1643

DRAFT
GEOTECHNICAL DESIGN REPORT
MIDDLE SEGMENT
STATE ROUTE 56 PROJECT
CITY OF SAN DIEGO, CALIFORNIA
11-SD-56, KP 3.3/10.5, EA 172820

Submitted to

The City of San Diego, California
CALTRANS District 11

Prepared for

BOYLE ENGINEERING CORPORATION
7807 Convoy Court, Suite 200
San Diego, California 92111

GROUP
DELTA
CONSULTANTS

Prepared by

GROUP DELTA CONSULTANTS, INC.
4455 Murphy Canyon Road, Suite 100
San Diego, California 92123
Tel. (619) 573-1777
Fax (619) 573-0069

GDC Project No. I-181-02
February 22, 1999

GROUP DELTA CONSULTANTS

Certified DBE/MBE

Geotechnical Engineering
Geology
Hydrogeology
Coastal Engineering
Hydrology
Hydraulics
Environmental Engineering

February 22, 1999

BOYLE ENGINEERING CORPORATION
7807 Convoy Court, Suite 200
San Diego, CA 92111

Attention: Mr. Clark Fernon
Project Manager

Subject: **Draft Geotechnical Design Report**
Middle Segment
State Route 56 Project
City of San Diego, California
11-SD-56-KP 3.3 TO 10.5, EA 172820
Group Delta Project No. I-181-02

Dear Clark:

Transmitted with this letter are five copies of our Draft Geotechnical Design Report for the proposed Middle Segment of State Route 56 alignment in San Diego, California.

Concurrent with this geotechnical investigation, we also performed geotechnical type-selection investigations for the seven proposed bridge structures in the Middle Segment, namely (west to east), Carmel Valley Road Undercrossing, Gonzales Creek Bridge, Camino Santa Fe Overcrossing, Rancho Santa Fe Farms Overcrossing, Vehicular Undercrossing at Station 87+96.601, McGonigle Creek Bridge, and Camino Ruiz Undercrossing. The results of these investigations were provided in separate Bridge Type Selection Reports. Laboratory testing is presently underway and the results of the laboratory testing will be included in the final report.

We appreciate the opportunity to serve on your design team for this project. Should you have any questions, please give us a call at (949) 975-7474.

Very truly yours,
GROUP DELTA CONSULTANTS, INC.

Curt Scheyhing

Curt Scheyhing
Project Engineer

Barry R Bevier

Barry R. Bevier, P.E., G.E.
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
BARRY R. BEVIER
No. 143
Exp. 12/31/00
GEOTECHNICAL
STATE OF CALIFORNIA

Jeff Brown, C.E.G.
Project Geologist

Kul

Kul Bhushan, Ph.D., G.E.
President

REGISTERED PROFESSIONAL ENGINEER
KUL BHUSHAN
GE 000144
Exp. 12/31/01
GEOTECHNICAL
STATE OF CALIFORNIA

3347 Michelson Drive, Suite 390 ▲ Irvine, California 92612-1692 ▲ (714) 975-7474 *voice* ▲ (714) 975-7390 *fax* ▲ gdcoc@aol.com *e-mail*
4455 Murphy Canyon Road, Suite 100 ▲ San Diego, California 92123-4379 ▲ (619) 573-1777 *voice* ▲ (619) 573-0069 *fax* ▲ gdcsd@aol.com *e-mail*

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

DRAFT GEOTECHNICAL DESIGN REPORT
MIDDLE SEGMENT
STATE ROUTE 56 PROJECT
CITY OF SAN DIEGO, CALIFORNIA
11-SD-56, KP 3.3/10.5, EA 172820

1. INTRODUCTION

1.1 General

This report presents the results of a geotechnical investigation performed by Group Delta Consultants, Inc. (GDC) to provide recommendations regarding the design and construction of the Middle Segment of the proposed State Route 56 (Ted Williams Freeway) extending from Rancho Penasquitos to Carmel Valley, in the City of San Diego, California (See Site Location Map, Figure 1).

The County and City of San Diego and the California Department of Transportation (Caltrans) District 11 have authorized improvements of the Middle Segment of State Route 56 (SR-56). The development limits for the overall SR-56 improvement project extend from Interstate 15 (Escondido Freeway) in Rancho Penasquitos to Interstate 5 (San Diego Freeway) in Carmel Valley. The Middle Segment extends from metric Station 45+13.527 on the west (in Carmel Valley) to metric Station 109+00 on the east.

Our understanding of the proposed project is based on discussions with designers at Boyle Engineering Corporation, and the following drawings provided by Boyle: a 1:2000 scale plan and profile drawing entitled "SR-56 Selected Alignment," dated August 10, 1998, and "Planning Study" drawings for the proposed bridge structures dated 1-98 through 9-98.

1.2 Purpose and Scope of Work

The purpose of this report is to document subsurface geotechnical conditions, provide analyses of anticipated site conditions, and to provide recommendations for the design and construction of the roadway and ancillary structures (which may include culverts, retaining walls, and soundwalls). This report establishes a geotechnical baseline to be used in assessing the existence and scope of changed site conditions. This report is intended for use by the project roadway design engineer, construction personnel, bidders and contractors.

Specifically, our scope of work included:

- Review of plans and existing data.
- Drilling a total of 52 borings and excavating 80 test pits (see Appendix A),
- Field and laboratory testing of soil samples (see Appendices A and B),.
- Engineering analyses to develop geotechnical recommendations for site grading, cut and fill slopes, one retaining wall, and pavement design. No soundwalls or culverts are shown on the existing plans, and,
- Preparation of this report.

The design and construction of the project will be performed in accordance with current Caltrans Standard Plans and Specifications.

2. EXISTING FACILITIES AND PROPOSED IMPROVEMENTS

2.1 Existing Facilities

This investigation addresses that portion of the State Route 56 (SR-56) alignment referred to as the Middle Segment. The Middle Segment extends from the existing Western Segment of SR-56 in Carmel Valley (metric Station 45+13), to the western end of the proposed Black Mountain Road (BMR) Segment of SR-56 near Rancho Penasquitos (metric Station 109+00), a distance of approximately 6,390 meters. The alignment and base topographic map are shown at a scale of 1:2000 on the Geologic Map and Exploration Location Plan, Figure 2. This map should be used as a guide when reading the following sections.

The subject alignment extends primarily through currently and historically farmed agricultural lands that comprise the open areas between the communities of Carmel Valley and Rancho Penasquitos, in the City of San Diego (see Site Location Map, Figure 1). The alignment crosses notable physiographic features including (west to east) Carmel Valley Road (Sta. 50+90), Gonzales Creek (Sta. 57+70), Rancho Santa Fe Farms Road (Sta. 82+40), and McGonigle Canyon (Sta. 97+00).

On the west end of the segment, residential subdivisions have been constructed to the north and south of the project alignment up to about Station 51+00. Extending east from this area of concentrated development, the alignment traverses low hills and intervening drainages that remain in a generally natural condition. The only existing developments within the alignment east of Station 51+00, excluding farmland, are a former nursery area and adjoining residence and commercial yard (Sta. 74+20 to 77+60), and two commercial nurseries located adjacent to existing Rancho Santa Fe Farms Road (a 2-lane paved roadway at Sta. 82+40).

At a minimum, several significant utilities exist within the project alignment Overhead electrical and communication lines cross the proposed alignment between Sta. 49+00 and 51+00. Farther east, at Rancho Santa Fe Farms Road, a water main and sewer line are located under the pavement on the east side of the roadway. Underground electrical (and possibly communication) lines are indicated to be present under the sidewalk on the west side of the roadway. High voltage wires on tall transmission towers cross the alignment within a San Diego Gas and Electric easement at Sta. 90+80. In the bottom of McGonigle Canyon, a City of San Diego sewer easement crosses the alignment near Sta. 97+20. A 46 cm sewer pipe is buried within this easement. Other utilities may exist within the alignment. The contractor should perform an independent and thorough utility research. Provisions to protect-in-place or relocate utilities should be made prior to construction.

Significant quantities of fill within the alignment were observed within three of the intervening canyon drainages crossing the alignment (Sta. 55+55, Sta. 67+70 and

Sta. 74+40) and within commercial nurseries located on both sides of Rancho Santa Fe Farms Road (Sta. 82+40). Other fill areas are present at a former nursery area and adjoining residence and commercial yard (Sta. 74+20 to 77+60). These fills, with the possible exception of that underlying Rancho Santa Fe Farms Road, are presumably undocumented. Sliver fill slopes associated with these graded areas are up to 6 m in height, generally between 1:1.5 and 1:2 inclinations. Cut slopes of up to 3 m in height and between 1:1.5 and 1:2 inclinations have been made within the alignment in the nursery area east of Rancho Santa Fe Farms Road. No evidence of significant slope distress was observed on existing cut and fill slopes on or adjacent to the proposed freeway right-of-way.

2.2 Proposed Improvements

Construction of the Middle Segment of SR-56 will consist of cut and fill mass grading to provide finish grades for roadway improvements. The project will include grading for an approximately 50 meter-wide roadway incorporating 6 travel lanes, center median, and sideboard emergency lanes. Current plans indicate that only the 2 outboard travel lanes for each direction, with attendant emergency shoulder lanes, will be paved at this time. The third lanes will be developed as-needed, based on future traffic patterns.

A bicycle lane will also be constructed parallel to the south side of the base roadway for the full length of the middle segment, extending into portions of the existing Western Segment and passing through the length of the BMR Segment. The bicycle lane will typically be higher or lower than the adjacent roadway grade. The details of the Bike Path alignment and profile, including associated bridge structures (where required), have not been finalized as of this writing.

Blk Mtn Rd.?

Rough roadway grading will include excavation to depths of approximately 15 m (Sta. 90+40) and construction of embankment fills up to approximately 25 m (Sta. 98+00) in thickness. Design cut and fill slopes will be up to approximately 18 m (Sta. 62+00) and 27 m (Sta. 96+00 at west abutment of McGonigle Creek Bridge), respectively, generally at a maximum 1:2 (vertical to horizontal) inclination. According to preliminary "Planning Study" bridge plans, cut and fill slopes beneath bridge abutments will be constructed at 1:1.5 inclinations. Available plans indicate that maximum heights of 1:1.5 cut and fill slopes below bridges will be approximately 7 m (Sta. 82+40 at south abutment of Rancho Santa Fe Farms Road Overcrossing) and 28 m (southeast abutment of McGonigle Creek Bridge), respectively.

Additional structures (and approximate center station) associated with the project (west to east) include the Carmel Valley Road Realignment and Undercrossing (Sta. 51+42), the Gonzales Corridor Bridges (including the roadway and separate bicycle bridges, Sta. 57+60), the Camino Santa Fe Overcrossing (Sta. 60+09), the Rancho Santa Fe Farms Road realignment and Overcrossing (Sta. 82+47), the Vehicular Undercrossing (Sta. 87+96.6), the McGonigle Creek Bridges ((including the roadway and separate bicycle bridges, Sta. 96+96)), and the Camino Ruiz Undercrossing (Sta. 108+31). Type selection reports for these structures (except for the bicycle bridges) were provided to Boyle previously (GDC, 1999).

On-ramps and off-ramps are ultimately proposed for Camino Santa Fe Overcrossing and the Camino Ruiz Undercrossing, but are not included in this phase of construction, since neither road currently extends into the area of the proposed SR 56 alignment. Freeway on- and off-ramps are not planned for the Carmel Valley Road Undercrossing, the Rancho Santa Fe Farms Overcrossing or the Vehicular Undercrossing.

Also associated with the SR-56 roadway construction is, construction of one retaining wall along the north side of SR-56 between the start of the alignment (at Sta. 45+13.527) and Sta. 48+00. The wall will retain a 1:2 existing fill slope and will have a maximum height of about 3 m.

The proposed project alignment and grading based on Boyle Engineering Plans dated 8-10-98, is shown in Figure 2 (sheets 1-12), "Geologic Map and Exploration Location Map." This figure illustrates centerline alignment, areas of cut and fill, geologic formations, landslides, locations of geologic cross-sections, and locations of exploratory borings, and test pits, superimposed on the alignment plans (12 sheets). The bridge borings were also used in developing our geologic map and their locations are shown in Figure 2.

3. PERTINENT REPORTS AND INVESTIGATIONS

Our understanding of this project is based on discussions with civil engineers at Boyle Engineering Corporation (BEC) and our review of design plans for the proposed roadway, bridges and associated structures. In addition, we have reviewed available geologic, geotechnical, and soil survey reports that address portions of the alignment and our type selection reports for the proposed overcrossings, undercrossings and bridges for the project. A list of references reviewed is provided in Appendix E of this report.

4. PHYSICAL SETTING

4.1 Climate

The project alignment extends through the City of San Diego from the community of Carmel Valley to Rancho Penasquitos. The alignment is situated at elevations ranging from approximately 34 meters (west end) to 127 meters (east end) above mean sea level (MSL). The climate in this area is considered semi-arid. Applicable climatic data for the inland portions of the alignment is available from Marine Corps Air Station (MCAS) - Miramar on nearby Kearny Mesa. The monitoring station is situated at elevation 145 m, approximately 9,000 m south of the alignment. Precipitation records from this station indicate that average rainfall is approximately 27 cm per year with nearly 90 percent of that recorded in November through April. Average rainfall is highest in the months of January (5.7 cm) and March (5.0 cm).

At the western end of the alignment (closer to the coast) precipitation records are available from the City of Del Mar Fire Station, located approximately 5,600 m northwest of the west end of the project. This station, which lies at the mouth of San Dieguito Valley, is at an elevation of approximately 4 m above MSL. Precipitation records from this station indicate that average rainfall is approximately 28 cm per year with over 91 percent of that recorded in November through April. As with the MCAS - Miramar, average rainfall is highest in the months of January (6.2 cm) and March (6.0 cm).

Temperature records from the Miramar station indicate that average high temperatures range through the year from approximately 19°C in the winter-early spring to 27°C in summer months. The yearly average high temperature is 22°C. Average low temperatures range from approximately 7°C in the winter to 17°C in the summer. The annual average low temperature is approximately 12°C. Although temperature records are not available from the Del Mar Fire Station, average high temperatures are expected to decrease a few degrees and average low temperatures increase a few degrees in portions of the alignment closer to the coast (west end). Soil freeze/thaw conditions are not expected to exist within the project alignment.

4.2 Topography and Drainage

In general, the subject alignment traverses portions of the tops and flanks of ridges, and intervening drainages that characterize the dissected mesa topography common to the coastal plain areas of San Diego. Existing elevations along the alignment generally rise to the east, ranging from approximately 34 m at the west end of the project to 127 m at the future Camino Ruiz Undercrossing (Sta. 108+31).

Beginning at the western limits of proposed improvements (Sta. 45+13), the current alignment transitions from the paved lanes of the existing Western Segment to the narrow 2-lane Carmel Valley Road (CVR), which sharply diverges to the north from the proposed Middle Segment alignment. In this area, cut and/or fill slopes up to 5 m and 8 m, respectively, in height, and at 1:2 inclination, have been constructed along the north and south sides of the alignment for adjacent residential subdivisions.

At Sta. 49+60, the proposed SR-56 alignment continues northeast across the toe of a hillside, and the proposed centerline crosses existing CVR at Sta. 50+90. From here the alignment crosses a drainage (Sta. 51+40), which envelopes the route for the proposed realignment of CVR (at the location of CVR Overcrossing), and continues over the undeveloped lower flanks of the hillsides along the northern edge of McGonigle Canyon.

Progressing easterly along the cultivated and periodically-farmed lower slopes of McGonigle Canyon, the alignment crosses several southerly-flowing tributary drainages (including Gonzales Creek). Within this reach of the alignment, near Sta. 64+00, the alignment begins a gentle turn to the northeast, eventually climbing obliquely onto a north-south ridgeline. Proposed grading in this area consists primarily of alternates between cuts (ridgelines and upslope areas) and fills (drainage bottoms and downslope areas).

On the ridgetop (primarily a cut area), the alignment gently returns to an easterly heading, extending through a few residential properties and plant nursery/equipment yards along the mesa top. After crossing the cultivated and farmed flanks and bottom area of another tributary drainage (Sta. 79+45), the alignment traverses the ridgeline (at Sta. 82+80) that is westerly-adjacent to Rancho Santa Fe Farms Road. At approximately 97 m elevation, this is the topographically highest portion of the alignment north of McGonigle Canyon (and west of McGonigle Creek Bridge).

Extending east from Rancho Santa Fe Farms Road, the alignment begins a gradual turn to the southeast as it crosses a series of three recently-farmed ridgelines and intervening drainages on its approach to McGonigle Canyon. Proposed grading consists of cuts on ridgelines and fills in drainages. A major overhead powerline easement (transmission lines on tall towers) crosses the alignment in this area at approximately Sta. 90+80.

Where the alignment crosses McGonigle Canyon, existing topography drops to approximately 67 m in the channel of the perennially-flowing McGonigle Creek (Sta. 96+95). The proposed McGonigle Creek Bridge will span the canyon, supported at the abutments by extensive embankment fill. Continuing southeast from the creek channel, the alignment obliquely clips the lower slopes of a narrow ridgeline, dips into a narrow tributary drainage (Sta. 98+40), and climbs up the steep canyon wall, eventually crossing the narrow ridgeline (Sta. 99+80) overlooking McGonigle Canyon. The large fill to be placed for the eastern abutment of McGonigle Creek Bridge extends nearly to this ridgeline.

From a narrow cut area across the ridgeline, the alignment dips obliquely across two broad hillside swales, and an intervening ridgeline saddle (Sta. 101+90) before reaching a nearly 300 m-long topographic bench situated at elevations of approximately 115 to 119 m (Sta. 105+00 to 108+00). On this bench the alignment begins a gentle adjustment to the south as it approaches the western end of the Black Mountain Road Segment (Sta. 109+00). Proposed grading through this area generally consists of cutting on the ridgelines and filling in the hillside swale areas. Most of the alignment across the broad topographic bench will receive fill.

At the east edge of this bench, topography along the alignment climbs slightly and cuts across a narrow ridge at the site of the Camino Ruiz Undercrossing. Topographically, this is the highest point along the alignment at nearly 127 m in elevation. Proposed grading indicates that only the eastern abutment of the northern (west-bound) bridge at Camino Ruiz is located in a small cut area; the remainder is to be filled. East of Camino Ruiz, the alignment transitions into grading proposed for the Black Mountain Road Segment.

As a result of current and past agricultural activities along the alignment, native vegetation has been removed from most hillsides that have inclinations shallower than 1:4 and locally 1:3. Where found, typically along the sides of steep-sided drainages, native vegetation largely consists of a moderate to very dense covering of chaparral. Vegetation within the canyon bottom area of McGonigle Canyon and at the southern ends of tributary drainages at Sta. 51+40 and Sta. 79+40 support a dense riparian habitat of trees and bushes. In areas west of McGonigle Canyon, which are regularly farmed, seasonal regrowth of weeds and grasses are typically tilled under; those drainage bottom areas which are not regularly cultivated may have a dense regrowth of weeds and grasses. East of McGonigle Canyon, vegetation typically consists of a moderate to dense regrowth of weeds and grasses.

4.3 Man-Made and Natural Features of Engineering and Construction Significance

Residential subdivisions have been constructed to the north and/or south of the project alignment from the beginning of the project up to approximately Sta. 51+00. Proposed grading along the north edge of the alignment will include placement of fill against an existing fill slope to grade and cutting into the slope at the edge of the right-of-way. Plans indicate that a retaining wall, up to about 3 m in height, will be constructed along the north side from the start of the alignment to about Sta. 48+00. A concrete lined swale extending west from Sta. 48+40 exists at the toe of the fill slope in this area. The swale drains to a shallow 4.6 m diameter concrete and rock lined sump basin at Sta. 47+10.

Along the southern edge of the alignment, a cut and fill slope extends from the SR-56 alignment down to existing residential properties to the South. The modifications to this slope will be largely dependent on the proposed grading for the bicycle path, which has not yet been determined.

Many side canyon drainages along the alignment have at least a veneer of fill soils and debris from local dumping. Our explorations indicate that extensive debris fills are present in drainages at Sta. 55+60, Sta. 67+75, and Sta. 71+40. Debris fills were observed to have high organic content (from dumping of vegetative waste), and to contain other miscellaneous materials such as wood, plastic, metal, and concrete debris. These unsuitable materials will require removal and offsite disposal prior to placing new fill, and could represent a significant effort during grading. Areally extensive (non-debris) fill soils are present in the plant nursery areas east and west of Rancho Santa Fe Farms Road.

Based on review of aerial photographs, surficial reconnaissance, and subsurface data collected during the investigation, several landslides and possible landslides were mapped along the alignment. Preliminary plans indicate that embankment fills will be placed on suspected landslides beneath the west abutment of Gonzales Creek Bridge and the east abutment of McGonigle Creek Bridge. Fill slopes will be placed over suspected landslides mapped on the lower slopes of drainages at Sta. 67+60, 69+60, 72+60, and Sta. 91+05 to 92+15. Possible landslides also underlie slope areas to be filled north of Sta. 97+60 to 99+20 (in the vicinity of east abutment, McGonigle Creek Bridge), north of the centerline at Sta. 99+80 to 100+60, and south of the centerline at Sta. 107+60 to 108+40. Cuts up to 7 m in height are planned on the south side of the alignment in a suspected landslide area from Sta. 99+55 to 100+80. The landslides will likely require removal of the landslide debris during project grading. Our preliminary recommendations for existing landslides are discussed in Section 7.1.3. and Table 4 of this report.

Our limited utility research indicates that overhead electrical and communication lines enter the alignment footprint from the northwest near Sta. 49+30, and parallel the north side of existing Carmel Valley Road (CVR). As CVR turns north (Sta. 50+40), the main overhead lines continue along its west side. A spur line extends due east across CVR and along the north side of an existing roadway entrance to residences and farms in McGonigle Canyon, exiting the south side of the alignment at about Sta. 51+50. The overhead lines along the roadway lie south of the proposed alignment.

Other known underground utilities along the alignment include those along the existing Rancho Santa Fe Farms Road (Sta. 82+40). A water line and sewer line are buried under the east side of the roadway pavement. Underground power (and possibly communication) lines are indicated to be present beneath the sidewalk on the west side of the road.

Farther east, high-voltage wires on tall transmission towers cross the alignment within a San Diego Gas & Electric easement about Sta. 90+80. Within McGonigle

Canyon, a City of San Diego sewer easement crosses the alignment about Sta. 97+20 in the canyon-bottom area. A 46 cm diameter sewer pipe is buried within this easement. Other utilities could be present in other areas of the alignment. The contractor should perform independent utility research to confirm the location of all utilities, and take measures to protect-in-place or relocate utilities as necessary prior to project construction.

4.4 Regional Geology and Seismicity

The SR 56 project lies within the Peninsular Ranges Geomorphic Province of California. The Middle Segment of the SR-56 alignment traverses the erosional remnants of Tertiary and Quaternary sedimentary rock formations, which are overlain by accumulations of Holocene (recent) overburden deposits and in many places by man-placed fill soils. The sedimentary rock formations lie unconformably on a erosional surface of older Mesozoic age granitic and metavolcanic bedrock which outcrops approximately 1700 m to the east (within the adjoining Black Mountain Road Segment of SR-56).

At the general latitude of San Diego County, the interaction between the North American and Pacific tectonic plates is considered to take place across a wide area extending from the San Andreas fault in the Imperial Valley, to nearly 100 km offshore to the west. The main fault zones west of the San Andreas include the San Jacinto and Elsinore fault zones (both northwest of the SR 56 alignment), the Rose Canyon fault zone (east of the alignment); and a complex system of northwest trending faults offshore from San Diego, which include the Coronado Banks, San Diego Trough, and San Clemente faults (see Figure 3).

The coastal plain of San Diego is traversed by two main zones of faulting: 1) Rose Canyon fault zone, which is considered to be active (MCE: M7), and 2) La Nacion fault zone, which is considered to be potentially active (MCE: M6½). The Rose Canyon fault zone is located about 9 km west of the alignment at its closest point. This active zone of faulting extends roughly parallel to much of coastal San Diego and is considered a significant potential hazard to the San Diego region (Berger and Schug, 1991).

The La Nacion fault extends from near the U.S./Mexico border north to Mission Valley. The La Nacion fault includes several subparallel north-trending fault strands that displace Tertiary and Quaternary sedimentary formations across a 2.5 km-wide area. The SR 56 alignment lies approximately 12 km north of the northernmost mapped traces of this fault zone.

The seismic ground shaking hazard to the SR 56 alignment is primarily controlled by the Rose Canyon fault zone, and to a lesser degree, by the La Nacion fault zone. More distant faults which could produce strong ground shaking along the alignment, include the Elsinore and San Jacinto faults located approximately 45 km and 83 km to the northeast (at the closest point on the alignment), respectively, as well as the Coronado Banks fault located approximately 31 km to the west (offshore). A listing of regional faults and estimated fault parameters is provided on Table 1.

4.5 Soil Survey Mapping

For our study, we reviewed the Soil Survey of San Diego Area, California, prepared by the U.S. Department of Agriculture (USDA), Soil Conservation Service (1973). Although the survey focuses primarily on agricultural issues, the report includes estimated near-surface soil properties which may be significant in engineering and land use planning.

Our review of the Soil Survey report indicates that there are eight different soil units from seven soil series identified within the alignment study area. The soil series name, the specific soil map designation, general soil characteristics, and a general description of where the soils are mapped along the alignment (referenced to centerline station) are presented below in order of appearance west to east:

Huerhuero Series (HrC2 and HrD2) and Loamy Alluvial Land-Huerhuero Complex (LvF3) of the Huerhuero Series are found at 3 separate places along the alignment: 1) the lower hillsides at the west end of the alignment, encompassing the east-west portion of existing Carmel Valley Road, and extending up to the west slopes of Gonzales Creek (up to approximate Sta. 57+40), 2) the upper mesa top areas in the vicinity of Rancho Santa Fe Farms Road (about Sta. 79+60 to 86+00), and 3) the mesa top areas in the vicinity of Camino Ruiz (from about Sta. 106+00 to 109+00). An area of Loamy Alluvial Land-Huerhuero Complex is mapped in a narrow side canyon drainage between Sta. 55+00 to 56+00, below hillside areas designated Huerhuero Series. Soils associated with the Huerhuero Series are typically on the order of 1.7 m in thickness and consist of silty topsoils, sandy residual clay, and a clayey sand weathering profile. Plasticity indices of these soils range from 5 to 10 for topsoils and weathered formation, to 15 to 30 for the residual clay horizon. Huerhuero soils are considered severely erodible, but good for use as road fill.

Salinas Series (SbC) soils are found along the alignment in the major canyon bottom areas within and adjacent to McGonigle Canyon, including Gonzales Creek (Sta. 57+40 to 58+00), the mouth of two unnamed tributary drainages (at Sta. 65+30 to 65+90 and Sta. 69+60 to 69+80), and the McGonigle Creek crossing (from Sta. 96+40 to 97+40). Soils classified as the Salinas Series (SbC) are typically on the order of 1.6 m in thickness, and are characterized as clay and silt with plasticity indices ranging from 10 to 25. They are considered moderately erodible, and poor for use as road fill.

Olivenhain Series (OhE) is the dominant soil type mapped on middle to lower hillsides, and within hillside drainages, in areas east of Gonzales Creek. These soils cover most portions of the alignment from Sta. 58+00 to 74+80, and from Sta.

79+00 to 106+00. The Olivenhain Series is described as being on the order of 1.5 m in thickness, and composed of sandy clays with some clayey sands, both with a large percentage of gravels. Plasticity indices range from 5 to 10 for topsoils, and 15 to 30 for residual clay horizons. The soils are described as severely erodible, and fair to poor for use as road fill.

Las Flores Series (LeC2) soils are mapped on the upper ridgeline areas between Sta. 74+80 to 79+00 and from Sta. 92+60 to 94+00. These soils are described as on the order of 1.2 m in thickness, and consisting of a thick residual clay horizon (plasticity index 20-35) between non-plastic silty sand layers of topsoil and weathered formation. The Las Flores Series is considered severely erodible, and good to poor for use as road fill.

Linne Series (LsE) soils are mapped on the upper and middle ridgeline areas that are topographically below those mapped as Huerhuero Series soils (at Sta. 85+80 to 82+20 and Sta. 89+00 to 91+00). The Linne Series soils are on the order of 0.9 m in thickness, and generally composed of silty lean clay. Plasticity indices range from 15 to 30. The clay is considered moderately erodible, and poor for use as road fill.

Diablo Series (DaC) soils are mapped across the mildly-dissected lower mesa top areas from Sta. 102+00 to 106+00. The Diablo Series soils are generally on the order of 0.8 m in thickness, and characterized as silty fat clay (plasticity indices of 30 to 40). The clay is considered slightly erodible, and poor for use as road fill.

5. EXPLORATION

5.1 Soil Drilling, Excavation and Sampling

Field studies for the SR-56 project included subsurface excavations to investigate proposed cut and fill areas and geologic features along the alignment. This work was initiated on August 13, 1998 and completed on January 11, 1999. During this time, 9 hollow stem auger borings, 43 bucket auger borings, and 80 backhoe test pits were excavated. The work also included the grading of access roads to several of the drill sites.

Test borings were advanced to depths ranging from about 6.2 to 29.0 m. In general, test borings were intended to extend through overburden soils or landslide debris into formational material and/or approximately 3 m below proposed road grade. However, at several locations, layers of cemented sand precluded the excavation of the test exploration to the target depth (see Table 2).

Backhoe pits were excavated at various locations to investigate overburden thickness (alluvium/slopewash, topsoil/colluvium or fill), and local geologic conditions. Backhoe test pits excavated for the project ranged from 1.4 to 5.5 m in total depth.

Both disturbed and relatively undisturbed soil samples were recovered from the test excavations. Sampling depths are noted on the boring and test pits logs presented in Appendix A. A detailed description of the field program, including excavation equipment and type of sampling, is provided in Appendix A. The location of all the test explorations is indicated on the Geologic Map and Exploration Location Plan, Figure 2. Groundwater summary is provided in Table 3.

5.2 Geologic Mapping

A surficial geologic reconnaissance was performed along the alignment during the period when field explorations were made. Additional field mapping was performed after office review of the excavation logs. In addition, our work included a review of available geologic and geotechnical reports (see References, Appendix E). Based on available information, and interpolation / extrapolation between exploration locations, a geologic map of the alignment was prepared. The map presents major geologic features, including soil / formation type and location of suspected landslides. The interpreted surface geology is presented on the Geologic Map and Exploration Location Plan, Figure 2.

5.3 Geophysical Studies

Geophysical surveys were not performed for this investigation.

5.4 Instrumentation

Geotechnical instrumentation was not installed during this investigation.

5.5 Exploration Notes

The results of our field program indicate that the subsurface materials along the alignment are generally rippable sedimentary formations. Several test excavations encountered conditions of refusal during drilling / excavation prior to achieving target depths. The cause of refusal was generally the presence of well-cemented sand layers within the formational materials. Refusal conditions are summarized in Table 2.

Extensive areas of dumped rubbish, debris, and agricultural waste are present in many of the Canyon areas. Where these materials exist within the limits of the grading, they will require removal and offsite disposal.

6. GEOTECHNICAL TESTING

6.1 In Situ Testing

Standard Penetration Tests (SPT) were performed in the hollow-stem auger borings to evaluate the density or consistency of the subsurface materials. The penetration resistance, or blow counts, and detailed description of the tests are presented in Appendix A.

6.2 Laboratory Testing

Laboratory tests were performed to characterize the soils and to develop indices and engineering properties of the soils. Descriptions of laboratory testing program and test results are provided in Appendix B. Laboratory tests performed consisted of :

- Atterberg Limits (Plastic and Liquid Limits Tests)
- Corrosivity Tests (pH, sulfates, chlorides, and electrical resistivity)
- Compaction Test (Max. Density- Optimum Moisture Content)
- Direct Shear Test
- Grain Size Distribution Test
- Pocket Penetrometer Test
- R-Value Test
- Sand Equivalent Test
- Wash Analysis (% Passing #200 Sieve or Fines Content)

Laboratory testing is in progress and will be submitted later.

7. GEOTECHNICAL CONDITIONS

7.1 Site Geology

The site is underlain by man-placed fill soils, Quaternary age overburden deposits (including alluvium, slopewash, colluvium and surficial topsoils), Quaternary age stream terrace deposits and Lindavista Formation, Eocene age Mission Valley Formation (including cobble interbeds similar to the Stadium Conglomerate) and undifferentiated Eocene formations of the La Jolla Group. These soil and rock units are described in the following paragraphs, generally in order of increasing age. The geologic symbol for each mapped unit is shown after the formal name of the unit. The estimated areal extent of each unit in the near surface, with the exception of the surficial soil horizons (topsoil, residual clay, and cultivated land) and localized zones of shallow fill, is shown within the right-of-way on the Geologic Map and Exploration Location Map, Figure 2. Confirmed or suspected areas of landsliding, designated by the map symbol Qls, are also indicated on Figure 2. A discussion of landslides mapped along the alignment is provided in Section 7.1.3 of this report and the landslides are summarized in Table 4. A cross-section along the SR-56 centerline (Figure 4) and a series of cross-sections perpendicular to the centerline (Figures 5 through 29) illustrate the general layering and vertical profile of the various geologic units along the alignment. Cross-sections through significant landslides are shown in Figures 30 through 32.

7.1.1 Lithology

7.1.1.1 Fill Soils (Qf, Qcf, Qdf)

Compacted fill (Qcf), undocumented fill and road fill (Qf), and loose debris fill (Qdf) are present in portions of the project right-of-way. In most areas, the fill appears to consist of locally-derived soil consisting primarily of silty to clayey sand with some sandy clay. Several areas of fill containing a large percentage of debris (organic and inorganic) were encountered in our test excavations.

Considering the current and past agricultural activities that occurred along most of the alignment, it is likely that many other small areas of clean fill and/or debris fill are present to significant thickness within the project alignment. Significant areas of fill observed during field studies are described in the paragraphs below and are summarized in Table 5.

Compacted fill (Qcf)

Starting at the west end of the alignment and up to Sta. 49+20, presumably compacted fills (compaction records were not obtained) were placed to fill a large tributary drainage (Bell Valley) that angled northeast-to-southwest across the alignment. Grading for the northerly adjacent residential subdivision resulted in the construction of 1:2 inclined fill slopes that extend into the alignment right-of-way. Similarly, fill slopes inclined at 1:2 descend from the proposed right-of-way down to an existing subdivision on the south side of the alignment in this area.

Undocumented fill & Road Fill (Qf)

Several areally extensive undocumented fill areas are present in the vicinity of the plant nurseries and residences located on the ridgelines near the northern-most reaches of the alignment. In this area, from Sta. 74+80 to 77+60, several fill areas for building pads were constructed. A sliver fill into an adjacent drainage was observed south of Sta. 77+60. These fills are estimated to be less than 3 m in thickness, and will be removed by cuts during project grading.

Fill soils were placed for the roadway alignment of Rancho Santa Fe Farms Road. Test excavations for the Rancho Santa Fe Farms Road Overcrossing (GDC, 1999) indicate that this road fill consists of medium dense clayey sand that extends to at least 3.2 m in maximum thickness.

Our field studies indicate that minor amounts of uncompacted road fill underlies narrow portions of the alignment near Sta. 63+00, north of Sta. 65+30, and crossing at Sta. 98+60. Test explorations (MGD-TP-63) and visual estimates indicate that road fills are up to 1.2 m in thickness and composed primarily of silty sand.

Debris Fills (Qdf)

West of Rancho Santa Fe Farms Road, a large volume of dumped fill soils is present within the alignment between Sta. 81+00 and 81+50. The fill piles are up to 2 m in height and include some concrete and asphalt debris. Westerly-adjacent to Rancho Santa Fe Farms Road are rows of loose fill soils placed for growing trees. These fills are typically up to 1 m in height and appear to consist of organic matter mixed with clayey sand soil.

Test pits made in the nursery terrace fills east of Rancho Santa Fe Farms Road (Sta. 82+60 to 83+90) indicate that this material is typically silty to clayey sand with a high organic content and some debris. The soil has a strong fertilizer odor. This material was observed up to about 3 m in thickness in Test Pit MGD-TP-37.

Debris fill soils, consisting of trash, yard waste, agricultural operational waste, and concrete debris mixed with soil have been dumped and spread within side canyon drainages crossing the alignment at Sta. 55+40 to 55+70, Sta. 67+60 to 67+90, and Sta. 71+20 to 71+60. This material is not suitable for use in compacted fills, or for support of the proposed fills. Fill thickness within these drainages, as indicated by test explorations, are in excess of 5.5 m (MGD-TP-69 through -71), approximately

1.5 m (MGD-TP-58 and -60), and on the order of 2.4 m (MGD-TP-54), respectively, in the three drainages. Test excavations indicate that the fill was placed over natural alluvial soils. Significant volumes of removal and off-site disposal of these materials should be anticipated during grading.

Observations in Test Pit MGD-TP-43 (Sta. 72+60), excavated upstream from MGD-TP-54 (Sta. 71+37), indicated that 0.6 m of burned brush and tree trimmings exists under 2.3 m of recent alluvial deposits. The layer of organic debris was in-turn underlain by an additional 0.6 m of alluvial soils. Similarly, in Test Pit MGD-TP-47 (south of Sta. 79+20), 0.9 m of recent alluvium had accumulated on 0.3 m layer of trash and vegetation waste which was observed to overlie an older deposit of alluvial soil. Based on apparent historic dumping practices and disturbance, it is possible that zones of debris and organic waste may be covered by recent accumulations of alluvium in other portions of drainages within the proposed alignment. Significant volumes of removal and off-site disposal of these materials should be anticipated during grading.

Test Pits MGD-TP-55 (south of Sta. 71+00) and MGD-TP-72 (north of Sta. 54+80) were excavated on hillside areas above and adjacent to debris-filled drainages. These excavations encountered 0.8 m (with debris lenses) and 1.1 m of fill soils, respectively, indicating that dumping extends out of the drainage bottoms in some areas.

Test Pit MGD-TP-30, excavated in a narrow, side canyon drainage south of Sta. 87+20, encountered what appeared to be a backfilled excavation. Over 2.4 m of loose silty sand soil containing some debris was observed in the test pit.

7.1.1.2 Alluvium (Qal) and Slopewash (Qsw)

Alluvial/slopewash deposits exist on the hillsides and in the bottoms of the canyon drainages within the project area. Test explorations in steeper hillside drainages (ex. at Sta. 53+50) and narrow, side canyon drainages (ex. at Sta. 60+10 and Sta. 69+70) along the alignment indicated loose sand, clay and gravel alluvium up to 2.7 m in thickness. As noted above, significant thickness of fill soils have locally been placed within drainages, covering the natural alluvial deposits. In addition, recent deposits of loose alluvium (1.7 m thick in Test Pit MGD-TP-43, Sta. 72+60) have accumulated over debris fills and older alluvial deposits in some drainages.

Larger side canyon drainages (Sta. 65+70) and some of the longer narrow, side canyon drainages (Sta. 91+80) typically contain thicker sections of alluvium (up to an estimated 6 m). The alluvium in the larger and more developed side canyon drainages typically consists of 1 to 2 m of loose clayey sand overlying thickly interlayered medium dense to locally dense sands and clays.

The major drainages that cross the alignment include Gonzales Creek and McGonigle Canyon. At Gonzales Creek (Sta. 57+70), test borings for the Gonzales Creek Bridge (GDC, 1999) indicate that nearly 7.5 m of alluvial soils have been deposited in that area. Similarly, alluvium up to 9.1 m in thickness was encountered in test borings (MGD-HSA-1 through -3, Sta. 63+50 to 66+50) made where larger side canyon drainages empty into McGonigle Canyon. In the confines of McGonigle Canyon (between Sta. 96+40 and 97+40), test excavations for this study (MGD-HSA-6 through -8 and MGD-TP-16) and test borings for the McGonigle Creek Bridge (GDC, 1999) encountered alluvial soils to depths of up to about 8 m within the canyon bottom. Based on data from these explorations, and analysis of cross-sections through the canyon, we estimate that alluvium could be present to depths of up to 10 m in the canyon bottom where crossed by the alignment (see Figure 4). The alluvium in this area consists primarily of interlayered loose, to progressively denser with depth, sands and clays, often with a characteristic basal gravel layer.

7.1.1.3 Surficial Topsoils (unmapped)

Natural surficial soils have been disturbed to depths on the order of 0.3 to 1 m by recent and/or past agricultural cultivation over the vast majority of the alignment. Although in localized areas part or all of the surficial soils have been removed by agricultural and other activities, significant horizons of surficial soils, including topsoils, colluvium and/or residual clay, typically overlie formational units on the undeveloped hillsides and ridgelines throughout the alignment.

Where stream terrace deposits are present, they are typically overlain by topsoils consisting of up to 0.3 m of silty to clayey sand and/or a residual clay layer about 0.2 m in thickness. However, in Test Boring MGD-BA-23 (Sta. 61+55), terrace deposits were observed to be overlain by 1.2 m of clayey colluvial (slopewash) soils.

In Test Boring MGD-BA-1 (Sta. 108+44), sediments of the Lindavista Formation were overlain by topsoil consisting of silty to clayey sands with gravel (0.7 m in thickness) and a residual clay layer of sandy clay and gravel (0.3 m in thickness).

The Mission Valley Formation is the primary geologic unit exposed at the surface along the majority of the alignment east of McGonigle Canyon. This unit was observed to be overlain by up to 0.9 m of sand and clay topsoils overlying residual clay up to 0.6 m in thickness. Both horizons of these surficial soils locally contained many gravels.

Although high variability should be anticipated because of the wide range of sedimentary formations involved, surficial soils overlying sediments of the La Jolla Group (generally west of McGonigle Canyon) generally tend to be slightly thinner overall than those of the Mission Valley Formation. Surficial soils observed in our test explorations typically consist of up to 0.6 m of sandy clay topsoil overlying up to 0.6

m of residual fat clay. In some middle to lower hillside areas, up to 1.2 m of topsoil/colluvium composed of clayey sand to sandy clay replaces the typical topsoil/residual clay sequence.

7.1.1.4 Landslide Debris (Qls)

Numerous fine grained interlayers were observed to be irregularly present within the primarily granular subsurface materials within the alignment. Owning to the presence of such layers, when weakened or adversely bedded, coupled with the presence of groundwater and/or removal of confining materials by erosion or excavation (ex. stream downcutting or grading), these materials can be susceptible to shallow or relatively deep-seated landsliding. In addition, in areas where loose overburden deposits (slopewash, alluvium, topsoils, etc.) accumulate near the base of steep slopes, these materials are prone to shallow slumping when subjected to saturation from heavy rains.

Based on our field studies, several landslides of varying size are interpreted to be located within and adjacent to the areas of proposed grading along the alignment. Further description of these landslides is provided under Section 7.1.3, Natural Slope Stability. The estimated areal limits of these landslides are indicated on the site geologic maps (Figure 2) using the designation Landslide Debris (Qls). The profile of these landslides along the alignment centerline is indicated on Figure 4. A summary sheet of landslide features that are expected to be affected by the proposed grading is provided as Table 4. More detailed cross-sections of some of the larger landslides, are presented on Figures 30 through 32.

7.1.1.5 Stream Terrace Deposits (Qt)

Our investigation indicates that small remnants of stream terrace deposits extend into the alignment along the fringe of McGonigle Canyon between Sta. 60+60 to 62+30, Sta. 67+00 to 67+60, and Sta. 68+05 to 69+20. Based on our field studies, these deposits appear to be on the order of 5 m in maximum thickness (within Test Boring MGD-BA-23, Sta. 61+55) and consist primarily of silty to clayey sands and gravels. Smaller remnants of the stream terrace deposits may have been concealed on the lower hillsides in this area by surface disturbance from agricultural activities.

7.1.1.6 Lindavista Formation (Qln)

Older, more indurated marine terrace deposits characteristic of the Lindavista Formation overlie the far eastern end of the alignment (north of Sta. 108+20 to 109+00) in the area of the Camino Ruiz Undercrossing. The Lindavista Formation is mapped in this area above an elevation of approximately 123.5 m. In general, these deposits consist of very dense clayey sand to sandy gravel with rare lenses of sandy clay. This unit is typically characterized by variable amounts of reddish iron oxide cementation which may cause some local excavation difficulties.

7.1.1.7 Mission Valley Formation (Tmv)

Beneath the overburden soils and Lindavista Formation (where present), sediments consisting of dense silty to clayey sands and sandy gravels (locally well cemented) with interbeds of hard clay and sandy clay, comprise the majority of the subsurface materials in the alignment area east of McGonigle Creek Bridge. Mission Valley Formation also caps the underlying La Jolla Group Formations in isolated areas west of McGonigle Creek Bridge (Sta. 81+50 to 82+40, 89+60 to 90+60, 84+60 to 86+00), as shown in Figures 2 and 4. These sediments appear to be similar in-part to sedimentary formations belonging to the Poway Group (Mission Valley Formation and Stadium Conglomerate) regionally mapped by Kennedy (1975) in the general project area. However, during our field investigation, the similarity in appearance, and interfingering nature of these geologic units did not facilitate reliable mapping on a formational basis. This difficulty was experienced by other consultants (Geocon, 1998) in their investigations for future subdivisions to the southwest and east of the eastern end of the project alignment and in the vicinity of McGonigle Canyon.

Data from these investigations (Geocon, 1998) also suggest that the base of the Poway Group (designated Mission Valley Formation for this study) is on the order of 89 m on the southeastern flanks of McGonigle Canyon and rising to 94 m on the northwest canyon flanks. In general, the basal contact between Tmv and the underlying La Jolla Group (Tlj) is interpreted to be at the bottom of the lowest observed major gravel bed, which may signify the base of the Stadium Conglomerate. The results of our exploration suggests that this contact would be closer to an elevation of 92 m on the hillsides of McGonigle Canyon, rising to a height of about 95 m on the ridgeline containing Rancho Santa Fe Farms Road at Sta. 82+40 (See Figure 4). This gently rising trend is reflected in the Tmv/Tlj contact shown in Figure 2 and 4. However, due to the complex interfingering of the formations, the actual contact elevation may vary locally up to a few meters from the value indicated in the figures.

In consideration of the similarity between engineering characteristics, and for ease in geologic evaluation, we have described both Poway Group formations within the project area (Mission Valley Formation and Stadium Conglomerate) as being assigned to the Mission Valley Formation. It is recognized that substantial gravel layers, possibly characteristic of the Stadium Conglomerate, are interlayered with more traditional Mission Valley Formation sediments. Our exploration indicates that such gravelly material comprises a large portion of the subsurface between general elevations of approximately 100 to 117 m in areas from approximately Sta. 105+00 to Sta. 109+00 and beyond. Based on proposed grades, it is not anticipated that significant excavation will occur in gravel beds assigned to the Mission Valley Formation. However, deep excavation into gravely layers for localized improvements may be difficult due to gravel size, gravel content and local cementation.

7.1.1.8 La Jolla Group (Tlj)

Our investigation indicates that sedimentary layers characteristic of several Eocene age formations underlie the large majority of the near-surface area north and west of the McGonigle Creek Bridge. Materials typically assigned to the Scripps Formation, the Torrey Sandstone, and the Del Mar Formation , all parts of the La Jolla Group (Kennedy, 1975), were commonly observed to be interlayered in test explorations. Because this extensive interfingering did not facilitate formational differentiation, we have mapped Eocene sediments beneath the Mission Valley Formation as the La Jolla Group.

In general, the La Jolla Group materials consist of thick layers of dense to very dense pale gray to light brown silty to clayey sand with interbedded gravels (typically found in the Scripps Formation and Torrey Sandstone) with interbedded dense to very dense pale olive to light yellowish-brown silty to clayey sands and silts (typical of Scripps Formation and Del Mar Formation). Relatively thin interbeds of hard silts and clays were typically observed within this unit. The La Jolla Group is mapped below the Mission Valley Formation at elevations below 92 m (McGonigle Creek Bridge area) to 95 m (Rancho Santa Fe Farms Road area).

7.1.2 Structure

The large majority of the subsurface materials encountered in our test explorations appeared to be massive or without discernible bedding. However, many bedding and contact attitude measurements were recoverable from the large-diameter bucket auger test excavations. These measurements, which were taken throughout the alignment, indicate a regional bedding inclination of 2 to 6 degrees of dip in a south to east-southeast direction. Localized variations in bedding typically yielded measurements of up to 22 degrees in a similar south to east-southeast direction or dip reversals of up to 9 degrees to the north to west-northwest. On a lesser scale, bedding was observed to locally dip in a north to northeast direction at angles typically in the range of 2 to 9 degrees, but of up to 34 degrees, primarily in the area of the alignment between Sta. 61+00 and Sta. 72+00. These dip variations, particularly those at higher dip angle, likely represent localized depositional cross-bedding.

No evidence of stratigraphic displacement or faulting was observed during our field exploration, and no mapped faults were discovered within, or trending toward, the project alignment in the geologic literature reviewed.

7.1.3 Natural Slope Stability

Natural hillside slopes along the alignment range from the relatively flat lying mesa tops to a typical maximum of 1:2 inclination on canyon slopes. The steepest natural slopes along the alignment are located on the northwest-facing hillsides below Sta. 71+60 to 75+00, and the lower slopes and side canyon slopes along the southeast flanks of McGonigle Canyon (Sta. 97+40 to 99+00). Existing fill and cut slopes in graded portions of the alignment (Sta. 74+80 to 77+70 and Sta. 81+00 to 84+00) are estimated to have been constructed generally at 1:1.5 to 1:2 inclinations.

The primarily granular formational soils at the site often contain clay/silt interbeds. Where stream channels have downcut through these formational soils, and adverse bedding and/ or groundwater conditions exist, these materials can be susceptible to shallow or relatively deep-seated landsliding. In addition, in areas where loose overburden deposits (slopewash, alluvium, topsoils, etc.) accumulate near the base of slopes, these materials are prone to shallow slumping when saturated from heavy rains and /or irrigation.

Several side-hill and ridgeline topographic benches, possibly indicative of landsliding, were observed in numerous areas along the alignment. Through test borings, the majority of these features were determined to be related to differential weathering within the formational soils underlying the alignment area. However, several landslides were confirmed or highly suspected based on downhole logging of test borings and/or analysis of stereographic photographs (Caltrans, 1996).

Regional geologic literature reviewed for our study (Kennedy, 1975; Tan, et. al., 1995) did not indicate that landslides are mapped along the proposed alignment. The local Seismic Safety Study (City of San Diego, 1995) maps the eastern flanks of Gonzales Creek within and north of the alignment (sta. 58+00) as possibly being underlain by a landslide. This possibility was restated in the geology report (Apex/GDC, 1995) prepared to support the environmental studies.

Our analysis of aerial photographs (Caltrans, 1996), field reconnaissance, and test explorations in this area indicate that landslides are present on the western flanks of Gonzales Creek (as discussed in the following sections) but not on the eastern flanks as previously hypothesized. The anomalous topography in this area, originally thought to be landslide related, is an erosional feature in alluvial deposits.

The landslides along the alignment are discussed in the following sections, and are summarized in Table 4.

7.1.3.1 LS-1 (1235CVR)

A shallow landslide is located on the eastern edge of the proposed realignment of Carmel Valley Road in the area of CVR Sta. 12+35 to 13+10. Observations within Test Boring MGD-BA-38 suggests that this landslide is on the order of only 2 m in thickness.

7.1.3.2 LS-2 (56-57)

A series of landslides, both shallow and deep-seated, are suspected along the east-facing slopes of Gonzales Creek in the vicinity of the proposed western abutment of the Gonzales Creek Bridge (Sta. 56+20 to 57+45). Test Boring MGD-BA-34, located at the south edge of the alignment below Sta. 56+55, encountered a basal landslide plane at a depth of 9.4 m. Landslide debris, composed primarily of disturbed formational materials, was logged to a depth of 2.7 m within Test Boring MGD-BA-33 (Sta. 57+20). Based of aerial photograph review, adjoining areas to the north and north-northeast are suspected as being underlain by additional landslide materials. Additional subsurface exploration in this area will be necessary to fully characterize the depth and extent of landslides in this area.

7.1.3.3 LS-3 through LS-7 (67-80)

Areally small landslides are present at the base of hillsides in several areas within and adjacent to the alignment. Typically, these landslides have occurred within thick accumulations of overburden soils at the base of steep hillsides and are on the order of 2 m in maximum depth. Such shallow landslides were observed to extend within or be immediately adjacent to proposed grading limits in areas southeast of Sta. 67+60 and northwest of Sta. 72+70 and Sta. 74+20.

A small, elongated landslide is interpreted as producing the narrow topographic bench on the lowest portion of the western hillside at the drainage crossing the alignment about Sta. 69+60. The observed bench, particularly because of its narrowness and length, could reflect differential weathering of formational materials. Based on topographic relationships, this landslide, if present, would likely be less than 3 m in maximum thickness.

7.1.3.4 LS-8 & LS-9 (91-96)

A group of landslides is suspected on the canyon walls extending up from the drainage that crosses the alignment at Sta. 91+90. Similarly, a large topographic bench possibly expressing a landslide, is located on the south-facing slopes of

McGonigle Canyon, south of Sta. 95+00 to 96+00. Although not investigated through test excavation, topographic position suggests that these landslides are similar depth and nature to those mapped in the western portions of the SR-56 Black Mountain Road Segment (GDC, 1999). As such, the base of disturbed material is expected to be on the order of 3 to 3.5 m in depth.

Several landslides are believed to be present on the northwest-facing slopes of McGonigle Canyon along the alignment route. One suspected landslide is located as underlying the area of the eastern abutments of the proposed McGonigle Creek Bridge (approximate Sta. 97+60). A test boring excavated for the bridge-type selection report (GDC, 1999) encountered apparently weakened formational material to a depth of 4.3 m and irregular sampler blow counts (a measure of soil strength) to a depth of 14 m, which is roughly equivalent to the adjacent canyon bottom. This indicates the possibility that landslide debris may be present, and that the debris could be composed of both relatively intact and broken-up pieces of formational soils. No distinct indications of landsliding were observed from the subsurface samples collected, but since the boring was small in diameter, down-hole observation was not possible.

7.1.3.5 LS-10 & LS-11 (98-101)

Interpretations from downhole logging indicate that a segmented large landslide underlies the northern end of the ridgeline to the immediate north of the alignment between Sta. 97+60 to 99+20. The basal slide plane was observed at depths of 19.5 m (Test Boring MGD-BA-6) in the upper landslide block. In the lower landslide block, Test Boring MGD-BA-43, encountered the slide surface at a depth of 12.5 m. Observations in this boring indicated that the toe of the slide mass has overridden alluvial deposits within the canyon bottom area. This encroachment of the slide mass onto the alluvial plain of McGonigle Canyon may have contributed to the anomalous deep erosion that has occurred on the opposing south-facing flanks of the canyon, north of the alignment.

Brecciated fine-grained soil was observed in Test Boring MGD-BA-5 (Sta. 100+18) dipping obliquely out-of-slope at a depth of 9.8 m. A second boring (MGD-BA-42) drilled downslope nearby, encountered a sheared silt and clay layer oriented more directly out-of-slope at a depth of 13.8 m. The relationships between depth and orientation of the observed slip planes suggests that they represent the basal plane of a deep-seated landslide. However, the possible limits of such a landslide is not readily apparent upon field observation or viewing aerial photographs. Based on topographic relationships, we have estimated that this landslide may cross the alignment between Sta. 99+55 to 100+80. Both cut and fill slopes are proposed within this suspected landslide area.

7.1.3.6 LS-12 (107-109)

Another landslide is suspected underlying the south edge of the proposed alignment from Sta. 107+60 to 108+40 in the vicinity of the proposed Camino Ruiz Undercrossing. A landslide in this area is suspected based on a pronounced topographic bench and a distinct redirection of the adjacent drainage to the west. However, this feature could also be attributed to differential weathering as has been seen to occur in many other portions of the alignment. A test exploration in this area would aid in determining the nature of the observed topographic conditions.

7.2 Subsurface Soil Conditions

7.2.1 General Description

Subsurface conditions along the alignment were investigated by drilling 52 borings, excavating 80 test pits, and performing laboratory tests on selected samples from the borings and test pits. The subsurface conditions along the alignment are quite variable and consist of compacted, uncompacted, and debris fill, slopewash / alluvium / top soils, and consolidated formational soils of the Stream Terrace Deposits, Lindavista Formation, Mission Valley Formation, and La Jolla Group (Refer to Geologic Profile of SR-56 Centerline, Figure 4).

Significant amounts of cuts and fills will be performed to achieve the proposed roadway grades. In the fill areas, the soils near the finish grade will consist of compacted fill consisting of the materials obtained from the cut areas. Fills will generally be used to cross the many alluvial drainages along the alignment.

Canyons to receive fill generally contain variable depths of alluvium (up to as much as 10 m in thickness) and debris fills (as much as 5.5 m or more). The alluvium is generally composed of loose to dense sand to silty and clayey sand, with occasional gravels and cobbles, locally with layers of stiff to hard clays. Density of the alluvium generally increases with depth and material is loose in the upper 3 m. A basal gravel layer was encountered in some of the larger drainages (such as McGonigle Creek). Where fill is placed over alluvium, settlement of the embankments will occur due to compression of the alluvium, as discussed in Section 8.3.2. In addition, the loose granular soils below the water table have a high potential for liquefaction under the maximum credible earthquake. The loose granular alluvium to depths of about 3 m should be removed and recompacted before placement of embankment fills.

Significant quantities of debris fills (some of which are buried under recent alluvium) line many of the canyon bottoms along the alignment. These materials consist generally of silty to clayey sands mixed with organic plant waste, trash, plastic, wood, and concrete, and are generally considered unsuitable for use in compacted fills or in areas to receive new fill. These materials must be removed prior to filling the canyons.

In the cut areas west of McGonigle Creek Bridge (Sta. 97+00), formational soils of the La Jolla Group will be the predominant material exposed at roadway grade. The upper portions of some of the cut slopes in this area will also expose Mission Valley Formation and Stream Terrace Deposits.

East of McGonigle Creek Bridge, cuts will expose mostly formational soils of the Mission Valley Formation at roadway grade. The upper 2.5 m of the cut slope at the northeast abutment of Camino Ruiz Undercrossing (Sta. 108+50) is anticipated to expose the Lindavista Formation.

Existing compacted fill is present near the eastern terminus of the existing Western Segment of SR-56 (up to about Sta. 49+20), and in the adjacent subdivisions along both sides of the proposed alignment in this area. Presumably compacted fill, consisting of medium dense to dense clayey sands, also exists to depths of about 3.5 m at the location of Rancho Santa Fe Farms Overcrossing.

The residual soils, top soils, uncompacted fill, and slope wash generally form a thin layer, less than a few meters thick, over the formation soils and consist of loose to medium dense clayey and silty sands and soft to stiff sandy clays to fat clays. Some of the residual soils consist of highly plastic clays. These soils contain varying amounts of gravels and cobbles. These soils have low to moderate bearing capacity and high compressibility.

The formational soils belonging to the Stream Terrace Deposits, Lindavista Formation, Mission Valley Formation, and La Jolla Group generally consist of dense to very dense silty and clayey sands, with interbeds of stiff to hard sandy clays and fat clays, with variable amounts of gravels and cobbles. These soils generally have high bearing capacity and low compressibility. Where clay beds with adverse bedding inclinations are present near natural or graded slopes, these materials may be susceptible to landsliding.

From a foundation point of view, the retaining wall at the west end of the alignment will be supported in existing (presumable compacted) fill. The roadway pavement will be supported on either compacted fill or on formational materials.

7.2.2 Engineering Properties

The engineering properties of the soils used for slope stability and foundation analyses are summarized in Table 6.

7.3 Water

7.3.1 Surface Water

The only natural drainage crossing the proposed roadway alignment that was observed to perennially contain flowing surface waters is McGonigle Canyon (Sta. 96+80). Some of the larger side canyon drainages likely support surface water flow after significant rainfall events.

McGonigle Canyon, in the vicinity of the alignment crossing, is well-incised with steep side slopes of up to 1:2 inclination on the southern flanks and generally shallower than 1:4 on the northern canyon hillsides. The canyon floodplain is on the order of 80 m in width in the area of the alignment crossing. Based on existing conditions, typical runoff volume through the canyon ranges from low to moderate, and is expected to vary seasonally.

7.3.1.1 Scour

No scour reports were provided to us by Boyle Engineering. We recommend that an evaluation of the scour potential be performed for the McGonigle Creek Bridge and any other areas of stream crossing.

7.3.1.2 Erosion

Visual observations in drainages crossing the alignment do not indicate significant erosion that may be indicative of potential adverse effects to fill slopes planned in these areas. Significant erosion on existing cut and fill slopes in the project area was not observed. However, the periodic cultivation of the majority of hillside areas within the alignment tends to obscure the localized erosion that likely occurs during the rainy season.

7.3.2 Groundwater

Groundwater was encountered within alluvial soils in test borings (MGD-HSA-6 through -9) made in canyon bottom areas of McGonigle Creek. Groundwater was also encountered within alluvial deposits located in some of the side canyon drainages (MGD-HSA-9 and MGD-TP-16). Zones of perched groundwater were observed in formational soils in several of the hollow-stem and large-diameter bucket auger test borings made along the alignment, primarily in areas north of McGonigle Canyon. The depth and elevation of groundwater occurrences observed in our test explorations are summarized in Table 3.

In general, test explorations exhibiting groundwater were located in or adjacent to drainages where flowing waters could infiltrate and migrate laterally through the granular subsoils while perched on finer-grained horizons. In addition, many of the shallow-sloping hillsides and ridgetop areas along the alignment have been or are extensively irrigated to support agricultural pursuits. Irrigation systems for farming in the area were observed to be crude and prone to leakage, thereby providing artificial sources of water for percolation into the subsurface. As such, and considering the irregular interlayering of fine-grained horizons in the formational materials, it is likely that localized zones of seepage will be encountered during site grading. The occurrence of seepage will likely increase with the proximity to both active drainages and areas under extensive irrigation in the past.

A local groundwater table has likely developed in the vicinity of McGonigle Canyon. Information from test borings within the bottom areas of the canyon near the proposed bridge crossing indicate a water table exists in the alluvial soils at elevations of about 64 to 67 m. Similar groundwater elevations were observed in deep borings made on the adjacent hillsides (ex. MGD-BA-7).

Farther west, as the alignment descends onto the lower hillsides adjoining the canyon bottom area (Sta. 63+00 to 66+00), a local groundwater elevation on the order of 38 to 40 m was observed in test borings. Due to high clay content in the alluvial soils, water levels were not able to stabilize in the hollow stem auger borings made in the adjacent canyon bottom areas.

7.4 Project Site Seismicity

7.4.1 Ground Motion

Historical earthquakes greater than magnitude 5.0 during the period from 1800 to 1990 in an area within a 100 km radius from the project site are shown in Figure 3. The closest active and potentially active major faults to the sites are the La Nacion Fault (MCE = M6.5) and the Rose Canyon Fault (MCE = M7) located at a distance of 12 and 9 km at the closest point to the alignment, respectively. A summary of nearby faults is shown in Table 1. Selection of the design ground motion parameters is discussed in Section 8.1.1.

7.4.2 Ground Surface Rupture and Displacement Due to Faulting

The entire SR-56 Middle Segment alignment is not located within any Alquist-Priolo Earthquake Fault Zones. There are no known active faults that trend toward or through the project site. Therefore, ground rupture is not anticipated.

8. GEOTECHNICAL ANALYSIS AND DESIGN

8.1 Dynamic Analysis

8.1.1 Parameter Selection

The site is located in a moderately active seismic region of southern California that is subject to significant hazards from moderate to large earthquakes. Ground shaking due to nearby and distant earthquakes should be anticipated during the life of the facilities. We performed a deterministic seismic hazard analysis using the computer program EQFAULT (Blake, 1996). The program computes the peak ground horizontal acceleration from the "maximum credible" and "maximum probable" (100 year return period) earthquakes on each of the faults found within a user specified radius. The computation of the peak acceleration is based on the closest distance between the site and each digitized fault and a user specified attenuation relationship.

Based on our analysis, the controlling faults for this project are the La Nacion Fault and the Rose Canyon Fault, located at a distance of about 12 km and 9 km, respectively, from the site. A summary of nearby faults is shown in Table 1. For our analysis, we used a 100-km radius and the attenuation relationship by Campbell & Bozorgnia (1994). The value of maximum probable and maximum credible acceleration are 0.24 g and 0.42 g, respectively. This is in general agreement with the California Seismic Hazard Map 1996 prepared by Caltrans (Mualchin, 1996). According to this map, the alignment is susceptible to peak horizontal acceleration of about 0.4 g. Therefore, we recommend a design peak ground acceleration (PGA) of 0.4 g for the Middle Segment.

The effective seismic horizontal coefficient, k_h, used in pseudostatic slope stability analysis is generally taken as one-third (1/3) to one-half (1/2) of the design peak ground acceleration (Marcuson, 1981). Therefore, we used k_h values of about 0.15 in seismic slope stability evaluation of proposed slopes. See Section 8.1.2 for discussion of results.

8.1.2 Analysis of Seismic Effects

Secondary seismic effects for any site include liquefaction, earthquake-induced settlements, lateral spreading, and slope instability.

Liquefaction involves a sudden loss in strength of a saturated, cohesionless soil (predominantly sand) caused by cyclic loading such as an earthquake. This results in temporary transformation of the soil to a fluid mass. Typically, liquefaction occurs in areas where groundwater is less than about 9 m from the surface and where the soils are composed predominantly of poorly-consolidated fine sands. The uppermost 3 m of the sandy alluvium in the creek bed of McGonigle Canyon is loose and the groundwater is high. Therefore, the potential for liquefaction is high in this area. This condition is shown in Section U-U', Figure 25. As shown in the section, this alluvium will support up to 27 m of embankment fill. The potential for lateral spreading of the slopes is high. We recommend that a minimum of the upper 3 m of the loose alluvium be removed and recompacted. Before construction of the abutment fills, all fill should be properly keyed into formational soils or competent alluvium to minimize any potential for lateral spreading of the abutment slopes.

Most of the soils along the alignment are formational materials not susceptible to settlement from seismic shaking. Therefore, seismic compaction along the alignment is not expected to be significant.

The proposed cut and fill slopes for the alignment are anticipated to be stable under seismic shaking. The results of slope stability analysis are discussed Section 8.2 and 8.3.

8.2 Cuts and Excavations

The planned grading includes excavation which will result in cut slopes up to approximately 18 meters in height. Cut areas are shown in yellow in Figure 2 and a summary of cut slopes is presented in Table 7. Cut slope inclinations for mainline SR-56 will be inclined at a gradient of 1:2 (vertical to horizontal). Cuts will expose (in order of increasing age) fills (Qcf, Qf, Qdf) / alluvium / slope wash, terrace deposits (Qln, Qt), Landslide Debris (Qls), Eocene sedimentary deposits (Tmv, Tlj). The majority of the excavated soils should be generally suitable for use in embankment fills.

8.2.1 Stability -Cut Slopes

We have evaluated the stability of the highest portions of the proposed 1:2 cut slopes along the SR-56 alignment. Most of the cut slopes will expose primarily the Mission Valley Formation (Tmv) and La Jolla Group (Tlj) formations. The 18 m high 1:2 cut slope at section F-F' (Station 61+55) was analyzed for static and pseudostatic seismic stability using the computer program PCSTABL5M, with strength values our experience with similar soils. A pseudostatic horizontal acceleration coefficient of 0.15 was used to assess seismic stability. The results of our analyses indicate static factor of safety in excess of 1.9 and seismic factor of safety in excess of 1.4. All cut slopes in formational materials without adverse bedding conditions and with slope heights smaller than 18 m are anticipated to have higher factor of safety than the 18 m high slope. The results of our analyses are summarized in Table 7, and computer outputs are presented in Appendix D.

8.2.1.1 Buttress Fills

Based on our evaluation of geologic conditions as shown by the field exploration we anticipate that about 50% of the slopes have what can be considered as adverse bedding over at least a portion of the slope. These slopes may need buttressing for long-term slope stability. The presence of numerous landslides along the alignment indicate the potential for instability of the adversely bedded slopes. Our field investigation shows that the geologic conditions along the alignment are quite variable due to the interfingering nature of the formations. This variability combined with the observed localized cross-bedding and the constantly changing orientation of the alignment make it difficult to identify with certainty which slopes would require buttressing based on the available information.

Due to this uncertainty, we strongly recommend that all cut slopes be carefully logged and evaluated during grading by a qualified engineering geologist to assess the need for buttressing. Where needed, we anticipate that the buttress widths will range between 5-15 m with key depths between 2 m to 3 m. The buttresses should be constructed in accordance with the standard details presented on Figure 33. We recommend a minimum buttress width of 5 m and key depth of 2 m for all adverse bedding slopes shorter than 7 m in height and the maximum buttress dimensions (15 m wide and 3 m deep) for the 15 m high slope. The buttress dimensions may be interpolated at intermediate slope heights. An analysis of typical buttress fill is shown in Appendix D. For preliminary budgeting purposes, we suggest that it should be assumed that 25 to 35 percent of the slopes may require buttressing.

The buttresses will require back cut slopes of 1:1.5 to 1:2. The allowable height and inclination of temporary slopes should be evaluated in the field during grading by the geotechnical engineer and engineering geologist.

We recommend that if important existing facilities or utilities are located behind the immediate vicinity of the proposed buttress excavations, field instrumentation should be installed to monitor potential movements which may damage these facilities. This instrumentation may include inclinometers and surface settlement monuments.

The project geologist should observe all cut slopes during construction. Based on field mapping during construction, if conditions differ from those anticipated, the buttress designs and the need for buttressing may require reevaluation.

8.2.1.2 Stabilization Fills

The Mission Valley and La Jolla Group sandstone and siltstones have clayey fines and, in general, surficial stability should be adequate. Localized areas of erosion prone soils, if encountered during excavations, may require stabilization fill or other erosion protection measures.

8.2.1.3 Slope Maintenance

It should be noted that all graded slopes are subject to possible surficial erosion and minor sloughing of the exposed face. Planting of the slope face with appropriate vegetation and control of surface runoff will minimize this erosion. The slope surface and subsurface drainage must be maintained, as recommended in this section, to reduce the potential for slope distress. Any burrowing rodent/animal population on the slope must be controlled. Burrowing animals promote the deterioration of the slope by facilitating surface water infiltration that leads to slaking and surface sliding during prolonged rainy periods.

Irrigation should be sufficient to maintain plant growth, but not excessive. Deep rooted, drought-resistant shrubs and trees should be considered to assist in maintaining slope stability; however, large trees should be avoided. A landscape architect familiar with slope planting should be consulted in this regard, if necessary.

8.2.2 Rippability

In our opinion, the fill and natural surficial soils and slopewash/alluvium along the alignment can be excavated with light to moderate effort with heavy-duty grading equipment. Excavation of the sedimentary rock formations in the area will likely require moderate to heavy ripping. Cemented concretions within the formational sandstones could cause localized excavation difficulties. Oversize (2 feet or more in maximum dimension) concretions and some large boulders may be generated from excavations in the Mission Valley and La Jolla Group Formations.

To provide a possible means of estimating the amount of concretions that may be encountered during grading, we have totaled the vertical thickness of cemented layers encountered in bucket auger borings along the project alignment. When compared to the total depth of those borings (which generally extended approximately 3 m below proposed grade), the cemented layers were estimated to represent about 3 percent of the total depth drilled.

8.2.3 Earthwork Grading Factors

Two primary types of materials will be excavated in the cut areas. These include: minor amounts of overburden and formational soils. Majority of the cut will come from the formational soils. We recommend an earthwork grading factor of about 0.9 to 1.0 for natural formational materials excavated from the alignment and reused for the new road fills. These factors are based on a comparison of in-place densities and compacted fill densities between 90 and 95 % of the maximum dry density.

8.3 Embankment

8.3.1 General Description

Embankments will be required for the roadway and bridge approaches. The planned grading will result in fill slopes up to approximately 27 meters in height. Fill areas are shown in blue in Figure 2 and a summary of fill slopes is presented in Table 8. Fill slope inclinations for mainline SR-56 will generally be inclined at a gradient of 1:2 (vertical to horizontal). Abutment fill slopes are proposed at 1:1.5 inclination. Fills will generally be placed over existing site soils, including alluvium, terrace deposits, Eocene sedimentary deposits. In a number of locations embankment fills will be placed in areas of existing landslide debris. The areas where the fill is to be placed on landslide debris or loose alluvium, removal and recompaction of the unsuitable soils will be required as discussed in Section 8.3.2.

Shallow landslides (LS-1, LS-3 through 7) were identified in our investigation in fill areas (see Table 4). We recommend that these shallow slides be removed to competent formational material and properly benched in accordance with Caltrans standard specifications prior to placement of new fill in this area.

Embankments constructed of materials removed from excavations are anticipated to be predominantly granular in nature, but some moderately to highly expansive materials are anticipated to be encountered locally. Some soils will require substantial processing of oversize materials. Appropriate recommendations for these items are provided in Section 12.0.

8.3.2 Removal of Unsuitable Soils and Landslide Debris

In areas to receive compacted fill, unsuitable surficial materials such as loose, liquefiable, collapsible, or highly compressible soils, or landslide debris, if present, should be removed before placement of new fill.

Based on our investigation, the soils in the fill areas are generally alluvial or colluvial deposits consisting of silty and clayey sands. No areas of highly compressible peat or soft clays were encountered in our borings. The granular alluvial soils are generally loose and would undergo settlement due to embankment fill loads. However, due to the sandy nature of the soils, a major portion of the settlement is expected to be completed in 30 to 60 days depending on the fill height.

After clearing and stripping of vegetation and debris, the surface should be excavated to a minimum depth of 0.6 m before placement of new fill. The exposed surface should be proof-rolled with loaded heavy equipment. Any areas of loose or yielding soils should be overexcavated and recompacted. Any soils which cannot be compacted or are otherwise unsuitable for the planned use should be excavated and disposed of. The exposed surface should then be scarified and compacted to the specified density before placement of new fill.

A total of 12 landslide areas were identified along the alignment, out of which two areas are offsite (LS-6 and LS-7) and are not anticipated to affect the alignment. Existing landslides are summarized in Table 4.

Four shallow slump type slides (LS-1, LS-3, LS-4, and LS-5) are located in the areas of the proposed grading. These materials should be removed and replaced with compacted fill. The extent of removal should be determined in the field by the geologist.

Three landslides within the formational soils (LS-2, LS-10, and LS-11) were identified along the proposed alignment during this investigation and are discussed in Section 7.1.3.

Three potential landslides (LS-8, LS-9 and LS-12) are inferred from aerial photographs but no data are available to confirm the depth or extent of the sliding.

Most of the landslide material within the limits of the grading, if confirmed, will have to be removed. Only limited investigation was done at each of the landslides and definitive data on the depths and areal extents of the slides are not available. Detailed calculations of slide stabilization measures are not warranted. Typical removal zone is shown in Figure 35. Preliminary calculations indicate that the following approximate volumes of removal of the landslide debris within the zone of influence of new fill:

Slide Designation	Estimated Volume Cubic Meters
LS-2	43,000
LS-10	165,000
LS-11	90,000

In addition to the landslide materials, debris fills and other undocumented fills are present along the alignment. These fills are summarized in Table 5. All undocumented fills and debris fills shall be removed before placement of new fill.

8.3.3 Slope Stability - Fill Slopes

We have evaluated the stability of the highest portions of the proposed 1:2 fill slopes along the SR-56 alignment. The 27 m high 1:2 fill slope at Section U-U' (Station 96+40) was analyzed for static and pseudostatic seismic stability using the computer program PCSTABL5M, with strength values based on our experience with similar soils. A pseudostatic horizontal acceleration coefficient of 0.15 was used to assess seismic stability. The results of our analyses indicate static factor of safety of about 1.5 and seismic factor of safety in about of 1.1. The 27 m high abutment slope is proposed at 1:1.5 slope. We estimate that the factor of safety of this 1:1.5 slope will be less than 1.5. This should be addressed in the Structure Foundation Report for McGonigle Creek bridge.

We also analyzed the 27 m high 1:2 fill slope for seismic stability assuming that upper 3 m of loose alluvium liquefies during a maximum credible earthquake. This analysis indicates a factor of safety of less than 1. We recommend that as a minimum, the upper 3 m of alluvium be removed and recompacted before placement of the abutment fill. Typical recommendations for a key at the toe of fill slopes over natural slope or alluvium is shown in Figure 34.

All 1:2 fill slopes with slope heights smaller than 27 m are anticipated to have higher factor of safety than the 1.5 static and 1.1 seismic. Typical computer outputs are presented in Appendix D.

8.3.4 Settlement of Embankments

The construction of embankments will cause settlement of foundation soils. The settlement characteristics of foundation soils were evaluated based on soil types encountered and results of field blow count of soils encountered in our borings. For areas receiving the maximum fill depth of 27 m, the estimated settlement ranges between 10 cm and 30 cm depending on the amount of alluvium present. For areas where new fill is placed directly on formational soils, settlement in the underlying soils may be estimated to be 4 to 6 mm per m of fill. For areas with up to 5 m of alluvium, the settlement is estimated to be 8 to 12 mm / m of fill placed. Due to the presence of overconsolidated formational soils or primarily granular alluvium, these settlements are expected to occur within a period of 30 days following embankment construction.

8.4 Earth Retaining Systems

Construction of one retaining wall along the north side of SR-56 between the start of the alignment (at Sta. 45+13.527) and Sta. 48+00 is planned. The wall will retain a 1:2 existing fill slope and will have a maximum height of about 3 m. The details of retaining wall have not been finalized. As shown in Section A-A', the wall will be supported on existing engineered fill.

8.4.1 Allowable Bearing Pressure

Based on soil conditions discussed in Section 7.2, for spread footings supported in compacted fill, we recommend a maximum allowable toe pressure as follows:

$$q_{all} = 90 + 69\ B$$

where q_{all} = allowable bearing capacity (kPa), and B = footing width (meters). This equation assumes a minimum footing embedment of 0.6 m below the lowest adjacent grade. All fills should be compacted in accordance with Caltrans Standard Specifications for structural backfill. This bearing pressure is applicable for level ground conditions where a minimum of 4 m of level ground is present in front of the retaining wall footing.

For footings supported in the formational soils, we recommend a preliminary nominal allowable bearing capacity of 300 kPa. This equation assumes a minimum footing embedment of 0.6 m below the lowest adjacent grade.

8.4.2 Lateral Resistance of Retaining Wall Footings

In general, footing resistance to lateral loads is provided by a combination of frictional sliding resistance at the footing-soil interface and passive soil resistance on the side of the embedded portion of the footing.

A sliding friction coefficient of 0.35 may be used for design. An equivalent fluid density of 5,606 kg/m^3 may be used for lateral passive soil resistance for footings poured neatly against competent, undisturbed native material or footings backfilled with 95% compacted fill. Both sliding and passive resistance may be used in combination without reduction.

8.4.3 Lateral Earth Pressures

8.4.3.1 Static Wall Pressures

Lateral soil pressures acting on the walls are dependent on the amount of wall deflection which is allowed to occur. Active earth pressures can be used for analyzing walls that can yield at least 0.6 cm laterally for each 3 m in vertical height under the imposed loads. For active and at-rest conditions, we recommend the following lateral earth pressures:

Backfill Slope	Active Pressure (kPa/m)	At-Rest Pressure (kPa/m)
Level	6	9
1:2	7	11
1:1.5	10	15

8.4.3.2 Seismic Wall Pressures

In general, walls designed for static lateral earth pressures have performed satisfactorily in past earthquakes. If required, seismic wall pressures may be estimated using the method of Mononobe-Okabe for cantilever walls (Seed and Whitman, 1970; and Whitman and Christian, 1990) for cantilever walls. In this method, the additional loads are estimated by a lateral pressure coefficient of 0.75 times the effective ground acceleration. Based on a peak ground acceleration of 0.3 g, we recommend an additional lateral soil pressure equivalent to a fluid pressure of 320 kg/m^3 per meter of wall height for cantilever walls. This dynamic pressure may be applied as a horizontal force at a height of 0.6 times the wall height from the base of the wall.

All of the above pressures assume that the wall has adequate drainage provisions to prevent the buildup of hydrostatic pressures in the soil backfill. The drainage system should be designed in accordance with Caltrans Standard Plan BO-3, Detail 3-1.

8.5 Culvert Foundations

Improvements to the alignment will include construction of culverts. However, the location and details of these culverts have not yet been finalized. The following general guidelines can be used for the design of culverts:

- Field and laboratory data indicate that the foundation soils, in general, will have adequate bearing capacity to support the culverts. In some areas, removal and recompaction of loose alluvial soils may be required to minimize post-construction settlements.

- The culvert should be designed to support the weight of the overburden and traffic surcharge. The overburden pressure on the pipe can be calculated by multiplying the unit weight of the soil cover by the thickness of this cover. For design purposes, a soil density of 2,000 kg/m^3 may be used.

- Caltrans Standard Plans and Specifications should be followed in the preparation of soils for the placement of culverts or other buried pipes and during backfilling operations. Corrosion characteristics and protection recommendations are discussed in Section 12.5 of this report.

8.6 Minor Structure Foundations

No soundwalls or other minor structures are currently identified along the alignment.

9. MATERIAL SOURCES

Off-alignment borrow areas are not planned for this project. If a shortage of material is anticipated during grading operations, road grades will likely be adjusted such that the project grading will balance. If however, road grades cannot be adjusted to accommodate a projected shortfall, many potential borrow areas exist within the undeveloped lands that border the alignment. In addition, if the easterly-adjacent Black Mountain Road Segment is constructed concurrently, any excess from that grading (if available) could be utilized within the Middle Segment.

10. MATERIAL DISPOSAL

In general, grading for the Middle Segment is designed to balance. At this time it is anticipated that road grades could be adjusted to accommodate any excess material generated. Since it is anticipated that off-site soil disposal areas will not be required for the proposed grading, investigation of potential sites was not in our scope of work.

The extensive debris fills within the project alignment (as discussed in Sections 4.3 and 7.1.1.1 of this report), composed of organic and inorganic trash and debris, are unsuitable for use in fills or in areas to receive new fill. This material will require removal and off-site disposal. The contractor should include the cost of removal and disposal of this material in the project bid.

11. CONSTRUCTION CONSIDERATIONS

11.1 Construction Advisories

During our subsurface investigation, cobble to boulder sized material were encountered in our explorations in the Lindavista Formation (Qln) and portions of the Mission Valley Formation (Tmv). The contractor should be made aware that boulders up to 0.6 m or larger may be encountered in excavations within these units. In addition, oversize materials may result from the excavation of cemented zones of formational soils. This may result in difficulty in excavation and require special equipment, handling, and processing of oversize materials. Large amounts of debris fills are present in many of the canyon areas along the alignment, as summarized in Table 5. These materials will require removal and offsite disposal.

11.1.1 Excavation and Embankment Construction

Based on our field exploration, excavated soils will consist of a variety of soil types. The majority of excavated soils will be derived from the La Jolla Group (Tlj), with significant quantities also generated from the Mission Valley Formation (Tmv), Lindavista Formation (Qln) and Stream Terrace Deposits (Qt). Minor amounts of Alluvium/Slopewash (Qal, Qsw), fill soils (Qf, Qdf), topsoil, and residual clays will also be excavated. The distribution and layering of the various units along the centerline is illustrated in the Geologic Profile of SR-56 Centerline, Figure 4. The location of the cobble and boulder layers is illustrated graphically on the section. All soils should be rippable with moderate to heavy effort using heavy-duty grading equipment.

The majority of the excavated soils, (with the possible exception of some of the oversize rock generated from the Qln, and Tmv Formations, and debris fills) may be used in embankment fills provided recommendations contained in Section 12.0 of this report are followed.

The cut and fill slopes will be susceptible to erosion if exposed to surface runoff. Slope protection and maintenance should include planting with deep-rooted, light weight, and drought resistant vegetation. If work is done during periods of rain, the contractor will have to make provisions to control the flow of water through the work area and to maintain a dry excavation. Surface drainage should be controlled along the top of slope to avoid water run-off running into the excavation and eroding the slope face.

No surcharge loads, such as the weight of heavy equipment should be placed within 1.5 m of the top of the excavation. Care should be taken during excavation to avoid removing support for any existing improvements, such as foundations, pavements and buried utilities. Where there is insufficient space for sloped excavation, or where existing improvements require protection, shoring should be used.

11.1.2 Buried Utilities

Known underground utilities along the alignment include those along the existing Rancho Santa Fe Farms Road (Sta. 82+40). A water line and sewer line are buried under the east side of the roadway pavement. Underground power (and possibly communication) lines are indicated to be present beneath the sidewalk on the west side of the road.

Within McGonigle Canyon, a City of San Diego sewer easement crosses the alignment about Sta. 97+20 in the canyon-bottom area. A 0.5-m diameter sewer pipe is buried within this easement. Other utilities could be present in other areas of the alignment. The contractor should perform independent utility research to confirm the location of all utilities, and take measures to protect-in-place or relocate utilities as necessary prior to project construction.

11.1.3 Remnants of Previous Construction

Construction of this improvement project may require the removal of existing facilities, including pavements, fencing, buried utilities, uncompacted fills, and other improvements.

11.2 Hazardous Waste Considerations

We did not observe any evidence of contamination of subsurface materials in our borings and test pit excavations.

11.3 Differing Site Conditions

Environmental restrictions precluded performing subsurface explorations in some areas of the proposed alignment. Our characterization of the site is based on the results of our field explorations, geologic analyses of cross-sections, and interpolation between exploration locations. If field conditions during construction appear to be different than is indicated in this report, we should be notified immediately so that we may assess the impact of such conditions on our recommendations.

Why was this not discussed in setion 5 ?

What were the restrictions? When will the restrictions be eliminated WHERE ARE They

12. RECOMMENDATIONS AND SPECIFICATIONS

12.1 Site Preparation

All areas to receive fill should be stripped of existing pavements, cleared of any structures, all existing vegetation, debris, landslide materials, and other unsuitable materials in accordance with Section 16 of Caltrans Standard Specifications. All debris fills and/or deleterious material encountered during the clearing operations should be removed from the site.

After clearing and stripping, the surface should be excavated to a minimum of 0.6 m before placement of new fill. The overburden soils may have to be excavated up to 1.2 m due to presence of large-size cobbles. The exposed surface should be proof-rolled with loaded heavy equipment. Any areas of loose or yielding soils, should be overexcavated and recompacted. Any soils which cannot be compacted or are otherwise unsuitable for the planned use should be excavated and removed off-site. The exposed surface should then be scarified and compacted to the specified density before placement of new fill.

12.2 Subgrade and Foundation Treatment

A minimum relative compaction of 95 percent must be obtained for the subgrade soils to a minimum depth of 15 cm below the grading plane for the width between the outer edges of shoulders, whether in fill or in excavation. In addition, for the width of the traveled way plus a distance of 0.9 m horizontally beyond, the subgrade materials to a depth of 0.75 m below the finished grade should also be compacted to at least 95 percent relative compaction, whether in embankment or excavation.

Except for structural approach fill, embankment compaction and excavation should conform to Sections 19-5 and 19-6, respectively, of Caltrans Standard Specifications. An additional specification is that material with dimension greater than 0.45 m should not be placed as fill but should be placed in windrows deeper than 0.9 m below proposed grades along the freeway centerline (underlying the median area) or crushed for use as subbase or base. Nesting of windrows should not be permitted; at least 0.9 m vertically of material less than 0.45 m) should be placed between windrows.

Embankments within 46 m of bridge abutments should be considered structural approach fills and should conform to Section 610.4 of the Caltrans Highway Design Manual. An additional specification is that material with a dimension greater than 7.5 cm should not be used in structural approach fills.

Backfill behind abutments and around the side and tops of footings should be compacted to a minimum of 95 % relative compaction.

Cobbly conditions are anticipated at or near foundation level for some of the proposed areas along the alignment. Some processing of backfill will be required to remove large cobbles and boulders. All backfill below the bottom of footings should have a maximum particle size of 7.5 cm and be compacted to a minimum of 95 % relative compaction.

12.3 Structural Pavement Sections

We understand that Caltrans will provide recommendations for pavement sections of the roadways for the Middle Segment of SR-56 Project. Based on the results of laboratory testing, the R-values ranged from 8 to 19. We recommend an R-value of 10 for preliminary pavement design.

12.4 Material Specifications

In general, earthwork should be performed in accordance with Sections 6 and 19 of the Caltrans Standard Specifications. Any soils used within 1.2 m of finished grade in pavement areas should have a minimum R-value consistent with the pavement design.

Recommended structural pavement materials should conform to the specified provisions in the Caltrans Standard Specifications including grading and quality requirements, shown below:

- Aggregate Base (AB) should be Class 2 and should conform to Section 26 of the Standard Specifications.

- Aggregate Subbase (AS) should be Class 4 and should conform to Section 25 of the Standard Specifications.

- Treated Permeable Bases shall be asphalt treated permeable base (ATPB) and should conform to Section 29 of the Standard Specifications.

- Portland Cement Concrete Pavement (PCCP) should conform to Section 40 of the Standard Specifications. The PCCP materials (pavement, structures, minor concrete) should conform to Section 90 of the Standard Specifications.

- Asphalt Concrete (AC) for pavement should be Type A and conform to Section 39 of the Standard Specifications. Asphalt concrete specimens should be tested for surface abrasion in accordance with California Test 360.

12.5 Corrosion Investigation

Five representative samples of the subsurface soils encountered at the site were tested to evaluate the corrosion potential of soils. The tests include pH, electrical resistivity, soluble chloride and sulfate concentrations characteristics. Results of the corrosivity tests performed are presented in Table 10.

The pH of the soil samples ranged from 6.7 to 7.7. The water soluble chloride content ranged from 37 ppm to 336 ppm. The water soluble sulfate content ranged from 122 to 247 ppm. The minimum electrical resistivity ranged from 280 to 580 Ohm-cm.

Section 3-1 of Caltrans Memo to Designers defined a corrosive area as "an area where the soil contains more than 500 ppm of chlorides, more than 2,000 ppm of sulfates or has a minimum resistivity of less than 1,000 Ohm-centimeters." Based on this Caltrans criteria, the on-site soils have high corrosion potential to buried metals in contact with on-site soils. We used CULVERT3 program (dated 4/16/94) by Caltrans to estimate the service lives of CSP culverts for different samples tested for corrosion potential. If soils different than those tested are used for backfilling culverts, additional corrosivity testing should be considered. Table 11 presents a summary of corrosion characteristics of the soils along the proposed alignment and provides recommendations for pipe selection and alternative culvert materials based on Section 854.3 of the Highway Design Manual (1995).

The water soluble sulfate content indicates that Type II cement may be used for concrete in contact with native soils.

13. APPENDICES

The following is a list of appendices attached in this report:

- Appendix A   Field Exploration
- Appendix B   Laboratory Testing
- Appendix C   EQFAULT Computer Output
- Appendix D   PCSTABL5M Computer Output
- Appendix E   References

TABLES

GROUP
DELTA
CONSULTANTS

TABLE 1
SUMMARY OF NEARBY FAULTS
MIDDLE SEGMENT
STATE ROUTE 56 PROJECT

Abbreviated Fault Name	Fault Type	Fault Distance (km)	Maximum Credible Earthquake Magnitude	Maximum Probable Earthquake Magnitude
La Nacion	Dip Slip	12	6.5	4.2
Rose Canyon	Strike Slip	9	7.0	5.9
Newport - Inglewood - Offshore	Strike Slip	30	7.1	5.9
Coronado Bank - Agua Blanca	Strike Slip	31	7.5	6.7
Elsinore	Strike Slip	45	7.5	6.6
San Diego Trough - Bahia Soledad	Strike Slip	46	7.5	6.2
Catalina Escarpment	Strike Slip	72	7.0	6.1
Coyote Creek (San Jacinto)	Strike Slip	81	7.0	6.1
Casa Loma - Clark (San Jacinto)	Strike Slip	83	7.0	7.0
San Clemente - San Isidro	Strike Slip	78	8.0	6.5
Hot Springs - Buck Ridge (San Jacinto)	Strike Slip	85	7.0	6.1
Palos Verdes Hills	Strike Slip	88	7.2	6.2
Borrego Mountain (San Jacinto)	Strike Slip	94	6.5	6.2
Glen Helen - Lytle Creek - Claremont (San Jacinto)	Strike Slip	96	7.5	6.7

Note: Fault data is from Blake (1996).

TABLE 2
REFUSAL CONDITIONS FOR TEST EXPLORATIONS
MIDDLE SEGMENT
STATE ROUTE 56 PROJECT

EXPLORATION TYPE	EXPLORATION NUMBER	TARGET DEPTH (meters below Surface)	REFUSAL DEPTH (meters below surface)
Bucket Auger	MGD-BA-8	19.8	18.6
	MDG-BA-23	21.3	21.0
	MGD-BA-27	19.8	19.8
	MGD-BA-34	16.8	16.7
	MGD-BA-35	7.6	7.0
Backhoe Test Pit	MGD-TP-77	N/A	2.4

TABLE 3
GROUNDWATER OCCURRENCE IN TEST EXPLORATIONS
MIDDLE SEGMENT, STATE ROUTE 56 PROJECT

Exploration Number	Surface Elevation (meters)	Groundwater Depth (meters)	Groundwater Elevation (meters)	Geologic Unit
MGD-BA-6	96.5	22.9	73.6	La Jolla Group
MGD-BA-7	80.3	12.5 (perched) 15.8	67.8 64.3	La Jolla Group
MGD-BA-8	81.2	16.5	64.7	La Jolla Group
MGD-BA-12	52.7	12.1 to 15.4 (perched)	40.6 to 37.3	La Jolla Group
MGD-BA-19	96.4	6.7 to 8.2 (perched)	89.7 to 88.2	La Jolla Group
MGD-BA-20	98.4	7.0 to 8.8 (perched)	91.4 to 89.6	La Jolla Group
MGD-BA-21	52.5	12.5	40.0	La Jolla Group
MGD-BA-22	53.3	14.7	38.6	La Jolla Group
MGD-BA-27	97.9	17.4 to 18.2 (perched)	79.7 to 80.5	La Jolla Group
MGD-BA-33	51.0	7.9 (perched)	43.1	La Jolla Group
MGD-BA-34	54.6	12.3 (perched)	42.3	La Jolla Group
MGD-BA-42	105.3	7.2 to 7.5 (perched)	97.5 to 97.8	Landslide Debris
MGD-BA-43	81.6	12.5	69.1	Alluvium
MGD-HSA-3	43.7	9.8	33.9	La Jolla Group
MGD-HSA-6	68.0	1.8	66.2	Alluvium
MGD-HSA-7	69.0	2.1	66.9	Alluvium
MGD-HSA-8	70.0	3.7	66.3	Alluvium
MGD-HSA-9	74.2	0.3	73.9	Alluvium
MGD-TP-16	70.5	3.4	67.1	Alluvium
MGD-TP-48	75.7	4.0	71.7	La Jolla Group
MGD-TP-54	58.7	2.4	56.3	Fill

GROUP
DELTA
CONSULTANTS

TABLE 4
SUMMARY OF EXISTING LANDSLIDES

Landslide No.	Station No. From	Station No. To	Description	Explorations	Estimated Depth of Removal (m)	Estimated Area of Removal (m^2)	Estimated Removal Volume *** (m^3)	Potential Impact on Project	Recommended Mitigation
LS-1	CVR* 12+40	CVR* 13+15	Landslide on natural slope, in area of proposed **cut** along CVR realignment	MGD-BA-38	Up to 3 m	3,000	6,000	Indicates potential for slope instability when making proposed cuts along CVR	Slide debris should be removed and recompacted during grading, cuts should be observed by an engineering geologist for adverse geologic conditions, may require stabilization fill along all or portions of the proposed road cut
LS-2	56+20	57+50	Series of Landslides (or possible landslides) in **fill** area, West Abutment of Gonzales Creek Bridge	MGD-BA-33, 34	Up to 10 m	8,000	43,000	Could adversely affect stability of West Abutment, Gonzales Creek Bridge	Slide debris should be removed and recompacted prior to placing abutment fill, keyed at toe and benched into formation, removals should be inspected by an engineering geologist, could require an estimated 43,000 cubic meters of removal and
LS-3	67+60	67+80	Small possible landslide, likely shallow slump in slopewash soils, undelies sloping canyon wall to receive embankment **fill**	No explorations	< 3	200	< 600	Unsuitable material to receive embankment fill, due to stability and settlement considerations	Slide should be removed prior to placing embankment fill, removals should be inspected by an engineering geologist, could require an estimated 600 cubic meters of removal and recompaction
LS-4	68+80	69+65	Likely long, shallow slump in colluvial (slopewash) soils at base of natural slope adjacent to alluvial drainage, in **fill** area	No explorations	< 4	1,000	< 4,000	Unsuitable material to receive embankment fill, due to stability and settlement considerations	Slide should be removed prior to placing embankment fill, removals should be inspected by an engineering geologist, could require an estimated 4,000 cubic meters of removal and recompaction
LS-5	72+50	72+80	Likely small, shallow slump in colluvial (slopewash) soils at base of natural slope adjacent to alluvial drainage, in area to receive embankment fill	No explorations	< 3	400	< 1,200	Unsuitable material to receive embankment fill, due to stability and settlement considerations	Slide should be removed prior to placing embankment fill, removals should be inspected by an engineering geologist, could require an estimated 1,200 cubic meters of removal and recompaction
LS-6	73+50	74+50	Two suspected small slides in colluvium at base of natural slope adjacent to alluvial drainage, outside area of proposed project grading	MGD-TP-42	NR**	NR	NR	No impact to project	Outside proposed grading, no action required
LS-7	79+50	79+90	Two suspected small slides in colluvium at base of natural slope adjacent to alluvial drainage, outside area of proposed project grading	No explorations	NR	NR	NR	No impact to project	Outside proposed grading, no action required

DELTA CONSULTANTS GROUP

...LE 4
SUMMARY OF EXISTING LANDSLIDES

Landslide No.	Station No. From	Station No. To	Description	Explorations	Estimated Depth of Removal (m)	Estimated Area of Removal (m^2)	Estimated Removal Volume *** (m^3)	Potential Impact on Project	Recommended Mitigation
LS-8	90+40	92+20	Three suspected landslides, two of which are in areas of proposed cut/fill grading	MGD-TP-22	Upto 4 m	4,500	13,500	Unsuitable material to receive embankment fill or to be left in place in cut areas, due to stability and settlement considerations	Slides in area of grading should be removed prior to placing embankment fill, removals should be inspected by an engineering geologist, could require an estimated 13,500 cubic meters of removal and recompaction
LS-9	95+20	96+20	Suspected landslide just south of toe of embankment fill, West Abutment McGonigle Creek Bridge	No explorations	Unknown	Unknown	Unknown	If the slide moves could remove support below toe of embankment fill	Slide debris in area of influence of embankment fill should be removed prior to placing fill, removals should be inspected by an engineering geologist, volume of removal and recompaction unknown.
LS-10	97+30	99+30	Landslide under East Abutment of McGonigle Creek Bridge, and very large landslide to the north under toe of embankment fill at same bridge abutment	MCB-HSA-1; MGD-BA-6, 43	Up to 20 m	10,500	165,000	Could adversely affect stability of East Abutment, McGonigle Creek Bridge	Slide debris in area of influence of embankment fill should be removed, keyed, and benched prior to placing new fill, removals should be inspected by an engineering geologist, volume of removal and recompaction up to 165,000 cubic meters.
LS-11	99+50	100+70	Large slide which crosses the alignment in a cut-fill transition area, cut planned at the head of slide, fill planned in middle of slide	MGD-BA-5, 42; MGD-TP-9	Up to 13 m	10,000	90,000	Could adversely affect stability of cuts and fills in this area	Slide debris in area of influence of embankment fill should be removed, keyed, and benched prior to placing new fill, removals should be inspected by an engineering geologist, volume of removal and recompaction up to 90,000 cubic meters.
LS-12	107+60	108+90	Suspected landslide south of proposed Camino Ruiz Undercrossing, fill planned at head of slide	No explorations	< 3	1,200	< 4,000	Could adversely affect stability of fill in this area as well as stability of southwest abutment, Camino Ruiz Undercrossing	Slide debris in area of influence of embankment fill should be removed, keyed, and benched prior to placing new fill, removals should be inspected by an engineering geologist, volume of removal and recompaction up to 4,000 cubic meters

NOTES:
* Carmel Valley Road
** Not Required
*** These estimates are approximate based on available data. These estimates could vary by ±30%.

DELTA GROUP CONSULTANTS

TABLE 5
SUMMARY OF EXISTING FILLS

STATION NUMBER[1]	GENERAL LOCATION	TYPE OF FILL	ESTIMATED AREA[2] (sq. meters)	ESTIMATED DEPTH[3] (meters)	UNDERLYING GEOLOGIC UNIT
45+13 to 49+30	Bell Valley	compacted fill	13,500	up to 10	alluvium or La Jolla Group
54+80 to 55+40	lower hillside	uncompacted fill	2,800	up to 1	surficial soils (over La Jolla Group)
55+15 to 55+90	side cyn. drainage	debris fill	3,000	up to 6.5	alluvium or La Jolla Group
67+35 to 68+20	side cyn. drainage	debris fill	3,000	up to 1.5	alluvium
70+05 to 71+75	side cyn. drainage	debris fill	5,000	up to 3	alluvium
70+60 to 71+40	lower hillside	uncompacted fill	850	up to 1	surficial soils (over La Jolla Group)
73+40 to 77+00	small ridgetop areas	uncompacted fill	8,500	up to 2	surficial soils (over La Jolla Group)
76+95 to 77+65	hillside drainage	uncompacted fill	850	up to 3	surficial soils and alluvium (over La Jolla Group)
81+00 to 81+55	flanks of ridgetop	uncompacted fill (locally with debris)	4,000	up to 2	surficial soils (over La Jolla Group)
81+90 to 82+20	ridgetop areas	uncompacted fill (with organics)	1,200	up to 1	surficial soils (over Mission Valley Fm.)
82+20 to 82+60	ridgetop areas	uncompacted fill (possibly compacted beneath RSFFR*)	3,300	up to 3.5	surficial soils and/or Mission Valley Fm. or La Jolla Group
82+60 to 83+90	flanks of ridgetop	uncompacted fill (locally with debris and organics)	6,500	up to 3	surficial soils and/or La Jolla Group

Note: Fills along the alignment incorporating an estimated surface area of less than 600 square meters are not included in this table.
[1] Approximate range of station numbers wherein fills encroach into proposed limits of grading for alignment.
[2] Approximate area within proposed grading limits underlain by fill.
[3] Depth estimated by test explorations and/or surface observations.
* Rancho Santa Fe Farms Road

TABLE 6
SUMMARY OF SOIL PARAMETERS
MIDDLE SEGMENT
STATE ROUTE 56 PROJECT

Material	In-Place Density (kN/m^3)	Cohesion (kPa)	Friction Angle (Degrees)
Fill	19.6	12	30
Alluvium / Colluvium (SANDY)	19.0	0	30
Alluvium / Colluvium (CLAYEY)	19.0	5	25
FORMATION (Tmv /Tlj)			
Cross Bedding	20.5	14.4	33
Clay Bedding	20.5	5.0	12

Notes:

1. Assumes all fill compacted to a minimum of 90% dry density determined in accordance with CALTRANS standards.
2. Clay bedding values are also applicable for clay seams within bedrock units.
3. The parameters are based on existing data along the alignment and our experience. They may be modified after completion of the laboratory testing.

TABLE 7
SUMMARY OF PROPOSED CUT SLOPES

SLOPE DESIGNATION	BEGINNING STATION	HIGH PT. STATION	ENDING STATION	MAXIMUM HEIGHT (m)	SLOPE FACES	BEDDING (2) CONDITION	RELEVANT X-SECTION	MAXIMUM SLOPE INCLINATION
C01	50+05	50+70	51+20	6	SE	A	B-B'	1:2
C02	51+85	52+60	55+10	12	SE	A	C-C'	1:2
C03	56+00	56+50	56+90	4	SE	A	N/A	1:2
C04	58+25	59+60	60+05	15	SE	F	E-E'	1:2
C05	58+40	59+00	59+65	5	NW	A	E-E'	1:2
C06	60+25	61+60	63+00	18	SE	F	F-F'	1:2
C07	60+20	61+20	63+05	6	NW	A	F-F'	1:2
C08	66+30	67+45	67+75	8	SE	A	I-I'	1:2
C09	68+20	69+00	69+45	12	SE	F	J-J'	1:2
C10	70+40	70+80	71+00	4	SE	ND	K-K'	1:2
C11	71+70	72+10	78+25	15	NW	F	L-L'	1:2
C12	74+55	77+10	78+40	8	SE	F	N-N'	1:2
C13	80+75	81+80	82+70	7	NW	F	P-P'	1:2
C14	81+25	82+20	83+35	8	SE	A	P-P'	1:2
C15	84+40	85+00	86+15	8	S	A	R-R'	1:2
C16	84+60	85+70	86+60	12	N	A	R-R'	1:2
C17	87+35	87+60	88+00	2	S	ND	N/A	1:2
C18	88+70	89+35	90+95	8	NE	A	S-S'	1:2
C19	89+05	90+50	91+60	16	SW	A	S-S'	1:2
C20	92+20	92+80	93+60	6	NE	F	T-T'	1:2
C21	92+45	93+10	94+00	11	SW	A	T-T'	1:2
C22	99+20	99+50	99+80	2	SW	ND	N/A	1:2
C23	99+55	100+20	103+00	7	NE	A	V-V'	1:2
C24	101+40	103+10	103+80	13	SW	A	W-W'	1:2
C25	104+45	104+70	105+10	2	NE	ND	N/A	1:2
C26	104+80	105+20	105+60	1	SW	F	N/A	1:2
C27	108+00	108+50	109+00	6	SW	F	Y-Y'	1:2

NOTES:

1. Stationing and slope heights are approximate..
2. "A" = Adversely bedded clay layers observed. "F" = No adversely bedded clay layers observed. "ND" = No data.
3. For adversely bedded slopes, buttressing may be required, see Section 8.2.1.1 of the text.

TABLE 8
SUMMARY OF PROPOSED FILL SLOPES

SLOPE DESIGNATION	BEGINNING STATION	HIGH PT. STATION	ENDING STATION	MAXIMUM HEIGHT (m)	SLOPE FACES	RELEVANT X-SECTION	MAXIMUM SLOPE INCLINATION
F01	50+00	55+55	56+60	11	SE	D-D'	1:2
F02	56+60	57+25	58+40	13	SE	N/A	1:2
F03	59+60	59+90	60+20	6	S	N/A	1:2
F04	63+05	65+60	68+20	12	SE	G-G', H-H', I-I'	1:2
F05	63+90	65+90	66+25	10	NW	H-H'	1:2
F06	68+50	70+60	71+70	15	SE	J-J', K-K'	1:2
F07	69+45	70+00	70+40	9	NW	N/A	1:2
F08	71+10	73+50	74+55	10	NW	L-L'	1:2
F09	78+20	78+80	80+70	18	SE	O-O'	1:2
F10	78+40	79+65	81+25	13	NW	O-O'	1:2
F11	82+75	84+10	84+60	12	SE	Q-Q'	1:2
F12	834+40	84+10	84+40	6	NW	Q-Q'	1:2
F13	86+15	86+55	87+35	7	N	N/A	1:2
F14	86+60	87+95	88+70	11	S	N/A	1:2
F15	88+00	88+40	89+05	6	N	N/A	1:2
F16	91+00	91+50	92+15	7	SW	N/A	1:2
F17	91+55	92+30	92+45	6	NE	N/A	1:2
F18	93+60	96+40	96+80	27	SW	U-U'	1:2
F19	94+00	96+40	96+80	19	NE	U-U'	1:2
F20	97+30	99+00	99+55	16	SW	N/A	1:2
F21	97+40	97+70	99+20	26	NE	N/A	1:2
F22	99+80	100+30	101+40	9	NE	V-V'	1:2
F23	103+00	103+75	104+45	6	SW	N/A	1:2
F24	103+85	104+40	104+75	<2	NE	N/A	1:2
F25	105+10	105+60	109+00	5	SW	X-X'	1:2
F26	105+60	106+90	108+00	<2	NE	N/A	1:2

NOTES:

1. Stationing and slope heights are approximate..
2. Stability analysis indicates that a 1:2 slope with a maximum height of 27 m over compacted alluvium has a minimum factor of safety of 1.5 static and 1.1 seismic.
3. All other slopes have a higher factor of safety than the 27 m high slope.

DELTA CONSULTANTS GROUP

TABLE 9
SUMMARY OF R-VALUE TEST RESULTS
MIDDLE SEGMENT, STATE ROUTE 56 PROJECT

Exploration No.	Station No. *	Offset *	Sample Depth (m)	USCS Soil Type	Equilibrium R-Value By Exudation	Equilibrium R-Value By Expansion
MGD-BA-10	68+98	42 m LT	4.9-5.2	SC	19	19
MGD-BA-7	95+94	38 m LT	4.6-4.9	SM	21	8
MGD-BA-5	100+18	51 m RT	7.6-7.9	CL	22	16
MGD-BA-1	108+44	39 m LT	2.4-2.7	SM	15	--

* Metric station and offset referenced from the centerline of SR-56

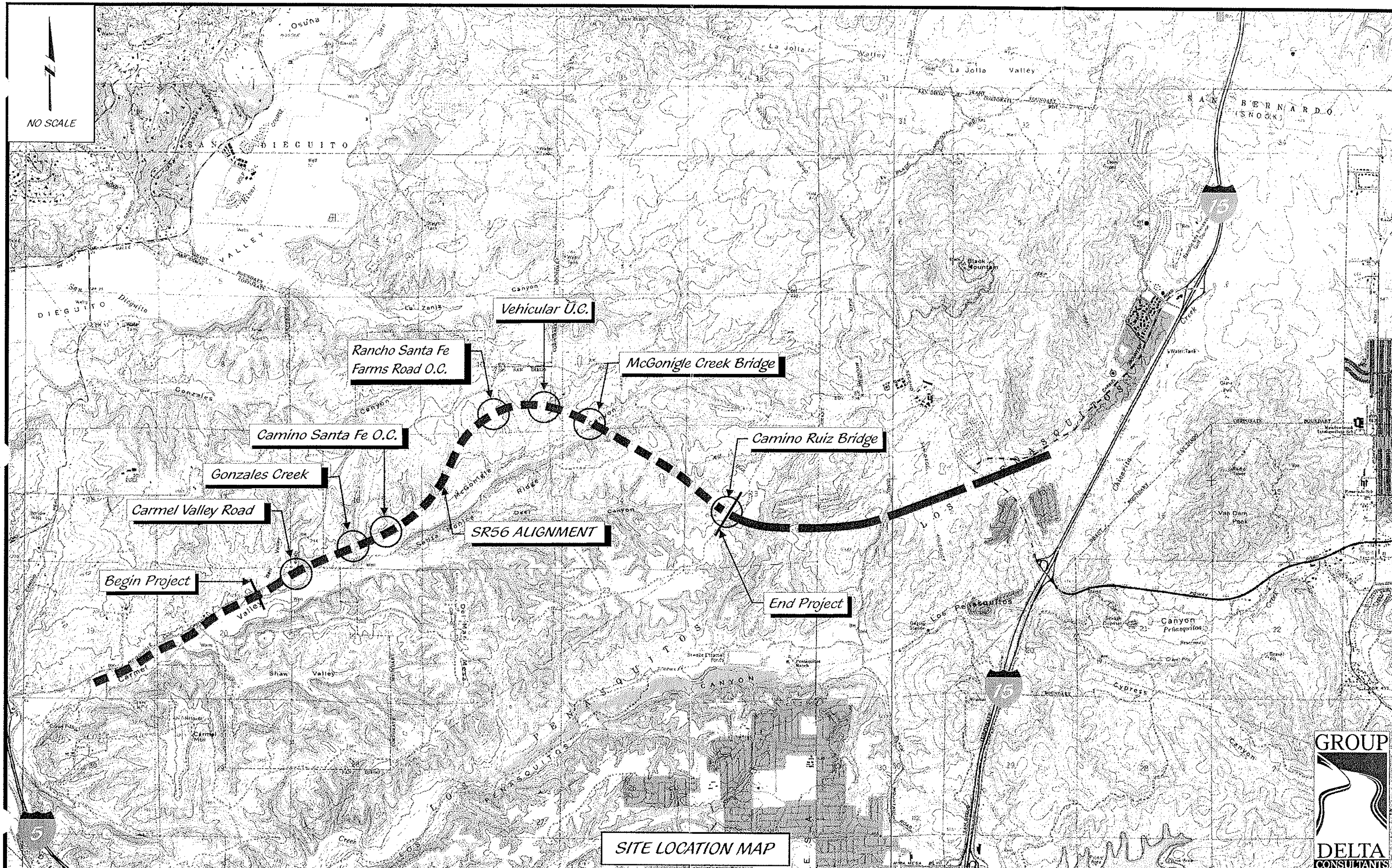
TABLE 10
SUMMARY OF CORROSION ASSESSMENT
MIDDLE SEGMENT, STATE ROUTE 56 PROJECT

Soil Sample Location				Corrosivity Test Results				Reinforced Concrete Pipe (RCP)		Estimated Minimum Gauges for 50-yr Service Life of Metal Pipes		
Boring/ Test Pit No.	Depth (m)	Station No.	Offset	pH	Minimum Resistivity (Ohm-cm)	Chloride (ppm)	Sulfate (ppm)	Est. Years to Corrosion	Minimum Cement Type	CSP	CAP	CASP
MGD-BA-9	1.8-2.1	68+37	19 m RT	6.7	300	37	247	> 50	II	8**	*	*
MGD-BA-10	4.9-5.2	68+98	42 m LT	7.3	280	70	156	> 50	II	8**	*	*
MGD-BA-18	4.0-4.3	77+40	26 m LT	7.7	580	84	132	> 50	II	16**	*	*
MGD-BA-20	2.1-2.4	82+39	44 m LT	7.5	. no data	336	222	> 50	II	14**	*	*
MGD-BA-7	4.6-4.9	995+94	38 m LT	7.0	320	54	173	> 50	II	10**	*	*

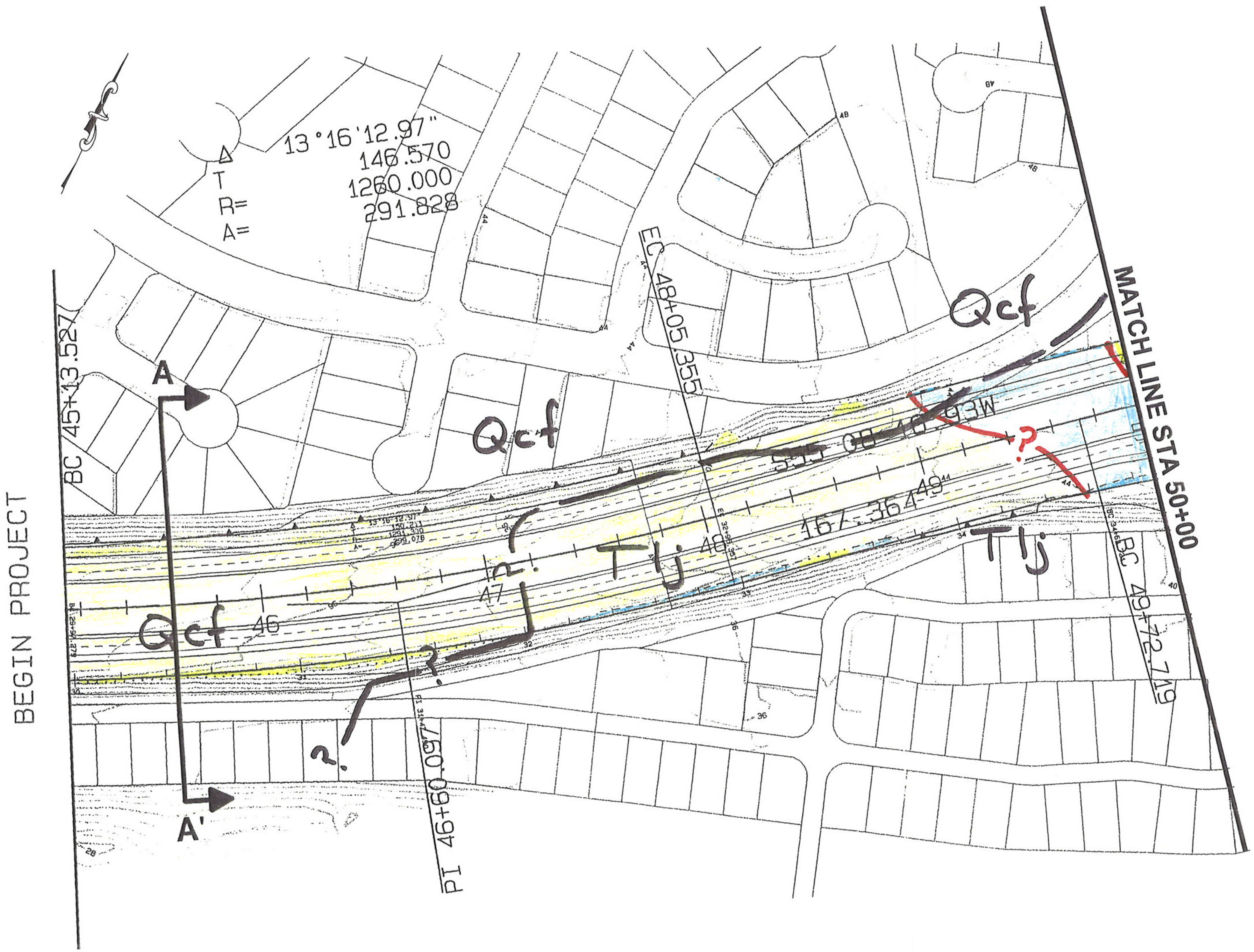
Notes:
* Indicated metal culverts should not be used due to corrosive conditions
** Requires bitumen coating
CSP = Corrugated Steel Pipe
CAP = Corrugated Aluminum Pipe
CASP = Corrugated Aluminized Steel Pipe

FIGURES

GROUP
DELTA
CONSULTANTS



GROUP DELTA CONSULTANTS, INC. - 4455 MURPHY CANYON RD., San Diego CA 92123 Project Name: Middle Segment Geotechnical Design Report - State Route 56 Project Number: I-181-02 Figure No. 1



LEGEND

- Proposed Fill Area
- Proposed Cut Area
- Approximate Cut/fill Transition
- Approximate Test Pit Location
- Approximate Bucket Boring Location
- Hollow Stem Auger Boring Location
- Approximate Geologic Contact
- Geologic Cross-section Location (A – A')

GEOLOGIC UNITS

Qf	Undocumented Fill
Qcf	Compacted Fill
Qdf	Debris Fill
Qal/Qsw	Alluvium /Slopewash
Qls	Landslide Debris
Qt	Stream Terrace Deposit
Qln	Linda Vista Formation
Tmv	Mission Valley Formation
Tlj	La Jolla Group

Reference:

The base map is from Boyle Engineering SR-56 Alignment, 8-10-1998

SCALE
1 : 2,000

GROUP DELTA

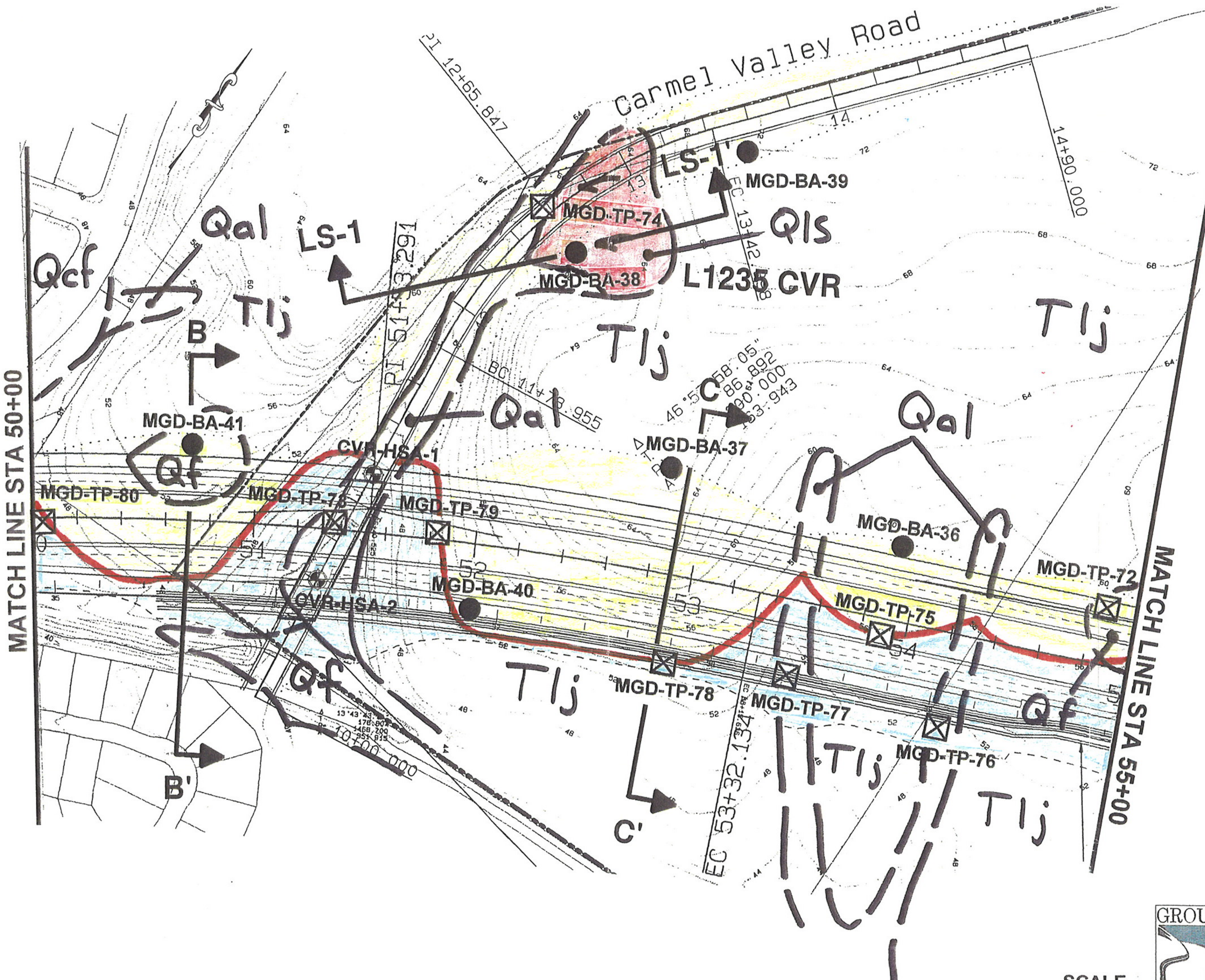
GDC Project No. I181-2

State Route 56 - Middle Segment

Geologic Map and Exploration Location Map

Sheet 1 of 12

Figure 2



SCALE
1 : 2,000

GROUP DELTA CONSULTANTS

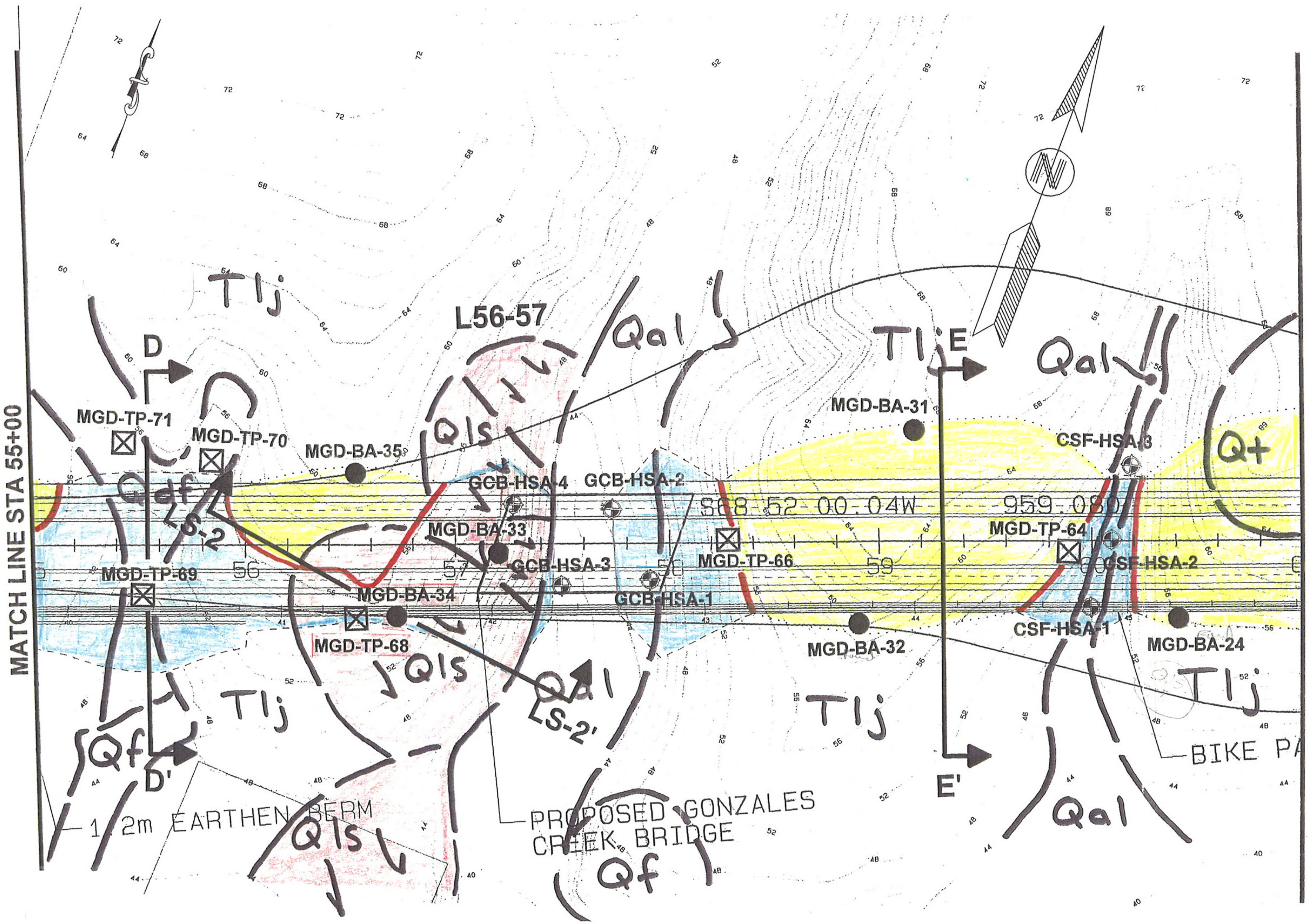
GDC Project No. I181-2

State Route 56 - Middle Segment

Geologic Map and Exploration Location Map

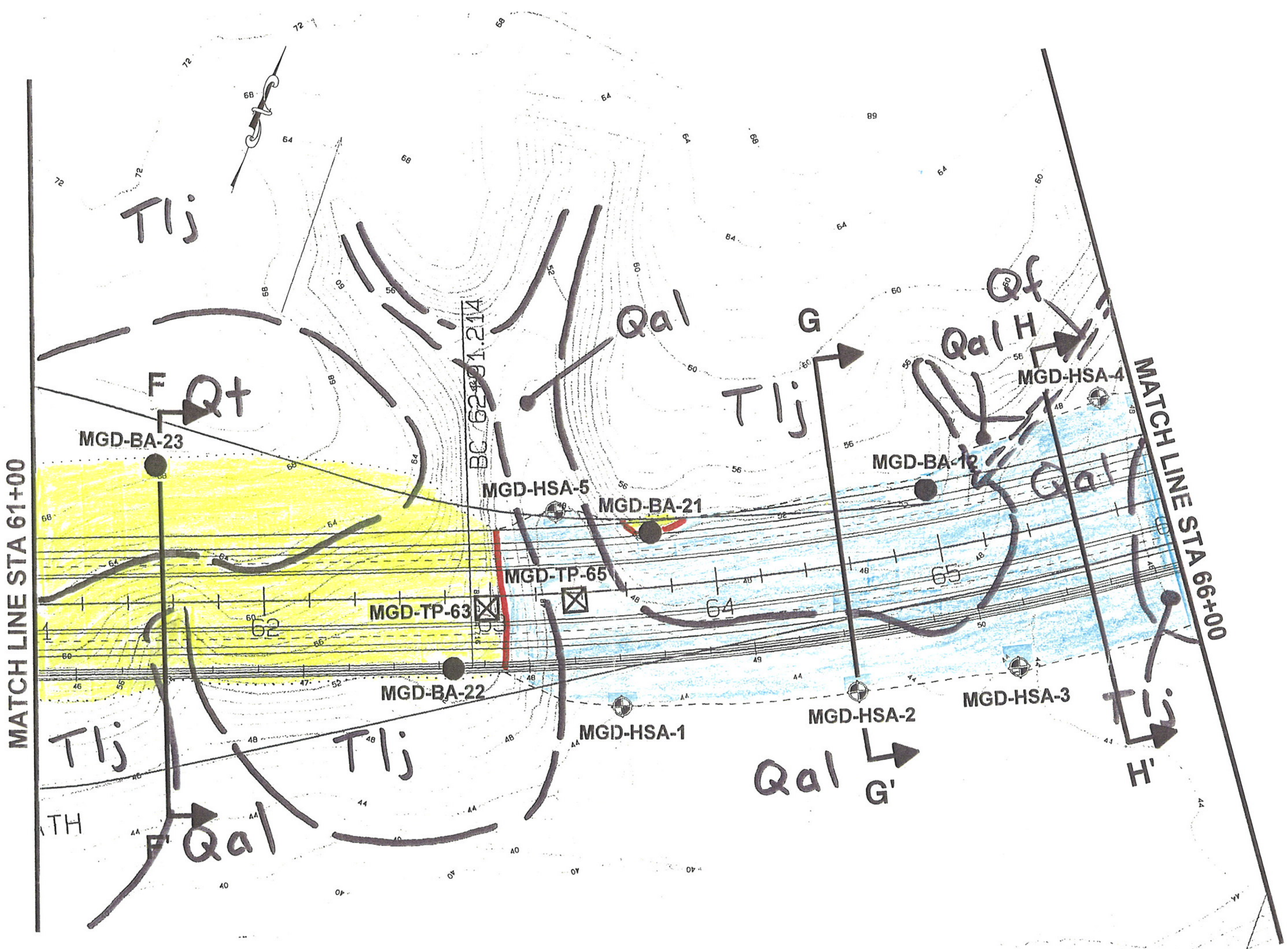
Sheet 2 of 12

Figure 2



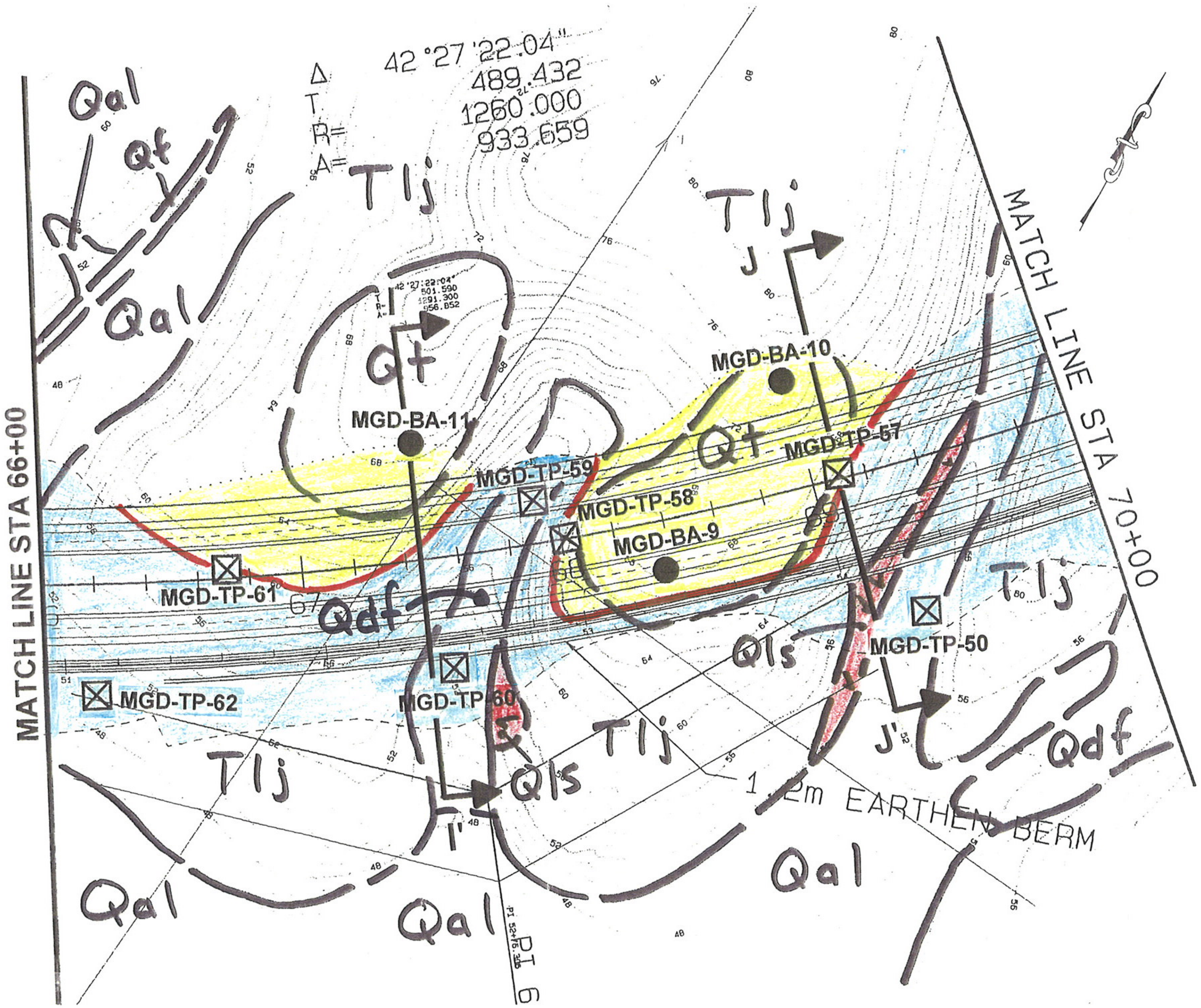
SCALE
1 : 2,000

GROUP DELTA	GDC Project No. I181-2
	State Route 56 - Middle Segment
	Geologic Map and Exploration Location Map
	Sheet 3 of 12 Figure 2



SCALE
1 : 2,000

GROUP DELTA CONSULTANTS	GDC Project No. I181-2
	State Route 56 - Middle Segment
	Geologic Map and Exploration Location Map
	Sheet 4 of 12 — Figure 2



SCALE
1 : 2 000

GROUP DELTA CONSULTANTS

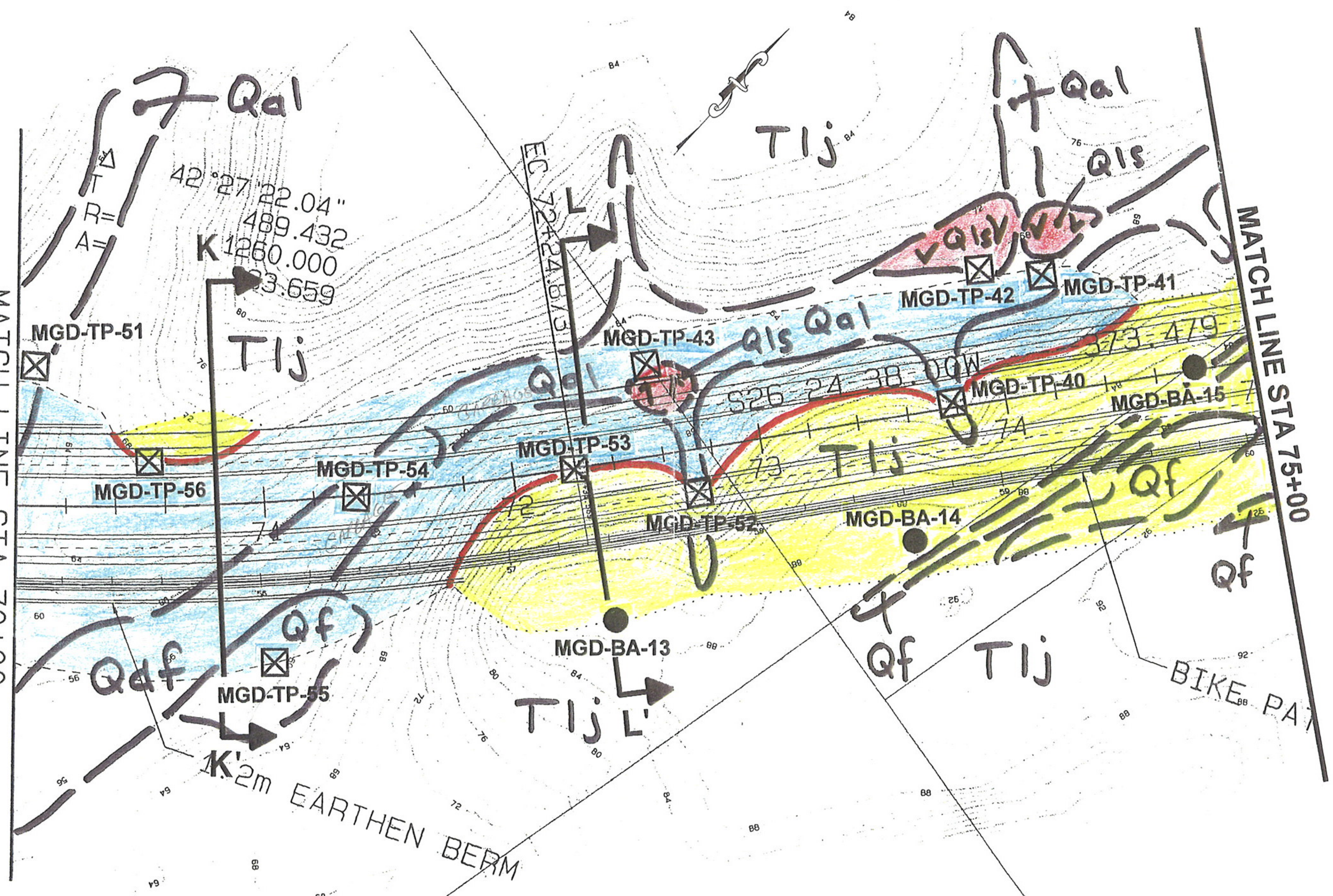
GDC Project No. I181-2

State Route 56 - Middle Segment

Geologic Map and Exploration Location Map

Sheet 5 of 12

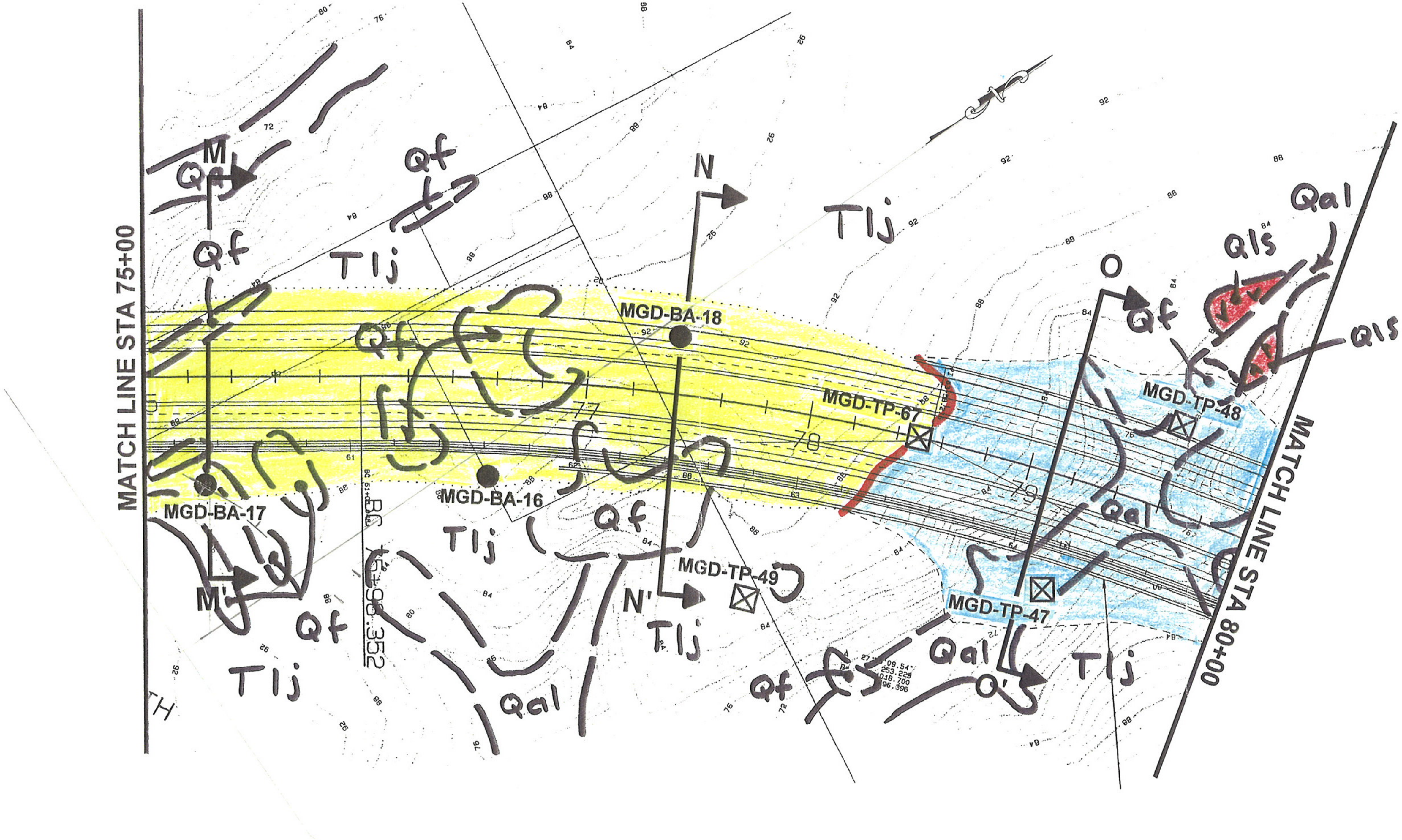
Figure 2



SCALE
1 : 2,000

GROUP DELTA

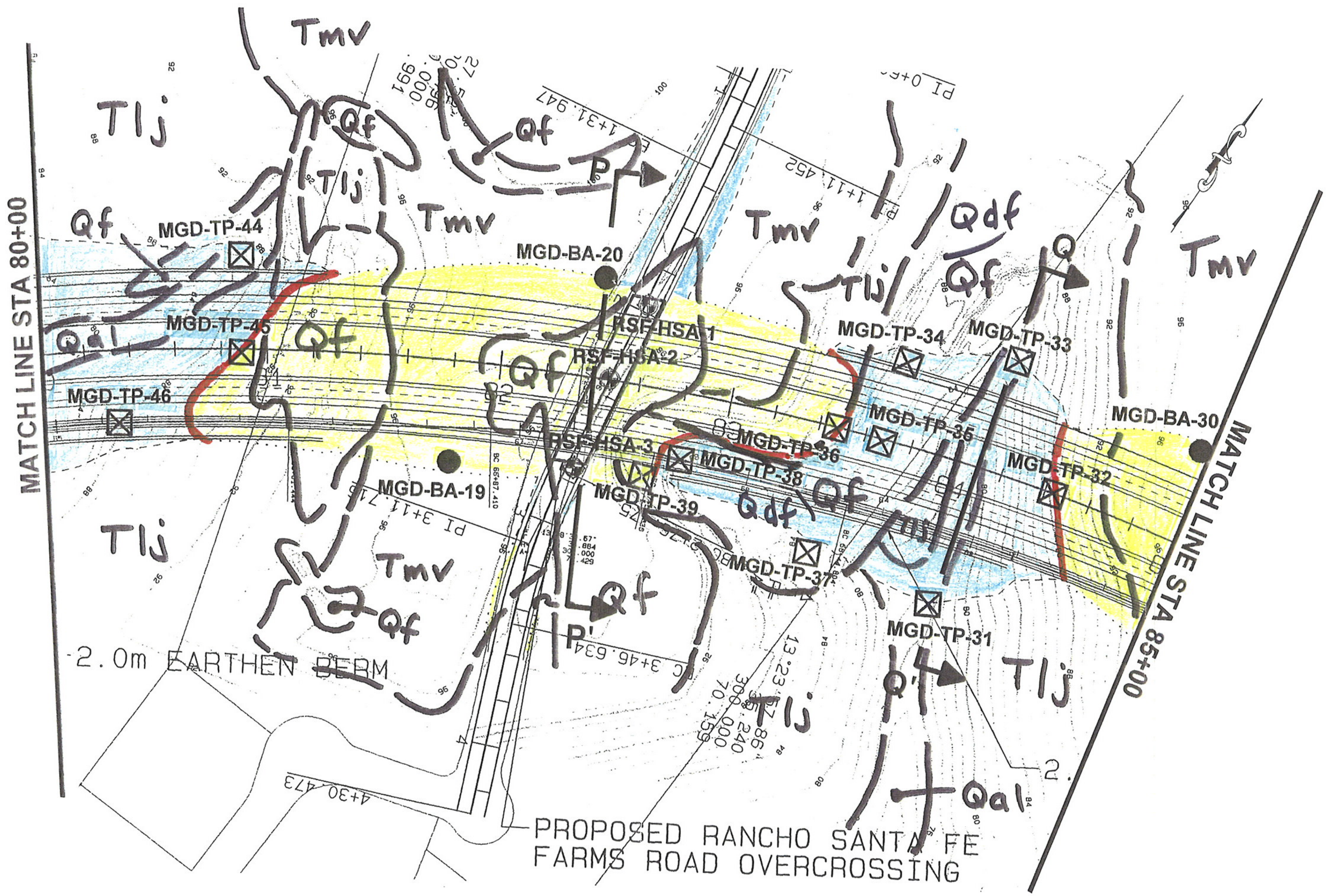
GDC Project No. I181-2
State Route 56 - Middle Segment
Geologic Map and Exploration Location Map
Sheet 6 of 12
Figure 2



SCALE
1 : 2,000

GROUP DELTA

GDC Project No. I181-2
State Route 56 - Middle Segment
Geologic Map and Exploration Location Map
Sheet 7 of 12
Figure 2



SCALE
1 : 2,000

GROUP DELTA

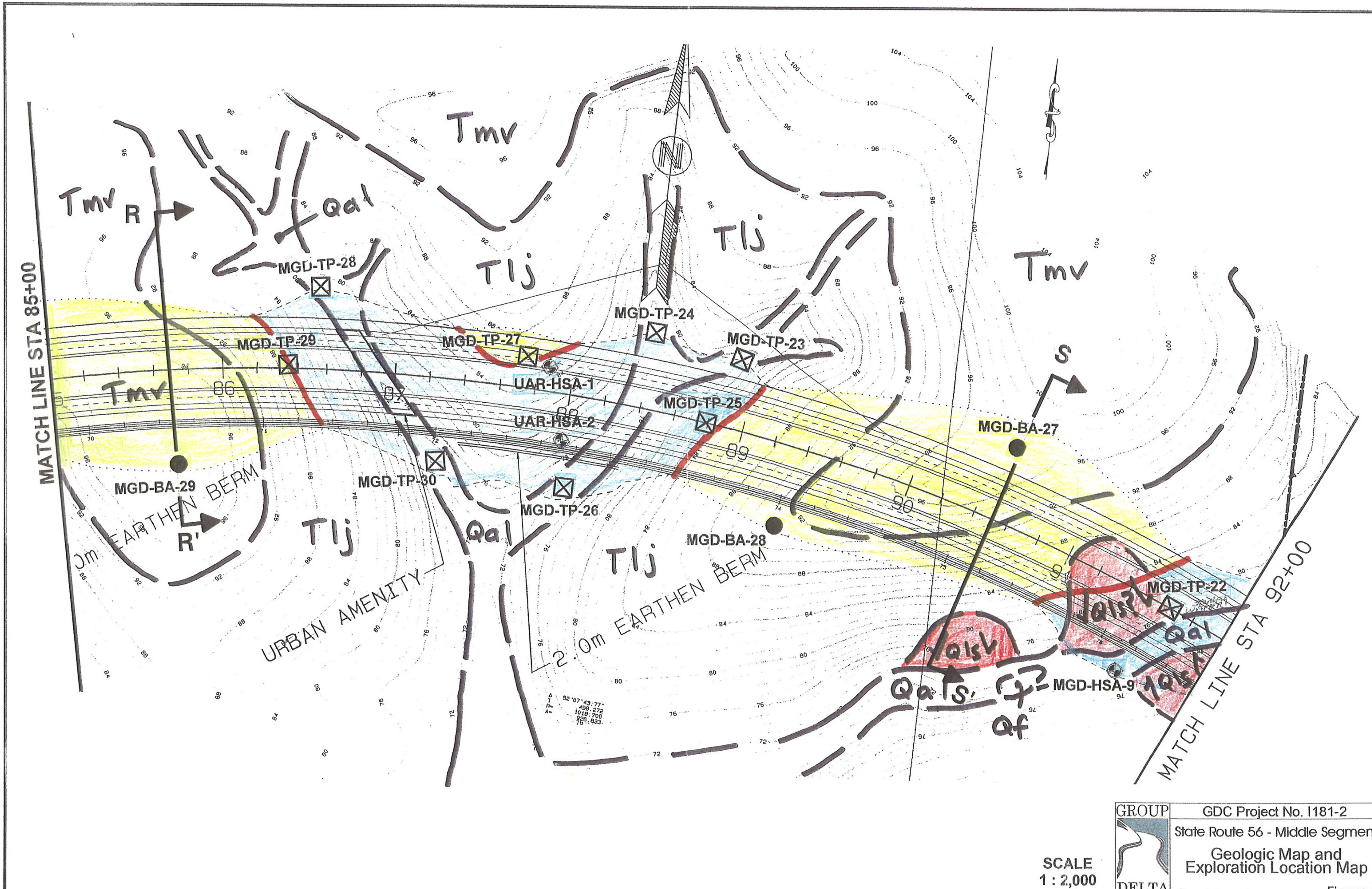
GDC Project No. I181-2

State Route 56 - Middle Segment

Geologic Map and
Exploration Location Map

Sheet 8 of 12

Figure 2



SCALE
1 : 2,000

GROUP DELTA

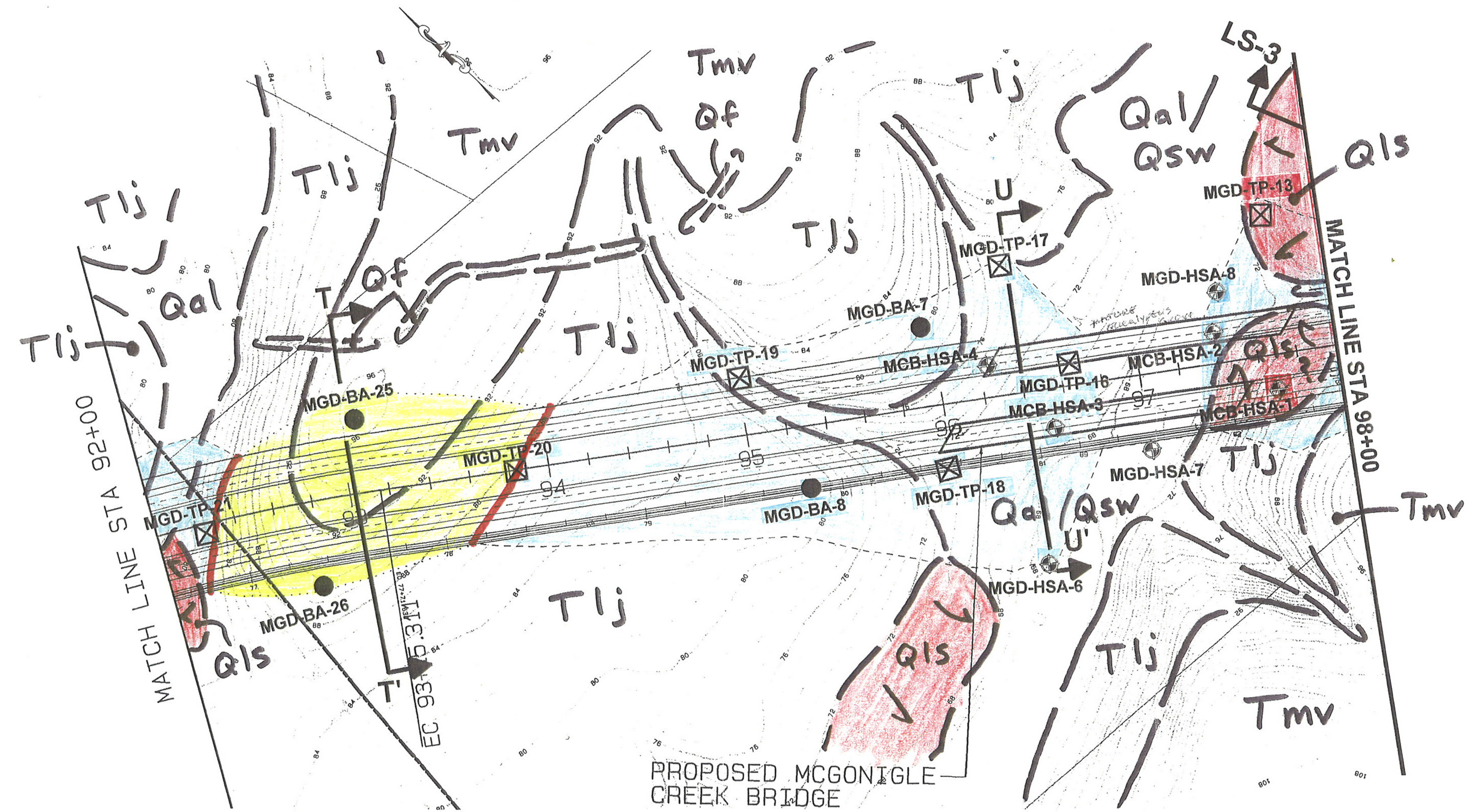
GDC Project No. I181-2

State Route 56 - Middle Segment

Geologic Map and Exploration Location Map

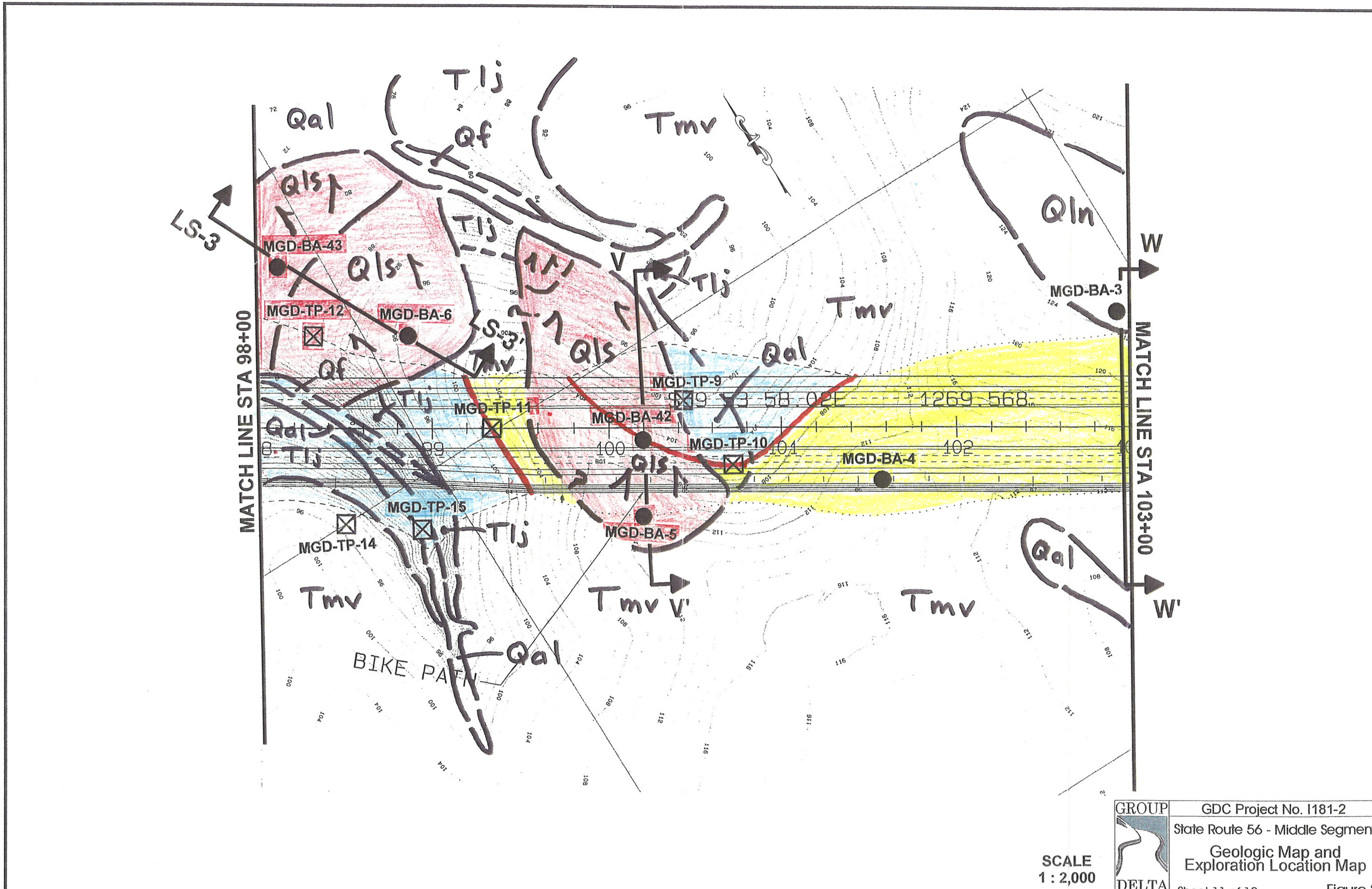
Sheet 9 of 12

Figure 2



SCALE 1 : 2,000

GROUP DELTA CONSULTANTS	GDC Project No. 1181-2
	State Route 56 - Middle Segment
	Geologic Map and Exploration Location Map
	Sheet 10 of 12 — Figure 2



SCALE
1 : 2,000

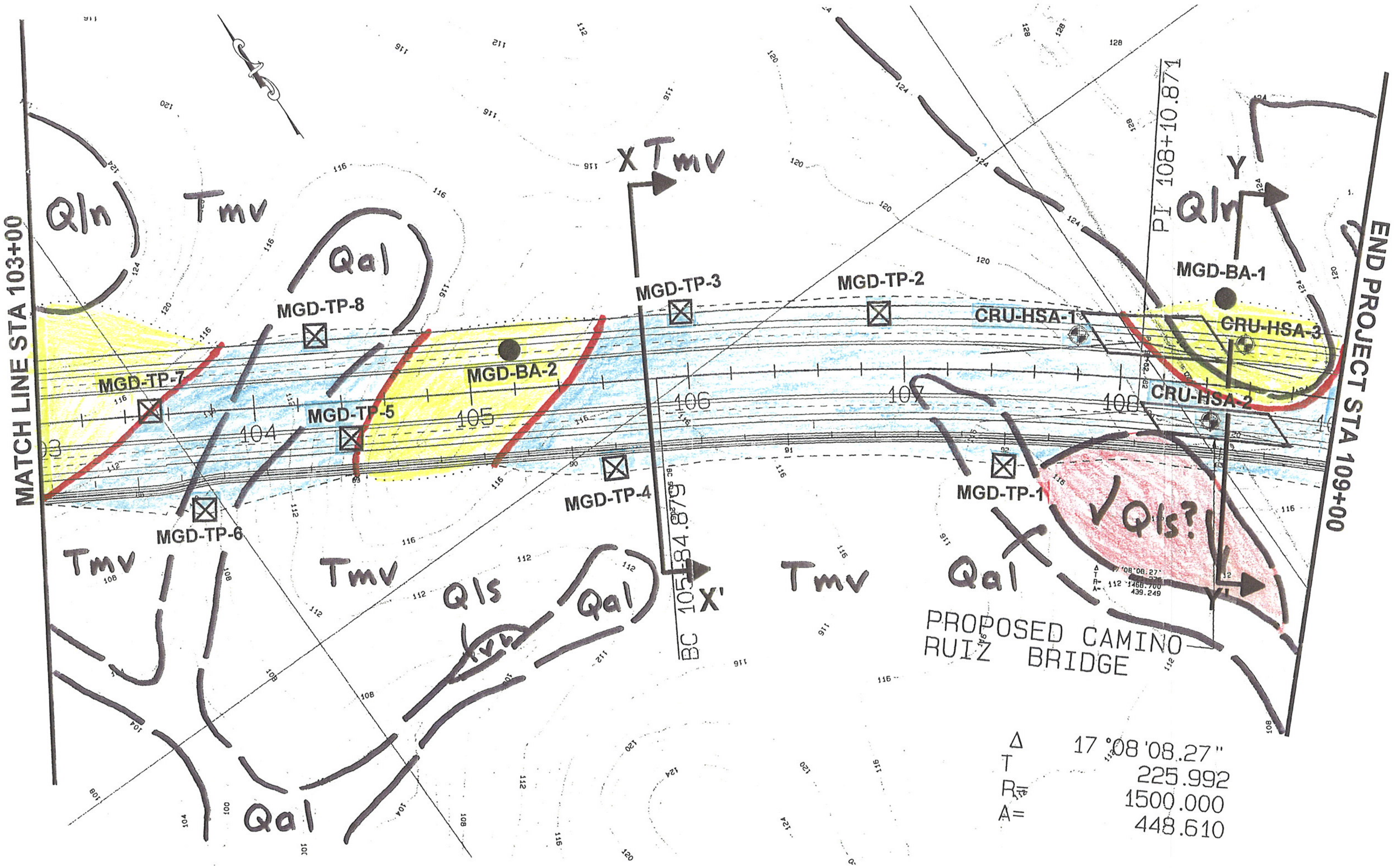
GDC Project No. I181-2

State Route 56 - Middle Segment

Geologic Map and Exploration Location Map

Sheet 11 of 12

Figure 2



SCALE
1 : 2,000

GROUP DELTA

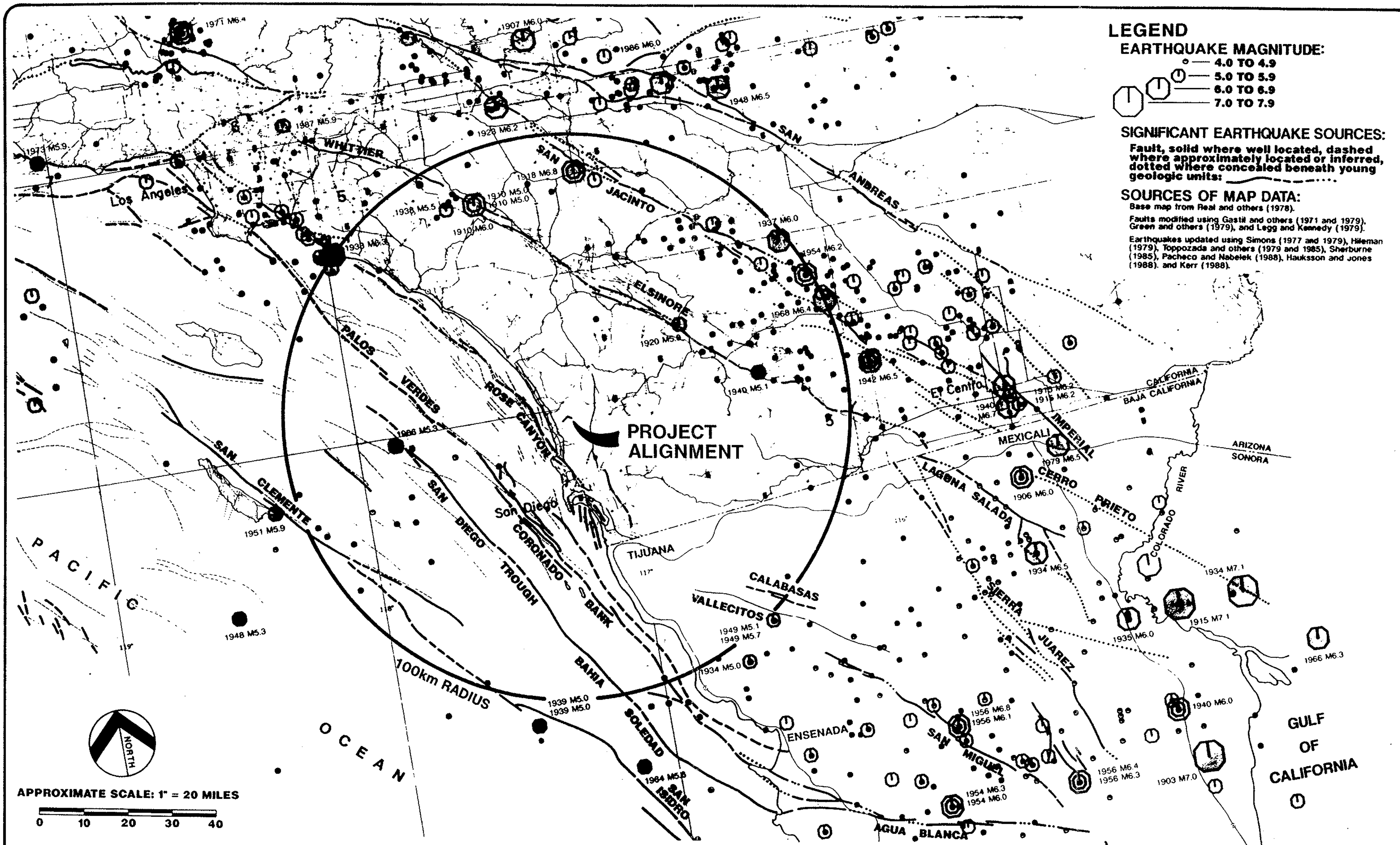
GDC Project No. I181-2

State Route 56 - Middle Segment

Geologic Map and Exploration Location Map

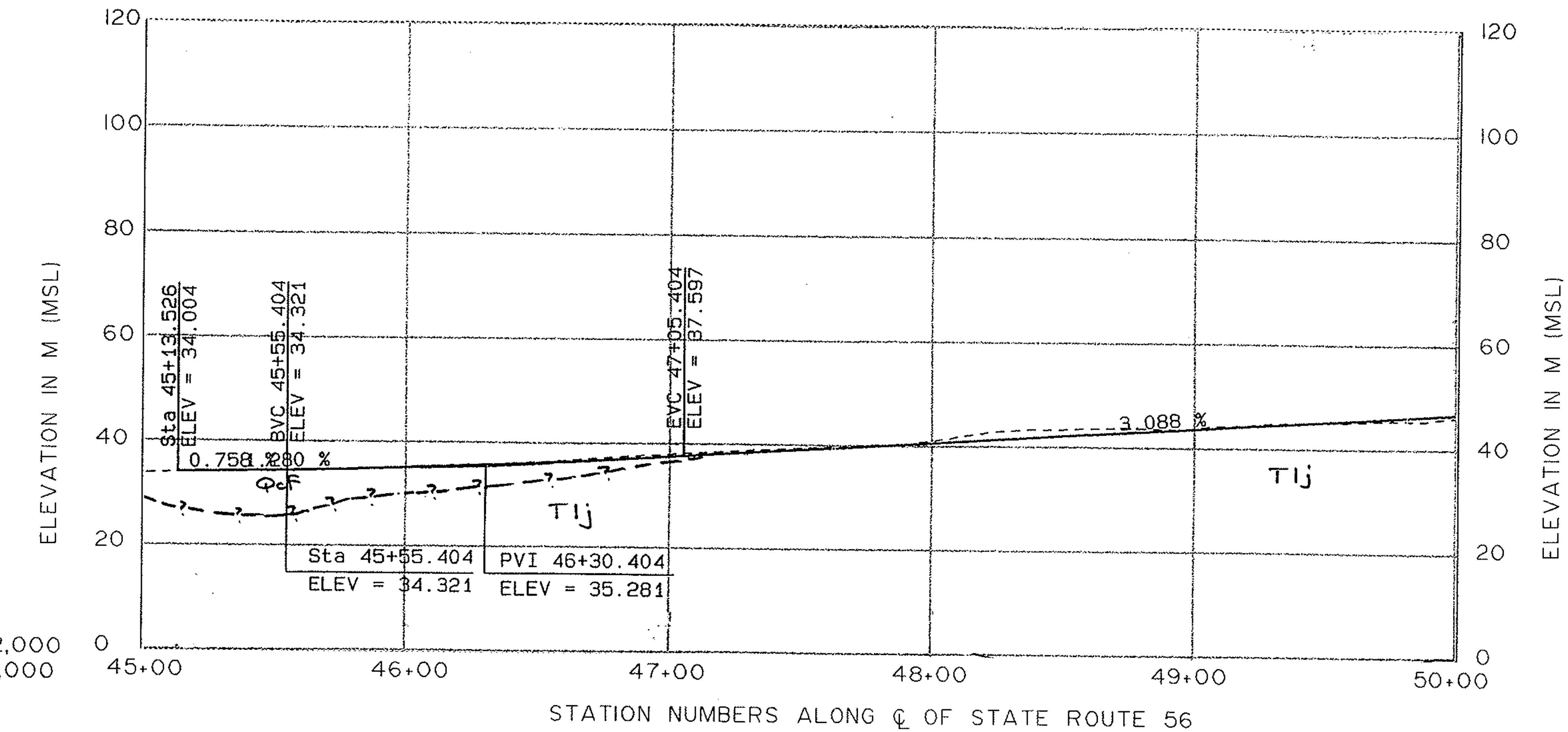
Sheet 12 of 12

Figure 2



Project	STATE ROUTE 56 PROJECT MIDDLE SEGMENT	FAULT AND EARTHQUAKE LOCATION MAP	Project No. I-181	Figure 3

GROUP DELTA CONSULTANTS, INC.



SCALE

H 1: 2,000
V 1: 1,000

LEGEND

——?——	GEOLOGIC CONTACT (QUERIED WHERE UNKNOWN)
	ESTIMATED LOCATION OF SUBSURFACE LAYER WITH HIGH GRAVEL CONTENT
Qal	ALLUVIUM
Qsw	SLOPEWASH
Qls	LANDSLIDE DEBRIS
Qt	STREAM TERRACE DEPOSITS
Qln	LINDAVISTA FORMATION
Tmv	MISSION VALLEY FORMATION
Tlj	LA JOLLA GROUP

EXPLORATION DESIGNATIONS

MGD	MIDDLE SEGMENT GEOTECHNICAL DESIGN REPORT
CVR	CARMEL VALLEY ROAD TYPE SELECTION REPORT
GCB	GONZALES CREEK BRIDGE TYPE SELECTION REPORT
CSF	CAMINO SANTA FE OVERCROSSING TYPE SELECTION REPORT
RSF	RANCHO SANTA FE FARMS TYPE SELECTION REPORT
UAR	VEHICULAR UNDERCROSSING (formerly Urban Amenity) TSR
MCB	MCGONIGLE CREEK BRIDGE TYPE SELECTION REPORT
CRU	CAMINO RUIZ UNDERCROSSING TYPE SELECTION REPORT
BA	BUCKET AUGER BORING
HSA	HOLLOW-STEM AUGER BORING
TP	BACKHOE TEST PIT

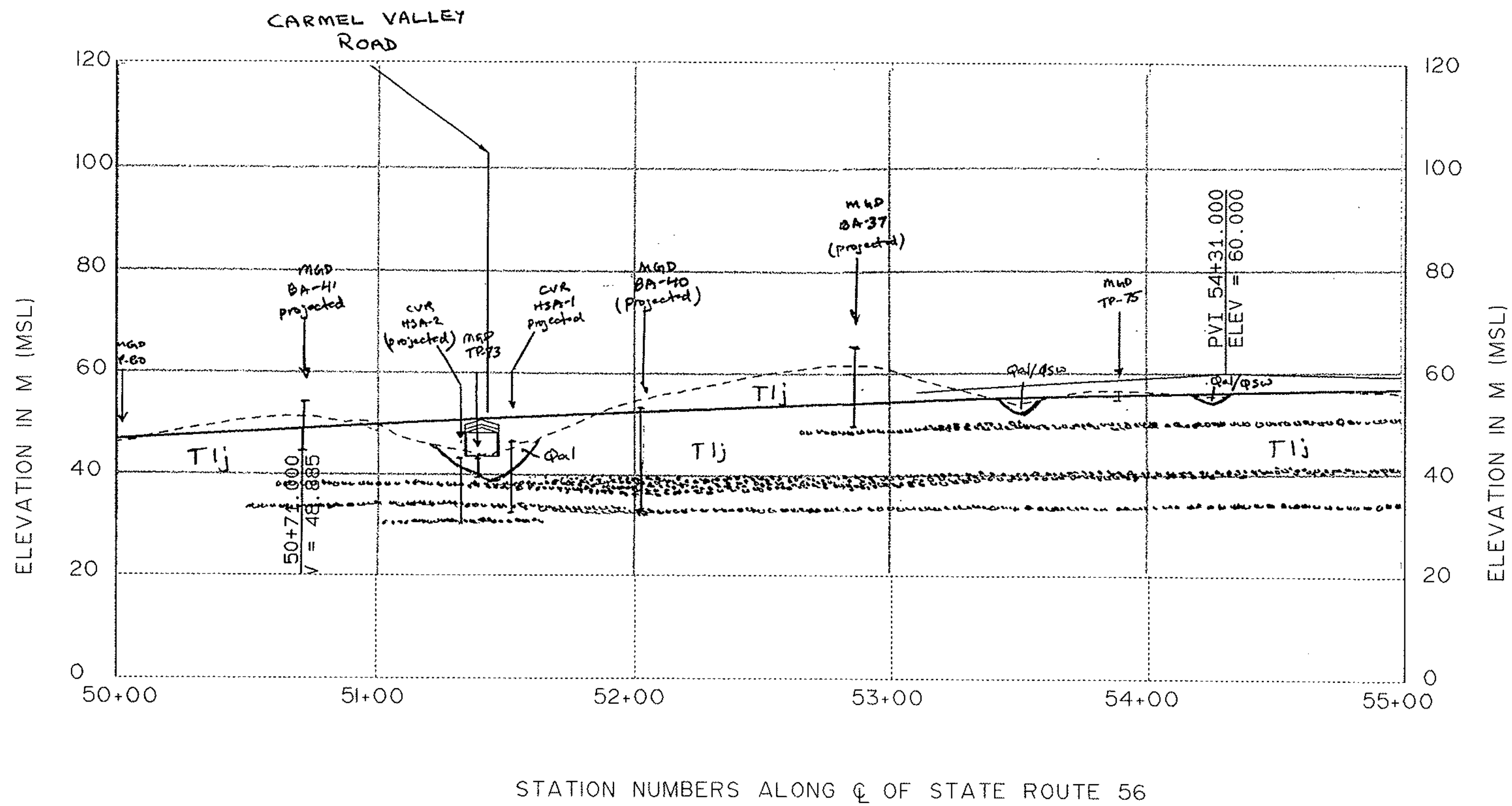
GROUP DELTA CONSULTANTS, INC.
4455 MURPHY CANYON DRIVE, SUITE 100
SAN DIEGO, CA 92612

GEOLOGIC PROFILE ALONG ALIGNMENT CENTERLINE
From Station 45+00 to 50+00

GDC PROJECT NO. I-181-2

STATE ROUTE 56 - MIDDLE SEGMENT
SAN DIEGO, CALIFORNIA

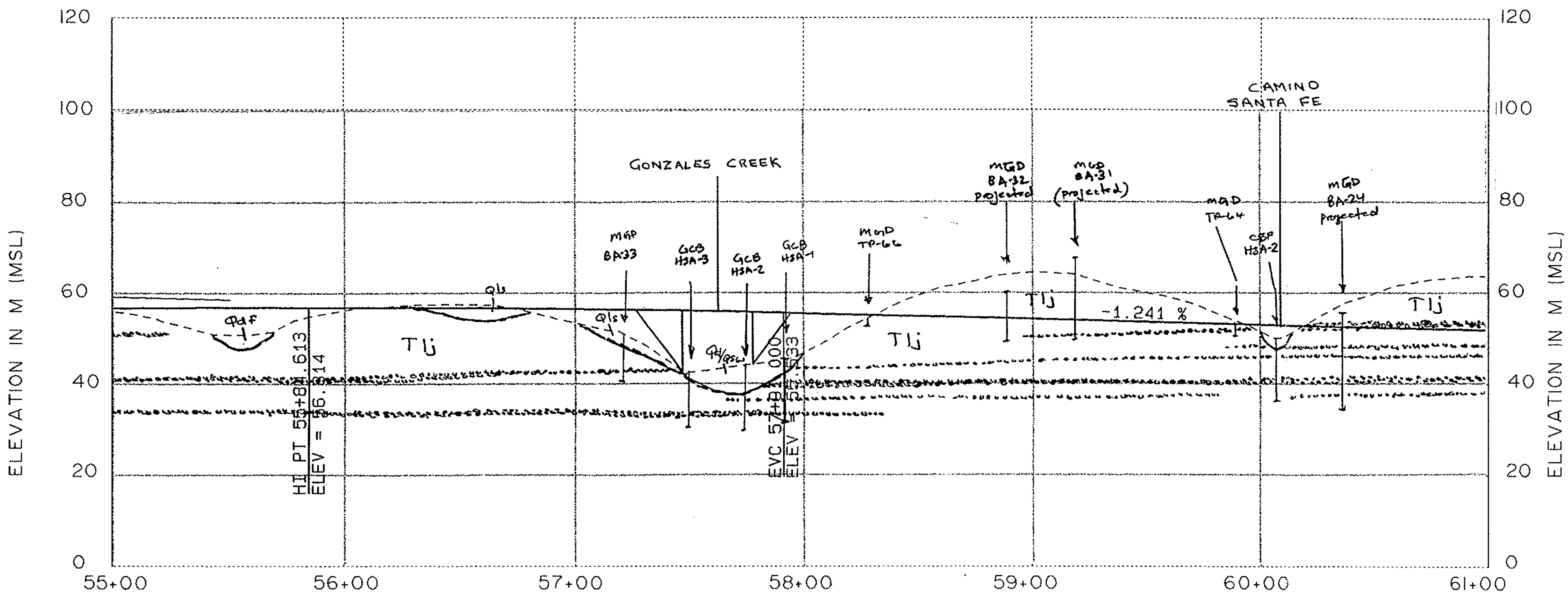
FIGURE - 4



SCALE

H 1: 2,000
V 1: 1,000

GROUP DELTA CONSULTANTS, INC. 4455 MURPHY CANYON DRIVE, SUITE 100 SAN DIEGO, CA 92612		**GEOLOGIC PROFILE ALONG ALIGNMENT CENTERLINE** **From Station 50+00 to 55+00**	GDC PROJECT NO. I-181-2 **STATE ROUTE 56 - MIDDLE SEGMENT** **SAN DIEGO, CALIFORNIA**	**FIGURE - 4** SHEET 2 OF 12



STATION NUMBERS ALONG ℄ OF STATE ROUTE 56

SCALE
H 1: 2,000
V 1: 1,000

GROUP DELTA CONSULTANTS, INC.
4455 MURPHY CANYON DRIVE, SUITE 100
SAN DIEGO, CA 92612

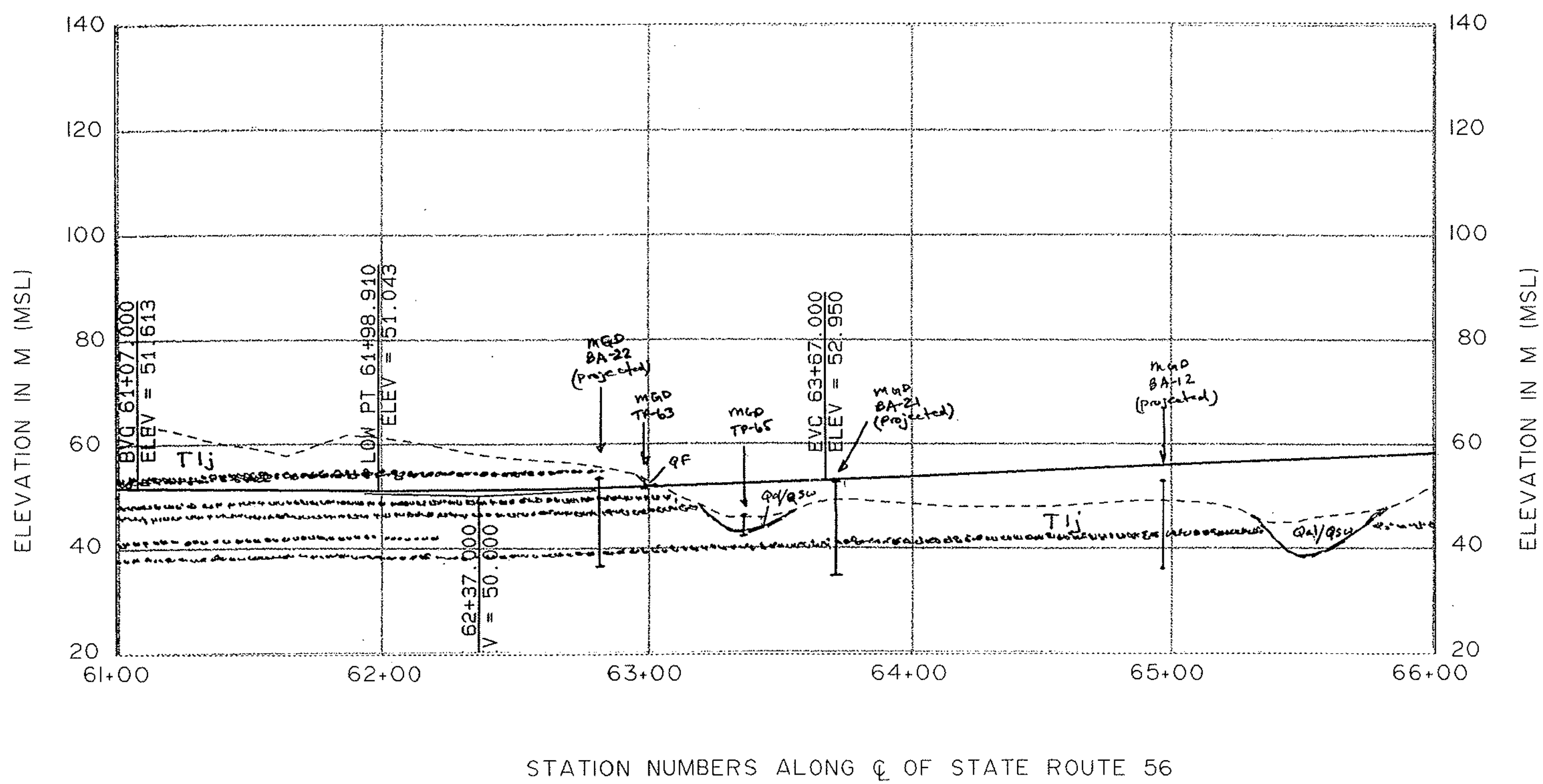
GEOLOGIC PROFILE ALONG ALIGNMENT CENTERLINE
From Station 55+00 to 61+00

GDC PROJECT NO. 1-181-2

STATE ROUTE 56 - MIDDLE SEGMENT
SAN DIEGO, CALIFORNIA

FIGURE - 4

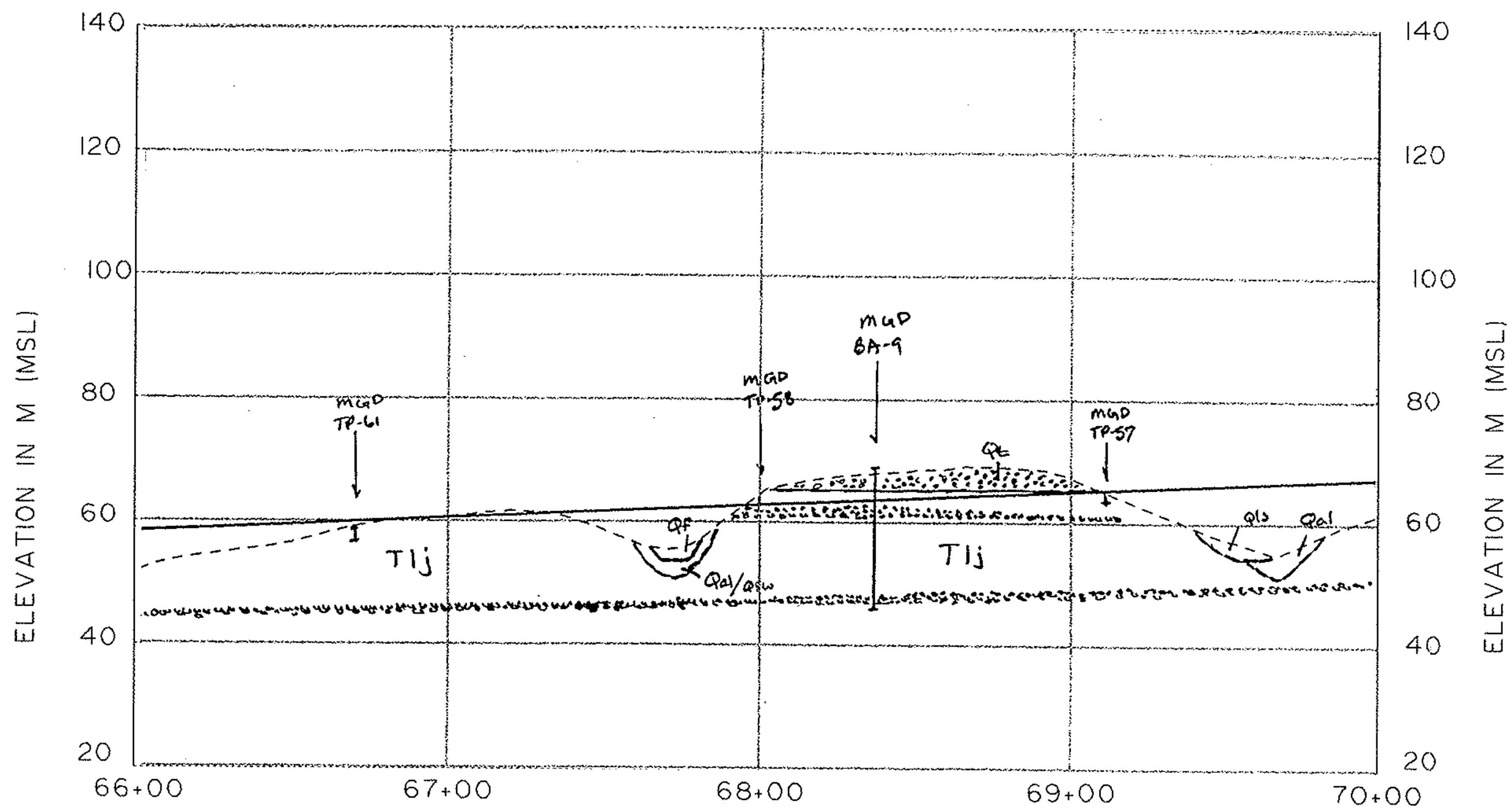
SHEET 3 OF 12



SCALE

H 1: 2,000
V 1: 1,000

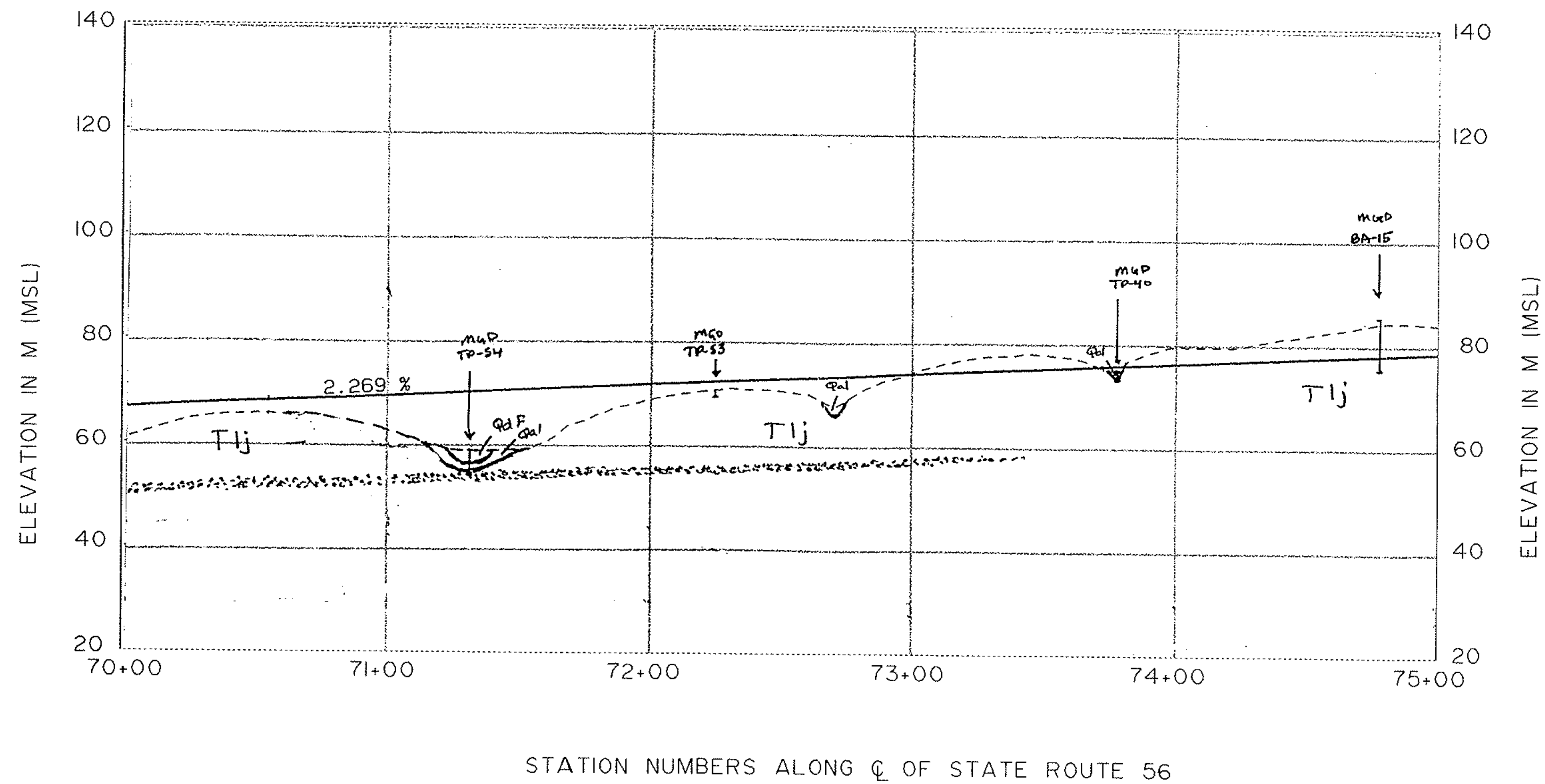
GROUP DELTA CONSULTANTS, INC. 4455 MURPHY CANYON DRIVE, SUITE 100 SAN DIEGO, CA 92612		**GEOLOGIC PROFILE ALONG ALIGNMENT CENTERLINE** **From Station 61+00 to 66+00**	GDC PROJECT NO. 1-181-2 **STATE ROUTE 56 - MIDDLE SEGMENT SAN DIEGO, CALIFORNIA**	**FIGURE - 4** SHEET 4 OF 12



STATION NUMBERS ALONG ℄ OF STATE ROUTE 56

SCALE
H 1: 2,000
V 1: 1,000

GROUP DELTA CONSULTANTS, INC. 4455 MURPHY CANYON ROAD, SUITE 100 SAN DIEGO, CA 92612		GEOLOGIC PROFILE ALONG ALIGNMENT CENTERLINE From Station 66+00 to 70+00	GDC PROJECT NO. 1-181-2 STATE ROUTE 56 - MIDDLE SEGMENT SAN DIEGO, CALIFORNIA	FIGURE - 4 SHEET 5 OF 12



SCALE
H 1: 2,000
V 1: 1,000

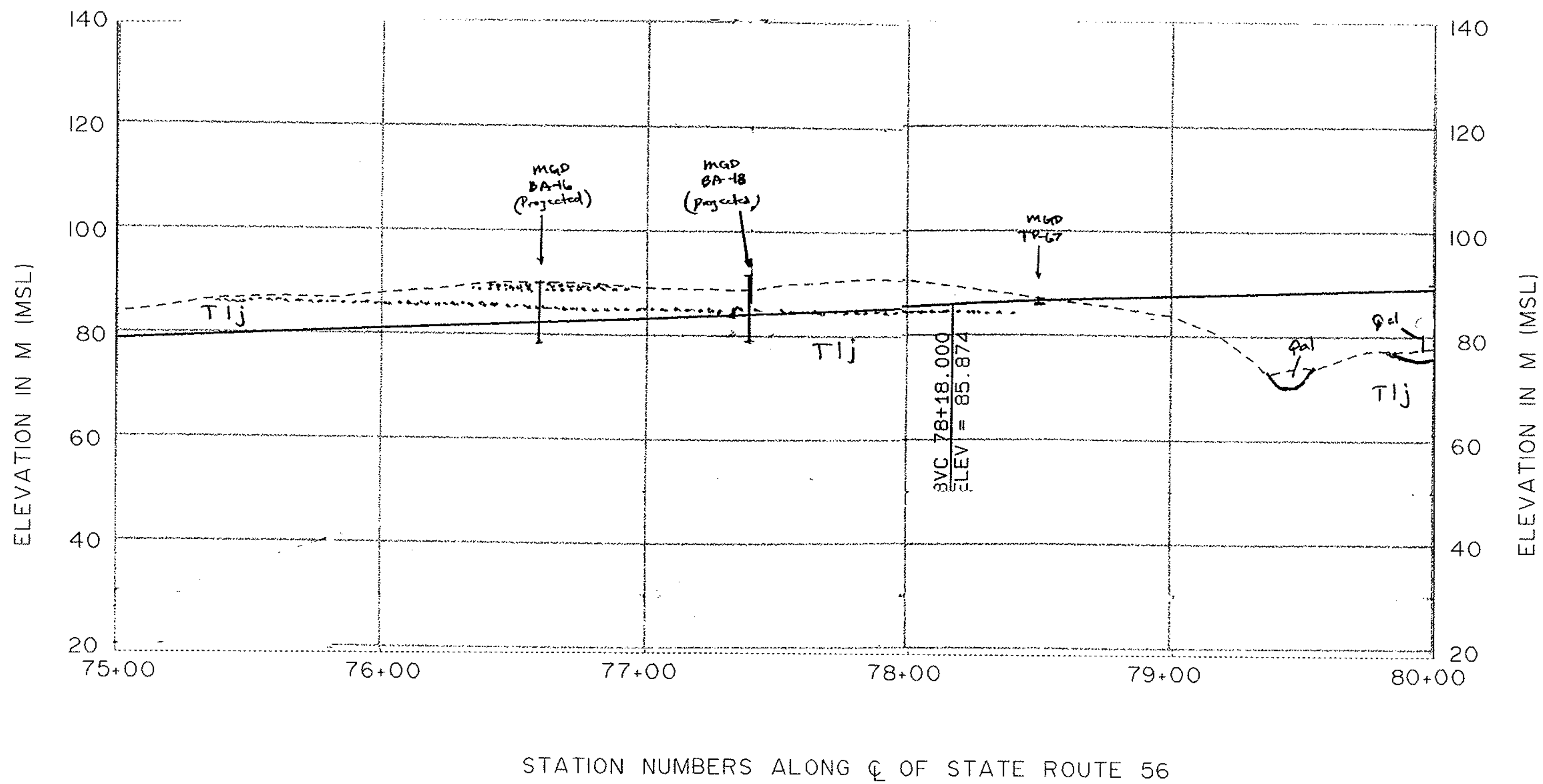
GROUP DELTA CONSULTANTS, INC.
4455 MURPHY CANYON DRIVE, SUITE 100
SAN DIEGO, CA 92612

GEOLOGIC PROFILE ALONG ALIGNMENT CENTERLINE
From Station 70+00 to 75+00

GDC PROJECT NO. 1-181-2

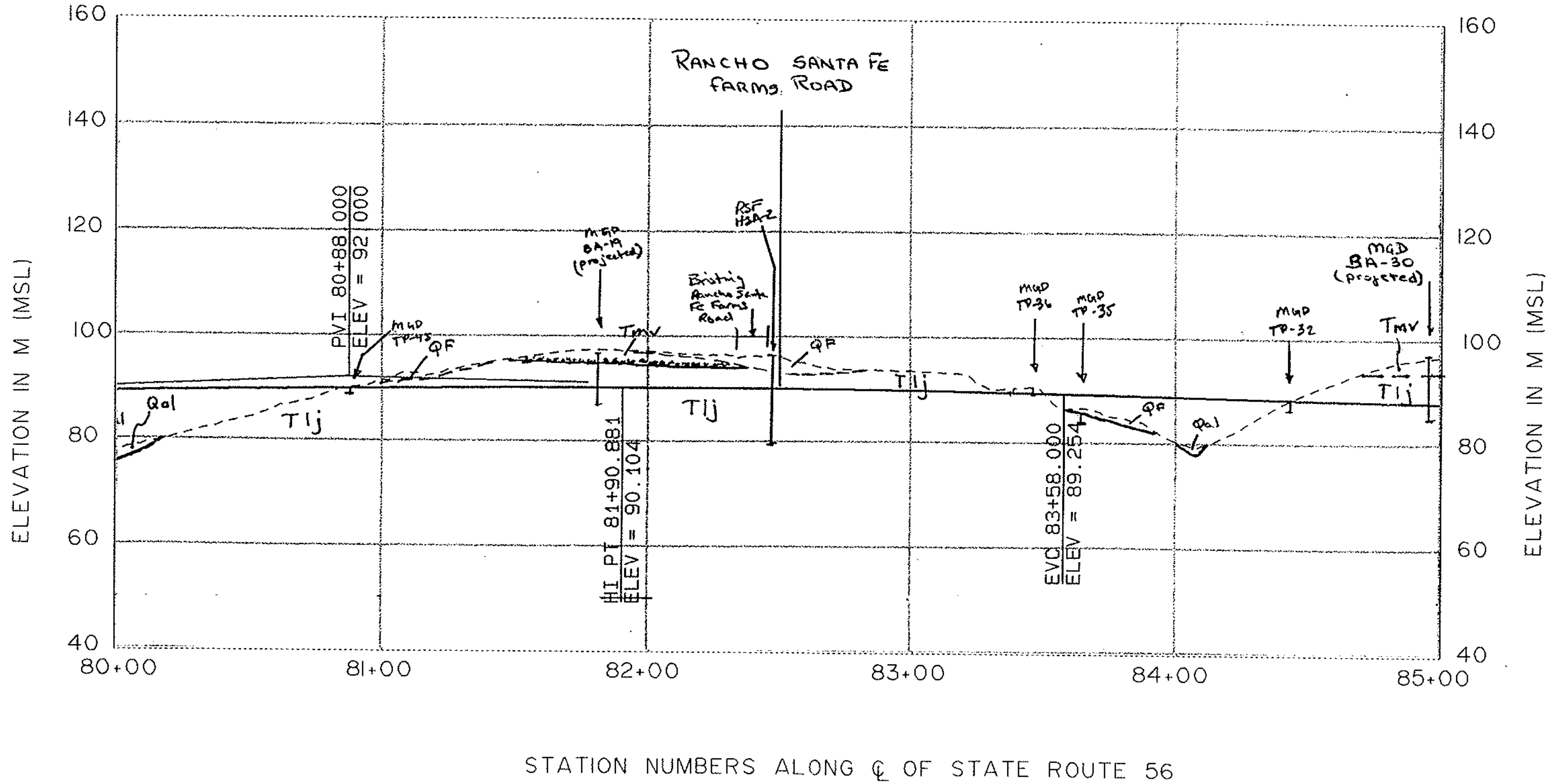
STATE ROUTE 56 - MIDDLE SEGMENT
SAN DIEGO, CALIFORNIA

FIGURE - 4



SCALE
H 1: 2,000
V 1: 1,000

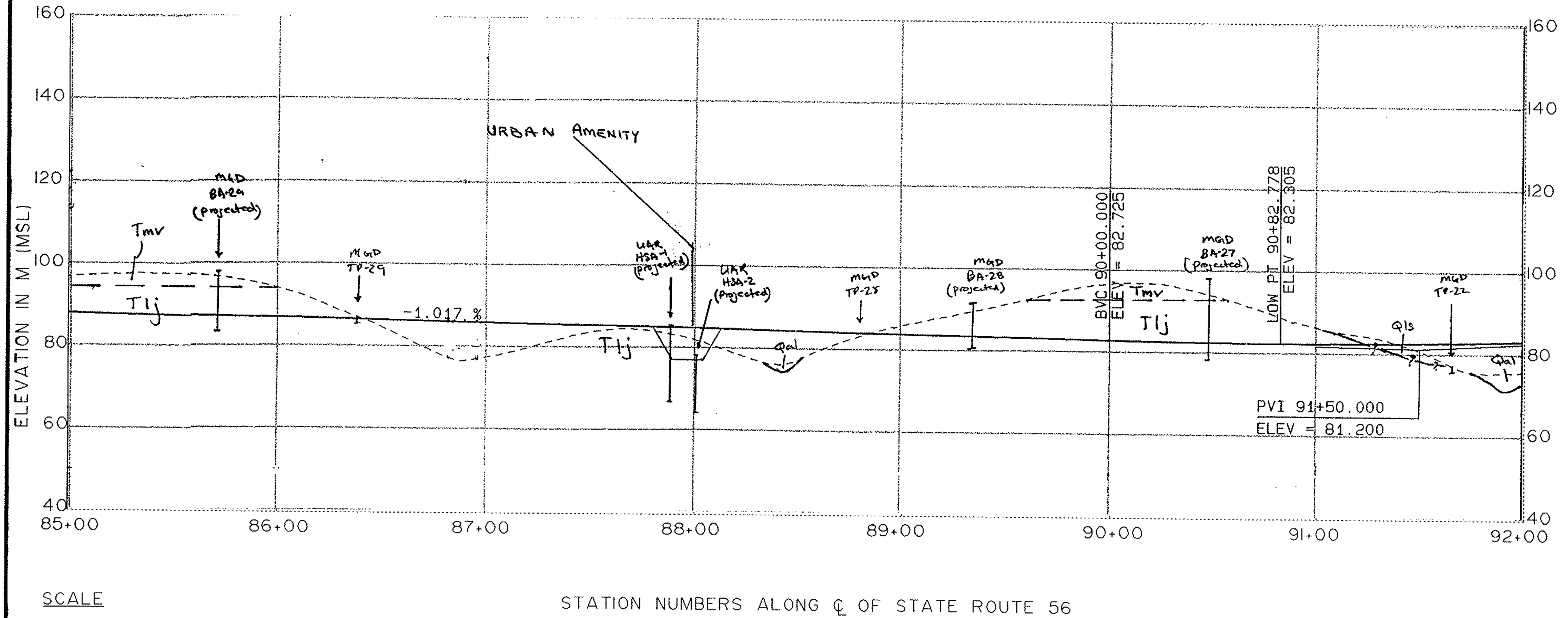
GROUP DELTA CONSULTANTS, INC. 4455 MURPHY CANYON DRIVE, SUITE 100 SAN DIEGO, CA 92612		**GEOLOGIC PROFILE ALONG ALIGNMENT CENTERLINE** **From Station 75+00 to 80+00**	GDC PROJECT NO. I-181-2 **STATE ROUTE 56 - MIDDLE SEGMENT** **SAN DIEGO, CALIFORNIA**	**FIGURE - 4** SHEET 7 OF 12



SCALE

H I: 2,000
V I: 1,000

GROUP DELTA CONSULTANTS, INC. 4455 MURPHY CANYON DRIVE, SUITE 100 SAN DIEGO, CA 92612		**GEOLOGIC PROFILE ALONG ALIGNMENT CENTERLINE** **From Station 80+00 to 85+00**	GDC PROJECT NO. I-181-2 **STATE ROUTE 56 - MIDDLE SEGMENT** **SAN DIEGO, CALIFORNIA**	**FIGURE - 4** SHEET 8 OF 12



SCALE
H 1: 2,000
V 1: 1,000

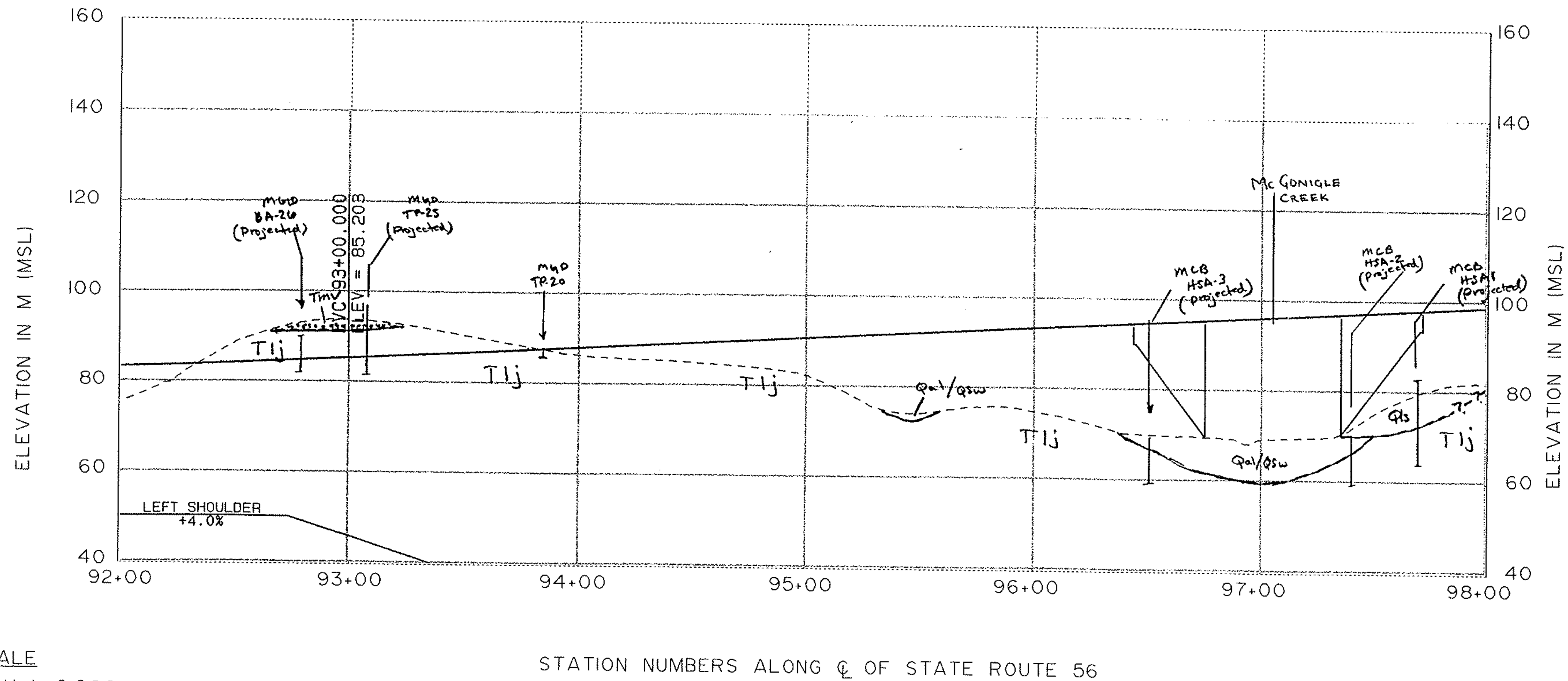
GROUP DELTA CONSULTANTS, INC.
4455 MURPHY CANYON DRIVE, SUITE 100
SAN DIEGO, CA 92612

GEOLOGIC PROFILE ALONG ALIGNMENT CENTERLINE
From Station 85+00 to 92+00

GDC PROJECT NO. I-181-2

STATE ROUTE 56 - MIDDLE SEGMENT
SAN DIEGO, CALIFORNIA

FIGURE - 4



SCALE

H 1: 2,000
V 1: 1,000

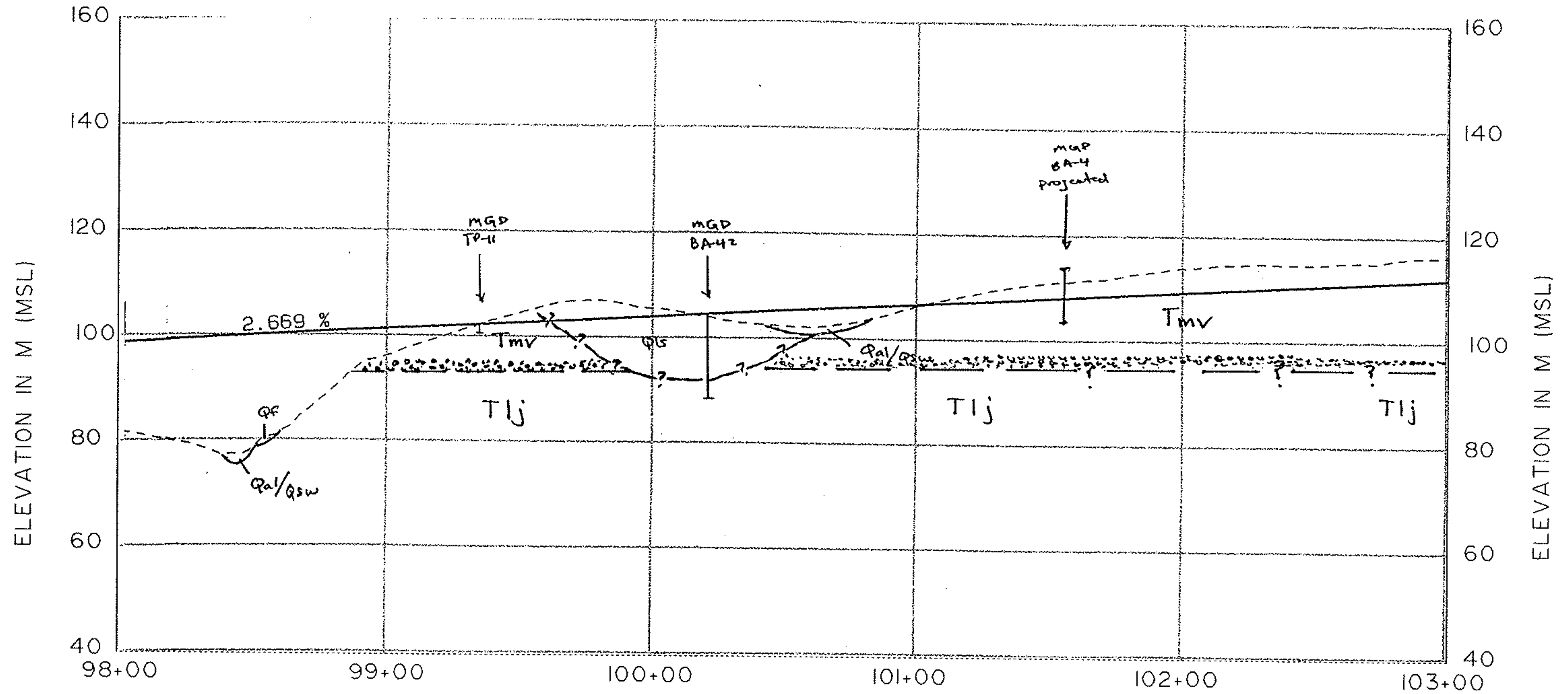
GROUP DELTA CONSULTANTS, INC.
4455 MURPHY CANYON DRIVE, SUITE 100
SAN DIEGO, CA 92612

GEOLOGIC PROFILE ALONG ALIGNMENT CENTERLINE
From Station 92+00 to 98+00

GDC PROJECT NO. I-181-2

STATE ROUTE 56 - MIDDLE SEGMENT
SAN DIEGO, CALIFORNIA

FIGURE - 4



SCALE
H 1: 2,000
V 1: 1,000

GROUP DELTA CONSULTANTS, INC.
4455 MURPHY CANYON ROAD, SUITE 100
SAN DIEGO, CA 92612

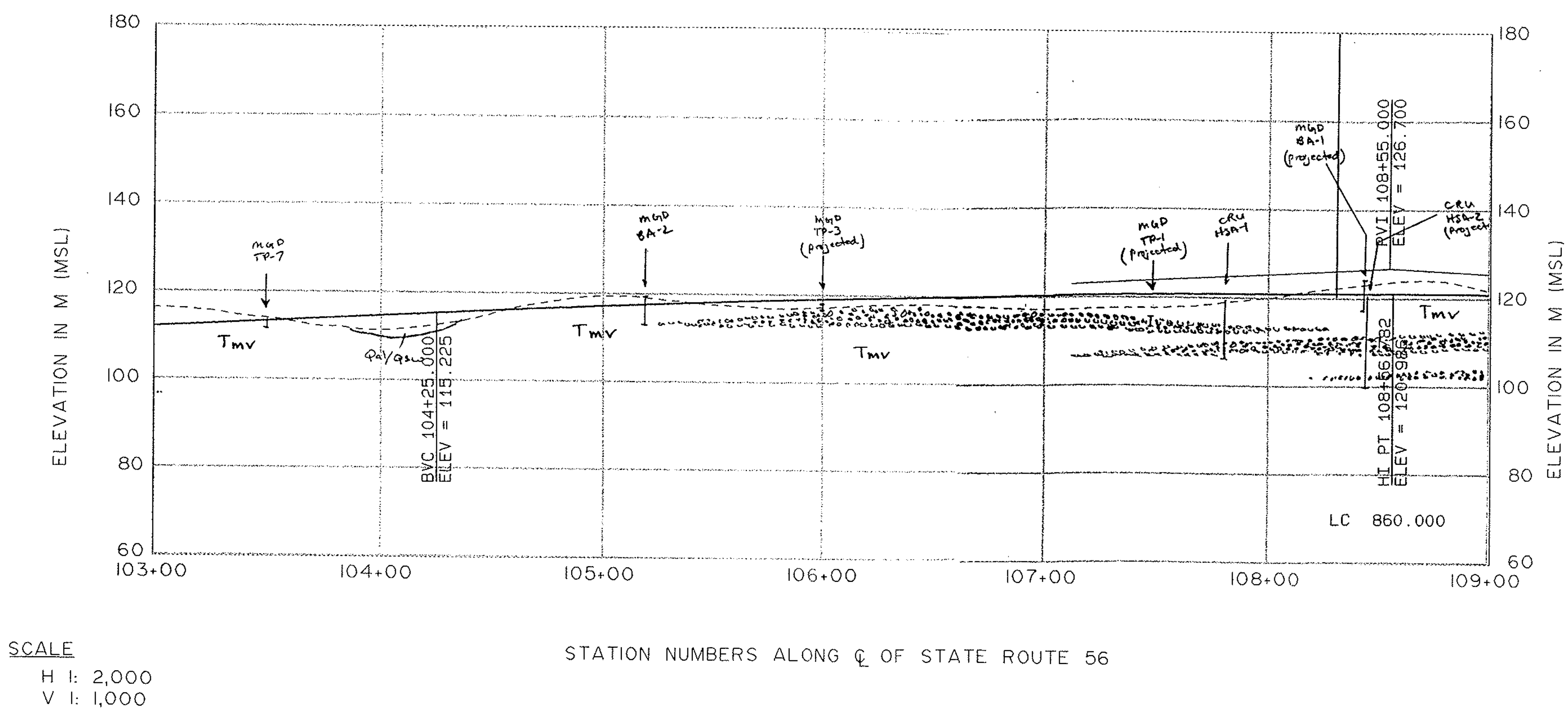
GEOLOGIC PROFILE ALONG ALIGNMENT CENTERLINE
From Station 98+00 to 103+00

GDC PROJECT NO. 1-181-2

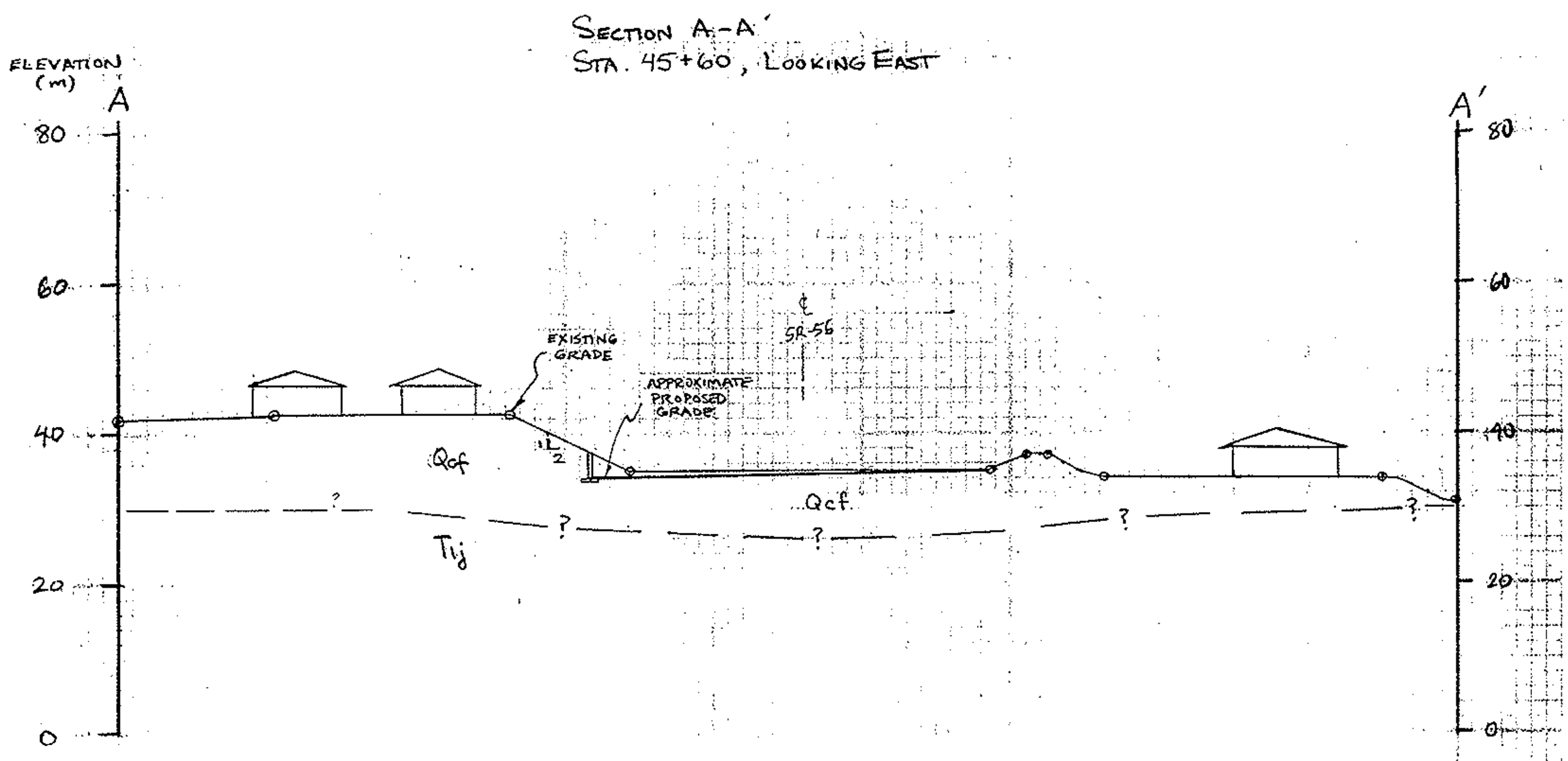
STATE ROUTE 56 - MIDDLE SEGMENT
SAN DIEGO, CALIFORNIA

FIGURE - 4

SHEET 11 OF 12



GROUP DELTA CONSULTANTS, INC. 4455 MURPHY CANYON DRIVE, SUITE 100 SAN DIEGO, CA 92612		**GEOLOGIC PROFILE ALONG ALIGNMENT CENTERLINE** **From Station 103+00 to 109+00**	GDC PROJECT NO. I-181-2 **STATE ROUTE 56 - MIDDLE SEGMENT** **SAN DIEGO, CALIFORNIA**	**FIGURE - 4** SHEET 12 OF 12



SCALE
1 : 1,000

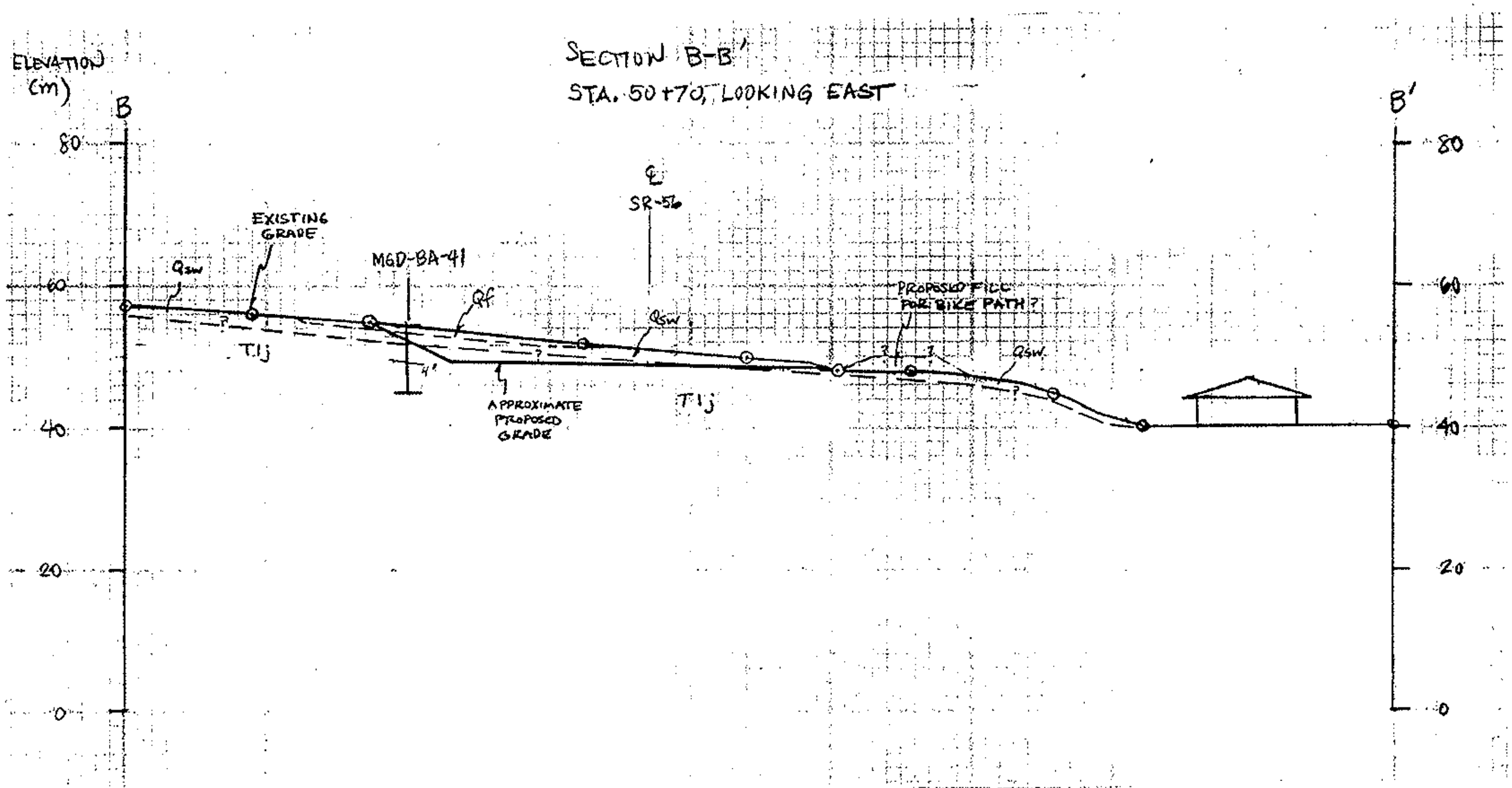
GROUP DELTA CONSULTANTS

GDC Project No. I181-2

State Route 56 - Middle Segment

Cross Section A-A'

Figure 5



SCALE
1 : 1,000

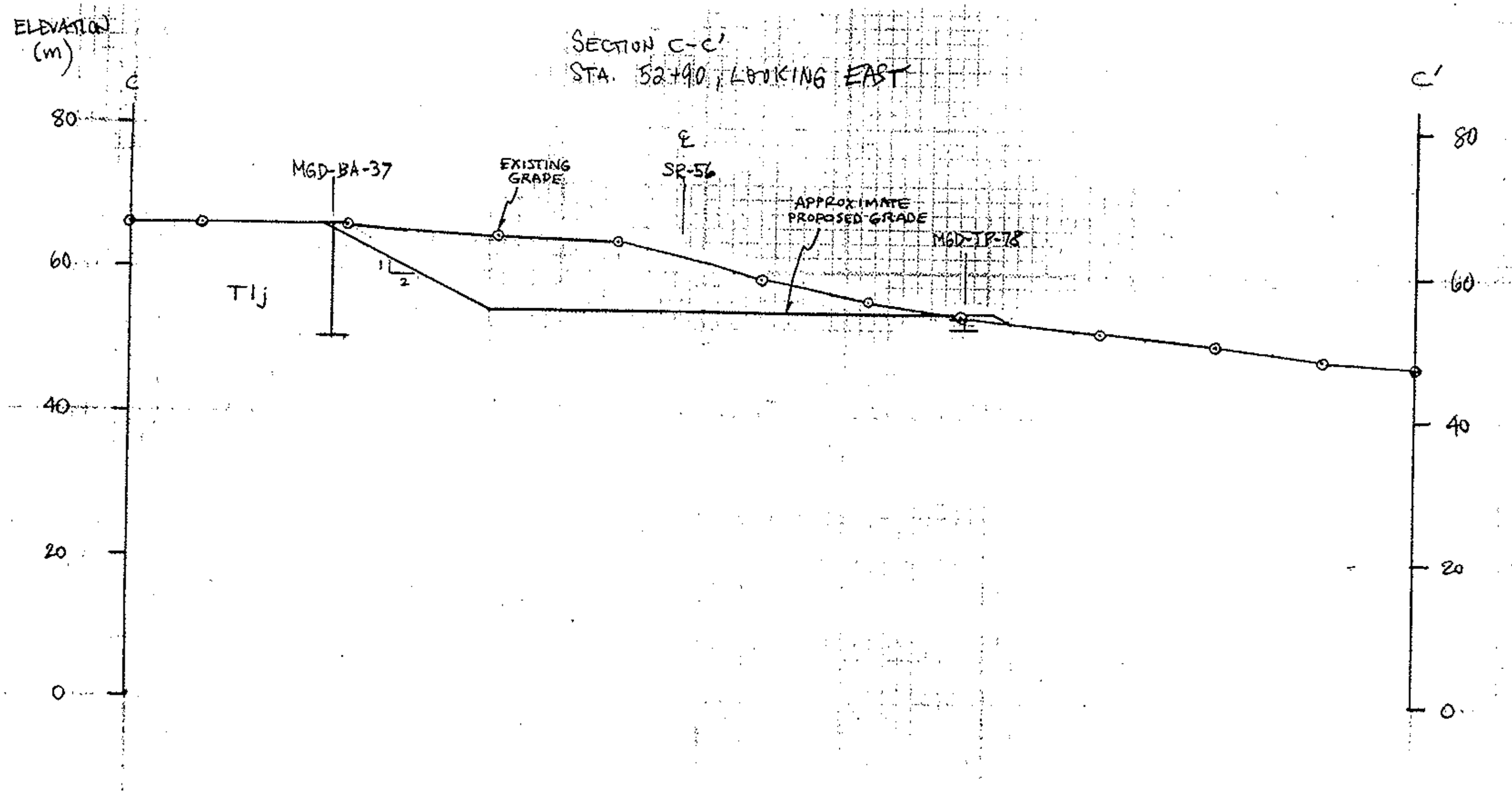
GROUP DELTA CONSULTANTS

GDC Project No. I181-2

State Route 56 - Middle Segment

Cross Section B-B'

Figure 6



SCALE
1 : 1,000

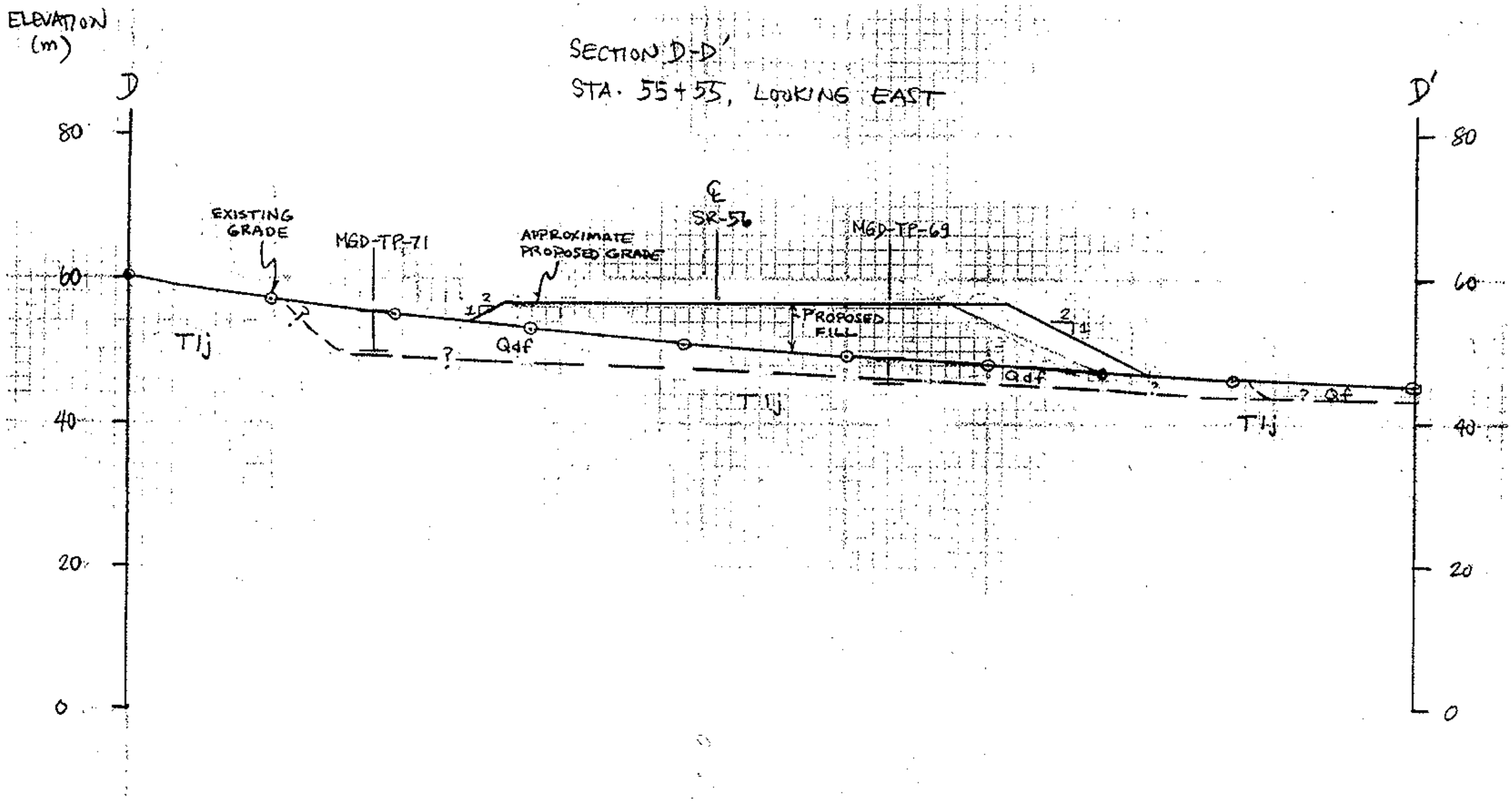
GROUP DELTA CONSULTANTS

GDC Project No. I181-2

State Route 56 - Middle Segment

Cross Section C-C'

Figure 7



SCALE
1 : 1,000

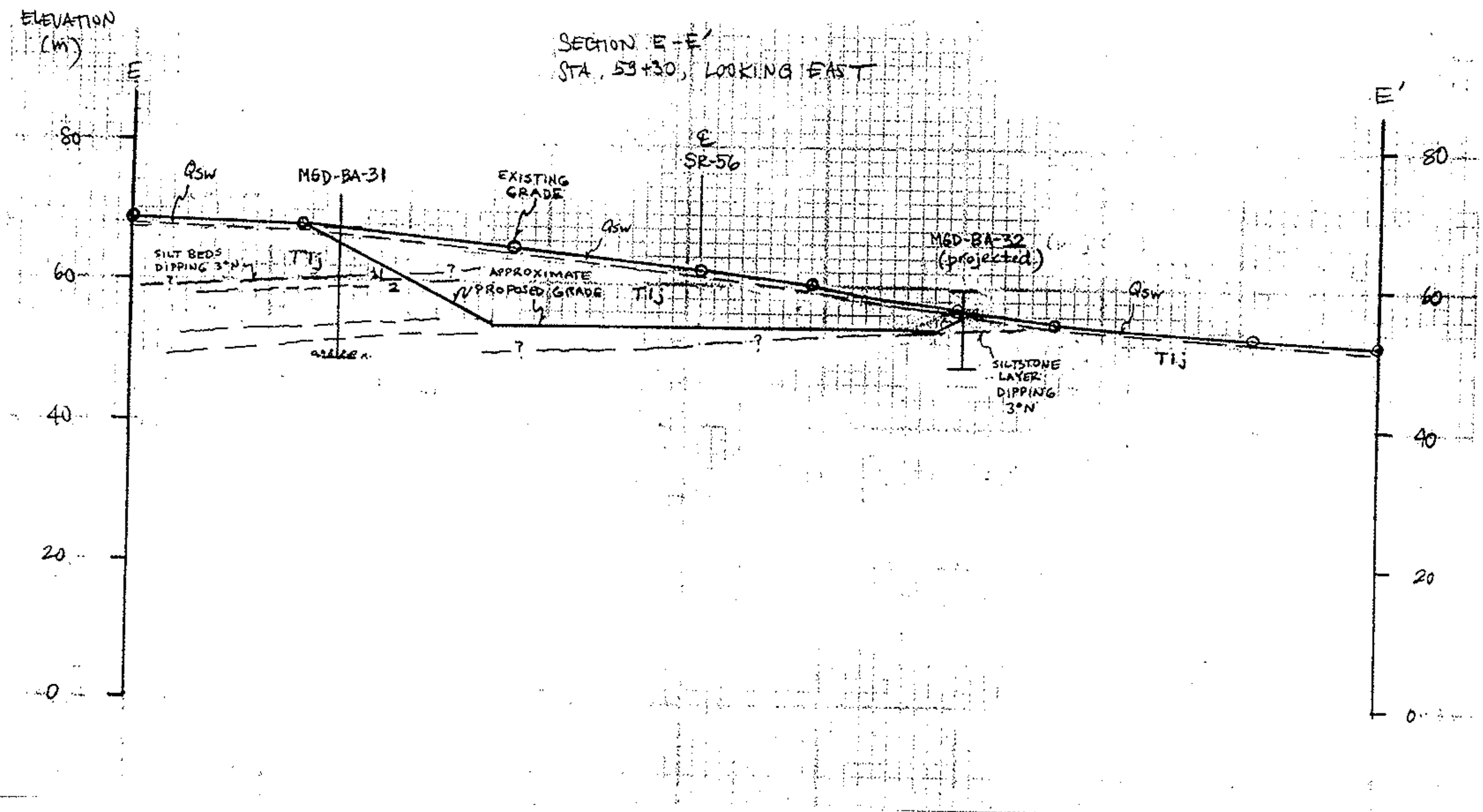
GROUP DELTA CONSULTANTS

GDC Project No. I181-2

State Route 56 - Middle Segment

Cross Section D-D'

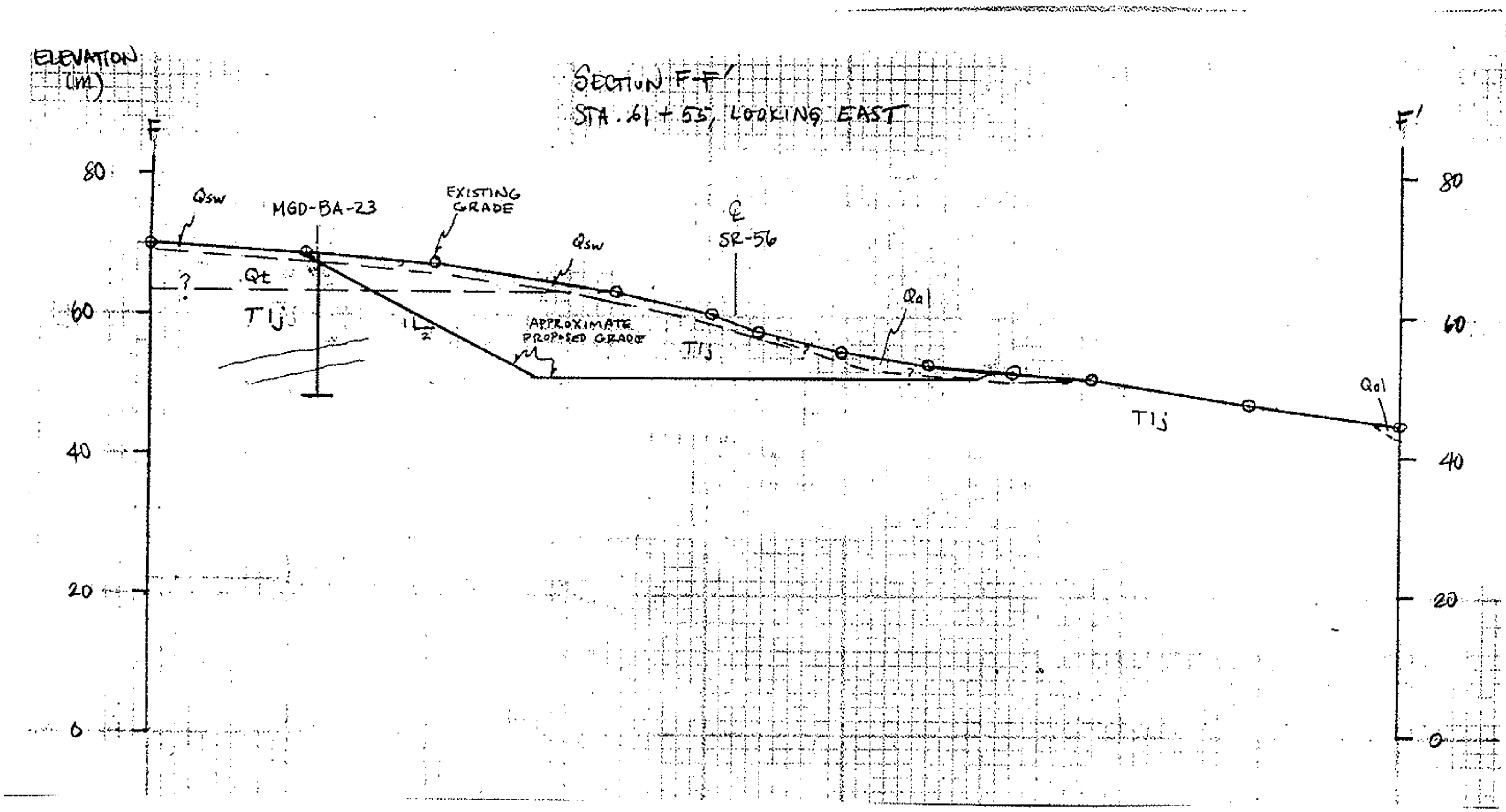
Figure 8



SCALE
1 : 1,000

GROUP DELTA CONSULTANTS

GDC Project No. I181-2
State Route 56 - Middle Segment
Cross Section E-E'
Figure 9



SCALE
1 : 1,000

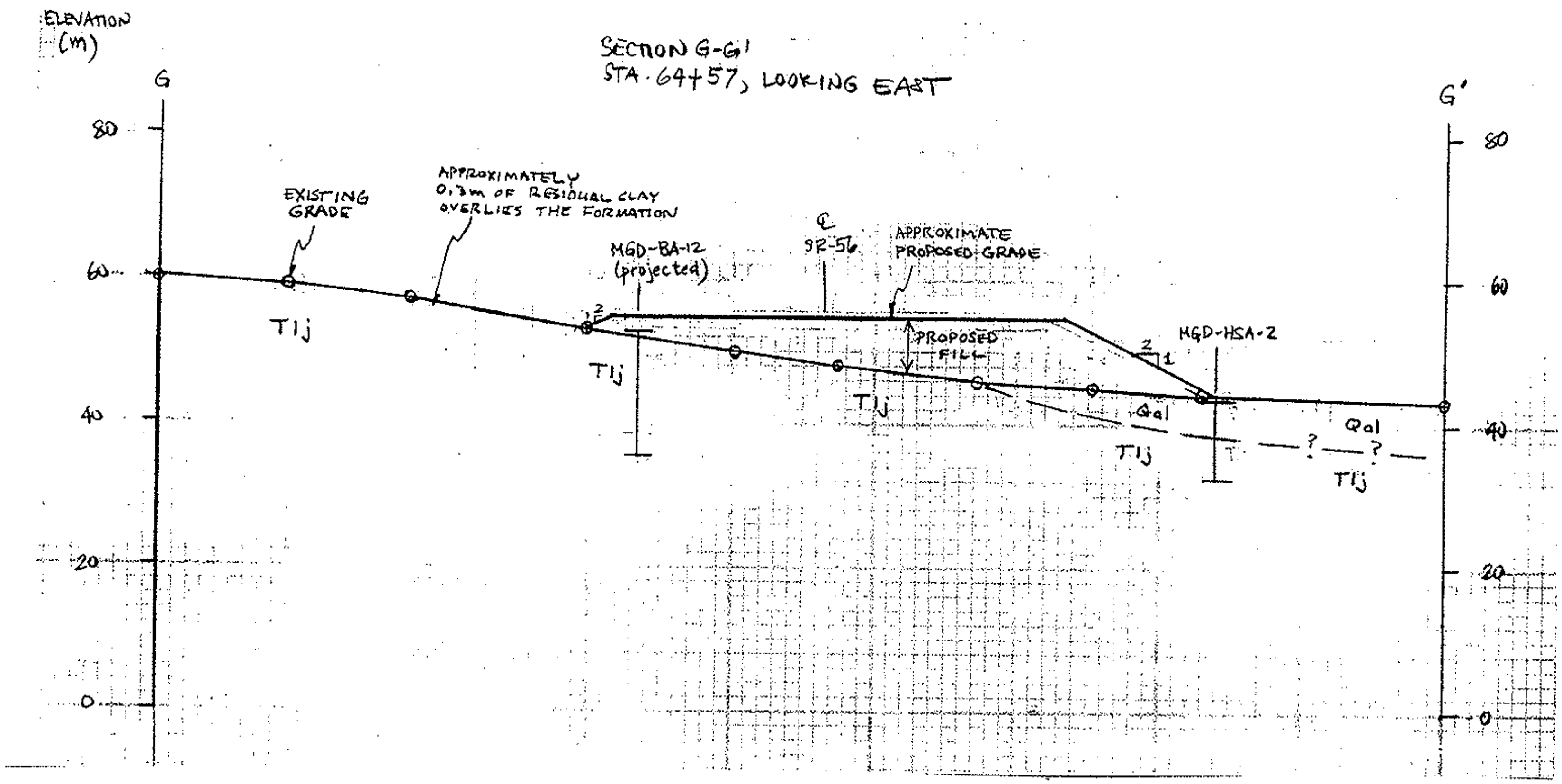
GROUP DELTA CONSULTANTS

GDC Project No. I181-2

State Route 56 - Middle Segment

Cross Section F-F'

Figure 10



SCALE
1 : 1,000

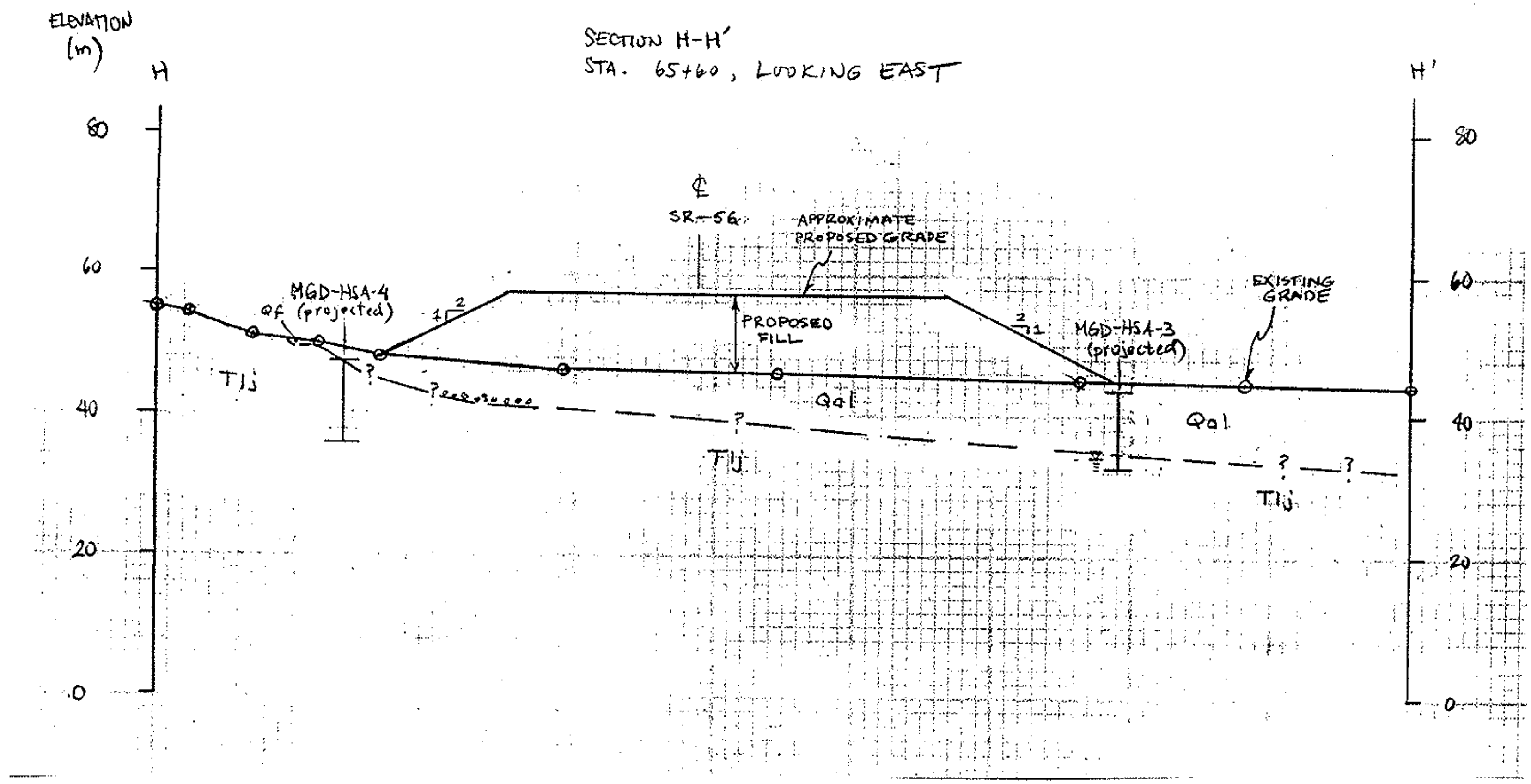
GROUP DELTA CONSULTANTS

GDC Project No. I181-2

State Route 56 - Middle Segment

Cross Section G-G'

Figure 11



SCALE
1 : 1,000

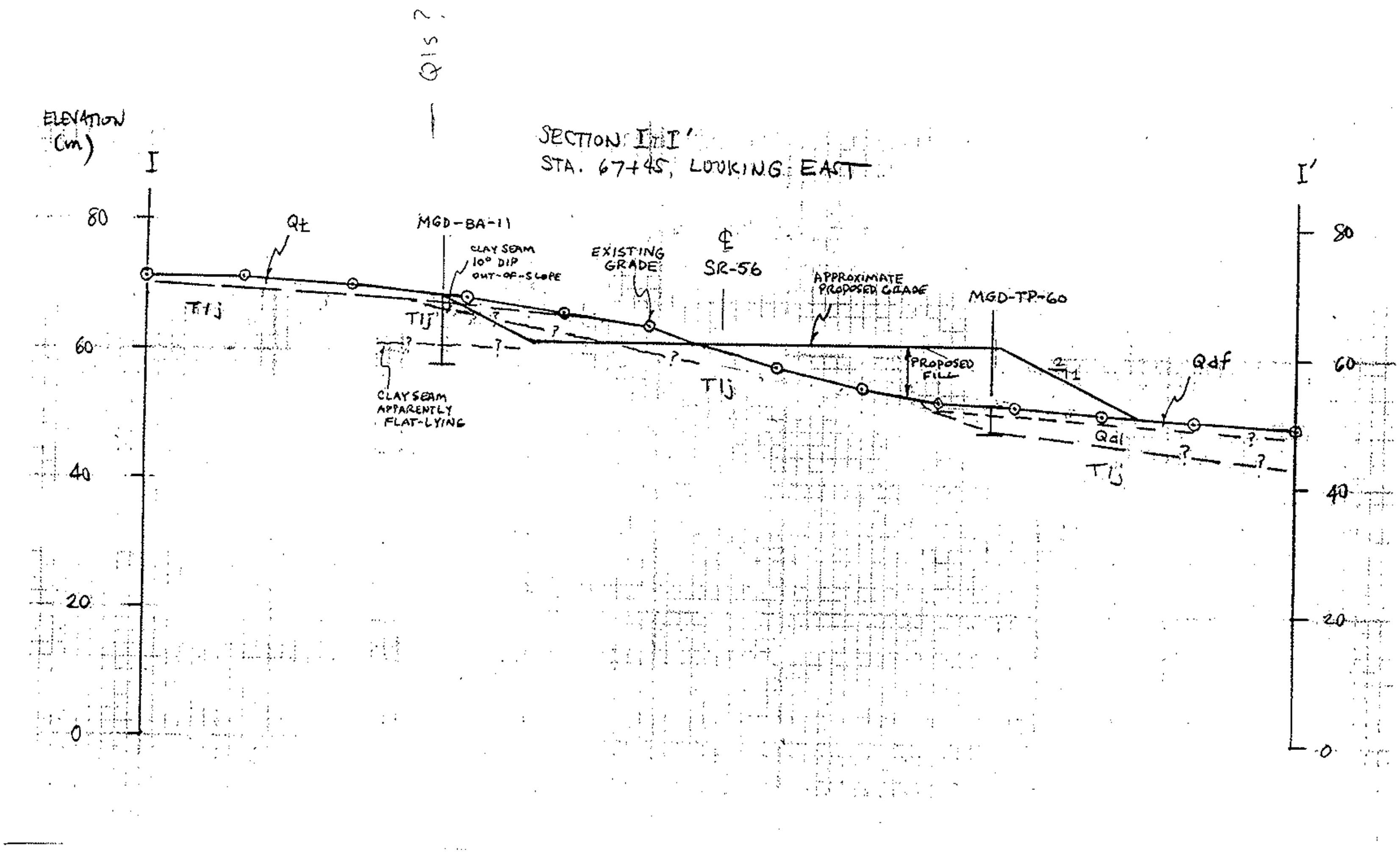
GROUP DELTA CONSULTANTS

GDC Project No. I181-2

State Route 56 - Middle Segment

Cross Section H-H'

Figure 12



SCALE
1 : 1,000

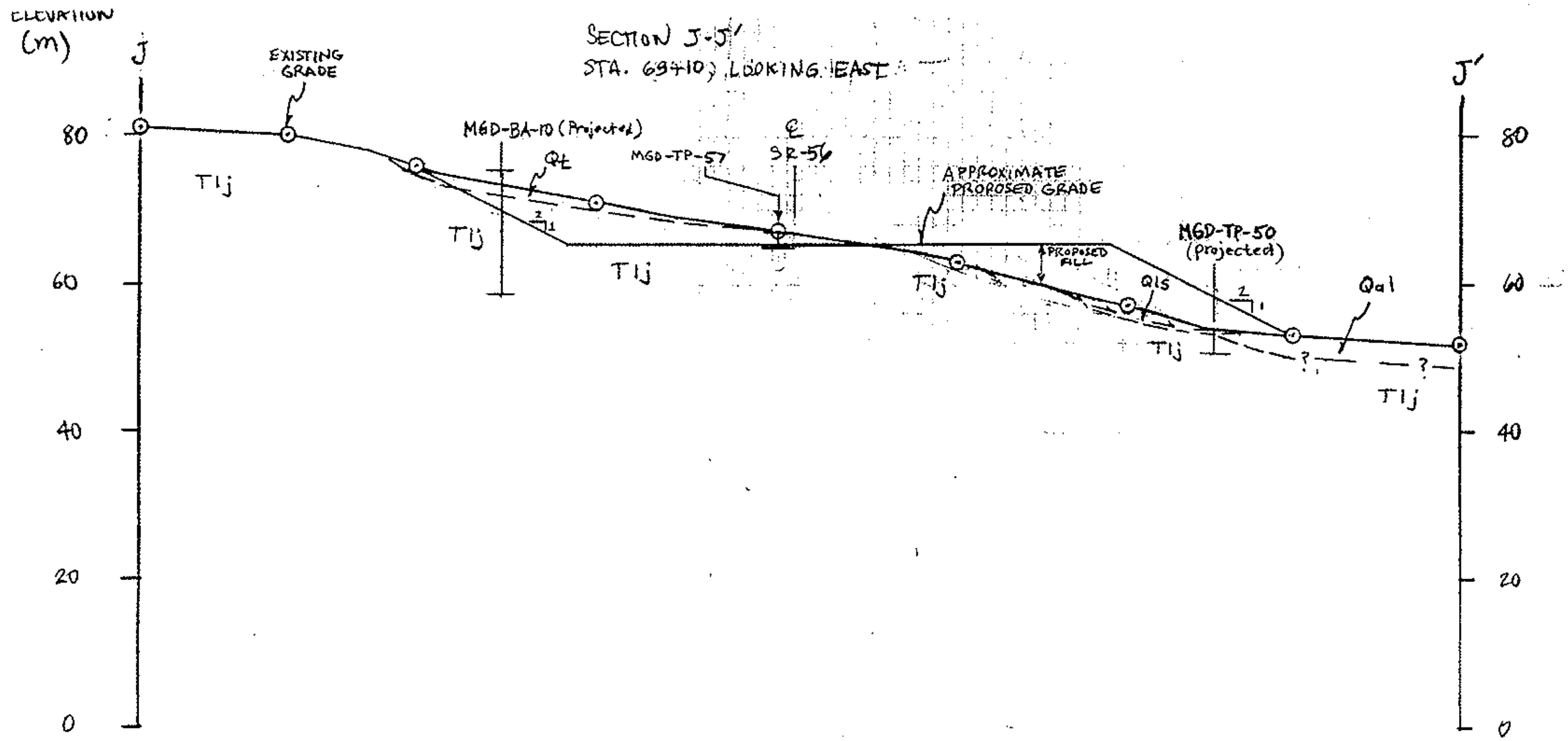
GROUP DELTA CONSULTANTS

GDC Project No. I181-2

State Route 56 - Middle Segment

Cross Section I-I'

Figure 13



SCALE 1 : 1,000

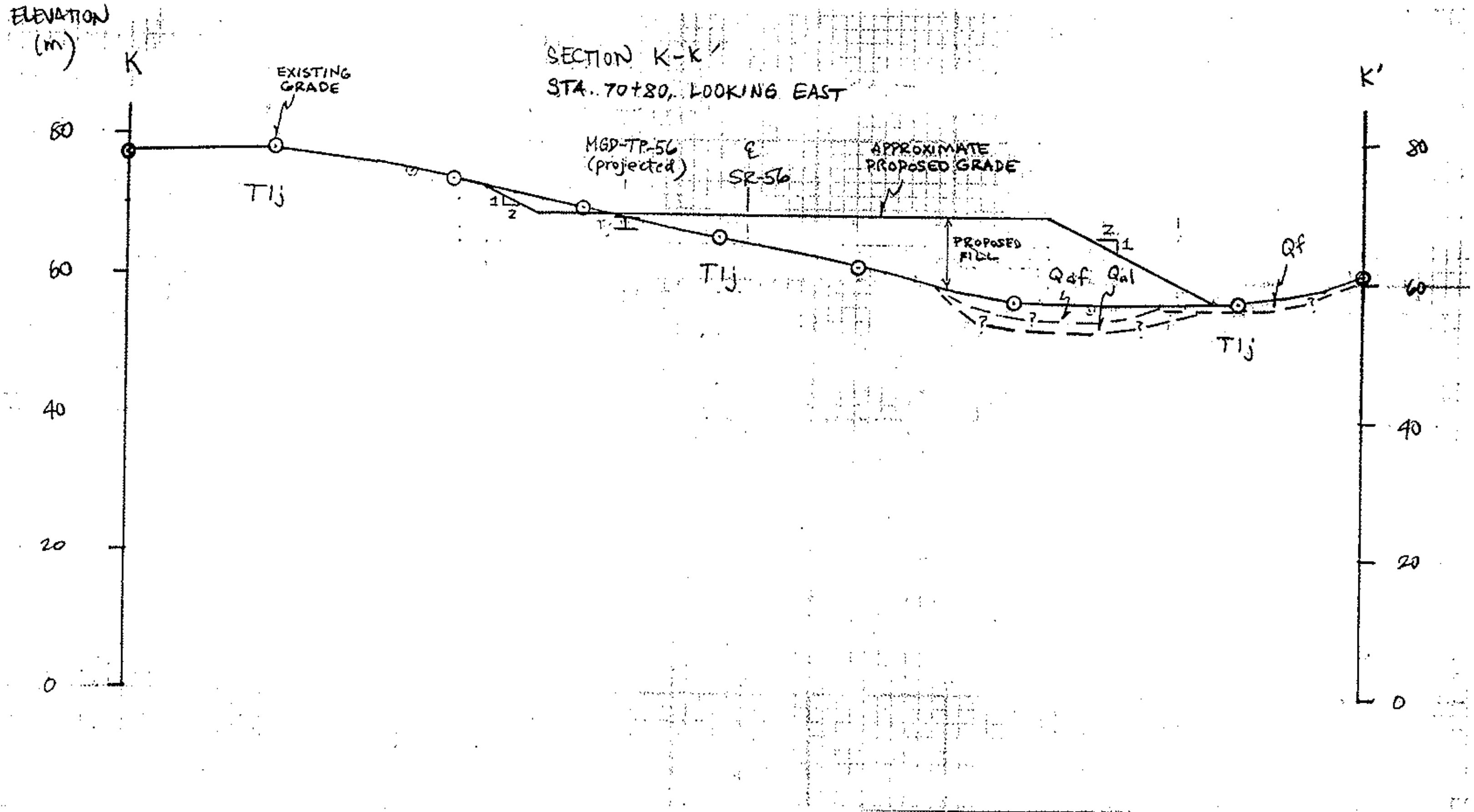
GROUP DELTA CONSULTANTS

GDC Project No. I181-2

State Route 56 - Middle Segment

Cross Section J-J'

Figure 14



SCALE
1 : 1,000

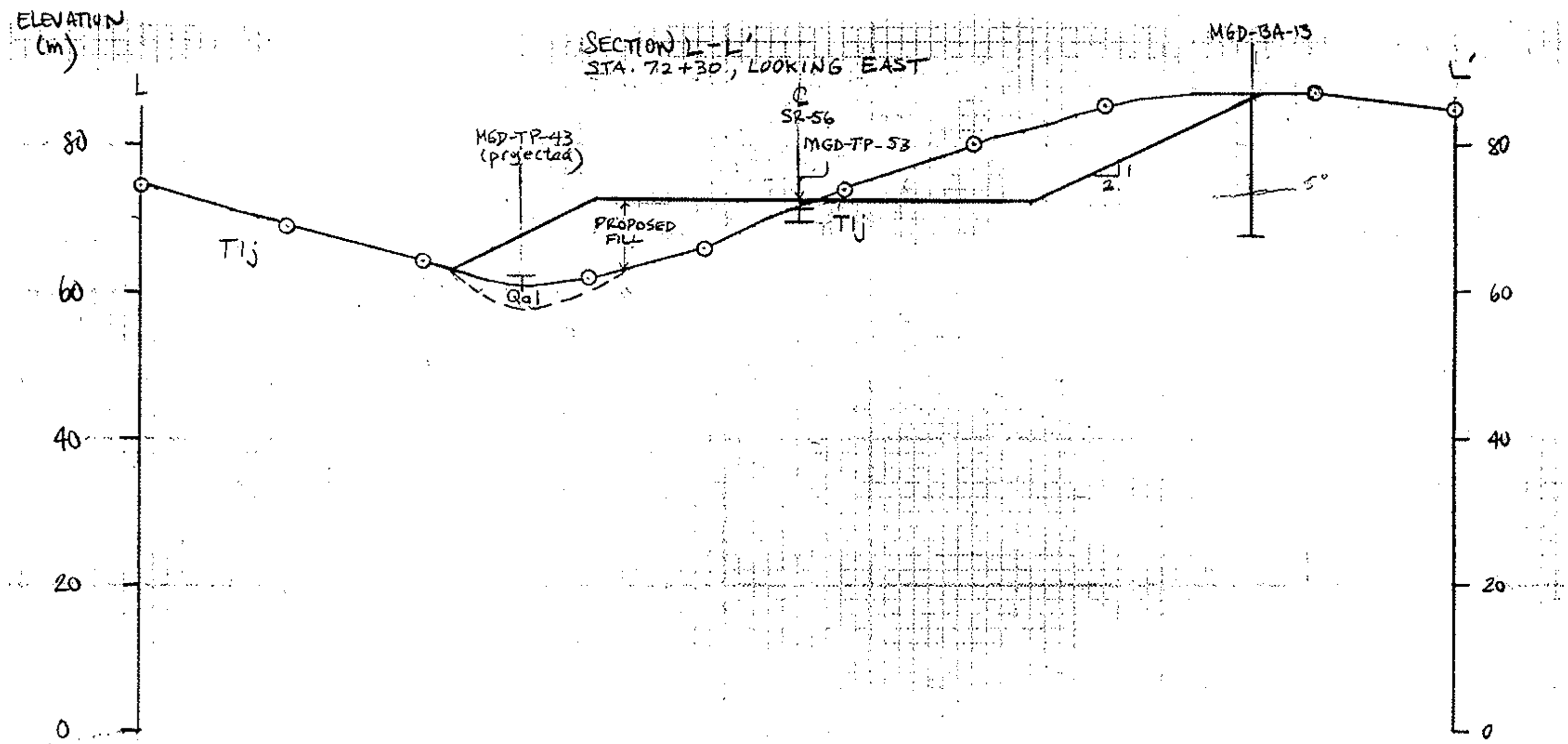
GROUP DELTA CONSULTANTS

GDC Project No. I181-2

State Route 56 - Middle Segment

Cross Section K-K'

Figure 15



SCALE
1 : 1,000

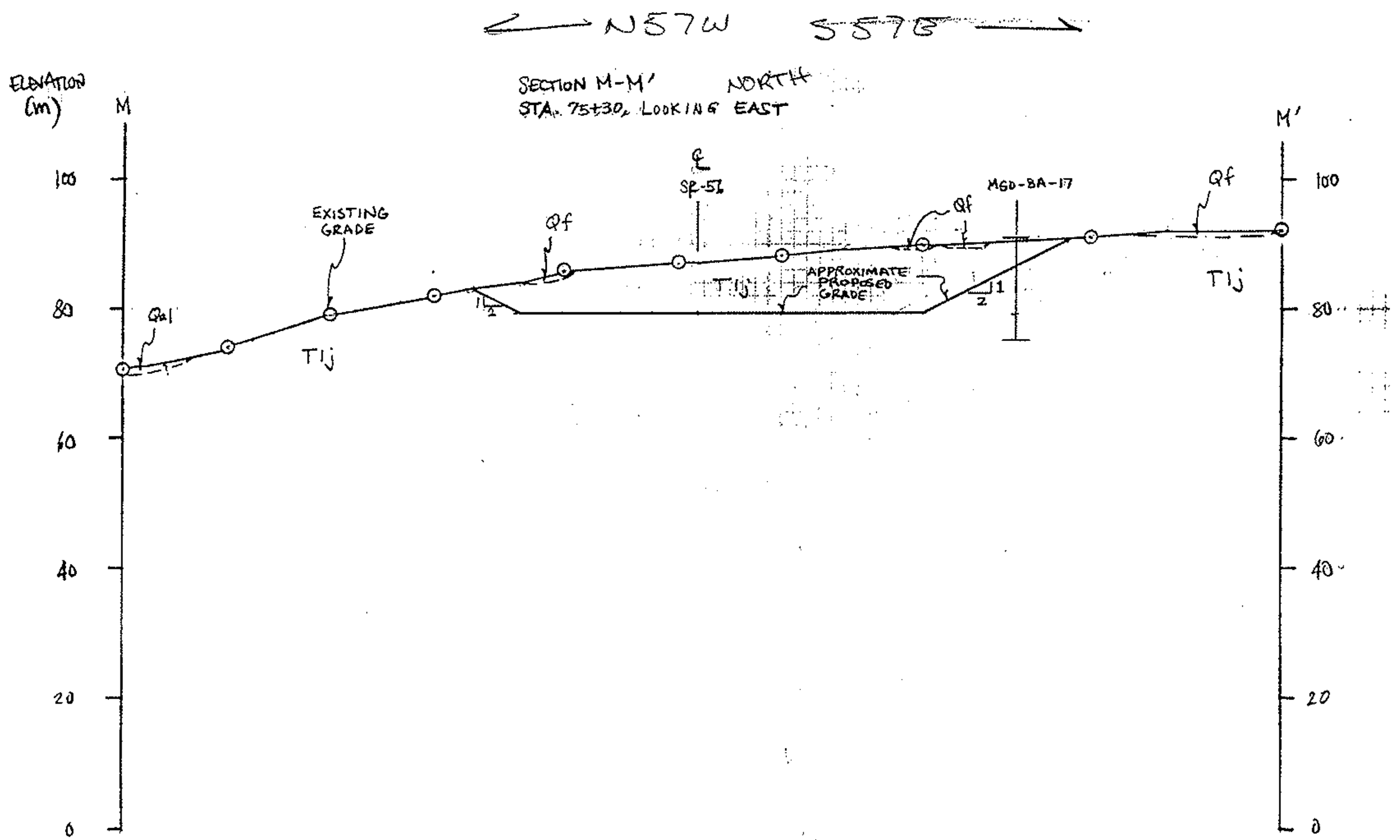
GROUP DELTA CONSULTANTS

GDC Project No. I181-2

State Route 56 - Middle Segment

Cross Section L-L'

Figure 16



SCALE
1 : 1,000

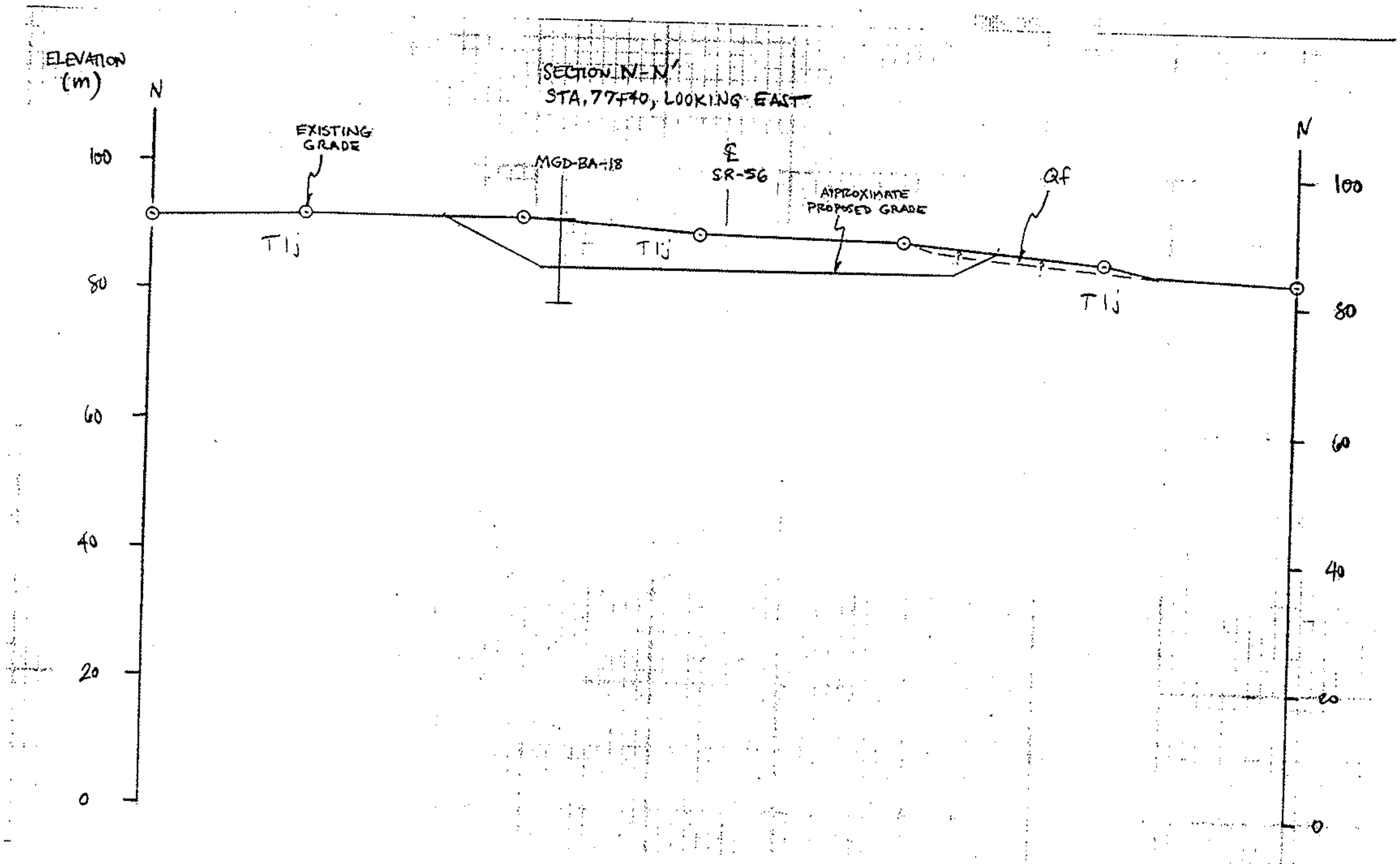
GROUP DELTA CONSULTANTS

GDC Project No. I181-2

State Route 56 - Middle Segment

Cross Section M-M'

Figure 17



SCALE
1 : 1,000

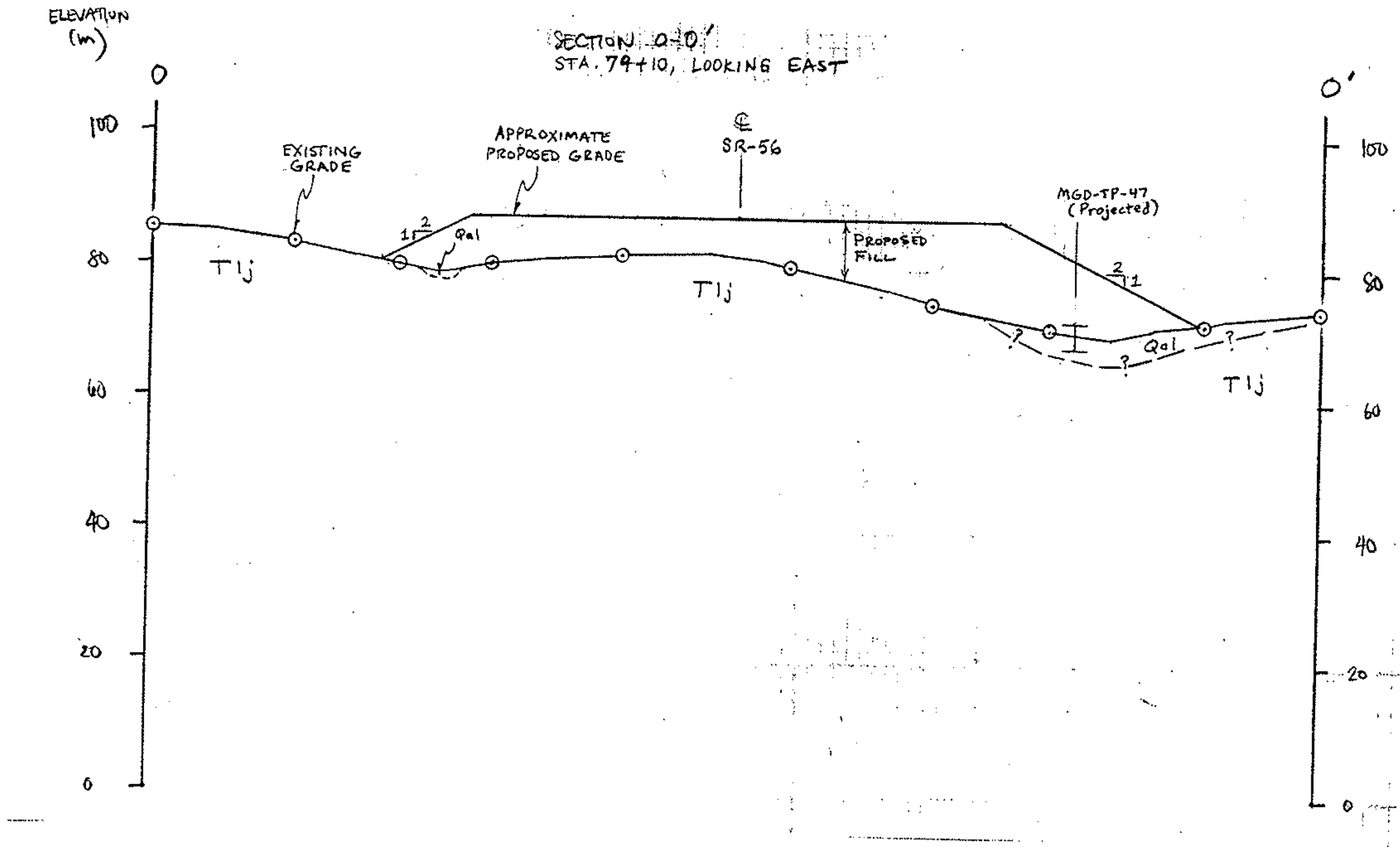
GROUP DELTA CONSULTANTS

GDC Project No. I181-2

State Route 56 - Middle Segment

Cross Section N-N'

Figure 18



SCALE 1 : 1,000

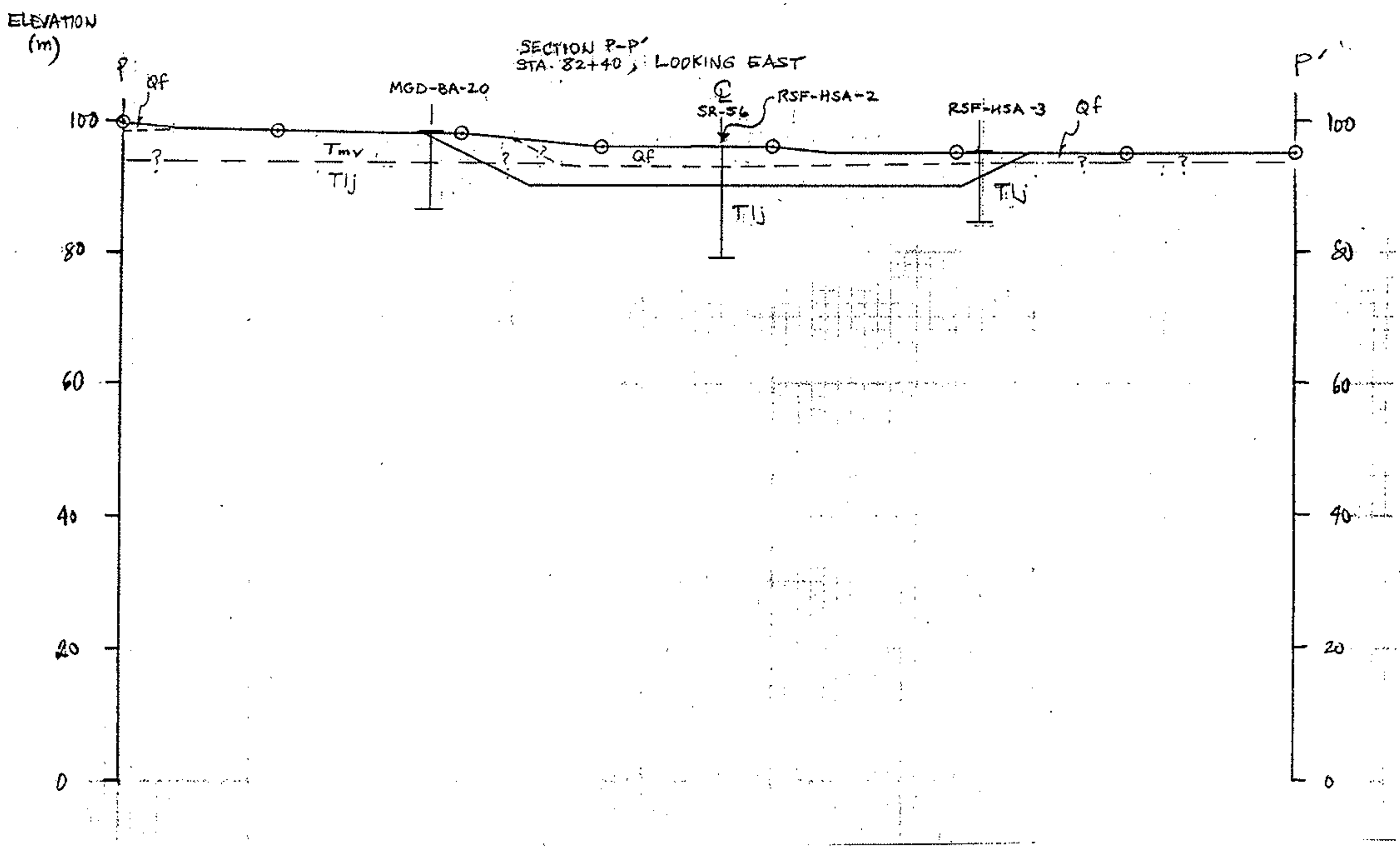
GROUP DELTA CONSULTANTS

GDC Project No. I181-2

State Route 56 - Middle Segment

Cross Section O-O'

Figure 19



SCALE
1 : 1,000

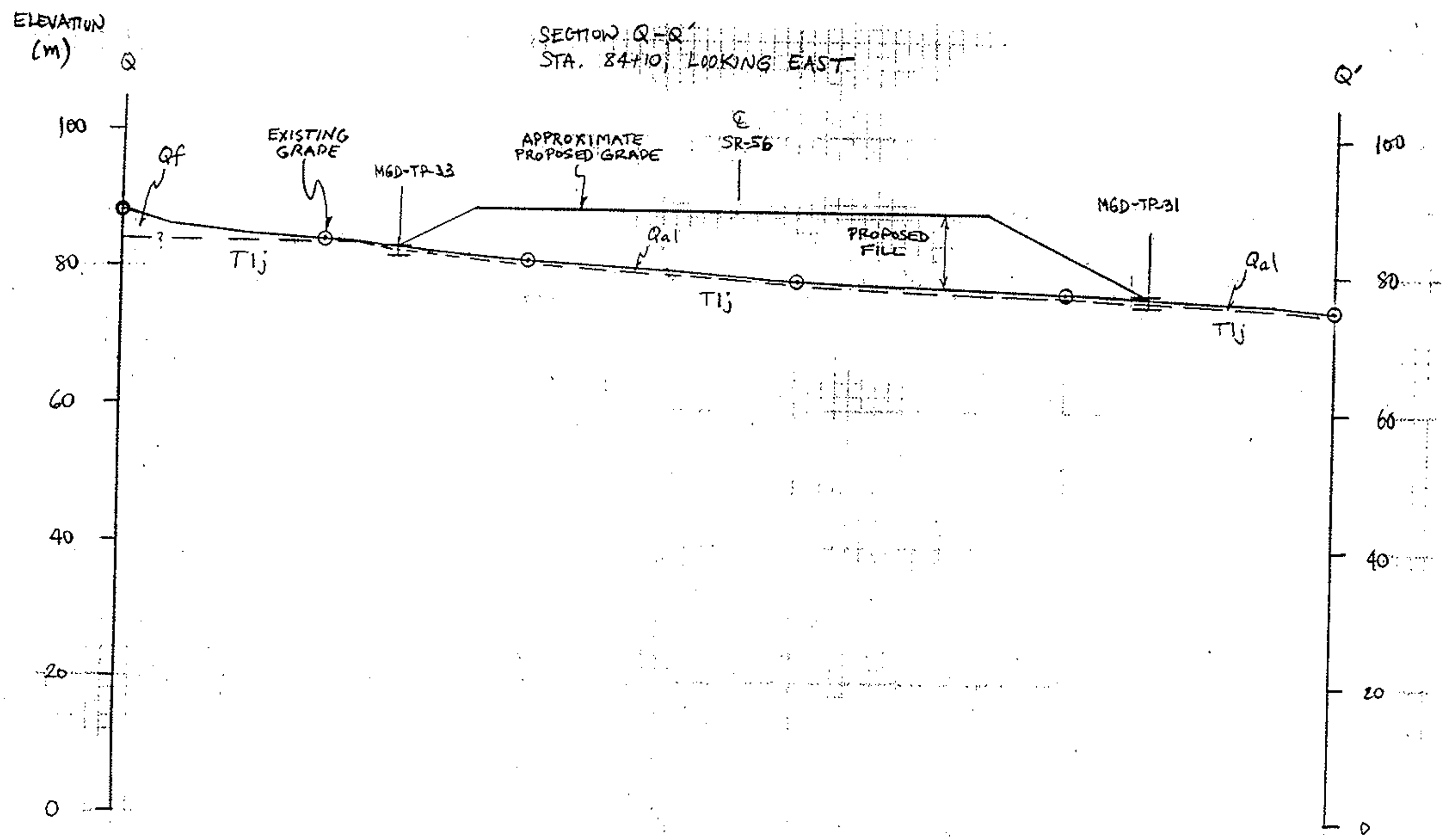
GROUP DELTA CONSULTANTS

GDC Project No. I181-2

State Route 56 - Middle Segment

Cross Section P-P'

Figure 20



SCALE
1 : 1,000

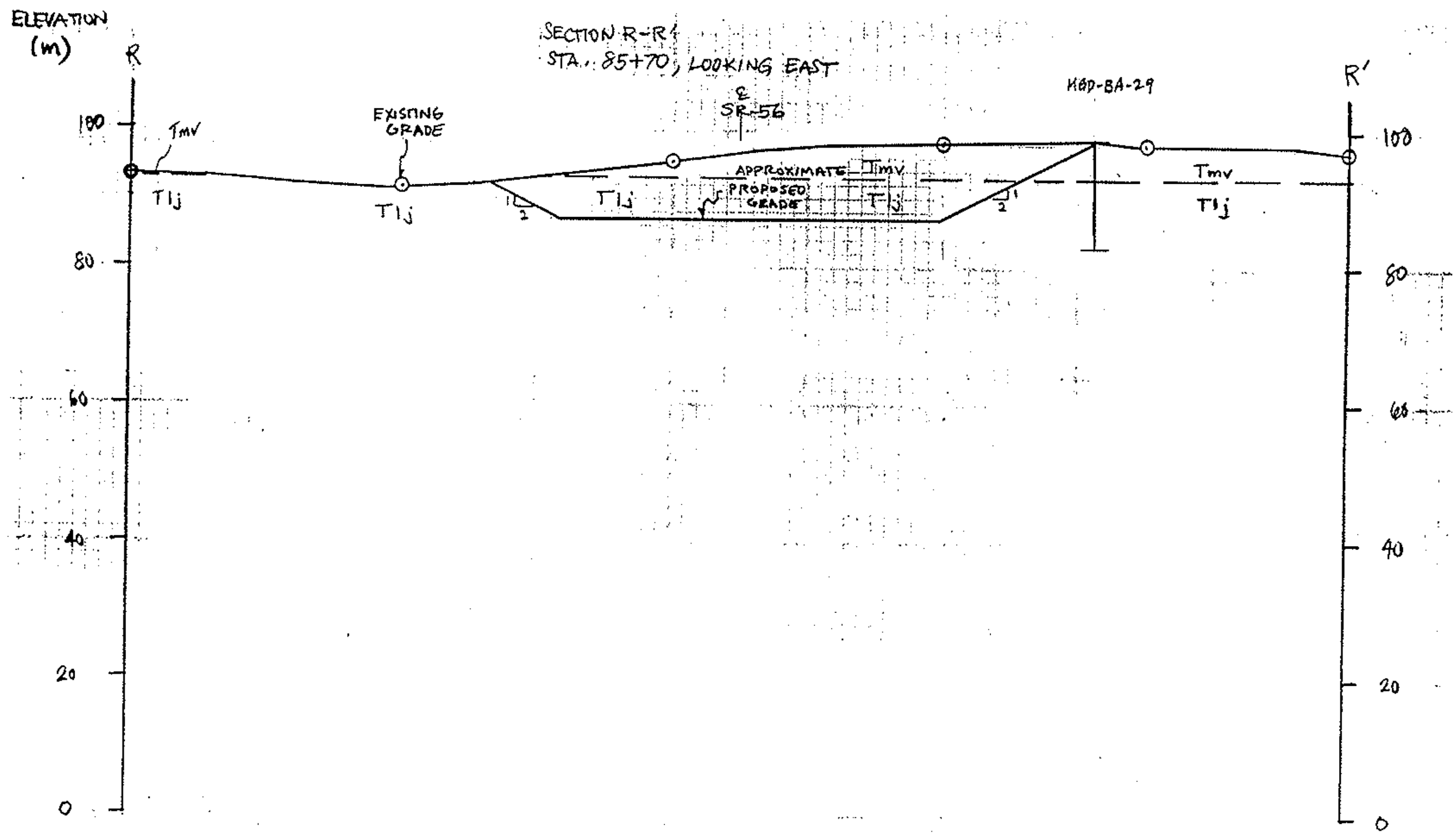
GROUP DELTA CONSULTANTS

GDC Project No. I181-2

State Route 56 - Middle Segment

Cross Section Q-Q'

Figure 21



SCALE
1 : 1,000

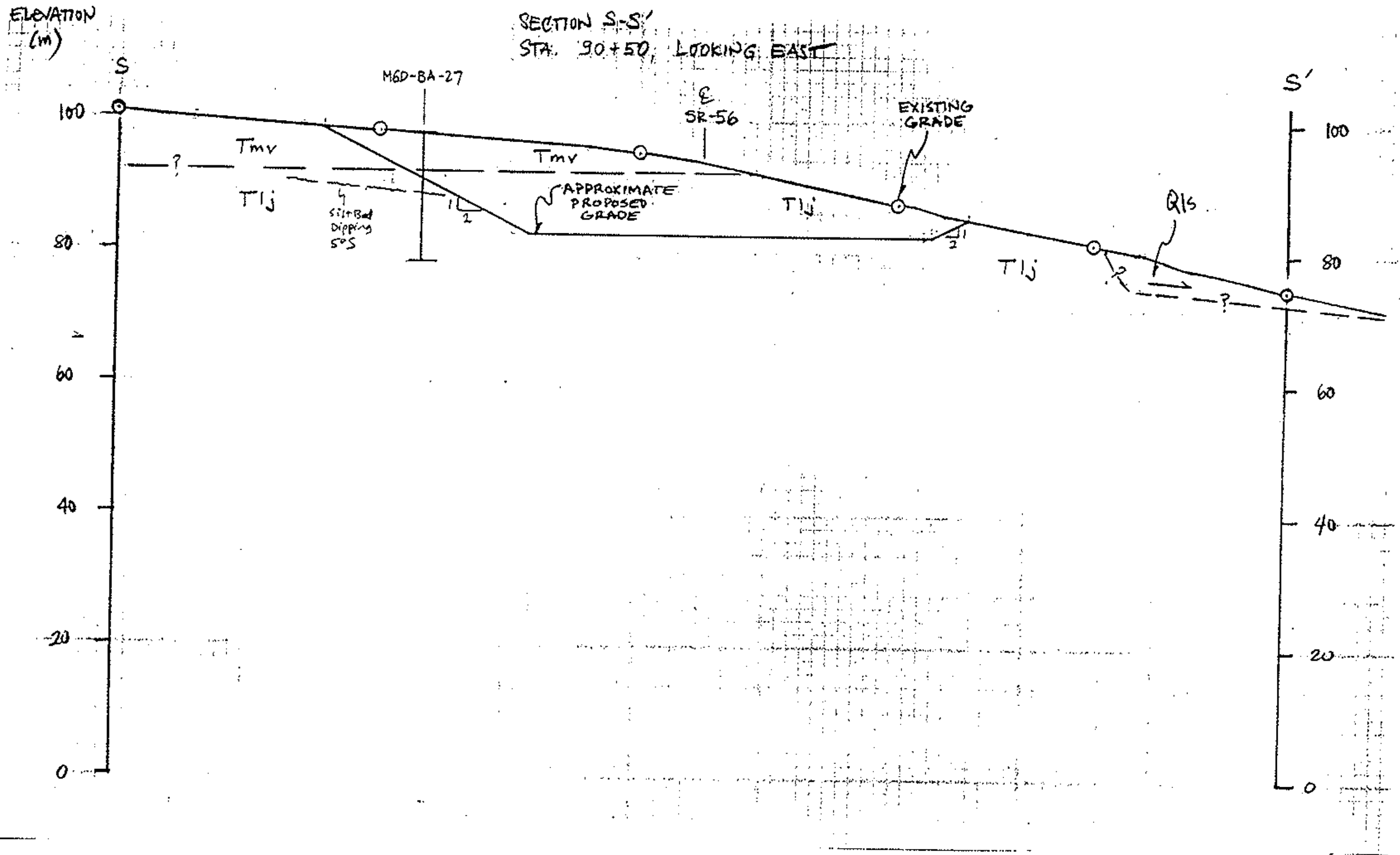
GROUP DELTA CONSULTANTS

GDC Project No. I181-2

State Route 56 - Middle Segment

Cross Section R-R'

Figure 22



SCALE
1 : 1,000

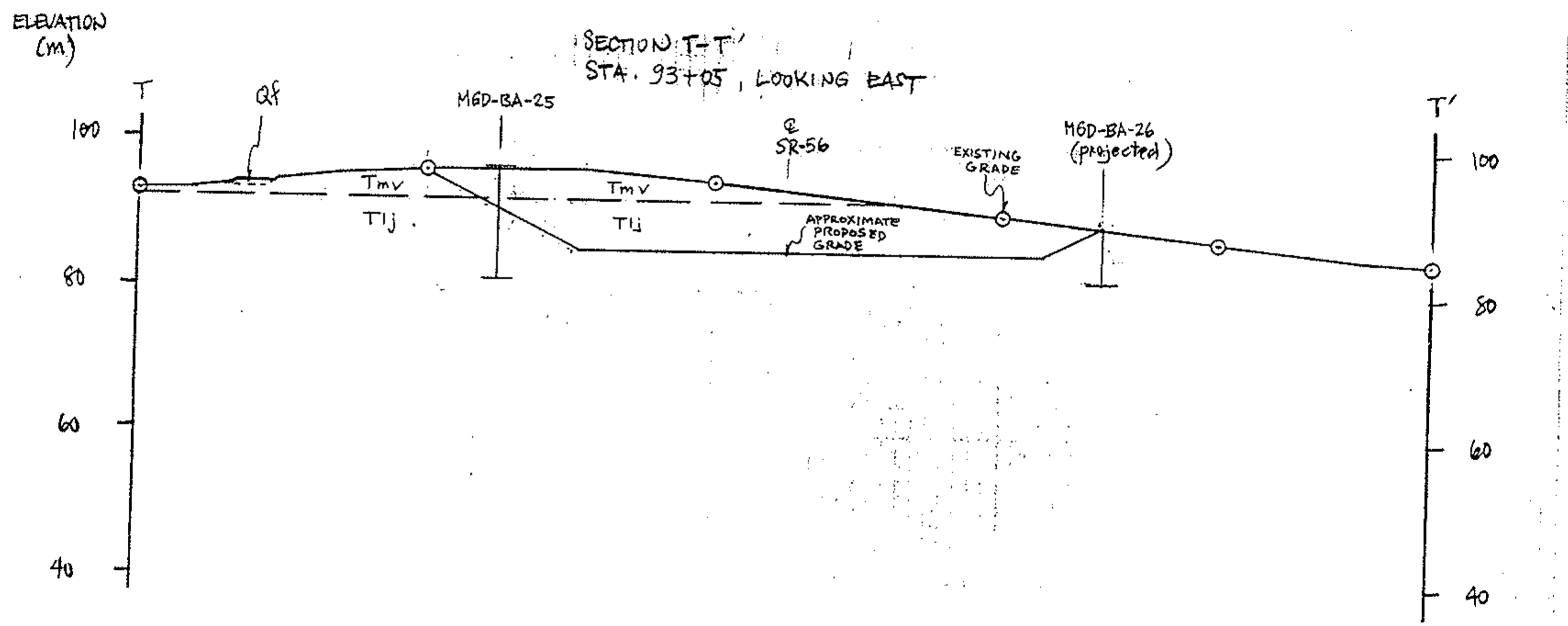
GROUP DELTA CONSULTANTS

GDC Project No. I181-2

State Route 56 - Middle Segment

Cross Section S-S'

Figure 23



SCALE
1 : 1,000

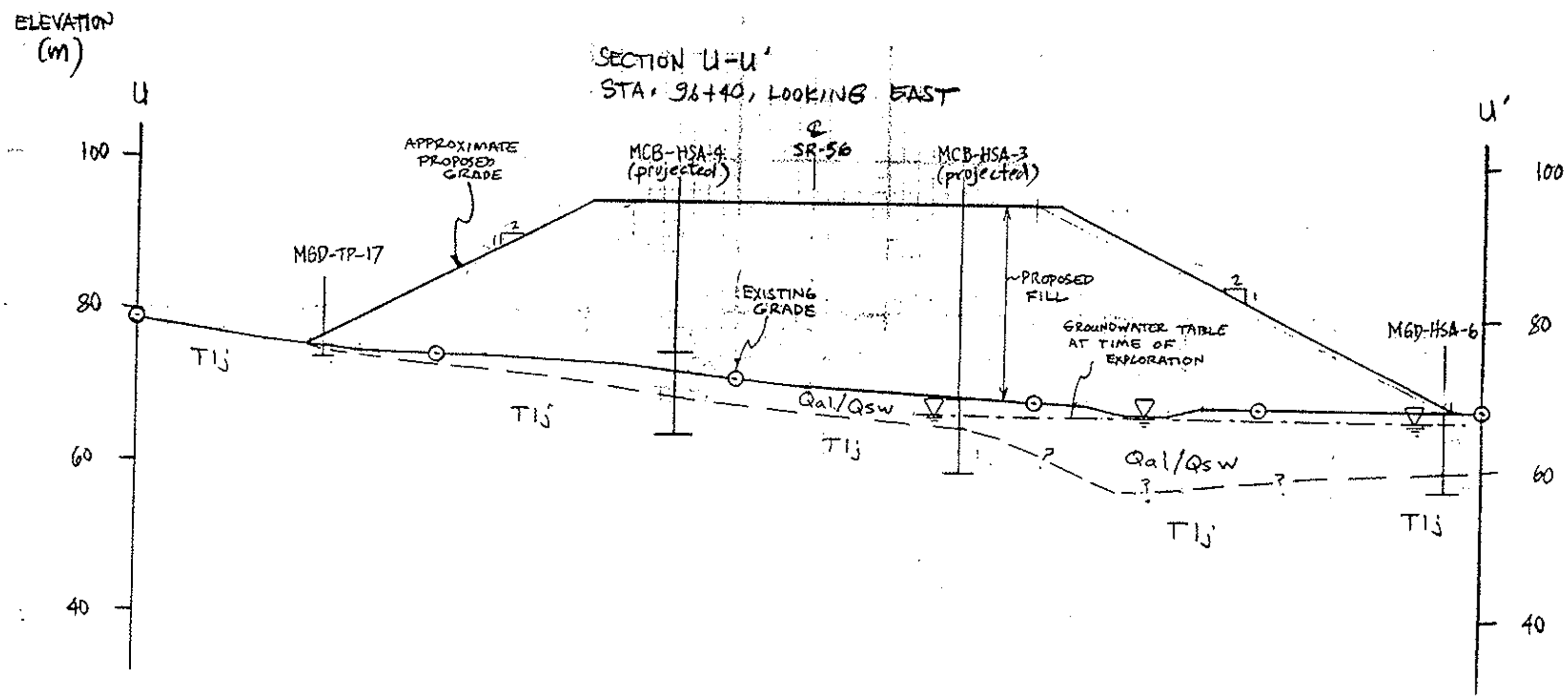
GROUP DELTA CONSULTANTS

GDC Project No. I181-2

State Route 56 - Middle Segment

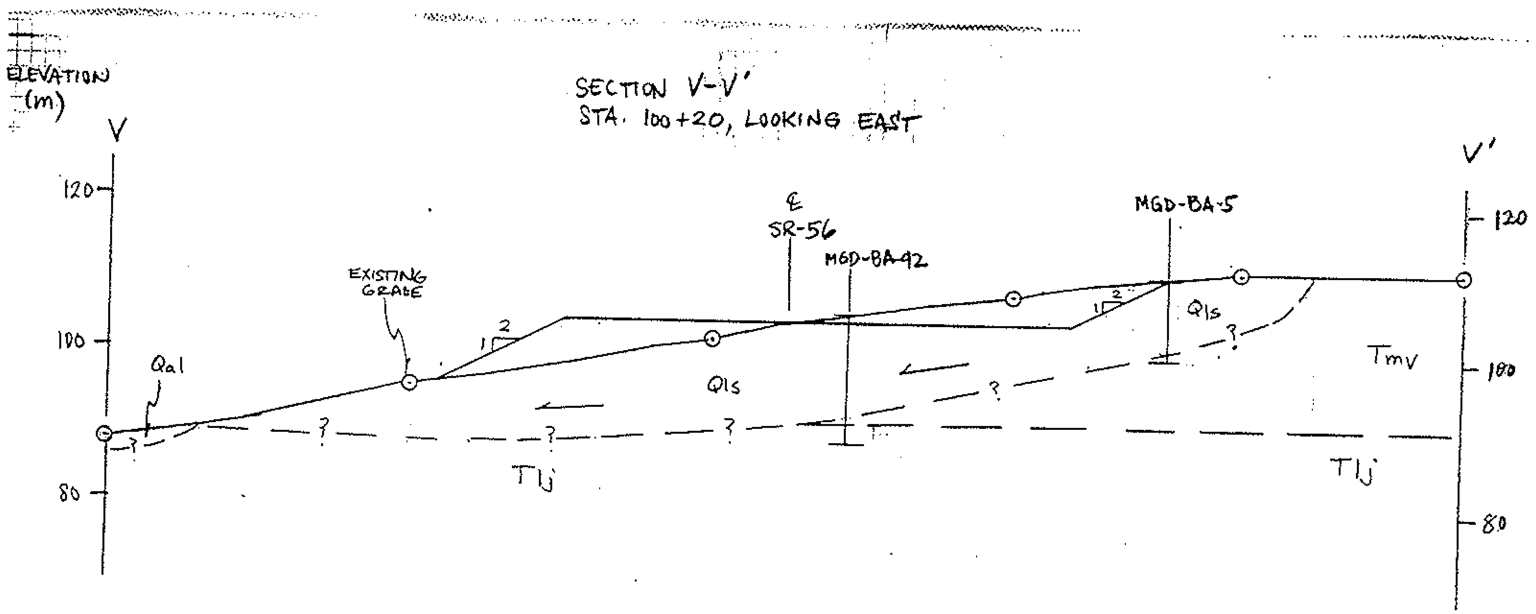
Cross Section T-T'

Figure 24



SCALE
1 : 1,000

GROUP DELTA CONSULTANTS	GDC Project No. I181-2
	State Route 56 - Middle Segment
	Cross Section U-U'
	Figure 25



SCALE
1 : 1,000

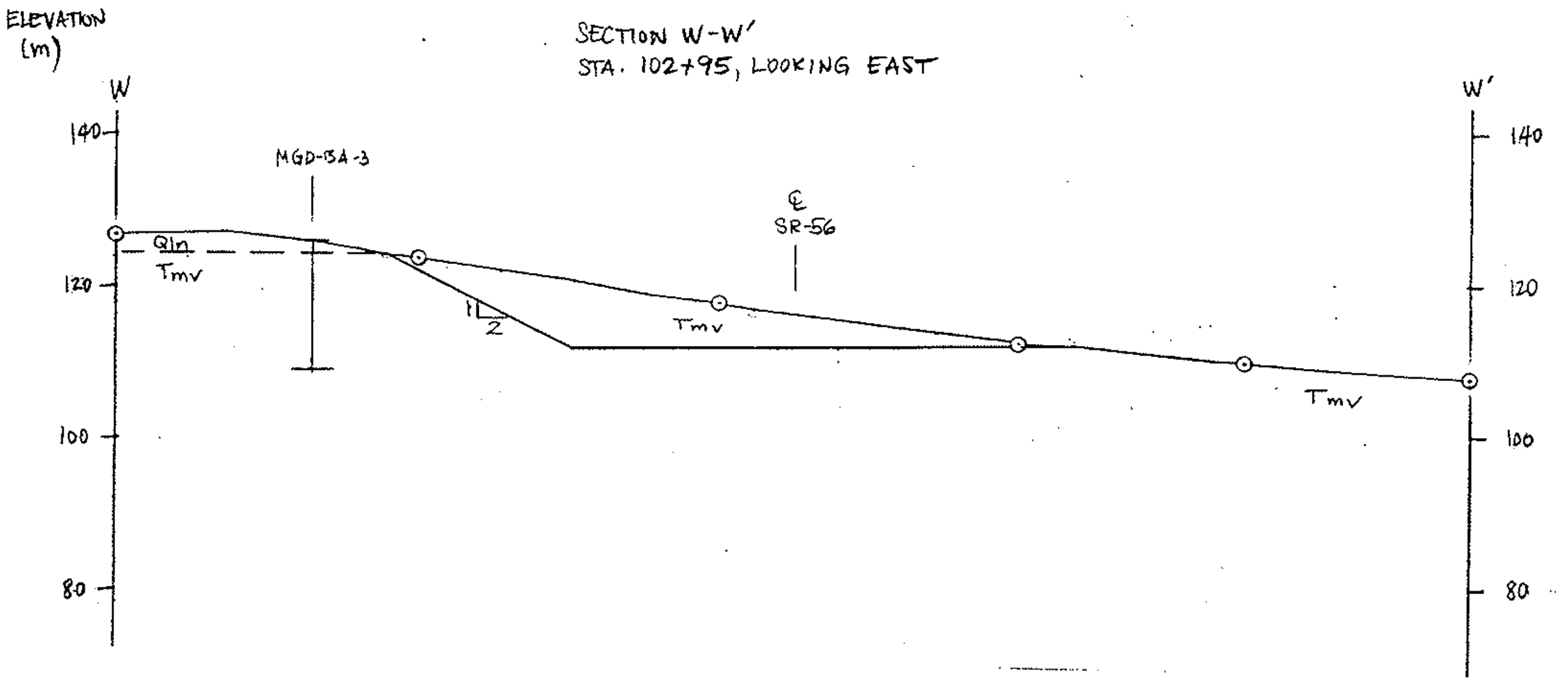
GROUP DELTA CONSULTANTS

GDC Project No. I181-2

State Route 56 - Middle Segment

Cross Section V-V'

Figure 26



SCALE
1 : 1,000

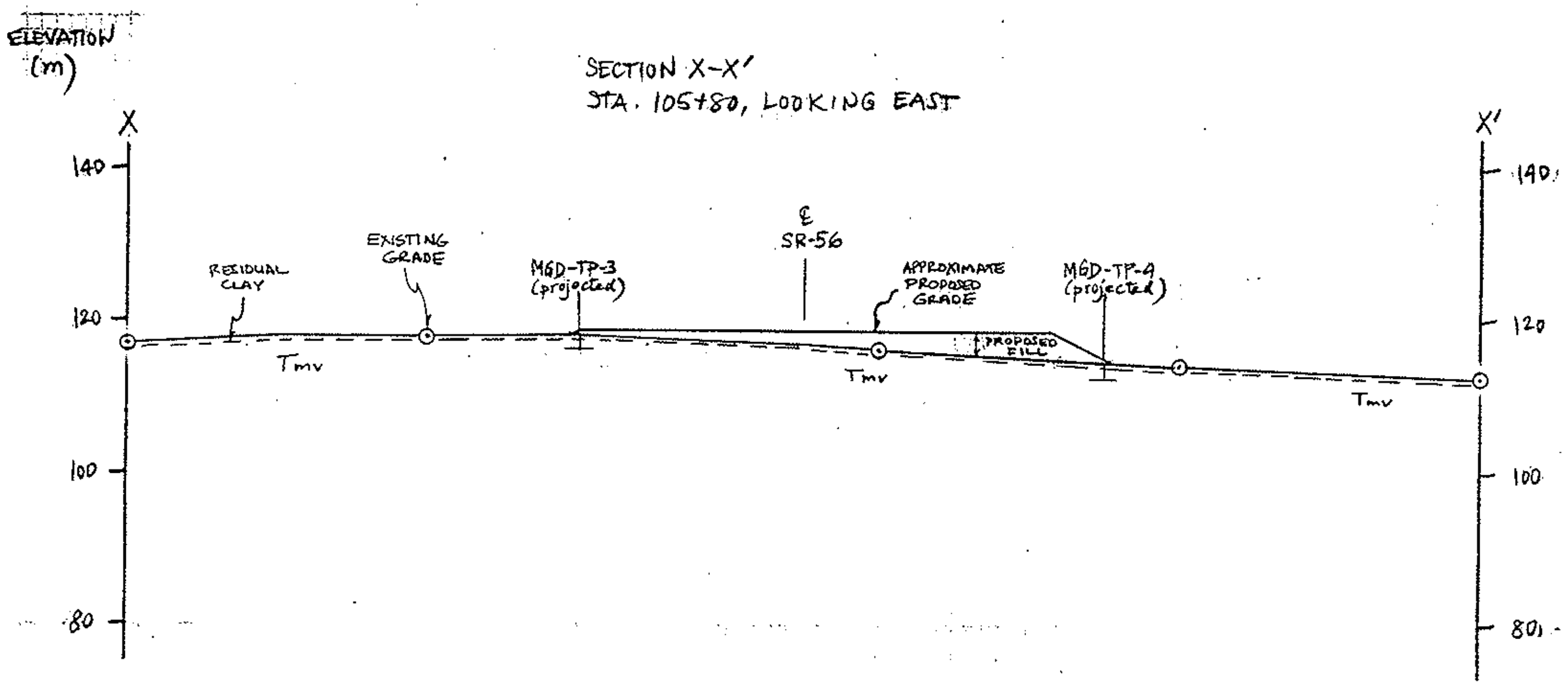
GROUP DELTA CONSULTANTS

GDC Project No. I181-2

State Route 56 - Middle Segment

Cross Section W-W'

Figure 27



SCALE
1 : 1,000

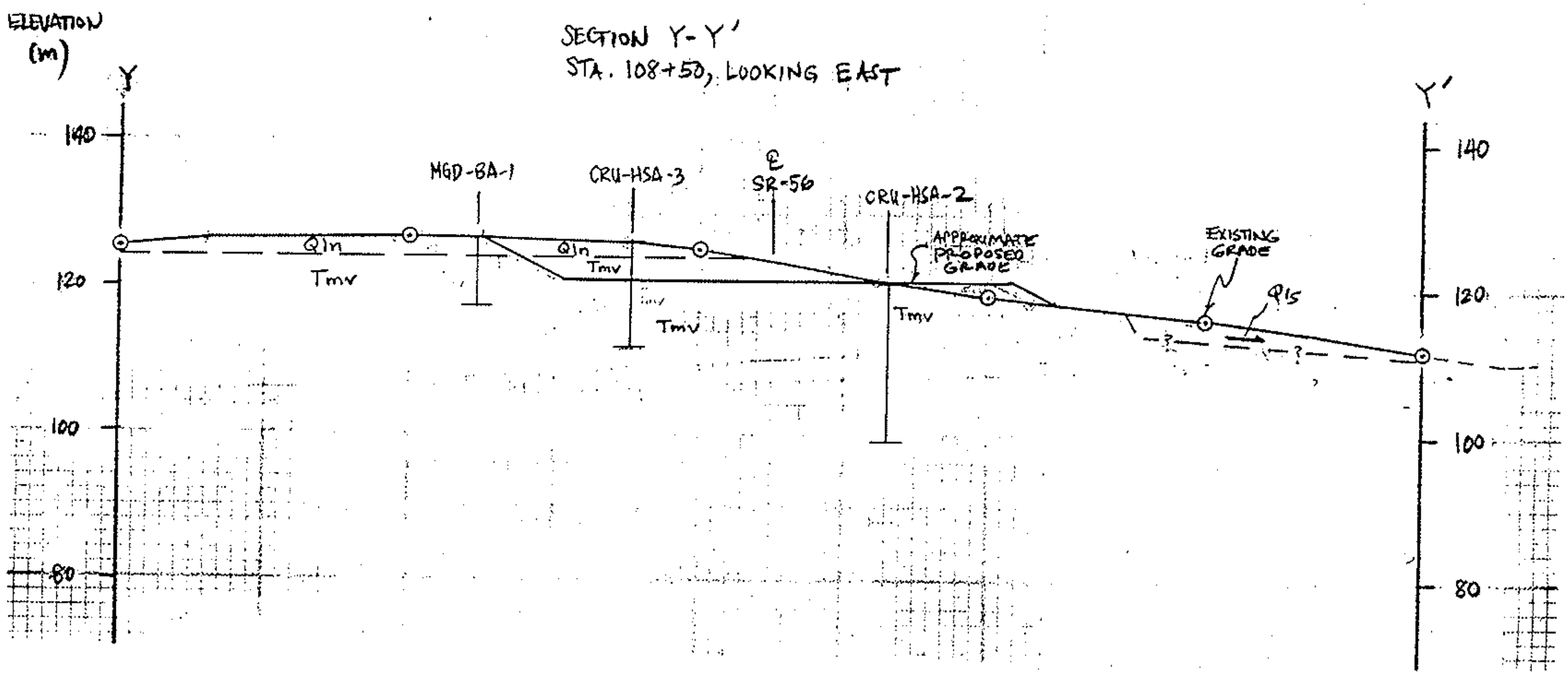
GROUP DELTA CONSULTANTS

GDC Project No. I181-2

State Route 56 - Middle Segment

Cross Section X-X'

Figure 28



SCALE
1 : 1,000

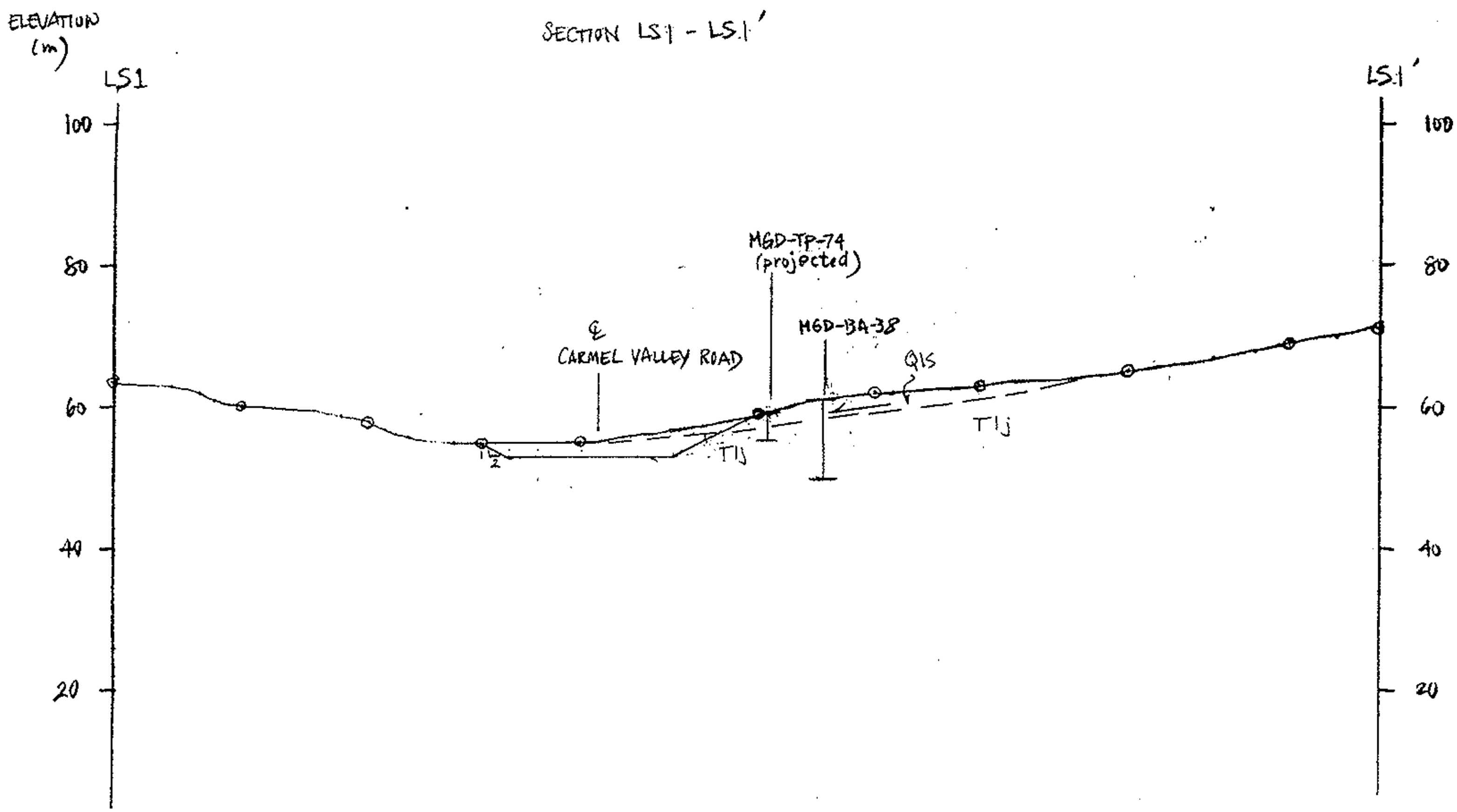
GROUP DELTA CONSULTANTS

GDC Project No. I181-2

State Route 56 - Middle Segment

Cross Section Y-Y'

Figure 29



SCALE
1 : 1,000

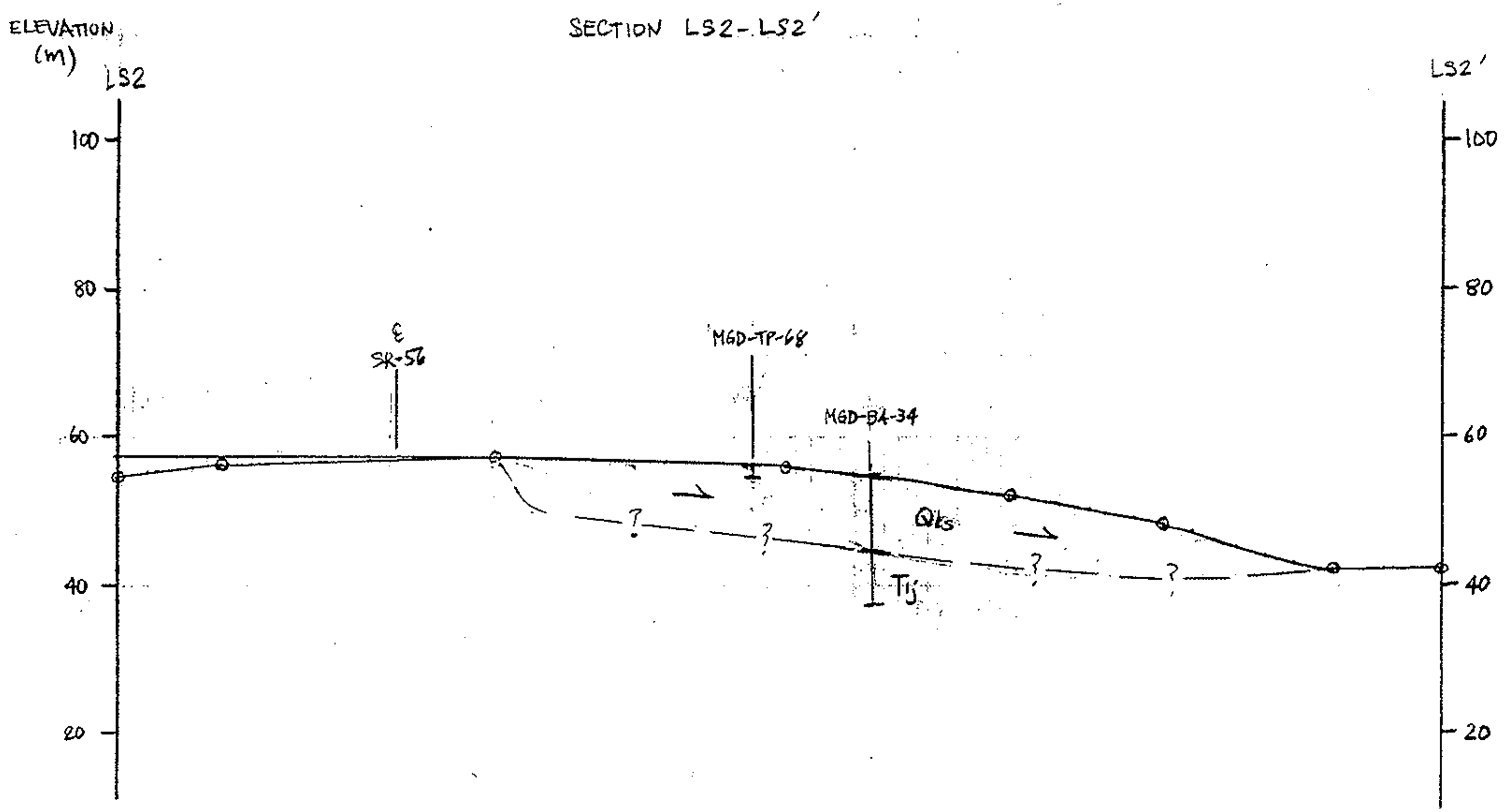
GROUP DELTA CONSULTANTS

GDC Project No. I181-2

State Route 56 - Middle Segment

Cross Section
LS-1 - LS-1'

Figure 30



SCALE
1 : 1,000

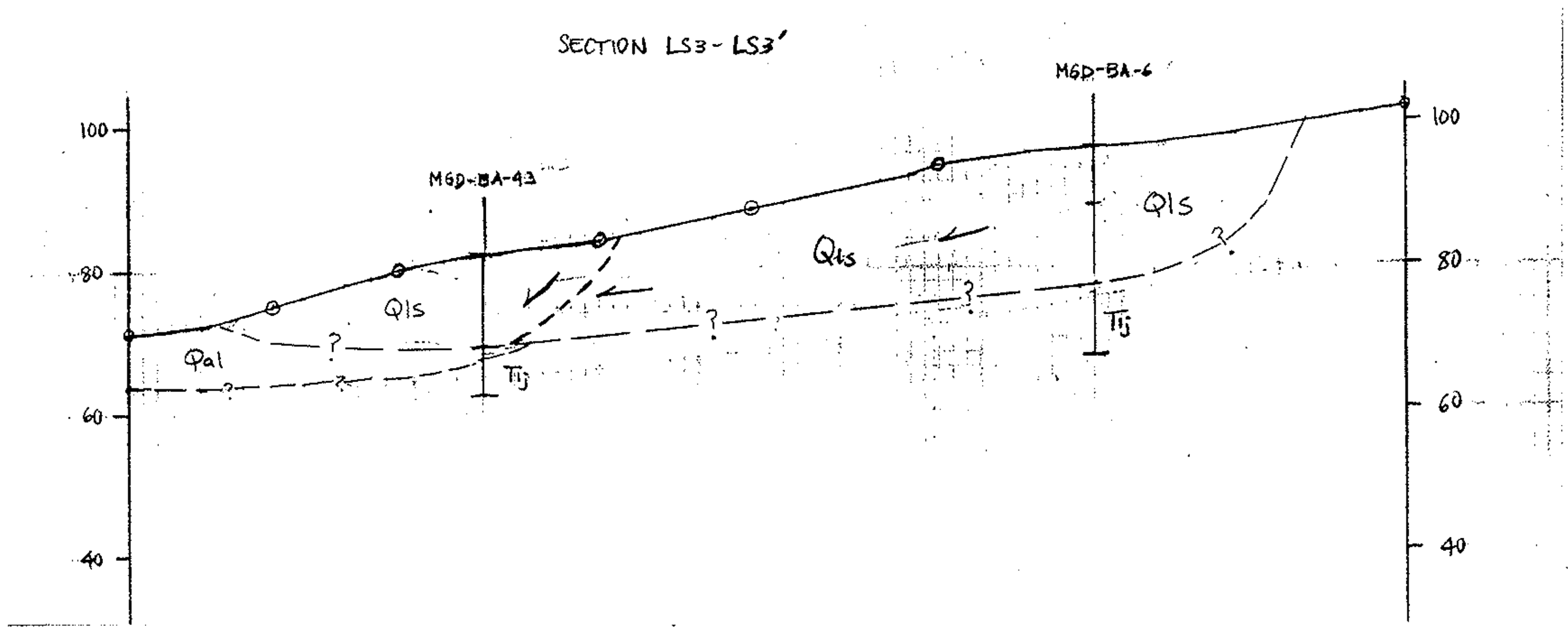
GROUP DELTA CONSULTANTS

GDC Project No. I181-2

State Route 56 - Middle Segment

Cross Section
LS-2 - LS-2'

Figure 31



SCALE
1 : 1,000

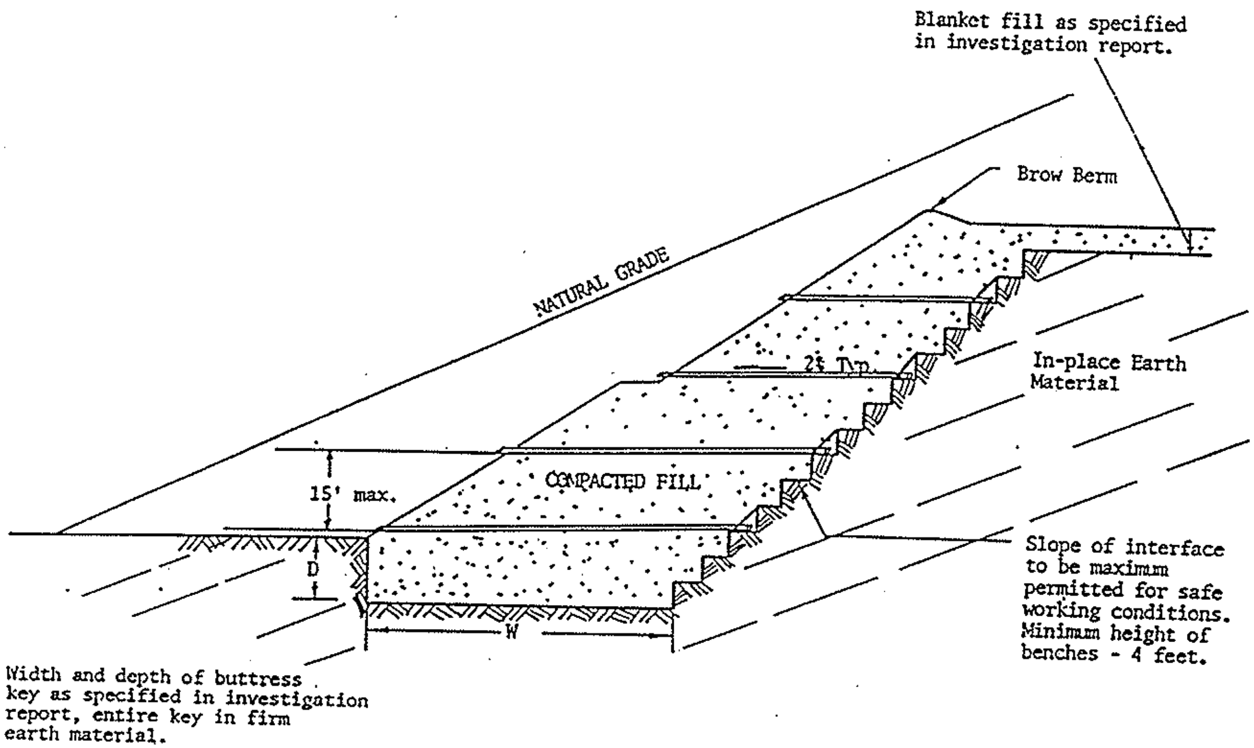
GROUP DELTA CONSULTANTS

GDC Project No. I181-2

State Route 56 - Middle Segment

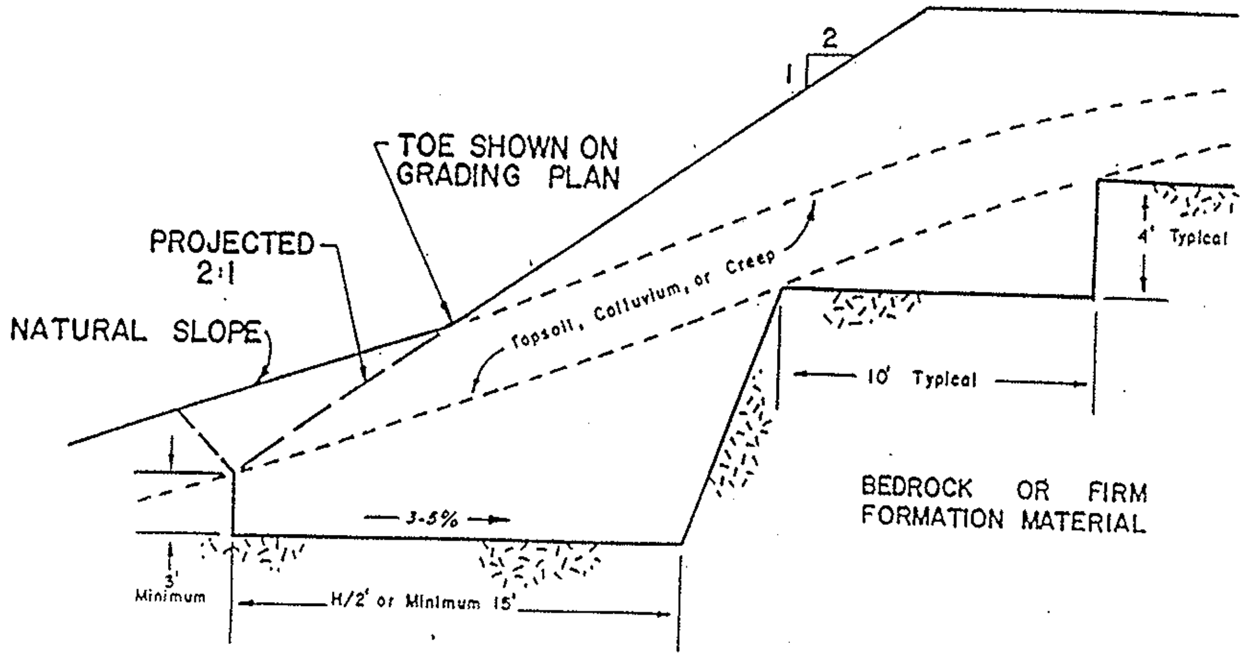
Cross Section
LS-3 - LS-3'

Figure 32



PROJECT NO. I-181	MIDDLE SEGMENT, STATE ROUTE 56 PROJECT (SAN DIEGO, CALIFORNIA)	
Group Delta Consultants	**TYPICAL BUTTRESS FILL** **MINIMUM STANDARD GRADING SPECIFICATIONS**	**Figure 33**

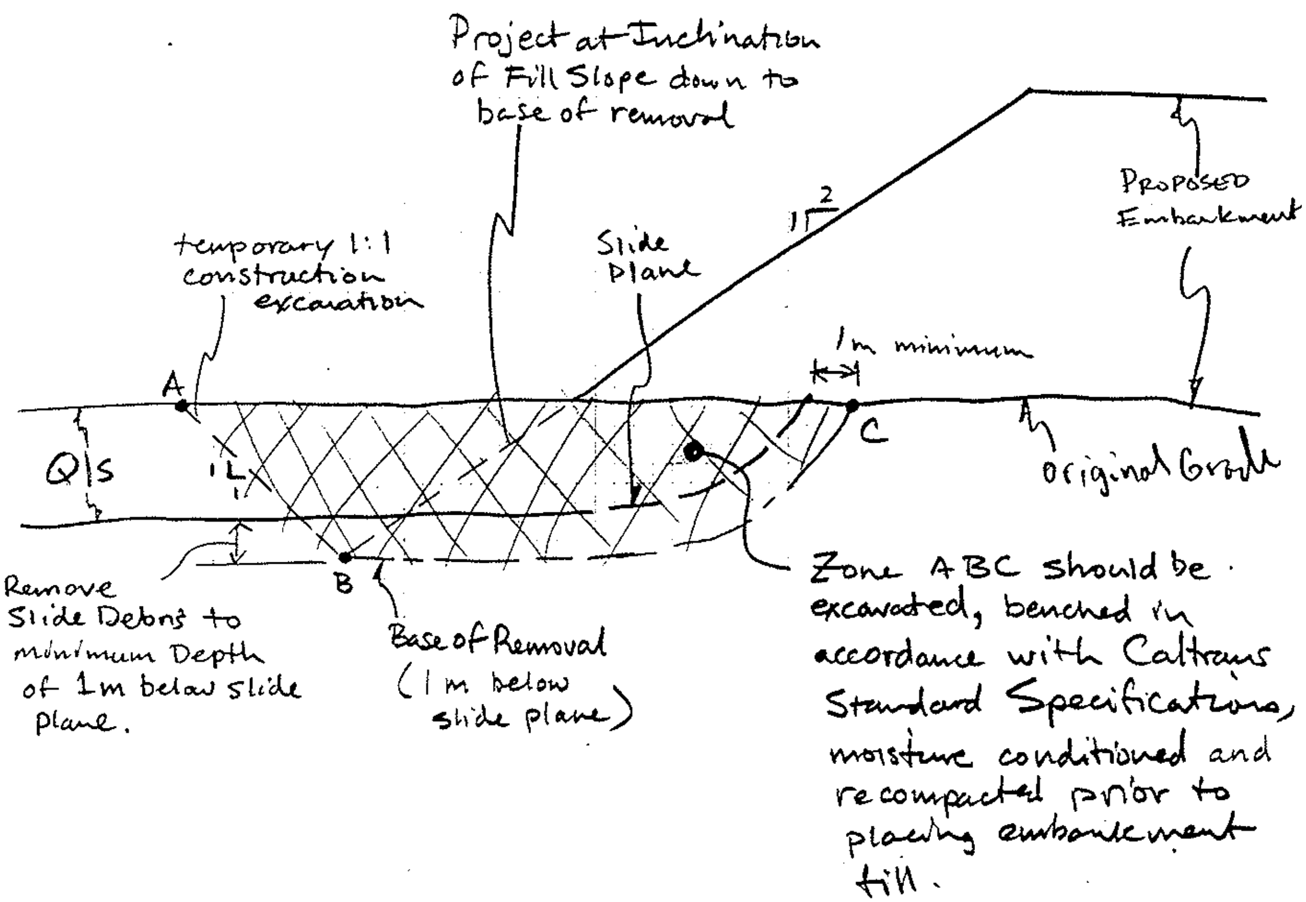
C:\PROJECTS\BOYLE\1524\FIG33.GRF



NOTE: WHERE NATURAL SLOPE GRADIENT IS 5:1 OR LESS BENCHING IS NOT NECESSARY, UNLESS STRIPPING DID NOT REMOVE ALL COMPRESSIBLE MATERIAL.

PROJECT NO. I-181	MIDDLE SEGMENT, STATE ROUTE 56 PROJECT (SAN DIEGO, CALIFORNIA)	
Group Delta Consultants	**TYPICAL FILL OVER NATURAL SLOPE OR ALLUVIUM DETAIL GENERAL GRADING RECOMMENDATIONS**	**Figure 34**

C:\PROJECTS\BOYLE\1524\FIG34.GRF



PROJECT NO. I-181	MIDDLE SEGMENT, STATE ROUTE 56 PROJECT (SAN DIEGO, CALIFORNIA)	
Group Delta Consultants	**LANDSLIDE REMOVAL IN AREAS TO RECEIVE EMBNAKMENT FILL**	**Figure 35**

C:\PROJECTS\BOYLE\1524\FIG35.GRF

APPENDIX A
FIELD EXPLORATION

APPENDIX A
FIELD EXPLORATION

A.1 Introduction

Subsurface conditions along the project alignment were investigated by Group Delta Consultants during the time period between August 13, 1998 and January 11, 1999. In total, the work for the alignment included a surficial and geologic site reconnaissance, the excavation of 9 hollow stem auger borings, 43 bucket auger borings, and 80 backhoe test pits.

Across the project, test borings were advanced to depths ranging from approximately 6.2 to 29 m below ground surface (bgs). Backhoe test pits ranged from approximately 1.4 to 5.5 m in depth.

A.2 Soil Drilling, Excavation and Sampling

The first eight of the hollow stem auger borings for the alignment were made by a CME 95 drill rig; Boring MGD-HSA-9 was excavated utilizing a CME 85 drill rig. All 43 bucket auger borings were made using an Earth Drill 45L rig. The 80 test pits were excavated using a John Deere 410E rubber-tire backhoe utilizing a 24-inch wide bucket.

The field explorations were performed under continual technical supervision of engineering geologists and geotechnical engineers from Group Delta Consultants, who visually observed the site, prepared detailed logs of the excavations, and classified the soils encountered. Each of the large-diameter (76.2 cm) bucket auger borings were downhole logged by a geologist from our firm. Samples of the subsurface materials were obtained intermittently from most of the test borings using both a Standard Penetration Test (SPT) split-spoon sampler or a California split-barrel drive sampler equipped with metal sample rings. The SPT sampler has an inside diameter (I.D.) of 34.9 mm, and an outside diameter (O.D.) of 50.8 mm. The California Samplers used had a ring I.D. of 61.5 mm, and an O.D. of either 76.2 mm or 82.6 mm. The samplers were typically driven a maximum of about 45.7 cm (less in very dense soils) into the material at the bottom of the test boring. Drive samples from the hollow stem auger borings were driven using a 63.6-kg hammer falling 76.2 cm. Samples from the bucket auger borings were driven by multiple applications of the weight of the drill rig's Kelly bar falling 30.5 m. The Kelly bar weight applied to the sampler varies with depth in accordance with the following table.

Bucket Auger Rig	Depth (meters)	Kelly Bar Weight (kg)
ED-45L	0 to 8.5	1584
	8.5 to 16.8	1086
	16.8 to 25.9	588

GROUP DELTA CONSULTANTS

The penetration resistance to the sampler was recorded in blows per lower foot of penetration and is presented on the boring logs. After the sampler was retrieved from the borings, the recovered soil was removed from the sampler, examined, and visually classified in the field in accordance with the Unified Soils Classification System (Figure A-1) . Samples from the SPT sampler were placed in sealable plastic bags. The metal rings containing the samples from the California sampler were placed in plastic containers and sealed to protect the natural moisture content. Representative disturbed samples of cuttings obtained from the test borings and test pits were also collected from most of the test excavations. All samples were brought to our office for further examination and assignment of laboratory tests. Selected samples were tested in the in the laboratory for relevant engineering properties (**TESTING IS CURRENTLY IN PROGRESS, APPENDIX B TO BE PROVIDED LATER**). Where soil classifications based on lab tests differ from visual classification in the field, the appropriate changes were made to the boring logs (**TO BE PERFORMED AFTER LABORATORY TESTING IS COMPLETE**).

The location of each test excavation and the elevation of the ground surface at each location were estimated from the site plans provided by Boyle Engineering Corporation. The locations of the test explorations are shown on the Geologic Map and Exploration Location Map, Figure 2, Sheets 1 through 12. Drafted logs of the borings and test pits are presented in Figures A-2 through A-203.

Test results for samples subjected to moisture content and dry density determinations are noted directly on the exploration logs (**TO BE PROVIDED UPON COMPLETION OF LABORATORY TESTING**). Additional laboratory tests performed on soil samples are indicated on the logs in the column "Other Tests" (**TO BE PROVIDED UPON COMPLETION OF LABORATORY TESTING**). The following abbreviations are used on the logs to indicate the type of test performed.

AL	Atterberg Limits
CO	Corrosivity Tests
CT	Compaction Test
DS	Direct Shear Test
GS	Grain Size Distribution Test
HY	Hydrometer Analysis
PP	Pocket Penetrometer Test
RV	R-Value Test
SE	Sand Equivalent Test
WA	Fines Content Wash Test

Descriptions and result summaries of laboratory tests performed are provided in Appendix B (**TO BE PROVIDED LATER**).

A.3 List of Attached Tables and Figures

TABLE A-1
EXPLORATION SUMMARY
MIDDLE SEGMENT, STATE ROUTE 56 PROJECT

Exploration No.	Station No.*	Offset * (m)	Surface Elevation (m)	Total Depth (m)	Hole Diameter (cm)	Groundwater Depth (m)	Excavation Equipment/Method
MGD-HSA-1	63+52	51 m RT	44.3	9.45	20.3	Not Encountered	CME 95/Hollow-stem auger
MGD-HSA-2	64+55	56 m RT	43.8	11.13	20.3	Not Encountered	CME 95/Hollow-stem auger
MGD-HSA-3	65+23	58 m RT	43.7	11.13	20.3	9.8	CME 95/Hollow-stem auger
MGD-HSA-4	65+86	51 m LT	47.1	11.13	20.3	Not Encountered	CME 95/Hollow-stem auger
MGD-HSA-5	63+30	36 m LT	47.8	12.5	20.3	Not Encountered	CME 95/Hollow-stem auger
MGD-HSA-6	96+39	86 m RT	68.0	10.98	20.3	1.8	CME 95/Hollow-stem auger
MGD-HSA-7	97+01	39 m RT	69.0	9.60	20.3	2.1	CME 95/Hollow-stem auger
MGD-HSA-8	97+44	34 m LT	70.0	9.60	20.3	3.7	CME 95/Hollow-stem auger
MGD-HSA-9	91+54	47 m RT	74.2	6.25	20.3	0.3	CME 85/Hollow-stem auger
MGD-TP-1	107+47	45 m RT	115.4	2.44	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-2	106+89	26 m LT	118.0	1.68	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-3	106+00	30 m LT	117.9	1.68	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-4	105+64	40 m RT	115.5	1.68	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-5	104+43	17 m RT	107.3	1.83	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-6	103+73	45 m RT	113.9	2.13	N/A	Not Encountered	John Deere 45L backhoe

* Metric station and offset referenced from the centerline of SR-56
** Perched groundwater

TABLE A-1 (Continued)
EXPLORATION SUMMARY
MIDDLE SEGMENT, STATE ROUTE 56 PROJECT

Exploration No.	Station No.*	Offset * (m)	Surface Elevation (m)	Total Depth (m)	Hole Diameter (cm)	Groundwater Depth (m)	Excavation Equipment/Method
MGD-TP-7	103+50	1 m LT	113.9	2.74	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-8	104+32	32 m LT	113.2	2.44	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-9	100+43	16 m LT	99.7	2.13	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-10	100+72	22 m RT	105.6	1.83	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-11	99+34	0	101.8	1.52	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-12	98+31	54 m LT	86.5	2.29	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-13	97+73	68 m LT	73.0	3.05	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-14	98+49	54 m RT	94.5	1.83	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-15	96+65	57 m RT	81.0	3.35	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-16	96+37	12 m LT	70.5	3.66	N/A	3.4	John Deere 45L backhoe
MGD-TP-17	95+96	64 m LT	75.0	1.52	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-18	95+00	31 m RT	69.9	2.13	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-19	93+84	28 m LT	77.6	2.13	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-20	92+24	0	87.4	1.52	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-21	91+65	6 m RT	81.0	2.44	N/A	Not Encountered	John Deere 45L backhoe

* Metric station and offset referenced from the centerline of SR-56
** Perched groundwater

DELTA CONSULTANTS GROUP

TABLE A-1 (Continued)
EXPLORATION SUMMARY
MIDDLE SEGMENT, STATE ROUTE 56 PROJECT

Exploration No.	Station No.*	Offset * (m)	Surface Elevation (m)	Total Depth (m)	Hole Diameter (cm)	Groundwater Depth (m)	Excavation Equipment/Method
MGD-TP-22	91+65	0	77.1	2.13	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-23	88+91	40 m LT	79.4	2.59	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-24	88+40	45 m LT	78.2	2.74	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-25	88+79	0	83.0	1.83	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-26	88+05	53 m RT	73.6	3.20	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-27	87+73	18 m LT	86.4	1.52	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-28	86+56	48 m LT	79.0	2.44	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-29	86+39	34 m LT	86.5	1.52	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-30	87+27	47 m RT	73.9	3.35	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-31	80+05	61 m RT	76.9	1.52	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-32	84+43	0	88.1	1.52	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-33	84+13	50 m LT	83.3	1.52	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-34	83+68	34 m LT	87.0	3.35	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-35	83+66	2 m RT	86.4	2.44	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-36	83+46	0	90.5	1.52	N/A	Not Encountered	John Deere 45L backhoe

* Metric station and offset referenced from the centerline of SR-56
** Perched groundwater

TABLE A-1 (Continued)
EXPLORATION SUMMARY
MIDDLE SEGMENT, STATE ROUTE 56 PROJECT

Exploration No.	Station No.*	Offset * (m)	Surface Elevation (m)	Total Depth (m)	Hole Diameter (cm)	Groundwater Depth (m)	Excavation Equipment/Method
MGD-TP-37	83+48	55 m RT	83.4	3.66	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-38	82+83	27 m RT	88.0	1.83	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-39	82+67	38 m RT	91.4	2.44	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-40	73+79	2 m LT	76.0	2.13	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-41	74+20	46 m LT	66.6	2.74	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-42	73+97	55 m LT	66.9	3.35	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-43	72+60	38 m LT	62.3	3.66	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-44	80+88	39 m LT	86.5	1.83	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-45	80+89	1 m RT	90.1	1.68	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-46	80+34	30 m RT	88.0	1.52	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-47	79+20	52 m RT	72.4	3.96	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-48	79+60	38 m LT	75.7	3.96	N/A	4.0	John Deere 45L backhoe
MGD-TP-49	77+80	87 m RT	86.4	1.83	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-50	69+27	57 m RT	53.8	3.35	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-51	70+07	58 m LT	59.9	3.66	N/A	Not Encountered	John Deere 45L backhoe

* Metric station and offset referenced from the centerline of SR-56
** Perched groundwater

TABLE A-1 (Continued)
EXPLORATION SUMMARY
MIDDLE SEGMENT, STATE ROUTE 56 PROJECT

Exploration No.	Station No.*	Offset * (m)	Surface Elevation (m)	Total Depth (m)	Hole Diameter (cm)	Groundwater Depth (m)	Excavation Equipment/Method
MGD-TP-52	72+71	16 m RT	72.5	2.44	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-53	72+25	0	70.8	1.52	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-54	71+37	0	58.7	3.96	N/A	2.4	John Deere 45L backhoe
MGD-TP-55	71+01	64 m RT	59.0	1.52	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-56	70+54	18 m LT	68.5	1.52	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-57	69+11	2 m LT	66.5	1.52	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-58	68+01	0	64.4	1.58	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-59	67+89	16 m LT	58.8	4.11	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-60	67+52	42 m RT	52.1	4.11	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-61	66+70	4 m LT	59.0	1.52	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-62	66+20	44 m RT	49.6	1.52	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-63	62+98	5 m RT	53.6	2.13	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-64	59+89	5 m RT	53.0	1.83	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-65	63+36	3 m RT	46.8	3.66	N/A	Not Encountered	John Deere 45L backhoe

* Metric station and offset referenced from the centerline of SR-56
** Perched groundwater

DELTA CONSULTANTS GROUP

TABLE A-1 (Continued)
EXPLORATION SUMMARY
MIDDLE SEGMENT, STATE ROUTE 56 PROJECT

Exploration No.	Station No.*	Offset * (m)	Surface Elevation (m)	Total Depth (m)	Hole Diameter (cm)	Groundwater Depth (m)	Excavation Equipment/Method
MGD-TP-66	58+27	1 m LT	54.6	1.52	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-67	78+50	0	87.1	1.37	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-68	56+52	35 m RT	55.4	1.52	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-69	55+52	24 m RT	48.9	3.35	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-70	55+84	39 m LT	54.7	5.49	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-71	55+45	48 m LT	55.4	5.49	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-72	54+86	26 m LT	58.8	1.83	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-73	51+38	2 m LT	44.3	2.74	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-74	52+10	153 m LT	58.6	3.66	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-75	53+88	8 m RT	55.9	1.52	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-76	54+23	44 m RT	50.5	1.83	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-77	53+52	33 m RT	50.2	2.44	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-78	52+93	40 m RT	53.8	1.52	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-79	51+83	3 m LT	51.5	1.52	N/A	Not Encountered	John Deere 45L backhoe
MGD-TP-80	50+04	1 m RT	46.4	1.52	N/A	Not Encountered	John Deere 45L backhoe

* Metric station and offset referenced from the centerline of SR-56
** Perched groundwater

TABLE A-1 (Continued)
EXPLORATION SUMMARY
MIDDLE SEGMENT, STATE ROUTE 56 PROJECT

Exploration No.	Station No.*	Offset * (m)	Surface Elevation (m)	Total Depth (m)	Hole Diameter (cm)	Groundwater Depth (m)	Excavation Equipment/Method
MGD-BA-1	108+44	39 m LT	126.8	9.45	76.2	Not Encountered	Earth Drill 45L/Bucket auger
MGD-BA-2	105+19	19 m LT	119.6	6.40	76.2	Not Encountered	Earth Drill 45L/Bucket auger
MGD-BA-3	102+96	66 m LT	125.9	16.77	76.2	Not Encountered	Earth Drill 45L/Bucket auger
MGD-BA-4	101+56	29 m RT	114.5	10.67	76.2	Not Encountered	Earth Drill 45L/Bucket auger
MGD-BA-5	100+18	51 m RT	111.0	10.97	76.2	Not Encountered	Earth Drill 45L/Bucket auger
MGD-BA-6	98+86	55 m LT	96.5	28.96	76.2	22.9	Earth Drill 45L/Bucket auger
MGD-BA-7	95+94	38 m LT	80.3	18.60	76.2	12.5** & 15.8	Earth Drill 45L/Bucket auger
MGD-BA-8	95+25	32 m RT	81.2	18.60	76.2	16.5	Earth Drill 45L/Bucket auger
MGD-BA-9	68+37	19 m RT	68.2	22.86	76.2	Not Encountered	Earth Drill 45L/Bucket auger
MGD-BA-10	68+98	42 m LT	75.3	16.77	76.2	Not Encountered	Earth Drill 45L/Bucket auger
MGD-BA-11	67+46	44 m LT	68.7	10.67	76.2	Not Encountered	Earth Drill 45L/Bucket auger
MGD-BA-12	64+97	26 m RT	52.8	17.38	76.2	12.1-15.4**	Earth Drill 45L/Bucket auger
MGD-BA-13	72+30	63 m LT	87.4	18.60	76.2	Not Encountered	Earth Drill 45L/Bucket auger
MGD-BA-14	73+53	50 m RT	89.6	19.82	76.2	Not Encountered	Earth Drill 45L/Bucket auger
MGD-BA-15	74+77	2 m LT	85.3	10.67	76.2	Not Encountered	Earth Drill 45L/Bucket auger

* Metric station and offset referenced from the centerline of SR-56
** Perched groundwater

DELTA CONSULTANTS GROUP

TABLE A-1 (Continued)
EXPLORATION SUMMARY
MIDDLE SEGMENT, STATE ROUTE 56 PROJECT

Exploration No.	Station No.*	Offset * (m)	Surface Elevation (m)	Total Depth (m)	Hole Diameter (cm)	Groundwater Depth (m)	Excavation Equipment/Method
MGD-BA-16	76+59	43 m RT	89.2	10.98	76.2	Not Encountered	Earth Drill 45L/Bucket auger
MGD-BA-17	75+28	49 m RT	90.8	15.55	76.2	Not Encountered	Earth Drill 45L/Bucket auger
MGD-BA-18	77+40	26 m LT	91.8	13.11	76.2	Not Encountered	Earth Drill 45L/Bucket auger
MGD-BA-19	81+81	43 m RT	96.4	9.45	76.2	6.7-8.2**	Earth Drill 45L/Bucket auger
MGD-BA-20	82+39	44 m LT	98.4	11.89	76.2	7.0-8.8**	Earth Drill 45L/Bucket auger
MGD-BA-21	63+72	23 m LT	52.5	17.68	76.2	12.5	Earth Drill 45L/Bucket auger
MGD-BA-22	62+82	31 m RT	53.3	17.07	76.2	14.7	Earth Drill 45L/Bucket auger
MGD-BA-23	61+55	59 m LT	68.3	21.04	76.2	Not Encountered	Earth Drill 45L/Bucket auger
MGD-BA-24	60+40	39 m RT	55.7	21.65	76.2	Not Encountered	Earth Drill 45L/Bucket auger
MGD-BA-25	93+07	38 m LT	96.5	15.55	76.2	Not Encountered	Earth Drill 45L/Bucket auger
MGD-BA-26	92+79	43 m RT	89.6	7.93	76.2	Not Encountered	Earth Drill 45L/Bucket auger
MGD-BA-27	90+47	42 m LT	97.9	19.82	76.2	17.4-18.2**	Earth Drill 45L/Bucket auger
MGD-BA-28	89+34	45 m RT	91.2	10.98	76.2	Not Encountered	Earth Drill 45L/Bucket auger
MGD-BA-29	85+70	53 m RT	98.7	15.55	76.2	Not Encountered	Earth Drill 45L/Bucket auger
MGD-BA-30	84+96	42 m LT	97.0	12.19	76.2	Not Encountered	Earth Drill 45L/Bucket auger

* Metric station and offset referenced from the centerline of SR-56

** Perched groundwater

TABLE A-1 (Continued)
EXPLORATION SUMMARY
MIDDLE SEGMENT, STATE ROUTE 56 PROJECT

Exploration No.	Station No.*	Offset * (m)	Surface Elevation (m)	Total Depth (m)	Hole Diameter (cm)	Groundwater Depth (m)	Excavation Equipment/Method
MGD-BA-31	59+18	52 m LT	67.5	18.29	76.2	Not Encountered	Earth Drill 45L/Bucket auger
MGD-BA-32	58+89	58 m RT	59.8	10.98	76.2	Not Encountered	Earth Drill 45L/Bucket auger
MGD-BA-33	57+20	3 m RT	51.0	10.67	76.2	7.9**	Earth Drill 45L/Bucket auger
MGD-BA-34	56+71	34 m RT	54.6	16.77	76.2	12.3**	Earth Drill 45L/Bucket auger
MGD-BA-35	56+53	34 m LT	61.0	7.01	76.2	Not Encountered	Earth Drill 45L/Bucket auger
MGD-BA-36	53+89	34 m LT	59.4	7.62	76.2	Not Encountered	Earth Drill 45L/Bucket auger
MGD-BA-37	52+83	48 m LT	65.5	15.55	76.2	Not Encountered	Earth Drill 45L/Bucket auger
MGD-BA-38	52+27	136 m LT	61.0	10.98	76.2	Not Encountered	Earth Drill 45L/Bucket auger
MGD-BA-39	52+94	193 m LT	71.7	9.45	76.2	Not Encountered	Earth Drill 45L/Bucket auger
MGD-BA-40	52+02	29 m RT	52.9	19.82	76.2	Not Encountered	Earth Drill 45L/Bucket auger
MGD-BA-41	50+71	35 m LT	54.4	12.50	76.2	Not Encountered	Earth Drill 45L/Bucket auger
MGD-BA-42	100+20	8 m RT	105.3	16.77	76.2	7.2-7.5**	Earth Drill 45L/Bucket auger
MGD-BA-43	98+09	92 m LT	81.6	19.51	76.2	12.5	Earth Drill 45L/Bucket auger

* Metric station and offset referenced from the centerline of SR-56
** Perched groundwater

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D-2487)

PRIMARY DIVISIONS			*GROUP SYMBOL*	*SECONDARY DIVISIONS*
COARSE GRAINED SOILS *More Than Half of Material Is Larger Than No.200 Sieve Size (Fines)*	GRAVELS *More Than Half of Coarse Fraction Is Larger Than No.4 Sieve*	CLEAN GRAVELS *(Less Than 5% Fines)*	GW	Well Graded Gravels, Gravels With Sand, Little Or No Fines.
			GP	Poorly Graded Gravels, Gravels With Sand, Little Or No Fines.
		GRAVEL *(More Than 12% Fines)*	GM	Silty Gravels, Silty Gravel With Sand, Non Plastic Fines.
			GC	Clayey Gravels, Clayey Gravel With Sand, Plastic Fines.
	SANDS *More Than Half of Coarse Fraction Is Smaller Than No.4 Sieve*	CLEAN SANDS *(Less Than 5% Fines)*	SW	Well Graded Sands, Sand With Gravel, Little Or No Fines.
			SP	Poorly Graded Sands, Little Or No Fines.
		SANDS *(More Than 12% Fines)*	SM	Silty Sands, Sand-Silt Mixtures. Non-Plastic Fines.
			SC	Clayey Sands, Sand-Clay Mixtures. Plastic Fines.
FINE GRAINED SOILS *More Than Half of Material Is Smaller Than No.200 Sieve Size*	SILTS AND CLAYS) *Liquid Limit Is Less Than 50*		ML	Inorganic Silts and Very Fine Sands, Rock Flour, Silty or Clayey Fine Sands or Clayey Silts With Slight Plasticity.
			CL	Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays.
			OL	Organic Silts and Organic Silty Clays of Low Plasticity.
	SILTS AND CLAYS *Liquid Limit Is Greater Than 50*		MH	Inorganic Elastic Silts, Micaceous or Diamaceous Fine Sandy or Silty Soils, Plastic Silts.
			CH	Inorganic Clays or High Plasticity, Fat Clays.
			OH	Organic Clays of Medium to High Plasticity, Organic Silts.
HIGHLY ORGANIC SOILS			PT	Peat and Other Highly Organic Soils.

Dual Group Symbols Are Used For Coarse Grained Soils With 5% To 12% Fines (Passing #200 Sieve) And For (CL-ML). Borderline Classification May Be Represented With Two Symbols Separated By A Slash.

CONSISTENCY CLASSIFICATION

GRANULAR	
Consistency	Blows/Foot*
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

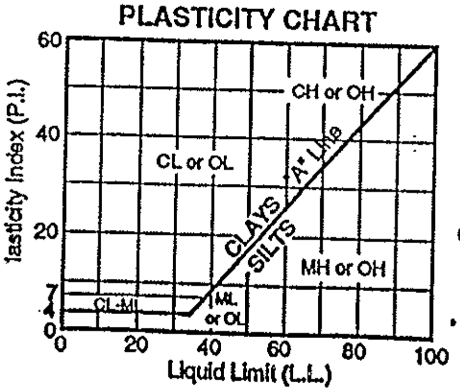
COHESIVE		
Consistency	Blows/Foot*	Strength**
Very Soft	< 2	<1/4
Soft	2 - 4	1/4 - 1/2
Firm	5 - 8	1/2 - 1
Stiff	9 - 15	1 - 1 1/2
Very Stiff	16 - 30	1 1/2 - 2
Hard	> 31	>2

*Number of Blows of 140 Pound Hammer Falling 30 Inches To Drive a 2-Inch O.D. (1-3/8 Inch I.D.) Split Barrel Sampler (ASTM D-1586 Standard Penetration Test).

**Shear Strength In KSF. Read From Pocket Penetrometer.

CLASSIFICATION CRITERIA BASED ON LAB TESTS

PLASTICITY CHART



CLAYS AND SILTS	SAND			GRAVEL		COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Coarse		

Sieve Sizes 200 40 10 4 3/4" 3" 12"

U.S. STANDARD SERIES SIEVE CLEAR SQUARE SIEVE OPENINGS

Classification of Earth Materials Is Based on Field Inspection and Should Not Be Construed To Imply Laboratory Analysis Unless So Stated.

GW and SW: $C_U = \frac{D_{60}}{D_{10}}$ Greater Than 4 For GW and 6 For SW; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3

GP and SP: Clean Gravel or Sand Not Meeting Requirement For GW and SW.
GM and SM: Atterberg Limit Below "A" Line or P.I. Less Than 4.
GC and SC: Atterberg Limit Above "A" Line P.I. Greater Than 7.

KEY FOR SOIL CLASSIFICATION

Figure A-1

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
			-	B	0	**Alluvium:** **Clayey Medium to Coarse Sand (SC),** with gravels up to 51 mm in size, dark brown, moist, medium dense	44.3 ±
							44
					1		
			18	S		becomes medium grained, gray brown	43
					2		42
			NR	D	3		41
						gravels up to 25 mm in size from 3.4 to 4.0 m	
					4	becomes orange brown	40
			40	S		**Silty Medium to Fine Sand (SM),** light brown, moist, medium dense	
					5		39
			100	D	6	becomes very dense, with trace Clay	38
					7		37
			84	S		Basal gravel layer at 7.6 m, gravels up to 19 mm in size	
					8	**La Jolla Group:** **Silty Medium to Fine Sand (SM),** light brown, moist, very dense with some gravels from 8.2 to 9.1 m	36
					9		
			42	D		becomes blue gray, dense	35
						Bottom of boring at El. 34.85 m Groundwater not encountered	

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 9-28-98

EQUIPMENT/METHOD USED: CME 95/8" HSA

SUPERVISOR: N NGHIEM

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-HSA- 1

FIGURE A-2

LBM MGD 2-8-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	<u>**Alluvium:**</u> **Silty Medium to Fine Sand (SM),** brown, with gravel up to 19 mm in size	43.8 ±
					1	**Sandy Clay (CL),** dark brown, moist, stiff	43
			10	S			
					2		42
			40	D	3	becomes blue gray, very stiff	41
					4	with some gravels up to 38 mm in size	40
			52	S			
					5	**Gravel (GP)** up to 38 mm in size, gray, moist, very dense	39
						<u>**La Jolla Group:**</u> **Clayey Medium to Fine Sand (SC),** light brown, moist, very dense,	
			100	D	6		38
					7		37
			57	S			
					8	**Silty Medium to Fine Sand (SM)** with trace Clay, light brown, moist, very dense, with occasional interbeds of **Silty Clay (CL),** dark gray, moist, hard	36
					9	becomes blue gray	35
			100	D			
						Clay interbed from 9.7 to 10.4 m	34

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 9-28-98

EQUIPMENT/METHOD USED: CME 95/8" HSA

SUPERVISOR: N. NGHIEM

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-HSA- 2

PAGE 1 OF 2

FIGURE A-3

LBM MGD 2-8-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					10		
			50	S			33
					11	Bottom of boring at El. 32.67 m Groundwater not encountered	
					12		32
					13		31
					14		30
					15		29
					16		28
					17		27
					18		26
					19		25
							24

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 9-28-98

EQUIPMENT/METHOD USED: CME 95/8" HSA

SUPERVISOR: N. NGHIEM

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-HSA- 2

FIGURE A-4

LBM MGD 2-8-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	**Alluvium:** **Clayey Medium to Coarse Sand (SC),** brown, moist, loose to medium dense	43.7 ±
						becomes gray	43
					1		
			17	S		becomes brown	
					2		42
							41
			32	D	3	**Sandy Clay (CL),** gray, moist, very stiff	
					4		40
			13	S		**Silty Medium to Fine Sand (SM)** with trace Clay, light brown, moist, medium dense	39
					5		
							38
			30	D	6	**Silty Clay (CL),** light brown, moist, very stiff	
					7		37
			31	S		**Silty Fine Sand (SM)** with trace Clay, light brown, moist, medium dense to dense	36
					8		
							35
			100	D	9		
						La Jolla Group: **Silty Fine sand (SM),** gray, moist, very dense	34

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 9-28-98

EQUIPMENT/METHOD USED: CME 95/8" HSA

SUPERVISOR: N. NGHIEM

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-HSA- 3

LBM MGD 2-8-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					10	groundwater at El. 33.94 m	±
						becomes light brown	
			100+	S			33
					11		
						Bottom of boring at El. 32.57 m Groundwater encountered at El. 33.94 m	
							32
					12		
							31
					13		
							30
					14		
							29
					15		
							28
					16		
							27
					17		
							26
					18		
							25
					19		
							24

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 9-28-98

EQUIPMENT/METHOD USED: CME 95/8" HSA

SUPERVISOR: N. NGHIEM

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-HSA- 3

FIGURE A-6

LBM MGD 2-8-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
			-	B	0	**Alluvium:** **Silty Medium Sand (SM)** with trace Clay, brown, moist, loose to medium dense	47.1 ±
					1		46
			23	S			
					2		45
			36	D	3	**Sandy Clay (CL),** orange brown, moist, very stiff	44
					4		43
			17	S			
					5	becomes brown	42
						gravel layer from 5.5 to 5.8 m	
			76	D	6	**La Jolla Group:** **Silty Medium Sand (SM)** with trace Clay, orange brown, moist, very dense	41
						Clayey Medium Sand (SC), gray blue, moist, very dense	
					7		40
			52	S		**Silty Medium Sand (SM),** light brown, moist, very dense	
					8		39
						Clayey Medium Sand (SC), blue gray, moist, very dense	
					9		38
			100	D		**Silty Medium Sand (SM),** light brown, moist, very dense	

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 9-28-98

EQUIPMENT/METHOD USED: CME 95/8" HSA

SUPERVISOR: N. NGHIEM

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-HSA- 4

FIGURE A-7

LBM MGD 2-8-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					10		
			36	S		becomes dense becomes gray	
					11		
						Bottom of boring at El. 35.97 m Groundwater not encountered	36
					12		35
					13		34
					14		33
					15		32
					16		31
					17		30
					18		29
					19		28

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 9-28-98

EQUIPMENT/METHOD USED: CME 95/8" HSA

SUPERVISOR: N. NGHIEM

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-HSA- 4

FIGURE A-8

LBM MGD 2-8-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	<u>Alluvium:</u> **Silty Medium Sand (SM)** with trace Clay, dark brown, moist, loose to medium dense	47.8
					1		47
			13	S			
					2	**Sandy Fat Clay (CH),** dark gray, moist, stiff	46
			60	D	3	**Sandy Lean Clay (CL),** brown, moist, hard	45
					4		44
			100+	S		basal gravel layer from 4.4 to 5.0 m, gravel greater than 38 mm in size	
					5	<u>La Jolla Group:</u> **Sandy Clay (CL),** orange, brown, moist, very stiff, highly weathered	43
			100+	D	6	**Silty Medium Sand (SM),** light brown, moist, very dense	42
					7	**Silty Medium Sand (SM),** light brown, moist, very dense, interbedded with **Sandy Silt (ML),** brown, moist, very dense	41
			100+	S	8		40
						Silty Medium Sand (SM) with trace Clay, orange brown, moist, very dense	
			100+	D	9		39
						with siltstone clasts up to 51 mm in size	38

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 9-29-98

EQUIPMENT/METHOD USED: CME 95/8" HSA

SUPERVISOR: N. NGHIEM

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Boring No. MGD-HSA- 5

FIGURE A-9

LBM MGD 2-4-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					10		±
			100+	S			
					11		37
							36
					12		
			100+	D			
						Bottom of boring at El. 35.30 m Groundwater not encountered	
					13		35
					14		34
					15		33
					16		32
					17		31
					18		30
					19		29
							28

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 9-29-98

EQUIPMENT/METHOD USED: CME 95/8" HSA

SUPERVISOR: N. NGHIEM

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-HSA- 5

FIGURE A-10

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
			-	B	0	**Alluvium:** **Silty Medium to Fine Sand (SM),** with gravels up to 51 mm in size and trace Clay, brown, dry, loose	68.0
					1	becomes dark brown, moist, medium grained	67
			4	S		becomes wet	
					2	groundwater at El. 65.87 m	66
			100	D	3	becomes very dense	65
					4		64
			76	S		**Poorly Graded Sand (SP),** with gravels up to 25 mm in size and trace Clay, brown, wet, very dense	
					5		63
						Silty Fine to Medium Sand (SM), brown, wet, very dense	
			100+	D	6		62
					7		61
			100+	S		becomes fine grained	
					8	**La Jolla Group:** **Silty Fine Sand (SM),** gray blue, moist, very dense	60
					9	becomes medium grained, with gravels up to 13 mm in size from 9.0 to 9.3 m	59
			100+	D			

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 9-29-98

EQUIPMENT/METHOD USED: CME 95/8" HSA

SUPERVISOR: N. NGHIEM

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Boring No. MGD-HSA- 6

FIGURE A-11

LBM MGD 2-4-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
			100+	D			
					11	Bottom of boring at El. 57.03 m Groundwater encountered at El. 65.87 m	57
					12		56
					13		55
					14		54
					15		53
					16		52
					17		51
					18		50
					19		49

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 9-29-98

EQUIPMENT/METHOD USED: CME 95/8" HSA

SUPERVISOR: N. NGHIEM

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Boring No. MGD-HSA- 6

FIGURE A-12

LBM MGD 2-4-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	**Alluvium:** **Silty Medium to Coarse Sand (SM)** with trace Clay, brown, moist, loose to medium dense	69.0
					1		68
			11	S		**Well Graded Sand (SW),** light brown, wet, medium dense	
					2	groundwater at El. 66.87 m	67
						Silty Medium Sand (SM) with trace Clay, dark brown, wet, very dense	
			100	D	3		66
						with many gravels from 3.2 to 4.3 m	
					4		65
			100+	D		with trace Clay and gravel	
					5	becomes light brown, moist	64
						with fine gravels up to 6 mm in size	
					6		63
			100+	S		**Fat Clay (CH),** rusty orange, moist, very stiff	
						Sandy Gravel (GP), tan, wet, very dense basal gravel layer	
					7	**La Jolla Group:** **Sandy Lean Clay (CL),** brown, wet, very stiff, very weathered formation	62
			100+	D		**Silty Fine Sand (SM),** blue gray, moist, very dense, unweathered formation	
					8		61
					9		60
			100+	S			
						Bottom of boring at El. 59.40 m Groundwater encountered at El. 66.87 m	

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 9-29-98

EQUIPMENT/METHOD USED: CME 95/8" HSA

SUPERVISOR: N. NGHIEM

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Boring No. MGD-HSA- 7

PAGE 1 OF 1

FIGURE A-13

LBM MGD 2-4-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	**Alluvium:** **Silty Medium to Fine Sand (SM)** with trace Clay, dark brown, moist, loose	70.0
					1		69
			6	S			
					2		68
						Fat Clay (CH), brown, moist, stiff	
			11	D	3		67
						becomes orange brown, wet	
						groundwater at El. 66.34 m	
					4		66
			14	S		**Silty Fine Sand (SM),** light brown, wet, medium dense	
					5		65
						becomes medium to fine grained	
					6		64
			24	D			
					7		63
			70	S		**La Jolla Group:** **Silty Fine Sand (SM),** blue gray, moist, very dense	
					8		62
					9		61
			100+	S		with hard siltstone clasts	
						Bottom of boring at El. 60.40 Groundwater encountered at El. 66.34 m	

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 9-29-98

EQUIPMENT/METHOD USED: CME 95/8" HSA

SUPERVISOR: N. NGHIEM

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Boring No. MGD-HSA- 8

PAGE 1 OF 1

FIGURE A-14

LBM MGD 2-4-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	74.2 ±
			4	S	0	**Alluvium:** **Sandy Lean Clay (CL),** gray brown, wet, soft	74
						Silty Medium to Fine Sand (SM), dark gray, wet, loose groundwater at El. 73.59 m	
					1	**Clayey Medium to Fine Sand (SC),** dark gray, wet, medium dense	73
			29	D	2		72
						Clayey Medium to Fine Sand (SC) to Locally Sandy Lean Clay (CL), gray brown, moist, dense / very stiff	
			36	S	3		71
					4		70
			50	D	5		
						La Jolla Group: **Silty Medium to Fine Sand (SM),** light gray, moist, very dense with trace gravel up to 51 mm in size, from 5.1 to 5.9 m	69
			100+	S	6		68
						Bottom of boring at El. 67.95 m Groundwater encountered at El. 73.59 m	
					7		67
					8		66
					9		65

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 1-11-99

EQUIPMENT/METHOD USED: CME 85/8" HSA

SUPERVISOR: J. BROWN

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-HSA- 9

FIGURE A-15

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	**Alluvium:** **Poorly Graded Medium to Fine Sand with Silt (SP-SM),** brown, moist to wet, loose, prone to caving	115.4 ±
							115
			-	B			
					1		
							114
						light water seepage at El. 113.72 m	
						Mission Valley Formation: **Silty Sand with Gravel to Silty Gravel with Sand (SM/GM),** dark brown, moist, very dense, estimated 50% gravel	
			-	B	2		
							113
						Bottom of test pit at El. 112.96 m Groundwater encountered at El. 113.72 m	
					3		
							112
					4		
							111
					5		
							110

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-12-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: J. BROWN

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP- 1

FIGURE A-16

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	**Top Soil / Residual Clay:** **Clayey Medium to Fine Sand (SC),** brown, dry to moist, loose to medium dense, and **Sandy Lean Clay (CL),** dark brown, moist, stiff	118.0 ±
			-	B			
						Mission Valley Formation: **Silty Gravel (GM) with Sand,** yellowish gray, moist, dense, estimated 55% gravel	
					1		117
			-	B			
						Bottom of test pit at El. 116.32 m Groundwater not encountered	
					2		116
					3		115
					4		114
					5		113

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-12-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: J. BROWN

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP- 2

FIGURE A-17

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Top Soil / Residual Clay:** **Sandy Lean to Fat Clay (CL/CH),** gray brown, moist, hard with occasional gravels	117.9 ±
			-	B			
					1	**Mission Valley Formation:** **Silty Gravel (GM) with Sand,** yellowish brown, moist, dense, estimated 55% gravel	117
			-	B			
						Bottom of test pit at El. 116.22 m Groundwater not encountered	
					2		116
					3		115
					4		114
					5		113
							112

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-12-98
EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE
SUPERVISOR: J. BROWN

GROUP DELTA

PROJECT NO. I-181
STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP- 3

FIGURE A-18

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Top Soil:** **Clayey Fine Sand (SC),** gray brown, moist, loose	114.3 ±
							114
			-	B		**Residual Clay:** **Sandy Fat Clay (CH),** dark gray brown, moist, very stiff to hard.	
					1	**Mission Valley Formation:** **Clayey Medium to Fine Sand (SC),** yellowish brown, moist, dense, with many gravels, estimated 40%	
			-	B			113
						Bottom of test pit at El. 112.62 m Groundwater not encountered	
					2		
							112
					3		
							111
					4		
							110
					5		
							109

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED:
10-12-98

EQUIPMENT/METHOD USED:
JD 410E/24" BACKHOE

SUPERVISOR:
J. BROWN

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP- 4

FIGURE A-19

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	**Top Soil / Residual Clay:** **Sandy Lean to Fat Clay (CL/CH),** gray brown to dark brown, dry to moist, hard	115.5 ±
			-	B			115
					1	**Mission Valley Formation:** **Silty Medium to Fine Sand (SM),** light gray brown, moist, very dense, with several filled rodent burrows to depth of 1.5 m	
			-	B			114
					2	Bottom of test pit at El. 113.67 Groundwater not encountered	
							113
					3		
							112
					4		
							111
					5		
							110

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-12-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: J. BROWN

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP- 5

PAGE 1 OF 1

FIGURE A-20

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	**Alluvium:** **Fine Sandy Lean to Fat Clay (CL/CH),** dark brown, moist, very stiff to hard	107.3 ±
							107
			-	B	1		
							106
			-	B	2	**Mission Valley Formation:** **Clayey Medium to Fine Sand (SC),** yellowish brown, moist, very dense	
						Bottom of test pit at El. 105.17 m Groundwater not encountered	105
					3		
							104
					4		
							103
					5		
							102

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-12-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: J. BROWN

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP- 6

FIGURE A-21

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Top Soil:** **Silty to Clayey Fine Sand (SM-SC),** brown to dark brown, dry to moist, with estimated 10% gravel	113.9 ±
					1	**Residual Clay:** **Sandy Clay (CL)** with some gravel, red brown, moist, firm	113
						Mission Valley Formation: **Sandy Clay (CL),** gray, moist, hard, highly fractured, highly weathered formation	
					2		112
						Silty Sand (SM), yellow orange, moist, very dense, unweathered formation	
						Bottom of test pit at El. 111.16 m Groundwater not encountered	111
					3		
					4		110
					5		109
							108

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-12-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP- 7

FIGURE A-22

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	**Alluvium:** **Clayey Sand (SC),** brown to dark brown, dry to moist, loose to medium dense, with some gravels estimated at 20%	113.2 ±
							113
			-	B			
					1		
							112
						Mission Valley Formation: **Clayey Fine Sand (SC),** light brown, moist, dense, highly weathered formation	
			-	B			
					2	**Silty Medium to Fine Sand (SM),** yellow gray, moist, very dense, unweathered formation	
							111
						Bottom of test pit at El. 110.76 m Groundwater not encountered	
					3		
							110
					4		
							109
					5		
							108

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-12-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP- 8

FIGURE A-23

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	**Alluvium / Slopewash:** **Clayey to Silty Sand (SC-SM),** brown to dark brown, dry to moist, with some gravel estimated at 20%	99.7 ±
							99
			-	B	1		
						Clayey Gravel (GC) with Sand to Clayey Sand (SC), with gravel and cobbles red orange to gray, moist	
						Landslide Debris **Clayey Medium to Fine Sand (SC)** gray, moist to wet, dense	98
			-	B	2		
						Bottom of test pit at El. 97.57 m Groundwater not encountered	
							97
					3		
							96
					4		
							95
					5		
							94

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:

- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-12-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP- 9

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	**Alluvium / Slopewash:** **Clayey Sand (SC) to Sandy Clay (CL),** dark brown, dry to moist	105.6 ±
			-	B			105
					1		
						Mission Valley Formation: **Silty Medium to Fine Sand (SM),** yellow orange, moist, very dense	
			-	B			104
					2	Bottom of test pit at El. 103.77 m Groundwater not encountered	
							103
					3		
							102
					4		
							101
					5		
							100

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-12-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-10

PAGE 1 OF 1

FIGURE A-25

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Residual Clay:** **Silty Clay (CL),** light gray to gray, moist	101.8 ±
						Mission Valley Formation: **Silty to Clayey Medium to Fine Sand (SM-SC),** yellow orange, moist, very dense	101
					1		
			-	B			
						Bottom of test pit at El. 100.28 m Groundwater not encountered	
							100
					2		
							99
					3		
							98
					4		
							97
					5		
							96

SAMPLE TYPES:

- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED:
10-12-98

EQUIPMENT/METHOD USED:
JD 410D/24" BACKHOE

SUPERVISOR:
S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-11

PAGE 1 OF 1

FIGURE A-26

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Landslide Debris:** **Clayey Gravel (GC)** with Sand, yellow gray, moist estimated 80% gravels and cobbles	86.5 ±
							86
					1	color changes to yellow orange	
							85
			-	B	2	**Clayey Fine Sand (SC),** yellow orange, moist, dense, intact weathered formational material within slide mass	
						Bottom of test pit at El. 84.21 m Groundwater not encountered	84
					3		
							83
					4		
							82
					5		
							81

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-12-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-12

FIGURE A-27

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Residual Clay:** **Sandy to Silty Clay (CL),** dark brown, dry to moist	73.0 ±
			-	B		**Landslide Debris:** **Clayey to Silty Medium to Coarse Sand (SC-SM),** brown, moist, with some gravel estimated at 10%	
					1		72
					2		71
			-	B		**Poorly Graded Medium to Fine Sand with Silt (SP-SM),** light gray, moist, dense	
					3	Bottom of test pit at El. 69.95 m Groundwater not encountered	70
					4		69
					5		68

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-12-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-13

FIGURE A-28

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	94.5 ±
					0	**Mission Valley Formation:** **Poorly Graded Gravel (GP),** conglomerate: gray to white, moist, very dense gravels and cobbles, clast supported in a weak to moderately cemented Silty to Clayey Sand matrix, estimated 80% gravels and cobbles	94
					1		93
					2	Bottom of test pit at El. 92.67 m Groundwater not encountered	92
					3		91
					4		90
					5		89

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-12-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-14

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Alluvium:** **Silty to Clayey Coarse to Fine Sand (SM-SC),** dark gray, dry to damp	81.0 ±
			-	B	1		80
						gravels along contact	
					2	**La Jolla Group:** **Silty to Clayey Medium to Fine Sand (SM-SC),** yellow orange, moist, dense, highly weathered formational material	79
						Poorly Graded Medium to Fine Sand with Silt (SP-SM), yellow gray, moist, dense with claystone clasts throughout, unweathered formation	
			-	B	3		78
						Bottom of test pit at El. 77.65 Groundwater not encountered	
					4		77
					5		76

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-14-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-15

FIGURE A-30

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Alluvium:** **Silty Coarse Fine Sand (SM),** gray, moist, loose to medium dense, with some gravels in upper 0.3 m	70.5 ±
							70
			-	B	1		
						Well Graded Sandy Gravel (GW), reddish brown, moist to wet, estimated 70% gravel	69
					2		
							68
			-	B	3		
						∇ water seepage at El. 67.15 m	67
						Bottom of test pit at El. 66.84 m Groundwater encountered at El. 67.15 m	
					4		
							66
					5		
							65

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-14-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-16

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	**Alluvium:** **Well Graded Gravel (GW)** with Sand cobbles and gravels in a Silty Sand matrix, estimated 80% gravels and cobbles	69.9 ±
					1	**La Jolla Group:** **Silty to Clayey Medium to Fine Sand (SM-SC),** yellow orange, moist, very dense, with some gravel estimated at 20%	69
			-	B			
						Bottom of test pit at El. 68.38 Groundwater not encountered	
					2		68
					3		67
					4		66
					5		65
							64

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-14-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-17

FIGURE A-32

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	**Alluvium:** **Well Graded Gravel with Sand and Silt (GW-GM),** gray to reddish brown, moist, estimated 70% gravels and cobbles	69.9 ±
			-	B			
					1		69
						La Jolla Group: **Silty Medium to Fine Sand (SM),** light gray, moist, very dense	
			-	B	2		68
						Bottom of test pit at El. 67.77 m Ground water not encountered	
					3		67
					4		66
					5		65
							64

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-14-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-18

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Debris Fill:** **Silty to Clayey Gravel (GM-GC)** with sand, dark brown, moist with trash and debris	77.6 ±
						Alluvium / Slopewash: **Silty to Clayey Gravel (GM-GC)** with sand, dark brown, moist, with cobbles	
			-	B			77
					1	carbon layer (possible burned zone)	
						La Jolla Group: **Silty to Clayey Medium to Fine Sand (SM-SC),** light gray, moist, very dense	76
			-	B	2		
						Bottom of test pit at El. 75.47 m Groundwater not encountered	
							75
					3		
							74
					4		
							73
					5		
							72

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED:
10-14-98

EQUIPMENT/METHOD USED:
JD 410E/24" BACKHOE

SUPERVISOR:
S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-19

PAGE 1 OF 1

FIGURE A-34

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Top Soil / Slopewash:** **Silty Clay to Fat Clay (CL/CH),** dark brown, moist with gravels near the surface	87.4 ±
							87
					1	**La Jolla Group:** **Silty Medium to Fine Sand (SM),** yellow orange, moist, very dense	
							86
						Bottom of test pit at El. 85.88 m Groundwater not encountered	
					2		
							85
					3		
							84
					4		
							83
					5		
							82

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-14-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-20

FIGURE A-35

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Top Soil / Slopewash:** **Clayey Sand (SC)**, dark brown, dry to moist	81.0 ±
						La Jolla Group **Silty medium to Fine Sand (SM),** yellow orange, moist, very dense, locally with moderate to strong cementation	
					1		80
			-	B			
						strongly cemented from 1.5 to 1.7 m	
					2		79
						Bottom of test pit at El. 78.56 m Groundwater not encountered	
					3		78
					4		77
					5		76

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-14-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-21

FIGURE A-36

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	77.1 ±
						Top Soil / Slopewash: **Silty Sand (SM),** gray, moist, loose to medium dense	77
					1	**La Jolla Group:** **Silty Medium to Fine Sand (SM),** yellow gray, moist, very dense	76
					2	**Silt (ML),** gray, moist, very dense, fractured	75
						Bottom of test pit at El. 74.97 m Groundwater not encountered	
					3		74
					4		73
					5		72

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-14-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-22

PAGE 1 OF 1

FIGURE A-37

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	**Alluvium:** **Silty Fine Sand (SM),** dark brown, moist, trace fine gravel	79.4 ±
							79
			-	B	1		
							78
					2	**La Jolla Group:** **Silty Sand to Sandy Silt (SM-ML),** yellow orange, moist, very dense	
			-	B			
							77
						Bottom of test pit at El. 76.81 m Groundwater not encountered	
					3		
							76
					4		
							75
					5		
							74

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-15-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-23

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	78.2 ±
						Alluvium: **Silty to Clayey Fine to Coarse Sand (SM-SC),** dark brown, to gray, moist	78
			-	B	1		77
					2	**La Jolla Group:** **Silty Medium to Fine Sand (SM),** light gray, moist, very dense, locally with strong cementation	76
			-	B			
						Bottom of test pit at El. 75.46 m Groundwater not encountered	
					3		75
					4		74
					5		73

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-15-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-24

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Top Soil / Slopewash:** **Silty to Clayey Sand (SM-SC),** dark brown, moist	83.0 ±
			-	B			
					1	**La Jolla Group:** **Silty Medium to Fine Sand (SM),** light gray, moist, very dense	82
						Bottom of test pit at El. 81.17 m Groundwater not encountered	
					2		81
					3		80
					4		79
					5		78

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-15-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-25

FIGURE A-40

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Alluvium:** **Silty to Clayey Fine to Coarse Sand (SM-SC),** dark brown to gray, moist, with trace of fine gravel	73.6 ±
							73
						Silty Medium to Fine Sand (SM), brown, moist, with some large gravel, estimated at 10%	
					1		
			-	B			
							72
					2		
						La Jolla Group: **Silty Medium to Fine Sand (SM),** light gray, moist, very dense	
							71
					3		
						Bottom of test pit at El. 70.40 m Groundwater not encountered	
							70
					4		
							69
					5		
							68

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-15-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-26

FIGURE A-41

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	**Top Soil / Slopewash:** **Silty to Clayey Sand (SM-SC),** brown, moist	86.4 ±
			-	B		**La Jolla Group:** **Silty Medium to Fine Sand (SM),** yellow orange, moist, very dense	86
			-	B	1	**Silt (ML),** gray, moist, hard, friable	
						Silty Medium to Fine Sand (SM), yellow orange, moist, very dense	85
						Bottom of test pit at El. 84.88 m Groundwater not encountered	
					2		84
					3		83
					4		82
					5		81

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-15-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-27

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Alluvium:** **Silty to Clayey Fine to Coarse Sand (SM-SC),** dark gray, moist	79.0 ±
			-	B			
					1		78
						La Jolla Group: **Silty Medium to Fine Sand (SM),** light gray, moist, very dense	
					2		77
						Bottom of test pit at El. 76.56 m Groundwater not encountered	
					3		76
					4		75
					5		74

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-15-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-28

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0		86.5 ±
			-	B		**Top Soil:** **Sandy to Silty Clay (CL),** dark brown to gray, moist, with gravels and cobbles at surface	86
					1	**La Jolla Group:** **Silty Medium to Fine Sand (SM),** light gray to yellow orange, moist, very dense	
						Bottom of test pit at El. 84.98 m Groundwater not encountered	85
					2		84
					3		83
					4		82
					5		81

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-15-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-29

FIGURE A-44

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Fill:** **Silty Sand (SM),** gray, moist, with some trash and debris, old backfilled excavation, becomes wet at 0.6 m, with extensive caving from 0.6 to 2.4 m depth	73.9 ±
					1		73
			-	B			
					2		72
						La Jolla Group: **Silty Medium to Fine Sand (SM),** light gray to yellow orange, moist to wet, very dense	
					3		71
						Bottom of test pit at El. 70.55 m Groundwater not encountered	
					4		70
					5		69
							68

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-15-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-30

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Alluvium:** **Silty Sand (SM),** dark gray, dry to moist, loose	76.9 ±
			-	B		**La Jolla Group:** **Silty Medium to Fine Sand (SM),** light gray to yellow orange, moist, very dense, with minor **Silt (ML)** lenses near the top	
					1		76
						Bottom of test pit at El. 75.38 m Groundwater not encountered	
					2		75
					3		74
					4		73
					5		72
							71

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-15-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-31

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	88.1 ±
			-	B	0	**Residual Clay** **Silty to Sandy Clay (CL),** dark gray, dry to moist, with some fine gravels	88
						La Jolla Group: **Silty Medium to Fine Sand (SM),** light gray, moist, very dense	
					1		87
						Bottom of test pit at El. 86.58 m Groundwater not encountered	
					2		86
					3		85
					4		84
					5		83

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-15-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-32

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	ELEVATION (meters)
					0		83.3 ±
			-	B		**Alluvium:** **Silty to Clayey Sand (SM-SC)** dark gray, moist, with some gravels near surface	83
					1		
			-	B		**La Jolla Group:** **Silty Medium to Fine Sand (SM),** light gray, moist, very dense	82
						Bottom of test pit at El. 81.78 m Groundwater not encountered	
					2		
							81
					3		
							80
					4		
							79
					5		
							78

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-15-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-33

PAGE 1 OF 1

FIGURE A-48

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	**Fill:** **Silty Sand (SM)** with gravel, mixed with plant matter, trash, and planting mix, strong chemical fertilizer odor	87.0 ±
					1		86
			-	B			
						La Jolla Group: **Silty Medium to Fine Sand (SM),** light gray, moist, very dense, weakly to moderately cemented	
					2		85
					3		84
			-	B			
						Bottom of test pit at El. 83.65 m Groundwater not encountered	
					4		83
					5		82

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED:
10-15-98

EQUIPMENT/METHOD USED:
JD 410E/24" BACKHOE

SUPERVISOR:
S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-34

PAGE 1 OF 1

FIGURE A-49

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Fill:** **Silty Sand (SM)** with gravel, mixed with plant matter, trash, and planting mix, strong chemical fertilizer odor	86.4 ±
							86
					1		
						La Jolla Group: **Silty Medium to Fine Sand (SM),** light gray to yellow orange, moist, very dense	85
						moderately to strongly cemented zone, from 1.8 to 2.0 m depth	
					2		
				B			
						Bottom of test pit at El. 83.96 m Groundwater not encountered	84
					3		
							83
					4		
							82
					5		
							81

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-16-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-35

FIGURE A-50

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	90.5 ±
						La Jolla Group: **Silty Sand (SM),** light gray, moist, very dense, with minor **Silt (ML)** lenses	90
					1		
						Bottom of test pit at El. 88.98 m Groundwater not encountered	89
					2		88
					3		87
					4		86
					5		85

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-16-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-36

FIGURE A-51

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	83.4 ±
						Fill: **Silty Sand (SM)** with gravel, and trace clay, mixed with plant matter, trash, and planting mix, strong chemical fertilizer odor	83
			-	B	1		
							82
					2		
							81
					3	**La Jolla Group:** **Silty Medium to Fine Sand (SM),** light gray, moist, very dense	
							80
						Bottom of test pit at El. 79.74 m Groundwater not Encountered	
					4		
							79
					5		
							78

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-16-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-37

PAGE 1 OF 1

FIGURE A-52

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Fill:** **Silty to Clayey Sand (SM-SC),** with plant matter and trash	88.0 ±
			-	B			
					1		87
						La Jolla Group: **Silty Medium to Fine Sand (SM),** light gray, moist, very dense, weakly cemented	
						Bottom of test pit at El. 86.17 m Groundwater not encountered	
					2		86
					3		85
					4		84
					5		83

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-16-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-38

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Fill:** **Silty Sand (SM),** dark gray, dry, with trash and plant matter	91.4 ±
							91
			-	B			
					1		
						La Jolla Group: **Silty Sand (SM) to Sandy Silt (ML),** yellow orange to gray, moist, very dense, blocky	90
			-	B	2		
						Bottom of test pit at El. 88.96 m Groundwater not encountered	89
					3		
							88
					4		
							87
					5		
							86

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-16-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-39

FIGURE A-54

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Slopewash:** **Silty Fine to Coarse Sand (SM),** dark gray to brown, dry, with some cobbles and gravels	76.0 ±
			-	B			
					1		75
						La Jolla Group: **Silty Medium to Fine Sand (SM),** light gray, moist, very dense	
					2		74
						Bottom of test pit at El. 73.87 m Groundwater not encountered	
					3		73
					4		72
					5		71

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-16-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-40

PAGE 1 OF 1

FIGURE A-55

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Alluvium:** **Silty to Clayey Coarse to Fine Sand (SM-SC),** gray, wet, with some gravels near surface	66.6 ±
							66
					1		
						La Jolla Group: **Silty Medium to Fine Sand (SM),** yellow orange, moist to wet, very dense	
							65
					2		
							64
						Bottom of boring at El. 63.86 m Groundwater not encountered	
					3		
							63
					4		
							62
					5		
							61

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-16-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-41

LBM MGD 2-11-99

Log of Test Pit

Pit Number: MGDTP-42

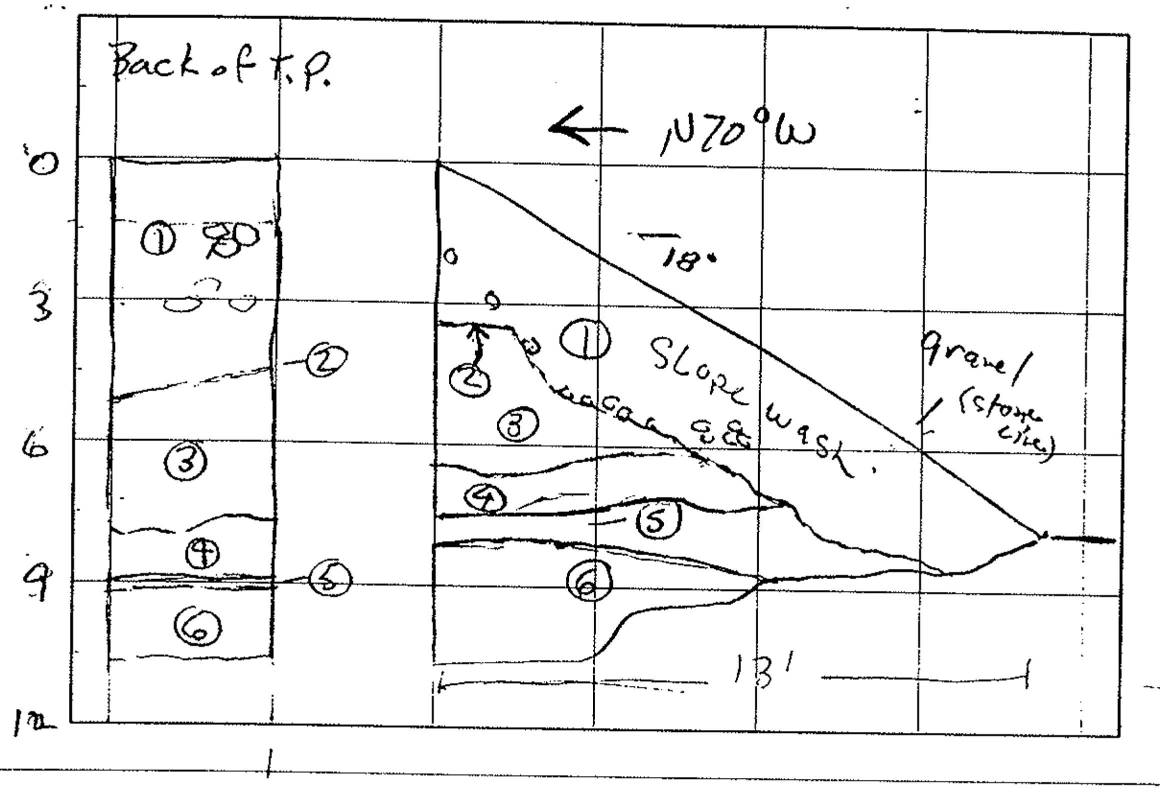
Project No. 1524-150 Date: 10/16/98 Logged By: SHK.

Elev. 106.9 M Contractor: Sample Method:

Pit Orientation: N70°W Ground Slope: 18° Drawing Scale:

Graphic Log

Elev.	Depth



Sample Summary

Sample No.	Sample Depth (Ft)		Blows/ Foot	Moisture Cont. (%)	Dry Density (PCF)	Description
						① Landslide: Dk Brown clayey to silty sand, Some gravel lenses. (SM-SC)
						② charcoal seam: black organic/charcoal zone.
						③ Landslide: gray clayey silt, soft, wet. Jumbled. (ML)
						④ Alluvium: yellow orange, loose, clean, moist sand, fine-grained. (SP)
						⑤ Alluvium: Dk. yellow-orange weathered zone on top of bedrock (Horizontal).
						⑥ Formation: gray mottled Dk. yellow-orange sandy silt moist to wet. (SM) B.H- 12'

Group Delta Consultants, Inc. Figure

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Alluvium:** **Silty Coarse to Fine Sand (SM),** dry to moist, with some gravels and trace clay, cobbles near surface	62.3 ±
							62
			-	B			
					1		
							61
						zone of burned brush and tree limbs, black, moist, with foul odor	
					2		
						Poorly Graded Medium to Fine Sand (SP), gray, moist, with some fine gravels	60
			-	B			
					3	**La Jolla Group:** **Silty Medium to Fine Sand (SM),** light gray to yellow orange, moist, very dense	
							59
						Bottom of test pit at El. 58.64 m Groundwater not encountered	
					4		
							58
					5		
							57

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-16-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-43

PAGE 1 OF 1

FIGURE A-58

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Alluvium:** **Silty Coarse to Medium Sand (SM),** dark brown, dry, with some fine gravels	86.5 ±
			-	B			86
					1	**La Jolla Group:** **Silty Medium to Fine Sand (SM),** light gray to yellow orange, moist, very dense	
							85
					2	Bottom of test pit at El. 84.67 m Groundwater not encountered	
							84
					3		
							83
					4		
							82
					5		
							81

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-19-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-44

FIGURE A-59

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	90.1 ±
			-	B		**Slopewash:** **Silty to Clayey Coarse to Fine Sand (SM-SC),** dark gray, dry	90
					1	**La Jolla Group:** **Silty Medium to Fine Sand (SM)** with some gravels, yellow orange, moist, very dense moderate to strong cementation from 0.8 to 1.2 m weakly cemented below	89
					2	Bottom of test pit at El. 88.42 m Groundwater not encountered	88
					3		87
					4		86
					5		85

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED:
10-19-98

EQUIPMENT/METHOD USED:
JD 410E/24" BACKHOE

SUPERVISOR:
S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181
STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-45

FIGURE A-60

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	**Top Soil / Slopewash:** **Silty to Clayey Coarse to Fine Sand (SM-SC),** dark gray, dry, with trace of fine gravels	88.0 ±
			-	B			
					1	**La Jolla Group:** **Silty to Clayey Medium to Fine Sand (SM-SC),** yellow orange, moist, very dense, locally strongly cemented	87
			-	B			
						Bottom of test pit at El. 86.48 m Groundwater not encountered	
					2		86
					3		85
					4		84
					5		83

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-19-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-46

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	72.4 ±
					0	**Alluvium:** **Silty to Clayey Sand (SM-SC),** dark gray, dry to damp	72
					1		71
						Poorly Graded Medium to Fine Sand (SP), gray, moist	
			-	B	2	**Sandy Clay (CL),** olive gray, moist	70
					3		
						La Jolla Group: **Silty Medium to Fine Sand (SM),** light gray, moist to wet, very dense	69
			-	B			
					4	Bottom of test pit at El. 68.44 m Groundwater not encountered	68
					5		67

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-19-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-47

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	**Recent Alluvium:** **Poorly Graded Medium to Fine Sand with Silt (SP-SM),** gray, dry to moist	75.7 ±
							75
					1	**Debris Fill:** **Sandy Silt (ML),** dark gray, moist, with abundant vegetative debris and trash	
			-	B		**Alluvium:** **Sandy Clay (CL),** dark gray, moist	74
					2		
						Silty Medium to Fine Sand (SM), gray, moist	73
			-	B	3		
						La Jolla Group: **Silty Medium to Fine Sand (SM),** yellow orange to gray, moist to wet, very dense	72
					4	Bottom of test pit at El. 71.74 m Water seepage at El. 71.74 m	
							71
					5		
							70

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-19-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-48

PAGE 1 OF 1

FIGURE A-63

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	**Residual Clay:** **Sandy Clay (CL),** dark gray, moist, with many gravels and cobbles	86.4 ±
			-	B			86
					1	**La Jolla Group:** **Silt (ML),** mottled gray to yellow orange, moist, hard, blocky	
							85
					2	Bottom of test pit at El. 84.57 m Groundwater not encountered	
							84
					3		
							83
					4		
							82
					5		
							81

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-19-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-49

FIGURE A-64

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	**Debris Fill:** **Silty Sand (SM),** light gray, dry to moist, with abundant trash and debris	53.8 ±
			-	B		**Alluvium:** **Silty Sand (SM),** dark gray, dry to moist, with trace of clay and fine gravel	53
					1		
						Clayey Medium to Fine Sand (SC), yellow orange, moist, with some gravels	52
			-	B	2		
							51
					3	**La Jolla Group:** **Silty to Clayey Sand (SM-SC),** light gray, moist, very dense	
						Bottom of test pit at El. 50.45 m Groundwater not encountered	
							50
					4		
							49
					5		
							48

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-19-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-50

FIGURE A-65

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	**Debris Fill:** **Silty Sand (SM),** light gray, dry to moist, with abundant trash and debris	59.9 ±
			-	B		**Alluvium:** **Sandy Clay (CL),** dark gray, dry to moist, with trace of gravel	
					1		59
						Silty Coarse to Fine Sand (SM), brown, moist, with some gravel and cobbles and trace of clay	
					2		58
			-	B			
					3		57
						La Jolla Group: **Silty Fine Sand (SM),** light gray, moist, very dense	
						Bottom of test pit at El. 56.24 m Groundwater not encountered	
					4		56
					5		55
							54

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-19-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-51

FIGURE A-66

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Alluvium:** **Silty Coarse to Fine Sand (SM)** with gravel to **Silty Gravel (GM)** with sand, dark gray, dry to moist, locally with estimated 50% gravel	72.5 ±
							72
					1		
			-	B		**Clayey Medium to Fine Sand (SC),** brown, moist, with estimated 25% gravel	
							71
						La Jolla Group: **Silty Sand (SM),** yellow orange, moist, very dense	
					2		
						Bottom of test pit at El. 70.06 m Groundwater not encountered	70
					3		
							69
					4		
							68
					5		
							67

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-20-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-52

PAGE 1 OF 1

FIGURE A-67

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	**Slopewash:** **Silty Sand (SM)** with gravels, dark brown, dry to moist	70.8 ±
						La Jolla Group: **Silty Medium to Coarse Sand (SM),** light gray, dry to moist, very dense	70
			-	B	1		
						Bottom of test pit at El. 69.28 m Groundwater not encountered	69
					2		
							68
					3		
							67
					4		
							66
					5		
							65

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-20-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-53

FIGURE A-68

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Debris Fill:** **Organic Silt (ML)** with Sand, black, moist, with abundant trash and debris	58.7 ±
							58
					1		
							57
					2	zone of burned vegetative matter with trash, black, wet	
						water seepage (heavy flow) at El. 56.26 m	
						Alluvium: **Silty Sand (SM),** olive gray, moist, with estimated 15% gravel	56
					3		
						La Jolla Group: **Poorly Graded Gravel with Silt (GP-GM),** yellow orange, moist, dense, with sand and cobbles	55
					4	Bottom of test pit at El. 54.74 m Groundwater encountered at El. 56.26 m	
							54
					5		
							53

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-20-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-54

FIGURE A-69

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Debris Fill:** **Poorly Graded Sand with Silt (SP-SM),** light gray, dry to moist with some gravel and trash	59.0 ±
			-	B			
			-	B	1	**Slopewash:** **Silty to Clayey Sand (SM-SC)** with gravel, dark brown, moist, estimated up to 40% gravel	58
						La Jolla Group: **Silty Sand (SM),** yellow orange, moist, very dense	
						Bottom of test pit at El. 57.48 m Groundwater not encountered	
					2		57
					3		56
					4		55
					5		54

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-20-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-55

FIGURE A-70

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	**Slopewash:** **Silty Sand (SM),** dark gray, dry, loose	68.5 ±
						La Jolla Group: **Silty Fine Sand (SM),** light gray, moist, very dense	68
					1		
						Bottom of test pit at El. 66.98 m Groundwater not encountered	67
					2		
							66
					3		
							65
					4		
							64
					5		
							63

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-20-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-56

FIGURE A-71

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
			-	B	0	**Top Soil:** **Silty Clay (CL)** with Sand, dark reddish brown, dry to moist, with gravels on surface	66.5 ±
						La Jolla Group: **Silt to Elastic Silt (ML/MH),** yellow orange, moist, very dense	66
					1		
						Bottom of test pit at El. 64.98 m Groundwater not encountered	65
					2		
							64
					3		
							63
					4		
							62
					5		
							61

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-20-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-57

FIGURE A-72

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Slopewash:** **Sandy Clay (CL),** dark reddish brown, dry to moist, with gravels on surface	64.4 ±
						La Jolla Group: **Silty Medium to Fine Sand (SM),** light gray, moist, very dense, with trace gravels and cobbles	64
					1		63
						Bottom of test pit El. 62.88 m Groundwater not encountered	
					2		62
					3		61
					4		60
					5		59

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-20-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-58

FIGURE A-73

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Debris Fill:** **Silty Sand (SM)** with decaying organic matter, dark gray to black, moist, with abundant trash and debris	58.8 ±
							58
					1		
						Alluvium: **Silt to Clayey Medium to Fine Sand (SM-SC),** yellow orange to gray, moist	
							57
					2		
			-	B			
							56
					3		
							55
						basal cobble and gravel layer on top of formation	
					4	**La Jolla Group:** **Silty Medium to Fine Sand (SM),** light gray, moist, very dense	
						Bottom of test pit at El. 54.69 m Groundwater not encountered	
							54
					5		
							53

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-19-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-59

FIGURE A-74

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Debris Fill:** **Silty Sand (SM)** with decaying organic matter, dark gray to black, moist, with abundant trash and debris	52.1 ±
							52
					1		51
						Alluvium: **Silt to Clayey Coarse to Fine Sand (SM-SC),** dark gray, moist, with occasional gravels	
					2		50
			-	B			
					3		49
					4	basal cobble and gravel layer on top of formation	
						La Jolla Group: **Silty Medium to Fine Sand (SM),** yellow orange, moist, very dense	48
						Bottom of test pit at El. 47.99 m Groundwater not encountered	
					5		47

SAMPLE TYPES:

- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-20-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-60

FIGURE A-75

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
			-	B	0	**Top Soil:** **Silty to Clayey Sand (SM-SC),** dark gray, dry	59.0 ±
			-	B		**La Jolla Group:** **Silty Fine Sand (SM),** yellow orange, moist, very dense	
					1		58
						Bottom of test pit at El. 57.48 m Groundwater not encountered	
					2		57
					3		56
					4		55
					5		54

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-20-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-61

PAGE 1 OF 1

FIGURE A-76

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Slopewash:** **Silty Sand (SM),** dark gray, dry to moist, loose	49.6 ±
						La Jolla Group: **Silty Medium to Fine Sand (SM),** light gray to yellow orange, moist, very dense	49
					1		
						Bottom of test pit at El. 48.08 m Groundwater not encountered	48
					2		
							47
					3		
							46
					4		
							45
					5		
							44

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-20-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-62

PAGE 1 OF 1

FIGURE A-77

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Fill:** **Silty Sand (SM)** with gravel, brown, dry, estimated 40% gravel	53.6 ±
			-	B			53
					1		
			-	B		**Slopewash:** **Clayey Medium to Fine Sand (SC),** dark gray/brown, moist	
						La Jolla Group: **Silty Medium to Fine Sand (SM),** light gray to yellow orange, moist, very dense, with gravel and cobble lenses	52
					2		
						Bottom of test pit at El. 51.47 m Groundwater not encountered	
							51
					3		
							50
					4		
							49
					5		
							48

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-21-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-63

FIGURE A-78

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
			-	B	0	**Slopewash:** **Clayey Coarse to Fine Sand (SC),** dark gray, dry to damp	53.0 ±
						La Jolla Group: **Silty Medium to Fine Sand (SM),** yellow orange, moist, very dense	
					1		52
						cobble and gravel bed	
						Bottom of test pit at El. 51.17 m Groundwater not encountered	
					2		51
					3		50
					4		49
					5		48

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-21-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-64

FIGURE A-79

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Alluvium:** **Silty to Clayey Medium to Fine Sand (SM-SC),** dark gray, moist, with few gravels	46.8 ±
							46
					1		
			-	B			
							45
					2		
							44
					3	basal gravel and cobble layer on top of formation	
						La Jolla Group: **Silty Fine Sand (SM),** light gray to yellow orange, moist, very dense	
						Bottom of test pit at El. 43.14 m Groundwater not encountered	43
					4		
							42
					5		
							41

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-21-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-65

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
			-	B	0	**Residual Clay:** **Sandy Clay (CL),** dark gray/brown, dry to moist	54.6 ±
						La Jolla Group: **Silty Medium to Fine Sand (SM),** light gray to yellow orange, moist, very dense	54
					1		
						Bottom of test pit at El. 53.08 m Groundwater not encountered	53
					2		
							52
					3		
							51
					4		
							50
					5		
							49

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-21-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-66

FIGURE A-81

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	87.1 ±
			-	B	0	**Slopewash:** **Silty Sand (SM),** dark gray, wet	87
						La Jolla Group: **Silty Fine Sand (SM),** light gray, moist, very dense	
					1		86
						Bottom of test pit at El. 85.73 Groundwater not encountered	
					2		85
					3		84
					4		83
					5		82

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-21-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-67

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
			-	B	0	**Landslide Debris:** **Silty to Clayey Sand (SM-SC),** dark brown, dry to moist	55.4 ±
						Silt (ML), gray, moist, hard, blocky, disturbed formational material	55
			-	B	1		
						Bottom of test pit at El. 53.88 m Groundwater not encountered	54
					2		53
					3		52
					4		51
					5		50

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-21-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-68

FIGURE A-83

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	**Debris Fill:** **Silty Sand (SM),** light brown, dry to moist, with large concrete debris	48.9 ±
						Silty to Clayey Sand (SM-SC), dark gray, moist, with vegetative debris, trash, and concrete	
					1		48
			-	B			
					2		47
					3	**La Jolla Group:** **Silty Medium to Fine Sand (SM),** light gray, moist, very dense, with siltstone clasts throughout	46
						Bottom of test pit at El. 45.55 m Groundwater not encountered	
					4		45
					5		44
							43

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-21-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-69

FIGURE A-84

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Debris Fill:** **Silty Sand (SM),** light brown, dry to moist, with concrete and masonry debris	54.7 ±
							54
					1	**Organic Sandy Silt (OL),** dark gray to black, moist, with abundant vegetative matter and trash, strong odor	
							53
					2		
							52
					3		
							51
					4		
							50
					5		
						Bottom of test pit at El. 49.21 m Groundwater not encountered	49

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-21-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-70

FIGURE A-85

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Debris Fill:** **Silty Sand (SM),** light brown, dry to moist, with concrete debris	55.4 ±
							55
					1	**Organic Silt (OL) and Silty Sand (SM),** dark gray to black, moist, with abundant vegetative matter and trash, strong odor	
							54
					2		
							53
					3		
							52
					4		
							51
					5		
							50
						Bottom of test pit at El. 49.91 m Groundwater not encountered	

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-22-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-71

FIGURE A-86

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Fill:** **Silty to Clayey Sand (SM-SC),** light brown, dry, loose, with some gravels	58.8 ±
							58
					1	**La Jolla Group:** **Silty Fine Sand (SM),** light gray to yellow orange, moist, very dense	
						Bottom of test pit at El. 56.97 m Groundwater not encountered	57
					2		
							56
					3		
							55
					4		
							54
					5		
							53

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-21-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-72

FIGURE A-87

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	**Slopewash / Alluvium:** **Silty to Clayey SAnd (SM-SC),** brown, dry to moist, loose to medium dense	44.3 ±
			-	B			44
					1		
							43
						Silty to Clayey Coarse to Fine Sand (SM-SC), brown, moist, with many cobbles and gravels	
					2		
							42
						La Jolla Group: **Silty Medium to Fine Sand (SM),** light gray, moist, very dense	
						Bottom of test pit at El. 43.56 m Groundwater not encountered	
					3		
							41
					4		
							40
					5		
							39

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-22-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-73

FIGURE A-88

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)
			-	B	
			-	B	

DESCRIPTION OF SUBSURFACE MATERIALS

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

ELEVATION (meters): 58.6 ±

Depth scale (meters): 0, 1, 2, 3, 4, 5

Elevation scale (meters): 58, 57, 56, 55, 54, 53

Alluvium:
Silty Sand (SM),
light brown, dry to moist, loose

Poorly Graded Sand with Silt (SP-SM),
gray, wet, with some silt and clay lenses

Sandy Clay (CL),
gray, wet

La Jolla Group:
Silt (ML),
yellow orange, moist, very dense

Bottom of test pit at El. 54.94 m
Groundwater not encountered

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-22-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHO

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-74

FIGURE A-89

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Slopewash:** **Silty to Clayey Sand (SM-SC),** dark gray, dry to moist, loose	55.9 ±
						La Jolla Group: **Silt (ML),** gray, moist, very dense, blocky structure	
						Silty Medium to Fine Sand (SM), yellow orange, moist, very dense	
					1		55
						Bottom of test pit at El. 54.38 m Groundwater not encountered	
					2		54
					3		53
					4		52
					5		51
							50

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-22-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-75

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	**Alluvium:** **Clayey to Silty Sand (SC-SM),** dark brown, dry to moist	50.5 ±
			-	B			50
						La Jolla Group: **Silt (ML),** gray, moist, hard, blocky structure	
					1	**Silty Medium to Fine Sand (SM),** yellow orange, moist, very dense	
							49
					2	Bottom of test pit at El. 48.67 m Groundwater not encountered	
							48
					3		
							47
					4		
							46
					5		
							45

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-22-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-76

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	50.2 ±
					0	**Alluvium:** **Silty to Clayey Sand (SM-SC),** dark brown, moist, dry on surface	50
			-	B			
					1		49
					2	**La Jolla Group:** **Silty Medium to Fine Sand (SM),** gray, moist, dense refusal on strongly cemented zone at 2.4 m depth	
			-	B			48
						Bottom of test pit at El. 47.76 m Groundwater not encountered	
					3		47
					4		46
					5		45

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-22-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-77

FIGURE A-92

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	**Slopewash:** **Silty to Clayey Sand (SM-SC),** brown, moist, loose	53.8 ±
						La Jolla Group: **Silty Medium to Fine Sand (SM),** light gray, moist, very dense	
							53
					1		
						Bottom of test pit at El. 52.28 m Groundwater not encountered	
							52
					2		
							51
					3		
							50
					4		
							49
					5		
							48

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-22-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-78

FIGURE A-93

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	**La Jolla Group:** **Silty Fine Sand (SM),** light gray to yellow orange, moist, very dense	51.5 ±
				B			51
					1		
						Bottom of test pit at El. 49.98 m Groundwater not encountered	50
					2		
							49
					3		
							48
					4		
							47
					5		
							46

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-22-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-79

FIGURE A-94

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	**Slopewash:** **Silty Medium to Fine Sand (SM),** brown, dry, with some fine gravels	46.4 ±
			-	B			46
					1		
						La Jolla Group: **Silty Medium to Fine Sand (SM),** yellow orange, dry to moist, very dense	45
						Bottom of test pit at El. 44.88 m Groundwater not encountered	
					2		
							44
					3		
							43
					4		
							42
					5		
							41

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 10-22-98

EQUIPMENT/METHOD USED: JD 410E/24" BACKHOE

SUPERVISOR: S. KOLTHOFF

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

Log of Test Pit No. MGD-TP-80

FIGURE A-95

LBM MGD 2-11-99

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	Topsoil: Silty Gravel with Sand (GM) brown, moist, loose to medium dense	126.8±
					1	Residual Clay: Sandy lean Clay (CL) reddish brown, moist, hard	126
			14	D		Lindavista Formation:	125
					2	Silty Fine to Medium Sand (SM) light reddish brown, moist, very dense	
			—	B		with gravels and cobbles Contact Attitude: N42°E 1°S	124
					3	Mission Valley Formation: Silty Fine to Medium Sand (SM) light gray, moist, dense to very dense with trace clay	123
					4	up to 25mm wide infilled fracture on south wall of boring	
			6	D	5		122
						increased clay content	121
					6		
					7		120
			12	D	8	Attitude on reddish brown banding: N44°E 2°S	119
					9		118
						Bottom of boring at El. 117.4 m Groundwater not encountered	117

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 8-13-98

EQUIPMENT/METHOD USED: ED 45L / 30" Bucket

SUPERVISOR: S. Kolthoff

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

MIDDLE SEGMENT

Log of Boring No. MGD-BA-1

PAGE 1 OF 1

FIGURE A-96

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	119.6±
						Topsoil: Sandy Lean Clay (CL) dark brown, moist, very stiff	119
					1	Residual Clay: Clayey Fine Sand (SC) dark reddish brown, damp, medium dense	
						Mission Valley Formation: Silty to Clayey Fine to Medium Sand (SM/SC) light olive gray, moist, very dense with few claystone clasts	118
					2		117
					3	300mm thick cemented layer	
			8	D		Silty Fine to Medium Sand (SM) light gray, moist, very dense	116
					4		115
					5		
			—	B			114
					6	300mm thick cemented layer	
			NR	D			
						Bottom of boring at El. 113.2 m Groundwater not encountered	113
					7		112
					8		111
					9		110

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 8-13-98
EQUIPMENT/METHOD USED: ED 45L / 30" Bucket
SUPERVISOR: S. Kolthoff

GROUP DELTA

PROJECT NO. I-181
STATE ROUTE 56 PROJECT
MIDDLE SEGMENT

Log of Boring No. MGD-BA-2

PAGE 1 OF 1 FIGURE A-97

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					0	Residual Clay: Clayey Gravel with Sand (GC) reddish brown, moist, very stiff	125.9 ±
					1	Lindavista Formation: Clayey Fine to Coarse Sand with Gravel (SC)	125
			2	D		Mission Valley Formation:	
					2	Silty Fine Sand (SM) yellowish brown, moist, loose to medium dense; Contact Attitude: N45°E 2°S	124
					3	Clayey Silt (MH) light gray, moist, dense; reduced clay. Change to yellowish brown color	123
					4		122
			12	D		Sandy Silt (ML) gray to medium gray, moist, very dense	
					5		121
					6		120
			–	B			
					7	thin layer of clayey silt. Contact Attitude N40°E 3°S	119
			12	D			
					8		118
			–	B	9	Silty Fine Sand (SM) light gray, moist, very dense; 150mm thick cemented layer	117
							116

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 8-14-98

EQUIPMENT/METHOD USED: ED 45L / 30" Bucket

SUPERVISOR: S. Kolthoff

GROUP DELTA

PROJECT NO. I-181
STATE ROUTE 56 PROJECT
MIDDLE SEGMENT

Log of Boring No. MGD-BA-3

PAGE 1 OF 2

FIGURE A-98

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters) ±
					10		
			NR	D			
					11		115
						Sandy Silt (ML) light gray, moist, dense	
						300 mm thick cemented layer	
					12	Bedding Attitude: N40°E, 4°S	114
					13		113
						Silty Fine to Medium Sand (SM) light gray, moist, very dense locally with light reddish staining	
			22	D			
					14		112
						thin gravel lens	
						300 mm thick cemented layer	
					15		111
					16		110
						Bottom of boring at El. 109.2 m	
					17	Groundwater not encountered	109
					18		108
					19		107
							106

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 8-14-98

EQUIPMENT/METHOD USED: ED 45L / 30" Bucket

SUPERVISOR: S. Kolthoff

GROUP DELTA

PROJECT NO. I-181
STATE ROUTE 56 PROJECT
MIDDLE SEGMENT

Log of Boring No. MGD-BA-3

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	Residual Clay: Sandy Lean Clay (CL)	114.5 ±
						Mission Valley Formation: Silty Fine to Medium Sand (SM) light gray, moist, very dense	114
					1	150mm thick caliche layer	113
			6	D			
					2		112
			–	B	3	with trace clay	
						300mm thick chalky silt layer Bedding Attitude N35°E 3°S	111
					4		110
			12	D			
					5		109
					6		108
					7	thin gravel layer; gravels up to 50mm in diameter Contact Attitude: N45°E 3°SE	107
			12	D			
					8		106
					9	thin gravel layer	
						150mm cemented layer	105

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 8-14-98

EQUIPMENT/METHOD USED: ED 45L / 30" Bucket

SUPERVISOR: S. Kolthoff

GROUP DELTA

PROJECT NO. I-181
STATE ROUTE 56 PROJECT
MIDDLE SEGMENT

Log of Boring No. MGD-BA-4

PAGE 1 OF 2

FIGURE A-100

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters) ±
					0	THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
			–	B		boring terminated on cemented layer	104
					1	Bottom of boring at El. 103.8 m Groundwater not encountered	
							103
					2		
							102
					3		
							101
					4		
							100
					5		
							99
					6		
							98
					7		
							97
					8		
							96
					9		
							95

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 8-14-98

EQUIPMENT/METHOD USED: ED 45L / 30" Bucket

SUPERVISOR: S. Kolthoff

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

MIDDLE SEGMENT

Log of Boring No. MGD-BA-4

PAGE 2 OF 2

FIGURE A-10

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0	THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	111.0 ±
						Residual Clay: Sandy Lean Clay (CL) dark brown, moist, very stiff	
					1	Landslide Debris: Silty Fine to Medium Sand (SM) light gray, moist, medium dense	110
			2	D			
					2	Bedding Attitude: N45°E 3°S	109
					3	350mm thick cemented layer	108
						thin gravel layer; Basal Contact Attitude: N40°E 5°S	
						with brecciated, thin claystone interbeds	
					4	Silty to Clayey Fine to Medium Sand (SM/SC) light brown, moist, very dense	107
			10	D			
					5	with thin (6mm) claystone interbeds Bedding Attitude: N45°E 2°S	106
			—	B	6		105
			—	B	7		104
			4	D			
					8	Sandy Lean Clay (CL) with interlayers of Clayey Fine Sand (SC) pale olive gray, moist, very stiff to medium dense with light reddish brown mottling	103
					9		102
						600mm thick layer of brecciated clayey silt (MH); interpreted as base of landslide Basal Attitude: N70°W 15°N	
			10	D			

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 8-13-98

EQUIPMENT/METHOD USED: ED 45L / 30" Bucket

SUPERVISOR: S. Kolthoff

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

MIDDLE SEGMENT

Log of Boring No. MGD-BA-5

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	±
					10	Mission Valley Formation: Silty Fine Sand (SM) light gray, moist, very dense	
					11	Bottom of boring at El. 100.0 m Groundwater not encountered	100
					12		99
					13		98
					14		97
					15		96
					16		95
					17		94
					18		93
					19		92

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 8-13-98

EQUIPMENT/METHOD USED: ED 45L / 30" Bucket

SUPERVISOR: S. Kolthoff

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

MIDDLE SEGMENT

Log of Boring No. MGD-BA-5

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	96.5 ±
					0	Topsoil/Colluvium:	
						Clayey Fine to Medium Sand (SC) dark brown, moist, loose to medium dense	96
					1	Landslide Debris:	
			10	D		Silty Gravel with Sand (GM) light brown, moist, medium dense	95
					2	Silty Fine to Medium Sand (SM) light reddish brown to gray, moist, very dense	
				B			94
					3	150mm thick gravel layer; gravels up to 100mm in diameter; Basal Contact Attitude: N40°E 5°S	
							93
					4		92
				B		Silty Gravel with Sand (GM) yellowish brown, moist, dense	
					5		91
					6		90
					7		89
					8	Silty Fine to Medium Sand (SM) light gray, moist, dense to very dense with light reddish brown banding	88
					9		
			16	D		with few to some gravels	87

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 8-17-98

EQUIPMENT/METHOD USED: ED 45L / 30" Bucket

SUPERVISOR: S. Kolthoff

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

MIDDLE SEGMENT

Log of Boring No. MGD-BA-6

PAGE 1 OF 3

FIGURE A-104

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	ELEVATION (meters) ±
					10		
						with few to some gravels	86
					11		
							85
			8	D			
					12		
							84
					13	thin, fractured claystone layer; Bedding Attitude: N10°E 15°S	
							83
			16	D			
					14		
							82
					15	fracture through boring; Attitude N90°E 62°N	
							81
					16		
						Fractured claystone layer; Bedding Attitude: N75°E 5°S	80
			16	D			
					17		
						6mm thick dark mineral sand layer; Bedding Attitude N80°E 10°S	79
					18		
			—	B			78
					19		
						200mm thick cemented layer	
						50mm thick layer of oxidized and sheared clay and silt; interpreted as landslide plane; Attitude: N90°E 12°N	77
			56	D			

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 8-17-98

EQUIPMENT/METHOD USED: ED 45L / 30" Bucket

SUPERVISOR: S. Kolthoff

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

MIDDLE SEGMENT

Log of Boring No. MGD-BA-6

PAGE 2 OF 3

FIGURE A-105

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters) ±
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					20	Fine Sandy Silt (ML) dark gray, moist, very dense	76
					21	change to light brown color	
							75
					22		74
					23	150 mm thick cemented layer Silty Fine to Medium Sand (SM) light gray, wet, very dense water seeps and caving	73
					24		72
					25		71
					26		70
					27		69
			42	D			
					28		68
					29	Bottom of boring at El. 67.6 m Groundwater table at El. 73.6m	67

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 8-17-98

EQUIPMENT/METHOD USED: ED 45L / 30" Bucket

SUPERVISOR: S. Kolthoff

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

MIDDLE SEGMENT

Log of Boring No. MGD-BA- 6

FIGURE A-106

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
					0		80.3±
						Topsoil/Colluvium (cultivated): Clayey Fine Sand (SC) dark brown, moist, loose	80
					1	La Jolla Group (weathered): Silty to Clayey Sand (SM/SC) light reddish brown, moist, medium dense	79
					2	with claystone interlayers Bedding Attitude N80°E 6°S	
						La Jolla Group: Silty Fine to Medium Sand (SM) light yellowish brown, moist, very dense	78
						100mm thick cemented layer	
			8	D	3		77
						with claystone interlayers Bedding Attitude: N75°E 2°S	
					4		76
			–	B		150mm thick sandy silt layer Basal Contact Attitude: N75°E 6°S	
					5	change to light gray color, locally with light reddish brown staining	75
					6	915mm thick cemented layer	74
			12	D	7		73
					8		72
			20	D	9		71

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 8-18-98

EQUIPMENT/METHOD USED: ED 45L / 30" Bucket

SUPERVISOR: S. Kolthoff

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

MIDDLE SEGMENT

Log of Boring No. MGD-BA-7

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters) ±
					10		70
					11		69
					12		68
			14	D		groundwater perched on 50mm thick clay layer	
					13		67
			-	B		300 mm thick cemented layer	
					14		66
					15		65
			22	D		groundwater seeps and caving below 15.8m	
					16	300mm thick cemented layer	64
					17		63
					18		62
			50	D			
					19	Bottom of boring at El. 61.7m Perched groundwater at El. 67.8m Groundwater table at El. 64.3m	61

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 8-18-98

EQUIPMENT/METHOD USED: ED 45L / 30" Bucket

SUPERVISOR: S. Kolthoff

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

MIDDLE SEGMENT

Log of Boring No. MGD-BA-7

PAGE 2 OF 2

FIGURE A-108

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	ELEVATION (meters)
					0		81.2 ±
						Topsoil/Colluvium: Sandy Lean Clay (CL) dark brown, moist, very stiff	81
					1	Residual Clay: Clayey Gravel with Sand (GC) dark brown, moist, medium dense	80
			2	D			
					2	La Jolla Group: Silty Fine to Medium Sand (SM) light gray, moist, medium dense to dense; locally with trace clay and/or light reddish brown staining	79
					3	Bedding Attitude: N85°E 5°S	78
						with some small clay clasts	
					4		77
						30mm thick hard clay layer Contact Attitude: N70°E 4°S	
			10	D			
					5		76
						60mm thick hard clay layer Contact Attitude N75°E 5°S	
					6		75
			—	B			
					7		74
						no distinct bedding from 7.6 to 10.8m	
			12	D			
					8		73
					9		72

SAMPLE TYPES:

- [C] Rock Core
- [S] Standard Split Spoon
- [D] Drive Sample
- [B] Bulk Sample
- [T] Tube Sample

DATE DRILLED: 8-19-98

EQUIPMENT/METHOD USED: ED 45L / 30" Bucket

SUPERVISOR: S. Kolthoff

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

MIDDLE SEGMENT

Log of Boring No. MGD-BA-8

FIGURE A-169

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	ELEVATION (meters) ±
					10		71
			20	D			
					11	thin gravel layer; gravels up to 63mm in diameter	70
					12		69
					13	460mm thick cemented layer	68
						Lean Clay (CL) dark gray, moist, hard	
			18	D			
					14	interlayer of very dense silty sand with thin gravel layer; Bedding Attitude: N70°E 6°S	67
						interlayer of sandy gravel; gravels up to 100mm in diameter	
					15	Silty Fine to Medium Sand (SM) dark gray, wet, very dense	66
					16	▽ Groundwater seepage below 16.2m	65
			–	B		150mm thick cemented layer	
			32	D			
					17		64
					18		63
						cemented layer	
					19	Bottom of boring at El. 62.6m Refusal on cemented layer Groundwater table at El. 65.0m	62

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 8-19-98
EQUIPMENT/METHOD USED: ED 45L / 30" Bucket
SUPERVISOR: S. Kolthoff

GROUP DELTA

PROJECT NO. I-181
STATE ROUTE 56 PROJECT
MIDDLE SEGMENT

Log of Boring No. MGD-BA-8

FIGURE A-116

BORING LOG

LOGGED BY: J. Brown	DATE DRILLED: 8-26-98	BORING ELEVATION: 68.2 M	BORING NO.: MGD-BA-9 B-
DRILL RIG: ED 45L (Larive)	BORING DIAMETER: 30 inch Bucket	HAMMER WT.: Varies DROP: 12"	

Depth (Feet)	Sample #	Type	Blow Ct.	Recovery	N S	DESCRIPTION
						loose to med dense, dry, Lt brn silty med to fine Sand (SM) w/ many gravels topsoil
						med dense, moist dark brn clayey gravel w/ sand (GC) w/ occasional clay
						Stream Terrace Deposits:
						Dense, moist Lt reddish brn clayey coarse to fine sand (SC) w/ many gravels (est 30-40% gvl)
5						
	1	B				
						irregular contact Approx attitude N55°E 90°N
						V. stiff, moist grey brn sandy lean clay (CL) Paleosol
						grades to
						Dense, moist, grey brn clayey fine sand (SC)
10						Depositional contact N67°E 22°N
						w/ some gravels on North side of boring
						La Jolla Group:
	2	D	8	80%		V. dense, moist, pale gray silty fine sand (SM) locally with Lt reddish brown to Lt yellowish brown staining
15						
20						V. dense, moist, Lt reddish brn silty fine sand (SM) w/ trace clay and some gravels (est 15% gvl)

Descriptions on this boring log apply only at the specific boring location and at the time the boring was made. The descriptions on this log are not warranted to be representative of subsurface conditions at other locations or times.

PROJECT NO.: I-181	SR-56 Middle Segment	FIGURE NO.: A-111

GROUP DELTA CONSULTANTS, INC.
Engineers and Geologists

BORING LOG

LOGGED BY: J. Brown	DATE DRILLED: 8-26-98	BORING ELEVATION: 68.2 M	BORING NO.: MGD BA-9 B -
DRILL RIG: ED 45L (Larive)	BORING DIAMETER: 30" Bucket	HAMMER WT.: Varies DROP: 12 in	

Depth (Feet)	Sample #	Type	Blow Ct.	Recovery	N S	DESCRIPTION
	3	B				
25						@25ft Bedding attitude on reddish brn band: N22°W 22°N
						@26ft Change to general dip due north
	4	D	10			
						V. dense, moist, pale gray silty fine Sand (SM) w/ Lt reddish brn and Lt yellowish brn staining and banding
						28-29ft w/ some gravels (est 10-15%) on NW side of hole only
30						@30ft Bedding Att N80W 34°N
						contact Attitude N75°W 10°N
						w/ gravel (est 20% gvl)
35						change to south dip on Lt reddish and Lt yellowish brn banding; probable cross bedding (to 40 ft)
						@38½ft Attitude N74°E 25°S on Lt reddish brn band
40						generally massive below 40ft

Descriptions on this boring log apply only at the specific boring location and at the time the boring was made. The descriptions on this log are not warranted to be representative of subsurface conditions at other locations or times.

PROJECT NO.: I-181	SR 56 Middle Segment	FIGURE NO.: A-112

BORING LOG

LOGGED BY: J. Brown	DATE DRILLED: 8-26-98	BORING ELEVATION: 68.2 M	BORING NO.:
DRILL RIG: ED 45L (Larive)	BORING DIAMETER: 30" Bucket	HAMMER WT.: Varies DROP: 12	MGD-BA-9 B -

Depth (Feet)	Sample #	Type	Blow Ct.	Recovery	N S	DESCRIPTION
	5	D	26			
						contact Attitude N89°E 70N
45						w/ gravel (est 20% gvl)
						w/ trace gravel and trace clasts of hard gray sandy lean clay (CL)
	6	B				w/ few large clasts of pale gray fat clay (CH) largest clast on South side of hole: dimensions 5" wide x 4½ ft around circumference of hole
	7	D	8			@51 ft Contact Attitude on basal gravel layer N28°W 40N
						w/ scattered trace gravel between thin gravel layers at 52', 53', and 54½'
	8	B				increased Lt yellowish brn staining
55						irregular layer with gravels (est 20-30% gvl)
						sand generally massive below 55½ ft
60						

Descriptions on this boring log apply only at the specific boring location and at the time the boring was made. The descriptions on this log are not warranted to be representative of subsurface conditions at other locations or times.

PROJECT NO.: I-181	SR-56 Middle Segment	FIGURE NO.: A-113

GROUP DELTA CONSULTANTS, INC.
Engineers and Geologists

BORING LOG

LOGGED BY: J. Brown	DATE DRILLED: 8-26-98	BORING ELEVATION: 68.2 M	BORING NO.: MGD-BA-9
DRILL RIG: ED45L (Lerive)	BORING DIAMETER: 30" Bucket	HAMMER WT.: Varies DROP: 12 in	

Depth (Feet)	Sample #	Type	Blow ct	Recovery	N S	DESCRIPTION
						irregular near-horizontal contact
65						W/ gravel (est 40% to 60% gvl)
	9	B				
75						Bottom of boring at 75 Ft Groundwater not encountered
80						

Descriptions on this boring log apply only at the specific boring location and at the time the boring was made. The descriptions on this log are not warranted to be representative of subsurface conditions at other locations or times.

JECT NO.: I-181	SR 56 Middle Segment	FIGURE NO.: A-114

GROUP DELTA CONSULTANTS, INC.
Engineers and Geologists

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	75.3±
					0	Topsoil (cultivated): Clayey Fine to Medium Sand (SC) light brown, dry to moist, medium dense, with many gravels	75
			–	B	1	Stream Terrace Deposits: Clayey Fine to Medium Sand (SC) light brown, moist, dense with 15-25% gravel	74
					2	Contact Attitude: N57°E 47°S	73
						La Jolla Group: Silty Fine Sand (SM) pale gray, moist, medium dense to dense	
			4	D	3	180mm thick cemented layer	72
					4		71
						460mm thick cemented layer	
			–	B	5		70
			2	D	6	light yellowish brown staining and banding from 6.1m to 7.6m	69
					7	Bedding Attitude: N65°E 22°S	68
						no distinct bedding below 7.6m	
					8		67
			14	D	9		66

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 8-27-98

EQUIPMENT/METHOD USED: ED 45L / 30" Bucket

SUPERVISOR: J. Brown

GROUP DELTA

PROJECT NO. I-181

STATE ROUTE 56 PROJECT

MIDDLE SEGMENT

Log of Boring No. MGD-BA-10

PAGE 1 OF 2

FIGURE A-115

OTHER TESTS	MOISTURE (%)	DRY DENSITY (kg/m3)	PENETRATION RESISTANCE (blows/0.3m)	SAMPLE TYPE	DEPTH (meters)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (meters)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	±
					10		
							65
						irregular zones of dark brown and black silty fine sand; contact attitude on base: N60°E 8°S	
					11		
						trace of gray brown claystone clasts	64
					12		
			20	D			63
					13		
							62
					14	with 30-40% gravel	
							61
			—	B		with 30-50% gravel, locally lightly cemented	
					15		
							60
					16		
							59
					17	Bottom of boring at El. 58.5 m Groundwater not encountered	
							58
					18		
							57
					19		
							56

SAMPLE TYPES:
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 8-27-98

EQUIPMENT/METHOD USED: ED 45L / 30" Bucket

SUPERVISOR: J. Brown

GROUP DELTA

PROJECT NO. I-181
STATE ROUTE 56 PROJECT
MIDDLE SEGMENT

Log of Boring No. MGD-BA-10

FIGURE A-116

BORING LOG

LOGGED BY: J. Brown	DATE DRILLED: 8-27-98	BORING ELEVATION: 68.7 M	BORING NO.: MGD-BA-11 B -
DRILL RIG: ED 45L (Larive)	BORING DIAMETER: 30" Bucket	HAMMER WT.: Varies DROP: 12 in	

Depth (Feet)	Sample #	Type	Blow ct.	Recovery	N S	DESCRIPTION
						upper 4" hard, dry & crumbly
						V. stiff moist, reddish brn very sandy fat clay (CH) w/ some gravels Residual Clay:
	1	B				Dense, moist, sandy lean to fat clay (CH) w/ many gravels (est 35-50% gvl) Stream Terrace Deposits:
						w/ discontinuous veins of gray brn lean clay
5						V. dense, moist pale olive gray w/ reddish brn staining silty v. fine sand (SM) La Jolla Group:
						Bag 1A from clay seam
	1A	PB				@ 7½' ⅛-⅜" thick irregular seam of v. stiff gray to reddish brn sandy lean to fat clay; Attitude N77°W 10°S; not remolded; locally w/ gypsum xtls PP: 2.5 TSF
						@ 8 ft - trace gravels
	2	D	2	100%		Thick zone of primarily brn silty med to fine sand (SM). locally w/ pockets of dark brn clayey fine sand (SC) (only on northern ¾ of hole)
						@ 12½ ft thin (<¼") layers of dark sands suggest horizontal bedding
15						
	3	B				
						@ 19 ft 3-4" thick zone of dark brn silty sand (SM) on NE half of hole
20						w/ gravels (est. 20-30% gvl)

Descriptions on this boring log apply only at the specific boring location and at the time the boring was made. The descriptions on this log are not warranted to be representative of subsurface conditions at other locations or times.

PROJECT NO.: I-181	SR56 Middle Segment	FIGURE NO.: A-117

GP DELTA CONSULTANTS, INC.
Engineers and Geologists

BORING LOG

LOGGED BY: J. Brown	DATE DRILLED: 8-29-98	BORING ELEVATION: 68.7M			BORING NO.: MGD-BA-11 B -
DRILL RIG: ED 45L (Larive)	BORING DIAMETER: 30" Bucket	HAMMER WT.: Varies	DROP: 12 in		

Depth (Feet)	Sample #	Type	Blow ct.	Recovery	DESCRIPTION (N S)
					w/gravel (est 20-30% gvl)
					w/gravel (est. 10% gvl)
					contact horizontal
	4	B			w/gravel (est 30-40% gvl)
25					contact w/ irregular dip to south
	5	D	14	100%	
					@27Ft 1/4-1" layer of reddish brn sands and gray fine sandy lean clay. Flatlying not remolded PP > 4.5 TSf on clay
	6	D	28	90%	4" layer w/ gravels (est 10-20% gvl); Flatlying
35		sample disturbed by rock content			Bottom of boring at 35Ft Groundwater not encountered
40					

Descriptions on this boring log apply only at the specific boring location and at the time the boring was made. The descriptions on this log are not warranted to be representative of subsurface conditions at other locations or times.

PROJECT NO.: I-181	SR 56 Middle Segment	FIGURE NO.: A-118

,P DELTA CONSULTANTS, INC.
Engineers and Geologists

BORING LOG

LOGGED BY: J. Brown	DATE DRILLED: 8-28-98	BORING ELEVATION: 52.7M
DRILL RIG: ED 45L (Larive)	BORING DIAMETER: 30" Bucket	HAMMER WT.: Varies DROP: 12 in

BORING NO.: MGD-BA-12 B -

Depth (Feet)	Sample #	Type	Blow Ct.	Recovery	DESCRIPTION
					upper 3" dry & Hard
					V. stiff, moist reddish brn sandy fat clay (CH) w/ some gravels (est 10-15% gvl) cultivated Residual clay:
					La Jolla Group:
					w/ gravels (est 10%) Flatlying contacts
					Dense, moist, pale gray silty fine sand (SM) w/ local reddish brn mottling
5					
					w/ large zone of reddish brn silty fine sand on W half of hole
					Trace gravel
					7-14Ft irregular Lt reddish brn banding
					@ 8Ft thin reddish brn band; Attitude N16°W14°S
					w/ small pockets of black silty sand
	1	D	10	100%	@ 11 Ft irregular thin reddish brn band Attitude N60°W 7°S
					@ 13½ Ft: 1" band of reddish brn staining Attitude N62°W 8°S
15					
20					irregular layer of reddish and yellowish brn mottling
	2	D	8	100%	

Descriptions on this boring log apply only at the specific boring location and at the time the boring was made. The descriptions on this log are not warranted to be representative of subsurface conditions at other locations or times.

PROJECT NO.: I-181	SR 56 Middle Segment	FIGURE NO.: A-119

JP DELTA CONSULTANTS, INC.
Engineers and Geologists

BORING LOG

LOGGED BY: J. Brown	DATE DRILLED: 8-28-98	BORING ELEVATION: 52.7M	BORING NO.: MGD-BA-12 B -
DRILL RIG: ED 45L (Larive)	BORING DIAMETER: 30" Bucket	HAMMER WT.: Varies DROP: 12 in	

Depth (Feet)	Sample #	Type	Blow Ct	Recovery	N S	DESCRIPTION
	2	D	8	100%		
25						irregular layer of dark yellowish brn silty sands and cemented zones on NE 2/3 of hole
						@ 28 ft w/ local zones of black silty sand
	3	D	14	100%		
						w/ gravel (est. 10-20% gvl)
35						@ 34 ft, 3" gravel layer (est 10% gvl), generally flatlying general change to pale gray brn color
						v. dense, moist to wet Lt gray brn silty med to fine sand (SM) w/ irregular Lt reddish brn mottles
40	4	D	16	100%	▽	moderate water below 40 ft

Descriptions on this boring log apply only at the specific boring location and at the time the boring was made. The descriptions on this log are not warranted to be representative of subsurface conditions at other locations or times.

PROJECT NO.: I-181	SR 56 Middle Segment	FIGURE NO.: A-120

JP DELTA CONSULTANTS, INC.
Engineers and Geologists

BORING LOG

LOGGED BY: J. Brown	DATE DRILLED: 8-28-98	BORING ELEVATION: 52.7M	BORING NO.: MGD-BA-12 B
DRILL RIG: ED 45L (Larive)	BORING DIAMETER: 30" Bucket	HAMMER WT.: Varies DROP: 12 in	

Depth (Feet)	Sample #	Type	Blow Ct	Recovery	DESCRIPTION			
	4	D	16	100%	moderate water seepage below 40 ft			
					w/ scattered small (<2") clasts of gray brn claystone			
45								
					irregular contacts on gravel layer			
					w/ gravels (est. 10% gravel)			
					w/ large (up to 12" across) clasts of gray brn and dark gray brn claystone			
					irregular contact - general Attitude N16°E 5°N			
					V. Hard, moist brn lean clay (CL) w/ thin (<¼") discontinuous lenses of yellow silt	PP. >4.5 TSF		
					Flatlying contact			
					V. dense, moist very dark gray very silty			
	5	B			V. fine sand (SM) to locally fine sandy silt (ML)			
55								
					Bottom of boring at 57 ft			
					Groundwater seepage 40 to 50½ ft			
60								

Descriptions on this boring log apply only at the specific boring location and at the time the boring was made. The descriptions on this log are not warranted to be representative of subsurface conditions at other locations or times.

PROJECT NO.: I-181	SR 56 Middle Segment	FIGURE NO.: A-121

JP DELTA CONSULTANTS, INC.
Engineers and Geologists

BORING LOG

LOGGED BY: J. Brown	DATE DRILLED: 9-1-98	BORING ELEVATION: 87.4M	BORING NO.: MGD-BA-13 B -
DRILL RIG: ED 45L (Larive)	BORING DIAMETER: 30" Bucket	HAMMER WT.: Varies DROP: 12 in	

Depth (Feet)	Sample #	Type	Blow Ct.	Recovery	N S	DESCRIPTION
						loose to med dense, dry, brn clayey med to fine Sand (SC) w/ few gravels **Topsoil:**
						Hard, moist, reddish brn gravelly Fat clay (CH) w/ trace sand (est 25-35% gvl) ~~grades to~~ Residual Clay:
						La Jolla Group: V. dense, moist, pale gray silty fine Sand (SM) w/ reddish and yellowish brn mottles massive no defined bedding
5	1	D	4	100%		
						generally med to fine sand
						@9Ft irregular, thin (<1/8") reddish brown band; Attitude N29°W 20°S
						w/ irregular reddish brn banding
						@11Ft: layer w/ few gravels w/ irregular 1"-6" thick cemented layer Basal Attitude N50°W 8°S
						w/ irregular reddish brn mottling
15	2	D	14	91%		
		only driven 6" due to high density				cemented layer in all but Southern 10% of hole
20						layer w/ gravel (Est 10-20% gravel); contacts Flatlying

Descriptions on this boring log apply only at the specific boring location and at the time the boring was made. The descriptions on this log are not warranted to be representative of subsurface conditions at other locations or times.

PROJECT NO.: I-181	SR-56 Middle Segment	FIGURE NO.: A-122

JP DELTA CONSULTANTS, INC.
Engineers and Geologists

BORING LOG

2 of 3

LOGGED BY: J. Brown	DATE DRILLED: 9-1-98	BORING ELEVATION: 87.4 M	BORING NO.: MGD-BA-13 B-
DRILL RIG: ED45L (Lamve)	BORING DIAMETER: 30" Bucket	HAMMER WT.: Varies DROP:	

Depth (feet)	Sample #	Type	Blow Ct.	Recovery	DESCRIPTION	
					layer w/ gravel (est 10-20% gvl); contacts flatlying	
					← w/ discontinuous thin (<1/8") reddish brn banding	
25						
	3	D	4	100%	← 1-2" layer of reddish brn staining & small (<1") clasts of gray brn claystone general attitude N36°E 5°S	
					← irregular cemented layer around Northern 3/4 of hole	
					w/ trace gravel (<3%) and many clasts (1/2"-10" across) of olive gray sandy siltstone	
					V. hard, moist Lt gray w/ reddish brn mottles, v. fine sandy silt (ML)	
					grades to	
	4	B			V. Hard, moist, olive gray brn w/ reddish brn banding, lean clay (CL)	PP. >4.5 TSF
	5	B			← @34.5 ft, slightly undulating, 1/8-1/4" thick seam of V. stiff, olive brn fat clay (CL); not remolded. basal plane slickensided; plane essentially flatlying; P.P. 3.5 TSF	
35	6	D	14	100%	Contact Attitude N70°W 3°S	
					V. dense, moist pale gray brn silty, med to fine sand (SM) w/ discontinuous lenses of gypsum	
					@37.5' irregular 1-2" thick cemented layer	
					V. Hard, moist gray brn fine sandy silt (ML)	
					grades to	
40					V. Hard, moist olive gray lean clay (CL)	PP >4.5 TSF

Descriptions on this boring log apply only at the specific boring location and at the time the boring was made. The descriptions on this log are not warranted to be representative of subsurface conditions at other locations or times.

PROJECT NO.: I-181	SR-56 Middle Segment	FIGURE NO.: A-123

JP DELTA CONSULTANTS, INC.
Engineers and Geologists

BORING LOG

3 of 3

LOGGED BY: J. Brown	DATE DRILLED: 9-1-98	BORING ELEVATION: 87.4M	BORING NO.: MGD-BA-13 B -
DRILL RIG: ED 45L (Larive)	BORING DIAMETER: 30" Bucket	HAMMER WT.: Varies DROP: 12 in	

Depth (Feet)	Sample #	Type	Blow Ct.	Recovery	DESCRIPTION		
					~~grades to~~		
					V. Hard, moist Lt gray brn fine sandy silt (ML) w/ discontinuous lenses of gypsum crystals	P.P >4.5 TSF	
					V. Hard, moist, dark gray brn fine sandy lean clay (CL) w/ discontinuous lenses of gypsum crystals and yellowish silt	PP >4.5 TSF	
45	7	D	10	100%	V. dense, moist Lt gray brn silty V. Fine Sand (SM) to locally Fine sandy silt (ML) w/ discontinuous lenses of gypsum crystals	PP. >4.5 TSF on clay layer	
					@ 45.8 ft 1" thick layer of V. Hard dark gray brn lean clay (CL) Attitude N88°E 5°N		
	8	B					
					V. dense, moist, Lt gray brn silty Fine sand (SM) w/ discontinuous lenses of gypsum crystals		
55	9	D	4	100%	w/ irregular cemented zones set in dark brn and black silty sand		
					V. Hard, moist olive gray, dark brn and dark gray Fine sandy lean clay (CL) to clayey silt (MH) w/ sand	PP >4.5 TSF	
					V. dense, moist gray brn silty Fine Sand (SM) to locally Fine sandy silt (ML) ; fossiliferous w/ discontinuous lenses of gypsum crystals		
	10	B					
60					V. dense, moist, pale gray silty fine Sand (SM) w/ few dark gray brn color zones and discontinuous lenses of gypsum crystals		
	11	B					

Descriptions on this boring log apply only at the specific boring location and at the time the boring was made. The descriptions on this log are not warranted to be representative of subsurface conditions at other locations or times.

PROJECT NO.: 1524-150	SR 56 MGD	FIGURE NO.: A-124

JP DELTA CONSULTANTS, INC.
Engineers and Geologists

Bottom of boring at 61 Ft
Groundwater not encountered

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA- 14
Date Drilled	9/2/98
Elevation	89.6 m
Field Log by	SHK
Drilling Contractor	Larive

Sheet 1 of 4

Depth (Feet)	Sample #	Type	Blows	Recovery	Description
0					Topsoil/colluvium Stiff, damp, Dk Br Sandy Clay, gravels in top 0.8 ft. Clast supported; blocky structure (CL) stiff
					Clay, sheared from expansion
					La Jolla Group:
					light olive gray silty sand, fine-grained, some gravel & silt, dense, moist (SM)
5					
					gravel bed with erosional contacts.
10					Green-gray silt, bedded
	1	D	6	100%	Dense, moist yellow-orange Sand, med to fine-grained (SM)
					fossiliferous Red. Br. Clay to Sandy Clay. Hard (CL)
					gravel to cobble conglomerate with non-cemented Coarse to fine-grained Sand matrix. (GM) yellowish brown, moist, very dense
					yellow-orange Sand, med to fine-grained (SM)
15					
					Very Dense Lt. gray Sand, fine-grained, X-bedded. (SM) moist
					Cemented layer At 18.4' Thin Dk. mineral bed. N65°E, 2°S (Bedding attitude)
20					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-125

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA- 14
Date Drilled	9/2/98
Elevation	89.6 m
Field Log by	SHK
Drilling Contractor	Larive

Sheet 2 of 4

Depth (Feet)	Sample #	Type	Blows	Recovery	Description
20					
	2	B			light olive gray silty Sand, med. to fine-grained, Iron Oxide Stains. Very dense, moist (SM)
					1ft Long Carbonate nodule on S. Side.
25					
					Coarse-grained, Iron oxide Stained Sand N 68°E, 2°S.
30					
	3	D	14	100%	Iron Stained Bed N 78°E, 6°S (bedding attitude)
					Start of Tabular X-bedding
35					
					Sand bed, N 78°E, 5°S (bedding attitude)
					End of X-bedding
					clayst, siltst rip-up clasts with volcanic gravels, erosional surface.
					Fine Sandy Silt (ML) light olive gray, moist, hard
40					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SK-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-126

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA- 14
Date Drilled	9/2/98
Elevation	89.6m
Field Log by	SHK
Drilling Contractor	Larive

Depth (feet)	Sample #	Type	Blows	Recovery	Description
40	4	D	24	100%	
					← Siltstone/Sandstone contact, slightly irregular N74°E, 5°S (contact attitude)
					Silty Fine to Medium Sand (SM) pale olive gray, moist, very dense
45					
					← Red. Br. Wet Sand, 1/4" thick N75°E, 5°S.
50					
					← X-bedding to bottom of boring
55					
					← Dk mineral bed. Near horizontal
60					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA-14
Date Drilled	9/2/98
Elevation	89.6m
Field Log by	SHK
Drilling Contractor	Larive

Depth (Feet)	Sample #	Type	Blows	Recovery	Description
60	6	D	48	10%	
65					Bottom of Boring at 65Ft Groundwater not encountered

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-128

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA- 15
Date Drilled	9/2/98
Elevation	85.3 m
Field Log by	SHK
Drilling Contractor	Larive

Sheet 1 of 2

Depth (Feet)	Sample #	Type	Blows	Recovery
0				
5	1	D	2	100%
10				
15	2	D	8	100%
20				

Topsoil/Colluvium: DK. Br. Sandy Clay with gravels and cobbles to 4" dia. (CL) Hard, moist

La Jolla Group: Lt. gy moist Sand, Med. to fine-grained Iron oxide stained. (SM) medium dense to dense, moist

← Iron oxide (Liesegang banding) stained bed. N 80E, 3°S.

Carbonate Filled bed. N 75°E, 3°S.

← Gravel bed, ½" thick Clayst. rip-up clast on an erosional surface N 70°E, 4°S.

Very dense Lt. gy to yellow-orange, moist Sand (SM) med. to fine-grained, Carbonate stringers and infillings. N75°E, 4°S

Cemented layer, gravelly with volcanic and Clayst clasts.

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SK-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-129

LOG OF BORING

Depth (Feet)	Sample #	Type	Blows	Recovery		
						Project No. 1524-150 Boring : MGD-BA-15 Date Drilled 9/2/98 Elevation 84.7 Field Log by SHK Drilling Contractor Larive Sheet 2 of 2
20						
	3	B				
						Gravelly Clayey siltstone bed N70°E, 4°S
25	4	D	8	100%		
						Lt. gy Sand, fine-grained, gradational with upper sand unit. (sm) very dense, moist
						layer of olive gray clayey to sandy silt (MH/ML), moist to wet, hard
30	5	B				carbonate nodules and stringers throughout.
						cemented layer
						continued silty fine sand (sm) Light gray, moist, very dense
35	6	D	18	100%		
						Bottom of boring at 35 ft Groundwater not encountered
40						

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA-16
Date Drilled	9/3/98
Elevation	89.2
Field Log by	SHK
Drilling Contractor	Larive

Sheet 1 of 2

Depth (Feet)	Sample #	Type	Blows	Recovery	Description
0					Topsoil/Colluvium: Dk gy gravel to cobble with a silty to Sandy Clay matrix. (GC) moist, medium dense
					La Jolla Group: Lt. gy to yellow-orange moist Sand, med. to fine-grained with gravels and cobbles, matrix supported. (SM) moist, medium dense
5					Lt. gy moist Sand, med. to fine-grained (SM) moist, medium dense
					oxidized bed with gypsum N85°E, 4°S.
					yellow-orange moist Sand, med. to fine-grained (SM) some angular siltst to silty clayst gravels (Rip-up clasts)
10	1	D	4		Clayey bed. medium dense
					fossiliferous bed, sandy matrix.
					siltst bed with gravels & carbonate N80°E, 4°S.
15					Gravel bed
					Cobbles & Gravels in a silty to clayey matrix, clast supported, carbonate coatings around clasts.
20					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR 56
middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-131

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA-16
Date Drilled	9/3/98
Elevation	91.7
Field Log by	SHK
Drilling Contractor	Larive

Sheet 2 of 2

Depth (Feet)	Sample #	Type	Blows	Recovery	Description
20					Cemented layer
					Lt. gy. to yellow-orange, moist Sand, Med. to fine-grained. (to bottom of boring) (sm) very dense
25	3	D	10	100%	2" thick gravel bed, Sand matrix supported, N75°E, 6°S
					Coarse-grained Sand, gradational Contact.
					Cemented layer
30					
35	4	D	22	100%	
					Bottom of Boring at 36 Ft Groundwater not encountered
40					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-132

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA- 17
Date Drilled	9/3/98
Elevation	90.8m
Field Log by	SHK
Drilling Contractor	Larive

Depth (Feet)	Sample #	Type	Blows	Recovery	Description
0					Fill : loose, moist cobbles & gravels in a yellow-orange Sandy Matrix (GM)
					La Jolla Group : ; Lt. gy moist sand, med. to fine-grained, Iron oxide stains. (SM) dense to very dense
5					2" thick siltst bed N65°E, 11°S
					Coarse-to fine-grained sand.
					½" thick siltst bed
					siltst lens 1½" thick on North side of bore
10	1	D	8	100%	
					fossiliferous bed N75°E, 4°N.
					Calcified zone.
15					Cobble to gravel bed
					Gravel bed to ½", N75°E 4°S.
20					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-133

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA- 17
Date Drilled	9/3/98
Elevation	90.8 m
Field Log by	SHK
Drilling Contractor	Larive

Sheet 2 of 3

Depth (Feet)	Sample #	Type	Blows	Recovery	Description
20					
	2	D	6	100%	
25					gravel bed ½" thick, N75°E, 3° S.
	3	B			
					cemented layer
	4	D	14	100%	Gravelly Sand zone, no bedding carbonate throughout; Iron oxide stains.
30					cemented layer
	5	B			Coarse-grained Sand.
					X-bedded Sand
35					irregular erosional surface, siltst rip-up clasts along surface.
					Green-gray, moist silt, massive (ML) Hard
					Erosional zone with rip-up clasts throughout. ≈ Attitude N65°E, 5° S.
40					Lt. gray sand, med. to fine-grained (SM) moist, very dense

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA-17
Date Drilled	9/3/98
Elevation	90.8 m
Field Log by	SHK
Drilling Contractor	Larive

Depth (Feet)	Sample #	Type	Blows	Recovery	Description
40	6	D	14	100%	moisture increase wet Claust clasts on S. Side of bore, soft by moistu. c, pocket pen - .5 Green gy silt-bed, moist erosional contact Attitude, N65° E, 4° S.
45					
50	7	D	20	100%	
					Bottom of Boring at 51 feet Groundwater not encountered
55					
60					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-135

BORING LOG

LOGGED BY: J. Brown	DATE DRILLED: 9-4-98	BORING ELEVATION: 91.8 M	BORING NO.: MGD-BA-18
DRILL RIG: ED45L (Larive)	BORING DIAMETER: 30" Bucket	HAMMER WT.: Varies DROP: 12 in	

Depth (feet)	Sample #	Type	Blow Counts	Recovery	DESCRIPTION
					upper 4" dry
					Stiff, wet, dark brn sandy Fat clay (CH)
					Residual Clay:
					La Jolla Group:
					V. dense, moist, pale gray silty Fine Sand (SM) w/ Lt reddish brn mottles generally massive
5	1	D	4	100%	cemented zones on west half of hole
					w/ discontinuous low angle (5-20°) lime-filled southerly dipping Fractures (up to 1/4" wide)
					w/ increased reddish brown staining
	2	B			w/ some medium-grained sands
15	3	D	8	100%	
					irregular zone of yellowish brn sand on N side of hole
					reduced reddish brn mottles below 16½ ft
20					irregular undulating contact
					primarily reddish brn color due to staining

Descriptions on this boring log apply only at the specific boring location and at the time the boring was made. The descriptions on this log are not warranted to be representative of subsurface conditions at other locations or times.

PROJECT NO.: I-181	SR-56 Middle Segment	FIGURE NO.: A-136

BORING LOG

2 of 2

LOGGED BY: J. Brown	DATE DRILLED: 9-4-98	BORING ELEVATION: 91.8 M	BORING NO.: MGD-BA-18 B -
DRILL RIG: ED 45L (Larive)	BORING DIAMETER: 30" Bucket	HAMMER WT.: Varies DROP: 12 in	

Depth (Feet)	Sample #	Type	Blow Ct.	Recovery	DESCRIPTION
					Primarily reddish brn color due to staining
					cemented zone across Northwest quadrant of hole
					w/ some medium-grained sand
					Cemented zone on Southwest half of hole
25					V. dense, moist Lt gray brn poorly graded coarse to fine sand (SP) w/ some gravel (est. 10-20% gvl) Contact Attitude N90°E 8° E
					w/ trace clay
	4	D	8	90%	V. dense moist, gray brn w/ reddish brn mottles, silty fine sand (SM)
	5	B			w/ trace to few small (< ½") shell fragments
					@ 30' 3" thick layer of primarily elongated clasts of V. Hard dark olive lean clay P.P. >4.5 Tsf on clasts Bottom contact Attitude N15°W 30°N
					w/ some clasts (<5" across) of V. Hard, dark gray brn lean clay (CL) and irregular cemented zones (<4" in size)
35					@ 35 ft, irregular 2-4" thick zones of cemented sand w/ few clasts (<3") of V. Hard dark gray brn sandy lean clay (CL)
	6	D	16	100%	
					V. dense, moist Lt gray brn silty med to med to fine sand (SM)
					w/ irregular cemented zones up to 6" thick and 18 inches across
40					
					BH. 43 ft

Descriptions on this boring log apply only at the specific boring location and at the time the boring was made. The descriptions on this log are not warranted to be representative of subsurface conditions at other locations or times.

PROJECT NO.: I-181	SR 56 Middle Segment	FIGURE NO.: A-137

JP DELTA CONSULTANTS, INC.
Engineers and Geologists

Bottom of boring at 43 ft
Groundwater not encountered

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA-19
Date Drilled	9/8/98
Elevation	96.4 m
Field Log by	SHK
Drilling Contractor	Larive

Sheet 1 of 2

Depth (Feet)	Sample #	Type	Blows	Recovery	Description
0					Topsoil: DK. Br. Silty to Clayey Sand, dry to damp some gravel & Cobbles, (SM/SC) loose to medium dense
					Mission Valley Formation: with some gravels Silty Fine to Medium Sand (SM) light yellowish brown, moist, dense
5					Bedding Attitude: N 81°E, 4°S
					with many gravels
					La Jolla Group: Silty Fine Sand (SM) light brown, moist, very dense
10	1	D	10	100%	layer of medium grained sand upper contact attitude N79°E 4°S
15					with carbonate concretions
					wet; water seeping from formation.
	2	B			carbonate nodules to 1" dia. on all sides of bore.
20					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-138

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA- 19
Date Drilled	9/8/98
Elevation	96.4m
Field Log by	SHK
Drilling Contractor	Larive

Sheet 2 of 2

Depth (Feet)	Sample #	Type	Blows	Recovery	Description
20		D	10	100%	
					Lt. gy wet silty Sand, Fine-grained (sm), very dense irregular contact, N 80°E, 9°S.
25					Cemented layer
					Gray silt, water seeping with air bubbles
					No groundwater seepage below 27ft
					Carbonate nodules on west side of bore
30		D	22	100%	
					Bottom of boring at 31 Ft Groundwater seepage from 17 to 27ft
35					
40					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
middle segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-139

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA-20
Date Drilled	9/8/98
Elevation	98.4m
Field Log by	SHK
Drilling Contractor	Larive

Sheet 1 of 2

Sample # | Type | Blows | Recovery

FILL: Medium dense; DK gy to DK Br. clayey to silty Sand with f.g. sand pockets. (SM/SC) moist

Mission Valley Formation:

Yellow-orange damp sand, med. to fine-grained, (SM) dense to very dense

5 Krotovina on North side of bore.

Carbonate filled bed N54°E, 4°S.

1 Sak Carbonate zone, soft, chocky across bore.

Color change to Lt. gray

10

2 Dr M 2/6" 5/6" 3500 100% Iron oxide stained bed N68°E, 4°S.

15 Erosional (irregular) surface.

Gravels & Cobbles in a med to fine-grained Sand matrix, clast supported N59°W, 6°W

La Jolla Group:

Lt. gy moist sand, med. to fine-grained. (SM) very dense

Thin dk mineral bed. N72°E, 8°S.

20

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56

Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-140

LOG OF BORING

Sample #	Type	Blows	Recovery		

Project No. 1524-150
Boring : MGD-BA-20
Date Drilled 9/8/98
Elevation 98.6 M
Field Log by SHK
Drilling Contractor Larive

Sheet 2 of 2

20

cemented on North side of bore

wet, water seeping from formation.

25 Thin Iron oxide stained bed, N75°E, 6°N

Sample #	Type	Blows	Recovery
4	PB		
5	P dm	5/6" 8/6" 240"	100%

wet above silt bed

Gray silt bed, damp to moist N78°E, 6°S.

30

Massive Sand med. to fine-grained.
(SM) Light gray, very dense

35

Gray moist Sand, fine-grained, silty.

cemented layer at bottom of boring

Bottom of boring at 39 Ft
Groundwater seepage from 22 to 29 Ft

40

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-141

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA- 21
Date Drilled	9/9/98
Elevation	52.5 M
Field Log by	SHK
Drilling Contractor	Larive

Depth (Feet)	Sample #	Type	Blows	Recovery	Description
0					Topsoil (cultivated): brown to light brown, moist, silty to Clayey Sand with some gravels & cobbles. (SM/SC), loose
					La Jolla Group : Yellow-orange to Lt. gy moist Sand, Med. to fine-grained, Iron oxide bands and Stains (SM) dense to very dense
5	1	D	10	100%	Gravels and Cobbles in a sand (coarse-to fine-grained) matrix, clast supported. (GM) very dense. Top & bottom contacts, erosional (irregular).
10					Silty Fine to Medium Sand (SM) light gray, moist, very dense
					Large Siltstone clasts along an erosional surface. No attitude.
15	2	D	10		Iron oxide stained bed: N 48°E, 2°N
					Dk. mineral bed (½" thick): N 84°E, 9°N.
20					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-142

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA-21
Date Drilled	9-9-98
Elevation	52.5M
Field Log by	SHK
Drilling Contractor	Larive

Sheet 2 of 3

Depth (Feet)	Sample #	Type	Blows	Recovery	Description
20					
					Lt. Br in color.
	3	B			MASSIVE Sand, Slightly X-bedded, Iron oxide stains. (sm) moist, very dense
25	4	D	10	100%	
					Thin silt and coarse-grained sand sequences: N45° E, 9° N.
30					cemented layer
					Color change from Lt. Br. to gray No change in sand content.
					Dk mineral bed: N 56° W, 2° N.
35	5	D	32		cemented layer
					gravels & cobbles with a coarse- to fine-grained matrix.
40					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-143

LOG OF BORING

Project No.	1524-150		
Boring :	MGD-BA-21	Sheet 3 of 3	
Date Drilled	9-9-98		
Elevation	52.5 M		
Field Log by	SHK		
Drilling Contractor	Larive		

Depth (feet)	Sample #	Type	Blows	Recovery	Description
40					Gravels & Cobbles cont.
					Cemented layer
					water seeps start at 41.5'; air bubbling out of formation (fizzing).
45	6	D	16	100%	DK mineral bed: N 45°W, 6°N.
50					Sequences of Red Brown silt to clay beds to 1/2" with white gypsum beds to 1/2", free flowing water
					Sandy Lean Clay (CL) dark gray, wet, hard
55	7	D	24	100%	
					2' of water on bottom
					Bottom of boring at 58 Ft. Groundwater seepage from 41 Ft to bottom of boring
60					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-144

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA-22
Date Drilled	9/9/98
Elevation	53.3 m
Field Log by	SHK
Drilling Contractor	Larive

Depth (Feet)	Sample #	Type	Blows	Recovery	Description
0					Topsoil (cultivated): Br, dry, Loose, Clayey to silty Sand with some gravels & Cobbles.
					Colluvium: Br. to Dk. Br damp clayey to silty sand, Some gravel & Cobble lenses that are clast supported.
					La Jolla Group: yellow-gray, damp to moist silty Sand, med. to fine-grained, Iron oxide stains, and banding. medium dense to dense (sm)
5		D	4	100%	
					Lense of red-orange silty sand with a rim of Reddish Br. Clay to 1/4" on North side of Bore.
					Iron oxide stained bed: N76°E, 2°S.
10					
					Gravels grading to 0.6' dia cobbles downward, Matrix; Coarse- to fine-grained Sand, Clast Supported.
15					Change to Light gray color
		D	8	100%	
					with some gravels
20					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA-22
Date Drilled	9/9/98
Elevation	53.3m
Field Log by	SHK
Drilling Contractor	Larive

Depth (feet)	Sample #	Type	Blows	Recovery	Description
20					Siltstone gravels in a sandy matrix. N80°W, 6°N.
	3	B			
25	4	D	10	100%	
					Sand x-bedded, no trend for attitudes
30					Sedimentary flame structures.
					N80°W, 6°N.
35	5	D	18	100%	
40					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-146

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA- 22
Date Drilled	9/9/98
Elevation	53.3 m
Field Log by	SHK
Drilling Contractor	Larive

Depth (feet)	Sample #	Type	Blows	Recovery	Description
40					
					Siltstone/Sandstone sequences from 0.4' to 0.5' thick N75°W, 5°N
45	NR	D	16	Bent Rings	
					Gravels in a Sandy matrix
					light seepage below 48.2 Ft.
50					
55	6	D	16	100%	
					Bottom of boring at 56 Ft Groundwater seepage below 48.2 Ft.
60					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

LOG OF BORING

Project No. 1524-150
Boring : MGD-BA-23
Date Drilled 9/10/98
Elevation 68.3 m
Field Log by SHK
Drilling Contractor Larive

Depth (Feet)	Sample #	Type	Blows	Recovery	Description
0					Topsoil (cultivated): Dk. Br. silty to sandy clay, some gravel, (CL), moist, stiff
					Colluvium: Dk. Br to Red Br. moist to wet silty to sandy clay (CL) moist, very stiff
					Stream Terrace Deposits:
5					– with some gravels
					Silty fine to medium sand (SM) Light gray, moist, dense to very dense
10	1	D	8	100%	
					– with some gravels
					– with coarse sands
					Iron oxide stained and carbonate deposits.
15					– with some gravels
					La Jolla Group:
					Lt. gray, moist sand, med. to fine-grained, Iron oxide staining (SM) dense to very dense
					Cross-bedded and sedimentary plane structures Tabular, Iron stained along bedding
20					N80°W, 3°N (Bedding Attitude)

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt. Var Lbs
Dropped 12 Inches
Hole Size 30 Inches
Rig ED45L

Group Delta Consultants, Inc.

FIGURE NO. A-148

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA-23
Date Drilled	9/10/98
Elevation	68.3 m
Field Log by	SHK
Drilling Contractor	Larive

Sheet 2 of 4

Depth (feet)	Sample #	Type	Blows	Recovery	Description
20	2	D	8	100%	
					cemented layer
	3	B			Interlayered Sandy Silt (ML) and Silty Fine Sand (SM) light gray, moist, very dense layers approx 2" in thickness
25	4	B			
30	5	D	14	100%	Contact Attitude: N85°W 40°N
					Blue-gray, moist silty Sand, fine-grained very dense (SM)
35					Silt bed to 1.5" N89°E, 4°N (Bedding Attitude)
40					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-149

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA-23
Date Drilled	9/10/98
Elevation	68.3 m
Field Log by	SHK
Drilling Contractor	Larive

Sheet 8 of 4

Depth (feet)	Sample #	Type	Blows	Recovery	Description
40	6	D	12	100%	Carbonate nodules to 1' wide
					← Color change to Lt. Brown
					Cross-bedded, Iron oxide stains along bedding
45					
					contact attitude : N80°W5°N
					← change to Lt gray color
50	7	D	28	100%	
55					← Silt bed ; contact Attitude : N85°W 5°N
60					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-150

LOG OF BORING

Project No.	1524-150	
Boring :	MGD-BA-23	Sheet 4 of 4
Date Drilled	9/10/98	
Elevation	68.2 M	
Field Log by	SHK	
Drilling Contractor	Larive	

Depth (feet)	Sample #	Type	Blows	Recovery		
60	8	D	40			
						← cemented layer
						← Gravel & cobble bed, cemented.
65						
						Cemented layer
						Bottom of boring at 69 ft Groundwater not encountered
70						
75						
80						

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-157

LOG OF BORING

Project No.	I-181
Boring :	MGD BA-24
Date Drilled:	9/21/98
Elevation:	55.7
Field Log by:	SHK
Drilling Contractor:	LARIVE

Sheet 1 of 4

Depth (feet)	Sample #	Type	Blows	Recovery	Description
0					Colluvium (cultivated): Br. to Red. Br moist Sandy to Silty Clay some gravel, (CL)
					La Jolla Group: Lt. gy to gn-gy damp to moist sand, Med- to fine grained, Iron oxide stained, very dense (sm)
5					
					with some gravels
					with few gravels
10					slightly cemented.
	1	D	12	100%	
					Silt bed. Approx. Attitude E-W, 3°N.
15					Cemented layer
					gravel lens on North side of bore.
20					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt. Variable Lbs
Dropped 12 Inches
Hole Size 30 Inches
Rig ED 45L

Group Delta Consultants, Inc.

FIGURE NO. A-151

LOG OF BORING

Project No.: I-181
Boring: MGD BA-24
Date Drilled: 9/21/98
Elevation: 55.7
Field Log by: SHK
Drilling Contractor: LARIVE

Sheet 2 of 4

Depth (feet)	Sample #	Type	Blows	Recovery	Description
20	2	D	10	/6@8	
					with many gravels
25					
					Silt bed, Iron oxide Stained, N65°E, 4°N (Bedding Attitude)
					Sands Coarser in texture.
30					with few gravels
					siltlenses ¼" thick, 1" long, discon
	4	D	28	/6@9	
	5	B			Gravel lense, thinning to the north, Approx. Attitude: N670E, 4°N.
35					Color Change to yellow-orange.
					Flame and Soft sediment deformation Iron Stained along structures.
					N65°E, 4°N (Bedding attitude)
					cemented layer
40					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt. Variable Lbs
Dropped 12 Inches
Hole Size 30 Inches
Rig ED45L

Group Delta Consultants, Inc.

FIGURE NO. A-151

LOG OF BORING

Project No.	I-181
Boring :	MGD BA-24
Date Drilled:	9/21/98
Elevation:	55.7
Field Log by:	SHK
Drilling Contractor:	LARNE

Depth (feet)	Sample #	Type	Blows	Recovery	Description
40	6	D	26	100%	
45					
					with some gravels
50					cemented layer
	7	D	22	100%	
55					
					with few gravels
60					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt. Variable Lbs
Dropped 12 Inches
Hole Size 30 Inches
Rig ED45L

Group Delta Consultants, Inc.

FIGURE NO. A-152

LOG OF BORING

Project No.	I-181	Sheet 4 of 4
Boring :	MGD BN-24	
Date Drilled:	9/21/98	
Elevation:	55.9	
Field Log by:	SHK	
Drilling Contractor:	Carvie	

Depth (feet)	Sample #	Type	Blows	Recovery		Description
60	8	D	44	100%		
						← Start of gypsum veins and sulphur smell, moisture increase.
65						change to Blue-gray color
						Cemented Zone
70	9	D	44			
						Bottom of boring at 71 ft Groundwater not encountered
75						
80						

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt. Variable Lbs
Dropped 12 Inches
Hole Size 30 Inches
Rig ED 45L

Group Delta Consultants, Inc.

FIGURE M.A-153

LOG OF BORING

Project No.	I-181	Sheet 1 of 3
Boring :	MGD BA-25	
Date Drilled:	9/22/98	
Elevation:	96.5 m	
Field Log by:	SHK	
Drilling Contractor:	LARIVE	

Depth (feet)	Sample #	Type	Blows	Recovery	Description
0					Collluvium (upper 1 ft cultivated): Dk. Br. damp to moist sandy to silty clay, some gravel, blocky structure (CL) stiff
					Mission Valley Formation: damp to moist silty sand Medium- to fine-grained, Carbonate Stringers to ½" thick, Iron oxide stained. (SM), light gray
5					
	1	B			
					← End of Carbonate stringers.
10	2	D	8	100%	mild cross-bedding, Iron oxide stains along bedding contacts, Some carbonate nodules.
					gravel layer, Iron oxide stains on top and bottom.
					siltstone clasts, sandy matrix supported.
15					La Jolla Group: Silty Fine to Medium Sand (SM) Light gray to pale olive gray, moist, very dense
					← Iron oxide Stained bed, N65°E, 3°S (Bedding Attitude)
20					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt. Var Lbs
Dropped 12 Inches
Hole Size 30 Inches
Rig ED 45 L

Group Delta Consultants, Inc.

FIGURE NO. A-154

LOG OF BORING

Project No.	I-181
Boring :	MGN RA-25
Date Drilled:	9/22/98
Elevation:	96.5 m
Field Log by:	SHK
Drilling Contractor:	Larive

Sheet 2 of 3

Depth (feet)	Sample #	Type	Blows	Recovery	Description
20	3	D	10	100%	
					Contact Attitude: N70°E 4°S
					Fine Sandy Silt (ML) light gray, moist, hard
25					Cemented layer
					Silty Fine to Medium Sand (SM) light gray, moist, very dense
30	4	D	16	100%	
35					Cemented layer
40					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt. Variable Lbs
Dropped 12 Inches
Hole Size 30 Inches
Rig ED 45L

Group Delta Consultants, Inc.

FIGURE NO. A-155

LOG OF BORING

Project No.	I-181		Sheet 3 of 3
Boring :	MGD-BA-25		
Date Drilled:	9/22/98		
Elevation:	96.5m		
Field Log by:	SHK		
Drilling Contractor:	LARIVE		

Depth (feet)	Sample #	Type	Blows	Recovery		Description
40						-Cemented layer
						← Color Change to Lt. Br.
						← Siltstone rip up clast, N78°E, 4°S (Bedding Attitude)
45	5	B				
50	6	D	28	100%		
						Bottom of boring at 51 Ft Groundwater not encountered
55						
60						

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt. Variable Lbs
Dropped 12 Inches
Hole Size 30 Inches
Rig ED 45L

Group Delta Consultants, Inc.

FIGURE NO. A-15b

LOG OF BORING

Project No. I-181
Boring : MGD BA-26
Date Drilled: 9/22/98
Elevation: 89.6
Field Log by: SHK
Drilling Contractor: LaRIVE

Sheet 1 of 2

Depth (feet)	Sample #	Type	Blows	Recovery	Description
0					Colluvium (cultivated): Dk. Br. dry to moist sandy to silty clay, some gravels. (CL)
					La Jolla Group: yellow orange to Lt. gy silty Sand, Med. to fine-grained, Iron oxide stained, (SM) moist, dense
5	1	D	6	100%	interlayered gray to light gray sandy silt (ML) and silty sand (SM), damp to moist, Iron oxide stained
					Siltstone bed, N60°E, 5°S (Bedding Attitude)
10					
					Gravel bed, N65°E, 4°S (Bedding Attitude)
15	2	D	10		
					Iron Oxide Stained bed, N70°E, 5°S (Bedding Attitude)
	3	B			
					cemented layer
20					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt. Variable Lbs
Dropped 12 Inches
Hole Size 3 Inches
Rig ED45L

Group Delta Consultants, Inc.

FIGURE NO. A-157

LOG OF BORING

Project No.	I-181
Boring :	MGD BA-26
Date Drilled:	9/22/98
Elevation:	89.6 m
Field Log by:	SHK
Drilling Contractor:	LaRIVE

Depth (feet)	Sample #	Type	Blows	Recovery		
20						← Siltstone clasts to 2".
25	4	D	8	10/89		
						Bottom of boring 26 Ft Groundwater not encountered

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt. Variable Lbs
Dropped 12 Inches
Hole Size 30 Inches
Rig ED45L

Group Delta Consultants, Inc.

FIGURE NO. A-158

LOG OF BORING

Project No.	I-181	Sheet 1 of 4
Boring :	MGD BA-27	
Date Drilled:	9/24/98	
Elevation:	97.9m	
Field Log by:	SHK	
Drilling Contractor:	Larvie	

Depth (feet)	Sample #	Type	Blows	Recovery	Description
0					Topsoil/Colluvium : Dk. Br. Moist sandy to silty clay (CL), stiff
					Mission Valley Formation: Lt. red brown to Lt. gy. Moist to damp Silty Sand (Sm) with trace gravel
5	1	D	4	100%	-Cemented zone, west side of bore.
					-Carbonate layers and stringers.
10					-Lt gy Sand with siltstone rip-up clasts to 1.5" dia., no orientation.
					←Carbonate nodule on South side of bore.
					Lt. gray damp silt bed with rare carbonate nodules.
					←N60°E, 4°N (contact attitude)
15	2	D	8	100%	
					Silt bed
					←N65°E, 4°N (contact attitude)
20					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt. Variable Lbs
Dropped 12" Inches
Hole Size 30" Inches
Rig ED45L

Group Delta Consultants, Inc.

FIGURE NO. A-159

LOG OF BORING

Project No.	I-181
Boring :	MGD BA-27
Date Drilled:	9/24/98
Elevation:	97.9m
Field Log by:	SHK
Drilling Contractor:	LaRIVE

Depth (Feet)	Sample #	Type	Blows	Recovery	Description
20					interlayer of sandy silt (ML); contact Attitude: N65°E 4°N
					La Jolla Group:
	3	B			Silty Fine to Medium Sand (Sm) light gray, moist, very dense
25	4	D	10	80%	
					← Carbonate nodule on north side of bore.
					← Silt stone rip-up clasts
					Hard silt layer (ML)
30					
					← Silt Layer N65°E, 5°S (Bedding Attitude)
35	5	D	22		interlayered Silt and Sand beds
					Cemented Zone.
40					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt. Variable Lbs
Dropped 12 Inches
Hole Size 30 Inches
Rig ED 45L

Group Delta Consultants, Inc.

FIGURE NO. A-160

LOG OF BORING

Project No.	I-181	Sheet 3 of 4
Boring :	MGD BA-27	
Date Drilled:	9/24/98	
Elevation:	97.9m	
Field Log by:	SHK	
Drilling Contractor:	LARIVE	

Depth (feet)	Sample #	Type	Blows	Recovery	Description
40					
					discontinous silt bed (x-bedding) N80°E, 9°N
					N80°E, 8°N (Bedding Attitude)
					Fine Sandy Silt (ML) gray, moist, hard
45	6	D	14	100%	
					interlayer of silty sand (SM)
					interlayer of silty sand (SM); Bedding Attitude N82°E 8°N
50					
					Cemented layer
55					Silt bed
					interlayer of silty sand (SM)
	7	D	16	100%	
					blue-gray color change, increase in clay.
	8	B			
					water seepage
					Sand lens
60					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt. Var Lbs
Dropped 12" Inches
Hole Size 30" Inches
Rig ED 452

Group Delta Consultants, Inc.

FIGURE NO. A-161

LOG OF BORING

Project No.	I-181	Sheet 4 of 4
Boring :	MGD BA-27	
Date Drilled:	9/24/98	
Elevation:	97.9 m	
Field Log by:	SHK	
Drilling Contractor:	LaRIVE	

Depth (feet)	Sample #	Type	Blows	Recovery		Description
60						Rd. Br. moist Sand, med. to fine-grained. (SM)
65						← cemented layer
						Bottom of boring at 65Ft Refusal on cemented layer Groundwater seepage 57 - 59.8 Ft
70						
75						
80						

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56

Middle Segment

Drive Wt. Var Lbs

Dropped 12 Inches

Hole Size 30 Inches

Rig ED 45L

Group Delta Consultants, Inc.

FIGURE NO. A-162

LOG OF BORING

Project No.	I-181
Boring :	MGD BA-2B
Date Drilled:	9/28/98
Elevation:	91.2m
Field Log by:	SHK
Drilling Contractor:	LaRIVE

Sheet 1 of 2

Depth (feet)	Sample #	Type	Blows	Recovery	Description
0					Topsoil : Br. to Dk. Br dry silty to clayey Sand (SM/SC) loose
					La Jolla Group : Silty Fine to Medium Sand (SM) light gray to gray, moist, dense to very dense with carbonate lenses to 10.2 Ft depth
5	1	D	8	100%	
10					← purplish silt lens on north Side of bore, 1/8" thick.
					purplish silt layer
					N 45° W, 3° N (Bedding Attitude)
					Carbonate nodules.
15	2	D	8	100%	
					gray silt beds with Iron oxide stained Sand between, N 50° W, 3° N (Bedding Attitude)
20					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56

Middle Segment

Drive Wt. Variable Lbs
Dropped 12 Inches
Hole Size 30 Inches
Rig ED 45L

Group Delta Consultants, Inc.

FIGURE NO. A-163

LOG OF BORING

Project No.	I-181
Boring :	MGD BA-2B
Date Drilled:	9/28/98
Elevation:	91.2 m
Field Log by:	SHK
Drilling Contractor:	LaRIVE

Sheet 2 of 2

Depth (feet)	Sample #	Type	Blows	Recovery	Description
20	3	B			cemented zone
					Channeled siltstone; basal contact Attitude: N75°E 3°N
25					cemented zone.
					silt layer
					purplish silty sand (fine-grained)
					silt layer; basal contact attitude N80°E 4°N
30					Fine Sandy Silt (ML) gray, moist, hard
35	4	D	16	100%	
					Bottom of boring at 36 ft Groundwater not encountered

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56

Middle Segment

Drive Wt. Variable Lbs
Dropped 12 Inches
Hole Size 30 Inches
Rig ED 45L

Group Delta Consultants, Inc.

FIGURE NO. A-164

LOG OF BORING

Project No.	I-181
Boring :	MGD-RA-29
Date Drilled:	9/28/98
Elevation:	98.7m
Field Log by:	SHK
Drilling Contractor:	LARIVE

Sheet 1 of 3

Depth (feet)	Sample #	Type	Blows	Recovery	Description
0					**Topsoil/Colluvium (upper 1.4 ft cultivated):** Sandy Lean clay to Lean Clay (CL) dark brown, dry to moist, stiff
					Mission Valley Formation: Silty Fine to Medium Sand (SM): light gray to pale gray, moist, very dense with light reddish brown staining and Carbonate lenses to 9.8 ft depth
5					
10					← layer of silt clasts up to 1/4" diameter Bedding Attitude : N65°E 3°N
	1	$\boxed{D}$	10	100%	
15					
					← carbonate nodule.
20					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt. Variable Lbs
Dropped 12 Inches
Hole Size 30 Inches
Rig ED 45L

Group Delta Consultants, Inc.

FIGURE NO. A-165

LOG OF BORING

Project No.	I-181	Sheet 2 of 3
Boring :	MGD BA-29	
Date Drilled:	9/28/98	
Elevation:	98.7m	
Field Log by:	SHK	
Drilling Contractor:	LaRIVE	

Depth (Feet)	Sample #	Type	Blows	Recovery	Description
20	2	D	10	100%	thin (1/4") silt layer ; Bedding Attitude N71°E 3°N
					La Jolla Group : (contact at 20 ft)
					Silty Medium to Fine Sand (SM) light gray, moist, very dense
					cemented zone
25					
30	3	D	24	100%	
					Dk mineral bed 1/8" thick, x-bedding, N18°E, 9°N.
	4	B			
35					Silt bed 1/8" thick, discontinous. N72°E, 4°N (contact Attitude)
					increase in moistnee.
40					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segments

Drive Wt. Variable Lbs
Dropped 12 Inches
Hole Size 30 Inches
Rig ED 45L

Group Delta Consultants, Inc.

FIGURE NO. A-166

LOG OF BORING

Project No.	I-181		
Boring :	MGD BA-29		Sheet 3 of 3
Date Drilled:	9/28/98		
Elevation:	98.7 m		
Field Log by:	SHK		
Drilling Contractor:	Laruie.		

Depth (feet)	Sample #	Type	Blows	Recovery	Description
40	5	D	24	100%	
45					
					Cemented layer
50	6	D	30		
					Bottom of boring at 51 ft. Groundwater not encountered
55					
60					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt. Variable Lbs
Dropped 12 Inches
Hole Size 30 Inches
Rig ED 45L

Group Delta Consultants, Inc.

FIGURE A-167

LOG OF BORING

Project No.	I-181
Boring:	MGD-BA-30
Date Drilled:	9/29/98
Elevation:	97.0 m
Field Log by:	SHK
Drilling Contractor:	LORIVE

Sheet 1 of 2

Depth (Feet)	Sample #	Type	Blows	Recovery	Description
0					Topsoil / Colluvium: Silty to Clayey Gravel with Sand (GM/GC)
					Mission Valley Formation: Silty Fine to Medium Sand (SM) light brown to light gray, moist, very dense with rare gravel and some light reddish brown staining to 9.8 Ft depth
5					
	1	B			
10					
	2	D	12	60%	La Jolla Group: Silty Fine to Medium Sand (SM) light gray, moist, very dense
15					
					← layer of sandy silt; bedding attitude N75°E 4°S
20					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
middle Segment

Drive Wt. Variable Lbs
Dropped 12 Inches
Hole Size 30 Inches
Rig ED 45L

Group Delta Consultants, Inc.

FIGURE NO. A-168

LOG OF BORING

Project No.	I-181	Sheet 2 of 2
Boring :	MGD RA-30	
Date Drilled:	9/29/98	
Elevation:	97.0 m	
Field Log by:	SHK	
Drilling Contractor:	LaRIVE	

Depth (Feet)	Sample #	Type	Blows	Recovery	Description
20	3	D	12	100%	
					- cemented zone on south side of bore
					- with light reddish brown staining
25					
					- with light reddish brown staining (north side only)
30					
					- cemented layer.
	5	D	20	100%	
35					
40	6	D	22	100%	Bottom of boring at 40 ft Groundwater not encountered

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt. Variable Lbs
Dropped 12 Inches
Hole Size 30 Inches
Rig ED 45L

Group Delta Consultants, Inc.

FIGURE NO. A-169

LOG OF BORING

Project No.: I-181
Boring: MGD BA-31
Date Drilled: 9/29/98
Elevation: 67.5m
Field Log by: SNK
Drilling Contractor: LaRIVE

Sheet 1 of 3

Depth (Feet)	Sample #	Type	Blows	Recovery	Description
0					Topsoil/Colluvium (upper 1.8ft cultivated): Silty to Sandy Clay (CL) dark brown, moist, stiff with few gravels
					La Jolla Group: Silty Fine to Medium Sand (SM) pale gray, moist, very dense with some light reddish brown staining
5					- with few clay clasts
10	1		12	100%	
15	2	B			- Cemented layer
20					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt. Variable Lbs
Dropped 12 Inches
Hole Size 30 Inches
Rig ED45L

Group Delta Consultants, Inc.

FIGURE NO. A-170

LOG OF BORING

Project No.	I-181
Boring :	MGD BA-31
Date Drilled:	9/29/98
Elevation:	67.5m
Field Log by:	SHK
Drilling Contractor:	LaRIVE

Depth (Feet)	Sample #	Type	Blows	Recovery	Description
20	3	D	6		
					Change to Light gray color
					light reddish brown staining; bedding attitude N81°E 5°N
					layer of gray silt; bedding attitude N86°W3°N
25					
					Gray silt layer; Flatlying
30	4	D	14		Minor thin silt layers, discontinous,
35					
					Olive gray, moist to wet silty sand (sm) Iron oxide stains, gradational contact with upper sand unit, Carbonate stringers & nodules throughout.
40					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
middle segment

Drive Wt. Variable Lbs
Dropped 12 Inches
Hole Size 30 Inches
Rig ED 45L

Group Delta Consultants, Inc.

FIGURE NO. A-171

(Depth (Feet)) | Sample # | Type | Blow | Recovery

LOG OF BORING

Project No. I-181
Boring: MGD BA-31
Date Drilled: 9/29/98
Elevation: 67.5m
Field Log by: SHK
Drilling Contractor: LaRIVE

Sheet 3 of 3

5 | D | 14

← Thin silt Layer N 89°W, 3°N (bedding Attitude)

Cemented layer

6 | D | 16

interlayered sandy silt (mL) and silty fine sand (sm) thinly bedded with few gypsum crystals

7 | B

N 59°E, 4°N (contact attitude)

with coarse sands and many gravels

Bottom of boring at 60 Ft
Groundwater not encountered

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR56
Middle Segment

Drive Wt. Variable Lbs
Dropped 12 Inches
Hole Size 30 Inches
Rig ED 45L

Group Delta Consultants, Inc.

FIGURE No. A172

LOG OF BORING

Project No.	I-181	Sheet 1 of 2
Boring :	MGD BA-32	
Date Drilled:	9/30/98	
Elevation:	59.8 m	
Field Log by:	SHK	
Drilling Contractor:	LARIVE	

Depth (Feet)	Sample #	Type	Blows	Recovery	Description
0					Colluvium: DK Brn Silty to Sandy Clay, moist some gravels and cobbles on surface. (CL), stiff
					La Jolla Group: Lt. gray damp to moist Silty Sand, fine-grained, (SM) very dense locally with Light reddish brown staining
5					
10	1	D	12	100%	
					← Thin Dk mineral bed Bedding attitude N78°E, 3°N.
15					Cemented zone on South side of bore
20					gray silt bed N 81°E 3°N (bedding attitude)

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt. Variable Lbs
Dropped 12 Inches
Hole Size 30 Inches
Rig ED 45L

Group Delta Consultants, Inc.

FIGURE NO. A-173

LOG OF BORING

Project No.	I-181
Boring :	MG-DBA-32
Date Drilled:	9/30/98
Elevation:	59.8 m
Field Log by:	SHK
Drilling Contractor:	Larive

Sheet 2 of 2

Depth (Feet)	Sample #	Type	Blows	Recovery
20	2	D	10	100%
25	3	B		
30	4	D	8	100%
35				
40				

Bottom of boring at 26 ft
Groundwater not encountered

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt. Variable Lbs
Dropped 12 Inches
Hole Size 30 Inches
Rig ED45L

Group Delta Consultants, Inc.

FIGURE NO. A-174

LOG OF BORING

Project No.	I-181
Boring :	MGD BA-33
Date Drilled:	9/30/98
Elevation:	51.0 m
Field Log by:	SHK
Drilling Contractor:	LaRIVE

Depth (Feet)	Sample #	Type	Blows	Recovery	Description
0					Landslide Debris: Lt. gray moist Sand, fine-grained, some Silt (SM) medium dense
					Silty Gravel with Sand (GM) light brown, moist, medium dense with some cobbles
5					
					Silty Fine to Medium Sand (SM) black, moist, medium dense with organic content
					contact Attitude N48°W 10°N
10	1	D	6	100%	La Jolla Group: Interlayered Silty Fine Sand (SM) and Sandy Silt (ML) light gray to gray, moist, dense
					2" layer of gray silt; contact Attitude: N68°E 3°N
					coarse-grained Silty sand (SM)
15	2	D	10	100%	Silt layer
					N75°E, 3°N (contact attitude)
					Silty Fine to Coarse Sand (SM) light Gray, moist, dense to very dense
	3	B			
20					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt. Variable Lbs
Dropped 12 Inches
Hole Size 30 Inches
Rig ED45L

Group Delta Consultants, Inc.

FIGURE NO. A-175

LOG OF BORING

Project No.	I-181	
Boring :	MGD BA-33	Sheet 2 of 2
Date Drilled:	9/30/98	
Elevation:	51.0	
Field Log by:	SHK	
Drilling Contractor:	LaRIVE	

Depth (Feet)	Sample #	Type	Blows	Recovery	Description
20					
					with few gravels
25					with some gravels and cobbles
	4	D	8	100%	Interlayered Silty Fine Sand (SM) and Sandy Silt (ML) gray to light gray, moist, dense to very dense
					← N75°E, 3°N (Bedding attitude)
30					
	5	D	8	100%	Dark gray moist Sand, fine-grained, minor silt. (SM), dense
35					Bottom of boring at 35 Ft Groundwater seepage at 26 Ft
40					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt. Variable Lbs
Dropped 12 Inches
Hole Size 30 Inches
Rig ED 45L

Group Delta Consultants, Inc.

FIGURE NO. A-175

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA- 34
Date Drilled	9/30/98
Elevation	54.6m
Field Log by	SHK
Drilling Contractor	Larive

Sheet 1 of 3

Depth (Feet)	Sample #	Type	Blows	Recovery	Description
0					Collwvium (cultivated): Dk. Br. moist silty to clayey Sand. (SM/SC) medium dense
					Landslide Debris: Silty Fine to Medium Sand (SM) light gray, moist, dense with interlayers of sandy silt (ML) with vertical sand-filled fractures
5	1	D	6		
					Dk. gray clay zone on S. side of bore N79°E, 9°S (Bedding Attitude)
					Contact attitude: N78°E 6°N
10					
					with gray silt clasts
					change to pale olive to light yellowish brown color
15	2	D	10		
					Biotubiol zone, burrows filled with less dense gray sand, med. to fine-grained, random siltstone rip-up clasts
20					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-179

LOG OF BORING

Depth (Feet) | Sample # | Type | Blows | Recovery

Project No.	1524-150
Boring :	MGD-BA-34
Date Drilled	9/30/98
Elevation	54.6 m
Field Log by	SHK
Drilling Contractor	Larive

Depth (Feet)	Sample #	Type	Blows	Description
20				
				Silty Fine to Coarse Sand (sm) light yellowish brown, moist, dense with many gravels and cobbles
25				
30				Silt Layer with organic material along contacts N72°E, 19°S (contact Attitude)
	3	D	2	Layer of black organic clayey sand (SC) (interpreted as basal slide plane)
				La Jolla Group: Yellow-orange to ct. gy moist Sand, fine-grained, some silt (sm) very dense
35	4	D	16	
				yellow-orange, moist to wet Sand, coarse- to medi-grained, some fine-grained gravel. N72°w, 24°S (x-bedd
				Fine-grained gravel Layer (x-bedded, truncated) N82°E, 22°S.
				with some gravels and cobbles
40				

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-178

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA- 34
Date Drilled	9/30/98
Elevation	54.6 m
Field Log by	SHK
Drilling Contractor	Larive

Depth (Feet)	Sample #	Type	Blows	Recovery	Description
40					~~with some gravels and cobbles~~
					minor groundwater seepage
					Cemented layer
					Interlayered Sandy Silt (ML) and Silty Fine Sand (SM) dark gray, moist, very dense
					Thin Coal seam, discontinous N82°E, 9°S. (Bedding Attitude)
45	S	D	24		
	6	B			
					Cemented layer.
50					
55					Bottom of Boring at 55 ft
					Groundwater seepage at 40.5 ft
60					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA-35
Date Drilled	10/1/98
Elevation	61.0 m
Field Log by	SHK
Drilling Contractor	Larive

Sheet 1 of 1

Depth (Feet) | Sample # | Type | Blows | Recovery

Depth (Feet)	Sample #	Type	Blows	Description
0				Colluvium (cultivated): Dr. Br. to Br. dry Silty Fine to medium Sand (SM), loose
				– with Few siltstone clasts
				La Jolla Group:
				Silty Fine to Medium Sand (SM) light gray, moist, dense locally with light reddish brown staining
5	1	D	6	← Contact. N 86°E, 5°N (contact Attitude)
				– layer of gray silt (ML)
				← Contact Attitude: N76°E, 9°S
10				
				– with some siltstone clasts; bottom contact attitude: N90°E 15°S
15				
				cemented layer
				Bottom of Boring at 23 ft Refusal on Cemented layer Groundwater not encountered
25				

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR 56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-78D

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA- 36
Date Drilled	10/1/98
Elevation	59.4 m
Field Log by	SHK
Drilling Contractor	Larive

Depth (Feet)	Sample #	Type	Blows	Recovery	Description
0					Colluvium (cultivated): Brown, dry silty sand (sm), loose
					- with filled animal burrows
					La Jolla Group: Lt. gray, moist silty sand med.-to fine grained (sm), dense locally with light reddish brown staining
5	1	D	8		thin layer of Lt. Br. silt, contact, Attitude: N57°E, 8°S.
					thin gravel layer; contact attitude: N60°E, 4°S.
10					
					- layer with increased silt content
					N65°E, 4°S, contact attitude
15					contact Attitude: N75°E, 8°S.
	2	D	8		- layer of gray sandy silt (mL)
					- cemented layer
20					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-181

LOG OF BORING

Project No. 1524-150
Boring : MGD-BA- 36
Date Drilled 10-1-98
Elevation 59.4m
Field Log by SHK
Drilling Contractor Larive

Sheet 2 of 2

Depth (Feet) | Sample # | Type | Blows | Recovery

20

-Cemented layer
with some gravels

25

Bottom of boring at 25ft
Groundwater not encountered

30

35

40

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-182

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA- 37
Date Drilled	10/5/98
Elevation	65.5 m
Field Log by	SHK
Drilling Contractor	Larive

Sheet 1 of 3

Depth (Feet)	Sample #	Type	Blows	Recov.	Description
0					Topsoil/Colluvium: Sandy Lean Clay (CL) dark brown, dry to moist, stiff
					La Jolla Group: Lt. gray to white Silty Sand moist, fine-grained, some fine gravel, (SM)
5					
					← with trace gravel and some carbonate infilling bedding attitude: N75°W 90°N
10					← carbonate filled bed or fracture 1/4" thick generally flatlying
	1	D	6		
					Soil filled root casts, some organic material.
15	2	B			
					← Change to Fine to coarse Sand, locally with cross-bedding
					← layer of fine cross-bedded sand N25°E, 15°N (Bedding attitude)
20					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-183

LOG OF BORING

Project No. 1524-150
Boring : MGD-BA-37
Date Drilled 10/15/98
Elevation 65.5m
Field Log by SHK
Drilling Contractor Larive

Sheet 2 of 3

Depth (Feet) | Sample # | Type | Blows | Recov.

Depth (ft)	Sample #	Type	Blows	Description
20	3	D	6	
				← Color change to light reddish brown color
25				
				thin gravel layer ;; contact attitude N78°E 4°N
				– layer of lean clay (CL)
				– zones of dark brown silty sand with organic material
				Silty Fine to Medium Sand (SM) pale olive gray, moist, very dense with regular interlayers of sandy silt (ML)
30				← cemented zone on south side of bore
	4	D	16	← layer with light reddish brown staining; bedding attitude N87°E 2°S
				contact attitude N85°E 2°S
				– layer of sandy silt (ML)
35				
				– layer of silty sand (SM)
				← Silt layer, very hard, discontinuous, 1/8" thick, N50°W, 90°N.
40				

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-184

LOG OF BORING

Project No.	1524-150	
Boring :	MGD-BA-37	Sheet 3 of 3
Date Drilled	10/5/98	
Elevation	65.5 m	
Field Log by	SHK	
Drilling Contractor	Larive	

Depth (Feet)	Sample #	Type	Blow	Recov.	Description
40	6	D	18		Silty Fine to medium Sand (SM) pale olive gray, moist, very dense
					← layer of light reddish brown staining; bedding attitude N0°E 40°E
45					Fine Sandy Silt (ML) light gray, moist, very dense
50	7	D	26		
					Bottom of boring at 51 ft Groundwater not encountered
55					
60					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-185

LOG OF BORING

Depth (feet)	Sample #	Type	Blows	Recov.		
						Project No. 1524-150 Boring : MGD-BA-38 Date Drilled 10/5/98 Elevation 61.0 m Field Log by SHK Drilling Contractor Larive Sheet 1 of 2
0						Landslide Debris :
						Lt. Br. to yellow-orange damp to moist sand, med.-to fine-grained, some silt. (SM) medium dense
5						- zones of dark brown silty sand with organic content
	1	D	4			
						La Jolla Group: contact attitude: N3°E 9°N
						- layer of sandy silt (ML)
						contact attitude: N10°E 5°N
10						Silty Fine to Medium Sand (SM) light olive gray, moist, very dense
	2	B				
						- with few siltstone clasts
15						Fine Sandy Silt (ML) light gray, moist to wet, hard
	3	D	10			
						Vertical fractures; bearing N10°E and N0°E
						Cemented layer
						Silty Fine to Medium Sand (SM) light gray, moist, very dense
20						

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-186

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA-38
Date Drilled	10/5/98
Elevation	61.0m
Field Log by	SHK
Drilling Contractor	Larive

Depth (Feet) | Sample # | Type | Blows | Recov.

20

← Bedding Attitude: N65°E 4°S

with cemented zones

Fine Sandy Silt to Silty Fine Sand (ML/SM)
light gray, moist, very dense

25

4 D 12

Carbonate nodules on S. side of bore

Silty Fine to Medium Sand (SM)
light gray, moist, very dense

30

with few siltstone clasts

35

5 D 24

Bottom of boring at 36 Ft
Groundwater not encountered

40

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA- 39
Date Drilled	10/6/98
Elevation	71.7m
Field Log by	SHK
Drilling Contractor	Larive

Sheet 1 of 2

Depth (Feet) | Sample # | Type | Blows | Recov.

0

with many gravels

Topsoil/Colluvium (upper 1 ft cultivated):

Silty to Clayey Sand (SM/SC)
dark brown, dry to moist, medium dense

La Jolla Group:

Silty Fine to Coarse Sand (SM)
light gray, moist, very dense
locally with light reddish brn staining

5

layer of light reddish brown staining; bedding attitude N21°E 40N

10

1 | D | 12

layer of light reddish brown staining; bedding attitude N24°W 6°N

15

thin, fine grained sand layer; bedding attitude N25°E 40N

20

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-188

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA-39
Date Drilled	10/6/98
Elevation	71.7 m
Field Log by	SHK
Drilling Contractor	Larive

Depth (feet)	Sample #	Type	Blows	Recov.	Description
20	2	D	12		carbonate concretions on north side of bore
	3	B			
25					
30	4	D	20		
					Bottom of boring at 31 ft. Groundwater not encountered
35					
40					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA- 40
Date Drilled	10/6/98
Elevation	52.9 m
Field Log by	SHK
Drilling Contractor	Larive

Sheet 1 of 4

Depth (Feet)	Sample #	Type	Blows	Recov.	Description
0					Colluvium (cultivated): Dark brn, dry to moist silty to clayey sand, med. to fine-grained (SM/SC) medium Dense
					La Jolla Group: Dk yellow-orange moist silty sand Med. to fine-grained (SM), dense
5	1	D	6		← Gray Hard silt, thin bed, N31°W, 6°N (Bedding Attitude)
	2	B			Fine Sandy Silt (ML) light brown, moist, hard
10					
15					← thin silty sand layer; bedding attitude N25°E 9°N cemented zone.
	3	D	10		
					Lt. gray damp to moist sand, fine-grained, some silt. (SM)
20					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-190

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA-40
Date Drilled	10/6/98
Elevation	52.9m
Field Log by	SHK
Drilling Contractor	Larive

Sheet 2 of 4

Depth (Feet)	Sample #	Type	Blows	Recovery	Description
20					
25	4	D	12		
					– with discontinuous layers of silt (ML)
					– silt layer with carbonate concretions
					basal contact attitude N20°E 8°N
30					
					– layer of sandy silt (ML); basal contact attitude: N19°E, 9°N
35					– layer of sandy silt (ML); basal contact attitude: N25°E 8°N
	5	D	18		
40					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-19[illegible]

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA-40
Date Drilled	10/6/98
Elevation	52.9m
Field Log by	SHK
Drilling Contractor	Larive

Sheet 3 of 4

Depth (Feet) | Sample # | Type | Blows | Recov.

40

Silty Gravel with Sand (GM)
light yellowish brown, moist, very dense

45

— Zone of silty sand with light reddish brown staining on north side of bore

50

55

— Cemented sand zone on west side of bore

Silty Fine Sand (SM)
light gray, moist, very dense
with light reddish brown staining

60

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-192

LOG OF BORING

Project No.	1524-150
Boring :	MGD-BA- 40
Date Drilled	10/6/98
Elevation	52.9m
Field Log by	SHK
Drilling Contractor	Larive

Sheet 4 of 4

Depth (Feet)	Sample #	Type	Blows	Recov.	Description
60	6	D	54		
					Silty Gravel with Sand (GM) light yellowish brown, moist, very dense
65					Bottom of boring at 65 Ft Groundwater not encountered
70					
75					
80					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt.	Var	Lbs
Dropped	12	Inches
Hole Size	30	Inches
Rig	ED45L	

Group Delta Consultants, Inc.

FIGURE NO. A-143

LOG OF BORING

Project No.: I-181
Boring: MGD-BA-41
Date Drilled: 10/7/98
Elevation: 54.4 m
Field Log by: SHK
Drilling Contractor: Larive

Sheet 1 of 2

Depth (Feet)	Sample #	Type	Blows	Recovery	Description
0					FILL: Lt. Br. dry to damp Sand to Silty Sand, fine grained, some gravel (SM) loose to medium dense
					Colluvium: Dk. Br. moist Silty to Sandy Clay. (CL) very stiff
5					Clayey Gravel with Sand (GC) dark brown, moist, medium dense
					La Jolla Group: Silty Fine to Coarse Sand (SM) gray, damp, very dense w/ few gravels
10	1	D	10		Yellow-orange, moist to damp Sand, med. to fine grained some silt, cross-bedded. (SM) very dense
					← Silt bed, Iron oxide stained along contact. Contact Attitude, N 90°E, 2°S.
					Sandy silt bed N 40°E, 2°S (Bedding Attitude)
15					← Thin sand bed N64°E, 4°S (Bedding Attitude)
					Alternating 2" thick sand & silt beds (mudstone) ← N65°E, 4°S (contact attitude)
20					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR-56
Middle Segment

Drive Wt. Variable Lbs
Dropped 12" Inches
Hole Size 30" Inches
Rig ED 45L

Group Delta Consultants, Inc.

FIGURE NO. A-194

LOG OF BORING

Project No.	I-181
Boring :	MGD BA-41
Date Drilled:	10/7/98
Elevation:	54.4 m
Field Log by:	SKH
Drilling Contractor:	Larive

Sheet 2 of 2

Depth (Feet)	Sample #	Type	Blows	Recov.	Description
20	2	D	12		
					← gradational coarsening of sand. (SM)
	3	B			Liesegang rings common.
25					
					← color change to white.
					← color change to yellow-orange. Cemented layer
30	4	D	24		
					Bottom of Boring at 31 ft Groundwater not encountered
35					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR 56
Middle Segment

Drive Wt. variable Lbs
Dropped 12 Inches
Hole Size 30 Inches
Rig ED 45L

Group Delta Consultants, Inc.

FIGURE NO. A-195

LOG OF BORING

Project No.	I-181
Boring:	MGD-BA-42
Date Drilled:	10/7/98
Elevation:	105.3
Field Log by:	SHK
Drilling Contractor:	Larive

Depth (Feet)	Sample #	Type	Blows	Recov.	Description
0					Topsoil/Slopewash: DK. Br. dry to damp silty to sandy clay, blocky structure (CL) very stiff
					Landslide Debris: Yellow-orange to Lt. gray, damp sand, med. to fine grained, Carbonate filled fractures and veins, (SM) dense
5	1	D	6		
					white damp sand med. to fine-grained, some silt, slightly to moderatly cemented (SM) dense
					Cemented zone on north side of bore
10					
					Cemented layer
15					start of stratified sands with gradational contacts
					Iron oxide stained sand bed N10°W, 19°N.
					gradational coarsening of sands
20					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR 56
Middle Segment

Drive Wt. Variable Lbs
Dropped 12 Inches
Hole Size 30 Inches
Rig ED45L

Group Delta Consultants, Inc.

LOG OF BORING

Project No.	I-181	
Boring :	MGD-BA-42	Sheet 2 of 3
Date Drilled:	10/7/98	
Elevation:	105.3m	
Field Log by:	SHK	
Drilling Contractor:	Larive	

Depth (Feet)	Sample #	Type	Blows	Recov.	Description
20					
~23					gravels & cobbles, sand matrix, abundant carbonate veins & nodules, clast supported
25					wet sand lenses.
~26.5					increase in silt content
30	3	D	16		
35					
~39					silt bed, Horizontal, siltstone rip-up clasts above contact.
40					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR 56
middle Segment

Drive Wt. Variable Lbs
Dropped 12 Inches
Hole Size 30 Inches
Rig ED45L

Group Delta Consultants, Inc.

FIGURE NO. A-197

LOG OF BORING

Project No.	I-181		
Boring :	MGD-BA-42	Sheet 3 of 3	
Date Drilled:	10/7/98		
Elevation:	105.3m		
Field Log by:	SHK		
Drilling Contractor:	Larive		

Depth (Feet)	Sample #	Type	Blows	Recov.	Description
40					← orange to reddish orange hard clay for 2" Sheared., P.P. >4.5 tsF
					numerous gypsum lenses
					layer of black clayey silt to silty clay (MH/CH); slickensided with some gypsum crystals, sulfur odor; Attitude N 55°E 5°N
	6	B			La Jolla Group:
45	5	D	26		Silty Fine to medium Sand (SM) dark gray, moist, very dense
50					
55					Bottom of boring at 55 ft Groundwater not encountered

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR 56
Middle Segment

Drive Wt. Variable Lbs
Dropped 12 Inches
Hole Size 30 Inches
Rig ED 45L

Group Delta Consultants, Inc.

FIGURE NO. A-198

LOG OF BORING

Project No.	I-181
Boring :	MGD-BA-43
Date Drilled:	10/8/98
Elevation:	81.6 M
Field Log by:	SHK
Drilling Contractor:	Larive

Depth (Feet)	Sample #	Type	Blows	Recovery	Description
0					Colluvium: DK. Br moist silty to sandy Clay (CL) with some gravel, very stiff
					Landslide Debris: Reddish Br moist sand, med to fine-gr. some silt & gravel (SM) medium dense
5					
					← Thin sand bed N 60°E, 15°S.
10	1	D	2		← Dk. Br. to gray fat clay to clayey sand, moist to wet, (CH/SC) stiff to medium dense with pockets of pale brn silty fine sand
15					gray to Lt. gray Sandy clay (CL) Iron Oxide Stained. moist, very stiff
					← Color Change to Dk. Yellow-orange with Carbonate deposits.
					Coarse-grained gravelly sand on S. Side,
20					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR 56
Middle Segment

Drive Wt. Variable Lbs
Dropped 12 Inches
Hole Size 30 Inches
Rig ED 45 L

Group Delta Consultants, Inc.

FIGURE NO-A-199

LOG OF BORING

Project No.	I-181
Boring :	MGD-BA-43
Date Drilled:	10/8/98
Elevation:	81.6 m
Field Log by:	SHK
Drilling Contractor:	Larive

Depth (Feet)	Sample #	Type	Blows	Recov.	Description
20	2	D	4		Lt. Br moist to wet silty clay to fat clay (CH) Slicked fractures in all directions; stiff
					Coarse-gr. Sand lens on south side of bore
25					
30	3	D	6		
					← Possible sea shell fragment.
35					
					Silty Fine to Medium Sand (SM) light brown, moist, medium dense, Fractured with many gravels
					↓ without gravels below 39 ft
40					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR 56
Middle Segment

Drive Wt. Variable Lbs
Dropped 12 Inches
Hole Size 30 Inches
Rig ED45L

Group Delta Consultants, Inc.

FIGURE NO. A-200

LOG OF BORING

Project No.	I-181
Boring :	MGD-BA-43
Date Drilled:	10/8/98
Elevation:	81.6m
Field Log by:	SHK
Drilling Contractor:	Larive

Depth (Feet)	Sample #	Type	Blows	Recov.	Description
40	4	D	6		layer of sheared hard lean clay (CL) with many gypsum lenses; Basal landslide plane - horizontal
					Alluvium: Poorly graded Sand to Poorly Graded Gravel (SP/GP) brown, wet, loose. Water seepage and caving 41 to 44½ ft
45					La Jolla Group: Silty Fine to Medium Sand (SM) gray, moist, very dense
50					Cemented layer
	5	D	18		
					Color change to dark gray
55					
					Cemented layer
					Bottom of boring at 64ft. Groundwater encountered in alluvium 41 to 44½ ft
65					

Note: The log of subsurface conditions shown hereon applied only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

SR 56
Middle Segment

Drive Wt. Variable Lbs
Dropped 12 Inches
Hole Size 30 Inches
Rig ED 45L

Group Delta Consultants, Inc.

APPENDIX B
LABORATORY TESTING

TO BE SUBMITTED LATER

APPENDIX C
EQFAULT OUTPUT

DATE: Saturday, January 23, 1999

```
*************************************
*                                   *
*           E Q F A U L T           *
*                                   *
*             Ver. 2.20             *
*                                   *
*                                   *
*************************************
```

(Estimation of Peak Horizontal Acceleration
From Digitized California Faults)

West End

Carmel Valley

SEARCH PERFORMED FOR: BOYLE

JOB NUMBER: I-181

JOB NAME: BOYLE

SITE COORDINATES:
LATITUDE: 32.948 N
LONGITUDE: 117.208 W

SEARCH RADIUS: 75 mi

ATTENUATION RELATION: 2) Campbell & Bozorgnia (1994) Horiz. - Soft Rock

UNCERTAINTY (M=Mean, S=Mean+1-Sigma): M

SCOND: 0

COMPUTE PEAK HORIZONTAL ACCELERATION

FAULT-DATA FILE USED: CALIFLT.DAT

SOURCE OF DEPTH VALUES (A=Attenuation File, F=Fault Data File): A

DETERMINISTIC SITE PARAMETERS

Page 1

ABBREVIATED FAULT NAME	APPROX. DISTANCE mi (km)	MAX. CREDIBLE EVENT			MAX. PROBABLE EVENT		
		MAX. CRED. MAG.	PEAK SITE ACC. g	SITE INTENS MM	MAX. PROB. MAG.	PEAK SITE ACC. g	SITE INTENS MM
BORREGO MTN. (San Jacinto)	62 (100)	6.50	0.017	IV	6.20	0.013	III
CASA LOMA-CLARK (S.Jacin.)	54 (87)	7.00	0.032	V	7.00	0.032	V
CATALINA ESCARPMENT	45 (72)	7.00	0.042	VI	6.10	0.019	IV
CHINO	62 (99)	7.00	0.024	V	5.40	0.007	II
CORONADO BANK-AGUA BLANCA	19 (31)	7.50	0.189	VIII	6.70	0.104	VII
COYOTE CREEK (San Jacinto)	53 (85)	7.00	0.032	V	6.10	0.015	IV
ELSINORE	30 (49)	7.50	0.109	VII	6.60	0.052	VI
GLN.HELEN-LYTLE CR-CLREMNT	61 (98)	7.00	0.027	V	6.70	0.020	IV
HOT S-BUCK RDG.(S.Jacinto)	55 (89)	7.00	0.031	V	6.10	0.014	III
LA NACION	8 (13)	6.50	0.302	IX	4.20	0.052	VI
NEWPORT-INGLEWOOD-OFFSHORE	18 (30)	7.10	0.151	VIII	5.90	0.057	VI
PALOS VERDES HILLS	54 (88)	7.20	0.037	V	6.20	0.015	IV
ROSE CANYON	6 (9)	7.00	0.420	X	5.90	0.242	IX
SAN CLEMENTE - SAN ISIDRO	49 (78)	8.00	0.086	VII	6.50	0.024	IV
SAN DIEGO TRGH.-BAHIA SOL.	29 (46)	7.50	0.117	VII	6.20	0.039	V
SAN GORGONIO - BANNING	72 (116)	7.50	0.029	V	6.60	0.014	IV
SUPERSTITION MTN.(S.Jacin)	73 (118)	7.00	0.020	IV	6.20	0.010	III
WHITTIER - NORTH ELSINORE	67 (107)	7.10	0.025	V	6.00	0.009	III

****

-END OF SEARCH- 18 FAULTS FOUND WITHIN THE SPECIFIED SEARCH RADIUS.

THE ROSE CANYON FAULT IS CLOSEST TO THE SITE.
IT IS ABOUT 5.5 MILES AWAY.

LARGEST MAXIMUM-CREDIBLE SITE ACCELERATION: 0.420 g

LARGEST MAXIMUM-PROBABLE SITE ACCELERATION: 0.242 g

DATE: Saturday, January 23, 1999

```
*************************************
*                                   *
*          E Q F A U L T            *
*                                   *
*            Ver. 2.20              *
*                                   *
*                                   *
*************************************
```

(Estimation of Peak Horizontal Acceleration
From Digitized California Faults)

East End

Carmel Mountain Rd.

SEARCH PERFORMED FOR: BOYLE

JOB NUMBER: I-181

JOB NAME: BOYLE

SITE COORDINATES:
LATITUDE: 32.954 N
LONGITUDE: 117.148 W

SEARCH RADIUS: 75 mi

ATTENUATION RELATION: 2) Campbell & Bozorgnia (1994) Horiz. - Soft Rock

UNCERTAINTY (M=Mean, S=Mean+1-Sigma): M

SCOND: 0

COMPUTE PEAK HORIZONTAL ACCELERATION

FAULT-DATA FILE USED: CALIFLT.DAT

SOURCE OF DEPTH VALUES (A=Attenuation File, F=Fault Data File): A

DETERMINISTIC SITE PARAMETERS

Page 1

ABBREVIATED FAULT NAME	APPROX. DISTANCE mi (km)	MAX. CREDIBLE EVENT MAX. CRED. MAG.	MAX. CREDIBLE EVENT PEAK SITE ACC. g	MAX. CREDIBLE EVENT SITE INTENS MM	MAX. PROBABLE EVENT MAX. PROB. MAG.	MAX. PROBABLE EVENT PEAK SITE ACC. g	MAX. PROBABLE EVENT SITE INTENS MM
BORREGO MTN. (San Jacinto)	58 (94)	6.50	0.018	IV	6.20	0.014	IV
CASA LOMA-CLARK (S.Jacin.)	51 (83)	7.00	0.034	V	7.00	0.034	V
CATALINA ESCARPMENT	48 (77)	7.00	0.038	V	6.10	0.017	IV
CHINO	62 (101)	7.00	0.024	V	5.40	0.007	II
CORONADO BANK-AGUA BLANCA	23 (37)	7.50	0.157	VIII	6.70	0.084	VII
COYOTE CREEK (San Jacinto)	50 (81)	7.00	0.035	V	6.10	0.016	IV
ELSINORE	28 (45)	7.50	0.121	VII	6.60	0.058	VI
GLN.HELEN-LYTLE CR-CLREMNT	59 (96)	7.00	0.028	V	6.70	0.021	IV
HOT S-BUCK RDG.(S.Jacinto)	53 (85)	7.00	0.033	V	6.10	0.015	IV
LA NACION	$\boxed{7 (12)}$	6.50	0.342	IX	4.20	0.060	VI
NEWPORT-INGLEWOOD-OFFSHORE	21 (34)	7.10	0.127	VIII	5.90	0.047	VI
PALOS VERDES HILLS	57 (92)	7.20	0.035	V	6.20	0.014	IV
ROSE CANYON	$\boxed{9 (14)}$	7.00	0.303	IX	5.90	0.147	VIII
SAN CLEMENTE - SAN ISIDRO	52 (83)	8.00	0.080	VII	6.50	0.022	IV
SAN DIEGO TRGH.-BAHIA SOL.	32 (51)	7.50	0.102	VII	6.20	0.034	V
SAN GORGONIO - BANNING	71 (114)	7.50	0.029	V	6.60	0.014	IV
SUPERSTITION MTN.(S.Jacin)	70 (113)	7.00	0.022	IV	6.20	0.011	III
WHITTIER - NORTH ELSINORE	68 (109)	7.10	0.025	V	6.00	0.009	III

****

-END OF SEARCH- 18 FAULTS FOUND WITHIN THE SPECIFIED SEARCH RADIUS.

THE LA NACION FAULT IS CLOSEST TO THE SITE.
IT IS ABOUT 7.4 MILES AWAY.

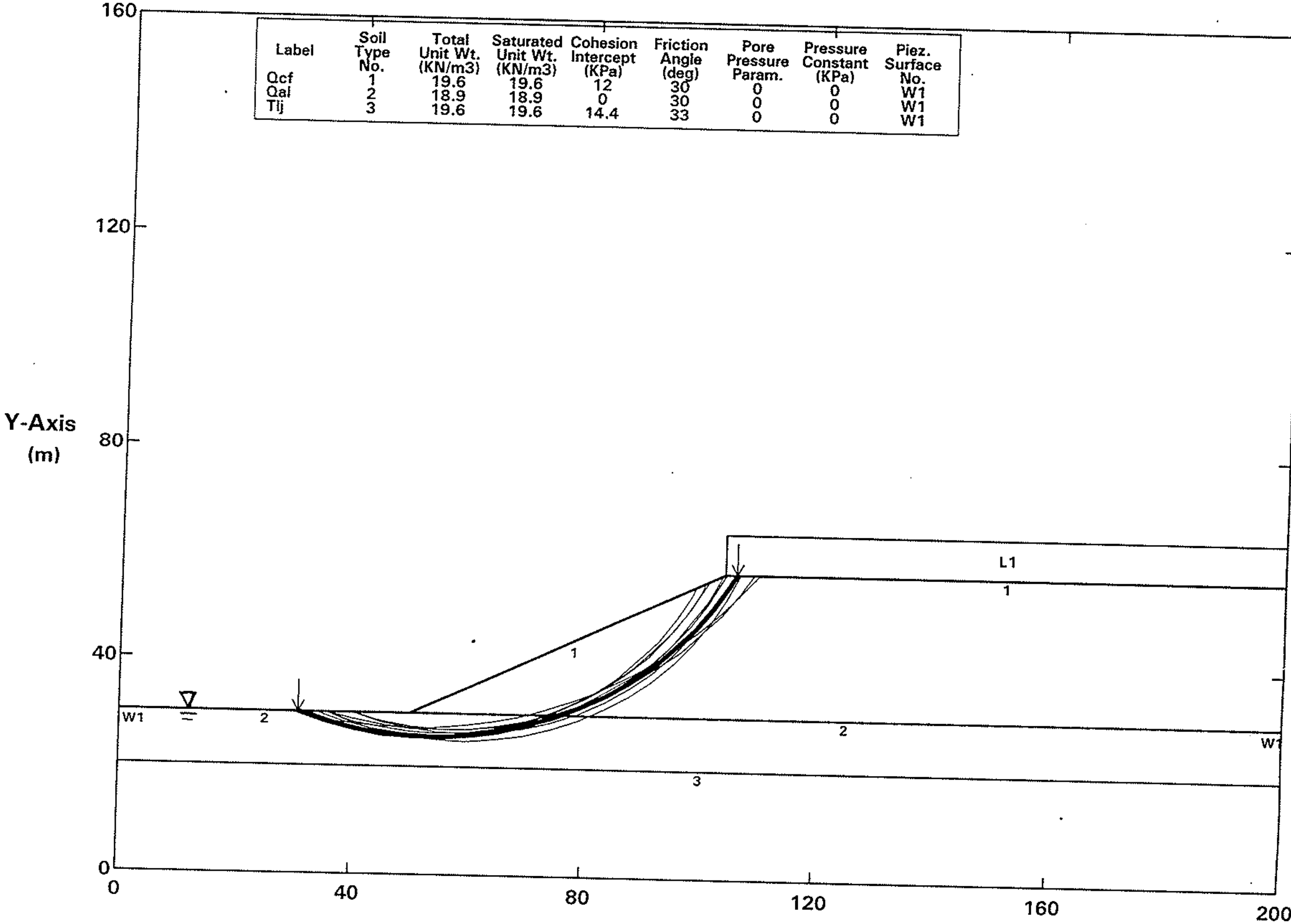
LARGEST MAXIMUM-CREDIBLE SITE ACCELERATION: 0.342 g

LARGEST MAXIMUM-PROBABLE SITE ACCELERATION: 0.147 g

□

APPENDIX D
PCSTABL OUTPUT

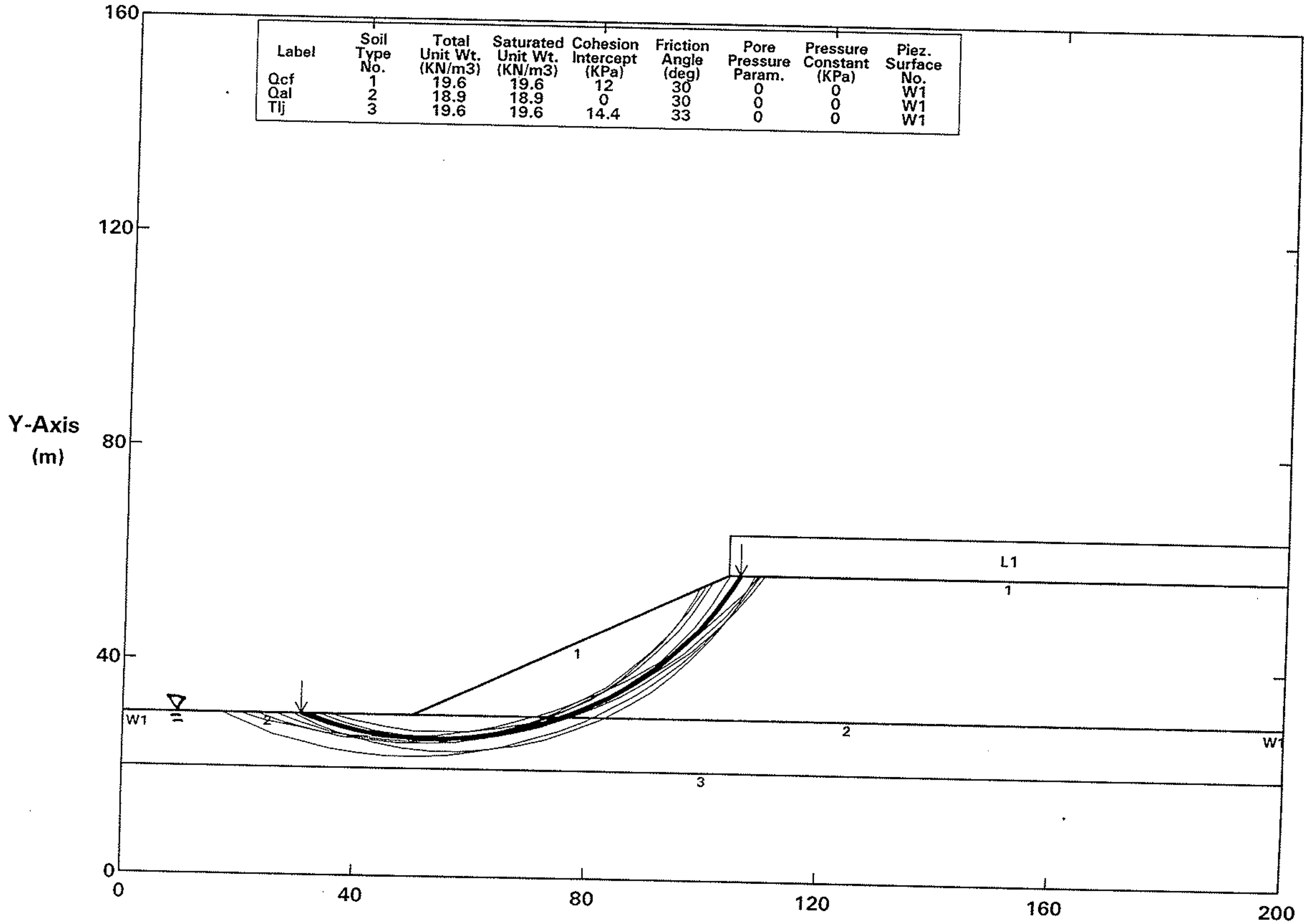
SR-56 MIDDLE SEGMENT, 2:1 Fill Slope on Sandy Alluvium, High GWT, Static
Ten Most Critical. C:F2.PLT By: CVA\ 2/19/99 10:31am



Label	Soil Type No.	Total Unit Wt. (KN/m3)	Saturated Unit Wt. (KN/m3)	Cohesion Intercept (KPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (KPa)	Piez. Surface No.
Qcf	1	19.6	19.6	12	30	0	0	W1
Qal	2	18.9	18.9	0	30	0	0	W1
Tlj	3	19.6	19.6	14.4	33	0	0	W1

PCSTABL5M/SI FSmin = 1.47 X-Axis (m)
Factors Of Safety Calculated By The Modified Bishop Method

SR-56 MIDDLE SEGMENT, 2:1 Fill Slope on Sandy Alluvium, High GWT,Seismic kh=0.15
Ten Most Critical. C:F2EQ.PLT By: CVA\ 2/19/99 10:33am

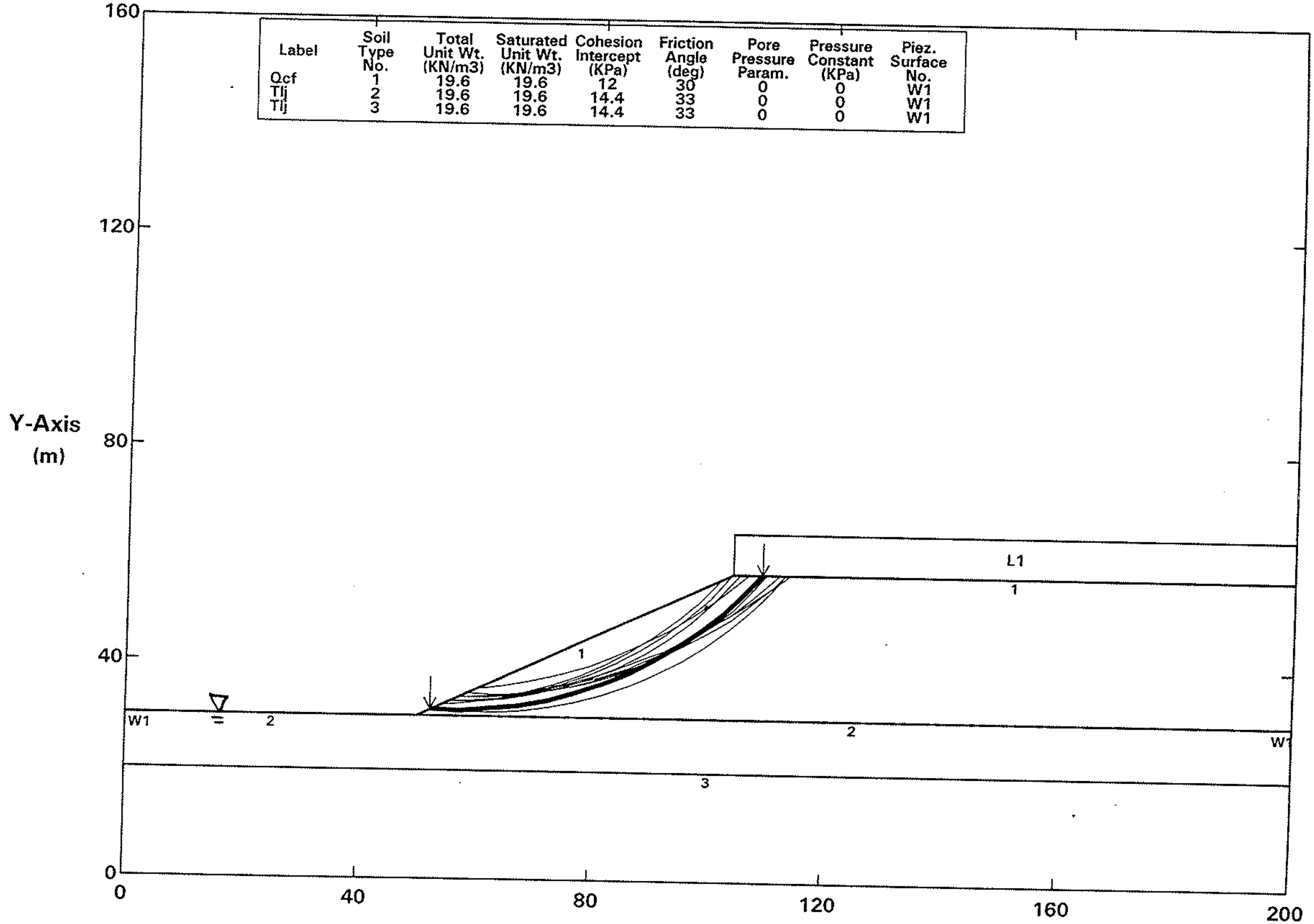


Label	Soil Type No.	Total Unit Wt. (KN/m3)	Saturated Unit Wt. (KN/m3)	Cohesion Intercept (KPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (KPa)	Piez. Surface No.
Qcf	1	19.6	19.6	12	30	0	0	W1
Qal	2	18.9	18.9	0	30	0	0	W1
Tlj	3	19.6	19.6	14.4	33	0	0	W1

PCSTABL5M/SI FSmin=1.04 X-Axis (m)
Factors Of Safety Calculated By The Modified Bishop Method

SR-56 MIDDLE SEGMENT, 2:1 Fill Slope on Formation, High GWT, Static

Ten Most Critical. C:F6.PLT By: CVA\ 2/19/99 10:55am



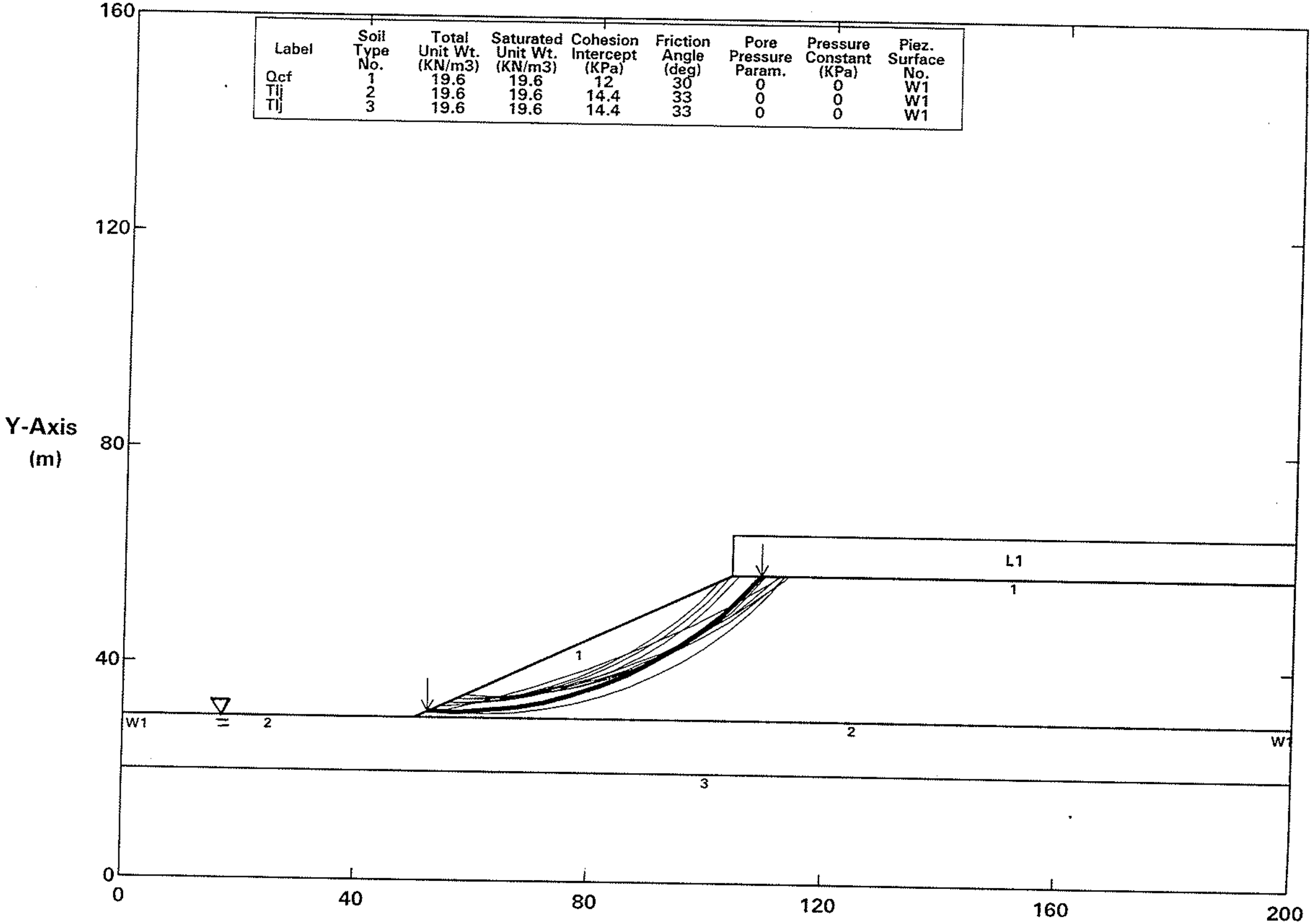
Label	Soil Type No.	Total Unit Wt. (KN/m3)	Saturated Unit Wt. (KN/m3)	Cohesion Intercept (KPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (KPa)	Piez. Surface No.
Qcf	1	19.6	19.6	12	30	0	0	W1
Tlj	2	19.6	19.6	14.4	33	0	0	W1
Tlj	3	19.6	19.6	14.4	33	0	0	W1

PCSTABL5M/SI FSmin = 1.59 X-Axis (m)

Factors Of Safety Calculated By The Modified Bishop Method

SR-56 MIDDLE SEGMENT, 2:1 Fill Slope on Formation, High GWT, Seismic kh=0.15

Ten Most Critical. C:F6EQ.PLT By: CVA\ 2/19/99 10:56am



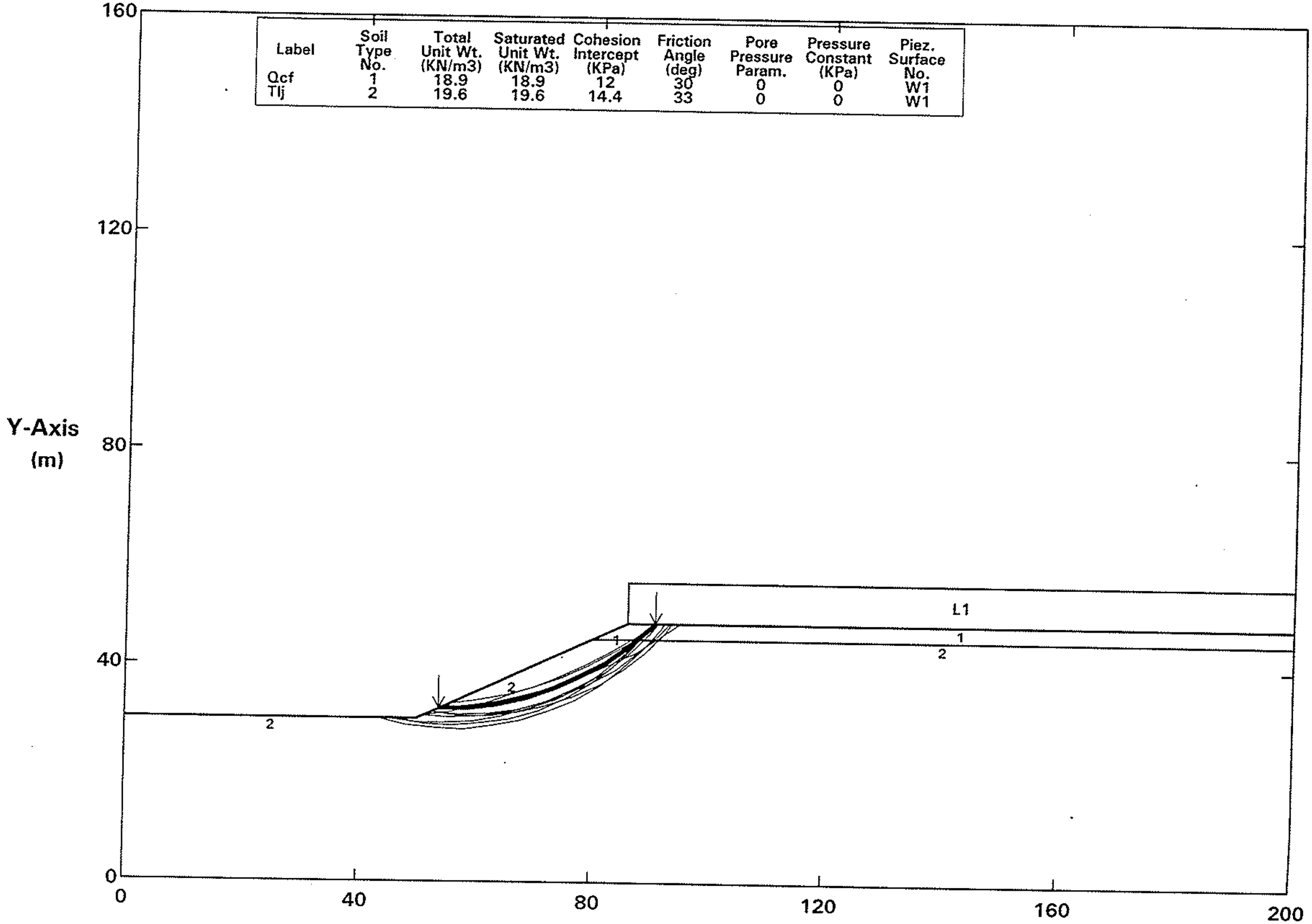
Label	Soil Type No.	Total Unit Wt. (KN/m3)	Saturated Unit Wt. (KN/m3)	Cohesion Intercept (KPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (KPa)	Piez. Surface No.
Qcf	1	19.6	19.6	12	30	0	0	W1
Tlj	2	19.6	19.6	14.4	33	0	0	W1
Tlj	3	19.6	19.6	14.4	33	0	0	W1

PCSTABL5M/SI FSmin=1.16 X-Axis (m)

Factors Of Safety Calculated By The Modified Bishop Method

SR-56 MIDDLE SEGMENT, 2:1 Cut Slope with No Adverse Bedding, Static

Ten Most Critical. C:C1.PLT By: CVA\ 2/19/99 11:25am

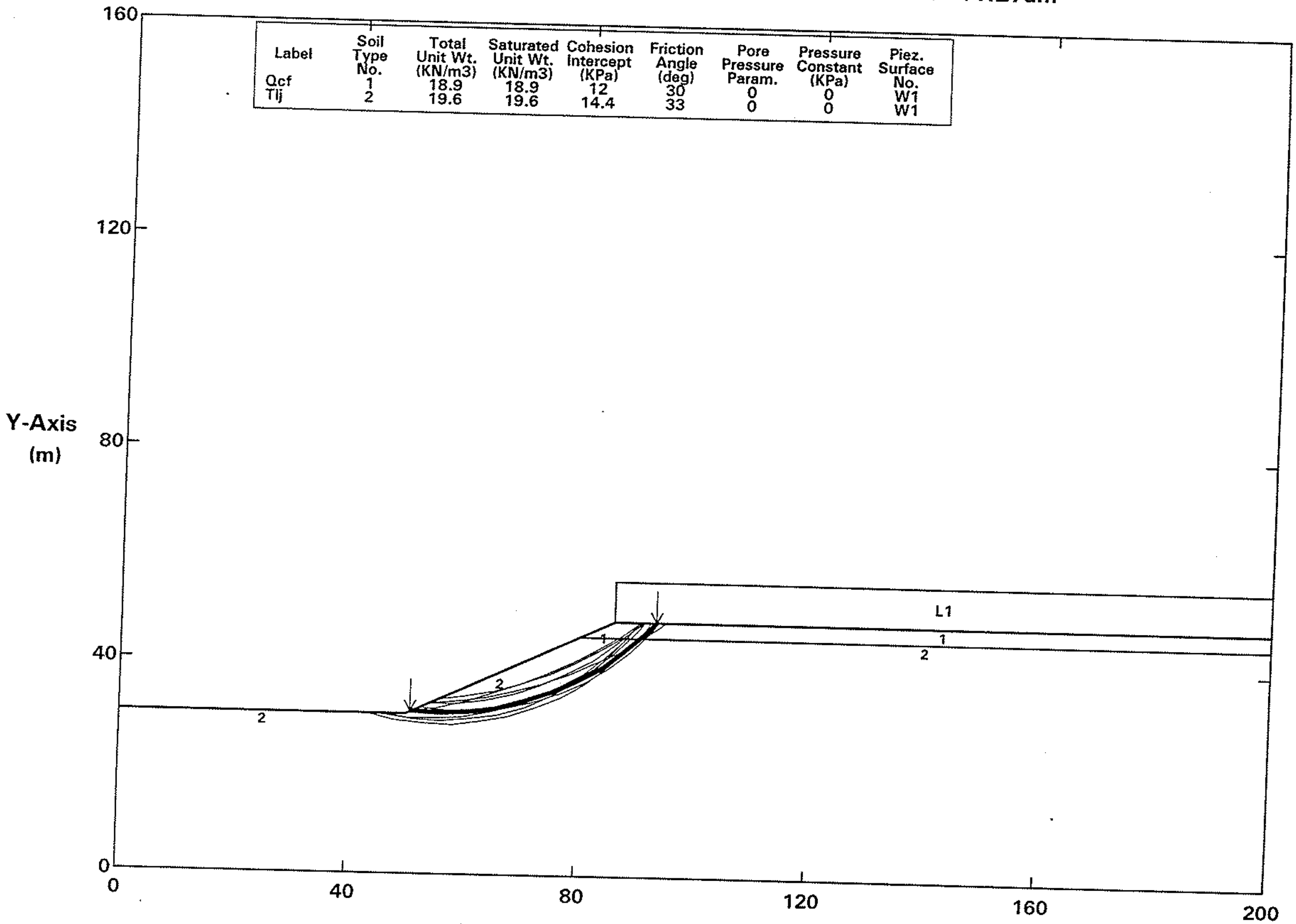


Label	Soil Type No.	Total Unit Wt. (KN/m3)	Saturated Unit Wt. (KN/m3)	Cohesion Intercept (KPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (KPa)	Piez. Surface No.
Qcf	1	18.9	18.9	12	30	0	0	W1
Tlj	2	19.6	19.6	14.4	33	0	0	W1

PCSTABL5M/SI FSmin = 1.99 X-Axis (m)

Factors Of Safety Calculated By The Modified Bishop Method

SR-56 MIDDLE SEGMENT, 2:1 Cut Slope with No Adverse Bedding, Seismic kh=0.15
Ten Most Critical. C:C1EQ.PLT By: CVA\ 2/19/99 11:27am

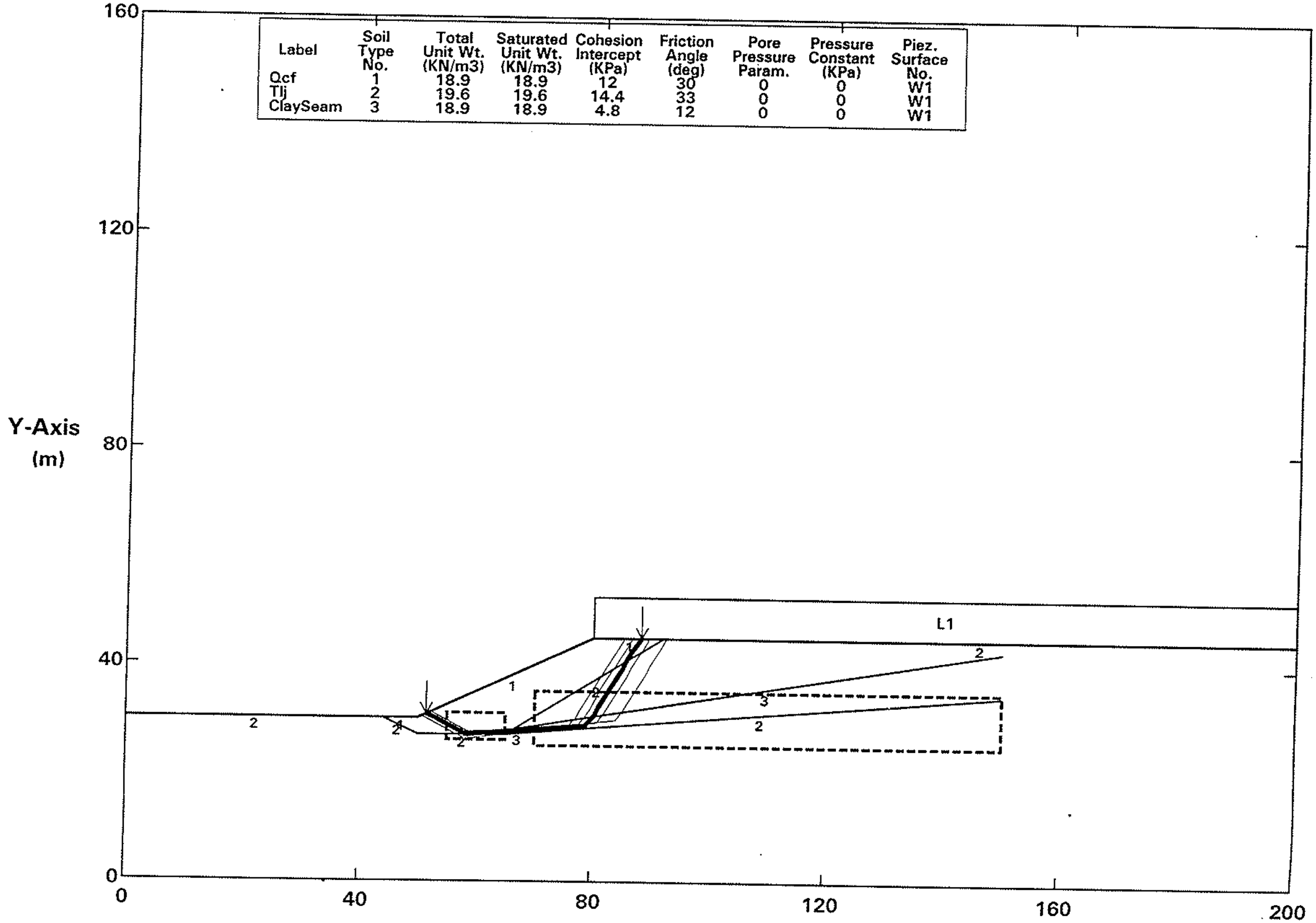


PCSTABL5M/SI FSmin=1.44 X-Axis (m)
Factors Of Safety Calculated By The Modified Bishop Method

SR-56 MIDDLE SEGMENT, 2:1 Cut Slope With Buttress Fill, Static

Ten Most Critical. C:C2.PLT By: CVA\ 2/22/99 12:00pm

Label	Soil Type No.	Total Unit Wt. (KN/m3)	Saturated Unit Wt. (KN/m3)	Cohesion Intercept (KPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (KPa)	Piez. Surface No.
Qcf	1	18.9	18.9	12	30	0	0	W1
Tlj	2	19.6	19.6	14.4	33	0	0	W1
ClaySeam	3	18.9	18.9	4.8	12	0	0	W1

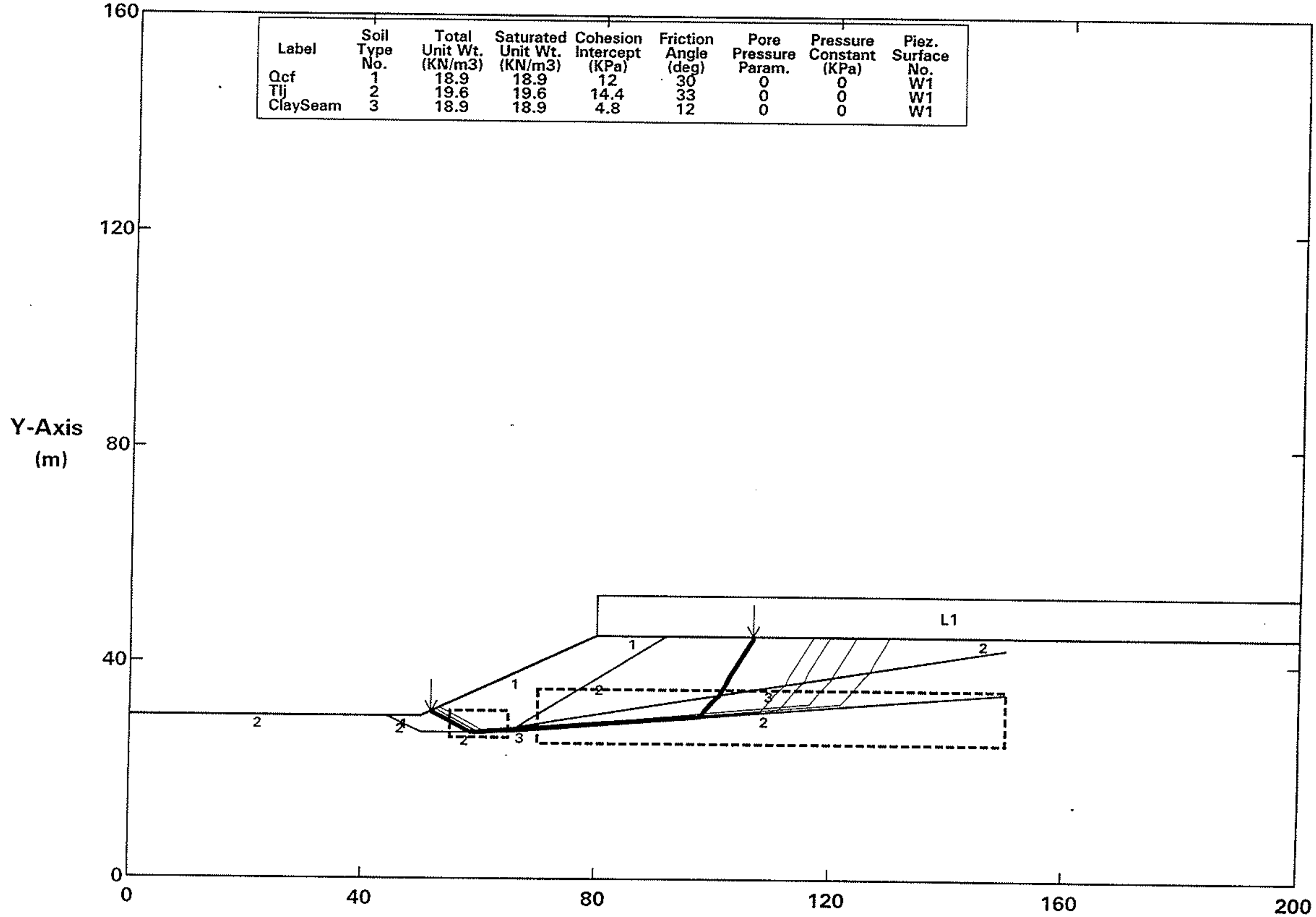


PCSTABL5M/SI FSmin = 1.61 X-Axis (m)

Factors Of Safety Calculated By The Modified Janbu Method

SR-56 MIDDLE SEGMENT, 2:1 Cut Slope With Buttress Fill, Seismic kh = 0.15

Ten Most Critical. C:C2EQ.PLT By: CVA\ 2/22/99 12:01pm



PCSTABL5M/SI FSmin = 1.07 X-Axis (m)

Factors Of Safety Calculated By The Modified Janbu Method

APPENDIX E
REFERENCES

APPENDIX E

REFERENCES

Apex Geotechnology, Inc. and Group Delta Consultants, 1996, "Final Technical Report, Geology/Soils State Rout 56 Between Interstate 5 and Interstate 15, Private Consultants report dated November 5, 1996."

Berger, V. and Schug, D. L., 1991, "Probabilistic Evaluation of Seismic Hazard in the San Diego- Tijuana Metropolitan Region" in Environmental Perils, San Diego Region, published for the Geological Society of America Annual Meeting by the San Diego Association of Geologists.

Blake, T. F., "EQFAULT--A Computer Program for the Deterministic Prediction of Peak Horizontal Acceleration from Digitized California Faults," July, 1989-93.

Geocon, Inc. 1998, "Draft copies of geologic map and test exploration logs for the Rhodes Subdivision project".

Group Delta Consultants, 1999, "Draft Type Selection Reports for Middle Segment Bridges," reports prepared for Boyle Engineering Corporation.

Jennings, Charles W., 1994, "Fault Activity Map of California and Adjacent Areas." California Division of Mines and Geology, Geology Data Map No. 6.

Kennedy, M. P., 1975, "Geology of the San Diego Metropolitan Area, California," California Division of Mines and Geology Bulletin 200.

Tan, Siang S. and Giffen, Desmond G., 1995, "Landslide Hazards in the Northern Part of the San Diego Metropolitan Area, San Diego County, California, Landslide Hazard Identification Map No. 35," California Division of Mines and Geology, Open-File Report 95-04.