Century City Area Fault Investigation Report

Volume 2 of 2

Appendix C—Logs of Borings
Appendix D—Geovision Reports

November 2011 (Rev 1)
APPENDIX C—Logs of Borings

Contents

Logs of Borings—Figures T1-B1a through T8-B6e
Logs of Prior Borings Rev 1
CPT Data—T1-C1 through T8-C15
APPENDIX C-1 LOGS OF BORINGS – CURRENT FAULT INVESTIGATION

Amec, Current Fault Investigation

**Rotary Wash Borings:**
- T1-B6, T2-B4, T2E-B2, T2E-B3, T3-B3, T4-B5, and T8-B2

**Hollow-stem Auger Borings:**
- T1-B1, T1-B2, T1-B3, T1-B4, T1-B5, T1-B7, and T1-B8
- T2-B1, T2-B2, T2-B3, T2-B5, T2-B6, T2-B7, T2-B8, T2-B9, and T2-B10
- T2E-B1, T2E-B4, T2E-B5, T2E-B7, T2E-B8, T2E-B9, and T2E-B10
- T3-B1, T3-B2, T3-B4, T3-B5, T3-B6, T3-B7, and T3-B9
- T4-B1, T4-B2, T4-B3, T4-B4, T4-B6, T4-B7, T4-B8, T4-B9, and T4-B10
- T7-B1, T7-B2, T7-B3, T7-B4, and T7-B5
- T8-B1, T8-B3, T8-B4, T8-B5, and T8-B6
### COLUMN DESCRIPTIONS

1. **ELEVATION**: Elevation, in feet (ft), referenced to mean sea level (MSL).
2. **DEPTH**: Distance (in feet) below ground surface.
3. **BOX #:** Recovered core box number.
4. **RUN #:** Individual coring interval number.
5. **RECOVERY**: Percentage of recovered core from the coring interval; calculated as length of recovered core divided by length of run.
6. **SAMPLE LOCATION**: Estimated depth of recovered core sample.
7. **SOIL GRAPHIC**: Graphical illustration of standardized soil type.
8. **SOIL TYPE**: Soil type label, based on the Unified Soil Classification System (USCS). No laboratory testing was performed as part of this investigation to confirm soil classifications.

### TYPICAL MATERIAL GRAPHIC SYMBOLS

- **Clay**
- **Sandy Clay**
- **Clay with Gravel**
- **Silt**
- **Well Graded Sand**
- **Poorly Graded Sand**
- **Silty Sand**
- **Silty Sand with Gravel**
- **Well Graded Gravel**

### OTHER GRAPHIC SYMBOLS

- ▼ Groundwater encountered during drilling
- ▼ Groundwater measured during drilling
- --- Approximate contact line between soil types and/or sub-units
- —— Approximate contact line between geologic units

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**Key to Log of Core Boring**

MTA Westside Subway Extension  
Los Angeles, California  
Project No. 4953-10-1561

Sheet 1 of 1  
Figure A-1
Asphaltic Concrete

FILL [AI]
Clayey Silt and Silty Clay, variable fine to coarse sand and gravel, gravel 2-25%, up to 1 inch; color variable, mainly dark yellowish brown (10YR 4/4) to dark grayish brown (10YR 4/2); appears very moist and stiff to very stiff; occasional very dark brown (10YR 2/2), organic-rich layers
Hand augered to 5-feet

NOTE:
Jsm = Santa Monica Slate
Tm = Modelo Formation
See end of log for more detailed descriptions of clasts

At 15.0 to 15.5' and 18.0 to 19.7': Organic-rich layer, 20-30% gravel

At 16.6': Small piece of glass
At 22.3': Asphalt fragment

OLDER ALLUVIAL FAN DEPOSITS [Qfo]
Sandy Silt, trace to some clay, trace coarse sand (Jsm and Tm); brown (7.5YR 4/4); appears very moist and stiff; lower contact is narrowly gradational
At 23.6': Possible detrital charcoal, sample obtained

Silty Sand with Gravel, fine grained, clasts 15-20% up to 1 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); brown (7.5YR 4/4); appears moist and dense

Clayey to Sandy Silt, variable coarse sand and fine gravel (Jsm and Tm), clasts 2-10%, up to ¾ inch; dark brown (7.5YR 3/3); appears very moist and stiff to very stiff; poorly sorted, lower contact is gradational
At 28.0 to 28.1': Silty Sand bed, fine grained
At 28.1 to 29.3': Gravel increases to 15-30%, up to ¾ inch (Jsm and Tm)

Clayey Gravel, clasts 50-70% up to 2 inches, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); matrix is fine to coarse clayey sand; color variable, mainly dark brown (7.5YR 3/4); appears very moist and dense; lower contact is sharp, erosional
At 32.5 to 33.1': Grades to Clayey Sand with Gravel, fine to coarse grained

Silty Clay and Clayey Silt, variable fine sand, trace coarse sand (Jsm and Tm); dark brown (7.5YR 3/4); appears moist and very stiff to hard; lower contact occurs between runs

Sandy Silt, trace to some clay; brown (7.5YR 4/4) to dark yellowish brown (10YR 4/6); appears moist to very moist and medium stiff to stiff; lower contact is sharp
At 38.3 to 38.7': Clayey to Sandy Silt; brown (7.5YR 4/4); appears very moist and stiff
ESTUARINE DEPOSITS \([Qe]\)  
Alternating beds of very fine Silty Sand/Sandy Silt and Silty Clay; rare (<1%) coarse sand; brown (7.5YR 4/4); appears very moist and stiff; lower contact is sharp

At 43.6 to 43.8': Silty Sand, fine to coarse grained; appears moist and dense; upper and lower contacts are sharp

OLDER ALLUVIAL FAN DEPOSITS \([Qf\alpha]\)  
Silty Gravel, clasts 50-60%, up to ¾ inch, mainly subangular to subrounded slate (Jsm), some shale (Tm), matrix is fine to coarse silty sand; very dark gray (7.5YR 3/1); appears very moist and dense; lower contact is sharp, erosional

At 55.7 to 56.3': Increasing sand, gradational transition to unit below

OLDER FLUVIAL DEPOSITS \([Qf\alpha]\)  
Clayey Gravel, clasts 50 to 60%, up to ¾ inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm), matrix is fine clayey sand; dark brown (7.5YR 3/2); appears very moist and stiff to very stiff; lower contact is gradational

At 58.6 to 58.8': Gravel increases to 30-40%
At 58.8 to 60.0': Grades to Clayey Sand, trace fine gravel
**LAKEWOOD FORMATION [Qlw]**

Silty Sand, fine to medium grained, color variable, mainly light yellowish brown (2.5Y 6/4) to yellowish brown (10YR 5/8); appears moist and dense, abundant laminations defined by variable oxidation

Encountered at 47 feet during drilling.

At 60.0 to 61.7': Gravel 70%; clast-supported, up to 2 inches, mainly subangular slate (Jsm) with some subangular to subrounded shale (Tm) and sandstone (Tm), lower contact is sharp, erosional

At 67.5 to 68.3': Becomes fine grained, color is grayish brown (2.5Y 5/2)

At 68.3 to 72.0': Color becomes light yellowish brown (2.5Y 6/3); occasional manganese oxide staining

At 69.2 to 69.4': Clayey Silty Gravel, clasts 50 to 60%, up to ½-inch, mainly subangular granitic rock, matrix is fine to coarse grained, clayey, silty sand; yellow (2.5Y 8/6) to reddish yellow (7.5YR 7/8)

At 71.5 to 72.0': Becomes gravelly, clasts 15-20%, up to ¾ inch, mainly subrounded slate and quartzite

At 73.2 to 73.3': Manganese oxide-rich bed; subangular slate (Jsm); color is dark gray (7.5YR 4/1)

At 73.3 to 74.0': Clayey Silty Gravel, fine grained; yellow (2.5Y 8/6) to brownish yellow (10YR 6/8)

At 74.0 to 75.0': No recovery

At 76.6 to 78.0': Oxidation decreases with depth

At 78.0': Color becomes light brownish gray (2.5Y 6/2) with faint strong brown (7.5YR 5/6) mottling; slightly micaceous
Encountered at 47 feet during drilling.

**Qlw Continued**

Silty Sand, very fine grained, lightly mottled, yellowish brown (10YR 5/8) to grayish brown (10YR 5/2); appears wet and dense; micaceous

Silty Sand and Silty Clay interbedded laminae, very fine grained; color variable, mainly grayish brown (10YR 5/2) to yellowish brown (10YR 5/6), to strong brown (7.5 YR 4/6); appears wet and dense/stiff; micaceous, typical bed and lamination thickness ¼ inch to 2 inches; lower contact is sharp

At 82.6 to 82.7': Oxidized Clay/Silt bed

**SAN PEDRO FORMATION [Qsp]**

Silty Sand; very fine grained, greenish gray (10BG 5/1); appears wet and dense; slightly micaceous

At 83.3' to 90.0': No recovery

Silty Sand, very fine grained, trace coarse sand and fine gravel (Jsm); dark greenish gray (10Y 4/1); appears wet and dense; occasional laminations

Silty Gravel, clasts 50 to 60%, up to ¾ inch, mainly subangular to subrounded slate (Jsm), some quartzite; matrix is fine to coarse silty sand; dark greenish gray (10Y 4/1); appears wet and dense; depth of lower contact uncertain due to poor recovery

At 91.7' to 95.0': No recovery

Silty Sand, very fine grained, trace coarse sand (Jsm and Tm); greenish gray (10BG 5/1); appears wet and dense

At 95.7 to 96.3' and 98.2 to 98.5': Gravel, clasts 50 to 60%, up to ½ inch, mainly subangular to subrounded slate (Jsm), some granitic rock

At 99.0 to 100.0': No recovery
**Notes:**
Boring backfilled with cement/bentonite grout from bottom up and patched.
- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted.
- Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch).
- Beds are generally massive unless otherwise noted.

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<th>RUN #</th>
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**Groundwater Readings**
Encountered at 47 feet during drilling.

**End of Boring at 100 Feet**
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This record is an interpretation of subsurface conditions at the exploration location. Latitude and longitude of boring location shown on logs are approximate. Interfaces between strata are approximate. Transitions between strata may be gradual.

**DRILLING COMPANY/DRILLING EQUIPMENT**
Jet Drilling/Tri Country / CME 75

**BORING COMPANY/DRILLING EQUIPMENT**
Jet Drilling/Tri Country / CME 75

**HOLE DIAMETER**
8 inches

**GROUNDWATER READINGS**
Encountered at 36½ feet during drilling.

12 inches of asphaltic concrete over 8 inches of base

Hand augered to 6 feet

**FILL [AF]**
Clayey to Sandy Silt, variable coarse sand and fine gravel, gravel 0-10%, up to ½ inch; dark yellowish brown (10YR 3/4); appears damp to moist and very stiff; trace asphalt and other fill debris

NOTE:
Jsm = Santa Monica Slate
Tm = Modelo Formation
See end of log for more detailed description of clasts

At 10.0': Color change to very dark grayish brown (10YR 3/2)

At 12.0 to 14.0': No recovery

At 14.8': Glass fragments

OLDER ALLUVIAL FAN DEPOSITS [Q6]
Sandy Silt, trace to some clay, trace coarse sand and fine gravel (Jsm and Tm); dark yellowish brown (10YR 3/4); appears damp and very stiff; lower contact is gradational

Geologist: LH/MF
Prepared/Date: YN/WL/MW 10/13/2011
Checked/Date: MW/MF 10/13/2011
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**DRILLING COMPANY/DRILLING EQUIPMENT**
Jet Drilling/Tri Country / CME 75

**BOREHOLE LOCATION**
See Plate 3

**DATES DRILLED**
2/14/11-2/15/11 and 6/30/11-7/1/11

**HOLE DIAMETER**
8 inches

**GROUNDWATER READINGS**
Encountered at 36½ feet during drilling.

**ESTUARINE DEPOSITS [Qe]**
Silty Sand, fine grained, trace coarse sand (Jsm and Tm); faintly mottled, dark grayish brown (2.5Y 4/2) to dark yellowish brown (10YR 3/6); appears wet; lower contact is sharp

**At 20.5':** Charcoal fragment, sample obtained
At 21.0': Gravel content increases to 5 to 10%

**Silty Sand, fine grained, some coarse sand and gravel, clasts 10 to 15%, up to 1½ inches; mainly subangular slate (Jsm) with lesser subrounded shale and sandstone (Tm); dark yellowish brown (10YR 3/6); appears damp and dense; lower contact is sharp**

**At 25.0 to 25.6':** Silty Clay; dark yellowish brown, appears moist and very stiff

**Silty Sand, fine grained, variable coarse sand and fine gravel, clasts 5 to 20%, up to ½ inch (Jsm and Tm); brown (10YR 5/3); appears dry/damp**

**At 26.0 to 29.0':** No recovery

**Silty Sand and Sandy Silt, fine grained, some coarse sand and fine gravel, clasts 5 to 15%, up to ¼ inch; mainly subangular, slate (Jsm) with lesser subrounded shale and sandstone (Tm); dark yellowish brown (10YR 3/4); appears moist and dense/very stiff; lower contact is gradational**

**Clayey to Sandy Silt, some coarse sand and gravel, clasts 5 to 15%, up to ¾ inch; mainly subangular to subrounded, slate (Jsm) with lesser subrounded shale and sandstone (Tm); dark yellowish brown (10YR 3/6); appears moist and very stiff; lower contact is sharp**

**At 35.0':** Coarse sand and gravel content decreases to trace

**At 36.5':** Groundwater encountered during drilling

**At 38.5 to 40.0':** No recovery

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**Geologist:** LH/MF
**Prepared/Date:** YN/WL/MW 10/13/2011
**Checked/Date:** MW/MF 10/13/2011
Encountered at 36½ feet during drilling.

**OLDER FLUVIAL DEPOSITS [Qfofl]**

Well Graded Gravel with Silt and Sand, soil matrix is fine to coarse sand, clasts 60 to 70%, up to 1½ inch, mainly Jsm and Tm, some granitic rock; dark yellowish brown (10YR 3/4); appears wet; lower contact occurs between runs

Poorly Graded Sand, fine grained; brown (10YR 4/3); appears wet and dense

Well Graded Sand with Gravel, fine to coarse grained, clasts 15 to 25%, up to ½ inch, mainly Jsm and Tm, some quartzite, gravel content increases with depth; dark olive brown (2.5Y 3/3); appears wet and dense; lower contact occurs between runs

At 50.0 to 51.5': Well Graded Sand, fine to medium grained, coarsens with depth; brown (10YR 4/3); appears wet and dense

**LAKEWOOD FORMATION [Qfw]**

Clayey to Sandy Silt, trace to some fine sand, trace coarse sand (Jsm and Tm); dark yellowish brown (10YR 4/4), trace magnesium oxide specks (<1/8 inch); appears very moist and very stiff; lower contact is sharp

At 57.5 to 60.0': No recovery
**Groundwater Readings**

Encountered at 36½ feet during drilling.

<table>
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<th>Elevation (ft)</th>
<th>Depth (ft)</th>
<th>Box #</th>
<th>Run #</th>
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**Qlw Continued**

*Marker Bed Mc*  
Silty Clay and Clay; trace to some fine sand; dark grayish brown (2.5Y 4/2); appears very moist and very stiff; some vertically-oriented, prismatic manganese flecks (5 to 20%, up to 1/16 inch x ¼ inch); lower contact is gradational

At 61.5 to 62.0': Becomes mottled, dark yellowish brown (10YR 4/3) to dark grayish brown (2.5Y 4/2)
At 62.0': Becomes very dark grayish brown (2.5Y 3/2), trace calcium carbonate nodules up to 1 inch

*Marker Bed Mg / Carbonate-rich Bed [Qlw]*  
Silty Clay with extensive carbonate development, calcium carbonate 70 to 90%, occurs as powdery deposits and clusters of subangular, 1/8 inch to ¼ inch concretions; silty clay is very dark grayish brown (2.5Y 3/2), calcium carbonate powdered deposits are white (10YR 9.5/1), calcium carbonate concretions are white (10YR 8/1); appears moist to very moist and very stiff to very hard (concretions); lower contact is narrowly gradational

At 64.0 to 65.0': No recovery
At 65.0': Appears very moist to wet and medium stiff to very hard

At 68.7 to 69.1': Grades to Sandy Silt, trace calcium carbonate; grayish brown (2.5Y 5/2); appears moist and hard
At 69.1 to 70.3': Calcium carbonate content decreases and becomes more variable, 10 to 30%

*Marker Bed Sp / Silty Clay*  
Silty Clay and Clay, trace to some fine sand; mottled, light olive brown (2.5Y 4/6) to dark yellowish brown (2.5Y 3/4); very moist; very stiff; 5-15% calcium carbonate, occurs as dispersed deposits and small (<¼ inch) nodules and vertically oriented prisms
At 71.3': ¾ inch thick layer with concentrated calcium carbonate deposits and small (<¼ inch) concretions
At 73.0 to 74.5': Little or no calcium carbonate

At 79.0 to 80.0': Marker Bed Mc - Grades to fine to coarse, poorly graded sand, 5 to 10% fine gravel (Jsm)

**Geologist:** LH/MF  
**Prepared/Date:** YN/WL/MW 10/13/2011  
**Checked/Date:** MW/MF 10/13/2011

MTA Westside Subway Extension  
Los Angeles, California
**SAN PEDRO FORMATION [Qsp]**

- **Silty Sand, very fine grained; very dark greenish gray (5GY 3/1)**
- **At 86.3 to 90.0': No recovery**

- **Silty Sand, fine grained, trace coarse sand and fine gravel (Jsm and quartzite); light olive brown (2.5Y 5/4) to yellowish brown (10YR 5/8) to strong brown (7.5YR 5/8); distinct laminations defined by variable oxidation**

**Qlw Continued**

- **At 81.0 to 82.4': Becomes strongly mottled, light olive brown (2.5Y 5/4) to yellowish brown (10YR 5/8); appears wet and dense; trace concretionary iron oxide laminations**
- **At 81.4': ½ inch thick, subhorizontal, concretionary iron oxide lamination**

**GROUNDWATER READINGS**

Encountered at 36½ feet during drilling.

**MTA Westside Subway Extension**

Los Angeles, California
### LOG OF BORING

**Project No.:** 4953-10-1561  
**Location:** MTA Westside Subway Extension  
**Location:** Los Angeles, California

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<th>ELEVATION (ft)</th>
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<th>RUN #</th>
<th>% RECOVERY</th>
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<td>At 100.5 to 102.5': No recovery</td>
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<td>At 102.5': Poorly Graded Sand, fine to very fine grained; dark greenish gray (5GY 4/1), sand becomes cemented near lower contact</td>
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<td>Clay; black (5Y 2.5/1); appears moist and stiff to very stiff; trace calcium carbonate and subrounded gravel (up to 1½ inch), thinly bedded to laminated with organic-rich sediments</td>
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|            |                |       |       |            | At 105.6': Bivalve shell, clay becomes calcium carbonate-rich with some calcium carbonate gravel and sand  
At 106.0 to 107.5': No recovery |
| 105        | 160            | 7     | 29    | 100        | SM                  |
|            |                |       |       |            | 10/3': Silty Sand, fine to medium grained; greenish black (10Y 2.5/1); appears moist and dense |
|            |                |       |       |            |                     |
| 105        | 155            | 7     | 30    | 20         |                     |
|            |                |       |       |            | At 111.0 to 115.0': No recovery |
| 105        | 150            | 7     | 31    | 35         | SM                  |
|            |                |       |       |            | At 115.0 to 116.7': Some calcium carbonate; some coarse gravel, up to 2½ inches  
At 116.7 to 120.0': No recovery |

*Geologist: LH/MF*  
*Prepared/Date: YN/WL/MW 10/13/2011*  
*Checked/Date: MW/MF 10/13/2011*
At 121': Some gravel and cobbles, no recovery to 122.5'

At 124.0 to 124.5': Silt content increasing, interbedded fine to coarse gravel layers

At 124.5 to 126.0': Sandy Silt interbeds

At 126.0 to 130.0': No recovery

END OF BORING AT 130 FEET

NOTES:
- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch).
- Beds are generally massive unless otherwise noted.
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<th>ELEVATION (ft)</th>
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<td></td>
<td>Encountered at 34-feet and measured at 17.6 feet during drilling.</td>
</tr>
<tr>
<td>270</td>
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<td>1</td>
<td>1</td>
<td>100</td>
<td>Hollow Stem Auger</td>
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<td>265</td>
<td>1</td>
<td>2</td>
<td>25</td>
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<td>At 9.0' to 9.5': Gravelly layer, clasts 30-40%, up to 1 inch</td>
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<tr>
<td>260</td>
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<td>4</td>
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<td>At 14.0' to 14.5': Decomposed organics, strong organic odor</td>
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<tr>
<td>25</td>
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<td>At 17.6': Groundwater measured during drilling</td>
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<td>15</td>
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<td></td>
<td></td>
<td></td>
<td>At 16.0 to 17.5': Silty Sand with Gravel, fine grained, gravel 15-20%, up to ½ inch, mainly subangular slate (Jsm) and subrounded quartzite and shale (Tm)</td>
</tr>
<tr>
<td>20</td>
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<td></td>
<td>Silty Sand with variable gravel, fine-grained, gravel 3-15%, up to 3/4 inch, mainly angular to subangular shale (Jsm) and subrounded shale (Tm) and quartzite; dark yellowish brown (10YR 4/6); appears dry to damp and dense; lower contact appears sharp</td>
</tr>
</tbody>
</table>

NOTE:

Jsm = Santa Monica Slate
Tm = Modelo Formation
See end of log for more detailed description of clasts

8 inches of asphaltic concrete over 3 inches of base

Hand augered to 6 feet

FILL [AF]
Clayey to Sandy Silt, variable coarse sand and fine gravel, clasts 0-10%, up to 3/4-inch; dark yellowish brown (10YR 3/4); appears damp to moist and very stiff
**Q60 Continued**

At 20.0 to 21.0' and 23.8 to 24.4': Soil matrix grades to fine to coarse sand with silt; yellowish brown (10YR 5/4); gravel as above

At 22.7 to 23.5': Clayey to Sandy Silt, trace coarse sand; dark yellowish brown (10YR 4/4); appears moist and stiff

At 24.4 to 25.2': Occasional Sandy Silt lenses

Well Graded Gravel with Sand, gravel 60-70%, up to 1 inch; mainly subangular slate (Jsm) and subangular to subrounded shale (Tm) and quartzite, matrix is fine to coarse, well graded sand; brown (10YR 5/3); appears dry to damp; lower contact is erosional, appears to dip about 10 degrees

Sandy Silt with Clay, trace coarse sand; dark yellowish brown (10YR 4/6); appears very moist and very stiff; lower contact occurs between runs

Clayey Silt and Silty Clay, trace to some fine sand, trace coarse sand and fine gravel (Jsm and Tm); dark brown (10YR 3/3); appears very moist and stiff to very stiff; lower contact occurs between runs

At 34': Groundwater encountered during drilling

Sandy to Clayey Silt, trace coarse sand and fine gravel (Jsm and Tm); lightly mottled, color variable, mainly brown (10YR 5/3) to strong brown (7.5YR 4/6); appears very moist to wet and stiff; lower contact is gradational

At 34.0 to 34.5': Gravelly bed, clasts 10-20%, up to 3/4-inch, mainly subangular slate (Jsm) and subrounded shale (Tm)

ESTUARINE DEPOSITS [Qe]

Sandy Silt, trace to some clay, trace coarse sand; brown (10YR 5/3) with light brownish gray (10YR 6/2) mottling; appears very moist to wet and stiff; well sorted; lower contact is gradational

Encountered at 34-feet and measured at 17.6 feet during drilling.
Continued

At 42.0 to 43.2': Mottling more distinct, dark grayish brown (10YR 4/2) to brown (7.5YR 4/4)

Silty Sand, fine grained; mottled, grayish brown (2.5Y 5/2) to strong brown (7.5YR 4/6); appears wet and dense; well sorted; lower contact appears narrowly gradational (not intact)

At 44.6 to 45.0': Grades to Sandy Silt with Clay

At 45.0 to 45.4': Little or no mottling, grayish brown (10YR 5/4)

OLDER FLUVIAL DEPOSITS [Qfo]

Well Graded Gravel with Sand; gravel 60-70%, up to 1½-inch; mainly subangular to subrounded slate (Jsm), some subrounded shale and fine sandstone (Tm), quartzite and granitic rock, some portions possibly clast-supported; soil matrix is fine to coarse sand; very dark grayish brown (10YR 3/2); appears wet and dense; abundant manganese oxide staining; lower contact occurs between runs

At 48.5 to 49.5': Soil matrix grades to clayey sand, fine to coarse grained

At 51.5 to 52.5': Poorly Graded Sand; fine to medium grained, yellowish brown (10YR 5/4)

At 55.3 to 56.5': No recovery

ESTUARINE DEPOSITS - FINE GRAINED [Qef]

Silty Clay and Clayey Silt, trace to some fine grained sand, trace coarse grained sand and fine gravel (Jsm and Tm), occasional clay beds; brown (7.5YR 4/4); appears very moist and very stiff

At 58.0 to 58.8': Grades to Sandy Silt with Clay

At 59.0 to 60.0': Lightly mottled, brown (7.5YR 4/4) to yellowish brown (10YR 5/4)
**ESTUARINE DEPOSITS [Qe]**
Silty Clay and Clayey Silt, variable fine to coarse sand; trace fine gravel (Jsm and Tm); brown (7.5YR 4/4); appears very moist and very stiff; lower contact is gradational

At 64.0 to 67.0': Becomes more clayey, mainly clay to silty clay, sand decreases

At 67.0 to 68.0': Faint subhorizontal laminations

At 68.0 to 71.0': Coarse sand and gravel content increasing with depth

**OLDER ALLUVIAL FAN / FLUVIAL DEPOSITS [Qfd]**
Silty, Clayey Gravel, gravel 50-60%, up to 1½ inches, mainly angular to subangular slate (Jsm), some shale, brick-red sandstone (Tm), and quartzite; matrix is fine to coarse silty, clayey sand; dark yellowish brown (10YR 4/4); appears wet and dense; lower contact appears gradational

At 75.0 to 76.0 Gravel decreases, grades to Silty, Clayey Sand with Gravel

**ESTUARINE DEPOSITS [Qe]**
Clayey to Sandy Silt, trace coarse sand; lightly mottled, color variable, mainly yellowish brown (10YR 5/4) with brown (7.5YR 4/4) mottles and laminations; appears very moist and very stiff; lower contact is erosional; appears to dip about 15 degrees

At 78.0 to 80.0': No recovery

Encountered at 34-feet and measured at 17.6 feet during drilling.
Encountered at 34-feet and measured at 17.6 feet during drilling.

**OLDER FLUVIAL FAN DEPOSITS [Qefl]**

Silty Sand with some clay, coarsens downward, increasing gravel, clasts 10-30%, up to 1/2 inch, mainly slate (Jsm) and sandstone (Tm); appears very moist to wet; lower contact is narrowly gradational

At 95.8 to 96.5': Clasts mainly angular to subangular, granitic rock and slate (Jsm), trace shale and sandstone (Tm) and quartzite; appears very moist to wet and dense

At 94.6': Cobble, granitic

At 86.3': Sharp contact with sand layer (1 inch thick), fine grained, trace fine gravel

At 88.5': Silty Sand layer (3 inches thick), some clay, trace fine gravel; dark grayish brown (2.5Y 3/2); appears moist and stiff; trace manganese staining, slight mottled oxidation

At 89.6': Color change to olive (5Y 4/3), becomes sandy with depth

At 83.9 to 84.2': Sand with Gravel; clasts mainly angular slate (Jsm), subangular shale (Tm), and sandstone (Tm); appears very moist

Clayey Silt; olive (5Y 4/3), trace manganese staining, mottled oxidation; appears moist and stiff

At 82.6 to 83.7': Interbedded clayey silt (2-6 inches thick); lower contact is narrowly gradational

At 80.2': Gravelly layer (1 inch thick); very dark grayish brown (2.5Y 3/2); clasts mainly subangular slate (Jsm), trace brick-red sandstone clast

At 100:

- Silty Sand to Sandy Silt, fine grained; light olive brown (2.5Y 5/4), mottled oxidation; appears moist and medium dense

**GROUND WATER READINGS**

Encountered at 34-feet and measured at 17.6 feet during drilling.

MTA Westside Subway Extension
Los Angeles, California
| ELEVATION (ft) | BOX # | RUN # | % RECOVERY | SAMPLE LOC.
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<td>Qfob Continued</td>
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<td>BASAL OLDER ALLUVIAL FAN UNIT [Qfob]</td>
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<td>ML</td>
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<tr>
<td>108.5 to 111.9</td>
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<td>7</td>
<td>100</td>
<td>SM</td>
</tr>
<tr>
<td>110.4-112.4</td>
<td>3</td>
<td>8</td>
<td>100</td>
<td>CL</td>
</tr>
</tbody>
</table>

Encountered at 34-feet and measured at 17.6 feet during drilling.

- Clayey Silt; olive (5Y 4/3); some fine sand
- At 101.8-105°: No recovery
- Silty Sand to Sandy Silt, fine grained; olive (5Y 5/4); appears moist and dense; trace fine gravel; poorly sorted
- At 106.6°: Thin Clay bed; appears to dip approximately 15 degrees
- At 108.2°: Increasing gravel
- At 108.5 to 111.9°: Sandy Silt, varying amount of clay and fine sand, sand content increasing with depth, lower contact is gradational
- At 110.4-112.4°: Calcium carbonate nodules and trace manganese staining
- Silty Sand, fine grained, some silt, trace clay, trace coarse sand and fine gravel (Jsm and Tm); dark yellowish brown (10YR 4/4) to yellowish brown (10YR 5/3); appears moist and dense, trace calcium carbonate nodules; lower contact is gradational
- At 118.9°: Thin Clay bed, appears near horizontal

MTA Westside Subway Extension
Los Angeles, California
**Qfo** Continued
trace calcium carbonate nodules; lower contact is sharp

At 123.4 to 123.9': Fault, approximate dip is 60 degrees, approximate 7 inches of offset; reverse displacement; upper contact has parallel shearing in clay, waxy warped surfaces

**BASAL ESTUARINE UNIT** [Qeb]
Clay; dark gray (5Y 4/1); appear moist and stiff, trace calcium carbonate nodules; lower contact is sharp

At 127.1 to 127.9': Bedding appears to dip approximately 15 degrees
Clayey Silt; dark gray (5Y 4/1); appears moist and medium stiff

At 127.9 to 129.7': Becomes Clay, sheared zones; punky texture, waxy parting surfaces; varying siltiness

At 129.7 to 131.0': Clay with varying silt content; dark gray (5Y 4/1); trace calcium carbonate nodules

At 131.0 to 131.6': Clay becomes softer; appears wet, punky texture, waxy parting surfaces, possible shearing; some calcium carbonate

At 132.8 to 134.8': Carbonate-rich bed, calcium carbonate 30-40%, broken up concretionary fragments; appears wet

At 134.2': Poorly Graded Sand; dark grayish green (5Y 4/2); fine grained; calcium carbonate-rich

At 134.8': Clay; dark olive gray (5Y 3/2); appears moist and very stiff; calcium carbonate 30-50%, some fine irregular oxidized pockets

At 135.6': Calcium carbonate decreases to 10-20%

At 139.1 to 140.0': Concretionary layer

Encountered at 34-feet and measured at 17.6 feet during drilling.
**Qeb Continued**

At 140-141.0': No sampling

Clay; black (5Y 2.5/1); appears damp to moist and very stiff; thin to laminated oxidized layers/lenses; some (5-10%) calcium carbonate nodules, up to 1/4 inch, some fine oxidized silt pockets

At 142.5 to 142.8': Poorly Graded Sand; fine grained

At 145.0 to 147.0': Clay appears sheared punky texture with waxy parting surfaces; black (5Y 2.5/2); appears damp and stiff

At 147.0': soft, possibly sheared, zone, (½-inch thick)

At 147.5 to 148.5': Some Silty Sand interbeds (gradational transition to unit below)

At 148.5 to 150.0': No recovery

**SAN PEDRO FORMATION [Qsp]**

Poorly Graded Sand, fine to medium grained; black (N 2.51); appears wet and dense

At 150.5': Becomes gravelly

At 150.9 to 155.0': No recovery

Poorly Graded Sand with Gravel; fine to medium grained, subangular fine to coarse granitic clasts, and subrounded to subangular slate (Jsm)

At 155.9 to 156.1': Poorly Graded Sand, some silt, very fine grained

At 156.1 to 156.3': Poorly Graded Sand with Gravel bed, fine to coarse, subangular to angular granitic and slate (Jsm) gravel; appears wet and medium dense

At 156.3 to 156.8': Poorly Graded Sand; fine to medium grained; appears wet and medium dense

At 156.8 to 160.0': No recovery
END OF BORING AT 160 FEET

NOTES:
Boring backfilled with cement/bentonite grout from bottom up and patched.
- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than 1/4 inch).
- Beds are generally massive unless otherwise noted.

Boring extended from 84-feet to 160-feet on 6/22/11-6/24/11. Offset from original boring location approximately less than 1-foot, north east.
### GROUNDWATER READINGS

Encountered perched groundwater at 5 feet and 9 feet. Groundwater at 24½ feet during drilling.

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<th>RUN #</th>
<th>BOX #</th>
<th>% RECOVERY</th>
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<td>33</td>
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<td>4</td>
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<td>1</td>
<td>5</td>
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</table>

#### OLDER ALLUVIAL FAN DEPOSITS [Qf/Qfo]
- Sandy to Clayey Silt, trace coarse sand and fine gravel (Jsm and Tm); dark yellowish brown (10YR 4/4); appears moist and stiff; lower contact occurs between runs
- At 10.7 to 14.0': No recovery

#### OLDER FLUVIAL DEPOSITS [Qfofl]
- Poorly Graded Sand with Gravel, fine to coarse grained, clasts 30-50%, up to 1 inch, mainly subangular to subrounded slate, with some subrounded shale, sandstone (Tm),
- At 17.5 to 19.0': No recovery

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**Drilling Company/Drilling Equipment:**
Jet Drilling / CME 75

**Borehole Location:**
See Plate 3

**Dates Drilled:**
3/24/11

**Hole Diameter:**
8 inches

**Ground El.:**
280 feet

**Project No.:**
4953-10-1561

**Geologist:**
DB/MF

**Prepared/Date:**
WL/YN/AR 10/13/2011

**Checked/Date:**
MW/MF 10/13/2011

MTA Westside Subway Extension
Los Angeles, California

(Continued on following figure)
<table>
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<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
<th>SAMPE LOC.</th>
<th>DRILLING METHOD</th>
<th>BOREHOLE LOCATION</th>
<th>DATES DRILLED</th>
<th>GROUNDWATER READINGS</th>
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<tr>
<td>255</td>
<td>25</td>
<td>1</td>
<td>7</td>
<td>100</td>
<td>ML</td>
<td>Hollow Stem Auger</td>
<td>See Plate 3</td>
<td>3/24/11</td>
<td>Groundwater encountered during drilling</td>
</tr>
<tr>
<td>250</td>
<td>30</td>
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<td>9</td>
<td>20</td>
<td>SM</td>
<td>Jet Drilling / CME 75</td>
<td>280 feet</td>
<td></td>
<td>Sandy to Clayey Silt, variable coarse sand and gravel, clasts 5-25%, up to 3/4-inch, mainly subangular slate (Jsm), with some shale and sandstone (Tm); brown (10YR 4/3); appears wet and medium dense, lower contact is sharp, erosional</td>
</tr>
<tr>
<td>245</td>
<td>35</td>
<td>2</td>
<td>11</td>
<td>96</td>
<td>SW</td>
<td>Jet Drilling / CME 75</td>
<td>280 feet</td>
<td></td>
<td>Silty Sand, fine grained; dark yellowish brown (10YR 4/4); appears wet and medium dense, lower contact is sharp, erosional</td>
</tr>
<tr>
<td>40</td>
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<td>100</td>
<td>SC/ML</td>
<td>Hollow Stem Auger</td>
<td>280 feet</td>
<td></td>
<td>Well Graded Sand with Silt, fine to medium grained; grayish brown (5Y 5/2); appears wet and medium dense, lower contact is sharp, erosional</td>
</tr>
</tbody>
</table>

**OLDER ALLUVIAL FAN DEPOSITS [Qfl]**
- At 24.5': Groundwater encountered during drilling
- Sandy to Clayey Silt, variable coarse sand and gravel, clasts 5-25%, up to 3/4-inch, mainly subangular slate (Jsm), with some shale and sandstone (Tm); brown (10YR 4/3); appears wet and medium dense, lower contact is gradational

**OLDER FLUVIAL / ALLUVIAL FAN DEPOSITS [Qflf / Qf o]**
- At 33.0 to 33.8': Grades to Well Graded Sand with fine Gravel, fine-coarse grained; clasts 15-20%, up to ½-inch, mainly subrounded slate (Jsm) and shale (Tm), coarse sand grains generally well rounded
- Silty Sand and Sandy Silt, fine grained; brown (10YR 4/3); appears wet and medium dense/stiff; upper 3 inches below upper contact is clayey, lower contact is sharp, erosional

**GEOLIST: DB/MF**
Prepared/Date: WL/YN/AR 10/13/2011
Checked/Date: MW/MF 10/13/2011

MTA Westside Subway Extension
Los Angeles, California
**GROUNDWATER READINGS**

Encountered perched groundwater at 5 feet and 9 feet, groundwater at 24½ feet during drilling.

**MINERALOGY / TEXTURAL CLASSIFICATION (ML)**

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<th>RUN #</th>
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<th>SAMPLE LOC.</th>
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<td>CL/ML</td>
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</tr>
</tbody>
</table>

**Qfo/Qfo Continued**

At 40.5': Organic rich bed, (½-inch thick)

At 40.5 to 42.3': Soft Clayey to Sandy Silt bed

At 43.5': Clay bed (1-inch thick); very dark gray (10YR 3/1); appears wet and soft; very sharp, subhorizontal upper and lower contacts

At 44.4 to 44.8': Grades to Sandy to Clayey Silt with Gravel, clasts 15-25%, up to 1 inch; mainly subangular to subrounded slate (Jsm)

**ESTUARINE DEPOSITS - FINE GRAINED [Qef]**

Silty Clay and Clayey Silt, variable fine sand, trace coarse sand (Jsm and Tm); dark grayish brown with variable dark yellowish brown (10YR 4/6) mottling; appears very moist and very stiff; lower contact is sharp, erosional

At 50.8': Grades to Silty Clay to Clayey Silt

Clay, rare (<1%) coarse sand (Jsm and Tm); dark gray (10YR 4/1) to brown (7.5Y 4/2); appears very moist and very stiff; some manganese oxide staining; occasional sandy lenses or pockets; lower contact is sharp

At 54.0 to 54.6': Color becomes very dark gray (10YR 3/1) to dark brown (7.5Y 3/3)

At 57.5 to 59.0': No recovery

**GROUNDWATER RECORDS**

Encountered perched groundwater at 5 feet and 9 feet, groundwater at 24½ feet during drilling.
### CL/ML

* Continued

Silty Clay to Clayey Silt, variable fine sand, trace coarse sand (Jsm and Tm); strongly mottled, dark grayish brown (10YR 4/2) to dark yellowish brown (10YR 4/4) to brown (10YR 4/4); appears very moist and very stiff to hard; variable subhorizontal laminations; rare (<1%) manganese oxide flecks; occasional sandy lenses or pockets; lower contact is gradational

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### OLDER ALLUVIAL FAN DEPOSITS [Qfo]

Clayey to Sandy Silt, trace coarse sand (Jsm and Tm); variable mottling, strong brown (7.5YR 4/4) to grayish brown (10YR 4/2); appears wet and medium stiff; lower contact is narrowly gradational

At 65.8 to 69.0': No recovery

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### Silty Sand

Fine grained, trace to some coarse sand, trace fine gravel (Jsm and Tm); brown (7.5YR 4/4); appears wet and dense

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**END OF BORING AT 74 FEET**

**NOTES:**

- Boring backfilled with cement/bentonite grout from bottom up and patched.
- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than 1/4 inch).
- Beds are generally massive unless otherwise noted.
Hand augered to 6 feet

**NOTE:**
Jsm = Santa Monica Slate
Tm = Modelo Formation
See end of log for more detailed description of clasts

### OLDER ALLUVIAL FAN DEPOSITS [Q60]
Silty Clay to Clayey Silt, variable fine sand, trace coarse sand and fine gravel (Jsm and Tm); dark brown (10YR 3/3); appears very moist and stiff to very stiff; lower contact is gradational

Clayey to Sandy Silt, trace to some coarse sand and fine gravel, clasts 2-10%, up to ½ inch, mainly subangular slate (Jsm) and subrounded shale (Tm) and sandstone (Tm), some brick-red sandstone; brown (10YR 4/3); appears very moist and stiff

At 10': Groundwater encountered during drilling
At 10.3 to 13.1': Grades to Sandy Silt and fine Silty Sand, appears wet and medium stiff/medium dense; gravel decreases to <5%

At 13.0 to 13.8': Grades to fine Silty Sand to Sandy Silt with Gravel, clasts 40-50%, up to ¾ inch, mainly subangular slate (Jsm), some subrounded shale and sandstone (Tm)

### OLDER FLUVIAL DEPOSITS [Q60f]
Well Graded Sand with Gravel; fine to coarse grained, clasts 30-50%, up to 1 inch, mainly subrounded slate (Jsm), some subrounded shale and sandstone (Tm), occasional quartzite also observed; color variable; appears very moist to wet and medium dense; occasionally grades to fine to coarse silty sand matrix; lower contact is sharp, erosional
At 15.0 to 16.5': No recovery
At 17.6 to 19.0': No recovery
At 19.0 to 19.8': Grades to Poorly Graded Sand, grades to fine to medium grained, trace fine gravel
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<tr>
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<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
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<tr>
<td>240</td>
<td>2</td>
<td>12</td>
<td>88</td>
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</tr>
</tbody>
</table>

**Groundwater Readings**

Encountered at 10 feet during drilling.

- **ESTUARINE DEPOSITS [Qe]**
  - Sandy Silt, trace to some clay, rare (<1%) coarse sand; brown (7.5YR 4/4) with variable pale brown (10YR 6/3) mottles and laminations; appears very moist and stiff; well sorted; lower contact is gradational

- **OLDER ALLUVIAL FAN DEPOSITS [Qf]**
  - Clayey to Sandy Silt, trace to some coarse sand (up to 10%, mainly Jsm and Tm), trace fine gravel (Jsm and Tm); dark yellowish brown (10YR 4/4) with variable pale brown (10YR 6/3) mottles; appears very moist and stiff; poorly sorted; lower contact occurs between runs

- **Qf** (Continued)
  - At 22.8 to 23.3': Distinct fine Sand with Silt bed; dark yellowish brown (10YR 4/4); bordered above and below by 1/2-inch, subhorizontal, silty clay beds, appears soft and wet

- At 30.1 to 31.2': Numerous well defined, subhorizontal laminations

- At 35.0 to 35.4' and 35.4 to 36.7': Distinct subhorizontal laminations, slightly sandier

- At 37.8 to 39.7': Coarsens downward, coarse sand increases to 15-30%, fine gravel 5-10%, up to 3/4 inch

**Drilling Company/Drilling Equipment**

Jet Drilling / CME 75

**Dates Drilled**

4/5/11

**Hole Diameter**

8 inches
### ESTUARINE DEPOSITS [Qe]
- Clayey to Sandy Silt, trace coarse sand, rare (<1%) fine gravel (Jsm and Tm); brown (7.5YR 4/4) with variable grayish brown (10YR 5/2) mottles; appears very moist and stiff, lower contact occurs between runs.
- At 44.7 to 44.9': Subhorizontal, grayish brown laminations.
- At 47.1 to 47.3': Fine Silty Sand bed, subhorizontal, sharp contacts.
- At 47.3 to 49.0': No recovery.
- At 49.8 to 50.3': Clay, strong brown (7.5YR 5/6) to grayish brown (10YR 5/2).
- At 50.7 to 51.0': Clay; reddish brown (5YR 5/4), trace manganese oxide flecks.
- At 51.0 to 51.1': Oxidized, subhorizontal silty sand bed.
- At 51.5 to 54.0': No recovery.
- Silty Sand, fine grained, trace coarse sand; brown (10YR 5/3) with occasional yellowish brown (10YR 5/6) mottling or laminations; appears very moist and dense; occasional faint subhorizontal laminations; well sorted; lower contact occurs between runs.
- At 55.4 to 56.5': No recovery.

### OLDER ALLUVIAL FAN DEPOSITS [Qfo]
- Clayey Gravel, clasts 50-60%, up to 1 inch, mainly subrounded slate (Jsm), shale (Tm) and sandstone (Tm), some subrounded quartzite, matrix is sandy clay and clayey sand; color generally is very dark grayish brown (10YR 3/2); appears wet and dense; lower contact appears narrowly gradational.

### GROUNDWATER READINGS
- Encountered at 10 feet during drilling.
- At 41.3 to 42.5': Gravel increases, 10-20%, up to 3/4 inch
- At 42.5 to 44.0': No recovery
- Depth of contact uncertain due to poor recovery.
### Boring No. T1-B5 (Continued)

**Drilling Company/Drilling Equipment:**
Jet Drilling / CME 75

**Drilling Method:**
Hollow Stem Auger

**Borehole Location:**
See Plate 3

**Dates Drilled:**
4/5/11

**Hole Diameter:**
8 inches

**Ground El.:**
277 feet

### Groundwater Readings
Encountered at 10 feet during drilling.

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<tr>
<th>Elevation (ft)</th>
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<th>Run #</th>
<th>Recovery</th>
<th>Sample Loc.</th>
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<tr>
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<td>68</td>
<td>4</td>
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</table>

- **Silty Clay to Clayey Silt,** variable fine sand, trace to some coarse sand (Jsm and Tm); mottled, strong brown (7.5YR 5/6) to grayish brown (10YR 5/2); appears very moist to wet and very stiff; lower contact is gradational

<table>
<thead>
<tr>
<th>Elevation (ft)</th>
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- **Clayey to Sandy Silt,** trace to some coarse sand and fine gravel (Jsm and Tm); mottled, yellowish brown (10YR 5/6) to brown (7.5YR 4/4) to grayish brown (10YR 5/2); appears very moist to wet and very stiff; lower contact is sharp

<table>
<thead>
<tr>
<th>Elevation (ft)</th>
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<th>Run #</th>
<th>Recovery</th>
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</table>

- **Older Alluvial Fan/Estuarine Deposits [Qfo/Qe]**

  - Silty Clay to Clayey Silt; trace to some coarse sand, and fine gravel (Jsm and Tm); mottled, yellowbrown (10YR 5/6) to brown (7.5YR 4/4); appears very moist and very stiff; lower contact is gradational

<table>
<thead>
<tr>
<th>Elevation (ft)</th>
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<th>Box #</th>
<th>Run #</th>
<th>Recovery</th>
<th>Sample Loc.</th>
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<td>68</td>
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</table>

- At 69.7 to 70.0': Gravel increases, gradational transition to unit below

  - **Silty Gravel,** clasts 60-70%, up to 3/4 inch, mainly slate (Jsm), shale (Tm), sandstone (Tm) and quartzite; matrix is fine to coarse silty sand with clay; very dark grayish brown (10YR 3/2); appears wet and dense; lower contact is sharp, erosional

<table>
<thead>
<tr>
<th>Elevation (ft)</th>
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</table>

- **Sandy to Clayey Silt,** trace coarse sand; mottled, color variable; appears very moist and very stiff; some manganese oxide staining

<table>
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<th>Run #</th>
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<td>24</td>
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</table>

- At 71.5 to 72.4': Gravel decreases to 30-50% (Silty Sand with Gravel)

- **Sandy to Clayey Silt,** trace coarse sand; mottled, color variable; appears very moist and very stiff; some manganese oxide staining

### End of Boring at 74 Feet

**Notes:**
Boring backfilled with cement/bentonite grout from bottom up and patched.

- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term “clasts” herein describes gravel-size rock fragments (larger than 1/4 inch).
- Beds are generally massive unless otherwise noted.
Grass at the surface
Hand augered to 6 feet

OLDER ALLUVIAL FAN DEPOSITS [Qfo]
Silt; dark yellowish brown (10YR 4/6); appears moist and soft

NOTE:
Jsm = Santa Monica Slate
Tm = Modelo Formation
See end of log for more detailed descriptions of clasts

At 6.0 to 8.0': No recovery
At 8.0 to 13.0': No recovery
At 16.0 to 16.4': Grades to fine Silty Sand with Gravel
At 18.4 to 20.5': No recovery

FLUVIAL DEPOSITS [Qfal]
Well Graded Sand with Gravel; fine to coarse grained, clasts 15-50%, up to 1/3 inch; mainly subangular to subrounded slate (Jsm), sandstone (Tm) and quartzite; color variable, appears moist and dense
At 14.2 to 15.5': No recovery
At 16.0 to 16.4': Grades to fine Silty Sand with Gravel
At 16.9 to 18.0': No recovery
At 18.4 to 20.5': No recovery
Qfof Continued

At 20.5 to 20.9': Grades to fine Silty Sand with Clay

At 20.9 to 21.0': Clay bed (1 inch thick)

At 21.0 to 21.4': Gradational zone

At 21.4 to 22.0': Silty Gravel, clasts 60-70%, up to 1 inch, mainly subangular to subrounded slate (Jsm), some very strong meta-basalt; soil matrix is fine to coarse silty sand

At 22.0 to 23.0': No recovery

OLDER ALLUVIAL FAN DEPOSITS [Qfo]

Silty Sand and Sandy Silt, very fine grained; dark grayish brown (10YR 4/2); appears very moist and dense/stiff; occasional clay/silt beds; lower contact occurs between runs

At 23.8 to 27.2': Variable gravel (5-30%), mainly subangular slate (Jsm), clasts up to 2 inches at 23.8 to 24.0'

OLDER ALLUVIAL FAN / ESTUARINE DEPOSITS [Qfo / Qe]

Clay and Silty Clay, occasional oxidized silt/sand lenses or pockets, trace coarse sand and fine gravel (Jsm and Tm); mottled, grayish brown (10YR 5/2) to reddish brown (5YR 4/4); appears very moist and very stiff; trace manganese oxide staining

At 32.2 to 32.5': Becomes gravelly

At 33.3 to 33.5': Grades to Clayey to Sandy Silt

OLDER ALLUVIAL FAN DEPOSITS [Qfo]

Silty Sand and Sandy Silt, fine grained, variable coarse sand and fine gravel, clasts 1-15%, up to ½ inch; mainly subangular slate (Jsm), some subangular to subrounded
Continued

shale and quartzite also observed; dark grayish brown (2.5Y 4/2); appears very moist and dense; lower contact appears gradational

At 39.4 to 39.7', 40.0 to 40.2', and 40.7 to 41.7': Well Graded Sand with Gravel, fine to coarse grained, clasts 20-50%, up to 3/4 inch, mainly subangular to subrounded slate (Jsm), some subrounded shale and sandstone (Tm) also observed

ESTUARINE DEPOSITS - Carbonate Rich [Qe]
Clay, trace fine to coarse sand; light brownish gray (2.5Y 6/2), appears very moist and very stiff; abundant (5-10%) fine, iron-oxide stained root structures; calcium carbonate filaments and small nodules (up to 1/8 inch) increase with depth, total calcium carbonate 5% at 43', 20% at 45'

At 45.2 to 45.8': Sandy Silt with Clay; brown (10YR 4/3); appears very moist and stiff

Sandy to Clayey Silt, trace coarse sand (Jsm and Tm); white (2.5Y 9/1) to pale yellow (2.5Y 8/2); appears very moist and very stiff; extensive calcium carbonate development, calcium carbonate occurs mainly as dispersed replacement of parent material and cemented nodules up to 1/4 inch, total calcium carbonate 70-90%; lower contact occurs between runs

At 48.0 to 53.0': Becomes gravelly, clasts 15-30%, up to ½ inch, mainly subangular slate (Jsm), some shale and sandstone (Tm) also observed; coarsens with depth

At 49.5 to 53.0': No recovery

FLUVIAL DEPOSITS [Qfofl]
Silty Sand with Gravel, fine to coarse grained, clasts 15-50%, up to 3/4-inch; mainly subangular to subrounded slate (Jsm), some subrounded shale (Tm) sandstone (Tm) and quartzite also observed; color variable, generally dark yellowish brown (10YR 4/4); appears wet and dense; lower contact is sharp, erosional

At 53.2 to 53.5' and 54.5 to 55.1': Grades to Silty Sand, fine to medium-grained

At 54': Groundwater encountered during drilling

At 58.4 to 58.8': Sandy Silt with variable coarse sand

At 58.8': Clay bed (½-inch thick), appears wet and soft
At 58.8 to 59.0': Calcium carbonate-rich sandy to clayey silt bed, total calcium carbonate 70-90%, contact appears sharp
At 59.0-59.5': Clayey Silt with Sand, dark greenish gray (5GY 4/1), some calcium carbonate nodules up to 1/4 inch, total calcium carbonate 10-25%

OLDER ALLUVIAL FAN DEPOSITS (Qfo)

Geologist: DB/MF
Prepared/Date: LM/YN/AR 10/13/2011
Checked/Date: MW/MF 10/13/2011

LOG OF BORING
Project No.: 4953-10-1561  Figure: T1-B6c
**OLDER FLUVIAL DEPOSITS [Qfofl]**

Well-Graded Sand with Gravel; fine to coarse grained, clasts 15-20%, up to 3/4 inch, mainly subangular slate (Jsm), some subrounded to rounded shale (Tm), sandstone (Tm) and quartzite also observed; color variable, generally grayish brown (2.5Y 5/2); appears wet and dense, lower contact is sharp

At 73.2 to 73.5': Clayey to Sandy Silt, micaceous, mottled, color variable

At 73.6 to 78.0': No recovery
<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
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<tr>
<td>180</td>
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</tbody>
</table>

**No sampling continued**

**Drilling Company/Drilling Equipment**
Gregg's Drilling / Mobile 8 - B-53

**Drilling Method**
Rotary Wash

**Borehole Location**
See Plate 3

**Dates Drilled**
4/18/11

**Hole Diameter**
8 inches

**Groundwater Readings**
Encountered at 54 feet during drilling.

**MTA Westside Subway Extension**
Los Angeles, California

**Geologist:** DB/MF
**Prepared/Date:** LM/YN/AR 10/13/2011
**Checked/Date:** MW/MF 10/13/2011

---

**T1-B6**

(Continued)
**BASAL ESTUARINE UNIT** (Qeb)
Clay; very dark greenish gray (5GY 3/1); appears very moist and very stiff; up to 15% calcium carbonate filaments; upper portion of core is disturbed, classification somewhat uncertain due to limited core sample (possible San Pedro Formation clay?)

At 105.5 to 106.3': Becomes black (N 2.5); micaceous, some decayed organics, little or no calcium carbonate

**SAN PEDRO FORMATION** (Qsp)
Silty Sand to Sandy Silt, fine grained, trace clay, coarse sand and fine gravel increase with depth; black (N 2.5); appears very moist and very stiff;

At 107.2 to 107.7': Some decayed organics, partially intact decayed roots

At 107.7 to 108.0': Grades to Clayey Silty Sand, fine to medium grained

At 108.0 to 118.0': No sampling

**Silty Sand, fine grained**: medium gray, no matching munsell color, closest match is dark gray, (N 4/1); appears wet and dense; occasionally grades to fine silty sand
<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
<th>SAMPLE LOC.</th>
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<td>Qsp Continued</td>
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<tr>
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<td></td>
<td>At 120.1': Organic-rich bed (½-inch thick); black (N2.5)</td>
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<tr>
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<td>At 120.1 to 120.8': Trace small shell fragments up to ½ inch</td>
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<td>150</td>
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<td></td>
<td>At 123.0 to 148.0': No sampling</td>
</tr>
</tbody>
</table>

**GROUNDWATER READINGS**

Encountered at 54 feet during drilling.

**Boring No.: T1-B6**

**Locations:**
- **Borehole Location:** T1-B6g
- **Project No.:** 4953-10-1561

**Drilling Details:**
- **Drilling Company/Drilling Equipment:** Gregg's Drilling / Mobile 8 - B-53
- **Drilling Method:** Rotary Wash
- **Dates Drilled:** 4/18/11
- **Hole Diameter:** 8 inches
- **Ground El.:** 278 feet

**Groundwater Readings:**

- **Run #**
- **Box #**

**Notes:**

- This record is an interpretation of subsurface conditions at the exploration location. Latitude and longitude of boring location shown on logs are approximate. Interfaces between strata are approximate. Transitions between strata may be gradual.

**Prepared/Date:** LM/YN/AR 10/13/2011

**Checked/Date:** MW/MF 10/13/2011

**Geologist:** DB/MF

**MTA Westside Subway Extension**

Los Angeles, California
GC-GM

100

Silty Clayey Gravel, clasts 50-70%, most up to 1 inch, maximum 2 inches, mainly angular slate (Jsm), some quartzite, meta-basalt and white igneous/metamorphic rock also observed; very dark gray (N 3/1); appears wet and dense; abundant coarse sand-size quartz grains

END OF BORING AT 153 FEET

No sampling continued

Boring backfilled with cement/bentonite grout from bottom up and patched.

-Munsell colors listed in order of predominance (most predominant color first).
-Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
-Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
-Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
-The term "clasts" herein describes gravel-size rock fragments (larger than 1/4 inch).
-Beds are generally massive unless otherwise noted.
Encountered at 10 feet during drilling.

**NOTE:**
Jsm = Santa Monica Slate  
Tm = Modelo Formation

See end of log for more detailed description of clasts

**FILL [Af]**
Clayey to Sandy Silt, trace coarse sand and fine gravel; very dark grayish brown (10YR 3/2); appears very moist and stiff; abundant dispersed organics

**OLDER ALLUVIAL FAN DEPOSITS [Qfo]**
Clayey to Sandy Silt and fine gravel; dark yellowish brown (10YR 4/4); appears very moist and soft to medium stiff; lower contact appears sharp

Silty Sand and Sandy Silt, fine grained, rare (<1%) coarse sand and fine gravel (Jsm and Tm); dark yellowish brown (10YR 3/4); appears wet and medium dense; lower contact appears sharp, erosional

At 6.5 to 6.7': Silty Sand bed, fine grained

At 8.4 to 9.0': Silty Sand with Gravel, fine to coarse grained, clasts 15 to 20%, up to 1½ inches, mainly subangular to subrounded slate (Jsm), some subrounded, tan to brick-red sandstone (Tm) also observed; color variable, appears wet and medium dense, lower contact occurs between runs

At 10.0': Perched groundwater encountered during drilling

At 11.4 to 14.0': No recovery

**OLDER FLUVIAL DEPOSITS [Qfofl]**
Well Graded Sand with variable Gravel, fine to coarse grained, clasts generally 10 to 30%, up to 1 inch, mainly subrounded slate (Jsm), some subrounded shale (Tm) and quartzite also observed, occasional slightly silty to silty beds; color variable, generally dark grayish brown (10YR 4/2); appears wet and medium dense; lower contact occurs between runs

At 16.0 to 16.5': Gravel content is 40 to 50%

At 16.5 to 19': No recovery

At 19.0 to 19.7': Grades to fine to medium, Poorly Graded Sand, gravel decreases to trace
<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
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<td>88</td>
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</tbody>
</table>

**DRILLING COMPANY/DRILLING EQUIPMENT**
Jet Drilling / CME 75

**DRILLING METHOD**
Hollow Stem Auger

**DATES DRILLED**
4/4/11 - 4/5/11

**BOREHOLE LOCATION**
See Plate 3

**HOLE DIAMETER**
8 inches

**GROUND EL.**
281 feet

**GROUNDWATER READINGS**
Encountered at 10 feet during drilling.

At 21.5 to 24.0': No Recovery

At 25.5 to 29.0': No recovery

At 31.2 to 31.5': Grades to Clayey, Silty Sand with Gravel
At 31.5 to 32.5': Grades to Poorly Graded Sand, fine to medium grained, trace gravel
At 34.0 to 34.5': Grades to Poorly Graded Sand, fine medium grained, trace gravel
At 36.5 to 37.3': Grades to Poorly Graded Sand, fine medium grained, trace gravel

**NOTE:** This record is an interpretation of subsurface conditions at the exploration location. Latitude and longitude of boring location shown on logs are approximate. Transitions between strata are approximate. Interfaces between strata may differ. Subsurface conditions at other locations and at other times may differ. **(Continued on following figure)**
<table>
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<tr>
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**OLDER ALLUVIAL FAN DEPOSITS [Qfo]**
- Clayey Sand to Sandy Clay, trace coarse sand to fine gravel; very dark grayish brown (10YR 4/2); appears wet and medium stiff/medium dense; abundant dispersed organics; calcium carbonate nodules up to ¼ inch increase with depth.
- Clay, trace coarse sand (Jsm and Tm); mottled, olive gray (5Y 3/2) to yellowish brown (10YR 5/6); appears very moist and stiff.
- Silty Sand, fine to medium grained, trace fine gravel (Jsm and Tm); dark grayish brown (10YR 4/2); appears wet and medium dense; poorly to moderately sorted; lower contacts generally appear sharp.
- At 43.2 to 44.0' and 44.8 to 47.8': Silty Clay, variable fine to coarse sand and fine gravel (Jsm and Tm); olive gray (5Y 4/2); appears very moist and stiff; some calcium carbonate nodules and filaments, total calcium carbonate 0 to 10%; occasional clayey sand beds; occasional oxidized dark yellowish brown (10YR 5/6) laminations, generally poorly sorted.
- At 49.9 to 50.2': Color is dark greenish gray (10Y 4/1)

**BASAL ESTUARINE UNIT (Qeb)**
- Silty Clay with variable Sand; color generally dark gray (5Y 4/1), some dark yellowish brown (10YR 5/6) mottles in upper 4 inches; trace calcium carbonate filaments and nodules up to 1/8 inch; appears very moist and stiff.
- At 50.9-51.0': Silty Sand bed
- At 55.8 to 56.2': Grades to fine to medium Clayey, Silty Sand
- At 56.2 to 59.0': Color becomes very dark greenish gray (5Gy 3/1); 5 to 15% calcium carbonates nodules, up to ¼ inch, some fine oxidized pockets
<table>
<thead>
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<th>Elevation (ft)</th>
<th>Depth (ft)</th>
<th>Box #</th>
<th>Run #</th>
<th>% Recovery</th>
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<td>19</td>
<td>40</td>
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<td>SM lower contact</td>
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<td>65</td>
<td>4</td>
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<td></td>
<td>SM Silty Sand, fine grained; medium gray (no matching munsell color), appears wet and dense; uniform grain size; lower contact is sharp</td>
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<td>4</td>
<td>21</td>
<td>80</td>
<td></td>
<td>CL/CH Clay to Silty Clay, occasional rare (&lt;1%) coarse sand and fine gravel (Jsm and Tm); greenish black (5GY 2.5/1); appears very moist and very stiff; dispersed organics; occasional micaceous beds; occasional slightly sandy beds or pockets</td>
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**Notes:**
- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modeling Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch).
- Beds are generally massive unless otherwise noted.
### LOG OF BORING

**BORING NO.** T1-B8

**GROUND EL.** 277 feet

**PROJECT NO.** 4953-10-1561

**DRILLING COMPANY/DRILLING EQUIPMENT**
Martini Drilling / CME 75

**DRILLING METHOD**
Hollow Stem Auger

**DATES DRILLED**
5/27/11

**HOLE DIAMETER**
8 inches

### GROUNDWATER READINGS

Measured at 39 feet during drilling.

### GROUND EL.

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<thead>
<tr>
<th>ELEVATION (ft)</th>
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</table>

**FILL [Af]**

Clayey to Sandy Silt, variable coarse sand and fine gravel, clasts 0-10% up to 1½ inches, (mainly Jsm and Tm); color variable, mainly dark yellowish brown (10YR 3/2); appears moist to very moist and very stiff; trace asphalt and other fine debris

### NOTE:

Jsm = Santa Monica Slate
Tm = Modelo Formation
See end of log for more detailed descriptions of clasts

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**OLDER ALLUVIAL FAN DEPOSITS [Qfo]**

Sandy Silt, trace to some clay, trace coarse sand and fine gravel (Jsm and Tm); dark yellowish brown (10YR 3/4); appears damp to moist and very stiff; lower contact occurs between runs At 17.0 to 17.3’ and 18.6 to 19.2’: Gravel increase to 20-25%, up to 3/4 inch, some brick-red sandstone (Tm)

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**METRO SOIL CORE**

S:\70131 GEOTECH\GINTW\FAULT_INVESTIGATION_WSE_LIBRARY AMEC OCTOBER2011 (2).GLB

G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.2 FAULT HAZARD INVESTIGATION\3.2 ALL FIELD NOTES\GINT LOGS\101561-TRANSECT 1.GPJ  10/14/11

**Geologist:** ME/MF

**Prepared/Date:** DR/YN/MW 10/13/2011

**Checked/Date:** MW/MF 10/13/2011

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MTA Westside Subway Extension
Los Angeles, California
OLDER FLUVIAL / ALLUVIAL FAN DEPOSITS [Qf0fl/Qf0l]
Silty Sand with Gravel, fine to coarse grained, clasts 20 to 50%, up to 1½ inch; mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm), some quartzite also observed; pale brown (10YR 6/3); appears damp and dense; lower contact is sharp, erosional

At 21.1 to 21.6': Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); dark yellowish brown (10YR 4/4); appears moist and stiff

At 22.3 to 25.0': No Recovery

At 26.8 to 28.9': Grades to fine Silty Sand with Gravel; clasts 15 to 25%, up to ¾ inch; dark yellowish brown (10YR 3/4); appears moist and dense

At 35: Clayey Silt, variable fine sand; trace coarse sand and fine gravel (Jsm and Tm); dark brown (10YR 3/3); appears very moist and stiff; poorly sorted, lower contact is narrowly gradational

OLDER FLUVIAL DEPOSITS [Qf0l]
Silty Gravel, clasts 50-70%, up to 2 inches; mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); matrix is fine to coarse silty sand; color variable; generally dark brown (10YR 3/3); appears wet and dense; lower contact occurs between runs

At 37.5 to 37.6': Clayey Silt bed

At 39': Groundwater measured during drilling
OLDER ALLUVIAL FAN DEPOSITS (Qfo)
Silty, Clayey Gravel, clasts 50 to 60%, up to 1 inch, subangular slate (Jsm), shale (Tm) and sandstone (Tm); matrix is fine to coarse silty, clayey sand; color variable; appears wet and dense; poorly sorted; lower contact occur between runs
At 40.3 to 41.2': Matrix grades to Clayey, Silty Sand
At 41.2 to 45.0': No recovery

ESTUARINE DEPOSITS [Qe]
Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); mottled, yellowish brown (10YR 5/6) to grayish brown (2.5Y 5/3); appears very moist and very stiff; trace manganese oxide flecks; lower contact is narrowly gradational
At 53.2 to 53.5': Some faint Silty Clay laminations

LAKEWOOD FORMATION [Qlw]
Sandy Silt; mottled, yellowish brown (10YR 5/6) to grayish brown (2.5Y 5/2); appears moist and stiff; well sorted; highly weathered; lower contact is gradational

Measured at 39 feet during drilling.
Sandy Silt with Clay; olive brown (2.5Y 4/4); appears very moist and very stiff; 5-10% manganese oxide flecks; highly weathered

At 61.6 to 62.3': Color becomes brown (7.5YR 4/4)

Marker Bed MH - Clay; dark gray (5Y 4/1); appears very moist and very stiff to hard; abundant manganese oxide flecks and staining; trace calcium carbonate nodules up to ¼ inch
At 62.3 to 62.8': 20 to 30% cemented manganese oxide nodules up to ¾ inch

Marker Bed MG - Carbonate Soil Horizon - Clay and Silty Clay; olive brown (2.5Y 4/4) to white (10YR 8/1); appears moist and very stiff; extensive calcium carbonate development, calcium carbonate occurs as dispersed deposits and cemented nodules up to 1 inch, total calcium carbonate 70 to 90%; lower contact is gradational

At 69.1 to 71.2': Calcium carbonate decreases to about 30 to 50%

Silty Sand, very fine grained; light brownish gray (2.5Y 6/2); appears very moist and dense; calcium carbonate occurs as dispersed deposits and cemented nodules up to ¾ inch, total calcium carbonate 25 to 50%

At 72.6 to 72.7': Calcium carbonate-rich bed, calcium carbonate occurs as dispersed deposits and concretions up to 1 inch, total calcium carbonate 60-70%
At 73.4 to 73.7': Highly oxidized bed; strong brown (7.5YR 5/8) predominant

At 75.0 to 75.5': Color becomes dark grayish brown (10YR 4/2); some strong brown (7.5YR 4/6) mottling

At 76.3 to 76.8': Grades to Clayey to Sandy Silt

At 76.9 to 77.9': Silty Clay, dark greenish gray (10Y 3/1) to olive gray (10YR 5/2); appears moist and very stiff; some waxy parting surfaces
At 77.5': soft/sheared clay seam, seam is Wavy, subhorizontal to 10 degrees
At 77.9 to 78.6': Increasing sand; gradational transition to unit below

At 80.0 to 81.2': Grades to fine to medium Poorly Graded Sand; light greenish gray (10YR 7/1)
## LOG OF BORING

### SAN PEDRO FORMATION (Qsp)

- **Silty Sand and Sandy Silt; very fine grained, dark greenish gray (5GY 4/1) with strong brown (7.5YR 4/6) mottling; appears wet and medium stiff; micaceous**

### Marker Bed MC

- **Grades to fine Poorly Graded Sand; light brownish gray (2.5Y 6/2); trace to some (2 to 10%) fine rounded gravel**

- **At 86.0': 3½ inch rounded quartzite clast**

### Qiw Continued

- At 81.2 to 82.2': Increasing silt and clay content, grades to fine to medium grained, clayey, silty sand; dark greenish gray (10GY 4/1)

- At 82.2 to 85.0': No recovery

- At 85.3 to 86.0': **Marker Bed MC**

- At 86.0': 3½ inch rounded quartzite clast

- At 86.0 to 90.0': No recovery

- At 91.0 to 91.9': Becomes oxidized, mottled, light yellowish brown (2.5Y 6/4) to yellowish red (5Y 4/6)

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**MTA Westside Subway Extension**

Los Angeles, California

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**DRILLING COMPANY/DRILLING EQUIPMENT**

Martini Drilling / CME 75

**BOREHOLE LOCATION**

See Plate 3

**DATES DRILLED**

5/27/11

**HOLE DIAMETER**

8 inches

**GROUND EL.**

277 feet

**% RECOVERY**

44

**ELEVATION (ft)**

195

**DEPTH (ft)**

85

**HOLE DIAMETER**

8 inches

**DRILLING METHOD**

Hollow Stem Auger

**GROUNDWATER READINGS**

Measured at 39 feet during drilling.
At 100.2 to 100.6': Grades to Clayey Silt; dark greenish gray (10Y 4/1) with strong brown (7.5YR 4/6) mottling; appears very moist and stiff.

At 101.5 to 110.0': No recovery.

Poorly Graded Sand with Silt; fine grained, very dark gray (2.5Y 3/1); appears wet and dense; slightly micaceous; lower contact is sharp, dips approximately 5 degrees.

Marker Bed MF - Clay, black (2.5Y 2.5/1); appears moist and very stiff; high organic content in upper 6 inches; lower contact is gradational.

Clayey, Silty Sand, fine grained, variable coarse sand and fine gravel, clasts 3-20%, up to ½ inch, mainly granitic rock and slate; black (2.5Y 2.5/1); appears very moist and dense; lower contact is gradational.

At 112.8 to 115.0': No recovery.

At 116.0 to 117.7': Gradational lightening of color, grades to dark gray (N 4); becomes moderately cemented (calcium carbonate).

At 117.3 to 117.7': Decreasing coarse sand and gravel, gradational change to unit below.

At 117.7 to 120.7': Silty Sand, fine grained; greenish gray (N 5/1) to dark gray (N 4); appears damp and dense; well cemented (calcium carbonate), fractured into 2 to 3 inch fragments in core sample.
**Qsp Continued**

At 120.7 to 121.9’: Gravel increases to 20 to 35%, most up to 1 inch, maximum 2 inches

At 121.9’ - 125.0’: No recovery

At 126.1’ - 130.0’: No recovery

At 130.9 to 131.0’: Well cemented bed (calcium carbonate), numerous subrounded slate clasts

Silty Sand, fine, trace coarse sand and fine gravel (Jsm and granitic rock); very dark gray (N 3/1); appears wet and dense; well sorted; lower contact occurs between runs

At 132.0 to 135.0’: No recovery

Sandy Silt; black (N 2.5/1); appears wet and stiff; lower contact occurs between runs

At 135.7 to 135.9’: Becomes gravelly, clasts 20-30%, up to 1 inch (Jsp)

At 136.0 to 140.0’: No recovery
SM

SM

Qsp Continued
Silty Sand, fine, trace coarse sand and fine gravel (Jsm and granitic rock); very dark gray (N 3/1); appears wet and dense; well sorted
At 140.8 to 141.3': Becomes well cemented, fractured in 1 to 2-inch fragments
At 141.3' - 145.0': No recovery

At 146.9' - 150.0': No recovery

END OF BORING AT 150 FEET
NOTES:
Boring backfilled with cement/bentonite grout from bottom up and patched.

-Munsell colors listed in order of predominance (most predominant color first).
-Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
-Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
-Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
-The term "clasts" herein describes gravel-size rock fragments (larger than 1/4 inch).
-Beds are generally massive unless otherwise noted.

Geologist: ME/MF
Prepared/Date: DR/YN/MW 10/13/2011
Checked/Date: MW/MF 10/13/2011
100 inches of asphalt concrete over 12 inches of base
Hand augered to 5 feet

NOTE:
Jsm = Santa Monica Slate
Tm = Modelo Formation
See end of log for more detailed description of clasts

FILL [AF]
Clayey to Sandy Silt, variable gravel, clasts 5 to 30%, up to 1 inch; dark brown (10YR 3/3); appears moist and very stiff; scattered asphalt and concrete fragments

OLDER ALLUVIAL FAN DEPOSITS [Qfo]
Sandy Silt, trace to some clay, variable gravel, clasts 2 to 20%, up to ½ inch, mainly subangular to subrounded slate (Jsm), shale (Tm), and sandstone (Tm), some quartzite; dark brown (10YR3/3); appears moist and stiff to very hard; poorly sorted; occasionally grades to very fine silty sand or clayey silt; lower contact is gradational

At 10.5 to 13.7': Color becomes dark yellowish brown (10YR 3/4); appears moist and stiff to very stiff
At 11.8 to 12.3': Grades to very fine Silty Sand
At 13.7 to 15.0': Grades to Clayey Silt with Sand, trace coarse sand and gravel; very dark grayish brown (10YR 3/2); appears moist and hard
At 15.0 to 17.2': Silty Sand to Sandy Silt, very fine grained, trace coarse sand and gravel (Jsm and Tm); yellowish brown (10YR 5/4) with occasional strong brown (7.5YR 5/6) mottles; appears moist and stiff/dense

Clayey to Sandy Silt with Gravel, clasts 15 to 25%, up to 3/4 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm), some brick-red sandstone; brown (7.5YR 4/4); appears moist and very stiff; poorly sorted; occasionally grades to clayey, silty sand with gravel; coarsens with depth; lower contact is gradational

At 20': Groundwater encountered during drilling

(Note: The above text is a transcription of the log of the boring results and the geological description of the subsurface conditions at the location of the boring T2-B1, as recorded by Martini Drilling / CME 75 on 5/18/11, with the driller being YN/WL and the geologist ME/MF.)
### ESTUARINE DEPOSITS (Qe)

- **Silty Clay; brown (7.5YR 4/4); appears wet and medium stiff, some varve-like bedding, lower contact is gradational**
- **Sandy to Clayey Silt, trace coarse sand and fine gravel (Jsm and Tm); strongly mottled, dark greenish gray (5GY 4/1) to brown (7.5YR 4/4); appears wet and medium stiff; lower contact is narrow and gradational**
- **Silty Clay and Clayey Silt, variable fine sand, trace coarse sand and fine gravel (Jsm and Tm); mottled, dark greenish gray (5GY 4/1) to brown (7.5YR 4/4); appears very moist to wet and medium stiff; lower contact is gradational**

- **At 29.2 to 30.0': Alternating beds of Silty Clay and Silty Clayey Sand**
  - **Silty Clay, variable fine sand, trace coarse sand; mottled, gray (10YR 5/1) to reddish brown (5YR 5/4); appears very moist and medium stiff; abundant (10 to 30%); manganese oxide flecks and staining; oxidized (reddish brown) pockets; lower contact is gradational**
  - **At 31.4 to 32.3': Silty Clay interbedded with fine Silty Sand beds; clay appears wet and soft**

- **At 32.9 to 33.3': Clayey Sand, fine to coarse grained, appears wet and dense; lower contact is sharp, appears to dip approximately 15 degrees**

- **At 33.3 to 34.5': Abundant oxidized, dark reddish brown (5YR 3/4) silt and sandy silt pockets and laminations**

- **At 34.5 to 35.0': Color becomes dark grayish brown (10YR 4/2), abundant magnesium oxide**

- **Clayey to Sandy Silt, variable coarse sand and fine gravel, clasts 2 to 15%, up to 1/2 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); strongly mottled, dark gray (5Y 4/1) to strong brown (7.5YR 4/6); appears very moist and stiff; occasionally grades to silty clay; some oxidized laminations; lower contact is sharp**

- **At 35.0 - 37.5': Gravelly, some varve-like bedding**

- **At 37.8 - 38.0': Trace gravel, prominent varve-like bedding**

- **At 38.4 to 40.4': Sandy Clay, variable gravel, clasts 5 to 25%, up to 1/4 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm), some quartzite, and brick red sandstone; color variable; appears very moist and very stiff**
At 40.4 to 43.6': Up to 5% manganese oxide flecks and staining; gravel decreases to 2-5%; occasional silty clay beds, some varve-like bedding and gravelly interbedding

At 43.6 to 44.0': Gravel increases to 30 to 40%

At 44.0 to 45.4 and 45.8 to 46.2': Grades to Silty Clay and Clayey Silt, trace coarse sand (Jsm and Tm); abundant oxidized laminations

At 45.4 to 45.8': Clayey to Silty Sand with Gravel, clasts 15 to 20%, up to 1/2 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); some brick-red sandstone (Tm)

Silty Clay and Clayey Silt, variable fine sand, trace coarse sand and fine gravel (Jsm and Tm); mottled, dark gray (10YR 4/1) to strong brown (7.5YR 4/6); appears very moist and very stiff; 2 to 5% calcium carbonate filaments and uncemented nodules up to 1/8 inch; punky texture, lower contact is narrowly gradational

At 51.3 to 52.4': Calcium carbonate increases to 5 to 15%, some cemented nodules up to 1/4 inch

At 58.8 to 60.2': Increasing sand and gravel; gradational transition to fan deposits below
**OLDER ALLUVIAL FAN DEPOSITS [Qfo]**

Clayey to Sandy Silt, variable coarse sand and fine gravel; clasts 2 to 15%, up to 3/4 inch; mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm), some granitic rock; strong brown (7.5YR 4/6); appears very moist and stiff to very stiff; poorly sorted; minor fracturing infilled with calcium carbonate and sandy silt; lower contact is gradational

Silty Sand and Sandy Silt, fine grained, trace clay, variable coarse sand and gravel, clasts 2 to 15%, up to ½ inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); brown (7.5YR 4/3); poorly sorted; contact is narrowly gradational

Clayey Silt, variable fine sand, trace coarse sand and fine gravel (Jsm and Tm); brown (7.5YR 4/4); appears very moist and soft to medium stiff; lower contact is narrowly gradational

At 70.5 to 70.8': Gravel increases to 10 to 15%

At 71.9 to 72.1': Grades to Sandy Silt

**OLDER FLUVIAL DEPOSITS [Qf0]**

Well Graded Sand with Gravel, fine to coarse grained, clasts 15 to 30%, up to 1 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); color variable, generally brown (7.5YR 4/3); appears wet and dense; lower contact is sharp and erosional

At 74.6 to 75.0': Alternating beds of Silty Clay and fine Silty Sand; clay appears wet and soft

At 75.0 to 75.8': Gravel decreases to 5%

At 75.8 to 77.0': Gravel increases with depth, 10 to 50% up to 3/4 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); some quartzite (Jsm) and granitic rock

**OLDER ALLUVIAL FAN DEPOSITS [Qfo]**

Silty Clay, trace coarse sand and fine gravel (Jsm); dark brown (7.5YR 4/3); appears moist and very stiff; lower contact is narrowly gradational, some distinct banded bedding

At 79.2 to 80.0': Clayey to Silty Sand, fine grained, trace coarse sand and fine gravel; strong brown (7.5YR 4/4); appears very moist and dense

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**REFERENCES:**

Geologist: ME/MF
Prepared/Date: YN/WL 10/13/2011
Checked/Date: MW/MF 10/13/2011

MTA Westside Subway Extension
Los Angeles, California

LOG OF BORING

Project No.: 4953-10-1561 Figure: T2-B1d
NOTES:

Boring backfilled with cement/bentonite grout from bottom up and patched.

- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted.
- Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch).
- Beds are generally massive unless otherwise noted.

Encountered at 20 feet during drilling
8 inches of asphalt concrete over 13 inches of concrete with Geofabric base
Hand augered to 6 feet

FILL [Af]
Silty Clay to Clayey Silt, variable coarse sand, trace gravel (Jsm and Tm); dark grayish brown (10YR 4/2); appears very moist and stiff to very stiff; occasional silty clay layers; lower contact occurs between runs

NOTE:
Jsm = Santa Monica Slate
Tm = Modelo Formation
See end of log for more detailed descriptions of clasts

At 6.0' to 9.0': No recovery

DEPTH OF CONTACT UNCERTAIN DUE TO POOR RECOVERY

OLDER ALLUVIAL FAN DEPOSITS [Qfo]
Sandy to Clayey Silt, trace coarse sand and fine gravel (Jsm and Tm); very dark grayish brown (10YR 3/2); appears moist to very moist
At 9.6-12.5': No recovery

Silty Sand to Sandy Silt, fine grained, variable clay, variable fine gravel, clasts 2 to 15%, up to 1/2 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); mottled, brown (10YR 4/3) to strong brown (7.5YR 4/6); appears moist and stiff to very stiff; lower contact occurs between runs

Sandy Clay, variable coarse sand, trace fine gravel (Jsm and Tm); very dark grayish brown; appears moist and very stiff to hard
At 15.5 to 15.8': Sandy Silt with Clay, trace fine gravel (Jsm and Tm); mottled, strong brown (7.5YR 4/6) to grayish brown (10YR 5/2); appears moist and very stiff; lower contact occurs between runs
At 15.7 to 19': No recovery

Sandy to Clayey Silt, variable coarse sand, trace fine gravel (Jsm and Tm); mottled, reddish brown (5YR 4/3) to grayish brown (10YR 5/2); appears very moist to wet and soft to medium stiff; lower contact is gradational

8 inches of asphalt concrete over 13 inches of concrete with Geofabric base
Hand augered to 6 feet

FILL [Af]
Silty Clay to Clayey Silt, variable coarse sand, trace gravel (Jsm and Tm); dark grayish brown (10YR 4/2); appears very moist and stiff to very stiff; occasional silty clay layers; lower contact occurs between runs

NOTE:
Jsm = Santa Monica Slate
Tm = Modelo Formation
See end of log for more detailed descriptions of clasts

At 6.0' to 9.0': No recovery

DEPTH OF CONTACT UNCERTAIN DUE TO POOR RECOVERY

OLDER ALLUVIAL FAN DEPOSITS [Qfo]
Sandy to Clayey Silt, trace coarse sand and fine gravel (Jsm and Tm); very dark grayish brown (10YR 3/2); appears moist to very moist
At 9.6-12.5': No recovery

Silty Sand to Sandy Silt, fine grained, variable clay, variable fine gravel, clasts 2 to 15%, up to 1/2 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); mottled, brown (10YR 4/3) to strong brown (7.5YR 4/6); appears moist and stiff to very stiff; lower contact occurs between runs

Sandy Clay, variable coarse sand, trace fine gravel (Jsm and Tm); very dark grayish brown; appears moist and very stiff to hard
At 15.5 to 15.8': Sandy Silt with Clay, trace fine gravel (Jsm and Tm); mottled, strong brown (7.5YR 4/6) to grayish brown (10YR 5/2); appears moist and very stiff; lower contact occurs between runs
At 15.7 to 19': No recovery

Sandy to Clayey Silt, variable coarse sand, trace fine gravel (Jsm and Tm); mottled, reddish brown (5YR 4/3) to grayish brown (10YR 5/2); appears very moist to wet and soft to medium stiff; lower contact is gradational

8 inches of asphalt concrete over 13 inches of concrete with Geofabric base
Hand augered to 6 feet

FILL [Af]
Silty Clay to Clayey Silt, variable coarse sand, trace gravel (Jsm and Tm); dark grayish brown (10YR 4/2); appears very moist and stiff to very stiff; occasional silty clay layers; lower contact occurs between runs

NOTE:
Jsm = Santa Monica Slate
Tm = Modelo Formation
See end of log for more detailed descriptions of clasts

At 6.0' to 9.0': No recovery

DEPTH OF CONTACT UNCERTAIN DUE TO POOR RECOVERY

OLDER ALLUVIAL FAN DEPOSITS [Qfo]
Sandy to Clayey Silt, trace coarse sand and fine gravel (Jsm and Tm); very dark grayish brown (10YR 3/2); appears moist to very moist
At 9.6-12.5': No recovery

Silty Sand to Sandy Silt, fine grained, variable clay, variable fine gravel, clasts 2 to 15%, up to 1/2 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); mottled, brown (10YR 4/3) to strong brown (7.5YR 4/6); appears moist and stiff to very stiff; lower contact occurs between runs

Sandy Clay, variable coarse sand, trace fine gravel (Jsm and Tm); very dark grayish brown; appears moist and very stiff to hard
At 15.5 to 15.8': Sandy Silt with Clay, trace fine gravel (Jsm and Tm); mottled, strong brown (7.5YR 4/6) to grayish brown (10YR 5/2); appears moist and very stiff; lower contact occurs between runs
At 15.7 to 19': No recovery

Sandy to Clayey Silt, variable coarse sand, trace fine gravel (Jsm and Tm); mottled, reddish brown (5YR 4/3) to grayish brown (10YR 5/2); appears very moist to wet and soft to medium stiff; lower contact is gradational
At 21.5 to 22.4 feet: Grades to fine, Clayey to Silty Sand, trace coarse sand; appears very moist to wet and dense

Clayey to Silty Sand, fine to coarse grained, some gravel, clasts 5 to 10%, up to 3/4 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); brown (7.5YR 4/4); appears wet and dense

ESTUARINE DEPOSITS [Qe]
Alternating beds of Silty Clay and fine Silty Sand, brown (7.5YR 4/4); appears wet and soft/medium dense
At 26.7-29 feet: No recovery
Silty Clay, dark grayish brown (10YR 4/2), manganese oxide specks, some organics
Silty Clay and Clayey Silt, variable fine to coarse sand, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); mottled, dark grayish brown (10YR 4/2) to strong brown (7.5YR 5/6); appears wet and soft/medium dense; clay/sand contacts are sharp
At 31 feet to 31.8 feet: Silty Clay, dark grayish brown (10YR 4/2), manganese oxide specks, some organics
Alternating beds of Silty Clay and fine Silty Sand/Sandy Silt; mottled dark grayish brown (10YR 4/2) to strong brown (7.5YR 5/6); appears wet and soft/medium dense; lower contact is sharp
Clay, rare (<1%) coarse sand (Jsm and Tm); mottled, color variable, mainly brown (7.5YR 4/3) to dark gray (7.5YR 4/1); appears very moist and stiff to very stiff; 5 to 15% manganese oxide flecks and staining; lower contact is narrowly gradational
At 37.5 to 39 feet: No recovery
Silty Clay and Clayey Silt, variable fine to coarse sand, trace fine gravel (Jsm and Tm); mottled, strong brown (7.5YR 4/6) to dark gray (7.5YR 4/1); appears very moist and very stiff; prominent varve-like bedding

At 43.4 to 44.8': Sand increases, grades to Clayey to Sandy Silt; trace fine gravel

OLDER ALLUVIAL FAN DEPOSITS [Qfo]
Clayey to Sandy Silt; variable coarse sand and fine gravel, clasts 5 to 20%, up to 1/2 inch, mainly subangular to subrounded slate (Jsm), some shale (Tm) and sandstone (Tm); reddish brown (5YR 4/4) with variable brown (7.5YR 4/3) mottling; appears very moist and stiff; poorly sorted; lower contact is narrowly gradational

At 49.0 to 50.3': Becomes more clayey, gravel 2 to 5%; brown (10YR 4/3) with occasional strong brown (7.5YR 5/6) mottling

Silty Clay with Gravel, abundant coarse sand, clasts 15 to 30%, up to 1 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm), some brick-red sandstone; color variable, mainly brown (10YR 4/3); appears very moist to wet and medium stiff to stiff; poorly sorted; occasionally grades to clayey sand/sandy clay with gravel; lower contact is gradational

At 52.6 to 54.0': No recovery

At 55.2 to 61.0': Appears very moist, very stiff

At 57.0 to 59.0': No recovery

Qc Continued
### ESTUARINE DEPOSITS - FINE GRAINED [Qef]

Clayey to Sandy Silt, coarse sand and fine gravel decrease with depth to trace, brown (10YR 4/3) to strong brown (7.5YR 4/6), appears moist and stiff, prominent varve-like bedding

- **At 61.0 to 62.7':** Prominent varve-like bedding
- **At 61.8 to 62.0':** Gravel increases to 15 to 20%, 10 to 15% calcium carbonate filaments
- **At 62.6 to 64.0':** No recovery
- **At 64.0 to 65.5':** Color variable mainly brown (7.5YR 4/3) with strong brown (7.5YR 5/6) mottling, speckled texture
- **At 65.0. to 65.5':** Occasional highly oxidized yellowish red (5YR 4/6) silt pockets up to 1/4-inch
- **At 66.5 to 67.0':** Grades to Clayey Sand, fine grained, gravel increases with depth from 2 to 15% (Jsm and Tm)
- **At 67.0' to 68.0':** Varve-like bedding
- **At 68.0 to 69.0':** No recovery
- **At 69.0 to 69.5':** Clayey to Silty Sand, fine grained, brown (7.5YR 5/4); appears wet and dense
- **At 69.6 to 70.4':** Color becomes dark grayish brown (10YR 4/2)
- **At 70.4 to 70.8' and 74.0 to 78.8':** Strongly mottled, grayish brown (2.5Y 5/2) to strong brown (7.5YR 4/6); appears very moist and very stiff
- **At 70.8 to 74':** No recovery
- **At 76.8 to 77.5':** Up to 5% calcium carbonate filaments and cemented nodules up to 1/8 inch
- **At 77.5 to 78.4':** Grades to Sandy to Clayey Silt

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**NOTES:**

Measured at 29 feet during drilling
Boring backfilled with cement/bentonite grout from bottom up and patched.

- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term “clasts” herein describes gravel-size rock fragments (larger than ¼ inch).
- Beds are generally massive unless otherwise noted.

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MTA Westside Subway Extension
Los Angeles, California

Geologist: BF/MF
Prepared/Date: YN/WL 10/10/2011
Checked/Date: MW/MF 10/11/2011

LOG OF BORING
Project No.: 4953-10-1561 Figure: T2-B2e
CL/ML
94
1
265
20

18 inches asphalt concrete over 6 inches of base

Hand augered to 5 feet

FILL [Af]
Sandy Silty Clay, fine grained

NOTE:
Jsm= Santa Monica Slate
Tm = Modelo Formation
See end of log for more detailed descriptions

CL/ML
Silty Clay and Clayey Silt, variable fine to coarse sand and gravel, clasts 5 to 15%, up to 3/4 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm), some brick-red sandstone, dark brown (7.5YR 3/2); appears very moist and medium stiff to stiff; poorly sorted; lower contact is gradational

At 8.4': Color becomes very dark brown (7.5YR 2.5/2)

CL/ML
Sandy to Clayey Silt, variable coarse sand, trace fine gravel (Jsm and Tm), some brick-red sandstone, very dark brown (7.5YR 2.5/2); appears very moist and stiff; poorly sorted; lower contact is gradational

Clayey to Sandy Silt, variable coarse sand and gravel, clasts 5 to 20%, up to 1 inch,
**Qfo Continued**

mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm), some brick-red sandstone; dark brown (10YR 3/3); appears very moist and medium stiff to stiff; occasionally grades to silty clay; lower contact is narrowly gradational

**ESTUARINE DEPOSITS [Qe]**

Clay and Silty Clay, rare (<1%) coarse sand; mottled, dark grayish brown (10YR 4/2) to yellowish red (5YR 5/6); appears very moist and very stiff, prominent varve-like bedding; lower contact is gradational

At 25.0 to 28.2': Silty Clay and Clayey Silt, trace coarse sand and gravel; variable varve-like bedding

At 29.3 to 30.0': Occasional slate (Jsm) clasts up to 1 inch

At 30.2 to 31.6': Grades to Clayey Silt, trace coarse sand and fine gravel (Jsm and Tm)

Clayey to Sandy Silt, variable coarse sand and fine gravel, clasts 2 to 15%, up to ½ inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); highly oxidized mottling, brown (7.5YR 4/4) to yellowish red (5YR 5/6); appears moist and very stiff; lower contact occurs between runs

Sandy Silt, trace coarse sand (Jsm and Tm); brown (7.5YR 4/4); appears moist to very moist and stiff; generally well sorted; lower contact is narrowly gradational; occasional varve-like bedding

At 38.1 to 39.9': Trace to some clay, variable gravel, clasts 2 to 15%, up to 3/4 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm)

**Groundwater Readings**

Encountered at 40 feet during drilling

At 40.0': Groundwater encountered during drilling

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**MTA Westside Subway Extension**

Los Angeles, California

**LOG OF BORING**

Project No.: 4953-10-1561  Figure: T2-B3b
Encountered at 40 feet during drilling

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**DRILLING COMPANY/DRILLING EQUIPMENT**
Martini Drilling / CME 75

**DRILLING METHOD**
Hollow-Stem Auger

**BOREHOLE LOCATION**
See Plate 3

**DATES DRILLED**
5/17/11

**HOLE DIAMETER**
8 inches

**GROUNDWATER READINGS**

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<td>At 56.0 to 56.6: Silty Gravel, clasts 50 to 60%, up to 3/4 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); brown (7.5YR 4/4); appears wet and dense; matrix occasionally grades to sandy clay; lower contact is sharp, gradational</td>
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<tr>
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<td>At 56.0 to 56.6: Silty Gravel, clasts 50 to 60%, up to 3/4 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); brown (7.5YR 4/4); appears wet and dense; matrix occasionally grades to sandy clay; lower contact is sharp, gradational</td>
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<td>Sandy to Clayey Silt, trace coarse sand and fine gravel (Jsm and Tm), some brick red sandstone; brown (7.5YR 4/4); appears very moist to wet and soft to stiff</td>
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**OLDER ALLUVIAL FAN DEPOSITS [Qf]**
Clayey to Sandy Silt, variable coarse sand and gravel, clasts 5 to 20%, up to 3/4 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); appears very moist and very stiff; poorly sorted; occasionally grades to sandy clay; lower contact is gradational

At 43.9': Clayey Silt with Sand, trace coarse sand and fine gravel (Jsm and Tm); brown (7.5YR 4/4)

At 42.6': Well graded Sand with Gravel, fine to coarse grained, clasts 15 to 20%, up to 3/4 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); dark brown (7.5YR 3/3); lower contact is sharp, erosional

Clayey to Sandy Silt, trace coarse sand and gravel, clasts 5 to 20%, up to 3/4 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); appears very moist and very stiff; poorly sorted; occasionally grades to sandy clay; lower contact is gradational

At 50.0': No recovery

At 50.7': Increasing gravel, gradational transition to unit below

**ESTUARINE DEPOSITS - FINE GRAINED [Qef]**
Alternating thin beds and laminations of Clayey Silt and Sandy Silt, color variable; appears very moist and stiff; bedding contacts sharp

At 41.3 to 43.9': Clayey Silt with Sand, trace coarse sand and fine gravel (Jsm and Tm); brown (7.5YR 4/4)

At 41.9 to 42.6': Well graded Sand with Gravel, fine to coarse grained, clasts 15 to 20%, up to 3/4 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); brown (7.5YR 4/4)

Clay, trace coarse sand and fine gravel (Jsm and Tm); mottled, brown (7.5YR 3/2) to strong brown (7.5YR 4/4); appears very moist and very stiff; trace manganese oxide staining; lower contact is narrowly gradational

At 49.0 to 50.0': No recovery

At 50.0 to 50.7': Increasing gravel, gradational transition to unit below

**Qe Continued**
Poorly Graded Sand with Silt, fine grained; brown (7.5YR 4/4); appears very moist to wet; lower contact is sharp, erosional, appears to dip 10 degrees

At 41.9 to 42.6': Well graded Sand with Gravel, fine to coarse grained, clasts 15 to 20%, up to 3/4 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); brown (7.5YR 4/4)

At 42.6 to 43.0': Clayey Silt with Sand, trace coarse sand and fine gravel (Jsm and Tm); brown (7.5YR 4/4)
Encountered at 40 feet during drilling

**ESTUARINE DEPOSITS (Qe)**

**Continued**

At 61.3 to 61.5’: Some cemented calcium carbonate nodules up to 3/4 inch
At 61.5 to 62.3’: Color becomes dark grayish brown (10YR 4/2)

**Continued**

Clay and Silty Clay, trace coarse sand and fine gravel (Jsm and Tm); highly oxidized, mottled, reddish brown (5YR 4/4) to dark gray (10YR 4/1); appears moist and very stiff; trace calcium carbonate filaments

At 65.0 to 65.8’: Increasing sand, gradational transition to unit below

**Clayey Silt to Silty Clay, trace coarse sand, dark grayish brown (10YR 4/2), appears moist and very stiff, 5 to 15% calcium carbonate filaments and nodules**

At 61.5 to 62.3’: Color becomes dark grayish brown (10YR 4/2)

At 65.0 to 65.8’: Increasing sand, gradational transition to unit below

**Clay and Silty Clay, trace coarse sand and fine gravel (Jsm and Tm); highly oxidized, mottled, reddish brown (5YR 4/4) to dark gray (10YR 4/1); appears moist and very stiff; trace calcium carbonate filaments**

At 68.6 to 68.9’: Calcium carbonate-rich bed, cemented and uncemented nodules up to 1 inch, total calcium carbonate 50 to 60%

At 69.1 to 70.0’: Grades to Silty Clay with variable coarse sand and gravel (Jsm and Tm)

**Silty Sand to Sandy Silt with Gravel, fine grained, clasts 15 to 30%, up to 1 inch, mainly subangular and subrounded slate (Jsm), shale (Tm) and sandstone (Tm); trace clay; dark grayish brown (10YR 4/2); appears very moist and dense/stiff**

At 73.7 to 74.9’: Grades to Silty Clay and Clayey Silt, trace coarse sand; highly oxidized, mottled, reddish brown (5YR 4/4) to dark grayish brown (10YR 4/2); appears moist and very stiff; some varve-like bedding; 10 to 20% calcium carbonate filaments

At 76.5 to 77.0’: Grades to fine Silty Sand

At 79.0 to 80.0’: Grades to Silty Clay and Clayey Silt, trace coarse sand; highly oxidized, mottled reddish brown (5YR 4/4) to dark grayish brown (10YR 4/2); appears moist and very stiff; variable (5 to 30%) calcium carbonate filaments
NOTES:
Boring backfilled with cement/bentonite grout from bottom up and patched.
- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted.
- Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch).
- Beds are generally massive unless otherwise noted.
**Grass at surface**
Hand augered to 6 feet

**FILL [At]**
Silty Clay and Clayey to Sandy Silt, variable gravel, 2-15%, up to 3/4 inch; color variable, mainly dark brown (7.5 4R 3/3); generally appears very moist

**NOTE:**
Jsm = Santa Monica Slate
Tm = Modelo Formation
See end of log for more detailed descriptions of clasts

At 6.0 to 7.0': Very fine Silty Sand with Gravel; appears moist and medium dense

**OLDER ALLUVIAL FAN DEPOSITS [Qfe]**
Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); brown (10YR 4/3); appears very moist and stiff; poorly sorted; lower contact is gradational

At 12.0 to 13.0': Coarse sand and gravel increase with depth, maximum gravel size is 1 inch, gradational transition to unit below

**Well Graded Gravel, clasts 30 to 60%, up to 1 inch, mainly subangular slate (Jsm), shale (Tm) and sandstone (Tm), matrix is fine to coarse, well graded sand; brown (10YR 4/3); appears damp and medium dense; lower contact occurs between runs**
At 13.5 to 15.0': No recovery

Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); brown (10YR 4/3); appears very moist and medium stiff to stiff; poorly sorted; lower contact is narrowly gradational

At 17.6 to 18.0': Grades to fine to coarse Silty Sand with Gravel, clasts 25 to 50%, up to 1½ inches, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm)
At 18.0 to 18.5': Grades to fine Silty Sand to Sandy Silt
At 18.5 to 20.0': No recovery

MTA Westside Subway Extension  
Los Angeles, California
Measured at 20 feet during drilling

**Qfo Continued**

At 20': Groundwater measured during drilling

- Silty, Clayey Sand, fine grained, variable coarse sand and gravel, clasts 5 to 25%, up to 3/4 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); brown (7.5YR 4/4); appears wet and medium dense; occasional silty sand and sandy clay beds; lower contact is sharp

Well Graded Sand with Gravel, clasts 25 to 50%, up to 1 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm), one granitic clast also observed; color variable; appears wet and medium dense; lower contact is sharp

At 26.0': Gravel decreases to 5-20%

At 26.5 to 30.0': No recovery

Sandy to Clayey Silt, variable gravel, clasts 5-20%, most up to 3/4 inch, maximum 1½ inches mainly shale (Tm), slate (Jsm) and sandstone (Tm); brown (7.5YR 4/4); appears wet and soft; poorly sorted; lower contact is sharp

**OLDER FLUVIAL DEPOSITS [Qfofl]**

- Silty Gravel, clasts 60 to 70%, up to 3/4 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm), matrix is fine to coarse silty sand; color variable; appears wet and dense; lower contact occurs between runs

At 34.2 to 34.9': Sandy Silt with Clay; mottled, dark grayish brown (10YR 4/2) to strong brown (7.5YR 4/6); appears wet and soft

At 34.5 to 35.0': Fault, approximate dip 40 to 45 degrees, planar surface, very fine sand below, sandy silt above, sandy silt above has near horizontal bedding

At 34.9 to 35.5': Clayey Silt with Sand; mottled; dark grayish brown (10YR 4/2) to strong brown (7.5YR 4/6); appears wet and soft

At 35.5 to 36.3': Fine to coarse Well Graded Sand; variable gravel, clasts 5 to 30%, up to 3/4 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm)

At 36.2 to 38.0': Matrix becomes lightly oxidized, dark reddish brown (2.5YR 3/4)

At 38.0 to 38.7': Matrix becomes fine to coarse Well Graded Sand; color variable
### Project No.: 4953-10-1561  
**LOG OF BORING**  
**T2-B4c**  
**MTA Westside Subway Extension**  
Los Angeles, California

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**DRILLING COMPANY/DRILLING EQUIPMENT**  
Martini Drilling / CME 75

**DRILLING METHOD**  
Hollow-Stem Auger

**DATES DRILLED**  
5/14/11 - 5/16/11

**HOLE DIAMETER**  
8 inches

**BOREHOLE LOCATION**  
See Plate 3

**GROUNDWATER READINGS**  
Measured at 20 feet during drilling

**ESTUARINE DEPOSITS - FINE GRAINED [Qef]**

- At 40.0 to 40.8': Fine to medium Poorly Graded Sand; brown (10YR 4/4)
- At 40.8 to 42': Matrix is fine to coarse well graded sand; color is variable, upper contact is sharp, appears to dip approximately 30 degrees
- At 41.6 to 42.0': Highly oxidized, dark reddish brown (2.5YR 3/4)
- At 42.0 to 45.0': No recovery

- Well Graded Sand, fine to coarse grained; variable gravel, clasts 5 to 35%, up to 1½ inches, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); color variable; appears wet and dense; some silt pockets or rip up clasts up to 1½ inches
- At 46.5 to 50.0': No recovery

- At 50.0 to 55.0': No recovery

**GROUND EL.**

- 280 feet

**GEOLIST:** ME/MF  
Prepared/Date:  
YN/WL 10/10/2011

**CHECKED/DATE:**  
MW/MF 10/11/2011

**NOTE:** This record is an interpretation of subsurface conditions at the exploration location. Latitudes and longitudes of boring location shown on logs are approximate. Subsurface conditions at other locations and at other times may differ. Interfaces between strata are approximate. Transitions between strata may be gradual.
CL/CH ML
GM SG GM ML SW GC/GM SM/ML

At 60.0 - 63.8': Trace manganese oxide flecks; brown (7.5YR 4/2) with occasional dark gray (2.5Y 4/1) mottling

At 61.0 - 61.4': Grades to Clayey to Sandy Silt

At 63.8 - 65.0': Clayey to Sandy Silt; variable coarse sand and gravel; clasts 2-15%, up to ½ inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); brown (10YR 4/4); appears very moist and very stiff; coarsens with depth, grades to unit below

OLDER ALLUVIAL FAN / FLUVIAL DEPOSITS [Qfo/Qfofl]
Silty Gravel, clasts 50-70%, up to 2 inches, mainly subangular to subrounded slate (Jsm), sandstone (Tm), quartzite (Jsm) and granitic rock, matrix is fine to coarse silty sand; color variable; mainly very dark grayish brown (10YR 3/2); appears wet and dense; lower contact is sharp

At 65.9 to 66.4': Grades to fine to coarse Silty Sand with Gravel
At 67.0 to 67.6': Clayey to Sandy Silt, trace coarse sand; brown (7.5YR 4/4); appears wet and soft to medium stiff

At 67.6 to 70.0': No recovery

Well Graded Sand, fine to medium grained; variable gravel, clasts 5-20%, brown (7.5YR 5/4); appears wet and dense; lower contact is gradational

Clayey, Silty Gravel, clasts 50-60%, up to 2 inches, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); appears wet and dense; lower contact occurs between runs
At 72.5 to 73.0': Color becomes dark brown (7.5YR 3/4), gravel increases to 5-10%, some varve-like bedding
At 73.2 to 75.0': No recovery

OLDER ALLUVIAL FAN DEPOSITS [Qfo]
Silty Sand and Sandy Silt, fine grained; variable clay, trace coarse sand and gravel (Jsm and Tm); brown (7.5YR 4/3) with occasional grayish brown (10YR 5/2) mottling; appears wet and dense/stiff; poorly sorted; lower contact occurs between runs
At 76.1 to 76.5': Increasing Silt and Gravel

At 77.2 to 80.0': No recovery

Geologist: ME/MF
Prepared/Date: YN/WL 10/10/2011
Checked/Date: MW/MF 10/11/2011
**ESTUARINE DEPOSITS - FINE GRAINED [Qf0]**

Alternating beds of Sandy Silt and Silty Clay; brown (7.5YR 4/4) to reddish brown (5YR 4/4); appears soft to medium stiff; lower contact is narrowly gradational

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**Silty Gravel, clasts 60 to 70%, up to 1 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); color variable; appears wet and dense; lower contact is gradational**

---

**Sandy to Clayey Silt, variable fine gravel, clasts 5 to 15%, up to ½ inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); some brick-red sandstone observed; brown (7.5YR 4/4); appears very moist to wet and stiff to very stiff; poorly sorted, becomes generally finer with depth; lower contact is gradational**

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**Geologist: ME/MF**
**Prepared/Date: YN/WL 10/10/2011**
**Checked/Date: MW/MF 10/11/2011**

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MTA Westside Subway Extension
Los Angeles, California

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LOG OF BORING
Project No.: 4953-10-1561
Figure: T2-B4e
### OLDER ALLUVIAL FAN DEPOSITS [Qfo]

- Sandy to Clayey Silt, variable coarse sand and gravel, clasts 2-20%, up to 3/4-inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); mottled, strong brown (10YR 5/6) to grayish brown (2.5Y 5/2); appears very moist and very stiff; trace manganese oxide flecks and staining; 2-10% calcium carbonate filaments, lower contact is narrowly gradational

- At 109.4 to 109.6': Gravel increases to 30-40%

- Silty, Clayey Gravel, clasts 50-70%, up to 1 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); some quartzite and granitic rock also observed; matrix is fine to coarse silty, clayey sand; color variable, appears very moist to wet and dense; matrix occasionally grades to sandy clay

- At 112.2 to 112.4': Grades to Well Graded Gravel, well graded sand matrix

- Sandy Silt, variable fine gravel, clast 5-15%, up to ½” (Jsm+Tm); color variable, appears wet and dense; lower contact is gradational

### ESTUARINE DEPOSITS [Qe]

- Silty Clay and Clayey Silt; strongly mottled, brown (7.5YR 4/4) to grayish brown (10YR 5/2); appears very moist and stiff to very stiff; occasional sandy silt beds; bedding contacts generally sharp; lower contact is gradational

- At 116.0 to 117.4': Grades to Clayey to Sandy Silt; variable gravel, clasts 2-15%, up to ½-inch (Jsm and Tm)

- At 117.4 to 118.5': Trace calcium carbonate filaments

- At 119.2 to 119.4': Silty Sand bed, fine grained; brown (7.5YR 4/4); sharp contacts
**GROUNDWATER READINGS**

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**Qe Continued**

Clay and Silty Clay, variable coarse sand, trace fine gravel; olive gray (5Y 4/2) with variable strong brown (7.5YR 4/6) mottling; appears very moist and very stiff; mottling occur mainly as fine, irregular pockets; 2-5% manganese oxide flecks; lower contact is gradational

**BASAL ALLUVIAL FAN / BASAL ESTUARINE UNIT [Qfob / Qeb]**

Silty Sand, fine grained, interbedded with silty clay; color variable, mainly olive gray (5Y 4/2) with variable oxidation; appears very moist and dense/stiff; lower contact is gradational

At 121.9 to 122.1': Calcium carbonate-rich bed, some cemented, irregular nodules up to 1½ inches

At 123.0 to 123.9': Silty Clay bed, trace cemented calcium carbonate nodules up to 1/4 inch; variable manganese oxide flecks (5 to 20%)

At 123.9 to 124.8': Calcium carbonate-rich bed, 50 to 70% dispersed calcium carbonate and cemented nodules up to ½ inch

At 124.8 to 128.0': Color becomes dark olive gray (5Y 3/2) with brown (7.5YR 4/4) irregular fine pockets, 10 to 15% calcium carbonate pockets and cemental nodules up to 1/4 inch; trace manganese oxide flecks; mainly silty clay

At 128.0 to 130.6': Color becomes grayish brown (2.5Y 5/2) with yellowish brown (10YR 5/6) mottles

At 129.0 to 130.6': Sand content increases with depth, gradational transition to unit below

**BASAL ALLUVIAL FAN UNIT [Qeb]**

Silty Sand and Sandy Silt, very fine grained, variable clay, trace coarse sand (Jsm and Tm); mottled, yellowish brown (10YR 5/4) to grayish brown (2.5Y 5/2); appears very moist and very stiff; faulted lower contact described below at 133.5'

At 130.6 to 131.8': Calcium carbonate filaments and nodules increase with depth

At 131.8 to 133.0': Calcium carbonate-rich bed, 60-70% dispersed calcium carbonate and cemented nodules up to 1/8 inch

At 133.0 to 134.1': Calcium carbonate decreases to 10-20%

At 134.0 to 134.8': Fault, shear zone approximately 1½ inches wide, parallel shears, dips approximately 60 to 70 degrees; Qeb above, Qfob below

At 134.1 to 134.4': Cemental bed, up to 70% calcium carbonate cemented nodules up to 1-inch

Contact is faulted

**BASAL ESTUARINE UNIT [Qeb]**

Silty Clay and Clayey Silt, trace coarse sand; dark gray (5Y 4/1) with occasional brown (7.5YR 4/4) mottles; appears very moist and very stiff to hard; 5-15% calcium carbonate filaments; clay is soft, crumbly possible shearing; lower contact is narrowly gradational

At 136.4 to 137.2': Abundant (70%), dispersed calcium carbonate, color becomes lighter, no matching Munsell color

At 137.2 to 138.0': Mottled, dark gray (2.5Y 4/1) to brown (7.5YR 4/4), irregular pockets of calcium-carbonate cemented nodules up to 1/4 inch, total calcium carbonate 10-60%

At 138 to 140': Color variable; mainly brown (7.5YR 4/2)

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MTA Westside Subway Extension
Los Angeles, California
### Qeb Continued

Clay and Silty Clay, trace coarse sand; generally dark gray (2.5Y 4/1) to (7.5YR 4/1) with variable brown (7.5YR 4/4) mottling; appears very moist and very stiff; 2-10% calcium carbonate filaments and cemented nodules up to 1/8 inch; trace manganese oxide flecks and staining; lower contact is sharp

At 142.0 to 142.2', 142.9 to 143.1' and 143.4 to 143.5': Silty Sand beds, very fine grained

At 143.5': Color becomes very dark greenish gray (5GY 3/1); occasional diffuse, irregular, oxidized strong brown (7.5YR 4/4) pockets; 5-10% calcium carbonate filaments and cemented nodules up to 1/8 inch

At 145.5 to 145.7': Abundant dispersed calcium carbonate and cemented nodules, total calcium carbonate 50-60%

### SAN PEDRO FORMATION (Spq)

Silty Sand and Sandy Silt, very fine grained; greenish gray (10Y 5/1); appears very moist to wet and stiff; trace calcium carbonate filaments

At 149.0': Clay increases, some decayed organics, very dark gray (N3); possible detrital charcoal at 149.2'

### End of Boring at 150 Feet

NOTES:

Boring backfilled with cement/bentonite grout from bottom up and patched.

- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than 1/4 inch).
- Beds are generally massive unless otherwise noted.
Grass surface
Hand augered to 6 feet

**FILL [AF]**
Sandy to Clayey Silt; trace coarse sand and fine gravel (Jsm and Tm); very dark grayish brown (10YR 3/2); appears very moist and stiff; lower contact occurs between runs

**NOTE:**
Jsm = Santa Monica Slate
Tm = Modelo Formation
See end of log for more detailed description of clasts

**OLDER ALLUVIAL FAN DEPOSITS [Q6]**
Clayey to Sandy Silt, trace coarse sand and fine gravel; brown (10YR 4/3); appears very moist and very stiff; poorly sorted; lower contact occurs between runs
At 6.5 to 9.0': No recovery

At 12.2 to 14.0': No recovery

At 14.3 to 15.0': Silty Sand, fine to coarse grained

At 15.0 to 16.0': Gravel increases to 10 to 20% (Jsm and Tm)
At 16.0 to 17.2': Silty Gravel, clasts 50 to 60%, up to 3/4 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); color variable; appears very moist and dense
At 17.0': Becomes wet (groundwater encountered)
At 17.2 to 19.0': No recovery

Sandy to Clayey Silt, trace coarse sand and fine gravel (Jsm and Tm); brown (7.5YR 4/4); appears wet and soft to medium stiff; lower contact is sharp

At 19.7 to 20.0': Silty Gravel, clasts 50 to 60%, up to 3/4 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); color variable; appears wet and dense

---

**BORING NO.**

**LOG OF BORING**

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**MTA Westside Subway Extension**

Los Angeles, California
**GROUNDWATER READINGS**

Measured at 20.9 feet and encountered at 17 feet during drilling

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**Qf6 Continued**

At 20.0 to 24.0': No recovery

At 20.9': Groundwater measured during drilling

At 17 feet and encountered at 20.9 feet during drilling

Poorly Graded Sand, fine to medium grained; color variable, generally brown (10YR 5/3); appears wet and dense; lower contact occurs between runs

At 24.6 to 24.8': Grades to fine to coarse Well Graded Sand

Silty Sand with Gravel, fine grained, clasts 15 to 20%, up to 1/2 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); dark grayish brown (10YR 4/2); appears wet and dense; lower contact is gradational

At 24.8 to 29.0': No recovery

At 29.6 to 29.9': Grades to Silty Sand with Gravel, fine to coarse grained, clasts 25 to 35%, up to 3/4 inch

Silty Clay to Clayey Silt, variable fine sand, trace coarse sand and fine gravel (Jsm and Tm); dark grayish brown (10YR 4/2); appears wet and soft; poorly sorted, lower contact occurs between runs

At 29.9 to 31.0': Becomes medium stiff, some fine oxidized, dark brown (7.5YR 3/4) pockets

At 31.0 to 31.4': Color becomes dark grayish brown (10YR 4/2) with occasional dark brown mottling

At 34.0 to 35.5': Color becomes dark grayish brown (10YR 4/2) with occasional dark brown mottling

At 34.2 to 34.5': Gravel increases to 30 to 40%, up to 1/2 inch

At 36.5 to 39.0': No recovery

**ESTUARINE DEPOSITS [Qe]**

Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); mottled, grayish brown (10YR 5/2) to dark brown (7.5YR 3/4); appears wet to medium stiff; well sorted; lower contact is sharp

At 25.0 to 30.0': Silty Sand with Gravel, fine grained, clasts 15 to 20%, up to 1/2 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); dark grayish brown (10YR 4/2); appears wet and dense; lower contact is gradational

At 29.6 to 29.9': Grades to Silty Sand with Gravel, fine to coarse grained, clasts 25 to 35%, up to 3/4 inch

Silty Clay to Clayey Silt, variable fine sand, trace coarse sand and fine gravel (Jsm and Tm); brown (7.5YR 4/2); appears wet and soft; poorly sorted, lower contact occurs between runs

At 31.0 to 31.4': Becomes medium stiff, some fine oxidized, dark brown (7.5YR 3/4) pockets

At 34.0 to 35.5': Color becomes dark grayish brown (10YR 4/2) with occasional dark brown mottling

At 34.2 to 34.5': Gravel increases to 30 to 40%, up to 1/2 inch

Clay, trace coarse sand and rare (<1%) fine gravel (Jsm and Tm); brown (10YR 4/3) with occasional strong brown (7.5YR 5/6) mottling; appears very moist and stiff; trace manganese oxide staining; one brick-red sandstone clast; varved-like bedding; lower contact is gradational

At 36.5 to 39.0': No recovery
**ESTUARINE DEPOSITS - FINE GRAINED [Qe] / Marker Bed MG**

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CL

Qe Continued

At 40.0 to 41.6': Becomes strongly mottled, brown (10YR 4/3) to strong brown (7.5YR 4/6); strong brown mottling occurs mainly as irregular pockets

At 41.8 to 44.0': No recovery

At 44.0 to 44.6': Color becomes dark grayish brown (10YR 4/2), 5-10% manganese oxide flecks

**ESTUARINE DEPOSITS - FINE GRAINED [Qe] / Marker Bed MG**

Silty Clay; very dark grayish brown (10YR 3/2), occasional strong brown (7.5YR 4/6) to dark reddish brown (5YR 3/4) mottling; appears very moist and stiff; possible weak soil development

At 49.0 to 51.2': Becomes brown (7.5YR 4/3) with occasional dark gray (10YR 4/1) mottling; appears very stiff

At 51.2 to 54.0': Becomes strongly mottled, brown (7.5YR 4/3) to gray (10YR 5/1) to strong brown (7.5YR 4/6); very stiff

**ESTUARINE DEPOSITS [Qe]**

Clayey to Sandy Silt, variable coarse sand, trace fine gravel (Jsm and Tm); brown (7.5YR 4/3) with occasional grayish brown (10YR 4/2) mottling; appears very moist to wet and soft to medium stiff; variable varve-like bedding with silt and sandy silt beds; lower contact is gradational

At 57.6 to 57.9': Fine Silty Sand to Sandy Silt, appears wet and soft and medium dense

At 57.9 to 58.6': Clay; trace coarse sand and fine gravel (Jsm and Tm); brown; appears very moist and very stiff
ML SC/SM SC/SM GM ML

100

Qe Continued (7.5YR 5/4) with occasional grayish, brown (10YR 5/2) mottling; appears very moist and stiff to very stiff

At 61.7 to 65.0': Coarsens with depth, becomes sandy silt with clay, coarse grained sand and fine gravel increase

At 63.2 to 65.5': Color becomes dark yellowish brown (10YR 4/4)

64.5 to 65.5': Variable varve-like bedding

OLDER FLUVIAL DEPOSITS [Qfoll]

Silty, Clayey Sand with Gravel, fine grained, clasts 25 to 35%, up to 3/4 inch; mainly subangular to subrounded slate (Jsm), some shale (Tm) and sandstone (Tm) also observed; appears wet and medium dense; lower contact is gradational

At 65.8 to 69.0': No recovery

Silty Gravel, clasts 50 to 60%, up to 3/4 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sanstone (Tm); color is variable; appears wet and dense; lower contact is sharp

At 70.8 to 74.0': No recovery

Sandy to Clayey Silt, trace coarse sand; dark reddish brown (5YR 3/3); appears wet and soft

At 75.7 to 79.0': No recovery

END OF BORING AT 79 FEET

NOTES:

Geologist: BF/MF
Prepared/Date: YN/WL 10/10/2011
Checked/Date: MW/MF 10/11/2011

MTA Westside Subway Extension
Los Angeles, California

LOG OF BORING
Project No.: 4953-10-1561 Figure: T2-B5d
Boring backfilled with cement/bentonite grout from bottom up and patched.

- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted.  

Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.

- The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch).
- Beds are generally massive unless otherwise noted.
Older alluvial fan deposits [Qfo]
Sandy to clayey silt, trace coarse sand and gravel (Jsm and Tm); brown (7.5YR 4/4); appears very moist and stiff to very stiff; poorly sorted; lower contact occurs between runs.
At 6.5 to 9.0': no recovery.

At 9.8 to 14.0': no recovery.

At 16.5': groundwater encountered during drilling.
Hand augered to 6 feet.

Gravelly sand, clasts 50 to 60%, up to ¾ inch, mainly subangular to subrounded slate (Jsm), shale (Tm), and sandstone (Tm); matrix is sandy sand/sandy clay; brown (7.5YR 4/3); appears wet and medium dense; lower contact occurs between runs.
At 16.5 to 17.8': becomes wet; soft; gravel increases to 10 to 20% mainly subangular to subrounded slate (Jsm), shale (Tm), and sandstone (Tm)
At 17.8 to 19.0': no recovery.

Clayey gravel, clasts 50 to 60%, mainly subangular to subrounded slate (Jsm), shale (Tm), and sandstone (Tm); matrix is clayey sand/sandy clay; brown (7.5YR 4/4); appears very moist and stiff to very stiff; poorly sorted; lower contact occurs between runs.

Hand augered to 6 feet.
Grab samples collected at 2 and 4.

NOTE: Jsm = Santa Monica Slate
Tm = Modelo Formation
JO = 10YR 4/3; misty to very moist and stiff to very stiff, occasional fine Silty

Hand augered to 6 feet during drilling.

See Plate 3.
<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
<th>SAMPLE LOC.</th>
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<tr>
<td>260</td>
<td></td>
<td>1</td>
<td>5</td>
<td>20</td>
<td>GP/GM</td>
</tr>
<tr>
<td>255</td>
<td></td>
<td>1</td>
<td>6</td>
<td>16</td>
<td>CL</td>
</tr>
<tr>
<td>250</td>
<td></td>
<td>1</td>
<td>7</td>
<td>10</td>
<td>CL</td>
</tr>
<tr>
<td>245</td>
<td></td>
<td>1</td>
<td>9</td>
<td>40</td>
<td>CL-SM</td>
</tr>
<tr>
<td>240</td>
<td></td>
<td>1</td>
<td>10</td>
<td>98</td>
<td>CL/CH</td>
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<tr>
<td>40</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

At 19.5 to 21.5': No recovery

At 21.5 to 21.9': Matrix becomes fine to coarse Silty Sand; dark yellowish brown (10YR 4/4); appears wet and dense; poor recovery

At 21.9 to 24.0': No recovery

At 24.0': Sandy Clay, trace gravel, brown (10YR 4/3); appears wet and stiff

At 24.3 to 26.5': No recovery

At 26.5 to 29.0': No recovery

At 31.0 to 34.0': No recovery

At 34.0 to 34.4': Clayey to Sandy Silt; mottled, grayish brown (10YR 4/3); appears wet and stiff

At 37.3 to 39.6': occasional micaceous Sandy Silt interbeds; appears wet and soft

ESTUARINE DEPOSITS [Qe]
Alternating beds of Silty Clay and fine Silty Sand; trace to some coarse sand and fine gravel (Jsm and Tm); clay is light brownish gray (2.5Y 6/2), sand is reddish brown (5YR 4/4); appears wet and soft/medium dense; lower contact occurs between runs

Purched groundwater encountered at 16½ feet during drilling

MTA Westside Subway Extension
Los Angeles, California

LOG OF BORING

Project No.: 4953-10-1561
Figure: T2-B6b
ML

Marker Bed MG
Silty Clay; dark brown (7.5YR 3/2) with highly oxidized, dark reddish brown (5YR 3/4) mottling; appears very moist and stiff; trace manganese-oxide flecks; possible weak soil development; lower contact is gradational

CL/CH

ESTUARINE DEPOSITS - FINE GRAINED [Qef]/Marker MF
Clay; grayish brown (2.5Y 5/2) with strong brown (7.5YR 4/6) mottles, strong brown color generally increases with depth, becomes predominant, coarse sand increases to 1 to 5% (Jsm and Tm), generally homogeneous and massive to thickly-bedded, occasional varve-like bedding; lower contact is gradational

At 46.0 to 47.5': Appears very moist to wet and medium stiff

Marker MF Continued
Clayey to Sandy Silt, trace coarse sand; brown (7.5YR 4/4) with occasional grayish brown (2.5Y 5/2) mottling; appears homogeneous; lower contact is narrowly gradational

Marker MF Continued
Clay and Silty Clay, rare (<1%) coarse sand; brown (7.5YR 4/4); appears wet and soft; variable varve-like bedding; lower contact occurs between runs

At 57.0 to 59.0': Coarsens with depth, gradational transition to unit below

SC/SM

ESTUARINE DEPOSITS [Qe]
Silty, Clayey Sand, fine grained, trace coarse sand and fine gravel (Jsm and Tm); yellowish brown (10YR 5/4); appears wet and dense; lower contact occurs between

This Record is an interpretation of subsurface conditions at the exploration location. Latitude and longitude of Boring location shown on logs are approximate. Subsurface conditions at other locations and at other times may differ. Interfaces between strata are approximate. Transitions between strata may be gradual.

Geologist: BF/MF
Prepared/Date: YN/WL 10/10/2011
Checked/Date: MW/MF 10/11/2011

This page is a continuation of the previous page, showing the log of boring for T2-B6. The details include elevation, depth, box number, run number, and percentage recovery. The description of the soil conditions is provided at various depths, with specific details on the type of soil and its characteristics.
At 61.5 to 64': No recovery

Clayey Silty Gravel, clasts 60 to 70%, up to ¾ inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); brown (7.5YR 4/4); appears wet and dense

Sandy to Clayey Silt, trace coarse sand and fine gravel (Jsm and Tm); brown (7.5YR 4/4); appears very moist to wet and medium stiff to stiff; occasional more gravelly beds with up to 20% fine gravel; variable varve-like bedding; lower contact is narrowly gradational

At 65.4 to 65.8': Grades to Clay, 5 to 10% calcium carbonate filaments
At 65.8 to 69.0': No recovery

At 69.0 to 70.1': Silty Sand and Sandy Silt, fine grained, some gravel, clasts 5 to 10%, up to ½ inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); well sorted

Clay and Silty Clay, trace coarse sand and fine gravel; reddish brown (5YR 3/4) with occasional gray (10YR 5/1) mottling; appears very moist to wet and soft to stiff; occasional sandy beds
At 70.5': Becomes brown (7.5YR 4/4)

At 71.7 to 72.0': Fine to medium Silty Sand with Gravel, clasts 15 to 25%, up to 1 inch (Jsm and Tm)
At 73.2 to 74.4': Grades to Clayey to Sandy Silt, trace coarse sand and gravel; brown (10YR 4/3); appears wet and medium stiff
At 74.0 to 74.4': Gravel increases to 20 to 25% (Jsm and Tm)
At 74.4': Becomes mottled, brown (10YR 4/3) to gray (10YR 5/1) to reddish brown (5YR 4/4)

At 76.7 to 79.0': No recovery

At 79.0 to 80.0': Alternating beds of very fine Silty Sand and Silty Clay/ Clayey Silt; slightly mottled, dark grayish brown (10YR 4/2) to yellowish brown (10YR 5/6); appears wet and dense/stiff; lower contact is sharp

This record is an interpretation of subsurface conditions at the exploration location. Latitude and longitude of boring location shown on logs are approximate. Interfaces between strata are approximate. Transitions between strata may be gradual.

Purched groundwater encountered at 16½ feet during drilling.

Groundwater readings

Run # | Box # | % Recovery | Sample Loc.
--- | --- | --- | ---
50 | 3 | 15 | SC/SM

Qe continued

15.5 to 64': No recovery

Jet Drilling / CME 75

Hollow-Stem Auger

5/14/11 - 6/14/11
OLDER ALLUVIAL FAN DEPOSITS [Qfo]
Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); color variable, appears very moist and stiff; poorly sorted; lower contact is sharp

At 81.1 to 84.0': No recovery

Silty Sand and Sandy Silt, very fine grained, mottled, grayish brown (10YR 5/2) to strong brown (7.5Y 5/6); appears wet and dense/stiff; moderately to poorly sorted, coarsens with depth; lower contact occurs between runs

At 87.2 to 89.0': No recovery

Poorly Graded Sand with Silt, fine to medium grained, brown (10YR 5/3); appears wet and dense; lower contact is narrowly gradational

At 91.9 to 92.7': Occasional Silty Clay beds and irregular pockets, increasing silt contact

Silty Sand with trace gravel (Jsm and Tm), fine to coarse grained, varying color, generally dark grayish brown (10YR 4/2); appears wet and dense

At 94.5 to 95.0': Increasing gravel, grades to fine to coarse grained, Well-Graded Sand with Gravel, clasts 40 to 50%, up to ¾ inch; mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm)

Silty Gravel; clasts 60 to 70% (up to ¾ inch); mainly subangular slate (Jsm); matrix is fine silty sand and sandy silt; appears wet and dense; lower contact occurs between runs

At 95.7 to 100.0': No recovery
<table>
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<tr>
<th>ELEVATION (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
<th>SAMPLE LOC.</th>
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<tbody>
<tr>
<td>180</td>
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<td>24</td>
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</table>

**ESTUARINE DEPOSITS - FINE GRAINED [Qef]**

- Silty Clay and Clayey Silt; light olive brown (2.5Y 5/3) with strong brown (7.5YR 4/6) mottling; appears very moist and stiff; strong brown mottling occurs mainly as fine, irregular pockets (up to ¼ inch), some varve-like bedding
- At 105.1 to 106.2': Grades to Clay, variable 5 to 20% manganese oxide flecks
- At 106.2 to 106.5': Silty Sand, fine grained; varying color, lightly calcium carbonate-cemented
- At 106.5 to 109.5': No recovery
- At 109.0 to 109.5': Becomes dark grayish brown (10YR 4/2) with strong brown (7.5YR 4/6) pockets
- At 109.5 to 114.0': No recovery

**BASAL ALLUVIAL FAN UNIT [Qfob]**

- Clayey Silt, variable fine to coarse granular sand, trace gravel (Jsm and Tm); color, variable, mainly light olive brown (2.5Y 5/3) to light gray (2.5Y 7/2); appears very moist and stiff; variable but generally abundant (10-40%) calcium carbonate, occurs as dispersed deposits and cemented nodules (up to 1/2 inch); occasional grades to sandy silt; lower contact is sharp

**GROUNDWATER READINGS**

- Purched groundwater encountered at 16½ feet during drilling
- Depth at contact uncertain due to poor recovery
- Groundwater readings:
  - PURCHASED GROUNDWATER ENCOUNTERED AT 16½ FEET DURING DRILLING
### MTA Westside Subway Extension
Los Angeles, California

<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
<th>Sample Loc.</th>
<th>DRILLING COMPANY/DRILLING EQUIPMENT</th>
<th>BOREHOLE LOCATION</th>
<th>DATES DRILLED</th>
<th>HOLE DIAMETER</th>
<th>GROUND EL.</th>
<th>GROUNDWATER READINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>160</td>
<td>6 28</td>
<td></td>
<td>94</td>
<td>Qfob Continued</td>
<td>ML</td>
<td>Jet Drilling / CME 75</td>
<td>See Plate 3</td>
<td>5/14/11 - 6/14/11</td>
<td>8 inches</td>
<td>281 feet</td>
<td>Purched groundwater encountered at 16½ feet during drilling</td>
</tr>
<tr>
<td>155</td>
<td>7 29</td>
<td>76</td>
<td></td>
<td>At 121.0 to 123.0': Some varve-like bedding</td>
<td>SM-SC</td>
<td>Hollow-Stem Auger</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>150</td>
<td>7 30</td>
<td>100</td>
<td></td>
<td>At 123.0 to 125.4': Increasing sand, grades to fine to coarse Clayey, Silty Sand, trace fine gravel</td>
<td>SM-SC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>145</td>
<td>7 31</td>
<td>98</td>
<td></td>
<td>At 125.5 to 129.8': Becomes mottled, yellowish brown (10YR 5/4) to gray (2.5Y 6/1); calcium carbonate decreases to &lt;5%, occasional varve-like bedding</td>
<td>ML</td>
<td></td>
<td></td>
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<tr>
<td>140</td>
<td>7</td>
<td></td>
<td></td>
<td>At 127.3 to 127.8': Grades to fine Clayey, Silty Sand</td>
<td>CL/CH</td>
<td></td>
<td></td>
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<tr>
<td>135</td>
<td>7</td>
<td></td>
<td></td>
<td>At 127.8 to 129.0': No recovery</td>
<td>Clay; dark grayish brown (2.5Y 4/2) with strong brown (7.5Y 4/6) mottling; appears moist and hard; trace calcium carbonate filaments; strong motting occurs as fine irregular pockets (up to 1/8 inch); lower contact is narrowly gradational</td>
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<tr>
<td>130</td>
<td>7</td>
<td></td>
<td></td>
<td>At 129.1': Oxidized, strong brown (7.5YR 4/6) silt bed at contact</td>
<td></td>
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<tr>
<td>125</td>
<td>7</td>
<td></td>
<td></td>
<td>At 130.0 to 132.0: Oxidized strong brown pockets decrease, some pockets of cemented calcium carbonate</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>120</td>
<td>7</td>
<td></td>
<td></td>
<td>At 133.2 to 135.8: Calcium carbonate increases to 15 to 30%, occurs mainly as irregular, vertically-oriented nodules</td>
<td></td>
<td></td>
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<tr>
<td>115</td>
<td>7</td>
<td></td>
<td></td>
<td>At 135.8 to 139.0: Becomes dark gray (10YR 4/1) with dark brown (7.5YR 3/4) mottled fine pockets; calcium carbonate decreases to 10 to 15%, occurs mainly as filaments and irregular, uncemented nodules</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>110</td>
<td>7</td>
<td></td>
<td></td>
<td>At 138.0 to 139.0: Oxidized strong brown pockets decrease, some pockets of cemented calcium carbonate</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

**This record is an interpretation of subsurface conditions at the exploration location. Latitude and longitude of boring location shown on logs are approximate. Transitions between strata are approximate. Interfaces between strata are gradational.**

**Reported groundwater encountered at 16½ feet during drilling.**

**Geologist:** BF/MF  
**Prepared/Date:** YN/WL 10/10/2011  
**Checked/Date:** MW/MF 10/11/2011

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**MTA Westside Subway Extension**  
**Los Angeles, California**

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**LOG OF BORING**  
**Project No.: 4953-10-1561**  
**Figure: T2-B6g**
<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
<th>SAMPLE LOC.</th>
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<tbody>
<tr>
<td>140</td>
<td>8</td>
<td>32</td>
<td>66</td>
<td>Qeb Continued</td>
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<tr>
<td>145</td>
<td>8</td>
<td>33</td>
<td>70</td>
<td>Clay, mottled dark gray (10YR 4/1) to strong brown (7.5YR 4/6); appears moist and hard; strong brown mottling occurs mainly as fine, irregular pockets (up to ¼ inch); 10 to 15% calcium carbonate, occurs as filaments and cemented nodules (up to ½ inch); lower contact occurs between runs</td>
<td></td>
</tr>
<tr>
<td>150</td>
<td>8</td>
<td>34</td>
<td>84</td>
<td>At 141.3 to 141.9': Becomes sandy, calcium carbonate increases to 60 to 70%, occurs as dispersed deposits, filaments, and cemented nodules up to ¼ inch</td>
<td></td>
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<tr>
<td>155</td>
<td>9</td>
<td>35</td>
<td>96</td>
<td>At 141.9 to 142.0': Grades to fine to coarse Silty Sand, slightly calcium carbonate cemented</td>
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<tr>
<td>160</td>
<td></td>
<td></td>
<td></td>
<td>At 142.0 to 144.0': No recovery</td>
<td></td>
</tr>
</tbody>
</table>

**GROUNDWATER READINGS**

Purched groundwater encountered at 16½ feet during drilling

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<table>
<thead>
<tr>
<th>BORING NO.</th>
<th>T2-B6</th>
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<tr>
<td>DRILLING COMPANY/DRILLING EQUIPMENT</td>
<td>Jet Drilling / CME 75</td>
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<tr>
<td>DRILLING METHOD</td>
<td>Hollow-Stem Auger</td>
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<tr>
<td>BOREHOLE LOCATION</td>
<td>See Plate 3</td>
</tr>
<tr>
<td>DATES DRILLED</td>
<td>5/14/11 - 6/14/11</td>
</tr>
<tr>
<td>HOLE DIAMETER</td>
<td>8 inches</td>
</tr>
<tr>
<td>GROUND EL.</td>
<td>281 feet</td>
</tr>
</tbody>
</table>

---

**SAN PEDRO FORMATION [Qsp]**

Clayey Silt and Silty Clay; dark greenish gray (5GY 4/1); appears moist and hard; 30 to 40% calcium carbonate filaments and cemented nodules (up to 1/8 inch)

At 154.8 to 155.6': Grades to Sandy Silt; micaceous Silty Clay and Clayey Silt; black (N 2.5); appears moist and hard; rare <1% coarse sand and calcium carbonate filaments; organic-rich; lower contact is narrowly gradational

At 156.6 and 157.0': Sample breaks along planar features, which dip approximately 50 degrees, shearing indicated by slicken-sides plunging in dip direction +/-10 degrees

At 157.0 to 160.8': Becomes black (N 2.5) to dark greenish gray (10GY 3/10)

At 159.0 to 159.5': Becomes black (N 2.5); punky texture with abundant waxy parting surfaces; possible shearing

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**MTA Westside Subway Extension**

Los Angeles, California

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**LOG OF BORING**

Project No.: 4953-10-1561  Figure: T2-B6h
Sandy to Clayey Silt; very dark greenish gray (5G 3/1); appears moist and very stiff; micaceous; lower contact is gradational

At 161.0 to 161.7': Increasing sand, gradational transition to unit below

Silty Sand, no matching munsell color, dark gray (N 4) is closest match; appears wet and dense; fine to medium grained

At 162.2 to 164.0': No recovery

Poorly Graded Sand, fine to medium grained, dark gray (N 4); appears wet and dense; uniform grain size

At 164.7 to 165.1': Clayey Silt with Sand; dark gray (2.5Y 4/1); appears wet and soft

At 165.7 to 169.0': No recovery

Well Graded Sand with Gravel, fine to coarse grained, clasts 15 to 40% (up to 1½ inches); mainly subangular granitic rock and meta-basalt

At 170.3 to 174.0': No recovery

Clay; dark gray (2.5Y 4/1) with strong brown (7.5YR 4/6) mottling; appears moist and hard; strong brown mottling occurs mainly as fine, irregular pockets (up to 1/8 inch); 2 to 10% calcium carbonates filaments

At 175 to 176.5': Clay appears wet and soft, possible shear zone

At 177.8 to 178.4': Calcium carbonate increases to 10 to 15%, occurs as filaments and vertically oriented, cemented and uncemented nodules

END OF BORING AT 179 FEET

NOTES:
Boring backfilled with cement/bentonite grout from bottom up and patched.

- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term “clasts” herein describes gravel-size rock fragments (larger than ¼ inch).
- Beds are generally massive unless otherwise noted.

Boring deepened from 79 to 179 on 6/13 to 6/14/11. Location of deepened boring offset south-east approximately 7 feet from original boring location.
<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
<th>SAMPLE LOC.</th>
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<td>275</td>
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<td>1</td>
<td>90</td>
<td>Grass surface</td>
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<td>FILL [A]</td>
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<tr>
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<td>Silty Sand and Gravel, fine to medium grained; dark grayish brown (10YR 4/2); appears very moist and dense</td>
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<tr>
<td>270</td>
<td>10</td>
<td>1</td>
<td>2</td>
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<td>OLDER ALLUVIAL FAN DEPOSITS [Qo]</td>
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<td></td>
<td></td>
<td>Clayey to Sandy Silt, trace to some coarse sand and gravel; brown (7.5R 4/4); appears very moist and very stiff</td>
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<td>NOTE:</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td>Jsm = Santa Monica Slate</td>
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<td>Tm = Modelo Formation</td>
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<td>See end of log for more detailed description of clasts</td>
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<td>At 6.0 to 6.5': Gravel increases to 20-25%, up to 1 inch</td>
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<td>At 6.9 to 8.0': Fine Silty Sand with Gravel, clasts 30-40%, up to 3/4 inch; dark grayish brown (10YR 4/2); appears dry to damp and loose to medium dense</td>
</tr>
<tr>
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<td>At 11.4 to 11.6': Grades to Clayey Sand</td>
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<tr>
<td>265</td>
<td>15</td>
<td>1</td>
<td>3</td>
<td>50</td>
<td>OLDER ALLUVIAL FAN DEPOSITS [Qo]</td>
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<td>Sandy to Clayey Silt with Gravel, clasts 15-25%, up to 3/4 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); mottled, brown (10YR 4/3)</td>
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<td>ESTUARINE / OLDER ALLUVIAL FAN DEPOSITS [Qe/Qo]</td>
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<td>Sandy to Clayey Silt, trace coarse sand; dark yellowish brown (10YR 4/4); appears very moist and soft to medium stiff; well sorted, faint varve-like bedding; lower contact occurs between runs</td>
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<td></td>
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<td>At 15.5 to 16.2': Grades to Silty Clay; mottled, dark grayish brown (10YR 4/2) to reddish brown (5YR 4/4); mottling occurs mainly as fine irregular, oxidized pockets</td>
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<tr>
<td></td>
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<td>At 16.2 to 16.5': 20-30% fine gravel (Jsm and Tm)</td>
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<td></td>
<td></td>
<td>At 16.5 to 19.0': No recovery</td>
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</table>

**GROUND WATER READINGS**

Measured at 33 feet and encountered at 49½ feet during drilling
**ESTUARINE DEPOSITS [Qe]**

Silty Sand, very fine to fine grained; strong brown (7.5YR 4/6); appears very moist and dense; well sorted; lower contact is gradational

At 24.0 to 24.5': Sand increases, gravel increases to 30-40%, up to ½ inches

Clayey, Silty Sand, fine grained, variable coarse sand and gravel, clasts 5-20%; up to 1 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); mottled brown (7.5YR 4/4) to grayish brown (2.5Y 5/2); appears very moist and medium stiff; lower contact is gradational

Sandy to Clayey Silt, trace coarse sand (Jsm and Tm); brown (7.5YR 4/4) with occasional gray (2.5Y 5/1) mottling; appears very moist and medium stiff, trace manganese oxide flecks; lower contact is gradational

At 27.0 to 29.0': No recovery

**ESTUARINE DEPOSITS - FINE GRAINED [Qef]** / Marker MF

Clay, trace coarse sand (Jsm and Tm); mottled, gray (5YR 4/1) to very dark reddish brown (5YR 3/1); appears very moist to wet and medium stiff; trace manganese oxide flecks; possible weak soil development; lower contact is gradational

At 34.0 to 34.9': Grades to Silty Clay and Clayey Silt; variable fine sand, trace coarse sand, mottled, brown (10YR 4/3) to strong brown (7.5YR 5/8); appears very moist to wet and medium stiff

Marker Bed MG

Silty Clay, trace coarse sand; mottled, dark gray (5YR 4/1) to very dark reddish brown (5YR 3/1); appears very moist to wet and medium stiff; trace manganese oxide flecks; possible weak soil development; lower contact is gradational

At 36.6 to 38.0': Varve-like bedding

At 39.0 to 40.0': No sampling

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**GROUNDWATER READINGS**

Measured at 33 feet and encountered at 49½ feet during drilling

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**MTA Westside Subway Extension**

Los Angeles, California

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**LOG OF BORING**

(Continued on following figure)
<table>
<thead>
<tr>
<th>ELEVATION</th>
<th>DEPTH</th>
<th>BOX</th>
<th>RUN</th>
<th>% RECOVERY</th>
<th>CLAY/</th>
<th>Silt/</th>
<th>SAND/</th>
<th>MARKER</th>
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<tr>
<td>235</td>
<td>45</td>
<td>3</td>
<td>8</td>
<td>78</td>
<td>CL/CH</td>
<td>ML</td>
<td>GC/GM</td>
<td>Qef</td>
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<td>50</td>
<td>4</td>
<td>10</td>
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<td></td>
<td>Marker M₁</td>
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<tr>
<td>225</td>
<td>55</td>
<td>4</td>
<td>11</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td>Older Alluvial Fan/Fluvial Deposits [Q₁₀ / Q₆₀]</td>
</tr>
</tbody>
</table>

**CLAY AND SILTY CLAY, TRACE COARSE SAND (JSM AND TM); MOTTLED, GRAY (7.5YR 5/1) TO REDDISH BROWN (5YR 4/4); APPEARS VERY MOIST AND SOFT TO MEDIUM STIFF; GENERALLY HOMOGENEOUS AND MASSIVE, LOWER CONTACT IS GRADATIONAL**

At 43.9 to 44.0': No recovery
Clay and Silty Clay, trace coarse sand (JSM and Tm); mottled, gray (7.5YR 5/1) to reddish brown (5YR 4/4); appears very moist to wet and soft to medium stiff; generally homogeneouse and massive, lower contact is gradational
At 45.0 to 49.5': Color becomes brown (7.5YR 5/4) with occasional gray brown (10YR 5/2) mottling

At 47.0 to 49.0': Variable fine sand, trace to some coarse sand (JSM and TM); appears very moist and very stiff
At 49.0 to 49.5': Groundwater encountered during drilling
Clayey to Sandy Silt, trace coarse sand and gravel (JSM and TM); appears very moist to wet and soft to medium stiff; occasional clay or silty clay beds; lower contact is narrowly gradational
At 52.1 to 54.0': No recovery

Older Alluvial Fan/Fluvial Deposits [Q₁₀ / Q₆₀]
Silty, Clayey Gravel, clasts 50-60%, up to 1 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); matrix is generally fine to coarse silty, clayey sand, occasionally sandy clay; color is variable, appears wet and dense; lower contact is sharp, erosional
At 56.0 to 59.0': No recovery

**MARKER M₁, CONTINUED**
At 43.9 to 44.0': No recovery
Clay and Silty Clay, trace coarse sand (JSM and Tm); mottled, gray (7.5YR 5/1) to reddish brown (5YR 4/4); appears very moist to wet and soft to medium stiff; generally homogeneouse and massive, lower contact is gradational
At 45.0 to 49.5': Color becomes brown (7.5YR 5/4) with occasional gray brown (10YR 5/2) mottling

At 47.0 to 49.0': Variable fine sand, trace to some coarse sand (JSM and TM); appears very moist and very stiff
At 49.0 to 49.5': Groundwater encountered during drilling
Clayey to Sandy Silt, trace coarse sand and gravel (JSM and TM); appears very moist to wet and soft to medium stiff; occasional clay or silty clay beds; lower contact is narrowly gradational
At 52.1 to 54.0': No recovery
ESTUARINE DEPOSITS - FINE GRAINED [Qef]
Clay and Silty Clay, variable fine sand, trace coarse sand; color variable, mainly brown (10YR 4/3); appears very moist and stiff to very stiff; variable (2-10%) manganese oxide flecks; lower contact is narrowly gradational
At 70.6 to 71.1': Color becomes reddish brown (5YR 4/3)

OLDER OLLUVIAL FAN DEPOSITS [Qfo]
Sandy to Clayey Silt, some gravel, clasts 10-15%, up to 3/4 inch (Jsm and Tm); dark grayish brown (10YR 4/2); appears very moist and very stiff
At 77.2 to 79.0': No recovery

END OF BORING AT 79 FEET
NOTES:
-Boring backfilled with cement/bentonite grout from bottom up and patched.
-Munsell colors listed in order of predominance (most predominant color first).
-Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
-Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
-Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
-The term “clasts” herein describes gravel-size rock fragments (larger than ¼ inch).
-Beds are generally massive unless otherwise noted.

### LOG OF BORING

<table>
<thead>
<tr>
<th>DRILLING NO.</th>
<th>Depth (ft)</th>
<th>Box #</th>
<th>Run #</th>
<th>% Recovery</th>
<th>Sample Loc.</th>
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<td>85</td>
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<td></td>
<td>100</td>
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</table>

**Boring No.: 4953-10-1561**

**MTA Westside Subway Extension**
Los Angeles, California

**Jet Drilling / CME 75**

**Hollow-Stem Auger**

**Borehole Location**
See Plate 3

**Dates Drilled**
5/12/11

**Hole Diameter**
8 inches

**Ground El.**
280 feet

**Groundwater Readings**
Measured at 33 feet and encountered at 49½ feet during drilling
<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
<th>SAMPLE LOC.</th>
<th>DRILLING COMPANY/DRILLING EQUIPMENT</th>
<th>BOREHOLE LOCATION</th>
<th>BORING NO.</th>
<th>DATES DRILLED</th>
<th>HOLE DIAMETER</th>
<th>GROUND EL.</th>
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</thead>
<tbody>
<tr>
<td>275</td>
<td>6</td>
<td>5</td>
<td></td>
<td></td>
<td>Grass surface</td>
<td>Jet Drilling / CME 75</td>
<td>See Plate 3</td>
<td>T2-B8</td>
<td>5/10/11-5/12/11</td>
<td>8 inches</td>
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<tr>
<td>270</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>93</td>
<td>FILL [A] Sandy to Clayey Silt with gravel, clasts 15-20% up to ¾ inch; very dark grayish brown; appears moist and dense; some asphalt fragments</td>
<td>5/10/11-5/12/11</td>
<td>8 inches</td>
<td>280 feet</td>
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<td></td>
<td>NOTE: Jsm = Santa Monica Slate Tm = Modelo Formation See end of log for more detailed description of clasts</td>
<td>5/10/11-5/12/11</td>
<td>8 inches</td>
<td>280 feet</td>
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<tr>
<td>265</td>
<td>15</td>
<td>1</td>
<td>3</td>
<td>10</td>
<td>OLDER ALLUVIAL FAN DEPOSITS [Q6o] Clayey to Sandy Silt, trace coarse sand and gravel (Jsm and Tm); dark yellowish brown (10YR 4/4); appears moist and very stiff; poorly sorted; lower contact is sharp</td>
<td>5/10/11-5/12/11</td>
<td>8 inches</td>
<td>280 feet</td>
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<td>At 6.4 to 6.8': Silty Gravel, clasts 50-60% up to ½ inch, mainly subangular to subrounded slate (Jsm) and shale (Tm), color variable</td>
<td>5/10/11-5/12/11</td>
<td>8 inches</td>
<td>280 feet</td>
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<td></td>
<td>Silty Clay to Clayey Silt, variable fine sand, trace coarse sand and fine gravel (Jsm and Tm); brown (7.5YR 4/3); appears moist and very stiff; poorly sorted lower contact occurs between runs</td>
<td>5/10/11-5/12/11</td>
<td>8 inches</td>
<td>280 feet</td>
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<td>OLDER ALLUVIAL FAN/FLUVIAL DEPOSITS [Q6o/Q6d] Silty Gravel, clasts 60-70%, up to ¾-inch, mainly subangular to subrounded slate (Jsm), shale (Tm), sandstone (Tm); some meta-basalt also observed; matrix is fine to coarse silty sand; color variable; appears damp and dense; lower contact occurs between runs</td>
<td>5/10/11-5/12/11</td>
<td>8 inches</td>
<td>280 feet</td>
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<td></td>
<td>At 11.0 to 14.0': No recovery</td>
<td>5/10/11-5/12/11</td>
<td>8 inches</td>
<td>280 feet</td>
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<td>OLDER ALLUVIAL FAN DEPOSITS [Q6o] Sandy to Clayey Silt with Gravel, clasts 15-20%, up to ½ inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); dark brown (7.5YR 3/4);</td>
<td>5/10/11-5/12/11</td>
<td>8 inches</td>
<td>280 feet</td>
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<td></td>
<td>At 14.0': Gravel becomes coarse, one mafic igneous clast (up to 1½ inch) observed</td>
<td>5/10/11-5/12/11</td>
<td>8 inches</td>
<td>280 feet</td>
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<td></td>
<td>At 14.3 to 16.5': No recovery</td>
<td>5/10/11-5/12/11</td>
<td>8 inches</td>
<td>280 feet</td>
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<td></td>
<td>At 16.5 to 19.0': No recovery</td>
<td>5/10/11-5/12/11</td>
<td>8 inches</td>
<td>280 feet</td>
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</tbody>
</table>

Geologist: BR/MF
Prepared/Date: YN/WL 10/10/2011
Checked/Date: MW/MF 10/11/2011

MTA Westside Subway Extension
Los Angeles, California

(Continued on following figure)
Silty Sand, fine grained, variable clay, variable coarse sand and fine gravel; clasts 5-15%, up to ½ inch (Jsm and Tm); mottled, grayish brown (10YR 5/2) to strong brown (7.5YR 5/6); appears moist and very stiff; poorly sorted; lower contact occurs between runs

At 24.0 to 29.0': Recovered only 3" of core sample, also recovered 6" from standard pin sample driven from 24.0' to 25.5'

At 29.0 to 31.5': No recovery

At 31.5 to 34.0': Poor to No recovery

Depth of contact uncertain due to poor recovery

Marker Bed MG - Clayey Silt to Silty Clay, trace coarse sand; mottled, very dark gray (5YR 3/1) to dark reddish brown (5YR 3/4); appears very moist and stiff; some manganese oxide flecks; some decayed organics; possible weak soil development; lower contact is gradational

At 35.8': Groundwater measured during drilling

At 39.0 to 43.0': Becomes very moist to wet, medium stiff to stiff, trace manganese oxide flecks, occasional silty clay beds and slightly sandy beds
CL/ML

Qef  Continued

At 43.0 to 43.6': Grades to Silty Clay to Clayey Silt, variable fine sand

Marker Mf Continued - Clayey Silt and Silty Clay, variable fine sand, trace coarse sand and fine gravel (Jsm and Tm); brown (7.5YR 4/4); appears very moist to wet and soft; lower contact is sharp

Marker Mf Continued - Silty Sand, fine grained, trace fine gravel (Jsm and Tm); brown (7.5YR 4/4); appears wet and medium dense; well sorted, lower contact is sharp

At 45.5 to 45.7': 10-20% gravel, up to 3/4 inch, mainly subrounded slate (Jsm) and shale (Tm)

Marker Mf Continued - Clay and Silty Clay, trace coarse sand; mottled, brown (7.5YR 4/4) to grayish brown (2.5Y 5/2); appears very moist and very stiff; occasional varve-like bedding; trace manganese oxide flecks; lower contact is gradational

At 47.5 to 49': No recovery

At 50.5 to 50.8': Increasing sand and gravel, gradational transition to bed below

ESTUARINE DEPOSITS / OLDER ALLUVIAL FAN DEPOSITS [Qe/Qfo]

Clayey to Sandy Silt; variable coarse sand and gravel, clasts 2-15%, up to 3/4 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); appears very moist and stiff to very stiff; moderately well sorted; lower contact is gradational

At 55.3 to 55.5': Gravel increases to 25%, organic-rich bed

Silty Clay and Clayey Silt, variable coarse sand, trace fine gravel (Jsm and Tm); grayish brown (2.5Y 5/2) with strong brown (7.5YR 5/6) mottling; appears very moist and stiff; mottling is mainly oxidized, pockets up to 3/4 inch, lower contact is gradational

At 58.0 to 59.0': Becomes less oxidized, some varve-like bedding

At 58.0 to 59.0': No recovery

At 59.0 to 60.0': Grades to Clayey to Sandy Silt with Gravel, clasts 15-20%, up to ½ inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm)
### Estuarine Deposits [Qe]

At 60.0 to 60.9': Silty Sand with Gravel (Jsm), fine to coarse grained, clasts 15-25%, up to 3/4 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); color generally dark grayish brown (10YR 4/2); appears wet and dense.

**Clay, trace coarse sand; dark grayish brown (10YR 4/2); appears very moist and stiff; occasional silty clay beds, prominent varve-like bedding; lower contact is narrowly gradational.**

At 60.9 to 61.1': Increasing clay, gradational transition to clay bed, appears wet and soft/loose.

At 61.1 to 61.4': Organic-rich zone.

At 63.0 to 64.0': No recovery.

### Estuarine Deposits - Fine Grained [Qef]

Silty Clay to Clayey Silt, trace coarse sand; mottled, grayish brown (10YR 4/2) to strong brown (7.5YR 4/6); appears very moist to wet and medium stiff; variable varve-like bedding; lower contact is gradational.

At 67.1 to 67.6': Grades to Sandy to Clayey Silt, trace coarse sand.

At 67.6 to 69.0': Prominent varve-like bedding.

At 69.0 to 70.3': Mottled, dark gray (7.5YR 4/1) to dark reddish brown (5YR 3/4), mottling generally occurs oxidized pockets.

At 70.3 to 72.5': Increasing sand and gravel, gradational transition to fan deposits below.

### Older Alluvial Fan Deposits [Qfo]

Sandy to Clayey Silt; variable coarse sand and fine gravel; clasts 15-30%, up to 1/2 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm), mottled gray (10YR 4/1) to brown (10YR 4/3) to strong brown (7.5YR 4/6); appears very moist and very stiff; coarsens with depth, grades to fan deposits below.

At 76.5 to 79.0': No recovery.

At 79.0 to 79.8': Grades to Silty Clay, trace coarse sand and fine gravel (Jsm and Tm).
At 81.2 to 81.4': Grades to fine Silty Sand

Well Graded Sand with Gravel, fine to coarse grained, clasts 20-30%, up to 3/4 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm), one granitic clast also observed; color variable, generally dark brown (7.5YR 3/4), appears wet and dense, lower contact is sharp

At 83.6 to 84.1': Grades to very fine Silty Sand

At 84.5 to 85.0': Clayey to Sandy Silt, mottled, brown (7.5YR 4/4), appears wet and very stiff

Clayey to Sandy Silt, mottled, brown (7.5YR 4/4), appears wet and very stiff

Clay, rare (<1%) coarse sand; lightly mottled, reddish brown (5YR 4/4) to dark grayish brown (10YR 4/2); appears very moist to very stiff; variable (2-15%) manganese flecks, lower contact is narrowly gradational

At 85.6 to 86.0': Irregular sandy silt pockets

Silty Sand with Gravel, fine grained, clasts 20-30%, up to 1 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm), dark yellowish brown (10YR 4/4), appears very moist to dense, lower contact is gradational

Sandy to Clayey Silt with Gravel, variable coarse sand, clasts 20-30%, up to ½ inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); mottled, strong brown (7.5YR 5/6) to grayish brown (10YR 5/2), appears very moist to very stiff; poorly sorted; lower contact is gradational

At 93.8 to 94.2': Grades to Clayey, Silty Gravel, clasts 60-70%, up to 1½ inch, mainly subangular to subrounded slate (Jsm), some shale (Tm) and sandstone (Tm) also observed, matrix is sandy silt with clay; color variable, appears wet and dense

At 95.8 to 98.3': Gravel increases to 30-40%, up to 1 inch; color becomes grayish brown (2.5Y 5/2); appears wet and stiff, matrix occasionally grades to fine clayey to silty sand

FLUVIAL DEPOSITS [Qf6d]

Silty Gravel, clasts 50-60%, up to 2 inches, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm), some quartzite also observed, color variable, generally dark grayish brown (10YR 4/2); appears wet and dense; lower contact occurs between runs
Well Graded Sand with Gravel, fine to coarse grained, clasts 30-50%, up to 3/4 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); color variable, mainly dark grayish brown (10YR 4/2); appears wet and dense; lower contact is sharp, erosional.

At 105.0 to 105.3', 106.1'-106.5' and 107.0'-107.3': Clay; mottled, mainly light brownish gray (10YR 6/2) to brown (7.5YR 5/4) to reddish brown (10YR 4/4); appears wet and soft; variable mica, occasional sandy zones, pockets or laminations; upper and lower contacts are sharp.

At 107.3 to 107.6': Silty Clay; dark brown (10YR 3/3); appears very moist and stiff.

At 107.6 to 108.0': Sandy to Clayey Silt, trace coarse sand (Jsm and Tm); color variable, mainly brown (7.5YR 4/3); appears wet and medium stiff.

At 111.0 to 112.6': Gravel decreases to 5-10%, up to ½ inch.

At 119.0 to 119.5': Oxidized pockets increase (25-35%), elongated vertical orientation.
BASAL ALLUVIAL FAN / BASAL ESTUARINE UNIT [Qfob/Qeb]
Clayey to Sandy Silt, variable coarse sand, trace fine gravel (Jsm and Tm); grayish brown (10YR 5/2) to light gray (10YR 7/2); appears very moist and very stiff; abundant calcium carbonate, occurs as dispersed deposits and cemented nodules up to ½ inch, total calcium carbonate about 50% at 119.9', decreasing with depth to 15% at 122.2'; lower contact is gradational
At 121.4 to 122.3': Increasing sand, grades to fine to coarse Clayey, Silty Sand, trace gravel

Silty Clay and Clayey Silt, rare (<1%) coarse sand (Jsm and Tm); mottled, very dark grayish brown (10YR 3/2) to strong brown (7.5YR 4/6), strong brown mottling occurs mainly as irregular, oxidized pockets, variable (2-15%) calcium carbonate, occurs as cemented and uncemented nodules up to ½ inch; lower contact is gradational

At 127.5 to 129.7': Generally coarsens with depth, becomes more poorly sorted, gradational transition to unit below

Sandy to Clayey Silt, trace coarse sand (Jsm and Tm); mottled, dark grayish brown (10YR 4/2) to strong brown (7.5YR 4/6); appears moist to very moist and very stiff to hard; 5-10% calcium carbonate, occurs as dispersed deposits and cemented nodules up to 1/8 inch, lower contact is gradational
At 127.5 to 129.7': Generally coarsens with depth, becomes more poorly sorted, gradational transition to unit below

BASAL ALLUVIAL FAN UNIT [Qfob]
Clayey, Silty Sand, fine grained, trace coarse grained sand and fine gravel (Jsm and Tm); light yellowish brown (2.5Y 6/3); appears very moist and dense; poorly sorted; trace dispersed calcium carbonate; lower contact is gradational
At 130.9 to 131.6': Gravel increases to 30-40%, up to 2 inches, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm)
At 131.6 to 132.8': Abundant (20-30%) dispersed calcium carbonate, color becomes light gray (2.5Y 7/2)

Sandy Silt with Clay, variable coarse sand, trace fine gravel (Jsm and Tm); mottled, light yellowish brown (2.5Y 6/3) to grayish brown (10YR 4/3); appears very moist and very stiff; 5-15% calcium carbonate, occurs as dispersed deposits and cemented nodules up to 1/8 inch; lower contact is sharp
At 135.0 to 140.8': Mottled, color variable, mainly light yellowish brown (2.5Y 6/3) to yellowish brown (10YR 5/4); appears very moist and very stiff; occasionally grades to very fine Clayey, Silty Sand
At 135.0 to 136.5': Calcium carbonate decreases with depth, 10-15% at 135.0', little or no calcium carbonate below 136.5'

At 139.0 to 140.0': No recovery

Geologist: BR/MF
Prepared/Date: YN/WL 10/10/2011
Checked/Date: MW/MF 10/11/2011

(Continued on following figure)
At 140.8': Poorly Graded Sand bed, 1 inch thick, fine to medium grained
At 140.8' to 143.8': Alternating beds of Silty Clay and very fine Sandy Silt; lightly mottled, grayish brown (2.5Y 5/2) to strong brown (7.5YR 5/6); appears very moist and very stiff to dense; lower contact is sharp

BASAL ESTUARINE UNIT [Qeb]
Clay, rare (<1%) coarse sand (Jsm and Tm), greenish gray (10Y 5/1), appears moist and hard, trace calcium carbonate, lower contact is narrowly gradational
At 144.6 to 147.7': Calcium carbonate increases to 30-40%, occurs as dispersed deposits and cemented and uncemented nodules up to 1/4 inch

Clayey Silt and Silty Clay, trace coarse sand; dark grayish brown (10YR 4/2); appears moist and very stiff to hard; 5-15% calcium carbonate, occurs as irregular, uncemented pockets
At 148.6 to 151.4': Irregular calcium carbonate pockets increase to 15-20%; color becomes dark gray (2.5Y 4/1)
A 150.0 to 151.4': Appears very moist and medium stiff
At 151.4 to 152.1': Calcium carbonate decreases to less than 5%, color is dark gray (2.5Y 4/1)
At 152.1 to 153.0': Sample appears disturbed, appears wet and soft, 10-20% cemented calcium carbonate nodules, generally up to ½ inch, one 2 inch calcium carbonate nodule
At 153.0 to 155.0': No recovery

Silty Clay and Clayey Silt; lightly mottled, dark gray (10YR 4/1) to brown (7.5YR 4/4); appears moist and very stiff; trace calcium carbonate filaments and cemented nodules up to 1/4 inch; abundant fine, irregular oxidized pockets, lower contact is gradational
At 159.3 to 161.7': Color becomes very dark greenish gray, calcium carbonate increases to 5-10%, trace fine, oxidized, strong brown (7.5YR 4/6) pockets up to 1/8
At 160 to 165': Appears sheared and broken up; some waxy parting surface

San Pedro Formation [Qsp]
Clayey Silt, variable fine sand, trace coarse sand (Jsp and Tm); dark gray (N 4); appears moist and very stiff to hard; trace calcium carbonate nodules up to 1/8 inch, lower contact is gradational
At 162.8': Trace bivalve shell fragments

At 164.6 to 165.0': Increasing sand, gradational transition to unit below

Poorly Graded Sand with Silt, fine grained; dark gray (2.5Y 4/1) to very dark gray (2.5Y 3/1); appears very moist to dense; lower contact is narrowly gradational
At 165.8 to 166.8': Grades to fine to medium Poorly Graded Sand

Silty Clay and Clayey Silt; black (2.5Y 2.5/1) with variable gray (10YR 5/1); appears moist and hard; gray color occurs mainly as varve-like bedding; appears organic rich; lower contact is narrowly gradational
At 167.3': Trace bivalve shell fragments at sand/clay contact

At 170.9 to 171.0': Poorly Graded Sand with Silt, fine grained, dark gray (2.5Y 4/1)
At 171.0' to 172.7': Abundant varve-like bedding defined by colors described above and apparent organic content

At 172.0 to 172.3': Organic-rich bed, two decayed roots observed
At 172.7 to 173.1': Organic-rich bed, abundant black decayed organics
Silty Sand, fine grained; dark gray (2.5Y 4/1); appears moist and dense; irregular black, vertically oriented, organic-rich structures extend down to 173.4' from unit above
Poorly Graded Sand, fine grained; gray (2.5Y 3/1); appears moist and dense
At 176.7 to 177.4': Some gravel, clasts, 5-15%, up to 1½ inch, mainly surrounded meta-basalt and slate
At 177.4' to 180.0': Grades to Poorly Graded Sand with Silt, very fine grained; light gray (N 7); appears damp and dense
Silty Sand with Gravel, fine to medium grained, clasts 30-50%, up to 1 inch, mainly subrounded, meta-basalt and slate; dark gray (2.5Y 4/1); appears wet and dense; trace mica

A 181.5 to 185.0': No recovery

Clay; very dark gray (2.5Y 3/1); appears very moist and stiff; slightly micaceous; trace dispersed calcium carbonate filaments

At 187.2 to 190.0': No recovery

END OF BORING AT 190 FEET

NOTES:
Boring backfilled with cement/bentonite grout from bottom up and patched.

-Munsell colors listed in order of predominance (most predominant color first).
-Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
-Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
-Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
-The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch).
-Beds are generally massive unless otherwise noted.

Boring extended from 79' to 190' on 6/9/2011 offset from original boring location approximately 1 foot south east.
Grass Surface
Hand augered to 6 feet

**FILL [Af]**
Silty Sand with Gravel, fine grained, clasts 20-35%, up to 3/4 inch; dark grayish brown (10YR 4/2); appears moist and dense

**NOTE:**
Jsm = Santa Monica Slate
Tm = Modelo Formation
See end of log for more detailed description of clasts

**OLDER ALLUVIAL FAN DEPOSITS [Qfo]**
Silty Clay to Clayey Silt, variable gravel, clasts 5-20%, up to 1/2 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); dark brown (7.5YR 3/3); appears very moist and very stiff; poorly sorted; lower contact is narrowly gradational

Silty Sand, fine grained, trace coarse sand and fine gravel (Jsm and Tm); brown (10YR 4/3); appears moist and dense; lower contact is sharp

Clayey Sand with Gravel, clasts 25-35%, up to 1 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); some brick-red sandstone; color variable; appears very moist and dense
At 7.8 to 8.4': Increasing clay, decreasing gravel; gradational transition to bed below

Clayey to Sandy Silt, variable coarse sand and gravel, clasts 2-20%, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); brown (7.5YR 4/4); appears very moist and stiff
At 13.0 to 14.0': No recovery

**ESTUARINE DEPOSITS [Qe]**
Silty Clay to Clayey Silt, variable fine to coarse sand, trace fine gravel (Jsm and Tm); brown (10YR 4/3); appears very moist and stiff, some varve-like bedding; lower contact occurs between runs
At 19.0': Becomes lightly mottled, brown (10YR 5/3) to strong brown (7.5YR 5/6)

At 19.5' to 19.9': Fine to coarse Silty Sand

---

**BORING NO.: T2-B9**

**LOG OF BORING**

**MTA Westside Subway Extension**
Los Angeles, California

**DRILLING COMPANY/DRILLING EQUIPMENT**
Jet Drilling / CME 75

**DRILLING METHOD**
Hollow-Stem Auger

**DATES DRILLED**
5/9/11

**BOREHOLE LOCATION**
See Plate 3

**HOLE DIAMETER**
8 inches

**GROUNDWATER READINGS**
Encountered at 50½ feet during drilling

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**ELEVATION (ft)**

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<th>RUN #</th>
<th>% RECOVERY</th>
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**MTA Westside Subway Extension**
Los Angeles, California

**Groundwater Readings**
Encountered at 50½ feet during drilling

**Drilling Company/Drilling Equipment**
Jet Drilling / CME 75

**Drilling Method**
Hollow-Stem Auger

**Dates Drilled**
5/9/11

**Borehole Location**
See Plate 3

**Hole Diameter**
8 inches

**Groundwater Readings**
Encountered at 50½ feet during drilling

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**Geologist:** BR/MF
**Prepared/Date:** YN/WL 10/10/2011
**Checked/Date:** MW/MF 10/11/2011
### Older Alluvial Fan Deposits ([Qe])

Clayey to Sandy Silt, variable gravel, clasts 5-15%, up to 1 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm), some quartzite and granitic rock also observed; brown (7.5YR 4/4); appears very moist and stiff; lower contact is narrowly gradational

- At 23.0': Becomes mottled, strong brown (7.5YR 4/6) to brown (10YR 4/3)
- At 25.7 to 26.0': Gravel increases
- At 26.0 to 27.3': Grades to fine to medium Silty Sand, trace coarse sand and fine gravel

### Estuarine Deposits ([Qe])

Clayey to Sandy Silt, trace coarse sand and fine gravel; brown 10YR 4/3; appears very moist to wet and soft to medium stiff

- At 26.0 to 27.3': Grades to fine to medium Silty Sand, trace coarse sand and fine gravel
- At 28.0 to 29.0': No recovery
- At 29.0 to 29.6': Gravel increases to 20-30%

### Marker Bed M_P

Silty Clay to Clayey Silt, variable fine sand, trace coarse sand and fine gravel (Jsm and Tm); mottled, grayish brown (10YR 5/2) to strong brown (7.5YR 4/6); appears very moist and stiff; trace manganese oxide flecks; possible weak soil development; lower contact is gradational

- At 30.0 to 32.0': Occasional varve-like bedding
- At 32.0 to 32.5': Color becomes brown (10YR 4/3)
- At 33.5 to 34.2': Becomes, dark reddish brown (5YR 3/3), trace manganese oxide

### Estuarine Deposits ([Qe]) / Marker M_P

Silty Clay to Clayey Silt, variable fine sand, trace coarse sand and fine gravel (Jsm and Tm); yellowish red (5YR 4/6) to brown (10YR 4/3); appears very moist and stiff; generally homogeneous and massive to thickly bedded

- At 38.5 to 44.6': Sand and gravel increase, clasts 5-20%, up to 3/4 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm)
- At 39.5 to 44.6': Appears very moist to wet and soft to medium stiff
At 42.7 to 44.6': Some brick-red sandstone, occasional granitic clasts observed

At 45.6 to 46.3': Decreasing sand and gravel, lower contact is gradational

Marker M<sub>f</sub> Continued - Clay, rare (<1%) coarse sand; brown (10YR 4/4); appears very moist and stiff; generally homogeneous and massive; lower contact is narrowly gradational

At 49.0' - 50.2': Grades to Silty Clay and Clayey Silt; some grayish brown (10YR 5/2) mottling, increasing sand

At 50.5': Groundwater encountered during drilling

ESTUARINE DEPOSITS (Qe) - Clayey to Sandy Silt; variable coarse sand and gravel occurring in distinct beds as noted below, clasts 2-15% up to 1/2-inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); lightly mottled, grayish brown (10YR 5/2) to strong brown (7.5YR 4/6); appears very moist to wet and medium stiff to stiff; generally well sorted, trace manganese oxide flecks; lower contact is narrowly gradational

At 53.0 to 53.5': Gravel increases to 20-25%, up to 3/4-inch

At 54.6 to 54.7': Gravel increases to 20-25%

At 54.7 to 55.0': Fine to medium Silty Sand

At 55.0 to 56.0': Grades to Clay

At 57.1 to 57.5': Gravel increases to 25-30%

At 59.0 to 60.0': No sampling
At 60.0 to 60.8': Fine Silty to Clayey Sand, 5-10% gravel (Jsm and Tm)

At 60.8 to 62.0': Interbedded clay and silt, trace coarse sand and gravel (Jsm and Tm), prominent varve-like bedding

At 62.5 to 64.0': No recovery

At 64.0 to 65.5': No recovery

At 65.5 to 66.7': Alternating Silty Sand and Clayey Silt beds / laminations, some manganese oxide staining

At 69.0 to 70.1': Becomes soft to medium stiff

Silty Clay to Clayey Silt, trace coarse sand; mottled, grayish brown (10YR 5/2) to strong brown (7.5YR 4/6); appears very moist and very stiff; occasional oxidized sandy silt pockets / lenses

At 73.2 to 74.0': Color becomes very dark grayish brown (10YR 3/2) to dark brown (7.5YR 3/4)

At 74.5 to 75.0': Appears very moist to wet and soft

At 76.0 to 76.7': Appears very moist to wet and soft

At 76.7 to 77.5': Up to 5% manganese oxide flecks

At 77.5 to 78.0': 5-10% gravel (Jsm and Tm)

At 78.0 to 79.0': No recovery

END OF BORING AT 79 FEET

NOTES:
Boring backfilled with cement/bentonite grout from bottom up and patched.

- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch).
- Beds are generally massive unless otherwise noted.

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<th>% RECOVERY</th>
<th>BORING COMPANY/DRILLING EQUIPMENT</th>
<th>BOREHOLE LOCATION</th>
<th>DATES DRILLED</th>
<th>HOLE DIAMETER</th>
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Encountered at 50½ feet during drilling
### OLDER ALLUVIAL FAN DEPOSITS [Qfo]
Clayey to sandy silt, variable coarse sand and gravel, 5-20%, up to 1/2-inch; subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); dark brown (10YR 3/3); appears moist and stiff to very stiff; lower contact is gradational.

- At 6.5': gravel decreases to <5%

### ESTUARINE DEPOSITS [Qe]
Silty clay and clayey silt, trace coarse sand (Jsm and Tm); dark brown (7.5YR 3/3); appears moist and stiff; lower contact is gradational.

- At 9.5 to 10.0': No sampling
- At 11.0 to 14.0': No recovery

Silty clay and clayey silt, trace coarse sand (Jsm and Tm); mottled, gray (2.5Y 5/1) to strong brown (7.5YR 4/6); appears very moist and stiff.

- At 18.0 to 19.0': No recovery

Clayey to silty sand, very fine grained, trace coarse sand; highly oxidized, mottled, reddish brown (5YR 4/4) to dark gray (7.5YR 4/1); appears very moist and dense; lower contact is gradational.

- At 20.5': gravel decreases to <5%
At 20.0': Grades to Clayey to Sandy Silt

At 22.3 to 24.0': No recovery

Very fine Silty Sand and Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); dark yellowish brown (10YR 3/4); appears very moist and stiff; lower contact is gradational

At 25.0 to 26.5': No recovery

Clayey to Sandy Silt, variable coarse sand and gravel, clasts 2 to 15%, up to 1 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm), some brick red sandstone (Tm); appears moist and stiff to hard; poorly sorted; lower contact is narrowly gradational

At 30.2 to 31.5': Gravel increases to 20 to 25%, abundant coarse sand

At 31.2 to 34.0': No recovery

Silty Clay and Clayey Silt, trace coarse sand and fine gravel (Jsm and Tm); dark brown (7.5YR 3/4); appears moist and very stiff; possible weak soil development; lower contact occurs between runs

At 36.0 to 36.6': Gravel increases to 5 to 10%

Depth of contact uncertain due to poor recovery

**ESTUARINE DEPOSITS [Qe] / Marker Bed M<sub>G</sub>**

Silty Clay and Clayey Silt, trace coarse sand and fine gravel (Jsm and Tm); dark brown (7.5YR 3/4); appears moist and very stiff; possible weak soil development; lower contact occurs between runs

At 36.0 to 36.6': Gravel increases to 5 to 10%

At 36.6 to 39.0': No recovery

Marker M<sub>Q</sub>: Sandy Clay, trace fine gravel; dark yellowish brown (10YR 4/4); appears very moist to wet and soft to medium stiff; lower contact is gradational
At 39.6 to 41.2': Grades to Sandy to Clayey Silt, trace coarse sand (Jsm and Tm); brown (7.5YR 4/4); appears very moist and medium stiff; lower contact is narrowly gradational.

Marker Mf Continued - Clay, trace coarse sand (Jsm and Tm); brown (7.5YR 4/4) with occasional grayish brown (10YR 5/2) mottling; appears moist and very stiff; generally homogeneous and massive lower contact is gradational.

At 41.5 to 41.8': Appears very moist to wet and soft.

At 42.5 to 43.0': Sand content increases.

At 43.0 to 43.4': Grades to Clayey to Sandy Silt

Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); mottled, reddish brown (5YR 4/4) to strong brown (7.5YR 4/4); appears wet and soft; lower contact is gradational.

At 46.0 to 46.9': Increasing sand and gravel, gradational transition to unit below.

Silty Gravel, clasts 60 to 70%, up to 1 inch; mainly subangular to subrounded slate (Jsm), shale (Tm), and sandstone (Tm); color varies; appears wet and dense; lower contact occurs between runs.

At 47.1 to 49.0': No recovery.

Well Graded Sand, fine to coarse grained, trace fine gravel (Jsm and Tm); color variable, generally dark grayish brown (10YR 4/2); appears wet and dense; lower contact occurs between runs.

At 50.7 to 54.0': No recovery.

Depth of contact uncertain due to poor recovery.

Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); brown (7.5YR 4/4); appears wet and soft.

At 55.3 to 55.7': Grades to Silty Clay, some varve-like bedding.

Silty Clay, trace coarse sand (Jsm and Tm); mottled, brown (7.5YR 3/3) to grayish brown (10YR 5/2); appears wet and soft.

At 57.2 to 57.5': and 58.1 to 58.3': Fine to coarse Silty Sand beds, contacts are sharp.

At 58.2 to 58.3': Abundant manganese oxide staining.

Clayey to Sandy Silt, trace coarse sand, lightly mottled, brown (7.5YR 5/3) to grayish brown (10YR 5/2); appears very moist and stiff; variable manganese oxide staining; prominent varve-like bedding.

The log indicates that the subsurface conditions at the exploration location are interpreted with due consideration of the approximate interfaces and transitions between strata.
**ESTUARINE DEPOSITS - FINE GRAINED [Qe]**

- Clay, trace coarse sand; mottled, dark reddish brown (5YR 3/3) to dark gray (7.5YR 4/1); appears moist and very stiff; rare (<1%) calcium carbonate filaments
- At 68.0 to 69.0': No recovery

- Clayey to Sandy Silt with Gravel; clasts 15 to 30%, up to 3/4 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); mottled, brown (10YR 4/3) to strong brown (7.5YR 4/6); appears very moist to wet and very stiff; lower contact is narrowly gradational
- At 65.5 to 66.5': No recovery

- Clayey Silty Sand
- At 66.9 to 67.9': Distinct laminations defined by variable oxidation

- Increasing sand and fine gravel, gradational transition to unit below
- At 70.5 to 71.6':

- Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); brown (7.5YR 4/4); appears very moist to wet and stiff to very stiff; generally moderately to well sorted; rare (<1%) calcium carbonate filaments; occasionally grades to Silty Clay, occasional more gravelly beds
- At 74.0 to 74.5': Calcium carbonate increases to 5 to 10%

- At 77.5 to 79.0': No recovery

**GROUNDWATER READINGS**

Not recorded

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**LOG OF BORING**

Project No.: 4953-10-1561

Figure: T2-B10d
Boring backfilled with cement/bentonite grout from bottom up and patched.

- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted.
- Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch).
- Beds are generally massive unless otherwise noted.

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This record is an interpretation of subsurface conditions at the exploration location. Latitude and longitude of boring location shown on logs are approximate. Subsurface conditions at other locations and at other times may differ. Interfaces between strata are approximate. Transitions between strata may be gradual.

---

**LOG OF BORING**

**DRILLING COMPANY/DRILLING EQUIPMENT**

Jet Drilling / CME 75

**DRILLING METHOD**

Hollow-Stem Auger

**HOLE DIAMETER**

8 inches

**DATES DRILLED**

5/20/11

**PROJECT DIRECTORIES**

4953-10-1561

**GROUNDWATER READINGS**

Not recorded

**SAMPLE LOC.**

Geologist: BF/MF
Prepared/Date: YN/WL 10/10/2011
Checked/Date: MW/MF 10/11/2011

**MTR SOIL CORE**

S:\70131 GEOTECH\GINTW\FAULT_INVESTIGATION_WSE_LIBRARY AMEC OCTOBER2011 (2).GLB

G:\PROJECT_DIRECTORIES\4953\2010\101561\METRO_WESTSIDE_EXTENSION\6.2.3.2 FAULT HAZARD INVESTIGATION\3.2 ALL FIELD NOTES\GINT LOGS\101561-TRANSECT 2.GPJ 10/14/11
LOG OF BORING

Geologist: DB/MF
Prepared/Date: YN/PK 10/14/2011
Checked/Date: MW/MF 10/14/2011

MTA Westside Subway Extension
Los Angeles, California

(Continued on Following Figure)

SM/SC

Surface is grass
Hand augered to 6 feet

FILL [Af]

Clayey Silty Sand with gravel, fine grained, clasts 30 to 40%, up to 1 inch; dark grayish brown (10YR 4/2); appears very moist

At 2.5': 8 inch concrete rubble fragment

OLDER ALLUVIAL FAN DEPOSITS [Qfo]
Silty, Clayey Sand with gravel, fine to coarse grained; clasts 20 to 30%, up to 1 inch; mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); appears very moist and dense; poorly sorted; lower contact is sharp

Silty Clay and Clayey Silt, variable fine to coarse sand and fine gravel; clasts 1 to 20%, up to ¾ inch; mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); brown (10YR 4/3); appears very moist and very stiff; poorly sorted; lower contact is narrowly gradational

At 10.5 to 10.7' and 10.9 to 11.5': Fine Clayey Sand; dark brown (7.5YR 3/4); appears very moist and dense

ESTUARINE DEPOSIT (Qe)
Clay, trace coarse sand (Jsm and Tm); mottled, dark gray (10YR 4/1) to brown (7.5YR 4/3); appears very moist and stiff; lower contact is gradational
At 12.5 to 14.0': Trace gravel (Jsm and Tm); color becomes dark brown (10YR 3/3)

At 14.0 to 14.8': Alternating beds of fine Silty Sand, dark yellowish brown (10YR 3/4) and Silty Clay

At 16.2 to 19.0': No recovery
OLDER ALLUVIAL FAN DEPOSITS [Qfo]
Clayey to Sandy Silt, variable coarse sand, trace fine gravel (Jsm and Tm); dark brown (7.5YR 3/4); appears very moist and very stiff; poorly sorted; lower contact occurs between runs
At 21.3 to 24.0': No recovery
At 24.0 to 25.7': Coarse sand and gravel decrease; some varve-like bedding
At 25.7 to 28.5': No recovery
At 28.5 to 31.5': Gravel increases to 10 to 15%, up to ¾ inch; mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm)

ESTUARINE DEPOSITS [Qe] / Marker Bed MG
Silty Clay and Clayey Silt, variable fine sand, trace coarse sand and fine gravel (Jsm and Tm); dark brown (7.5YR 3/3) with reddish brown (5YR 4/4) mottling; appears moist and very moist and very stiff; possible weak soil development; lower contact is gradational
At 32.4 to 33.7': Some strong brown (7.5YR 5/6) mottling
At 37.0 to 38.2': Becomes highly oxidized dark reddish brown (5YR 3/4)
At 38.2 to 38.8': Increasing sand and fine gravel, gradational transition to bed below

GROUNDWATER READINGS
Measured at 42.3 feet during drilling

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MTA Westside Subway Extension
Los Angeles, California

LOG OF BORING

T2E-B1 (Continued)

---

Prepared/Date: YN/PK 10/14/2011
Checked/Date: MW/MF 10/14/2011
CLAY, trace coarse sand; dark brown (7.5YR 3/4); appears very moist and stiff to very stiff; variable varve-like bedding; lower contact occurs between runs

At 41.2 to 42.5': Increasing fine sand content; becomes lightly mottled, brown (7.5YR 4/4) to reddish brown (5YR 4/4)

At 42.3': Groundwater measured during drilling
At 42.4 to 44.0': No recovery

At 44.0 to 45.0': No sampling

At 45.0 to 46.8': Becomes reddish brown (5YR 5/4) with grayish brown (10YR 5/2) mottling; 2 to 5% manganese oxide flecks

At 47.0 to 47.6': Increasing sand, fine to coarse grained, trace gravel
At 47.6 to 49.0': No recovery

CLAYEY TO SANDY SILT, variable fine gravel, clasts 2 to 15%, up to ½ inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); mottled, light brownish gray (10YR 6/2) to yellowish brown (10YR 5/4); appears very moist and soft to medium stiff; occasional interbeds of silty clay and fine silty sand; lower contact occurs between runs

At 51.5 to 54.0': No recovery

Alternating beds of Silty Clay and fine Silty Sand/Sandy Silt; trace coarse sand (Jsm and Tm); mottled, grayish brown (10YR 5/2) to reddish brown (5YR 4/4); appears wet and soft to medium dense; silty clay beds typically 3 to 6 inches thick, sand/silt beds typically 1 to 2 inches thick; lower contact is narrowly gradational

At 56.1 to 56.9': Fine to course Clayey to Silty Sand with Gravel; clasts 15 to 20%, up to ¾ inch; mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); brown (7.5YR 4/4); appears wet and dense; upper and lower contacts are sharp

At 57.4 to 59.0': No recovery

---

**GROUNDWATER READINGS**

Measured at 42.3 feet during drilling

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**LOG OF BORING**

MTA Westside Subway Extension
Los Angeles, California
SC- SM
SC- CH
ML
ML- CH
CL- CH
CL/ CH
Qe Continued

At 60.7 to 61': Grades to fine to coarse Silty, Clayey Sand; grayish brown (10YR 5/2); appears wet and dense
At 61.2 to 61.7': Abundant (40 to 50%) manganese oxide flecks and staining; prominent varve-like bedding
At 61.7 to 64.0': No recovery

At 64.0 to 64.5': Abundant manganese oxide-rich laminae and irregular pockets, total manganese oxide 40 to 60%
At 64.5 to 64.9': Increasing fine to coarse sand
At 64.9 to 65.3': Fine to coarse Clayey Sand; grayish brown (10YR 5/2); appears wet and dense
At 65.8 to 66.3': Increasing fine to coarse Sand; calcium carbonate occurs as dispersed deposits and cemented, irregular nodules up to ½ inch, total calcium carbonate 15 to 30%

ESTUARINE DEPOSITS - FINE GRAINED (Qef)
Clay and Silty Clay, variable coarse sand (Jsm and Tm); strongly mottled, dark grayish brown (10YR 4/2) to strong brown (7.5YR 4/6); appears moist and very stiff to hard; abundant fine, irregular, oxidized pockets; trace calcium carbonate filaments; lower contact is gradational
At 67.8 to 69.0': No recovery

At 71.7 to 72.8': Increasing sand content, grades to Clayey to Sandy Silt, trace coarse sand (Jsm and Tm)
At 72.8 to 74.0': No recovery

Clay and Silty Clay, variable fine sand, trace coarse sand and fine gravel (Jsm and Tm); brown (7.5YR 4/4); appears moist and very stiff to hard; occasional grayish brown (10YR 5/2) mottling and laminae; lower contact is gradational
At 77.8 to 79.0': No recovery

OLDER ALLUVIAL FAN DEPOSITS [Qfo]
Clayey Silt and Silty Clay, variable fine to coarse sand and fine gravel, clasts 2 to 5%, up to ½ inch (Jsm and Tm); color variable, mainly brown (7.5YR 4/4); appears moist
81.4 to 84.0': No recovery

At 84.0 to 84.3': Fine Silty Sand; dark brown (7.5YR 3/4); appears wet and dense, lower contact is sharp

At 84.6 to 84.7' and 85.1 to 85.3': Fine to coarse Silty Sand; brown (7.5YR 4/4); appears wet and dense; upper and lower contacts are sharp

At 85.8 to 86.5': 5 to 10% calcium carbonate filaments

At 86.5 to 89.0': No recovery

At 89.0 to 91.3': Clayey and Silty Clay, trace coarse sand, rare (<1%) fine gravel; occasional reddish brown (5YR 4/3) mottling; trace calcium carbonate filaments

Sandy to Clayey Silt, variable fine to coarse sand, trace fine gravel (Jsm and Tm); strongly mottled, dark grayish brown (10YR 4/2) to strong brown (7.5YR 5/8); appears very moist and very stiff; trace calcium carbonate filaments

At 93.0 to 94.0': No recovery

At 94.0 to 95.2': Increasing coarse sand and fine gravel, clasts 10 to 20%, up to ½ inch

At 94.7 to 95.4': Mottling becomes light, predominantly dark grayish brown (10YR 4/2); gravel increases to 5 to 10%

At 95.4 to 104.0': Recovered only limited slough

This record is an interpretation of subsurface conditions at the exploration location. Latitude and longitude of boring location shown on logs are approximate; transitions between strata are approximate; transitions between strata may be gradual.

MTA Westside Subway Extension
Los Angeles, California
Alternating beds of Clay and fine Silty Sand; rare (<1%) coarse sand and fine gravel (Jsm and Tm); mottled, color variable, mainly brown (10YR 4/3) with grayish brown (2.5Y 5/2) and strong brown (7.5YR 4/6) mottling; appears very moist and very stiff/dense; scattered managanese oxide flecks

At 106.9 to 109.0': No recovery

At 109.0 to 109.7': Clay bed; appears wet and soft

At 109.7 to 110.1': Well Graded Sand, fine to coarse grained; appears wet and dense

At 110.1 to 110.4': Increasing clay, gradational transitional from fine to coarse sand bed above to unit below

Clay; mottled, grayish brown (2.5Y 3/2) to brown (7.5Y 4/4); appears very moist and stiff to very stiff; occasional 1 inch thick beds with up to 10% manganese oxide flecks; occasional sandy silt laminae and varve-like bedding; lower contact occurs between runs

At 112.5 to 114.0': No recovery

At 114.7 to 114.9': Clay bed, strongly mottled, brownish yellow (10YR 6/6) to gray (10YR 5/1), ¾ inch thick band with 40 to 50% manganese oxide at center of bed

At 114.9 to 115.3' and 115.7 to 116.3': Color becomes very dark grayish brown (2.5Y 3/2); trace calcium carbonate filaments

At 115.3 to 115.7': Clayey Silt; dark brown (10YR 3/3)

At 116.3 to 119.0': No recovery

Sandy to Clayey Silt, trace coarse sand (Jsm and Tm); brown (10YR 4/3); appears very moist and very stiff; variable (2 to 15%) calcium carbonate filaments and uncremented nodules, up to ¼ inch; lower contact is sharp

Geologist: DB/MF
Prepared/Date: YN/PK 10/14/2011
Checked/Date: MW/MF 10/14/2011

MTA Westside Subway Extension
Los Angeles, California

LOG OF BORING
Project No.: 4953-10-1561 Figure: T2E-B1f
### ESTUARINE DEPOSITS - FINE GRAINED (Qef)

- **Silty Clay and Clayey Silt, variable fine to coarse sand and fine gravel, clasts 5 to 30%, up to ½ inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); some brick-red sandstone; color variable, mainly dark grayish brown (10YR 4/2); appears very moist and very stiff; variable calcium carbonate, occurs as dispersed deposits and diffuse, non-cemented nodules up to ½ inch, total calcium carbonate generally 5 to 15%; lower contact is narrowly gradational**

### BASAL ALLUVIAL FAN/BASAL ESTUARINE UNIT [Qfob/Qeb]

- **Sandy to Clayey Silt, trace coarse sand and fine gravel (Jsm and Tm); grayish brown (10YR 5/2) to light gray (10YR 7/2); appears very moist and very stiff; poorly sorted; 20 to 40% calcium carbonate, occurs as dispersed deposits and uncemented nodules up to ¼ inch; lower contact is gradational**

- **Fine, irregular oxidized strong brown (7.5YR 4/6) pockets increase with depth**

- **At 130.5 to 130.9: Increasing sand and calcium carbonate filaments, gradational transition to unit below**

- **Clay and Silty Clay, variable fine sand, trace coarse sand (Jsm and Tm); color variable, mainly olive gray (5Y 5/2); appears very moist and very stiff; 5 to 10% cemented and uncemented calcium carbonate nodules up to ¼ inch; lower contact is narrowly gradational**

- **At 135.6 to 139.0: No recovery**

- **At 139 to 140.5: No sampling**

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**DRILLING COMPANY/DRILLING EQUIPMENT**
Jet Drilling / CME 75

**BOREHOLE LOCATION**
T2E-B1

**DATES DRILLED**

**GROUNDWATER READINGS**
Measured at 42.3 feet during drilling

**GROUND EL.**
278 feet

**% RECOVERY**
- 94%
- 56%

**LOG OF BORING**

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**GROUNDWATER READINGS**
Measured at 42.3 feet during drilling

**BORING NO.**
T2E-B1

**LOG OF BORING**

**GEOLOGIST:** DB/MF
**PREPARED/DATE:** YN/PK 10/14/2011
**CHECKED/DATE:** MW/MF 10/14/2011

**MTA Westside Subway Extension**
Los Angeles, California

**Project No.: 4953-10-1561**

**Figure:** T2E-B1g

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**MTA Westside Subway Extension**
Los Angeles, California

**Project No.: 4953-10-1561 Figure: T2E-B1g**

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**METRO SOIL CORE S:\70131 GEOTECH\GINTW\FAULT_INVESTIGATION_WSE_LIBRARY AMEC OCTOBER2011 (2).GLB**

**G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.2 FAULT HAZARD INVESTIGATION\3.2 ALL FIELD NOTES\GINT LOGS\101561-TRANSECT 2E.GPJ 10/14/11**
### GROUNDWATER READINGS

Measured at 42.3 feet during drilling

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**Qfob Continued**

At 140.5 to 144.0': No recovery

At 144.0 to 144.5': Alternating beds of Silty Clay and fine Silty Sand; dark grayish brown (10YR 4/2); appears very moist to wet and stiff to dense; lower contact is sharp

At 144.5 to 146.7': Increasing clay, gradational transition to unit below

At 144.8 to 146.0': Cemented calcium carbonate nodules, up to ½ inch, increase with depth, < 5% at 144.8' to 25 to 20% at 146.0'

At 146.7 to 149.0': No recovery

**BASAL ESTUARINE UNIT [Qeb]**

Clay, rare (<1%) coarse sand; dark greenish gray (5GY 4/1); appears moist and very stiff to hard; lower contact is narrowly gradational

At 149.0 to 149.4': 15 to 20% cemented calcium carbonate nodules up to ½ inch

At 149.4 to 150.3': Calcium carbonate nodules decrease to <5%

At 150.3 to 153.8': Increasing fine, irregular, oxidized pockets, up to 50%

At 153.8 to 154.9': Increasing fine sand, trace coarse sand (Jsm and Tm); oxidized pockets up to 50%, calcium carbonate nodules decrease to 5 to 10%

At 154.9 to 155.4': Indistinct laminae, defined by variable color, calcium carbonate less than 5%

Clayey, Silty Sand, fine grained; dark grayish brown (10YR 4/2); appears very moist and dense; lower contact not encountered

At 155.8 to 159.0': No recovery

**END OF BORING AT 159 FEET**

**NOTES:**

Geologist: DB/MF  
Prepared/Date: YN/PK 10/14/2011  
Checked/Date: MW/MF 10/14/2011
Boring backfilled with cement/bentonite grout from bottom up and patched.

- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted.
- Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch).
- Beds are generally massive unless otherwise noted.
Grass Surface

FILL [Af]
Silty Sand, fine grained, trace medium grained; olive yellow; appears damp to moist; trace roots

At 2.0': Some gravel up to ¾ inch

At 4.0': Fine to medium sand, some coarse sand, some clay, some fine gravel (up to ¼ inch); olive brown to yellow brown; appears moist

OLDER ALLUVIAL FAN DEPOSITS [Qfo]
Clayey to Sandy Silt with Gravel, fine to medium sand, fine to coarse gravel, 10 to 25%, mainly subangular to angular, shale (Tm), sandstone (Tm) and slate (Jsm), and mafic; very dark grayish brown (2.5Y 3/2); appears moist and dense

At 6.5 to 10.0': No recovery

Clayey Silt with some sand, fine sand; dark yellowish brown (10YR 3/6); appears moist and very stiff to hard; faint mottling

At 12.7': Becomes Sandy Clay, increasing gravel, mainly subangular slate (Jsm)

At 13.0 to 16.4': Sample disturbed, appears wet
Silty Sand, some gravel, grades from fine to medium, increasing gravel to 16.0'

Appears wet and dense
At 16.4': Becomes Silt
At 16.9': Becomes Poorly Graded Sand, fine to medium grained

ESTUARINE DEPOSITS (Qe)
Clayey Silt; dark grayish brown (10YR 4/2) to strong brown (7.5YR 4/6), appears moist and stiff, trace coarse sand and fine gravel; variable varve-like bedding
At 17.5 to 20.0': No recovery

Encountered at 46 feet during drilling and measured at 72 feet after 24-hrs.
**Log of Boring**

**Location:** MTA Westside Subway Extension, Los Angeles, California

**Boring No.:** T2E-B2

**Drilling Company/Drilling Equipment:** Jet Drilling / Tri County / CME 85 / D120

**Drilling Method:** Hollow-Stem Auger / Mud 

**Borehole Location:** See Plate 3

**Dates Drilled:** 7/5/11 - 7/7/11

**Hole Diameter:** 8 inches

**Ground El.:** 276 feet

**Groundwater Readings:** Encountered at 46 feet during drilling and measured at 72 feet after 24-hrs.

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**Marker Bed MK:** Clayey to Sandy Silt, reddish brown (5YR 4/4); appears moist and hard; 5 to 10% gravel, mainly fine sandstone (Tm) and slate (Jsm); indistinct laminated oxidation; possible weak soil development

**Marker Bed MQ:** Carbonate layer (laminae), trace angular granitic rock up to 1 inch Clay and Silty Clay, variable coarse sand, trace fine gravel, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); mottled brown (7.5YR 4/4) to dark gray (10YR 4/1) to reddish brown (5YR 4/3); variable near horizontal laminae

At 34.0 to 35.0': No recovery

At 35.5 to 36.5': Prominent varve-like bedding

At 38.5 to 40.0': No recovery

**Sandy Silt:** Mottled, dark yellowish brown (10YR 4/6) to strong brown (7.5YR 4/6); appears moist and very stiff; trace gravel; fine, indistinct thin oxidation layering, variable varve-like bedding texture

At 26.5': Color becomes olive (5Y 4/3) to strong brown (7.5YR 4/6), some varve-like bedding

At 28.5 to 30.0': No recovery

**NOTE:**
This record is an interpretation of subsurface conditions at the exploration location. Latitude and longitude of boring location shown on logs are approximate. Subsurface conditions at other locations and at other times may differ. Interfaces between strata are approximate. Transitions between strata may be gradual.

**Geologist:** LH/MW/MF

**Prepared/Date:** WL/PK 10/14/2011

**Checked/Date:** MW/MF 10/14/2011

**Project No.:** 4953-10-1561 Figure: T2E-B2b

**Figure:** T2E-B2b

**Groundwater Readings:** Run # Box #
Marker \( M_f \) Continued

At 41.0 to 42.5': Olive brown (2.5Y 4/6) laminae

At 41.5': Increasing gravel to 10%, fine gravel and coarse sand, trace brick-red sandstone

At 42.5 to 47.0': Less mottled, mainly dark brown (7.5YR 3/4)

At 43.5 to 45.0': No recovery

At 46.0': Groundwater encountered during drilling

At 50.0 to 53.0': Variable varve-like bedding, less coarse sand and fine gravel

At 51.0' to 51.4': Silty Sand bed, fine grained, lower contact is sharp

At 53.8 to 55.0': No recovery

Lower contact is narrowly gradational

At 55.0 to 55.7': Silty Gravel, silty sand matrix, fine to coarse gravel, mainly subangular to subrounded slate (Jsm), some shale (Tm) and sandstone (Tm) also observed (disturbed sample).

ESTUARINE DEPOSITS (Qe)

Sandy to Clayey Silt, fine grained sand; mottled, yellowish brown (10YR 5/6) to light olive brown (2.5Y 5/4); thin interbeds of clayey sand, varve-like bedding, generally coarsening with depth

At 58.0 to 60.0': No recovery
At 60.0': Sample appears wet
At 60.5' to 60.9': Silty Sand with gravelly interbeds, fine to medium; dark brown (10YR 3/3)
Clayey Silt, thinly interbedded with Silty Sand (3 to 6 inch thick beds); silt is olive (5Y 4/4) and sand is dark yellowish brown (10YR 3/6)
At 63.0 to 65.0': No recovery
At 67.5 to 70.0': No recovery

ESTUARINE DEPOSITS - FINE GRAINED (Qef)
Clayey Silt with occasional fine silty sand interbeds; silt is olive (5Y 4/4), sand is dark yellowish brown (10YR 3/6)
At 72': Groundwater measured after 24 hours

At 77.9 to 78.5': Some sand and fine gravel; angular to subangular sandstone (Tm), shale (Tm), and granitics, lower contact is narrowly gradational
At 78.8': Becomes sandy with oxidized mottling
### BORING No. T2E-B2

#### LOG OF BORING

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<th>BOREHOLE LOCATION</th>
<th>DATES DRILLED</th>
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### ESTUARINE DEPOSITS/OLDER ALLUVIAL FAN DEPOSITS [Qe/Qof]

- *At 80.0 to 81.0':* Some coarse gravel, mainly shale (Tm) and slate (Jsm)

- *At 83.0':* Calcium carbonate-cemented sand/gravel bed (< ½ inch)

- *At 83.5 to 85.0':* No recovery

- *At 86.2':* Silt becomes Sandy, very fine to fine sand; dark yellowish brown (10YR 4/6)

- *At 89.5':* Concretionary calcium carbonate-cemented sand bed (broken during sampling)

- *At 92.2':* Clayey Silt with trace to some sand

- *At 92.5':* Gravel bed (2 inches thick), Clayey Sand below

- *At 93.0' to 95.0':* No recovery

- Depth of contact uncertain due to poor recovery
**ESTUARINE DEPOSITS [Qe]**

Silty Sand/Sandy Silt, very fine grained; olive (5Y 4/3); appears very moist and dense/stiff

- At 107.5': Thinly interbedded (2 inch to 6 inch) Sandy Silt and fine to medium grained Silty Sand

**GROUNDWATER READINGS**

Encountered at 46 feet during drilling and measured at 72 feet after 24 hrs.

**GEOLOGIST:** LH/MW/MF  
**Prepared/Date:** WL/PK 10/14/2011  
**Checked/Date:** MW/MF 10/14/2011
**ESTUARINE DEPOSITS - FINE GRAINED [Qef]**

Clayey Silt; dark grayish brown (2.5Y 4/2); trace to some fine to coarse sand, trace fine gravel, indistinct silty to sandy oxidized pockets;

At 136.5': Becomes hard

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<th>RUN #</th>
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<th>BOREHOLE LOCATION</th>
<th>DRILLING METHOD</th>
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<td>At 124.2': Silty Sand and Sandy Silt, thinly interbedded</td>
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<td>Clayey Silt, olive gray (5Y 4/2); trace fine gravel (5%), mainly sandstone (Tm), some manganese oxide splotches At 127.5': Gravel increases to 10 to 15%; mainly slate (Jsm), shale (Tm) and sandstone (Tm)</td>
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<td>At 128.6': Sandy Silt, olive brown (2.5Y 4/4), variable clay, trace gravel, mainly sandstone (Tm) and slate (Jsm); lower contact is gradational</td>
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<td>At 130.8': Silty Sand, very fine grained, some silt At 131.0 to 132.5': No recovery</td>
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<td>At 132.5': Becomes clayey and gravelly, clasts 10% to 50%, mainly slate (Jsm)</td>
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<td>Clayey Silt; dark grayish brown (2.5Y 4/2); trace to some fine to coarse sand, trace fine gravel, indistinct silty to sandy oxidized pockets;</td>
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<td>At 139.5 to 139.9': Silty Gravel bed; color variable; fine silty sand matrix; gravel mainly sub-angular slate (Jsm), some shale (Tm) and sandstone (Tm), lower contact is sharp</td>
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</table>
### BASAL ALLUVIAL FAN UNIT [Qfob]

- Sandy Silt; olive gray (5Y 5/2); variable coarse sand and fine gravel (Jsm and Tm); poorly sorted

- At 142.3' Grades to Silty Sand; abundant calcium carbonate; pale olive (5Y 6/3)

- At 144.3 and 144.8': Silty Sand beds, 2 to 4 inches thick, trace subrounded granitic rock and angular slate (Jsm) and shale (Tm)

- At 145.1': Less calcium carbonate, trace to some nodules

- Clayey to Sandy Silt; olive gray (5Y 5/2); appears moist and stiff, variable coarse sand, thinly bedded

- At 149.5 to 151.0': No recovery

- Clayey to Sandy Silt, trace coarse sand and fine gravel, olive gray (5Y 5/2), indistinct oxidation splotches; thin gradational to irregular bedding, appears very moist and stiff to medium dense

- At 154.5 to 156.0': No recovery

- At 159.6': Calcium carbonate becomes less, some filaments, trace nodules

---

### BASAL ESTUARINE UNIT [Qeb]

- Clayey Silt to Silty Clay; dark grayish olive (10Y 4/2); appears moist and very stiff; trace calcium carbonate nodules

- At 157.3': Clayey Silt; olive gray (5Y 4/2); some calcium carbonate filaments

- At 157.5 to 158.5': No recovery

- At 158.5': Calcium carbonate becomes abundant, vertical veins, possible fracturing

- At 159.6': Calcium carbonate becomes less, some filaments, trace nodules
<table>
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<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
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**NOTES:**
- Boring backfilled with cement/bentonite grout from bottom up and patched.
- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch).
- Beds are generally massive unless otherwise noted.

**GROUNDWATER READINGS**
Encountered at 46 feet during drilling and measured at 72 feet after 24-hrs.
**BORING NO.: T2E-B3**

**LOG OF BORING**

**Project No.: 4953-10-1561**

**MTA Westside Subway Extension**
Los Angeles, California

**Geologist: ME/MF**
**Prepared/Date: YN/PK 10/14/2011**
**Checked/Date: MW/MF 10/14/2011**

**BOREHOLE LOCATION**

See Plate 3

**HOLE DIAMETER**

8 inches

**GROUND EL.**

273 feet

**DRILLING COMPANY/DRILLING EQUIPMENT**

Martini Drilling and C&L Drilling / Mayhew 1000

**DRILLING METHOD**

Hollow Stem Auger / Rotary Wash

**SURFACE CONDITIONS**

Encountered at 49 feet during drilling; dry at 196 feet

**GROUNDWATER READINGS**

Encountered at 49 feet during drilling; dry at 196 feet

**NOTES:**

Sandy Silt to Clayey Silt with Gravel

**FILL [Af]**

Sandy Silt to Clayey Silt with Gravel

**NOTE:**

Jsm = Santa Monica Slate
Tm = Modelo Formation
See end of log for more detailed descriptions of clasts

**YOUNGER/OLDER ALLUVIAL FAN DEPOSITS [Qf/Qfo]**

Clayey Silt, variable fine sand, trace coarse sand and fine gravel (Jsm and Tm); dark brown (7.5YR 3/2); appears very moist and medium stiff; poorly sorted, lower contact is indistinct

**OLDER ALLUVIAL FAN DEPOSITS [Qfo]**

Clayey to Sandy Silt, trace coarse sand and fine gravel; dark brown (7.5YR 3/4); appears very moist and medium stiff; lower contact is narrowly gradational

At 7.4 to 8.7': Silty Clay, variable coarse sand, trace fine gravel (Jsm and Tm); dark brown (10YR 3/3); appears moist to very moist and stiff to very stiff

At 8.7 to 10.0': Grades to Silty Clay/Clayey Silt, variable coarse sand, trace fine gravel (Jsm and Tm); dark yellowish brown (10YR 4/4); appears moist and very stiff

At 10.0 to 13.7': Becomes brown (10YR 4/3)

At 10.0 to 12.5': Crumbly/ punky texture

Clay, rare (<1%) coarse sand (Jsm and Tm); lightly mottled, very dark grayish brown (10YR 3/2) to strong brown (7.5YR 4/6); appears moist and hard; some fine root structures; lower contact is gradational

At 15.0 to 15.7': Increasing silt and sand content, crumbly/punky texture; gradational transition to bed below

**AT 18.8 TO 19.0': Grades to Silty Clay**

**At 15.0 to 15.7': Increasing silt and sand content, crumbly/punky texture; gradational transition to bed below**

Clayey to Sandy Silt, variable gravel, clasts 5 to 20%; up to ¾ inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); dark grayish brown (10YR 4/2); appears very moist and very stiff; poorly sorted, becomes generally coarser with depth; lower contact is gradational

**At 18.8 to 19.0': Grades to Silty Clay**
Encountered at 49 feet during drilling; dry at 196 feet

**ESTUARINE DEPOSITS [Qe]**

Clayey Silt and Silty Clay, trace to some fine sand, rare (<1%) coarse sand; strongly mottled, gray (10YR 5/1) to strong brown (7.5YR 5/6); appears moist and very stiff; variable varve-like bedding; lower contact is gradational

At 23.5 to 24.3': Laminae defined by variable silt content

Sandy to Clayey Silt, trace coarse sand and fine gravel (Jsm and Tm); mottled, dark grayish brown (10YR 4/2) to strong brown (7.5YR 5/6); appears moist and stiff to very stiff; variable, varve-like bedding; lower contact is narrowly gradational

At 26.6 to 30.0': Grades to Silty Clay, trace coarse sand (Jsm and Tm); mottled, grayish brown (2.5Y 5/2) to strong brown (7.5YR 5/8); appears moist and very stiff

At 29.5 to 30.0': Oxidized strong brown (7.5YR 4/6) Sandy Silt laminations

At 33.0 to 35.0': Occasional varve-like Silty Clay interbeds, trace manganese oxide flecks

At 35.0 to 35.2': Increasing silt and sand content, predominantly sandy silt, trace clay, well sorted

**Silty Clay and Clayey Silt, rare (<1%) coarse sand (Jsm and Tm); dark grayish brown (10YR 4/2); appears very moist and medium stiff; lower contact is sharp**

At 37.7 to 39.0': Grades to Clay; appears moist and very stiff to hard

**Marker Bed M**: Clayey Silt, trace coarse sand (Jsm and Tm); mottled reddish brown (5YR 4/4) to dark grayish brown (10YR 4/2); appears very moist and very stiff; possible weak soil development
Marker Bed M<sub>cont</sub> Continued
At 40.0 to 41.2': Increasing sand and fine gravel (Jsm and Tm); mottled, dark gray (10YR 4/1) to strong brown (7.5YR 4/6); grades to fan deposits below

OLDER ALLUVIAL FAN DEPOSITS [Qfo]
Clayey Gravel, clasts 50 to 60%, up to 1 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm), some granitic rock also observed; varying color; appears very moist and dense; lower contact is gradational
At 42.5 to 43.0': Gravel decreases, gradational transition to unit below

Clayey to Sandy Silt with Gravel, clasts 15-25%, up to ½ inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm), some brick-red sandstone; brown (7.5YR 4/4) with occasional gray (10YR 5/1) mottling; appears moist and very stiff to hard; lower contact is narrowly gradational

At 44.5 to 45.3': Grades to Silty Clay; some distinct gray (10YR 5/1) laminations

Silty Gravel, clasts 50 to 60%, up to 1½ inch, mainly subangular to subrounded slate (Jsm) shale (Tm) and sandstone (Tm); matrix is fine to coarse silty sand; color variable, generally brown (7.5YR 4/4); appears wet and dense; lower contact is sharp, erosional
At 48.3 to 49.1': Alternating beds of Silty Clay and Sandy Silt; brown (7.5YR 4/4); appears very moist to wet and soft to medium stiff; upper and lower contacts are sharp
At 49': Groundwater encountered during drilling

At 50.0 to 51.2': Grades to Silty Sand with Gravel, fine to coarse grained; clasts 30 to 40%, up to ¾ inch

Silty Sand with Gravel, fine grained, clasts 15 to 25%, up to ¾ inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); brown (7.5YR 4/3); appears wet and dense; numerous silty clay interbeds as noted below; lower contact is narrowly gradational
At 52.2 to 52.5', 52.7 to 52.9', 54.0' to 54.2' and 54.6 to 54.8': Silty Clay interbeds; brown (7.5YR 4/4); appear very moist and medium stiff; generally sharp contacts

ESTUARINE DEPOSITS - FINE GRAINED [Qef]
Silty Clay and Clayey Silt, variable fine sand, trace coarse sand; mottled, grayish brown (2.5Y 5/2) to strong brown (7.5YR 4/6); appears moist and very stiff; well sorted; occasional scattered manganese oxide flecks; occasionally grades to sandy silt; lower contact is gradational
Encountered at 49 feet during drilling; dry at 196 feet.

Sandy to Clayey Silt, trace coarse sand (Jsm and Tm); grayish brown (2.5Y 5/2) with occasional strong brown (7.5YR 4/6) mottling; appears moist to very moist and very stiff; occasional scattered manganese oxide flecks; lower contact is gradational.

At 64.5 to 64.7': Manganese oxide flecks increase to 10 to 15%

Estuarine Deposits (Qe)

Sandy to Clayey Silt, trace coarse sand (Jsm and Tm); grayish brown (2.5Y 5/2) with strong brown (7.5YR 4/1) mottling; appears very moist and very stiff; occasional silty sand interbeds as noted below.

At 65.9 to 66.1': Silty Sand with Gravel, clasts 20 to 25%, up to ¾ inch, mainly subangular to subrounded slate (Jsm), shale (Tm), and sandstone (Tm)

At 67.6 to 67.9': Grades to fine Silty Sand

At 68.8 to 68.9': Fine to coarse Silty Sand

Silty Clay and Clayey Silt, rare (<1%) coarse sand (Jsm and Tm); mottled, grayish brown (10YR 5/2) to reddish brown (5YR 4/3) to red (2.5YR 5/6); appears moist to very moist and stiff to very stiff; occasional sandy silt pockets/lenses.

At 73.5 to 73.9': Increasing sand, gradational transition to silty sand unit below.

At 73.9 to 74.7': Sandy Silt, trace coarse sand (Jsm and Tm); dark yellowish brown (10YR 4/4); appears wet and stiff; slightly micaceous.

At 75.0 to 76.4': Occasional oxidized, strong brown (7.5YR 5/6) pockets and varve-like bedding

Clay, rare (<1%) coarse sand (Jsm and Tm); grayish brown (10YR 5/2) with variable strong brown (7.5YR 4/6) mottling; appears moist and very stiff; prominent varve-like bedding; 5 to 15% manganese oxide flecks and staining; lower contact is sharp.

At 77.1 to 77.5': Occasional oxidized reddish brown (5YR 4/4), fine pockets up to ¼ inch

Silty Sand, fine to coarse grained; trace fine gravel (Jsm and Tm); color variable, abundant white/light colored sand grains; appears very moist to wet and dense; occasional ¼ inch dark gray (10YR 4/1) clay laminations; lower contact occurs between runs.

At 77.8' to 80.0': No Recovery.
**LOG OF BORING**

**T2E-B3 (Continued)**

**MTA Westside Subway Extension**
Los Angeles, California

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<td>Clay, trace coarse sand (Jsm and Tm); dark grayish brown (10YR 4/2); appears very moist to wet and soft to medium stiff; lower contact is narrowly gradational</td>
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<td>Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); light brownish gray (10YR 6/2); appears very moist to wet and stiff to very stiff</td>
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<td>Clayey Silt and Silty Clay; trace coarse sand; mottled, dark grayish brown (10YR 4/2) to strong brown (7.5YR 4/6); appears moist and very stiff</td>
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<td>Sandy to Clayey Silt with Gravel, clasts 15 to 25%; up to 1 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); some brick-red sandstone; appears very moist to wet and very stiff; lower contact is narrowly gradational</td>
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<td>At 88.1: one 3 inch slate clast</td>
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<td>Silty Clay, variable very fine sand, trace coarse sand and fine gravel (Jsm and Tm); lightly mottled, brown (7.5YR 4/4) to reddish brown (5YR 4/4); appears moist and very stiff to hard; occasional very fine silty sand pockets and laminations</td>
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<td>At 92.4 to 95.5: Silty Clay described above alternates with Clayey to Sandy Silt, trace coarse sand (Jsm and Tm); brown (7.5YR 4/4); trace calcium carbonate filaments</td>
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<td>At 93.1 to 93.5: 10 to 15% calcium carbonate filaments and uncemented nodules up to ¼ inch</td>
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<td>At 95.0 to 95.5: Appears wet and soft</td>
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<td>Clayey Silt and Silty Clay, variable fine sand, trace coarse sand and fine gravel (Jsm and Tm); some brick-red sandstone; brown (7.5YR 4/4); appears very moist and very stiff; lower contact is gradational</td>
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<td>Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); some brick-red sandstone; brown (7.5YR 4/4); appears very moist and very stiff to hard; occasional silty clay beds; occasional scattered manganese oxide flecks; lower contact is gradational</td>
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</tbody>
</table>

**DRILLING COMPANY/DRILLING EQUIPMENT**
Martini Drilling and C&L Drilling / Mayhew 1000

**BOREHOLE LOCATION**
See Plate 3

**DATES DRILLED**
6/29/11 - 6/30/11 and 6/29/11 - 6/30/11

**HOLE DIAMETER**
8 inches

**GROUND EL.**
8 feet

**GROUNDWATER READINGS**
Encountered at 49 feet during drilling; dry at 196 feet
At 100.8 to 102.1': Gravel increases to 10 to 15%, up to ¾ inch

At 103.0 to 103.1': Fine Silty Sand bed

Marker Bed M<sub>G</sub> - Silty Clay, trace coarse sand (Jsm and Tm); dark gray (10YR 4/1); appears moist and hard; trace calcium carbonate filaments; coarsens downward; distinct color and texture

At 106.3 to 107.5': Increasing silt and sand content, grades to Silty Clay and Clayey Silt with variable fine sand

Clayey to Sandy Silt; color variable, generally dark gray (10YR 4/1) with strong brown (7.5YR 4/6) mottling; appears moist and hard

At 109.0': Clayey to Silty Sand with Gravel, fine to coarse, clasts 15 to 20%, up to ½ inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); brown (10YR 4/3); appears wet and dense; lower contact is sharp, erosional

Clay and Silty Clay, trace coarse sand (Jsm and Tm); motled, very dark gray (10YR 5/3) to strong brown (7.5YR 4/4); appears very moist and very stiff to hard; oxidized strong brown sandy silt pockets increase with depth; trace calcium carbonate filaments; lower contact is gradational

At 111.0 to 111.2': Gravel increases to 10 to 15%

OLDER ALLUVIAL FAN DEPOSITS [Q<sub>f</sub>]

Clayey to Sandy Silt; variable fine gravel; clasts 5 to 20%, up to ½ inch; mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); motled, dark grayish brown (2.5Y 4/2) to strong brown (7.5YR 5/6); appears very moist and very stiff to hard; poorly sorted; lower contact is narrowly gradational

At 116.2 to 116.8': Gravel increases to 40 to 50 %, most up to ¾ inch, some 3 inch shale clasts, mainly subangular shale (Tm) and slate (Jsm)

At 117.2 to 119.1': Color becomes brown (10YR 5/3); occasional manganese oxide-stained zones and laminations, trace calcium carbonate filaments

ESTUARINE DEPOSITS [Q<sub>e</sub>]

Alternating beds of Sandy Silt and Silty Clay; trace coarse sand and fine gravel (Jsm and Tm); motled, brown (10YR 4/3) to yellowish brown (10YR 5/6) to gray (2.5Y 4/1); appears moist and hard; trace calcium carbonate filaments; lower contact is gradational

Geologist: ME/MF
Prepared/Date: YN/PK 10/14/2011
Checked/Date: MW/MF 10/14/2011

MTA Westside Subway Extension
Los Angeles, California

LOG OF BORING
Project No.: 4953-10-1561 Figure: T2E-B3f
Encountered at 49 feet during drilling; dry at 196 feet

At 122.4 to 122.8': Fine Silty Sand bed, varying color

At 123.8 to 124.1': Fine to coarse Silty Sand with Gravel, varying color

Marker Bed MC - Silty Gravel, clasts 60 to 70%, up to 1½ inches; mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); dark brown (10YR 3/3); appears wet and dense; lower contact occurs between runs

At 126.3' 130.0': No recovery

Clay, mottled, color variable, mainly dark grayish brown (10YR 4/2) to strong brown (7.5YR 4/6); appears moist and hard; variable (1-10%) manganese oxide flecks

Clay, trace coarse sand (Jsm and Tm); brown (7.5YR 4/5); appears very moist and very stiff to hard; lower contact is gradational

At 126.3' 130.0': No recovery

At 130.9 to 131.5': Oxidized yellowish red (5YR 4/6), fine pockets (<¼ inch)

At 133.2': Fine Silty Sand bed, ½ inch thick

At 133.5 to 134.3': Interbeds of fine Silty Sand, 1 to 2 inches thick

At 135.0 to 137.0': Marker Bed Mv - Clay and Silty Clay, variable fine sand, trace to some coarse sand and fine gravel (Jsm and Tm); dark gray (10YR 4/1); appears moist and very stiff to hard; distinct color and texture; lower contact is narrowly gradational

At 137.0 to 138.5': Trace oxidized, strong brown (7.5YR 4/6), fine silt pockets (<¼ inch); color becomes more variable

MTA Westside Subway Extension
Los Angeles, California

LOG OF BORING

Geologist: ME/MF
Prepared/Date: YN/PK 10/14/2011
Checked/Date: MW/MF 10/14/2011
At 140.0 to 140.2' and 141.3 to 141.4': Silty Clay interbeds

At 141.2 to 141.5': Clay, trace coarse sand and fine gravel (Jsm and Tm); dark gray (10YR 4/1); appears very moist and stiff

At 142.8 to 143.6': Alternating beds of Silty Clay and fine Silty Sand, generally sharp contacts

Marker Bed MA - Silty Clay and Clayey Silt, trace coarse sand and fine gravel (Jsm and Tm); mottled, very dark grayish brown (10YR 3/2) to strong brown (7.5YR 5/6); appears moist and hard; possible weak soil development; lower contact occurs between runs
At 144.0 to 145.0': No recovery

OLDER ALLUVIAL FAN DEPOSITS [Qfo]
Clayey to Sandy Silt, variable coarse sand and fine gravel, clasts 2 to 20%, up to ¾ inch; mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); mottled, strong brown (7.5YR 4/6) to dark grayish brown (10YR 4/2); appears moist and very stiff; lower contact is gradational

At 148.3 to 148.5': Gravel increases to 25 to 35%

At 150.0 to 150.5': Well Graded Gravel, clasts 50 to 60%, up to 1 inch; mainly slate (Jsm), some sandstone (Tm) also observed; varying color, generally very dark grayish brown (10YR 3/2); lower contact is sharp, erosional

At 152.0 to 152.3': Grades to Silty Clay; trace manganese oxide flecks

At 152.3 to 153.5': Predominately Clayey Silt, gravel decreases to <2%

BASAL ALLUVIAL FAN UNIT/BASAL ESTUARINE UNIT [Qfob/Qeb]
Clayey to Sandy Silt, variable coarse sand and fine gravel, clasts 5 to 20%, up to ¾ inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); grayish brown (2.5Y 5/2) with occasional strong brown (7.5YR 5/6) mottling; appears very moist and very stiff; poorly sorted; variable calcium carbonate filaments and uncremented nodules up to ¼ inch, total calcium carbonate 5 to 20%; lower contact is gradational
At 155.0 to 157.0': Increasing coarse sand and gravel; abundant calcium carbonate and fine, irregular oxidized pockets

At 157.0 to 158.8': Becomes more strongly mottled, light brownish gray (2.5Y 6/2) to strong brown (7.5YR 4/6)

At 158.8 to 160.6': Fine to coarse Silty Sand; more oxidized, predominantly strong brown (7.5YR 4/6) with some light brownish gray (2.5Y 6/2)
Silty Sand, fine to coarse grained, trace fine gravel (Jsm and Tm); color variable, generally yellowish brown (10YR 5/4); appears very moist to wet and dense; lower contact is sharp

Alternating beds of Silty Clay and fine Silty Sand, trace coarse sand (Jsm and Tm); mottled, grayish brown (2.5Y 5/2) to strong brown (7.5YR 5/6); appears very moist to wet and stiff/dense; lower contact is sharp, erosional

BASAL ESTUARINE UNIT [Qeb]

Silty Clay; strongly mottled, dark gray (5Y 4/1) to dark grayish brown (10YR 4/2) to light gray (5Y 7/1); appears moist to very moist and very stiff to hard; abundant (20 to 50%) dispersed calcium carbonate deposits and irregular nodules up to ½ inch; lower contact is gradational

At 164.7 to 165.3': Color is dark greenish gray (10Y 4/1); calcium carbonate less than 5%

At 168.3 to 170.8': Increase oxidation, mottled as above, dark grayish brown dominant color; calcium carbonate occurs mainly as irregular, steeply dipping stringers; trace manganese oxide flecks

At 170.8 to 171.0': Grades to Sandy Silt; brown (10YR 4/3); slightly micaceous Clay and Silty Clay; very dark gray (10YR 3/1) with strong brown (7.5YR 4/4) mottling; appears moist and hard; strong brown motting occurs mainly as fine, irregular pockets, 5 to 10% calcium filaments and irregular uncemented nodules up to ¼ inch; lower contact is gradational

At 174.8 to 175.6': Increasing sand

SAN PEDRO FORMATION [Qsp]

Poorly Graded Sand with Silt; fine to medium grained, dark gray (10YR 4/1); appears wet and dense; lower contact occurs between runs

At 177.0 to 177.8': Grades to fine to medium Silty Sand

At 177.8' to 180.0': No recovery
At 180.0 to 181.6': Becomes grayish brown (10YR 5/2)

At 181.6 to 182.0': Becomes greenish gray (5GY 5/1)
At 182.0' to 185.0': No recovery

At 186.0 to 186.9': Becomes gravelly, clasts 15 to 20%, up to ½ inch, mainly subrounded slate (Jsm), one quartzite (Jsm) clast also observed

At 187.0' to 190.0': No recovery

At 190.8 to 191.6': Coarsens downward, grades to fine to medium Poorly Graded Sand, little to no silt
At 191.6 to 192.2': Fine to medium Silty Sand with Gravel; clasts 30 to 40%, up to 1 inch, mainly subrounded slate (Jsm), some quartzite (Jsm) also observed
At 192.2' to 195.0': No recovery

At 190.8 to 191.6': Coarsens downward, grades to fine to medium Poorly Graded Sand, little to no silt
At 191.6 to 192.2': Fine to medium Silty Sand with Gravel; clasts 30 to 40%, up to 1 inch, mainly subrounded slate (Jsm), some quartzite (Jsm) also observed
At 192.2' to 195.0': No recovery

At 195.5 to 197.0': Scattered subrounded gravel up to ½ inches, observed clasts are shale (Tm), sandstone (Tm), quartzite, and porphyritic volcanic rock, no slate observed
**NOTES:**

Boring backfilled with cement/bentonite grout from bottom up and patched.

- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch).
- Beds are generally massive unless otherwise noted.

Boring redrilled to 210-feet on 6/29/2011. Location of deepened boring offset NW approximately 7 feet from original boring location.
**LOG OF BORING**

**T2E-B4**

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<th>RUN #</th>
<th>% RECOVERY</th>
<th>SAMPLE LOC.</th>
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<td>2</td>
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**DRILLING COMPANY/DRILLING EQUIPMENT**
Martini Drilling / CME 75

**BOREHOLE LOCATION**
See Plate 3

**HOLE DIAMETER**
8 inches

**DRILLING METHOD**
Hollow Stem Auger

**DATES DRILLED**
6/29/11-6/30/11

**GROUNDWATER READINGS**
Encountered at 37 feet during drilling

18 inches of asphaltic concrete
Hand augered to 5 feet

**FILL [Af]**
Sandy Silt to Clayey Silt with Gravel

NOTE:
Jsm = Santa Monica Slate
Tm = Modelo Formation
See end of log for more detailed descriptions of clasts

At 5.0': 1½ inch thick asphaltic concrete fragment

**YOUNGER/OLDER ALLUVIAL FAN DEPOSITS [Qf/Qfo]**
Clayey Silt, some fine sand, trace fine gravel; more clay with depth; very dark grayish brown (10YR 3/2); appears damp to dry and stiff

At 14.0': Becomes dark yellowish brown (10YR 4/6); variable gravel (5 to 15%)

At 14.2 to 14.6': Silty Sand with Gravel, fine to coarse grained sand and gravel, clasts mainly shale (Tm), up to 1 inch

At 18.4 to 19.6': Grades to Clayey Silt, less sand than above, more oxidized

At 19.6 to 20.7': Silty Sand, some fine to medium gravel, mainly subangular to
ESTUARINE DEPOSITS [Qe]

Clayey Silt; olive brown (2.5Y 4/4) with oxidized sandy layers; appears moist and stiff; prominent varve-like bedding

At 31.4 to 32.9': Becomes thinly bedded to laminated with oxidized sand

At 32.9': Sandy beds become interfingering irregular lenses; clayey silt becomes very stiff

Clayey to Sandy Silt with variable fine sand; some mottling and laminations, dark yellowish brown (10YR 4/4) and olive gray (5Y 4/2); occasional very fine grained silt, sand beds/zones; appears moist and firm; lower contact is sharp

At 37.0': Groundwater encountered during drilling

Silty Sand, very fine to fine grained; dark yellowish brown (10YR 4/4); appears very moist
**LOG OF BORING**  

Project No.: 4953-10-1561 Figure: T2E-B4c

**MTA Westside Subway Extension**  
Los Angeles, California

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<th>BOREHOLE LOCATION</th>
<th>GROUND EL.</th>
<th>DRILLING METHOD</th>
<th>BOREHOLE LOCATION</th>
<th>DATES DRILLED</th>
<th>HOLE DIAMETER</th>
<th>GROUNDWATER READINGS</th>
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<td>Martini Drilling / CME 75</td>
<td>See Plate 3</td>
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<td>6/29/11-6/30/11</td>
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<td>230</td>
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<td></td>
<td>At 40.6 to 41.0': Silty and becomes fine to coarse, 5% fine gravel, angular to subangular; appears very moist to wet and dense</td>
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<td>At 41.0 to 41.1': Becomes more silty and fine grained</td>
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<td>225</td>
<td>50</td>
<td>3</td>
<td>9</td>
<td>100</td>
<td>ML</td>
<td>Clayey Silt; olive brown (2.5Y 4/4); appears wet, trace fine sand, scattered oxidized nodules, trace manganese oxidized flecks</td>
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<td>Silty Sand bed, fine to coarse grained, some gravel (5 to 10%), similar to above; lower contact is sharp, subhorizontal</td>
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<td>At 43.6 to 44.4': Grades to silt, light olive brown (2.5Y 5/4) to sand; lower contact is sharp, irregular and erosional</td>
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<td>220</td>
<td>55</td>
<td>4</td>
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<td>Clayey Silt; olive brown (2.5Y 4/4); appears wet, trace fine sand, scattered oxidized nodules, trace manganese flecks, lower contact is sharp and irregular</td>
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<td>Silty Clay; very dark brown (7.5YR 5/3); mottled dark brown (7.5YR 7/3) oxidation within very fine silty sand/sandy silt pockets; lower contact is gradational</td>
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<tr>
<td>60</td>
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<td>4</td>
<td>11</td>
<td>100</td>
<td>SM/ML</td>
<td>Silty Sand/Sandy Silt, very fine grained, variable clay, trace coarse sand and gravel (Jsm and Tm); dark yellowish brown (10YR 4/4 - 3/4); appears wet and dense; generally well sorted, gradational variation of silt and clay within the bed</td>
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</table>

Geologist: ME/MW/MF  
Prepared/Date: MW/PK 10/14/2011  
Checked/Date: MW/MF 10/14/2011

This record is an interpretation of subsurface conditions at the exploration location. Latitude and longitude of boring location shown on logs are approximate. Transitions between strata may be gradual. Subsurface conditions at other locations and at other times may differ. Interfaces between strata are approximate. Transitions between strata may be gradual.

(CO N T I N U E D ON FOLLOWING FIGURE)
### LOG OF BORING

**MTA Westside Subway Extension**  
Los Angeles, California

<table>
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<th>ELEVATION (ft)</th>
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<td>4</td>
<td>12</td>
<td>100</td>
<td>SM</td>
<td>At 60.0 to 67.0': As above, sandy silt more common, less very fine silty sand</td>
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<tr>
<td>210</td>
<td>65</td>
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<td>ML</td>
<td>At 63.3': Silty Clay bed, (1 inch thick); dark yellowish brown (10YR 4/4); appears to dip approximately 25 degrees; contacts are sharp</td>
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<td></td>
<td>4</td>
<td>13</td>
<td>100</td>
<td>ML</td>
<td>Silt with interbeds varying from sand to clayey silt (approximately 2 to 4 inches thick); light olive brown (2.5Y 5/4); varve like bedding</td>
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<td>205</td>
<td>70</td>
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<td>SP- SM</td>
<td>SP- Poorly Graded Sand with Silt, fine grained, coarsening downward to fine to medium, trace coarse gravel (up to 1½ inches) at upper contact; dark yellowish brown (10YR 4/4)</td>
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<tr>
<td></td>
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<td>5</td>
<td>14</td>
<td>48</td>
<td>GP</td>
<td>OLDER ALLUVIAL FAN/ESTUARINE DEPOSITS [Qfo/Qe]</td>
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<td>GP</td>
<td>Poorly Graded Gravel, clasts mainly subangular slate (Jsm), some shale (Tm), and others; fine to coarse grained</td>
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<td>GP</td>
<td>At 72.4 to 75.0': No recovery</td>
</tr>
<tr>
<td>200</td>
<td>75</td>
<td></td>
<td></td>
<td></td>
<td>SC</td>
<td>Clayey to Sandy Silt; olive (5Y 3/4); appears very moist and dense; thin to laminated oxidation; clayey to silty sand interbedding</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>15</td>
<td>100</td>
<td>ML</td>
<td>At 77.0 to 80.0': Grades to Sandy Silt with prominent laminations and varve-like bedding</td>
</tr>
</tbody>
</table>

**DRILLING COMPANY/DRILLING EQUIPMENT**  
Martini Drilling / CME 75

**BOREHOLE LOCATION**  
See Plate 3

**DATES DRILLED**  
6/29/11-6/30/11

**HOLE DIAMETER**  
8 inches

**GROUND EL.**  
275 feet

**% RECOVERY**  
Sample Loc.

**GROUNDWATER READINGS**  
Encountered at 37 feet during drilling

**Dates Drilled**  
6/29/11-6/30/11

**Hole Diameter**  
8 inches

**Drilling Method**  
Hollow Stem Auger

**Drilling Company/Drilling Equipment**  
Martini Drilling / CME 75

**Boring No.**  
T2E-B4d

**Geologist**  
ME/MW/MF

**Prepared/Date**  
MW/PK 10/14/2011

**Checked/Date**  
MW/MF 10/14/2011

**Project No.**  
4953-10-1561

**Log of Boring**  
MTA Westside Subway Extension

**Los Angeles, California**
At 80.0 to 80.6': Poorly Graded Sand with Silt, very fine grained; dark yellowish brown (10YR 4/4); appears wet and dense

At 80.6 to 81.4': Poorly Graded Sand with Gravel, fine to medium grained; appears wet; clasts mainly angular to subangular slate (Jsm) and granitic rock with some shale (Tm) and other

At 81.4 to 82.6': Sand becomes fine to coarse; lower contact is sharp

Sandy Silt, very fine sand, variable clay; thin to laminated oxidation bedding; yellowish brown (10YR 5/6) to light olive brown (2.5Y 5/3); appears wet and stiff; lower contact is narrowly gradational

At 84.0 to 85.0': No recovery

At 85.3 to 85.9': Silty Sand, fine grained

Well Graded Gravel, fine to coarse grained, angular to subangular, slate (Jsm), some sandstone (Tm) and shale (Tm); matrix is fine to coarse well graded sand; color is variable; lower contact is sharp, approximate dip 10 to 15 degrees

Sandy Silt, very fine sand, trace clay, clay increasing with depth, grades to clayey silt; olive (5Y 4/3); appears very moist and stiff; variable laminations and varve-like bedding

At 93.2 to 94.0': Fine Silty Sand interbeds

At 93.7: Thin carbonate Sand beds, (1/4 inch thick)

At 97.7: Carbonates-rich clayey layer, (1 inch thick)

At 98.2: Carbonate-rich sandy layer, (1½ inches thick)

Silty Clay; olive gray (5Y 4/2) to strong brown (7.5YR 4/6); appears moist and very stiff; trace (2% to 5%) carbonate nodules, silty oxidized lenses create mottled coloring
At 100.6 to 103.8': Becomes less clayey with depth, grades to Clayey Silt, lower contact is gradational

At 103.8': Gravelly bed (1 inch thick)
Clayey Silt with Sand, some fine to medium grained, trace gravel (up to 3 inches), mainly subrounded shale (Tm), granitic rock and some slate (Jsm)

At 105.0 to 105.9': Silty Sand, some gravel

At 105.9 to 107.6': Less gravel, grades from Silty Sand to Sandy Silt

At 107.6 to 108.0': Poorly Graded Sand, fine to medium grained, some fine gravel, mainly subangular slate (Jsm) and shale (Tm); dark yellowish brown (10YR 4/4)
Silty Sand, very fine grained, to Sandy Silt, variable clay; dark yellowish brown (10YR 4/6); appears moist and dense to stiff; generally well sorted; lower contact is gradational

At 111.4 to 113.1': Coarsens to fine to medium Silty Sand, trace gravel (up to 2½ inches)
SM

ML

ML

ML

ML

ML

ML

ML

Marker Bed M<sub>r</sub> - Clayey Silt, very dark grayish brown (10YR 3/2) with strong brown (7.5YR 4/6) mottling; appears moist and stiff; distinct color and texture

Sandy Silt with variable clay; sand is fine grained; trace coarse sand and gravel; dark yellowish brown (10YR 4/4); appears moist and stiff; generally well sorted

At 128.9': Irregular bed (4 inches thick) with calcium carbonate gravel and angular granitic gravel (up to 1 inch)

At 130.6 to 131.6': Silt with abundant fine gravels, possibly shearing, trace to some coarse sands, shears appear to dip 50 degrees

At 133.0 to 133.6': Faint varve-like bedding

At 133.6 to 134.0' and 134.3 to 134.5': Fine to coarse silty sand beds with gravel, contact at 134.5' is erosional

Clayey Silt, trace coarse sand and gravel; dark yellowish brown, appears moist and stiff

At 135.0 to 136.0' and 139.0 to 140.0': Varve-like bedding

At 137 to 138.3': Soft zone, possible shearing; appears moist to very moist

At 120.0 to 121.3': Becomes olive brown (2.5Y 4/4)

At 121.3 to 123.3': Grades to Clayey Silt, appears moist and stiff

At 123.3': Grades to Sandy Silt, sand is fine grained

This record is an interpretation of subsurface conditions at the exploration location. Latitude and longitude of boring location shown on logs are approximate. Interfaces between strata are approximate. Transitions between strata may be gradual.
### Marker Bed M<sub>l</sub>
Silty Gravel, clasts mainly subangular slate (Jsm), up to 1 inch, matrix is fine to coarse silt, sand; color is variable (poor sample recovery)

### Marker Bed M<sub>g</sub> - Sandy Clay, trace to some fine gravel, clasts 5 to 20%, up to ½ inch; trace brick-red sandstone, mainly angular to subangular sandstone (Tm), granitic rock and slate (Tsg); dark olive gray (5Y 3/2); coarsening downward; distinct color and texture

### Silty Clay, laminated to thinly bedded; olive (5Y 5/3); appears damp; lower contact is sharp, appears to dip in 15 degrees
At 148.3': Fine to medium, Poorly Graded Sand bed (3 inches thick)
At 148.3 to 150.0': No recovery

### Silty Gravel bed, gravel up to 2 inches
At 150.4 to 150.6': Silty Gravel bed, gravel up to 2 inches

### Marker Bed M<sub>g</sub> - Sandy Clay, trace to some fine gravel, clasts 5 to 20%, up to ½ inch; trace brick-red sandstone, mainly angular to subangular sandstone (Tm), granitic rock and slate (Tsg); dark olive gray (5Y 3/2); coarsening downward; distinct color and texture

### Silty Clay to Clayey Silt, trace coarse sand and fine gravel (Jsm and Tm); olive (5Y 4/3); appears moist and stiff
At 152.9 to 155.0': No recovery

### Silty Sand, fine grained; olive brown (2.5Y 4/6); becomes gravelly
At 157.0 to 157.9': Silty Sand, fine grained; olive brown (2.5Y 4/6); becomes gravelly

### Gravel bed, angular to subangular slate (Tsm), granitics and mafic, fine to coarse (up to 1 inch)
At 157.9 to 161.2': Gravel bed, angular to subangular slate (Tsm), granitics and mafic, fine to coarse (up to 1 inch)

### Claysilt, coarsening to Clayey fine Sand
At 158.2 to 158.8': Clayey Silt, coarsening to Clayey fine Sand
At 158.8': Clayey Silt; dark grayish brown (2.5Y 4/2); trace gravel; mainly shale (Tm) and sandstone (Tm); faint varve-like bedding
At 160.5': Becomes Sandy

At 161.9 to 162.1': Sandy Gravel bed, fine to coarse grained, mainly subangular slate (Jsm), clayey silt matrix

At 162.1 to 164.1': Silt, thinly bedded to laminated with clayey and sandy layers, olive brown (2.5Y 4/4); appears moist and stiff, trace brick-red sandstone (Tm) and slate (Jsm)

At 164.0 to 165.0': No recovery

At 165.0 to 165.8': Silty Sand, fine grained; some clay, appears moist and dense, coarsening downward

FLUVIAL DEPOSITS [Qf]
Clayey, Silty Gravel, clasts 50 to 70%, up to 1½ inches, mainly subangular to angular shale (Tm) and slate (Jsm), trace brick-red sandstone; matrix is variable, generally fine to coarse clayey or silty sand, occasional clayey silt; color is variable; appears moist and dense

At 168.8 to 170.0': No recovery

At 171.7 to 172.9': Silt; laminated with clayey to very fine sandy beds

Silty Sand with Gravel, fine to coarse grained, clasts 15 to 50%, up to 1 inch, mainly angular to subangular shale (Tm) and slate (Jsm)

At 176.5 to 180.0': No recovery

Encountered at 37 feet during drilling
<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
<th>SAMPLE LOC.</th>
<th>DRILLING COMPANY/DRILLING EQUIPMENT</th>
<th>BOREHOLE LOCATION</th>
<th>DATES DRILLED</th>
<th>HOLE DIAMETER</th>
<th>GROUND EL.</th>
</tr>
</thead>
<tbody>
<tr>
<td>90-185</td>
<td>12</td>
<td>36</td>
<td></td>
<td>50</td>
<td>SM</td>
<td>Martini Drilling / CME 75</td>
<td>See Plate 3</td>
<td>6/29/11-6/30/11</td>
<td>8 inches</td>
<td>275 feet</td>
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<td>Qfofl Continued</td>
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<td></td>
<td>At 182.5 to 185.0: No recovery</td>
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<tr>
<td>185-190</td>
<td>13</td>
<td>37</td>
<td></td>
<td>96</td>
<td>SM</td>
<td>At 185.0 to 185.4: Silty Sand, fine to medium grained; olive (5Y 4/3)</td>
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<td></td>
<td>Clayey Silt; dark olive gray (5Y 3/2); appears moist and stiff, trace pockets of oxidized silt and very fine sand, some clay laminations</td>
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<td></td>
<td>At 187.3 to 188.5: Laminae become wavy</td>
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<td></td>
<td>At 187.3 to 188.5: Very fine Silty Sand laminae, calcium carbonate rich; olive (5Y 4/3); lower contact is sharp</td>
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<td></td>
<td>Clayey to Silty Clay; olive gray (5Y 4/2); some calcium carbonate filaments and fine oxidized pockets; appears moist and stiff</td>
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<td></td>
<td>At 190.6 to 192.4: Color becomes dark olive gray (5Y 3/2)</td>
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<tr>
<td>190-200</td>
<td>13</td>
<td>38</td>
<td></td>
<td>100</td>
<td>ML</td>
<td>Sandy Silt with some Clay; calcium carbonate infill, irregular near- vertical veins, dark olive gray (5Y 3/2); appears moist and stiff</td>
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<td></td>
<td>At 195.0 to 200.0: No recovery</td>
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</tbody>
</table>

Encountered at 37 feet during drilling.

BASAL ESTUARINE UNIT [Qeb]

GROUNDWATER READINGS

Encountered at 37 feet during drilling.

At 182.5 to 185.0: No recovery

At 185.0 to 185.4: Silty Sand, fine to medium grained; olive (5Y 4/3)

Clayey Silt; dark olive gray (5Y 3/2); appears moist and stiff, trace pockets of oxidized silt and very fine sand, some clay laminations

At 187.3 to 188.5: Laminae become wavy

At 187.3 to 188.5: Very fine Silty Sand laminae, calcium carbonate rich; olive (5Y 4/3); lower contact is sharp

Clayey to Silty Clay; olive gray (5Y 4/2); some calcium carbonate filaments and fine oxidized pockets; appears moist and stiff

At 190.6 to 192.4: Color becomes dark olive gray (5Y 3/2)

Sandy Silt with some Clay; calcium carbonate infill, irregular near- vertical veins, dark olive gray (5Y 3/2); appears moist and stiff

At 195.0 to 200.0: No recovery
NOTES:
- Boring backfilled with cement/bentonite grout from bottom up and patched.
- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted.
- Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch).
- Beds are generally massive unless otherwise noted.
<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
<th>SAMPLE LOC.</th>
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</thead>
<tbody>
<tr>
<td>265</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>SM</td>
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<td></td>
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<td></td>
<td>Asphaltic concrete Hand augered to 5 feet</td>
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<td>FILL [Af]</td>
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<td></td>
<td></td>
<td>Silty Sand, fine to medium grained; appears moist</td>
</tr>
</tbody>
</table>

**NOTE:**

Jsm = Santa Monica Slate
Tm = Modelo Formation
See end of log for more detailed descriptions of clasts

<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
<th>SAMPLE LOC.</th>
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<tbody>
<tr>
<td>260</td>
<td>10</td>
<td></td>
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<td>ML</td>
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<td></td>
<td></td>
<td>YOUNGER/OLDER ALLUVIAL FAN DEPOSITS [Qf/Qfo] Clayey Silt, trace sand and gravel; very dark grayish brown (10YR 3/2); appears dry and hard; lower contact is gradational</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
<th>SAMPLE LOC.</th>
</tr>
</thead>
<tbody>
<tr>
<td>255</td>
<td>15</td>
<td></td>
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<td></td>
<td>SM</td>
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<td></td>
<td>OLDER ALLUVIAL FAN DEPOSITS [Qf] Silty Sand, fine to medium grained, trace fine gravel; dark yellowish brown (10YR 4/6); appears dry and dense; poorly sorted; lower contact is narrowly gradational</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>At 10.0 to 12.1: Trace gravel, coarsens up to 1 inch, mainly angular to subangular, slate (Jsm) and shale (Tm)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
<th>SAMPLE LOC.</th>
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<tbody>
<tr>
<td>20</td>
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<td>ML</td>
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<td></td>
<td></td>
<td>Clayey Silt with Sand, fine to coarse grained; dark yellowish brown (10YR 4/4); appears dry and hard; poorly sorted</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
<th>SAMPLE LOC.</th>
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<td></td>
<td>Clayey Silt, trace coarse sand and gravel (Jsm and Tm); dark yellowish brown (10YR 4/4); appears dry to damp and hard; poorly sorted; lower contact is gradational</td>
</tr>
</tbody>
</table>

(Continued on following figure)
Qfo continued

Silty Sand, fine grained, trace clay, trace coarse sand and fine gravel; dark yellowish brown (10YR 4/4); appears dry and dense; poorly sorted

At 21.8 to 22.5': Gravel increases to 15 to 30%, mainly sandstone (Tm), slate (Jsm), granitic rock, and others; poorly sorted

Clayey Silt with some fine sand; trace coarse sand and fine gravel (Jsm and Tm)

At 24.3 to 25.0': Silty Sand, fine grained, trace gravel; appears dry and dense

Sandy Silt, very fine grained, trace clay; light olive brown (2.5Y 5/6); appears damp and stiff

At 26.9 to 27.3': Gravelly bed, fine to coarse grained, mainly subangular shale (Tm), granitic rock, and others

Estuarine Deposits [Qe]

Interbedded Clayey Silt and Sandy Silt; dark reddish brown (5YR 3/4); appears damp and stiff

At 29.2 to 29.7': Gravelly bed, fine to coarse grained rock, mainly subangular granitic rock, lesser slate (Jsm), and shale (Tm)

Interbedded Clayey Silt and Silty Sand, thinly bedded to laminated, some varve-like bedding; sandy layers more oxidized, dark yellowish brown (10YR 3/4), clayey silt is olive gray (5Y/5); appears damp and stiff; lower contact is sharp

At 34.3 to 35.0': Some varve-like bedding

At 35.0': Appears moist

At 37.7 to 38.6': Poorly Graded Sand with gravel bed, fine to medium sand and gravel

Clayey Silt, thickly bedded, some interfingering sandy lenses; mottled dark grayish brown (10YR 4/2) to brown (7.5YR 4/4); appears moist and stiff; lower contact is narrowly gradational
<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
<th>SAMPLE LOC.</th>
</tr>
</thead>
<tbody>
<tr>
<td>225</td>
<td>45</td>
<td>3</td>
<td>8</td>
<td>100</td>
<td>SC/CL</td>
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<td></td>
<td>Clayey Sand and Sandy Clay; color is variable; appears moist and stiff; lower contact is sharp</td>
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<td>ML</td>
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<td>Clayey Silt; olive (5Y 4/3) spotted to blotchy oxidation; appears moist and stiff</td>
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<td>SM</td>
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<td></td>
<td></td>
<td>Silty Sand, fine grained; dark yellowish brown (10YR 3/4); appears moist and dense</td>
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<td></td>
<td>9</td>
<td>93</td>
<td>SP</td>
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<td></td>
<td>At 47.2 to 48.1': Fine to medium grained, Poorly Graded Sand with some thin Gravel beds; lower contact is sharp</td>
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<td>ML</td>
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<td></td>
<td></td>
<td>Clayey Silt, some lenses of silty very fine sand; dark yellowish brown (10YR 4/4); appears moist and stiff</td>
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<td>At 50.0 to 51.2': Becomes olive (5Y 4/3) with strong brown (7.5YR 4/6) mottling; trace fine gravel</td>
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<td>Clayey to Sandy Silt, some very fine to fine grained silty sand thinly interbedded; trace manganese flecks; oxidized splotchy color, olive brown (2.5Y 4/3) to strong brown (7.5YR 4/6)</td>
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<td></td>
<td>At 57.2 to 58.0': Color becomes very dark grayish brown (10YR 3/2)</td>
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<td></td>
<td>At 58.0 to 59.5': Color becomes light olive brown (2.5Y 5/4) with yellowish brown (10YR 5/6) mottling; increase coarse sand and fine gravel</td>
</tr>
</tbody>
</table>

Qe continued
At 40.5 - 42.2': Trace manganese flecks

**Note:** This record is an interpretation of subsurface conditions at the exploration location. Latitude and longitude of boring location shown on logs are approximate. Interfaces between strata are approximate. Transitions between strata may be gradual.
At 59.5 to 61.3': Grades to Clayey to Sandy Silt with some fine gravel (5-10%); dark brown (10YR 3/3); appears damp and hard

Qe continued

Silty Sand and Sandy Silt, fine grained, trace fine to coarse gravel (Jsm and Tm); dark yellowish brown (10YR 3/6); appears moist and dense/stiff; lower contact is narrowly gradational

OLDER ALLUVIAL FAN DEPOSITS [Qfo]

Silty Sand, very fine grained, some gravel increasing with depth; color variable; appears moist and dense

At 65.6 to 66.3': Silty Gravel bed, clasts mainly angular slate (Jsm) and subangular granitic rock, up to 1½ inches

At 66.3 to 66.8': Poorly Graded Sand, some gravel, up to 1 inch

At 66.8': Clayey Silt with some fine sand, trace gravel; olive brown (2.5Y 4/3); appears moist and stiff

Silty Sand with Gravel, clasts mainly subangular to subrounded slate (Jsm) and granitic rock, up to 2 inches

Silty Sand, very fine grained, trace fine gravel; yellowish brown (10YR 5/4)

Silty Gravel, clasts up to 1 T/2 inches, matrix is fine to coarse silty sand; color is variable

At 75.0 - 80.0': No recovery

Geologist: AR/MW/MF
Prepared/Date: WL/PK 10/14/2011
Checked/Date: MW/MF 10/14/2011

MTA Westside Subway Extension
Los Angeles, California

(Continued on Following Figure)
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<th>% RECOVERY</th>
<th>GROUNDWATER READINGS</th>
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<td>86</td>
<td>At 83.0 to 84.0': Grades to fine Silty Sand</td>
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<td>Sandy Silt, fine grained, some clay; olive (5Y 4/3) with splotchy oxidation; well sorted; becomes sander with depth</td>
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<td>Silty Sand, very fine grained, thinly interbedded with fine to medium sand, trace to some gravel; dark yellowish brown (10YR 4/4); appears moist and dense</td>
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<td>180</td>
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<td>Clay, thinly interbedded sandy clay and clayey silt; indistinct varve-like bedding; generally olive (5Y 4/3); sandy beds are oxidized</td>
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<td>Sandy Silt, variable clay; olive (5Y 4/3) with strong brown (7.5YR 4/6) motling; appears moist and dense; prominent varve-like bedding</td>
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<td>At 88.5 to 90.0': No recovery</td>
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<td>175</td>
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<td>Clayey Silt to Silty Clay, trace gravel; mottled, dark yellowish brown (10YR 4/6) and strong brown (7.5YR 4/6)</td>
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<td>ML</td>
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<td>Clayey, Silty Sand with Gravel, clasts up to 1 inch, mainly angular slate (Jsm) and shale (Tm)</td>
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<td>SM</td>
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<td>At 92.1': Silty Gravel, clasts up to 3 inches; mainly subrounded granitic rock; matrix is fine to coarse silty sand</td>
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<td>At 92.5': Groundwater measured after 15 hours</td>
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<td>SP</td>
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<td>Silty Sand, very fine; dark yellowish brown (10YR 4/6) to dark grayish brown (10YR 4/2); appears very moist; fine to medium sand, fine gravel 1 to 2%; well sorted</td>
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<td>At 95.0 to 97.0': Grades to fine to medium, Poorly Graded Sand with Silt</td>
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<td>SM</td>
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<td>At 97.0 to 100.0': No recovery</td>
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*This record is an interpretation of subsurface conditions at the exploration location. Latitude and longitude of boring location shown on logs are approximate. Interfaces between strata are approximate. Transitions between strata are gradual.*

*Groundwater readings measured at 92.5 feet after 15 hours.*

*Prepared/Date: WL/PK 10/14/2011*

*Checked/Date: MW/MF 10/14/2011*
At 100.0': Silt, interfingering thin lenses of very fine sand and clay beds; olive gray (5Y 5/2) to olive (5Y 5/3); appears moist and stiff; micaceous
At 100.8 to 102.0': Prominent varve-like bedding
At 102.0 to 102.6': Silty Clay bed; very dark grayish brown (2.5Y 3/2); appears moist and very stiff to hard
At 102.6 to 103.0': Grades to Silty Sand, very fine to fine grained, trace coarse sand and fine gravel; well oxidized; dark yellowish brown (10YR 4/6); thinly bedded
At 103.0 to 105.0': No recovery

ESTUARINE DEPOSITS - FINE GRAINED [Qef]
Clayey Silt; dark gray (5Y 4/1); appears moist and stiff; trace calcium carbonate filaments
At 105.0 to 106.2': Calcium carbonate increases to 15 to 20%
At 106.9 to 108.8': Thin interfingering very fine sand lenses; mottled yellowish brown (10YR 5/8) to olive gray (5Y 5/2); trace calcium carbonate nodules
At 108.8 to 110.0': No recovery

ESTUARINE DEPOSITS [Qe]
Silty Clay and Clayey Silt; very dark grayish brown (10YR 3/2) with strong brown (7.5YR 4/6) mottling; appears very moist and stiff; prominent varve-like bedding; some oxidized sand-silt pockets; trace calcium carbonate nodules and manganese flecks
At 114.0 to 116.2': Becomes blotchy with oxidized fine sandy pockets

Silty Sand and Sandy Silt, variable clay, trace to some gravel, up to 1.5-inch, mainly shale (Tm) and sandstone (Tm); dark yellowish brown (10YR 4/4)
At 117.0': Silty Sand, fine grained, trace gravel up to 1 inch; dark brown (10YR 3/3)
At 118.6': Gravelly bed (1 inch thick); similar make-up as above

Clayey Silt, trace gravel, variable fine sand; dark yellowish brown (10YR 3/4); well sorted

Geologist: AR/MW/MF
Prepared/Date: WL/PK 10/14/2011
Checked/Date: MW/MF 10/14/2011

MTA Westside Subway Extension
Los Angeles, California
**At 122.4 to 123.2':** Gravel layer composed almost entirely of shale (Tm)

**Sandy Silt, fine grained, trace to some clay, trace fine gravel; dark yellowish brown (10YR 4/4); appears moist and stiff; generally massive; well sorted**

**At 130.9':** Clayey Silt, trace fine gravel; very dark grayish brown (2.5Y 3/2); appears moist and very stiff; trace fine calcium carbonate nodules; generally massive; well sorted

**At 133.2 to 134.0':** Fine gravel and sand increasing with depth

**At 134.0':** Silty Sand, fine to coarse grained, some fine gravel; dark grayish brown (2.5Y 4/2); appears moist and dense

**At 135.0 to 136.3':** Becomes fine grained

**At 138.2 to 139.0':** Becomes very dark brown (7.5YR 2.5/3); oxidation splotches

**OLDER ALLUVIAL FAN DEPOSITS [Qf]**

Clayey to Sandy Silt variable gravel, (5 to 15%), mainly sandstone (Tm) and slate (Jsm), trace brick red sand stone; color variable; appears moist and hard; poorly sorted

---

**DRILLING COMPANY/DRILLING EQUIPMENT**
Martini Drilling / CME 75

**DRILLING METHOD**
Hollow Stem Auger

**BOREHOLE LOCATION**
See Plate 3

**DATES DRILLED**
7/5/11 - 7/7/11

**HOLE DIAMETER**
8 inches

**GROUND EL.**
270 feet

**% RECOVERY**

---

**GROUNDWATER READING**
Measured at 92.5 feet after 15 hours

---
At 141.7 to 142.4': Fracture infilled with calcium carbonate

At 145.0 to 148.1': Becomes mottled dark yellowish brown (10YR 4/4) to olive gray (5Y 4/2); gravel decreases to trace

At 148.1 to 150.0': No recovery

At 150.0 to 150.6': Clay; dark brown (10YR 3/3); appears moist and stiff

At 150.6 to 151.3': Becomes Clayey Silt with some sand

At 151.3 to 151.5': Clay bed

At 151.5 to 152.2': Silty Sand, grades to Silty Sand with Gravel

Silty Gravel, clasts mainly subangular slate (Jsm) and shale (Tm), up to 1 inch; color variable; matrix is fine to coarse silty sand; lower contact is sharp

Clayey Silt becomes sandier with depth; color variable; appears moist and hard; faint varve-like bedding

Poorly Graded Sand with Silt; appears wet; (disturbed sample)

At 156.8': Becomes gravelly, clasts mainly granitic rock, shale (Tm), and slate (Jsm); some calcium carbonate nodules

At 156.9 to 160.0': No recovery
**ESTUARINE DEPOSITS [Qe]**

At 160.0 to 160.5': Very fine Silty Sand, thinly interbedded; light yellowish brown (10YR 6/4)
Clayey Silt; mottled, light olive brown (2.5Y 5/3 to 5/6); appears moist and very stiff

At 161.6 to 161.9': Silty Sand, very fine to medium grained

At 162.4': Silty Sand bed, very fine to medium (1 inch thick)
Clayey Silt with very fine sand; trace fine gravels and oxidized sandy pockets; trace calcium carbonate nodules to veins; very dark grayish brown (2.5Y 3/2)

At 165.1 to 165.6': Silty Sand with some gravel, fine sand, and gravel
Sandy to Clayey Silt, trace gravel (3-5%), mainly angular to subangular shale (Tm), sandstone (Tm), and slate (Jsm); olive gray (5Y 4/2); appears moist and hard

At 167.3 to 168.7': Silt becomes discretely interbedded, thin very fine sandy silt and clayey silt beds; dark olive brown (2.5Y 3/3)

At 168.7': Becomes gravelly, clasts up to 2 inches, mainly slate (Jsm) and granitic rock
At 168.8 to 170.0': No recovery

**OLDER FLUVIAL DEPOSITS [Qf0fl]**

Silty Gravel, clasts up to 2 inches, mainly angular slate, some subangular shale (Tm), granitic rock, and sandstone (Tm), matrix is fine to coarse silty sand; trace interbedded fine sand layers (1 to 3 inches thick); color variable; appears wet and dense

At 175.0 to 180.0: Recover only slough (sand and gravel)
**ESTUARINE DEPOSITS - FINE GRAINED [Qef]**
Silty Clay; very dark grayish brown (10YR 3/2); appears moist and hard; discrete small oxidized pockets, and some manganese stains; trace fine gravel

At 182.0 to 183.3': 5% fine gravel

At 185.0 to 186.5': Sandy Clay; olive (5Y 5/3); appears moist and hard; trace gravel; becomes sandier with depth

**BASAL ALLUVIAL FAN UNIT [Qfob]**
Silty Sand and Sandy Silt, some calcium carbonate veins & nodules; trace to some fine gravel, mainly subangular slate (Jsm) and sandstone (Tm), trace oxidized nodules and manganese flecks; poorly sorted

At 192.2 to 193.0': Grades to Clayey Silt; color becomes grayish olive (10Y 5/2)

At 195.0 to 195.7': Silty Sand, very fine to fine, trace gravel, mainly angular slate (Jsm), and granitic rock; appears moist; lower contact is sharp

Clayey Silt with some fine sand; grayish brown (2.5Y 5/2); thin interbeds of oxidized fine sand, trace gravel, mainly slate (Jsm) and sandstone (Tm); beds have sharp contacts

**BASAL ESTUARINE UNIT? [Qeb?]**
Silty Clay; dark gray (5Y 4/1); appears damp and hard; classification uncertain due to limited sample

Geologist: AR/MW/MF
Prepared/Date: WL/PK 10/14/2011
Checked/Date: MW/MF 10/14/2011

(Continued on following figure)

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**LOG OF BORING**

MTA Westside Subway Extension
Los Angeles, California
NOTES:

- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted.
- Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch).
- Beds are generally massive unless otherwise noted.

END OF BORING AT 200 FEET

Boring backfilled with cement/bentonite grout from bottom up and patched.

---

**MTA Westside Subway Extension**

Los Angeles, California

---

**LOG OF BORING**

Project No.: 4953-10-1561  Figure: T2E-B5k

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**DRILLING COMPANY/DRILLING EQUIPMENT**

Martini Drilling / CME 75

**DRILLING METHOD**

Hollow Stem Auger

**BOREHOLE LOCATION**

See Plate 3

**DATES DRILLED**

7/5/11 - 7/7/11

**HOLE DIAMETER**

8 inches

**GROUND EL.**

270 feet

---

**GROUNDWATER READINGS**

Measured at 92.5 feet after 15 hours

---

**DRILLING COMPANY/DRILLING EQUIPMENT**

Martini Drilling / CME 75

**Borehole Location**

See Plate 3

**Dates Drilled**

7/5/11 - 7/7/11

**Hole Diameter**

8 inches

**Ground El.**

270 feet

---

**Notes:**

- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted.
- Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch).
- Beds are generally massive unless otherwise noted.
### LOG OF BORING

**BORING NO.:** T2E-B7

**Drilling Company/Drilling Equipment:**
Tri Country Drilling / CME 75

**Drilling Method:**
Hollow-Stem Auger

**Dates Drilled:**
6/8/11 - 6/28/11

**Ground Diameter:**
8 inches

**Ground El.:**
280 feet

**Borehole Location:**
See Plate 3

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**Elevation (ft)**
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**Groundwater Readings:**
Encountered at 44 feet during drilling

- **Fill [Af]**
  - Silty Sand, trace fine gravel up to ¾ inch; very dark grayish brown (10YR 3/2); appears moist
  - **NOTE:**
    - Jsm = Santa Monica Slate
    - Tm = Modelo Formation
    - See end of log for more detailed description of clasts

- **Younger/Older Alluvial Fan Deposits [Qf/Qfo]**
  - Sandy to Clayey Silt, variable gravel, clasts 2 to 15%, up to ¾ inch; mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); very dark grayish brown (10YR 3/2); appears moist and hard; lower contact is gradational
  - Grades to Silty Clay
  - At 7.9 to 10.0': No recovery

- **Estuarine Deposits [Qe]**
  - Clay and Silty Clay, rare (<1%) coarse sand (Jsm and Tm); brown (10YR 4/3); appears moist and hard; lower contact is gradational
  - At 12.6 to 14.0': 5 to 10% calcium carbonate filaments
  - At 13.5 to 14.0': Increasing fine sand, gradational transition to unit below
  - At 14.0 to 15.0': No recovery
  - Sandy to Clayey Silt, trace coarse sand and fine gravel (Jsm and Tm); brown (7.5YR 4/4); appears moist; moderately well sorted; lower contact occurs between runs
  - At 17.4 to 20.0': No recovery

---

**Geologist:** LH/MF/MW

**Prepared/Date:** YN/PK 10/14/2011

**Checked/Date:** MW/MF 10/14/2011

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MTA Westside Subway Extension
Los Angeles, California

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**FLUVIAL DEPOSITS [Qfl]**
Gravel, clasts 50 to 60%, up to 1½ inches, mainly subangular to subrounded slate (Jsm), some shale (Tm) and sandstone (Tm) also observed; matrix is fine to coarse silty sand; color is variable, generally dark grayish brown (10YR 4/2); appears damp and dense; lower contact occurs between runs

At 23.0 to 25.0': No recovery

Silty Gravel as above

**OLDER ALLUVIAL FAN DEPOSITS [Qfl]**
Sandy to Clayey Silt, trace fine gravel (Jsm and Tm); brown (10YR 4/3); appears very moist and stiff to very stiff; poorly sorted; lower contact occurs between runs

At 28.8 to 29.7': Grades to Silty Clay, some strong brown (7.5YR 4/6) mottling

Silty Sand, trace to some clay, fine grained, trace coarse sand and fine gravel (Jsm and Tm); brown (7.5YR 4/4); appears very moist and dense; lower contact occurs between runs

At 30.9 to 31.4': Increasing clay

Silty Clay; dark yellowish brown (10YR 4/4)

At 32.5 to 32.8': Increasing soil and gravel

At 32.8 to 33.0': Grades to Clayey, Silty Sand with Gravel, clasts 15 to 20%, up to 1½ inches, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); color variable; appears very moist and dense; poorly sorted

At 33.0 to 35.0': No recovery

**ESTUARINE DEPOSITS - FINE GRAINED [Qef]**
Clay, trace coarse sand (Jsm and Tm); mottled, dark grayish brown (10YR 4/2) to strong brown (7.5YR 5/6); appears very moist and stiff to very stiff; occasional sandy lenses and beds, varve like bedding, scattered manganese oxide flecks

At 37.7 to 37.9': Grades to Sandy Silt

At 38.6 to 39.6': Color becomes olive brown (2.5Y 4/3) with occasional strong brown (7.5YR 4/6) mottling

At 39.2 to 39.3' and 39.6 to 39.7': Clayey, Silty Sand beds, fine grained; olive brown (2.5Y 4/3); appears very moist and dense

At 39.6 to 39.9': Color becomes olive brown (2.5Y 4/3) with occasional strong brown (7.5YR 4/6) mottling

Geologist: LH/MF/MW
Prepared/Date: YN/PK 10/14/2011
Checked/Date: MW/MF 10/14/2011

MTA Westside Subway Extension
Los Angeles, California

LOG OF BORING
Project No.: 4953-10-1561 Figure: T2E-B7b
### Groundwater Readings

Encountered at 44 feet during drilling

**At 41.0 to 41.5 feet:** Increasing Sand and Gravel, gradational transition to unit below

Clayey to Sandy Silt with variable Gravel; clasts generally 5 to 30%, up to 1½ inches, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); mottled, dark grayish brown (10YR 5/6); appears very moist and stiff to very stiff; lower contact is narrowly gradational

**At 41.9 to 42.1 feet:** Gravelly bed, clasts 60 to 70%, up to 1 inch

**At 43.2 to 45.2 feet:** Gravel decreases to less than 5%, up to ½ inch

**At 44.0 feet:** Groundwater encountered during drilling

Silty Clay and Clayey Silt, trace coarse sand (Jsm and Tm); strongly mottled, dark brown (7.5YR 3/4) to dark grayish brown (2.5Y 4/2); scattered manganese oxide flecks

**At 48.3 to 50.2 feet:** Grades to Clay; appears moist and very stiff to hard

**At 50.2 to 51.5 feet:** Fine Silty Sand beds; alternate with clay described above

**At 53.4 to 54.2 feet:** Some gray (2.5Y 5/1) laminations and varve-like bedding

Contact based mainly on nearby CPT signatures and other borings

**Estuarine Deposits [Qe]**

Silty Clay and Clayey Silt; trace coarse sand (Jsm and Tm); brown (10YR 4/3) with variable dark gray (2.5Y 4/1) motting; appears very moist and very stiff; slightly micaceous; lower contact is narrowly gradational

**At 55.7 to 56.4 feet:** Some reddish brown (5YR 4/3) motting

**At 56.4 feet:** Some gray (2.5Y 5/1) laminations and varve-like bedding

Contact based mainly on nearby CPT signatures and other borings

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**MTA Westside Subway Extension**

Los Angeles, California

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**LOG OF BORING**

**PROJECT NO.: 4953-10-1561**

**DRILLING COMPANY/DRILLING EQUIPMENT**

Tri Country Drilling / CME 75

**DRILLING METHOD**

Hollow-Stem Auger

**BOREHOLE LOCATION**

See Plate 3

**DATES DRILLED**

6/8/11 - 6/28/11

**HOLE DIAMETER**

8 inches

**GROUND EL.**

280 feet

---

**GROUNDWATER READINGS**

Encountered at 44 feet during drilling

**At 41.0 to 41.5 feet:** Increasing Sand and Gravel, gradational transition to unit below

Clayey to Sandy Silt with variable Gravel; clasts generally 5 to 30%, up to 1½ inches, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); mottled, dark grayish brown (10YR 5/6); appears very moist and stiff to very stiff; lower contact is narrowly gradational

**At 41.9 to 42.1 feet:** Gravelly bed, clasts 60 to 70%, up to 1 inch

**At 43.2 to 45.2 feet:** Gravel decreases to less than 5%, up to ½ inch

**At 44.0 feet:** Groundwater encountered during drilling

Silty Clay and Clayey Silt, trace coarse sand (Jsm and Tm); strongly mottled, dark brown (7.5YR 3/4) to dark grayish brown (2.5Y 4/2); scattered manganese oxide flecks

**At 48.3 to 50.2 feet:** Grades to Clay; appears moist and very stiff to hard

**At 50.2 to 51.5 feet:** Fine Silty Sand beds; alternate with clay described above

**At 53.4 to 54.2 feet:** Some gray (2.5Y 5/1) laminations and varve-like bedding

Contact based mainly on nearby CPT signatures and other borings

**Estuarine Deposits [Qe]**

Silty Clay and Clayey Silt; trace coarse sand (Jsm and Tm); brown (10YR 4/3) with variable dark gray (2.5Y 4/1) motting; appears very moist and very stiff; slightly micaceous; lower contact is narrowly gradational

**At 55.7 to 56.4 feet:** Some reddish brown (5YR 4/3) motting

**At 56.4 feet:** Some gray (2.5Y 5/1) laminations and varve-like bedding

Contact based mainly on nearby CPT signatures and other borings

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**PROJECT NO.: 4953-10-1561**

**Figure:** T2E-B7c

**Prepared/Date:** YN/PK 10/14/2011

**Checked/Date:** MW/MF 10/14/2011

**Geologist:** LH/MF/MW

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**METRO SOIL CORE** S:\70131 GEOTECH\GINTW\FAULT_INVESTIGATION_WSE_LIBRARY AMEC OCTOBER2011 (2).GLB

**G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.2 FAULT HAZARD INVESTIGATION\3.2 ALL FIELD NOTES\GINT LOGS\101561-TRANSECT2E.GPJ 10/14/11
**Groundwater Readings**

Encountered at 44 feet during drilling

- **Qe Continued**
  - Alternating beds of fine to coarse Silty Sand and heterogenous Silty Clay to Clayey Silt with variable sand; color is variable, appears wet and dense and soft to medium stiff; typical bed thickness is 3 to 6 inches; contacts between beds are generally sharp; lower contact is sharp

- **Older Alluvial Fan Deposits [Qfo]**
  - Clayey Silt and Silty Clay, trace coarse sand and fine gravel (Jsm and Tm); faintly mottled, dark reddish brown (5YR 3/3) to very dark gray (7.5YR 3/1); appears moist and hard; coarsens with depth, grades to coarser bed below

- **Estuarine Deposits [Qe]**
  - Estuarine Deposits [Qe]
    - Clay, rare (<1%), coarse sand (Jsm and Tm); lightly mottled, dark reddish brown (5YR 3/3) to very dark gray (7.5YR 3/1); appears moist and hard; mainly dark grayish brown (10YR 4/1); appears moist and soft; lower contact is gradational

**Boring No.** T2E-B7

**Elevation (ft):** 215

**Depth (ft):** 65

**Box:** 4

**Run:** 13

**% Recovery:** 100

**Sample Loc:**

- **SM+:/CL/ML**
- **CL/CH**
- **ML/CL**
- **GM**

**Drilling Method:** Hollow-Stem Auger

**Drilling Company/Drilling Equipment:** Tri Country Drilling / CME 75

**Dates Drilled:** 6/8/11 - 6/28/11

**Hole Diameter:** 8 inches

**Groundwater Readings**

At 68.7: Silty Gravel, clasts 50 to 60%, up to ¾ inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm), some quartzite also observed; matrix is fine to coarse silty sand

At 76.2 to 76.7: Color becomes brown (7.5YR 4/3)

At 77.8 to 78.5: Increasing clay, gradational transition to unit below

**Geologist:** LH/MF/MW

**Prepared/Date:** YN/PK 10/14/2011

**Checked/Date:** MW/MF 10/14/2011

**MTA Westside Subway Extension**

**Los Angeles, California**
**OLDER ALLUVIAL FAN DEPOSITS [Q6]**

Clayey, Silty Gravel, clasts 50 to 60%, up to 1 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); matrix is fine to coarse clayey, silty sand; color variable, generally very dark grayish brown, (10YR 3/2); appears wet and dense; lower contact is sharp

Silty Sand and Sandy Silt, very fine grained; brown (10YR 4/3); appears very moist and stiff; slightly micaceous; lower contact is gradational

Silty Sand with Gravel, fine to coarse grained, clasts 15 to 20%, up to ½ inch, mainly subangular slate (Jsm), shale (Tm) and sandstone (Tm), some brick-red sandstone; color highly variable; appears moist and dense

At 91.4 to 92.2': Some distinct thin (1/8 to ¼ inch) laminations defined by variable color and mafic content; lightly to moderately cemented

At 92.3 to 95.0': No recovery

At 97.7 to 100.0': No recovery

---

At 80.0 to 90.0': No sampling - barrel stuck in auger
**ESTUARINE DEPOSITS - FINE GRAINED [Qef]**
Clay; mottled, olive brown (2.5Y 4/3); appears very moist and very stiff; lower contact occurs between runs
At 101.0 to 102.9': Increasing fine Sand and Silt, some oxidized strong brown (7.5YR 4/6) pockets and varve-like bedding

At 102.9 to 105.0': No recovery

Silty Clay, variable fine sand, trace coarse sand and gravel (Jsm and Tm); mottled, strong brown (7.5YR 4/6) to dark grayish brown (10YR 4/2); appears very moist and stiff; lower contact is sharp
At 106.5 to 106.6': Becomes dark reddish brown (5YR 3/3)

**OLDER ALLUVIAL FAN DEPOSITS [Qfo]**
Sandy to Clayey Silt; trace coarse sand and fine gravel (Jsm and Tm); mottled, dark yellowish brown (10YR 4/4) to grayish brown (2.5Y 5/2); appears very moist to wet and stiff; poorly sorted; lower contact occurs between runs

Well-Graded Sand with Gravel, fine to coarse grained, clasts 30 to 40%, up to 1½ inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm), some granitic rock and quartzite also observed; color is variable, generally dark grayish brown (10YR 4/2); appears wet and dense; lower contact occurs between runs
At 111.6 to 115.0': No recovery

Clay, trace coarse sand and fine gravel (Jsm and Tm); dark grayish brown (10YR 4/2); appears very moist and stiff; lower contact is gradational

Clayey, Silty Sand with Gravel, sand is fine to coarse grained, clasts 20 to 35%, up to ½ inch, mainly subangular slate (Jsm), shale (Tm) and sandstone (Tm); color variable, generally dark grayish brown (2.5Y 4/2); appears moist and dense; lightly to moderately cemented
At 117.6 to 120.0': No recovery
ESTUARINE DEPOSITS [Qe]

Clay; dark grayish brown (10YR 4/2); appears very moist and stiff; lower contact is narrowly gradational

At 120.0 to 120.3' and 120.9 to 121.2': Silty Clayey Sand beds, fine to coarse grained; appears wet and dense; coarse sand includes abundant granitic rock fragments

Alternating beds of Clay and Clayey Silt; clay is very dark grayish brown (10YR 3/2), clayey silt is strong brown (7.5YR 4/6); appears very moist and stiff to very stiff, clay contains variable manganese oxide flecks; clayey silt is micaceous; typical bed thickness 2 to 4 inches

Sandy Silt; dark grayish brown (2.5Y 4/2); appears moist and very stiff; lower contact occurs between runs

At 124.3 to 124.5': Some coarse sand and gravel, clasts 5-10% (Jsm and Tm)

At 125.0 to 125.5': Increasing clay, grades to Clayey to Sandy Silt

Sandy Clay; very dark grayish brown (2.5Y 3/3), mottled sandier zones oxidized; appears moist and very stiff; lower contact is gradational

At 128.1 to 128.5': Silty Sand with Gravel, clasts up to 1 inch in diameter, lower contact is gradational

At 128.1 to 128.5': Silty Sand with Gravel, clasts up to 1 inch in diameter, lower contact is gradational

At 129.2': Fine to medium Silty Sand with Gravel, subangular, up to 1 inch, mainly slate (Jsm)

At 129.5 to 130.5': No recovery

At 130.5': Continue Silty Sand with Gravel; lower contact is sharp

Silty Sand, fine to medium grained, trace subangular to subrounded gravel; dark grayish brown (2.5Y 4/2); appears moist and moderately dense; some clayey mottling; lower contact is sharp

At 129.2': Fine to medium Silty Sand with Gravel, subangular, up to 1 inch, mainly slate (Jsm)

At 129.5 to 130.5': No recovery

At 130.5': Continue Silty Sand with Gravel; lower contact is sharp

Clayey Sand, fine to medium grained; dark grayish brown (2.5Y 4/2); appears moist and moderately dense; lower contact is sharp

Clayey Sand, fine to medium grained, trace subangular to subrounded gravel; dark grayish brown (2.5Y 4/2); appears moist and moderately dense; some clayey mottling; lower contact is sharp

Silty Clay; very dark grayish brown (2.5Y 3/3), mottled sandier zones oxidized; appears moist and very stiff; lower contact is gradational

At 128.1 to 128.5': Silty Sand with Gravel, clasts up to 1 inch in diameter, lower contact is gradational

At 129.2': Fine to medium Silty Sand with Gravel, subangular, up to 1 inch, mainly slate (Jsm)

At 129.5 to 130.5': No recovery

At 130.5': Continue Silty Sand with Gravel; lower contact is sharp

Clay to Silty Clay; very dark grayish brown (2.5Y 4/2), fine to medium grained; appears moist and very stiff, lower contact occurs between runs

OLDER ALLUVIAL FAN DEPOSITS [Qfo]

Sandy to Clayey Silt, trace subangular to subrounded gravel; very dark brown (7.5YR 2.5/2); appears moist and very stiff

At 137.8 to 138.1': Clayey clastic layer, subangular slate (Jsm), shale (Tm) and sandstone (Tm), up to 1 inch

At 138.1': Sand, fine to medium grained, some silt and clay, trace coarse grained, up to ½ inch

At 138.8 to 140.0: No recovery

At 137.8 to 138.1': Clayey clastic layer, subangular slate (Jsm), shale (Tm) and sandstone (Tm), up to 1 inch

At 138.1': Sand, fine to medium grained, some silt and clay, trace coarse grained, up to ½ inch

At 138.8 to 140.0: No recovery

Geologist: LH/MF/MW
Prepared/Date: YN/PK 10/14/2011
Checked/Date: MW/MF 10/14/2011
**Qfo Continued**

At 140.0 to 140.6': Silty Sand with Gravel, clasts mainly angular slate (Jsm), up to 2 inches; olive gray (5Y 4/2); appears very moist and loose to medium dense; lower contact is sharp. 

Silty Sand, fine to medium grained, some clay, trace coarse gravel, up to 2 inches; very dark brown (7.5YR 2.5/2); appears moist and dense.

At 143.5': Concretionary zone (1 to 2 inches thick), moderately cemented sand below.

At 143.5 to 145.0': No recovery.

At 148.0 to 148.3': Silty Sand with Gravel, fine to medium grained with some coarse, angular to subangular gravel, up to ½ inch.

At 148.3: Silty Sand, fine grained; very dark brown (7.5YR 2.5/2); appears moist and medium dense, lower contact occurs between runs.

**ESTUARINE DEPOSITS [Qe]**

Sandy Silt; dark brown (10YR 3/3); some clay; appears moist and stiff; trace gravel.

At 151.5': Increasing clay to Clay and Clayey Silt; dark gray (10YR 4/1).

At 153.8 to 155.0': No recovery.

At 156.4 to 157.9': Interbedded Clayey Silt layers (2 inches thick); dark gray (5Y 4/1).

At 157.8': Silty Sand layer (1/2 inch thick); fine to coarse grained; trace calcium carbonate nodules.

Clayey Silt; dark gray (5Y 4/1); trace small calcium carbonate nodules; lower contact occurs between runs.
Continued

Clayey Silt; very dark grayish brown (2.5Y 3/2); thin indistinct oxidized sandy layers; trace to some fine to coarse gravel, mainly angular to subangular slate (Jsm), shale (Tm), sandstone (Tm), and other; appears moist and stiff; some varve-like bedding

At 163.9 to 165.3': Becomes clayier; appears moist and very stiff

OLDER ALLUVIAL FAN/ESTUARINE DEPOSITS [Qfo/Qe]

Silty Gravel; mainly subrounded granitic and slate clasts; trace shale (Tm); silty sand matrix; appears very moist and medium dense; lower contact is sharp

Silty Sand, very fine to fine grained; mottled, mostly dark grayish brown (2.5Y 4/2); appears very moist and medium dense, lower contact is sharp

Gravelly layer (2 inches thick); mainly angular shale (Tm) and slate (Jsm), some subangular, granitic rock, fine to coarse grained; lower contact is sharp

Sandy to Clayey Silt, indistinct varve-like bedding
At 169.2 to 170.0': Increasing fine to coarse gravel to 10%

At 171.7 to 172.0': Fine to coarse Gravel layer, mainly subrounded to angular granitic rock, slate (Jsm) and shale (Tm)

At 172.0 to 175.0': No recovery

Silty Sand, fine to coarse grained; dark brown (7.5YR 3/3); appears wet

At 176.1': Clayey Silt layer, (1½ inches thick)

At 177 to 180.0': No recovery
**OLDER ALLUVIAL FAN DEPOSITS [Qfo]**

Silty Gravel, fine to coarse grained, mainly angular slate (Jsm), some shale (Tm) and granitic rock; dark olive brown (2.5Y 3/2); appears wet and loose; disturbed sample; lower contact is sharp

Silty Sand with Gravel; olive gray (5Y 4/2)

Silty Sand, trace to some fine gravel; olive gray (5Y 4/2); appears very moist and medium dense

Sandy Silt with some Clay and trace gravel; dark olive gray (5Y 3/2); coarsens downward

**Clayey Silt; olive brown (2.5Y 4/6); appears moist and stiff; lower contact is gradational**

**Clayey to Sandy Silt with gravel; fine to medium grained, coarsens downward; dark yellowish brown (2.5Y 4/4)**

**Silty Sand with Gravel; fine to coarse gravel, mainly angular to subangular granitic rock, slate (Jsm) and shale (Tm); lower contact is sharp; approximate dip 15 degrees**

**Clayey Silt; vary dark grayish brown (2.5Y 3/2); appears moist and stiff; lower contact is gradational**

At 184.1': Trace coarse, angular shale (Tm) and slate (Jsm) gravel

At 185.0': Grades to clayey to sandy silt with gravel, coarsens downward

At 186.8': Increasing gravel

At 187.7': Sand with Gravel layer (2 inches thick)

Sandy Silt with some gravel; appears moist and stiff

At 188.8 to 190.0: No recovery

At 192.5 to 193.4: Clayey Silt; dark grayish brown (10YR 4/2)

At 193.4 to 194.4: Fine to medium sand with trace gravel; mainly slate (Jsm), sandstone (Tm), and shale (Tm), and other, trace brick-red sandstone

**Drilling Company/Drilling Equipment**
Tri Country Drilling / CME 75

**Drilling Method**
Hollow-Stem Auger

**Dates Drilled**
6/8/11 - 6/28/11

**Hole Diameter**
8 inches

**Ground El.**
280 feet

**Geologist:** LH/MF/MW

**Prepared/Date:** YN/PK 10/14/2011

**Checked/Date:** MW/MF 10/14/2011

**MTA Westside Subway Extension**
Los Angeles, California

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**LOG OF BORING**

Project No.: 4953-10-1561

Figure: T2E-B7j
**Q60 Continued**

Well Graded Sand; fine to coarse grained; some gravel, mainly shale (Tm), sandstone (Tm) and slate (Jsm); fine to medium grained, subangular

END OF BORING AT 200 FEET

**NOTES:**

- Boring backfilled with cement/bentonite grout from bottom up and patched.
- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch).
- Beds are generally massive unless otherwise noted.

Boring deepened from 155 to 200 on 6/27 to 6/28/11. Location of deepened boring offset south-east approximately 1-foot from original boring location.
**PROJECT NO.: 4953-10-1561**

**LOG OF BORING**

**T2E-B8**

<table>
<thead>
<tr>
<th>BORING NO.</th>
<th>DRILLING METHOD</th>
<th>BOREHOLE LOCATION</th>
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<td>T2E-B8</td>
<td>Hollow-Stem Auger</td>
<td>See Plate 3</td>
</tr>
</tbody>
</table>

**DATES DRILLED:**

6/4/11

**HOLE DIAMETER:**

8 inches

**GROUND EL.:**

269 feet

---

**GROUNDDWATER READINGS**

Encountered at 34.6 feet during drilling

---

**GROUND EL.**

T2E-B8

---

**HOLE LOCATION**

269 feet

---

**DRILLING COMPANY/DRILLING EQUIPMENT**

Martini Drilling / CME 75

---

**HOLE DIAMETER**

8 inches

---

**% RECOVERY**

100

---

**SAMPLE LOC.**

1 1 100

---

**ELEVATION (ft)**

265

---

**DEPTH (ft)**

5

---

**BOX #**

1 1

---

**RUN #**

1

---

**% RECOVERY**

100

---

**SAMPLE LOC.**

1 2 90

---

**ELEVATION (ft)**

260

---

**DEPTH (ft)**

10

---

**BOX #**

1

---

**RUN #**

2

---

**% RECOVERY**

90

---

**SAMPLE LOC.**

1 3 90

---

**ELEVATION (ft)**

255

---

**DEPTH (ft)**

15

---

**BOX #**

1

---

**RUN #**

3

---

**% RECOVERY**

90

---

**SAMPLE LOC.**

20

---

**ELEVATION (ft)**

250

---

**GROUNDWATER READINGS**

Encountered at 34.6 feet during drilling

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**NOTE:**

Jsm = Santa Monica Slate
Tm = Modelo formation
See end of log for more detailed descriptions of clasts

---

**FILL [Af]**

Clayey to Sandy Silt, dark brown (10YR 3/3)

---

**YOUNGER/OLDER ALLUVIAL FAN DEPOSITS [Qf/Qfo]**

Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); dark brown (10YR 3/3); appears very moist and medium stiff; lower contact is gradational

---

Silty Clay and Clayey Silt, trace coarse sand and fine gravel (Jsm and Tm); very dark grayish brown (10YR 3/2); appears moist and very stiff; lower contact is gradational

---

At 8.8 to 12.8': Trace calcium carbonate filaments and fine nodules up to 1/8 inch

---

**ESTUARINE DEPOSITS [Qe]**

Clayey to Sandy Silt, rare (<1%) coarse sand (Jsm and Tm); brown (7.5YR 4/3); appears moist and very stiff; well sorted; trace very fine (<1/32 inch) calcium carbonate filaments; lower contact is gradational

---

Silty Sand and Sandy Silt, very fine grained; rare (<1%) coarse sand (Jsm and Tm); yellowish brown (10YR 5/4); appears moist and stiff/dense; well sorted; lower contact is narrowly gradational

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Silty Sand with Gravel, fine grained, clasts 20 to 40%, up to 3/4 inch, mainly subangular

---

Geologist: ME/MF
Prepared/Date: WL/PK 10/14/2011
Checked/Date: MW/MF 10/14/2011
**FLUVIAL DEPOSITS [Qfofl]**

Silty Gravel, clasts (50 to 70%), up to 1½ inches, mainly subangular to subrounded slate (Js) with some granitic rock, sandstone (Tm) and shale (Tm); matrix is fine to coarse silty sand; brown (10YR 5/3); appears damp and dense; upper contact is sharp, lower contact is gradational

At 27.9 to 29.0': Poorly Graded Sand with Gravel and Silt, fine grained; clasts 15 to 25%, up to 1 inch; mainly subangular to subrounded slate (Js) with some granitic rock, sandstone (Tm) and shale (Tm); brown (10YR 5/3); appears damp to dense; upper contact is sharp, lower contact is gradational

At 30.0 to 31.7': Gravel becomes coarser, maximum size 2½ inches

At 32.4': Becomes wet

Groundwater encountered during drilling

---

**DESCRIPTION OF REFERENCE STRATA**

Qe Continued to subrounded slate (Js), some subangular granitic rock also observed; brown (7.5YR 4/4); appears moist and dense

At 21.3 to 22.0' and 22.4 to 22.7': Grades to Silty Sand to Sandy Silt, very fine grained, trace coarse sand and fine gravel (Js and Tm); well sorted
### ESTUARINE DEPOSITS - FINE GRAINED [Qef]

- **Clayey Silt and Silty Clay, variable fine sand, trace coarse sand and fine gravel (Jsm and Tm); mottled, grayish brown (10YR 5/2) to strong brown (7.5YR 4/4); appears very moist and stiff to very stiff; occasional scattered manganese oxide flecks and staining; lower contact is gradational.**

- **Clayey to Sandy Silt, trace coarse sand (Jsm and Tm), strongly mottled, gray (2.5Y 5/1) to reddish brown (2.5YR 4/3); appears wet and stiff; variable manganese oxide staining and flecks (0 to 15%); lower contact occurs between runs.**

- **Clay and Silty Clay, trace coarse sand and fine gravel (Jsm and Tm); brown (7.5 YR 4/3) with variable dark gray (2.5Y 4/1) mottling; appears moist and very stiff to hard; some vertically oriented dark gray mottled zones; lower contact is sharp.**

- **At 52.1 to 52.4': Becomes dark gray (2.5Y 4/1).**

- **At 53.7 to 54.0': Gravel increases to 20 to 25%, up to ¾ inch.**

- **Silty Gravel, clasts, 50 to 60%, up to 1½ inches; mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); matrix is fine to coarse silty sand, color is variable, generally dark brown (7.5YR 3/4); appears wet and dense; lower contact is sharp.**

- **At 55.2 to 55.5': Becomes wet and soft.**

- **Silty Clay and Clayey Silt, trace coarse sand (Jsm and Tm); brown (7.5YR 4/4); appears very moist to wet and soft to stiff; occasional manganese oxide flecks; lower contact occurs between runs.**

- **At 57.6 to 57.8', 58.3 to 58.6', and 59.3 to 59.5': Fine Silty Sand beds.**

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**LOG OF BORING**

*Project No.: 4953-10-1561  Figure: T2E-B8c*

**Geologist:** ME/MF  
**Prepared/Date:** WL/PK 10/14/2011  
**Checked/Date:** MW/MF 10/14/2011
At 60.0 to 60.7': Silty Gravel clasts 70%+, up to ¾ inch, appears clast-supported, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); appears wet and dense, lower contact is sharp

At 60.7 to 62.0': Silty Clay and Clayey Silt as above

At 62.0 to 65.0': No recovery

OLDER ALLUVIAL FAN DEPOSITS [Qfo]
Silty Clay and Clayey Silt, variable fine to coarse sand and fine gravel; clasts, 2 to 15%, up to ½ inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); brown (7.5YR 4/4), with occasional grayish brown (10YR 5/2) mottling; appears moist to very moist and very stiff; lower contact is gradational

Clayey to Sandy Silt, variable coarse sand and fine gravel, clasts 5 to 25%, up to ¾ inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); brown (7.5YR 4/4) with dark grayish brown (2.5Y 4/2) mottling; appears very moist and very stiff; lower contact is gradational

At 73.6 to 78.5': Gravel increases to 20 to 35%; color becomes strong brown (7.5YR 4/6) to yellowish red (5YR 4/3); appears very moist and very stiff

Clayey Gravel, clasts 50 to 60.4% up to 1 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); matrix is fine to coarse clayey sand; brown (7.5YR 4/4); appears wet and dense
**ESTUARINE DEPOSITS** (Qeo)

Clayey Silt and Silty Clay, variable fine sand, trace coarse sand (Jsm and Tm); brown (7.5YR 4/3) with grayish brown (2.5Y 5/2) mottling; appears moist and very stiff to hard; lower contact is narrowly gradational

Clay, trace coarse sand (Jsm and Tm); mottled, dark reddish brown (5YR 3/4) to dark gray (7.5YR 4/1); appears moist and hard; lower contact is gradational

Silty Clay and Clayey Silt, rare (<1%) coarse sand (Jsm and Tm); dark brown (7.5YR 3/4); appears moist and very stiff; lower contact is narrowly gradational

Clayey to Sandy Silt, variable coarse sand, trace fine gravel (Jsm and Tm); brown (7.5YR 4/4); appears very moist and very stiff; well sorted; occasionally grades to Silty Clay; occasional fine silty, clayey sand pockets; lower contact is narrowly gradational

At 92.2 to 93.6': Gravel increases to 10 to 30%, up to ½ inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); gradational transition to unit below

**OLDER FLUVIAL DEPOSITS** (Qfdo)

Silty Gravel, clasts 50 to 60%, up to 1 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); matrix is fine to coarse silty sand; color is variable, generally brown (10YR 4/3); appears wet and dense

At 96.1 to 98.7': Grades to Silty Sand with Gravel, fine to coarse grained, clasts 20 to 40%, up to 1 inch

At 98.6 to 100.0': No recovery
**Qfo/Qfo<sub>s</sub> Continued**

At 100.0 to 105.0':Recovered only slough

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END OF BORING AT 105 FEET

NOTES:

Boring backfilled with cement/bentonite grout from bottom up and patched.

- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch).
- Beds are generally massive unless otherwise noted.
YOUNGER / OLDER ALLUVIAL FAN DEPOSITS [Qf/Qfo]
Clayey Silt, variable fine sand, trace coarse sand and fine gravel (Jsm and Tm); very
dark grayish brown (10YR 3/2); appears moist

At 6.1 to 9.0': No recovery

Clay and Silty Clay, trace coarse sand (Jsm and Tm); very dark grayish brown (10YR 3/2); appears moist and very stiff to hard; lower contact is gradational

At 11.7 to 12.6': Trace calcium carbonate filaments and uncemented nodules up to 1/8 inch

ESTUARINE DEPOSITS [Qe]
Clayey to Sandy Silt; dark yellowish brown (10YR 4/6); appears damp to moist and very stiff to hard; faint brown (10YR 4/3) laminations, rare (<1%) coarse sand and fine gravel (Jsm and Tm); well sorted; lower contact is gradational

At 15.5 to 19.0': No recovery

At 19.0 to 20.0': Silty Sand with Gravel, fine to coarse grained, clasts 20 to 30% up to 1 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); dark yellowish brown (10YR 4/4); appears moist and dense

NOTE:
Jsm = Santa Monica Slate
tm = Modelo formation
See end of log for more detailed descriptions of clasts
At 20.0 to 21.5': No recovery

Clayey to Sandy Silt as above

At 22.3 to 24.0': No recovery

At 24.5' to 27.7': Predominantly Sandy Silt, trace to some clay

At 26.5 to 31.5': Becomes very moist and medium stiff

At 29.5 to 31.5': Color becomes dark brown (10YR 3/3)

Silty Clay, rare (<1%) coarse sand and fine gravel (Jsm and Tm); dark grayish brown (10YR 4/2); appears very moist to wet and soft; variable manganese oxide staining; lower contact occurs between runs

At 32.7 to 34.0': No Recovery

At 35.2 to 35.8': Color becomes dark gray (2.5Y 4/1), slightly micaceous

At 36.9 to 37.4': Silty Clay with Sand, sand decreases with depth; dark grayish brown (10YR 4/2); appears wet and soft

At 37.4 to 39.0': No recovery

Older Alluvial Fan Deposits [Q6]

Clayey. Silty Sand, fine grained; dark grayish brown (10YR 4/2); appears wet and medium dense

At 36.9 to 37.4': Silty Clay with Sand, sand decreases with depth; dark grayish brown (10YR 4/2); appears wet and soft

At 37.4 to 39.0': No recovery

Poorly Graded Sand, fine to medium grained; color variable, generally very dark grayish brown (2.5Y 3/2); appears wet and dense; coarse sand content increasing with depth; lower contact is gradational

MTA Westside Subway Extension
Los Angeles, California

Geologist: LH/MF
Prepared/Date: WL/PK 10/14/2011
Checked/Date: MW/MF 10/14/2011

LOG OF BORING
Project No.: 4953-10-1561 Figure: T2E-B9b
Silty Clay, variable fine sand, trace coarse sand (Jsm and Tm), dark gray (10YR 4/1), appears wet and soft; poorly sorted

At 42.7 to 42.9': Becomes gravelly, clasts 30 to 40%, up to 1½ inches, mainly subangular slate (Jsm)
At 42.9 to 44.0': No recovery

Silty Gravel, clast 60 to 70%, up to 1 inch, mainly slate (Jsm), matrix is fine silty sand, very dark grayish brown (10YR 3/2), appears wet and dense, lower contact is sharp, erosional

Clay to Silty Clay, variable fine sand, trace coarse sand and fine gravel (Jsm and Tm); strongly mottled, grayish brown (10YR 5/2) to strong brown (7.5YR 5/6), appears very moist and stiff; occasional sandy silt pockets; lower contact is narrowly gradational
At 46.0 to 49.0': No recovery

At 49.0 to 52.0': Becomes mottled, grayish brown (10YR 5/2) to reddish brown (5YR 4/4); occasional manganese oxide flecks and staining

Clay, mottled, brown (7.5YR 4/4) to dark grayish brown (10YR 4/2); appears moist and very stiff to hard; variable (2 to 15%) manganese oxide flecks and staining

At 54.5 to 55.5': Occasional reddish brown (5YR 4/4), mottling

At 59.0 to 61.9': Appears very moist to wet and soft to medium stiff; variable fine to coarse sand
**ESTUARINE DEPOSITS (Qe)**

Clay; mottled, brown (7.5YR 4/4) to dark grayish brown (10YR 4/2); appears moist and very stiff to hard; occasional gravelly or sandy beds as noted above; lower contact is gradational.

- At 61.1 to 61.9': Becomes gravelly, clasts 25 to 35%, up to 1-inch, mainly subrounded slate (Jsm), shale (Tm) and sandstone (Tm).
- At 61.9 to 62.3': Some oxidized, strong brown (7.5YR 4/6) silt laminations.
- At 62.0 to 64.0': No recovery.
- At 64.0 to 64.8': Grades to Sandy Clay.
  - Silty Clay and Sandy Clay, variable fine to coarse sand, trace fine gravel (Jsm and Tm); color variable; very dark grayish brown (10YR 3/2); occasional dark reddish brown (5YR 3/4) mottling; appears wet and soft to medium stiff; lower contact occurs between runs.
  - At 67.9 to 68.1': Becomes very moist and very stiff.
  - At 68.0 to 69.0': No recovery.

**OLDER ALLUVIAL FAN DEPOSITS (Qfo)**

Clayey Sand with gravel, fine to coarse grained, clasts 15 to 20%, up to ¾ inch; mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); color variable; appears wet and dense.

- At 69.9 to 70.3': Silty Clay, dark reddish brown (5YR 3/4); appears wet and soft.
- At 74.0 to 77.7': Becomes brown (7.5YR 4/4); appears very moist to wet and medium stiff.
- At 77.7 to 80.2': Becomes reddish brown (5YR 4/4); appears very moist to wet and stiff.
CL/ML

ESTUARINE DEPOSITS [Qe]
Silty Clay and Clayey Silt, variable fine sand, trace coarse sand and fine gravel (Jsm and Tm); brown (7.5YR 4/4) with occasional grayish brown (2.5Y 5/2) mottling; appears very moist and very stiff; lower contact is narrowly gradational

At 85.0 to 85.8': Gravel increases to 25 to 30%

At 86.3 to 89.0': Trace manganese oxide flecks

At 86.5 to 86.3': Some grayish brown laminations

GROUNDWATER READINGS
Encountered at 38 feet.

At 91.8 to 92.2': Grades to Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm)

At 92.2 to 94.0': No recovery

At 94.0 to 95.1': Sandy Silt, variable clay, trace coarse sand and fine gravel (Jsm and Tm); brown (7.5YR 4/4); appears very moist and stiff; micaceous

At 95.9 to 99.0': No recovery

OLDER ALLUVIAL FAN DEPOSITS [Qf0]
Clay and Silty Clay, variable fine to coarse sand; brown (7.5YR 5/4); appears very moist to wet and medium stiff; poorly sorted; occasional clayey silt and sandy silt

Clay, rare (<1%) coarse sand (Jsm and Tm); brown (7.5YR 4/4); appears moist and very stiff to hard; variable varve-like bedding; lower contact occurs between runs

At 91.8 to 92.2': Grades to Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm)

At 92.2 to 94.0': No recovery

At 94.0 to 95.1': Sandy Silt, variable clay, trace coarse sand and fine gravel (Jsm and Tm); brown (7.5YR 4/4); appears very moist and stiff; micaceous

At 95.9 to 99.0': No recovery

LOG OF BORING

MTA Westside Subway Extension
Los Angeles, California
<table>
<thead>
<tr>
<th>SAMPLE LOC.</th>
<th>ESTUARINE DEPOSITS - FINE GRAINED [Qef]</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 25 70</td>
<td>Clay, strongly mottled, grayish brown (2.5YR 5/2) to strong brown (7.5YR 4/6), occasional reddish brown (5YR 4/4) mottles; appears moist and stiff to very stiff; lower contact is gradational</td>
</tr>
<tr>
<td>7 26 24</td>
<td>Sandy Clay with Gravel, clasts, 20 to 30%, up to 2 inches, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); mottled, color variable; appears wet and medium stiff; lower contact is null</td>
</tr>
<tr>
<td>165 105</td>
<td>Qo Continued; occasional strong brown (7.5YR 4/6) or grayish brown (10YR 5/2) mottling</td>
</tr>
<tr>
<td>160 110</td>
<td>At 101.1 to 102.2: Trace manganese oxide flecks</td>
</tr>
<tr>
<td>155 115</td>
<td>At 104.7 to 105.2: Clay; mottled, light brownish gray (10YR 6/2); appears very moist and stiff; trace manganese oxide flecks</td>
</tr>
<tr>
<td>120</td>
<td>At 119.0 to 119.5: Sandy Silt to Clayey Silt interbeds</td>
</tr>
<tr>
<td>119.5</td>
<td>At 119.8 to 120.2: Distinct laminations defined by color</td>
</tr>
<tr>
<td>119.0</td>
<td>At 115.8 to 115.9: Clayey Sand bed, fine to coarse grained</td>
</tr>
<tr>
<td>118</td>
<td>At 115.0 to 115.8: Distinct laminations defined by color</td>
</tr>
<tr>
<td>114</td>
<td>At 113.0 to 114.0: No recovery</td>
</tr>
<tr>
<td>112</td>
<td>At 111.2 to 112.2: Clay described above alternates with Sandy Silt beds; slightly micaceous; appears very moist and medium stiff to stiff</td>
</tr>
<tr>
<td>110</td>
<td>At 110.5 to 111.2: Prominent varve-like bedding</td>
</tr>
<tr>
<td>105</td>
<td>At 105.2 to 106.2: No recovery</td>
</tr>
<tr>
<td>104.7</td>
<td>At 125.0 to 126.0: No recovery</td>
</tr>
<tr>
<td>104.7</td>
<td>At 104.7 to 105.2: Clay; mottled, light brownish gray (10YR 6/2); appears very moist and stiff; trace manganese oxide flecks</td>
</tr>
<tr>
<td>105.2</td>
<td>At 105.2 to 106.2: No recovery</td>
</tr>
</tbody>
</table>

**Groundwater Readings**

Encountered at 38 feet.
**OLDER ALLUVIAL FAN DEPOSITS [Qfo]**

Clayey Silt with sand and gravel increasing with depth; mottled, grayish brown (2.5Y 5/2) to strong brown (7.5YR 4/6); appears moist and stiff

At 120.7 to 124.0': No recovery

Well Graded Sand, fine to coarse grained, trace fine gravel (Jsm and Tm); light brownish gray (2.5Y 6/2); appears wet and dense

At 125.7 to 129.0': No recovery

At 129.0 to 134.0': Recovered only slough

**ESTUARINE DEPOSITS -FINE GRAINED [Qe/Qef]**

Clay, very dark grayish brown (10YR 3/2); appears very moist and very stiff; variable % RECOVERY

At 134 to 134.3': Clayey Silty Sand with Gravel, fine to coarse grained; clasts 20 to 30%, up to ½ inch, mainly subangular to subrounded slate (Jsm); brown (7.5YR 4/4); appears wet and dense; lower contact is sharp

Clay, rare (<1%) coarse sand (Jsm and Tm); strongly mottled, very dark gray (10YR 3/1) to strong brown (7.5YR 4/6); appears moist and very stiff to hard; variable varve-like bedding; strong brown mottling occurs as coarse, irregular pockets and diffuse zones; trace manganese oxide flecks; lower contact is gradational

At 137.0 to 139': No recovery

At 139 to 141.5': Color becomes dark gray (10YR 4/1) with strong brown (7.5YR 5/6) mottling; trace coarse sand and fine gravel (Jsm and Tm)
<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
<th>SAMPLE LOC.</th>
<th>DRILLING COMPANY/DRILLING EQUIPMENT</th>
<th>BOREHOLE LOCATION</th>
<th>DATES DRILLED</th>
<th>HOLE DIAMETER</th>
<th>GROUND EL.</th>
</tr>
</thead>
</table>

**GROUNDWATER READINGS**

Encountered at 38 feet.

**OLDER ALLUVIAL FAN DEPOSITS [Qfo]**

Silty Sand with Gravel, trace to some clay, clasts 15 to 20% up to 1 inch, mainly sandstone and shale (Tm) and slate (Jsm), subangular, dark yellowish brown (10YR 3/6) to (10YR 4/4); appears moist and dense; poorly sorted; lower contact occurs between runs

At 151.5 to 154.0': No recovery

Clayey Silt, variable fine to medium sand, trace gravel, occasional more gravelly beds; dark yellowish brown (10YR 4/4); appears very moist to wet and firm

At 155.8 to 156.2': Silty Sand, trace gravel

At 157.3': Trace calcium carbonate
At 157.5 to 159.0': No recovery

---

**Qef Continued**

At 141.5 to 142.1': Increasing fine to coarse sand and fine gravel, clasts 5 to 10%, up to ½ inch (Jsm and Tm)

At 142.3 to 142.7' and 144.0-145.4': Color becomes dark brown (7.5YR 3/2) with dark gray (10YR 4/1) mottling
At 142.7 to 144.0': No recovery

Clay, very dark gray (10YR 3/1); appears very moist and very stiff; calcium carbonate occurs as irregular, steeply dipping stringers and pockets, total calcium carbonate about 10%; lower contact is gradational

Clay and Silty Clay, rare (<1%) coarse sand (Jsm and Tm); dark brown (7.5YR 3/3); appears very moist and stiff to very stiff; trace calcium carbonate filaments and stringers

Top 12 inches of sample disturbed

Clay, dark brown (7.5YR 3/2), appears wet and soft, lower contact is narrowly gradational
**LOG OF BORING**

**MTA Westside Subway Extension**

**Los Angeles, California**

<table>
<thead>
<tr>
<th>BORING NO.</th>
<th>T2E-B9</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DEEP DEPOSITS</strong></td>
<td></td>
</tr>
<tr>
<td><strong>ESTUARINE DEPOSITS [Qe]</strong></td>
<td></td>
</tr>
<tr>
<td>Sandy Silt, trace clay; dark grayish brown (2.5Y 4/2); well sorted</td>
<td></td>
</tr>
<tr>
<td>At 168.0 to 169.0: No recovery</td>
<td></td>
</tr>
<tr>
<td>Clayey Silt; olive brown (2.5Y 4/3); indistinct laminations of oxidized siltier beds</td>
<td></td>
</tr>
<tr>
<td>At 169.5 to 171.7: Distinct wavy laminations and thin beds of oxidized, fine Silty Sand</td>
<td></td>
</tr>
<tr>
<td>At 170.3: Decomposing wood fragment</td>
<td></td>
</tr>
<tr>
<td>At 172.5 to 172.8: Silty Clay bed, olive brown (2.5Y 4/3)</td>
<td></td>
</tr>
<tr>
<td>At 173.1 to 175.0: Becomes Sandy Silt with some Clay and trace fine gravel, lower contact occurs between runs</td>
<td></td>
</tr>
<tr>
<td>175.0 to 179.0: No recovery</td>
<td></td>
</tr>
</tbody>
</table>

| **OLDER ALLUVIAL FAN / ESTUARINE DEPOSITS [Qfo/Qe]** |
| Clayey Silt with Gravel, clasts 30 to 40%, up to 2 inches, mainly subangular slate (Jsm) and shale (Tm); lower contact is sharp |

**DRILLING COMPANY/DRILLING EQUIPMENT**
Jet Drilling / CME 75

**BOREHOLE LOCATION**
See Plate 3

**DATES DRILLED**

**HOLE DIAMETER**
8 inches

**GROUND EL.**
270 feet

**ELEVATION (ft)**

<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>ML</th>
<th>% RECOVERY</th>
</tr>
</thead>
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<tr>
<td>165</td>
<td>1</td>
<td>3</td>
<td>94</td>
<td>105</td>
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<tr>
<td>170</td>
<td>2</td>
<td>4</td>
<td>80</td>
<td>105</td>
</tr>
<tr>
<td>175</td>
<td>2</td>
<td>5</td>
<td>88</td>
<td>100</td>
</tr>
<tr>
<td>180</td>
<td>2</td>
<td>6</td>
<td>20</td>
<td>95</td>
</tr>
</tbody>
</table>

**GROUNDWATER READINGS**
Encountered at 38 feet.

**HOLE DIAMETER**
8 inches

**GEOLOGIST:** LH/MF

**PREPARED/DATE:** WL/PK 10/14/2011

**CHECKED/DATE:** MW/MF 10/14/2011

**METRO SOIL CORE:** S:\70131 GEOTECH\GINTW\FAULT_INVESTIGATION_WSE_LIBRARY AMEC OCTOBER2011 (2).GLB

**G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.2 FAULT HAZARD INVESTIGATION\3.2 ALL FIELD NOTES\GINT LOGS\101561-TRANSECT 2E.GPJ 10/14/11**
Qfo/Qc Continued
At 180.7': Silt bed (1/3 inch thick); dark reddish brown (5YR 2.5/2); clayey to sandy silt; olive brown (2.5Y 4/4); appears wet and firm to stiff, thin sand and clay interbeds; sandier beds are dark reddish brown (5YR 4/3); occasional beds with trace fine gravel

At 183.0 to 184.0': No recovery

At 186.4': Coarse gravelly layer, mainly slate (Jsm) and shale (Tm)
At 187.1 to 187.5': Grades to fine sand
At 187.4': Sand becomes fine to coarse grained, lower contact occurs between runs
At 187.5 to 189.0': No recovery

Clayey to sandy silt, coarsening downward to sand

At 189.7 to 189.9': Appears very moist to wet and stiff to dense, lower contact is sharp, subhorizontal
At 189.9 to 191.2': Clay; olive brown (2.5Y 4/3); appears very moist and stiff

Clayey silt, olive brown (2.5Y 4/3); appears very moist and stiff; trace gravel (2%), mainly shale (Tm), sandstone (Tm), and slate (Jsm)
At 191.2 to 191.7': Fracture infilled with calcium carbonate

At 195.0 to 195.8': Poorly graded sand, some clay and silt, fine to medium grained, some coarse, trace gravels, fine shale (Tm), sandstone (Tm) and slate (Jsm)

At 195.8 to 196.7': Silty sand, very fine grained; olive brown (2.5Y 4/4); appears very moist and dense
At 196.1 to 199.0 No recovery

END OF BORING AT 199 FEET

NOTES:
Boring backfilled with cement/bentonite grout from bottom up and patched.

- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch). Beds are generally massive unless otherwise noted.

Boring deepened from 149 to 199 on 6/28 to 6/30/11. Location of deepened boring offset south-east approximately 1 foot from original boring location.
6 inches of asphaltic concrete
Hand augered to 6 feet

FILL [AF]
Sandy Clay, brown, some fine to medium sand; appears damp and very stiff

NOTE:
Js = Santa Monica Slate
Tm = Modelo Formation
See end of log for more detailed description of clasts

At 6.0 to 9.0': No recovery; poor recovery in shoe of sampler only

Sandy Silt, trace to some clay, trace to some coarse sand and fine gravel, clasts 2 to 15%, up to ½ inch; dark yellowish brown (10YR 4/4); appears moist and very stiff

OLDER ALLUVIAL FAN DEPOSITS [Qfo]
Clayey to Sandy Silt, trace to some coarse sand and fine gravel, clasts 2 to 15%, up to ¾ inch, mainly slate (Js) and shale (Tm), some basalt, granitic rock, and quartzite also observed; dark brown (10YR 3/3) to brown (10YR 4/3); appears damp to moist and hard; lower contact is gradational
At 14.5 to 16.0': Gravel content increases to 10 to 20%
Clayey Silt with Sand, trace fine gravel (Js and Tm); color variable, mainly brown (7.5YR 5/4); appears moist and very stiff/dense
LAKEWOOD FORMATION [Qlw]

Poorly Graded Sand with Silt, very fine to fine grained, trace coarse sand (mainly Jsm and quartzite); light yellowish brown (2.5Y 6/4); appears damp and dense; lower contact occurs between runs

At 24.0 to 24.4': Becomes gravelly, clasts 10 to 15%, up to ½ inch (mainly Jsm and Tm), variable, some subhorizontal laminations

At 24.4 to 24.8': Marker Bed M₄ Manganese oxide-rich bed, very dark gray (10YR 3/1)

At 24.8 to 26.5': Color change to yellowish brown (10YR 5/6)

Marker Bed M₅ - Silty Sand with Gravel, fine to medium grained, clasts 15 to 20%, up to ¾ inch; mainly slate (Jsm) and quartzite; dark yellowish brown (10YR 3/4) to very dark brown (10 YR 2/2), some manganese flecks; appears moist and dense; lower contact narrowly gradational

At 27.5 to 29.7': Becomes coarser, more gravelly with depth, grades to silty gravel with sand; gravel 60 to 70%; up to 1 inch, mainly quartzite, some slate (Jsm) and shale (Tm) also observed; dark yellowish brown (10YR 4/6) to (10YR 3/4); appears damp to moist and dense

Silty Sand, fine to medium grained, trace fine gravel (Jsm and quartzite); mottled, light yellowish brown (10YR 6/4) to strong brown (7.5Y 5/8); appears very moist; lower contact occurs between runs

At 32.0 to 34.0': No recovery

Silty Sand, fine grained; pale brown (2.5Y 7/3); appears damp to moist and dense; lower contact is gradational

At 35.0 to 36.5': Becomes gravelly, clasts 15 to 20%, up to 1 inch, mainly quartzite and slate (Jsm), some basalt and granitic rock also observed

At 36.5' to 39.0': Gravel decreases to trace, becomes mottled, white (2.5Y 8/1) to yellowish brown (2.5Y 5/6) to strong brown (7.5Y 5/8)

At 39': Groundwater encountered during drilling

Silty Sand to Sandy Silt, very fine grained sand; variable motting and oxidized laminations; grayish brown (2.5Y 5/2) to yellowish brown (10YR 5/8); appears very moist to wet and stiff; lower contact is narrowly gradational

Geologist: DB/MF
Prepared/Date: WL/AR 10/13/2011
Checked/Date: MW/MF 10/13/2011
At 40.8 to 41.0': Strongly oxidized layer (10YR 5/8)

At 43.8 to 44.0': Becomes very lightly cemented, some fine oxidized laminations

At 48.5 to 49.0': Mottling becomes less strong

At 49.0 to 51.4': Small (<1/16 inch) manganese oxide flecks

At 51.3': **Marker Bed MC** - Silt/Clay bed (1 ½ inches thick); dark yellowish brown (10YR 4/6)

**Marker Bed MB**

At 58.7 to 60.0': **Marker Bed MB** - Becomes finer, mainly Sandy Silt, trace calcium carbonate stringers and bivalve shell fragments, shells up to 5%, maximum size ½ inch
SM
ML
Qlw Continued
At 60.7 to 61.0': Indistinct, subhorizontal, wavy laminations with some oxidation
At 61.0': Appears very moist to wet, some clay
At 61.6': Oxidized bed (½ inch thick), dips approximately 15 degrees
Silt and Sandy Silt; very dark gray; appears very moist to wet and medium stiff; trace manganese-oxide flecks; lower contact is sharp

At 64.0 to 65.0': Marker Bed MA - Silty Sand with Gravel, fine grained, clasts 15 to 25%, up to 1½ inch, mainly basalt and slate (Jsm); dark gray (10YR 4/1); appears very moist to wet
SAN PEDRO FORMATION [Qsp]
Sandy Silt, trace to some clay, occasional sand laminations; very dark gray (2.5Y 3/1); appears very moist and stiff; lower contact is gradational
At 65.3': Sand lamination, appears to dip 10 degrees
At 65.8': Detrital charcoal (sample collected)
At 66.5': Root fragment (sample collected)
Silty Sand, fine grained; gray (N6); appears damp and dense; well cemented (calcium carbonate); abundant bivalve shell fragments and casts, shell fragments up to 10%, most <¼ inch, one intact half-shell is ¾ inch
Refusal at 69.0' on cemented layer
END OF BORING AT 69 FEET
NOTES:
Boring backfilled with cement/bentonite grout from bottom up and patched.
-Munsell colors listed in order of predominance (most predominant color first).
-Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
-Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
-Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
-The term "clasts" herein describes gravel-size rock fragments (larger than 1/4 inch).
Hand augered to 6 feet

**NOTE:**
- Jsm = Santa Monica Slate
- Tm = Modelo Formation
- See end of log for more detailed description of clasts

**FILL [Af]**
Silty Clay, trace coarse sand and fine gravel (Jsm and Tm); dark yellowish brown (10YR 4/4); appears moist and very stiff
At 7': Becomes more sandy/gravelly

**LAKEWOOD FORMATION [Qlw]**
Silty Sand to Sandy Silt, very fine grained; light yellowish brown (2.5Y 6/3); appears dry and dense to very stiff
At 8.5 to 9.0': Grades to Sandy Silt, becomes lightly cemented/cohesive
Silty Sand, very fine grained, pale brown (2.5Y 7/4), generally massive, well sorted; with rare yellowish brown (10YR 5/8) mottling; appears dry and dense; lower contact is gradational; upper contact occurs between runs
At 20.0 to 20.2': Manganese oxide-rich bed, very dark gray (10YR 3/1)

At 21.7 to 22.1': Grades to fine Silty Sand; pale brown (10YR 7/3)

At 24.5 to 25.0': Marker Bed ME - Manganese oxide-rich bed; very dark gray (10YR 3/1)

At 25.0 to 25.7': Coarse sand and gravel increase, gravel 5 to 10%, up to ½ inch, mainly slate (Tm), slate (Jsm) and quartzite

At 25.7 to 26.3': Becomes heavily oxidized, strong brown (7.5YR 5/8)

At 27.8 to 28.2': Gravel increases, 10 to 15%, up to ½ inch, mainly slate (Jsm) and quartzite

At 28.2 to 28.5': Poorly Graded Sand with Silt, fine to coarse grained, trace fine gravel (Jsm and Tm); lightly mottled; yellowish brown (10YR 5/8) to yellow (2.5Y 7/6); appears dry to damp and dense; lower contact occurs between runs

At 28.5 to 29.0': Silty Gravel, clasts 60 to 75%, most <3/4 inch, maximum 2 inches, mainly subrounded to subangular slate (Jsm), shale (Tm), quartzite and basalt; soil matrix is fine to medium silty sand; brownish yellow (10YR 6/6); appears dry and dense

At 30.8 to 31.3': Silty Sand, fine to medium grained; pale brown (2.5Y 7/4), some oxidized yellowish brown (10YR 6/6) laminations

At 31.5': Gravel decreases to about 50%, color is pale brown (2.5Y 7/3)

At 35.0 to 36.5': No recovery

At 37.1 to 37.4': Silty Sand; very fine grained, pale brown (2.5Y 8/3); appears dry and dense; some cemented zones/lenses

At 37.4 to 37.5': Color changes to pale brown (2.5Y 7/3)

At 38.0 to 38.9': Grades to Poorly Graded Sand with Silt, fine grained, very pale brown (10YR 7/4)

At 38.9 to 39.5': Silty Sand, very fine grained, occasional sandy silt lenses; variable mottling, light gray (2.5Y 7/2) to brownish yellow (10YR 6/8) to strong brown (7.5YR 5/8); mottling occurs as irregular zones or sub-horizontal laminations; appears damp and dense; generally massive and well sorted; lower contact is sharp, wavy
At 38.9 to 40.2': Slightly cemented Qlw Continued

At 42.5 to 42.8': Clayey Silt; mottled, brown (10YR 4/3) to strong brown (7.5YR 5/8); appears moist and stiff

At 44.5 to 48.5': Variable irregular, sub-horizontal oxidized laminations

At 47.5 to 48.5': Appears moist

At 49.0 to 50.4': Grades to fine Silty Sand to Sandy Silt; trace manganese oxide-rich flecks and laminations

At 50.5': Marker Bed MC - Clay bed (1½ inches thick); dark yellowish brown (10YR 4/6); upper and lower contacts sharp, wavy, subhorizontal
Silty Sand, very fine grained, occasionally grades to Sandy Silt; lightly mottled, yellowish brown (10YR 5/6) to light gray (5Y 7/2); appears moist and dense; variable subhorizontal laminations; lower contact appears sharp (not intact)

At 52.5 to 54.0': Appears damp, yellow (10YR 7/6) to yellowish brown (10YR 5/6)

At 58.8 to 59.6': Marker Bed MB - Trace calcium carbonate filaments and bivalve shell fragments, shells ≤5%, up to 1/8 inch
At 59.0 to 62.5': Becomes finer (mainly Sandy Silt)
At 62': Groundwater encountered during drilling
Silt and Sandy Silt; light olive brown (2.5Y 5/3); appears very moist and very stiff;
lower contact occurs between runs

At 62.8': Silt bed (1 inch thick); strongly oxidized, subhorizontal
At 63.2 to 63.4': Oxidized fracture dips about 50 degrees

Marker Bed M1 - Silty Sand and Sandy Silt with Gravel, fine grained; clasts 15 to 20%,
up to 2 inches, mainly rounded sandstone (Tm), quartzite, mafic igneous rock,
and subangular slate (Jsm); gray (2.5Y 5/1); appears very moist to wet and dense/stiff;
lower contact occurs between runs
At 65.0 to 69.0': No recovery

Depth of contact uncertain due to poor recovery

SAN PEDRO FORMATION [Qsp]
Poorly Graded Sand; fine to medium grained, trace gravel (Jsm) and silt nodules; gray
(2.5Y 6/1); appears very moist to wet and dense
At 70.0 to 74.0': No recovery

END OF BORING AT 74 FEET

NOTES:
Boring backfilled with cement/bentonite grout from bottom up and patched.
-Munsell colors listed in order of predominance (most predominant color first).
-Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
-Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
-Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
-The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch).
-Beds are generally massive unless otherwise noted.
10½ inches of Asphaltic Concrete over 6 inches of base

Hand augered to 6 feet

OLDER ALLUVIAL FAN DEPOSITS [Q6]
Sandy to Clayey Silt, trace to some coarse sand and fine gravel (Jsm and Tm); dark yellowish brown (10YR 5/6); appears very moist

NOTE:
Jsm = Santa Monica Slate
Tm = Modelo Formation
See end of log for more detailed descriptions of clasts
Moisture, and colors described are affected by rotary was fluids

ESTUARINE DEPOSITS [Qe]
Sandy Silt, trace clay, trace coarse sand (Jsm and Tm); yellowish brown (10YR 5/6); appears moist and very stiff; well sorted; trace roots structures with open voids and manganese-oxide, some fine pores (<1/32 inch)

At 10.2 to 11.1': Appears damp; brownish yellow (10YR 6/6)

At 11.1 to 12.5': Becomes mottled, color variable, mainly brown (7.5YR) to light yellowish brown (10YR 6/4); abundant bioturbation (root structures), some with manganese-oxide or iron-oxide staining, abundant black, decayed root remnants, fine pores (<1/32 inch)

Paleosol - Marker Bed Mg
Clayey Silt to Silty Clay, trace to some sand; mottled, brown (7.5YR 4/3) to dark grayish brown (10YR 4/2) to reddish brown (5YR 4/3); appears damp to moist and very stiff; moderate ped development with subangular blocky structure, some clay films; some fine, random and vertically oriented root structures

At 15.5 to 17.2': Weathering zone, gradational transition to Lakewood Formation below

LAKEWOOD FORMATION [Q6]
Silty Sand to Sandy Silt, fine grained, trace clay; mottled, light yellowish brown (2.5Y 6/3) to dark yellowish brown (10YR 4/6); appears wet and dense/stiff; well sorted
At 19.0 to 23.0': No recovery

MTA Westside Subway Extension
Los Angeles, California

Geologist: DB/MF
Prepared/Date: WL/AR 10/13/2011
Checked/Date: MW/MF 10/13/2011

LOG OF BORING
Project No.: 4953-10-1561 Figure: T3-B3a
**Silty Sand, very fine grained; mottled, light yellowish brown (2.5Y 6/3) to strong brown (7.5YR 5/8); appears very moist and dense; trace bivalve shell fragments and calcium carbonate filaments, shells up to ¼ inch, lower contact occurs between runs**

At 25.6 to 26.3': **Marker Bed MF** - Shell bed, abundant shell fragments, shells 25 to 35%, up to ½ inch

At 26.3 to 26.8': Shells decrease to less than 5%; some calcium carbonate cementation of soil matrix

At 26.8 to 28.0': No recovery

**Poorly Graded Sand with Silt, fine to medium grained; strongly mottled brown (2.5Y 5/4) to yellowish brown (10YR 5/8); appears very moist and dense; variable manganese oxide staining, lower contact occurs between runs**

At 31.4 to 32.0': **Marker Bed M_e** - Manganese oxide-rich bed

At 32.0 to 33.0': No recovery

At 33.8 to 34.2': Distinct subhorizontal laminations

At 35.0 to 37.0': Mottling less distinct, less oxidized, pale brown (2.5Y 7/3) to gray (10YR 5/1)

At 37.0 to 38.0': No recovery

**Marker Bed M_g** - Silty Gravel with Sand, clasts 50 to 70%, up to 1 inch, mainly subangular to subrounded slate (Jsm), shale (Tm), sandstone (Tm), quartzite and metabasalt; soil matrix is fine to coarse silty sand; color highly variable, abundant iron-oxide and manganese-oxide staining; appears wet and dense; matrix occasional grades to fine to coarse well graded sand with silt; lower contact occurs between runs

At 38.0 to 38.5': Gravel becomes coarser, some clasts up to 1½ inches
<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
<th>DRILLING COMPANY/DRILLING EQUIPMENT</th>
<th>SAMPLE LOC.</th>
<th>DRILLING METHOD</th>
<th>BOREHOLE LOCATION</th>
<th>DATES DRILLED</th>
<th>HOLE DIAMETER</th>
<th>GROUND EL.</th>
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<td>235</td>
<td></td>
<td>2</td>
<td>8</td>
<td>80</td>
<td>Gregg's Drilling / B53 Modelo</td>
<td>GM</td>
<td>Rotary Wash</td>
<td>See Plate 3</td>
<td>4/11/11</td>
<td>8 inches</td>
<td>275.6 feet</td>
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<td>45</td>
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<td>3</td>
<td>9</td>
<td>73</td>
<td>Silty Sand, very fine to fine grained, rare (&lt;1%) coarse sand and fine gravel (JsM and Tm); occasionally grades to fine Poorly Graded Sand with Silt; light yellowish brown (2.5Y 6/4); appears very moist and dense; well sorted; lower contact is gradational</td>
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<td>At 41.5 to 42.0': Gravel becomes coarse; some clasts up to 2 inches</td>
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<td>At 42.0 to 43.0': No recovery</td>
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<tr>
<td>220</td>
<td></td>
<td>3</td>
<td>10</td>
<td>100</td>
<td>Silty Sand, fine grained; mottled, yellowish brown (10YR 5/6) to grayish brown (10YR 5/2); appears very moist and dense; well sorted; lower contact is gradational</td>
<td>SM</td>
<td></td>
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<tr>
<td>215</td>
<td></td>
<td>3</td>
<td>11</td>
<td>100</td>
<td>At 53.0 to 53.2': Granitic clast, full width of core, likely cobble (&gt;3&quot;)</td>
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<tr>
<td>210</td>
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<td>At 53.7 to 54.5': Strong brown (7.5YR 5/8) mottling</td>
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<td>0</td>
<td>At 58.0 to 58.2': Marker Bed M_c - Clay bed, (2 inches thick); dark grayish brown (10YR 4/2); appears very moist and very stiff; lower contact is narrowly gradational</td>
<td></td>
<td></td>
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<tr>
<td>200</td>
<td></td>
<td>3</td>
<td>11</td>
<td>100</td>
<td>Silty Sand, very fine grained; strongly mottled, grayish brown (7.5YR 5/6) to strong brown (7.5YR 5/6); appears very moist and dense/stiff; well sorted; micaceous; lower contact is sharp</td>
<td>SM</td>
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<tr>
<td>195</td>
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<td>0</td>
<td>At 59.0': Strong brown color becomes dominant, less dark grayish brown</td>
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*Note: This record is an interpretation of subsurface conditions at the exploration location. Latitude and longitude of boring location shown on logs are approximate.*

**SM**  
Qlw Continued

At 62.5 to 63.0': Some manganese oxide flecks

At 64.7': Becomes lightly mottled, yellowish brown (10YR 5/4) to gray (10YR 6/1)

Silty Sand and Sandy Silt, sand very fine grained; strongly mottled, yellowish brown (10YR 5/8) to gray (10YR 6/1); appears moist and dense; variable calcium carbonate filaments and very small bivalve(?) shell fragments, shells <1/16 inch, total calcium carbonate 2 to 15%; lower contact is sharp

At 68.2 to 68.4': **Marker Bed MB** - Very hard, well cemented (calcium carbonate) bed, numerous bivalve shells in lower ½ inch of bed, shell fragments up to ½ inch, total calcium carbonate up to 40%

At 71.1': Becomes dark gray (5Y 4/1); trace soft, deteriorated, bivalve shell fragments, shells up to ¼ inch, total calcium carbonate <2%

At 71.7 and 72.4': Detrital charcoal

SAN PEDRO FORMATION (Qsp)
Silty Sand, fine-grained, trace coarse sand and fine gravel (Jsm and Tm); gray (2.5Y 5/1); appears very moist and dense; lower contact is sharp

At 74.7': Quartzite clast, 2 inches in size, subrounded

At 74.9 to 75.5': Poorly Graded Sand with Silt, fine grained, light gray (2.5Y 7/1)

CL/CH

At 76.2': **Clay**, black (5Y 2.5/1); appears moist and hard; some 1½ inch partially cemented nodules; upper 1 inch is dark olive gray (5Y 3/2); exhibits waxy parting surfaces

END OF BORING AT 78 FEET

**NOTES:**
Boring backfilled with cement/bentonite grout from bottom up and patched.
-Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch).
- Beds are generally massive unless otherwise noted.
Asphaltic concrete over base
Hand augered to 6 feet

**NOTE:**
Jsm = Santa Monica Slate
Tm = Modelo Formation
See end of log for more detailed description of clasts

<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
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<td>270</td>
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<td>1</td>
<td>2</td>
<td>100</td>
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<tr>
<td>265</td>
<td>15</td>
<td>1</td>
<td>3</td>
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<td>20</td>
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<td>1</td>
<td>4</td>
<td>100</td>
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</table>

**OLDER ALLUVIAL DEPOSITS [Qo]**
Clayey to Sandy Silt, trace to some coarse sand and fine gravel; dark grayish brown (10YR 4/2); appears damp and stiff

**ESTUARINE DEPOSITS [Qe]**
Silty Sand and Sandy Silt, fine grained, trace to some clay, trace coarse sand and fine gravel (Jsm and Tm); light yellowish brown (10YR 6/4); appears dry and hard/dense; well sorted; lower contact occurs between runs

At 11.3 to 12.6': Grades to fine Silty Sand

Sandy Silt, trace to some clay, trace coarse sand and fine gravel (Jsm and Tm); yellowish brown (10YR 5/4); appears dry and hard; well sorted; lower contact is erosional
At 12.6 to 13.2': Some irregular strongly oxidized mottling, yellowish red (5YR 5/8)
At 14.0 to 15.0': Abundant bioturbation (fine vertical root structures +/- burrows), some with open voids up to 1/8 inch, some with strongly oxidized, yellowish red (5YR 5/8) staining or infill; some fine spherical pores (<1/32 inch)
At 15.0 to 20.2': Abundant bioturbation (vertical and random root structures +/- burrows), up to 1/16 inch diameter, most are open voids, some with black manganese-oxide staining, some fine spherical pores (<1/32 inch); general color is brown (7.5YR 5/4), some gray (10YR 6/1) mottling/staining, especially around root structures
**Paleosol - Marker Bed M<sub>C</sub>** - Clayey Silt to Silty Clay, trace to some sand; mottled, brown (7.5YR 4/4) to reddish brown (5YR 4/4) to dark grayish brown (10YR 4/2); appears damp to moist and very stiff; moderate ped development with subangular blocky structure, some clay films; lower contact is gradational

At 23.0 to 24.5': Weathering zone, gradational transition to Lakewood Formation below

**Lakewood Formation [Qlw]**

Silty Sand and Sandy Silt, fine grained sand; lightly mottled, brownish yellow (10YR 6/6) to light gray (2.5Y 7/2); appears dry to damp and very stiff/dense; well sorted; variable bioturbation (irregular root structures) up to 1/16 inch diameter, most with iron or manganese oxide infill/staining, some open voids, some fine spherical pores (<1/16 inch), lower contact occurs between runs

At 25.5 to 29.0': Color change to pale brown (2.5Y 7/4) with slight to moderate yellow (10YR 7/8) mottling

At 29.0 to 29.8': Color becomes yellow (10YR 7/6)

At 30.5 to 31.0': Some indistinct oxidized laminations defined by variable oxidation

**Silty Sand** - fine grained; slightly mottled, pale brown (2.5Y 8/3) to yellow (10YR 7/8); appears dry to damp and dense; lower contact is gradational

At 32.2 to 33.0': **Marker Bed M<sub>E</sub>** - Abundant shell fragments (primarily bivalves) and calcium carbonate flecks, shells 10 to 20%, most <¼ inch, max ¾ inch

**Poorly Graded Sand with Silt** - fine to medium grained; lightly mottled, pale brown (2.5Y 8/3) to yellow (10YR 7/8); appears dry and dense; lower contact occurs between runs

At 34.0 to 35.0': Trace shell fragments up to ¼ inch

At 38.0 to 38.5': Trace shell fragments up to ¼ inch

At 38.8 to 39.0': Some dispersed manganese-oxide

At 39.0 to 41.5': No recovery
Silty Sand, fine grained, trace coarse sand and fine gravel (Jsm and Tm); yellowish brown (10YR 5/4); appears dry and dense; lower contact is narrowly gradational

At 42.0 to 42.5': Marker Bed ME - Manganese oxide-rich bed; irregular, wavy, laminar; dark grayish brown (10YR 4/2) to light yellowish brown (2.5Y 6/4); appears damp and dense

Poorly Graded Sand, fine to medium grained, trace to some coarse sand and gravel (Jsm and Tm); variable mottling, white (2.5Y 8/1) to strong brown (7.5YR 5/8); appears dry to damp and dense; lower contact occurs between runs

At 43.5 to 43.7': Sub-horizontal, strongly oxidized layer

At 43.7 to 44.0': Mafic/magnesium oxide-stained sand laminations common

At 44.0 to 46.0': Alternating beds of sand similar to above and gravel similar to below, 4 to 6 inches typical thickness, gradational transition to unit below

Marker Bed MD - Silty Gravel with Sand; clasts 50 to 70%, up to 2½ inches, mainly rounded to subrounded meta-basalt, quartzite and slate (Jsp), some sandstone (Tm); soil matrix is fine to coarse silty sand; light yellowish brown (10YR 5/4); appears dry to damp and dense; lower contact appears sharp

At 47.5 to 48.0': Soil matrix grades to Sandy Silt

At 48.0 to 49.0': No recovery

Silty Sand, fine, trace to some coarse sand and fine gravel clasts 2 to 10%, up to ½ inch (Jsm); pale brown (2.5Y 7/3); appears dry to damp and dense; well sorted; lower contact is 2 inch clay bed at 63.0'

At 50.0 to 51.5': No recovery

At 52.5 to 53.5': Becomes gravelly, clasts 20 to 40%, up to 1½ inches, mainly meta-basalt, quartzite and slate (Jsm)

At 55.5 to 59.5': Becomes moist to very moist, slightly mottled, light olive brown (2.5Y 5/6) to yellowish brown (10YR 5/8) to gray (2.5Y 6/1)
Qlw Continued
At 60.5 to 63.0': Oxidized iron laminations common, generally subhorizontal

At 63.0 to 63.2':
- Marker Bed MC - Clay bed, (2 inches thick); dark grayish brown (10YR 4/2); appears moist and very stiff; upper and lower contacts are sharp, wavy, subhorizontal
- Silty Sand and Sandy Silt, very fine grained; slightly mottled, light olive brown (2.5Y 5/4) to yellow (2.5Y 7/6); appears dry and dense/very stiff; well sorted

At 63.2 to 63.5': Very fine Silty Sand; pale brown (2.5Y 7/3); appears dry and dense

At 64.8 to 68.1': Becomes moist; yellowish brown (10YR 5/6) to pale brown (10YR 6/3); uniform subhorizontal oxidized laminations

At 68.1': Appears dry to damp, color yellow (10YR 7/6) to pale brown (2.5Y 8/3) to reddish yellow (7.5YR 6/6)

Silty Sand, fine grained, mottled, yellowish brown (10YR 5/6) to gray (2.5Y 5/1); appears moist and dense; variable subhorizontal, oxidized laminations; lower contact is gradational

At 71.5 to 74.0': Mottling and laminations absent to infrequent, color light yellowish brown (10YR 7/4)

At 73.5':
- Marker Bed M6a - Sandy Silt; pale brown (2.5Y 7/4); appears damp and very stiff; abundant bivalve shells and shell fragments, shells 10 to 25%, up to ¾ inch, at least one intact bivalve shell, ½ inch

END OF BORING AT 74 FEET

NOTES:
Boring backfilled with cement/bentonite grout from bottom up and patched.

- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch).
- Beds are generally massive unless otherwise noted.
**Hand augered to 6 feet**

**NOTE:**

Jsm = Santa Monica Slate

Tm = Modelo Formation

See end of log for more detailed description of clasts

**OLDER ALLUVIAL FAN DEPOSITS [Qfo]**

Sandy to Clayey Silt, trace coarse sand (Jsm and Tm), dark brown (7.5YR 3/4); appears dry to damp and hard; lower contact is gradational

**ESTUARINE DEPOSITS [Qe]**

Sandy Silt, trace to some clay, trace coarse sand and fine gravel (Jsm and Tm), occasional clayey silt beds; yellowish brown (10YR 5/4); appears dry and hard; well sorted; lower contact is narrowly gradational

At 9.0 to 10.4': Silty Sand, very fine grained, trace coarse sand (Jsm and Tm); yellowish brown (10YR 5/6); appears dry and dense; upper and lower contacts are narrowly gradational

At 12.5 to 14.0': No recovery

At 14.0 to 14.8': Silty Sand; very fine grained, trace coarse sand and fine gravel (Jsm and Tm); yellowish brown (10YR 5/6); appears dry and dense; upper and lower contacts are narrowly gradational

At 14.8 to 17.5': Becomes dark yellowish brown (10YR 4/4); appears damp

At 17.5 to 22.5': Becomes mottled, generally brown (7.5YR 4/4) with gray (2.5Y 6/1); appears dry to damp; some bioturbation (vertical and random root structures, +/- burrows), gray staining common around root structures, occasional subhorizontal laminations

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**Log of Boring**

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<tr>
<th>BORING NO.</th>
<th>T3-B5</th>
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**Geologist:** DB/MF  
**Prepared/Date:** WL/AR 10/13/2011  
**Checked/Date:** MW/MF 10/13/2011

**MTA Westside Subway Extension**  
**Los Angeles, California**
Paleosol - Marker Bed M<sub>C</sub> - Clayey Silt, trace to some sand; lightly mottled, dark grayish brown (10YR 4/2) to reddish brown (5YR 5/4); appears damp and hard; some faint subhorizontal laminations; weak ped development; some clay films; lower contact appears gradational (not intact)

At 25.5 to 26.4': Appears damp to moist and very stiff

At 26.4 to 27.5': Weathering zone, gradational transition to Lakewood Formation below

LAKewood Formation [Q<sub>lw</sub>]

Silty Sand and Sandy Silt; very fine-grained, mottled, pale brown (2.5Y 8/3) to yellow (10YR 7/8); appears dry to damp and dense/very stiff; well sorted; occasional subhorizontal oxidized laminations; lower contact occurs between runs

Silty Sand, fine grained, trace coarse sand; brownish yellow (10YR 6/6) with occasional light gray (2.5Y 7/2) mottling; appears dry and dense; well sorted; subhorizontal laminations, lower contact appears narrowly gradational (not intact)

At 35.0 to 36.5': No recovery

Note: Marker Bed M<sub>P</sub> not observed. (shell bed). Possibly occurs in non-recovery zone above based on stratigraphic position in other borings.
### LOG OF BORING

**MTA Westside Subway Extension**  
Los Angeles, California

<table>
<thead>
<tr>
<th>Sample Location</th>
<th>Description</th>
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<tbody>
<tr>
<td>Qw Cont.</td>
<td>Poorly Graded Sand with Silt, fine-grained; pale brown (2.5Y 8/2) to yellow (10YR 7/8); appears dry and dense; variable subhorizontal laminations; lower contact appears sharp.</td>
</tr>
<tr>
<td>At 41.8 to 42.0'</td>
<td>Manganese oxide-rich bed; pale brown (2.5Y 7/4) to dark gray (10YR 4/1)</td>
</tr>
<tr>
<td>At 42.5 to 43.0'</td>
<td>Marker Bed Me - Manganese oxide-rich laminations alternate with oxidized laminations; light yellowish brown (2.5Y 6/3) to dark yellowish brown (10YR 4/6) to pale brown (2.5Y 8/3).</td>
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<tr>
<td>At 43.5 to 44.0'</td>
<td>Distinct lenses defined by variable oxidation</td>
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<td>Marker Bed Me - Silty Sand</td>
<td>fine-grained; trace to some clay, variable coarse sand and fine gravel, clasts 2 to 20%, moist &lt;½ inch, maximum 1½ inches, mainly subangular slate (Jsp) and subrounded quartzite, meta-basalt and shale (Tm); brown (10YR 5/3); appear dry and stiff; lower contact occurs between runs</td>
</tr>
<tr>
<td>At 45.5 to 46.5'</td>
<td>No recovery</td>
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<tr>
<td>At 47.5 to 48.0'</td>
<td>Subhorizontal laminations</td>
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<tr>
<td>At 48.0 to 49.0'</td>
<td>No recovery</td>
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<tr>
<td>Silty Sand with Gravel</td>
<td>very fine grained, clasts 15 to 35%, up to 2 inches, mainly subangular slate (Jsm) and subrounded quartzite, meta-basalt and shale (Tm); yellow (10YR 7/6); appears dry and dense</td>
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<tr>
<td>At 50.5 to 51.5'</td>
<td>No recovery</td>
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<tr>
<td>At 52.0 to 52.5'</td>
<td>Soil matrix becomes Sandy Silt; light gray (10YR 7/2)</td>
</tr>
<tr>
<td>At 52.5 to 54.0'</td>
<td>Becomes mottled, very pale brown (10YR 7/3) to yellow (10YR 7/6)</td>
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<td>Refusal at 54.0'</td>
<td>on gravel/cobbles</td>
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**Groundwater Readings**

Not encountered during drilling.

**Drilling Details**

**Drilling Equipment**

Jet Drilling / CME 75

**Drilling Method**

Hollow Stem Auger

**Dates Drilled**

3/9/11

**Sample Locations**

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<td>72%</td>
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<td>68%</td>
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**Groundwater Readings**

Not encountered during drilling.

**Notes**

- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch).
- Beds are generally massive unless otherwise noted.

**Geologist**

DB/MF

**Prepared/Date**

WL/AR 10/13/2011

**Checked/Date**

MW/MF 10/13/2011

**Project No.** 4953-10-1561  
**Figure:** T3-B5c
<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
<th>SAMPLE LOC.</th>
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<tr>
<td></td>
<td>270</td>
<td>5</td>
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<td></td>
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<tr>
<td></td>
<td>265</td>
<td>10</td>
<td>1</td>
<td>100</td>
<td></td>
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<tr>
<td></td>
<td>260</td>
<td>15</td>
<td>1</td>
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<tr>
<td></td>
<td>20</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

9 inches of asphaltic concrete over 3 inches of base
Grab sample collected at 2' and 4'
Hand augered to 6 feet

FILL [Af]
Silty Sand with Gravel, fine-grained, 15 to 25%, up to ¾ inch, dark brown (10YR 3/3); appears damp

ESTUARINE DEPOSITS [Qe]
Clayey Silt with fine Sand, trace to some coarse sand and fine gravel, mainly subangular slate (Jsm) and subrounded shale (Tm); dark yellowish brown (10YR 4/4); appears very moist

Clay, trace coarse sand (Jsm); brown (7.5YR 4/2); appears moist and very stiff; lower contact gradational

Clayey Silt, trace to some fine sand, trace coarse sand and gravel (Jsm and Tm); mottled, brown (7.5YR 4/3) to strong brown (7.5YR 4/6) to gray (2.5Y 6/1); appears damp and hard; lower contact is narrowly gradational

Silty Clay to Clayey Silt, trace to some fine sand, trace coarse sand and fine gravel (Jsm and Tm); lightly mottled (7.5YR 3/2) to strong brown (7.5YR 4/6); appears damp and hard; coarsens gradually with depth; lower contact is gradational

NOTE:
JSM = Santa Monica Slate
Tm = Modelo Formation
See end of log for more detailed descriptions of clasts

OLDER ALLUVIAL FAN/ESTUARINE DEPOSITS [Qfo/Qe]
Sandy to Clayey Silt, trace to some coarse sand and gravel, clasts 5 to 20%, up to ¾ inch, mainly subangular slate (Jsm) and subrounded shale and fine sandstone (Tm); appears damp and hard; coarsens with depth, lower contact is gradational

At 18.4 to 18.6': Gravelly bed, gravel 25 to 40%, up to ¾ inch, mainly subrounded fine sandstone (Tm), some subangular slate (Jsm)
At 19.0 to 20.4': Gravel content decreases to <5%, gradational transition to unit below
### ESTUARINE DEPOSITS [Qe]

- Sandy to Clayey Silt, trace coarse sand (Jsm and Tm); lightly mottled, generally brown (7.5YR 4/3 to strong brown (7.5YR 4/6), with occasional gray (10YR 5/1); appears moist and very stiff; well sorted; occasional root structures or other bioturbation with gray staining.

- At 22.7 to 23.1': Clayey Sand with Gravel; fine to coarse grained, clasts 30 to 40%, up to ¾ inch. mainly subangular shale (Jsp) and subrounded fine sandstone (Tm).

- Sandy Silt with Clay, trace coarse sand (Jsm and Tm); mottled, brown (7.5YR 4/3 to dark grayish brown (10YR 4/2); appears wet and soft to medium stiff; some manganese oxide staining.

- At 24': Groundwater encountered during drilling.

- Silty Sand, fine grained, trace to some clay, dark yellowish brown (10YR 4/4); appears wet and medium dense; trace manganese oxide staining; well sorted; lower contact occurs between runs.

- At 26.7 to 27.2': Coarse Sand and Gravel content increases, gravel 10 to 20%, up to ½ inch, mainly subangular slate (Jsm) and subrounded fine sandstone (Tm); lower contact occurs between runs.

- At 27.2 to 29.0': No recovery.

- Contact depth uncertain due to poor recovery.

- Clayey Sand with Gravel, fine to coarse grained, gravel 30 to 40%, up to 1 inch, mainly angular to subangular slate (Jsm), and subangular to subrounded fine sandstone (Tm) and quartzite.

- At 30.5 to 31.0': Silty Clay; lightly mottled, dark yellowish brown (10YR 4/2) to dark yellowish brown (10YR 4/6); appears wet and soft; upper and lower contacts are sharp.

- At 31.0 to 31.6': Silty Sand, fine-grained; lightly mottled, brown (7.5YR 4/3) to strong brown (7.5YR 5/6); appears wet and medium dense; lower contact appears erosional.

- Sandy to Clayey Silt, trace coarse sand and fine gravel (Jsm and Tm); strongly mottled, gray (2.5Y 6/1) to yellow (2.5Y 7/6) to strong brown (7.5YR 5/8); appears very moist and very stiff; occasional manganese oxide staining; lower contact is gradational.

- At 32.2 to 34.0': No recovery.

- At 34.0 to 37.0': Distinct varve-like bedding.

- At 39.5 to 40.0': Slightly finer, mainly clayey silt, gradational transition to beds below.

### GROUNDWATER READINGS

Encountered at 24 feet during drilling.

- Groundwater encountered at 22.7 to 23.1'.
- Groundwater encountered at 24'.
- Groundwater encountered at 26.7 to 27.2'.
- Groundwater encountered at 34.0 to 37.0'.

---

**MTA Westside Subway Extension**

**Los Angeles, California**

**Geologist:** DB/MW/MF

**Prepared/Date:** WL/AR 10/13/2011

**Checked/Date:** MW/MF 10/13/2011

**LOG OF BORING**

**Project No.: 4953-10-1561**

**Figure:** T3-B6b
**ESTUARINE DEPOSITS - FINE GRAINED [Qef]** *(possible sag pond deposits?)*

<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
<th>SAMPLE LOC.</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>230</td>
<td>45</td>
<td>3</td>
<td>9</td>
<td>100</td>
<td>CL</td>
<td>Qe Continued Clayey Silt and Silty Clay, variable fine sand, occasionally grades to sandy silt, trace coarse sand and fine gravel (Jsm and Tm); mottled, strongly oxidized reddish brown (5YR 4/4) to strong brown (7.5YR 5/6); appears moist and stiff; occasional manganese oxide staining; possible weak soil development; lower contact is gradational</td>
</tr>
<tr>
<td>225</td>
<td>50</td>
<td>3</td>
<td>10</td>
<td>100</td>
<td>SM/ML</td>
<td>Silty Sand to Sandy Silt, fine grained, trace to some clay; mottled, dark yellowish brown (10YR 4/6) to light yellowish brown (2.5Y 6/3); appears very moist and medium dense/medium stiff; well sorted; variable subhorizontal bedding, some oxidized laminations and varve-like bedding; some manganese oxide staining; lower contact occurs between runs</td>
</tr>
<tr>
<td>220</td>
<td>55</td>
<td>4</td>
<td>12</td>
<td>100</td>
<td>CL</td>
<td>Poorly Graded Sand with Silt, fine to medium grained, dark yellowish brown (10YR 3/4); appears wet and dense; lower contact is sharp, erosional, black, manganese oxide stained sand layer (½ inch thick) at contact</td>
</tr>
<tr>
<td>220</td>
<td>55</td>
<td>4</td>
<td>13</td>
<td>88</td>
<td>CL</td>
<td>ESTUARINE DEPOSITS - FINE GRAINED [Qef] Silty Clay, variable fine to coarse sand; strongly mottled; grayish brown (2.5Y 5/2) to strong brown (7.5YR 5/8) to very dark gray (7.5Y 3/1); appears very moist to wet and stiff; numerous subhorizontal laminations exhibit above colors, very dark gray layers appear organic rich, also possible black manganese oxide staining, lower contact occurs between runs At 51.5 to 52.3°: Poorly Graded Sand with Silt bed, similar to bed at 49.0 to 49.9°, up to 1 inch of black manganese oxide-stained sand at lower contact, contact erosional, appears to dip 10 to 15°</td>
</tr>
<tr>
<td>220</td>
<td>55</td>
<td>4</td>
<td>14</td>
<td>100</td>
<td>CL</td>
<td>Clay, variable silt and fine sand; trace coarse sand; strongly mottled, dark yellowish brown (10YR 3/4) to gray (N5) to brown (7.5YR 4/4); appears very moist and very stiff; occasional manganese oxide flecks At 59.0 to 59.3°: Calcium carbonate occurs as filaments and uncemented nodules up to 3/4 inch, calcritions up to ½ inch, total calcium carbonate up to about 15% of soil mass At 59.3 to 64.0°: Trace widely scattered calcium carbonate filaments</td>
</tr>
<tr>
<td>220</td>
<td>55</td>
<td>4</td>
<td>15</td>
<td>100</td>
<td>CL</td>
<td></td>
</tr>
</tbody>
</table>

**LOG OF BORING**

MTA Westside Subway Extension
Los Angeles, California

Geologist: DB/MW/MF
Prepared/Date: WL/AR 10/13/2011
Checked/Date: MW/MF 10/13/2011

Project No.: 4953-10-1561  Figure: T3-B6c
At 61.0 to 63.5': Mottling becomes less distinct

At 63.5 to 64.0': Evenly spaced, oxidized laminations

At 64.3 to 65.7': Strongly mottled, reddish brown (5YR 4/3) to brown (7.5YR 5/4), abundant manganese-oxide in flecks or irregular concentrations

At 65.7 to 74.0': Variable colors and strength of mottling, colors mainly brown (7.5YR 4/4) to very dark grayish brown (10YR 3/2) to grayish brown (10YR 5/2) to reddish brown (5YR 4/4)

At 74 to 75': No sampling

**Lakewood Formation (Qw)**

Poorly Graded Sand with Silt, fine to medium grained; light olive brown (2.5Y 4/6); appears very moist to wet and dense; slight oxidized mottling
**LOG OF BORING**

**MTA Westside Subway Extension**

Los Angeles, California

---

<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
<th>SAMPLE LOC.</th>
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<tbody>
<tr>
<td>190</td>
<td>85</td>
<td>6</td>
<td>2</td>
<td>22</td>
<td>SP</td>
</tr>
<tr>
<td>185</td>
<td>90</td>
<td>6</td>
<td>3</td>
<td>78</td>
<td>SM</td>
</tr>
<tr>
<td>180</td>
<td>95</td>
<td>7</td>
<td>4</td>
<td>34</td>
<td>SP-SM</td>
</tr>
<tr>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SM</td>
</tr>
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</table>

**DRILLING COMPANY/DRILLING EQUIPMENT**
Jet Drilling / CME 75

**BORING METHOD**
Hollow Stem Auger

**BOREHOLE LOCATION**
See Plate 3

**DATES DRILLED**
3/11/11 and 6/21/11

**HOLE DIAMETER**
8 inches

**GROUNDWATER READINGS**
Encountered at 24 feet during drilling

<table>
<thead>
<tr>
<th>RUN #</th>
<th>BOX #</th>
<th>% RECOVERY</th>
<th>SAMPLE LOC.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>6</td>
<td>22</td>
<td>SP</td>
</tr>
<tr>
<td>78</td>
<td>6</td>
<td></td>
<td>SM</td>
</tr>
<tr>
<td>34</td>
<td>7</td>
<td></td>
<td>SP-SM</td>
</tr>
<tr>
<td>65</td>
<td>7</td>
<td></td>
<td>SM</td>
</tr>
</tbody>
</table>

**Silty Sand with Gravel, fine to coarse grained, clasts 30 to 50%, up to 1 inch; mainly subrounded granitic rock, quartzite and slate; color is variable; appears wet and dense; lower contact is sharp**

**Silty Sand, fine grained, trace fine gravel; pale brown (2.5Y 7/3); appears wet and dense; well sorted**

At 81.1 to 85': No recovery

At 88.1 to 88.4': Possible fault, dips approximately 60 to 65 degrees, gravel above, fine sand below, parallel lineations; bedding, dips 15 degrees below fault and near horizontal above fault

At 88.9 to 90.0': No recovery

At 90.0 to 91.7': Alternating beds (2 to 6 inch thick), defined by variable oxidation

At 91.7 to 95': No recovery

At 96.7': Becomes oxidized, dark yellowish brown (10YR 4/6)

At 97.4': Possible fault, clay gouge zone (1 inch thick), sand above, silty sand below, apparent dip approximately 30 to 40 degrees

At 97.6 to 99': No recovery

**SAN PEDRO FORMATION [Qsp]**

At 99 to 102': Silty Sand, very fine to fine grained; dark grayish green (5GY 4/2); appears wet and dense (Disturbed sample)

**GEOLOGIST:** DB/MW/MF

**Prepared/Date:** WL/AR 10/13/2011

**Checked/Date:** MW/MF 10/13/2011

---

**MTA Westside Subway Extension**

Los Angeles, California

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**LOG OF BORING**

Project No.: 4953-10-1561 Figure: T3-B6e
### LOG OF BORING

**Project No.:** 4953-10-1561  
**LOG OF BORING (Continued)**  
**BORING NO.** T3-B6  
**GROUND EL.** 275 feet

<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
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<th>RUN #</th>
<th>% RECOVERY</th>
<th>SAMPLE LOC.</th>
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<tbody>
<tr>
<td>100</td>
<td>100.4'</td>
<td>SM</td>
<td></td>
<td></td>
<td>Qsp Continued</td>
</tr>
<tr>
<td>101.4'</td>
<td>SM-ML</td>
<td>CL</td>
<td></td>
<td></td>
<td>Clayey Silt; very dark greenish gray (5GY 3/1); appears very moist and very stiff</td>
</tr>
<tr>
<td>102.2 to 102.4'</td>
<td>ML</td>
<td>CL</td>
<td></td>
<td></td>
<td>Trace shell fragments</td>
</tr>
<tr>
<td>102.7 to 105.9'</td>
<td></td>
<td>CL</td>
<td></td>
<td></td>
<td>Near vertical fracture, infilled with silt and sand from above and calcium carbonate</td>
</tr>
<tr>
<td>104.5 to 106'</td>
<td></td>
<td>CL</td>
<td></td>
<td></td>
<td>Shell fragments</td>
</tr>
<tr>
<td>106.4 to 107.2'</td>
<td>CL/ML</td>
<td>CL</td>
<td></td>
<td></td>
<td>Fault, dips approximately 70 degrees; gouge zone, 1 inch wide, infilled with very fine silty sand</td>
</tr>
<tr>
<td>109.5 to 111.0'</td>
<td>CL</td>
<td>CL/ML</td>
<td></td>
<td></td>
<td>Clay; very dark gray (5Y 3/1) to black (5Y 2.5/1); some waxy surfaces and slickensides, appears sheared along lineations sub-parallel to fault above</td>
</tr>
<tr>
<td>110.4 to 110.2'</td>
<td></td>
<td>CL</td>
<td></td>
<td></td>
<td>Approximate apparent dip 25 to 35 degrees; sub-parallel, sheared, waxy parting surfaces</td>
</tr>
<tr>
<td>111'</td>
<td></td>
<td>CL</td>
<td></td>
<td></td>
<td>Increasing silt</td>
</tr>
<tr>
<td>111.6 to 113.0'</td>
<td></td>
<td>SP</td>
<td></td>
<td></td>
<td>Broken up calcium carbonate concretion</td>
</tr>
<tr>
<td>113.0 to 113.5'</td>
<td></td>
<td>ML</td>
<td></td>
<td></td>
<td>Grades to Clayey Silt, micaceous</td>
</tr>
<tr>
<td>113.5 to 115.5'</td>
<td></td>
<td>ML</td>
<td></td>
<td></td>
<td>Grades to Poorly Graded Sand, fine to medium grained, with some coarse sand; lower contact is sharp</td>
</tr>
<tr>
<td>115.5'</td>
<td></td>
<td>ML</td>
<td></td>
<td></td>
<td>Clayey Silt; very dark greenish gray (10Y 3/1); appears very moist and very stiff; lower contact is sharp</td>
</tr>
<tr>
<td>116.0 to 118.5'</td>
<td></td>
<td>ML</td>
<td></td>
<td></td>
<td>Some indistinct fracturing; some calcium carbonate nodules, shell fragments and fine gravel</td>
</tr>
<tr>
<td>118.5'</td>
<td></td>
<td>CL</td>
<td></td>
<td></td>
<td>Sand layer (1 inch thick)</td>
</tr>
<tr>
<td>119.5'</td>
<td></td>
<td>CL</td>
<td></td>
<td></td>
<td>Broken up concretion (2 inches thick)</td>
</tr>
<tr>
<td>119.5 to 123.0'</td>
<td></td>
<td>CL</td>
<td></td>
<td></td>
<td>Color becomes dark greenish gray (5GY 4/3)</td>
</tr>
</tbody>
</table>

**DRILLING COMPANY/DRILLING EQUIPMENT**  
Jet Drilling / CME 75

**DRILLING METHOD**  
Hollow Stem Auger

**DATES DRILLED**  
3/11/11 and 6/21/11

**HOLE DIAMETER**  
8 inches

**BOREHOLE LOCATION**  
See Plate 3

**SUBSURFACE CONDITIONS**

*(Continued on following figure)*

---

**Prepared/Date:** WL/AR 10/13/2011  
**Checked/Date:** MW/MF 10/13/2011

---

**MTA Westside Subway Extension**  
Los Angeles, California

---

**Geologist:** DB/MW/MF

---

**LOG OF BORING**  
Project No.: 4953-10-1561  
Figure: T3-B6f
**GROUNDWATER READINGS**

Encountered at 24 feet during drilling.

---

**ML**

Qsp Continued

At 120 to 120.6': Grades to Sandy Silt

At 120.6': Some fine gravel and sand

**SP**

Sand, fine to medium grained; very dark greenish gray (5G 2.5/3/1); appears wet and dense

---

**END OF BORING AT 124½ FEET**

Boring backfilled with cement/bentonite grout from bottom up and patched.

- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch).
- Beds are generally massive unless otherwise noted.

Boring extended from 75 to 124½ feet on 6/20/2011. Offset from original boring location approximately 1-foot north east.

---

**NOTES:**

- Boring backfilled with cement/bentonite grout from bottom up and patched.
- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch).
- Beds are generally massive unless otherwise noted.

Boring extended from 75 to 124½ feet on 6/20/2011. Offset from original boring location approximately 1-foot north east.
Encountered at 23 feet during drilling

OLDER ALLUVIAL FAN DEPOSITS [Qfo]
Clayey Silt, variable fine sand, trace coarse sand and fine gravel (Jsm and Tm); dark brown (7.5YR 3/4); appears very moist and medium stiff; poorly sorted; lower contact occurs between runs
At 2.0': Minor dispersed organics

NOTE:
Jsm = Santa Monica Slate
Tm = Modelo Formation
See end of log for more detailed descriptions of clasts

Silty Clay, trace to some fine sand, trace coarse sand and fine gravel (Jsm and Tm); very dark grayish brown (10YR 3/2); appears moist to very moist and very stiff; poorly sorted; lower contact is narrowly gradational

ESTUARINE DEPOSITS [Qe]
Clayey to Sandy Silt; mottled, light olive brown (2.5Y 5/3) to dark yellowish brown (10YR 4/6); appears very moist and very stiff; lower contact is narrowly gradational

Sandy Silt, trace to some clay, trace coarse sand (Jsm and Tm); mottled, light olive brown (2.5Y 5/3) to dark yellowish brown (10YR 4/6); appears moist and stiff; occasional clayey silt beds; variable varve-like bedding; lower contact occurs between runs
At 16.8 to 19.0': No recovery
### MTA Westside Subway Extension
Los Angeles, California

**LOG OF BORING**

**T3-B7**

(Continued from preceding figure)

**DRILLING COMPANY/DRILLING EQUIPMENT**
Jet Drilling / CME 75

**DRILLING METHOD**
Hollow Stem Auger

**BOREHOLE LOCATION**
See Plate 3

**DATES DRILLED**
3/17/2011

**HOLE DIAMETER**
8 inches

**GROUND EL.**
271 feet

**GROUNDWATER READINGS**

<table>
<thead>
<tr>
<th>RUN</th>
<th>BOX</th>
<th>% RECOVERY</th>
<th>ELEVATION (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ML</td>
<td>2</td>
<td>100</td>
<td>250</td>
</tr>
<tr>
<td>SM</td>
<td>2</td>
<td>36</td>
<td>245</td>
</tr>
</tbody>
</table>

Encountered at 23 feet during drilling

- **At 23**: Groundwater encountered during drilling
- **At 23.3 to 23.6' and 24.0 to 24.9'**: Silty Sand, fine grained, some coarse sand and gravel, gravel 5 to 15%, up to ½ inch, mainly subangular slate (Jsm); dark yellowish brown (10YR 3/6); appears very moist to wet and medium dense

At 25.8 to 29.0': No recovery

Depth of contact uncertain due to poor recovery

- **At 30**: Becomes siltier, some coarse sand and gravel, gravel 5 to 15%, up to ½ inch, mainly subangular slate (Jsm)
- **At 30.3 to 31.0'**: Grades to fine to medium grained, trace coarse sand (Jsm)
- **At 31.0 to 31.5', 33.2 to 34.0', and 36.0 to 36.5'**: Clayey to Sandy Silt; mottled, grayish brown (2.5Y 5/2) to brown (7.5YR 4/4); appears very moist to wet and soft; appears poorly consolidated; variable varve-like bedding; lower contact occurs between runs

At 34.0 to 35.3': Grades to fine to medium grained, trace coarse sand (Jsm)

- **At 35.3 to 36.0' and 37.3 to 38.0':** Gradational zones (grades from sand to clayey silt)

**Geologist:** DB/MF
**Prepared/Date:** WL/AR 10/13/2011
**Checked/Date:** MW/MF 10/13/2011
At 40.7': Possible detrital charcoal, sample collected
At 40.7 to 50.2': Some irregular, subhorizontal laminations

Poorly Graded Sand, fine grained; brown (7.5YR 4/4); appears very moist and medium dense; lower contact is sharp, erosional

At 46.5 to 48.7': Grades to Poorly Graded Sand with Silt, fine grained

Clay and Silty Clay, variable fine to coarse sand, coarse sand mainly slate (Jsm) with some brick-red sandstone (Tm); variable mottling and colors, mainly brown (7.5YR 4/2 and 7.5YR 4/4) to gray (10YR 5/1); appears very moist and stiff; occasional indistinct laminations

At 51.0 to 52.2': Sandy to Clayey Silt, trace coarse sand and gravel (Jsm and Tm); mottled, brown (7.5YR 4/4) to dark gray (7.5YR 4/1); appears very moist and very stiff

At 52.5': Small root, sample collected

At 54.5 to 55.8': Sand generally increases with depth, gradational transition to unit below

OLDER ALLUVIAL FAN/ESTUARINE DEPOSITS [Qfo/Qe]
Sandy Clay to Clayey Sand with Gravel, clasts 25 to 50%, most < ½ inch, maximum 1½ inches, mainly subangular slate (Jsm) with some subrounded shale (Tm) and granitic rock; brown (7.5YR 4/2); appears very moist and medium stiff to stiff; lower contact occurs between runs

At 58.0 to 59.0': Becomes less gravelly (<10%), appears moist and very stiff

ESTUARINE DEPOSITS - FINE GRAINED [Qef]
Sandy Silt, trace clay; mottled, gray (10YR 6/1) to yellowish brown (10YR 5/8); appears moist and stiff to very stiff; trace calcium carbonate filaments and manganese
| ELEVATION (ft) | DEPTH (ft) | BOX # | RUN # | % RECOVERY |_samples loc.
|---------------|-----------|-------|-------|------------|-----------------------------
| 210           | 4         | 17    | 100   | 100        | oxide staining; lower contact occurs between runs
| 100           | 5         | 18    | 20    | 100        | qef Continued
| 65            | 0         | 0     | 0     | 0          | At 60.1': Sand bed (1 inch thick); subhorizontal, upper-contact is narrowly gradational, lower contact is sharp
| 205           | 5         | 19    | 100   | 100        | At 60.5 to 61.5': Clay content increases, sand decreases (gradational zone); mottled, brown (7.5YR 4/4) to dark gray (10YR 4/1); appears very moist and very stiff
| 70            |           |       |       |            | At 63.0 to 64.0': Trace coarse sand and fine gravel (Jsm and Tm)
| 200           |           |       |       |            | At 64.0 to 66.0': No sampling
| 75            |           |       |       |            | At 66.0 to 66.5': Silty Clay with Sand; mottled, brown (7.5YR 4/4) to dark gray (10YR 4/1); appears very moist and very stiff
| 80            |           |       |       |            | At 66.5 to 69.0': Recovered only slough
| 195           |           |       |       |            | Contact uncertain due to poor recovery
| 195           |           |       |       |            | Clay; yellowish brown (10YR 5/4); appears very moist and soft; some calcite carbonate flecks and un cemented nodules, contact below is sharp, subhorizontal
| 195           |           |       |       |            | Clay, trace coarse sand and fine gravel (Jsm and Tm); dark brown (7.5YR 3/2); appears very moist and stiff; appears to have high organic content; lower contact is narrowly gradational
| 195           |           |       |       |            | At 70.3 to 72.0': Organics decrease (minimal), trace fine gravel (Jsm and Tm)
| 195           |           |       |       |            | estuarine deposits [qe]
| 195           |           |       |       |            | At 72.0 to 72.3': Gravelly bed, gravel 20 to 30%, up to ½ inch, mainly slate (Jsm), shale and sandstone (Tm)
| 195           |           |       |       |            | Sandy to Clayey Silt, trace coarse sand and fine gravel (Jsm and Tm); brown (7.5YR 4/4) to gray (2.5Y 5/1); appears very moist and very stiff

End of Boring at 74 feet

Notes:

Boring backfilled with cement/bentonite grout from bottom up and patched.

-Munsell colors listed in order of predominance (most predominant color first).
-Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
-Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
-Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded slate and sandstone unless otherwise noted.
-The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch).
-Beds are generally massive unless otherwise noted.

Geologist: DB/MF
Prepared/Date: WL/AR 10/13/2011
Checked/Date: MW/MF 10/13/2011
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6 inches of asphaltic concrete over 3 inches of base
Hand augered to 6 feet

**FILL [Af]**
Silty Sand, fine grained, trace fine gravel, trace clay; brown (10YR 4/3); appears moist and dense

Grab samples collected at 2', 3.5', and 5'

**NOTE:**
Jsm = Santa Monica Slate
Tm = Modelo Formation
See end of log for more detailed descriptions of clasts

**OLDER ALLUVIAL FAN DEPOSITS [Qfo]**
Sandy Silt, trace to some clay; trace coarse sand and fine gravel (Jsm); brown (7.5YR 4/4); appears very moist and medium stiff; poorly sorted; lower contact is narrowly gradational

Silty Sand and Sandy Silt, very fine grained, trace to some coarse sand and fine gravel, gravel 0 to 15%, up to ½ inch, mainly angular to subrounded slate (Jsm) with some subrounded shale and brick-red sandstone (Tm); strong brown (7.5YR 5/6); appears dry to damp and dense/hard; lower contact is sharp

At 11.3 to 11.5': Silty Sand, fine to coarse-grained; color variable
Silty Sand with Gravel, fine to coarse-grained, trace to some clay; gravel content variable, generally 15 to 50%, up to 1 inch, mainly angular to subangular slate (Jsm) and subrounded shale and fine brick-red sandstone (Tm), some rounded quartzite; dark brown (7.5YR 3/4); appears very moist and dense; occasionally grades to clayey sand with gravel; lower contact is gradational

Sandy Silt, trace to some clay, trace coarse sand and fine gravel (Jsm and Tm); strong brown (7.5YR 4/6); appears very moist and stiff; lower contact occurs between runs

At 19.0 to 20.0': Sandy Silt alternates with 2 to 3 inch thick gravelly beds, gravel up to 50%, up to ¾ inch, mainly subangular slate (Jsp), some shale and sandstone (Tm); lower contact of upper gravel bed at 19.3' appears to dip approximately 30 degrees
ESTUARINE DEPOSITS [Qe]
Clayey to Sandy Silt, rare (<1%) coarse sand (Jsm and Tm); olive brown (2.5Y 4/3); appears moist and very stiff, trace manganese oxide staining; lower contact is gradational

At 24.5 to 26.0': Becomes less clayey; color change to light olive brown (2.5Y 5/3); gradational transition to bed below

Sandy Silt with variable Clay, rare (<1%) coarse sand (Jsm and Tm); mottled, strong brown (7.5YR 4/6) to gray (2.5Y 6/1); appears very moist and medium stiff to stiff; occasional subhorizontal laminations, lower contact is gradational

At 29.0 to 32.0': Distinct varve-like bedding

At 32.0 to 35.0': Coarsens downward, gradational transition to fan deposits below

OLDER ALLUVIAL FAN DEPOSITS [Qf0]
Sandy to Clayey Silt, trace to some gravel, clasts up to 15%, up to ¾ inch, mainly subangular slate (Jsm), some subrounded shale and brick-red sandstone (Tm) also observed; dark brown (7.5YR 3/4); appears very moist and stiff; poorly sorted

At 36.0': Color becomes brown (7.5YR 4/4)

At 39.0 to 39.5': Becomes more gravelly, clasts 20 to 30%, up to 1 inch
At 42.4 to 44.0': No recovery

At 44.0 to 44.8': Becomes lightly mottled, brown (7.5YR 5/4) to reddish brown (5YR 4/4); possible weak soil development

At 44.8 to 45.6': Gradational transition to Estuarine Deposits below

At 46.5 to 49.0': Becomes slightly mottled, brown (10YR 4/3) to yellowish brown (10YR 4/6) to light brownish gray (2.5Y 6/2); appears moist to very moist and very stiff; trace calcium carbonate filaments

Clayey Silt and Silty Clay, variable fine sand, trace coarse sand and fine gravel; mottled, grayish brown (10YR 5/2) to strong brown (7.5YR 5/6); appears very moist and stiff; trace calcium carbonate filaments and manganese oxide staining; occasional thin sandy silt beds and laminations; lower contact is gradational

At 51.8 to 54.0': Clayey to Sandy Silt, trace coarse sand (Jsm and Tm); mainly grayish brown (2.5Y 5/2) with strong brown (7.5YR 5/8) mottling; appears moist and very stiff; trace manganese oxide staining, trace to some (up to 15%) calcium carbonate filaments and small (<1/8 inch) uncemented nodules

At 54.0 to 57.5': Appears very moist to wet and soft to medium stiff

At 57.5 to 59.0': Grades to Clayey to Sandy Silt; trace coarse sand and fine gravel; appears moist to very moist and very stiff

At 59.0 to 60.0': Abundant manganese oxide staining, color is mainly dark brown (7.5YR 3/3) to dark yellowish brown (7.5YR 4/4)
At 64.0 to 67.3': Sandy Silt, laminations more common, variable varve-like bedding

At 68.5': Becomes slightly mottled, brown (10YR 5/3) to grayish brown (10YR 5/2) to strong brown (7.5YR 4/4)

At 70.0 to 73.0': Occasional 2 to 3 inch thick interbeds of Sandy Clay/Clayey Sand

At 73.0 to 74.0 Distinct varve-like bedding

END OF BORING AT 74 FEET

NOTES:
Boring backfilled with cement/bentonite grout from bottom up and patched.

-Munsell colors listed in order of predominance (most predominant color first).
-Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
-Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
-Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
-The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch). Beds are generally massive unless otherwise noted.
**GEOLOGICAL LOG**

**PROJECT:** MTA Westside Subway Extension  
**LOCATION:** Los Angeles, California  
**DATE & TIME:** 10/10/2011  
**LOG PREPARED BY:** WL/YN/AR  
**CHECKED BY:** MW/MF  

**LOG NO.** T4-B1

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**HOLE DIAMETER:** 8 inches  
**BOREHOLE LOCATION:** 265 feet

**DRILLING COMPANY/DRILLING EQUIPMENT:** Jet Drilling / CME 75  
**DATE DRILLED:** 3/19/11

**GROUNDWATER READINGS:** Encountered at 47-ft during drilling

**NOTE:**

- Jsm = Santa Monica Slate  
- Tm = Modelo Formation  

- See end of log for more detailed descriptions of clasts  
- At 4.0 to 8.5': Becomes dark brown (10YR 3/3)

- At 6.0 to 7.0': Becomes gravelly

- At 8.5': Becomes lightly mottled, color variable, mainly dark grayish brown (10YR 4/2) to light brownish yellow (10YR 6/4)

- At 16.0': Calcium carbonate decreases to trace, becomes more clayey

- At 17.8 to 19.0': No recovery

- At 19.0 to 21.0': Becomes strongly mottled, yellowish brown (10YR 5/8) to gray (10YR 6/1)

8 inches of asphaltic concrete over 4 inches of base  
Hand augered to 6 feet

**FILL [Af]**

Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); brown (10YR 4/3); appears moist and stiff to very stiff

**YOUNGER/OLDER ALLUVIAL FAN DEPOSITS [Qf/Qfo]**

Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); brown (10YR 4/3); appears moist and stiff; poorly sorted; lower contact is gradational

At 8.5': Becomes lightly mottled, color variable, mainly dark grayish brown (10YR 4/2) to light brownish yellow (10YR 6/4)

**ESTUARINE DEPOSITS [Qe]**

Sandy Silt, trace to some clay; lightly mottled, grayish brown (2.5Y 5/2) to brown (7.5YR 5/4); appears moist and stiff; well sorted; lower contact is narrowly gradational

At 16.0': Calcium carbonate decreases to trace, becomes more clayey

**ESTIMATED DEPTH:** 265 feet

**REFERENCES:**  
See end of log for more detailed descriptions of clasts

**LOG OF BORING**

**T4-B1a**

**MTA Westside Subway Extension**

**Los Angeles, California**

**AMEC**

**LOG OF BORING**

**Project No.: 4953-10-1561 Figure: T4-B1a

Geologist: DB/MF  
Prepared/Date: WL/YN/AR 10/10/2011  
Checked/Date: MW/MF 10/10/2011
At 22.0 to 25.0’: Trace coarse sand and fine gravel (Jsm and Tm), occasional subangular slate (Jsm) up to 1 inch; strongly mottled, strong brown (7.5YR 5/8) to gray (10YR 6/1); variable faint laminations (Possible Poorly Developed Paleosol)

Marker Bed MC - Silty Clay to Clayey Silt, trace to some fine sand, trace coarse sand and fine gravel (Jsm and Tm); dark brown (7.5YR 3/4) with occasional light brownish gray (10YR 6/2) mottling, appears very moist and very stiff; generally poorly sorted; grades downward into fan deposits below, possible poorly developed paleosol

FAN DEPOSITS [Qfo]
Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); color variable; generally brown (10YR 4/3), some subhorizontal, strong brown (7.5YR 5/6) to gray (10YR 5/1) laminations in upper 6 inches of bed; generally poorly sorted; appears very moist and stiff; lower contact is narrowly gradational

Silty Sand and Sandy Silt, very fine grained, trace to some clay, trace coarse sand and fine gravel (Jsm and Tm); dark yellowish brown (10YR 3/6); appears very moist and dense/stiff; lower contact occurs between runs

At 31.6 to 34.0’: No recovery

At 34.0 to 34.8’: Fine to coarse, Clayey Silty Sand with Gravel, clasts 15-20%, up to 3/4 inch, mainly subangular to subrounded slate (Jsm) and shale (Tm); dark brown (10YR 3/3); appears moist and dense

ESTUARINE DEPOSITS - FINE GRAINED [Qef]
Clayey Silt and Silty Clay, fine grained, trace to some fine sand, mottled, yellowish brown (10YR 5/4) to strong brown (10YR 5/8); appears very moist and very stiff; moderately well sorted; variable manganese oxide staining, slightly micaceous; lower contact is gradational

At 38.7 to 39.3’: Becomes more sandy, abundant manganese oxide staining

ENCOUNTERED AT 47-FT DURING DRILLING

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(Continued on following figure)
**ESTUARINE DEPOSITS [Qe]**

- **Silty Sand with Gravel**, fine grained, gravel 15-20%, up to 3/4 inch, mainly subangular to subrounded slate (Jsm), some subrounded shale (Tm) and granitic rock also observed; color variable; appears very moist and dense

- **Clayey to Sandy Silt**, trace coarse sand and fine gravel (Jsm and Tm); brown with variable yellowish brown (10YR 5/6) mottling; appears very moist and very stiff; some varve-like bedding; lower contact is gradational

At 44.7 to 44.9° and 45.6 to 45.8°: Silty Sand with Gravel, fine grained, contacts are sharp to narrowly gradational, sub-horizontal

At 45.3 to 45.6° and 45.8 to 46.1°: Silty Clay, trace coarse sand, contacts are narrowly gradational to sharp; sub-horizontal

At 46.1 to 49.0°: No recovery

At 47°: Groundwater encountered during drilling

- **Poorly Graded Sand with Silt**, fine to medium grained, trace coarse sand (Jsm and Tm); dark yellowish brown (10YR 4/4); appears wet and dense; depth of contacts uncertain due to poor recovery

At 49.0 to 49.5°: Poorly Graded Sand with Silt, fine to medium grained, trace coarse sand (Jsm and Tm); dark yellowish brown (10YR 4/4); appears wet and dense; depth of contacts uncertain due to poor recovery

At 49.5 to 51.5°: No recovery

- **Silty Clay**, trace coarse sand (Jsm and Tm); grayish brown (2.5Y 4/2) with variable light yellowish brown (10YR 6/4) mottling; appears moist to very moist and very stiff; variable varve-like bedding; lower contact occurs between runs

At 54.0 to 55.2°: Clay alternates with numerous subhorizontal Silt and fine Silty Sand laminations, generally light yellowish brown (10YR 6/4) to dark yellowish brown (10YR 4/6)

At 55.2 to 57.0°: Some (5-10%) calcium carbonate filaments

- **ESTUARINE DEPOSITS-FINE GRAINED [Qef]**

- **Silty Clay**, trace coarse sand (Jsm); grayish brown with variable faint mottling; appears moist to very moist and stiff; variable varve-like bedding

At 57.0 to 59.0°: Variable sub-horizontal Silt and Sand laminations and irregular pockets
**OLDER ALLUVIAL FAN DEPOSITS [Qfo]**

Sandy to Clayey Silt, trace coarse sand and fine gravel (Jsm and Tm), rare (<1%) gravel up to 1 inch; light yellowish brown (10YR 6/4); appears moist and hard, trace calcium carbonate filaments

At 69.0 to 74.0': Becomes very moist, very stiff, mottled, brown (7.5YR 4/4) to dark grayish brown (10YR 4/2)

At 71.5 to 74.0': Gravel increases to about 5-10%, up to ½ inch, mainly subangular to subrounded shale and fine sandstone (Tm) and slate (Jsm), some brick red sandstone (Tm); trace calcium carbonate filaments and nodules up to 1/8-inch

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**Qf Continued**

Silty Clay, trace coarse sand and fine gravel (Jsm and Tm), including some brick-red sandstone; clay generally dark grayish brown (10YR 4/2); silt is strong brown (7.5YR 4/6); appears very moist and stiff; irregular, oxidized silt pockets and/or lenses; lower contact is gradational

At 60.5 to 61.8': Calcium carbonate filaments increase with depth, near 5%

At 62.0 to 67.0': Coarsens with depth, oxidized silt increases, calcium carbonate occurs as filaments and nodules up to 1/4 inch, total calcium carbonate about 5-15%; coarse sand and fine gravel increase slightly, occasional rare gravelly beds

At 64.0 to 64.2': Gravel increases to about 10-15%, fine grained, mainly shale and fine sandstone (Tm)

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**NOTES:**

Boring backfilled with cement/bentonite grout from bottom up and patched.

-Munsell colors listed in order of predominance (most predominant color first).
-Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
-Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
-Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
-The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch).
-Beds are generally massive unless otherwise noted.
Asphaltic concrete over base
Hand augered to 6 feet

NOTE:
Jsm = Santa Monica Slate
Tm = Modelo Formation
See end of log for more detailed descriptions of clasts

No sampling to 8.0'

FILL [Af]
Clayey Sand, fine to coarse grained, some gravel, 10-15%, up to ½ inch; very dark grayish brown (10YR 3/2); appears very moist and medium dense

ESTUARINE DEPOSITS [Qe]
Silty Clay and Clayey Silt, trace to some fine sand, trace coarse sand (Jsm and Tm); mottled, dark grayish brown (10YR 4/2) to strong brown (7.5YR 4/6); appears very moist and stiff; variable oxidized silt laminations; well sorted; lower contact is narrowly gradational

At 12.1 to 13.0': Clay, dark grayish brown (10YR 4/2)

At 17.5 to 18.0': Grades to Silty Clay

At 19.0 to 19.7': Grades to Silty Sand with Clay, becomes more sandy with depth, transition to gravel bed below, gravel 50-60%, up to 3/4 inch
At 19.7 to 20.5': Silty Gravel with Sand, mainly subangular to subrounded slate (Jsm),...
Qalo Continued
subrounded shale (Tm) and quartzite; soil matrix is fine to coarse silty sand with clay; very dark grayish brown (10YR 3/2); appears moist and dense; lower contact is erosional At 20.5 to 21.3': Color becomes dark yellowish brown (10YR 4/4) At 21.0': Thin (1/8 inch) oxidized silt lamination, approximate dip 10 degrees At 21.2 to 23.0': Becomes mottled, dark brown (10YR 3/3) to strong brown (7.5YR 4/6); some evenly spaced, subhorizontal laminations At 23.0 to 26.1': Mottled gray (10YR 5/1) to dark yellowish brown (10YR 4/4)

Marker Bed Me
Silty Clay to Clayey Silt, trace to some fine sand, trace coarse sand and fine gravel (Jsm and Tm); dark brown (7.5YR 3/4) with occasional gray (10YR 5/1) motting and laminations; appears moist and very stiff; possible weak soil development; lower contact occurs between runs

OLDER ALLUVIAL FAN DEPOSITS [Qfo]
Clayey to Sandy Silt; trace coarse sand and fine gravel; brown (7.5YR 4/3); appears moist and very stiff; poorly sorted; lower contact occurs between runs

At 32.0 to 33.0': No recovery

Clayey to Silty Sand with Gravel, fine to coarse grained; clasts 15-25%, up to 2 inches, mainly subangular to subrounded slate (Jsm); shale (Tm) and brick-red fine sandstone (Tm); dark brown (10YR 3/3); appears moist and dense; lower contact is gradational

At 35.5 to 36.0': Sandy Silt with variable clay, trace coarse sand and fine gravel (Jsm and Tm); brown (7.5YR 4/3); appears very moist and stiff
At 36.0 to 38.0': No recovery

Silty Sand, fine to coarse grained, trace clay, trace fine gravel (Jsm and Tm); brown (7.5YR 4/4); appears very moist to wet and dense; lower contact occurs between runs

At 39.5': Groundwater encountered during drilling

At 40.0': Groundwater encountered during drilling
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</table>

**GROUNDWATER READINGS**

Encountered at 39.5-ft during drilling

**Qfo Continued**
Silty Sand as above, increasing gravel

At 40.9 - 43.0': No recovery

At 43.6 - 46.0': No recovery

At 46.0 to 50.0': No recovery

At 50.0 to 51.0': Appears wet, more gravelly, gravel 15-20%, up to 3/4 inch, mainly subangular to subrounded slate (Jsm) and shale (Tm), recovery possibly slough

At 51.0 - 53.0': No recovery

At 52.0': About 15' of material heaved up into auger. Auger redrilled from about 37' to 53.0', no sampling at 52.0 to 53.0'

At 53.0 to 65.5': No reliable intact sample obtained. Material recovered consists of fine to coarse Silty Sand with variable clay and gravel; likely drill slough/disturbed material below 53.0'

At 58.0 to 59.0': Recovered only slough/disturbed material

At 59.0 - 63.0': No recovery
Qfo Continued

At 63.0 to 64.0': Recovered only slough/disturbed material

At 64.0 - 65.5': No recovery

At 65.5 to 72.0': No recovery

END OF BORING AT 72 FEET

NOTES:
Boring backfilled with cement/bentonite grout from bottom up and patched.

-Munsell colors listed in order of predominance (most predominant color first).
-Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
-Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
-Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
-The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch).
-Beds are generally massive unless otherwise noted.
**Hand augered to 6 feet**

**Grab sample collected at 2’**

**FILL [Af]**

**Silty Sand with Gravel, fine to coarse grained**

**NOTE:**

**Jsm = Santa Monica Slate**

**Tm = Modelo Formation**

See end of log for more descriptions of clasts

**YOUNGER/OLDER ALLUVIAL FAN DEPOSITS [Qf/Qfo]**

Clay and Silty Clay, trace coarse sand (Jsm and Tm); brown (10YR 4/3); appears wet and medium stiff

Sandy Clay and Clayey Sand with Gravel, clasts 15-20%, up to 1/2 inch, mainly subangular slate (Jsm), sandstone (Tm) and shale (Tm); dark brown (10YR 3/3); appears moist and stiff/medium dense; poorly sorted; lower contact appears narrowly gradational

**ESTUARINE DEPOSITS [Qe]**

Clayey Silt, variable fine sand; lightly mottled, grayish brown (10YR 5/2) to strong brown (10YR 6/8); trace coarse sand (Jsm and Tm)

At 9.0 to 9.5’: Color becomes grayish brown (10YR 5/2) to brownish yellow (10YR 6/8); trace coarse sand (Jsm and Tm)

At 9.5 to 9.9’: Silty Sand, fine grained; lightly mottled, grayish brown (10YR 6/2) to strong brown (7.5YR 5/8)

At 9.9 to 10.5’: Sandy to Clayey Silt with Gravel, clasts 15-20%, up to 3/4 inch, mainly subangular slate (Jsm) and shale (Tm); dark grayish brown (10YR 4/2)

Clay and Silty Clay, trace coarse sand (Jsm and Tm); lightly mottled, grayish brown (2.5Y 5/2) to light yellowish brown (2.5Y 6/3) to yellowish brown (10YR 5/8); appears moist and very stiff; some varve-like bedding; lower contact is narrowly gradational

Clayey to Sandy Silt, rare (<1%) coarse sand (Jsm and Tm); lightly mottled, grayish brown (10YR 5/2) to light yellowish brown (2.5Y 6/3); appears moist and very stiff; lower contact is gradational

Clayey to Sandy Silt, rare (<1%) coarse sand (Jsm and Tm); strongly mottled, brown (10YR 5/3) to strong brown (7.5Y 5/8); appears moist and very stiff to hard; variable (0-10%) manganese oxide flecks; prominent varve-like bedding; lower contact is gradational

Encountered at 46-ft during drilling

**SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.**

**LOG OF BORING**

<table>
<thead>
<tr>
<th>BOREHOLE LOCATION</th>
<th>GROUND EL.</th>
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<tbody>
<tr>
<td>T4-B3</td>
<td>260 feet</td>
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</table>

**DRILLING COMPANY/DRILLING EQUIPMENT**

Jet Drilling / CME 75

**DRILLING METHOD**

Hollow-Stem Auger

**DATES DRILLED**

4/20/11 - 4/22/11

**HOLE DIAMETER**

8 inches

**GROUNDWATER READINGS**

Encountered at 46-ft during drilling

**% RECOVERY**

**SAMPLE LOC.**

Hand augered to 6 feet

Grab sample collected at 2’

**FILL [Af]**

Silty Sand with Gravel, fine to coarse grained

**NOTE:**

**Jsm = Santa Monica Slate**

**Tm = Modelo Formation**

See end of log for more descriptions of clasts

**YOUNGER/OLDER ALLUVIAL FAN DEPOSITS [Qf/Qfo]**

Clay and Silty Clay, trace coarse sand (Jsm and Tm); brown (10YR 4/3); appears wet and medium stiff

Sandy Clay and Clayey Sand with Gravel, clasts 15-20%, up to 1/2 inch, mainly subangular slate (Jsm), sandstone (Tm) and shale (Tm); dark brown (10YR 3/3); appears moist and stiff/medium dense; poorly sorted; lower contact appears narrowly gradational

**ESTUARINE DEPOSITS [Qe]**

Clayey Silt, variable fine sand; lightly mottled, grayish brown (10YR 5/2) to strong brown (7.5Y 4/6); appears very moist and medium stiff; lower contact is gradational

At 9.0 to 9.5’: Color becomes grayish brown (10YR 5/2) to brownish yellow (10YR 6/8); trace coarse sand (Jsm and Tm)

At 9.5 to 9.9’: Silty Sand, fine grained; lightly mottled, grayish brown (10YR 6/2) to strong brown (7.5YR 5/8)

At 9.9 to 10.5’: Sandy to Clayey Silt with Gravel, clasts 15-20%, up to 3/4 inch, mainly subangular slate (Jsm) and shale (Tm); dark grayish brown (10YR 4/2)

Clay and Silty Clay, trace coarse sand (Jsm and Tm); lightly mottled, grayish brown (2.5Y 5/2) to light yellowish brown (2.5Y 6/3) to yellowish brown (10YR 5/8); appears moist and very stiff; some varve-like bedding; lower contact is narrowly gradational

Clayey to Sandy Silt, rare (<1%) coarse sand (Jsm and Tm); lightly mottled, grayish brown (10YR 5/2) to light yellowish brown (2.5Y 6/3); appears moist and very stiff; lower contact is gradational

Clayey to Sandy Silt, rare (<1%) coarse sand (Jsm and Tm); strongly mottled, brown (10YR 5/3) to strong brown (7.5Y 5/8); appears moist and very stiff to hard; variable (0-10%) manganese oxide flecks; prominent varve-like bedding; lower contact is gradational
Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); lightly mottled, brown (10YR 5/3) to strong brown (7.5YR 5/8); appears moist and very stiff; prominent varve-like bedding; lower contact is sharp

21.5 to 22.5': Gravel increases, 15-20%, up to 1 1/2 inches

22.0 to 22.1': Fine Silty Sand bed, strong brown (7.5YR 4/6)

23.5 to 25.5': Trace manganese oxide flecks, up to 1/8 inch

Marker Bed ME
Clayey Silt, trace to some fine sand, trace coarse sand (Jsm and Tm); mottled, dark reddish brown (5YR 3/4) to yellowish red (5YR 4/6) to brown (7.5YR 5/2); appears very moist and stiff; lower contact is gradational; possible weak soil development

27.1 to 27.5': Gradational transition to fan deposits below

OLDER ALLUVIAL FAN DEPOSITS [Qfo]
Clayey to Sandy Silt, trace to some coarse sand and fine gravel, clasts 2-15%, up to 1/2 inch, mainly subangular slate (Jsm), shale (Tm) and sandstone (Tm); strongly mottled, color variable, mainly strong brown (7.5YR 5/6) to brown (7.5YR 4/4); appears moist and very stiff to hard; generally poorly sorted; occasional fine grained beds with varve-like bedding; lower contact occurs between runs

30.2 to 34.0': No Recovery

34.0 to 34.4': Clayey Sand with Gravel, fine to coarse grained; clasts 20-30%, up to 1/2 inch, mainly subrounded slate (Jsm), shale (Tm) and sandstone (Tm), some brick-red sandstone; color variable, generally dark brown (7.5YR 3/3); appears very moist to wet and dense; lower contact is sharp, erosional

Sandy to Clayey Silt, trace to some coarse sand and gravel; clasts 2-10%, up to 1/2 inch, mainly subrounded slate (Jsm), shale (Tm) and sandstone (Tm); brown (7.5YR 4/4) with variable grayish brown (10YR 5/2) mottles; appears very moist and stiff; poorly sorted; lower contact occurs between runs

36.3 to 36.8': Fine grained bed with varve-like bedding

ESTUARINE DEPOSITS [Qe]
Clayey to Sandy Silt; trace coarse sand and gravel (Jsm and Tm); color variable, mainly brown (7.5YR 4/4) to grayish brown (10YR 5/2); appears very moist and stiff;
<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>% Recovery</th>
<th>Sample Location</th>
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<tbody>
<tr>
<td>215</td>
<td>100</td>
<td>ML generally well sorted; variable varve-like bedding and laminations; lower contact occurs between runs</td>
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<tr>
<td>215</td>
<td>50</td>
<td>Qe Continued At 39.0 to 42.5’: Trace manganese oxide flecks up to 1/16 inch</td>
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<tr>
<td>215</td>
<td>50</td>
<td>At 42.5 to 44.0: Variable (5-20%) manganese oxide flecks and nodules up to 1/4 inch</td>
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<td>215</td>
<td>50</td>
<td>At 44.0 to 46.5: Only slough recovered</td>
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<td>At 46: Groundwater encountered during drilling</td>
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<td>At 46.5 to 49.0: No recovery</td>
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<td>215</td>
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<td>Depth of contact uncertain due to poor recovery</td>
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<td>OLDER ALLUVIAL FAN DEPOSITS [Qfol] Well Graded Sand, fine to coarse grained, variable gravel, clasts 0-20%, up to 1/2 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); color variable, generally brown (10YR 4/3); appears wet and dense; lower contact is sharp, erosional</td>
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<td>215</td>
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<td>At 49.3 to 49.5: Sandy Silt bed Sandy to Clayey Silt with Gravel, clasts 25-50%, up to 3/4 inch, mainly subangular to subrounded slate (Jsm), sandstone (Tm), shale (Tm) and quartzite; brown (7.5YR 4/4) appears very moist and stiff</td>
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<td>215</td>
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<td>At 51.0 to 51.5: Several quartzite clasts up to 3/4 inch</td>
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<td>At 52.0 to 54.0: No recovery</td>
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<td>At 54.4 to 54.9: Grades to Silty Sand, fine-medium grained</td>
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<td>215</td>
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<td>At 54.9 to 55.2: Grades to Silty Sand with distinct laminations; brown (7.5YR) to grayish brown (10YR 5/2), very fine grained</td>
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<td>215</td>
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<td>ESTUARINE DEPOSITS [Qe] At 55.2 to 55.6: Clay, strong brown (7.5YR 4/6) with some grayish brown (10YR 5/2) mottles. 1/2 inch thick manganese oxide staining at base of bed</td>
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<td>215</td>
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<td>At 55.6 to 56.4: Clasts include brick-red sandstone (Tm) Clay and Silty Clay, trace coarse sand (Jsm and Tm); mottled strong brown (7.5YR 5/6) to grayish brown (2.5YR 5/2); appears very moist and stiff to very stiff; variable varve-like bedding and laminations; lower contact is narrowly gradational</td>
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<td>At 58.0 to 60.0: Shear/Fault zone; numerous steep, irregular, shears, dip 60 to 80 degrees</td>
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<td>At 58.5 to 58.7: Distinct laminations</td>
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<td>At 59.2 to 60.2: Subhorizontal lenses and irregular pockets of highly oxidized silt; dark reddish brown (5YR 3/4)</td>
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</table>

MTA Westside Subway Extension
Los Angeles, California

LOG OF BORING

Project No.: 4953-10-1561 Figure: T4-B3c
CL  100
ML  100
CL  100
SM/  100
CH  100
CL  100
SM/  100
ML  100
CL  100
SM/  100
ML  100
CL  100
SM/  100
ML  100

At 60.2 to 60.6': Color becomes dark grayish brown (10YR 4/2), 5-10% calcium carbonate filaments up to 1/16 inch

At 61.2 to 61.7': Grades to Clayey to Sandy Silt

At 61.7 to 62.6': Color becomes dark grayish brown (10YR 4/2), 10-20% calcium carbonate filaments up to 1/16 inch

At 63.0 to 63.4': Grades to Sandy to clayey Silt, mottled, color variable

At 63.4 to 64.0': Distinct varve like bedding

At 64.3': 1/2 inch Sandy Silt bed

At 64.5 to 65.5': 10-20% calcium carbonate filaments up to 1/8 inch

At 64.8': 1/2 inch Silty Sand bed

At 65.5 to 65.9': Silty Sand to Sandy Silt, very fine grained, distinct laminations, lower contact is sharp, appears erosional

Clay, dark grayish brown (10YR 4/2); appears very moist and very stiff to hard; 10-25% calcium carbonate filaments and uncemented, irregular nodules up to 1/4-inch; lower contact is gradational

Clay and Silty Clay, rare (<1%) coarse sand (Jsm and Tm); dark grayish brown (10YR 4/2) with variable strong brown (7.5YR 5/8) mottling; appears very moist and very stiff to hard; variable (2-15%) calcium carbonate filaments and cemented nodules up to 1/4-inch; occasional sandy beds; lower contact is gradational

At 64.3': 1/2 inch Sandy Silt bed

At 64.5 to 65.5': 10-20% calcium carbonate filaments up to 1/8 inch

At 64.8': 1/2 inch Silty Sand bed

At 65.5 to 65.9': Silty Sand to Sandy Silt, very fine grained, distinct laminations, lower contact is sharp, appears erosional

Estuarine Deposits-Fine Grained [Qef]

Clay and Silty Clay, trace coarse sand (Jsm and Tm); brown (7.5YR 4/4) with occasional dark grayish brown (10YR 4/2) mottles; appears very moist and hard; rare calcium carbonate filaments up to 1/16-inch; generally thickly bedded; lower contact is gradational

At 77.5 to 78.3': Grades to fine Silty Sand/Sandy Silt

At 79.4': Possible detrital charcoal, sample collected

At 79.5 to 82.0': Grades to Clayey to Sandy Silt; trace coarse sand (Jsm and Tm)
### Clay and Silty Clay as above

- At 82.4 to 84.0': No recovery

### Calcium Carbonate Filaments Increase to 5-10%, up to 1/8 inch

- At 84.0 to 86.0': Color becomes dark grayish brown, occasional highly oxidized strong brown (7.5YR 5/6), irregular pockets up to 1/2 inch; variable (2-15%) calcium carbonate filaments up to 1/4-inch

### Calcium Carbonate Increases, 15-20% Calcium Carbonate Filaments and Cemented Nodules up to 1/4 inch

- At 89.0 to 90.5': Scattered chalk clasts and sediment pockets
- At 92.0 to 95.0': Manganese oxide flecks and staining, 5-15%
- At 95.0 to 95.5': Silty Sand, fine-medium grained, dark brown (7.5YR 3/4)

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**ESTUARINE DEPOSITS [Qe]**

- Clayey to Sandy Silt, variable coarse sand and gravel, clasts 5-25%, up to 3/4 inch, mainly subangular slate (Jsm), sandstone (Tm) and shale (Tm); strongly mottled, color variable, mainly strong brown (7.5YR 5/8) to dark grayish brown (10YR 4/2); appears very moist and very stiff to hard; variable (2-20%) calcium carbonate filaments and cemented nodules up to 1/4 inch
- At 92.0 to 95.0': Scattered chalk clasts and sediment pockets
- At 92.6 to 94.0': No recovery

### Calcium Carbonate Increases, 15-20% Calcium Carbonate Filaments and Cemented Nodules up to 1/4 inch

- At 95.0 to 95.5': Manganese oxide flecks and staining, 5-15%
<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
<th>SAMPLE LOC.</th>
<th>DRILLING COMPANY/DRILLING EQUIPMENT</th>
<th>BOREHOLE LOCATION</th>
<th>DATES DRILLED</th>
<th>HOLE DIAMETER</th>
<th>GROUND EL.</th>
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<tbody>
<tr>
<td>105</td>
<td>110</td>
<td>7</td>
<td>21</td>
<td>64</td>
<td>Stiff Clay</td>
<td>Jet Drilling / CME 75</td>
<td>See Plate 3</td>
<td>4/20/11 - 4/22/11</td>
<td>8 inches</td>
<td>260 feet</td>
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</tbody>
</table>

**Qe Continued**

At 101.4 to 101.9': Becomes gravelly, clasts 25-35%, up to 3/4 inch, mainly subangular to subrounded slate (Jsm), sandstone (Tm) and shale

At 102.6 to 104.0': No recovery

At 104.5 to 105.5': Silty Sand, fine grained; mottled, yellowish brown (10YR 5/4) to grayish brown (10YR 5/2); some laminations and varve-like bedding

At 105.5 to 106.1': Alternating laminations Clay and fine Silty Sand; colors similar to silty sand bed above

At 106.7 to 107.5': Occasional Silt laminations and pockets

At 107.4 to 114.0': No recovery

Sandy to Clayey Silt, rare (<1%) coarse sand (Jsm and Tm); grayish brown (2.5Y 5/2) with variable brownish yellow (10YR 6/6) mottling; appears very moist and very stiff to hard; lower contact is sharp

At 114.0 to 114.3': Gravelly bed, clasts 20-35%, up to 3/4 inch, mainly subrounded slate (Jsm) and sandstone (Tm)

At 114.5': Silty Sand bed, fine grained; ½ inch thick; light brownish gray (10YR 6/2)

Estuarine Deposits - Fine Grained [Qef]

Silty Clay and Clayey Silt, variable fine sand, trace coarse sand (Jsm and Tm); mottled, grayish brown (2.5Y 5/2) to strong brown (7.5YR 5/6); appears very moist and very stiff to hard; varve like bedding; occasional beds with rare (<1%) calcium carbonate filaments

At 118.0 to 119.0': No recovery

This record is an interpretation of subsurface conditions at the exploration location. Latitude and longitude of boring location shown on logs are approximate. Interactions between strata are approximate. Transitions between strata may be gradual.

Subsurface conditions at other locations and at other times may differ.

Geologist: DB/MF
Prepared/Date: WL/YN/MW 10/11/2011
Checked/Date: MW/MF 10/11/2011
At 123.0 to 124.7': Color becomes dark brown (7.5YR 3/2) to brown (7.5YR 4/4); distinct laminations, trace manganese oxide flecks

OLDER ALLUVIAL FAN/ESTUARINE DEPOSITS [Qfe/Qe]
Sandy Clay to Clayey Sand with Gravel; clasts 25-30%, up to 1/2 inch, mainly subangular slate (Jsm) and sandstone (Tm); color variable
At 125.6 to 129.0': No recovery

At 129.0 to 129.5': Clayey Sand to Sandy Clay with Gravel, clasts 25-35%, up to 1 inch, mainly subrounded slate (Jsm) and sandstone (Tm); color variable
Silty Clay and Clayey Silt, variable fine sand, trace coarse sand and fine gravel (Jsm and Tm); mottled dark grayish brown (2.5Y 4/2) to reddish yellow (7.5YR 6/6); appears very moist and very stiff to hard; trace manganese oxide flecks; well sorted; lower contact is gradational
At 132.3 to 134.0': No recovery

At 134.0 to 134.0': Sand increases, gradational transition to unit below
Sandy to Clayey Silt, abundant coarse sand and trace fine gravel (Jsm and Tm); mottled light olive brown (2.5Y 5/3) to strong brown (7.5YR 5/6); appears moist to very moist and very stiff to hard; poorly sorted; 10-20% calcium carbonate filaments and fine cemented and uncemented nodules up to 1/4-inch; lower contact is missing/disturbed in core
At 137.9 to 138.4': Sandy Silt; mottled, light yellowish brown (2.5Y 6/3) to reddish yellow (7.5YR 6/6); appears moist and very stiff, rare (<1%) coarse sand (Jsm and Tm)

END OF BORING AT 139 FEET

NOTES:
Boring backfilled with cement/bentonite grout from bottom up and patched.

- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term “clasts” herein describes gravel-size rock fragments (larger than ¼ inch).
- Beds are generally massive unless otherwise noted.

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<tr>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
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</tbody>
</table>

Encountered at 46-ft during drilling
### HAND AUGERED TOP 6 FEET

- **Sample Location**: Hand augered top 6 feet
- **Description**:
  - Younger/Older Alluvial Fan Deposits [Qf/Qfo]
  - Silty Sand, fine grained, trace fine gravel (Jsm and Tm); dark yellowish brown (10YR 4/6); appears damp and medium dense; lower contact is gradational
  - Silty Sand and Sandy Silt, fine grained, trace coarse sand and fine gravel (Jsm and Tm), trace clay; dark yellowish brown (10YR 3/6); appears damp to moist and dense/very stiff; lower contact is gradational
  - NOTE:
    - Jsm = Santa Monica Slate
    - Tm = Modelo Formation
    - See end of log for more detailed description of clasts

- **Older Alluvial Fan Deposits [Qfo]**
  - Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); slightly mottled, olive brown (2.5Y 4/3) to dark yellowish brown (10YR 4/6); appears damp to moist and very stiff; trace calcium carbonate flecks; lower contact is gradational

- **Estuarine Deposits [Qe]**
  - Sandy Silt with Clay; olive brown (2.5Y 4/3) to dark yellowish brown (10YR 4/6); appears moist and very stiff; trace calcium carbonate flecks; poorly sorted; lower contact narrowly gradational
  - At 14.0 to 15.0': Mottling becomes strong
  - At 15.0 to 15.5': Gravelly lens, Jsm fragments to 1-inch

- **Clayey Silt with fine Sand, trace coarse sand (Jsm and Tm); very dark grayish brown (2.5Y 3/2); appears damp and hard; trace calcium carbonate flecks; lower contact occurs between runs

- **Clayey Silt to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); very dark grayish brown (2.5Y 3/2); appears moist and very stiff; lower contact gradational

- **Clayey Silt; mottled, dark grayish brown (2.5Y 4/2) to dark yellowish brown (10YR 4/6); appears damp to moist and hard; generally thickly bedded, occasional sandy silt lenses; lower contact narrowly gradational
- At 19.0 to 20.0': Waxy parting surfaces, possible shearing

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**LOG OF BORING**

<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
<th>SAMPLE LOC.</th>
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<tr>
<td>255</td>
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<td>220</td>
<td>40</td>
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</table>

*This record is an interpretation of subsurface conditions at the exploration location. Latitude and longitude of boring location shown on logs are approximate. Interfaces between strata may vary.*

*MtA Westside Subway Extension
Los Angeles, California*
**LOG OF BORING**

**PROJECT NO.** 4953-10-1561

**MTA Westside Subway Extension**

**Los Angeles, California**

---

**DRILLING METHOD**

Hollow-Stem Auger

**BOREHOLE LOCATION**

See Plate 3

**DATES DRILLED**

2/4/11

**HOLE DIAMETER**

8 inches

**GROUND EL.**

259 feet

---

**GROUNDWATER READINGS**

Encountered at 33.5-ft during drilling

---

**OLDER ALLUVIAL FAN DEPOSITS [Q0] - Marker Bed M**

Clayey to Sandy Silt, trace coarse sand and gravel (Jsm and Tm); mottled, dark yellowish brown (10YR 4/4); appears moist and very stiff; becomes coarser with depth; lower contact gradational

At 38.0 to 38.5': Dark brown (7.5YR 3/3) becomes predominant color

---

**Qe Continued**

At 20.0 to 27.2': Trace coarse sand and fine gravel (Jsm and Tm)

At 23.0 to 24.0': Some waxy parting surfaces, possible shearing

At 27.2 to 28.0': Sandy Silt to Silty Sand, fine grained; mottled, light olive brown (2.5Y 5/3) to dark yellowish brown (10YR 4/4); appears moist and dense/very stiff; upper and lower contacts are sharp

At 28.0 to 33.5': Occasional indistinct varve like bedding

---

**At 33.5 ft: Ground water encountered during drilling**

---

**MARKER BED MC**

Clayey to Sandy Silt, trace coarse sand and fine gravel, clasts mainly subangular to subrounded slate (Jsm) with lesser subrounded shale and sandstone (Tm); slightly mottled, brown (10YR 4/3) to dark yellowish brown (10YR 4/4); appears very moist to wet and very stiff; possible weak soil development; lower contact gradational

---

**At 220 ft: Coarse sand and fine gravel increasing with depth; clasts mainly angular to subangular, slate (Jsm) with lesser rounded to subrounded, shale (Tm), rare quartzite and other rock types; poorly sorted**
At 42.0 to 43.0' Gradational transition to unit below

**FLUVIAL DEPOSITS [Qflo]**
Silty Gravel, clasts 50-70%, up to 2 inches, mainly subangular to subrounded slate (Jsm) with lesser rounded to subrounded shale and sandstone (Tm), soil matrix is fine to coarse silty sand, trace to some clay; variable color, generally brown (10YR 4/3) to dark yellowish brown (10YR 4/6); appears wet

**ESTUARINE DEPOSITS [Qe]**
Clayey Silt, trace to some fine to coarse grained; coarse sand mainly subangular to subrounded, slate (Jsm) with lesser subrounded shale and sandstone (Tm); mottled, brown (10YR 4/3) to dark yellowish brown (10YR 4/6); appears very moist and very stiff; lower contact is gradational

Clayey to Sandy Silt, trace coarse sand and fine gravel; coarse sand and gravel mainly subangular to subrounded slate (Jsm) with lesser subrounded shale and sandstone (Tm); mottled, brown (10YR 4/3) to dark yellowish brown (10YR 4/6); appears very moist and very stiff; lower contact is gradational

**Silty Gravel, gravel 50-70%, up to 2 inches; gravel mainly subangular to subrounded slate (Jsm) with lesser subrounded shale and sandstone (Tm); soil matrix is fine to coarse silty sand, trace to some clay; brown (10YR 4/3); appears wet; lower contact is sharp, erosional**

**Well Graded Sand with Silt, fine to coarse grained, dark yellowish brown (10YR 4/4); appears wet; lower contact narrowly gradational**

**Silty Sand with Gravel, fine to coarse grained, clasts 20-40%, up to 2 inches, mainly subangular to subrounded slate (Jsm) with lesser subrounded shale and sandstone (Tm); brown (10YR 4/3); appears wet; lower contact sharp, erosional**

**Silty Gravel, clasts 50-70%, up to 2 inches, mainly subangular to subrounded slate (Jsm) with lesser rounded to subrounded shale and sandstone (Tm), soil matrix is fine to coarse silty sand, trace to some clay; variable color, generally brown (10YR 4/3) to dark yellowish brown (10YR 4/6); appears wet**
<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
<th>SAMPLE LOC.</th>
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<td>Cl/ML</td>
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<td>SM/ML</td>
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<td>185</td>
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<td>Cl/ML</td>
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<tr>
<td>80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SM/ML</td>
</tr>
</tbody>
</table>

Qc Continued
Silty Sand to Sandy Silt, fine grained; dark yellowish brown (10YR 4/4); appears wet and dense/stiff; well sorted; lower contact is gradational

At 62.5 to 63.6': Some Clayey Silt lenses (gradational zone)

Silty Clay to Clayey Silt, trace to some fine to coarse sand (Jsm and Tm); lightly mottled, brown (10YR 4/3) to dark yellowish brown (10YR 4/4); uppermost 3/4 inch is brown (7.5YR 4/2) clay; appears very moist and very stiff

At 64.8 to 65.1': Silty Sand beds, fine grained; olive brown (2.5Y 4/3); appears very moist
At 65.0 to 65.5’: Thin layer of Silty Sand, fine grained; dark yellowish brown (10YR 4/3); appears wet

At 67.2 to 67.6’: Subhorizontal oxidized Silt laminations alternating with Silty Clay

At 68.3’: Oxidized Silty Sand pocket, fine to coarse grained, 2 inches thick
At 69.0 to 70.0’: No recovery

At 70.0 to 70.4’: Silty Sand and Sandy Silt; dark yellowish brown (10YR 4/4); appears wet and dense/stiff

At 72.6 to 73.5’: Sandy Silt; mottled, brown (10 YR 4/3) to dark yellowish brown (10YR 4/6); appears wet and medium stiff
At 73.4 to 73.5’: Subhorizontal oxidized Silt lamination

At 74.3 to 75’: Silty Sand to Sandy Silt layer, thin; slightly mottled, dark grayish brown (10YR 4/2) to dark yellowish brown (10YR 4/4); appears wet and dense/stiff

END OF BORING AT 75 FEET

NOTES:
Boring backfilled with cement/bentonite grout from bottom up and patched.

-Munsell colors listed in order of predominance (most predominant color first).
-Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
-Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
-Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
-The term “clasts” herein describes gravel-size rock fragments (larger than ¼ inch).
-Beds are generally massive unless otherwise noted.
## LOG OF BORING

**BORING NO.**

T4-B5

### BOREHOLE LOCATION

**GROUND EL.**

258 feet

#### DRILLING COMPANY/DRILLING EQUIPMENT

Gregg's Drilling / CME 75

#### DRILLING METHOD

Mud Rotary

#### DATES DRILLED

1/26/11

#### HOLE DIAMETER

5-3/8 inches

### GROUNDWATER READINGS

Encountered at 14-ft during drilling

6 inches of asphaltic concrete over 8 inches of concrete

Hand augered to 10 feet

**YOUNGER/OLDER ALLUVIAL FAN DEPOSITS [Q6/Qfo]**

- Clayey Silt, very dark grayish brown (10YR 3/2); fine to medium sand, some coarse sand

**NOTE:**

- Jsm = Santa Monica Slate
- Tm = Modelo Formation

See end of log for more detailed descriptions

### SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

### % RECOVERY

### SAMPLE LOC.

#### DRILLING COMPANY/DRILLING EQUIPMENT

Gregg's Drilling / CME 75

#### DRILLING METHOD

Mud Rotary

#### DATES DRILLED

1/26/11

#### HOLE DIAMETER

5-3/8 inches

### GROUNDWATER READINGS

Encountered at 14-ft during drilling

6 inches of asphaltic concrete over 8 inches of concrete

Hand augered to 10 feet

**YOUNGER/OLDER ALLUVIAL FAN DEPOSITS [Q6/Qfo]**

- Clayey Silt, very dark grayish brown (10YR 3/2); fine to medium sand, some coarse sand

**NOTE:**

- Jsm = Santa Monica Slate
- Tm = Modelo Formation

See end of log for more detailed descriptions

### SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

### % RECOVERY

### SAMPLE LOC.
<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
<th>SAMPLE LOC.</th>
<th>GROUNDWATER READINGS</th>
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<tbody>
<tr>
<td>235</td>
<td>1</td>
<td>3</td>
<td>100</td>
<td>Qfo Continued</td>
<td>lower contact is sharp</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>At 21.3 to 21.9': Silty Sand; fine to medium grained; dark yellowish brown (10YR 4/6); appears moist; upper contact is gradational, lower contact is sharp</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td></td>
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<td></td>
<td>ESTUARINE DEPOSITS [Qe]</td>
<td>Clayey Silt, trace to some fine to coarse sand (Jsm and Tm), occasional silty clay lenses, dark grayish brown (2.5Y 4/2); appears very moist to wet and stiff to very stiff; lower contact is gradational</td>
</tr>
<tr>
<td>230</td>
<td>2</td>
<td>4</td>
<td>80</td>
<td>At 22.7 to 30.0': Trace calcium carbonate flecks</td>
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<tr>
<td></td>
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<td></td>
<td></td>
<td>At 27.0': Becomes mottled; very dark grayish brown (2.5Y 3/2) to olive brown (2.5Y 4/4)</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td>At 28.2 to 28.5': Silty Sand; trace gravel</td>
<td></td>
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<tr>
<td></td>
<td></td>
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<td></td>
<td>At 29.0 to 30.0': No recovery</td>
<td></td>
</tr>
<tr>
<td>225</td>
<td>2</td>
<td>5</td>
<td>100</td>
<td>At 30.0': Mottling becomes stronger; very dark grayish brown (2.5Y 3/2) to dark yellowish brown (10YR 4/4)</td>
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<td></td>
<td>At 31.8': Possible charcoal fragment, sampled collected</td>
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<td>35</td>
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<td></td>
<td>At 33.0 to 35.0': Alternating layers of Clayey to Sandy Silt; trace coarse sand and fine gravel (Jsm and Tm); slightly mottled, brown (10YR 4/3) to dark yellowish brown (10YR 4/4); appears wet and stiff; contacts are gradational</td>
<td></td>
</tr>
<tr>
<td>220</td>
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<td></td>
<td>Silty Clay; trace fine to coarse sand; lightly mottled, dark grayish brown (2.5Y 4/2) to dark yellowish brown (10YR 4/4); appears wet and stiff</td>
<td></td>
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<tr>
<td>40</td>
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<td></td>
<td>Clayey Silt to Silty Clay, trace coarse sand and fine gravel (Jsm and Tm); mottled, dark grayish brown (2.5Y 4/2) to olive brown (2.5Y 4/4); appears very moist to wet and stiff to very stiff; occasional oxidized pockets or lenses; lower contact occurs between runs</td>
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</tbody>
</table>

MTA Westside Subway Extension
Los Angeles, California

Log of Boring
Project No.: 4953-10-1561 Figure: T4-B5b

Geologist: PR/MF
Prepared/Date: WL/YN/MW 10/11/2011
Checked/Date: MW/MF 10/11/2011
**OLDER ALLUVIAL FAN DEPOSITS [Qfo]** - Marker Bed MB

Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); dark grayish brown (2.5Y 4/2) to dark yellowish brown (10YR 4/6); appears very moist to wet and very stiff; poorly sorted, generally coarsens with depth; lower contact is gradational

At 48.3': Becomes gravelly, 25-35%, up to 3/4 inch; gravel mainly angular to subangular, slate (Jsm) with lesser rounded to subrounded, shale (Tm), rare quartzite and other rock types

**FLUVIAL DEPOSITS [Qfo]**

Silty Gravel, clasts 50-70%, up to 1½ inches, mainly subangular to subrounded slate (Jsm) with lesser subrounded shale and sandstone (Tm); soil matrix is fine to coarse silty sand with trace clay; dark brown (10 YR 3/3); appears wet; lower contact is sharp, erosional
<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
<th>SAMPLE LOC.</th>
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<tr>
<td>180</td>
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<td>100</td>
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<tr>
<td>258 feet</td>
<td></td>
<td></td>
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</table>

**ESTUARINE DEPOSITS [Qe]**

Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); occasional silty clay lenses; mottled, dark grayish brown (10YR 4/2) to dark yellowish brown (10YR 3/6); appears very moist to wet and very stiff; numerous oxidized pockets; lower contact is gradational.

At 73.0': Slight color change, mottled, olive brown (2.5Y 4/3) to dark yellowish brown (10YR 4/6)

At 73': Mottling decreases to slightly mottled

Well Graded Sand with Silt, fine to coarse grained, some gravel, 10-15%, up to 3/4 inch; gravel mainly subangular slate (Jsm) with lesser subdued sand and sandstone (Tm); dark yellowish brown (10 YR 4/4); appears wet and dense

END OF BORING AT 75 FEET

**NOTES:**

- Boring backfilled with cement/bentonite grout from bottom up and patched.
- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subdued sand and sandstone unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subdued sand and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than 1/4 inch).
- Beds are generally massive unless otherwise noted.
**GROUNDWATER READINGS**

Encountered at 34-ft during drilling

<table>
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<th>SAMPLE LOC.</th>
<th>% RECOVERY</th>
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<td>ML</td>
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<td>1</td>
<td>100</td>
<td>ML</td>
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</tr>
<tr>
<td>245</td>
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<td>80</td>
<td>GC/GM</td>
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</tr>
<tr>
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<td>1</td>
<td>2</td>
<td>90</td>
<td>GM</td>
<td></td>
</tr>
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<td>20</td>
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<td></td>
<td></td>
<td>GM</td>
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</tr>
</tbody>
</table>

6 inches of asphaltic concrete over 6 inches of concrete

Hand augered to 6 feet

**YOUNGER / OLDER ALLUVIAL FAN DEPOSITS [Qf/Qfo]**

Clayey Silt, trace to some fine sand and coarse sand (Jsm and Tm); brown (10YR 4/3); appears damp to moist and hard; lower contact occurs between runs

NOTE:

Jsm = Santa Monica Shale
Tm = Modelo Formation

See end of log for more detailed clast descriptions

**OLDER ALLUVIAL FAN DEPOSITS [Qfo]**

Clayey Silt with fine Sand, trace coarse sand and fine gravel (Jsm and Tm); brown (10YR 4/3); appears damp and hard; poorly sorted; sand and gravel content increases with depth; lower contact is gradational

At 10.0 to 13.0': Color grades to dark yellowish brown (10YR 4/4)

**FLUVIAL DEPOSITS [Qf0fl]**

Silty Sand with fine Gravel, clasts 25-40%, mostly 1/4 inch to ½ inch, mainly angular to subangular slate (Jsm); yellowish brown (10YR 5/4); appears damp; lower content is narrowly gradational
### MTA Westside Subway Extension
Los Angeles, California

<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
<th>SAMPLE LOC.</th>
<th>DRILLING COMPANY/DRILLING EQUIPMENT</th>
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<tr>
<td>235</td>
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<td>30</td>
<td>GM</td>
<td>Jet Drilling / CME 75</td>
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<td>25</td>
<td>2</td>
<td>5</td>
<td></td>
<td>46</td>
<td>ML</td>
<td>Hollow-Stem Auger</td>
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<tr>
<td>30</td>
<td>2</td>
<td>6</td>
<td></td>
<td>46</td>
<td>CL</td>
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<td>44</td>
<td>SM</td>
<td>BOREHOLE LOCATION</td>
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<tr>
<td>220</td>
<td>2</td>
<td>7</td>
<td></td>
<td>44</td>
<td>GM</td>
<td>See Plate 3</td>
</tr>
</tbody>
</table>

#### GROUNDWATER READINGS

- At 21.5 to 25.0': No recovery
- At 25.0 to 26.3': Becomes moist to very moist
- At 26.3': Possible minor perched groundwater on contact
- Silty Clay, trace coarse sand and fine gravel (Jsm and Tm); lightly mottled, dark grayish brown (10YR 4/2) to brown (10YR 4/3); appears very moist and stiff; poorly sorted; lower contact is gradational
- At 32.3 to 35.0': No recovery
- At 34': Groundwater encountered during drilling
- At 36.5 to 37.2': Silty Gravel, clasts 50-70%, up to 3/4 inch, mainly subangular slate (Jsm) with lesser subrounded shale (Tm); soil matrix is fine to coarse silty sand; dark yellowish brown (10YR 3/4); appears wet and dense
- At 37.2 to 41.0': No recovery

#### FLUVIAL DEPOSITS [Qflf]

- Silty Sand with Gravel, fine to coarse grained, clasts 25-40%, up to 3/4 inch, mainly subangular slate (Jsm) with lesser subrounded shale (Tm); dark yellowish brown (10YR 3/4); appears wet; lower contact occurs between runs
- At 36.5 to 37.2': Silty Gravel, clasts 50-70%, up to 3/4 inch, mainly subangular slate (Jsm) with lesser subrounded shale (Tm); soil matrix is fine to coarse silty sand; dark yellowish brown (10YR 3/4); appears wet and dense
- At 37.2 to 41.0': No recovery

#### OLDER ALLUVIAL FAN DEPOSITS [Qfo]

- Clayey to Sandy Silt, mottled dark grayish brown (10YR 4/2) to dark yellowish brown (10YR 4/4); appears very moist and stiff; poorly sorted; lower contact is gradational
- At 27.3 to 30.0': No recovery
- Silty Clay, trace coarse sand and fine gravel (Jsm and Tm); lightly mottled, dark grayish brown (10YR 4/2) to brown (10YR 4/3); appears very moist and stiff to very stiff; poorly sorted; lower contact is gradational
- At 32.3 to 35.0': No recovery

#### LOG OF BORING

- **T4-B6**
- **Project No.: 4953-10-1561**
- **Geologist: DB/MF**
- **Prepared/Date: WL/YN/MW 10/11/2011**
- **Checked/Date: MW/MF 10/11/2011**

**MTA Westside Subway Extension**
Los Angeles, California

**BORING NO.**

**LOG OF BORING**

**T4-B6**

**CONTINUED ON FOLLOWING FIGURE**

**Geologist: DB/MF**

**Prepared/Date: WL/YN/MW 10/11/2011**

**Checked/Date: MW/MF 10/11/2011**
ESTUARINE DEPOSITS [Qe]
Clayey Silt with Sand, trace coarse sand and fine gravel; (Jsm and Tm); dark yellowish brown (10YR 3/4); appears very moist to wet and very stiff; lower contact is sharp

Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); mottled brown (10YR 4/3) to dark yellowish brown (10YR 3/6); appears very moist to wet and very stiff; moderately well sorted, occasional silty sand beds; lower contact is gradational

Marker Bed Mc
Clay and Silty Clay, trace coarse sand (Jsm and Tm); mottled, very dark brown (10YR 2/2) to dark yellowish brown (10YR 3/6); appears very moist and very stiff; possible weak soil development; lower contact is gradational

At 53.0 to 54.2': Prominent varve-like bedding

OLDER ALLUVIAL FAN DEPOSITS [Qfo]
Silty Clay and Clayey Silt, trace coarse sand (Jsm and Tm); dark yellowish brown (10YR 4/4); appears very moist and medium stiff to stiff; lower contact is gradational

Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); lightly mottled, dark yellowish brown (10YR 4/4) to dark grayish brown (10YR 4/2); appears very moist to wet and stiff to very stiff; generally moderately to poorly sorted, occasional silty clay layers and gravelly layers; lower contact is sharp

At 58.2 to 60.0': No recovery
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<th>RUN #</th>
<th>% RECOVERY</th>
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**DRILLING COMPANY/DRILLING EQUIPMENT**
Jet Drilling / CME 75

**DRILLING METHOD**
Hollow-Stem Auger

**BOREHOLE LOCATION**
See Plate 3

**DATES DRILLED**
1/26/11 - 1/27/11

**HOLE DIAMETER**
8 inches

**GROUND EL.**
257 feet

**GROUNDRIDEADINGS**
Encountered at 34-ft during drilling

At 61.2 to 61.4': Silty Sand bed

At 65.8 to 69.0': More gravelly (15% fine gravel), coarse sand and gravel mainly angular to subangular slate (Jsm), with lesser rounded to subrounded shale (Tm), some quartzite and other rock types

**FLUVIAL DEPOSITS [Qfo]**
Silty Gravel, clasts 50-70%, up to 2 inches, mainly subangular to subrounded slate (Jsm) with lesser subrounded shale and sandstone (Tm); soil matrix is fine to coarse silty sand with occasional clayey lenses; dark olive brown (2.5Y 3/3); appears wet and dense

**END OF BORING AT 75 FEET**

**NOTES:**
Boring backfilled with cement/bentonite grout from bottom up and patched.

- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch).
- Beds are generally massive unless otherwise noted.
6 inches of asphaltic concrete over 6 inches of concrete

Hand augered top 6 feet

**YOUNGER / OLDER ALLUVIAL FAN DEPOSITS [Qf/Qfo]**

Clayey Silt, trace to some fine sand; brown (10YR 4/3); appears moist and very stiff

NOTE:

Jsm = Santa Monica Slate
Tm = Modelo Formation

See end of log for more detailed description of clasts

Clayey Silt, trace to some fine sand, trace coarse sand and fine gravel (Jsm); very dark grayish brown (10YR 3/2); appears moist and very stiff; trace dispersed calcium carbonate, occasional concentrated zones with up to 30% calcium carbonate; lower contact is gradational

**OLDER ALLUVIAL FAN DEPOSITS [Qfo]**

Clayey Silt with fine Sand, trace coarse sand and fine gravel (Jsm and Tm); dark yellowish brown (10YR 4/4); appears damp and hard; sand and gravel content generally increases with depth; lower contact occurs between runs

At 13.5 to 15.0': No recovery

Silty Sand with Gravel, very fine grained, gravel 20-30%, up to 1 inch; mainly subangular slate (Jsm) with lesser subrounded shale (Tm); yellowish brown (10YR 5/4); appears damp and dense; lower contact is gradational

At 16.0 to 17.5': No recovery

Silty Sand, fine grained, trace coarse sand and fine gravel (Jsm and Tm); yellowish brown (10YR 5/4); appears damp and dense; lower contact occurs between runs

At 19.2' - 19.6': Sandy Silt layer
At 20.8 to 21.4': Gravel increases, 20-30%, up to 1½ inches; mainly subangular to subrounded slate (Jsm) with lesser subrounded shale and sandstone (Tm)

At 23.0 to 25.0': Gravel decreases, 10-15%, up to 3/4 inch, appears moist; dark yellowish brown (10YR 4/4)

At 25.0 to 28.5': Gravel decreases to trace

At 27.0': Appears very moist, dark yellowish brown (10YR 3/4)

At 28.5 to 30.0': No recovery

At 30.0': Possible minor perched groundwater encountered

Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); very dark grayish brown (2.5Y 3/2); appears very moist and soft to medium stiff; lower contact is sharp

At 31.6': Grades to Clay, appears stiff

At 33.0': Groundwater encountered during drilling

Sandy Clay, trace fine gravel (Jsm and Tm); very dark grayish brown (2.5Y 3/2); appears wet and medium stiff; lower contact is gradational

Sandy Silt with Clay, trace fine gravel (Jsm and Tm); very dark grayish brown (2.5Y 3/2); appears wet and stiff; poorly sorted; lower contact is gradational

Silty Clay, trace coarse sand (Jsm and Tm); dark brown (7.5YR 3/2); appears wet and soft to medium stiff; lower contact is gradational

Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); slight intermittent mottling, very dark grayish brown (2.5Y 3/2) with intermittent olive brown (10YR 4/3); appears very moist to wet and very stiff; poorly sorted; lower contact occurs between runs

At 38.9 to 40.0': No recovery
At 40.0’ to 41.6’: Silty to Clayey Gravel with Sand, gravel 50-60%, up to 1-inch; gravel mainly subangular slate (Jsm) with lesser subrounded shale and sandstone (Tm); soil matrix is variable clay, silt and fine to coarse sand; very dark grayish brown (2.5Y 3/2); appears wet; lower contact is sharp; erosional

Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); slight intermittent mottling, very dark grayish brown (2.5Y 3/2) with intermittent olive brown (10YR 4/3); appears very moist to wet and very stiff; poorly sorted

At 41.0 to 41.6’ and 43.4 to 43.8’: Becomes oxidized, dark yellowish brown (10 YR 3/4)

At 44.0 to 45.0’: No recovery

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Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); intermittant light mottling, very dark brown (10YR 2/2) to dark yellowish brown (10YR 3/6); appears very moist and very stiff; lower contact is gradational

At 47.8 to 48.8’: prominent varve like bedding

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Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); intermittent mottling, very dark grayish brown (2.5Y 3/2) with sparse dark yellowish brown (10YR 4/4); appears very moist to wet and stiff to very stiff; occasional silty clay layers; lower contact is gradational

At 52.8 to 53.6’: Becomes gravelly, 30-40%, up to 2 inch; gravel mainly subangular to subrounded slate (Jsm) with lesser subrounded shale and sandstone (Tm)

At 53.6 to 59.0’: Less gravel, trace coarse sand, occasiona1 faint laminations and varve like bedding
ML/CL continued

At 60.4': Possible charcoal fragments, sample collected

Marker Bed MC

Clayey Silt and Silty Clay, trace coarse sand (Jsm); color variable, mainly very dark grayish brown (10YR 3/2) with some dark reddish brown (5YR 3/4); appears very moist and stiff; possible weak soil development; lower contact is gradational

OLDER ALLUVIAL FAN DEPOSITS (Qfo)/Marker Bed MA

Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); strongly mottled, dark yellowish brown (10YR 4/4) to dark grayish brown (2.5Y 4/2); appears very moist and very stiff

Clayey to Sandy Silt, variable gravel, clasts 10-15%; up to 3/4-inch; mainly subangular to subrounded slate (Jsm) with lesser subrounded shale and sandstone (Tm); colors as above, appears very moist and very stiff

At 72.5 to 75.0': Slight color change, mottled, dark grayish brown (2.5Y 4/2) to dark yellowish brown (10YR 4/4); coarse sand and gravel decrease to trace

END OF BORING AT 75 FEET

NOTES:
Boring backfilled with cement/bentonite grout from bottom up and patched.

-Munsell colors listed in order of predominance (most predominant color first).
-Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
-Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
-Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
-The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch).
-Beds are generally massive unless otherwise noted.

Geologist: DB/MF
Prepared/Date: WL/YN/MW 10/11/2011
Checked/Date: MW/MF 10/11/2011
Asphaltic concrete over concrete

Hand augered to 6 feet

YOUNGER / OLDER ALLUVIAL FAN DEPOSITS [Qf/Qfo]
Clayey Silt, trace to some fine sand; brown (10YR 4/3); appears damp to moist and very stiff

NOTE:
Jsm = Santa Monica Slate
Tm = Modelo Formation
See end of log for more detailed description of clasts

At 6.0 to 6.5': Grades to Sandy Silt with Clay

Older Alluvial Fan Deposits [Qfo]
Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); dark grayish brown (10YR 4/2); appears damp to moist and hard; trace dispersed calcium carbonate, some concentrated zones with up to 20% calcium carbonate deposits; lower contact occurs between runs

At 15.8 to 16.8': Grades to fine Silty Sand to Sandy Silt with variable coarse sand and fine gravel, clasts 0-20%, up to ⅜ inch (Jsm and Tm)

Older Fluvial/Alluvial Fan Deposits [QfOd/Qfo]
Silty Gravel, clasts 50-70%, up to 2 inches; mainly subangular to subrounded slate (Jsm) with lesser subrounded shale and sandstone (Tm); soil matrix is fine to coarse silty sand with trace clay; dark grayish brown (2.5Y 4/2); appears damp and dense; lower contact occurs between runs
### LOG OF BORING

**MTA Westside Subway Extension**  
*Los Angeles, California*

**Project No.: 4953-10-1561**  
**Figure: T4-B8b**  
**Prepared/Date: WL/YN/MW 10/11/2011**  
**Checked/Date: MW/MF 10/11/2011**

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<th>SAMPLE LOC.</th>
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<td>Qfo/Qfo-fl Continued</td>
<td>At 22.8 to 24.0: Grades to fine Silty Sand to Sandy Silt; trace fine gravel (Jsm); dark yellowish brown (10YR 3/6); appears moist</td>
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<td>At 25.5 to 26.5: Soil matrix becomes dark yellowish brown (10YR 4/4)</td>
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<td>At 26.5 to 27.2: Grades to fine Silty Sand to Sandy Silt; trace fine gravel (Jsm); dark yellowish brown (10YR 3/6); appears moist</td>
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<td>At 29.4 to 30.0: Silty Sand, fine to medium grained, trace fine gravel (Jsm); dark yellowish brown (10YR 3/4); appears very moist</td>
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<td>At 30: Becomes very moist; soil matrix becomes very dark grayish brown (2.5Y 3/2)</td>
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<td>Silty Sand with Gravel, fine to coarse grained, clasts 20-40%, up to 3/4 inch; gravel mainly subangular to subrounded slate (Jsm); very dark grayish brown (2.5Y 3/2); appears wet and dense; occasional more clayey beds; lower contact is gradational</td>
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<td>At 36.5 to 37.5: Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm); dark grayish brown (2.5Y 4/2); appears wet; medium stiff</td>
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<td>At 38.6 to 38.9: Silty Clay lens, dark grayish brown (2.5Y 4/2); appears wet and medium stiff</td>
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**DRILLING COMPANY/DRILLING EQUIPMENT**  
Jet Drilling / CME 75

**HOLLOW-STEM AUGER**  
See Plate 3

**DATES DRILLED**  
2/2/11 - 2/3/11

**HOLE DIAMETER**  
8 inches

**GROUNDWATER READINGS**  
Encountered at 37-ft during drilling

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This record is an interpretation of subsurface conditions at the exploration location. Latitude and longitude of boring location shown on logs are approximate. Interfaces between strata are approximate. Transitions between strata may be gradual.

*MTA Westside Subway Extension*  
*Los Angeles, California*
Qfo/Qfof Continued
At 40.0 to 40.8': Poorly Graded Sand, fine to medium grained; yellowish brown (10YR 5/4); appears wet

At 42.8 to 44.0': Clayey Silt; trace fine to coarse sand; (Jsm and Tm); mottled, very dark grayish brown (2.5Y 3/2) to dark brown (7.5YR 3/3); appears very moist and medium stiff

At 44.0 to 44.6': Gradational zone
Silty Sand, fine to coarse grained; trace fine gravel (Jsm and Tm); very dark grayish brown (10YR 2/3); appears wet and dense; lower contact is sharp

At 46.3 to 46.5': Clayey to Sandy Silt lenses; brown (10YR 4/3); appears wet and medium stiff

At 47.3 to 47.6': Clayey to Sandy Silt lenses; brown (10YR 4/3); appears wet and medium stiff

At 48.5 to 50.0': Sandy Silt to Silty Sand, thinly bedded to laminated, bedding subhorizontal; silt is dark grayish brown (2.5Y 4/2), sand is dark olive brown (2.5Y 3/3); appears wet and medium stiff/medium dense

At 51.6 to 52.3': Grades to Sandy Silt with Gravel; trace clay; clasts 20-35%, up to 1/2 inch; mainly subangular to subrounded slate (Jsm) with lesser subrounded shale and sandstone (Tm); very dark grayish brown (2.5Y 3/2); appears wet and very stiff
Silty Sand, fine, trace coarse sand (Jsm and Tm), some silt nodules up to 1 inch; dark grayish brown (2.5Y 4/2); appears wet; lower contact is gradational

At 52.3 to 52.5': Grades to Sandy Silt with Gravel; trace clay; clasts 20-35%, up to 1/2 inch; mainly subangular to subrounded slate (Jsm) with lesser subrounded shale and sandstone (Tm); very dark grayish brown (2.5Y 3/2); appears wet and very stiff
Silty Sand, fine, trace coarse sand (Jsm and Tm), some silt nodules up to 1 inch; dark grayish brown (2.5Y 4/2); appears wet; lower contact is gradational

At 55.4 to 55.7': Soil matrix grades to sandy silt with clay

At 57.2 to 57.7': Gradational zone

ESTUARINE DEPOSITS [Qe]
Silty Clay to Clayey Silt, lightly mottled, very dark grayish brown (2.5Y 3/2) to dark olive brown (2.5Y 3/3); appears very moist and very stiff; faint varve-like bedding

At 59.8 to 60.0': Silty Sand lenses, fine grained; olive brown (2.5Y 4/3); appears wet
### LOG OF BORING

#### T4-B8

**Project No.: 4953-10-1561**  
**Figure: T4-B8d**  
**MTA Westside Subway Extension**  
**Los Angeles, California**

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<th>SAMPLE LOC.</th>
<th>DRILLING COMPANY/DRILLING EQUIPMENT</th>
<th>BOREHOLE LOCATION</th>
<th>DRILLING METHOD</th>
<th>DATES DRILLED</th>
<th>HOLE DIAMETER</th>
<th>GROUND EL.</th>
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<td>Jet Drilling / CME 75</td>
<td>See Plate 3</td>
<td>Hollow-Stem Auger</td>
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<td>Silty Clay and Clayey Silt, trace coarse sand (Jsm and Tm); lightly mottled, very dark grayish brown (2.5Y 3/2) to dark yellowish brown (10YR 4/6); appears very moist and very stiff</td>
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<td>Silty Sand with Gravel, fine to coarse grained, clasts 15-25%, up to 1½ inch; mainly subangular to subrounded slate (Jsm) with lesser subrounded shale and sandstone (Tm); dark yellowish brown (10YR 3/6); appears wet and dense</td>
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</table>
| 195            |            | 5     | 0     | 0          | Qe          | Qe Continued  
At 60.0 to 65.0': No Recovery  

**OLDER ALLUVIAL FAN DEPOSITS [Qfo]-Marker Bed M0**  
Silty Clay and Clayey Silt, trace coarse sand (Jsm and Tm); very dark gray (2.5Y 3/1) to dark reddish brown (5YR 3/4); appears very moist and very stiff; grades downward into alluvial fan deposits below possible weak soil development  
At 66.8 to 71.4': Oxidized bed

### NOTES:
- Boring backfilled with cement/bentonite grout from bottom up and patched.  
- Munsell colors listed in order of predominance (most predominant color first).  
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.  
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.  
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.  
- The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch).  
- Beds are generally massive unless otherwise noted.

**Prepared/Date:** WL/YN/MW 10/11/2011  
**Checked/Date:** MW/MF 10/11/2011
Hand augered to 5 feet

No sampling upper 5 feet

NOTE:
Jsm = Santa Monica Slate
Tm = Modelo Formation
See end of log for more detailed descriptions of clasts

YOUNGER/OLDER ALLUVIAL FAN DEPOSITS [Qf/Qfo]
Clayey Silt, trace to some fine sand, trace coarse sand and gravel (Jsm and Tm); dark yellowish brown (10YR 3/4); appears moist and very stiff; poorly sorted; rare (<1%) calcium carbonate filaments; occasional more sandy beds; lower contact is narrowly gradational

At 7.0': Becomes very dark grayish brown (10YR 3/2)

OLDER ALLUVIAL FAN DEPOSITS [Qf]
Clayey to Sandy Silt, variable gravel, clasts 5-25%, up to 1 inch, mainly subangular to subrounded slate (Jsm) and shale (Tm); dark yellowish brown (10YR 3/4), appears moist and very stiff; poorly sorted; lower contact occurs between runs

At 13.0 to 13.5': Grades to Sandy Silt, trace gravel

Silty Sand and Sandy Silt, trace to some clay, trace to some sand and fine gravel, clasts 5-15%, up to 3/4 inch (Jsm and Tm); dark yellowish brown (10YR 3/4); appears moist and dense; occasional fine Silty Sand beds

At 19.0 to 20.0': No recovery
Silty Sand, very fine, trace to some coarse sand and fine gravel, clasts 2-10%, up to 1/2 inch (Jsm and Tm); dark yellowish brown (10YR 4/4); appears moist and dense; lower contact is sharp

At 23.2': Grades to Sandy Silt

At 24.5 to 25.0': Silty Sand with Gravel, fine to coarse grained, clasts 20-30%, up to 1 inch, mainly subrounded slate (Jsm) and shale (Tm)

Silty Sand and Sandy Silt, very fine grained, trace to some clay, rare (<1%) coarse sand; dark brown (10YR 3/3); appears very moist and stiff/dense

Clayey to Sandy Silt, variable (0-20%) gravel, clasts mainly subrounded slate (Jsm) and shale (Tm); dark gray (10YR 4/1) with reddish brown (5YR 4/4) mottles; appears very moist and medium stiff

At 25': Groundwater encountered during drilling

Silty Sand, very fine, trace to some coarse sand and fine gravel, clasts 2-10%, up to 1 inch, mainly subrounded slate (Jsm) and shale (Tm); dark yellowish brown (10YR 4/4); appears moist and dense; lower contact is sharp

At 25.1 to 31.4': Grades to fine to coarse Clayey Sand with Gravel, clasts 20-50%, up to 1 inch, mainly subangular to subrounded (Jsm), shale (Tm) and sandstone (Tm); some brick-red sandstone, coarsens downward into gravel bed below

Clayey to Silty Gravel, clasts 50-70%, up to 2 inches, mainly subangular to subrounded (Jsm), some subrounded sandstone (Tm) and shale (Tm) also observed; matrix is fine to coarse clayey, silty sand; color variable, mainly dark brown (7.5YR 3/2); appears wet and dense, lower contact occurs between runs

At 35': Groundwater encountered during drilling

At 38.2 to 40.0': No recovery

Geologist: DB/MF
Prepared/Date: WL/YN/MW 10/11/2011
Checked/Date: MW/MF 10/11/2011
### OLDER FLUVIAL DEPOSITS [Qfcl]
At 40.0 to 40.7': Grades to Well Graded Sand with Gravel, fine to coarse grained, clasts 15-25%, up to 1/2 inch, mainly subrounded slate (Jsm); coarse sand is mainly subrounded to rounded slate (Jsm), shale (Tm) and sandstone

At 40.7 to 45.0': Some subrounded quartzite and metabasalt (?) observed

### ESTUARINE DEPOSITS [Qe] - Marker Bed MD
Clayey Silt and Silty Clay, trace to some fine sand, trace coarse sand (Jsm and Tm); mottled, strong brown (7.5YR 4/6) to gray (10YR 5/1) to dark brown (7.5YR 3/3); appears very moist and very stiff to hard; variable varve-like bedding; lower contact is sharp

At 49.3 to 50.0': Sand increases, some oxidized laminations

Sandy Silt, variable clay, trace to some coarse sand and fine gravel, clasts 2-15%, up to 1/2 inch, mainly subangular slate (Jsm), some subangular shale (Tm) also observed; lightly mottled, color variable, mainly dark gray (10YR 4/1) to brown (7.5YR 4/4); appears very moist and very stiff; occasionally grades to clayey silt; some varve-like bedding; lower contact is narrowly gradational

At 52.8 to 55.0': No recovery

Clayey Silt and Silty Clay, variable fine sand, trace coarse sand (Jsm and Tm); dark gray (2.5Y 4/1) with variable strong brown (7.5YR 4/6) mottling; appears very moist and very stiff; occasional small oxidized pockets; trace manganese oxide flecks; variable varve-like bedding; lower contact is gradational

At 57.8': Likely detrital charcoal, sample collected

At 58.1 to 58.4': Sandy Silt bed, micaceous, trace manganese oxide flecks and staining

At 58.4 to 60.0': Distinct oxidized strong brown laminations common

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### LOG OF BORING

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### BOREHOLE LOCATION

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### LOG OF BORING

**BORING NO.: T4-B9**

- **DRILLING COMPANY/DRILLING EQUIPMENT**: Martini Drilling / CME 75
- **DRILLING METHOD**: Hollow-Stem Auger
- **BOREHOLE LOCATION**: See Plate 3
- **DATES DRILLED**: 5/4/11 - 5/6/11
- **HOLE DIAMETER**: 8 inches
- **GROUND EL.**: 259 feet

### GROUNDWATER READINGS

Encountered at 35-ft during drilling

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**Qe Continued**

At 60.0': Becomes strongly mottled, dark gray (2.5Y 4/1) to strong brown (7.5YR 4/6); trace manganese oxide

At 61.5': possible detrital charcoal, collected sample

At 63.5 to 65.0': No recovery

At 66.1 to 66.8': Distinct oxidized Sandy Silt laminations

At 66.8': **Marker Bed MC** - Clayey to Sandy Silt, trace coarse sand (Jsm and Tm); very dark gray (5YR 3/1) with dark reddish brown (5YR 3/4) mottling; appears very moist and very stiff; possible weak soil development; lower contact is gradational

At 69.0 to 70.4': Gradational transition to unit below

**OLDER ALLUVIAL FAN DEPOSITS (Qf0) - Marker Bed MA**

Clayey to Sandy Silt, trace to some coarse sand and fine gravel (Jsm and Tm), clasts 2-15%, up to 1/2-inch; lightly mottled, dark yellowish brown (10YR 4/4) to dark gray (10YR 4/1); appears very moist and very stiff; lower contact occurs between runs

At 72.6 to 73.1': Grades to Clayey Sand with Gravel; clasts 15-20%, up to 1/2-inch, mainly subangular slate (Jsm) and shale (Tm); appears wet and dense

At 74.0 to 75.0': No recovery

- Fine Clayey Sand with Gravel; clasts 15-20%, up to 1/2-inch, mainly subangular slate (Jsm) and shale (Tm); dark gray (10YR 4/1); appears very moist and dense

At 75.6 to 77.2': Grades to Clayey Silt to Silty Clay, brown (7.5YR 4/4) with highly oxidized, reddish brown (5YR 4/4) stained root structures and variable strong brown (7.5YR 5/8) motting

At 77.2 to 78.1': Silty Sand and Sandy Silt, very fine grained; lightly mottled, grayish brown (10YR 5/2) to dark yellowish brown (10YR 4/6), occasional strong brown (7.5YR 5/8) staining around fine root structures

At 78.1 to 80.0': Grades to Sandy to Clayey Silt

### PROJECT NO.: 4953-10-1561

- **MTA Westside Subway Extension**
  - **Los Angeles, California**

**LOG OF BORING**

- **Prepared/Date:** WL/YN/MW 10/11/2011
- **Checked/Date:** MW/MF 10/11/2011

**Geologist:** DB/MF

**METRO SOIL CORE**

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At 80.0 to 80.8': Clay, trace coarse sand (Jsm and Tm); brown (10YR 4/3) with strong brown (10YR 4/6) mottles
Clayey to Sandy Silt, variable coarse sand, trace fine gravel (Jsm and Tm); strongly mottled, strong brown (7.5YR 4/6) with grayish brown (10YR 5/2) mottling; appears moist and very stiff to hard; moderately to poorly sorted; lower contact occurs between runs

At 84.1 to 84.6': Gravel increases to 10-20%, up to 3/4 inch, mainly subangular slate (Jsm)

At 85.0 to 90.0': No sampling

Depth of contact uncertain due to poor recovery

OLDER FLUVIAL DEPOSITS [Qfofl]
Well Graded Gravel, clasts 60-70%, up to 1 inch, mainly subangular slate (Jsm), some quartzite and brick-red sandstone also observed, quartzite up to 10%; matrix is fine to coarse sand; color variable, lower contact is 1 inch thick, lightly cemented bed with abundant manganese oxide staining

At 84.1 to 84.6': Gravel increases to 10-20%, up to 3/4 inch, mainly subangular slate (Jsm)

At 85.0 to 90.0': No sampling
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**Qfo/Qfoll Continued**

Well Graded Sand, fine-coarse grained; color variable, generally yellowish brown (10YR 5/4); abundant white or tan shale sand grains

- At 100 to 101.2': Silty Clay, trace coarse sand (Jsm); very dark grayish brown (10YR 3/2); appears very moist and very stiff; organic-rich
- At 101.2 to 101.3': Increasing Gravel
- At 101.3 to 101.4': Well Graded Gravel bed, clasts 60-70%, up to 3/4 inch; highly variable, subangular slate (Jsm), shale (Tm), quartzite, sandstone (Tm), and granitic rock observed; matrix is fine to coarse sand; color variable, generally yellowish brown (10YR 5/4); appears wet and dense
- At 101.4 to 101.7': Oxidized Sandy Silt bed
- At 101.9 to 102.3': Gravel decreases, gradational transition to bed below
- At 102.3 to 103.1': Silty Sand to Sandy Silt, fine grained, trace coarse sand; dark yellowish brown (10YR 4/4) to light yellowish brown (2Y 6/4); some laminations
- At 103.1 to 107.5': Clayey Silty Sand with Gravel; fine to coarse, clasts 25-40%, up to 3/4 inch, mainly slate (Jsm), shale (Tm) and quartzite; sharp lower contact
- At 105.2 to 105.4': Oxidized Sandy Silt bed
- At 106.0 to 110.0': No recovery

**ESTUARINE DEPOSITS [Qe]**

Silty Clay and Clayey silt; variable fine sand, rare (<1%) to trace coarse sand (Jsm and Tm); grayish brown (2.5Y 5/2); appears very moist and very stiff; variable varve-like bedding; occasional oxidized silt or sandy silt beds; brownish yellow (10YR 6/6) to yellowish red (5YR 5/6), most significant silt beds noted below

- At 110.0 to 110.4': Oxidized Sandy Silt
- At 114.4 to 116.8': Grades to Sandy Clay, variable fine gravel, clasts 5-20%, up to 1/2 inch, mainly subangular slate (Jsm), shale (Tm) sandstone (Tm) and quartzite
- At 118.3 to 120.0': No recovery

**Silty Sand, fine to coarse grained, color variable; mainly strong brown (7.5YR 5/6); appears wet and dense; lower contact is sharp**

**Sandy Silt; brown (10YR 3/3); appears wet and medium stiff, micaceous, lower contact occurs between runs, depth of contact uncertain due to poor recovery**

MTA Westside Subway Extension
Los Angeles, California
Silty Sand with Gravel, fine-coarse, clasts 20-35%, up to 1 inch, mainly slate (Jsm), some shale (Tm), sandstone (Tm) and quartzite also observed; color variable; appears wet and dense lower contact is sharp, erosional, oxidized

At 120.6’: Silt/Clay pocket
Alternating beds of Silty Clay and Sandy Silt; trace coarse sand; color variable, clay generally dark gray (10YR 4/1) with strong brown (7.5YR 5/8) mottling; sandy silt generally very pale brown (10YR 7/3) with occasional brownish yellow (10YR 6/8) mottling; appears moist and very stiff; trace manganese oxide flecks, sandy silt beds; lower contact occurs between runs; typical bed thickness is 2 to 5 inches

At 123.5 to 125.0’: No recovery

At 125.0 to 125.6’: Grades to Sandy Clay, brown (10YR 4/3)

At 125.6 to 127.0’: Sandy Silt beds became highly oxidized, strong brown (7.5YR 5/6), micaceous

At 127.0 to 128.9’: Predominately Silty Clay with occasional 1 to 2 inches sandy silt beds

At 128.8 to 135.0’: No recovery

At 135.0 to 136.0’: Clayey Silt is very moist to wet, soft to medium stiff

At 136.2: Likely Charcoal, collected sample

Calcium carbonate increases to 10-15%, filaments and cemented nodules up to 1/8-inch
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<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
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<td>Sandy to Clayey Silt with Gravel; clasts 15-25%, up to 3/4 inch, mainly subangular slate (Jsm) and subrounded slate (Tm); dark yellowish brown (10YR 4/4) with strong brown (7.5YR 4/6) mottling; appears very moist and stiff; variable calcium carbonate, some pockets up to 1 inch with dispersed calcium carbonate within soil matrix.</td>
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<td>Sandy Silt, trace to some clay; very dark gray (10YR 3/7) with variable olive brown (2.5Y 4/3) mottling; appears very moist and very stiff; 5-15% calcium carbonate filaments and cemented nodules up to 1/8 inch; appears organic-rich; lower contact occurs between runs.</td>
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<td>At 142.5': Color becomes dark gray (2.5Y 4/1) with dark yellowish brown (10YR 4/4) mottling.</td>
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<td>At 144.5 to 145.0': Increasing coarse Sand and fine Gravel content, clasts 2-10%; up to 1/2 inch; mainly shale and sandstone (Tm), little or no slate.</td>
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<td>149.0 to 150.0</td>
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<td>Sandy to Clayey Silt with Gravel; clasts 15-25%, up to 3/4 inch, mainly subangular slate (Jsm) and subrounded slate (Tm); dark yellowish brown (10YR 4/4) with strong brown (7.5YR 4/6) mottling; appears very moist and stiff; variable calcium carbonate, some pockets up to 1 inch with dispersed calcium carbonate within soil matrix.</td>
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<td>At 149.0 to 150.0': No recovery.</td>
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END OF BORING AT 150 FEET

NOTES:
- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded slate and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than 1/4 inch).
- Beds are generally massive unless otherwise noted.

Boring deepened from 100-ft to 150-ft on 5/5/11 to 5/6/11. Location of deepened boring offset from original boring location.
**LOG OF BORING**

**BORING NO.**
T4-B10

**DRILLING COMPANY/DRILLING EQUIPMENT**
Martini Drilling / CME 75

**DRILLING METHOD**
Hollow-Stem Auger

**BOREHOLE LOCATION**
See Plate 3

**DATES DRILLED**
6/16/11 - 6/20/11

**HOLE DIAMETER**
8 inches

**GROUND EL.**
280 feet

**GROUNDWATER READINGS**

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- **8 inches of reinforced concrete**
- **Hand augered to 6 feet**
- **FILL [Af]**
  - Sandy Silt, brown
- **At 3': Clayey Sand, fine to medium grained, brown, appears moist**
- **NOTE:**
  - Jsm = Santa Monica Slate
  - Tm = Modelo Formation
  - See end of log for more detailed descriptions of clasts
- **At 6': Mottled Clayey Silt and Clayey Sand, fine grained, olive brown, appears moist and soft to loose; sand and gravel at lower contact**
- **ESTUARINE DEPOSITS [Qe]**
  - Clayey to Sandy Silt, trace fine subangular gravel; olive gray (5Y 4/2); appears moist and stiff; discrete oxidized with interlayering laminae; lower contact occurs between runs
  - (Sample disturbed) Poorly Graded Sand with Gravel, fine to medium grained, subangular to subrounded
  - (Sample less disturbed) More fines less gravel; lower contact is gradational
  - Silty Sand grading to Clayey Silt; fine grained, trace sand; olive brown (2.5Y 4/3); thin oxidized lenses/laminae; lower contact occurs between runs
  - (Sample disturbed) Sand with Gravel, fine to very fine grained; angular clay clasts
  - At 16': (Sample less disturbed) Silty Sand, fine grained, 5% angular gravel
- **Clayey Silt with some fine sand and gravel (2-5%); dark yellowish brown (10YR 3/4); appears moist and very stiff; some varve-like bedding**

**PROJECT NO.:**
4953-10-1561

**LOG OF BORING**

**MTA Westside Subway Extension**
Los Angeles, California
### OLDER ALLUVIAL FAN DEPOSITS [Q6b]

At 20': (Disturbed Sample) Sandy Silt with some Clay and Gravel

At 21.1 to 21.8': Increasing Gravel and Sand, grades to Silty Sand with Gravel; lower contact is gradational

At 21.8': Silty Sand, fine to medium grained, some clay, trace fine gravel; dark yellowish brown (10YR 4/6); appears moist and moderately dense; lower contact is gradational

At 22.5': (less disturbed) Clayey Silt, trace gravel and sand; thin oxidized layers/lenses; lower contact is sharp

At 23.5': Gravel and Sand bed (2 inches thick), fine to coarse grained, angular to rounded, thin fine sandy layers interfingering

At 24': Silt, manganese stained splotches, increasing fine sand with depth, lower contact is gradational

At 25': (disturbed sample) Increasing Clay, dark reddish brown (5YR 3/4) mottling; depth of contact uncertain due to poor recovery

At 26': Clayey Sand with Gravel, clayey matrix, clasts are angular and fine grained, mostly slate and granitic; lower contact is narrowly gradational; (less disturbed)

Silt, some very fine sand and trace clay; olive brown (2.5Y 4/4) increasing clay, grades to Silty Clay with depth, trace gravel; thin oxidized layers interfingering; lower contact is gradational

### OLDER FLUVIAL FAN DEPOSITS [Q6d]

Well Graded Sand with Gravel, fine to medium sand, fine to coarse gravel, angular to subangular

Well Graded Sand, fine to medium grained; olive brown (2.5Y 4/4); lower contact is sharp

Clayey Silt with Gravel; olive brown (2.5Y 4/6)

At 38.4': Clayey Sand to Sand; lower contact is gradational

At 38.6 to 40.0': No recovery

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**MTA Westside Subway Extension**

Los Angeles, California

Geologist: DB/MW
Prepared/Date: WL/YN/MW 10/11/2011
Checked/Date: MW/MF 10/11/2011

LOG OF BORING

Project No.: 4953-10-1561 Figure: T4-B10b
ESTUARINE DEPOSITS [Qe]
Clayey Sand grades to Clayey Silt; olive brown (2.5Y 4/4); thin oxidized interfingering layers; increasing clay with depth

At 46.5-46.8': Thin fine Silty Sand interbeds
Clay, very dark grayish brown (2.5Y 3/2); some silt, trace fine sand; trace calcium carbonate concretion nodules, gravel size

At 48.5-48.7': Thin carbonate layers, near horizontal zones of calcium carbonate concretion
Clay, very dark grayish brown (2.5Y 3/2); abundant fine shell fragments and calcium carbonate nodules

At 50-52.5': Sample disturbed
Silty Sand, very fine to fine grained, trace gravel, trace calcium carbonate nodules

Clayey Silt, some fine sand; dark greyish brown (10YR 4/2); appears moist and stiff; thin oxidized interfingering layers; trace calcium carbonate nodules; lower contact is gradational; increasing clay with depth

Clay bed
Clayey Silt, some fine sand; dark brown (7.5YR 3/4); near vertical calcium carbonate vein; increasing sand to Sandy Silt with trace coarse gravel; 2 to 5% up to 1 inch in diameter, angular slate and subrounded granitics

Poorly Graded Sand, fine to medium grained; appears moist and medium dense
Silt to Clayey Silt; appears moist and stiff; thin oxidized interbeds; trace fine sand

Qfof continued
Poor to no recovery (slough)
At 41.3 to 45': No recovery

Geologist: DB/MW
Prepared/Date: WL/YN/MW 10/11/2011
Checked/Date: MW/MF 10/11/2011

MTA Westside Subway Extension
Los Angeles, California
### OLDER ALLUVIAL FAN DEPOSITS [Q6a]

At 61.2-62.3': Trace gravel increasing sand grades to Sandy Silt; near vertical calcium carbonate filaments

Clayey Silt, some fine to coarse gravel; dark yellowish brown (10YR 4/4); trace calcium carbonate nodules; appears very moist and soft; lower contact occurs between runs

### ESTUARINE DEPOSITS - FINE GRAINED [Q6f]

Clayey Silt, trace fine to medium grained gravel; dark yellowish brown (10YR 3/4); appears moist and medium dense; fine to coarse gravel; angular to subangular

Increasing Silt, fine grained sand; dark yellowish brown (10YR 3/4); appears moist and medium dense, trace clay; lower contact is gradational

At 67.5-68.0': Increasing Sand, fine to medium grained; trace gravel

At 73': Color changes to very dark grayish brown (2.5Y 3/2)

At 74': Color changes to dark olive gray (5Y 3/2); clayey, trace calcium carbonate filaments

Clay; black (5Y 2.5/2); punky texture with waxy parting surfaces (possible shearing); appears moist and soft; splotchy oxidation

At 78.6': Abundant calcium carbonate nodules; lower contact occurs between runs

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**LOG OF BORING**

**Drilling Company/Drilling Equipment:** Martini Drilling / CME 75

**Drilling Method:** Hollow-Stem Auger

**Borehole Location:** See Plate 3

**Dates Drilled:** 6/16/11 - 6/20/11

**Hole Diameter:** 8 inches

**Ground El.:** 280 feet

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**Elevation (ft):**

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<th>Box #</th>
<th>Run #</th>
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**Drill Site Location:**

** borehole location:**

**Hole Diameter:**

**Groundwater Readings:**

**Sample Loc.:**

**Drill Method:**

**Dates Drilled:**

**Borehole Location:**

**Groundwater Readings:**

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**Geologist:** DB/MW

**Prepared/Date:** WL/YN/MW 10/11/2011

**Checked/Date:** MW/MF 10/11/2011

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**MTA Westside Subway Extension**

Los Angeles, California

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**Project No.:** 4953-10-1561 **Figure:** T4-B10d
**ESTUARINE DEPOSITS [Qe]**

- At 80-81': Disturbed sample
  - Clayey Sand, fine grained, some fine to medium gravel; dark grayish brown (2.5Y 4/2); appears moist and dense; well sorted

- Increasing Silt to Clayey Silt; dark grayish brown (2.5Y 4/2); lower contact is narrowly gradational

- At 84.8': Grades to Clayey fine Sand
  - At 85.7': Grades to Clayey Silt, some very fine sand; dark yellowish brown (10Y 3/6); varying amount of sand and clay

- Sand with Gravel, fine to coarse grained, fine to coarse gravel; subangular to angular; lower contact is gradational

- Clayey Silt; appears moist and soft to medium stiff; very dark grayish brown (2.5Y 3/2)

- At 91-92.2': Increasing Sand and Gravel, fine to coarse grained; subrounded; lower contact occurs between runs; (sample disturbed)
  - At 92.2-95': No recovery

- Clayey Silt; olive brown (2.5Y 4/4); thin interbedded clay; very dark grayish brown (2.5Y 3/2); lower contact is gradational

- At 97.4-97.8': Grades to Silty Sand, fine to medium grained; dark grayish brown (2.5Y 4/2); appears moist and medium dense; slight oxidation mottling; lower contact is gradational
  - At 97.8': Silt; lower contact is gradational

**GROUNDWATER READINGS**

- Geologist: DB/MW
- Prepared/Date: WL/YN/MW 10/11/2011
- Checked/Date: MW/MF 10/11/2011

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**MTA Westside Subway Extension**

Los Angeles, California

LOG OF BORING

Project No.: 4953-10-1561 Figure: T4-B10e
At 100-100.8': Thin Clay interbeds

At 100.8': Trace fine gravel, subrounded; lower contact is gradational

Well Graded Sand with Gravel, fine to coarse grained; angular to subangular; very dark grayish brown (2.5Y 3/2)

Clayey Silt, trace fine gravel; dark gray (5Y 4/1); appears moist and stiff; lower contact occurs between runs

Clayey Sand, fine to medium grained; dark grayish brown (2.5Y 4/2); trace calcium carbonate nodules, decrease quantity with depth; lower contact is narrowly gradational

Clayey Silt; dark grayish brown (2.5Y 3/2); some fine sand and variable clay; appears moist and stiff; slightly splotchy oxidation; lower contact is narrowly gradational

BASAL ALLUVIAL FAN UNIT [Qfob]
Silty Sand to Sandy Silt; fine grained, trace coarse, some clay, coarse sand and gravel increasing with depth; olive brown (2.5Y 4/3); trace calcium carbonate nodules; appears moist and medium dense; poorly sorted

At 116.9': Calcium carbonate becomes more abundant
### BASAL ALLUVIAL UNIT [Qfob]

At 119.7': Clayey Silt with some fine Sand; light yellowish brown (2.5Y 6/3); trace to some calcium carbonate nodules; appears moist and stiff; poorly sorted; lower contact is gradational

At 121.9': Fine Silty Sand; lower contact is narrowly gradational

At 123.0': Fine Silty Sand; dark greenish gray (5GY 4/1); lower contact is sharp

At 126.6': Silty fine Sand; dark grayish olive (10Y-5GY 4/2); variable gravel, fine to coarse; trace silt and clay, occasional clayey silt interbeds

Poorly Graded Sand, fine to medium grained; very dark greenish gray (5GY 3/1); appears moist and loose to medium dense; lower contact is sharp

At 126.6': Silty fine Sand; dark grayish olive (10Y-5GY 4/2); variable gravel, fine to coarse; trace silt and clay, occasional clayey silt interbeds

### BASAL ESTUARINE UNIT [Qeb]

Silty Clay; dark greenish gray (5GY 4/1); lower contact is gradational

At 131.8': Some calcium carbonate nodules; gravel ½-inch in diameter, mostly sandstone

At 132.8-133.2': Grades to fine Silty Sand

Clayey Silt; abundant calcium carbonate veins and nodules; dark olive gray (5Y 3/2); appears moist and soft; varying amounts of fine sand and clay; some fine oxidized pockets

At 134.2': Increases consistency to very stiff to hard

At 135.6-137.5': Abundant coarse gravel

At 137.5': Fine, irregular, oxidized pockets
### LOG OF BORING

**PROJECT NO.:** 4953-10-1561  
**FiguRe:** T4-B10h  
**MTA Westside Subway Extension**  
**Los Angeles, California**

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Varying fine sand; abundant calcium carbonate; lower contact is sharp

At 145.5': Becomes olive gray (5Y 4/2), abundant calcium carbonate, some fine irregular oxidized pockets

At 148.0 to 149.0': Highly oxidized, sharp contact with unit below

| 125 - 155      | 10 30      | 100   |       |            |SAN PEDRO FORMATION [Qsp]|

At 149.3-149.4': Sand bed; very dark gray (5Y 3/1); appears dense; lower contact is sharp

At 149.4-149.85': Clay bed; olive gray (5Y 4/2); appears moist and very stiff; lower contact is sharp

Poorly Graded Sand with Silt; grades from fine to medium grained; very dark gray (5Y 3/1); appears very moist to moist and medium dense; trace subangular gravel; lower contact occurs between runs

At 150.0 to 152.0': Poorly Graded Sand with Silt,

At 152.8': Becomes fine grained; light olive gray (5Y 6/2)

| 160            | 11 31      | 86    |       |            |              |

Geologist: DB/MW  
Prepared/Date: WL/YN/MW 10/11/2011  
Checked/Date: MW/MF 10/11/2011

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MTA Westside Subway Extension  
Los Angeles, California

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At 160.5': Grades to Well Graded Sand, fine to coarse grained

At 162.3-165.0': No recovery

Poorly Graded Sand with Gravel; clasts mostly subrounded to subangular granitic rock and slate; smaller gravel is subrounded; lower contact occurs between runs

At 166-170': No recovery

Clayey Silt; dark olive gray (5Y 3/2); trace small shell fragments; interbedded sandy silt beds

At 143.6-175': No recovery

END OF BORING AT 175 FEET

NOTES:
- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term “clasts” herein describes gravel-size rock fragments (larger than ¼ inch).
- Beds are generally massive unless otherwise noted.

Boring backfilled with cement/bentonite grout from bottom up and patched.

Geologist: DB/MW
Prepared/Date: WL/YN/MW 10/11/2011
Checked/Date: MW/MF 10/11/2011

MTA Westside Subway Extension
Los Angeles, California
7 inches of asphaltic concrete over 18 inches of base
Hand augered to 5.5 feet

FILL [Af]
Sandy Silt with some clay and fine gravel; dark yellowish brown (10YR 3/4); appears moist and dense

NOTE:
Jsm = Santa Monica Slate
Tm = Modelo Formation
See end of log for more detailed clast descriptions

Silty Sand, fine grained, some gravel, clasts 5 to 15%, up to ¾ inches, mainly subangular to subrounded slate (Jsm), sandstone (Tm) and shale, some brick-red sandstone (Tm); dark brown (10YR 3/3); appears moist and medium dense; lower contact is sharp

At 7.1 to 7.5': Silty Sand with Gravel, appears dry and loose, clasts mainly subangular to subrounded slate (Jsm) and shale (Tm), granitic clasts also observed

OLDER ALLUVIAL FAN DEPOSITS [Qfo]
Sandy to Clayey Silt, variable gravel, clasts 2 to 10%, up to ¾ inches, mainly subangular to subrounded slate (Jsm) and shale (Tm), some brick-red sandstone (Tm); color variable, generally yellowish brown (10YR 3/4); appears moist and very stiff; poorly sorted, lower contact occurs between runs
At 8.6 to 10.0': No recovery
Clayey Silt to Silty Clay; dark grayish brown (2.5Y 4/2) with strong brown (7.5YR 4/6) mottling ; appears very moist and very stiff; punky texture with waxy parting surfaces
At 11.5 to 12.8': Increasing sand and mottling; gradational transition to unit below

OLDER FLUVIAL DEPOSITS [Qfodl]
Silty Sand with Gravel, fine to coarse grained, clasts 30 to 50%, up to ½ inch, mainly subangular slate (Jsm), some sandstone (Tm), shale (Tm) and quartzite also observed; color variable, generally yellowish brown (10YR 3/4); appears moist and dense; lower contact is sharp, erosional
At 14.4 to 15.2': Silty Clay, variable sand, dark grayish brown (2.5Y 4/2) with strong brown (7.5YR 4/6) mottling ; appears very moist and very stiff
At 15.2 to 15.9': Silty Sand with Gravel; fine grained, clasts as above; dark yellowish brown (10YR 4/4)
At 15.9': Appears very moist, oxidized strong brown (7.5YR 4/6)

At 19.2 to 19.6': Silty Sand, fine grained; brown (7.5YR 4/4)
OLDER ALLUVIAL FAN DEPOSITS \([Q_6]o\)

At 22.0 to 22.6': Clay, variable coarse sand and gravel \((Jsm \text{ and } Tm)\); dark grayish brown \((2.5Y 4/2)\)

At 22.6 to 23.2': Clayey to Sandy Silt with Gravel, clasts 5 to 20%, up to 1 inch, mainly subrounded slate \((Jsm)\), shale \((Tm)\) and sandstone \((Tm)\)

Silty Clay to Clayey Silt, trace coarse sand and gravel \((Jsm \text{ and } Tm)\); mottled, grayish brown \((10YR 5/2)\) to strong brown \((7.5YR 5/8)\); appears moist to very moist; lower contact is gradational

At 24.6 to 25.2': 5 to 15% calcium carbonate filaments and nodules up to ½ inch

At 25.8 to 27.0': Increasing sand and gravel; gradational transition to gravel unit below

At 27.0 to 28.0': Clayey Silty Gravel, clasts 60 to 70%, up to 1½ inch, mainly subangular shale \((Tm)\), some subangular slate \((Jsm)\) and minor quartzite; color variable

ESTUARINE DEPOSITS \([Q_6]e\)

Silty Clay to Clayey Silt, trace coarse sand, grayish brown \((10YR 5/2)\); appears moist to very moist; lower contact is gradational

At 30.0 to 30.7': Becomes mottled, brown \((7.5YR 4/4)\) to dark grayish brown \((10YR 4/2)\)

At 30.7 to 34.4': Alternating beds of Silty Clay to Clayey Silt and Sandy to Clayey Silt with variable gravel, clasts in coarser beds 5 to 15%, up to ¾ inch, mainly subangular slate \((Jsm)\), some shale \((Tm)\); color variable, mottled, generally dark grayish brown \((10YR 4/2)\) to brown \((7.5YR 4/3)\)

At 35.0 to 35.8': Sand increases with depth, grades to Sandy to Clayey Silt; appears very moist and medium stiff, gradational transition to unit below

At 35.7 to 37.0': Clayey to Sandy Silt, mottled, grayish brown \((2.5Y)\) to strong brown \((7.5YR 5/6)\); appears very moist and stiff to very stiff; well sorted; lower contact is gradational

At 37.6 to 38.5': Silty Sand, fine grained; abundant manganese oxide staining, becomes coarser with depth, grades to fine to medium Silty Sand

At 38.6 to 40.0': Variable coarse sand, trace fine gravel, abundant manganese oxide staining, some irregular manganese oxide-rich laminations
**LOG OF BORING**

*Continued*

**Drilling Method**: Hollow Stem Auger

**Date Drilled**: 5/9/11 - 5/10/11

**Hole Diameter**: 8-inch

**Ground El.**: 259 feet

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**Encountered at 45-ft during drilling**

- **Qc Continued**
  - At 40.3 to 40.7': Grades to fine Silty Sand
  - At 41.6 to 43.0': Variable manganese oxide staining

- **215 ft**
  - At 43.8 to 45.0': Clay increases, mainly Clayey Silt, coarse sand (Jsm and Tm) increases with depth
  - At 45': Groundwater encountered during drilling

- **205 ft**
  - At 43.8 to 45.0': Clay increases, mainly Clayey Silt, coarse sand (Jsm and Tm) increases with depth
  - At 45.0 to 45.7': Sand increases, gradational transition to unit below

- **200 ft**
  - Silty Sand, trace to some gravel, fine to coarse grained, clasts 2 to 15%, up to ¾ inch, mainly subrounded slate (Jsm) and shale (Tm); color variable; appears wet and dense
  - At 46.3 to 46.7': Some silt nodules

- **195 ft**
  - At 47.3 to 47.8': Grades to fine to coarse, Well Graded Sand

- **190 ft**
  - At 47.8 to 48.2': Clayey Silt, upper contact is irregular (erosional)

- **185 ft**
  - Clayey to Sandy Silt, variable coarse sand and gravel, clasts 5 to 20%, up to ¾ inch, mainly subangular to subrounded slate (Jsm) shale (Tm) and sandstone (Tm); color variable, mainly brown (10YR 4/3) with strong brown (7.5YR 4/6); appears very moist and stiff

- **180 ft**
  - At 51.5 to 52.6': Silty Sand, fine to medium grained, variable gravel, clasts 5 to 10%, up to ½ inch, mainly slate (Jsm) and shale (Tm), heavily oxidized at base of bed

- **175 ft**
  - At 52.6 to 52.8': Gravel decreases to trace, some manganese oxide-rich lenses

- **170 ft**
  - Clayey to Sandy Silt, trace coarse sand; grayish brown (10YR 5/2) with variable strong brown (7.5YR 4/6) mottling; appears very moist and stiff; variable manganese oxide stains; 5 to 15% calcium carbonate filaments and cemented nodules

- **165 ft**
  - Marker Bed **ML**: Silty Clay to Clayey Silt, trace to some fine sand, trace coarse sand; very dark grayish brown (10YR 3/2) with strong brown (7.5YR 4/6) mottling; appears moist and very stiff; some calcium carbonate filaments and cemented nodules (5 to 10%), up to ¼ inch, some fine, irregular oxidized pockets; distinct color and texture

Geologist: ME/MF
Prepared/Date: DRWL/MW 10/10/2011
Checked/Date: MW/MF 10/14/2011

MTA Westside Subway Extension
Los Angeles, California

LOG OF BORING

Project No.: 4953-10-1561
Figure: T7-B1c
Qe Continued
mainly subangular to subrounded slate (Jsm), shale (Tm), and sandstone (Tm); strongly mottled, brown (7.5YR 4/4) to gray brown (10YR 5/2); appears moist and very stiff
At 61.8 to 65.0': Grades to Clayey Silt
At 61.8 to 62.7': 10 to 15% calcium carbonate filaments and nodules, variable fine, irregular oxidized pockets
At 62.7': Calcium carbonate and oxidized pockets decrease to trace
Clayey to Sandy Silt, variable coarse sand and gravel, clasts 5 to 13%, up to ¾ inch, mainly subangular to subrounded slate (Jsm), shale (Tm), and sandstone (Tm); strongly mottled, brown (7.5YR 4/4) to grayish brown (10YR 5/2); appears moist and very stiff
At 67.0 to 68.5': Increasing manganese oxide staining
At 68.5 to 71.5': Abundant manganese oxide flecks and staining, total manganese oxide 10 to 20%
At 69.3 to 70.1': Grades to Silty Clay to Clayey Silt
At 71.8 to 73.0': Gravel increases to 20 to 30%, numerous shale and sandstone clasts up to 1 inch
At 73.0 to 75.3': Color becomes grayish brown (2.5Y 6/1) to yellowish brown (10YR 5/8)
At 73.0 to 77.5': Coarse sand and gravel decreases to less than 5%
At 78.3 to 80.0': Grades to Silty Clay
At 78.3 to 78.5': Distinct fine mottling, color variable, mainly gray (2.5Y 6/1) to yellow (10YR 7/6), spotted texture
** grounds water readings**

Encountered at 45-ft during drilling

- **SM/ML** Silty Sand and Sandy Silt, fine-grained, variable clay, variable gravel, clasts 2 to 20%, up to ¼ inch, mainly subangular slate (Jsm) and shale (Tm); lightly mottled, brown (10YR 4/4) to grayish brown (10YR 5/2); appears very moist and very stiff/dense; coarsens downward, grades to gravel bed below

- At 83.9 to 85.6': **Marker Bed M:** Silty Gravel, clasts 50 to 60%, up to 1 inch, mainly subangular to subrounded slate (Jsm), some subrounded shale (Tm), sandstone (Tm) and granitic rock; color variable, appears damp and dense

- At 85.6 to 88.3': Gravel less than 5%, up to ½ inch; thinly bedded, some varve-like bedding

- At 88.3 to 89.4': Grades to fine to medium Silty Sand, gravel 15 to 20% Clay and Silty Clay, variable fine sand, trace to some coarse sand (Jsm and Tm); mottled, dark grayish brown (10YR 4/2) to strong brown (10YR 4/6); appears very moist and very stiff

- At 90.8 to 92.6': 5 to 15% calcium carbonate filaments and nodules up to 1/8 inch

- At 91.0 to 92.6': Up to 5% manganese oxide flecks and staining

**older alluvial fan deposits [Qf]**

Clayey to Sandy Silt, trace to some coarse sand and gravel, clasts 2 to 10%, up to ½ inch, mainly subrounded slate (Jsm), some subrounded shale (Tm), sandstone (Tm); lightly mottled, brown (7.5YR 4/3) to dark grayish brown (10YR 4/2); appears very moist and very stiff; poorly sorted; lower contact is gradational

- At 95.0 to 96.5': Gravel increases to 10 to 20%, some brick-red sandstone

- At 95.0 to 100.3': Mainly dark grayish brown (10YR 4/2) with variable brown (7.5YR 4/3) mottling

- At 96.5 to 97.6': Grades to fine Silty Sand with Clay, gravel 20 to 30%, some brick-red sandstone

- At 97.6 to 100.3': Gravel increases to 40 to 50%
Encountered at 45-ft during drilling

**Qf0 Continued**
At 100.3 to 101.2': Clayey Silt, trace coarse sand; mottled, light yellowish brown (10YR 6/3) with reddish yellow (7.5YR 6/6)

**BASAL ALLUVIAL FAN UNIT [Qfob]**
Clayey Sand and Sandy Clay, trace to some coarse sand and fine gravel (Jsm and Tm); color variable, generally light gray (2.5Y 7/2); appears very moist and very stiff/dense; abundant calcium carbonate, occurs as cemented nodules up to ¼ inch and dispersed within soil mass, total calcium carbonate 50 to 70%

At 102.3 to 103.5': Grades to Clayey Sand; fine to coarse, yellowish brown (10YR 5/4), calcium carbonate decreases to 15 to 20%

At 103.5 to 104.3': Grades to fine to medium Silty Sand with Clay, gravel 5 to 10%, up to ½ inch (Jsm and Tm); yellowish brown (10YR 5/4)

Clayey to Sandy Silt, trace coarse sand (Jsm and Tm); light olive brown (2.5Y) with yellowish brown (10YR 5/6) mottling; appears very moist and very stiff/hard; lower contact is narrowly gradational

**BASAL ESTUARINE UNIT [Qeb]**
Clay; dark gray (2.5Y 4/1); appears very moist and very stiff to hard; trace calcium carbonate filaments up to 1/16 inch

At 108.0 to 108.8': Color becomes dark gray (5Y 4/1), calcium carbonate filaments increase to 10 to 15%

At 108.8 to 110.3': Color becomes dark grayish brown (2.5Y 4/2), 5 to 15%, cemented nodules up to ½ inch

At 110.3 to 111.0': Becomes mottled, dark grayish brown (2.5Y 4/2) with brown (7.5YR 4/4) mottling; some fine, irregular oxidized pockets; calcium carbonate increases with depth, 5% manganese oxide flecks

At 111.0 to 112.1': Calcium carbonate 50 to 70%, occurs mainly as dispersed material with soil mass

At 112.1 to 113.0': Grades to Silty Sand, fine grained, 40 to 70% dispersed calcium carbonate

At 113.0 to 113.6': Silty Sand, 20 to 30% cemented calcium carbonate nodules up to ¾ inch, dispersed calcium carbonate, total calcium carbonate 60 to 70%

**SAN PEDRO FORMATION [Qsp]**
Poorly Graded Sand with Silt; fine grained, brown (10YR 4/3); appears damp and dense; well sorted

At 113.6 to 114.8': Weathered zone, faint gray (10YR 5/1) motting, 10 to 15% diffuse calcium carbonate nodules, up to ½ inch

At 118.8 to 119.4': Becomes slightly cemented
At 119.4 to 120.2': Silty Gravel, clasts 50 to 60%, up to 1½ inch, mainly subangular to subrounded slate (Jsm), some shale (Tm), sandstone (Tm), matrix is fine to coarse, moderately cemented, silty sand; color is variable
**Qsp Continued**
Silty Gravel, clasts 50 to 60%, most up to 1½ inches, maximum 3 inches; mainly subrounded slate (Jsm), quartzite, sandstone (Tm) and granitic rock, 2 quartzite clasts >2 inches; matrix is fine to coarse silty sand, generally light olive brown (2.5Y 5/3); appears moist and dense; lower contact is sharp, erosional

Silty Sand; fine grained, light olive gray (5Y 6/2); appears moist and dense; well sorted; occasional dark yellowish brown (10YR 4/4) mottling

Poorly Graded Sand with Silt, very fine grained; light gray (2.5Y 7/1); appears moist and dense; well sorted; lower contact is gradational

At 126.5 to 127.2': Scattered rounded clasts, up to 2.5 inches; appear to be mainly granitic rock, quartzite and mafic igneous/metamorphic rock

At 128.0 to 130.0': No recovery

At 132.7 to 135.0': No recovery

At 135.5 to 136.0': Scattered, well rounded clasts up to ¾ inch, mainly slate (Jsm)

At 136.0 to 136.8': Oxidized irregular laminations and lenses, brownish yellow (10YR 6/6)

At 136.8 to 137.2': Very thin (<1/16 inch) black laminations (manganese oxide)

At 138.5 to 139.5': Trace manganese oxide flecks
NOTES:
- Boring backfilled with cement/bentonite grout from bottom up and patched.
- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than 1/4 inch).
- Beds are generally massive unless otherwise noted.

END OF BORING AT 140 FEET

MTA Westside Subway Extension
Los Angeles, California
### YOUNGER/OLDER ALLUVIAL FAN DEPOSITS [Qf/Qf0]

Clayey Silt to Silty Clay, variable fine sand and gravel; dark brown (10YR 3/3); appears very moist to wet and soft; some dispersed organics

### ESTUARINE DEPOSITS [Qe]

Clayey Silt to Silty Clay, trace coarse sand (Jsm and Tm): mottled, grayish brown (2.5Y 5/2) to strong brown (7.5YR 4/6); appears very moist and very stiff; lower contact occurs between runs

Clayey Silt to Silty Clay; dark grayish brown (2.5Y 4/2); appears very moist and stiff; some punky texture with waxy parting surfaces

At 12.0 to 12.8': Alternating beds of Silty Clay and fine to coarse Silty, Clayey Sand

At 12.8 to 13.9': Silty Sand with Gravel, fine to coarse grained, clasts 30 to 40%, up to ¾ inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm), some quartzite also observed; color variable; appears very moist to wet and dense

At 13.9 to 15.0': Clay and Silty Clay, trace coarse sand; mottled, dark gray (10YR 4/1) to strong brown (7.5YR 4/6); appears very moist and very stiff; lower contact occurs between runs

Clayey to Sandy Silt, trace coarse sand and fine gravel; mottled, dark gray (10YR 4/1) to strong brown (7.5YR 4/6); appears very moist and medium stiff to stiff, lower contact is narrowly gradational

At 16.0 to 17.0': Coarsens with depth, grades to fine Silty Sand

### DRILLING COMPANY/DRILLING EQUIPMENT

Martini Drilling / CME 75

Hollow Stem Auger

See Plate 3

5/11/11-5/13/11 and 6/13/11-6/14/11

8-inch

266 feet

This record is an interpretation of subsurface conditions at the exploration location. Latitude and longitude of boring location shown on logs are approximate. Transitions between strata may be gradual. Subsurface conditions at other locations and at other times may differ. Interfaces between strata are approximate. Transitions between strata may be gradual.

Encountered at 41-ft during drilling

7 inches of asphaltic concrete over base

Hand augered to 6 feet

NOTE:

Jsm = Santa Monica Slate

Tm = Modelo Formation

See end of log for more detailed clast descriptions
At 20.8 to 22.0': Grades to Silty Clay/Clayey Silt with sand

Silty Clay to Clayey Silt; trace coarse sand (Jsm and Tm); mottled, grayish brown (2.5Y 5/2) to strong brown (7.5YR 4/6); appears moist and very stiff; some varve like bedding and irregular oxidized pockets; lower contact is gradational

At 24.7 to 25.0': Sand and gravel increase, lower contact is gradational

At 25.0 to 25.8': Silty Sand, fine to coarse grained, trace fine gravel (Jsm and Tm); dark yellowish brown (10YR 4/4); appears very moist and dense

At 25.8 to 26.7': Increasing clay, decreasing sand; some varve-like bedding; gradational transition to beds below

At 27.6 to 29.5': Frequent oxidized Sandy Silt thin beds and laminations

At 29.5 to 30.3': Color becomes dark gray (10YR 4/1)

Marker Bed M₄ - Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); dark gray (10YR 4/1); appears very moist and stiff; indistinct varve-like bedding texture

At 32.0 to 32.6': Gravel increases to 20 to 25%

OLDER ALLUVIAL FAN DEPOSITS [Qf6]
Silty Clay and Clayey Silt, variable coarse sand, trace fine gravel (Jsm and Tm); strong brown (7.5YR 4/4) with occasional dark grayish brown mottling; appears moist and very stiff to hard; poorly sorted; generally coarsens with depth, lower contact is sharp

At 35.3 to 36.3': Grades to Sandy Silt with Clay

At 36.3 to 37.5': Grades to Clayey to Sandy Silt

FLUVIAL DEPOSITS [Qf6fl]
Silty Gravel, clasts 60 to 70%; up to 1 inch, mainly subangular to subrounded slate (Jsm), shale (Tm), and sandstone (Tm), some quartzite (Jsm) and brick-red sandstone (Tm) also observed, matrix is fine to coarse silty sand; color variable; appears very moist and dense; matrix occasionally grades to fine to coarse well graded sand or...
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<th>RUN #</th>
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<th>SAMPLE LOC.</th>
<th>DRILLING METHOD</th>
<th>BOREHOLE LOCATION</th>
<th>GROUNDWATER READINGS</th>
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<td>Hollow Stem Auger</td>
<td>See Plate 3</td>
<td>At 40.4: Becomes wet</td>
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<td>At 41: Groundwater encountered during drilling</td>
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<td>At 42: Large slate clast, &gt;3½ inches, full width of sampler</td>
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<td>At 42.5 to 43.6: Grades to Clayey Silty Sand with Gravel, fine to coarse grained, clasts 30 to 50%, up to 1 inch</td>
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<td>At 48.0: 2 inches slate clast</td>
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<td>ESTUARINE DEPOSITS - FINE GRAINED [Qef]</td>
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<td>Clayey to Sandy Silt, variable coarse sand, trace fine gravel (Jsm and Tm); dark yellowish brown (10YR 4/4); appears very moist to wet and medium stiff</td>
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<td>Clay and Silty Clay, variable fine sand, rare (&lt;1%) coarse sand (Jsm and Tm); brown (10YR 5/3) with strong brown (7.5YR 5/6) mottling; appears very moist and very stiff; mottling is primarily in fine, irregular pockets, up to 5% manganese oxide flecks and staining; lower contact is gradational</td>
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<td>At 55.0 to 55.4: Manganese oxide-rich laminations</td>
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<td>At 57.0 to 57.6: Oxidized mottling, brown (7.5YR 4/4); manganese oxide increases to 10 to 15%</td>
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<td>Clayey Sand to Sandy Clay, variable gravel, clasts 5 to 20%, up to ½ inch (Jsm and Tm); color variable, appears wet and dense/stiff</td>
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<td>At 58.8 to 59.5: Silty Sand, fine grained, trace clay; mottled, grayish brown (10YR 5/2) to strong brown (7.5YR 4/6); appears wet and dense</td>
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<td>At 59.5 to 60.0: Silty Gravel, clasts 50 to 60%, up to 1 inch (Jsm and Tm); color variable; appears wet and dense</td>
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</table>

This record is an interpretation of subsurface conditions at the exploration location. Latitude and longitude of boring location shown on logs are approximate. Interfaces between strata are approximate. Transitions between strata may be gradual.

Geologist: ME/MF
Prepared/Date: YN/WL/MW 10/10/2011
Checked/Date: MW/MF 10/14/2011

LOG OF BORING
Project No.: 4953-10-1561 Figure: T7-B2c

MTA Westside Subway Extension
Los Angeles, California
### DRILLING COMPANY/DRILLING EQUIPMENT
- **Martini Drilling / CME 75**

### BOREHOLE LOCATION
- **T7-B2**

### DRILLING METHOD
- **Hollow Stem Auger**

### DATES DRILLED
- 5/11/11 - 5/13/11 and 6/13/11 - 6/14/11

### GROUNDWATER READINGS
- 8-inch

#### Encountered at 41-ft during drilling

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### SANDY SILT AND CLAYEY SILT, TRACE COARSE SAND AND FINE GRAVEL (JSM AND TM): MOTTLED, GRAYISH BROWN (10YR 5/2) TO BROWN (7.5YR 4/4); APPEARS WET AND STIFF; OCCASIONAL MORE SANDY/GRAVELLY BEDS, LOWER CONTACT IS NARROWLY GRADATIONAL

- At 60.0 to 60.7': Grades to fine Silty Sand
- At 61.5 to 61.8': Gravel increases to 10 to 15%
- At 63.0 to 63.4': Gravel increases to 15 to 20%, becomes stiff to very stiff

### CLAY, TRACE COARSE SAND AND FINE GRAVEL (JSM AND TM); OLIVE BROWN (2.5Y 4/3) WITH OCCASIONAL STRONG BROWN (7.5YR 4/6) POCKETS; APPEARS VERY MOIST AND STIFF TO VERY STIFF; TRACE MANGANESE OXIDE FLECKS, OCCASIONAL OXIDIZED BEDS TYPICALLY ½ TO 2 INCHES THICK

- At 70.0 to 71.7': Alternating Silty Clay and Silty Sand beds; sand, fine to medium grained, color variable; silty sand beds oxidized; appears wet and soft/medium dense
- At 71.7 to 72.4': Fine to medium Sand with Silt; oxidized, brown (7.5YR 4/4)
- At 72.4 to 72.7': Silty, organic-rich bed, very dark grayish brown (2.5Y 3/2)
- At 72.7 to 73.0': Clay, dark grayish brown (10YR 4/2)
- At 73.0 to 73.5': Carbonate-rich laminations (½ inch thick), 80 to 90% calcium carbonate

### FINE TO COARSE WELL GRADED SAND; COLOR VARIABLE, ABUNDANT ROUNDED SHALE GRAINS

- At 74.0 to 74.7': Alternating Silty Clay and Silty Sand beds as at 70.0 to 71.7'
- At 75.0 to 75.5': Silty Sand bed, fine grained; light brownish gray (2.5YR 6/2)
- At 76.4 to 76.9': ½ inch laminations with 90%+ calcium carbonate

### MARKER BED ME - SANDY TO CLAYEY SILT, TRACE COARSE SAND (JSM AND TM); GRAYISH BROWN (2.5Y 5/2) WITH STRONG 7.5YR 4/6 MOTTLING; APPEARS VERY MOIST AND VERY STIFF; 5 TO 10% CALCIUM CARBONATE FILAMENTS AND CEMENTED NODULES UP TO 1/8 INCH, CALCIUM CARBONATE HAS PREFERRED VERTICAL ORIENTATION; SOME FINE, IRREGULAR OXIDIZED POCKETS; DISTINCT COLOR AND TEXTURE
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**ML**  
*Qe Continued*  
At 80.5 to 83.1": Color becomes very dark grayish brown (10YR 3/2) to dark brown (7.5YR 3/4), mottled

At 82.7 to 83.1": Gravel increases to 5 to 15%

Sandy to Clayey Silt, trace coarse sand (Jsm and Tm); brown (7.5YR 4/4); appears moist and very stiff; trace calcium carbonate filaments; well sorted, massive

At 85.0 to 95.8": Color becomes variable mainly brown (7.5YR 4/4) with grayish brown (2.5YR 5/2) mottling, trace calcium carbonate filaments

At 92.0": Calcium carbonate filaments decrease to less than 1%

At 95.0 to 95.8": Grades to fine Silty Sand to Sandy Silt, no calcium carbonate

At 95.8": Becomes yellowish brown (10YR 5/4) with gray (10YR 6/1) mottling; appears damp to moist and very stiff to hard

At 97.6 to 98.3": Grades to fine to medium Silty Sand

**Marker Bed M<sub>cl</sub>**  
Clayey Silt to Silty Clay, variable fine sand, trace coarse sand (Jsm and Tm); dark grayish brown (10YR 4/2); appears moist to very moist and stiff to very stiff; rare (<1%) calcium carbonate filaments; distinct color and texture; lower contact occurs between runs

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**MTA Westside Subway Extension**  
Los Angeles, California
At 100.0 to 100.6': Grades to Clayey to Sandy Silt
At 101.0 to 101.2': Grades to fine Silty Sand
Clayey Silt; dark grayish brown (10YR 4/2) with strong brown (7.5YR 4/6) mottling; appears moist and very stiff to hard; 5 to 10% calcium carbonate filaments
At 103.0 to 103.5': Color becomes dark brown (7.5YR 3/2) with subtle reddish brown (5YR 4/4) mottling; appears moist and very stiff to hard
At 103.5 to 105.0': No recovery

OLDER ALLUVIAL FAN DEPOSITS [Qfo]
Clayey to Sandy Silt, variable coarse sand, trace fine gravel (Jsm and Tm); dark grayish brown (10YR 4/2) with dark yellowish brown (10YR 4/6) mottling; appears very moist and very stiff; trace calcium carbonate filaments; poorly sorted; lower contact is narrowly gradational
At 107.4 to 108.3': Gravel increases to 15 to 25%, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm)
At 108.3 to 111.0': Gravel 5 to 15%, 5 to 10% calcium carbonate filaments and nodules up to 1/8 inch
At 111.0 to 111.6': Grades to fine to coarse Clayey Sand with Gravel, fine to coarse, clasts 20 to 25%, up to ½ inch (Jsm and Tm)

ESTUARINE DEPOSITS [Qe]
Silty Clay/Clayey Silt; dark grayish brown (2.5Y 4/2) with strong brown (7.5YR 4/6) mottles; appears moist and very stiff to hard, lower contact is gradually
At 111.0 to 111.6': Grades to fine to coarse Clayey Sand with Gravel, fine to coarse, clasts 20 to 25%; up to ½ inch (Jsm and Tm)

OLDER ALLUVIAL FAN/ESTUARINE DEPOSITS [Qfo/Qe]
Silty Gravel, clasts 50 to 60%, up to 1 inch, mainly subangular to subrounded slate (Jsm), shale (Tm), and sandstone (Tm), some quartzite also observed; matrix is fine to coarse silty sand; color variable, generally dark brown (7.5 YR 3/2); appears wet and dense; lower contact is gradational
At 116.7 to 118.0': Sandy Silt, appears very moist to wet
ESTUARINE DEPOSITS [Qe]
Sandy to Clayey Silt, trace coarse sand (Jsm and Tm); light olive brown (2.5Y 5/3) with faint, light brown (7.5YR 6/4) mottling; appears very moist and medium stiff to stiff; occasional manganese oxide flecks
At 120.5 to 122.4': Alternating Silty Clay and fine Silty Sand beds, color variable, appears very moist to wet and soft/medium dense

Silty Clay and Clayey Silt, rare (<1%) coarse sand (Jsm and Tm); strongly mottled, color variable, mainly dark grayish brown (10YR 4/2) with strong brown (7.5YR 4/6), appears moist and very stiff to hard; trace manganese oxide flecks; some varve-like bedding; lower contact is gradational

Clayey to Sandy Silt; variable coarse sand, trace fine gravel (Jsm and Tm); dark gray (7.5YR 4/1) with strong brown (7.5YR 4/6) mottling; appears moist to very moist and very stiff, mottling occurs mainly as small, irregular, oxidized pockets (<¼ inch); scattered calcium carbonate filaments (<1% overall)

At 127.0 to 130.0': Becomes finer grained, less coarse sand and gravel

At 128.0 to 128.5': Distinct laminations

At 129.0 to 130.0': Coarsens downward, gradational transition to bed below

At 130.0 to 133.4': Grades to fine Clayey, Silty Sand, gravel increases with depth (Jsm and Tm), clasts 2 to 15%, up to ¾ inch

Marker Bed M1 - Clayey Silt/Silty Clay, trace coarse sand (Jsm and Tm); olive brown (2.5Y 4/3) with strong brown (7.5YR 4/6) mottling; appears moist and hard; variable small, irregular, oxidized, pockets up to ½ inch; possible weak soil development; lower contact is gradational

OLDER ALLUVIAL FAN DEPOSITS [Qfo]
Silty Sand to Sandy Silt, very fine grained, trace coarse sand and fine gravel (Jsm and Tm); grayish brown (10YR 5/2); appears wet and dense/stiff; lower contact is gradational

Well Graded Sand with Gravel, fine to coarse grained, clasts 20 to 40%, up to ½ inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); color variable, mainly dark grayish brown (10YR 4/2); appears wet and dense; lower contact occurs between runs
Qf6 continued
Sandy to Clayey Silt, trace coarse sand (Jsm and Tm); brown (10YR 4/3); appears moist to very stiff; poorly sorted, generally coarsens with depth; lower contact is gradational

At 141.8 to 145.0': Gravel increases to 5 to 15%

At 145 to 145.8': Grades to Silty Sand, very fine grained, trace gravel

At 145.5 to 147.0': Gradational transition to unit below

BASAL ALLUVIAL FAN UNIT [Qfob]
Silty Sand to Sandy Silt, fine grained, variable clay, trace gravel (Jsm and Tm); yellowish brown (10YR 5/2); appears moist and dense/very stiff; 5 to 20% calcium carbonate, occurs as dispersed deposits and filaments

At 147.2': Some quartzite to clasts up to 1 inch

At 148.7 to 150.0': Fine to coarse Clayey, Silty Sand with Gravel, clasts 15 to 25%, up to ½ inch; mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); color variable; appears moist and dense

At 150 to 151': No sample

At 151.0 to 152.5': Color variable, mainly gray (2.5Y 5/1) to brown (7.5YR 4/4)

At 152.5 to 153.2' and 153.8 to 154.3': Grades to fine to coarse Clayey, Silty Sand with Gravel, clasts 15 to 25%, up to ¾ inch; mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm)

BASAL ESTUARINE UNIT [Qeb]
Silty Clay to Clayey Silt, variable fine sand, trace coarse sand (Jsm and Tm); grayish brown (2.5Y 5/2) with oxidized, strong brown (7.5YR 4/6) pockets; appears moist and very stiff; lower contact is sharp

At 156.9 to 157.0': Well Graded Sand, fine to medium grained

At 157.0': Contact is sharp, erosional, appears to dip 15 degrees

Silty Clay, rare (<1%) coarse sand (Jsm); dark greenish gray (10Y 4/1); appears moist and hard, lower contact is gradational

At 158.4 to 159.7': Variable (10 to 40%) calcium carbonate occurs as filaments and cemented and uncemented nodules; color becomes greenish gray (10Y 5/1)

At 159.7 to 162.4': Calcium carbonate 15 to 30%, occurs mainly as vertically oriented
<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
<th>SAMPLE LOC.</th>
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<tr>
<td>105</td>
<td>5/11/11-5/13/11 and 6/13/11-6/14/11</td>
<td>11</td>
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<td>Qeb Continued&lt;br&gt;uncemented nodules/filaments, some cemented nodules up to ¼ inch; some irregular,&lt;br&gt;oxidized, strong brown (7.5YR 4/6) pockets up to 1/8 inch in size</td>
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<td>165</td>
<td>162.4 to 162.9': Calcium carbonate 60 to 70%, occurs mainly as dispersed&lt;br&gt;deposits, increasing sand content, gradational transition to unit below</td>
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<td>Clayey to Silty Sand, fine grained; greenish gray (10Y 4/1); appears very moist and dense; 20 to 30% calcium carbonate, occurs mainly as irregular, vertically oriented&lt;br&gt;pockets of dispersed calcium carbonate; oxidizes upon exposure to air</td>
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<td>100</td>
<td>164.5 to 165.5': Decreasing silt and clay content, gradational transition to unit&lt;br&gt;below, calcium carbonate rich zone, numerous irregular, calcium carbonate cemented&lt;br&gt;soil nodules up to 2 inches</td>
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<td>11</td>
<td>33</td>
<td>40</td>
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<td>SAN PEDRO FORMATION [Qsp]&lt;br&gt;Poorly Graded Sand with Silt, fine grained; light brownish gray (10YR 6/2); appears&lt;br&gt;moist and dense</td>
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<tr>
<td>170</td>
<td>At 170.0 to 172.0': Alternating beds with variable oxidation and manganese oxide; typically 1 to 6 inches thick</td>
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<td>At 172.5 to 175.0': No recovery</td>
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<td>175</td>
<td>At 175.0 to 176.6': Becomes pale olive (5Y 6/2) with faint oxidized mottling</td>
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<td>At 176.6 to 177.2': Becomes gravelly, clasts 40 to 50%, up to 2 inches, mainly&lt;br&gt;quartzite and fine grained igneous rock</td>
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<td>180</td>
<td>At 177.2 to 180': No recovery</td>
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**GROUNDWATER READINGS**

Encountered at 41-ft during drilling

**BORING COMPANY/DRILLING EQUIPMENT**

Martini Drilling / CME 75

**DRILLING METHOD**

Hollow Stem Auger

**DATES DRILLED**

5/11/11-5/13/11 and 6/13/11-6/14/11

**HOLE DIAMETER**

8-inch

**GROUND EL.**

266 feet

**T7-B2**

(Continued)
### LOG OF BORING

**T7-B2**

<table>
<thead>
<tr>
<th>BOREHOLE LOCATION</th>
<th>HOLE DIAMETER</th>
<th>GROUND EL.</th>
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<tbody>
<tr>
<td>See Plate 3</td>
<td>8-inch</td>
<td>266 feet</td>
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**DRILLING COMPANY/DRILLING EQUIPMENT**

Martini Drilling / CME 75

**DRILLING METHOD**

Hollow Stem Auger

**DATES DRILLED**

5/11/11-5/13/11 and 6/13/11-6/14/11

**GROUNDWATER READINGS**

Encountered at 41-ft during drilling

---

**SP**

Poorly Graded Sand with Gravel, fine grained, clasts 40 to 50% up to 1½ inch, mainly subrounded slate and meta-basalt; light gray (2.5Y 7/1); appears damp and dense; lower contact is narrowly gradational.

At 181.1 to 181.8': Becomes gravelly, clasts 10 to 30%; mostly ¾ to 1½ inch, limited fine gravel, mainly subrounded quartzite and slate.

At 181.8 to 185': No recovery.

**SM**

Silty Sand, very fine grained; gray (2.5Y 6/1); appears damp and dense.

At 186.5 to 187.5': Trace gravel, mostly ¾ to 1 inch; mainly quartzite.

At 187.8 to 190': No recovery.

At 190 to 191': No sampling.

**Silty Sand with Gravel, fine grained, clasts 15 to 20%, up to 2 inches, mainly subrounded slate (Jsm), some subrounded granitic rock, meta-basalt and sandstone (Tm); light brownish gray (2.5Y 6/2); appears damp and dense.**

At 196 to 196.5': Irregular iron oxide stringers, possible fracture staining.

At 197.1 to 197.8': Faint laminations defined by variable oxidation.

At 197.8 to 198.3': Fine to medium grained.

At 198.3 to 200': Very fine grained; very dark gray (5Y 3/1), slightly micaceous.

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**MTA Westside Subway Extension**

Los Angeles, California

**Geologist:** ME/MF

**Prepared/Date:** YN/WL/MW 10/10/2011

**Checked/Date:** MW/MF 10/14/2011
NOTES:
Boring backfilled with cement/bentonite grout from bottom up and patched.

-Munsell colors listed in order of predominance (most predominant color first).
-Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
-Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
-Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
-The term "clasts" herein describes gravel-size rock fragments (larger than 1/4 inch).
-Beds are generally massive unless otherwise noted.
| ELEVATION | DEPTH | BOX # | RUN # | SAMPLE LOC. | % RECOVERY | DRILLING COMPANY/DRILLING EQUIPMENT | BOREHOLE LOCATION | DATES DRILLED | HOLE DIAMETER | GROUND EL. | GROUNDWATER READINGS |
|-----------|-------|-------|-------|-------------|------------|--------------------------------------|-------------------|---------------|---------------|-------------|-------------|-----------------------------------|
| 5         |       |       |       | CL          | 100        | Martini Drilling / CME 75             | See Plate 3       | 5/26/11       | 8-inch       | 270 feet    | Encountered at 56-ft during drilling |

**Hand Augered to 5 feet**

**FILL [Af]**

Silty Clay

**NOTE:**

Jsm = Santa Monica Slate

Tm = Modelo Formation

See end of log for more detailed descriptions of clasts

At 2.0 to 2.5': Asphalt fragments with soil

At 2.5 to 5.0': Sandy to Clayey Silt; dark brown (7.5YR 3/3); appears moist and stiff; some asphalt fragments up to ¾ inch

**YOUNGER/OLDER ALLUVIAL FAN DEPOSITS [Qf0]**

Clay, trace coarse sand (Jsm and Tm); very dark gray (7.5YR 3/1) with occasional strong brown (7.5YR 4/6) mottling; appears moist and very stiff to hard; lower contact is gradational

At 9.6 to 10.0': Faint oxidized laminations, defined by variable color

Sandy to Clayey Silt, trace coarse sand (Jsm); dark yellowish brown (10YR 4/3); appears moist and stiff; poorly sorted, lower contact is sharp

At 12.2 to 12.8': Grades to fine to coarse Silty Sand with 5 to 10% fine gravel (Jsm and Tm)

At 12.8 to 14.5': Grades to Clayey Silt with variable fine sand, trace coarse sand (Jsm and Tm)

At 14.5 to 16.1': Fine to coarse Silty Sand with 5 to 10% fine gravel (Jsm and Tm)

**OLDER ALLUVIAL FAN DEPOSITS [Qf0]**

Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); mottled, brown (10YR 4/3) to dark gray (10YR 4/1) to strong brown (7.5YR 4/6); appears moist and very stiff to hard; poorly sorted, lower contact occurs between runs

**ESTUARINE DEPOSITS [Qe]**

Sandy Silt, trace to some Clay; trace coarse sand (Jsm); brown (10YR 4/3) with occasional strong brown (7.5YR 4/6) mottling; appears moist and stiff; prominent varve-like bedding and laminations

Sandy to Clayey Silt, trace coarse sand (Jsm and Tm); mottled dark grayish brown (10YR 4/2) to strong brown (7.5YR 4/6); appears very moist and stiff; lower contact is gradational

Geologist: ME/MF

Prepared/Date: DR/WL/MW 10/10/2011

Checked/Date: MW/MF 10/14/2011

MTA Westside Subway Extension
Los Angeles, California

LOG OF BORING
Project No.: 4953-10-1561 Figure: T7-B3a
ML Qe Continued
At 20.0 to 22.4': Becomes very moist, medium stiff

CL Silty Clay; trace coarse sand (Jsm and Tm); mottled, dark grayish brown (10YR 4/2)
to strong brown (7.5YR 5/6); appears moist and very stiff to hard; strong brown
mottling occurs mainly as irregular pockets; lower contact occurs between runs

ML Clayey Silt; trace coarse sand (Jsm and Tm); dark grayish brown (10YR 4/2) with
occasional strong brown (7.5YR 4/6) mottling; appears moist and very stiff; lower
contact is gradational

ML Sandy to Clayey Silt, trace coarse sand (Jsm and Tm); grayish brown (2.5Y 5/2) to
strong brown (7.5YR 5/8); appears very moist and stiff, lower contact is gradational

At 28.1 to 29.8': Varve-like bedding

At 29.7': ½ inch gravelly bed

At 30.0 to 33.3': Sand content increases, predominantly sandy silt

At 31.6 to 32.0': Color becomes dark brown (7.5YR 3/4)

CL ML Marker Bed M<sub>C</sub> - Silty Clay and Clayey Silt, variable fine sand, trace coarse sand
(Jsm and Tm); dark grayish brown (2.5Y 4/2); appears very moist and stiff to very
stiff; trace manganese oxide flecks; possible weak soil development; lower contact is
gradational
At 35.0 to 36.2': Increasing sand, gradational transition unit below

SM-SC OLDER ALLUVIAL FAN DEPOSITS [Q<sub>f</sub>]
Clayey to Silty Sand with Gravel, fine grained, clasts 20 to 40%, up to 1½ inches,
mainly subangular to subrounded slate (Jsm), some shale (Tm) and sandstone (Tm)
also observed, some brick-red sandstone (Tm); brown (7.5YR 4/4); appears moist and
dense; lower contact is gradational

ML Clayey to Sandy Silt with Gravel; clasts 15 to 25%, up to ½ inch, mainly subangular
to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); strong brown (7.5YR
4/4); appears moist and very stiff; occasional gray (2.5Y 5/1) laminations; generally
poorly sorted, lower contact is narrowly gradational
At 40.8 to 42.6': Grades to Clayey Silt and Silty Clay, trace coarse sand (Jsm and Tm); dark reddish brown (5YR 3/3) with grayish brown (2.5Y 5/2) mottles; appears moist and stiff to very stiff

Silty Clay, trace coarse sand and fine gravel (Jsm and Tm), some brick-red sandstone; brown (7.5YR 5/6) to strong brown (7.5YR 5/6) to gray (10YR 5/1); appears very moist and very stiff; lower contact is gradational

Sandy Silt with Gravel, trace to some clay, clasts 15 to 25%, up to ½ inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); brown (7.5YR 4/4); appears very moist and stiff; poorly sorted; lower contact is sharp

At 46.7 to 48.4': Gravel decreases to <5%

At 48.4 to 48.6': Silty Clay; reddish brown (5YR 4/4)

Clayey Gravel, clasts 50 to 60%, up to ½ inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); matrix is fine to coarse clayey sand; color variable, generally very dark grayish brown (10YR 3/2); appears wet and dense; lower contact is sharp, erosional

At 51.1': ½ inch organic-rich Silty Clay bed

At 51.5 to 55.0': No recovery

At 55.0 to 57.9': Matrix becomes fine to coarse Silty Sand, trace to some clay

At 56': Groundwater encountered during drilling

---

**FLUVIAL DEPOSITS [Qfo]**

Clayey Gravel, clasts 50 to 60%, up to ½ inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); matrix is fine to coarse clayey sand; color variable, generally very dark grayish brown (10YR 3/2); appears wet and dense; lower contact is sharp, erosional

At 51.1': ½ inch organic-rich Silty Clay bed

At 51.5 to 55.0': No recovery

At 55.0 to 57.9': Matrix becomes fine to coarse Silty Sand, trace to some clay

At 56': Groundwater encountered during drilling
### ESTUARINE DEPOSITS \([Qe]\)

Sandy to Clayey Silt with Gravel, clasts 15 to 30%, up to 1½ inches, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); color variable, mainly brown (10YR 4/6) to strong brown (7.5YR 4/6); appears very moist and stiff; poorly sorted, occasionally grades to very fine silty sand

At 61.8 to 62.1': Grades to Silty Clay

At 62.6 to 62.7': Fine to medium Sand bed

Clayey to Sandy Silt, variable sand; variable color, mainly brown (10YR 4/3) and strong brown (7.5YR 4/6); prominent varve-like bedding texture; occasional silty sand beds

At 67.5 to 68.6': Distinct laminations defined by variable oxidation

At 68.6 to 70.5': Clay and Silty Clay; trace coarse sand (Jsm and Tm); mottled; grayish brown (10YR 5/2) to reddish brown (5YR 4/4); appears very moist and very stiff

At 70.6 to 71.2': Fine to coarse Silty Sand; brown (7.5YR 4/4); appears wet and dense

Silty Sand, fine to coarse grained, variable gravel, clasts 0 to 15%, up to 1 inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); dark yellowish brown (10YR 4/4); appears wet and dense; occasional sandy silt and clayey silt interbeds; lower contact is sharp

Silty Clay and Clayey Silt, rare (<1%) coarse sand; dark gray (2.5Y 4/1); appears moist and very stiff; variable (2 to 10%) manganese oxide flecks and staining; variable organic content

At 76.7 to 80.0': Occasional 1 to 2 inch thick, fine Silty Sand and Sandy Silt interbeds; prominent varve-like bedding

At 78.3 to 80.0': Uncemented calcium carbonate nodules, 5 to 10%, up to ¼ inch

At 79.4 to 79.5': Fine Silty Sand bed; light brownish gray (2.5Y 6/2)

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**MTA Westside Subway Extension**  
**Los Angeles, California**

**LOG OF BORING**  
**Project No.: 4953-10-1561**  
**Figure: T7-B3d**
NOTES:
- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than 1/4 inch).
- Beds are generally massive unless otherwise noted.

END OF BORING AT 80 FEET

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<th>RUN #</th>
<th>% RECOVERY</th>
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Geologist: ME/MF
Prepared/Date: DR/WL/MW 10/10/2011
Checked/Date: MW/MF 10/14/2011

MTA Westside Subway Extension
Los Angeles, California

LOG OF BORING
Project No.: 4953-10-1561 Figure: T7-B3e
18 inches of asphaltic concrete over 6 inches of base
Hand augered to 6 feet

YOUNGER/OLDER ALLUVIAL FAN DEPOSITS [Qf/Qf0]
Clayey to Sandy Silt, variable coarse sand, trace fine gravel (Jsm and Tm); very dark grayish brown (10YR 3/2); appears very moist and stiff; occasionally grades to silty clay; lower contact is gradational

NOTE:
Jsm = Santa Monica Slate
Tm = Modelo Formation
See end of log for more detailed descriptions of clasts

OLDER ALLUVIAL FAN DEPOSITS [Qf0]
Clayey to Sandy Silt, variable coarse sand, trace to some fine gravel (Jsm and Tm); dark brown (10YR 3/2); appears moist and stiff
At 8.3 to 8.8': Increasing coarse sand and fine gravel content; gradational transition to unit below
Clayey to Silty Sand, fine grained, variable coarse sand and fine gravel, clasts 5 to 20%, up to ½ inch, mainly subrounded shale (Tm) and sandstone (Tm), some slate (Jsm); brown (7.5YR 4/4); appears moist and dense; lower contact is narrowly gradational
At 9.9 to 10.2': Gravel increases to 20 to 30%, up to ½ inch
Clay, trace coarse sand (Jsm and Tm); very dark grayish brown (10YR 3/2); appears moist and very stiff to hard; lower contact is gradational
At 12.5 to 12.8': Silty Sand with Gravel; fine to coarse grained, clasts 15 to 20%, up to ½ inch, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); brown (7.5YR 3/3); appears moist and dense; lower contact is sharp
At 12.9 to 14.0': No recovery
At 14.0': Becomes very moist

Silty Sand, fine to coarse grained, variable gravel, clasts 5 to 25%, most up to ½ inch, maximum 1½ inches; mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); brown (7.5YR 4/4); appears very moist and dense; poorly sorted, lower contact is gradational
At 16.7 to 19.0': No recovery

This record is an interpretation of subsurface conditions at the exploration location. Latitude and longitude of boring location shown on logs are approximate. Interfaces between strata are approximate. Transitions between strata may be gradational.
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<th>ELEVATION (ft)</th>
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<th>% RECOVERY</th>
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**G)c Continued**

**Marker Bed M<sub>q</sub>** - Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); mottled, dark brown (7.5YR 3/4) to gray (7.5YR 4/1) with some reddish brown (5YR 3/3); appears moist and very stiff; possible weak soil development; lower contact is gradational

**ESTUARINE DEPOSITS [Qe]**

Clayey to Sandy Silt, trace coarse sand and fine gravel (Jsm and Tm); mottled dark brown (7.5YR 3/4); appears moist and very stiff; generally moderately to well sorted; lower contact is narrowly gradational

At 22.2 to 23.1: Grades to Silty Clay
At 23.1 to 24.0': No recovery

At 24.0 to 25.8': Mottled, dark reddish brown (5YR 3/3) to dark gray (7.5YR 4/1)

At 25.8 to 30.9': Mottled, strong brown (7.5YR 5/6) to grayish brown (10YR 5/2)

At 30.3 to 30.9' and 31.8 to 32.4': Grades to fine Silty Sand, gravel increases to 5 to 15% (Jsm and Tm)
At 30.0 to 31.5': Faint varve-like bedding

At 34.0 to 34.5': Fine Silty Sand; gradational lower contact

At 37.8 to 39.0': No recovery

**OLDER ALLUVIAL FAN DEPOSITS [Qf]</sup>**

Clayey to Silty Sand, fine grained, variable course sand, trace fine gravel (Jsm and Tm); dark greyish brown (2.5YR 4/2) to brown (7.5YR 4/2) with occasional strong brown (7.5YR 4/6) motting; appears moist and very stiff; distinct color and texture; possible weak soil development; lower contact occurs between runs

At 37.8 to 39.0': No recovery

---

**GROUNDWATER READINGS**

Encountered at 49-ft during drilling
CL

At 40.4 to 41.2': Sandy Clay with Gravel, clasts 30 to 40%, up to 1 inch; mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); color variable, mainly brown (10YR 4/3) to strong brown (7.5YR 4/6); appears moist and hard; lower contact is gradational

At 41.2 to 43.0': Gravel content 30 to 40%; strong brown (7.5YR 5/6)

Clayey Silt, variable fine sand, trace coarse sand and fine gravel; brown (7.5YR 5/4); appears moist and very stiff to hard; poorly sorted; lower contact occurs between runs

At 44.0 to 45.5': No sampling

At 45.5 to 46.2': Appears very moist and stiff, gravel increases to 10 to 15%, up to 1 inch

At 46.2 to 49.0': No recovery

OLDER FLUVIAL DEPOSITS [Qfofl]

Silty Gravel, clasts 50 to 60%, up to 1½ inches, mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm), some quartzite (Jsm) also observed; matrix is fine to coarse silty sand; very dark grayish brown (10YR 3/2); appears wet and dense

At 50.2 to 51.5': No recovery

At 52.5 to 54.0': No recovery

At 54.7 to 56.5': No recovery

At 56.7 to 60.0': Matrix becomes fine to coarse Clayey, Silty Sand

At 59.0': Color becomes dark grayish brown (10YR 4/2)
ESTUARINE DEPOSITS - FINE GRAINED [Qef]
Clay and Silty Clay, trace coarse sand (Jsm and Tm); mottled, brown (10YR 5/3) to reddish brown (5YR 4/4); appears very moist and stiff to very stiff; trace manganese oxide flecks; prominent varve-like bedding, lower contact is gradational.

At 61.6 to 62.8': Increasing silt and sand content; mottled, brown (10YR 5/3) to strong brown (7.5YR 5/6); variable varve-like bedding, gradational transition to unit below.

Sandy to Clayey Silt, trace coarse sand and fine gravel (Jsm and Tm); mottled, brown (10YR 5/3) to strong brown (7.5YR 5/6); appears very moist and very stiff; lower contact is gradational.

At 64.0 to 65.5': Graysih brown (10YR 5/2) to reddish brown (5Y 5/4), occasional faint laminations defined by variable color/oxidation.

ESTUARINE DEPOSITS [Qe]
Sandy to Clayey Silt, trace coarse sand and fine gravel (Jsm and Tm); color variable, mainly brown (10YR 5/3) to strong brown (7.5YR 5/6); appears very moist and very stiff; lower contact is gradational, occasional silty clay beds.

At 66.9 to 72.7': Prominent varve-like bedding, occasional oxidized sandy silt laminations.

Clayey to Silty Sand with Gravel, fine grained, clasts 15 to 20%, up to ½ inch; mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); grayish brown (10YR 5/2) with occasional strong brown (7.5YR 5/6) mottling; appears very moist to wet and dense; lower contact is sharp.

At 74.0 to 74.3': Strongly oxidized, strong brown (7.5YR 5/6) predominant.

At 74.3 to 74.6': Silty Clay bed; appears very moist and soft to medium stiff.

Clay, trace coarse sand (Jsm and Tm); dark grayish brown (10YR 4/2); appears very moist and stiff to very stiff; trace manganese oxide flecks; prominent varve-like bedding texture.

At 76.6': ½ inch thick fine Silty Sand bed.

At 77.4 to 78.0': Some oxidized, yellowish red (5YR 4/6), irregular pockets.

At 78.6 to 78.7': Fine Silty Sand to Sandy Silt bed.

END OF BORING AT 79 FEET.

NOTES:
Boring backfilled with cement/bentonite grout from bottom up and patched.

- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term “clasts” herein describes gravel-size rock fragments (larger than 1/4 inch).
- Beds are generally massive unless otherwise noted.

<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
<th>SAMPLE LOC.</th>
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</table>

Groundwater readings encountered at 49-ft during drilling.

Boring No.: T7-B4

Project No.: 4953-10-1561

MTA Westside Subway Extension
Los Angeles, California

Geologist: BF/MF
Prepared/Date: DR/WL/MW 10/10/2011
Checked/Date: MW/MF 10/14/2011

LOG OF BORING
Project No.: 4953-10-1561 Figure: T7-B4e
 Surface is grass
Hand augered to 5 feet

### Older Alluvial Fan Deposits [Qfo]

Silty Clay, trace coarse sand (Jsm and Tm); dark brown (7.5YR 3/4); appears very moist and stiff

**Note:**
Jsm = Santa Monica Shale
Tm = Modelo Formation
See end of log for more detailed clast descriptions

**Older Alluvial Fan/Estuarine Deposits [Qfo/Qe]**

Alternating beds of Silty Fine Sand and Clayey Silt; dark yellowish brown (10YR 3/4); appears very moist and stiff to dense; lower contact occurs between runs

### Groundwater Readings

Measured at 52-ft during drilling

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>% Recovery</th>
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</thead>
<tbody>
<tr>
<td>270</td>
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<td>265</td>
<td>94</td>
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<td>260</td>
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<td>20</td>
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<tr>
<td>DEPTH (ft)</td>
<td>ELEVATION (ft)</td>
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<tr>
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<tr>
<td>25</td>
<td>250</td>
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<tr>
<td>30</td>
<td>245</td>
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<tr>
<td>35</td>
<td>240</td>
</tr>
</tbody>
</table>

**ESTUARINE DEPOSITS [Qe]**

- Sandy to Clayey Silt; dark gray (7.5YR 4/1) to brown (7.5YR 4/4); appears moist and stiff; 5 to 10% calcium carbonate filaments and cemented nodules up to ¼ inch; lower contact is gradational
- At 23.8 to 25.0': Clayey Silt to Silty Clay; trace coarse sand (Jsm and Tm); mottled, dark reddish brown (5YR 3/3) to dark reddish yellow (5YR 4/1); appears moist and hard; trace calcium carbonate filaments and cemented nodules up to 1/8 inch; possible weak soil development
- Sandy to Clayey Silt, variable coarse sand and gravel, clasts 2 to 10%, up to ½ inch, mainly subangular to subrounded slate (Jsm), shale (Tm), and sandstone (Tm); mottled, grayish brown (2.5Y 5/2) to strong brown (7.5YR 5/6); appears very moist and very stiff; trace calcium filaments; some oxidized laminations and varve-like bedding; lower contact occurs between runs
- Sandy Silt, trace to some clay, trace coarse sand (Jsm and Tm); mottled, color variable, mainly grayish brown (10YR 5/2) to brown (7.5YR 5/4), occasionally reddish brown (5YR 4/4); appears very moist and stiff; lower contact occurs between runs
- At 30.0 to 31.2': Some lightly cemented zones
- At 31.8 to 32.9': Grades to fine Silty Sand, 5 to 10% gravel, up to ½ inch (Jsm and Tm), 1 granitic clast observed
- At 33.0 to 35.0': Some indistinct varve-like bedding
- At 34.2 to 35.0': Becomes very stiff, trace manganese oxide flecks and staining
- Well Graded Sand with Gravel, fine to coarse grained, clasts 20 to 30%, up to ½ inch; mainly subangular to subrounded slate (Jsm), shale (Tm), and sandstone (Tm); some quartzite and granitic rock also observed; color variable, generally yellowish brown (10YR 5/4); appears moist and dense; lower contact is sharp, erosional
- At 35.6 to 35.7: Grades to fine Silty Sand; well sorted
- 37.7 to 38.4': Grades to fine Silty Sand; well sorted; sharp lower contact

**Marker Bed MF**

- Clay to Silty Clay, trace coarse sand (Jsm); dark grayish brown (10YR 4/2); appears moist and very stiff; fine oxidized strong brown (7.5YR 4/6) pockets/specks, generally less than 1/8 inch; possible weak soil development; lower contact occurs between runs

**GROUNDWATER READINGS**

Measured at 52-ft during drilling

<table>
<thead>
<tr>
<th>RUN #</th>
<th>BOX #</th>
<th>GROUNDWATER READINGS</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Measured at 52-ft during drilling</td>
</tr>
</tbody>
</table>
### Marker Bed M<sub>i</sub> continued
Clayey Silt, variable fine sand, trace coarse sand (Jsm and Tm); dark reddish brown (5YR 3/3); appears moist and stiff; core sample broken up; lower contact is gradational

At 43.8 to 45.0': Clayey Silt predominant

At 45.0 to 46.8': Increasing sand, Sandy Silt predominant

At 47.7 to 48.5': Gravel increases to 20 to 30%

### OLDER ALLUVIAL FAN DEPOSITS [Q<sub>fo</sub>]
Clayey to Sandy Silt, variable coarse sand and fine gravel, clasts 2 to 20%, up to ½ inch, mainly subangular to subrounded slate (Jsm), shale (Tm), and sandstone (Tm); strong brown (7.5YR 4/6); appears moist and very stiff to hard; poorly sorted; lower contact is sharp

At 43.8 to 45.0': Clayey Silt predominant

At 45.0 to 46.8': Increasing sand, Sandy Silt predominant

At 47.7 to 48.5': Gravel increases to 20 to 30%

### OLDER FLUVIAL DEPOSITS [Q<sub>fofl</sub>]
Silty Gravel; clasts 70%+, up to 2 inches, mainly angular to subangular slate (Jsm), some shale (Tm) and sandstone (Tm) also observed; appears to be clast-supported, matrix is fine to coarse silty sand; color is variable, appears moist and dense; lower contact is gradational

Clayey, Silty Sand with Gravel, fine to coarse grained, clasts 20 to 50%, up to ½ inch (Jsm and Tm)

At 52': Groundwater measured during drilling

### OLDER ALLUVIAL FAN DEPOSITS [Q<sub>fo</sub>]
Clayey Silt and Silty Clay, variable fine sand and fine gravel, clasts 5 to 20%, up to ½ inch, mainly subangular to subrounded slate (Jsm), shale (Tm), and sandstone (Tm); brown (7.5YR 4/4); appears very moist and very stiff; lower contact is gradational

At 54.6 to 55.3' and 55.7 to 56.0': Color becomes reddish brown (5YR 4/3)

At 55.3 to 55.7': Clayey Sand with Gravel, fine to coarse grained, clasts 30 to 40%, up to ½ inch (Jsm and Tm)

At 56.0 to 60.0': Poor to no recovery, slough only
ESTUARINE DEPOSITS - FINE GRAINED (Qef)

Sandy to Clayey Silt, variable coarse sand, trace fine gravel (Jsm and Tm); dark brown (7.5YR 3/4); appears very moist and stiff; generally well sorted; lower contact is narrowly gradational

At 61.7 to 61.8 and 62.3 to 62.4': Fine to coarse Silty Sand beds
At 61.8 to 62.3': Very fine Silty Sand to Sandy Silt

At 64.0 to 65.0': Trace manganese oxide flecks
At 65.0 to 65.9': Manganese oxide flecks and staining increase 10 to 20%

ESTUARINE DEPOSITS [Qe]

Clayey to Sandy Silt, variable coarse sand and fine gravel, clasts 1 to 10%, up to ¾ inch; mainly subangular to subrounded slate (Jsm), shale (Tm) and sandstone (Tm); mottled, grayish brown (10YR 5/2) to strong brown (7.5YR 4/6); appears very moist to wet and medium stiff to stiff; lower contact is gradational

At 68.3 to 70.8': Some laminations defined by variable oxidation

Well Graded Sand with Gravel, fine to coarse grained, clasts 30 to 40%, up to ¾ inch, mainly subangular to subrounded slate (Jsm), shale (Tm), and sandstone (Tm); dark yellowish brown (10YR 4/4); appears wet and dense

At 72.9 to 73.7': Clayey Silt and Silty Clay, variable fine to coarse sand, trace fine gravel (Jsm and Tm); mottled, grayish brown (10YR 5/2) to strong brown (7.5YR 4/6)
At 73.7 to 75.0': No recovery
At 75.0 to 76.7': Gravel decreases to less than 5%
At 77.5 to 80.0': No recovery
## LOG OF BORING

**BORING NO.**

T7-B5  
(Continued)

**DRILLING COMPANY/DRILLING EQUIPMENT**

Martini Drilling / CME 75

**DRILLING METHOD**

Hollow Stem Auger

**BOREHOLE LOCATION**

See Plate 3

**DATES DRILLED**

5/23/11

**HOLE DIAMETER**

8-inch

**GROUND EL.**

275 feet

---

<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
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<td>100</td>
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</tbody>
</table>

**NOTES:**

Boring backfilled with cement/bentonite grout from bottom up and patched.

- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than 1/4 inch).
- Beds are generally massive unless otherwise noted.

---

**BORING COMPANY**

Martini Drilling / CME 75

**DRILLING METHOD**

Hollow Stem Auger

**DATES DRILLED**

5/23/11

**HOLE DIAMETER**

8-inch

**GROUND EL.**

275 feet

---

**NOTES:**

Boring backfilled with cement/bentonite grout from bottom up and patched.

- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than 1/4 inch).
- Beds are generally massive unless otherwise noted.

---

**Geologist:** ME/MF

**Prepared/Date:** DR/WL/MW 10/10/2011

**Checked/Date:** MW/MF 10/14/2011

---

**MTA Westside Subway Extension**  
Los Angeles, California

**LOG OF BORING**  
Project No.: 4953-10-1561  
Figure: T7-B5e
### BORING NO.

**T8-B1**

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<th>RUN #</th>
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<td>295</td>
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<td>300 feet</td>
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**ELEVATION (ft)**

- 295

**DEPTH (ft)**

- 5

**BOX #**

- 1

**RUN #**

- 1

**% RECOVERY**

- 100

**GROUND EL.**

- 300 feet

---

### GROUNDWATER READINGS

Measured at 65-ft after 24-hrs

- 10 inches asphaltic concrete over 10 inches base
- Hand augered to 7 feet
- NOTE: Jsm = Santa Monica Slate
- Tm = Modelo formation
- See end of log for more detailed descriptions of clasts

- **FILL [AF]**
  - Sandy Gravel, some cobble

- **ML**
  - Sandy Silt, some gravel and cobbles; yellowish brown; appears moist

- **CL**
  - Clay; brown
  - Sandy Clay, trace gravel, subangular, ½ inch; dark yellowish brown; appears moist and stiff
  - At 8.0 to 9.0'; Clay with some fine to medium sand
  - Clayey to Silty Sand, fine to medium grained, trace gravel; dark yellowish brown
  - Clay bed; very dark brown; appears moist and soft to stiff
  - At 16.5 to 19.0'; No recovery
  - At 19.0'; Clay, mottled with Sand and Silt, abundant fine to coarse gravel; very dark gray and very dark brown; sample is broken up

---

**PROJECT NO.: 4953-10-1561**

**LOG OF BORING**

MTA Westside Subway Extension

Los Angeles, California

Geologist: DB/MW/MF

Prepared/Date: WL/PK 10/13/2011

Checked/Date: MF/MW 10/13/2011

**LOG OF BORING**

(Continued on following figure)
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<th>ELEVATION (ft)</th>
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<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
<th>SAMPLE LOC.</th>
<th>DRILLING COMPANY/DRILLING EQUIPMENT</th>
<th>BOREHOLE LOCATION</th>
<th>DATES DRILLED</th>
<th>HOLE DIAMETER</th>
<th>GROUND EL.</th>
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<td>84</td>
<td>CL</td>
<td>Jet Drilling / CME 75</td>
<td>See Plate 3</td>
<td>5/24/11 - 5/28/11</td>
<td>8 inches</td>
<td>300 feet</td>
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<td>ESTUARINE DEPOSITS - FINE GRAINED [Qef]</td>
<td>Clay, olive brown (2.5Y 4/3); appears moist and very stiff; lenses of fine yellow brown sand and thin reddish brown and grayish brown layering, varve like bedding; lower contact is sharp</td>
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<tr>
<td>275</td>
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<td></td>
<td>SM</td>
<td>Silty Sand, fine to medium grained, some angular gravel, ¼ inch; dark brown (7.5YR 3/3); appears damp to moist and medium dense</td>
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<tr>
<td>270</td>
<td>30</td>
<td>2</td>
<td>6</td>
<td>38</td>
<td>SM</td>
<td>Marker Bed Me - Clay, trace coarse sand; very dark grayish brown (10YR 3/2); appears moist and stiff; some thin interfingering layers/lenses of fine yellow sand</td>
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<td></td>
<td>At 26.8': increasing Silt and Sand, olive (5Y 4/3)</td>
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<td>At 27.0 to 29.0': No recovery</td>
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<td>Clay, trace dispersed calcium carbonate; weak carbonate soil horizon?; lower contact is gradational</td>
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<td>At 30.0' to 30.9'; Gradational transition to Lakewood Formation below</td>
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<td>265</td>
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<td>7</td>
<td>44</td>
<td>SP- SM</td>
<td>LAKEWOOD FORMATION [Qlw]</td>
<td>Silty Sand; very fine grained, light yellowish brown (2.5Y 6/3); appears moist and dense; well sorted; lower contact occurs between runs</td>
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<td>At 30.9 to 34.0': No recovery</td>
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<td></td>
<td>Poorly Graded Sand with Silt, fine grained; olive yellow (2.5Y 6/6); appears damp and dense; lower contact is narrowly gradational</td>
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<tr>
<td>40</td>
<td></td>
<td>2</td>
<td>8</td>
<td>44</td>
<td>SP</td>
<td>At 37.0': Increasing moisture and oxidation</td>
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<td></td>
<td>At 37.6 to 39.0': No recovery</td>
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</tbody>
</table>

This record is an interpretation of subsurface conditions at the exploration location. Latitude and longitude of boring location shown on logs are approximate. Transitions between strata are approximate. Interfaces between strata may be gradational.

% RECOVERY

Sample Loc.

At Continued

Silty Sand; fine to medium grained, some angular gravel, ¼ inch; dark brown (7.5YR 3/3); appears damp to moist and medium dense

Marker Bed Me - Clay, trace coarse sand; very dark grayish brown (10YR 3/2); appears moist and stiff; some thin interfingering layers/lenses of fine yellow sand

At 26.8': increasing Silt and Sand, olive (5Y 4/3)
At 27.0 to 29.0': No recovery

Clay, trace dispersed calcium carbonate; weak carbonate soil horizon?; lower contact is gradational

At 30.0' to 30.9'; Gradational transition to Lakewood Formation below

Silty Sand; very fine grained, light yellowish brown (2.5Y 6/3); appears moist and dense; well sorted; lower contact occurs between runs
At 30.9 to 34.0': No recovery

Poorly Graded Sand with Silt, fine grained; olive yellow (2.5Y 6/6); appears damp and dense; lower contact is narrowly gradational

At 35.1 to 36.5': No recovery

At 37.0': Increasing moisture and oxidation
At 37.6 to 39.0': No recovery

At Continued
Clay; light olive gray (2.5Y 6/2); appears damp and hard; thinly layered; lower contact occurs between runs
At 40.6 to 41.5': No recovery
At 41.5 to 43.3': Clay; dark grayish brown (2.5Y 4/2); small splotches of oxidization, punky texture with waxy parting surfaces; appears damp and soft; zones with more silt, oxidized thin wavy clay layers at lower contact, lower contact is sharp
Silt; very dark brown (10YR 2/2) to dark brown (10YR 3/3) and light yellowish brown (2.5Y 6/4), lower contact is sharp
Clayey Sand, fine to medium grained; olive (5Y 5/3); appears moist and dense, lower contact is narrowly gradational
Clay; olive brown (2.5Y 4/3) small oxidization splotches, crumbles when broken, waxy parting surfaces; some sand and silt, lower contact is sharp
Silty Sand, fine grained; brownish yellow (10YR 6/8) and very pale brown (10YR 7/3); appears moist and dense
At 46.6': Clastic layer, Clayey Sand matrix, subrounded to subangular gravel, some near horizontal imbrication of elongated slate (Jsm) clasts
At 46.6 to 49.0': No recovery
Marker Bed M1 - Sand with Gravel, fine to medium grained, clasts 10 to 20 %, up to 1 inch, mainly subangular to subrounded slate (Jsm), quartzite and granitic rock; color variable; appears moist and dense; lower contact occurs between runs
At 49.4: Clastic layer (2-inch thick)
At 49.6 to 50.3: Sand, fine grained; brownish yellow (10YR 6/8); thinly bedded, near horizontal bedding
At 50.3 to 54.0': No recovery
Silty Sand, very fine to fine grained; olive (5Y 5/3); appears moist and dense; trace oxidation mottling; poorly recovery (sample not intact); lower contact is sharp
Sand, fine to medium grained; dark greenish gray (5GY 4/1)
### LOG OF BORING

**BORING NO.** T8-B1  
(Continued)

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**GROUNDWATER READINGS**

- **Qlw Continued**
  - At 60': Silty Sand continued
  - At 61.0 to 61.5': No recovery

- **SAN PEDRO FORMATION** [Qsp]
  - Silty Sand, very fine grained, some clay; olive (5Y 4/3); appears very moist and dense
  - At 65.5': **Marker Bed MB** - Oxidized Clay/Silt bed (½ inch thick)
  - At 65.6': Becomes gray (5Y 6/1), very fine grained
  - At 66.7' to 69.0': No recovery

- **Silty Sand, very fine to fine grained; grayish olive (10Y 5/2); appears very moist and dense**
  - At 69.0' to 69.5': **Marker Bed MA** - Gravelly bed, clasts 15 to 30%, up to 1 inch, mainly subrounded slate (Jsm) and quartzite
  - At 70.9 to 74.0': No Recovery

**END OF BORING AT 74 FEET**

**NOTES:**
- Boring backfilled with cement/bentonite grout from bottom up and patched.
- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch).
- Beds are generally massive unless otherwise noted.

**Geologist:** DB/MW/MF  
**Prepared/Date:** WL/PK 10/13/2011  
**Checked/Date:** MF/MW 10/13/2011
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12 inches of asphaltic concrete over 18 inches of base

NOTE:
Js = Santa Monica Slate
Tm = Modelo formation
See end of log for more detailed descriptions of clasts

Grab samples taken at 2' and 4'

FILL [Af]
Sand with Gravel, fine to coarse; olive gray, appears wet

At 3.5': Clay; brown

Silty Clay, trace coarse sand; brown (10YR 4/4); appears very moist and stiff

At 8.0 to 8.3': Becomes dark brown (5YR 3/4)

At 9.0 to 11.3': Occasional Sandy beds

Grades to Sandy to Clayey Silt

Silty Clay and Clayey Silt, variable fine to coarse sand, trace fine gravel; brown (10YR 4/3) to black (7.5YR 2.5/1); appears moist to very moist and very stiff to hard; alternating organic rich (black) and non-organic (brown) layers

At 12.6 to 14.0': No recovery

At 19.0 to 21.3': Sand and fine gravel content increases
**ESTUARINE DEPOSITS - FINE GRAINED [Qef]**

Sandy to Clayey Silt, trace coarse sand (Jsm and Tm); brown (10YR 4/3); appears very moist and stiff; lower contact is sharp

At 22.1 to 24.0': No recovery

At 24.0 to 26.2': Variable varve-like bedding, brown (10Y 4/3) to strong brown (7.5YR 5/6)

At 26.3 to 29.0': No recovery

At 29.0 to 33.4': Variable color and mottling, mainly grayish brown (2.5Y 5/2) to reddish brown (5YR 5/4) to yellowish brown (10YR 5/6); some faint laminations and varve-like bedding

**Marker Bed ME**

- Clayey Silt and Silty Clay, trace coarse sand (Jsm and Tm); mottled, dark gray (10YR 4/1) to light brown (10YR 4/2) to reddish brown (5YR 5/3); appears moist and very stiff; lower contact is sharp

At 35.4 to 35.6': Appears to be upper part of gradational transition to Lakewood Formation below

At 35.0 to 35.6': Trace dispersed calcium carbonate; possible weak carbonate soil horizon

At 35.6 to 39.0': No recovery

**LAKEWOOD FORMATION [Qlw]**

Silty Sand, fine grained; pale brown (2.5Y 7/3); appears dry and dense; well sorted;

Depth of contact uncertain due to poor recovery

(Continued on following figure)
lower contact occurs between runs
At 39.6 to 40.1°: Distinct laminations defined by varying manganese oxide content and oxidation
Qhw Continued
At 40.5 to 44.0°: No recovery
Clayey to Silty Sand, fine grained, trace coarse sand; varying color and oxidation, generally yellowish brown (10YR 5/6) to strong brown (7.5YR 4/6); appears moist and dense
At 44.5 to 45.3°: Grades to Sandy Clay, some oxidized laminations
At 45.3°: ¼ inch very dark gray (7.4YR 3/1) clay bed
At 45.8 to 46.8°: Becomes yellowish brown (10YR 5/4)
Silty Sand, fine grained, yellowish brown (10YR 5/8) to brown (10YR 4/3); appears dry to damp and dense; distinct laminations defined by color and manganese oxide content
At 47.5 to 49.0°: No recovery
Marker Bed MC - Silty Sand with Gravel, very fine grained, clasts 15 to 20%, up to ½ inch, mainly subrounded slate (Jsm), quartzite and granitic rock; brown (10YR 4/3) to dark gray (10YR 4/1); appears dry to damp and dense; distinct laminations defined by color and manganese oxide content
At 50.2 to 51.5°: No recovery
Silty Sand, fine grained, trace clay; dark grayish brown (10YR 4/2) to dark yellowish brown (10YR 4/6); appears very moist and dense
At 51.8 to 54.0°: No recovery
Silty Sand to Sandy Silt, fine grained; dark grayish brown (10YR 4/2); very moist; stiff; lower contact is indistinct
Silty Sand, fine grained; pale brown (2.5Y 7/4) to brownish yellow (10YR 6/8); appears moist and dense; well sorted; lower contact is gradational
At 54.5 to 54.9°: Trace gravel, mainly slate (Jsm), one ½ inch rounded granitic rock clast observed
At 55.1 to 55.5°: Grades to very fine grained Silty Sand and Sandy Silt
At 59.0 to 61.8°: Becomes strongly mottled; gray (2.5Y 6/1) to strong brown (7.5YR 5/8); appears very moist

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Geologist: BF/MF
Prepared/Date: WL/PK 10/13/2011
Checked/Date: MF/MW 10/13/2011
At 61.8': Becomes mottled, light yellowish brown (2.5Y 6/3) to brownish yellow (10YR 6/6); appears wet

At 63.2 to 64.0': No recovery

At 64.0 to 65.0': No sampling

At 65.0 to 69.0': Recovered only slough

At 69.0': Marker Bed MB - Oxidized Clay/Silt bed (1 inch thick)

- Silty Sand, very fine grained; greenish gray (10GY 5/1); appears wet and dense; slightly micaceous; scattered fine, irregular, oxidized pockets; lower contact is narrowly gradational

At 71.4 to 71.8': Marker MA - 20 to 30% gravel, up to 1 inch, mainly subrounded slate (Jsm) and granitic rock

- Poorly Graded Sand with Silt, fine grained; gray (5Y 5/1); appears wet and dense

At 72.2 to 74.0': No recovery

END OF BORING AT 74 FEET

NOTES:

- Boring backfilled with cement/bentonite grout from bottom up and patched.
- Munsell colors listed in order of predominance (most predominant color first).
- Where observed, contacts and bedding appear subhorizontal unless otherwise noted.
- Non-recovery intervals are assumed to occur at the bottom of run unless otherwise noted.
- Santa Monica Slate (Jsm) clasts are generally very dark gray, subangular to subrounded slate unless otherwise noted. Modelo Formation (Tm) clasts are generally white to pale yellow to tan, subangular to subrounded shale and sandstone unless otherwise noted.
- The term "clasts" herein describes gravel-size rock fragments (larger than ¼ inch).
- Beds are generally massive unless otherwise noted.
**LOG OF BORING**

**BORING NO.**
T8-B3

**DRILLING COMPANY/DRILLING EQUIPMENT**
Martini Drilling / CME 75

**DRILLING METHOD**
Hollow-Stem Auger

**BOREHOLE LOCATION**
See Plate 3

**DATES DRILLED**
5/25/11

**HOLE DIAMETER**
8 inches

**GROUND EL.**
292 feet

**GROUNDWATER READINGS**
Not encountered during drilling

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16 inches of asphaltic concrete over 32 inches of subbase sand

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**FILL [Af]**
Silty Clay and Clayey Silt, variable fine to coarse grained, trace gravel; varying color, mainly dark grayish brown (10YR 4/2); appears moist to very moist and very stiff; occasional more gravelly layers with up to 20% gravel

At 9.6': Brick fragment, 2 inches

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**PROJECT NO.:** 4953-10-1561

**MTA Westside Subway Extension**
Los Angeles, California

**LOG OF BORING**

**Geologist:** ME/MF
**Prepared/Date:** WL/PK 10/13/2011
**Checked/Date:** MF/MW 10/13/2011

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<th>% RECOVERY</th>
<th>SAMPLE LOC.</th>
<th>DEPTH (ft)</th>
<th>BOX #</th>
<th>RUN #</th>
<th>% RECOVERY</th>
<th>SAMPLE LOC.</th>
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**Marker Bed M**<sub>cl</sub> - Clay; rare (<1%) coarse grained sand; lightly mottled; dark grayish brown (10YR 4/2) to dark yellowish brown (10YR 4/6); appears moist and very stiff to hard; lower contact is sharp

**Marker Bed M**<sub>ML</sub> - Carbonate Soil Horizon - Silt (calcium carbonate); white (N 9.5); appears damp and hard; 95% of bed composed of silt-size calcium carbonate deposits; moderately to well cemented; lower contact is narrowly gradational

**LAKEWOOD FORMATION [Qlw]**
Silty Sand, fine grained; olive gray (5Y 5/2) with occasional yellowish brown (10YR 5/8) mottling and laminations; appears very moist and dense; well sorted; lower contact is gradational

At 38.6 to 40.5': Becomes pale brown (2.5Y 3/3) with occasional dark yellowish brown (10YR 5/8) mottling and laminations; appears damp and dense

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**MTA Westside Subway Extension**
Los Angeles, California

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**LOG OF BORING**

MTA Westside Subway Extension
Los Angeles, California

**DRILLING COMPANY/DRILLING EQUIPMENT**
Martini Drilling / CME 75

**BOREHOLE LOCATION**
See Plate 3

**DATES DRILLED**
5/25/11

**HOLE DIAMETER**
8 inches

**GROUND EL.**
292 feet

**GROUNDWATER READINGS**
Not encountered during drilling

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**PREPARED/DATE**
WL/PK 10/13/2011

**CHECKED/DATE**
MF/MW 10/13/2011

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**METRO SOIL CORE**
S:\70131 GEOTECH\GINTW\FAULT_INVESTIGATION_WSE_LIBRARY AMEC OCTOBER2011 (2).GLB

**G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.2 FAULT HAZARD INVESTIGATION\3.2 ALL FIELD NOTES\GINT LOGS\101561-TRANSECT 8.GPJ  10/14/11
**Qw Continued**

- Poorly Graded Sand with Silt, fine grained; lightly mottled, varying color; generally pale brown (2.5Y 8/3) to yellow (10YR 7/6); appears damp and dense

At 43.5 to 44.2': Clayey Silty Sand, fine grained; varying color, generally light yellowish brown (2.5Y 6/4) to brownish yellow (10YR 6/8); appears moist and dense

At 46.5 to 49.0': Becomes fine to medium grained, trace coarse grained and fine gravel (Jsm)

At 50.0 to 53.4': Appears moist; occasional laminations defined by oxidation and manganese oxide content

At 53.6': Subangular meta-basalt clasts, up to 3 inches

At 53.8 to 55.0': No recovery

**Marker Bed MC**

- Silty Sand with Gravel, fine grained; clasts 15 to 20%; up to 1 inch, mainly subrounded slate (Jsm), quartzite (Jsm) and granitic rock; strong brown (7.5YR 4/6); appears moist and dense; lower contact is narrowly gradational

At 55.3 to 56.1': Grades to fine Silty Sand; light yellowish brown (2.5Y 6/4)

At 56.1 to 57.0': Varying color, mainly yellowish brown (10YR 5/6)

- Silty Sand and Sandy Silt, very fine grained; light yellowish brown (2.5Y 6/4); appears moist and dense; well sorted; lower contact is narrowly gradational

At 57.4 to 60.0': No recovery

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MTA Westside Subway Extension
Los Angeles, California

Log of Boring

**Geologist:** ME/MF
**Prepared/Date:** WL/PK 10/13/2011
**Checked/Date:** MF/MW 10/13/2011

**LOG OF BORING**

**Project No.: 4953-10-1561**

**Figure:** T8-B3c