ENVIRON

May 4, 2011

Mr. Michael Anderson
Nevada Division of Water Resources
901 South Stewart Street, Suite 2002
Carson City, NV 89701

Re: Nevada Environmental Response Trust Site – Henderson, Nevada

Dear Mr. Anderson:

On behalf of the Nevada Environmental Response Trust (NERT), ENVIRON International Corporation (ENVIRON) is submitting the attached GW-11 Dam Permit Application. The application is associated with the 11-acre aquifer retention basin to be used for the temporary storage of groundwater. The property is located in Section 12, T 22 South, R 62 East in the City of Henderson, Clark County.

As indicated in your previous discussions with ENVIRON, the grading plan may change slightly from the existing plan included within the permit. Any substantial changes that could affect the aquifer retention basin will be submitted to your office as an Engineering Design Change.

If you have any questions or require further information, please contact me at (510) 420-2565.

Sincerely,

Allan J. DeLorme, PE
Managing Principal

6001 Shellmound Street, Suite 700, Emeryville, CA 94608
Tel: +1 510.655.7400 Fax: +1 510.655.9517
www.environcorp.com

GW-11 Dam Permit Application Forms

PROOF OF COMPLETION OF WORK AND REQUEST FOR APPROVAL TO IMPOUND
COVER SHEET

PURSUANT TO NEVADA ADMINISTRATIVE CODE (NAC) 535.300

Name and serial number of dam: Aquifer Retention Basin , J-

Name, address and telephone number of design engineer:
Western States Engineering, 8040 So. Kolb Rd. Tucson, AZ 85106 tel. (520) 889-2040
ETEC Testing Laboratories, Inc., 4150 Pioneer Avenue #A Las Vegas, NV 89102-8241 tel. (702) 367-0100

Name of "on-site" engineer (if not the design engineer): Theodore Splitter, Northgate Environmental Management

Name of firm providing quality assurance and quality control testing: ETEC Testing Laboratories

Name and address of lead contractor:
Northern and portion of eastern embankment built in 1940's; contractor unknown. Contractor for western, southern, and portion of eastern embankments is Pacific Process Corporation (no longer in business).

Was the design altered in any way during the course of construction? No

If "YES," please include a description of any alterations and the date of the State Engineer's approval in the construction certification report. Record drawings ("as-built") will absolutely be required if an alteration to the dam height, alignment, or reservoir area was made.

Please respond to the following questions with either the date of submittal or "attached."

Compaction test results/summaries: Attached

Progress reports ("daily" sheets): Attached

Emergency Action Plan (EAP), if required: NA

Other material test results (liner, concrete, etc.):
None

Record Drawings: Design drawings attached

Construction certification report and affidavit: Attached

Finished elevations above mean seal level as determined by the North American Vertical Datum of 1988 OR

NAVD 1983 Datum:

Maximum crest elevation: 1750

Minimum crest elevation: 1750

Spillway crest elevation: NA

Capacity to crest of dam (in acre-feet): 139

A FIFTY DOLLAR ($50) FILING FEE MUST ACCOMPANY THIS FORM.

STATE OF NEVADA
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES

Filed _____ J - _____

APPLICANT MUST NOT FILL IN ABOVE BLANKS NV _____

APPLICATION FOR APPROVAL OF THE PLANS AND SPECIFICATIONS FOR THE CONSTRUCTION, RECONSTRUCTION OR ALTERATION OF A DAM

This Application Involves in No Way the Right to Appropriate Water

To secure the right to appropriate water, application should be made to the State Engineer on forms which will be furnished upon request.

I, Nevada Environmental Response Trust (Name of applicant) of 35 East Wacker Dr. Suite 1550 (Address) Chicago, IL 60606, hereby make application for the approval of

Plans and Specifications for the existing (Construction, reconstruction, alteration) of Aquifer Retention Basin (Name of dam) dam.

The owner of the proposed dam is Nevada Environmental Response Trust (Name of owner)

of 35 Wacker Dr. Suite 1550, Chicago (Address) State of Illinois

If the owner is a corporation, give name and address of president and secretary:

The applicant is acting for the owner in the legal capacity of Project Engineer (Agent, Lessee, Trustee, etc.)

Location of Dam

1. The source of water to be stored is GW extraction wells which is a tributary of NA,

and the proposed dam to be located within the ____ ¼, ____ ¼, Sec. 12

T. 22, R. 62 E., M.D.B.&M. in Clark County, Nevada further described as

being at Latitude 36° 03'00.38" N. Longitude 115°00'19.91 W. (at a point pursuant to NAC 535.210(6b).

Description and Dimensions of Dam

(If for an alteration, the data given below is for the altered dam)

2. Type of dam Earthen embankment (Concrete arch or gravity, earth, rockfill, etc.) 3. Length of crest 3266 ft.

4. Height stream bed to spillway crest NA ft. 5. Height foundation to spillway crest 20 ft.

6. Freeboard 3' min. (Spillway crest to top) ft. 7. Thickness at top 20 ft. 8. Thickness at bottom 80 to 144 ft.

9. Slope upstream* 3:1 10. Slope downstream* 2:1 to 4:1 11. Upstream facing HDPE membran (Concrete or rock paving, etc.)

*This information to be supplied for earth or rockfill dams.

12. Amount of material in dam 109,000 cu. yds. 13. Estimated Cost $2,700,000.00

14. Spillway data NA (Type, capacity, etc.)

15. Outlet data NA (Type, capacity, etc.)

Revised 07/09 - dam_plans

$1,000 filing fee must accompany this application

16. Elevation of crest of dam 1750 above NAVD 1983 datum
Approximate elevation to be given if true elevation not available

17. Area of reservoir at spillway level 16.8 acres. 18. Capacity of reservoir 114 ac. ft.

General Information

19. State the **purpose** of the dam Temporary storage of groundwater
Diversion only; storage only; storage and diversion; debris storage, flood control, etc.

20. State the **use** that is to be made of water treated to remove contaminants, released into Las Vegas Wash
municipal, domestic, irrigation, power, mining and milling, recreation, stockwatering or none

21. Engineers
Western States Engineering, 8040 So. Kolb Rd., Tucson, AZ 85706

ETEC Testing Laboratories, Inc., 4150 Pioneer Ave #A, Las Vegas, NV 89102-8241

Name and address of Engineers preparing plans

22. If the proposed dam is to be built under Federal supervision, state what department has jurisdiction.
NA

23. The maps, plans and specifications accompanying this application are a part thereof.

[Signed] Theodore Schiller

this 14 day of April, 20 11

APPROVAL OF APPLICATION NO. _____, INCLUDING PLANS AND SPECIFICATIONS

This Is to Certify That Application No. _____, including plans and specifications for the _____ dam has been examined and the same is hereby approved, subject to the following conditions:

Witness my hand and seal this _____ day of _____, 20____

_____
State Engineer

FILE IN TRIPLICATE

NEVADA DIVISION OF WATER RESOURCES
ENGINEERING REVIEW OF DAMS:
DESIGN, PLANS, AND SPECIFICATIONS

Instructions: Note page on which noted information lies. Leave no blanks.
Use check mark if page number is inappropriate.
Note deficiencies and inconsistencies on last page.

1. APPLICATION FORM

1.1. Y Heading properly completed
1.2. Y Location properly completed
1.3. Y Dam information complete
1.4. Y Engineer listing complete
1.5. N Original signature of person listed in heading

2. PLANS

2.1. Y Owner names on plans and dam name
2.2. Y Vicinity/location
2.3. N Survey tie to found section corner
2.4. NA Plan view of watershed boundary. Tributary area drainage study att.
2.5. N Downstream hazard
2.6. N Reservoir storage capacity curve
2.6.1. Y Capacity to spillway invert Y at elevation 1750
2.6.2. Y Capacity to crest of dam Y at elevation 1750
2.7. N Reservoir area curve
2.7.1. Y Area at spillway invert Y at elevation 1750
2.7.2. Y Area at crest of dam Y at elevation 1750
2.8. NA Discharge curves for outlet(s) and spillway(s)
2.9. Y Plan view of dam and reservoir area
2.10. Y Post-construction topography with elevation contours
2.11. N Reference point on dam. Latitude N Longitude N
2.12. N Limits of stripping
2.13. Y Borrow areas
2.14. Y Test pits/boreholes
2.15. N Cross section alignments
2.16. Y Cross sections
2.16.1. N Along axis
2.16.2. NA At outlet
2.16.3. NA At Spillway

2.16.4. Y Other

2.16.5. Y Dam crest elevation 1750

2.16.6. Y Spillway crest elevation 1750

2.16.7. Y Water level elevations

2.16.7.1. N At maximum conservation N

2.16.7.2. N At IDF N

2.16.7.3. N At minimum pool (if applicable) N

2.16.7.4. N Maximum flow line in spillway and elevation N

2.16.8. N Foundation elevation (after stripping and after any improvement)

2.16.9. NA Location and dimensions of core

2.16.10. NA Location and dimensions of filter and drain zones

2.16.11. NA Location and dimensions of shell or random fill zones

2.16.12. NA Location and dimensions of erosion protection

2.16.13. Y Dam face slopes

2.16.14. NA Dam crest camber

2.17. NA Spillway plan view and cross sections

2.17.1. NA Energy dissipation

2.17.2. NA Erosion protection

2.17.3. NA Grade control

2.17.4. NA Concrete details

2.17.5. NA Reservoir control works details

2.18. NA Outlet pipe plan view and cross sections

2.18.1. NA Detail of inlet. Invert elevation NA

2.18.1.1. NA Trash rack

2.18.1.2. NA Gate(s)

2.18.1.3. NA Gate operator(s)

2.18.1.4. NA Vent

2.18.1.5. NA Protection from ice, vandalism, wave action

2.18.1.6. NA Structural details

2.18.2. NA Detail of outfall. Invert elevation NA

2.18.2.1. NA Structural details

2.18.2.2. NA Tailwater control

2.18.2.3. NA Energy dissipater. Type NA

2.18.3. NA Detail of pipe

2.18.3.1. NA Support

2.18.3.2. NA Joints

2.18.3.3. NA Cut off collars (NOT ADVISED AS SOLE MEANS OF SEEP CONTROL)

2.18.3.4. NA Seep control, collection and disposal

2.19. NA Drains

2.19.1. NA Type and location NA

2.19.2. NA Filters

2.19.3. NA Details of construction

2.19.4. NA Access/cleanouts

2.20. Y Monitoring works

2.20.1. Y Type, location and details

2.21. Y Foundation improvement

2.21.1. NA Dental concrete

2.21.2. NA Grouting program

2.21.3. NA Piles

2.21.4. Y Over excavation

2.21.5. N Consolidation

2.21.6. N Relief wells

2.21.7. N Drains

2.22. Y Other considerations or details

3. BASIS OF DESIGN

3.1. **HAZARD CLASSIFICATION** NA

3.2. **HYDROLOGY**

3.2.1. NA Tributary area described

3.2.1.1. NA Nature of tributary area

3.2.1.2. NA Base flow

3.2.2. NA Storm recurrence interval NA

3.2.2.1. NA Appropriate for hazard/size?

3.2.2.2. NA Incremental damage analysis?

3.2.3. NA Runoff calculation method utilized NA

3.2.3.1. NA Appropriate curve numbers or infiltration rates

3.2.4. NA Flood routing method utilized NA

3.2.5. Y Freeboard to crest of dam 3 ft.

3.2.6. NA Freeboard in spillway NA ft.

3.2.7. NA Dam break analysis

3.2.7.1. NA Method utilized NA

3.2.7.2. NA Appropriate constants applied?

3.2.7.3. NA Inundation maps

3.2.8. N Potential for seiche due to landslide into reservoir

3.2.9. N Reservoir fetch and wave run up calculations

3.3. FOUNDATION

3.3.1. Y Geotechnical report

3.3.1.1. Y Surface conditions

3.3.1.2. Y Possible geological hazards Area within 1000 feet of mapped wash

3.3.1.3. Y Stripping requirements

3.3.1.4. Y Borrow area(s)

3.3.1.5. Y Shear strength for each zone

3.3.1.6. N Permeability

3.3.1.7. Y Grain size distribution and classification

3.3.2. Y Boring/test pit logs

3.3.2.1. Y Located on plans

3.3.2.2. Y Located in report

3.3.2.3. Y Total depth

3.3.2.4. Y Stratigraphy with location of various formations and depth to groundwater

3.3.3. NA Seep analysis

3.3.4. NA Foundation cut-off

3.3.5. Y Strength of foundation materials

3.3.6. NA Foundation/abutment improvement necessary

3.3.7. N Expected settlement

3.3.8. Y Overall depth to groundwater

3.3.9. Y Deficiencies or special conditions

3.4. EMBANKMENT

3.4.1. Y Availability of suitable materials

3.4.2. Y Soil properties

3.4.2.1. CPT Shear strength tests. Max. allowable shear stress

3.4.2.1.1. Core phi=38 deg. psi

3.4.2.1.2. Shell or random fill phi=38 deg. psi

3.4.2.1.3. Other structural zone phi=32-35 deg. psi

3.4.2.2. NA Particle size distribution and classification

3.4.2.2.1. NA Core

3.4.2.2.2. NA Drain(s)

3.4.2.2.3. NA Filters

3.4.2.2.4. N Shell or random fill

3.4.2.2.5. Y Erosion protection

3.4.2.2.6. NA Erosion protection bedding

3.4.2.3. Y Density curves. Method ASDM D1557

3.4.2.4. NA Filter compatibility between zones

3.4.3. Y Slope stability

3.4.3.1. Y Factors of safety

3.4.3.1.1. Post-construction static Y

3.4.3.1.2. Steady state seep NA

3.4.3.1.3. Rapid fill NA

3.4.3.1.4. Rapid draw down NA

3.4.3.1.5. Seismic Y

3.4.3.1.5.1. Method of determining seismic stability Pseudo-static

3.4.3.1.5.2. Constants used _____

3.4.3.1.5.3. Pseudo-static seismic coefficient 0.159 hor/vert

3.4.3.1.5.4. Y Assumptions stated?

3.4.4. NA Seep analysis

3.4.5. NA Armoring

3.4.5.1. NA Riprap calculations including bedding

3.4.5.2. NA Soil-cement design

3.4.5.3. NA RCC design

3.4.5.4. NA Other revetment design

4. SPECIFICATIONS

4.1. N Standard specification cited N

4.2. Y Inspection and testing schedules for all facets of work and materials

4.3. Y Test or inspection failure procedure

4.4. Y Clearing and grubbing construction area

4.4.1. Y Stripping unsuitable material

4.4.2. Y Identification of waste dumps

4.4.3. Y Identification of areas of over stripping

4.5. Y Borrow sources

4.5.1. Y Material stockpiles

4.5.2. Y Material handling

4.5.3. Y Rejection of loads

4.5.4. Y Moisture conditioning

4.6. Y Foundation preparation and compaction

4.6.1. Y Relative compaction 95% Mod. Proctor/Proctor

4.6.2. Y Special requirements

4.7. Y Placement of embankment materials

4.7.1. Y Lift thickness

4.7.2. Y Relative compaction 95% Mod. Proctor/Proctor

4.7.3. N Equipment requirements

4.7.4. NA Filter and drain placement

4.8. NA Concrete

4.8.1. NA Strengths

4.9. Y Erosion protection

4.9.1. NA Riprap

4.9.2. NA Soil-cement

4.9.3. NA RCC

4.9.4. Y Other

NOTES ON NEXT PAGE

REVIEW NOTES:

Robert K. Martinez, P.E.
Chief, Engineering and Dam Safety
Nevada Division of Water Resources
901 S. Stewart Street, Suite 2002
Carson City, NV 89701

Re: J- _____; Aquifer Retention Basin Dam

Dear Rob,

We hereby certify that the Aquifer Retention Basin dam has been completed in general accordance with the State Engineer's approved plans and specifications. During the construction period, a registered professional engineer was in residence at the construction site and was responsible for the project quality control program.

Attached are the QA/QC records. Any material that was tested and failed to meet specifications was (reworked, remixed, remoistened, recompacted) and tested until the material met or exceeded the specification.

The following specifications/materials were changed during the construction of the dam in order to accommodate field conditions:

Sincerely,

Theodore Splitter

Theodore Splitter PE 20615
Project Engineer

ETEC Document 1:

Geotechnical Investigation Report

ETEC TESTING LABORATORIES, INC.
4150 W. Pioneer Ave., Suite A • Las Vegas, NV 89102
Phone: (702) 367-0100 FAX: (702) 367-3651

Kerr McGee Chemical Corporation
P.O. Box 55
Henderson, Nevada 89009

March 27, 1998

Attention: Mr. Benton Marshall

Subject: Geotechnical Investigation Report
11-Acre Wastewater Retention Pond
Northwestern Portion of Kerr-McGee Plant
Henderson, Nevada

ETEC NO.: 81143

Mr. Marshall:

We are pleased to present the results of our geotechnical investigation for the proposed wastewater retention pond. Our study has indicated that the proposed construction is feasible.

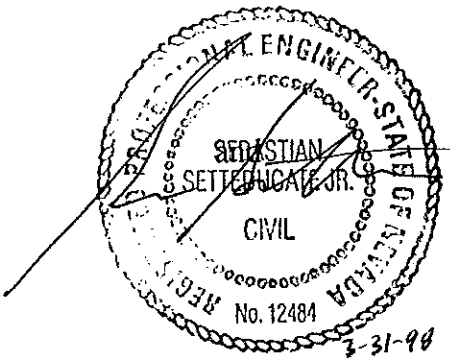
Conclusions and recommendations have been based upon our analyses of data obtained from our field and laboratory investigations and upon our previous geotechnical experience in the vicinity. Please contact us if you have questions concerning the report.

Respectfully submitted,
ETEC TESTING LABORATORIES, INC.

william a. Zeeh
William A. Zeeh

WAZ/rn
Dist: 3/Addressee

Reviewed By:



Sebastian Setteducate Jr., P.E.

GEOTECHNICAL INVESTIGATION REPORT
11-ACRE WASTEWATER RETENTION POND
NORTHWESTERN PORTION OF KERR-MCGEE PLANT
HENDERSON, NEVADA

PREPARED FOR:
KERR-MCGEE CHEMICAL CORPORATION
P.O. BOX 55
HENDERSON, NEVADA 89009

PREPARED BY:
ETEC TESTING LABORATORIES, INC.
4150 WEST PIONEER AVENUE, SUITE A
LAS VEGAS, NEVADA 89102

ETEC REFERENCE NO.: 81143

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P.O. Box 55
Henderson, Nevada 89009

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Respectfully submitted,
ETEC TESTING LABORATORIES, INC.

Reviewed By:

William A. Zeeh

WAZ/rn
Dist: 3/Addressee

REGISTERED PROFESSIONAL ENGINEER - STATE OF NEVADA
SEBASTIAN SETTEDUCATE JR.
CIVIL
No. 12484

Sebastian Setteducate Jr., P.E.

INTRODUCTION

General

This report presents the results of our geotechnical investigation for the proposed retention pond. The purposes of our investigation have been to determine the nature and engineering properties of the subsurface materials and to provide recommendations for embankment slope, seismicity, groundwater proximity, and the possibility of providing a layer of clay with very low permeability to underlay the synthetic liner.

Project Description

The proposed construction includes an 11-acre pit with approximate maximum dimensions of 750 feet by 600 feet which is approximately square in plan view. The central portion of the pond bottom will be 20 feet lower than the surrounding berm and will be sloped downward toward the corners at a grade of ½ percent. It is our understanding that the pond bottom surface will be lined with 2 layers of 60 mil polyethylene filled to within approximately 3 feet of the top surface of the berm. The location and configuration of the pond are shown on the Site Plan. The existing elevations and contours are shown on the Topographic Site Plan, and the general site location is shown on the attached Vicinity Map.

FIELD INVESTIGATION

The subsurface conditions were explored by drilling five 30-foot deep borings, one at each corner of the site and one in the center as shown on the Site Plan. The subsurface conditions were continually recorded at the time of drilling and are summarized on the attached boring logs.

The borings were made with a truck-mounted rotary drill rig which used air to maintain circulation of the cuttings. Samples were taken at selected depths with a 2½-inch inside diameter ring sampler driven by a 340-pound weight falling freely through a vertical distance of 30 inches.

The sampler driving resistance in blows per 6 inches of penetration is given on the boring logs. Each sample was classified in the field for logging purposes; representative portions were packaged and transported to our laboratory for testing and additional classification.

SITE AND SUBSURFACE CONDITIONS

At the time of our exploration, the site was graded as shown on the Topographic Site Plan. The area slopes generally downward to the south southeast at a gradient of about 2 percent. An existing berm is located at the north border and along the northern portions of the east and west site boundaries. Two prefabricated metal buildings and associated flatwork, scheduled for removal, are centrally located on the site. The mostly rough graded site has very little vegetation and the lower surface is covered with fill which appears to be settlings from a previous pond.

From the surface down, we encountered from 15½ to 26 feet of loose to very dense silty sand with fine to coarse gravel, which consists of fill down to depths of 5 to 6 feet. Traces of weak scattered cementation was encountered in the lower portions of this layer in several of the borings. Underlying the silty sand to the 30-foot boring depth is loose to medium dense clayey silt with varying amounts of sand and/or fine to medium gravel.

Groundwater was encountered in Borings B-1, B-2 and B-4 at depths ranging from 25½ to 28 feet and was not encountered in Borings B-3 and B-5.

SEISMICITY AND LOCAL FAULTING

The site is located in Seismic Zone 2B (Uniform Building Code) which represents a low to moderately active seismic area. The nearest fault with possible evidence of geologically recent movement is located near the western foot of Frenchman Mountain, about 5 miles northeast of the site. The Uniform Building Code Soil Profile Type for this site is S_D . Clark County has not historically recorded any near-destructive seismic events. Significant surface displacement is not likely during an earthquake. The underlying soils are not subject to liquefaction.

The nearest mapped compaction fault is located about 1 mile southwest of the site. This location was determined from "Subsidence in Las Vegas Valley," John W. Bell and Jonathan G. Price, Nevada Bureau of Mines and Geology, Final Project Report, 1991. Compaction faults are thought to be related to deep-seated differential consolidation of the underlying alluvial soils with different compressibility characteristics. It is believed that compaction fault movement has not occurred within the previous several thousand years. No signs of compaction faults were noted on the site. In our opinion, compaction faults do not pose geotechnical problems associated with development of this site.

CLARK COUNTY SOIL HAZARD TYPE

The Clark County Soil Guidelines Map (1996) delineates four types of potential soil hazards and a non-hazard type generally consisting of mixed alluvial sand and gravel. The four hazard types are:

(i) Areas within 2000 feet of compaction or tectonic faults. These areas include 90 percent of all mapped fissure zones. Soil subsidence is the general hazard

associated with this type of soil. These phenomena are discussed in the previous report section, Seismicity and Local Faulting.

(ii) Areas within 1000 feet of mapped washes. Aside from evaluating possible erosional damage to the property, the general hazards associated with these areas include recent sediment deposits and soils with a potential for solubility, clay swell, corrosion, gypsum salts, or hydrocollapse.

(iii) Areas with the same potential hazards as described in Paragraph (ii) except for the recent sediment deposits and possible erosional damage.

(iv) Areas with ground slopes in excess of 15 percent and the potential for shallow bedrock.

The general non-hazard areas usually have mixed alluvial sand and gravel. Caliche is often present in these areas. Although caliche is not a hazard, it can increase developmental costs for basements and pads.

The subject site is located within the hazard area described in Paragraph (iii). Based upon the soils encountered and the site location relative to previously defined soil conditions, special considerations have been given to the following adverse soil conditions (where applicable) in subsequent report sections: clay swell, consolidation or collapse, chemical heave and corrosion, solubility, uncontrolled fills and high ground water table.

LABORATORY INVESTIGATION

Representative samples were tested in the laboratory to obtain pertinent engineering properties for our analyses. Dry density and moisture content tests were made on selected samples to characterize the soil zones encountered. Strengths were determined with a calibrated penetrometer. These test data are provided on the boring logs. A chemical test was performed by KLA Environmental Testing, Inc., to evaluate concrete durability requirements with respect to sulfate exposure. The results are presented below along with a table correlating sulfate exposure to percentage of soluble sulfates with recommendations for concrete.

Concrete Durability Requirements

The 0.57 percent concentration of soluble sulfates obtained from Boring B-2 at a depth of 14 feet may be considered to be severe with respect to concrete deterioration. All concrete in contact with the on-site soils should be prepared in accordance with the following table:

SULFATE EXPOSURE	WATER-SOLUBLE SULFATE (SO_4) IN SOIL, percentage by weight	SULFATE (SO_4) IN WATER, ppm	CEMENT TYPE	MAXIMUM WATER TO CEMENT RATIO	MINIMUM f'_c NORMAL-WEIGHT AND LIGHTWEIGHT AGGREGATE CONCRETE, psi
Negligible	0.00-0.10	0-150	---	---	---
Moderate	0.10-0.20	150-1500	II, IP (MS), IS, (MS)	0.50	4,000
Severe	0.20-2.00	1500-10,000	V	0.45	4,500
Very Severe	Over 2.00	Over-10,000	V plus pozzolan	0.45	4,500

These recommendations are based on the chemical properties of the on-site soils. Landscaping materials that are high in sulfates could cause deterioration of concrete made with Type II cement.

General

Based on the results of our investigation and analyses of information from field exploration and laboratory testing, we offer the following conclusions and recommendations regarding embankment design, proximity of the pond bottom to groundwater, and the possibility of using a clay layer beneath the surface lining for the purpose of reducing permeability.

Embankments

It is our understanding that the berms on the east and west will be constructed of soil removed from the bottom and the berm on the south side will consist of natural soil left in place after removals are finished.

The slope of embankments constructed of the silty sand currently existing on the surface should be limited to a ratio of 3:1 (3 horizontal to 1 vertical).

In the area of the embankments, the top 1½ feet of soils should be removed and the surface scarified to a depth of 6 inches and watered to slightly over the optimum moisture content and compacted to a minimum of 95 percent of the maximum dry density as determined by the ASTM D1557 "proctor" test. The fill should then be placed in thin lifts and compacted to a minimum of 95 percent of the maximum dry density for granular soils and a minimum of 90 percent for clayey soils. The sides of the embankment should be either compacted or overbuilt and trimmed back to compacted soil.

Excavation Difficulty

We expect the excavation operations to be entirely in the upper silty sands and no unusual difficulties are expected, although high blow counts indicate dense soil and traces of weak scattered cementation may be encountered in the southwest corner.

Groundwater

The elevations at which groundwater was encountered during this investigation are approximately 9 feet below the planned elevation of the pond bottom of the south end. Groundwater was not encountered in the borings at the north end.

Clay Liner

In consideration of the possibility of providing a clay layer of low permeability to line the pond, the availability of suitable material may be considered. Approximately 21,000 cubic yards would be required to construct a 1-foot thick layer over the entire pond surface. Fat clay, which would be suitable for this purpose, exists in natural deposits in the north central area of Las Vegas. This type of soil is undesirable as structural fill because of its tendency for seasonal shrinking and swell which can cause excessive stress to foundations, and may be available in sufficient quantities.

This type of layer, if constructed with continuous coverage over the pond surface and berm sides, would considerably slow the migration of contaminated water and possibly allow detection of a leak and remedial action before groundwater is affected. The inclusion of sand in the clay would not significantly effect its permeability.

It should be considered that migrating water is very effective at finding and following the path of least resistance, and complete, uninterrupted coverage of the surface would be necessary in order to provide an effective barrier to water seepage.

If a clay liner is used, the clay should be placed as fill on the pond surface. The surface should be scarified to a depth of 6 inches, watered to slightly over optimum moisture content, and recompacted to a minimum density of 90 percent of maximum as determined by ASTM D1557. The clay fill should be placed in thin lifts of 6 inches or less, watered to near optimum and compacted to a minimum density of 88 to 92% with a sheepsfoot roller until the desired thickness is achieved.

To place clay on the berm surface, the clay could be placed and compacted as fill along the edge of the berm during grading operations. If clay is not included as a integral component of the berm or pre-existing berms, the clay should be placed as fill by constructing a key 2 feet deep at the "heel" and 1 foot deep at the "toe". The fill could then be placed along the berm side and trimmed back to the desired contour although a minimum of 3 feet of clay should be left in place. The clay fill should extend to the top of the berm and include a 3-foot "cap" to prevent water drainage from moving between the clay and the sand.

LIMITATIONS

The conclusions and recommendations contained in this report are based on the assumption that the materials encountered in the borings represent the site conditions. We make no other warranty, either express or implied. If any unforeseen difficulties or unusual conditions are encountered, the geotechnical engineer should be contacted immediately in order to make supplemental recommendations. Any person using this report for bidding purposes should perform such independent investigations as he deems necessary to satisfy himself as to the subsurface conditions or construction procedures to be used. The evaluation of potential environmental hazards is beyond the scope of this report.

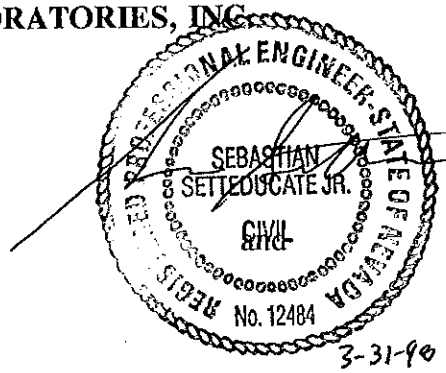
This report completes our present assignment for this project. As the design nears completion, we recommend that you consult with us on unanticipated problems or questions regarding the design and/or review of any plans or specifications. The work assignment for these services is subject to your prior approval and authorization.

CLOSURE

Our conclusions and recommendations are predicated on a geotechnical engineer's observation and testing of the excavation and foundation preparations. It would be logical for ETEC Testing Laboratories, Inc. to provide these services since we are best able to determine if the conditions encountered match those used in our analyses, to determine if modifications to our recommendations are needed, and to make such modifications if necessary.

If we are not retained for these services, they should be performed by a geotechnical engineer registered to practice in Nevada who will make sufficient observations, tests, and re-tests to support an opinion that the finished work conforms with our recommendations and will prepare and submit a report to that effect. Unless we are notified, and concur, we will not be responsible for any modification of our recommendations by others. Unless specifically requested by our client, we will discard all soil samples after 30 days from the final report date.

Respectfully submitted,
ETEC TESTING LABORATORIES, INC.



William A. Zeeh

Reviewed By:

Sebastian Setteducate Jr., P.E.

Kerr-McGee Corporation
11-Acre Retention Pond
NWC of Henderson Facility
Clark County, Nevada

LOG OF BORING NUMBER B-1

ETEC NO: 81143 DATE DRILLED: 3/20/98

TYPE BORING: 6" Rotary air TYPE RIG: Mayhew

ELEV. REF.: Topographic Map

ELEVATION: 1747' GROUNDWATER: Encountered @ 26.0'

SOIL DESCRIPTION

DEPTH IN FEET	SAMPLE TYPE	RESIST BLOWS/6"	COHESION ksf	MOISTURE PERCENT	DRY DENSITY pcf	UNIFIED CLASS	SOIL DESCRIPTION
						SM	Light brown Silty SAND with fine gravel, medium dense.
	R	12/15		6	102		
5							
	R	38/6" 10/0"		5	89		(less silt, very dense)
10							
	R	35/6" 10/0"		11	108		

Kerr-McGee Corporation
11-Acre Retention Pond
NWC of Henderson Facility
Clark County, Nevada

LOG OF BORING NUMBER B-1 cont.

ETEC NO: 81143 DATE DRILLED: 3/20/98

TYPE BORING: 6" Rotary air TYPE RIG: Mayhew

ELEV. REF.: Topographic Map

ELEVATION: 1747' GROUNDWATER: Encountered @ 26.0'

SOIL DESCRIPTION

DEPTH IN FEET	SAMPLE TYPE	RESIST BLOWS / 6"	COHESION ksf	MOISTURE PERCENT	DRY DENSITY pcf	UNIFIED CLASS	SOIL DESCRIPTION
						SM	Light brown Silty SAND with fine gravel, very dense.
							(moist)
20							
	R	30/6" 10/0"		17	82		(trace gravel, trace weak scattered cementation)
25							
						▽	(groundwater)
						ML/CL	Medium tan Clayey SILT, little fine sand, trace fine gravel, loose.
	R	5/5	1.5	57	66		

BOTTOM OF BORING

Kerr-McGee Corporation
11-Acre Retention Pond
NWC of Henderson Facility
Clark County, Nevada

LOG OF BORING NUMBER B-2

ETEC NO: 81143 DATE DRILLED: 3/20/98

TYPE BORING: 6" Rotary air TYPE RIG: Mayhew

ELEV. REF.: Topographic Map

ELEVATION: 1746' GROUNDWATER: Encountered @ 27.8'

DEPTH IN FEET	SAMPLE TYPE	RESIST BLOWS/6"	CONESION ksf	MOISTURE PERCENT	DRY DENSITY pcf	UNIFIED CLASS	SOIL DESCRIPTION
						SM	Light brown Silty SAND with fine gravel, medium dense, fill.
	R	11/18		7	98		(clay rich zone for 8")
							(asphalt fragment)
5							(native)
	R	28/6" 25/3" 10/0"		7	118		(very dense)
10							(more silt, trace clay)
	R	27/27		77	57		(trace weak scattered cementation, trace salts)

Kerr-McGee Corporation
11-Acre Retention Pond
NWC of Henderson Facility
Clark County, Nevada

LOG OF BORING NUMBER B-2 cont.

ETEC NO: 81143 DATE DRILLED: 3/20/98

TYPE BORING: 6" Rotary air TYPE RIG: Mayhew

ELEV. REF.: Topographic Map

ELEVATION: 1746' GROUNDWATER: Encountered @ 27.8'

SOIL DESCRIPTION

DEPTH IN FEET	SAMPLE TYPE	RESIST BLOWS/6"	COHESION ksf	HOISTURE PERCENT	DRY DENSITY pcf	UNIFIED CLASS	SOIL DESCRIPTION
						SM	Lt. brn. Silty SAND with fine gravel, v. dense.
						ML/CL	Medium tan Clayey SILT, some caliche sand, medium dense.
20							
	R	14/14	4.3	77	57		(trace fine to coarse caliche gravel, slightly mottled)
25							
							(less silt)
						▽	(groundwater, little fine sand, mottled)
	R	8/9	2.5	83	54		

BOTTOM OF BORING

Kerr-McGee Corporation
11-Acre Retention Pond
NWC of Henderson Facility
Clark County, Nevada

LOG OF BORING NUMBER B-3

ETEC NO: 81143 DATE DRILLED: 3/20/98

TYPE BORING: 6" Rotary air TYPE RIG: Mayhew

ELEV. REF.: Topographic Map

ELEVATION: 1736' GROUNDWATER: None encountered

DEPTH IN FEET	SAMPLE TYPE	RESIST BLOWS/6"	COHESION ksf	MOISTURE PERCENT	DRY DENSITY pcf	UNIFIED CLASS	SOIL DESCRIPTION
						SM	Light brown Silty SAND with fine gravel, medium dense, fill. (sludge for 1')
	R	11/6" 15/4" 10/0"		6	105		
							(concrete fragment)
5							(native)
	R	50/6" 10/0"		12	94		(very dense)
10							(less silt, trace gravel)
	R	26/30		10	103		(trace clay, trace weak scattered cementation)

Kerr-McGee Corporation
11-Acre Retention Pond
NWC of Henderson Facility
Clark County, Nevada

LOG OF BORING NUMBER B-3 cont.

ETEC NO: 81143 DATE DRILLED: 3/20/98

TYPE BORING: 6" Rotary air TYPE RIG: Mayhew

ELEV. REF.: Topographic Map

ELEVATION: 1736' GROUNDWATER: None encountered

SOIL DESCRIPTION

DEPTH IN FEET	SAMPLE TYPE	RESIST BLOWS/6"	COHESION ksf	MOISTURE PERCENT	DRY DENSITY pcf	UNIFIED CLASS	SOIL DESCRIPTION
						SM	Light brown Silty SAND with fine gravel, trace clay, trace weak scattered cementation, very dense. (more gravel for 6")
							(more gravel)
20							(trace gravel)
	R	48/6"		14	99		
25							
						ML/CL	Medium tan Clayey SILT, trace fine to medium gravel, trace fine sand, hard.
	R	17/19	3.5	51	70		

BOTTOM OF BORING

Kerr-McGee Corporation
11-Acre Retention Pond
NWC of Henderson Facility
Clark County, Nevada

LOG OF BORING NUMBER B-4

ETEC NO: 81143 DATE DRILLED: 3/20/98

TYPE BORING: 6" Rotary air TYPE RIG: Mayhew

ELEV. REF.: Topographic Map

ELEVATION: 1736' GROUNDWATER: Encountered @ 25.5'

SOIL DESCRIPTION

DEPTH IN FEET	SAMPLE TYPE	RESIST BLOWS/6"	COHESION ksf	MOISTURE PERCENT	DRY DENSITY pcf	UNIFIED CLASS	SOIL DESCRIPTION
						SM	Light brown Silty SAND with fine gravel, loose, fill.
	R	5/18		9	86		(medium dense)
5							(native)
	R	18/24		8	101		(dense)
10							(some medium to coarse gravel, less silt, medium dense)
	R	12/11		8	107		

Kerr-McGee Corporation
11-Acre Retention Pond
NWC of Henderson Facility
Clark County, Nevada

LOG OF BORING NUMBER B-4 cont.

ETEC NO: 81143 DATE DRILLED: 3/20/98

TYPE BORING: 6" Rotary air TYPE RIG: Mayhew

ELEV. REF.: Topographic Map

ELEVATION: 1736' GROUNDWATER: Encountered @ 25.5'

SOIL DESCRIPTION

DEPTH IN FEET	SAMPLE TYPE	RESIST BLOWS/6"	COHESION ksf	MOISTURE PERCENT	DRY DENSITY pcf	UNIFIED CLASS	SOIL DESCRIPTION
						SM	Light brown Silty SAND, some medium to coarse gravel, medium dense.
20							(little salts, trace gravel)
	R	21/20 NO RECOVERY					
25						▽	(groundwater)
						ML/CL	Medium tan Clayey SILT, trace fine to medium gravel, trace fine sand, medium dense.
	R	11/17	3.0	43	78		

BOTTOM OF BORING

Kerr-McGee Corporation
11-Acre Retention Pond
NWC of Henderson Facility
Clark County, Nevada

LOG OF BORING NUMBER B-5

ETEC NO: 81143 DATE DRILLED: 3/20/98

TYPE BORING: 6" Rotary air TYPE RIG: Mayhew

ELEV. REF.: Topographic Map

ELEVATION: 1737' GROUNDWATER: None encountered

DEPTH IN FEET	SAMPLE TYPE	RESIST BLOWS/6"	COHESION ksf	MOISTURE PERCENT	DRY DENSITY pcf	UNIFIED CLASS	SOIL DESCRIPTION
						SM	Light brown Silty SAND with fine gravel, medium dense, fill.
							(black contaminant to 6')
5							
							(no contaminant, native)
	R	11/14		7	102		
10							
	R	30/5" 10/0"		23	105		(very dense, trace weak scattered cementation)

Kerr-McGee Corporation
11-Acre Retention Pond
NWC of Henderson Facility
Clark County, Nevada

LOG OF BORING NUMBER B-5 cont.

ETEC NO: 81143 DATE DRILLED: 3/20/98

TYPE BORING: 6" Rotary air TYPE RIG: Mayhew

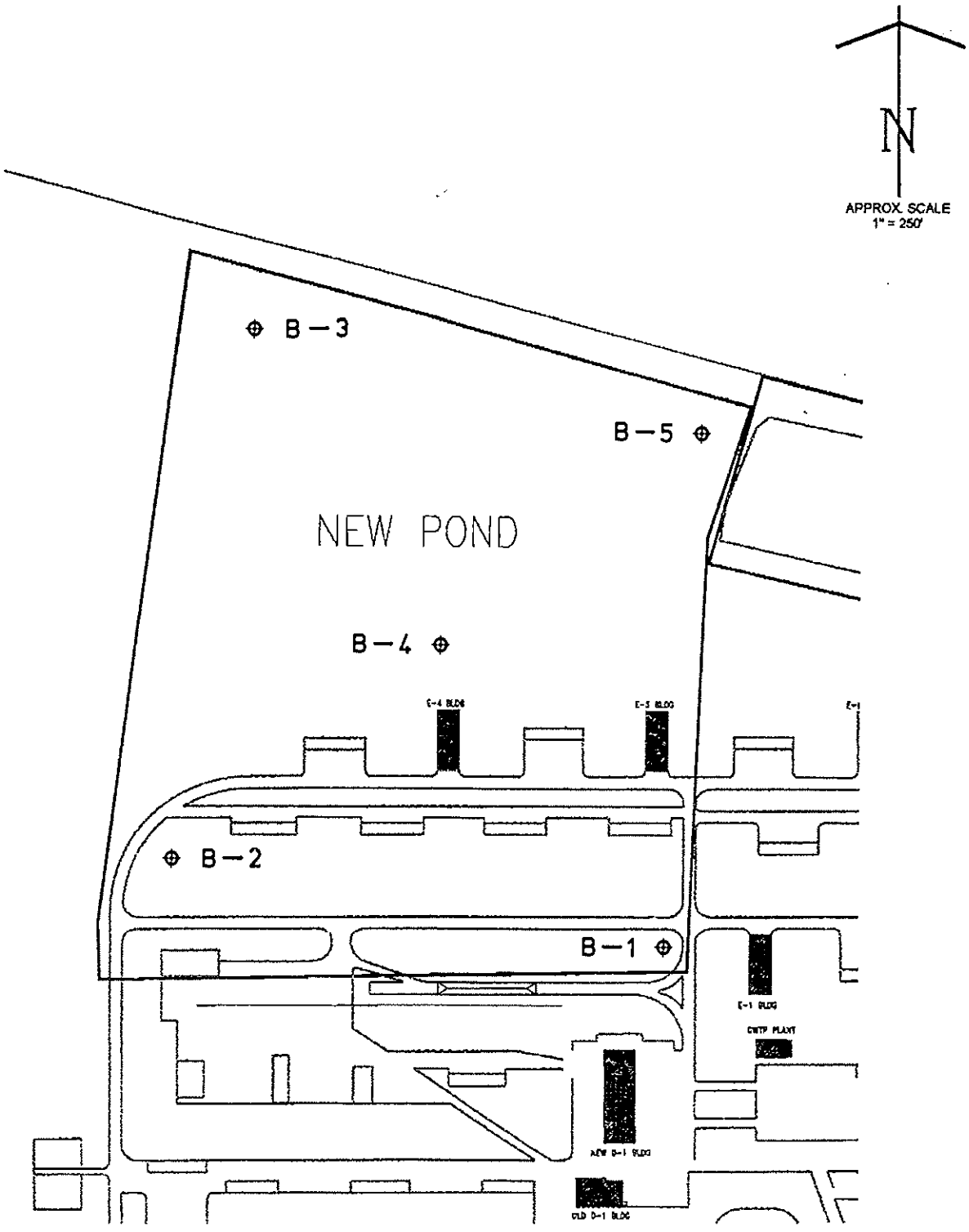
ELEV. REF.: Topographic Map

ELEVATION: 1737' GROUNDWATER: None encountered

DEPTH IN FEET	SAMPLE TYPE	RESIST BLOWS/6"	COHESION ksf	MOISTURE PERCENT	DRY DENSITY pcf	UNIFIED CLASS	SOIL DESCRIPTION
						SM	Light brown Silty SAND with fine gravel, trace weak scattered cementation, very dense.
20	R	9/19		5	105		(medium dense, little salts, trace gravel)
25							(cemented moderately hard for 3")
						ML/CL	Medium tan Clayey SILT, trace fine to medium gravel, trace fine sand, medium dense.
							(cemented, moderately hard)

BOTTOM OF BORING

SITE PLAN / TEST BORING LOCATION

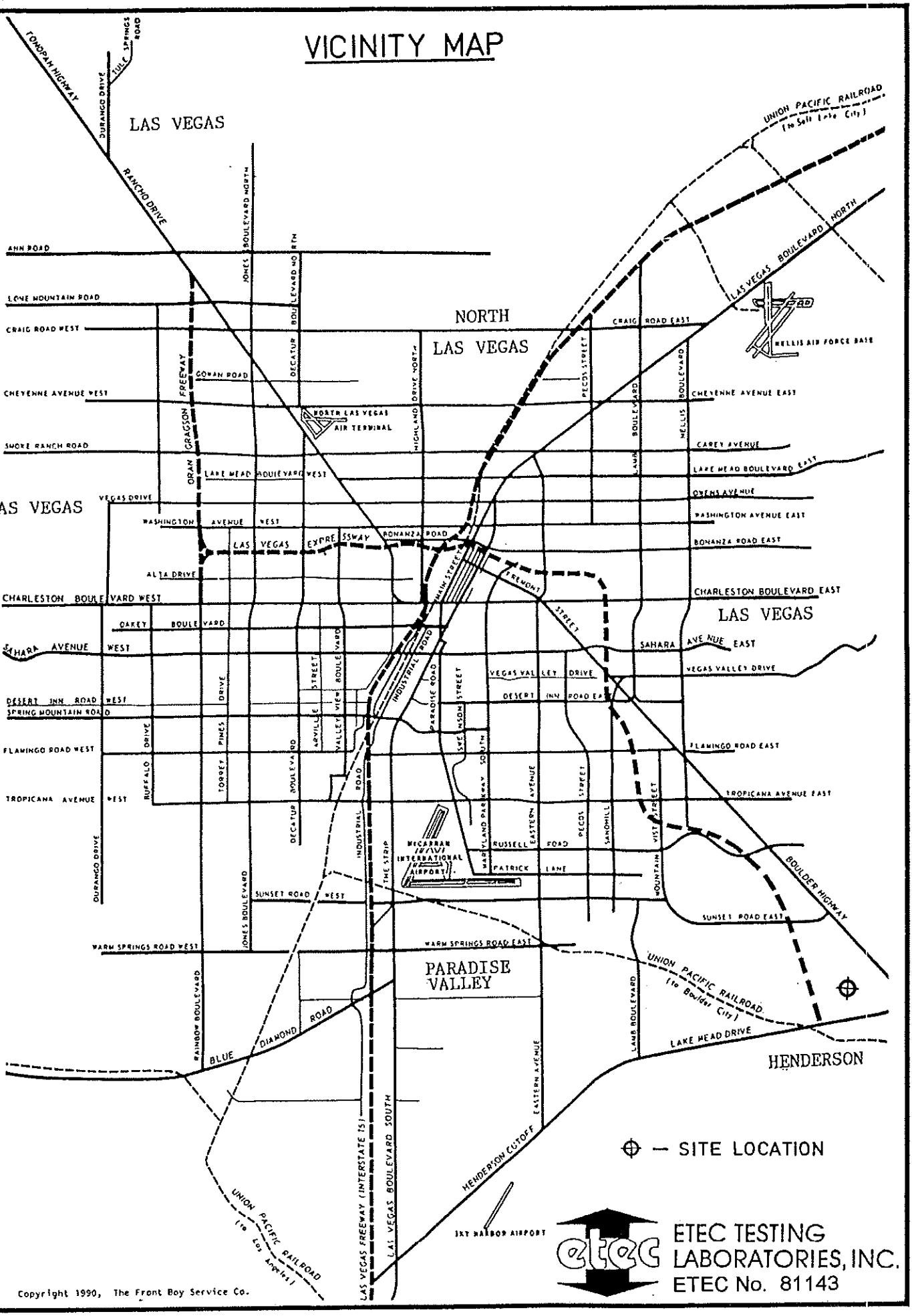


SITE PLAN AS PROVIDED BY CLIENT; SOURCE UNKNOWN

ETEC

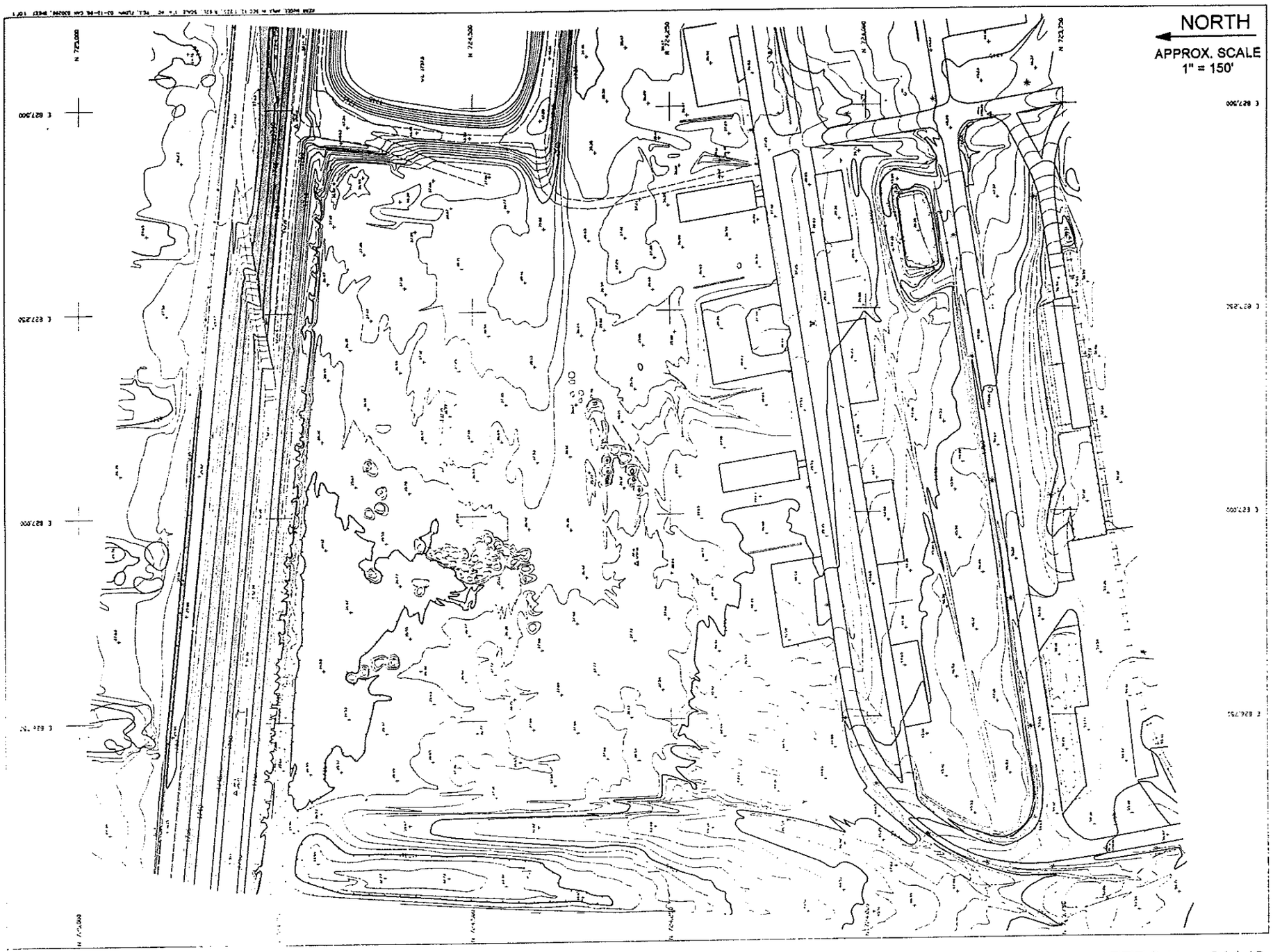
ETEC No. 81143

VICINITY MAP



ETEC TESTING LABORATORIES, INC.
ETEC No. 81143

TOPOGRAPHIC SITE PLAN



ETEC No. 81143

ETEC Document 2:

Addendum 1 to Geotechnical Investigation Report

ETEC TESTING LABORATORIES, INC.
4150 W. Pioneer Ave., Suite A • Las Vegas, NV 89102
Phone: (702) 367-0100 FAX: (702) 367-3651

Kerr McGee Chemical Corporation
P.O. Box 55
Henderson, Nevada 89009

April 14, 1998

Attention: Mr. Benton Marshall

Subject: Geotechnical Investigation Report Addendum No. 1
11-Acre Wastewater Retention Pond
Northwestern Portion of Kerr-McGee Plant
Henderson, Nevada

ETEC NO.: 81143

Mr. Marshall:

The purposes of this addendum are to (1) clarify the optional nature of the clay liner considered in the referenced report and (2) provide recommendations for a sand layer between the liners.

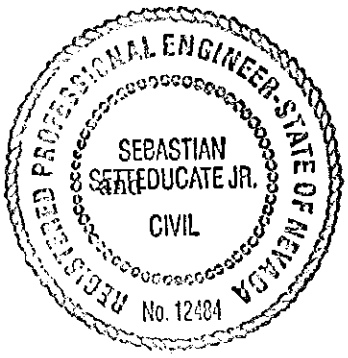
Item 1: The recommendations for a clay layer to line the surface of the retention pond were offered as an option. The clay liner is not a necessary component in the pond design, but could be used as a redundant barrier to water migration if desired.

Item 2: The sand to be placed between the liners should be clean, washed, natural rounded sand similar to ASTM C33 fine aggregate. Mechanical compaction should not be necessary and should be avoided in order to minimize stress on the bottom line. When placed, the sand should contain enough moisture to cover the surface of the particles and may be sprayed with water while in place. Mechanical compaction should be avoided.

Respectfully submitted,
ETEC TESTING LABORATORIES, INC.

William A. Zeeh

WAZ/rn
Dist: 3/Addressee



Reviewed By:

Sebastian Setteducate Jr., P.E.

ETEC Document 3:

Final – QAA Special Investigation Agreement

FINAL-QAA SPECIAL INSPECTION AGREEMENT
AQUIFER RETENTION BASIN
8000 WEST LAKE MEAD DRIVE
NORTHWESTERN PORTION OF KERR-MCGEE PLANT
CLARK COUNTY, NEVADA
C.C.B.D. PERMIT # 98-11482

PREPARED FOR:
KERR-MCGEE CHEMICAL CORPORATION
P.O. Box 55
HENDERSON, NEVADA 89009-7000

PREPARED BY
ETEC TESTING LABORATORIES, INC.
4150 WEST PIONEER AVENUE, SUITE A
LAS VEGAS, NEVADA 89102

ETEC REFERENCE NO. 82143

July 31, 1998

Kerr-McGee Chemical Corporation
P.O. Box 55
Henderson, Nevada 89009-7000

July 31, 1998

Reference: Final-QAA Special Inspection Agreement
Aquifer Retention Pond
8000 West Lake Mead Drive
Clark County Nevada

ETEC No.: 82143

CLARK COUNTY BUILDING PERMIT NO.: 98-11482

Attached are copies of our On-Site Inspection Reports and test results for this project, with services for each category as follows:

ITEM 13 - SPECIAL GRADING, EXCAVATION AND FILLING

We had sufficient time to complete our inspections and testing with full cooperation from the contractor. The work requiring special inspection for the above item was, to the best of our knowledge, in conformance with approved plans and specifications, and the applicable workmanship provision of the Uniform Building code, 1997 Edition.

A copy of this letter and the attached reports have been forwarded to the Clark County Building Department. Should you have any questions concerning our services or the attached reports, please feel free to contract us.

Respectfully submitted,
ETEC TESTING LABORATORIES, INC.

Daniel C. Thorne

REGISTERED PROFESSIONAL ENGINEER - STATE OF NEVADA
SEBASTIAN SETTEDUCATE JR.
CIVIL
No. 12484

Sebastian Setteducate Jr., P.E.

DCT/rn
Attachments
cc: Clark County Building Department (Mr. Joe Thompson)

TABLE OF CONTENTS

82143

Department of Building

County of Clark, State of Nevada

QUALITY ASSURANCE AGENCY SPECIAL INSPECTION AGREEMENT

PAC # 98-11482

On this date **JUNE 12, 1998** , the Clark County Building Department, acting through the BUILDING OFFICIAL and **KERR MCGEE CHEMICAL CORP.** as the OWNER or OWNERS AGENT for the construction and/or alteration of a structure/building known as **AQUIFER-RETENTION BASIN** at **8000 W. LAKE MEAD DR.** for work described as **GRADING** with inspection or testing services being performed by **ETEC** an approved quality assurance/testing agency in the County of Clark, State of Nevada, agree to the following:

1. That the BUILDING OFFICIAL, in accordance with Section 22.02.880 of the Building Administrative Code of Clark County has identified a requirement for onsite special inspection and/or testing services for that work which falls within the categories specifically identified on the attached addendum.

2. That the OWNER or OWNER'S AGENT is responsible for obtaining all testing and/or special inspection services from a quality assurance or testing agency approved by the BUILDING OFFICIAL.

3. That all work falling within the categories identified on the attached addendum shall be inspected or tested in accordance with the provisions of Section 22.02.900 of the Building Code of Clark County, and that written results of those inspections or tests shall be provided to the BUILDING OFFICIAL with copies available to the permit holder upon permittee's request.

4. That the BUILDING OFFICIAL shall determine when special inspections or testing services are to commence and terminate based on the scope and progress of work.

5. That no testing services will be performed by Clark County.

THIS AGREEMENT IS ACKNOWLEDGED BY THE SIGNATURES SHOWN BELOW

CLARK COUNTY DEPARTMENT OF BUILDING

By: DODIE FORNEY for:

SCOTT TELFORD
Planchecker

By: Benton Marshall

(Print Name) Benton Marshall

(Print Company Name) Kerr-McGee

DEPARTMENT OF BUILDING

County of Clark, State of Nevada PAC # 98-11482

ADDENDUM TO SPECIAL INSPECTION AGREEMENT

In addition to the inspections required by Section 22.02.730 of the Building Administrative Code of Clark County, a special inspector must be present during construction and the following types of work, and must verify approved size, location and connections of all structural members fabricated on or off site included in this work. Some inspections may be made on a periodic basis to satisfy the requirements of the continuous inspection at Clark County's discretion. Agency inspections or testing may only be conducted by a firm approved by Clark County.

THE FINAL QAA REPORT SHALL BE SUBMITTED TO THE CLARK COUNTY BUILDING DEPARTMENT FOR IT'S ACCEPTANCE A MINIMUM OF SEVEN DAYS PRIOR TO REQUESTING A FINAL INSPECTION.

A FINAL INSPECTION REQUEST WILL NOT BE GRANTED UNTIL THE FINAL QAA REPORT HAS BEEN ACCEPTED BY THE CLARK COUNTY BUILDING DEPARTMENT.

13. SPECIAL GRADING, EXCAVATION AND FILLING: During earthwork excavations, grading and filling operations inspections to satisfy requirements of Chapter 18 and Chapter 33 (Appendix of the UBC).

    Location: **BUILDING PAD AND SUBSURFACE CONSTRUCTION SHALL BE AS DETAILED IN ETEC REPORT # 81143 GEOTECHNICAL INVESTIGATION DATED MARCH 27, 1998.**

Clark County Building Department

PERMIT

500 S Grand Central Pkwy • PO Box 551540 • Las Vegas NV 89155-1540
(702) 455-3000

IMPORTANT: Always use the permit number below when requesting inspections or information concerning this permit.

PERMIT NUMBER	PHONE SYSTEM NUMBER	ISSUE DATE
98-11482 GD5	2975423	6/16/98

PROJECT NAME: KERR MCGEE/GRADING/AQUIFER
SUBDIVISION:

PARCEL NO: 178-12-201-004 RANGE-TOWNSHIP-SECTION: 62-22-12

SITE ADDRESS: 8000 W LAKE MEAD DR 525
TENANT NAME: KERR MCGEE/GRADING/BASIN TENANT NO:

PROPERTY OWNER: AMERICAN POTASH & CHEMICAL COR
CONTRACTOR: KERR - MCGEE CHEMICAL CORP

PERMIT: GRADING 10,001- 100M CY.
GRADING-COMMERCIAL VALUATION: 0
GRADING FOR AQUIFER RETENSION BASIN/LNH
MUST COMMENCE BY 6/4/99 /CLL

UNITS/RMS: 0 SQ FOOTAGE: 0 NO. STORIES: 0 QAA: YES
OCCUPANCY: TYPE OF CONST: SPRINKLER REQ:

PMT DETAIL:

QTY	ITEM
1.00	10,001-100,000CU.YDS
8.00	10,001-100,000CY/ADD CY

FEE SUMMARY	CHARGED	PAID PREV	PAID
PERMIT FEE	563.40	.00	563.40
BLDG/ZONE PLANSCHECK FEE	56.34	.00	56.34
PLANCHECK FEE, GRADING	159.50	.00	159.50
		TOTAL PAID	779.24

CONDITIONS OF PERMIT

I agree to build according to declared description, approved plans, specifications and the Clark County Code. I also agree to call 455-3000 for required inspections as each construction phase is completed.

LICENSED CONTRACTORS DECLARATION

I hereby affirm that I am licensed under the provisions of NRS 624.330

Contractor Signature

CA 7560

OWNER-BUILDER DECLARATION

I, as owner of the property upon which I am requesting to build or improve a structure, and the structure to be built or improved is a residential structure which I intend to occupy.

I do not intend to sell said structure or transfer ownership of said structure at least until I occupy the premises for a period of one year under NRS 624.330.

I intend to act as my own contractor and I understand that I am liable to criminal prosecution under 624.230 if I engage in business as a contractor without a license and will not be exempt from license requirement as outlined in NRS 624.330.

Applicant Signature

6/16/98
Date

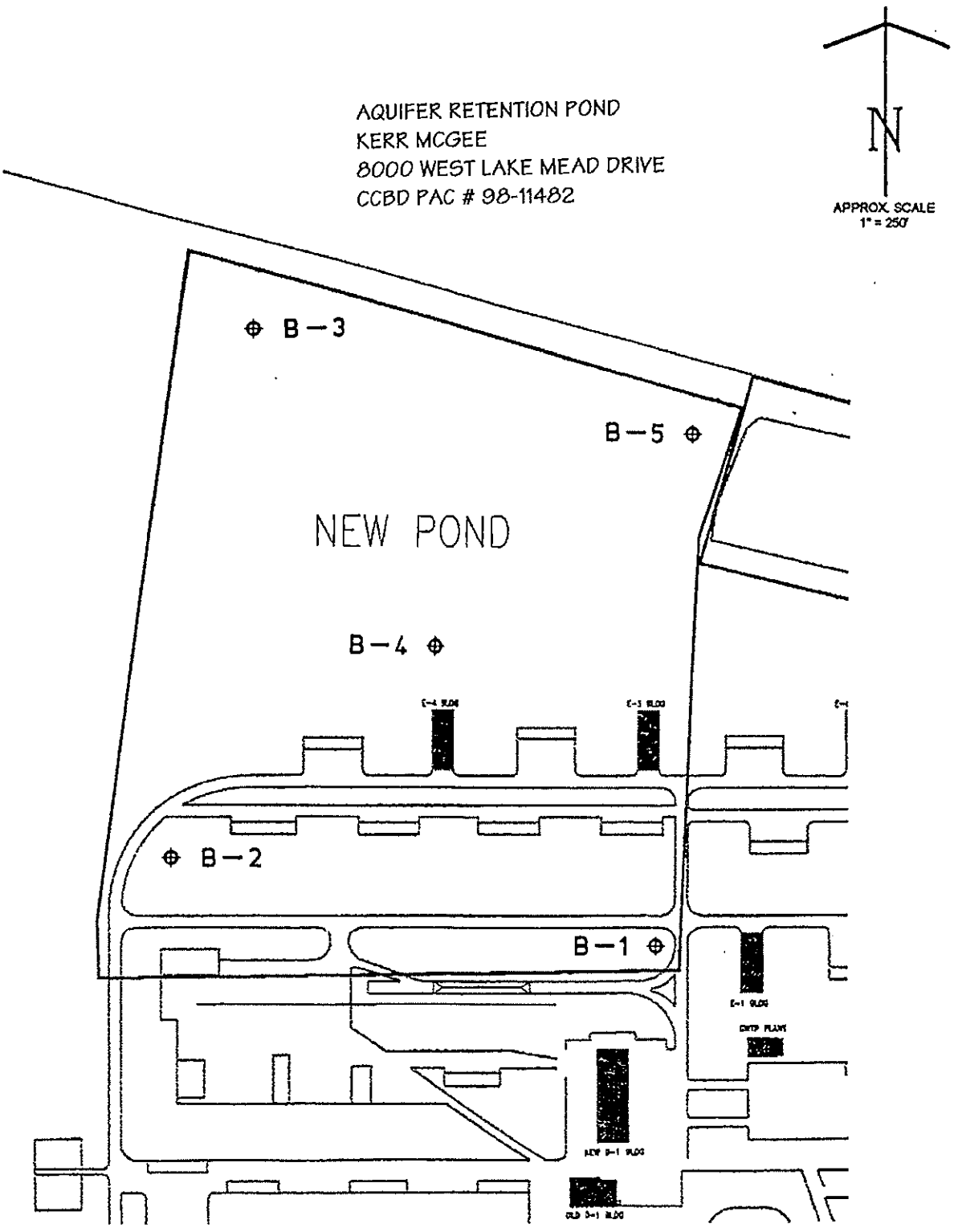
Issued By

THIS PERMIT BECOMES NULL AND VOID if work or construction is not commenced within 180 days from date of issuance. or work is suspended or abandoned for a period of 180 days any time after work is commenced.

BUILDING DEPT. COPY

SITE PLAN / TEST BORING LOCATION

AQUIFER RETENTION POND
KERR MCGEE
8000 WEST LAKE MEAD DRIVE
CCBD PAC # 98-11482



SITE PLAN AS PROVIDED BY CLIENT; SOURCE UNKNOWN

ETEC

ETEC No. 81143

ETEC NO: 82143

STATEMENT OF COMPLETION

Project Name: Aquifer Retention Basin

Project Address: 8000 West Lake Mead Drive

Clark County Building Department PAC No: 98-11482

Approved Plans Dated: 06-16-98

ITEM: NO. 13 SPECIAL GRADING, EXCAVATION AND FILLING

Scope of Services: Field observation and density/moisture testing was performed during the construction of the north, south, east and west berms for the Aquifer Retention Basin. The berm construction is in accordance with the Geotechnical Report #81143 dated 03-27-98 by ETEC Testing Laboratories, Inc.

The Geotechnical Report indicated a severe sulfate exposure per UBC Table 19-A-4.

Field Density Tests #1 through 33 and Grading Reports G1 thru G3 are attached.

The above work requiring Special Inspection was, to the best of my knowledge, in conformance with the aforementioned approved plans and specifications and the applicable workmanship provisions of the Uniform Building Code 1997 Edition.

Special Inspector:

_____ Date: _____

Bill Zeeh

Reviewed by:

_____ P.E.

Date: 8-10-98

CLIENT: Kerr McGee Chemical Corp.
P.O. Box 55
Henderson, NV 89009-7000

ETEC NO: 82143
REPORT DATE: 06-30-98

PROJECT: Aquifer Retention Pond
LOCATION: 8000 W. Lake Mead Dr.
TYPE OF MTL.: 1)& 2)Sand w/Silt & Gravel **TESTED:** HM/ETEC
SOURCE: 1)W. Side @ Sta. 05+32 2)NWC @ 0.5' **AUTHORIZED BY:** Client
MOISTURE DENSITY RELATION: ASTM D1557 **TEST LOCATIONS DESIGNATED BY:** ETEC
NUCLEAR DENSIMETER MODEL: CPN MC-3 **METHOD:** Direct Transmission

SOIL/AGGREGATE FIELD DENSITY

Test Number	Date	Location	Elevation**	Depth Of Fill
1	05-29-98	W. side berm area @ middle	-15.0'	0
2	05-29-98	area @ S. end	-15.0'	0
3	05-29-98	S. side berm area @ W. end	-15.0'	0
4	06-08-98	W. side berm area @ S. end	0	1.5'
5	06-08-98	E. side berm area @ S. end	-14.5'	3.5'
6	06-08-98	@ middle	-14.5'	3.5'
7	06-08-98	@ N. end	-14.5'	3.5'
8	06-18-98	N. side berm @ W. end on lower area	-14.0'	4.0'
9	06-18-98	@ W. end on middle area	- 4.0'	10.0'
10	06-18-98	@ middle on lower area	-12.0'	6.0'
11	06-18-98	@ middle area	- 6.0'	12.0'
12	06-18-98	@ E. end on lower area	-16.0'	2.0'
13	06-18-98	@ E. end on middle area	-10.0'	8.0'
14	06-18-98	E. side berm @ N. end on middle area	-10.0'	8.0'
15	06-18-98	@ N. end area	- 4.0'	14.0'
16	06-18-98	@ N½ on middle area	- 8.0'	10.0'
17	06-18-98	@ middle area	- 2.0'	16.0'
18	06-18-98	@ S½ area	-12.0'	6.0'
19	06-18-98	@ S. end area	- 8.0'	10.0'
20	06-22-98	N. side berm @ W. end on top portion	- 1.0'	17.0'
21	06-22-98	@ W½ on top portion	0	18.0'
22	06-22-98	@ E½ on top portion	- 2.0'	16.0'
23	06-22-98	@ E. end area	0	18.0'
24	06-22-98	E. side berm @ N. end area	0	18.0'
25	06-22-98	@ middle area	- 2.0'	16.0'
26	06-22-98	@ S. end area	0	18.0'
27	06-22-98	W. side berm @ N. end area	-15.0'	3.0'
28	06-22-98	@ N½ on midway area	-14.0'	4.0'
29	06-26-98	@ middle area @ midway	-10.0'	8.0'
30	06-26-98	@ middle area @ top	- 2.0'	16.0'
31	06-26-98	@ N½ area @ middle	- 8.0'	10.0'
32	06-26-98	@ N½ area @ top	- 1.0'	17.0'
33	06-26-98	@ N. end area @ midway	- 6.0'	12.0'

Test No.	Moisture Density Number	Optimum Moisture Percent	Maximum Dry Density PCF	Moisture Content Percent	Dry Density PCF	Relative Compaction Percent	Within Specs?	Note*
1	1	9.5	126.5	7.9	119.8	95	Yes	1,2,3
2	1	9.5	126.5	8.2	121.9	96	Yes	1,2,3
3	1	9.5	126.5	9.3	121.7	96	Yes	1,2,3
4	1	9.5	126.5	8.4	126.5	100	Yes	1,3,4
5	1	9.5	126.5	8.4	122.4	97	Yes	1,3,4
6	1	9.5	126.5	7.6	123.0	97	Yes	1,3,4
7	1	9.5	126.5	9.2	122.8	97	Yes	1,3,4
8	2	16.5	109.5	14.8	106.2	97	Yes	1,3,4
9	2	16.5	109.5	12.8	105.7	97	Yes	1,3,4
10	2	16.5	109.5	16.2	104.8	96	Yes	1,3,4
11	2	16.5	109.5	15.8	108.4	99	Yes	1,3,4
12	2	16.5	109.5	14.9	106.7	97	Yes	1,3,4
13	2	16.5	109.5	15.3	107.4	98	Yes	1,3,4
14	1	9.5	126.5	8.0	122.8	97	Yes	1,3,4
15	1	9.5	126.5	14.2	128.2	100+	Yes	1,3,4
16	1	9.5	126.5	10.8	123.8	98	Yes	1,3,4
17	1	9.5	126.5	9.6	120.7	95	Yes	1,3,4
18	1	9.5	126.5	10.8	125.6	99	Yes	1,3,4
19	1	9.5	126.5	9.8	124.2	98	Yes	1,3,4
20	2	16.5	109.5	10.2	109.8	100	Yes	1,3,4
21	2	16.5	109.5	11.6	108.7	99	Yes	1,3,4
22	2	16.5	109.5	14.2	106.7	97	Yes	1,3,4
23	2	16.5	109.5	12.7	109.7	100	Yes	1,3,4
24	1	9.5	126.5	8.6	122.6	97	Yes	1,3,4
25	1	9.5	126.5	9.2	124.8	98	Yes	1,3,4
26	1	9.5	126.5	8.8	123.2	98	Yes	1,3,4
27	2	16.5	109.5	15.2	110.4	100	Yes	1,3,4
28	2	16.5	109.5	16.8	106.8	98	Yes	1,3,4
29	1	9.5	126.5	8.2	123.8	98	Yes	1,3,4
30	1	9.5	126.5	9.2	122.6	97	Yes	1,3,4
31	1	9.5	126.5	8.6	124.4	98	Yes	1,3,4
32	1	9.5	126.5	8.8	120.4	95	Yes	1,3,4
33	1	9.5	126.5	9.6	122.5	97	Yes	1,3,4

*Notes: 1. Tested ASTM D2922
2. Subgrade
3. 95% Min. Required

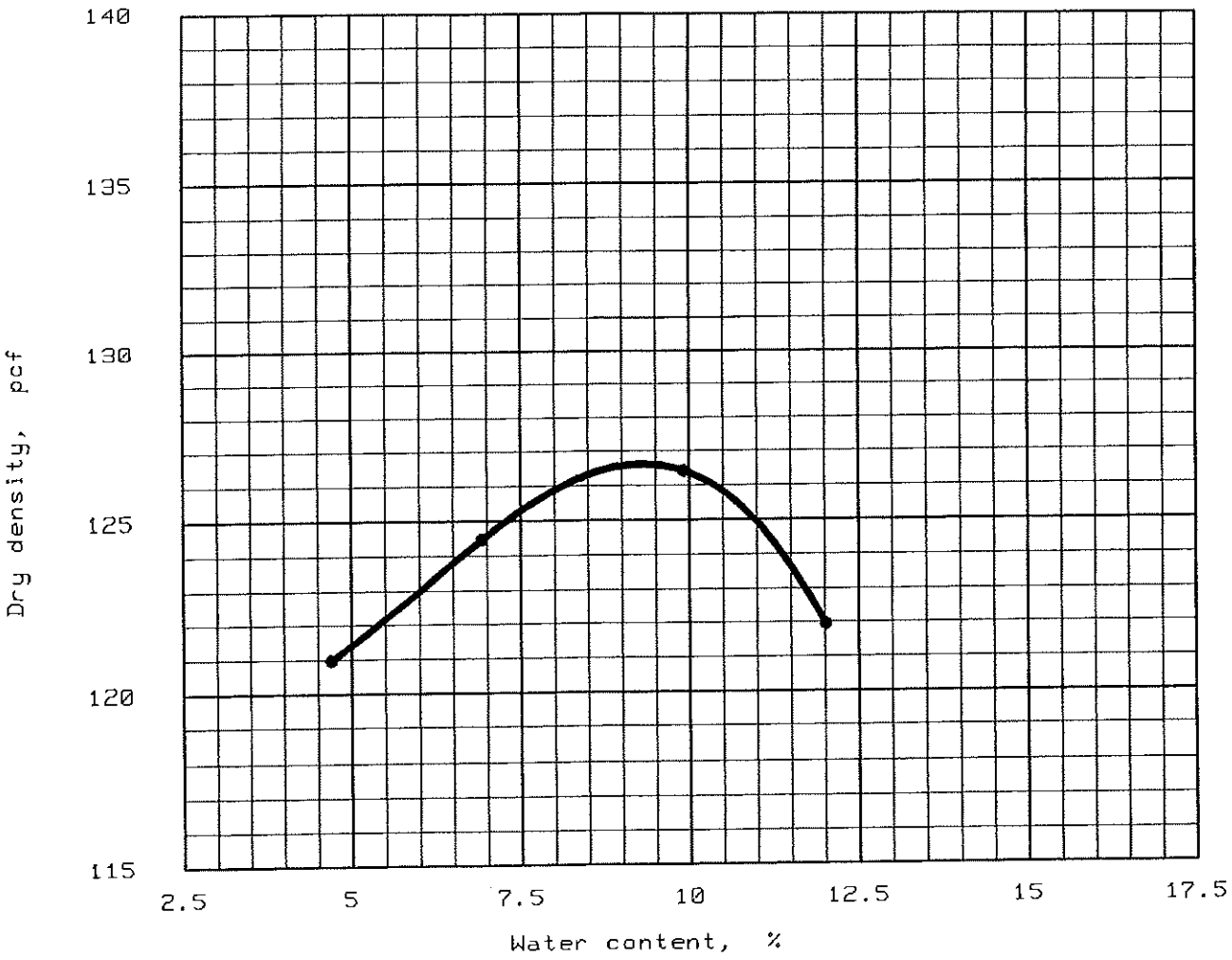
**Datum Finished Subbase

4. Subbase

Respectfully submitted,
ETEC TESTING LABORATORIES, INC.

Daniel C. Thorne and Sam Sette Jr., P.E.

MOISTURE-DENSITY RELATIONSHIP



"Modified" Proctor, ASTM D 1557, Method C

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in	% < No.200
	USCS	AASHTO						
	SP-SM		6.9 %				4.7 %	

TEST RESULTS	MATERIAL DESCRIPTION
Optimum moisture = 9.5 % Maximum dry density = 126.5 pcf	EMBANKMENT SAND WITH SILT & GRAVEL

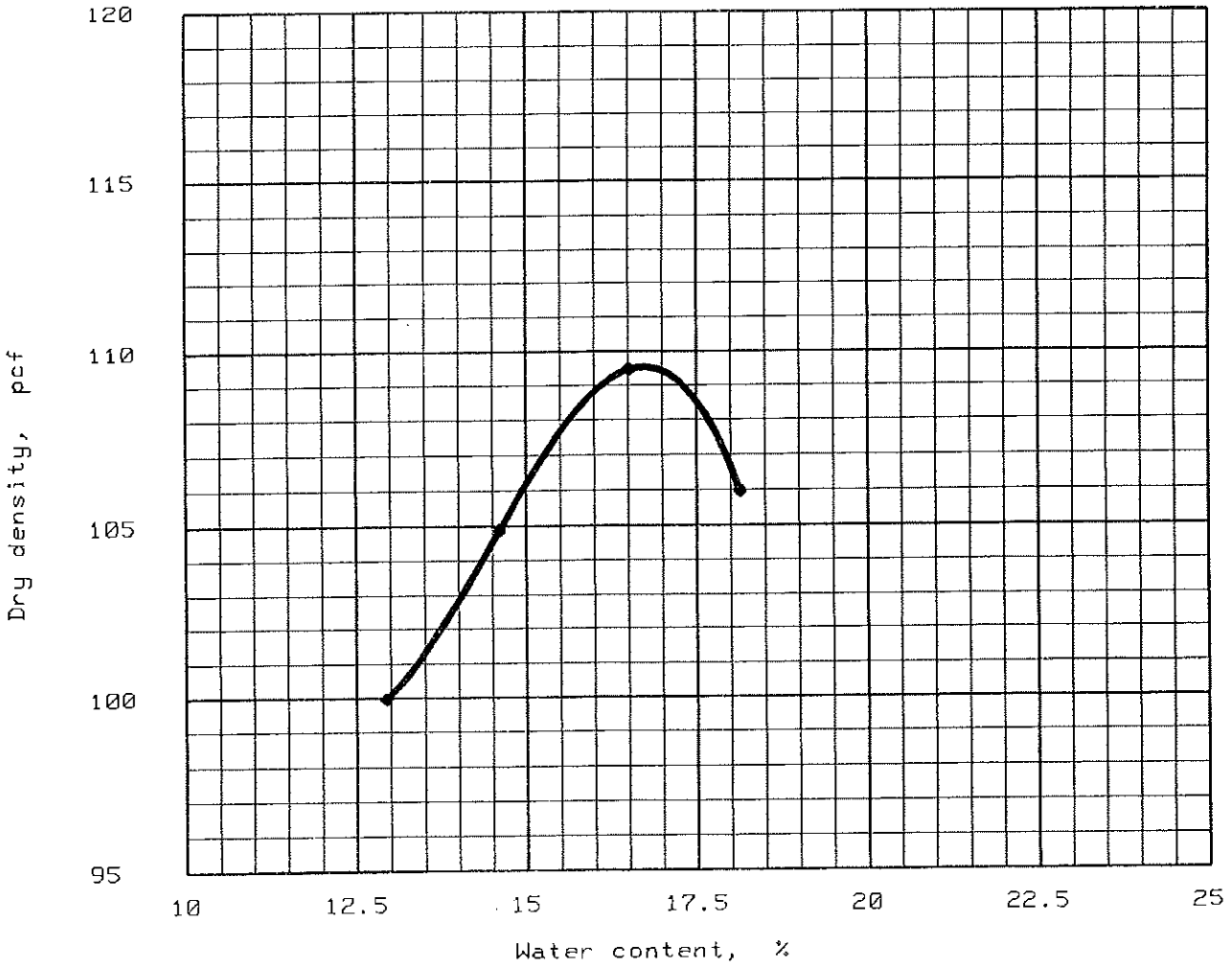
Project No.: 82143-1
Project: WASTE WATER RETENTION POND
Location: KERR MCGEE CHEMICAL PLANT BMI
HENDERSON, NEVADA
Date: 6-02-1998

Remarks:
NATIVE MATERIAL
WESTSIDE @ STA.05+32
SAMPLED: 05-29-98 ETEC

MOISTURE-DENSITY RELATIONSHIP
ETEC TESTING LABORATORIES, INC.
4150 West Pioneer Ave., Suite A

Figure No. P1

MOISTURE-DENSITY RELATIONSHIP



"Modified" Proctor, ASTM D 1557, Method C

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in	% < No.200
	USCS	AASHTO						
	SP-SM		12.9 %				4.2 %	

TEST RESULTS	MATERIAL DESCRIPTION
Optimum moisture = 16.5 % Maximum dry density = 109.5 pcf	BASIN FLOOR SAND WITH SILT & GRAVEL

Project No.: 82143-2
Project: WASTE WATER RETENTION POND
Location: KERR MCGEE CHEMICAL PLANT BMI
HENDERSON, NEVADA
Date: 06-23-98

Remarks:
NATIVE MATERIAL
NW CORNER @ 0.5' ABOVE
BASIN BOTTOM 06-18-98

MOISTURE-DENSITY RELATIONSHIP
ETEC TESTING LABORATORIES, INC.
4150 West Pioneer Ave., Suite A

Figure No. P2

ETEC TESTING LABORATORIES, INC.
4150 W. Pioneer Ave., Suite A • Las Vegas, NV 89102
(702) 367-0100

ON-SITE INSPECTION REPORT

Report No: 6-1
ETEC No: 8243

Client: Ken McGee Chemical Plant
Date: 5/29/98 Time:
Project: Westewater Retention Pond
Address: Henderson, Nevada
Contractor: CCBD Permit No:
Item: Special Coating
Location: Northeast of Ken McGee Plant & Retention Pond on the berm

Inspection/Testing: Compaction Test taken at westside and Eastside area and Southside of westend area, test #1-3 does comply with 95% or greater,
Date 6/8/98 Westside and Eastside of the berm area compaction test has been taken test #1-7 density complies with 95% or greater. Contractor is excavating at the bottom of the pond area, Material is being use to build up the berm.
There is a existing berm on the northside and portion on the eastside of the north end area, on the existing embankment it will be trimmed and built and compacted with on-site soil material

Reference Specification: Soil report by ETEC #8243 Dated March 27, 1998

Compliance/Comments: At the northwest corner area there was sludge material and concrete fragments at time of the investigation there were notice, Contractor was removing the material, it will be excavate out and disposed of at.

Inspected By: D. McCabe Reviewed By:

ETEC TESTING LABORATORIES, INC.
4150 W. Pioneer Ave., Suite A • Las Vegas, NV 89102
(702) 367-0100

ON-SITE INSPECTION REPORT

Report No: 6-2
ETEC No: 82143

Client: Ken McGee Chemical Plant
Date: 6/18/98 Time:
Project: Waste water Retention Pond
Address: Henderson, Nevada
Contractor: CCBD Permit No:
Item: Special Grading
Location: Retention Pond with a berm.

Inspection/Testing: Compaction test has been taken at the northend and eastend at the berm area, the lower portion to midheight at the northside area Test# 1-13 and eastend from middle to midheight area Test# 14-19. Sample material for proctor ASTM D1557. Sample at the northeast corner area elevation is a cut area from 2'to 4'. Material is silty sand w/ fine gravel material. Contractor is compacting the soil with sheep foot roller and water truck.
Contractor has started grading at the westside berm on the north area.
Date 6/22/98 Compaction taken at northend, eastend and westend on north area Test# 20-28 density Complies with 95% for granular and 90% for clayey material.

Reference Specification: Soil Report ETEC # 81143 Dated March 27, 1998

Compliance/Comments: The two prefabricated metal buildings and that work area has been removed from the site

Inspected By: W. McCabe Reviewed By:

SOILS INVESTIGATION AND FOUNDATION ENGINEERING; CONCRETE AND MATERIAL CONSULTANTS;
MIX DESIGN SERVICES; TESTING SERVICES; TROUBLESHOOTING CONSULTANTS; NON-DESTRUCTIVE STEEL AND WELDING CERTIFICATION

ETEC TESTING LABORATORIES, INC.
4150 W. Pioneer Ave., Suite A • Las Vegas, NV 89102
(702) 367-0100

ON-SITE INSPECTION REPORT

Report No: B-3
ETEC No: 82143

Client: Kerr McGee Chemical Plant
Date: 6/26/92 Time:
Project: Waste water Retention Pond
Address: Henderson, Nevada
Contractor: CCBD Permit No:
Item: Grade Grading
Location: Retention Pond with Berm

Inspection/Testing: Compaction test taken at westerly berm at the north 1/2 area Test # 29-33 Lifts and height to top portion density samples with 95% or greater for granular and 90% for clayey material. At this portion of retention pond is still being excavate out to elevation. Material is being stockpile at southwest corner area of the retention pond area.

Reference Specification: Soil Report ETEC # 82143 Dated March 27, 1992

Compliance/Comments:

Inspected By: J. McCabe Reviewed By:

RCI Drainage Study

TECHNICAL DRAINAGE STUDY
FOR
TRONOX SOIL REMEDIATION
TREATMENT BASINS

Prepared for:

Northgate Environmental
300 Frank H. Ogawa Plaza
Suite 510
Oakland, California 94612
Phone: (510) 839-0688
Fax: (510) 839-4350

October 2010

PROJECT 4160.0001

RCI Engineering
3281 S. Highland Drive Suite 810 * Las Vegas, NV 89109
Tel: 702.453.0800 * Fax: 702.453.0801
www.rcicnevada.com

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Tronox Soil Remediation Date: October 2010

Location of Development: a) Descriptive (Cross Streets) North/South: Warm Springs / Lake Mead Boulevard

East/West: Boulder Highway / US 95

b) Section: 12 , 13 Township: 22 S Range: 62 E

c) APN : 178-13-101-002, 178-12-401-002, 178-12-401-004, 178-12-401-005, 178-12-301-003 178-12-201-004, 178-12-601-004, 178-12-701-003, 178-12-701-003, 178-12-801-001

Name of Owner: Tronox LLC

Telephone No.: 702-651-2200 Fax No.: 651-2310 E-Mail Address:

Address: 560 West Lake Mead Parkway Henderson, Nevada 89015

Contact Person-Name: Chris Zrinyi, P.E. **Telephone No.:** 702-453-0800

*** E-Mail Address:** czrinyi@rcinevada.com **Fax No.:** 702-453-0801

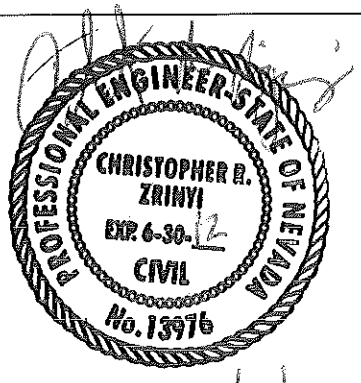
Firm: RCI Engineering

Address: 3281 S. Highland Drive Suite 801 Las Vegas, Nevada 89109

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		

1. Total Owned Land Area: At Site: 346 Acres +/- Being Developed/Disturbed: 68 Acres +/-
2. Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? ☒ **Yes**** ☐ **No**
3. Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? ☐ **Yes**** ☒ **No**
4. Proposed type of development (Residential, Commercial, Etc.): Grading for soil remediation
5. Approximate upstream land area which drains to the subject site: 0.95 square miles +/-
6. Has the site drainage been evaluated in the past? ☒ **YES** ☐ **NO** If yes, please identify documentation: Conceptual Drainage Study for Gate 2 by LR Nelson Consulting Engineers HTE# 07-35686
7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: North to existing 10-foot wide by 5-foot high RCB crossing at Warm Springs Road
8. Briefly describe your proposed schedule for the subject project: ASAP



Engineer's Seal 10/28/10

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

*New Required Field

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

Revision	Date

Local Entity File No.

REFERENCE:

STANDARD FORM 1

Updated 05/01/2008

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

Project Name:	Tronox Soil Remediation Treatment Basins		Map ID:	
Firm Name:	RCI Engineering		Engineer: Chris Zrinyi, P.E.	
Address:	3281 S. Highland Drive Suite 810			
City:	Las Vegas	State: Nevada		Zip: 89109
Phone Number:	702-453-0800	Fax Number: 702-453-0801		
Property Owner: Tronox				
560 W. Lake Mead Parkway				
City: Henderson		State: Nevada	Zip: 89015	
Reviewed By:		Date Received:	Date Accepted for Review:	

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

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

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

I. GENERAL REQUIREMENT:

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

Reference:	**STANDARD FORM 2**

DRAINAGE SUBMITTAL CHECKLIST

II. MAPS AND EXHIBITS

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

III. DRAINAGE PLAN

Yes	No	
X		Sheet size: 24" x 36" sealed by a registered engineer in the State of Nevada.
	X	Minimum scale: 1" = 60'. **1"=100' to match previous plan set through Building Dept.**
X		Project name.
X		Vicinity Map with local and major cross streets.
X		Revision box.
X		North arrow and bar scale.
X		Engineer's/consultant's address and phone number.
X		Elevation datum and benchmark.
X		Legend for symbols and abbreviations.
X		Cut/fill scarps, where applicable.
	X	Street names, grades, widths. **All onsite private**
	X	Proposed future and existing spot grades for top of curbs and street crowns at lot lines, grade breaks, and along curb returns on both sides of the street.

REFERENCE:	STANDARD FORM 2

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
X		Existing contours encompassing the site and 100 feet beyond with spot elevations for important locations, where appropriate.
	N/A	Minimum finish floor elevations with top-of-curb elevations at upstream end of lot.
	N/A	Proposed typical street sections.
	N/A	Streets with off-set crowns.
X		Proposed contours or spot elevations in sufficient detail to exhibit intended drainage patterns and slopes.
X		Property lines.
X		Right-of-way lines and widths, existing and proposed.
X		Existing improvements and their elevations.
X		Delineation of proposed on-site drainage basins indicating area and 10-year and 100-year storm peak flows at basin concentration points.
X		Concentration points and drainage flow direction with Q_{100} and V_{100} and D_{100} in streets.
X		Cumulative flows, velocity, and direction of flow at upstream and downstream ends of site for the 10-year and 100-year flows.
	N/A	Location and cross-section of street capacity calculations.
X		Cross-sectional detail for channels, including cutoff wall locations.
X		Existing and proposed drainage facilities, appurtenances, and connections (i.e., sidewalk, ditches, swales, storm drain systems, unimproved and improved channels, and culverts, etc.) stating size, material, shape, and slope with plan and profile and HGL calculations.
	N/A	Existing and proposed drainage easements and widths shown with sufficient detail. A cross sectional detail must be provided that shows appropriate lining and reinforcement.
	N/A	Location and detail of existing, proposed, and future block wall openings. Minimum size is16"x48". Wrought iron gate is required for flows > 10 cfs.
	N/A	Location and detail of flood walls illustrating depth of flow, proposed grouting height, etc.

REFERENCE:	STANDARD FORM 2

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
	N/A	Perimeter retaining wall locations. All existing and proposed walls (retaining screen and flood) must be shown with adjacent ground elevations. Flood Walls with 8-inch concrete masonry unit.
	N/A	Building and/or lot numbers.
X		Alignment of all existing, proposed, or future Regional Facilities adjacent to the site.
X		Limits of existing floodplain based on current FIRM or best available information; limits of proposed floodplains based on best available information.
	N/A	For areas in Zone A, AE, AH, and AO, base flood elevations (BFEs) must be shown for each lot; BFEs may be listed on each lot, or in a table. Finish floor elevations must be a minimum of 18 inches above BFE.
	N/A	Appropriately elevated "humps" 6 inches above the 100-year water surface elevation at site accesses where the intent is to protect the site from the Q_{100} flows.
	N/A	Street slopes for perimeter and interior streets. The minimum slope is 0.4 percent.

IV. HYDROLOGIC ANALYSIS

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

REFERENCE:	STANDARD FORM 2

DRAINAGE SUBMITTAL CHECKLIST

V. HYDRAULIC ANALYSIS

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

REFERENCE: | **STANDARD FORM 2**

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LIST OF FIGURES

I. INTRODUCTION

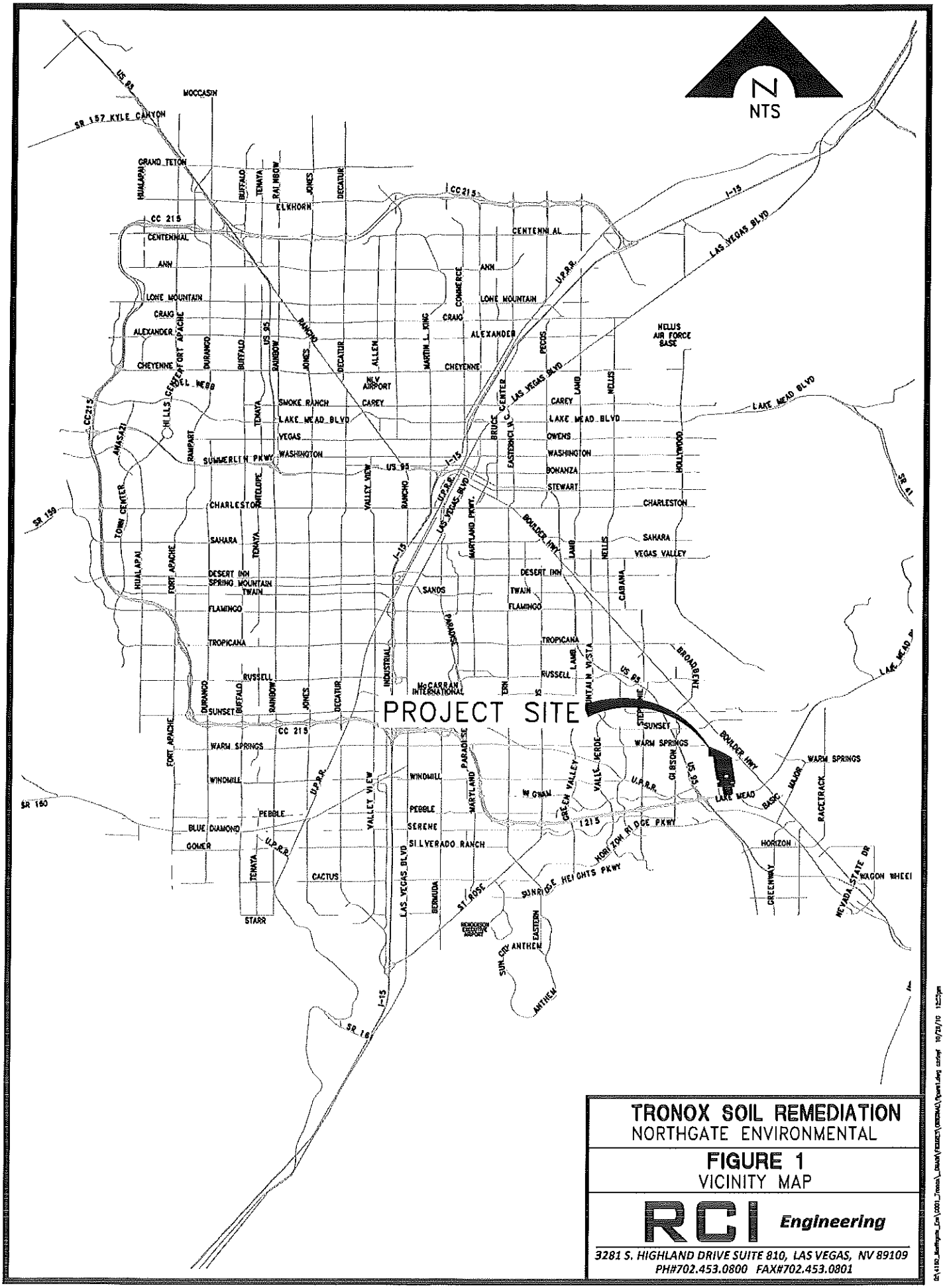
Tronox LLC is proposing soil remediation within portions of the 346 +/- acre site north of Lake Mead Boulevard and east of US 95. The remediation will consist of removal of contaminated soils that will be transported to the Apex Landfill, backfill portions of the excavation with uncontaminated soil, and the construction of interim onsite treatment basins to contain storm water flows for treatment prior to discharge into the groundwater aquifer. The purpose of this report is to accompany the grading plans prepared by Northgate Environmental and to provide detailed hydrological and hydraulic analyses for the proposed interim treatment basins. The following tasks were performed in the preparation of this report:

- Identify previous drainage studies for the project site and surrounding areas.
- Identify the FEMA floodplain designation for the project site.
- Identify existing and proposed regional drainage facilities adjacent to the site.
- Estimate runoff generated for the peak offsite and onsite 10-year and 100-year return period storms for existing and proposed conditions.
- Recommend drainage facilities for storage and treatment of storm water flows.

This report and the accompanying improvement plans do not represent ultimate condition improvements for the site. The interim treatment basins may be removed in the future once remediation of the site has been completed. The facilities designed with this study should not be relied upon to be in place for future downstream development. Any additional improvements proposed onsite will need a technical drainage study that addresses ultimate condition flow rates, discharge corridors, and long term operation of the treatment facilities.

II. LOCATION AND DESCRIPTION

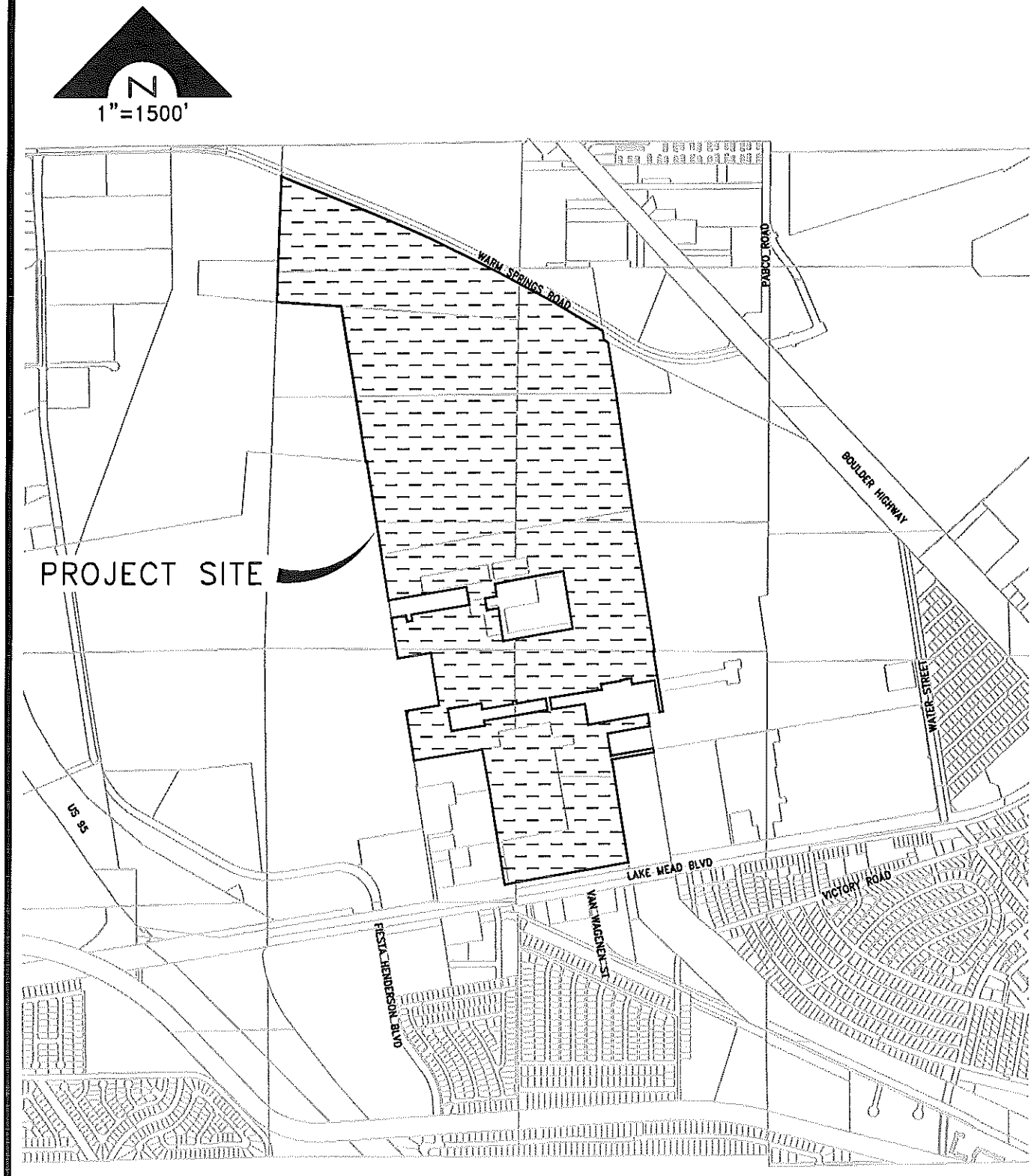
The Project is located in Section 12, Township 22 South, Range 62 East, M.D.M., in Clark County, Nevada. The site is located on the north side of Lake Mead Boulevard, south side of Warm Springs Road, west of Boulder Highway, and east of US 95. Please refer to Figures 1 and 2 for the vicinity and location maps.



TRONOX SOIL REMEDIATION
NORTHGATE ENVIRONMENTAL

FIGURE 1
VICINITY MAP

RCI Engineering
3281 S. HIGHLAND DRIVE SUITE 810, LAS VEGAS, NV 89109
PH#702.453.0800 FAX#702.453.0801



750' 0' 750' 1500'

SCALE: 1" =1500'

TRONOX SOIL REMEDIATION
NORTHGATE ENVIRONMENTAL

FIGURE 2
LOCATION MAP

RCI Engineering
3281 S. HIGHLAND DRIVE SUITE 810, LAS VEGAS, NV 89109
PH#702.453.0800 FAX#702.453.0801

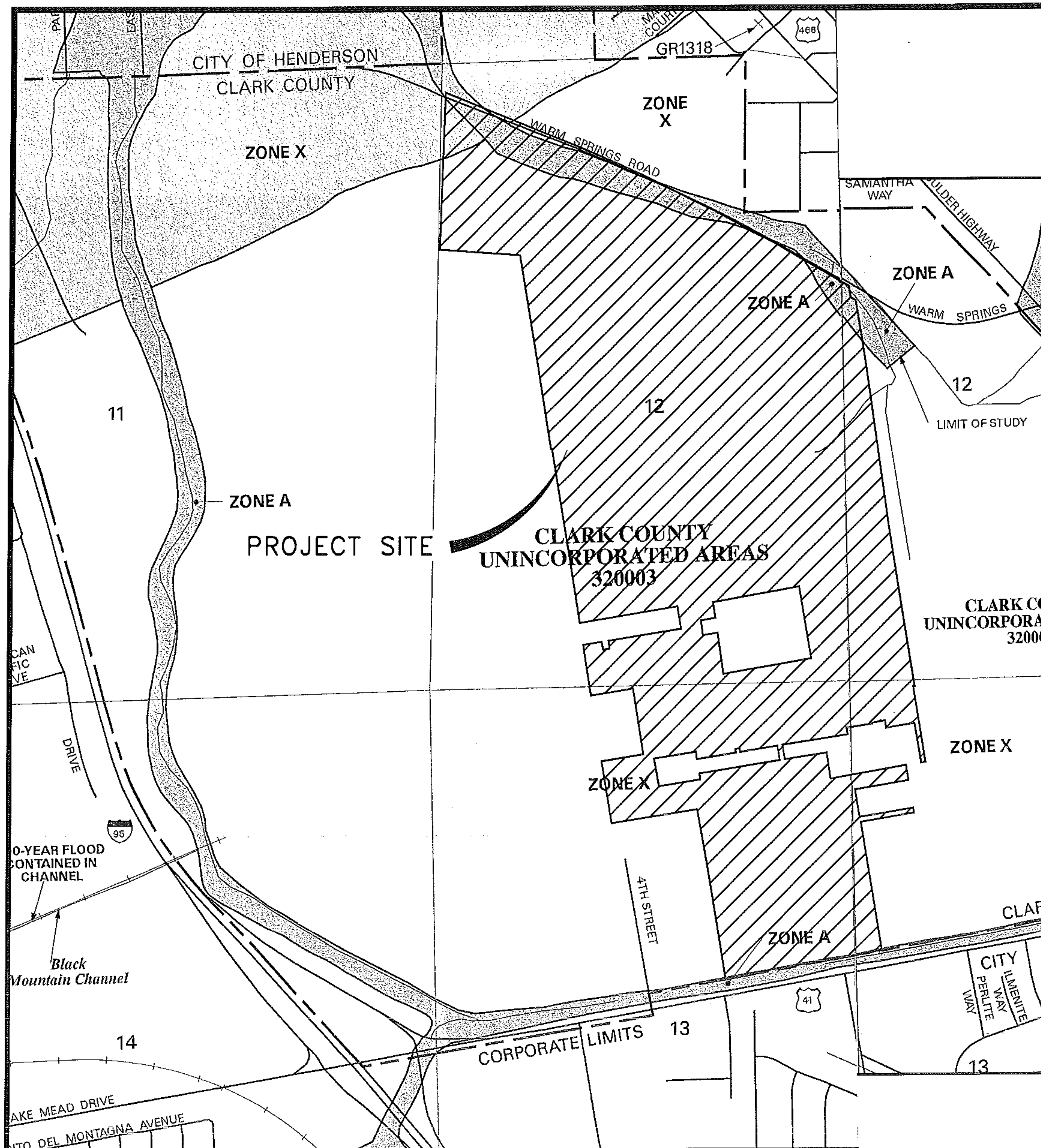
The project is bordered by existing industrial developments as well as the Lake Mead Crossing Commercial Center to the east, Warm Springs Road to the north, The Eastside Landfill and Detention Basin to the West, existing Lake Mead Boulevard full street improvements to the south and several islands of existing industrial sites are intermixed within the property borders. The project includes existing industrial developments as well as abandoned structures and facilities. An extensive onsite storm drain network with multiple drop inlets and facilities defines the onsite drainage patterns. These facilities will be discussed later in this report.

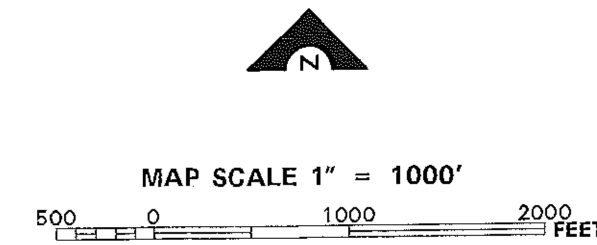
The site was previously analyzed in a study entitled *Conceptual Drainage Study for Gate 2* by L.R. Nelson Consulting Engineers (HTE# 07-35686 Reference 1 hereinafter referred to as the Conceptual Study). The Conceptual Study was performed for Parcel Mapping purposes only and did not provide a detailed hydrological analysis based on 1-foot topography. Therefore, the hydrological analysis presented in this report will supersede the Conceptual Study.

III. FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) FLOOD HAZARD ANALYSIS

Figure 3 was reproduced from the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) containing Community Panel Numbers 32003C2595 E and 32003C2615 E, dated September 27, 2002. Review of the FIRM shows that the site is currently located within a Zone X and partially within a Zone A.

Zone A areas are Special Flood Hazard Areas (SFHA) defined as areas within the 100-year floodplains that are determined by approximate methods. Detailed hydraulic analyses are not performed for these areas, therefore no base flood elevations or depths are shown within this zone. The proposed soil remediation area of work is not located within the portions of the site that are within SFHA Zone A. Zone X areas are defined as areas outside of the 100-year floodplains; areas of 100 year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100 year flood. The proposed soil remediation area of work is located within the portions of the site that are within Zone X areas. Therefore, the project work area is not located within a FEMA-designated SFHA.





PANEL 2615 E

FIRM
FLOOD INSURANCE RATE MAP
CLARK COUNTY,
NEVADA AND
INCORPORATED AREAS

PANEL 2615 OF 4090
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
HENDERSON, CITY OF	320005	2615	E
CLARK COUNTY, UNINCORPORATED AREAS	320003	2615	E

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

MAP NUMBER 32003C2615 E

MAP REVISED: SEPTEMBER 27, 2002

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

PANEL 2595 E

FIRM
FLOOD INSURANCE RATE MAP
CLARK COUNTY,
NEVADA AND
INCORPORATED AREAS

PANEL 2595 OF 4090
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
HENDERSON, CITY OF	320005	2595	E
CLARK COUNTY, UNINCORPORATED AREAS	320003	2595	E

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

MAP NUMBER 32003C2595 E

MAP REVISED: SEPTEMBER 27, 2002

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

TRONOX SOIL REMEDIATION
NORTHGATE ENVIRONMENTAL

FIGURE 3
F.I.R.M. MAP

RCI Engineering

3281 S. HIGHLAND DRIVE SUITE 810, LAS VEGAS, NV 89109
PH#702.453.0800 FAX#702.453.0801

IV. CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT FACILITIES

Figure 4 is reproduced from Figure F-45 of the 2008 *Clark County Regional Flood Control District (CCRFCD) Master Plan Update* (Reference 2, hereinafter referred to as the 2008 MPU). This figure depicts the project site in relation to existing and proposed CCRFCD facilities. As shown on the figure, the site is not traversed or adjacent to CCRFCD facilities.

V. HYDROLOGY

The methodology presented in this study is in compliance with the *CCRFCD Hydrologic Criteria and Drainage Design Manual* (Reference 3, hereinafter referred to as the Manual).

Model Description - The watersheds were modeled using the SCS Unit Hydrograph method within the U.S. Army Corps of Engineers *HEC-1 Flood Hydrograph Package* (Reference 4).

Precipitation - The project site and offsite subbasins lie outside the McCarran Rainfall Area as delineated in the Design Manual. The rainfall depths for the project site were calculated from Figures 503 and 506 of the Manual. The rainfall depths have been adjusted according to the ratios outlined on Table 501 of the Manual. The 10-year and 100-year adjusted point precipitation values for the project will be 1.74 inches and 2.86 inches during a 6-hour storm event, respectively. This equates to a 0.61 ratio between the 10-year and 100-year storm events. (See Appendix A)

Since the drainage area for the project will be less than 8 square miles, an SDN 3 design storm distribution per Table 503 of the Manual was selected for use in the HEC-1 computer model.

AREA OF STUDY

GALLERIA DR
SUNSET RD
WARM SPRINGS RD
NAVARRE LA
TRAIL CANYON RD
WIGWAM PKWY
PASEO VERDE PKWY
HORIZON RIDGE PKWY
VALLE VERDE DR
STEPHANIE ST
MARKS ST
GIBSON RD
BOULDER HWY
LAKE MEAD PKWY
WATER ST
BASIC RD
VAN WAGENEN ST
FABCO RD
ARROYO GRANDE BLVD

US 95
I-15
I-215

2008 LAS VEGAS VALLEY FLOOD CONTROL MASTER PLAN UPDATE

FIGURE F-45
FLOOD CONTROL FACILITIES

LEGEND

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

Remove & Replace/Parallel Facilities

Category A	Category B
Channel	Channel
Stormdrain	Stormdrain
Crossing	Crossing

FIGURE 4

N

0 500 1,000 2,000 3,000
Feet
Scale: 1 inch = 2,000 feet

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

PBS&J
PB

Curve Numbers (CN) – The soils boundary for the subject study area was obtained from electronic GIS data distributed with the 2002 MPU. The electronic GIS soil coverage delineates families of soil types and the soil name and map symbol of each family. The subbasin study area has been delineated on the Soils Map exhibits included in Appendix A. The study area is comprised of three soil types. Soil type 184 Caliza, soil type 187 Caliza, and soil type 615 Urban Land.

The 2002 MPU GIS soil coverage was based on the soil information provided in the SCS Soil Survey of Las Vegas Valley Area (Reference 5, hereinafter referred to as the SCS Study). References from the SCS Study have been included in Appendix A that delineates soil type 184 and 187 as HSG "B". Soil type 615 does not include an HSG classification. The 2008 MPU classified this soil as an HSG "C". However, portions of the site soils are to be replaced with uncontaminated soils from various sources. Since the SCS Study didn't include an HSG classification and the import soils have not been determined, soil type 615 will be modeled as an HSG "D" for purposes of this study.

For the given soil values, CN values were determined from the appropriate columns of Table 602 of the Manual. Under existing conditions the site and offsites north of Lake Mead Boulevard were modeled as HSG "B" and HSG "D" type soil with undeveloped Desert Shrub cover and Industrial land use. The offsite subbasin south of Lake Mead Boulevard was modeled as HSG ""B" and HSG "D" type soil with undeveloped Desert Shrub cover and Commercial land use. Under proposed conditions the site and offsites north of Lake Mead Boulevard were modeled as HSG "B" and HSG "D" type soil with Industrial land use. The offsite subbasin south of Lake Mead Boulevard was modeled as HSG ""B" and HSG "D" type soil with Commercial land use. Curve number calculations have been included in Appendix A.

Drainage Areas and Flow Patterns - The onsite subbasins and flow patterns used in the hydrologic modeling under existing conditions and proposed conditions were determined from aerial topography with a 1-foot contour interval. Offsite subbasins that extended beyond the 1-foot contours were determined based on 5-foot Clark County GIS contours. Under proposed conditions, electronic files of the proposed treatment basin areas for the Project were used to modify the onsite drainage patterns. Additionally, approved improvement plans and technical drainage studies

for existing offsite developments were researched to determine changes from the 5-foot Clark County GIS contours due to development. Subbasin boundaries will be described in further detail later on in this report.

Lag Time - The lag time (TLAG) is described as the time between the center of mass of rainfall and the time of peak discharge from a basin. Lag time can be related to time of concentration (Tc) by the following relationship: TLAG = 0.6 (Tc). The time of concentration (Tc) is defined as the time required for runoff to flow from the most remote part of the basin area to the outlet of the basin or a design point under consideration. The procedure for calculating Tc is outlined in Section 602 of the Manual. Lag time calculations for the drainage subbasins have been included in Appendix A on Standard Form 4.

VI. EXISTING CONDITIONS

Figure 5 depicts the existing condition subbasins, flow patterns, and existing drainage facilities. The existing onsite storm drain network was constructed in 1941. Included in Appendix C is Sheet R-27 supplied by Tronox which locates the storm drain sizes, drop inlets locations, and manholes for the facilities. This sheet was digitized into Autocad and the facilities are shown on Figure 5. One change to the storm drain system occurred in 1991 to tie a piece of storm drain in to Tronox facilities that used to tie into Pioneer Company facilities to the west. Appendix C includes a copy of the GIS inventory of facilities showing the change to the 4th Street storm drain between Avenue H and Avenue K.

Subbasin EX1 was delineated by existing developed residential homes on the east, the centerline of Van Wagenen Street on the west, and an existing channel on the north side of Lake Mead Boulevard. Lake Mead Boulevard was constructed with a landscaped and rock lined channel along the north side of Lake Mead Boulevard from Boulder Highway to US95. The channel improvements include double 36-inch RCP culverts at roadway and driveway crossings as shown on Figure 5. While the channel has capacity to convey 100-year storm flows, it appears that the culverts will be the limiting capacity for conveyance to the west. Subbasin EX1 was analyzed to determine how much flow will be generated during a 100-year storm event to the existing culvert crossings.

Subbasin EX2, EX3, and EX4 were delineated based off of 1-foot and 5-foot topography and the extents of the existing storm drain network. All three subbasins are bound on the north by an existing channel referred to as the Beta Channel. Subbasins EX3 and EX4 are bound by the Lake Mead Channel to the south. The western boundary of Subbasin EX4 was based on the 5-foot contours that run along the existing railroad tracks. The eastern boundary of Subbasin EX2 was based on the 5-foot contours and the limit of the existing storm drain network. Subbasin EX5 is bound by the Beta Channel on the south and an existing berm to the north. The western and eastern limits of this subbasin were based on the 1-foot topography.

Subbasins EX6 and EX7 are bound on the south by an existing landfill with an equalizer detention basin. These facilities were analyzed in the Technical Drainage Study for Eastside Landfill by PBS&J Engineering (HTE# 06-44325 Reference 6 herein after referred to as the Landfill Study). Pertinent references from this study have been included in Appendix C. Improvement plans for the Landfill Project were digitized into Autocad to determine boundaries for Subbasins EX6 and EX7. The equalizer basin sends flows west into a storm drain system and allows 26 cfs to spill north into Subbasin EX7 during a 100-year storm event.

Subbasin EX8 is bound by Warm Springs Road to the north and the landfill and a berm to the south. GIS 5-foot contours were used to determine the west edge of this basin. The east edge of the basin was set based on the contours and references from the Technical Drainage Study for B & E Auto and Conceptual Drainage Study for the Remainder of BMI Gate 5 and Northgate by PBS&J Engineering (HTE# 08-18408 Reference 7 hereinafter referred to as the B & E Auto Study). The B& E Auto Study included a copy of the improvement plan for the existing 10-foot wide by 5-foot high RCB that crosses Warm Springs Road at the north west corner of Subbasin EX8.

The existing condition HEC-1 model has been included in Appendix A. Table 1 summarizes the existing condition 100-year and 10-year flow rates for each of the identified basins.

TABLE 1
EXISTING CONDITIONS
HEC-1 MODEL SUMMARY

SUBBASIN OR CP*	BASIN AREA (AC)	100 YR (cfs)	10 YR (cfs)
EX1	41.35	62	24
EX2	83.23	180	93
EX3	182.77	339	172
EX4	109.85	231	119
EX5	86.12	154	75
CP1	N/A	858	430
EX6	14.56	32	15
EX7	9.97	23	11
CP2	N/A	54	25
CP2**	N/A	80	25
EX8	124.27	145	55
CP3	N/A	1013	492
CP3**	N/A	1039	492

See Figure 5
**Add 26 cfs to 100-Year flow at CP2 and CP3 for overflow from existing equalizer basin –Eastside Landfill

Subbasin EX1 produces 62 cfs during a 100-year storm event. This flow is directed to the Lake Mead Channel through several 18-inch RCPs and the design of the intersection of Van Wagenen Street and Lake Mead Boulevard which directs flows north across Lake Mead Boulevard. This flow combines with 83 cfs that is directed into the channel by the Lake Mead Crossing project. The 83 cfs in the channel was determined in the Technical Drainage Study for Lake Mead Crossing by Carter Burgess Inc. (HTE# 07-3280 Reference 8, herein after referred to as LM Crossing Study). The 83 cfs will combine with the 62 cfs from Subbasin EX1 for a total 100-year flow rate of 145 cfs at the double 36-inch RCPs crossing under Van Wagenen Street. A culvert master calculation was prepared for these pipes which shows that the pipes have capacity to convey 126 cfs before the remaining flow of 19 cfs will spill out of the channel to the north. The excess flow will be conveyed north and collected by the storm drain system that drains east of Subbasin EX2. A flow master calculation was prepared for the channel west of the RCPs at the minimum slope of

0.5 percent. This calculation shows that the channel has capacity to convey 126 cfs at a depth of 1.8 feet in the 4-foot deep channel. The only other flows to enter the channel downstream of this section would be minor nuisance flows generated in the half street of Lake Mead Boulevard and collected by local drop inlets. Therefore, no additional flows will spill north of the channel downstream of Van Wagenen Street.

Subbasins EX2, EX3, and EX4 generate 180, 339, and 231 cfs respectively during a 100-year storm event. The flows from these subbasins are collected by the existing storm drain network and conveyed north east through the Beta Channel into Subbasin EX5. Subbasin EX5 will generate 154 cfs during a 100-year storm event that will combine with the flows from Subbasins EX2, EX3, and EX4 at Concentration Point CP1 for a total 100-year flow rate of 858 cfs. This flow will pond up in the low lying area in the north east corner of Subbasin EX5 and either infiltrate into the soil or weir to the north.

Subbasins EX6 and EX7 will generate 32 cfs and 23 cfs respectively during a 100-year storm event. These flows combine at Concentration Point CP2 for a total flow rate of 54 cfs during a 100-year storm event. The 26 cfs overflow from the Landfill Equalizer Basin will combine with this flow for a total of 80 cfs directed north towards Warm Springs Road.

Subbasin EX8 will generate 145 cfs during a 100-year storm event. This flow will combine with the flows from Concentration Points CP1 and CP2 at the existing 10-foot wide by 5-foot high RCB that crosses Warm Springs Road. Concentration Point CP3 shows a total flow rate of 1039 cfs at the existing culvert. The upstream tributary drainage areas includes multiple low lying areas that could detain storm water flows and reduce the peak flow rate to this culvert. However, during a pre-design meeting held between CCPW, Northgate Environmental, and RCI Engineering it was determined that storage should not be accounted for in these areas that could be filled in and are not maintained. Additionally, the existing condition model was developed to conservatively determine the magnitude of flows that are generated and conveyed through the existing sporadically developed industrial areas.

VII. PROPOSED CONDITIONS

Figure 6 depicts the proposed condition subbasins, flow patterns, existing facilities, and proposed treatment areas. The proposed condition HEC-1 model has been included in Appendix A. Table 2 summarizes the proposed condition 100-year and 10-year flow rates for each of the identified basins.

TABLE 2
PROPOSED CONDITIONS
HEC-1 MODEL SUMMARY

SUBBASIN OR CP*	BASIN AREA (AC)	100 YR (cfs)	10 YR (cfs)
PRO1	41.35	96	49
PRO3	181.41	351	183
PRO2	83.29	188	100
PRO5	79.39	175	93
CP5	N/A	362	192
PRO4	132.45	203	106
PRO7	9.97	29	15
CP2**	N/A	55	15
PRO8	124.27	220	108
CP3	N/A	233	115
CP3**	N/A	259	115

*See Figure 6

**Add 26 cfs to 100-Year flow at CP2 and CP3 for overflow from existing equalizer basin –Eastside Landfill

Under proposed conditions all subbasins are fully developed and proposed onsite treatment basins are in place. The purpose of this study is not for development of the industrial site but instead to adequately size the onsite treatment basins to allow for storm flows to be retained and treated prior to recharge into the groundwater system. Subbasin boundaries and offsite cut off points were explained in detail in the existing conditions section of this report. Changes from the existing condition model to the proposed condition model consist of the following:

- Increase the CN values of all subbasins to fully developed conditions as commercial land use south of Lake Mead Boulevard and industrial land use north of Lake Mead Boulevard.
- Revise the subbasin boundaries to reflect proposed treatment basins.
- Route Subbasins PRO2 and PRO4 north through proposed trapezoidal earthen lined channels.

Subbasin PRO1 produces 96 cfs during a 100-year storm event. This flow is directed to the Lake Mead Channel through several 18-inch RCPs and the design of the intersection of Van Wagenen Street and Lake Mead Boulevard which directs flows north across Lake Mead Boulevard. This flow combines with 83 cfs that is directed into the channel by the Lake Mead Crossing project. The 83 cfs will combine with the 96 cfs from Subbasin PRO1 for a total 100-year flow rate of 179 cfs at the double 36-inch RCPs crossing under Van Wagenen Street. A culvert master calculation was prepared for these pipes which shows that the pipes have capacity to convey 126 cfs before the remaining flow of 53 cfs will spill out of the channel to the north. The excess flow will be conveyed north and collected by the storm drain system that drains east of Subbasin PRO2. A flow master calculation was prepared for the channel west of the RCPs at the minimum slope of 0.5 percent. This calculation shows that the channel has capacity to convey 126 cfs at a depth of 1.8 feet in the 4-foot deep channel. The only other flows to enter the channel downstream of this section would be minor nuisance flows generated in the half street of Lake Mead Boulevard and collected by local drop inlets. Therefore, no additional flows will spill north of the channel downstream of Van Wagenen Street.

The site currently includes a 60-foot deep +/- buried slurry wall located in the middle of Subbasin PRO5. This slurry wall allows for groundwater to be pumped to a treatment facility prior to recharging into the groundwater system downstream of the slurry wall. The flows retained from Subbasin PRO3 are intended to percolate into the soils upstream of the slurry wall. Wells will extract this water along with the containments washed through the soil and treat these flows prior to release. Subbasin PRO3 produces 351 cfs during a 100-year storm event which will be retained within Treatment Basin #2. Treatment Basin #2 has been designed to retain a total volume of 31.1 acre feet. The downstream natural ground elevation is located at elevation 1763. The below grade storage volume at elevation 1763 will be 16.9 acre feet including 1.36 acre feet of storage for the 100-year sediment load. The above grade storage volume during a 100-year storm event will be 14.2 acre feet (31.1-16.9 =14.2). Therefore, the proposed treatment basin will include less than 20-acre feet of above grade storage and will not need a Dam Safety Permit.

Sediment calculations and stage storage calculations have been included in Appendix B. Sediment load calculations were based on the Modified Universal Soil Loss Equation for the wash load and the Meyer-Peter Equation for the bed load per

the Design Manual Criteria. The Design Manual recommends an annual sediment yield based on the weighted average of the 100, 50, 25, 10, and 2-year return period storm events. However, this study has conservatively used the entire 100-year return period storm event sediment yield for all treatment basins. Treatment Basin #2 includes two 12-foot wide maintenance access ramps sloped at 10 percent. The western maintenance ramp will allow for access to the bottom of the western and eastern portions of the basin. The eastern maintenance ramp will allow for access to the top tier of the eastern portion of the basin. All facilities are on private property and will be maintained by Tronox.

Treatment Basin #2 includes a spillway weir elevation set at 1766. The 100-year storm event will be maintained in the basin at a peak stage elevation of 1765.65. The top of embankment elevation for this basin will be at elevation 1767.5. The PMF storm event was calculated using an adjusted precipitation value (5.72) of twice the 100-year precipitation value of 2.86. The PMF storm event is safely conveyed over the weir structure at a maximum elevation of 1766.31 which includes approximately 1.2 feet of freeboard above the PMF spillway elevation.

The capacity of the treatment system will not allow for the entire 100-year storm event flows tributary to the entire site to be treated by the extraction wells upstream of the slurry wall. However, the owner, Tronox, through ongoing discussion with Nevada Department of Environmental Protection (NDEP) has determined that Tronox prefers to retain the majority of onsite storm flows due to the nature of the contaminants of the onsite soils. Therefore, two treatment basins are proposed downstream of the onsite slurry walls.

Subbasins PRO2 and PRO5 produce 188 cfs and 175 cfs during a 100-year storm event which will be retained within Treatment Basin #1. These flows combine in the basin at Concentration Point CP5 for a total 100-year flow rate of 362 cfs. An earthen channel with an 80-foot bottom width, 3 to1 side slopes and a minimum depth of 2-feet conveys the 188 cfs from Subbasin PRO2 into Treatment Basin #1 at a depth of 0.5-feet and a velocity of 5 feet per second. Normal depth calculations prepared in Flowmaster have been included for this channel based on Cross Section 10 from the detail sheets. The Flowmaster calculation for the channel shows that the velocity in the channel will be less than 5-feet per second which is considered non erosive. Treatment Basin #1 has been designed to retain a total volume of 28.7

acre feet. The downstream natural ground elevation is located at elevation 1738. The below grade storage volume at elevation 1738 will be 19.7 acre feet including 1.21 acre feet of storage for the 100-year sediment load. The above grade storage volume during a 100-year storm event will be 9.0 acre feet (28.7-19.7=9.0). Therefore, the proposed treatment basin will include less than 20-acre feet of above grade storage and will not need a Dam Safety Permit.

Sediment calculations and stage storage calculations have been included in Appendix B. Sediment load calculations were based on the Modified Universal Soil Loss Equation for the wash load and the Meyer-Peter Equation for the bed load per the Design Manual Criteria. The Design Manual recommends an annual sediment yield based on the weighted average of the 100, 50, 25, 10, and 2-year return period storm events. However, this study has conservatively used the entire 100-year return period storm event sediment yield for all treatment basins. Treatment Basin #1 includes maintenance access from the south bank sloped at 10 percent as well as the northeast bank that is also sloped at 10 percent. All facilities are on private property and will be maintained by Tronox.

Treatment Basin #1 includes a spillway weir elevation set at 1741. The 100-year storm event will be maintained in the basin at a peak stage elevation of 1739.27. The top of embankment elevation for this basin will be at elevation 1745. The PMF storm event was calculated using an adjusted precipitation value (5.72) of twice the 100-year precipitation value of 2.86. The PMF storm event is safely conveyed over the weir structure at a maximum elevation of 1742.6 which includes approximately 2.4 feet of freeboard above the PMF spillway elevation.

The flow generated by Subbasin PRO4 would be too much volume for Treatment Basin #2. Therefore, an earthen lined channel will convey the flows from this Subbasin north into Treatment Basin #3. An earthen channel with an 80-foot bottom width, 3 to1 side slopes and a minimum depth of 2-feet conveys the 203 cfs from Subbasin PRO2 into Treatment Basin #3 at a depth of 0.5-feet and a velocity of 5 feet per second. Normal depth calculations prepared in Flowmaster have been included for this channel based on Cross Section 11 from the detail sheets. The Flowmaster calculation for the channel shows that the velocity in the channel will be less than 5-feet per second which is considered non erosive. Subbasin PRO4 produces 203 cfs during a 100-year storm event which will be retained within

Treatment Basin #3. Treatment Basin #3 has been designed to retain a total volume of 23.2 acre feet. The downstream natural ground elevation is located at elevation 1730. The below grade storage volume at elevation 1730 will be 7.5 acre feet including 0.61 acre feet of storage for the 100-year sediment load. The above grade storage volume during a 100-year storm event will be 15.7 acre feet (23.2-7.5=15.7). Therefore, the proposed treatment basin will include less than 20-acre feet of above grade storage and will not need a Dam Safety Permit.

Sediment calculations and stage storage calculations have been included in Appendix B. Sediment load calculations were based on the Modified Universal Soil Loss Equation for the wash load and the Meyer-Peter Equation for the bed load per the Design Manual Criteria. The Design Manual recommends an annual sediment yield based on the weighted average of the 100, 50, 25, 10, and 2-year return period storm events. However, this study has conservatively used the entire 100-year return period storm event sediment yield for all treatment basins. Treatment Basin #3 includes maintenance access from the existing evaporation pond access road to the middle of the basin that is sloped at 10 percent. All facilities are on private property and will be maintained by Tronox.

Treatment Basin #3 includes a spillway weir elevation set at 1738. The 100-year storm event will be maintained in the basin at a peak stage elevation of 1735.29. The top of embankment elevation for this basin will be at elevation 1745. The PMF storm event was calculated using an adjusted precipitation value (5.72) of twice the 100-year precipitation value of 2.86. The PMF storm event is safely conveyed over the weir structure at a maximum elevation of 1738.39 which includes approximately 6.6 feet of freeboard above the PMF spillway elevation.

Subbasin PRO7 will generate 29 cfs during a 100-year storm event. The 26 cfs overflow from the Landfill Equalizer Basin will combine with this flow for a total of 54 cfs directed north towards Warm Springs Road. Subbasin PRO8 will generate 220 cfs during a 100-year storm event. This flow will combine with the flows from Concentration Points CP1 and CP2 at the existing 10-foot wide by 5-foot high RCB that crosses Warm Springs Road. Concentration Point CP3 shows a total flow rate of 259 cfs at the existing culvert. This is substantially less than the 1039 cfs at this point under existing conditions. Therefore, the development of the proposed treatment basins will not negatively impact downstream conveyance facilities under

proposed conditions.

The Design Manual does not include specific guidelines for local major retention basins since these facilities are not recommended. However, the atypical Tronox site includes contaminated soils that need to be treated and retention of storm flows will aid in the treatment of the contaminants. The treatment basin have been designed with maintenance access ramps, 1-foot of freeboard above the emergency spillway, allowance for bypass of the peak runoff for storm events larger than the 100-year event, and sediment storage for the 100-year design storm event. Appendix B includes a letter from the Geotechnical Engineer and a summary table of Laboratory Hydraulic Conductivity Test Results. The hydraulic conductivity of the site soils ranges from 2.1 inches per hour to 0.013 inches per hour. The average value of 0.33 inches per hour was used to determine the average drain time for Treatment Basins #1 and #3. This number should be conservative since the rate of infiltration will increase with the depth of water in the basin. Treatment Basin #2 includes the extraction wells so the drain time for this basin will be controlled through the rate of the treatment. Drain time calculations for the entire retained volumes have been included in Appendix B which shows that Treatment Basin #1 will drain within 6 days and Treatment Basin #2 will drain with 10 days. The proposed retention basins are located on private property, maintained by Tronox, and located within a secure area that require visitors to pass though security prior to entry due to the onsite contaminants.

VIII. ULTIMATE CONDITIONS

An ultimate condition HEC-1 model was not prepared for the following reasons:

- The proposed condition model of the site included all onsite and offsite basins as fully developed per their adopted land uses.
- Development patterns onsite would be revised in ultimate conditions based on the possible removal of treatment basins after completion of remediation.
- Development that occurs as industrial land use and follows the established drainage patterns and existing storm drain network has been accounted for in the proposed condition modeling.

Future development that proposes land use other than industrial or is located downstream of the proposed interim treatment basins will need a technical drainage study update prior to development.

IX. CONCLUSIONS AND RECOMMENDATIONS

1. Methodology used in this report is in compliance with the Clark County Regional Flood Control District (CCRFCD) criteria.

2. The property lies within a FEMA Zone X and partially within a FEMA Zone A. The proposed soil remediation area of work is located within the portions of the site that are within Zone X areas. Therefore, the project work area is not located within a FEMA-designated SFHA.

3. The proposed development does not increase existing peak flows downstream of the development.

4. The site treatment basins will be constructed per the improvement plans prepared by Northgate Environmental included with this drainage study.

X. REFERENCES

1. L.R. Nelson Consulting Engineers, *Conceptual Drainage Study for Gate 2* and Addendum#1. August 2007 and February 2008.

2. Post, Buckley, Schuh & Jernigan Inc., Louis Berger Group, and Parsons Brinckerhoff, *Clark County Regional Flood Control District - The 2008 Las Vegas Valley Master Plan Update, September* 2008.

3. Clark County Regional Flood Control District *Hydrologic Criteria and Drainage Design Manual*, updated August 1999.

4. U.S. Army Corps of Engineers, *HEC-1 Flood Hydrograph Package,* June 1998.

5. U.S. Department of Agriculture, Soil Conservation Service. SCS Soil Survey of Las Vegas Valley Area. July 1985.

6. PBS&J Engineering, Technical Drainage Study for Eastside Landfill and Addendum#1. October 2006 and November 2006

7. PBS&J Engineering, Technical Drainage Study for B & E Auto and Conceptual Drainage Study for the Remainder of BMI Gate 5 and Northgate and Addendum #1. May 2002 and July 2002.

8. Carter Burgess Inc., Technical Drainage Study for Lake Mead Crossing and All Addenda. October 2006, November 2006, December 2006, January 2007, April 2007, June 2007, and July 2007.

EXISTING CONDITIONS HEC-1 MODEL SUMMARY			
SUBBASIN OR CP	BASIN AREA (AC)	100 YR (cfs)	10 YR (cfs)
EX1	41.35	62	24
EX2	83.23	180	93
EX3	182.77	339	172
EX4	109.85	231	119
EX5	86.12	154	75
CP1	N/A	858	430
EX6	14.56	32	15
EX7	9.97	23	11
CP2	N/A	54	25
CP2*	N/A	80	25
EX8	124.27	145	55
CP3	N/A	1013	492
CP3*	N/A	1039	492

*ADD 26 CFS TO 100 YEAR FLOW AT CP2 AND CP3 FOR OVERFLOW FROM EXISTING EQUALIZER BASIN - EASTSIDE LANDFILL

N

200' 0' 200' 400'

SCALE: 1" = 400'

LEGEND

- EXISTING FLOW DIRECTION
- EXISTING SUBBASIN BOUNDARY
- EXISTING STORM DRAIN PIPE
- EX1 EXISTING DRAINAGE SUBBASIN
- CP1 CONCENTRATION POINT

TRONOX SOIL REMEDIATION
NORTHGATE ENVIRONMENTAL

FIGURE 5
EXISTING CONDITIONS MAP

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WARM SPRINGS ROAD
EX 10X5 RCB
CP3
WARM SPRINGS ROAD
PRO8
U.S HWY NO 93-95-466
BOULDER HWY
PABCO RD
EX DET BASIN
PRO7
TB#3
CP5
TB#1
EQUALIZER BASIN
26 CFS TO NORTH
EASTSIDE LANDFILL SITE
EX GROUNDWATER SLURRY WALL
PRO5
TB#2
PRO3
PRO2
AVE F
PRO4
AVE G
ELEVENTH ST
AVE H
AVE J
AVE K
AVE L
EIGHT ST
SIXTH ST
FOURTH ST
LAKE MEAD CROSSING SITE
83 CFS IN CHANNEL
REFERENCED FROM LM CROSSING STUDY
EX 2:36-IN SD
LAKE MEAD DR
ATLANTIC AVE
PRO1
VICTORY RD
VAN WAGENEN ST
BASIC RD
U.S 95 FREEWAY
CASA DEL FUEGO
LAS PALMAS ENTRADA
FIESTA HENDERSON BLVD
INDUSTRIAL PARK RD

ULTIMATE CONDITIONS HEC-1 MODEL SUMMARY			
SUBBASIN OR CP	BASIN AREA (AC)	100 YR (cfs)	10 YR (cfs)
PRO1	41.35	96	49
PRO3	181.41	351	183
PRO2	83.29	188	100
PRO5	79.39	175	93
CP5	N/A	362	192
PRO4	132.45	203	106
PRO7	9.97	29	15
CP2*	N/A	55	15
PRO8	124.27	220	108
CP3	N/A	233	115
CP3*	N/A	259	115

*ADD 26 CFS TO 100 YEAR FLOW AT CP2 AND CP3 FOR OVERFLOW FROM EXISTING EQUALIZER BASIN - EASTSIDE LANDFILL

N

200' 0' 200' 400'

SCALE: 1" = 400'

LEGEND

- PROPOSED FLOW DIRECTION
- PROPOSED SUBBASIN BOUNDARY
- EXISTING STORM DRAIN PIPE
- PRO1 PROPOSED DRAINAGE SUBBASIN
- CP1 CONCENTRATION POINT

TRONOX SOIL REMEDIATION
NORTHGATE ENVIRONMENTAL

FIGURE 6
PROPOSED CONDITIONS MAP

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APPENDIX A – HYDROLOGIC CALCS

Precipitation References

Soils Maps

Soils References

Curve Number References

Existing Conditions

- Curve Number Calculations
- Standard Form 4
- HEC-1 Model

Ultimate Conditions

- Curve Number Calculations
- Standard Form 4
- HEC-1 Model

PRECIPITATION ADJUSTMENT RATIOS

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

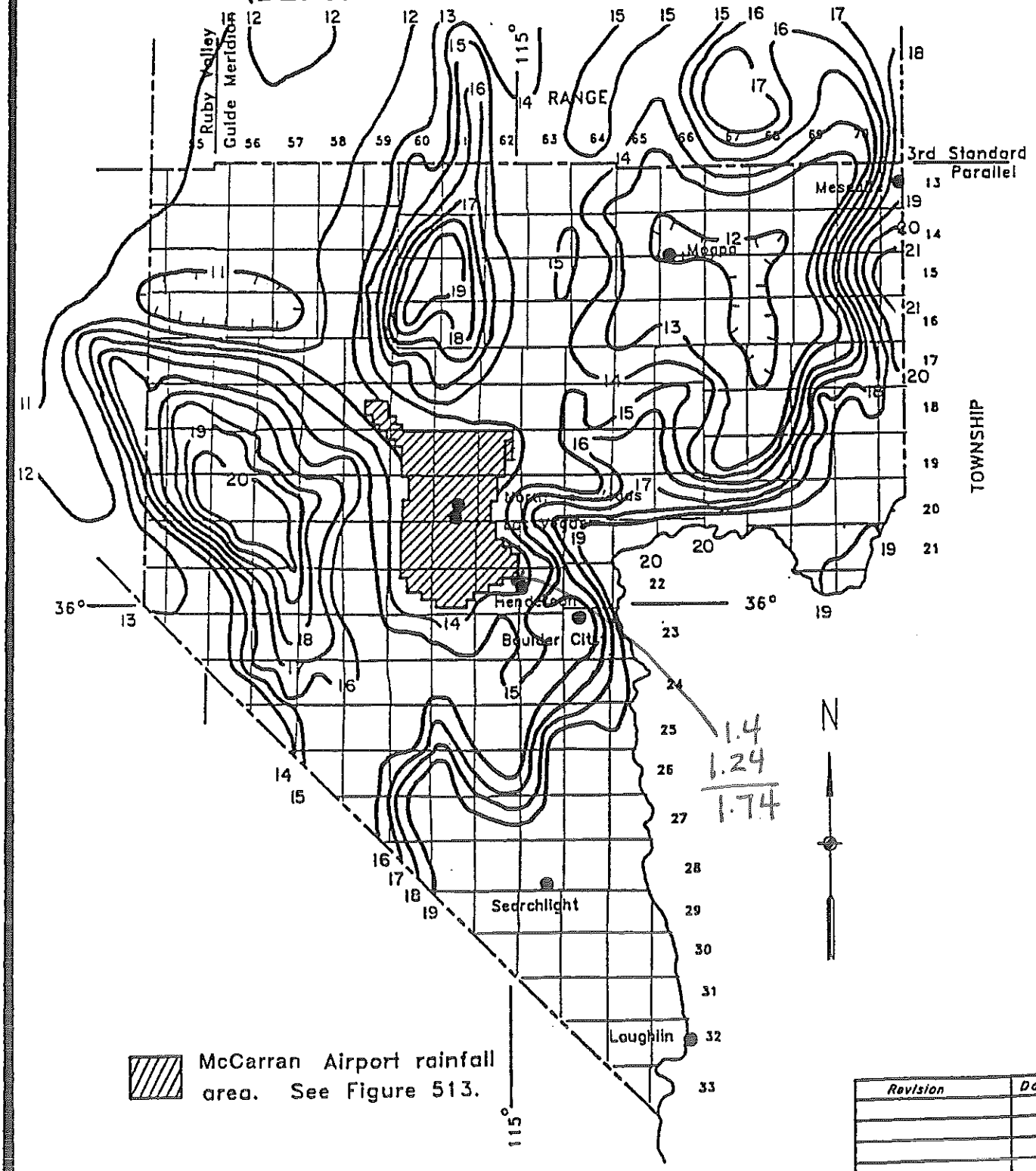
NOTE: 1. Multiply the values obtained from the NOAA Atlas 2 by the above ratios to obtain the adjusted precipitation values.

2. NOAA Atlas 2 values for use with TR-55 shall not be adjusted by the above ratios.

3. Tables 505 and 506 require no adjustments.

Revision	Date

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



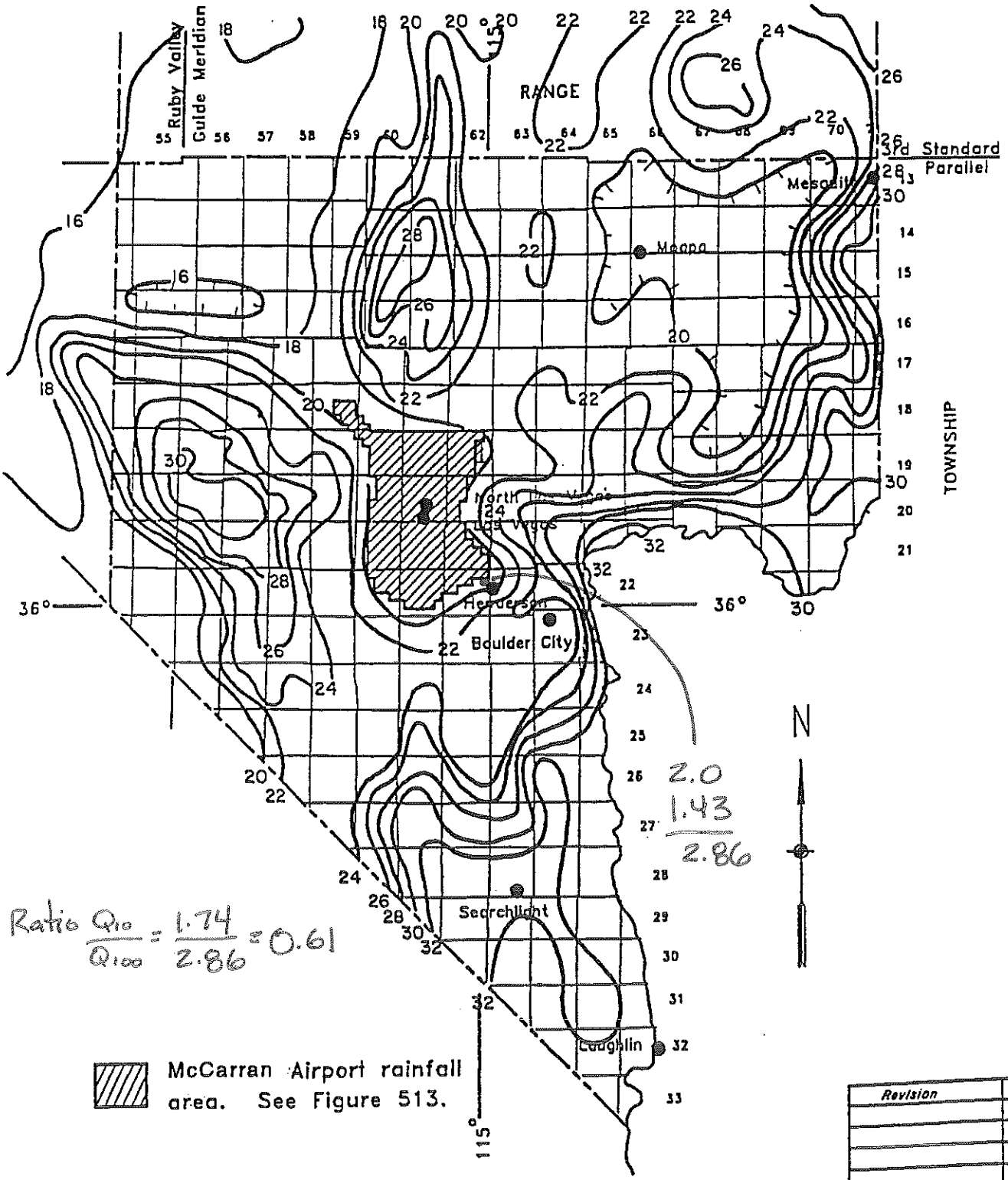
Revision	Date

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)



2.0
1.43
2.86

Ratio $\frac{Q_{10}}{Q_{100}} = \frac{1.74}{2.86} = 0.61$

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.

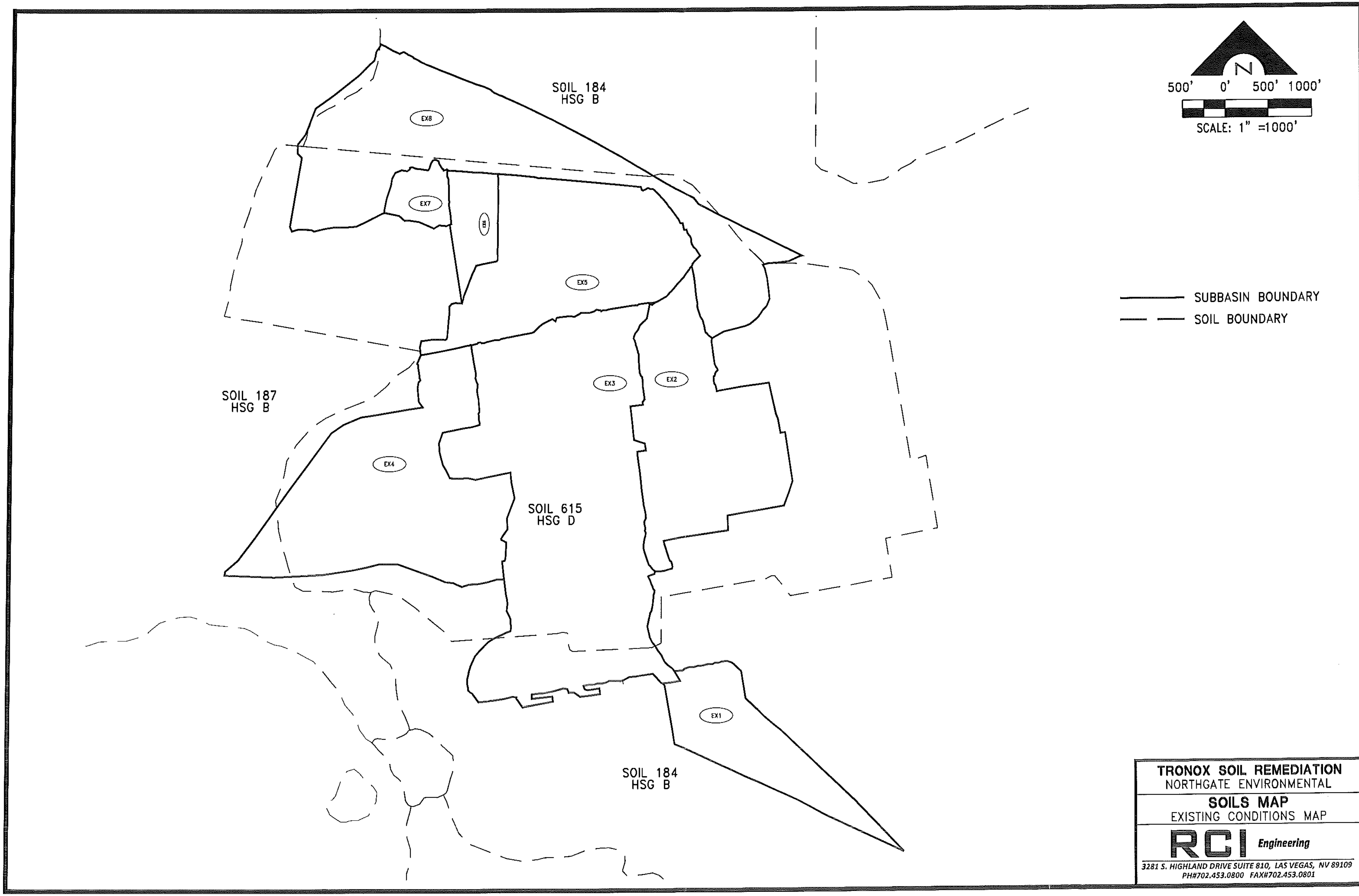
2. Consult with the local entity and/or the CCRFCD for guidance in using the Depth-Area Reduction Factors for drainage areas greater than 200 square miles.

Revision	Date

DARF INTERPOLATER

		DARF	From Table 502 Design Manual
SQ MILES	0.5	0.98	
	1	0.97	

SQ MILES AT CP	0.72	0.95
RATE OF CHANGE	-0.02	-0.02
CHANGE	0.22	0.45
DARF AT CP	**0.976**	**0.971**


SOIL 184
HSG B
500' 0' 500' 1000'
SCALE: 1" =1000'
N
EX8
EX7
EX6
EX5
EX3
EX2
EX4
EX1
SOIL 187
HSG B
SOIL 615
HSG D
SOIL 184
HSG B
SUBBASIN BOUNDARY
SOIL BOUNDARY
TRONOX SOIL REMEDIATION
NORTHGATE ENVIRONMENTAL
SOILS MAP
EXISTING CONDITIONS MAP
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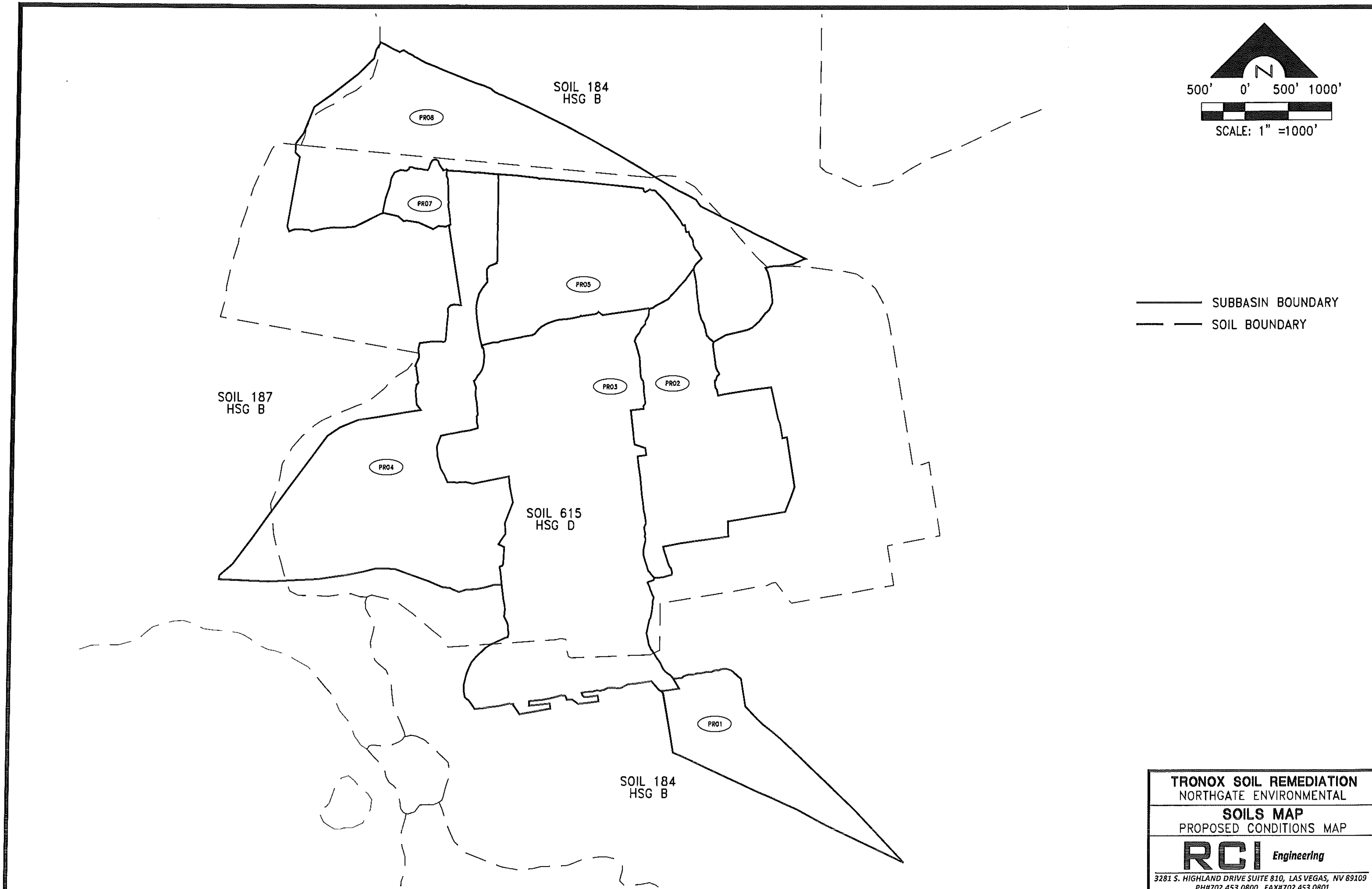


TRONOX SOIL REMEDIATION
NORTHGATE ENVIRONMENTAL

SOILS MAP
PROPOSED CONDITIONS MAP

RCI Engineering

3281 S. HIGHLAND DRIVE SUITE 810, LAS VEGAS, NV 89109
PH#702.453.0800 FAX#702.453.0801

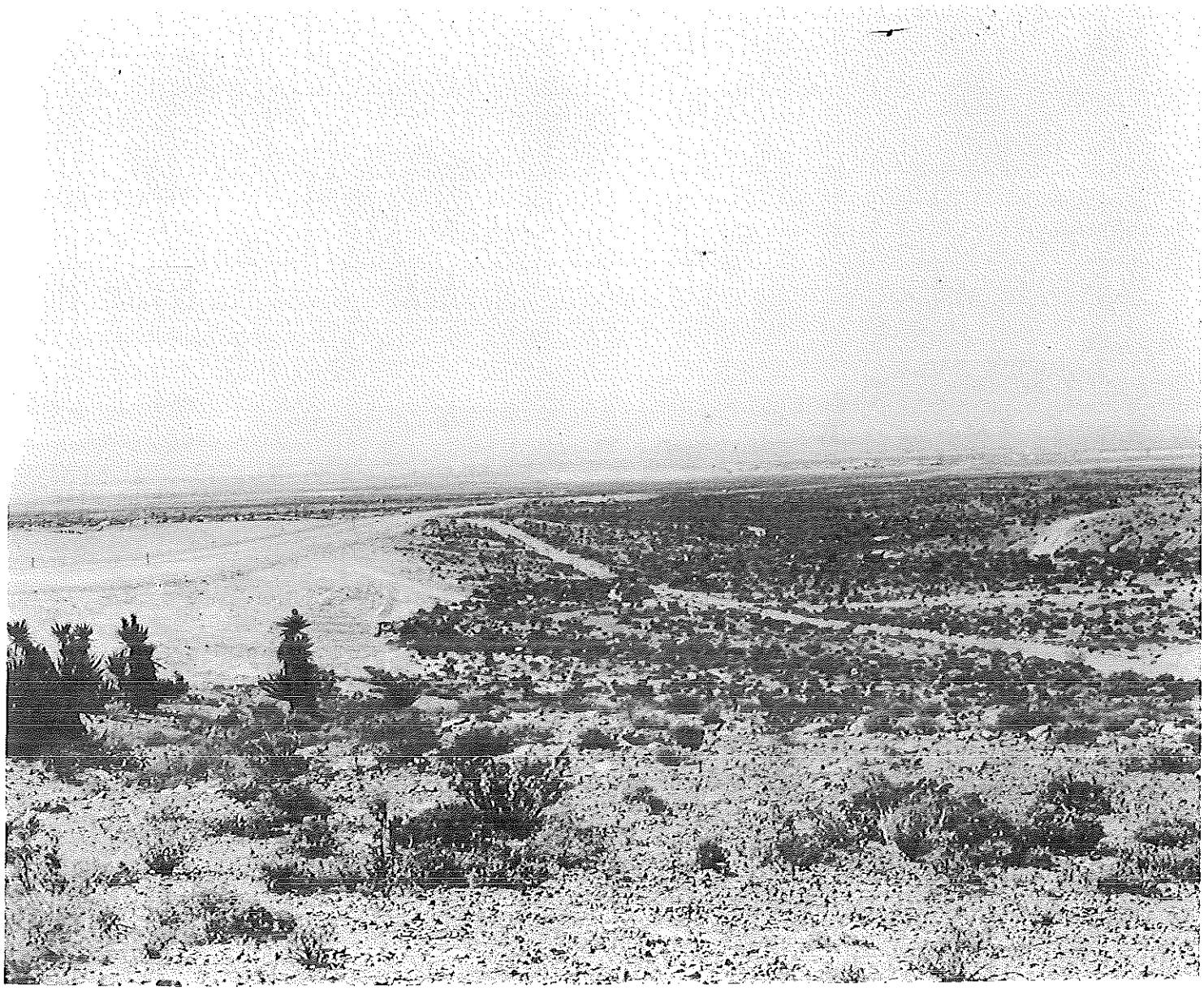
United States Department of Agriculture

Soil Conservation Service

In cooperation with United States Department of the Interior, Bureau of Land Management, and University of Nevada Agricultural Experiment Station

Soil Survey of Las Vegas Valley Area Nevada

Part of Clark County



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

This unit is well suited to the construction of dwellings.

Unless the density of housing is too high, septic tank absorption fields normally function well on this unit.

Roads can easily be constructed and maintained on this unit.

The main limitations for lawns and landscaping are the cobbles and pebbles throughout the soil. Topsoil is needed for best results when landscaping, particularly in areas used for lawns. 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 2.

184—Caliza 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, the surface layer is light brown very gravelly sandy loam about 3 inches thick. The upper 13 inches of the underlying material is light brown very gravelly sandy loam, and the lower part to a depth of 60 inches or more is light brown, stratified very gravelly coarse sand to very gravelly loamy sand.

Included in this unit is about 5 percent Aztec soils on erosional fan remnants. The percentage varies from one area to another.

Permeability of the Caliza soil is moderately rapid. Available water capacity is very 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 moderate. 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 limitation for construction of dwellings is the hazard of flooding.

Dikes and channels that have outlets for floodwater can be used to protect onsite sewage disposal systems from flooding.

Channeling and deposition can be minimized and maintenance costs reduced by protecting roads from flooding.

The main limitation for lawns and landscaping is the content of pebbles in the soil. Topsoil is needed for best results when landscaping, particularly in areas used for lawns. 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 IVs, irrigated, and VIIs, nonirrigated. It is in horticultural group 2.

187—Caliza extremely cobbly fine sandy loam, 2 to 8 percent slopes. This very deep, well drained soil is on inset fan remnants. It formed in alluvium derived from various kinds of rock.

Typically, about 85 percent of the surface is covered with a desert pavement of cobbles, stones, and pebbles. The surface layer is a light brown extremely cobbly fine sandy loam about 2 inches thick. The upper 12 inches of the underlying material is light brown and pink very gravelly sandy loam, and the lower part to a depth of 60 inches or more is light brown and pink, stratified material that averages very gravelly loamy coarse sand. In some areas of similar included soils, the surface layer is extremely stony fine sandy loam.

Included in this unit are about 5 percent Arizo soils, flooded, in channels; 5 percent Pittman soils on erosional fan remnants; and 5 percent Aztec 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 this Caliza soil is moderately rapid. 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 moderate if the surface is disturbed.

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

This unit is well suited to the construction of dwellings.

Unless the density of housing is too high, septic tank absorption fields normally function well on this unit.

Roads can easily be constructed and maintained on this unit.

The main limitation for lawns and landscaping is the stones, cobbles, and pebbles on the surface and throughout the soil. Topsoil is needed for best results when landscaping, particularly in areas used for lawns. 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.

Intermittent streams form the drainageways in this unit. These drainageways are subject to rare or occasional periods of high-velocity flooding. Care should be taken during urbanization to accommodate the runoff from the drainageways. If drains become plugged during a major flood, accelerated erosion and damage to roads, buildings, and other structures can occur.

This map unit is in capability subclass VIIs, nonirrigated, and in horticultural group 2.

190—Dalian very gravelly fine sandy loam, 2 to 4 percent slopes. This very deep, well drained soil is on fan skirts. It formed in alluvium derived dominantly from limestone and dolomite.

Typically, 65 percent of the surface is covered with a weakly developed desert pavement of pebbles. The surface layer is light yellowish brown very gravelly fine

The main limitations for lawns and landscaping are the presence of pebbles throughout the soil and the very low available water capacity of the Weiser soil. Topsoil is needed for best results when landscaping, particularly in areas used for lawns. Frequent irrigation of lawns, gardens, and most other plantings is needed because of the limited available water capacity of the soil. Lawn grasses, shrubs, and trees that are not sensitive to lime-induced chlorosis are well suited to use in landscaping. Annual applications of iron chelates reduce the effects of chlorosis.

Intermittent streams form the drainageways in this unit. These drainageways are subject to rare or occasional periods of high-velocity flooding. Care should be taken during urbanization to accommodate the runoff from the drainageways. If drains become plugged during a major flood, accelerated erosion and damage to roads, buildings, and other structures can occur.

This map unit is in capability subclasses IVs, irrigated, and VIIs, nonirrigated. It is in horticultural group 2.

545—Weiser-Goodsprings complex, 2 to 4 percent slopes. This map unit is on erosional fan remnants.

This unit is 60 percent Weiser extremely gravelly fine sandy loam, 2 to 4 percent slopes, and 25 percent Goodsprings very gravelly fine sandy loam, 2 to 4 percent slopes. The Weiser and Goodsprings soils are on summits and shoulders of the fan remnants. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are about 5 percent Las Vegas soils and 10 percent Skyhaven soils on relict alluvial flats. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Weiser soil is very deep and well drained. It formed in alluvium derived dominantly from limestone and dolomite. Typically, 90 percent of the surface layer is covered with a desert pavement of pebbles. There is a dark desert varnish on the exposed surfaces of the rock fragments. The surface layer is light yellowish brown extremely gravelly fine sandy loam about 1 inch thick. The underlying material to a depth of 63 inches is light brown extremely gravelly fine sandy loam and very gravelly fine sandy loam, averaging extremely gravelly fine sandy loam.

Permeability of the Weiser soil is moderately rapid. Available water capacity is very 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 moderate if the desert pavement is disturbed.

The Goodsprings soil is shallow and well drained. It formed in alluvium derived from various kinds of rock. Typically, 90 percent of the surface is covered with a desert pavement of pebbles. The surface layer is light brown very gravelly fine sandy loam about 5 inches thick. The upper 10 inches of the underlying material is pink gravelly fine sandy loam, the next 37 inches is pinkish white, strongly lime-cemented hardpan, and the lower part to a depth of 60 inches or more is pink extremely gravelly loamy fine sand. Depth to the hardpan ranges from 9 to 20 inches.

Permeability of the Goodsprings soil is moderate above the hardpan. Available water capacity is very low. Effective rooting depth is 9 to 20 inches. Runoff is medium, and the hazard of water erosion is slight. The hazard of soil blowing is high if the desert pavement 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 hardpan in areas of the Goodsprings soil. Roads should be designed to minimize cuts. Heavy equipment is needed for excavation.

This map unit is in capability subclass VIIs, nonirrigated. The Weiser soil is in horticultural group 2, and the Goodsprings soil is in horticultural group 6.

600—Slickens. Slickens consists of accumulations of fine-textured material such as that separated in ore-mill operations. It is largely freshly ground rock that commonly has undergone chemical treatment during the milling process. Slickens is commonly confined in specially constructed basins.

This map unit is in capability subclass VIIIs, nonirrigated.

605—Dumps. Dumps consists of areas of smoothed or uneven accumulations of waste rock and general refuse.

This map unit is in capability subclass VIIIs, nonirrigated.

610—Pits, gravel. Pits, gravel, consists of open excavations from which soil material and gravel have been removed, exposing rock, a hardpan, or other material.

This map unit is in capability subclass VIIIs, nonirrigated.

615—Urban land. Urban land consists of areas covered by asphalt, concrete, and buildings or other urban structures.

This map unit is in capability subclass VIIIs, nonirrigated.

630—Badland. Badland is moderately steep to very steep barren land dissected by many intermittent drainage channels that have cut into soft geologic material. The areas ordinarily are not stony. Local relief generally ranges from 25 to 100 feet. Potential runoff is very high, and erosion is active. Some small included areas of identifiable soils support vegetation.

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			
182*:											
Caliza	B	None	---	>6.0	---	>60	---	---	---	High	Low.
Pittman	C	None	---	>6.0	---	>60	---	20-30	Thick	High	Low.
Arizo	A	Occasional	Mar-Sep	>6.0	---	>60	---	---	---	High	Low.
183--- Caliza	B	None	---	>6.0	---	>60	---	---	---	High	Low.
184--- Caliza	B	Rare	---	>6.0	---	>60	---	---	---	High	Low.
187--- Caliza	B	None	---	>6.0	---	>60	---	---	---	High	Low.
190--- Dalian	B	None	---	>6.0	---	>60	---	---	---	High	Low.
191--- Dalian	B	Rare	---	>6.0	---	>60	---	---	---	High	Low.
192*:											
Dalian	B	Rare	---	>6.0	---	>60	---	---	---	High	Low.
McCullough	B	Rare	---	>6.0	---	>60	---	---	---	High	Low.
200--- Glencarb	B	Rare	---	>6.0	---	>60	---	---	---	High	Moderate.
206--- Glencarb	C	Occasional	Jul-Sep	3.0-5.0	Jul-Jun	>60	---	---	---	High	High.
222--- Glencarb	C	Rare	---	3.0-5.0	Jul-Jun	>60	---	---	---	High	High.
236--- Glencarb	B	Rare	---	>6.0	---	>60	---	---	---	High	High.
237--- Glencarb	B	Rare	---	>6.0	---	>60	---	40-60	Thick	High	Low.
240--- Goodsprings	D	None	---	>6.0	---	>60	---	9-20	Thick	High	Low.
252, 255--- Grapevine	B	Rare	---	>6.0	---	>60	---	---	---	High	High.
260--- Jean	A	Rare	---	>6.0	---	>60	---	---	---	High	Low.
262*:											
Jean	A	Rare	---	>6.0	---	>60	---	---	---	High	Low.
Jean	A	Occasional	Jun-Sep	>6.0	---	>60	---	---	---	High	Low.
Goodsprings	D	Rare	---	>6.0	---	>60	---	9-20	Thick	High	Low.
263*:											
Jean	A	Rare	---	>6.0	---	>60	---	---	---	High	Low.
Jean	A	Occasional	Jun-Sep	>6.0	---	>60	---	---	---	High	Low.
264--- Jean	A	Rare	---	>6.0	---	>60	---	---	---	High	Low.

See footnote at end of table.

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			
419*:											
Aztec	B	None	---	>6.0	---	>60	---	---	---	High	High.
Bracken	B	None	---	>6.0	---	40-60	Soft	---	---	High	High.
430	B	None	---	>6.0	---	>60	---	---	---	High	Low.
Knob Hill											
440	B	None	---	>6.0	---	40-60	Hard	---	---	High	Low.
Nickel											
450	D	None	---	>6.0	---	>60	---	5-18	Thick	High	High.
Cave Variant											
481, 484	D	None	---	>6.0	---	8-20	Hard	---	---	High	Low.
Hobog											
500*											
Canutio	B	None	---	>6.0	---	40-60	Hard	---	---	High	Low.
Akela	D	None	---	>6.0	---	10-20	Hard	---	---	High	Low.
501	B	None	---	>6.0	---	>60	---	---	---	High	Low.
Canutio											
502*:											
Canutio	B	None	---	>6.0	---	>60	---	---	---	High	Low.
Cave	D	None	---	>6.0	---	>60	---	4-20	Thick	High	Low.
505*											
Canutio	B	None	---	>6.0	---	40-60	Hard	---	---	High	Low.
Akela	D	None	---	>6.0	---	10-20	Hard	---	---	High	Low.
510*:											
Akela	D	None	---	>6.0	---	10-20	Hard	---	---	High	Low.
Rock outcrop.											
540	B	None	---	>6.0	---	>60	---	---	---	High	Low.
Weiser											
542*:											
Weiser	B	None	---	>6.0	---	>60	---	---	---	High	Low.
Aztec	B	None	---	>6.0	---	>60	---	---	---	High	High.
545*:											
Weiser	B	None	---	>6.0	---	>60	---	---	---	High	Low.
Goodsprings	D	None	---	>6.0	---	>60	---	9-20	Thick	High	Low.
600*.											
Slickens											
605*.											
Dumps											
610*.											
Pits											
615*.											
Urban land											
630*.											
Badlands											
635*, 640*.											
Rock outcrop											
645*.											
Pits											

* See description of the map unit for composition and behavior characteristics of the map unit.

RUNOFF CURVE NUMBERS
(URBAN AREAS[1])

Cover description		Curve numbers for hydrologic soil group—			
Cover type and hydrologic condition	Average percent impervious area[2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.)[3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only)[4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					

See Table 602A

Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)[5]		77	86	91	94

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

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

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

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

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

Revision	Date

RUNOFF CURVE NUMBERS
(SEMIARID RANGELANDS[1])

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

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

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

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

Revision	Date

CN CALCULATIONS - EXISTING CONDITIONS

Basin	% SOIL TYPE	HYDRO	CN- DESERT SHRUB POOR CONDITION %		CN- COMMERCIAL %		CN- INDUSTRIAL %		WEIGHTED CN
EX1		A		63		89		81	0.0
	100	B	61	77	39	92		88	82.9
		C		85		94		91	0.0
		D		88		95		93	0.0
									82.9

Basin	% SOIL TYPE	HYDRO							WEIGHTED CN
EX2		A		63		89		81	0.0
		B		77		92		88	0.0
		C		85		94		91	0.0
	100	D	25	88		95	75	93	91.8
									91.8

Basin	% SOIL TYPE	HYDRO							WEIGHTED CN
EX3		A		63		89		81	0.0
	16	B	27	77		92	73	88	13.6
		C		85		94		91	0.0
	84	D	7	88		95	93	93	77.8
									91.4

Basin	% SOIL TYPE	HYDRO							WEIGHTED CN
EX4		A		63		89		81	0.0
	6	B		77		92	100	88	5.3
		C		85		94		91	0.0
	94	D	13	88		95	87	93	86.8
									92.1

Basin	% SOIL TYPE	HYDRO							WEIGHTED CN
EX5		A		63		89		81	0.0
		B		77		92		88	0.0
		C		85		94		91	0.0
	100	D	63	88		95	37	93	89.9
									89.9

CN CALCULATIONS - EXISTING CONDITIONS

Basin	% SOIL TYPE	HYDRO	CN- DESERT SHRUB POOR CONDITION		CN- COMMERCIAL		CN- INDUSTRIAL		WEIGHTED CN
EX6 AND EX7		A		63		89		81	0.0
		B		77		92		88	0.0
		C		85		94		91	0.0
	100	D	100	88		95		93	88.0
									88.0

Basin	% SOIL TYPE	HYDRO							WEIGHTED CN
EX8		A		63		89		81	0.0
	53	B	100	77		92		88	40.8
		C		85		94		91	0.0
	47	D	100	88		95		93	41.4
									82.2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

TIME OF CONCENTRATION

RCI
ENGINEERING

TRONOX SOIL REMEDIATION
Existing Conditions

BY: CZ
DATE: 9/16/10

SUB-BASIN DATA						INITIAL / OVERLAND TIME (Ti)			TRAVEL TIME (Tt)					Tc	Tc Check	Tlag	REMARKS
DESIG:	DEV./EX. (D or E)	CN	K	AREA Ac	AREA Mi^2	INITIAL LENGTH Feet	SLOPE %	Ti Min	TRAVEL LENGTH Feet	SLOPE %	V1 VELOCITY FPS	V2 VELOCITY FPS	Tt Min	Min	Min	Tlag= 0.6Tc/60 Hours	
(1)			(2)	(3)		(4)	(5)	(6)	(7)	(8)	(9a)	(9b)	(10)	(13)	(14)		
EX1	E	82.9	0.7043	41.35	0.0646	300	1.7	10.4	3232	2.4	2.3	4.6	13.5	23.9	N/A	0.239	
EX2	D	91.8	0.8218	83.23	0.1301	500	2.6	8.1	3758	2.1	2.9	4.4	15.1	23.2	33.7	0.232	
EX3	D	91.4	0.8165	182.77	0.2856	300	4.7	5.3	6031	1.6	2.6	3.9	27.0	32.2	45.2	0.322	
EX4	D	92.1	0.8257	109.85	0.1716	300	2.0	6.8	3793	1.3	2.3	3.5	19.0	25.8	32.7	0.258	
EX5	E	89.9	0.7967	86.12	0.1346	286	1.4	8.3	3533	1.0	1.5	3.0	22.3	30.6	N/A	0.306	
EX6	E	88.0	0.7716	14.56	0.0227	293	2.3	7.6	1301	1.5	1.8	3.6	8.3	16.0	N/A	0.160	
EX7	E	88.0	0.7716	9.97	0.0156	500	2.9	9.3	682	2.2	2.2	4.4	4.5	13.8	N/A	0.138	
EX8	E	82.2	0.6950	124.27	0.1942	312	7.1	6.7	5339	1.2	1.6	3.2	30.7	37.4	N/A	0.374	

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 (Developed) = 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
Minimum Tc (EX) = 10 Min per Section 602 Minimum Tc (DEV) = 5 Min per Section 602.1

REFERENCE : **STANDARD FORM 4**

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             JUN   1998                *
*           VERSION 4.1                 *
*                                       *
*  RUN DATE   16SEP10  TIME  16:37:28   *
*                                       *
*****************************************
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```
*****************************************
*                                       *
*    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 26 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


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

              *DIAGRAM
    1         ID
    2         ID    TRONOX SITE
    3         ID    EXISTING CONDITION ANALYSIS
    4         ID
    5         ID
    6         ID
    7         ID    INPUT FILE = EX.DAT
    8         ID    DESIGN STORM = 100-YEAR 6-HR STORM
    9         ID    STORM DISTRIBUTION = SDN #3
   10         ID
   11         ID
   12         ID     JR CARD RATIOS REPRESENT 100-YEAR (1.0) AND 10-YEAR (0.61)
   13         ID     DARF  0.72 SQ MILES = 0.976  (100-YEAR) 0.595  (10-YEAR)
   14         ID           0.95 SQ MILES = 0.971  (100-YEAR) 0.592  (10-YEAR)
   15         ID
   16         IT       5       0       0     300
   17         IO       5       0       0
   18         IN       5       0       0
   19         JR    PREC     1.0   0.976   0.971    0.61   0.595   0.592
              *
   20         KK     EX1
   21         KM   THIS BASIN IS SOUTH OF LAKE MEAD AND DRAINS INTO THE LAKE MEAD CHANNEL
   22         KM   THE BASIN WAS ANALYZED TO DETERMINE FLOW CAPACITY OF THE CHANNEL AND
   23         KM   EXISTING STORM DRAIN CROSSINGS
   24         BA   .0646
   25         PB    2.86
   26         PC       0    0.02   0.057    0.07   0.087   0.108   0.124    0.13    0.13    0.13
   27         PC    0.13    0.13    0.13   0.133    0.14   0.142   0.148   0.158   0.172   0.181
   28         PC    0.19   0.197   0.199     0.2   0.201   0.204   0.214   0.229   0.241   0.249
   29         PC   0.251   0.256    0.27   0.278   0.281   0.283   0.295   0.322   0.352   0.409
   30         PC   0.499    0.59    0.71   0.744   0.781   0.812   0.819   0.835   0.851   0.856
   31         PC    0.86   0.868   0.876   0.888    0.91   0.926   0.937    0.95    0.97   0.976
   32         PC   0.982   0.985   0.987   0.989    0.99   0.993   0.993   0.994   0.995   0.998
   33         PC   0.998   0.999       1
   34         LS       0    82.9
   35         UD   0.239
              *
   36         KK     EX2
   37         KM   DEVELOPED AS INDUSTRIAL WITH PORTIONS OF UNDEVELOPED DESERT SHRUB
   38         BA   .1301
   39         LS       0    91.8
   40         UD   0.232
              *
   41         KK     EX3
   42         KM   DEVELOPED AS INDUSTRIAL WITH PORTIONS OF UNDEVELOPED DESERT SHRUB
   43         BA   .2856
   44         LS       0    91.4
   45         UD   0.322
              *
```



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

   46         KK     EX4
   47         KM   DEVELOPED AS INDUSTRIAL WITH PORTIONS OF UNDEVELOPED DESERT SHRUB
   48         BA   .1716
   49         LS       0    92.1
   50         UD   0.258
              *
   51         KK     EX5
```

```
52          KM   EXISTING DESERT SHRUB WITH PORTIONS OF DEVELOPED INDUSTRIAL
53          BA   .1346
54          LS      0    89.9
55          UD   0.306
            *

56          KK     CP1
57          KM   COMBINE SUBBASINS EX2, EX3, EX4, AND EX5
58          HC       4
            *

59          KK     EX6
60          KM   EXISTING DESERT SHRUB
61          BA   .0227
62          LS      0      88
63          UD   0.160
            *

64          KK     EX7
65          KM   EXISTING DESERT SHRUB
66          BA   .0156
67          LS      0      88
68          UD   0.138
            *

69          KK     CP2
70          KM   COMBINE EX6 AND EX7
71          HC       2
            *

72          KK     EX8
73          KM   EXISTING DESERT SHRUB
74          BA   .1942
75          LS      0    82.2
76          UD   0.374
            *

77          KK     CP3
78          KM    COMBINE CP1 AND CP2 AT EXISTING CULVERT CROSSING WARM SPRINGS ROAD
79          HC       3
            *
80          ZZ
1
              SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

    20         EX1
                 .
                 .
    36           .          EX2
                 .            .
                 .            .
    41           .            .          EX3
                 .            .            .
                 .            .            .
    46           .            .            .          EX4
                 .            .            .            .
                 .            .            .            .
    51           .            .            .            .          EX5
                 .            .            .            .            .
                 .            .            .            .            .
    56           .          CP1.....................................
                 .            .
                 .            .
    59           .            .          EX6
                 .            .            .
                 .            .            .
    64           .            .            .          EX7
                 .            .            .            .
                 .            .            .            .
    69           .            .          CP2.............
                 .            .            .
                 .            .            .
    72           .            .            .          EX8
                 .            .            .            .
                 .            .            .            .
    77           .          CP3.........................

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              JUN  1998                *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   16SEP10  TIME  16:37:28   *
*                                       *
*****************************************

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

TRONOX SITE
EXISTING CONDITION ANALYSIS


INPUT FILE = EX.DAT
DESIGN STORM = 100-YEAR 6-HR STORM
```

STORM DISTRIBUTION = SDN #3

JR CARD RATIOS REPRESENT 100-YEAR (1.0) AND 10-YEAR (0.61)
DARF 0.72 SQ MILES = 0.976 (100-YEAR) 0.595 (10-YEAR)
0.95 SQ MILES = 0.971 (100-YEAR) 0.592 (10-YEAR)

```
    17 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       .98       .97       .61       .60       .59
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 .98	RATIO 3 .97	RATIO 4 .61	RATIO 5 .60	RATIO 6 .59
HYDROGRAPH AT										
+	EX1	.06	1	FLOW	62.	59.	59.	24.	23.	22.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT										
+	EX2	.13	1	FLOW	180.	174.	173.	93.	89.	89.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT										
+	EX3	.29	1	FLOW	339.	329.	327.	172.	166.	164.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75
HYDROGRAPH AT										
+	EX4	.17	1	FLOW	231.	224.	223.	119.	115.	114.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT										
+	EX5	.13	1	FLOW	154.	150.	149.	75.	72.	72.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75
4 COMBINED AT										
+	CP1	.72	1	FLOW	886.	858.	853.	446.	430.	427.
				TIME	3.67	3.67	3.67	3.75	3.75	3.75
HYDROGRAPH AT										
+	EX6	.02	1	FLOW	32.	31.	30.	15.	14.	14.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT										
+	EX7	.02	1	FLOW	23.	22.	22.	11.	10.	10.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT										
+	CP2	.04	1	FLOW	54.	52.	52.	25.	24.	24.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT										
+	EX8	.19	1	FLOW	145.	139.	138.	55.	52.	52.
				TIME	3.83	3.83	3.83	3.83	3.83	3.83
3 COMBINED AT										
+	CP3	.95	1	FLOW	1054.	1020.	1013.	515.	496.	492.
				TIME	3.67	3.67	3.67	3.75	3.75	3.75

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

CN CALCULATIONS - PROPOSED CONDITIONS

			CN-COMMERCIAL		CN-INDUSTRIAL		
Basin	% SOIL TYPE	HYDRO	%		%		WEIGHTED CN
PRO1		A		89		81	0.0
	100	B	100	92		88	92.0
		C		94		91	0.0
		D		95		93	0.0
							92.0
Basin	% SOIL TYPE	HYDRO					WEIGHTED CN
PRO2, PRO5, PRO7		A		89		81	0.0
		B		92		88	0.0
		C		94		91	0.0
	100	D		95	100	93	93.0
							93.0
Basin	% SOIL TYPE	HYDRO					WEIGHTED CN
PRO3		A		89		81	0.0
	15	B		92	100	88	13.2
		C		94		91	0.0
	85	D		95	100	93	79.1
							92.3
Basin	% SOIL TYPE	HYDRO					WEIGHTED CN
PRO4		A		89		81	0.0
	5	B		92	100	88	4.4
		C		94		91	0.0
	95	D		95	100	93	88.4
							92.8
Basin	% SOIL TYPE	HYDRO					WEIGHTED CN
PRO8		A		89		81	0.0
	53	B		92	100	88	46.6
		C		94		91	0.0
	47	D		95	100	93	43.7
							90.4

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

TIME OF CONCENTRATION

RCI
ENGINEERING

TRONOX SOIL REMEDIATION
Proposed Conditions

BY: CZ
DATE: 9/16/10

SUB-BASIN DATA						INITIAL / OVERLAND TIME (Ti)			TRAVEL TIME (Tt)					Tc	Tc Check	Tlag	REMARKS
DESIG:	DEV./EX. (D or E)	CN	K	AREA Ac	AREA Mi^2	INITIAL LENGTH Feet	SLOPE %	Ti Min	TRAVEL LENGTH Feet	SLOPE %	V1 VELOCITY FPS	V2 VELOCITY FPS	Tt Min	Min	Min	Tlag= 0.6Tc/60 Hours	
(1)			(2)	(3)		(4)	(5)	(6)	(7)	(8)	(9a)	(9b)	(10)	(13)	(14)		
PRO1	D	92.0	0.8244	41.35	0.0646	300	1.7	7.2	3232	2.4	3.2	4.8	12.2	19.4	29.6	**0.194**	
PRO2	D	93.0	0.8376	83.29	0.1301	500	2.6	7.7	3758	2.1	2.9	4.4	15.1	22.8	33.7	**0.228**	
PRO3	D	92.3	0.8284	181.41	0.2835	300	4.7	5.1	5980	1.7	2.6	4.0	26.3	31.3	44.9	**0.313**	
PRO4	D	92.8	0.8350	132.45	0.2069	300	2.0	6.6	8101	1.1	2.1	3.2	44.2	50.7	56.7	**0.507**	
PRO5	D	93.0	0.8376	79.39	0.1240	500	1.8	8.7	2690	1.0	2.0	3.1	16.0	24.7	27.7	**0.247**	
PRO7	D	93.0	0.8376	9.97	0.0156	300	4.8	4.8	881	1.6	2.6	3.9	4.8	9.7	16.6	**0.097**	
PRO8	D	90.4	0.8033	124.27	0.1942	312	7.1	4.9	5339	1.2	2.2	3.3	28.3	33.2	41.4	**0.332**	

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 (Developed) = 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
Minimum Tc (EX) = 10 Min per Section 602
Minimum Tc (DEV) = 5 Min per Section 602.1

REFERENCE :

STANDARD FORM 4

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             JUN  1998                 *
*          VERSION 4.1                  *
*                                       *
*  RUN DATE   05OCT10  TIME  11:27:35   *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*   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
    1         ID
    2         ID    TRONOX SITE
    3         ID    PROPOSED CONDITION ANALYSIS
    4         ID
    5         ID
    6         ID
    7         ID    INPUT FILE = PRO.DAT
    8         ID    DESIGN STORM = 100-YEAR 6-HR STORM
    9         ID    STORM DISTRIBUTION = SDN #3
   10         ID
   11         ID
   12         ID     JR CARD RATIOS REPRESENT 100-YEAR (1.0) AND 10-YEAR (0.61)
   13         ID
   14         ID
   15         IT       5       0       0     300
   16         IO       5       0       0
   17         IN       5       0       0
   18         JR    PREC     1.0    0.61
              *

   19         KK    PRO1
   20         KM   THIS BASIN IS SOUTH OF LAKE MEAD AND DRAINS INTO THE LAKE MEAD CHANNEL
   21         KM   THE BASIN WAS ANALYZED TO DETERMINE FLOW CAPACITY OF THE CHANNEL AND
   22         KM   EXISTING STORM DRAIN CROSSINGS
   23         BA   .0646
   24         PB    2.86
   25         PC       0    0.02   0.057    0.07   0.087   0.108   0.124    0.13    0.13    0.13
   26         PC    0.13    0.13    0.13   0.133    0.14   0.142   0.148   0.158   0.172   0.181
   27         PC    0.19   0.197   0.199     0.2   0.201   0.204   0.214   0.229   0.241   0.249
   28         PC   0.251   0.256    0.27   0.278   0.281   0.283   0.295   0.322   0.352   0.409
   29         PC   0.499    0.59    0.71   0.744   0.781   0.812   0.819   0.835   0.851   0.856
   30         PC    0.86   0.868   0.876   0.888    0.91   0.926   0.937    0.95    0.97   0.976
   31         PC   0.982   0.985   0.987   0.989    0.99   0.993   0.993   0.994   0.995   0.998
   32         PC   0.998   0.999       1
   33         LS       0      92
   34         UD   0.194
              *

   35         KK    PRO3
   36         KO       1
   37         KM   DEVELOPED INDUSTRIAL SITE
   38         BA   .2835
   39         LS       0    92.3
   40         UD   0.313
              *

   41         KK     TB2
   42         KM   TREATMENT BASIN #2 CENTER OF SITE OLD BETA CHANNEL
   43         RS       1    STOR       0       0
   44         SV     0.6     3.4     7.7    12.2    16.9    21.9    27.2    33.2    39.8    43.3
   45         SE    1759    1760    1761    1762    1763    1764    1765    1766    1767  1767.5
   46         SQ       0       0       0       0       0       0       0       0    2700    4960
              *
```



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

   47         KK    PRO2
   48         KM   DEVELOPED INDUSTRIAL SITE
   49         BA   .1301
   50         LS       0      93
   51         UD   0.228
              *
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```
          52          KK    PRO5
          53          KM   DEVELOPED INDUSTRIAL SITE
          54          BA   .1240
          55          LS      0      93
          56          UD   0.247
                      *

          57          KK     CP5
          58          KO       1
          59          KM   COMBINE PRO2 AND PRO5 AT TREATMENT BASIN #1
          60          HC       2
                      *

          61          KK     TB1
          62          KM   TREATMENT BASIN #1 AT NORTH EAST CORNER OF SITE
          63          RS       1    STOR       0       0
          64          SV       2     7.3    13.2    19.7    26.7    34.2    42.3    51.6    62.6
          65          SE    1735    1736    1737    1738    1739    1740    1741    1742    1743
          66          SQ       0       0       0       0       0       0       0     294     832
                      *

          67          KK    PRO4
          68          KO       1
          69          KM   DEVELOPED INDUSTRIAL SITE
          70          BA   .2069
          71          LS       0    92.8
          72          UD   0.507
                      *

          73          KK     TB3
          74          KM   TREATMENT BASIN #3 AT NORTH WEST CORNER OF SITE
          75          RS       1    STOR       0       0
          76          SV     1.3     2.6     4.0     5.5     7.5    10.0    12.7    15.6    18.7    22.1
          77          SV    25.9    30.0    34.1    38.9    44.2
          78          SE    1726    1727    1728    1729    1730    1731    1732    1733    1734    1735
          79          SE    1736    1737    1738    1739    1740
          80          SQ       0       0       0       0       0       0       0       0       0       0
          81          SQ       0       0       0     576    2036
                      *

          82          KK    PRO7
          83          KM   DEVELOPED INDUSTRIAL SITE
          84          BA   .0156
          85          LS       0      93
          86          UD   0.097
                      *
1                                                  HEC-1 INPUT                                                 PAGE  3

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

          87          KK    PRO8
          88          KM    DEVELOPED INDUSTRIAL SITE
          89          BA   .1942
          90          LS       0    90.4
          91          UD   0.332
                      *

          92          KK     CP3
          93          KM   COMBINE REMAINING FLOW AT EXISTING CULVERT CROSSING WARM SPRINGS
          94          HC       5
                      *
          95          ZZ
1
              SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

    19       PRO1
               .
               .
    35         .       PRO3
               .         V
               .         V
    41         .        TB2
               .         .
               .         .
    47         .         .       PRO2
               .         .         .
               .         .         .
    52         .         .         .       PRO5
               .         .         .         .
               .         .         .         .
    57         .         .        CP5.........
               .         .         V
               .         .         V
    61         .         .        TB1
               .         .         .
               .         .         .
    67         .         .         .       PRO4
               .         .         .         V
               .         .         .         V
    73         .         .         .        TB3
               .         .         .         .
               .         .         .         .
    82         .         .         .         .       PRO7
               .         .         .         .         .
               .         .         .         .         .
    87         .         .         .         .         .       PRO8
               .         .         .         .         .         .
               .         .         .         .         .         .
    92         .        CP3.........................................
```

```
 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*               JUN  1998               *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   05OCT10  TIME  11:27:35   *
*                                       *
*****************************************
```

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

TRONOX SITE
PROPOSED CONDITION ANALYSIS

INPUT FILE = PRO.DAT
DESIGN STORM = 100-YEAR 6-HR STORM
STORM DISTRIBUTION = SDN #3

JR CARD RATIOS REPRESENT 100-YEAR (1.0) AND 10-YEAR (0.61)

```
  16 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       .61
```

*** ***

```
            **************
            *            *
  35 KK     *      PRO3  *
            *            *
            **************

  36 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           1  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                          DEVELOPED INDUSTRIAL SITE

               SUBBASIN RUNOFF DATA

  38 BA          SUBBASIN CHARACTERISTICS
                      TAREA         .28  SUBBASIN AREA

               PRECIPITATION DATA

  24 PB               STORM        2.86  BASIN TOTAL PRECIPITATION

  25 PI             INCREMENTAL PRECIPITATION PATTERN
                      .02       .04       .01       .02       .02       .01       .00       .00       .00
                      .00       .00       .00       .01       .00       .01       .01       .01       .01       .01
                      .01       .00       .00       .00       .00       .01       .02       .01       .01       .00
                      .01       .01       .01       .00       .00       .01       .03       .03       .06       .09
                      .09       .12       .03       .04       .03       .01       .02       .02       .00       .00
                      .01       .01       .01       .02       .02       .01       .01       .02       .01       .01
                      .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                      .00       .00

  39 LS          SCS LOSS RATE
                      STRTL         .17  INITIAL ABSTRACTION
                     CRVNBR       92.30  CURVE NUMBER
                      RTIMP         .00  PERCENT IMPERVIOUS AREA
```

40 UD SCS DIMENSIONLESS UNITGRAPH
TLAG .31 LAG

***

UNIT HYDROGRAPH
21 END-OF-PERIOD ORDINATES

51. 163. 319. 384. 365. 297. 199. 132. 92. 63.
43. 29. 20. 14. 9. 6. 4. 3. 2. 1.
0.

****

HYDROGRAPH AT STATION PRO3

****

DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q
1		0000	1	.00	.00	.00	0.	1		1230	151	.00	.00	.00	0.
1		0005	2	.06	.06	.00	0.	1		1235	152	.00	.00	.00	0.
1		0010	3	.11	.11	.00	0.	1		1240	153	.00	.00	.00	0.
1		0015	4	.04	.04	.00	0.	1		1245	154	.00	.00	.00	0.
1		0020	5	.05	.04	.01	1.	1		1250	155	.00	.00	.00	0.
1		0025	6	.06	.05	.01	2.	1		1255	156	.00	.00	.00	0.
1		0030	7	.05	.03	.01	5.	1		1300	157	.00	.00	.00	0.
1		0035	8	.02	.01	.01	10.	1		1305	158	.00	.00	.00	0.
1		0040	9	.00	.00	.00	13.	1		1310	159	.00	.00	.00	0.
1		0045	10	.00	.00	.00	14.	1		1315	160	.00	.00	.00	0.
1		0050	11	.00	.00	.00	13.	1		1320	161	.00	.00	.00	0.
1		0055	12	.00	.00	.00	10.	1		1325	162	.00	.00	.00	0.
1		0100	13	.00	.00	.00	7.	1		1330	163	.00	.00	.00	0.
1		0105	14	.01	.01	.00	5.	1		1335	164	.00	.00	.00	0.
1		0110	15	.02	.01	.01	4.	1		1340	165	.00	.00	.00	0.
1		0115	16	.01	.00	.00	5.	1		1345	166	.00	.00	.00	0.
1		0120	17	.02	.01	.01	6.	1		1350	167	.00	.00	.00	0.
1		0125	18	.03	.02	.01	8.	1		1355	168	.00	.00	.00	0.
1		0130	19	.04	.02	.02	10.	1		1400	169	.00	.00	.00	0.
1		0135	20	.03	.01	.01	14.	1		1405	170	.00	.00	.00	0.
1		0140	21	.03	.01	.01	19.	1		1410	171	.00	.00	.00	0.
1		0145	22	.02	.01	.01	22.	1		1415	172	.00	.00	.00	0.
1		0150	23	.01	.00	.00	24.	1		1420	173	.00	.00	.00	0.
1		0155	24	.00	.00	.00	24.	1		1425	174	.00	.00	.00	0.
1		0200	25	.00	.00	.00	21.	1		1430	175	.00	.00	.00	0.
1		0205	26	.01	.00	.00	17.	1		1435	176	.00	.00	.00	0.
1		0210	27	.03	.01	.02	14.	1		1440	177	.00	.00	.00	0.
1		0215	28	.04	.02	.03	15.	1		1445	178	.00	.00	.00	0.
1		0220	29	.03	.01	.02	19.	1		1450	179	.00	.00	.00	0.
1		0225	30	.02	.01	.01	25.	1		1455	180	.00	.00	.00	0.
1		0230	31	.01	.00	.00	29.	1		1500	181	.00	.00	.00	0.
1		0235	32	.01	.01	.01	31.	1		1505	182	.00	.00	.00	0.
1		0240	33	.04	.01	.03	30.	1		1510	183	.00	.00	.00	0.
1		0245	34	.02	.01	.02	29.	1		1515	184	.00	.00	.00	0.
1		0250	35	.01	.00	.01	30.	1		1520	185	.00	.00	.00	0.
1		0255	36	.01	.00	.00	30.	1		1525	186	.00	.00	.00	0.
1		0300	37	.03	.01	.02	29.	1		1530	187	.00	.00	.00	0.
1		0305	38	.08	.02	.05	30.	1		1535	188	.00	.00	.00	0.
1		0310	39	.09	.02	.06	38.	1		1540	189	.00	.00	.00	0.
1		0315	40	.16	.04	.13	56.	1		1545	190	.00	.00	.00	0.
1		0320	41	.26	.05	.21	90.	1		1550	191	.00	.00	.00	0.
1		0325	42	.26	.04	.22	143.	1		1555	192	.00	.00	.00	0.
1		0330	43	.34	.04	.31	216.	1		1600	193	.00	.00	.00	0.
1		0335	44	.10	.01	.09	288.	1		1605	194	.00	.00	.00	0.
1		0340	45	.11	.01	.10	341.	1		1610	195	.00	.00	.00	0.
1		0345	46	.09	.01	.08	351.	1		1615	196	.00	.00	.00	0.
1		0350	47	.02	.00	.02	327.	1		1620	197	.00	.00	.00	0.
1		0355	48	.05	.00	.04	283.	1		1625	198	.00	.00	.00	0.
1		0400	49	.05	.00	.04	231.	1		1630	199	.00	.00	.00	0.
1		0405	50	.01	.00	.01	187.	1		1635	200	.00	.00	.00	0.
1		0410	51	.01	.00	.01	151.	1		1640	201	.00	.00	.00	0.
1		0415	52	.02	.00	.02	120.	1		1645	202	.00	.00	.00	0.
1		0420	53	.02	.00	.02	96.	1		1650	203	.00	.00	.00	0.
1		0425	54	.03	.00	.03	80.	1		1655	204	.00	.00	.00	0.
1		0430	55	.06	.00	.06	71.	1		1700	205	.00	.00	.00	0.
1		0435	56	.05	.00	.04	71.	1		1705	206	.00	.00	.00	0.
1		0440	57	.03	.00	.03	76.	1		1710	207	.00	.00	.00	0.
1		0445	58	.04	.00	.03	80.	1		1715	208	.00	.00	.00	0.
1		0450	59	.06	.00	.05	83.	1		1720	209	.00	.00	.00	0.
1		0455	60	.02	.00	.02	83.	1		1725	210	.00	.00	.00	0.
1		0500	61	.02	.00	.02	81.	1		1730	211	.00	.00	.00	0.
1		0505	62	.01	.00	.01	75.	1		1735	212	.00	.00	.00	0.
1		0510	63	.01	.00	.01	65.	1		1740	213	.00	.00	.00	0.
1		0515	64	.01	.00	.01	54.	1		1745	214	.00	.00	.00	0.
1		0520	65	.00	.00	.00	42.	1		1750	215	.00	.00	.00	0.
1		0525	66	.01	.00	.01	33.	1		1755	216	.00	.00	.00	0.
1		0530	67	.00	.00	.00	26.	1		1800	217	.00	.00	.00	0.
1		0535	68	.00	.00	.00	21.	1		1805	218	.00	.00	.00	0.
1		0540	69	.00	.00	.00	16.	1		1810	219	.00	.00	.00	0.
1		0545	70	.01	.00	.01	13.	1		1815	220	.00	.00	.00	0.
1		0550	71	.00	.00	.00	12.	1		1820	221	.00	.00	.00	0.
1		0555	72	.00	.00	.00	10.	1		1825	222	.00	.00	.00	0.
1		0600	73	.00	.00	.00	9.	1		1830	223	.00	.00	.00	0.
1		0605	74	.00	.00	.00	8.	1		1835	224	.00	.00	.00	0.
1		0610	75	.00	.00	.00	7.	1		1840	225	.00	.00	.00	0.
1		0615	76	.00	.00	.00	5.	1		1845	226	.00	.00	.00	0.
1		0620	77	.00	.00	.00	4.	1		1850	227	.00	.00	.00	0.
1		0625	78	.00	.00	.00	3.	1		1855	228	.00	.00	.00	0.
1		0630	79	.00	.00	.00	2.	1		1900	229	.00	.00	.00	0.
1		0635	80	.00	.00	.00	1.	1		1905	230	.00	.00	.00	0.
1		0640	81	.00	.00	.00	1.	1		1910	231	.00	.00	.00	0.
1		0645	82	.00	.00	.00	1.	1		1915	232	.00	.00	.00	0.
1		0650	83	.00	.00	.00	0.	1		1920	233	.00	.00	.00	0.
1		0655	84	.00	.00	.00	0.	1		1925	234	.00	.00	.00	0.

1	0700	85	.00	.00	.00	0.	*	1	1930	235	.00	.00	.00	0.
1	0705	86	.00	.00	.00	0.	*	1	1935	236	.00	.00	.00	0.
1	0710	87	.00	.00	.00	0.	*	1	1940	237	.00	.00	.00	0.
1	0715	88	.00	.00	.00	0.	*	1	1945	238	.00	.00	.00	0.
1	0720	89	.00	.00	.00	0.	*	1	1950	239	.00	.00	.00	0.
1	0725	90	.00	.00	.00	0.	*	1	1955	240	.00	.00	.00	0.
1	0730	91	.00	.00	.00	0.	*	1	2000	241	.00	.00	.00	0.
1	0735	92	.00	.00	.00	0.	*	1	2005	242	.00	.00	.00	0.
1	0740	93	.00	.00	.00	0.	*	1	2010	243	.00	.00	.00	0.
1	0745	94	.00	.00	.00	0.	*	1	2015	244	.00	.00	.00	0.
1	0750	95	.00	.00	.00	0.	*	1	2020	245	.00	.00	.00	0.
1	0755	96	.00	.00	.00	0.	*	1	2025	246	.00	.00	.00	0.
1	0800	97	.00	.00	.00	0.	*	1	2030	247	.00	.00	.00	0.
1	0805	98	.00	.00	.00	0.	*	1	2035	248	.00	.00	.00	0.
1	0810	99	.00	.00	.00	0.	*	1	2040	249	.00	.00	.00	0.
1	0815	100	.00	.00	.00	0.	*	1	2045	250	.00	.00	.00	0.
1	0820	101	.00	.00	.00	0.	*	1	2050	251	.00	.00	.00	0.
1	0825	102	.00	.00	.00	0.	*	1	2055	252	.00	.00	.00	0.
1	0830	103	.00	.00	.00	0.	*	1	2100	253	.00	.00	.00	0.
1	0835	104	.00	.00	.00	0.	*	1	2105	254	.00	.00	.00	0.
1	0840	105	.00	.00	.00	0.	*	1	2110	255	.00	.00	.00	0.
1	0845	106	.00	.00	.00	0.	*	1	2115	256	.00	.00	.00	0.
1	0850	107	.00	.00	.00	0.	*	1	2120	257	.00	.00	.00	0.
1	0855	108	.00	.00	.00	0.	*	1	2125	258	.00	.00	.00	0.
1	0900	109	.00	.00	.00	0.	*	1	2130	259	.00	.00	.00	0.
1	0905	110	.00	.00	.00	0.	*	1	2135	260	.00	.00	.00	0.
1	0910	111	.00	.00	.00	0.	*	1	2140	261	.00	.00	.00	0.
1	0915	112	.00	.00	.00	0.	*	1	2145	262	.00	.00	.00	0.
1	0920	113	.00	.00	.00	0.	*	1	2150	263	.00	.00	.00	0.
1	0925	114	.00	.00	.00	0.	*	1	2155	264	.00	.00	.00	0.
1	0930	115	.00	.00	.00	0.	*	1	2200	265	.00	.00	.00	0.
1	0935	116	.00	.00	.00	0.	*	1	2205	266	.00	.00	.00	0.
1	0940	117	.00	.00	.00	0.	*	1	2210	267	.00	.00	.00	0.
1	0945	118	.00	.00	.00	0.	*	1	2215	268	.00	.00	.00	0.
1	0950	119	.00	.00	.00	0.	*	1	2220	269	.00	.00	.00	0.
1	0955	120	.00	.00	.00	0.	*	1	2225	270	.00	.00	.00	0.
1	1000	121	.00	.00	.00	0.	*	1	2230	271	.00	.00	.00	0.
1	1005	122	.00	.00	.00	0.	*	1	2235	272	.00	.00	.00	0.
1	1010	123	.00	.00	.00	0.	*	1	2240	273	.00	.00	.00	0.
1	1015	124	.00	.00	.00	0.	*	1	2245	274	.00	.00	.00	0.
1	1020	125	.00	.00	.00	0.	*	1	2250	275	.00	.00	.00	0.
1	1025	126	.00	.00	.00	0.	*	1	2255	276	.00	.00	.00	0.
1	1030	127	.00	.00	.00	0.	*	1	2300	277	.00	.00	.00	0.
1	1035	128	.00	.00	.00	0.	*	1	2305	278	.00	.00	.00	0.
1	1040	129	.00	.00	.00	0.	*	1	2310	279	.00	.00	.00	0.
1	1045	130	.00	.00	.00	0.	*	1	2315	280	.00	.00	.00	0.
1	1050	131	.00	.00	.00	0.	*	1	2320	281	.00	.00	.00	0.
1	1055	132	.00	.00	.00	0.	*	1	2325	282	.00	.00	.00	0.
1	1100	133	.00	.00	.00	0.	*	1	2330	283	.00	.00	.00	0.
1	1105	134	.00	.00	.00	0.	*	1	2335	284	.00	.00	.00	0.
1	1110	135	.00	.00	.00	0.	*	1	2340	285	.00	.00	.00	0.
1	1115	136	.00	.00	.00	0.	*	1	2345	286	.00	.00	.00	0.
1	1120	137	.00	.00	.00	0.	*	1	2350	287	.00	.00	.00	0.
1	1125	138	.00	.00	.00	0.	*	1	2355	288	.00	.00	.00	0.
1	1130	139	.00	.00	.00	0.	*	2	0000	289	.00	.00	.00	0.
1	1135	140	.00	.00	.00	0.	*	2	0005	290	.00	.00	.00	0.
1	1140	141	.00	.00	.00	0.	*	2	0010	291	.00	.00	.00	0.
1	1145	142	.00	.00	.00	0.	*	2	0015	292	.00	.00	.00	0.
1	1150	143	.00	.00	.00	0.	*	2	0020	293	.00	.00	.00	0.
1	1155	144	.00	.00	.00	0.	*	2	0025	294	.00	.00	.00	0.
1	1200	145	.00	.00	.00	0.	*	2	0030	295	.00	.00	.00	0.
1	1205	146	.00	.00	.00	0.	*	2	0035	296	.00	.00	.00	0.
1	1210	147	.00	.00	.00	0.	*	2	0040	297	.00	.00	.00	0.
1	1215	148	.00	.00	.00	0.	*	2	0045	298	.00	.00	.00	0.
1	1220	149	.00	.00	.00	0.	*	2	0050	299	.00	.00	.00	0.
1	1225	150	.00	.00	.00	0.	*	2	0055	300	.00	.00	.00	0.
							*							

****

TOTAL RAINFALL = 2.86, TOTAL LOSS = .80, TOTAL EXCESS = 2.06

	PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	24.92-HR
+	(CFS)	(HR)				
			(CFS)			
+	351.	3.75	63.	16.	15.	15.
			(INCHES) 2.052	2.056	2.056	2.056
			(AC-FT) 31.	31.	31.	31.

CUMULATIVE AREA = .28 SQ MI

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HYDROGRAPH AT STATION PRO3
PLAN 1, RATIO = 1.00

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DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	*	DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q
								*								
1		0000	1	.00	.00	.00	0.	*	1		1230	151	.00	.00	.00	0.
1		0005	2	.06	.06	.00	0.	*	1		1235	152	.00	.00	.00	0.
1		0010	3	.11	.11	.00	0.	*	1		1240	153	.00	.00	.00	0.
1		0015	4	.04	.04	.00	0.	*	1		1245	154	.00	.00	.00	0.
1		0020	5	.05	.04	.01	1.	*	1		1250	155	.00	.00	.00	0.
1		0025	6	.06	.05	.01	2.	*	1		1255	156	.00	.00	.00	0.
1		0030	7	.05	.03	.01	5.	*	1		1300	157	.00	.00	.00	0.
1		0035	8	.02	.01	.01	10.	*	1		1305	158	.00	.00	.00	0.
1		0040	9	.00	.00	.00	13.	*	1		1310	159	.00	.00	.00	0.
1		0045	10	.00	.00	.00	14.	*	1		1315	160	.00	.00	.00	0.
1		0050	11	.00	.00	.00	13.	*	1		1320	161	.00	.00	.00	0.
1		0055	12	.00	.00	.00	10.	*	1		1325	162	.00	.00	.00	0.
1		0100	13	.00	.00	.00	7.	*	1		1330	163	.00	.00	.00	0.

1	0105	14	.01	.01	.00	5.	*	1	1335	164	.00	.00	.00	0.
1	0110	15	.02	.01	.01	4.	*	1	1340	165	.00	.00	.00	0.
1	0115	16	.01	.00	.00	5.	*	1	1345	166	.00	.00	.00	0.
1	0120	17	.02	.01	.01	6.	*	1	1350	167	.00	.00	.00	0.
1	0125	18	.03	.02	.01	8.	*	1	1355	168	.00	.00	.00	0.
1	0130	19	.04	.02	.02	10.	*	1	1400	169	.00	.00	.00	0.
1	0135	20	.03	.01	.01	14.	*	1	1405	170	.00	.00	.00	0.
1	0140	21	.03	.01	.01	19.	*	1	1410	171	.00	.00	.00	0.
1	0145	22	.02	.01	.01	22.	*	1	1415	172	.00	.00	.00	0.
1	0150	23	.01	.00	.00	24.	*	1	1420	173	.00	.00	.00	0.
1	0155	24	.00	.00	.00	24.	*	1	1425	174	.00	.00	.00	0.
1	0200	25	.00	.00	.00	21.	*	1	1430	175	.00	.00	.00	0.
1	0205	26	.01	.00	.00	17.	*	1	1435	176	.00	.00	.00	0.
1	0210	27	.03	.01	.02	14.	*	1	1440	177	.00	.00	.00	0.
1	0215	28	.04	.02	.03	15.	*	1	1445	178	.00	.00	.00	0.
1	0220	29	.03	.01	.02	19.	*	1	1450	179	.00	.00	.00	0.
1	0225	30	.02	.01	.01	25.	*	1	1455	180	.00	.00	.00	0.
1	0230	31	.01	.00	.00	29.	*	1	1500	181	.00	.00	.00	0.
1	0235	32	.01	.01	.01	31.	*	1	1505	182	.00	.00	.00	0.
1	0240	33	.04	.01	.03	30.	*	1	1510	183	.00	.00	.00	0.
1	0245	34	.02	.01	.02	29.	*	1	1515	184	.00	.00	.00	0.
1	0250	35	.01	.00	.01	30.	*	1	1520	185	.00	.00	.00	0.
1	0255	36	.01	.00	.00	30.	*	1	1525	186	.00	.00	.00	0.
1	0300	37	.03	.01	.02	29.	*	1	1530	187	.00	.00	.00	0.
1	0305	38	.08	.02	.05	30.	*	1	1535	188	.00	.00	.00	0.
1	0310	39	.09	.02	.06	38.	*	1	1540	189	.00	.00	.00	0.
1	0315	40	.16	.04	.13	56.	*	1	1545	190	.00	.00	.00	0.
1	0320	41	.26	.05	.21	90.	*	1	1550	191	.00	.00	.00	0.
1	0325	42	.26	.04	.22	143.	*	1	1555	192	.00	.00	.00	0.
1	0330	43	.34	.04	.31	216.	*	1	1600	193	.00	.00	.00	0.
1	0335	44	.10	.01	.09	288.	*	1	1605	194	.00	.00	.00	0.
1	0340	45	.11	.01	.10	341.	*	1	1610	195	.00	.00	.00	0.
1	0345	46	.09	.01	.08	361.	*	1	1615	196	.00	.00	.00	0.
1	0350	47	.02	.00	.02	327.	*	1	1620	197	.00	.00	.00	0.
1	0355	48	.05	.00	.04	283.	*	1	1625	198	.00	.00	.00	0.
1	0400	49	.05	.00	.04	231.	*	1	1630	199	.00	.00	.00	0.
1	0405	50	.01	.00	.01	187.	*	1	1635	200	.00	.00	.00	0.
1	0410	51	.01	.00	.01	151.	*	1	1640	201	.00	.00	.00	0.
1	0415	52	.02	.00	.02	120.	*	1	1645	202	.00	.00	.00	0.
1	0420	53	.02	.00	.02	96.	*	1	1650	203	.00	.00	.00	0.
1	0425	54	.03	.00	.03	80.	*	1	1655	204	.00	.00	.00	0.
1	0430	55	.06	.00	.06	71.	*	1	1700	205	.00	.00	.00	0.
1	0435	56	.05	.00	.04	71.	*	1	1705	206	.00	.00	.00	0.
1	0440	57	.03	.00	.03	76.	*	1	1710	207	.00	.00	.00	0.
1	0445	58	.04	.00	.03	80.	*	1	1715	208	.00	.00	.00	0.
1	0450	59	.06	.00	.05	83.	*	1	1720	209	.00	.00	.00	0.
1	0455	60	.02	.00	.02	83.	*	1	1725	210	.00	.00	.00	0.
1	0500	61	.02	.00	.02	81.	*	1	1730	211	.00	.00	.00	0.
1	0505	62	.01	.00	.01	75.	*	1	1735	212	.00	.00	.00	0.
1	0510	63	.01	.00	.01	65.	*	1	1740	213	.00	.00	.00	0.
1	0515	64	.01	.00	.01	54.	*	1	1745	214	.00	.00	.00	0.
1	0520	65	.00	.00	.00	42.	*	1	1750	215	.00	.00	.00	0.
1	0525	66	.01	.00	.01	33.	*	1	1755	216	.00	.00	.00	0.
1	0530	67	.00	.00	.00	26.	*	1	1800	217	.00	.00	.00	0.
1	0535	68	.00	.00	.00	21.	*	1	1805	218	.00	.00	.00	0.
1	0540	69	.00	.00	.00	16.	*	1	1810	219	.00	.00	.00	0.
1	0545	70	.01	.00	.01	13.	*	1	1815	220	.00	.00	.00	0.
1	0550	71	.00	.00	.00	12.	*	1	1820	221	.00	.00	.00	0.
1	0555	72	.00	.00	.00	10.	*	1	1825	222	.00	.00	.00	0.
1	0600	73	.00	.00	.00	9.	*	1	1830	223	.00	.00	.00	0.
1	0605	74	.00	.00	.00	8.	*	1	1835	224	.00	.00	.00	0.
1	0610	75	.00	.00	.00	7.	*	1	1840	225	.00	.00	.00	0.
1	0615	76	.00	.00	.00	5.	*	1	1845	226	.00	.00	.00	0.
1	0620	77	.00	.00	.00	4.	*	1	1850	227	.00	.00	.00	0.
1	0625	78	.00	.00	.00	3.	*	1	1855	228	.00	.00	.00	0.
1	0630	79	.00	.00	.00	2.	*	1	1900	229	.00	.00	.00	0.
1	0635	80	.00	.00	.00	1.	*	1	1905	230	.00	.00	.00	0.
1	0640	81	.00	.00	.00	1.	*	1	1910	231	.00	.00	.00	0.
1	0645	82	.00	.00	.00	1.	*	1	1915	232	.00	.00	.00	0.
1	0650	83	.00	.00	.00	0.	*	1	1920	233	.00	.00	.00	0.
1	0655	84	.00	.00	.00	0.	*	1	1925	234	.00	.00	.00	0.
1	0700	85	.00	.00	.00	0.	*	1	1930	235	.00	.00	.00	0.
1	0705	86	.00	.00	.00	0.	*	1	1935	236	.00	.00	.00	0.
1	0710	87	.00	.00	.00	0.	*	1	1940	237	.00	.00	.00	0.
1	0715	88	.00	.00	.00	0.	*	1	1945	238	.00	.00	.00	0.
1	0720	89	.00	.00	.00	0.	*	1	1950	239	.00	.00	.00	0.
1	0725	90	.00	.00	.00	0.	*	1	1955	240	.00	.00	.00	0.
1	0730	91	.00	.00	.00	0.	*	1	2000	241	.00	.00	.00	0.
1	0735	92	.00	.00	.00	0.	*	1	2005	242	.00	.00	.00	0.
1	0740	93	.00	.00	.00	0.	*	1	2010	243	.00	.00	.00	0.
1	0745	94	.00	.00	.00	0.	*	1	2015	244	.00	.00	.00	0.
1	0750	95	.00	.00	.00	0.	*	1	2020	245	.00	.00	.00	0.
1	0755	96	.00	.00	.00	0.	*	1	2025	246	.00	.00	.00	0.
1	0800	97	.00	.00	.00	0.	*	1	2030	247	.00	.00	.00	0.
1	0805	98	.00	.00	.00	0.	*	1	2035	248	.00	.00	.00	0.
1	0810	99	.00	.00	.00	0.	*	1	2040	249	.00	.00	.00	0.
1	0815	100	.00	.00	.00	0.	*	1	2045	250	.00	.00	.00	0.
1	0820	101	.00	.00	.00	0.	*	1	2050	251	.00	.00	.00	0.
1	0825	102	.00	.00	.00	0.	*	1	2055	252	.00	.00	.00	0.
1	0830	103	.00	.00	.00	0.	*	1	2100	253	.00	.00	.00	0.
1	0835	104	.00	.00	.00	0.	*	1	2105	254	.00	.00	.00	0.
1	0840	105	.00	.00	.00	0.	*	1	2110	255	.00	.00	.00	0.
1	0845	106	.00	.00	.00	0.	*	1	2115	256	.00	.00	.00	0.
1	0850	107	.00	.00	.00	0.	*	1	2120	257	.00	.00	.00	0.
1	0855	108	.00	.00	.00	0.	*	1	2125	258	.00	.00	.00	0.
1	0900	109	.00	.00	.00	0.	*	1	2130	259	.00	.00	.00	0.
1	0905	110	.00	.00	.00	0.	*	1	2135	260	.00	.00	.00	0.
1	0910	111	.00	.00	.00	0.	*	1	2140	261	.00	.00	.00	0.
1	0915	112	.00	.00	.00	0.	*	1	2145	262	.00	.00	.00	0.
1	0920	113	.00	.00	.00	0.	*	1	2150	263	.00	.00	.00	0.
1	0925	114	.00	.00	.00	0.	*	1	2155	264	.00	.00	.00	0.
1	0930	115	.00	.00	.00	0.	*	1	2200	265	.00	.00	.00	0.
1	0935	116	.00	.00	.00	0.	*	1	2205	266	.00	.00	.00	0.
1	0940	117	.00	.00	.00	0.	*	1	2210	267	.00	.00	.00	0.

1	0945	118	.00	.00	.00	0.	*	1	2215	268	.00	.00	.00	0.
1	0950	119	.00	.00	.00	0.	*	1	2220	269	.00	.00	.00	0.
1	0955	120	.00	.00	.00	0.	*	1	2225	270	.00	.00	.00	0.
1	1000	121	.00	.00	.00	0.	*	1	2230	271	.00	.00	.00	0.
1	1005	122	.00	.00	.00	0.	*	1	2235	272	.00	.00	.00	0.
1	1010	123	.00	.00	.00	0.	*	1	2240	273	.00	.00	.00	0.
1	1015	124	.00	.00	.00	0.	*	1	2245	274	.00	.00	.00	0.
1	1020	125	.00	.00	.00	0.	*	1	2250	275	.00	.00	.00	0.
1	1025	126	.00	.00	.00	0.	*	1	2255	276	.00	.00	.00	0.
1	1030	127	.00	.00	.00	0.	*	1	2300	277	.00	.00	.00	0.
1	1035	128	.00	.00	.00	0.	*	1	2305	278	.00	.00	.00	0.
1	1040	129	.00	.00	.00	0.	*	1	2310	279	.00	.00	.00	0.
1	1045	130	.00	.00	.00	0.	*	1	2315	280	.00	.00	.00	0.
1	1050	131	.00	.00	.00	0.	*	1	2320	281	.00	.00	.00	0.
1	1055	132	.00	.00	.00	0.	*	1	2325	282	.00	.00	.00	0.
1	1100	133	.00	.00	.00	0.	*	1	2330	283	.00	.00	.00	0.
1	1105	134	.00	.00	.00	0.	*	1	2335	284	.00	.00	.00	0.
1	1110	135	.00	.00	.00	0.	*	1	2340	285	.00	.00	.00	0.
1	1115	136	.00	.00	.00	0.	*	1	2345	286	.00	.00	.00	0.
1	1120	137	.00	.00	.00	0.	*	1	2350	287	.00	.00	.00	0.
1	1125	138	.00	.00	.00	0.	*	1	2355	288	.00	.00	.00	0.
1	1130	139	.00	.00	.00	0.	*	2	0000	289	.00	.00	.00	0.
1	1135	140	.00	.00	.00	0.	*	2	0005	290	.00	.00	.00	0.
1	1140	141	.00	.00	.00	0.	*	2	0010	291	.00	.00	.00	0.
1	1145	142	.00	.00	.00	0.	*	2	0015	292	.00	.00	.00	0.
1	1150	143	.00	.00	.00	0.	*	2	0020	293	.00	.00	.00	0.
1	1155	144	.00	.00	.00	0.	*	2	0025	294	.00	.00	.00	0.
1	1200	145	.00	.00	.00	0.	*	2	0030	295	.00	.00	.00	0.
1	1205	146	.00	.00	.00	0.	*	2	0035	296	.00	.00	.00	0.
1	1210	147	.00	.00	.00	0.	*	2	0040	297	.00	.00	.00	0.
1	1215	148	.00	.00	.00	0.	*	2	0045	298	.00	.00	.00	0.
1	1220	149	.00	.00	.00	0.	*	2	0050	299	.00	.00	.00	0.
1	1225	150	.00	.00	.00	0.	*	2	0055	300	.00	.00	.00	0.

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TOTAL RAINFALL = 2.86, TOTAL LOSS = .80, TOTAL EXCESS = 2.06

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	24.92-HR
+ (CFS)	(HR)					
		(CFS)				
+ 351.	3.75		63.	16.	15.	15.
		(INCHES)	2.052	2.056	2.056	2.056
		(AC-FT)	31.	31.	31.	31.

CUMULATIVE AREA = .28 SQ MI

****

HYDROGRAPH AT STATION PRO3
PLAN 1, RATIO = .61

****

DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q		DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q
1		0000	1	.00	.00	.00	0.	*	1		1230	151	.00	.00	.00	0.
1		0005	2	.03	.03	.00	0.	*	1		1235	152	.00	.00	.00	0.
1		0010	3	.06	.06	.00	0.	*	1		1240	153	.00	.00	.00	0.
1		0015	4	.02	.02	.00	0.	*	1		1245	154	.00	.00	.00	0.
1		0020	5	.03	.03	.00	0.	*	1		1250	155	.00	.00	.00	0.
1		0025	6	.04	.04	.00	0.	*	1		1255	156	.00	.00	.00	0.
1		0030	7	.03	.03	.00	0.	*	1		1300	157	.00	.00	.00	0.
1		0035	8	.01	.01	.00	1.	*	1		1305	158	.00	.00	.00	0.
1		0040	9	.00	.00	.00	1.	*	1		1310	159	.00	.00	.00	0.
1		0045	10	.00	.00	.00	1.	*	1		1315	160	.00	.00	.00	0.
1		0050	11	.00	.00	.00	1.	*	1		1320	161	.00	.00	.00	0.
1		0055	12	.00	.00	.00	1.	*	1		1325	162	.00	.00	.00	0.
1		0100	13	.00	.00	.00	1.	*	1		1330	163	.00	.00	.00	0.
1		0105	14	.01	.00	.00	1.	*	1		1335	164	.00	.00	.00	0.
1		0110	15	.01	.01	.00	1.	*	1		1340	165	.00	.00	.00	0.
1		0115	16	.00	.00	.00	1.	*	1		1345	166	.00	.00	.00	0.
1		0120	17	.01	.01	.00	1.	*	1		1350	167	.00	.00	.00	0.
1		0125	18	.02	.01	.00	2.	*	1		1355	168	.00	.00	.00	0.
1		0130	19	.02	.02	.01	3.	*	1		1400	169	.00	.00	.00	0.
1		0135	20	.02	.01	.00	4.	*	1		1405	170	.00	.00	.00	0.
1		0140	21	.02	.01	.00	5.	*	1		1410	171	.00	.00	.00	0.
1		0145	22	.01	.01	.00	7.	*	1		1415	172	.00	.00	.00	0.
1		0150	23	.00	.00	.00	8.	*	1		1420	173	.00	.00	.00	0.
1		0155	24	.00	.00	.00	8.	*	1		1425	174	.00	.00	.00	0.
1		0200	25	.00	.00	.00	7.	*	1		1430	175	.00	.00	.00	0.
1		0205	26	.01	.00	.00	6.	*	1		1435	176	.00	.00	.00	0.
1		0210	27	.02	.01	.01	5.	*	1		1440	177	.00	.00	.00	0.
1		0215	28	.03	.02	.01	5.	*	1		1445	178	.00	.00	.00	0.
1		0220	29	.02	.01	.01	7.	*	1		1450	179	.00	.00	.00	0.
1		0225	30	.01	.01	.01	9.	*	1		1455	180	.00	.00	.00	0.
1		0230	31	.00	.00	.00	11.	*	1		1500	181	.00	.00	.00	0.
1		0235	32	.01	.00	.00	12.	*	1		1505	182	.00	.00	.00	0.
1		0240	33	.02	.01	.01	12.	*	1		1510	183	.00	.00	.00	0.
1		0245	34	.01	.01	.01	12.	*	1		1515	184	.00	.00	.00	0.
1		0250	35	.01	.00	.00	12.	*	1		1520	185	.00	.00	.00	0.
1		0255	36	.00	.00	.00	12.	*	1		1525	186	.00	.00	.00	0.
1		0300	37	.02	.01	.01	12.	*	1		1530	187	.00	.00	.00	0.
1		0305	38	.05	.02	.02	13.	*	1		1535	188	.00	.00	.00	0.
1		0310	39	.05	.02	.03	16.	*	1		1540	189	.00	.00	.00	0.
1		0315	40	.10	.04	.06	25.	*	1		1545	190	.00	.00	.00	0.
1		0320	41	.16	.05	.11	41.	*	1		1550	191	.00	.00	.00	0.
1		0325	42	.16	.04	.12	68.	*	1		1555	192	.00	.00	.00	0.
1		0330	43	.21	.05	.16	106.	*	1		1600	193	.00	.00	.00	0.
1		0335	44	.06	.01	.05	145.	*	1		1605	194	.00	.00	.00	0.
1		0340	45	.06	.01	.05	175.	*	1		1610	195	.00	.00	.00	0.
1		0345	46	.05	.01	.05	183.	*	1		1615	196	.00	.00	.00	0.

1	0350	47	.01	.00	.01	172.	*	1	1620	197	.00	.00	.00	0.
1	0355	48	.03	.00	.02	150.	*	1	1625	198	.00	.00	.00	0.
1	0400	49	.03	.00	.02	123.	*	1	1630	199	.00	.00	.00	0.
1	0405	50	.01	.00	.01	101.	*	1	1635	200	.00	.00	.00	0.
1	0410	51	.01	.00	.01	82.	*	1	1640	201	.00	.00	.00	0.
1	0415	52	.01	.00	.01	65.	*	1	1645	202	.00	.00	.00	0.
1	0420	53	.01	.00	.01	53.	*	1	1650	203	.00	.00	.00	0.
1	0425	54	.02	.00	.02	44.	*	1	1655	204	.00	.00	.00	0.
1	0430	55	.04	.01	.03	39.	*	1	1700	205	.00	.00	.00	0.
1	0435	56	.03	.00	.02	39.	*	1	1705	206	.00	.00	.00	0.
1	0440	57	.02	.00	.02	42.	*	1	1710	207	.00	.00	.00	0.
1	0445	58	.02	.00	.02	45.	*	1	1715	208	.00	.00	.00	0.
1	0450	59	.03	.00	.03	46.	*	1	1720	209	.00	.00	.00	0.
1	0455	60	.01	.00	.01	47.	*	1	1725	210	.00	.00	.00	0.
1	0500	61	.01	.00	.01	46.	*	1	1730	211	.00	.00	.00	0.
1	0505	62	.01	.00	.00	42.	*	1	1735	212	.00	.00	.00	0.
1	0510	63	.00	.00	.00	37.	*	1	1740	213	.00	.00	.00	0.
1	0515	64	.00	.00	.00	30.	*	1	1745	214	.00	.00	.00	0.
1	0520	65	.00	.00	.00	24.	*	1	1750	215	.00	.00	.00	0.
1	0525	66	.01	.00	.00	19.	*	1	1755	216	.00	.00	.00	0.
1	0530	67	.00	.00	.00	15.	*	1	1800	217	.00	.00	.00	0.
1	0535	68	.00	.00	.00	12.	*	1	1805	218	.00	.00	.00	0.
1	0540	69	.00	.00	.00	9.	*	1	1810	219	.00	.00	.00	0.
1	0545	70	.01	.00	.00	8.	*	1	1815	220	.00	.00	.00	0.
1	0550	71	.00	.00	.00	7.	*	1	1820	221	.00	.00	.00	0.
1	0555	72	.00	.00	.00	6.	*	1	1825	222	.00	.00	.00	0.
1	0600	73	.00	.00	.00	5.	*	1	1830	223	.00	.00	.00	0.
1	0605	74	.00	.00	.00	5.	*	1	1835	224	.00	.00	.00	0.
1	0610	75	.00	.00	.00	4.	*	1	1840	225	.00	.00	.00	0.
1	0615	76	.00	.00	.00	3.	*	1	1845	226	.00	.00	.00	0.
1	0620	77	.00	.00	.00	2.	*	1	1850	227	.00	.00	.00	0.
1	0625	78	.00	.00	.00	2.	*	1	1855	228	.00	.00	.00	0.
1	0630	79	.00	.00	.00	1.	*	1	1900	229	.00	.00	.00	0.
1	0635	80	.00	.00	.00	1.	*	1	1905	230	.00	.00	.00	0.
1	0640	81	.00	.00	.00	0.	*	1	1910	231	.00	.00	.00	0.
1	0645	82	.00	.00	.00	0.	*	1	1915	232	.00	.00	.00	0.
1	0650	83	.00	.00	.00	0.	*	1	1920	233	.00	.00	.00	0.
1	0655	84	.00	.00	.00	0.	*	1	1925	234	.00	.00	.00	0.
1	0700	85	.00	.00	.00	0.	*	1	1930	235	.00	.00	.00	0.
1	0705	86	.00	.00	.00	0.	*	1	1935	236	.00	.00	.00	0.
1	0710	87	.00	.00	.00	0.	*	1	1940	237	.00	.00	.00	0.
1	0715	88	.00	.00	.00	0.	*	1	1945	238	.00	.00	.00	0.
1	0720	89	.00	.00	.00	0.	*	1	1950	239	.00	.00	.00	0.
1	0725	90	.00	.00	.00	0.	*	1	1955	240	.00	.00	.00	0.
1	0730	91	.00	.00	.00	0.	*	1	2000	241	.00	.00	.00	0.
1	0735	92	.00	.00	.00	0.	*	1	2005	242	.00	.00	.00	0.
1	0740	93	.00	.00	.00	0.	*	1	2010	243	.00	.00	.00	0.
1	0745	94	.00	.00	.00	0.	*	1	2015	244	.00	.00	.00	0.
1	0750	95	.00	.00	.00	0.	*	1	2020	245	.00	.00	.00	0.
1	0755	96	.00	.00	.00	0.	*	1	2025	246	.00	.00	.00	0.
1	0800	97	.00	.00	.00	0.	*	1	2030	247	.00	.00	.00	0.
1	0805	98	.00	.00	.00	0.	*	1	2035	248	.00	.00	.00	0.
1	0810	99	.00	.00	.00	0.	*	1	2040	249	.00	.00	.00	0.
1	0815	100	.00	.00	.00	0.	*	1	2045	250	.00	.00	.00	0.
1	0820	101	.00	.00	.00	0.	*	1	2050	251	.00	.00	.00	0.
1	0825	102	.00	.00	.00	0.	*	1	2055	252	.00	.00	.00	0.
1	0830	103	.00	.00	.00	0.	*	1	2100	253	.00	.00	.00	0.
1	0835	104	.00	.00	.00	0.	*	1	2105	254	.00	.00	.00	0.
1	0840	105	.00	.00	.00	0.	*	1	2110	255	.00	.00	.00	0.
1	0845	106	.00	.00	.00	0.	*	1	2115	256	.00	.00	.00	0.
1	0850	107	.00	.00	.00	0.	*	1	2120	257	.00	.00	.00	0.
1	0855	108	.00	.00	.00	0.	*	1	2125	258	.00	.00	.00	0.
1	0900	109	.00	.00	.00	0.	*	1	2130	259	.00	.00	.00	0.
1	0905	110	.00	.00	.00	0.	*	1	2135	260	.00	.00	.00	0.
1	0910	111	.00	.00	.00	0.	*	1	2140	261	.00	.00	.00	0.
1	0915	112	.00	.00	.00	0.	*	1	2145	262	.00	.00	.00	0.
1	0920	113	.00	.00	.00	0.	*	1	2150	263	.00	.00	.00	0.
1	0925	114	.00	.00	.00	0.	*	1	2155	264	.00	.00	.00	0.
1	0930	115	.00	.00	.00	0.	*	1	2200	265	.00	.00	.00	0.
1	0935	116	.00	.00	.00	0.	*	1	2205	266	.00	.00	.00	0.
1	0940	117	.00	.00	.00	0.	*	1	2210	267	.00	.00	.00	0.
1	0945	118	.00	.00	.00	0.	*	1	2215	268	.00	.00	.00	0.
1	0950	119	.00	.00	.00	0.	*	1	2220	269	.00	.00	.00	0.
1	0955	120	.00	.00	.00	0.	*	1	2225	270	.00	.00	.00	0.
1	1000	121	.00	.00	.00	0.	*	1	2230	271	.00	.00	.00	0.
1	1005	122	.00	.00	.00	0.	*	1	2235	272	.00	.00	.00	0.
1	1010	123	.00	.00	.00	0.	*	1	2240	273	.00	.00	.00	0.
1	1015	124	.00	.00	.00	0.	*	1	2245	274	.00	.00	.00	0.
1	1020	125	.00	.00	.00	0.	*	1	2250	275	.00	.00	.00	0.
1	1025	126	.00	.00	.00	0.	*	1	2255	276	.00	.00	.00	0.
1	1030	127	.00	.00	.00	0.	*	1	2300	277	.00	.00	.00	0.
1	1035	128	.00	.00	.00	0.	*	1	2305	278	.00	.00	.00	0.
1	1040	129	.00	.00	.00	0.	*	1	2310	279	.00	.00	.00	0.
1	1045	130	.00	.00	.00	0.	*	1	2315	280	.00	.00	.00	0.
1	1050	131	.00	.00	.00	0.	*	1	2320	281	.00	.00	.00	0.
1	1055	132	.00	.00	.00	0.	*	1	2325	282	.00	.00	.00	0.
1	1100	133	.00	.00	.00	0.	*	1	2330	283	.00	.00	.00	0.
1	1105	134	.00	.00	.00	0.	*	1	2335	284	.00	.00	.00	0.
1	1110	135	.00	.00	.00	0.	*	1	2340	285	.00	.00	.00	0.
1	1115	136	.00	.00	.00	0.	*	1	2345	286	.00	.00	.00	0.
1	1120	137	.00	.00	.00	0.	*	1	2350	287	.00	.00	.00	0.
1	1125	138	.00	.00	.00	0.	*	1	2355	288	.00	.00	.00	0.
1	1130	139	.00	.00	.00	0.	*	2	0000	289	.00	.00	.00	0.
1	1135	140	.00	.00	.00	0.	*	2	0005	290	.00	.00	.00	0.
1	1140	141	.00	.00	.00	0.	*	2	0010	291	.00	.00	.00	0.
1	1145	142	.00	.00	.00	0.	*	2	0015	292	.00	.00	.00	0.
1	1150	143	.00	.00	.00	0.	*	2	0020	293	.00	.00	.00	0.
1	1155	144	.00	.00	.00	0.	*	2	0025	294	.00	.00	.00	0.
1	1200	145	.00	.00	.00	0.	*	2	0030	295	.00	.00	.00	0.
1	1205	146	.00	.00	.00	0.	*	2	0035	296	.00	.00	.00	0.
1	1210	147	.00	.00	.00	0.	*	2	0040	297	.00	.00	.00	0.
1	1215	148	.00	.00	.00	0.	*	2	0045	298	.00	.00	.00	0.
1	1220	149	.00	.00	.00	0.	*	2	0050	299	.00	.00	.00	0.
1	1225	150	.00	.00	.00	0.	*	2	0055	300	.00	.00	.00	0.

TOTAL RAINFALL = 1.74, TOTAL LOSS = .71, TOTAL EXCESS = 1.03

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	24.92-HR
(CFS)	(HR)					
		(CFS)				
183.	3.75		31.	8.	8.	8.
		(INCHES)	1.031	1.032	1.032	1.032
		(AC-FT)	16.	16.	16.	16.

CUMULATIVE AREA = .28 SQ MI

57 KK CP5

58 KO OUTPUT CONTROL VARIABLES
IPRNT 1 PRINT CONTROL
IPLOT 0 PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE
COMBINE PRO2 AND PRO5 AT TREATMENT BASIN #1

60 HC HYDROGRAPH COMBINATION
ICOMP 2 NUMBER OF HYDROGRAPHS TO COMBINE

HYDROGRAPH AT STATION CP5
SUM OF 2 HYDROGRAPHS
PLAN 1, RATIO = 1.00

DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW
1		0000	1	0.	1		0615	76	3.	1		1230	151	0.	1		1845	226	0.
1		0005	2	0.	1		0620	77	2.	1		1235	152	0.	1		1850	227	0.
1		0010	3	0.	1		0625	78	1.	1		1240	153	0.	1		1855	228	0.
1		0015	4	0.	1		0630	79	1.	1		1245	154	0.	1		1900	229	0.
1		0020	5	2.	1		0635	80	0.	1		1250	155	0.	1		1905	230	0.
1		0025	6	5.	1		0640	81	0.	1		1255	156	0.	1		1910	231	0.
1		0030	7	11.	1		0645	82	0.	1		1300	157	0.	1		1915	232	0.
1		0035	8	16.	1		0650	83	0.	1		1305	158	0.	1		1920	233	0.
1		0040	9	18.	1		0655	84	0.	1		1310	159	0.	1		1925	234	0.
1		0045	10	16.	1		0700	85	0.	1		1315	160	0.	1		1930	235	0.
1		0050	11	11.	1		0705	86	0.	1		1320	161	0.	1		1935	236	0.
1		0055	12	7.	1		0710	87	0.	1		1325	162	0.	1		1940	237	0.
1		0100	13	4.	1		0715	88	0.	1		1330	163	0.	1		1945	238	0.
1		0105	14	3.	1		0720	89	0.	1		1335	164	0.	1		1950	239	0.
1		0110	15	3.	1		0725	90	0.	1		1340	165	0.	1		1955	240	0.
1		0115	16	5.	1		0730	91	0.	1		1345	166	0.	1		2000	241	0.
1		0120	17	7.	1		0735	92	0.	1		1350	167	0.	1		2005	242	0.
1		0125	18	9.	1		0740	93	0.	1		1355	168	0.	1		2010	243	0.
1		0130	19	13.	1		0745	94	0.	1		1400	169	0.	1		2015	244	0.
1		0135	20	19.	1		0750	95	0.	1		1405	170	0.	1		2020	245	0.
1		0140	21	24.	1		0755	96	0.	1		1410	171	0.	1		2025	246	0.
1		0145	22	26.	1		0800	97	0.	1		1415	172	0.	1		2030	247	0.
1		0150	23	25.	1		0805	98	0.	1		1420	173	0.	1		2035	248	0.
1		0155	24	22.	1		0810	99	0.	1		1425	174	0.	1		2040	249	0.
1		0200	25	17.	1		0815	100	0.	1		1430	175	0.	1		2045	250	0.
1		0205	26	13.	1		0820	101	0.	1		1435	176	0.	1		2050	251	0.
1		0210	27	11.	1		0825	102	0.	1		1440	177	0.	1		2055	252	0.
1		0215	28	15.	1		0830	103	0.	1		1445	178	0.	1		2100	253	0.
1		0220	29	23.	1		0835	104	0.	1		1450	179	0.	1		2105	254	0.
1		0225	30	30.	1		0840	105	0.	1		1455	180	0.	1		2110	255	0.
1		0230	31	33.	1		0845	106	0.	1		1500	181	0.	1		2115	256	0.
1		0235	32	30.	1		0850	107	0.	1		1505	182	0.	1		2120	257	0.
1		0240	33	27.	1		0855	108	0.	1		1510	183	0.	1		2125	258	0.
1		0245	34	28.	1		0900	109	0.	1		1515	184	0.	1		2130	259	0.
1		0250	35	30.	1		0905	110	0.	1		1520	185	0.	1		2135	260	0.
1		0255	36	29.	1		0910	111	0.	1		1525	186	0.	1		2140	261	0.
1		0300	37	26.	1		0915	112	0.	1		1530	187	0.	1		2145	262	0.
1		0305	38	29.	1		0920	113	0.	1		1535	188	0.	1		2150	263	0.
1		0310	39	44.	1		0925	114	0.	1		1540	189	0.	1		2155	264	0.
1		0315	40	72.	1		0930	115	0.	1		1545	190	0.	1		2200	265	0.
1		0320	41	120.	1		0935	116	0.	1		1550	191	0.	1		2205	266	0.
1		0325	42	189.	1		0940	117	0.	1		1555	192	0.	1		2210	267	0.
1		0330	43	273.	1		0945	118	0.	1		1600	193	0.	1		2215	268	0.
1		0335	44	344.	1		0950	119	0.	1		1605	194	0.	1		2220	269	0.
1		0340	45	362.	1		0955	120	0.	1		1610	195	0.	1		2225	270	0.
1		0345	46	329.	1		1000	121	0.	1		1615	196	0.	1		2230	271	0.
1		0350	47	274.	1		1005	122	0.	1		1620	197	0.	1		2235	272	0.
1		0355	48	213.	1		1010	123	0.	1		1625	198	0.	1		2240	273	0.
1		0400	49	166.	1		1015	124	0.	1		1630	199	0.	1		2245	274	0.
1		0405	50	130.	1		1020	125	0.	1		1635	200	0.	1		2250	275	0.
1		0410	51	101.	1		1025	126	0.	1		1640	201	0.	1		2255	276	0.
1		0415	52	78.	1		1030	127	0.	1		1645	202	0.	1		2300	277	0.
1		0420	53	61.	1		1035	128	0.	1		1650	203	0.	1		2305	278	0.
1		0425	54	53.	1		1040	129	0.	1		1655	204	0.	1		2310	279	0.
1		0430	55	54.	1		1045	130	0.	1		1700	205	0.	1		2315	280	0.
1		0435	56	63.	1		1050	131	0.	1		1705	206	0.	1		2320	281	0.

1	0440	57	72.	*	1	1055	132	0.	*	1	1710	207	0.	*	1	2325	282	0.
1	0445	58	75.	*	1	1100	133	0.	*	1	1715	208	0.	*	1	2330	283	0.
1	0450	59	75.	*	1	1105	134	0.	*	1	1720	209	0.	*	1	2335	284	0.
1	0455	60	75.	*	1	1110	135	0.	*	1	1725	210	0.	*	1	2340	285	0.
1	0500	61	71.	*	1	1115	136	0.	*	1	1730	211	0.	*	1	2345	286	0.
1	0505	62	62.	*	1	1120	137	0.	*	1	1735	212	0.	*	1	2350	287	0.
1	0510	63	49.	*	1	1125	138	0.	*	1	1740	213	0.	*	1	2355	288	0.
1	0515	64	37.	*	1	1130	139	0.	*	1	1745	214	0.	*	2	0000	289	0.
1	0520	65	27.	*	1	1135	140	0.	*	1	1750	215	0.	*	2	0005	290	0.
1	0525	66	21.	*	1	1140	141	0.	*	1	1755	216	0.	*	2	0010	291	0.
1	0530	67	16.	*	1	1145	142	0.	*	1	1800	217	0.	*	2	0015	292	0.
1	0535	68	13.	*	1	1150	143	0.	*	1	1805	218	0.	*	2	0020	293	0.
1	0540	69	10.	*	1	1155	144	0.	*	1	1810	219	0.	*	2	0025	294	0.
1	0545	70	9.	*	1	1200	145	0.	*	1	1815	220	0.	*	2	0030	295	0.
1	0550	71	8.	*	1	1205	146	0.	*	1	1820	221	0.	*	2	0035	296	0.
1	0555	72	8.	*	1	1210	147	0.	*	1	1825	222	0.	*	2	0040	297	0.
1	0600	73	7.	*	1	1215	148	0.	*	1	1830	223	0.	*	2	0045	298	0.
1	0605	74	6.	*	1	1220	149	0.	*	1	1835	224	0.	*	2	0050	299	0.
1	0610	75	5.	*	1	1225	150	0.	*	1	1840	225	0.	*	2	0055	300	0.

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	24.92-HR
(CFS)	(HR)				
		(CFS)			
362.	3.67	58.	14.	14.	14.
		(INCHES) 2.118	2.120	2.120	2.120
		(AC-FT) 29.	29.	29.	29.

CUMULATIVE AREA = .25 SQ MI

HYDROGRAPH AT STATION CP5
SUM OF 2 HYDROGRAPHS
PLAN 1, RATIO = .61

DA	MON	HRMN	ORD	FLOW	*	DA	MON	HRMN	ORD	FLOW	*	DA	MON	HRMN	ORD	FLOW	*	DA	MON	HRMN	ORD	FLOW
1		0000	1	0.	*	1		0615	76	2.	*	1		1230	151	0.	*	1		1845	226	0.
1		0005	2	0.	*	1		0620	77	1.	*	1		1235	152	0.	*	1		1850	227	0.
1		0010	3	0.	*	1		0625	78	1.	*	1		1240	153	0.	*	1		1855	228	0.
1		0015	4	0.	*	1		0630	79	0.	*	1		1245	154	0.	*	1		1900	229	0.
1		0020	5	0.	*	1		0635	80	0.	*	1		1250	155	0.	*	1		1905	230	0.
1		0025	6	0.	*	1		0640	81	0.	*	1		1255	156	0.	*	1		1910	231	0.
1		0030	7	1.	*	1		0645	82	0.	*	1		1300	157	0.	*	1		1915	232	0.
1		0035	8	2.	*	1		0650	83	0.	*	1		1305	158	0.	*	1		1920	233	0.
1		0040	9	3.	*	1		0655	84	0.	*	1		1310	159	0.	*	1		1925	234	0.
1		0045	10	3.	*	1		0700	85	0.	*	1		1315	160	0.	*	1		1930	235	0.
1		0050	11	2.	*	1		0705	86	0.	*	1		1320	161	0.	*	1		1935	236	0.
1		0055	12	1.	*	1		0710	87	0.	*	1		1325	162	0.	*	1		1940	237	0.
1		0100	13	1.	*	1		0715	88	0.	*	1		1330	163	0.	*	1		1945	238	0.
1		0105	14	1.	*	1		0720	89	0.	*	1		1335	164	0.	*	1		1950	239	0.
1		0110	15	1.	*	1		0725	90	0.	*	1		1340	165	0.	*	1		1955	240	0.
1		0115	16	1.	*	1		0730	91	0.	*	1		1345	166	0.	*	1		2000	241	0.
1		0120	17	2.	*	1		0735	92	0.	*	1		1350	167	0.	*	1		2005	242	0.
1		0125	18	3.	*	1		0740	93	0.	*	1		1355	168	0.	*	1		2010	243	0.
1		0130	19	4.	*	1		0745	94	0.	*	1		1400	169	0.	*	1		2015	244	0.
1		0135	20	6.	*	1		0750	95	0.	*	1		1405	170	0.	*	1		2020	245	0.
1		0140	21	8.	*	1		0755	96	0.	*	1		1410	171	0.	*	1		2025	246	0.
1		0145	22	9.	*	1		0800	97	0.	*	1		1415	172	0.	*	1		2030	247	0.
1		0150	23	9.	*	1		0805	98	0.	*	1		1420	173	0.	*	1		2035	248	0.
1		0155	24	8.	*	1		0810	99	0.	*	1		1425	174	0.	*	1		2040	249	0.
1		0200	25	6.	*	1		0815	100	0.	*	1		1430	175	0.	*	1		2045	250	0.
1		0205	26	5.	*	1		0820	101	0.	*	1		1435	176	0.	*	1		2050	251	0.
1		0210	27	4.	*	1		0825	102	0.	*	1		1440	177	0.	*	1		2055	252	0.
1		0215	28	6.	*	1		0830	103	0.	*	1		1445	178	0.	*	1		2100	253	0.
1		0220	29	9.	*	1		0835	104	0.	*	1		1450	179	0.	*	1		2105	254	0.
1		0225	30	12.	*	1		0840	105	0.	*	1		1455	180	0.	*	1		2110	255	0.
1		0230	31	13.	*	1		0845	106	0.	*	1		1500	181	0.	*	1		2115	256	0.
1		0235	32	12.	*	1		0850	107	0.	*	1		1505	182	0.	*	1		2120	257	0.
1		0240	33	11.	*	1		0855	108	0.	*	1		1510	183	0.	*	1		2125	258	0.
1		0245	34	12.	*	1		0900	109	0.	*	1		1515	184	0.	*	1		2130	259	0.
1		0250	35	13.	*	1		0905	110	0.	*	1		1520	185	0.	*	1		2135	260	0.
1		0255	36	13.	*	1		0910	111	0.	*	1		1525	186	0.	*	1		2140	261	0.
1		0300	37	11.	*	1		0915	112	0.	*	1		1530	187	0.	*	1		2145	262	0.
1		0305	38	13.	*	1		0920	113	0.	*	1		1535	188	0.	*	1		2150	263	0.
1		0310	39	20.	*	1		0925	114	0.	*	1		1540	189	0.	*	1		2155	264	0.
1		0315	40	34.	*	1		0930	115	0.	*	1		1545	190	0.	*	1		2200	265	0.
1		0320	41	58.	*	1		0935	116	0.	*	1		1550	191	0.	*	1		2205	266	0.
1		0325	42	94.	*	1		0940	117	0.	*	1		1555	192	0.	*	1		2210	267	0.
1		0330	43	140.	*	1		0945	118	0.	*	1		1600	193	0.	*	1		2215	268	0.
1		0335	44	180.	*	1		0950	119	0.	*	1		1605	194	0.	*	1		2220	269	0.
1		0340	45	192.	*	1		0955	120	0.	*	1		1610	195	0.	*	1		2225	270	0.
1		0345	46	177.	*	1		1000	121	0.	*	1		1615	196	0.	*	1		2230	271	0.
1		0350	47	149.	*	1		1005	122	0.	*	1		1620	197	0.	*	1		2235	272	0.
1		0355	48	117.	*	1		1010	123	0.	*	1		1625	198	0.	*	1		2240	273	0.
1		0400	49	91.	*	1		1015	124	0.	*	1		1630	199	0.	*	1		2245	274	0.
1		0405	50	72.	*	1		1020	125	0.	*	1		1635	200	0.	*	1		2250	275	0.
1		0410	51	56.	*	1		1025	126	0.	*	1		1640	201	0.	*	1		2255	276	0.
1		0415	52	44.	*	1		1030	127	0.	*	1		1645	202	0.	*	1		2300	277	0.
1		0420	53	34.	*	1		1035	128	0.	*	1		1650	203	0.	*	1		2305	278	0.
1		0425	54	30.	*	1		1040	129	0.	*	1		1655	204	0.	*	1		2310	279	0.
1		0430	55	31.	*	1		1045	130	0.	*	1		1700	205	0.	*	1		2315	280	0.
1		0435	56	36.	*	1		1050	131	0.	*	1		1705	206	0.	*	1		2320	281	0.
1		0440	57	41.	*	1		1055	132	0.	*	1		1710	207	0.	*	1		2325	282	0.
1		0445	58	43.	*	1		1100	133	0.	*	1		1715	208	0.	*	1		2330	283	0.
1		0450	59	43.	*	1		1105	134	0.	*	1		1720	209	0.	*	1		2335	284	0.
1		0455	60	43.	*	1		1110	135	0.	*	1		1725	210	0.	*	1		2340	285	0.
1		0500	61	41.	*	1		1115	136	0.	*	1		1730	211	0.	*	1		2345	286	0.

1	0505	62	35.	*	1	1120	137	0.	*	1	1735	212	0.	*	1	2350	287	0.
1	0510	63	28.	*	1	1125	138	0.	*	1	1740	213	0.	*	1	2355	288	0.
1	0515	64	21.	*	1	1130	139	0.	*	1	1745	214	0.	*	2	0000	289	0.
1	0520	65	16.	*	1	1135	140	0.	*	1	1750	215	0.	*	2	0005	290	0.
1	0525	66	12.	*	1	1140	141	0.	*	1	1755	216	0.	*	2	0010	291	0.
1	0530	67	9.	*	1	1145	142	0.	*	1	1800	217	0.	*	2	0015	292	0.
1	0535	68	7.	*	1	1150	143	0.	*	1	1805	218	0.	*	2	0020	293	0.
1	0540	69	6.	*	1	1155	144	0.	*	1	1810	219	0.	*	2	0025	294	0.
1	0545	70	5.	*	1	1200	145	0.	*	1	1815	220	0.	*	2	0030	295	0.
1	0550	71	5.	*	1	1205	146	0.	*	1	1820	221	0.	*	2	0035	296	0.
1	0555	72	4.	*	1	1210	147	0.	*	1	1825	222	0.	*	2	0040	297	0.
1	0600	73	4.	*	1	1215	148	0.	*	1	1830	223	0.	*	2	0045	298	0.
1	0605	74	3.	*	1	1220	149	0.	*	1	1835	224	0.	*	2	0050	299	0.
1	0610	75	3.	*	1	1225	150	0.	*	1	1840	225	0.	*	2	0055	300	0.
				*					*					*				

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	PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	24.92-HR
+	(CFS)	(HR)					
			(CFS)				
+	192.	3.67		30.	7.	7.	7.
			(INCHES)	1.082	1.083	1.083	1.083
			(AC-FT)	15.	15.	15.	15.

CUMULATIVE AREA = .25 SQ MI

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          **************
          *            *
67 KK     *     PRO4   *
          *            *
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68 KO OUTPUT CONTROL VARIABLES

IPRNT	1	PRINT CONTROL
IPLOT	0	PLOT CONTROL
QSCAL	0.	HYDROGRAPH PLOT SCALE

DEVELOPED INDUSTRIAL SITE

SUBBASIN RUNOFF DATA

70 BA SUBBASIN CHARACTERISTICS

TAREA	.21	SUBBASIN AREA

PRECIPITATION DATA

24 PB STORM 2.86 BASIN TOTAL PRECIPITATION

25 PI INCREMENTAL PRECIPITATION PATTERN

.02	.04	.01	.02	.02	.02	.01	.00	.00	.00
.00	.00	.00	.01	.00	.01	.01	.01	.01	.01
.01	.00	.00	.00	.00	.01	.02	.01	.01	.00
.01	.01	.01	.00	.00	.01	.03	.03	.06	.09
.09	.12	.03	.04	.03	.01	.02	.02	.00	.00
.01	.01	.01	.02	.02	.01	.01	.02	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00								

71 LS SCS LOSS RATE

STRTL	.16	INITIAL ABSTRACTION
CRVNBR	92.80	CURVE NUMBER
RTIMP	.00	PERCENT IMPERVIOUS AREA

72 UD SCS DIMENSIONLESS UNITGRAPH

TLAG	.51	LAG

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UNIT HYDROGRAPH
32 END-OF-PERIOD ORDINATES

12.	35.	73.	122.	161.	181.	181.	167.	147.	120.
89.	69.	53.	43.	33.	26.	20.	16.	12.	10.
7.	6.	5.	4.	3.	2.	2.	1.	1.	1.
1.	0.								

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HYDROGRAPH AT STATION PRO4

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DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	*	DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q
								*								
1		0000	1	.00	.00	.00	0.	*	1		1230	151	.00	.00	.00	0.
1		0005	2	.06	.06	.00	0.	*	1		1235	152	.00	.00	.00	0.
1		0010	3	.11	.11	.00	0.	*	1		1240	153	.00	.00	.00	0.
1		0015	4	.04	.03	.00	0.	*	1		1245	154	.00	.00	.00	0.
1		0020	5	.05	.04	.01	0.	*	1		1250	155	.00	.00	.00	0.
1		0025	6	.06	.04	.02	1.	*	1		1255	156	.00	.00	.00	0.
1		0030	7	.05	.03	.02	2.	*	1		1300	157	.00	.00	.00	0.
1		0035	8	.02	.01	.01	3.	*	1		1305	158	.00	.00	.00	0.
1		0040	9	.00	.00	.00	5.	*	1		1310	159	.00	.00	.00	0.
1		0045	10	.00	.00	.00	7.	*	1		1315	160	.00	.00	.00	0.
1		0050	11	.00	.00	.00	8.	*	1		1320	161	.00	.00	.00	0.
1		0055	12	.00	.00	.00	8.	*	1		1325	162	.00	.00	.00	0.
1		0100	13	.00	.00	.00	8.	*	1		1330	163	.00	.00	.00	0.
1		0105	14	.01	.01	.00	7.	*	1		1335	164	.00	.00	.00	0.
1		0110	15	.02	.01	.01	6.	*	1		1340	165	.00	.00	.00	0.

1	0115	16	.01	.00	.00	5.	*	1	1345	166	.00	.00	.00	0.
1	0120	17	.02	.01	.01	5.	*	1	1350	167	.00	.00	.00	0.
1	0125	18	.03	.02	.01	5.	*	1	1355	168	.00	.00	.00	0.
1	0130	19	.04	.02	.02	6.	*	1	1400	169	.00	.00	.00	0.
1	0135	20	.03	.01	.01	7.	*	1	1405	170	.00	.00	.00	0.
1	0140	21	.03	.01	.01	9.	*	1	1410	171	.00	.00	.00	0.
1	0145	22	.02	.01	.01	11.	*	1	1415	172	.00	.00	.00	0.
1	0150	23	.01	.00	.00	13.	*	1	1420	173	.00	.00	.00	0.
1	0155	24	.00	.00	.00	14.	*	1	1425	174	.00	.00	.00	0.
1	0200	25	.00	.00	.00	15.	*	1	1430	175	.00	.00	.00	0.
1	0205	26	.01	.00	.00	15.	*	1	1435	176	.00	.00	.00	0.
1	0210	27	.03	.01	.02	14.	*	1	1440	177	.00	.00	.00	0.
1	0215	28	.04	.02	.03	14.	*	1	1445	178	.00	.00	.00	0.
1	0220	29	.03	.01	.02	14.	*	1	1450	179	.00	.00	.00	0.
1	0225	30	.02	.01	.01	14.	*	1	1455	180	.00	.00	.00	0.
1	0230	31	.01	.00	.00	16.	*	1	1500	181	.00	.00	.00	0.
1	0235	32	.01	.00	.01	18.	*	1	1505	182	.00	.00	.00	0.
1	0240	33	.04	.01	.03	19.	*	1	1510	183	.00	.00	.00	0.
1	0245	34	.02	.01	.02	20.	*	1	1515	184	.00	.00	.00	0.
1	0250	35	.01	.00	.01	21.	*	1	1520	185	.00	.00	.00	0.
1	0255	36	.01	.00	.00	22.	*	1	1525	186	.00	.00	.00	0.
1	0300	37	.03	.01	.02	22.	*	1	1530	187	.00	.00	.00	0.
1	0305	38	.08	.02	.06	22.	*	1	1535	188	.00	.00	.00	0.
1	0310	39	.09	.02	.07	24.	*	1	1540	189	.00	.00	.00	0.
1	0315	40	.16	.03	.13	28.	*	1	1545	190	.00	.00	.00	0.
1	0320	41	.26	.04	.22	37.	*	1	1550	191	.00	.00	.00	0.
1	0325	42	.26	.03	.23	53.	*	1	1555	192	.00	.00	.00	0.
1	0330	43	.34	.03	.31	78.	*	1	1600	193	.00	.00	.00	0.
1	0335	44	.10	.01	.09	109.	*	1	1605	194	.00	.00	.00	0.
1	0340	45	.11	.01	.10	143.	*	1	1610	195	.00	.00	.00	0.
1	0345	46	.09	.01	.08	174.	*	1	1615	196	.00	.00	.00	0.
1	0350	47	.02	.00	.02	195.	*	1	1620	197	.00	.00	.00	0.
1	0355	48	.05	.00	.04	203.	*	1	1625	198	.00	.00	.00	0.
1	0400	49	.05	.00	.04	200.	*	1	1630	199	.00	.00	.00	0.
1	0405	50	.01	.00	.01	187.	*	1	1635	200	.00	.00	.00	0.
1	0410	51	.01	.00	.01	168.	*	1	1640	201	.00	.00	.00	0.
1	0415	52	.02	.00	.02	147.	*	1	1645	202	.00	.00	.00	0.
1	0420	53	.02	.00	.02	125.	*	1	1650	203	.00	.00	.00	0.
1	0425	54	.03	.00	.03	107.	*	1	1655	204	.00	.00	.00	0.
1	0430	55	.06	.00	.06	92.	*	1	1700	205	.00	.00	.00	0.
1	0435	56	.05	.00	.04	81.	*	1	1705	206	.00	.00	.00	0.
1	0440	57	.03	.00	.03	74.	*	1	1710	207	.00	.00	.00	0.
1	0445	58	.04	.00	.04	69.	*	1	1715	208	.00	.00	.00	0.
1	0450	59	.06	.00	.05	67.	*	1	1720	209	.00	.00	.00	0.
1	0455	60	.02	.00	.02	66.	*	1	1725	210	.00	.00	.00	0.
1	0500	61	.02	.00	.02	64.	*	1	1730	211	.00	.00	.00	0.
1	0505	62	.01	.00	.01	63.	*	1	1735	212	.00	.00	.00	0.
1	0510	63	.01	.00	.01	60.	*	1	1740	213	.00	.00	.00	0.
1	0515	64	.01	.00	.01	56.	*	1	1745	214	.00	.00	.00	0.
1	0520	65	.00	.00	.00	50.	*	1	1750	215	.00	.00	.00	0.
1	0525	66	.01	.00	.01	44.	*	1	1755	216	.00	.00	.00	0.
1	0530	67	.00	.00	.00	38.	*	1	1800	217	.00	.00	.00	0.
1	0535	68	.00	.00	.00	32.	*	1	1805	218	.00	.00	.00	0.
1	0540	69	.00	.00	.00	26.	*	1	1810	219	.00	.00	.00	0.
1	0545	70	.01	.00	.01	22.	*	1	1815	220	.00	.00	.00	0.
1	0550	71	.00	.00	.00	18.	*	1	1820	221	.00	.00	.00	0.
1	0555	72	.00	.00	.00	16.	*	1	1825	222	.00	.00	.00	0.
1	0600	73	.00	.00	.00	13.	*	1	1830	223	.00	.00	.00	0.
1	0605	74	.00	.00	.00	11.	*	1	1835	224	.00	.00	.00	0.
1	0610	75	.00	.00	.00	10.	*	1	1840	225	.00	.00	.00	0.
1	0615	76	.00	.00	.00	8.	*	1	1845	226	.00	.00	.00	0.
1	0620	77	.00	.00	.00	7.	*	1	1850	227	.00	.00	.00	0.
1	0625	78	.00	.00	.00	6.	*	1	1855	228	.00	.00	.00	0.
1	0630	79	.00	.00	.00	5.	*	1	1900	229	.00	.00	.00	0.
1	0635	80	.00	.00	.00	4.	*	1	1905	230	.00	.00	.00	0.
1	0640	81	.00	.00	.00	3.	*	1	1910	231	.00	.00	.00	0.
1	0645	82	.00	.00	.00	2.	*	1	1915	232	.00	.00	.00	0.
1	0650	83	.00	.00	.00	2.	*	1	1920	233	.00	.00	.00	0.
1	0655	84	.00	.00	.00	1.	*	1	1925	234	.00	.00	.00	0.
1	0700	85	.00	.00	.00	1.	*	1	1930	235	.00	.00	.00	0.
1	0705	86	.00	.00	.00	1.	*	1	1935	236	.00	.00	.00	0.
1	0710	87	.00	.00	.00	1.	*	1	1940	237	.00	.00	.00	0.
1	0715	88	.00	.00	.00	0.	*	1	1945	238	.00	.00	.00	0.
1	0720	89	.00	.00	.00	0.	*	1	1950	239	.00	.00	.00	0.
1	0725	90	.00	.00	.00	0.	*	1	1955	240	.00	.00	.00	0.
1	0730	91	.00	.00	.00	0.	*	1	2000	241	.00	.00	.00	0.
1	0735	92	.00	.00	.00	0.	*	1	2005	242	.00	.00	.00	0.
1	0740	93	.00	.00	.00	0.	*	1	2010	243	.00	.00	.00	0.
1	0745	94	.00	.00	.00	0.	*	1	2015	244	.00	.00	.00	0.
1	0750	95	.00	.00	.00	0.	*	1	2020	245	.00	.00	.00	0.
1	0755	96	.00	.00	.00	0.	*	1	2025	246	.00	.00	.00	0.
1	0800	97	.00	.00	.00	0.	*	1	2030	247	.00	.00	.00	0.
1	0805	98	.00	.00	.00	0.	*	1	2035	248	.00	.00	.00	0.
1	0810	99	.00	.00	.00	0.	*	1	2040	249	.00	.00	.00	0.
1	0815	100	.00	.00	.00	0.	*	1	2045	250	.00	.00	.00	0.
1	0820	101	.00	.00	.00	0.	*	1	2050	251	.00	.00	.00	0.
1	0825	102	.00	.00	.00	0.	*	1	2055	252	.00	.00	.00	0.
1	0830	103	.00	.00	.00	0.	*	1	2100	253	.00	.00	.00	0.
1	0835	104	.00	.00	.00	0.	*	1	2105	254	.00	.00	.00	0.
1	0840	105	.00	.00	.00	0.	*	1	2110	255	.00	.00	.00	0.
1	0845	106	.00	.00	.00	0.	*	1	2115	256	.00	.00	.00	0.
1	0850	107	.00	.00	.00	0.	*	1	2120	257	.00	.00	.00	0.
1	0855	108	.00	.00	.00	0.	*	1	2125	258	.00	.00	.00	0.
1	0900	109	.00	.00	.00	0.	*	1	2130	259	.00	.00	.00	0.
1	0905	110	.00	.00	.00	0.	*	1	2135	260	.00	.00	.00	0.
1	0910	111	.00	.00	.00	0.	*	1	2140	261	.00	.00	.00	0.
1	0915	112	.00	.00	.00	0.	*	1	2145	262	.00	.00	.00	0.
1	0920	113	.00	.00	.00	0.	*	1	2150	263	.00	.00	.00	0.
1	0925	114	.00	.00	.00	0.	*	1	2155	264	.00	.00	.00	0.
1	0930	115	.00	.00	.00	0.	*	1	2200	265	.00	.00	.00	0.
1	0935	116	.00	.00	.00	0.	*	1	2205	266	.00	.00	.00	0.
1	0940	117	.00	.00	.00	0.	*	1	2210	267	.00	.00	.00	0.
1	0945	118	.00	.00	.00	0.	*	1	2215	268	.00	.00	.00	0.
1	0950	119	.00	.00	.00	0.	*	1	2220	269	.00	.00	.00	0.

1	0955	120	.00	.00	.00	0.	*	1	2225	270	.00	.00	.00	0.
1	1000	121	.00	.00	.00	0.	*	1	2230	271	.00	.00	.00	0.
1	1005	122	.00	.00	.00	0.	*	1	2235	272	.00	.00	.00	0.
1	1010	123	.00	.00	.00	0.	*	1	2240	273	.00	.00	.00	0.
1	1015	124	.00	.00	.00	0.	*	1	2245	274	.00	.00	.00	0.
1	1020	125	.00	.00	.00	0.	*	1	2250	275	.00	.00	.00	0.
1	1025	126	.00	.00	.00	0.	*	1	2255	276	.00	.00	.00	0.
1	1030	127	.00	.00	.00	0.	*	1	2300	277	.00	.00	.00	0.
1	1035	128	.00	.00	.00	0.	*	1	2305	278	.00	.00	.00	0.
1	1040	129	.00	.00	.00	0.	*	1	2310	279	.00	.00	.00	0.
1	1045	130	.00	.00	.00	0.	*	1	2315	280	.00	.00	.00	0.
1	1050	131	.00	.00	.00	0.	*	1	2320	281	.00	.00	.00	0.
1	1055	132	.00	.00	.00	0.	*	1	2325	282	.00	.00	.00	0.
1	1100	133	.00	.00	.00	0.	*	1	2330	283	.00	.00	.00	0.
1	1105	134	.00	.00	.00	0.	*	1	2335	284	.00	.00	.00	0.
1	1110	135	.00	.00	.00	0.	*	1	2340	285	.00	.00	.00	0.
1	1115	136	.00	.00	.00	0.	*	1	2345	286	.00	.00	.00	0.
1	1120	137	.00	.00	.00	0.	*	1	2350	287	.00	.00	.00	0.
1	1125	138	.00	.00	.00	0.	*	1	2355	288	.00	.00	.00	0.
1	1130	139	.00	.00	.00	0.	*	2	0000	289	.00	.00	.00	0.
1	1135	140	.00	.00	.00	0.	*	2	0005	290	.00	.00	.00	0.
1	1140	141	.00	.00	.00	0.	*	2	0010	291	.00	.00	.00	0.
1	1145	142	.00	.00	.00	0.	*	2	0015	292	.00	.00	.00	0.
1	1150	143	.00	.00	.00	0.	*	2	0020	293	.00	.00	.00	0.
1	1155	144	.00	.00	.00	0.	*	2	0025	294	.00	.00	.00	0.
1	1200	145	.00	.00	.00	0.	*	2	0030	295	.00	.00	.00	0.
1	1205	146	.00	.00	.00	0.	*	2	0035	296	.00	.00	.00	0.
1	1210	147	.00	.00	.00	0.	*	2	0040	297	.00	.00	.00	0.
1	1215	148	.00	.00	.00	0.	*	2	0045	298	.00	.00	.00	0.
1	1220	149	.00	.00	.00	0.	*	2	0050	299	.00	.00	.00	0.
1	1225	150	.00	.00	.00	0.	*	2	0055	300	.00	.00	.00	0.

****

TOTAL RAINFALL = 2.86, TOTAL LOSS = .76, TOTAL EXCESS = 2.10

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	24.92-HR
+ (CFS)	(HR)					
		(CFS)				
+ 203.	3.92		47.	12.	11.	11.
		(INCHES)	2.090	2.102	2.102	2.102
		(AC-FT)	23.	23.	23.	23.

CUMULATIVE AREA = .21 SQ MI

****

HYDROGRAPH AT STATION PRO4
PLAN 1, RATIO = 1.00

****

DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q		DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q
1		0000	1	.00	.00	.00	0.	*	1		1230	151	.00	.00	.00	0.
1		0005	2	.06	.06	.00	0.	*	1		1235	152	.00	.00	.00	0.
1		0010	3	.11	.11	.00	0.	*	1		1240	153	.00	.00	.00	0.
1		0015	4	.04	.03	.00	0.	*	1		1245	154	.00	.00	.00	0.
1		0020	5	.05	.04	.01	0.	*	1		1250	155	.00	.00	.00	0.
1		0025	6	.06	.04	.02	1.	*	1		1255	156	.00	.00	.00	0.
1		0030	7	.05	.03	.02	2.	*	1		1300	157	.00	.00	.00	0.
1		0035	8	.02	.01	.01	3.	*	1		1305	158	.00	.00	.00	0.
1		0040	9	.00	.00	.00	5.	*	1		1310	159	.00	.00	.00	0.
1		0045	10	.00	.00	.00	7.	*	1		1315	160	.00	.00	.00	0.
1		0050	11	.00	.00	.00	8.	*	1		1320	161	.00	.00	.00	0.
1		0055	12	.00	.00	.00	8.	*	1		1325	162	.00	.00	.00	0.
1		0100	13	.00	.00	.00	8.	*	1		1330	163	.00	.00	.00	0.
1		0105	14	.01	.01	.00	7.	*	1		1335	164	.00	.00	.00	0.
1		0110	15	.02	.01	.01	6.	*	1		1340	165	.00	.00	.00	0.
1		0115	16	.01	.00	.00	5.	*	1		1345	166	.00	.00	.00	0.
1		0120	17	.02	.01	.01	5.	*	1		1350	167	.00	.00	.00	0.
1		0125	18	.03	.02	.01	5.	*	1		1355	168	.00	.00	.00	0.
1		0130	19	.04	.02	.02	6.	*	1		1400	169	.00	.00	.00	0.
1		0135	20	.03	.01	.01	7.	*	1		1405	170	.00	.00	.00	0.
1		0140	21	.03	.01	.01	9.	*	1		1410	171	.00	.00	.00	0.
1		0145	22	.02	.01	.01	11.	*	1		1415	172	.00	.00	.00	0.
1		0150	23	.01	.00	.00	13.	*	1		1420	173	.00	.00	.00	0.
1		0155	24	.00	.00	.00	14.	*	1		1425	174	.00	.00	.00	0.
1		0200	25	.00	.00	.00	15.	*	1		1430	175	.00	.00	.00	0.
1		0205	26	.01	.00	.00	15.	*	1		1435	176	.00	.00	.00	0.
1		0210	27	.03	.01	.02	14.	*	1		1440	177	.00	.00	.00	0.
1		0215	28	.04	.02	.03	14.	*	1		1445	178	.00	.00	.00	0.
1		0220	29	.03	.01	.02	14.	*	1		1450	179	.00	.00	.00	0.
1		0225	30	.02	.01	.01	14.	*	1		1455	180	.00	.00	.00	0.
1		0230	31	.01	.00	.00	16.	*	1		1500	181	.00	.00	.00	0.
1		0235	32	.01	.00	.01	18.	*	1		1505	182	.00	.00	.00	0.
1		0240	33	.04	.01	.03	19.	*	1		1510	183	.00	.00	.00	0.
1		0245	34	.02	.01	.02	20.	*	1		1515	184	.00	.00	.00	0.
1		0250	35	.01	.00	.01	21.	*	1		1520	185	.00	.00	.00	0.
1		0255	36	.01	.00	.00	22.	*	1		1525	186	.00	.00	.00	0.
1		0300	37	.03	.01	.02	22.	*	1		1530	187	.00	.00	.00	0.
1		0305	38	.08	.02	.06	22.	*	1		1535	188	.00	.00	.00	0.
1		0310	39	.09	.02	.07	24.	*	1		1540	189	.00	.00	.00	0.
1		0315	40	.16	.03	.13	28.	*	1		1545	190	.00	.00	.00	0.
1		0320	41	.26	.04	.22	37.	*	1		1550	191	.00	.00	.00	0.
1		0325	42	.26	.03	.23	53.	*	1		1555	192	.00	.00	.00	0.
1		0330	43	.34	.03	.31	78.	*	1		1600	193	.00	.00	.00	0.
1		0335	44	.10	.01	.09	109.	*	1		1605	194	.00	.00	.00	0.
1		0340	45	.11	.01	.10	143.	*	1		1610	195	.00	.00	.00	0.
1		0345	46	.09	.01	.08	174.	*	1		1615	196	.00	.00	.00	0.
1		0350	47	.02	.00	.02	195.	*	1		1620	197	.00	.00	.00	0.
1		0355	48	.05	.00	.04	203.	*	1		1625	198	.00	.00	.00	0.

1	0400	49	.05	.00	.04	200.	*	1	1630	199	.00	.00	.00	0.
1	0405	50	.01	.00	.01	187.	*	1	1635	200	.00	.00	.00	0.
1	0410	51	.01	.00	.01	168.	*	1	1640	201	.00	.00	.00	0.
1	0415	52	.02	.00	.02	147.	*	1	1645	202	.00	.00	.00	0.
1	0420	53	.02	.00	.02	125.	*	1	1650	203	.00	.00	.00	0.
1	0425	54	.03	.00	.03	107.	*	1	1655	204	.00	.00	.00	0.
1	0430	55	.06	.00	.06	92.	*	1	1700	205	.00	.00	.00	0.
1	0435	56	.05	.00	.04	81.	*	1	1705	206	.00	.00	.00	0.
1	0440	57	.03	.00	.03	74.	*	1	1710	207	.00	.00	.00	0.
1	0445	58	.04	.00	.04	69.	*	1	1715	208	.00	.00	.00	0.
1	0450	59	.06	.00	.05	67.	*	1	1720	209	.00	.00	.00	0.
1	0455	60	.02	.00	.02	66.	*	1	1725	210	.00	.00	.00	0.
1	0500	61	.02	.00	.02	64.	*	1	1730	211	.00	.00	.00	0.
1	0505	62	.01	.00	.01	63.	*	1	1735	212	.00	.00	.00	0.
1	0510	63	.01	.00	.01	60.	*	1	1740	213	.00	.00	.00	0.
1	0515	64	.01	.00	.01	56.	*	1	1745	214	.00	.00	.00	0.
1	0520	65	.00	.00	.00	50.	*	1	1750	215	.00	.00	.00	0.
1	0525	66	.01	.00	.01	44.	*	1	1755	216	.00	.00	.00	0.
1	0530	67	.00	.00	.00	38.	*	1	1800	217	.00	.00	.00	0.
1	0535	68	.00	.00	.00	32.	*	1	1805	218	.00	.00	.00	0.
1	0540	69	.00	.00	.00	26.	*	1	1810	219	.00	.00	.00	0.
1	0545	70	.01	.00	.01	22.	*	1	1815	220	.00	.00	.00	0.
1	0550	71	.00	.00	.00	18.	*	1	1820	221	.00	.00	.00	0.
1	0555	72	.00	.00	.00	16.	*	1	1825	222	.00	.00	.00	0.
1	0600	73	.00	.00	.00	13.	*	1	1830	223	.00	.00	.00	0.
1	0605	74	.00	.00	.00	11.	*	1	1835	224	.00	.00	.00	0.
1	0610	75	.00	.00	.00	10.	*	1	1840	225	.00	.00	.00	0.
1	0615	76	.00	.00	.00	8.	*	1	1845	226	.00	.00	.00	0.
1	0620	77	.00	.00	.00	7.	*	1	1850	227	.00	.00	.00	0.
1	0625	78	.00	.00	.00	6.	*	1	1855	228	.00	.00	.00	0.
1	0630	79	.00	.00	.00	5.	*	1	1900	229	.00	.00	.00	0.
1	0635	80	.00	.00	.00	4.	*	1	1905	230	.00	.00	.00	0.
1	0640	81	.00	.00	.00	3.	*	1	1910	231	.00	.00	.00	0.
1	0645	82	.00	.00	.00	2.	*	1	1915	232	.00	.00	.00	0.
1	0650	83	.00	.00	.00	2.	*	1	1920	233	.00	.00	.00	0.
1	0655	84	.00	.00	.00	1.	*	1	1925	234	.00	.00	.00	0.
1	0700	85	.00	.00	.00	1.	*	1	1930	235	.00	.00	.00	0.
1	0705	86	.00	.00	.00	1.	*	1	1935	236	.00	.00	.00	0.
1	0710	87	.00	.00	.00	1.	*	1	1940	237	.00	.00	.00	0.
1	0715	88	.00	.00	.00	0.	*	1	1945	238	.00	.00	.00	0.
1	0720	89	.00	.00	.00	0.	*	1	1950	239	.00	.00	.00	0.
1	0725	90	.00	.00	.00	0.	*	1	1955	240	.00	.00	.00	0.
1	0730	91	.00	.00	.00	0.	*	1	2000	241	.00	.00	.00	0.
1	0735	92	.00	.00	.00	0.	*	1	2005	242	.00	.00	.00	0.
1	0740	93	.00	.00	.00	0.	*	1	2010	243	.00	.00	.00	0.
1	0745	94	.00	.00	.00	0.	*	1	2015	244	.00	.00	.00	0.
1	0750	95	.00	.00	.00	0.	*	1	2020	245	.00	.00	.00	0.
1	0755	96	.00	.00	.00	0.	*	1	2025	246	.00	.00	.00	0.
1	0800	97	.00	.00	.00	0.	*	1	2030	247	.00	.00	.00	0.
1	0805	98	.00	.00	.00	0.	*	1	2035	248	.00	.00	.00	0.
1	0810	99	.00	.00	.00	0.	*	1	2040	249	.00	.00	.00	0.
1	0815	100	.00	.00	.00	0.	*	1	2045	250	.00	.00	.00	0.
1	0820	101	.00	.00	.00	0.	*	1	2050	251	.00	.00	.00	0.
1	0825	102	.00	.00	.00	0.	*	1	2055	252	.00	.00	.00	0.
1	0830	103	.00	.00	.00	0.	*	1	2100	253	.00	.00	.00	0.
1	0835	104	.00	.00	.00	0.	*	1	2105	254	.00	.00	.00	0.
1	0840	105	.00	.00	.00	0.	*	1	2110	255	.00	.00	.00	0.
1	0845	106	.00	.00	.00	0.	*	1	2115	256	.00	.00	.00	0.
1	0850	107	.00	.00	.00	0.	*	1	2120	257	.00	.00	.00	0.
1	0855	108	.00	.00	.00	0.	*	1	2125	258	.00	.00	.00	0.
1	0900	109	.00	.00	.00	0.	*	1	2130	259	.00	.00	.00	0.
1	0905	110	.00	.00	.00	0.	*	1	2135	260	.00	.00	.00	0.
1	0910	111	.00	.00	.00	0.	*	1	2140	261	.00	.00	.00	0.
1	0915	112	.00	.00	.00	0.	*	1	2145	262	.00	.00	.00	0.
1	0920	113	.00	.00	.00	0.	*	1	2150	263	.00	.00	.00	0.
1	0925	114	.00	.00	.00	0.	*	1	2155	264	.00	.00	.00	0.
1	0930	115	.00	.00	.00	0.	*	1	2200	265	.00	.00	.00	0.
1	0935	116	.00	.00	.00	0.	*	1	2205	266	.00	.00	.00	0.
1	0940	117	.00	.00	.00	0.	*	1	2210	267	.00	.00	.00	0.
1	0945	118	.00	.00	.00	0.	*	1	2215	268	.00	.00	.00	0.
1	0950	119	.00	.00	.00	0.	*	1	2220	269	.00	.00	.00	0.
1	0955	120	.00	.00	.00	0.	*	1	2225	270	.00	.00	.00	0.
1	1000	121	.00	.00	.00	0.	*	1	2230	271	.00	.00	.00	0.
1	1005	122	.00	.00	.00	0.	*	1	2235	272	.00	.00	.00	0.
1	1010	123	.00	.00	.00	0.	*	1	2240	273	.00	.00	.00	0.
1	1015	124	.00	.00	.00	0.	*	1	2245	274	.00	.00	.00	0.
1	1020	125	.00	.00	.00	0.	*	1	2250	275	.00	.00	.00	0.
1	1025	126	.00	.00	.00	0.	*	1	2255	276	.00	.00	.00	0.
1	1030	127	.00	.00	.00	0.	*	1	2300	277	.00	.00	.00	0.
1	1035	128	.00	.00	.00	0.	*	1	2305	278	.00	.00	.00	0.
1	1040	129	.00	.00	.00	0.	*	1	2310	279	.00	.00	.00	0.
1	1045	130	.00	.00	.00	0.	*	1	2315	280	.00	.00	.00	0.
1	1050	131	.00	.00	.00	0.	*	1	2320	281	.00	.00	.00	0.
1	1055	132	.00	.00	.00	0.	*	1	2325	282	.00	.00	.00	0.
1	1100	133	.00	.00	.00	0.	*	1	2330	283	.00	.00	.00	0.
1	1105	134	.00	.00	.00	0.	*	1	2335	284	.00	.00	.00	0.
1	1110	135	.00	.00	.00	0.	*	1	2340	285	.00	.00	.00	0.
1	1115	136	.00	.00	.00	0.	*	1	2345	286	.00	.00	.00	0.
1	1120	137	.00	.00	.00	0.	*	1	2350	287	.00	.00	.00	0.
1	1125	138	.00	.00	.00	0.	*	1	2355	288	.00	.00	.00	0.
1	1130	139	.00	.00	.00	0.	*	2	0000	289	.00	.00	.00	0.
1	1135	140	.00	.00	.00	0.	*	2	0005	290	.00	.00	.00	0.
1	1140	141	.00	.00	.00	0.	*	2	0010	291	.00	.00	.00	0.
1	1145	142	.00	.00	.00	0.	*	2	0015	292	.00	.00	.00	0.
1	1150	143	.00	.00	.00	0.	*	2	0020	293	.00	.00	.00	0.
1	1155	144	.00	.00	.00	0.	*	2	0025	294	.00	.00	.00	0.
1	1200	145	.00	.00	.00	0.	*	2	0030	295	.00	.00	.00	0.
1	1205	146	.00	.00	.00	0.	*	2	0035	296	.00	.00	.00	0.
1	1210	147	.00	.00	.00	0.	*	2	0040	297	.00	.00	.00	0.
1	1215	148	.00	.00	.00	0.	*	2	0045	298	.00	.00	.00	0.
1	1220	149	.00	.00	.00	0.	*	2	0050	299	.00	.00	.00	0.
1	1225	150	.00	.00	.00	0.	*	2	0055	300	.00	.00	.00	0.
							*							

****

TOTAL RAINFALL = 2.86, TOTAL LOSS = .76, TOTAL EXCESS = 2.10

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	24.92-HR
+ (CFS)	(HR)	(CFS)			
+ 203.	3.92	47.	12.	11.	11.
		(INCHES) 2.090	2.102	2.102	2.102
		(AC-FT) 23.	23.	23.	23.

CUMULATIVE AREA = .21 SQ MI

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HYDROGRAPH AT STATION PRO4
PLAN 1, RATIO = .61

****

DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	*	DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q
								*								
1		0000	1	.00	.00	.00	0.	*	1		1230	151	.00	.00	.00	0.
1		0005	2	.03	.03	.00	0.	*	1		1235	152	.00	.00	.00	0.
1		0010	3	.06	.06	.00	0.	*	1		1240	153	.00	.00	.00	0.
1		0015	4	.02	.02	.00	0.	*	1		1245	154	.00	.00	.00	0.
1		0020	5	.03	.03	.00	0.	*	1		1250	155	.00	.00	.00	0.
1		0025	6	.04	.04	.00	0.	*	1		1255	156	.00	.00	.00	0.
1		0030	7	.03	.02	.00	0.	*	1		1300	157	.00	.00	.00	0.
1		0035	8	.01	.01	.00	0.	*	1		1305	158	.00	.00	.00	0.
1		0040	9	.00	.00	.00	0.	*	1		1310	159	.00	.00	.00	0.
1		0045	10	.00	.00	.00	1.	*	1		1315	160	.00	.00	.00	0.
1		0050	11	.00	.00	.00	1.	*	1		1320	161	.00	.00	.00	0.
1		0055	12	.00	.00	.00	1.	*	1		1325	162	.00	.00	.00	0.
1		0100	13	.00	.00	.00	1.	*	1		1330	163	.00	.00	.00	0.
1		0105	14	.01	.00	.00	1.	*	1		1335	164	.00	.00	.00	0.
1		0110	15	.01	.01	.00	1.	*	1		1340	165	.00	.00	.00	0.
1		0115	16	.00	.00	.00	1.	*	1		1345	166	.00	.00	.00	0.
1		0120	17	.01	.01	.00	1.	*	1		1350	167	.00	.00	.00	0.
1		0125	18	.02	.01	.00	1.	*	1		1355	168	.00	.00	.00	0.
1		0130	19	.02	.02	.01	1.	*	1		1400	169	.00	.00	.00	0.
1		0135	20	.02	.01	.00	2.	*	1		1405	170	.00	.00	.00	0.
1		0140	21	.02	.01	.01	2.	*	1		1410	171	.00	.00	.00	0.
1		0145	22	.01	.01	.00	3.	*	1		1415	172	.00	.00	.00	0.
1		0150	23	.00	.00	.00	4.	*	1		1420	173	.00	.00	.00	0.
1		0155	24	.00	.00	.00	5.	*	1		1425	174	.00	.00	.00	0.
1		0200	25	.00	.00	.00	5.	*	1		1430	175	.00	.00	.00	0.
1		0205	26	.01	.00	.00	5.	*	1		1435	176	.00	.00	.00	0.
1		0210	27	.02	.01	.01	5.	*	1		1440	177	.00	.00	.00	0.
1		0215	28	.03	.02	.01	5.	*	1		1445	178	.00	.00	.00	0.
1		0220	29	.02	.01	.01	5.	*	1		1450	179	.00	.00	.00	0.
1		0225	30	.01	.01	.01	5.	*	1		1455	180	.00	.00	.00	0.
1		0230	31	.00	.00	.00	6.	*	1		1500	181	.00	.00	.00	0.
1		0235	32	.01	.00	.00	7.	*	1		1505	182	.00	.00	.00	0.
1		0240	33	.02	.01	.01	8.	*	1		1510	183	.00	.00	.00	0.
1		0245	34	.01	.01	.01	8.	*	1		1515	184	.00	.00	.00	0.
1		0250	35	.01	.00	.00	9.	*	1		1520	185	.00	.00	.00	0.
1		0255	36	.00	.00	.00	9.	*	1		1525	186	.00	.00	.00	0.
1		0300	37	.02	.01	.01	9.	*	1		1530	187	.00	.00	.00	0.
1		0305	38	.05	.02	.03	9.	*	1		1535	188	.00	.00	.00	0.
1		0310	39	.05	.02	.03	10.	*	1		1540	189	.00	.00	.00	0.
1		0315	40	.10	.04	.06	12.	*	1		1545	190	.00	.00	.00	0.
1		0320	41	.16	.05	.11	17.	*	1		1550	191	.00	.00	.00	0.
1		0325	42	.16	.04	.12	25.	*	1		1555	192	.00	.00	.00	0.
1		0330	43	.21	.04	.17	38.	*	1		1600	193	.00	.00	.00	0.
1		0335	44	.06	.01	.05	54.	*	1		1605	194	.00	.00	.00	0.
1		0340	45	.06	.01	.05	72.	*	1		1610	195	.00	.00	.00	0.
1		0345	46	.05	.01	.05	89.	*	1		1615	196	.00	.00	.00	0.
1		0350	47	.01	.00	.01	101.	*	1		1620	197	.00	.00	.00	0.
1		0355	48	.03	.00	.02	106.	*	1		1625	198	.00	.00	.00	0.
1		0400	49	.03	.00	.02	105.	*	1		1630	199	.00	.00	.00	0.
1		0405	50	.01	.00	.01	99.	*	1		1635	200	.00	.00	.00	0.
1		0410	51	.01	.00	.01	90.	*	1		1640	201	.00	.00	.00	0.
1		0415	52	.01	.00	.01	79.	*	1		1645	202	.00	.00	.00	0.
1		0420	53	.01	.00	.01	68.	*	1		1650	203	.00	.00	.00	0.
1		0425	54	.02	.00	.02	58.	*	1		1655	204	.00	.00	.00	0.
1		0430	55	.04	.00	.03	50.	*	1		1700	205	.00	.00	.00	0.
1		0435	56	.03	.00	.02	44.	*	1		1705	206	.00	.00	.00	0.
1		0440	57	.02	.00	.02	40.	*	1		1710	207	.00	.00	.00	0.
1		0445	58	.02	.00	.02	38.	*	1		1715	208	.00	.00	.00	0.
1		0450	59	.03	.00	.03	37.	*	1		1720	209	.00	.00	.00	0.
1		0455	60	.01	.00	.01	37.	*	1		1725	210	.00	.00	.00	0.
1		0500	61	.01	.00	.01	36.	*	1		1730	211	.00	.00	.00	0.
1		0505	62	.01	.00	.00	35.	*	1		1735	212	.00	.00	.00	0.
1		0510	63	.00	.00	.00	34.	*	1		1740	213	.00	.00	.00	0.
1		0515	64	.00	.00	.00	31.	*	1		1745	214	.00	.00	.00	0.
1		0520	65	.00	.00	.00	28.	*	1		1750	215	.00	.00	.00	0.
1		0525	66	.01	.00	.00	25.	*	1		1755	216	.00	.00	.00	0.
1		0530	67	.00	.00	.00	21.	*	1		1800	217	.00	.00	.00	0.
1		0535	68	.00	.00	.00	18.	*	1		1805	218	.00	.00	.00	0.
1		0540	69	.00	.00	.00	15.	*	1		1810	219	.00	.00	.00	0.
1		0545	70	.01	.00	.00	13.	*	1		1815	220	.00	.00	.00	0.
1		0550	71	.00	.00	.00	10.	*	1		1820	221	.00	.00	.00	0.
1		0555	72	.00	.00	.00	9.	*	1		1825	222	.00	.00	.00	0.
1		0600	73	.00	.00	.00	8.	*	1		1830	223	.00	.00	.00	0.
1		0605	74	.00	.00	.00	6.	*	1		1835	224	.00	.00	.00	0.
1		0610	75	.00	.00	.00	6.	*	1		1840	225	.00	.00	.00	0.
1		0615	76	.00	.00	.00	5.	*	1		1845	226	.00	.00	.00	0.
1		0620	77	.00	.00	.00	4.	*	1		1850	227	.00	.00	.00	0.
1		0625	78	.00	.00	.00	3.	*	1		1855	220	.00	.00	.00	0.
1		0630	79	.00	.00	.00	3.	*	1		1900	229	.00	.00	.00	0.
1		0635	80	.00	.00	.00	2.	*	1		1905	230	.00	.00	.00	0.
1		0640	81	.00	.00	.00	2.	*	1		1910	231	.00	.00	.00	0.

1	0645	82	.00	.00	.00	1.	*	1	1915	232	.00	.00	.00	0.
1	0650	83	.00	.00	.00	1.	*	1	1920	233	.00	.00	.00	0.
1	0655	84	.00	.00	.00	1.	*	1	1925	234	.00	.00	.00	0.
1	0700	85	.00	.00	.00	1.	*	1	1930	235	.00	.00	.00	0.
1	0705	86	.00	.00	.00	0.	*	1	1935	236	.00	.00	.00	0.
1	0710	87	.00	.00	.00	0.	*	1	1940	237	.00	.00	.00	0.
1	0715	88	.00	.00	.00	0.	*	1	1945	238	.00	.00	.00	0.
1	0720	89	.00	.00	.00	0.	*	1	1950	239	.00	.00	.00	0.
1	0725	90	.00	.00	.00	0.	*	1	1955	240	.00	.00	.00	0.
1	0730	91	.00	.00	.00	0.	*	1	2000	241	.00	.00	.00	0.
1	0735	92	.00	.00	.00	0.	*	1	2005	242	.00	.00	.00	0.
1	0740	93	.00	.00	.00	0.	*	1	2010	243	.00	.00	.00	0.
1	0745	94	.00	.00	.00	0.	*	1	2015	244	.00	.00	.00	0.
1	0750	95	.00	.00	.00	0.	*	1	2020	245	.00	.00	.00	0.
1	0755	96	.00	.00	.00	0.	*	1	2025	246	.00	.00	.00	0.
1	0800	97	.00	.00	.00	0.	*	1	2030	247	.00	.00	.00	0.
1	0805	98	.00	.00	.00	0.	*	1	2035	248	.00	.00	.00	0.
1	0810	99	.00	.00	.00	0.	*	1	2040	249	.00	.00	.00	0.
1	0815	100	.00	.00	.00	0.	*	1	2045	250	.00	.00	.00	0.
1	0820	101	.00	.00	.00	0.	*	1	2050	251	.00	.00	.00	0.
1	0825	102	.00	.00	.00	0.	*	1	2055	252	.00	.00	.00	0.
1	0830	103	.00	.00	.00	0.	*	1	2100	253	.00	.00	.00	0.
1	0835	104	.00	.00	.00	0.	*	1	2105	254	.00	.00	.00	0.
1	0840	105	.00	.00	.00	0.	*	1	2110	255	.00	.00	.00	0.
1	0845	106	.00	.00	.00	0.	*	1	2115	256	.00	.00	.00	0.
1	0850	107	.00	.00	.00	0.	*	1	2120	257	.00	.00	.00	0.
1	0855	108	.00	.00	.00	0.	*	1	2125	258	.00	.00	.00	0.
1	0900	109	.00	.00	.00	0.	*	1	2130	259	.00	.00	.00	0.
1	0905	110	.00	.00	.00	0.	*	1	2135	260	.00	.00	.00	0.
1	0910	111	.00	.00	.00	0.	*	1	2140	261	.00	.00	.00	0.
1	0915	112	.00	.00	.00	0.	*	1	2145	262	.00	.00	.00	0.
1	0920	113	.00	.00	.00	0.	*	1	2150	263	.00	.00	.00	0.
1	0925	114	.00	.00	.00	0.	*	1	2155	264	.00	.00	.00	0.
1	0930	115	.00	.00	.00	0.	*	1	2200	265	.00	.00	.00	0.
1	0935	116	.00	.00	.00	0.	*	1	2205	266	.00	.00	.00	0.
1	0940	117	.00	.00	.00	0.	*	1	2210	267	.00	.00	.00	0.
1	0945	118	.00	.00	.00	0.	*	1	2215	268	.00	.00	.00	0.
1	0950	119	.00	.00	.00	0.	*	1	2220	269	.00	.00	.00	0.
1	0955	120	.00	.00	.00	0.	*	1	2225	270	.00	.00	.00	0.
1	1000	121	.00	.00	.00	0.	*	1	2230	271	.00	.00	.00	0.
1	1005	122	.00	.00	.00	0.	*	1	2235	272	.00	.00	.00	0.
1	1010	123	.00	.00	.00	0.	*	1	2240	273	.00	.00	.00	0.
1	1015	124	.00	.00	.00	0.	*	1	2245	274	.00	.00	.00	0.
1	1020	125	.00	.00	.00	0.	*	1	2250	275	.00	.00	.00	0.
1	1025	126	.00	.00	.00	0.	*	1	2255	276	.00	.00	.00	0.
1	1030	127	.00	.00	.00	0.	*	1	2300	277	.00	.00	.00	0.
1	1035	128	.00	.00	.00	0.	*	1	2305	278	.00	.00	.00	0.
1	1040	129	.00	.00	.00	0.	*	1	2310	279	.00	.00	.00	0.
1	1045	130	.00	.00	.00	0.	*	1	2315	280	.00	.00	.00	0.
1	1050	131	.00	.00	.00	0.	*	1	2320	281	.00	.00	.00	0.
1	1055	132	.00	.00	.00	0.	*	1	2325	282	.00	.00	.00	0.
1	1100	133	.00	.00	.00	0.	*	1	2330	283	.00	.00	.00	0.
1	1105	134	.00	.00	.00	0.	*	1	2335	284	.00	.00	.00	0.
1	1110	135	.00	.00	.00	0.	*	1	2340	285	.00	.00	.00	0.
1	1115	136	.00	.00	.00	0.	*	1	2345	286	.00	.00	.00	0.
1	1120	137	.00	.00	.00	0.	*	1	2350	287	.00	.00	.00	0.
1	1125	138	.00	.00	.00	0.	*	1	2355	288	.00	.00	.00	0.
1	1130	139	.00	.00	.00	0.	*	2	0000	289	.00	.00	.00	0.
1	1135	140	.00	.00	.00	0.	*	2	0005	290	.00	.00	.00	0.
1	1140	141	.00	.00	.00	0.	*	2	0010	291	.00	.00	.00	0.
1	1145	142	.00	.00	.00	0.	*	2	0015	292	.00	.00	.00	0.
1	1150	143	.00	.00	.00	0.	*	2	0020	293	.00	.00	.00	0.
1	1155	144	.00	.00	.00	0.	*	2	0025	294	.00	.00	.00	0.
1	1200	145	.00	.00	.00	0.	*	2	0030	295	.00	.00	.00	0.
1	1205	146	.00	.00	.00	0.	*	2	0035	296	.00	.00	.00	0.
1	1210	147	.00	.00	.00	0.	*	2	0040	297	.00	.00	.00	0.
1	1215	148	.00	.00	.00	0.	*	2	0045	298	.00	.00	.00	0.
1	1220	149	.00	.00	.00	0.	*	2	0050	299	.00	.00	.00	0.
1	1225	150	.00	.00	.00	0.	*	2	0055	300	.00	.00	.00	0.
							*							

****

TOTAL RAINFALL = 1.74, TOTAL LOSS = .68, TOTAL EXCESS = 1.07

	PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
				6-HR	24-HR	72-HR	24.92-HR
+	(CFS)	(HR)					
			(CFS)				
+	106.	3.92		24.	6.	6.	6.
			(INCHES)	1.064	1.068	1.068	1.068
			(AC-FT)	12.	12.	12.	12.

CUMULATIVE AREA = .21 SQ MI

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	.61
HYDROGRAPH AT						
+	PRO1	.06	1	FLOW	96.	49.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	PRO3	.28	1	FLOW	351.	183.
				TIME	3.75	3.75
ROUTED TO						

+	TB2	.28	1	FLOW	0.	0.
				TIME	.00	.00

** PEAK STAGES IN FEET **

1	STAGE	1765.65	1762.72
	TIME	7.33	7.25

HYDROGRAPH AT

+	PRO2	.13	1	FLOW	188.	100.
				TIME	3.67	3.67

HYDROGRAPH AT

+	PRO5	.12	1	FLOW	175.	93.
				TIME	3.67	3.67

2 COMBINED AT

+	CP5	.25	1	FLOW	362.	192.
				TIME	3.67	3.67

ROUTED TO

+	TB1	.25	1	FLOW	0.	0.
				TIME	.00	.00

** PEAK STAGES IN FEET **

1	STAGE	1739.27	1737.23
	TIME	7.17	7.08

HYDROGRAPH AT

+	PRO4	.21	1	FLOW	203.	106.
				TIME	3.92	3.92

ROUTED TO

+	TB3	.21	1	FLOW	0.	0.
				TIME	.00	.00

** PEAK STAGES IN FEET **

1	STAGE	1735.29	1731.66
	TIME	8.17	8.17

HYDROGRAPH AT

+	PRO7	.02	1	FLOW	29.	15.
				TIME	3.50	3.50

HYDROGRAPH AT

+	PRO8	.19	1	FLOW	220.	108.
				TIME	3.75	3.75

5 COMBINED AT

+	CP3	.95	1	FLOW	233.	115.
				TIME	3.75	3.75

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

APPENDIX B – HYDRAULIC CALCS

Lake Mead Culvert Capacity

Lake Mead Channel Capacity Calculation

Cross Section 10 Northeast Channel 100-Year Flow

Cross Section 11 Northwest Channel 100-Year Flow

Treatment Basin#1

- Stage Storage Calculations
- Hydrograph
- Wash Load Calculation
- Bed Load Calculation

Treatment Basin#2

- Stage Storage Calculations
- Hydrograph
- Wash Load Calculation
- Bed Load Calculation

Treatment Basin#3

- Stage Storage Calculations
- Hydrograph
- Wash Load Calculation
- Bed Load Calculation

PMF HEC-1 Model

Drain Time Calculations

FED. RD. REG. NO.	STATE	PROJECT NO.	COUNTY	SHEET NO.
9	NEVADA	STP-146(1)	CLARK	7

** - LIMITS OF COLDMILLING/PAVING

"P" 114+34
"P" 114+69 REMOVE CURB AND GUTTER LT.
"P" 114+69 CONSTRUCT CONCRETE SLOPE PAVING BEHIND NEW HEADWALL

"P" 115+21
"P1" 18+10 REMOVE EXISTING SIDEWALK OR UNPAVED AREA. CONSTRUCT 5' SIDEWALK ~~WITH TYPE "R" PEDESTRIAN RAIL LT.~~ (DELETED AS PER CHANGE ORDER 5) CONSTRUCT TYPE "D" MODIFIED CURB RAMP AT "P1" 10+11 (86' LT.) AND "P1" 18+01 (85' LT.) SEE SHEET 12 FOR DETAILS. CONSTRUCT 3:1 SAFETY SLOPE BEHIND SIDEWALK.

"P" 115+21
"P1" 10+46 REMOVE AND REPLACE CURB AND GUTTER LT. (DEPRESS FOR CURB RAMPS--FOR WIDTHS REFER TO STANDARDS)

"P" 115+29
"P1" 19+75 REMOVE MEDIAN ISLAND.

"P1" 10+00.43 CLEAN PIPE

"P1" 10+08
"P1" 19+70 CONSTRUCT NEW MEDIAN ISLAND. (SEE DETAIL F) (SEE SHEET NO.17)

"P1" 14+67.43 CLEAN PIPE

"P1" 15+28 INSTALL TRAFFIC LOOP DETECTORS WITH NO. 3½ PULL BOX

"P1" 18+34 PATCH WIDENED APPROACH LT.

"P1" 17+79
"P1" 18+10 REMOVE AND REPLACE CURB AND GUTTER LT. (DEPRESS FOR CURB RAMPS--FOR WIDTHS REFER TO STANDARDS)

"P1" 18+59
"P1" 27+72 REMOVE UNPAVED AREA. CONSTRUCT 5' SIDEWALK ~~WITH TYPE "R" PEDESTRIAN RAIL LT.~~ (DELETED AS PER CHANGE ORDER 5) CONSTRUCT TYPE "D" MODIFIED CURB RAMP AT "P1" 18+68 (85' LT.) AND "P1" 27+64 (85' LT.) SEE SHEET 12 FOR DETAILS. CONSTRUCT 3:1 SAFETY SLOPE BEHIND SIDEWALK.

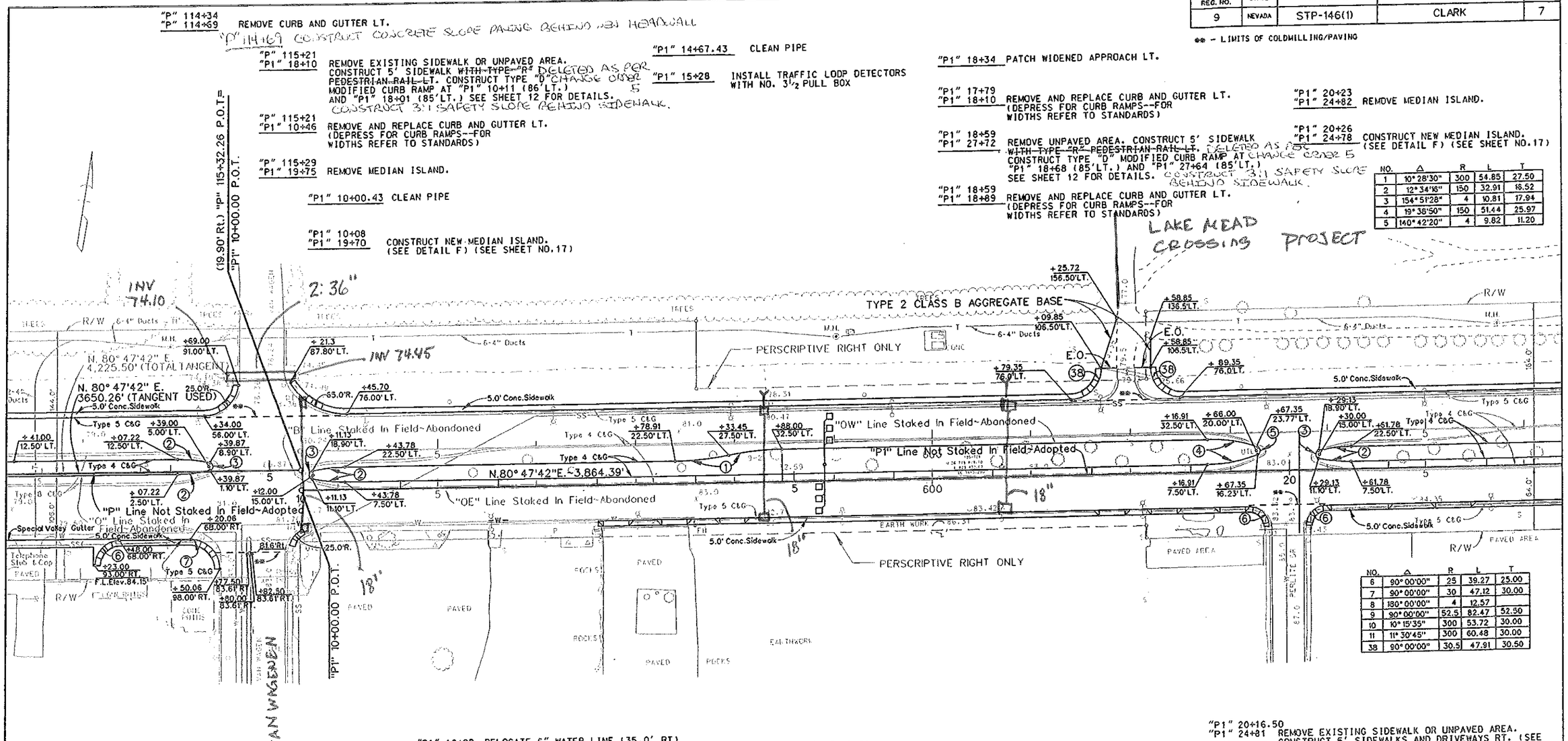
"P1" 18+59
"P1" 18+89 REMOVE AND REPLACE CURB AND GUTTER LT. (DEPRESS FOR CURB RAMPS--FOR WIDTHS REFER TO STANDARDS)

"P1" 20+23
"P1" 24+82 REMOVE MEDIAN ISLAND.

"P1" 20+26
"P1" 24+78 CONSTRUCT NEW MEDIAN ISLAND. (SEE DETAIL F) (SEE SHEET NO.17)

NO.	Δ	R	L	T
1	10°28'30"	300	54.85	27.50
2	12°34'16"	150	32.91	16.52
3	154°51'28"	4	10.81	17.94
4	19°38'50"	150	51.44	25.97
5	140°42'20"	4	9.82	11.20

LAKE MEAD CROSSING PROJECT



NO.	Δ	R	L	T
6	90°00'00"	25	39.27	25.00
7	90°00'00"	30	47.12	30.00
8	180°00'00"	4	12.57	
9	90°00'00"	52.5	82.47	52.50
10	10°15'35"	300	53.72	30.00
11	11°30'45"	300	60.48	30.00
38	90°00'00"	30.5	47.91	30.50

"P" 113+23
"P" 114+50.06 REMOVE EXISTING SIDEWALK OR UNPAVED AREA. CONSTRUCT 5' SIDEWALK RT. CURB RAMPS AT "P" 113+36--80.5' RT. AND "P" 114+41--77' RT. (TYPE D WITH BACK CURB)(SEE DETAIL B) (SEE SHEET NO.15)

"P" 113+23.00
"P" 114+50.06 CONSTRUCT CURB AND GUTTER RT. (DEPRESS CURB FOR CURB RAMPS AT RADII)(SEE DETAIL A) (SEE SHEET NO.15)

"P" 114+80 RELOCATE ISLAND NOSE AT VAN WAGENEN FROM 68' RT. TO 83.5' RT. (SEE DETAIL V1) (SEE SHEET NO.18)

"P" 115+25 REMOVE EXISTING CURB RAMP. CONSTRUCT NEW CURB RAMP 65.5' RT. (TYPE D WITH BACK CURB)

"P1" 10+00 RELOCATE 6" WATER LINE (35.0' RT) (SEE DETAIL J)(SEE SHEET NO.15)

"P1" 12+00 RELOCATE 6" WATER LINE (35.0' RT) (SEE DETAIL J)(SEE SHEET NO.15)

"P1" 13+01
"P1" 19+79 REMOVE EXISTING SIDEWALK OR UNPAVED AREA.CONSTRUCT 5' SIDEWALKS AND DRIVEWAYS RT. (SEE SHEET S-08 FOR LOCATIONS OF SIDEWALKS AND DRIVEWAYS) (SEE DETAILS B AND H) CONSTRUCT CURB RAMP AT "P1" 19+73 42' RT. (TYPE D WITH BACK CURB) (SEE SHEET NO. 15 & 16)

"P1" 13+01
"P1" 13+37 REMOVE AND REPLACE CURB AND GUTTER RT. (DEPRESS FOR DRIVEWAY--W=26')(SEE DETAIL H) (SEE SHEET NO.16)

"P1" 13+60
"P1" 13+96 REMOVE AND REPLACE CURB AND GUTTER RT. (DEPRESS FOR DRIVEWAY--W=26')(SEE DETAIL H) (SEE SHEET NO.16)

"P1" 14+19
"P1" 14+55 REMOVE AND REPLACE CURB AND GUTTER RT. (DEPRESS FOR DRIVEWAY--W=26')(SEE DETAIL H) (SEE SHEET NO. 16)

"P1" 18+02
"P1" 18+38 REMOVE AND REPLACE CURB AND GUTTER RT. (DEPRESS FOR DRIVEWAY--W=26')(SEE DETAIL H) (SEE SHEET NO.16)

"P1" 18+54
"P1" 18+90 REMOVE AND REPLACE CURB AND GUTTER RT. (DEPRESS FOR DRIVEWAY--W=26')(SEE DETAIL H) (SEE SHEET NO.16)

"P1" 19+23
"P1" 19+59 REMOVE AND REPLACE CURB AND GUTTER RT. (DEPRESS FOR DRIVEWAY--W=26')(SEE DETAIL H) (SEE SHEET NO.16)

"P1" 19+59
"P1" 19+79 REMOVE AND REPLACE CURB AND GUTTER RT. (DEPRESS FOR CURB RAMP--FOR WIDTHS REFER TO STANDARDS)

"P1" 20+16.50
"P1" 24+81 REMOVE EXISTING SIDEWALK OR UNPAVED AREA. CONSTRUCT 5' SIDEWALKS AND DRIVEWAYS RT. (SEE (SEE SHEET S-08 FOR LOCATIONS OF SIDEWALKS AND DRIVEWAYS) (SEE DETAILS B AND H) CONSTRUCT CURB RAMPS AT "P1" 20+22 42' RT. AND "P1"24+75 42' RT. (TYPE D WITH BACK CURB) (SEE SHEET NO. 15 & 16)

"P1" 20+16.50
"P1" 20+36.50 REMOVE AND REPLACE CURB AND GUTTER RT. (DEPRESS FOR CURB RAMP--FOR WIDTHS REFER TO STANDARDS)

"P1" 20+36.50
"P1" 21+04.50 REMOVE AND REPLACE CURB AND GUTTER RT. (DEPRESS FOR DRIVEWAY--W=58')(SEE DETAIL H) (SEE SHEET NO. 16)

"P1" 21+43
"P1" 21+89 REMOVE AND REPLACE CURB AND GUTTER RT. (DEPRESS FOR DRIVEWAY--W=36')(SEE DETAIL H) (SEE SHEET NO.16)

Culvert Calculator Report
LAKE MEAD 2:36 Van Wagenen

Solve For: Discharge

Culvert Summary					
Allowable HW Elevation	1,881.00 ft	Headwater Depth/Height	2.18		
Computed Headwater Elev	1,881.00 ft	Discharge	126.38 cfs	← MAX CAPACITY	
Inlet Control HW Elev.	1,879.05 ft	Tailwater Elevation	0.00 ft	BEFORE OVER FLOW	
Outlet Control HW Elev.	1,881.00 ft	Control Type	Outlet Control		

Grades			
Upstream Invert	1,874.45 ft	Downstream Invert	1,874.10 ft
Length	291.00 ft	Constructed Slope	0.001203 ft/ft

Hydraulic Profile			
Profile	CompositeM2PressureProfile	Depth, Downstream	2.56 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	2.56 ft
Velocity Downstream	9.85 ft/s	Critical Slope	0.008422 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	3.00 ft
Section Size	36 inch	Rise	3.00 ft
Number Sections	2		

Outlet Control Properties			
Outlet Control HW Elev.	1,881.00 ft	Upstream Velocity Head	1.24 ft
Ke	0.20	Entrance Loss	0.25 ft

Inlet Control Properties			
Inlet Control HW Elev.	1,879.05 ft	Flow Control	Submerged
Inlet Type	Groove end projecting	Area Full	14.1 ft2
K	0.00450	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	3
C	0.03170	Equation Form	1
Y	0.69000		

Worksheet for Lake Mead Channel

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00500	ft/ft
Discharge	126.40	ft^3/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	1879.00
0+02	1878.00
0+04	1877.00
0+06	1876.00
0+07	1875.00
0+22	1875.00
0+25	1876.00
0+27	1877.00
0+29	1878.00
0+31	1879.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1879.00)	(0+31, 1879.00)	0.035

Results

Normal Depth	1.80	ft
Elevation Range	1875.00 to 1879.00 ft	
Flow Area	32.88	ft^2
Wetted Perimeter	22.70	ft
Top Width	21.79	ft
Normal Depth	1.80	ft
Critical Depth	1.24	ft
Critical Slope	0.01811	ft/ft

Worksheet for Lake Mead Channel

Results

Velocity		3.84	ft/s
Velocity Head		0.23	ft
Specific Energy		2.03	ft
Froude Number		0.55	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth		0.00	ft
Length		0.00	ft
Number Of Steps		0	

GVF Output Data

Upstream Depth		0.00	ft
Profile Description			
Profile Headloss		0.00	ft
Downstream Velocity		Infinity	ft/s
Upstream Velocity		Infinity	ft/s
Normal Depth		1.80	ft
Critical Depth		1.24	ft
Channel Slope		0.00500	ft/ft
Critical Slope		0.01811	ft/ft

Cross Section for Lake Mead Channel

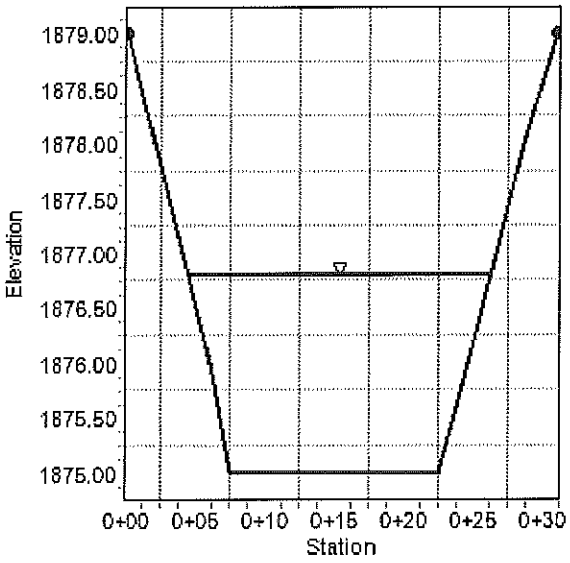
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00500	ft/ft
Normal Depth	1.80	ft
Discharge	126.40	ft^3/s

Cross Section Image



Worksheet for Trapezoidal Channel - Section 10

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.025	
Channel Slope	0.02000	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	80.00	ft
Discharge	188.00	ft^3/s

Results

Normal Depth	0.46	ft
Flow Area	37.79	ft^2
Wetted Perimeter	82.94	ft
Top Width	82.79	ft
Critical Depth	0.55	ft
Critical Slope	0.01121	ft/ft
Velocity	4.97	ft/s
Velocity Head	0.38	ft
Specific Energy	0.85	ft
Froude Number	1.30	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.46	ft
Critical Depth	0.55	ft
Channel Slope	0.02000	ft/ft
Critical Slope	0.01121	ft/ft

Cross Section for Trapezoidal Channel - Section 10

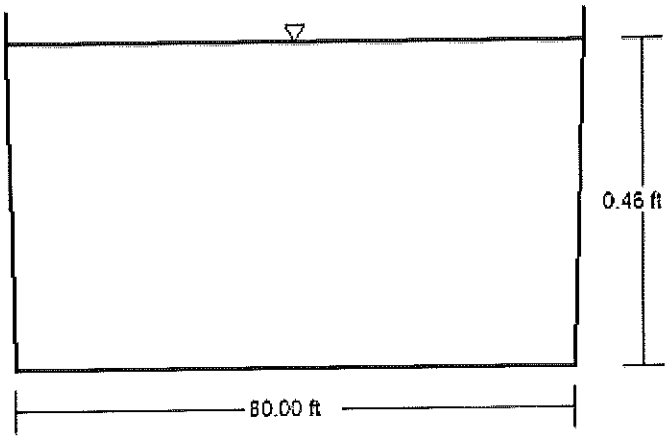
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.025	
Channel Slope	0.02000	ft/ft
Normal Depth	0.46	ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	80.00	ft
Discharge	188.00	ft³/s

Cross Section Image



V: 100
H: 1

$F_B = 1.0 + 0.025 (V)(d)^{1/3}$

$= 1.0 + 0.025 (5)(0.46)^{1/3}$

$F_B = 1.1'$

Depth Required = $1.1 + 0.46 \approx 1.6'$

Worksheet for Trapezoidal Channel - Section 11

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.025	
Channel Slope	0.01800	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	80.00	ft
Discharge	203.00	ft^3/s

Results

Normal Depth	0.50	ft
Flow Area	40.87	ft^2
Wetted Perimeter	83.17	ft
Top Width	83.01	ft
Critical Depth	0.58	ft
Critical Slope	0.01103	ft/ft
Velocity	4.97	ft/s
Velocity Head	0.38	ft
Specific Energy	0.88	ft
Froude Number	1.25	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.50	ft
Critical Depth	0.58	ft
Channel Slope	0.01800	ft/ft
Critical Slope	0.01103	ft/ft

Cross Section for Trapezoidal Channel - Section 11

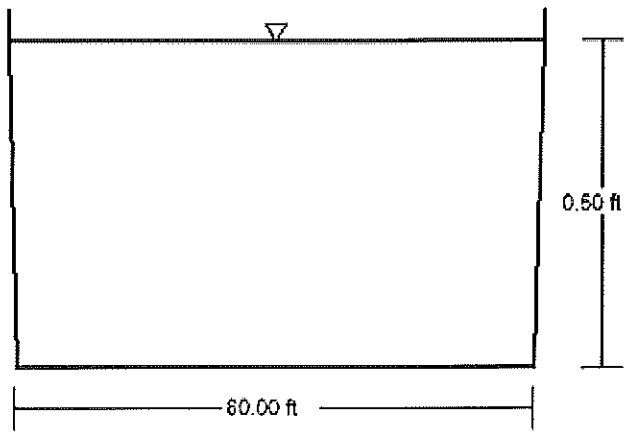
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.025	
Channel Slope	0.01800	ft/ft
Normal Depth	0.50	ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	80.00	ft
Discharge	203.00	ft³/s

Cross Section Image



V: 100
H: 1

$F_B = 1.0 + 0.025(V)d^{1/3}$

$= 1.0 + 0.025(5)(0.5)^{1/3}$

$F_B = 1.1'$

Depth Required $= 1.1 + 0.5 = 1.6'$

Job: **4160.0001**

Stage/Storage Calc. (Ave. End Method)

Treatment Basin # 1 (CP5)

Contour Elevation	Area (sf)	Stage Volume (cf)	Cumulative Volume (cf)	(ac-ft)	Volume - Sediment (ac-ft)
1734	32139.4	16070	16070	0.4	-0.8
1735	213418.9	122779	138849	3.2	2.0
1736	246557.7	229988	368837	8.5	7.3
1737	271810.6	259184	628021	14.4	13.2
1738	293559.1	282685	910706	20.9	19.7
1739	315680.4	304620	1215326	27.9	26.7
1740	339101.2	327391	1542717	35.4	34.2
1741	369046.8	354074	1896791	43.5	42.3
1742	441989.4	405518	2302309	52.9	51.6
1743	509794.5	475892	2778201	63.8	62.6

Sediment Load	
Washload	1.04
Bedload	0.1723
Total	1.21

Emergency Weir Calcs			
WEIR	1741.0	1742.0	1743.0
L	98	98	98
C	3.0	3.0	3.0
H	0.0	1.0	2.0
Q (cfs)	0	294	832

100-Year Storm
Peak Storage 1739.27
Downstream Natural Grade 1738
28.7 ACRE FEET - 19.7 = 9.0 AC-FEET FOR DAM SAFETY
Weir Elevation 1741

PMF PEAK = 1431 CFS
PMF 623 CFS SPILLS AT ELEVATION 1742.6

HYDROGRAPH FOR CONCENTRATION POINT CP5

MON HRMN	ORD	Q (CFS)	Q * T	Q (CF)	VOLUME (AC-FT)
0	1	0	0	0	0
5	2	0	0	0	0
10	3	0	0	0	0
15	4	0	0	0	0
20	5	2	10	600	0.013774105
25	6	5	25	1500	0.034435262
30	7	11	55	3300	0.075757576
35	8	16	80	4800	0.110192837
40	9	18	90	5400	0.123966942
45	10	16	80	4800	0.110192837
50	11	11	55	3300	0.075757576
55	12	7	35	2100	0.048209366
100	13	4	20	1200	0.027548209
105	14	3	15	900	0.020661157
110	15	3	15	900	0.020661157
115	16	5	25	1500	0.034435262
120	17	7	35	2100	0.048209366
125	18	9	45	2700	0.061983471
130	19	13	65	3900	0.08953168
135	20	19	95	5700	0.130853994
140	21	24	120	7200	0.165289256
145	22	26	130	7800	0.179063361
150	23	25	125	7500	0.172176309
155	24	22	110	6600	0.151515152
200	25	17	85	5100	0.11707989
205	26	13	65	3900	0.08953168
210	27	11	55	3300	0.075757576
215	28	15	75	4500	0.103305785
220	29	23	115	6900	0.158402204
225	30	30	150	9000	0.20661157
230	31	33	165	9900	0.227272727
235	32	30	150	9000	0.20661157
240	33	27	135	8100	0.185950413
245	34	28	140	8400	0.192837466
250	35	30	150	9000	0.20661157
255	36	29	145	8700	0.199724518
300	37	26	130	7800	0.179063361
305	38	29	145	8700	0.199724518
310	39	44	220	13200	0.303030303
315	40	72	360	21600	0.495867769
320	41	120	600	36000	0.826446281
325	42	189	945	56700	1.301652893
330	43	273	1365	81900	1.880165289
335	44	344	1720	103200	2.369146006
340	45	362	1810	108600	2.493112948
345	46	329	1645	98700	2.26584022

HYDROGRAPH FOR CONCENTRATION POINT CP5

MON HRMN	ORD	Q (CFS)	Q * T	Q (CF)	VOLUME (AC-FT)
350	47	274	1370	82200	1.887052342
355	48	213	1065	63900	1.466942149
400	49	166	830	49800	1.143250689
405	50	130	650	39000	0.895316804
410	51	101	505	30300	0.695592287
415	52	78	390	23400	0.537190083
420	53	61	305	18300	0.420110193
425	54	53	265	15900	0.365013774
430	55	54	270	16200	0.371900826
435	56	63	315	18900	0.433884298
440	57	72	360	21600	0.495867769
445	58	75	375	22500	0.516528926
450	59	75	375	22500	0.516528926
455	60	75	375	22500	0.516528926
500	61	71	355	21300	0.488980716
505	62	62	310	18600	0.426997245
510	63	49	245	14700	0.337465565
515	64	37	185	11100	0.254820937
520	65	27	135	8100	0.185950413
525	66	21	105	6300	0.144628099
530	67	16	80	4800	0.110192837
535	68	13	65	3900	0.08953168
540	69	10	50	3000	0.068870523
545	70	9	45	2700	0.061983471
550	71	8	40	2400	0.055096419
555	72	8	40	2400	0.055096419
600	73	7	35	2100	0.048209366
605	74	6	30	1800	0.041322314
610	75	5	25	1500	0.034435262
615	76	3	15	900	0.020661157
620	77	2	10	600	0.013774105
625	78	1	5	300	0.006887052
630	79	1	5	300	0.006887052
635	80	0	0	0	0
640	81	0	0	0	0
645	82	0	0	0	0
650	83	0	0	0	0
655	84	0	0	0	0
700	85	0	0	0	0
					28.7

DETENTION BASIN SEDIMENTATION ANALYSIS

PROJECT: TRONOX
CALCULATED BY: cz

Modified Universal Soil Loss Equation (MUSLE)

$Y=C1((V_w*qp)^{C2}*K*LS*CP$

Y=Sediment yield (tons)
Vw=Runoff volume (ac-ft)
qp=Peak flow rate (cfs)
C1=coefficient=95
C2=coefficient=0.56

LS=Equation: $LS=X_r^{0.5}(0.0076+0.53S_o+7.6S_o^2)$

CP=Crop Management and Erosion Control "CP" Values taken as 1 and 0.47 (Conservative Estimate)

100-YEAR SEDIMENT YIELD VOLUME ESTIMATE

Treatment Basin	Subbasin	Contributing Area (Acre)	X_r (ft)	S_o (ft/ft)	V_w100 (ac-ft)	Q_{100} (cfs)	K	LS	CP	Yield (tons)	Yield (ac-ft)
#1	CP5	162.68	4456	0.025	28.7	362	0.2	1.71	0.47	2709.28	1.04

Total Sediment Storage Volume Needed for Detention Basin = 1.04

SEDIMENTATION ANALYSIS CONCENTRATION POINT CP5

BED LOAD CALCULATION - Meyer-Peter Equation

$qb = (39.25*q^{2/3}*So-9.95*dm)^{1.5}$

Tronox Soil Remediation
Inflow to Treatment Basin #1

DATE: 9/17/2010
BY: cz

MEYER-PETER EQUATION

SEGMENT	Q (cfs)	Y (ft)	V (fps)	q (cfs/ft)	S (ft/ft)	dm (ft)	qb (lbs/sec)	TIME (min)	Wsoil (lbs/c.f.)	VOL. SED. (acre-ft)
1	0	0.00	0.00	0.00	0.025	0.02	0.0000	5.00	110.00	0.0000
2	0	0.00	0.00	0.00	0.025	0.02	0.0000	5.00	110.00	0.0000
3	0	0.00	0.00	0.00	0.025	0.02	0.0000	5.00	110.00	0.0000
4	0	0.00	0.00	0.00	0.025	0.02	0.0000	5.00	110.00	0.0000
5	2	0.09	1.72	0.16	0.025	0.02	0.0267	5.00	110.00	0.0000
6	5	0.13	2.07	0.28	0.025	0.02	0.1010	5.00	110.00	0.0001
7	11	0.18	2.43	0.44	0.025	0.02	0.2261	5.00	110.00	0.0004
8	16	0.21	2.61	0.55	0.025	0.02	0.3154	5.00	110.00	0.0006
9	18	0.22	2.68	0.60	0.025	0.02	0.3486	5.00	110.00	0.0007
10	16	0.21	2.61	0.55	0.025	0.02	0.3154	5.00	110.00	0.0000
11	11	0.18	2.43	0.44	0.025	0.02	0.2261	5.00	110.00	0.0000
12	7	0.15	2.22	0.34	0.025	0.02	0.1457	5.00	110.00	0.0000
13	4	0.12	1.98	0.24	0.025	0.02	0.0773	5.00	110.00	0.0000
14	3	0.11	1.87	0.20	0.025	0.02	0.0524	5.00	110.00	0.0000
15	3	0.11	1.87	0.20	0.025	0.02	0.0524	5.00	110.00	0.0000
16	5	0.13	2.07	0.28	0.025	0.02	0.1010	5.00	110.00	0.0000
17	7	0.15	2.22	0.34	0.025	0.02	0.1457	5.00	110.00	0.0000
18	9	0.17	2.33	0.39	0.025	0.02	0.1872	5.00	110.00	0.0000
19	13	0.20	2.51	0.49	0.025	0.02	0.2631	5.00	110.00	0.0000
20	19	0.23	2.71	0.61	0.025	0.02	0.3647	5.00	110.00	0.0000
21	24	0.25	2.83	0.71	0.025	0.02	0.4417	5.00	110.00	0.0000
22	26	0.26	2.88	0.74	0.025	0.02	0.4710	5.00	110.00	0.0000
23	25	0.25	2.86	0.72	0.025	0.02	0.4564	5.00	110.00	0.0000
24	22	0.24	2.79	0.67	0.025	0.02	0.4116	5.00	110.00	0.0000
25	17	0.22	2.65	0.58	0.025	0.02	0.3322	5.00	110.00	0.0000
26	13	0.20	2.51	0.49	0.025	0.02	0.2631	5.00	110.00	0.0000
27	11	0.18	2.43	0.44	0.025	0.02	0.2261	5.00	110.00	0.0000
28	15	0.21	2.58	0.53	0.025	0.02	0.2983	5.00	110.00	0.0000
29	23	0.25	2.81	0.69	0.025	0.02	0.4268	5.00	110.00	0.0000
30	30	0.27	2.96	0.81	0.025	0.02	0.5273	5.00	110.00	0.0000
31	33	0.28	3.02	0.86	0.025	0.02	0.5679	5.00	110.00	0.0000
32	30	0.27	2.96	0.81	0.025	0.02	0.5273	5.00	110.00	0.0000
33	27	0.26	2.90	0.76	0.025	0.02	0.4853	5.00	110.00	0.0000
34	28	0.27	2.92	0.78	0.025	0.02	0.4995	5.00	110.00	0.0000
35	30	0.27	2.96	0.81	0.025	0.02	0.5273	5.00	110.00	0.0000
36	29	0.27	2.94	0.79	0.025	0.02	0.5135	5.00	110.00	0.0000
37	26	0.26	2.88	0.74	0.025	0.02	0.4710	5.00	110.00	0.0000
38	29	0.27	2.94	0.79	0.025	0.02	0.5135	5.00	110.00	0.0000
39	44	0.32	3.20	1.02	0.025	0.02	0.7071	5.00	110.00	0.0000
40	72	0.39	3.53	1.37	0.025	0.02	1.0148	5.00	110.00	0.0000
41	120	0.48	3.91	1.86	0.025	0.02	1.4548	5.00	110.00	0.0059
42	189	0.57	4.28	2.44	0.025	0.02	1.9849	5.00	110.00	0.0096
43	273	0.66	4.61	3.04	0.025	0.02	2.5392	5.00	110.00	0.0143
44	344	0.72	4.83	3.49	0.025	0.02	2.9583	5.00	110.00	0.0182
45	362	0.74	4.88	3.60	0.025	0.02	3.0592	5.00	110.00	0.0192
46	329	0.71	4.79	3.40	0.025	0.02	2.8728	5.00	110.00	0.0174
47	274	0.66	4.61	3.05	0.025	0.02	2.5453	5.00	110.00	0.0143
48	213	0.60	4.39	2.62	0.025	0.02	2.1513	5.00	110.00	0.0109
49	166	0.54	4.17	2.26	0.025	0.02	1.8178	5.00	110.00	0.0084
50	130	0.49	3.97	1.95	0.025	0.02	1.5376	5.00	110.00	0.0064
51	101	0.44	3.78	1.68	0.025	0.02	1.2902	5.00	110.00	0.0049
52	78	0.40	3.59	1.43	0.025	0.02	1.0747	5.00	110.00	0.0037
53	61	0.36	3.42	1.24	0.025	0.02	0.9002	5.00	110.00	0.0028
54	53	0.34	3.32	1.14	0.025	0.02	0.8121	5.00	110.00	0.0024
55	54	0.35	3.33	1.15	0.025	0.02	0.8233	5.00	110.00	0.0024
56	63	0.37	3.44	1.26	0.025	0.02	0.9215	5.00	110.00	0.0029
57	72	0.39	3.53	1.37	0.025	0.02	1.0148	5.00	110.00	0.0033
58	75	0.39	3.56	1.40	0.025	0.02	1.0450	5.00	110.00	0.0035
59	75	0.39	3.56	1.40	0.025	0.02	1.0450	5.00	110.00	0.0035
60	75	0.39	3.56	1.40	0.025	0.02	1.0450	5.00	110.00	0.0035
61	71	0.39	3.52	1.36	0.025	0.02	1.0047	5.00	110.00	0.0033
62	62	0.36	3.43	1.25	0.025	0.02	0.9109	5.00	110.00	0.0028
63	49	0.33	3.27	1.09	0.025	0.02	0.7663	5.00	110.00	0.0022
64	37	0.30	3.09	0.92	0.025	0.02	0.6202	5.00	110.00	0.0016
65	27	0.26	2.90	0.76	0.025	0.02	0.4853	5.00	110.00	0.0011
66	21	0.24	2.76	0.65	0.025	0.02	0.3962	5.00	110.00	0.0008
67	16	0.21	2.61	0.55	0.025	0.02	0.3154	5.00	110.00	0.0006
68	13	0.20	2.51	0.49	0.025	0.02	0.2631	5.00	110.00	0.0004
69	10	0.18	2.38	0.42	0.025	0.02	0.2069	5.00	110.00	0.0003
70	9	0.17	2.33	0.39	0.025	0.02	0.1872	5.00	110.00	0.0000
71	8	0.16	2.28	0.37	0.025	0.02	0.1668	5.00	110.00	0.0000
72	8	0.16	2.28	0.37	0.025	0.02	0.1668	5.00	110.00	0.0000
73	7	0.15	2.22	0.34	0.025	0.02	0.1457	5.00	110.00	0.0000
74	6	0.14	2.15	0.31	0.025	0.02	0.1238	5.00	110.00	0.0000
75	5	0.13	2.07	0.28	0.025	0.02	0.1010	5.00	110.00	0.0000
76	3	0.11	1.87	0.20	0.025	0.02	0.0524	5.00	110.00	0.0000
77	2	0.09	1.72	0.16	0.025	0.02	0.0267	5.00	110.00	0.0000
78	1	0.07	1.50	0.11	0.025	0.02	0.0027	5.00	110.00	0.0000
79	1	0.07	1.50	0.11	0.025	0.02	0.0027	5.00	110.00	0.0000
80	0	0.00	0.00	0.00	0.025	0.02	0.0000	5.00	110.00	0.0000
81	0	0.00	0.00	0.00	0.025	0.02	0.0000	5.00	110.00	0.0000
82	0	0.00	0.00	0.00	0.025	0.02	0.0000	5.00	110.00	0.0000
83	0	0.00	0.00	0.00	0.025	0.02	0.0000	5.00	110.00	0.0000
84	0	0.00	0.00	0.00	0.025	0.02	0.0000	5.00	110.00	0.0000
85	0	0.00	0.00	0.00	0.025	0.02	0.0000	5.00	110.00	0.0000
86	0	0.00	0.00	0.00	0.025	0.02	0.0000	5.00	110.00	0.0000
87	0	0.00	0.00	0.00	0.025	0.02	0.0000	5.00	110.00	0.0000
88	0	0.00	0.00	0.00	0.025	0.02	0.0000	5.00	110.00	0.0000
89	0	0.00	0.00	0.00	0.025	0.02	0.0000	5.00	110.00	0.0000
90	0	0.00	0.00	0.00	0.025	0.02	0.0000	5.00	110.00	0.0000
91	0	0.00	0.00	0.00	0.025	0.02	0.0000	5.00	110.00	0.0000
92	0	0.00	0.00	0.00	0.025	0.02	0.0000	5.00	110.00	0.0000
93	0	0.00	0.00	0.00	0.025	0.02	0.0000	5.00	110.00	0.0000
									TOTAL	0.1723

Job: **4160.0001**

Stage/Storage Calc. (Ave. End Method)

Treatment Basin # 2 PRO3

Contour Elevation	Area (sf)	Stage Volume (cf)	Cumulative Volume (cf)	(ac-ft)	Volume - Sediment (ac-ft)
1758	56464	28232	28232	0.6	-0.7
1759	60195	58330	86562	2.0	0.6
1760	181297	120746	207308	4.8	3.4
1761	191139	186218	393526	9.0	7.7
1762	201037	196088	589614	13.5	12.2
1763	210991	206014	795628	18.3	16.9
1764	221060	216025	1011653	23.2	21.9
1765	243026	232043	1243696	28.6	27.2
1766	281698	262362	1506058	34.6	33.2
1767	296083	288890	1794948	41.2	39.8
1767.5	309387	151368	1946316	44.7	43.3

Sediment Load	
Washload	1.13
Bedload	0.231
Total	1.36

Emergency Weir Calcs			
WEIR	1766.0	1767.0	1767.5
L	900	900	900
C	3.0	3.0	3.0
H	0.0	1.0	1.5
Q (cfs)	0	2700	4960

100-Year Storm
Peak Storage 1765.65
Downstream Natural Grade 1763
31.1 ACRE FEET - 16.9 = 14.2 AC-FEET FOR DAM SAFETY
Weir Elevation 1766

PMF PEAK = 779 CFS
PMF 841 CFS SPILLS AT ELEVATION 1766.31

HYDROGRAPH FOR SUBBASIN PRO3

MON HRMN	ORD	Q (CFS)	Q * T	Q (CF)	VOLUME (AC-FT)
0	1	0	0	0	0
5	2	0	0	0	0
10	3	0	0	0	0
15	4	0	0	0	0
20	5	1	5	300	0.006887052
25	6	2	10	600	0.013774105
30	7	5	25	1500	0.034435262
35	8	10	50	3000	0.068870523
40	9	13	65	3900	0.08953168
45	10	14	70	4200	0.096418733
50	11	13	65	3900	0.08953168
55	12	10	50	3000	0.068870523
100	13	7	35	2100	0.048209366
105	14	5	25	1500	0.034435262
110	15	4	20	1200	0.027548209
115	16	5	25	1500	0.034435262
120	17	6	30	1800	0.041322314
125	18	8	40	2400	0.055096419
130	19	10	50	3000	0.068870523
135	20	14	70	4200	0.096418733
140	21	19	95	5700	0.130853994
145	22	22	110	6600	0.151515152
150	23	24	120	7200	0.165289256
155	24	24	120	7200	0.165289256
200	25	21	105	6300	0.144628099
205	26	17	85	5100	0.11707989
210	27	14	70	4200	0.096418733
215	28	15	75	4500	0.103305785
220	29	19	95	5700	0.130853994
225	30	25	125	7500	0.172176309
230	31	29	145	8700	0.199724518
235	32	31	155	9300	0.213498623
240	33	30	150	9000	0.20661157
245	34	29	145	8700	0.199724518
250	35	30	150	9000	0.20661157
255	36	30	150	9000	0.20661157
300	37	29	145	8700	0.199724518
305	38	30	150	9000	0.20661157
310	39	38	190	11400	0.261707989
315	40	56	280	16800	0.385674931
320	41	90	450	27000	0.619834711
325	42	143	715	42900	0.984848485
330	43	216	1080	64800	1.487603306
335	44	288	1440	86400	1.983471074
340	45	341	1705	102300	2.348484848
345	46	351	1755	105300	2.417355372
350	47	327	1635	98100	2.252066116
355	48	283	1415	84900	1.949035813

HYDROGRAPH FOR SUBBASIN PRO3

MON HRMN	ORD	Q (CFS)	Q * T	Q (CF)	VOLUME (AC-FT)
400	49	231	1155	69300	1.590909091
405	50	187	935	56100	1.287878788
410	51	151	755	45300	1.039944904
415	52	120	600	36000	0.826446281
420	53	96	480	28800	0.661157025
425	54	80	400	24000	0.550964187
430	55	71	355	21300	0.488980716
435	56	71	355	21300	0.488980716
440	57	76	380	22800	0.523415978
445	58	80	400	24000	0.550964187
450	59	83	415	24900	0.571625344
455	60	83	415	24900	0.571625344
500	61	81	405	24300	0.55785124
505	62	75	375	22500	0.516528926
510	63	65	325	19500	0.447658402
515	64	54	270	16200	0.371900826
520	65	42	210	12600	0.289256198
525	66	33	165	9900	0.227272727
530	67	26	130	7800	0.179063361
535	68	21	105	6300	0.144628099
540	69	16	80	4800	0.110192837
545	70	13	65	3900	0.08953168
550	71	12	60	3600	0.082644628
555	72	10	50	3000	0.068870523
600	73	9	45	2700	0.061983471
605	74	8	40	2400	0.055096419
610	75	7	35	2100	0.048209366
615	76	5	25	1500	0.034435262
620	77	4	20	1200	0.027548209
625	78	3	15	900	0.020661157
630	79	2	10	600	0.013774105
635	80	1	5	300	0.006887052
640	81	1	5	300	0.006887052
645	82	1	5	300	0.006887052
650	83	0	0	0	0
655	84	0	0	0	0
700	85	0	0	0	0
705	86	0	0	0	0
710	87	0	0	0	0
715	88	0	0	0	0
720	89	0	0	0	0

DETENTION BASIN SEDIMENTATION ANALYSIS

PROJECT: TRONOX
CALCULATED BY: cz

Modified Universal Soil Loss Equation (MUSLE)

$Y=C1((V_w*qp)^{C2}*K*LS*CP$

Y=Sediment yield (tons)
Vw=Runoff volume (ac-ft)
qp=Peak flow rate (cfs)
C1=coefficient=95
C2=coefficient=0.56

LS=Equation: $LS=X_r^{0.5}(0.0076+0.53S_o+7.6S_o^2)$

CP=Crop Management and Erosion Control "CP" Values taken as 1 and 0.47 (Conservative Estimate)

100-YEAR SEDIMENT YIELD VOLUME ESTIMATE

Treatment Basin	Subbasin	Contributing Area (Acre)	X_r (ft)	S_o (ft/ft)	V_w100 (ac-ft)	Q_{100} (cfs)	K	LS	CP	Yield (tons)	Yield (ac-ft)
#2	PRO3	181.41	4025	0.028	31.1	351	0.2	1.80	0.47	2936.61	1.13

Total Sediment Storage Volume Needed for Detention Basin = 1.13

SEDIMENTATION ANALYSIS SUBBASIN PRO 3

BED LOAD CALCULATION - Meyer-Peter Equation

$qb = (39.25*q^{2/3}*So-9.95*dm)^{1.5}$

Tronox Soil Remediation
Inflow to Treatment Basin #2

DATE: 9/17/2010
BY: cz

MEYER-PETER EQUATION										
SEGMENT	Q (cfs)	Y (ft)	V (fps)	q (cfs/ft)	S (ft/ft)	dm (ft)	qb (lbs/sec)	TIME (min)	Wsoil (lbs/c.f.)	VOL. SED. (acre-ft)
1	0	0.00	0.00	0.00	0.028	0.02	0.0000	5.00	110.00	0.0000
2	0	0.00	0.00	0.00	0.028	0.02	0.0000	5.00	110.00	0.0000
3	0	0.00	0.00	0.00	0.028	0.02	0.0000	5.00	110.00	0.0000
4	0	0.00	0.00	0.00	0.028	0.02	0.0000	5.00	110.00	0.0000
5	1	0.07	1.50	0.11	0.028	0.02	0.0098	5.00	110.00	0.0000
6	2	0.09	1.72	0.16	0.028	0.02	0.0436	5.00	110.00	0.0000
7	5	0.13	2.07	0.28	0.028	0.02	0.1379	5.00	110.00	0.0002
8	10	0.18	2.38	0.42	0.028	0.02	0.2680	5.00	110.00	0.0004
9	13	0.20	2.51	0.49	0.028	0.02	0.3364	5.00	110.00	0.0006
10	14	0.20	2.54	0.51	0.028	0.02	0.3581	5.00	110.00	0.0000
11	13	0.20	2.51	0.49	0.028	0.02	0.3364	5.00	110.00	0.0000
12	10	0.18	2.38	0.42	0.028	0.02	0.2680	5.00	110.00	0.0000
13	7	0.15	2.22	0.34	0.028	0.02	0.1930	5.00	110.00	0.0000
14	5	0.13	2.07	0.28	0.028	0.02	0.1379	5.00	110.00	0.0000
15	4	0.12	1.98	0.24	0.028	0.02	0.1082	5.00	110.00	0.0000
16	5	0.13	2.07	0.28	0.028	0.02	0.1379	5.00	110.00	0.0000
17	6	0.14	2.15	0.31	0.028	0.02	0.1660	5.00	110.00	0.0000
18	8	0.16	2.28	0.37	0.028	0.02	0.2189	5.00	110.00	0.0000
19	10	0.18	2.38	0.42	0.028	0.02	0.2680	5.00	110.00	0.0000
20	14	0.20	2.54	0.51	0.028	0.02	0.3581	5.00	110.00	0.0000
21	19	0.23	2.71	0.61	0.028	0.02	0.4597	5.00	110.00	0.0000
22	22	0.24	2.79	0.67	0.028	0.02	0.5183	5.00	110.00	0.0000
23	24	0.25	2.83	0.71	0.028	0.02	0.5527	5.00	110.00	0.0000
24	24	0.25	2.83	0.71	0.028	0.02	0.5527	5.00	110.00	0.0000
25	21	0.24	2.76	0.65	0.028	0.02	0.4978	5.00	110.00	0.0000
26	17	0.22	2.65	0.58	0.028	0.02	0.4202	5.00	110.00	0.0000
27	14	0.20	2.54	0.51	0.028	0.02	0.3581	5.00	110.00	0.0000
28	15	0.21	2.58	0.53	0.028	0.02	0.3792	5.00	110.00	0.0000
29	19	0.23	2.71	0.61	0.028	0.02	0.4597	5.00	110.00	0.0000
30	25	0.25	2.86	0.72	0.028	0.02	0.5704	5.00	110.00	0.0000
31	29	0.27	2.94	0.79	0.028	0.02	0.6392	5.00	110.00	0.0000
32	31	0.28	2.98	0.82	0.028	0.02	0.6724	5.00	110.00	0.0000
33	30	0.27	2.96	0.81	0.028	0.02	0.6559	5.00	110.00	0.0000
34	29	0.27	2.94	0.79	0.028	0.02	0.6392	5.00	110.00	0.0000
35	30	0.27	2.96	0.81	0.028	0.02	0.6559	5.00	110.00	0.0000
36	30	0.27	2.96	0.81	0.028	0.02	0.6559	5.00	110.00	0.0000
37	29	0.27	2.94	0.79	0.028	0.02	0.6392	5.00	110.00	0.0000
38	30	0.27	2.96	0.81	0.028	0.02	0.6559	5.00	110.00	0.0000
39	38	0.30	3.11	0.93	0.028	0.02	0.7830	5.00	110.00	0.0000
40	56	0.35	3.36	1.18	0.028	0.02	1.0384	5.00	110.00	0.0000
41	90	0.42	3.69	1.56	0.028	0.02	1.4504	5.00	110.00	0.0052
42	143	0.51	4.05	2.06	0.028	0.02	1.9908	5.00	110.00	0.0086
43	216	0.60	4.40	2.64	0.028	0.02	2.6233	5.00	110.00	0.0134
44	288	0.67	4.66	3.14	0.028	0.02	3.1708	5.00	110.00	0.0182
45	341	0.72	4.82	3.48	0.028	0.02	3.5408	5.00	110.00	0.0217
46	351	0.73	4.85	3.54	0.028	0.02	3.6081	5.00	110.00	0.0224
47	327	0.71	4.78	3.39	0.028	0.02	3.4454	5.00	110.00	0.0208
48	283	0.67	4.64	3.11	0.028	0.02	3.1346	5.00	110.00	0.0179
49	231	0.62	4.46	2.75	0.028	0.02	2.7425	5.00	110.00	0.0144
50	187	0.57	4.27	2.42	0.028	0.02	2.3835	5.00	110.00	0.0115
51	151	0.52	4.09	2.13	0.028	0.02	2.0653	5.00	110.00	0.0092
52	120	0.48	3.91	1.86	0.028	0.02	1.7675	5.00	110.00	0.0071
53	96	0.43	3.74	1.63	0.028	0.02	1.5166	5.00	110.00	0.0056
54	80	0.40	3.61	1.46	0.028	0.02	1.3363	5.00	110.00	0.0046
55	71	0.39	3.52	1.36	0.028	0.02	1.2290	5.00	110.00	0.0040
56	71	0.39	3.52	1.36	0.028	0.02	1.2290	5.00	110.00	0.0040
57	76	0.40	3.57	1.41	0.028	0.02	1.2892	5.00	110.00	0.0043
58	80	0.40	3.61	1.46	0.028	0.02	1.3363	5.00	110.00	0.0046
59	83	0.41	3.63	1.49	0.028	0.02	1.3711	5.00	110.00	0.0048
60	83	0.41	3.63	1.49	0.028	0.02	1.3711	5.00	110.00	0.0048
61	81	0.41	3.62	1.47	0.028	0.02	1.3479	5.00	110.00	0.0047
62	75	0.39	3.56	1.40	0.028	0.02	1.2773	5.00	110.00	0.0043
63	65	0.37	3.46	1.29	0.028	0.02	1.1547	5.00	110.00	0.0037
64	54	0.35	3.33	1.15	0.028	0.02	1.0117	5.00	110.00	0.0030
65	42	0.31	3.17	0.99	0.028	0.02	0.8429	5.00	110.00	0.0022
66	33	0.28	3.02	0.86	0.028	0.02	0.7048	5.00	110.00	0.0017
67	26	0.26	2.88	0.74	0.028	0.02	0.5880	5.00	110.00	0.0013
68	21	0.24	2.76	0.65	0.028	0.02	0.4978	5.00	110.00	0.0010
69	16	0.21	2.61	0.55	0.028	0.02	0.4000	5.00	110.00	0.0007
70	13	0.20	2.51	0.49	0.028	0.02	0.3364	5.00	110.00	0.0000
71	12	0.19	2.47	0.47	0.028	0.02	0.3142	5.00	110.00	0.0000
72	10	0.18	2.38	0.42	0.028	0.02	0.2680	5.00	110.00	0.0000
73	9	0.17	2.33	0.39	0.028	0.02	0.2439	5.00	110.00	0.0000
74	8	0.16	2.28	0.37	0.028	0.02	0.2189	5.00	110.00	0.0000
75	7	0.15	2.22	0.34	0.028	0.02	0.1930	5.00	110.00	0.0000
76	5	0.13	2.07	0.28	0.028	0.02	0.1379	5.00	110.00	0.0000
77	4	0.12	1.98	0.24	0.028	0.02	0.1082	5.00	110.00	0.0000
78	3	0.11	1.87	0.20	0.028	0.02	0.0769	5.00	110.00	0.0000
79	2	0.09	1.72	0.16	0.028	0.02	0.0436	5.00	110.00	0.0000
80	1	0.07	1.50	0.11	0.028	0.02	0.0098	5.00	110.00	0.0000
81	1	0.07	1.50	0.11	0.028	0.02	0.0098	5.00	110.00	0.0000
82	1	0.07	1.50	0.11	0.028	0.02	0.0098	5.00	110.00	0.0000
83	0	0.00	0.00	0.00	0.028	0.02	0.0000	5.00	110.00	0.0000
84	0	0.00	0.00	0.00	0.028	0.02	0.0000	5.00	110.00	0.0000
85	0	0.00	0.00	0.00	0.028	0.02	0.0000	5.00	110.00	0.0000
86	0	0.00	0.00	0.00	0.028	0.02	0.0000	5.00	110.00	0.0000
87	0	0.00	0.00	0.00	0.028	0.02	0.0000	5.00	110.00	0.0000
88	0	0.00	0.00	0.00	0.028	0.02	0.0000	5.00	110.00	0.0000
89	0	0.00	0.00	0.00	0.028	0.02	0.0000	5.00	110.00	0.0000
90	0	0.00	0.00	0.00	0.028	0.02	0.0000	5.00	110.00	0.0000
91	0	0.00	0.00	0.00	0.028	0.02	0.0000	5.00	110.00	0.0000
92	0	0.00	0.00	0.00	0.028	0.02	0.0000	5.00	110.00	0.0000
93	0	0.00	0.00	0.00	0.028	0.02	0.0000	5.00	110.00	0.0000
									TOTAL	0.2310

Job: **4160.0001**

Stage/Storage Calc. (Ave. End Method)

Treatment Basin # 3 PRO4

Contour Elevation	Area (sf)	Stage Volume (cf)	Cumulative Volume (cf)	(ac-ft)	Volume - Sediment (ac-ft)
1725	53702	26851	26851	0.6	0.0
1726	56933	55318	82169	1.9	1.3
1727	60287	58610	140779	3.2	2.6
1728	63742	62015	202793	4.7	4.0
1729	67303	65523	268316	6.2	5.5
1730	104031	85667	353983	8.1	7.5
1731	112959	108495	462478	10.6	10.0
1732	122143	117551	580029	13.3	12.7
1733	131324	126734	706762	16.2	15.6
1734	140421	135873	842635	19.3	18.7
1735	149432	144927	987561	22.7	22.1
1736	182862	166147	1153708	26.5	25.9
1737	175980.8	179421	1333130	30.6	30.0
1738	184494.0	180237	1513367	34.7	34.1
1739	228430.0	206462	1719829	39.5	38.9
1740	238658.1	233544	1953373	44.8	44.2

Sediment Load	
Washload	0.54
Bedload	0.0716
Total	0.61

Emergency Weir Calcs			
WEIR	1738.0	1739.0	1740.0
L	93	192	240
C	3.0	3.0	3.0
H	0.0	1.0	2.0
Q (cfs)	0	576	2036

100-Year Storm
Peak Storage 1735.29
Downstream Natural Grade 1730
23.2 ACRE FEET - 7.5 = 15.7 AC-FEET FOR DAM SAFETY
Weir Elevation 1738

PMF PEAK =449 CFS
PMF 226 CFS SPILLS AT ELEVATION 1738.39

HYDROGRAPH FOR SUBBASIN PRO4

MON HRMN	ORD	Q (CFS)	Q * T	Q (CF)	VOLUME (AC-FT)
0	1	0	0	0	0
5	2	0	0	0	0
10	3	0	0	0	0
15	4	0	0	0	0
20	5	0	0	0	0
25	6	1	5	300	0.006887052
30	7	2	10	600	0.013774105
35	8	3	15	900	0.020661157
40	9	5	25	1500	0.034435262
45	10	7	35	2100	0.048209366
50	11	8	40	2400	0.055096419
55	12	8	40	2400	0.055096419
100	13	8	40	2400	0.055096419
105	14	7	35	2100	0.048209366
110	15	6	30	1800	0.041322314
115	16	5	25	1500	0.034435262
120	17	5	25	1500	0.034435262
125	18	5	25	1500	0.034435262
130	19	6	30	1800	0.041322314
135	20	7	35	2100	0.048209366
140	21	9	45	2700	0.061983471
145	22	11	55	3300	0.075757576
150	23	13	65	3900	0.08953168
155	24	14	70	4200	0.096418733
200	25	15	75	4500	0.103305785
205	26	15	75	4500	0.103305785
210	27	14	70	4200	0.096418733
215	28	14	70	4200	0.096418733
220	29	14	70	4200	0.096418733
225	30	14	70	4200	0.096418733
230	31	16	80	4800	0.110192837
235	32	18	90	5400	0.123966942
240	33	19	95	5700	0.130853994
245	34	20	100	6000	0.137741047
250	35	21	105	6300	0.144628099
255	36	22	110	6600	0.151515152
300	37	22	110	6600	0.151515152
305	38	22	110	6600	0.151515152
310	39	24	120	7200	0.165289256
315	40	28	140	8400	0.192837466
320	41	37	185	11100	0.254820937
325	42	53	265	15900	0.365013774
330	43	78	390	23400	0.537190083
335	44	109	545	32700	0.750688705
340	45	143	715	42900	0.984848485
345	46	174	870	52200	1.198347107
350	47	195	975	58500	1.342975207
355	48	203	1015	60900	1.398071625
400	49	200	1000	60000	1.377410468
405	50	187	935	56100	1.287878788
410	51	168	840	50400	1.157024793

HYDROGRAPH FOR SUBBASIN PRO4

MON HRMN	ORD	Q (CFS)	Q * T	Q (CF)	VOLUME (AC-FT)
415	52	147	735	44100	1.012396694
420	53	125	625	37500	0.860881543
425	54	107	535	32100	0.736914601
430	55	92	460	27600	0.633608815
435	56	81	405	24300	0.55785124
440	57	74	370	22200	0.509641873
445	58	69	345	20700	0.475206612
450	59	67	335	20100	0.461432507
455	60	66	330	19800	0.454545455
500	61	64	320	19200	0.44077135
505	62	63	315	18900	0.433884298
510	63	60	300	18000	0.41322314
515	64	56	280	16800	0.385674931
520	65	50	250	15000	0.344352617
525	66	44	220	13200	0.303030303
530	67	38	190	11400	0.261707989
535	68	32	160	9600	0.220385675
540	69	26	130	7800	0.179063361
545	70	22	110	6600	0.151515152
550	71	18	90	5400	0.123966942
555	72	16	80	4800	0.110192837
600	73	13	65	3900	0.08953168
605	74	11	55	3300	0.075757576
610	75	10	50	3000	0.068870523
615	76	8	40	2400	0.055096419
620	77	7	35	2100	0.048209366
625	78	6	30	1800	0.041322314
630	79	5	25	1500	0.034435262
635	80	4	20	1200	0.027548209
640	81	3	15	900	0.020661157
645	82	2	10	600	0.013774105
650	83	2	10	600	0.013774105
655	84	1	5	300	0.006887052
700	85	1	5	300	0.006887052
705	86	1	5	300	0.006887052
710	87	1	5	300	0.006887052
715	88	0	0	0	0
720	89	0	0	0	0
725	90	0	0	0	0
730	91	0	0	0	0
735	92	0	0	0	0
740	93	0	0	0	0
745	94	0	0	0	0
750	95	0	0	0	0
755	96	0	0	0	0

DETENTION BASIN SEDIMENTATION ANALYSIS

PROJECT: TRONOX
CALCULATED BY: cz

Modified Universal Soil Loss Equation (MUSLE)

$Y=C1((V_w*qp)^{C2}*K*LS*CP$

Y=Sediment yield (tons)
Vw=Runoff volume (ac-ft)
qp=Peak flow rate (cfs)
C1=coefficient=95
C2=coefficient=0.56

LS=Equation: $LS=X_r^{0.5}(0.0076+0.53S_o+7.6S_o^2)$

CP=Crop Management and Erosion Control "CP" Values taken as 1 and 0.47 (Conservative Estimate)

100-YEAR SEDIMENT YIELD VOLUME ESTIMATE

Treatment Basin	Subbasin	Contributing Area (Acre)	X_r (ft)	S_o (ft/ft)	V_w100 (ac-ft)	Q_{100} (cfs)	K	LS	CP	Yield (tons)	Yield (ac-ft)
#3	PRO4	132.45	5263	0.0175	23.2	203	0.2	1.39	0.47	1418.07	0.54

Total Sediment Storage Volume Needed for Detention Basin = 0.54

SEDIMENTATION ANALYSIS SUBBASIN PRO4

BED LOAD CALCULATION - Meyer-Peter Equation

$qb = (39.25*q^{2/3}*So-9.95*dm)^{1.5}$

Tronox Soil Remediation
Inflow to Treatment Basin #3

DATE: 9/17/2010
BY: cz

MEYER-PETER EQUATION										
SEGMENT	Q (cfs)	Y (ft)	V (fps)	q (cfs/ft)	S (ft/ft)	dm (ft)	qb (lbs/sec)	TIME (min)	Wsoil (lbs/c.f.)	VOL. SED. (acre-ft)
1	0	0.00	0.00	0.00	0.018	0.02	0.0000	5.00	110.00	0.0000
2	0	0.00	0.00	0.00	0.018	0.02	0.0000	5.00	110.00	0.0000
3	0	0.00	0.00	0.00	0.018	0.02	0.0000	5.00	110.00	0.0000
4	0	0.00	0.00	0.00	0.018	0.02	0.0000	5.00	110.00	0.0000
5	0	0.00	0.00	0.00	0.018	0.02	0.0000	5.00	110.00	0.0000
6	2	0.09	1.72	0.16	0.018	0.02	0.0001	5.00	110.00	0.0000
7	2	0.09	1.72	0.16	0.018	0.02	0.0001	5.00	110.00	0.0000
8	3	0.11	1.87	0.20	0.018	0.02	0.0075	5.00	110.00	0.0000
9	5	0.13	2.07	0.28	0.018	0.02	0.0280	5.00	110.00	0.0000
10	7	0.15	2.22	0.34	0.018	0.02	0.0491	5.00	110.00	0.0000
11	8	0.16	2.28	0.37	0.018	0.02	0.0595	5.00	110.00	0.0000
12	8	0.16	2.28	0.37	0.018	0.02	0.0595	5.00	110.00	0.0000
13	8	0.16	2.28	0.37	0.018	0.02	0.0595	5.00	110.00	0.0000
14	7	0.15	2.22	0.34	0.018	0.02	0.0491	5.00	110.00	0.0000
15	6	0.14	2.15	0.31	0.018	0.02	0.0386	5.00	110.00	0.0000
16	5	0.13	2.07	0.28	0.018	0.02	0.0280	5.00	110.00	0.0000
17	5	0.13	2.07	0.28	0.018	0.02	0.0280	5.00	110.00	0.0000
18	5	0.13	2.07	0.28	0.018	0.02	0.0280	5.00	110.00	0.0000
19	6	0.14	2.15	0.31	0.018	0.02	0.0386	5.00	110.00	0.0000
20	7	0.15	2.22	0.34	0.018	0.02	0.0491	5.00	110.00	0.0000
21	9	0.17	2.33	0.39	0.018	0.02	0.0697	5.00	110.00	0.0000
22	11	0.18	2.43	0.44	0.018	0.02	0.0895	5.00	110.00	0.0000
23	13	0.20	2.51	0.49	0.018	0.02	0.1087	5.00	110.00	0.0000
24	14	0.20	2.54	0.51	0.018	0.02	0.1180	5.00	110.00	0.0000
25	15	0.21	2.58	0.53	0.018	0.02	0.1271	5.00	110.00	0.0000
26	15	0.21	2.58	0.53	0.018	0.02	0.1271	5.00	110.00	0.0000
27	14	0.20	2.54	0.51	0.018	0.02	0.1180	5.00	110.00	0.0000
28	14	0.20	2.54	0.51	0.018	0.02	0.1180	5.00	110.00	0.0000
29	14	0.20	2.54	0.51	0.018	0.02	0.1180	5.00	110.00	0.0000
30	14	0.20	2.54	0.51	0.018	0.02	0.1180	5.00	110.00	0.0000
31	16	0.21	2.61	0.55	0.018	0.02	0.1361	5.00	110.00	0.0000
32	18	0.22	2.68	0.60	0.018	0.02	0.1538	5.00	110.00	0.0000
33	19	0.23	2.71	0.61	0.018	0.02	0.1624	5.00	110.00	0.0000
34	20	0.23	2.73	0.63	0.018	0.02	0.1709	5.00	110.00	0.0000
35	21	0.24	2.76	0.65	0.018	0.02	0.1793	5.00	110.00	0.0000
36	22	0.24	2.79	0.67	0.018	0.02	0.1875	5.00	110.00	0.0000
37	22	0.24	2.79	0.67	0.018	0.02	0.1875	5.00	110.00	0.0000
38	22	0.24	2.79	0.67	0.018	0.02	0.1875	5.00	110.00	0.0000
39	24	0.25	2.83	0.71	0.018	0.02	0.2038	5.00	110.00	0.0000
40	28	0.27	2.92	0.78	0.018	0.02	0.2351	5.00	110.00	0.0000
41	37	0.30	3.09	0.92	0.018	0.02	0.3012	5.00	110.00	0.0008
42	53	0.34	3.32	1.14	0.018	0.02	0.4075	5.00	110.00	0.0012
43	78	0.40	3.59	1.43	0.018	0.02	0.5542	5.00	110.00	0.0019
44	109	0.46	3.84	1.75	0.018	0.02	0.7154	5.00	110.00	0.0028
45	143	0.51	4.05	2.06	0.018	0.02	0.8745	5.00	110.00	0.0038
46	174	0.55	4.21	2.32	0.018	0.02	1.0081	5.00	110.00	0.0047
47	195	0.58	4.31	2.49	0.018	0.02	1.0937	5.00	110.00	0.0054
48	203	0.59	4.34	2.55	0.018	0.02	1.1254	5.00	110.00	0.0056
49	200	0.58	4.33	2.52	0.018	0.02	1.1136	5.00	110.00	0.0055
50	187	0.57	4.27	2.42	0.018	0.02	1.0615	5.00	110.00	0.0051
51	168	0.54	4.18	2.27	0.018	0.02	0.9829	5.00	110.00	0.0045
52	147	0.52	4.07	2.10	0.018	0.02	0.8923	5.00	110.00	0.0039
53	125	0.48	3.94	1.90	0.018	0.02	0.7922	5.00	110.00	0.0033
54	107	0.45	3.82	1.73	0.018	0.02	0.7055	5.00	110.00	0.0027
55	92	0.43	3.71	1.58	0.018	0.02	0.6293	5.00	110.00	0.0023
56	81	0.41	3.62	1.47	0.018	0.02	0.5707	5.00	110.00	0.0020
57	74	0.39	3.55	1.39	0.018	0.02	0.5320	5.00	110.00	0.0018
58	69	0.38	3.50	1.33	0.018	0.02	0.5035	5.00	110.00	0.0016
59	67	0.38	3.48	1.31	0.018	0.02	0.4920	5.00	110.00	0.0016
60	66	0.37	3.47	1.30	0.018	0.02	0.4861	5.00	110.00	0.0015
61	64	0.37	3.45	1.27	0.018	0.02	0.4744	5.00	110.00	0.0015
62	63	0.37	3.44	1.26	0.018	0.02	0.4685	5.00	110.00	0.0015
63	60	0.36	3.40	1.23	0.018	0.02	0.4505	5.00	110.00	0.0014
64	58	0.35	3.36	1.18	0.018	0.02	0.4261	5.00	110.00	0.0013
65	50	0.33	3.28	1.10	0.018	0.02	0.3884	5.00	110.00	0.0011
66	44	0.32	3.20	1.02	0.018	0.02	0.3492	5.00	110.00	0.0009
67	38	0.30	3.11	0.93	0.018	0.02	0.3083	5.00	110.00	0.0008
68	32	0.28	3.00	0.84	0.018	0.02	0.2652	5.00	110.00	0.0006
69	26	0.26	2.88	0.74	0.018	0.02	0.2196	5.00	110.00	0.0005
70	22	0.24	2.79	0.67	0.018	0.02	0.1875	5.00	110.00	0.0000
71	18	0.22	2.68	0.60	0.018	0.02	0.1538	5.00	110.00	0.0000
72	16	0.21	2.61	0.55	0.018	0.02	0.1361	5.00	110.00	0.0000
73	13	0.20	2.51	0.49	0.018	0.02	0.1087	5.00	110.00	0.0000
74	11	0.18	2.43	0.44	0.018	0.02	0.0895	5.00	110.00	0.0000
75	10	0.18	2.38	0.42	0.018	0.02	0.0797	5.00	110.00	0.0000
76	8	0.16	2.28	0.37	0.018	0.02	0.0595	5.00	110.00	0.0000
77	7	0.15	2.22	0.34	0.018	0.02	0.0491	5.00	110.00	0.0000
78	6	0.14	2.15	0.31	0.018	0.02	0.0386	5.00	110.00	0.0000
79	5	0.13	2.07	0.28	0.018	0.02	0.0280	5.00	110.00	0.0000
80	4	0.12	1.98	0.24	0.018	0.02	0.0175	5.00	110.00	0.0000
81	3	0.11	1.87	0.20	0.018	0.02	0.0075	5.00	110.00	0.0000
82	2	0.09	1.72	0.16	0.018	0.02	0.0001	5.00	110.00	0.0000
83	2	0.09	1.72	0.16	0.018	0.02	0.0001	5.00	110.00	0.0000
84	2	0.09	1.72	0.16	0.018	0.02	0.0001	5.00	110.00	0.0000
85	2	0.09	1.72	0.16	0.018	0.02	0.0001	5.00	110.00	0.0000
86	2	0.09	1.72	0.16	0.018	0.02	0.0001	5.00	110.00	0.0000
87	2	0.09	1.72	0.16	0.018	0.02	0.0001	5.00	110.00	0.0000
88	0	0.00	0.00	0.00	0.018	0.02	0.0000	5.00	110.00	0.0000
89	0	0.00	0.00	0.00	0.018	0.02	0.0000	5.00	110.00	0.0000
90	0	0.00	0.00	0.00	0.018	0.02	0.0000	5.00	110.00	0.0000
91	0	0.00	0.00	0.00	0.018	0.02	0.0000	5.00	110.00	0.0000
92	0	0.00	0.00	0.00	0.018	0.02	0.0000	5.00	110.00	0.0000
93	0	0.00	0.00	0.00	0.018	0.02	0.0000	5.00	110.00	0.0000
									TOTAL	0.0716

PMF ANALYSIS

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             JUN  1998                 *
*           VERSION 4.1                 *
*                                       *
*  RUN DATE   05OCT10  TIME  11:47:44   *
*                                       *
*****************************************
```

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

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

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

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

1 HEC-1 INPUT PAGE 1

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

              *DIAGRAM
    1         TD
    2         ID    TRONOX SITE
    3         ID    PMF ANALYSIS
    4         ID
    5         ID
    6         ID
    7         ID    INPUT FILE = PMF.DAT
    8         ID    DESIGN STORM = PMF 6-HR STORM
    9         ID    STORM DISTRIBUTION = SDN #3
   10         ID
   11         ID
   12         ID     JR CARD RATIOS REPRESENT PMF (1.0)
   13         ID
   14         TD
   15         IT       5       0       0     300
   16         IO       5       0       0
   17         IN       5       0       0
   18         JR    PREC     1.0
              *

   19         KK    PRO1
   20         KM   THIS BASIN IS SOUTH OF LAKE MEAD AND DRAINS INTO THE LAKE MEAD CHANNEL
   21         KM   THE BASIN WAS ANALYZED TO DETERMINE FLOW CAPACITY OF THE CHANNEL AND
   22         KM   EXISTING STORM DRAIN CROSSINGS
   23         BA   .0646
   24         PB    5.72
   25         PC       0    0.02   0.057    0.07   0.087   0.108   0.124    0.13    0.13    0.13
   26         PC    0.13    0.13    0.13   0.133    0.14   0.142   0.148   0.158   0.172   0.181
   27         PC    0.19   0.197   0.199     0.2   0.201   0.204   0.214   0.229   0.241   0.249
   28         PC   0.251   0.256    0.27   0.278   0.281   0.283   0.295   0.322   0.352   0.409
   29         PC   0.499    0.59    0.71   0.744   0.781   0.812   0.819   0.835   0.851   0.856
   30         PC    0.86   0.868   0.876   0.888    0.91   0.926   0.937    0.95    0.97   0.976
   31         PC   0.982   0.985   0.987   0.989    0.99   0.993   0.993   0.994   0.995   0.998
   32         PC   0.998   0.999       1
   33         LS       0      92
   34         UD   0.194
              *

   35         XX    PRO3
   36         KM   DEVELOPED INDUSTRIAL SITE
   37         BA   .2835
   38         LS       0    92.3
   39         UD   0.313
              *

   40         KK     TB2
   41         KM   TREATMENT BASIN #2 CENTER OF SITE OLD BETA CHANNEL
   42         RS       1    STOR       0       0
   43         SV     0.6     3.4     7.7    12.2    16.9    21.9    27.2    33.2    39.8    43.3
   44         SE    1759    1760    1761    1762    1763    1764    1765    1766    1767  1767.5
   45         SQ       0       0       0       0       0       0       0       0    2700    4960
              *
```

1 HEC-1 INPUT PAGE 2

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

   46         KK    PRO2
   47         KM   DEVELOPED INDUSTRIAL SITE
   48         BA   .1301
   49         LS       0      93
   50         UD   0.228
              *

   51         KK    PRO5
```

```
             52          KM   DEVELOPED INDUSTRIAL SITE
             53          BA   .1240
             54          LS      0      93
             55          UD   0.247
                         *

             56          KK     CP5
             57          KM   COMBINE PRO2 AND PRO5 AT TREATMENT BASIN #1 AND PMF OVERFLOW FROM TB2
             58          HC      3
                         *

             59          KK     TB1
             60          KM   TREATMENT BASIN #1 AT NORTH EAST CORNER OF SITE
             61          RS      1    STOR       0       0
             62          SV      2     7.3    13.2    19.7    26.7    34.2    42.3    51.6    62.6
             63          SE   1735    1736    1737    1738    1739    1740    1741    1742    1743
             64          SQ      0       0       0       0       0       0       0     294     832
                         *

             65          KK    PRO4
             66          KM   DEVELOPED INDUSTRIAL SITE
             67          BA   .2069
             68          LS      0    92.8
             69          UD   0.507
                         *

             70          KK     TB3
             71          KM   TREATMENT BASIN #3 AT NORTH WEST CORNER OF SITE
             72          RS      1    STOR       0       0
             73          SV    1.3     2.6     4.0     5.5     7.5    10.0    12.7    15.6    18.7    22.1
             74          SV   25.9    30.0    34.1    38.9    44.2
             75          SE   1726    1727    1728    1729    1730    1731    1732    1733    1734    1735
             76          SE   1736    1737    1738    1739    1740
             77          SQ      0       0       0       0       0       0       0       0       0       0
             78          SQ      0       0       0     576    2036
                         *

             79          KK    PRO7
             80          KM   DEVELOPED INDUSTRIAL SITE
             81          BA   .0156
             82          LS      0      93
             83          UD   0.097
                         *
1                                                    HEC-1 INPUT                                                 PAGE  3

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

             84          KK    PRO8
             85          KM    DEVELOPED INDUSTRIAL SITE
             86          BA   .1942
             87          LS      0    90.4
             88          UD   0.332
                         *

             89          KK     CP3
             90          KM   COMBINE REMAINING FLOW AT EXISTING CULVERT CROSSING WARM SPRINGS
             91          HC      4
                         *
             92          ZZ
1
              SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

    19        PRO1
                .
                .
    35          .        PRO3
                .          V
                .          V
    40          .         TB2
                .          .
                .          .
    46          .          .        PRO2
                .          .          .
                .          .          .
    51          .          .          .        PRO5
                .          .          .          .
                .          .          .          .
    56          .         CP5.........................
                .          V
                .          V
    59          .         TB1
                .          .
                .          .
    65          .          .        PRO4
                .          .          V
                .          .          V
    70          .          .         TB3
                .          .          .
                .          .          .
    79          .          .          .        PRO7
                .          .          .          .
                .          .          .          .
    84          .          .          .          .        PRO8
                .          .          .          .          .
                .          .          .          .          .
    89          .         CP3.........................................

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************                                  ****************************************
```

```
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              JUN  1998                *
*           VERSION 4.1                 *
*                                       *
*  RUN DATE   05OCT10  TIME  11:47:44   *
*                                       *
*****************************************
```


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


TRONOX SITE
PMF ANALYSIS

INPUT FILE = PMF.DAT
DESIGN STORM = PMF 6-HR STORM
STORM DISTRIBUTION = SDN #3

JR CARD RATIOS REPRESENT PMF (1.0)

```
   16 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
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
HYDROGRAPH AT					
+	PRO1	.06	1	FLOW	216.
				TIME	3.58
HYDROGRAPH AT					
+	PRO3	.28	1	FLOW	779.
				TIME	3.75
ROUTED TO					
+	TB2	.28	1	FLOW	841.
				TIME	3.83
			** PEAK STAGES IN FEET **		
			1	STAGE	1766.31
				TIME	3.83
HYDROGRAPH AT					
+	PRO2	.13	1	FLOW	410.
				TIME	3.67
HYDROGRAPH AT					
+	PRO5	.12	1	FLOW	383.
				TIME	3.67
3 COMBINED AT					
+	CP5	.54	1	FLOW	1431.
				TIME	3.83
ROUTED TO					
+	TB1	.54	1	FLOW	623.
				TIME	4.17
			** PEAK STAGES IN FEET **		

```
                                    1   STAGE     1742.61
                                        TIME         4.17

 HYDROGRAPH AT
+                    PRO4       .21     1   FLOW         449.
                                        TIME         3.92

 ROUTED TO
+                     TB3       .21     1   FLOW         226.
                                        TIME         4.42

                                    ** PEAK STAGES IN FEET **
                                    1   STAGE     1738.39
                                        TIME         4.42

 HYDROGRAPH AT
+                    PRO7       .02     1   FLOW          63.
                                        TIME         3.50

 HYDROGRAPH AT
+                    PRO8       .19     1   FLOW         509.
                                        TIME         3.75

  4 COMBINED AT
+                     CP3       .95     1   FLOW         911.
                                        TIME         4.08


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

northgate

environmental management, inc.

October 25, 2010

Chris Zrinyi
RCI Engineering
3281 S. Highland Drive, Suite 810
Las Vegas, Nevada 89109

RE: Estimation of Infiltration Rate
Tronox Facility, Henderson, Nevada
Project # 2027.01

Dear Chris:

Northgate Environmental Management, Inc. (Northgate) has performed some permeability testing on the Tronox Facility Site soils and testing has also been performed by other consultants previous to our work. The infiltration data that exists consists of vertical permeability test results on collected samples of the shallow soils. This data is presented in Table 1, attached to this letter for your review. In general the Site soils consist of sands and gravels with varying amounts of silt.

The results in Table 1 are presented in terms of hydraulic conductivity. As such, these values represent the infiltration rate under saturated conditions and a unit hydraulic gradient (head). Since the infiltration mechanism is through infiltration basins, the assumption of saturation may be a reasonable one given the function of the basins for water storage/infiltration. The gradient will vary depending on the amount (depth) of the water in the pond (the greater the depth, the greater the gradient and rate of infiltration).

The hydraulic conductivity values vary from 2.1 inches per hour to 0.013 inches per hour. The average hydraulic conductivity of the available 16 test results is 0.33 inches per hour. As stated above, the actual infiltration rate will be a function of the gradient (head) in the pond.

We trust that this information is helpful for your infiltration basin design work.

If you should have any questions regarding this information, please feel free to contact me at (510) 839-0688 x204 or via e-mail at ted.splitter@ngem.com.

Sincerely,

Northgate Environmental Management, Inc.

Ted Splitter, P.E.
Principal

ENCLOSURE

Table 1 – Laboratory Hydraulic Conductivity Test Results

TABLE 1
Laboratory Hydraulic Conductivity Test Results
Tronox Facility
Henderson, Nevada

Sample ID	SYS Sample Code	Geo Code	Start Depth	Water-Filled Porosity (cc/cc)	Dry Bulk Density (g/cc)	Total Porosity (cc/cc)	Hydraulic Conductivity (cm/s)	Hydraulic Conductivity (ft/d)	Sample Orientation	Depth Interval
RSAL6-0.5BSPLP	RSAL6-0.5B	Qal	0.5	0.31	1.71	0.36	6.16E-05	0.174724335	V	SHALLOW
RSAR3-0.5BSPLP	RSAR3-0.5B	Qal	0.5	0.17	1.73	0.37	9.43E-05	0.267285094	V	SHALLOW
SA30-9BSPLP	SA30-9B	Qal	9	0.16	1.80	0.33	2.09E-04	0.591243679	V	MIDDLE
SA56-10BSPLP	SA56-10B	Qal	10	0.13	1.69	0.38	1.50E-03	4.241041818	V	MIDDLE
RSAM3-10BSPLP	RSAM3-10B	Qal	10	0.15	1.59	0.40	1.19E-04	0.336715193	V	MIDDLE
SA166-10BSPLP	SA166-10B	Qal	10	0.10	1.72	0.36	1.60E-04	0.454424211	V	MIDDLE
SA182-10BSPLP	SA182-10B	Qal	10	0.18	1.74	0.33	3.58E-04	1.015239144	V	MIDDLE
SA64-10BSPLP	SA64-10B	Qal	10	0.15	1.72	0.35	1.22E-05	0.034525507	V	MIDDLE
SA102-10BSPLP	SA102-10B	Qal	10	0.14	1.77	0.34	9.30E-05	0.263682277	V	MIDDLE
SA128-10BSPLP	SA128-10B	Qal	10	0.16	1.65	0.38	5.96E-05	0.169031518	V	MIDDLE
SA148-10BSPLP	SA148-10B	Qal	10	0.12	1.76	0.36	1.64E-04	0.464335648	V	MIDDLE
RSAQ4-10BSPLP	RSAQ4-10B	Qal	10	0.14	1.84	0.32	5.57E-05	0.157762538	V	MIDDLE
RSAN8-10BSPLP	RSAN8-10B	Qal	10	0.19	1.68	0.37	1.84E-04	0.52177074S	V	MIDDLE
RSAQ8-10BSPLP	RSAQ8-10B	Qal	10	0.15	1.70	0.37	4.34E-04	1.228993035	V	MIDDLE
SA34-10BSPLP	SA34-10B	Qal	10	0.17	1.74	0.36	1.38E-04	0.392426824	V	MIDDLE
RSAI7-10B	RSAI7-10B	Qal	10	0.14	1.66	0.38	1.37E-05	0.038869607	V	MIDDLE

Calculated Drain Times

Hydraulic Conductivity = $0.33 \frac{IN}{HR} \frac{FT}{12 IN} \frac{24 HR}{DAY} = 0.66 \frac{FT}{DAY}$

Treatment Basin #1

Storage = 28.7 AC-FT = 1,250,172 CF

Surface Area = 315,680 SF

$$\text{Drain Time} = \frac{1250172 \text{ CF}}{315\,680 \text{ SF}} \Big| \frac{\text{DAY}}{0.66 \text{ FT}} = 6 \text{ days}$$

Treatment Basin #2

Storage = 232 AC-FT = 1,010,592 CF

Surface Area = 149,432 SF

$$\text{Drain Time} = \frac{1010\,592 \text{ CF}}{149,432 \text{ SF}} \Big| \frac{\text{DAY}}{0.66} = 10 \text{ days}$$

APPENDIX C – REFERENCE MATERIALS

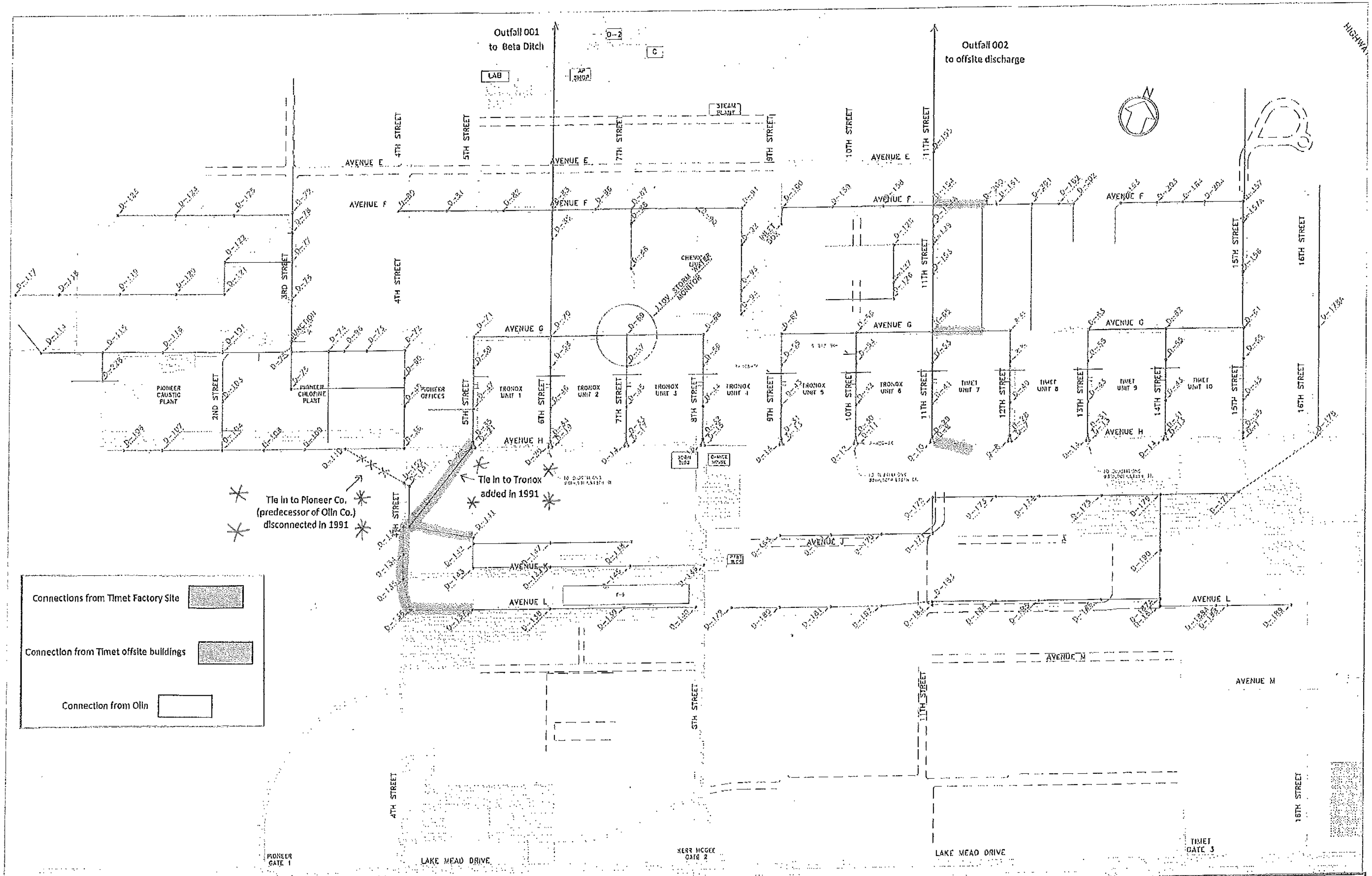
Tronox Management Storm Drain Inventory Sheets

Technical Drainage Study for Gate 2 by L.R. Nelson Consulting Engineers.

Technical Drainage Study for Eastside Landfill by PBS&J.

Technical Drainage Study for B & E Auto BMI Gate 5 & Northgate by PBS&J.

Technical Drainage Study for Lake Mead Crossing by Carter & Burgess.



SCALE: 1"=225'-0"

BASIC WATER COMPANY
875 West Warm Springs Road
Henderson, Nevada 89011

BASIC WATER COMPANY

BASIC MAGNESIUM, INC.
LAS VEGAS, NEVADA
1942

Figure 1. Stormwater Sewer System.

NOTE/ SEE DRAWINGS R-123 AND R-124 FOR INLETS BETWEEN AVENUES F AND H, WEST OF 4TH ST.

LEGEND

= STORM WATER DRAIN WITH MANHOLE

= INLET

= REFERENCE DWG. NO

= MANHOLE WITH C.I. RING & COVER

= STORM WATER SEWER CONSTRUCTED UNDER FERGUSON CONTRACT.

KEY MAP

STORM WATER SEWERS

SCALE 1" = 200'

NOTE/ FOR B/M AND M.H. DATA SEE R-27, SHEET 2.

NOTE/ THIS DWG. VOIDS DWG. R-27, ISSUE 7

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FINAL APPROVAL		DATE
D. R. C.		
CH. DRAFTSMAN		
CH. DES ENGR.	W. B. DYER	1-13-42

	PRELIMINARY - DO NOT USE FOR CONSTRUCTION
✓	PURCHASED BY B. M. I. / PURCHASED BY McNEIL CONST. CO.
✓	APPROVED FOR CONSTRUCTION

Issue No.	Description	Drawn by	Traced by	Checked by	Interdiv. check	B/M check by	Approved by dept. head	Date of issue
1		C.L. KNAUS 12-17-41	C.L.K. 1-13-42	C.L.K./G.M.E. 1-13-42			W.W.P./W.J.H. 1-13-42	
2	ADDED KEY MAP, MANHOLE LIST AND CORRECTED TO DWG. R-28.	C.L.K. 1-27-42					W.P. 1-27-42	
3	CORRECTED TO DWG. NOS. R-29 & R-30	C.L.K.					W.P.	2-5-42
4	CORRECTED TO DWG. NO R-36. (NOT FINISHED)	E.H.						2-14-42
5	UP TO DATE	E.H.					R.W. O'N.	4-2-42
6	UP TO DATE	WILKERSON					R. O'N.	5-20-42
7	CORRECTED TO DATE.	J.R.C.					R. O'N.	7-28-42 / 7-29-42
8	REDRAWN ON 2 SHEETS. CORRECTED TO DATE.	HOLMES	HOLMES	G.M.E. 12-29-42				

BASIC MAGNESIUM INC.
LAS VEGAS, NEVADA

WATER, EFFLUENT & SERVICE
STORM WATER SEWERS
TITLE SHEET

SCALE 1" = 200'
ACC. NO. 341-1215

R-27
SHEET 1 OF 2
ISSUE NO. 8

CORRECTED TO DATE 7-1-43

REGIONAL FLOOD CONTROL DISTRICT

R

LTR
07-35686

March 24, 2008

Mr. Layne Weber, P.E.
Department of Development Services
500 S. Grand Central Parkway
Las Vegas, NV 89155

DISTRICT CONCURRENCE: GATE 2
(HTE #07-35686) (RFCD No. 08-7617)

Dear Mr. Weber:

Clark County Regional Flood Control District (District) reviewed Conceptual Drainage Study dated August 2, 2007, Addendum No. 1 dated February 11, 2008 for above-mentioned project as submitted by L.R.NELSON CONSULTING ENGINEERS, INC. In addition, District is in receipt of the Conditional Letter of Acceptance from Department of Development Services dated February 22, 2008.

District concurs with acceptance of this Technical Drainage Study by Department of Development Services.

District's review of this project was limited to issues of Regional Flood Control Significance as defined in *Uniform Regulations for the Control of Drainage*. As noted in study, site resides in a Special Flood Hazard Area (SFHA) designated as "Zone A" per the effective Flood Insurance Rate Map (FIRM). Therefore, consultant should be advised that this acceptance does not serve to amend the FIRM or remove the SFHA.

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

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

BY: Abigail Mayrena, P.E., CFM
Senior Engineer

Andrew R. Trelease, P.E., CFM
Principal Civil Engineer

AM:ART:ph

c: David W. Trushaw, P.E., L.R. NELSON CONSULTING ENGINEERS, INC.

P:\Letters and Memos\Local Drainage\Land Development & Drainage\Concurrence Letters\2008\Mar08\22-62-12.LRN.doc

600 S. Grand Central Parkway, Suite 300 • Las Vegas, Nevada 89106-4511
(702) 455-3139 • FAX: (702) 455-3870
Website: *http://www.regionalflood.org*

Department of Development Services

500 S Grand Central Pky 1st Fl • Box 551799 • Las Vegas NV 89155-1799
(702) 455-4600 • Fax (702) 388-2550
Ronald L. Lynn, Director/Building Official

Dean Friedli, Assistant Director, Administrative Division
Greg Franklin, Assistant Director, Building Division
Robert Thompson, Assistant Director, Civil Engineering Division

Conceptual Approval Letter

07-35686
LTR

Date: February 22, 2008
Firm: L.R. Nelson Consulting Engineers, Inc.
Engineer: David W. Trushaw, P.E.
Address: 6765 W. Russell Road., Suite 200, Las Vegas, NV 89118
Phone: (702) 798-7978
Fax: (702) 451-2296
E-mail: lrnelson@lrneng.com

Subject: Conceptual Drainage Study for Gate 2
Location: North side of Lake Mead Boulevard at Van Wagenen Street
APN: 178-12-201-004 etal.
Sec, Township, Range: S12-13, T22S, R62E
Flood Zone & Panel: Zone X and A, 2595, Effective 9/27/02 and 23615, Revised 1/16/04
Application Tracking #: 07-35686

HTE07-35686CDD

Submittals	Date Received	Date Returned	Clark Co. Reviewer	WILLDAN Reviewer	Misc.
CDS	8/13/2007	8/27/2007	rm	TLC	
Addendum #1	2/12/2008	02/22/2008		TLC	

Concurrence Required: (Must be obtained prior to permit issuance)		Reason Concurrence is required
X	City of Henderson	Adjacent to or Impacts Henderson
	City of Las Vegas	Adjacent to or Impacts Las Vegas
	City of North Las Vegas	Adjacent to or Impacts North Las Vegas
	Nevada Department of Transportation	Adjacent to or Impacts NDOT Facility
	Clark County Public Works	Impacts a CCPW Facility
	US Army Corp of Engineers	Impacts a USACOE Facility
X	Clark County Regional Flood Control District	Adjacent to or Impacts CCRFCD MPU Facility or In a SFHA

The above referenced **Conceptual Drainage Study** has been reviewed and is accepted as complying with the minimum improvement standards, subject to the following conditions and restrictions:

1. This Conceptual Drainage Study establishes existing hydrologic conditions impacting the site by defining offsite and proposed offsite flows;

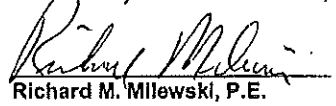
2. This approval does not allow any construction activity including grading, placement of fill or excavation of any kind;

3. An approved Technical Drainage Study is required prior to any construction activity. In addition the Technical Drainage Study must address any required drainage easements, establish FF elevations and provide hydraulic calculations for all required drainage facilities;

4. Future technical drainage studies will be required to address surface drainage easements to be privately maintained for flows from offsite properties (NAP1, NAP2, NAP3, NAP4 and NAP5 from the original submittal) and for flows crossing property lines;

5. It is noted that a parcel map signed and sealed by a professional land survery or professional engineer was not submitted. The approval of this study is for the hydrology only. Technical drainage study(ies) will be necessary for any future development;

The County's review is solely based on the information submitted by the Engineer of Record. The County's review is strictly limited to compliance with minimum County Codes and Standards. The Engineer of Record is responsible for researching and addressing situations that may require designs above and beyond the minimum codes for issues of public safety and impacts to upstream, downstream and adjacent properties. The County assumes no liability for information data, designs or conclusions of the Engineer of Record.

By 

Richard M. Milewski, P.E.
Senior Civil Engineer
Department of Development Services
Civil Engineering Division

cc: The Landwell Company
Development File
Willdan

07-35686
2/12/08
ADD 1

ADDENDUM #1 TO THE CONCEPTUAL DRAINAGE STUDY FOR GATE 2

CLARK COUNTY, NEVADA
Project Number: 1444-012-063
February 2008

Prepared For: The Landwell Company
875 W. Warm Springs Road
Henderson, NV 89015
(702) 567-0400

Prepared By: David W. Trushaw, P.E.
L.R. Nelson Consulting Engineers
6765 W. Russell Rd., Suite 200
Las Vegas, Nevada 89118
(702) 798-7978

LARRY R. NELSON, P.E.
President

• STRUCTURAL
• CIVIL
• SURVEY
• PLANNING

NEVADA
L. R. NELSON
CONSULTING ENGINEERS, INC.
6765 West Russell Road, Suite 200
Las Vegas, NV 89118-1811
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FAX: 702/451-2296
Email: lrnelson@lrneng.com

UTAH
L. R. NELSON
CONSULTING ENGINEERS, L.L.C.
51 West 9000 South
Sandy, UT 84070-2008
Phone: 801/565-8580
FAX: 801/565-9340
Email: lrnengineers@lrnllc.com

Project Number: 1444-012-063
February 7, 2008

Jeffery J. Jensen, P.E.
Clark County Development Services
500 S. Grand Central Parkway
Las Vegas, Nevada 89155

Re: Addendum #1 to the Technical Drainage Study for Gate 2
HTE# 07-35686

Mr. Jensen:

We have received the Clark County review comments for the above-mentioned study, dated June 20, 2007. The comments are restated and addressed as follows:

1. **The approval of the conceptual study will only allow for the parcel map to record. A technical drainage study will be required for any future improvements proposed. The technical drainage study will also need to address any revisions to the proposed easements shown;**

This study is for Parcel Map recordation only. A technical drainage study will be prepared with any future improvements to the site.

2. **The study must address flows from the parcels N.A.P. conveying flow through the subject site. The study must also address flows crossing parcel boundaries. Proposed drainage easements to convey the flow through the site, across parcel boundaries must be delineated and labeled. Facilities shown to convey these flows must be addressed in the future technical drainage study(ies);**

During our meeting with Clark County staff and a representative of the property owner, it was determined that public drainage easements can not be provided for this area. This is due to the special properties of the existing soil. The concern was that if easements were to be provided, this would allow the County and or the parcel owners to install additional storm drains or other types of conveyance systems. If the soils were to be disturbed by such activity, said activity would void the area's NDEP permits. It was decided; however, that the property owners would provide Clark County any as-built documentation of existing storm drains. Said documentation is enclosed with this addendum. It was also agreed by all attendees that any future technical drainage studies for future development will have to address the existing flows that are currently being conveyed through said parcel.

3. **The study must provide discussion of the flows in Lake Mead Drive and the Lake Mead Channel. It is noted that the basin map labels a 100-year flow of 155 cfs in the Lake Mead Channel, and a portion of the MPU HEC-1 analysis for the Pittman Wash is provided. This must be addressed;**

9. **Section 203 of the HCDDM provides a guideline for the contents of a Conceptual Drainage Study. Please review this criteria for the preparation of the addendum;**

This study is for a parcel map and is covered more specifically under Section 203.3 which does not require all of the items required for a typical Conceptual Drainage Study. Portions of the HCDDM are included in the Appendix for reference.

10. **Basin Map (Fignre 7) appears to be identifying political land parcels not individual watersbed basins? These are survey basin shapes are not topographic in nature. The water has to be collected in each basin and be routed through the site. These irregular basin shapes (NAP4, G2, etc) do not correlate with the general land contours. Revise the basin map and resubmit;**

The area drainage analysis has been revised to have one basin for the entire area now called G2. Refer to the revised lag time calculation, HEC-1 analayis, and Figure 7. Flow is routed through the site within an existing storm drain system as shown on the Storm Drain System Map. This item was discussed in the meeting between L.R. Nelson Consulting Engineers, an owner's representative, and Clark County staff. During said meeting, it was suggested that the existing storm drain sizes be verified. After some discussion, it was agreed that this could not be performed due to the soil conditions.

11. **The HEC-1 hydrualic analysis must be revised to reflect the flows per comment #9. Review and revise the HEC-1 analysis;**

It is assumed that the reflection of flow pertain to comment #10, not 9. The basins and HEC-1 analysis have been revised accordingly.

12. **There have been previous drainage studies in the adjacent lands which may provide information about the general drainage patterns, facilities, and mitigation in this area of Clark County. Please review these studies (HTE: 06-44325 Eastside Landfill, HTE: 07-27571 Gate 7);**

The above-mentioned studies have been reviewed and do not help with site specific drainage patterns, facilities, or mitigation. One is too far to the west and the other used the Master Plan Update flows for offsites.

13. **The predetermination exhibit notes many easement areas within the study area. Please review each easement. If these are drainage easements, then indicate the type of existing facility and the conveyance capacity for each;**

The easements are all access easements between parcels. There are no existing drainage easements located within the site.

Department of Development Services
Civil Engineering Division

500 S Grand Central Pky 1st Fl • Box 551799 • Las Vegas NV 89155-1799
(702) 455-4600 • Fax (702) 388-2550

Phil Rosenquist, Director

December 19, 2006

06-44325
LTR

PBS&J
2270 Corporate Circle, Suite 100
Henderson, NV 89074

SUBJECT: WILLDAN/Clark County Development Services Dept. Plan Review Contract
Technical Drainage Study for Eastside Landfill **(5405)**
Study Dated: ~~October 6, 2006~~
Addendum Dated: November 28, 2006
Location: Southeast of Eastgate Road and Warm Springs Road
(Sec. 11 & 12, T. 22 S., R. 62 E.)
HTE# 06-44325

The Referenced **Technical Drainage Study** has been reviewed and is accepted as complying with the minimum improvement standards. As set forth in the subject drainage study, the following measures will be taken to mitigate flood hazards.

1. The site shall be graded with respect to drainage as shown on "Grading Plans for Eastside Landfill" sheets C1, C2, D1, D2, signed and sealed by M. Lee Jacoby, P.E., on November 22, 2006, and sheets H1, MG1, G1 through G7, P1 through P8, S1 and S2, signed and sealed by M. Lee Jacoby Jr., P.E., on November 27, 2006;

2. The following drainage facilities shall be constructed:

   a. A 9 ac-ft onsite detention basin located at the northwest corner of the site as shown on sheets P5 and P6

   b. An onsite concrete lined trapezoidal embankment channel, at the inlet to the above-mentioned detention basin 2(a), as shown on sheets P5 and P6

   c. Approximately 60 lf of 60-inch RCP extending northwest from the above-mentioned onsite detention basin 2(a). The proposed 60-inch RCP has an NDOT standard headwall and trash rack at the inlet, and an NDOT standard manhole et the outlet, and is connected to an existing 60-inch RCP as shown on sheets P5 and P6 and details on sheets D1 and D2

d. A 0.97 ac. onsite equalizer basin located at the northeast corner of the site, with approximately 1248 lf of 42-inch RCP draining into the above-mentioned detention basin 2(a), with NDOT standard headwalls and riprap pads (d50 = 12 inches, thickness = 24 inches) at the inlet and outlet as shown on sheet P8

e. An onsite concrete lined trapezoidal embankment channel at the inlet to the above-mentioned equalizer basin 2(d) as shown on sheet P8

f. Onsite channels along the toe of the landfill as shown on the above-mentioned grading plans

3. A bond estimate must be submitted to Clark County Civil Engineering Division for the above-mentioned stormwater management facilities, items (2a) through (2e);

4. Please note that further development on the site may be required to address easement need for drainage facilities;

5. The site is adjacent to the City of Henderson. Concurrence from the City of Henderson is required;

6. The subject site is located within Zone X, as shown on FIRM Community Panel Number 32003C2595E, revised September 27, 2002. Zone X is determined to be outside the 0.2% annual chance flood plain;

7. Mylars of the grading plan must be submitted to and/or revised at the Clark County Civil Engineering Division Plan Check for approval signatures prior to permit issuance;

8. **The drainage/grading plans submitted for this project have been red lined for minor revisions;**

The County's review is solely based on the information submitted by the Engineer of Record. The County's review is strictly limited to compliance with minimum County Codes and Standards. The Engineer of Record is responsible for researching and addressing situations that may require designs above and beyond the minimum codes for issues of public safety and impacts to upstream, downstream and adjacent properties. The County assumes no liability for information data, designs or conclusions of the Engineer of Record;

DEPARTMENT OF DEVELOPMENT SERVICES

BY: _____

Jeffery J. Jensen, P.E.
Senior Engineer
Civil Engineering Division

JJJ/pts

cc: Basic Remediation Company
Development File

06-44325
10.06.06
1 OF 2 TDS

TECHNICAL DRAINAGE STUDY FOR EASTSIDE LANDFILL

Volume I of II

Prepared for:

Basic Remediation Company
875 W. Warm Springs Road
Henderson, NV 89015

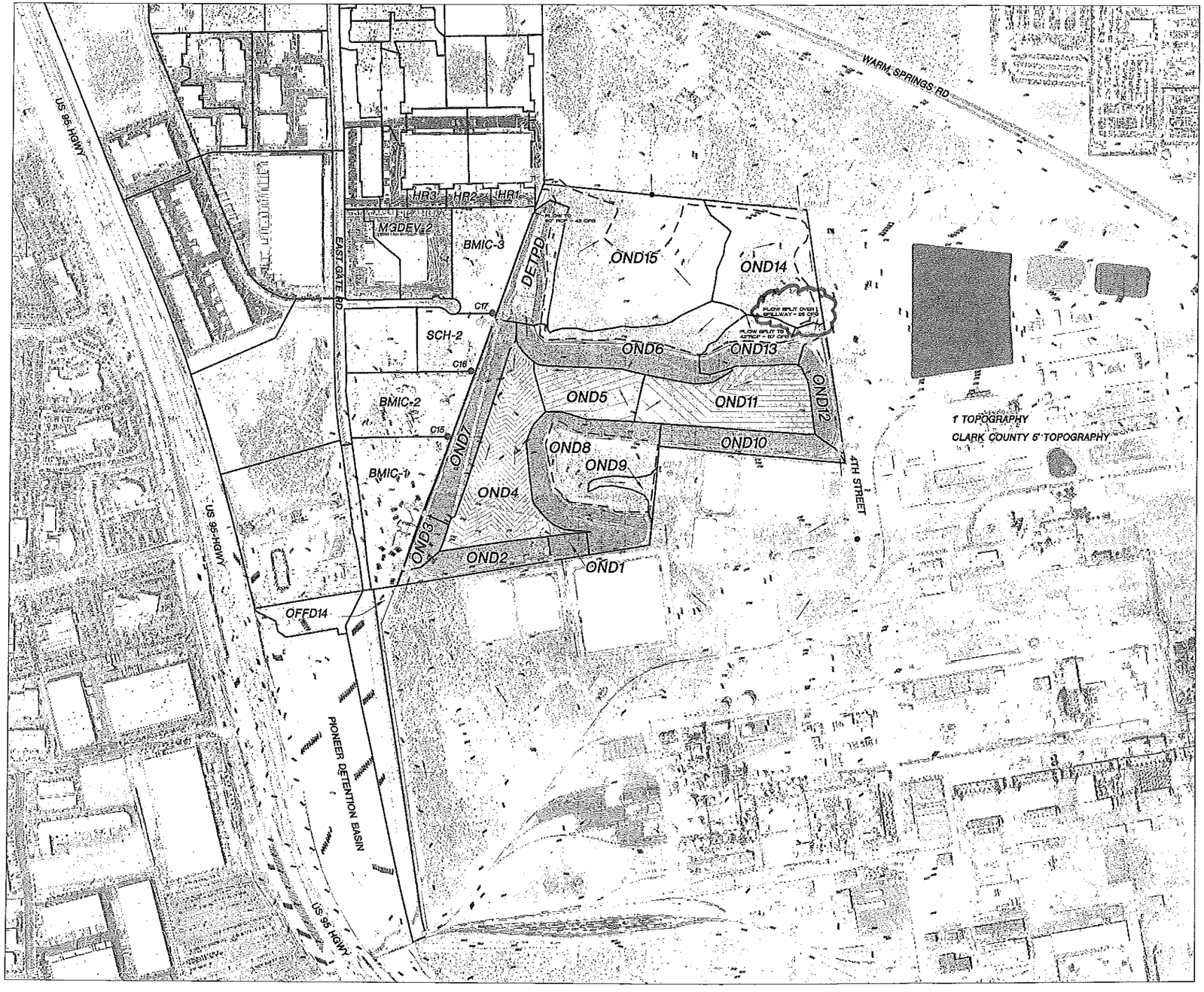
F

TO: WILLDAN & ASSOC. FOR REVIEW
FROM: CLARK COUNTY DEV. SERVICES
ORIGINAL ✓ ADDENDUM #_____
BY AOT DATE 10.06.06

Prepared by:

PBS&J
2270 Corporate Circle, Suite 100
Henderson, Nevada 89074-6382
Phone: (702)-263-7275

October 6, 2006
PBS&J Reference No.: 511693.19



LEGEND

- ONSITE BASIN BOUNDARY
- OFFSITE BASIN BOUNDARY
- REFERENCED BASIN BOUNDARY
- OND1 — ONSITE BASIN LABEL
- OFFSITE BASIN LABEL
- HR1 — REFERENCED BASIN LABEL
- HEC-1 COMBINATION POINT
- DISCHARGE POINT
- FLOW DIRECTION
- REFERENCED BASIN BOUNDARY
- EXISTING LANDFILL BOUNDARY

NOTES

"ADDENDUM #1 TO THE TECHNICAL DRAINAGE STUDY FOR HENDERSON COMMERCE CENTER TWO (FORMERLY KNOWN AS HARSCH)" PREPARED BY PBS&J (FEBRUARY 2003) WAS USED FOR REFERENCED BASINS

BASIN ID	AREA (ac)	Q_{100} (cfs)	Q_{10} (cfs)
OND1	0.94	3	1
OND2	3.70	8	4
OND3	1.38	4	2
OND4	11.67	27	13
OND5	5.03	12	6
OND6	9.90	23	11
OND7	5.87	16	8
OND8	14.26	33	16
OND9	1.09	3	2
OND10	4.28	10	5
OND11	9.60	24	12
OND12	2.77	8	4
OND13	4.70	12	6
OND14	11.12	31	15
OND15	21.47	57	28
DETPD	5.14	16	8
OFFD1	42.20	87	39
OFFD2	9.83	23	10
OFFD3	16.40	35	16
OFFD4	7.61	19	9
OFFD5	5.11	13	6
CR-1	NA	25	11
CR-2	NA	120	54
CR-3	NA	121	54
CR-4	NA	131	59
CR-5	NA	40	19
CR-6	NA	254	119
CR-7	NA	37	17
CR-8	NA	70	33
CR-9	NA	89	41
CR-10	NA	127	60
CR-10A	NA	92	43
CR-11	NA	39	15
C18	NA	126	68
C18B	NA	136	74

N

PBSJ

GRAPHIC SCALE

300 0 150 300 600 1200

(IN FEET)
1 inch = 300 ft

51963.19 OCTOBER 2003

FIGURE 6
DEVELOPED CONDITION DRAINAGE MAP

TECHNICAL DRAINAGE STUDY FOR EASTSIDE LANDFILL

PBSJ
2270 Corporate Circle
Suite 100
Henderson, Nevada 89074-6332
Telephone: 702/263-7275
Fax: 702/263-7290
ENGINEERING PLANNING SURVEYING CONSTRUCTION SERVICES

L:\PROJECTS\51963.19-Eastside landfill\Figures\Hydro\Figure6_Developed Oct 06, 2003 - 2:20pm 39322

I. Introduction and Purpose

This report is intended to serve as the Technical Drainage Study (TDS) for Eastside Landfill. The purpose of this study is to establish a technical analysis of peak flow rates affecting the site under existing, interim and developed conditions. It includes an analysis of onsite and offsite drainage patterns and flow rates for use in the design of flood protection facilities. The study shows that the flood protection facilities designed within this study will improve/ perpetuate existing drainage patterns.

This study was conducted in accordance with the criteria set forth by Clark County Regional Flood Control District (CCRFCD) *Hydrologic Criteria and Drainage Design Manual* (Criteria Manual), prepared by WRC Engineering and updated by Montgomery Watson, August 1999.

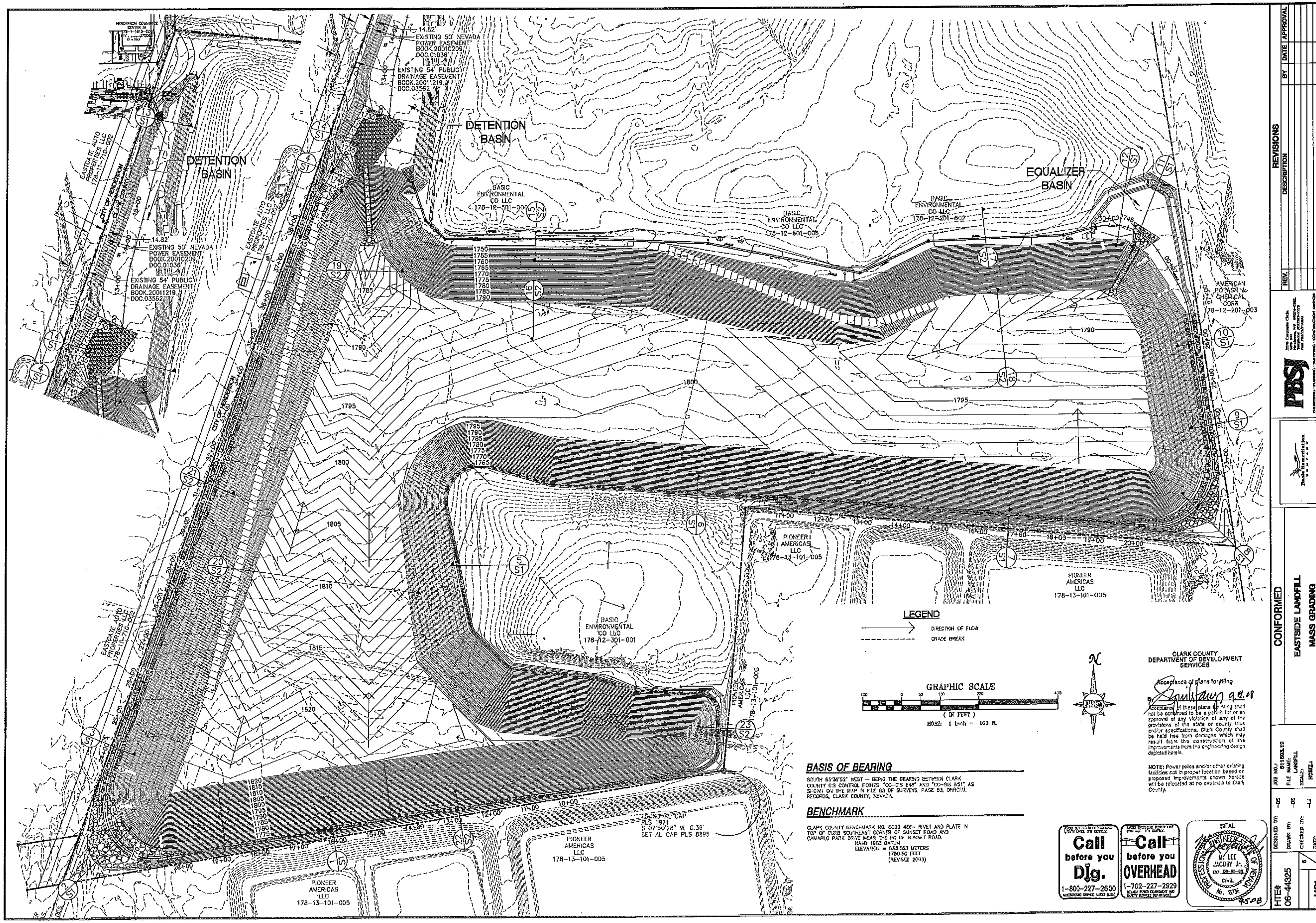
II. General Information

A. Location and Description

The Eastside Landfill property is located within Sections 11 and 12, Township 22 South, Range 62 East of Clark County, Nevada. The Assessor's Parcel Numbers for the subject site are 178-11-501-006, 178-12-201-002, and 178-12-301-001. The proposed development is located south of Warm Springs Road, west of 4th Street and north of the Union Pacific Railroad (UPRR).

The proposed site is bordered to the north by undeveloped land and to the south by Pioneer America LLC (north of the Union Pacific Railroad). American Potash & Chemical Corporation is located east of the project site and undeveloped land is west of the project site. Henderson Commerce Center II (formerly known as Harsch Development) is northwest of the site. Please refer to **Figure 1: Area/Vicinity Map** in **Appendix A**.

The project site area is approximately 113 (+/-) acres. The project entails the construction of a landfill with a total volume of approximately 2.6 million cubic yards of fill. The top of the proposed landfill will be approximately 40 feet above existing grade to reach the desired volume. Channels are proposed around the perimeter of the landfill to collect / convey the offsite and onsite flows. These proposed channels will serve as drainage facilities as wells as access roads for the maintenance of the landfill. The west channel (Channel C-1) drains into a proposed detention basin, with a volume of 16+/- ac-ft, located in the northwest corner of the project site. The purpose of this detention basin is to provide necessary storage to perpetuate the design outflow of the existing 60" storm drain constructed with the Harsch Development. The east channel (Channel C-2) drains into an equalizer basin located just northeast of the proposed landfill. This equalizer basin was designed to split the flow north to perpetuate the existing drainage conditions and west through a proposed storm drain that drains into the detention basin. The top of the landfill was graded such that the runoff would reach the two proposed


DETENTION BASIN
DETENTION BASIN
EQUALIZER BASIN
EXISTING 50' NEVADA POWER EASEMENT BOOK 20010209 DOC.01036
EXISTING 54' PUBLIC DRAINAGE EASEMENT BOOK 20011219 DOC.03562
BASIC ENVIRONMENTAL CO LLC 178-12-501-006
BASIC ENVIRONMENTAL CO LLC 178-12-501-005
BASIC ENVIRONMENTAL CO LLC 178-12-201-002
BASIC ENVIRONMENTAL CO LLC 178-12-301-001
AMERICAN POTASH & CHEMICAL CORP 178-12-201-003
PIONEER AMERICAS LLC 178-13-101-005
LEGEND
DIRECTION OF FLOW
GRADE BREAK
GRAPHIC SCALE
(IN FEET)
HORZ: 1 inch = 100 ft.
CLARK COUNTY DEPARTMENT OF DEVELOPMENT SERVICES
Acceptance of plans for filing
9.12.08
Acceptance of these plans for filing shall not be construed to be a permit for or an approval of any violation of any of the provisions of the state or county laws and/or specifications. Clark County shall be held free from damages which may result from the construction of the improvements from the engineering design depicted herein.
NOTE: Power poles and/or other existing facilities not in proper location based on proposed improvements shown hereon will be relocated at no expense to Clark County.
BASIS OF BEARING
SOUTH 65°36'52" WEST – BEING THE BEARING BETWEEN CLARK COUNTY GIS CONTROL POINTS "CC-GIS 848" AND "CC-GIS Y51" AS SHOWN ON THE MAP IN FILE 88 OF SURVEYS, PAGE 53, OFFICIAL RECORDS, CLARK COUNTY, NEVADA.
BENCHMARK
CLARK COUNTY BENCHMARK NO. 6C22 456– RIVET AND PLATE IN TOP OF CURB SOUTHEAST CORNER OF SUNSET ROAD AND CAMARLO PARK DRIVE NEAR THE PC OF SUNSET ROAD.
NAVD 1988 DATUM
ELEVATION = 533.563 METERS
1750.50 FEET
(REVISED 2003)
Call before you Dig.
1-800-227-2600
Call before you OVERHEAD
1-702-227-2929
SEAL
M. LEE JACOBY Jr.
CIVIL
No. 6736
REVISIONS
CONFORMED
EASTSIDE LANDFILL
MASS GRADING
HTE# 06-44325
MG1

C L A R K C O U N T Y
REGIONAL FLOOD CONTROL DISTRICT

August 7, 2002

RECEIVED
AUG 12 2002
PUBLIC WORKS
COMMUNITY DEVELOPMENT

Mr. Dave Betley, P.E.
Department of Development Services
500 S. Grand Central Parkway
Las Vegas, NV 89155

DISTRICT CONCURRENCE: B & E AUTO BMI GATE 5 & NORTGATE (HTE #02-18408) (PN #2002740059)

Dear Mr. Betley:

Clark County Regional Flood Control District (District) reviewed Technical Drainage Study dated May 30, 2002, for the above-mentioned project as submitted by PBS & J. In addition, District is in receipt of the Conditional Letter of Acceptance from Clark County Public Works dated June 25, 2002.

District concurs with acceptance of this Technical Drainage Study by Clark County Public Works.

District's review of this project was limited to issues of Regional Flood Control Significance as defined in *Uniform Regulations for the Control of Drainage.* As noted in study, site resides in a Special Flood Hazard Area (SFHA) designated as "Zone A" per the effective Flood Insurance Rate Map (FIRM). Therefore, consultant should be advised that this acceptance does not serve to amend the FIRM or remove the SFHA.

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

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

BY: _____
Andrew R. Trelease, P.E.
Senior Civil Engineer

ART:css

c: Mark A. Sorensen, P.E., PBS & J
Curt Chandler, P.E., City of Henderson Public Works

File: 22-62-12 & 1.PBS

600 S. Grand Central Parkway, Suite 300 • Las Vegas, Nevada 89106-4511
(702) 455-3139 • FAX: (702) 455-3870
Website: http://www.ccrfcd.org

Department of Public Works

500 S Grand Central Pky • PO Box 554000 • Las Vegas NV 89155-4000
(702) 455-6000 • Fax (702) 455-6040

M.J. Manning, Director • E-Mail: mjm@co.clark.nv.us

June 25, 2002

PBS&J, Inc.
901 N. Green Valley Parkway, Suite 100
Henderson, NV 89014

Dear Sirs:

Re: WILLDAN/Clark County Public Works Plan Review Contract
Technical Drainage Study for B and E Auto and **Conceptual Drainage Study** for BMI Gate 5 and Northgate **(3788)**
Study Dated: May 30, 2002
Location: Southwest corner of Boulder Highway and Warm Springs Road (Sec. 12,01, T. 22S., R. 62E.)
HTE #02-18408

The referenced **Technical Drainage Study** has been reviewed and is accepted as complying with minimum improvement standards. As set forth in the subject drainage study, the following measures will be taken to mitigate flood hazards:

1. The B & E Auto site shall be graded with respect to drainage as shown on "B and E Auto," sheets 1 through 3 signed and sealed by Lee C. Farris, P.E., on May 20, 2002 and sheet 4 dated May 31, 2002;

2. The following comments and restrictions regarding the conceptual drainage study portion are noted:

   a. The onsite and offsite flows are as developed in the Conceptual Drainage Study for BMI Gate 5 and Northgate, last revised May 30, 2002

   b. This approval does not allow any construction activity including grading, placement of fill or excavation of any kind, outside of the B& E Auto site . An approved technical drainage study shall be required prior to any construction activity

3. The following drainage facilities shall be constructed for the portion labeled B and E Auto:

a. Two (2) 8-foot wide concrete valley gutters located on the north side of Warm Springs Road crossing the driveway entrances

b. A 3ft concrete valley gutter within a 5ft private drainage easement along the east side of the site from the block wall openings mentioned in 3c to the Boulder Highway Right-of-Way

c. Three (3) 16-inch by 48-inch block wall openings located along the east property line as shown on sheet 4 and detail D sheet 4

d. Wrought iron gate located at the west boundary as indicated on sheet 3

4. A bond estimate must be submitted to Clark County Public Works for the above-mentioned stormwater management facilities, except 3(c) and 3(d);

5. Section 2 of the Clark County Building Department's Drainage Compliance Report must be completed by the engineer for the facilities listed in Item 3 above;

6. A majority of the subject site is located within shaded Zone X and Zone X, with the southwest corner of Northgate and the northwest corner of B and E Auto are located within Zone A, as shown on FIRM Community Panel Number 32003C2595D, revised August 16, 1995, and revised to reflect LOMR dated March 21, 2000 and FIRM Community Panel Number 32003C2615D, revised August 16, 1995. Shaded Zone X is an area of 500-year flood and an area of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile. Also, an area protected by levees from the 100-year flood. Zone X is determined to be outside the 500-year flood plain. Zone A is a special flood hazard area determined to be within the 100-year flood plain. No base flood elevations have been determined by FEMA;

7. Clark County Regional Flood Control District (CCRFCD) concurrence is required since the site is located within Flood Zone A and is adjacent to a proposed master planned facility. As a condition of final approval, the applicant must submit a copy of the drainage study and any addenda to the CCRFCD. Permits will not be issued until concurrence is obtained from the CCRFCD;

8. Mylars of the grading plan must be submitted to the Clark County Plan Check department for approval signatures prior to permit issuance;

9. At the request of Clark County Public Works, drainage/grading plans for the proposed development have been reviewed for compliance to the requirements set forth in the "Minimum Drainage Study Criteria Checklist," "Drainage Plan Information," dated July 15, 1997. **As a condition of final approval, the drainage/grading plans submitted for this project require the following modifications to meet the minimum standards outlined in the above-referenced regulation:**

   a. Show the 3ft valley gutter within the 5ft private drainage easement, along the east side of the site, from the block wall openings to the Boulder Highway Right-of-Way.

No liability is assumed by the County for information, data, and conclusions of the consulting engineer.

M.J. MANNING
DIRECTOR OF PUBLIC WORKS

BY: _____
Dave Betley, P.E.
Senior Engineer
Community Development Division

DB/AW/bk

cc: Robert Ellis
Development File

C:\Drainage\Approval Letters\2002\02-18408.wpd

TECHNICAL DRAINAGE STUDY FOR B & E AUTO AND CONCEPTUAL DRAINGE STUDY FOR THE REMAINDER OF BMI GATE 5 AND NORTHGATE

Prepared for:

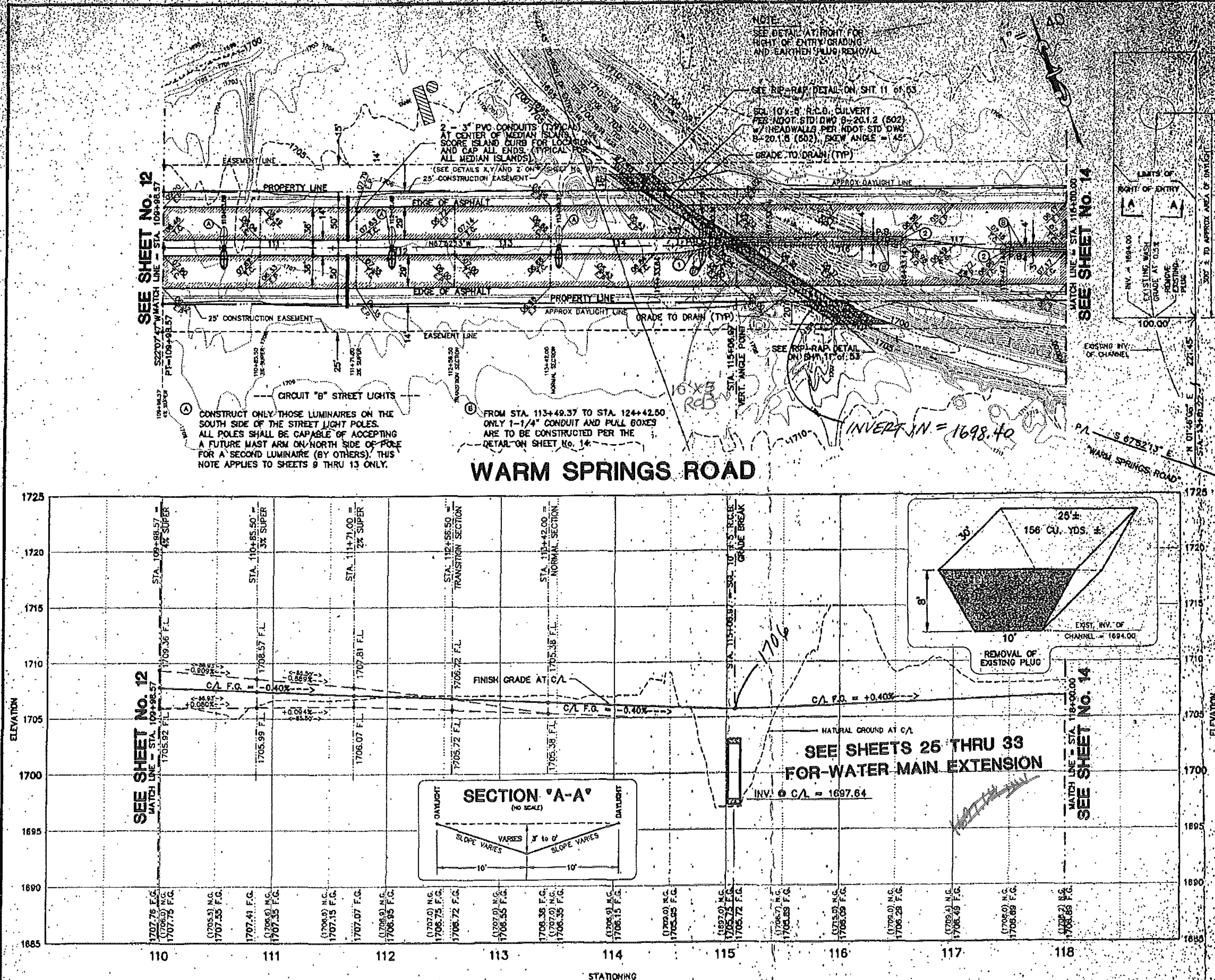
City of Henderson Public Works Department
240 Water Street
Henderson, Nevada 89015

Prepared by:

PBS&J
901 North Green Valley Parkway, Suite 100
Henderson, Nevada 89014

May 30, 2002

PBS&J



Quantities This Sheet

R.T.C. QUANTITIES

4" A.C. PAVEMENT	3,657 SQ. YDS
9" TYPE 2 AGGREGATE	5,843 SQ. YDS
6" SUB GRADE PREP/COMPACTION	5,843 SQ. YDS
"A" TYPE MEDIAN CURB	1,476 LIN. FT
CONCRETE MEDIAN NOSE	1,310 SQ. FT
1-1/2" MEDIAN PVMNT	750 SQ. YDS
10' x 5' R.C.B. CULVERT	184 LIN. FT
CONCRETE HEADWALL	TWO (2) EACH
RIP-RAP PAVING	1407 SQ. FT
3" PVC CONDUIT	160 LIN. FT
3-1/2 PULL BOX	THREE (3) EACH
1-1/4" PVC CONDUIT	315 LIN. FT
ROADWAY EXCAVATION	5,977 CU. YDS

B.M.I. QUANTITIES

STREET LIGHTS,250 HPS,SQL LUMINAIRE	THREE (3) EACH

CURVE TABLE

No.	DELTA	RADIUS	TANGENT	LENGTH
1	11°28'40"	250.00'	25.12'	50.08'
2	180°00'00"	2.00'	INFINITE	6.48'

Call before you Dig
IT'S THE LAW
1-800-227-2600

FILE NAME: WSR-13.DWG PROJECT No.: 9314
FORMAT: ACAD R13 C4a CONTRACT No.: 97-98-12

Revisions

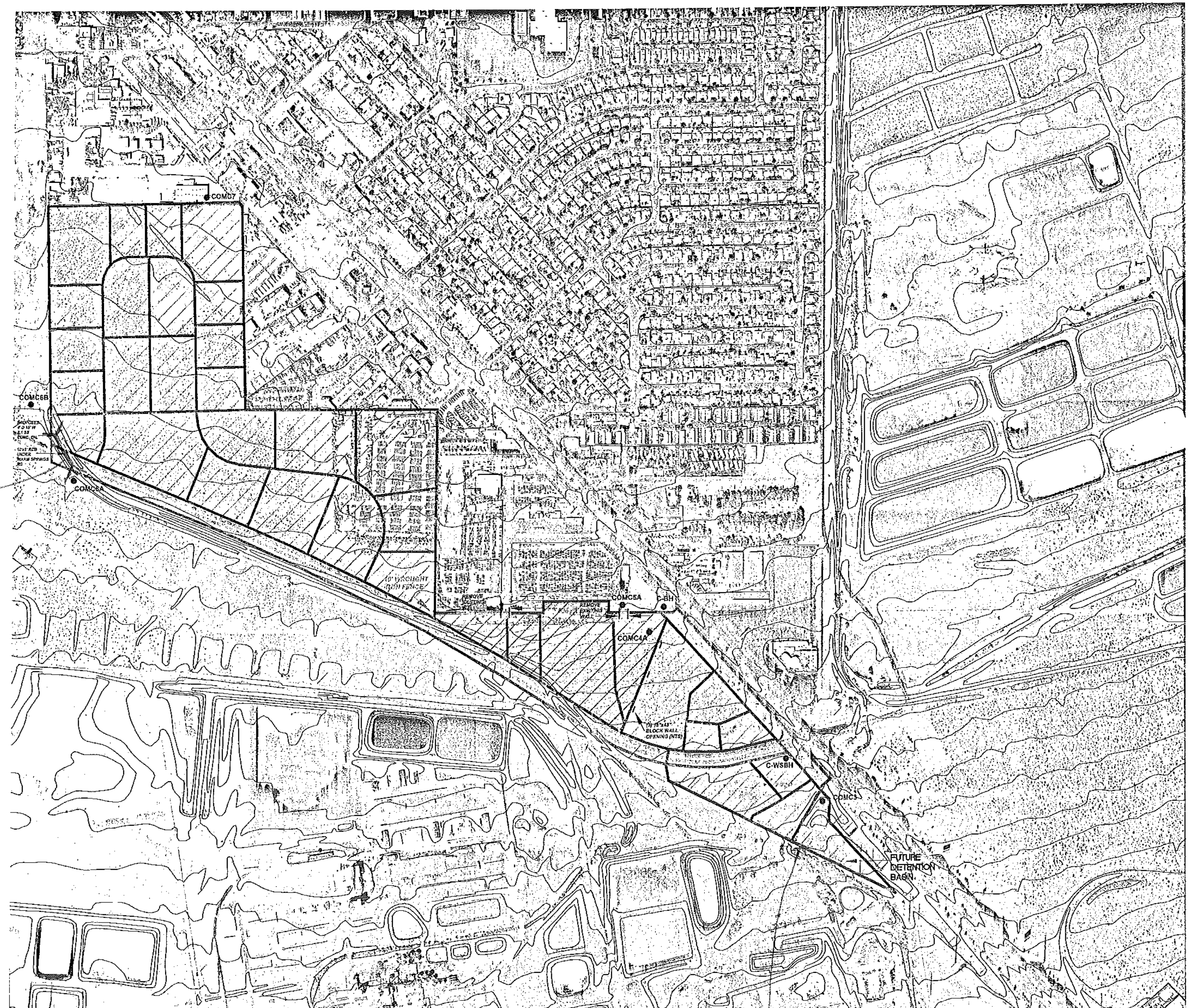
No.	DESCRIPTION	BY	DATE	APPROVAL

City of Henderson, Nevada
Department of Public Works
Engineering Services Division

WARM SPRINGS ROAD
PARKSON ROAD - PABCO ROAD
Sta. 109+98.57 - Sta. 118+00.00

SCALE: HORIZONTAL: 1" = 40' VERTICAL: 1" = 4'
DATE: 7-30-98 DRAWN: H.E. HALL CHECKED: G.A.N.
SHEET No. 13 of 53

APPROVAL: ROBERT A. BURNANE KEVIN L. HILL
DRAWING No. 05089



LEGEND:

- BASIN BOUNDARIES ONSITE
- BMI GATE 5
- B & E AUTO AUCTION
- NORTHGATE
- PROPOSED CONTOURS FOR B & E AUTO AUCTION

N

GRAPHIC SCALE

300 0 150 300 600 1200

(IN FEET)

1 inch = 300 ft.

City of Henderson

REVISIONS

NO.	DATE	DESCRIPTION	APPV'D

PROJECT MANAGER: MARK SORENSEN
DESIGNED BY: PW
DRAWN BY: AV/DF
CHECKED BY: VF
DATE: MAY 29, 2002

TITLE: TECHNICAL DRAINAGE STUDY FOR B+E AUTO AND CONCEPTUAL DRAINAGE STUDY FOR THE REMAINDER OF BMI GATE 5 AND NORTHGATE

SHEET: FIGURE 6

ONSITE DEVELOPED BASINS

SHEET: 1 of 1

DRAWING NO.

FIG 6

LTR

07-3280

Department of Development Services
Civil Engineering Division

500 S Grand Central Pky 1st Fl • Box 551799 • Las Vegas NV 89155-1799
(702) 455-4600 • Fax (702) 388-2550

Ronald L. Lynn, Building Official

July 9, 2007

07-3280
LTR

Carter & Burgess, Inc
6655 Bermuda Road
Las Vegas, Nevada 89119

Re: **Technical Drainage Study Concurrence** for Lake Mead Crossing
Study Dated: October 10, 2006
COH Addendum #1 Dated: November 22, 2006
COH Addendum #2 Dated: December 28, 2006
COH Addendum #3 Dated: January 11, 2007
Interagency Addendum #4 Dated: April 17, 2007
Interagency Addendum #5 Dated: June 5, 2007
COH Addendum #6 Dated: June 18, 2007
Interagency Addendum #7 Dated: July 6, 2007
Location: NWC of Lake Mead Parkway and Water Street
(Sec. 18, T. 22 S., R. 63 E.)
COH Permit Number: 2006780182
HTE# 07-3280

The above-referenced project is located within the **City of Henderson** adjacent to Clark County unincorporated areas. The drainage study was submitted to the County for concurrence on January 17, 2007 with response to Clark County comments dated April 17, 2007, June 15, 2007, and July 6, 2007 with the City of Henderson Addendum #6 dated June 18, 2007. In addition, the County has received the City of Henderson acceptance letter dated June 21, 2007 for the Technical Drainage Study.

The County concurs with the acceptance of this Technical Drainage Study by the City of Henderson. Please note that the County's review of this development is limited to drainage issues significant to Clark County unincorporated areas as follow:

1. The site shall be graded with respect to drainage as shown on "Lake Mead Crossings", sheets C3.01, C3.04, C3.09, C3.10, C3.11, C3.12, C5.01 through C5.06, C5.09, C5.14, and C5.17, signed and sealed by Curtis R. Horton, P.E., on July 6, 2007 from the latest revised Clark County plan set.

2. The subject site is located within Zone A and Zone X, as shown on FIRM Community-Panel Number 320003C 2615E, dated September 27, 2002 and revised to reflect LOMR January 16, 2004. Zone A is a special flood hazard area subject to inundation by the 1% annual chance flood event. No base flood elevations have been determined by FEMA. Zone X is determined to be outside the 0.2% annual chance flood plain.

3. Since the project proposes construction within a SFHA Zone A, the Engineer will need to notify FEMA of the proposed changes to the flood. Coordinate with the City of Henderson on CLOMR and LOMR conditions for site development.

4. The proposed storm drain facility along the project's northern perimeter extends into Clark County jurisdiction. A legal description of the drainage easement to be privately maintained, and a copy of this drainage study approval letter must be submitted to the Clark County Department of Development Services, Civil Engineering Division, Right-of-Way/Mapping counter for review and approval. Upon approval of the legal description and the copy of the "Grant of Private Drainage Easement" that is to be recorded, the easement will be executed and recorded by separate document.

5. It is noted that the proposed 36-inch and 60-inch RCP appears to be in Clark County jurisdiction at the northern perimeter of the project site. However, the interagency agreement with the City of Henderson allows this facility to be bonded and constructed under the City of Henderson permit process.

6. The proposed design to capture the onsite break-out flows in the City of Henderson in the existing conditions is acceptable to the County. Regional concurrence will be required from CCRFCD regarding the routing of the Lake Mead break-out flows to Boulder Highway, and the associated impacts to the SFHA Zone and downstream properties.

7. The Technical Drainage Study shows that the development of the project site will decrease flow quantities impacting downstream properties in Clark County jurisdiction on Lake Mead Parkway by routing flow to Water Street. Any subsequent modifications to the proposed design that increases the flow quantity impacting the Clark County jurisdiction will require an updated concurrence from Clark County Development Services.

8. **As a condition of approval, the drainage/grading plans submitted for this project require the following modifications prior to Civil Engineering Plan Check submittal:**

   a. Verify the CCAUSD number for the type II manhole for storm drain construction note 4.

   b. Verify the latest FIRM panel revision date.

   c. Clarify the locking manhole as specified in the TDS on sheet C5.01 of the grading plans.

   d. Label the 30-ft slope easement to include a drainage easement to be privately maintained along the northern perimeter of the project site.

The County's review is solely based on the information submitted by the Engineer of Record. The County's review is strictly limited to compliance with minimum County Codes and Standards. The Engineer of Record is responsible for researching and addressing situations that may require designs above and beyond the minimum codes for issues of public safety and impacts to upstream, downstream and adjacent properties. The County assumes no liability for information data, designs or conclusions of the Engineer of Record.

DEPARTMENT OF DEVELOPMENT SERVICES

BY: _____

Glenn S. Hale, P.E
Senior Civil Engineer
Civil Engineering Division

GH/ccw

cc: Andrew Trelease, CCRFCD
Jeff Swartzlander, City of Henderson
Juliet Property Co.
Development File

07-3280 A007
07.06.07

ADDENDUM #7 TO THE TECHNICAL DRAINAGE STUDY FOR

Lake Mead Crossing

APN # 179-18-101-005

T-1 COM

Prepared for:

Juliet Property Co.
8375 W. Flamingo Rd. Ste. 200
Las Vegas, NV 89147
Office: (702) 368-5800
Fax: (702) 368-5899

Prepared by:

Carter & Burgess, Inc.
6655 Bermuda Road
Las Vegas, NV 89119
Office: (702) 938-5400
Fax: (702) 938-5454

July 6, 2007
Job #241654

CRB Nevada, Inc. 6655 Bermuda Road Las Vegas, Nevada 89119-3605 Phone: 702.938.5400 Fax: 702.938.5454

Response: On June 28, 2007, Mark Fakler, P.E. and Tara Alexander, P.E. of Carter & Burgess performed a site visit to the area encompassed by OFF-1 in order to verify the basin delineation as outlined in the previous submittal, Addendum #5 dated June 5, 2007. The street slope directions, high points and valley gutters were easily identified by site visit.

The referenced basin OFF-1 (Water Street Parcel Conceptual Drainage Study, H.T.E. #04-47485) is illustrated on the enclosed exhibit, *LAKE MEAD PARKWAY - OFFSITE BASIN DELINEATION.* The exhibit shows the locations of the pertinent high points and valley gutters in order to determine the portions that will discharge to both Basic Road and Atlantic Avenue. Basin OFF-1 is divided into basins OFF1-A and OFF-1B accordingly. The following table explains how basin OFF-1 has been delineated in both Addendum #5 and this Addendum #7.

Subdivision of Basin OFF-1
0.13 mi^2, Q_{10}/Q_{100}= 75/ 160 cfs

Basin	Portion of OFF-1	Q_{10}/Q_{100} (CFS)	Discharge Location
Addendum #5 – June 5, 2007			
OFF-1A	0.05/0.13	30/62	ATLANTIC
OFF1-B	0.08/0.13	45/98	BASIC
Addendum #7 – This Submittal			
OFF-1A – 39.1 AC	48% by AutoCAD	36/77	ATLANTIC
OFF1-B – 42.1 AC	52% by AutoCAD	39/83	BASIC

This table illustrates that 15 cfs more will be accepted into the onsite storm drain system. All onsite calculations pertaining to this assumption have been revised. The increased offsite runoff into the storm drain will not cause failure to the system.

There is one revision to the onsite storm drain system necessitated by the increase. The portion of storm drain at the northwest of the site had to be adjusted. Originally, 26 cfs enters the main system at storm manhole SDMH #08 from the west. This western portion of the storm drain is set at a minimum of 0.5% slope due to downstream constraints which make these manholes shallower in this section. Due to the increase flow, one manhole (SDMH #17) was removed, a locking manhole is necessary at SDMH #16 and the top of grate elevation for drop inlet SDDI #24 was raised from 1849.0 to 1850.1. All manholes and inlets adjusted per this submittal are within a private system.

The associate revised calculations and figures pertaining to this adjustment are included in the Appendix of this Addendum:

Subbasin Boundary

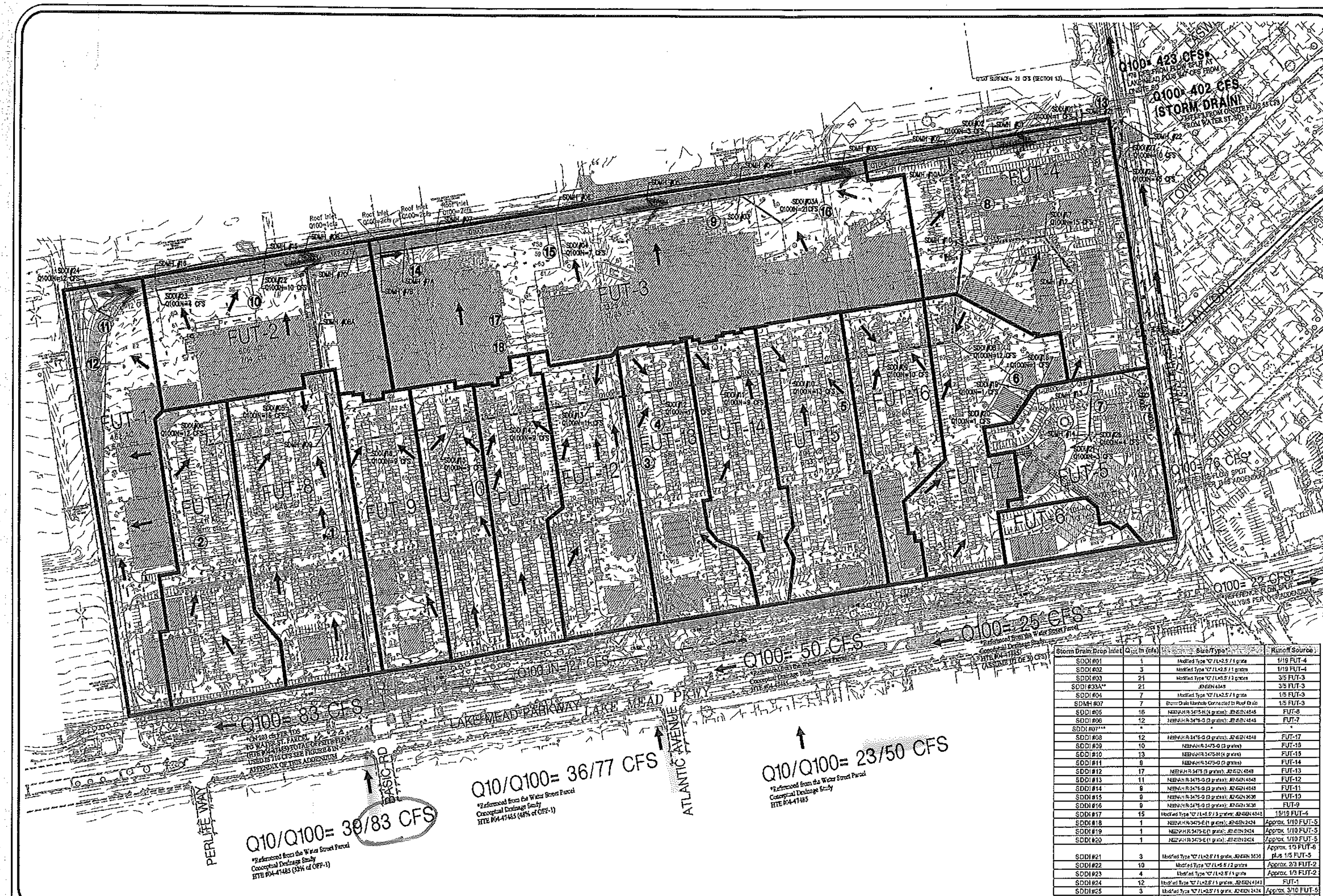
LAKE MEAD CROSSING

LAKE MEAD PARKWAY – OFFSITE BASIN DELINEATION

Carter:Burgess
Consultants in Planning, Engineering, Construction Management, and Related Services
6855 Bermuda Road
Las Vegas, Nevada 89119
(702) 938-5400 Fax (702) 938-5454

ADDENDUM

D/S 07-3280



Storm Drain Drop Inlet	Q_{100} in (cfs)	Size/Type*	Runoff Source
SDDI #01	1	Modified Type "C" / L=2.5' / 1 grate	1/19 FUT-4
SDDI #02	3	Modified Type "C" / L=2.5' / 1 grate	1/19 FUT-4
SDDI #03	21	Modified Type "C" / L=6.5' / 3 grates	3/5 FUT-3
SDDI #03A**	21	JENSEN 4848	3/5 FUT-3
SDDI #04	7	Modified Type "C" / L=2.5' / 1 grate	1/5 FUT-3
SDMH #07	7	Storm Drain Manhole Connected to Roof Drain	1/5 FUT-3
SDDI #05	16	NEENAH R-3475-N (4 grates); JENSEN 4848	FUT-8
SDDI #06	12	NEENAH R-3475-G (3 grates); JENSEN 4848	FUT-7
SDDI #07***	*	*	*
SDDI #08	12	NEENAH R-3475-G (3 grates); JENSEN 4848	FUT-17
SDDI #09	10	NEENAH R-3475-G (3 grates)	FUT-16
SDDI #10	13	NEENAH R-3475-N (4 grates)	FUT-15
SDDI #11	9	NEENAH R-3475-G (3 grates)	FUT-14
SDDI #12	17	NEENAH R-3475 (5 grates); JENSEN 4848	FUT-13
SDDI #13	11	NEENAH R-3475-G (3 grates); JENSEN 4848	FUT-12
SDDI #14	9	NEENAH R-3475-G (3 grates); JENSEN 4848	FUT-11
SDDI #15	9	NEENAH R-3475-G (3 grates); JENSEN 3636	FUT-10
SDDI #16	9	NEENAH R-3475-G (3 grates); JENSEN 3636	FUT-9
SDDI #17	15	Modified Type "C" / L=8.5' / 3 grates; JENSEN 4848	15/19 FUT-4
SDDI #18	1	NEENAH R-3475-E (1 grate); JENSEN 2424	Approx. 1/10 FUT-5
SDDI #19	1	NEENAH R-3475-E (1 grate); JENSEN 2424	Approx. 1/10 FUT-5
SDDI #20	1	NEENAH R-3475-E (1 grate); JENSEN 2424	Approx. 1/10 FUT-5
SDDI #21	3	Modified Type "C" / L=2.5' / 1 grate; JENSEN 3636	Approx. 1/3 FUT-6 plus 1/5 FUT-5
SDDI #22	10	Modified Type "C" / L=5.5' / 2 grates	Approx. 2/3 FUT-2
SDDI #23	4	Modified Type "C" / L=2.5' / 1 grate	Approx. 1/3 FUT-2
SDDI #24	12	Modified Type "C" / L=2.5' / 1 grate; JENSEN 4848	FUT-1
SDDI #25	3	Modified Type "C" / L=2.5' / 1 grate; JENSEN 2424	Approx. 3/10 FUT-5
SDDI #26	4	Modified Type "C" / L=2.5' / 1 grate; JENSEN 3636	Approx. 2/3 FUT-6 plus 1/5 FUT-5
SDDI #27	10	Modified Type "C" / L=17.5' / 6 grates	Existing Water St. HEC-RAS 47+00
SDDI #28	45	6 grates per CCAUSD #417; JENSEN 4848 (2)	Existing Water St. HEC-RAS 47+00

*The Size/Types are minimum, an equivalent inlet may be used
**SDDI #03A is additional drop inlet added per Addendum #4, the design paramaters used at this inlet are the same used and maintained for drop inlet SDDI#03
***Removed per Addendum #2

LAKE MEAD CROSSING
FUTURE CONDITIONS

(3H FEET)
1 inch = 120 ft.

LEGEND

- **FUT-1** *BASIN NAME*
- *FLOW DIRECTION*
- *BASIN BOUNDARY*
- (1) *SECTION LINE*

PEAK FLOW SUMMARY			
FUTURE CONDITION			
BASIN NAME / CONC. POINT	AREA (ACRES)	10-YR FLOW (CFS)	100-YR FLOW (CFS)
FUT-1	4.62	6	12
FUT-2	5.06	7	14
FUT-3	13.25	17	35
FUT-4	7.12	9	19
FUT-5	3.37	5	10
FUT-6	1.01	1	3
FUT-7	4.11	6	12
FUT-8	5.46	8	16
FUT-9	3.16	4	9
FUT-10	2.73	4	9
FUT-11	2.83	4	9
FUT-12	3.80	6	11
FUT-13	5.69	8	17
FUT-14	2.93	5	9
FUT-15	4.04	6	13
FUT-16	2.92	5	10
FUT-17	4.03	6	12
CP-ALL		104	215

HYDRAULIC CALCULATIONS					
SECT	SLOPE (%)	Q_{100} (cfs)	D_{100} (ft)	V_{100} (fps)	D x V
1	2.50	16	0.15	3.69	0.55
2	1.20	12	0.38	3.33	1.27
3	4.03	11	0.14	3.86	0.54
4	4.00	17	0.09	3.66	0.33
5	4.00	10	0.21	4.17	0.88
6	1.72	12	0.46	4.45	2.05
7	3.47	10	0.19	3.58	0.68
8	1.25	19	0.41	3.31	1.36
9	1.00	20	0.51	3.12	1.59
10	1.00	14	0.47	2.92	1.37
11	14.00	12	0.68	16.12	10.96
12	3.20	12	0.55	6.40	3.52
13	2.50	21	0.46	3.14	1.44
14	1.00	7	0.38	2.52	0.96
15	1.00	7	0.38	2.52	0.96
16	1.00	21	0.52	3.15	1.64
17	1.00	1.5	0.11	1.32	0.15
18	1.38	0.5	0.12	0.66	0.08

FUTURE CONDITIONS
FIGURE F-2

Carter::Burgess
Consultants in Planning, Engineering, Construction Management, and Related Services
6855 Bermuda Road
Las Vegas, Nevada 89119
(702) 938-5400 Fax (702) 938-5454

ADDENDUM #7

Northgate Slope Stability Memo

northgate
environmental management, inc.

From: Deni Chambers
Derrick Willis
Ted Splitter

Date: October 18, 2010

To: Shannon Harbour, P.E.
Nevada Division of Environmental Protection

RE: Revised Engineering Evaluation of Slope Stability, WC and GW-11 Pond Embankments
Phase B Soil Remediation of RZ-D, Tronox LLC, Henderson, Nevada

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Introduction

Northgate Environmental Management, Inc. (Northgate) submits this revised memorandum on behalf of Tronox LLC, presenting the results of Northgate's engineering evaluation of the slope stability of the WC and GW-11 Pond embankments for the *Phase B Soil Remediation of RZ-D* (see Figure 1, Site Location Map). Northgate previously submitted the original Slope Stability Memorandum, dated August 23, 2010. Based on comments from NDEP, field exploration work was performed and the stability of the embankments was reanalyzed. The results of the analyses indicate that the factors of safety for static and seismic loading conditions are in the acceptable range without setbacks if the excavation slopes are constructed at 3 horizontal to 1 vertical.

Historical Geotechnical Data and Field Exploration

A significant number of laboratory classification data reports are available for the Site soils. Tests performed include grain size analyses, specific gravity, porosity, bulk density, hydraulic conductivity, and permeability. The grain size analyses indicate that the Site soils are primarily granular in nature and would generally be characterized as sand and gravel mixtures with traces of silt and clay. One sample of the soil was found to be fine sand and one sample was classified as silt.

Because no data was available for soil density, soil strength and documentation on construction, Northgate selected Cone Penetrometer Testing (CPT) as the method to supplement the classification data for use in assessing slope stability. Advantages of the CPT exploration method are:

- CPT testing is an in situ method that gives reliable data for the in-place soil;
- CPT eliminates the issues surrounding sample disturbance of sandy and gravelly soils which normally occurs during conventional sampling;
- CPT eliminates the need to establish in-place field densities for use in fabricating samples for laboratory testing;

- CPT eliminates the need for fabrication of laboratory samples and laboratory testing programs;
- CPT provides continuous data with depth which allows for assessment of soil layering and associated classification and engineering characteristics in the fill and native materials; and
- CPT provides timely results including classification, density, and strength.

CPT exploration work was performed on October 4, 2010 at three locations on the pond embankments. Location PSS-1 is located in the central portion of the southern WC Pond embankment, PSS-2 is located in the central eastern portion of the GW-11 Pond embankment, and PSS-3 is located in the northern portion of the western GW-11 Pond embankment. The exploratory locations are shown on Figure 2. CPT Locations PSS-2 and PSS-3 were pushed to depths of 28 and 26 feet, respectively. At these depths the embankment materials and the foundation materials were fully characterized. At location PSS-1, the CPT reached early refusal and only limited data was obtained. PSS-1 was also the location of the dilatometer testing which also reached early refusal. The data from the two successful CPT borings were used in the stability analysis for the PSS-1 location.

The CPT data are presented in Attachment 1 to this memorandum. As shown in the data, the soil strengths exceed normally expected strengths for sand and silty sand. Northgate consulted with Mr. Umesh Bachu, the president of U.S. operations and lead technical leader of Lankelma (the company that performed the CPT work). Mr. Bachu explained that the CPT correlations for strength are based on recently placed or "young" materials and often aged and /or partially cemented materials give very high results. He stated that in his work on assessing levee stability throughout the United States, he applies a reduction factor of 10 degrees on very high strengths. He also stated that he limits the maximum strength for granular soils to a phi angle of 35 degrees. The maximum strength obtained by the CPT at Tronox is 48 degrees. Based on the above recommendations from Lankelma, Northgate selected 38 degrees as the maximum strength and used similar reductions for the similarly high strengths less than 48 degrees.

Stability Analyses

Three locations were selected as representative of the steeper portions of the GW-11 Pond and WC Ponds (see Figure 2). Cross-sections were drawn through these locations and were used to model the Site surface and subsurface conditions in the slope stability analyses. STABL software was utilized for the analyses. STABL uses the PCSTABL slope stability analysis program from Purdue University. It allows calculations using Bishop's Simplified Method, Spencer's Method, as well as other methods. Both Bishop's Modified Method and Spencer's Method were utilized in these analyses.

Eight cases were selected for analysis. The cases are as follows:

1. WC pond configuration with slope of the existing embankment (2 horizontal on 1 vertical) extending to the design excavation depths of 14 feet without setback from the embankment;
2. WC pond configuration with slope of the existing embankment (2 horizontal on 1 vertical) extending to the design excavation depths of 14 feet without setback from the embankment including using a pseudo-static coefficient of 0.15g to account for seismic loading;
3. WC pond configuration with the subsurface cut slope at an inclination of 3 horizontal on 1 vertical extending to the design excavation depths of 14 feet without setback from the embankment;
4. WC pond configuration with the subsurface cut slope at an inclination of 3 horizontal on 1 vertical extending to the design excavation depths of 14 feet without setback from the embankment including using a pseudo-static coefficient of 0.15g to account for seismic loading;
5. GW-11 pond configuration of the eastern slope with the slope of the existing embankment (3 horizontal on 1 vertical) extending to the design depth of the excavation without setback from the embankment;
6. GW-11 pond configuration of the eastern slope with the slope of the existing embankment extending to the design depth of the excavation without setback from the embankment including using a pseudo-static coefficient of 0.15g to account for seismic loading;
7. GW-11 pond configuration of the western slope with the slope of the existing embankment (3 horizontal on 1 vertical) extending to the design depth of the excavation without setback from the embankment; and
8. GW-11 pond configuration of the western slope with the slope of the existing embankment extending to the design depth of the excavation without setback from the embankment including using a pseudo-static coefficient of 0.15g to account for seismic loading.

In all the analyses, Northgate assumed that the ponds contained water with a freeboard of 2 feet from the top of the embankments. The water was modeled to reflect its weight only. The soils were assumed to be moist but not saturated. These conditions would be typical for watertight lined ponds such as the GW-11 and WC ponds. The slope stability analyses are attached for NDEP review as Attachment 2. The results of the analyses are presented below:

Pond	Height of Cut Slope, Feet	Minimum Factor of Safety Static Case	Minimum Factor of Safety Seismic Case
WC (No Setback, Excavate Cut Slope at 2:1 Slope to Excavation Depth)	14	1.5	1.0

WC (No Setback, Excavate Cut Slope at 3:1 to Design Depth)	14	1.8	1.2
GW-11 Eastern Slope (No Setback, Excavate Cut Slope at 3:1 to Design Depth)	10	1.9	1.2
GW-11 Western Slope, (No Setback, Excavate Cut Slope at 3:1 to Design Depth)	10	2.2	1.3

All of the cases were analyzed using Bishop's Modified Method. Several of the exact same cases were also analyzed using Spencer's Method. The results of Spencer's Method were slightly lower but did not result in a significant change from Bishop's Modified Method; therefore, the analyses presented in Attachment 2 are Bishop's Modified Method.

Selection of acceptable factors of safety depends on the level of risk that Tronox is willing to accept and, in some cases, what the Nevada Division of Water Resources (NDWR), Engineering and Dam Safety program set as a minimum. The acceptable factors of safety are also selected based on the consequences of failure (potential for loss of life, property damage, and loss of facility use). Acceptable factors of safety for static conditions can range from 1.5 minimum to 3 or more. Acceptable factors of safety for seismic conditions can typically range from 1.1 to 1.5.

The factor of safety obtained for the WC Ponds for a cut slope inclination of 2:1 horizontal to vertical for static conditions is 1.5 and for seismic conditions is 1.0. These factors of safety are low and are not considered acceptable. If the cut slope is flattened to 3:1, the resulting factors of safety for static conditions of 1.8 and for seismic conditions of 1.2 are considered acceptable.

The static analysis for the GW-11 Pond embankments yields factors of safety of 1.9 to 2.2 for the 3:1 cut slope and are considered acceptable. The seismic factors of safety for the GW-11 Pond embankments with a 3:1 cut slope are 1.2 to 1.3 and are also considered acceptable.

Conclusion

Based on the above results, we conclude that the embankment slopes for the WC and GW-11 Ponds are stable under both static and seismic loading conditions with the proposed excavation slopes cut at 3:1 to the design depths. Northgate recommends that for differing excavation depths the 3:1 cut slope be utilized.

If you have any questions, please contact me at (510) 839-0688, ext. 204.

Sincerely,

Northgate Environmental Management, Inc.

Theodore Splitter, P.E., 020615

ENCLOSURES:

Figures

1 Site Location Map

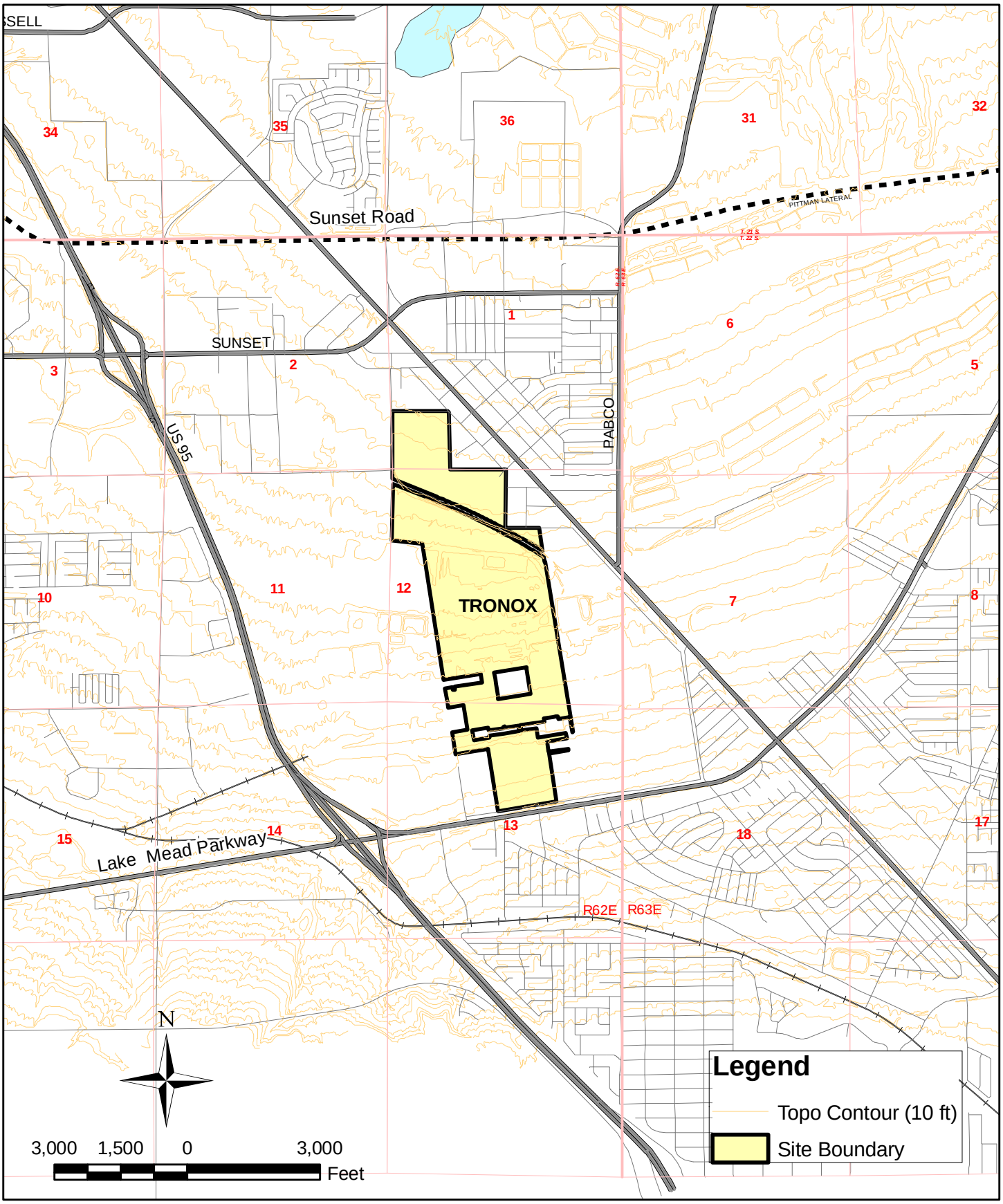
2 Site Plan

Attachment

1 Laboratory Data

2 Slope Stability Analyses

M:\01_Projects\2027_Tronox\2027_01_Plans_and_Investigation\T90_Excavation_Plans\RZD\Slope Stability\P2027_01_T90_F1_Site_Location.mxd



SHEET NUMBER:	FIGURE NUMBER:
1	1

SITE LOCATION MAP

Tronox LLC
Henderson, Nevada

SCALE:	DATE:	PROJECT NUMBER:
1:36,000	06/18/10	2027.01 T90

DESIGNED BY:	REVISIONS			
NGEM	NO.:	DESCRIPTION:	DATE:	BY:
DRAWN BY:				
NGEM				
CHECKED BY:				
NGEM				
APPROVED BY:				
NGEM				

northgate environmental management, inc.
TRONOX
www.ngem.com

\\ng-oak1\ng-gis\01_Projects\2027_Tronox\2027_01_Plans_and_Investigation\T90_Excavation_Plans\RZD\Slope Stability\P2027_01_T90_F2_RZD_Slope_Stability_KPH_101018.mxd Last updated 10/18/2010 11:52:33 AM

DRAFT

RZ-D-04A 3'
RZ-D-03 4'
RZ-D-01B 16'
RZ-D-01C 15'
RZ-D-04 10'
RZ-D-05 8'
RZ-D-01D1 11'
RZ-D-01A 24'
RZ-D-01D2 11'
RZ-D-02 3'
RZ-D-06 2'
RZ-D-06A >6'
RZ-D-10B 2'
RZ-D-07 10'
RZ-D-10A 1'
RZ-D-10 0.33'
RZ-D-08A 1.5'
RZ-D-08 1'
RZ-D-11 1'
RZ-D-11A 0.5'
RZ-D-11B >0.5'
RZ-D-12 10'
RZ-D-14 1'
RZ-D-13A 4'
RZ-D-13 5'
RZ-D-15 10'
RZ-D-21A 11'
RZ-D-21B 6'
RZ-D-21D 10'
RZ-D-18 5'
RZ-D-21C 11'
RZ-D-21E 14'
RZ-D-21F 10'
RZ-D-19 3'
RZ-D-20 1.5'
RZ-D-17B 1'
RZ-D-17-C 0.33'
RZ-D-17A >3'
RZ-D-16 9'
RZ-D-17 0.33'
RZ-D-23A 10'
RZ-D-23 6'
RZ-D-22 5'
RZ-D-24A 1'
RZ-D-24 3'
RZ-D-25 1'
RZ-D-28 >0.5'
RZ-D-30 1'
RZ-D-26 0.33'
RZ-D-29 0.5'
RZ-D-27 >0.5'
RZ-D-31 0.33'
RZ-E-01 10'
RZ-C-33 1'
RZ-C-30 0.5'
RZ-C-32
RZ-C-28A 0.5'
RZ-C-29
RZ-C-31
RZ-C-39A >1.17'
RZ-C-28 0.5'
RZ-C-31A 10'
RZ-C-35 6'
RZ-C-36 3'
RZ-C-37 1.5'
RZ-C-40A
RZ-C-34

PSS-01
PSS-02
PSS-03

NORTH LOOP RD
SOUTH LOOP RD
DRYER BUILDING RD
MID RD
EAST ST
WEST ST

Geotechnical Sampling Location
1 Foot Contour
5 Foot Contour
Property Boundary
Street Centerline
Excavation Boundary
Buildings & Tanks
Remediation Zone D

N

0 25 50 100 150 200
Feet

northgate environmental management, inc.
www.ngem.com
TRONOX

REVISIONS:	NO:	DESCRIPTION:	DATE:	BY:

DRAWN BY:	NGEM
CHECKED BY:	NGEM
APPROVED BY:	NGEM

SLOPE STABILITY STUDY
Tronox LLC
Henderson, Nevada

PROJECT NUMBER:	2027.01 T90
DATE:	10/18/2010
SCALE:	1 in = 200 ft

FIGURE NUMBER: **2**

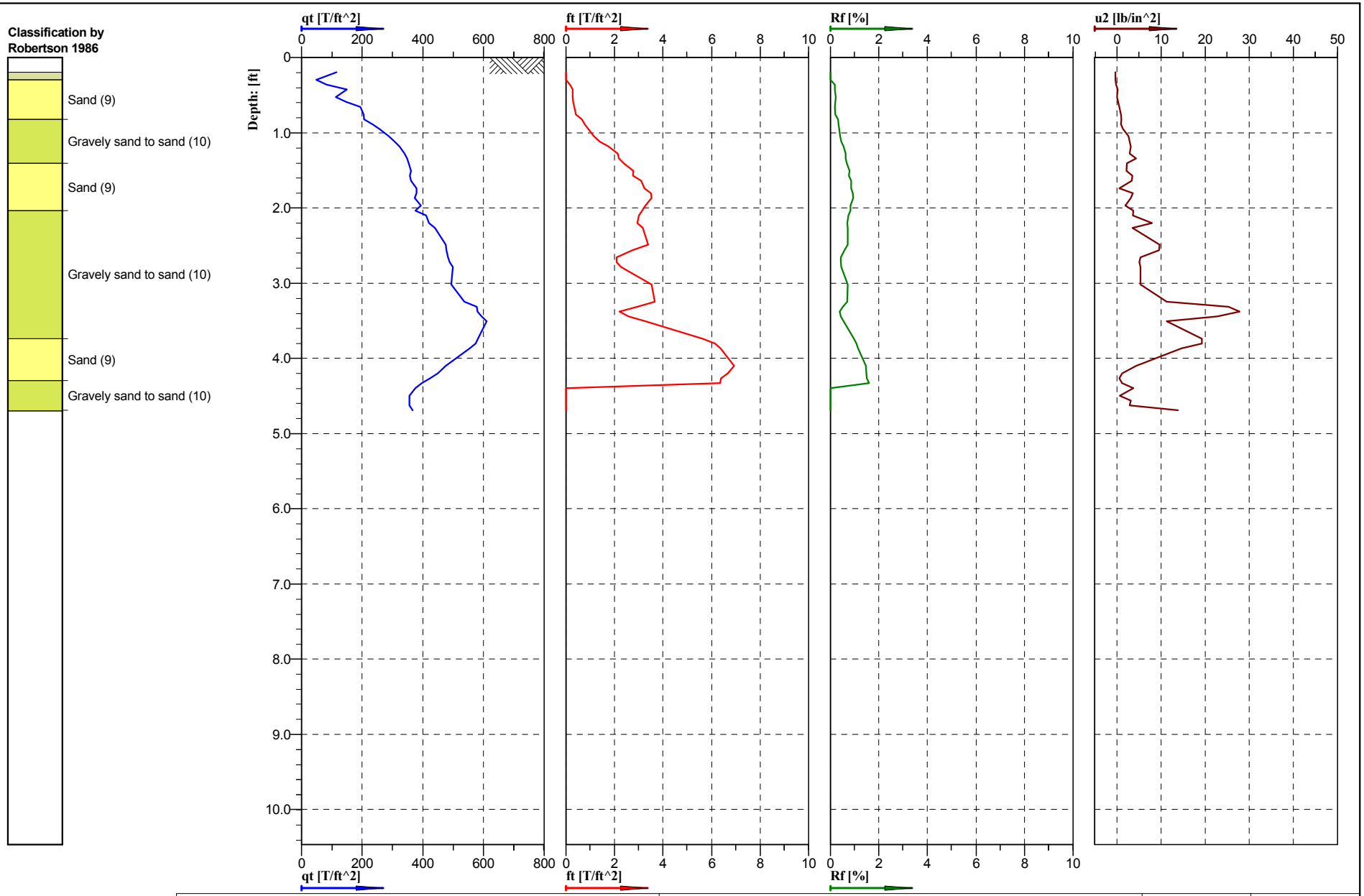
SHEET NUMBER: 1

Client: NORTHGATE
Project name: TRONOX REMEDIATION
Test no.: PSS-1
Location: Nevada I Henderson NV

Depth	Point resistance	Corrected point resistance	Sleeve friction resistance	Corrected local friction	Friction ratio = ft/qt*100%	Pore pressure behind cone	Unit weight [SBT Fr 1986]
	qc	qt	fs	ft	Rf	U_2	UW
[ft]	[T/ft^2]	[T/ft^2]	[T/ft^2]	[T/ft^2]	[%]	[lb/in^2]	[lb/ft^3]
0.32	101.58	101.58	0.13	0.13	0.12	-0.12	123.49
0.57	164.61	164.62	0.32	0.32	0.20	0.44	124.13
0.82	225.14	225.15	0.69	0.69	0.30	1.05	125.72
1.07	302.80	302.84	1.47	1.47	0.48	2.61	127.31
1.32	350.26	350.30	2.36	2.36	0.67	2.94	126.51
1.57	363.81	363.84	2.97	2.97	0.82	2.39	124.13
1.82	380.07	380.10	3.39	3.39	0.89	2.32	124.13
2.07	399.25	399.31	3.09	3.09	0.78	4.31	125.72
2.32	444.43	444.53	3.17	3.17	0.71	7.06	127.31
2.57	480.24	480.34	2.58	2.58	0.54	7.43	127.31
2.82	493.01	493.08	2.62	2.62	0.53	5.27	127.31
3.07	514.38	514.49	3.60	3.60	0.70	8.34	127.31
3.32	578.90	579.17	2.93	2.93	0.51	19.72	127.31
3.57	595.34	595.55	4.45	4.45	0.75	15.30	127.31
3.82	546.51	546.71	6.27	6.27	1.16	14.39	124.92
4.07	462.34	462.37	6.80	6.80	1.47	2.76	124.13
4.32	399.79	399.81	3.88	3.88	0.92	1.48	124.76
4.57	359.43	359.52	0.00	0.00	0.00	6.93	127.31

Client: NORTHGATE
Project name: TRONOX REMEDIATION
Location: Nevada Facility Henderson NV
Test no.: PSS-1

Depth	Normalized cone resistance	Normalized friction ratio	Relative density	Effective friction angle	Undrained shear strength	Constrained modulus	Ic	N160	N160Ic
	Qt	FR	I_D	Φ	S_U	M	I_C	$(N1)_{60}$	$(N1)_{60Ic}$
[ft]	[]	[%]	[%]	[deg]	[T/ft^2]	[T/ft^2]	[]	[blows]	[blows]
0.32	225505.60	0.12	102.13	48.00		837.94	0.40	20	13
0.57	6105.40	0.20	132.03	48.00		1357.85	0.61	36	21
0.82	5556.70	0.30	135.52	48.00		1857.17	0.75	51	30
1.07	5301.00	0.48	139.09	48.00		2497.92	0.93	72	42
1.32	4717.80	0.67	139.56	48.00		2889.37	1.07	86	51
1.57	4104.80	0.82	138.12	48.00		3000.95	1.14	91	54
1.82	3693.70	0.89	137.23	48.00		3134.98	1.17	96	57
2.07	3401.60	0.78	136.75	48.00		3293.35	1.11	99	59
2.32	3346.10	0.71	138.05	48.00		3666.25	1.07	110	64
2.57	3176.30	0.54	138.43	48.00		3961.56	0.94	114	67
2.82	2970.60	0.53	137.84	48.00		4066.55	0.93	117	69
3.07	2783.80	0.70	137.52	48.00		4243.02	1.07	127	74
3.32	2888.20	0.51	139.73	48.00		4776.47	0.92	137	80
3.57	2760.80	0.75	139.48	48.00		4911.50	1.08	147	87
3.82	2364.70	1.16	135.92	48.00		4508.38	1.28	143	84
4.07	1858.30	1.47	130.20	48.00		3812.53	1.40	126	74
4.32	1538.20	0.92	125.29	48.00		3296.28	0.86	97	57
4.57	1293.00	0.00	121.41	48.00		2963.77	0.00	68	40



Location: Nevada Facility, Henderson, NV	Position:	Ground level:	Test No.: PSS-1
Project ID:	Client: NORTHGATE	Date: 10-4-10	Scale: 1 : 22
Project: TRONOX REMEDIATION		Page: 1/1	Fig.:
		File: CA04O1001C.cpd	

Client: NORTHGATE
Project name: TRONOX REMEDIATION
Location: Nevada Henderson NV
Test no.: PSS-2

Depth	Point resistance	Corrected point resistance	Sleeve friction resistance	Corrected local friction	Friction ratio = ft/qt*100%	Pore pressure behind cone	Unit weight [SBT Fr 1986]
	qc	qt	fs	ft	Rf	U_2	UW
[ft]	[T/ft^2]	[T/ft^2]	[T/ft^2]	[T/ft^2]	[%]	[lb/in^2]	[lb/ft^3]
0.29	140.75	140.76	0.55	0.55	0.31	0.67	122.85
0.54	252.15	252.17	1.61	1.61	0.65	1.60	124.92
0.79	236.68	236.69	2.40	2.40	1.01	1.23	124.13
1.04	285.10	285.14	3.35	3.35	1.17	2.93	124.13
1.29	322.28	322.34	3.80	3.80	1.18	3.95	124.13
1.54	282.77	282.81	4.17	4.17	1.49	3.41	121.74
1.79	240.90	240.92	3.85	3.85	1.60	1.20	120.94
2.04	206.37	206.40	2.90	2.90	1.40	2.18	121.74
2.29	221.66	221.70	2.80	2.80	1.26	2.55	124.13
2.54	232.37	232.42	2.71	2.71	1.17	3.92	124.13
2.79	256.80	256.86	2.63	2.63	1.02	4.64	124.13
3.04	284.56	284.64	3.57	3.57	1.26	5.85	124.13
3.29	281.96	282.05	3.91	3.91	1.39	6.34	124.13
3.54	283.84	283.92	3.93	3.93	1.38	6.13	123.33
3.79	285.60	285.70	3.84	3.84	1.35	7.51	124.13
4.04	275.07	275.19	3.39	3.39	1.23	8.63	124.13
4.29	276.22	276.34	3.12	3.12	1.13	8.73	124.13
4.54	251.13	251.24	2.99	2.99	1.19	7.40	124.13
4.79	222.95	223.03	2.57	2.57	1.15	6.16	124.13
5.04	215.15	215.28	3.45	3.45	1.60	9.37	121.58
5.29	231.56	231.68	4.65	4.65	2.02	8.56	120.15
5.54	200.89	200.98	4.51	4.51	2.24	6.45	118.56
5.79	176.48	176.58	2.88	2.88	1.62	7.60	120.94
6.04	157.23	157.30	1.84	1.84	1.17	5.44	121.74
6.29	152.27	152.31	2.05	2.05	1.35	2.76	120.94

6.54	157.00	157.02	2.38	2.38	1.52	1.33	120.94
6.79	179.52	179.51	2.35	2.35	1.31	-0.22	120.94
7.04	206.27	206.30	2.49	2.49	1.21	2.50	122.53
7.29	229.58	229.65	3.11	3.11	1.35	5.26	120.94
7.54	281.05	281.27	4.49	4.49	1.58	16.68	120.94
7.79	319.36	319.67	6.46	6.46	2.02	22.98	120.94
8.04	357.23	357.68	6.78	6.78	1.90	32.88	120.94
8.29	400.85	401.19	6.59	6.59	1.65	24.59	122.22
8.54	416.06	416.20	6.74	6.74	1.62	10.11	121.74
8.79	412.51	412.71	6.47	6.47	1.57	14.61	122.53
9.04	445.51	445.87	7.04	7.04	1.58	26.10	123.06
9.29	472.51	472.78	8.32	8.32	1.76	19.50	120.94
9.54	460.72	460.88	7.16	7.16	1.55	11.84	123.06
9.79	430.83	430.95	7.12	7.12	1.65	8.41	121.74
10.04	399.33	399.46	7.31	7.31	1.83	9.21	120.94
10.29	354.31	354.39	6.51	6.51	1.84	5.92	120.94
10.54	325.75	325.83	7.55	7.55	2.34	5.51	120.15
10.79	276.30	276.41	6.73	6.73	2.42	8.63	119.35
11.04	307.77	308.05	5.34	5.34	1.78	20.59	121.74
11.29	356.32	356.68	4.24	4.24	1.19	26.29	124.13
11.54	337.16	337.20	4.49	4.49	1.33	2.61	124.13
11.79	356.63	356.69	5.00	5.00	1.40	4.42	124.13
12.04	381.40	381.51	5.34	5.34	1.40	8.30	124.13
12.29	377.91	378.00	4.77	4.77	1.26	6.64	124.13
12.54	367.24	367.33	5.16	5.16	1.41	6.14	124.13
12.79	400.37	400.48	5.78	5.78	1.45	7.94	124.13
13.04	452.91	453.03	5.87	5.87	1.30	8.90	124.13
13.29	445.84	445.96	3.23	3.23	0.72	8.66	126.51
13.54	449.16	449.25	4.24	4.24	0.94	6.38	126.25
13.79	452.44	452.48	6.47	6.47	1.43	3.38	124.13
14.04	438.40	438.48	6.24	6.24	1.42	6.26	124.13
14.29	432.58	432.77	7.25	7.25	1.68	13.52	121.74
14.54	417.08	417.28	6.48	6.48	1.55	14.65	123.06
14.79	414.45	414.63	4.21	4.21	1.02	13.34	125.40

15.04	371.82	371.89	5.40	5.40	1.45	5.37	124.13
15.29	334.31	334.40	5.79	5.79	1.74	6.73	121.58
15.54	282.51	282.61	5.48	5.48	1.95	7.40	120.94
15.79	245.22	245.32	5.25	5.25	2.14	7.86	119.67
16.04	239.13	239.24	4.81	4.81	2.01	8.27	119.35
16.29	266.45	266.57	3.65	3.65	1.39	9.11	122.22
16.54	327.89	328.08	2.53	2.53	0.77	13.41	124.13
16.79	349.46	349.58	4.33	4.33	1.24	8.85	124.13
17.04	335.50	335.59	4.73	4.73	1.41	6.32	123.49
17.29	322.96	323.07	3.59	3.59	1.11	8.16	124.13
17.54	326.15	326.27	4.20	4.20	1.29	8.99	124.13
17.79	325.08	325.19	5.50	5.50	1.69	8.23	121.74
18.04	324.96	325.09	5.70	5.70	1.75	9.74	120.94
18.29	374.38	374.54	5.30	5.30	1.43	11.60	122.53
18.54	465.33	465.58	3.78	3.78	0.82	17.98	126.03
18.79	484.21	484.37	3.98	3.98	0.82	12.11	127.31
19.04	475.79	476.03	4.82	4.82	1.02	18.03	125.19
19.29	459.43	459.61	7.83	7.83	1.71	12.91	122.00
19.54	452.05	452.32	8.96	8.96	1.98	19.20	120.94
19.79	445.27	445.56	6.49	6.49	1.46	21.14	123.49
20.04	415.30	415.52	8.08	8.08	1.96	15.47	122.00
20.29	372.46	372.65	8.05	8.05	2.15	13.53	120.94
20.54	319.33	319.46	5.48	5.48	1.71	10.10	122.00
20.79	299.69	299.80	2.90	2.90	0.97	7.80	124.13
21.04	290.51	290.58	3.31	3.31	1.14	5.37	124.13
21.29	263.35	263.41	3.75	3.75	1.42	4.79	121.74
21.54	232.56	232.61	2.99	2.99	1.29	3.71	123.49
21.79	221.88	221.93	2.85	2.85	1.28	3.95	123.33
22.04	222.74	222.83	3.24	3.24	1.46	6.67	120.94
22.29	252.90	253.01	4.11	4.11	1.62	8.29	120.94
22.54	281.07	281.24	4.76	4.76	1.70	12.25	120.94
22.79	277.78	277.96	5.01	5.01	1.80	12.76	120.94
23.04	265.23	265.42	4.35	4.35	1.64	13.70	120.94
23.29	250.98	251.12	3.61	3.61	1.44	10.63	122.00

23.54	245.16	245.27	3.57	3.57	1.46	7.98	121.74
23.79	235.97	236.08	3.71	3.71	1.57	7.98	120.94
24.04	214.77	214.86	3.18	3.18	1.48	6.12	120.94
24.29	203.40	203.48	2.53	2.53	1.25	6.27	122.53
24.54	211.83	211.90	2.60	2.60	1.23	4.97	123.33
24.79	245.09	245.16	2.99	2.99	1.22	4.90	124.13
25.04	277.26	277.34	2.91	2.91	1.05	5.69	124.13
25.29	326.04	326.12	2.82	2.82	0.87	5.54	124.13
25.54	390.40	390.51	3.05	3.05	0.78	7.47	126.51
25.79	479.82	479.98	3.52	3.52	0.74	11.49	127.31
26.04	556.39	556.62	3.86	3.86	0.70	16.88	127.31
26.29	557.24	557.51	3.22	3.22	0.58	20.05	127.31
26.54	537.09	537.19	3.64	3.64	0.68	7.83	127.31
26.79	542.57	542.72	3.59	3.59	0.66	11.22	127.31
27.04	544.45	544.60	3.46	3.46	0.64	11.27	127.31
27.29	536.53	536.71	3.48	3.48	0.65	13.05	127.31
27.54	517.68	517.84	1.71	1.71	0.33	12.15	127.31
27.79	534.49	534.58	0.00	0.00	0.00	6.38	127.31
28.04	543.61	543.62	0.00	0.00	0.00	0.58	127.31

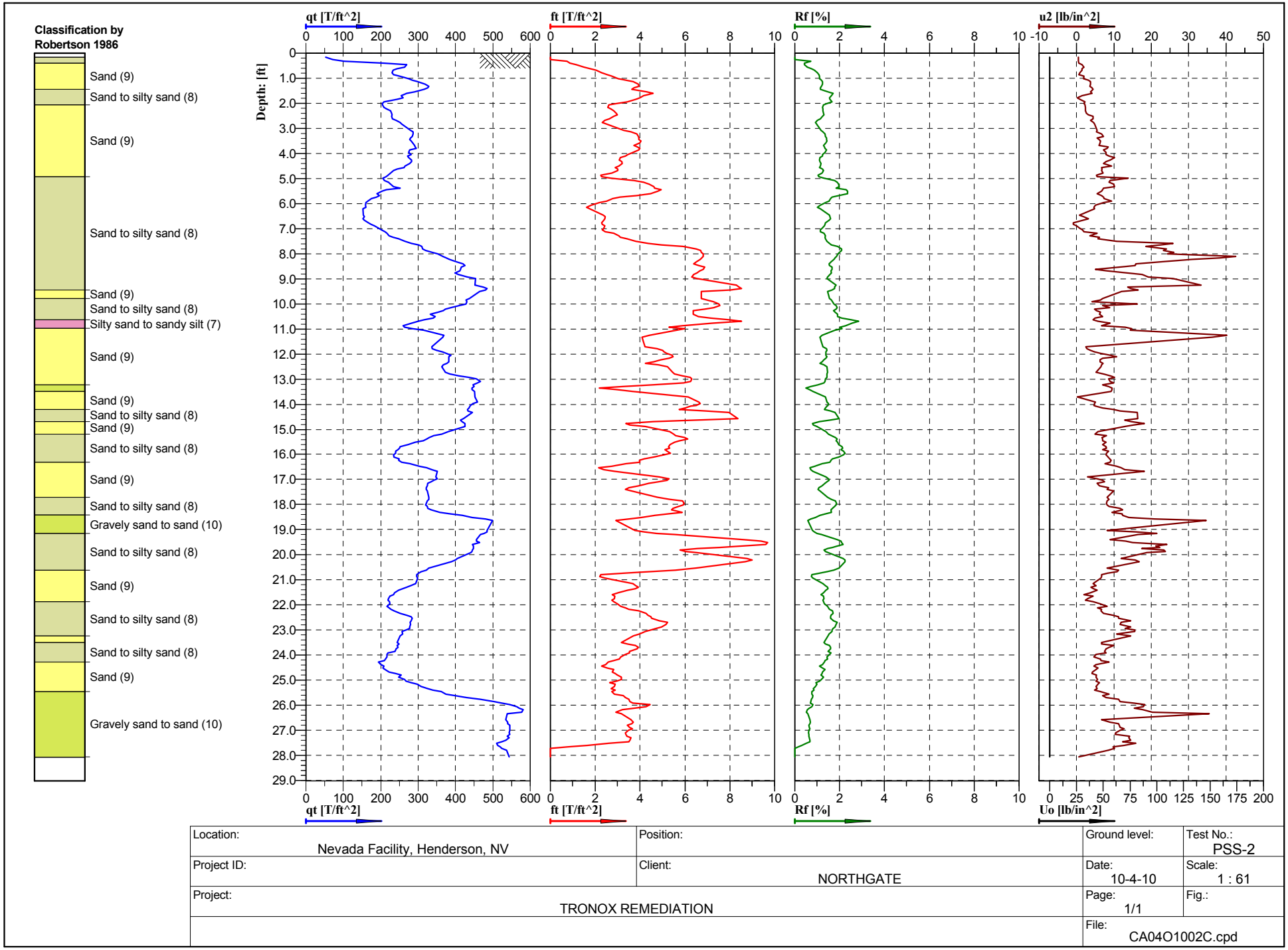
Client: NORTHGATE
Project name: TRONOX REMEDIATION
Location: Nevada Facility Henderson NV
Test no.: PSS-2

Depth	Normalized cone resistance	Normalized friction ratio	Relative density	Effective friction angle	Undrained shear strength	Constrained modulus	Ic	N160	N160Ic
	Qt	FR	I_D	Φ	S_U	M	I_C	$(N1)_{60}$	$(N1)_{60Ic}$
[ft]	[]	[%]	[%]	[deg]	[T/ft^2]	[T/ft^2]	[]	[blows]	[blows]
0.29	111625.60	0.31	112.86	48.00		1161.20	0.68	33	20
0.54	10355.30	0.65	145.58	48.00		2080.22	1.16	64	37
0.79	5999.20	1.01	137.30	48.00		1952.38	1.26	62	36
1.04	5041.20	1.17	137.52	48.00		2351.90	1.31	75	44
1.29	4424.30	1.18	137.44	48.00		2658.68	1.30	85	50
1.54	3275.80	1.49	131.08	48.00		2332.50	1.39	77	45
1.79	2386.10	1.60	124.28	48.00		1986.76	1.43	66	39
2.04	1789.80	1.40	118.10	48.00		1701.85	1.38	56	33
2.29	1679.80	1.26	118.22	48.00		1827.94	1.34	59	35
2.54	1565.60	1.17	117.89	48.00		1916.26	1.32	62	36
2.79	1558.00	1.02	119.24	48.00		2117.73	1.26	67	39
3.04	1545.20	1.26	120.61	48.00		2346.77	1.35	76	45
3.29	1440.90	1.39	119.47	48.00		2325.25	1.40	77	45
3.54	1357.90	1.39	118.72	48.00		2340.62	1.40	77	45
3.79	1269.90	1.35	117.83	48.00		2355.18	1.40	78	46
4.04	1141.30	1.23	115.78	48.00		2268.30	1.37	74	44
4.29	1074.20	1.13	114.96	48.00		2277.67	1.35	74	43
4.54	918.40	1.19	111.32	48.00		2070.46	1.39	68	40
4.79	776.00	1.15	107.22	48.00		1837.62	1.41	61	36
5.04	709.30	1.60	105.44	48.00		1773.53	1.54	61	36
5.29	725.00	2.02	106.77	48.00		1908.69	1.64	68	40
5.54	604.20	2.25	102.14	48.00		1655.34	1.72	61	36
5.79	507.40	1.62	97.71	47.79		1453.92	1.62	52	30
6.04	430.70	1.17	93.81	47.35		1294.74	1.54	44	26
6.29	401.00	1.35	92.34	47.09		1253.43	1.60	43	26
6.54	396.20	1.52	92.60	47.05		1292.12	1.65	45	27

6.79	435.30	1.32	95.84	47.39		1477.60	1.58	49	30
7.04	484.60	1.21	99.39	47.75		1698.51	1.52	54	34
7.29	522.80	1.35	101.99	47.94		1891.00	1.55	60	38
7.54	617.80	1.59	107.22	48.00		2316.74	1.57	72	48
7.79	679.10	2.02	110.47	48.00		2633.41	1.65	83	55
8.04	738.80	1.90	113.28	48.00		2946.87	1.62	90	61
8.29	801.90	1.65	116.10	48.00		3305.70	1.54	98	67
8.54	806.90	1.62	116.75	48.00		3429.38	1.54	99	69
8.79	779.50	1.57	116.12	48.00		3400.52	1.53	97	69
9.04	818.10	1.58	117.92	48.00		3673.91	1.52	103	74
9.29	839.80	1.76	119.14	48.00		3895.82	1.56	109	80
9.54	799.30	1.55	118.05	48.00		3797.52	1.52	104	77
9.79	723.40	1.65	115.69	48.00		3550.41	1.56	97	73
10.04	655.90	1.83	113.15	48.00		3290.48	1.62	90	69
10.29	568.40	1.84	109.41	48.00		2918.63	1.65	80	61
10.54	509.90	2.34	106.63	47.86		2682.82	1.76	75	59
10.79	424.00	2.42	101.62	47.28		2275.03	1.81	65	51
11.04	461.20	1.78	104.22	47.53		2535.93	1.67	67	54
11.29	517.50	1.19	108.13	47.90		2936.91	1.50	73	59
11.54	475.10	1.33	106.16	47.69		2776.05	1.56	69	57
11.79	496.80	1.41	107.59	47.83		2936.80	1.57	73	60
12.04	522.60	1.40	109.29	47.97		3141.45	1.56	77	64
12.29	507.90	1.27	108.75	47.90		3112.35	1.53	75	63
12.54	483.30	1.41	107.63	47.74		3024.19	1.58	73	62
12.79	515.30	1.45	109.74	47.89		3297.58	1.58	79	68
13.04	571.80	1.30	113.03	48.00		3730.98	1.51	87	75
13.29	552.20	0.72	112.32	48.00		3672.50	1.29	79	69
13.54	546.90	0.94	112.29	48.00		3699.55	1.39	81	72
13.79	537.50	1.43	112.14	48.00		3726.04	1.56	85	76
14.04	512.40	1.42	111.01	47.93		3610.44	1.57	82	74
14.29	496.60	1.68	110.36	47.83		3563.15	1.64	82	75
14.54	469.30	1.56	109.03	47.65		3435.25	1.61	78	71
14.79	459.20	1.03	108.60	47.57		3413.27	1.47	73	68
15.04	403.60	1.46	105.23	47.12		3060.54	1.63	69	64
15.29	358.70	1.74	101.98	46.63		2751.13	1.72	63	59
15.54	298.20	1.95	96.87	45.85		2323.74	1.81	55	52

15.79	254.70	2.15	92.68	45.25		2015.98	1.88	48	46
16.04	244.50	2.02	91.74	45.08		1965.72	1.87	47	45
16.29	268.20	1.40	94.54	45.44		2191.08	1.71	49	47
16.54	325.20	0.78	100.30	46.21		2698.35	1.46	55	53
16.79	340.90	1.24	101.93	46.42		2875.63	1.60	61	60
17.04	322.30	1.41	100.53	46.16		2760.02	1.67	59	59
17.29	305.40	1.12	99.23	45.93		2656.64	1.61	55	55
17.54	304.30	1.29	99.32	45.92		2682.87	1.65	56	57
17.79	299.30	1.70	99.03	45.86		2673.87	1.76	58	58
18.04	294.90	1.76	98.81	45.81		2672.91	1.77	58	59
18.29	335.10	1.44	102.57	46.33		3080.74	1.67	64	65
18.54	409.80	0.82	108.61	47.16		3831.67	1.42	72	75
18.79	416.60	0.82	109.47	47.24		3986.51	1.42	74	78
19.04	407.40	1.02	108.89	47.16		3917.64	1.50	75	78
19.29	389.30	1.71	107.75	46.98		3782.03	1.69	77	81
19.54	378.50	1.98	107.10	46.86		3721.76	1.76	77	81
19.79	368.40	1.46	106.51	46.76		3665.88	1.65	72	77
20.04	338.90	1.97	104.29	46.38		3417.88	1.78	70	75
20.29	300.20	2.16	100.91	45.87		3064.14	1.85	64	69
20.54	253.80	1.72	96.41	45.23		2625.21	1.80	54	58
20.79	235.80	0.97	94.46	44.92		2462.88	1.62	47	52
21.04	225.20	1.15	93.35	44.71		2386.72	1.69	46	51
21.29	201.90	1.43	90.37	44.19		2162.46	1.80	43	48
21.54	176.00	1.29	86.63	43.61		1908.20	1.81	38	43
21.79	165.80	1.29	85.13	43.38		1819.93	1.83	36	41
22.04	164.80	1.46	85.09	43.35		1827.23	1.87	37	42
22.29	185.00	1.63	88.48	43.81		2076.12	1.87	42	47
22.54	203.50	1.70	91.43	44.22		2308.86	1.86	46	52
22.79	199.00	1.81	90.95	44.10		2281.69	1.89	46	52
23.04	188.20	1.65	89.48	43.87		2178.12	1.87	43	50
23.29	176.10	1.44	87.74	43.62		2060.06	1.84	40	47
23.54	169.70	1.47	86.89	43.48		2011.61	1.86	39	46
23.79	161.90	1.58	85.65	43.27		1935.71	1.90	38	45
24.04	145.60	1.49	82.81	42.81		1760.48	1.91	35	41
24.29	136.30	1.26	81.09	42.49		1666.51	1.88	32	38
24.54	140.70	1.24	82.12	42.65		1735.78	1.86	33	40

24.79	161.20	1.23	86.11	43.25		2010.05	1.82	38	45
25.04	180.60	1.06	89.52	43.71		2275.42	1.74	41	50
25.29	210.30	0.87	93.97	44.37		2677.73	1.63	46	56
25.54	249.40	0.78	99.00	45.15		3208.81	1.55	54	65
25.79	304.00	0.74	104.76	45.92		3946.87	1.47	64	78
26.04	349.30	0.70	108.92	46.24		4579.00	1.41	73	89
26.29	345.80	0.58	108.80	46.19		4586.19	1.35	71	88
26.54	329.40	0.68	107.60	46.13		4418.42	1.42	70	86
26.79	330.50	0.66	107.79	46.10		4463.91	1.41	70	87
27.04	328.60	0.64	107.76	46.05		4479.28	1.40	70	87
27.29	320.60	0.65	107.19	46.01		4414.07	1.41	69	86
27.54	305.90	0.33	106.01	45.93		4258.29	1.02	60	75
27.79	312.70	0.00	106.79	45.93		4396.25	0.00	47	59
28.04	315.70	0.00	107.17	45.91		4470.72	0.00	48	60



Location: Nevada Facility, Henderson, NV	Position:	Ground level:	Test No.: PSS-2
Project ID:	Client: NORTHGATE	Date: 10-4-10	Scale: 1 : 61
Project: TRONOX REMEDIATION		Page: 1/1	Fig.:
		File: CA04O1002C.cpd	

Client: NORTHGATE
Project name: TRONOX REMEDIATION
Location: Nevada Henderson NV
Test no.: PSS-3

Depth	Point resistance	Corrected point resistance	Sleeve friction resistance	Corrected local friction	Friction ratio = ft/qt*100%	Pore pressure behind cone	Unit weight [SBT Fr 1986]
	qc	qt	fs	ft	Rf	U_2	UW
[ft]	[T/ft^2]	[T/ft^2]	[T/ft^2]	[T/ft^2]	[%]	[lb/in^2]	[lb/ft^3]
0.33	250.98	251.00	1.68	1.68	0.60	1.94	124.13
0.58	388.19	388.25	4.27	4.27	1.09	4.64	124.13
0.83	480.80	480.89	7.72	7.72	1.57	6.72	123.06
1.08	693.18	693.34	13.26	13.26	1.91	11.65	120.94
1.33	645.86	646.13	16.11	16.11	2.52	19.40	120.94
1.58	525.32	525.56	15.14	15.14	2.88	17.94	120.94
1.83	451.82	452.10	12.73	12.73	2.81	20.39	120.94
2.08	407.26	407.52	9.61	9.61	2.35	19.00	120.94
2.33	347.76	347.97	6.62	6.62	1.90	15.43	120.94
2.58	311.87	312.07	5.00	5.00	1.60	14.50	121.74
2.83	299.94	300.13	3.20	3.20	1.06	13.78	124.13
3.08	309.81	309.93	3.62	3.62	1.17	9.14	124.13
3.33	330.14	330.28	4.04	4.04	1.21	10.04	124.13
3.58	385.60	385.73	5.76	5.76	1.49	9.64	124.13
3.83	382.21	382.37	5.93	5.93	1.55	11.53	122.53
4.08	377.96	378.15	6.12	6.12	1.62	13.34	120.94
4.33	384.77	384.96	6.32	6.32	1.64	14.36	120.94
4.58	389.88	390.08	6.47	6.47	1.66	14.61	120.94
4.83	340.11	340.32	6.40	6.40	1.89	15.48	120.94
5.08	294.93	295.18	6.01	6.01	2.04	18.13	120.94
5.33	292.72	292.96	5.13	5.13	1.76	17.55	120.94
5.58	333.43	333.69	5.50	5.50	1.65	19.00	120.94
5.83	401.98	402.28	6.22	6.22	1.55	21.95	122.85
6.08	379.01	379.29	6.57	6.57	1.74	20.21	120.94
6.33	341.23	341.50	5.24	5.24	1.53	19.43	122.53

6.58	363.71	364.04	3.13	3.13	0.83	23.93	126.03
6.83	466.67	466.95	6.21	6.21	1.33	20.45	124.13
7.08	431.61	431.91	6.35	6.35	1.48	21.72	123.49
7.33	324.16	324.37	5.39	5.39	1.67	15.15	120.94
7.58	275.79	276.00	4.96	4.96	1.79	14.98	120.94
7.83	241.76	241.99	4.44	4.44	1.84	16.28	120.94
8.08	216.53	216.71	4.85	4.85	2.25	13.69	118.40
8.33	204.70	204.95	4.91	4.91	2.41	17.91	118.56
8.58	277.26	277.61	4.07	4.07	1.52	25.27	122.53
8.83	351.34	351.63	4.32	4.32	1.22	20.98	123.06
9.08	341.91	342.00	6.18	6.18	1.82	6.82	120.94
9.33	288.85	289.01	6.09	6.09	2.11	11.02	119.67
9.58	283.13	283.31	5.33	5.33	1.88	12.80	120.94
9.83	275.38	275.57	4.69	4.69	1.70	13.63	120.94
10.08	250.94	251.13	4.13	4.13	1.64	14.24	120.94
10.33	258.55	258.75	4.03	4.03	1.56	15.15	120.94
10.58	286.37	286.60	4.21	4.21	1.47	16.68	122.00
10.83	304.82	305.01	4.82	4.82	1.58	13.74	121.74
11.08	339.17	339.37	6.17	6.17	1.81	14.75	120.94
11.33	408.66	409.06	8.87	8.87	2.16	28.94	120.94
11.58	415.05	415.50	10.85	10.85	2.67	32.77	120.94
11.83	281.02	281.33	9.56	9.56	3.40	22.95	120.94
12.08	226.55	226.85	7.73	7.73	3.41	22.08	120.94
12.33	184.79	185.12	6.36	6.36	3.44	24.42	120.94
12.58	198.18	198.57	6.43	6.43	3.25	29.00	120.94
12.83	195.10	195.44	5.99	5.99	3.06	24.98	119.35
13.08	182.80	183.10	4.68	4.68	2.56	21.63	118.40
13.33	190.90	191.27	3.53	3.53	1.85	27.12	120.94
13.58	252.89	253.61	6.65	6.65	2.51	52.35	119.88
13.83	286.61	287.57	11.29	11.29	3.97	70.28	124.13
14.08	233.47	234.34	12.91	12.91	5.54	63.98	130.49
14.33	222.06	223.02	12.70	12.70	5.70	70.41	130.49
14.58	267.26	268.23	10.05	10.05	3.84	70.43	123.33
14.83	319.55	320.37	7.73	7.73	2.42	59.74	119.67

15.08	309.42	310.11	6.84	6.84	2.20	50.75	120.94
15.33	277.23	277.77	5.86	5.86	2.11	39.01	120.15
15.58	268.85	269.32	5.20	5.20	1.94	34.08	120.31
15.83	314.09	314.56	3.01	3.01	0.97	34.29	123.33
16.08	331.05	331.47	2.73	2.73	0.83	30.21	124.13
16.33	299.47	299.77	3.63	3.63	1.22	21.71	124.13
16.58	286.04	286.33	4.24	4.24	1.48	21.40	122.22
16.83	283.89	284.19	4.11	4.11	1.46	21.82	122.53
17.08	326.20	326.46	3.57	3.57	1.10	19.29	124.13
17.33	307.09	307.26	4.03	4.03	1.33	12.04	122.53
17.58	312.78	312.92	5.52	5.52	1.76	10.37	120.94
17.83	381.01	381.21	9.00	9.00	2.39	14.54	120.94
18.08	384.26	384.51	12.63	12.63	3.31	18.46	120.94
18.33	384.19	384.58	12.05	12.05	3.16	28.35	120.94
18.58	365.21	365.72	8.52	8.52	2.37	37.32	121.58
18.83	373.96	374.29	3.84	3.84	1.02	23.85	124.13
19.08	299.73	300.01	3.19	3.19	1.07	20.55	124.13
19.33	213.24	213.48	2.45	2.45	1.15	17.65	124.13
19.58	175.91	176.14	2.20	2.20	1.25	16.17	121.74
19.83	165.00	165.22	2.20	2.20	1.33	15.95	120.94
20.08	170.90	171.12	2.01	2.01	1.17	15.99	122.53
20.33	179.36	179.57	2.09	2.09	1.16	15.32	122.00
20.58	192.83	193.02	2.52	2.52	1.30	14.32	120.94
20.83	212.48	212.67	2.82	2.82	1.33	14.21	122.53
21.08	206.24	206.43	2.97	2.97	1.45	13.67	121.74
21.33	188.21	188.40	2.98	2.98	1.58	13.40	120.94
21.58	196.95	197.11	3.02	3.02	1.54	11.93	120.94
21.83	197.60	197.75	2.92	2.92	1.48	10.62	120.94
22.08	177.98	178.11	2.58	2.58	1.45	9.97	120.94
22.33	158.77	158.91	2.11	2.11	1.33	10.40	120.94
22.58	166.37	166.53	1.88	1.88	1.13	11.34	122.22
22.83	187.76	187.92	1.96	1.96	1.04	11.64	124.13
23.08	209.66	209.82	2.39	2.39	1.13	11.89	124.13
23.33	219.06	219.23	2.94	2.94	1.34	12.83	121.74

23.58	219.03	219.22	3.12	3.12	1.43	13.67	120.94
23.83	225.96	226.14	2.84	2.84	1.26	13.34	123.06
24.08	245.99	246.18	2.92	2.92	1.18	13.83	124.13
24.33	264.03	264.23	3.58	3.58	1.35	14.79	123.33
24.58	276.63	276.85	4.76	4.76	1.72	15.88	120.94
24.83	347.86	348.11	6.41	6.41	1.85	18.33	120.94
25.08	458.86	459.18	6.01	6.01	1.33	23.02	124.13
25.33	544.37	544.73	2.73	2.73	0.50	26.28	127.31
25.58	498.61	498.92	0.00	0.00	0.00	22.19	127.31

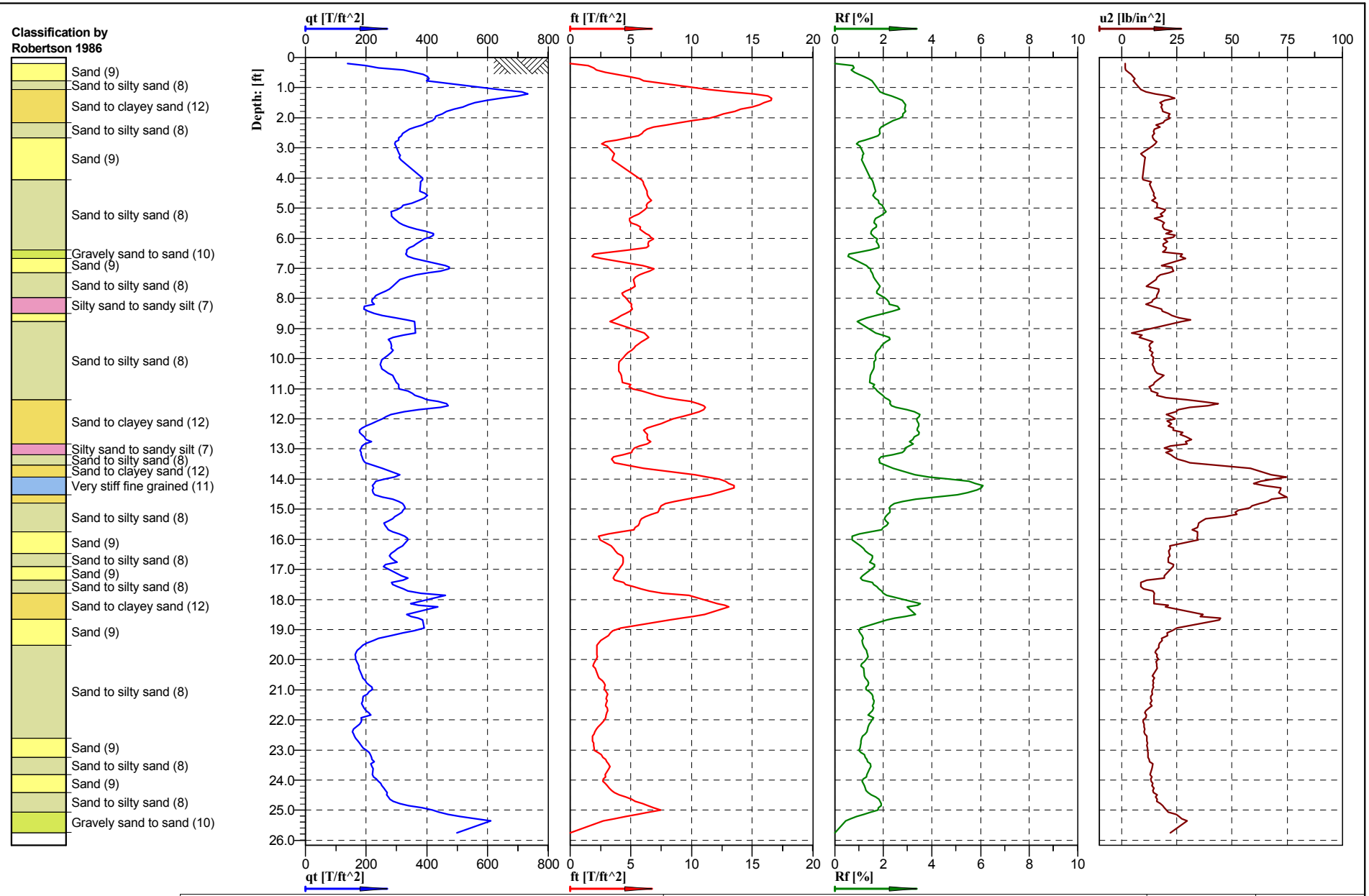
Client: NORTHGATE
Project name: TRONOX REMEDIATION
Location: Nev Henderson NV
Test no.: PSS-3

Depth	Normalized cone resistance	Normalized friction ratio	Relative density	Effective friction angle	Undrained shear strength	Constrained modulus	Ic	N160	N160Ic
	Qt	FR	I_D	Φ	S_U	M	I_C	$(N1)_{60}$	$(N1)_{60Ic}$
[ft]	[]	[%]	[%]	[deg]	[T/ft^2]	[T/ft^2]	[]	[blows]	[blows]
0.32	287560.10	0.60	129.02	48.00		2070.71	1.17	65	39
0.57	16340.80	1.09	158.65	48.00		3202.89	1.45	107	63
0.82	11987.10	1.57	157.11	48.00		3966.99	1.54	137	81
1.07	12013.30	1.91	162.73	48.00		5719.55	1.62	202	119
1.32	9274.10	2.52	157.71	48.00		5329.95	1.69	193	114
1.57	6130.80	2.88	149.05	48.00		4335.16	1.71	158	93
1.82	4479.40	2.81	142.37	48.00		3729.00	1.68	135	79
2.07	3493.60	2.35	137.37	48.00		3361.13	1.59	118	69
2.32	2735.80	1.91	131.87	48.00		2929.33	1.50	100	59
2.57	2174.90	1.65	126.94	48.00		2603.44	1.44	87	51
2.82	1826.40	1.06	123.73	48.00		2474.70	1.26	78	46
3.07	1681.70	1.17	123.04	48.00		2555.45	1.31	82	48
3.32	1640.90	1.21	123.54	48.00		2723.12	1.33	88	52
3.57	1641.30	1.49	125.83	48.00		3180.39	1.42	105	62
3.82	1600.30	1.55	125.34	48.00		3152.57	1.44	105	62
4.07	1559.50	1.59	124.83	48.00		3122.08	1.45	104	61
4.32	1495.20	1.63	124.37	48.00		3154.93	1.46	106	62
4.57	1440.40	1.66	124.10	48.00		3215.94	1.47	108	64
4.82	1194.50	1.89	119.39	48.00		2805.31	1.55	97	57
5.07	988.60	2.04	114.67	48.00		2432.78	1.60	86	50
5.32	931.20	1.76	113.75	48.00		2414.29	1.55	83	49
5.57	1011.10	1.65	116.76	48.00		2750.18	1.51	94	55
5.82	1166.80	1.55	121.50	48.00		3315.97	1.47	112	66
6.07	1074.40	1.72	119.69	48.00		3174.99	1.52	109	64
6.32	925.60	1.58	116.03	48.00		2850.50	1.50	96	57

6.57	922.90	0.83	116.55	48.00		3000.06	1.23	91	55
6.82	1132.80	1.33	123.25	48.00		3848.91	1.41	120	75
7.07	1025.50	1.48	120.55	48.00		3559.77	1.46	112	70
7.32	739.90	1.67	111.80	48.00		2672.41	1.56	85	55
7.57	603.00	1.80	106.66	48.00		2273.17	1.63	72	47
7.82	516.30	1.84	102.51	47.87		1992.55	1.67	63	42
8.07	461.00	2.17	99.74	47.59		1829.98	1.75	59	40
8.32	420.00	2.38	97.46	47.24		1721.72	1.81	56	38
8.57	569.10	1.40	106.36	47.86		2419.93	1.53	70	49
8.82	673.60	1.30	112.10	48.00		2968.82	1.46	83	59
9.07	623.20	1.82	110.19	48.00		2816.97	1.63	82	59
9.32	522.30	2.14	105.33	47.89		2395.75	1.72	71	52
9.57	493.30	1.93	104.15	47.81		2325.36	1.69	68	50
9.82	468.40	1.71	103.03	47.64		2268.61	1.66	64	48
10.07	417.70	1.66	100.10	47.24		2070.88	1.67	58	44
10.32	414.00	1.58	100.22	47.21		2107.79	1.65	58	44
10.57	451.10	1.48	103.06	47.52		2359.20	1.61	63	49
10.82	466.90	1.58	104.46	47.64		2510.95	1.63	67	52
11.07	509.40	1.82	107.19	47.88		2794.32	1.67	75	59
11.32	600.60	2.16	112.15	48.00		3369.13	1.70	90	72
11.57	631.10	2.52	113.82	48.00		3608.98	1.75	97	79
11.82	421.90	3.32	102.43	47.19		2465.45	1.94	70	57
12.07	311.90	3.42	94.31	46.03		1865.52	2.01	54	45
12.32	249.80	3.44	88.31	45.15		1522.00	2.06	45	37
12.57	249.70	3.37	88.57	45.15		1549.97	2.05	45	38
12.82	254.50	3.10	89.38	45.23		1612.25	2.02	45	39
13.07	232.10	2.57	87.13	44.85		1504.09	1.97	41	36
13.32	238.00	1.86	88.10	44.95		1571.38	1.85	41	35
13.57	308.60	2.52	95.39	45.94		2085.53	1.89	54	48
13.82	343.80	3.98	99.08	46.80	18.28	2365.60	2.04	64	57
14.07	276.10	5.56	93.02		15.51	1926.34	2.22	56	50
14.32	257.50	5.72	91.36	45.32	14.67	1832.80	2.24	53	48
14.57	304.00	3.85	96.22	45.91		2205.63	2.05	59	53
14.82	357.90	2.46	101.29	46.62		2633.26	1.85	65	59

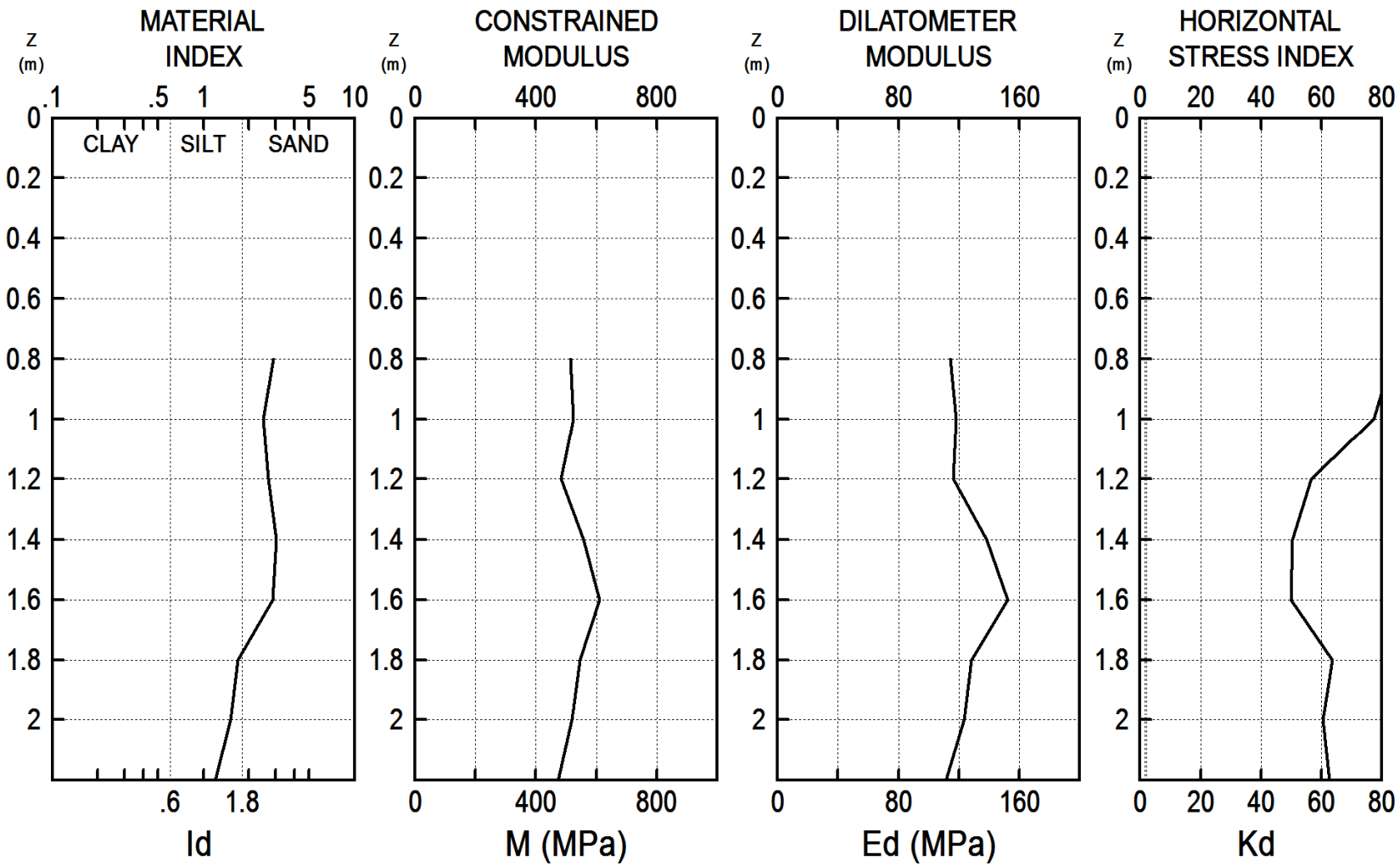
15.07	345.10	2.22	100.48	46.46		2582.15	1.82	62	58
15.32	300.20	2.12	96.73	45.86		2284.01	1.84	55	51
15.57	286.00	1.95	95.62	45.69		2214.12	1.82	52	49
15.82	333.10	0.93	100.22	46.31		2626.06	1.51	55	53
16.07	338.40	0.89	100.92	46.38		2706.99	1.49	57	54
16.32	303.80	1.22	98.03	45.92		2464.99	1.64	54	52
16.57	282.10	1.50	96.14	45.65		2322.51	1.73	52	50
16.82	279.90	1.48	96.10	45.59		2347.31	1.72	52	51
17.07	313.20	1.10	99.71	46.03		2684.70	1.59	56	55
17.32	299.30	1.25	98.44	45.86		2581.64	1.65	55	54
17.57	288.60	1.72	97.62	45.72		2522.74	1.77	55	55
17.82	353.00	2.40	103.44	46.51		3136.10	1.84	70	70
18.07	326.90	3.48	101.68	46.23		2951.13	2.00	69	71
18.32	344.00	3.25	103.07	46.42		3129.56	1.97	72	74
18.57	324.10	2.38	101.78	46.19		3007.95	1.84	66	68
18.82	326.00	1.03	102.22	46.20		3078.44	1.56	60	63
19.07	258.90	1.08	95.47	45.22		2465.59	1.64	49	52
19.32	189.00	1.15	86.89	43.89		1820.63	1.75	38	40
19.57	152.30	1.24	80.92	42.99		1485.42	1.84	32	34
19.82	136.80	1.34	78.14	42.51		1353.18	1.90	29	31
20.07	140.10	1.18	78.97	42.62		1401.75	1.85	30	32
20.32	145.30	1.17	80.18	42.79		1471.34	1.84	31	33
20.57	152.00	1.28	81.67	43.00		1560.08	1.85	33	35
20.82	165.50	1.34	84.23	43.36		1717.61	1.84	36	39
21.07	161.00	1.46	83.62	43.24		1692.53	1.87	35	39
21.32	145.30	1.60	80.88	42.80		1543.61	1.93	33	36
21.57	148.30	1.56	81.64	42.89		1596.26	1.92	33	37
21.82	148.80	1.49	81.85	42.88		1620.52	1.91	34	37
22.07	132.50	1.46	78.74	42.34		1458.42	1.93	30	34
22.32	116.80	1.34	75.33	41.78		1299.86	1.94	27	31
22.57	119.20	1.16	76.05	41.85		1340.10	1.89	27	31
22.82	132.80	1.06	79.29	42.35		1512.38	1.83	30	34
23.07	149.20	1.14	82.81	42.92		1719.55	1.82	34	39
23.32	154.40	1.35	83.92	43.07		1797.04	1.86	35	41

23.57	152.70	1.44	83.76	43.02		1796.78	1.88	36	41
23.82	155.60	1.27	84.48	43.11		1853.76	1.84	36	42
24.07	167.90	1.19	86.77	43.43		2018.95	1.80	38	45
24.32	178.30	1.36	88.65	43.67		2167.74	1.82	41	49
24.57	185.20	1.73	89.85	43.80		2271.77	1.89	44	52
24.82	230.50	1.86	96.02	44.74		2859.56	1.86	54	65
25.07	301.40	1.34	103.99	45.89		3775.70	1.66	67	80
25.32	353.60	0.50	108.70	46.31		4481.34	1.03	67	80
25.57	319.10	0.00	106.08	46.11		4103.23	0.00	46	55



Location: Nevada Facility, Henderson, NV	Position:	Ground level:	Test No.: PSS-3
Project ID:	Client: NORTHGATE	Date: 10-4-10	Scale: 1 : 55
Project: TRONOX REMEDIATION		Page: 1/1	Fig.:
		File: CA04O1003C.csv	

DILATOMETER TEST (D M T)



INTERPRETED GEOTECHNICAL PARAMETERS

Lankelma, Inc.

Northgate Environmental Management, Inc

Henderson, NV

TEST **SA-1**

14 OCT 2010

SA-1

14 OCT 2010

Lankelma, Inc.
Northgate Environmental Management, Inc

Henderson, NV

LEGEND
Z = Depth Below Ground Level
Po,P1,P2 = Corrected A,B,C readings
Id = Material Index
Ed = Dilatometer Modulus
Ud = Pore Press. Index = (P2-Uo)/(Po-Uo)
Gamma = Bulk unit weight
Sigma' = Effective overb. stress
Uo = Pore pressure

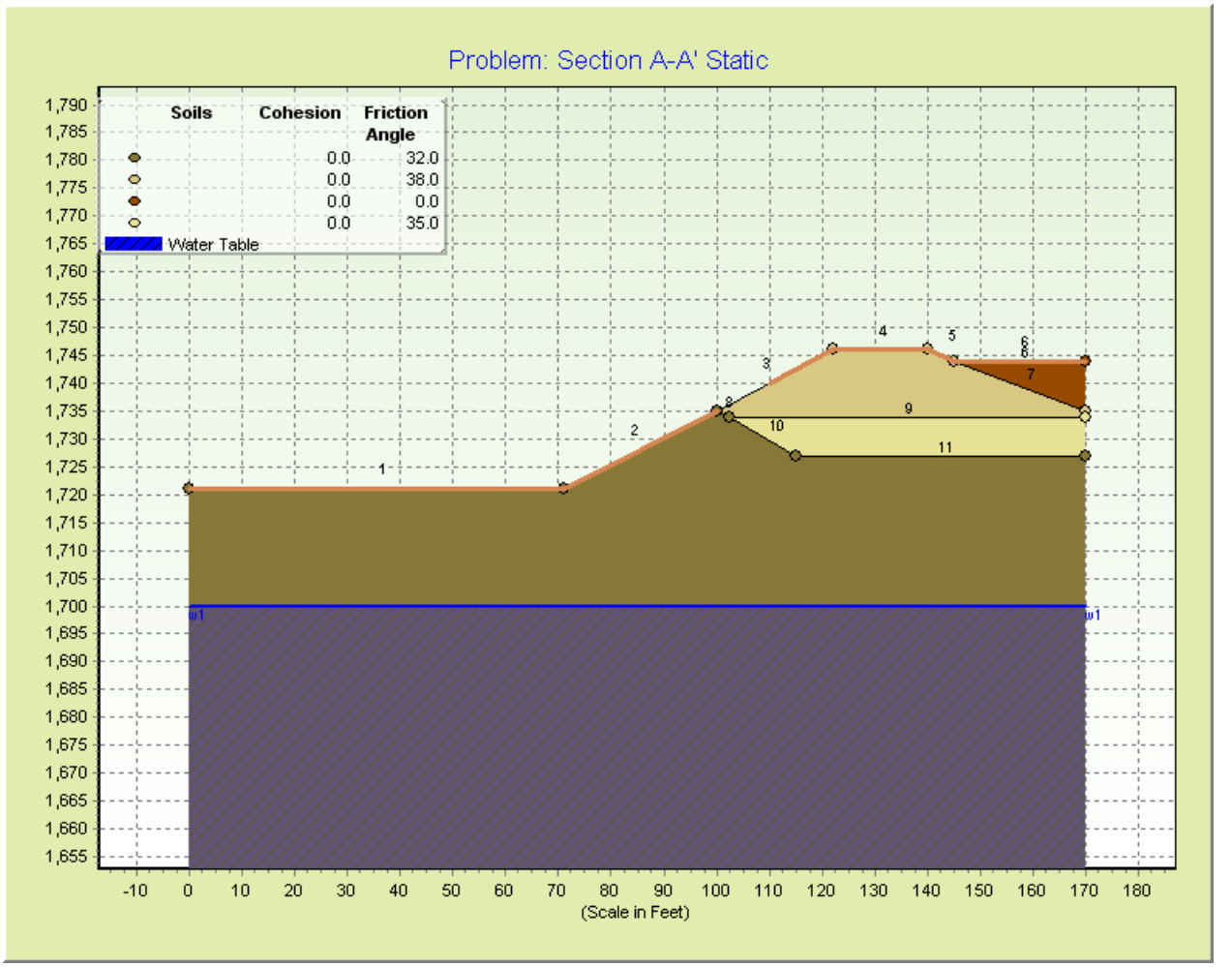
INTERPRETED PARAMETERS
Phi = Safe floor value of Friction Angle
Ko = In situ earth press. coeff.
M = Constrained modulus (at Sigma')
Cu = Undrained shear strength
Ocr = Overconsolidation ratio
(OCR = 'relative OCR'- generally realistic. If accurate independent OCR available, apply suitable factor)

GENERAL PARAMETERS
DeltaA = 10 kPa
DeltaB = 96 kPa
GammaTop = 17.0 kN/m^3
FactorEd = 34.7
Zm = 0.0 kPa
Zabs = 0.0 m
Zw > Zfinal

Water Level below end of sounding
Reduction formulae according to Marchetti, ASCE Geot.Jnl.Mar. 1980, Vol.109, 299-321; Phi according to TC16 ISSMGE, 2001

Z (m)	A (kPa)	B (kPa)	C (kPa)	Po (kPa)	P1 (kPa)	P2 (kPa)	Gamma (kN/m^3)	Sigma' (kPa)	Uo (kPa)	Id	Kd	Ed (MPa)	Ud	Ko	Ocr	Phi (Deg)	M (MPa)	Cu (kPa)	SA-1 DESCRIPTION
0.8	1280	4520		1133	4424		21.1	14	0	2.90	83.3	114.2				48	514.7		SILTY SAND
1.0	1530	4880		1378	4784		21.1	18	0	2.47	77.3	118.2				48	524.4		SILTY SAND
1.2	1400	4700		1250	4604		21.1	22	0	2.68	56.7	116.4				47	482.2		SILTY SAND
1.4	1500	5400		1320	5304		21.1	26	0	3.02	50.3	138.2				47	557.0		SILTY SAND
1.6	1720	6000		1521	5904		21.1	30	0	2.88	49.9	152.1				47	611.7		SILTY SAND
1.8	2370	6000		2204	5904		20.6	35	0	1.68	63.5	128.4				47	545.7		SANDY SILT
2.0	2510	6000		2351	5904		20.6	39	0	1.51	60.6	123.3					518.5		SANDY SILT
2.2	2830	6000		2687	5904		20.6	43	0	1.20	62.6	111.6		5.2	>99.9		472.9	699	SILT

========== DATA SUMMARY ==========



Profile Data

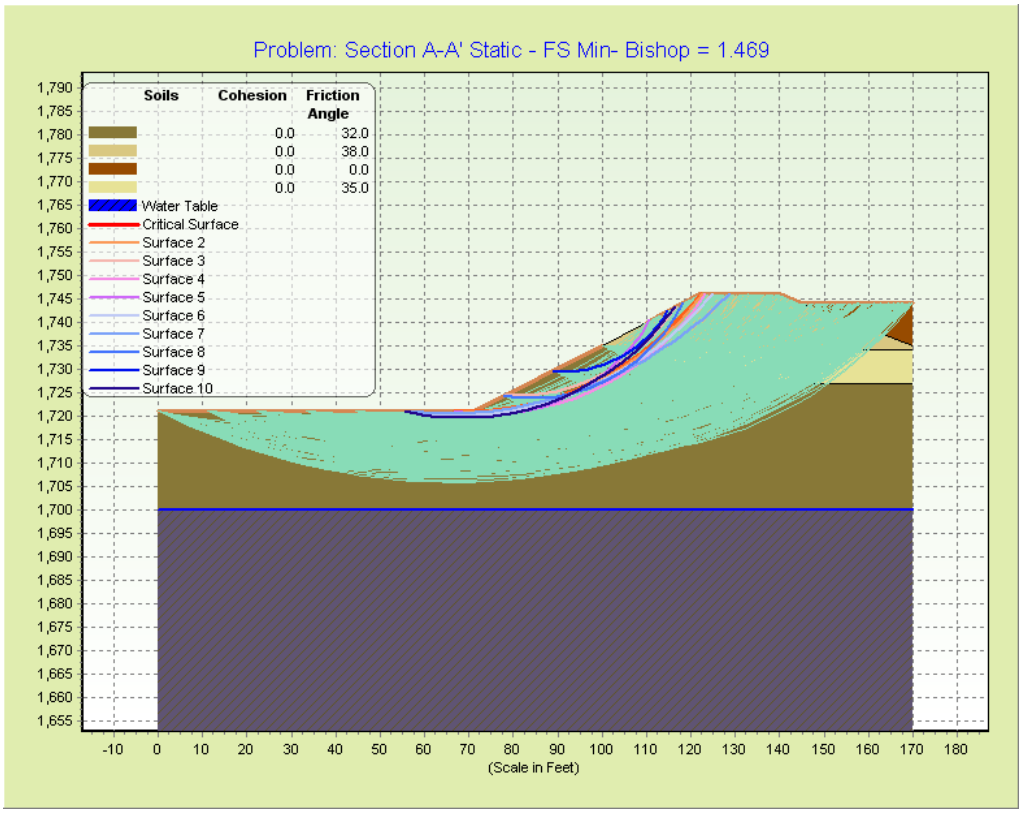
Segment Number	Left Extreme X	Left Extreme Y	Right Extreme X	Right Extreme Y	Soil Under Segment
1	0	1721	71	1721	1
2	71	1721	100	1735	1
3	100	1735	122	1746	2
4	122	1746	140	1746	2
5	140	1746	145	1744	2
6	145	1744	170	1744	4
7	145	1744	170	1735	2
8	100	1735	102.5	1734	1
9	102.5	1734	170	1734	3
10	102.5	1734	115	1727	1

Segment Number	Left Extreme X	Left Extreme Y	Right Extreme X	Right Extreme Y	Soil Under Segment
11	115	1727	170	1727	1

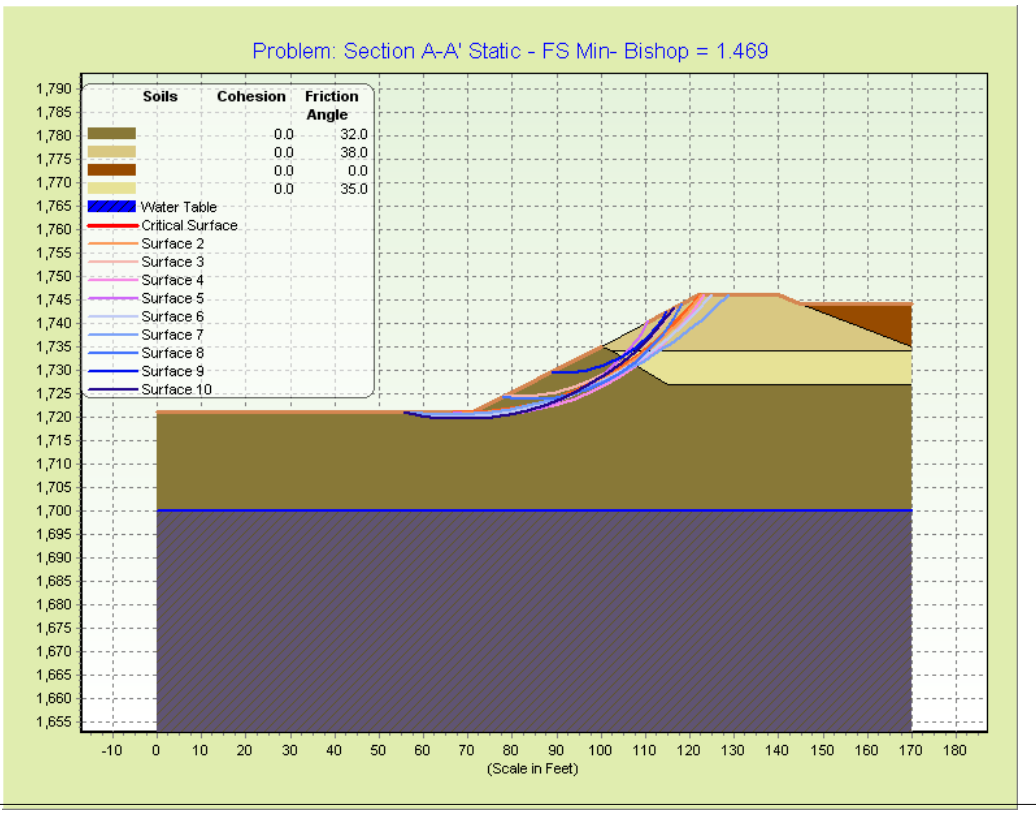
Soil Properties

Soil Number	Wet Unit Weight	Saturated Unit Weight	Cohesive Intercept	Friction Angle	Ru	Pressure Head	Water Table	Soil Name
1	120	60	0	32	0	0	1	
2	120	60	0	38	0	0	1	
3	122	62	0	35	0	0	1	
4	62.4	62.4	0	0	0	0	1	

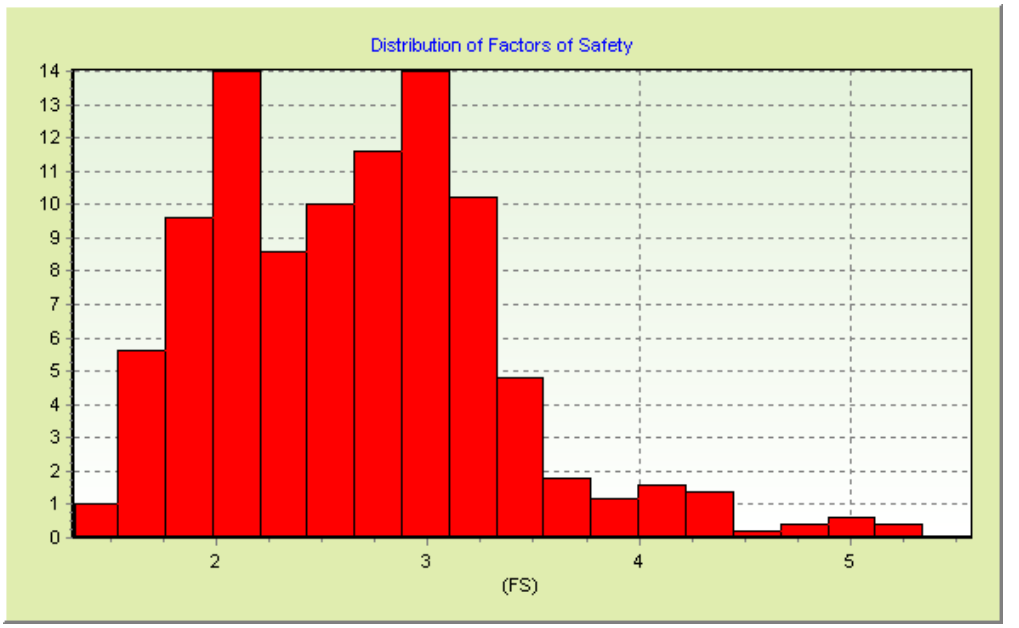
========== All Surfaces Generated ==========



========== 10 Most Critical Surfaces ==========



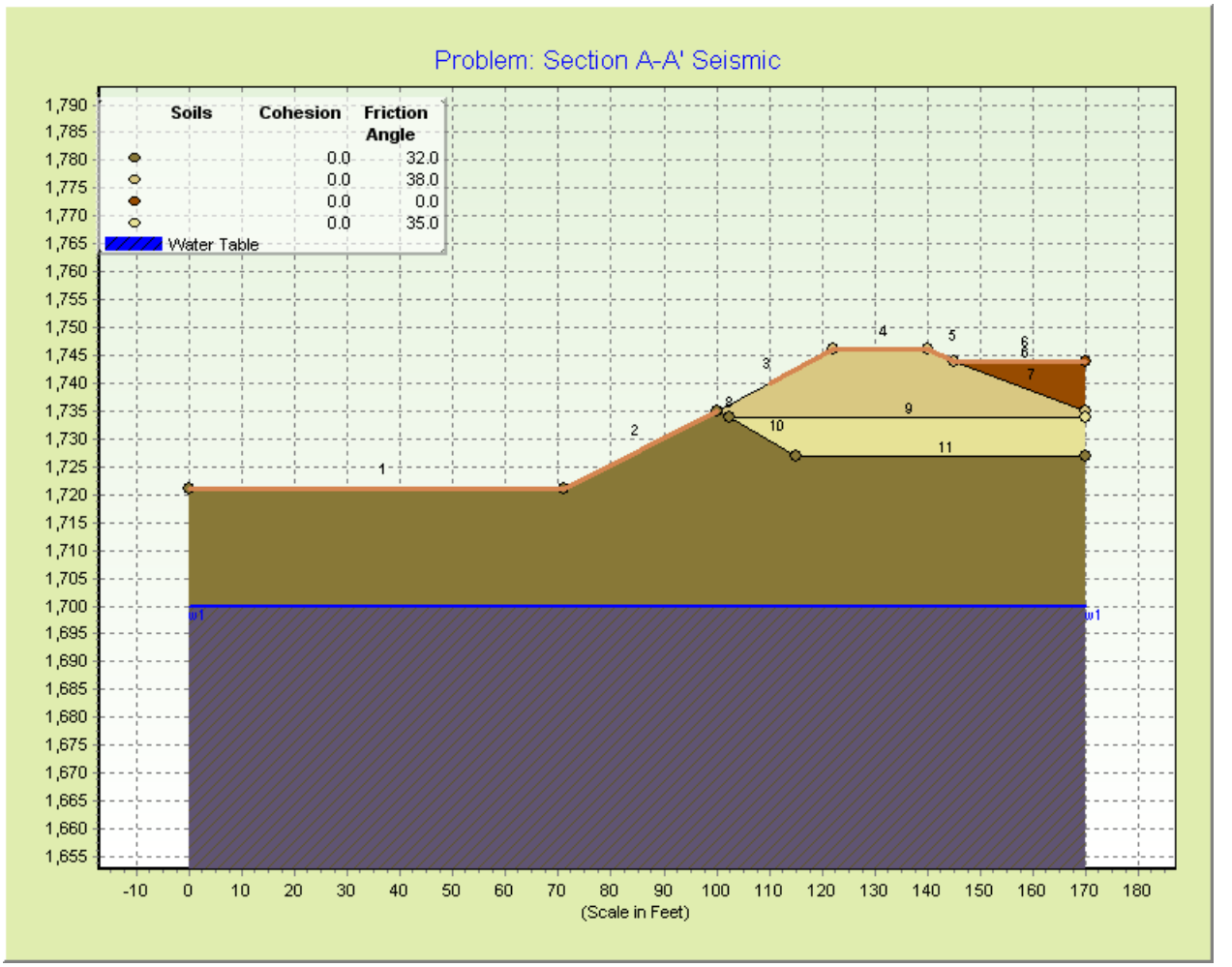
========== Factor of Safety Histogram ==========



======== Factors of Safety of 10 Most Critical Surfaces =======

Surface Number	Factor of Safety
1	1.469
2	1.478
3	1.503
4	1.528
5	1.532
6	1.549
7	1.576
8	1.591
9	1.593
10	1.593

========== DATA SUMMARY ==========



Profile Data

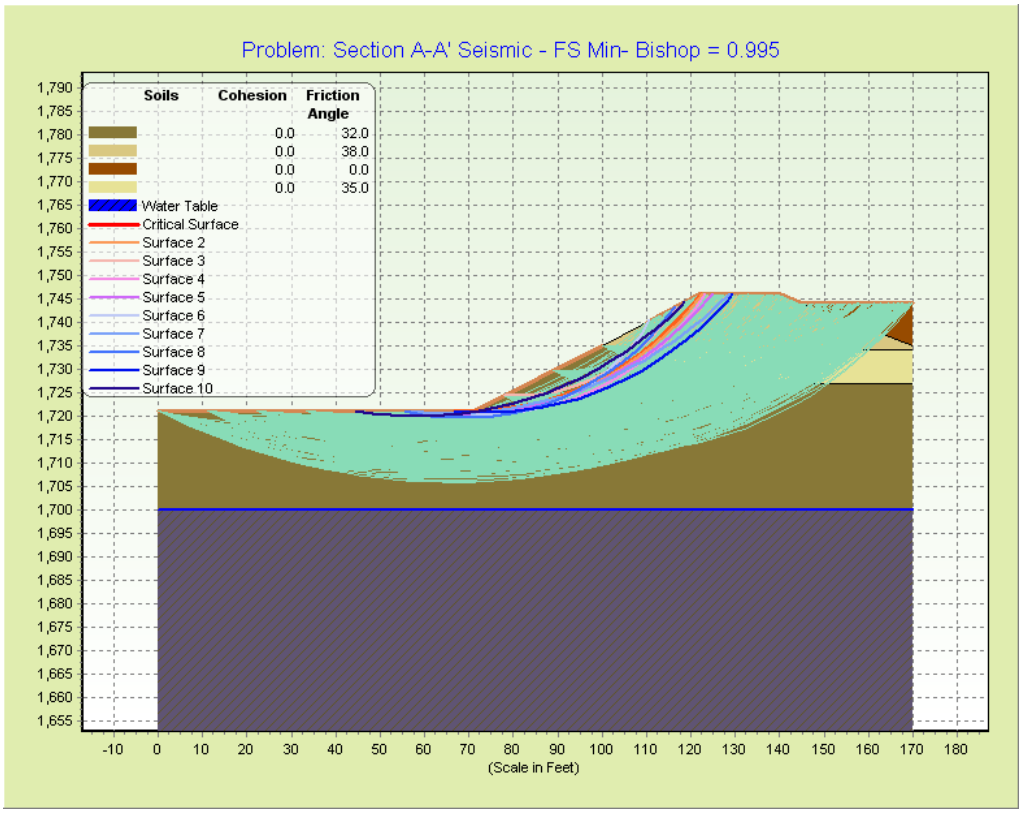
Segment Number	Left Extreme X	Left Extreme Y	Right Extreme X	Right Extreme Y	Soil Under Segment
1	0	1721	71	1721	1
2	71	1721	100	1735	1
3	100	1735	122	1746	2
4	122	1746	140	1746	2
5	140	1746	145	1744	2
6	145	1744	170	1744	4
7	145	1744	170	1735	2
8	100	1735	102.5	1734	1
9	102.5	1734	170	1734	3
10	102.5	1734	115	1727	1

Segment Number	Left Extreme X	Left Extreme Y	Right Extreme X	Right Extreme Y	Soil Under Segment
11	115	1727	170	1727	1

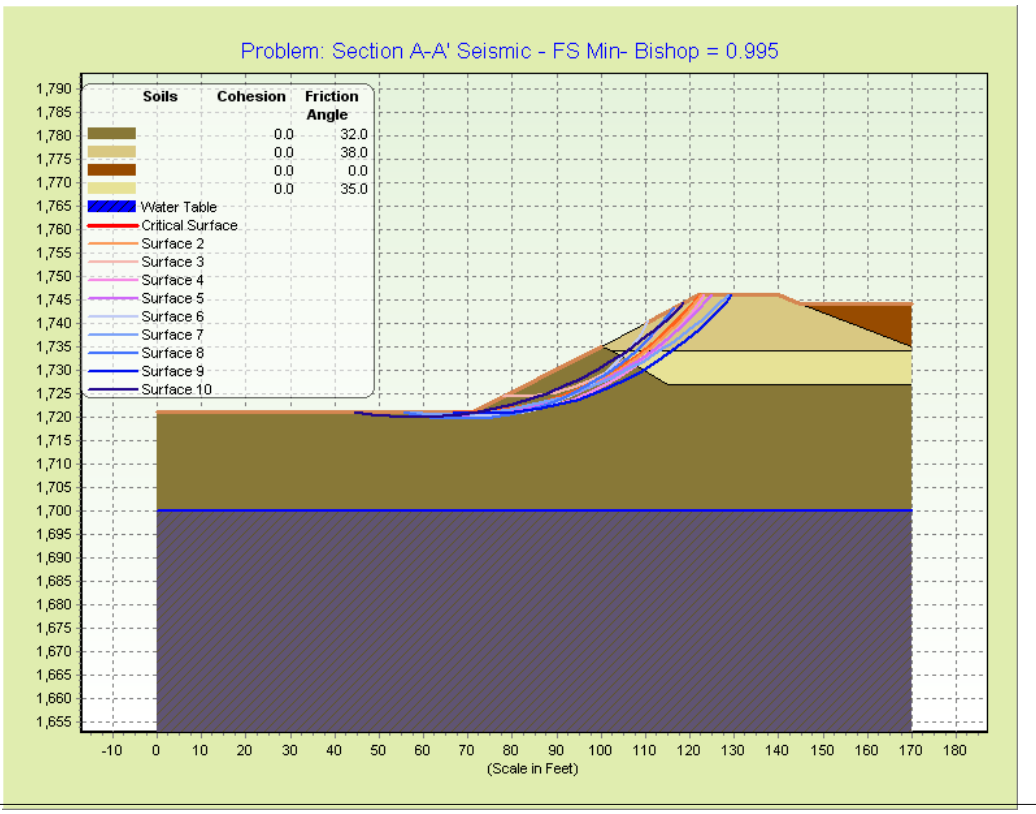
Soil Properties

Soil Number	Wet Unit Weight	Saturated Unit Weight	Cohesive Intercept	Friction Angle	Ru	Pressure Head	Water Table	Soil Name
1	120	60	0	32	0	0	1	
2	120	60	0	38	0	0	1	
3	122	62	0	35	0	0	1	
4	62.4	62.4	0	0	0	0	1	

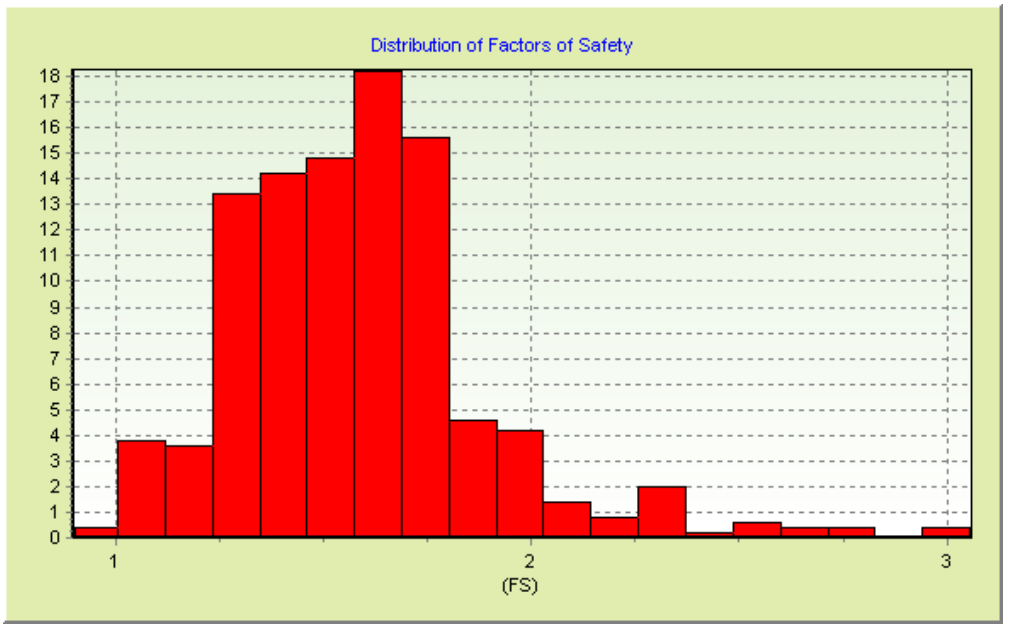
========== All Surfaces Generated ==========



========== 10 Most Critical Surfaces ==========



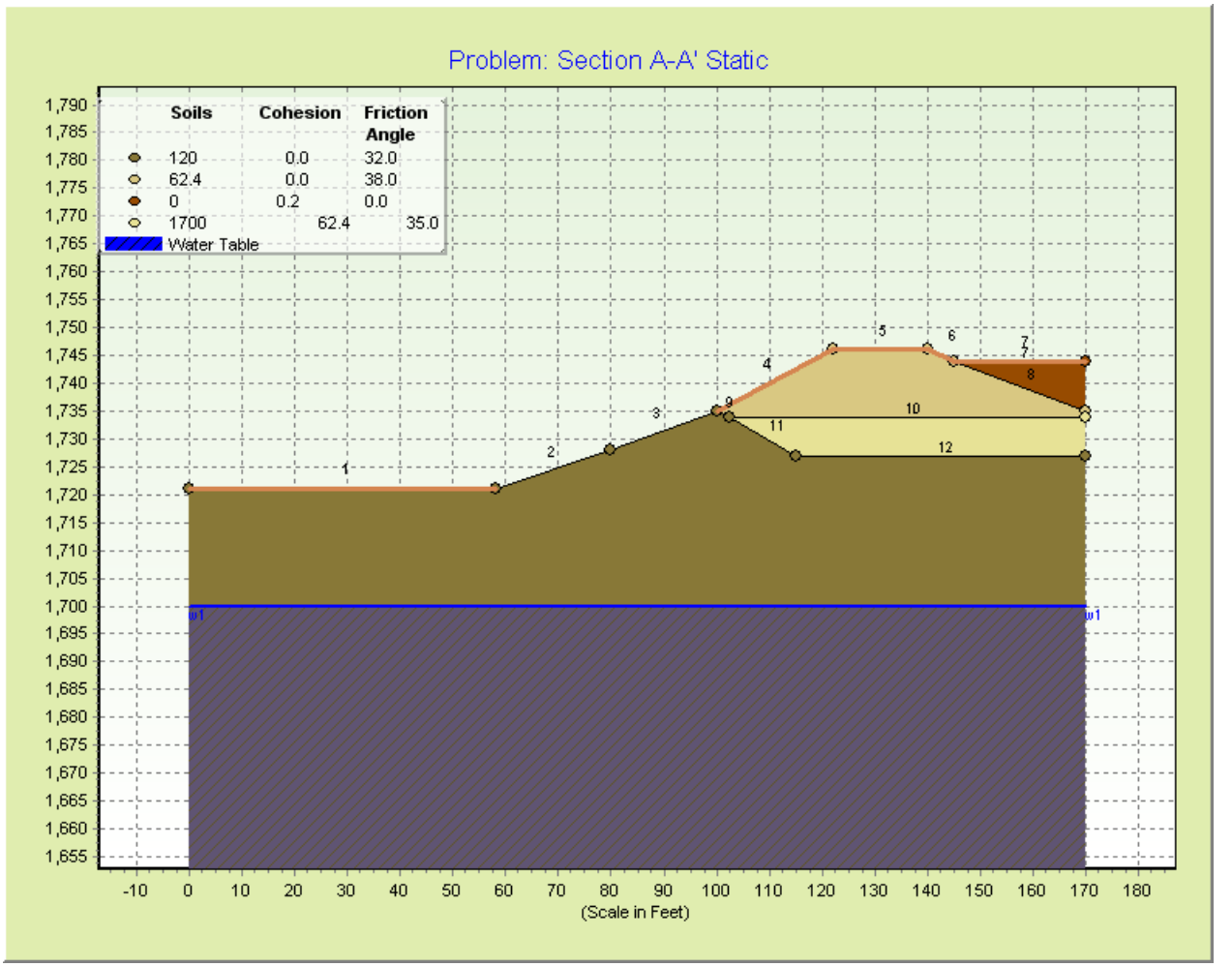
========== Factor of Safety Histogram ==========



======== Factors of Safety of 10 Most Critical Surfaces =======

Surface Number	Factor of Safety
1	.995
2	1.002
3	1.021
4	1.039
5	1.039
6	1.045
7	1.051
8	1.066
9	1.073
10	1.081

========== DATA SUMMARY ==========



Profile Data

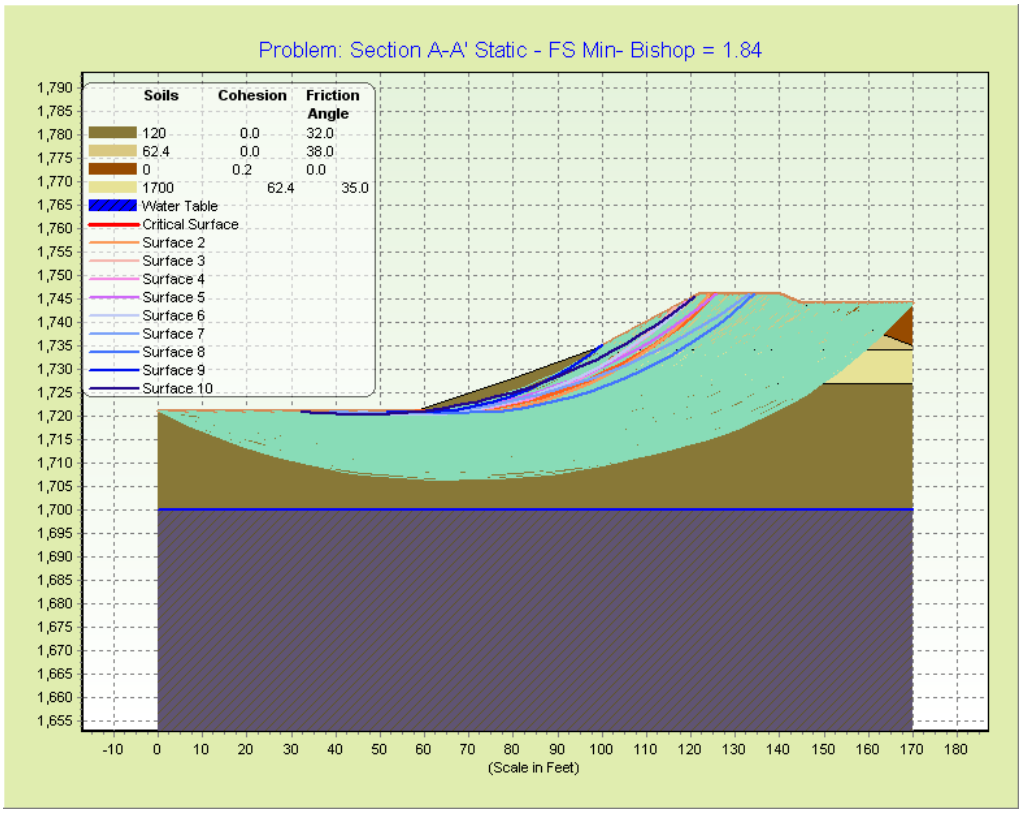
Segment Number	Left Extreme X	Left Extreme Y	Right Extreme X	Right Extreme Y	Soil Under Segment
1	0	1721	58	1721	1
2	58	1721	80	1728	1
3	80	1728	100	1735	1
4	100	1735	122	1746	2
5	122	1746	140	1746	2
6	140	1746	145	1744	2
7	145	1744	170	1744	4
8	145	1744	170	1735	2
9	100	1735	102.5	1734	1
10	102.5	1734	170	1734	3

Segment Number	Left Extreme X	Left Extreme Y	Right Extreme X	Right Extreme Y	Soil Under Segment
11	102.5	1734	115	1727	1
12	115	1727	170	1727	1

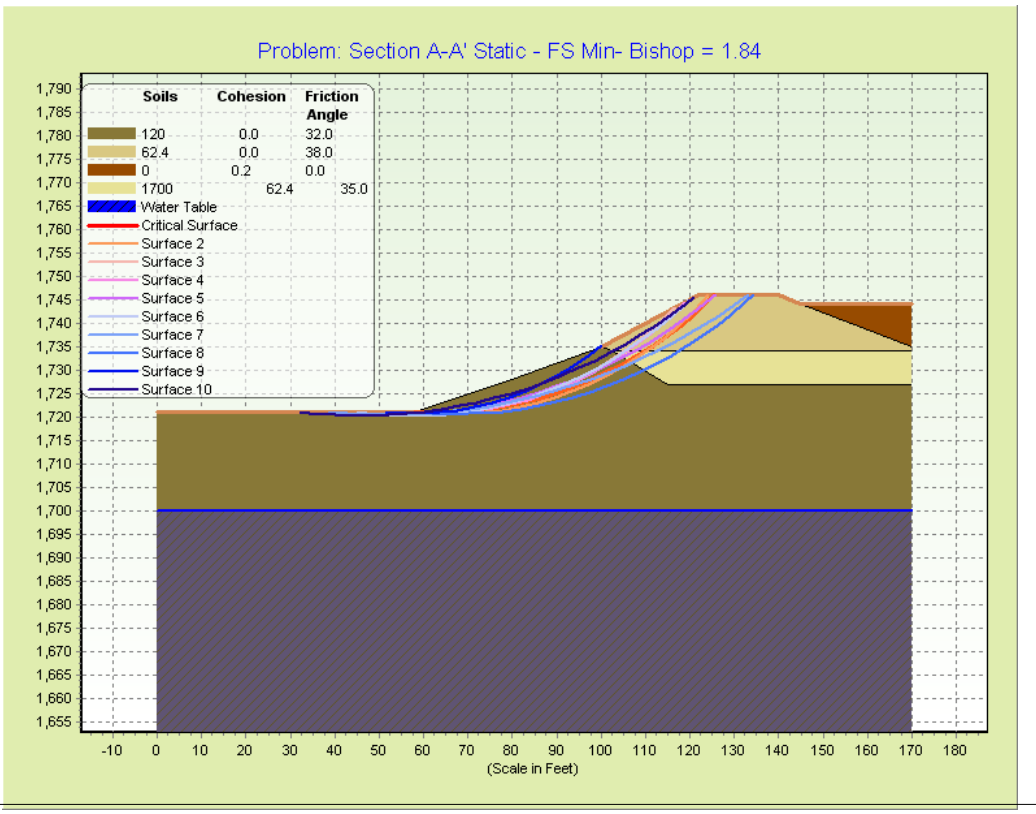
Soil Properties

Soil Number	Wet Unit Weight	Saturated Unit Weight	Cohesive Intercept	Friction Angle	Ru	Pressure Head	Water Table	Soil Name
1	120	60	0	32	0	0	1	120 60
2	120	62	0	38	0	0	1	62.4 62.4
3	122	62	62.4	35	0	0	1	1700
4	62.4	62.4	0.15	0	0	0	1	0 100

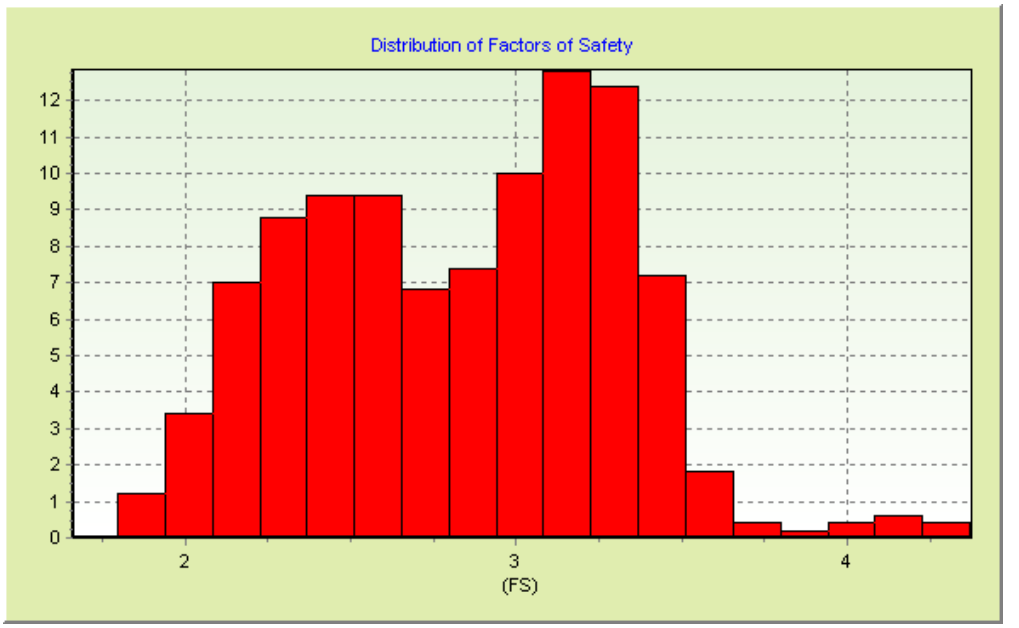
========== All Surfaces Generated ==========



========== 10 Most Critical Surfaces ==========



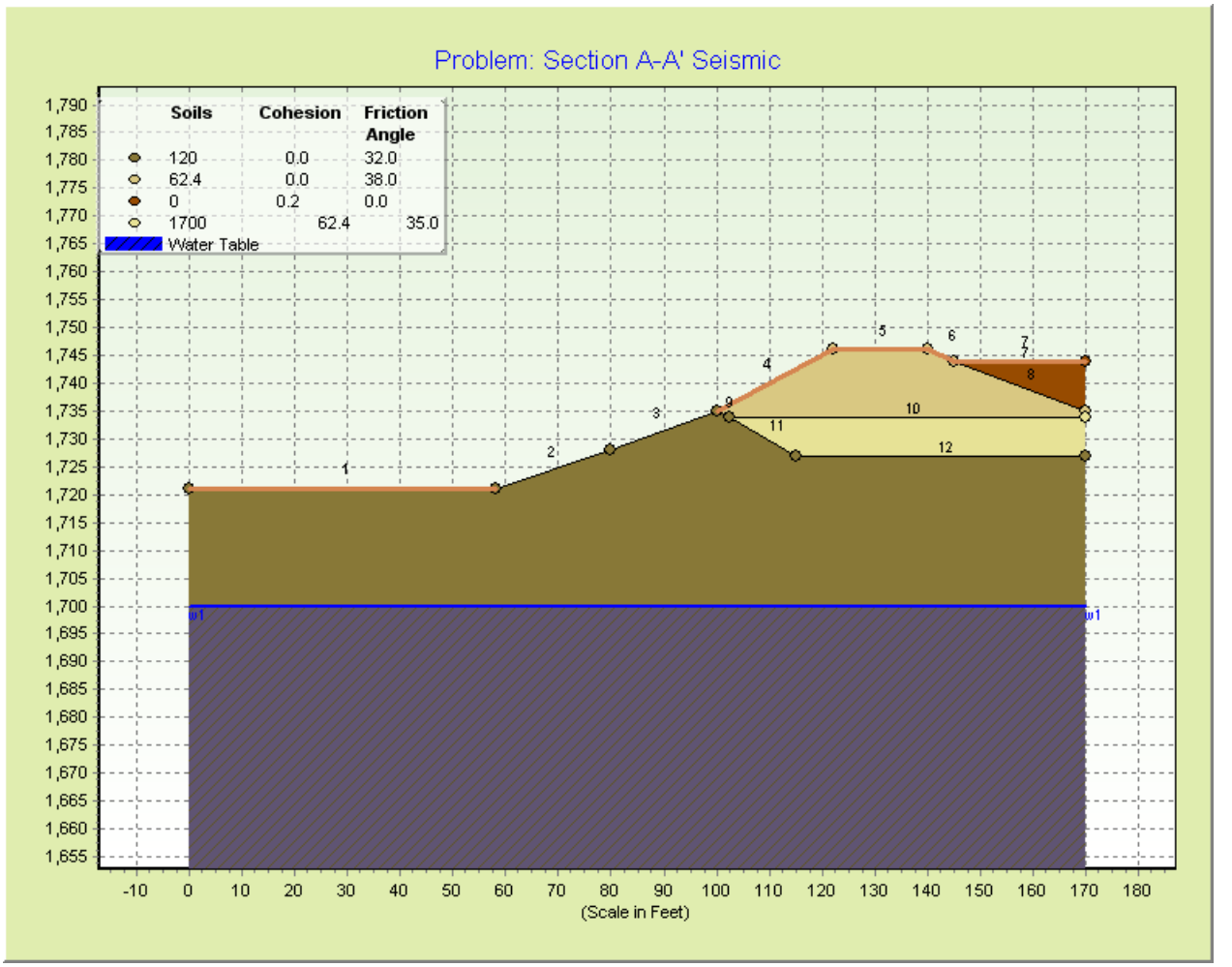
========== Factor of Safety Histogram ==========



======== Factors of Safety of 10 Most Critical Surfaces =======

Surface Number	Factor of Safety
1	1.84
2	1.866
3	1.88
4	1.885
5	1.899
6	1.919
7	1.982
8	1.984
9	1.989
10	1.991

========== DATA SUMMARY ==========



Profile Data

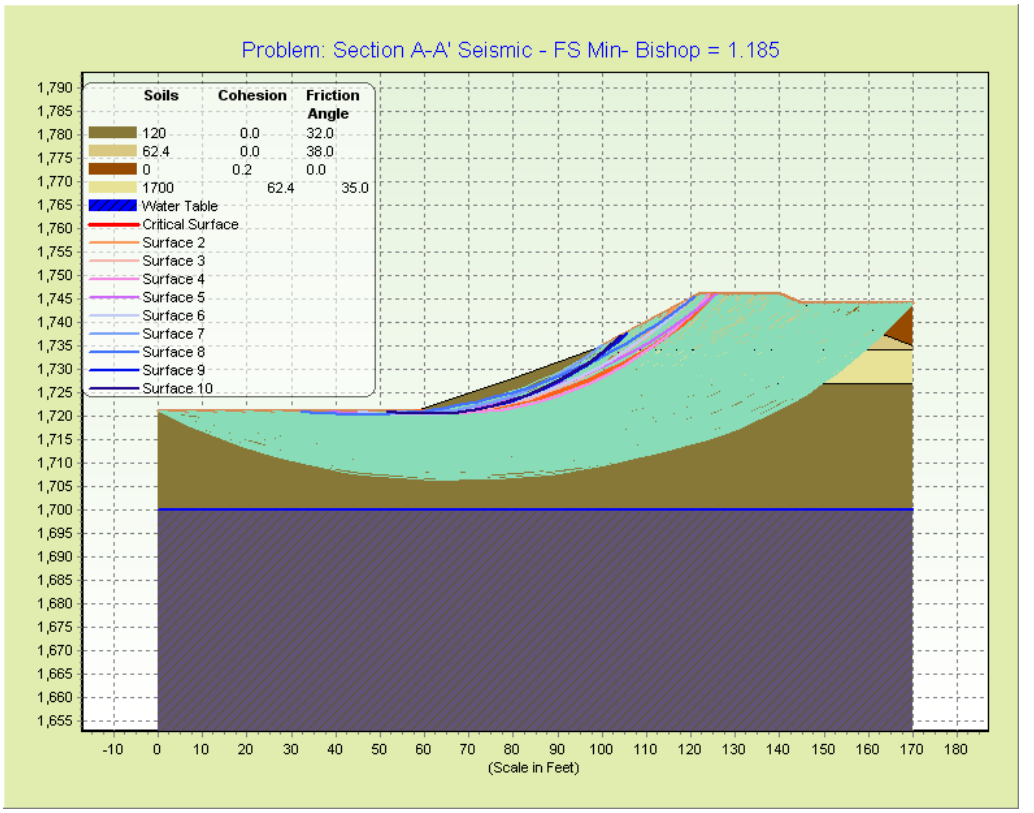
Segment Number	Left Extreme X	Left Extreme Y	Right Extreme X	Right Extreme Y	Soil Under Segment
1	0	1721	58	1721	1
2	58	1721	80	1728	1
3	80	1728	100	1735	1
4	100	1735	122	1746	2
5	122	1746	140	1746	2
6	140	1746	145	1744	2
7	145	1744	170	1744	4
8	145	1744	170	1735	2
9	100	1735	102.5	1734	1
10	102.5	1734	170	1734	3

Segment Number	Left Extreme X	Left Extreme Y	Right Extreme X	Right Extreme Y	Soil Under Segment
11	102.5	1734	115	1727	1
12	115	1727	170	1727	1

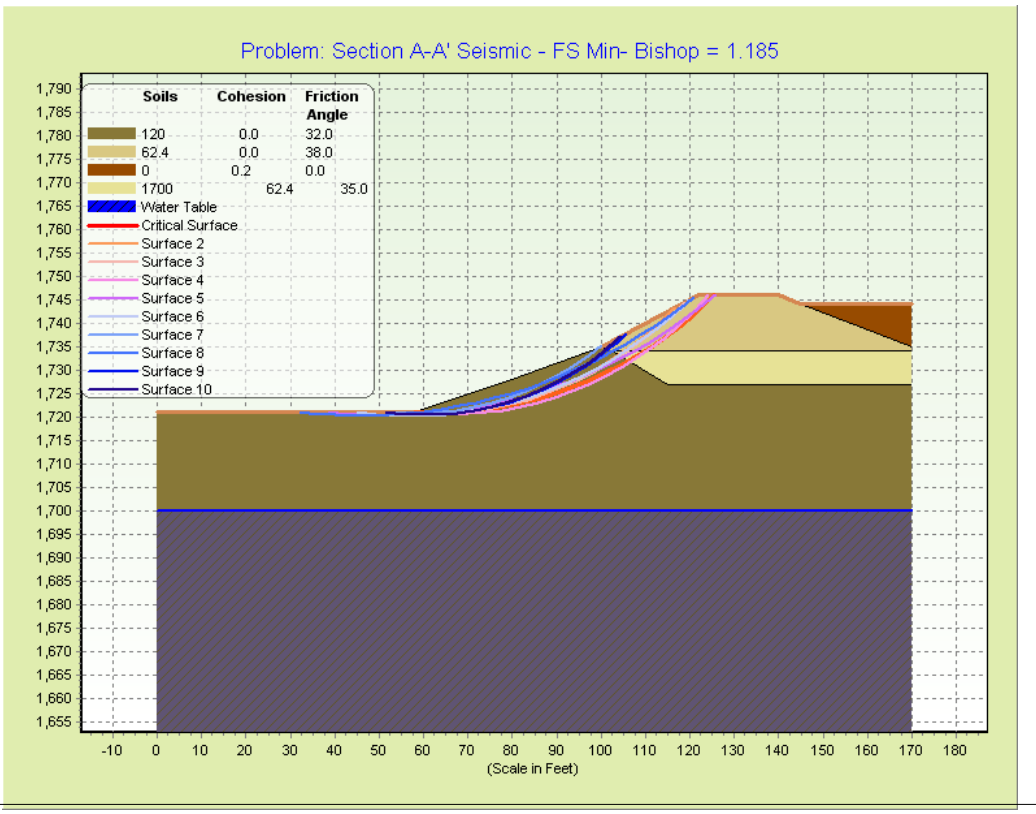
Soil Properties

Soil Number	Wet Unit Weight	Saturated Unit Weight	Cohesive Intercept	Friction Angle	Ru	Pressure Head	Water Table	Soil Name
1	120	60	0	32	0	0	1	120 60
2	120	62	0	38	0	0	1	62.4 62.4
3	122	62	62.4	35	0	0	1	1700
4	62.4	62.4	0.15	0	0	0	1	0 100

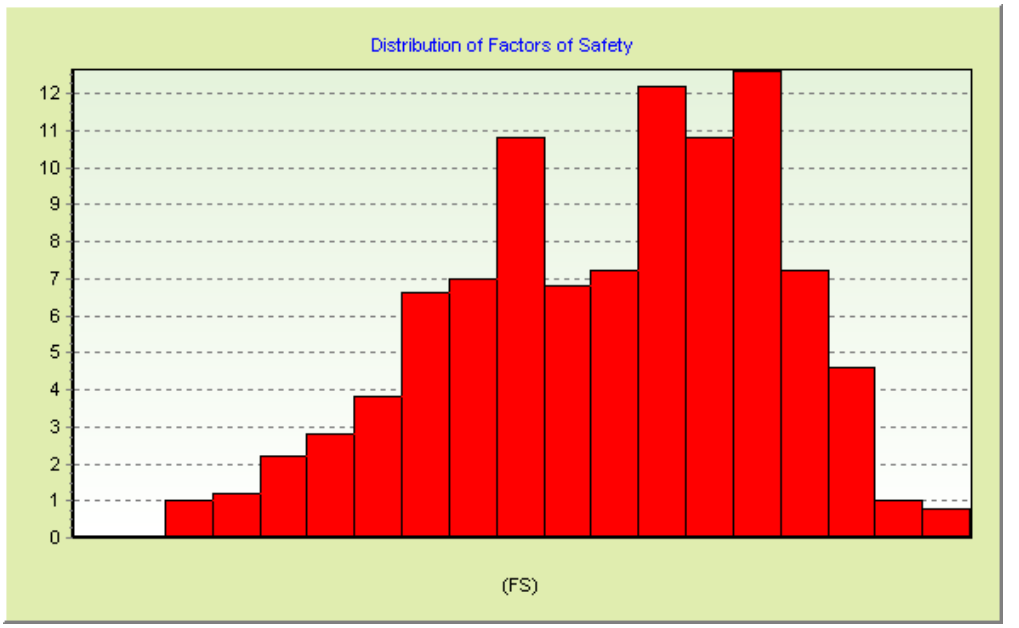
========== All Surfaces Generated ==========



========== 10 Most Critical Surfaces ==========



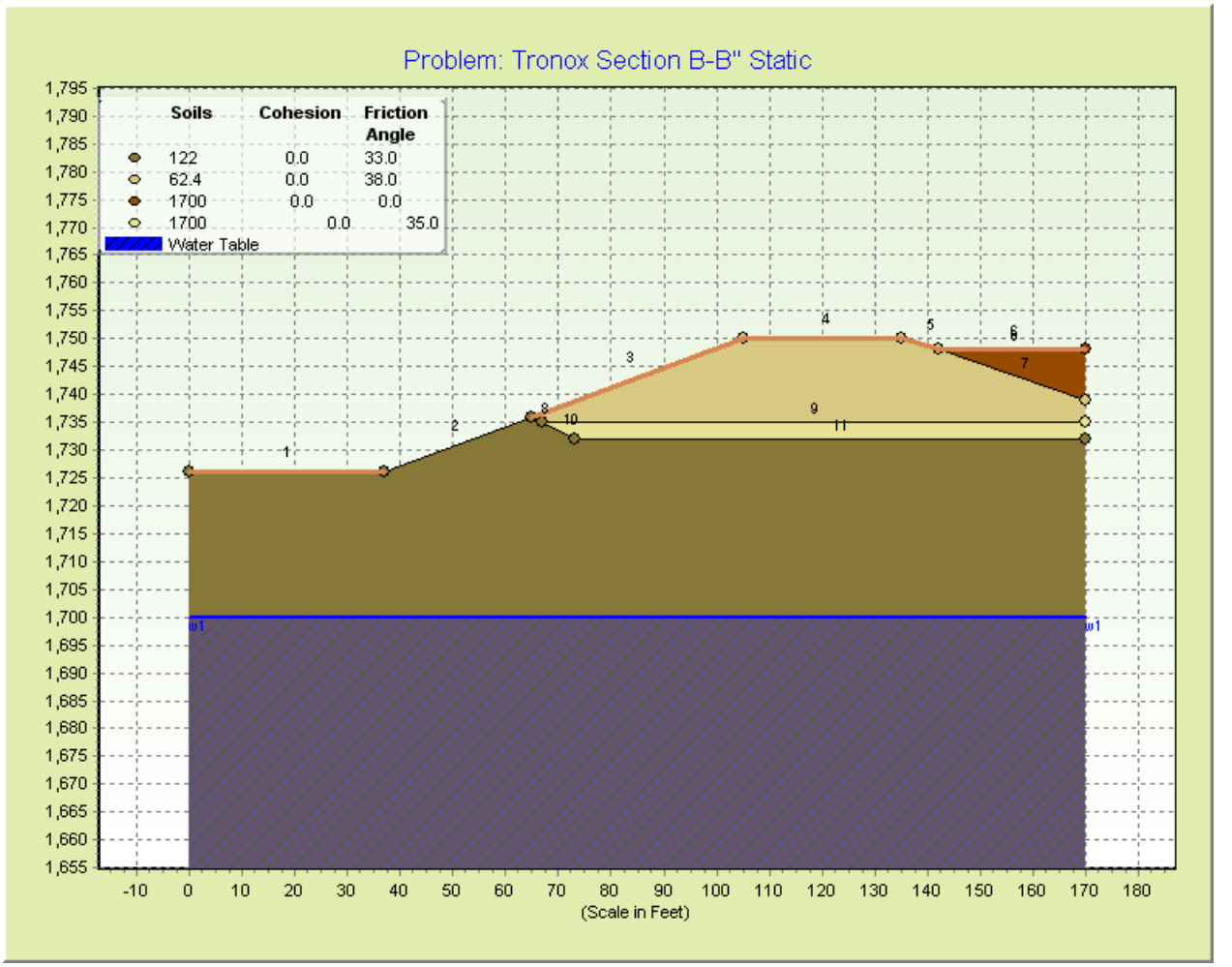
========== Factor of Safety Histogram ==========



======== Factors of Safety of 10 Most Critical Surfaces =======

Surface Number	Factor of Safety
1	1.185
2	1.194
3	1.198
4	1.204
5	1.205
6	1.21
7	1.226
8	1.233
9	1.242
10	1.244

================== DATA SUMMARY ====================



Profile Data

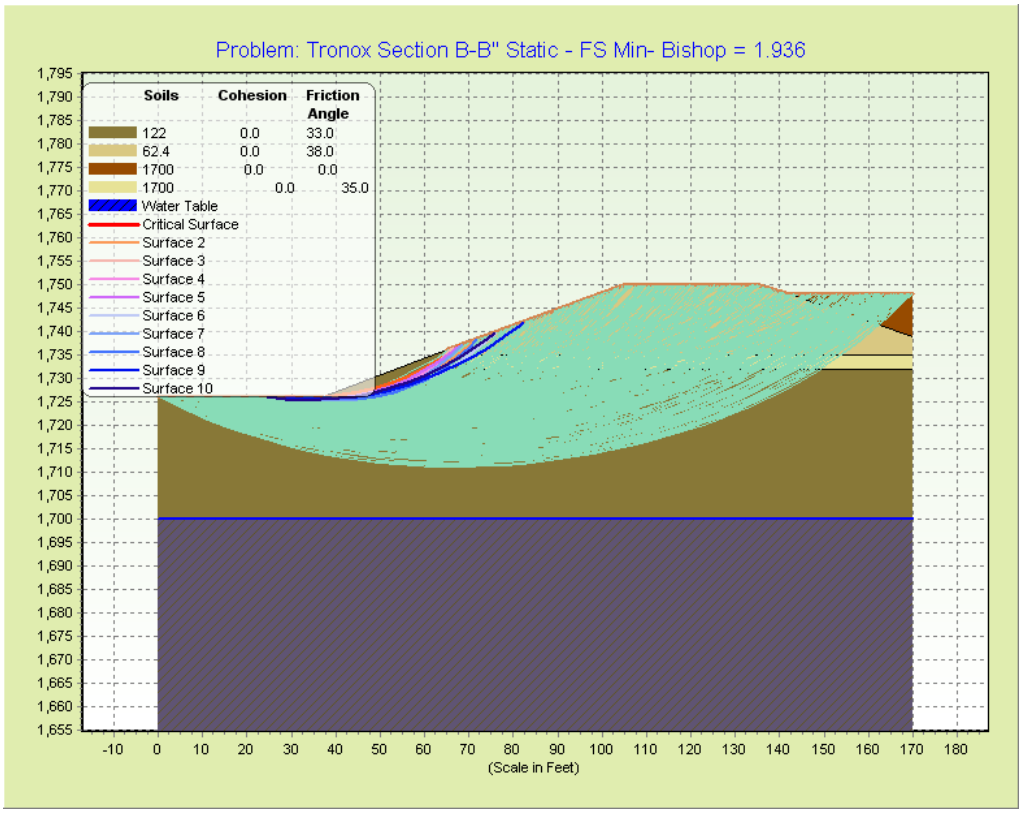
Segment Number	Left Extreme X	Left Extreme Y	Right Extreme X	Right Extreme Y	Soil Under Segment
1	0	1726	37	1726	1
2	37	1726	65	1736	1
3	65	1736	105	1750	2
4	105	1750	135	1750	2
5	135	1750	142	1748	2
6	142	1748	170	1748	4
7	142	1748	170	1739	2
8	65	1736	67	1735	1
9	67	1735	170	1735	3
10	67	1735	73	1732	1

Segment Number	Left Extreme X	Left Extreme Y	Right Extreme X	Right Extreme Y	Soil Under Segment
11	73	1732	170	1732	1

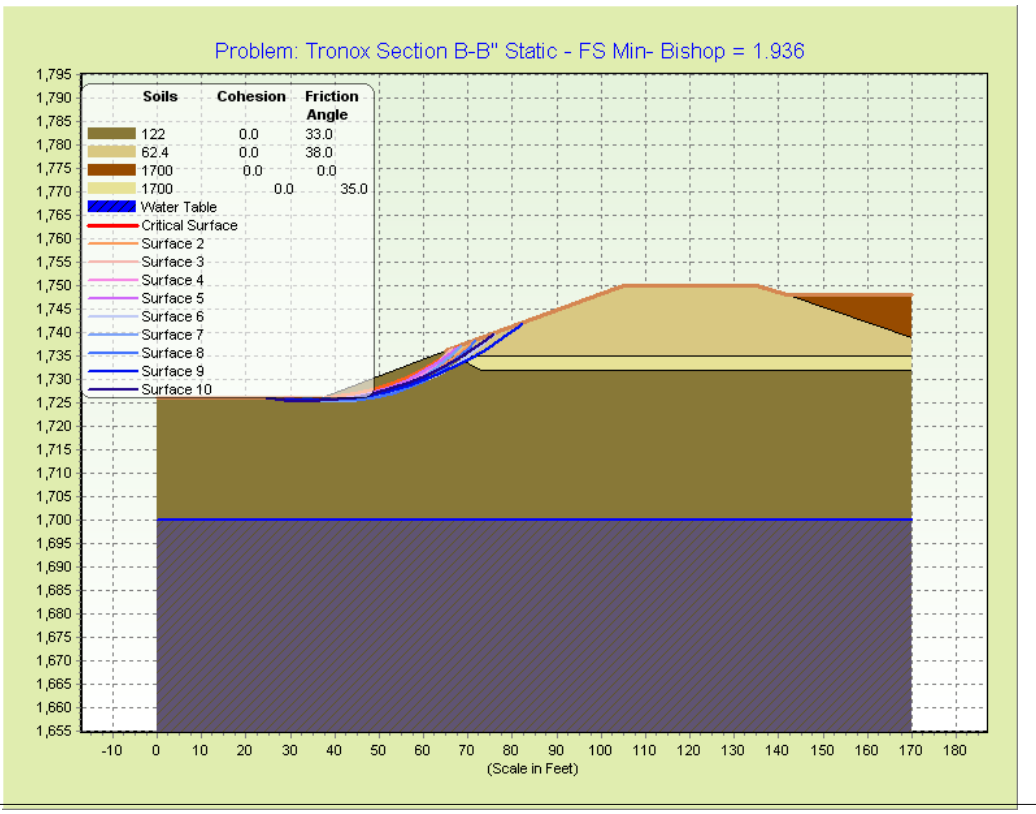
Soil Properties

Soil Number	Wet Unit Weight	Saturated Unit Weight	Cohesive Intercept	Friction Angle	Ru	Pressure Head	Water Table	Soil Name
1	122	60	0	33	0	0	1	122 60
2	122	62	0	38	0	0	1	62.4 62.4
3	122	62	0	35	0	0	1	1700
4	62.4	62.4	0	0	0	0	1	1700 4

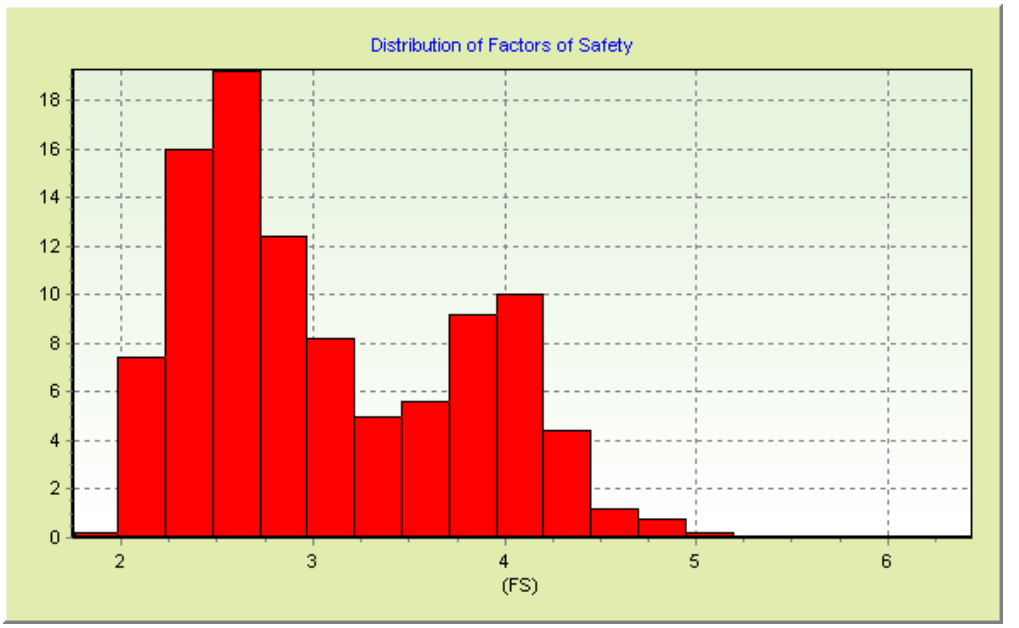
========== All Surfaces Generated ==========



========== 10 Most Critical Surfaces ==========



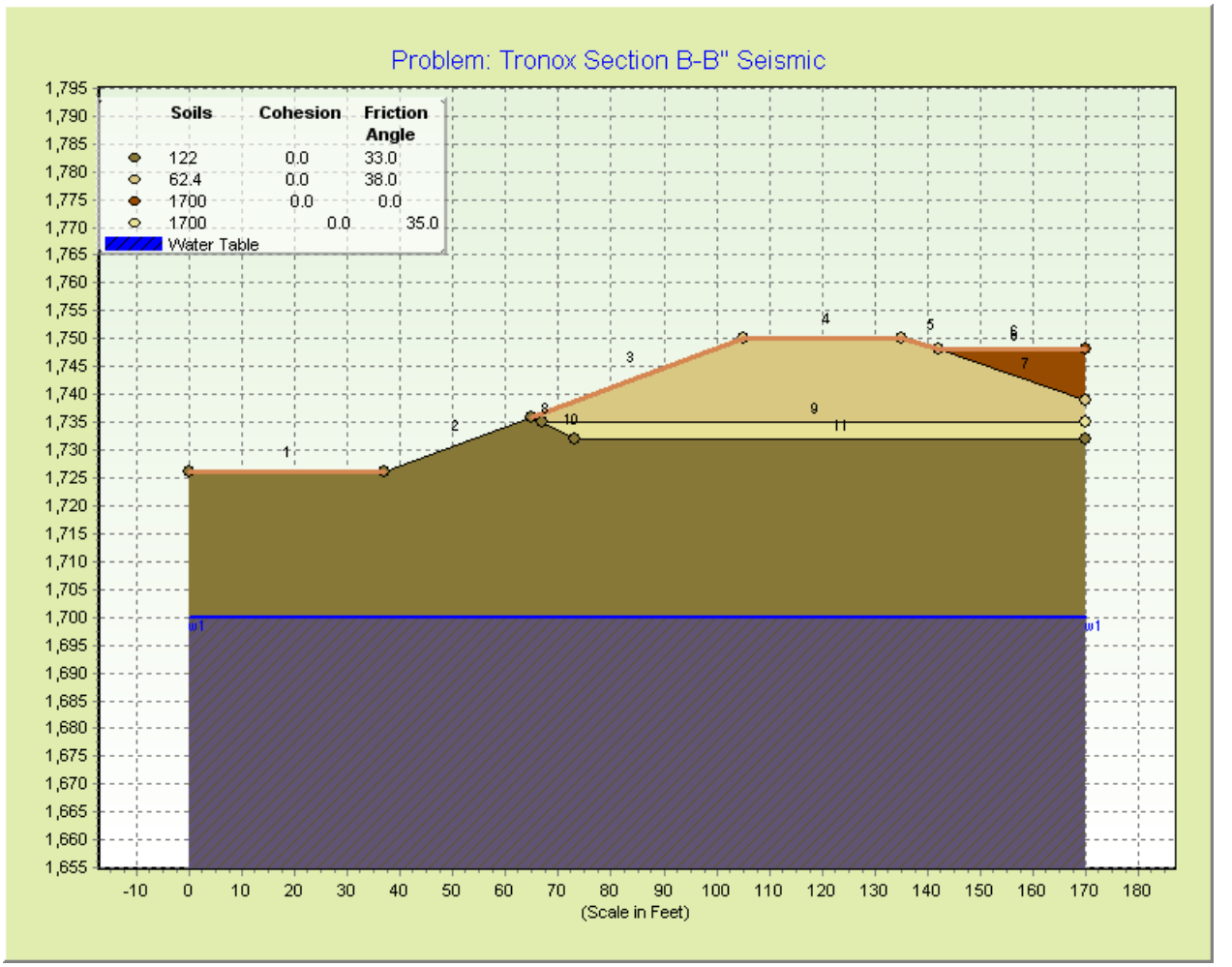
========== Factor of Safety Histogram ==========



======== Factors of Safety of 10 Most Critical Surfaces =======

Surface Number	Factor of Safety
1	1.936
2	1.99
3	1.995
4	2.001
5	2.004
6	2.009
7	2.036
8	2.04
9	2.063
10	2.07

================== DATA SUMMARY ====================



Profile Data

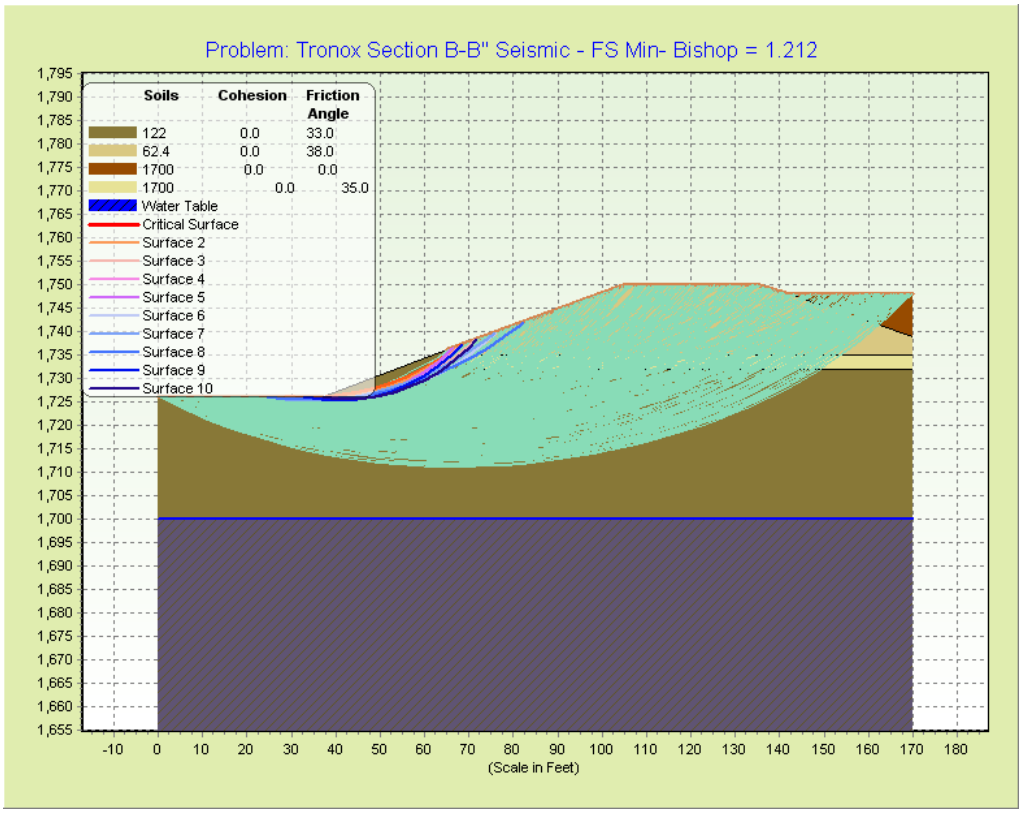
Segment Number	Left Extreme X	Left Extreme Y	Right Extreme X	Right Extreme Y	Soil Under Segment
1	0	1726	37	1726	1
2	37	1726	65	1736	1
3	65	1736	105	1750	2
4	105	1750	135	1750	2
5	135	1750	142	1748	2
6	142	1748	170	1748	4
7	142	1748	170	1739	2
8	65	1736	67	1735	1
9	67	1735	170	1735	3
10	67	1735	73	1732	1

Segment Number	Left Extreme X	Left Extreme Y	Right Extreme X	Right Extreme Y	Soil Under Segment
11	73	1732	170	1732	1

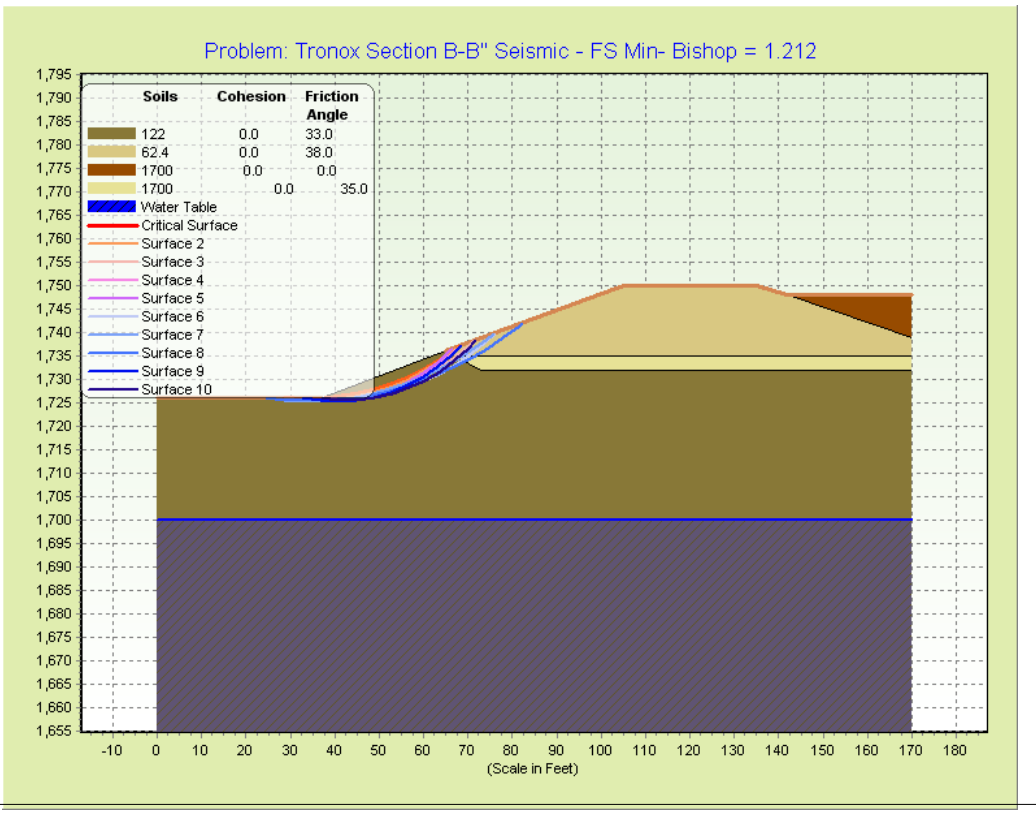
Soil Properties

Soil Number	Wet Unit Weight	Saturated Unit Weight	Cohesive Intercept	Friction Angle	Ru	Pressure Head	Water Table	Soil Name
1	122	60	0	33	0	0	1	122 60
2	122	62	0	38	0	0	1	62.4 62.4
3	122	62	0	35	0	0	1	1700
4	62.4	62.4	0	0	0	0	1	1700 4

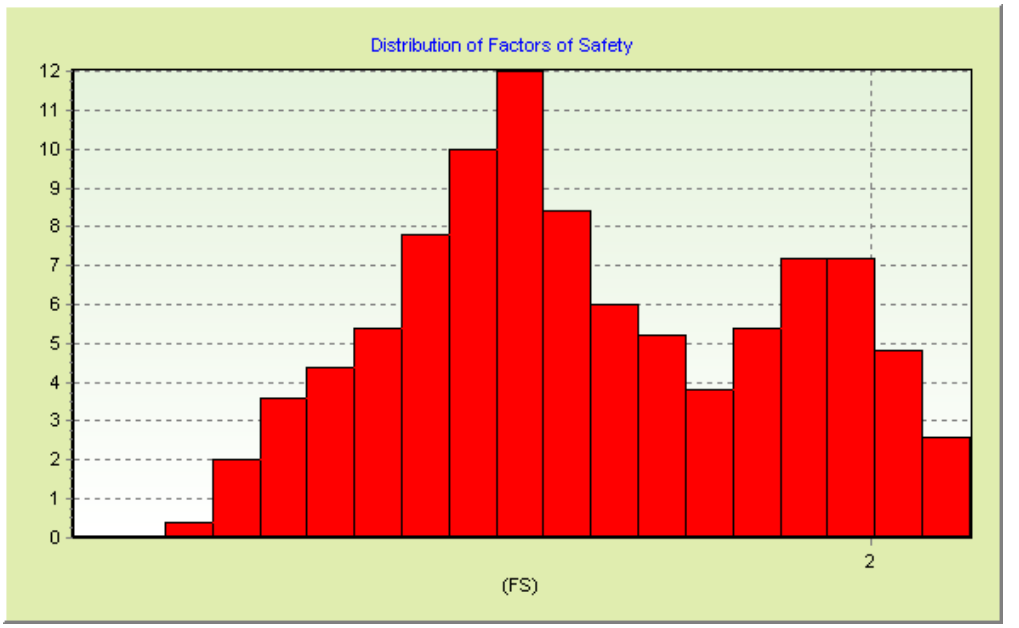
========== All Surfaces Generated ==========



========== 10 Most Critical Surfaces ==========



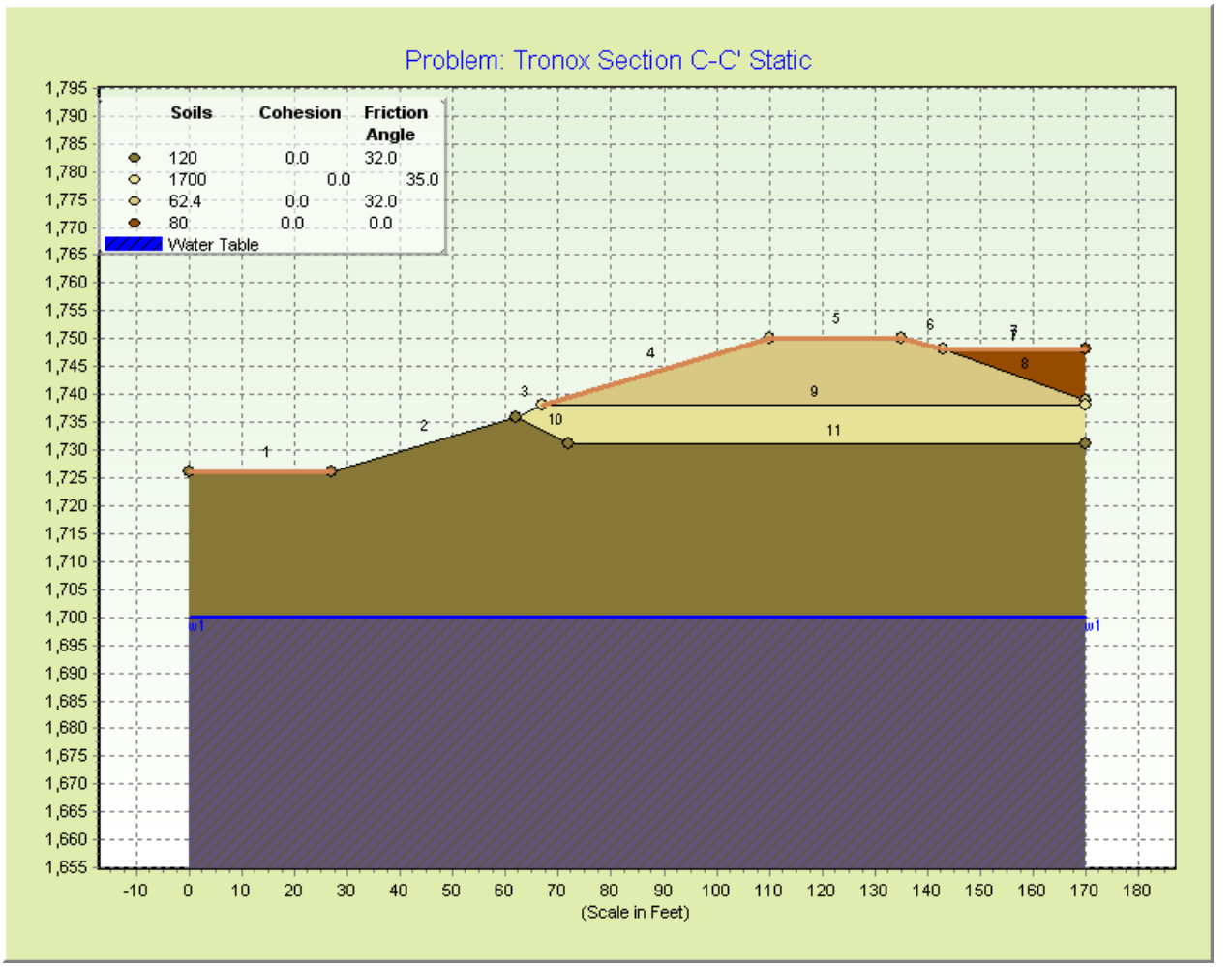
========== Factor of Safety Histogram ==========



======== Factors of Safety of 10 Most Critical Surfaces =======

Surface Number	Factor of Safety
1	1.212
2	1.25
3	1.257
4	1.26
5	1.262
6	1.264
7	1.281
8	1.281
9	1.284
10	1.291

========== DATA SUMMARY ==========



Profile Data

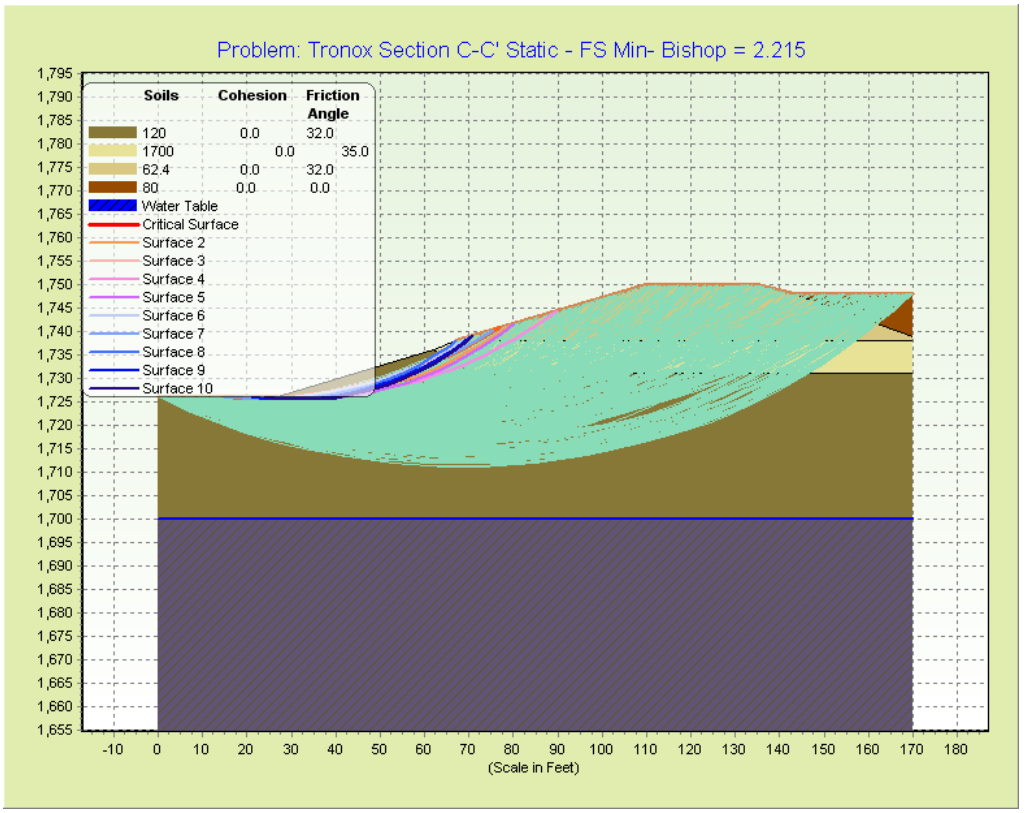
Segment Number	Left Extreme X	Left Extreme Y	Right Extreme X	Right Extreme Y	Soil Under Segment
1	0	1726	27	1726	1
2	27	1726	62	1736	1
3	62	1736	67	1738	3
4	67	1738	110	1750	2
5	110	1750	135	1750	2
6	135	1750	143	1748	2
7	143	1748	170	1748	4
8	143	1748	170	1739	2
9	67	1738	170	1738	3
10	62	1736	72	1731	1

Segment Number	Left Extreme X	Left Extreme Y	Right Extreme X	Right Extreme Y	Soil Under Segment
11	72	1731	170	1731	1

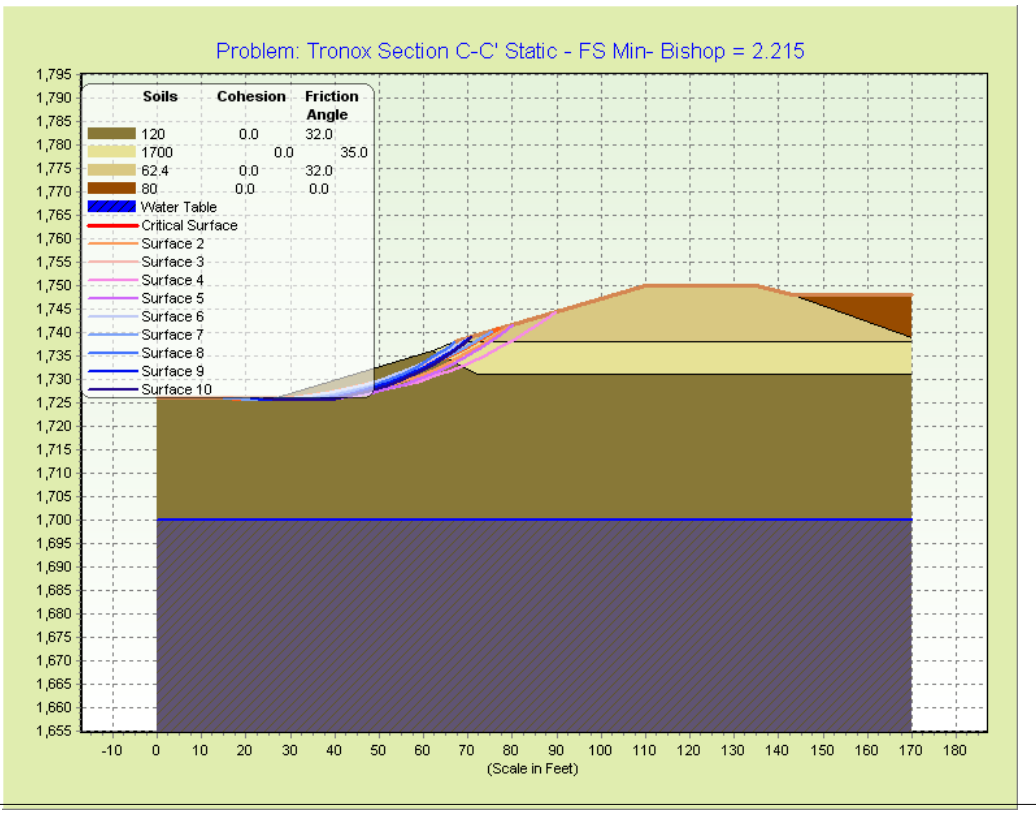
Soil Properties

Soil Number	Wet Unit Weight	Saturated Unit Weight	Cohesive Intercept	Friction Angle	Ru	Pressure Head	Water Table	Soil Name
1	120	60	0	32	0	0	1	120 60
2	120	60	0	32	0	0	1	62.4 62.4
3	122	62	0	35	0	0	1	1700
4	62.4	62.4	0	0	0	0	1	80 170

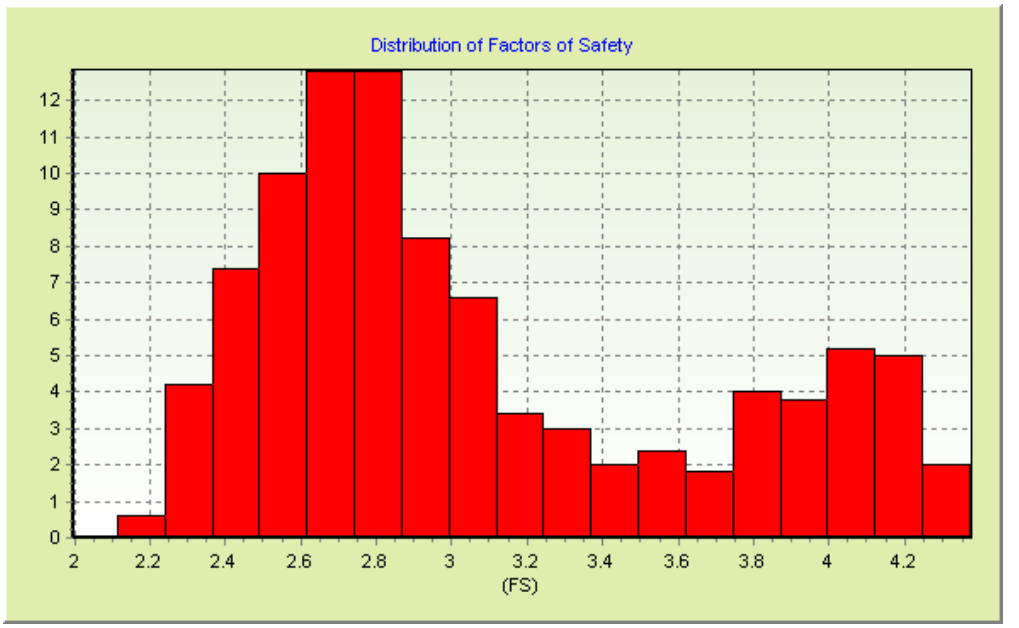
========== All Surfaces Generated ==========



========== 10 Most Critical Surfaces ==========



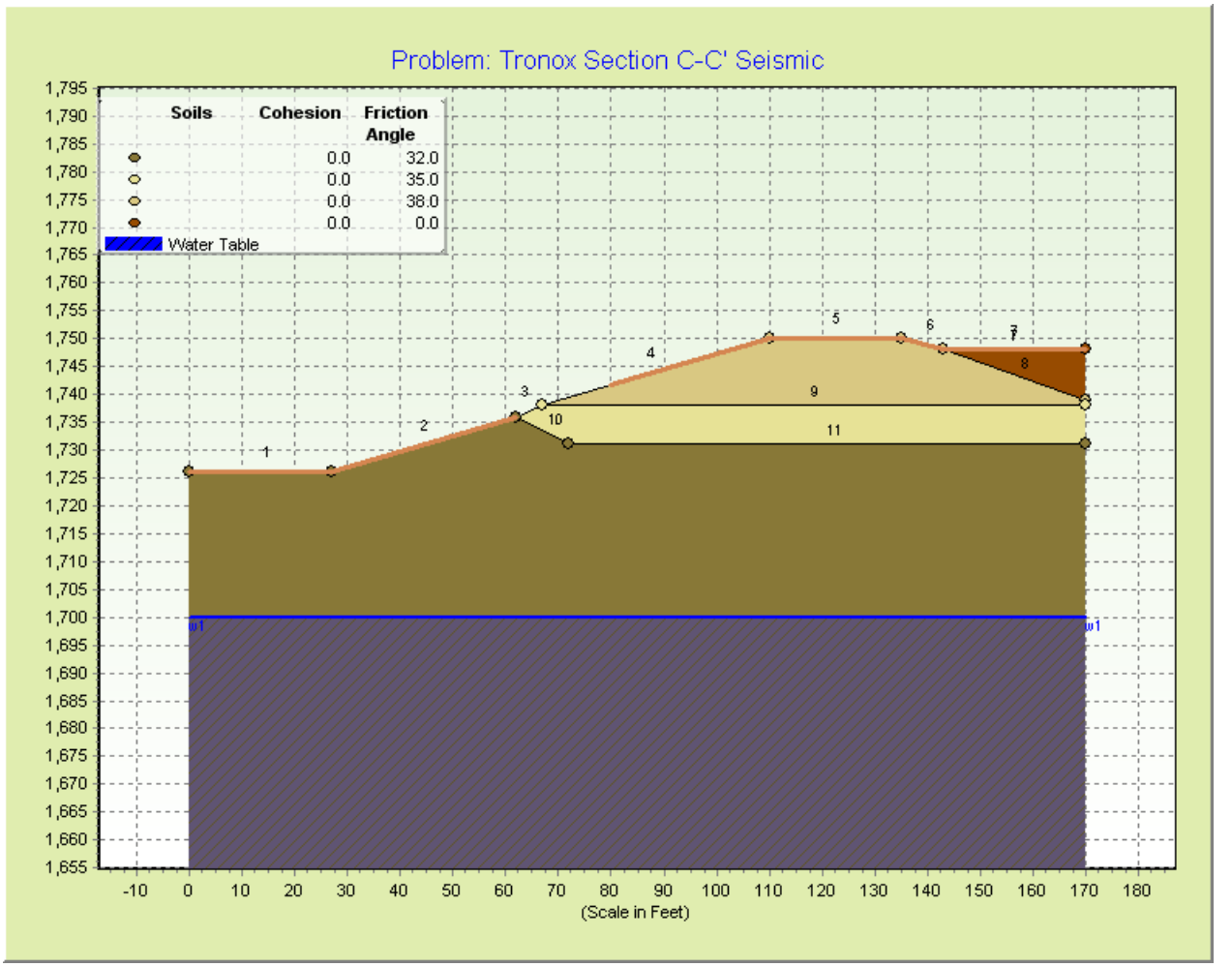
========== Factor of Safety Histogram ==========



======== Factors of Safety of 10 Most Critical Surfaces =======

Surface Number	Factor of Safety
1	2.215
2	2.231
3	2.238
4	2.261
5	2.262
6	2.269
7	2.273
8	2.274
9	2.28
10	2.284

========== DATA SUMMARY ==========



Profile Data

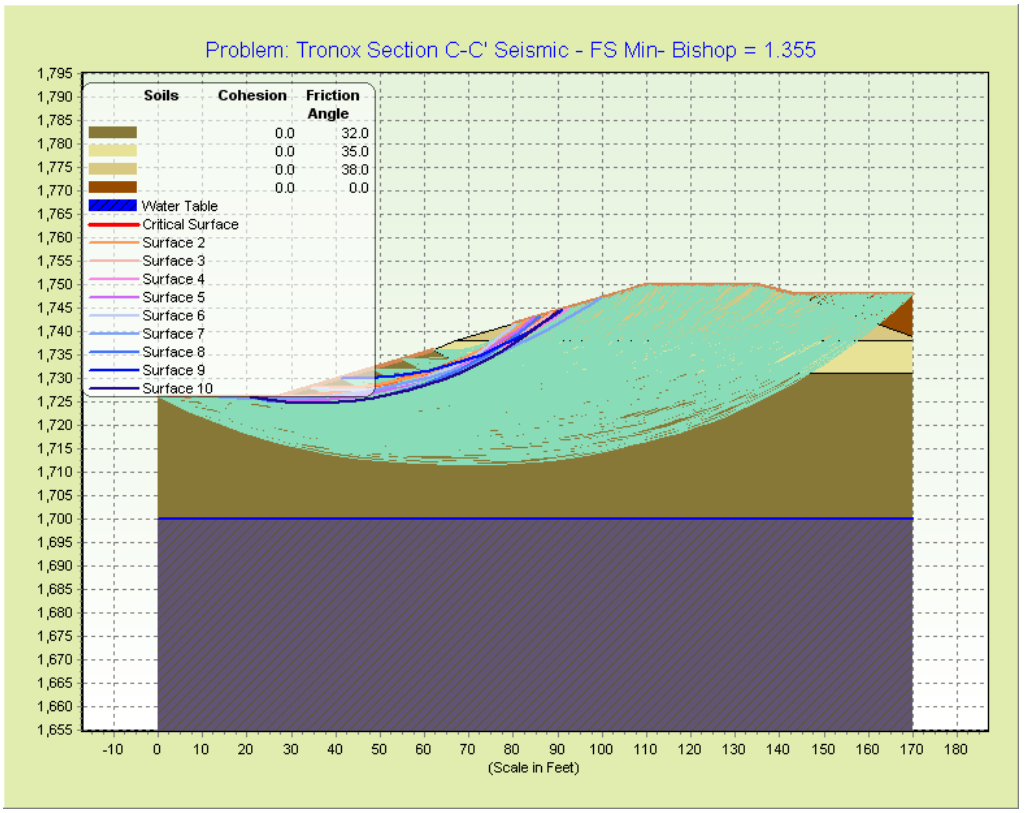
Segment Number	Left Extreme X	Left Extreme Y	Right Extreme X	Right Extreme Y	Soil Under Segment
1	0	1726	27	1726	1
2	27	1726	62	1736	1
3	62	1736	67	1738	3
4	67	1738	110	1750	2
5	110	1750	135	1750	2
6	135	1750	143	1748	2
7	143	1748	170	1748	4
8	143	1748	170	1739	2
9	67	1738	170	1738	3
10	62	1736	72	1731	1

Segment Number	Left Extreme X	Left Extreme Y	Right Extreme X	Right Extreme Y	Soil Under Segment
11	72	1731	170	1731	1

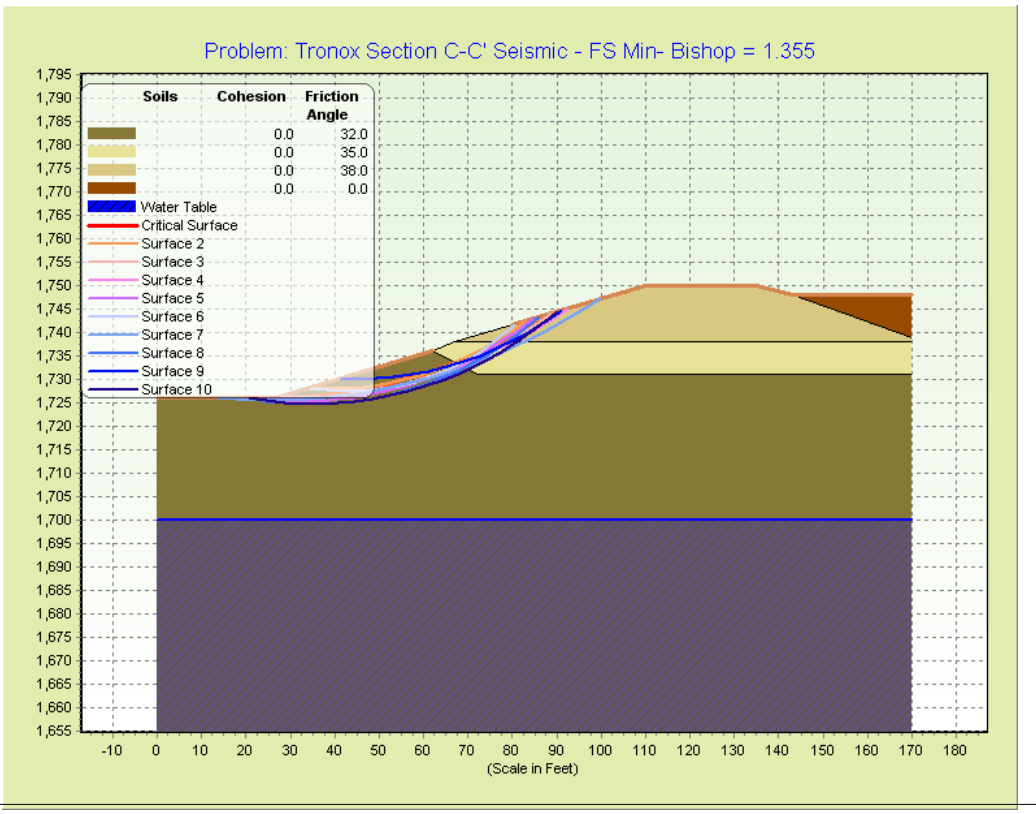
Soil Properties

Soil Number	Wet Unit Weight	Saturated Unit Weight	Cohesive Intercept	Friction Angle	Ru	Pressure Head	Water Table	Soil Name
1	122	60	0	32	0	0	1	
2	120	60	0	38	0	0	1	
3	122	62	0	35	0	0	1	
4	62.4	62.4	0	0	0	0	1	

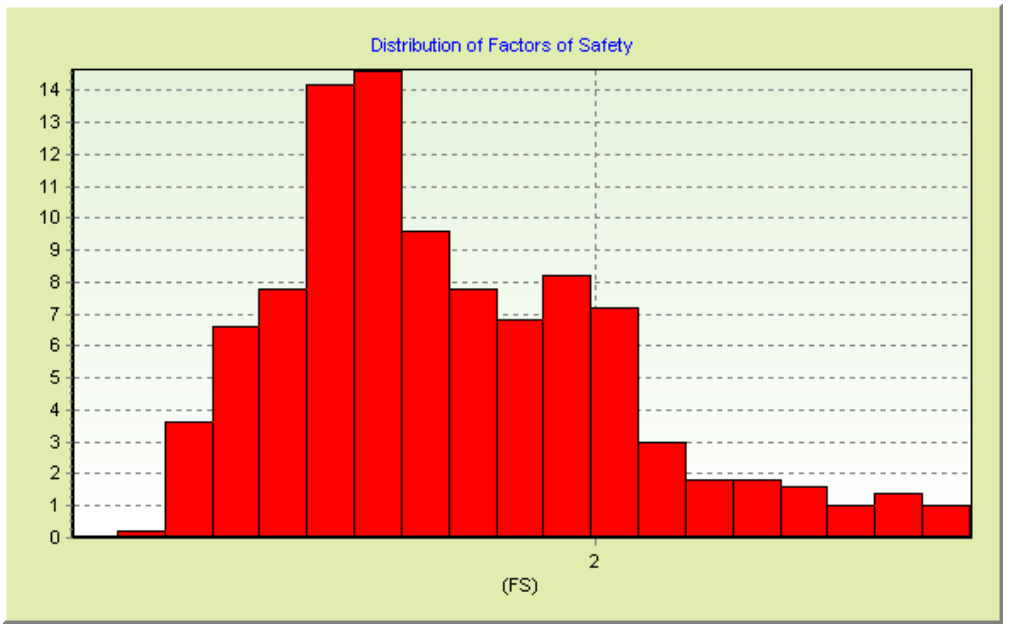
========== All Surfaces Generated ==========



========== 10 Most Critical Surfaces ==========



========== Factor of Safety Histogram ==========



======== Factors of Safety of 10 Most Critical Surfaces =======

Surface Number	Factor of Safety
1	1.355
2	1.362
3	1.369
4	1.376
5	1.377
6	1.397
7	1.402
8	1.404
9	1.405
10	1.409