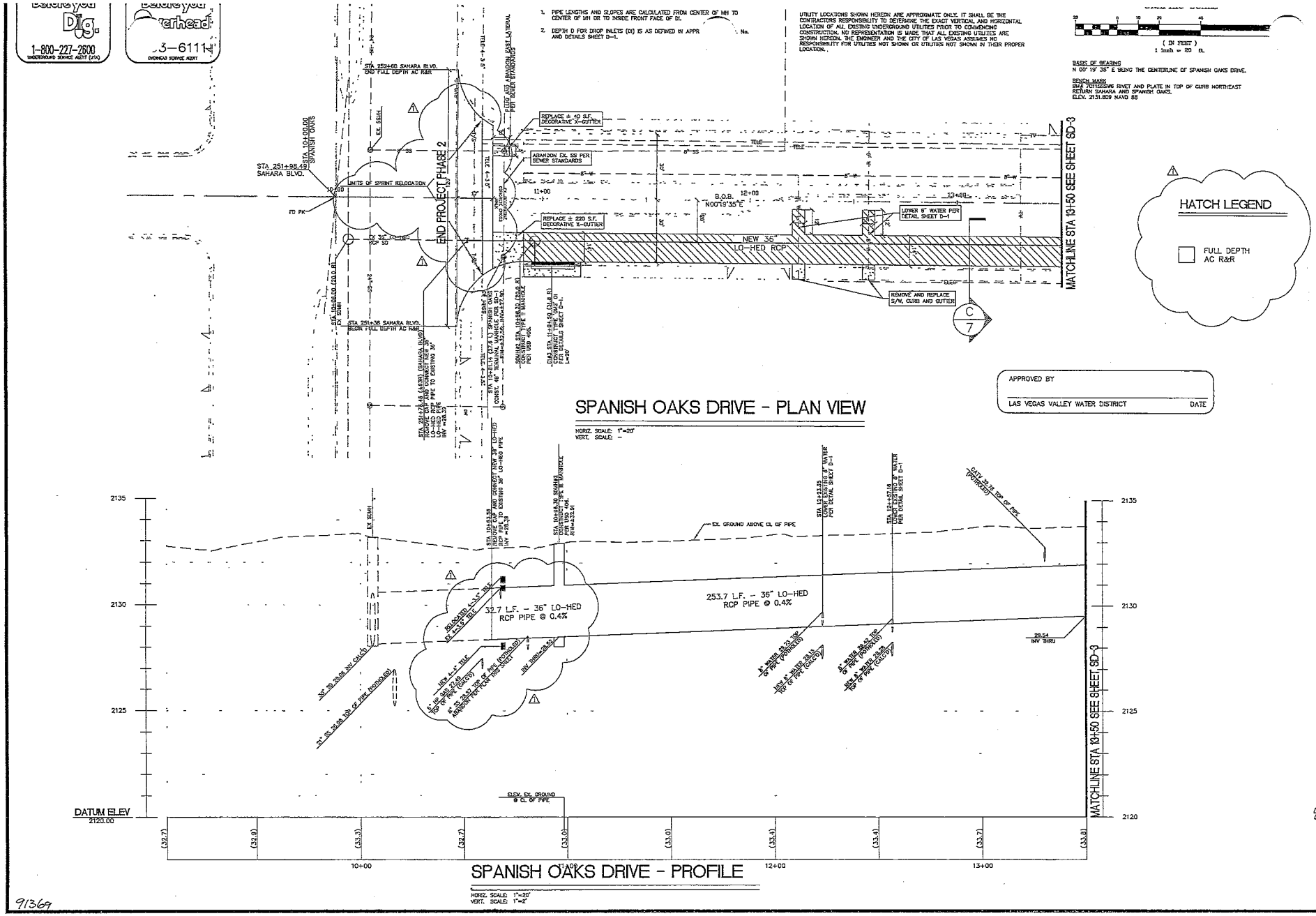
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION
CITY ENGINEER: CHARLES KAJKOWSKI, JR., P.E.
PROJECT MANAGER: ED NETTENSTROM, P.E.
DESIGNED BY: MAS
DRAWN BY: MAS
CHECKED BY: RCH
HORIZONTAL SCALE: 1"=20'
VERTICAL SCALE: 1"=2'
DATE: 08/30/00

TITLE: VALLEY VIEW STORM DRAIN PHASE 2 - LOWER SYSTEM
SHEET: PLAN AND PROFILE STA 13+50 TO 17+50

REGISTERED PROFESSIONAL ENGINEER — ED NETTENSTROM — No. 5078 — STATE OF NEVADA

10/25/00

Sheet SD-3
5 of 7
DRAWING NO. 327-V262
BID# 01.1730.15



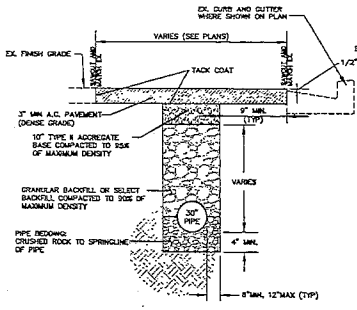
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION
CITY ENGINEER: CHARLES KAMINSKI, JR., P.E.
PROJECT MANAGER: ED NETTENSTROM, P.E.
DESIGNED BY: MAS HORIZONTAL SCALE: 1"=20'
DRAWN BY: MAS VERTICAL SCALE: 1"=2'

REVISIONS
1/9/2 REVISIONS FOR NDOT PERMIT ADDI

TITLE: VALLEY VIEW STORM DRAIN PHASE 2 - LOWER SYSTEM
SHEET: PLAN AND PROFILE STA 10+50 TO 13+50

Sheet SD-4
6 of 7
DRAWING NO 327-V262
BID#: 01.1730.1

91369



A EL CAMINO SECTION
STORM DRAIN PIPE SECTION
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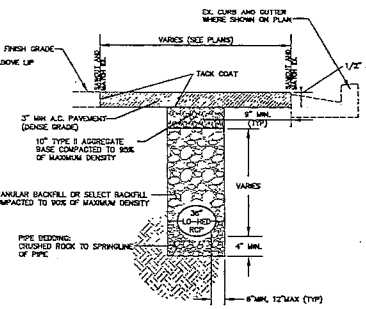
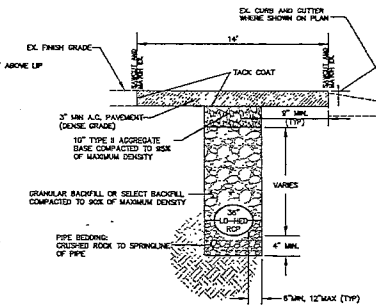
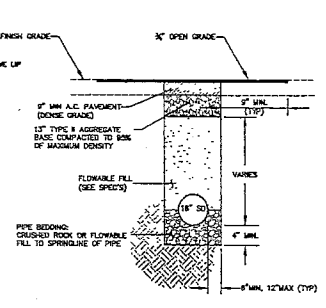


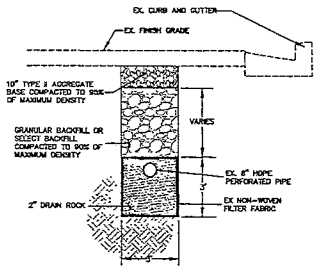
B EL CAMINO SECTION
STORM DRAIN PIPE SECTION
N.T.S.



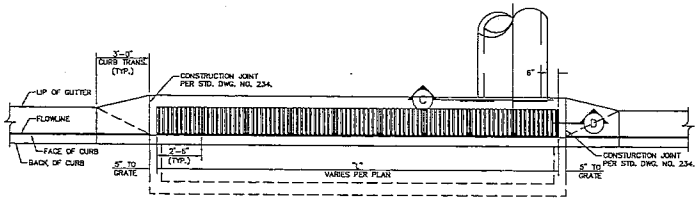
C SPANISH OAKS SECTION
STORM DRAIN PIPE SECTION
N.T.S.



D SAHARA AVE. STORM DRAIN TRENCH
36" LO-HED RCP
N.T.S.



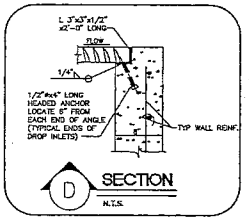
F EXISTING EL CAMINO TEMPORARY UNDER DRAIN SECTION
8" DRAIN SECTION
N.T.S.
NOTE: SECTION DETAIL PROVIDED AS A REFERENCE ONLY



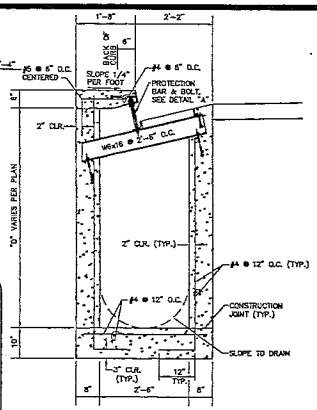
DROP INLET LAYOUT PLAN

TYPE 'DM2' DROP INLET NOTES

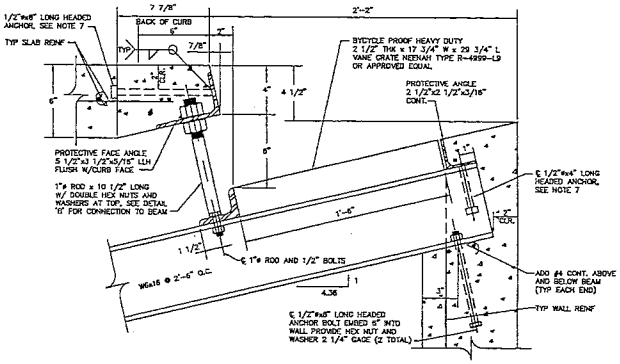
1. ALL EXPOSED METALS SHALL BE HOT DIP GALVANIZED AFTER FABRICATION.
2. PROVIDE 1/2" (MIN.) CLEARANCE ALL AROUND THE STEEL BEAM, DRY PACK AFTER INSTALLATION.
3. WHEN REQUIRED BY LENGTH OF OPENING, PLATE ANGLE MAY BE DELIVERED IN SECTIONS AND BUTT WELDED IN PLACE.
4. ALL GALVANIZING DAMAGED BY WELDING SHALL RECEIVE TWO COATS OF GALVALLOY OR EQUAL.
5. CONCRETE SHALL BE MODIFIED CLASS 0A, SEE SPECIAL PROVISIONS SECTION 501.
6. ANGLE ANCHORS SHALL BE EMBEDDED MIDPOINT IN EACH ENDWALL AND EVENLY SPACED. (MAXIMUM SPACING OF 2')



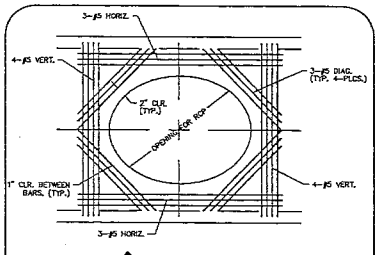
D SECTION
N.T.S.



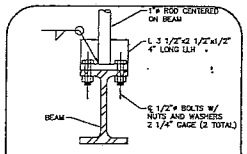
TYPE 'DM2' DROP INLET SECTION
N.T.S.



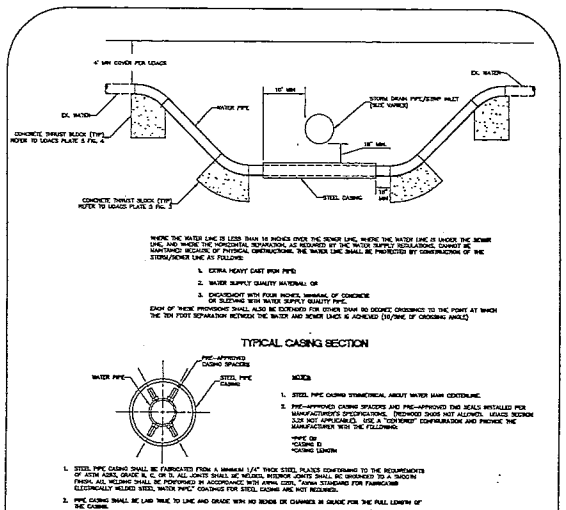
DETAIL "A" - PROTECTIVE FACE + ROD
N.T.S.



C SECTION
N.T.S.



DETAIL 'B'
N.T.S.



WHERE THE WATER LINE IS LESS THAN 10 INCHES OVER THE SEWER LINE, WHERE THE WATER LINE IS UNDER THE SEWER LINE, AND WHERE THE HORIZONTAL SEPARATION, AS REQUIRED BY THE WATER SUPPLY REGULATIONS, CANNOT BE MAINTAINED BECAUSE OF PHYSICAL OBSTRUCTIONS, THE WATER LINE SHALL BE PROTECTED BY CONSTRUCTIONS OF THE STORM/SEWER LINE AS FOLLOWS:

1. EXTRA HEAVY CAST IRON PIPE.
2. WATER SUPPLY QUALITY MATERIAL OR
3. ENCASEMENT WITH FOUR INCHES MINIMUM OF CONCRETE OR SLEEVING WITH WATER SUPPLY QUALITY PIPE.

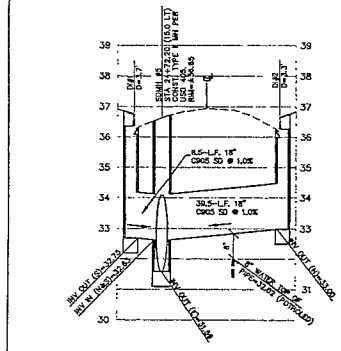
EACH OF THESE PROVISIONS SHALL ALSO BE EXTENDED FOR OTHER THAN 90 DEGREE CROSSINGS TO THE POINT AT WHICH THE TEN FOOT SEPARATION BETWEEN THE WATER AND SEWER LINES IS ACHIEVED (10/SINE OF CROSSING ANGLE)

TYPICAL CASING SECTION

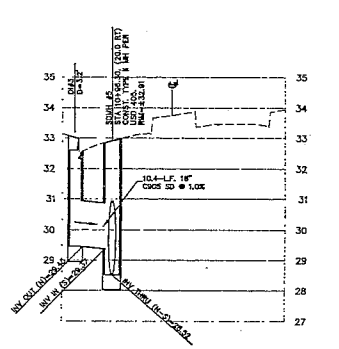
NOTES

1. STEEL PIPE CASING SYMMETRICAL ABOUT WATER MAIN CENTERLINE.
2. PRE-APPROVED CASING SPACERS AND PRE-APPROVED END SEALS INSTALLED PER MANUFACTURER'S SPECIFICATIONS. (REDWOOD SHIMS NOT ALLOWED. LOCASS SECTION 3.08 NOT APPLICABLE). USE A "CONTRACT" CONFIGURATION AND PREPARE THE MANUFACTURER WITH THE FOLLOWING:
   - "A" = CASING ID
   - "B" = CASING LENGTH
3. STEEL PIPE CASING SHALL BE FABRICATED FROM A MINIMUM 1/4" THICK STEEL PLATES CONFORMING TO THE REQUIREMENTS OF ASTM A285, GRADE B, C, OR D. ALL JOINTS SHALL BE WELDED. INTERIOR JOINTS SHALL BE GROUNDED TO A SMOOTH FINISH. ALL WELDING SHALL BE PERFORMED IN ACCORDANCE WITH AWWA C206, "AWWA STANDARD FOR FABRICATION ELECTRICALLY WELDED STEEL WATER PIPE" CODINGS FOR STEEL CASING ARE NOT REQUIRED.
4. PIPE CASING SHALL BE LAID TRUE TO LINE AND GRADE WITH NO SUDDEN OR CHANGES IN GRADE FOR THE FULL LENGTH OF THE CASING.
5. THE PIPE SHALL BE SUPPORTED AT EACH END WITH SPACERS. AFTER INSTALLATION OF THE PIPE, THE CASING SHALL BE SEALED AT BOTH ENDS WITH CASING END SEALS. DUCTILE IRON PIPE JOINTS INSIDE CASING ARE TO BE RESTRAINED.

WATER CROSSING DETAIL



A LATERAL SECTION-DI'S 1+2
N.T.S.



B LATERAL SECTION-DI 3
N.T.S.

APPROVED BY
LAS VEGAS VALLEY WATER DISTRICT
10/3/00
DATE

Call before you Dig. 1-800-227-2600 UNDERGROUND SERVICE ALERT (USA)

SAFETY ALERT
Call before you Overhead
593-6111
OVERHEAD SERVICE ALERT

REVISIONS

NO.	DATE:	DESCRIPTION	APP'D

DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION

CITY ENGINEER: CHARLES KAMOWSKI, JR., P.E.
PROJECT MANAGER: ED HETTENSTROM, P.E.
DESIGNED BY: MAS — HORIZONTAL SCALE: N/A
DRAWN BY: MAS — VERTICAL SCALE: N/A
CHECKED BY: ECH — DATE: 09/26/00

TITLE: VALLEY VIEW STORM DRAIN PHASE 2 - LOWER SYSTEM
SHEET: DETAILS

Sheet D-1
7 of 7
DRAWING NO. 327-V261
BID# 01.1730.15

24317

Call before you Dig. 1-800-227-2600 UNDERGROUND SERVICE ALERT (USA)

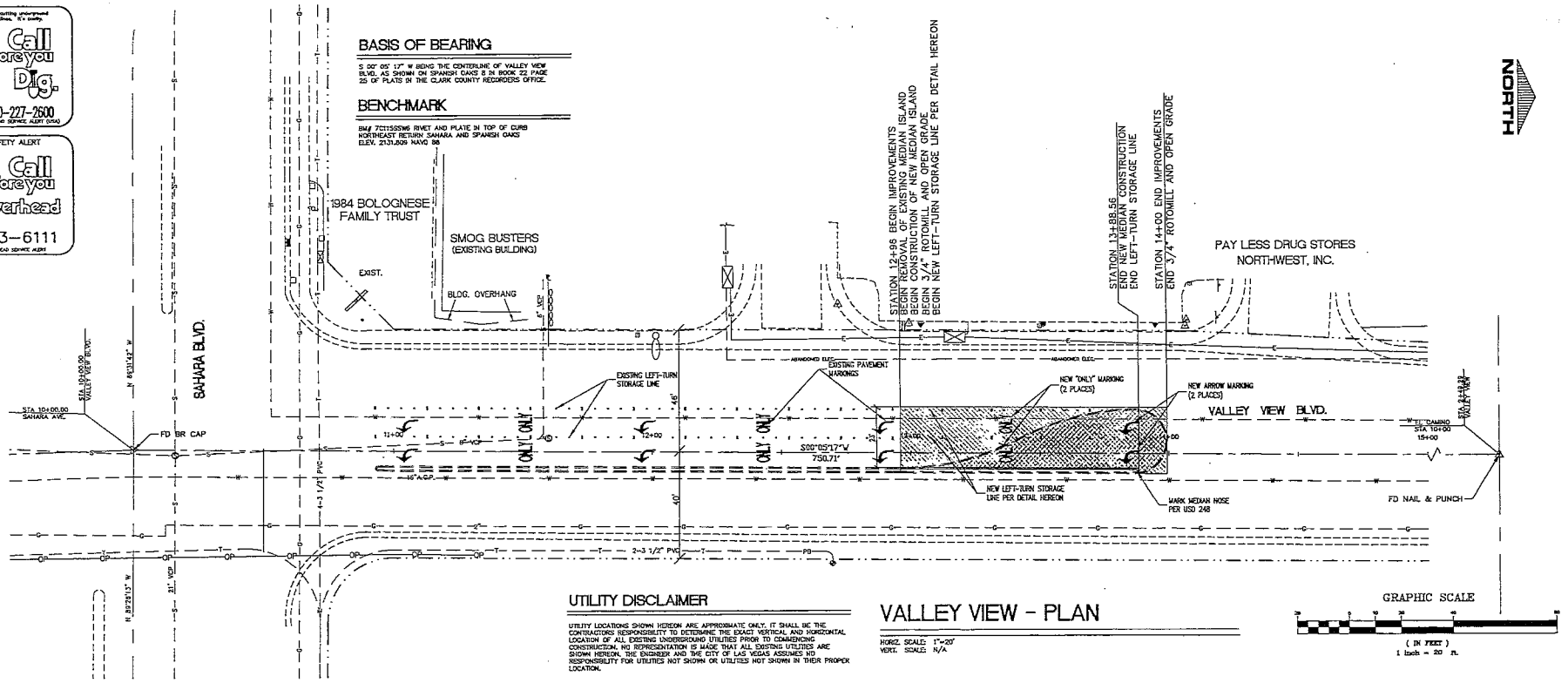
SAFETY ALERT
Call before you Overhead
593-6111
OVERHEAD SERVICE ALERT

BASIS OF BEARING

S 00° 05' 17" W BEING THE CENTERLINE OF VALLEY VIEW BLVD. AS SHOWN ON SPANISH OAKS 8 IN BOOK 22 PAGE 25 OF PLATS IN THE CLARK COUNTY RECORDERS OFFICE.

BENCHMARK

BM# 7C1152SW6 RIVET AND PLATE IN TOP OF CURB NORTHEAST RETURN SAHARA AND SPANISH OAKS ELEV. 2131.809 NAVD 88



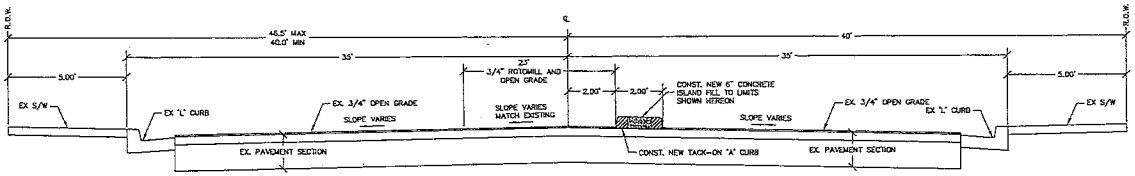
UTILITY DISCLAIMER

UTILITY LOCATIONS SHOWN HEREON ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTORS 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 AND THE CITY OF LAS VEGAS ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR UTILITIES NOT SHOWN IN THEIR PROPER LOCATION.

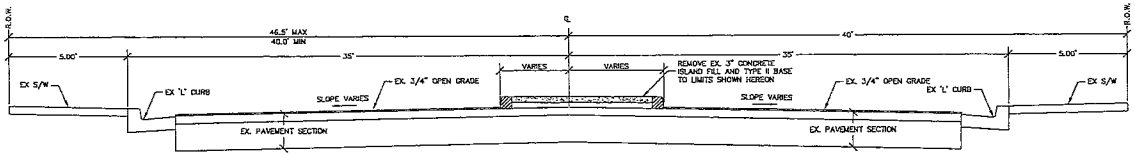
VALLEY VIEW - PLAN

HORZ. SCALE: 1"=20'
VERT. SCALE: N/A

GRAPHIC SCALE
(IN FEET)
1 inch = 20 ft.



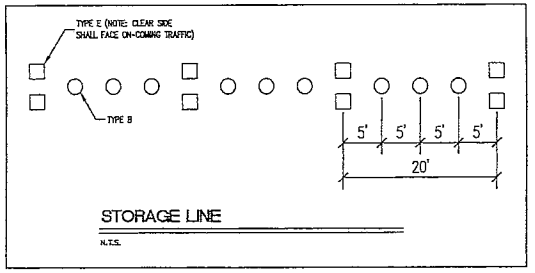
M NEW MEDIAN SECTION
N.T.S.



M EXISTING MEDIAN SECTION
N.T.S.

HATCH LEGEND

- MEDIAN ISLAND REMOVAL
- 3/4" ROTOMILL AND OPEN GRADE



STORAGE LINE
N.T.S.

DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION
ACTING CITY ENGINEER: JERRY WALKER, P.E.
PROJECT MANAGER: ED METTENSTROM, P.E.
DESIGNED BY: MAS
DRAWN BY: MAS
CHECKED BY: EGN
HORIZONTAL SCALE: 1"=20'
VERTICAL SCALE: N/A
DATE: 01/01/00

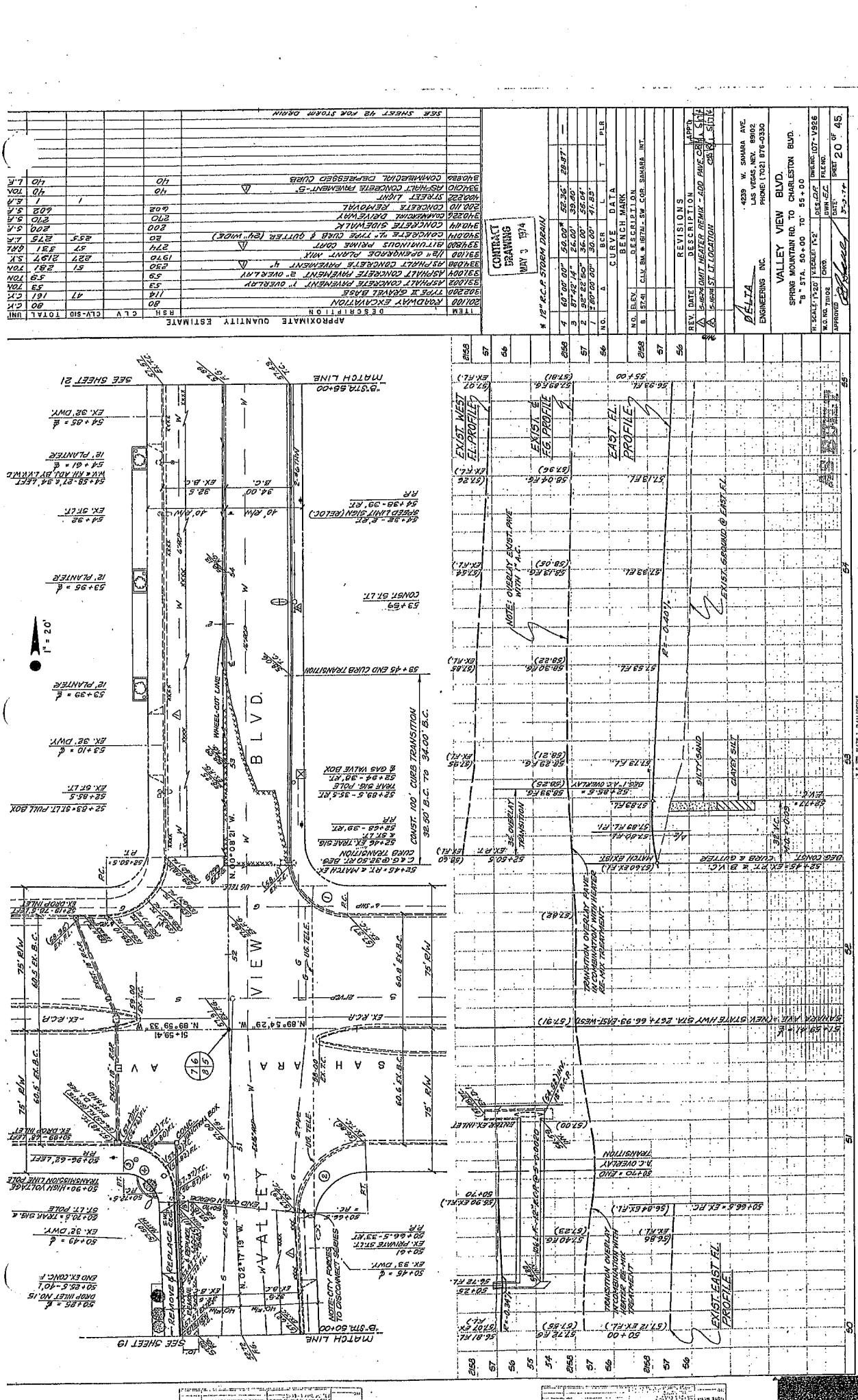
NO.	DATE:	DESCRIPTION	APP'D
		REVISIONS	

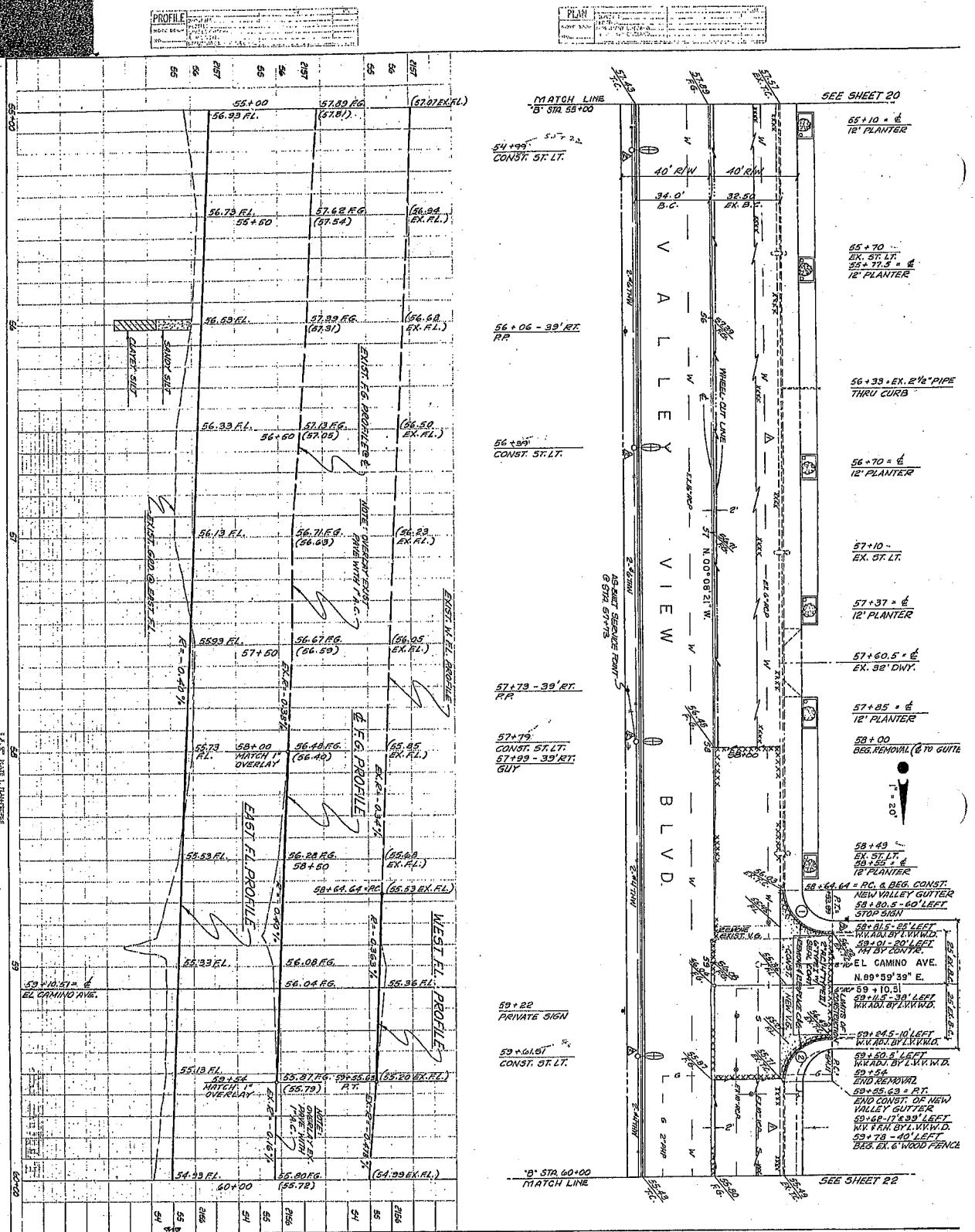
TITLE: VALLEY VIEW STORM DRAIN PHASE 1 - UPPER SYSTEM

SHEET: VALLEY VIEW AT SAHARA MEDIAN ADJUSTMENT

Sheet D-3
9 of 9
DRAWING NO. 327-V259
BID# 00.1730.21

25747


CONTRACT DRAWING
MAY 3 1974
* 18" R.C.P. STORM DRAIN
CURVE DATA
BENCH MARK
DESCRIPTION
REVISIONS
DELIA ENGINEERING INC.
4239 W. SAHARA AVE.
LAS VEGAS, NEV. 89102
PHONE (702) 876-0339
VALLEY VIEW BLVD.
SPRING MOUNTAIN RD. TO CHARLESTON BLVD.
"B" STA. 50+00 TO 55+00
SHEET 20 OF 45
SEE SHEET 12 FOR STORM DRAIN
SEE SHEET 21
SEE SHEET 19
MATCH LINE
EXIST. WEST EL. PROFILE
EXIST. EG. PROFILE
EAST EL. PROFILE
EXIST. EAST EL. PROFILE
EXIST. GROUND @ EAST EL.
NOTE: OVERLAY EXIST. A.C. WITH 1" A.C.
TRANSITION OVERLAY AVE. IN COMBINATION WITH HEATER RE-MIX TREATMENT
CONST. 100' C.R. TRANSITION
CONST. 150' C.R. TRANSITION
CURB & GUTTER TRANSITION
CONST. 6" CURB & GUTTER
CONST. 6" SWK.
CONST. 12" SLOPED CURB
CONST. 12" SLOPED CURB & GUTTER
CONST. 12" SLOPED CURB & GUTTER TRANSITION
CONST. 6" CURB & GUTTER TRANSITION
CONST. 6" CURB TRANSITION
CONST. 6" SWK. TRANSITION
CONST. 6" SWK. & CURB TRANSITION
CONST. 6" SWK. & CURB & GUTTER TRANSITION
CONST. 6" SWK. & CURB & GUTTER
CONST. 6" SWK. & CURB
CONST. 6" SWK. & CURB & GUTTER TRANSITION
CONST. 6" SWK. & CURB



APPROXIMATE QUANTITY ESTIMATE						
ITEM	DESCRIPTION	R S H	CLV	CLV-SID	TOTAL	UNI
201.100	ROADWAY EXCAVATION	85			85	C.Y.
302.100	TYPE I GRAVEL BASE	34			34	C.Y.
302.200	TYPE II GRAVEL BASE	316		96	412	C.Y.
331.002	ASPHALT CONCRETE PAVEMENT - OVERLAY	62			62	TON
334.008	ASPHALT CONCRETE PAVEMENT - 4"	595		105	700	TON
333.500	½" PLANTMIX BITUMINOUS OPEN-GRADED SURFACE	3108		457	3565	S.Y.
340.014	CONCRETE "L" TYPE CURB & GUTTER (24" WIDE)	64		500	564	LIN.
340.319	VALLEY GUTTER	609			609	50.0
334.600	BITUMINOUS PRIME COAT	594		117	711	GAL
202.110	CONCRETE REMOVAL	188			188	50.0
512.500	ADJUST SANITARY SEWER MANHOLE		1		1	EA.
334.004	ASPHALT CONCRETE PAVEMENT- 2"	10			10	TON
400.222	STREET LIGHT			4	4	EA.

DELTA ENGINEERING INC.
4239 W. SAHARA AVE.
LAS VEGAS, NEV. 89102
PHONE: (702) 876-0350

VALLEY VIEW BLVD.
SPRING MOUNTAIN RD. TO CHARLESTON BLVD.
"B" STA. 55+00 TO 60+00

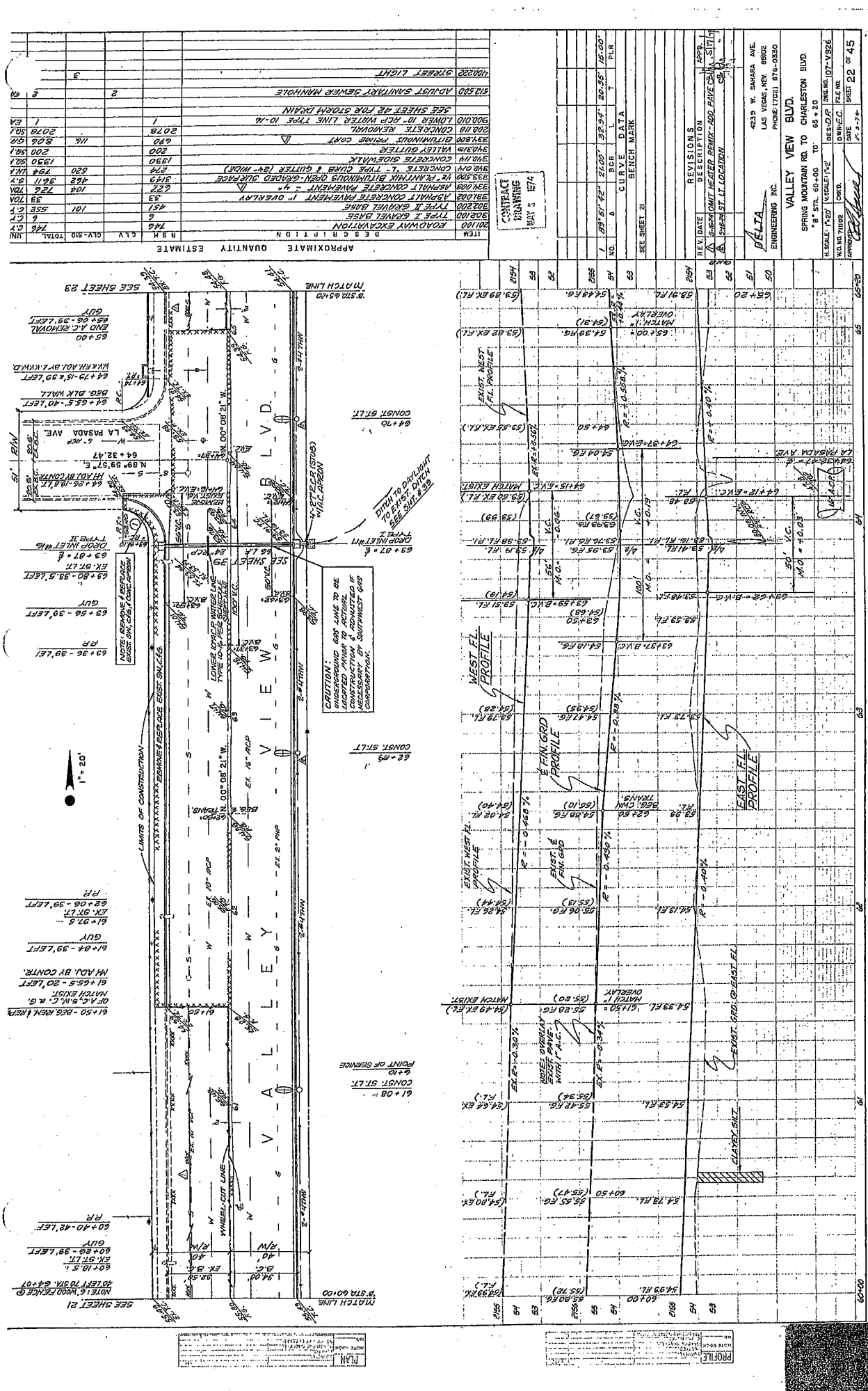
H. SCALE: 1"=20' | V. SCALE: 1"=2' | DES. OF | DWG. NO. 107-V926
CONTR. | DWN. EF | FILE NO.
APPROVED | DATE 5-1-74 | SHEET 21 OF 45

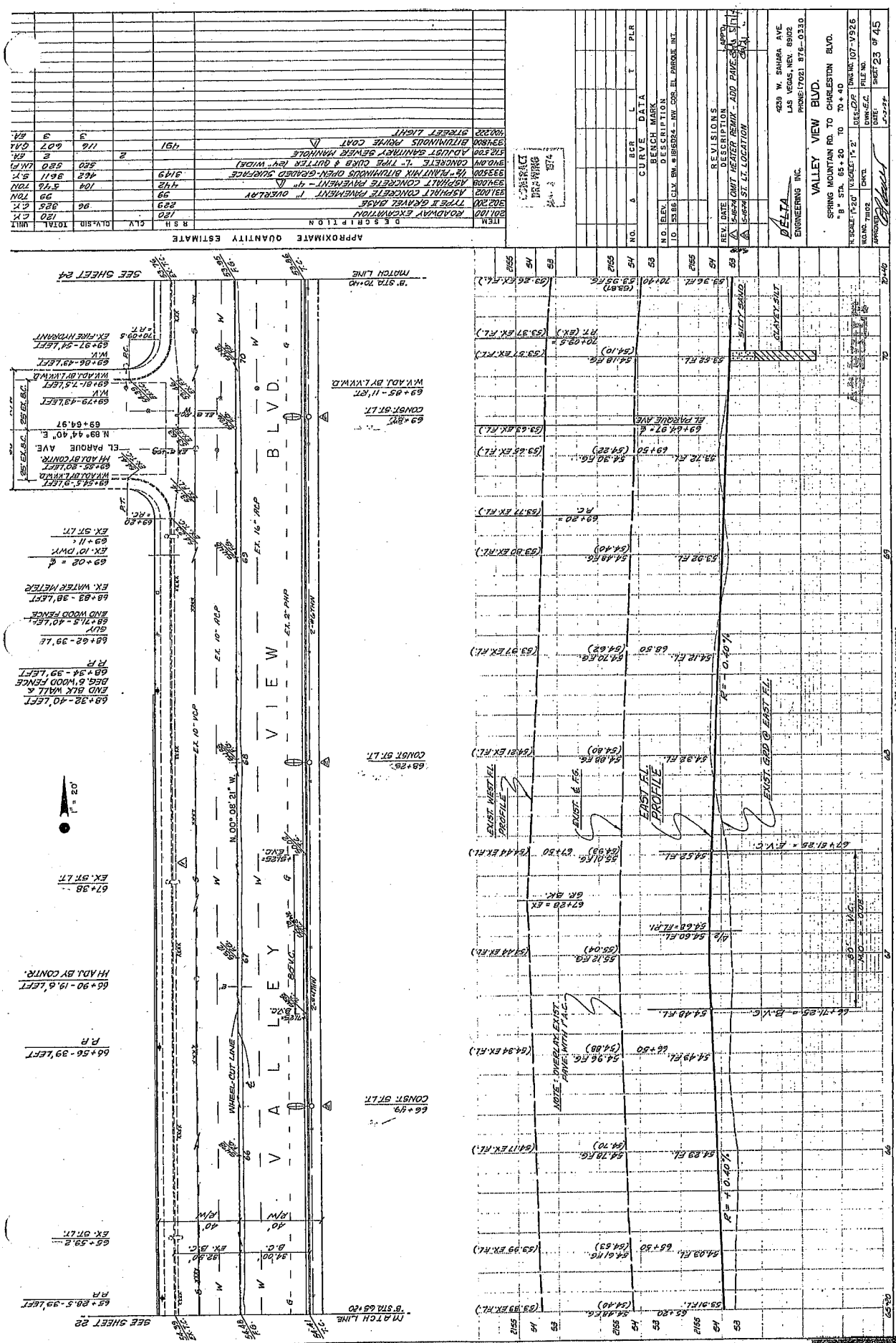
REVISIONS			
NO.	DATE	DESCRIPTION	APP'D
1	2-25-74	OMIT HEATER REMIX - ADD PAVE CRACK	
2	5-1-74	ST. LT. LOCATION	

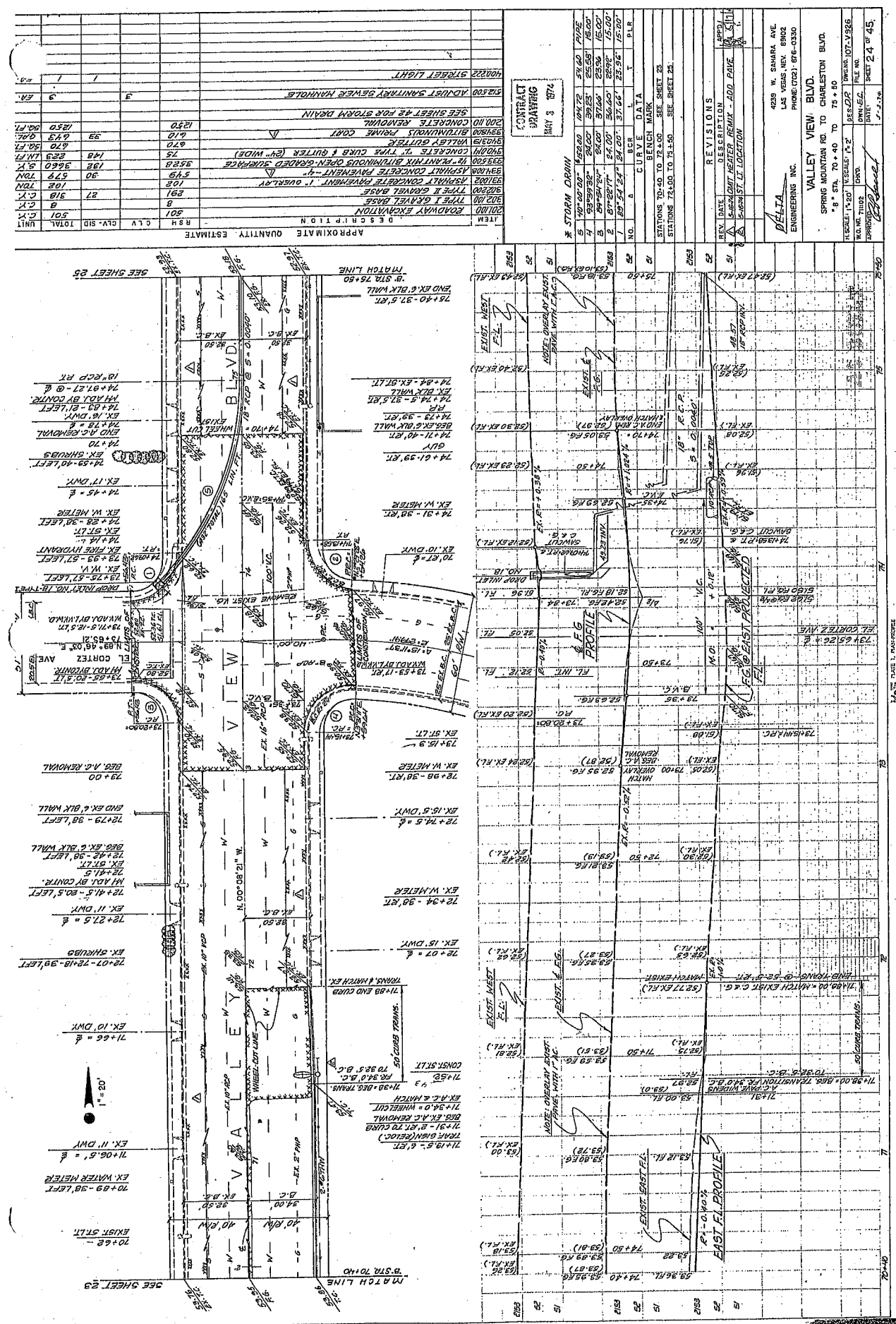
BENCH MARK			
NO.	ELEV.	DESCRIPTION	
3	3622	CLV, BM #16505 - SW COR. EL CAMINO INT.	

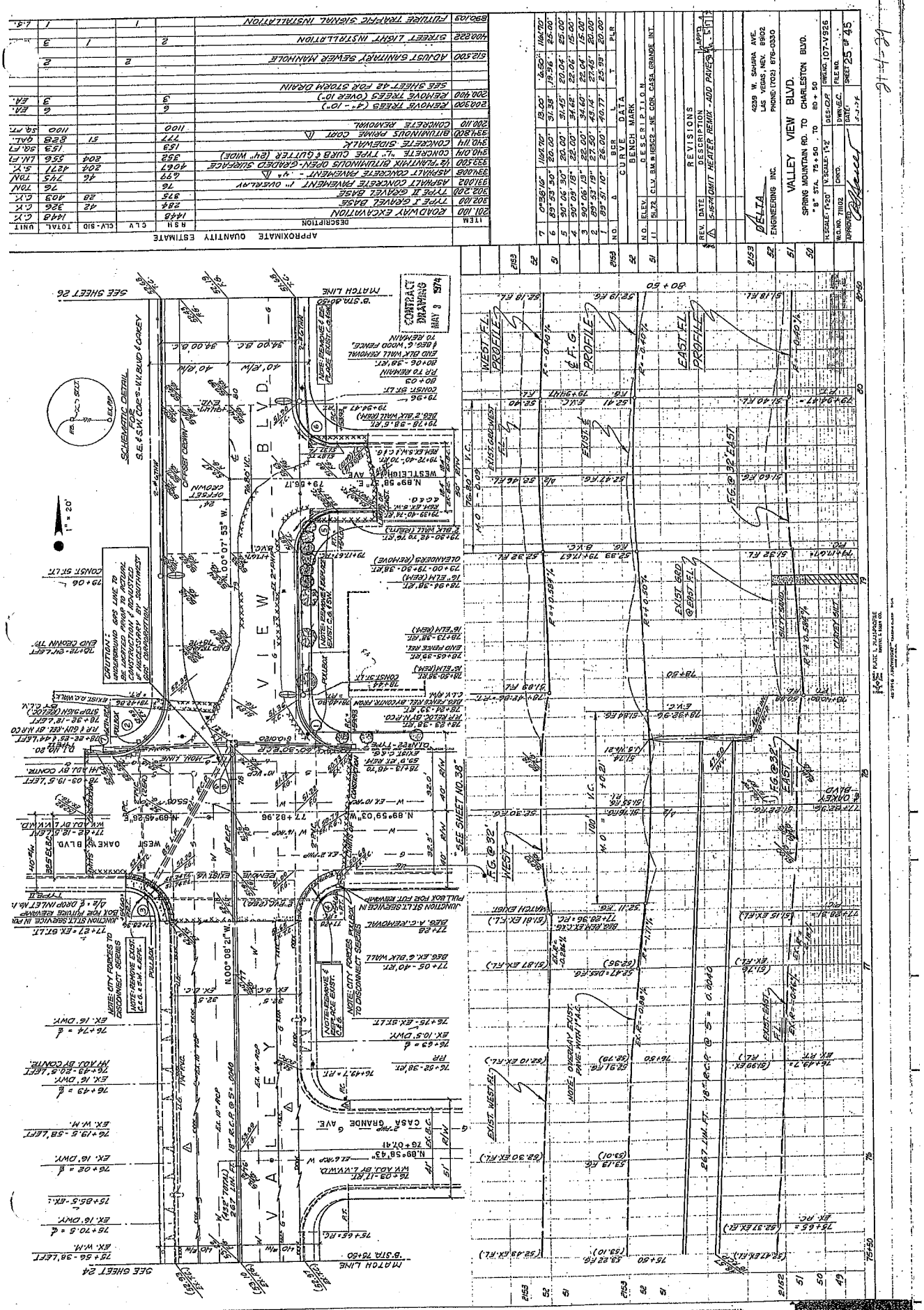
CURVE DATA				
NO.	Δ	R	L	T
1	29°52'00"	21.00'	32.54'	20.35'
2	90°05'00"	20.00'	31.46'	20.05'
				P.I.R. 15.00'

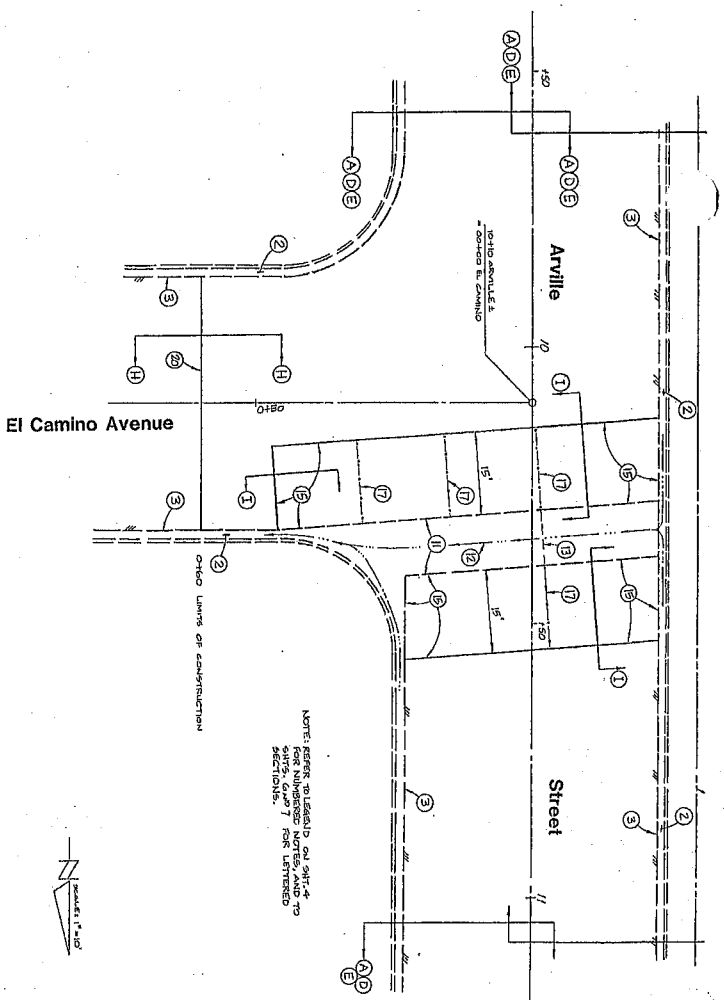
CONSTRUCTION DRAWING
APPROVED
DATE 5-1-74


APPROXIMATE QUANTITY ESTIMATE
ITEM
DESCRIPTION
R S H
C L Y
CLY-BD
TOTAL
UNIT
201100 ROADWAY EXCAVATION 746 C.Y.
302100 TYPE I GRAVEL BASE 6 C.Y.
302200 TYPE II GRAVEL BASE 461 556 101 C.Y.
339200 ASPHALT CONCRETE PAVEMENT 1" OVERLAY 33 TON
339208 ASPHALT CONCRETE PAVEMENT - 4" 622 TON
339300 12" PLANTMIX BITUMINOUS OPEN-GRADED SURFACE 3149 462 5611 S.Y.
390.014 CONCRETE "L" TYPE CURB & GUTTER (24" WIDE) 274 620 794 LN.FT.
390.019 VALLEY GUTTER 200 200 S.Y.
390.044 CONCRETE SIDEWALK 1390 1390 S.Y.
390.045 12" PLANTMIX BITUMINOUS OPEN-GRADED SURFACE 690 116 806 S.Y.
390.100 CONCRETE "L" TYPE CURB & GUTTER (24" WIDE) 2078 2078 LN.FT.
390.110 CONCRETE RENEWAL 2078 SQ.FT.
390.210 LOWER 10" ACP WATER LINE TYPE 10-16 1 1 EA.
SEE SHEET 42 FOR STORM DRAIN
416.500 ADJUST SANITARY SEWER MANHOLE 2 2 EA.
416222 STREET LIGHT 3 EA.
CONTRACT DRAWING MAY 3 1974
CURVE DATA
BENCH MARK
SEE SHEET 21
NO. Δ BCR L T PLR
1 29°51'42" 21.00' 32.94' 20.35' 15.00'
REVISIONS
REV. DATE DESCRIPTION APPD.
5/14/74 OMIT HEATER REMIX-ADD PAVE CS
6/24/74 ST. LT. LOCATION CS
DELTA ENGINEERING INC.
4239 W. SAHARA AVE.
LAS VEGAS, NEV. 89102
PHONE (702) 876-0350
VALLEY VIEW BLVD.
SPRING MOUNTAIN RD. TO CHARLESTON BLVD.
"B" STA. 60+00 TO 65+20
H. SCALE 1"=20' V. SCALE 1"=2'
W.O. NO. 711102
DES. D.A.P.
DWN. E.C.
CHK'D.
APPROVED
DATE 2-74
DWG. NO. 107-V926
FILE NO.
SHEET 22 OF 45
SEE SHEET 23
SEE SHEET 21
SEE SHEET 39
MATCH LINE
VALLEY VIEW BLVD.
LA PASADA AVE.
HAL APRON
DITCH TO DAYLIGHT TO EXIST. DITCH SEE SHT. #39
CONST. STK.
CAUTION: UNDERGROUND GAS LINE TO BE EXPOSED BY HAND BY CONTRACTOR & ADJUSTED IF NECESSARY BY SOUTHWEST GAS CORPORATION.
LIMITS OF CONSTRUCTION
REMOVE EXIST. SIDEWALK
LOWER 10"ACP WATER LINE TYPE 10-16 PER SPECIFICATIONS
WHEEL-CUT LINE
EXIST. WEST FL. PROFILE
EXIST. E FIN. GRD PROFILE
EAST FL. PROFILE
EXIST. GRD. @ EAST FL.
CLAY & SILT
NOTES: OVERLAY EXIST. PAVE. WITH 1" A.C.
MATCH EXIST.
MATCH 1" OVERLAY
POINT OF SERVICE
NOTE: REMOVE & REPLACE EXIST. SW. CONC. AS REQ'D.
NOTE: 6' WOOD FENCE @ 40' LEFT 70 STA. 64+07
PLAN
PROFILE


APPROXIMATE QUANTITY ESTIMATE
ITEM | DESCRIPTION | R S H | CLV | QUANTITY | TOTAL | QUANTITY | UNIT
201.100 | ROADWAY EXCAVATION | | | 120 | 120 | | C.Y.
302.200 | TYPE II GRAVEL BASE | | | 229 | 96 | | S.Y.
331.002 | ASPHALT CONCRETE PAVEMENT 1" OVERLAY | | | 99 | 99 | | TON
334.002 | ASPHALT CONCRETE PAVEMENT - 4" | | | 442 | 104 | | TON
333.500 | 1/2" PLANT MIX BITUMINOUS OPEN-GRADED SURFACE | 3149 | | | | | S.Y.
340.004 | CONCRETE 4" TYPE CURB & GUTTER (24" WIDE) | | | 920 | 920 | | LNFT
512.500 | ADJUST SANITARY SEWER MANHOLE | | 2 | 2 | 2 | | EA
334.800 | BITUMINOUS PRIME COAT | 191 | | 116 | 6.07 | 0.41 | GAL
100.222 | STREET LIGHT | | | 3 | 3 | | EA
DELTA ENGINEERING INC. 4239 W. SAHARA AVE. LAS VEGAS, NEV. 89102 PHONE: (702) 876-0330
VALLEY VIEW BLVD. SPRING MOUNTAIN RD. TO CHARLESTON BLVD. "B" STA. 65+20 TO 70+40
H. SCALE 1"=20' V. SCALE 1"=2' DES. DRWN. CHK'D. APPROVED
DWG. NO. 107-V926 FILE NO. DATE 1-3-74 SHEET 23 OF 45
REVISIONS: NO. | DATE | DESCRIPTION | APP'D. — 1 | 5-14-74 | OMIT HEATER REMIX - ADD PAVEMENT | CMH — 2 | 5-16-74 | ST. LT. LOCATION | CMH
NO. | Δ | BCR | L | T | PLR
CURVE DATA
BENCH MARK
NO. ELEV. DESCRIPTION
1 | 53.86 | CLV RIM, #18/8074 - NW COR. EL PARQUE INT.
SEE SHEET E4
MATCH LINE "B" STA. 70+40
SEE SHEET E2
MATCH LINE "B" STA. 65+20
VALLEY VIEW BLVD.
EX. 16" RCP
EX. 10" RCP
EX. 2" PHP
WHEEL CUT LINE
N. 00° 08' 12" W.
EL. PARQUE AVE.
N. 89° 44' 40" E.
69+64.97
CONST. ST. LT.
EX. ST LT.
EX. DWY.
EX. WATER METER
EX. FIRE HYDRANT
W.V.
W.V. ADJ. BY CONTR.
END BLK WALL & WOOD FENCE
END WOOD FENCE
GUY
EXIST. WEST EL. PROFILE
EXIST. 16' F.G.
EAST EL. PROFILE
EXIST. GRD @ EAST EL.
NOTE: OVERLAY EXIST. PAVE. WITH 1" A.C.
R = - 0.40%
R = + 0.40%
E.V.C.
B.V.C.
A/2
A/2
A/2


APPROXIMATE QUANTITY ESTIMATE
ITEM
DESCRIPTION
UNIT
CLY
CLY-SID
TOTAL
ROADWAY EXCAVATION
TYPE I GRAVEL BASE
TYPE II GRAVEL BASE
ASPHALT CONCRETE PAVEMENT 1" OVERLAY
ASPHALT CONCRETE PAVEMENT 4"
4" PERMANENT BITUMINOUS OPEN-GRADED SURFACE
12" PERMANENT BITUMINOUS OPEN-GRADED SURFACE
CONCRETE 6" TYPE CURB & GUTTER (24" WIDE)
VALLEY GUTTER
CONCRETE REMOVAL
BITUMINOUS PRIME COAT
SEE SHEET 4E FOR STORM DRAIN
ADJUST SANITARY SEWER MANHOLE
STREET LIGHT
CONTRACT DRAWING
* STORM DRAIN
CURVE DATA
BENCH MARK
STATIONS 70+40 TO 72+00 SEE SHEET 23
STATIONS 73+00 TO 75+80 SEE SHEET 25
REVISIONS
DELTA ENGINEERING INC.
4239 W. SAHARA AVE. LAS VEGAS, NEV. 89102 PHONE: (702) 876-0330
VALLEY VIEW BLVD.
SPRING MOUNTAIN RD. TO CHARLESTON BLVD.
"8" STA. 70 + 40 TO 75 + 50
SHEET 24 OF 45
SEE SHEET 23
SEE SHEET 25
MATCH LINE
EL. CORTEZ AVE
EXIST. WEST F.L.
EXIST. E.P.G.
EXIST. EAST F.L.
E.P.G. PROFILE
EAST F.L. PROFILE
1" = 20'

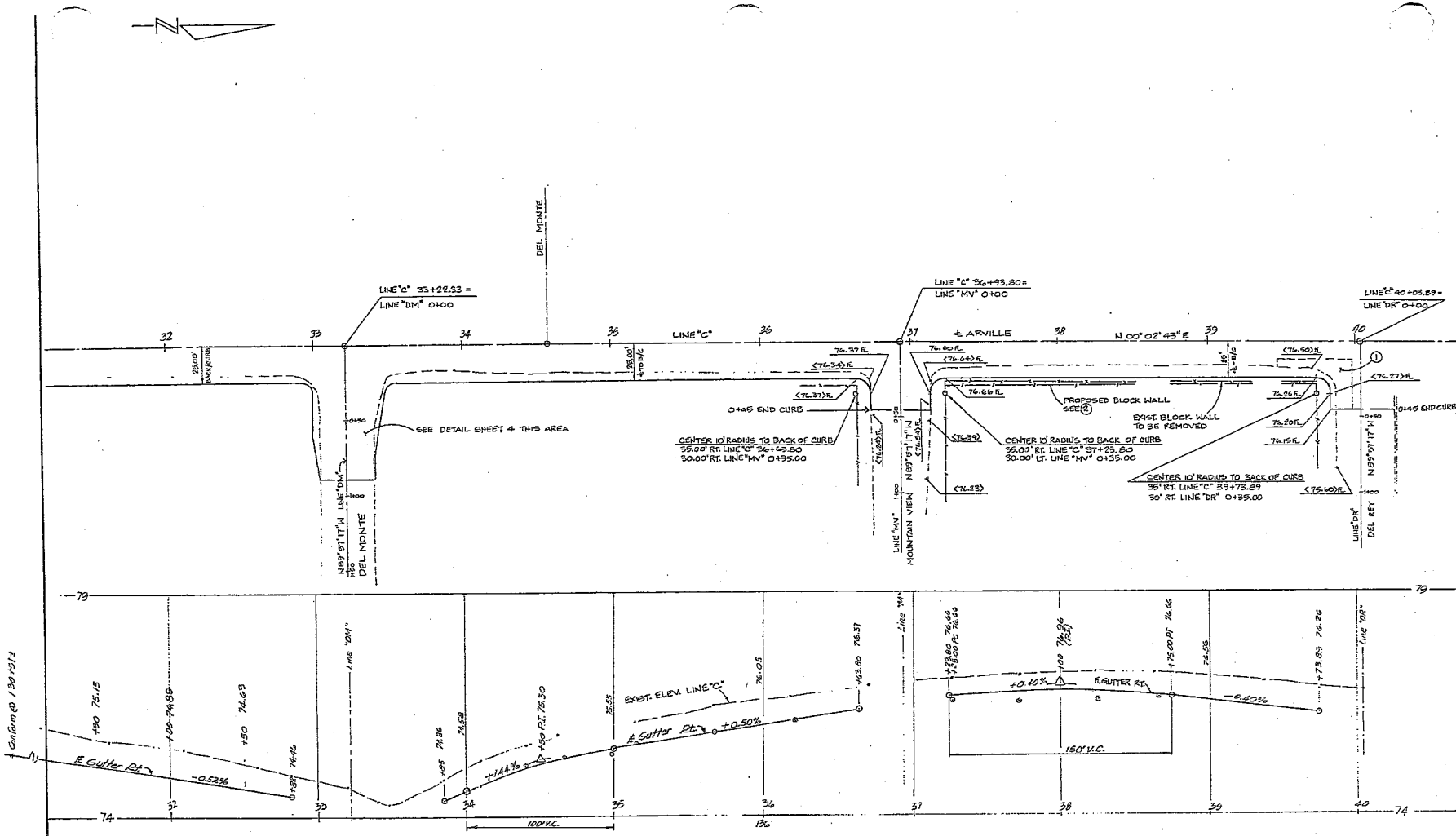

APPROXIMATE QUANTITY ESTIMATE
ITEM
DESCRIPTION
UNIT
TOTAL
CLV-SID
CLV
R.S.H.
FUTURE TRAFFIC SIGNAL INSTALLATION
STREET LIGHT INSTALLATION
ADJUST SANITARY SEWER MANHOLE
SEE SHEET-42 FOR STORM DRAIN
REMOVE TREES (4"- 10")
REMOVE TREES (OVER 10")
CONCRETE REMOVAL
BITUMINOUS PRIME COAT
CONCRETE SIDEWALK
CONCRETE "L" TYPE CURB & GUTTER (24" WIDE)
ASPHALT CONCRETE PAVEMENT "I" OVERLAY
ASPHALT CONCRETE PAVEMENT - "A"
TYPE II GRAVEL BASE
TYPE I GRAVEL BASE
EXCAVATION
ROADWAY
SCHEMATIC DETAIL
S.E. & S.W. CORNERS - W. BLVD. & CASEY
CONTRACT DRAWING
MAY 8 1974
MATCH LINE
SEE SHEET 26
SEE SHEET 24
SEE SHEET NO. 38
WEST VIEW BLVD.
VALLEY VIEW BLVD.
WEST OAKEY BLVD.
CASEY AVE.
CASA GRANDE AVE.
WESTLEIGH AVE.
EXISTING WEST F.L. PROFILE
E.F.G. PROFILE
EXISTING EAST F.L. PROFILE
F.G. @ 32' WEST
F.G. @ 32' EAST
EXIST. 60D @ EAST F.L.
CAUTION: UNDERGROUND GAS LINE TO BE LOCATED PRIOR TO ANY EXCAVATION IF NECESSARY PLAY SOUTHWEST
CONST. SIDEWALK
CONST. GUTTER
CONST. 2' CURB & GUTTER
CONST. 3' CURB & GUTTER
CONST. 5' CURB & GUTTER
CONST. 6' CURB & GUTTER
CONST. 8' CURB & GUTTER
CONST. 10' CURB & GUTTER
CONST. 12' CURB & GUTTER
CONST. 14' CURB & GUTTER
CONST. 16' CURB & GUTTER
CONST. 18' CURB & GUTTER
CONST. 20' CURB & GUTTER
CONST.



Department of Public Works			
EL CAMINO AVENUE INTERSECTION	ARVILLE STREET REHABILITATION		
Scale (h) 1" = 10'-0"	Scale (v)	W.A.	
Fld. bk. no.	Date MAY 1990		
Design by C. E. GILPIN	Drawn by		
Drawing no. 107-V175	38		Revisions

12-3-124

J-31-90



(1) ENGINEER TO OUTLINE LIMITS OF R&R AFTER CONSTRUCTION OF CURB & GUTTER.

(2) TOP OF WALL FOOTING TO BE AT OR BELOW FLOWLINE ELEV. OF CURB AND GUTTER AT ALL POINTS.

(76.50) SIGNIFIES EXISTING ELEVATION

76.26 SIGNIFIES PROPOSED ELEVATION

Department of Public Works

Arville Street Rehabilitation

Curb and Gutter Location and Profile

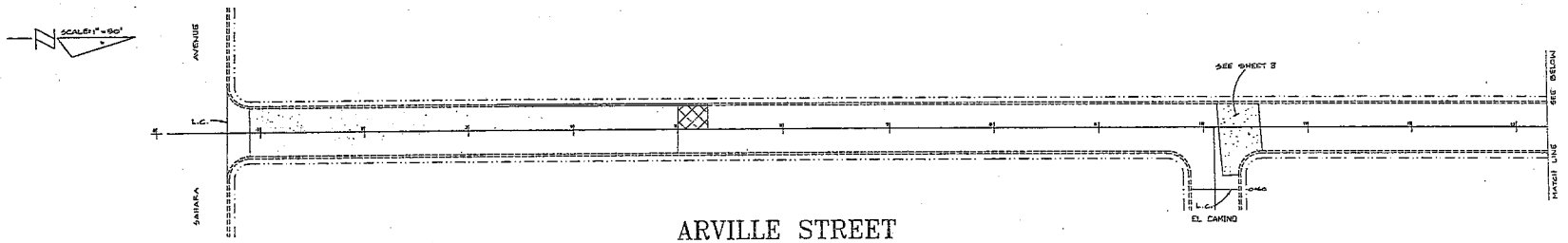
Scale (h) 1"=50' | Scale (v) 1"=1' | W.A.

Fld. bk. no. | Date | Drawn by | Date

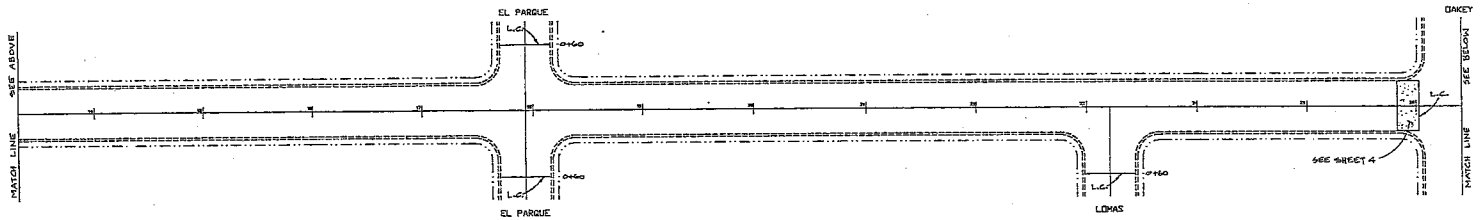
Design by | Approved by

Revisions

Drawing no. 107-V1751 4A / 8



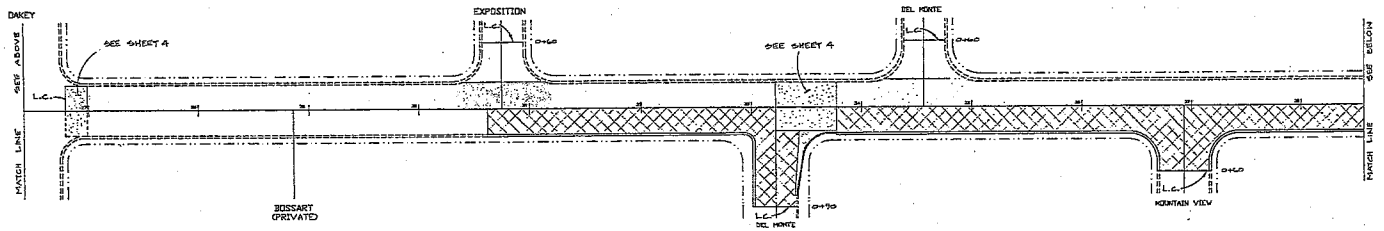
ARVILLE STREET



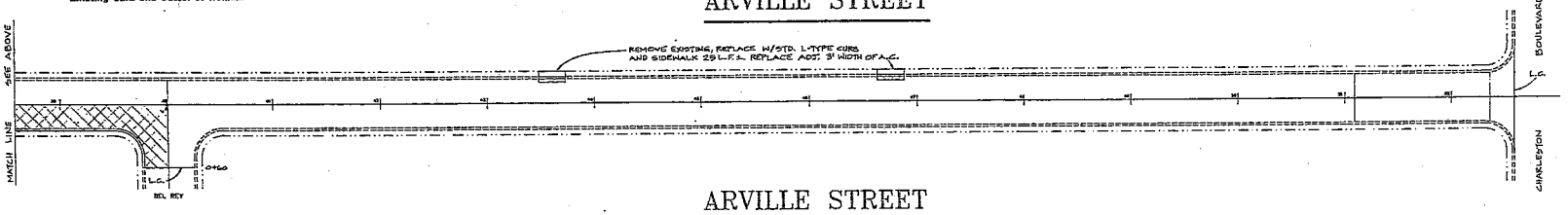
ARVILLE STREET

LEGEND

- Remove and Replace A.C.
- Patch Cracking, Overlay Existing Pavement with Geotechnical Fabric and Asphaltic Concrete
- Widen and Overlay
- L.C. Limits of Construction
- New Curb and Gutter
- Existing Curb and Gutter to Remain



ARVILLE STREET



ARVILLE STREET

DEPARTMENT OF PUBLIC WORKS

SHEET: PLAN SHEET

PROJECT: ARVILLE STREET REHABILITATION

ENGINEERING DESIGN DIVISION

CITY ENGINEER: GARY A. PRESSWOOD, P.E.
DIVISION CHIEF: E. L. GILPIN, P.E.
PROJECT ENGINEER: BRUCE R. WALSH, P.E.

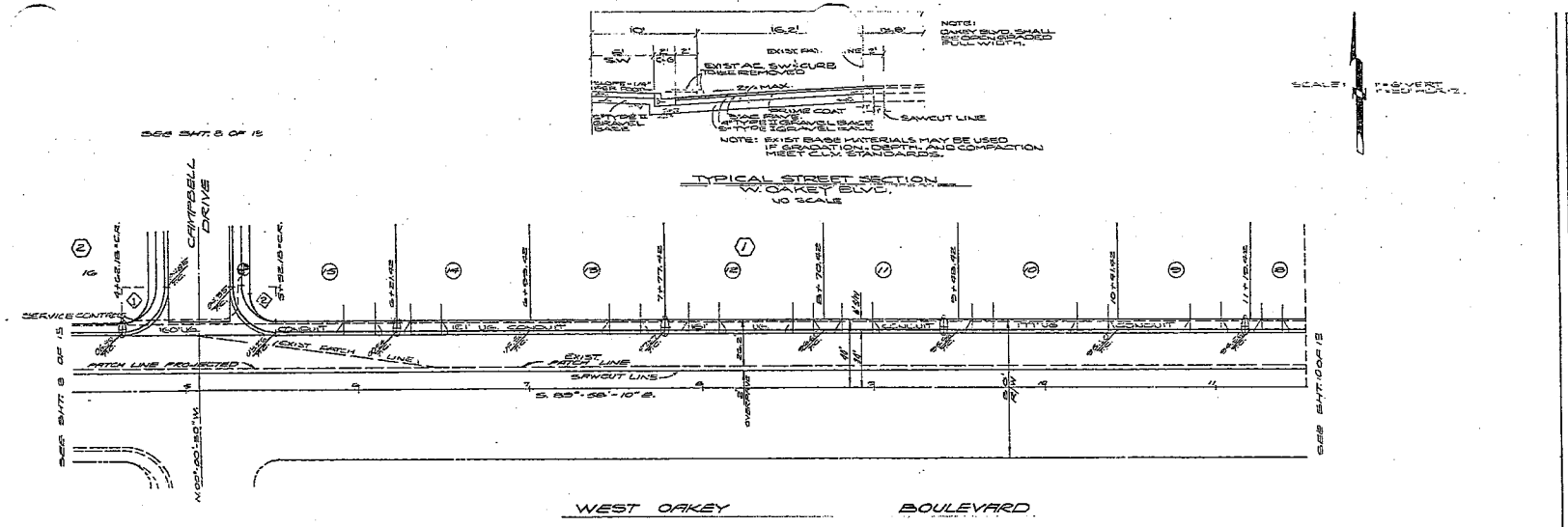
SCALE (H) 1"=50' | SCALE (V) N/A | DATE MAY 1990 | DESIGN BY BPW | W.A. # WU9025 | FED. RR. # N/A

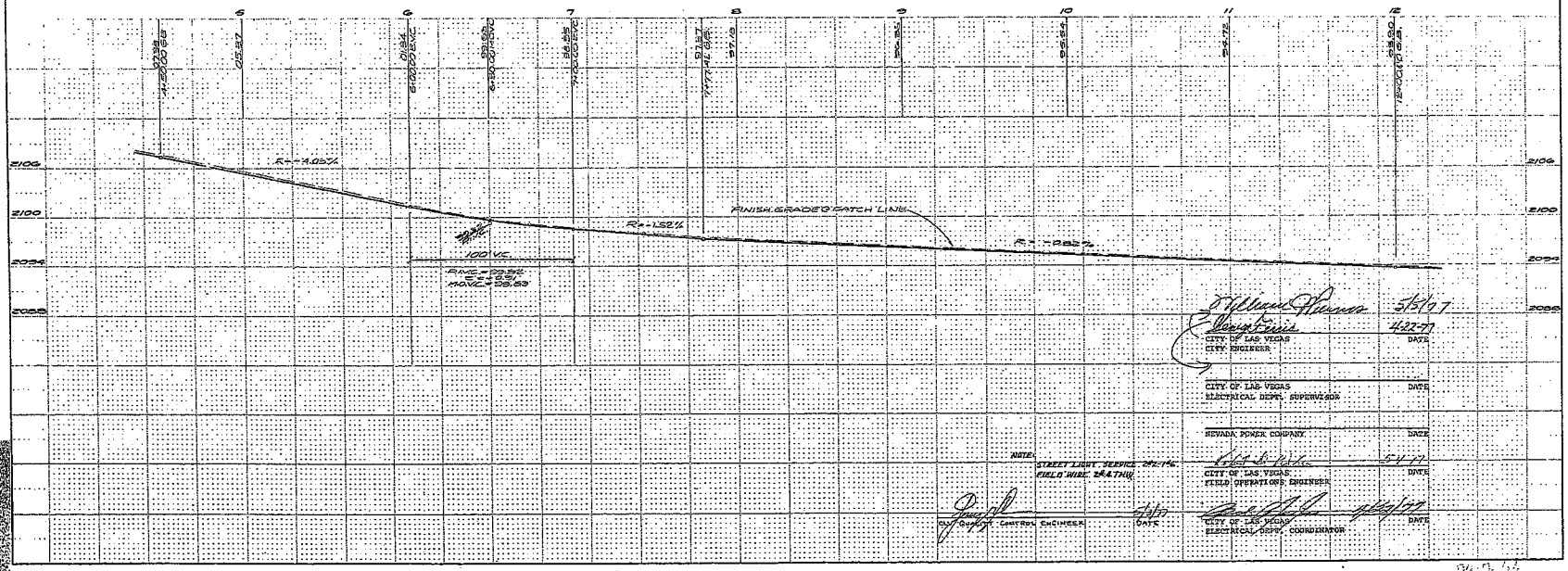
REVISIONS

DRAWING NO. 107-V1751 | 2/8

5-31-90

16 3-163





NOTE:
STREET LIGHT SERVICE CBL. #6
FIELD WIRE 2#4 THW

	CITY OF LAS VEGAS CITY ENGINEER	DATE
	CITY OF LAS VEGAS ELECTRICAL DEPT. SUPERVISOR	DATE
	NEVADA POWER COMPANY	DATE
	CITY OF LAS VEGAS FIELD OPERATIONS ENGINEER	DATE
	CITY OF LAS VEGAS ELECTRICAL DEPT. COORDINATOR	DATE

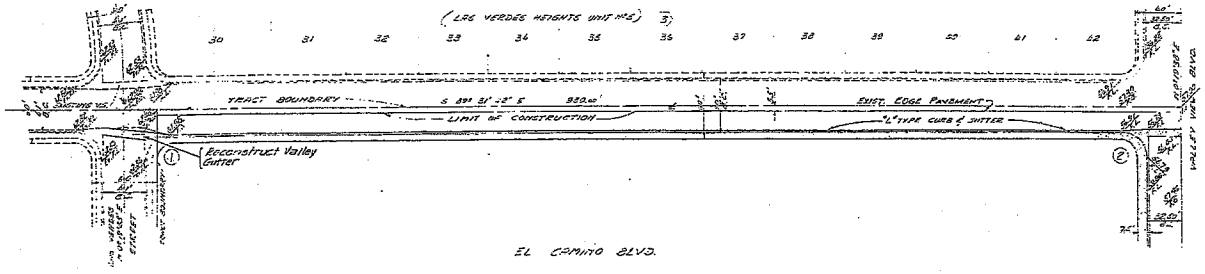
McNEIL MANOR TRACT-3
B.J.A. DEVELOPMENT OF NEVADA
STREET IMPROVEMENTS
WEST OAKEY BOULEVARD
LAS VEGAS, NEVADA

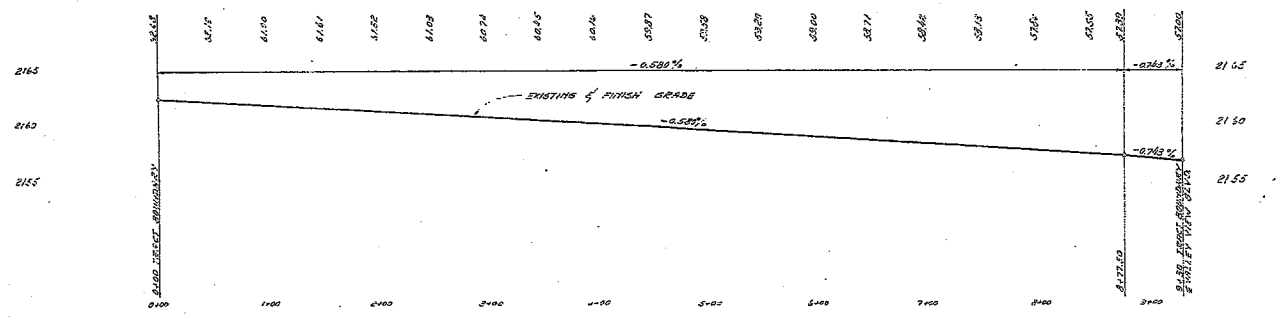
SPARKS, NEVADA
LAS VEGAS, NEVADA
SEATTLE, WASHINGTON
incorporated
ENGINEERS/PLANNERS
ARCHITECTS

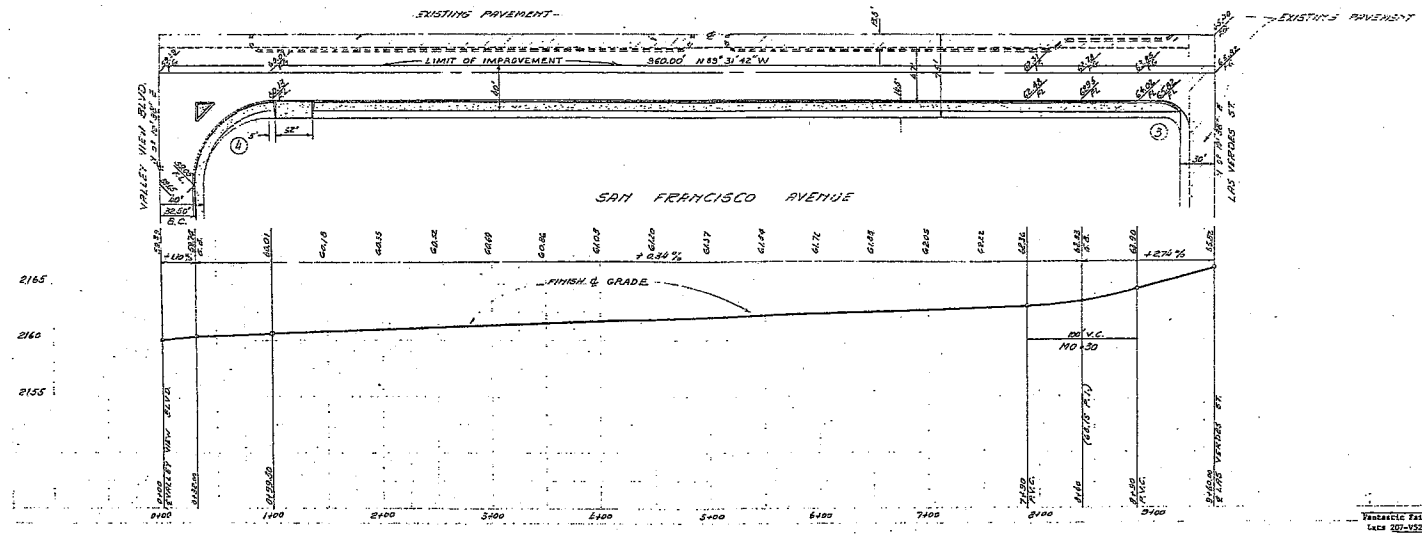
JOB NO.	2-015-004-7603
DESIGNED	HOLT
DRAWN	MS
COMP.	WDJ
CHECKED	
DATE	MARCH, 1977
SHEET NO.	9

9 OF 13 SHEETS

1079-2110-3







HORIZ. SCALE 1" = 50'
VERT. SCALE 1" = 5'

APPROVALS

CITY ENGINEER — DATE 7/10/62

FIELD ENGINEER — DATE 7-24-62

REV.	DATE	DESCRIPTION	BY	APPR.
A	9-10-62	LOWERED & RAISE SAN FRANCISCO AVE.		

LAS VERDES HEIGHTS
COMMERCIAL PROPERTY

STREET PLAN & PROFILE

DESIGNED E.B. | DRAWN E.B. | CHECKED

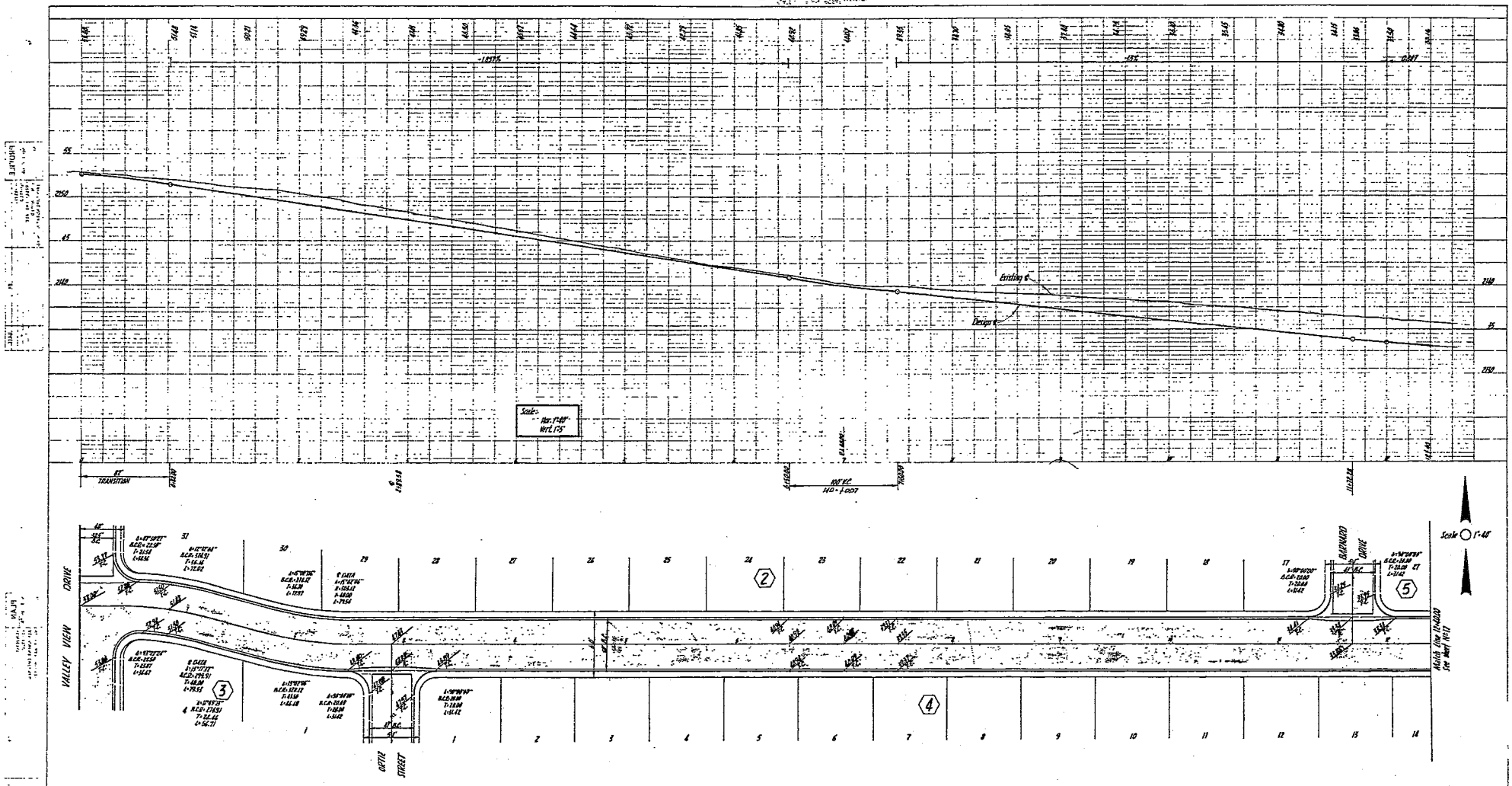
WESTERN ENGINEERS, INC.
LAS VEGAS NEVADA

APPROVED — DATE 7-24-62

SHEET 1 OF 3

Pacific Gas (Gov Gardens Rd)
Lacs 207-V52, Sewer 307-V299, Water 565-51

107-V1/72
34-66



EL CORTEZ AVENUE

Charles D. Lawver
R.C.E. #7333

	E.S.U. REVISED		
NO.	DATE	REVISIONS	BY / DATE / CLIENT APPROVAL

BUSINESS ENGINEERING ARCHITECTURE MANAGEMENT, INC.
LAS VEGAS, NEVADA — ALBUQUERQUE, NEW MEXICO

CLIENT APPR. DATE

DRAWN BY — CHECKED BY

SUB. SPEC. — SCALE

WESTWOOD VILLAGE
STREET PLAN & PROFILE

TRACT 1 — UNIT 1 — SHEET 16 OF 23

DRAWING NO.

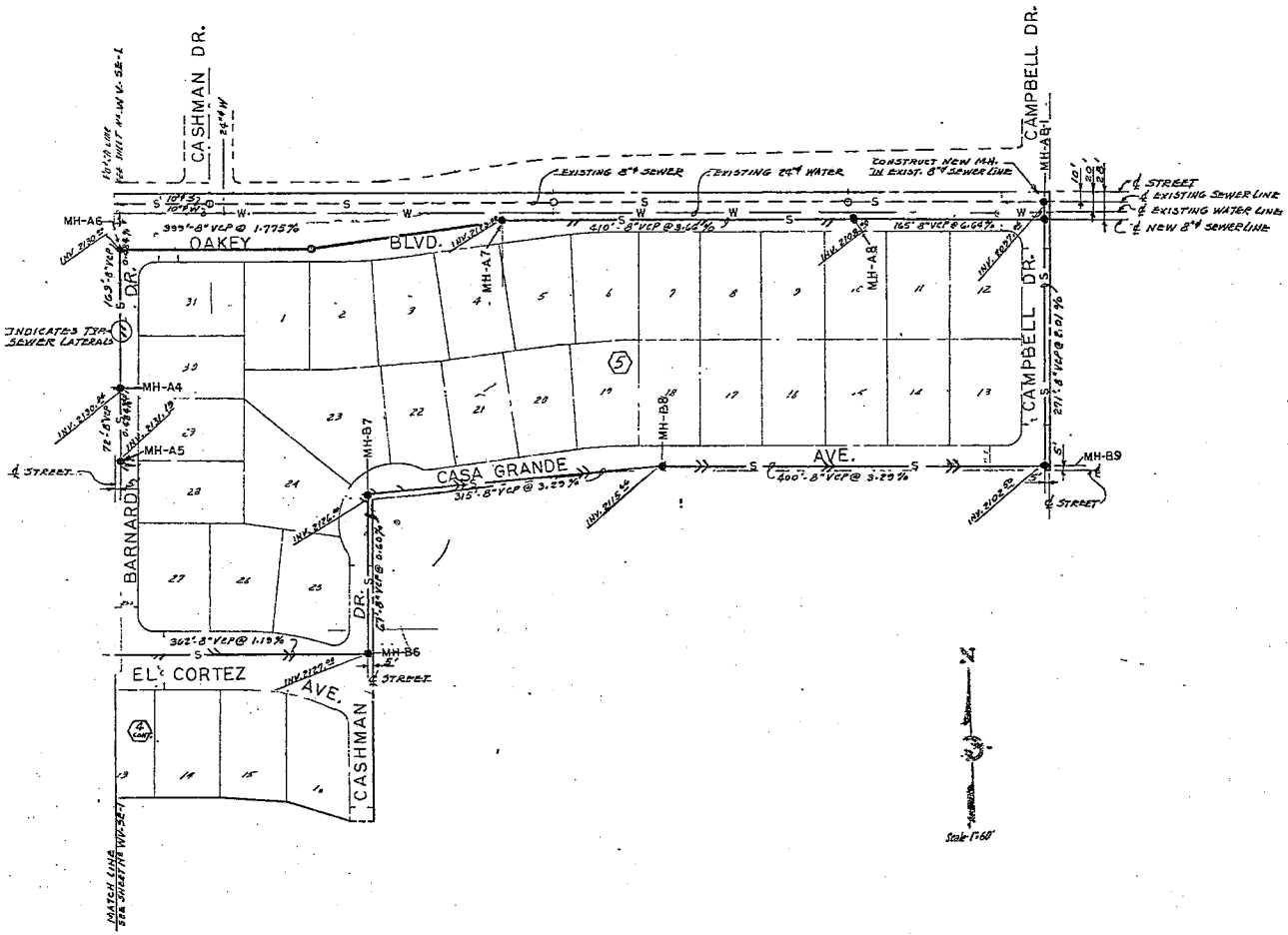
beam, inc. — WVPP-ST-2

El Cortez 0+00 to 12+10

10TY-3330-1

L. K. Lawver — CITY ENG — 6-13-63 DATE

James A. Rankin 6-13-63



NOTE:-
1. FOR SEWER LINE PLAN SHEET #1, REFERENCE DRAWING LIST, SPECIFICATIONS & MATERIAL LIST SEE DRWG No WV-SE-1

APPROVALS

CITY ENGINEER	1-19-43 DATE
SANITATION DEPT.	5-21-43 DATE

ENGINEER
CHAS. D. MERCER R.C.E. NEV. #1535

4/9/43 CKD.

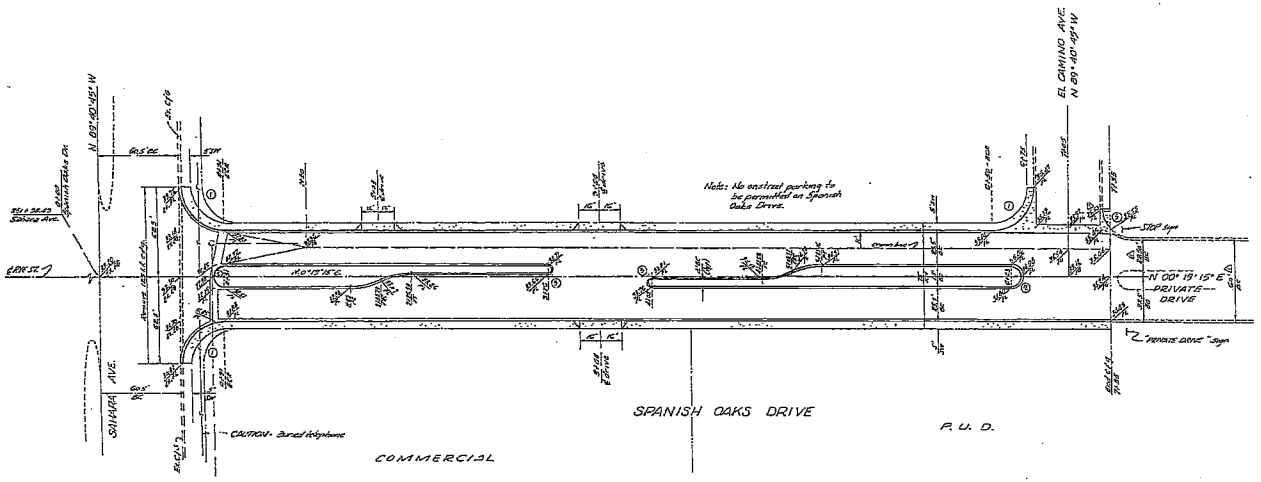
BUSINESS ENGINEERING ARCHITECTURE MANAGEMENT, INC.

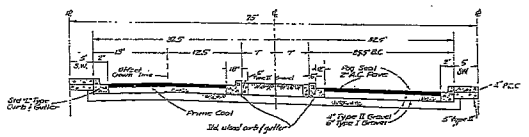
WESTWOOD VILLAGE
SEWER LINE PLAN SHEET #2
UNIT 1

beam, inc. WV-SE-2
drw# 3074-3330-1

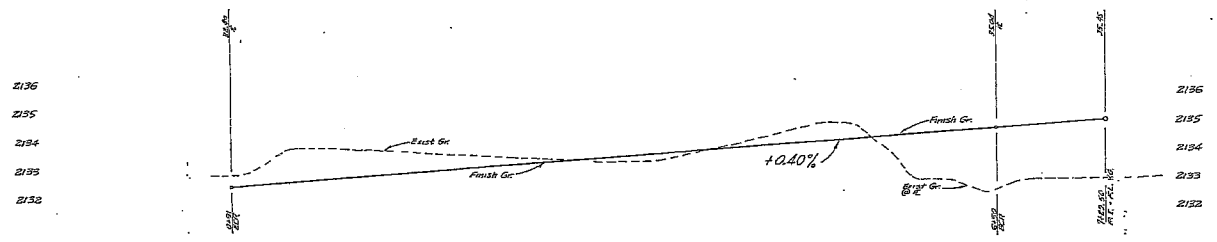
3-9-25

BUSINESS ENGINEERING ARCHITECTURE MANAGEMENT, INC.
WESTWOOD VILLAGE
SEWER PLAN & PROFILE
UNIT 1
APPLI 1
Casa Grande Ave
Barnard Dr.
BARNARD DRIVE
CASA GRANDE AVENUE
APPROVALS
City Engineer
Sanitation Dept.
ENGINEER
Chas. O. Hauser
DATE
SCALE
Scale: 1"=40'
Scale: 1"=50'
Scale: 1"=10'
Scale: 1"=5'
N
Date: 6-15-63
Date: 6-15-63
Date: 6-15-63

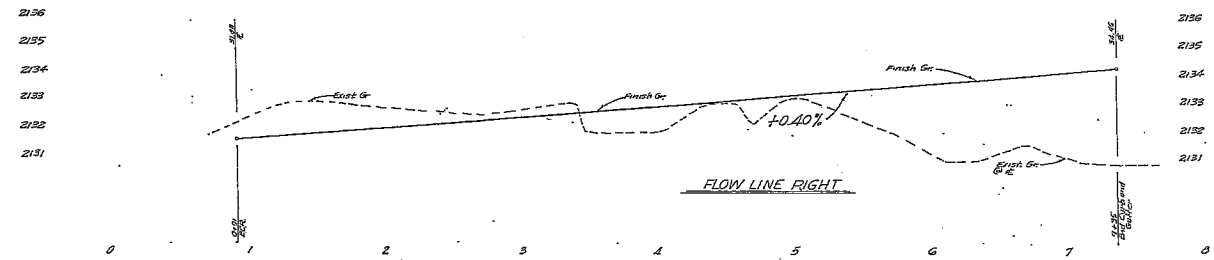




TYPICAL STREET SECTION



FLOW LINE LEFT



FLOW LINE RIGHT

0 1 2 3 4 5 6 7 8

CURVE DATA

No.	R	Δ	L
1	30.50	30°08'00"	47.91
2	7.50	180°00'00"	23.56
3	2.50	180°00'00"	7.85
4	50.00	25°59'31"	22.55
5	20.50	42°58'18"	15.37

ESTIMATE OF QUANTITIES

Remove curb & gutter -	L.S.
Curb & gutter - 24" -	1362 L.f.
Curb & gutter - 18" -	1058 L.f.
Sidewalk -	6810 S.f.
Valley gutter -	866 S.f.
2" AC pave -	3034 S.f.

BENCH MARK:
C.L.V. No. 16120, J - Elev = 2157.410
Intersection of Valley View Blvd. and Sahara Ave., S.W. Corner

Rev. 4-16-74 Removed driveway @ East-east side. RK
Rev. 4-9-74 Widened Private Street to 60' Sc RK
Rev. 4-6-74 - Center median design & geometrics RK
Rev. 3-18-74 RK

APPROVALS

J. O. Duke 4-4-74
City Engr. Date

[illegible] 4/8/74
for City Engr. Date

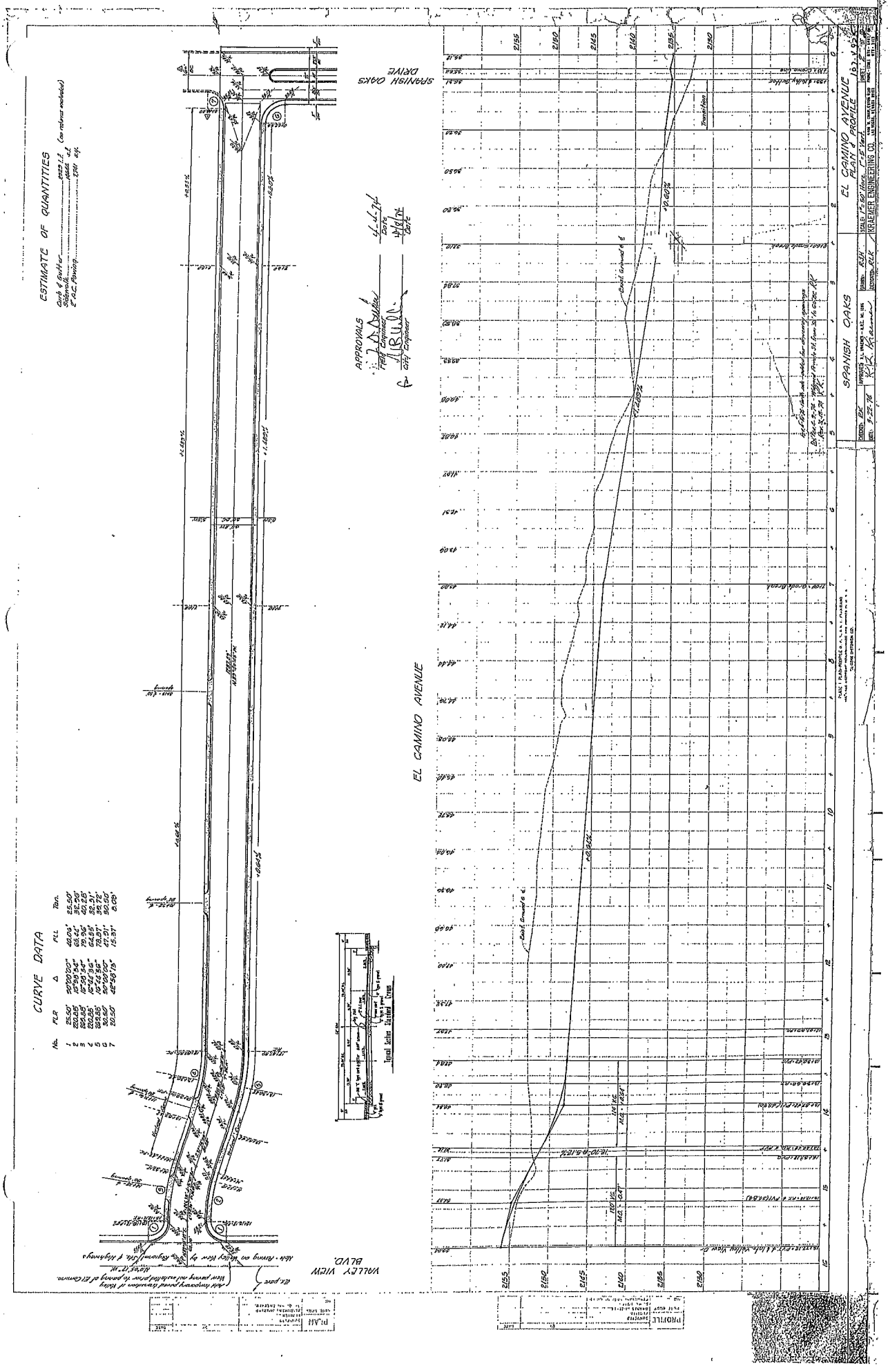
[illegible] 4-8-74
Traffic Engr. Date

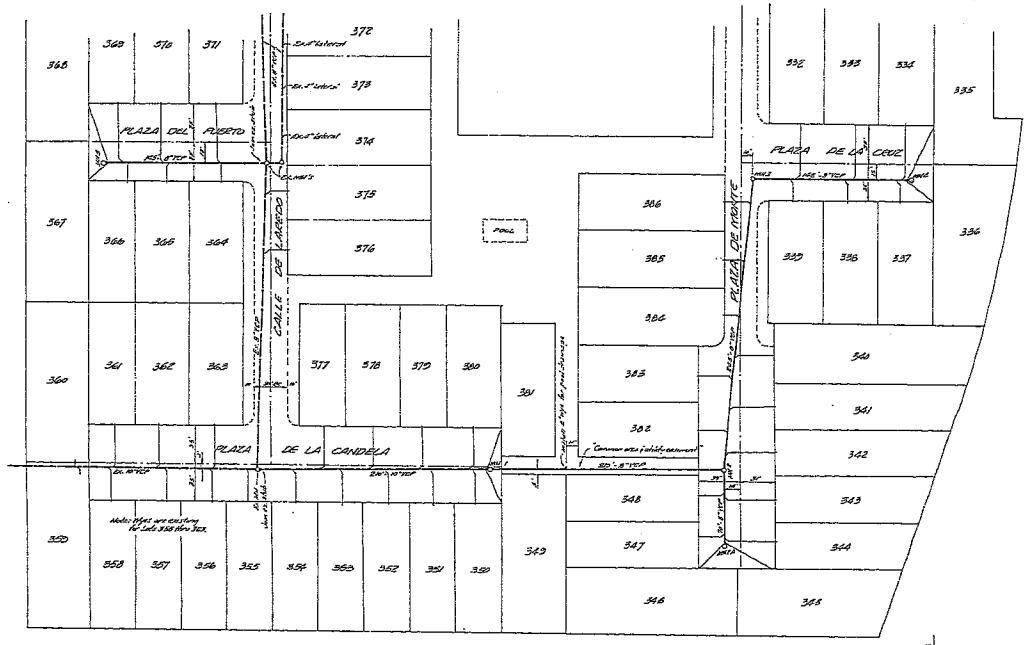
SPANISH OAKS
Tract 207-#137

SPANISH OAKS DRIVE
PLAN - PROFILE

CHECKED: E.K.	APPROVED: AS PLOTTED — R.E.C. 45, 1974	DESIGNED: R.H.K.	SCALE: 1"=2' Horiz. and 1"=10' Vertical
DATE: 2/4/74	R.C. Kraemer	DESIGNED: R.K.	KRAEMER ENGINEERING CO.

SHEET 1 OF 2


EL CAMINO AVENUE
PLAN & PROFILE
SPANISH OAKS
SPANISH OAKS DRIVE
VALLEY VIEW BLVD.
EL CAMINO AVENUE
CURVE DATA
ESTIMATE OF QUANTITIES
APPROVALS
KRAEMER ENGINEERING CO.
DRAWN: RSH
RECHKD: RLK
DATE: 9-25-78
APPROVED: K.K.
Typical Section Sidewalk Transit
Typical Section Sidewalk Transit



NOTE:
1. All labor and materials per standard plans and specifications of the C.I.Y.
2. Contractor responsible for damages to any existing utilities and improvements

OWNER / DEVELOPER:
ROYAL CREST, INC.
PO 42427
Las Vegas, NV.

ENGINEER:
Kramer Engineering Co.
3100 W. Sahara A-16
Las Vegas, NV.

BENCHMARK:
C.I.Y. 1617-41
Str. corner Sahara & Valley View Blvd. 2157-41

ESTIMATE OF QUANTITIES:

8" VCP	835 L.F.
4" VCP	1717 L.F.
Manhole Assmbly	6 ea.
10" VCP	210 L.F.

Scale: 1"=50' Hor., 1"=5' Ver.

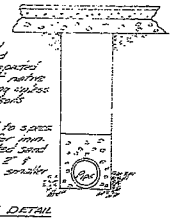
APPROVALS:

5-24-78 — Dept. of Sanitation — Date

5-31-78 — Field Engr. — Date

5 31/78 — Quality Control Engr. — Date

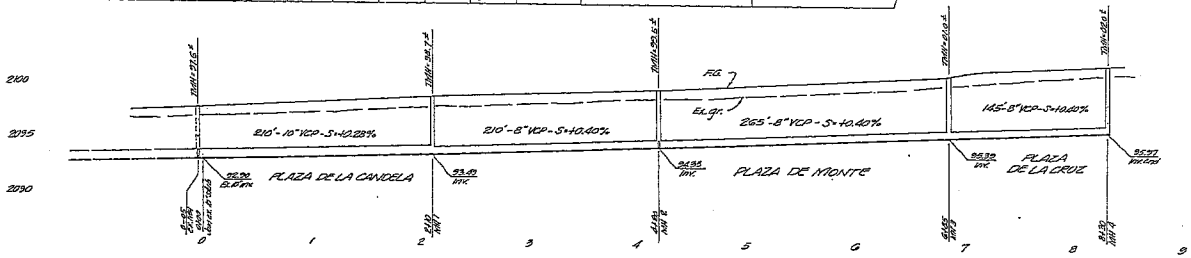
5/31/78 — City Engr. — Date

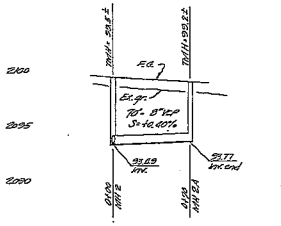


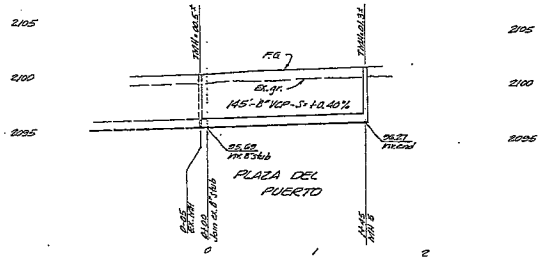
Backfill shall be any material free from lg (4") lumps and organic matter, to be compacted to the density of adjacent native soils by tamping or flooding unless specified otherwise by a Soils Engineer.

Gravel 1 yard to be placed to a point shown on plan. Backfill for min. of 12 over pipe into selected sand or gravel no larger than 2" placed by hand for pipe smaller than 27" dia.

TRENCH DETAIL

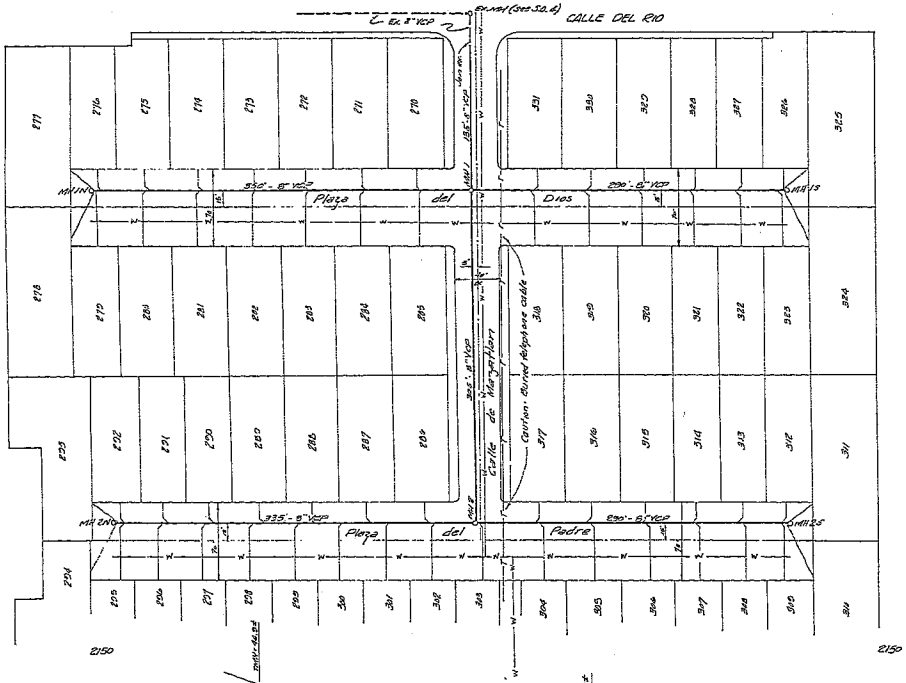


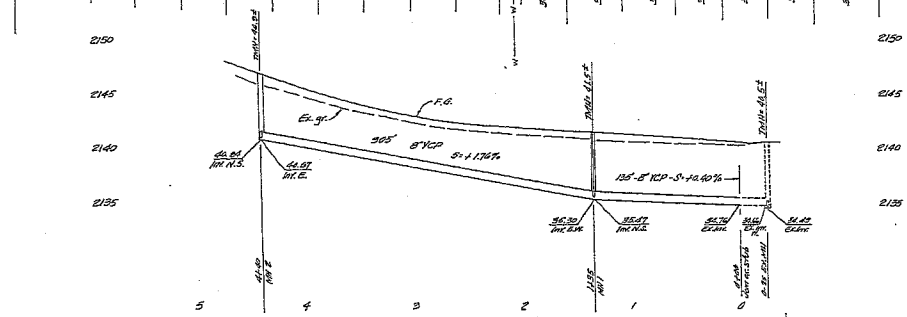


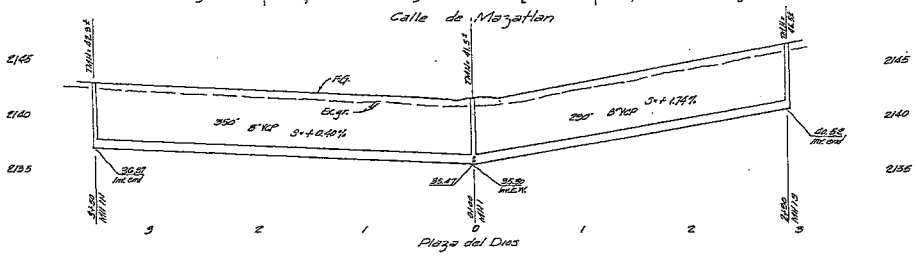


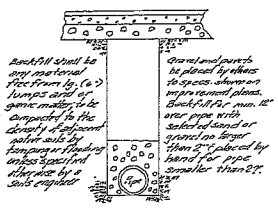
SPANISH OAKS 9
SEWER PLAN-PROFILE

17.63 307 y - 2787-9









TRENCH DETAIL

Scale: Hor. 1"=50'
Vert. 1"=5'

STANDARD SEWER NOTES

1. All labor and materials per standard plans and specifications of the City of Las Vegas, 1978 Edition.
2. Contractor responsible for damages to any utilities or improvements.
3. Manholes to have collars at surface of paved areas.

OWNER - DEVELOPER:
Royal Crest, Inc.
PO 42427
Las Vegas, Nv. 89104

BENCHMARK:
CLV 4th Ord 7 A1 SW corner, Valley View and Sahara. Elev.: 2157.41'

Quantity Estimates:

8" VCP Sewer	1705 l.f.
4" VCP Sewer	1260 l.f.
Manhole	6 ea.

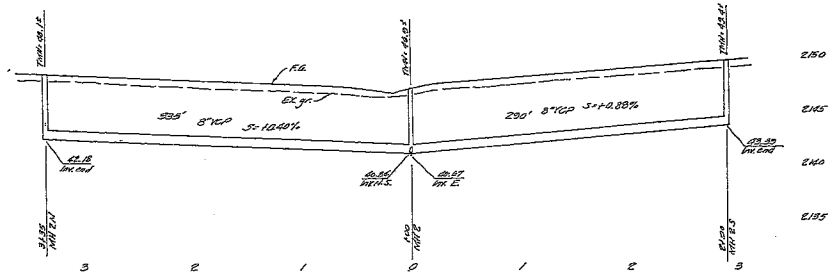
APPROVALS:

J. B. Autry — 4-13-79
Supt. of Sanitation — Date

CLV Field Engineer — Date

4/12/79
Quality Control — Date

William Turner — 4-16-79
CLV City Engineer — Date



SPANISH OAKS 8

SEWER PLAN-PROFILE

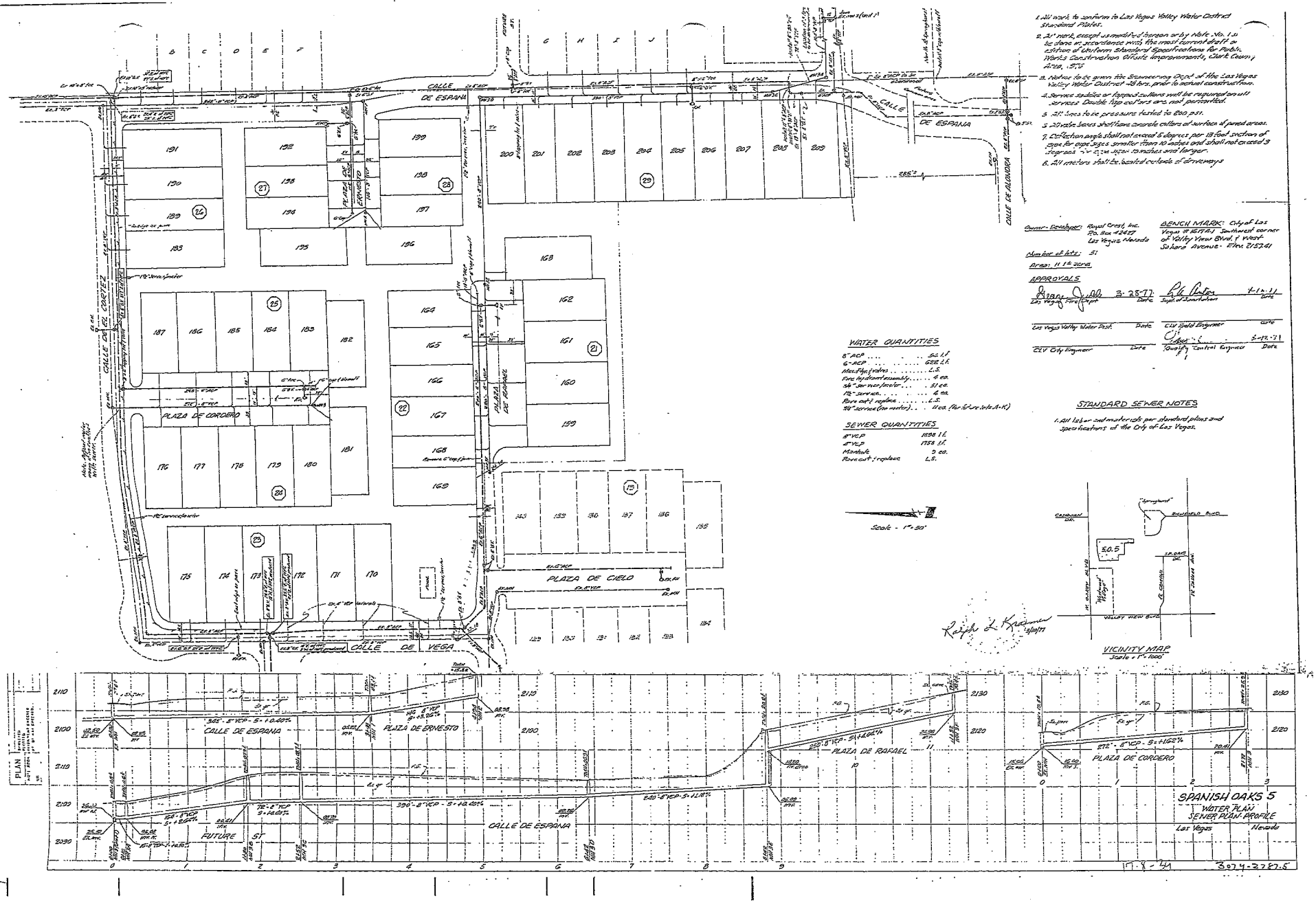
Las Vegas Nevada

March 2, 1978

Sheet 1 of 2

301-4-2787-8

17-8-757



1. All work to conform to Las Vegas Valley Water District Standard Plates.
2. All work, except as modified hereon or by Note No. 1 to be done in accordance with the most current draft of Uniform Standard Specifications for Public Works Construction Offsite Improvements, Clark County, Nev. 5"ST
3. Notice to be given the Engineering Dept. of the Las Vegas Valley Water District 48 hrs. prior to actual construction.
4. Service saddles or tapped outlets will be required on all services. Double tap outlets are not permitted.
5. All lines to be pressure tested to 200 psi.
6. All hydrant bases shall have concrete collars at surface of paved areas.
7. Deflection angle shall not exceed 5 degrees per 18 foot section of pipe for pipe types 4 smaller. Pipe 10 inches and shall not exceed 3 degrees for pipe types 12 inches and larger.
8. All meters shall be located outside of driveways

Owner - Developer: Royal Crest, Inc.
P.O. Box 42427
Las Vegas, Nevada

Number of lots: 51

Area: 11.1± acres

BENCH MARK: City of Las Vegas B.M. #17A1 - Southwest corner of Valley View Blvd. & West Sahara Avenue - Elev. 2152.41

APPROVALS

Las Vegas Fire Dept. — Date 3-25-71

Supt. of Construction — Date 4-14-71

Las Vegas Valley Water Dist. — Date

CLV Field Engineer — Date

CLV City Engineer — Date

Quality Control Engineer — Date 5-19-71

WATER QUANTITIES

8" AC.P.	52 L.F.
6" AC.P.	6222 L.F.
Mueller fixtures	L.S.
Fire hydrant assembly	4 ea.
3/4" service valve	51 ea.
1" service	4 ea.
Pave cut & replace	L.S.
3/4" service (no meter)	11 ea. (See Std. Sht. No. A-K)

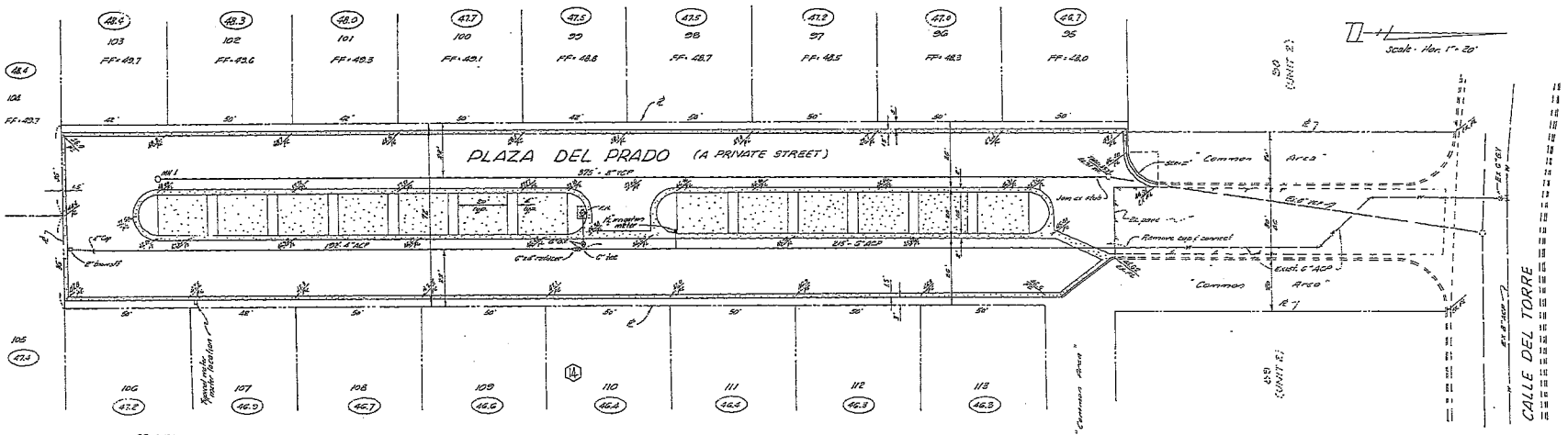
SEWER QUANTITIES

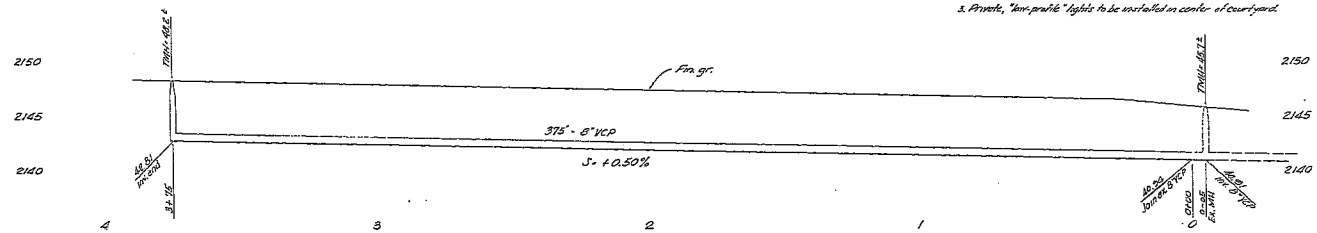
8" V.C.P.	1139 L.F.
4" V.C.P.	1158 L.F.
Manhole	9 ea.
Pave cut & replace	L.S.

STANDARD SEWER NOTES

1. All labor and materials per standard plans and specifications of the City of Las Vegas.

VICINITY MAP
Scale - 1" = 1000'





PRIVATE DRIVE QUANTITIES

"L" type curb & gutter	621 l.f.
L.S. mtc conc. drwy.	885 l.f.
20' mtc conc. storm	679 l.f.
valley gutter	340 s.f.
Stamped concrete	4160 s.f.
2" AC/6" type II gravel	2772 s.y.

QUANTITIES - SEWER SYSTEM

6" VCP	375 l.f.
4" VCP	695 l.f.
Manhole	1 ea.

QUANTITIES - WATER SYSTEM

6" ACP	215 l.f.
4" ACP	198 l.f.
Fire hydrant assembly	1 ea.
¾" meter	13 ea.
1½" meter	1 ea.
Misc. Figs. & valves	L.S.

STANDARD SEWER NOTES

1. All labor and materials per C.L.V. Standards.
2. Location of 4" VCP laterals to be determined in field.
3. Private, "low profile" lights to be installed on center of courtyard.

STANDARD WATER NOTES

1. All work to conform to L.V.V.W.D. Standard Spec S-1, and Standard plates.
2. All work, except as modified herein, shall be done in accordance with Clark County Std. Specs.
3. Notice to be given Engineering Department of the L.V.V.W.D. 48 hours prior to actual construction.
4. Service saddles or tapped collars will be required on all services.
5. Contractor to provide thrust blocks as required.
6. All lines to be pressure tested to 200 psi.
7. All flanged fittings to be coated with IEC-244 and wrapped with 6 mil thick polyethylene, two layers.
8. All valve boxes shall have concrete collars at surface of paved areas.
9. No other utility lines may be placed in same trench with water line.
10. Parallel sewer and water lines shall have a minimum of 10 feet horizontal separation and 3 feet vertical separation on all water lines.
11. Deflection angle shall not exceed 5° per 13 foot section of pipe for pipe sizes smaller than 10 inches and shall not exceed 3° for pipe sizes 10 inches and larger.
12. All water valves shall be operated only under direction of L.V.V.W.D.
13. All water lines to be flushed to a velocity of 10 feet per second.
14. Contractor to furnish and install meter boxes to District Specs.
15. *Fire hydrant assembly to be constructed per C.L.V. Stds.*
16. *Meters for each lot to be installed adjacent to 12" master. Verify turned prop. line.*

APPROVALS:

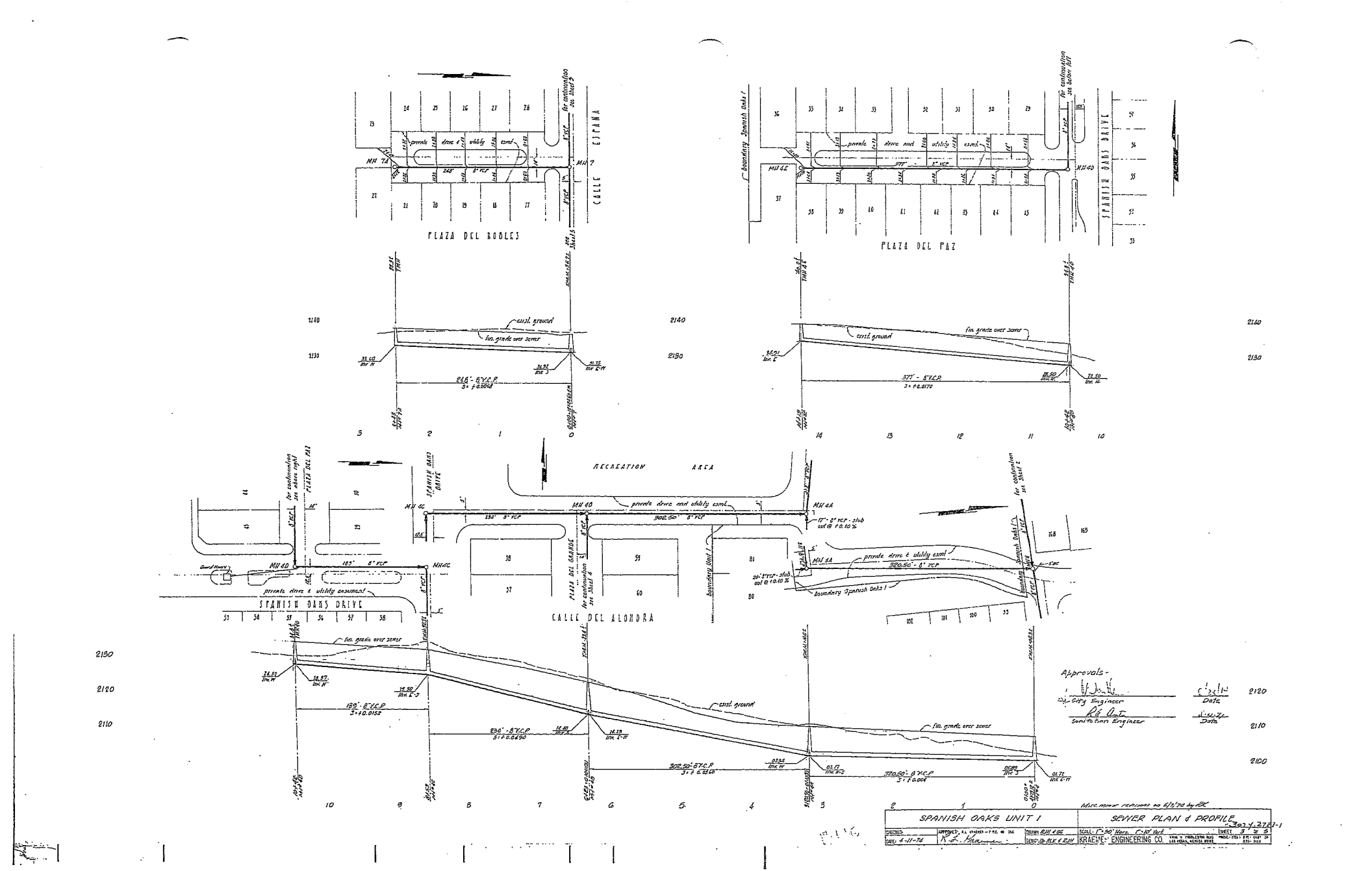
Las Vegas Fire Dept.	1-23-76 Date
	1-28-76 Date
	3/8/76
	1-25-76

Ralph T. Karamen

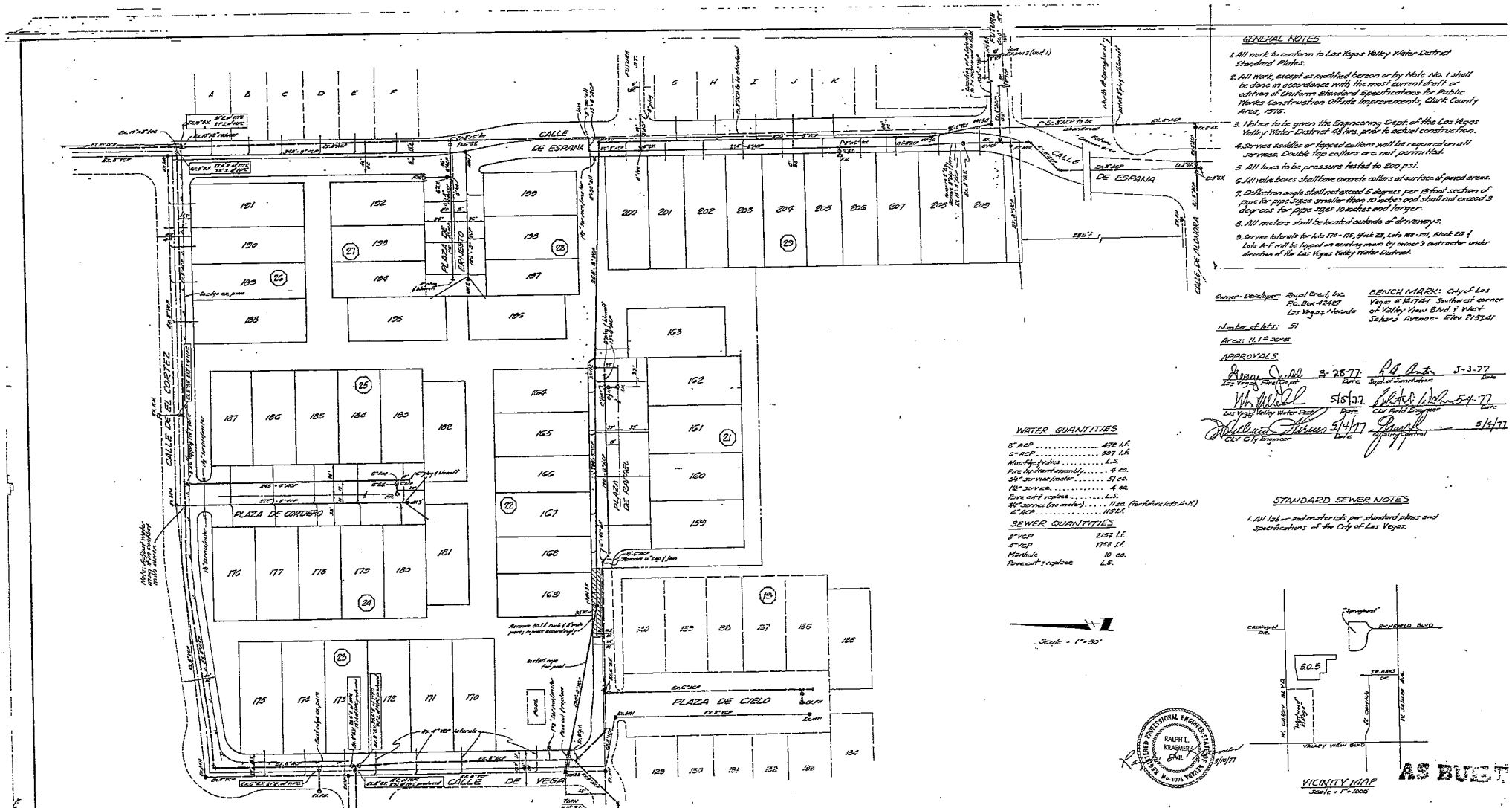
SPANISH OAKS 3
WATER & SEWER PLAN
SEWER PROFILE

Sheet 1 of 1 Dated: Jan. 5, 1976

307 y. 2787-3


PLAZA DEL ROBLES
PLAZA DEL PAZ
CALLE ESTRADA
SPANISH OAKS DRIVE
RECREATION AREA
CALLE DEL ALONDRA
PLAZA DEL GRANDE
private drive and utility easement
boundary Unit I
boundary Spanish Oaks I
for continuation see Sheet 2
for continuation see above right
MH 7A
MH 7
MH 4C
MH 4D
MH 4E
MH 4A
MH 4B
existing ground
fin. grade over sewer
246' - 8" V.C.P. S = +0.0004
377' - 8" V.C.P. S = +0.0170
189' - 8" V.C.P. S = +0.0152
230' - 8" V.C.P. S = +0.0490
302.50' - 8" V.C.P. S = +0.0220
320.50' - 8" V.C.P. S = +0.0066
Approvals -
City Engineer
Sanitation Engineer
Date
Misc. minor revisions as 6/12/74 by RJK
SPANISH OAKS UNIT I
SEWER PLAN & PROFILE
3074.27A1-1
SCALE: 1"=50' Horiz. 1"=10' Vert.
SHEET 3 OF 5
DATE: 4-11-74
KRAEMER ENGINEERING CO.

TYPICAL LOCATION OF COURTYARD METERS
(Note - Meters along Calle De Corrida to be located behind "C" type curb.)
WESTWOOD VILLAGE
BARNARD DRIVE
EL CORTEZ AVE.
CALLE DEL RIO
CALLE DE CORRIDA
PLAZA DE RAFAEL
PLAZA DE MADRE
PLAZA DE CIELO
CALLE DEL TORRE
CALLE DEL VEGA
SPANISH OAKS 4
SPANISH OAKS UNIT 3
141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158
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
Clark County Standard Specs.
3. Notice to be given Engineering Dept. of the Las Vegas Valley Water District 48 hours prior to actual construction
4 Service saddles or tapped collars will be required on all services; double tap collars are not permitted
5. Contractor to provide thrust blocks as required
6. All lines to be pressure tested to 200 p.s.i.
7. All flange fittings to be coated with EC-226 and wrapped with 6 mil. thick polyethylene, two layers
8. All valve boxes shall have concrete collars at surface of paved areas
9. All water utility lines may be placed in trench with water line horizontal separation and 3 feet min. vertical separation.
11. Deflection angle shall not exceed 5° per 13-foot section of pipe for pipe sizes smaller than 10-inches and shall not exceed 3° for pipe sizes 12 inches and larger.
12. All water valves shall be operated only under the direction of the Las Vegas Valley Water District.
13. All fire hydrants to be painted to conform to color code of the Las Vegas Valley Water District.
15. Contractor to furnish thrust blocks as required.
16. Provide min. 36" cover.
Owner Developer: Royal Crest, Inc. P.O. Box 12527 Las Vegas, Nevada
Number of lots: 42
Area: 3.6 acres
APPROVALS
Las Vegas Valley Water Dist. — Date
3/13/76
Las Vegas Valley Water Dist. — Date
Scale: 1" = 50'
6" ACP 1542 L.F.
8" ACP 605 L.F.
Manhole 5 ea.
Fire Hyd. 2 ea.
30° Bend 45 ea.
1½" Service 2 ea.
Pave cut & replace 6 S.Y.
W. OAKEY BLVD.
SPANISH OAKS 4
Westwood Village
Springhurst
S. TAMARA AVE.
VICINITY MAP
Scale - 1" = 1000'
BENCH MARK: 2" dia. brass cap in Las Vegas 4" x 16" x 4" - South west corner of 1925 Valley Blvd. & West Sahara Avenue - Elev. 2157.20
SEWER QUANTITIES
8" V.C.P. 1607 L.F.
4" P.C.P. 1428 L.F.
Manhole 8 ea.
Manhole Tap 1 ea.
Pave cut & replace 6 S.Y.
STANDARD SEWER NOTES
1. All labor and materials per standard plans and specifications of the City of Las Vegas.
APPROVALS
Sept. of Sanitation — 6-11-76 Date
CLV Field Engineer — 6-14-76 Date
CLV City Engineer — 6/14/76 Date
REVISED - 2/22/76 - Added Lots 156, 157 & 158, including 3 additional water and sewer services.
APPROVED
Las Vegas Valley Water Dist. — Date
10-12-76
CLV Sept. of Sanitation — Date
10-13-76
CLV Field Engineer — Date
CLV City Engineer — Date
SPANISH OAKS 4
WATER PLAN
SEWER PLAN-PROFILE
Las Vegas Nevada
May 28, 1976
AE 2069 GS 163 XC-1327 307 y 2787-4
301' - 8"VCP - S = +0.00% CALLE DE VEGA
270' - 8"VCP - S = +0.46%
270' - 8"VCP - S = +0.22% CALLE DE CORRIDA
205' - 8"VCP - S = +0.92%
270' - 8"VCP - S = +0.44% CALLE DEL RIO
228' - 8"VCP - S = +0.61%
234' - 8"VCP - S = +2.26%



GENERAL NOTES

1. All work to conform to Las Vegas Valley Water District Standard Plates.
2. All work, except as modified hereon or by Note No. 1 shall be done in accordance with the most current draft or edition of Uniform Standard Specifications for Public Works Construction Offsite Improvements, Clark County Area, 1976.
3. Notice to be given the Engineering Dept. of the Las Vegas Valley Water District 48 hrs. prior to actual construction.
4. Service saddles or tapped collars will be required on all services. Double tap collars are not permitted.
5. All lines to be pressure tested to 200 psi.
6. All valve boxes shall have concrete collars at surface of paved areas.
7. Deflection angle shall not exceed 5 degrees per 18 foot section of pipe for pipe sizes smaller than 10 inches and shall not exceed 3 degrees for pipe sizes 10 inches and larger.
8. All meters shall be located outside of driveways.
9. Service laterals for lots 174 - 175, Block 23, Lots 118 - 121, Block 25 & Lots A-F will be tapped on overlay mains by owner's contractor under direction of the Las Vegas Valley Water District.

Owner - Developer: Royal Crest, Inc. P.O. Box 42417 Las Vegas, Nevada

BENCH MARK: City of Las Vegas #167A-1 Southwest corner of Valley View Blvd. & West Sahara Avenue - Elev. 2157.41

Number of lots: 51

Area: 11.12 acres

APPROVALS

Las Vegas Fire Dept.	3-25-77 Date	Dept. of Transportation	5-3-77 Date
Las Vegas Valley Water Dist.	5/6/77 Date	City Field Engineer	5-4-77 Date
Clk Co. City Engineer	5/4/77 Date	Quality Control	5/4/77

WATER QUANTITIES

8" ACP	472 l.f.
6" ACP	907 l.f.
Misc. fittings/valves	L.S.
Fire hydrant assembly	4 ea.
3/4" service/meter	51 ea.
1" service	4 ea.
Pave cut & replace	L.S.
4" Concrete (for meter)	9 sq. yds. (for future lots A-K)
6" ACP	1151 l.f.

SEWER QUANTITIES

8" VCP	2132 l.f.
8" VCP	1758 l.f.
Manhole	10 ea.
Pave cut & replace	L.S.

Scale - 1" = 50'

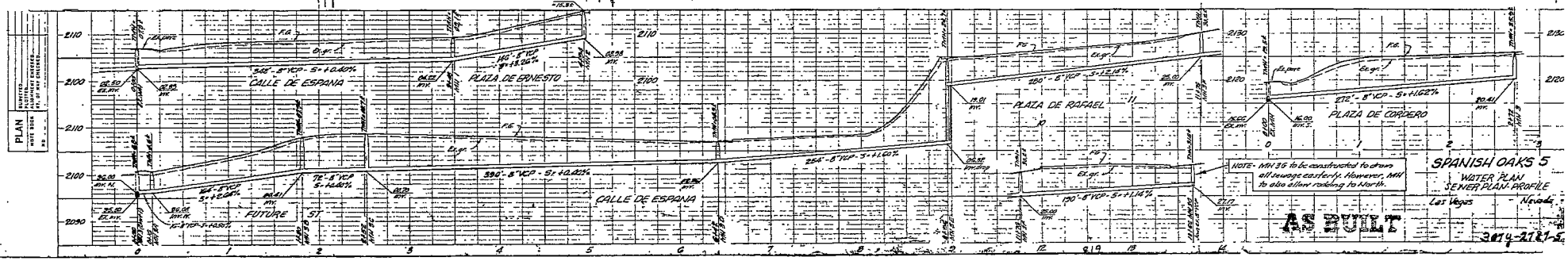
STANDARD SEWER NOTES

1. All labor and materials per standard plans and specifications of the City of Las Vegas.

RALPH L. KRAEMER — REGISTERED PROFESSIONAL ENGINEER — No. 1096 — STATE OF NEVADA — 5/3/77

VICINITY MAP
Scale - 1" = 1000

AS BUILT

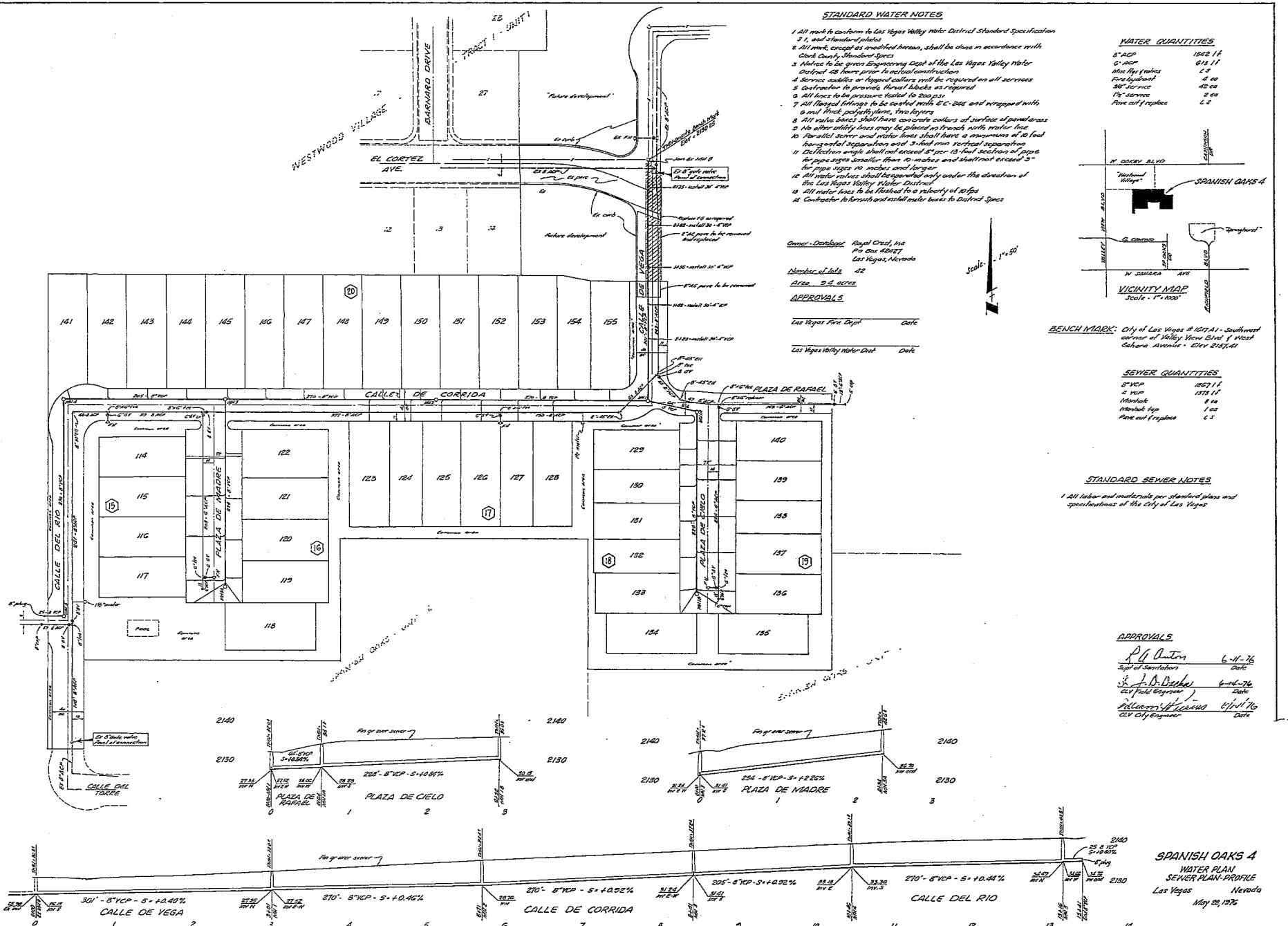


NOTE - MH 35 to be constructed to drain all sewage easterly. However, MH to also allow routing to North.

SPANISH OAKS 5
WATER PLAN
SEWER PLAN - PROFILE
Las Vegas Nevada

AS BUILT

3014-2121-5



STANDARD WATER NOTES

1 All work to conform to Las Vegas Valley Water District Standard Specification S 1, and standard plates
2 All work, except as modified hereon, shall be done in accordance with Clark County Standard Specs
3 Notice to be given Engineering Dept of the Las Vegas Valley Water District 48 hours prior to actual construction
4 Service saddles or tapped collars will be required on all services
5 Contractor to provide thrust blocks as required
6 All lines to be pressure tested to 200 psi
7 All flanged fittings to be coated with EC-226 and wrapped with 8 mil Trail, polyethylene, two layers
8 All valve boxes shall have concrete collars at surface of paved areas
9 No other utility lines may be placed in trench with water line
10 Parallel sewer and water lines shall have a minimum of 10 feet horizontal separation and 3-foot min vertical separation
11 Deflection angle shall not exceed 5° per 18 foot section of pipe. For pipe sizes smaller than 10-inches and shall not exceed 3° for pipe sizes 10 inches and larger
12 All water valves shall be operated only under the direction of the Las Vegas Valley Water District
13 All water lines to be flushed to a velocity of 10 fps
14 Contractor to furnish and install meter boxes to District Specs

Owner - Developer: Regal Crest, Inc, Po Box 42827, Las Vegas, Nevada
Number of lots: 42
Area: 3.4 acres

APPROVALS

Las Vegas Fire Dept. Date
Las Vegas Valley Water Dist. Date

Scale: 1" = 50'

WATER QUANTITIES

8" ACP	1542 LF
6" ACP	613 LF
Mtce Rpr fittings	6 ea
Fire hydrant	4 ea
3/4" service	42 ea
1" service	2 ea
Pave cut/replace	6 S

VICINITY MAP
Scale - 1" = 1000'

BENCH MARK: City of Las Vegas # 1617 A1 - Southwest corner of Valley View Blvd & West Sahara Avenue - Elev 2137.41

SEWER QUANTITIES

8" VCP	1867 LF
4" VCP	1373 LF
Manhole	8 ea
Manhole top	1 ea
Pave cut/replace	6 S

STANDARD SEWER NOTES

1 All labor and materials per standard plans and specifications of the City of Las Vegas.

APPROVALS

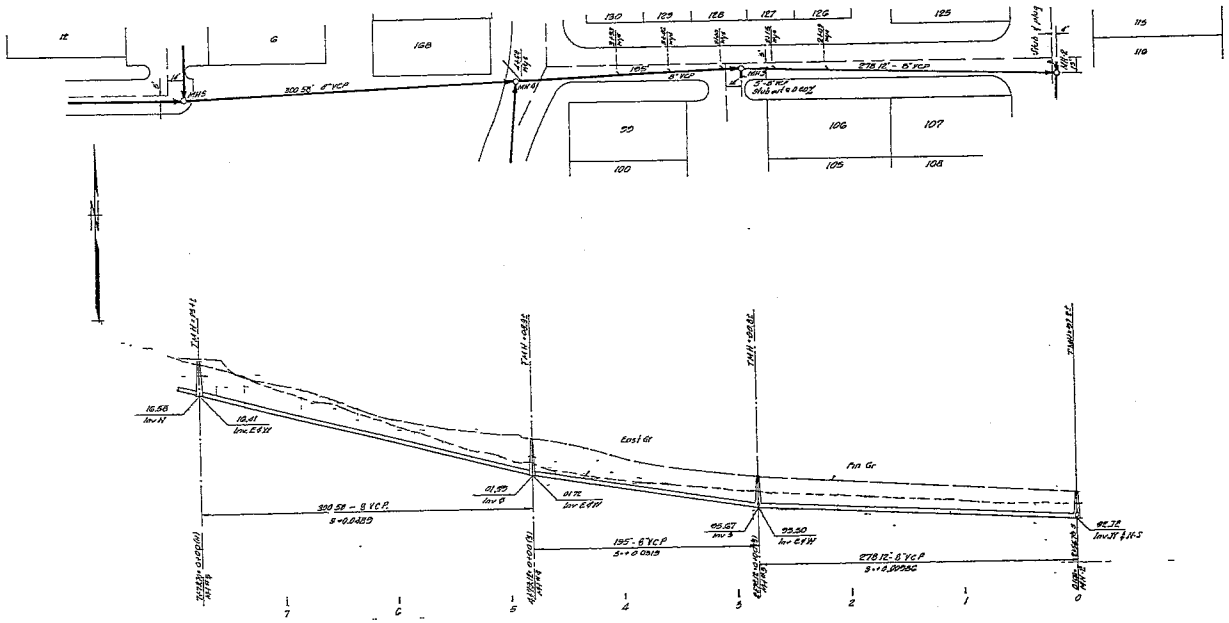
R G Outen — 6-11-76
Supt of Sanitation — Date

J. O. Decker — 6-14-76
CLV Field Engineer — Date

Richard H. Hawkins — 6/21/76
CLV City Engineer — Date

SPANISH OAKS 4
WATER PLAN
SEWER PLAN-PROFILE
Las Vegas Nevada
May 28, 1976

17-7-41 — 3079-2787-4


300 SF - 8" VCP
8" VCP
278.12' - 8" VCP
195' - 8" VCP
390 SF - 8 VCP
East Gr
Fin Gr
MH-1
MH-2
MH-3
MH-4
MH-5
MH-6
MH-7
MH-8
MH-9
MH-10
MH-11
MH-12
MH-13
MH-14
MH-15
MH-16
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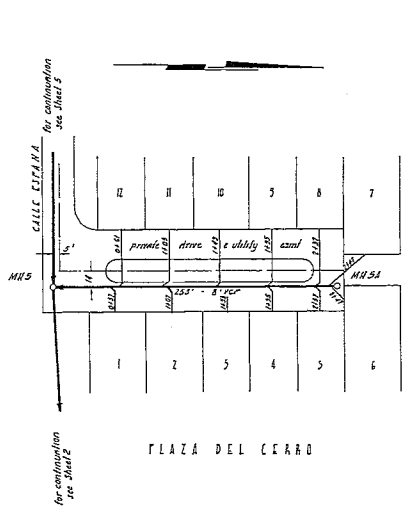
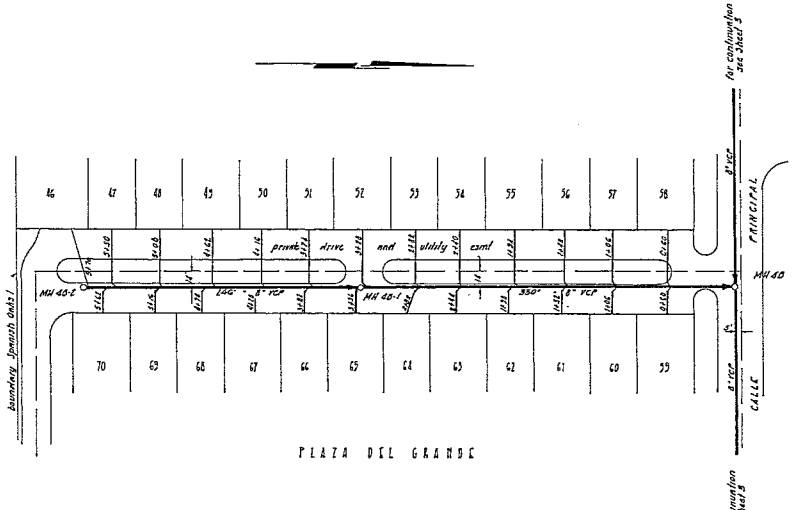
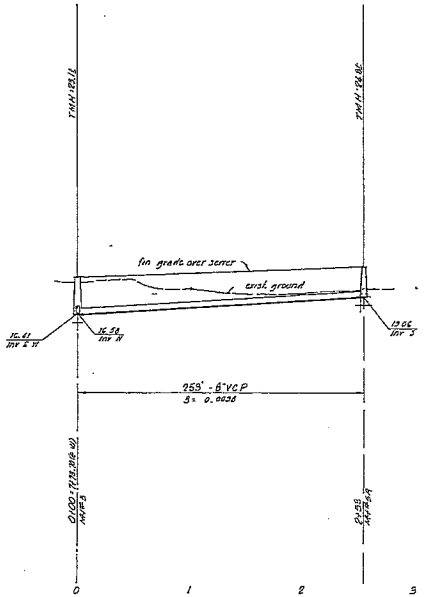
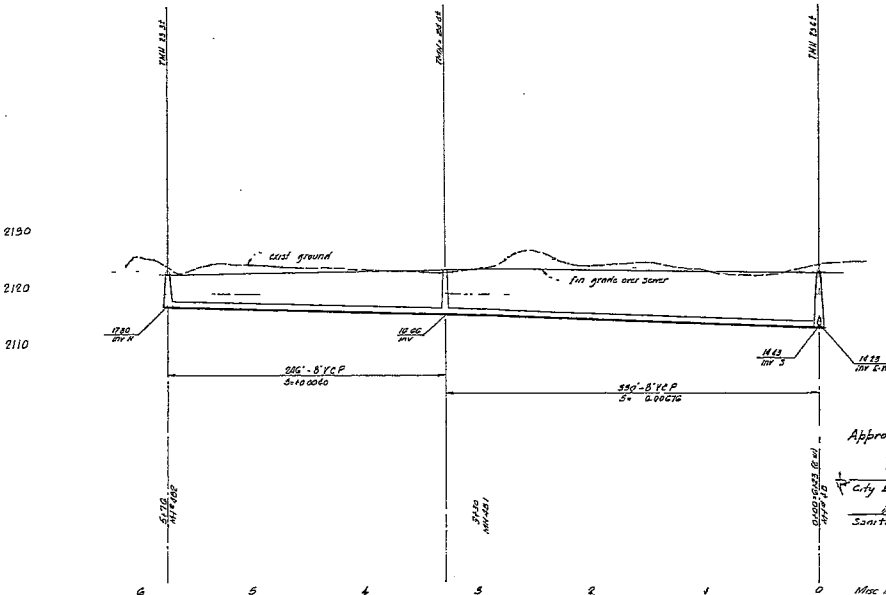
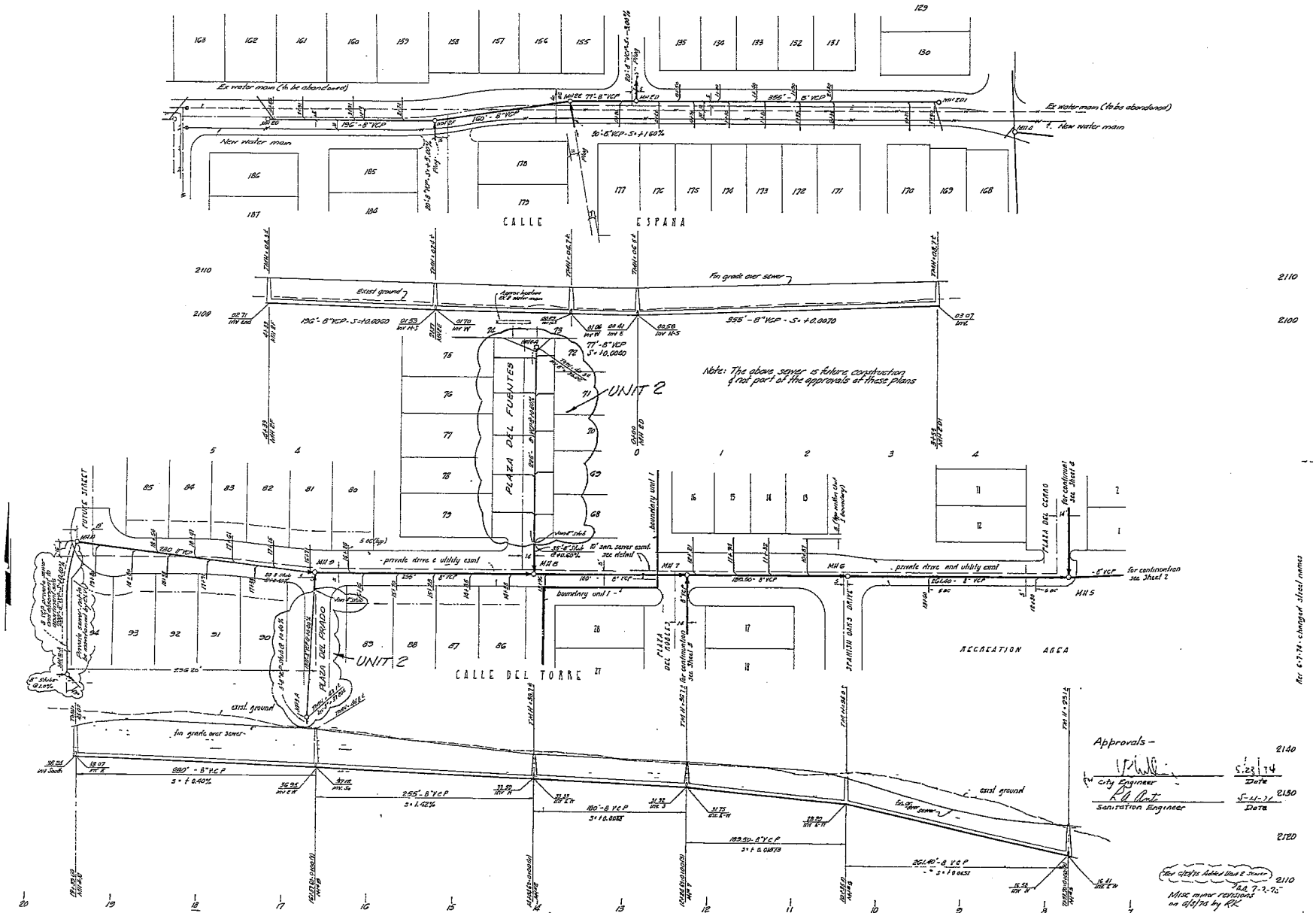
MH-39
MH-40

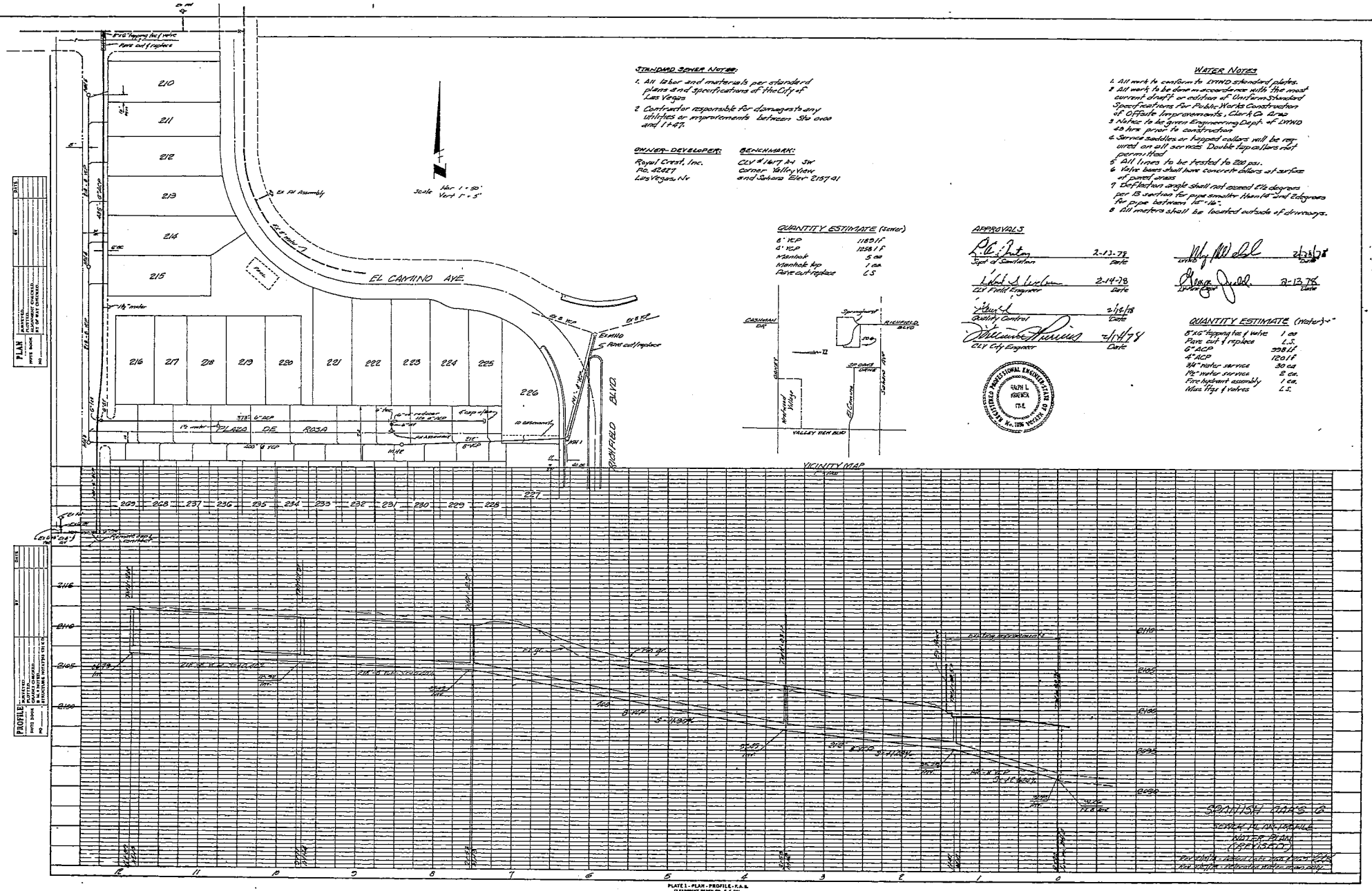

for continuation see Sheet 5
CALLE CIPRINA
12
11
10
9
8
7
private drive
utility easmt
MH 5
MH 5A
255' - 8" VCP
1
2
3
4
5
6
for continuation see Sheet 2
PLAZA DEL CERRO


for continuation see Sheet 5
46
47
48
49
50
51
52
53
54
55
56
57
58
8" VCP
PRINCIPAL
private drive
road utility easmt
MH 48
MH 48-2
MH 48-1
246' - 8" VCP
330' - 8" VCP
laundress Spanish Oaks
70
69
68
67
66
65
64
63
62
61
60
59
CALLE
for continuation see Sheet 3
PLAZA DEL GRANDE


2130
2120
2110
TMH 129.1E
TMH 124.8E
fin grade over sewer
exist ground
IE 41 Inv E IN
IE 36 Inv W IN
12 DC Inv S
259' - 8" VCP
S= 0.0036
0
1
2
3


2130
2120
2110
TMH 93.5E
TMH 88.4E
TMH 78.1E
exist ground
fin grade over sewer
17.80 Inv W
18.66 Inv
14.43 Inv S
14.23 Inv E-W
286' - 8" VCP
S=0.0040
330' - 8" VCP
S= 0.00376
6
5
4
3
2
1
0
Approvals:
City Engineer
Date
Sanitation Engineer
Date
3074-2787-1
Misc minor revisions on 6/17/78 by RK
SPANISH OAKS UNIT 1
SEWER PLAN & PROFILE
CHECKED RLK
DATE 4-11-78
R. L. Kraemer
DESIGNED RLK & P.W.
SCALE 1"=50' Horiz. 1"=10' Vert.
KRAEMER ENGINEERING CO
SHEET 2 OF 2


CALLE ESPANA
PLAZA DEL FUENTES
UNIT 2
Note: The above sewer is future construction & not part of the approvals of these plans
PLAZA DEL PRADO
UNIT 2
CALLE DEL TORRE
RECREATION AREA
Ex water main (to be abandoned)
New water main
Existing ground
Fin grade over sewer
Approx location of water main
private drive & utility esmt
10' san. sewer esmt. (to be retired)
boundary unit 1 - 2
for continuation see Sheet 2
Approvals -
City Engineer
Sanitation Engineer
SPANISH OAKS UNIT 1 & 2
SEWER PLAN & PROFILE
CHECKED R.L.K.
DATE 4-11-74
APPROVED R. L. KRAEMER - R.E. NO 1096
R. L. Kraemer
DRAWN R.J.H. 1-GG
DESIGNED R.L.K. & R.J.H.
SCALE 1"=50' Horz 1"=10' Vert
KRAEMER ENGINEERING CO
SHEET 5 OF 6
2024-21[illegible]
17B-4.1



STANDARD SEWER NOTES:

1. All labor and materials per standard plans and specifications of the City of Las Vegas
2. Contractor responsible for damages to any utilities or improvements between Sta 0+00 and 1+47.

OWNER-DEVELOPER:
Royal Crest, Inc.
P.O. 42827
Las Vegas, Nv

BENCHMARK:
CLV # 1617 A-1 SW
Corner Valley View
and Sahara Elev 2137.91

QUANTITY ESTIMATE (Sewer)

6" VCP	1189 lf
4" VCP	1258 lf
Manhole	5 ea
Manhole top	1 ea
Pave cut replace	LS

APPROVALS

Supt of Sanitation	2-13-78 Date
CLV Field Engineer	2-14-78 Date
Quality Control	2/16/78 Date
CLV City Engineer	2/14/78 Date
Utilities Mgr	2/23/78 Date
Water Engr	2-13-78 Date

WATER NOTES

1. All work to conform to LVWD standard plates.
2. All work to be done in accordance with the most current draft or edition of Uniform Standard Specifications for Public Works Construction of Offsite Improvements, Clark Co Area
3. Notice to be given Engineering Dept. of LVWD 48 hrs prior to construction
4. Service saddles or tapped collars will be required on all services. Double tap collars not permitted
5. All lines to be tested to 200 psi.
6. Valve bases shall have concrete collars at surface of paved areas
7. Deflection angle shall not exceed 6½ degrees per 18 section for pipe smaller than 14" and 3 degrees for pipe between 16"-16".
8. All meters shall be located outside of driveways.

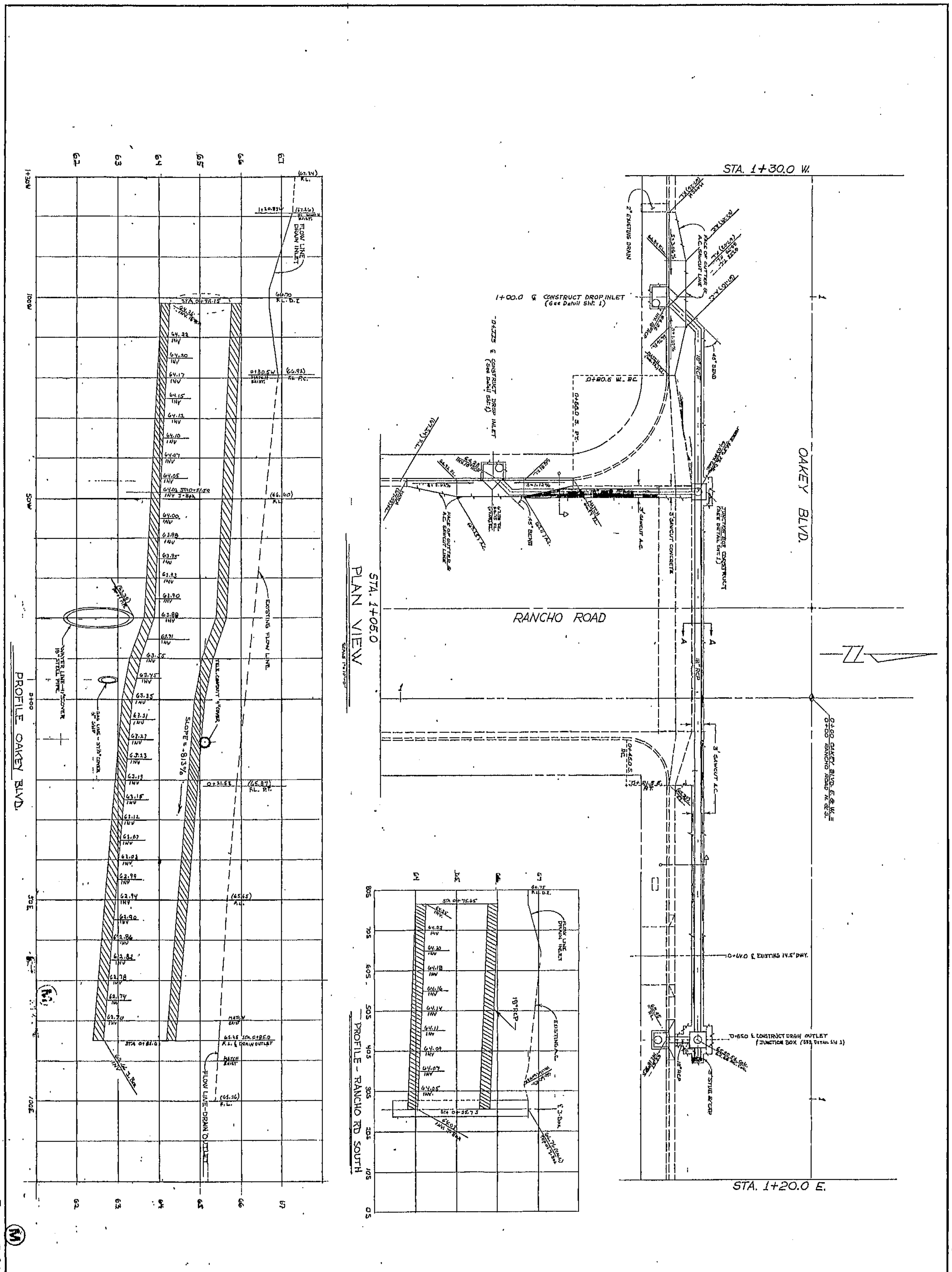
QUANTITY ESTIMATE (Water)

6"x6" tapping tee & valve	1 ea
Pave cut & replace	L.S.
6" ACP	2981 lf
4" ACP	1201 lf
¾" water service	30 ea
1½" water service	2 ea.
Fire hydrant assembly	1 ea.
Misc Mgr & valves	L.S.

PLATE 1 - PLAN - PROFILE - T.A.B.
CLEARPRINT PAPER CO., S.F. CAL.
NO 2000-1

5150

3074-2787-6



Department of Public Services	Engineering Design Division
RANCHO/OAKEY INTERSECTION NUISANCE WATER DRAIN	PLAN & PROFILE

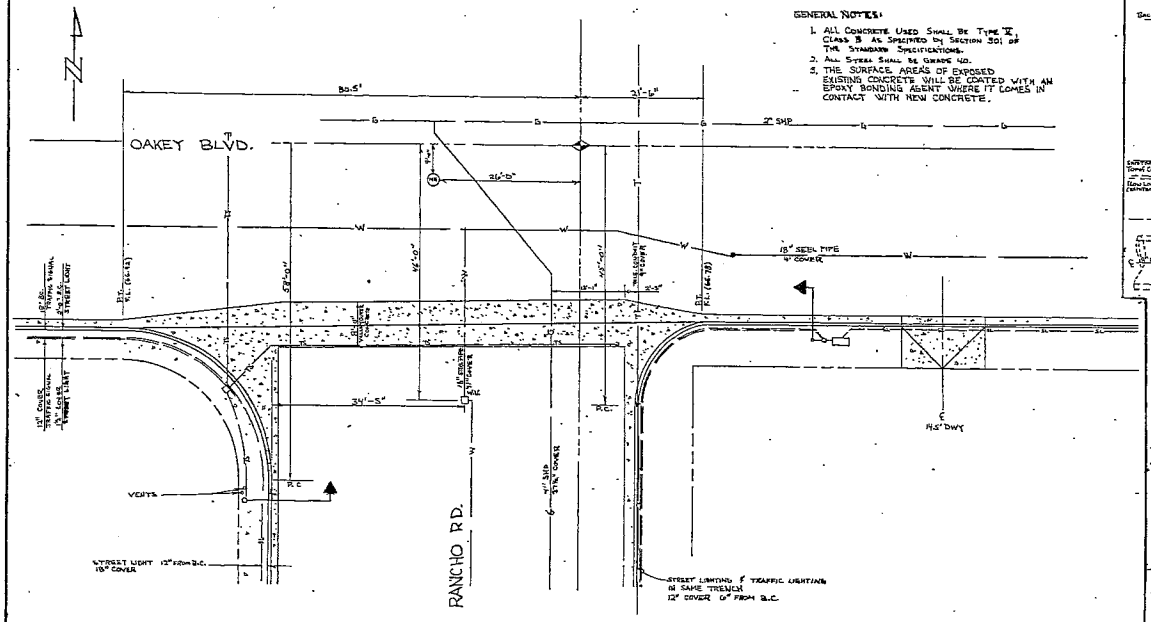
Drawing no. 2/2 327-176

Scale (h) 1" = 10'	Scale (v) 1" = 1'-0"	W.A. 2070
Fld. bk. no. 79-9X	Date SEP. 80	
Design by C. KATKOWSKI	Drawn by S.S. NORATH	

Revisions	Date

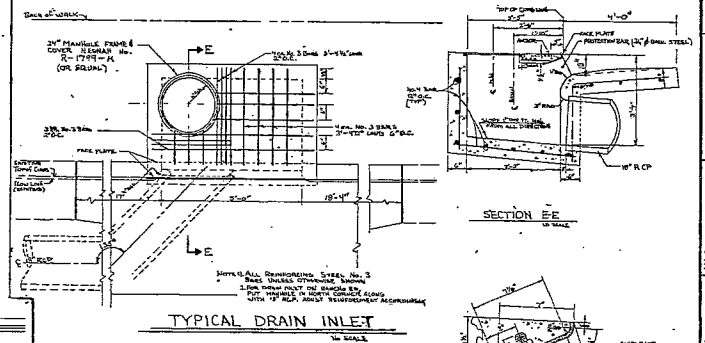
25-5-86

85-5-87



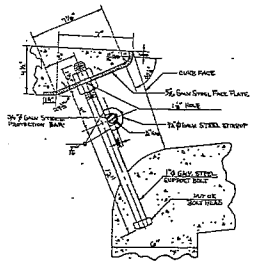
EXISTING PLAN

SCALE: 1" = 10'-0"

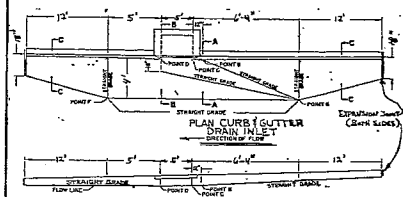


TYPICAL DRAIN INLET

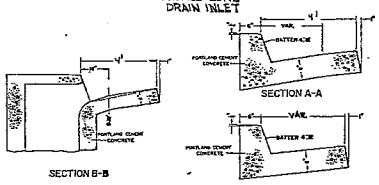
SECTION E-E

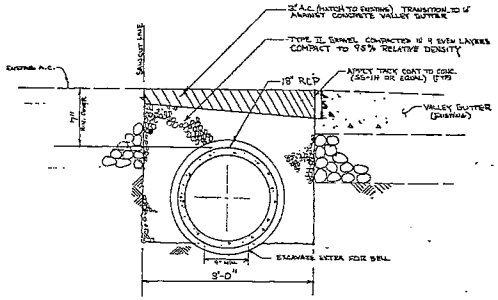


SUPPORT BOLT AND FACE PLATE DETAIL



NOTE: 10" CORB FACE AT POINTS B, C, & D.

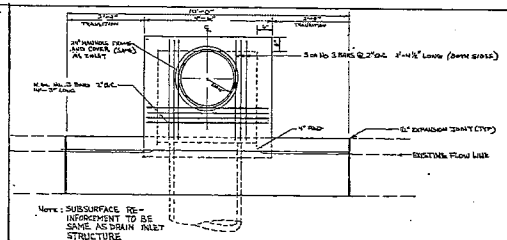




SECTION F-F

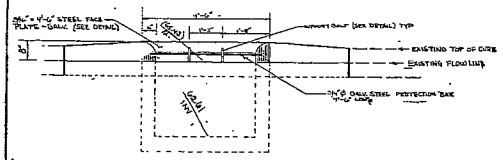
TYPICAL PIPE BED & BACKFILL

NO SCALE



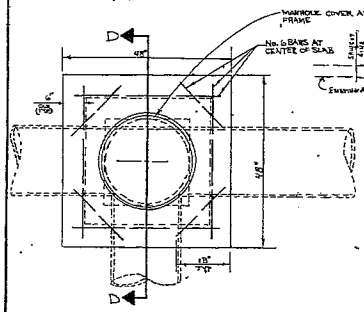
DRAIN OUTLET

NO SCALE



FRONT VIEW - DRAIN OUTLET

NO SCALE



JUNCTION BOX

NO SCALE

SECTION D-D

NO SCALE

Scale (h) 1"=10'-0" | Scale (v) SAME | W.A. 2070
Fld. bk. no. 79-9X | Date SEPT 80 | Drawn by N. R. HARP
Design by C. KAJTKOWSKI
Name: Designers Type In-House Construction

Revisions | Date

Department of Public Services — Engineering Design Division

RANCHO/OAKEY INTERSECTION
NUISANCE WATER
DRAIN

EXISTING PLAN, INLET/OUTLET & J-BOX DETAILS

Drawing no. 1/2

2400 JUN 27 1985 327-176

DS# 2738

DS INDEX

APN 164-04-401-001, 002, 003 & 004

PROJECT Sahara / Rancho Office Park

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TECHNICAL DRAINAGE STUDY

FOR

SAHARA/RANCHO OFFICE PARK

July 11, 2000

Prepared For

JMA ARCHITECTURE STUDIOS
10150 Covington Cross
Las Vegas, NV 89144
(702) 731-2033

Prepared By

THE KEITH COMPANIES, INC.
444 E. Warm Springs Road
Suite 110
Las Vegas, NV 89119
(702) 263-8206

PLANNING • ENGINEERING • LAND SURVEYING • DEVELOPER SERVICES
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PROJECT Sahara/Rancho Office Park

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CCRFCD

The Keith Companies | TKC

ADDENDUM # 1

TO THE

TECHNICAL DRAINAGE STUDY

FOR

SAHARA/RANCHO OFFICE PARK

September 5, 2000

Prepared For

JMA ARCHITECTURE STUDIOS
10150 Covington Cross
Las Vegas, NV 89144
(702) 731-2033

Prepared By

THE KEITH COMPANIES, INC.
444 E. Warm Springs Road
Suite 110
Las Vegas, NV 89119
(702) 263-8206

PLANNING • ENGINEERING • LAND SURVEYING • DEVELOPER SERVICES
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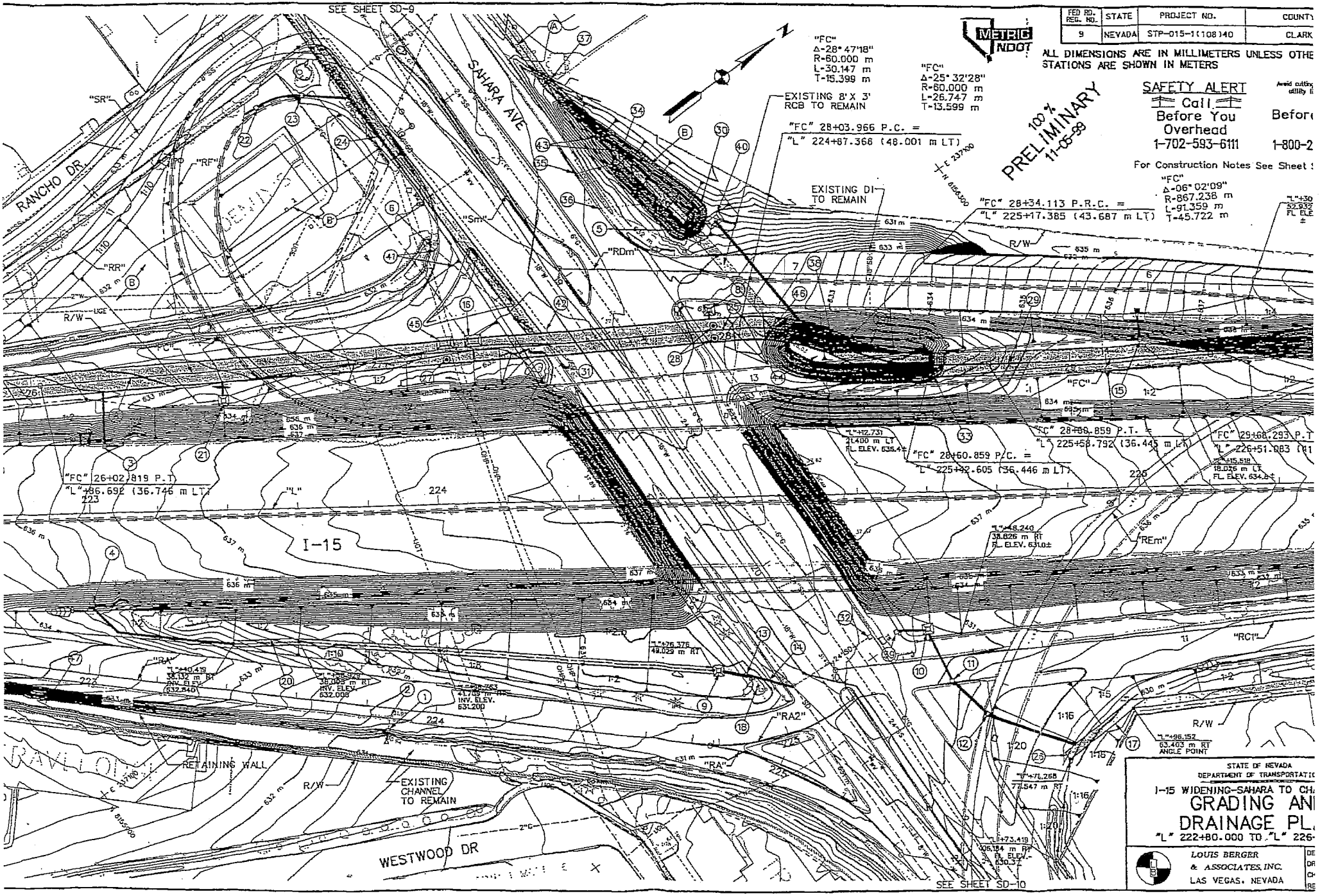


FED RD. REG. NO.	STATE	PROJECT NO.	COUNTY
9	NEVADA	STP-015-1(108)40	CLARK

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATIO

I-15 WIDENING-SAHARA TO CH

GRADING AN DRAINAGE PL

"L" 222+80.000 TO "L" 226-

LOUIS BERGER
& ASSOCIATES, INC.
LAS VEGAS, NEVADA

FED RD. REG. NO.	STATE	PROJECT N.	COUNTY
9	NEVADA	STP-015-1(108)40	CLARK

METRIC NDOT

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHE
STATIONS ARE SHOWN IN METERS

CONSTRUCTION NOTES

①	"RA" 223+86.700	CONSTRUCT TYPE 2 DI, 7.360 m RT WITH 450 mm X 3.0 m SLOTTED DRAIN. INSTALL 450 mm X 2.0 m CMP WITH END SECTION (SEE SHEET SD-16).
②	"RA" 223+86.7±	REMOVE DI, SLOTTED DRAIN AND STORM DRAIN, 3.0± m RT.
③	"L" 223+05.000	CONSTRUCT TYPE 2 DI, 19.756 m LT WITH 450 mm X 3.0 m SLOTTED DRAIN. INSTALL 450 mm X 15.5 m CMP. CONNECT TO 3000 mm X 2400 mm RCB (SEE SHEET SD-16).
④	"L" 223+00.000	CONSTRUCT TYPE 2 DI, 26.800 m RT WITH 450 mm X 3.0 m SLOTTED DRAIN. INSTALL 450 mm X 43.9 m RCP WITH END SECTION. CONNECT TO 1800 mm VALLEY GUTTER (SEE SHEET SD-16).
⑤	"Sm" 19+07.253	CONSTRUCT CONCRETE SCUPPER, 33.260 m LT (SEE SHEET SD-36).
⑥	"Sm" 18+68.0±	REMOVE SCUPPER 26.0± m RT.
⑦	"Sm" 19+23.0±	REMOVE DI, AND ABANDON 24" RCP, 22.0± m RT.
⑧	"Sm" 19+32.200	CONSTRUCT TYPE 2A DI, 27.700 m LT WITH CONCRETE APRON. INSTALL 450 mm X 2.0 m RCP. CONNECT TO 3000 mm X 2400 mm RCB (SEE SHEET SD-17).
⑨	"Sm" 20+17.233	CONSTRUCT TYPE 2A DI, 27.323 m RT WITH CONCRETE APRON. INSTALL 450 mm X 7.5 m RCP. CONNECT TO TYPE 3 DI (SEE SHEET SD-17).
⑩	"RC1" 10+27.300	CONSTRUCT TYPE 2A DI, 10.500 m LT WITH CONCRETE APRON. INSTALL 450 mm X 14.5 m RCP. CONNECT TO TYPE 2 DI (SEE SHEET SD-17).
⑪	"RC1" 10+36.974	CONSTRUCT TYPE 2 DI, 7.500 m RT INSTALL 450 mm X 13.5 m RCP. CONNECT TO TYPE 3 DI (SEE SHEET SD-17).
⑫	"RC1" 10+42.991	CONSTRUCT TYPE 3 DI, 18.091 m RT INSTALL 450 mm X 25.6 m RCP. CONNECT TO U-CHANNEL (SEE SHEET SD-17).
⑬	"Sm" 20+22.600	CONSTRUCT TYPE 3 DI, 21.000 m RT INSTALL 450 mm X 12.5 m RCP. CONNECT TO EXISTING 36" STORM DRAIN (SEE SHEET SD-17).
⑭	"Sm" 20+28.8±	REMOVE DI AND 24" STORM DRAIN, 16.0± m RT.
⑮	"RF" 14+10.000	CONSTRUCT TYPE 2 DI, 6.600 m LT WITH 450 mm X 3.0 m SLOTTED DRAIN. INSTALL 450 mm X 5.2 m CMP WITH METAL END SECTION AND CLASS 150 RIP RAP APRON (SEE SHEET SD-17).
⑯	"FC" 27+28.000	CONSTRUCT MODIFIED TYPE 8 DI WITH CONCRETE APRON, 2.815 m LT CONNECT TO 3000 mm X 2400 mm RCB (SEE SHEET SD-25).
⑰	"L" 225+80.639 TO "L" 234+80.000	CONSTRUCT U-CHANNEL (SEE SHEET SD-14).
⑱	"Sm" 20+22.0±	REMOVE DI AND 24" RCP STORM DRAIN, 21.0± m RT.
⑲	"RDm" 6+74.0±	REMOVE A PORTION OF THE 18" RCP AND CONNECT TO 3000 mm X 2400 mm RCB.
⑳	"L" 223+40.419 TO "L" 224+76.376	CONSTRUCT CONCRETE VALLEY GUTTER (SEE SHEET SD-26).
㉑	"L" 223+40.000	CONSTRUCT TYPE 2A DI WITH CONCRETE APRON, 31.200 m LT. INSTALL 450 mm X 5.0 m RCP. CONNECT TO 3000 mm X 2400 mm RCB (SEE SHEET SD-17).
㉒	"RF" 10+59.000	CONSTRUCT TYPE 2 DI, 11.100 m LT WITH 450 mm X 3.0 m SLOTTED DRAIN. INSTALL 450 mm X 9.5 m RCP (SEE SHEET SD-17).
㉓	"RF" 10+39.000	CONSTRUCT TYPE 3 DI, 11.100 m LT. INSTALL 450 mm X 13.0 m RCP (SEE SHEET SD-17).
㉔	"Sm" 17+56.096 TO "Sm" 19+08.313	CONSTRUCT 3000 mm X 1800 mm X 144.0 m RCB, 21.166 m RT TO 16.289 m RT. CONNECT TO 3000 mm X 2400 mm RCB (SEE SHEET SD-21).
㉕	"FC" 27+97.000 TO "FC" 28+00.000	CONSTRUCT PRECAST TO CAST-IN-PLACE RCB TRANSITION (SEE SHEET SD-29).
㉖	"L" 225+78.268 TO "L" 225+80.639	CONSTRUCT U-CHANNEL RAMP, 77.547 m RT TO 75.701 m RT (SEE SHEET SD-29)
㉗	"FC" 27+20.000	CONSTRUCT MODIFIED TYPE I MANHOLE, 2.910 m RT CONNECT TO 3000 mm X 2400 mm PRECAST RCB (SEE SHEET SD-12).
㉘	"FC" 27+97.000	CONSTRUCT MODIFIED TYPE I MANHOLE, 2.910 m RT AND 0.670 m LT. CONNECT TO 3000 mm X 2400 mm PRECAST RCB (SEE SHEET SD-13).
㉙	"FC" 28+59.859 TO "FC" 29+90.000	REMOVE 2-10'X8' RCB
㉚	"RDm" 7+30.000	CONSTRUCT TYPE 2A DI WITH CONCRETE APRON, 19.000 m RT. INSTALL 600 mm X 2.0 m RCP. CONNECT TO 3000 mm X 1200 mm RCB (SEE SHEET SD-18).
㉛	"Sm" 19+20.0±	REMOVE DI, 16.0± m RT.
㉜	"Sm" 20+40.0±	REMOVE DI, AND ABANDON 24" RCP, 14.0 m LT.
㉝	"FC" 28+60.859	REMOVE HEADWALL AND RCB PLUG.
㉞	"Sm" 18+51.000 TO "Sm" 19+07.650	REMOVE HEADWALL AND CONSTRUCT 3000 mm X 1200 mm X 89.0 m RCB CULVERT EXTENSION, 27.640 m LT TO 38.280 m LT (SEE SHEET SD-21).
㉟	"Sm" 18+77.7±	REMOVE DI, 42" RCP STORM DRAIN, AND END SECTION, 19.0± m LT.
㊱	"Sm" 18+89.6±	REMOVE DI, 30" RCP STORM DRAIN, AND END SECTION, 19.0± m LT.
㊲	"Sm" 18+50.700 TO "Sm" 18+51.000	CONSTRUCT CAST-IN-PLACE TO PRECAST RCB TRANSITION, 27.500 m RT (SEE SHEET SD-29).
㊳	"FC" 28+00.000 TO "FC" 29+90.000	CONSTRUCT 2- 3000 mm X 2400 mm CAST-IN-PLACE RCB (SEE SHEET SD-13).
㊴	"Sm" 20+37.643	CONSTRUCT TYPE 3 DI, 21.398 m LT INSTALL 450 mm X 7.5 m RCP (SEE SHEET SD-17).
㊵	"RDm" 7+23.868	CONSTRUCT TYPE 2A DI WITH CONCRETE APRON, 15.000 m RT INSTALL 1050 mm X 37.0 m RCP. CONNECT TO 3000 mm X 2400 mm RCB (SEE SHEET SD-18).
㊶	"Sm" 18+71.5± TO "Sm" 19+21.0±	REMOVE DI AND 36" RCP STORM DRAIN 27.0± m RT TO 13.0± m RT.
㊷	"Sm" 19+08.5± TO "Sm" 19+21.0±	REMOVE 36" RCP STORM DRAIN AND CONNECT TO 3000 mm X 2400 mm RCB (SEE SHEET SD-12).
㊸	"Sm" 18+40.0± TO "Sm" 19+10.0±	REMOVE EXISTING RIPRAP. CONSTRUCT RIPRAP SWALE (SEE SHEET SD-38).
㊹	"FC" 28+20.0± TO "FC" 28+61.0±	REMOVE CONCRETE RUBBLE.
㊺	"FC" 27+20.000	CONSTRUCT MODIFIED TYPE 8 DI WITH CONCRETE APRON, 2.815 m LT CONNECT TO 3000 mm X 2400 mm RCB (SEE SHEET SD-25).
㊻	"FC" 28+13.2±	REMOVE HEADWALL, TRASH RACK, AND A PORTION OF THE 10' X 4' RCB. CONNECT TO 300 mm X 2400 RCB
㊼	"RA" 222+40.0± TO "RA" 223+50.0±	REMOVE RIP RAP, 9.0± m RT.

Ⓐ FOR CONSTRUCTION NOTES SEE SHEET SD-2 AND SD-9.

Ⓑ FOR GRADING DETAILS SEE SHEET SD-40.

PRELI 100

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATI

I-15 WIDENING-SAHARA TO CH

GRADING AN DRAINAGE PL

"L" 222+80.000 TO "L" 226

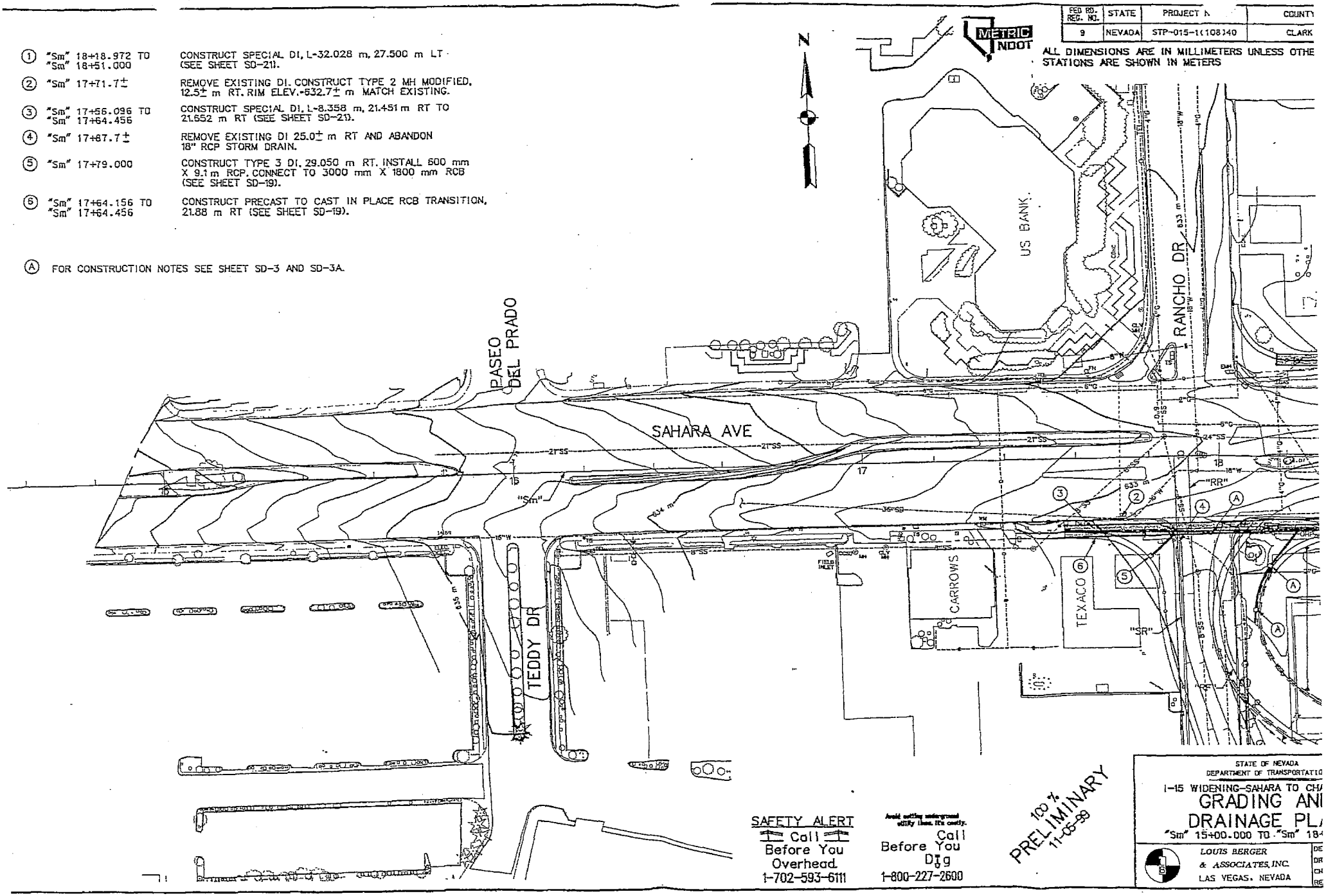
LOUIS BERGER & ASSOCIATES, INC.
LAS VEGAS, NEVADA

FED RD. REG. NO.	STATE	PROJECT N	COUNTY
9	NEVADA	STP-015-1(108)40	CLARK

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHE
STATIONS ARE SHOWN IN METERS

①	"Sm" 18+18.972 TO "Sm" 18+51.000	CONSTRUCT SPECIAL DI, L-32.028 m, 27.500 m LT (SEE SHEET SD-21).
②	"Sm" 17+71.7±	REMOVE EXISTING DI. CONSTRUCT TYPE 2 MH MODIFIED, 12.5± m RT. RIM ELEV.=632.7± m MATCH EXISTING.
③	"Sm" 17+56.096 TO "Sm" 17+64.456	CONSTRUCT SPECIAL DI, L-8.358 m, 21.451 m RT TO 21.652 m RT (SEE SHEET SD-21).
④	"Sm" 17+67.7±	REMOVE EXISTING DI 25.0± m RT AND ABANDON 18" RCP STORM DRAIN.
⑤	"Sm" 17+79.000	CONSTRUCT TYPE 3 DI, 29.050 m RT. INSTALL 600 mm X 9.1 m RCP. CONNECT TO 3000 mm X 1800 mm RCB (SEE SHEET SD-19).
⑥	"Sm" 17+64.156 TO "Sm" 17+64.456	CONSTRUCT PRECAST TO CAST IN PLACE RCB TRANSITION, 21.88 m RT (SEE SHEET SD-19).

Ⓐ FOR CONSTRUCTION NOTES SEE SHEET SD-3 AND SD-3A.



SAFETY ALERT
Call Before You Overhead
1-702-593-6111

Avoid cutting underground utility lines. It's costly.
Call Before You Dig
1-800-227-2600

100 % PRELIMINARY 11-06-98

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATIO

I-15 WIDENING-SAHARA TO CHA

GRADING AN
DRAINAGE PL

"Sm" 15+00.000 TO "Sm" 18+

LOUIS BERGER & ASSOCIATES, INC.
LAS VEGAS, NEVADA

DS# 2738

DS INDEX

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PROJECT Sahara / Rancho Office Park

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The Keith Companies

ADDENDUM #2TO THE TECHNICAL DRAINAGE STUDY FOR SAHARA/RANCHO OFFICE PARK

September 25, 2000

Prepared for

JMA ARCHITECTURE STUDIOS
10150 Covington Cross Drive
Las Vegas, NV 89144
(702) 731-2033

Prepared by

THE KEITH COMPANIES, INC.
444 E. Warm Springs Road
Suite 110
Las Vegas, NV 89119
(702) 263-8206

PLANNING • ENGINEERING • LAND SURVEYING • DEVELOPER SERVICES
WATER RESOURCES • PUBLIC WORKS

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PROJECT Sahara / Rancho Office Park

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UPDATE TO THE TECHNICAL DRAINAGE STUDY

FOR

SAHARA/RANCHO OFFICE PARK

January 8, 2002

Prepared For

JMA ARCHITECTURE STUDIOS
10150 Covington Cross Drive
Las Vegas, NV 89144
(702) 731-2033

Prepared By

THE KEITH COMPANIES, INC.
444 E. Warm Springs Road
Suite 110
Las Vegas, NV 89119
(702) 263-8206

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WATER RESOURCES • PUBLIC WORKS

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The Keith Companies | TKC

ADDENDUM #1 TO THE UPDATE TO THE TECHNICAL DRAINAGE STUDY

FOR

SAHARA/RANCHO OFFICE PARK

March 21, 2002

Prepared For

JMA ARCHITECTURE STUDIOS
10150 Covington Cross Drive
Las Vegas, NV 89144
(702) 731-2033

Prepared By

THE KEITH COMPANIES, INC.
444 E. Warm Springs Road
Suite 110
Las Vegas, NV 89119
(702) 263-8206

PLANNING • ENGINEERING • LAND SURVEYING • DEVELOPER SERVICES
WATER RESOURCES • PUBLIC WORKS

APR 16 2002

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R-04
$250

The Keith Companies | TKC

SUPPLEMENT TO ADDENDUM #1 TO THE UPDATE TO THE TECHNICAL DRAINAGE STUDY

FOR

SAHARA/RANCHO OFFICE PARK

April 15, 2002

Prepared For

SAHARA RANCHO OFFICE CENTER, LLC
2300 S. Rancho Drive
Las Vegas, NV 89102
(702) 384-1494

Prepared By

THE KEITH COMPANIES, INC.
444 E. Warm Springs Road
Suite 110
Las Vegas, NV 89119
(702) 263-8206

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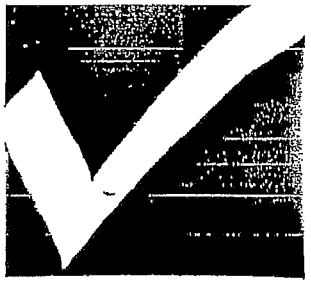
WATER RESOURCES • PUBLIC WORKS



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PN 164-04-401-001, 002, 003 & 004

ROJECT Sahara / Rancho Office Park

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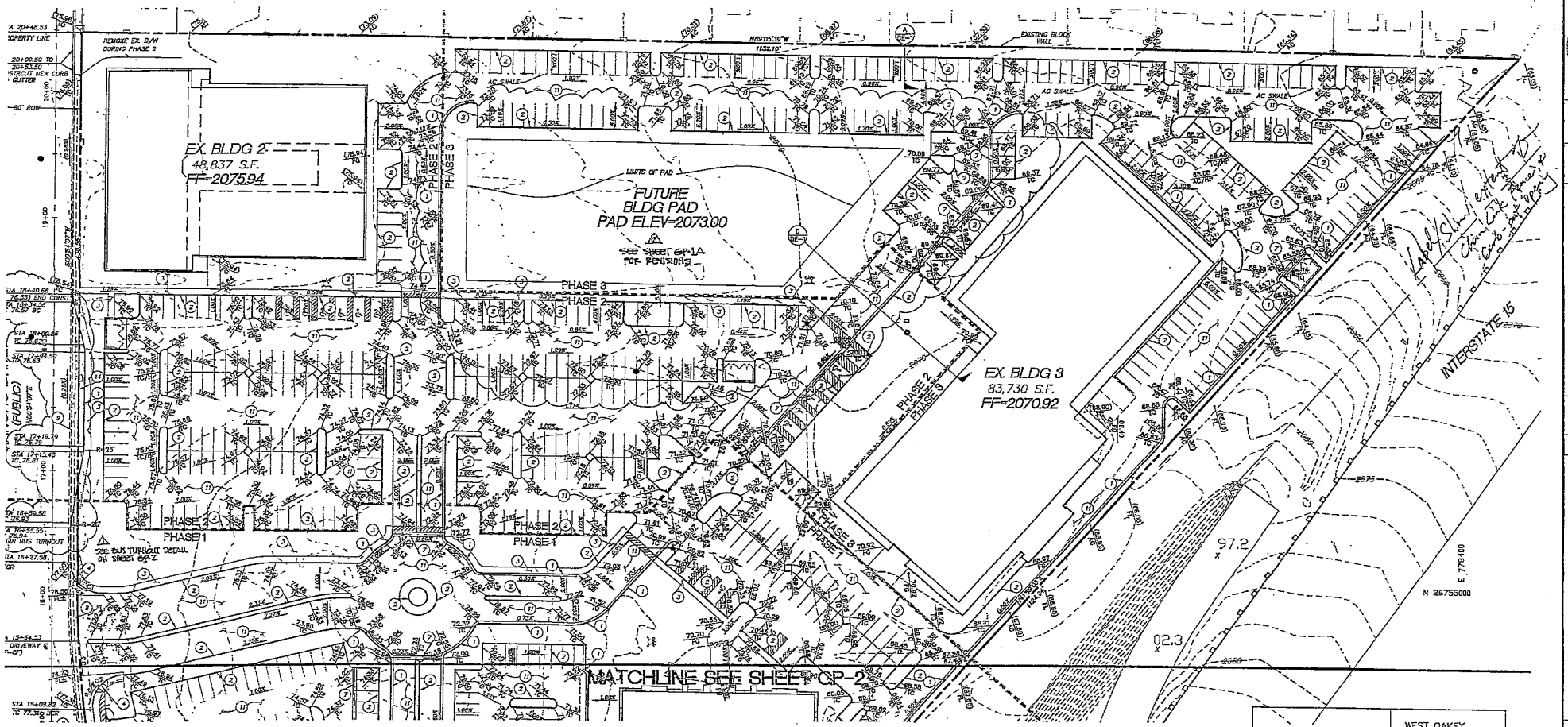


CONSTRUCTION NOTES

No.	ITEM
1	CONSTRUCT "L" TYPE CURB AND GUTTER PER STD DWG NO. 216
2	CONSTRUCT "A" TYPE CURB PER STD DWG NO. 219
3	CONSTRUCT SIDEWALK PER STD DWG NO. 234
4	CONSTRUCT SIDEWALK RAMP PER STD DWG NO. 235, CASE I (A=6'-8" U.N.O.)
5	DEMOLISH AND REMOVE EXISTING ASPHALT AS NECCESSARY
6	SAW CUT EXISTING AC TO SMOOTH FACE AND TACK COAT
7	CONSTRUCT VALLEY GUTTER PER DETAIL X ON SHEET DE-1
8	CONSTRUCT 8" CROSS GUTTER PER STD DWG 228
9	SAWCUT AND REMOVE EXISTING "L" TYPE CURB & GUTTER
10	CONSTRUCT CHANNEL PER DETAIL J ON SHEET DE-1
11	CONSTRUCT 2.5" MIN. AC OVER 6.5" TYPE II AB
12	CONSTRUCT COMMERCIAL DRIVEWAY PER CC AREA STD. DWG. NO. 222-A
13	CONSTRUCT CHANNEL PER DETAIL 6 ON SHEET DE-1
14	CONSTRUCT BUS TURNOUT PER STD. DWG. #234.1

LEGEND

- PROPERTY LINE
- STREET CENTERLINE
- EXISTING INDEX CONTOUR (2125)
- EXISTING CONTOUR (2124)
- EXISTING BUILDING
- EX. CURB & GUTTER
- EX. CURB
- AREA OF DEMOLITION
- EXISTING CHAIN LINK FENCE
- EXISTING BLOCK WALL
- CONSTRUCTION NOTE (X)
- EXISTING GRADE (75.00 TC)
- DIRECTION OF FLOW
- EXISTING STREET LIGHT
- EXISTING AREA LIGHTING
- EXISTING UTILITY POLE
- EXISTING FIRE HYDRANT

NORTH

GRAPHIC SCALE

(IN FEET)
1 inch = 40 ft.

LINE	LENGTH	BEARING
L1	11.16	N00°54'07"E

NOTE:

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 LOCATION. ALL DISCREPANCIES MUST BE IMMEDIATELY REPORTED TO THE ENGINEER. CALL BEFORE YOU DIG: 1-800-227-2600.

NOTE

ALL CONSTRUCTION SHALL CONFORM WITH THE SOILS REPORT PREPARED BY KLEINFELDER DATED JULY 10, 2000 PROJECT No. 31-150407-001

FEMA FLOOD ZONE

FEMA MAP DATED AUGUST 16, 1995 (PANEL No. 32003C2170 D)

PROJECT SITE LIES WITHIN AND AREA WHICH IS NOT LOCATED IN A DESIGNATED SPECIAL FLOOD HAZARD AREA, ALSO IDENTIFIED AS ZONE X.

BASIS OF BEARINGS

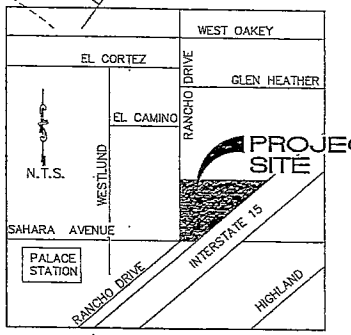
THE BASIS OF BEARINGS FOR THIS PROJECT IS GRID NORTH, AS DEFINED BY THE NEVADA COORDINATE SYSTEM OF 1983 (NCS83), EAST ZONE, AS DETERMINED BY PUBLISHED VALUES BY NATIONAL GEODETIC SURVEY — HIGH ACCURACY REFERENCE NETWORK AS SHOWN BY MAP ON FILE IN FILE 88, PAGE 53 OF SURVEYS IN THE CLARK COUNTY, NEVADA RECORDER'S OFFICE

BENCHMARK

CITY OF LAS VEGAS BENCHMARK STATION 7C11 4SWS

DESCRIPTION
A RIVET & PLATE IN THE TOP OF CURB ON THE NORTHEAST RETURN OF RANCHO ROAD AND SAHARA AVENUE

NAVD '88 ELEV. = 632.6872 METERS (2075.74 FEET)



VICINITY MAP

This grading plan is a part of drainage study # 2738 which was received on 9/11/02. Page 1 of 1

I CERTIFY: THAT THIS GRADING PLAN IS IN CONFORMANCE WITH THE APPROVED DRAINAGE STUDY ON FILE WITH THE CITY OF LAS VEGAS FOR THIS PROJECT

JOE P. GWERDER, P.E. NO. 13636 — DATE

EARTHWORK QUANTITIES

NOTE: THESE QUANTITIES ARE APPROXIMATE AND ARE RAW VOLUMES ONLY. OVEREXCAVATION, SUBSIDENCE, SHRINKAGE, AND BULKING FACTORS ARE NOT TAKEN INTO ACCOUNT.

CUT = 16,800 CY
FILL = 8,100 CY

Call before you Dig. 1-800-227-2600

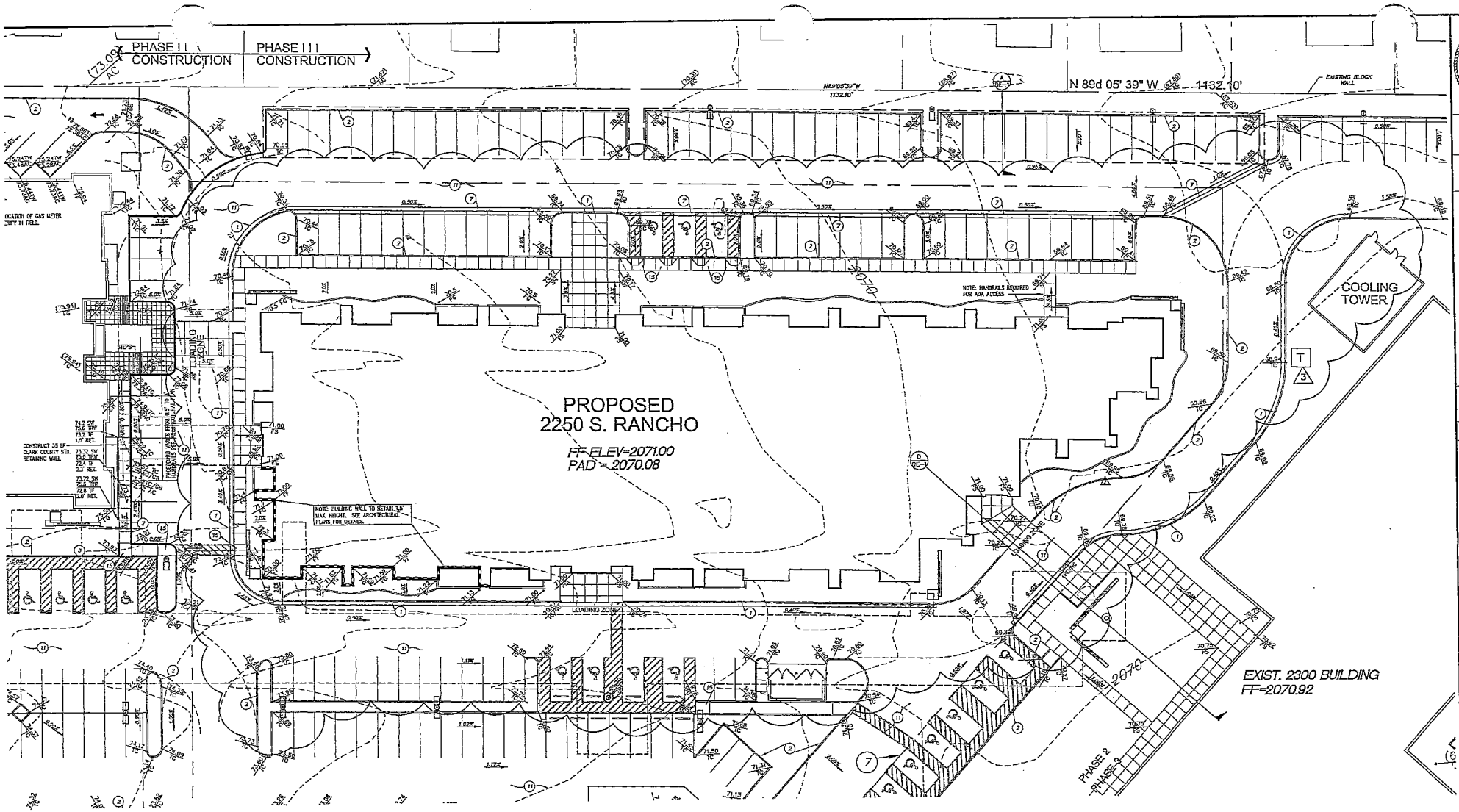
Call before you OVERHEAD 1-702-595-8111

The Keith Companies

SAHARA RANCHO OFFICE CENTER, LLC
RANCHO OFFICE PARK

JOB # 51386
SHEET NO.: GP-1
6 OF 10
HTE# 4646

107-V3399



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4	CONSTRUCT SIDEWALK RAMP PER STD DWG NO. 235, CASE 1 (A=8',B=6' U.N.O.)
5	DEMOLISH AND REMOVE EXISTING ASPHALT AS NECCESSARY
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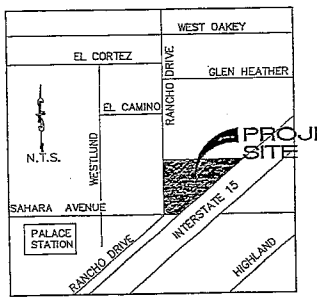
7	CONSTRUCT VALLEY GUTTER PER DETAIL X ON SHEET DE-1
8	CONSTRUCT 8" CROSS GUTTER PER STD DWG 228
9	SAWCUT AND REMOVE EXISTING "L" TYPE CURB & GUTTER
10	CONSTRUCT CHANNEL PER DETAIL J ON SHEET DE-1
11	CONSTRUCT 2.5" MIN. AC OVER 6.5" TYPE II AB
12	CONSTRUCT COMMERCIAL DRIVEWAY PER CC AREA STD. DWG. NO. 222-A
13	CONSTRUCT CHANNEL PER DETAIL E ON SHEET DE-1
14	CONSTRUCT BUS TURNOUT PER STD. DWG. #234.1
15	CONSTRUCT RAMP PER CASO/ ANSI A117.1 ADA STDS.
16	NOT USED
17	NOT USED

LEGEND

- PROPERTY LINE
- STREET CENTERLINE
- EXISTING INDEX CONTOUR
- EXISTING CONTOUR
- EXISTING BUILDING
- EX. CURB & GUTTER
- EX. CURB
- AREA OF DEMOLITION
- EXISTING CHAIN LINK FENCE
- EXISTING BLOCK WALL
- CONSTRUCTION NOTE
- EXISTING GRADE
- DIRECTION OF FLOW
- EXISTING STREET LIGHT
- EXISTING AREA LIGHTING
- EXISTING UTILITY POLE
- EXISTING FIRE HYDRANT



VICINITY MAP

NORTH

GRAPHIC SCALE

(IN FEET)
1 inch = 20 ft.

Call before you Dig. 1-800-227-2600

Call before you OVERHEAD 1-702-593-6111

NOTE

ALL CONSTRUCTION SHALL CONFORM WITH THE SOILS REPORT PREPARED BY KLEINFELDER DATED JULY 10, 2020 PROJECT No. 31-150407-001

BASIS OF BEARINGS

THE BASIS OF BEARINGS FOR THIS PROJECT IS GRID NORTH, AS DEFINED BY THE NEVADA COORDINATE SYSTEM OF 1983 (NCS83), EAST ZONE, AS DETERMINED BY PUBLISHED VALUES BY NATIONAL GEODETIC SURVEY HIGH ACCURACY REFERENCE NETWORK AS SHOWN BY MAP ON FILE IN FILE 88, PAGE 53 OF SURVEYS IN THE CLARK COUNTY, NEVADA RECORDER'S OFFICE

BENCHMARK

CITY OF LAS VEGAS BENCHMARK STATION 7C11 4SWS

DESCRIPTION
A RIVET & PLATE IN THE TOP OF CURB ON THE NORTHEAST RETURN OF RANCHO ROAD AND SAHARA AVENUE

NAVD '88 ELEV. = 632.6872 METERS (2075.74 FEET)

NOTE:

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FEMA FLOOD ZONE

FEMA MAP DATED AUGUST 16, 2012 (PANEL No. 32003C2170 D)

PROJECT SITE LIES WITHIN ZONE X WHICH IS NOT LOCATED IN A DESIGNATED SPECIAL FLOOD HAZARD AREA, ALSO IDENTIFIED AS ZONE X.

I CERTIFY THAT THIS GRADING PLAN IS IN CONFORMANCE WITH THE APPROVED DRAINAGE STUDY ON FILE WITH THE CITY OF LAS VEGAS FOR THIS PROJECT

JOE P. GWERDER, P.E. NO. 13636 DATE

grading p... part of drainag... 2328

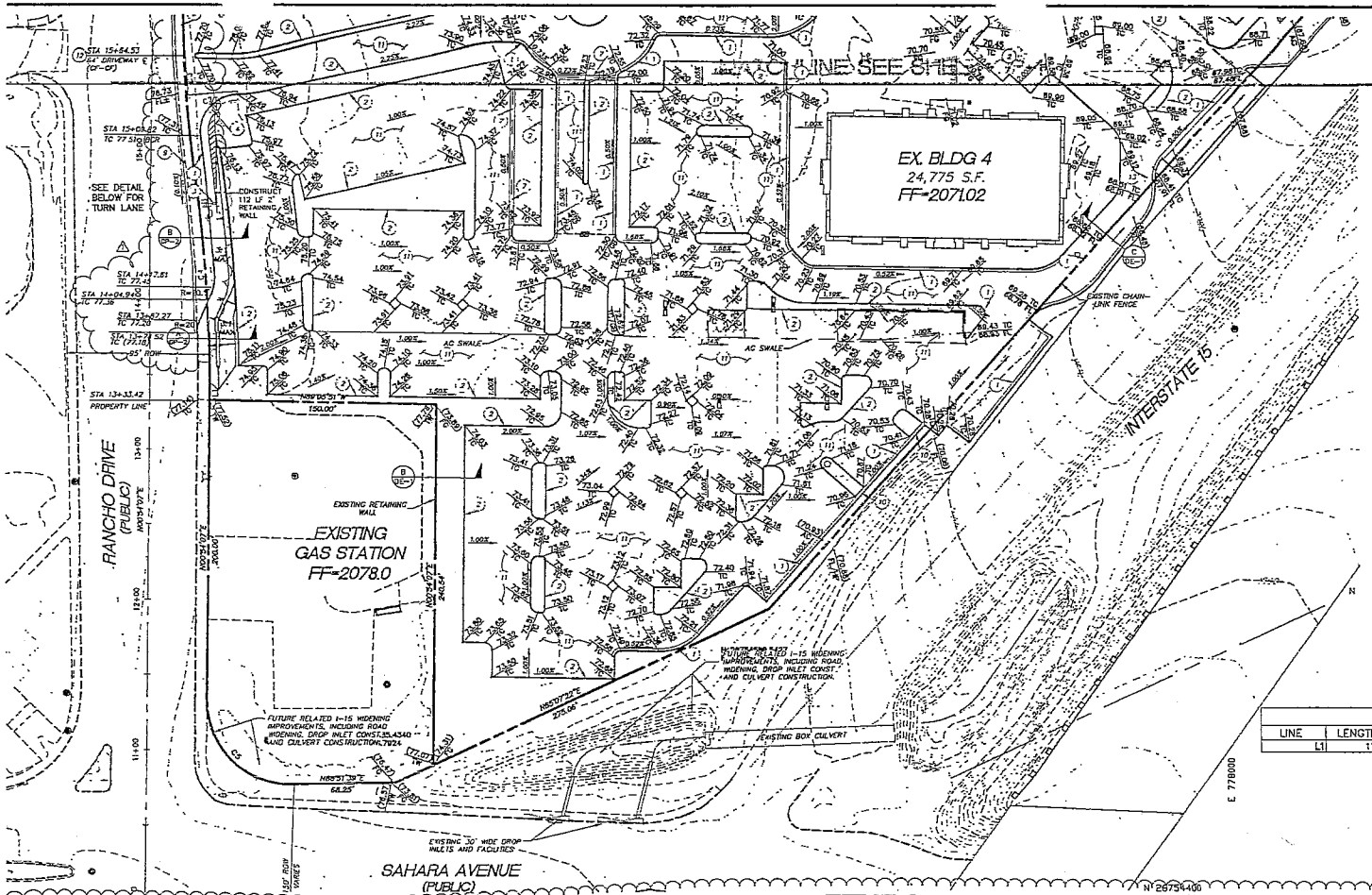
4/16/...

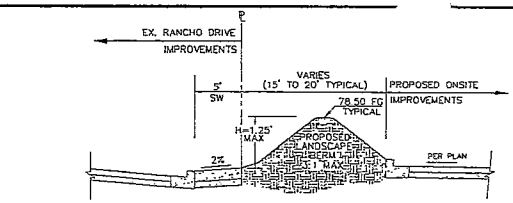
Page ...

SAHARA RANCHO OFFICE CENTER, LLC
RANCHO OFFICE PARK

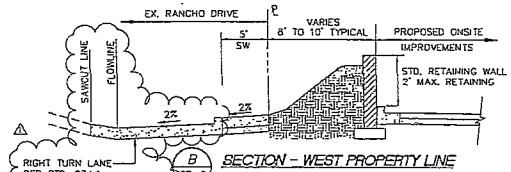
The Keith Companies

JOB # 5...
SHEET NO. GP.
6A OF 1...
PROJECT





A (SP-2) SECTION - WEST PROPERTY LINE (NOT TO SCALE)



B (SP-2) SECTION - WEST PROPERTY LINE (NOT TO SCALE)

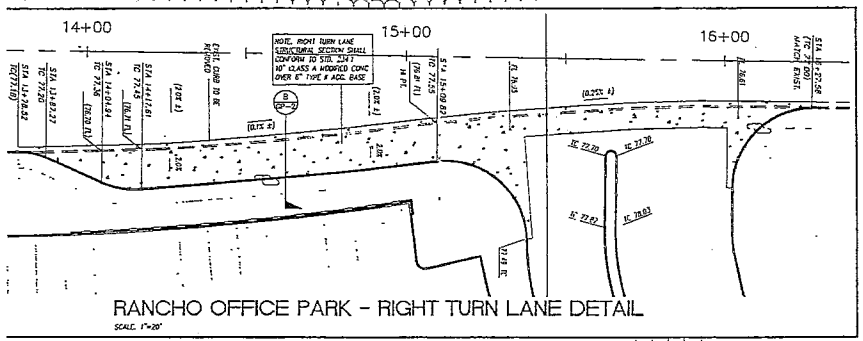
LEGEND

- PROPERTY LINE
- STREET CENTERLINE
- EXISTING INDEX CONTOUR
- EXISTING CONTOUR
- EXISTING BUILDING
- EX. CURB & GUTTER
- EX. CURB
- AREA OF DEMOLITION
- EXISTING CHAIN LINK FENCE
- EXISTING BLOCK WALL
- CONSTRUCTION NOTE
- EXISTING GRADE
- DIRECTION OF FLOW
- EXISTING STREET LIGHT
- EXISTING AREA LIGHTING
- EXISTING UTILITY POLE
- EXISTING FIRE HYDRANT

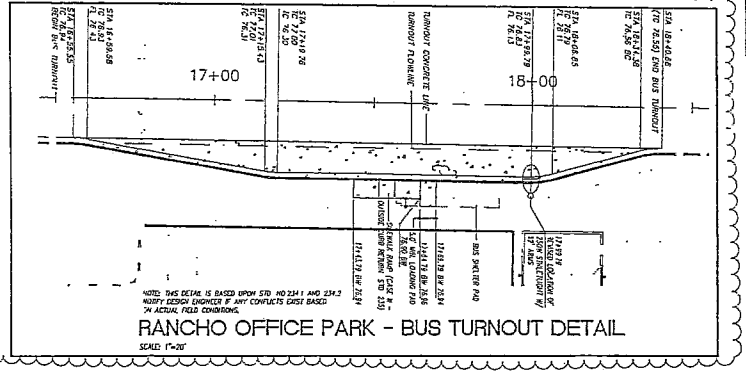
LINE	LENGTH	BEARING
L1	11.16	N00°54'07"E

CONSTRUCTION NOTES

No.	ITEM
1	CONSTRUCT "L" TYPE CURB AND GUTTER PER STD DWG NO. 216
2	CONSTRUCT "A" TYPE CURB PER STD DWG NO. 219
3	CONSTRUCT SIDEWALK PER STD DWG NO. 234
4	CONSTRUCT SIDEWALK RAMP PER STD DWG NO. 225, CASE 1 (A=6'.B=8' U.N.O.)
5	DEMOLISH AND REMOVE EXISTING ASPHALT AS NECCESSARY
6	SAW CUT EXISTING AC TO SMOOTH FACE AND TACK COAT
7	CONSTRUCT VALLEY GUTTER PER DETAIL K ON SHEET DE-1
8	CONSTRUCT 8" CROSS GUTTER PER STD DWG 228
9	SAWCUT AND REMOVE EXISTING "L" TYPE CURB & GUTTER
10	CONSTRUCT CHANNEL PER DETAIL J ON SHEET DE-1
11	CONSTRUCT 2.5" MIN. AC OVER 6.5" TYPE II AB
12	CONSTRUCT COMMERCIAL DRIVEWAY PER CC AREA STD. DWG. NO 222-A
13	CONSTRUCT CHANNEL PER DETAIL G ON SHEET DE-1



RANCHO OFFICE PARK - RIGHT TURN LANE DETAIL
SCALE: 1"=20'



NOTE: THIS DETAIL IS BASED UPON STD. NO 234.1 AND 234.2 NUCITY DESIGN. ENGINEER IF ANY CONFLICTS EXIST BASED ON ACTUAL FIELD CONDITIONS.

RANCHO OFFICE PARK - BUS TURNOUT DETAIL
SCALE: 1"=20'

NORTH

GRAPHIC SCALE

(IN FEET)
1 inch = 40 ft.

EARTHWORK QUANTITIES

NOTE: THESE QUANTITIES ARE APPROXIMATE AND ARE MEANT TO BE USED FOR GRADING PERMIT PURPOSES ONLY. OVEREXCAVATION, SUBSIDENCE, SHRINKAGE, AND BULKING FACTORS ARE NOT TAKEN INTO ACCOUNT.

CUT 2,000 CY
FILL 2,000 CY

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Call before you Dig. 800-227-2600

Call before you OVERHEAD 1-702-595-6111

NOTE

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BASIS OF BEARINGS

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FEMA FLOOD ZONE

FEMA MAP DATED AUGUST 16, 1995
(PANEL No. 32003C2170 D)

PROJECT SITE LIES WITHIN AND AREA WHICH IS NOT LOCATED IN A DESIGNATED SPECIAL FLOOD HAZARD AREA, ALSO IDENTIFIED AS ZONE X.

BENCHMARK

CITY OF LAS VEGAS BENCHMARK STATION 2C11 4SWS

DESCRIPTION
A RIVET & PLATE IN THE TOP OF CURB ON THE NORTHEAST RETURN OF RANCHO ROAD AND SAHARA AVENUE

NAVD '88 ELEV. = 632.6872 METERS (2075.74 FEET)

I CERTIFY THAT THIS GRADING PLAN IS IN CONFORMANCE WITH THE APPROVED DRAINAGE STUDY ON FILE WITH THE CITY OF LAS VEGAS FOR THIS PROJECT.

4/8/02

JOE P. GWERDER, P.E. NO. 13636 DATE

The Keith Companies

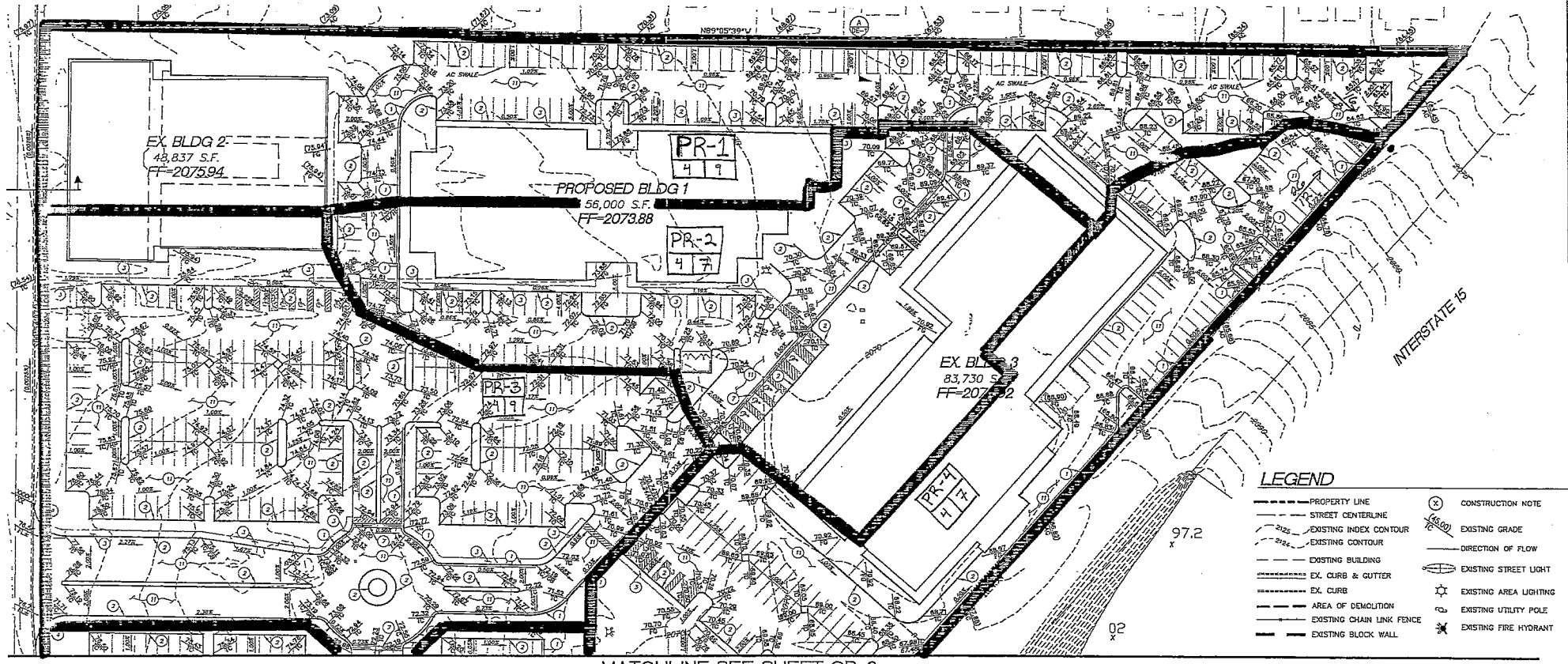
SAHARA-RANCHO OFFICE CENTER, LLC

RANCHO OFFICE PARK

JOB # 1

SHEET 1

7 OF 14



MATCHLINE SEE SHEET GP-2

CONSTRUCTION NOTES

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12	CONSTRUCT COMMERCIAL DRIVEWAY PER CC AREA STD. DWG. NO. 226-A

EARTHWORK QUANTITIES

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CUT = _____ CY
FILL = _____ CY

NORTH

GRAPHIC SCALE

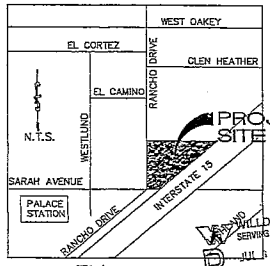
(IN FEET)
1 inch = 40 ft.

Call before you Dig. 1-800-227-2600

Call before you OVERHEAD 1-702-593-6111

LEGEND

- BASIN BOUNDARY
- BASIN — Q_{10} Q_{100} — BASIN FLOWRATES (FLOWRATES IN CFS)
- $\frac{Q_{100}}{Q_{10}}$ — 10 YR AND 100 YR. CUMMULATIVE FLOWRATE (CFS)



VICINITY MAP

NOTE

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BENCHMARK

CITY OF LAS VEGAS BENCHMARK STATION 7C11 4SWS

DESCRIPTION
A RIVET & PLATE IN THE TOP OF CURB ON THE NORTHEAST RETURN OF RANCHO ROAD AND SAHARA AVENUE

NAVD '88 ELEV. = 632.6872 METERS (2073.288 FEET)

JOE P. GWERDER, P.E. NO. 13636 DATE

RECEIVED
CLARK COUNTY, NEVADA
JUL 14 2000
DEPARTMENT OF COMPREHENSIVE PLANNING

BOYD WILLDAN 3016
SERVING PUBLIC AGENCIES

RECEIVED
JUL 14 2000
CITY OF LAS VEGAS

part of drainage study
2738 which was received
on 7/13/00 and is on
Page 1 Of 2.

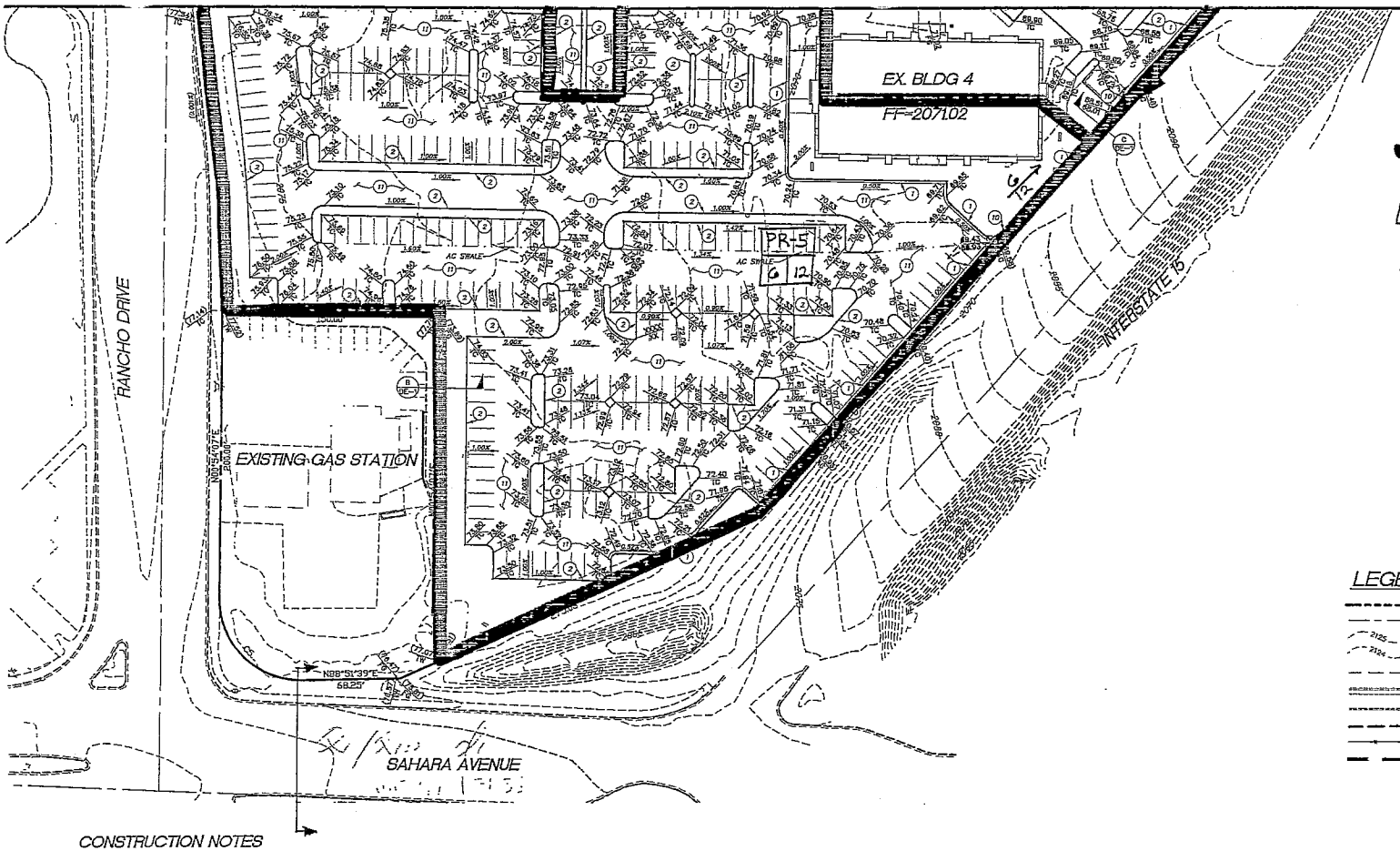
I CERTIFY THAT THIS GRADING PLAN IS IN CONFORMANCE WITH THE APPROVED DRAINAGE STUDY ON FILE WITH THE CITY OF LAS VEGAS FOR THIS PROJECT

SAHARA RANCHO OFFICE CENTER, LLC
RANCHO OFFICE PARK

The Keith Companies

SHEET NO
GP
5 OF 11

MATCHLINE SEE SHEET C



LEGEND

- BASIN BOUNDARY
- BASIN Q_{10} Q_{100} – BASIN FLOWRATES (FLOWRATES IN CFS)
- $\frac{Q_{100}}{Q_{10}}$ – 10 YR. AND 100 YR. CUMMULATIVE FLOWRATE (CFS)

LEGEND

- PROPERTY LINE
- STREET CENTERLINE
- EXISTING INDEX CONTOUR
- EXISTING CONTOUR
- EXISTING BUILDING
- EX. CURB & GUTTER
- EX. CURB
- AREA OF DEMOLITION
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CUT = _____ CY
FILL = _____ CY

NORTH

GRAPHIC SCALE

40 0 20 40 80 160
(IN FEET)
1 inch = 40 ft.

Call before you Dig. 1-800-227-2600

Call before you OVERHEAD 1-702-980-6111

NOTE

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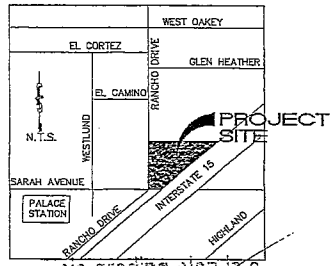


VICINITY MAP

No grading plan is a part of final drainage study # 2738 which was received on 7/13/00 and _____ on _____. Page 2 Of 2.

I CERTIFY THAT THIS GRADING PLAN IS IN CONFORMANCE WITH THE APPROVED DRAINAGE STUDY ON FILE WITH THE CITY OF LAS VEGAS FOR THIS PROJECT

JOE P. GWERDER, P.E. NO. 13636 DATE

The Keith Companies

SAHARA RANCHO OFFICE CENTER, LLC

RANCHO OFFICE PARK

SHEET NO

GP

6 OF 11

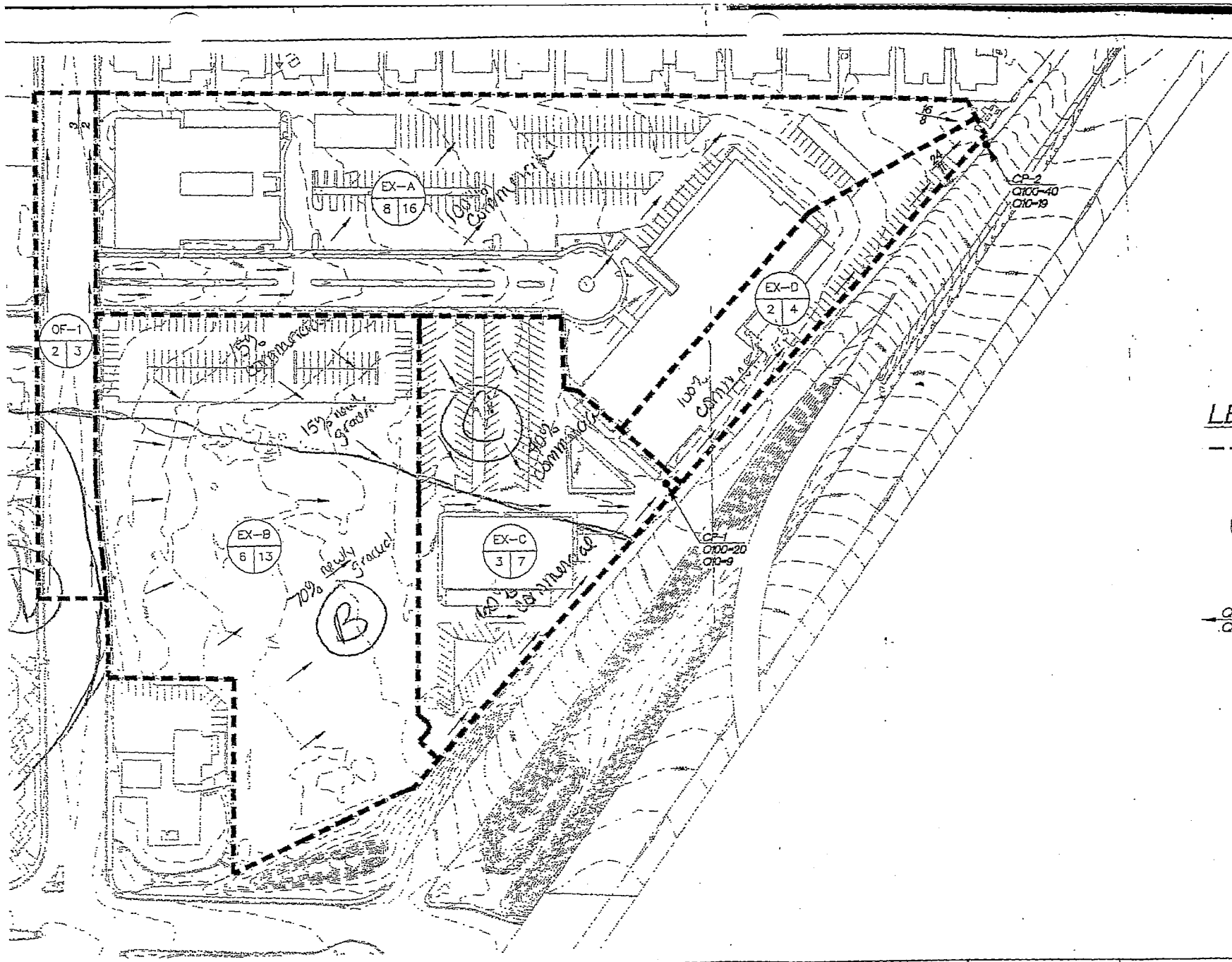
DS# 2738

DS INDEX

APN 164-04-401-001, 002, 003 & 004

PROJECT Sahara / Rancho Office Park

SUBMITTAL Photo & Misc. Docs.



NORTH

GRAPHIC SCALE

120 0 60 1

(IN FEET)

1 inch = 120 ft.

LEGEND:

BASIN BOUNDARY

BASIN Q10 Q100 — BASIN FLOWRATE INFO (FLOWRATES IN CFS)

Q100 (V100) / Q10 (V10) — CUMULATIVE FLOWRATE NOTE: ALL FLOWRATES CFS AND ALL VELOCITI IN FT/S.

The Keith Companies TKC

444 East Warm Springs Road, Suite 110, Las Vegas, Nevada 89119 (702) 263-8206

Water Resources Land Planning Civil Engineering Land Surveying Mapping Environmental Services

SAHARA/RANCHO OFFICE PAI
EXISTING ONSITE BASINS
FIGURE 6

S# 830

S INDEX 1497

APN 162-06-402-001

PROJECT Sahara Pavilion North -
Taco Cabana Pad

SUBMITTAL 1st Submittal - Drainage Study

scanning.doc

CITY OF LAS VEGAS

INTER-OFFICE MEMORANDUM

DATE: March 4, 1992

TO:

Paul Webster
Land Development Services
Department of Public Works

FROM: MAS for
Tom Chiatovich, PE
Chief, Flood Control
Dept. of Public Works

SUBJECT:

Sahara Pavilion North - Taco Cabana Pad

File No. DS830A
Date of Engineer's Stamp: 01/22/92
Date Received by City: 01/27/92

COPIES TO:

Baughman and Turner

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. A more detailed grading plan for the Taco Cabana site must be submitted showing proposed A-curbs, L-curbs, valley gutters, etc. and all related top of curb and flow line elevations.

2. The onsite runoff appears to be drained in a northeasterly direction, therefore, an opening through the curb island to the west of the building between the parking stalls may be needed.

END OF REMARKS
ssn

T/R/S: 21/61/06
R-06, Z-57-87

Baughman & Turner, Inc.
Consulting Engineers & Land Surveyors
1210 HINSON ST.
LAS VEGAS, NEVADA 89102-1604
PHONE (702) 870-8771
FAX (702) 878-2695

January 24, 1992

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

Attn: Mr. Thomas Chiatovich, P.E.
Flood Control Supervisor

SUBJECT: Remaining Pad at Sahara Pavilion North

A master Hydrology Study for Sahara Pavilion North was submitted to the City of Las Vegas on October 17, 1988 and was approved. Since that time, the 30-acre shopping center has been completely developed except for a 1 acre pad at the extreme southwest corner of the site (see attached plan). Existing construction includes complete off-site improvements and landscape buffers along street frontages.

This letter, along with attached plans and completed "Drainage Study Information Form", is being submitted to serve as the Conceptual Drainage Study for the remaining 1-acre pad. It should be considered supplemental to the master drainage study previously approved.

The proposed pad development is in compliance with the conceptual drainage patterns that were proposed and approved in the master Hydrology Study for Sahara Pavilion North. Both on-site and off-site underground drainage facilities have been constructed and grades established per previously approved plans.

If there are any questions concerning this Conceptual Drainage Study or if additional information is needed, please call this office.

Very truly yours,

BAUGHMAN & TURNER, INC.

James W. Leland

James W. Leland, P.E.

Attachments

cc: Pan Pacific Development

S# 830

S INDEX

PN 162-06-402-001

PROJECT Sahara Pavilion North -
Taco Cabana Pad

SUBMITTAL 2nd Submittal - Revised - G.P.

CITY OF LAS VEGAS

INTER-OFFICE MEMORANDUM

DATE: March 5, 1992

TO:

Paul Webster
Land Development Services
Department of Public Works

FROM: MAS for
Tom Chiatovich, PE
Chief, Flood Control
Dept. of Public Works

SUBJECT:

Sahara Pavilion North - Taco Cabana Pad

File No. DS830B
Date of Engineer's Stamp: 02/20/92
Date Received by City: 02/05/92

COPIES TO:

Baughman and Turner

John McNellis, PE
Charles Kajkowski, PE

HISTORY:

1st Submittal	03/04/92 - Not Acceptable
2nd Submittal	(See comment below)

REMARKS:

2nd Submittal (Revised G.P.)

The drainage study for the subject project has been reviewed and

__X__ is acceptable in concept.

_____ must be resubmitted or supplemented.

END OF REMARKS
ssn

T/R/S: 21/61/06
R-06, Z-57-87

Baughman & Turner, Inc.
Consulting Engineers & Land Surveyors
1210 HINSON ST. PHONE (702) 870-8771
LAS VEGAS, NEVADA 89102-1604 FAX (702) 878-2695

January 24, 1992

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

Attn: Mr. Thomas Chiatovich, P.E.
Flood Control Supervisor

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James W. Leland

James W. Leland, P.E.

Attachments

cc: Pan Pacific Development

S# 830

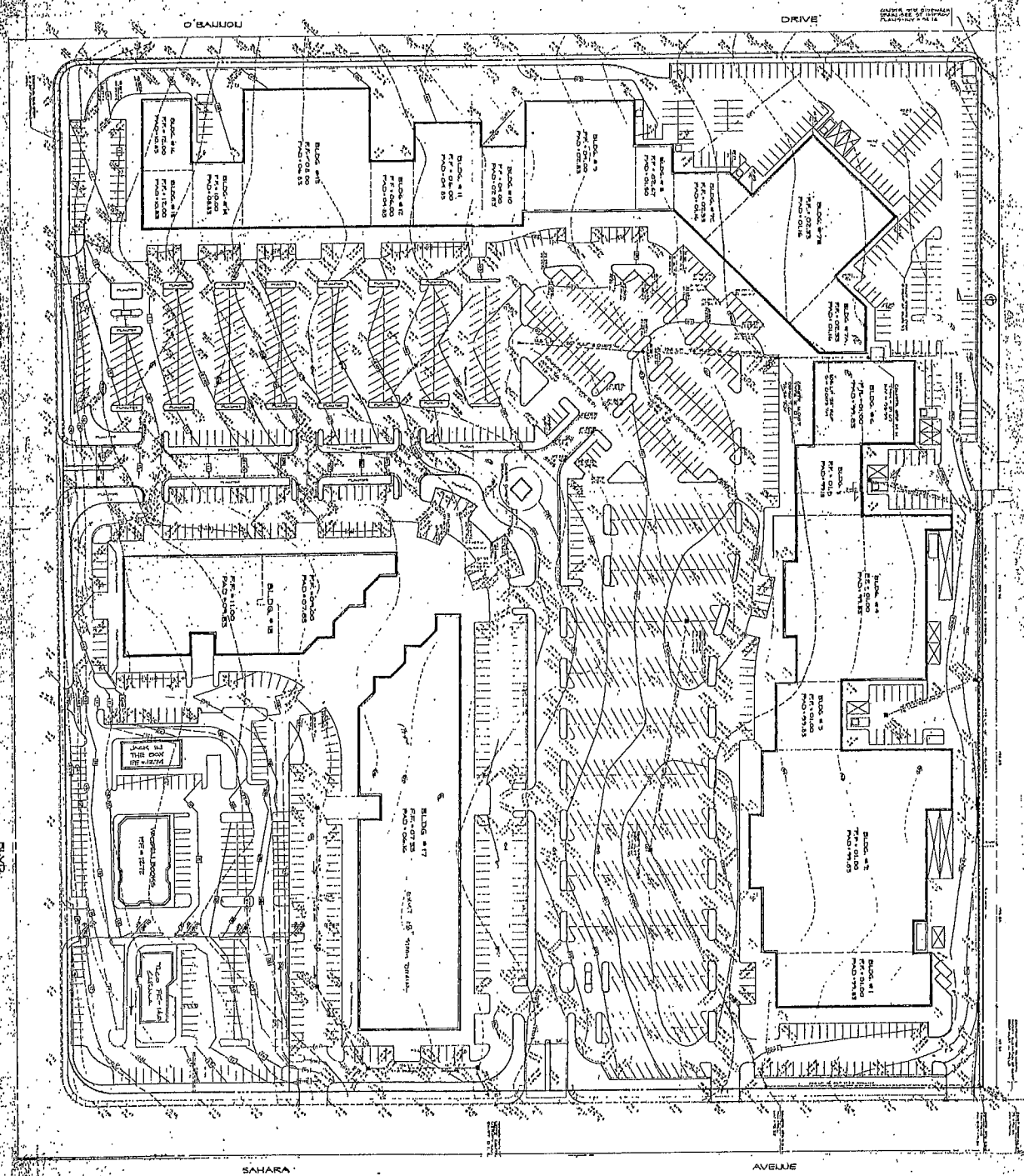
S INDEX

APN 162-06-402-001

PROJECT Sahara Pavilion North
Taco Cabana Pad

SUBMITTAL Grading & Drainage Plans

scanning.doc



GRADING PLANS COMPOSITE

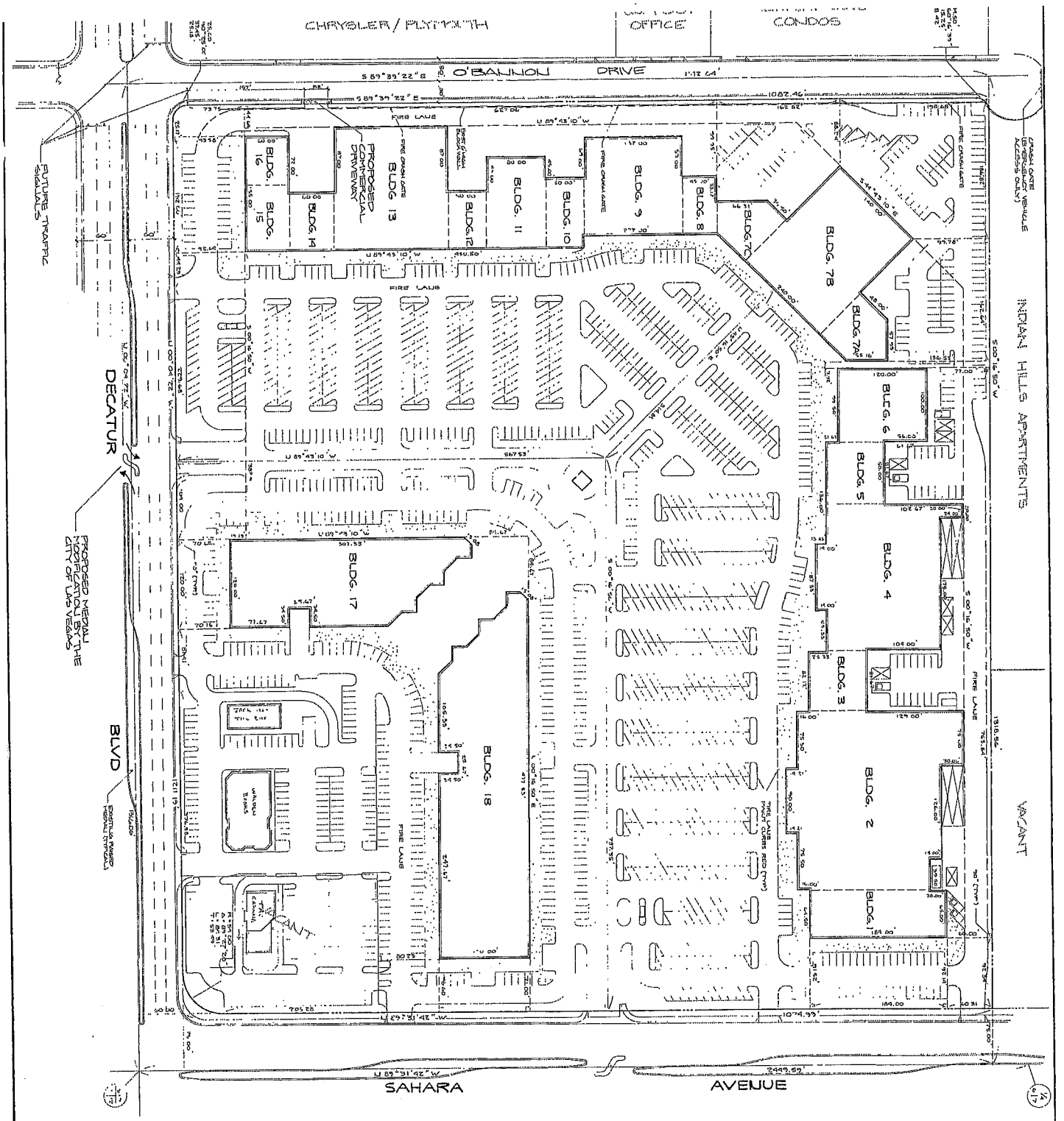
SECTION 6, TOWNSHIP 21 SOUTH, RANGE 61 EAST, M.D.B.&M.
CITY OF LAS VEGAS CLARK COUNTY NEVADA

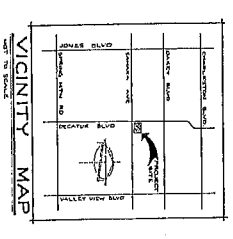
BAUGHMAN & TURNER
CIVIL ENGINEERS MINING ENGINEERS
LAND SURVEYORS

DATE
DESIGN G.A.F.
DRAWN D.S.T.

PREPARED FOR:
ALLIED DEVELOPMENT CO.

DATE	NO	REVISIONS	APP'D





LEGEND

Property Line
Street Centerline
Concrete
Building Line

OWNER/DEVELOPER

PAN PACIFIC DEVELOPMENT (NEVADA) INC.
225 BROADWAY, SUITE 1822
SAN DIEGO, CA 92101
(619) 237-1002

LEGAL DESCRIPTION

Situate in the County of Clark, State of Nevada, described as follows:

PARCEL I:

That portion of the Southwest Quarter (SW 1/4) of Section 6, Township 21 South, Range 61 East, M.D.B.&M., described as follows:

Lot Four (4) as shown by map thereof on file in File 54 of Parcel Maps, Page 12, recorded September 17, 1987 in Book 870917 of Official Records as Document No. 80413.

PARCEL II:

The Southwest Quarter (SW 1/4) of the Southwest Quarter (SW 1/4) of Section 6, Township 21 South, Range 61 East, M.D.B.&M.

EXCEPTING THEREFROM any portion thereof lying within the exterior boundary of Parcel Map File 54, Page 12.

ALSO EXCEPTING THEREFROM all that portion as condemned by the State of Nevada for road purposes by Order recorded June 30, 1975 in Book 930 of Official Records as Document No. 489966.

AND FURTHER EXCEPTING THEREFROM all that portion as condemned by the City of Las Vegas for road purposes by Order recorded June 27, 1978 in Book 407 of Official Records as Document No. 846488.

Containing 10.01 acres more or less.

PRESENT & PROPOSED USE

SHOPPING CENTER

CONDITION BEING REVIEWED

TO ALLOW VEHICLE WORKSHOP BEARING DIRECTLY TO OBTAIN/DRIVE WHERE ACCESS WAS PROHIBITED UNDER PREVIOUS APPROVAL.

PLOT PLAN TO ACCOMPANY "REVIEW OF CONDITION" APPLICATION
SECTION 6, TOWNSHIP 21 SOUTH, RANGE 61 EAST, M.D.B.&M.
CITY OF LAS VEGAS — CLARK COUNTY — NEVADA

BAUGHMAN & TURNER
CIVIL ENGINEERS — MINING ENGINEERS
LAND SURVEYORS

DATE APR. 25, 1991
DESIGN J.W.L.
DRAWN C.A.

PREPARED FOR:
PAN PACIFIC DEVELOPMENT CO.

DATE	NO	REVISIONS	APP'D

DS# 1788

DS INDEX 4166

APN 162-06-813-007

PROJECT BLOCKBUSTER VIDEO (SAHARA/VALLE VIEW

SUBMITTAL 1ST SUBMITTAL, UPDATE TO THE TECHNICAL DRAINAGE STUDY

scanning.doc

ID # 1788
R-6
$ 160
Rec'd 2/28/96

UPDATE TO THE TECHNICAL DRAINAGE STUDY FOR THE SAHARA AVENUE/ VALLEY VIEW BOULEVARD COMMERCIAL SUBDIVISION (PARCEL J-BLOCKBUSTER VIDEO)

Prepared for:

DAVID A. LEYVAS, President
Diversified Realty Services, Inc.
6194 N. 28th Place
Phoenix, Arizona 85016

Prepared by:

Post, Buckley, Schuh & Jernigan, Inc.
901 N. Green Valley Parkway, Suite 100
Henderson, Nevada 89014

PBS&J Reference Number 51855.00
February 1996

PBS&J

DS# 1788

DS INDEX 4167

PN 162-06-813-007

PROJECT BLOCKBUSTER VIDEO (SAHARA / VALLEY VIEW)

SUBMITTAL 2ND SUBMITTAL, AMENDMENT TO THE TECHNICAL DRAINAGE STUDY

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File

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM	DATE: July 15, 1996
TO: Dan Bender Land Development Services Department of Public Works	FROM: Dennis W. Stransky, P.E. Flood Control Department of Public Works
SUBJECT: Technical Drainage Study for: **Blockbuster Video (Sahara/Valley View)** FILE NO. H:\DEPOT\DS\DS1788B.DOC	COPIES TO: PBS&J John McNellis, P.E. Diversified Realty Services, Inc.

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES
1st Submittal	2/28/96	03/08/96	Accepted	$250.00
2nd Submittal	07/12/96	07/15/96	See below	N/C
			TOTAL FEES	$250.00

REMARKS:

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

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

1. The finish floor of the building being built at 2160.60 (approximately 0.5' lower than the CCRFCD criteria) is acceptable. The flow within Sahara Avenue is lower than that determined in the study due to the Sahara Avenue Storm Drain System that is in place.

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.

PLANS SENT TO LAND DEVELOPMENT sent on 03/08/96

END OF REMARKS
cz

T/R/S 21s/61e/06
AREA R-06

DS# 1788

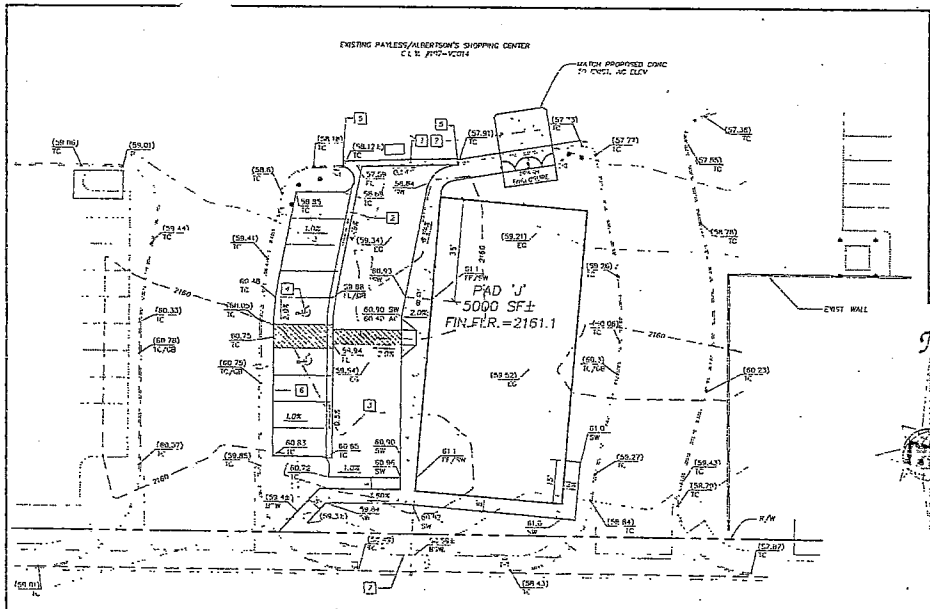
DS INDEX

APN 162-06-813-007

PROJECT BLOCKBUSTER VIDEO (SAHARA/VALLEY VIEW)

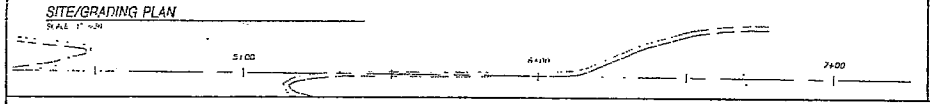
SUBMITTAL MISC; GRADING PLAN

scanning.doc



SITE/GRADING PLAN

SCALE 1" = 50'



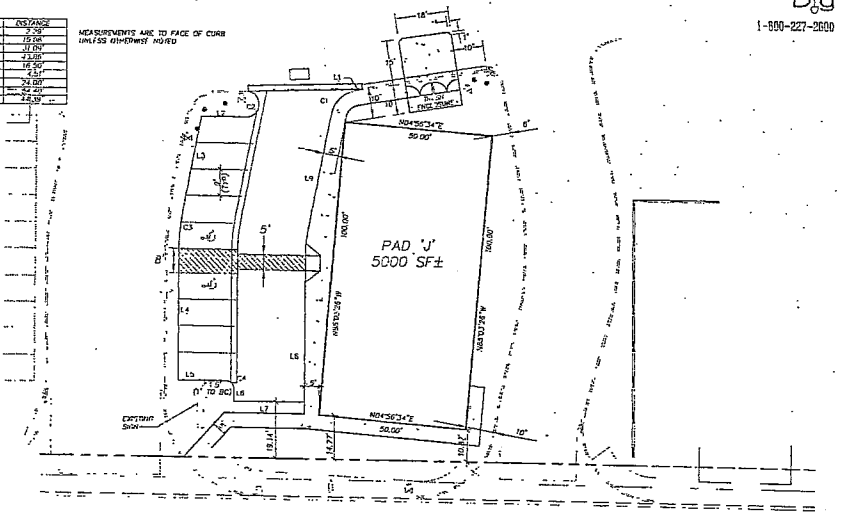
CURVE DATA

CURVE	RADIUS	LENGTH	TANGENT	DELTA
C1	11.00'	17.28'	11.00'	90°00'00"
C2	4.49'	12.71'	44.99'	180°00'00"
C3	64.00'	15.21'	7.63'	13°37'02"
C4	7.50'	3.93'	1.50'	30°00'00"

LINE DATA

LINE	DIRECTION	DISTANCE
L1	S35°57'27"E	7.28'
L2	S00°23'18"W	19.06'
L3	N74°42'43"W	31.00'
L4	N0°23'22"E	43.05'
L5	S89°38'18"W	16.50'
L6	N43°16'05"W	4.54'
L7	S89°38'18"W	24.00'
L8	N0°23'22"E	44.40'
L9	S74°42'43"E	44.99'

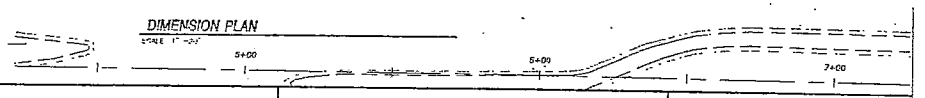
MEASUREMENTS ARE TO FACE OF CURB UNLESS OTHERWISE NOTED



SAHARA AVENUE

DIMENSION PLAN

SCALE 1" = 50'



CONSTRUCTION KEY NOTES

1. REMOVE EXISTING CURB
2. INSTALL 2' VALLEY GUTTER. REFER TO DETAIL A ON THIS SHEET.
3. CONSTRUCT A.C. SECTION PER DETAIL B ON THIS SHEET.
4. CONSTRUCT INTERNATIONAL HANDICAP SYMBOL, SIGN AND STRIPING PER DETAIL C ON THIS SHEET.
5. MATCH PROPOSED CURB TO EXISTING CURB.
6. CONSTRUCT "A" TYPE CURB PER DETAIL D ON THIS SHEET
7. MATCH PROPOSED SIDEWALK TO EXISTING SIDEWALK

GENERAL CONSTRUCTION NOTES

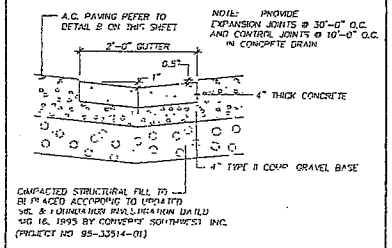
1. CONSTRUCTION SIGNS, PERMANENT SIGNS AND BARRICADES SHALL CONFORM TO THE REQUIREMENTS OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, (MUTCD)
2. VEGETATION AND WILDLIFE OUTSIDE LIMITS OF CONSTRUCTION SHALL NOT BE DISTURBED. CONTRACTOR TO REPAIR ANY DAMAGE TO EXISTING SITE CAUSED BY CONSTRUCTION ACTIVITIES.
3. SLOPE NEW PAVING SURFACES SO AS TO DRAIN WATER AWAY FROM BUILDINGS.
4. ALL DEBRIS CREATED BY CONSTRUCTION ACTIVITIES SHALL BE REMOVED AND DISPOSED OF LEGALLY.
5. SET ASPHALT PLANS FOR PAVING AND CONSTRUCTION
6. CONTRACTOR SHALL USE CARE IN ALL DEMOLITION AND CONSTRUCTION WORK AROUND EXISTING SEWER MANHOLE AND DAMAGE TO EXISTING SEWER LINE AND MANHOLE SHALL BE REPAIRED AT NO COST TO THE OWNER
7. REFERENCE CLV #187-VC014 (PAYLESS/ALBERTSON'S SHOPPING CENTER) FOR OFF SITE IMPROVEMENTS
8. GAS LINE TO BE DESIGNED/COORDINATED BY OWNER/OWNER REPRESENTATIVE WITH SOUTHWEST GAS.
9. ELECTRICAL SERVICE TO BE DESIGNED/COORDINATED BY OWNER/ OWNER AGENT/CONTACT WITH NEVADA POWER
10. LANDSCAPING DISTURBED DUE TO CONSTRUCTION ACTIVITIES, AND WILL BE REPLANTED AT MINIMUM SAME EXISTENCE

LEGAL DESCRIPTION

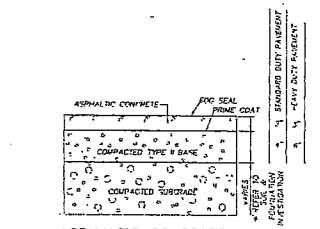
BEING A PORTION OF THE SOUTHEAST QUARTER (SE 1/4) OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 6, TOWNSHIP 21 NORTH, RANGE 61 EAST, M.D.B.&M., CITY OF LAS VEGAS, CLARK COUNTY, NEVADA AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE SOUTHEAST CORNER OF SOUTHEAST QUARTER (SE 1/4) OF SECTION 6, SAID POINT BEING THE CENTERLINE INTERSECTION OF SAHARA AVENUE AND VALLEY VIEW BOULEVARD; THENCE ALONG THE CENTERLINE OF SAHARA AVENUE, N 89°31'42" W A DISTANCE OF 470.27 FEET; THENCE LEAVING SAID CENTERLINE, N 00°28'18" E A DISTANCE OF 25.00 FEET TO THE INTERSECTION OF RIGHT-OF-WAY OF SAID SAHARA AVENUE AND THE POINT OF BEGINNING; THENCE LEAVING SAID RIGHT-OF-WAY N 00°28'18" E A DISTANCE OF 140.31 FEET; THENCE S 89°31'42" E A DISTANCE OF 125.07 FEET; THENCE S 00°18'31" W A DISTANCE OF 148.51 FEET TO THE APPROXIMATED RIGHT-OF-WAY OF SAHARA AVENUE; THENCE ALONG SAID RIGHT-OF-WAY N 89°31'42" W A DISTANCE OF 125.07 FEET TO THE POINT OF BEGINNING

SAID PARCEL CONTAINS APPROXIMATELY 36,809 SQUARE FEET OR 0.597 ACRES.



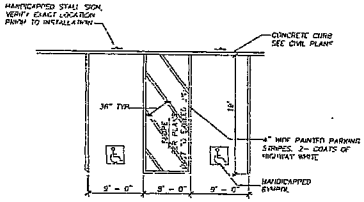
A (1/1) CONCRETE VALLEY GUTTER (ON-SITE)
N.T.S. NOTE: MATERIAL AND CONCRETE THICKNESSES TO BE DETERMINED BY SOIL'S ENGINEER.



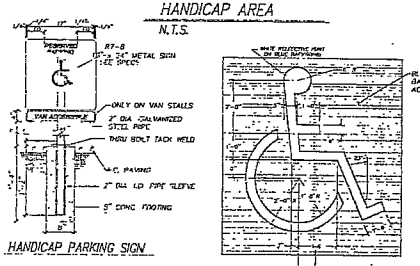
ASPHALTIC CONCRETE PAVEMENT

*UPDATED SOIL & FOUNDATION INVESTIGATION DATED AUGUST 16, 1995 BY CONSERVE CONSULTANTS (NORTHWEST INC (PROJECT NO. 95-33514-01)

B (2/2) ONSITE A.C. PAVEMENT DETAIL
N.T.S.

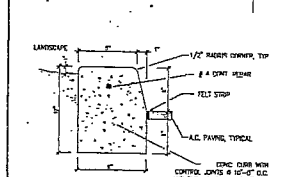


HANDICAP AREA
N.T.S.



HANDICAP PARKING SIGN

C (3/3) INTERNATIONAL HANDICAP SYMBOL (ON-SITE)
N.T.S.



D (3/3) "A" CURB SECTION (ON-SITE)
N.T.S.

Call before you Dig
1-800-227-2600

Grading plan is part of drainage study #1138 which was received on 2-28-96 and Accepted on 3/6/96. Page

VERNON R. HARDING
No. 5913
EXPIRES 6-30-96

No.	REVISIONS	Date/Init	Appr.	Date

POST, BUCKLEY, SCHUH & JERNIGAN
7251 W. Lake Mead Blvd., Suite 300, Las Vegas, Nevada 89128-5834, PH: (702) 853-3600, FAX: (702) 853-3700
ENGINEERING • PLANNING • CONSTRUCTION SERVICES

BLOCKBUSTER VIDEO
SAHARA AVENUE
LAS VEGAS, NEVADA

GRADING & DIMENSION PLANS

Job Number	5855
Sheet Number	2 OF 3
Drawn by	BNAF
Checked by	VRH
Date	FEB 8, 1996
Scale	1" = 20'
File No.	855-02

DRAWING 855-02 PLOT DATE: FEB 19 1996

S# 994

S INDEX 2033

PN 102-04-210-099

ROJECT PM-25-92

SUBMITTAL 1st Submittal Drainage Study

canning.doc

994
R-4
12/29/92

HYDROLOGY STUDY
SECTION 04, TOWNSHIP 21 SOUTH, RANGE 61 EAST
CITY OF LAS VEGAS, NEVADA

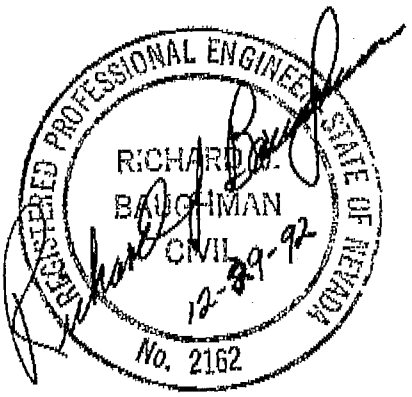
December 29, 1992

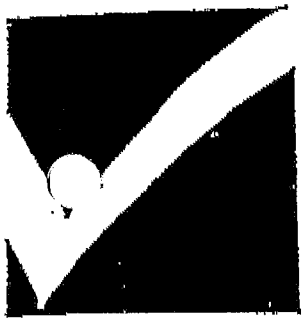
PREPARED FOR:

Mark & Estelle Corrigan

PREPARED BY:

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





S# 994

S INDEX

PN 102-04-210-099

ROJECT PM-25-92

SUBMITTAL Grading & Drainage Plans

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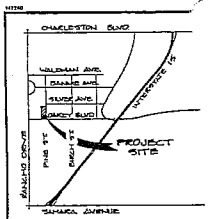
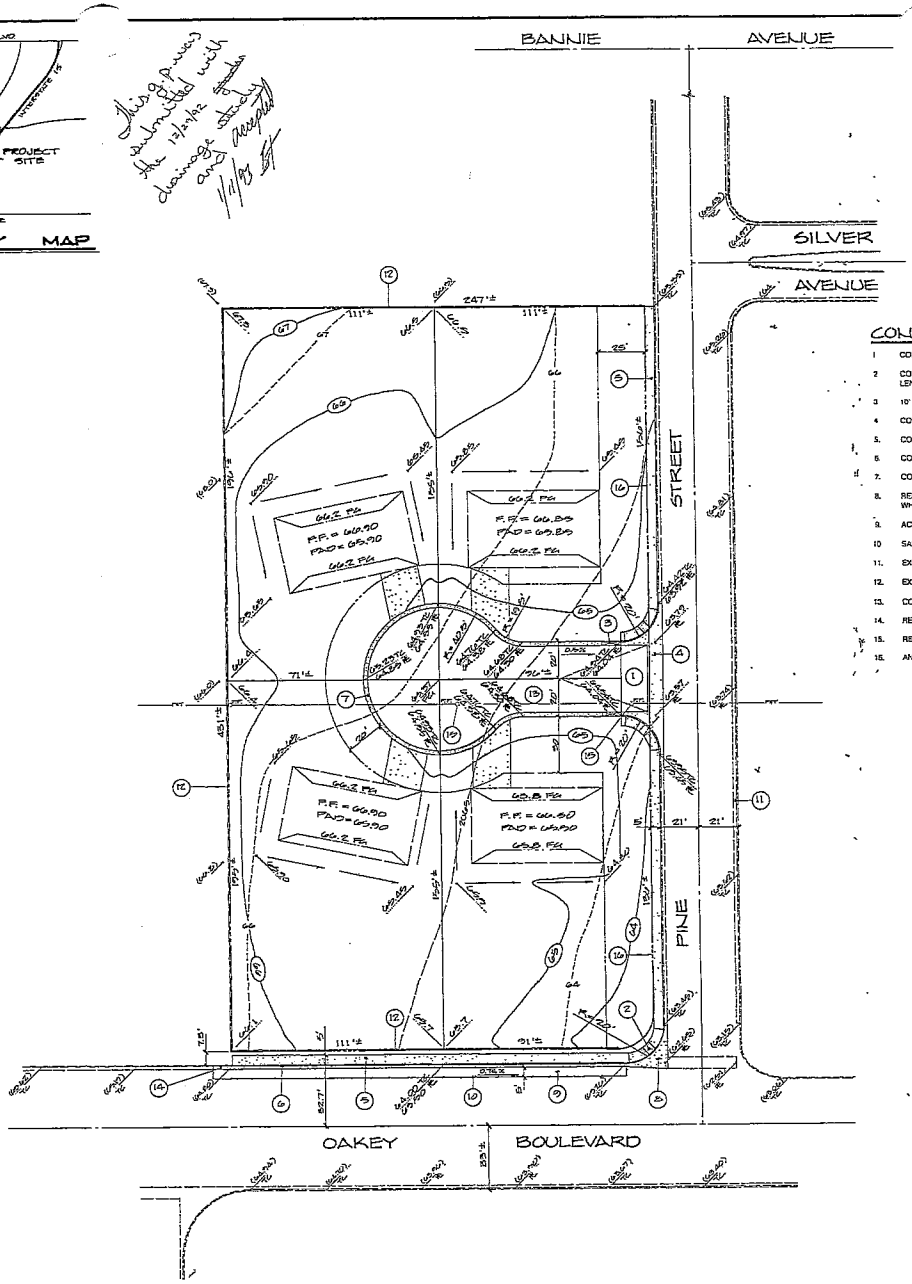


VICINITY MAP

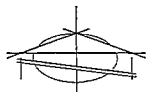
NO SCALE

Missing Pages submitted with the 12/24/92 drainage study and accepted 1/11/93 BT



LEGEND

- PROPERTY LINE
- STREET CENTERLINE
- BUILDING LINE
- (99.00) EXISTING ELEVATION
- 99.00 FINISH DESIGN ELEVATION
- DRAINAGE SWALE (1% MIN.)
- EXISTING CONTOUR LINE
- DESIGN CONTOUR LINE



SCALE: 1" = 30'

GRAPHIC SCALE

(IN FEET)

1 inch = 30 ft.

BENCH MARK

1614811 – BOLT AND PLATE IN THE TOP OF CURB AT THE SOUTHEAST CORNER OF PINE STREET AND SILVER AVENUE.

ELEVATION = 2065.28' C.L.V. DATUM.

CONSTRUCTION NOTES

1. CONSTRUCT DRIVEWAY PER STD DWG 225
2. CONSTRUCT WHEELCHAIR RAMP PER STD DWG 235 CASE 1 W/ 8' (A&B) TRANSITION LENGTH (TYP 3 PLACES)
3. 10' TRANSITION FROM 30" ROLL CURB TO 24" "L" TYPE CURB.
4. CONSTRUCT 8' VALLEY GUTTER PER STD. DWG. 228
5. CONSTRUCT 5' SIDEWALK PER STD DWG 234 (TYP.)
6. CONSTRUCT 2' "L" TYPE CURB & GUTTER PER STD. DWG. 215.
7. CONSTRUCT 30" ROLL TYPE CURB & GUTTER PER STD. DWG. 217 A.
8. REMOVE & REPLACE PORTION OF EXISTING VALLEY GUTTER AS REQUIRED TO CONTRUCT WHEELCHAIR RAMP
9. AC PAVEMENT AND GRAVEL BASE PER STD. DWG 205 OR MATCH EXISTING
10. SAWCUT & MATCH EXISTING AC PAVEMENT
11. EXISTING "L" TYPE CURB & GUTTER (TYP.).
12. EXISTING 6" HIGH BLOCK WALL (TYP.).
13. CONSTRUCT CUL-DE-SAC IMPROVEMENTS PER STD. DWG. 210.
14. REMOVE & REPLACE EXISTING CURB & GUTTER (10'±).
15. RELOCATE EXISTING POWER POLES PER NEVADA POWER CO.
16. ANY FUTURE BLOCK WALLS MUST ALLOW FOR DRAINAGE.

GENERAL NOTES

*REQUIRED NOTES – OTHERS ONLY IF APPLICABLE

1. ALL CONSTRUCTION AND MATERIALS SHALL BE IN ACCORDANCE WITH THE "UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION OFF-SITE IMPROVEMENTS, CLARK COUNTY AREA NEVADA", LATEST ISSUE; THE "UNIFORM STANDARD DRAWINGS FOR PUBLIC WORKS CONSTRUCTION, CLARK COUNTY AREA NEVADA", LATEST ISSUE; AND OTHER APPLICABLE APPROVED STANDARDS ISSUED BY THE CONTROLLING AGENCY; THE UNIFORM BUILDING CODE; AND ALL LOCAL CITY CODES AND ORDINANCES APPLICABLE,EXCEPT AS NOTED ON THIS SHEET.
2. THE EXISTENCE AND LOCATION OF ANY UNDERGROUND UTILITY PIPES OR STRUCTURES SHOWN ON THESE PLANS ARE OBTAINED BY A RESEARCH OF THE AVAILABLE RECORDS. THE CONTRACTOR IS REQUIRED TO TAKE PRECAUTIONARY MEASURES TO PROTECT THE UTILITY LINES SHOWN AND ANY OTHER LINES NOT OF RECORD OR NOT SHOWN ON THESE DRAWINGS. EXISTING UTILITIES ARE LOCATED ON PLANS ONLY FOR THE CONVENIENCE OF THE CONTRACTOR. EXISTING UTILITY SERVICE LATERALS MAY NOT BE SHOWN ON THE PLANS.
* 3. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT EXISTING IMPROVEMENTS WHICH ARE TO REMAIN IN PLACE, FROM DAMAGE AND ALL SUCH IMPROVEMENTS OF STRUCTURES DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED OR RECONSTRUCTED SATISFACTORY TO THE OWNER AT THE EXPENSE OF THE CONTRACTOR.
4. THE CONTRACTOR SHALL NOT BACKFILL ANY TRENCHES IN WHICH WATER LINES HAVE BEEN UNCOVERED UNTIL THE WATERLINES HAVE BEEN INSPECTED BY THE LAS VEGAS VALLEY WATER DISTRICT. THE WATER DISTRICT SHALL BE NOTIFIED 48 HOURS IN ADVANCE OF CONSTRUCTION IN THE VICINITY OF WATER LINES.
* 5. ALL CONSTRUCTION SHALL BE AS SHOWN ON THESE PLANS, ANY ALTERATIONS SHALL HAVE THE PRIOR WRITTEN APPROVAL OF THE CITY ENGINEER.
* 6. TYPE V CEMENT SHALL BE USED IN ALL OFF-SITE CONCRETE WORK. CONCRETE TO BE 3000 P.S.I. MINIMUM @ 28 DAYS. MIX DESIGN TO BE APPROVED BY THE QUALITY CONTROL DIVISION PRIOR TO USE ON THE PROJECT.
7. THE CONTRACTOR SHALL, AT HIS OWN EXPENSE, LOCATE ALL OVERHEAD INTERFERENCES WHICH MAY AFFECT HIS OPERATION DURING CONSTRUCTION AND SHALL TAKE ALL NECESSARY PRECAUTIONS TO AVOID DAMAGE TO SAME. THE CONTRACTOR SHALL USE EXTREME CAUTION WHEN WORKING NEAR OVERHEAD OR UNDERGROUND POWER, GAS AND/OR OTHER UTILITIES SO AS TO SAFELY PROTECT ALL PERSONNEL AND EQUIPMENT, AND SHALL BE RESPONSIBLE FOR ALL COSTS AND LIABILITY IN CONNECTION THEREWITH.
* 8. PERMITS ARE REQUIRED FOR ANY WORK IN THE PUBLIC RIGHT-OF-WAY. THE CONTRACTOR SHALL SECURE ALL PERMITS AND INSPECTIONS REQUIRED FOR THIS CONSTRUCTION.
9. EXPANSION JOINTS REQUIRED, MAXIMUM EVERY 300' IN EXTRUDED TYPE CURB.
10. AC PAVEMENT TO BE 1/2" ABOVE LIP OF ALL GUTTERS OR VALLEY GUTTERS AFTER COMPACTION.
11. APPLY FOG SEAL ONLY AFTER ALL CORRECTIONS AND ADJUSTMENTS HAVE BEEN MADE.
12. CURB & GUTTER WITH A GRADE OF LESS THAN FOUR TENTHS OF ONE PERCENT SHALL BE CONSTRUCTED BY FORMING. EACH JOINT SHALL BE CHECKED FOR GRADE PRIOR TO CONSTRUCTION AND WATER TESTED AS SOON AS POSSIBLE AFTER CONSTRUCTION.
*13. WHEELCHAIR RAMPS SHALL BE CONSTRUCTED IN EACH QUADRANT OF AN INTERSECTION PER STANDARD DRAWING 235. EXACT LOCATION OF RAMPS MAY BE ADJUSTED IN THE FIELD BY A CITY INSPECTOR.
*14. CONTRACTOR SHALL PROVIDE ALL NECESSARY HORIZONTAL AND VERTICAL TRANSITIONS BETWEEN NEW CONSTRUCTION AND EXISTING SURFACES TO PROVIDE FOR PROPER DRAINAGE AND FOR INGRESS AND EGRESS TO NEW CONSTRUCTION. THE EXTENT OF TRANSITIONS TO BE AS SHOWN ON PLANS, OR AS DESIGNATED IN THE FIELD BY A CITY INSPECTOR.
15. ALL GRADING WORK SHALL CONFORM TO THE SOILS REPORT AS PREPARED BY THE SOILS ENGINEER AND APPROVED BY THE CITY ENGINEER.
16. EXACT LOCATION OF ALL SAWCUT LINES MAY BE DETERMINED IN THE FIELD BY A CITY OF LAS VEGAS INSPECTOR IF LOCATION ON PLANS IS NOT CLEARLY SHOWN, OR EXISTING PAVEMENT CONDITION REQUIRES RELOCATION.
*17. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONS NECESSARY TO PROTECT EXISTING PERMANENT SURVEY MONUMENTS. ANY MONUMENTS DISTURBED SHALL BE REPLACED AND ADJUSTED PER AVAILABLE RECORDS IN ACCORDANCE WITH N.R.S. STATUTE NO. 625.550.
*18. UTILITY COMPANY METER BOXES, MANHOLE LIDS, VALVE COVERS, ETC. SHALL BE LOCATED OUT OF DRIVEWAYS, DRIVEWAY APRONS, FLOWLINES, AND VALLEY GUTTERS UNLESS WRITTEN APPROVAL IS GRANTED BY THE UTILITY COMPANY.

12-28-92

DATE | REVISIONS | APP'D

PREPARED FOR: MARK CORRIGAN

DATE JAN. 1993 | DESIGN R.E.T. | DRAWN R.E.T. | CHECK | SCALE 1" = 30'

BAUGHMAN & TURNER INC.
CIVIL ENGINEERS LAND PLANNERS LAND SURVEYORS
1120 HUSTON STREET (702) 870-8271 LAS VEGAS, NEVADA 89101

PLOT & GRADING PLAN

A PORTION OF THE SW1/4 OF THE NW1/4 OF SECTION 4, TOWNSHIP 21 SOUTH, RANGE 61 EAST, M.D.B.&M. CITY OF LAS VEGAS, CLARK COUNTY, NEVADA

SHEET

PROJ. NO

DS# 1237

DS INDEX 2683

APN 162-05-818-003

PROJECT ROMANO'S MACARONI GRILL

SUBMITTAL 1ST SUBMITTAL, TECHNICAL DRAINAGE STUDY

scanning.doc

MAR 04 199

HYDROLOGY STUDY

for

Romano's Macaroni Grill

City of Las Vegas,
Clark County, Nevada

Dunnam Civil Engineers, Inc.
3305 Spring Mountain Road Suite 83
Las Vegas, NV 89102
(702) 367-0588
FAX 367-8145

DS# 1124

DS INDEX 2356

APN 162-05-816-004 to 162-05-816-007
162-05-816-011 to 162-05-816-013

PROJECT SAHARA / RICHFIELD

SUBMITTAL 1ST SUBMITTAL, HYDROLOGY STUDY

scanning.doc

ID#1124
Z-108-63(10)
R-5
Rec'd 8/12/93

HYDROLOGY STUDY

FOR

SAHARA/RICHFIELD

CITY OF LAS VEGAS

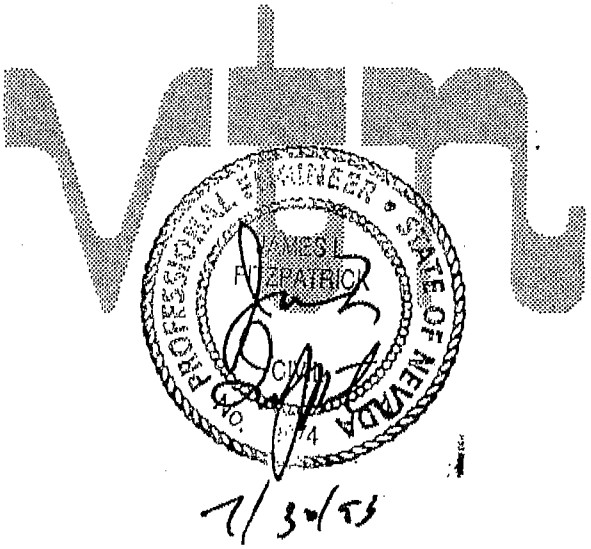
W.O. #2514-X

Prepared for:

MIDBY JOHN H. & ASSOCIATES INC

Submitted to:

CITY OF LAS VEGAS,
NEVADA



7/30/93

DS# 1124

DS INDEX 2357

APN 162-05-816-004 to 162-05-816-007
162-05-816-011 to 162-05-816-013

PROJECT SAHARA / RICHFIELD

SUBMITTAL 2ND SUBMITTAL, ADDENDUM #1

scanning.doc

ID # 1124
Z-108-63(10)
R-5
Rec'd 9/29/93

ADDENDUM #1 TO THE HYDROLOGY STUDY

FOR

SAHARA/RICHFIELD

CITY OF LAS VEGAS, NEVADA

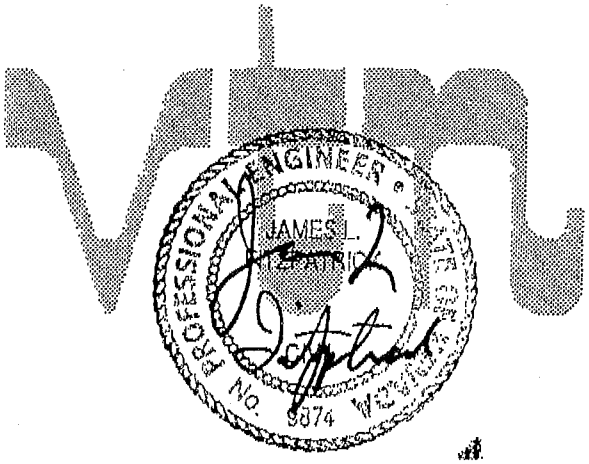
W.O. #2514-X

Prepared for:

MIDBY JOHN H. & ASSOCIATES, INC.

Submitted to:

CITY OF LAS VEGAS, NEVADA



9/29/93

DS# 1124

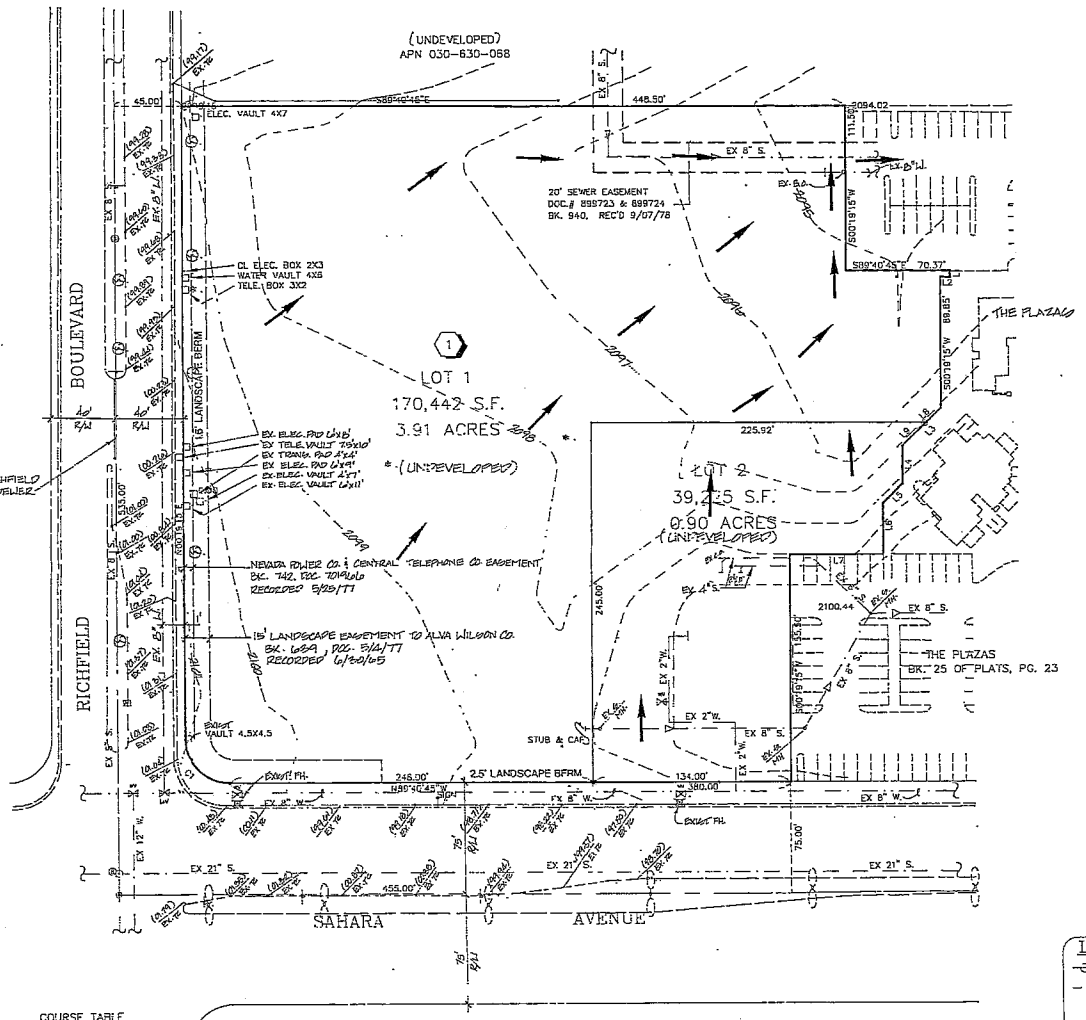
DS INDEX

APN 162-05-816-004 to 162-05-816-007
162-05-816-011 to 162-05-816-013

PROJECT SAHARA / RICHFIELD

SUBMITTAL MISC, GRADING PLANS

scanning.doc



NOTE: DRIVEWAY ADJACENT TO SAHARA SHOULD BE HUMPED 2.0'+
AND ADJACENT TO RICHFIELD SHOULD BE HUMPED 1.6'+.

COURSE TABLE

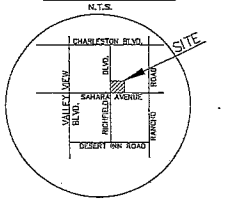
LINE	DIRECTION	DISTANCE
L1	S00°19'15"W	3.07'
L2	N89°40'45"W	6.37'
L3	S45°19'15"W	37.23'
L4	S00°19'15"W	25.70'
L5	S45°19'15"W	18.63'
L6	S00°19'15"W	34.68'
L7	N89°40'45"W	63.00'
L8	S45°19'15"W	14.96'
L9	S45°19'15"W	23.27'

CURVE TABLE

CURVE	RADIUS	LENGTH	TANGENT	DELTA
C1	30.00'	47.12'	30.00'	90°00'00"

VICINITY MAP

N.T.S.



1" = 40'

BENCHMARK

C.L.V. NO. 1618-A2
SOUTHEAST CORNER OF THE INTERSECTION OF TEDDY DRIVE AND SAHARA AVENUE.

ELEVATION = 2068.69'

OWNER/DEVELOPER

JOHN H. MIDBY & ASSOC., INC., A NEVADA CORP.
2300 PASEO DEL PRADO STE.C104
LAS VEGAS, NEVADA 89102
(702) 362-2111

TABULATION

EXISTING ZONING	C-1
GROSS ACREAGE	6.076
TOTAL NO. LOTS	2

LEGAL DESCRIPTION

A PORTION OF THE NORTHEAST QUARTER (NE1/4) OF THE SOUTHEAST QUARTER (SE1/4) OF SEC. 30 T.21S., R60E., M.D.M., CITY OF LAS VEGAS, CLARK COUNTY, NEVADA

Part of a/22/93 S.U.M. Hrl

LEGEND

- EX 8"S — EXISTING SEWER LINE AND MANHOLE
- EX 8"W. — EXISTING WATER LINE
- 2 — LOT NUMBER
- (4) — BLOCK NUMBER
- BOUNDARY LINE
- CENTERLINE
- LOT LINE
- L4 — COURSE NUMBER
- C5 — CURVE NUMBER

GENERAL NOTES

1. ALL IMPROVEMENTS SHALL CONFORM TO THE UNIFORM STANDARDS AND SPECIFICATIONS OF THE CITY OF LAS VEGAS.
2. UTILITY SERVICES PROVIDED AS FOLLOWS:

WATER	LAS VEGAS VALLEY WATER DISTRICT
ELECTRIC	NEVADA POWER COMPANY
GAS	SOUTHWEST GAS CORPORATION
SEWER	CITY OF LAS VEGAS
SOLID WASTE DISPOSAL	SILVER STATE DISPOSAL SERVICE
TELEPHONE	CENTEL

3. UTILITY EASEMENTS TO BE DEDICATED TO RESPECTED AGENCIES.
4. SEWER CONTRIBUTION = 0.01 M.G.D.

JOHN H. MIDBY & ASSOC., INC.
A NEVADA CORP., CITY OF LAS VEGAS.

CONSULTING ENGINEERS • PLANNERS • LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89102-5148 PHONE (702) 873-7550 FAX (702) 362-2597

TITLE: TENTATIVE MAP

PROJECT: SAHARA / RICHFIELD

SCALE

3/12/92

WO NO. 2514-X

BY TZ\BAK

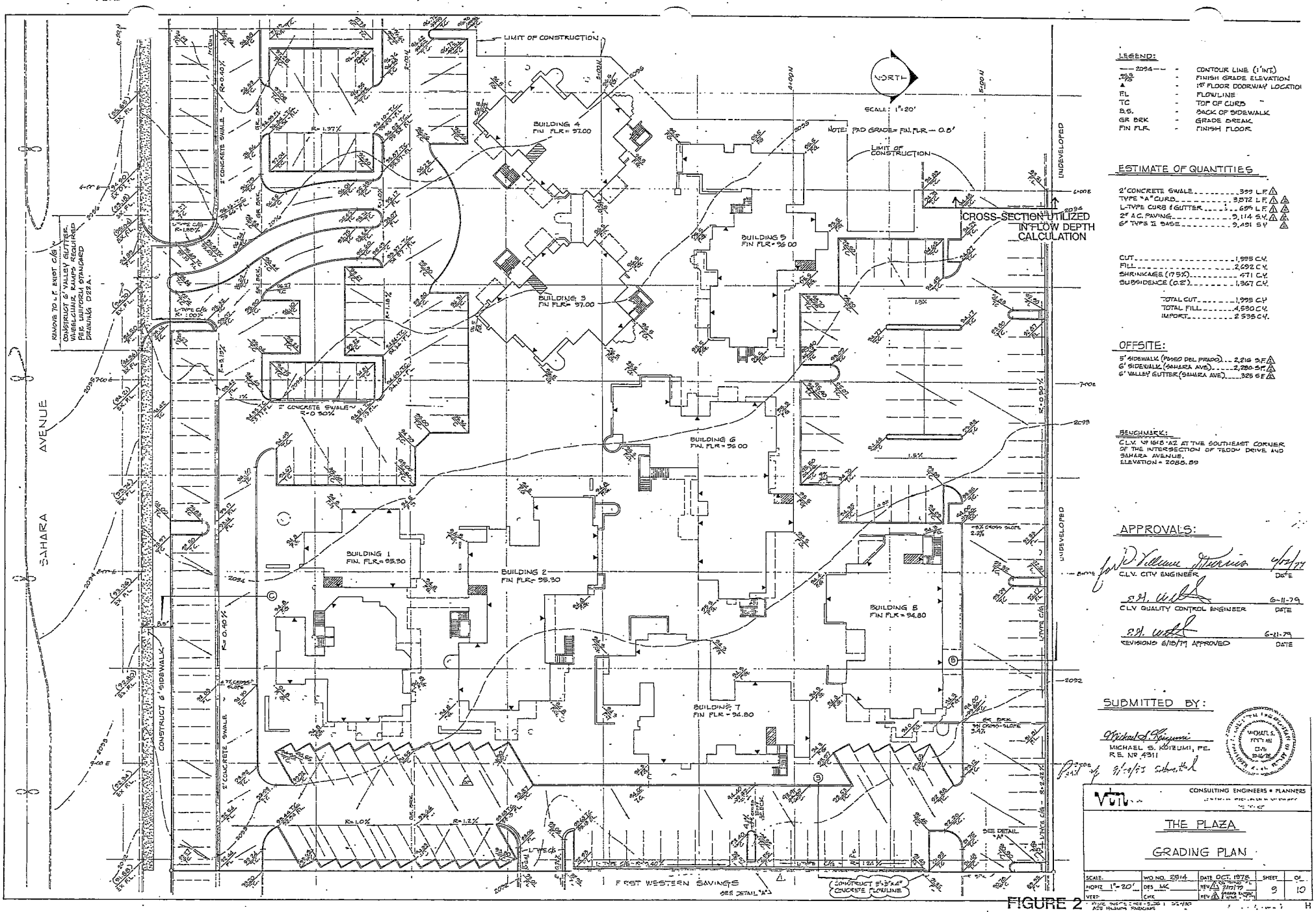
DATE 7/20/92

SCALE HORIZ. 1"=40' VERT.

SHEET 1 OF 1 SHEET

FIGURE 4

H



LEGEND:

2094	-	CONTOUR LINE (1' INT.)
93.5	-	FINISH GRADE ELEVATION
▲	-	1ST FLOOR DOORWAY LOCATION
FL	-	FLOWLINE
TC	-	TOP OF CURB
B.S.	-	BACK OF SIDEWALK
GR BRK	-	GRADE BREAK
FIN FLR.	-	FINISH FLOOR

ESTIMATE OF QUANTITIES

2' CONCRETE SWALE	399 L.F.
TYPE "A" CURB	3,872 L.F.
L-TYPE CURB & GUTTER	695 L.F.
2" A.C. PAVING	9,114 S.Y.
6" TYPE II BASE	9,451 S.Y.

CUT	1,995 C.Y.
FILL	2,692 C.Y.
SHRINKAGE (17.5%)	471 C.Y.
SUBSIDENCE (0.2')	1,367 C.Y.
TOTAL CUT	1,995 C.Y.
TOTAL FILL	4,530 C.Y.
IMPORT	2,535 C.Y.

OFFSITE:

5' SIDEWALK (PASEO DEL PRADO)	2,216 S.F.
6' SIDEWALK (SAHARA AVE.)	2,280 S.F.
6' VALLEY GUTTER (SAHARA AVE.)	325 S.F.

BENCHMARK:

C.L.V. M 1818 AZ AT THE SOUTHEAST CORNER OF THE INTERSECTION OF TEDDY DRIVE AND SAHARA AVENUE.
ELEVATION = 2088.89

APPROVALS:

C.L.V. CITY ENGINEER — DATE 6/21/79

C.L.V. QUALITY CONTROL ENGINEER — DATE 6-11-79

REVISIONS 6/18/79 APPROVED — DATE 6-21-79

SUBMITTED BY:

MICHAEL S. KOIZUMI, P.E.
R.E. NO. 4311

6/19/79

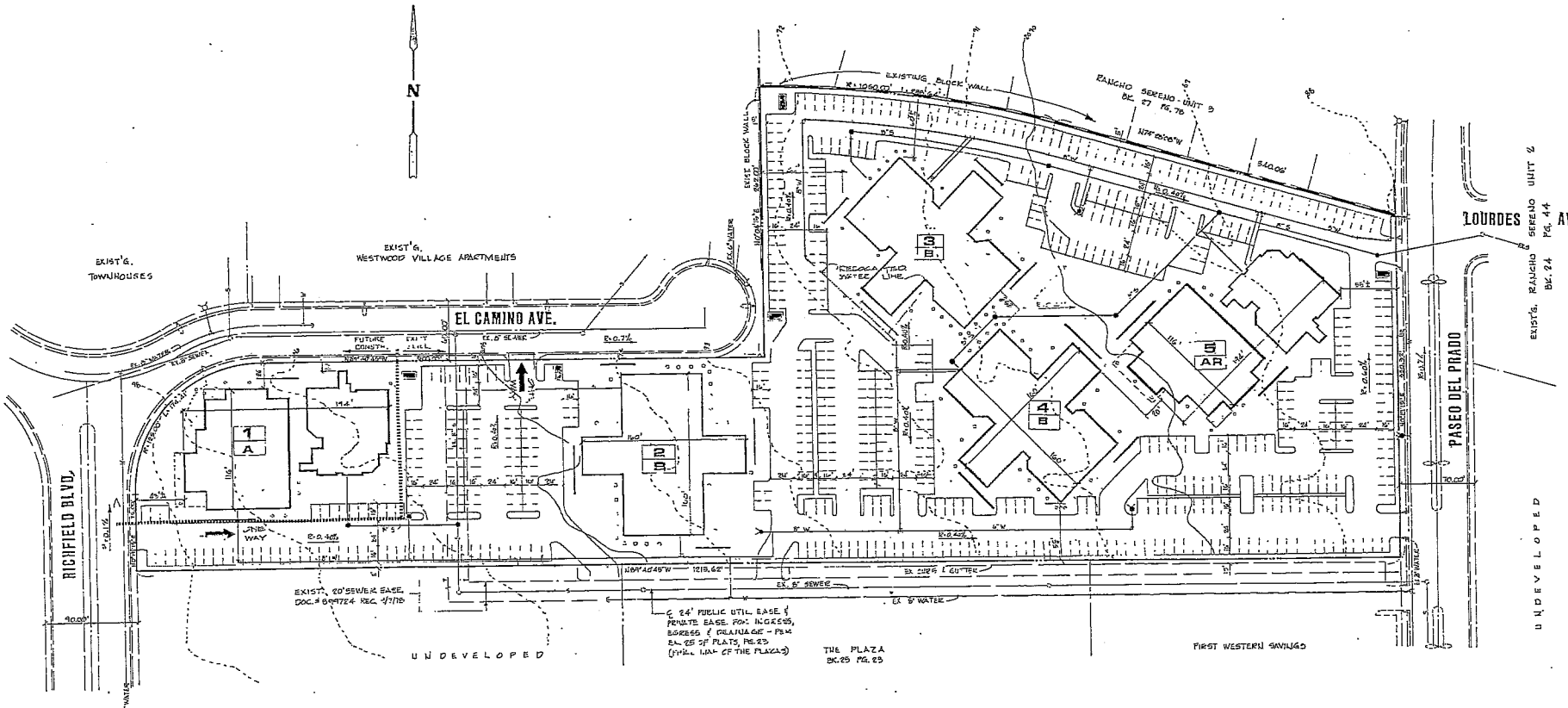
CONSULTING ENGINEERS • PLANNERS

THE PLAZA

GRADING PLAN

SCALE: HORIZ. 1"=20' VERT.	WO NO. 2514 DES. MK CHK	DATE OCT. 1978 REV. 1 2/27/79 REV. 2	SHEET 9	OF 10

FIGURE 2



LEGEND

- EXIST. SEWER LINE & MANHOLE
- PROPOSED SEWER LINE & MANHOLE
- EXIST. WATER LINE & FIRE HYDRANT
- PROPOSED WATER LINE & FIRE HYDRANT
- EXIST./PROPOSED STREET LIGHT
- TRASH/DUMPSTER LOCATION
- BUILDING SCREEN WALL
- EXIST. CONTOUR LINE
- RATE OF GRADE & DIRECTION OF FLOW
- 2 — BLOCK NUMBER
- B — BUILDING TYPE

NOTE: SEE SHEET 2 FOR LOT BREAKDOWN

OWNER / DEVELOPER

RANCHO BONITO ASSOC.
℄ JOHN MIDBY
2500 PASEO DEL PRADO
BUILDING 2, SUITE 107
LAS VEGAS, NV. 89102

LEGAL DESCRIPTION

A PORTION OF THE SE 1/4 OF SECTION 5, T. 21 S., R. 61 E., M.D.M., CITY OF LAS VEGAS, CLARK COUNTY, NEVADA.

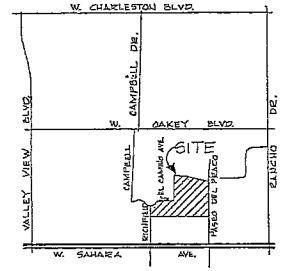
GENERAL NOTES

1. ALL IMPROVEMENTS SHALL CONFORM TO THE CITY OF LAS VEGAS UNIFORM STANDARD SPECIFICATIONS.
2. UTILITY SERVICES:
   - WATER..... LAS VEGAS VALLEY WATER DISTRICT
   - SEWER..... CITY OF LAS VEGAS
   - ELECTRIC..... NEVADA POWER CO
   - GAS..... SOUTHWEST GAS CORP
   - TELEPHONE..... CENTRAL TELEPHONE CO.
   - SOLID WASTE..... SILVER STATE DISPOSAL SERVICE
3. UTILITY EASEMENTS TO BE DEDICATED AS REQUIRED.
4. STORM WATER TO DRAIN ON TO PUBLIC STREETS.
5. RATE OF GRADE SHOWN ON PRIVATE STREETS ALSO APPLIES TO SEWER UNLESS INDICATED OTHERWISE.
6. MINIMUM BUILDING SEPARATION TO BE 20'.
7. THIS DEVELOPMENT IS SHOWN IN IT'S ENTIRETY ON THIS TENTATIVE MAP AND IS NOT A PORTION OF ANY MASTER PLANNED AREA.

TABULATION

NET AREA	6.423 AC.
EXIST'G. ZONING	C-1
TOT. PARKING REQUIRED	316 SPACES
TOT. PARKING PROVIDED	345 SPACES
TOTAL BUILDING AREA	157,830 SQ. FT.
TOTAL LOTS	140

VICINITY MAP



Part of 9/19/83 submittal

FIGURE 3

REV	DATE	BY	REVISION
E	3/22/84	LCC	CLARIFY EXIST/FUTURE PATTERN TRAFFIC FLOW
D	1/26/84	DMD	ADJ. SEW. & DR. & PARKING
C	10/28/83	MSK	CHANGED "B" PAD LOCATIONS & ADDED STREETS
B	09/15/83	DM	PLANTING PLAN SA TO A 45
A	9/19/83	KDF	SUBMITTAL PLANTING PLAN & REVISIONS

Michael K. Kosinski
MICHAEL K. KOSINSKI, P.E.
NEV. CERT., NO. 6811
4/18/83
DATE

CONSULTING ENGINEERS • PLANNERS
2800 WEST SAHARA AVENUE BUILDING 4 SUITE B

TITLE: TENTATIVE MAP
SEC. 5, T. 21 S., R. 61 E., M.D.M.
CITY OF LAS VEGAS, CLARK COUNTY, NEVADA.

PROJECT: PLAZAS OFFICE PARK
IS CONDOMINIUMS CONVERSION

WO NO.	2049
BY	DMD/MSK
DATE	APRIL 15, 19
SCALE	1" = 50'

SHEET 1 OF 2 SHEETS

DS# 1051

DS INDEX 2141

APN 1102-05-818-001

PROJECT Hydrology Study

SUBMITTAL 1st Submittal - Drainage Study

scanning.doc

REC'D 4/5/93

HYDROLOGY STUDY

FOR

PARCEL 030 - 630 - 063

CITY OF LAS VEGAS, NEVADA

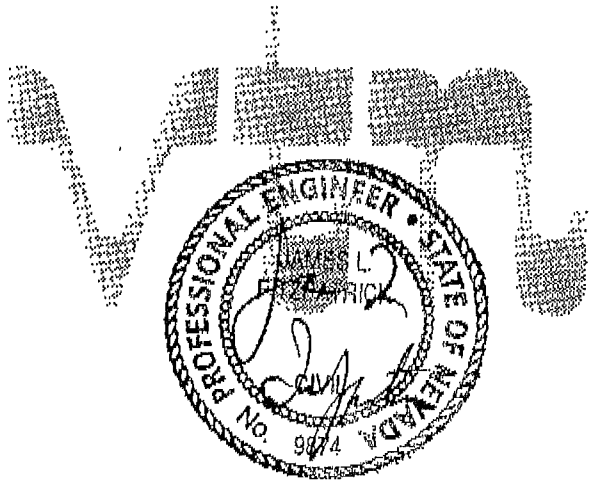
W.O. #4467

Prepared for:

WILLIAM L. TRENT

Submitted to:

CITY OF LAS VEGAS, NEVADA



4/2/93

DS# 1057

DS INDEX 2142

APN 162-05-818-001

PROJECT Hydrology Study

SUBMITTAL 2ND Submittal - Drainage Study

scanning.doc

1051
4/20/93

ADDENDUM #1 TO THE HYDROLOGY STUDY

FOR

PARCEL 030 - 630 - 063

CITY OF LAS VEGAS, NEVADA

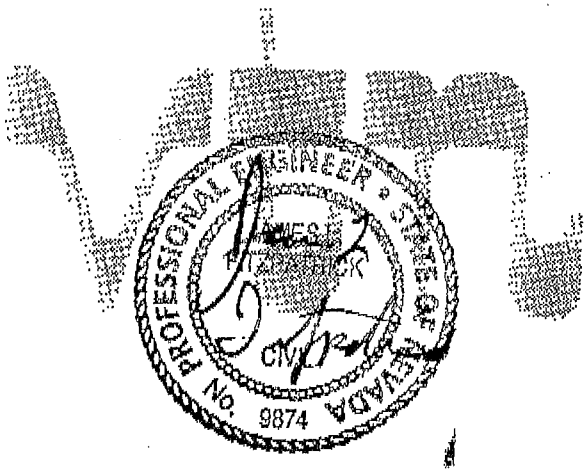
W.O. #4467

Prepared for:

WILLIAM L. TRENT

Submitted to:

CITY OF LAS VEGAS, NEVADA



4/26/93

DS# 1051

DS INDEX 2143

APN 1102-05-818-001

PROJECT Hydrologic Study for Parcel 030-690-09

SUBMITTAL 3RD Submittal - Drainage Study

scanning.doc

CITY OF LAS VEGAS	DATE:
INTER-OFFICE MEMORANDUM	August 6, 1993

TO:	FROM:
~~Joel Harris~~ Adam Mirkowski Land Development Division Department of Public Works	T. Chiatovich, PE Chief Flood Control Dept. Public Works
SUBJECT:	**COPIES TO:**
Hydrology Study for Parcel 030-630-063 File No. DS1051C Date of Engineer's Stamp: N/A Date Received by City: 08/02/93	VTN John McNellis, PE Charles Kajkowski, PE

HISTORY:

1st Submittal	04/23/93 - Not Acceptable
2nd Submittal	04/27/93 - Acceptable
3rd Submittal	08/06/93 - (See comments below)

REMARKS:

3rd Submittal

The drainage study for the subject project has been reviewed and

__X__ is acceptable in concept subject conformance to all City standards and the following conditions:

_____ must be resubmitted or supplemented.

1. Prior to issuance of building/grading permits for any of the lots a technical drainage study update addressing onsite design with a detailed grading plan for each parcel must be submitted to CLV Flood Control for review. Any necessary improvements to the proposed 20-foot drainage easement on Lot 3 must be addressed at that time.

2. The grading plans must show first floor elevations set per the CCRFCD Design Manual (based on adjacent street flow) and/or berming around the site with vertical curves at the entrances to the site.

3. **The 20 foot drainage easement must be called out as private and recorded with the parcel map.**

4. A stamped copy of the text of this addendum must be submitted to CLV Flood Control.

5. This submittal included the revised parcel map but not the revised "parcel map conceptual drainage plan" which included top of curb elevations, topo., and proposed discharge points. This plan must be submitted to CLV Flood Control.

END OF REMARKS T/R/S R5

mas

DS# 1051

DS INDEX

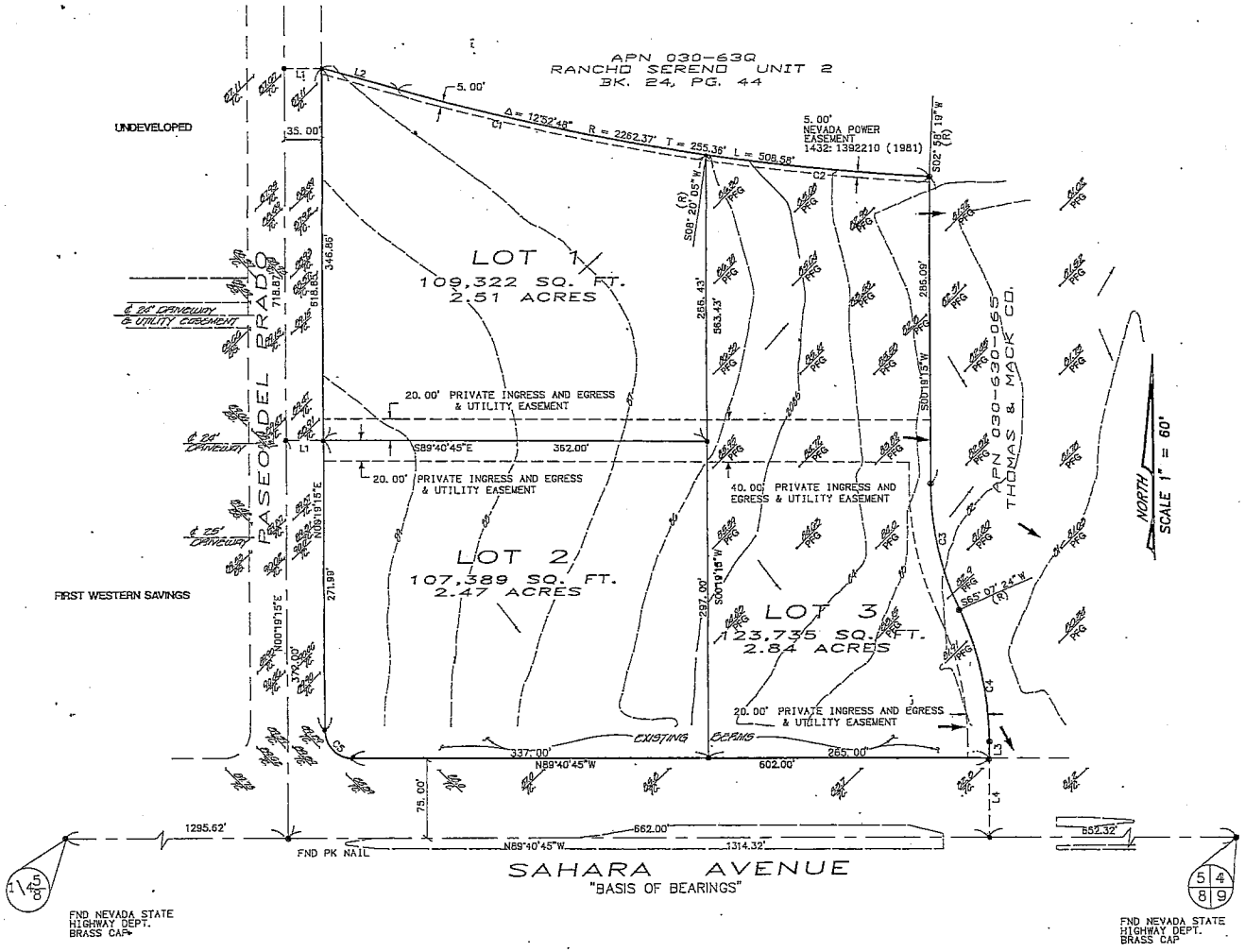
A.N 162-05-818-007

PROJECT Hydrology Study

SUBMITTAL Drainage & Grading Plans

scanning.doc

SITE PLAN



SURVEYOR'S CERTIFICATE

I, STEPHEN P. GURLIDES, A PROFESSIONAL LAND SURVEYOR IN THE STATE OF NEVADA DO HEREBY CERTIFY THAT THIS PARCEL MAP, CONSISTING OF ONE SHEET, ACCURATELY AND COMPLETELY DELINEATES A SURVEY MADE BY ME OR UNDER MY DIRECT SUPERVISION, AT THE INSTANCE OF WILLIAM L. TRENT ALL MONUMENTS ARE OF THE CHARACTER AND OCCUPY THE POSITIONS SHOWN AND ARE SUFFICIENT TO ENABLE THE SURVEY TO BE RETRACED, THIS SURVEY CONFORMS WITH THE DEFINTIONS AND PROVISIONS OF THE NEVADA REVISED STATUTES 278.010 THROUGH 278.630 INCLUSIVE, AND THAT THIS SURVEY WAS COMPLETED ON 03/01/93.

STEPHEN P. GURLIDES, P.L.S.
NEVADA CERTIFICATE NO. 9105

OWNER'S CERTIFICATE

3/3/93

WILLIAM L. TRENT DOES HEREBY CERTIFY THAT BEING THE OWNER OF THE LAND SUBDIVIDED WITHIN THE BOUNDARY SHOWN HEREON, CONSENTS TO THE PREPARATION AND RECORDATION OF THIS PARCEL MAP HAS CAUSED THE LAND TO BE SURVEYED AND PLATTED INTO PARCELS, STREETS _____ AS SHOWN HEREON AND DOES HEREBY OFFER AND DEDICATE TO THE CITY OF LAS VEGAS, IT'S SUCCESSORS AND ASSIGNS, STREETS _____ AS SHOWN HEREON, TO AND FOR THE USE OF THE PUBLIC, AND EASEMENTS AS SHOWN HEREON DESIGNATED AS "P.U.E.", PUBLIC UTILITY EASEMENT, FOR THE CONSTRUCTION AND MAINTENANCE OF SURFACE AND SUBTERRANEAN UTILITIES, AND SUCH GRADING AND DRAINAGE AS REQUIRED PER N.R.S. 278.010 TO 278.630 AND CONFORMANCE WITH FLOOD CONTROL DIVISION REQUIREMENTS.

WILLIAM L. TRENT

ACKNOWLEDGEMENT

STATE OF NEVADA)
) SS
COUNTY OF NYE)

ON THIS 11th DAY OF March 1993, WILLAIM L. TRENT PERSONALLY APPEARED BEFORE ME, A NOTARY PUBLIC, AND ACKNOWLEDGED TO ME THAT HE EXECUTED THE ABOVE INSTRUMENT.

PHYLLIS CHAMBERLAIN
NOTARY PUBLIC IN AND FOR SAID COUNTY AND STATE
MY COMMISSION EXPIRES MAY 10, 1995

NOTARY PUBLIC STATE OF NEVADA County of Nye PHYLLIS CHAMBERLAIN My Appointment Expires May 10, 1995

APPROVAL

THIS IS TO CERTIFY THAT THE DEPARTMENT OF COMMUNITY PLANNING AND DEVELOPMENT, CITY OF LAS, CLARK COUNTY, NEVADA ON THIS ____ DAY OF _____ 1993, DID APPROVE FOR THE PURPOSES OF LAND DIVISION AND ACCEPT IN BEHALF OF THE PUBLIC, THIS MAP AND ANY PARCELS OF LAND OFFERED FOR DEDICATION FOR PUBLIC USE IN CONFORMITY WITH THE TERMS OF THE OFFER OF DEDICATION PER N.R.S. 278.010 TO 278.630.

NORMAN R. STANDERFER, DIRECTOR

MAP APPROVED FOR THE PURPOSE OF LAND DIVISION THE ____ DAY OF _____ 1993.

RITA M. LUMOS – PLS 5094
CITY OF LAS VEGAS SURVEYOR

REFERENCE MAPS

PARCEL MAP	FL 71 PG 26
PARCEL MAP	FL 51 PG 98
PARCEL MAP	FL 65 PG 53

BASIS OF BEARINGS

N. 89° 40' 45"W., BEING THE SOUTH LINE OF THE SE1/4 OF SECTION 5, T. 21 S., R. 61 E., M.D.M., AS SHOWN IN FILE 17 OF PARCEL MAPS, PAGE 26, IN THE OFFICE OF THE CLARK COUNTY RECORDER, CLARK COUNTY, NEVADA.

LEGEND

L4	COURSE NUMBER
C5	CURVE NUMBER
●	SET REBAR W/ALUM CAP PLS 9105
⊛	FND. REBAR W/ALUM CAP PLS 4046 (UNLESS OTHERWISE NOTED)
———	BOUNDARY LINE
— — —	CENTERLINE
- - - - -	EASEMENT LINE
———	EXISTING LOT LINE
PFG	PROPOSED FINISH GRADE

COURSE TABLE

LINE	DIRECTION	DISTANCE
L1	S 89° 40' 45" E	35.00'
L2	S 74° 08' 53" E	74.34'
L3	S 00° 19' 15" W	15.00'
L4	N 00° 19' 15" E	75.00'

CURVE TABLE

CURVE	RADIUS	LENGTH	TANGENT	DELTA
C1	2262.37'	296.82'	148.62'	07° 31' 02"
C2	2282.37'	211.76'	105.96'	05° 21' 46"
C3	285.00'	125.34'	63.70'	25° 11' 51"
C4	265.00'	125.34'	63.70'	25° 11' 51"
C5	25.00'	39.27'	25.00'	90° 00' 00"

ANY SUBSEQUENT CHANGES TO THIS MAP SHOULD BE EXAMINED AND MAY BE DETERMINED BY REFERENCE TO THE COUNTY RECORDER'S CUMULATIVE MAP INDEX NRS 278.5695

VTN nevada
CONSULTING ENGINEERS • PLANNERS • LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89102
(702) 873 – 7550 FAX (702) 362 – 2597

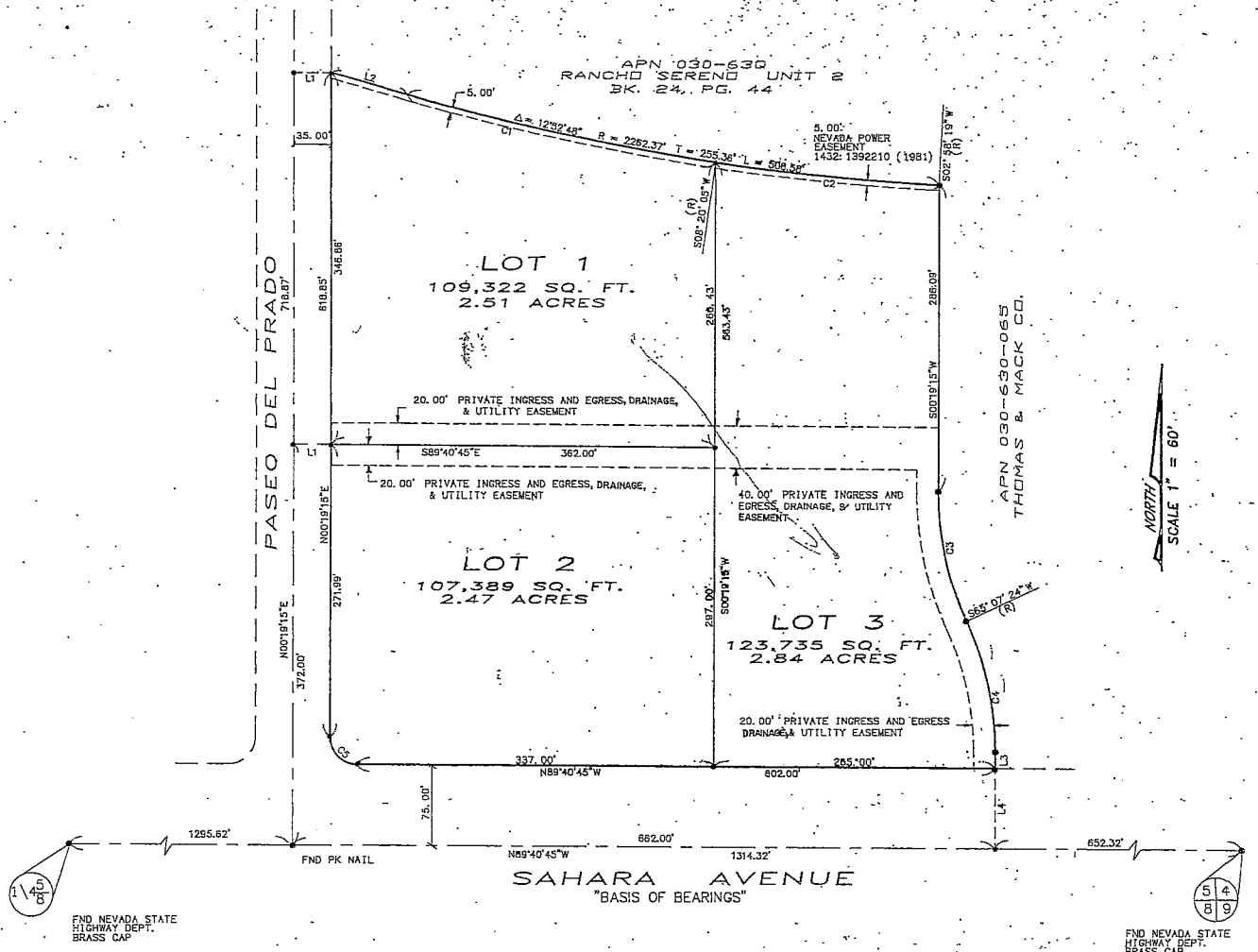
PARCEL MAP
OF
A PORTION OF LOT 4 OF PARCEL MAP FILE 17, PAGE 26

WILLIAM TRENT
A PORTION OF
SECTION 5, T. 21 S., R. 61 E., M.D.M.,
CITY OF LAS VEGAS, CLARK COUNTY, NEVADA

SCALE: 1" = 60'	W.O. # 4467	DATE: 2/5/93	SHEET	OF
FILE: 4457PM.DWG	DRN. BY: PAC	REV.	1	1
	CKD. BY: JHG			

NO.:
FILED AT THE REQUEST OF :
VTN NEVADA
DATED _____ AT _____ M
FILE _____ PAGE _____
OF PARCEL MAPS
OFFICIAL RECORDS BOOK, NO. _____
CLARK COUNTY, NEVADA RECORDS
JOAN L. SWIFT, RECORDER
FEE $ _____ DEPUTY _____

FIGURE 6



SURVEYOR'S CERTIFICATE

I, STEPHEN P. GURLIDES, A PROFESSIONAL LAND SURVEYOR IN THE STATE OF NEVADA DO HEREBY CERTIFY THAT THIS PARCEL MAP, CONSISTING OF ONE SHEET, ACCURATELY AND COMPLETELY DELINEATES A SURVEY MADE BY ME OR UNDER MY DIRECT SUPERVISION. AT THE INSTANCE OF WILLIAM L. TRENT ALL MONUMENTS ARE OF THE CHARACTER AND OCCUPY THE POSITIONS SHOWN AND ARE SUFFICIENT TO ENABLE THE SURVEY TO BE RETRACED, THIS SURVEY CONFORMS WITH THE DEFINITIONS AND PROVISIONS OF THE NEVADA REVISED STATUTES 278.010 THROUGH 278.630 INCLUSIVE, AND THAT THIS SURVEY WAS COMPLETED ON 03/01/93.

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OWNER'S CERTIFICATE

3/3/93

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FOR THE CONSTRUCTION AND MAINTENANCE OF SURFACE AND SUBTERRANEAN UTILITIES, AND SUCH GRADING AND DRAINAGE AS REQUIRED PER N. R. S. 278.010 TO 278.630 AND CONFORMANCE WITH FLOOD CONTROL DIVISION REQUIREMENTS.

WILLIAM L TRENT

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) SS
COUNTY OF NYE)

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PHYLLIS CHAMBERLAIN
NOTARY PUBLIC IN AND FOR SAID COUNTY AND STATE
MY COMMISSION EXPIRES MAY 10, 1995

NOTARY PUBLIC STATE OF NEVADA County of Nye PHYLLIS CHAMBERLAIN My Appointment Expires May 10, 1995

APPROVAL

THIS IS TO CERTIFY THAT THE DEPARTMENT OF COMMUNITY PLANNING AND DEVELOPMENT, CITY OF LAS, CLARK COUNTY, NEVADA ON THIS _____ DAY OF _____ 1993, DID APPROVE FOR THE PURPOSES OF LAND DIVISION AND ACCEPT IN BEHALF OF THE PUBLIC, THIS MAP AND ANY PARCELS OF LAND OFFERED FOR DEDICATION FOR PUBLIC USE IN CONFORMITY WITH THE TERMS OF THE OFFER OF DEDICATION PER N. R. S. 278.010 TO 278.630.

NORMAN R. STANDERFER, DIRECTOR

MAP APPROVED FOR THE PURPOSE OF LAND DIVISION THE _____ DAY OF _____ 1993.

RITA M. LUMOS – PLS 5094
CITY OF LAS VEGAS SURVEYOR

ANY SUBSEQUENT CHANGES TO THIS MAP SHOULD BE EXAMINED AND MAY BE DETERMINED BY REFERENCE TO THE COUNTY RECORDER'S CUMULATIVE MAP INDEX NRS 278.5695

REFERENCE MAPS

PARCEL MAP	FL 71 PG 26
PARCEL MAP	FL 51 PG 96
PARCEL MAP	FL 65 PG 53

BASIS OF BEARINGS

N. 89° 40' 45"W., BEING THE SOUTH LINE OF THE SE1/4 OF SECTION 5, T. 21 S., R. 61 E., M.D.M., AS SHOWN IN FILE 17 OF PARCEL MAPS, PAGE 26, IN THE OFFICE OF THE CLARK COUNTY RECORDER, CLARK COUNTY, NEVADA.

LEGEND

L4	COURSE NUMBER
C5	CURVE NUMBER
●	SET REBAR W/ALUM CAP PLS 9105
●	FND. REBAR W/ALUM CAP PLS 4046 (UNLESS OTHERWISE NOTED)
———	BOUNDARY LINE
———	CENTERLINE
- - - - -	EASEMENT LINE
———	EXISTING LOT LINE

COURSE TABLE

LINE	DIRECTION	DISTANCE
L1	S 89° 40' 45" E	35.00'
L2	S 74° 08' 53" E	74.34'
L3	S 00° 19' 15" W	15.00'
L4	N 00° 19' 15" E	75.00'

CURVE TABLE

CURVE	RADIUS	LENGTH	TANGENT	DELTA
C1	2262.37'	296.82'	148.52'	07° 31' 02"
C2	2262.37'	211.76'	105.96'	05° 21' 46"
C3	285.00'	125.34'	63.70'	25° 11' 51"
C4	285.00'	125.34'	63.70'	25° 11' 51"
C5	25.00'	39.27'	25.00'	90° 00' 00"

VTN nevada
CONSULTING ENGINEERS • PLANNERS • LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89102
(702) 873 – 7550 FAX (702) 362 – 2697

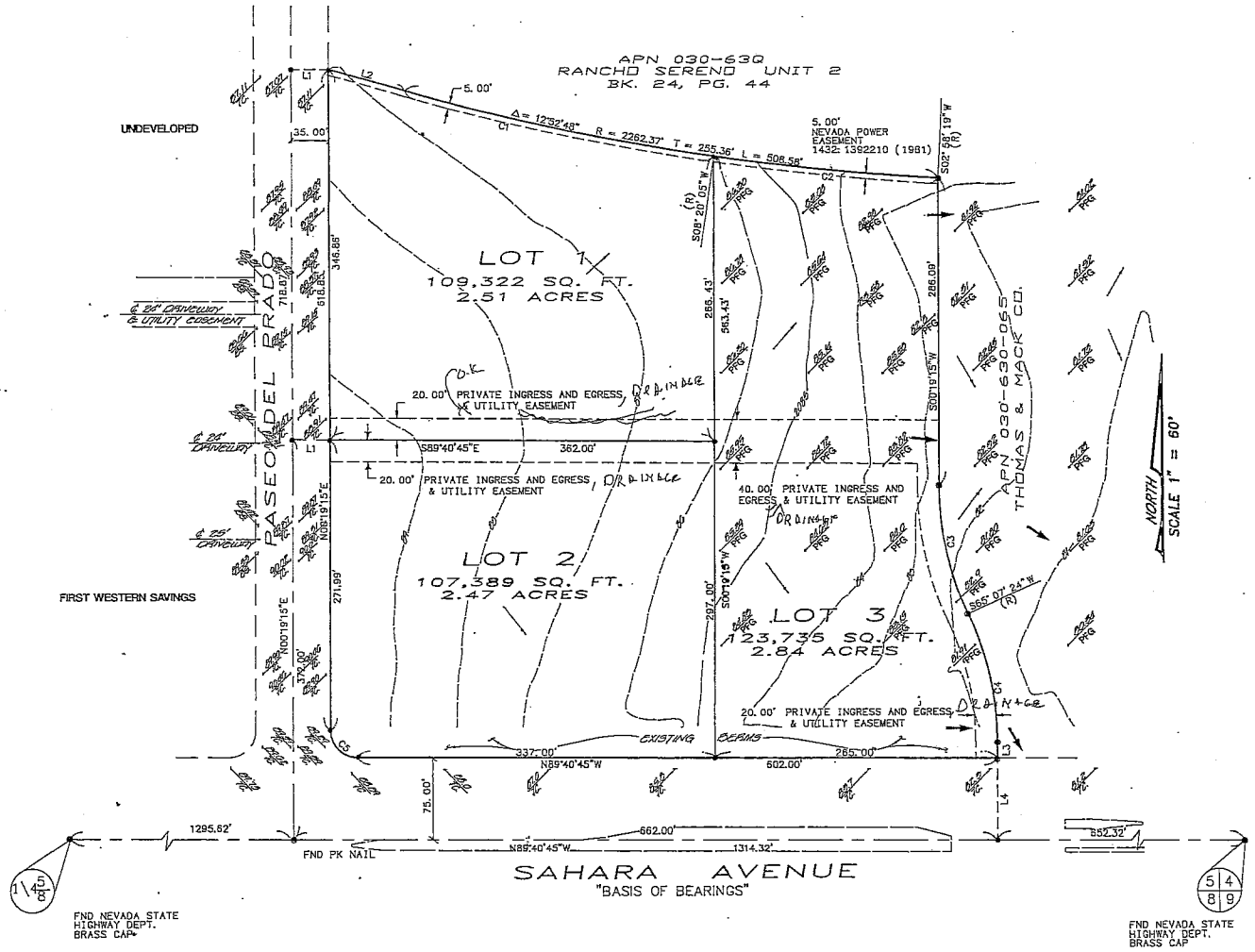
PARCEL MAP
OF
A PORTION OF LOT 4 OF PARCEL MAP FILE 17, PAGE 26

WILLIAM TRENT
A PORTION OF
SECTION 5, T. 21 S., R. 61 E., M.D.M.,
CITY OF LAS VEGAS, CLARK COUNTY, NEVADA

SCALE: 1" = 60'	W.O. # 4467	DATE: 2/5/93	SHEET	OF
FILE: 4467PM.DWG	DRN. BY: PAC	REV.	1	1
	CKD. BY: JHG			

NO._____
FILED AT THE REQUEST OF :
VTN NEVADA
DATED _____ AT _____ M
FILE _____ PAGE _____
OF PARCEL MAPS
OFFICIAL RECORDS BOOK, NO. _____
CLARK COUNTY, NEVADA RECORDS
JOAN L. SWIFT, RECORDER
FEE $_____ DEPUTY_____

SITE PLAN



SURVEYOR'S CERTIFICATE

I, STEPHEN P. GURLIDES, A PROFESSIONAL LAND SURVEYOR IN THE STATE OF NEVADA DO HEREBY CERTIFY THAT THIS PARCEL MAP, CONSISTING OF ONE SHEET, ACCURATELY AND COMPLETELY DELINEATES A SURVEY MADE BY ME OR UNDER MY DIRECT SUPERVISION, AT THE INSTANCE OF WILLIAM L. TRENT ALL MONUMENTS ARE OF THE CHARACTER AND OCCUPY THE POSITIONS SHOWN AND ARE SUFFICIENT TO ENABLE THE SURVEY TO BE RETRACED, THIS SURVEY CONFORMS WITH THE DEFINTIONS AND PROVISIONS OF THE NEVADA REVISED STATUTES 278.010 THROUGH 278.630 INCLUSIVE, AND THAT THIS SURVEY WAS COMPLETED ON 03/01/93.

STEPHEN P. GURLIDES, P.L.S.
NEVADA CERTIFICATE NO. 9105

3/3/93

OWNER'S CERTIFICATE

WILLIAM L. TRENT DOES HEREBY CERTIFY THAT BEING THE OWNER OF THE LAND SUBDIVIDED WITHIN THE BOUNDARY SHOWN HEREON, CONSENTS TO THE PREPARATION AND RECORDATION OF THIS PARCEL MAP HAS CAUSED THE LAND TO BE SURVEYED AND PLATTED INTO PARCELS, STREETS _____ AS SHOWN HEREON AND DOES HEREBY OFFER AND DEDICATE TO THE CITY OF LAS VEGAS, IT'S SUCCESSORS AND ASSIGNS, STREETS _____ AS SHOWN HEREON, TO AND FOR THE USE OF THE PUBLIC, AND EASEMENTS AS SHOWN HEREON DESIGNATED AS "P.U.E.", PUBLIC UTILITY EASEMENT, FOR THE CONSTRUCTION AND MAINTENANCE OF SURFACE AND SUBTERRANEAN UTILITIES, AND SUCH GRADING AND DRAINAGE AS REQUIRED PER N.R.S. 278.010 TO 278.630 AND CONFORMANCE WITH FLOOD CONTROL DIVISION REQUIREMENTS.

WILLIAM L. TRENT

ACKNOWLEDGEMENT

STATE OF NEVADA)
) SS
COUNTY OF NYE)

ON THIS 11th DAY OF March 1993, WILLAIM L. TRENT PERSONALLY APPEARED BEFORE ME, A NOTARY PUBLIC, AND ACKNOWLEDGED TO ME THAT HE EXECUTED THE ABOVE INSTRUMENT.

PHYLLIS CHAMBERLAIN
NOTARY PUBLIC IN AND FOR SAID COUNTY AND STATE
MY COMMISSION EXPIRES MAY 10, 1995

NOTARY PUBLIC STATE OF NEVADA County of Nye PHYLLIS CHAMBERLAIN My Appointment Expires May 10, 1995

APPROVAL

THIS IS TO CERTIFY THAT THE DEPARTMENT OF COMMUNITY PLANNING AND DEVELOPMENT, CITY OF LAS, CLARK COUNTY, NEVADA ON THIS ____DAY OF _____1993, DID APPROVE FOR THE PURPOSES OF LAND DIVISION AND ACCEPT IN BEHALF OF THE PUBLIC, THIS MAP AND ANY PARCELS OF LAND OFFERED FOR DEDICATION FOR PUBLIC USE IN CONFORMITY WITH THE TERMS OF THE OFFER OF DEDICATION PER N.R.S. 278.010 TO 278.630.

NORMAN R. STANDERFER, DIRECTOR

MAP APPROVED FOR THE PURPOSE OF LAND DIVISION THE ____DAY OF _____ 1993.

RITA M. LUMOS – PLS 5094
CITY OF LAS VEGAS SURVEYOR

REFERENCE MAPS

PARCEL MAP	FL 71	PG 26
PARCEL MAP	FL 51	PG 96
PARCEL MAP	FL 85	PG 53

BASIS OF BEARINGS

N. 89° 40' 45" W., BEING THE SOUTH LINE OF THE SE1/4 OF SECTION 5, T. 21 S., R. 61 E., M.D.M., AS SHOWN IN FILE 17 OF PARCEL MAPS, PAGE 26, IN THE OFFICE OF THE CLARK COUNTY RECORDER, CLARK COUNTY, NEVADA.

LEGEND

L4	COURSE NUMBER
C5	CURVE NUMBER
●	SET REBAR W/ALUM CAP PLS 9105
●	FND. REBAR W/ALUM CAP PLS 4046 (UNLESS OTHERWISE NOTED)
———	BOUNDARY LINE
———	CENTERLINE
- - - - -	EASEMENT LINE
———	EXISTING LOT LINE
PFG	PROPOSED FINISH GRADE

COURSE TABLE

LINE	DIRECTION	DISTANCE
L1	S 89° 40' 45" E	35.00'
L2	S 74° 08' 53" E	74.34'
L3	S 00° 19' 15" W	15.00'
L4	N 00° 19' 15" E	75.00'

CURVE TABLE

CURVE	RADIUS	LENGTH	TANGENT	DELTA
C1	2262.37'	296.82'	148.62'	07° 31' 02"
C2	2262.37'	211.76'	105.95'	05° 21' 46"
C3	285.00'	125.34'	63.70'	25° 11' 51"
C4	285.00'	125.34'	63.70'	25° 11' 51"
C5	25.00'	39.27'	25.00'	90° 00' 00"

ANY SUBSEQUENT CHANGES TO THIS MAP SHOULD BE EXAMINED AND MAY BE DETERMINED BY REFERENCE TO THE COUNTY RECORDER'S CUMULATIVE MAP INDEX NRS 278.5695

VTN nevada
CONSULTING ENGINEERS • PLANNERS • LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89102
(702) 873 – 7550 FAX (702) 362 – 2597

PARCEL MAP
OF
A PORTION OF LOT 4 OF PARCEL MAP FILE 17, PAGE 26

WILLIAM TRENT
A PORTION OF
SECTION 5, T. 21 S., R. 61 E., M.D.M.
CITY OF LAS VEGAS, CLARK COUNTY, NEVADA

SCALE: 1" = 60'	W.O. # 4467	DATE: 2/5/93	SHEET	OF
FILE: 4467PM.DWG	DRN. BY: PAC	REV.	1	1
	CKD. BY: JHG			

NO._____

FILED AT THE REQUEST OF :

VTN NEVADA

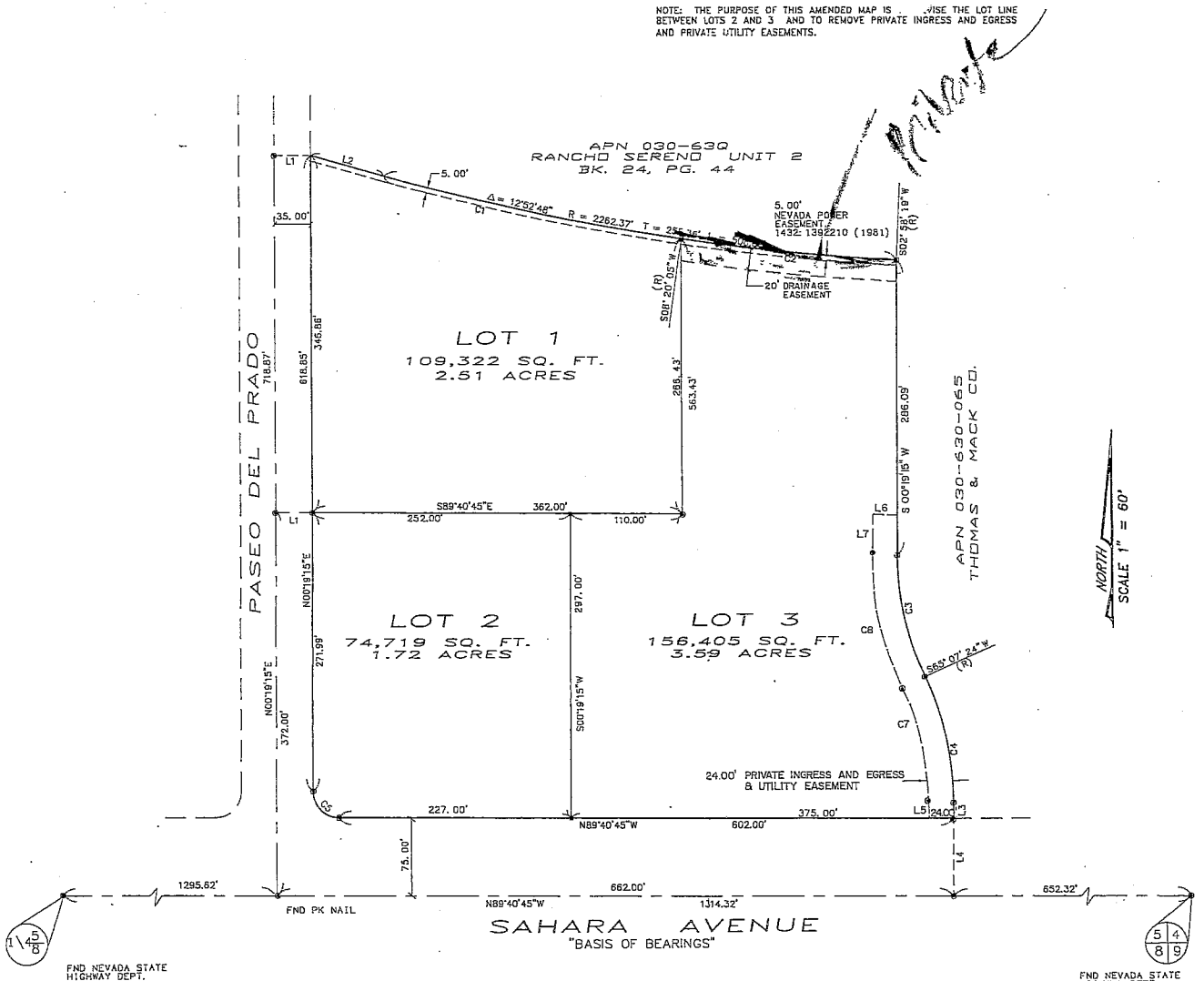
DATED_____ AT_____ M
FILE_____ PAGE_____
OF PARCEL MAPS
OFFICIAL RECORDS BOOK, NO._____

CLARK COUNTY, NEVADA RECORDS
JOAN L. SWIFT, RECORDER

FEE $_____ DEPUTY_____

FIGURE 6

NOTE: THE PURPOSE OF THIS AMENDED MAP IS TO REVISE THE LOT LINE BETWEEN LOTS 2 AND 3 AND TO REMOVE PRIVATE INGRESS AND EGRESS AND PRIVATE UTILITY EASEMENTS.



SURVEYOR'S CERTIFICATE

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STEPHEN P. GURLIDES, P.L.S.
NEVADA CERTIFICATE NO. 9105

OWNER'S CERTIFICATE

6/16/93

WILLIAM L. TRENT DOES HEREBY CERTIFY THAT BEING THE OWNER OF THE LAND SUBDIVIDED WITHIN THE BOUNDARY SHOWN HEREON, CONSENTS TO THE PREPARATION AND RECORDATION OF THIS PARCEL MAP HAS CAUSED THE LAND TO BE SURVEYED AND PLATTED INTO PARCELS, STREETS _____ AS SHOWN HEREON AND DOES HEREBY OFFER AND DEDICATE TO THE CITY OF LAS VEGAS, IT'S SUCCESSORS AND ASSIGNS, STREETS _____ AS SHOWN HEREON, TO AND FOR THE USE OF THE PUBLIC, AND EASEMENTS AS SHOWN HEREON DESIGNATED AS "P.U.E.", PUBLIC UTILITY EASEMENT, FOR THE CONSTRUCTION AND MAINTENANCE OF SURFACE AND SUBTERRANEAN UTILITIES, AND SUCH GRADING AND DRAINAGE AS REQUIRED PER N.R.S. 278.010 TO 278.630 AND CONFORMANCE WITH FLOOD CONTROL DIVISION REQUIREMENTS.

WILLIAM L TRENT — DATE 6/16/93

ACKNOWLEDGEMENT

STATE OF NEVADA)
) SS
COUNTY OF NYE)

ON THIS 16th DAY OF June 1993, WILLIAM L. TRENT PERSONALLY APPEARED BEFORE ME, A NOTARY PUBLIC, AND ACKNOWLEDGED TO ME THAT HE EXECUTED THE ABOVE INSTRUMENT.

PHYLLIS CHAMBERLAIN
NOTARY PUBLIC IN AND FOR SAID COUNTY AND STATE
MY COMMISSION EXPIRES MAY 10, 1995

NOTARY PUBLIC STATE OF NEVADA County of NYE PHYLLIS CHAMBERLAIN My Appointment Expires May 10, 1995

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NORMAN R. STANDERFER, DIRECTOR

MAP APPROVED FOR THE PURPOSE OF LAND DIVISION THE _____DAY OF _____ 1993.

RITA M. LUMOS - PLS 5094
CITY OF LAS VEGAS SURVEYOR

This Pm a part of 93
8-2-93
Accepted 8-6-93 MB

ANY SUBSEQUENT CHANGES TO THIS MAP SHOULD BE EXAMINED AND MAY BE DETERMINED BY REFERENCE TO THE COUNTY RECORDER'S CUMULATIVE MAP INDEX NRS 278.5695

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LEGEND

L4	COURSE NUMBER
C5	CURVE NUMBER
●	SET REBAR W/ALUM CAP PLS 9105
⊕	FND. REBAR W/ALUM CAP PLS 4046 (UNLESS OTHERWISE NOTED)
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— — —	CENTERLINE
— - — - —	EASEMENT LINE
———	EXISTING LOT LINE

COURSE TABLE

LINE	DIRECTION	DISTANCE
L1	S 89° 40' 45" E	35.00'
L2	S 74° 08' 53" E	74.34'
L3	S 00° 19' 15" W	15.00'
L4	N 00° 19' 15" E	75.00'
L5	N 00° 19' 15" E	15.00'
L6	S 89° 40' 45" E	24.00'
L7	N 00° 19' 15" E	38.10'

CURVE TABLE

CURVE	RADIUS	LENGTH	TANGENT	DELTA
C1	2252.37'	296.82'	148.62'	07° 31' 02"
C2	2262.37'	211.76'	105.96'	05° 21' 46"
C3	285.00'	125.34'	63.70'	25° 11' 51"
C4	265.00'	123.34'	63.70'	25° 11' 51"
C5	25.00'	39.27'	25.00'	90° 00' 00"
C6	25.00'	15.31'	7.91'	35° 04' 59"
C7	251.00'	114.79'	58.34'	25° 11' 51"
C8	309.00'	135.90'	69.07'	25° 11' 51"
C9	25.00'	37.89'	23.66'	86° 50' 12"

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2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89102
(702) 873 - 7550 FAX (702) 362 - 2597

AMENDED PARCEL MAP
OF
FILE 75 OF PARCEL MAPS, PAGE 62
WILLIAM TRENT
A PORTION OF
SECTION 5, T. 21 S., R. 61 E., M.D.M.
CITY OF LAS VEGAS, CLARK COUNTY, NEVADA

SCALE: 1" = 60'	W.O. # 4467	DATE: 5/14/93	SHEET	OF
FILE: 4467AMP4.DWG	DRN. BY: PAC	REV.	1	1
	CKD. BY: SG			

NO. _____
FILED AT THE REQUEST OF :
VTN NEVADA
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FILE _____ PAGE _____
OF PARCEL MAPS
OFFICIAL RECORDS BOOK, NO. _____
CLARK COUNTY, NEVADA RECORDS
JOAN L. SWIFT, RECORDER
FEE $ _____ DEPUTY _____

DS# 615

DS INDEX 996

APN 162-06-402-003

PROJECT Indian Hills Apt.'s

SUBMITTAL Technical Drainage Study

scanning.doc

Flood control File 21-61-6

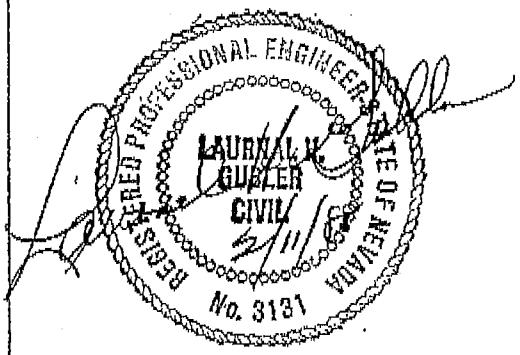
TECHNICAL DRAINAGE STUDY

FOR

INDIAN HILLS APARTMENTS

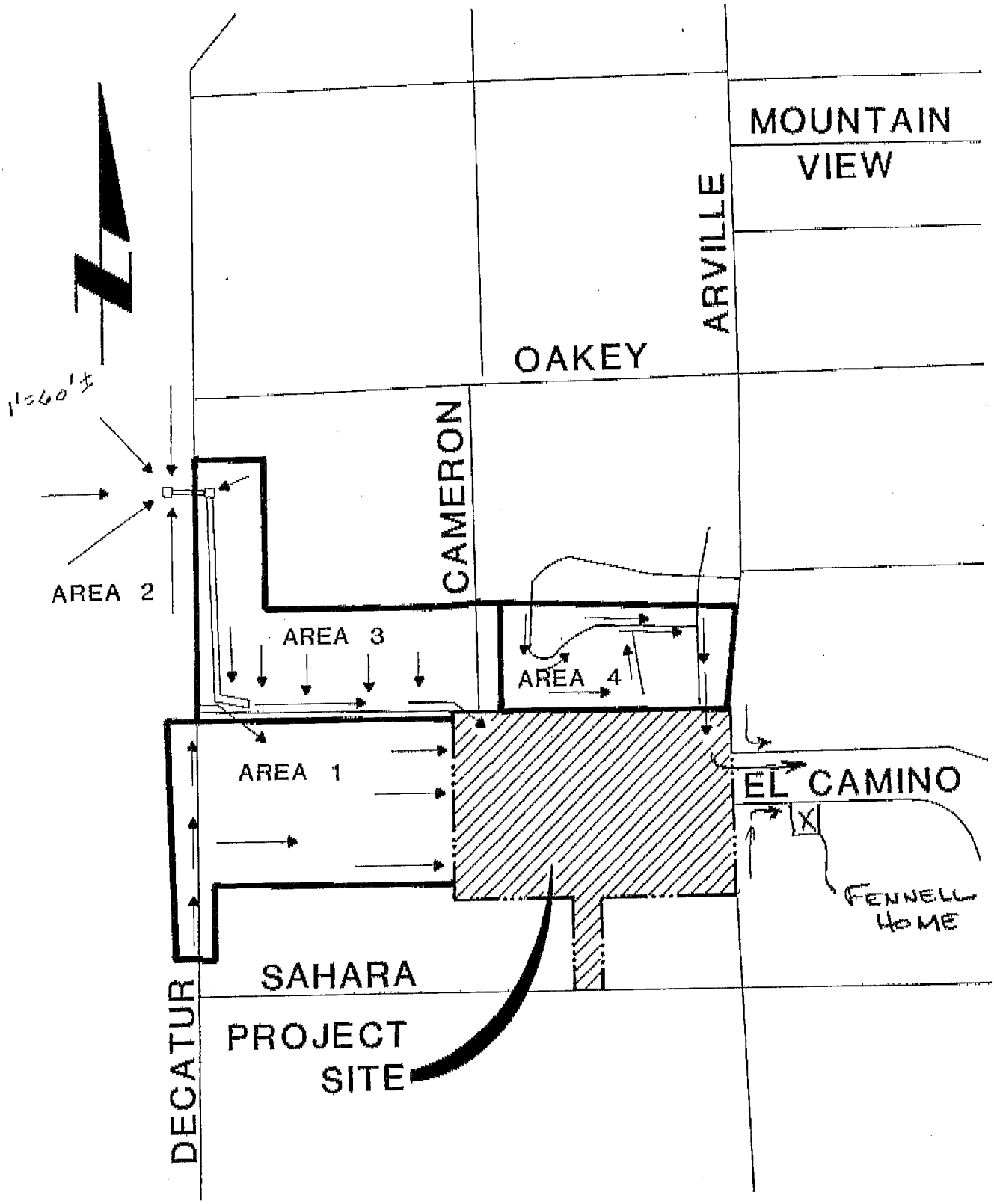
SAHARA AVENUE
& ARVILLE STREET

FEBRUARY 1988



MEA
CONSULTING ENGINEERS

Z-64-87



DRAINAGE STUDY BY MEA FEB. 88

FIGURE 2

S# 609

S INDEX 989

PN 1102-05-220-006

PROJECT Cashman Court

SUBMITTAL Addendum to Drainage study fo C.C. subdivision

scanning.doc

E. J. WOJCIK ENGINEERING

CIVIL ENGINEERING CONSULTANT

Edmund J. Wojcik, P.E.
(702) 369-9707

3549 So. Industrial Road
Suite 7
Las Vegas, Nevada 89109

7/9/86

July 9, 1986

City Of Las Vegas
Attn: Steve J. Jackson
Land Development and Flood Control
400 East Stewart Avenue
Las Vegas, Nevada 89101

Re: Addendum to Drainage Study for Cashman Court Subdivision.

Dear Mr. Jackson:

Submitted herewith, for your approval, are the hydraulics calculations for the referenced subdivision. This is intended to supplement the Drainage Study dated April 8, 1986 to incorporate all the changes and additions agreed upon at a July 1, 1986 meeting with Charles Kajkowski, Acting City Engineer. These items are as follows:

1. Analysis of flows from Oakey Boulevard to Cashman Drive and Westleigh Avenue cul-de-sac assuming design storm runoff flow at three (3) inches above top of curb.

2. Analysis of design flow capacities for all components of Westleigh Avenue cul-de-sac.

The drainage system will carry the required storm runoff flows.

If you should have any questions, please call me.

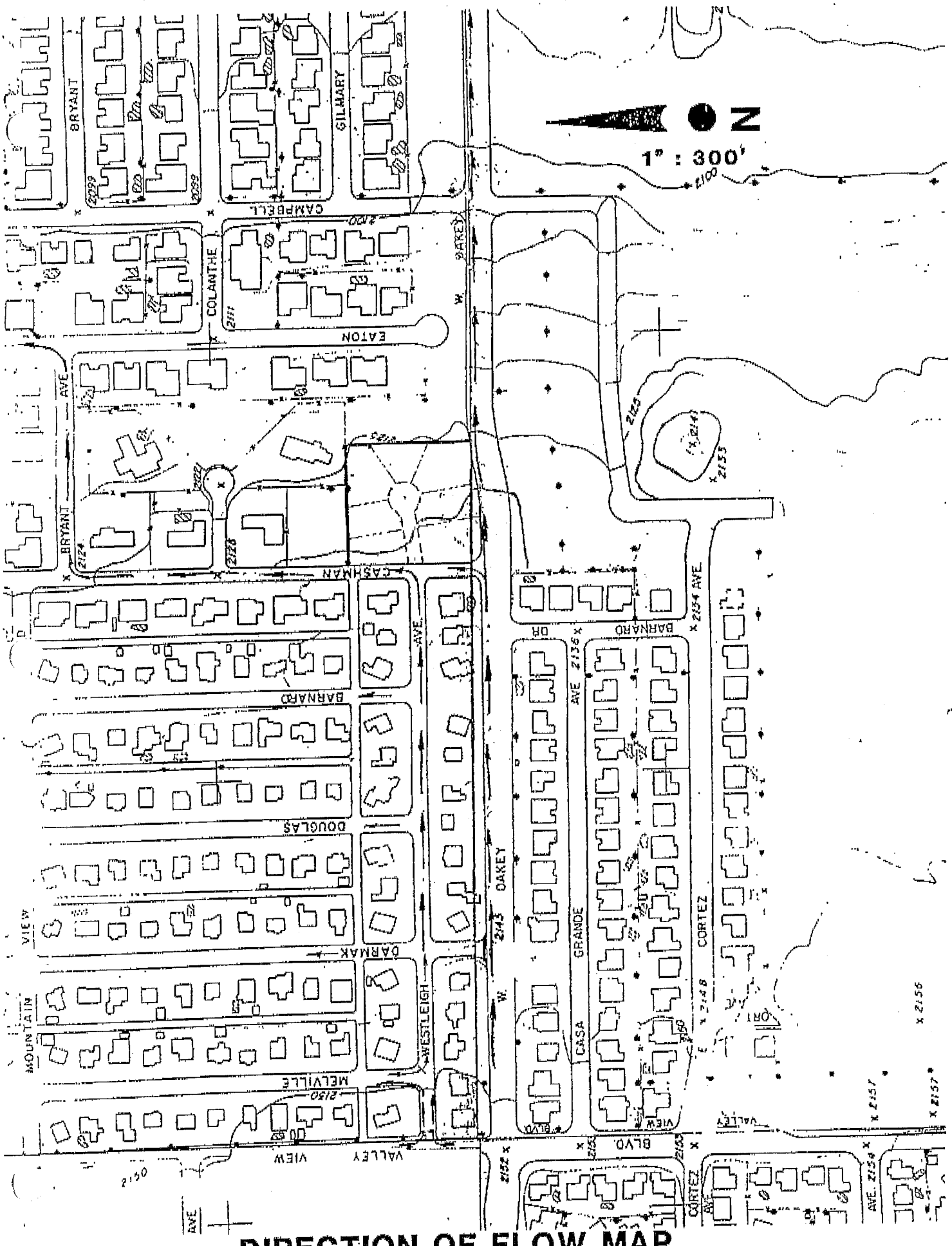
Sincerely,

E. J. WOJCIK ENGINEERING

EDMUND J. WOJCIK, P.E.

REGISTERED PROFESSIONAL ENGINEER STATE OF NEVADA
EDMUND J. WOJCIK
CIVIL
No. 4317

EJW:dh



DIRECTION OF FLOW MAP

DS# 610

DS INDEX 990

APN 102-05-802-009

PROJECT NEVADA FINANCIAL CENTER

SUBMITTAL DRAINAGE STUDY 8/15/86
7/30/86

scanning.doc

G.C. WALLACE, INC.
Engineering/Architecture

G.C. WALLACE, P.E.
MICHAEL RADOJEVICH
KAY L. ADAMS, L.S.
GARY J. SPINKELINK

THOMAS COYLE, A.I.A.
JACK H. MITCHELL, P.E.
TERRILL B. ADAMS
PRAVIN P. BAKRANIA, A.I.A.
JAMES A. DUDDLESTON, P.E.
JOHN C. LESTER, JR., P.E.
VAN H. MIERSCH

397.415

July 29, 1986

City of Las Vegas
400 E. Stewart Avenue
Las Vegas, NV 89101

Attention: C. E. (Gil) Gilpin
City Engineer

Subject: Drainage Study
Nevada Financial Center

Gentlemen:

Submitted herewith are two copies of the subject Drainage Study for your review and approval.

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

Very truly yours,

Calvin L. Black, P.E.

klw
Enclosure

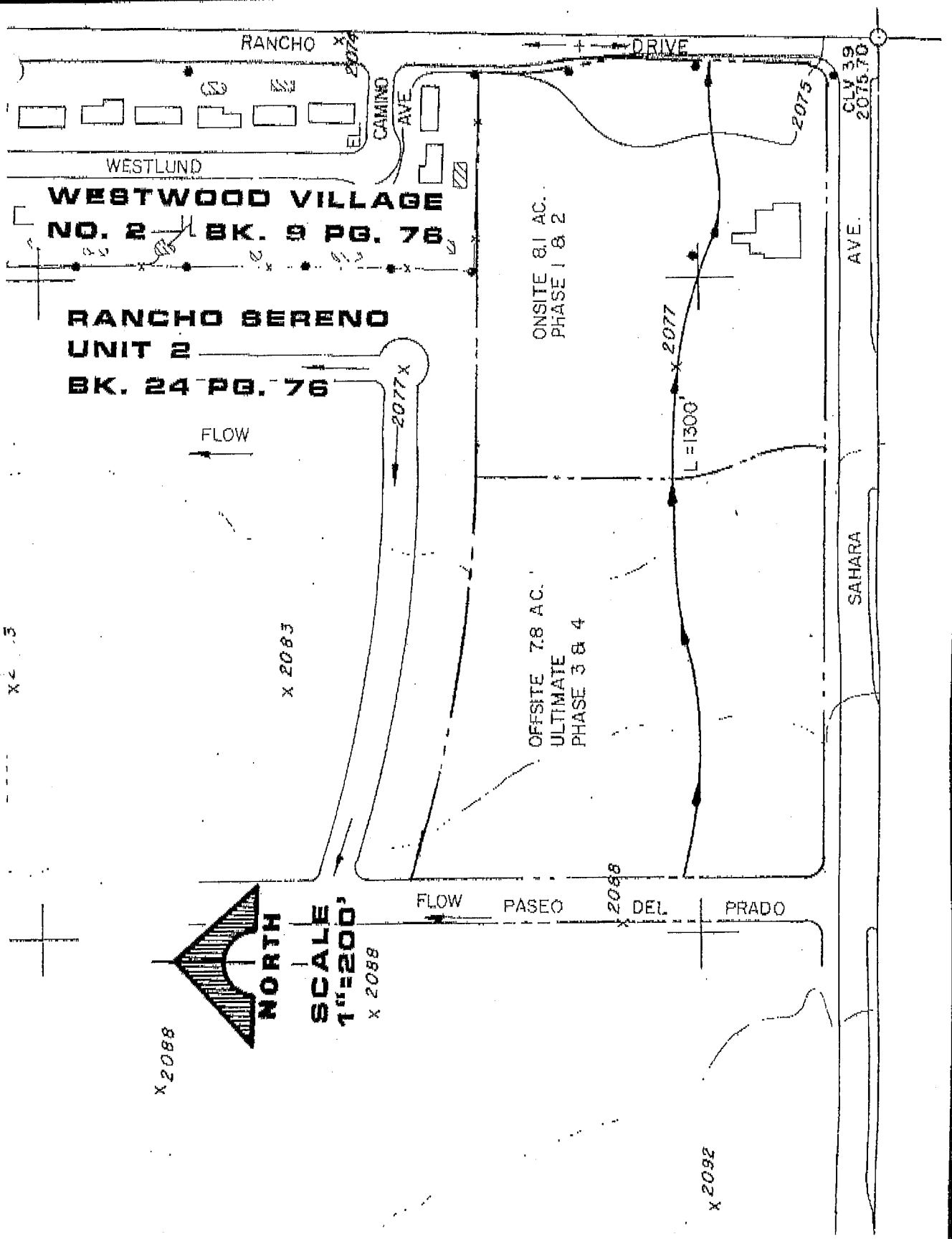
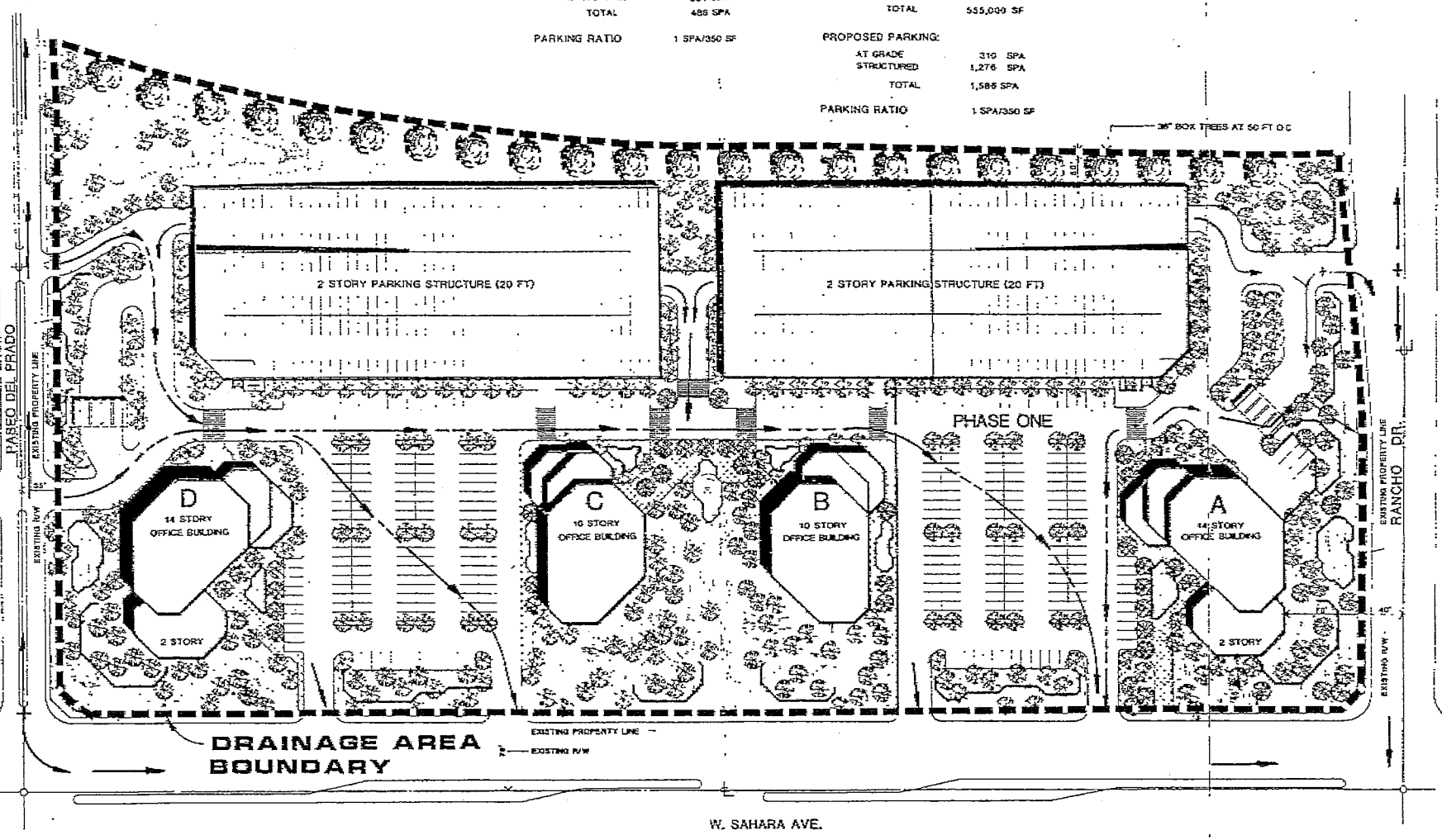


FIGURE NO. 2
EXISTING DRAINAGE
PATTERNS

PROJECT SUMMARY

PHASE ONE		ULTIMATE PROJECT	
NET SITE AREA	5.28 AC/230,000 SF	NET SITE AREA	15.86 AC/690,852 SF
BUILDING AREA		BUILDING AREA	
BUILDING A	170,000 SF	BUILDING A	170,000 SF
		BUILDING B	110,000 SF
		BUILDING C	105,000 SF
		BUILDING D	170,000 SF
		TOTAL	555,000 SF
PROPOSED PARKING:		PROPOSED PARKING:	
AT GRADE	155 SPA	AT GRADE	310 SPA
STRUCTURED	331 SPA	STRUCTURED	1,276 SPA
TOTAL	486 SPA	TOTAL	1,586 SPA
PARKING RATIO	1 SPA/350 SF	PARKING RATIO	1 SPA/350 SF



SCHEMATIC PLAN

FIGURE NO. 3
PROPOSED DRAINAGE PATTERNS

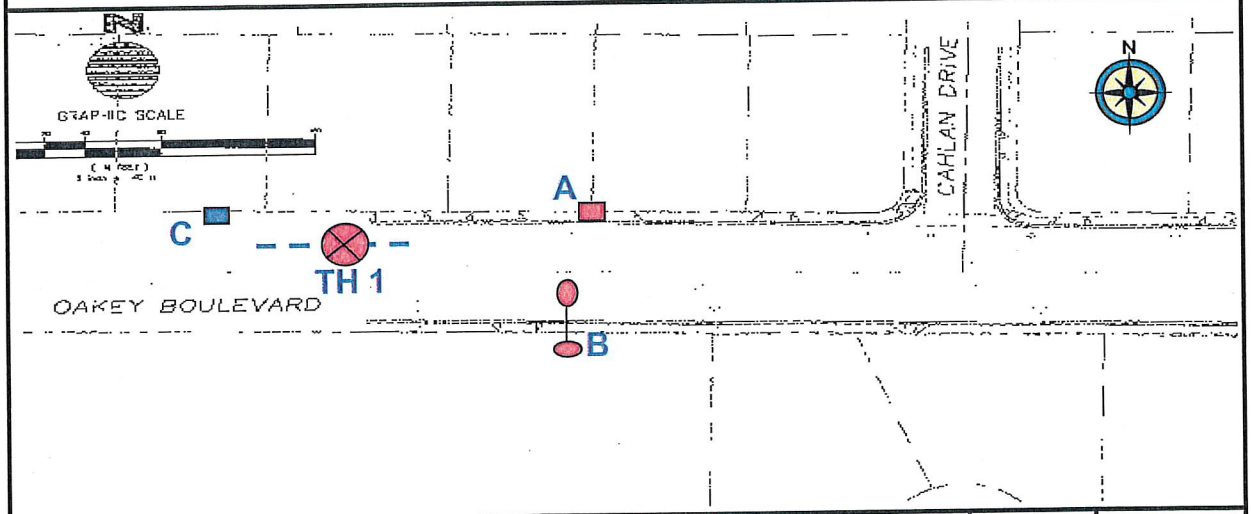
PRINTED
JUL 01 1986

Appendix L – Potholing Data

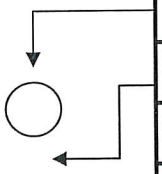
TEST HOLE DATA SHEET

Test Hole No.	1	TBE GROUP, Inc. 2875 East Patrick Lane Ste. K Las Vegas NV. 89120 702.458.4092 702.895.8415 fax	SUE Crew	CP / GT
Date Excavated	10/06/06		City	Las Vegas
Client Project No.	N/A		County	Clark
TBE Project No	NV042-007-00		Route No.	Oakey Blvd.
TBE Truck No	55-236		Location	West of Cahlan

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Asphalt
Thickness	7"
Soil Conditions	Type II
UTL Type	Water
Nominal Pipe Size	6"
UTL Material	ACP



Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	2.85'	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Electric Vault	42'
B	Street Light	70'
C	Water Vault	23'

Remarks:

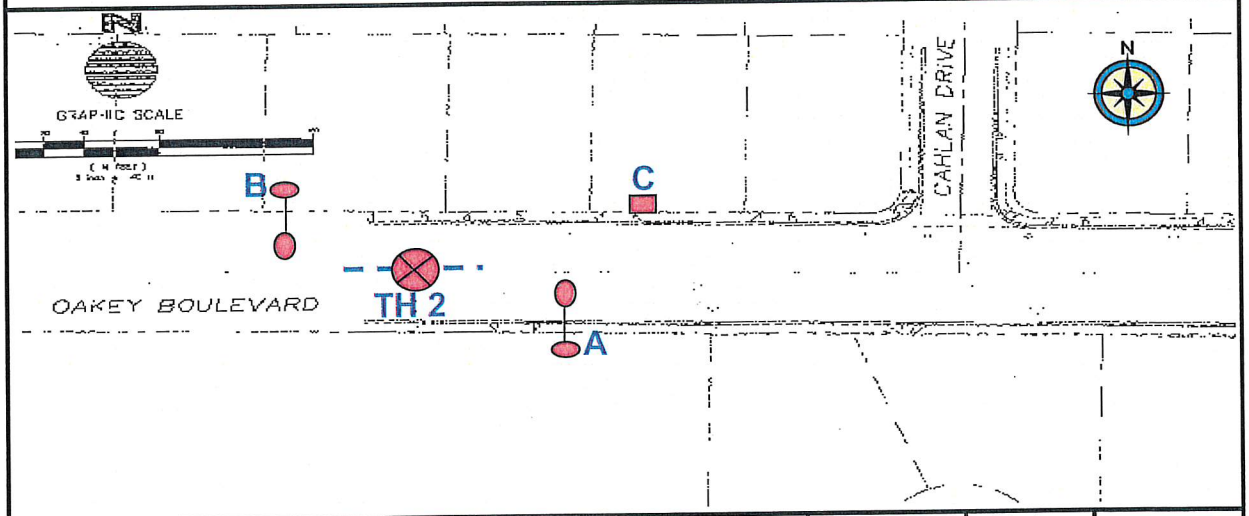
Data Entered By: CP

Reviewed By: GT

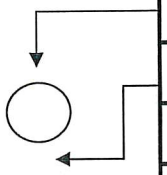
TEST HOLE DATA SHEET

Test Hole No.	2	**TBE GROUP, Inc.** 2875 East Patrick Lane Ste. K Las Vegas NV. 89120 702.458.4092 702.895.8415 fax	SUE Crew	CP/CW
Date Excavated	10/09/06		City	Las Vegas
Client Project No.	N/A		County	Clark
TBE Project No	NV042-007-00		Route No.	Oakey Blvd.
TBE Truck No	55-236		Location	West of Cahlan

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Asphalt
Thickness	7"
Soil Conditions	Type II
UTL Type	Water
Nominal Pipe Size	18"
UTL Material	ACP



Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	**4.07'**	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Street Light	41'
B	Street Light	72'
C	Electric Vault	74'

Remarks:

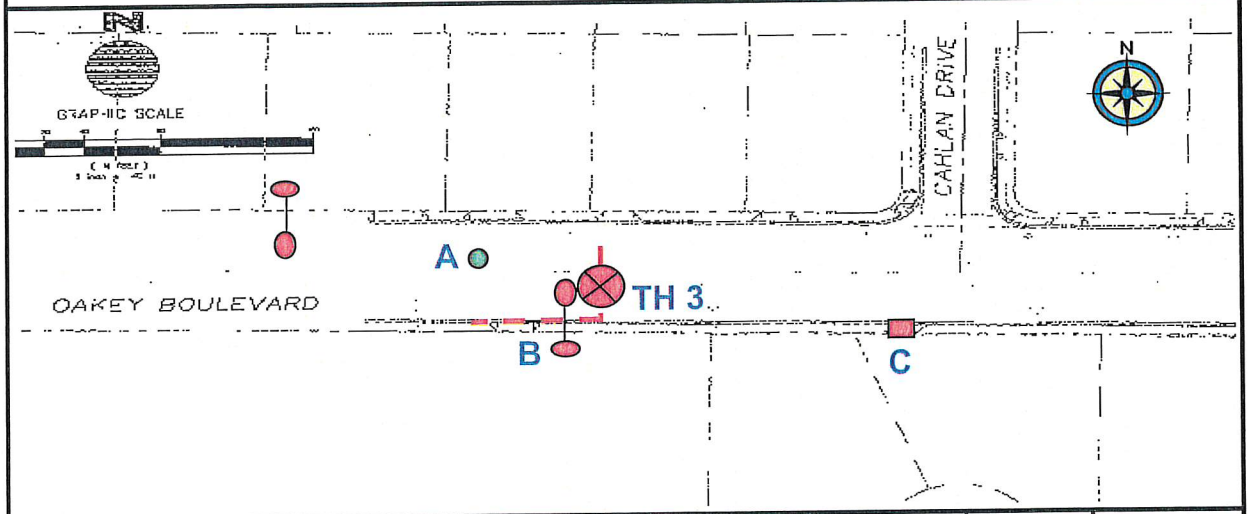
Data Entered By: CP

Reviewed By: GT

TEST HOLE DATA SHEET

Test Hole No.	3	**TBE GROUP, Inc.** 2875 East Patrick Lane Ste. K Las Vegas NV. 89120 702.458.4092 702.895.8415 fax	SUE Crew	CP/CW
Date Excavated	10/09/06		City	Las Vegas
Client Project No.	N/A		County	Clark
TBE Project No	NV 042-007-00		Route No.	Oakey Blvd.
TBE Truck No	55-236		Location	West of Cahlan

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/	Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ Monument	/	Rod @ UTL-Bot.	/	Elev.	/
English / Metric	English	Rod @ Marker	/		
Surface Type	Asphalt	Calc. UTL-Top	**2.31'**	Hand Meas.Top	/
Thickness	7"	Calc. UTL-Bot.	/	Hand Meas.Bot	/
Soil Conditions	Type II	Swing Ties from Structure			Dist.
UTL Type	Traffic Signal	A	Sanitary Manhole		18'
Nominal Pipe Size	2"	B	Street Light		11'
UTL Material	PVC	C	Traffic Signal Vault		90'

Remarks:

Data Entered By: CP

Reviewed By: GT

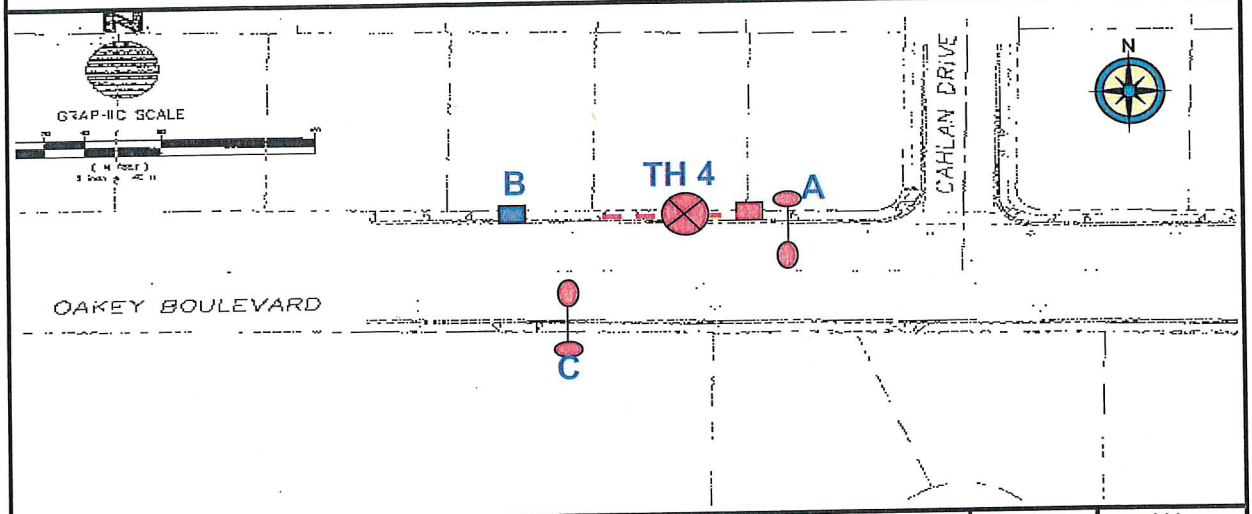
TEST HOLE DATA SHEET

Test Hole No.	4
Date Excavated	10/05/06
Client Project No.	N/A
TBE Project No	NV042-007-00
TBE Truck No	55-236

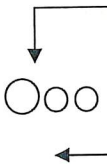
TBE GROUP, Inc.
2875 East Patrick Lane Ste. K
Las Vegas NV. 89120
702.458.4092
702.895.8415 fax

SUE Crew	CP/CW
City	Las Vegas
County	Clark
Route No.	Oakey Blvd
Location	West of Cahlan

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Concrete
Thickness	4"
Soil Conditions	Type II
UTL Type	Electric
Nominal Pipe Size	1" / 2x.5"
UTL Material	Direct Buried Cable



Rod @ UTL-Top	/	Marker Set	X in Concrete
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	**3.24'**	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Street Light	85'
B	Water Vault	15'
C	Street Light	73'

Remarks:

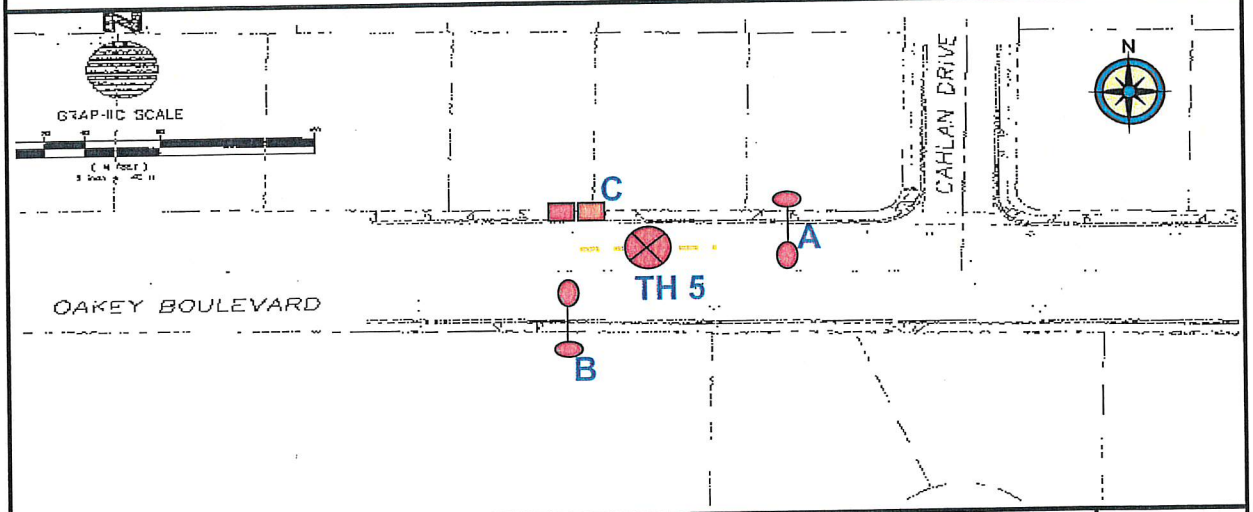
Data Entered By: CP

Reviewed By: GT

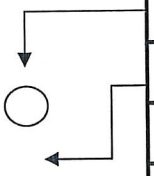
TEST HOLE DATA SHEET

Test Hole No.	5	TBE GROUP, Inc. 2875 East Patrick Lane Ste. K Las Vegas NV. 89120 702.458.4092 702.895.8415 fax	SUE Crew	CP/CW
Date Excavated	10/05/06		City	Las Vegas
Client Project No.	N/A		County	Clark
TBE Project No	NV042-007-00		Route No.	Oakey
TBE Truck No	55-236		Location	West of Cahlan

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Asphalt
Thickness	7"
Soil Conditions	Type II
UTL Type	Gas
Nominal Pipe Size	2"
UTL Material	PE



Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	3.37'	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Street Light	63'
B	Street Light	68'
C	Catv Vault	8'

Remarks:

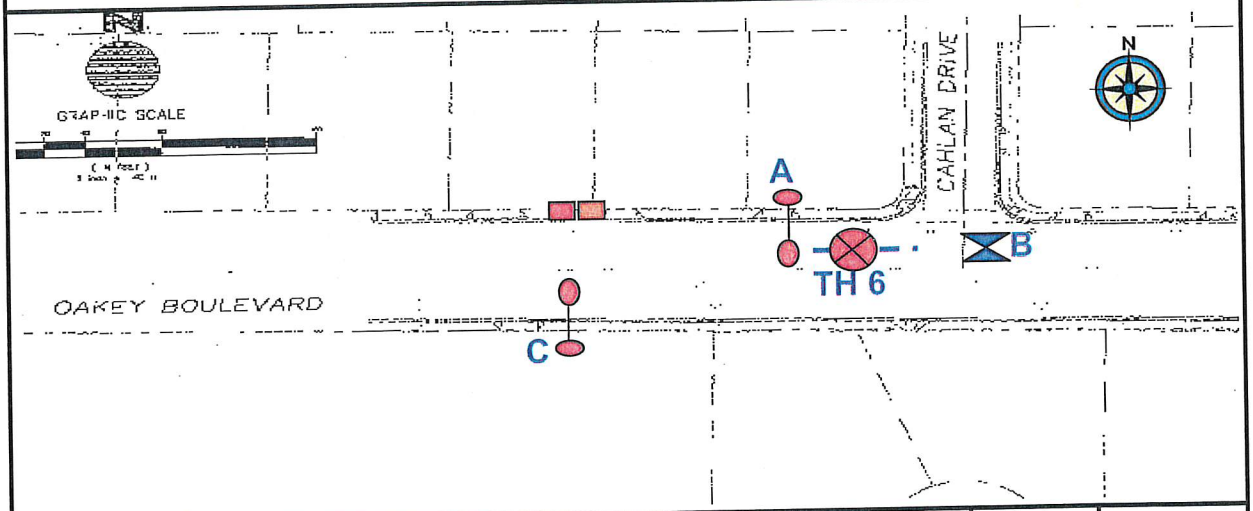
Data Entered By: CP

Reviewed By: GT

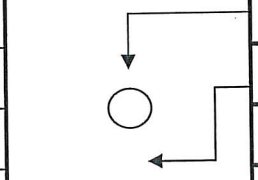
TEST HOLE DATA SHEET

Test Hole No.	6	TBE GROUP, Inc. 2875 East Patrick Lane Ste. K Las Vegas NV. 89120 702.458.4092 702.895.8415 fax	SUE Crew	CP/CW
Date Excavated	10/05/06		City	Las Vegas
Client Project No.	N/A		County	Clark
TBE Project No	NV042-007-00		Route No.	Oakey Blvd.
TBE Truck No	55-236		Location	West of Cahlan

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Asphalt
Thickness	7"
Soil Conditions	Type II
UTL Type	Water
Nominal Pipe Size	6"
UTL Material	ACP



Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	4.25'	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Street Light	11'
B	Water Valve	29'
C	Street Light	103'

Remarks:

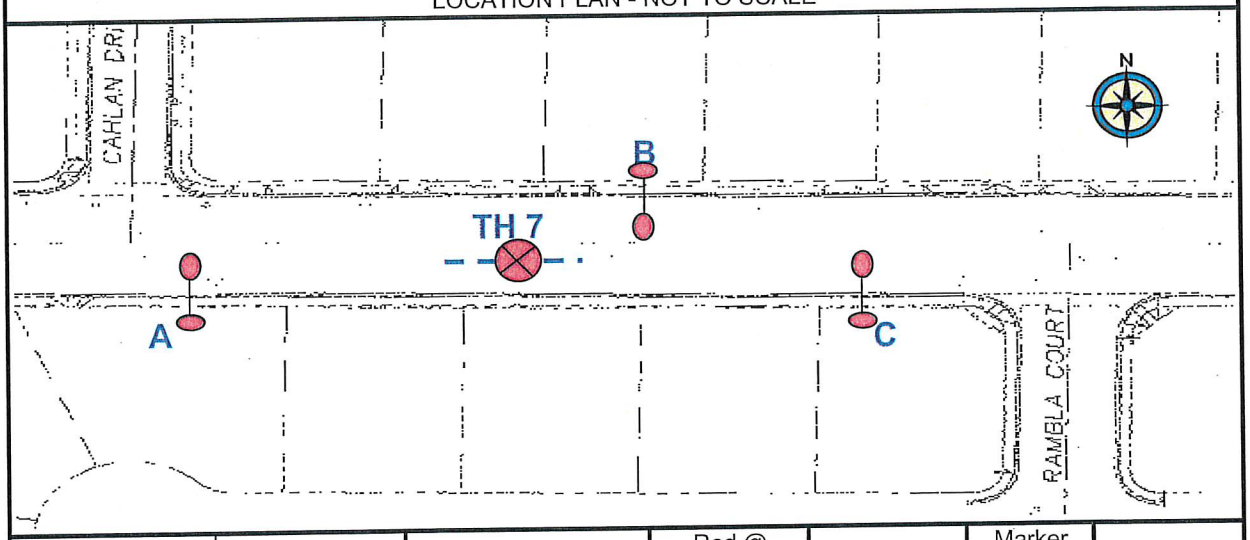
Data Entered By: CP

Reviewed By: GT

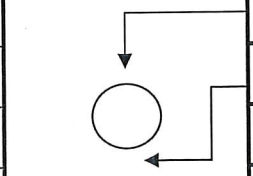
TEST HOLE DATA SHEET

Test Hole No.	7	TBE GROUP, Inc. 2875 East Patrick Lane Ste. K Las Vegas NV. 89120 702.458.4092 702.895.8415 fax	SUE Crew	CP/CW
Date Excavated	10/09/06		City	Las Vegas
Client Project No.	N/A		County	Clark
TBE Project No	NV042-007-00		Route No.	Oakey Blvd.
TBE Truck No	55-236		Location	East of Cahlan

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Asphalt
Thickness	9"
Soil Conditions	Type II
UTL Type	Water
Nominal Pipe Size	18"
UTL Material	ACP



Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	**3.05'**	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Street Light	62'
B	Street Light	58'
C	Street Light	126'

Remarks:

Data Entered By: CP

Reviewed By: GT

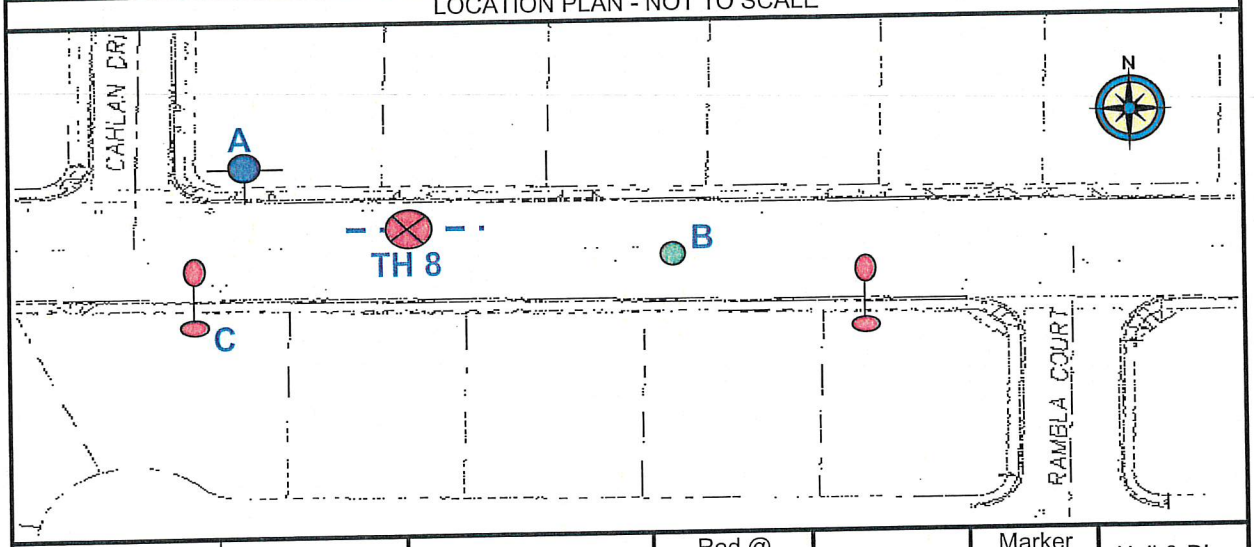
TEST HOLE DATA SHEET

Test Hole No.	8
Date Excavated	10/05/06
Client Project No.	N/A
TBE Project No	NV042-007-00
TBE Truck No	55-236

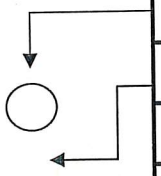
TBE GROUP, Inc.
2875 East Patrick Lane Ste. K
Las Vegas NV. 89120
702.458.4092
702.895.8415 fax

SUE Crew	CP/CW
City	Las Vegas
County	Clark
Route No.	Oakey Blvd.
Location	East of Cahlan Dr.

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Asphalt
Thickness	7"
Soil Conditions	Type II
UTL Type	Water
Nominal Pipe Size	8"
UTL Material	ACP



Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	**3.91'**	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Fire Hydrant	66'
B	Sanitary Manhole	84'
C	Street Light	85'

Remarks:

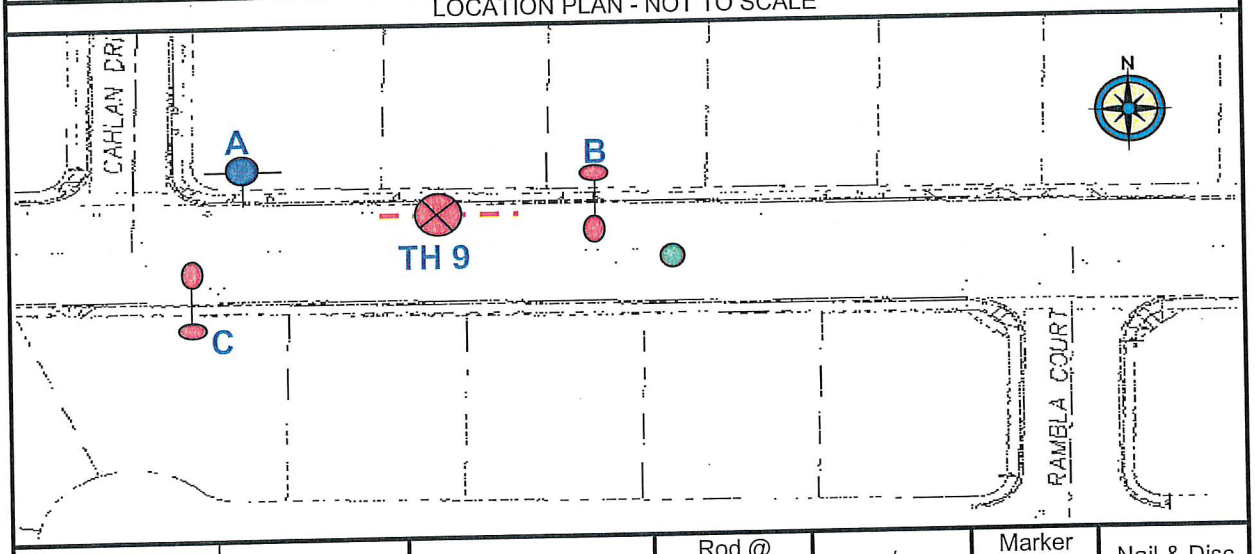
Data Entered By: CP

Reviewed By: GT

TEST HOLE DATA SHEET

Test Hole No.	9	TBE GROUP, Inc. 2875 East Patrick Lane Ste. K Las Vegas NV. 89120 702.458.4092 702.895.8415 fax	SUE Crew	CP/CW
Date Excavated	10/12/06		City	Las Vegas
Client Project No.	N/A		County	Clark
TBE Project No	NV042-007-00		Route No.	Oakey Blvd.
TBE Truck No	55-236		Location	East of Cahlan Dr.

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Asphalt
Thickness	5"
Soil Conditions	Type II
UTL Type	Traffic Signal
Nominal Pipe Size	1.5"
UTL Material	PVC

Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	**0.69'**	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Fire Hydrant	38'
B	Street Light	37'
C	Street Light	73'

Remarks:

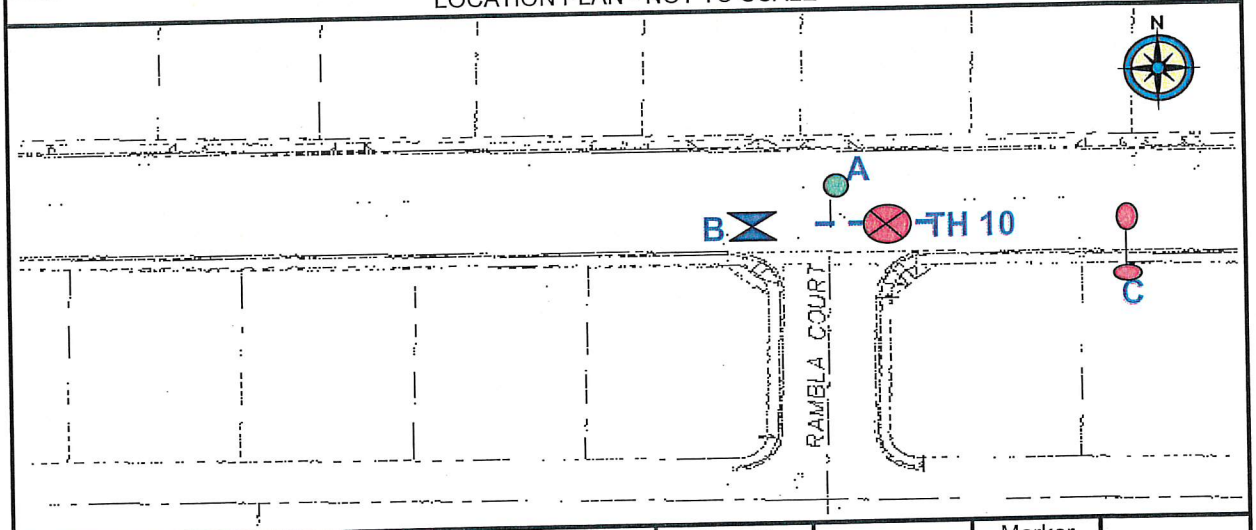
Data Entered By: CP

Reviewed By: GT

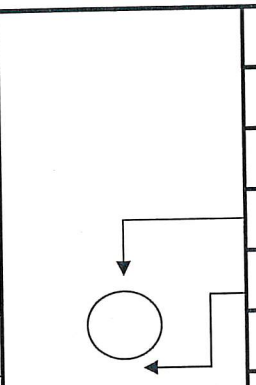
TEST HOLE DATA SHEET

Test Hole No.	10	TBE GROUP, Inc. 2875 East Patrick Lane Ste. K Las Vegas NV. 89120 702.458.4092 702.895.8415 fax	SUE Crew	CP/CW
Date Excavated	10/10/06		City	Las Vegas
Client Project No.	N/A		County	Clark
TBE Project No	NV042-007-00		Route No.	Oakey Blvd.
TBE Truck No	55-236		Location	Rambla Ct.

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Asphalt
Thickness	9"
Soil Conditions	Type II
UTL Type	Water
Nominal Pipe Size	18"
UTL Material	ACP



Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	**2.69'**	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Sanitary Manhole	16'
B	Water Valve	32'
C	Street Light	110'

Remarks:

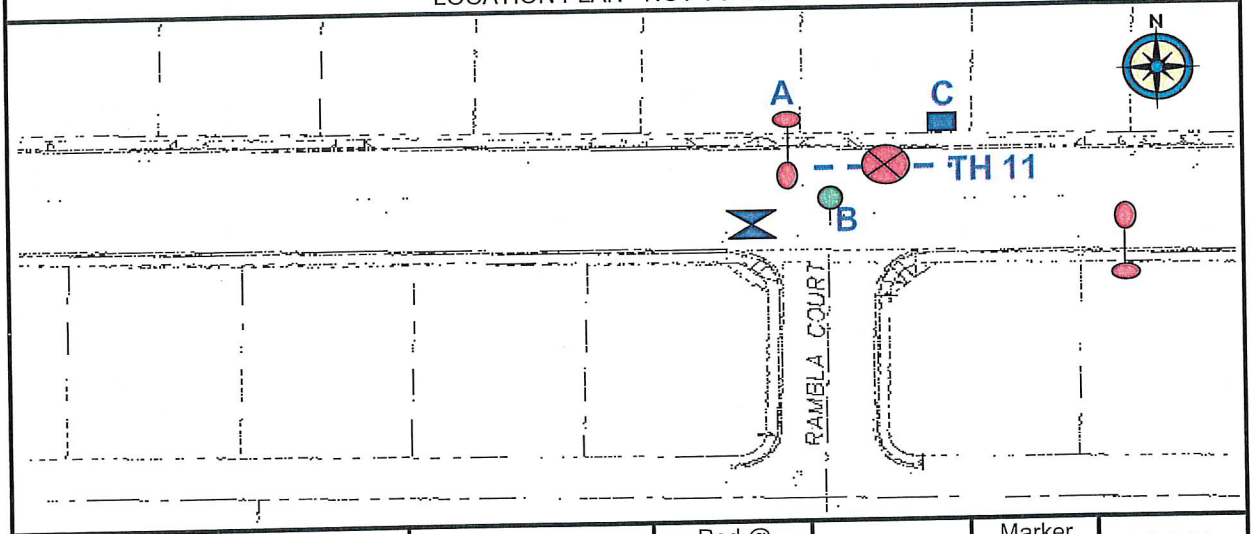
Data Entered By: CP

Reviewed By: GT

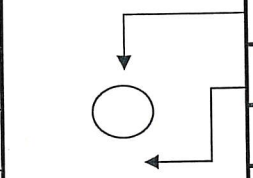
TEST HOLE DATA SHEET

Test Hole No.	11	TBE GROUP, Inc. 2875 East Patrick Lane Ste. K Las Vegas NV. 89120 702.458.4092 702.895.8415 fax	SUE Crew	CP/CW
Date Excavated	10/03/06		City	Las Vegas
Client Project No.	N/A		County	Clark
TBE Project No	NV042-007-00		Route No.	Oakey Blvd.
TBE Truck No	55-236		Location	Rambla Ct.

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Asphalt
Thickness	7"
Soil Conditions	Type II
UTL Type	Water
Nominal Pipe Size	8"
UTL Material	ACP



Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	4.43'	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Street Light	10'
B	Sanitary Manhole	37'
C	Water Vault	22'

Remarks:

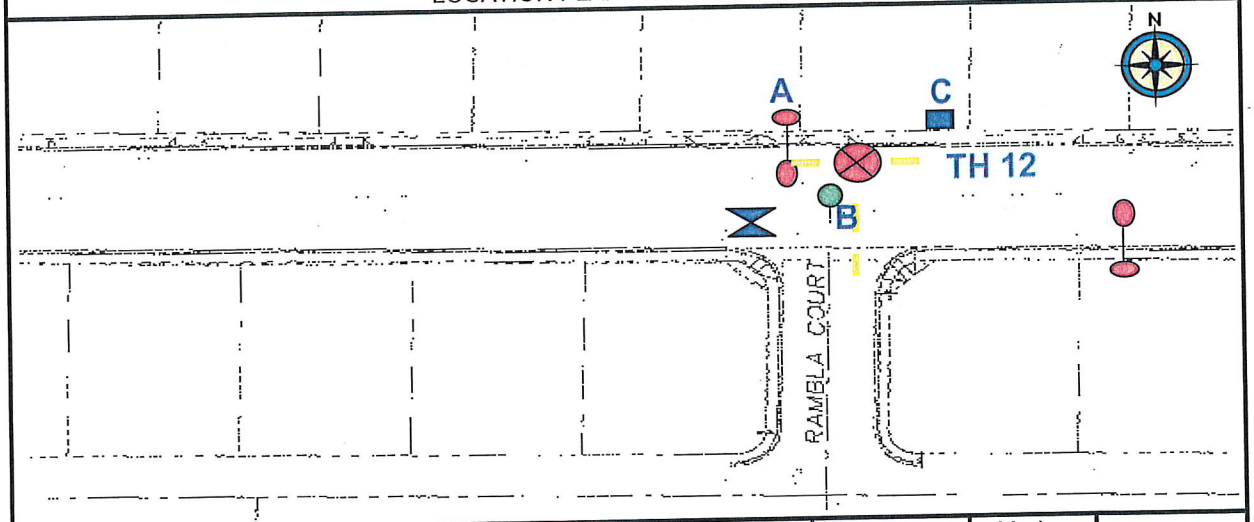
Data Entered By: CP

Reviewed By: GT

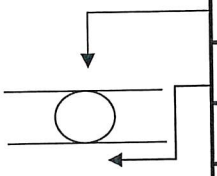
TEST HOLE DATA SHEET

Test Hole No.	12	TBE GROUP, Inc. 2875 East Patrick Lane Ste. K Las Vegas NV. 89120 702.458.4092 702.895.8415 fax	SUE Crew	CP/CW
Date Excavated	10/03/06		City	Las Vegas
Client Project No.	N/A		County	Clark
TBE Project No	NV042-007-00		Route No.	Oakey Blvd.
TBE Truck No	55-236		Location	Rambla Ct.

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Asphalt
Thickness	7"
Soil Conditions	Type II
UTL Type	Gas
Nominal Pipe Size	2"
UTL Material	PE



Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	**2.90'**	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Street Light	5'
B	Sanitary Manhole	43'
C	Water Vault	18'

Remarks:

Reference point set 8" east of tee connection.

Data Entered By: CP

Reviewed By: GT

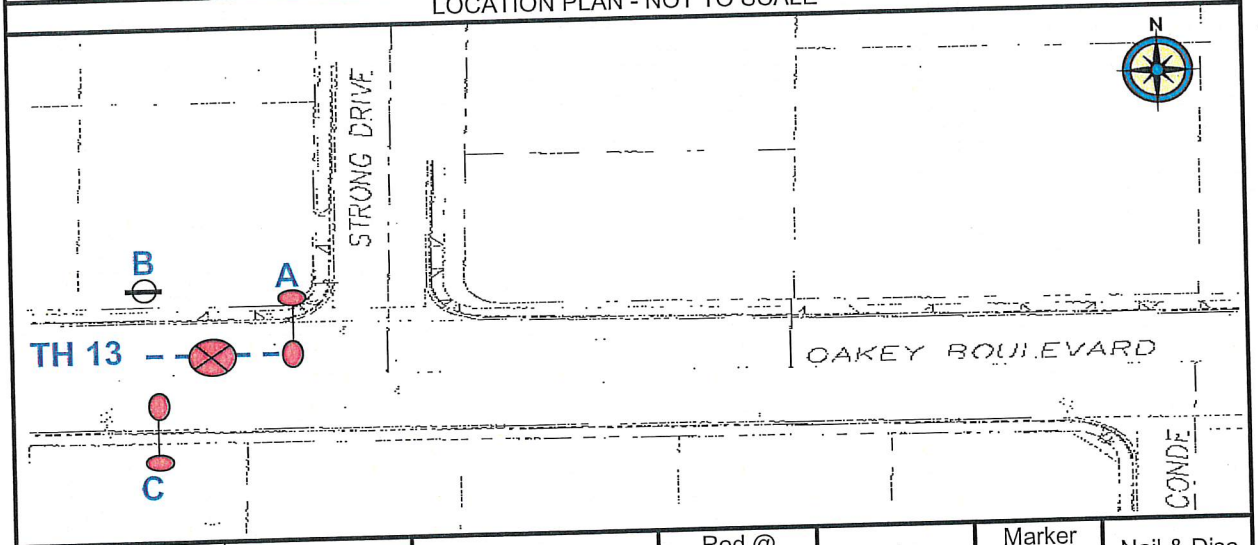
TEST HOLE DATA SHEET

Test Hole No.	13
Date Excavated	10/03/06
Client Project No.	N/A
TBE Project No	NV042-007-00
TBE Truck No	55-236

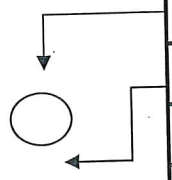
TBE GROUP, Inc.
2875 East Patrick Lane Ste. K
Las Vegas NV. 89120
702.458.4092
702.895.8415 fax

SUE Crew	CP/CW
City	Las Vegas
County	Clark
Route No.	Oakey Blvd.
Location	West of Strong Dr.

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Asphalt
Thickness	5"
Soil Conditions	Type II
UTL Type	Water
Nominal Pipe Size	8"
UTL Material	ACP



Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	**4.01'**	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Street Light	9'
B	Power Pole	73'
C	Street Light	87'

Remarks:

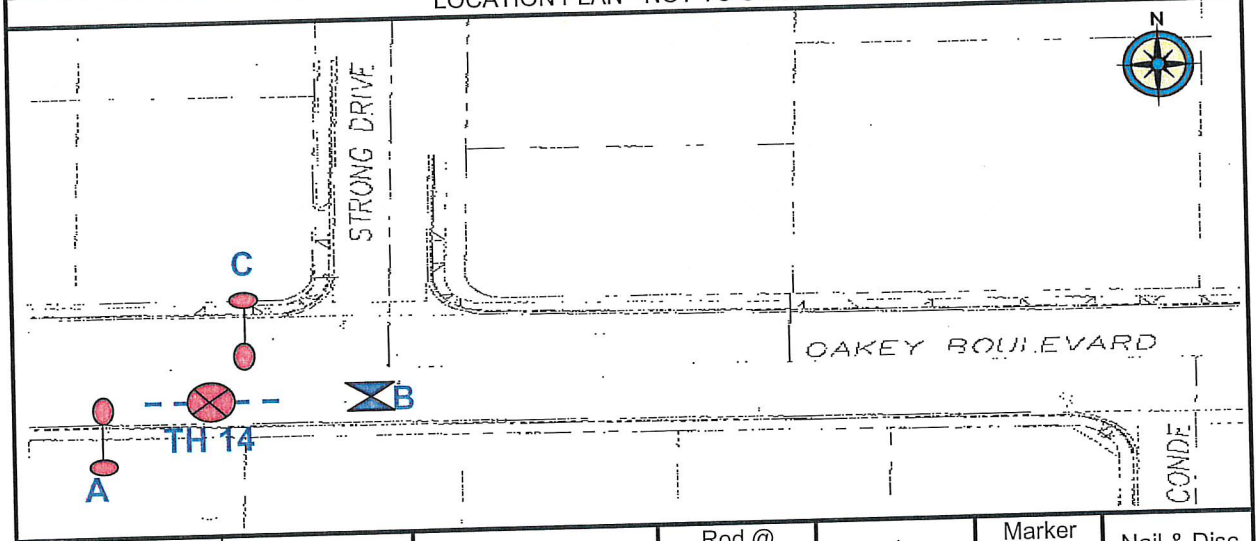
Data Entered By: CP

Reviewed By: GT

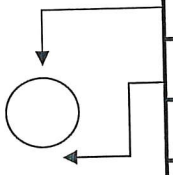
TEST HOLE DATA SHEET

Test Hole No.	14	TBE GROUP, Inc. 2875 East Patrick Lane Ste. K Las Vegas NV. 89120 702.458.4092 702.895.8415 fax	SUE Crew	CP/CW
Date Excavated	10/09/06		City	Las Vegas
Client Project No.	N/A		County	Clark
TBE Project No	NV042-007-00		Route No.	Oakey Blvd.
TBE Truck No	55-236		Location	Strong Dr.

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Asphalt
Thickness	9"
Soil Conditions	Type II
UTL Type	Water
Nominal Pipe Size	18"
UTL Material	ACP



Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	1.95'	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Street Light	63'
B	Water Valve	33'
C	Street Light	54'

Remarks:

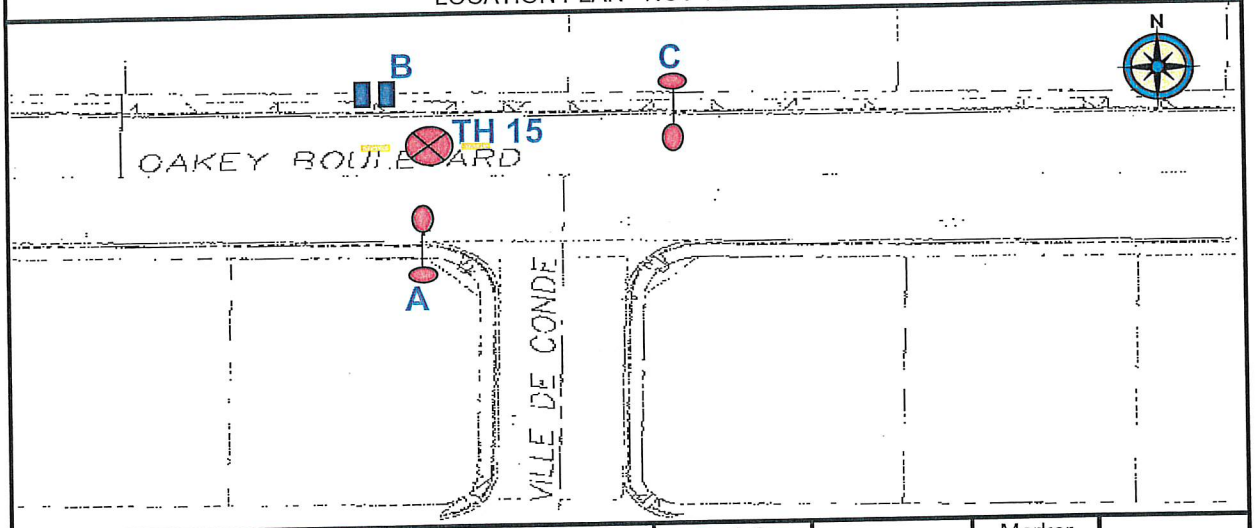
Data Entered By: CP

Reviewed By: GT

TEST HOLE DATA SHEET

Test Hole No.	15	TBE GROUP, Inc. 2875 East Patrick Lane Ste. K Las Vegas NV. 89120 702.458.4092 702.895.8415 fax	SUE Crew	CP/CW
Date Excavated	10/03/06		City	Las Vegas
Client Project No.	N/A		County	Clark
TBE Project No	NV042-007-00		Route No.	Oakey Blvd.
TBE Truck No	55-236		Location	Villa De Conde

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Asphalt
Thickness	6"
Soil Conditions	Slurry
UTL Type	Gas
Nominal Pipe Size	2"
UTL Material	PE

Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	3.46'	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Street Light	61'
B	Water Vault	18'
C	Street Light	126'

Remarks:

Data Entered By: CP

Reviewed By: GT

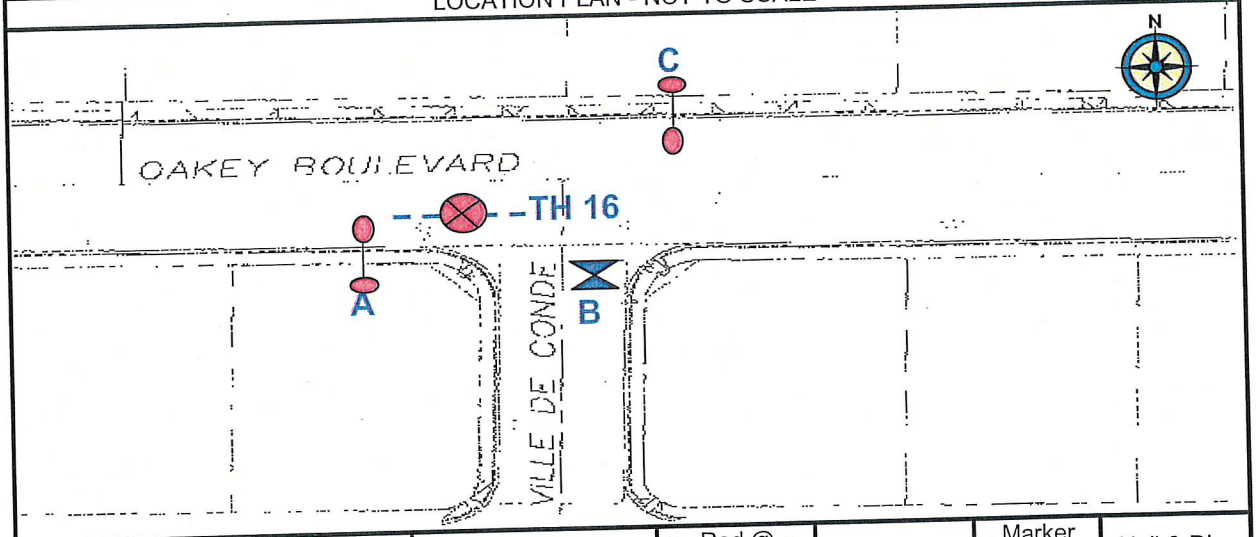
TEST HOLE DATA SHEET

Test Hole No.	16
Date Excavated	10/10/06
Client Project No.	N/A
TBE Project No	NV042-007-00
TBE Truck No	55-232

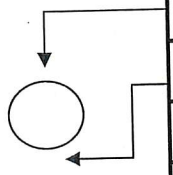
TBE GROUP, Inc.
2875 East Patrick Lane Ste. K
Las Vegas NV. 89120
702.458.4092
702.895.8415 fax

SUE Crew	SH/RR
City	Las Vegas
County	Clark
Route No.	Oakey Blvd.
Location	Villa De Conde

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Asphalt
Thickness	8"
Soil Conditions	Sand
UTL Type	Water
Nominal Pipe Size	18"
UTL Material	ACP



Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	**2.26'**	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Street Light	16'
B	Water Valve	71'
C	Street Light	129'

Remarks:

Data Entered By: SH

Reviewed By: GT

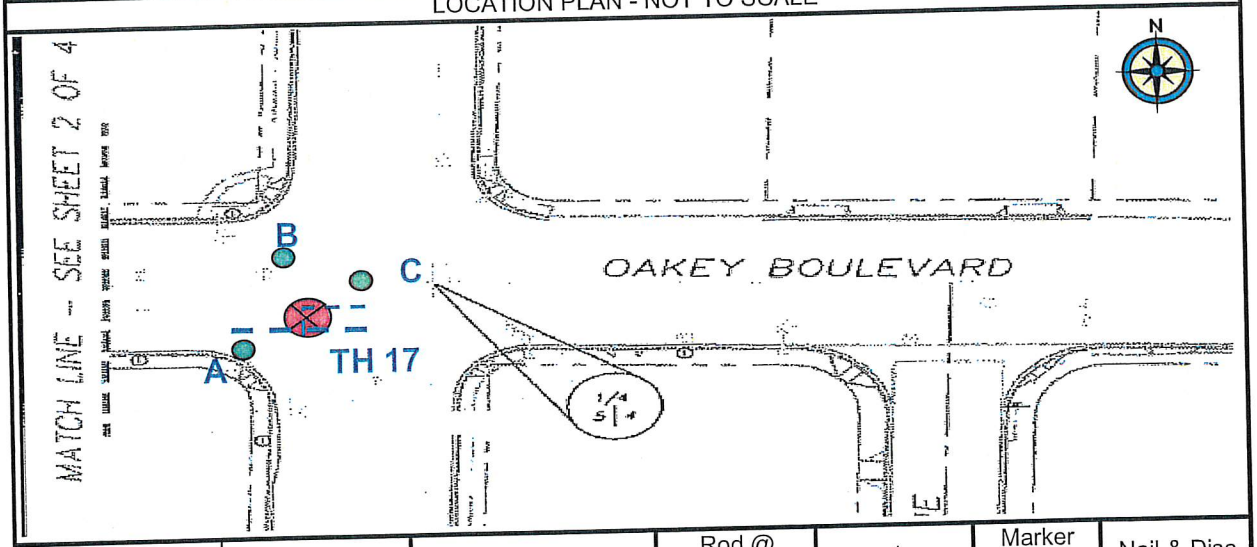
TEST HOLE DATA SHEET

Test Hole No.	17
Date Excavated	10/19/06
Client Project No.	N/A
TBE Project No	NV 042-007-00
TBE Truck No	55-236

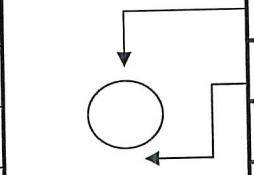
TBE GROUP, Inc.
2875 East Patrick Lane Ste. K
Las Vegas NV. 89120
702.458.4092
702.895.8415 fax

SUE Crew	CP/CW
City	Las Vegas
County	Clark
Route No.	Oakey Blvd.
Location	Rancho

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Asphalt
Thickness	9"
Soil Conditions	Type II
UTL Type	Water
Nominal Pipe Size	18"
UTL Material	Steel



Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	**3.76'**	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Storm Manhole	11'
B	Storm Manhole	23'
C	Sanitary Manhole	19'

Remarks:

Pothole dug between valve and 90 bend.

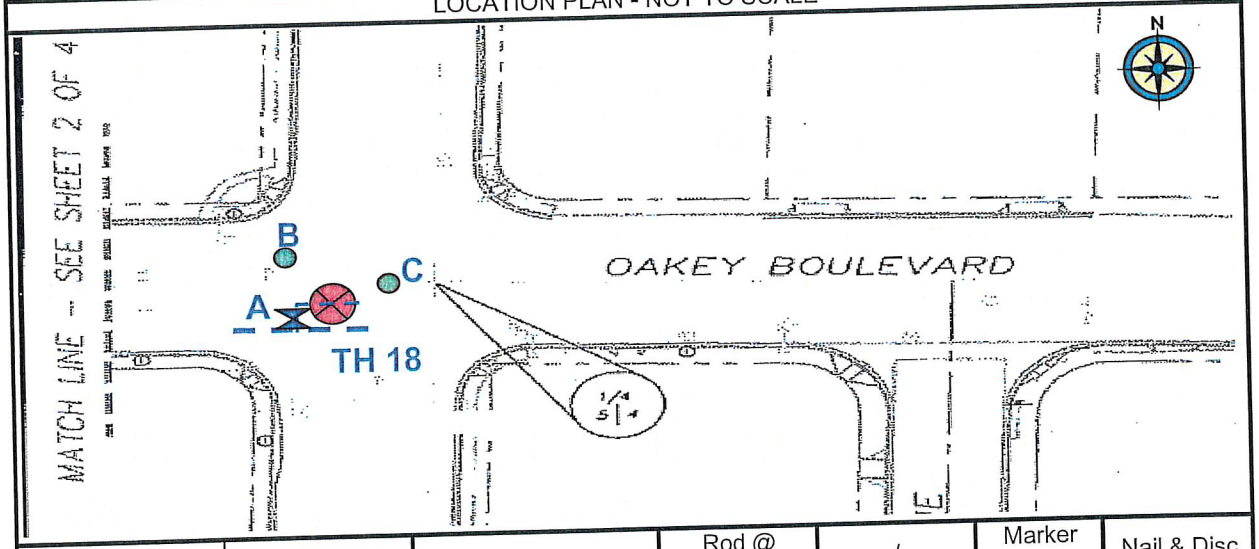
Data Entered By: CP

Reviewed By: GT

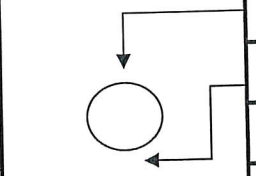
TEST HOLE DATA SHEET

Test Hole No.	18	TBE GROUP, Inc. 2875 East Patrick Lane Ste. K Las Vegas NV. 89120 702.458.4092 702.895.8415 fax	SUE Crew	CP/CW
Date Excavated	10/19/06		City	Las Vegas
Client Project No.	N/A		County	Clark
TBE Project No	NV042-007-00		Route No.	Oakey Blvd.
TBE Truck No	55-236		Location	Rancho

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Asphalt
Thickness	9"
Soil Conditions	Type II
UTL Type	Water
Nominal Pipe Size	8"
UTL Material	Steel



Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	**3.62'**	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Water Valve	5'
B	Storm Manhole	25'
C	Sanitary Manhole	16'

Remarks:

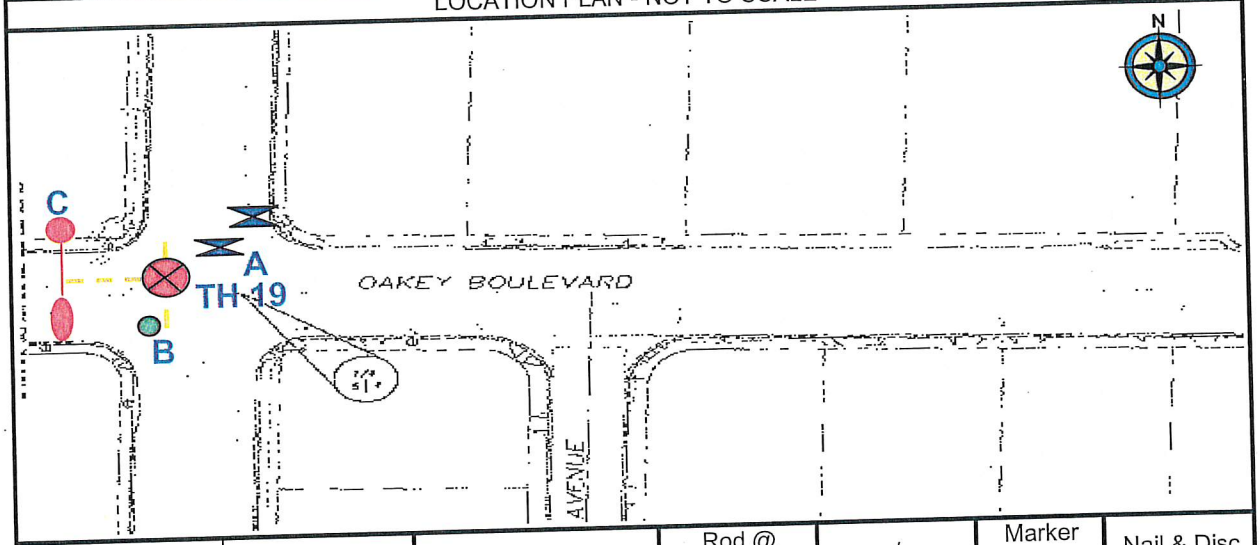
Data Entered By: CP

Reviewed By: GT

TEST HOLE DATA SHEET

Test Hole No.	19	TBE GROUP, Inc. 2875 East Patrick Lane Ste. K Las Vegas NV. 89120 702.458.4092 702.895.8415 fax	SUE Crew	CP/CW
Date Excavated	10/24/06		City	Las Vegas
Client Project No.	N/A		County	Clark
TBE Project No	NV 042-007-00		Route No.	Oakey Blvd.
TBE Truck No	55-236		Location	Rancho

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Asphalt
Thickness	7"
Soil Conditions	Slurry / Sand
UTL Type	Gas
Nominal Pipe Size	4"
UTL Material	PE

Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	3.14'	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Water Valve	20'
B	Sanitary Manhole	18'
C	Street Light	46'

Remarks:

Pothole on 4" gas tee.

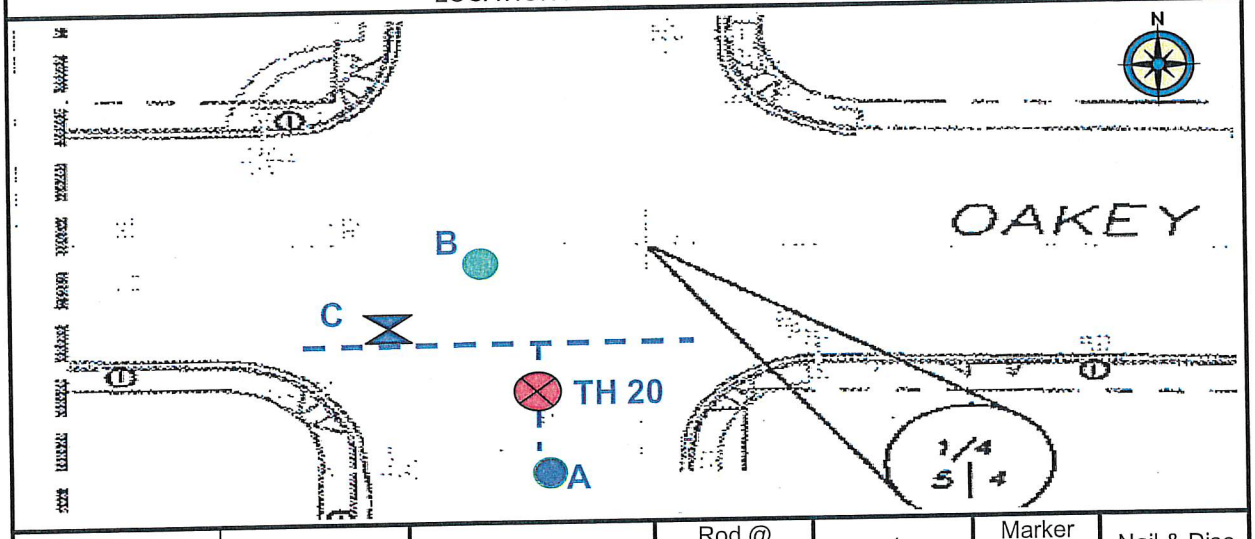
Data Entered By: CP

Reviewed By: GT

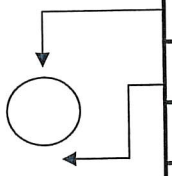
TEST HOLE DATA SHEET

Test Hole No.	20	TBE GROUP, Inc. 2875 East Patrick Lane Ste. K Las Vegas NV. 89120 702.458.4092 702.895.8415 fax	SUE Crew	CP/CW
Date Excavated	10/24/06		City	Las Vegas
Client Project No.	N/A		County	Clark
TBE Project No	NV042-007-00		Route No.	Oakey Blvd.
TBE Truck No	55-236		Location	Rancho

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Asphalt
Thickness	12"
Soil Conditions	Type II
UTL Type	Water
Nominal Pipe Size	18"
UTL Material	ACP



Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	3.34'	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Water Manhole	24'
B	Storm Manhole	15'
C	Water Valve	26'

Remarks:

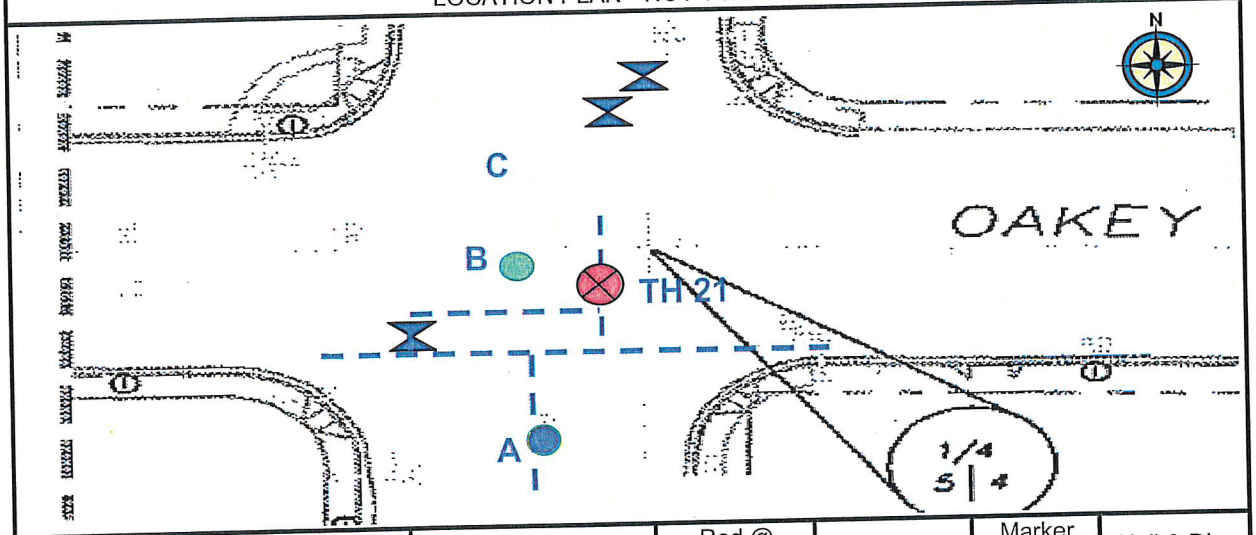
Data Entered By: CP

Reviewed By: GT

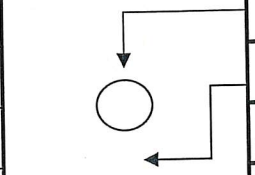
TEST HOLE DATA SHEET

Test Hole No.	21	TBE GROUP, Inc. 2875 East Patrick Lane Ste. K Las Vegas NV. 89120 702.458.4092 702.895.8415 fax	SUE Crew	CP/CW
Date Excavated	10/25/06		City	Las Vegas
Client Project No.	N/A		County	Clark
TBE Project No	NV042-007-00		Route No.	Oakey Blvd.
TBE Truck No	55-236		Location	Rancho

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Asphalt
Thickness	10"
Soil Conditions	Type II
UTL Type	Water
Nominal Pipe Size	8"
UTL Material	ACP



Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	2.65'	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Water Manhole	38'
B	Sanitary Manhole	12'
C	Water Valve	52'

Remarks:

Data Entered By: CP

Reviewed By: GT

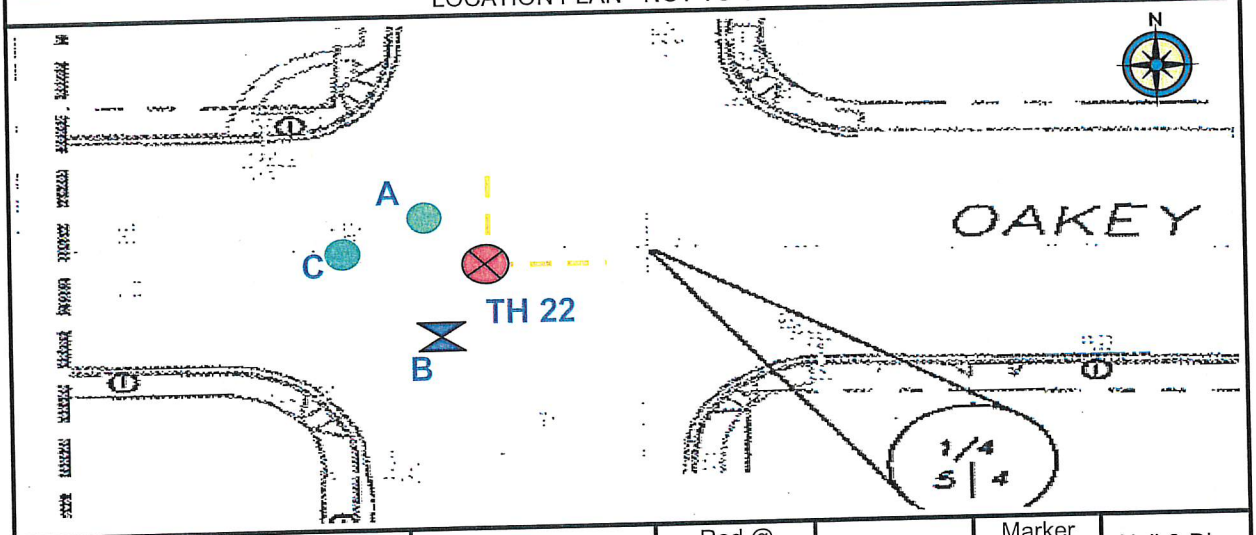
TEST HOLE DATA SHEET

Test Hole No.	22
Date Excavated	10/25/06
Client Project No.	N/A
TBE Project No	NV042-007-00
TBE Truck No	55-236

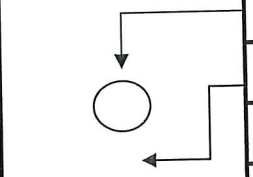
TBE GROUP, Inc.
2875 East Patrick Lane Ste. K
Las Vegas NV. 89120
702.458.4092
702.895.8415 fax

SUE Crew	CP/CW
City	Las Vegas
County	Clark
Route No.	Oakey Blvd.
Location	Rancho

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Asphalt
Thickness	10"
Soil Conditions	Type II
UTL Type	Gas
Nominal Pipe Size	4"
UTL Material	Steel



Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	3.43'	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Sanitary Manhole	16'
B	Water Valve	23'
C	Storm Manhole	30'

Remarks:

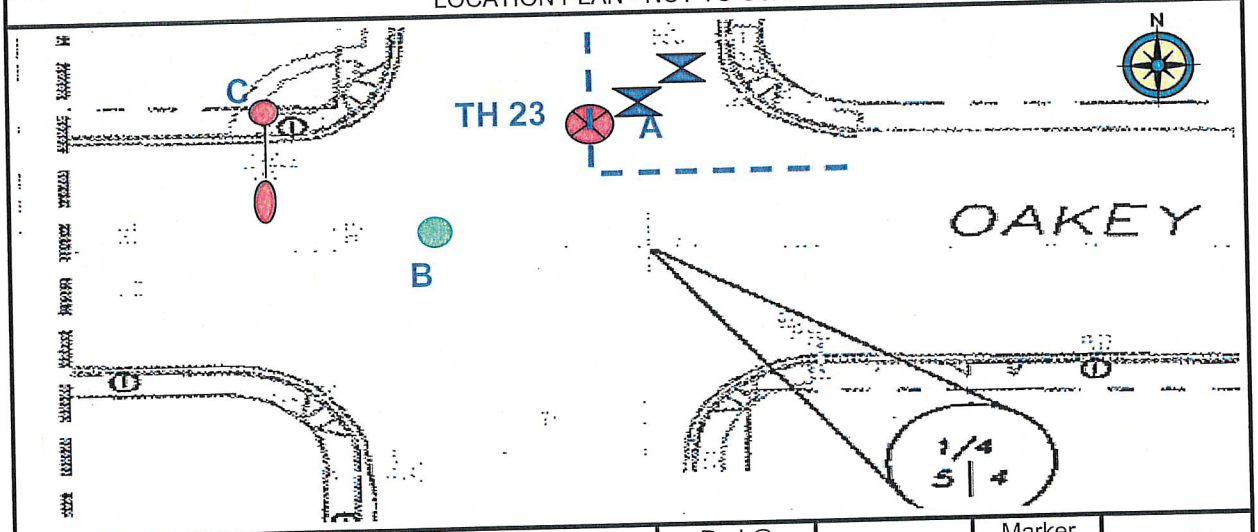
Data Entered By: CP

Reviewed By: GT

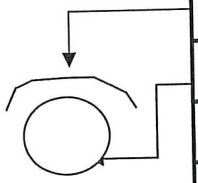
TEST HOLE DATA SHEET

Test Hole No.	23	TBE GROUP, Inc. 2875 East Patrick Lane Ste. K Las Vegas NV. 89120 702.458.4092 702.895.8415 fax	SUE Crew	CP/CW
Date Excavated	10/25/06		City	Las Vegas
Client Project No.	N/A		County	Clark
TBE Project No	NV042-007-00		Route No.	Oakey Blvd.
TBE Truck No	55-236		Location	Rancho

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/	Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ Monument	/	Rod @ UTL-Bot.	/	Elev.	/
English / Metric	English	Rod @ Marker	/		
Surface Type	Asphalt	Calc. UTL-Top	**4.70'**	Hand Meas.Top	/
Thickness	9"	Calc. UTL-Bot.	/	Hand Meas.Bot	/
Soil Conditions	Type II	Swing Ties from Structure			Dist.
UTL Type	Water	A	Water Valve		8'
Nominal Pipe Size	36"	B	Sanitary Manhole		27'
UTL Material	Concrete covered	C	Street Light		55'



Remarks:

Attempted to pothole at angle point but found concrete cover. Moved north on pipeline still finding concrete cover. Measure down taken to top of concrete cover.

Data Entered By: CP

Reviewed By: GT

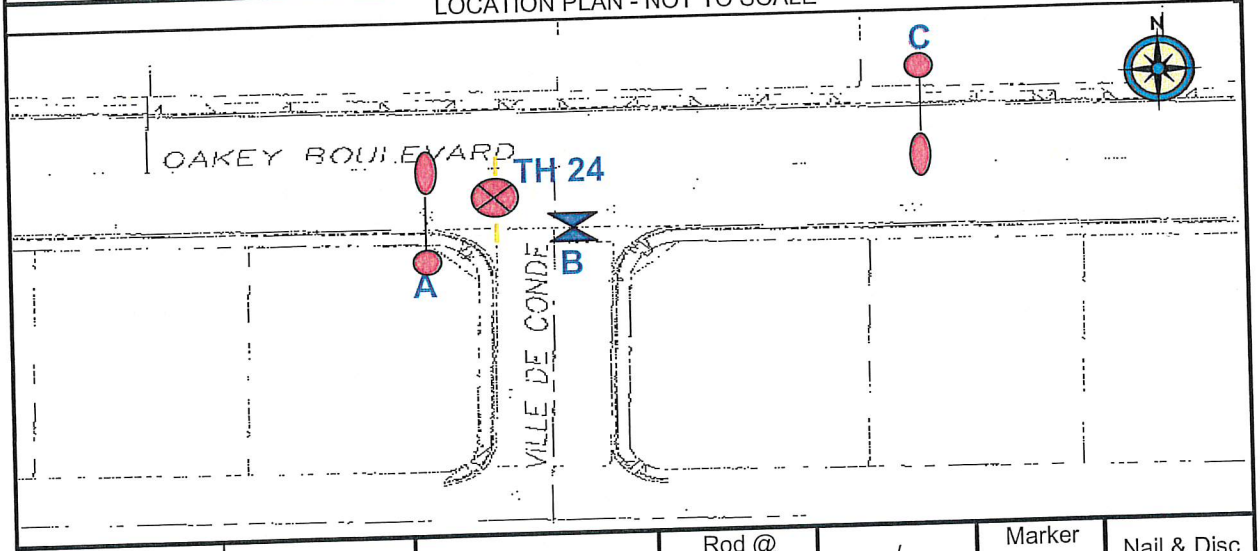
TEST HOLE DATA SHEET

Test Hole No.	24
Date Excavated	10/10/06
Client Project No.	N/A
TBE Project No	NV042-007-00
TBE Truck No	55-236

TBE GROUP, Inc.
2875 East Patrick Lane Ste. K
Las Vegas NV. 89120
702.458.4092
702.895.8415 fax

SUE Crew	SH/RR
City	Las Vegas
County	Clark
Route No.	Oakey Blvd.
Location	Villa De Conde

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Asphalt
Thickness	8"
Soil Conditions	Slurry
UTL Type	Gas
Nominal Pipe Size	2"
UTL Material	PE

Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	4.21'	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Street Light	42'
B	Water Valve	41'
C	Street Light	99'

Remarks:

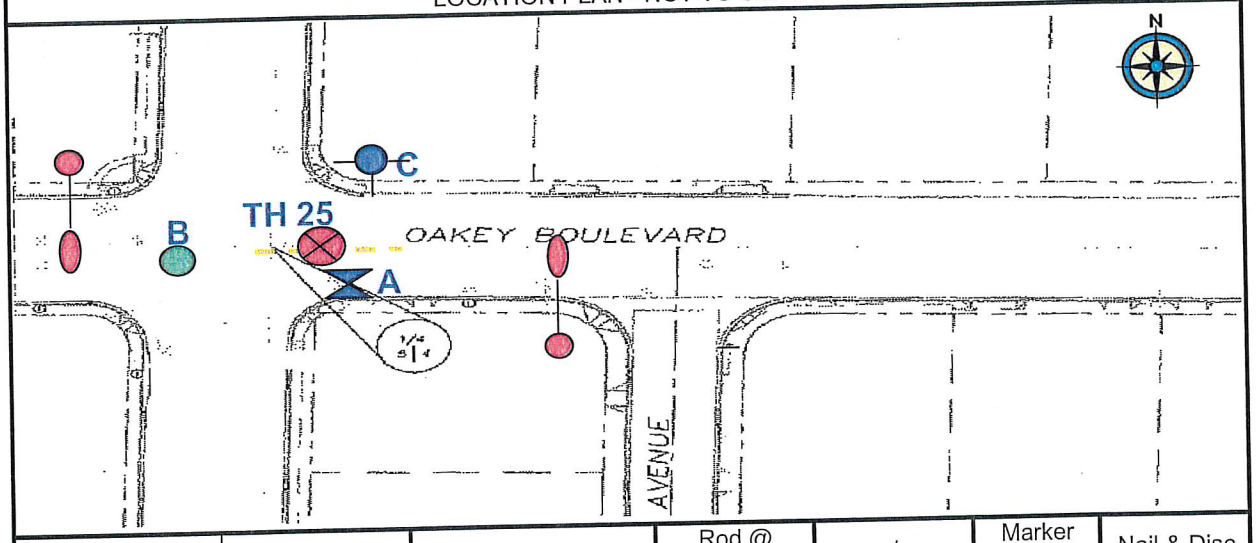
Data Entered By: SH

Reviewed By: GT

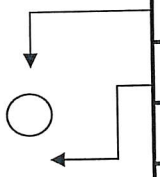
TEST HOLE DATA SHEET

Test Hole No.	25	**TBE GROUP, Inc.** 2875 East Patrick Lane Ste. K Las Vegas NV. 89120 702.458.4092 702.895.8415 fax	SUE Crew	CP/CW
Date Excavated	10/25/06		City	Las Vegas
Client Project No.	N/A		County	Clark
TBE Project No	NV042-007-00		Route No.	Oakey Blvd.
TBE Truck No	55-236		Location	Rancho Dr.

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Asphalt
Thickness	9"
Soil Conditions	Type II
UTL Type	Gas
Nominal Pipe Size	2"
UTL Material	Steel



Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	**2.86'**	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Water Valve	18'
B	Sanitary Manhole	47'
C	Fire Hydrant	57'

Remarks:

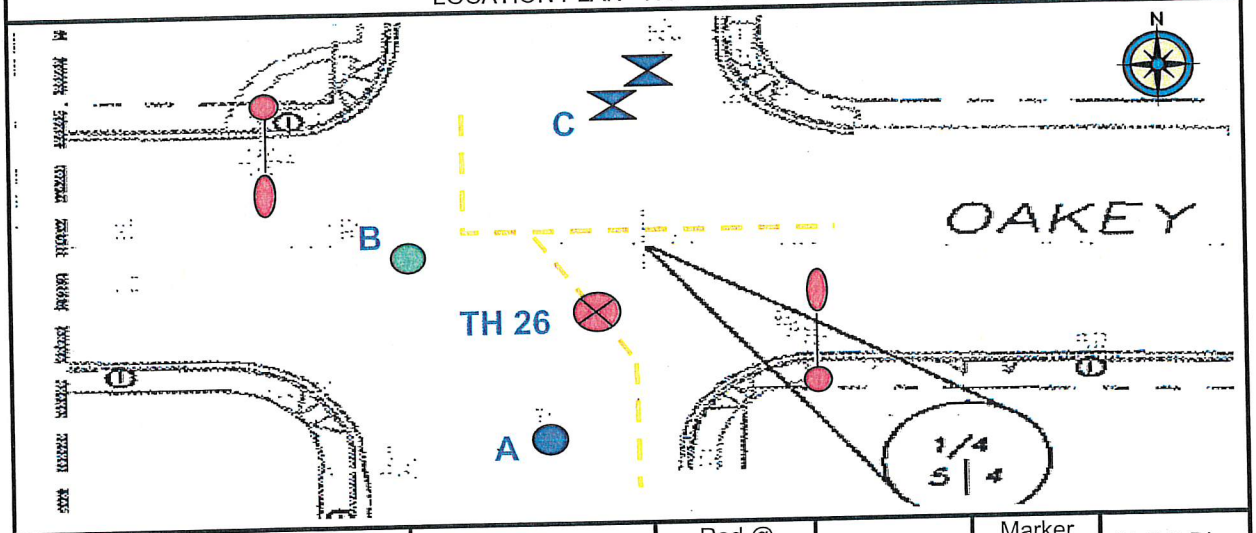
Data Entered By: CP

Reviewed By: GT

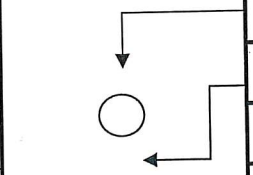
TEST HOLE DATA SHEET

Test Hole No.	26	TBE GROUP, Inc. 2875 East Patrick Lane Ste. K Las Vegas NV. 89120 702.458.4092 702.895.8415 fax	SUE Crew	CP/CW
Date Excavated	10/25/06		City	Las Vegas
Client Project No.	N/A		County	Clark
TBE Project No	NV042-007-00		Route No.	Oakey Blvd.
TBE Truck No	55-236		Location	Rancho Dr.

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Asphalt
Thickness	10"
Soil Conditions	Type II
UTL Type	Gas
Nominal Pipe Size	4"
UTL Material	Steel



Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	3.32'	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Water Manhole	38'
B	Sanitary Manhole	10'
C	Water Valve	52'

Remarks:

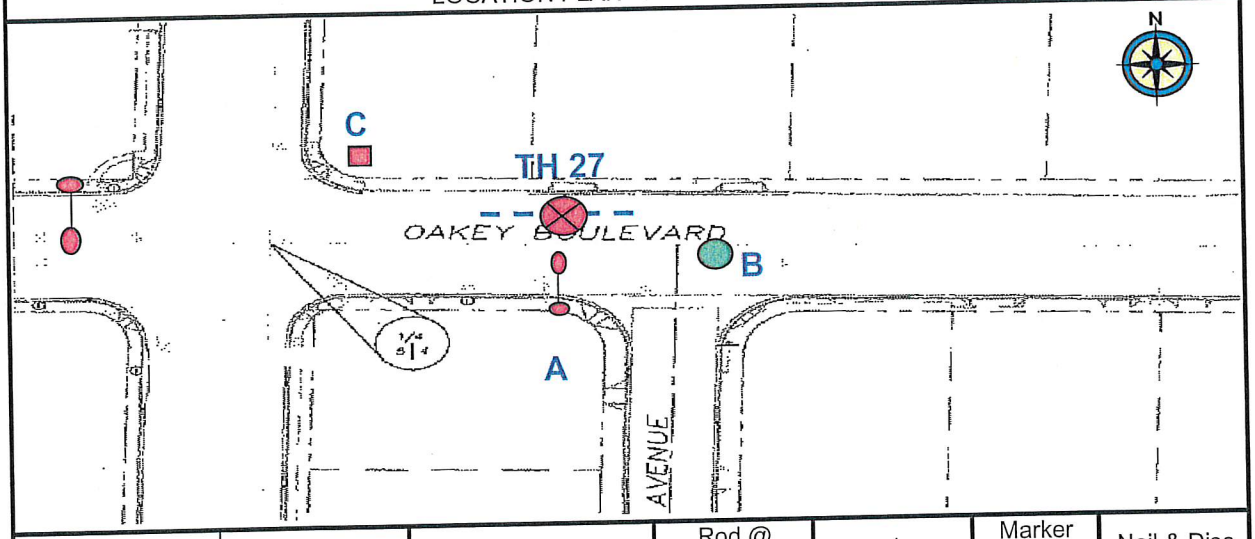
Data Entered By: CP

Reviewed By: GT

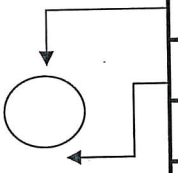
TEST HOLE DATA SHEET

Test Hole No.	27	TBE GROUP, Inc. 2875 East Patrick Lane Ste. K Las Vegas NV. 89120 702.458.4092 702.895.8415 fax	SUE Crew	CP/CW
Date Excavated	10/12/06		City	Las Vegas
Client Project No.	N/A		County	Clark
TBE Project No	NV042-007-00		Route No.	Oakey Blvd.
TBE Truck No	55-236		Location	East of Rancho Dr.

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Asphalt
Thickness	9"
Soil Conditions	Type II
UTL Type	Water
Nominal Pipe Size	36"
UTL Material	SCCP



Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	4.76'	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Street Light	59'
B	Sanitary Manhole	80'
C	Traffic Signal Vault	93'

Remarks:

Data Entered By: CP

Reviewed By: GT

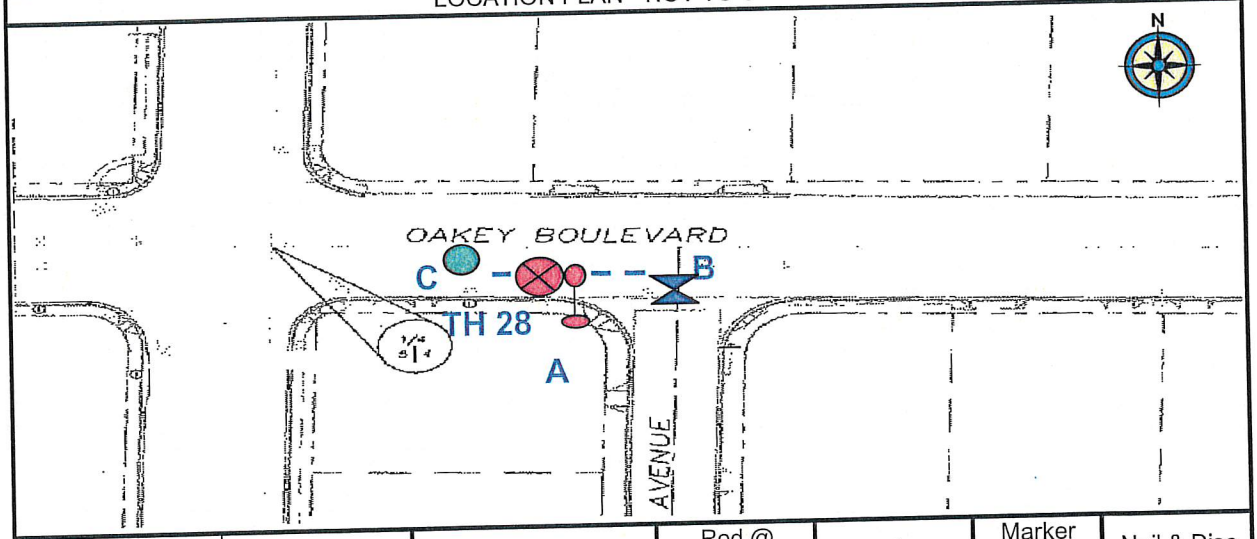
TEST HOLE DATA SHEET

Test Hole No.	28
Date Excavated	10/10/06
Client Project No.	N/A
TBE Project No	NV042-007-00
TBE Truck No	55-236

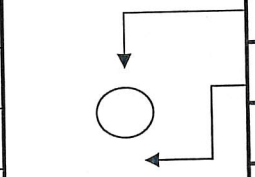
TBE GROUP, Inc.
2875 East Patrick Lane Ste. K
Las Vegas NV. 89120
702.458.4092
702.895.8415 fax

SUE Crew	CP/CW
City	Las Vegas
County	Clark
Route No.	Oakey Blvd.
Location	East of Rancho Dr.

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Asphalt
Thickness	8"
Soil Conditions	Type II
UTL Type	Water
Nominal Pipe Size	8"
UTL Material	ACP



Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	**2.71'**	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Street Light	14'
B	Water Valve	45'
C	Storm Manhole	31'

Remarks:

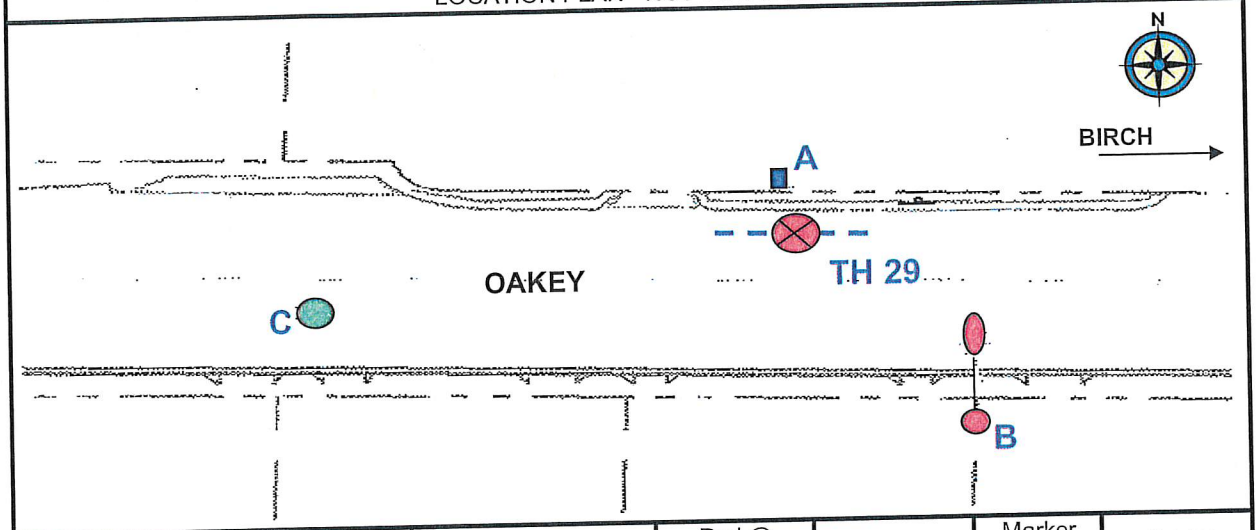
Data Entered By: CP

Reviewed By: GT

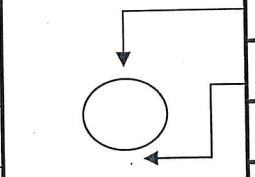
TEST HOLE DATA SHEET

Test Hole No.	29	TBE GROUP, Inc. 2875 East Patrick Lane Ste. K Las Vegas NV. 89120 702.458.4092 702.895.8415 fax	SUE Crew	CP/CW
Date Excavated	10/12/06		City	Las Vegas
Client Project No.	N/A		County	Clark
TBE Project No	NV042-007-00		Route No.	Oakey Blvd.
TBE Truck No	55-236		Location	East of Rancho

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Asphalt
Thickness	7"
Soil Conditions	Type II
UTL Type	Water
Nominal Pipe Size	36"
UTL Material	SCCP



Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	3.47'	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Water Vault	16'
B	Street Light	65'
C	Sanitary Manhole	138'

Remarks:

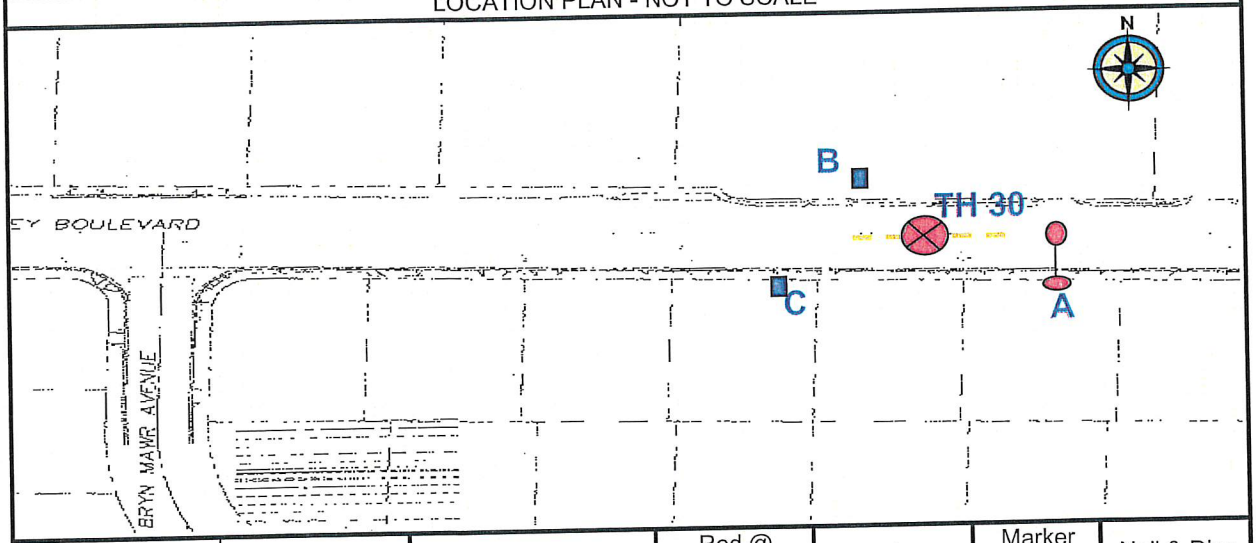
Data Entered By: CP

Reviewed By: GT

TEST HOLE DATA SHEET

Test Hole No.	30	TBE GROUP, Inc. 2875 East Patrick Lane Ste. K Las Vegas NV. 89120 702.458.4092 702.895.8415 fax	SUE Crew	SH/RR
Date Excavated	10/26/06		City	Las Vegas
Client Project No.	N/A		County	Clark
TBE Project No	NV042-007-00		Route No.	Oakey Blvd.
TBE Truck No	55-236		Location	East of Rancho Dr.

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/	Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ Monument	/	Rod @ UTL-Bot.	/	Elev.	/
English / Metric	English	Rod @ Marker	/		
Surface Type	Asphalt	Calc. UTL-Top	3.73'	Hand Meas.Top	/
Thickness	5"	Calc. UTL-Bot.	/	Hand Meas.Bot	/
Soil Conditions	Sand	Swing Ties from Structure			Dist.
UTL Type	Gas	A	Street Light		29'
Nominal Pipe Size	2"	B	Water Meter Box		53'
UTL Material	Steel	C	Water Meter Box		46'

Remarks:

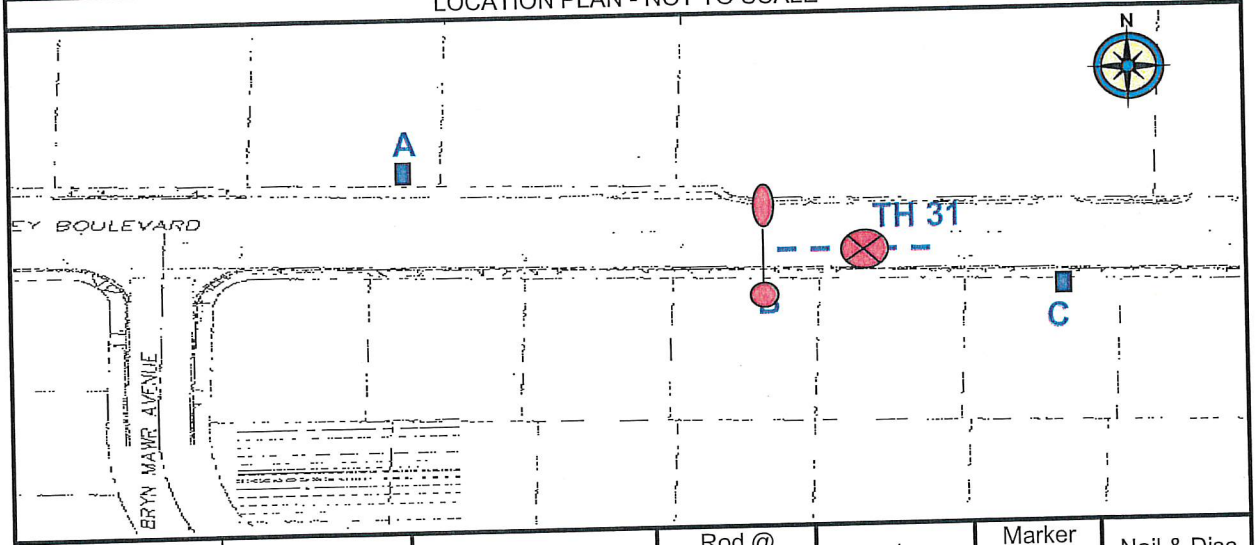
Data Entered By: SH

Reviewed By: GT

TEST HOLE DATA SHEET

Test Hole No.	31	TBE GROUP, Inc. 2875 East Patrick Lane Ste. K Las Vegas NV. 89120 702.458.4092 702.895.8415 fax	SUE Crew	SH/RR
Date Excavated	10/12/06		City	Las Vegas
Client Project No.	N/A		County	Clark
TBE Project No	NV042-007-00		Route No.	N/A
TBE Truck No	55-232		Location	East of Rancho Dr.

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/	Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ Monument	/	Rod @ UTL-Bot.	/	Elev.	/
English / Metric	English	Rod @ Marker	/		
Surface Type	Asphalt	Calc. UTL-Top	3.43'	Hand Meas.Top	/
Thickness	7"	Calc. UTL-Bot.	/	Hand Meas.Bot	/
Soil Conditions	Sand	Swing Ties from Structure			Dist.
UTL Type	Water	A	Water Meter Box		91'
Nominal Pipe Size	6"	B	Street Light		33'
UTL Material	ACP	C	Water Meter Box		56'

Remarks:

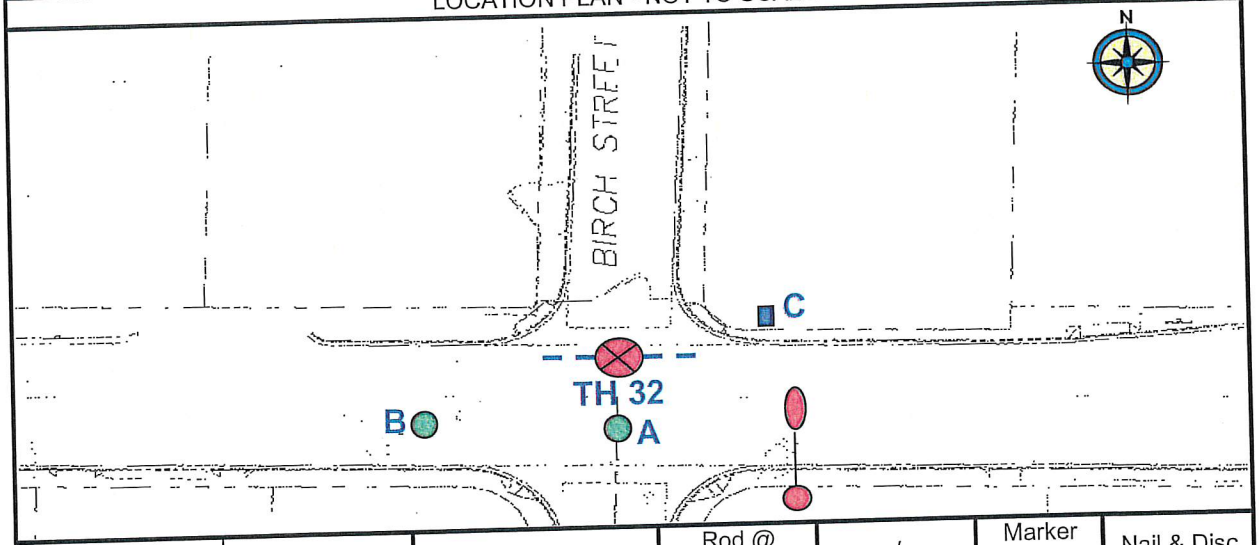
Data Entered By: SH

Reviewed By: GT

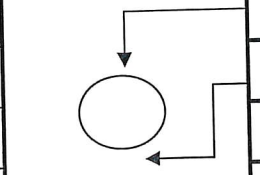
TEST HOLE DATA SHEET

Test Hole No.	32	TBE GROUP, Inc. 2875 East Patrick Lane Ste. K Las Vegas NV. 89120 702.458.4092 702.895.8415 fax	SUE Crew	CP/CW
Date Excavated	10/12/06		City	Las Vegas
Client Project No.	N/A		County	Clark
TBE Project No	NV042-007-00		Route No.	Oakey Blvd.
TBE Truck No	55-236		Location	Birch St.

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Asphalt
Thickness	7"
Soil Conditions	Type II
UTL Type	Water
Nominal Pipe Size	36"
UTL Material	SCCP



Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	6.34'	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Sanitary Manhole	7'
B	Sanitary Manhole	64'
C	Water Vault	47'

Remarks:

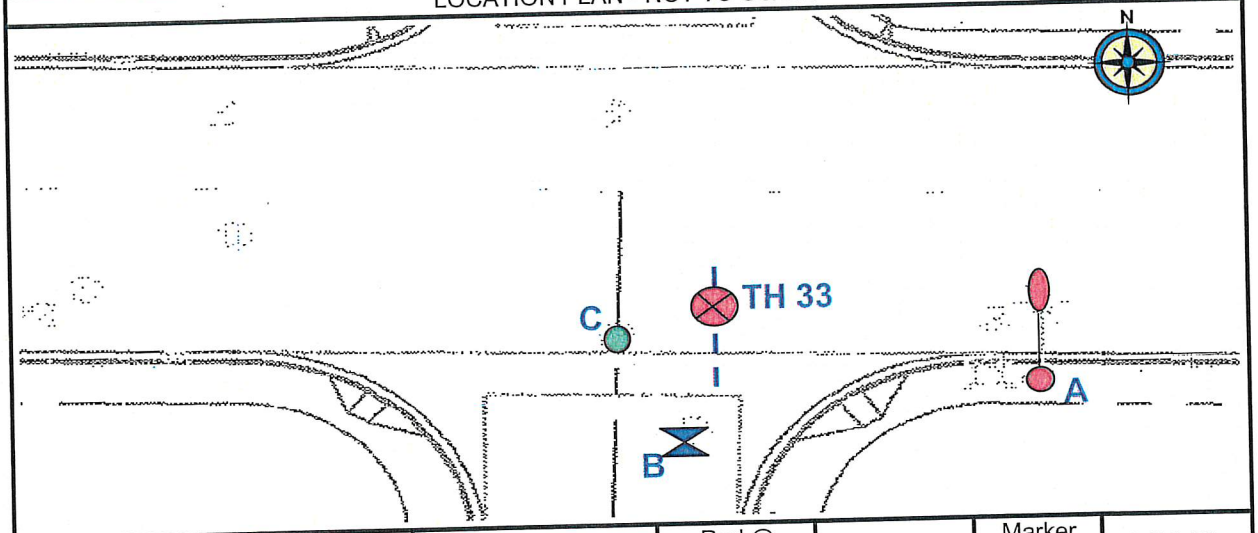
Data Entered By: CP

Reviewed By: GT

TEST HOLE DATA SHEET

Test Hole No.	33	TBE GROUP, Inc. 2875 East Patrick Lane Ste. K Las Vegas NV. 89120 702.458.4092 702.895.8415 fax	SUE Crew	SH/RR
Date Excavated	10/12/06		City	Las Vegas
Client Project No.	N/A		County	Clark
TBE Project No	NV042-007-00		Route No.	Oakey Blvd.
TBE Truck No	55-232		Location	Birch St.

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/	Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ Monument	/	Rod @ UTL-Bot.	/	Elev.	/
English / Metric	English	Rod @ Marker	/		
Surface Type	Asphalt	Calc. UTL-Top	3.58'	Hand Meas.Top	/
Thickness	8"	Calc. UTL-Bot.	/	Hand Meas.Bot	/
Soil Conditions	Rocky				
UTL Type	Water				
Nominal Pipe Size	6"				
UTL Material	ACP				

Swing Ties from Structure		Dist.
A	Street Light	50'
B	Water Valve	25'
C	Sanitary Manhole	15'

Remarks:

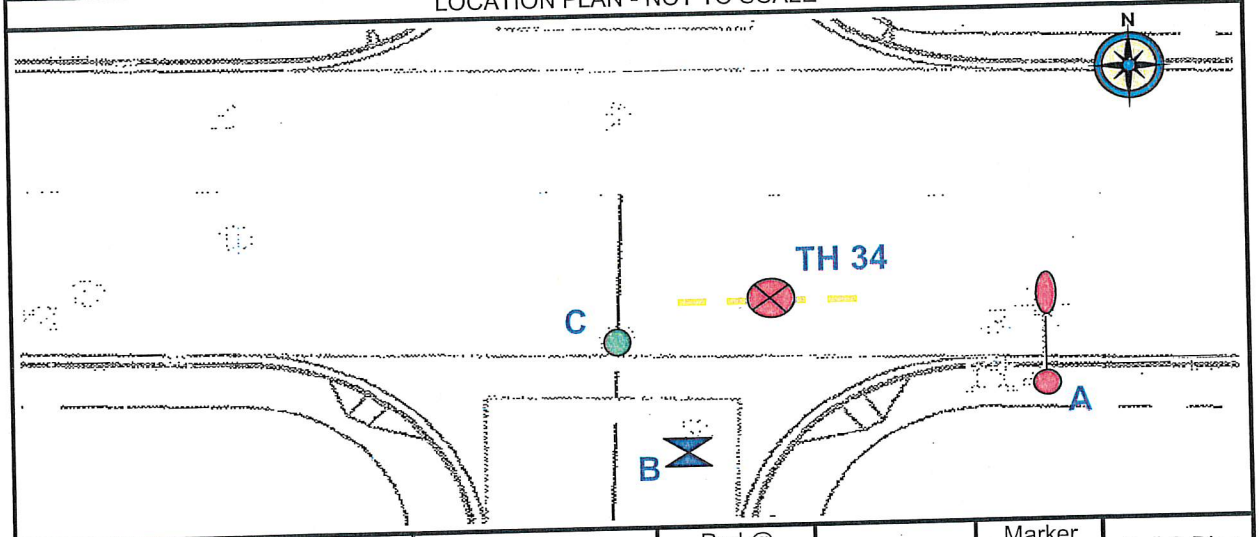
Data Entered By: CP

Reviewed By: GT

TEST HOLE DATA SHEET

Test Hole No.	34	TBE GROUP, Inc. 2875 East Patrick Lane Ste. K Las Vegas NV. 89120 702.458.4092 702.895.8415 fax	SUE Crew	SH/RR
Date Excavated	10/11/06		City	Las Vegas
Client Project No.	N/A		County	Clark
TBE Project No	NV042-007-00		Route No.	Oakey Blvd.
TBE Truck No	55-232		Location	Birch St.

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Asphalt
Thickness	8"
Soil Conditions	Slurry
UTL Type	Gas
Nominal Pipe Size	2"
UTL Material	PE

Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	2.74'	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Street Light	49'
B	Water Valve	19'
C	Sanitary Manhole	15'

Remarks:

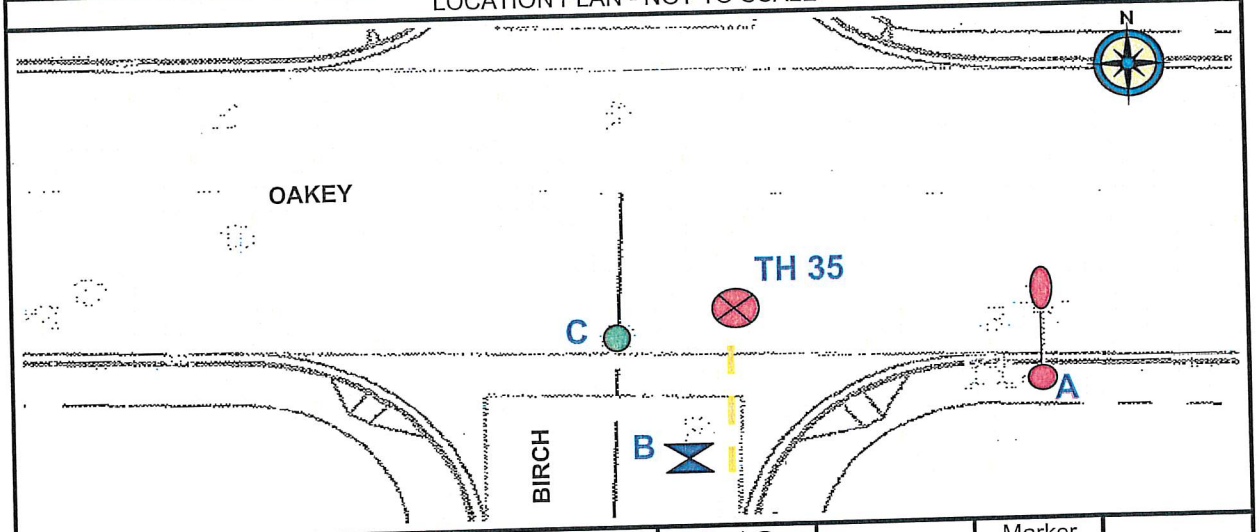
Data Entered By: SH

Reviewed By: GT

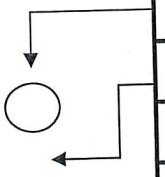
TEST HOLE DATA SHEET

Test Hole No.	35	TBE GROUP, Inc. 2875 East Patrick Lane Ste. K Las Vegas NV. 89120 702.458.4092 702.895.8415 fax	SUE Crew	SH/RR
Date Excavated	10/11/06		City	Las Vegas
Client Project No.	N/A		County	Clark
TBE Project No	NV042-007-00		Route No.	Oakey Blvd.
TBE Truck No	55-232		Location	Birch St.

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Asphalt
Thickness	8"
Soil Conditions	Slurry
UTL Type	Gas
Nominal Pipe Size	2"
UTL Material	Steel



Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	3.13'	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Street Light	48'
B	Water Valve	20'
C	Sanitary Manhole	16'

Remarks:

Pothole identifies 2" stub

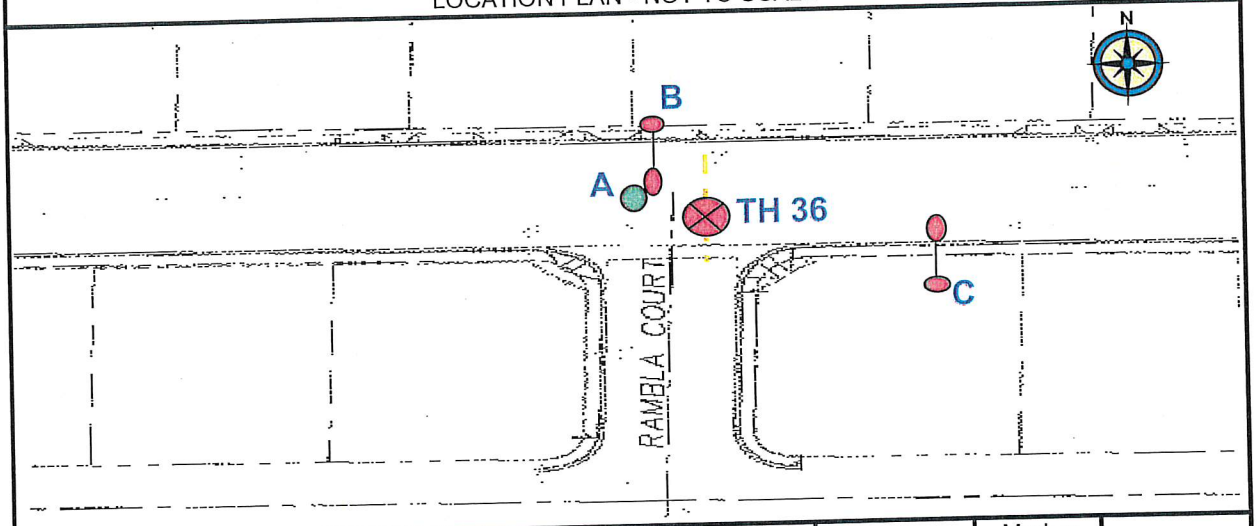
Data Entered By: SH

Reviewed By: GT

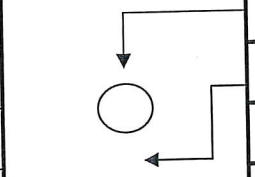
TEST HOLE DATA SHEET

Test Hole No.	36	TBE GROUP, Inc. 2875 East Patrick Lane Ste. K Las Vegas NV. 89120 702.458.4092 702.895.8415 fax	SUE Crew	CP/CW
Date Excavated	10/10/06		City	Las Vegas
Client Project No.	N/A		County	Clark
TBE Project No	NV042-007-00		Route No.	Oakey Blvd.
TBE Truck No	55-236		Location	Rambla Ct.

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Asphalt
Thickness	9"
Soil Conditions	Type II
UTL Type	Gas
Nominal Pipe Size	2"
UTL Material	PE



Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	**2.71'**	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Sanitary Manhole	13'
B	Street Light	47'
C	Street Light	109'

Remarks:

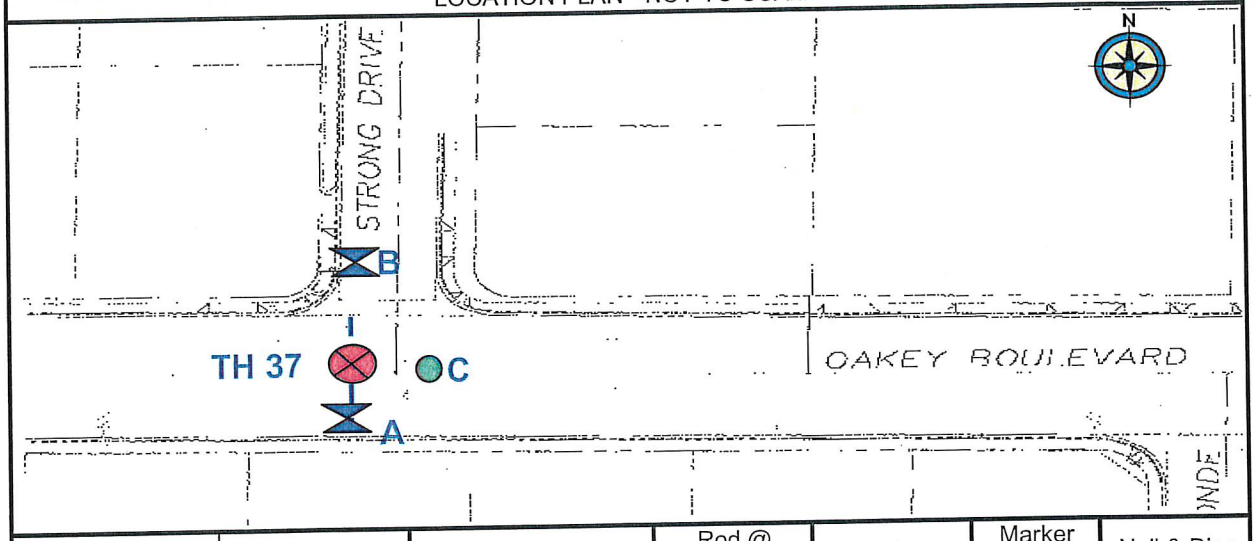
Data Entered By: SH

Reviewed By: GT

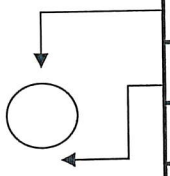
TEST HOLE DATA SHEET

Test Hole No.	37	**TBE GROUP, Inc.** 2875 East Patrick Lane Ste. K Las Vegas NV. 89120 702.458.4092 702.895.8415 fax	SUE Crew	CP/CW
Date Excavated	10/10/06		City	Las Vegas
Client Project No.	N/A		County	Clark
TBE Project No	NV042-007-00		Route No.	Oakey Blvd.
TBE Truck No	55-236		Location	Strong Ave.

LOCATION PLAN - NOT TO SCALE



Monument Elev.	/
Rod @ Monument	/
English / Metric	English
Surface Type	Asphalt
Thickness	8"
Soil Conditions	Type II
UTL Type	Water
Nominal Pipe Size	12"
UTL Material	ACP



Rod @ UTL-Top	/	Marker Set	Nail & Disc
Rod @ UTL-Bot.	/	Elev.	/
Rod @ Marker	/		
Calc. UTL-Top	**4.49'**	Hand Meas.Top	/
Calc. UTL-Bot.	/	Hand Meas.Bot	/

Swing Ties from Structure		Dist.
A	Water Valve	5'
B	Water Valve	39'
C	Sanitary Manhole	21'

Remarks:

Data Entered By: CP

Reviewed By: GT