GEOTECHNICAL INVESTIGATION

WEST DIMOND BOULEVARD UPGRADE
Jodhpur Road to Sand Lake Road

PM&E Project No. 05-005

Prepared for:

Municipality of Anchorage
Department of Public Works
Project Management & Engineering Department
P.O. Box 196650
4700 S. Bragaw Street
Anchorage, Alaska 99519-6650

Prepared by:

R&M Consultants, Inc.
9101 Vanguard Drive
Anchorage, Alaska 99507

February, 2007

R&M
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9101 Vanguard Drive, Anchorage, Alaska 99507

February 1, 2007 R&M No. 1317.01

Municipality of Anchorage
Department of Public Works
Project Management & Engineering Department
P.O. Box 196650
4700 S. Bragaw Street
Anchorage, Alaska 99519-6650

ATTN: Mr. John Smith, P.E.

RE: Geotechnical Investigation
West Dimond Boulevard Upgrade, Jodhpur Road to Sand Lake Road
Anchorage, Alaska
PM&E Project No. 05-005

Dear Mr. Smith:

Enclosed are three (3) bound copies of our geotechnical investigation for the West Dimond Boulevard Upgrade project. The work was performed in accordance with an agreement between the Municipality of Anchorage and R&M Consultants, Inc. dated January 30, 2006.

We trust that this report is found to be responsive to your requirements. Should you have any questions, or desire additional information, please call.

Very truly yours,

R&M CONSULTANTS, INC.

Robert M. Pintner, P.E.
Senior Geotechnical Engineer

RMP*slv

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Anchorage, Alaska

PM&E Project No. 05-005

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

LIST OF TABLES

LIST OF APPENDICES

GEOTECHNICAL INVESTIGATION

WEST DIMOND BOULEVARD UPGRADE

Jodhpur Road to Sand Lake Road
Anchorage, Alaska

PM&E Project No. 05-005

1.0 INTRODUCTION

1.1 Background

R&M Consultants, Inc. (R&M) has been retained by the Municipality of Anchorage (MOA) to provide professional engineering services including survey, geotechnical and civil design for the planned improvement of West Dimond Boulevard between Jodhpur Road and Sand Lake Road.

1.2 Contract Authorization

This study has been conducted under the terms of an agreement dated January 30, 2006, between the MOA and R&M.

Measurements and weights presented in this report are generally shown as customary Imperial units. However, a conversion chart is included as Table 1 for use in conversion from Imperial to the International System (SI). Actual conversion should be made with the appropriate number carried to three or more significant figures.

1.3 Scope-of-Work

The intent of this investigation has been to gather data on the geologic and geotechnical conditions which could affect development, engineering design, and construction of the proposed roadway improvements. This report presents a summary of the results of R&M's site exploration program and our interpretation of site conditions.

1.4 Existing Geotechnical Data

No geotechnical data was available within the project right-of-way. A limited number of logs were available for test holes drilled within 200 feet of the centerline of West Dimond Boulevard. One prior test hole was drilled on Bluff Circle, approximately 180 feet south of the centerline of West Dimond Boulevard. This log showed sand and gravel with frost classification of F1 to NFS. Two test holes were drilled on Skyhills Drive, approximately 180 and 200 feet north of the centerline of West Dimond Boulevard. One of these logs showed a thick layer (>10 feet) of organic material, the other showed silty soils with a frost classification of F4.

2.0 REGIONAL SETTING

2.1 Location

The project area is located in Anchorage, Alaska, approximately three miles south of Ted Stevens Anchorage International Airport. The area is primarily residential with some undeveloped property. A vicinity map is included as Drawing A-01 of Appendix A.

2.2 General Geology

Anchorage lies on the upper Cook Inlet-Susitna Lowland within a trough between the Alaska Range and the Chugach Mountains. The area has been extensively glaciated and numerous glacial tills, moraines, glacio-fluvial and estuarine deposits are associated with several glacial advances.

The project area is underlain by the Bootlegger Cove Formation (Updike and Ulery, 1986). In this area of the Anchorage Bowl, the Bootlegger Cove Formation generally consists of fine to medium sand with layers of silt and gravel overlying sandy gravel to gravelly sand with layers of silt and fine sand. Alluvial deposits consisting primarily of sand and gravel locally overlie the Bootlegger materials. Fill material, of unknown composition and thickness, is present along the existing road alignment.

2.3 Geologic Hazards

The primary geologic hazards in Anchorage are associated with earthquakes (i.e. strong ground motions and ground failure potential). Other geologic hazards in Anchorage include seasonal frost action and surface drainage problems. Note that permafrost has not been recorded, nor is it suspected to exist, in the immediate project area.

Anchorage is located in a very active seismic environment associated with the lithospheric ‘Pacific’ plate drifting north-northwesterly, and subducting the North American plate, at a rate on the order of several inches per year (i.e. the ‘Aleutian Subduction Zone’). The seismicity of the shallow, ‘inter-plate’ portion of this subduction zone is characterized by infrequent but great earthquakes; while the deeper ‘intra-plate’ region is characterized by more frequent, yet less severe earthquakes. Anchorage overlies the transition between these two portions of the Aleutian Subduction Zone at a depth of about 20 miles. Following Wesson et al. (1999), the maximum credible earthquakes generated on the inter- and intra-plate portions of the Aleutian Subduction Zone are presently considered to have moment magnitudes of about 9.2 (equal to the 1964 event; with a return period of about 700 to +1,200 years), and 7.5 (with a return period between 100 to 200 years), respectively.

2.4 Climate

Anchorage experiences a transitional climate, variably influenced by the adjacent maritime and continental (interior) environments, characterized by relatively moderate daily and seasonal temperature changes, cloudiness and precipitation. Based on data recorded at Anchorage

International Airport since 1952, the mean annual air temperature is about 36.0°F, with mean monthly temperatures ranging from about 15°F in January to 65°F in July. Since 1970, the annual freeze index has ranged from about 620 to 3,000°F-Days; with a mean of about 1,940°F-Days and 'design' (average of the three coldest winters) of about 2,780°F-Days (Scher, 2002). Most precipitation falls between mid-June and December, with the average first snowfall typically in October. The mean annual precipitation is about 16 inches, with mean monthly values ranging from about one-half inch in April to almost three inches in August. The mean annual snowfall is about 70 inches. A summary of climatological data obtained from the Anchorage International Airport recording station is presented in Table 2.

3.0 FIELD INVESTIGATION

A total of twenty (20) test borings, numbered TB-01 through TB-20, were drilled by R&M in July, 2006. The depth of the drill holes ranged from 16.5 to 21.5 feet. Drilling and sampling operations were performed by Discovery Drilling, Inc. under subcontract to R&M. Borings were located during the drilling program using a handheld GPS unit. The approximate locations of test borings are shown on Drawings A-02 through A-04 of Appendix A.

The drilling program was conducted under the supervision of an experienced R&M engineering geologist who maintained a detailed log of the materials encountered and the recovered samples. After visual and tactile classification in the field, all samples were returned to the R&M laboratory. Representative samples were then selected for further examination and testing.

Drilling and sampling were performed using a CME-75 drill rig mounted on a truck. The test borings were advanced using a continuous-flight 8-inch hollow stem auger. Representative samples were obtained during the drilling by means of auger grab samples and split-spoon samplers. Split-spoon samples were obtained using a 2.5-inch I.D. (3.0-inch O.D.) sampler driven by a 340-pound hammer. An automatic hammer was used on this project. The penetration resistance, defined as the number of blows required to drive the sampler the last 12 inches of an 18-inch interval, gives an indication of the in-place relative density for unfrozen cohesionless soils, and is recorded on the boring logs in Appendix B. Note, that the blow counts appearing on the log of test borings are actual values, not converted Standard Penetration Test (SPT) values. All soils recovered were visually classified and logged in the field following ASTM Designation D 2488.

A field log was prepared for each boring by the field geologist. The log contains information concerning the boring methods, samples attempted and recovered, indications of the presence of various materials, and observations of groundwater. It also contains the field geologist’s interpretation of the conditions in intervals between recovered samples. Therefore, these logs contain both factual and interpretive information. The final drafted logs represent interpretation of the field logs and the results of the laboratory tests of samples. The final logs are included within the appendices of this report. It is emphasized that because of the inclusion of laboratory data, the interpretations are based on the contents of the final logs and the information contained therein, and not on the field logs.

Test boring logs are presented on Drawings B-03 through B-22 of Appendix B. An explanation of the symbols used for the logs is provided on Drawings B-01 and B-02.

4.0 LABORATORY TESTING PROGRAM

The laboratory testing program was developed to provide data on the important soil characteristics necessary for subsurface characterization of the roadway improvements. These tests verified and modified the field descriptions, improving the database for engineering application and geotechnical interpretation of subsurface conditions. The laboratory testing was performed in accordance with the following ASTM procedures (ASTM, 2006):

TEST	ASTM DESIGNATION
Moisture Content	D 2216
Particle Size Distribution (Sieve)	D 422
Particle Size Distribution (Hydrometer)	D 422
Organic Content	D 2974
Classification of Soils	D 2487 D 2488

In addition to the Unified Soil Classification (USC), selected samples were assigned a frost classification based on the U.S. Army Corps of Engineers Method (USACE, 1992). Each classification method (USC and USACE) is presented on the log of test boring and laboratory data summary sheets for those respective samples tested.

A summary of the laboratory test results is provided in Appendix C, Drawings C-03 and C-04. The Unified Soil Classification System and Frost Design Soil Classification are presented on Drawings C-01 and C-02, respectively.

5.0 PROJECT SITE CONDITIONS

The field investigation has revealed a complex variety of both surface and subsurface conditions along the road alignment. To facilitate a discussion, the alignment was divided into segments based upon the presence of common or similar subsurface conditions. Each segment is identified by approximate roadway stationing. Properties that characterize a segment often have gradual variation over distance along the alignment, rather than abrupt changes, so segment boundaries identified should be considered as approximate. Subsurface conditions within each segment also vary as noted, and presence of uniform or homogeneous subsurface soil and groundwater properties within a segment should not be inferred. The reader is referred to the drawings included within the appendices of this report for graphic representation of the various conditions encountered.

5.1 Beginning of Project (BOP) to Station 79+00

Thirteen test holes (TB-08 to TB-20) were drilled in this segment. The subsurface conditions in this segment generally consisted of at least two feet of granular fill over a variable subgrade. The thickness of the granular fill varied from about two to 10 feet, and was approximately two feet thick in all but three of the test holes. The granular fill consisted of well to poorly graded gravel with silt and sand to sand with silt and gravel. The P200 ranged from 3.7 to 11.0 percent with an average of 7.0 percent. Moisture contents ranged form 2.4 to 4.0 percent. Variable soils underlay the granular fill, these soils ranged from fill consisting of silty sand and gravel to natural soils consisting of silty sand and sandy silt. Including only test results form the upper 10 feet, the percent passing the No. 200 sieve (P200) ranged form 5.0 to 73 percent with an average of 22 percent. Moisture contents ranged form 2.9 to 15 percent.

The pavement in this segment was generally in fair to poor condition. Most of the pavement distress appeared to be related fatigue of the pavement structure. Significant alligator cracking with associated potholes were observed in some areas. There were no large scale deformations caused by settlement or frost action. The asphalt thickness measured in the test holes ranged from 1.0 to 1.5 inches.

5.2 Station 79+00 to Station 86+00

Three test holes (TB-05 to TB-07) were drilled in this segment. Subsurface conditions generally consisted of 3.5 to 4.5 feet of granular fill over a silty subgrade. The granular fill consisted of poorly graded sand with silt and gravel. The P200 ranged from 7.2 to 10 percent with an average of 8.5 percent. Moisture contents ranged form 3.1 to 5.9 percent. The soils underlying the granular fill consisted of silty sand to sandy silt. The P200 of the silt averaged 73 percent. Moisture contents ranged form 8.3 to 25 percent.

The pavement in this segment was generally in fair to poor condition. Most of the pavement distress appeared to be related fatigue of the pavement structure. Significant alligator cracking with associated potholes were observed in some areas. There were no large scale deformations caused by settlement or frost action. The asphalt thickness measured in the test holes ranged from 1.0 to 2.5 inches.

5.3 Station 86+00 to End of Project (EOP)

Four test holes (TB-01 through TB-04) were drilled in this segment. The subsurface conditions in this segment generally consisted of at least two feet of granular fill over a generally granular subgrade. The granular fill consisted of well to poorly graded gravel with silt and sand to sand with silt and gravel. The P200 ranged from 8.3 to 9.0 percent. Moisture contents ranged form 2.1 to 3.1 percent. The subgrade mostly consisted of well to poorly graded gravel with silt and sand. In Test Boring TB-03, a 1.5-foot thick layer of silt was present below the fill material.

The pavement in this segment was generally in good to excellent condition. Much of the asphalt pavement appeared to be newer than in the other segments. Some minor fatigue cracking was observed in the vicinity of Test Boring TB-03. There were no large scale deformations caused by settlement or frost action. The asphalt thickness measured in the test holes ranged from 2.0 to 3.0 inches.

5.4 Groundwater

No groundwater was observed during drilling. However, local perched water tables could be present, particularly following periods of heavy rainfall, or snow melt.

5.5 Frozen Soils

Seasonal frost or permafrost was not encountered in any of the test borings drilled at the site.

6.0 GEOTECHNICAL DESIGN RECOMMENDATIONS AND CONSTRUCTION CONSIDERATIONS

Our geotechnical design recommendations regarding excavation requirements, site drainage, foundation design, and other construction related elements are presented in the following paragraphs. These recommendations are based on our understanding of the subsurface data obtained from the test borings, and of the proposed construction of the road improvements. It is emphasized that our understanding of the planned improvements is limited in some cases to only general information regarding the nature of the various proposed developments.

Because the project design is still at an early stage, a number of our design recommendations are necessarily somewhat broad. It is anticipated that as the final design progresses, we will have the opportunity to provide more specificity, as required.

6.1 General Recommendations

6.1.1 General Conditions

The existing roadway structural section consisted of about two to four feet of granular fill over subgrade. The subgrade was mostly F1 and F2, with some areas of F4. No groundwater was observed, and there was no observed pavement distress due to differential frost action.

6.1.2 Climate and Seasonal Frost

Thermal evaluations of the civil works should use the following climate parameters.

MODEL	MEAN ANNUAL AIR TEMP (T_{MA}), °F	AIR FREEZE INDEX (AFI), °F-DAYS
Mean	36.0	1,900
Design		2,780

Based on the above climate parameters, the following table characterizes the potential depth of maximum annual frost penetration expected at the project site as a function of the surface conditions.

SURFACE CONDITION	ESTIMATED MAXIMUM ANNUAL FROST PENETRATION, FT
Turf	7 to 9
AC/PCC Pavement	9 to 11
Behind a Vertical Retaining Wall	10 to 12

6.1.3 Earthwork Materials

Specifications for earthwork materials should conform to the Municipality of Anchorage Standard Specifications (MASS), 1994.

6.1.4 Excavations

All excavation (e.g. for foundation, utility trenches, etc.) slopes should conform to Federal and State standards as a function of the depth, exposed soil type, moisture/groundwater condition, time left open, and adjacent surface loads, foundations or traffic. The site soils generally classify as Type C (29 CFR Parts 1926.650 - 652). Excavated cuts may not be stable at slopes steeper than about 1.5 (H) to 1 (V), especially when exposed to groundwater seepage, or surface water flows.

6.2 Pavements

Pavement section recommendations for the roadway and separated pathways were developed based on consideration of seasonal frost action and the past performance of existing roadway pavements. The existing conditions in the project area suggest that the long-term performance of the pavements will be primarily influenced by fatigue of the pavement. Differential settlement or frost action does not appear to have been a problem along the existing roadway. However, Anchorage is subject to rather extreme winter freezing conditions (see Section 2.4), and frost action must be considered in the design of the pavement structural section. Based on texture, the in-situ foundation soils in the project area are interpreted to be generally low to medium frost susceptible. The absence of groundwater within the top 20 feet contributes to the low frost susceptibility of the area.

The Municipality of Anchorage (MOA) Design Criteria Manual (January, 2007), Chapter 1.10, requires that pavement overlying moderately or highly frost susceptible soils be designed using the limited frost penetration method. The manual further states that the maximum frost penetration into the subgrade shall be 10 percent of the overall structural pavement section thickness. Based on these requirements, the design structural section thickness for the project would be eight feet. This thickness could be reduced to four feet by placing two inches of insulation at a depth of 18 inches below the pavement surface.

Previous versions of the MOA Design Criteria Manual allowed the use of the Reduced Subgrade Strength Method for pavement design. Following this method, the design structural pavement section of the project would be four feet, without insulation. In our opinion, a structural pavement section of four feet will be adequate for the proposed roadway and paths. A structural section thicker than four feet, or the use of insulation is not considered to be necessary because there is no past history of significant frost heaving, and no groundwater was observed during the investigation. However, because the current MOA Design Criteria Manual only allows the use of the Limited Frost Penetration Method, the Reduced Subgrade Strength design section is given as an alternative.

6.2.1 BOP to Station 79+00

The existing structural section in this segment was typically about two feet thick over a variable, moderately frost susceptible subgrade, with some areas of F4 subgrade. It is recommended that the section be reconstructed with one of the following alternatives:

Alternate 1 (Limited Frost Penetration):

AC – 2 inches
Leveling Course – 2 inches
Classified Fill, Type IIa – 6 inches
Classified Fill, Type II – 86 inches

Alternate 2 (Limited Frost Penetration with insulation):

AC – 2 inches
Leveling Course – 2 inches
Classified Fill, Type IIa – 14 inches
Rigid Insulation – 2 inches
Classified Fill, Type IIa – 6 inches
Classified Fill, Type II – 22 inches

Alternate 3 (Reduced Subgrade Strength):

AC – 2 inches
Leveling Course – 2 inches
Classified Fill, Type IIa – 6 inches
Classified Fill, Type II – 38 inches

6.2.2 Station 79+00 to Station 86+00

The existing pavement section was 3.5 to 4.5 feet thick over a generally F4 subgrade. The existing Classified Fill was of marginal quality, with P200 contents exceeding the specification. It is recommended that the section be replaced in this segment with the same section as used for the previous segment.

6.2.3 Station 86+00 to EOP

In this segment, the subgrade generally had low frost susceptibility except in the vicinity of Station 92+50 where silt was encountered at a depth of about three feet. For most of the segment, the following pavement section is recommended:

AC – 2 inches
Leveling Course – 2 inches
Classified Fill, Type IIa – 6 inches
Classified Fill, Type II – 11 inches

Where the grade will not be raised, the existing fill material may be left in place for the Type II layer, but new Type IIa and leveling course is recommended. In the vicinity of Station 92+50, the silt layer may be left in place if the final grade will be at least four feet above the top of the silt. If not, the silt should be removed.

6.2.4 General Earthwork

A. All earthwork should be performed only when the exposed subgrade or subbase materials are completely thawed and the average daily air temperatures are above freezing.

B. Excavations above the groundwater table may not be stable at slopes greater than 1:1 when left open for extended periods or when exposed to water. Local seeps of perched groundwater are also to be expected during construction, especially when penetrating seasonally frozen materials, following heavy precipitation, or when digging close to existing or former drainage courses. Cut slope raveling or slumping could occur suddenly. Proper excavation safety precautions and pertinent regulations must be followed at all times.

C. Fill material should not be placed directly on seasonally frozen soils. If frozen soils are encountered at the bottom of an excavation, the work in that area should be delayed until the materials have thawed. Alternatively, the excavation could be continued at least two feet deeper, and backfilled with *Type II* material.

D. Some of the subgrade will consist of fine-grained sand and silt deposits which are expected to be very sensitive to water. To minimize the potential for pumping, the bottom of all excavations should be protected from surface water prior to placing the *Type II* material. Further, the contractor should proceed with caution when adding water to each lift of classified material to facilitate compaction.

6.2.5 Subgrade Preparation

A. Clear and grub all existing vegetation, organic matter, and muck from beneath all pavement surfaces. The width of the clearing and grubbing limits should not be less than delineated by a 1:1 plane projected down and outward from the pavement edge.

B. Excavate to the design subgrade level (bottom of the new pavement section). The width of all excavations under the new pavements should not be less than delineated by a 1:1 plane projected down and outward from the edge of pavement. After removal of the non-desirable materials, the exposed subgrade should be proof-rolled prior to backfilling. Excavation areas that are inaccessible to proof-rolling should be inspected by hand probing or shallow test pits. Any evident loose or disturbed areas should be recompacted, or removed and replaced with *Type II* material.

C. Where fill is required to achieve the design subgrade level, use *Type II* material compacted to at least 95 percent maximum density, as determined by ASTM D 1557.

6.3 Site Drainage

Groundwater could be encountered in trenches and excavations extended deeper than 10 to 12 feet. Excavations which encounter groundwater will be unstable and the need for dewatering (and shields in trenches) should be expected. Use of sump pits and pumping procedures within some of the excavations should be anticipated. Surface water should also be controlled by grading the surface to drain away from excavations.

6.4 Reuse of Existing Materials

Most of the existing fill material had P200 contents greater than six percent, and therefore will not be suitable for use as Type II fill. These materials will however be suitable for use in deeper fill sections below the bottom of the structural section.

7.0 CLOSURE

The engineering recommendations presented in this report have been based on the pertinent information listed herein. Significant alteration of any design concepts could alter the foregoing engineering recommendations. We would, therefore, appreciate having the opportunity to review final design plans and evaluate any such design changes and, where necessary, present any required changes to our present recommendations. Additionally, because subsurface characteristics can change significantly within a given area and with the passing of time, the possibility exists that important subsurface conditions not disclosed by this field investigation may be discovered during construction. Should this situation occur, the influence of the new information on the present recommendations should be evaluated without delay. Also, we recommend that any excavations be inspected by a qualified geotechnical engineer or engineering geologist to evaluate the subsurface conditions encountered during construction and to recommend any changes, if needed, from the present recommendations.

R&M Consultants, Inc. performed this work in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No warranty, express or implied, beyond exercise of reasonable care and professional diligence, is made. This report is intended for use only in accordance with the purposes of study described within.

We appreciate the opportunity to perform this subsurface investigation. Should you require further information concerning the subsurface investigation or this report, please contact us at your convenience.

Very truly yours,

R&M CONSULTANTS, INC.

STATE OF ALASKA
49TH
Robert M. Pintner
CE 8525
2/1/06
REGISTERED PROFESSIONAL ENGINEER

Charles H. Riddle, C.P.G.
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RMP:CHR:slv

8.0 REFERENCES

American Society for Testing and Materials (ASTM), “Annual Book of ASTM Standards”, Vols. 04.08, and 04.09, Soil and Rock, 2006.

Code of Federal Regulation (CFR), “Occupational Safety and Health Administration Excavation Standard”, 29 CFR Part 1926, Effective 1/2/90.

Department of the Army, U.S. Army Corps of Engineers (USACE), “Chapter 18 – Seasonal Frost Conditions”, IN Pavement Design for Roads, Streets, Walks, and Open Storage Areas, TM 5-822-5, June, 1992.

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Updike, R.G., and Ulery, C.A., “Engineering Geologic Map of Southwest Anchorage, Alaska”, Alaska Geological & Geophysical Surveys Professional Report 89, Fairbanks, AK, 1986.

Wesson, et al., “Probabilistic Seismic Hazard Maps of Alaska”, U.S.G.S. Open File Report 99-36, 1999.

TABLE 1

CONVERSION FACTORS FOR SI UNITS

CONVERSION TO THE SI INTERNATIONAL SYSTEM OF UNITS		
To Convert From	**To**	**Multiply By**
Station	Meter (m)	30.48
Mile	Kilometer (km)	1.609344
Mile	Meter (m)	1,609.344
Foot	Meter (m)	0.3048
Foot	Centimeter (cm)	30.48
Inch	Centimeter (cm)	2.54
Square Foot	Square Meter (m^2)	0.09290304
Square Yard	Square Meter (m^2)	0.8361274
Acre	Square Meter (m^2)	4,046.873
Cubic Foot	Cubic Meter (m^3)	0.02831685
Cubic Yard	Cubic Meter (m^3)	0.7645549
Gallon (U.S. Liquid)	Cubic Meter (m^3)	0.003785412
M.Gal.	Cubic Meter (m^3)	3.785412
Pound-Mass (lbf)	Kilogram (kg)	0.4535924
Ton (short)	Kilogram (kg)	907.1847
Pound-Force (lbf)	Newton (N)	4.448222
Footcandle	Lux (lx)	10.76391
Degree Fahrenheit (°F)	Degree Celsius (°C)	$t°_C=(t°_F-32)/1.8$

TABLE 2

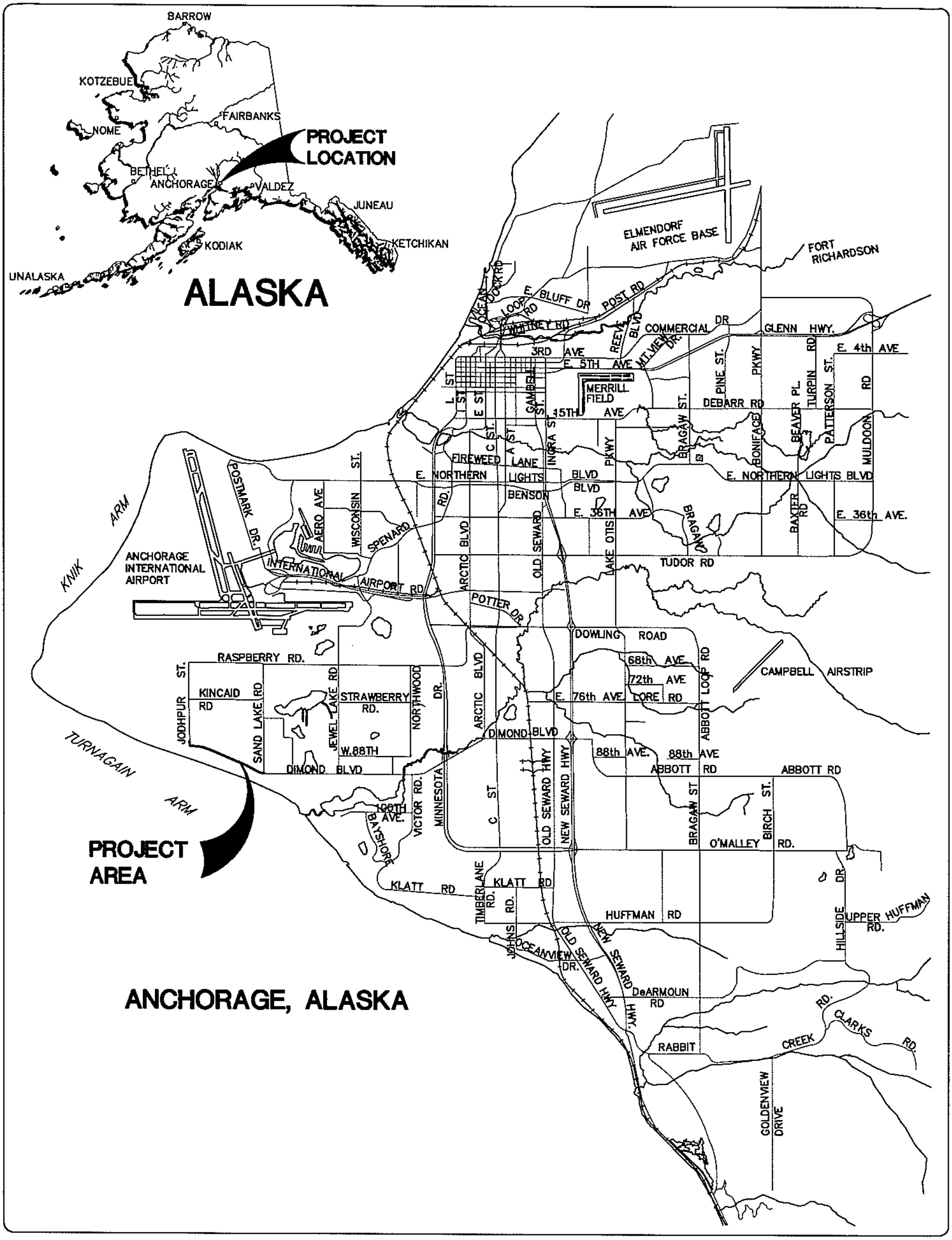
CLIMATOLOGICAL DATA
ANCHORAGE, ALASKA

LOCATION	**ANCHORAGE INT'L. AIRPORT**
Period of Record	1952-2003
Elevation (ft.)	114
Mean Annual Temperature (°F)	36.0
Mean Max. Daily Temperature (°F)	43.0
Mean Min. Daily Temperature (°F)	29.1
Record High Temperature (°F)	85.0
Record Low Temperature (°F)	-34.0
Mean Annual Precipitation (in.)	15.7
Maximum Monthly Precipitation (in.)	9.8
Mean Annual Snowfall (in.)	68.9
Maximum Monthly Snowfall (in.)	51.2

From: Western Regional Climate Center (http://www.wrccdri.edu)

APPENDIX A

SITE MAPS



project\1307.01_Civil\VICMAP, 1=1, 02/17/06 at 16:28 by oep VIEW: LASER

DWN: O.E.P.
CKD: R.M.P.
DATE: JAN 2007
SCALE: N.T.S.

R&M
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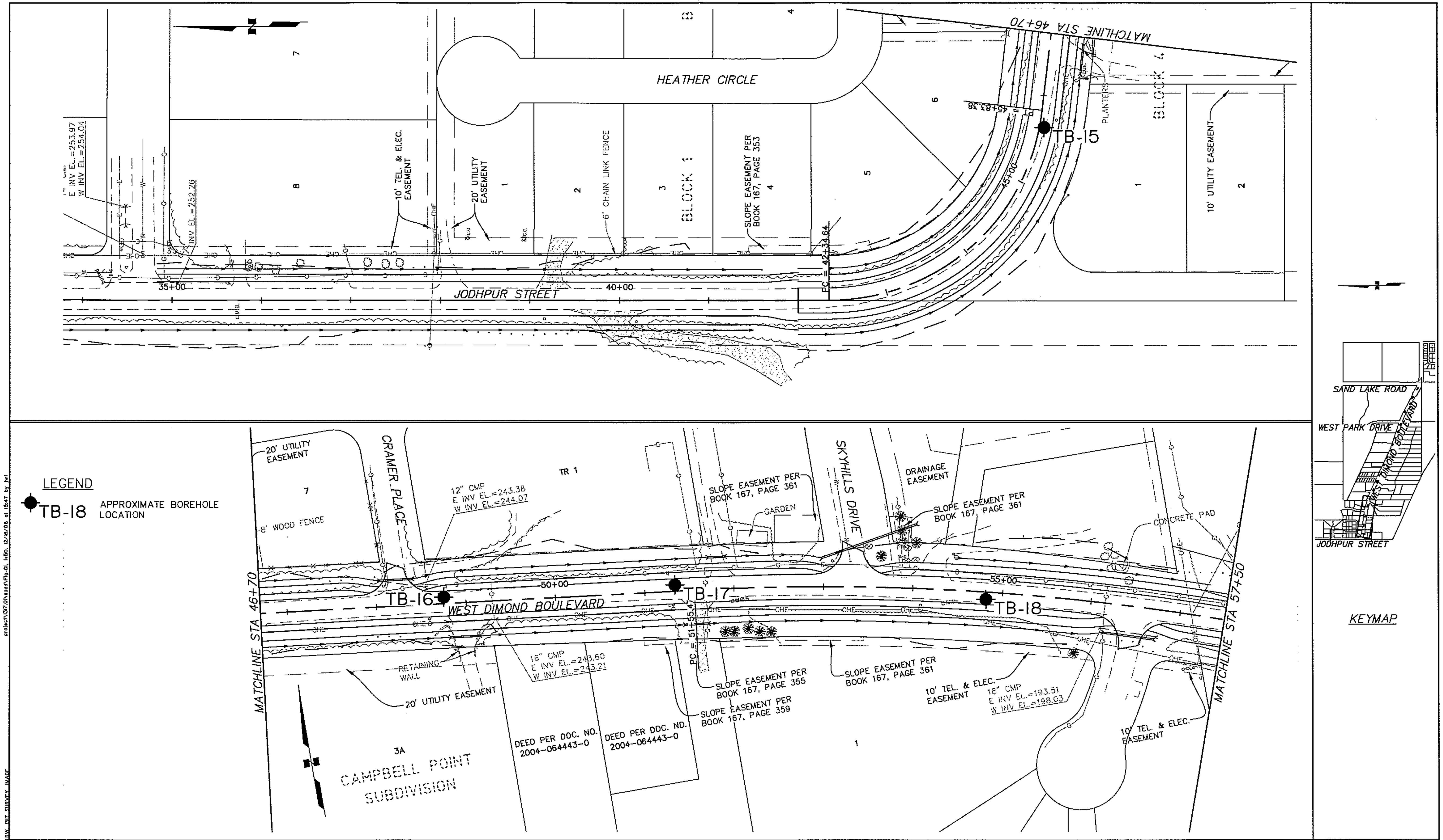
West Dimond Boulevard Upgrade
ANCHORAGE, ALASKA

VICINITY MAP

FB: N.A.
GRID: N.A.
PROJ.NO: 1317.01
DWG.NO: A-01



LEGEND

● TB-18 APPROXIMATE BOREHOLE LOCATION

project\1317.01\cadd\Fig-01, 1=50, 12/18/06 at 16:47 by [illegible]

VIEW: QPDL_H_L5000
XREF: 1317 BOOL 1317 DESIGN 1317 ROW 1317 SURVEY IMAGE

FIELD BOOKS	BM NO.	LOCATION	ELEV.	DATA	DRAWN BY	CHECKED BY	DATA	DRAWN BY	CHECKED BY	REV	DATE	DESCRIPTION	BY	REV	DATE	DESCRIPTION	BY
DESIGN				BASE			TELEPHONE										
				TOPOGRAPHY			ELECTRIC										
STAKING				PROFILE			CABLE TV										
				SANITARY SEWER			DESIGN										
ASBUILT				STORM SEWER			QUANTITIES										
CONTRACTOR	BASIS OF THIS DATUM			WATER			MUN. FINAL CHECK										
INSPECTOR				GAS													
CONSTRUCTION RECORD	VERTICAL DATUM			PLAN CHECK						REVISIONS							

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CONSULTANT

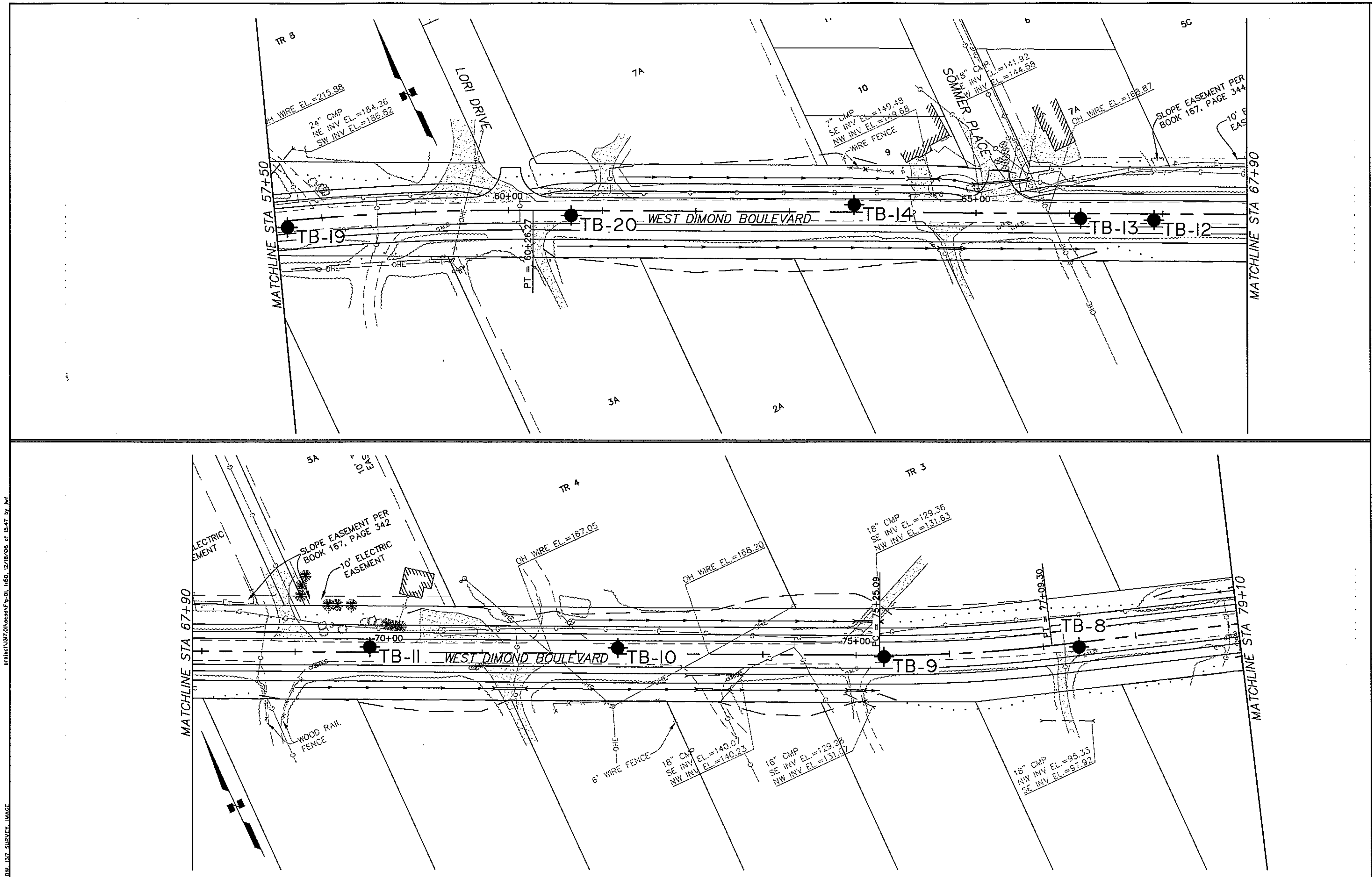
Todd C. Jacobson
CE 9132
SEAL

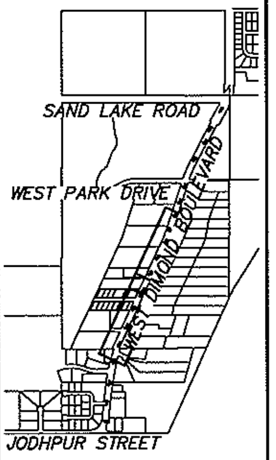
DEPARTMENT OF PUBLIC WORKS
OFFICE OF THE MUNICIPAL ENGINEER

05-04

WEST DIMOND BOULEVARD UPGRADE
JODHPUR STREET TO SAND LAKE ROAD
BOREHOLE LOCATION MAP

SCALE 1"=100'
DATE 1/23/07
GRID
PROJECT NO. 1317.01
DRAWING A-02





KEYMAP

FIELD BOOKS	BM NO.	LOCATION	ELEV.	DATA	DRAWN BY	CHECKED BY	DATA	DRAWN BY	CHECKED BY	REV	DATE	DESCRIPTION	BY	REV	DATE	DESCRIPTION	BY
DESIGN				BASE			TELEPHONE										
				TOPOGRAPHY			ELECTRIC										
STAKING				PROFILE			CABLE TV										
				SANITARY SEWER			DESIGN										
ASBUILT				STORM SEWER			QUANTITIES										
CONTRACTOR	BASIS OF THIS DATUM			WATER			MUN. FINAL CHECK										
INSPECTOR				GAS													
CONSTRUCTION RECORD	VERTICAL DATUM			PLAN CHECK						REVISIONS							

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PLANNERS
COMPUTER SERVICES
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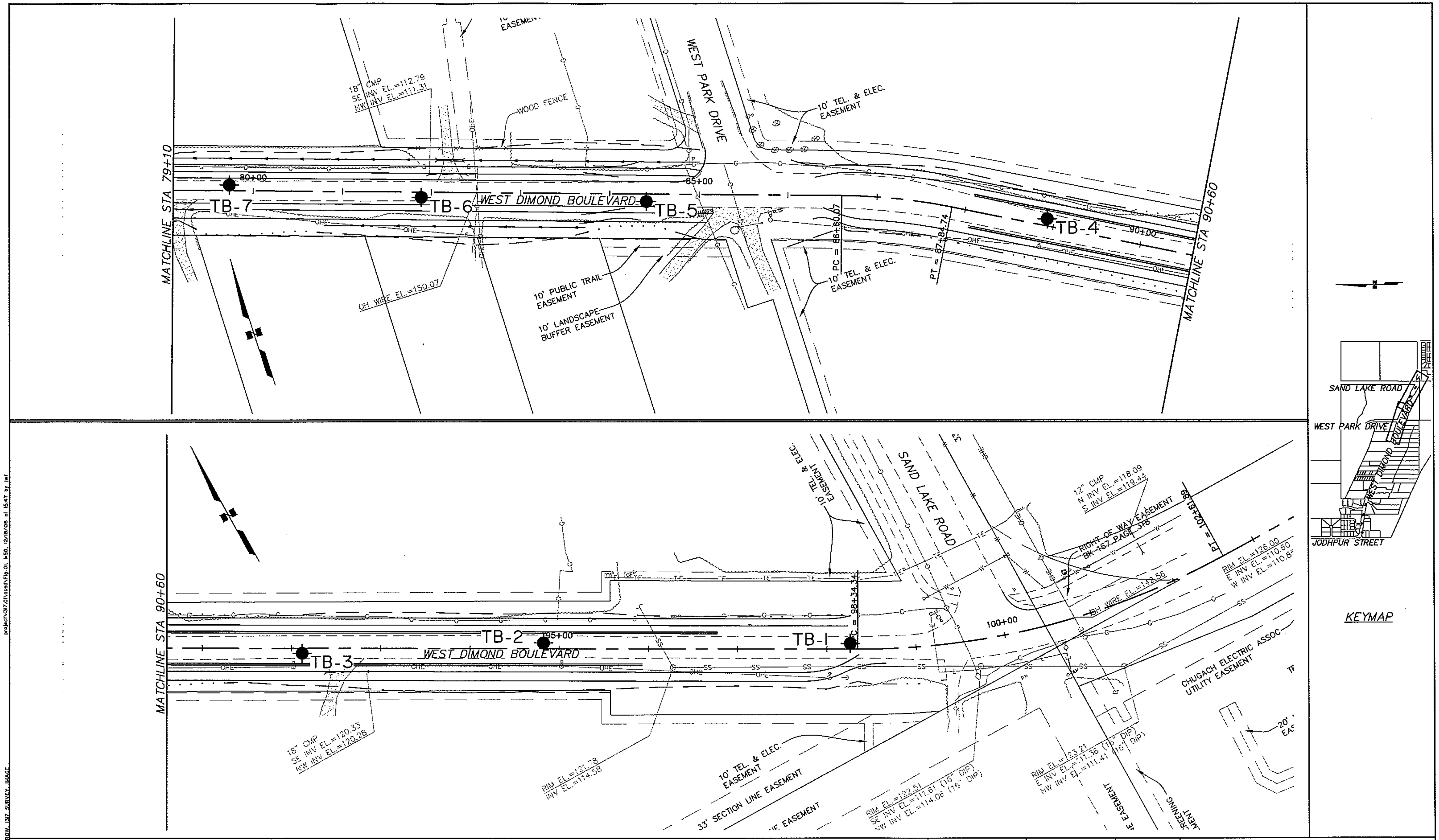
05-04
WEST DIMOND BOULEVARD UPGRADE
JODHPUR STREET TO SAND LAKE ROAD
BOREHOLE LOCATION MAP

SCALE 1"=100'
DATE 1/23/07
GRID
PROJECT NO. 1317.01
DRAWING A-03

project\1317.01\ecad\Fig-01, 1=50, 12/18/06 at 15:47 by jwl
VIEW: OPOL_M_L5000
XREF: 1317_ROW, 1317_DESIGN, 1317_ROW, 1317_SURVEY, IMAGE

project\1317.01\acad\Fig-01, 1=50, 12/19/06 at 15:47 by jwf



VIEW: OPOL_H_L5000
XREF: 1317 BDOL 1317 DESIGN 1317 ROW 1317 SURVEY IMAGE

FIELD BOOKS	BM NO.	LOCATION	ELEV.	DATA	DRAWN BY	CHECKED BY	DATA	DRAWN BY	CHECKED BY	REV	DATE	DESCRIPTION	BY	REV	DATE	DESCRIPTION	BY
DESIGN				BASE			TELEPHONE										
				TOPOGRAPHY			ELECTRIC										
STAKING				PROFILE			CABLE TV										
				SANITARY SEWER			DESIGN										
ASBUILT				STORM SEWER			QUANTITIES										
CONTRACTOR	BASIS OF THIS DATUM			WATER			MUN. FINAL CHECK										
INSPECTOR				GAS													
CONSTRUCTION RECORD	VERTICAL DATUM			PLAN CHECK						REVISIONS							

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05-04

WEST DIMOND BOULEVARD UPGRADE
JODHPUR STREET TO SAND LAKE ROAD

BOREHOLE LOCATION MAP

SCALE 1"=100'
DATE 1/23/07
GRID
PROJECT NO. 1317.01
DRAWNG A-04

APPENDIX B

LOGS OF TEST BORINGS

SOILS

CONSISTENCY AND SYMBOLS

CLASSIFICATION: Identification and classification of the soil is accomplished in accordance with the ASTM version of the Unified Soil Classification System. When laboratory testing data on material passing the 75-mm sieve is available Standard D 2487 (Classification of Soils for Engineering Purposes) is used and when laboratory data is not available D 2488 Visual-Manual Procedure) is used. This classification system identifies three major soil divisions: coarse-grained soils, fine-grained soils, and highly organic soils. These three divisions are further subdivided into a total of 15 basic soils groups. Based on the results of visual observations and prescribed laboratory tests, a soil is catalogued according to the basic soil groups, assigned a group symbol(s) and name, and thereby classified. Flow charts contained in the two standards can be used to assign the appropriate group symbol(s) and name.

SOIL DENSITY/CONSISTENCY - CRITERIA: Soil density/consistency as defined below and determined by normal field and laboratory methods applies only to non-frozen material. For these materials, the influence of such factors as soil structure, i.e. fissure systems shrinkage cracks, slickensides, etc., must be taken into consideration in making any correlation with the consistency values listed below. In permafrost zones, the consistency and strength of frozen soil may vary significantly and inexplicably with ice content, thermal regime and soil type.

COHESIONLESS

Description	N * (blows/FT.)	Relative Density
Loose	0 - 10	0 to 40%
Medium Dense	10 - 30	40 to 70%
Dense	30 - 60	70 to 90%
Very Dense	>60	90 to 100%

* Standard Penetration "N": Blows per 12 inches of a 140-pound manual hammer (lifted with rope & cathead) falling 30 inches on a 2-inch O.D. split-spoon sampler except where noted.

COHESIVE

Consistency	Shear Strength (TSF)	Unconfined Compressive Strength (TSF)
Very Soft	0.0 - 0.25	0.0 - 0.5
Soft	0.25 - 0.5	0.5 - 1.0
Firm	0.5 - 1.0	1.0 - 2.0
Stiff	1.0 - 2.0	2.0 - 4.0
Very Stiff	2.0 - 4.0	4.0 - 8.0
Hard	OVER 4.0	OVER 8.0

KEY TO TEST RESULTS

DD - Dry Density
LL - Liquid Limit
MC - Moisture Content
Org - Organic Content
PI - Plastic Index
PL - Plastic Limit

PP - Pocket Penetrometer
P200 - % Passing No. 200 Screen
P.02 - % Passing 0.02 mm
SG - Specific Gravity
TV - Torvane

DWN: K.J.P.
CKD: R.M.P.
DATE: FEB 06
SCALE: NONE

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GENERAL
NOTES

FB: N/A
GRID: N/A
PROJ.NO: GENERAL
DWG.NO: B-01

Z:\EARTHSC\GINT FORMS\B01&B02.GDW (DRAWING C - B-01 COE ASTM (ENGLISH)) 1/19/07 02:25 PM

STANDARD SYMBOLS

SYMBOL	NAME	PARTICLE SIZE	SYMBOL	NAME
☰	CLAY	< 0.002mm, Plastic	≈	ORGANICS
▨	SILT	0.002mm, - #200	■	ICE
░	SAND	#200, - #4	▨	ICE W/SOIL INCLUSIONS
⁘	GRAVEL	#4, - 3"	▨	ICE LENSE IN SILT
◯	COBBLES & BOULDERS	3" - 12" & > 12"	☰	ICE CRYSTALS IN CLAY

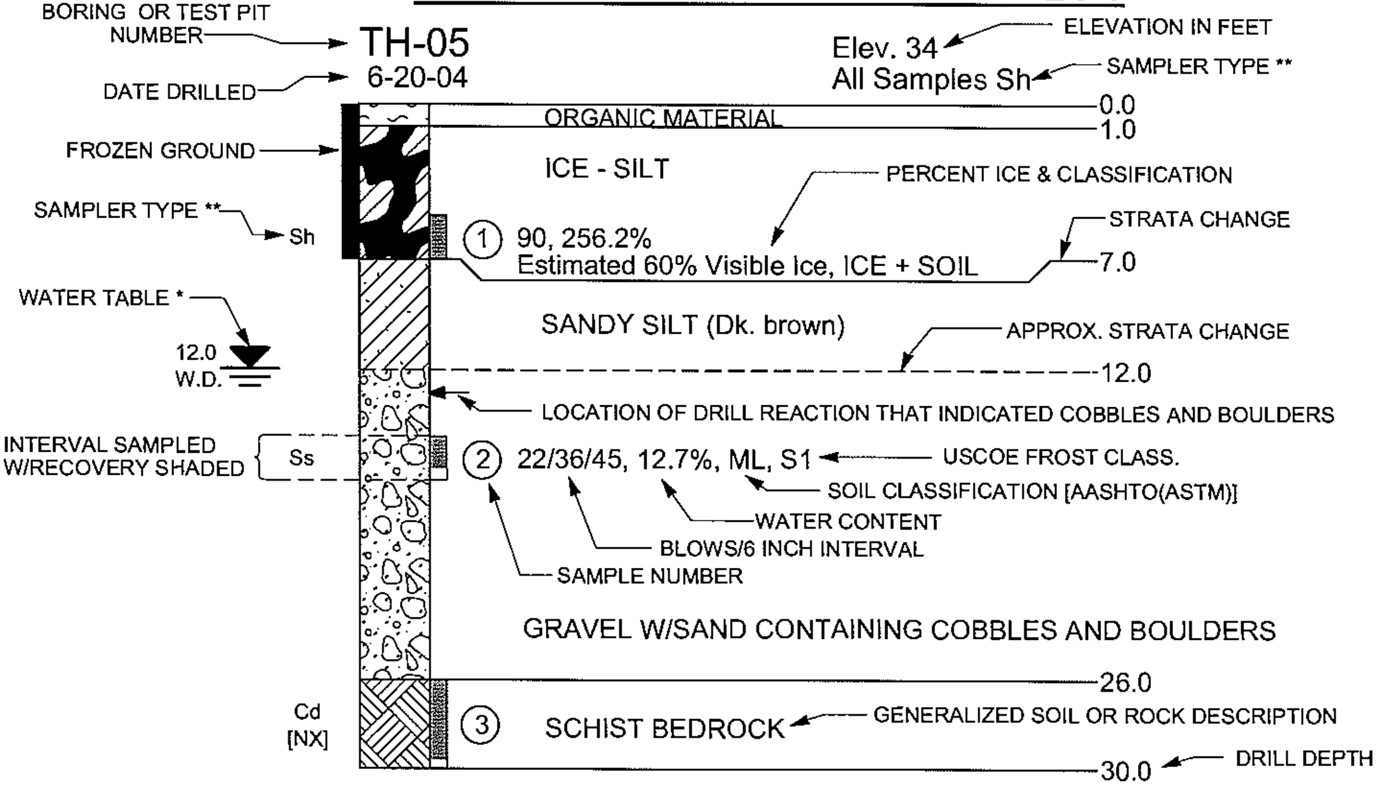
(The symbols shown above are frequently used in combinations, e. g. GRAVEL W/SILT AND SAND)

SAMPLER TYPE SYMBOLS

A	Auger Sample	Sh	2.5 In. Split Spoon w/340 lb. Manual Hammer	Sp	2.5 In. Split Spoon Pushed
C	Cuttings Sample	Sha	2.5 In. Split Spoon w/340 lb. Auto Hammer	Sz	1.4 In. Split Spoon w/340 lb. Hammer
Cd	Double Tube Core Barrel	Sl	2.5 In. Split Spoon w/140 lb. Hammer	Ts	Shelby Tube
Ct	Triple Tube Core Barrel	Ss	1.4 In. Split Spoon w/140 lb. Manual Hammer	Tm	Modified Shelby Tube
Cs	Auger Core Barrel	Ssa	1.4 In. Split Spoon w/140 lb. Auto Hammer	[x]	Sampler I. D. (Added to Symbol)
G	Grab Sample				

NOTE: Sampler types are either noted above the boring log or adjacent to it at the respective depth. An individual log may not utilize all of the items listed.

TYPICAL BORING AND TEST PIT LOG



* W.D. - WHILE DRILLING, A.B. - AFTER BORING, Ref. - SAMPLER REFUSAL

** - REFER TO SAMPLER SYMBOL (Ss, Sh, ETC.) FOR SAMPLER I.D. & HAMMER WEIGHT/TYPE

NOTE: Water levels shown on the boring logs are the levels measured in the boring at the times indicated.

DWN:	P.K.H.
CKD:	C.H.R.
DATE:	JUNE 04
SCALE:	NONE

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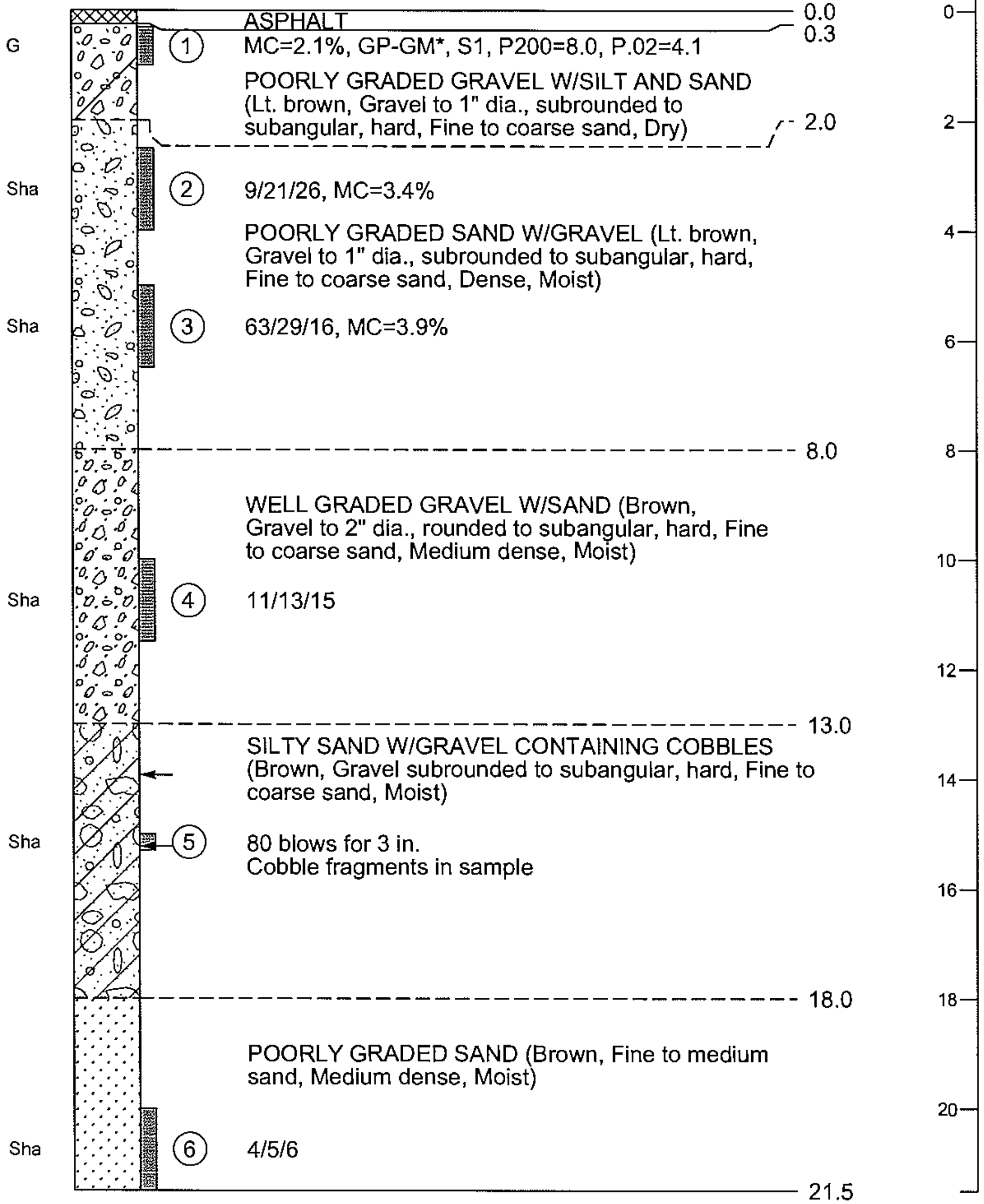
EXPLANATION OF SELECTED SYMBOLS

FB:	N/A
GRID:	N/A
PROJ.NO:	GENERAL
DWG.NO:	B-02

Z:\EARTHSCI\GINT FORMS\B01&B02.GDW (DRAWING T - B-02 COE (ENG.)) 1/19/07 02:25 PM

TB-01

N 6,781,829
E 339,369
7/17/06



0.0
ASPHALT
0.3

G ① MC=2.1%, GP-GM*, S1, P200=8.0, P.02=4.1

POORLY GRADED GRAVEL W/SILT AND SAND (Lt. brown, Gravel to 1" dia., subrounded to subangular, hard, Fine to coarse sand, Dry)

2.0

Sha ② 9/21/26, MC=3.4%

POORLY GRADED SAND W/GRAVEL (Lt. brown, Gravel to 1" dia., subrounded to subangular, hard, Fine to coarse sand, Dense, Moist)

Sha ③ 63/29/16, MC=3.9%

8.0

WELL GRADED GRAVEL W/SAND (Brown, Gravel to 2" dia., rounded to subangular, hard, Fine to coarse sand, Medium dense, Moist)

Sha ④ 11/13/15

13.0

SILTY SAND W/GRAVEL CONTAINING COBBLES (Brown, Gravel subrounded to subangular, hard, Fine to coarse sand, Moist)

Sha ⑤ 80 blows for 3 in.
Cobble fragments in sample

18.0

POORLY GRADED SAND (Brown, Fine to medium sand, Medium dense, Moist)

Sha ⑥ 4/5/6

21.5

* Estimated Classification
No groundwater was observed while drilling
Coordinates are provided in UTM Format, WGS84 Datum, Zone 6V

DWN:	A.T.B.
CKD:	C.H.R.
DATE:	OCT 06
SCALE:	1"=3'

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WEST DIMOND BLVD. UPGRADE
JODHPUR RD. TO SAND LAKE RD.

LOG OF TEST BORING
TB-01

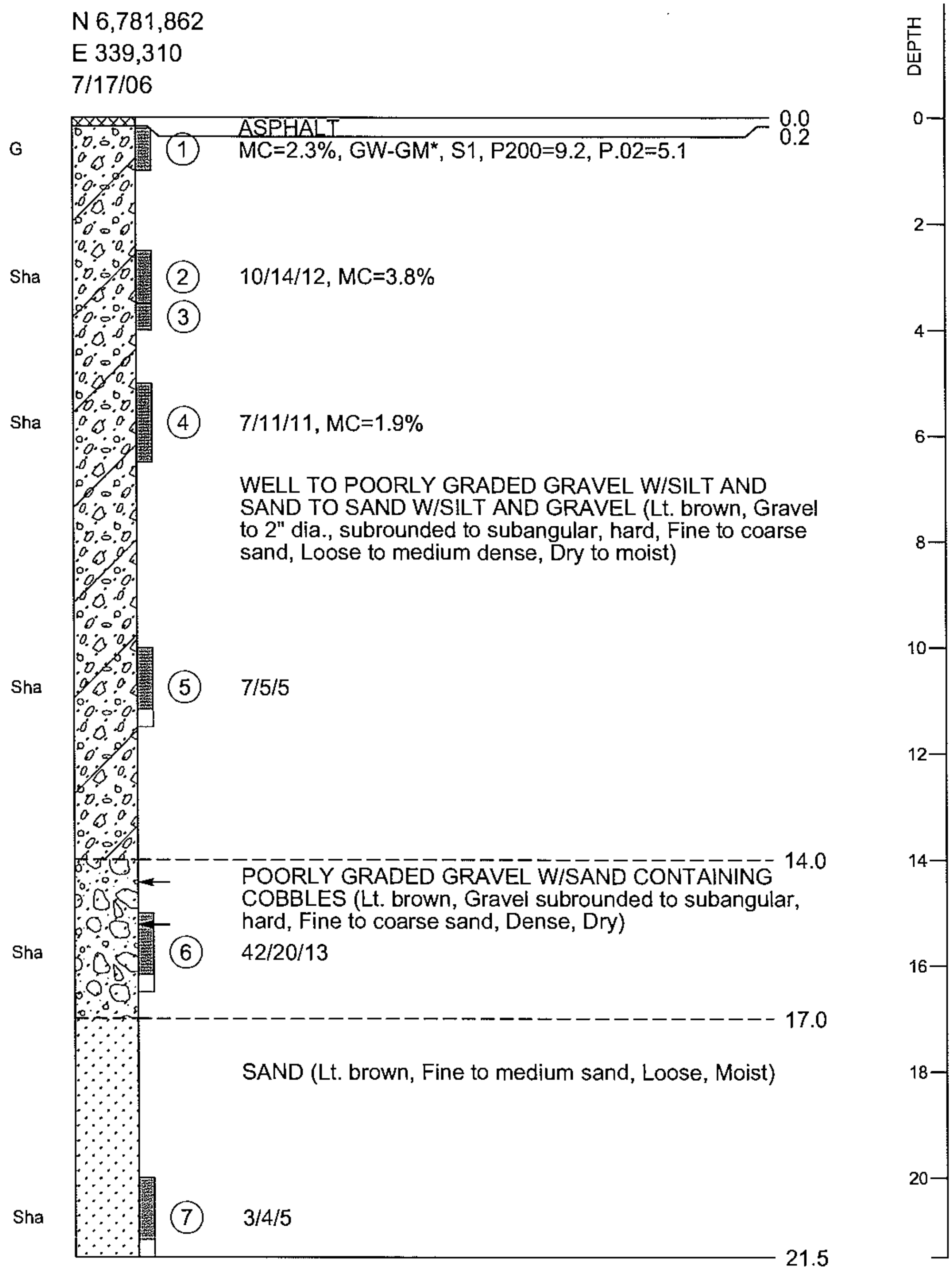
FB:	NA
GRID:	ANCHORAGE
PROJ.NO:	1317.01
DWG.NO:	B-03

Z:\PROJECT\1317.01\EARTH\LOGS\W DIMOND UPGRADE.GPJ

MASTER ONE COL/PAGE W DIMOND UPGRADE.GPJ MASTER2.GDT 10/30/06

TB-02

N 6,781,862
E 339,310
7/17/06



0.0–0.2 ASPHALT

① MC=2.3%, GW-GM*, S1, P200=9.2, P.02=5.1

② 10/14/12, MC=3.8%

③

④ 7/11/11, MC=1.9%

WELL TO POORLY GRADED GRAVEL W/SILT AND SAND TO SAND W/SILT AND GRAVEL (Lt. brown, Gravel to 2" dia., subrounded to subangular, hard, Fine to coarse sand, Loose to medium dense, Dry to moist)

⑤ 7/5/5

14.0 POORLY GRADED GRAVEL W/SAND CONTAINING COBBLES (Lt. brown, Gravel subrounded to subangular, hard, Fine to coarse sand, Dense, Dry)

⑥ 42/20/13

17.0 SAND (Lt. brown, Fine to medium sand, Loose, Moist)

⑦ 3/4/5

21.5

* Estimated Classification
No groundwater was observed while drilling
Coordinates are provided in UTM Format, WGS84 Datum, Zone 6V

Z:\PROJECT\1317.01\EARTH\LOGS\W DIMOND UPGRADE.GPJ

MASTER ONE COL/PAGE W DIMOND UPGRADE.GPJ MASTER2.GDT 10/30/06

DWN: A.T.B.
CKD: C.H.R.
DATE: OCT 06
SCALE: 1"=3'

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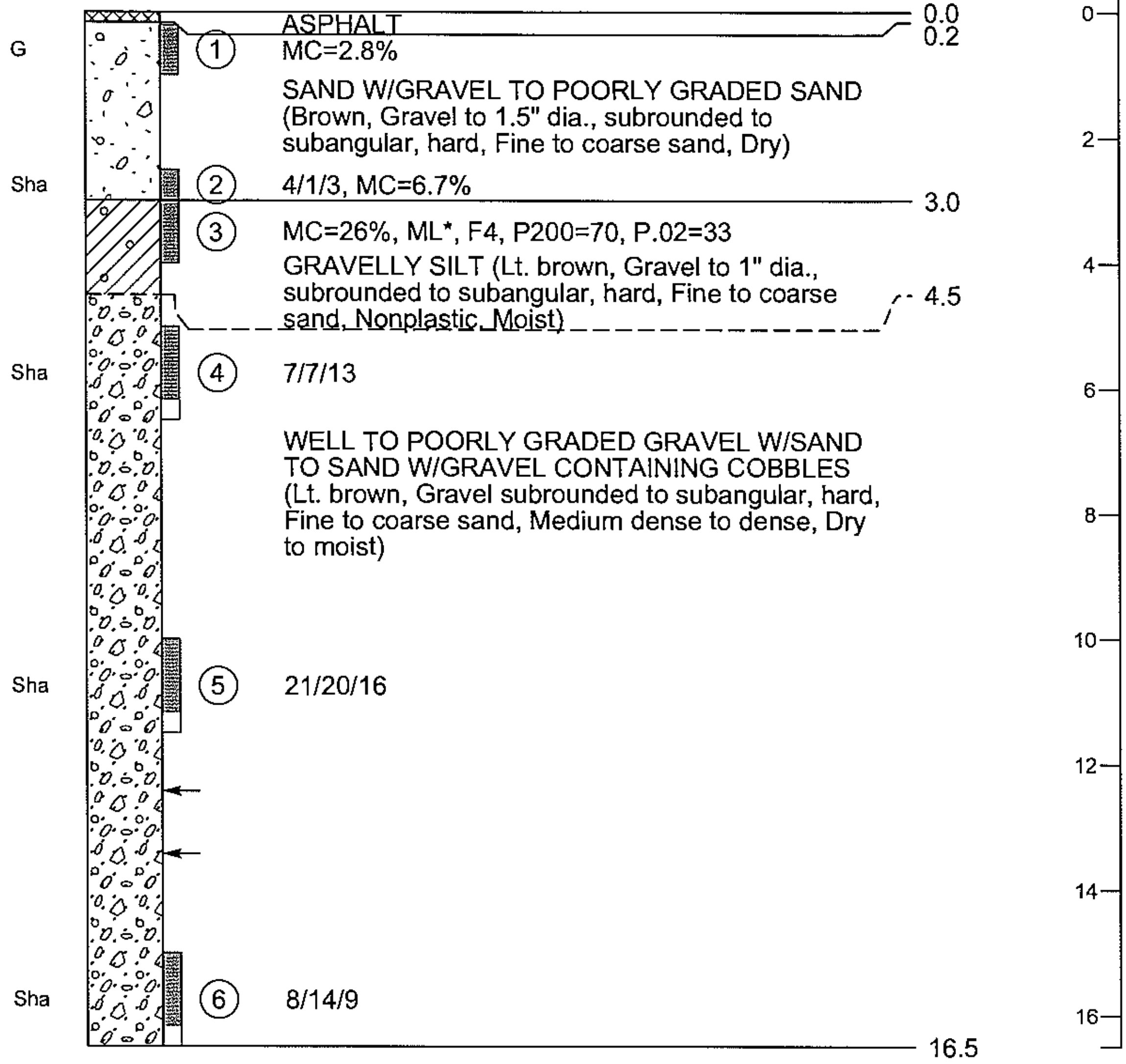
WEST DIMOND BLVD. UPGRADE
JODHPUR RD. TO SAND LAKE RD.
LOG OF TEST BORING
TB-02

FB: NA
GRID: ANCHORAGE
PROJ.NO: 1317.01
DWG.NO: B-04

TB-03

N 6,781,897
E 339,237
7/17/06



ASPHALT

① MC=2.8%

SAND W/GRAVEL TO POORLY GRADED SAND (Brown, Gravel to 1.5" dia., subrounded to subangular, hard, Fine to coarse sand, Dry)

② 4/1/3, MC=6.7%

③ MC=26%, ML*, F4, P200=70, P.02=33

GRAVELLY SILT (Lt. brown, Gravel to 1" dia., subrounded to subangular, hard, Fine to coarse sand, Nonplastic, Moist)

④ 7/7/13

WELL TO POORLY GRADED GRAVEL W/SAND TO SAND W/GRAVEL CONTAINING COBBLES (Lt. brown, Gravel subrounded to subangular, hard, Fine to coarse sand, Medium dense to dense, Dry to moist)

⑤ 21/20/16

⑥ 8/14/9

* Estimated Classification
No groundwater was observed while drilling
Coordinates are provided in UTM Format, WGS84 Datum, Zone 6V

Z:\PROJECT\1317.01\EARTH\LOGS\W DIMOND UPGRADE.GPJ

MASTER ONE COL/PAGE W DIMOND UPGRADE.GPJ MASTER2.GDT 10/30/06

DWN:	A.T.B.
CKD:	C.H.R.
DATE:	OCT 06
SCALE:	1"=3'

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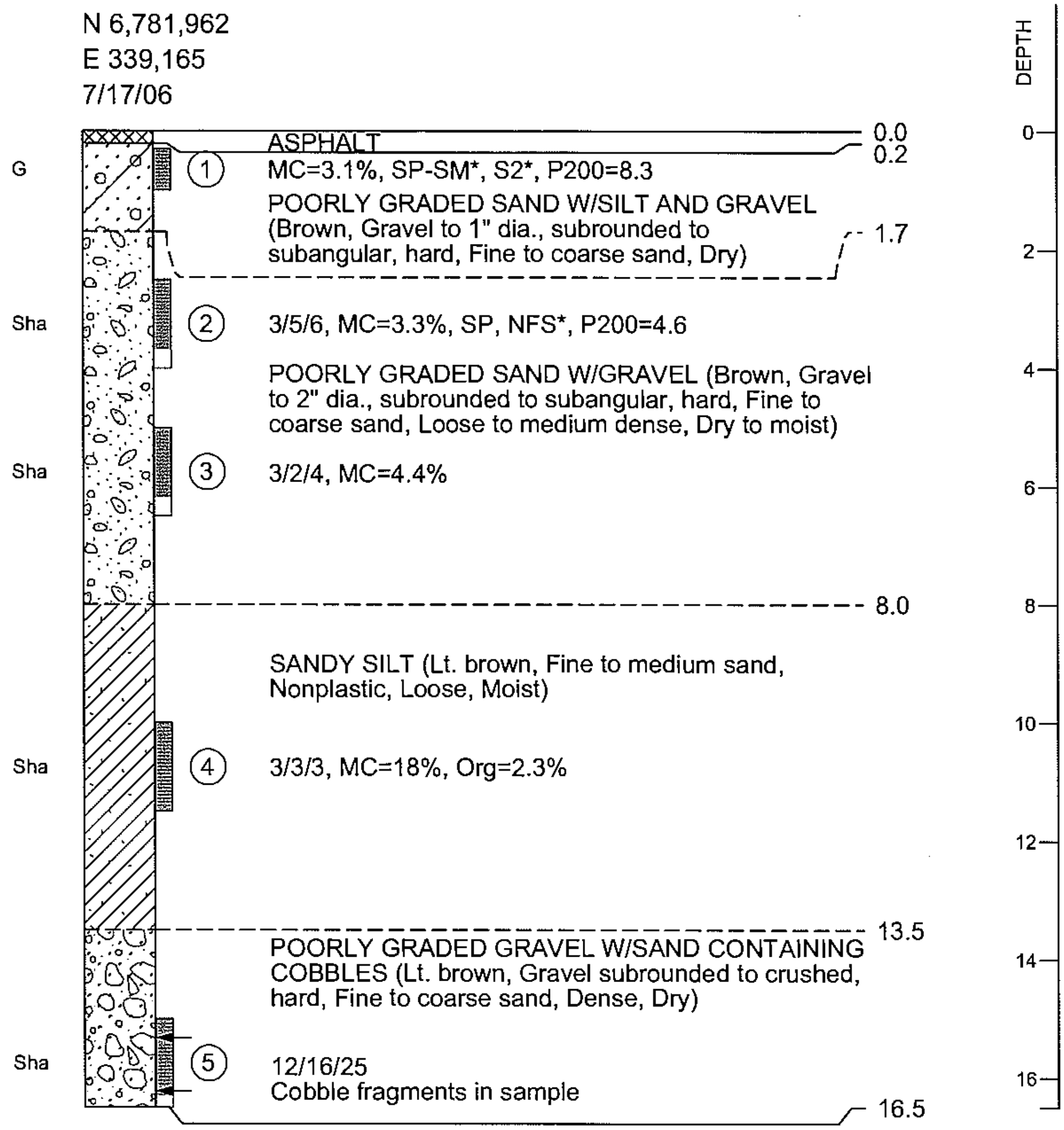
WEST DIMOND BLVD. UPGRADE
JODHPUR RD. TO SAND LAKE RD.

LOG OF TEST BORING
TB-03

FB:	NA
GRID:	ANCHORAGE
PROJ.NO:	1317.01
DWG.NO:	B-05

TB-04

N 6,781,962
E 339,165
7/17/06



ASPHALT

(1) MC=3.1%, SP-SM*, S2*, P200=8.3

POORLY GRADED SAND W/SILT AND GRAVEL (Brown, Gravel to 1" dia., subrounded to subangular, hard, Fine to coarse sand, Dry)

(2) 3/5/6, MC=3.3%, SP, NFS*, P200=4.6

POORLY GRADED SAND W/GRAVEL (Brown, Gravel to 2" dia., subrounded to subangular, hard, Fine to coarse sand, Loose to medium dense, Dry to moist)

(3) 3/2/4, MC=4.4%

SANDY SILT (Lt. brown, Fine to medium sand, Nonplastic, Loose, Moist)

(4) 3/3/3, MC=18%, Org=2.3%

POORLY GRADED GRAVEL W/SAND CONTAINING COBBLES (Lt. brown, Gravel subrounded to crushed, hard, Fine to coarse sand, Dense, Dry)

(5) 12/16/25
Cobble fragments in sample

* Estimated Classification
No groundwater was observed while drilling
Coordinates are provided in UTM Format, WGS84 Datum, Zone 6V

Z:\PROJECT\1317.01\EARTH\LOGS\W DIMOND UPGRADE.GPJ

MASTER ONE COL/PAGE W DIMOND UPGRADE.GPJ MASTER2.GDT 10/30/06

DWN:	A.T.B.
CKD:	C.H.R.
DATE:	OCT 06
SCALE:	1"=3'

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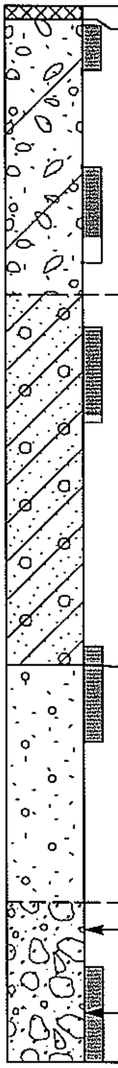
WEST DIMOND BLVD. UPGRADE
JODHPUR RD. TO SAND LAKE RD.
LOG OF TEST BORING
TB-04

FB:	NA
GRID:	ANCHORAGE
PROJ.NO:	1317.01
DWG.NO:	B-06

TB-05

N 6,782,031
E 339,003
7/17/06



0.0 ASPHALT 0.2

G ① MC=5.9%, SP-SM*, S2*, P200=10

POORLY GRADED SAND W/SILT AND GRAVEL (Brown, Gravel to 1.5" dia., subrounded to subangular, hard, Fine to coarse sand, Medium dense, Moist)

Sha ② 8/8/7, MC=3.5%, SP-SM*, S2*, P200=7.7

4.5

Sha ③ 5/4/4, MC=8.3%, Org=1.8%

SILTY SAND W/GRAVEL (Brown, Gravel to 1.5" dia., subrounded to subangular, hard, Fine to coarse sand, Nonplastic, Loose to medium dense, Moist)

Sha ④ 6/6/8, MC=10%

10.3

⑤

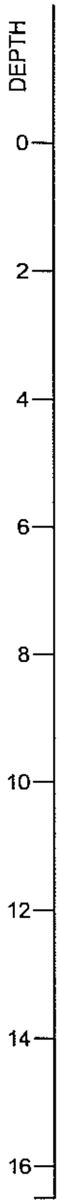
POORLY GRADED SAND W/GRAVEL (Brown-gray, Gravel to 1" dia., subrounded to subangular, hard, Fine to coarse sand, Medium dense, Moist)

14.0

POORLY GRADED GRAVEL W/SAND CONTAINING COBBLES (Brown, Gravel subrounded to crushed, hard, Fine to coarse sand, Medium dense, Moist)

Sha ⑥ 10/9/8

16.5



* Estimated Classification
No groundwater was observed while drilling
Coordinates are provided in UTM Format, WGS84 Datum, Zone 6V

DWN:	A.T.B.
CKD:	C.H.R.
DATE:	OCT 06
SCALE:	1"=3'

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WEST DIMOND BLVD. UPGRADE
JODHPUR RD. TO SAND LAKE RD.
LOG OF TEST BORING
TB-05

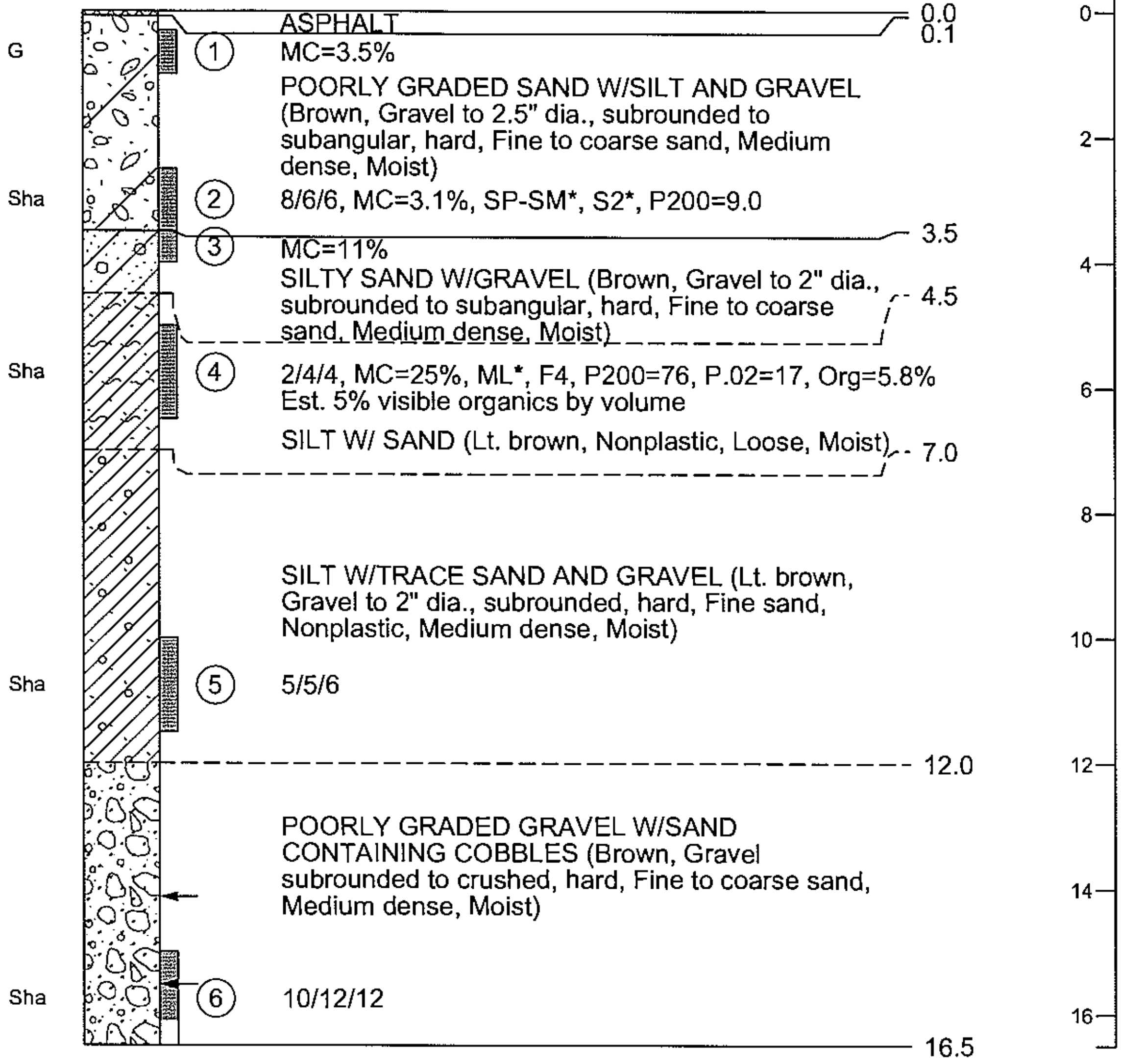
FB:	NA
GRID:	ANCHORAGE
PROJ.NO:	1317.01
DWG.NO:	B-07

Z:\PROJECT\1317.01\EARTH\LOGS\W DIMOND UPGRADE.GPJ

MASTER ONE COL/PAGE W DIMOND UPGRADE.GPJ MASTER2.GDT 10/30/06

TB-06

N 6,782,035
E 338,929
7/17/06



ASPHALT

① MC=3.5%

POORLY GRADED SAND W/SILT AND GRAVEL (Brown, Gravel to 2.5" dia., subrounded to subangular, hard, Fine to coarse sand, Medium dense, Moist)

② 8/6/6, MC=3.1%, SP-SM*, S2*, P200=9.0

③ MC=11%

SILTY SAND W/GRAVEL (Brown, Gravel to 2" dia., subrounded to subangular, hard, Fine to coarse sand, Medium dense, Moist)

④ 2/4/4, MC=25%, ML*, F4, P200=76, P.02=17, Org=5.8%
Est. 5% visible organics by volume

SILT W/ SAND (Lt. brown, Nonplastic, Loose, Moist)

SILT W/TRACE SAND AND GRAVEL (Lt. brown, Gravel to 2" dia., subrounded, hard, Fine sand, Nonplastic, Medium dense, Moist)

⑤ 5/5/6

POORLY GRADED GRAVEL W/SAND CONTAINING COBBLES (Brown, Gravel subrounded to crushed, hard, Fine to coarse sand, Medium dense, Moist)

⑥ 10/12/12

* Estimated Classification
No groundwater was observed while drilling
Coordinates are provided in UTM Format, WGS84 Datum, Zone 6V

Z:\PROJECT\1317.01\EARTH\LOGS\W DIMOND UPGRADE.GPJ

MASTER ONE COL/PAGE W DIMOND UPGRADE.GPJ MASTER2.GDT 10/30/06

DWN:	A.T.B.
CKD:	C.H.R.
DATE:	OCT 06
SCALE:	1"=3'

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CONSTRUCTION SERVICES
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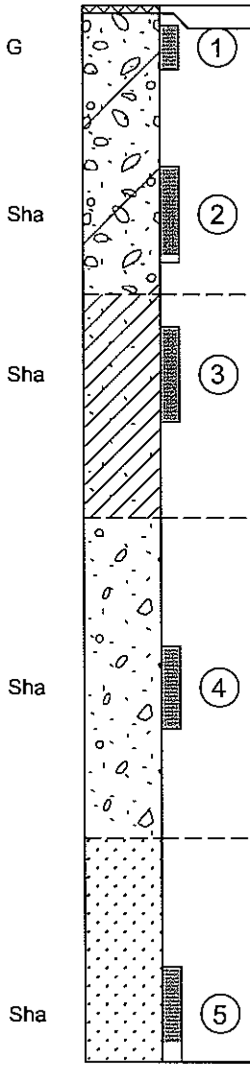
WEST DIMOND BLVD. UPGRADE
JODHPUR RD. TO SAND LAKE RD.
LOG OF TEST BORING
TB-06

FB:	NA
GRID:	ANCHORAGE
PROJ.NO:	1317.01
DWG.NO:	B-08

TB-07

N 6,782,067
E 338,900
7/17/06



0.0
ASPHALT
0.1

① MC=3.4%

POORLY GRADED SAND W/SILT AND GRAVEL (Dk. brown, Gravel to 1.5" dia., subrounded to subangular, hard, Fine to coarse sand, Medium dense, Moist)

② 8/11/10, MC=3.6%, SP-SM*, S2*, P200=7.2

4.5

③ 4/8/6, MC=17%, ML*, F4, P200=69, P.02=18, Org=2.6%

SANDY SILT (Lt. brown w/ some oxidation staining, Nonplastic, Medium dense, Moist)

8.0

POORLY GRADED SAND W/GRAVEL (Brown, Gravel to 1" dia., subrounded to subangular, hard, Fine to coarse sand, Medium dense, Moist)

④ 5/7/10, MC=4.6%

13.0

POORLY GRADED SAND (Brown-gray, Fine to medium sand, Medium dense, Moist)

⑤ 4/6/10

16.5

* Estimated Classification
No groundwater was observed while drilling
Coordinates are provided in UTM Format, WGS84 Datum, Zone 6V

Z:\PROJECT\1317.01\EARTH\LOGS\W DIMOND UPGRADE.GPJ

MASTER ONE COL/PAGE W DIMOND UPGRADE.GPJ MASTER2.GDT 10/30/06

DWN: A.T.B.
CKD: C.H.R.
DATE: OCT 06
SCALE: 1"=3'

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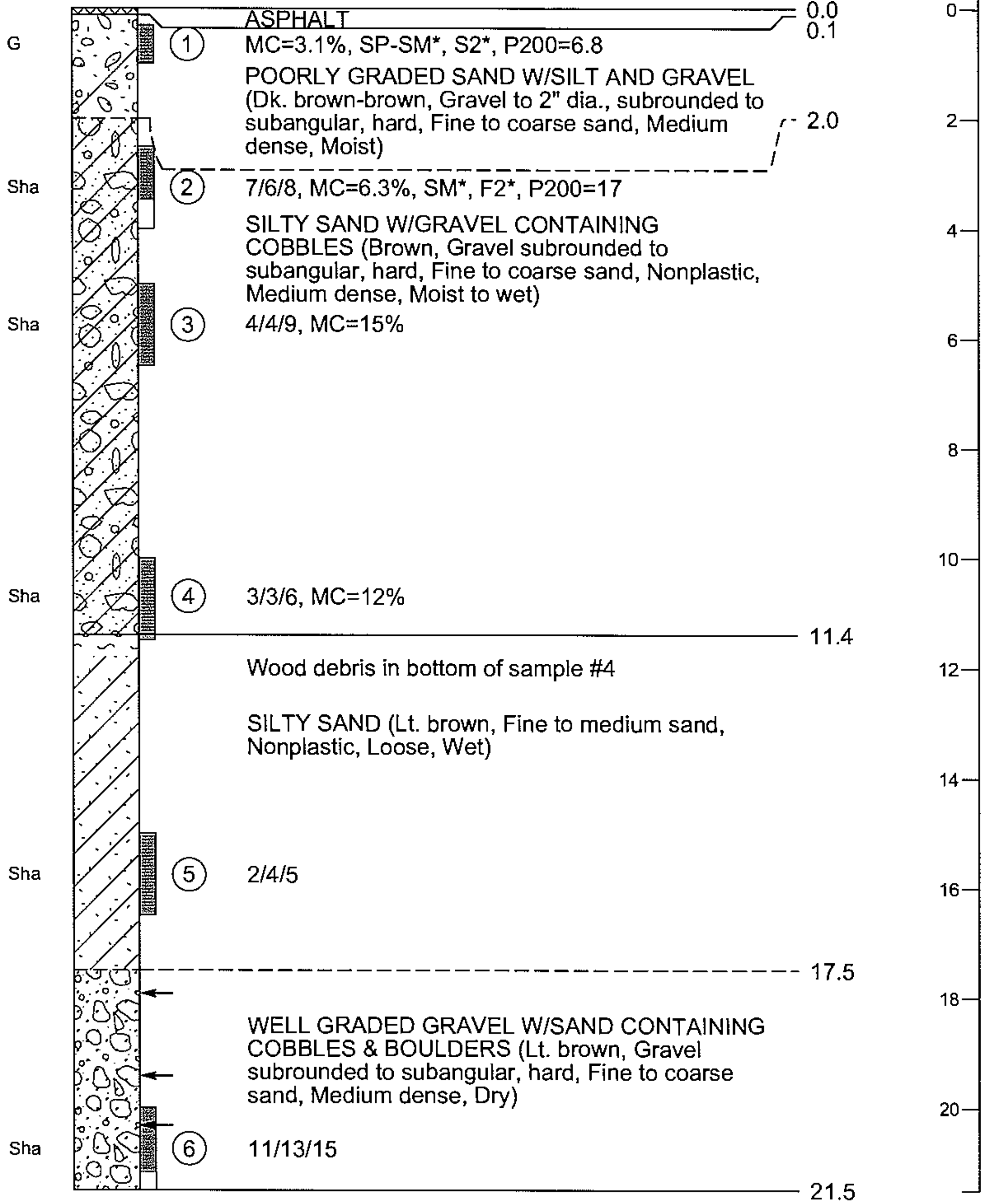
CONSTRUCTION SERVICES
9101 Vanguard Drive, Anchorage, Alaska 99507 (907) 522-1707

WEST DIMOND BLVD. UPGRADE
JODHPUR RD. TO SAND LAKE RD.
LOG OF TEST BORING
TB-07

FB: NA
GRID: ANCHORAGE
PROJ.NO: 1317.01
DWG.NO: B-09

TB-08

N 6,782,070
E 338,840
7/18/06



ASPHALT

① MC=3.1%, SP-SM*, S2*, P200=6.8

POORLY GRADED SAND W/SILT AND GRAVEL (Dk. brown-brown, Gravel to 2" dia., subrounded to subangular, hard, Fine to coarse sand, Medium dense, Moist)

② 7/6/8, MC=6.3%, SM*, F2*, P200=17

SILTY SAND W/GRAVEL CONTAINING COBBLES (Brown, Gravel subrounded to subangular, hard, Fine to coarse sand, Nonplastic, Medium dense, Moist to wet)

③ 4/4/9, MC=15%

④ 3/3/6, MC=12%

Wood debris in bottom of sample #4

SILTY SAND (Lt. brown, Fine to medium sand, Nonplastic, Loose, Wet)

⑤ 2/4/5

WELL GRADED GRAVEL W/SAND CONTAINING COBBLES & BOULDERS (Lt. brown, Gravel subrounded to subangular, hard, Fine to coarse sand, Medium dense, Dry)

⑥ 11/13/15

* Estimated Classification
No groundwater was observed while drilling
Coordinates are provided in UTM Format, WGS84 Datum, Zone 6V

DWN:	A.T.B.
CKD:	C.H.R.
DATE:	OCT 06
SCALE:	1"=3'

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WEST DIMOND BLVD. UPGRADE
JODHPUR RD. TO SAND LAKE RD.
LOG OF TEST BORING
TB-08

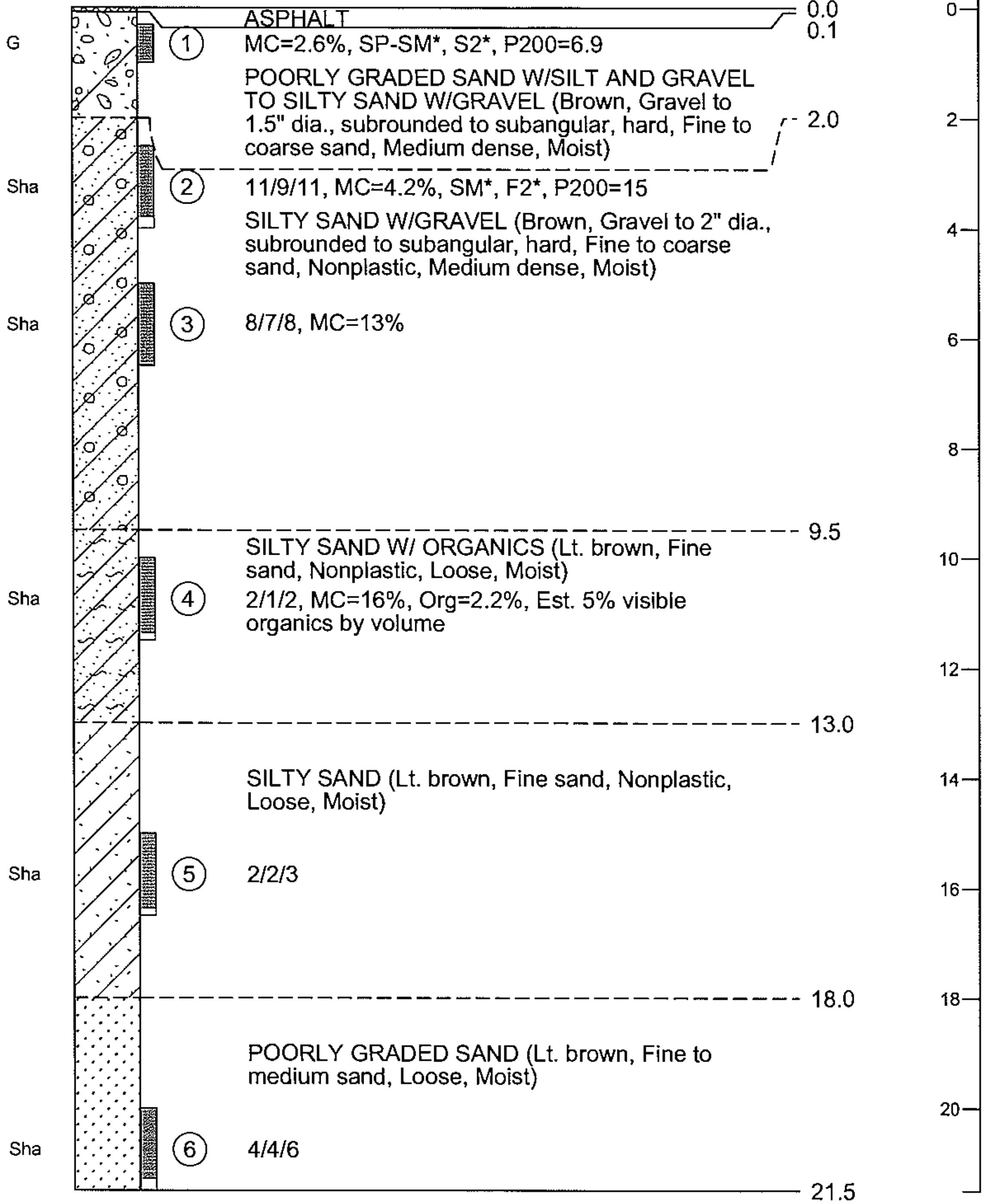
FB:	NA
GRID:	ANCHORAGE
PROJ.NO:	1317.01
DWG.NO:	B-10

Z:\PROJECT\1317.01\EARTH\LOGS\W DIMOND UPGRADE.GPJ

MASTER ONE COLPAGE W DIMOND UPGRADE.GPJ MASTER2.GDT 11/1/06

TB-09

N 6,782,104
E 338,782
7/18/06



0.0

ASPHALT

0.1

① MC=2.6%, SP-SM*, S2*, P200=6.9

POORLY GRADED SAND W/SILT AND GRAVEL TO SILTY SAND W/GRAVEL (Brown, Gravel to 1.5" dia., subrounded to subangular, hard, Fine to coarse sand, Medium dense, Moist)

2.0

② 11/9/11, MC=4.2%, SM*, F2*, P200=15

SILTY SAND W/GRAVEL (Brown, Gravel to 2" dia., subrounded to subangular, hard, Fine to coarse sand, Nonplastic, Medium dense, Moist)

③ 8/7/8, MC=13%

9.5

SILTY SAND W/ ORGANICS (Lt. brown, Fine sand, Nonplastic, Loose, Moist)

④ 2/1/2, MC=16%, Org=2.2%, Est. 5% visible organics by volume

13.0

SILTY SAND (Lt. brown, Fine sand, Nonplastic, Loose, Moist)

⑤ 2/2/3

18.0

POORLY GRADED SAND (Lt. brown, Fine to medium sand, Loose, Moist)

⑥ 4/4/6

21.5

* Estimated Classification
No groundwater was observed while drilling
Coordinates are provided in UTM Format, WGS84 Datum, Zone 6V

Z:\PROJECT\1317.01\EARTH\LOGS\W DIMOND UPGRADE.GPJ

MASTER ONE COL/PAGE W DIMOND UPGRADE.GPJ MASTER2.GDT 11/1/06

DWN:	A.T.B.
CKD:	C.H.R.
DATE:	OCT 06
SCALE:	1"=3'

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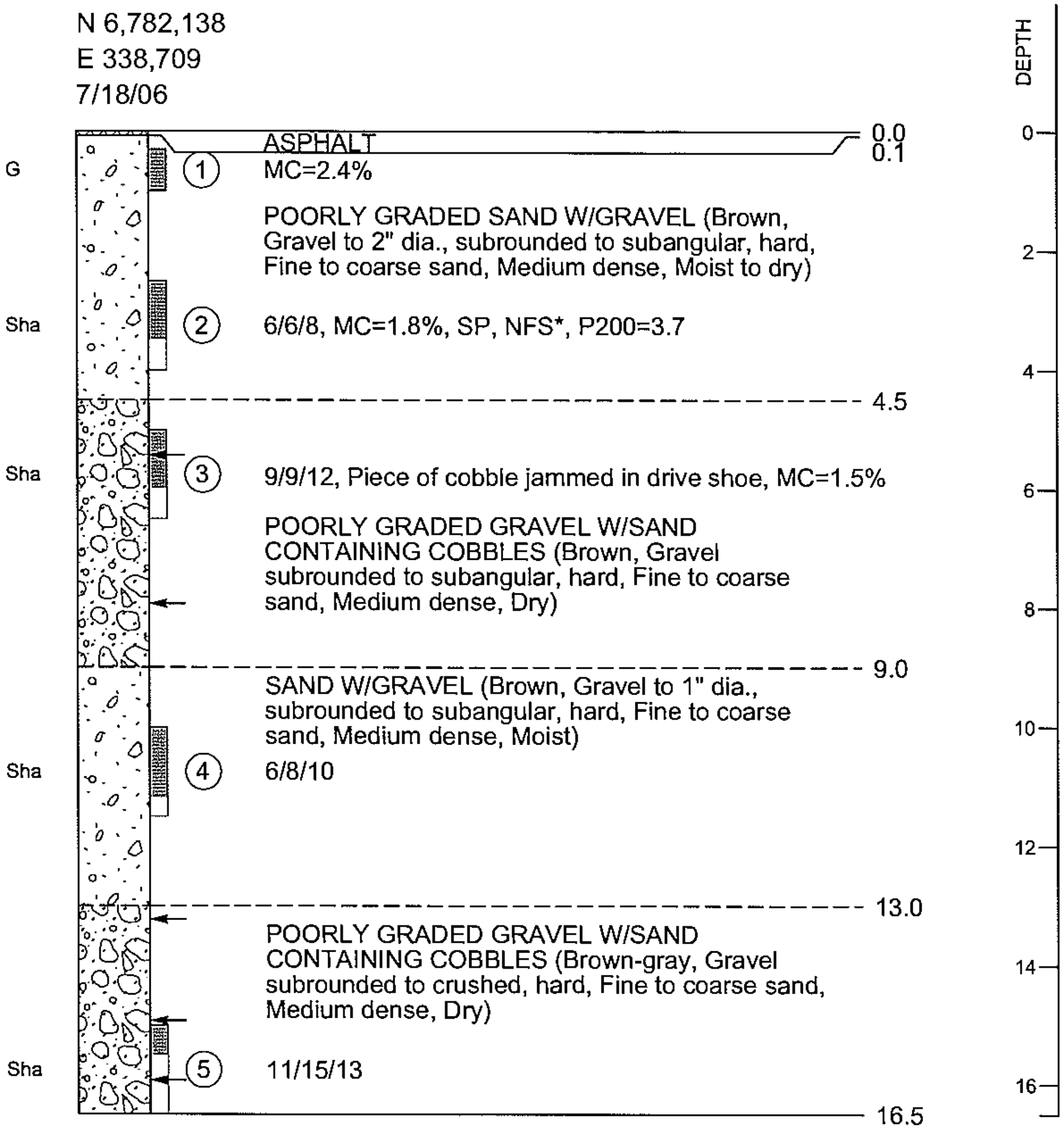
WEST DIMOND BLVD. UPGRADE
JODHPUR RD. TO SAND LAKE RD.
LOG OF TEST BORING
TB-09

FB:	NA
GRID:	ANCHORAGE
PROJ.NO:	1317.01
DWG.NO:	B-11

TB-10

N 6,782,138
E 338,709
7/18/06



0.0

ASPHALT

0.1

① MC=2.4%

POORLY GRADED SAND W/GRAVEL (Brown, Gravel to 2" dia., subrounded to subangular, hard, Fine to coarse sand, Medium dense, Moist to dry)

② 6/6/8, MC=1.8%, SP, NFS*, P200=3.7

4.5

③ 9/9/12, Piece of cobble jammed in drive shoe, MC=1.5%

POORLY GRADED GRAVEL W/SAND CONTAINING COBBLES (Brown, Gravel subrounded to subangular, hard, Fine to coarse sand, Medium dense, Dry)

9.0

SAND W/GRAVEL (Brown, Gravel to 1" dia., subrounded to subangular, hard, Fine to coarse sand, Medium dense, Moist)

④ 6/8/10

13.0

POORLY GRADED GRAVEL W/SAND CONTAINING COBBLES (Brown-gray, Gravel subrounded to crushed, hard, Fine to coarse sand, Medium dense, Dry)

⑤ 11/15/13

16.5

* Estimated Classification
No groundwater was observed while drilling
Coordinates are provided in UTM Format, WGS84 Datum, Zone 6V

Z:\PROJECT\1317.01\EARTH\LOGS\W DIMOND UPGRADE.GPJ

MASTER ONE COL/PAGE W DIMOND UPGRADE.GPJ MASTER2.GDT 10/30/06

DWN:	A.T.B.
CKD:	C.H.R.
DATE:	OCT 06
SCALE:	1"=3'

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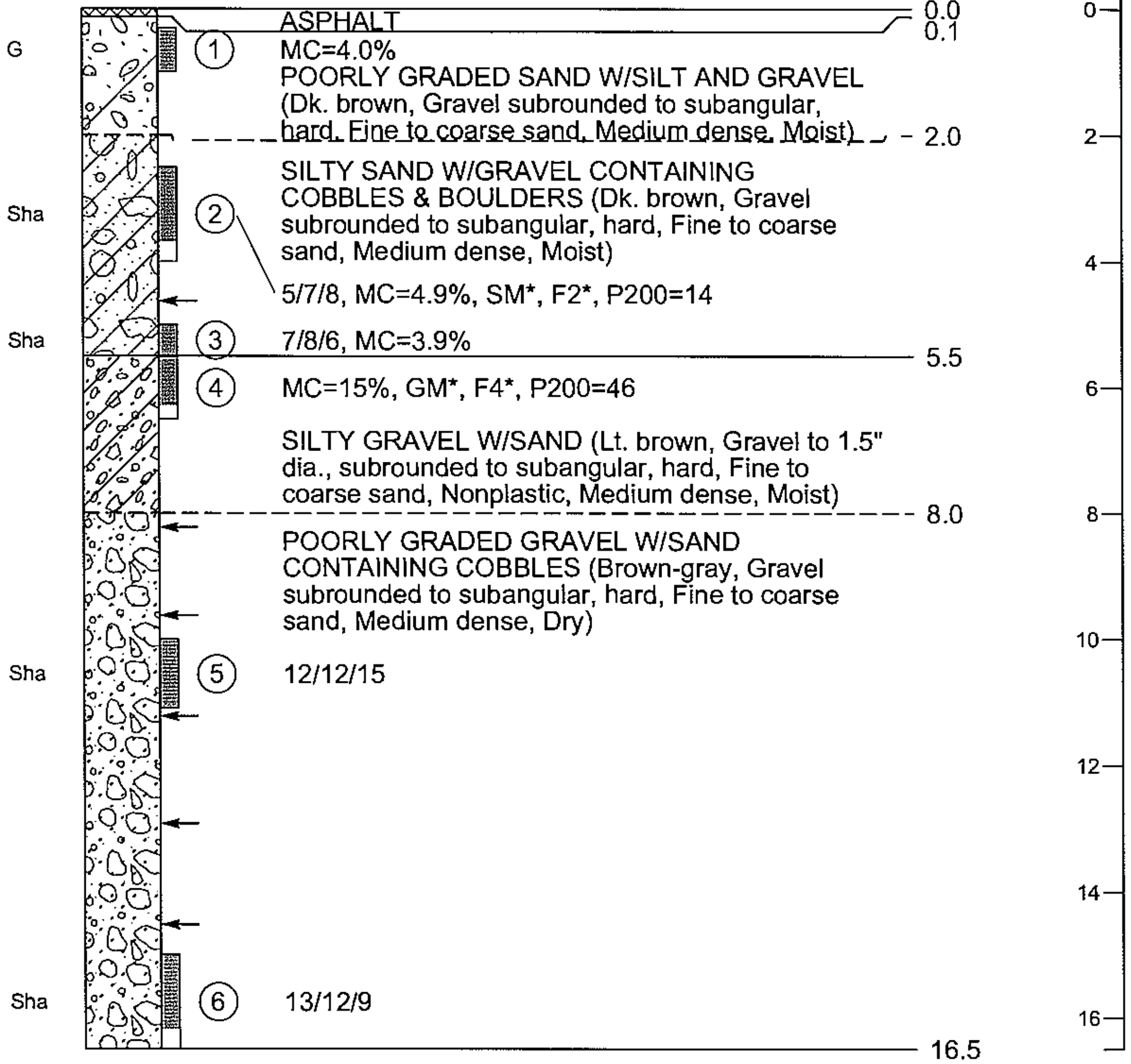
WEST DIMOND BLVD. UPGRADE
JODHPUR RD. TO SAND LAKE RD.

LOG OF TEST BORING
TB-10

FB:	NA
GRID:	ANCHORAGE
PROJ.NO:	1317.01
DWG.NO:	B-12

TB-11

N 6,782,172
E 338,635
7/18/06



ASPHALT

MC=4.0%
POORLY GRADED SAND W/SILT AND GRAVEL (Dk. brown, Gravel subrounded to subangular, hard. Fine to coarse sand, Medium dense, Moist)

SILTY SAND W/GRAVEL CONTAINING COBBLES & BOULDERS (Dk. brown, Gravel subrounded to subangular, hard, Fine to coarse sand, Medium dense, Moist)

5/7/8, MC=4.9%, SM*, F2*, P200=14

7/8/6, MC=3.9%

MC=15%, GM*, F4*, P200=46

SILTY GRAVEL W/SAND (Lt. brown, Gravel to 1.5" dia., subrounded to subangular, hard, Fine to coarse sand, Nonplastic, Medium dense, Moist)

POORLY GRADED GRAVEL W/SAND CONTAINING COBBLES (Brown-gray, Gravel subrounded to subangular, hard, Fine to coarse sand, Medium dense, Dry)

12/12/15

13/12/9

* Estimated Classification
No Groundwater was observed while drilling
Coordinates are provided in UTM Format, WGS84 Datum, Zone 6V

Z:\PROJECT\1317.01\EARTH\LOGS\W DIMOND UPGRADE.GPJ

MASTER ONE COL/PAGE W DIMOND UPGRADE.GPJ MASTER2.GDT 1/17/07

DWN:	A.T.B.
CKD:	C.H.R.
DATE:	OCT 06
SCALE:	1"=3'

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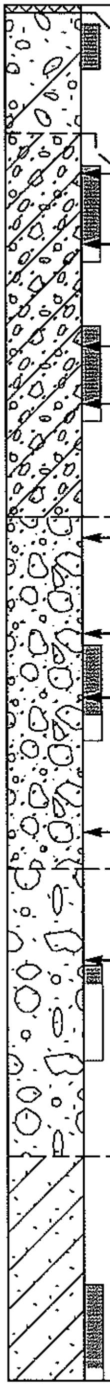
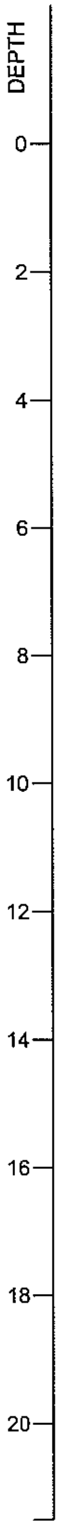
WEST DIMOND BLVD. UPGRADE
JODHPUR RD. TO SAND LAKE RD.
LOG OF TEST BORING
TB-11

FB:	NA
GRID:	ANCHORAGE
PROJ.NO:	1317.01
DWG.NO:	B-13

TB-12

N 6,782,206
E 338,577
7/18/06





0.0 ASPHALT
0.1

G ① MC=3.8%, SP-SM*, S2*, P200=6.8

POORLY GRADED SAND W/SILT AND GRAVEL (Brown, Gravel to 1" dia., subrounded to subangular, hard, Fine to coarse sand, Moist)

2.0

Sha ② 10/12/12, MC=4.7%, GM*, S1, P200=13, P.02=5.0

SILTY GRAVEL W/SAND CONTAINING COBBLES (Brown, Gravel subrounded to crushed, hard, Fine to coarse sand, Medium dense, Moist)

Sha ③ 6/13/12, MC=5.0%

8.0

POORLY GRADED GRAVEL W/SAND CONTAINING COBBLES (Brown, Gravel subrounded to crushed, hard, Fine to coarse sand, Dense, Dry)

Sha ④ 13/19/20, MC=3.6%

13.5

WELL GRADED SAND W/GRAVEL CONTAINING COBBLES (Gray, Gravel subrounded to crushed, hard, Fine to coarse sand, Medium dense, Moist)

Sha ⑤ 15/6/7, Piece of cobble jammed in drive shoe

18.0

SILTY SAND (Gray-brown, Fine sand, Nonplastic, Loose, Moist)

Sha ⑥ 4/4/4

21.5

* Estimated Classification
No groundwater was observed while drilling
Coordinates are provided in UTM Format, WGS84 Datum, Zone 6V

Z:\PROJECT\1317.01\EARTH\LOGS\W DIMOND UPGRADE.GPJ

MASTER ONE COL/PAGE W DIMOND UPGRADE.GPJ MASTER2.GDT 10/30/06

DWN:	A.T.B.
CKD:	C.H.R.
DATE:	OCT 06
SCALE:	1"=3'

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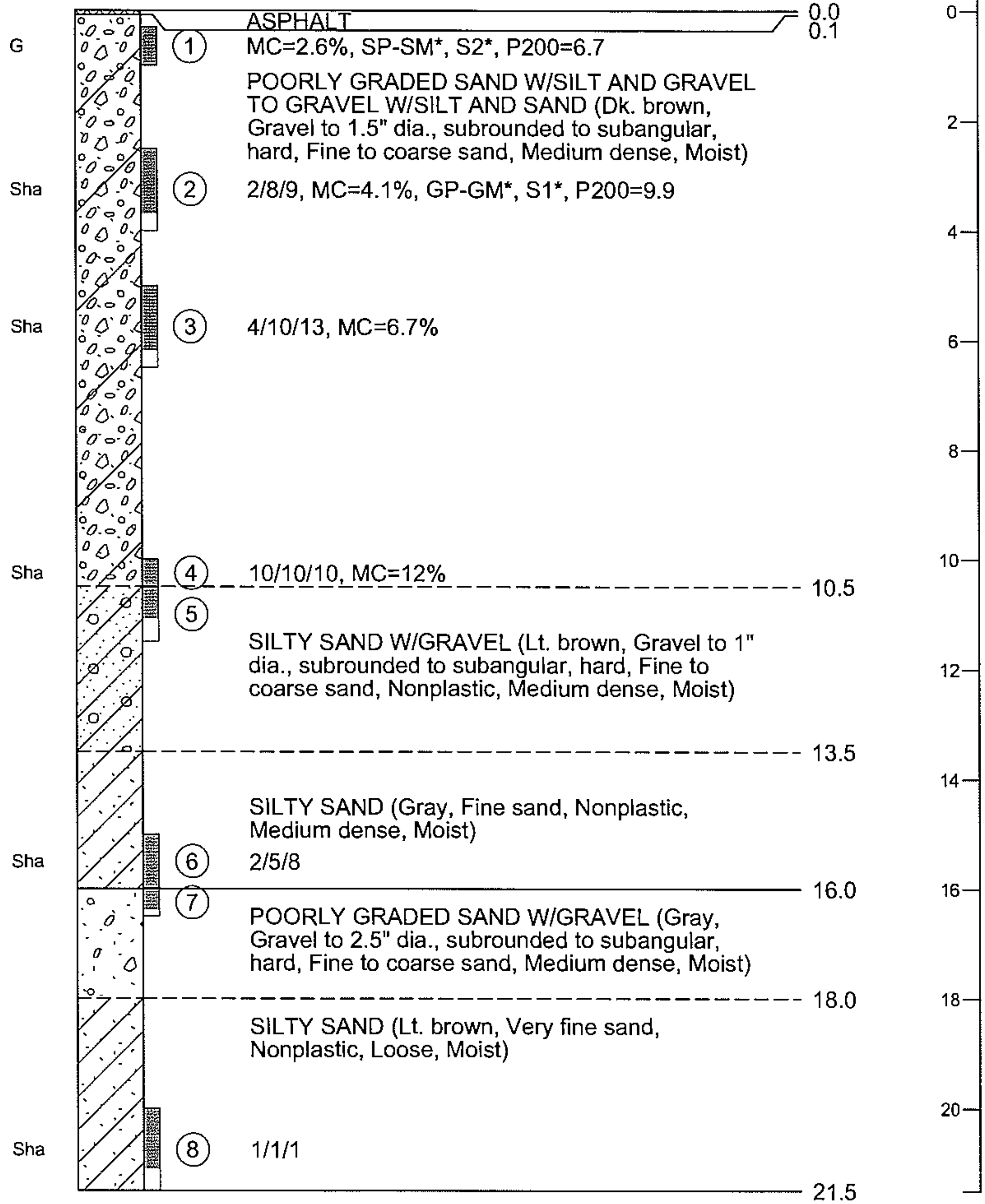
WEST DIMOND BLVD. UPGRADE
JODHPUR RD. TO SAND LAKE RD.

LOG OF TEST BORING
TB-12

FB:	NA
GRID:	ANCHORAGE
PROJ.NO:	1317.01
DWG.NO:	B-14

TB-13

N 6,782,207
E 338,562
7/18/06



Sample type	Sample	Depth	Description
		0.0	ASPHALT
G	①	0.1	MC=2.6%, SP-SM*, S2*, P200=6.7 POORLY GRADED SAND W/SILT AND GRAVEL TO GRAVEL W/SILT AND SAND (Dk. brown, Gravel to 1.5" dia., subrounded to subangular, hard, Fine to coarse sand, Medium dense, Moist)
Sha	②		2/8/9, MC=4.1%, GP-GM*, S1*, P200=9.9
Sha	③		4/10/13, MC=6.7%
Sha	④		10/10/10, MC=12%
	⑤	10.5	SILTY SAND W/GRAVEL (Lt. brown, Gravel to 1" dia., subrounded to subangular, hard, Fine to coarse sand, Nonplastic, Medium dense, Moist)
Sha	⑥	13.5	SILTY SAND (Gray, Fine sand, Nonplastic, Medium dense, Moist) 2/5/8
	⑦	16.0	POORLY GRADED SAND W/GRAVEL (Gray, Gravel to 2.5" dia., subrounded to subangular, hard, Fine to coarse sand, Medium dense, Moist)
Sha	⑧	18.0	SILTY SAND (Lt. brown, Very fine sand, Nonplastic, Loose, Moist) 1/1/1
		21.5	

* Estimated Classification
No groundwater was observed while drilling
Coordinates are provided in UTM Format, WGS84 Datum, Zone 6V

Z:\PROJECT\1317.01\EARTH\LOGS\W DIMOND UPGRADE.GPJ

MASTER ONE COL/PAGE W DIMOND UPGRADE.GPJ MASTER2.GDT 10/30/06

DWN:	A.T.B.
CKD:	C.H.R.
DATE:	OCT 06
SCALE:	1"=3'

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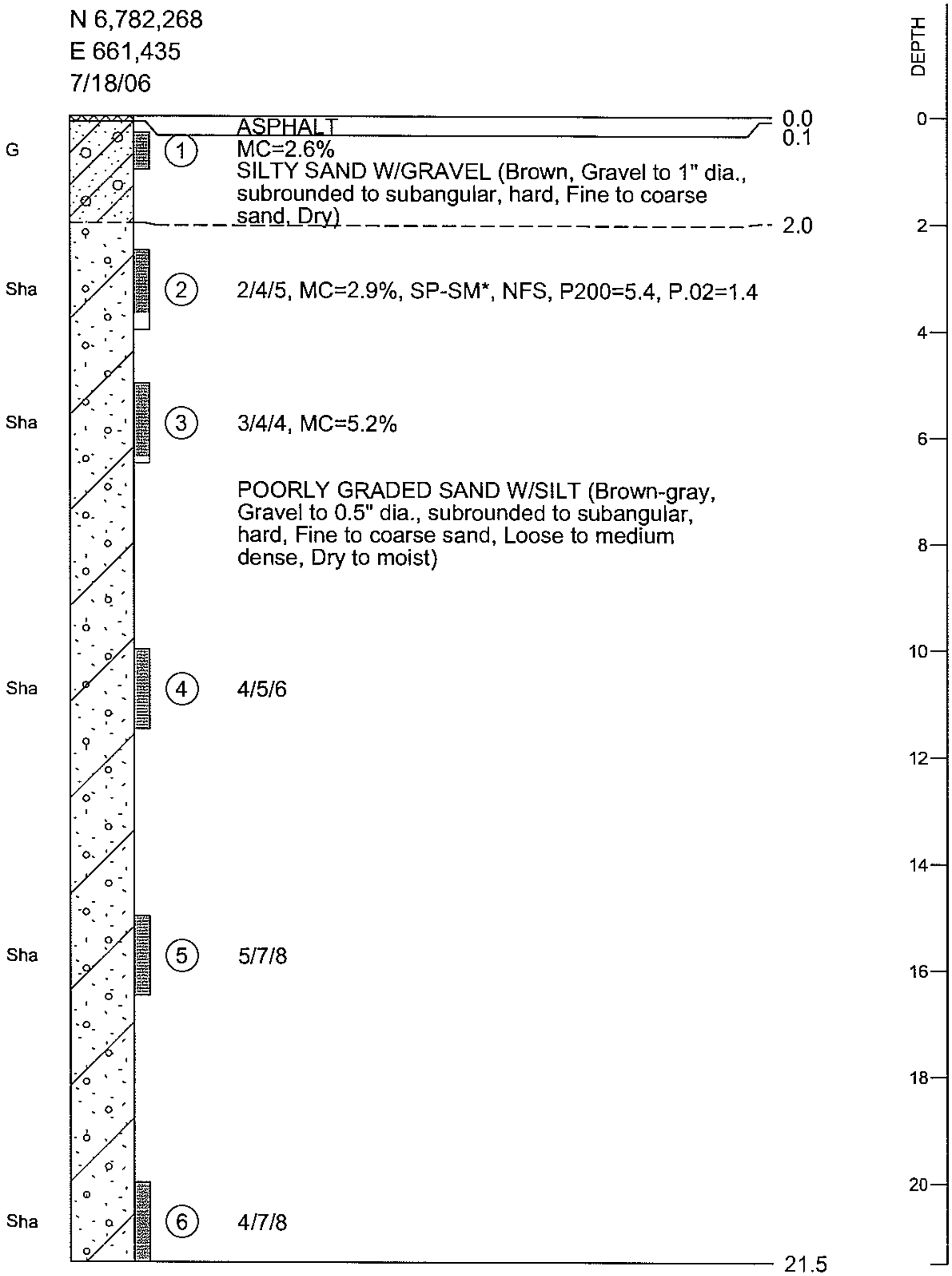
WEST DIMOND BLVD. UPGRADE
JODHPUR RD. TO SAND LAKE RD.

LOG OF TEST BORING
TB-13

FB:	NA
GRID:	ANCHORAGE
PROJ.NO:	1317.01
DWG.NO:	B-15

TB-14

N 6,782,268
E 661,435
7/18/06



ASPHALT

① MC=2.6%
SILTY SAND W/GRAVEL (Brown, Gravel to 1" dia., subrounded to subangular, hard, Fine to coarse sand, Dry)

② 2/4/5, MC=2.9%, SP-SM*, NFS, P200=5.4, P.02=1.4

③ 3/4/4, MC=5.2%

POORLY GRADED SAND W/SILT (Brown-gray, Gravel to 0.5" dia., subrounded to subangular, hard, Fine to coarse sand, Loose to medium dense, Dry to moist)

④ 4/5/6

⑤ 5/7/8

⑥ 4/7/8

* Estimated Classification
No groundwater was observed while drilling
Coordinates are provided in UTM Format, WGS84 Datum, Zone 5V

DWN:	A.T.B.
CKD:	C.H.R.
DATE:	OCT 06
SCALE:	1"=3'

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WEST DIMOND BLVD. UPGRADE
JODHPUR RD. TO SAND LAKE RD.

LOG OF TEST BORING
TB-14

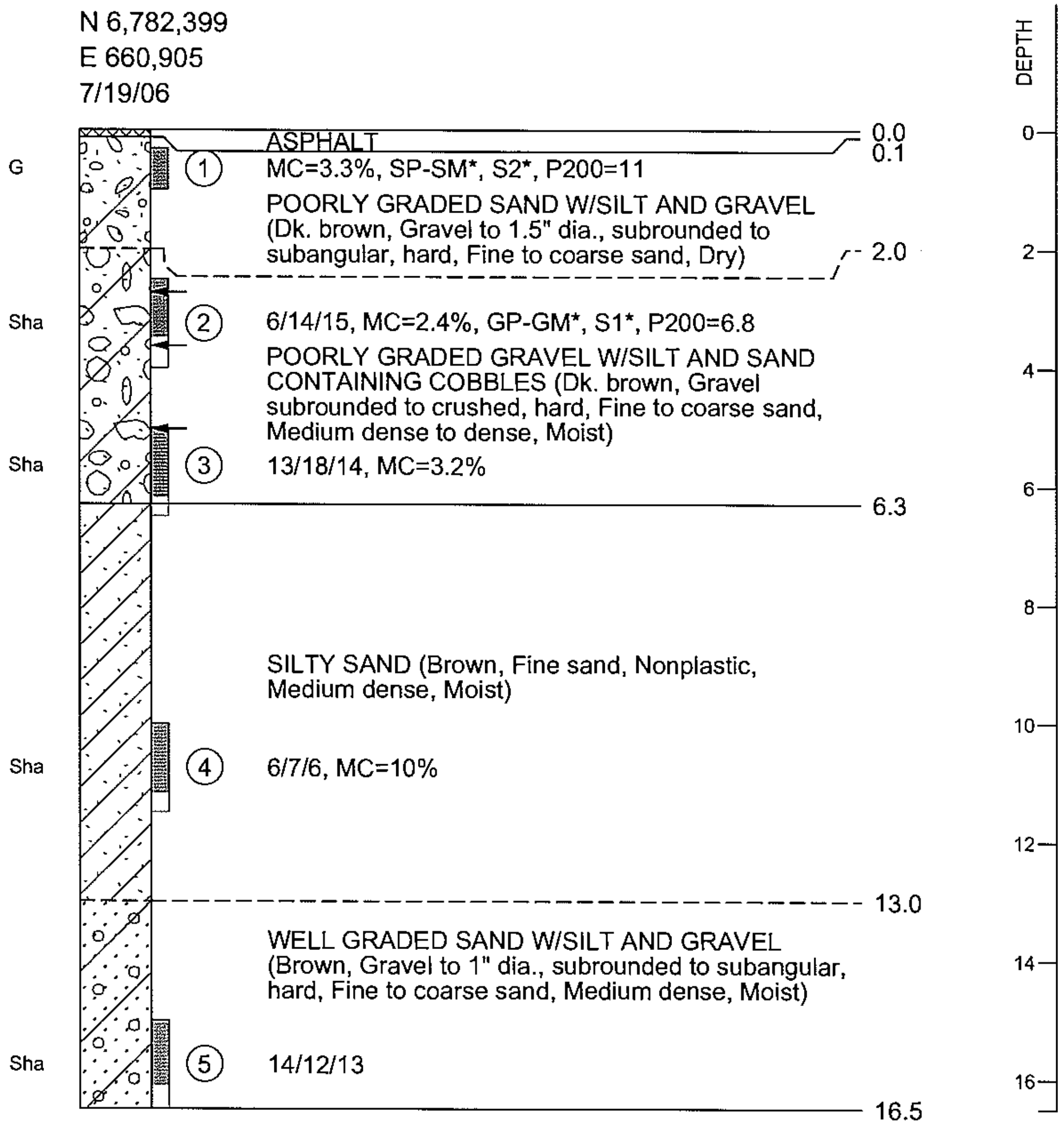
FB:	NA
GRID:	ANCHORAGE
PROJ.NO:	1317.01
DWG.NO:	B-16

Z:\PROJECT\1317.01\EARTH\LOGS\W DIMOND UPGRADE.GPJ

MASTER ONE COL/PAGE W DIMOND UPGRADE.GPJ MASTER2.GDT 10/30/06

TB-15

N 6,782,399
E 660,905
7/19/06



0.0 ASPHALT 0.1

① G — MC=3.3%, SP-SM*, S2*, P200=11

POORLY GRADED SAND W/SILT AND GRAVEL (Dk. brown, Gravel to 1.5" dia., subrounded to subangular, hard, Fine to coarse sand, Dry) — 2.0

② Sha — 6/14/15, MC=2.4%, GP-GM*, S1*, P200=6.8

POORLY GRADED GRAVEL W/SILT AND SAND CONTAINING COBBLES (Dk. brown, Gravel subrounded to crushed, hard, Fine to coarse sand, Medium dense to dense, Moist)

③ Sha — 13/18/14, MC=3.2% — 6.3

SILTY SAND (Brown, Fine sand, Nonplastic, Medium dense, Moist)

④ Sha — 6/7/6, MC=10% — 13.0

WELL GRADED SAND W/SILT AND GRAVEL (Brown, Gravel to 1" dia., subrounded to subangular, hard, Fine to coarse sand, Medium dense, Moist)

⑤ Sha — 14/12/13 — 16.5

* Estimated Classification
No groundwater was observed while drilling
Coordinates are provided in UTM Format, WGS84 Datum, Zone 5V

Z:\PROJECT\1317.01\EARTH\LOGS\W DIMOND UPGRADE.GPJ

MASTER ONE COL/PAGE W DIMOND UPGRADE.GPJ MASTER2.GDT 10/30/06

DWN:	A.T.B.
CKD:	C.H.R.
DATE:	OCT 06
SCALE:	1"=3'

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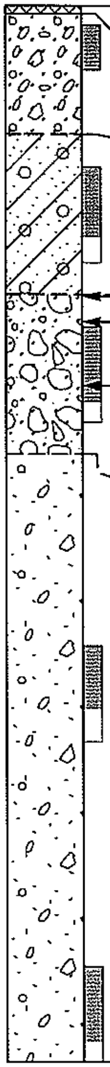
WEST DIMOND BLVD. UPGRADE
JODHPUR RD. TO SAND LAKE RD.
LOG OF TEST BORING
TB-15

FB:	NA
GRID:	ANCHORAGE
PROJ.NO:	1317.01
DWG.NO:	B-17

TB-16

N 6,782,373
E 661,011
7/19/06



DEPTH

0.0 ASPHALT
0.1

G ① MC=2.7%
WELL GRADED GRAVEL W/SAND (Brown, Gravel to 1.5" dia., subrounded to subangular, hard, Fine to coarse sand, Dry)

2.0 SILTY SAND W/GRAVEL (Brown, Gravel to 2" dia., subrounded to subangular, hard, Fine to coarse sand, Medium dense, Moist)

Sha ② 8/11/14, MC=6.1%, GM*, F1*, P200=17

4.5 POORLY GRADED GRAVEL W/SAND CONTAINING COBBLES (Brown, Gravel subrounded to subangular, hard, Fine to coarse sand, Dense, Dry)

Sha ③ 15/15/16, Cobble fragments in sample, MC=1.8%

7.0 POORLY GRADED SAND W/GRAVEL (Lt. brown, Gravel to 0.5" dia., subrounded to subangular, hard, Fine to coarse sand, Medium dense, Dry to moist)

Sha ④ 5/8/12

Sha ⑤ 13/14/12

16.5

* Estimated Classification
No groundwater was observed while drilling
Coordinates are provided in UTM Format, WGS84 Datum, Zone 5V

DWN:	A.T.B.
CKD:	C.H.R.
DATE:	OCT 06
SCALE:	1"=3'

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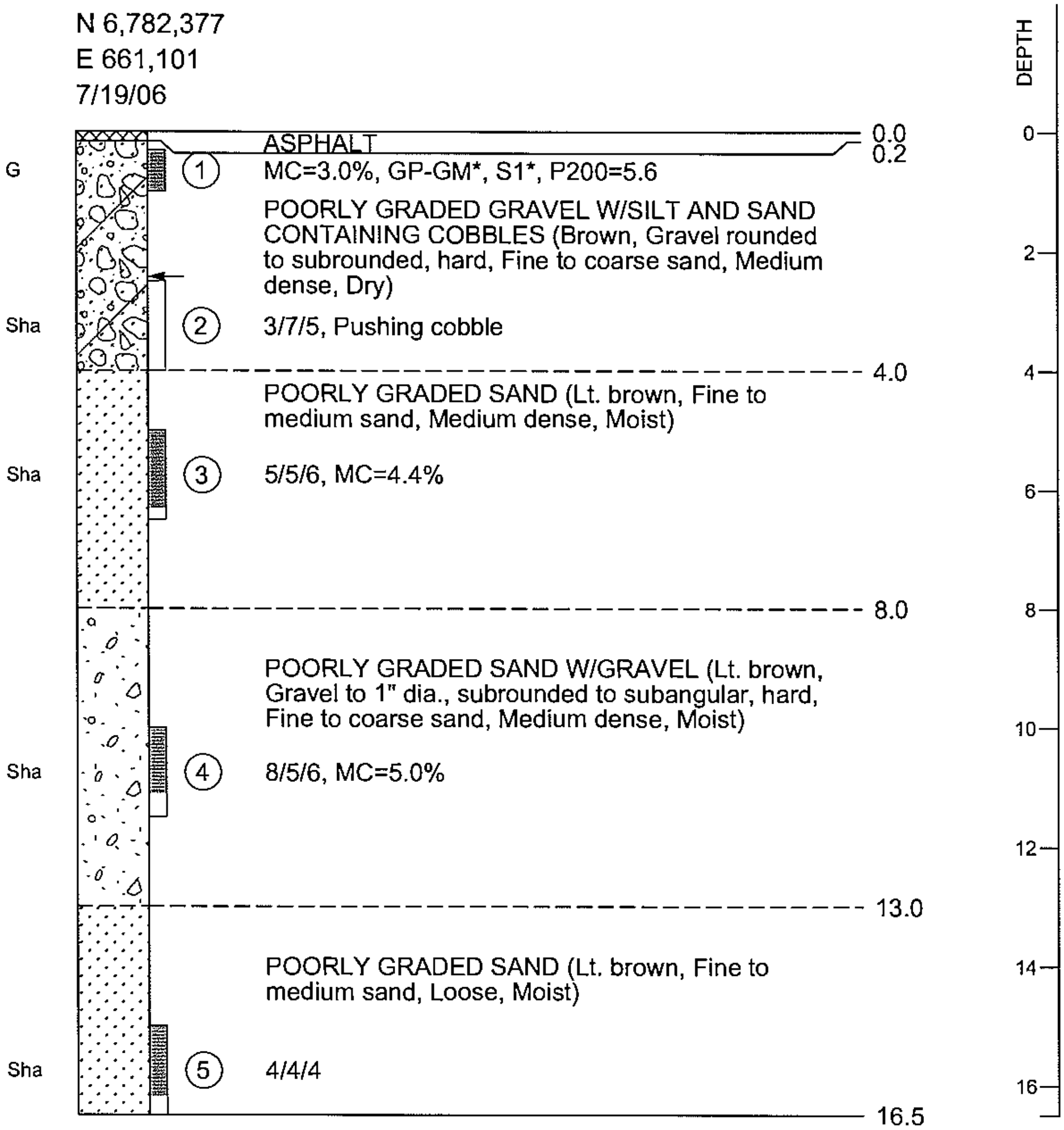
WEST DIMOND BLVD. UPGRADE
JODHPUR RD. TO SAND LAKE RD.
LOG OF TEST BORING
TB-16

FB:	NA
GRID:	ANCHORAGE
PROJ.NO:	1317.01
DWG.NO:	B-18

TB-17

N 6,782,377
E 661,101
7/19/06



ASPHALT

① MC=3.0%, GP-GM*, S1*, P200=5.6

POORLY GRADED GRAVEL W/SILT AND SAND CONTAINING COBBLES (Brown, Gravel rounded to subrounded, hard, Fine to coarse sand, Medium dense, Dry)

② 3/7/5, Pushing cobble

POORLY GRADED SAND (Lt. brown, Fine to medium sand, Medium dense, Moist)

③ 5/5/6, MC=4.4%

POORLY GRADED SAND W/GRAVEL (Lt. brown, Gravel to 1" dia., subrounded to subangular, hard, Fine to coarse sand, Medium dense, Moist)

④ 8/5/6, MC=5.0%

POORLY GRADED SAND (Lt. brown, Fine to medium sand, Loose, Moist)

⑤ 4/4/4

* Estimated Classification
No groundwater was observed while drilling
Coordinates are provided in UTM Format, WGS84 Datum, Zone 5V

Z:\PROJECT\1317.01\EARTH\LOGS\W DIMOND UPGRADE.GPJ

MASTER ONE COL/PAGE W DIMOND UPGRADE.GPJ MASTER2.GDT 10/30/06

DWN: A.T.B.
CKD: C.H.R.
DATE: OCT 06
SCALE: 1"=3'

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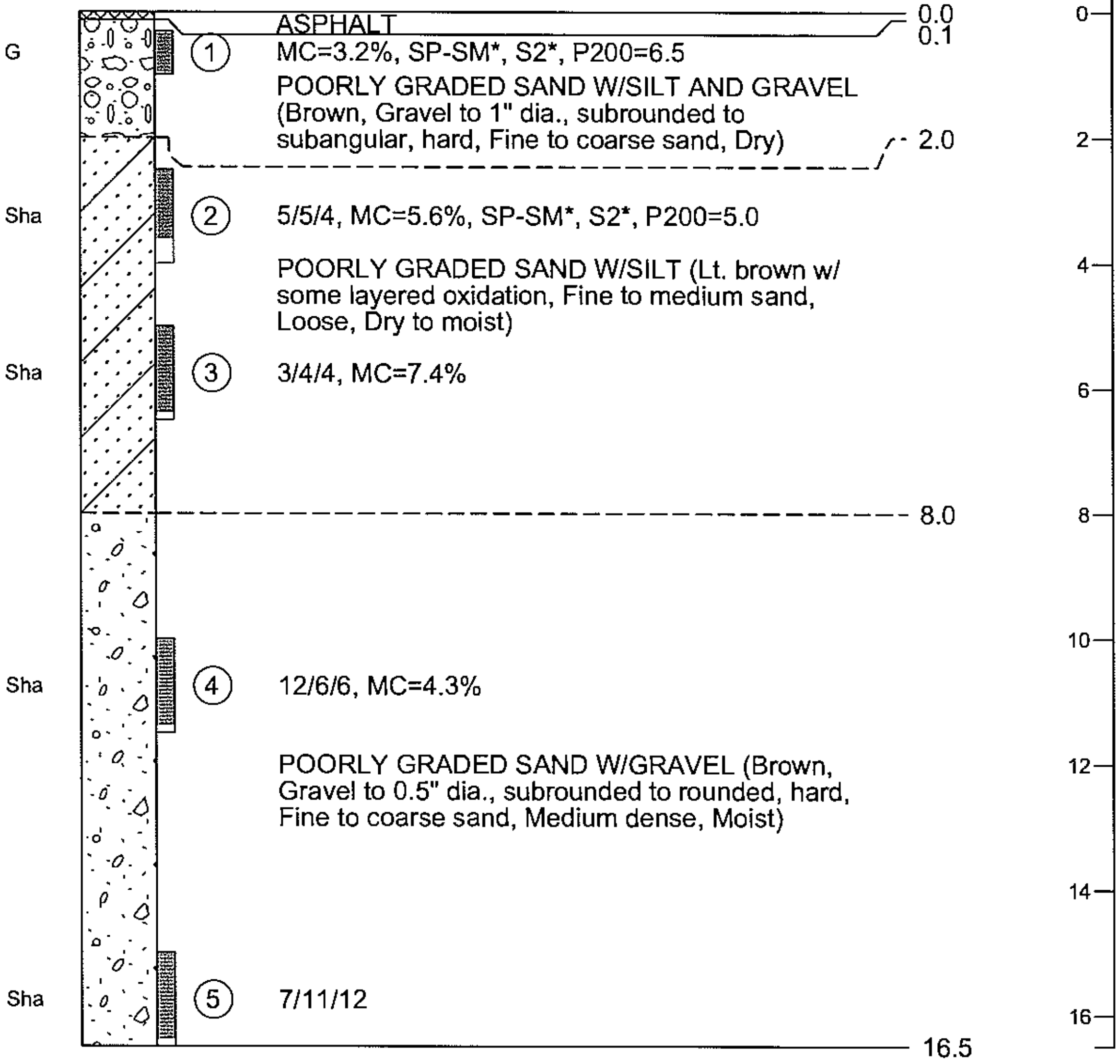
9101 Vanguard Drive, Anchorage, Alaska 99507 (907) 522-1707

WEST DIMOND BLVD. UPGRADE
JODHPUR RD. TO SAND LAKE RD.
LOG OF TEST BORING
TB-17

FB: NA
GRID: ANCHORAGE
PROJ.NO: 1317.01
DWG.NO: B-19

TB-18

N 6,782,350
E 661,192
7/19/06



ASPHALT

① MC=3.2%, SP-SM*, S2*, P200=6.5

POORLY GRADED SAND W/SILT AND GRAVEL (Brown, Gravel to 1" dia., subrounded to subangular, hard, Fine to coarse sand, Dry)

② 5/5/4, MC=5.6%, SP-SM*, S2*, P200=5.0

POORLY GRADED SAND W/SILT (Lt. brown w/ some layered oxidation, Fine to medium sand, Loose, Dry to moist)

③ 3/4/4, MC=7.4%

④ 12/6/6, MC=4.3%

POORLY GRADED SAND W/GRAVEL (Brown, Gravel to 0.5" dia., subrounded to rounded, hard, Fine to coarse sand, Medium dense, Moist)

⑤ 7/11/12

* Estimated Classification
No groundwater was observed while drilling
Coordinates are provided in UTM Format, WGS84 Datum, Zone 5V

Z:\PROJECT\1317.01\EARTH\LOGS\W DIMOND UPGRADE.GPJ

MASTER ONE COL/PAGE W DIMOND UPGRADE.GPJ MASTER2.GDT 10/30/06

DWN:	A.T.B.
CKD:	C.H.R.
DATE:	OCT 06
SCALE:	1"=3'

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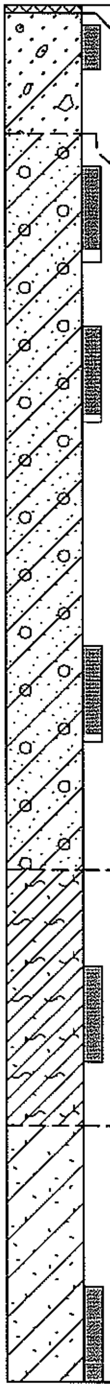
WEST DIMOND BLVD. UPGRADE
JODHPUR RD. TO SAND LAKE RD.
LOG OF TEST BORING
TB-18

FB:	NA
GRID:	ANCHORAGE
PROJ.NO:	1317.01
DWG.NO:	B-20

TB-19

N 6,782,323
E 661,283
7/19/06



0.0
0.1
ASPHALT

G ① MC=3.4%, SP-SM*, S2*, P200=9.4

POORLY GRADED SAND W/SILT AND GRAVEL (Brown, Gravel to 1" dia., subrounded to rounded, hard, Fine to coarse sand, Dry)

2.0

Sha ② 5/5/6, MC=11%, SM*, F2, P200=36, P.02=13

Sha ③ 2/8/14, MC=8.2%

SILTY SAND W/GRAVEL (Brown, Gravel to 1.5" dia., subrounded to subangular, hard, Fine to coarse sand, Medium dense, Moist)

Sha ④ 8/5/9, MC=14%

13.5

SANDY SILT (Lt. brown, Very fine to fine sand, Nonplastic, Loose, Moist)

Sha ⑤ 2/2/2, MC=28%, Org=3.2%, Est. 5% visible organics by volume

17.5

SILTY SAND (Lt. brown, Fine to coarse sand, Nonplastic, Loose, Moist)

Sha ⑥ 4/4/4

21.5

DEPTH
0
2
4
6
8
10
12
14
16
18
20

* Estimated Classification
No groundwater was observed while drilling
Coordinates are provided in UTM Format, WGS84 Datum, Zone 5V

Z:\PROJECT\1317.01\EARTH\LOGS\W DIMOND UPGRADE.GPJ

MASTER ONE COL/PAGE W DIMOND UPGRADE.GPJ MASTER2.GDT 10/30/06

DWN:	A.T.B.
CKD:	C.H.R.
DATE:	OCT 06
SCALE:	1"=3'

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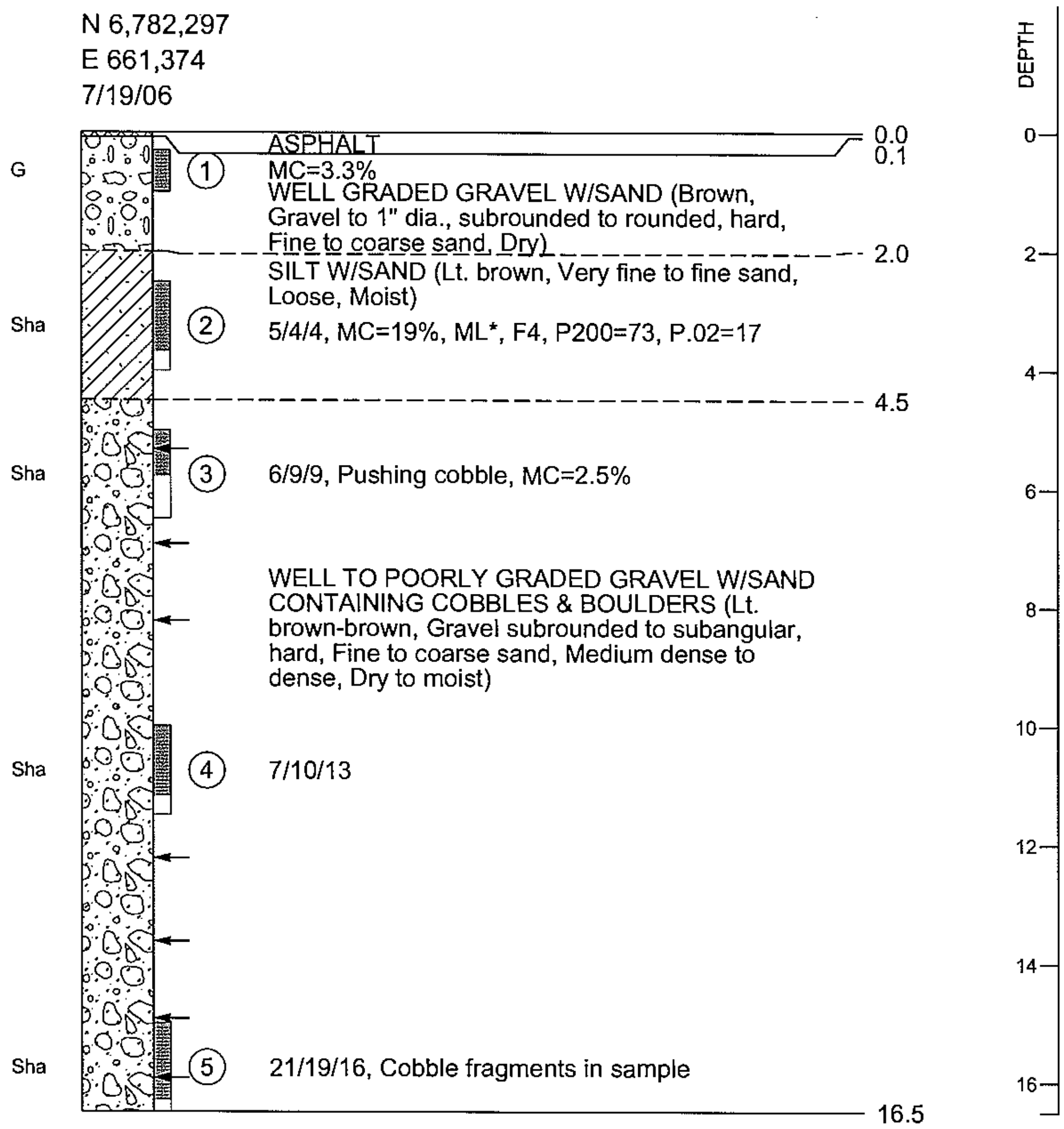
9101 Vanguard Drive, Anchorage, Alaska 99507 (907) 522-1707

WEST DIMOND BLVD. UPGRADE
JODHPUR RD. TO SAND LAKE RD.
LOG OF TEST BORING
TB-19

FB:	NA
GRID:	ANCHORAGE
PROJ.NO:	1317.01
DWG.NO:	B-21

TB-20

N 6,782,297
E 661,374
7/19/06



ASPHALT

① MC=3.3%
WELL GRADED GRAVEL W/SAND (Brown, Gravel to 1" dia., subrounded to rounded, hard, Fine to coarse sand, Dry)

SILT W/SAND (Lt. brown, Very fine to fine sand, Loose, Moist)

② 5/4/4, MC=19%, ML*, F4, P200=73, P.02=17

③ 6/9/9, Pushing cobble, MC=2.5%

WELL TO POORLY GRADED GRAVEL W/SAND CONTAINING COBBLES & BOULDERS (Lt. brown-brown, Gravel subrounded to subangular, hard, Fine to coarse sand, Medium dense to dense, Dry to moist)

④ 7/10/13

⑤ 21/19/16, Cobble fragments in sample

* Estimated Classification
No groundwater was observed while drilling
Coordinates are provided in UTM Format, WGS84 Datum, Zone 5V

Z:\PROJECT\1317.01\EARTH\LOGS\W DIMOND UPGRADE.GPJ

MASTER ONE COL/PAGE W DIMOND UPGRADE.GPJ MASTER2.GDT 10/30/06

DWN: A.T.B.
CKD: C.H.R.
DATE: OCT 06
SCALE: 1"=3'

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WEST DIMOND BLVD. UPGRADE
JODHPUR RD. TO SAND LAKE RD.

LOG OF TEST BORING
TB-20

FB: NA
GRID: ANCHORAGE
PROJ.NO: 1317.01
DWG.NO: B-22

APPENDIX C

LABORATORY TEST RESULTS

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification	
				Group Symbol	Group Name[B]
Coarse-grained Soils More than 50% retained on the No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$[E]	GW	Well-graded gravel[F]
			$Cu < 4$ and/or $1 > Cc > 3$[E]	GP	Poorly-graded gravel[F]
		Gravels with Fines More than 12% fines[C]	Fines classify as ML or MH	GM	Silty gravel[F,G,H]
			Fines classify as CL or CH	GC	Clayey gravel[F,G,H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5 % fines[D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$[E]	SW	Well-graded sand[I]
			$Cu < 6$ and/or $1 > Cc > 3$[E]	SP	Poorly-graded sand[I]
		Sands with Fines More than 12 % fines[D]	Fines classify as ML or MH	SM	Silty sand[G,H,I]
			Fines classify as CL or CH	SC	Clayey sand[G,H,I]
Fine-grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid Limit less than 50	inorganic	$PI > 7$ and plots on or above "A" line[J]	CL	Lean clay[K, L, M]
			$PI < 4$ and plots below "A" line[J]	ML	Silt[K, L, M]
		organic	$\frac{\text{Liquid limit - oven dried}}{\text{Liquid limit - not dried}} < 0.75$	OL	Organic Clay[K, L, M,N] Organic Silt[K, L, M,O]
	Silts and Clays Liquid Limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay[K, L, M]
			PI plots below "A" line	MH	Elastic silt[K, L, M]
		organic	$\frac{\text{Liquid limit - oven dried}}{\text{Liquid limit - not dried}} < 0.75$	OH	Organic Clay[K, L, M,P] Organic Silt[K, L, M,Q]
Highly organic soils	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-in. (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravel with 5 to 12 % fines require dual symbols:
- GW-GM well-graded gravel with silt
- GW-GC well-graded gravel with clay
- GP-GM poorly-graded gravel with silt
- GP-GC poorly-graded gravel with clay

[D] Sands with 5 to 12 % fines require dual symbols:
- SW-SM well-graded sand with silt
- SW-SC well-graded sand with clay
- SP-SM poorly-graded sand with silt
- SP-SC poorly-graded sand with clay

[E] $Cu = D_{60} / D_{10} \qquad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand " to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200, predominantly sand, add "sandy" to group name.

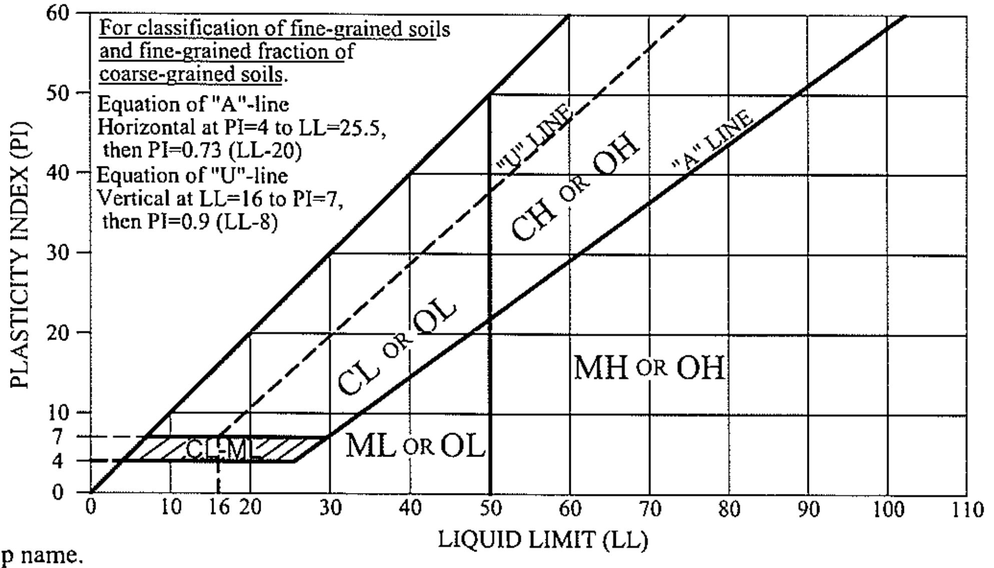
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 and plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



Z:\EARTHSCI\GINT FORMS\ASTM.GDW (DRAWING ASTM CLASS) 1/19/07 02:26 PM

DWN: P.K.H.
CKD: C.H.R.
DATE: JUNE 04
SCALE: NONE

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CLASSIFICATION OF SOILS
FOR
ENGINEERING PURPOSES
ASTM D 2487

FB: N/A
GRID: N/A
PROJ.NO: GENERAL
DWG.NO: C-01

U.S. ARMY CORPS OF ENGINEERS
FROST DESIGN SOIL CLASSIFICATION

FROST GROUP	KIND OF SOIL	PERCENTAGE FINER THAN 0.02 mm BY WEIGHT	TYPICAL SOIL TYPES UNDER UNIFIED SOIL CLASSIFICATION SYSTEM
NFS*	(a) Gravels Crushed Stone Crushed Rock	0 - 1.5	GW, GP
	(b) Sands	0 - 3	SW, SP
PFS+	(a) Gravels Crushed Stone Crushed Rock	1.5 - 3	GW, GP
	(b) Sands	3 - 10	SW, SP
S1	Gravelly Soils	3 - 6	GW, GP, GW-GM, GP-GM
S2	Sandy Soils	3 - 6	SW, SP, SW-SM, SP-SM
F1	Gravelly Soils	6 - 10	GM, GW-GM, GP-GM
F2	(a) Gravelly Soils	10 - 20	GM, GW-GM, GP-GM
	(b) Sands	6 - 15	SM, SW-SM, SP-SM
F3	(a) Gravelly Soils	Over 20	GM, GC
	(b) Sands, Except Very Fine Silty Sands	Over 15	SM, SC
	(c) Clays, PI>12	--------	CL, CH
F4	(a) All Silts	--------	ML, MH
	(b) Very Fine Silty Sand	Over 15	SM
	(c) Clays PI<12	--------	CL, CL-ML
	(d) Varved Clays and Other Fine-grained Banded Sediments	--------	CL, CL-ML CL and ML CL, ML, and SM; CL, CH and ML; CL, CH, ML and SM

* Non-frost-susceptible

\+ Possibly frost-susceptible, but requires laboratory test to determine frost design soils classification.

From: "Seasonal Frost Conditions", June, 1992, U.S. Army Corps of Engineers TM-5-822-5.

DWN:	P.K.H.
CKD:	C.H.R.
DATE:	GENERAL
SCALE:	NONE

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FROST DESIGN
SOIL CLASSIFICATION

FB:	N/A
GRID:	N/A
PROJ.NO:	GENERAL
DWG.NO:	C-02

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SUMMARY OF LABORATORY DATA
WEST DIMOND BLVD. UPGRADE

SAMPLE INDENTIFICATION			PARTICLE SIZE ANALYSIS (% FINER)															MOISTURE CONTENT %	ORGANIC CONTENT %	USC	FROST CLASS.
			STANDARD SIEVE SIZE														(mm)				
HOLE	NO.	DEPTH (FT.)	3"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	#4	#10	#20	#40	#60	#140	#200	.02				
TB-01	1	0.3 - 1.0			100	98	93	79	67	47	31	22	17	13	9.1	7.9	4.1	2.1		GP-GM*	S1
	2	2.5 - 4.0																3.4			
	3	5.0 - 6.5																3.9			
TB-02	1	0.2 - 1.0			100	94	89	72	63	48	35	27	22	16	11	9.2	5.1	2.3		GW-GM*	S1
	2	2.5 - 3.5																3.8			
	4	5.0 - 6.5																1.9			
TB-03	1	0.2 - 1.0																2.8			
	2	2.5 - 3.0																6.7			
	3	3.0 - 4.0			100	91	89	85	84	82	79	77	76	74	72	70	33	26		ML*	F4
TB-04	1	0.3 - 1.0			100	97	93	84	77	65	54	45	33	21	10	8.3		3.1		SP-SM*	S2**
	2	2.5 - 4.0		100	88	88	86	84	82	75	69	62	45	24	6.7	4.6		3.3		SP	NFS**
	3	5.0 - 6.5																4.4			
	4	10.0 - 11.5																18	2.3		
TB-05	1	0.3 - 1.0				100	95	88	83	71	60	53	43	29	13	10		5.9		SP-SM*	S2**
	2	2.5 - 4.0				100	98	90	83	71	59	48	32	19	9	7.7		3.5		SP-SM*	S2**
	3	5.0 - 6.5																8.3	1.8		
	4	10.0 - 10.3																10			
TB-06	1	0.3 - 1.0																3.5			
	2	2.5 - 3.5		100	87	87	75	71	67	60	52	42	29	18	10	9.0		3.1		SP-SM*	S2**
	3	3.5 - 4.0																11			
	4	5.0 - 6.5							100	100	99	98	97	95	88	76	17	25	5.8	ML*	F4
TB-07	1	0.3 - 1.0																3.4			
	2	2.5 - 4.0			100	91	86	77	73	63	53	41	34	18	9.0	7.2		3.6		SP-SM*	S2**
	3	5.0 - 6.5					100	100	98	97	95	92	90	87	80	69	18	17	2.6	ML*	F4
	4	10.0 - 11.3																4.6			
TB-08	1	0.3 - 1.0				100	96	87	79	66	52	38	25	15	8.0	6.8		3.1		SP-SM*	S2**
	2	2.5 - 4.0		100	93	87	86	83	81	73	67	58	43	30	20	17		8.3		SM*	F2**
	3	5.0 - 6.5																15			
	4	10.0 - 11.4																12			
TB-09	1	0.3 - 1.0			100	89	86	77	69	54	40	28	19	13	8.1	6.9		2.6		SP-SM*	S2**
	2	2.5 - 4.0			100	96	89	82	77	65	54	41	30	23	18	15		4.2		SM*	F2**
	3	5.0 - 6.5																13			
	4	10.0 - 11.5																16	2.2		
TB-10	1	0.3 - 1.0																2.4			
	2	2.5 - 4.0			100	90	86	83	83	75	60	30	10	6.2	4.2	3.7		1.8		SP	NFS**
	3	5.0 - 6.5																1.5			

*Indicates USC classification based on an estimated plasticity value.
**Indicates frost classification based on an estimated percent passing 0.02mm.

SUMMARY OF LABORATORY DATA
WEST DIMOND BLVD. UPGRADE

SAMPLE			PARTICLE SIZE ANALYSIS (% FINER)														MOISTURE CONTENT %	ORGANIC CONTENT %	USC	FROST CLASS.
INDENTIFICATION			STANDARD SIEVE SIZE													(mm)				
HOLE	NO.	DEPTH (FT.)	3"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	#4	#10	#20	#40	#60	#140	#200	.02			
TB-11	1	0.3 - 1.0																4.0			
	2	2.5 - 4.0		100	100	94	92	85	78	66	55	44	36	31	19	14		4.9		SM*	F2**
	3	5.0 - 5.5																3.9			
	4	5.5 - 6.5		100	93	89	86	81	79	72	67	64	60	58	53	46		15		GM*	F4**
TB-12	1	0.3 - 1.0				100	97	87	81	67	55	43	32	20	8.3	6.8		3.8		SP-SM*	S2**
	2	2.5 - 4.0			100	87	81	73	67	56	45	37	28	21	15	13	5.0	4.7		GM*	S1
	3	5.0 - 6.5																5.0			
	4	10.0 - 11.5																3.6			
TB-13	1	0.3 - 1.0			100	97	89	79	72	55	44	34	24	15	8.0	6.7		2.6		SP-SM*	S2**
	2	2.5 - 4.0		100	88	87	83	71	64	53	43	34	25	18	12	10		4.1		GP-GM*	S1**
	3	5.0 - 6.5																6.7			
	4	10.0 - 10.5																12			
TB-14	1	0.3 - 1.0																2.6			
	2	2.5 - 4.0					100	100	100	99	99	98	92	69	10.1	5	1.4	2.9		SP-SM*	NFS
	3	5.0 - 6.5																5.2			
TB-15	1	0.3 - 1.0			100	96	93	86	79	65	55	47	36	24	13	11		3.3		SP-SM*	S2**
	2	2.5 - 4.0		100	90	74	70	62	55	42	34	28	21	14	8.2	6.8		2.4		GP-GM*	S1**
	3	5.0 - 6.3																3.2			
	4	10.0 - 11.5																10			
TB-16	1	0.3 - 1.0																2.7			
	2	2.5 - 4.0			100	90	89	82	77	65	56	48	39	31	21	17		6.1		GM*	F1*
	3	5.0 - 6.5																1.8			
TB-17	1	0.3 - 1.0		100	89	77	76	66	58	47	39	32	23	14	6.9	5.6		3.0		GP-GM*	S1**
	3	5.0 - 6.5																4.4			
	4	10.0 - 11.5																5.0			
TB-18	1	0.3 - 1.0				100	97	85	79	66	57	48	33	17	8.0	6.5		3.2		SP-SM*	S2**
	2	2.5 - 4.0						100	100	100	100	99	85	34	7.6	5.0		5.6		SP-SM*	S2**
	3	5.0 - 6.5																7.4			
	4	10.0 - 11.5																4.3			
TB-19	1	0.3 - 1.0			100	98	92	80	71	57	46	38	28	18	11	9.4		3.4		SP-SM*	S2**
	2	2.5 - 4.0			100	98	98	93	89	83	77	70	61	52	42	36	13	11		SM*	F2
	3	5.0 - 6.5																8.2			
	4	10.0 - 11.5																14			
	5	15.0 - 16.5																28	3.2		
TB-20	1	0.3 - 1.0																3.3			
	2	2.5 - 4.0			100	97	97	96	96	94	88	87	86	85	82	73	17	19		ML*	F4
	3	5.0 - 6.5																2.5			

*Indicates USC classification based on an estimated plasticity value.
**Indicates frost classification based on an estimated percent passing 0.02mm.